GEOLOGIC
DATA REPORTS

Book 3 of 4

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DATA REPORT F
FIELD DISCONTINUITY MEASUREMENTS

DIABLO CANYON ISFSI

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DIABLO CANYON ISFSI

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1.0 INTRODUCTION

Detailed surveys of discontinuities (fractures, joints, faults, and bedding) were conducted in trench exposures, roadcut exposures, and surface outcrops, to provide data for evaluation of the rock mass properties within the ISFSI study area and along Reservoir Road, the alignment of the future transport route. The results of these rock mass surveys are presented in this data report. The purpose of the surveys was to collect sufficient data to characterize the geometry, intensity and mechanical properties of discontinuities in the area. These data were used to assess the influence of discontinuities on the stability of the slope above the ISFSI, the cutslope, and the slope above Reservoir Road, and to develop estimates of in situ rock mass strength for stability and foundation analysis. Trenches used for discontinuity measurements are described in William Lettis & Associates, Inc. (2001) Diablo Canyon ISFSI Data Report D, and shown on Figure F-1. Road cut and outcrop measurements were distributed throughout the ISFSI study area. In particular, discontinuity measurements were made in road cuts along the tower access road above the ISFSI site (Figure F-1), along Reservoir Road southwest the ISFSI (RR-1 and RR-2; Figure F-2), and in a bulldozer cut near Trench 11 (DS-1, Figure F-1). The geologic mapping at the ISFSI site and nearby areas is described in Diablo Canyon ISFSI Data Report A.

The preparation of this data report was performed under the2000 WLA Work Plan (William Lettis & Associates, Inc., Work Plan, 2000) using data collected under that Work Plan and the 2001 WLA Work Plan (William Lettis & Associates, Inc., Work Plan 2001).

2.0 METHODOLOGY

Field discontinuities were measured by Jeff Bachhuber, Charles Brankman, John Baldwin, John Helms, and Rich Koehler of William Lettis & Associates, Inc., (WLA). Charles Brankman prepared this document. William D. Page of PG&E's Geosciences Department provided overall supervision and William Lettis provided peer review and overall project management. The field work was performed in June, August, and December 2000, and in February and April 2001.

Twenty-two trenches were excavated in the ISFSI site area to assess the stratigraphy, joints, and faults at the site (Figure F-1). The trenches typically were oriented in two perpendicular directions (northwest and northeast) to help reduce a possible directional bias in the data set. Discontinuity line surveys were performed in selected trenches (Trenches T-1, T-2, T-3, T-4, T-5, T-6, T-11a, T-11b, T-12, T-13, T-14a, and T-15; Figure F-1) that provided sufficient rock exposure (trench depth) to permit evaluation and measurement of discontinuities. Portions of the low cutslope along the tower access road between trenches were also integrated into the trench discontinuity surveys. The surveys were performed by extending a measuring tape along the trench wall or road cut and measuring the orientation of each joint, fracture or discontinuity that was crossed by the tape. Discontinuity orientations were measured using a Brunton compass and recorded on a Discontinuity Characterization Form for each trench (Attachment 1). Over 800 individual measurements of discontinuities from the ISFSI study area are presented on these data forms.

A separate data set of discontinuity surveys were performed for cut slope rock exposures along Reservoir Road, which is coincident with the proposed transport route (RR-1, RR-2, Figure F-2). A total of 37 discontinuity measurements were collected in these road cuts.

All the data from the discontinuity characterization forms were entered into a spread sheet (Excel 2000 running under Microsoft Window 98) on an IBM-compatible computer

(Dell Dimension XPS T800R). The fractures were then analyzed for mean spacing (Figure F-4).

3.0 RESULTS

Joints are pervasive and common throughout the ISFSI study area, and are dominated by steeply-dipping, west-northwest to northwest-striking primary sets. Secondary sets strike northeast, but are subordinate to the primary sets in frequency and continuity. Numerous small faults are present within the rock, and typically exhibit a west-northwest strike with steep dips. The faults, and fault-parallel joints, impart a prominent fabric in the rock, and are the dominant discontinuity features in the ISFSI study area. Faults divide the rock mass into large structural blocks, whereas joints form smaller blocks. Discontinuities in all sets are generally steeply dipping, although a few, less well-developed, low angle joints, probably along indistinct bedding, are present. Some low angle joints clearly occur along bedding surfaces, but bedding does not impart a strong fabric in the rock.

Joint roughness coefficients (JRC) as defined by Barton and Choubey (1977) were estimated for discontinuity surfaces observed in the field. Tables F-1 through F-4 present measured joint roughness coefficient (JRC) values noted on the field Discontinuity Characterization Forms. The JRC measurements provide quantitative estimates of the roughness of discontinuity surfaces that are used for evaluating the frictional resistance of rock blocks to sliding along discontinuities. JRC estimates were made by visually comparing discontinuity surface conditions with standardized roughness profiles presented by Barton and Choubey (1977). The range of JRC values for each of the four rock types tabulated in Tables F-1 through F-4 are graphically shown in Figure F-3.

Faults also provide distinct continuities in the rock mass. Fault data including fault plane geometry, trend and rake of slickensides, and weathering characteristics is shown on Table F-5.

Discontinuities (joints and fractures) have lengths on the order of a few inches to several tens of feet. Discontinuity spacing varies between inches and several feet, averaging between 1 and 3 feet with a maximum of about 14 feet. The fracture spacing varied by trench, as shown on Table F-6 and Figure F-4. Mean spacing ranged between 0.5 and 3.2 feet. The maximum spacing ranged between 1.7 and 14 feet. Beds of friable sandstone contain few apparent discontinuities, with remnant discontinuities visible as linear zones of staining and remnant calcite and other fracture coatings present in places. Beds of friable dolomite with "block-in-matrix" texture have discontinuities within the harder rock blocks but no discontinuities in the soil-like friable matrix.

4.0 REFERENCES

Barton, N.R., and Choubey, V., 1977, The Shear Strength of Rock Joints in Theory and Practice; Rock Mechanics, V.10, No. 1-2, P. 1-54

William Lettis & Associates, Inc., Work Plan, 2000, Additional Geologic Mapping, Exploratory Drilling, and Completion of Kinematic Analyses for the Diablo Canyon Power Plant, Independent Spent Fuel Storage Installation Site, Rev. 2, November 28, 2000.

William Lettis & Associates, Inc., Work Plan, 2001, Additional Exploratory Drilling and Geologic Mapping for the DCPP ISFSI Site, Rev. 1, September 19, 2001.

William Lettis & Associates, Inc., 2001, Diablo Canyon ISFSI Data Report A, Rev. 1, Geologic Mapping in the Plant Site Area and ISFSI Study Area.

William Lettis & Associates, Inc., 2001, Diablo Canyon ISFSI Data Report D, Rev. 1, Trenches in the ISFSI Study Area.

Table F-1. Discontinuity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1})

Trench and Station No. (meters + centimeters)	Discontinuity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-1 1+40	Jo	4-5	4-5		
T-1 1+80	Jo	5-6	5-6		
T-1 2+00	Jo	5-6	5-6		
T-1 2+00	Jo	5-6	5-6		
T-1 2+40	Jo	6-7	6-7		
T-1 2+40	Jo	6-7	6-7		
T-1 2+70	Fa	2-3			2-3
T-1 2+80	Jo	6-7	6-7		
T-1 2+80	Jo	6-7	6-7		
T-1 2+86	Jo	5	5		
T-1 24+36	Fa	2-3			2-3
T-1 24+40	Fa	2-3			2-3
T-1 24+50	Jo	4-5	4-5		
T-1 24+55	Jo	6	6		
T-1 24+64	Jo	4-5	4-5		
T-1 24+68	Jo	5-6	5-6		
T-1 24+86	Jo	3-5	3-5		
T-1 25+10	Jo	6-8	6-8		
T-1 25+28	Jo	5-6	5-6		
T-1 25+40	Jo	6	6		
T-1 25+88	Jo	7-8	7-8		
T-1 26+04	Jo	7	7		
T-1 26+60	Jo	5-6	5-6		
T-1 26+84	Jo	6	6		
T-1 26+84	Jo	6-7	6-7		
T-1 27+20	Jo	6	6		
T-1 27+20	Jo	5-6	5-6		
T-1 27+40	Jo	5	5		
T-1 27+44	Jo	7-8	7-8		
T-1 27+55	Jo	7	7		
T-1 27+62	Jo	6	6		
T-1 27+82	Jo	6-7	6-7		

Table F-1. Discontinuity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinuity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-2A 0+40	Jo	5-6	5-6		
T-2A 0+50	Jo	6-7	6-7		
T-2A 0+63	Jo	5-6	5-6		
T-2A 0+80	Jo	4-5	4-5		
T-2A 0+95	Jo	4-5	4-5		
T-2A 1+00	Jo	4-5	4-5		
T-2A 1+18	Jo	3-4	3-4		
T-2A 1+35	Jo	5-6	5-6		
T-2A 1+65	Jo	3-4	3-4		
T-2A 1+67	Jo	3	3		
T-2A 1+75	Jo (?)	4-5	4-5		
T-2A 1+80	Jo	3	3		
T-2A 2+00	Jo	3	3		
T-2A 2+85.	Jo	4-5	4-5		
T-2A 2+93	Jo	5	5		
T-2A 3+10	Jo	4	4		
T-2A 3+20	Jo	4	4		
T-2A 4+25	Jo	3	3		
T-2A 4+73	Jo	3	3		
T-2A 5+60	Jo	3	3		
T-2A 5+80	Jo	5-6	5-6		
T-2A 5+90	Jo	5	5		
T-2A 6+10	Jo	4-5	4-5		
T-2A 6+50	Jo	2-3	2-3		
T-2A 6+90	Jo	4	4		
T-2A 7+70	Jo	2-3	2-3		
T-2A 9+90	Jo	3-4	3-4		
T-2A 10+70	Jo	3-4	3-4		
T-2A 12+20	Jo	5	5		
T-2A 13+20	Jo	3-4	3-4		
T-2A 14+20	Jo	2-3	2-3		
T-2A 14+20	Jo	2-3	2-3		
T-2A 14+40	Jo	3-4	3-4		
T-2A 14+50	Jo	3-4	3-4		

Table F-1. Discontinunity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-2A 14+60	Jo	0-1	0-1		
T-2A 14+75	Jo	0-1	0-1		
T-2A 15+10	Jo	2	2		
T-2A 15+20	Jo	4	4		
T-2A 15+40	Jo	3	3		
T-2A 15+50	Jo	0-2	0-2		
T-2A 16+25	Jo	2	2		
T-2A 17+00	Jo	3	3		
T-2A 17+06	Jo	2	2		
T-2A 17+50	Jo	4-6	4-6		
T-2A 18+10	Jo	3	3		
T-2A 18+20	Jo	4	4		
T-2A 18+60	Jo	4	4		
T-2A 18+90	Jo	3-5	3-5		
T-2A 19+70	Jo	3	3		
T-2A 19+80	Jo	4-5	4-5		
T-2A 19+90	Jo	4-5	4-5		
T-2A 20+10	Jo	4	4		
T-2A 20+75	Jo	4	4		
T-2A 21+40	Jo	4-5	4-5		
T-2A 21+80	Jo	4	4		
T-2B 21+90	Jo	5	5		
T-2B 22+20	Jo	5	5		
T-2B 24+60	Jo	4	4		
T-2B 24+90	Jo	6	6		
T-2B 25+05	Jo	3	3		
T-2B 25+35	Jo	7	7		
T-2B 25+60	Jo	6	6		
T-2B 25+80	Jo	6	6		
T-2B 26+20	Jo	5-6	5-6		
T-2B 26+60	Jo	4-5	4-5		
T-2B 26+70	Jo	4	4		
T-2B 26+75	Jo	4	4		
T-2B 26+85	Jo	7	7		
T-2B 27+20	Jo	7	7		

Table F-1. Discontinuity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinuity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-2B 27+30	Jo	6-7	6-7		
T-2C 0+00	Fa	3-4			3-4
T-2C 0+00	Fa	3-4			3-4
T-2C 0+70	Jo	5	5		
T-2C 0+80	Jo	4	4		
T-2C 1+10	Fa	3-4			3-4
T-2C 1+10	Jo	4	4		
T-2C 1+20	Jo	3-4	3-4		
T-2C 1+40	Fa	3			3
T-2C 1+70	Jo	5-6	5-6		
T-2C 1+70	Jo	6-7	6-7		
T-2C 3+70	Fa	3			3
T-2C 4+00	Jo	2-3	2-3		
T-2C 4+30	Jo	5-6	5-6		
T-2C 4+90	Jo	4-5	4-5		
T-2C 5+00	Jo	3-4	3-4		
T-2C 5+70	Jo	4-5	4-5		
T-3 0+20	Jo	3	3		
T-3 0+25	Jo	3-4	3-4		
T-3 0+45	Fa	2			2
T-3 0+50	Jo	3	3		
T-3 1+60	Jo	2-3	2-3		
T-3 2+40	Jo	3-4	3-4		
T-3 3+15	Jo	4	4		
T-3 3+70	Jo	5-6	5-6		
T-3 4+50	Jo	3	3		
T-3 5+35	Jo	4-6	4-6		
T-3 5+35	Jo	4-6	4-6		
T-3 5+35	Jo	5	5		
T-3 5+75	Jo	3	3		
T-3 5+90	Jo	3-5	3-5		
T-3 7+00	Fa	2-3			2-3
T-3 7+20	Jo	4-5	4-5		
T-3 7+30	Jo	3-4	3-4		
T-3 7+50	Fa	2-3			2-3

Table F-1. Discontinunity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation: Joints	Bedding	Faults / Shears
T-3 8+40	Jo	3-4	3-4		
T-3 8+60	Jo	4-5	4-5		
T-3 9+00	Jo	3-5	3-5		
T-3 9+55	Jo	3-4	3-4		
T-3 9+60	Jo	3-4	3-4		
T-3 9+90	Jo	4-5	4-5		
T-3 10+00	Jo	6	6		
T-4 0+60	Jo	5	5		
T-4 0+70	Jo	3-4	3-4		
T-4 0+70	crushed zone	3-4	3-4		
T-4 2+00	Jo	4	4		
T-4 2+10	Jo	3-4	3-4		
T-4 2+15	Jo	4-5	4-5		
T-4 2+25	Jo	3-4	3-4		
T-4 2+45	Jo	3-4	3-4		
T-4 2+50	Jo	3-4	3-4		
T-4 2+60	Jo	4-5	4-5		
T-4 2+80	Jo	3-4	3-4		
T-4 2+92	Jo	5	5		
T-4 3+08	Jo	4	4		
T-4 3+28	Jo	5-6	5-6		
T-4 3+28	Jo	4-5	4-5		
T-4 3+40	Jo	4-5	4-5		
T-4 3+60	Jo	5-6	5-6		
T-4 3+78	Jo	3-4	3-4		
T-4 3+82	Jo	5-6	5-6		
T-4 3+94	Jo	3-4	3-4		
T-4 4+10	Jo	4-5	4-5		
T-4 4+20	Jo	6-7	6-7		
T-4 4+30	Jo	4-5	4-5		
T-4 4+50	Jo	3-4	3-4		
T-4 4+52	Jo	4	4		
T-4 4+68	Fa	4			4
T-4 4+78	Jo	5	5		
T-4 4+80	Jo	5-6	5-6		

Table F-1. Discontinunity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-4 4+90	Jo	4-5	4-5		
T-4 4+90	Jo	3	3		
T-4 5+10	Jo	4-5	4-5		
T-4 5+48	Jo	3-4	3-4		
T-4 5+56	Jo	3-4	3-4		
T-4 5+62	Jo	4	4		
T-4 5+92	Jo	5	5		
T-4 6+00	Jo	4-5	4-5		
T-4 6+14	Jo	3-4	3-4		
T-4 6+30	Jo	3-4	3-4		
T-4 6+40	Jo	5-6	5-6		
T-4 6+60	Jo	5	5		
T-4 6+68	Jo	7-8	7-8		
T-4 7+02	Jo	4	4		
T-4 7+02	Jo	3-4	3-4		
T-4 7+28	Jo	4	4		
T-4 7+32	crushed zone	3-4	3-4		
T-4 7+42	Jo	4-5	4-5		
T-4 7+60	Jo	3	3		
T-4 8+02	Jo	3-4	3-4		
T-4 8+28	Jo	3-4	3-4		
T-4 8+60	Jo	4-5	4-5		
T-4 9+12	Jo	3	3		
T-4 9+30	Jo	3	3		
T-5 0+05	Bd	4		4	
T-5 0+05	Jo	3	3		
T-5 1+20	Bd	4-5		4-5	
T-5 2+50	Jo	5		5	
T-5 4+00	Jo	5	5		
T-5 5+00	Jo	4	4		
T-5 5+40	Jo	6	6		
T-5 5+50	Jo	5	5		
T-5 5+60	Jo	5-6	5-6		
T-5 6+70	Jo	3	3		
T-5 7+40	Jo	5	5		

Table F-1. Discontinunity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-5 8+40	Fa	4			4
T-5 8+50	Fa	6-8			6-8
T-5 8+70	Jo	4	4		
T-5 9+60	Jo	4-5	4-5		
T-5 9+90	Jo	5-6	5-6		
T-5 10+00	Fa	4-6			4-6
T-5 10+70	Jo	4	4		
T-5 10+90	Jo	4	4		
T-5 11+00	Jo	6-7	6-7		
T-5 11+40	Jo	7	7		
T-5 11+75	Jo	5	5		
T-5 12+00	Jo	4	4		
T-5 12+20	Jo	6	6		
T-5 12+50	Jo	5	5		
T-5 12+70.	Bd	3-4		3-4	
T-5 12+80	Jo	5	5		
T-5 13+00	Jo	5	5		
T-5 13+05	Fa	4			4
T-5 13+30	Jo	4	4		
T-5 13+60	Jo	5	5		
T-5 14+40	Jo	7	7		
T-5 14+40	Jo	5	5		
T-5 14+50	Bd	4		4	
T-5 15+30	Jo	4	4		
T-5 15+55	Jo	5	5		
T-5 15+80	Jo	5	5		
T-5 16+00	Jo	3-4	3-4		
T-5 16+30	Jo	3-4	3-4		
T-5 16+40	Jo	6-7	6-7		
T-5 16+60	Jo	7	7		
T-5 16+80	Jo	5	5		
T-5 16+90	Jo	5-6	5-6		
T-5 17+60	Jo	6-7	6-7		
T-5 17+90	Fa	3			3
T-5 18+40	Jo (Breccia zone)	5	5		

Table F-1. Discontinunity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-5 18+50	Jo	4-5	4-5		
T-5 19+00	Jo	4	4		
T-5 19+00	Jo	6	6		
T-5 19+10	Bd	6		6	
T-5 19+10	Jo	4	4		
T-5 19+10	Jo	4	4		
T-5 19+70	Jo	5-6	5-6		
T-5 20+00	Jo	6	6		
T-6 10+58	Jo	3-4	3-4		
T-6 10+80	Jo	4-5	4-5		
T-6 11+08	Jo	2-3	2-3		
T-6 11+10	Fa	1-2			1-2
T-6 11+60	Jo	3-4	3-4		
T-6 11+80	Jo	5-7	5-7		
T-6 11+88	Jo	5-6	5-6		
T-6 11+90	Jo	3	3		
T-6 12+06	Jo	5-6	5-6		
T-6 12+28	Jo	6-7	6-7		
T-6 12+70	Jo	5-6	5-6		
T-6 12+80	Jo	2-4	2-4		
T-6 13+76	Jo	3-4	3-4		
T-6 13+84	Jo	6-7	6-7		
T-6 13+84	Jo	6-7	6-7		
T-6 14+02	Bd	5-6		5-6	
T-6 14+02	Jo	4-5	4-5		
T-6 14+40	Jo	3-4	3-4		
T-6 14+60	Jo	3-4	3-4		
T-6 14+80	Jo	4-5	4-5		
T-6 15+02	Bd	2-3		2-3	
T-6 15+90	Jo	3-4	3-4		
T-6 16+02	Jo	2-3	2-3		
T-6 16+24	Jo	3-4	3-4		
T-6 16+60	Jo	5-6	5-6		
T-6 16+82	Jo	5-6	5-6		
T-6 17+20	Jo	3-4	3-4		

Table F-1. Discontinuity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-6 17+50	Bd	3-4		3-4	
T-6 18+14	Jo	3-4	3-4		
T-6 18+24	Bd	5-6		5-6	
T-6 18+40	Jo	5-6	5-6		
T-11A 0+77	Jo	5-6	5-6		
T-11A 0+80	Jo	4-5	4-5		
T-11A 1+30	Jo	5	5		
T-11A 2+40	Jo	5	5		
T-11A 2+60	Jo	5	5		
T-11A 3+65	Jo	3	3		
T-11A 4+20	Jo	5-6	5-6		
T-11A 4+20	Jo	4-5	4-5		
T-11A 4+80	Jo	3	3		
T-11A 5+70	Jo	5	5		
T-11A 5+70	Jo	3-4	3-4		
T-11A 6+50	Jo	3-4	3-4		
T-11A 7+30	Jo	3	3		
T-11A 7+30	Jo	6	6		
T-11A 8+00	Jo	2-3	2-3		
T-11A 8+30	Jo	4-5	4-5		
T-11A 8+50	Jo	2-3	2-3		
T-11A 8+70	Jo	4	4		
T-11A 9+00	Jo	2-3	2-3		
T-11A 9+10	Jo	2	2		
T-11A 9+40	Jo	4	4		
T-11A 10+60	Jo	4	4		
T-11A 10+60	Jo	3	3		
T-11A 10+90	Jo	3	3		
T-11A 10+90	Jo	3-4	3-4		
T-11A 10+90	Bd	4-5		4-5	
T-11A 11+10	Jo	3	3		
T-11A 12+30	Jo	5	5		
T-11B 0+40	Jo	5-6	5-6		
T-11B 0+70	Jo	5-6	5-6		
T-11B 0+80	Jo	6-7	6-7		

Table F-1. Discontinuity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinuity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-11B 2+45	Jo	3	3		
T-11B 3+00	Jo	4-5	4-5		
T-11B 4+30	Jo	3	3		
T-11B 4+50	Jo	3-4	3-4		
T-11B 4+50	Jo	6-7	6-7		
T-11B 5+50	Jo	4-5	4-5		
T-12 3+30	Jo	5-6	5-6		
T-12 4+00	Jo	3-4	3-4		
T-12 4+00	Fa	3-8			3-8
T-12 4+30	Jo	4	4		
T-12 5+02	Jo	5-6	5-6		
T-12 6+00	Jo	3	3		
T-12 7+40	Jo	4-5	4-5		
T-12 7+80	Jo	5-6	5-6		
T-12 7+80	Jo	3-4	3-4		
T-12 8+30	Jo	3	3		
T-12 12+60	Jo	3-4	3-4		
T-12 13+10	Jo	4-5	4-5		
T-12 13+60	Jo	3	3		
T-12 13+60	Jo	4-5	4-5		
T-12 14+00	Fa	5			5
T-12 14+30	Fa	6-7			6-7
T-13 0+00	Jo	4-5	4-5		
T-13 1+80	Jo	5-6	5-6		
T-13 2+10	Jo	4-5	4-5		
T-13 2+90	Jo	5-6	5-6		
T-13 5+50	Jo	2-3	2-3		
T-13 6+30	Jo	3	3		
T-13 7+00	Fa	3			3
T-13 7+10	Fa	3			3
T-13 7+40	Jo	6	6		
T-13 7+60	Jo	5	5		
T-13 7+90	Jo	5	5		
T-13 8+50	Jo	4	4		
T-13 8+60	Jo	3-4	3-4		

Table F-1. Discontinunity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-13 8+60	Jo	4-5	4-5		
T-13 11+90	Jo	5	5		
T-13 14+50	Jo	4-5	4-5		
T-13 18+10	Jo	5	5		
T-13 18+50	Jo	5-6	5-6		
T-13 18+60	Jo	3	3		
T-13 18+80	Jo	3	3		
T-13 19+30	Jo	7	7		
T-13 19+50	Jo	3-4	3-4		
T-14 0+30	Jo	3	3		
T-14 0+50	Jo	4	4		
T-14 0+70	Jo	3-4	3-4		
T-14 0+85	Jo	5	5		
T-14 1+00	Jo	6-7	6-7		
T-14 1+10	Jo	6	6		
T-14 1+10	Jo	6-7	6-7		
T-14 1+10	Jo	5	5		
T-14 1+40	Jo	7	7		
T-14 1+40	Jo	6	6		
T-14 1+50	Jo	6-7	6-7		
T-14 1+60	Jo	5	5		
T-14 1+90	Jo	4	4		
T-14 2+10	Jo	6	6		
T-14 2+40	Jo	6	6		
T-14 3+00	Jo	8	8		
T-14 3+30	Jo	5	5		
T-14 4+00	Jo	4-5	4-5		
T-14 4+30	Jo	4-5	4-5		
T-14 4+50	Jo	7-8	7-8		
T-14 4+50	Jo	3-4	3-4		
T-14 4+70	Jo	5	5		
T-14 4+80	Jo	6-7	6-7		
T-14 6+20	Jo	5-6	5-6		
T-14 6+60	Jo	7	7		
T-14 7+00	Jo	4	4		

Table F-1. Discontinuity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinuity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-14 7+20	Jo	4	4		
T-14 7+60	Jo	3	3		
T-14 7+70	Jo	4-5	4-5		
T-14 8+10	Jo	3	3		
T-14 8+50	Jo	2-3	2-3		
T-14 8+70	Jo	3	3		
T-14 8+90	Jo	3	3		
T-14 9+10	Jo	3-4	3-4		
T-14 9+50	Jo	6-7	6-7		
T-14 9+70	Jo	6-7	6-7		
T-14 10+50	Jo	6-7	6-7		
T-14 10+70	Jo	6	6		
T-14 10+70	Jo	4	4		
T-14 12+80	Jo	2	2		
T-14 13+20	Jo	3	3		
T-14 14+20	Jo	5	5		
T-14 15+40	Jo	8	8		
T-14 21+40	Jo	6-7	6-7		
T-14 21+40	Jo	6-7	6-7		
T-15 1+20	Jo	3-4	3-4		
T-15 2+00	Jo	5-6	5-6		
T-15 3+30	Jo	5	5		
T-15 3+60	Jo	4	4		
T-15 4+00	Jo	4	4		
T-15 4+70	Jo	6	6		
T-15 5+10	Jo	6	6		
T-15 5+20	Jo	4	4		
T-15 5+20	Jo	4	4		
T-15 5+80	Jo	6	6		
T-15 5+80	Jo	6	6		
T-15 6+30	Jo	7	7		
T-15 6+90	Jo	4-5	4-5		
T-15 7+60	Jo	3-4	3-4		
T-15 7+80	Jo	2-3	2-3		
T-15 8+10	Jo	4-8	4-8		

Table F-1. Discontinunity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-15 8+40	Jo	4	4		
T-15 9+50	Jo	5	5		
T-15 9+70	Jo	6-7	6-7		
T-15 9+70	Jo	5	5		
T-15 9+80	Jo	3-4	3-4		
T-15 11+30	Jo	4	4		
T-15 17+00	Jo	4-5	4-5		
T-15 18+20	Jo	3-4	3-4		
T-15 18+30	Jo	4	4		
T-15 18+80	Jo	4-5	4-5		
T-15 19+10	Jo	4	4		
T-15 19+30	Jo	4-5	4-5		
T-15 19+50	Fa	4-5			4-5
T-17 0+16	Jo	6-10	6-10		
T-17 0+25	Jo	8-10	8-10		
T-17 0+25	Jo	6-10	6-10		
T-17 0+39	Jo	10-14	10-14		
T-17 0+66	Jo	6-10	6-10		
T-17 0+74	Jo	4-6	4-6		
T-17 0+88	Jo	4-8	4-8		
T-17 0+88	Jo	6-8	6-8		
T-17 1+14	Jo	6-10	6-10		
T-17 1+24	Jo	10-14	10-14		
T-17 1+40	Jo	6-10	6-10		
T-17 2+19	Jo	4-6	4-6		
T-17 2+35	Jo	6-8	6-8		
T-17 2+75	Jo	4-8	4-8		
T-17 2+95	Jo	6-10	6-10		
T-17 3+18	Jo	8-10	8-10		
T-17 3+30	Jo	6-10	6-10		
T-17 3+40	Jo	6-10	6-10		
T-17 3+70	Jo	8-12	8-12		
T-17 3+90	Jo	6-8	6-8		
T-17 4+50	Jo	4-8	4-8		
T-17 4+70	Jo	8-12	8-12		

Table F-1. Discontinunity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation: Joints	Bedding	Faults / Shears
T-17 5+60	Fa	8-10			8-10
T-17 6+10	Jo	4-6	4-6		
T-17 6+17	Jo	6-8	6-8		
T-17 6+37	Jo	10-12	10-12		
T-17 6+61	Jo	8-10	8-10		
T-17 6+28	Jo	4-6	4-6		
T-17 7+30	Jo	6-10	6-10		
T-17 7+55	Jo	4-6	4-6		
T-17 7+98	Jo	6-8	6-8		
T-17 8+40	Jo	4-6	4-6		
T-17 8+68	Jo	4-6	4-6		
T-17 8+90	Jo	6-8	6-8		
T-17 9+00	Jo	4-6	4-6		
T-17 9+74	Fa	6-8			6-8
T-17 9+88	Fa	6-10			6-10
T-17 10+15	Jo	8-10	8-10		
T-17 10+40	Fa	2-4			2-4
T-17 10+60	Jo	6-8	6-8		
T-17 10+66	Jo	8-12	8-12		
T-17 10+82	Jo	6-8	6-8		
T-17B 0+26	Jo	6-8	6-8		
T-17B 0+45	Jo	6-8	6-8		
T-17B 0+53	Jo	10-12	10-12		
T-17B 1+18	Jo	4-6	4-6		
T-17B 2+12	Jo	6-8	6-8		
T-17B 3+00	Jo	8-10	8-10		
T-17B 3+62	Jo	4-8	4-8		
T-17B 3+84	Jo	6-8	6-8		
T-17B 4+28	Jo	6-8	6-8		
T-17B 4+60	Jo	8-10	8-10		
T-17B 5+10	Jo	8-10	8-10		
T-17B 5+60	Jo	8-10	8-10		
T-17B 5+90	Jo	8-10	8-10		
T-17B 6+10	Jo	8-10	8-10		
T-17B 6+21	Jo	6-8	6-8		

Table F-1. Discontinunity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-17B 6+35	Jo	6-8	6-8		
T-17B 6+48	Jo	10-12	10-12		
T-17B 6+62	Jo	6-8	6-8		
T-17B 7+06	Jo	6-8	6-8		
T-17B 7+36	Jo	10-12	10-12		
T-17B 7+77	Jo	10-12	10-12		
T-17B 8+00	Jo	8-10	8-10		
T-18A 0+20	Jo	2-4	2-4		
T-18A 0+60	Jo	4-6	4-6		
T-18A 1+05	Jo	8-10	8-10		
T-18A 1+40	Jo	8-10	8-10		
T-18A 1+60	Jo	6-8	6-8		
T-18A 1+90	Jo	6-8	6-8		
T-18A 2+00	Jo	8-10	8-10		
T-18A 2+38	Jo	12-14	12-14		
T-18A 2+38	Jo	8-10	8-10		
T-18A 3+10	Jo	6-8	6-8		
T-18A 3+10	Jo	8-10	8-10		
T-18A 4+00	Jo	10-12	10-12		
T-18A 4+60	Jo	8-10	8-10		
T-18A 5+70	Jo	6-8	6-8		
T-18A 2+90	Jo	8-10	8-10		
T-18A 3+80	Jo	8-10	8-10		
T-18A 5+10	Jo	8-10	8-10		
T-18B 0+40	Jo	6-10	6-10		
T-18B 0+60	Jo	6-10	6-10		
T-18B 0+72	Jo	6-8	6-8		
T-18B 0+89	Jo	8-10	8-10		
T-18B 0+90	Jo	8-12	8-12		
T-18B 1+00	Jo	6-12	6-12		
T-18B 1+20	Jo	4-6	4-6		
T-18B 1+21	Jo	6	6		
T-18B 1+45	Jo	4-6	4-6		
T-18B 1+60	Jo	6-8	6-8		
T-18B 1+68	Jo	6-10	6-10		

Table F-1. Discontinunity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation: Joints	Bedding	Faults / Shears
T-18B 1+82	Jo	8-10	8-10		
T-18B 1+94	Jo	8-10	8-10		
T-18B 2+00	Jo	6-8	6-8		
T-18B 2+08	Jo	4-6	4-6		
T-18B 2+15	Fa	6-8			6-8
T-18B 2+64	Jo	8-10	8-10		
T-18B 2+78	Jo	6-8	6-8		
T-18B 2+94	Jo	6-10	6-10		
T-18B 3+10	Jo	6-8	6-8		
T-18B 3+24	Jo	2-4	2-4		
T-18B 3+40	Jo	2-4	2-4		
T-18B 3+98	Jo	6-8	6-8		
T-18B 3+98	Jo	6-8	6-8		
T-18B 4+30	Jo	2-4	2-4		
T-18B 4+30	Jo	4-6	4-6		
T-18B 5+44	Jo	6-8	6-8		
T-18B 6+60	Jo	6-8	6-8		
T-18B 6+70	Jo	4-6	4-6		
T-18B 7+23	Jo	4-6	4-6		
T-18B 7+60	Jo	6-8	6-8		
T-18B 7+70	Jo	6-8	6-8		
T-18B 7+80	Jo	4-6	4-6		
T-18B 8+00	Jo	6-8	6-8		
T-18B 8+15	Fa	6-12			6-12
T-18B 8+54	Jo	8-10	8-10		
T-18B 8+68	Jo	6-10	6-10		
T-18B 8+96	Jo	8-10	8-10		
T-18B 9+10	Jo	6-8	6-8		
T-18B 9+28	Jo	4-6	4-6		
T-18B 9+50	Jo	6-8	6-8		
T-18B 9+66	Fa	4-8			4-8
T-18B 9+90	Jo	4-6	4-6		
T-18B 9+90	Jo	4-6	4-6		
T-18B 10+40	Jo	6-8	6-8		
T-18B 10+70	Jo	4-6	4-6		

Table F-1. Discontinuity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinuity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-18B 10+78	Jo	6-8	6-8		
T-19 1	Jo	6-8	6-8		
T-19 2	Jo	4-6	4-6		
T-19 3	Jo	4-6	4-6		
T-19 4	Jo	4-6	4-6		
T-19 5	Jo	4-6	4-6		
T-19 6	Jo	2-4	2-4		
T-19 7	Jo	6-8	6-8		
T-19 8	Jo	4-6	4-6		
T-19 9	Jo	6-8	6-8		
T-19 10	Jo	8-10	8-10		
T-19 11	Jo	8-10	8-10		
T-19 12	Jo	8-10	8-10		
T-19 13	Jo	6-8	6-8		
T-19 14	Jo	6-8	6-8		
T-20B 0-40	Jo	4-6	4-6		
T-20B 0-05	Jo	8-10	8-10		
T-20B 0+00	Jo	8-10	8-10		
T-20B 0+01	Jo	6-8	6-8		
T-20B 0+35	Jo	6-8	6-8		
T-20B 0+70	Jo	4-6	4-6		
T-20B 2+3	Jo	2-4	2-4		
T-20B 2+65	Jo	2-4	2-4		
T-20B 2+9	Jo	4-6	4-6		
T-20B 3+15	Fa	2-4			2-4
T-20B 3+4	Jo	8-10	8-10		
T-20B 3+5	Jo	6-8	6-8		
T-20B 4+2	Jo	8-10	8-10		
T-20B 7+0	Jo	8-12	8-12		
T-20B 7+4	Jo	6-8	6-8		
T-20B 7+9	Jo	8-10	8-10		
T-20B 7+9	Bd	2-4		2-4	
T-20B 7+9	Jo	8-10	8-10		
T-20B 7+7	Jo	8-10	8-10		
T-21 1+25	Jo	4-6	4-6		

Table F-1. Discontinunity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-21 1+50	Jo	4-6	4-6		
T-21 14+00	Jo	6-8	6-8		
T-21 15+00	Jo	2-4	2-4		
T-21 16+50	Jo	4-6	4-6		
T-21 19+00	Jo	2-4	2-4		
T-21 18+50	Jo	6-8	6-8		
T-21 20+00	Jo	8-10	8-10		
T-21 20+50	Jo	6-8	6-8		
T-21 23+00	Jo	4-6	4-6		
T-21 23+50	Jo	4-6	4-6		
T-21 26+00	Jo	6-8	6-8		
T-21 26+00	Jo	6-8	6-8		
T-21 26+50	Jo	8-10	8-10		
RR-1 24	Bd	4-6		4-6	
RR-1 25	Jo	4-6	4-6		
RR-1 26	Jo	6-8	6-8		
RR-1 27	Jo	6	6		
RR-1 28	Bd	6		6	
RR-1 29	Jo	8-10	8-10		
RR-1 30	Jo	8	8		
RR-1 31	Bd	6		6	
RR-1 32	Jo	6	6		
RR-1 33	Jo	6-8	6-8		
RR-1 34	Bd	4		4	
RR-1 35	Jo	8-10	8-10		
RR-1 36	Jo	10	10		
RR-1 37	Jo	8	8		
DS-1 0+10	Jo	10-12	10-12		
DS-1 0+30	Jo	10	10		
DS-1 0+30	Jo	12	12		
DS-1 0+50	Jo	6-8	6-8		
DS-1 0+70	Jo	14	14		
DS-1 0+90	Jo	8-10	8-10		
DS-1 0+90	Jo	6-8	6-8		
DS-1 1+00	Jo	8-10	8-10		

Table F-1. Discontinunity Joint Roughness Coefficient Table - Dolomite (Tof_{b-1}) (Continued)

No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
DS-1 1+00	Jo	6-8	6-8		
DS-1 1+50	Jo	6-8	6-8		
DS-1 1+50	Jo	4-6	4-6		
DS-1 1+80	Jo	4-6	4-6		
DS-1 3+00	Jo	6-8	6-8		
DS-1 3+80	Jo	14-16	14-16		
DS-1 3+80	Fa	8-10			8-10
DS-1 4+10	Fa	6-8			6-8
DS-1 4+10	Fa	6-8			6-8
DS-1 4+80	Jo	4-6	4-6		
DS-1 4+80	Fa	6-8			6-8
DS-1 5+00	Jo	8-10	8-10		
DS-1 5+20	Jo	6-8	6-8		
DS-1 5+20	Fa	14-16			14-16
DS-1 5+50	Fa	12-14			12-14
DS-1 5+80	Fa	6-8			6-8
DS-1 5+80	Fa	6-8			6-8
		JRC Compilation Value Average=	5.60	4.40	5.54
		JRC Compilation Value Standard Deviation=	2.29	1.22	3.24
			Joints	Bedding	Faults / Shears

Table F-2. Discontinuity Joint Roughness Coefficient Table - Sandstone (Tof_{b-2})

Trench and Station No. (meters + centimeters)	Discontinuity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-1 3+26	Jo	4-5	4-5		
T-1 3+27	Jo	4-5	4-5		
T-1 3+28	Jo	4-5	4-5		
T-1 3+55	Fa	2-3			2-3
T-1 3+70	Jo	4-6	4-6		
T-1 3+75	Jo	4-6	4-6		
T-1 3+80	Jo	4-6	4-6		
T-1 4+06	Fa	2-3			2-3
T-1 22+64	Jo	7-8	7-8		
T-1 22+76	Jo	5-6	5-6		
T-1 22+94	Jo	5-7	5-7		
T-1 23+06	Jo	5-6	5-6		
T-1 23+08	Jo	6	6		
T-1 23+24	Jo	3-4	3-4		
T-1 23+60	Jo	6-7	6-7		
T-1 23+68	Jo	5-4	5-4		
T-1 24+00	Fa	2-3			2-3
T-1 24+04	Fa	2-3			2-3
T-17 11+05	Fa	6-10			6-10
T-17 11+76	Fa	2-4			2-4
T-17 12+02	Fa	2-4			2-4
T-17 11+74	Jo	4-6	4-6		
T-17 12+30	Jo	4-6	4-6		
T-17 12+62	Jo	4-6	4-6		
T-17 12+64	Jo	2-4	2-4		
T-17 12+80	Jo	2-4	2-4		
T-17 13+70	Jo	8-10	8-10		
T-17 14+12	Jo	4-6	4-6		
T-17 15+10	Jo	4-8	4-8		
T-17 15+30	Fa	2-4			2-4
T-17 15+60	Jo	4-6	4-6		
T-17 15+90	Jo	10-12	10-12		

Table F-2. Discontinunity Joint Roughness Coefficient Table - Sandstone (Tof_{b-2}) (Continued)

Trench and Station No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-17 16+30	Fa	2-4			2-4
T-17 16+50	Jo	4-6	4-6		
T-17 16+50	Jo	6-10	6-10		
T-17 16+82	Jo	4-6	4-6		
T-17 17+28	Jo	4-6	4-6		
T-17 17+45	Jo	4-6	4-6		
T-17 17+80	Jo	6-8	6-8		
T-17 17+94	Jo	4-6	4-6		
T-17 18+10	Jo	8-10	8-10		
T-17 18+20	Jo	4-6	4-6		
T-17 18+72	Fa	4-6			4-6
T-17 19+00	Fa	2-6			2-6
T-17 19+23	Fa	6-8			6-8
T-17 19+37	Jo	2-4	2-4		
T-17 19+47	Jo	4-6	4-6		
T-17 20+11	Jo	4-6	4-6		
T-17 20+45	Jo (Fa?)	6-8	6-8		
T-17 20+93	Jo	6-8	6-8		
T-17 21+19	Jo	4-6	4-6		
T-17 21+27	Jo	2-4	2-4		
T-17 21+27	Jo	2-4	2-4		
T-17 22+43	Jo	2-4	2-4		
T-17 22+55	Jo	2-4	2-4		
T-17 25+20	Fa	0-2			0-2
T-17 25+40	Jo	2-6	2-6		
T-17 25+43	Jo	4-6	4-6		
T-17 25+47	Jo	4-6	4-6		
T-17 26+40	Jo	6-8	6-8		
T-17 28+38	Jo	4-6	4-6		
T-17 28+65	Jo	2-4	2-4		
T-17 28+73	Jo	4-6	4-6		
T-17 29+08	Jo	2-6	2-6		
T-17 29+44	Jo	2-4	2-4		

Table F-2. Discontinunity Joint Roughness Coefficient Table - Sandstone (Tof_{b-2}) (Continued)

Trench and Station No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation		
			Joints	Bedding	Faults / Shears
T-17 30+30	Jo	4-6	4-6		
T-17 30+75	Jo	4-6	4-6		
RR-1 1	Jo	14	14		
RR-1 2	Jo	6	6		
RR-1 3	Jo	8	8		
RR-2 4	Jo	12-14	12-14		
RR-2 5	Jo	6-8	6-8		
RR-2 6	Jo	8-10	8-10		
RR-2 7	Jo	8-10	8-10		
RR-2 8	Jo	6-8	6-8		
RR-2 9	Jo	10-12	10-12		
RR-2 10	Jo	8-10	8-10		
RR-2 11	Jo	8	8		
RR-2 12	Jo	6-8	6-8		
RR-2 13	Jo	10-12	10-12		
RR-2 16	Bd	6		6	
RR-2 17	Jo	4-6	4-6		
RR-2 18	Jo	8	8		
RR-2 19	Jo	8	8		
RR-2 20	Bd	6-8		6-8	
RR-2 21	Jo	8	8		
RR-2 22	Jo	12-14	12-14		
RR-2 23	Bd	6		6	

	Joints	Bedding	Faults / Shears
JRC Compilation Value Average=	5.99	6.50	3.60
JRC Compilation Value Standard Deviation=	2.64	1.00	2.27
	Joints	Bedding	Faults / Shears

Table F-3. Discontinunity Joint Roughness Coefficient Table - Friable Dolomite (Tof_{b-1a})

Trench and Station No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation: Joints	Bedding	Faults / Shears
T-6 0+64	Jo	3-4	3-4		
T-6 0+64	Jo	3	3		
T-6 2+53	Jo	4-5	4-5		
T-6 4+02	Jo	3	3		
T-6 4+40	Jo	3	3		
T-6 4+60	Jo	2-3	2-3		
T-6 4+98	Jo	2-3	2-3		
T-6 5+60	Jo	4-5	4-5		
T-6 5+72	Jo	2-3	2-3		
T-6 6+28	Jo	3-4	3-4		
T-6 7+26	Jo	3	3		
T-6 7+56	Jo	2-3	2-3		
T-6 7+88	Jo	2-3	2-3		
T-6 8+72	Fa	2-3			2-3
T-6 8+84	Jo	3-4	3-4		
T-6 8+88	Jo	3-4	3-4		
T-6 9+40	Jo	3	3		
T-6 9+40	Jo	2-3	2-3		
T-6 9+64	Jo	3-4	3-4		
T-6 10+08	Jo	3-4	3-4		
T-6 10+08	Jo	5-6	5-6		
T-6 10+08	Jo	4	4		
T-6 10+36	Jo	3-4	3-4		
	JRC Compilation Value Average=		3.34	0	2.50
	JRC Compilation Value Standard Deviation=		0.94	0	0.71
			Joints	Bedding	Faults / Shears

Table F-4. Discontinunity Joint Roughness Coefficient Table - Friable Sandstone (Tof_{b-2a})

Trench and Station No. (meters + centimeters)	Discontinunity Type	JRC Range	JRC Value Compilation: Joints	JRC Value Compilation: Bedding	JRC Value Compilation: Faults / Shears
T-1 4+34	Jo	5	5		
T-1 4+34	Jo	4	4		
T-14+56	Jo	6-7	6-7		
T-1 4+62	Jo	5	5		
T-1 14+60	Fa	2			2
T-1 16+34	Fa	2-3			2-3
T-1 16+38	Fa	2-3			2-3
T-1 21+50	Jo	3-5	3-5		
T-1 21+68	Jo	5-7	5-7		
T-1 21+72	Jo	8-9	8-9		
T-1 21+90	Jo	4-6	4-6		
T-1 22+20	Jo	5-7	5-7		
T-1 22+32	Jo	5-6	5-6		
T-1 22+44	Jo	7	7		
	JRC Compilation Value Average=		5.78	0.00	2.40
	JRC Compilation Value Standard Deviation=		1.52	0.00	0.55
			Joints	Bedding	Faults / Shears

Table F-5: Discontinuity Data for Minor Faults[1]

Trench/Field Number	Trench Location	Fault Strike	Fault Dip	Fault Striation Rake	Slickensides (s) or mullions (m)	Person and Date
T-1	St. 23	170	85 S	50 S	m	JLB 6/9/00
T-1	St. 24	297	72 S	5-10 W	s	CMB 6/9/00
T-2A	St 0.4	279	70 S	8 E	m	JLB 6/11/00
T-2A	St. 15	286	75 NE	20 W	s	JLB 6/11/00
T-2C	St. 3.6	281	70 N	68 E	s	JNB/CMB 6/20/00
T-2C	St. 1.2	264	84 S	15 W	s	JNB/CMB 6/20/00
T-2C	St. 0	280	70 S	0	s	JNB/CMB 6/20/00
T-2C	St. 0	295	80 S	0	s	JNB/CMB 6/20/00
T-3	St. 7.5	295	55-75 S	18 SE	m	WDP 7/10/00
T-5	St. 18	70	85 N	2 E	s	WDP 8/2/00
T-7	St. 3.6	265	65 N	15 E	s	JLB 6/12/00
T-11A	St. 6	304	81 S	43 E	s	RDK 8/8/00
T-11A	St. 2.4	282	87 N	Subhor.	s	RDK 8/8/00
T-11C	St. 3.5	85	73 S	Subhor.	s	JNB 6/19/00
T-12	St. 4	291	75 N	10 E	s	JNB 6/20/00
T-12	St. 4	291	75 N	8 E	m	JNB 6/20/00
T-12	St. 4.7	300	56 S	10 E	s	JNB 6/20/00
T-12	St. 14	292	60 S	10 W	s	JNB 6/20/00
T-13	St. 6.5	301	44 S	10 W	s	JNB 6/20/00
T-14B	St. 1.0	95	81 N	0	m	JLB 8/7/00
T-14B	St. 1.5	101	86 S	Subhor.	m	JLB 8/7/00
T-14B	St. 2.0	104	88 N	Subhor.	m	JLB 8/7/00
T-15	St. 18.5	297	83 N	Subhor.	s	JNB 6/20/00
T-17A	St. 41	265	84 N	65 W	s	JLB 8/2/00
T-17A	St. 39	296	80 N	47 W	s	JLB 8/2/00
T-17A	St. 45.5	254	65 N	Subhor.	s	JLB 8/2/00
T-17A	St. 11	90	85 S	Subhor.	s	JLB 8/2/00
T-18B	St. 7.5	300	86-90 S	Subhor.-45	m	JLB 8/23/00
T-20A	St. 26	298	63 S	16 SE	s	JLB 11/30/00

Table F-5: Discontinuity Data for Minor Faults[1] (continued)

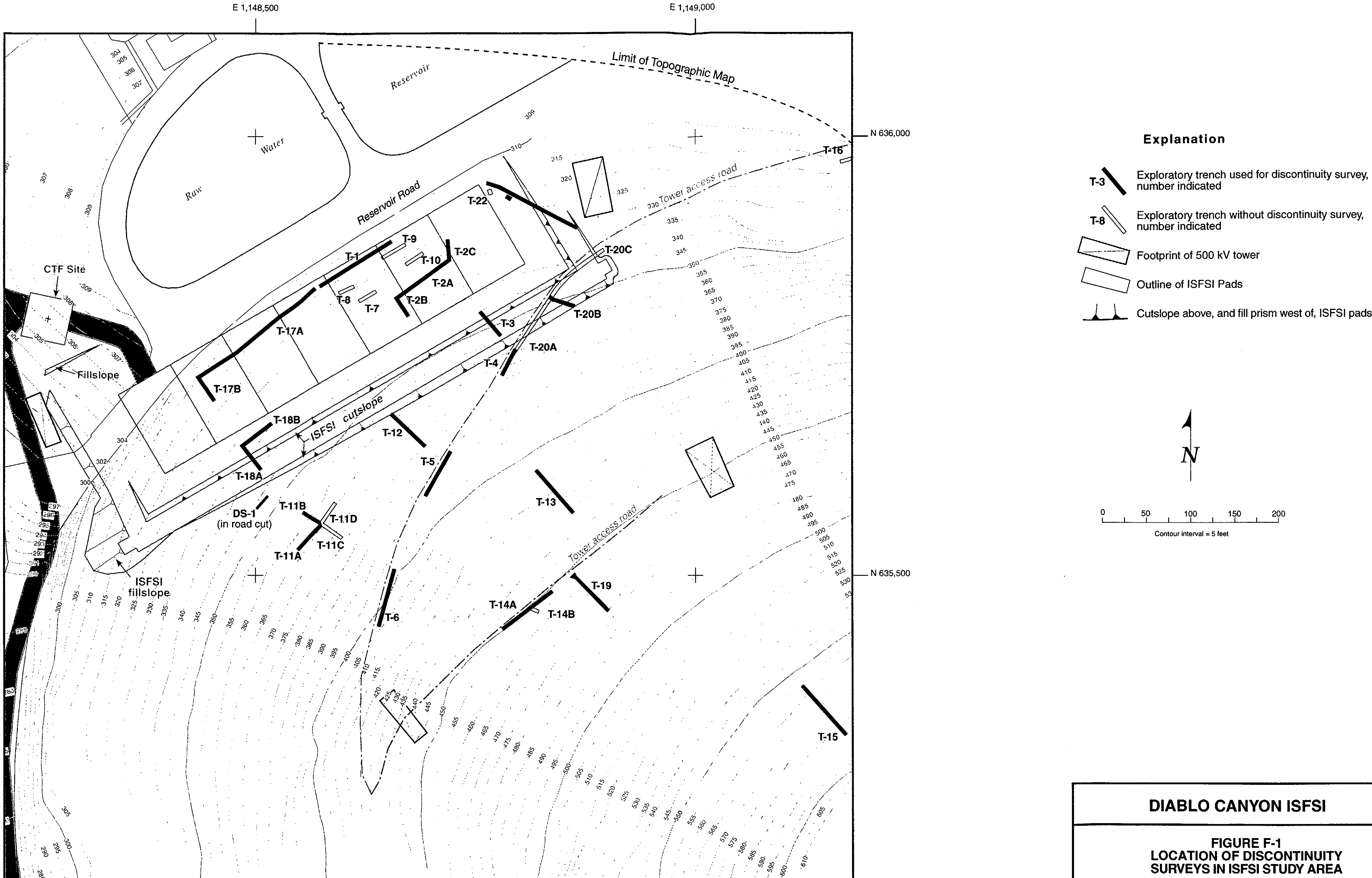
Trench/Field Number	Trench Location	Fault Strike	Fault Dip	Fault Striation Rake	Slickensides (s) or mullions (m)	Person and Date
T-20B	St. 3.2	273	61 S	16 W	s	JLB 12/6/00
T-21	St. 20.5	286	80 N	Subhor.	s	JLB 4/16/01 WRL 4/28/01
Field 1	Diablo Canyon Rd. cut	305	75 N	Subhor.	m+s	WRL
Field 2	Diablo Canyon Rd. cut across from Raw Water Reservoirs and along projection of ISFSI site faults. Confirmed with JLB-17-1 station GPS 023 N 35° 51.264' W 120° 51.264'.	305	75 N	10 E	m+s	WRL/JLB/WDP 5/17/01
JLB-17-2	GPS 024 N35°12.927' W120°51.234'. North wall of Diablo Canyon.	296	80 N	10 E	m (?)	WRL/JLB/WDP

[1] Fault is any discontinuity along which displacement of rock has occurred.

