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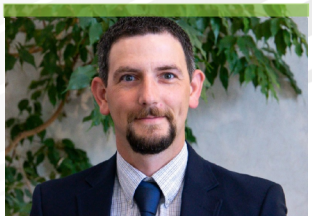
Soils & Masonry Testing



Joseph Ridgway, PE

Laboratory Manager

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Agenda – Special Inspections

- Soils
  - Geotechnical Reports
  - Soil Classification
  - Proof rolling & Compaction
- Masonry
  - Material Testing

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Geotechnical Report


GEOTECHNICAL ENGINEERING SERVICES
VINELAND FIRE HEADQUARTERS BUILDING
NORTHWEST BOULEVARD AND EAST PLUM STREET
CITY OF VINELAND
CUMBERLAND COUNTY, NEW JERSEY

Submitted To:
New Road Construction Management
Mr. Bruce Farrell, Project Executive
1876 Greentree Road
Cherry Hill, NJ 08003

Murat Arkan, PE
Senior Geotechnical Engineer

- Importance
  - Essential Information about the physical and mechanical properties of the soil and rock at the project site.
- Contents:
  - Summary of Geologic Conditions
  - Proposed construction
  - Field and Lab work performed in analysis
  - Site conditions
  - Subsurface Stratigraphy
  - Analysis and Recommendations
  - Earthwork
  - Proposed foundation systems and design parameters
  - Boring Logs

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GEOTECHNICAL REPORT

- Key Items within Geotechnical Reports
  - Preparations of subgrade
  - Re-use of onsite soils
  - Imported Fill Materials
  - Bearing Stratum Identification
  - Boring Logs
  - Compaction **Control** Requirements
  - Ground water elevations

5.2. EARTHWORK

As mentioned earlier, it is anticipated that the ground floor slab level of the proposed Fire HQ Building will range between Elev. 103.5 and 106.5, moderately higher than the existing grades. Therefore, up to 5 ft new fill will be necessary to attain the ground floor slab subgrade level in portions of the proposed building area, except in the central portion of the existing building, where approximately 8 to 9 ft thick new fill will be required to fill the basement volume.

Initially, the existing building which partially occupies the area of proposed Fire HQ Building will be demolished. After the existing structure is razed, the foundations and floor slab concrete of the existing building, basement slab and walls, including all existing pavements, concrete walks, vegetation, topsoil, etc., should be completely removed from the area of proposed construction. In addition, any existing underground utilities should also be removed from the area of the proposed building. Underground utilities to be abandoned may be left in place provided that they are completely filled with concrete grout and that they do not conflict with the new foundations of the proposed Building

After the above operations, the exposed subgrades, including in the area of the previously existing basement, should be densified with a heavy vibratory roller, such as a Dynapac CA-25, or equal, to detect and repair loose areas. During densification, any unstable area found should be stabilized by excavating and replacing those soils with suitable soil (adequately compacted, see below), by lowering the moisture content of the subgrade soils and compacting them, or by other methods (placing a geotextile and stone layer, etc.).

Our experience and laboratory test results indicate that the on-site, existing near surface soils can be reused in compacted load bearing fills. Laboratory testing indicates that the near surface soils of Stratum 1 consist of sands with varying amounts of silt and gravel. Laboratory test results also indicate that the present moisture content (8% to 9%) of these soils appears to be within the optimum moisture content normally associated with these soils to achieve desired degree of compaction. Adjusting the moisture contents of these on-site soils before use in any compacted fills and/or subgrade preparation should be expected. Proper compaction equipment and placing soil in thinner layers should be considered when preparing earthwork schedules.

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SOIL CLASSIFICATION

- Importance
  - Knowledge of material and ability to work with material
  - Ability to verify material
  - Ability to apply laboratory data with field data

CLIENT New Road Construction Management — PROJECT NAME Vineland Fire Headquarters Building
PROJECT NUMBER NEWRD22003 — PROJECT LOCATION Vineland, NJ
DATE STARTED 3/2/22 — COMPLETED 3/2/22 — GROUND ELEVATION 98.5'
DRILLING CONTRACTOR CGC Geoservices, LLC — WATER ENCOUNTERED:
DRILLING METHOD Hollow Stem Auger — ▽ DURING DRILLING 20.0' / Elev 78.5'
DRILLER / HELPER Eugene /Justin — ▼ AT END OF DRILLING 20.0' / Elev 78.5'
LOGGED BY M. Arkan — CHECKED BY M. Arkan — ▼ AFTER DRILLING 20.0' / Elev 78.5'

DEPTH (ft)	SAMPLE TYPE NUMBER	RECOVERY (in.)	BLOW COUNTS	GRAPHIC LOG	STRATA	DESCRIPTION	Depth	Elev.	REMARKS
0					T	Topsoil	0.3	98.2	
	S-1	10	2-3-6-5		F	Fill: Brown F/M SAND, trace Silt, trace Gravel, trace Cinders			
	S-2	12	2-3-2-2			Fill: Brown F/M SAND, trace to little Silt, trace Gravel (Disturbed)	4.0	94.5	
5	S-3	16	3-4-5-10			Brown F/M/C SAND, trace Silt, trace to little Gravel			
	S-4	16	7-14-11-13						
10	S-5	18	7-11-10-9						
					1	Light Brown to Gray F/M/C SAND, some Gravel, trace Silt			
15	S-6	20	8-10-12-12						
							19.5	79.0	
20 ▼	S-7	22	8-9-9-11			Brown F SAND, trace Silt			
					2				
25	S-8	20	14-8-16-20				25.0	73.5	
						Borehole terminated at 25.0 feet			

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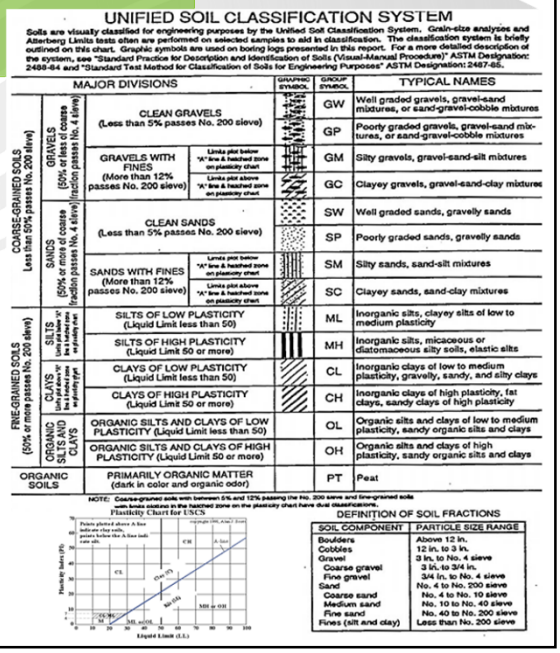
Soil Classification

- Classification Systems
  - USCS (most common)
  - AASHTO (Transportation)
  - USDA (Stormwater)



UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified for engineering purposes by the Unified Soil Classification System. Grain-size analyses and Atterberg Limits tests often are performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. Graphic symbols are used on boring logs presented in this report. For a more detailed description of the system, see "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)" ASTM Designation: 2488-84 and "Standard Test Method for Classification of Soils for Engineering Purposes" ASTM Designation: 2487-85.

