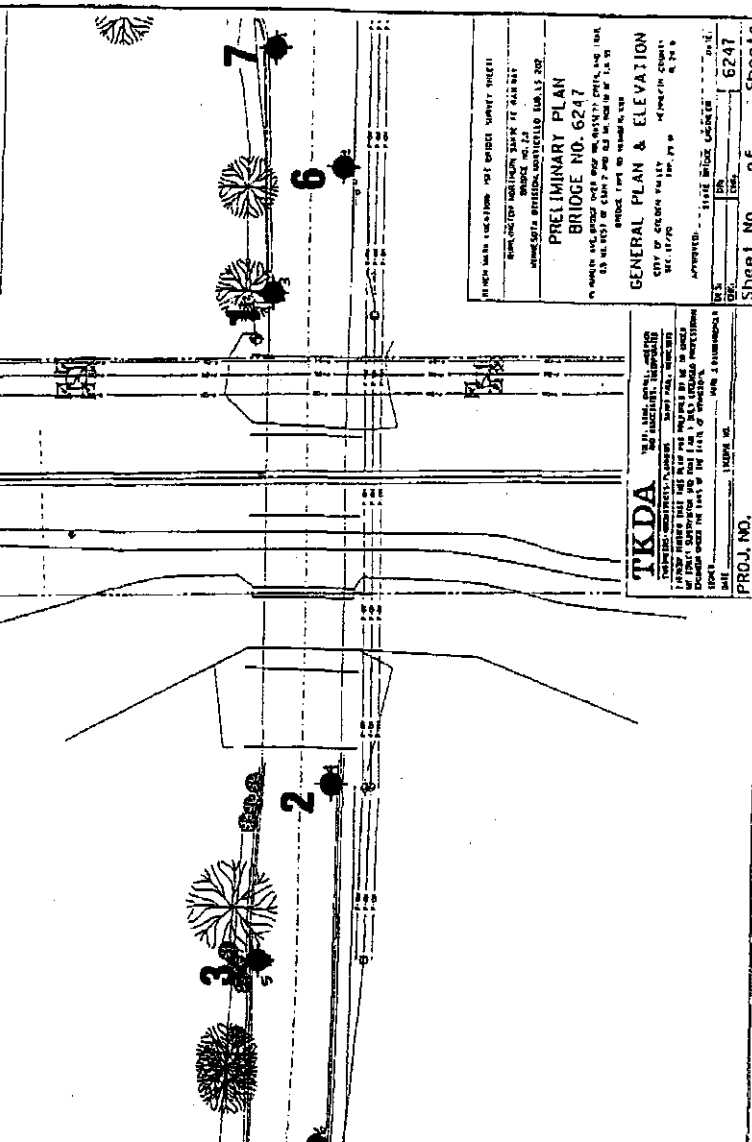


PROJ. NO.
DESIGN DATA
 DESIGNER: TPKDA
 CHECKED: J. J. JENSEN
 DATE: 11/12/02
 SCALE: AS SHOWN
 SHEET NO. 6247 OF 6247



PROJ. NO. _____ of _____ Sheets
 SHEET NO. 6247

TKDA
 TPKDA ENGINEERING, INC.
 11000 UNIVERSITY AVENUE, SUITE 100
 GOLDEN VALLEY, MINNESOTA 55426
 PHONE: 763-438-1100
 FAX: 763-438-1101
 WWW.TPKDA.COM

PRELIMINARY PLAN
 BRIDGE NO. 6247
 GENERAL PLAN & ELEVATION
 CITY OF GOLDEN VALLEY
 11/12/02

CONSTRUCTION NOTES:
 1. THE WORK SHOWN ON THIS DRAWING IS THE RESULT OF FIELD SURVEYING AND INVESTIGATION.
 2. THE WORK SHOWN ON THIS DRAWING IS THE RESULT OF FIELD SURVEYING AND INVESTIGATION.
 3. THE WORK SHOWN ON THIS DRAWING IS THE RESULT OF FIELD SURVEYING AND INVESTIGATION.
 4. THE WORK SHOWN ON THIS DRAWING IS THE RESULT OF FIELD SURVEYING AND INVESTIGATION.
 5. THE WORK SHOWN ON THIS DRAWING IS THE RESULT OF FIELD SURVEYING AND INVESTIGATION.