Table F-6. Discontinuity Spacing Measurements from Test Trenches, ISFSI Study Area.

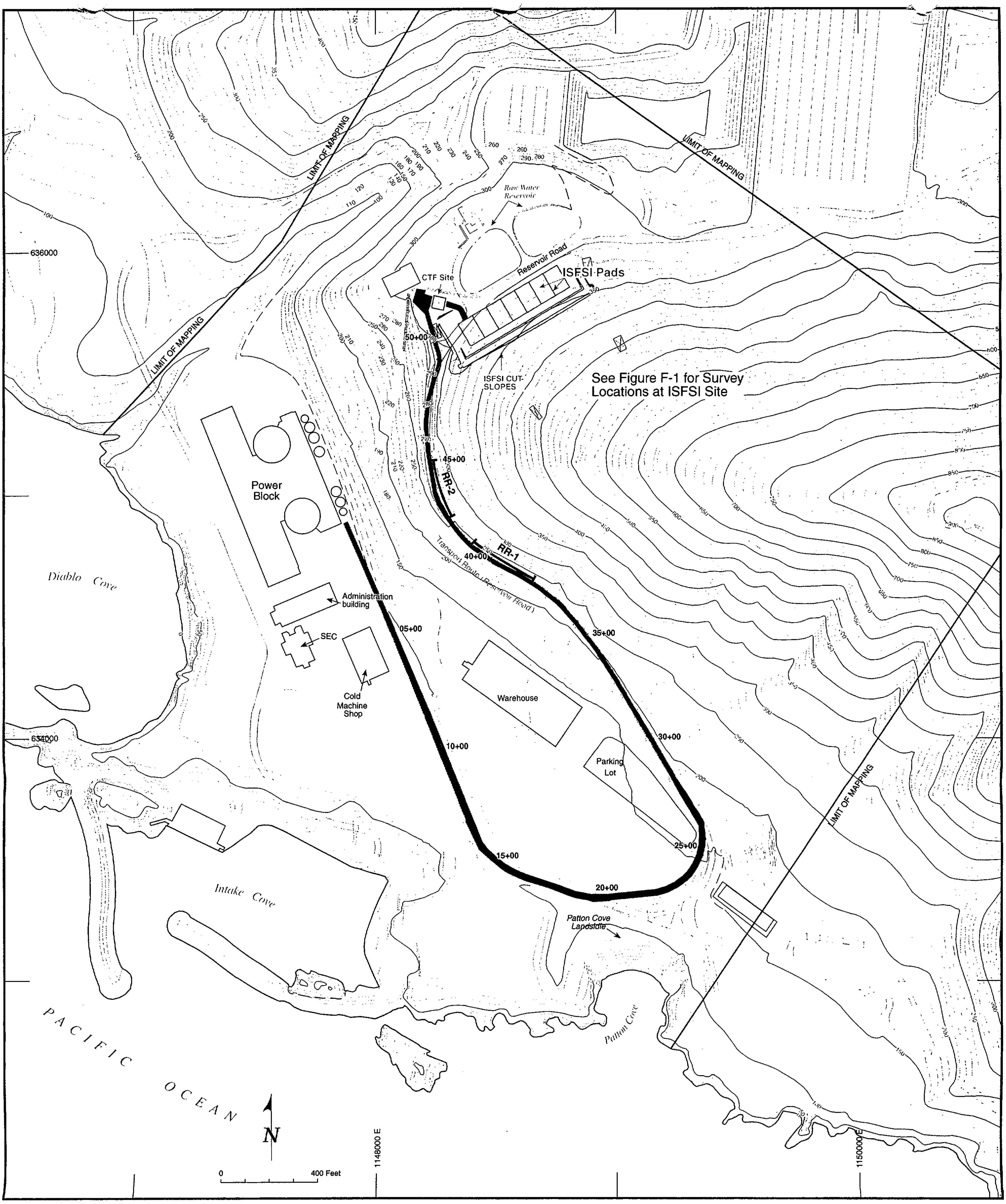
Test Pit	Mean Discontinuity Spacing (ft)	Standard Deviation (ft)	Maximum Discontinuity Spacing (ft)
T-1	0.51	0.44	1.84
T-2	1.24	1.51	7.87
T-3	1.29	1.19	3.61
T-4	0.49	0.36	1.71
T-5	1.23	1.19	4.92
T-6	0.82	0.72	3.15
T-11	1.47	1.51	5.41
T-12	2.26	3.40	14.10
T-13	2.78	3.63	11.81
T-14	1.10	1.31	6.89
T-15	1.43	1.36	4.92
T-17	0.92	0.75	3.08
T-18	1.06	1.08	3.80
T-20	1.43	2.21	9.18
T-21	3.22	2.89	8.20

Includes all data from the discontinuity characterization forms (Attachment 1). Spacing measurements exclude friable zones (Tof_{b-1a} and Tof_{b-2a}) and zones of poor exposure in the trenches.



DIABLO CANYON ISFSI

FIGURE F-1
LOCATION OF DISCONTINUITY SURVEYS IN ISFSI STUDY AREA



Explanation

Footprint of 500 kV tower

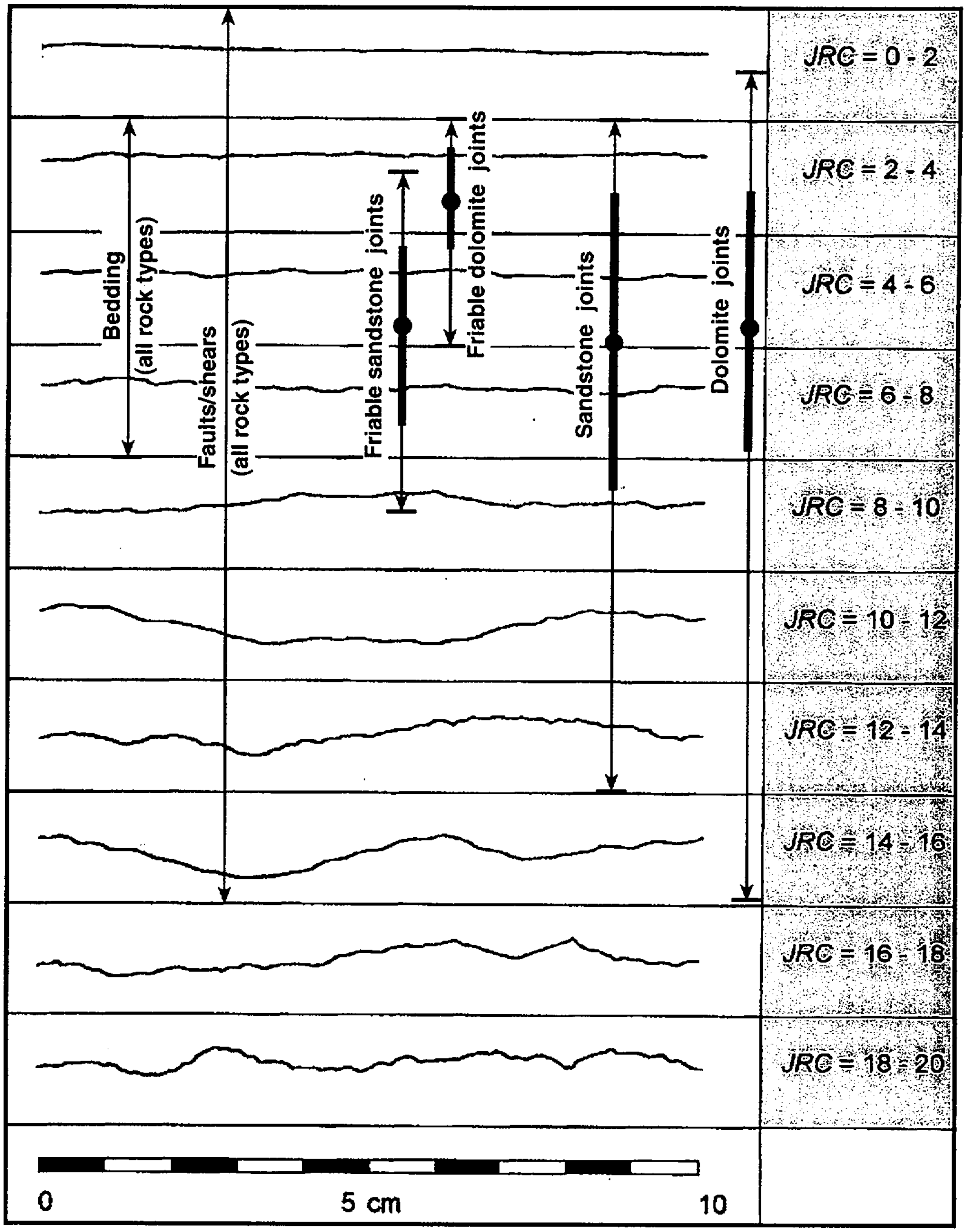
Outline of ISFSI Pads

Transport route, station indicated (30+00)

Discontinuity survey (RR-2)

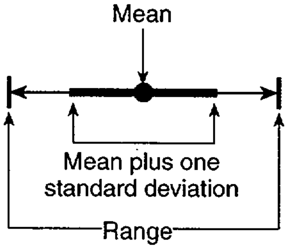
DIABLO CANYON ISFSI

FIGURE F-2
LOCATION OF DISCONTINUTY SURVEYS
ALONG RESERVOIR ROAD



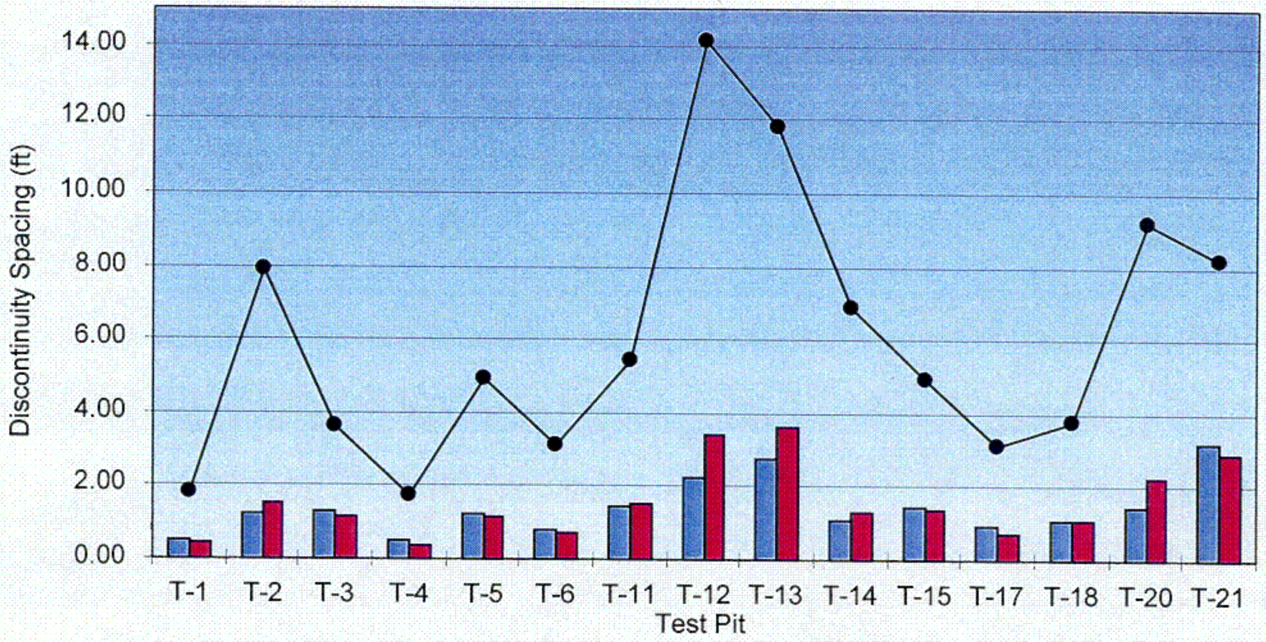
Note: JRC = Joint roughness coefficient

Chart from Barton and Choubey (1977)



DIABLO CANYON ISFSI

FIGURE F-3
JOINT ROUGHNESS PROFILES (JRC) AND TYPICAL RANGE IN ROUGHNESS OF JOINTS, BEDDING PLANES, AND FAULTS



Explanation

Mean Discontinuity Spacing (ft)

Standard Deviation (ft)

Maximum Spacing (ft)

Note: Analysis of all data from the discontinuity characterization forms (attachment 1) as tabulated on Table F-6

DIABLO CANYON ISFSI

FIGURE F-4
DISCONTINUITY SPACING AT ISFSI SITE-EXCLUDING ALTERED ROCK AND COVERED ZONES

C01

ATTACHMENT 1

DATA REPORT F

DISCONTINUITY CHARACTERIZATION FORMS

T-1
T-2a
T-2b
T-2c
T-3
T-4
T-5
T-6
T-11a
T-11b
T-12
T-13
T-14a
T-15
T-17a
T-17b
T-18a
T-18b
T-19
T-20a and T-20c
T-20b
T-21
Reservoir Road Cut RR
Reservoir Road Cut RR-2
Dozer Cut DS-1

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/10/00 **Logged By:** J. Bachhuber, C. Brankman **Location:** DCPP ISFSI Trench T1 (1 of 3)

Station ~~No.~~	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
1+40	Joint	270	56			Ti - Sl.Op.	Mn staining,	4-5		Dry	
1+80	Joint	347	88				some weathering; Mn	5-6			
2+00	Joint	200	60			Ti	Surf. Oxidation, Mn	5-6			
2+00	Joint	200	84			Ti	"	5-6			
2+40	Joint	010	75			Ti - Sl.Op.	"	6-7			
2+40	Joint	005	74			"	"	6-7			
2+70	Fault	198	84			Ti	1mm gouge	2-3			
2+80	Joint	78	76			Ti	Slight Oxidation	6-7			
2+80	Joint	78	76			Ti	"	6-7			
2+86	Joint	215	78			Ti	Slightly Weathered	5			
3+26	Joint	202	47			Ti	"	4-5			
3+27	Joint	202	47			Ti	"	4-5			
3+28	Joint	202	47			Ti	"	4-5			
3+55	Fault	355	72			Ti	½-1cm clayey Gouge	2-3			
3+70	Joint	190	58			Ti	Sl. Weathered; Mn	4-6			
3+75	Joint	182	82			Ti	"	4-6			
3+80	Joint	190	88			Ti	"	4-6			
4+06	Fault	175	72			Ti	0.1-1.0 cm clay gouge	2-3			
4+34	Joint	192	82			Ti	Sl. Weathering	5			
4+34	Joint	185	65			Ti	"	4			
4+56	Joint	192	86			Ti	"	6-7			
4+62	Joint	192	86			Ti	"	5			
14+60	Fault	210	76			Ti	0.5-1.5 cm Clay gouge	2		↓	

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

Station measurements in meters. Starting @ 0+00 @ east end of trench

JRC from 0 to 10

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/10/00 **Logged By:** J. Bachhuber, C. Brankman **Location:** DCPP ISFSI T-1 (2 of 3)

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
										Dry	
16+34	Fault	195	85			T_i	0.5-1.0 cm clay gouge	2-3			
16+38	Fault	195	85			T_i	"	2-3			
21+50	Joint	175	48			T_i	Oxidized; Thin Clay Coat.	3-5			
21+68	Joint	296	72			T_i	Sl. Oxidation	5-7			
21+72	Joint	235	83			T_i	Sl. Weathered	8-9			
21+90	Joint	290	28			T_i	"	4-6			
22+20	Joint	205	80			T_i	"	5-7			
22+32	Joint	200	80			T_i	Sl. Weathered; Mn	5-6			
22+44	Joint	260	88			T_i	Sl. Weathered, Oxid.	7			
22+64	Joint	242	64			T_i - Sl. Op.	Sl. Weathered	7-8			
22+60	Bedding	175-195	5-10								
22+76	Joint	285	87			T_i	Oxidized	5-6			
22+94	Joint	198	70			T_i	Gypsum & Qtz coating	5-7			
23+06	Joint	071	74			T_i	Oxidized	5-6			
23+08	Joint	204	87			T_i	Sl. Weathered	6			
23+24	Joint	075	54			T_i	Sl. Weathered	3-4			
23+60	Joint	095	76			T_i	"	6-7			
23+68	Joint	255	64			T_i	"	5-4			
24+00	Fault	207	72			see next	page for surface descriptions			↓	

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

Trench 1 (3 of 3) **Domain** [ ]

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/10/00 **Logged By:** J. Bockhuber, C. Brankman **Location:** DCPP ISFSI Trench T-1 (3 of 3)

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
24+04	Fault	195	72				5mm-2cm clay gouge;			Dry	
24+36	Fault	203	79			Ti	↓	2-3, wavy			
24+40	Fault	210	70								
24+50	Joint	060	76			Ti	Sl. Weathered	4-5			
24+55	Joint	220	85			Ti	"	6			
24+64	Joint	235	78			Ti	"	4-5			
24+68	Joint	040	70			Ti	Sl. Weathered; Mn	5-6			
24+86	Joint	175	60			Ti	Thin clay coating	3-5			
25+10	Joint	025	65			Ti	Sl. Weathered, Qtz	6-8			
25+28	Joint	210	86			Ti	Sl. Weathered	5-6			
25+40	Joint	008	80			Ti	Sl. Weathered; Qtz	6			
25+88	Joint	305	88			Ti	"	7-8			
26+04	Joint	200	80			Ti	Sl. Weathered	7			
26+60	Joint	015	82			Ti	"	5-6			
26+84	Joint	194	86			Ti	"	6			
26+84	Joint	268	52			Ti	"	6-7			
27+20	Joint	252	80			Ti	"	6			
27+20	Joint	186	85			Ti	Sl. Weathered; Qtz	5-6			
27+40	Joint	250	70			Ti	Sl. Weathered	5			
27+44	Joint	210	86			Ti	"	7-8			
27+55	Joint	260	74			Ti	"	7			
27+62	Joint	205	82			Ti	"	6			
27+82	Joint	265	55			Ti	Sl. Weathered; Qtz	6-7		↓	

gray ss.
↕
Tof b
dolo-ss

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

Within Dolomitic Sandstone, joint continuity is typically 0.5-1.0 m. most joints are tight and healed w/ Quartz

[signatures]

TRENCH T-2a

Domain [ ]

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

T-2 /1

Date: 6/11/00 **Logged By:** J. Bachhuber, C. Brankman **Location:** DCPP ISFSI Trench T-2a; East-West Portion

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
	0+40 J	253	76			Ti-sl. op.	sl. wthd. Oxidized Mn.	5-6		Dry (all)	
	0+50 J	187	85			Ti	sl. wthd. Mn	6-7			
	0+63 J	246	71			Ti-sl. op.	Mn ctg.	5-6			
	0+80 J	001	73			Ti	Mn ctg.	4-5			
	0+95 J	251	67			Ti	Mn. ctg.	4-5			
	1+00 J	199	86			Ti	Mn., sl. wthd.	4-5			
	1+18 J	284	70			Ti	Mn., ox.	3-4			
	1+35 J	024	75			Ti	Mn, ox	5-6			
	1+65 J	263	71			Ti	2mm white bleach sl. Mn.	3-4			
	1+67 J	229	84			Ti	"	3			
	1+75	297	45			Ti	-	4-5			
	1+80 J	223	86			Ti	-	3			
	2+00 J	359	25			-	sl. mn. faint slicks (no gouge)	3			
							Slicks 020, 23				
	2+85 J	277	56			Ti	Mn. stain	4-5			
	2+93 J	012	70			Ti	Mn stain, oxid.	5			
	3+10 J	251	65			Ti	Mn	4 stepped			
	3+20 J	015	57			Ti	Mn	4			
	4+25 J	246	64			Ti	-	3			
	4+73 J	244	62			Ti	-	3			
	5+60 J	290	76			Ti	Mn, ox.	3			
	5+80 J	249	70			Ti-sl. op.	Mn	5-6			
	5+90 J	311	40			Ti	Mn	5			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

Jrc number from 1-10 or left margin of Barton chart
Mn = manganese

TRENCH T-2a

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

T2/2

Date: 6/11/00 **Logged By:** JLB/CMB **Location:** DCPP ISFSI Trench T-2a E-W Segment

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
	6+10 J	350	83			Ti	Mn stain	4-5			
	6+50 J	211	89			Ti	Mn, ox	2-3			
	6+90 J	219	79			Ti	-	4			
	7+70 J	065	78			Ti	Mn	2-3			
	Rock in trench bottom, but			not walls, tight rock		7+70 to	9+90				
	9+90 J	249	69			Ti	-	3-4			
	10+70 J	236	71			Ti	-	3-4			
	12+20 J	273	70			Ti	-	5			
	13+20 J	026	84			Ti	-	3-4			
	14+20 J	090	80			Ti	-	2-3			
	14+20 J	215	84			Ti	-	2-3			
	14+40 Shear J	195	64			8cm wide	Mn, crushed zone, parallel joints	3-4			
	14+50 J	266	65			Ti	Sl. Mn.	3-4			
	14+60 J	204	79			Ti-sl. open	Smooth polished, sl subhor. fabric	0-1			
	14+75 Shear J	286	75			Ti-sl. open	2 parallel joints w/ slicks	0-1			
	15+10 J	235	62			Ti	Mn, ox	2			
	15+20 J	323	53			Ti	Sl. wthd., oxid.	4			
	15+40 J	258	83			Ti-sl op.	Mn, ox	3			
	15+50 J	220	88			Sl. op.	Sl. oxid., polish	0-2			
	16+25 J	223	80			Ti	-	2			
	17+00 J	106	86			Ti-sl op.	Mn.	3			
	17+06 J	220	90			Ti	White halo 1mm Mn	2			
	17+50 J	194	80			Ti	Mn	4-6			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 2a E-W

Domain [ ]

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

T2/3

Date: 6/11/00 **Logged By:** CMB/JLB **Location:** DCPP ISFSI Trench T-2a E-W segment

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
	18+10 J	114	89			Ti	oxidized (ox)	3			
	18+20 J	211	76			Ti	Mn	4			
	18+60 J	196	85			Ti	Mn-ox	4			
	18+90 J	122	74			Ti	ox	3-5			
	19+70 J	289	86			Ti	Mn, ox	3			
	19+80 J	227	84			Ti	sl. Mn.	4-5			
	19+90 J	100	80			Ti-sl. op.	ox.	4-5			
	20+10 J	118	84			Ti	ox.	4			
	20+75 J	301	51			Ti-sl.op.	ox	4			
	21+40 J	268	46			Ti-sl.op.	ox, sl.mn.	4-5			
	21+80 J	119	81			Ti	ox.	4			
	End E-W Trench										

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

[signatures]

TRENCH 2b N-S

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/11/00 **Logged By:** CMB, JLB **Location:** DC PP ISFSI Trench T-2b N-S Segment T2/4

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
	21+90 J	269	86			Ti, sl. op.	ox.	5			
	22+20 J	200	85			Ti-sl. op.	ox.	5			
	24+60 J	261	59			Ti	ox.	4			
	24+90 J	095	86			Ti	ox., Mn	6			
	25+05 J	201	77			Ti	ox.	3			
	25+35 J	278	84			Ti-sl. op	ox.	7			
	25+60 J	036	86			Ti	ox	6			
	25+80 J	198	44			Ti	-	6			
	26+20 J	075	87			Ti	ox, Mn	5-6			
	26+60 J	212	65			Ti	–	4-5			
	26+70 J	113	80			Ti	ox	4			
	26+75 J	222	74			Ti	ox	4			
	26+85 J	272	84			Ti	ox	7			
	27+20 J	216	86			Ti	ox	7			
	27+30 J	256	83			Ti	ox	6-7			

Note: Rock in N-S trench appears more massive, tighter than in E-W trench; breakage across joints common.

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 2c

Domain [ ]

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/20/2000 **Logged By:** CMB, TNB **Location:** DCPP Borrow Site Trench T-2c ext

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
0+00	Fault	190	70			Sl. Op.	Mn; Ox	3-4			
0+00	Fault	205	80			Ti	"	3-4			
0+70	Joint	003	89			Ti-Sl. Op.	Mn	5			
0+80	Joint	263	72			Ti	Sl. Mn	4	(on opposite wall)		
1+10	Fault	174	84			Ti	* Slicks	3-4			
1+10	Joint	032	81			Ti	Sl. Ox.	4			
1+70	Joint	181	90			Ti-Sl. Op	Mn	3-4			
1+40	Fault	176	87			Ti	Clay Gouge (~2mm)	3			
1+70	Joint	002	60			Ti	-	5-6			
1+70	Joint	256	64			Ti	Sl. Ox	6-7			
3+70	Fault	011	80			Ti	Ox, Slicks	3			
4+00	Joint	199	55			Ti	Sl. Mn	2-3			
4+30	Joint	191	61			Ti	-	5-6			
4+90	Joint	035	90			Ti	Sl. Mn	4-5			
5+00	Joint	286	61			-	-	3-4			
5+70	Joint	276	55			-	-	4-5			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses, controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 3

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

T3/1

Date: 6/1/00 **Logged By:** CMB, JLB **Location:** DCPP Trench ISFSI T-3

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
	0+20 J	208	71			Ti	Manganese (Mn) oxidized (ox)	3			✓
	0+25 J	261	69			Ti	ox, Mn	3-4			
	0+45 Shear J	226	74			Ti	Mn faint slicks subhoriz.	2			
	0+50 J	091	85			Ti	ox, mn	3			
	1+60 J	261	76			Ti	sl. ox	2-3			
	2+40 J	320	76			Ti	sl. mn	3-4			
	3+15 J	234	73			Ti	sl. mn	4			
	3+70 J	020	76			Ti	sl. Mn	5-6			✓
	4+50 J	190	90			Ti	sl. ox	3			
Wedge	5+35 J	009	67			Ti	ox, mn	4-6			✓
Wedge	5+35 J	206	30			Ti	ox, mn	4-6			
Wedge	5+35 J	301	79			Ti	ox, mn	5			
	5+75 J	187	65			Ti	ox.	3			
	5+90 J	240	64			Ti	ox, sl. mn	3-5			✓
	fault 7+00 Shear J	208	74			Ti	ox, mn sl. slicks 10° plunge E	2-3			
	7+20 J	255	60			Ti	ox, sl. mn	4-5 (steps)			
	7+30 J	180	85			Ti	ox, mn *	3-4			
	fault 7+50 Shear J	248	51			Ti	ox, mn slicks = No gouge 330° 10° E-18E plunge JLB	2-3	mullions - examined by WDP, SH 7/10/00 continuous through trench		3 6+40 - 8+40±
	8+40 J	021	66			Ti	sl. ox	3-4	JLB WDP 7/10/00		
	8+60 J	208	61			Ti	Mn	4-5			
	9+00 J	218	79			Ti	Mn	3-5			
	9+30 to	9+50		Weak rock zone							

* 11/10/00 3+50± Bedding (defined by parting surfaces) 214, 24° WDP check; partly bonded, wavy, rough surfaces.

✓ = more continuous, sign. joint

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 3

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

T3/2

Date: 6/11/00 **Logged By:** JLB/CMB **Location:** Trench ISFSI T-3

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
	9+55 J	205	90			Ti	ox	3-4			
	9+60 J	291	62			Ti	ox, mn	3-4			
	9+90 J	201	74			Ti	–	4-5			
	10+00 J	269	90			Ti	sl. ox, mn	6			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 4 (1 of 3) **Domain** ☐ ☐

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/11/00 **Logged By:** J Bachhuber, C. Brankman **Location:** DCPP ISFSI Borrow Site Trench T-4 (1-3)

Station ~~No.~~	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
0+00-	} Fragmented crush	variable	variable		< 1 cm		Mn; Ox.			Dry	
1+60	} zone										
1+60	Joint	275	88			Ti - Sl. Op	Mn; Oxidized	5			
1+70	Joint	005	85			Sl. Op.	Mn; Ox	3-4			
1+70-	} crushed zone -	258	70-85		< 1 cm		Mn; Ox	3-4			
1+90	} multiple joints	(fabric of	zone)								
2+00	Joint	248	75			Ti - Sl. Op	Mn, Ox	4			
2+10	Joint	105	88			Ti - Sl. Op	Mn; Ox	3-4			
2+15	Joint	011	60			Ti	Mn; Ox	4-5			
2+25	Joint	085	89			Ti - Sl. Op	Mn, Ox	3-4			
2+50	Joint	005	60			Ti	Mn; Ox	3-4			
2+45	Joint	186	58			Sl. Op	–	3-4			
2+60	Joint	094	86			Ti - Sl. Op	Ox	4-5			
2+80	Joint	340	42			Sl Op	Ox; Mn	3-4			
2+92	Joint	100	65			Sl. Op	Mn, Ox	5			
3+08	Joint	105	86			Ti	Mn	4			
3+28	Joint	106	88			Sl. Op	Mn, Ox	5-6			
3+28	Joint	185	30			Ti	Mn; Ox	4-5			
3+40	Joint	158	56			Ti	Mn	4-5			
3+60	Joint	275	86			Ti	–	5-6			
3+78	Joint	220	74			Ti	Mn	3-4			
3+82	Joint	095	74			Ti	Mn; Ox	5-6			
3+94	Joint	352	50			Ti - Sl. Op	Thin clay coating < 1 mm	3-4			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 4 (2 of 3)

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/11/00 **Logged By:** J Bachhuber, C. Brankman **Location:** DCPP ISFSI Borrow Site Trench T-4 (2/3)

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
4+10	Joint	332	35			Sl. Op.	Mn	4-5		Dry ↓	
4+20	Joint	~~0~~ 240	66			Ti	Sl. Mn;	6-7			
4+30	Joint	347	42			Ti	–	4-5			
4+50	Joint	250	62			Sl. Op	Mn; thin clay c 1mm	3-4			
4+52	Joint	200	70	*	JLB 7/10/00	Sl. Op	Mn, Ox	4			
4+68	~~Joint~~ *Fault Shear Joint JLB	355	82	Mullions 265/15	mullions 350 35	Sl. Op	Mn, Ox	4			
4+78	Joint	125	82			Ti	Mn; Ox	5			
4+80	Joint	330	88			Ti - Sl. Op	Mn; Ox	5-6			
4+90	Joint	115	80			Ti	Sl. Ox	4-5			
4+90	Joint	275	12			Ti	-	3			
5+10	Joint	278	48			Ti	Sl Mn, Ox	4-5			
5+48	Joint	335	68			Sl. Op	Sl. ~~Mn~~ Ox	3-4			
5+56	Joint	342	70			Ti	Sl. Weathering	3-4			
5+62	Joint	005	82			Ti	Sl. Ox	4			
5+92	Joint	260	52			Sl. Op	Sl. Ox	5			
6+00	Joint	164	80			Ti	–	4-5			
6+14	Joint	238	65			Ti	-	3-4			
6+30	Joint	215	75			Ti	–	3-4			
6+40	Joint	190	80			Ti	–	5-6			
6+60	Joint	220	45			Ti	Sl Ox, Mn	5			
6+68	Joint	330	68			Ti	-	7-8 (Step)			
7+02	Joint	272	68			Ti	Sl. Mn, Ox	4			
7+02	Joint	185	82			Ti	–	3-4		↓	

6+80 bedding 270°, 6° laminations, sand lenses JLB 7/10/00 WDP

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 4
(3 of 3)

Domain [ ]

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/11/00 **Logged By:** J. Bachhuber, C. Brankman **Location:** DCPP ISFSI Borrow Site Trench T-4 (3/3)

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
7+28	Joint	060	80			Ti	Sl. Mn	4		Dry	
7+32	Crushed Zone ½ cm wide	200	88			Sl. Op	Sl. Ox	3-4		↓	
7+42	Joint	280	58			Ti	-	4-5			
7+60	Joint	275	72			Ti	Sl. Mn	3			
8+02	Joint	250	8			Ti	-	3-4			
8+28	Joint	305	89			Ti	Mn	3-4			
8+60	Joint	275	70			Ti	Mn	4-5			
9+12	Joint	340	76			Ti	Mn	3			
9+30	Joint	260	62			Ti	Sl. Mn	3		↓	

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

[signatures]

TRENCH 5 (1 of 3)

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

T5/1

Date: 6/11/00 **Logged By:** J. Bachhuber, C. Brankman **Location:** DCPP ISFSI Borrow Site Trench T-5

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
	0+00 to 4+80		Very tight, massive to blocky rock								
	0+05 *Bdg.	284	11	0.25-1m	5cm-0.5m	Tight-banded	–	4			
	0+05 J	277	90			Ti	Bleached	3			
	2+50 J	307	90			Ti	–	5			
	1+20 *Bdg.	266	10			Ti		4-5			
	4+00 J	301	87			Ti	Mn, ox	5			
	5+00 J	283	90			Ti-Sl. op.	mn, ox	4			
	5+40 J	217	50			Ti	Bleached	6			
	5+50 J	198	83			Ti	–	5			
	5+60 J	121	70			Ti	ox	5-6	massive 5+60 to 6+70		
	6+70 J	201	90			Ti	–	3			
	7+40 J	070	70	brecciated		Ti-Sl. op.	ox, mn	5	Brecciated Zone 7+40 -		
fault	8+40 Shear J	330	85			Sl. op.	little qtz. slicks 330, 10	4			
fault	8+50 *Breccia Fabric	070	70			Sl. op.	ox, sl. alt.	6-8			
	8+70 J	076	76	brecciated		Ti-Sl. op.	mn, ox, qtz	4			
	9+60 J	105	77			Sl. op.	Sl. ox	4-5			
	9+90 J	291	64			Sl. op.	ox, mn	5-6			
fault	10+00 to 10+40 *Breccia Fabric	042 Breccia	90 Zone			Sl. op.	ox, mn	4-6			
	10+70 J	294	87			Sl. op.	ox, mn	4			
	10+90 J	131	57			Ti	ox, mn	4			
	11+00 J	265	55			Ti	ox, mn	6-7			
	11+40 J	344	75			Ti-sl. op.	ox	7			
	11+75 J	254	50			Ti	–	5			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

Note:
* END OF Trench survey mark 286 is @ station 2+58m of trench.

TRENCH 5 (2 of 3)

Domain ☐ ☐

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

T5/2

Date: 6/11/00 **Logged By:** JLB/CMB **Location:** DCPP ISFSI Trench T-5

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
	12+00 J	144	70			Ti	–	4			
	12+20 J	249	65			Ti	–	6			
	12+50 J	146	83			Ti	–	5			
	12+70* Bdg.	244	05	5cm-0.5m	0.25-0.5m	Ti	Bonded –	3-4	Possible fossils on bdg. surface		
Form wedge	12+80 J	055	84			Ti	–	5			
	13+00 J	165	78			Ti	–	5			
	13+05 Fault-Shear	250	63			5-8cm zone	1cm-5cm zone crushed rock seams	4			
	13+30 J	252	86			Ti-sl.op.	mn	4			
	13+60 J	345	74			Ti	mn	5			
	14+40 J	242	25			Ti	–	7			
	14+40 J	264	75			sl. op.	sl. ox	5			
	14+50* Bdg.	276	13			Ti	–	4			
	15+30 J	271	63			Ti-sl.op	ox, mn	4			
	15+55 J	249	78			sl. op.	sl. ox.	5			
	15+80 J	209	77			Ti	–	5			
	16+00 J	270	70			Ti	–	3-4			
	16+30 J	261	86			Ti	ox, mn	3-4			
	16+40 J	204	76			Ti	ox, mn	6-7			
	16+60 J	280	51			Ti	–	7			
	16+80 J	252	70			Ti	ox	5			
	16+90 J	018	74			Ti	ox, mn	5-6			
	17+60 J	258	75			Ti	ox, mn	6-7			
	17+90* Shear-Fault	339	90			sl. op.	Slicks subhor. ox, mn no gouge	3	mvmt. prob. left lat.		

Significance Rating: (1)-primary influence on gross stability and slope geometry

(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability

(3)- moderate influence on gross stability, controls smaller failures

(4)- influences surficial raveling, but not gross cut stability

(5)-minor influence on slope stability and rock mass response

TRENCH 5 (3 of 3)

Domain [ ]

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

T5/3

Date: 6/11/00 **Logged By:** CMB/JLB **Location:** ISFSI Trench T-5

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
	18+40 breccia zone	J 340	85			T:	–	5 stepped			
	18+50 J	206	79			T:	sl. ox	4-5			
	19+00 J	071	78			T:	ox, mn	4			
	19+00 J	185	83			T:	sl. ox	6			
	19+10 J	289	84			T:	sl. ox	4			
	19+10 J	226	57			T:	ox, mn	4			
	19+70 J	243	61			T:	ox, mn	5-6	fractured zone		
	20+00 J	241	75			T: - slope	ox	6			
	19+00 * bdg	230	10	* Checked [illegible] WDP 7/25							
			Prominent steep	wedges	formed by	steep NW	: NNW sets				
		Note: Survey	monument 287	marking	end of	trench is	0.53 m	west of	our staked end	of trench.	

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

[signatures]

TRENCH 6 (1 of 3)

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/11/00 **Logged By:** J. Bachhuber, C. Brankman **Location:** DCPP ISFSI Borrow Site Trench T-6 (1 of 3)

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
0+64	Joint	000	70			Ti	Mn	3-4		Dry	
0+64	Joint	215	40			Ti	Sl. Mn	3		↓	
↕	Massive; no joints										
2+58	Joint	010	48			Ti	Sl. Ox	4-5			
4+02	Joint (?)	220	90			Ti	Sl. Ox	3			
4+40	Joint	070	78			Ti	Sl. Ox; Mn	3			
4+60	Joint	082	89			Ti	Ox; Mn	2-3			
4+98	Joint	092	71			Ti	Ox, Mn	2-3			
5+60	Joint	265	82			Ti	Ox; Mn	4-5			
5+72	Joint - Shear	025	68	1-2cm wide zone		Ti	Slicks 10° SE	2-3			
6+28	Joint	105	88			Ti	Ox; Mn	3-4			
7+26	Joint	052	82			Ti	Mn, Ox	3			
7+56	Joint	095	88			Ti	Ox; Mn	2-3			
7+88	Joint	310	90			Ti	Ox, Mn	2-3			
8+72	Joint	015	62			Ti	Ox, Mn	2-3			
8+84	Joint	240	15			Ti	-	3-4			
8+88	Joint	006	70			Ti	-	3-4			
9+40	Joint	085	88			Ti	Ox; Mn	3			
9+40	Joint	225	22			Ti	Ox, Mn	2-3			
9+64	Joint	255	80			Ti	Sl. Ox	3-4			
10+08	Joint	345	84			Ti-Sl.Op	Sl. Ox	3-4			
10+08	Joint	230	18			Ti	Sl. Mn	5-6			
10+08	Joint	075	74			Ti	Ox; Mn	4		↓	

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 6 (2 of 3)

Domain [ ]

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/11/00 **Logged By:** J. Bachhuber, C. Bronkman **Location:** DCPP ISFSI Borrow Site Trench T-6 (2 of 3)

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
10+36	Joint	238	72			Sl. Open	Ox; Mn	3-4		Dry	
10+52	Joint	004	76			Ti	Mn	3-4		↓	
10+80	Joint	190	86			Ti	Ox	4-5			
11+08	Joint	070	78			Ti	Ox; Mn	2-3			
11+10	Sheared Joint	200	82	Polished surf. w/	1mm Qtz fill	Ti	1mm Qtz fill	1-2			
11+60	Joint	265	89			Ti	Ox	3-4			
11+80	Joint	255	78			Ti	Mn	5-7			
11+88	Joint	235	22			Ti	–	5-6			
11+90	Joint	180	89			Sl. Open	Sl. Ox	3			
12+06	Joint	270	85			Ti	Sl. Mn	5-6			
12+28	Joint	145	85			Ti	–	6-7			
12+70	Joint (Bed?)	235	22			Ti	–	5-6			
12+80	Joint	070	82			Sl. Op	Ox; Mn	2-4			
13+76	Joint	255	80			Open 0.5cm	Ox; Mn	3-4			
13+84	Joint	145	90			Ti	–	6-7			
13+84	Joint	046	86			Ti	Sl. Mn	6-7			
14+02	~~Joint~~ (Bedding	232	16			Ti	–	5-6			
14+02	Joint	292	78			Ti	Sl. Mn	4-5			
14+40	Joint	333	76			Ti	–	3-4			
14+60	Joint	290	80			Ti	Sl. Mn	3-4			
14+80	Joint	~~06~~ 185	78			Sl. Op	Sl. Ox	4-5			
15+02	Bedding	205	16			Ti	Sl. Weathered	2-3			
15+90	Joint (Bedding?)	215	14			Ti	Sl. Mn	3-4		↓	

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

[signatures]

TRENCH 6 (3 of 3) Domain [ ]

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/11/00 **Logged By:** J. Bachhuber, C. Brankman **Location:** DCPP ISFSI Borrow Site Trench 6 (3 of 3)

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
16+02	Joint	185	84			Sl. Op.	Sl. Weath.	2-3			
16+24	Joint	245	74			Ti	Sl Mn; Sl Ox	3-4			
16+60	Joint	260	78			Ti-Sl.Op	Mn	5-6			
16+82	Joint	215	86			Sl. Op	Sl. Mn	5-6			
17+70	Joint	065	76			Mo Ti	Mn	3-4			
17+50	Bedding	204	15			Ti	—	3-4			
18+14	Joint	250	75			Sl. Op	Mn	3-4			
18+24	Bedding	210	14			Ti	-	5-6			
18+40	Joint	010	75			Sl. Op	Mn	5-6			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 11a (1 of 2) JNB/CL

Domain [ ]

PG&E Diablo Canyon ISFSI Project

Trench #11 a

Additions by J Bachhuber 8/1/00

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/19/00 **Logged By:** CMB JNB **Location:** DCPP Borrow Site 1 of 2

(Weathering key: SL – Oxide – MnO2 – Calcite)

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperture (Tight (no space), Slight open (few mm), Open (? mm))	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
0+77	Joint	122°	79°	—		Not visible	NOT PRES	5 to 6			
0+80 (1+00)	Joint	346°	63°	1+00 clay e bedding	222, 8 to 248, 6	Not visible	NOT PRES.	4 to 5			
1+30	Joint	317°	80°			TIGHT	Not Present	5			
2+40	Joint	015°	81°			Not visible	Slight FeO_2 / " MnO4	5			
2+60	Joint	349°	65°			T - SO	SL. OXIDATION	5			
3+65	Joint	041°	78°			T	OXIDIZED - Fe THIN CL. FILM	3			
4+20	Joint	314°	65°			T	SL. OXIDIZED - Fe	5 to 6			
4+20 (4+25)	Joint	238°	70°	4+25 bedding?	265, 7 ?	T	SL. OXIDIZED - Fe	4 to 5			
4+80	Joint	1°	70°	4+80 clay-rock	271; 12 contact/bed?	T - SO	SL. OXID - Fe	3			
5+70	Joint	285°	85°			T	OXIDIZED - FE	5			
5+70	Joint	295°	84°			T	SL. OXIDATION FE	3 to 4			
6+50	Joint	198°	75°			T	OXIDIZED - FE	3 to 4			
7+30	Joint	355°	50°			T	SL. OXIDIZED FE	3			
7+30	Joint	260°	55°			T	SL. OXIDIZED - FE / " " MN	6			
8+00	Joint	180°	86°			T	SL. OXIDAT. FE	2 to 3			
8+30	Joint	255°	87°			T - SO	SL. OXIDE - FE	4 to 5			
8+50	Joint	10°	85°			T - SO	OXIDE - FE	2 to 3			
8+70	Joint	281°	70°			Not Visible	SL - MnO_2	4			
9+00	Joint	314°	35°			T - SO	SL. MnO_2	2 to 3			
9+10	Joint	249°	90°			T	MnO_2	2			
9+40	Joint	264°	82°			T - SO	SL. MnO_2	4			
10+60	Joint	260	65°			T	FeO_x / MnO_2	4			
10+60	Joint	171°	85°			T	FeO_x - coat $CaCO_3$	3			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses, controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

[signatures]

TRENCH 11a

(2 of 2)

Domain TD-11a

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: **Logged By:** **Location:** Trench 11 2 of 2

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
10+90	Joint	208°	71°			T	FeO2 w/ CaCO3	3			
10+90	Joint	242°	89°			T-SO	slight FeO2	3 to 4			
10+90	BEDDING	305°	12°			T	Sl. FeO2 Sl. MnO	4 to 5			
11+10	JOINT	255°	90°			T	Sl. FeO2 Sl. MnO	3			
12+30	JOINT	0.00	64°			T	Sl. FeO2 w/ CaCO3	5			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 11 B

Domain

PG&E Diablo Canyon ISFSI Project

(NW- SE SEG)

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/19/2000 **Logged By:** CMB, JNB **Location:** DCPP Borrow Site, Trench 11 b (NW-SE segment) (1 of 1)

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
0+40	Joint	070	68			Ti	Qtz Fill/Coating	5-6		Dry	
0+70	Joint	221	72			–	Mn, Ox	5-6			
0+80	Joint	061	84			Ti	–	6-7			
2+45	Joint	164	80			–	–	3			
3+00	Fault	267	76			~~St.~~ Op		4-5			
4+30	Joint	066	81			Ti - Sl Op	Mn, Ox	3			
4+50	Joint	006	79			Sl. Op	Sl. Ox	3-4			
4+50	Joint (bad surface?)	229	79			–	Mn Stain	6-7			
5+50	Joint	193	77			Ti	–	4-5			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

[illegible initials]
[illegible initials]

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/20/00 **Logged By:** CMB, JNB **Location:** DCPP Borrow Site, Trench T-12 1 of 1

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Apèrature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
3+30	Joint	274	49			–	Sl. Mn, Sl. Ox	5-6			
4+00	Joint	236	83			Open	Prominent Mn Staining	3-4			
4+00	Fault	020	79			Ti - Sl. Op	Strong Mn; Ox	8 perp to mullions 3 parallel to mullions	Polished surface with mullions and striations		
4+30	Joint	180	77			-	Ox	4			
5+2	Joint	197	79			–	Mn; Ca crystalization	5-6			
6+00	Joint	001	85			Ti	-	3			
7+40	Joint	231	77			Ti	Mn, Ox	4-5			
7+70	Joint	258	55			Ti	Mn; Ox	5-6			
7+70	Joint	175	64			–	–	3-4			
8+30	Joint	226	73			–	Sl. Mn	3			
12+60	Joint	228	88			Sl. Op	Sl Mn, Ox	3-4			
13+10	Joint	213	45			-	Mn, Ox	4-5			
13+60	Joint	025	90			Sl Op - Op	–	3			
13+60	Joint	221	67			–	Sl. Ox (?)	4-5			
14+00	Fault	158	60			[illegible] –	-	5			
14+30	Fault	350	80			Sl Op	-	6-7			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/20/2000 **Logged By:** CMB, JNB **Location:** DCPP Borrow Site, Trench T-13 (1 of 1)

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
0+00	Joint	208	81			Ti - Sl Op	-	4-5			
1+80	Joint	195	90			Ti	Sl. Ox; Sl. Mn	5-6	(On trench floor)		
2+10	Joint	248	66			Ti	"	4-5	(On trench floor)		
2+90	Joint	244	89			Ti	Sl Mn	5-6			
5+50	Joint	202	87			Ti	Sl. Ox	2-3			
6+30	Joint	248	82			-	Sl. Mn	3			
7+00	Fault	210	55			Ti	Sl. Mn; Slicks	3	same surface,		
7+10	Fault	209	43			Ti	"	3	different location		
7+40	Joint	265	79			Ti	Calcite Coating	6			
7+60	Joint	205	23			Ti	-	5			
7+90	Joint	085	~~7~~ 81			Ti	Mn; Ox	5			
8+50	Joint	046	47			Ti	Sl. Mn; Ox	4			
8+60	Joint	200	61			Ti	Sl. Mn.	3-4			
8+60	Joint (Bedding?)	200	14			Ti	-	4-5			
11+90	Joint	186	80	11+60 Joint 12,88 Ti		Ti	Sl. Mn.	5	(on floor?) (On trench floor)		
14+50	Joint	009	69			Ti	-	4-5	(On trench floor)		
18+10	Joint	256	76			Ti - Sl. Op	Mn	5			
18+50	Joint	254	51			-	Sl. Ox	5-6			
18+60	Joint	024	82			Ti	Sl. Mn	3			
18+80	Joint	195	83			Ti	Sl Ox, Sl Mn	3			
19+30	Joint (Fault?)	233	60			-	Ox; Mn; Roots	7			
19+50	Joint	015	86			Ti	-	3-4	(On trench floor)		

7+25 fault w/ thin gouge 340,81

8+25 bedding?, lam. 245,11?

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

9/6/00 [signature]

TRENCH 13

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/20/2000 **Logged By:** CMB, JNB **Location:** DCPP Borrow Site, Trench T-13 (1 of 1)

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
0+00	Joint	208	81			Ti - Sl Op	-	4-5			
1+80	Joint	195	90			Ti	Sl. Ox; Sl. Mn	5-6	(On trench floor)		
2+10	Joint	248	66			Ti	"	4-5	(On trench floor)		
2+90	Joint	244	89			Ti	Sl. Mn	5-6			
5+50	Joint	202	87			Ti	Sl. Ox	2-3			
6+30	Joint	248	82			-	Sl. Mn	3			
7+00	Fault	210	55			Ti	Sl. Mn; Slicks	3	} same surface,		
7+10	Fault	209	43			Ti	"	3	} different location		
7+40	Joint	265	79			Ti	Calcite Coating	6			
7+60	Joint	205	23			Ti	-	5			
7+90	Joint	085	~~X~~81			Ti	Mn; Ox	5			
8+50	Joint	046	47			Ti	Sl. Mn, Ox	4			
8+60	Joint	200	61			Ti	Sl. Mn.	3-4			
8+60	Joint (Bedding?)	200	14			Ti	-	4-5			
11+90	Joint	186	80	11+60 Joint 12,88 Ti		Ti	Sl. Mn.	5	(on floor?) (On trench floor)		
14+50	Joint	009	69			Ti	-	4-5	(On trench floor)		
18+10	Joint	256	76			Ti - Sl. Op	Mn	5			
18+50	Joint	254	51			-	Sl. Ox	5-6			
18+60	Joint	024	82			Ti	Sl Mn	3			
18+90	Joint	195	83			Ti	Sl Ox, Sl Mn	3			
19+30	Joint (Fault?)	233	60			-	Ox, Mn; Roots	7			
19+50	Joint	015	86			Ti	-	3-4	(On trench floor)		

7+25 Fault w/ thin gouge 340,81

8+25 bedding?, lam. 245,11?

