CGC, Inc.

Construction • Geotechnical
Consulting Engineering/Testing

August 21, 2012
C12214

Mr. Dave Nelsen, P.E.
Ruedebusch Development & Construction
4605 Dovetail Drive
Madison, WI 53704

Re: Preliminary Geotechnical Exploration Report
Proposed Fitchburg Technology Campus – Phase II
Nobel Drive
Fitchburg, Wisconsin

Dear Mr. Nelsen:

Construction • Geotechnical Consultants, Inc. (CGC) has completed the preliminary geotechnical exploration program for the proposed eastward expansion of the Fitchburg Technology Campus. The purpose of this exploration program was to evaluate the subsurface conditions within the proposed building lots and to provide preliminary geotechnical recommendations regarding site preparation, foundation and floor slab design/construction. We are sending you an electronic copy of this report, and can provide a paper copy upon request.

PROJECT DESCRIPTION

We understand that the Fitchburg Technology Campus will be expanded east over about 55 to 60 acres. Nobel Drive will be extended east, and Mica Road, Quartz Road and Granite Road will be extended south. Grading will be required during site development, but proposed grades were not provided. Development plans for the proposed lots have not been determined, but buildings within the existing campus are one to three story structures.

SITE CONDITIONS

The site is located east of the present termination of Nobel Drive and south of the present terminations of Quartz, Granite and Mica Roads. The site is primarily agricultural land with rolling, variable topography. A stormwater infiltration basin currently exists in the northeast area of the site, and a drainage ditch exists in the northwest quadrant of the proposed development. The site is bounded by a narrow wood line and then agricultural land along the east and south sides, with wooded land also present in the east-central portion of the site. A residential subdivision exists north of the site.

2921 Perry Street, Madison WI 53713
Telephone: 608/288-4100
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SUBSURFACE CONDITIONS

Subsurface conditions on site were explored by drilling a total of nine Standard Penetration Test (SPT) soil borings to planned depths of 15 ft below existing site grades at locations selected by Ruedebusch and located in the field by CGC. Note that Boring 8 was offset about 100 ft west since the original location was within a heavily wooded area. The borings were drilled on August 3 and 6, 2012 by Soil Essentials (under subcontract to CGC) using a track-mounted Geoprobe 7822DT rotary drill rig equipped with hollow-stem augers and an automatic hammer. The boring locations are shown in plan on the Soil Boring Location Map attached in Appendix B. Ground surface elevations at the boring locations were estimated using a provided topographic map and are referenced to USGS datum.

The subsurface profile at the boring locations is somewhat variable, but can generally be described by the following strata, in descending order:

- 10 to 15 in. of silty, sandy and clayey ***topsoil***; followed by
- 1.5 to 10.5 medium stiff to hard ***lean clay***, or very loose to medium dense ***silt*** to ***clayey silt***; this layer was not detected in Borings 2 and 8; over
- Loose to very dense ***sand*** with variable silt and gravel content and scattered cobbles/boulders to the maximum depth explored.

Groundwater was encountered in Borings 3, 4, 5 and 6 at 11 to 13.5 ft below existing site grades during or shortly after drilling. Groundwater levels can be expected to fluctuate with seasonal variations in precipitation, infiltration, evapotranspiration and other factors. A more detailed description of the site soil and groundwater conditions is presented on the Soil Boring Logs attached in Appendix B.

Based on the *Soil Survey of Dane Country, Wisconsin*, the soils within the proposed campus expansion consist primarily of St. Charles silt loam (ScB), McHenry silt loam (MdC2), Ringwood silt loam (RnB) and Dodge silt loam (DnB). A smaller tract of Troxel silt loam (TrB) exists in the west area of the site, Virgil silt loam (VrB) exists in the northeast area of the site, Griswold silt loam (GwC) exists in the southeast corner of the site, and Plano silt loam (PnB) exists in the east-central area of the site (see Appendix B for the soil series map). The Dodge, Griswold, McHenry, Plano, Ringwood, and St. Charles series are generally described as deep, well drained and moderately well drained soils on glaciated uplands. A typical profile of these soils consists of silt loam (topsoil) over silty clay loam, sandy clay loam and sandy loam. The seasonal high groundwater table is typically greater than 5 ft below the ground surface, with some areas having occasional groundwater as shallow as 3 ft. The Troxel and Virgil series are described as somewhat poorly drained to well-drained soils in draws, on fans, in drainageways, and on low benches on uplands and in stream valleys. The Troxel series consists of silt loam over silty clay loam and silt loam, and the Virgil series is similar to those previously described. Seasonal high groundwater is between 3 to 5 ft for the Troxel series and 1 to 3 ft for the Virgil series. The soil profiles in the soil borings were generally similar to the soil mapping descriptions.

DISCUSSION AND PRELIMINARY RECOMMENDATIONS

Subject to the limitations described below and based on the subsurface exploration, it is our opinion that this area is generally suitable for the proposed construction and that the structures can likely be supported by conventional spread footing foundations. However, the presence of softer clays and looser silts in some areas are reflected in the preliminary site preparation and foundation recommendations, which are provided in the following subsections, along with recommendations regarding floor slab design/construction. *Follow-up soil borings are recommended as development plans progress and specific site and building plans are determined.* Additional information regarding the conclusions and recommendations presented in this report is discussed in Appendix C.

