185 ft to Rock

PRELIMINARY GEOTECHNICAL REPORT

for

PROPOSED NEW LABORATORY BUILDING

NEW YORK STATE HEALTH DEPARTMENT

New Scotland Avenue

Albany, New York

February 27, 1987

PRELIMINARY

M. J. ENGINEERING, P.C.
1 Mari Nol Drive
Clifton Park, New York 12065

INTRODUCTION:

The preliminary subsurface investigation for the proposed New Laboratory Building to be located at the N.Y.S. Health Department Facility on New Scotland Avenue, Albany, New York has been completed. Two (2) soil borings have been completed at the site by Empire Soils Investigation, Inc. of Latham, New York. The logs of these borings along with a location diagram have been included in the appendix of this report.

It is our understanding that the proposed construction will include an office and laboratory building located approximately as indicated on the boring location diagram. We understand that the owner would like to have as much floor space on the site as possible, up to 3 to 5 floor levels. However, the cost of foundations will be a factor in making a final decision regarding the size and weight of the building.

The purpose of this report is to describe the preliminary investigation conducted and the results obtained; to analyze and interpret the data obtained; and to make preliminary recommendations for the design and construction of the feasible foundation types.

FIELD INVESTIGATION PROCEDURES:

The borings were performed with a truck-mounted, hollow- stem- auger- type, drilling rig.

The borings were extended by means of 3.5 inch I.D., hollow- stem, augers and a roller cone rock bit using circulating drilling fluid to remove the cuttings from the boring hole. At greater depths four inch flush joint casing and open hole drilling techniques were used rather than the augers.

Representative samples were obtained from the boring holes by means of the split-spoon sampling procedure performed in accordance with ASTM D 1586. The standard penetration values obtained from this procedure have been indicated, graphically, by crossed circles on the soil boring logs.

Soil samples obtained from these procedures were examined in the field, sealed in containers, and shipped to the laboratory for further examination, classification and testing, as applicable.

Below a depth of 120 feet at the B-1 location the bore hole was advanced by drilling with a 3.5 inch rock bit. Wash samples were taken to identify the general nature of the soils penetrated. The purpose of extending the hole to refusal was to estimate the required pile length for end-bearing piles.

During the investigation, water level readings were obtained at various times where water accumulated in the boring hole. The water level reading along with an indication of the time of the reading relative to the boring procedure, have been indicated on the soil boring logs.

In addition to the field boring investigation, the soils engineer visited the site to observe the surface conditions.

LABORATORY INVESTIGATION:

All samples were examined in the laboratory by a soils engineer and classified according to the Unified Soil Classification System. In this system the soils are classified according to texture and plasticity. The appropriate group symbol is indicated on the soil boring logs.

Selected samples exhibiting significant percentages of fine-grained soils or organic materials were subjected to moisture content testing. This testing was performed in accordance with ASTM Specification D 2216-71. The results of these tests are indicated, graphically, by solid, black, circles on the soil boring logs.

The relatively stiffer clay samples were tested with a calibrated, spring-loaded, penetrometer. This test is used to estimate the unconfined compressive strength of the soil sample by measuring the soil's resistance to the penetration of the penetrometer needle. The results of these tests are indicated, graphically, by open circles with an asterisk on the soil boring logs.

The softer silty clay and clayey-silt samples were tested with a "torvane" vane shear device. This device estimates the cohesion strength of the soil. The results are indicated with the soil descriptions on the logs.

SITE CONDITIONS:

The site is a level site with a basement level cut at the site of the existing four-story building. The existing, adjacent buildings are two to four stories in height with basements approximately 6 to 9 feet below the prevailing grade. The existing brick wall buildings appear to be in reasonably good condition on the exterior.

SUBSURFACE CONDITIONS:

The specific subsurface conditions encountered at each boring location are indicated on the individual soil boring logs. However, to aid in the evaluation of this data, we have prepared a generalized description of the soil conditions based on the boring log data.

The topsoils and fills are thin. The virgin soils are the lacustrine Lake Albany Clays. The upper, brown, desiccated, clay soils are about 12 to 15 feet thick. The strength of these soils is typically very stiff.

The soils below the brown clays are varved silts, silty clays and clayey silts in a generally loose or soft to medium condition to a depth of about 100 feet. Below 100 feet the soils are stiff.

The lacustrine silts and clays extend to a depth of about 150 feet; silts and sands from 150 to 163 feet; silts and gravels (possible glacial till)to 170 feet; and silt, gravel and cobbles to 185.6 feet. At 185.6 feet deep the boring was terminated on a "rock-like refusal" using a roller bit.

GROUNDWATER CONDITIONS:

Based on the groundwater levels recorded during the boring investigation and the moisture condition and color of the samples recovered from the boring holes, we judge that the general groundwater level was located between depths of 13 feet and 14 feet below the ground surface.

Perched groundwater tables may occur at higher elevations in the soil profile due to groundwater being retained by layers or lenses of silt or clay soils. However, the quantities of water and flow rates anticipated to be involved with these water tables would be relatively small.

Some fluctuation in hydrostatic groundwater levels and perched water conditions should be anticipated with variations in the seasonal rainfall and surface runoff.

PRELIMINARY ANALYSIS AND RECOMMENDATIONS:

Building Foundations - General:

The type of foundation best used is related to the size of the structural loads; the allowable settlements (relates to type of structure and required use); and the proximity of the existing structures.

We have indicated below the foundation options now considered feasible with an indication of the limitations and important features of the option. We have also indicated some foundation design approaches not recommended with the reasons for those recommendations.

The recommendations are preliminary and a complete subsurface investigation will be required to provide detailed recommendations for final design. The recommendations are based on the two borings done and the soil index tests performed.

Spread Footings:

Structures with two to three supported floors could be supported on spread footings. For the larger loads a partial basement or full basement would be recommended to balance the added loads by relief of the overburden stress. The bearing pressure used and the limiting column load size will depend on the type of structure; the depth of the basement, if any; the bay spacing; and the design floor loads.

There would be advanages in keeping bay spaces and floor loads down, using a flexible structure such as steel frame and choosing a ground floor grade that provides substantial unloading of the soil while keeping footings well above the soft to medium clays. A basement or ground floor grade about 6 to 8 feet below existing grade would probably be well balanced in these respects. Apparently this was done with the existing buildings.

The maximum column loads for normal settlement limits are estimated at 300 to 400 kips.