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH T-14a

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

NOTE: Add JB Clay Zone from [illegible] [illegible] [illegible] [illegible]

Date: 6/20/00 **Logged By:** CMB, JNB **Location:** DCPP Borrow Site, Trench T-14 (1 of 2)

(m) No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
0+30	Joint	011	87			Ti	-	3			
0+50	Joint	266	49			Ti-Sl.Op.	Sl. Mn	4			
0+70	Joint	002	83			Sl. Op	Sl. Ox	3-4			
0+85	Joint	195	74			Ti	-	5			
1+00	Joint	099	68			-	Ox	6-7			
1+10	Joint	154	48			SL	—	6			
1+10	Joint	226	90°			SL-O	OX	6-7			
1+10	Joint	001	30			T-SL	OX SL Mn	5			
1+40	Joint	245	68			T	SL Mn	7			
1+40	Joint	183	86			T	Mn OX	6			
1+50	Joint	273	74			T	—	6-7			
1+60	Joint	004	59			T	SL Mn	5			
1+90	Joint	184	52			T-SO	—	4			
2+10	Joint	185	50			T-SO	SL Ox	6			
2+40	Joint	165	78			SL	Mn/Ox	6			
3+00	Joint	264	71			SL-O	—	8			
3+30	Joint	178	76			T-SO	SL OX	5			
4+00	Joint	279	85			T-SL	Mn	4-5			
4+30	Joint	299	87			T	SL Mn	4-5			
4+50	Joint	250	83			T-SL	SL Mn	7-8			
4+50	Joint	000	84			SL-O	SL Mn SL OX	3-4			
4+70	Joint	279	86			T	OX	5			
4+80	Joint	352	80			—	—	6-7			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses, controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 14a

Domain [ ] [ ]

Trench 14

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6·20·00 **Logged By:** CMB/JNB **Location:** DCPP Borrow Site P(2 of 2)

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
6+20	Joint	322	85			—	—	5 to 6			
6+60	Joint	002	90			—	SL Mn	7			
7+00	Joint	006	79			—	Mn	4			
7+20	Joint	185	88			SL	Mn Ox	4			
7+60	Joint	270	90			SL-O	Mn	3			
7+70	Joint	356	52			T	—	4-5			
8+10	Joint	162	75			T	SLMn / Ox	3			
8+50	Joint	013	90			SL	Mn / Ox	2-3			
8+70	Joint	330	84			—	Mn / Ox	3			
8+90	Joint	022	85			T	Mn/Ox	3			
9+10	Joint	266	80			T	SL Ox	3-4			
9+50	Joint	176	61			—	Mn/Ox	6-7			
9+70	Joint	279	90			T	Mn/Ox	6-7			
10+50	Joint	333	84			—	Mn/Ox	6-7			
10+70	Joint	81	85			T-SL	SLMn/SLOx	6			
10+70	Joint	28	80			T	MnOx	4			
12+80	Joint	196	86			T	Ox	2			
13+20	Joint	174	81			T	SL Ox	3			
13+40	BEDDING	211	14 SW								
14+20	Joint	115	85			SL-O	Mn/O	5			
15+40	Joint	003	69			—	—	8			
21+40	Joint	96	81			T	Mn/O	6-7			
21+40	Joint	220	90			T	Mn/O	6-7			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

[signatures]

TRENCH 15 (1 of 2)

Domain [ ]

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/20/2000 **Logged By:** JNB; CMB **Location:** DCPP Borrow Site Trench T-15 1 of 2

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
1+20	Joint	229	77			Ti	-	3-4	(On trench floor)		
2+00	Joint	209	66			Ti	-	5-6	(On trench floor)		
3+30	Joint	069	83			Ti	Mn; Ox	5			
3+60	Joint	072	85			Ti	-	4			
4+00	Joint	066	90			Ti	Mn; Ox	4			
4+70	Joint	070	86			Ti - Sl. Op	Ox; Sl Mn	6			
5+10	Joint	032	90			Ti - Sl. Op	Mn	6			
5+20	Joint	064	90			Ti - Sl. Op.	Mn	4			
5+?0	Joint	071	87			Ti	Mn	4			
5+80	Joint	246	85			Ti	Ox	6			
5+80	Joint	140	30			Ti	Sl. Mn	6			
6+30	Joint	044	83			Ti	Ox; $CaCO_3$	7			
6+90	Joint	185	69			Ti	-	4-5			
7+60	Joint	248	83	7+65 ← clay-Tofb-l contact	325,17	Ti	-	3-4			
7+80	Joint	081	80			Ti	-	2-3	(On trench floor)		
8+40	Joint	039	62			Ti	-	4			
9+50	Joint	238	81			Ti	Mn	5			
9+70	Joint	312	65			-	Mn; Ox	6-7			
9+70	Joint	056	60			Ti - Sl. Op	Mn	5			
9+30	Joint (Fault?)	255	76			Ti	Mn; clay	3-4			
11+30	Joint	254	72			Ti - Sl. Op	Mn; Ox	4			
17+00	Joint (fault?)	222	78			Ti - Sl. Op	Mn	4-5			
18+20	Joint (fault?)	025	84			Sl. Op	Mn	3-4			

8+10 → clay seam/rock surface 321,20, 1½-8" thick stiff clay, irregular, JRC ± 4-8, damp

13+55 290-320, 20-15° Clay/claystone — Tofb-l limestone contact

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 15

Domain

PG&E Diablo Canyon ISFSI Project (2 of 2)

DISCONTINUITY CHARACTERIZATION FORM

Date: 6/20/00 **Logged By:** & JNB; CMB **Location:** DCPP Borrow Site Trench #15 2 of 2

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
18+30	Joint (fault?)	3021	87			Sl.Op. - Op.	Mn	4			
18+80	Joint	250	90			Ti - Sl.Op	Mn	4-5			
19+10	Joint (fault?)	240	87			Sl. Op	Mn	4			
19+30	Joint	272	90			-	Mn	4-5			
19+50	Fault	280-290	85-90			Sl. Op.	2"-4" crushed rock zone w/ Mn	4-5			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 17a (1 of 4)

Domain ___

T-17/1

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 8/3/00 **Logged By:** J. Bachhuber, R. Kochler **Location:** Trench T-17a

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
0+16	j	270	70°			ti	sl. ox.	6-10		dry	
0+25	j	290	86°			ti	sl. ox	8-10		dry	
0+25	j	190	50°			ti - sl.op.	sl. ox	6-10		dry	
[illegible]	j	250	85°			ti	sl. ox & mn.	10-14		dry	
0+66	j	235	46°			ti	sl. ox	6-10		dry	
0+74	j	285	75°			ti - sl.op.	mn & ox	4-6		dry	
0+88	j	286	68			ti	ox	4-8		dry	
0+88	j	205	40			ti	sl. ox.	6-8		dry	
0+98	sz	235	84			op. 2cm	ox	—		dry	
1+14	j	228	66			ti - sl.op	sl. ox	6-10		dry	
1+24	j	220	80			ti	sl. ox	10-14		dry	
1+40	j	90	22			sl. op	ox	6-10		dry	
2+19	j	250	80			sl. op.	ox	4-6		dry	
2+36	j	75	78			ti	ox	6-8		dry	
2+75	j	270	88			ti - sl.op	ox + MN	4-8			
2+95	j	268	82			ti - sl.op	sl. ox	6-10			
3+18	j	82	72			sl.op - op	sl. ox.	8-10			
3+30	j	280	87			sl. op	sl. ox	6-10			
3+40	j	345	78			ti	sl. mn.	6-10			
3+70	j	90	26			sl. op	sl. ox + mn	8-12			
3+90	j	266	88			ti - sl.op	sl. ox.	6-8			
4+50	j	135	56			ti - sl.op	sl. ox + mn	4-8			
4+70	j	138	47			ti - sl.op	sl. ox + mn	8-12		↓	

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

(j) joint
(b) bedding
(f) fault
(sz) shear zone

[signatures]

TRENCH 17a (2 of 4)

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

T-17/2

Date: 8/3/00 **Logged By:** J. Bachhuber R. Kochler **Location:** Trench T-17a

No	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperture	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
5+60	F - Flt zone/sz	~~70~~ 65	75			10 cm	Thin clay gouge Crushed rock	8-10			
6+10	j	75	58			Ti - sl op.	sl. ox.	4-6			
6+17	j	190	72			sl. op.	sl. ox.	6-8			
6+37	j	205	65			sl. op.	sl. ox.	10-12			
6+61	j	260	85			Ti - sl op.	sl ox, mn	8-10			
6+28	j	230	90			sl. op.	sl ox, mn	4-6			
7+30	j	250	90			sl. op. - ½"	mn	6-10			
7+55	j	230	84			sl. op.	sl. ox.	4-6			
7+98	j	252	85			op. ¼"	sl. ox.	6-8			
8+40	j	345	70			Ti	mn & ox	4-6			
8+68	j	60	84			sl. op.	mn & ox	4-6			
8+90	j	205	86			Ti	sl. mn, ox	6-8			
9+00	j	325	34			Ti	sl. ox, mn	4-6			
9+74	j - sz	75	64			sl. op.	~~sl. op.~~ sl. ox.	6-8			
9+88	j - sz	80	81			Ti	sl. ox.	6-10			
10+15	j	75	72			Ti - sl. op.	mn, ox	8-10			
10+40	j - F (minor)	313	10			sl. op.	slicks sl. mn, ox	2-4			
10+60	j	305	86			sl. op.	sl mn, ox	6-8			
10+66	j	15	74			Ti	sl. mn, ox	8-12			
10+82	j	92	68			Ti	sl mn, ox	6-8			
11+05	Fault	180	85			sl op.	slicks sl. mn.	6-10			
11+76	Fault	190	74			–	Thin clay gouge	2-4			
12+02	Fault	182	90			–	Thin clay	2-4			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

9-6-00 [signature]

TRENCH 17a
(3 of 4)

T-17/3

PG&E Diablo Canyon ISFSI Project

Trench T-17/3

Domain [ ]

DISCONTINUITY CHARACTERIZATION FORM

Date: 8/3/00 **Logged By:** JLB, RDK **Location:** Trench T-17a ISFSI

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
11+74	J.	65	72			Ti-sl.op.	sl. mn.	4-6			
12+30	J	170	76			Ti - sl. op.	sl. ox	4-6			
12+62	J	236	58			ti	sl. ox	4-6			
12+74	J	200	68			ti	ox	2-4			
12+80	f	220	68			ti	thin clay gouge	2-4			
13+70	J	255	60			ti	ox	8-10			
14+12	J	22	50			ti	sl. ox.	4-6			
15+10	J	210	68			ti	sl. ox.	4-8			
15+30	f	342	65			ti	clay gouge [illegible]	2-4			
15+60	J	65	85			ti	sl. ox thin clay	4-6			
15+92	J	302	38			ti - sl. op	sl. ox	10-12			
16+30	f	280	74			ti - sl. op.	[illegible]	2-4			
16+45	J	272	64			sl. op.	ox.	4-6			
16+50	J	356	52			sl. op.	sl. ox	6-10			
16+82	J	243	69			ti	ox.	4-6			
17+28	J	210	77			sl. op.	ox.	4-6			
17+45	J	68	72			ti	ox. & mn	4-6			
17+80	J	184	86			sl. op	sl. ox	6-8			
17+99	J	236	86			sl. op	ox	4-6			
18+10	J	282	56			sl. op.	sl. ox.	8-10			
18+20	J	256	72			sl. op	sl. ox.	4-6			
18+72	f	172	70			ti	thin clay gouge	4-6			
19+00	f - J	255	63			sl. op - ti	thin clay coating	2-6			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 17a
(4 of 4)

T-17/4

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Trench T-17/4

Date: 8/3/00 **Logged By:** JLB, RDK **Location:** Trench T-17a ISFSI

No	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
19+23	Fault	30	78			Ti	ox. thin clay gouge	6-8			
19+37	j	40	82			Ti	sl. ox.	2-4			
19+47	j	15	75			Ti	sl. ox.	4-6			
20+11	j	275	86			sl. op.	sl. ox.	~~sl. op.~~ 4-6			
20+45	j-F?	15	76			Ti	Thin clay	6-8			
20+93	j	60	85			Ti	sl. ox, mn	6-8			
21+19	j	85	88			Ti	sl. ox.	4-6			
21+27	j	345	45			Ti	—	2-4			
21+27	j	315	41			Ti	sl. ox.	2-4			
22+43	j	235	90			Ti	sl. ox.	2-4			
22+55	j	245	56			Ti	sl. ox.	2-4			
25+20	Fault	205	65			sl. op.	Thin clay ½ cm	0-2			
25+40	j	185	65			Ti-sl op.	sl. ox, thin clay	2-6			
25+43	j	236	60			Ti	—	4-6			
25+47	j	350	69			Ti-sl. op.	sl. ox.	4-6			
26+40	j	182	38			Ti	sl. ox.	6-8			
28+38	j	204	74			Ti	sl. ox.	4-6			
28+65	j	335	64			Ti	—	2-4			
28+73	j	232	64			Ti	sl. ox	4-6			
29+08	j	245	66			Ti	sl. ox	2-6			
29+44	j	200	77			Ti	sl. mn., ox	2-4			
30+30	j	15	82			sl. op. 4mm	sl. mn, ox	~~6-8~~ 4-6			
30+75	j	320	63			Ti	Thin clay 1mm	4-6			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

Trench 17 B

Domain [ ]

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 8/7/00 **Logged By:** JLC & RDK **Location:** Trench 17B

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
0+26	J	182	82			Ti	sl. ox.	6-8		dry	
0+45	J	191	64			ti-op [illegible]	sl. ox.	6-8			
0+55	J	270	87			ti	sl. ox.	10-12			
1+18	J	244	88			ti.	sl. ox	4-6			
2+12	J	272	27			ti-sl. op.	sl. ox.	6-8			
3+00	B(?)-J	217	12			ti	sl. ox.	8-10			
3+62	J	78	74			ti	ox	4-8			
3+84	J	49	74			ti	ox	6-8			
4+28	J	271	90			ti	ox.	6-8			
4+40	B(?)-J	221	4			ti-sl. op.	sl. ox.	8-10			
5+10	J	269	88			ti-sl. op.	sl. ox.	8-10			
5+60	B(?)-J	220	21			ti-sl. op.	sl. ox	8-10			
5+90	J	196	74			op. [illegible]	sl. ox	8-10			
6+10	J	70	89			ti-sl. op	sl. ox.	8-10			
6+21	J	120	88			sl. op. [illegible]	ox.	6-8			
6+35	J	254	88			[illegible] op	sl. ox	6-8			
6+48	J	207	82			ti.	sl. ox	10-12			
6+62	J	33	68			ti.	sl. ox	6-8			
7+06	J	120	82			ti.	sl. ox.	6-8			
7+36	B(?)-J	195	11			ti.	sl. ox.	10-12			
7+77	J	185	81			ti.	sl. ox.	10-12			
8+00	J	256	84			ti	sl. ox	8-10			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

[signatures]

TRENCH 18A

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

T-18A/1

Date: 8/3/00 **Logged By:** JLB, RDK **Location:** Trench T-18A

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Apetature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
0+20	J	[illegible]	46			ti.	sl. MN	2-4			
0+60	J	245	47			ti.	sl. MN	4-6			
1+05	J	240	80			ti.	sl. MN.	8-10			
1+40	J	148	68			ti	sl. MN.	8-10			
1+60	J	237	70			ti	sl. MN	6-7			
1+90	J	235	26			sl. op.	sl. MN	6-8			
2+00	J	300	87			ti	sl. MN	8-10			
2+32	J	228	73			ti-sl. op	sl. ox	12-14			
2+38	J	236	25			sl. op.	ox	8-10			
2+10	J	222	71			ti	sl. MN	6-8			
3+10	J	218	80			ti-sl. op	ox.	[illegible]			
4+00	J	225	24			sl. op.	ox.	10-12			
4+60	J	221	89			sl. op.	sl. MN	8-10			
5+70	J	247	34			sl. op.	sl. ox.	6-9			
2+[illegible]	[illegible]	[illegible]	32			ti	ox.	8-10			
2+80	J	227	82			ti	ox.	8-10			
5+10	J	215	23			ti	sl. MN	8-10			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 18B (2 of 2) Domain [ ]

T-18b/2

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 8/3/00 **Logged By:** JLB, ROK **Location:** Trench T-18b Borrow Site

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
0+40	J	05	75			Ti	sl. ox.	6-10		dry	
0+60	J	298	76			Ti	sl. ox., mn	6-10		↓	
0+72	J	46	88			Ti - sl. op.	sl ox, mn	6-8			
0+89	J	250	57			sl. op.	sl. mn	8-10			
0+90	J	250	79			Ti	sl mn	8-12			
1+00	J	215	86			sl. op.	sl. ox	6-12			
1+20	J	250	28			Ti - sl. op.	sl ox	4-6			
1+21	J	279	88			sl. op.	sl. ox.	6			
1+45	J	240	84			sl. op. - op	sl. mn.	4-6			
1+60	J	292	69			sl. op.	mn	6-8			
1+68	J	205	70			sl op.	mn	6-10			
1+82	J	285	68			sl. op	mn	8-10			
1+94	J	210	87			sl. op	mn	8-10			
2+00	J	287	72			sl. op	mn	6-8			
2+08	J	257	67			sl. op.	mn	4-6			
2+15	SZ	205	80			sl op. crushed rock		6-8			
2+69	J	325	38			ti	sl MN	8-10			
2+78	J	80	78			ti	MN	6-8			
2+94	J	10	76			sl op.	sl. MN	6-10			
3+10	J	110	80			sl. op.	sl. ox, MN	6-8			
3+24	F	5	83			ti - sl. op [illegible]	[illegible] ox & MN	2-4			
3+40	F	16	82			op. [illegible]	[illegible]	2-4			
3+98	J	282	60			sl op.	sl. MN	6-8			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

9/6/00 [signature]

TRENCH 18E (1 of 2)

Domain ________

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Trench T-18b/1

Date: 8/3/00 **Logged By:** RDK, JLB **Location:** Trench T-18b

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
3+98	J	210	87			sl. op.	sl. ox.	6-8			
4+50	J	[illegible]	78			ti - sl op.	sl MN	2-4			
4+30		192	80			ti	sl. MN	4-6			
5+44	J	98	72			sl. op	sl. MN.	6-8			
6+60	J	270	84			ti	sl. MN.	6-8			
6+70	J	325	84			ti	sl. MN	4-6			
7+28	J	268	[illegible]			ti	sl. MN	4-6			
7+60	J	234	75			ti - sl. op.	MN	6-8			
7+70	J	210	87			sl. op.	sl. ox + MN	6-8			
7+80	J	[illegible]	82			sl. op.	sl. MN	4-6			
8+00	J	220	77			ti	MN.	6-8			
8+15	SZ	40	76			ti [illegible]	ox.	6-12			
8+54	J	245	78			ti - sl. op.	sl. MN	8-10			
8+68		~~[illegible]~~ 88	88			sl. op	sl. MN	6-10			
8+96	J	254	79			ti	sl. ox.	8-10			
9+10	J	100	87			ti	sl. MN	6-8			
9+28	J	~~[illegible]~~ 95	89			ti. op.	sl. MN	4-6			
9+50	J	28[illegible]	82			sl. op.	sl. MN	6-8			
9+66	SZ	250	80			ti [illegible]	ox.	4-8			
9+90	J	265	62			sl. op	sl. MN.	4-6			
9+90	J	[illegible]	82			sl. op.	sl. MN	4-6			
10+4[illegible]	J	[illegible]	72			ti	sl. MN	6-8			
10+75	J	5	80			ti - sl. op	sl. MN	4-6			
10+78	J	263	85			sl. op.	sl. MN	6-8			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

9-6-00 [signature]

TRENCH 19
(1 of 2)

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 9 Dec. 2000 **Logged By:** JGH **Location:** T-19 (See Geologic Map)

No	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
1	JO	N42E	71	S.C.	Ti		OX + MnO	6-8			3
2	JO	N32E	85	Dis	Ti		OX	4-6			3
3	JO	S15E	84	Dis	Ti		Sl OX	4-8			4
4	JO	S44W	74	S.C.	Ti		MnO, OX	4-6			2
5	JO	N28W	74	Dis - S.C.	Ti		MnO, Sl. OX	4-6			4
6	JO	N22E	76	S.C.	Ti		MnO, Sl. OX	2-4			3
7	JO	N5W	79	S.C.	Ti		OX	6-8			3
8	JO	N16W	96	S.C.	Ti		Sl. OX, MnO	4-6			2
9	JO	S44W	88	S.C.	Ti		OX	6-8			2
10	JO	S11E	85	S.C.	Sl op		OX & Clay	8-10			2
11	JO	N75E	68	Dis	Ti		MnO	8-10			3
12	JO	S18E	88	S.C.	Ti		MnO & OX	8-10			3
13	JO	S46W	86	S.C	Ti		" "	6-8			2
14	JO	S20E	86	S.C	Sl op.		Clay & OX	6-8			2

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

[signature] for JGH

TRENCH 19
(2 of 2)

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Stationing According to Log

Date: 12/6/00 **Logged By:** JLB/JGH **Location:** Trench 19

Stn. No. ← m	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperture	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
17	Bedding	213	10								
5.5	Bedding	183	3								
2.0	Bedding	215	12								
13.5	Fault	319	38								
	Joints										

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses, controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 20A and 20C

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Stns. according to log.

Date: 12/6/00 **Logged By:** JLB/JGH **Location:** T-20 A T-20C

	ST. No ←m	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperture	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
20A	26.5	Fault	208	63								
20A ↓	26.7	Fault	011	75								
20C	0.0	Bedding	208	5								
	1.2	Fault	351	60								
	3.9	Fault	176	76								
	10.2	Fault	185	68								
	11.0	Jnt	010	80								
	11.0	Jnt	290	85								

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 20B

Domain [ ]

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Stationing according to T20B log, meters

Date: 12/6/00 **Logged By:** JLB/JGH **Location:** Trench T-20B

No	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
-.40	Jnt.	242	68			Ti	Ox	4-6			3
-.05	Jnt	316	53			Ti-Sl.op	ox: Mg: HC	8-10			
0.0	Jnt	189	72			Sl.op	" "	8-10			
.10	Jnt	264	69			Sl.op.	Ox, Mg	6-8			
0.35	Jnt	047	83			Ti	Sl. ox.	6-8			
0.70	Jnt	261	84			Ti	Ox.	4-6			
2.30	Jnt	029	82			Ti	Mg., Sl. Ox	2-4			
2.65	Jnt	289	77			Sl. op.	Sl. ox.	2-4			
2.90	Jnt	264	63			Sl. op.	Sl. ox., HC	4-6			
3.15	Flt. *Also on log	215	59			Ti-Sl.op.	mineralized	2-4			
3.40	Jnt.	270	70			Ti	ox.	8-10			
3.50	Jnt.	048	70			Ti-sl.op.	1/16" HC	6-8			
4.20	Jnt.	293	62			Sl. op.	Sl. ox.	8-10			
7.00	Jnt.	220	61			Ti-Sl.op	Sl ox	8-12			
7.40	Jnt.	291	80			Ti	ox, HC	6-8			
7.90	Jnt.	205	82			Ti	1/16" HC, ox	8-10			
7.90	Bddg. *Also on log	216	04			Ti, bonded	Sl. ox	2-4			
7.90	Jnt.	231	74			Ti	HC, sl. ox.	8-10			
7.70	Jnt.	286	56			Ti	HC, ox.	9-10			

HC = hydrocarbon Ox = oxidation
Mg = Manganese

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

TRENCH 21

Domain [ ]

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 7 Dec. 2000 **Logged By:** JGH **Location:** T-21 See Sketch Map + Log

No.	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
1	1.25m JO	N36W	51°	Dis	Ti		OX	4-6			2
2	1.5m JO	N7W	85°	Dis	Ti		OX	4-6			4
~~3~~	~~[illegible] JO~~										
3	14m JO	N28E	25°	SC	Ti-Op		Clay-OX	6-8			4
4	15m JO	N42E	44°	Dis	Ti		OX	2-4			4
5	16.5m JO	N7E	56°	Dis	Ti		OX	4-6			3
6	17m JO	N68E	77°	SC	Ti		Sl. Ox.	2-4			2
7	18.5m JO	N4E	71°	SC	Ti		OX	6-8			~~3~~ 2
8	20m JO	N29W	40°	Dis	Ti		OX	8-10			4
9	20.5m JO	N28W	48°	S.C.	Ti		OX MnO	6-8			4
10	23 JO	N16W	20°	Dis	Ti		OX	4-6			3
11	23.5 JO	N40E	80°	S.C.	Ti		OX-MnO	4-6			3
12	26 JO	N40W	53°	S.C.	Ti		OX	6-8			4
13	26.5 JO	S8W	77°	S.C.	Ti		MnO	8-10			3
14	26.0 JO	N46W	83°	Dis	Ti		OX	6-8			
	~~Diabase Dike~~ Fault (CMB 5 July 2001)	N87W	64 N	⇒ this measurement is in Strike/Dip; equivalent Dip Direction/Dip Magnitude is 003/64 (CMB 5 July 2001)							

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

[signature] for JGH

Reservoir Rd Cut - RR-1

Domain [ ]

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 2/7/01 Logged By: CMB / JLB Location: RR-1 Reservoir Road cut, South of Plant (Reservoir Road cut S of Plant)

No	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
24	B	349	50	1-4m	8cm-1m	Ti	Sl. oxid.	4-6			
25	J	264	60	0.5m	2m	Ti-Sl op.	Sl. wthd.	4-6			
26	J	268	75	1m	1m	Ti	"	6-8			
27	J	223	28	0.5m	1m +	Ti	"	6			
28	B	356	57	1-3m	4cm-1m	Ti	"	6			
29	J	240	66	1m	-	Ti	"	8-10			
30	J	155	54	1m	-	Ti	"	8			
31	B	356	54	2-3m	-	Ti	"	6			
32	J	157	36	0.5-1m	4cm-1m	Ti	"	6			
33	J	086	70	1m	-	Sl. op.	"	6-8			
34	B	341	51	2-4m	4cm-1m	Sl. op	"	4			
35	J	259	86	0.5m	-	-	"	8-10			
36	J	212	41	1m	-	Ti	"	10			
37	J	258	90	1m	-	Ti	"	8			

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

B-bedding
J-Joint
F-Fault

[signatures]

Reservoir Rd Cut RR-2

Domain 1/2

PG&E Diablo Canyon ISFSI Project

Dolomite - Dol. Sandstone

DISCONTINUITY CHARACTERIZATION FORM

Date: 2/7/01 **Logged By:** JLB/CMB **Location:** RR-2 Reservoir Rd Cut, above PP

No	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
1	J	220	90	2m	1-5m±	op	—	14		dry	
2	J	44	84	1m	1-5m	op	—	6			
3	J	268	88	2-3m	2m+	op	sl. oxid.	8			
4	J	274	67	3m	—	op-sl.op	"	12-14			
5	J	240	85	2m	—	sl.op-op	"	6-8			
6	J	05	85	3-4m	-	sl. op-op	"	8-10			
7	J	75	84	3m	~	sl. op.	"	8-10			
8	J	002	50	1m	2"-8"	Ti-sl.op	"	6-8	Set of 10±		
9	J	45	80	2m	—	sl. op.	"	10-12	Form small		
10	J	135	70	2m	—	sl. op	"	8-10	wedge scar		
11	J	265	33	1.5m	-	op	"	8	± 1m3		
12	J	55	78	2-3m	—	sl. op	"	6-8			
13	J	344	54	1.5m	-	Ti-sl.op	"	10-12			
14	Domain 1 B Low level certainty	140	4	Thin laminations							
15	B ?	35	35								
16	B	346	45	3m	1-2m	Ti	sl. oxid.	6	South of 500kv lines		
17	Domain 2 J	245	90	0.5m	—	Ti	2mm vein fill ", mgn.	4-6			
18	J	146	42	0.25m	-	—	sl. oxid.	8			
19	J	244	90	0.5m	-	—	1mm calcite sl. wthd.	8			
20	B	350	50	1-3m	8cm-1m	—	sl. oxid.	6-8			
21	J	142	48	1m	-	—	"	8			
22	J	246	45	0.5m	—	Ti		12-14			
23	B	344	46	1-2m	8cm-1m	Ti		6			

Margin notes (rows 13–17): * under 500kv Tower lines; Add to Map

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

J= Joint
B= bedding
F= fault

[signatures]

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

Date: 4/27/01 **Logged By:** J. Bachhuber / C. Brankman **Location:** ISFSI 2001 Bulldozer Cut Line DS-1 Sheet 1/2

No.	Station (m)	Discontinuity Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
1	0.1	Jo	010	78	1mt		Sl. open	-	10-12		dry	1-2
2	0.3	Jo	260	75			open	-	10			3-5
3	0.3	Jo	010	70			Sl. open	-	12			1-2
4	0.5	Jo	345	85			open	Sl. ox.	6-8			3-5
5	0.7	Jo	246	77			Sl. open	mn. ox.	14			3-5
6	0.9	Jo	010	66			Ti	Sl. ox.	8-10			1-2
7	0.9	Jo	206	56			Sl. open	mn. - ox.	6-8			3-5
8	1.0	Jo	255	90			Ti	mn.	8-10			3-5
9	1.0	Jo	014	80			Sl. open	mn.	6-8			1-2
10	1.5	Jo	235	80			Sl. open	mn. - ox.	6-8			3-5
11	1.5	Jo	009	85			Sl. open	ox.	4-6			1-2
12	1.8	Jo	030	90			Sl. open	mn.	4-6			3-5
					disturbed cut	loosened	by bulldozer	1.8-3.0 m				
13	3.0	Jo	011	85			Sl. open	ox.	6-8			1-2
14	3.8	Jo	242	65			Sl. open	Sl. mn	14-16			3-5
15	3.8	fault/Jo	342	82			Sl. open	Mn. ox, slicks	8-10	Slicks rake 20° east		3-5
16	4.1	↓	345	90			Ti	ox - mn	6-8			3-5
17	4.1	fault/Jo	180	75			open	ox - mn	6-8	Vertical fabric		3-5
18	4.8	Jo	038	75			Sl. open	Sl. mn	4-6			3-5
19	4.8	fault/Jo	260	71			Sl. open	-	6-8			3-5
20	5.0	Jo	200	85			Ti	Sl. mn.	8-10			3-5
21	5.2	Jo	074	80			Sl. open	mn.	6-8			3-5
22	5.2	fault/Jo	009	80			Sl. open	-	14-16			1-2
23	5.5	fault/Jo	345	65	↓		Sl. open	Sl. mn.	12-14		↓	3-5

* direction of survey line N40E

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

Domain

PG&E Diablo Canyon ISFSI Project

DISCONTINUITY CHARACTERIZATION FORM

DS-1

Date: 4/27/01 **Logged By:** J. Bachhuber / C. Brankman **Location:** ISFSI 2001 Bulldozer Out line Sheet 2/2

No.	Discontinuity Station (a) Type	Dip Geometry Direction	Dip Geometry Magnitude	Continuity	Spacing	Aperature	Weathering/ Infilling	(JRC) Roughness	Hammer Reaction	Water Conditions	Significance Rating (1-5)
24	5.8 Fault/Jo	~~24~~ 235	85			Sl. open	mn.	6-8			3-
25	5.8 Fault/Jo	008	70			Sl. open	Sl. ox.	6-8			1-2

Significance Rating: (1)-primary influence on gross stability and slope geometry
(2)-strong influence on gross stability, bounds large unstable blocks or thick potentially unstable rock masses; controls deep stability
(3)- moderate influence on gross stability, controls smaller failures
(4)- influences surficial raveling, but not gross cut stability
(5)-minor influence on slope stability and rock mass response

DATA REPORT G

SOIL LABORATORY TEST DATA

(Cooper Testing Laboratory)

DIABLO CANYON ISFSI

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DATA REPORT G

SOIL LABORATORY TEST DATA
(Cooper Testing Laboratory)

DIABLO CANYON ISFSI

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Attachment 2 Monotonic Direct Shear Tests
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DATA REPORT G

SOIL LABORATORY TEST DATA

(Cooper Testing Laboratory)

DIABLO CANYON ISFSI

1.0 INTRODUCTION

Laboratory testing was performed on selected samples of the clay beds collected in trenches T-14B, T-11, and T-15, and in boring 98BA-1 in the ISFSI study area (Figure G-1). Borings and trenches were excavated and logged by William Lettis &Associates (WLA) of Walnut Creek, California, and are described in William Lettis & Associates, Inc. (2001) Data Reports B and D. Laboratory testing was performed by Cooper Testing Laboratory (Cooper) in Mountain View, California and laboratory test data sheets are included in Attachments 1 through 7. Samples were delivered to Cooper, visually inspected in the laboratory and selected for testing by Geomatrix Consultants (Geomatrix). Jeff Bachhuber of WLA and Dave Cooper of Cooper signed the sample chain of custody form on September 15, 2000. Interpretation of the test results was performed by Faiz Makdisi of Geomatrix and Joseph Sun of PG&E, Geosciences Department, with geological input to the interpretation provided by Dr. William Page of PG&E, Geosciences Department. Independent technical review was performed by Robert White of PG&E, Geosciences Department.

The preparation of this data report was performed under the WLA Work Plan (Rev. 2) dating November 28, 2000. The laboratory testing was performed under Geomatrix Consultants, Inc., Work Plan, Rev. 0, August 29, 2000 and Rev. 1, October 5, 2000.

2.0 PURPOSE

Selected clay bed samples retrieved from the exploratory trenches and borings were examined and tested to evaluate their physical characteristics and engineering properties. Properties measured in the laboratory testing program were used to develop strength parameters for use in the evaluation of the stability of the slope above the ISFSI pads and the foundation stability beneath the pads.

3.0 METHODOLOGY

The clay bed samples from the trenches were collected in the field by geologists from William Lettis & Associates. Twenty four samples of clay bed material were obtained from trenches T-11A, T14A, T14B, and T-15 in the slope above the ISFSI pads, and core from borings BA98-1 and BA98-2. Samples included hand-driven tube and ring samples obtained from trench sidewalls (Figure G-2) or exposed clay bed surfaces in trenches, bag samples of trench spoil, or bag samples of clay material from stored core. Drive samples were collected by hand-driving 2.5-inch outside diameter (O.D.) brass or steel sample tubes (5 to 6-inches tall) or 2.5-inch O.D. rings (1-inch tall). The sample locations are documented on the trench and boring logs (Diablo Canyon ISFSI Data Reports B and D).

The samples were collected in three batches: (1) a bag sample from trench T-15 on July 10, 2000; (2) a batch of seven bag and hand-driven samples from trenches T-11 A and T-14B collected on August, 8, 2000; and, (3) a batch of seventeen bag and hand-driven samples from trench T-14A and stored core from borings BA98-1 and BA98-2 collected on September, 14, 2000.

Drive samples from the August 8, 2000 batch were driven horizontally into the sidewall of the trench, parallel to the relatively flat-lying clay bed (Figure G-2). Drive samples from the September 14, 2000 batch were all driven vertically into the top of a clay bed (perpendicular to the clay bed) that was exposed in the trench sidewall by removing overlying rock beds.

Sampled portions of clay beds in both trenches T-14A and T-14B were intact and relatively undisturbed by trench excavation, and varied between about 2 and 5 inches thick. The clay beds did not exhibit strong bedding-parallel structure or evidence of significant past shearing, but did exhibit a local blocky structure with random slightly polished surfaces. Sample tubes and rings were seated into the clay bed by pressing the open end of the tube/ring into the clay bed. After the tube/ring was set, it was driven into the clay bed by placing a wood block on the other end of the tube/ring, and striking a hammer against the wood block. Sample driving was stopped either when the tube was filled, the clay bed was penetrated, or the tube/ring met driving refusal. After driving, the sample was retrieved by removing the surrounding clay with a knife, and gentle twisting of the tube. The clay exposed in the end of the sample tubes was examined after retrieval, and tight-fitting plastic end caps and tape were used to seal the sample ends to preserve sample integrity and in situ moisture. Sample tubes/rings, core, and bulk samples were placed in plastic zip-lock freezer storage bags for transport to the laboratory. Chain-of-custody forms were completed and sent along with each sample batch.

Sampling produced some disturbance in the samples, but in general appeared to be relatively intact and largely preserved in situ conditions of the clay. The cohesive nature of the clay helped reduce disturbance of in situ structure, however, some entrained rock fragments or sample driving refusal produced localized disturbance in some samples.

Laboratory tests were performed to measure Atterberg limits, grain-size distribution, moisture content, dry unit weight, and strength. Undrained direct shear (both monotonic and cyclic), drained direct shear, and undrained triaxial compression (CU) tests with pore-pressure measurements were conducted to measure the shear-strength properties of the soil. All clay samples were saturated prior to direct-shear and triaxial testing. A summary of test results is presented on Table G-1; the complete set of test results are attached.

Consolidated-Undrained Triaxial Compression Tests

Three clay bed samples collected in brass rings were selected for consolidated-undrained triaxial testing. All samples were collected in Trench T-14B. The tests were performed in general accordance with ASTM Test Method D-4767.

Direct Shear

Six samples were selected for undrained monotonic direct shear tests, three samples were selected for drained monotonic direct shear tests, and four samples were selected for undrained cyclic direct shear tests. All samples were collected in Trench T-14B. The drained and undrained direct shear tests were performed in general accordance with ASTM Test Method D3080 and D6528, respectively. Cyclic undrained direct-shear tests were conducted to displacement amplitudes of ±0.5 inch for three loading cycles at a loading rate of 0.2 inch/min. Monotonic undrained direct shear tests were conducted at a loading rate of 0.02 to 0.025 inch/min. Drained direct shear tests were performed at a loading rate of 0.002inch/min.

Atterberg Limits

Tests were performed to determine the Atterberg limits (liquid limit and plastic limit) of 15 clay bed samples recovered from the boring and trenches. These tests were conducted in general accordance with ASTM Test Method D-4318 (wet preparation).

Grain Size Distribution

Particle size analyses were performed on 15 clay bed samples collected from the boring and trenches to determine their grain size distribution. Sieve analyses with hydrometers were performed in general accordance with ASTM Test Method D-422.

Moisture Content and Unit Weight

Measurement of moisture content and dry unit weight were performed on 21 clay bed samples recovered from the boring and trenches. These tests were conducted in general accordance with ASTM Test Method D-2216.

Specific Gravity

Tests were performed to determine the specific gravity of three samples recovered from the trenches. These tests were conducted in general accordance with ASTM Test Method D-854.

4.0 RESULTS

The results of the laboratory testing described above are presented at the end of this report. A summary of results is presented on Table G-1.

Index Property Test Results

Specific gravity (G_S) tests show that the G_S for the clay bed samples vary between 2.66 to 2.70, which is a typical range for clayey soils. Atterberg limits test results show that with the exception of the sample from Trench T-15, all other samples have liquid limits that vary between 35 and 67 with a median and average value of 50. The plasticity indices vary between 18 and 45 with a median value of 30 and an average value of 29. These ranges are typical for medium plasticity clays (CL to CH). Average fines content of the clay bed samples is 75% and average clay fraction is about 43%.

The dry unit weight of the clay bed samples vary between 88 to 106 pcf with an average of 99 pcf. Moisture contents of the samples vary between 4 % and 29 % with an average of 19 %.

Drained Strength Test Results

Drained strengths of the clay beds were obtained from three multi-stage consolidated undrained tests with pore pressure measurements and three drained direct shear tests. Deviatoric stress at 5% strain range from 6.3 to 21.1 ksf for confining stresses ranging from 9.8 to 19.8 ksf. In general, the stress-strain curves show ductile behavior and do not exhibit reductions in strength at high strains.

Undrained Strength Test Results

Undrained strengths of the clay beds were obtained from three multi-stage consolidated undrained triaxial tests, six monotonic direct shear tests, and four cyclic direct shear tests. Sample T14B-H appears to exhibit anomalously high strength; all other strengths appear reasonable for these soil types.

5.0 REFERENCES

ASTM, 1985, Test D421-85(1998) Standard Practice for Dry Preparation of Soil Samples for Particle-Size Analysis and Determination of Soil Constants

ASTM, 1963, Test D422-63(1998) Standard Test Method for Particle-Size Analysis of Soils

ASTM, 2000, Test D854-00 Standard Test Methods for Specific Gravity of Soil Solids by Water Pcynometer

ASTM, 2000, Test D2166-00, Standard Test Method for Unconfined Compressive Strength of Cohesive Soil

ASTM, 1998, Test D2216-98 Standard Test Method for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass

ASTM, 1995, Test D2850-95 (1999) Standard Test Method for Unconsolidated, Undrained Triaxial Compression Test on Cohesive Soils

ASTM, 1998, Test D3080-98 Standard Test Method for Direct Shear Test of Soils Under Consolidated Drained Conditions

ASTM, 2000, Test D4318-00 Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

ASTM, 1995, Test D4767-95 Standard Test Method for Consolidated Undrained Triaxial Compression Test for Cohesive Soils

ASTM, 2000, Test D6528-00 Standard Test Method for Consolidated Undrained Direct Simple Shear Testing of Cohesive Soils

Geomatrix Consultants, Inc., Work Plan, Laboratory Testing of Soil Samples, Slope Stability Analyses, and Excavation Design for the Diablo Canyon Power Plant, Independent Spent Fuel Storage Installation Site, Rev. 0, August 29, 2000, and Rev. 1, October 5, 2000.

William Lettis & Associates, Inc., Work Plan, 2000, Additional Geologic Mapping, Exploratory Drilling, and Completion of Kinematic Analyses for the Diablo Canyon Power Plant, Independent Spent Fuel Storage Installation Site, Rev. 2, November 28, 2000.

William Lettis & Associates, Inc., 2001, Diablo Canyon ISFSI Data Report B, Rev. 1, Borings in ISFSI Study Area.

William Lettis & Associates, Inc., 2001, Diablo Canyon ISFSI Data Report D, Rev. 1, Trenches in the ISFSI Study Area.

TABLE G-1
Summary Test Results for Clay Bed Samples from Trenches and Borings in ISFSI Site Area

Boring/ Trench	Sample Number	Depth		Sample Type[1]	USCS	Moisture Content (%)	Dry Unit Weight (pcf)	Specific Gravity	Fines Content[2] (%)	Atterberg Limits[3]		Direct Shear[4]		CU Triaxial[5]	
		Top (feet)	Bottom (feet)							LL	PI	σ_n (ksf)	τ_{res} (ksf)	$\Delta\sigma_{d(5\%)}$ (ksf)	σ_{3C} (ksf)
T-14 A	A	2.6	2.9	Tube											
T-14 A	B	2.6	2.9	Ring		19	99		81	52	29				
T-14 A	C	2.6	2.9	Tube											
T-14 A	D	2.6	2.9	Ring	CH	15	101		93	60	35	6	3.4		
T-14 A	E	2.6	2.9	Tube	CL	22	102		63	48	26	8	2.7		
T-14 A	E	2.6	2.9			21	106					10	3.9		
T-14 A	F	2.6	2.9	Ring	CH	18	103		85	67	45	10	2.5		
T-14 A	F	2.6	2.9	Ring		20	102					14	6.1		
T-14 A	G	2.6	2.9	Tube											
T-14 A	H	2.6	2.9	Tube	CL	21	101		75	49	27	14	7.4		
T-14 A	H	2.6	2.9	Tube		19	105					18	13.7		
T-14 A	I	2.6	2.9	Tube											
T-14 A	J	2.6	2.9	Tube	CH	22	99		92	51	30			6.3	9.8
T-14 A	J	2.6	2.9	Tube										7.3	15.9
T-14 A	K	2.6	2.9	Tube	CH	23	100		95	58	37			7.8	11.9
T-14 A	K	2.6	2.9	Tube										12.6	17.9
T-14 A	L	2.6	2.9	Tube											
T-14 A	M	2.6	2.9	Tube	CL	19	100		64	48	26			13.9	13.8
T-14 A	M	2.6	2.9	Tube										21.1	19.8
T-14 A	N	2.6	2.9	Tube	GC	21	102		43	46	23	22	5.5		
T-14 A	N	2.6	2.9	Tube		21	103					26	9.9		
T-14 B	S7-A	2.6	2.6	Bag	CL				82	39	20				
T-11 A	S4-A	3.9	3.9	Bag	CL			2.70	66	38	18				
T-14 B	S4-1	2.6	2.6	Tube	CH	23	88	2.68	95	61	39	12	3.4		
T-14 B	S4-2	2.6	2.6	Tube		22	89					16	4.2		
T-14 B	S4-3	2.6	2.6	Tube		26	90					20	4.2		
T-14 B	S4-4	2.6	2.6	Tube		29	89					24	5.3		
T-14 B	Block 1	2.6	2.6	Tube	CL	17	106	2.66	93	41	23				
T-14 B	Block 2	2.6	2.6	Tube		19	104								
98BA-1	9/14/2000	66.3	67.0	Bag	CL	4			55	35	20				
98BA-2	9/14/2000	53.6	54.3	Bag											
T-15	7/10/2000	1.6	1.6	Bag	GC	8			39	95	63				

NOTES: 1. Tube = 2-inch diameter, 6-inch tall; Ring = 2.5-inch diameter, 2-inch tall
2. Fines Content = percent passing the #200 sieve; complete grain size distribution curves presented in Appendix G.
3. LL = Liquid Limit; PI = Plasticity Index
4. Drained and undrained direct shear tests; σ_n = normal stress; τ_{res} = residual stress
5. Consolidated undrained triaxial compression tests with pore pressure measurements; σ_{3C} = initial confining stress; $\Delta\sigma_{d(5\%)}$ = deviator stress at 5% strain

EXPLANATION

T-15 — Exploratory trench where clay bed samples were obtained, trench number indicated

Footprint of 500 kV tower

Outline of ISFSI Pads

Cutslope above, and fill prism west of, ISFSI pads

98BA-1 — Boring for ISFSI, number indicated (initial is year drilled)

N

0 50 100 150 200

Contour interval = 5 feet

DIABLO CANYON ISFSI

FIGURE G-1
EXPLORATION TRENCHES AND BORINGS WHERE CLAYBED SAMPLES WERE TAKEN

Clay bed in dolomite (Tof_{b-1}), Trench T-14B. Clay bed is up to 4 inches thick. The brass tubes contain samples being taken for laboratory testing. Photo roll JLB-8.

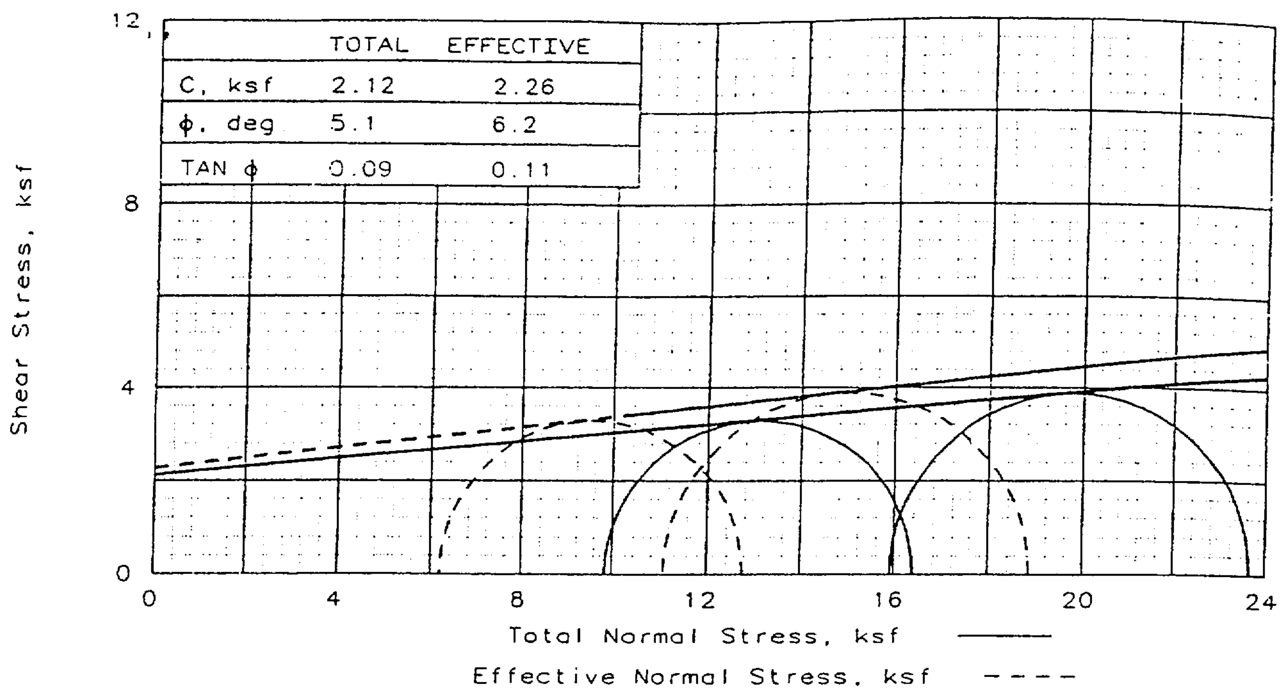
DIABLO CANYON ISFSI

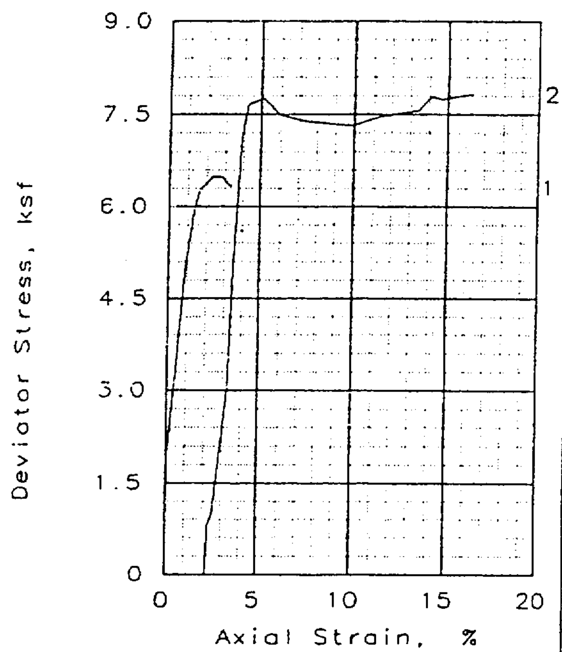
FIGURE G-2
CLAY BED IN TRENCH T-14B

ATTACHMENT 1
DATA REPORT G

TRIAXIAL TESTS

Sample T14B-J
Sample T14B-M
Sample T14B-K





SAMPLE NO.:		1	2
INITIAL	WATER CONTENT, %	22.3	
	DRY DENSITY, pcf	99.0	
	SATURATION, %	85.6	
	VOID RATIO	0.703	
	DIAMETER, in	1.93	
	HEIGHT, in	3.99	
AT TEST	WATER CONTENT, %	24.3	23.6
	DRY DENSITY, pcf	101.7	103.0
	SATURATION, %	100.0	100.0
	VOID RATIO	0.657	0.637
	DIAMETER, in	1.92	1.93
	HEIGHT, in	3.90	3.82
Strain rate, %/min		0.0050	0.0050
EFF CELL PRESSURE, ksf		9.8	15.9
Deviator Stress, ksf		6.6	7.8
EXCESS PORE PR., ksf		3.6	4.8
STRAIN, %		2.8	3.0
ULT. STRESS, ksf			
EXCESS PORE PR., ksf			
STRAIN, %			
$\bar{\sigma}_1$ FAILURE, ksf		12.8	18.9
$\bar{\sigma}_3$ FAILURE, ksf		6.2	11.1

TYPE OF TEST:
CU with Pore Pressures

SAMPLE TYPE: Undisturbed

DESCRIPTION: yellow brown claystone

ASSUMED SPECIFIC GRAVITY= 2.7

REMARKS: **Staged Test**
Strengths picked at the peak stress ratio.

Fig. No.: ______

CLIENT: GeoMatrix

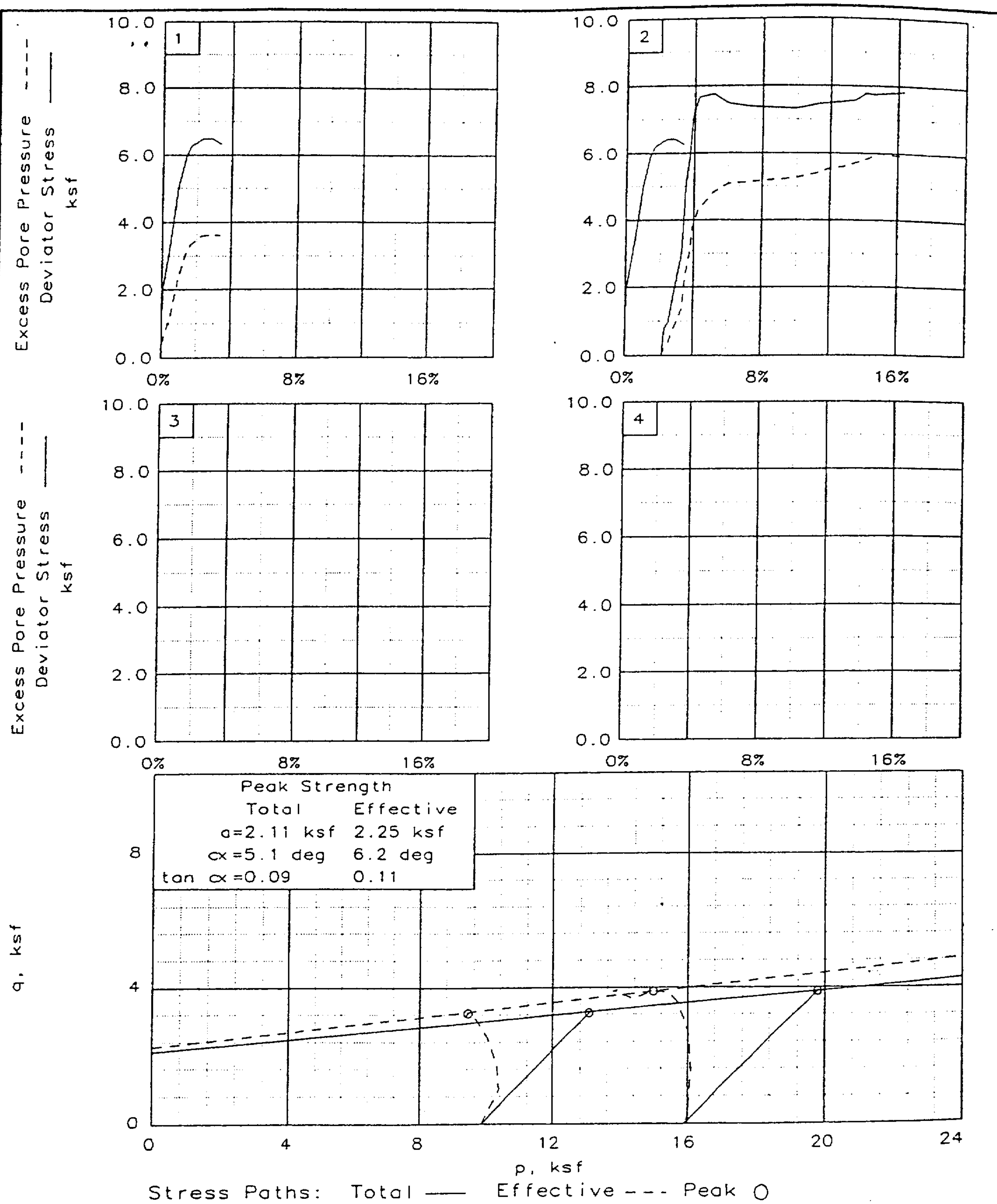
PROJECT: 6427.001

SAMPLE LOCATION: TB14-J

PROJ. NO.: 109-290b DATE: 10/23/00

TRIAXIAL SHEAR TEST REPORT

COOPER TESTING LABORATORY



Client: GeoMatrix

Project: 6427.001

Location: TB14-J

File: 109-290B Project No.: 109-290b Fig. No.: ______

Project and Sample Data

Date: 10/23/00
Client: GeoMatrix
Project: 6427.001
Sample location: TB14-J
Sample description: yellow brown claystone
Remarks: **Staged Test** Strengths picked at the peak stress ratio.
Fig no.: 2nd page Fig no. (if applicable):
Type of sample: Undisturbed
Assumed specific gravity= 2.70 LL= PL= PI=
Test method: ASTM - Method B w/saturation est. (staged method triaxial test)

Specimen Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Wt. moist soil and tare:	368.500			372.400
Wt. dry soil and tare:	301.300			301.300
Wt. of tare:	0.000			0.000
Weight, gms:	368.5			
Diameter, in:	1.925		1.919	
Area, in^2:	2.910		2.891	
Height, in:	3.985		3.903	
Net decrease in height, in:		0.000	0.082	
Net decrease in water volume, cc:			16.400	
% Moisture:	22.3		24.3	23.6
Wet density, pcf:	121.0		126.5	
Dry density, pcf:	99.0		101.7	
Void ratio:	0.7031		0.6569	
% Saturation (est.):	85.6		100.0	

Test Readings Data for Specimen No. 1

Deformation dial constant= 0.001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 0 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Consolidation cell pressure = 119.40 psi = 17.19 ksf
Consolidation back pressure = 51.10 psi = 7.36 ksf
Consolidation effective confining stress = 9.84 ksf
Strain rate, %/min = 0.01
Deviator Stress = 6.56 ksf at reading no. 7
ULT. STRESS = not selected

Test Readings Data for Specimen No. 1

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf	Cumulative Strain (%)
0	0.0	0.000	0.00	0.0	0.0	0.00	9.84	9.84	1.00	51.10	9.84	0.00	
1	2.0	0.002	39.40	39.4	0.1	1.96	9.39	11.35	1.21	54.20	10.37	0.98	
2	20.0	0.020	69.50	69.5	0.5	3.44	8.60	12.04	1.40	59.70	10.32	1.72	
3	37.0	0.037	102.10	102.1	0.9	5.04	7.52	12.55	1.67	67.20	10.04	2.52	
4	54.0	0.054	121.40	121.4	1.4	5.96	6.77	12.73	1.88	72.40	9.75	2.98	
5	65.0	0.065	128.10	128.1	1.7	6.27	6.49	12.77	1.97	74.30	9.63	3.14	
6	91.0	0.091	133.30	133.3	2.3	6.49	6.24	12.72	2.04	76.10	9.48	3.24	
7	111.0	0.111	134.00	134.0	2.8	6.49	6.21	12.69	2.04	76.30	9.45	3.24	
8	126.0	0.126	132.00	132.0	3.2	6.36	6.22	12.58	2.02	76.20	9.40	3.18	
9	131.0	0.131	131.40	131.4	3.4	6.33	6.22	12.55	2.02	76.20	9.38	3.16	

Specimen Parameters for Specimen No. 2

Specimen Parameter	Initial	Cum. for Test	Consolidated	Final
Wt. moist soil and tare:	368.500			372.400
Wt. dry soil and tare:	301.300			301.300
Wt. of tare:	0.000			0.000
Weight, gms:	368.5			
Diameter, in:	1.925		1.928	
Area, in²:	2.910		2.920	
Height, in:	3.985		3.818	
Net decrease in height, in:		0.213	-0.046	
Net decrease in water volume, cc:			2.200	
% Moisture:	22.3		23.6	23.6
Wet density, pcf:	121.0		127.3	
Dry density, pcf:	99.0		103.0	
Void ratio:	0.7031		0.6371	
% Saturation (est.):	85.6		100.0	

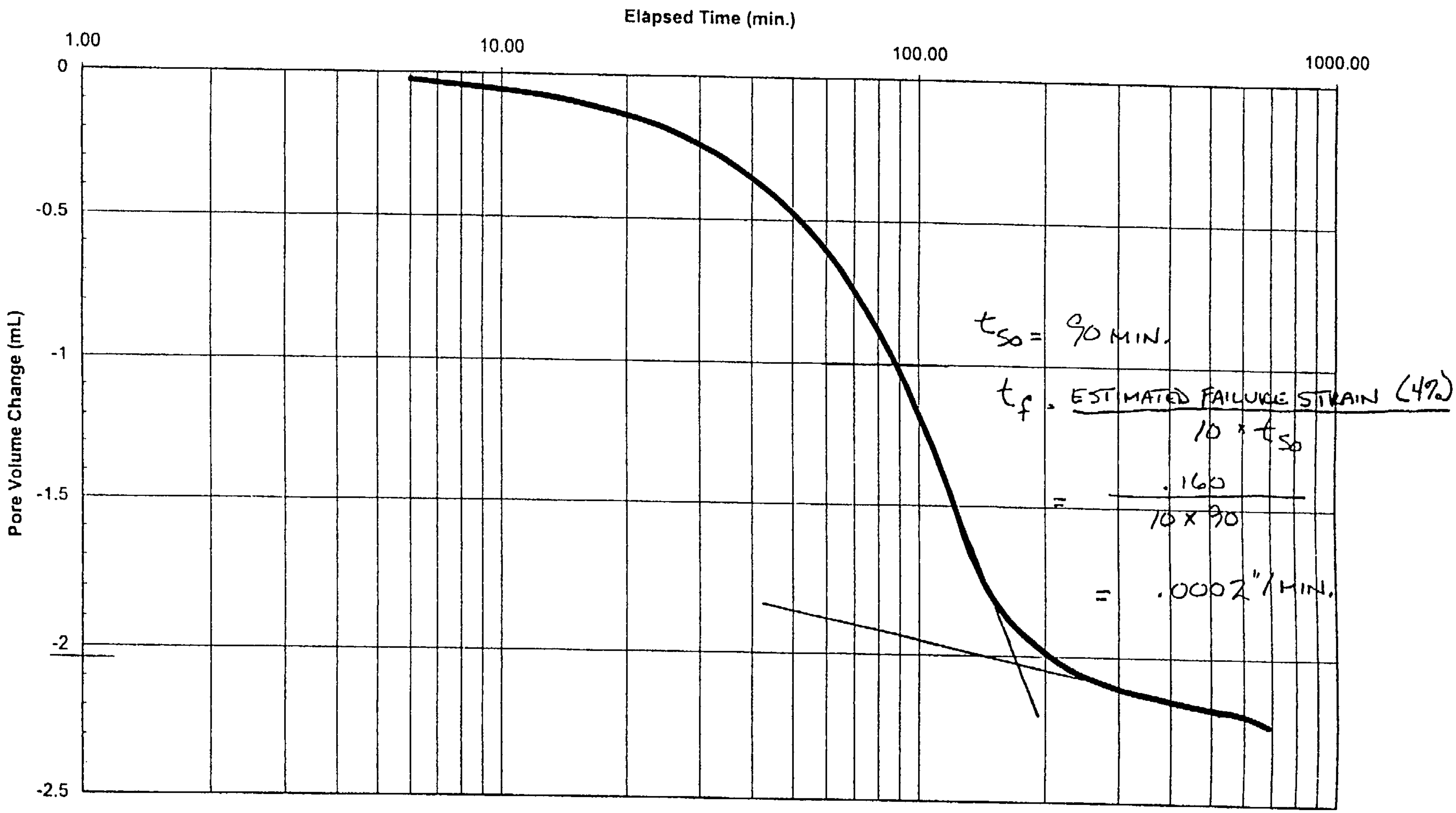
Test Readings Data for Specimen No. 2

Deformation dial constant= 0.001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 0 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Consolidation cell pressure = 161.10 psi = 23.20 ksf
Consolidation back pressure = 50.60 psi = 7.29 ksf
Consolidation effective confining stress = 15.91 ksf
Strain rate, %/min = 0.01
Deviator Stress = 7.76 ksf at reading no. 8
ULT. STRESS = not selected

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Effective Stresses Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf	Cumulative Strain (%)
0	85.0	0.000	24.80	0.0	0.0	0.00	15.91	15.91	1.00	50.60	15.91	0.00	
1	91.0	0.006	41.40	16.6	0.2	0.82	15.67	16.48	1.05	52.30	16.08	0.41	
2	99.0	0.014	44.60	19.8	0.4	0.97	15.54	16.51	1.06	53.20	16.02	0.49	
3	129.0	0.044	87.10	62.3	1.2	3.04	14.57	17.61	1.21	59.90	16.09	1.52	
4	137.0	0.052	127.20	102.4	1.4	4.98	13.56	18.55	1.37	66.90	16.06	2.49	
5	146.0	0.061	147.80	123.0	1.6	5.97	12.93	18.90	1.46	71.30	15.92	2.98	
6	153.0	0.068	172.00	147.2	1.8	7.13	12.12	19.25	1.59	76.90	15.69	3.56	
7	166.0	0.081	183.60	158.8	2.1	7.67	11.58	19.24	1.66	80.70	15.41	3.83	
8	200.0	0.115	187.00	162.2	3.0	7.76	11.10	18.86	1.70	84.00	14.98	3.88	
9	235.0	0.150	182.80	158.0	3.9	7.49	10.83	18.31	1.69	85.90	14.57	3.74	
10	283.0	0.198	182.80	158.0	5.2	7.39	10.77	18.16	1.69	86.30	14.47	3.69	
11	386.0	0.301	186.00	161.2	7.9	7.32	10.66	17.98	1.69	87.10	14.32	3.66	
12	441.0	0.356	191.70	166.9	9.3	7.46	10.48	17.95	1.71	88.30	14.21	3.73	
13	467.0	0.382	193.70	168.9	10.0	7.50	10.37	17.86	1.72	89.10	14.12	3.75	
14	497.0	0.412	196.10	171.3	10.8	7.54	10.32	17.86	1.73	89.40	14.09	3.77	
15	525.0	0.440	198.20	173.4	11.5	7.57	10.21	17.78	1.74	90.20	13.99	3.78	
16	550.0	0.465	204.40	179.6	12.2	7.78	10.09	17.87	1.77	91.00	13.98	3.89	
17	563.0	0.478	204.70	179.9	12.5	7.76	10.04	17.80	1.77	91.40	13.92	3.88	
18	570.0	0.485	204.60	179.8	12.7	7.74	9.91	17.65	1.78	92.30	13.78	3.87	
19	637.0	0.552	210.40	185.6	14.5	7.83	10.01	17.84	1.78	91.60	13.92	3.91	

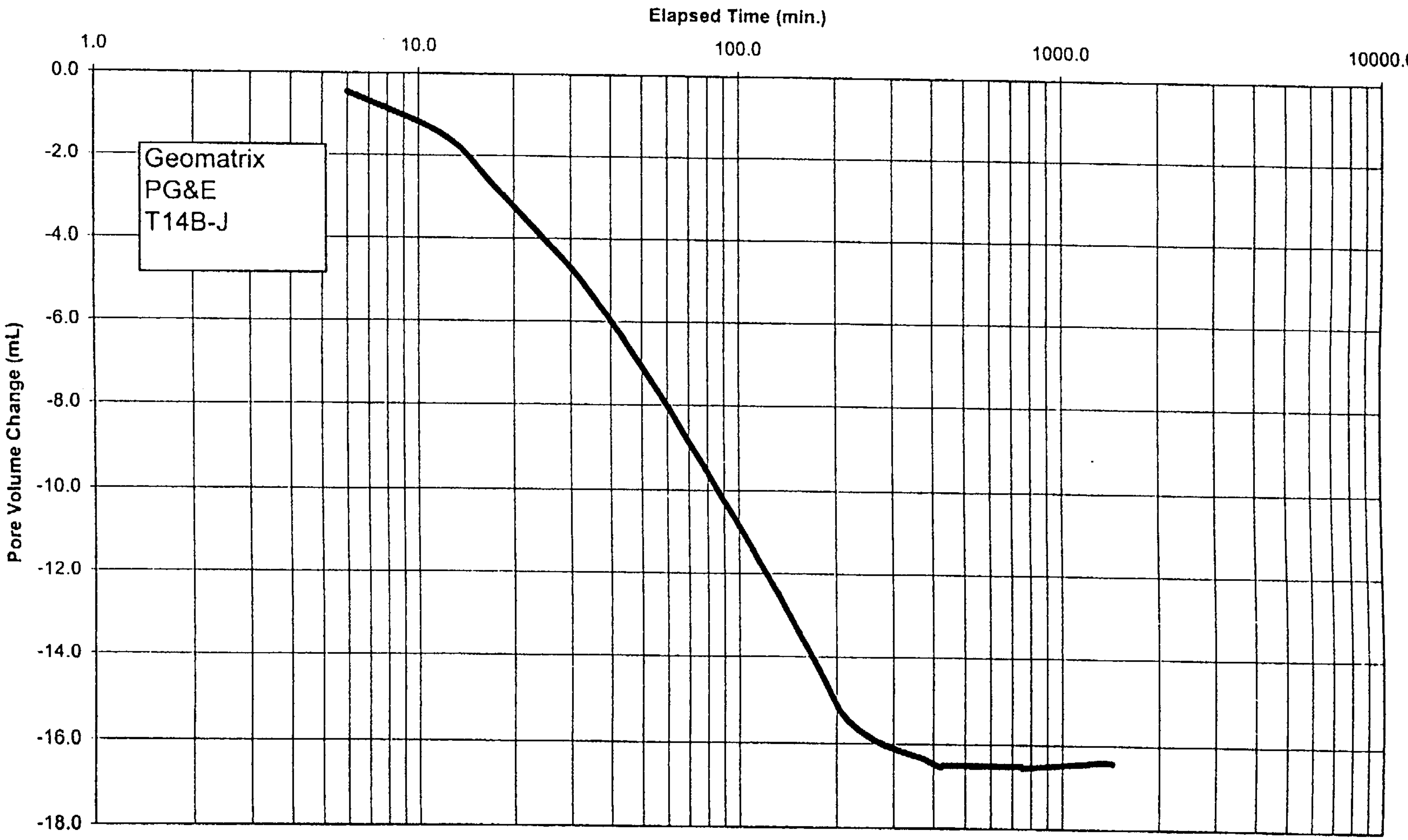
TB 14-J
1ST STAGE

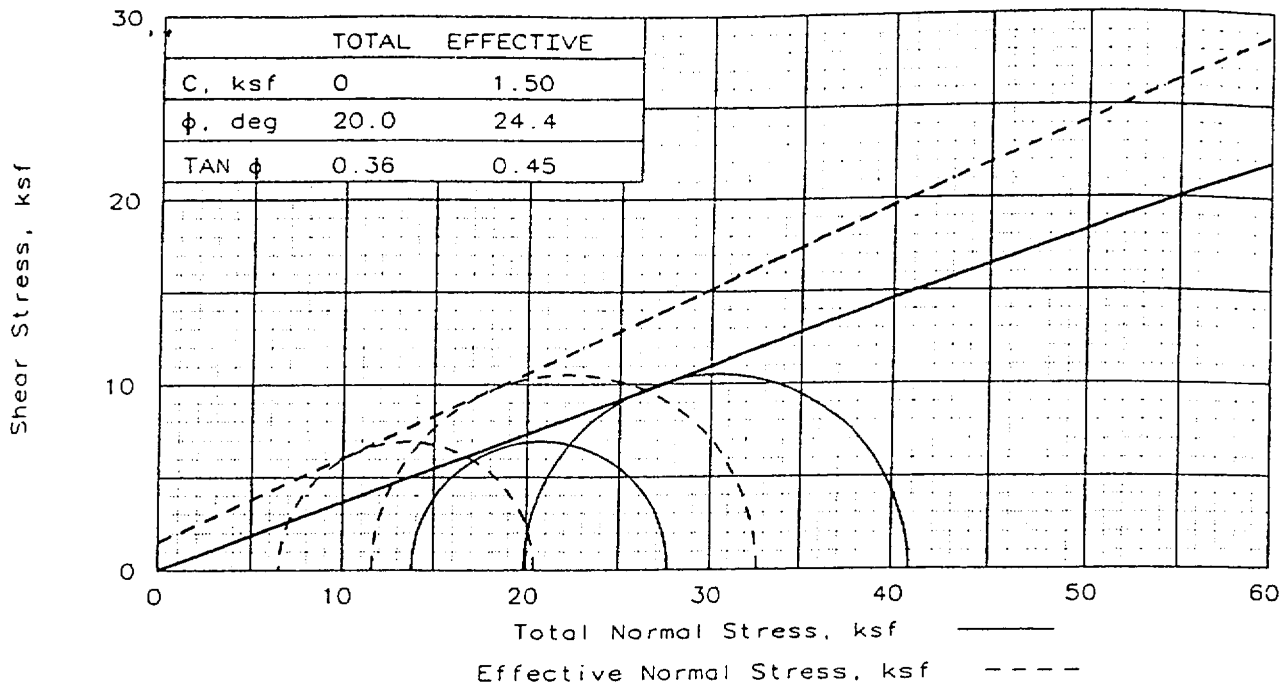
Cooper Testing Labs, Inc.



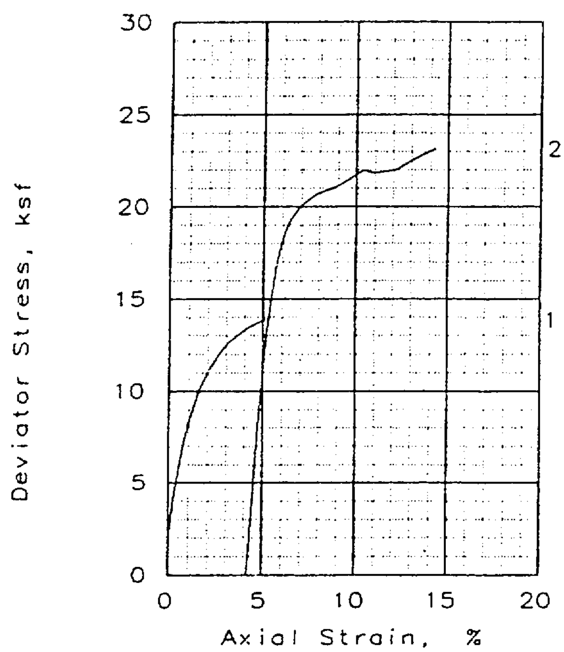
2ND STAGE

Volume Change During Consolidation





	TOTAL	EFFECTIVE
C, ksf	0	1.50
ϕ, deg	20.0	24.4
TAN ϕ	0.36	0.45



SAMPLE NO.:		1	2
INITIAL	WATER CONTENT, %	18.8	
	DRY DENSITY, pcf	99.7	
	SATURATION, %	73.6	
	VOID RATIO	0.690	
	DIAMETER, in	1.94	
	HEIGHT, in	4.00	
AT TEST	WATER CONTENT, %	22.5	21.6
	DRY DENSITY, pcf	104.8	106.5
	SATURATION, %	100.0	100.0
	VOID RATIO	0.608	0.583
	DIAMETER, in	1.92	1.95
	HEIGHT, in	3.87	3.71
Strain rate, %/min		0.0025	0.0025
EFF CELL PRESSURE, ksf		13.8	19.8
Deviator Stress, ksf		13.9	21.1
EXCESS PORE PR., ksf		7.3	8.2
STRAIN, %		5.1	4.9
ULT. STRESS, ksf			
EXCESS PORE PR., ksf			
STRAIN, %			
$\bar{\sigma}_1$ FAILURE, ksf		20.4	32.7
$\bar{\sigma}_3$ FAILURE, ksf		6.5	11.6

TYPE OF TEST:
CU with Pore Pressures

SAMPLE TYPE: undisturbed

DESCRIPTION: yellow brown sandy CLAY w/1/4" clay strati.

ASSUMED SPECIFIC GRAVITY= 2.7

REMARKS:

CLIENT: Geomatrix

PROJECT: 6427.001

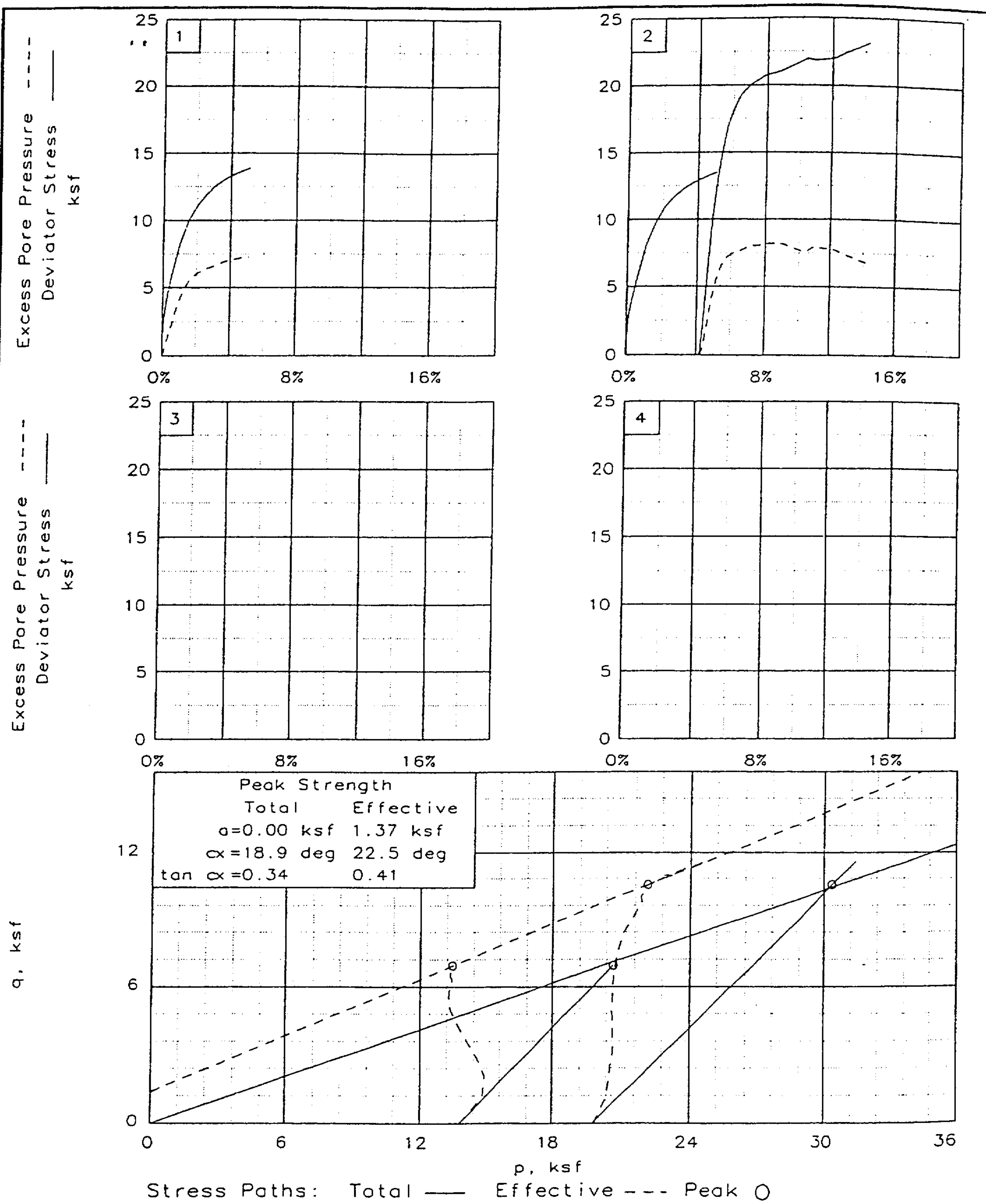
SAMPLE LOCATION: T14B-M

PROJ. NO.: 109-290d DATE: 11/14/00

TRIAXIAL SHEAR TEST REPORT

COOPER TESTING LABORATORY

Fig. No.: ____



Client: Geomatrix
Project: 6427.001
Location: T14B-M
File: 109-2900 Project No.: 109-290d Fig. No.: ____

Project and Sample Data

Date: 11/14/00
Client: Geomatrix
Project: 6427.001
Sample location: T14B-M
Sample description: yellow brown sandy CLAY w/1/4" clay strati.
Remarks:

Fig no.: 2nd page Fig no. (if applicable):
Type of sample: undisturbed
Assumed specific gravity= 2.70 LL= PL= PI=
Test method: ASTM - Method B w/saturation est. (staged method triaxial test)

Specimen Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Wt. moist soil and tare:	366.500			375.100
Wt. dry soil and tare:	308.500			308.500
Wt. of tare:	0.000			0.000
Weight, gms:	366.5			
Diameter, in:	1.936		1.920	
Area, in^2:	2.944		2.896	
Height, in:	4.003		3.872	
Net decrease in height, in:		0.000	0.131	
Net decrease in water volume, cc:			13.000	
% Moisture:	18.8		22.5	21.6
Wet density, pcf:	118.5		128.4	
Dry density, pcf:	99.7		104.8	
Void ratio:	0.6900		0.6083	
% Saturation (est.):	73.6		100.0	

Test Readings Data for Specimen No. 1

Deformation dial constant= 0.001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 0 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Consolidation cell pressure = 177.20 psi = 25.52 ksf
Consolidation back pressure = 81.40 psi = 11.72 ksf
Consolidation effective confining stress = 13.80 ksf
Strain rate, %/min = 0.00
Deviator Stress = 13.87 ksf at reading no. 13
ULT. STRESS = not selected

Test Readings Data for Specimen No. 1

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf	Cumulative Strain (%)
0	0.0	0.000	0.00	0.0	0.0	0.00	13.80	13.80	1.00	81.40	13.80	0.00	
1	2.0	0.002	46.90	46.9	0.1	2.33	13.67	16.00	1.17	82.30	14.83	1.17	
2	10.0	0.010	83.40	83.4	0.3	4.14	12.86	17.00	1.32	87.90	14.93	2.07	
3	20.0	0.020	115.40	115.4	0.5	5.71	11.72	17.43	1.49	95.80	14.58	2.85	
4	30.0	0.030	143.40	143.4	0.8	7.07	10.63	17.70	1.67	103.40	14.16	3.54	
5	40.0	0.040	168.30	168.3	1.0	8.28	9.68	17.96	1.86	110.00	13.82	4.14	
6	60.0	0.060	204.60	204.6	1.5	10.02	8.37	18.38	2.20	119.10	13.37	5.01	
7	80.0	0.080	228.60	228.6	2.1	11.13	7.73	18.86	2.44	123.50	13.30	5.57	
8	100.0	0.100	247.00	247.0	2.6	11.96	7.39	19.35	2.62	125.90	13.37	5.98	
9	120.0	0.120	261.50	261.5	3.1	12.60	7.16	19.76	2.76	127.50	13.46	6.30	
10	140.0	0.140	271.90	271.9	3.6	13.03	6.85	19.89	2.90	129.60	13.37	6.52	
11	161.0	0.161	281.10	281.1	4.2	13.40	6.71	20.11	3.00	130.60	13.41	6.70	
12	181.0	0.181	288.40	288.4	4.7	13.67	6.57	20.24	3.08	131.60	13.40	6.83	
13	197.0	0.197	293.90	293.9	5.1	13.87	6.54	20.41	3.12	131.80	13.47	6.93	

Specimen Parameters for Specimen No. 2

Specimen Parameter	Initial	Cum. for Test	Consolidated	Final
Wt. moist soil and tare:	366.500			375.100
Wt. dry soil and tare:	308.500			308.500
Wt. of tare:	0.000			0.000
Weight, gms:	366.5			
Diameter, in:	1.936		1.947	
Area, in²:	2.944		2.978	
Height, in:	4.003		3.706	
Net decrease in height, in:		0.328	-0.031	
Net decrease in water volume, cc:			2.900	
% Moisture:	18.8		21.6	21.6
Wet density, pcf:	118.5		129.5	
Dry density, pcf:	99.7		106.5	
Void ratio:	0.6900		0.5829	
% Saturation (est.):	73.6		100.0	

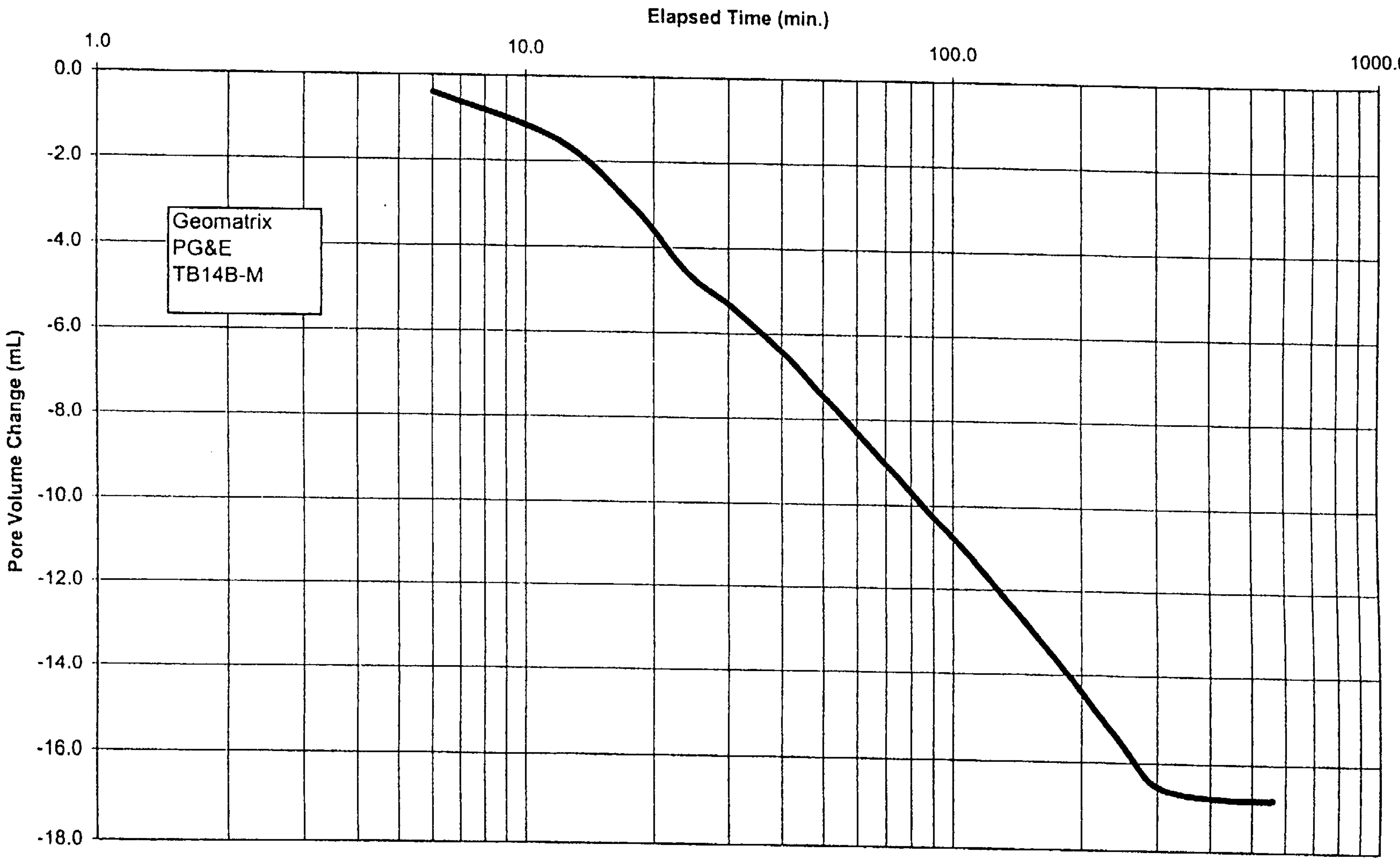
Test Readings Data for Specimen No. 2

Deformation dial constant= 0.001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 0 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Consolidation cell pressure = 220.60 psi = 31.77 ksf
Consolidation back pressure = 82.80 psi = 11.92 ksf
Consolidation effective confining stress = 19.84 ksf
Strain rate, %/min = 0.00
Deviator Stress = 21.05 ksf at reading no. 14
ULT. STRESS = not selected

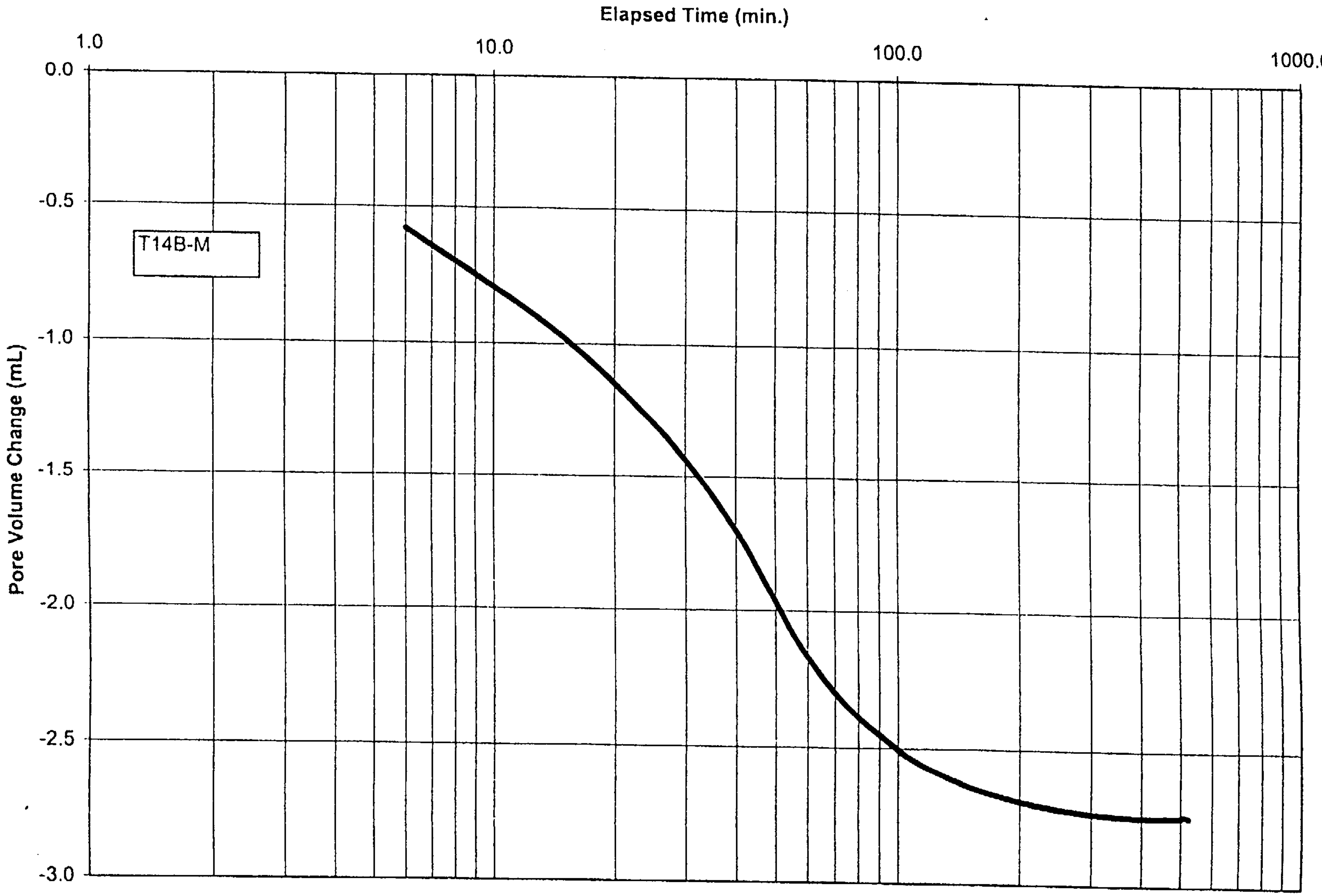
No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf	Cumulative Strain (%)
0	162.0	0.000	42.80	0.0	0.0	0.00	19.84	19.84	1.00	82.80	19.84	0.00	
1	165.0	0.003	55.40	12.6	0.1	0.61	19.74	20.35	1.03	83.50	20.05	0.30	
2	170.0	0.008	92.20	49.4	0.2	2.38	19.27	21.65	1.12	86.80	20.46	1.19	
3	180.0	0.018	179.90	137.1	0.5	6.60	17.44	24.04	1.38	99.50	20.74	3.30	
4	190.0	0.028	252.00	209.2	0.8	10.04	15.67	25.71	1.64	111.80	20.69	5.02	
5	200.0	0.038	311.20	268.4	1.0	12.85	14.31	27.16	1.90	121.20	20.74	6.42	
6	210.0	0.048	357.30	314.5	1.3	15.01	13.39	28.40	2.12	127.60	20.90	7.51	
7	222.0	0.060	398.30	355.5	1.6	16.91	12.74	29.66	2.33	132.10	21.20	8.46	
8	230.0	0.068	418.20	375.4	1.8	17.82	12.51	30.33	2.42	133.70	21.42	8.91	
9	242.0	0.080	441.00	398.2	2.2	18.84	12.30	31.14	2.53	135.20	21.72	9.42	
10	250.0	0.088	452.00	409.2	2.4	19.32	12.24	31.56	2.58	135.60	21.90	9.66	
11	270.0	0.108	469.90	427.1	2.9	20.05	11.87	31.92	2.69	138.20	21.89	10.03	
12	302.0	0.140	487.00	444.2	3.8	20.67	11.76	32.43	2.76	138.90	22.10	10.33	
13	319.0	0.157	492.40	449.6	4.2	20.82	11.66	32.48	2.78	139.60	22.07	10.41	
14	343.0	0.181	500.50	457.7	4.9	21.05	11.64	32.69	2.81	139.80	22.16	10.53	
15	359.0	0.197	507.70	464.9	5.3	21.28	11.81	33.09	2.80	138.60	22.45	10.64	
16	401.0	0.239	528.60	485.8	6.4	21.98	12.33	34.30	2.78	135.00	23.31	10.99	
17	422.0	0.260	528.30	485.5	7.0	21.83	11.94	33.77	2.83	137.70	22.85	10.91	
18	452.0	0.290	535.00	492.2	7.8	21.94	12.02	33.96	2.82	137.10	22.99	10.97	
19	472.0	0.310	540.10	497.3	8.4	22.03	12.10	34.13	2.82	136.60	23.11	11.02	
20	502.0	0.340	555.20	512.4	9.2	22.50	12.50	35.00	2.80	133.80	23.75	11.25	
21	552.0	0.390	577.90	535.1	10.5	23.15	13.06	36.21	2.77	129.90	24.64	11.58	

1ST STAGE THB-M

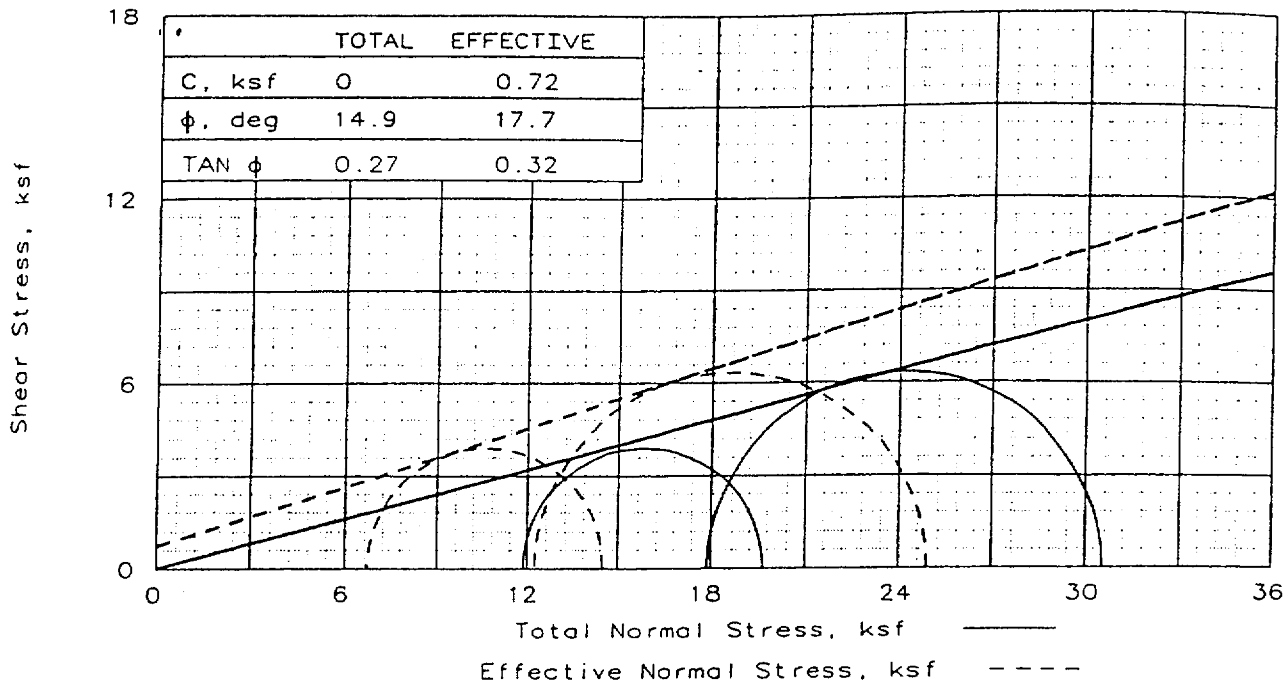
Cooper Testing Labs, Inc.

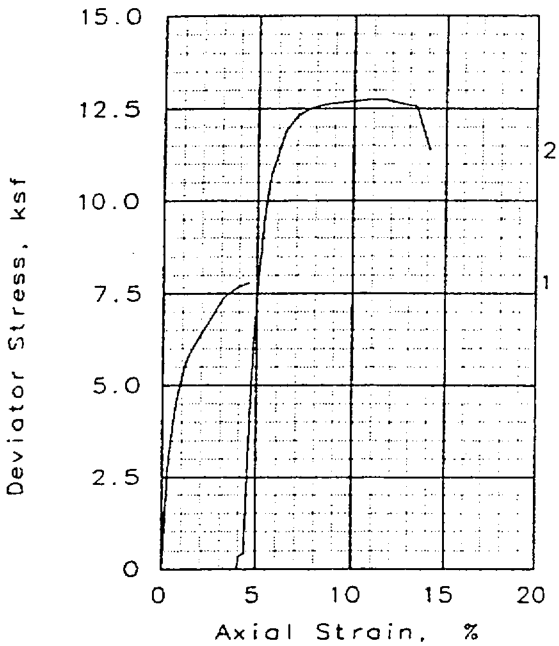


2ND STAGE T14B-M



	TOTAL	EFFECTIVE
C, ksf	0	0.72
φ, deg	14.9	17.7
TAN φ	0.27	0.32





SAMPLE NO.:		1	2
INITIAL	WATER CONTENT, %	22.7	
	DRY DENSITY, pcf	100.0	
	SATURATION, %	89.5	
	VOID RATIO	0.685	
	DIAMETER, in	1.92	
	HEIGHT, in	3.99	
AT TEST	WATER CONTENT, %	24.1	22.2
	DRY DENSITY, pcf	102.2	105.4
	SATURATION, %	100.0	100.0
	VOID RATIO	0.650	0.599
	DIAMETER, in	1.92	1.93
	HEIGHT, in	3.90	3.75
Strain rate, %/min		0.0030	0.0030
EFF CELL PRESSURE, ksf		11.9	17.9
Deviator Stress, ksf		7.8	12.6
EXCESS PORE PR., ksf		5.2	5.6
STRAIN, %		4.6	5.3
ULT. STRESS, ksf			
EXCESS PORE PR., ksf			
STRAIN, %			
$\bar{\sigma}_1$ FAILURE, ksf		14.5	24.9
$\bar{\sigma}_3$ FAILURE, ksf		6.7	12.3

TYPE OF TEST:
CU with Pore Pressures

SAMPLE TYPE: Undisturbed

DESCRIPTION: yellow brown claystone

ASSUMED SPECIFIC GRAVITY= 2.7

REMARKS: **Staged Test**
Strengths picked at the peak stress ratio.

Fig. No.: ______

CLIENT: GeoMatrix

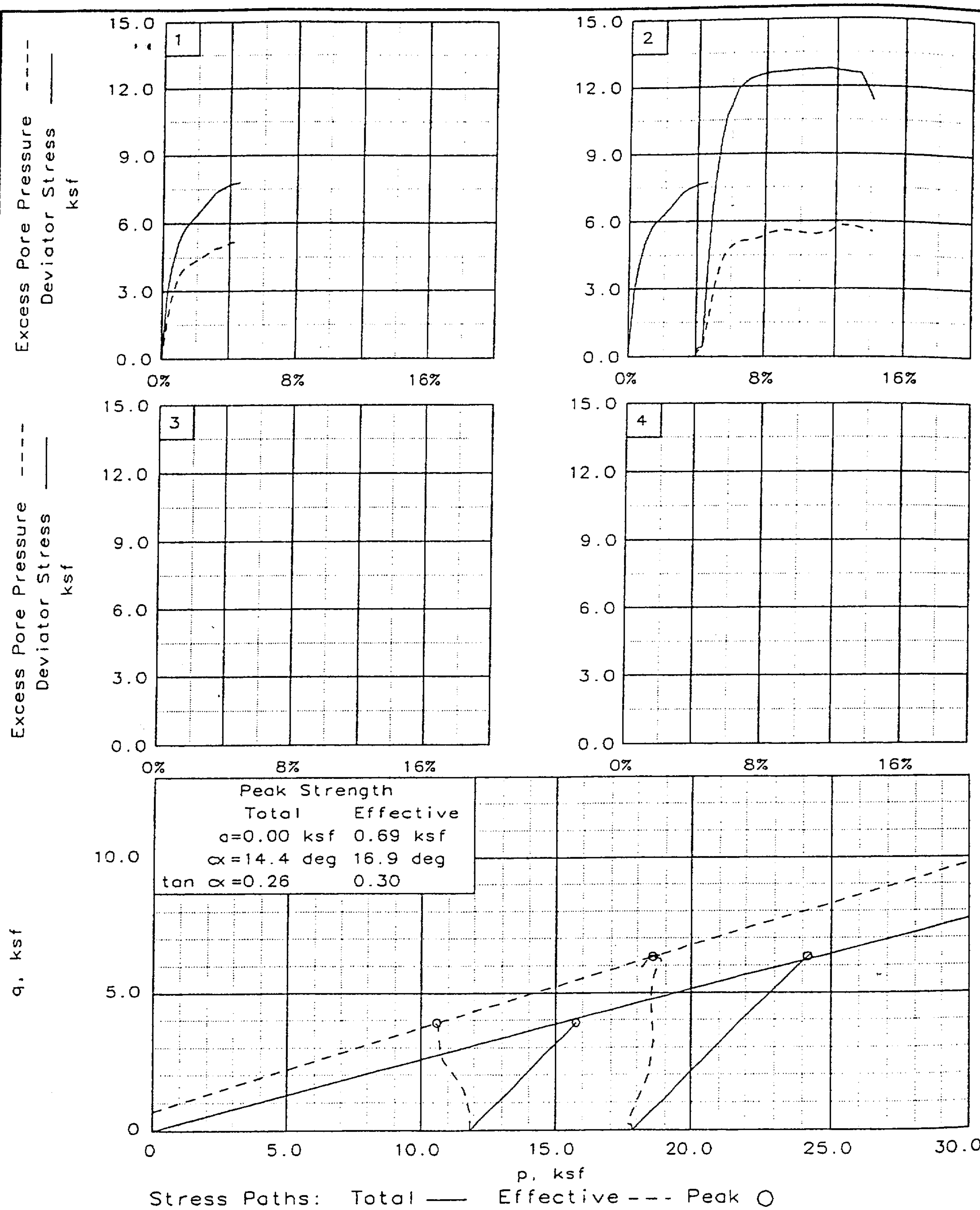
PROJECT: 6427.001

SAMPLE LOCATION: TB14-K

PROJ. NO.: 109-290c DATE: 10/31/00

TRIAXIAL SHEAR TEST REPORT

COOPER TESTING LABORATORY



Client: GeoMatrix
Project: 6427.001
Location: TB14-K
File: 109-290C Project No.: 109-290c Fig. No.: ____

Project and Sample Data

Date: 10/31/00
Client: GeoMatrix
Project: 6427.001
Sample location: TB14-K
Sample description: yellow brown claystone
Remarks: **Staged Test** Strengths picked at the peak stress ratio.
Fig no.: 2nd page Fig no. (if applicable):
Type of sample: Undisturbed
Assumed specific gravity= 2.70 LL= PL= PI=
Test method: ASTM - Method B w/saturation est. (staged method triaxial test)

Specimen Parameters for Specimen No. 1

Specimen Parameter	Initial	Saturated	Consolidated	Final
Wt. moist soil and tare:	372.200			370.600
Wt. dry soil and tare:	303.300			303.300
Wt. of tare:	0.000			0.000
Weight, gms:	372.2			
Diameter, in:	1.920		1.922	
Area, in²:	2.895		2.900	
Height, in:	3.990		3.900	
Net decrease in height, in:		0.000	0.090	
Net decrease in water volume, cc:			16.400	
% Moisture:	22.7		24.1	22.2
Wet density, pcf:	122.7		126.8	
Dry density, pcf:	100.0		102.2	
Void ratio:	0.6852		0.6499	
% Saturation (est.):	89.5		100.0	

Test Readings Data for Specimen No. 1

Deformation dial constant= 0.001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 0 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Consolidation cell pressure = 163.30 psi = 23.52 ksf
Consolidation back pressure = 80.90 psi = 11.65 ksf
Consolidation effective confining stress = 11.87 ksf
Strain rate, %/min = 0.00
Deviator Stress = 7.81 ksf at reading no. 16
ULT. STRESS = not selected

Test Readings Data for Specimen No. 1

No.	Def. Dial Units	Def. in	Load Dial' Units	Load lbs	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf	Cumulative Strain (%)
0	0.0	0.000	31.90	0.0	0.0	0.00	11.87	11.87	1.00	80.90	11.87	0.00	
1	5.0	0.005	54.30	22.4	0.1	1.11	11.32	12.43	1.10	84.70	11.87	0.56	
2	13.0	0.013	91.90	60.0	0.3	2.97	10.14	13.11	1.29	92.90	11.62	1.48	
3	23.0	0.023	114.00	82.1	0.6	4.05	9.20	13.25	1.44	99.40	11.23	2.03	
4	30.0	0.030	124.80	92.9	0.8	4.58	8.71	13.29	1.53	102.80	11.00	2.29	
5	37.0	0.037	135.30	103.4	0.9	5.09	8.29	13.38	1.61	105.70	10.84	2.54	
6	47.0	0.047	145.70	113.8	1.2	5.58	7.95	13.53	1.70	108.10	10.74	2.79	
7	54.0	0.054	151.30	119.4	1.4	5.85	7.79	13.64	1.75	109.20	10.71	2.92	
8	121.0	0.121	184.80	152.9	3.1	7.36	6.98	14.34	2.05	114.80	10.66	3.68	
9	131.0	0.131	187.70	155.8	3.4	7.48	6.93	14.40	2.08	115.20	10.66	3.74	
10	140.0	0.140	189.70	157.8	3.6	7.55	6.88	14.44	2.10	115.50	10.66	3.78	
11	147.0	0.147	191.40	159.5	3.8	7.62	6.83	14.45	2.12	115.90	10.64	3.81	
12	154.0	0.154	192.90	161.0	3.9	7.68	6.75	14.43	2.14	116.40	10.59	3.84	
13	157.0	0.157	193.50	161.6	4.0	7.70	6.72	14.43	2.15	116.60	10.58	3.85	
14	164.0	0.164	194.60	162.7	4.2	7.74	6.70	14.44	2.16	116.80	10.57	3.87	
15	172.0	0.172	195.70	163.8	4.4	7.78	6.68	14.46	2.16	116.90	10.57	3.89	
16	178.0	0.178	196.60	164.7	4.6	7.81	6.70	14.50	2.17	116.80	10.60	3.90	

Specimen Parameters for Specimen No. 2

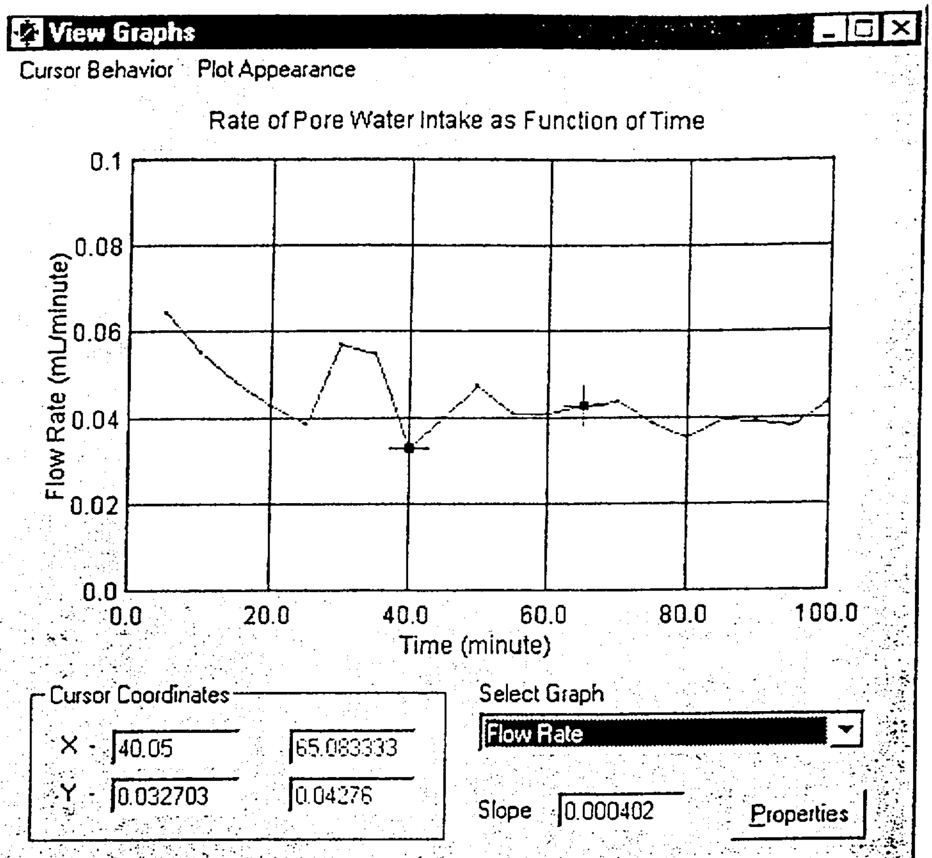
Specimen Parameter	Initial	Cum. for Test	Consolidated	Final
Wt. moist soil and tare:	372.200			370.600
Wt. dry soil and tare:	303.300			303.300
Wt. of tare:	0.000			0.000
Weight, gms:	372.2			
Diameter, in:	1.920		1.930	
Area, in²:	2.895		2.926	
Height, in:	3.990		3.746	
Net decrease in height, in:		0.268	-0.024	
Net decrease in water volume, cc:			5.700	
% Moisture:	22.7		22.2	22.2
Wet density, pcf:	122.7		128.8	
Dry density, pcf:	100.0		105.4	
Void ratio:	0.6852		0.5991	
% Saturation (est.):	89.5		100.0	

Test Readings Data for Specimen No. 2

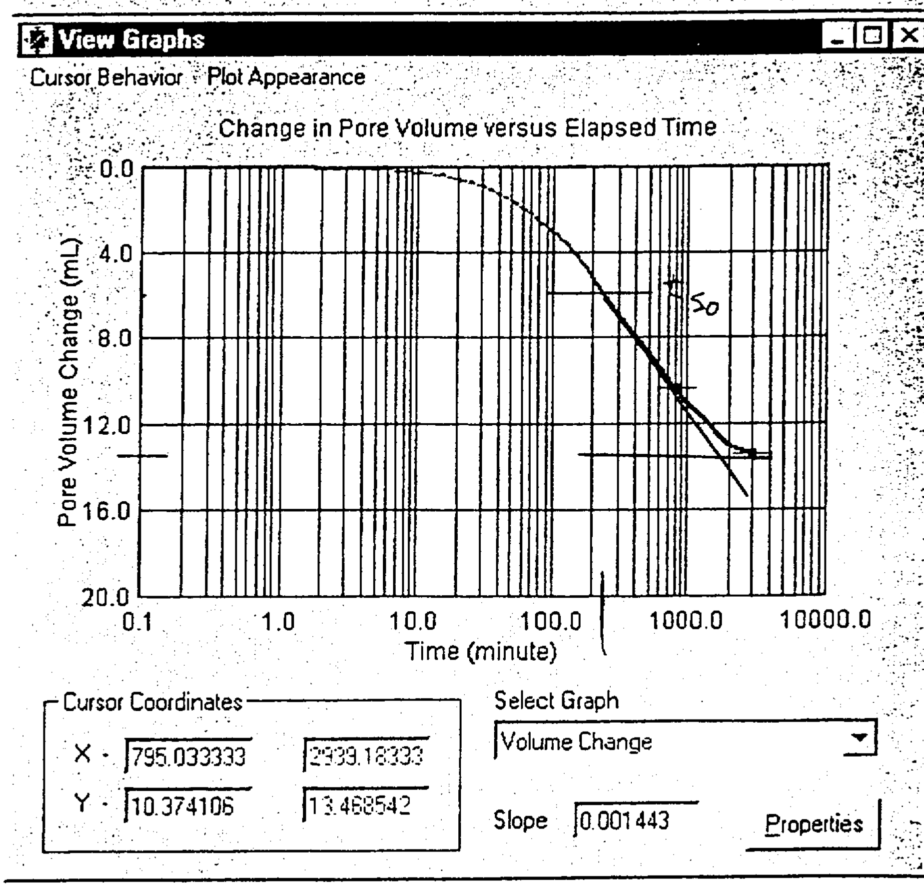
Deformation dial constant= 0.001 in per input unit
Primary load ring constant= 1 lbs per input unit
Secondary load ring constant= 0 lbs per input unit
Crossover reading for secondary load ring= 0 input units
Consolidation cell pressure = 205.00 psi = 29.52 ksf
Consolidation back pressure = 80.90 psi = 11.65 ksf
Consolidation effective confining stress = 17.87 ksf
Strain rate, %/min = 0.00
Deviator Stress = 12.65 ksf at reading no. 12
ULT. STRESS = not selected

No.	Def. Dial Units	Def. in	Load Dial Units	Load lbs	Strain %	Deviator Stress ksf	Effective Stresses Minor ksf	Major ksf	1:3 Ratio	Pore Pres. psi	P ksf	Q ksf	Cumulative Strain (%)
0	154.0	0.000	35.90	0.0	0.0	0.00	17.87	17.87	1.00	80.90	17.87	0.00	
1	160.0	0.006	43.30	7.4	0.2	0.36	17.65	18.02	1.02	82.40	17.84	0.18	
2	170.0	0.016	44.70	8.8	0.4	0.43	17.45	17.88	1.02	83.80	17.67	0.22	
3	180.0	0.026	114.40	78.5	0.7	3.84	16.50	20.34	1.23	90.40	18.42	1.92	
4	190.0	0.036	167.40	131.5	1.0	6.41	15.41	21.82	1.42	98.00	18.61	3.20	
5	198.0	0.044	198.60	162.7	1.2	7.91	14.62	22.53	1.54	103.50	18.57	3.96	
6	210.0	0.056	234.10	198.2	1.5	9.61	13.72	23.33	1.70	109.70	18.53	4.80	
7	222.0	0.068	257.40	221.5	1.8	10.70	13.20	23.91	1.81	113.30	18.56	5.35	
8	250.0	0.096	284.20	248.3	2.6	11.91	12.77	24.68	1.93	116.30	18.73	5.95	
9	274.0	0.120	294.60	258.7	3.2	12.32	12.70	25.02	1.97	116.80	18.86	6.16	
10	299.0	0.145	300.30	264.4	3.9	12.51	12.60	25.11	1.99	117.50	18.85	6.25	
11	323.0	0.169	304.00	268.1	4.5	12.60	12.37	24.97	2.02	119.10	18.67	6.30	
12	351.0	0.197	307.20	271.3	5.3	12.65	12.25	24.90	2.03	119.90	18.58	6.32	
13	373.0	0.219	309.80	273.9	5.8	12.69	12.30	24.99	2.03	119.60	18.64	6.35	
14	404.0	0.250	313.00	277.1	6.7	12.73	12.41	25.14	2.03	118.80	18.78	6.36	
15	424.0	0.270	315.10	279.2	7.2	12.75	12.44	25.19	2.02	118.60	18.82	6.37	
16	454.0	0.300	317.70	281.8	8.0	12.76	12.33	25.08	2.03	119.40	18.70	6.38	
17	474.0	0.320	317.90	282.0	8.5	12.69	12.05	24.74	2.05	121.30	18.40	6.35	
18	504.0	0.350	318.50	282.6	9.3	12.61	12.07	24.67	2.04	121.20	18.37	6.30	
19	524.0	0.370	319.40	283.5	9.9	12.57	12.17	24.74	2.03	120.50	18.45	6.29	
20	552.0	0.398	294.50	258.6	10.6	11.37	12.33	23.70	1.92	119.40	18.01	5.69	

Project no.:109-290c COOPER TESTING LABORATORY Data file: 109-290C



← BACK PRESSURE SATURATION PHASE



← CONSOLIDATION

$t_f = \frac{\text{ESTIMATED STRAIN @ FAILURE (4\%)}}{10 \times t_{50}}$

$= \frac{0.160}{10 \times 240}$

$= .0001''/\text{MIN.}$

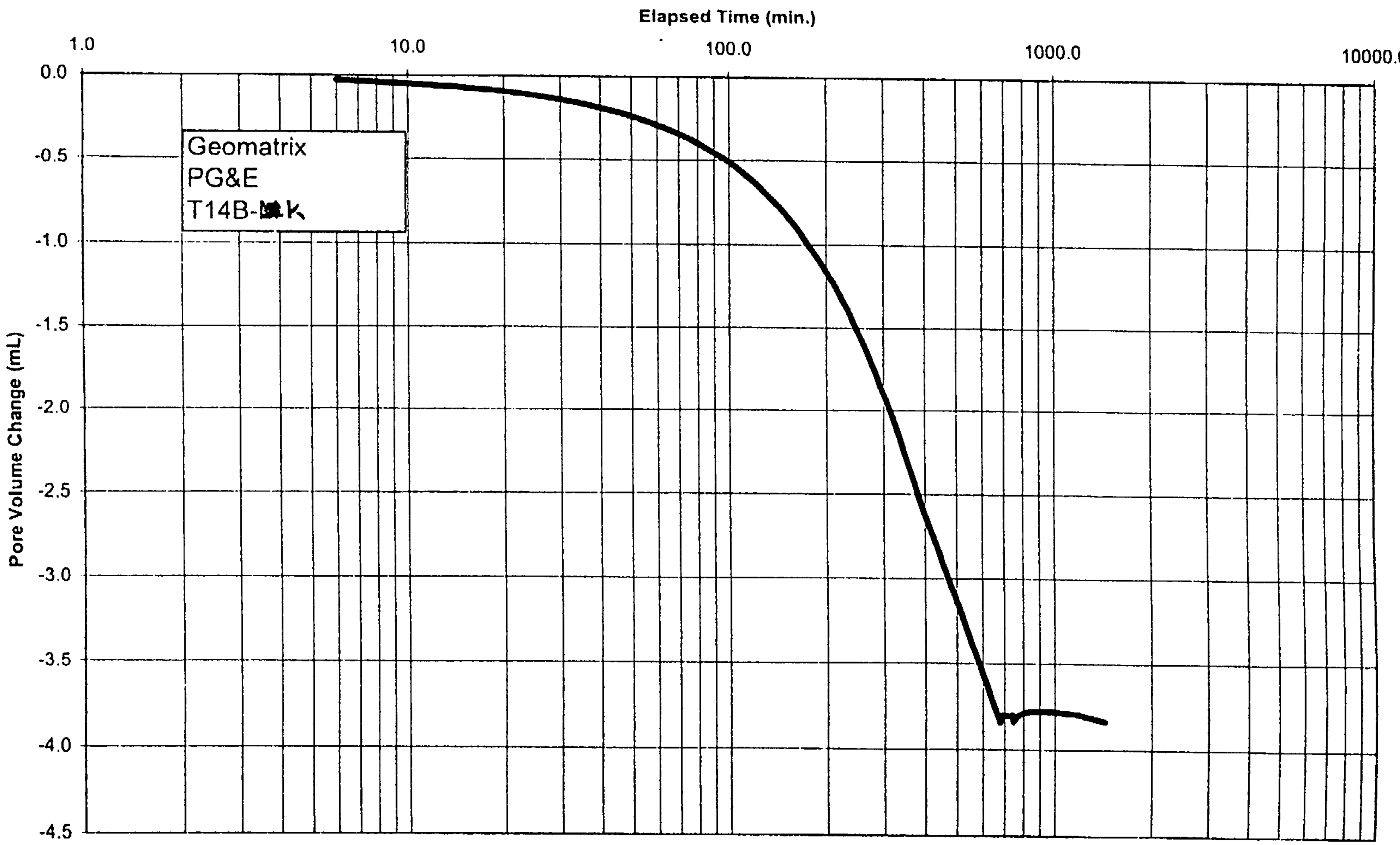
$D_{100} = 13.4 \div 2 = 6.7$ $t_{50} = 240 \text{ MIN.}$

.57 FEC DIV.

TB 14 K

2ND STAGE

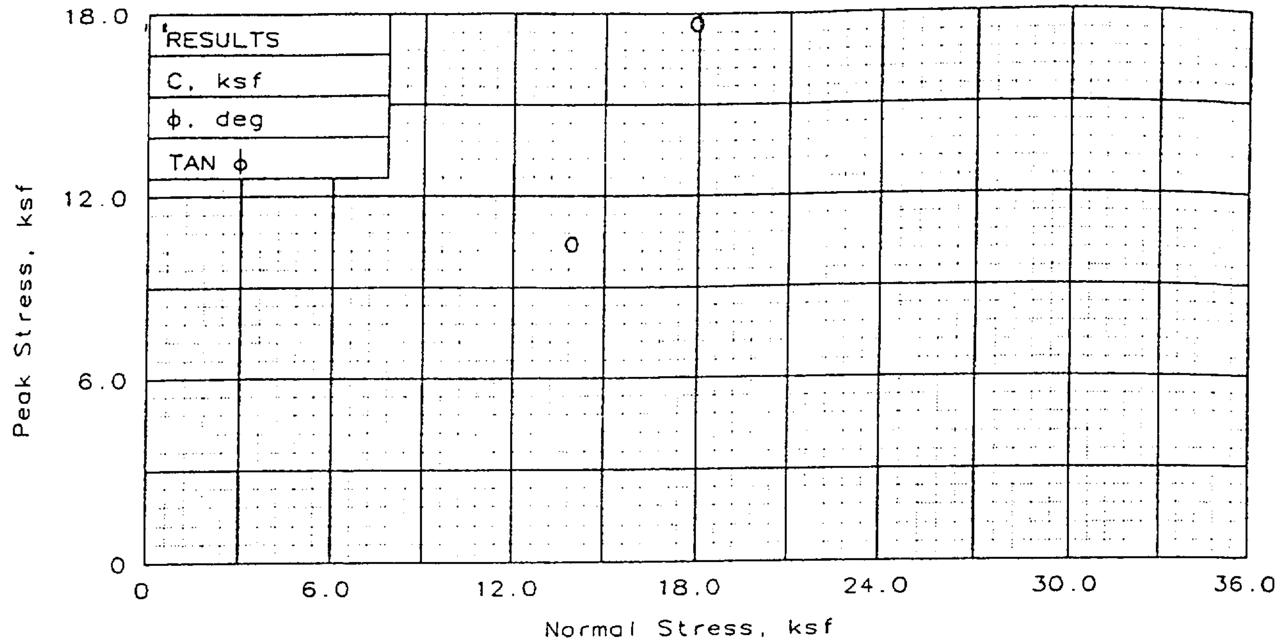
Volume Change During Consolidation

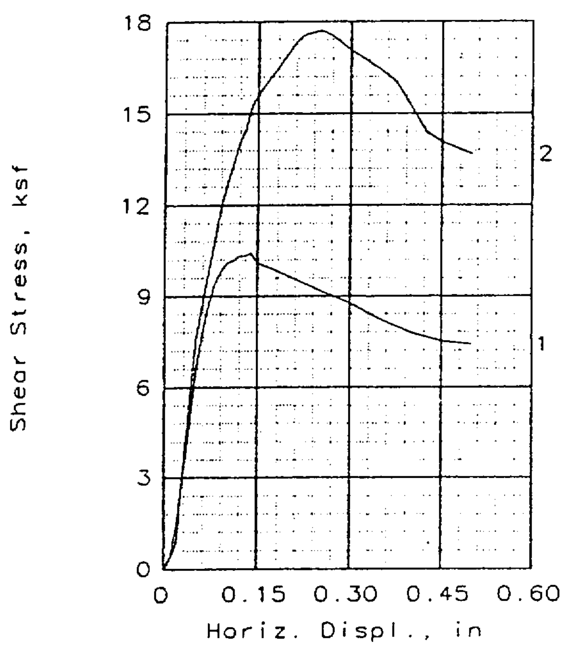


ATTACHMENT 2
DATA REPORT G

MONOTONIC DIRECT SHEAR TESTS

T14B-B, T14B-F, and T14B-D (drained)
TB14-H (undrained)
T14B, S4 –1, - 2, -3, -4 (undrained)





SAMPLE NO.:		1	2
INITIAL	WATER CONTENT, %	20.7	19.1
	DRY DENSITY, pcf	101.0	105.3
	SATURATION, %	83.5	81.1
	VOID RATIO	0.668	0.661
	DIAMETER, in	1.94	1.92
	HEIGHT, in	1.00	1.00
AT TEST	WATER CONTENT, %	22.7	20.4
	DRY DENSITY, pcf	104.5	111.2
	SATURATION, %	100.0	99.8
	VOID RATIO	0.613	0.572
	DIAMETER, in	1.94	1.92
	HEIGHT, in	0.97	0.95
NORMAL STRESS, ksf		14.0	18.0
Peak Stress, ksf		10.4	17.7
DISPLACEMENT, in		0.14	0.26
Ultimate Stress, ksf		7.4	13.7
DISPLACEMENT, in		0.50	0.50
Strain rate, %/min		1.00	1.00

SAMPLE TYPE: Undisturbed
DESCRIPTION: tan CLAY with claystone

ASSUMED SPECIFIC GRAVITY= 2.7
REMARKS: **DS-CU**
An undrained condition cannot be completely accomplished.

Fig. No.: ______

CLIENT: GeoMatrix

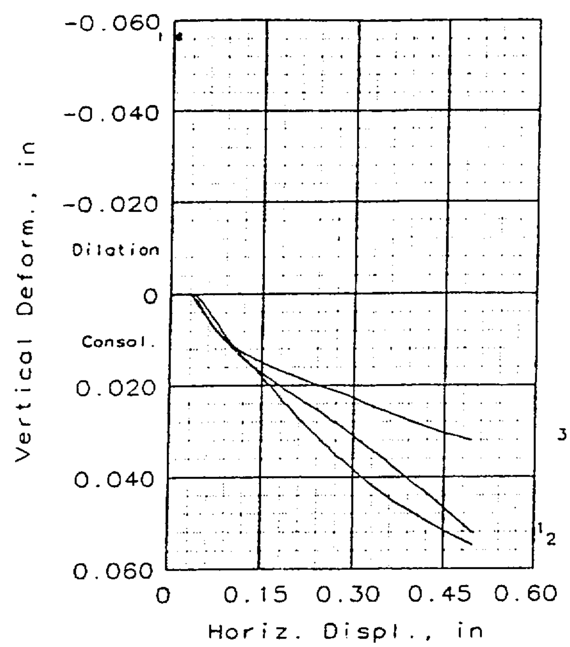
PROJECT: 6427.001

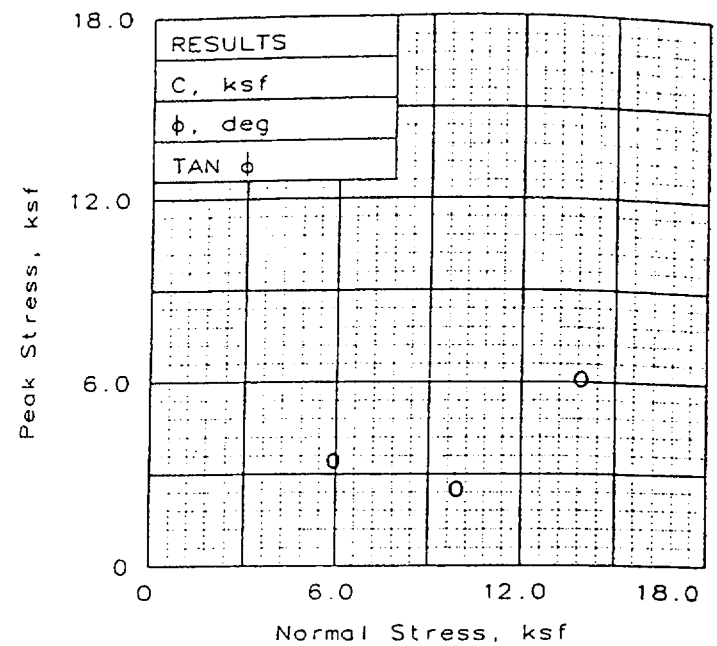
SAMPLE LOCATION: TB14/H

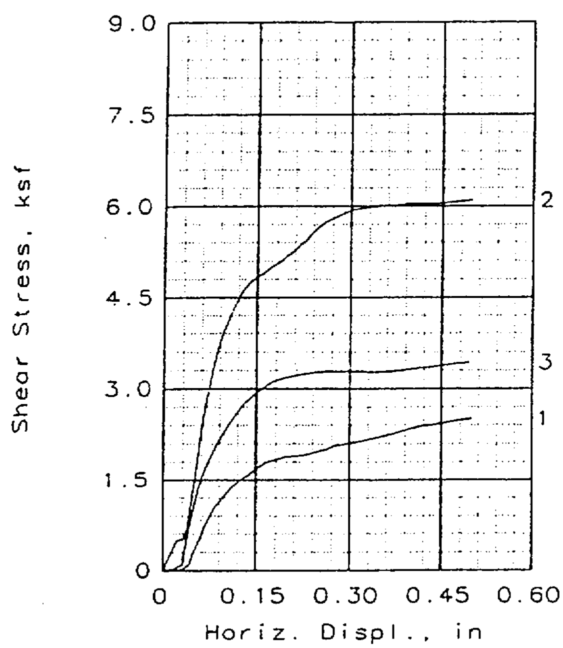
PROJ. NO.: 109-290 DATE: 10/05/00

DIRECT SHEAR TEST REPORT

COOPER TESTING LABORATORY







	SAMPLE NO.:	1	2	3
INITIAL	WATER CONTENT, %	17.9	19.5	15.0
	DRY DENSITY, pcf	103.3	102.2	100.6
	SATURATION, %	72.3	76.8	57.1
	VOID RATIO	0.693	0.711	0.737
	DIAMETER, in	2.38	2.38	2.38
	HEIGHT, in	1.01	1.01	1.00
AT TEST	WATER CONTENT, %	20.6	21.6	23.0
	DRY DENSITY, pcf	110.6	108.6	106.1
	SATURATION, %	99.5	99.1	99.4
	VOID RATIO	0.580	0.610	0.647
	DIAMETER, in	2.38	2.38	2.38
	HEIGHT, in	0.94	0.95	0.95
	NORMAL STRESS, ksf	10.00	14.00	6.00
	Peak Stress, ksf	2.51	6.10	3.43
	DISPLACEMENT, in	0.50	0.50	0.49
	Staged Stress, ksf			
	DISPLACEMENT, in			
	Strain rate, %/min	0.20	0.20	0.20

SAMPLE TYPE: undisturbed
DESCRIPTION: Yellow-Brown CLAY

ASSUMED SPECIFIC GRAVITY= 2.8
REMARKS: Moisture and density values had to be estimated due to soil loss during test.

Fig. No.: ______

CLIENT: Geomatrix

PROJECT: 6427.001 PG&E

SAMPLE LOCATION: T14b-F & D
F: #1 & 2, D #3

PROJ. NO.: 109-292 DATE: 11/01/00

DIRECT SHEAR TEST REPORT

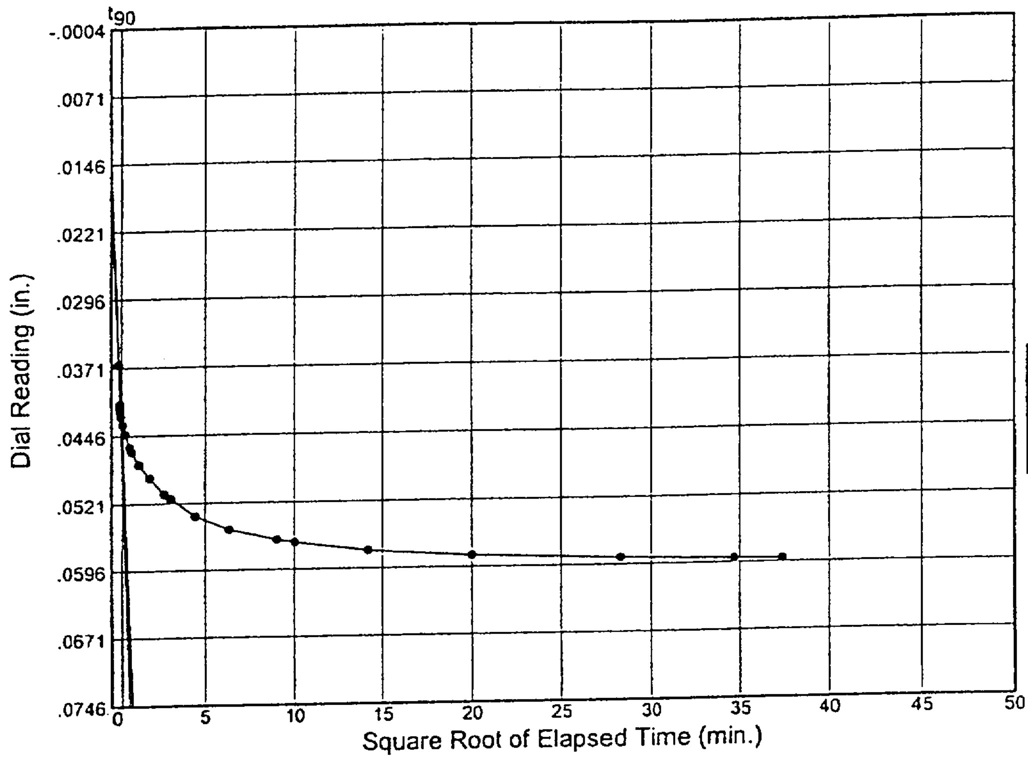
COOPER TESTING LABORATORY

Dial Reading vs. Time

Project No.: 109-290
Project: 6427.001

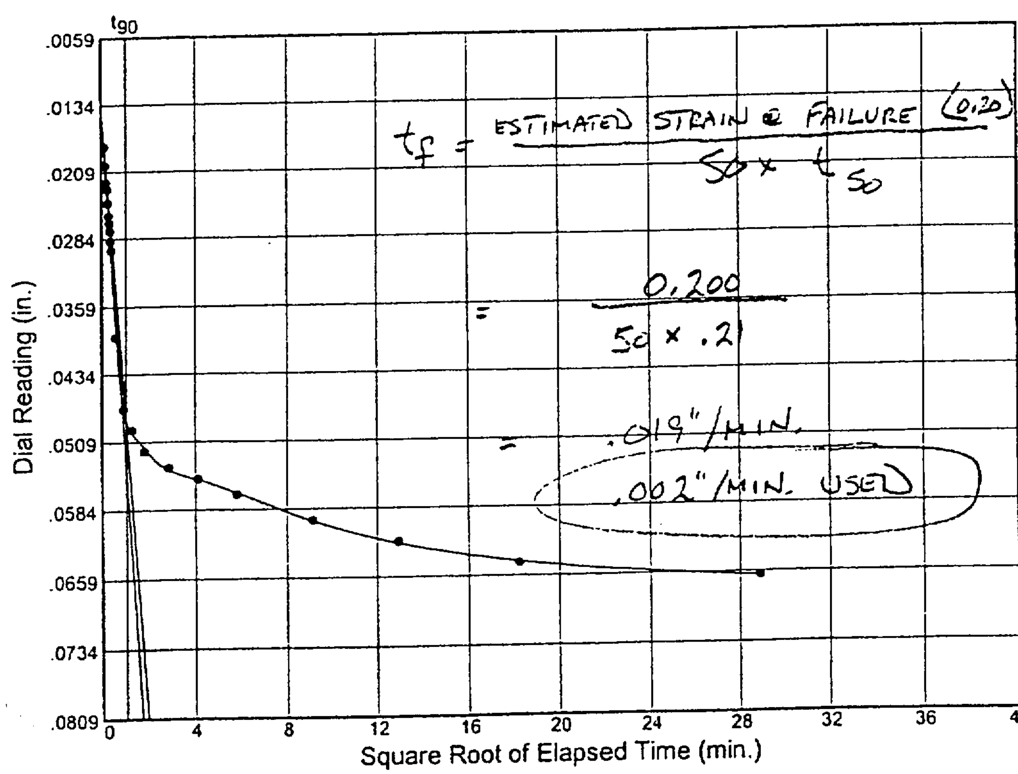
Source: T-14B

Sample No.: F



Load No.= 1
Load= 14.00 ksf
D_0 = 0.01460
D_{90} = 0.04311
D_{100} = 0.04628
T_{90} = 0.29 min.

C_v @ T_{90}
0.0116 in.^{2}/sec.



Load No.= 2
Load= 10.00 ksf
D_0 = 0.01340
D_{50} = 0.04868
D_{100} = 0.05260
T_{50} = .0.21 min.

C_v @ T_{50}
0.0034 in.^{2}/sec.

Plate

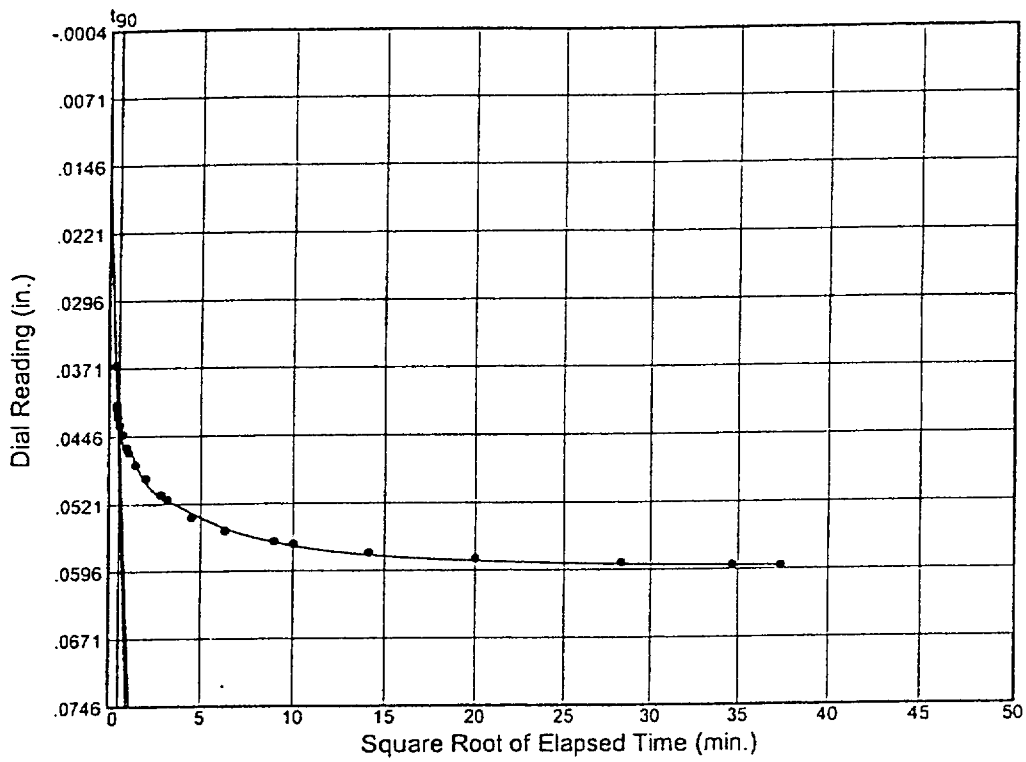
COOPER TESTING LABORATORY

Dial Reading vs. Time

Project No.: 109-290
Project: 6427.001

Source: T-14B

Sample No.: F



Load No.= 1

Load= 14.00 ksf

D_0 = 0.01460

D_{90} = 0.04383

D_{100} = 0.04707

T_{90} = 0.30 min.

C_v @ T_{90}
0.0111 in.^{2}/sec.

$$t_f = \frac{\text{ESTIMATED STRAIN @ FAILURE (0.200")}}{50 \times t_{50}}$$

$$= \frac{0.200}{50 \times .07}$$

$$= .057"/\text{MIN.}$$

.02"/MIN USED

Plate

COOPER TESTING LABORATORY

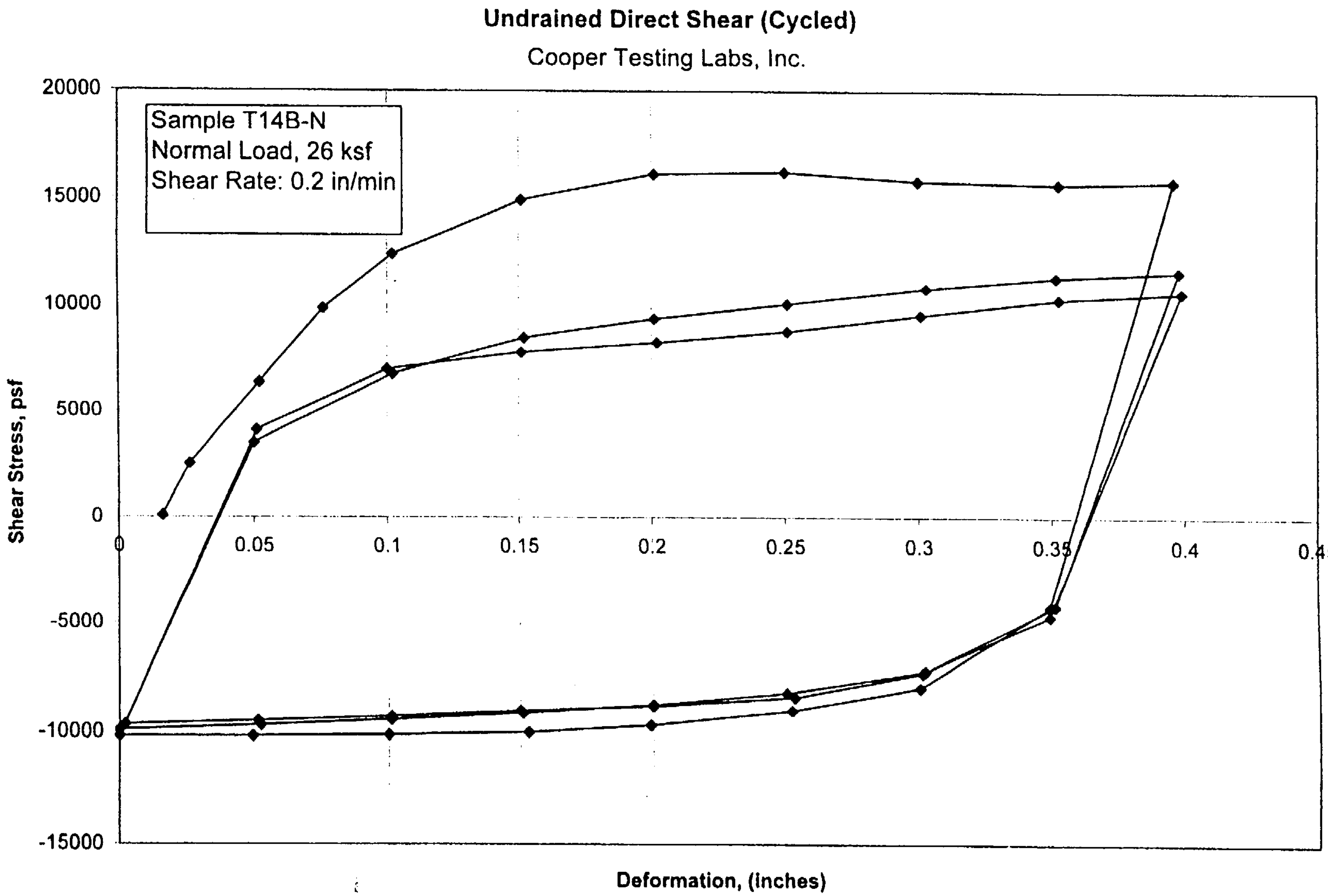
ATTACHMENT 3

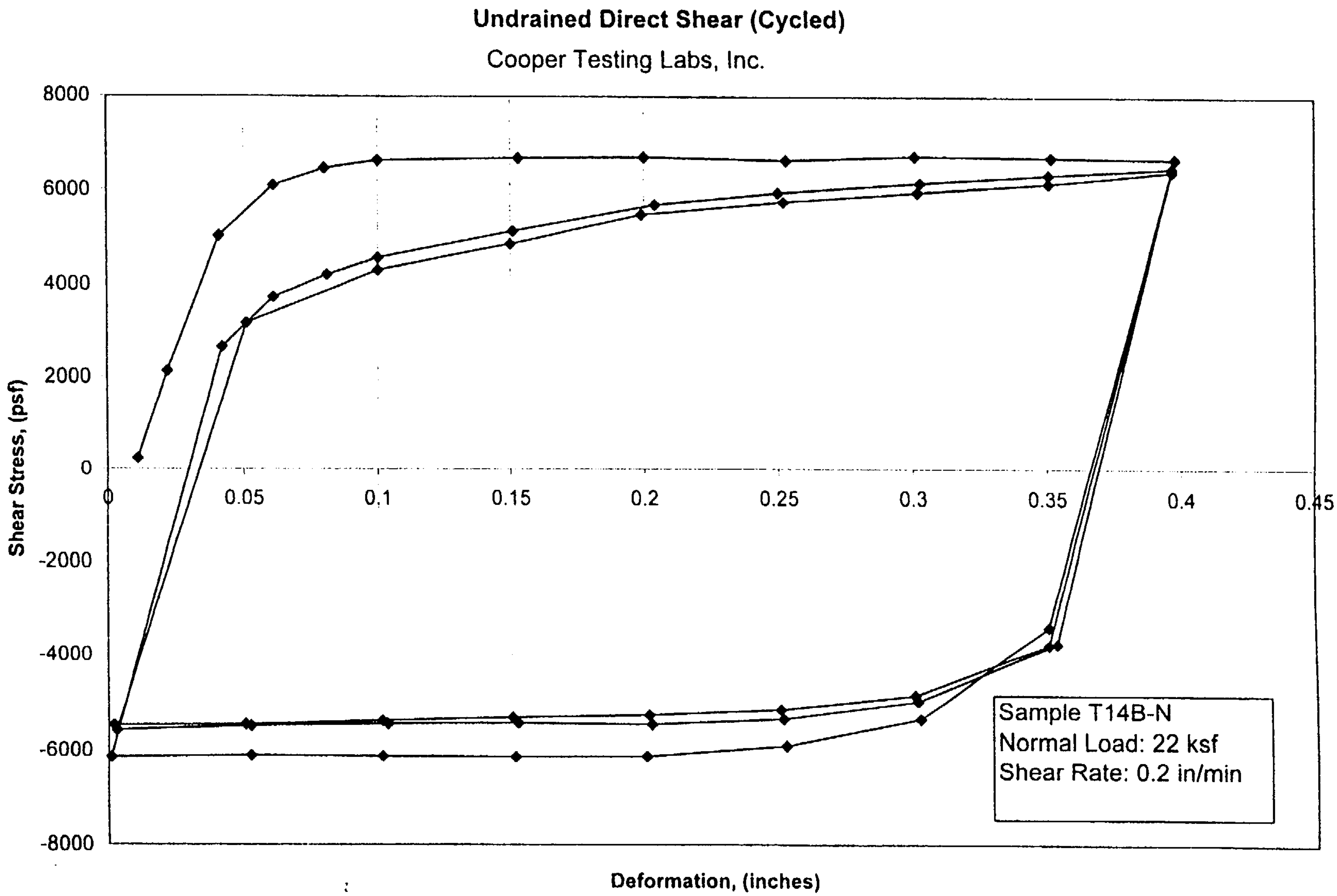
DATA REPORT G

CYCLIC DIRECT SHEAR TESTS

Sample T14B-N

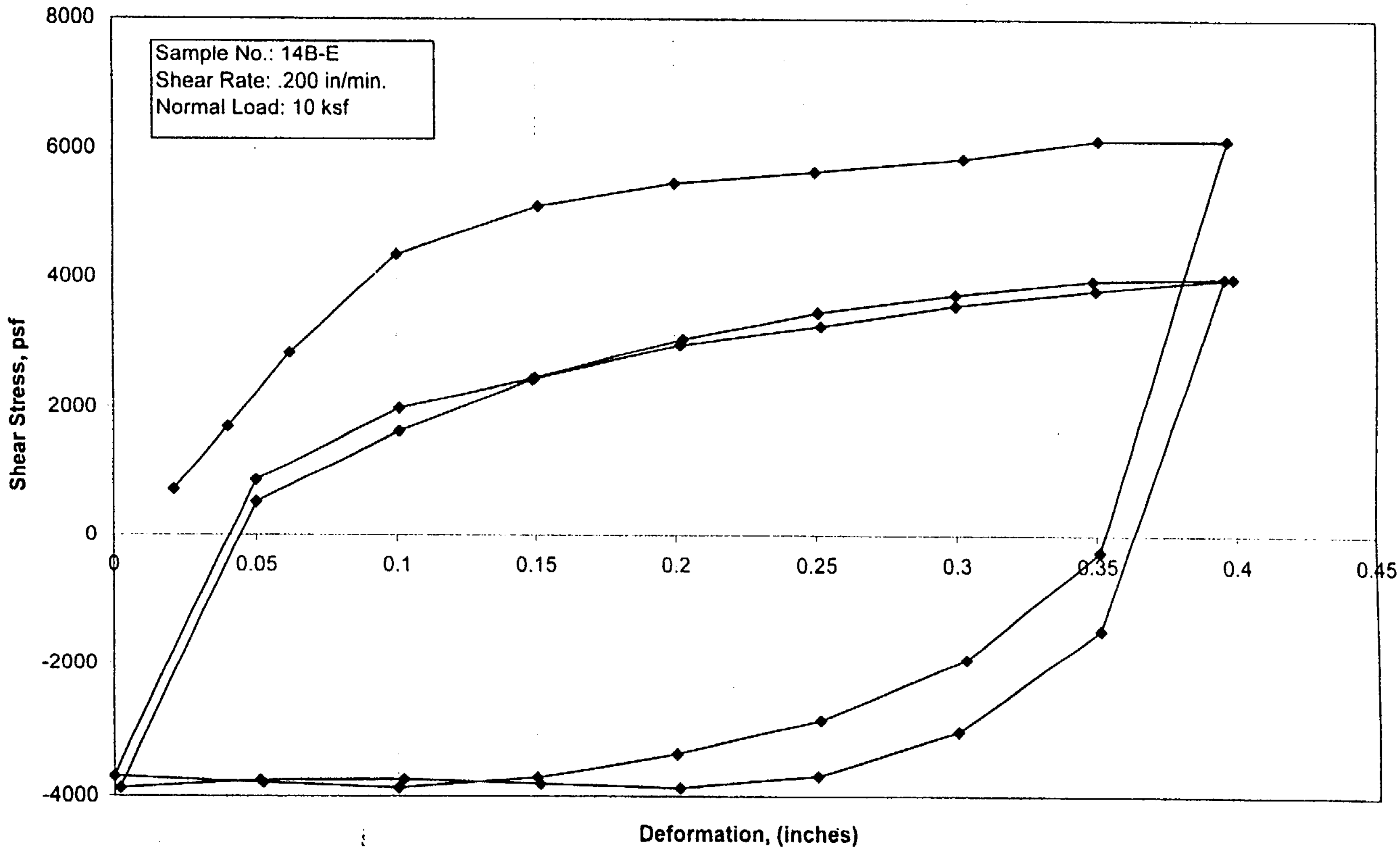
Sample T14B-E

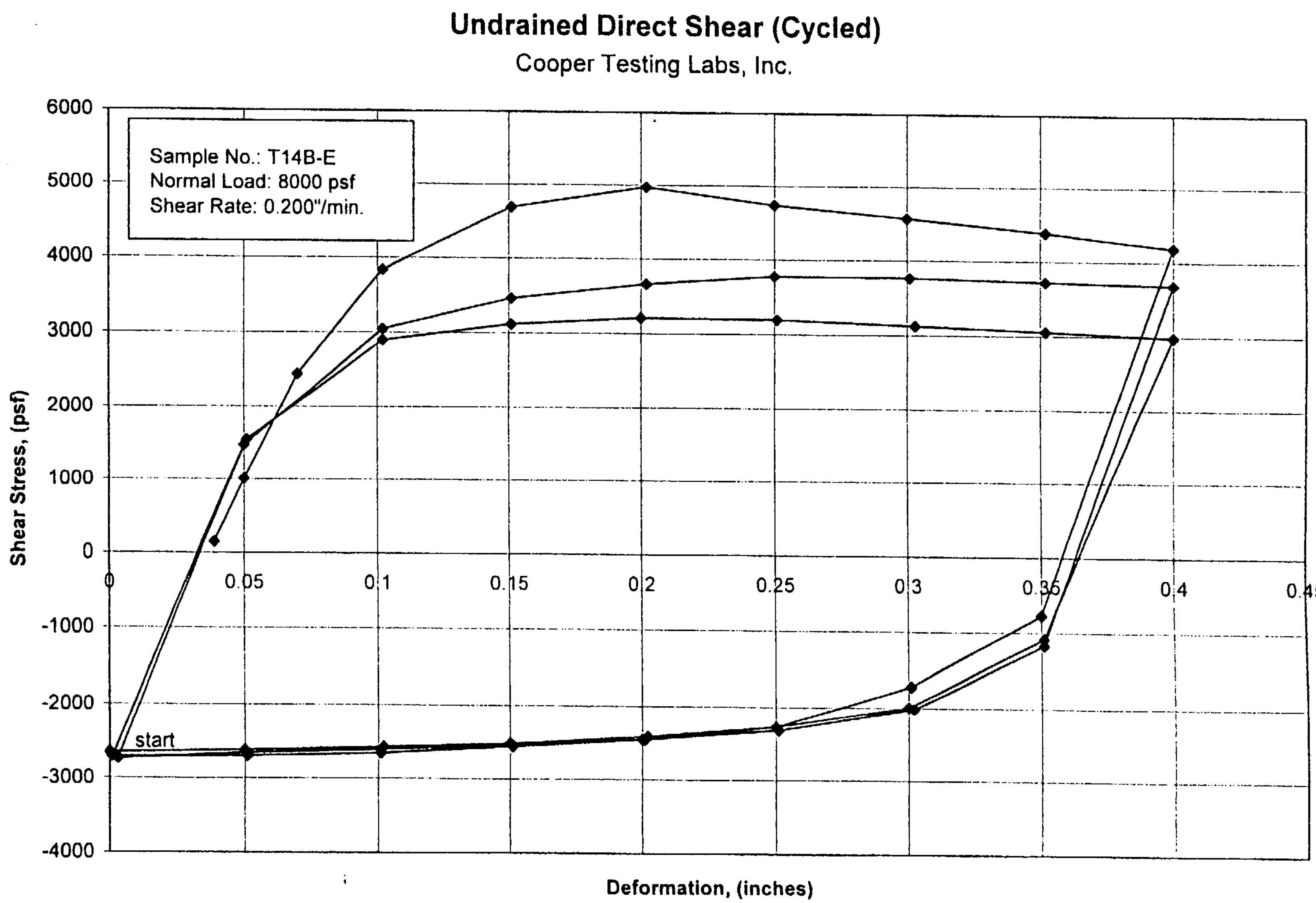

Undrained Direct Shear (Cycled)
Cooper Testing Labs, Inc.
Sample T14B-N
Normal Load, 26 ksf
Shear Rate: 0.2 in/min
Shear Stress, psf
20000
15000
10000
5000
0
-5000
-10000
-15000
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
Deformation, (inches)

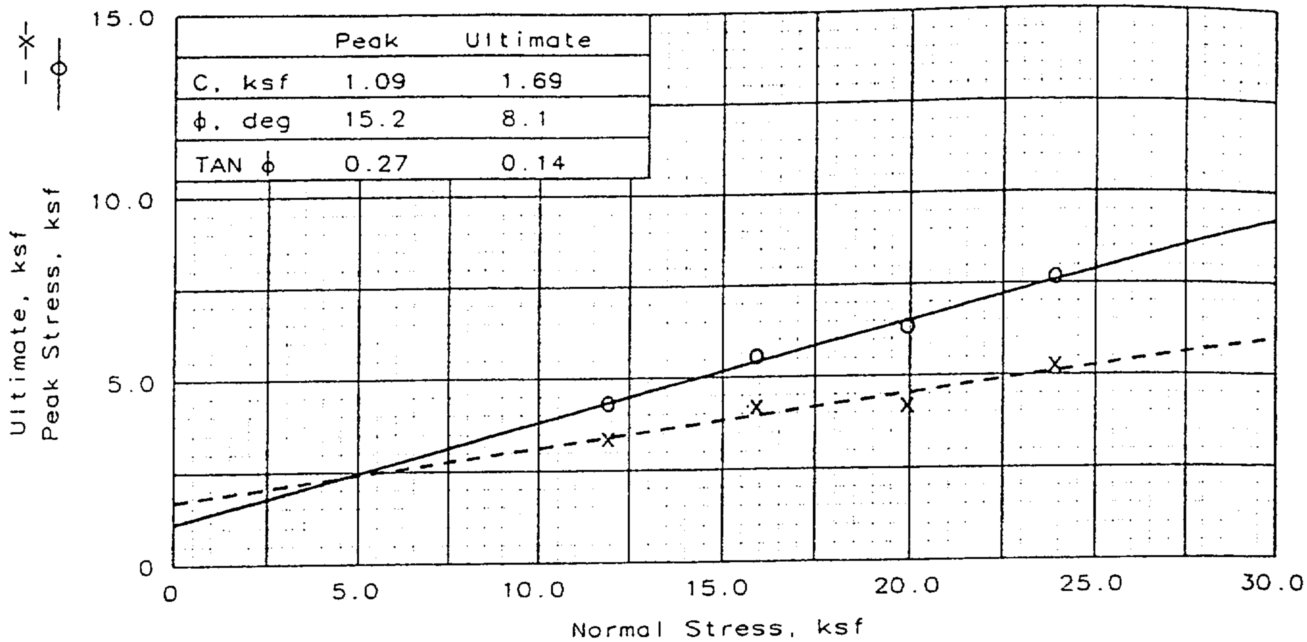

Undrained Direct Shear (Cycled)
Cooper Testing Labs, Inc.
8000
6000
4000
2000
0
-2000
-4000
-6000
-8000
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
Shear Stress, (psf)
Deformation, (inches)
Sample T14B-N
Normal Load: 22 ksf
Shear Rate: 0.2 in/min

Undrained Direct Shear (Cycled)

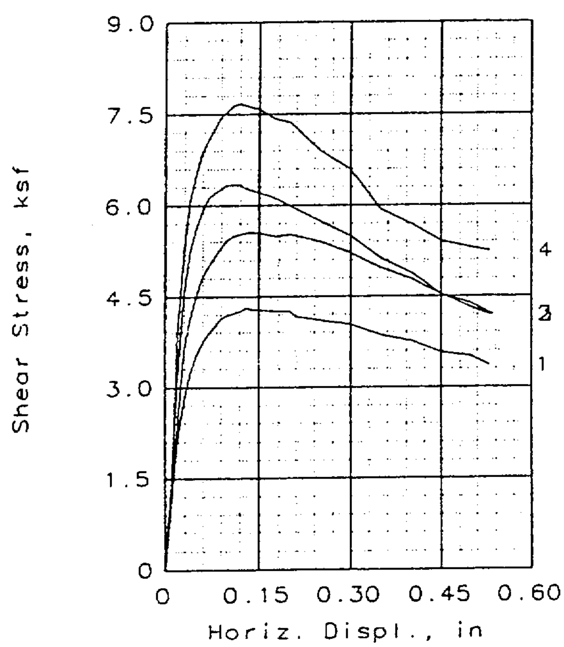
Cooper Testing Labs, Inc.