1. Site Preparation

We recommend that topsoil and vegetation be stripped at least 5 ft beyond the proposed construction areas, including areas required for cuts and fills beyond the building footprint or pavement limits. Variable topsoil thickness should be expected due to past grading and agricultural activities. The topsoil can be stockpiled on-site and re-used as fill in landscaped areas. Tree and tree root removal, where required, should occur in conjunction with topsoil stripping.

The exposed soils should be carefully checked for soft/yielding areas by proof-rolling with a loaded dump truck or other heavy rubber tire piece of construction equipment. If soft/yielding areas are encountered, these areas should be undercut and replaced with granular backfill compacted to at least 95% compaction based on modified Proctor methods (ASTM D1557). Alternatively, 3-in. dense graded base can be used to restore grades in undercut areas.

Fill placement (where required) to establish grades can then proceed. We recommend using granular soils (i.e., sands/gravels) as structural fill within building envelopes because these soils are relatively easy to place and compact in most weather conditions. Clay/silt soils are not recommended as structural fill because moisture conditioning will be required to achieve desired compaction levels, which could delay construction progress. Clay/silt soils may be used as fill in landscaped areas or in pavement areas provided the soils are dried back to facilitate compaction. We recommend that structural fill/backfill be compacted to at least 95% compaction (ASTM D1557) in accordance with our Recommended Compacted Fill Specifications presented in Appendix D. Periodic field density tests should be taken by CGC staff within the fill/backfill to document the adequacy of compactive effort.

Note that the very loose to loose silt and medium stiff to stiff clay soils in Borings 4 through 7 in the southern portion of the site are considered to be slightly to moderately compressible. Therefore, if high fills are planned in southern portions of the site, early fill placement (potentially a couple months prior to building construction) may be required to minimize potential problems associated with unacceptable settlement due to consolidation under the weight of the new fill. We can provide additional details as site plans are developed.

2. Preliminary Foundation Design

In our opinion and based on the subsurface exploration, the proposed building lots are generally suitable for development of buildings using conventional reinforced concrete spread footing foundations bearing on the native soils or well-compacted granular fill. Foundation design for the lots along the southern portion of the site (see Borings 4 through 7 and potentially elsewhere) is complicated by the softer clays and looser silts at shallow to moderate depths. A relatively low bearing pressure and/or undercutting/replacement should be expected in the southern lots and potentially elsewhere. In most cases, including a basement will at least partially bypass the marginal soils and allow for a higher bearing pressure or reduce the amount of overexcavation. The depth and extent of undercutting can be better determined by conducting supplemental borings after the building locations are determined. Preliminary estimated allowable bearing pressures are included in Table 1.

Table 1 - Summary of Approximate Bearing Pressures
Fitchburg Technology Campus - Phase II
Fitchburg, WI

Boring	Approximate Boring Elevation (ft)	Estimated Allowable Bearing Pressure (psf)		Potential Soil Issues
		Slab-on-Grade (no basement)	With Basement	
1	1024	3000	5000	Shallow Loose Sands
2	1018	4000	4000	None present in boring
3	1030	3000	3000	Loose Sands; Groundwater near 11 ft
4	1026	2000	2000	Medium Stiff Clays; Groundwater near 13.5 ft
5	1027	2000	4000	Medium Stiff Clays; Groundwater near 13.5 ft
6	1024	2000	4000	Very Loose Silt/Clayey Silt; Groundwater near 13.5 ft
7	1020	2000	3000	Very Loose Silt; Loose Sand
8	1024	4000	5000	None present in boring
9	1009	4000	5000	None present in boring

The additional following parameters should also be used for foundation design:

- Minimum foundation widths:
  - -- Continuous wall footings: 18 in.
  - -- Column pad footings: 30 in.

- Minimum footing depths:
  - -- Exterior/perimeter footings: 4 ft
  - -- Interior footings: no minimum requirement

Undercutting below footing grade will be required if unsuitable fill or native soils are observed at or slightly below footing grade, which should be determined by CGC during footing excavations. Where undercutting is required, the base of the undercut excavation should be widened beyond the footing edges at least 0.5 ft in each direction for each foot of undercut depth for stress distribution purposes. Granular backfill compacted to at least 95% (ASTM D1557) compaction should be used to re-establish footing grade. As an alternative, 3-in. dense graded base could be placed/compacted to re-establish footing grade. CGC should be present during footing excavations to check whether subgrades are satisfactory for the design bearing pressure and to advise on corrective measures, where necessary.

We recommend using a smooth-edged backhoe bucket for footing excavations. Additionally, granular soils exposed at footing grade that are at least 2 ft above the water table should be recompacted with a large vibratory plate compactor prior to formwork/concrete placement to densify soils loosened during the excavation process. Soils susceptible to disturbance from recompaction (or close to the water table) should be hand-trimmed. Provided the foundation design/construction recommendations discussed above are followed, we estimate that total and differential settlements should be on the order of 1.0 and 0.5 in., respectively.

3. Floor Slabs

We anticipate that the floor slab subgrades for the buildings will likely consist of newly-placed granular fill or native cohesive and granular soils, and in our opinion a subgrade modulus of 100 pci will likely be appropriate for slab design. Prior to slab construction, the slab subgrades should be thoroughly proof-rolled/recompacted as described in the Site Preparation section of this report to densify soils that may become disturbed or loosened during construction activities. The design subgrade modulus is based on a recompacted subgrade such that non-yielding conditions are developed. Areas that do not proof-roll satisfactorily or that remain loose after recompaction should be undercut and replaced with compacted breaker rock or granular fill. To serve as a capillary break, the final 4 in. of soil placed below the slab should consist of well-graded sand or gravel with no more than 5 percent by weight passing a No. 200 U.S. standard sieve. (Note that some structural engineers require a 4 to 6 in. layer of dense graded base (e.g., 1.25-in. crushed aggregate base course) below the slab (in lieu of the drainage layer) to increase the subgrade modulus immediately below the slab; if dense-graded base is used below the floor slab, the subgrade modulus can be increased to 150 pci.) To further minimize the potential for moisture migration or if the capillary break layer is omitted, a plastic vapor barrier can also be utilized. Fill and drainage course material placed below the floor slabs should be placed as described in the Site Preparation section of this report. The slabs should be structurally separate from the foundations and have construction joints and reinforcement for crack control.

Note that if basements or below-grade parking levels are planned, special attention will be required so that the below-grade slabs are sufficiently above (at least 2 to 3 ft) the water table to avoid moisture issues. If floor slabs will be within about 2 ft of the water table, the floor slab design should include a subfloor drainage system, which typically involves about 12 in. of clear stone with regularly-spaced drain tile draining to one or more sumps. Additional details can be provided, if needed, at the appropriate time.

4. Seismic Design Category

In our opinion, the average soil/rock properties in the upper 100 ft of the site (based on SPT blow counts (N-values) of greater than 15 blows/ft, on average, in the soils underlying the site) may be characterized as a stiff soil profile. This characterization would place the site in Site Class D for seismic design according to the International Building Code (see Table 1615.1.1).

CONSTRUCTION CONSIDERATIONS

Due to variations in weather, construction methods and other factors, specific construction problems are difficult to predict. Soil related difficulties that could be encountered on the site are discussed below:

- Due to the potentially sensitive nature of the on-site soils, we recommend that final site grading activities be completed during dry weather, if possible. Construction traffic should be avoided on prepared subgrades to minimize potential disturbance.

- Earthwork construction during the early spring or late fall could be complicated as a result of wet weather and freezing temperatures. During cold weather, exposed subgrades should be protected from freezing before and after footing construction. Fill should never be placed while frozen or on frozen ground.

- Excavations extending greater than 4 ft in depth below the existing ground surface should be sloped or braced in accordance with current OSHA standards.

- Based on observations made during the field exploration and our understanding of the proposed construction, groundwater infiltration into footing excavations for slab-on-grade buildings is generally not expected. However, some dewatering could potentially be required in deeper undercuts or basement footing excavations. Water accumulating at the base of excavations as a result of precipitation or seepage should be controlled and quickly removed using pumps operating from filtered sump pits. Potential site specific dewatering issues should be accessed as plans develop.

RECOMMENDED CONSTRUCTION MONITORING

The quality of the foundation and floor slab subgrades will be largely determined by the level of care exercised during site development. To check that earthwork and foundation construction proceeds in accordance with our recommendations, the following operations should be monitored by CGC:

- Topsoil stripping/subgrade proof-rolling within the construction areas;
- Fill/backfill placement and compaction;
- Foundation excavation/subgrade preparation; and
- Concrete placement.

FOLLOW-UP EXPLORATION

The soil borings were intended to provide preliminary, generalized soil information and were not intended to provide sufficient information for foundation and floor slab design of individual structures. Based on the variable soil and groundwater conditions encountered at this site, we recommend that supplemental soil borings be completed to provide geotechnical recommendations for site and structure design. We can provide additional information at the appropriate time.

* * * * *

It has been a pleasure to serve you on this project. If you have any questions or need additional consultation, please contact us.

Sincerely,

CGC, Inc.

David Staab

David A. Staab, P.E., LEED AP
Consulting Professional

William W. Wuellner /DAS

William W. Wuellner, P.E.
Senior Geotechnical Engineer

Encl:	Appendix A -	Field Exploration
	Appendix B -	Soil Boring Location Map
		Web Soil Survey Map
		Logs of Test Borings (9)
		Log of Test Boring-General Notes
		Unified Soil Classification System
	Appendix C -	Document Qualifications
	Appendix D -	Recommended Compacted Fill Specifications

APPENDIX A

FIELD EXPLORATION

APPENDIX A

FIELD EXPLORATION

A total of nine Standard Penetration Test (SPT) soil borings were to planned depths of 15 ft below existing site grades at locations selected by Ruedebusch and located in the field by CGC. Note that Boring 8 was offset about 100 ft west since the original location was within a heavily wooded area. The borings were drilled on August 3 and 6, 2012 by Soil Essentials (under subcontract to CGC) using a track-mounted Geoprobe 7822DT rotary drill rig equipped with hollow-stem augers and an automatic hammer. The boring locations are shown in plan on the Soil Boring Location Map attached in Appendix B. Ground surface elevations at the boring locations were estimated using a provided topographic map and are referenced to USGS datum.

In each boring, soil samples were obtained at 2.5 foot intervals to a depth of 10 ft and at 5 ft intervals thereafter. The soil samples were obtained in general accordance with specifications for standard penetration testing, ASTM D 1586. The specific procedures used for drilling and sampling are described below.

1. Boring Procedures between Samples

   The boring is extended downward, between samples, by a hollow-stem auger.

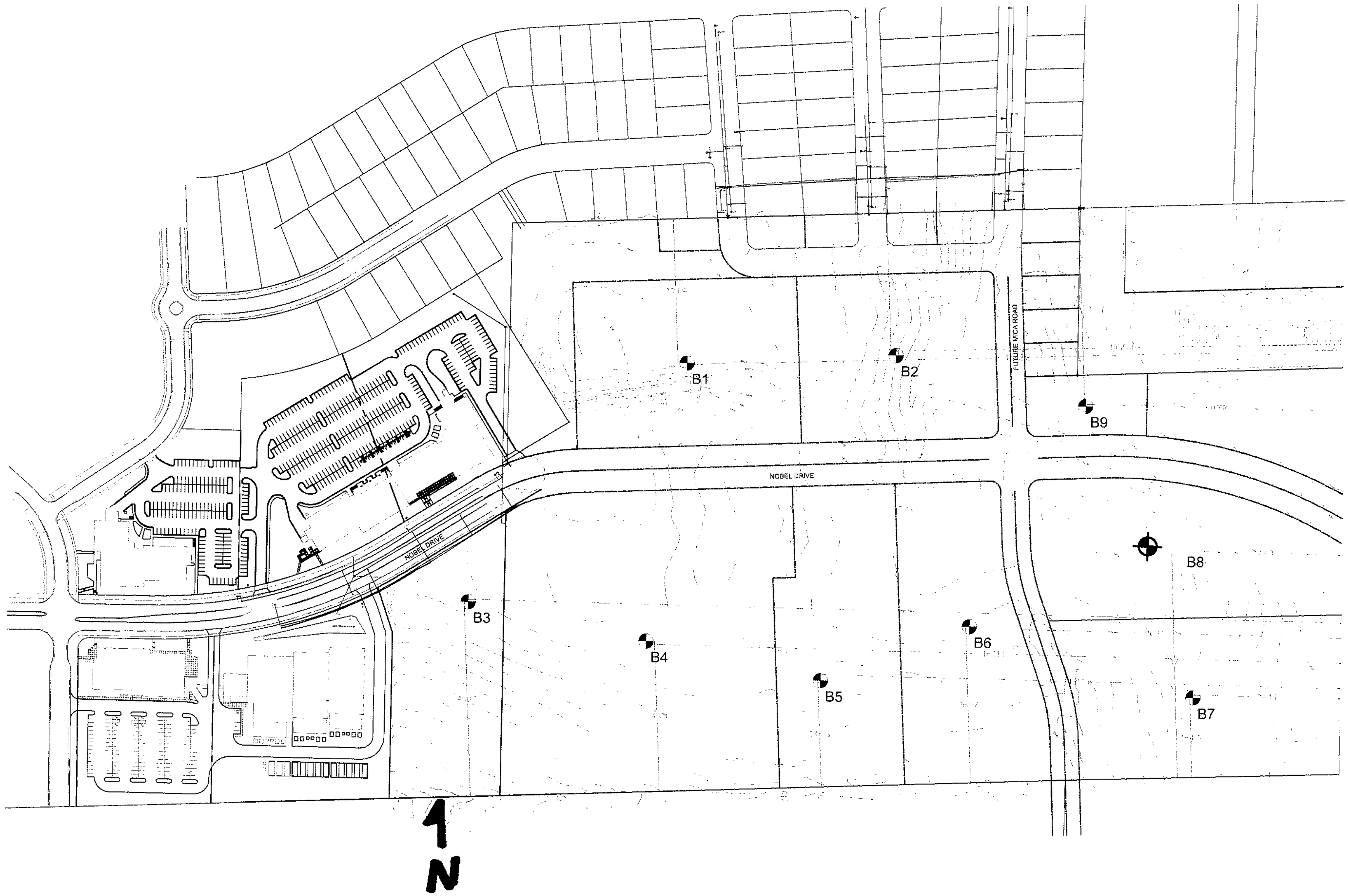
2. Standard Penetration Test and Split-Barrel Sampling of Soils
   (ASTM Designation: D 1586)

   This method consists of driving a 2-inch outside diameter split-barrel sampler using a 140-pound weight falling freely through a distance of 30 inches. The sampler is first seated 6 inches into the material to be sampled and then driven 12 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the log of borings and is known as the Standard Penetration Resistance.

During the field exploration, the driller visually classified the soil and prepared a field log. *Field screening of the soil samples for possible environmental contaminants was not conducted by the drillers as environmental site assessment activities were not part of CGC's work scope.* Water level observations were made in each boring during and after drilling and are shown at the bottom of each boring log. Upon completion of drilling, the borings were backfilled with bentonite (where required) to satisfy WDNR regulations and the soil samples were delivered to our laboratory for visual classification and laboratory testing. The soil samples were visually classified by a geotechnical engineer using the Unified Soil Classification System. The final logs prepared by the engineer and a description of the Unified Soil Classification System are presented in Appendix B.

APPENDIX B

SOIL BORING LOCATION MAP
WEB SOIL SURVEY MAP
LOGS OF TEST BORINGS (9)
LOG OF TEST BORING-GENERAL NOTES
UNIFIED SOIL CLASSIFICATION SYSTEM



Legend

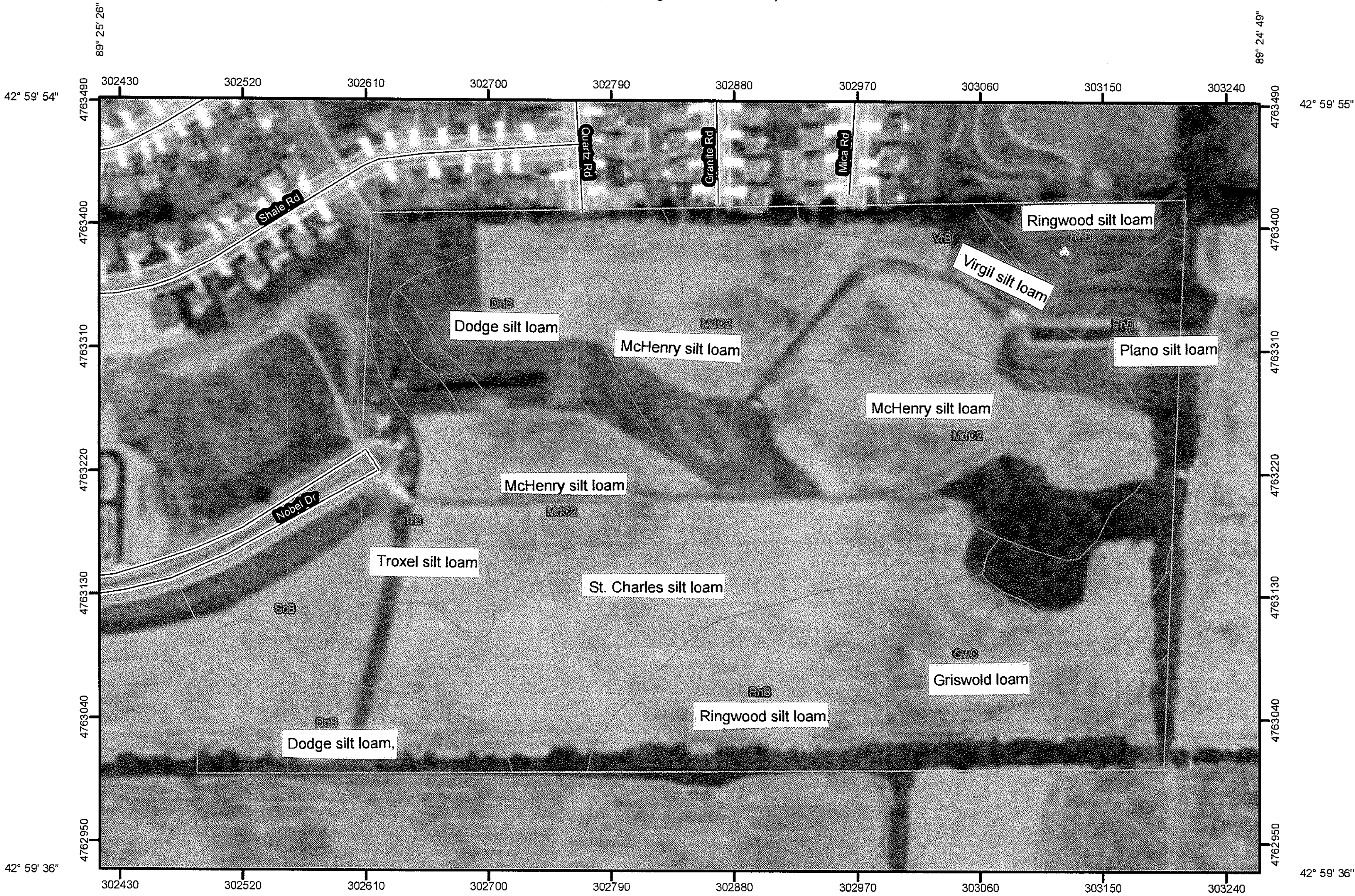
Soil boring location and number

Notes

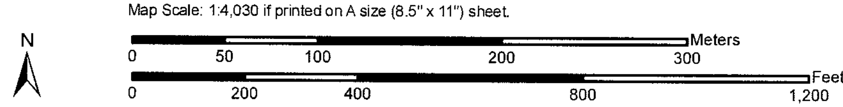
1. Soil borings drilled by Soil Essentials in August 2012.
2. Base map provided by Ruedebusch.
3. Boring locations are approximate.

Date: 8/12	CGC, Inc.	**SOIL BORING LOCATION MAP** **Proposed Fitchburg Technology Campus - Phase II** **Nobel Drive** **Fitchburg, Wisconsin**
Job No. C12214		

Soil Map—Dane County, Wisconsin
(Fitchburg Tech. - Phase II)



Map Scale: 1:4,030 if printed on A size (8.5" x 11") sheet.



CGC Inc.

LOG OF TEST BORING

Project: Fitchburg Technology Campus - Ph II
Nobel Drive
Location: Fitchburg, Wisconsin

Boring No. 1
Surface Elevation (ft) 1024±
Job No. C12214
Sheet 1 of 1

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
						16 in.± Silty Sand TOPSOIL (OL)					
1		16	M	8		Hard, Brown to Brown/Gray (Mottled) Lean CLAY, Trace Sand and Gravel (CL)	(4.5+)				
2		6	M	5		Loose to Dense, Brown Fine to Medium SAND, Some Gravel, Little to Some Silt, Scattered Cobbles/Boulders (SP-SM/SM)					
					5						
3		15	M	37							
4		16	M	19							
					10						
5		17	M	17		Grades to trace silt (SP) near 15 ft					
					15	End Boring at 15 ft Borehole backfilled with bentonite chips					
					20						

WATER LEVEL OBSERVATIONS

While Drilling ∇ NW   Upon Completion of Drilling NW
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/3/12 End 8/3/12
Driller SE Chief CRJ Rig Geoprobe
Logger CRJ Editor DAS 7822DT
Drill Method 2 1/4" HSA; Autohammer

CGC Inc.

LOG OF TEST BORING

Project: Fitchburg Technology Campus - Ph II
Nobel Drive
Location: Fitchburg, Wisconsin

Boring No. 2
Surface Elevation (ft) 1018±
Job No. C12214
Sheet 1 of 1

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						10 in. Silty Sand TOPSOIL (OL)					
1		12	M	12		Medium Dense, Brown Silty Fine SAND, Little Gravel (SM)					
2		15	M	42		Dense, Brown Fine to Medium SAND, Some Gravel, Trace to Little Silt (SP/SP-SM)					
					5						
						Medium Dense, Red-Brown Fine to Medium SAND, Some Silt and Gravel, Scattered Cobbles/Boulders (SM)					
3		15	M	24							
						Medium Dense, Light Brown Fine SAND, Trace to Little Silt, Scattered Silt Pockets/Seams (SP/SP-SM)					
4		16	M	19		Medium Dense, Red-Brown Fine to Medium SAND, Some Silt and Gravel, Scattered Cobbles/Boulders (SM)					
					10						
5		10	M	18							
					15	End Boring at 15 ft Borehole backfilled with bentonite chips					
					20						

WATER LEVEL OBSERVATIONS

While Drilling ∇ NW   Upon Completion of Drilling NW
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/3/12 End 8/3/12
Driller SE Chief CRJ Rig Geoprobe 7822DT
Logger CRJ Editor DAS
Drill Method 2 1/4" HSA; Autohammer

CGC Inc.

LOG OF TEST BORING

Project: Fitchburg Technology Campus - Ph II
Nobel Drive
Location: Fitchburg, Wisconsin

Boring No. 3
Surface Elevation (ft) 1030±
Job No. C12214
Sheet 1 of 1

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
						11 in. Clayey TOPSOIL (OL)					
1		16	M	9		Very Stiff to Hard, Brown to Brown/Gray (Mottled) Lean CLAY, Trace Sand and Gravel (CL)	(4.5)				
2		14	M	9	5		(2.5)				
3		0	M	60/<1"		Loose to Medium Dense, Brown Fine to Medium SAND, Some Silt and Gravel, Scattered Cobbles/Boulders (SM) Apparent Cobble/Boulder from 5.5 to 6.5 ft					
4		14	M/W	9	10						
5		13	W	20	15						
					20	End Boring at 15 ft Borehole backfilled with bentonite chips					

WATER LEVEL OBSERVATIONS

While Drilling	▽ NW	Upon Completion of Drilling			
Time After Drilling					
Depth to Water				11.0'	▼
Depth to Cave in				10.0'	

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/6/12 End 8/6/12
Driller SE Chief DAP Rig Geoprobe
Logger DAP Editor DAS 7822DT
Drill Method 2 1/4" HSA; Autohammer

CGC Inc.

LOG OF TEST BORING

Project: Fitchburg Technology Campus - Ph II, Nobel Drive
Location: Fitchburg, Wisconsin

Boring No. 4
Surface Elevation (ft) 1026±
Job No. C12214
Sheet 1 of 1

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	Type	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						14 in. Clayey TOPSOIL (OL)					
1		10	M	7		Medium Stiff to Hard, Brown to Brown/Gray (Mottled) Lean CLAY, Trace Sand and Gravel (CL)	(4.5+)				
2		10	M	12	5		(1.5)				
3		14	M	4			(0.75-1.0)	25.9			
4		18	M	9	10	Loose, Brown Fine to Medium SAND, Some Gravel, Trace to Little Silt (SP/SP-SM)					
5		14	W	50	15	Dense to Very Dense, Brown Fine to Medium SAND, Some Gravel, Little to Some Silt, Scattered Cobbles/Boulders (SP-SM/SM)					
					20	End Boring at 15 ft Borehole backfilled with bentonite chips					

WATER LEVEL OBSERVATIONS

While Drilling ▽ NW   Upon Completion of Drilling
Time After Drilling
Depth to Water 13.5' ▼
Depth to Cave in 11.0'

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/6/12 End 8/6/12
Driller SE Chief DAP Rig Geoprobe 7822DT
Logger DAP Editor DAS
Drill Method 2 1/4" HSA; Autohammer

CGC Inc.

LOG OF TEST BORING

Project: Fitchburg Technology Campus - Ph II, Nobel Drive
Location: Fitchburg, Wisconsin

Boring No. 5
Surface Elevation (ft) 1027±
Job No. C12214
Sheet 1 of 1

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						12 in. Silty TOPSOIL (OL)					
1		11	M	9		Stiff to Hard, Brown to Brown/Gray (Mottled) Lean CLAY, Trace Sand and Gravel (CL)	(4.5)				
2		10	M	6	5		(1.0)	25.2			
3		14	M	16		Medium Dense, Light Brown Fine to Medium SAND, Trace to little Silt (SP/SP-SM)					
4		14	M	20	10	Medium Dense, Brown to Red-Brown Fine to Medium SAND, Some Silt and Gravel, Scattered Cobbles/Boulders (SM)					
5		10	W	14	15						
					20	End Boring at 15 ft Borehole backfilled with bentonite chips					

WATER LEVEL OBSERVATIONS

While Drilling ▽ NW   Upon Completion of Drilling
Time After Drilling
Depth to Water 13.5' ▼
Depth to Cave in 11.4'

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/6/12 End 8/6/12
Driller SE Chief DAP Rig Geoprobe 7822DT
Logger DAP Editor DAS
Drill Method 2 1/4" HSA; Autohammer

LOG OF TEST BORING

CGC Inc.

Project	Fitchburg Technology Campus - Ph II, Nobel Drive
Location	Fitchburg, Wisconsin
Boring No.	6
Surface Elevation (ft)	1024±
Job No.	C12214
Sheet	1 of 1

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						13 in. Silty TOPSOIL (OL)					
1		18	M	8		Stiff to Hard, Brown to Brown/Gray (Mottled) Lean CLAY, Trace Sand and Gravel (CL)	(4.5+)				
2		12	M	6	5		(1.0)	24.0			
3		12	M	4		Very Loose to Loose, Brown/Gray (Mottled) SILT to Clayey SILT (ML)	(0.75-1.0)	22.1			
4		10	M	37	10	Dense, Brown Fine to Medium SAND, Some Gravel, Little to Some Silt, Scattered Cobbles/Boulders (SP-SM/SM)					
						Dense, Red-Brown Fine to Medium SAND, Some Silt and Gravel, Scattered Cobbles/Boulders (SM)					
5		17	W	31	15						
					20	End Boring at 15 ft Borehole backfilled with bentonite chips					

WATER LEVEL OBSERVATIONS

While Drilling	∇ NW	Upon Completion of Drilling			
Time After Drilling					
Depth to Water					13.5' ▼
Depth to Cave in					11.5'

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start	8/6/12	End	8/6/12		
Driller	SE	Chief	DAP	Rig	Geoprobe 7822DT
Logger	DAP	Editor	DAS		
Drill Method	2 1/4" HSA; Autohammer				

CGC Inc.

LOG OF TEST BORING

Project: Fitchburg Technology Campus - Ph II
Nobel Drive
Location: Fitchburg, Wisconsin

Boring No. 7
Surface Elevation (ft) 1020±
Job No. C12214
Sheet 1 of 1

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE						VISUAL CLASSIFICATION and Remarks	SOIL PROPERTIES				
No.	TYPE	Rec (in.)	Moist	N	Depth (ft)		qu (qa) (tsf)	W	LL	PL	LI
						15 in. Clayey TOPSOIL (OL)					
1		10	M	7		Very Stiff to Hard, Brown to Brown/Gray (Mottled) Lean CLAY, Trace Sand and Gravel, Scattered Sand Seams (CL)	(4.5)				
2		8	M	6			(3.5)				
					5	Loose, Brown Fine SAND, Some Silt and Gravel (SM)					
3		10	M	3		Very Loose to Medium Dense, Brown SILT, Scattered Sand Seams (ML)	(0.75-1.0)	21.6			
4		10	M	11							
					10						
						Very Dense, Brown Fine to Medium SAND, Some Silt and Gravel, Scattered Cobbles/Boulders (SM)					
5		12	M	52							
					15	End Boring at 15 ft Borehole backfilled with bentonite chips					
					20						

WATER LEVEL OBSERVATIONS

While Drilling ▽ NW Upon Completion of Drilling NW
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/6/12 End 8/6/12
Driller SE Chief DAP Rig Geoprobe
Logger DAP Editor DAS 7822DT
Drill Method 2 1/4" HSA; Autohammer

LOG OF TEST BORING

CGC Inc.

Project: Fitchburg Technology Campus - Ph II, Nobel Drive
Location: Fitchburg, Wisconsin

Boring No. 8
Surface Elevation (ft) 1024±
Job No. C12214
Sheet 1 of 1

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						10 in. Silty TOPSOIL (OL)					
1		12	M	26		Medium Dense, Brown Silty Fine SAND to Sandy SILT, Trace to Little Gravel, Scattered Cobbles/Boulders (SM/ML)					
2		12	M	18	5	Medium Dense to Very Dense, Brown to Red-Brown Fine to Medium SAND, Some Silt and Gravel, Scattered Cobbles/Boulders (SM)					
3		17	M	27							
4		18	M	22	10						
5		18	M	51	15						
					20	End Boring at 15 ft Borehole backfilled with bentonite chips Note: Boring 8 was offset about 100 ft west due to heavily wooded area.					

WATER LEVEL OBSERVATIONS

While Drilling ∇ NW   Upon Completion of Drilling NW
Time After Drilling
Depth to Water
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/6/12 End 8/6/12
Driller SE Chief DAP Rig Geoprobe 7822DT
Logger CRJ Editor DAS
Drill Method 2 1/4" HSA; Autohammer

CGC Inc.

LOG OF TEST BORING

Project: Fitchburg Technology Campus - Ph II
Nobel Drive
Location: Fitchburg, Wisconsin

Boring No. 9
Surface Elevation (ft) 1009±
Job No. C12214
Sheet 1 of 1

2921 Perry Street, Madison, WI 53713 (608) 288-4100, FAX (608) 288-7887

SAMPLE No.	TYPE	Rec (in.)	Moist	N	Depth (ft)	VISUAL CLASSIFICATION and Remarks	qu (qa) (tsf)	W	LL	PL	LI
						14 in. Silty Sand TOPSOIL (OL)					
1		14	M	7		Very Stiff to Hard, Brown to Brown/Gray (Mottled) Lean CLAY, Trace Sand and Gravel (CL)	(4.5+)				
2		13	M	9	5		(2.5)				
3		10	M	18		Medium Dense, Brown Silty Fine SAND, Little Gravel (SM)					
4		15	M	56	10	Medium Dense to Very Dense, Brown Fine to Medium SAND, Some Gravel, Trace to Little Silt (SP/SP-SM)					
5		15	M	27	15	Medium Dense, Red-Brown Silty Fine SAND, Little Gravel, Trace Clay (SM)					
					20	End Boring at 15 ft Borehole backfilled with bentonite chips					

WATER LEVEL OBSERVATIONS

While Drilling ▽ NW   Upon Completion of Drilling NW
Time After Drilling
Depth to Water ▼
Depth to Cave in

The stratification lines represent the approximate boundary between soil types and the transition may be gradual.

GENERAL NOTES

Start 8/3/12 End 8/3/12
Driller SE Chief CRJ Rig Geoprobe 7822DT
Logger CRJ Editor DAS
Drill Method 2 1/4" HSA; Autohammer

CGC, Inc.

LOG OF TEST BORING

General Notes

DESCRIPTIVE SOIL CLASSIFICATION

Grain Size Terminology

Soil Fraction	Particle Size	U.S. Standard Sieve Size
Boulders	Larger than 12"	Larger than 12"
Cobbles	3" to 12"	3" to 12"
Gravel: Coarse	¾" to 3"	¾" to 3"
Fine	4.76 mm to ¾"	#4 to ¾"
Sand: Coarse	2.00 mm to 4.76 mm	#10 to #4
Medium	0.42 to mm to 2.00 mm	#40 to #10
Fine	0.074 mm to 0.42 mm	#200 to #40
Silt	0.005 mm to 0.074 mm	Smaller than #200
Clay	Smaller than 0.005 mm	Smaller than #200

Plasticity characteristics differentiate between silt and clay.

General Terminology

Physical Characteristics
Color, moisture, grain shape, fineness, etc.
Major Constituents
Clay, silt, sand, gravel
Structure
Laminated, varved, fibrous, stratified, cemented, fissured, etc.
Geologic Origin
Glacial, alluvial, eolian, residual, etc.

Relative Density

Term	"N" Value
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	Over 50

Relative Proportions Of Cohesionless Soils

Proportional Term	Defining Range by Percentage of Weight
Trace	0% - 5%
Little	5% - 12%
Some	12% - 35%
And	35% - 50%

Consistency

Term	q_u-tons/sq. ft
Very Soft	0.0 to 0.25
Soft	0.25 to 0.50
Medium	0.50 to 1.0
Stiff	1.0 to 2.0
Very Stiff	2.0 to 4.0
Hard	Over 4.0

Organic Content by Combustion Method

Soil Description	Loss on Ignition
Non Organic	Less than 4%
Organic Silt/Clay	4 – 12%
Sedimentary Peat	12% - 50%
Fibrous and Woody Peat	More than 50%

Plasticity

Term	Plastic Index
None to Slight	0 - 4
Slight	5 - 7
Medium	8 - 22
High to Very High	Over 22

The penetration resistance, N, is the summation of the number of blows required to effect two successive 6" penetrations of the 2" split-barrel sampler. The sampler is driven with a 140 lb. weight falling 30" and is seated to a depth of 6" before commencing the standard penetration test.

SYMBOLS

Drilling and Sampling

CS – Continuous Sampling
RC – Rock Coring: Size AW, BW, NW, 2"W
RQD – Rock Quality Designation
RB – Rock Bit/Roller Bit
FT – Fish Tail
DC – Drove Casing
C – Casing: Size 2 ½", NW, 4", HW
CW – Clear Water
DM – Drilling Mud
HSA – Hollow Stem Auger
FA – Flight Auger
HA – Hand Auger
COA – Clean-Out Auger
SS - 2" Dia. Split-Barrel Sample
2ST – 2" Dia. