

# SHAHEEN & PEAKER LIMITED

CONSULTING GEO-ENVIRONMENTAL AND CONSTRUCTION MATERIALS ENGINEERS

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Project: SP3012

December 14, 1999

Ministry of Transportation  
Geotechnical Section, 4<sup>th</sup> Floor  
447 McKeown Avenue, Suite 301  
North Bay, Ontario  
P1B 9S9

Attention: Mr. J. D. Smith, P.Eng.

Dear Sirs:

N/R GEOTECHNICAL DEC 15 1999			
GEOTEC ENG		FOR YOUR INFO	
PROJ. NAME		PLEASE DISCUSS	
CLIENT		RESPOND WITH COMMENTS	
DATE		TAKE APP. ACTIONS	
SECRETARY			
POE'S			
Exploratory Boreholes			
W.P. 147-98-00		FILE #	

Agreement No. PO5005A000062

Please find attached the results of the five (5) sampled exploratory boreholes as required at 'Calamity Gulch' within the limits of W.P. 147-98-00 between Sta. 17+550 – 17+750 Dymond Township.

The location of the boreholes are shown on the accompanying borehole logs and are approximated as follows:

Sta 17+550 o/s 3.4 m Lt  
Sta 17+590 o/s 3.5 m Lt  
Sta 17+630 o/s 3.1 m Rt  
Sta 17+670 o/s 2.9 m Lt  
Sta 17+710 o/s 4.5 m Rt

The predominant soil encountered below the pavement structure fill was a varved clay. The varved clay generally consisted of layers of clay 12 to 35 mm thick and layers of silt 6 to 12 mm thick.

A summary of the strength results, from the field vane, the standard penetration test (SPT), pocket penetrometer and undrained shearing strength from laboratory testing, is presented in the attached tables.

As can be seen from the test results, the field strength test values from the vane tests are larger than the unconfined compression tests. This can be expected for a varved clay due to the influence of the silt layers on the vane test. It should also be pointed out that the boreholes were drilled from the top of road embankments. The test results would, therefore, reflect the influence of additional stresses under the fill embankment and can be expected to deviate from soil strength values, which would be measured outside the influence of embankment surcharge.

The grain size analysis charts are attached for selected samples.

We trust the above is satisfactory for your purposes at this time. If there are any questions, please contact this office.

Yours very truly

**SHAHEEN & PEAKER LIMITED**

  
Paul MacDonald, P.Eng.  


PM:tr/d#z3  
Attach.

TABLE No. 1

Borehole DBI STA 17 + 550 o/s 3.4 m Lt.

Depth		Field Vane Cu	Remolded Vane Cu (kPa)	Sensitivity	PP (kPa)	SPT (N)	Cu ** kPa
From (m)	To (m)	(kPa)					
1.5	2.0				120	16	
3.1	3.5				140	13	
4.6	5.0					6	
5.3	5.6	42	8	5.3			
6.1	6.6						
6.9	7.3				24	1	
7.6	7.9	34	8	4.3			
8.4	8.8				24	0	
9.2	9.5	22	6	3.7			
9.2	9.6						
9.9	10.4					1	
10.7	11.1	26	8	3.3			
11.4	11.9						12

P.P. – Pocket Penetrometer

STP – Standard Penetration Test (N-blows/300 mm)

\*\* Laboratory, unconsolidated, un-drained triaxial compression test on Shelby tube sample.

Sensitivity – Field Vane Cu/Remolded Field Vane Cu

TABLE No. 2

DB2 STA 17 + 590 o/s 3.5 m Lt

Depth		Field Vane Cu (kPa)	Remolded Vane Cu (kPa)	Sensitivity	PP (kPa)	SPT (N)	Cu ** kPa
From (m)	To (m)						
1.5	2.0					12	
3.1	3.5					16	
4.6	5.0				12	4	
6.1	6.6						
6.6	6.9	42	8	5.3			
6.9	7.3					3	
9.2	9.6						12
9.6	9.9	42	11	3.8			
9.9	10.4					3	
10.7	11.1						
11.1	11.6	38	8	4.8			
12.2	12.7						
12.7	13.1	50	11	4.5			
13.1	13.6				12	1	
15.3	15.7						(13 + 18)
15.7	16.2	50	15	3.3			
16.2	16.6					8	
18.3	18.8						
18.8	19.1	61	15	4.1			
19.1	19.5					7	
21.4	21.8						
21.8	22.1	57	21	2.7			
22.1	22.6				12	8	
22.9	23.3						
23.3	23.6	65	15	4.3			
24.4	24.9						
24.9	25.2	69	19	3.6			
25.2	25.6				12	10	
25.9	26.4						
26.4	26.7	72	19	3.8			
27.5	27.9				12	10	
27.9	28.1					50/130 mm	

(13 + 18) – Two tests were conducted on the same tube samples

P.P. – Pocket Penetrometer

STP – Standard Penetration Test (N-blows/300 mm)

\*\* Laboratory, unconsolidated, un-drained triaxial compression test on Shelby tube sample.

Sensitivity – Field Vane Cu/Remolded Field Vane Cu

TABLE No. 3

DB3 STA 17 + 630 o/s 3.1 m Rt.

Depth		Field Vane Cu (kPa)	Remolded Vane Cu (kPa)	Sensitivity	PP (kPa)	SPT (N)	Cu ** KPa
From (m)	To (m)						
1.5	2.0						
3.1	3.5				160	19	
4.6	5.0				120	32	
6.1	6.6					20	
7.6	8.1				70	9	
8.4	8.8				120	11	
9.2	9.6				160	21	
9.9	10.4				90	19	
10.7	11.1				70	10	
11.3	11.9				20	7	
12.2	12.7				30	3	
13.0	13.1	38	11	3.5		4	
13.1	13.7						
13.7	13.9						
14.2	14.5	53	11	4.8			
14.5	14.9				40	5	
15.3	15.7						
15.7	16.0	54	10	5.4			
16.8	17.2						16
17.2	17.5	54	11	4.9			
17.5	18.0				20	1	
19.8	20.3						
20.3	20.7				20	5	
20.7	21.0	57	13	4.4			
23.2	23.6						39
23.6	24.1				20	5	
24.4	24.9	42	8	5.3			
25.9	26.4						
26.4	26.6				20	NFP	

NFP – No further penetration

P.P. – Pocket Penetrometer

STP – Standard Penetration Test (N-blows/300 mm)

\*\* Laboratory, unconsolidated, un-drained triaxial compression test on Shelby tube sample.

Sensitivity – Field Vane Cu/Remolded Field Vane Cu

TABLE No. 4

DB4 STA 17 + 640 o/s 2.9 m Rt.

Depth		Field Vane Cu (kPa)	Remolded Vane (kPa) Cu	Sensitivity	PP (kPa)	SPT (N)	Cu ** kPa
From (m)	To (m)						
1.5	2.0						
3.1	3.5						
4.6	5.0						
6.1	6.6						
7.6	8.1						
9.2	9.6						
10.7	11.3						
12.2	12.7						
13.0	13.4						
13.7	14.2						
14.5	14.9						
15.3	15.7						
16.0	16.5						
16.5	16.9	68	15	4.5			
17.5	18.0						
18.0	18.3	46	11	4.2			
18.3	18.8				24	3	
19.1	19.5						
19.5	19.8	42	13	3.2			
20.6	21.0						32
21.0	21.4	53	15	3.5			
21.4	21.8				24	3	

P.P. – Pocket Penetrometer

STP – Standard Penetration Test (N-blows/300 mm)

\*\* Laboratory, unconsolidated, un-drained triaxial compression test on Shelby tube sample.

Sensitivity – Field Vane Cu/Remolded Field Vane Cu

TABLE No. 5

DB5 STA 17 + 710 o/s 4.5 m Rt.

Depth		Field Vane	Remolded Vane (kPa) Cu	Sensitivity	PP (kPa)	SPT (N)	Cu ** kPa
From (m)	To (m)						
1.5	2.0						
3.1	3.5						
4.6	5.0						
6.1	6.6				40		
6.9	7.3				70		
9.2	8.1				90		
8.4	8.8				70		
9.2	9.6				20		
10.7	11.1						
11.1	11.6	30	8	3.8			
11.6	12.0					4	
12.2	12.7						
12.6	13.1	42	11	3.8			
13.7	14.2						15
14.2	14.6	38	11	3.5			
14.6	15.1					3	
15.3	15.7						
15.7	16.2	50	11	4.5			
16.8	17.2						
17.2	17.7	57	11	5.2			
17.7	18.1				20	3	
18.3	18.8						
18.8	19.2	53	11	4.8			
19.8	20.3						
20.3	20.7				20	3	
20.7	21.2	61	19	3.2			
21.3	21.8						
21.8	22.3	68	15	4.5			
22.3	22.7				20	6	
24.7	25.2						25
25.2	25.6					11	
25.6	25.9						

P.P. – Pocket Penetrometer

STP – Standard Penetration Test (N-blows/300 mm)

\*\* Laboratory, unconsolidated, un-drained triaxial compression test on Shelby tube sample.

Sensitivity – Field Vane Cu/Remolded Field Vane Cu

**METRIC**

ORIGINATED BY T.B

COMPILED BY G.T

CHECKED BY \_\_\_\_\_ P.M

+ 3, x 3: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No DB2

1 OF 2

METRIC

W.P. WP147-98-00

LOCATION Hwy 11 Dymond Twp Stn 17+590 O/S 3.5 m Lt.

ORIGINATED BY T.B

DIST Northern HWY Hwy 11

BOREHOLE TYPE Solid Stem Augers

COMPILED BY G.T

DATUM

DATE 10.05.99 & 10.05.99

CHECKED BY P.M

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20	40	60	80	100	W <sub>p</sub>	W	W <sub>L</sub>		
	Ground Surface																
0.0	140 mm Asphalt																
0.1	160 mm Sand and gravel, brown, moist																
0.3	SAND: with trace gravel, coarse, brown																
1.5	FILL: sand with trace gravel, brown, moist, over sandy silt with trace clay, brown, moist medium sand, over silty clay, grey, moist (possible native)			SPT	12												
				SPT	16												
4.5	VARVED CLAY: rhythmic layers of dark grey silty clay to clay and light grey clayey silt to silt.			SPT	4												
				SHELBY													
				SPT	3												
				SHELBY													
				SPT	3												
				SHELBY													
				SPT	1												
	Clay layers are approximately 25 mm thick with 12 mm thick silt layers, firm but readily separates on horizontal planes																

Continued Next Page

+ 3, x 3: Numbers refer to Sensitivity 20 15 10 (%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No DB2

2 OF 2

METRIC

W.P. WP147-98-00 LOCATION Hwy 11 Dymond Twp Stn 17+590 O/S 3.5 m Lt. ORIGINATED BY T.B  
 DIST Northern HWY Hwy 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T  
 DATUM \_\_\_\_\_ DATE 10.05.99 & 10.05.99 CHECKED BY P.M

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT			UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			"N" VALUES	20	40	60	80	100	W P	W			W L
	Clay layers are approximately 12 mm thick with 6 mm thick silt layers, firm but readily separates on horizontal planes			SHELBY		14											
				SPT	8												
					SHELBY												
					SPT	7											
					SHELBY												
					SPT	8											
					SHELBY												
					SPT	10											
27.4	SILTY CLAY TILL			SHELBY												0/0/65/35	
28.1	End of borehole Refusal to further augering at 28.1 m Note: Water level in open borehole at 24.4 m on completion			SPT 150/13.7m													

+ 3, x 3: Numbers refer to Sensitivity 20 15 10 (% STRAIN AT FAILURE

## METRIC

+ 3, x 3: Numbers refer to Sensitivity

# RECORD OF BOREHOLE No DB3

2 OF 2

METRIC

W.P. WP147-98-00 LOCATION Hwy 11 Dymond Twp Stn 17 + 630 O/S 3.1 m Rt. ORIGINATED BY T.B  
 DIST Northern HWY Hwy 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T  
 DATUM DATE 10.05.99 & 10.05.99 CHECKED BY P.M

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)						
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)					
								○ UNCONFINED + FIELD VANE										● QUICK TRIAXIAL × LAB VANE					
								20	40	60	80	100						20	40	60	20	40	60

+ 3, × 3: Numbers refer to Sensitivity 20 15 10 (% STRAIN AT FAILURE

# RECORD OF BOREHOLE No DB4

1 OF 2

METRIC

W.P. WP147-98-00 LOCATION Hwy 11 Dymond Twp Stn 17+679 O/S 2.9 m Lt. ORIGINATED BY T.B  
 DIST Northern HWY Hwy 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T  
 DATUM \_\_\_\_\_ DATE 10.05.99 & 10.05.99 CHECKED BY P.M

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES		20	40	60	80	100					
0.0	Ground Surface															
0.2	195 mm Asphalt															
	FILL: sand and gravel, moist															
				SPT	27											
				SPT	11											
				SPT	27											
	with trace clay															
				SPT	10											
				SPT	8											
9.1	CLAYEY SILT: with some sand and gravel, brown			SPT	15											
	with some organics															
10.6	CLAYEY SILT: with some gravel and organics, brown, moist			SPT	14											
				SPT	20											
12.8	SILTY CLAY: grey, organics			SPT	27											
				SPT	19											
	becoming brown with trace			SPT	9											

Continued Next Page

+ 3, x 3: Numbers refer to  
Sensitivity

20  
15  
10  
(%) STRAIN AT FAILURE

# RECORD OF BOREHOLE No DB4

2 OF 2

METRIC

W.P. WP147-98-00 LOCATION Hwy 11 Dymond Twp Stn 17 + 679 O/S 2.9 m Lt. ORIGINATED BY T.B  
 DIST Northern HWY Hwy 11 BOREHOLE TYPE Solid Stem Augers COMPILED BY G.T  
 DATUM \_\_\_\_\_ DATE 10.05.99 & 10.05.99 CHECKED BY P.M

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT NATURAL MOISTURE CONTENT LIQUID LIMIT			UNIT WEIGHT  γ  kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)  GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			20 40 60 80 100					w <sub>p</sub> w w <sub>L</sub>					
								SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE					WATER CONTENT (%)					
							20 40 60 80 100					20 40 60						
14.8	<div>organics</div> <div>VARVED CLAY: rhythmic layers of dark grey silty clay to clay and light grey clayey silt to silt.</div> <div>Clay layers are approximately 25 mm thick with 12 mm thick silt layers, firm but readily separates on horizontal planes</div>	<div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div>		SPT	9													
				SHELB														
				SHELB														
				SPT	3													
				SHELB														
				SHELB														
				SPT	3													
21.9	End of borehole Note: Borehole dry on completion																	

# RECORD OF BOREHOLE No DB5

1 OF 2

METRIC

W.P. WP147-98-00

LOCATION Hwy 11 Dymond Twp OIS 4.5 m Rt.