PROJECT	PLYMOUTH AVENUE BRIDGE OVER BNSF RAILROAD Golden Valley, Minnesota	
SUBJECT	Boring Locations	
SCALE	None	CHECKED BY
		DRAWN BY SDK

AMERICAN ENGINEERING TESTING, INC.

AET JOB NO. 01-0141J
 DATE November 12, 2002
Figure 1



AMERICAN
ENGINEERING
TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: 01-01411 LOG OF BORING NO. 1 (p. 1 of 3)
 PROJECT: Plymouth Avenue Bridge Over BNSF Railroad; Golden Valley, MN

DEPTH IN FEET	SURFACE ELEVATION: <u>853.6</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-200	
1	Fill, mostly silty sand with gravel, black	FILL										
2												
3	Fill, mostly silty sand, a little gravel, limestone and sand, dark brown and brown		28	M		SS	18					
4												
5			8	M		SS	18					
6	Fill, mostly sandy lean clay, a little gravel, brown											
7			4	M		SS	18					
8												
9												
10	Fill, mixture of silty sand and cinders, brown and dark brown		4	M		SS	18					
11												
12			5	M		SS	8					
13												
14	Fill, mostly sandy lean clay, a little gravel, brown and dark brown		5	M		SS	18					
15												
16												
17			6	M		SS	10					
18												
19			6	M		SS	12					
20												
21												
22												
23	Fill, mixture of lean clay and sandy lean clay, a little gravel, reddish brown and brown				TW	11						
24												
25		6	M		SS	18						
26												
27		5	M		SS	18						
28												
29												
30		4	M		SS	18						
31												
32												
33												
34												
35		68	M		SS	18						
36												
37												
38	Fill, mostly sandy lean clay, a little gravel, brown and light gray											
39												
40		8	M		SS	18						
41												
42												
43												
44	Organic clay, black, firm (OH)											
45												
46	Lean clay, gray, firm (CL)											
47												
48	Organic clay with shells, dark gray and dark brown, firm (OH/PT)											
49												

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-49½'	3.25" HSA								
49½-155½'	RD w/DM	10/9/02	1:08	51.0	49.5	50.7		45.2	
Bentonite	Grout								
BORING COMPLETED:	10/9/02								
CC: JS	CA: DS	Rig: 91							



SUBSURFACE BORING LOG

AET JOB NO: 01-01411

LOG OF BORING NO. 1 (p. 2 of 3)

PROJECT: Plymouth Avenue Bridge Over BNSF Railroad; Golden Valley, MN

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-200
51	Organic clay with shells, dark gray and dark brown, firm (OH/PT)	SWAMP DEPOSIT	6	M	SS	18	92				
52											
53											
54	Organic clay, black, firm (OH)	SWAMP DEPOSIT	7	M	SS	18					
55											
56											
57											
58											
59											
60	Sand with silt, a little gravel, medium grained, brown, waterbearing, loose (SP-SM)	COARSE ALLUVIUM	8	W	SS	18					
61											
62											
63	Lean clay, a little gravel, brown, stiff (CL)	MIXED ALLUVIUM	12	M	SS	18					
64											
65											
66	Lean clay, dark gray, firm, laminations of silt and waterbearing sand (CL)	FINE ALLUVIUM	7	W	SS	18	37				
67											
68											
69											
70											
71											
72	Silt, gray, wet, loose, lenses of waterbearing sand (ML)	FINE ALLUVIUM	7	W	SS	18					
73											
74											
75	Sandy lean clay, a little gravel, brown, stiff, lenses of waterbearing sand (CL)	MIXED ALLUVIUM	17	W	SS	18					
76											
77											
78											
79											
80	Sandy lean clay, a little gravel, reddish brown and gray mottled, very stiff (CL)	TILL	18	M	SS	18					
81											
82											
83											
84											
85	Lean clay, brown, very stiff (CL)	FINE ALLUVIUM	19	M	SS	18					
86											
87											
88											
89											
90			18	M	SS	18					
91											
92											
93											
94											
95			19	M	SS	18					
96											
97											
98											
99											
100			19	M	SS	18					
101											
102											
103											
104											
105			16	M	SS	18					
106											
107											
108											



AMERICAN
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TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: 01-01411

LOG OF BORING NO. 1 (p. 3 of 3)

PROJECT: Plymouth Avenue Bridge Over BNSF Railroad; Golden Valley, MN

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-200	
110	Sand, a little gravel, apparent cobbles, medium grained, brown, waterbearing, medium dense (SP)		19	W	X	SS	10					
111												
112												
113												
114												
115	Sand, fine grained, brown, waterbearing, dense to loose, some lenses of silty sand below about 13.5' (SP)	COARSE ALLUVIUM	35	W	X	SS	18					
116												
117												
118												
119												
120												
121												
122												
123												
124												
125	Sand, a little gravel, medium grained, brown, waterbearing, medium dense (SP)		19	W	X	SS	18					
126												
127												
128												
129												
130	Clayey sand, a little gravel, brown, very stiff, lenses of waterbearing sand (SC)	MIXED ALLUVIUM	12	W	X	SS	18					
131												
132												
133												
134												
135	Sandstone, tan to white, waterbearing	ST. PETER FORMATION	10	W	X	SS	18					
136												
137												
138												
139												
140	Sand, a little gravel, medium grained, brown, waterbearing, medium dense (SP)		52	W	X	SS	18					
141												
142												
143												
144												
145	Sandstone, tan to white, waterbearing		67	W	X	SS	18					
146												
147												
148												
149												
150	END OF BORING	*FINE ALLUVIUM	100/5	W	X	SS	-					
151												
152												
153												
154												
155												



SUBSURFACE BORING LOG

AET JOB NO: 01-01411

LOG OF BORING NO. 2 (p. 1 of 3)

PROJECT: Plymouth Avenue Bridge Over BNSF Railroad; Golden Valley, MN

DEPTH IN FEET	SURFACE ELEVATION: <u>851.6</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS								
							WC	DEN	LL	PL	%-200				
1	3" Bituminous pavement														
2	Fill, mostly silty sand with gravel, dark brown														
3	Fill, mostly silty sand, pieces of limestone and bituminous pavement, brown and black		25	M	SS	10									
4															
5	Fill, mostly sandy lean clay, a little gravel, brown, a little dark brown		7	M	SS	18									
6															
7	Fill, mixture of sandy lean clay, clayey sand and silty sand, a little gravel, brown		3	M	SS	18									
8															
9	Fill, mostly silty sand with cinders, a little gravel, dark brown		2	M	SS	12									
10															
11															
12															
13			1½	M	SS	18									
14															
15	Fill, mostly silty sand, a little lean clay, brown, a little dark brown		2	M	SS	18									
16															
17															
18			4	M	SS	18									
19															
20		FILL	5	M	SS	18									
21															
22															
23			5	M	SS	18									
24															
25	Fill, mixture of sandy lean clay and lean clay, a little gravel and silty sand, brown, a little dark brown		7	M	SS	18									
26															
27															
28			8	M	SS	18									
29															
30			5	M	SS	18									
31															
32															
33			11	M	SS	18									
34															
35			6	M	SS	18									
36															
37			7	M	SS	18									
38															
39			6	M	SS	18									
40															
41															
42															
43	Organic clay, black, very soft (OH/PT)	SWAMP DEPOSIT													
44															
45	Sand, medium grained, brown, waterbearing, very loose (SP)	COARSE ALLUVIUM	2	W	SS	18	94								
46															
47	Organic clay with shells, gray, very soft (OH/PT)	SWAMP DEPOSIT													
48															
49	Lean clay, a little wood, lenses of black, gray, firm (CL)	FINE ALLUVIUM													

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
0-44½'	3.25" HSA								
44½'-130'	RD w/DM	10/11/02	10:30	46.0	44.5				36.7
Bentonite	Grout								
BORING COMPLETED:	10/14/02								
CC: JS	CA: DS	Rig: 91							



AMERICAN
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SUBSURFACE BORING LOG

AET JOB NO: 01-01411

LOG OF BORING NO. 2 (p. 2 of 3)

PROJECT: Plymouth Avenue Bridge Over BNSF Railroad; Golden Valley, MN

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-200	
51	Lean clay, a little wood, lenses of black, gray, firm (CL)	FINE ALLUVIUM	6	M	SS	18	56					
52												
53												
54	Sand with silt, a little gravel, medium grained, gray, waterbearing, medium dense (SP-SM)	COARSE ALLUVIUM	11	W	SS	18						
55												
56												
57	Lean clay, a little gravel, gray, stiff (CL)	MIXED ALLUVIUM OR WEATHERED TILL	11	M	SS	18	28					
58												
59												
60	Sandy lean clay, a little gravel, gray, stiff (CL)	TILL	9	M	SS	18						
61												
62												
63	Silty sand, a little gravel, brown, wet medium dense, lenses of waterbearing sand (SM)	TILL OR MIXED ALLUVIUM	23	W	SS	18						
64												
65												
66	Sandy lean clay, a little gravel, brown to gray, very stiff (CL)	TILL	26	M	SS	18						
67												
68												
69			19	M	SS	18						
70												
71												
72	Lean clay, brown, very stiff (CL)	FINE ALLUVIUM	21	M	SS	18						
73												
74												
75	Sand with silt, a little gravel, medium grained, brown, waterbearing, loose (SP-SM)		9	W	SS	18						
76												
77												
78	Sand with gravel, medium grained, brown, waterbearing, medium dense (SP)	COARSE ALLUVIUM	11	W	SS	18						
79												
80												
81			16	W	SS	8						
82												
83												
84	Gravel with sand, brown, waterbearing, medium dense (GP)											
85												
86												
87												
88												
89												
90												
91												
92												
93												
94												
95												
96												
97												
98												
99												
100												
101												
102												
103												
104												
105												
106												
107												
108												



SUBSURFACE BORING LOG

AET JOB NO: 01-01411

LOG OF BORING NO. 2 (p. 3 of 3)

PROJECT: Plymouth Avenue Bridge Over BNSF Railroad; Golden Valley, MN

DEPTH IN FEET	MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-200
110	Gravel with sand, brown, waterbearing, medium dense (GP)		19	W	SS	10					
111											
112	No samples taken, action of drilling rig indicated very gravelly material and drilling fluid could not keep boring hole from caving in										
113											
114											
115											
116											
117											
118											
119											
120											
121											
122											
123											
124											
125											
126											
127											
128											
129											
130	END OF BORING										



**AMERICAN
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TESTING, INC.**

SUBSURFACE BORING LOG

AET JOB NO: 01-01411 LOG OF BORING NO. 3 (p. 1 of 1)
 PROJECT: Plymouth Avenue Bridge Over BNSF Railroad; Golden Valley, MN

DEPTH IN FEET	SURFACE ELEVATION: <u>846.7</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-200	
1	6" Bituminous pavement	FILL	15	M	X X X X X X X	SS	18					
2	Fill, mostly silty sand with gravel, dark brown											
3	Fill, mixture of lean clay and silty sand, a little gravel, brown and dark brown											
4	Fill, mostly lean clay, brown and dark brown											
5	Fill, mostly sandy lean clay, a little gravel, brown											
6	Fill, mostly sandy lean clay, a little gravel, brown											
7	Fill, mostly sand with cinders, brown and dark brown											
8												
9												
10												
11	END OF BORING											

DEPTH: DRILLING METHOD		WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
0-9½'	3.25" HSA								
BORING COMPLETED: 10/14/02									
CC: JS CA: DS Rig: 91									



**AMERICAN
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SUBSURFACE BORING LOG

AET JOB NO: **01-01411**

LOG OF BORING NO. **4 (p. 1 of 1)**

PROJECT: **Plymouth Avenue Bridge Over BNSF Railroad; Golden Valley, MN**

DEPTH IN FEET	SURFACE ELEVATION: 842.0 MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-200
1	3.5" Bituminous pavement	FILL	6	M	SS	18					27
2	Fill, mostly silty sand with gravel, dark brown										
3	Fill, mixture of clayey sand and silty sand, a little gravel, brown, a little dark brown										
4	Fill, mostly sandy lean clay, a little gravel, brown										
5	Fill, mostly sandy lean clay, a little gravel, brown										
6	Fill, mostly sandy lean clay, a little gravel, brown										
7											
8	Fill, mostly sand with silt, a little gravel and silty sand, brown and dark brown		4	M	SS	18					
9											
10			2	M	SS	18					
11	END OF BORING										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS							NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG
0-9 1/2'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL	WATER LEVEL	
BORING COMPLETED: 10/14/02									
CC: JS CA: DS Rig: 91									



AMERICAN
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TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: 01-01411

LOG OF BORING NO. 5 (p. 1 of 1)

PROJECT: Plymouth Avenue Bridge Over BNSF Railroad; Golden Valley, MN

DEPTH IN FEET	SURFACE ELEVATION: <u>834.9</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS					
							WC	DEN	LL	PL	%-200	
1	6" Bituminous pavement											
2	6" Concrete											
3	Fill, mostly sand, a little gravel, brown and dark brown		10	M	SS	5						
4												
5	Fill, mostly sandy lean clay, a little gravel, brown	FILL	5	M	SS	18						50
6												
7	Fill, mostly sand, a little gravel, brown		2	M	SS	18						
8												
9	Fill, mostly lean clay, brown		2	M	SS	18						
10												
11	END OF BORING											

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
0-9 1/2'	3.25" HSA	DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
BORING COMPLETED: 10/14/02									
CC: JS CA: DS Rig: 91									



AMERICAN
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TESTING, INC.

SUBSURFACE BORING LOG

AET JOB NO: 01-01411

LOG OF BORING NO. 6 (p. 1 of 1)

PROJECT: Plymouth Avenue Bridge Over BNSF Railroad; Golden Valley, MN

DEPTH IN FEET	SURFACE ELEVATION: <u>850.4</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS				
							WC	DEN	LL	PL	%-200
1	2" Bituminous pavement	FILL	5	M	SS	18					
2	Fill, mostly silty sand with gravel, dark brown										
3	Fill, mixture of silty sand and clayey sand, a little gravel, brown, a little dark brown										
4											
5											
6	Fill, mixture of sandy lean clay and lean clay, a little gravel, brown, a little dark brown		3	M	SS	16					
7											
8											
9											
10											
11	END OF BORING										

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
0-9½'	3.25" HSA								
BORING COMPLETED: 10/15/02									
CC: JS CA: DS Rig: 91									



**AMERICAN
ENGINEERING
TESTING, INC.**

SUBSURFACE BORING LOG

AET JOB NO: 01-01411

LOG OF BORING NO. 7 (p. 1 of 1)

PROJECT: Plymouth Avenue Bridge Over BNSF Railroad; Golden Valley, MN

DEPTH IN FEET	SURFACE ELEVATION: <u>848.5</u> MATERIAL DESCRIPTION	GEOLOGY	N	MC	SAMPLE TYPE	REC IN.	FIELD & LABORATORY TESTS							
							WC	DEN	LL	PL	%-200			
1	2.5" Bituminous pavement													
2	Fill, mostly sandy lean clay, some pieces of limestone, dark brown	FILL	5	M	X X X X	SS	18							
3														
4														
5														
6	Fill, mixture of sandy lean clay and lean clay, a little gravel and silty sand, brown, a little dark brown and black													
7														
8														
9														
10														
11	END OF BORING													

