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# Exhibit AA.
# South Lafourche Airport North Site Preliminary Geotechnical Engineering Report


SLEC
South Louisiana Economic Council
Assumption • Lafourche • St. Mary • Terrebonne

STRATUM ENGINEERING, LLC
Geotechnical Engineering ◆ Testing and Inspection Services

March 8, 2024

South Louisiana Economic Council
322 Audubon Avenue
NSU-Babington Hall
Thibodaux, Louisiana 70310

Attn: Mr. Vic Lafont

# South Lafourche Airport North Site Preliminary Geotechnical Engineering Report

Re: Preliminary Geotechnical Engineering Report
LED Site Characterization
South Lafourche Airport - North Site
Lafourche Parish, Louisiana
SE Project No. G24-012

Dear Mr. Lafont:

Stratum Engineering, LLC (SE) is pleased to submit our Preliminary Geotechnical Engineering Report for the above referenced project. The report includes the results of field and laboratory testing, as well as preliminary recommendations regarding the suitability of the site for future industrial developments.

We appreciate the opportunity to perform this geotechnical study and look forward to the development of the property and our continued involvement with this project. If you have any questions pertaining to this report, or if we may be of further service, please contact our office.

Respectfully submitted,
STRATUM ENGINEERING, LLC

William "Dean" McInnis, P.E.
Vice President

Tony Y. Maroun, P.E.
Principal

STATE OF LOUISIANA
TONY Y. MAROUN
License No. 26198
PROFESSIONAL ENGINEER
CIVIL ENGINEERING
3/8/24

WDM/TYM

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# PROJECT INFORMATION

## Project Authorization

Stratum Engineering, LLC (SE) has completed a preliminary geotechnical exploration to characterize the North Site at the South Lafourche Airport for a potential future development in Lafourche Parish, Louisiana in support of the Louisiana Economic Development (LED) Site Certification process. The exploration was accomplished in general accordance with SE Proposal No. G23-091, dated May 11, 2023.

## Project Description

The north site at the South Lafourche Airport property is located on the north side of Airport Road just west of the existing airport near Galliano, Louisiana. In anticipation of potential business or industrial development on this property, the site will be characterized to verify the soil conditions and provide preliminary foundation recommendations for typical structures which could be constructed at the property.

Generally, industrial developments could consist of multiple structures with associated light and heavy duty pavements. The buildings may be single or multi-story structures with steel frames and load bearing masonry or tilt up walls, or could be of cast-in-place concrete. Depending on the building spans, maximum interior column load could range from 100 to 300 kips. Maximum wall loads are assumed to be 5 to 10 kips per foot. Floor loads could range between 150 to 700 psf. The structures may be grade supported or dock high, requiring 4 to 5 feet of fill to reach the building finished floor elevation.

Traffic associated with industrial facilities of this size could consist of heavy tractor trailers with an average daily traffic (ADT) of 50 to 100 trucks per day for a design life of 20 years. For these types of facilities, rigid pavements are widely considered for their longevity and ability to support the high volume of traffic.

## Purpose and Scope of Services

The purpose of this study was to explore the subsurface conditions at the site in order to enable an evaluation of a suitable foundation system for potential future industrial facilities.

Based on the parcel size and the criteria provided by CSRS, the scope of services included drilling three (3) borings to a depth ranging from 30 to 100 feet at accessible locations across the site. The borings were located in the field by a Stratum Engineering representative using normal taping from existing landmarks as indicated on the attached Boring Location Plan which is a reproduction of an aerial photograph of the property.

In addition to drilling the soil borings, our scope of services included a reconnaissance of the project site, select laboratory testing, and preparation of this preliminary geotechnical report. The report briefly outlines the testing procedures, presents available project information, describes the site and subsurface conditions, and provides results of analysis and recommendations regarding the following:

- Preliminary foundation types, depths, allowable pile capacities, and estimate of settlements;
- Seismic site classification;
- Typical soil parameters for flexible and rigid pavements.

The scope of geotechnical services did not include an environmental assessment for determining the presence or absence of wetlands, or hazardous or toxic materials in the soil, surface water, groundwater, or air on or below, or around this site. Any statements in this report or on the boring logs regarding odors, colors, and unusual or suspicious items or conditions are strictly for informational purposes.

## SITE AND SUBSURFACE CONDITIONS

### Site Description and Location

The property is situated on the north side of Airport Road just west of the South Lafourche Airport. The north site encompasses approximately 200 acres of undeveloped property which appears to have been used for agricultural purposes. The property was covered with surface vegetation and was accessible to standard drilling equipment.

Detailed grading information was not available at the time this report was prepared. However, it was assumed that two (2) to 3 feet of fill may be needed to reach the design grades.

### Drilling and Sampling

The borings were drilled with an All-Terrain Vehicle (ATV) mounted drilling rig. Wet rotary drilling techniques were used to advance the borings. Samples were generally obtained continuously from the ground surface to a depth of ten feet and at maximum five foot intervals thereafter. Drilling and sampling techniques were accomplished in general accordance with ASTM Standards.

Undisturbed samples of cohesive soils were generally obtained using thin-wall tube sampling procedures in general accordance with the procedures for "Thin-Walled Tube Geotechnical Sampling of Soils" (ASTM D1587). These samples were extruded in the field with a hydraulic ram and were wrapped in aluminum foil prior to placement in a plastic wrapping to preserve moisture. The samples were transported to the laboratory in containers to prevent disturbance.

For cohesionless soils and semi-cohesive soils, Standard Penetration Tests (SPT) were performed to obtain standard penetration values of the soil. The standard penetration value (N) is defined as the number of blows of a 140 pound hammer, falling 30 inches, required to advance the split-barrel sampler one (1) foot into the soil. Samples of granular soils were obtained utilizing a two (2) inch O.D. split-barrel sampler in general accordance with procedures for "Penetration Test and Split-Barrel Sampling of Soils" (ASTM D1586). To perform the test and obtain a sample, the sampler is lowered to the bottom of the previously cleaned drill hole and advanced by blows from the hammer. The number of blows is recorded for each of three (3) successive increments of six (6) inches penetration. The "N" value is obtained by adding the second and third incremental numbers. The results of the standard penetration test indicate the relative density of cohesionless soils and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components. The split spoon samples were identified according to the project number, boring number and depth, and were also placed in polyethylene plastic wrapping to protect against moisture loss.

The laboratory testing program included supplementary visual classification and water content tests on all of the soil samples. In addition, selected samples were subjected to unconfined compression testing, percent passing the #200 sieve and Atterberg Limits determination. Additional estimates of unconfined compressive strength and undrained shear strength were made using a hand penetrometer and a torvane, respectively. The laboratory testing was performed in general accordance with ASTM Standard Procedures.

## Subsurface Conditions

Based on the borings, about 10 to 12 inches of silty topsoil with organics covered the surface. The topsoil was generally underlain by firm to very stiff fat clay extending to a depth of 2 to 4 feet. Layers of loose silty, silty clayey and poorly graded sands were noted to around 12 to 17 feet in the northern half of the property (borings N-1 and N-2), but were not encountered in boring N-3 where very soft lean clay with sand and sandy silty clay were found to about 12 feet. The sandy material was underlain by very soft to soft fat clay to a depth of 32 feet at which depth medium dense sand and silt layers were noted to approximately 47 feet. Soft to firm fat clay continued below the sand and extended to about 62 feet. Another zone of loose to medium dense silt and sand was encountered between 62 and 82 feet at which depth the material transitioned to firm to stiff fat clay extending to a depth of at least 100 feet, the maximum depth explored.

The above subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs included in the Appendix should be reviewed for specific information at the boring locations. These records include soil descriptions, stratification, penetration resistances, and locations of the samples and laboratory test data. The stratification shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratification represents the approximate boundary between subsurface materials and the actual transition may be gradual. Water level information obtained during field operations is also shown on the boring logs. The samples, which were not altered by laboratory testing, will be retained for 60 days from the date of this report and then will be discarded.

## Groundwater Conditions

Groundwater was initially encountered in the borings at a depth of 6 feet during drilling and was measured at a depth of 4 to 5 feet upon completion of drilling. However, it should be noted that groundwater levels will fluctuate with seasonal variations in rainfall, extended periods of drought or surface runoff. Therefore, it is recommended that the actual groundwater level at the site be determined by the contractor at the time of the construction activities, if needed.

## IBC Site Classification

*The International Building Code (IBC), 2021 Edition,* was reviewed to determine the site classification for seismic design. Based on the soils encountered in the borings and our experience in the general vicinity, the site can be classified as Site Class "E" as outlined in Section 1613.2.2 of the Building Code.

# EVALUATION AND RECOMMENDATIONS

## General

The type and depth of foundation suitable for a given structure primarily depends on several factors including the subsurface conditions, the function of the structure, the loads it may carry, the cost of the foundation and the criteria set by the Design Engineer with respect to vertical and differential movement which the structure can withstand without damage.

It is our understanding the site will be marketed for development of potential industrial facilities. Typical structures could be grade supported or dock high facilities requiring 4 to 5 feet of fill to reach the design grade.

The results of the exploration indicate that the soils at the site are poor in bearing quality and compressible in nature. This material will experience significant amount of settlement with the addition of fill or application of moderate structural loads. Therefore, any potential improvements will likely need to be supported on a deep foundation system. Details related to foundation recommendations and construction considerations are presented in subsequent sections of this report.

## Settlement

Areal settlement under a building is generally caused by the amount of fill placed, the building footprint and the subsurface soil conditions encountered in the building area. Similarly, footing induced settlement depends on the footing size as well as the soil conditions below the footing. At the time this report was prepared, the type of structures had not been identified and the amount of fill needed to achieve the design grade was not known. However, based on the subsurface conditions encountered at the site, areal settlement is anticipated to be significant with the addition of fill.

Given the presence of substantial sand layers within the upper 50 feet, evaluation of a surcharge program may be feasible to mitigate some of the post construction settlements which may be completed within a reasonable period of time. However, since the presence, depth and consistency of the sand layers varied across the limited investigation area, a thorough geotechnical study will be crucial to make recommendations for any site mitigation options.

## Deep Foundations

Generally, deep foundations systems are used to support heavily loaded structures by transferring the structural loads through the soft surficial soils to more adequate bearing strata and hence minimizing long term settlements.

Typical deep foundation systems used in the area include timber piles, pre-cast concrete piles and auger cast-in-place piles which will derive their support capabilities mainly from skin friction with some end bearing support if the piles are embedded in the sand layer around 40 feet or 70 feet below the existing ground surface.

Large timber piles driven to a penetration depth of 40 to 45 feet could yield a maximum allowable compression capacity of about 15 to 18 tons. Should the piles be extended to the deeper sand layer around 70 feet, the large timber piles could be designed for an allowable compression capacity of approximately 25 tons. Furthermore, 14-inch diameter auger cast-in-place piles and 12-inch square pre-cast concrete piles installed to a penetration depth of about 70 feet could yield maximum allowable compression capacities of 50 to 60 tons.

The use of small timber piles should be limited to lightly loaded ancillary structures in areas receiving minimal fill. These piles could have a maximum allowable compression capacity on the order of 8 to 10 tons when tipped in the sand layer around 40 feet. The preliminary capacities presented in the report include a factor of safety of two (2) in compression.

### Structural Floor Slab

The building floor slab, including sidewalks, landings, and ramps immediately adjacent to the building, should be pile supported. While detailed site preparation recommendations were beyond the scope of this study, stripping of at least 12 inches should be anticipated to remove the topsoil, organics and other deleterious materials. Proofrolling and compaction of any required fill may be waived in the pile supported building areas.

### Parameters for Pavement Design

Parking areas and drives associated with an industrial park are expected to consist generally of light duty pavement for employee parking as well as heavy duty pavement for large truck staging areas, parking areas and drives.

Based on the field data and laboratory test results, the near surface soil consists of fat clay. Typical California Bearing Ratio (CBR) values for the existing clay subgrade or imported clayey sand structural fill were estimated to be on the order of 3 to 5 corresponding to a Modulus of Subgrade Reaction (k) of about 100 to 125 pci which may be used for the design of flexible and rigid pavements, respectively. These values may be used along with the frequency and magnitude of anticipated traffic loads associated with the type of facility being constructed to yield adequate pavement sections for the development. The Class II Base including crushed limestone would be a viable option for the flexible pavement while granular structural fill, such as sand, would be an adequate base for the rigid pavement.

## CONSTRUCTION CONSIDERATIONS

### Moisture Sensitive Soils/Weather Related Concerns

The upper soils encountered at the site are relatively sensitive to changes in moisture content and may lose significant strength if allowed to become saturated. In addition, soils that become wet may be slow to dry and thus significantly retard the progress of grading and compaction activities. During wet weather periods, increases in the moisture content of the upper soils can cause some reduction in the soil strength and support capabilities. Therefore, it will be advantageous to perform earthwork construction activities during dry weather. The site contractor shall be responsible for maintaining a firm, unyielding and stable subgrade condition. Should the near surface soils become wet, the contractor should be prepared to mitigate these conditions by repeated aeration and exposure to sunlight or by admixture treatment.

## REPORT LIMITATIONS

The recommendations submitted in this report are based on the available subsurface information obtained by SE and assumed typical design loads for industrial developments. These recommendations are preliminary and general in nature. They should not be used in the design of a specific structure without conducting a detailed project specific investigation to verify the subsurface soil condition and determine if revisions to the recommendations are necessary.

The Geotechnical Engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

Once specific plans for a potential development are prepared, Stratum Engineering may be retained and provided the opportunity to conduct a more thorough geotechnical investigation and analysis utilizing project specific plans and specifications under consideration.

This report has been prepared for the exclusive use of the South Louisiana Economic Council for marketing and planning of the North Site at the South Lafourche Airport in Lafourche Parish, Louisiana.

# APPENDIX

STRATUM ENGINEERING, LLC


STRATUM ENGINEERING, LLC

# BORING LOCATION PLAN

**SE PROJECT NO. G24-012**

GEOTECHNICAL ENGINEERING SERVICES
**LED SITE CHARACTERIZATION**
**SOUTH LAFOURCHE AIRPORT - NORTH SITE**
LAFOURCHE PARISH, LOUISIANA

STRATUM ENGINEERING, LLC

# LOG OF BORING N-1

## LED SITE CHARACTERIZATION
## SOUTH LAFOURCHE AIRPORT - NORTH SITE
## LAFOURCHE PARISH, LOUISIANA

**TYPE OF BORING:** WET ROTARY **LOCATION:** NW CORNER OF SITE **PROJECT NO.:** G24-012

| DEPTH, FT. | SOIL TYPE | SAMPLES | DESCRIPTION | N-BLOWS/FT. | UNCONFINED COMPRESSIVE STRENGTH tsf | HAND PENTROMETER tsf | TORVANE tsf | UNIT DRY WEIGHT pcf | MOISTURE CONTENT % | LIQUID LIMIT | PLASTICITY INDEX | % PASSING #200 SIEVE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 10" Silty Topsoil with organics<br>Firm gray Fat Clay with trace of organics | | | 0.75 | | | 51 | | | |
| | | | Loose gray Silty Sand | 2 | | | | | 26 | | | 25 |
| 5 | | | ▼ | 6 | | | | | 30 | | | |
| | | | ▽ | 6 | | | | | 33 | | | 12 |
| | | | Loose gray Silty Clayey Sand | 2 | | | | | 40 | | | |
| 10 | | | | | | | | | | | | |
| 15 | | | | 3 | | | | | 38 | | | 39 |
| | | | Very soft blue-gray Fat Clay | | 0.12 | | 0.10 | 70 | 50 | | | |
| 20 | | | | | | | | | | | | |
| 25 | | | | | | | 0.15 | | 43 | | | |
| | | | - soft with trace of organics at 28' | | 0.28 | | 0.20 | 60 | 66 | 90 | 62 | 97 |
| 30 | | | | | | | | | | | | |
| | | | Medium dense gray Poorly Graded Sand | 18 | | | | | 28 | | | 11 |
| 35 | | | | | | | | | | | | |
| | | | Medium dense gray Silty Sand | 25 | | | | | 30 | | | 22 |
| 40 | | | | | | | | | | | | |
| | | | Medium dense gray Sandy Silt | 29 | | | | | 30 | | | 67 |
| 45 | | | | | | | | | | | | |
| | | | Firm gray Fat Clay<br>- with silt seams at 48' | | 0.62 | 0.75 | | 67 | 59 | | | |
| 50 | | | | | | | | | | | | |