Undrained Direct Shear (Cycled)
Cooper Testing Labs, Inc.
Sample No.: T14B-E
Normal Load: 8000 psf
Shear Rate: 0.200"/min.
6000
5000
4000
3000
2000
1000
0
-1000
-2000
-3000
-4000
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
start
Shear Stress, (psf)
Deformation, (inches)



	Peak	Ultimate
C, ksf	1.09	1.69
ϕ, deg	15.2	8.1
TAN ϕ	0.27	0.14



	SAMPLE NO.:	1	2	3	4
INITIAL	WATER CONTENT, %	22.9	22.1	25.9	29.0
	DRY DENSITY, pcf	87.9	88.6	90.3	88.7
	SATURATION, %	67.8	66.2	80.6	87.0
	VOID RATIO	0.904	0.902	0.867	0.900
	DIAMETER, in	2.43	2.43	2.43	2.43
	HEIGHT, in	1.01	1.01	1.02	1.03
AT TEST	WATER CONTENT, %	25.5	24.1	25.6	28.0
	DRY DENSITY, pcf	99.5	101.8	99.4	95.9
	SATURATION, %	100.2	99.2	99.4	99.8
	VOID RATIO	0.682	0.655	0.696	0.758
	DIAMETER, in	2.43	2.43	2.43	2.43
	HEIGHT, in	0.89	0.87	0.93	0.95
	NORMAL STRESS, ksf	12.00	16.00	20.00	24.00
	Peak Stress, ksf	4.32	5.56	6.33	7.67
	DISPLACEMENT, in	0.13	0.13	-0.10	0.12
	Ultimate, ksf	3.35	4.19	4.19	5.25
	DISPLACEMENT, in	0.53	0.54	0.53	0.53
	Strain rate, %/min	1.00	1.00	1.00	1.00

SAMPLE TYPE: Undisturbed
DESCRIPTION: yellow brown CLAY
with claystone nodules

ASSUMED SPECIFIC GRAVITY= 2.68
REMARKS: **DS-CU**
An undrained condition cannot
be completely accomplished.

Fig. No.: ______

CLIENT: GeoMatrix

PROJECT: 6427.001

SAMPLE LOCATION: T14-B S4-1,4-2,4-3,4-4

PROJ. NO.: 109-287 DATE: 9/11/00

DIRECT SHEAR TEST REPORT

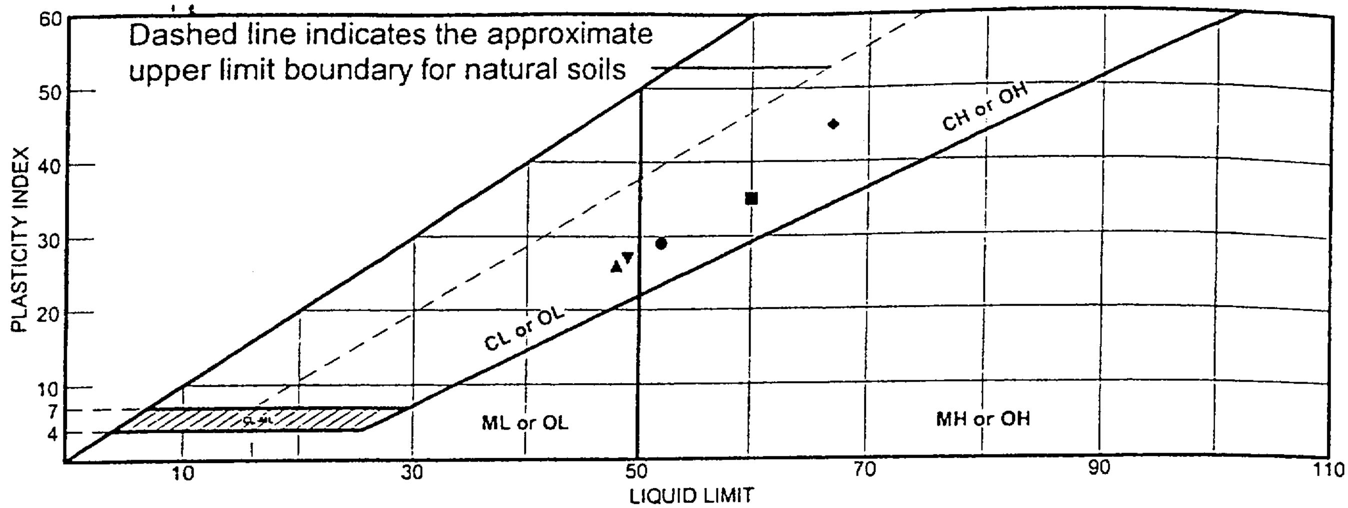
COOPER TESTING LABORATORY

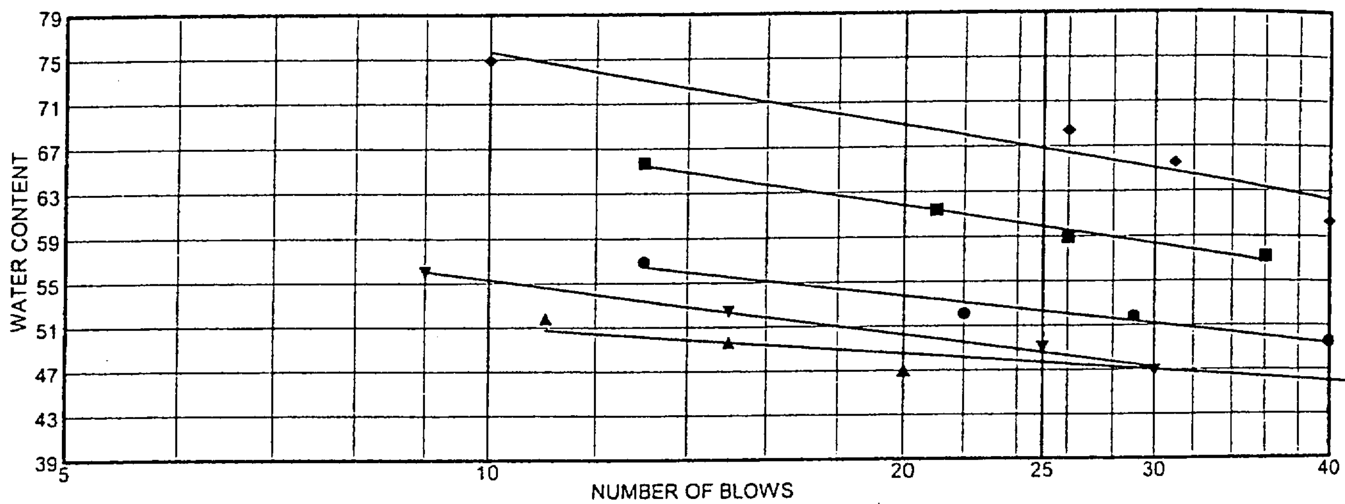
ATTACHMENT 4

DATA REPORT G

ATTERBERG LIMITS TESTS

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	yellow brown CLAY with cs & sand	52	23	29			
■	yellow brown CLAY w/sand	60	25	35			
▲	yellow brown sandy CLAY with weathered claystone (gravelly lean Clay with sand)	48	22	26	71.2	63.1	CL
◆	yellow brown CLAY w/sand	67	22	45	97.0	85.1	CH
▼	tan CLAY w/sand	49	22	27	85.4	74.5	CL

Project No. 109-290 **Client:** GeoMatrix

Project: 6427.001

● **Source:** T-14B **Sample No.:** B

■ **Source:** T-14B **Sample No.:** D

▲ **Source:** T-14B **Sample No.:** E

◆ **Source:** T-14B **Sample No.:** F

▼ **Source:** T-14B **Sample No.:** H

Remarks:

●

■

▲

◆

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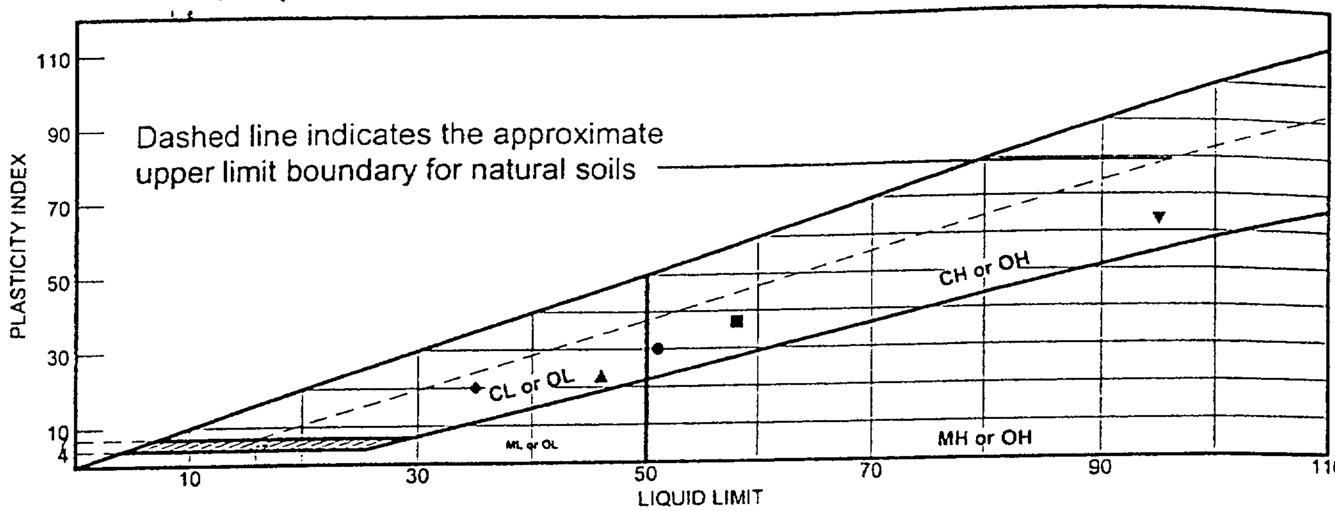
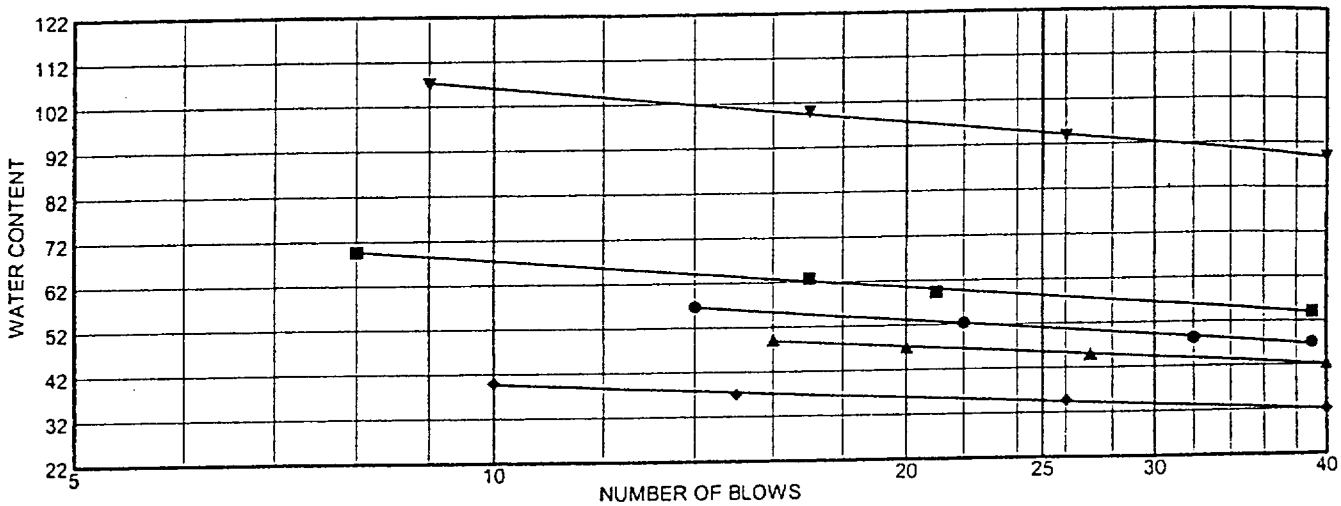
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Plate

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	yellow brown CLAY with sand	51	21	30	99.4	92.0	CH
■	yellow brown CLAY	58	21	37	99.7	95.2	CH
▲	yellow brown clayey GRAVEL w/sand (weathered Claystone)	46	23	23	48.7	43.4	GC
◆	tan sandy CLAY w/trace gravel	35	15	20	69.7	54.8	CL
▼	tan clayey GRAVEL	95	32	63	41.8	39.2	GC

Project No. 109-290 **Client:** GeoMatrix

Project: 6427.001

● **Source:** T-14B **Sample No.:** J

■ **Source:** T-14B **Sample No.:** K

▲ **Source:** T-14B **Sample No.:** N

◆ **Source:** BA98-1 **Elev./Depth:** 66.3-67

▼ **Source:** T-15 **Sample No.:** 8+40 **Elev./Depth:** 0.5

Remarks:

●

■

▲

◆

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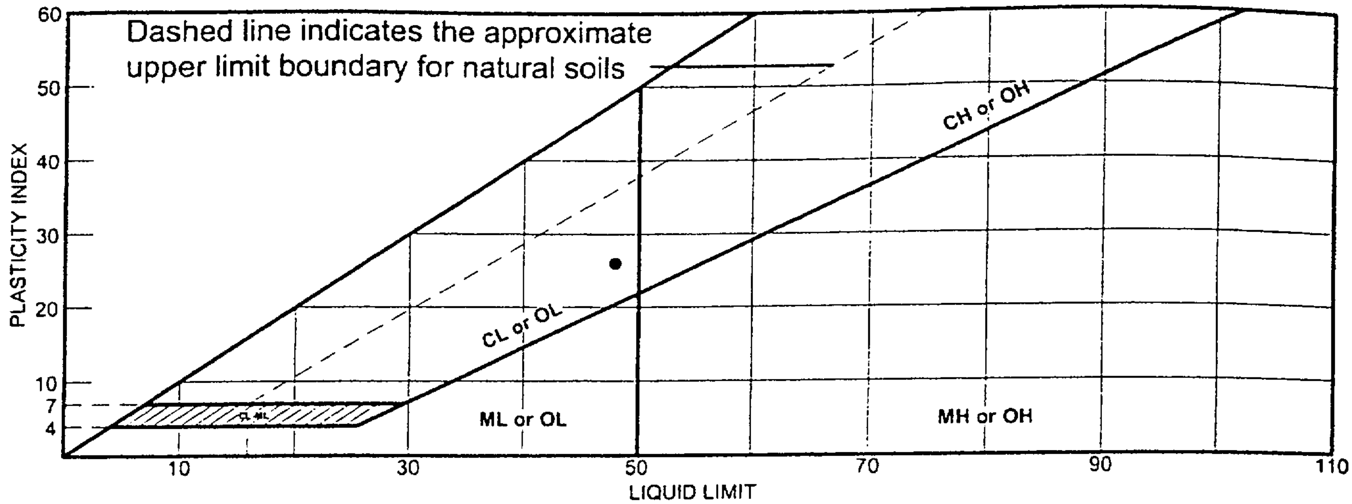
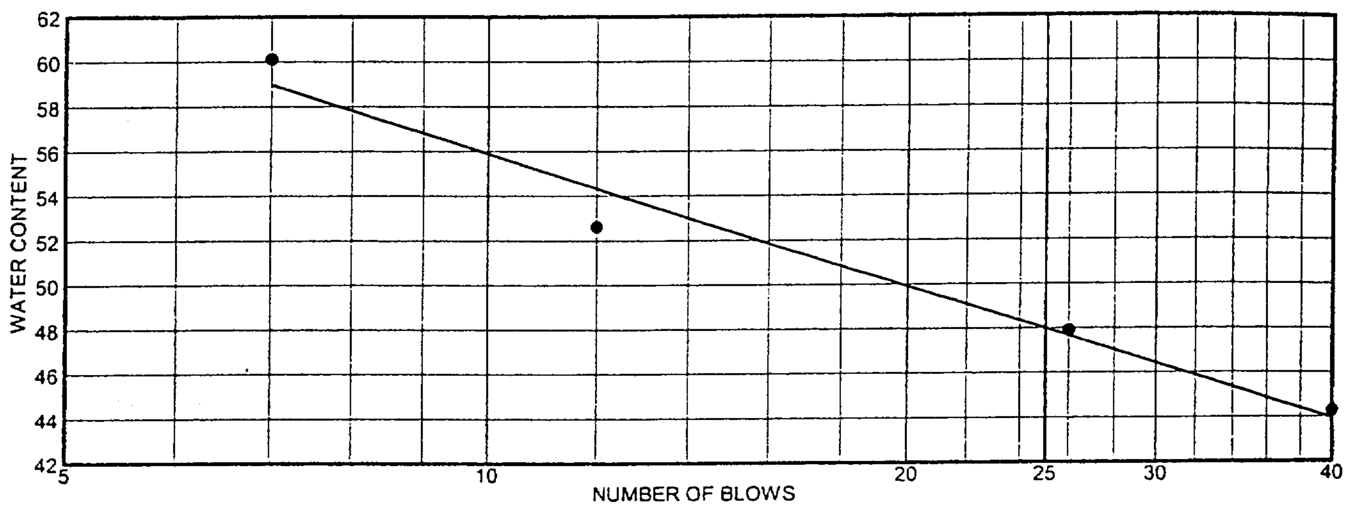
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Plate

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	yellow brown sandy CLAY w/trace claystone gravel; 1/4" clay stringer (strati) very clearly stratified	48	22	26	72.0	63.5	CL

Project No. 109-290 **Client:** GeoMatrix

Project: 6427.001

● **Source:** T-14B **Sample No.:** M

Remarks:

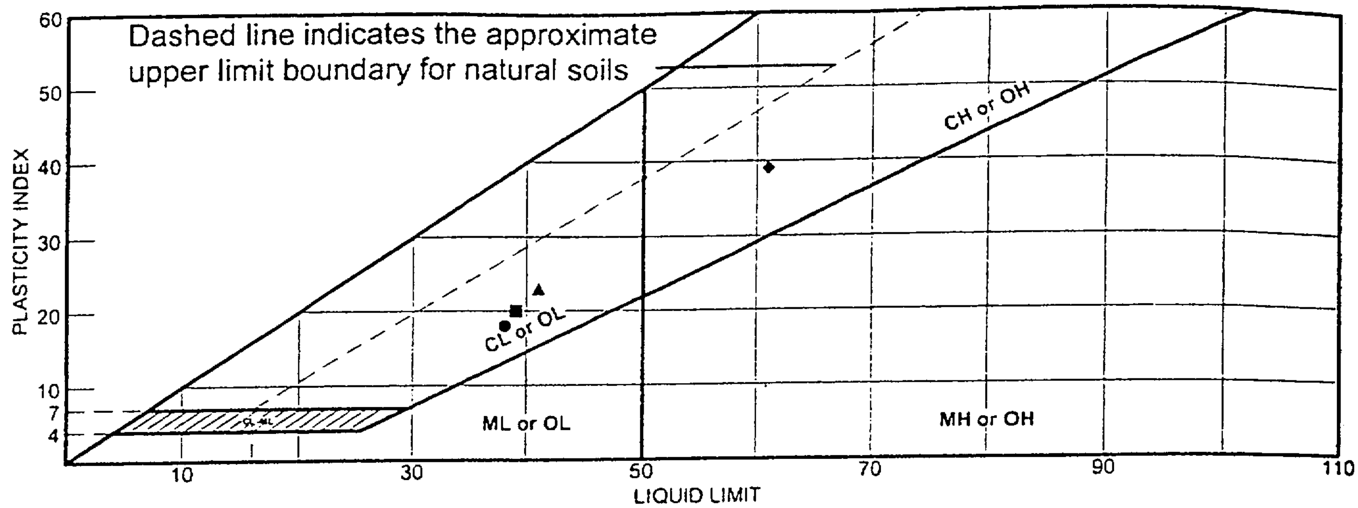
●

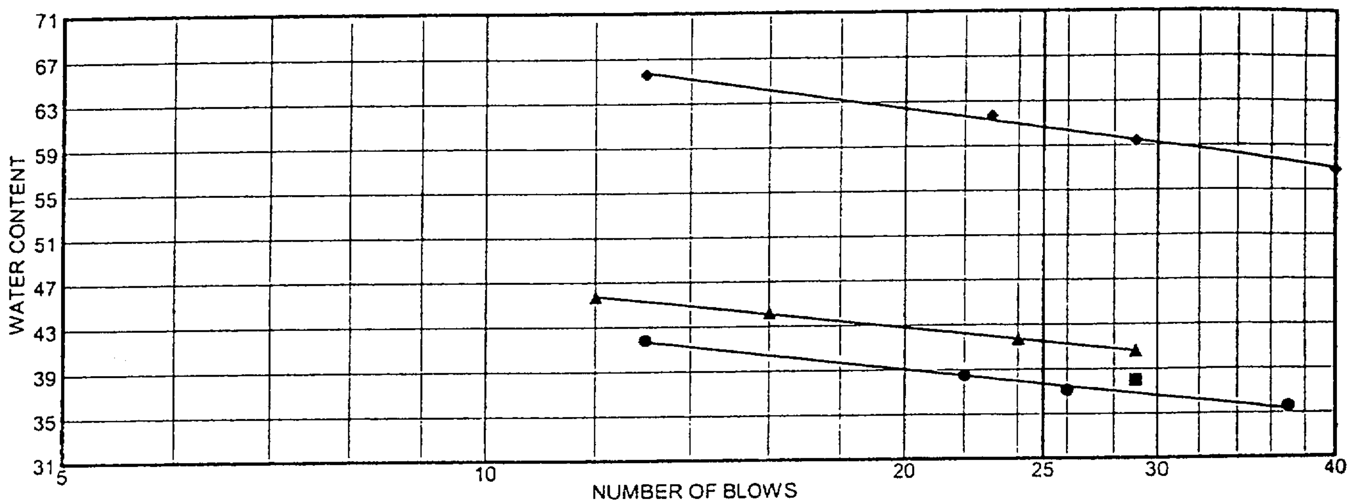
LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

Plate

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	brown sandy CLAY, trace gravel (very silty)	38	20	18	83.9	65.8	CL
■	light brown CLAY w/sand	39	19	20	91.7	82.0	CL
▲	tan CLAY, (silty)	41	18	23	98.9	93.1	CL
◆	yellow brown CLAY	61	22	39	99.6	94.9	CH

Project No. 109-287 **Client:** GeoMatrix

Project: PG&E 6427.001

● **Source:** T11A **Sample No.:** 4

■ **Source:** T-14B **Sample No.:** 7

▲ **Source:** T-14B **Sample No.:** Blocks 1 & 2

◆ **Source:** T-14B **Sample No.:** S4-1,4-2,4-3,4-4

Remarks:
●
■
▲
◆

LIQUID AND PLASTIC LIMITS TEST REPORT

COOPER TESTING LABORATORY

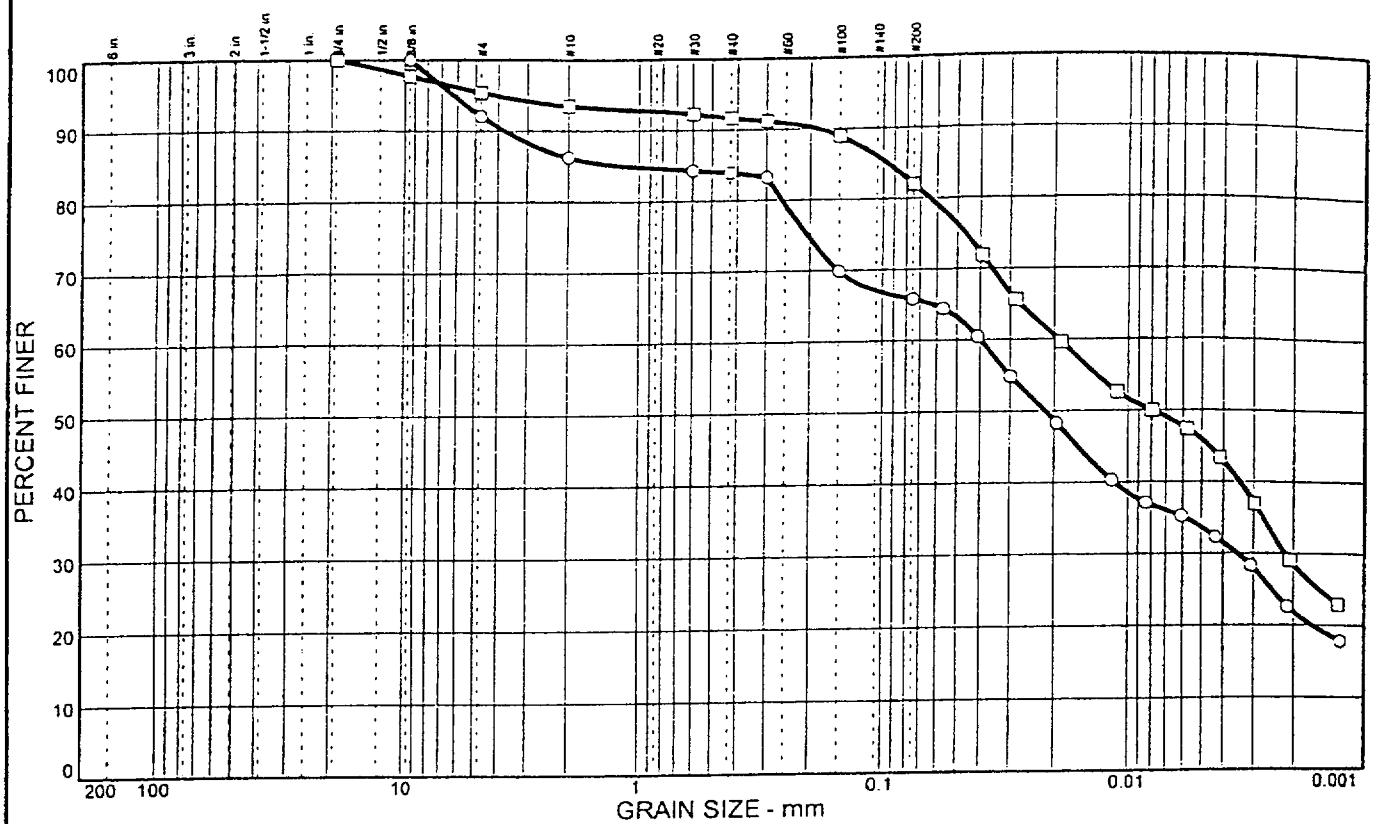
Plate

ATTACHMENT 5

DATA REPORT G

GRAIN SIZE DISTRIBUTION TESTS

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY	% FINES	USCS	AASHTO	PL	LL
○		7.9	26.3	32.1	33.7	65.8			20	38
□		4.6	13.4	36.1	45.9	82.0	CL		19	39

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □	
3/4		100.0	
3/8	100.0	97.7	
	GRAIN SIZE		
D_{60}	0.0401	0.0193	
D_{30}	0.0035	0.0022	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIZE	PERCENT FINER ○	PERCENT FINER □	
#4	92.1	95.4	
#10	86.2	93.5	
#30	84.3	92.3	
#40	83.9	91.7	
#50	83.2	91.2	
#100	69.9	88.9	
#200	65.8	82.0	
0.0567 mm.	64.4		
0.0410 mm.	60.4		
0.0393 mm.		71.9	
0.0299 mm.	54.8		
0.0287 mm.		65.6	
0.0195 mm.	48.3		
0.0187 mm.		59.6	
0.0117 mm.	40.3		
0.0111 mm.		52.6	
0.0084 mm.	37.1		
0.0080 mm.		50.0	
0.0061 mm.	35.2		
0.0058 mm.		47.4	
0.0043 mm.	32.3		
0.0041 mm.		43.4	
0.0031 mm.	28.3		
0.0030 mm.		36.9	
0.0021 mm.	22.6	29.0	
0.0013 mm.	17.8	23.9	

SOIL DESCRIPTION

○ brown CLAY with sand, trace gravel (very silty)

□ light brown CLAY w/sand

REMARKS:

○

□

○ Source: T11A

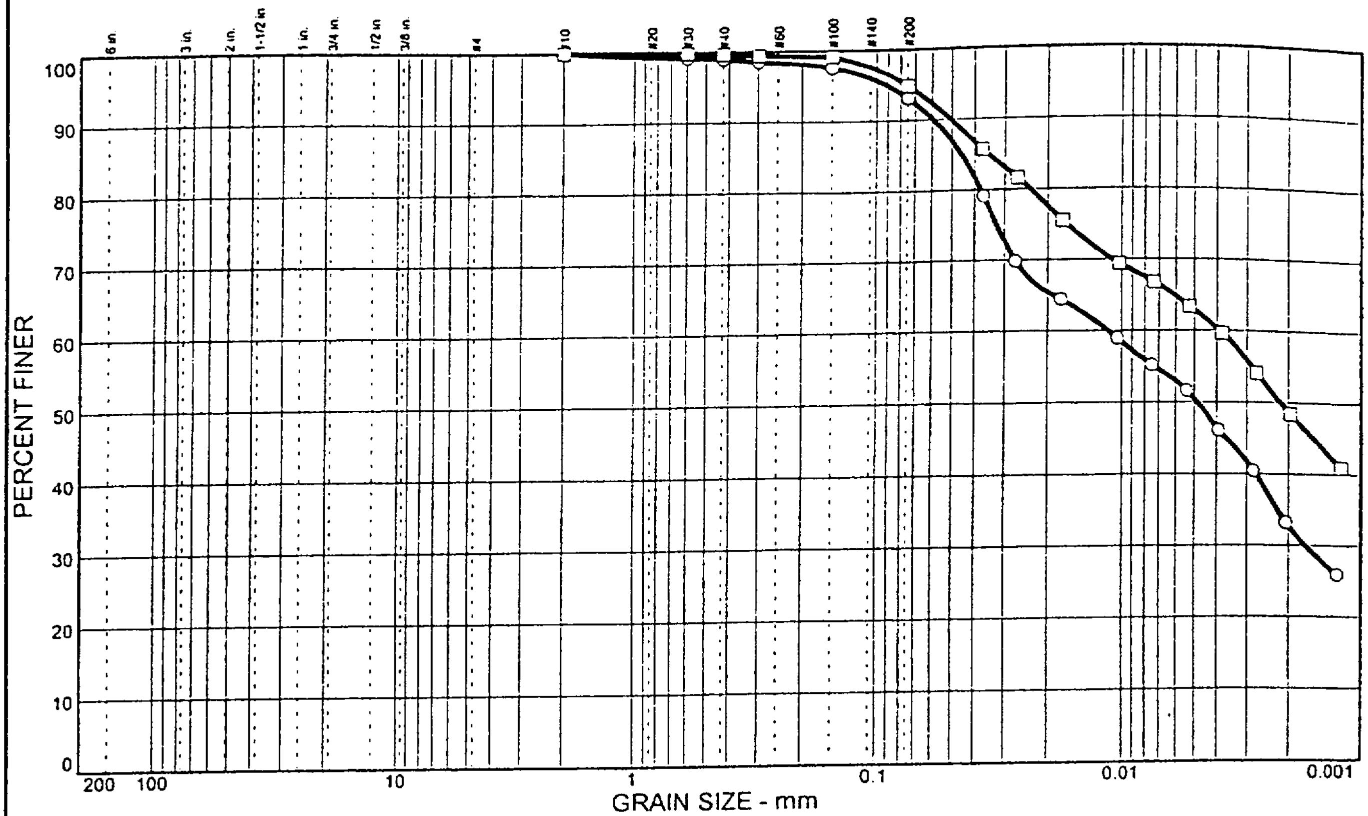
□ Source: T-14B

Sample No.: 4

Sample No.: 7

COOPER TESTING LABORATORY	Project: PG&E 6427.001 Feature: Project No.: 109-287

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY	% FINES	USCS	AASHTO	PL	LL
○			6.9	42.7	50.4	93.1	CL		18	41
□			5.1	32.2	62.7	94.9	CH		22	61

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □	
	GRAIN SIZE		
D_{60}	0.0115	0.0039	
D_{30}	0.0017		
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIZE	PERCENT FINER ○	PERCENT FINER □	
#10	100.0	100.0	
#30	99.1	99.8	
#40	98.9	99.6	
#50	98.5	99.4	
#100	97.6	99.2	
#200	93.1	94.9	
0.0371 mm.		85.7	
0.0367 mm.	79.1		
0.0272 mm.	69.9		
0.0267 mm.		81.6	
0.0177 mm.	64.4		
0.0174 mm.		75.5	
0.0104 mm.	58.9		
0.0103 mm.		69.4	
0.0075 mm.	55.2		
0.0073 mm.		66.8	
0.0054 mm.	51.6		
0.0053 mm.		63.3	
0.0039 mm.	46.1		
0.0038 mm.		59.6	
0.0028 mm.	40.5		
0.0027 mm.		54.1	
0.0020 mm.	33.2	48.4	
0.0013 mm.	25.9		
0.0012 mm.		40.9	

SOIL DESCRIPTION

○ tan CLAY, (silty)

□ yellow brown CLAY

REMARKS:

○

□

○ Source: T-14B

□ Source: T-14B

Sample No.: Blocks 1 & 2

Sample No.: S4-1,4-2,4-3,4-4

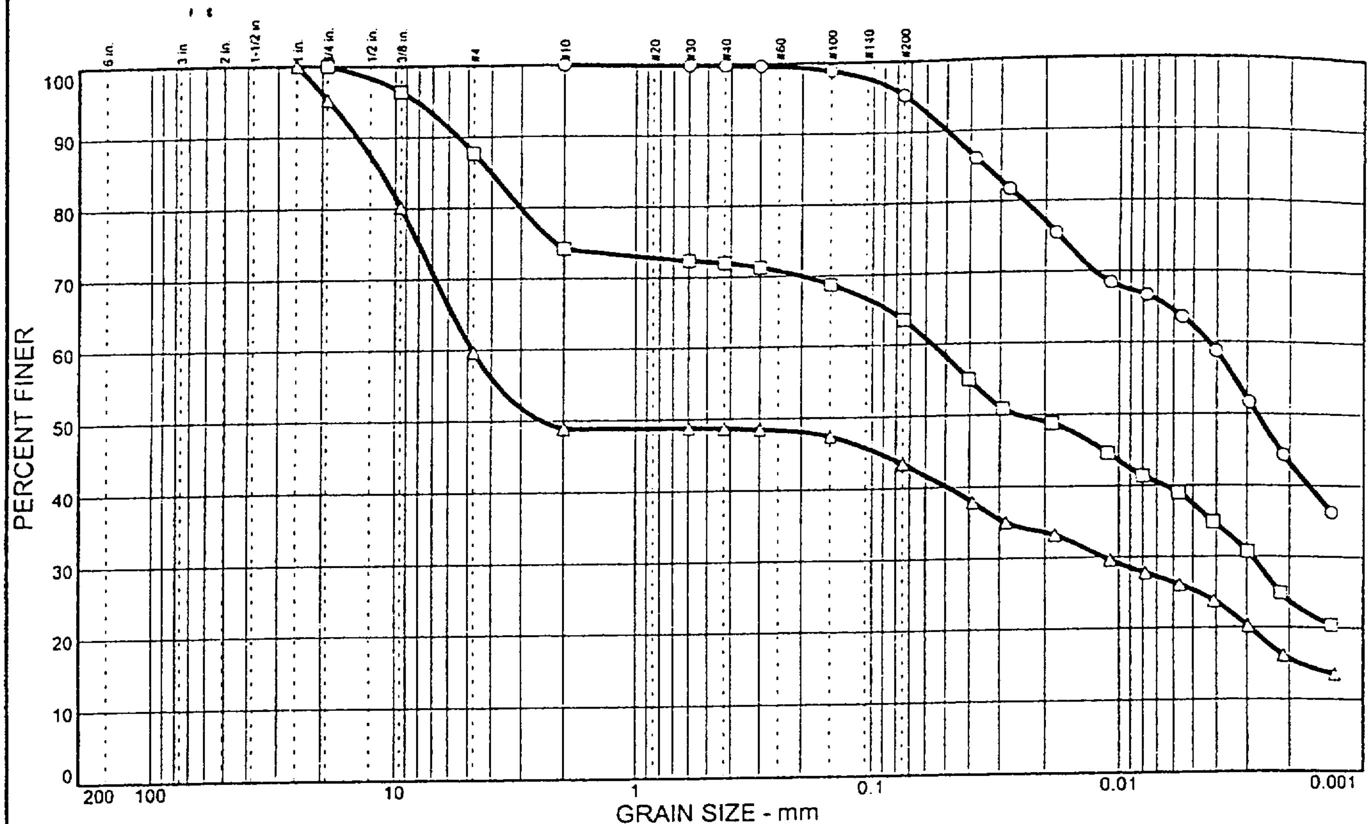
COOPER TESTING LABORATORY

Project: PG&E 6427.001

Feature:

Project No.: 109-287

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY	% FINES	USCS	AASHTO	PL	LL
○			4.8	33.1	62.1	95.2	CH		21	58
□		12.3	24.2	26.1	37.4	63.5	CL		22	48
△		40.3	16.3	18.1	25.3	43.4	GC		23	46

SIEVE inches size	PERCENT FINER ○	□	△
1			100.0
3/4		100.0	95.3
3/8		96.4	80.2
	GRAIN SIZE		
D_{60}	0.0043	0.0568	4.81
D_{30}		0.0029	0.0115
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIZE	PERCENT FINER ○	□	△
#4		87.7	59.7
#10	100.0	74.2	48.9
#30	99.8	72.4	48.8
#40	99.7	72.0	48.7
#50	99.6	71.3	48.5
#100	98.8	68.7	47.4
#200	95.2	63.5	43.4
0.0403 mm.		55.0	
0.0388 mm.			37.9
0.0381 mm.	86.1		
0.0293 mm.		50.9	
0.0283 mm.			35.0
0.0277 mm.	81.7		
0.0188 mm.		48.8	
0.0182 mm.			33.2
0.0181 mm.	75.5		
0.0111 mm.		44.6	
0.0109 mm.	68.4		29.6
0.0080 mm.		41.4	
0.0078 mm.	66.6		27.8
0.0057 mm.		39.0	26.1
0.0056 mm.	63.5		
0.0041 mm.		34.9	23.8
0.0040 mm.	58.7		
0.0030 mm.		30.7	20.2
0.0029 mm.	51.6		
0.0022 mm.		24.9	
0.0021 mm.	44.3		16.1
0.0014 mm.	36.2	20.4	
0.0013 mm.			13.5

SOIL DESCRIPTION

○ yellow brown CLAY

□ yellow brown sandy CLAY w/trace claystone gravel;
1/4" clay stringer (strati) very clearly stratified

△ yellow brown clayey GRAVEL w/sand (weathered Claystone)

REMARKS:

○

□

△

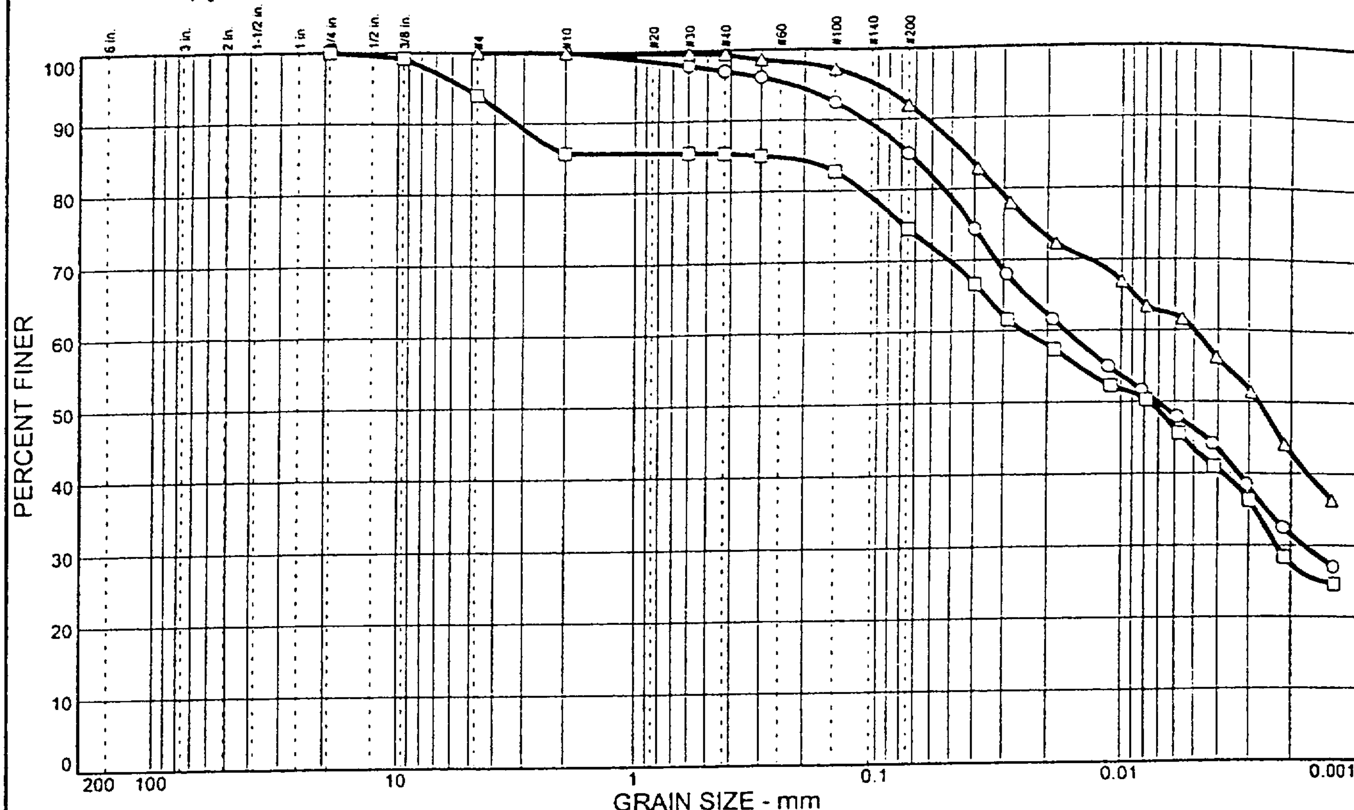
○ Source: T-14B — Sample No.: K

□ Source: T-14B — Sample No.: M

△ Source: T-14B — Sample No.: N

COOPER TESTING LABORATORY	Project: 6427.001
	Feature:
	Project No.: 109-290

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY	% FINES	USCS	AASHTO	PL	LL
○			14.9	38.9	46.2	85.1	CH		22	67
□		6.0	19.5	31.1	43.4	74.5	CL		22	49
△			8.0	32.1	59.9	92.0	CH		21	51

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □	PERCENT FINER △
3/4		100.0	
3/8		99.2	
	GRAIN SIZE		
D_{60}	0.0169	0.0251	0.0050
D_{30}	0.0018	0.0023	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIZE	PERCENT FINER ○	PERCENT FINER □	PERCENT FINER △
#4 #10 #30 #40 #50 #100 #200 0.0400 mm. 0.0398 mm. 0.0389 mm. 0.0292 mm. 0.0289 mm. 0.0283 mm. 0.0190 mm. 0.0187 mm. 0.0185 mm. 0.0113 mm. 0.0111 mm. 0.0100 mm. 0.0082 mm. 0.0079 mm. 0.0059 mm. 0.0058 mm. 0.0056 mm. 0.0042 mm. 0.0041 mm. 0.0031 mm. 0.0030 mm. 0.0029 mm. 0.0022 mm. 0.0021 mm. 0.0014 mm. 0.0013 mm.	100.0 97.8 97.0 96.1 92.5 85.1 74.4 68.0 61.6 55.0 51.6 47.9 44.2 35.5 32.5 27.0	94.0 85.7 85.5 85.4 85.0 82.7 74.5 66.6 61.6 57.4 52.3 50.3 45.6 41.0 36.3 28.4 24.6	100.0 99.9 99.5 99.4 98.6 97.2 92.0 82.9 78.0 72.3 66.9 63.4 61.6 56.2 51.4 44.1 36.3

SOIL DESCRIPTION

○ yellow brown CLAY w/sand

□ tan CLAY w/sand

△ yellow brown CLAY with sand

REMARKS:

○

□

△

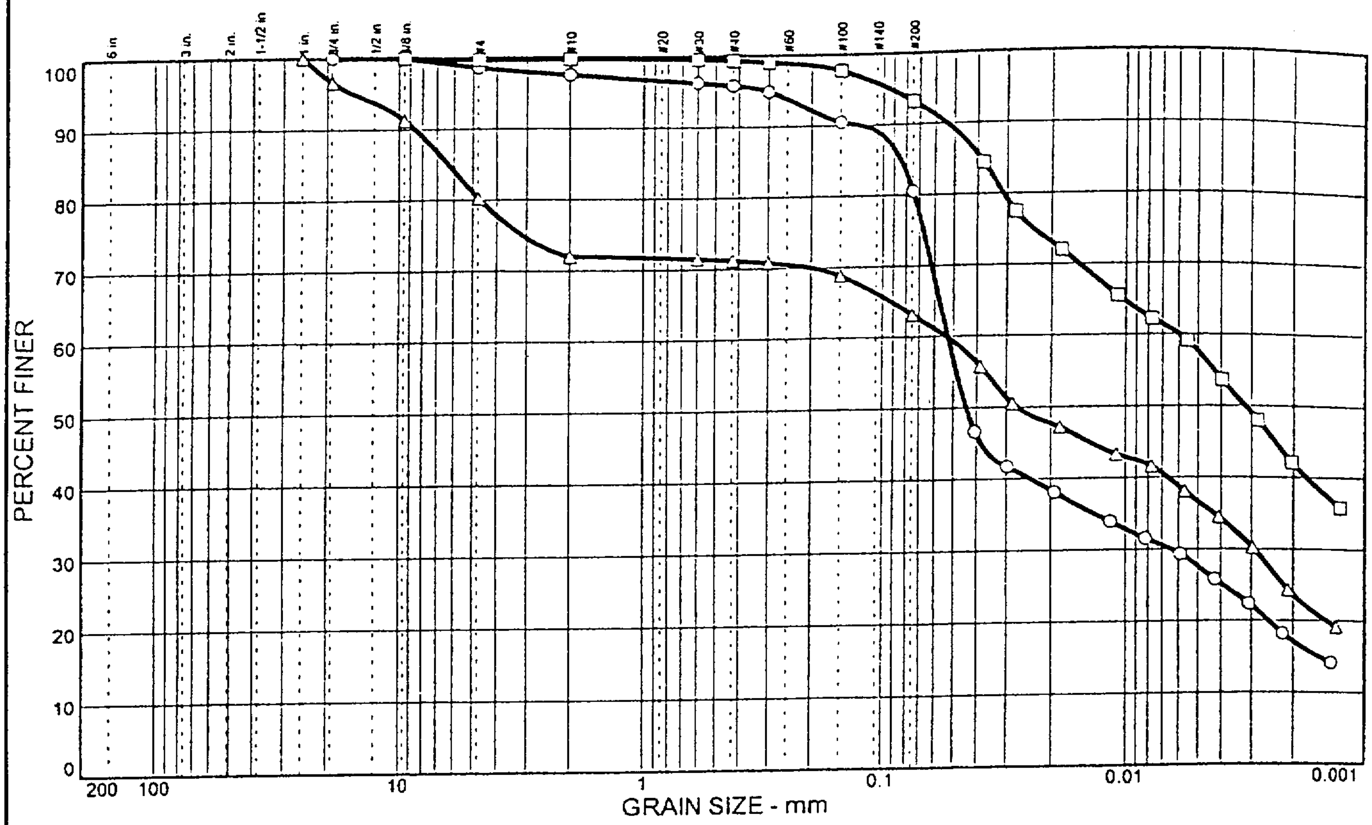
○ Source: T-14B Sample No.: F

□ Source: T-14B Sample No.: H

△ Source: T-14B Sample No.: J

COOPER TESTING LABORATORY	Project: 6427.001 Feature: Project No.: 109-290

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY	% FINES	USCS	AASHTO	PL	LL
○		1.4	18.1	52.9	27.6	80.5			23	52
□		0.3	6.5	35.6	57.6	93.2	CH		25	60
△		19.8	17.1	26.4	36.7	63.1	CL		22	48

SIEVE inches size	PERCENT FINER ○	□	△
1			100.0
3/4	100.0		96.6
3/8	100.0	100.0	91.3
	GRAIN SIZE		
D_{60}	0.0529	0.0060	0.0537
D_{30}	0.0064		0.0029
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIZE	PERCENT FINER ○	□	△
#4	98.6	99.7	80.2
#10	97.5	99.7	72.0
#30	96.2	99.5	71.5
#40	95.8	99.3	71.2
#50	94.9	99.0	70.5
#100	90.5	97.7	68.5
#200	80.5	93.2	63.1
0.0407 mm.	46.6		
0.0387 mm.			55.7
0.0380 mm.		84.4	
0.0298 mm.	41.7		
0.0284 mm.			50.5
0.0279 mm.		77.5	
0.0193 mm.	38.1		
0.0154 mm.			47.2
0.0181 mm.		72.0	
0.0115 mm.	33.9		
0.0109 mm.			43.3
0.0108 mm.		65.5	
0.0082 mm.	31.5		
0.0078 mm.			41.6
0.0077 mm.		62.2	
0.0059 mm.	29.3		
0.0057 mm.			38.1
0.0056 mm.		59.1	
0.0042 mm.	25.8		
0.0041 mm.			34.5
0.0040 mm.		53.6	
0.0031 mm.	22.4		
0.0030 mm.			30.2
0.0025 mm.		48.0	
0.0022 mm.	18.2		
0.0021 mm.			24.3
0.0020 mm.		42.1	
0.0014 mm.	14.1		
0.0013 mm.		35.8	19.1

SOIL DESCRIPTION

○ yellow brown CLAY with cs & sand

□ yellow brown CLAY w/ trace sand

△ yellow brown sandy CLAY with weathered claystone (gravelly lean Clay with sand)

REMARKS:

○

□

△

○ Source: T-14B Sample No.: B

□ Source: T-14B Sample No.: D

△ Source: T-14B Sample No.: E

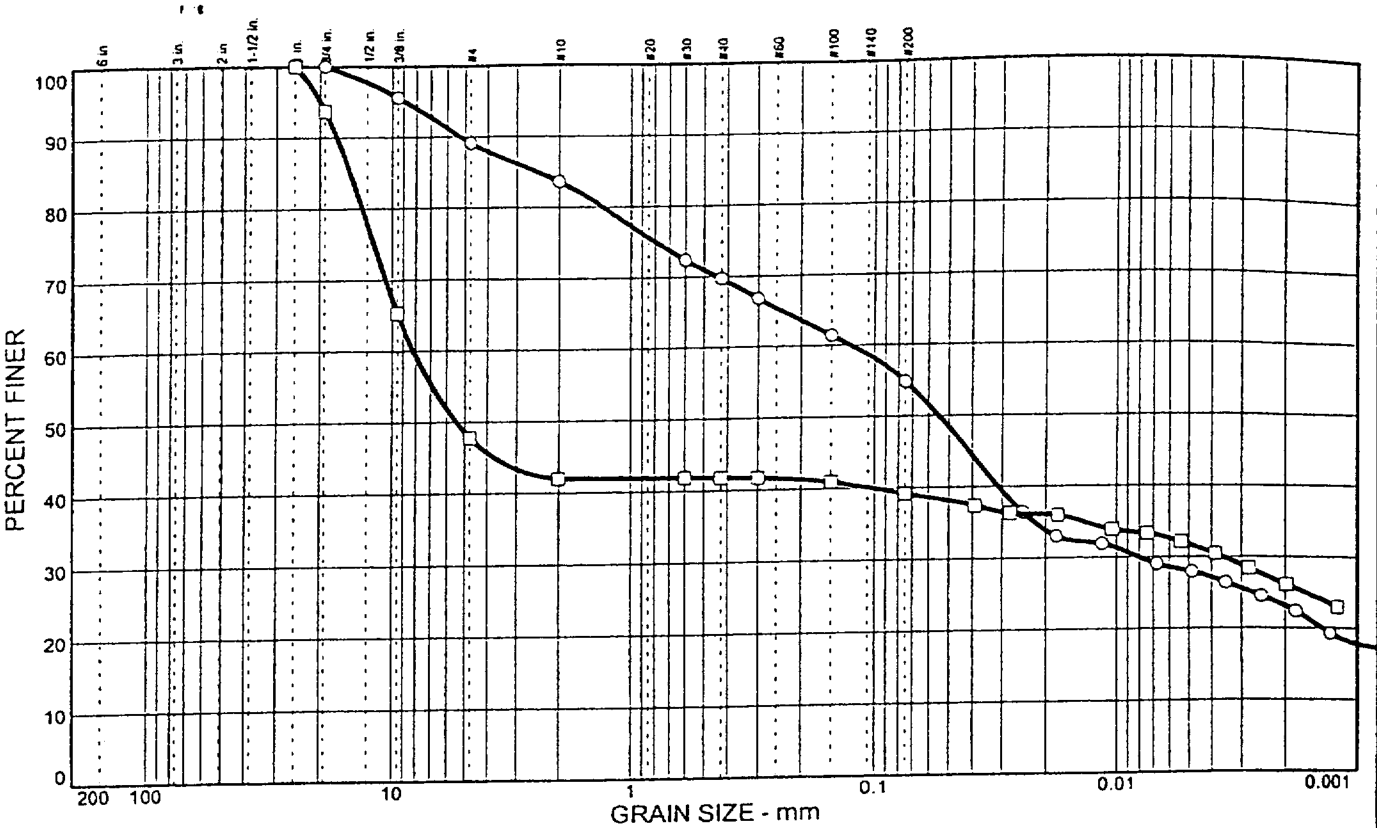
COOPER TESTING LABORATORY

Project: 6427.001

Feature:

Project No.: 109-290

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% + 3"	% GRAVEL	% SAND	% SILT	% CLAY	% FINES	USCS	AASHTO	PL	LL
○		10.9	34.3	26.8	28.0	54.8	CL		15	35
□		52.2	8.6	7.4	31.8	39.2	GC		32	95

SIEVE inches size	PERCENT FINER ○	PERCENT FINER □	
1		100.0	
3/4	100.0	93.7	
3/8	95.6	65.3	
	GRAIN SIZE		
D_{60}	0.125	8.20	
D_{30}	0.0081	0.0036	
D_{10}			
	COEFFICIENTS		
C_c			
C_u			

SIZE	PERCENT FINER ○	PERCENT FINER □	
#4	89.1	47.8	
#10	83.6	42.0	
#30	72.4	41.9	
#40	69.7	41.8	
#50	66.8	41.7	
#100	61.4	41.0	
#200	54.8	39.2	
0.0391 mm.		37.4	
0.0279 mm.		36.3	
0.0248 mm.	36.4		
0.0180 mm.	33.0		
0.0177 mm.		36.0	
0.0115 mm.	31.9		
0.0104 mm.		33.9	
0.0074 mm.		33.3	
0.0068 mm.	29.0		
0.0054 mm.		32.1	
0.0048 mm.	27.9		
0.0039 mm.		30.4	
0.0035 mm.	26.4		
0.0028 mm.		28.4	
0.0025 mm.	24.5		
0.0020 mm.		26.1	
0.0018 mm.	22.4		
0.0013 mm.	19.3		
0.0012 mm.		23.0	
0.0008 mm.	17.1		

SOIL DESCRIPTION

○ tan sandy CLAY w/trace gravel

□ tan clayey GRAVEL

REMARKS:

○

□

○ Source: BA98-1 Elev./Depth: 66.3-67

□ Source: T-15 Sample No.: 8+40 Elev./Depth: 0.5

COOPER TESTING LABORATORY

Project: 6427.001

Feature:

Project No.: 109-290

ATTACHMENT 6

DATA REPORT G

MOISTURE CONTENT AND DRY UNIT WEIGHT TESTS

COOPER TESTING LABS

MOISTURE DENSITY - POROSITY DATA SHEET

Job # Client Project/Location Date	109-290 GeoMatrix PG&E 9/27/00

Boring #	T-14B				
Depth (ft)	B	E	E	N	N
Soil Type	see sieve				
Specific Gravity	2.70 ASSUMED	2.70 ASSUMED	2.70 ASSUMED	2.70 ASSUMED	2.70 ASSUMED
Volume Total cc	131.736	47.445	47.445	47.445	47.445
Volume of Solids	76.973	28.675	29.709	28.790	29.068
Volume of Voids	54.763	18.770	17.736	18.655	18.377
Void Ratio	0.711	0.655	0.597	0.648	0.632
Porosity %	41.6%	39.6%	37.4%	39.3%	38.7%
Saturation %	71.3%	89.9%	94.1%	86.7%	91.0%
Moisture %	18.8%	21.8%	20.8%	20.8%	21.3%
Dry Density (pcf)	98.5	101.9	105.5	102.3	103.3

Remarks

COOPER TESTING LABS

MOISTURE DENSITY - POROSITY DATA SHEET

Job # Client Project/Location Date	109-290A Geomatrix 6427.001 11/13/00				
Boring #	BA98-1	T-15			
Depth (ft)	66.3-67	STA. 8+40			
Soil Type	tan CLAY	tan CLAY			
Specific Gravity					
Volume Total cc					
Volume of Solids					
Volume of Voids					
Void Ratio					
Porosity %					
Saturation %					
Moisture %	3.8%	7.7%			
Dry Density (pcf)					

Remarks

COOPER TESTING LABS

MOISTURE DENSITY - POROSITY DATA SHEET

Job # Client Project/Location Date	109-287 GeoMatrix PG&E 8/31/00				
Boring #	T-14-B	T-14-B			
Depth (ft)	Block2	Block1			
Soil Type	yellow brown CLAY with sand	yellow brown CLAY with SAND			
Specific Gravity	2.66 ASSUMED	2.66			
Volume Total cc	149.505	118.054			
Volume of Solids	93.335	75.478			
Volume of Voids	56.170	42.576			
Void Ratio	0.602	0.564			
Porosity %	37.6%	36.1%			
Saturation %	81.8%	78.3%			
Moisture %	18.5%	16.6%			
Dry Density (pcf)	103.7	106.2			

Remarks

ATTACHMENT 7

DATA REPORT G

SPECIFIC GRAVITY TESTS

Specific Gravity
ASTM D-854

Cooper Testing Lab

Job#: 109-287 Date: 09/06/00
Client: Geomatrix By: DC
Project: 6427.001

Boring: Sample: Depth, ft.:	T-14B Block 1	T-11A 4	T-14B S4-1,4-2 4-3,4-4			
Soil Classification: (visual)	see sieve					
Wt. of Pycnometer Soil & Water, gm:	687	710.4	710			
Temp. centigrade:	21.5	21.5	24			
Wt. of Pycnometer & Water, gm:	675.56	671.82	671.55			
Wt. Dry Soil, gm:	18.34	61.25	61.4			
Temp. Correction Factor:	1	1	1			
Specific Gravity:	2.66	2.70	2.68	ERR	ERR	ERR

Remarks: The temperature correction factor is shown as 1 if the weight of the pycnometer is taken from the lab temperature correction curve.

DIABLO CANYON ISFSI DATA REPORT H
ROCK STRENGTH DATA AND GSI SHEETS

DIABLO CANYON ISFSI

PREPARED BY	[signature]	DATE	11/5/01
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DIABLO CANYON ISFSI DATA REPORT H

ROCK STRENGTH DATA AND GSI SHEETS

DIABLO CANYON ISFSI

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Table H-4 GSI and m_i Values for Sandstone (Tof_{b-2})

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Diablo Canyon ISFSI Data Report H
Rock Strength Data and GSI Sheets

1.0 INTRODUCTION

Rock strength and rock structure data were collected in exploratory trenches following the procedure outlined in Hoek (2000) for the purpose of evaluating rock mass properties at the Diablo Canyon ISFSI site. This method allows for the estimation of the in situ strength of the rock mass, and is used to extrapolate strength from laboratory uniaxial compression and/or, triaxial compression tests (Diablo Canyon ISFSI Data Reports G and I) to the in situ rock mass with consideration of weakening effects of joints, weathering, and scaling. Figure H-1 shows the locations of exploratory trenches used to perform the rock strength field evaluation.

The preparation of this Diablo Canyon ISFSI Data Report was performed under the WLA Work Plan (Rev. 2) dating November 28, 2000 using data collected under that Work Plan and a second WLA Work Plan (Rev. 1) dated September 19, 2001.

2.0 METHODOLOGY

Geologic mapping and field classifications were used to evaluate rock mass condition and stability based on combinations of lithology, bedding structure and prominence, fault persistence and geometry, degree and character of jointing, and in situ strength properties. Rock mass evaluation was performed between June and December 2000, by Jeff Bachhuber, Charles Brankman, John Baldwin, John Helms, and Rich Koehler of William Lettis & Associates, Inc (WLA). Quantification of rock mass properties was performed by visual inspection, and simple field tests in selected ISFSI site trenches that were also used for discontinuity surveys as described in Diablo Canyon ISFSI Data

Report F. The Geologic Strength Index (GSI; Hoek, 2000) of various lithologic units was estimated independently by at least two site geologists, and compared and discussed prior to assignment of final field values. Field estimates of rock block compressive strength were made for each lithologic/structural rock unit by hammer rebound and scratch hardness testing. Finally, the Hoek-Brown constant m_i (Hoek, 1998) was estimated in the field for each rock type.

GSI is a field-based empirical property that quantifies the character of a given rock mass based on two characteristics: the style and intensity of fracturing, and the average or typical surface condition of the fractures. The structure of the intact rock blocks defined by individual fractures and fracture sets is compared with a chart of fracture styles derived by Hoek (2000). The surface conditions of the fractures are also compared to the criteria described in the chart, and the resulting GSI value derived by correlation between the fracture frequency and surface condition. The resulting GSI value is used in rock strength calculations to extrapolate the intact rock block strength to a jointed rock mass, and accounts for the weakening effect of discontinuities and weathering. GSI field sheets are included in this Diablo Canyon ISFSI Data Report.

The Hoek-Brown constant m_i is an empirical value that factors the strength effect of rock mineralogy and lithology (Hoek, 2000). The m_i value accounts for cementation, grain size, chemical composition, and degree of grain interlocking. Values of m_i can either be derived from extensive triaxial testing of rock specimens, or by matching rock type to standardized rock types and corresponding values on the m_i reference table of Hoek (2000). The latter approach was used for evaluation of m_i in the ISFSI site area. Where lithology in the trench was intermediate between standardized rock types on the reference table (Hoek, 2000), an m_i value was interpolated based on the degree of similarity to the standard types. Interpolated m_i values were estimated independently by at least two site geologists and compared and discussed before final values were assigned. The m_i constant is then used as input for the calculation of a failure envelope for in situ rock. Table H-2 (Hoek, 2000) shows estimated ranges in m_i for each rock type at the ISFSI site.

Tables H-3 through H-7 provide statistical compilations of GSI and m_i values for the five different rock types of dolomite (Tof_{b-1}), sandstone (Tof_{b-2}), friable dolomite (Tof_{b-1a}), friable sandstone (Tof_{b-2a}), and fault zone rock. Estimation of the unfractured rock (rock block) uniaxial compressive strength was made using data from Hoek (2000), which provide a range of values based on hammer response or resistance to scratching by knife. These field estimates were used for initial rock mass evaluation, but were superceded by laboratory uniaxial test results presented in Diablo Canyon ISFSI Data Report I.

3.0 RESULTS

Compilation of the mass characterization data from different rock types is shown in Tables H-1 through H-7.

In the dolomite (Unit Tof_{b-1}), GSI ranged between 35 and 72, and averaged 56, corresponding to a very blocky rock structure and good fracture surface condition. Field-estimated rock strength for the dolomite ranged from very weak (R1) to medium strong (R3), with an average of weak (R2). The m_i values for dolomite ranged between 12 and 20, and had an average of 15.

In the sandstone (Unit Tof_{b-2}), GSI ranged between 60 and 69, and averaged 65, corresponding to a very blocky to blocky rock structure and good fracture surfaces. Rock strength for sandstone estimated in the field ranged from weak (R2) to medium strong (R3), with an average in the upper portion of weak (R2+). The m_i values for sandstone ranged from 16 to 19, with an average of 18.

The friable dolomite (Unit Tof_{b-1a}) has a block-in-matrix texture, consisting of hard, competent blocks of dolomite in a softer, "punky" altered matrix. This unit behaves more as a stiff soil than a fractured rock mass. Despite this, we assigned values of GSI, rock strength, and m_i by focusing on the blocks within the matrix that appeared to be more competent and blocky. These blocks in the altered dolomite have a GSI range of between 35 and 45 with an average GSI of about 41, corresponding to a blocky/seamy rock structure and fair fracture surfaces. Rock strength for the friable dolomite ranged from extremely weak (R0) to weak (R2), with an average of very weak (R1). The m_i values for the altered dolomite ranged from 9 to 18, with an average of 13. These values represent only the more competent, blockier portions of the altered dolomite.

The friable sandstone (Unit Tof_{b-2a}) is generally massive, with rare through-going fractures that divide the rock into blocks. As a result, we only assigned values of GSI, rock strength, and m_i at two locations within the friable sandstone where fractures defined rock blocks. The GSI values for the friable sandstone ranged from 39 to 41.5, with an average of 40, corresponding to blocky/seamy rock structure and fair fracture surfaces. Rock strength for the friable sandstone was very weak (R1). The m_i values for the friable sandstone ranged from 16 to 18, with an average of 17.

Numerous minor faults and shears occur in the rock mass. Rock within these zones is more highly fractured than adjacent rock, and contains localized polished surfaces, slickensides, and clay seams. The rock quality/character in fault zones varies significantly. Estimated values for GSI, m_i, and strength were made at four representative locations. The following average estimates were obtained for rock within fault/shear zones: GSI values ranged between 21 to 46, with an average of 36, m_i 6-15 with an average of 11, and the field estimated rock strength was R1 (very weak). Because conditions in fault zones can be highly variable with possible, localized weak and slickensided surfaces, these values should be used with caution, and should be conservatively interpreted as maximum values.

4.0 REFERENCES

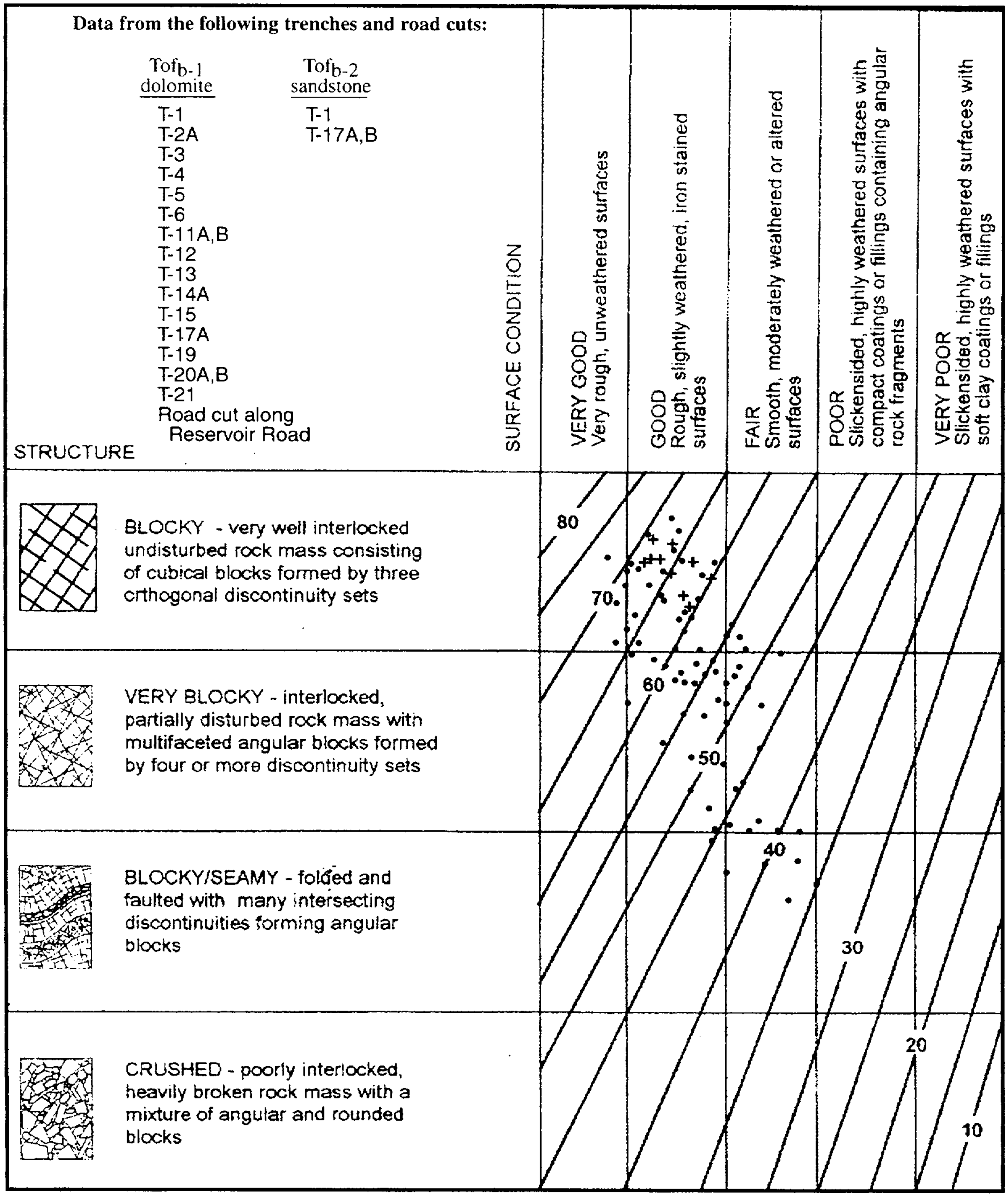
Diablo Canyon ISFSI Data Report G, Soil Laboratory Test Data (Cooper Testing Laboratory), prepared by William Lettis & Associates, Inc., November 5, 2001.

Diablo Canyon ISFSI Data Report I, Rock Laboratory Test Data (GeoTest Umlimited), prepared by William Lettis & Associates, Inc., November 5, 2001.

Hoek, E., 2000, Rock Engineering Course Notes: internet website at www.rocscience.com/roc/Hoek (December 2000 update).

William Lettis & Associates Work Plan, Additional Geologic Mapping, Exploratory Drilling, and Completion of Kinematic Analyses for the Diablo Canyon Power Plant, Independent Spent Fuel Storage Installation Site, Rev. 3, November 28, 2000.

William Lettis & Associates Work Plan, Additional Exploratory Drilling and Geologic Mapping for the DCPP ISFSI Site, Rev. 1, September 19, 2001.



07/23/01

Dolomite (Tof_{b-1}): median GSI = 55.7 (84 measurements[7 duplicate points]).

Sandstone (Tof_{b-2}): median GSI = 65 (10 measurements).

Explanation

- • Dolomite (Tof_{b-1})
- + Sandstone (Tof_{b-2})

Refer to ISFSI SAR Section 2.6 Appendix H for original GSI data sheets.

Table H-1. Field estimates of Hoek-Brown geologic strength index for rocks in ISFSI site area.

Table H-2. Material index (m_i) value for rocks in ISFSI site area using the Hoek field classification chart.

Rock type	Class	Group	Texture: Coarse	Texture: Medium	Texture: Fine	Texture: Very fine
SEDIMENTARY	Clastic		Conglomerate (22)	Sandstone 19	Siltstone 9	Claystone 4
				—— Greywacke —— (18)		
	Non-Clastic	Organic		—— Chalk —— 7		
				—— Coal —— (8-21)		
		Carbonate	Breccia (20)	Sparitic Limestone (10)	Micritic Limestone 8	
		Chemical		Gypstone 16	Anhydrite 13	
METAMORPHIC	Non Foliated		Marble 9	Hornfels (19)	Quartzite 24	
	Slightly foliated		Migmatite (30)	Amphibolite 25 - 31	Mylonite (6)	
	Foliated*		Gneiss 33	Schist 4 - 8	Phyllite (10)	Slate 9
IGNEOUS	Light		Granite 33		Rhyolite (16)	Obsidian (19)
			Granodiorite (30)		Dacite (17)	
			Diorite (28)		Andesite 19	
	Dark		Gabbro 27	Dolerite (19)	Basalt (17)	
			Norite 22			
	Extrusive pyroclastic type		Agglomerate (20)	Breccia (18)	Tuff (15)	

Material index (m_i) values for intact rock, classified by rock group.

After Hoek, 1998

Key to ISFSI Rock Types

M_i = 12-20	Tofb-1	Dolomite
M_i = 9-12	Tofb-1a	Friable (altered) dolomite
M_i = 16-19	Tofb-2	Sandstone
M_i = 16-18	Tofb-2a	Friable (altered) sandstone

Table H-3. GSI and m_i Values for Dolomite (Tof_{b-1})

Trench	GSI Values (1)	m_i Constant Range (2)
T-1	60 58 55 55 52.5	15-18
T-2	69 68 68 66 66 65.5 64.5 64	14-15
T-3	65 65 55.5 47	14-16 15-17
T-4	66 62 60 56	14-15
T-5	69.5 66 65.5 64 52 44	15-18 14-16 15-18
T-6	70 66	14 -16
T-11A	60.5 45 42	nr
T-11B	45 45 40	14-15

Table H-3. (Continued) GSI and m_i Values for Dolomite (Tof_{b-1})

Trench	GSI Values (1)	m_i Constant Range (2)
T-12	55	
	60	14
	60	
	37	
	40	12
	42.5	
	42.5	
	45	
T-13	66	
	65	
	61	
	57	
	55	13-14
	54	
	53	
	52	
	52	
	51	
	50	
T-14	60	
	60	14-15
	55	
	55	
	35	
	37	12
	37.5	
T-15	68	
	66	
	61	
	45	
	47	
	48	14-15
	48	
	50	
	50	
	52	

Table H-3. (Continued) GSI and m_i Values for Dolomite (Tof_{b-1})

Trench	GSI Values [1]	m_i Constant Range [2]
T17A	50 46 45	18-20
T-19	58	n r
T-20A	55.5	15
T-20B	52.5 52.5 69 72	12-20
T-21	56	n r
Road Cut	60.5 61 66	nr
Average =	**55.7**	**15.3** [3]
Standard Deviation =	**9.3**	**2.0** [3]

Footnotes:

(1) GSI = Geologic Strength Index (Hoek, 2000); GSI values typically estimated at multiple localities within each trench for a given rock type.

(2) m_i = Material Index Constant (Hoek, 2000); a single value or range of m_i values was typically assigned for the rock type exposed in each trench;
nr = not recorded.

(3) The average and standard deviation of the m_i constant were simply derived from the minimum and maximum values of each estimate. These statistics do not represent a rigorous attempt to weight the m_i values based on lineal feet of exposure for each range of m_i assigned in the field.

Table H-4. GSI and m_i Values for Sandstone (Tof_{b-2})

Trench	GSI Values [1]	m_i Constant Range [2]
T-1	65 63 62 60	18-19
T-17A	67 68	16-18
T17B	61 66 67 69	 18 18
Average =	**64.8**	**17.8**[3]
Standard Deviation =	**3.1**	**1.0**[3]

Footnotes:

(1) GSI = Geologic Strength Index (Hoek, 2000); GSI values typically estimated at multiple localities within each trench for a given rock type.

(2) m_i = Material Index Constant (Hoek, 2000); a single value or range of m_i values was typically assigned for the rock type exposed in each trench; nr = not recorded.

(3) The average and standard deviation of the m_i constant were simply derived from the minimum and maximum values of each estimate. These statistics do not represent a rigorous attempt to weight the m_i values based on lineal feet of exposure for each range of m_i assigned in the field.

Table H-5. GSI and m_i Values for Friable Dolomite (Tofb-1a)

Trench / I. D.	GSI Values[1]	m_i Constant Range [2]
T-11A	45	n r
T-12	38 40 42.5 43 45	12
T-14	37 37.5 35	12
T-20A	43	9
T-21	42	n r
Average =	**40.7**	**13.4** [3]
Standard Deviation =	**3.4**	**3.5** [3]

Footnotes:

(1) GSI = Geologic Strength Index (Hoek, 2000); GSI values typically estimated at multiple localities within each trench for a given rock type.

(2) m_i = Material Index Constant (Hoek, 2000); a single value or range of m_i values was typically assigned for the rock type exposed in each trench; nr = not recorded.

(3) The average and standard deviation of the m_i constant were simply derived from the minimum and maximum values of each estimate. These statistics do not represent a rigorous attempt to weight the m_i values based on lineal feet of exposure for each range of m_i assigned in the field.

Table H-6. GSI and m_i Values for Friable Sandstone (Tof_{b-2a})

Trench / I. D.	GSI Values [1]	m_i Constant Range [2]
T-17A	39 41.5	16-18
GSI average = 40.3		m_i constant average = 17.0 [3]
GSI standard deviation = 1.8		m_i constant standard deviation = 1.4 [3]

Footnotes:

(1) GSI = Geologic Strength Index (Hoek, 2000); GSI values typically estimated at multiple localities within each trench for a given rock type.

(2) m_i = Material Index Constant (Hoek, 2000); a single value or range of m_i values was typically assigned for the rock type exposed in each trench; nr = not recorded.

(3) The average and standard deviation of the m_i constant were simply derived from the minimum and maximum values of each estimate. These statistics do not represent a rigorous attempt to weight the m_i values based on lineal feet of exposure for each range of m_i assigned in the field.

Table H-7. GSI and m_i Values for Fault Zone Rock

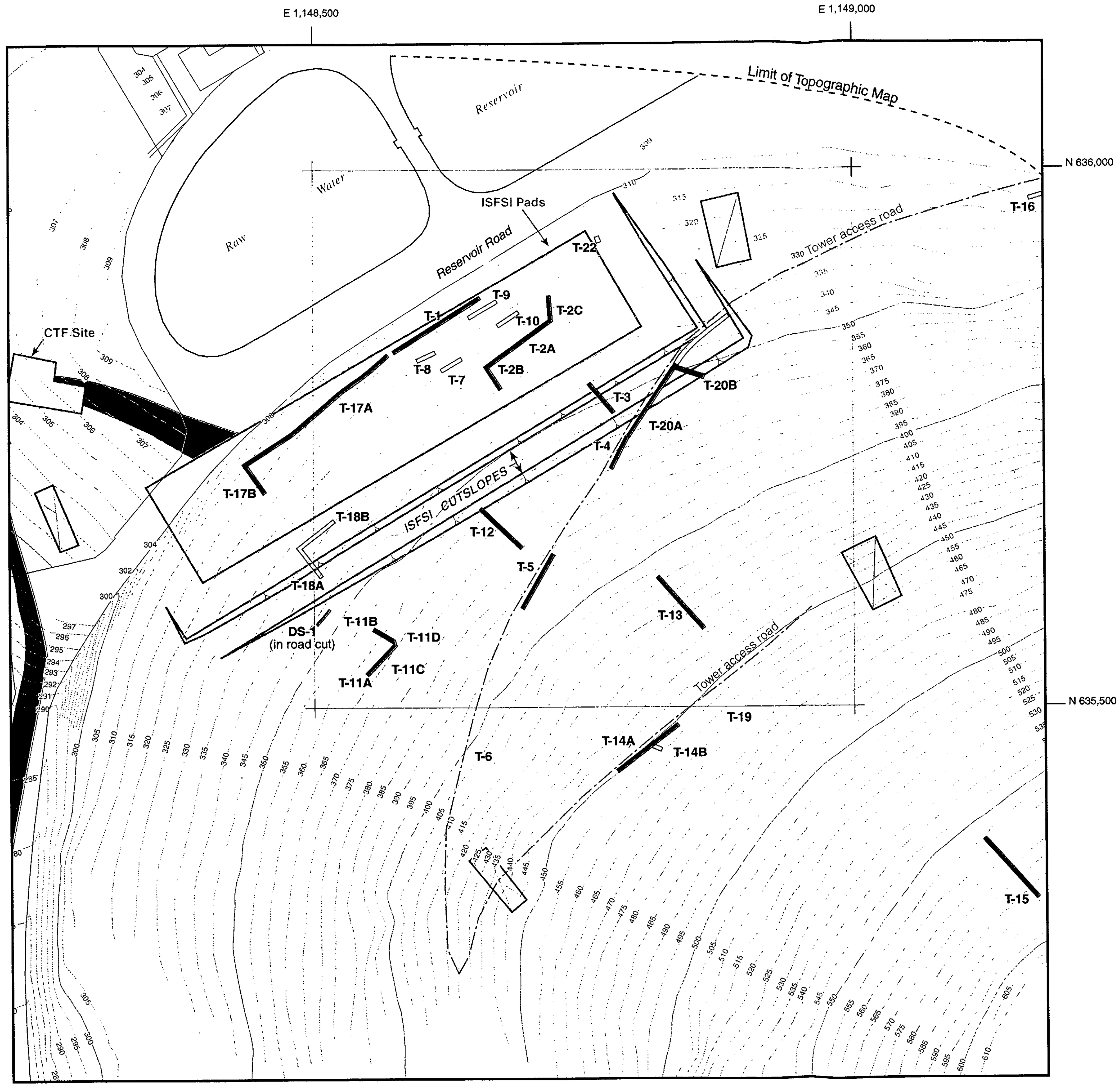
Trench / I. D.	GSI Values [1]	m_i Constant Range [2]
T-4	35 37	n r
T-5	38 35	12-15
T-12	21 24	n r
T-15	46 42 41 38	6-12
T-21	37	n r
Average =	**35.8**	**11.3**[3]
Standard Deviation =	**7.4**	**3.8** [3]

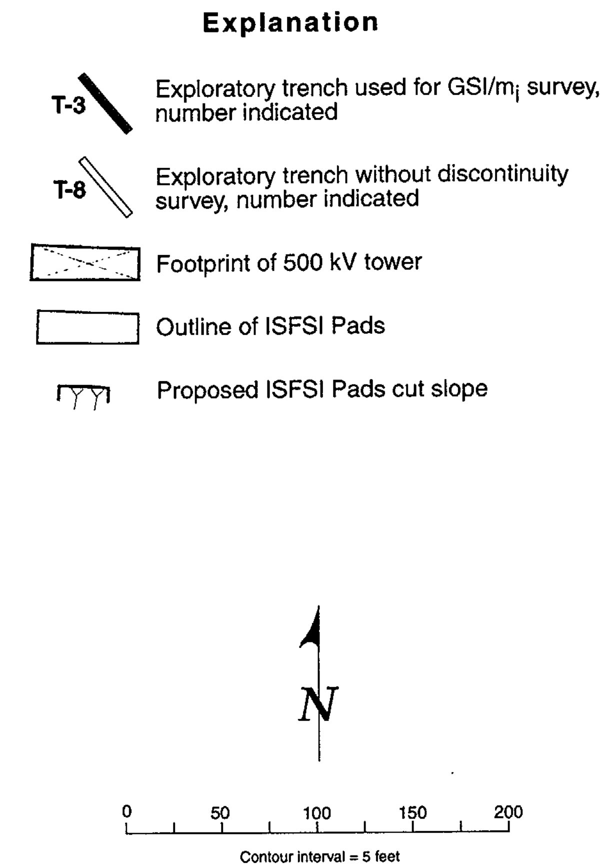
Footnotes:

(1) GSI = Geologic Strength Index (Hoek, 2000); GSI values typically estimated at multiple localities within each trench for a given rock type.

(2) m_i = Material Index Constant (Hoek, 2000); a single value or range of m_i values was typically assigned for the rock type exposed in each trench;
nr = not recorded.

(3) The average and standard deviation of the m_i constant were simply derived from the minimum and maximum values of each estimate. These statistics do not represent a rigorous attempt to weight the m_i values based on lineal feet of exposure for each range of m_i assigned in the field.





SAFETY ANALYSIS REPORT

DIABLO CANYON ISFSI

FIGURE H-1
LOCATION OF GSI/m_i SURVEYS AT ISFSI SITE

ATTACHMENT 1

DATA REPORT H

GSI FIELD DATA SHEETS

T-1

TRENCH 1

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP ISFSI Borrow Site Number: ISFSI T-1 Date: 6/10/00

Investigator: JLB, CMB

LOCATION:

Borrow Site Trench ISFSI T-1

Rock Conditions in trench

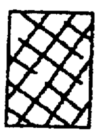
Units: 1. Tofb-1 (Dolomite) JLB 6/22/01 Tan, dolomitic sandstone

2. ~~Tofb-2.0~~ Tofb-2 Tan, hard, med. grained sandstone

3. ~~Tofb-2.1~~ Tofb-2a JLB 6/22/01 Blue-gray, soft med. grained sandstone

SURFACE CONDITION: VERY GOOD – Very rough, unweathered surfaces; GOOD – Rough, slightly weathered, iron stained surfaces; FAIR – Smooth, moderately weathered or altered surfaces; POOR – Slickensided, highly weathered surfaces with compact coatings or fillings containing angular rock fragments; VERY POOR – Slickensided, highly weathered surfaces with soft clay coatings or fillings

STRUCTURE

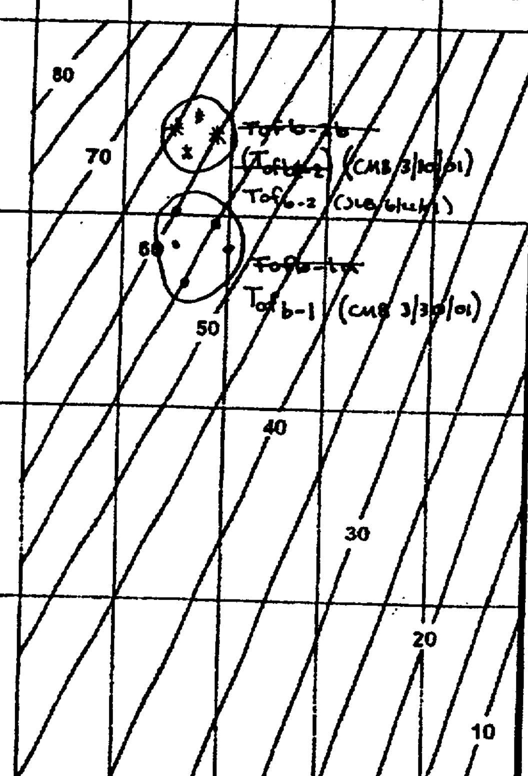


BLOCKY - very well interlocked undisturbed rock mass consisting of cubical blocks formed by three orthogonal discontinuity sets

VERY BLOCKY - interlocked, partially disturbed rock mass with multifaceted angular blocks formed by four or more discontinuity sets

BLOCKY/SEAMY - folded and faulted with many intersecting discontinuities forming angular blocks

CRUSHED - poorly interlocked, heavily broken rock mass with a mixture of angular and rounded blocks



GSI for Tofb 2-1 & not applicable

~~Station~~ Unit	mi constant	Strength (R)	Station	mi constant	Strength (R)
• Tofb-1	15-18	R3 (midrange)			
* Tofb-2	18-19	R3 (low end)			
x ~~Tofb-2.1~~	~~17~~ 14	R0 (high end)			

gouge at 14.40 - pocket pen. 4.0+ TSF

MM R1

T-2A

Trench T-2A

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP ISFSI Borrow Site Number: T-2A Date: 6/11/00

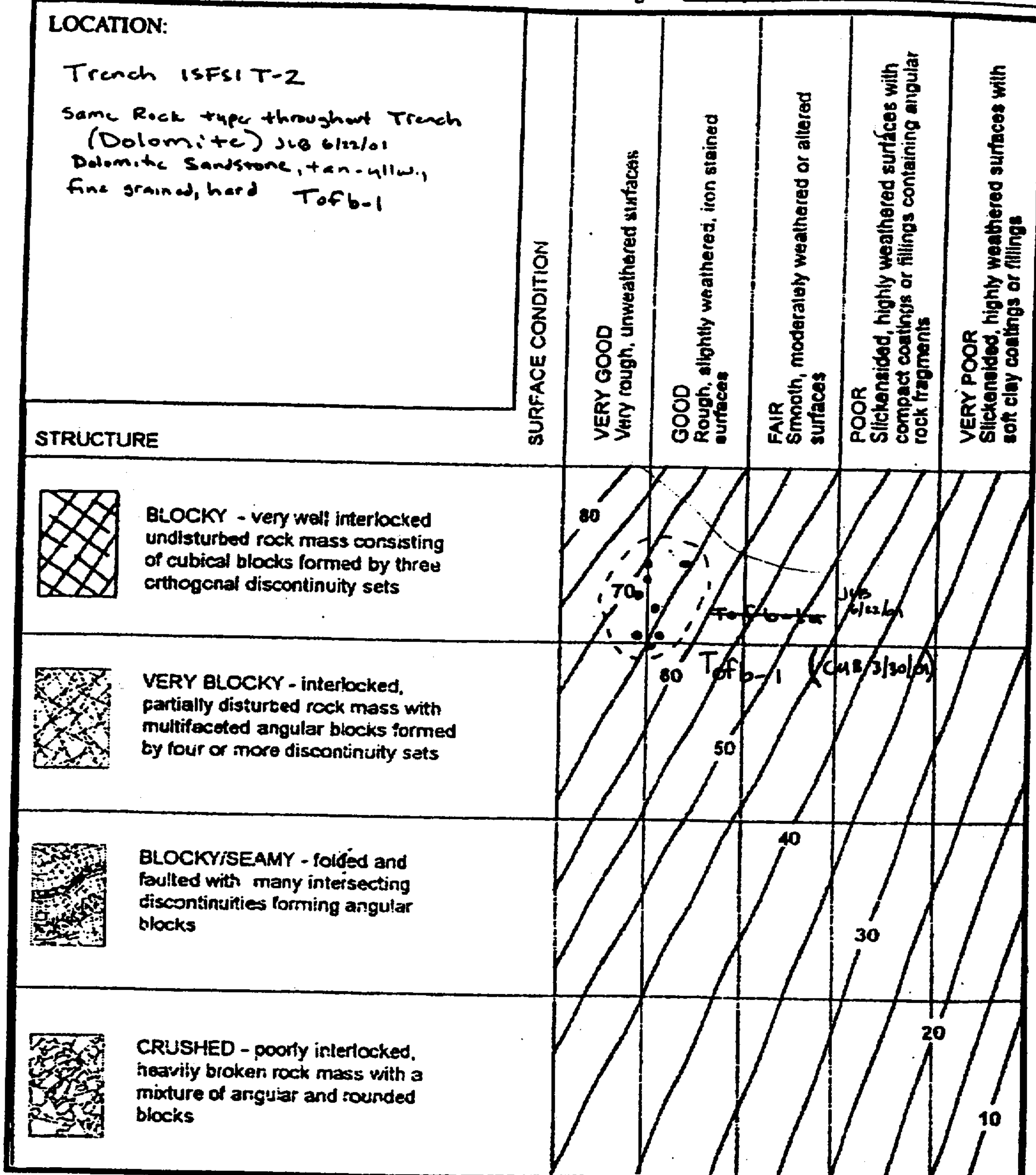
Investigator: JLB, CMB

LOCATION:

Trench ISFSI T-2

Same Rock type throughout Trench (Dolomite) JLB 6/22/01

Dolomitic Sandstone, tan-yellow, fine grained, hard Tofb-1



Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
	14-15	R3 w/ localized zones of R3-			

T-3

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP ISFSI Borrow Site   Number: T-3   Date: 6/11/00

Investigator: JLB / CMB

TRENCH 3

LOCATION:

Trench ISFSI T3

Rock Mass Conditions

Entire trench in dolomitic sandstone - mod. - sl. wthd.

(Tofb-1 Dolomite)

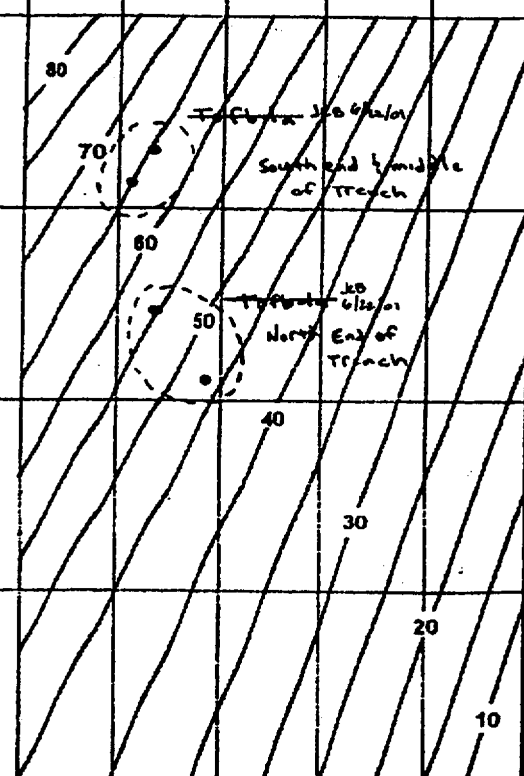
JLB 6/22/01

SURFACE CONDITION

- VERY GOOD: Very rough, unweathered surfaces
- GOOD: Rough, slightly weathered, iron stained surfaces
- FAIR: Smooth, moderately weathered or altered surfaces
- POOR: Slickensided, highly weathered surfaces with compact coatings or fillings containing angular rock fragments
- VERY POOR: Slickensided, highly weathered surfaces with soft clay coatings or fillings

STRUCTURE

- BLOCKY - very well interlocked undisturbed rock mass consisting of cubical blocks formed by three orthogonal discontinuity sets
- VERY BLOCKY - interlocked, partially disturbed rock mass with multifaceted angular blocks formed by four or more discontinuity sets
- BLOCKY/SEAMY - folded and faulted with many intersecting discontinuities forming angular blocks
- CRUSHED - poorly interlocked, heavily broken rock mass with a mixture of angular and rounded blocks



← Tofb-1

(CMB 3/30/0[illegible]

Tofb-1

Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
7+00-10+00	14-16	R2 to R2+	Mod-highly wthd.		
0+00-7+00	15-17	R3 to R3-	Sl. wthd.		

[illegible] RL

T-4

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP ISFSI Borrow Site Number: T-4 Date: 6/11/00

Investigator: JLB, CMB

TEST PIT 4

LOCATION: Trench T-4

Borrow Site Test Pit T-4

Rock Mass conditions exposed in trench (Dolomite) JLB 6/22/01

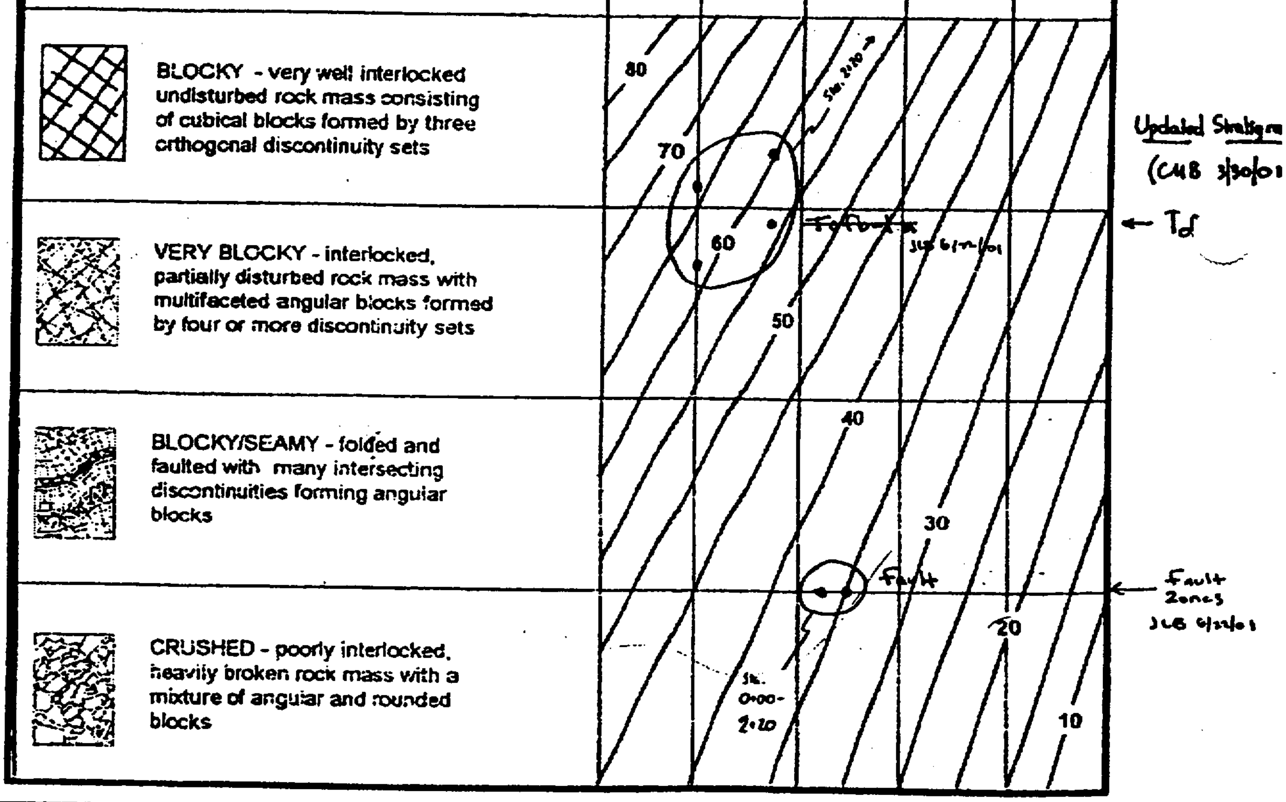
Unit: Tof_b: dolomitic sandstone, tan, hard, fine grained

SURFACE CONDITION

- VERY GOOD – Very rough, unweathered surfaces
- GOOD – Rough, slightly weathered, iron stained surfaces
- FAIR – Smooth, moderately weathered or altered surfaces
- POOR – Slickensided, highly weathered surfaces with compact coatings or fillings containing angular rock fragments
- VERY POOR – Slickensided, highly weathered surfaces with soft clay coatings or fillings

STRUCTURE

- BLOCKY - very well interlocked undisturbed rock mass consisting of cubical blocks formed by three orthogonal discontinuity sets
- VERY BLOCKY - interlocked, partially disturbed rock mass with multifaceted angular blocks formed by four or more discontinuity sets
- BLOCKY/SEAMY - folded and faulted with many intersecting discontinuities forming angular blocks
- CRUSHED - poorly interlocked, heavily broken rock mass with a mixture of angular and rounded blocks



Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
	14-15	R3(-) (Sta. 0+00 to 2+20)			
		R3 - R3(+) (Sta. 2+20 to end)			

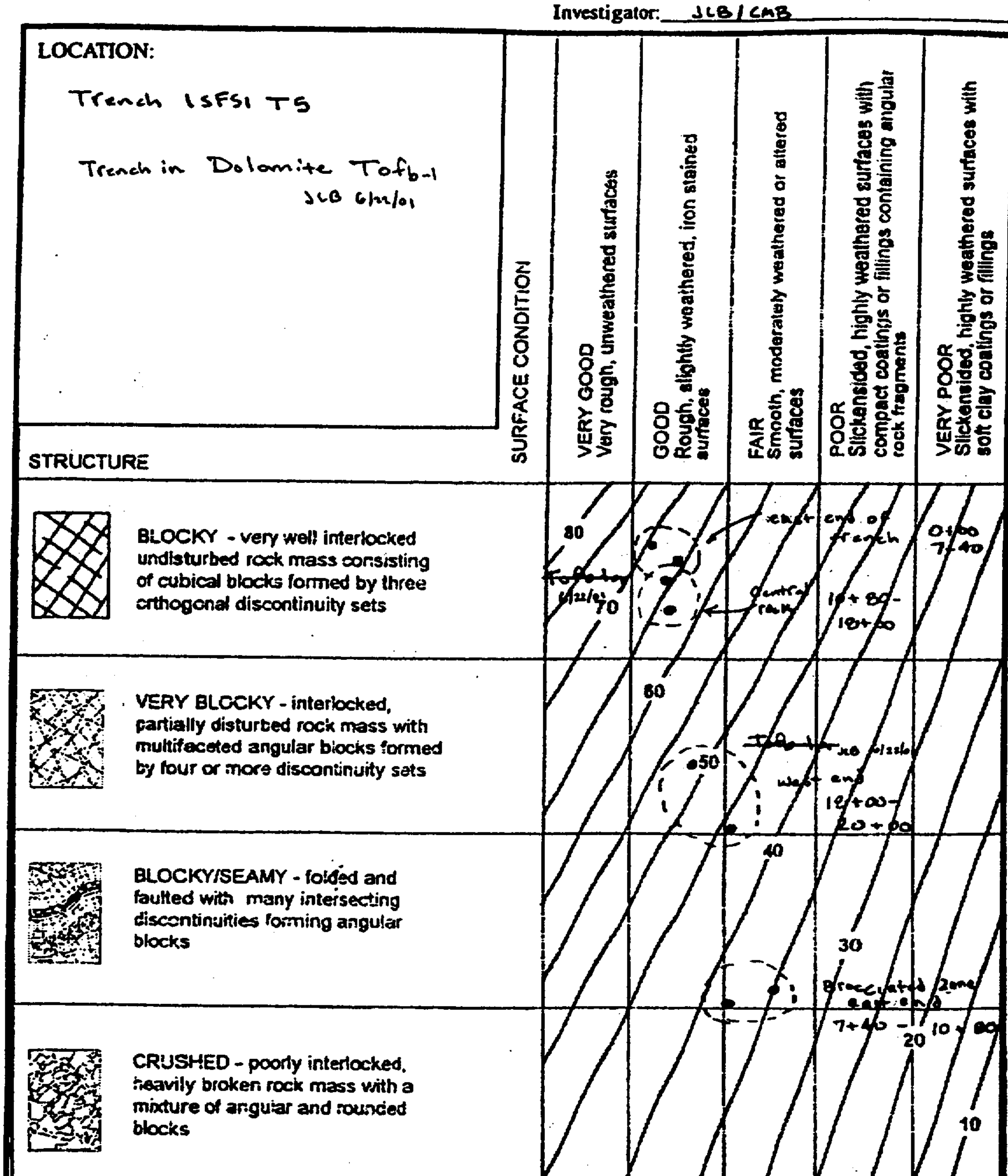
T-5

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: ISFSI Borrow Site Number: T-5 Date: 6/11/00

Investigator: JLB / CMB

TRENCH 5



Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
0+00 - 7+40	15-18	R2+ to R3-			
7+40 - 10+80	12-15	R1			
10+80 - 18+00	15-18	R3-			
18+00 - 20+00	14-16	R2			

T-6

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP ISFSI Borrow Site Number: T-6 Date: 6/11/00

Investigator: JLB CMB

TEST PIT 6

LOCATION:

DCPP ISFSI Borrow Site Test Pit T-6

Rock Mass Conditions exposed in pit

Bedrock: unit Tofb-1 (~~Tofb-?~~ Tofb-1 JLB 6/12/01) – tan dolomitic sandstone, hard, finegrained, with softer / more tuffaceous beds ~~Tofb-3~~

(CMB 3/30/01) → Tofb-1a

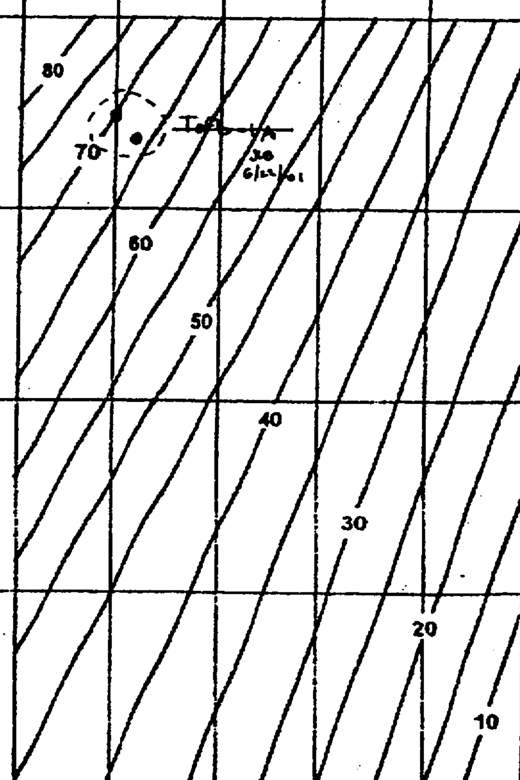
* GSI not applicable for unit Tofb... Strength of weaker sandstone in Us would be ~ same as in situ rock

SURFACE CONDITION

- VERY GOOD – Very rough, unweathered surfaces
- GOOD – Rough, slightly weathered, iron stained surfaces
- FAIR – Smooth, moderately weathered or altered surfaces
- POOR – Slickensided, highly weathered surfaces with compact coatings or fillings containing angular rock fragments
- VERY POOR – Slickensided, highly weathered surfaces with soft clay coatings or fillings

STRUCTURE

- BLOCKY - very well interlocked undisturbed rock mass consisting of cubical blocks formed by three orthogonal discontinuity sets
- VERY BLOCKY - interlocked, partially disturbed rock mass with multifaceted angular blocks formed by four or more discontinuity sets
- BLOCKY/SEAMY - folded and faulted with many intersecting discontinuities forming angular blocks
- CRUSHED - poorly interlocked, heavily broken rock mass with a mixture of angular and rounded blocks



Updated Strength (CMB 3/30/01) ← Tofb-1

Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
Tofb-1	14-16	R2+ to R3-			
Tofb-1a (~~2~~ JLB 6/25/01)	12-13	R1			

T-11A

TEST PIT 11A

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP ISFSI Borrow Site Number: T-11A Date: 6/19/00

Investigator: CMB JWB

LOCATION:

Test Pit #11a (NE-SW segment)

Tofb-1 - Dolomite

~~Tofb-3~~ JLB 6/22/01

Tofb-1a Friable Dolomite

far west of slope

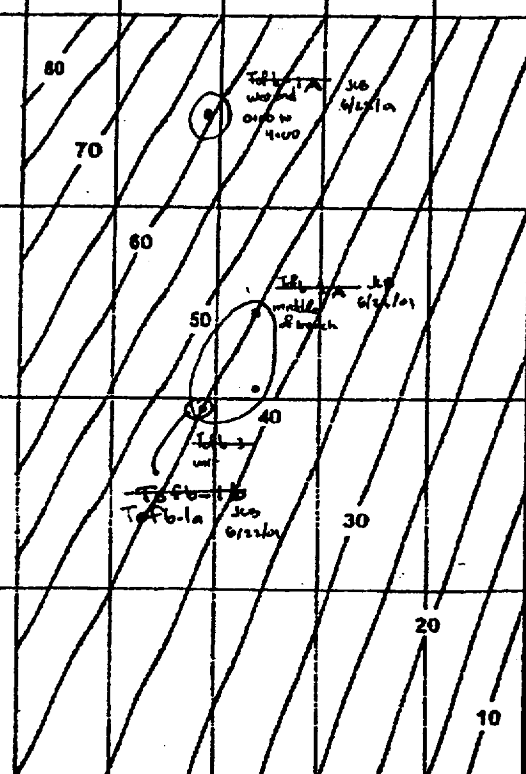
SURFACE CONDITION:

- VERY GOOD: Very rough, unweathered surfaces
- GOOD: Rough, slightly weathered, iron stained surfaces
- FAIR: Smooth, moderately weathered or altered surfaces
- POOR: Slickensided, highly weathered surfaces with compact coatings or fillings containing angular rock fragments
- VERY POOR: Slickensided, highly weathered surfaces with soft clay coatings or fillings

STRUCTURE:

- BLOCKY - very well interlocked undisturbed rock mass consisting of cubical blocks formed by three orthogonal discontinuity sets ← Tofb-1
- VERY BLOCKY - interlocked, partially disturbed rock mass with multifaceted angular blocks formed by four or more discontinuity sets ← Tofb-1
- BLOCKY/SEAMY - folded and faulted with many intersecting discontinuities forming angular blocks ← Tofb-1a
- CRUSHED - poorly interlocked, heavily broken rock mass with a mixture of angular and rounded blocks

Updated Stratigraphy (CMB 3/30/01)



Station	mi constant	Strength (R)	Station	mi constant	Strength (R)

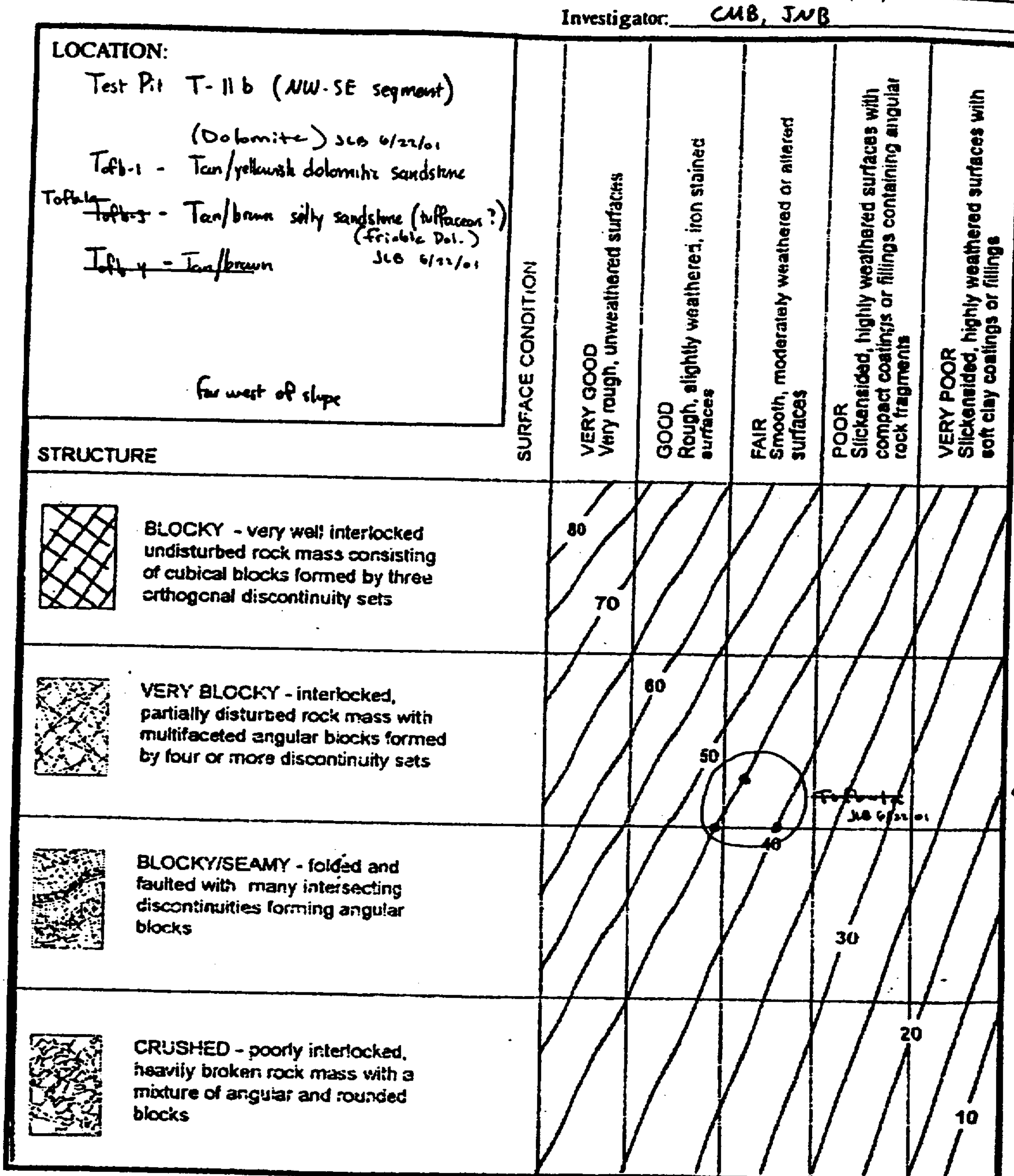
TEST PIT 11 B (NW-SE)

TP-11 B

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP ISFSI Borrow Site Number: T-11 B Date: 6/19/2000

Investigator: CMB, JNB



Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
Tofb-1~~A~~	14-15	R2 (mid)	JLB 6/25/01		
~~Tofb-3/1B~~	~~12~~	~~R1 (high)~~			
~~Tofb-4~~	~~16~~	~~R3 (mid-high)~~			

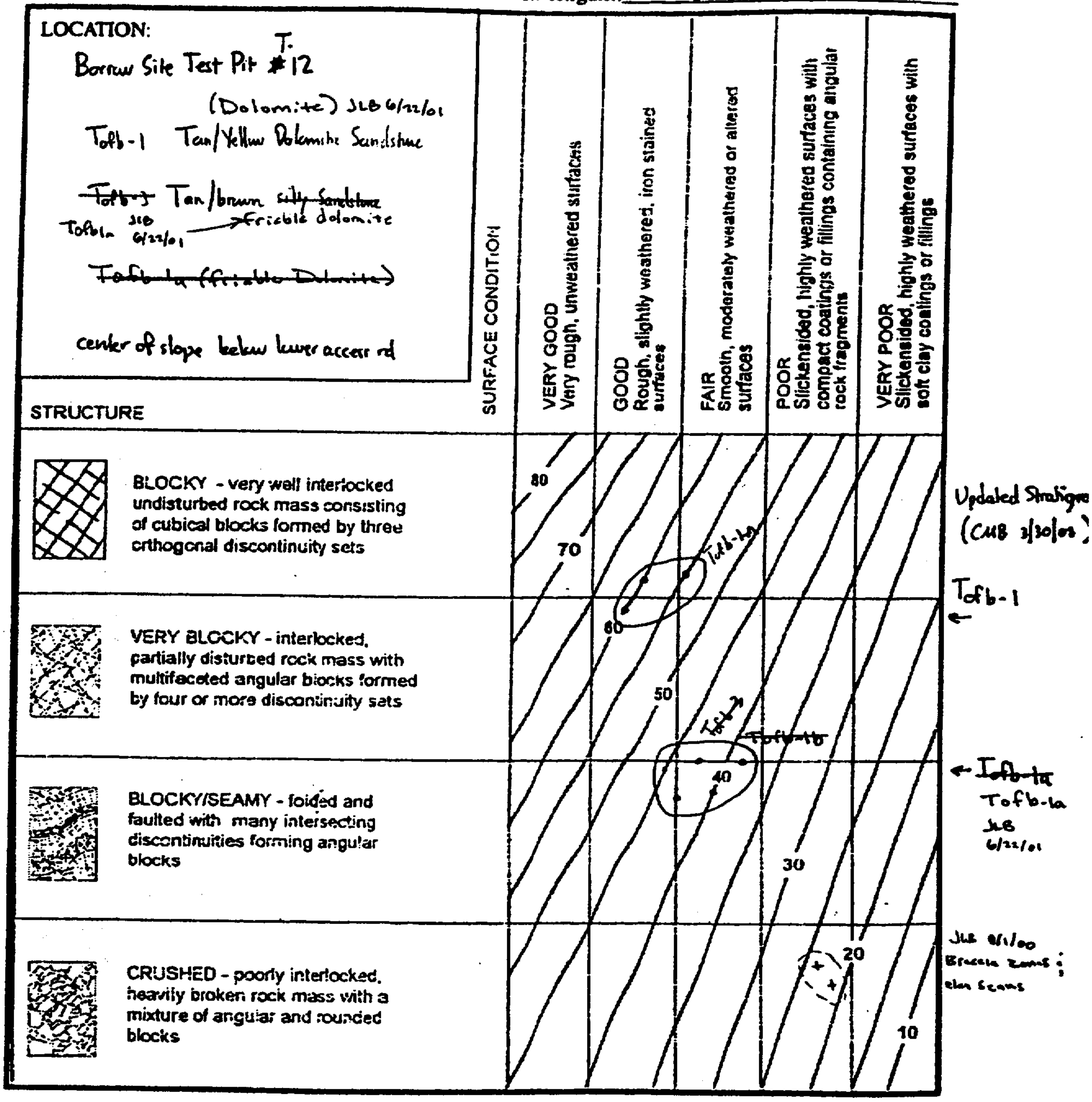
T-12

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP ISFSI Borrow Site Number: T-12 Date: 6/19/00

Investigator: CMB JWB

TEST PIT 12



Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
~~Tofb-1A~~ Tofb-1	14	R2 (mid)			
~~Tofb-X1B~~ JLB 6/25/01 Tofb1a	12	R2 (low)-R3 (high)			

T-13

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP ISFSI Borrow Site Number: T-13 Date: 6/19/00

Investigator: CMB JVR

Test Pit 13

LOCATION:

Borrow Site Test Pit T-13

Tofb-1 (Dolomite) JLB 6/22/01

~~Tofb-1~~: Tan-yellow dolomite/dolomitic sandstone

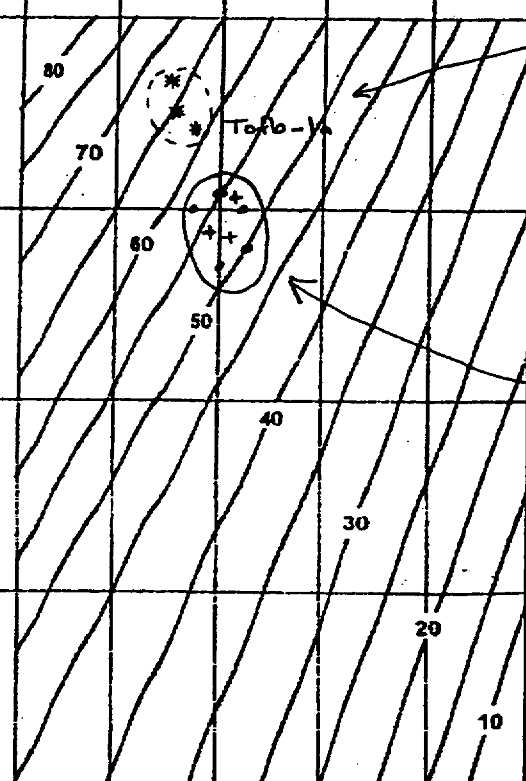
below upper access rd

SURFACE CONDITION

- VERY GOOD: Very rough, unweathered surfaces
- GOOD: Rough, slightly weathered, iron stained surfaces
- FAIR: Smooth, moderately weathered or altered surfaces
- POOR: Slickensided, highly weathered surfaces with compact coatings or fillings containing angular rock fragments
- VERY POOR: Slickensided, highly weathered surfaces with soft clay coatings or fillings

STRUCTURE

- BLOCKY - very well interlocked undisturbed rock mass consisting of cubical blocks formed by three orthogonal discontinuity sets
- VERY BLOCKY - interlocked, partially disturbed rock mass with multifaceted angular blocks formed by four or more discontinuity sets
- BLOCKY/SEAMY - folded and faulted with many intersecting discontinuities forming angular blocks
- CRUSHED - poorly interlocked, heavily broken rock mass with a mixture of angular and rounded blocks



Updated Strategy Tb (CMB 3/30)

* JLB call 7/01 Tofb-1 zone upper part of trench

+ JLB '01 less-… deeper parts of trench

Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
Tofb-1	~~12~~ 13-14	R2 (low-mid)			

T-14A

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP ISFSI Borrow Site   Number: T-14A   Date: 6/19/2000

Investigator: CMB JWR

TEST PIT 14A

LOCATION:

Borrow Site Test Pit T-14

(Dolomite) JLB 6/22/01

Tofb-1 - Tan/Yellow dolomitic sandstone

~~Tofb~~-3 - Tan/Brown Silty Sandstone (Tuffaceous?)

~~Tofb-1a~~ No JLB 6/22/01

(CMB 3/30/01)

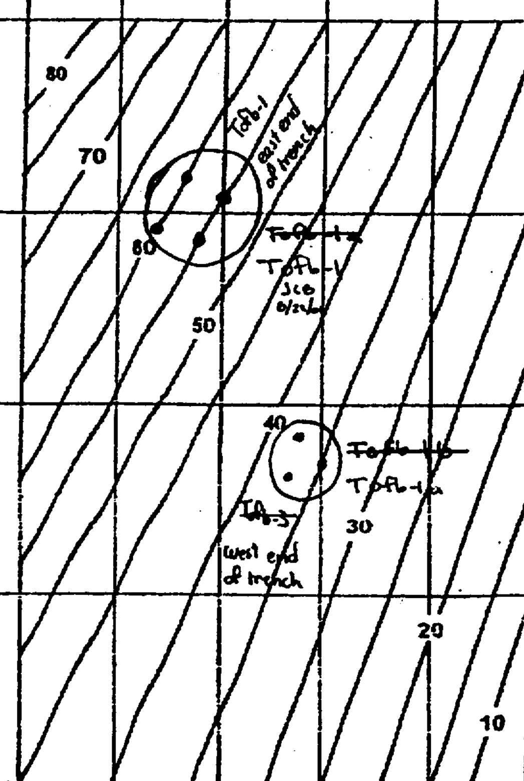
along upper access rd

SURFACE CONDITION

- VERY GOOD - Very rough, unweathered surfaces
- GOOD - Rough, slightly weathered, iron stained surfaces
- FAIR - Smooth, moderately weathered or altered surfaces
- POOR - Slickensided, highly weathered surfaces with compact coatings or fillings containing angular rock fragments
- VERY POOR - Slickensided, highly weathered surfaces with soft clay coatings or fillings

STRUCTURE

- BLOCKY - very well interlocked undisturbed rock mass consisting of cubical blocks formed by three orthogonal discontinuity sets
- VERY BLOCKY - interlocked, partially disturbed rock mass with multifaceted angular blocks formed by four or more discontinuity sets
- BLOCKY/SEAMY - folded and faulted with many intersecting discontinuities forming angular blocks
- CRUSHED - poorly interlocked, heavily broken rock mass with a mixture of angular and rounded blocks



Updated Strength (CMB 3/30/01)

← Tofb-1

← ~~Tofb-1a~~ Tofb-1a JLB 6/22/01

Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
~~Tofb-1a~~	14-15 Tofb-1	R2 (mid-high)			
~~Tofb-X1B~~	12 Tofb-1a JLB 6/22/01	R2 (low)			

[signatures]

T-15

Test Pit 15

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP ISFSI Borrow Site Number: T-15 Date: 6/19/00

Investigator: CMB JNB

LOCATION:

Borrow Site Test Pit T-15

~~Tofb-1A~~ Tan/Yellow Dolomitic Sandstone (Dolomite) JLB 6/22/01

Tofb-1 (CMB 3/30/01)

note: relatively few fractures exposed in test pit

top of slope

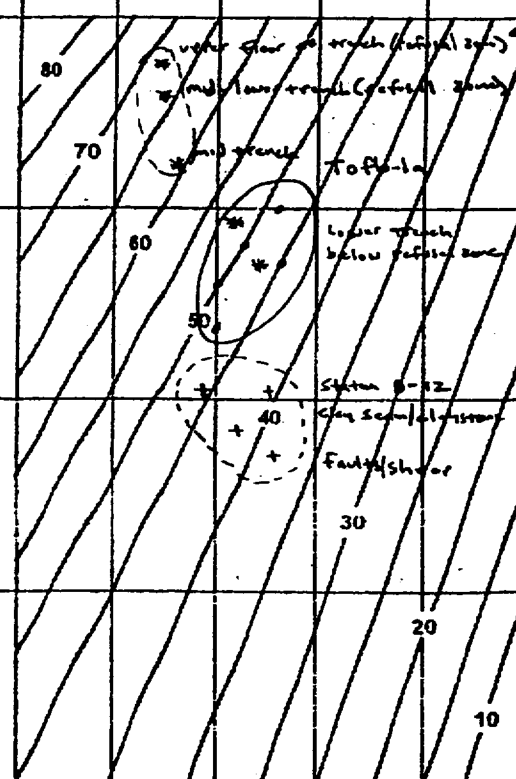
SURFACE CONDITION:

- VERY GOOD - Very rough, unweathered surfaces
- GOOD - Rough, slightly weathered, iron stained surfaces
- FAIR - Smooth, moderately weathered or altered surfaces
- POOR - Slickensided, highly weathered surfaces with compact coatings or fillings containing angular rock fragments
- VERY POOR - Slickensided, highly weathered surfaces with soft clay coatings or fillings

Updated Strategy (CMB 3/30/01)

STRUCTURE:

- BLOCKY - very well interlocked undisturbed rock mass consisting of cubical blocks formed by three orthogonal discontinuity sets
- VERY BLOCKY - interlocked, partially disturbed rock mass with multifaceted angular blocks formed by four or more discontinuity sets
- BLOCKY/SEAMY - folded and faulted with many intersecting discontinuities forming angular blocks
- CRUSHED - poorly interlocked, heavily broken rock mass with a mixture of angular and rounded blocks



Tofb-1

Tofb #=JLB calls 7/11/00

+ shear/fracture zones calls

← Tofb-1

Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
Tofb-1	14-15	R2 (med.)			
Clay-claystone-(fractured) Tofb-1	6-12	R1- low			

T-17A

TRENCH 17-A

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP - ISFSI   Number: T17-A   Date: 8/7/00

Investigator: JLB/RDK

LOCATION:

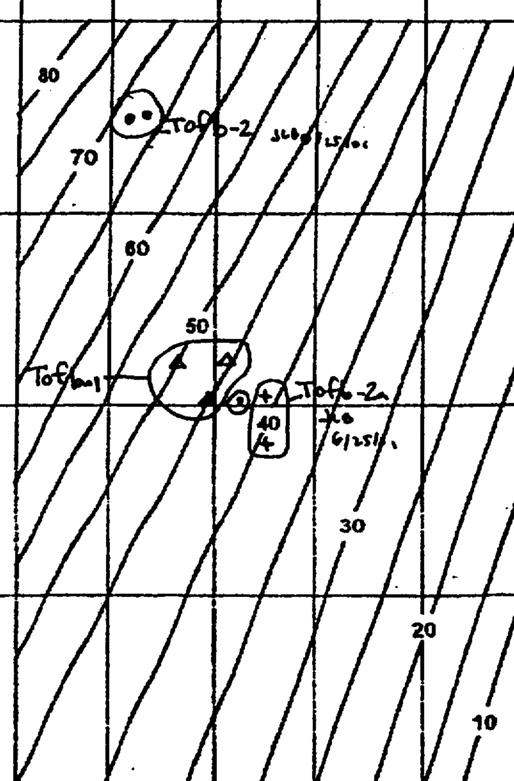
• (Sandstone Tofb2 JLB 6/25/01) gray-orange coarse-med. sandstone, blocky to very blocky, slightly wthd. Tofb-2b

⊙ same as •, but more-wthd.

+ (Friable Sandstone, Tofb-2a JLB 6/25/01) gray-orange and blue-gray (distinct) Tofb-2a coarse-med. sandstone, massive (soil-like friable) to very blocky, sl. to mod. wthd. — Friable zones are not rock-like & Hoek criteria does not apply

Δ (Dolomite, Tofb-1 JLB 6/25/01) gray-orange dolomite to sandy dolomite, slightly wthd. Tofb-1a

STRUCTURE \ SURFACE CONDITION	VERY GOOD Very rough, unweathered surfaces	GOOD Rough, slightly weathered, iron stained surfaces	FAIR Smooth, moderately weathered or altered surfaces	POOR Slickensided, highly weathered surfaces with compact coatings or fillings containing angular rock fragments	VERY POOR Slickensided, highly weathered surfaces with soft clay coatings or fillings
BLOCKY - very well interlocked undisturbed rock mass consisting of cubical blocks formed by three orthogonal discontinuity sets					
VERY BLOCKY - interlocked, partially disturbed rock mass with multifaceted angular blocks formed by four or more discontinuity sets					
BLOCKY/SEAMY - folded and faulted with many intersecting discontinuities forming angular blocks					
CRUSHED - poorly interlocked, heavily broken rock mass with a mixture of angular and rounded blocks					



Updated Strata (CMB 3/30/01)

• = ~~Cemented Sandstone~~ Dolomite (Tofb)

⊙ = ~~Cemented Sandstone in shear zone~~ (Tofb-1)

+ = ~~friable sandstone~~ altered dolomite Tofb-

Δ = ~~dolomite (Tofb-1)~~

JLB 6/25/01

Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
0+00 to 15+00	18±	• R-2/R-3 ⊙ R-1/R-3			
15+00 to 39+00	16-18	+ R-1			
39+00 - end	18-20	R3/R3-			

T-17B

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP ISFSI   Number: T-17B   Date: 8/1/00

Investigator: JLB RDH

TRENCH 17B

LOCATION: Trench T17B

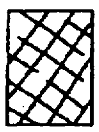
Gray-orange, coarse-med, sandstone, blocky, slightly weathered

(Sandstone) Tofb-2 JLB 6/25/01

SURFACE CONDITION

- VERY GOOD — Very rough, unweathered surfaces
- GOOD — Rough, slightly weathered, iron stained surfaces
- FAIR — Smooth, moderately weathered or altered surfaces
- POOR — Slickensided, highly weathered surfaces with compact coatings or fillings containing angular rock fragments
- VERY POOR — Slickensided, highly weathered surfaces with soft clay coatings or fillings

STRUCTURE

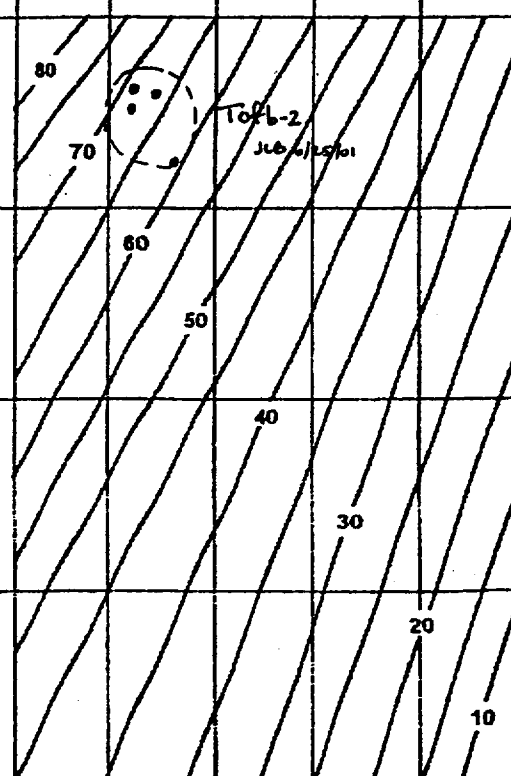


BLOCKY - very well interlocked undisturbed rock mass consisting of cubical blocks formed by three orthogonal discontinuity sets

VERY BLOCKY - interlocked, partially disturbed rock mass with multifaceted angular blocks formed by four or more discontinuity sets

BLOCKY/SEAMY - folded and faulted with many intersecting discontinuities forming angular blocks

CRUSHED - poorly interlocked, heavily broken rock mass with a mixture of angular and rounded blocks



Tofb-1 (CAB 3)

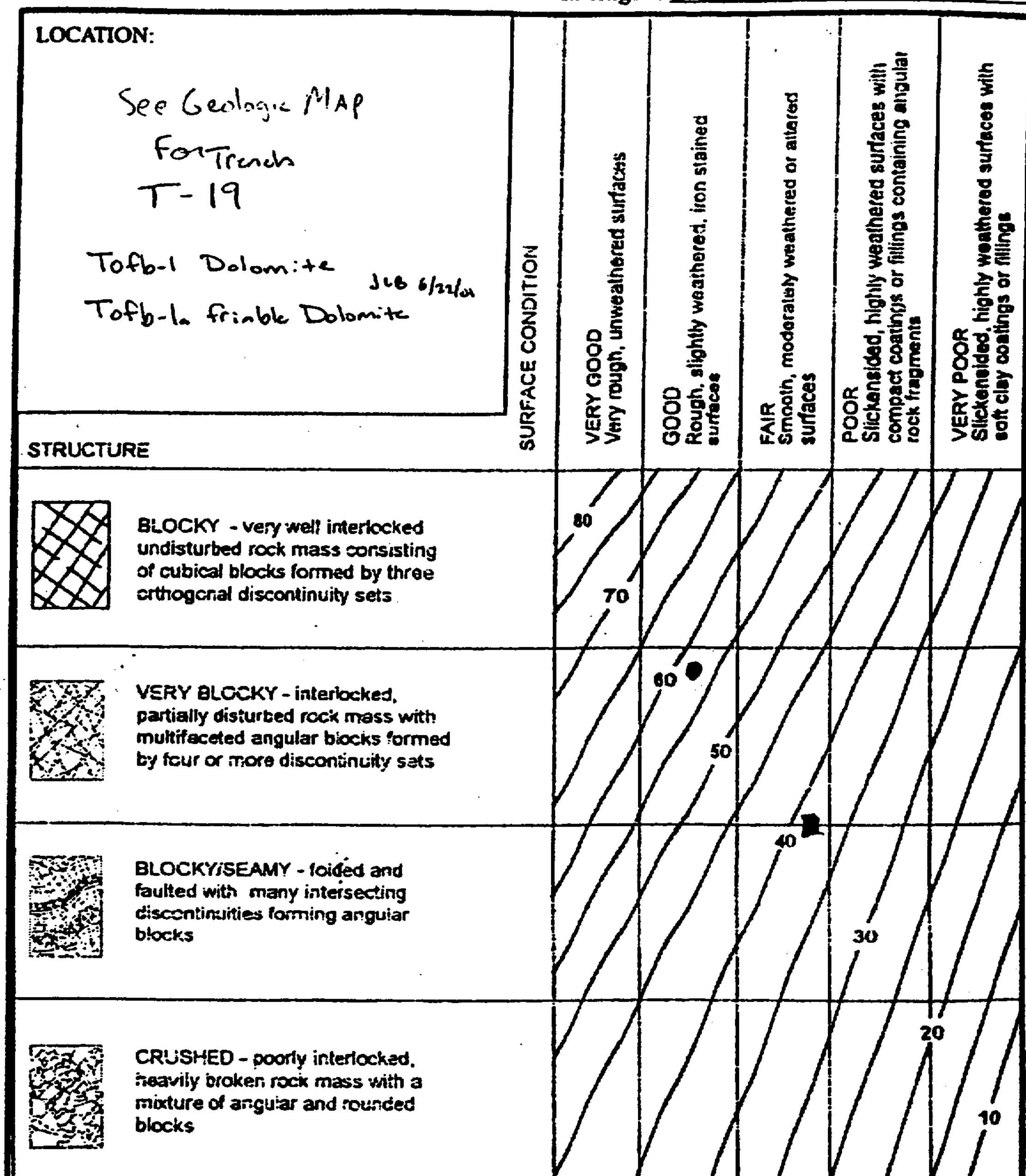
Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
0+00 to 2+00	60-70 18	R-2 | R-3			
2+00 →	60-70 18	R-2 | R-3			

T-19

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP IFSFI Number: 1223-49 T-19 Date: 9 Dec. 2000

Investigator: JGH



Station	GSI ~~mi~~ constant	Strength (R)	Station	mi constant	Strength (R)
Tofb-1 ● Dolomitic S.S	38 GSI	R1⁻			
Tofb-1a ■ Diamictite!	58 GSI	R2			
JLB 6/25/01	JLB 7/1/01				

JGH for JGH

T-20A

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: PG&E DCPP ISFSI **Number:** T-20A **Date:** 12/6/00

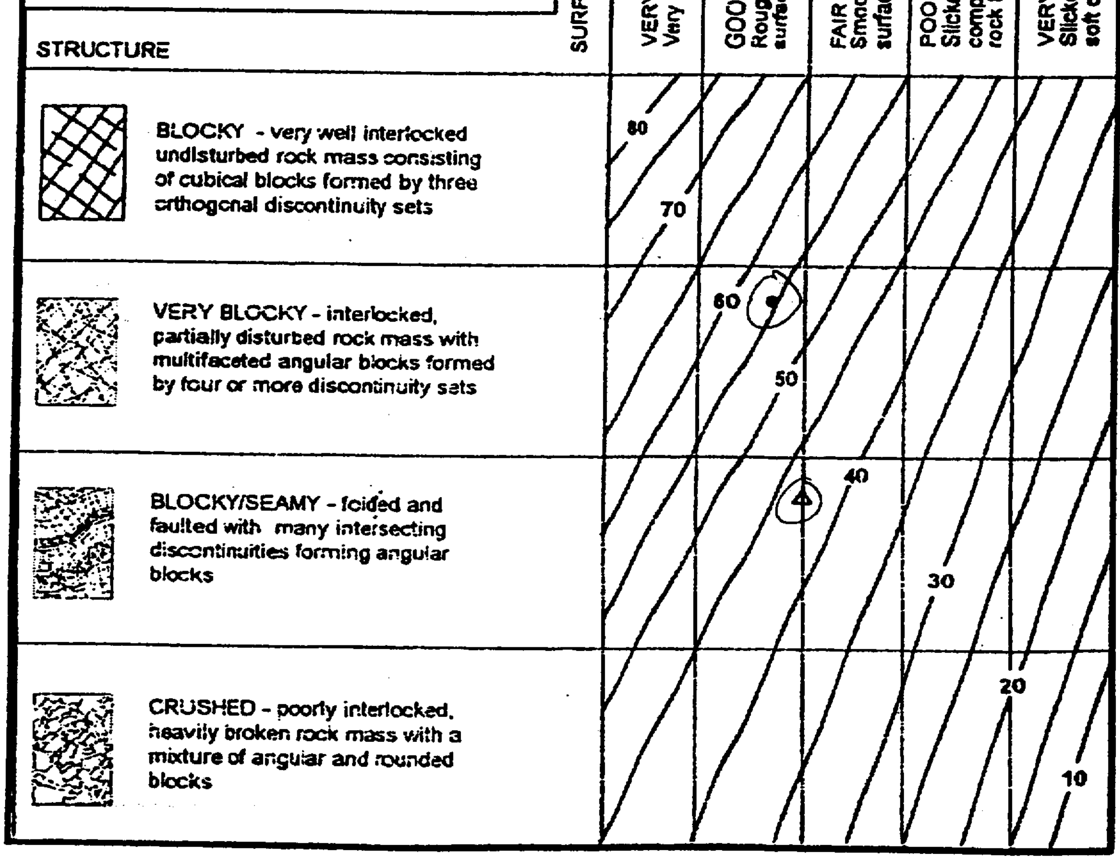
Investigator: JLB/JGH

LOCATION:

Trench T20a

Tofb-1 (CMB 3/30/01) (Dolomite, JLB 6/25/01)
~~Tofb-1a~~ Hard dolomite, dol. sandstone: limestone blocks, fractured w/ random orientations, no fabric, no weathered rinds

Tofb-1a (CMB 3/30/01) (Friable Dolomite - JLB 6/25/01)
~~Tofb-1b~~ Brecciated block in matrix unit, Blocks mod. hard to hard Tofb-1a, sharp contacts, no shear fabric



Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
Tofb-1 • GSI 55	15	R2+			
Tofb-1a Δ GSI 42	9	R0-R1			
JLB 6/25/01					

T-20B
Tof

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP ISFSI Borrow Area Number: T20B Date: 12/6/00
Investigator: JLB/JGH

LOCATION:

Trench T-20B

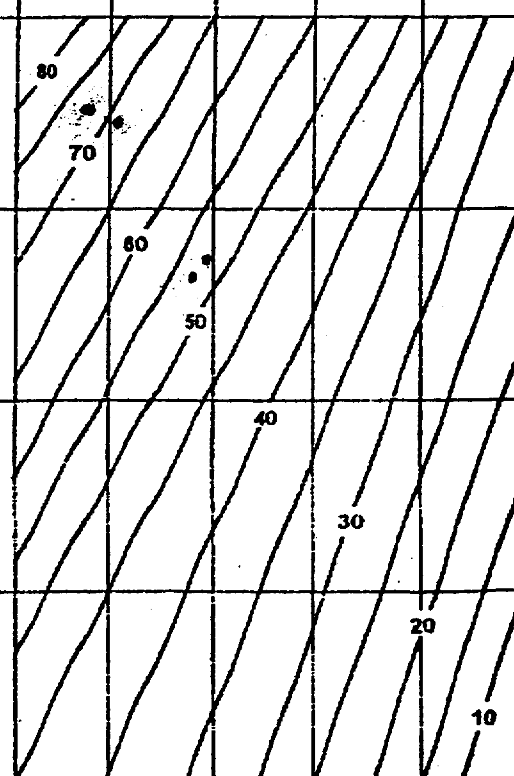
All rock in trench is
• ~~Tof b-ta~~ Tofb-1 (CMB 3/30/01)
Hard Dolomite to dolomitic sandstone, slightly wthd. (Dolomite)

SURFACE CONDITION

- VERY GOOD Very rough, unweathered surfaces
- GOOD Rough, slightly weathered, iron stained surfaces
- FAIR Smooth, moderately weathered or altered surfaces
- POOR Slickensided, highly weathered surfaces with compact coatings or fillings containing angular rock fragments
- VERY POOR Slickensided, highly weathered surfaces with soft clay coatings or fillings

STRUCTURE

- BLOCKY - very well interlocked undisturbed rock mass consisting of cubical blocks formed by three orthogonal discontinuity sets — Lower end of trench
- VERY BLOCKY - interlocked, partially disturbed rock mass with multifaceted angular blocks formed by four or more discontinuity sets — Upper end of trench and more-fract zones
- BLOCKY/SEAMY - folded and faulted with many intersecting discontinuities forming angular blocks
- CRUSHED - poorly interlocked, heavily broken rock mass with a mixture of angular and rounded blocks



Tofb-1 (CMB 3/30/01)

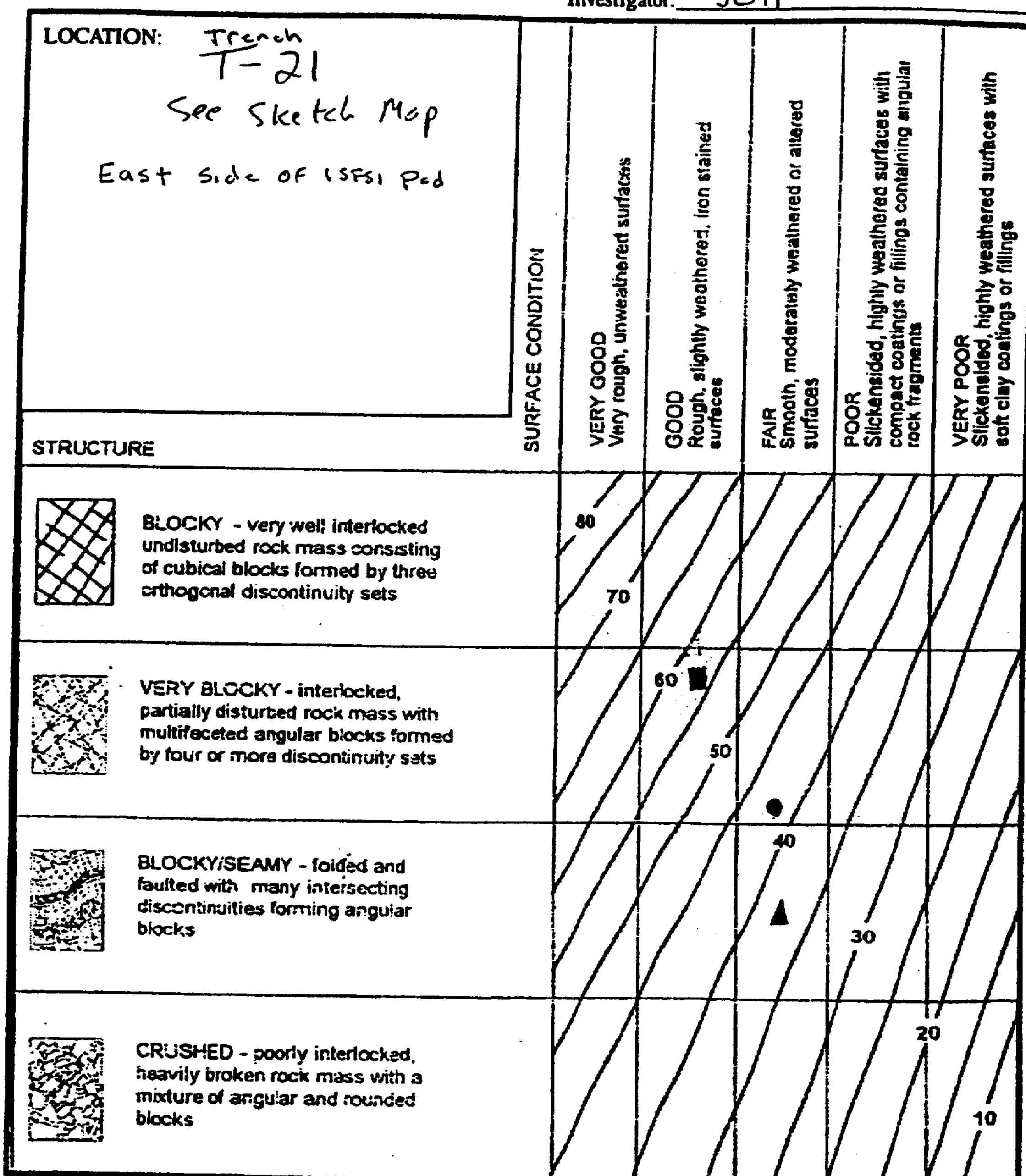
Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
Tofb-1 GSI 52-74	12-20	R2+ to R3			

T-21

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP ISFSI Number: 1223-49 T-21 Date: 9 Dec. 2000

Investigator: JGH



CWB 3/20/01

← Tofb-1a

← Shale/ faulted rock block JLB 6/25/01

GSI JLB 7/2/01

	Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
JLB 6/25/01 Tofb-1	■ (Dolomitic) Dolomitic S.S.	56	R1+	~~Tofb-1A~~ Tofb-1		
Tofb-1a	● (Friable Dolo.) ~~Diamictite~~	42	R1⁻	~~Tofb-1a~~ Tofb-1a		
Shale	▲ ~~Diabase~~ (Shale) JLB 6/25/01	37	R1⁻	-		

[signature] for JGH

Res. Road cut above PP.

ROCK MASS CHARACTERIZATION - GEOLOGIC STRENGTH INDEX

Project: DCPP ISFSI   Number: —   Date: 2/7/01

Investigator: JLB/CMB

LOCATION:

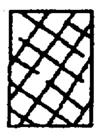
Reservoir Road

North part of Reservoir Road in cut above plant

SURFACE CONDITION

- VERY GOOD – Very rough, unweathered surfaces
- GOOD – Rough, slightly weathered, iron stained surfaces
- FAIR – Smooth, moderately weathered or altered surfaces
- POOR – Slickensided, highly weathered surfaces with compact coatings or fillings containing angular rock fragments
- VERY POOR – Slickensided, highly weathered surfaces with soft clay coatings or fillings

STRUCTURE



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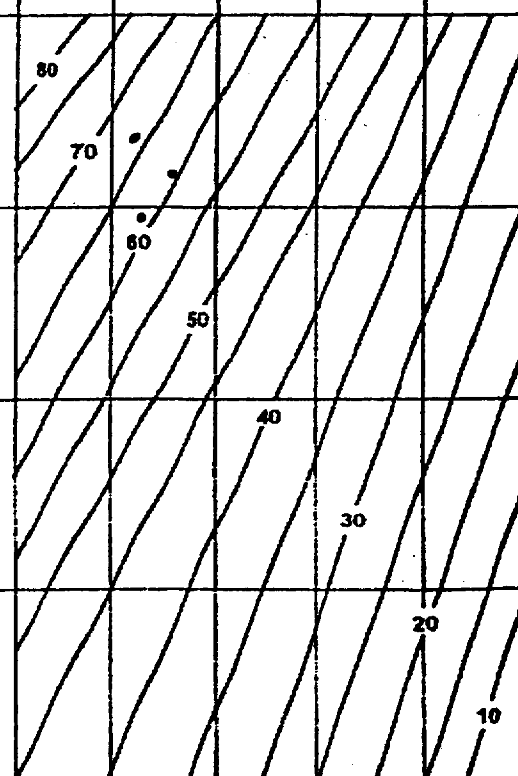
VERY BLOCKY - interlocked, partially disturbed rock mass with multifaceted angular blocks formed by four or more discontinuity sets

BLOCKY/SEAMY - folded and faulted with many intersecting discontinuities forming angular blocks

CRUSHED - poorly interlocked, heavily broken rock mass with a mixture of angular and rounded blocks



Tofb-1 & Tofb-2(?)' (CMB 7/10/ JLB 6/25/0

Station	mi constant	Strength (R)	Station	mi constant	Strength (R)
	ss/ss/dol.	R3 - R2+			