ORIGINATED BY T.B

DIST Northern HWY Hwy 11

BOREHOLE TYPE Solid Stem Augers

COMPILED BY G.T

DATUM

DATE 10.05.99 & 10.05.99

CHECKED BY P.M

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ kN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES			SHEAR STRENGTH kPa									
	Ground Surface							20	40	60	80	100					
0.0	270 mm Asphalt																
0.3	420 mm Sand and gravel, brown, moist																
0.6	90 mm Asphalt																
0.7	Sand and gravel FILL: clayey silt with some gravel and fine sand, brown, moist			SPT	10												
				SPT	37												
	silty sand, with zones of some clay and gravel, trace organics			SPT	7												
5.0	VARVED CLAY: rhythmic layers of dark grey silty clay to clay and light grey clayey silt to silt.																
				SPT	9												
				SPT	13												
				SPT	17												
				SPT	7												
				SHELBY													
				SPT	4												
				SHELBY													
				SHELBY													
	Clay layers are approximately 25 mm thick with 6 mm thick silt layers, firm but readily separates on horizontal planes			SPT	3												

Continued Next Page

+ 3 x 3: Numbers refer to  
Sensitivity

20  
15  
10

(%) STRAIN AT FAILURE

## METRIC

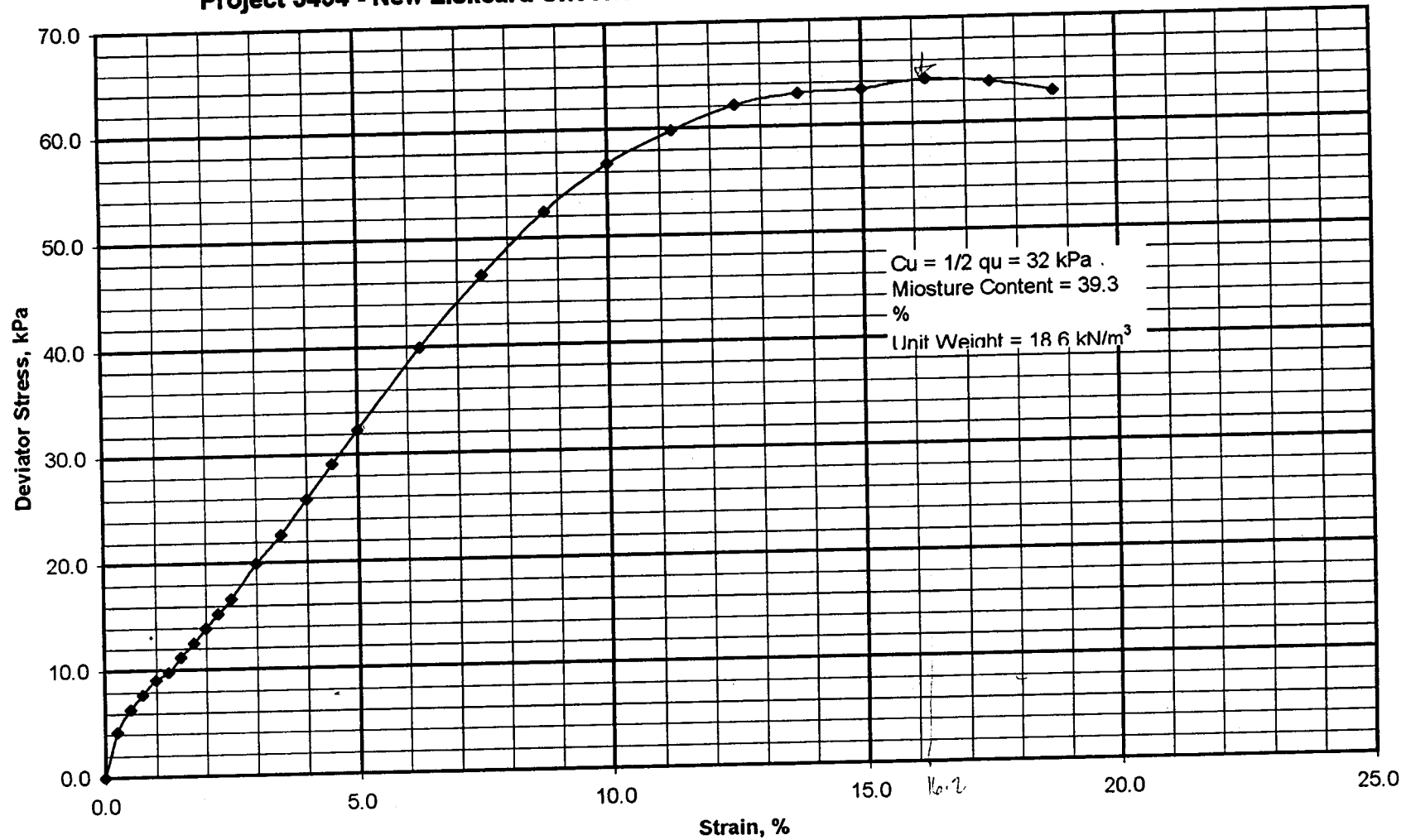
ORIGINATED BY T.B

COMPILED BY G.T

CHECKED BY \_\_\_\_\_ P.M.

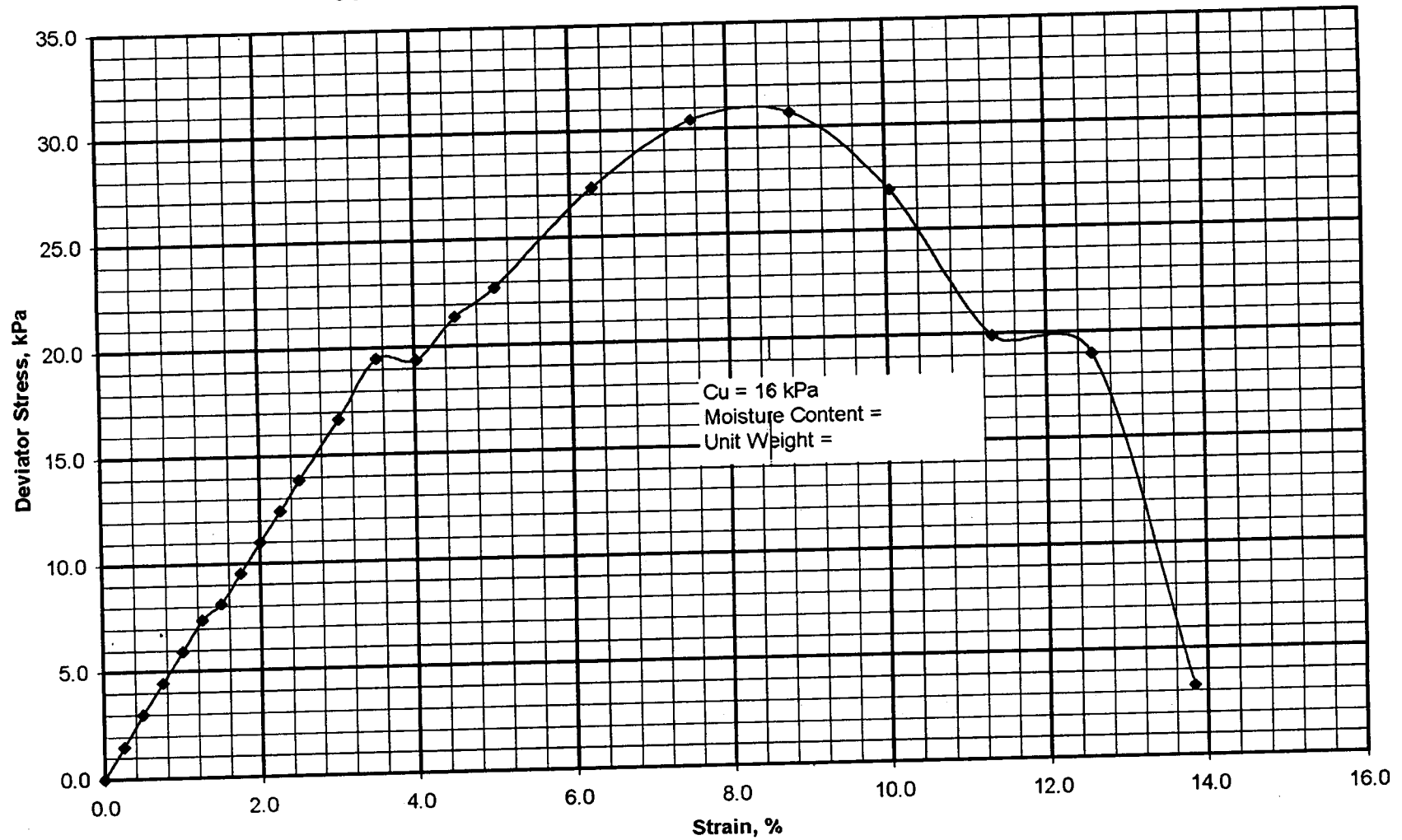
+ 3, x 3: Numbers refer to Sensitivity

# Project J494 - New Liskeard Unconsolidated Triaxial Test at Overburden Pressure



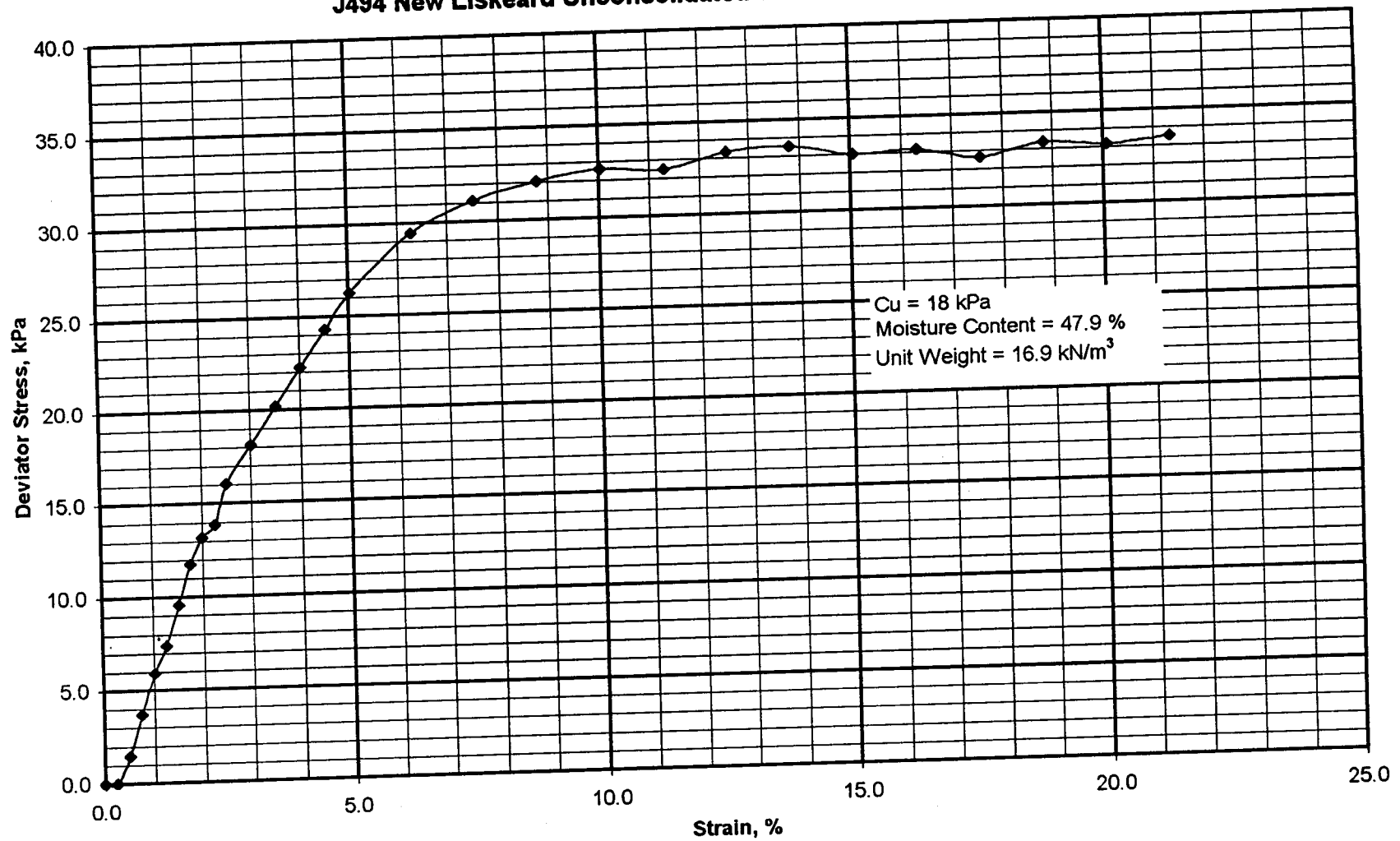
Drawing No. 1: Stress Strain Plot for Borehole No. 4, 20.8 m