**DEPTH OF BORING:** 100 Feet **GROUNDWATER:** Measured at 4 Feet Upon Completion of Drilling
**DATE:** 2/19/2024

STRATUM ENGINEERING, LLC

# LOG OF BORING N-1 (continued)

**LED SITE CHARACTERIZATION**
**SOUTH LAFOURCHE AIRPORT - NORTH SITE**
**LAFOURCHE PARISH, LOUISIANA**

**TYPE OF BORING:** WET ROTARY **LOCATION:** NW CORNER OF SITE **PROJECT NO.:** G24-012

| DEPTH, FT. | SOIL TYPE | SAMPLES | DESCRIPTION | N-BLOWS/FT. | UNCONFINED COMPRESSIVE STRENGTH tsf | HAND PENTROMETER tsf | TORVANE tsf | UNIT DRY WEIGHT pcf | MOISTURE CONTENT % | LIQUID LIMIT | PLASTICITY INDEX | % PASSING #200 SIEVE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Soft to firm gray Fat Clay | | | 0.50 | | | 52 | | | |
| 55 | | | | | | | | | | | | |
| | | | - with silt seams at 58' | | 0.48 | 0.50 | | 71 | 59 | | | |
| 60 | | | | | | | | | | | | |
| | | | Loose gray Sandy Silt | 9 | | | | | 33 | | | |
| 65 | | | | | | | | | | | | |
| | | | Medium dense to dense gray Silty Sand | 31 | | | | | 22 | | | 18 |
| 70 | | | | | | | | | | | | |
| | | | | 30 | | | | | 29 | | | 27 |
| 75 | | | | | | | | | | | | |
| | | | Medium dense gray Sandy Silt | 15 | | | | | 38 | | | 61 |
| 80 | | | | | | | | | | | | |
| | | | Firm to stiff gray Fat Clay with silt seams and sand lenses | | 0.94 | 1.00 | | 70 | 54 | | | |
| 85 | | | | | | | | | | | | |
| | | | | | | 1.00 | | | 52 | | | |
| 90 | | | | | | | | | | | | |
| | | | | | 0.89 | 1.00 | | 77 | 47 | | | |
| 95 | | | | | | | | | | | | |
| | | | | | | 1.00 | | | 48 | | | |
| 100 | | | | | | | | | | | | |

**DEPTH OF BORING:** 100 Feet
**DATE:** 2/19/2024

STRATUM ENGINEERING, LLC

# LOG OF BORING N-2

## LED SITE CHARACTERIZATION
## SOUTH LAFOURCHE AIRPORT - NORTH SITE
## LAFOURCHE PARISH, LOUISIANA

**TYPE OF BORING:** WET ROTARY **LOCATION:** EAST SIDE OF SITE **PROJECT NO.:** G24-012

| DEPTH, FT. | SOIL TYPE | SAMPLES | DESCRIPTION | N-BLOWS/FT. | UNCONFINED COMPRESSIVE STRENGTH tsf | HAND PENTROMETER tsf | TORVANE tsf | UNIT DRY WEIGHT pcf | MOISTURE CONTENT % | LIQUID LIMIT | PLASTICITY INDEX | % PASSING #200 SIEVE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 12" Silty Topsoil with organics | | | 1.00 | | | 49 | | | |
| | | | Firm to stiff gray Fat Clay with trace of organics | | | | | | | | | |
| | | | Soft to firm gray Fat Clay with sand ▼ | | 0.46 | 0.50 | | 83 | 41 | 60 | 37 | 84 |
| 5 | | | Loose gray Poorly Graded Sand ▽ | 9 | | | | | 25 | | | 6 |
| | | | Loose gray Silty Clayey Sand | 6 | | | | | 41 | | | |
| | | | | 4 | | | | | 30 | | | 23 |
| 10 | | | | | | | | | | | | |
| | | | Very soft to soft blue-gray Fat Clay | | | | 0.15 | | 41 | | | |
| 15 | | | | | | | | | | | | |
| | | | | | 0.25 | | 0.15 | 77 | 51 | | | |
| 20 | | | | | | | | | | | | |
| | | | - soft to firm dark gray with trace of organics at 23' | | | 0.50 | | | 74 | | | |
| 25 | | | | | | | | | | | | |
| | | | - becomes soft to firm with sand at 28' | | 0.43 | | 0.25 | 82 | 37 | 57 | 35 | 83 |
| 30 | | | | | | | | | | | | |
| | | | Medium dense gray Silty Sand | 13 | | | | | 33 | | | 28 |
| 35 | | | | | | | | | | | | |
| | | | - dense at 38' | 33 | | | | | 28 | | | 23 |
| 40 | | | | | | | | | | | | |
| | | | Loose gray Sandy Silt | 6 | | | | | 30 | | | 61 |
| 45 | | | | | | | | | | | | |
| | | | Firm gray Fat Clay with silt seams | | 0.64 | 0.75 | | 76 | 51 | | | |
| 50 | | | | | | | | | | | | |

**DEPTH OF BORING:** 50 Feet **GROUNDWATER:** Measured at 4 Feet Upon Completion of Drilling
**DATE:** 2/20/2024

STRATUM ENGINEERING, LLC

# LOG OF BORING N-3

## LED SITE CHARACTERIZATION
## SOUTH LAFOURCHE AIRPORT - NORTH SITE
## LAFOURCHE PARISH, LOUISIANA

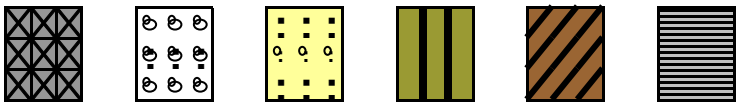
**TYPE OF BORING:** WET ROTARY **LOCATION:** SW CORNER OF SITE **PROJECT NO.:** G24-012

| DEPTH, FT. | SOIL TYPE | SAMPLES | DESCRIPTION | N-BLOWS/FT. | UNCONFINED COMPRESSIVE STRENGTH tsf | HAND PENTROMETER tsf | TORVANE tsf | UNIT DRY WEIGHT pcf | MOISTURE CONTENT % | LIQUID LIMIT | PLASTICITY INDEX | % PASSING #200 SIEVE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 10" Silty Topsoil with organics | | | 2.00 | | | 55 | | | |
| | | | Stiff to very stiff gray Fat Clay | | | | | | | | | |
| | | | - with organics, 0 to 2' | | | 1.00 | | | 44 | | | |
| | | | - firm to stiff at 2' | | | | | | | | | |
| 5 | | | Very soft to soft gray Lean Clay with sand ▼ | | 0.23 | | 0.15 | 89 | 34 | 31 | 10 | 75 |
| | | | ▽ | | | | 0.15 | | 37 | | | 71 |
| 10 | | | Very soft gray Sandy Silty Clay | | | | 0.10 | | 38 | | | 60 |
| 15 | | | Very soft to soft blue-gray Fat Clay | | 0.22 | | 0.10 | 77 | 46 | | | |
| 20 | | | - with traces of sand, 18' to 25' | | | | 0.20 | | 39 | | | |
| 25 | | | | | 0.25 | | 0.15 | 87 | 40 | | | |
| 30 | | | | | | | 0.20 | | 58 | | | |
| 35 | | | Boring terminated at 30 feet | | | | | | | | | |
| 40 | | | | | | | | | | | | |
| 45 | | | | | | | | | | | | |
| 50 | | | | | | | | | | | | |

**DEPTH OF BORING:** 30 Feet **GROUNDWATER:** Measured at 5 Feet Upon Completion of Drilling
**DATE:** 2/20/2024

# KEY TO TERMS AND SYMBOLS USED ON LOGS

## SOIL TYPE

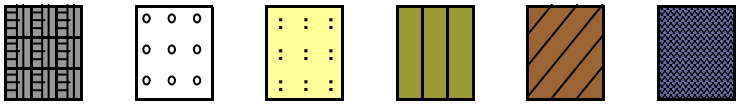


ROCK | GRAVEL | SAND | SILT | CLAY | PEAT

## SAMPLER TYPE

NO SAMPLE | AUGER SAMPLE | SHELBY TUBE | SPLIT SPOON

## MODIFIERS



STONE | GRAVELY | SANDY | SILTY | CLAYEY | FILL

NO RECOVERY | ROCK CORE | 2" SHELBY TUBE | TXDOT CONE

## UNIFIED SOIL CLASSIFICATION SYSTEM - ASTM D 2487 (1980)

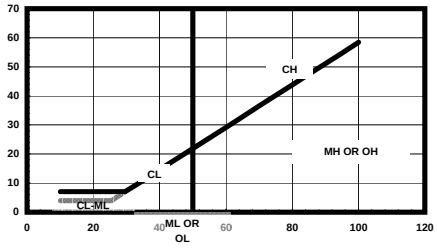
| MAJOR DIVISIONS | | | LETTER SYMBOL | TYPICAL DESCRIPTIONS |
|---|---|---|---|---|
| COARSE GRAINED SOILS LESS THAN 50% PASSING NO. 200 SIEVE | GRAVEL & GRAVELY SOILS LESS THAN 50% PASSING NO. 4 SIEVE | CLEAN GRAVEL (LITTLE OR NO FINES | GW | WELL GRADED GRAVEL, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES |
| | | | GP | POORLY GRADED GRAVEL, GRAVEL-SAND MIXTURES WITH LITTLE OR NO FINES |
| | | W/ APPRECIABLE FINES | GM | SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURES |
| | | | GC | CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES |
| | SANDS MORE THAN 50% PASSING NO. 4 SIEVE | CLEAN SANDS LITTLE FINES | SW | WELL GRADED SAND, GRAVELY SAND (LITTLE FINES) |
| | | | SP | POORLY GRADED SANDS, GRAVELY SAND (L.FINES) |
| | | SANDS WITH APPREA. FINES | SM | SILTY SANDS, SAND-SILT MIXTURES |
| | | | SC | CLAYEY SANDS,SAND-CLAY MIXTURES |
| FINE GRAINED SOILS MORE THAN 50% PASSING NO. 200 SIEVE | SILTS AND CLAYS LIQUID LIMIT LESS THAN 50 | | ML | INORGANIC SILTS & VERY FINE SANDS,ROCK FLOUR SILTY OR CLAYEY FINE SANDS OR CLAYEY SILT W/ LOW PI |
| | | | CL | INORGANIC CLAY OF LOW TO MEDIUM PI LEAN CLAY GRAVELY CLAYS, SANDY CLAYS, SILTY CLAYS |
| | | | OL | ORGANIC SILTS & ORGANIC SILTY CLAYS OF LOW PI |
| | SILTS AND CLAYS LIQUID LIMIT GREATER THAN 50 | | MH | INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS, ELASTIC SILTS |
| | | | CH | INORGANIC CLAYS OF HIGH PLASTICITY FAT CLAYS |
| | | | OH | ORGANIC CLAYS OF MED TO HIGH PI, ORGANIC SILT |
| HIGHLY ORGANIC SOIL | | | PT | PEAT AND OTHER HIGHLY ORGANIC SOILS |
| UNCLASSIFIED FILL MATERIALS | | | ARTIFICIALLY DEPOSITED AND OTHER UNCLASSIFIED SOILS AND MAN-MADE SOIL MIXTURES | |

## CONSISTENCY OF COHESIVE SOILS

| CONSISTENCY | SHEAR STRENGTH IN TONS/FT$^2$ |
|---|---|
| VERY SOFT | 0. TO 0.125 |
| SOFT | 0.125 TO 0.25 |
| FIRM | 0.25 TO 0.5 |
| STIFF | 0.5 TO 1.0 |
| VERY STIFF | 1.0 TO 2.0 |
| HARD | > 2.0 OR 2.0+ |

## RELATIVE DENSITY - GRANULAR SOILS

| CONSISTENCY | N-VALUE (BLOWS/FOOT) |
|---|---|
| VERY LOOSE | 0-4 |
| LOOSE | 4-9 |
| MEDIUM DENSE | 10-29 |
| DENSE | 30-49 |
| VERY DENSE | > 50 OR 50+ |




## ABBREVIATIONS

HP - HAND PENETROMETER
TV - TORVANE
MV - MINIATURE VANE
UC - UNCONFINED COMPRESSION TEST
UU - UNCONSOLIDATED UNDRAINED TRAIXIAL
CU - CONSOLIDATED UNDRAINED

NOTE: PLOT INDICATES SHEAR STRENGTH AS OBTAINED BY ABOVE TESTS

DELAYED GROUNDWATER LVL

LEVEL GROUNDWATER ENCOUNTERED

## CLASSIFICATION OF GRANULAR SOILS

U.S. STANDARD SIEVE SIZE(S)

| 6" | 3" | 3/4" | 4 | 10 | 40 | 200 |
|---|---|---|---|---|---|---|

| BOUL--DERS | COBBLES | GRAVEL | | SAND | | | SILT | CLAY |
|---|---|---|---|---|---|---|---|---|
| | | COARSE | FINE | COARSE | MEDIUM | FINE | | |

| 152 | 76.2 | 19.1 | 4.76 | 2.0 | 0.42 | 0.075 | 0.002 |
|---|---|---|---|---|---|---|---|

GRAIN SIZE IN MM