Mat Foundations:

A mat foundation with a basement or partial basement could be used to support a building five or more stories high. This type of building can tolerate higher column loads because of the reduction in total and differential settlements afforded by the stiff mat and the stress relief of excavation. It would still be more economical to keep bay spacings down to produce a more even load distribution.

Piles:

End-bearing piles could be driven to practical refusal in the very dense glacial till or on rock. Pile capacities of 100 to 150 tons could be used. The pile tips would be driven to about 185 to 190 feet below the existing grade.

The piles could be the larger sections of steel "H" piles. The 14 inch, 89 pounds/foot section, or similar, could be considered for estimating purposes.

This type of foundation would allow a building of many stories; if required.

Friction piles are not normally used in Albany for substantial building loads since the clays are soft to medium and are compressible. Also, pile foundations will settle unless driven to good bearing materials. They will, however, reduce differential settlements. We do not recommend friction piles based on the available data and our understanding of the proposed construction.

Other Recommendations:

Preloading is not recommended due to the proximity of the existing structures. These buildings prevent a large enough pre-load fill from being placed and they would suffer settlement damage from the adjacent settlement crater.

Deep Basements:

Deep basements are not recommended. Existing buildings would be undermined by the excavations unless underpinned. Underpinnings would be very expensive in these soils.

Slurry walls or very stiff sheeting would be needed to maintain a deep excavation in these soils. Tie-backs or elaborate bracing would be required. Bottom heave of the excavation would have to be prevented at some point as deeper excavations are considered.

It is recommended that basements be limited to the levels of the existing foundations.

CONSTRUCTION PROCEDURES AND PROBLEMS:

All excavations of more than a few feet should be sheeted and braced or layed back to prevent sloughing in of the sides.

The existing building and utilities will need to be protected from settlements.

Sump- pit and sump- pump- type dewatering may be required in excavations or low areas during wet weather or if groundwater is encountered.

Vacuum well points or an electro-osmosis technique would be needed to predrain deep excavations extended well below the groundwater table. Ordinary well points will not work well in these soils.

The existing foundations and utilities need to be considered in designing and building new foundations. Space limitations can become very critical to structural design and construction procedure.

Proposed New Laboratory Building
New York State Health Department
February 27, 1987
Appendix Page

CONTENTS OF APPENDIX:

GENERAL NOTES

DRILLING & SAMPLING SYMBOLS

SS : Split-Spoon – 1⅜" I.D., 2" O.D., except where noted
ST : Shelby Tube – 2" O.D., except where noted
PA : Power Auger Sample
DB : Diamond Bit – NX: BX: AX:
CB : Carboloy Bit – NX: BX: AX:
OS : Osterberg Sampler – 3" Shelby Tube
HS : Housel Sampler
WS : Wash Sample
FT : Fish Tail
RB : Rock Bit
WO : Wash Out

Standard "N" Penetration: Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch OD split spoon, except where noted.

WATER LEVEL MEASUREMENT SYMBOLS

WL : Water Level
WCI : Wet Cave In
DCI : Dry Cave In
WS : While Sampling
WD : While Drilling
BCR : Before Casing Removal
ACR : After Casing Removal
AB : After Boring

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. In pervious soils, the indicated elevations are considered reliable ground water levels. In impervious soils, the accurate determination of ground water elevations is not possible in even several days observation, and additional evidence on ground water elevations must be sought.

CLASSIFICATION

COHESIONLESS SOILS

"Trace"	:	1% to 10%	
"Trace to some"	:	10% to 20%	
"Some"	:	20% to 35%	
"And"	:	35% to 50%	
Loose	:	0 to 9 Blows	or equivalent
Medium Dense	:	10 to 29 Blows	
Dense	:	30 to 59 Blows	
Very Dense	:	≥ 60 Blows	

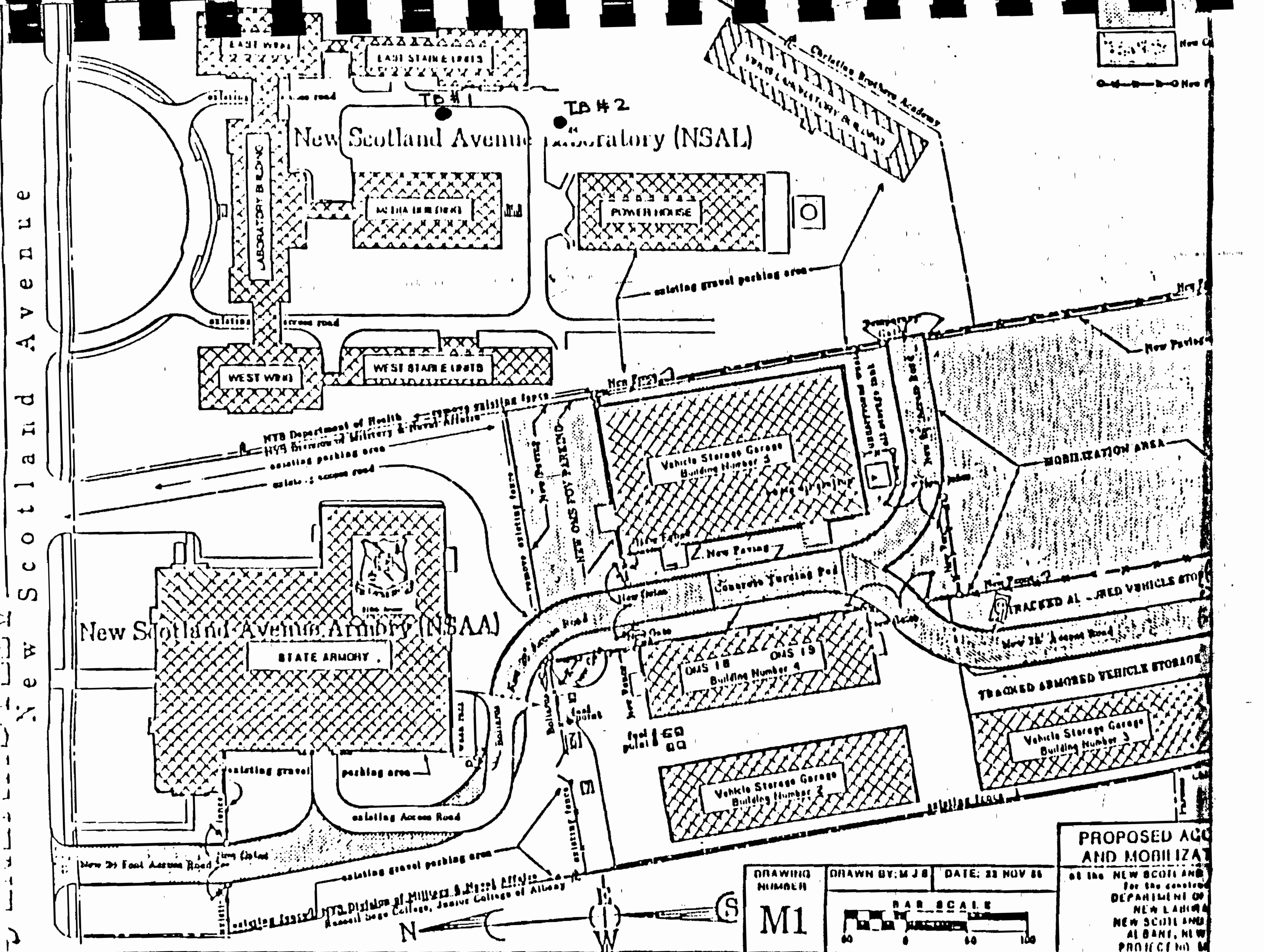
COHESIVE SOILS

If clay content is sufficient so that clay dominates soil properties, then clay becomes the principle noun with the other major soil constituent as modifier; i.e., silty clay. Other minor soil constituents may be added according to classification breakdown for cohesionless soils; i.e., silty clay, trace to some sand, trace gravel.

Soft	:	0.00 -- 0.59	tons ft²
Medium	:	0.60 -- 0.99	tons ft²
Stiff	:	1.00 -- 1.99	tons ft²
	:	2.00 3.99	tons ft²
Very Stiff / Hard	:	≥ 4.00	tons ft²

GENERAL NOTES

VERNON HOFFMAN PE
SOIL AND FOUNDATION
ENGINEERING
BOX 341 GUILDERLAND NY 12084
518 355-7852 732-284



New Scotland Avenue
New Scotland Avenue Laboratory (NSAL)
TB #1
TB #2
EAST WING
EAST STAIRE UNITS
LABORATORY BLDG
WEST WING
WEST STAIRE UNITS
POWER HOUSE
existing gravel parking area
existing access road
Christian Brothers Academy
New Scotland Avenue Armory (NSAA)
STATE ARMORY
NYS Department of Health
NYS Division of Military & Naval Affairs
remove existing fence
existing parking area
existing access road
NEW ONS FOR PARKING
New Paving
Vehicle Storage Garage Building Number 5
Concrete Turning Pad
OMS 18
OMS 19
Building Number 4
Vehicle Storage Garage Building Number 2
Vehicle Storage Garage Building Number 3
TRACKED ARMORED VEHICLE STORAGE
MOBILIZATION AREA
New Paving
Temporary Gate
New 28' Access Road
existing gravel parking area
existing Access Road
parking area
existing fence
New 24 Foot Access Road
Bollards
fuel outlet
existing gravel parking area
NYS Division of Military & Naval Affairs
Russell Sage College, Junior College of Albany
N
S
W
DRAWING NUMBER
M1
DRAWN BY: M J B
DATE: 23 NOV 86
BAR SCALE
60
0
60
100
PROPOSED AG
AND MOBILIZAT

OWNER
New York State Health Department

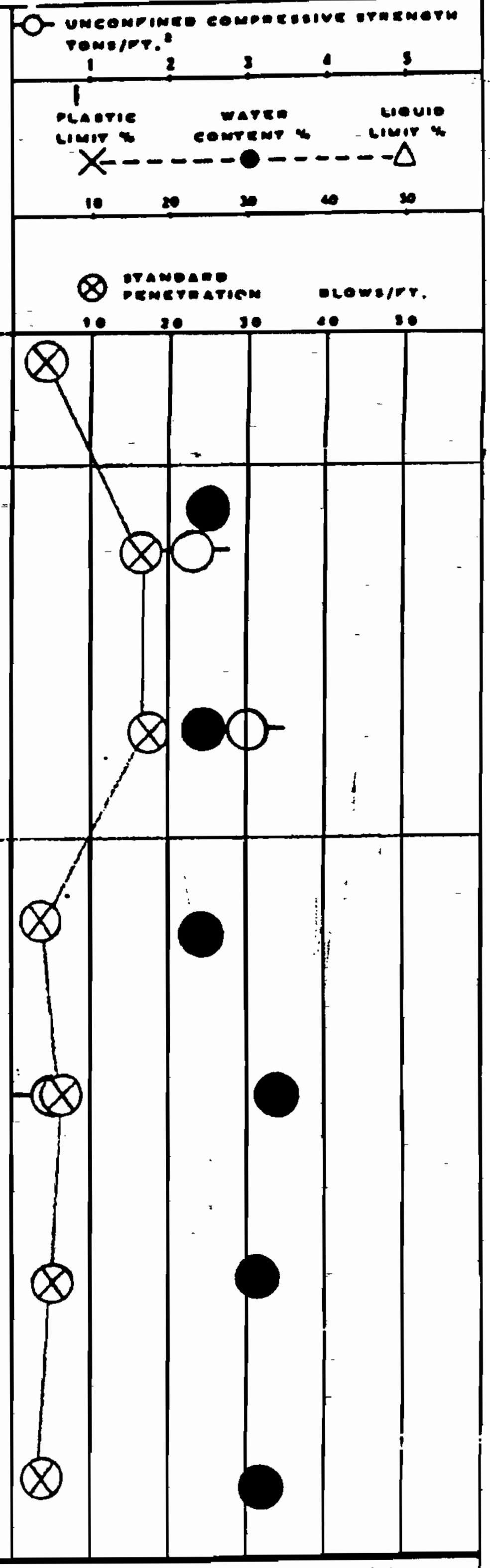
LOG OF BORING NUMBER
B-1 (Page 1)

PROJECT NAME
Proposed New Laboratory Building

ARCHITECT-ENGINEER
M.J. Engineering, P.C.