DEPTH:	DRILLING METHOD	WATER LEVEL MEASUREMENTS						NOTE: REFER TO THE ATTACHED SHEETS FOR AN EXPLANATION OF TERMINOLOGY ON THIS LOG	
		DATE	TIME	SAMPLED DEPTH	CASING DEPTH	CAVE-IN DEPTH	DRILLING FLUID LEVEL		WATER LEVEL
0-9 1/2'	3.25" HSA								
BORING COMPLETED: 10/15/02									
CC: JS CA: DS Rig: 91									

BORING LOG NOTES

DRILLING AND SAMPLING SYMBOLS

Symbol	Definition
B,H,N:	Size of flush-joint casing
CA:	Crew Assistant (initials)
CAS:	Pipe casing, number indicates nominal diameter in inches
CC:	Crew Chief (initials)
COT:	Clean-out tube
DC:	Drive casing; number indicates diameter in inches
DM:	Drilling mud or bentonite slurry
DR:	Driller (initials)
DS:	Disturbed sample from auger flights
FA:	Flight auger; number indicates outside diameter in inches
HA:	Hand auger; number indicates outside diameter
HSA:	Hollow stem auger; number indicates inside diameter in inches
LG:	Field logger (initials)
MC:	Column used to describe moisture condition of samples and for the ground water level symbols
N (BPF):	Standard penetration resistance (N-value) in blows per foot (see notes)
NQ:	NQ wireline core barrel
PQ:	PQ wireline core barrel
RD:	Rotary drilling with fluid and roller or drag bit
REC:	In split-spoon (see notes) and thin-walled tube sampling, the recovered length (in inches) of sample. In rock coring, the length of core recovered (expressed as percent of the total core run). Zero indicates no sample recovered.
REV:	Revert drilling fluid
SS:	Standard split-spoon sampler (steel; 1 3/8" is inside diameter; 2" outside diameter); unless indicated otherwise
SU:	Spin-up sample from hollow stem auger
TW:	Thin-walled tube; number indicates inside diameter in inches
WASH:	Sample of material obtained by screening returning rotary drilling fluid or by which has collected inside the borehole after "falling" through drilling fluid
WH:	Sampler advanced by static weight of drill rod and 140-pound hammer
WR:	Sampler advanced by static weight of drill rod
94mm:	94 millimeter wireline core barrel
▼:	Water level directly measured in boring
▽:	Estimated water level based solely on sample appearance

TEST SYMBOLS

Symbol	Definition
CONS:	One-dimensional consolidation test
DEN:	Dry density, pcf
DST:	Direct shear test
E:	Pressuremeter Modulus, tsf
HYD:	Hydrometer analysis
LL:	Liquid Limit, %
LP:	Pressuremeter Limit Pressure, tsf
OC:	Organic Content, %
PERM:	Coefficient of permeability (K) test; F - Field; L - Laboratory
PL:	Plastic Limit, %
q _p :	Pocket Penetrometer strength, tsf (<u>approximate</u>)
q _c :	Static cone bearing pressure, tsf
q _u :	Unconfined compressive strength, psf
R:	Electrical Resistivity, ohm-cms
RQD:	Rock Quality Designator in percent (aggregate length of core pieces 4" or more in length as a percent of total core run)
SA:	Sieve analysis
TRX:	Triaxial compression test
VS _R :	Vane shear strength, remoulded (field), psf
VS _U :	Vane shear strength, undisturbed (field), psf
WC:	Water content, as percent of dry weight
%-200:	Percent of material finer than #200 sieve

STANDARD PENETRATION TEST NOTES

The standard penetration test consists of driving the sampler with a 140-pound hammer and counting the number of blows applied in each of three 6" increments of penetration. If the sampler is driven less than 18" (usually in highly resistant material), permitted in ASTM:D1586, the blows for each complete 6" increment and for each partial increment is on the boring log. For partial increments, the number of blows is shown to the nearest 0.1' below the slash.

The length of sample recovered, as shown on the "REC" column, may be greater than the distance indicated in the N column. The disparity is because the N-value is recorded below the initial 6" set (unless partial penetration defined in ASTM:D1586 is encountered) whereas the length of sample recovered is for the entire sampler drive (which may even extend more than 18").

CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES
ASTM Designation: D 2487
 (Based on Unified Soil Classification System)

**AMERICAN ENGINEERING
 TESTING, INC.**

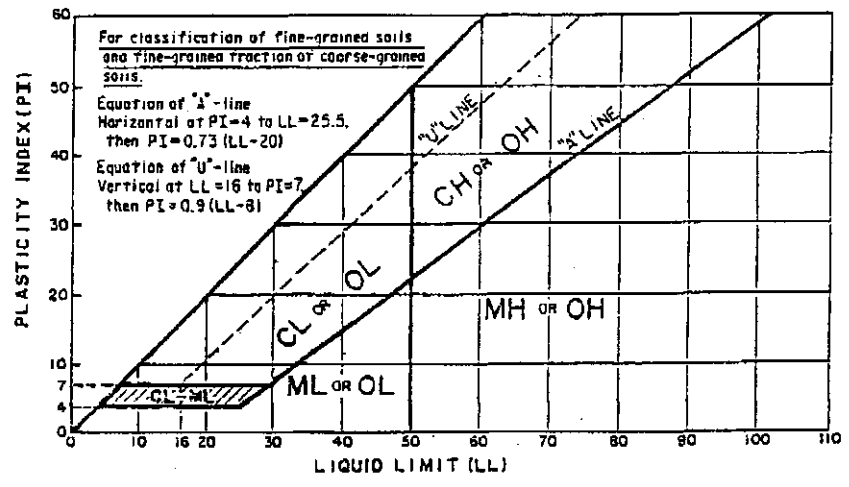
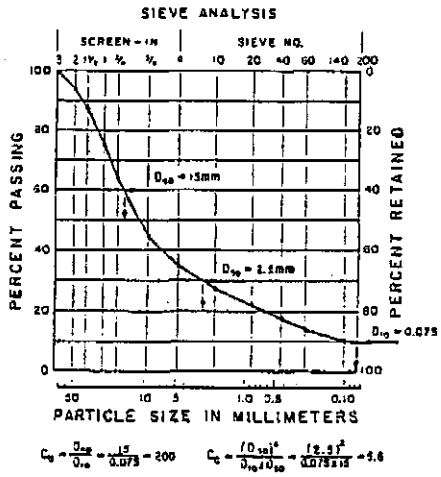
Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests ^A				Soil Classification	
				Group Symbol	Group Name ^B
Coarse-Grained Soils More than 50% retained on No. 200 sieve	Gravels More than 50% coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines ^C	$Cu \geq 4$ and $1 \leq Cc \leq 3^E$	GW	Well graded gravel ^F
			$Cu < 4$ and/or $1 > Cc > 3^E$	GP	Poorly graded gravel ^F
		Gravels with Fines More than 12% fines ^C	Fines classify as ML or MH	GM	Silty gravel ^{F,G,H}
		Fines classify as CL or CH	GC	Clayey gravel ^{F,G,H}	
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines ^D	$Cu \geq 6$ and $1 \leq Cc \leq 3^E$	SW	Well-graded sand ^I
			$Cu < 6$ and/or $1 > Cc > 3^E$	SP	Poorly graded sand ^I
Sands with Fines More than 12% fines ^D		Fines classify as ML or MH	SM	Silty sand ^{G,H,I}	
		Fines classify as CL or CH	SC	Clayey sand ^{G,H,I}	
Fine-Grained Soils 50% or more passes the No. 200 sieve	Silt and Clays Liquid limit less than 50	inorganic	$PI > 7$ and plots on or above "A" line ^J	CL	Lean clay ^{K,L,M}
			$PI < 4$ or plots below "A" line ^J	ML	Silt ^{K,L,M}
		organic	Liquid limit - oven dried < 0.75 Liquid limit - not dried	OL	Organic clay ^{K,L,M,N} Organic silt ^{K,L,M,O}
	Silt and Clays Liquid limit 50 or more	inorganic	PI plots on or above "A" line	CH	Fat clay ^{K,L,M}
			PI plots below "A" line	MH	Elastic silt ^{K,L,M}
		organic	Liquid limit - oven dried < 0.75 Liquid limit - not dried	OH	Organic clay ^{K,L,M,P} Organic silt ^{K,L,M,O}
	Highly organic soils	Primarily organic matter, dark in color, and organic odor		PT	Peat

^ABased on the material passing the 3-in. (75-mm) sieve.
^BIf field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.
^CGravels with 5 to 12% fines require dual symbols:
 GW-GM well-graded gravel with silt
 GW-GC well-graded gravel with clay
 GP-GM poorly graded gravel with silt
 GP-GC poorly graded gravel with clay
^DSands with 5 to 12% fines require dual symbols:
 SW-SM well-graded sand with silt
 SW-SC well-graded sand with clay
 SP-SM poorly graded sand with silt
 SP-SC poorly graded sand with clay

$$C_u = D_{60} / D_{10} \quad C_c = \frac{(D_{30})^2}{D_{10} \cdot D_{60}}$$

^FIf soil contains $\geq 15\%$ sand, add "with sand" to group name.
^GIf fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.
^HIf fines are organic, add "with organic fines" to group name.
^IIf soil contains $\geq 15\%$ gravel, add "with gravel" to group name.

^JIf Atterberg limits plot in hatched area, soil is a CL-ML silty clay.
^KIf soil contains 15 to 29% plus No. 200, and "with sand" or "with gravel," whichever is predominant.
^LIf soil contains $\geq 30\%$ plus no. 200, predominantly sand, add "sandy" to group name.
^MIf soil contains $\geq 30\%$ plus No. 200, predominantly gravel, add "gravelly" to group name.
^N $PI \geq 4$ and plots on or above "A" line.
^O $PI < 4$ or plots below "A" line.
^P PI plots on or above "A" line.
^Q PI plots below "A" line.



**GENERAL TERMINOLOGY NOTES FOR
SOIL IDENTIFICATION AND DESCRIPTION**

<u>GRAIN SIZE</u>		<u>GRAVEL PERCENTAGES</u>	
<u>Term</u>	<u>Particle Size</u>	<u>Term</u>	<u>Percent</u>
Boulders	Over 12"	A Little Gravel	3%-15%
Cobbles	3" to 12"	With Gravel	15%-30%
Gravel	#4 sieve to 3"	Gravelly	30%-50%
Sand	#200 to #4 sieve		
Fines (silt & clay)	Pass #200 sieve		
<u>CONSISTENCY OF PLASTIC SOILS</u>		<u>RELATIVE DENSITY OF NON-PLASTIC SOILS</u>	
<u>Term</u>	<u>N-Value, BPF</u>	<u>Term</u>	<u>N-Value, BPF</u>
Very Soft	less than 2	Very Loose	0-4
Soft	2-4	Loose	5-10
Firm (Medium)	5-8	Medium Dense	11-30
Stiff	9-15	Dense	31-50
Very Stiff	16-30	Very Dense	Greater than 50
Hard	Greater than 30		
<u>MOISTURE/FROST CONDITION</u> (MC Column)		<u>LAYERING NOTES</u>	
D (Dry):	Absence of moisture, dusty, dry to touch.	Laminations:	Layers less than ½" thick of differing material or color.
M (Moist):	Damp, although free water not visible. Soil may still have a high water content (over "optimum").	Lenses:	Pockets or layers greater than ½" thick of differing material or color.
W (Wet/ Waterbearing):	Free water visible. Intended to describe non-plastic soils. Waterbearing usually relates to sands and sands with silt.		
F (Frozen):	Soil frozen.		
<u>FIBER CONTENT OF PEAT</u>		<u>ORGANIC/ROOTS DESCRIPTION</u>	
<u>Term</u>	<u>Fiber Content (Visual Estimate)</u>	Soils are described as organic, if soil is not peat and is judged to have sufficient organic fines content to influence the soil properties.	
Fibric:	Greater than 67%	With roots:	Judged to have sufficient quantity of roots to influence the soil properties.
Hemic:	33-67%	Trace roots:	Small roots present, but not judged to be in sufficient quantity to significantly affect soil properties.
Sapric:	Less than 33%		