MAJOR DIVISIONS			GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (More than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)		GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures
				GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve) — Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve) — Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (50% or more of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 sieve)		SW	Well graded sands, gravelly sands
				SP	Poorly graded sands, gravelly sands
		SANDS WITH FINES (More than 12% passes No. 200 sieve) — Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures
		SANDS WITH FINES (More than 12% passes No. 200 sieve) — Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS (Limits plot below "A" line or plot in hatched zone on plasticity chart)	SILTS OF LOW PLASTICITY (Liquid Limit less than 50)		ML	Inorganic silts, clayey silts of low to medium plasticity
		SILTS OF HIGH PLASTICITY (Liquid Limit 50 or more)		MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts
	CLAYS (Limits plot above "A" line or plot in hatched zone on plasticity chart)	CLAYS OF LOW PLASTICITY (Liquid Limit less than 50)		CL	Inorganic clays of low to medium plasticity, gravelly, sandy, and silty clays
		CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more)		CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity
	ORGANIC SILTS AND CLAYS	ORGANIC SILTS AND CLAYS OF LOW PLASTICITY (Liquid Limit less than 50)		OL	Organic silts and clays of low to medium plasticity, sandy organic silts and clays
		ORGANIC SILTS AND CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more)		OH	Organic silts and clays of high plasticity, sandy organic silts and clays
ORGANIC SOILS		PRIMARILY ORGANIC MATTER (dark in color and organic odor)		PT	Peat

NOTE: Coarse-grained soils with between 5% and 12% passing the No. 200 sieve and fine-grained soils with limits plotting in the hatched zone on the plasticity chart have dual classifications.

Plasticity Chart for USCS

DEFINITION OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Boulders	Above 12 in.
Cobbles	12 in. to 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to 3/4 in.
Fine gravel	3/4 in. to No. 4 sieve
Sand	No. 4 to No. 200 sieve
Coarse sand	No. 4 to No. 10 sieve
Medium sand	No. 10 to No. 40 sieve
Fine sand	No. 40 to No. 200 sieve
Fines (silt and clay)	Less than No. 200 sieve

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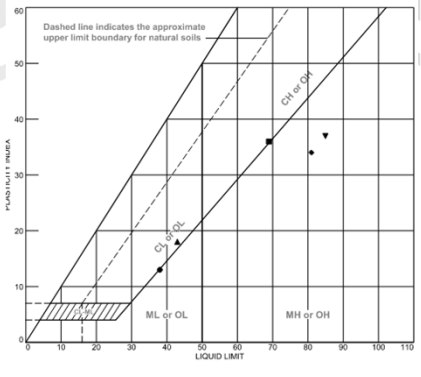
Soil Classification

- Gradation and Atterberg Limits
  - Gradation – Particle size distribution
- Atterberg Limits – defining the boundaries between the soil consistency with moisture
  - Solid – Semi-Solid – Plastic – Liquid

Particle Sizes:

Boulders	=	Greater than 12 inches
Cobbles	=	3 inches to 12 inches
Gravel	- Coarse	=	¾ inches to 3 inches
	- Fine	=	No. 4 sieve/ 3/16 inches to ¾ inches
Sand	- Coarse	=	No. 10 sieve to No. 4 sieve
	- Medium	=	No. 40 sieve to No. 10 sieve
	- Fine	=	No. 200 sieve to No. 40 sieve
Silt		=	.005 mm to No. 200 sieve
Clay		=	Less than .005 mm

LIQUID AND PLASTIC LIMITS TEST REPORT



SOIL DATA

SYMBOL	SOURCE	SAMPLE NO.	DEPTH	NATURAL WATER CONTENT (%)	PLASTIC LIMIT (%)	LIQUID LIMIT (%)	PLASTICITY INDEX (%)	USCS
◆	BS-1	Bulk		31.4	25	38	13	SM
■	BS-2	Bulk		61.0	33	69	36	CH
▲	BS-3	Bulk		40.0	25	43	18	CL
◆	BS-4	Bulk		53.5	47	81	34	MH
▼	BS-5	Bulk		51.8	48	85	37	MH

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Bearing Capacity

- Visual verification of subgrade below excavation (shallow foundation)
  - Identify the type of soil and stratum for the subgrade is required in the Geotechnical Report
  - Does not mean a verification of compaction or actual bearing capacity
- If no Geotechnical Report is provided, additional testing/verification is needed
  - Dynamic Cone Penetration Test (DCPT)
  - Boring or Test Pits
  - Bearing Plate Testing

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Compaction

- Proof Rolling is performed on building pad after the excavation to the designated stratum identified in the geotechnical report
- Process includes
  - Excavation of existing soil material to designated stratum
  - Compacting the existing material with large rollers (specified in geotechnical report)
  - Fully loaded tri-axle dump trucks drives over prepared areas
  - Observation of the soil reaction beneath the tires
    - Looking for signs of instability, rutting, pumping
  - Deficient areas are excavated and replaced with suitable material per the Geotechnical report

Courtesy of https://thespecialinspector.com/

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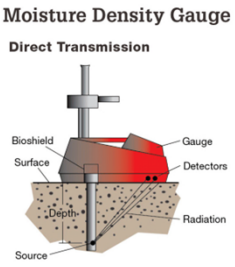
COMPACTION

- Nuclear Density Gauge is most frequently used tool for compaction control
- Nuclear density gauge requires the fill materials maximum density and optimum moisture content (Lab provided values)
- Verification of fill material is applicable to the provided lab values
- After compaction, the probe is entered into the ground and calculates the moisture content and density
- The compaction values (expressed as percentage) are compared to project specification or geotechnical report requirements.
- Prior to nuclear gauge density testing the soil is visually verified for acceptance (firm, stable, proper stratum/fill material)



Source: U.S. Nuclear Regulatory Commission (NRC)

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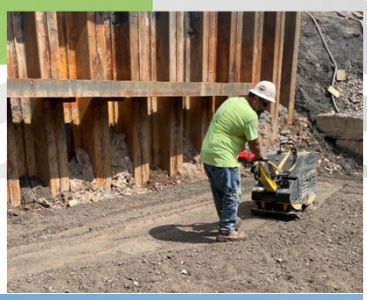
COMPACTION - LABORATORY TESTING



- Moisture-Density Relationship (Proctor)
  - Modified (ASTM D1557)
  - Standard (ASTM D698)
  - Type of proctor based on compaction efforts

Courtesy of https://www.constructionequipment.com/

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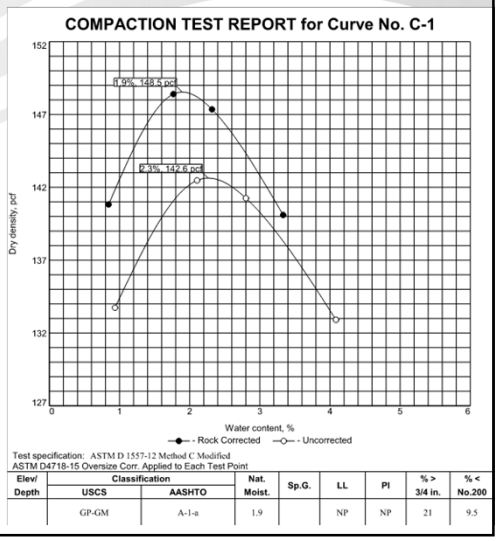
Compaction - Laboratory Testing

- The proctor curve describes the moisture density relationship under certain compaction efforts
- Graph is parabolic
  - Modified - higher density / lower moisture
- Shape of parabolic curve is dependent on the type of soils
  - Sharper curve – silty and clayey soils
  - Flat curve - granular



Elev/ Depth	Classification USCS	Classification AASHTO	Nat. Moist.	Sp.G.	LL	PI	% > 3/4 in.	% < No.200
	GP-GM	A-1-a	1.9		NP	NP	21	9.5

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Masonry

- Material Qualification Testing
  - Components of Masonry Testing
- Concrete Masonry Unit (ASTM C90)
  - Compression, Absorption, & Density (ASTM C140)

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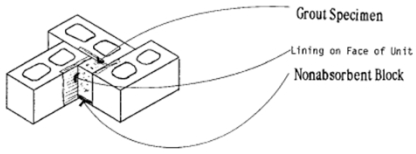
MASONRY

- Mortar (ASTM C780)
  - Consistency, Air Content, Compression, & Splitting Tensile
- Grout (ASTM C1019)
  - Consistency, Temperature, & Compressive strength



Courtesy of ASTM C1019

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MASONRY

- Masonry Prism (ASTM C1314)
  - Compressive strength

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QUESTIONS

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