# J494 New Liskeard Unconsolidated Undrained Triaxial Test



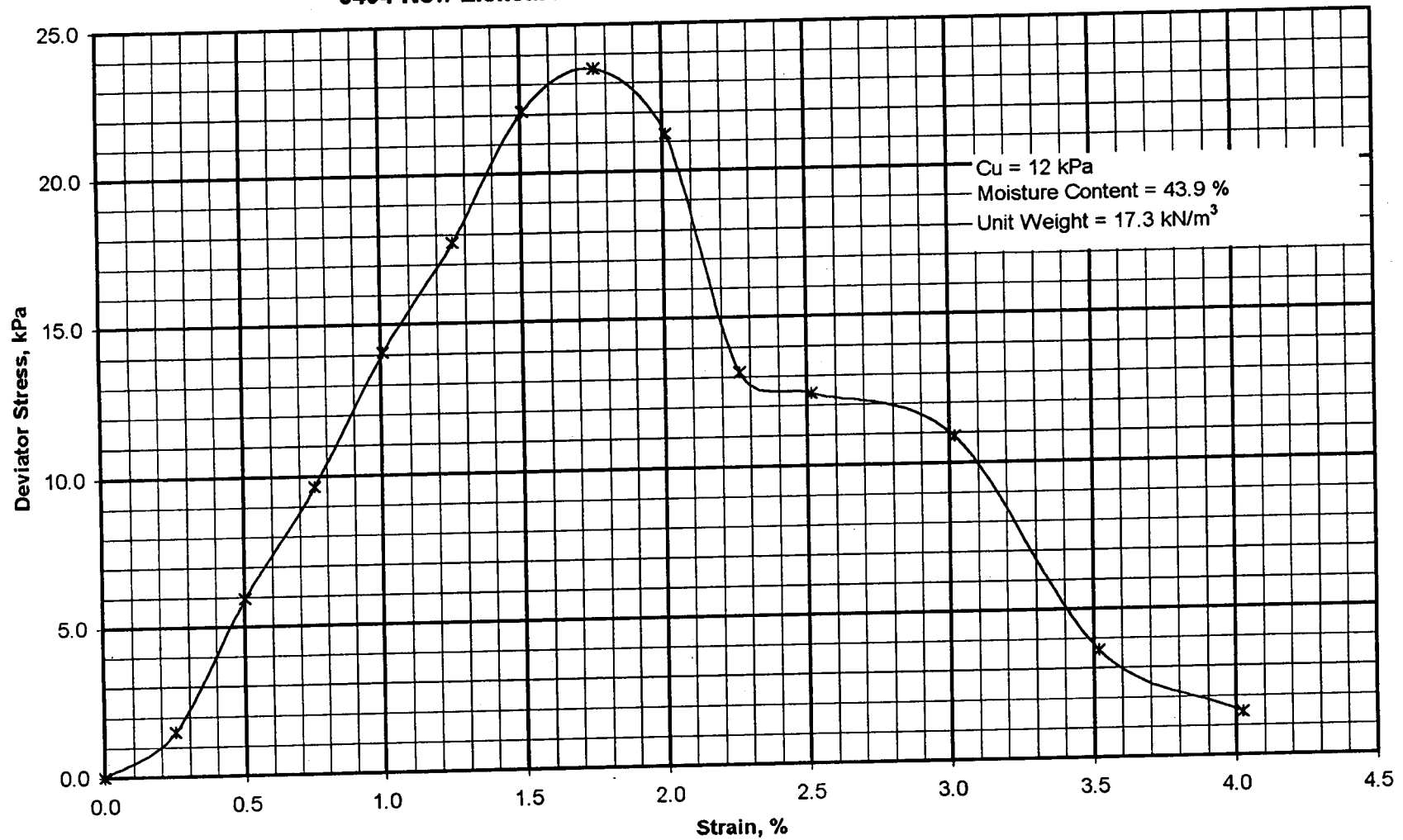
Drawing No. 10: Stress Strain Plot for Borehole No. 3, 17.0 m

### J494 New Liskeard Unconsolidated Undrained Triaxial Test

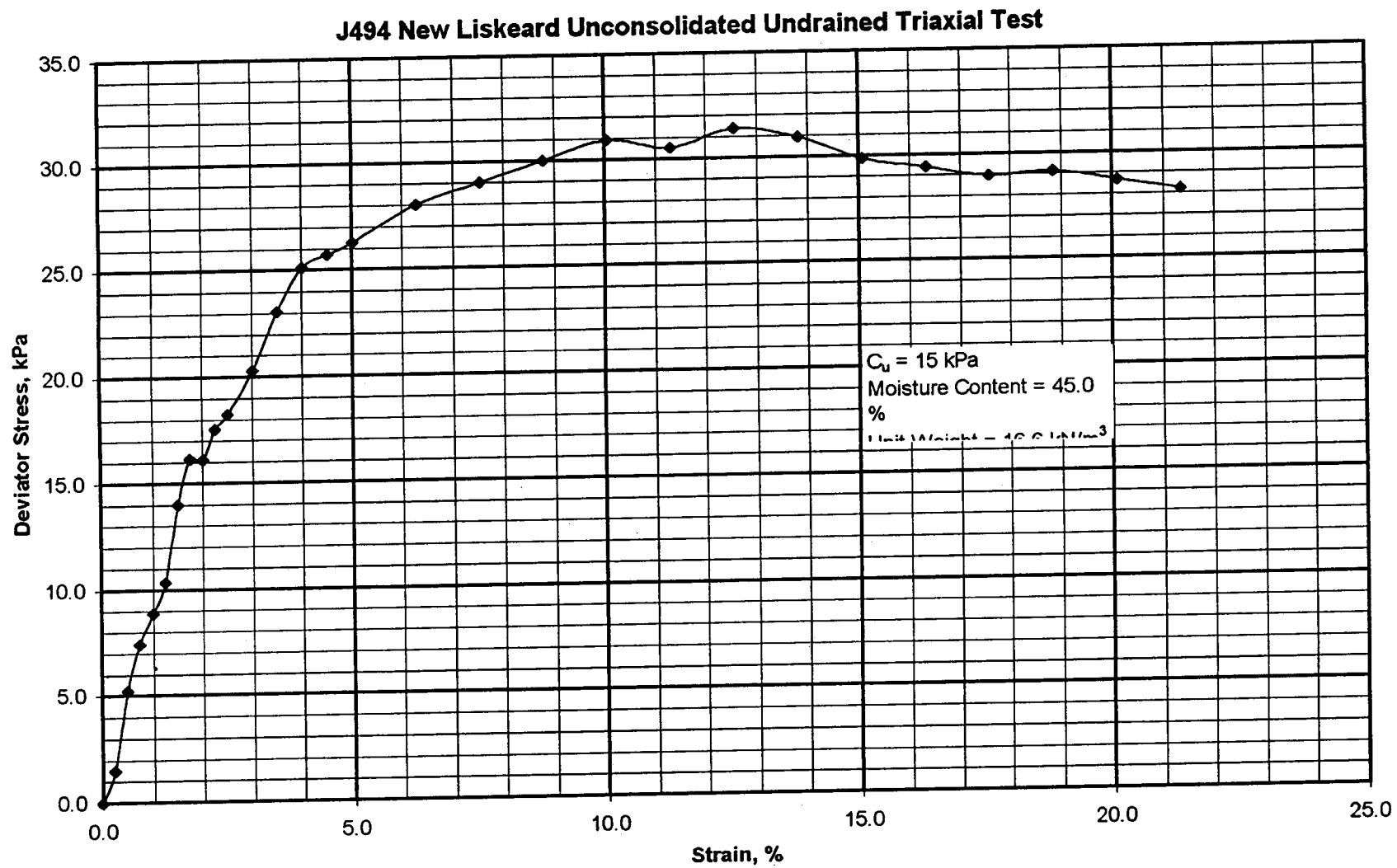


Drawing No. 3: Stress Strain Plot for Borehole No. 2, 15.5 m

### J494 New Liskeard Unconsolidated Undrained Triaxial Test

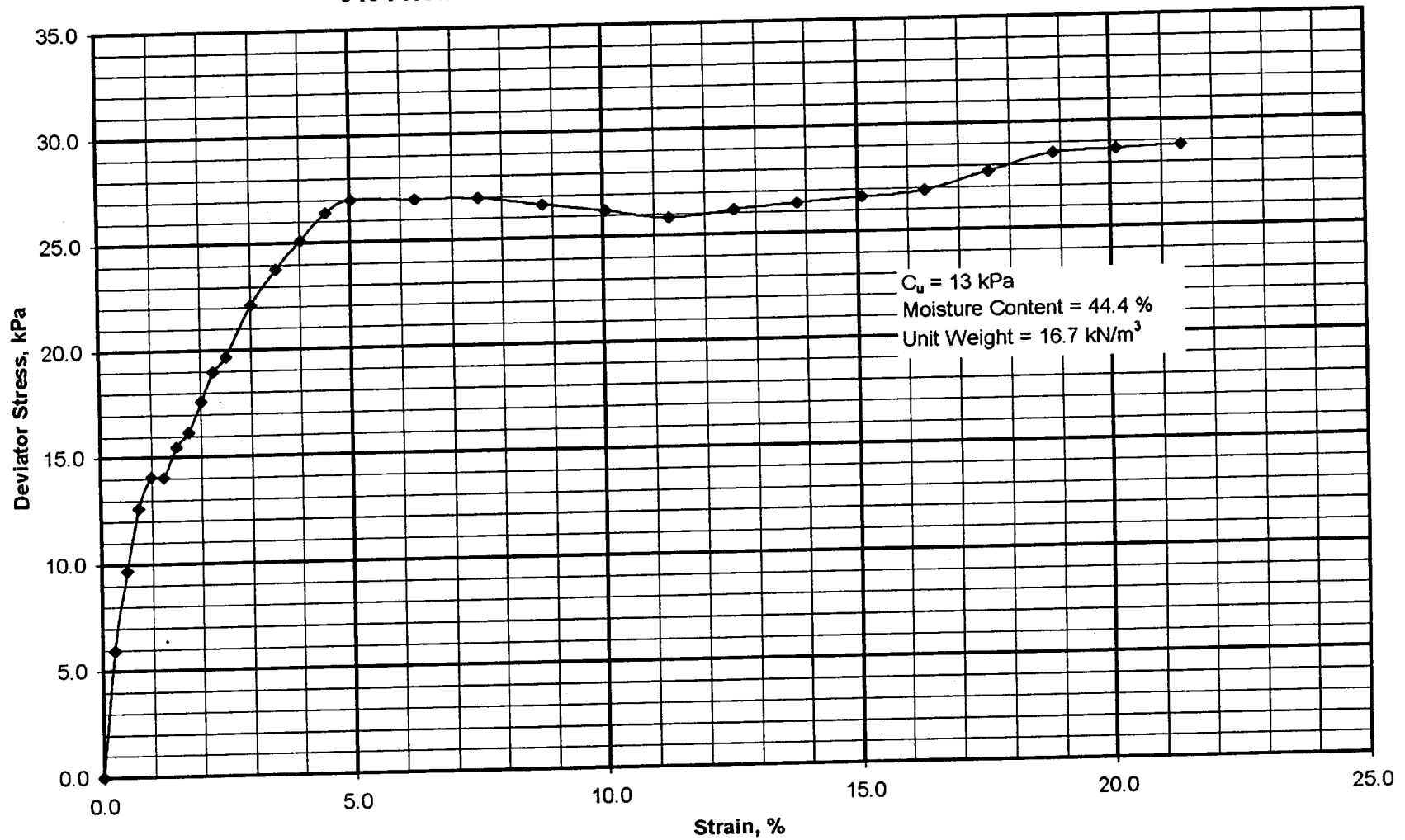


Drawing No. 2: Stress Strain Plot for Borehole No. 2, 9.2 m.