SITE LOCATION
New Scotland Avenue, Albany, New York

ELEVATION / DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY (In.)	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	UNIT DRY WT. LBS./FT.³
	S1	SS		10	Silt, trace to some fine sand, brown, moist, loose (ML)	
		PA				
5.0	S2	SS		12	Silty-clay, some silt layers, brown, very stiff (CL) Varved	
		PA				
10.0	S3	SS		20		
		PA				
15.0	S4	SS		10	Silty clay, some silt layers, grey, wet, loose, soft to medium (CL-ML) Varved Sample 4 Torvane = 0.25 kg/cm²	
		PA				
20.0	S5	SS		18	Sample 5 Torvane = 0.27	
		PA				
25.0	S6	SS		18	Sample 6 Torvane = 0.25	
		PA				
30.0	S7			15	Sample 7 Torvane = 0.30 BORING CONTINUED	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL 19.0' @ 4:30 pm on 1/28/87 - 14.5' on 1/29/87 with hole @ 70'	BORING STARTED 1-28-87	Vernon C. Hoffman, Jr., P.E. Schenectady, NY
	BORING COMPLETED 1-30-87	
	RIG FOREMAN	APPROVED BY VCH

BL:1

OWNER
New York State Health Department

LOG OF BORING NUMBER
B-1 (Page 2)

PROJECT NAME
Proposed New Laboratory Building

ARCHITECT-ENGINEER
M.J. Engineering, P.C.

SITE LOCATION
New Scotland Avenue, Albany, New York

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

ELEVATION / DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY (Inches)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	UNIT DRY WT. LBS./FT.³	STANDARD PENETRATION BLOWS/FT.
					Silty clay, some silt layers, grey, wet, loose, soft to medium (CL-ML) Varved		
35.0	S8	SS		18	Sample 8 Torvane = 0.40		
		PA					
40.0	S9	SS		18	Clayey-silt, some silty-clay layers, grey, wet, loose (ML-CL and CL-ML) Varved		wh/2
		PA			Silty-clay, grey, wet, soft to medium (CL-ML) Varved		
45.0	S10	SS		20	Sample 10 Torvane = 0.10		wh/2
		PA					
50.0	S11	SS		20	Sample 11 Torvane = 0.35		wh/3
		PA					
55.0	S12	SS		18	Sample 12 Torvane = 0.40		
		PA					
60.0	S13			13	Sample 13 Torvane = 0.32		wh/wh
					BORING CONTINUED		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL WS or WD	BORING STARTED 1-28-87	Vernon C. Hoffman, Jr., PE Schenectady, NY
WL BCR ACR	BORING COMPLETED 1-30-87	
WL	RIG FOREMAN	APPROVED BY

BL:1

OWNER	LOG OF BORING NUMBER
New York State Health Department	B-1 (Page 3)
PROJECT NAME	ARCHITECT-ENGINEER
Proposed New Laboratory Building	M.J. Engineering, P.C.

SITE LOCATION
New Scotland Avenue, Albany, New York

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

ELEVATION	DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY (In.)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	UNIT DRY WT. LBS./FT.³	Blows
	65.0							
		S14	SS		20	Sample 14 Torvane = 0.30 kg/cm²		wh/wh
			PA					
	70.0							
		S15	SS		20	Sample 15 Torvane = 0.30		
			PA					
	75.0							
		S16	SS		18	Sample 16 Torvane = 0.25		
			PA					
	80.0							
		S17	SS		18	Sample 17 Torvane = 0.20		wh/2
			PA					
	85.0							
		S18	SS		18	Sample 18 Torvane = 0.40		
			PA					
	90.0							
		S19	SS		6	Sample 19 Torvane = 0.38		wr/wh
						BORING CONTINUED		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL WS or WD	BORING STARTED 1-28-87	Vernon C. Hoffman, Jr., PE Schenectady, NY
WL BCR ACR	BORING COMPLETED 1-30-87	
WL	RIG FOREMAN	APPROVED BY

BL:I

OWNER	LOG OF BORING NUMBER
New York State Health Department	B-1 (Page 4)
PROJECT NAME	**ARCHITECT-ENGINEER**
Proposed New Laboratory Building	M.J. Engineering, P.C.
SITE LOCATION	
New Scotland Avenue, Albany, New York	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

ELEVATION / DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL (SURFACE ELEVATION)	UNIT DRY WT. LBS./FT.³	STANDARD PENETRATION BLOWS/FT.
					Silty-clay, grey, wet, soft to medium (CL-ML) Varved		
95.0							
	S20	SS		18	Sample 20 Torvane = 0.35		wh/wh
		PA					
100.0							
	S21	SS		18	Silty-clay, trace to some silt layers, medium/stiff (CL) Varved		wr/wr
		PA					
105.0							
	S22	SS		18			wh/wh
		PA					
110.0							
	S23	SS		--			wr/wr
		PA					
115.0							
	S24	SS		--			wr/wr
120.0							wh/wh
	S25	RB		20			
					BORING CONTINUED		

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL WS or WD	BORING STARTED 1-28-87	Vernon C. Hoffman, Jr., PE Schenectady, NY
WL BCR ACR	BORING COMPLETED 1-30-87	
WL	RIG FOREMAN	APPROVED BY

BL:1

OWNER	LOG OF BORING NUMBER
New York State Health Department	B-1 (Page 5)
PROJECT NAME	ARCHITECT-ENGINEER
Proposed New Laboratory Building	M.J. Engineering, P.C.
SITE LOCATION	
New Scotland Avenue, Albany, New York	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

ELEVATION	DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	UNIT DRY WT. LBS./FT.³
	150		RB			Silt and gravel @ 150' (By Wash)	
	155						
	160						
	165		RB			Silt and gravel (Possible glacial till) @ 163' (By Wash)	
	170		RB			Silt, gravel and cobbles (By Wash) @ 170'	
	175	S26	RB			Fine sand and silt, grey, wet (SM) @ 172' (Wash Sample)	

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL	WS or WD	BORING STARTED 1-28-87	Vernon C. Hoffman, Jr., PE Schenectady, NY
WL BCR	ACR	BORING COMPLETED 1-30-87	
WL		RIG FOREMAN	APPROVED BY

BL:1

OWNER	LOG OF BORING NUMBER
New York State Health Department	B-1 (Page 6)
PROJECT NAME	ARCHITECT-ENGINEER
Proposed New Laboratory Building	M.J. Engineering, P.C.

SITE LOCATION
New Scotland Avenue, Albany, New York

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

ELEVATION	DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL SURFACE ELEVATION	UNIT DRY WT. LBS./FT.³
	180						
	185						
			RB			Refusal on rock or boulders @ 185.6'	

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL WS or WD	BORING STARTED 1-28-87	Vernon C. Hoffman, Jr., PE Schenectady, NY
WL BCR ACR	BORING COMPLETED 1-30-87	
WL	RIG FOREMAN	APPROVED BY

BL:1

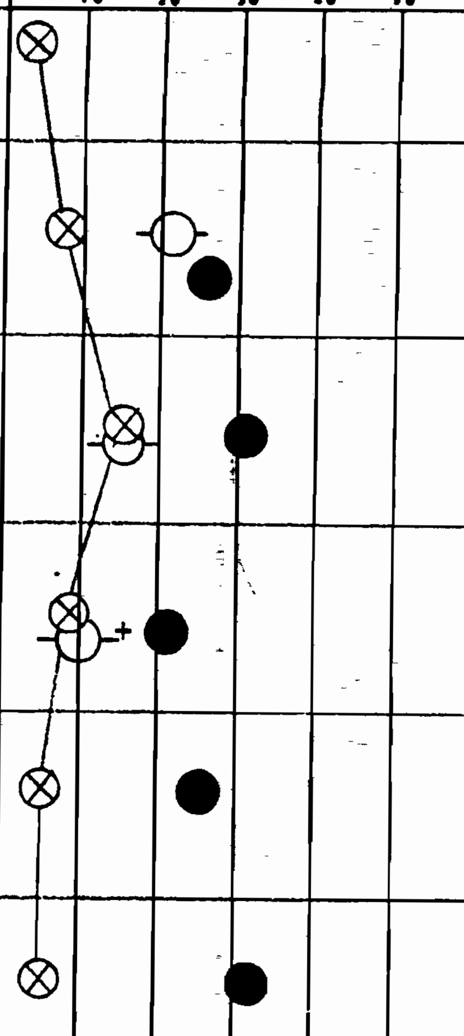
OWNER	LOG OF BORING NUMBER
New York State Health Department	B-2 (Page 1)
PROJECT NAME	**ARCHITECT-ENGINEER**
Proposed New Laboratory Building	M.J. Engineering, P.C.
SITE LOCATION	
New Scotland Avenue, Albany, New York	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

ELEVATION	DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY (In.)	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	UNIT DRY WT. LBS./FT.³
		S1	SS		12	Fine sand & silt, dark brown & light brown, moist, loose (SM-ML)	
			PA				
	5.0	S2	SS		18	Silty-clay, brown, very stiff (CL) Varved	
			PA				
	10.0	S3	SS		20	Silty-clay, some layers of silt, light brown, moist, medium dense, stiff (CL-ML & ML) Varved	
			PA				
	15.0	S4	SS		20	Silty-clay, trace to some layers of silt, trace fine sand, grey, moist to wet, loose to medium dense, stiff (CL-ML & ML) Varved	
			PA				
	20.0	S5	SS		20	Silty-clay, trace to some silt layers, grey, moist to wet, loose (CL-ML) Torvane = 0.24 kg/cm^2	
			PA				
	25.0	S6	SS		20	Silty-clay, trace to some silt layers, grey, soft (CL) Torvane = 0.16 kg/cm^2	
						BORING CONTINUED	



THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL Dry with hole @ 17'	BORING STARTED 1-27-87	Vernon C. Hoffman, Jr., P.E.
and augers @ 15'	BORING COMPLETED 1-27-87	Schenectady, NY
WL 13' 1/2 hour later	RIG FOREMAN	APPROVED BY VCH

BL: No Free Water After Boring

OWNER	LOG OF BORING NUMBER
New York State Health Department	B-2 (Page 2)
PROJECT NAME	**ARCHITECT-ENGINEER**
Proposed New Laboratory Building	M.J. Engineering, P.C.
SITE LOCATION	
New Scotland Avenue, Albany, New York	

UNCONFINED COMPRESSIVE STRENGTH TONS/FT.² 1 2 3 4 5

PLASTIC LIMIT % — WATER CONTENT % — LIQUID LIMIT % 10 20 30 40 50

STANDARD PENETRATION BLOWS/FT. 10 20 30 40 50

ELEVATION	DEPTH	SAMPLE NO.	SAMPLE TYPE	SAMPLE DISTANCE	RECOVERY	DESCRIPTION OF MATERIAL / SURFACE ELEVATION	UNIT DRY WT. LBS./FT.³
	30.0					Silty-clay, some silt layers, grey, loose, soft (CL-ML and MC)	
		S7	SS		24	Sample 7 Torvane = 0.14	
			PA				
	35.0	S8	SS		24	Sample 8 Torvane = 0.10	
			PA				
	40.0	S9	SS		20		
						END OF BORING - 40.0 feet	

THE STRATIFICATION LINES REPRESENT THE APPROXIMATE BOUNDARY LINES BETWEEN SOIL TYPES: IN-SITU, THE TRANSITION MAY BE GRADUAL.

WL WS or WD	BORING STARTED 1-27-87	Vernon C. Hoffman, r. P.E.
WL BCR ACR	BORING COMPLETED 1-27-87	
WL	RIG FOREMAN	APPROVED BY

BL:I

DATE	TIME	DRILLED FROM	DRILLED TO	WEATHER	TEMP
1/23/87		0.0	70.0	Clear	-10°
1/29/87		70.0	155.0	"	+10°
1/30/87		155.0			

EMPIRE SOILS INVESTIGATIONS INC

FIELD LOG

HOLE NO. B-1
GRD. ELEV.

PROJECT Dept of Health
LOCATION Albany NY
Sheet 1 of 5

DEPTH OF SAMPLE	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	SAMPLE RECOVERY	CLASSIFICATION OF MATERIALS DRILLED	OTHER DATA	WELL DETAILS
0-2	1	1	1 / 2	2	3		m / m	Br / BR	10"	TOPSOIL 0.6' / f SAND, Some SILT 4.0'	Auger to 10' with 3¼" Auger	
5-7	2	5	7 / 9	6	16		m	BR	12"	SILTY, CLAY	Set 4" ID casing to 15' open hole to	
10-12	3	10	10 / 3	3	18		m	BR	20"	SILTY, CLAY, f-SAND SEAMS	with 3½" Roller Bit	
15-17	4	1	2 / 1	1	3		W	gr	10"	SILTY, CLAY		
20-21.5	5	2	3	3	6		W	gr	18"	" "		
25-26.5	6	2	3	2	5		W	gr	18"	" "	Water on Comp. @ 34.4'	
30-31.5	7	1	2	1	3		W	gr	15"	" "		
35-36.5	8	2	2	2	4		W	gr	18"			

NOTATION: SIZE AUGERS / CASING 3¼" HSA to 4" flush joint casing SIZE SPOON 2"
SIZE THIN-WALLED TUBE ______ SIZE CORE ______

N = NO. OF BLOWS TO DRIVE 2 "SPOON / 2" WITH 140 lb. WEIGHT FALLING 30 PER BLOW
C = NO. OF BLOWS TO DRIVE ___ "CASING ___" WITH ___ lb. WEIGHT FALLING ___ PER BLOW

FILL OUT BACK OF LOG AND SIGN YOUR NAME

DATE	TIME	DRILLED FROM	DRILLED TO	WEATHER	TEMP

EMPIRE SOILS INVESTIGATIONS INC

FIELD LOG

HOLE NO. B-1

GRD. ELEV.

PROJECT Health Dept.

LOCATION Albany

Sheet 2 of 5

DEPTH OF SAMPLE	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	SAMPLE RECOVERY	CLASSIFICATION OF MATERIALS DRILLED	OTHER DATA	WELL DETAILS
											1/28/89	
40-41.5	9	WH	WH	2	–		W	gr	18"	Silty, clay	hole 70'	
											4:30pm water 19.0'	
45-46.5	10	WH	WH	2	–		W	gr	20"		1/29/89	
											water 14.5'	
50-51.5	11	WH	WH	3	–		W	gr	20"	Clay		
55-56.5	12	WH	1	1	2		W	gr	18"	"		
60-61.5	13	WH	WH	WH	–		W	gr	15"			
65-66.5	14	WH	WH	WH	–		W	gr	20"			
70-71.5	15	WH	3	3	6		W	gr	20"			
75-76.5	16	2	2	2	4		W	gr	18"	" "		

NOTATION: SIZE AUGERS/CASING On Sheet #1 SIZE SPOON

SIZE THIN-WALLED TUBE SIZE CORE

N = NO. OF BLOWS TO DRIVE "SPOON "WITH lb. WEIGHT FALLING PER BLOW

C = NO. OF BLOWS TO DRIVE "CASING " WITH lb. WEIGHT FALLING PER BLOW

FILL OUT BACK OF LOG AND SIGN YOUR NAME

DATE	TIME	DRILLED FROM	DRILLED TO	WEATHER	TEMP

EMPIRE SOILS INVESTIGATIONS INC

FIELD LOG

HOLE NO. B-1
GRD. ELEV.

PROJECT Health Dept
LOCATION ALBANY Sheet 3 of 5

DEPTH OF SAMPLE	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	SAMPLE RECOVERY	CLASSIFICATION OF MATERIALS DRILLED	OTHER DATA	WELL DETAILS
80-81.5	17	wH	wH	2	-		w	gr	18"	Sl CLAY, Som SiLT		
85-86.5	18	wH	1	2	3		w	gr	18"	"		
90-91.5	19	wr	wr	wH	-		w	gr	6"	"		
95-96.5	20	wr	wH	wH	-		w	gr	18"	"		
100-101.5	21	wr	wr	wr	-	-	w	gr	18"	"		
105-106.5	22	wr	wH	wH	-		w	gr	18"			
110-111.5	23	wr	wr	wr	-							
115-116.5	24	wr	wr	wr	-							

NOTATION: SIZE AUGERS/CASING ____ SIZE SPOON ____
SIZE THIN-WALLED TUBE ____ SIZE CORE ____

N : NO. OF BLOWS TO DRIVE "SPOON "WITH lb. WEIGHT FALLING PER BLOW
C : NO. OF BLOWS TO DRIVE "CASING " WITH lb. WEIGHT FALLING PER BLOW

FILL OUT BACK OF LOG AND SIGN YOUR NAME

DATE	TIME	DRILLED FROM	DRILLED TO	WEATHER	TEMP

EMPIRE
SOILS INVESTIGATIONS INC

FIELD LOG

HOLE NO. B-1
GRD. ELEV.

PROJECT
LOCATION
Sheet 4 of 5

DEPTH OF SAMPLE	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	SAMPLE RECOVERY	CLASSIFICATION OF MATERIALS DRILLED	OTHER DATA	WELL DETAILS
120-121.5	23	WH	WH	WH	—		W	gr	20"	& CLAY, Som SILT		
										Drill open hole with 3½" Roller bit to No samples per client		
										120' ± to 150' ±		
										~~SLIP~~ CLAY, SILT (BY Roller bit guding)		
										150' ± to 163' ±		
										Poss. silts & sand ~~[illegible]~~ (By wash)		

NOTATION: SIZE AUGERS/CASING ______ SIZE SPOON ______
SIZE THIN-WALLED TUBE ______ SIZE CORE ______

N : NO. OF BLOWS TO DRIVE "SPOON "WITH lb. WEIGHT FALLING PER BLOW
C : NO. OF BLOWS TO DRIVE "CASING " WITH lb. WEIGHT FALLING PER BLOW

FILL OUT BACK OF LOG AND SIGN YOUR NAME

DATE	TIME	DRILLED FROM	DRILLED TO	WEATHER	TEMP

EMPIRE
SOILS INVESTIGATIONS INC

FIELD LOG

HOLE NO. B-1
GRD. ELEV.

PROJECT
LOCATION
Sheet 5 of 5

DEPTH OF SAMPLE	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	SAMPLE RECOVERY	CLASSIFICATION OF MATERIALS DRILLED	OTHER DATA	WELL DETAILS
										163 ±		
	25	wash Sample								Silts & gravel poss (fill) By wash		
										170' ±		
										Silt, gravel cobbles		
										Rock like Refusal, 185.6	with Roller Bit	

NOTATION: SIZE AUGERS/CASING ______ SIZE SPOON ______
SIZE THIN-WALLED TUBE ______ SIZE CORE ______

N : NO. OF BLOWS TO DRIVE "SPOON "WITH lb. WEIGHT FALLING PER BLOW
C : NO. OF BLOWS TO DRIVE "CASING " WITH lb. WEIGHT FALLING PER BLOW

FILL OUT BACK OF LOG AND SIGN YOUR NAME

DATE	TIME	DRILLED FROM	DRILLED TO	WEATHER	TEMP
1/27/87		0.0	40.0	clear	

EMPIRE SOILS INVESTIGATIONS INC

FIELD LOG

HOLE NO. B-2
GRD. ELEV.

PROJECT NYS Dept of Health
LOCATION Albany NY Sheet ____ of ____

DEPTH OF SAMPLE	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOWS ON CASING C	MOISTURE	COLOR	SAMPLE RECOVERY	CLASSIFICATION OF MATERIALS DRILLED	OTHER DATA	WELL DETAILS
0-2	1	2	1		3		M	BR	12"	TOPSOIL 1.0	hole to 17'	
			2	3			M	BR		f-sand, silt	Augers @ 15' Dry	
										5.5'		
5-7	2	2	4		8		M	BR	18"	SILTY CLAY	1/2 hr Lunch	
			4	7							water @ 13.0' in Augers	
10-12	3	5	7		14		M	BR	20"	SILTY CLAY f-sand layers		
			7	9								
15-17	4	3	3		9		M	gr	20"	SILTY, CLAY, sm f sand		
			6	6								
20-22	5	3	2		5		M	gr	20"	" " " "	Augers Dry No free water on comp.	
			3	3								
25-27	6	2	3		5		M	gr	20"	" "	Augers Sealed off	
			2	2								
30-32	7	2	3		6		M	gr	24"			
			3	3								
35-37	8	2	4		5		M	gr	24"			
			1	3								
38-40	9	2	3		5						B.T. 40.0	
			2	3			M	gr	20"	" "		

NOTATION: SIZE AUGERS ~~/CASING~~ 3 1/4" HSA SIZE SPOON 2"
SIZE THIN-WALLED TUBE ____ SIZE CORE ____

N : NO. OF BLOWS TO DRIVE 2 "SPOON 2 " WITH 140 lb. WEIGHT FALLING 30 PER BLOW
C : NO. OF BLOWS TO DRIVE "CASING " WITH lb. WEIGHT FALLING PER BLOW

FILL OUT BACK OF LOG AND SIGN YOUR NAME

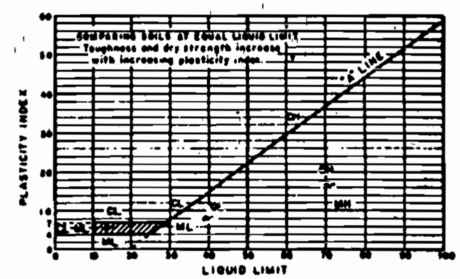
UNIFIED SOIL CLASSIFICATION
INCLUDING IDENTIFICATION AND DESCRIPTION

Major divisions			FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 3 inches and basing fractions on estimated weights)	GROUP SYMBOLS *	TYPICAL NAMES	INFORMATION REQUIRED FOR DESCRIBING SOILS	LABORATORY CLASSIFICATION CRITERIA
COARSE GRAINED SOILS More than half of material is larger than No. 200 sieve size ** (The No. 200 sieve size is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than No. 4 sieve size (For visual classifications, the $\frac{1}{4}''$ size may be used as equivalent to the No. 4 sieve size.)	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes	GW	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name; indicate approximate percentages of sand and gravel, max size, angularity, surface condition, and hardness of the coarse grains, local or geologic name and other pertinent descriptive information, and symbol in parentheses	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3
			Predominantly one size or a range of sizes with some intermediate sizes missing	GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW
		GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)	GM	Silty gravels, poorly graded gravel-sand-silt mixtures.		Atterberg limits below "A" line, or PI less than 4 — Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols.
			Plastic fines (for identification procedures see CL below).	GC	Clayey gravels, poorly graded gravel-sand-clay mixtures.	For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics	Atterberg limits above "A" line with PI greater than 7
	SANDS More than half of coarse fraction is smaller than No. 4 sieve size	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes.	SW	Well graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6; $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between one and 3
			Predominantly one size or a range of sizes with some intermediate sizes missing	SP	Poorly graded sands, gravelly sands, little or no fines.	EXAMPLE:- Silty sand, gravelly; about 20% hard, angular gravel particles $\frac{1}{2}$-in maximum size; rounded and subangular sand grains coarse to fine; about 15% non-plastic fines with low dry strength; well compacted and moist in place; alluvial sand; (SM)	Not meeting all gradation requirements for SW
		SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)	SM	Silty sands, poorly graded sand-silt mixtures		Atterberg limits below "A" line or PI less than 4 — Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols.
			Plastic fines (for identification procedures see CL below).	SC	Clayey sands, poorly graded sand-clay mixtures		Atterberg limits above "A" line with PI greater than 7

Use grain size curve in identifying the fractions as given under field identification

Determine percentages of gravel and sand from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size) coarse grained soils are classified as follows:
Less than 5% — GW, GP, SW, SP.
More than 12% — GM, GC, SM, SC.
5% to 12% — Borderline cases requiring use of dual symbols

Major divisions		IDENTIFICATION PROCEDURES ON FRACTION SMALLER THAN No. 40 SIEVE SIZE: DRY STRENGTH (CRUSHING CHARACTERISTICS)	DILATANCY (REACTION TO SHAKING)	TOUGHNESS (CONSISTENCY NEAR PLASTIC LIMIT)	GROUP SYMBOLS	TYPICAL NAMES	INFORMATION REQUIRED FOR DESCRIBING SOILS
FINE GRAINED SOILS More than half of material is smaller than No. 200 sieve size. (The No. 200 sieve size is about the smallest particle visible to the naked eye)	SILTS AND CLAYS Liquid limit less than 50	None to slight	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	Give typical name, indicate degree and character of plasticity, amount and maximum size of coarse grains; color in wet condition, odor if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses.
		Medium to high	None to very slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	
		Slight to medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity	For undisturbed soils add information on structure, stratification, consistency in undisturbed and remolded states, moisture and drainage conditions
	SILTS AND CLAYS Liquid limit greater than 50	Slight to medium	Slow to none	Slight to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	
		High to very high	None	High	CH	Inorganic clays of high plasticity, fat clays	EXAMPLE:- Clayey silt, brown; slightly plastic, small percentage of fine sand, numerous vertical root holes; firm and dry in place; loess; (ML)
		Medium to high	None to very slow	Slight to medium	OH	Organic clays of medium to high plasticity.	
HIGHLY ORGANIC SOILS		Readily identified by color, odor, spongy feel and frequently by fibrous texture.			Pt	Peat and other highly organic soils	



PLASTICITY CHART
FOR LABORATORY CLASSIFICATION OF FINE GRAINED SOILS

* Boundary classifications - Soils possessing characteristics of two groups are designated by combinations of group symbols. For example GW-GC, well graded gravel-sand mixture with clay binder.
** All sieve sizes on this chart are U.S. standard

FIELD IDENTIFICATION PROCEDURES FOR FINE GRAINED SOILS OR FRACTIONS

These procedures are to be performed on the minus No. 40 sieve size particles, approximately $\frac{1}{64}$ in. For field classification purposes, screening is not intended, simply remove by hand the coarse particles that interfere with the tests

DILATANCY (Reaction to shaking)

After removing particles larger than No. 40 sieve size, prepare a pat of moist soil with a volume of about one-half cubic inch. Add enough water if necessary to make the soil soft but not sticky.
Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consists of the appearance of water on the surface of the pat which changes to a livery consistency and becomes glossy. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens, and finally it cracks or crumbles. The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the fines in a soil.
Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction. Inorganic silts, such as a typical rock flour, show a moderately quick reaction.

DRY STRENGTH (Crushing characteristics)

After removing particles larger than No 40 sieve size, mold a pat of soil to the consistency of putty, adding water if necessary. Allow the pat to dry completely by oven, sun, or air drying, and then test its strength by breaking and crumbling between the fingers. This strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity.
High dry strength is characteristic for clays of the CH group. A typical inorganic silt possesses only very slight dry strength. Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

TOUGHNESS (Consistency near plastic limit)

After removing particles larger than the No 40 sieve size, a specimen of soil about one-half inch cube in size, is molded to the consistency of putty. If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. Then the specimen is rolled out by hand on a smooth surface or between the palms into a thread about one-eighth inch in diameter. The thread is then folded and rerolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached.
After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles.
The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil. Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic clay of low plasticity, or materials such as kaolin-type clays and organic clays which occur below the A-line.
Highly organic clays have a very weak and spongy feel at the plastic limit

ADOPTED BY - CORPS OF ENGINEERS AND BUREAU OF RECLAMATION - JANUARY 1952

Soil Characteristics Pertinent to Roads and Airfields

Major Divisions (1)	(2)	Symbol: Letter (3)	Symbol: Matching (4)	Symbol: Color (5)	Name (6)	Value as Subgrade When Not Subject to Frost Action (7)	Value as Subbase When Not Subject to Frost Action (8)	Value as Base When Not Subject to Frost Action (9)	Potential Frost Action (10)	Compressibility and Expansion (11)	Drainage Characteristics (12)	Compaction Equipment (13)	Unit Dry Weight lb. per cu. ft. (14)	Typical Design Values: CBR (15)	Typical Design Values: Subgrade Modulus k lb. per cu. in. (16)
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	GW		Red	Well-graded gravels or gravel-sand mixtures, little or no fines	Excellent	Excellent	Good	None to very slight	Almost none	Excellent	Crawler-type tractor, rubber-tired roller, steel-wheeled roller	125-140	40-80	300-500
		GP		Red	Poorly graded gravels or gravel-sand mixtures, little or no fines	Good to excellent	Good	Fair to good	None to very slight	Almost none	Excellent	Crawler-type tractor, rubber-tired roller, steel-wheeled roller	110-140	30-60	300-500
		GM d		Yellow	Silty gravels, gravel-sand-silt mixtures	Good to excellent	Good	Fair to good	Slight to medium	Very slight	Fair to poor	Rubber-tired roller, sheepsfoot roller; close control of moisture	125-145	40-60	300-500
		GM u		Yellow		Good	Fair	Poor to not suitable	Slight to medium	Slight	Poor to practically impervious	Rubber-tired roller, sheepsfoot roller	115-135	20-30	200-500
		GC		Yellow	Clayey gravels, gravel-sand-clay mixtures	Good	Fair	Poor to not suitable	Slight to medium	Slight	Poor to practically impervious	Rubber-tired roller, sheepsfoot roller	130-145	20-40	200-500
	SAND AND SANDY SOILS	SW		Red	Well-graded sands or gravelly sands, little or no fines	Good	Fair to good	Poor	None to very slight	Almost none	Excellent	Crawler-type tractor, rubber-tired roller	110-130	20-40	200-400
		SP		Red	Poorly graded sands or gravelly sands, little or no fines	Fair to good	Fair	Poor to not suitable	None to very slight	Almost none	Excellent	Crawler-type tractor, rubber-tired roller	105-135	10-40	150-400
		SM d		Yellow	Silty sands, sand-silt mixtures	Fair to good	Fair to good	Poor	Slight to high	Very slight	Fair to poor	Rubber-tired roller, sheepsfoot roller; close control of moisture	120-135	15-40	150-400
		SM u		Yellow		Fair	Poor to fair	Not suitable	Slight to high	Slight to medium	Poor to practically impervious	Rubber-tired roller, sheepsfoot roller	100-130	10-20	100-300
		SC		Yellow	Clayey sands, sand-clay mixtures	Poor to fair	Poor	Not suitable	Slight to high	Slight to medium	Poor to practically impervious	Rubber-tired roller, sheepsfoot roller	100-135	5-20	100-300
FINE GRAINED SOILS	SILTS AND CLAYS LL IS LESS THAN 50	ML		Green	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity	Poor to fair	Not suitable	Not suitable	Medium to very high	Slight to medium	Fair to poor	Rubber-tired roller, sheepsfoot roller; close control of moisture	90-130	15 or less	100-200
		CL		Green	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays	Poor to fair	Not suitable	Not suitable	Medium to high	Medium	Practically impervious	Rubber-tired roller, sheepsfoot roller	90-130	15 or less	50-150
		OL		Green	Organic silts and organic silt-clays of low plasticity	Poor	Not suitable	Not suitable	Medium to high	Medium to high	Poor	Rubber-tired roller, sheepsfoot roller	90-105	5 or less	50-100
	SILTS AND CLAYS LL IS GREATER THAN 50	MH		Blue	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	Poor	Not suitable	Not suitable	Medium to very high	High	Fair to poor	Sheepsfoot roller, rubber-tired roller	80-105	10 or less	50-100
		CH		Blue	Inorganic clays of high plasticity, fat clays	Poor to fair	Not suitable	Not suitable	Medium	High	Practically impervious	Sheepsfoot roller, rubber-tired roller	90-115	15 or less	50-150
		OH		Blue	Organic clays of medium to high plasticity, organic silts	Poor to very poor	Not suitable	Not suitable	Medium	High	Practically impervious	Sheepsfoot roller, rubber-tired roller	80-110	5 or less	25-100
HIGHLY ORGANIC SOILS		Pt		Orange	Peat and other highly organic soils	Not suitable	Not suitable	Not suitable	Slight	Very high	Fair to poor	Compaction not practical	—	—	—

Note:

1. Column 3, division of GM and SM groups into subdivision of d and u are for roads and airfields only. Subdivision is on basis of Atterberg limits; suffix d (e.g., GMd) will be used when the liquid limit is 25 or less and the plasticity index is 6 or less; the suffix u will be used otherwise.

2. See DM-7, Ch. 9 for compaction procedures and equipment.

3. Column 14, unit dry weights are for compacted soil at optimum moisture content for modified AASHO compaction effort.

4. In column 15, the maximum value that can be used in design of airfields is, in some cases, limited by gradation and plasticity requirements.