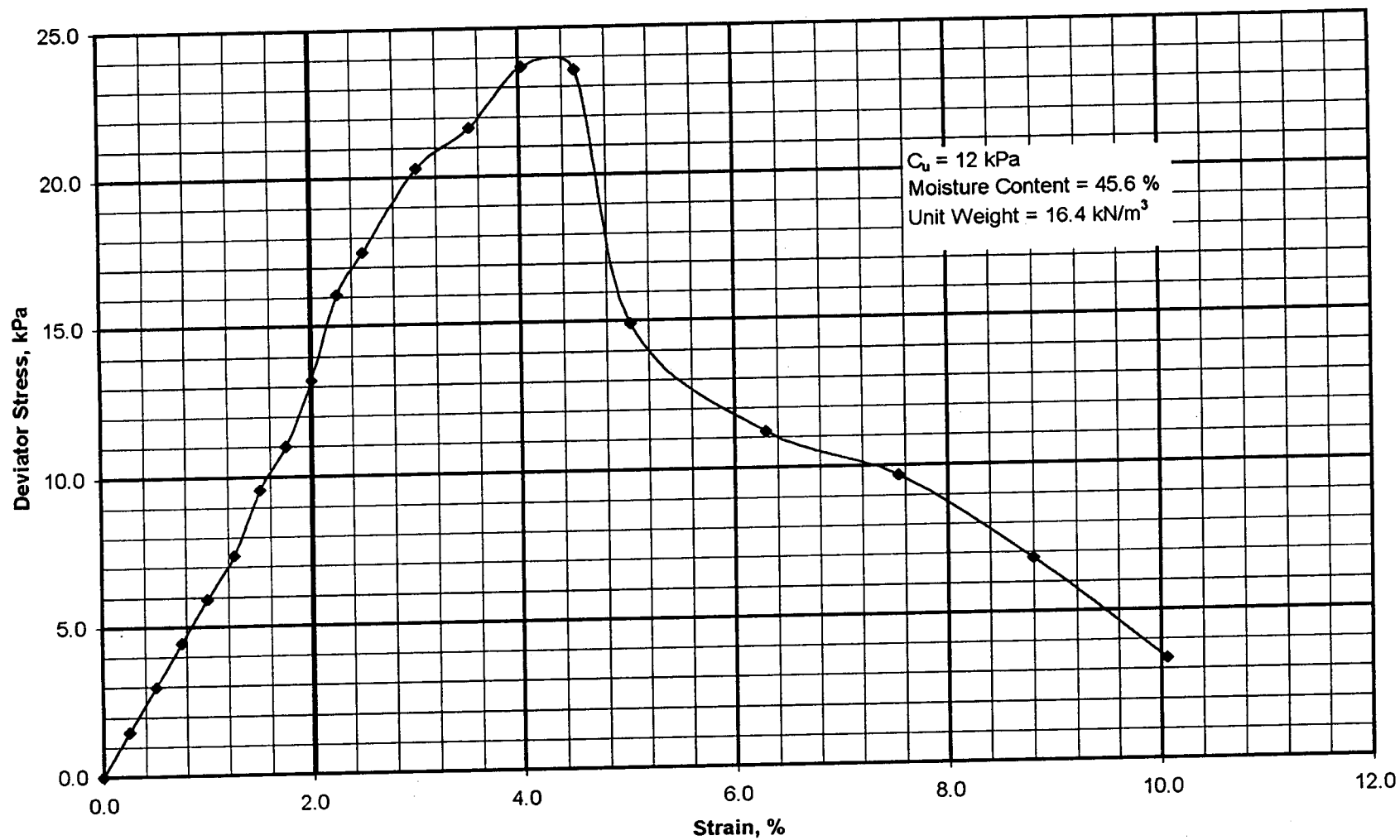
Drawing No. 5: Stress Strian Plot for Borehole 5, 13.9 m

### J494 New Liskeard Unconsolidated Undrained Triaxial Test



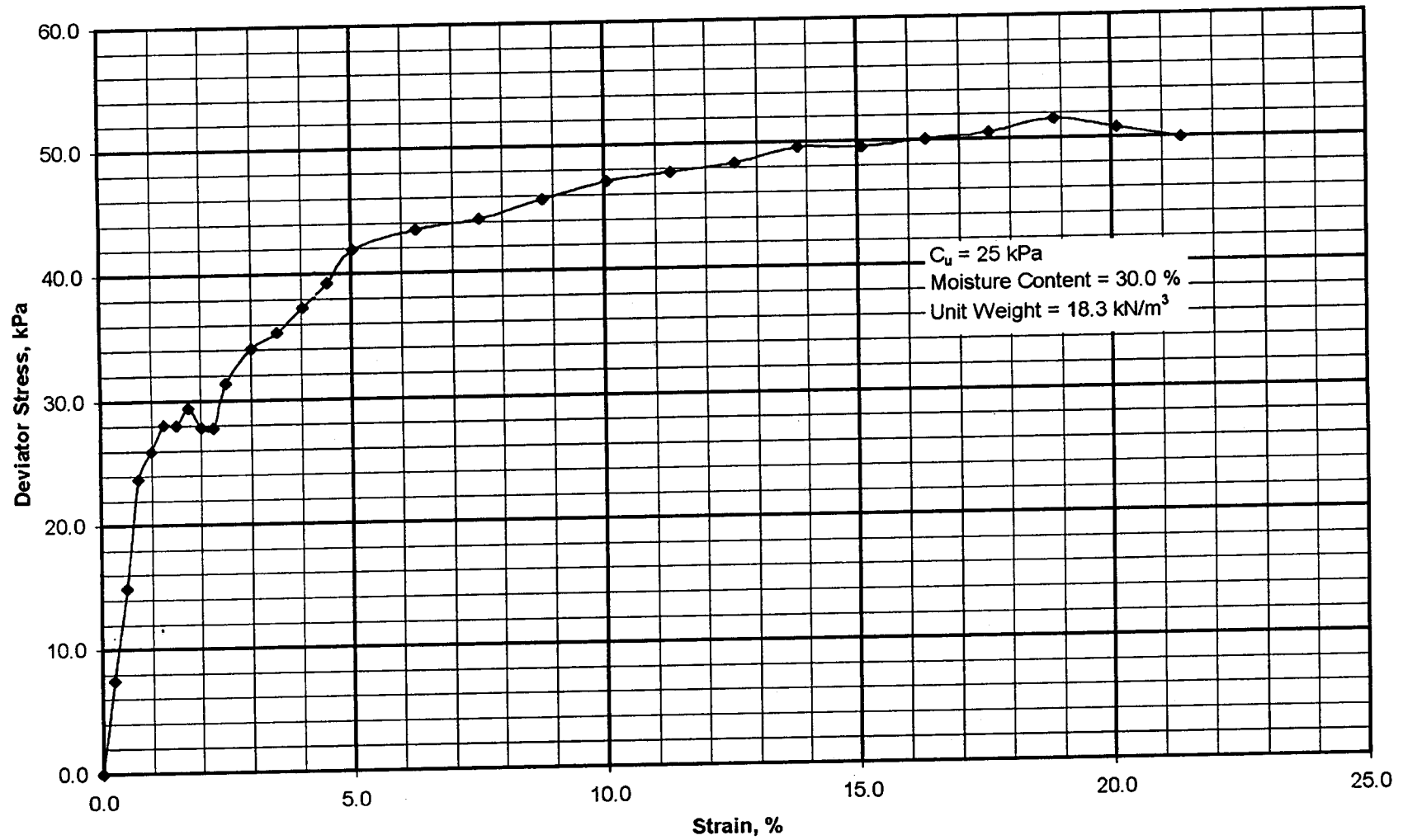
Drawing No. 6: Stress Strain Plot for Borehole No. 2, 15.5 m

# J494 New Liskeard Unconsolidated Undrained Triaxial Test



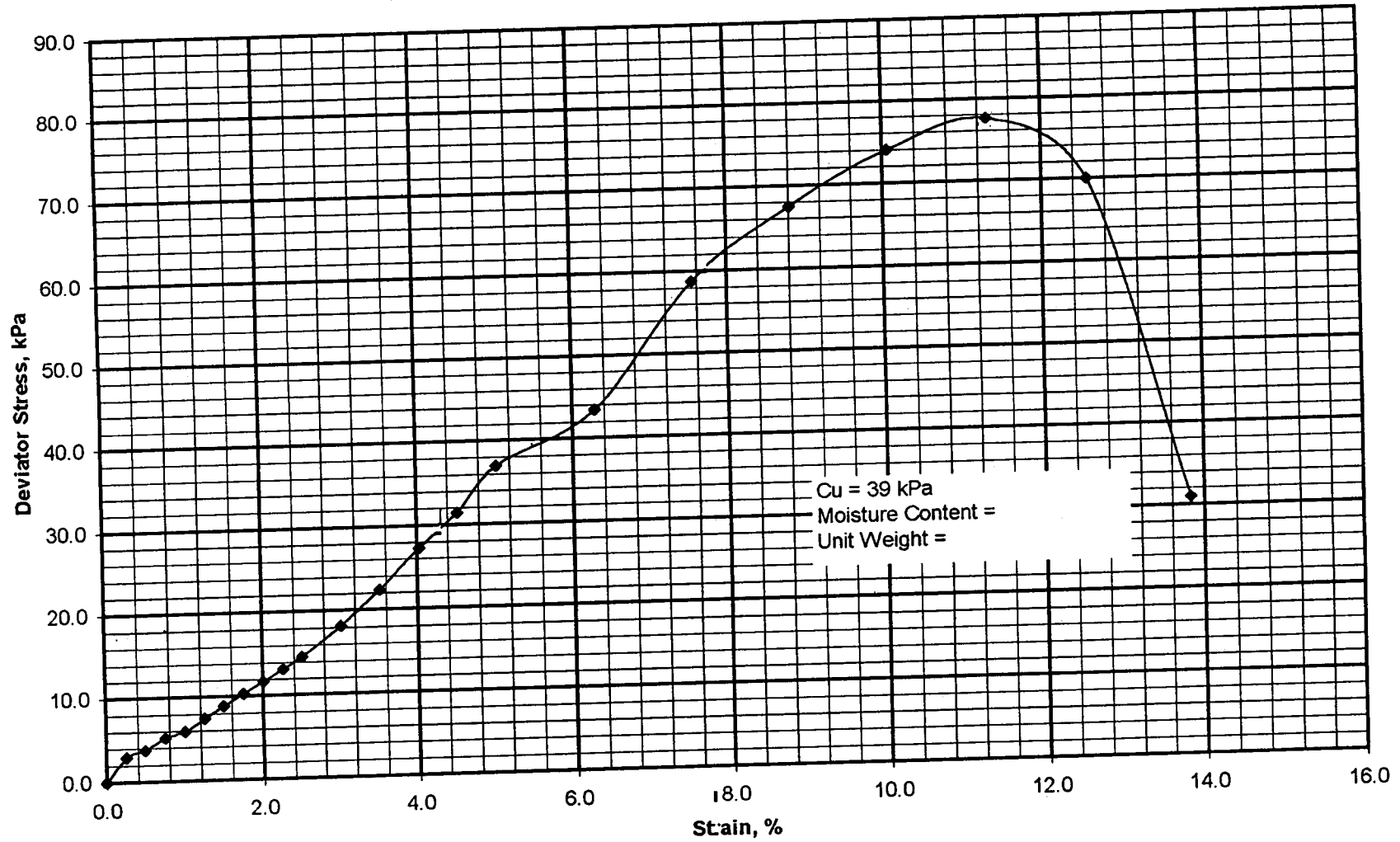
Drwaing No. 1: Stress Strain Plot for Borehole No. 1, 11.7 m

### J494 New Liskeard Unconsolidated Undrained Triaxial Test



Drawing No. 8: Stress Strain Plot for Borehole No. 5, 24.5 m

J494 New Liskeard Unconsolidated Unconfined Triaxial Test



Drawing No. 9: Stress Strain Plot for Borehole No. 3, 23.5 m

Unconsolidated Undrained Triaxial Test						
Project No.	J494	Project Name	New Liskeard	Moisture Content	Inmming	Sample
Borehole No.	4	Sample Weight, gms	371.6	Tare & Wet	82.50	369.20
Sample No.	TW4	Sample Volume, m <sup>3</sup>	0.000196312	Tare & Dry	62.60	265.90
Sample Depth, ft	67 1/2 - 69.0	Unit Weight, kN/m <sup>3</sup>	18.6	Tare	3.20	3.20
Sample Depth, m	20.8			MC, %	33.50	39.32
Sample Diameter, mm	49.6	Ring Id. # 6480 - Wykeham-Farrance		Average	36.4	
Sample Height, mm	101.6	Proving Ring Factor	1.370738358	Intercept	0	
Initial C/S Area, m <sup>2</sup>	0.001932					
Change in Height, ins	Strain, %	C/S Area, m <sup>2</sup>	Proving Ring Rdg, div	Applied Load, kN	Stress, kPa	
0	0.0	0.001932205	0	0.0000	0.0	
10	0.3	0.001937048	6	0.0082	4.2	
20	0.5	0.001941915	9	0.0123	6.4	
30	0.8	0.001946806	11	0.0151	7.7	
40	1.0	0.001951722	13	0.0178	9.1	
50	1.3	0.001956663	14	0.0192	9.8	
60	1.5	0.00196163	16	0.0219	11.2	
70	1.8	0.001966621	18	0.0247	12.5	
80	2.0	0.001971638	20	0.0274	13.9	
90	2.3	0.00197668	22	0.0302	15.3	
100	2.5	0.001981749	24	0.0329	16.6	
120	3.0	0.001991964	29	0.0398	20.0	
140	3.5	0.002002285	33	0.0452	22.6	
160	4.0	0.002012714	38	0.0521	25.9	
180	4.5	0.002023251	43	0.0589	29.1	
200	5.0	0.0020339	48	0.0658	32.3	
250	6.3	0.002061019	60	0.0822	39.9	
300	7.5	0.00208887	71	0.0973	46.6	
350	8.8	0.002117485	81	0.1110	52.4	
400	10.0	0.002146895	89	0.1220	58.8	
450	11.3	0.002177133	95	0.1302	59.8	
500	12.5	0.002208234	100	0.1371	62.1	
550	13.8	0.002240238	103	0.1412	63.0	
600	15.0	0.002273183	105	0.1439	63.3	
650	16.3	0.002307111	108	0.1480	64.2	
700	17.5	0.002342067	109	0.1494	63.8	
750	18.8	0.002378099	109	0.1494	62.8	
800	20.0	0.002415256	126	0.1727	71.5	
850	21.3	0.002453594	170	0.2330	95.0	
900	22.5	0.002493168	190	0.2604	104.5	
Soil Description:	Varved Clay rhythmic layers of dark grey silty clay to clay and light grey clayey silt to silt. Clay layers are approximately 25 mm thick with 12 mm thick silt layers, firm but readily separates on horizontal planes, moist.					
Failure Description:	Bulging of the clay layers only. Silt layer pushed into the clay. No shear planes observed.					

Unconsolidated Undrained Triaxial Test						
Project No.	J494	Project Name	New Liskeard	Moisture Content	Inmmings	Sample
Borehole No.	2	Sample Weight, gms	366.8	Tare & Wet	175.9	368.2
Sample No.	TW9	Sample Volume, m³	0.00020471	Tare & Dry	125.3	259.6
Sample Depth, ft	30 - 31 1/2	Unit Weight, kN/m³	17.6	Tare	3.2	3.2
Sample Depth, m	9.4			MC, %	41.4	42.4
Sample Diameter, mm	50.8			Average	41.9	
Sample Height, mm	101	Ring Id # S-64-150				0
Initial C/S Area, m²	0.002027	Proving Ring Factor	1.444396671			
				</		

Unconsolidated Undrained Triaxial Test						
Project No.	J494	Project Name	New Liskeard	Moisture Content	Trimings	Sample
Borehole No.	2	Sample Weight, gms	348.9	Tare & Wet	78.6	348.3
Sample No.	TW3	Sample Volume, m <sup>3</sup>	0.0002027	Tare & Dry	53.3	238
Sample Depth, ft	35-36 1/2	Unit Weight, kN/m <sup>3</sup>	16.9	Tare	1.5	3.7
Sample Depth, m	15.5			MC, %	48.8	47.1
Sample Diameter, mm	50.5			Average	48.0	
Sample Height, mm	101.2	Ring Id. # S-64-150		Intercept		0
Initial C/S Area, m <sup>2</sup>	0.002003	Proving Ring Factor	1.444396671			
Change in Height, ins	Strain, %	C/S Area, m <sup>2</sup>	Proving Ring Rdg. div	Applied Load, kN	Stress, kPa	
0	0.0	0.001932205	0	0.0000	0.0	
10	0.3	0.001937067	0	0.0000	0.0	
20	0.5	0.001941953	2	0.0029	1.5	
30	0.8	0.001946864	5	0.0072	3.7	
40	1.0	0.0019518	8	0.0116	5.9	
50	1.3	0.001956761	10	0.0144	7.4	
60	1.5	0.001961748	13	0.0188	9.6	
70	1.8	0.001966759	16	0.0231	11.8	
80	2.0	0.001971797	18	0.0260	13.2	
90	2.3	0.00197688	19	0.0274	13.9	
100	2.5	0.00198195	22	0.0318	16.0	
120	3.0	0.001992208	25	0.0361	18.1	
140	3.5	0.002002572	28	0.0404	20.2	
160	4.0	0.002013045	31	0.0448	22.2	
180	4.5	0.002023628	34	0.0491	24.3	
200	5.0	0.002034323	37	0.0534	26.3	
250	6.3	0.002061562	42	0.0607	29.4	
300	7.5	0.00208954	45	0.0650	31.1	
350	8.8	0.002118288	47	0.0679	32.0	
400	10.0	0.002147838	48.5	0.0701	32.6	
450	11.3	0.002178224	49	0.0708	32.5	
500	12.5	0.002209482	51	0.0737	33.3	
550	13.8	0.00224165	52	0.0751	33.6	
600	15.1	0.002274769	52	0.0751	33.0	
650	16.3	0.002308881	53	0.0766	33.2	
700	17.6	0.002344032	53	0.0766	32.7	
750	18.8	0.00238027	55	0.0794	33.4	
800	20.1	0.002417645	55.5	0.0802	33.2	
850	21.3	0.002456214	57	0.0823	33.5	
Soil Description:	Varved Clay: rhythmic layers of dark grey silty clay to clay and light grey clayey silt to silt. Clay layers are approximately 12 mm thick with 6 mm thick silt layers, firm but readily separates on horizontal planes, moist.					
Failure Description:	Bulging of the clay layers only. Silt layer pushed into the clay. No shear planes observed.					
Sample Description:						
Failure Description:						
Test Note:						



Unconsolidated Undrained Triaxial Test						
Project No.	J494	Project Name	New Liskeard	Moisture Content	Trimings	Sample
Borehole No.	5	Sample Weight, gms	359.6	Tare & Wet	130	356.2
Sample No.	TV3	Sample Volume, m <sup>3</sup>	0.000213059	Tare & Dry	89.4	248.6
Sample Depth, ft	45 to 46 1/2	Unit Weight, kN/m <sup>3</sup>	16.6	Tare	1.4	3.5
Sample Depth, m	13.9			MC, %	46.1	43.9
Sample Diameter, mm	51.8			Average	45.0	
Sample Height, mm	101.1	Ring Id. # S 64-150		Intercept	0	
Initial C/S Area, m <sup>2</sup>	0.002107	Proving Ring Factor	1.444396671			
Change in Height, ins	Strain, %	C/S Area, m <sup>2</sup>	Proving Ring Rdg, div	Applied Load, kN	Stress, kPa	
0	0.0	0.001932205	0	0.0000	0.0	
10	0.3	0.001937072	2	0.0029	1.5	
20	0.5	0.001941963	7	0.0101	5.2	
30	0.8	0.001946879	10	0.0144	7.4	
40	1.0	0.00195182	12	0.0173	8.9	
50	1.3	0.001956788	14	0.0202	10.3	
60	1.5	0.001961777	19	0.0274	14.0	
70	1.8	0.001966794	22	0.0318	16.2	
80	2.0	0.001971837	22	0.0318	16.1	
90	2.3	0.001976906	24	0.0347	17.5	
100	2.5	0.001982	25	0.0361	18.2	
120	3.0	0.001992269	28	0.0404	20.3	
140	3.5	0.002002644	32	0.0462	23.1	
160	4.0	0.002013129	35	0.0506	25.1	
180	4.5	0.002023723	38	0.0520	25.7	
200	5.0	0.00203443	37	0.0534	26.3	
250	6.3	0.002061699	40	0.0578	28.0	
300	7.5	0.002089708	42	0.0607	29.0	
350	8.8	0.00211849	44	0.0636	30.0	
400	10.0	0.002148075	46	0.0664	30.9	
450	11.3	0.002178498	46	0.0664	30.5	
500	12.6	0.002209796	48	0.0693	31.4	
550	13.8	0.002242006	48	0.0693	30.9	
600	15.1	0.002275168	47	0.0679	29.8	
650	16.3	0.002309327	47	0.0679	29.4	
700	17.6	0.002344526	47	0.0679	29.0	
750	18.8	0.002380816	48	0.0693	29.1	
800	20.1	0.002418246	48	0.0693	28.7	
850	21.4	0.002456873	48	0.0693	28.2	
Sample Description:		Sensitive Varved Clay: rhythmic layers of dark grey silty clay to clay and light grey clayey silt to silt. Clay layers are approximately 25 mm thick with 6 mm thick silt layers, firm but readily separates on horizontal planes, moist.				
Failure Description:		Brittle failure, bulging of the clay layers only. Silt layer pushed into the clay. No shear planes observed.				





Unconsolidated Undrained Triaxial Test						
Project No.	J494	Project Name	New Liskeard	Moisture Content	Trimming	Sample
Borehole No.	5	Sample Weight, gms	397.3	Tare & Wet	253.3	379.5
Sample No.	TW9	Sample Volume, m <sup>3</sup>	0.000212849	Tare & Dry	197.3	289.6
Sample Depth, ft	81 to 82½	Unit Weight, kN/m <sup>3</sup>	18.3	Tare	1.3	3.3
Sample Depth, m	24.8			MC, %	28.6	31.4
Sample Diameter, mm	51.8			Average	30.0	
Sample Height, mm	101	Ring Id. # S 64-150		Intercept	0	
Initial C/S Area, m <sup>2</sup>	0.002107	Proving Ring Factor	1.444396671			
Change in Height, ins	Strain, %	C/S Area, m <sup>2</sup>	Proving Ring Rdg, div	Applied Load, kN	Stress, kPa	
0	0.0	0.001932205	0	0.0000	0.0	
10	0.3	0.001937077	10	0.0144	7.5	
20	0.5	0.001941973	20	0.0289	14.9	
30	0.8	0.001946894	32	0.0462	23.7	
40	1.0	0.001951839	35	0.0506	25.9	
50	1.3	0.001956811	38	0.0549	28.0	
60	1.5	0.001961807	38	0.0578	29.4	
70	1.8	0.001966829	40	0.0649	27.8	
80	2.0	0.001971877	38	0.0649	27.8	
90	2.3	0.001976951	38	0.0621	31.3	
100	2.5	0.001982051	43	0.0679	34.1	
120	3.0	0.00199233	47	0.0708	35.3	
140	3.5	0.002002717	49	0.0751	37.3	
160	4.0	0.002013212	52	0.0794	39.3	
180	4.5	0.002023818	55	0.0852	41.9	
200	5.0	0.002034536	59	0.0896	43.4	
250	6.3	0.002061835	62	0.0924	44.2	
300	7.5	0.002089877	64	0.0968	45.7	
350	8.8	0.002118692	67	0.1011	47.1	
400	10.1	0.002148313	70	0.1040	47.7	
450	11.3	0.002178773	72	0.1069	48.4	
500	12.6	0.00221011	74	0.1112	49.6	
550	13.8	0.002242361	77	0.1127	49.5	
600	15.1	0.002275568	78	0.1156	50.0	
650	16.3	0.002309773	80	0.1184	50.5	
700	17.6	0.002345022	82	0.1228	51.6	
750	18.9	0.002381363	85	0.1228	50.8	
800	20.1	0.002418849	85	0.1228	50.0	
850	21.4	0.002457533	85			
Sample Description: Sensitive Varved Clay, rhythmic layers of dark grey silty clay to clay and light grey clayey silt to silt. Clay layers are approximately 37 mm thick with 6 mm thick silt layers, firm but readily separates on horizontal planes, wet, soft.						
Failure Description: Bulging of the clay layers only. Silt layer pushed into the clay. No shear planes observed.						
Test Note: Sample tends to bulge under its own weight.						

Unconsolidated Undrained Triaxial Test						
Project No.	J494	Project Name	New Liskeard	Moisture Content	Trimings	Sample
Borehole No.	3	Sample Weight, gms	378.1	Tare & Wet	182.3	380
Sample No.	TW6	Sample Volume, m <sup>3</sup>	0.000212849	Tare & Dry	124.8	277
Sample Depth, ft	76 1/2 to 77 1/2	Unit Weight, kN/m <sup>3</sup>	17.4	Tare	1.3	3.3
Sample Depth, m	23.5			MC, %	46.6	37.6
Sample Diameter, mm	51.8			Average	42.1	
Sample Height, mm	101	Ring Id. # S 64-150		Intercept		0
Initial C/S Area, m <sup>2</sup>	0.002107	Proving Ring Factor	1.444396671			
Change in Height, ins	Strain, %	C/S Area, m <sup>2</sup>	Proving Ring Rdg, div	Applied Load, kN	Stress, kPa	
0	0.0	0.001932205	0	0.0000	0.0	
10	0.3	0.001937077	4	0.0058	3.0	
20	0.5	0.001941973	5	0.0072	3.7	
30	0.8	0.001946894	7	0.0101	5.2	
40	1.0	0.001951839	8	0.0116	5.9	
50	1.3	0.001956811	10	0.0144	7.4	
60	1.5	0.001961807	12	0.0173	8.8	
70	1.8	0.001966829	14	0.0202	10.3	
80	2.0	0.001971877	16	0.0231	11.7	
90	2.3	0.001976951	18	0.0260	13.2	
100	2.5	0.001982051	20	0.0289	14.6	
120	3.0	0.00199233	25	0.0361	18.1	
140	3.5	0.002002717	31	0.0448	22.4	
160	4.0	0.002013212	38	0.0549	27.3	
180	4.5	0.002023818	44	0.0636	31.4	
200	5.0	0.002034536	52	0.0751	36.9	
250	6.3	0.002061835	62	0.0896	43.4	
300	7.5	0.002089877	85	0.1228	58.7	
350	8.8	0.002118692	99	0.1430	67.5	
400	10.1	0.002148313	110	0.1589	74.0	
450	11.3	0.002178773	117	0.1690	77.6	
500	12.6	0.00221011	107	0.1546	69.9	
550	13.8	0.002242361	48	0.0693	30.9	
600	15.1	0.002275568		0.0000	0.0	
650	16.3	0.002309773		0.0000	0.0	
700	17.6	0.002345022		0.0000	0.0	
750	18.9	0.002381363		0.0000	0.0	
800	20.1	0.002418849		0.0000	0.0	
850	21.4	0.002457533		0.0000	0.0	
Sample Description: Sensitive Varved Clay, rhythmic layers of dark grey silty clay to clay and light grey clayey silt to silt. Clay layers are approximately 37 mm thick with < 6 mm thick silt layers, firm but readily separates on horizontal planes, wet, soft.						
Failure Description: Bulging of the clay layers only. Silt layer pushed into the clay. No shear planes observed. Sudden or brittle failure after 10 % strain.						

Unconsolidated Undrained Triaxial Test						
Project No.:	J494	Project Name	New Liskeard	Moisture Content	Trimming	Sample
Borehole No.	3	Sample Weight, gms	348.1	Tare & Wet	166.9	344
Sample No.	TVV4	Sample Volume, m <sup>3</sup>	0.000213059	Tare & Dry	120	234.8
Sample Depth, ft	55 to 56 1/2	Unit Weight, kN/m <sup>3</sup>	16.0	Tare	13	3.3
Sample Depth, m	17.0			MC, %	39.5	47.2
Sample Diameter, mm	51.8	Ring Id. # S 64-150		Average	43.3	
Sample Height, mm	101.1	Proving Ring Factor	1.444398671	Intercept	0	
Initial C/S Area, m <sup>2</sup>	0.002107					
Change in Height, ins	Strain, %	C/S Area, m <sup>2</sup>	Proving Ring Rdg, div	Applied Load, kN	Stress, kPa	
0	0.0	0.001932205	0	0.0000	0.0	
10	0.3	0.001937077	2	0.0029	1.5	
20	0.5	0.001941973	4	0.0058	3.0	
30	0.8	0.001946894	6	0.0087	4.5	
40	1.0	0.001951839	8	0.0116	5.9	
50	1.3	0.001956811	10	0.0144	7.4	
60	1.5	0.001961807	11	0.0159	8.1	
70	1.8	0.001966829	13	0.0188	9.5	
80	2.0	0.001971877	15	0.0217	11.0	
90	2.3	0.001976951	17	0.0246	12.4	
100	2.5	0.001982051	19	0.0274	13.8	
120	3.0	0.00199233	23	0.0332	16.7	
140	3.5	0.002002717	27	0.0390	19.5	
160	4.0	0.002013212	27	0.0390	19.4	
180	4.5	0.002023818	30	0.0433	21.4	
200	5.0	0.002034536	32	0.0462	22.7	
250	6.3	0.002061835	39	0.0563	27.3	
300	7.5	0.002089877	44	0.0636	30.4	
350	8.8	0.002118692	45	0.0650	30.7	
400	10.1	0.002148313	40	0.0578	26.9	
450	11.3	0.002178773	30	0.0433	19.9	
500	12.6	0.00221011	29	0.0419	19.0	
550	13.8	0.002242361	5	0.0072	3.2	
600	15.1	0.002275568		0.0000	0.0	
650	16.3	0.002309773		0.0000	0.0	
700	17.6	0.002345022		0.0000	0.0	
750	18.9	0.002381363		0.0000	0.0	
800	20.1	0.002418949		0.0000	0.0	
850	21.4	0.002457533		0.0000	0.0	
Sample Description: Sensitive Varved Clay: rhythmic layers of dark grey silty clay to clay and light grey clayey silt to silt. Clay layers are approximately 25 mm thick with 6 mm thick silt layers, firm but readily separates on horizontal planes, wet, soft.						
Failure Description: Bulging of the clay layers only. Silt layer pushed into the clay. No shear planes observed.						

SAMPLE NUMBER: 2946/1

PROJECT NUMBER: SP3012

PROJECT: New Liskard

CONTRACT:

CLIENT: Ministry of Transportation

CONTRACTOR:

PROJECT MANAGER:

PROJECT SITE:

SAMPLED BY: T. Bhatti

DATE SAMPLED: 9/30/99

SUPPLIER:

SAMPLE LOCATION: DB#1 (11.43-11.8 m)

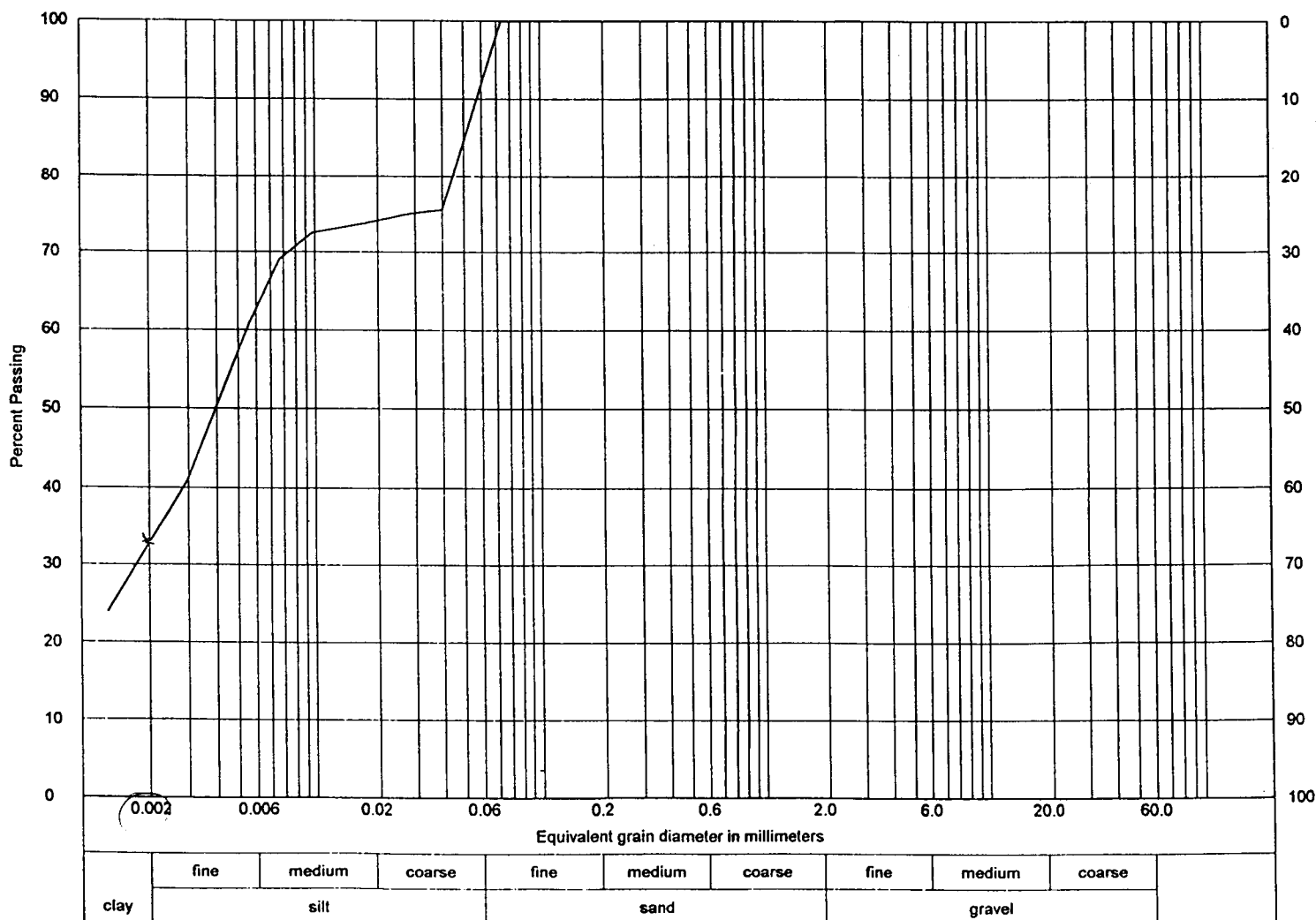
DESCRIPTION: Clayey silt

PROPOSED USE:

DATE TESTED: 11/21/99

SPECIFICATION: Hydrometer

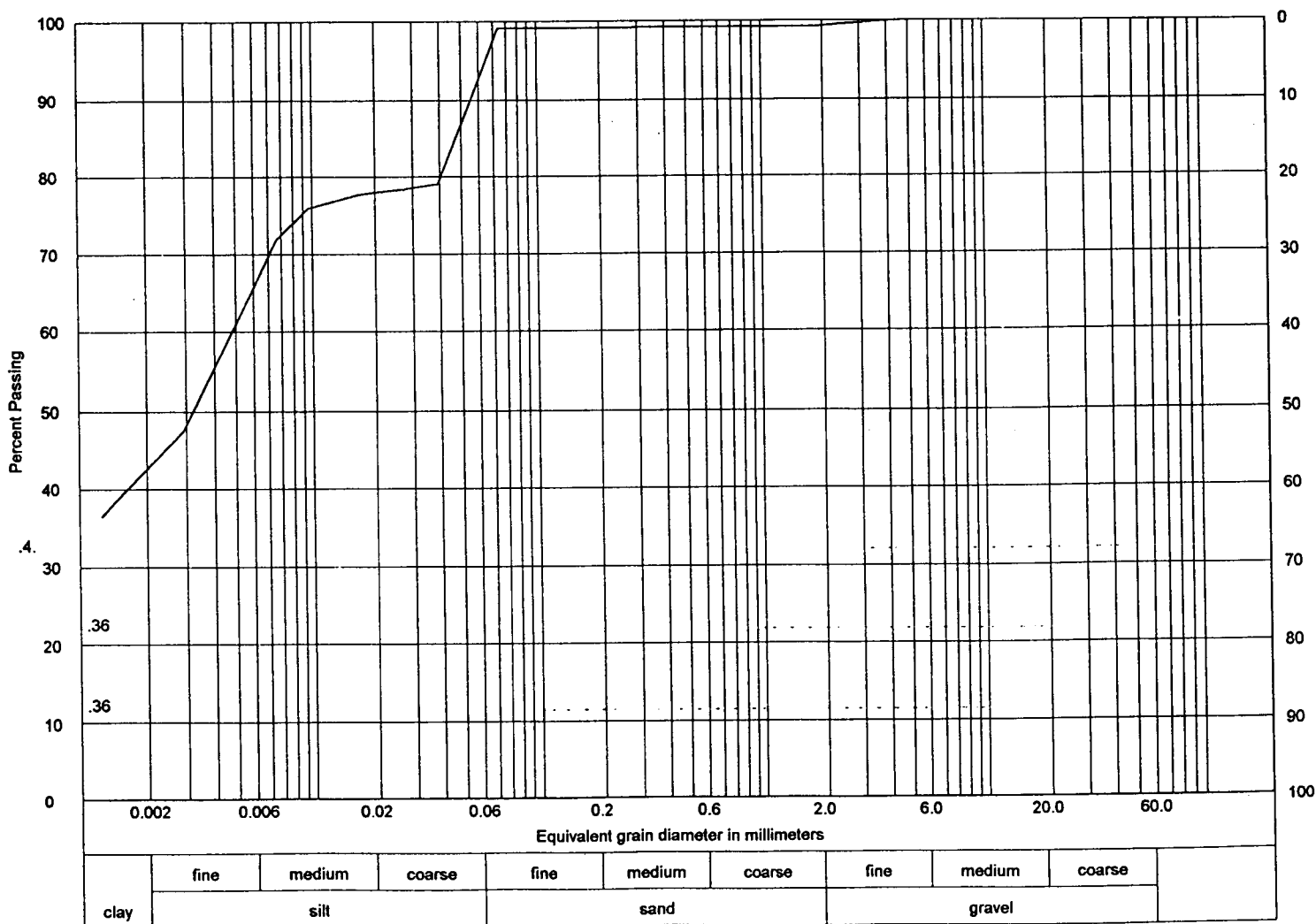
SIEVE SIZE	PERCENT PASSING	SPECIFICATION
19.0 mm	100.0	
16.0 mm	100.0	
13.2 mm	100.0	
9.5 mm	100.0	
4.75 mm	100.0	
2.36 mm	100.0	
2.00 mm	100.0	
1.18 mm	100.0	
600 mic	100.0	
300 mic	100.0	
150 mic	99.9	
75 mic	99.9	



COMMENTS

**SAMPLE NUMBER:** 2946/3  
**PROJECT NUMBER:** SP3012  
**PROJECT:** New Liskard  
**CONTRACT:**  
**CLIENT:** Ministry of Transportation  
**CONTRACTOR:**  
**PROJECT MANAGER:**  
**PROJECT SITE:**  
**SAMPLED BY:** T. Bhatti  
**DATE SAMPLED:** 9/30/99  
**SUPPLIER:**  
**SAMPLE LOCATION:** DB# 2 SB-5 (10.67-11.13m)  
**DESCRIPTION:** Clay and silt, trace sand  
**PROPOSED USE:**  
**DATE TESTED:** 11/21/99  
**SPECIFICATION:** Hydrometer

SIEVE SIZE	PERCENT PASSING	SPECIFICATION
19.0 mm	100.0	
16.0 mm	100.0	
13.2 mm	100.0	
9.5 mm	100.0	
4.75 mm	100.0	
2.36 mm	99.5	
2.00 mm	99.2	
1.18 mm	99.2	
600 mic	99.2	
300 mic	99.2	
150 mic	99.1	
75 mic	99.1	



COMMENTS

SAMPLE NUMBER: 2946/4

PROJECT NUMBER: SP3012

PROJECT: New Liskard

CONTRACT:

CLIENT: Ministry of Transportation

CONTRACTOR:

PROJECT MANAGER:

PROJECT SITE:

SAMPLED BY: T. Bhatti

DATE SAMPLED: 9/30/99

SUPPLIER:

SAMPLE LOCATION: DB# 2 SB-9 (24.4-24.76m)

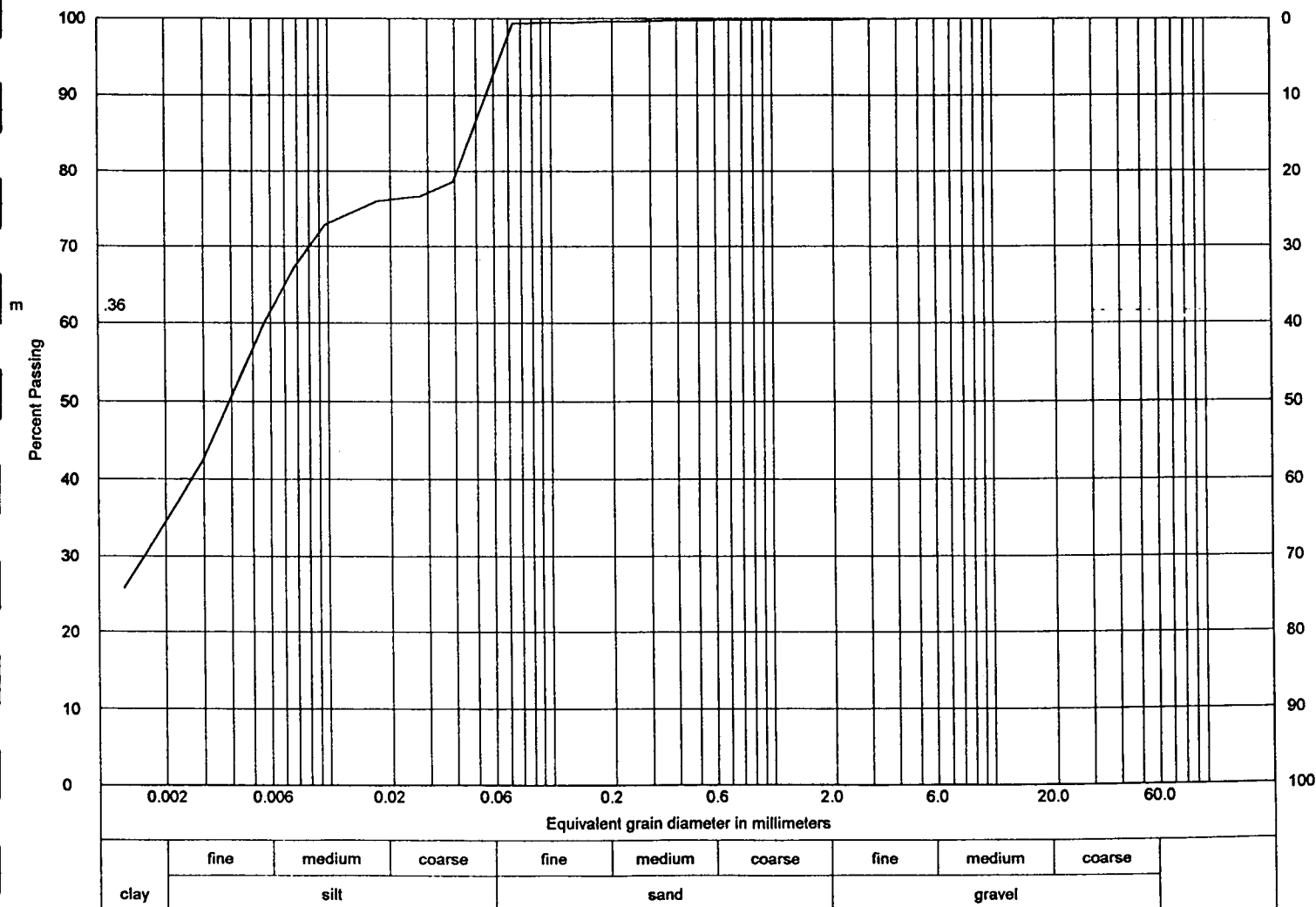
DESCRIPTION: Clay and silt, trace sand

PROPOSED USE:

DATE TESTED: 11/21/99

SPECIFICATION: Hydrometer

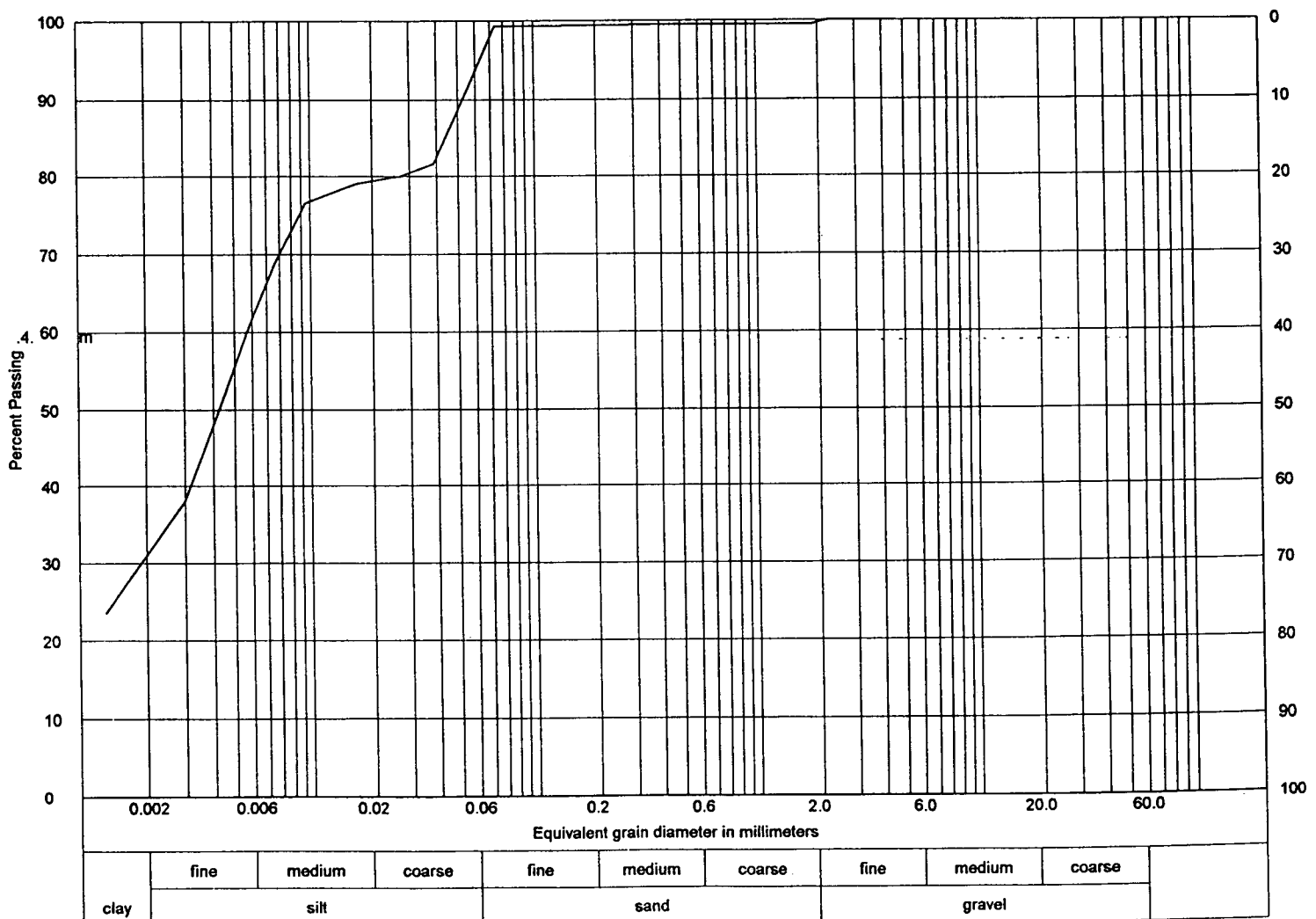
SIEVE SIZE	PERCENT PASSING	SPECIFICATION
19.0 mm	100.0	
16.0 mm	100.0	
13.2 mm	100.0	
9.5 mm	100.0	
4.75 mm	100.0	
2.36 mm	99.9	
2.00 mm	99.8	
1.18 mm	99.8	
600 mic	99.8	
300 mic	99.6	
150 mic	99.5	
75 mic	99.3	



COMMENTS

SAMPLE NUMBER: 2946/5  
PROJECT NUMBER: SP3012  
PROJECT: New Liskard  
CONTRACT:  
CLIENT: Ministry of Transportation  
CONTRACTOR:  
PROJECT MANAGER:  
PROJECT SITE:  
SAMPLED BY: T. Bhatti  
DATE SAMPLED: 9/30/99  
SUPPLIER:  
SAMPLE LOCATION: DB# 3 SB-4 (16.77-17.23m)  
DESCRIPTION: Clay and silt, trace sand  
PROPOSED USE:  
DATE TESTED: 11/21/99  
SPECIFICATION: Hydrometer

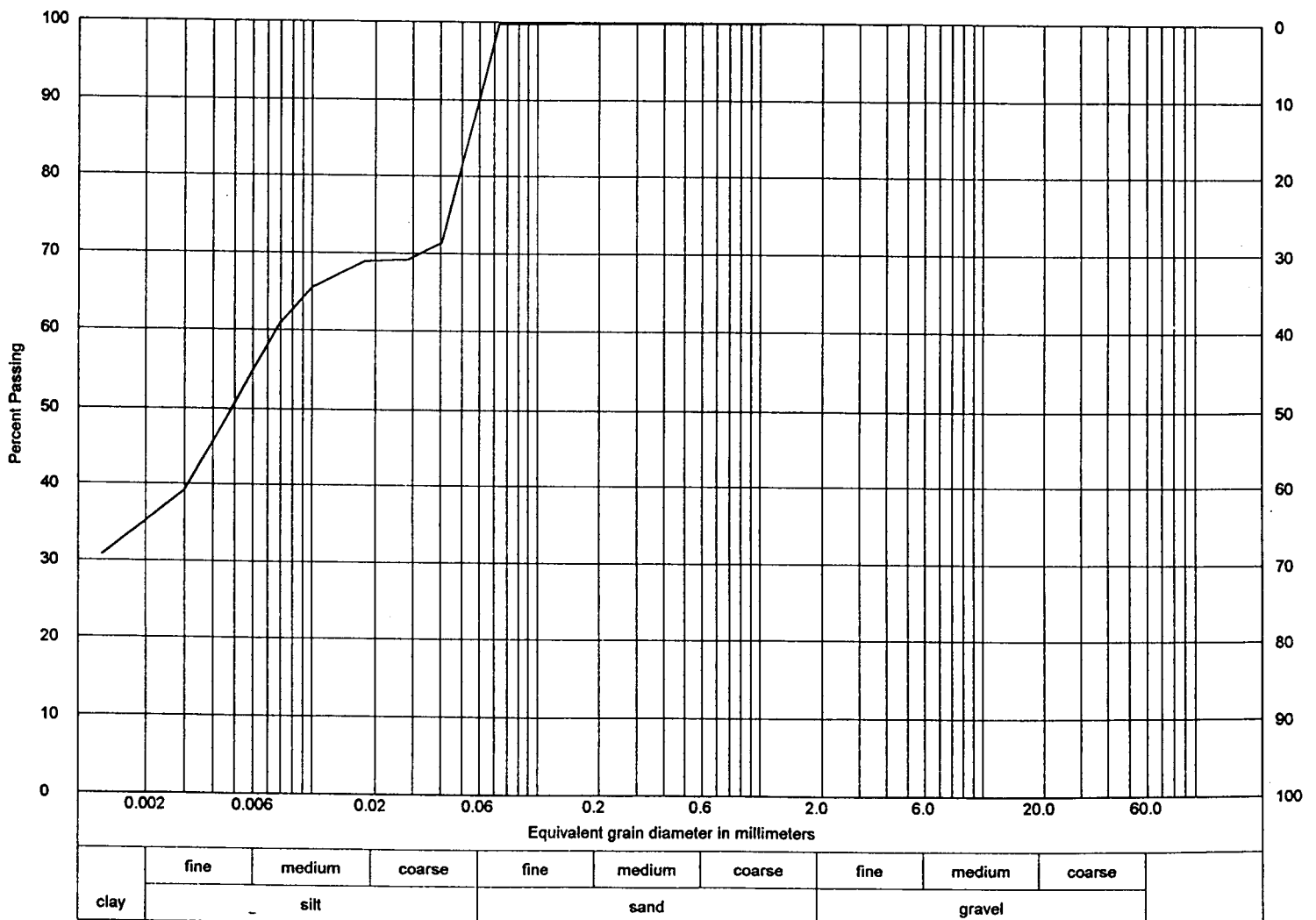
SIEVE SIZE	PERCENT PASSING	SPECIFICATION
19.0 mm	100.0	
16.0 mm	100.0	
13.2 mm	100.0	
9.5 mm	100.0	
4.75 mm	100.0	
2.36 mm	100.0	
2.00 mm	99.5	
1.18 mm	99.5	
600 mic	99.5	
300 mic	99.4	
150 mic	99.4	
75 mic	99.3	



COMMENTS

SAMPLE NUMBER: 2946/6  
 PROJECT NUMBER: SP3012  
 PROJECT: New Liskard  
 CONTRACT:  
 CLIENT: Ministry of Transportation  
 CONTRACTOR:  
 PROJECT MANAGER:  
 PROJECT SITE:  
 SAMPLED BY: T. Bhatti  
 DATE SAMPLED: 9/30/99  
 SUPPLIER:  
 SAMPLE LOCATION: DB# 3 SB-6 (23.18-23.64m)  
 DESCRIPTION: Clay and silt, trace sand  
 PROPOSED USE:  
 DATE TESTED: 11/21/99  
 SPECIFICATION: Hydrometer

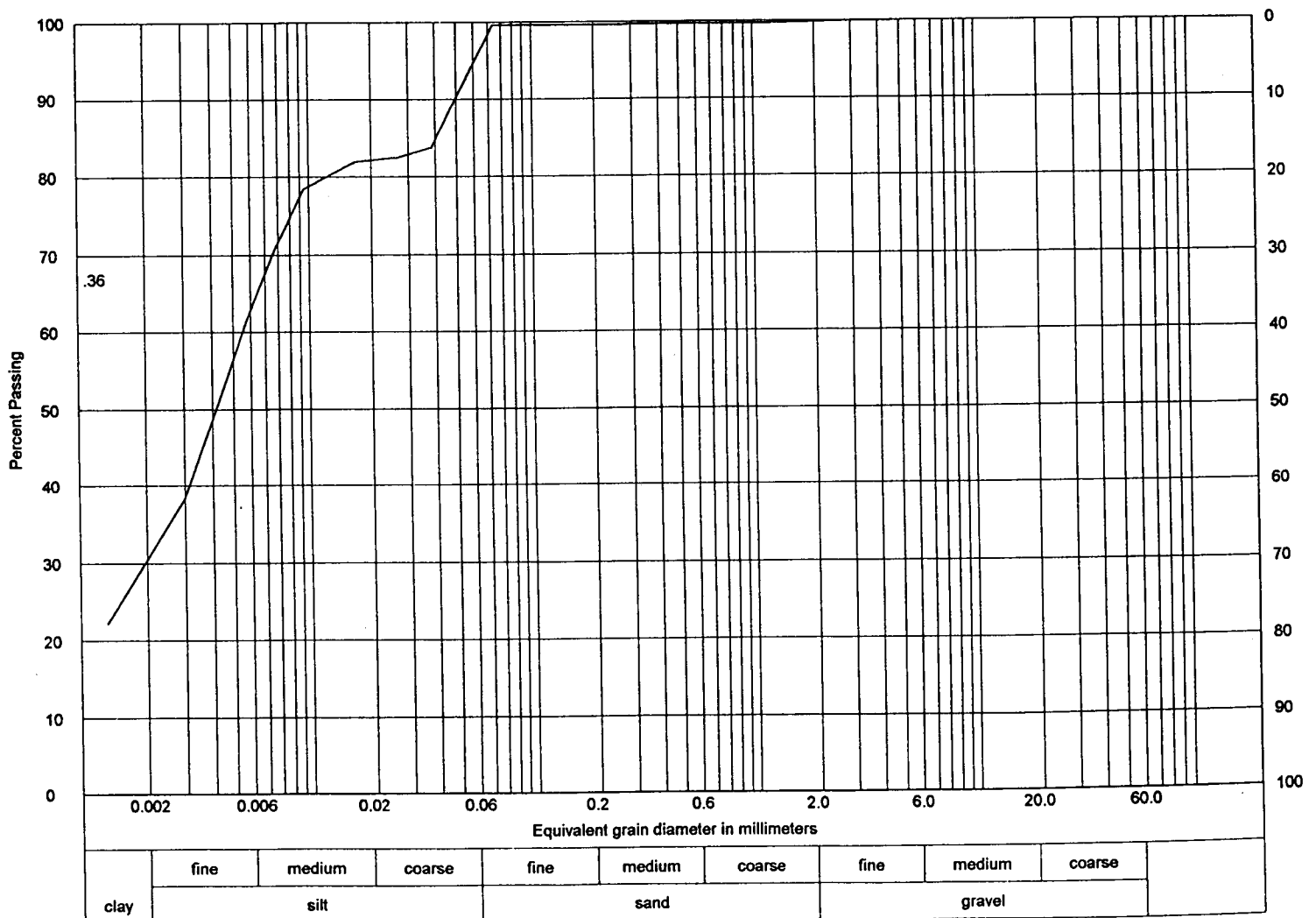
SIEVE SIZE	PERCENT PASSING	SPECIFICATION
19.0 mm	100.0	
16.0 mm	100.0	
13.2 mm	100.0	
9.5 mm	100.0	
4.75 mm	100.0	
2.36 mm	100.0	
2.00 mm	100.0	
1.18 mm	99.9	
600 mic	99.9	
300 mic	99.8	
150 mic	99.8	
75 mic	99.7	



COMMENTS

**SAMPLE NUMBER:** 2946/7  
**PROJECT NUMBER:** SP3012  
**PROJECT:** New Liskard  
**CONTRACT:**  
**CLIENT:** Ministry of Transportation  
**CONTRACTOR:**  
**PROJECT MANAGER:**  
**PROJECT SITE:**  
**SAMPLED BY:** T. Bhatti  
**DATE SAMPLED:** 8/31/99  
**SUPPLIER:**  
**SAMPLE LOCATION:** DB# 4 SB-4 (20.58-21.04m)  
**DESCRIPTION:** Clayey silt, trace sand  
**PROPOSED USE:**  
**DATE TESTED:** 11/21/99  
**SPECIFICATION:** Hydrometer

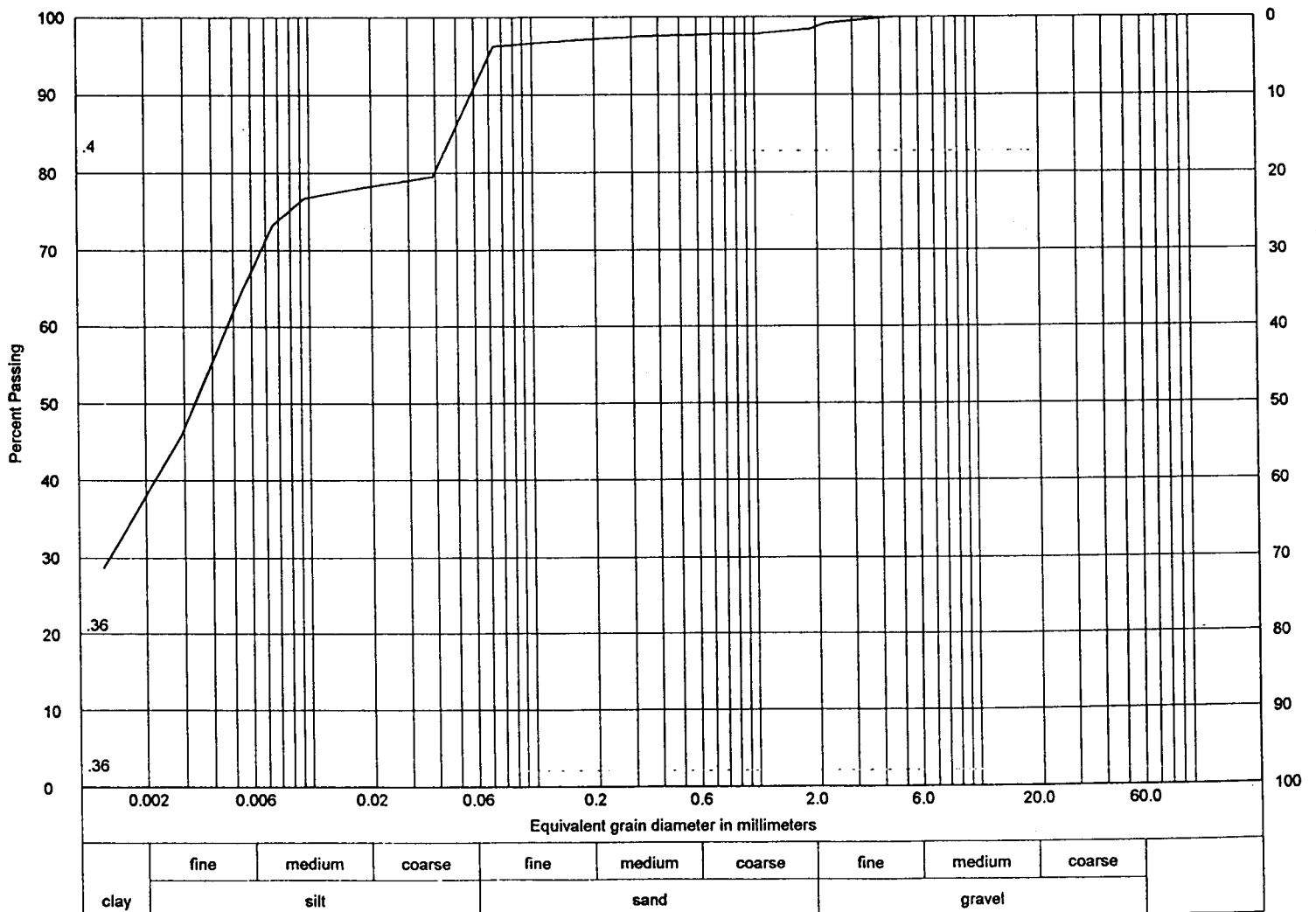
SIEVE SIZE	PERCENT PASSING	SPECIFICATION
19.0 mm	100.0	
16.0 mm	100.0	
13.2 mm	100.0	
9.5 mm	100.0	
4.75 mm	100.0	
2.36 mm	99.8	
2.00 mm	99.8	
1.18 mm	99.7	
600 mic	99.7	
300 mic	99.6	
150 mic	99.6	
75 mic	99.6	



COMMENTS

SAMPLE NUMBER: 2946/8  
 PROJECT NUMBER: SP3012  
 PROJECT: New Liskard  
 CONTRACT:  
 CLIENT: Ministry of Transportation  
 CONTRACTOR:  
 PROJECT MANAGER:  
 PROJECT SITE:  
 SAMPLED BY: T. Bhatti  
 DATE SAMPLED: 8/31/99  
 SUPPLIER:  
 SAMPLE LOCATION: DB# 5 SB-3 (13.72-14.18m)  
 DESCRIPTION: Clay and sil, trace sand  
 PROPOSED USE:  
 DATE TESTED: 11/21/99  
 SPECIFICATION: Hydrometer

SIEVE SIZE	PERCENT PASSING	SPECIFICATION
19.0 mm	100.0	
16.0 mm	100.0	
13.2 mm	100.0	
9.5 mm	100.0	
4.75 mm	100.0	
2.36 mm	99.2	
2.00 mm	98.4	
1.18 mm	97.8	
600 mic	97.7	
300 mic	97.4	
150 mic	96.9	
75 mic	96.2	



COMMENTS

SAMPLE NUMBER: 2946/9

PROJECT NUMBER: SP3012

PROJECT: New Liskard

CONTRACT:

CLIENT: Ministry of Transportation

CONTRACTOR:

PROJECT MANAGER:

PROJECT SITE:

SAMPLED BY: T. Bhatti

DATE SAMPLED: 8/31/99

SUPPLIER:

SAMPLE LOCATION: DB# 5 SB-9 (24.4-24.85m)

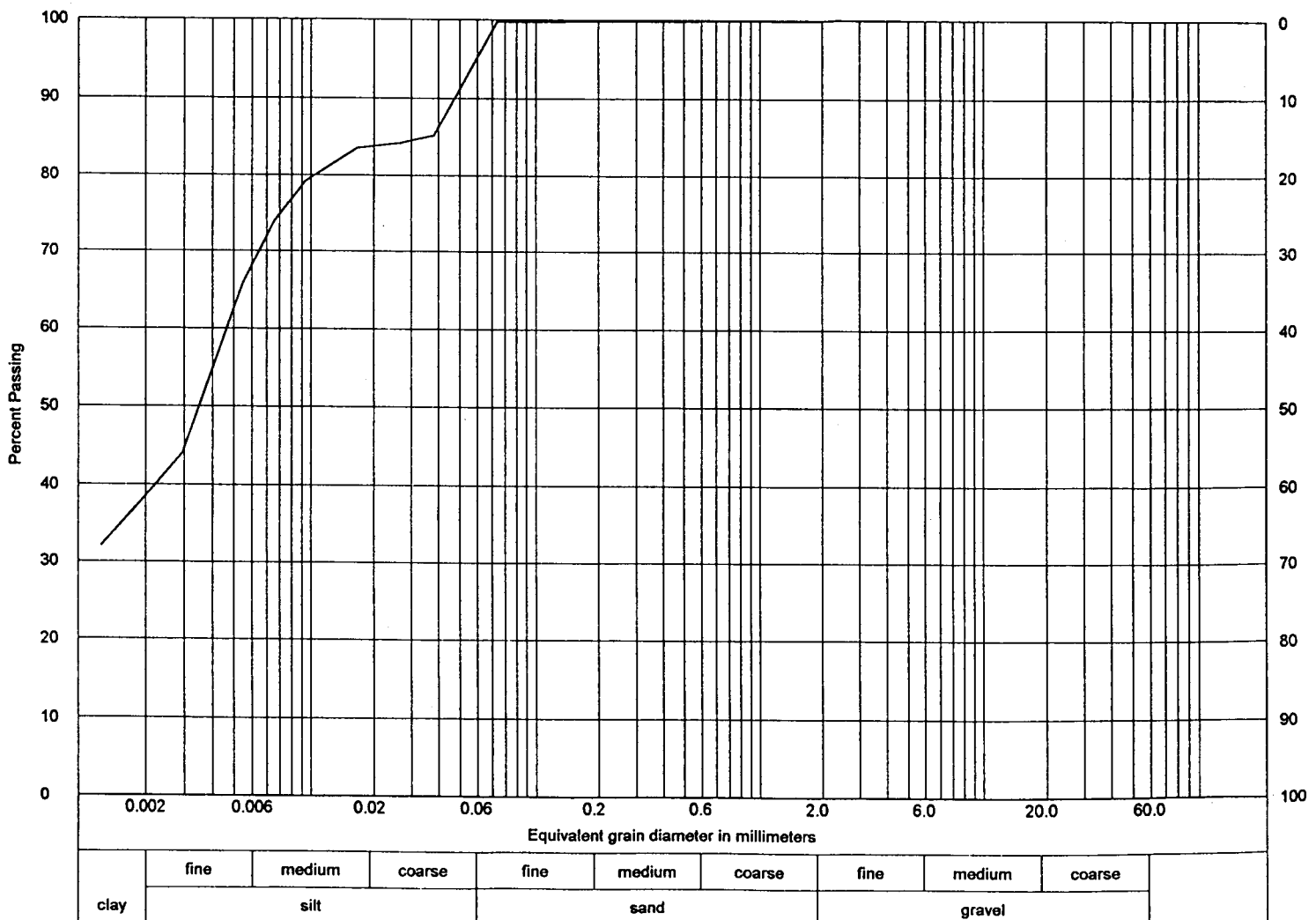
DESCRIPTION: Clay and silt, trace sand

PROPOSED USE:

DATE TESTED: 11/21/99

SPECIFICATION: Hydrometer

SIEVE SIZE	PERCENT PASSING	SPECIFICATION
19.0 mm	100.0	
16.0 mm	100.0	
13.2 mm	100.0	
9.5 mm	100.0	
4.75 mm	100.0	
2.36 mm	100.0	
2.00 mm	99.8	
1.18 mm	99.8	
600 mic	99.8	
300 mic	99.8	
150 mic	99.8	
75 mic	99.7	



COMMENTS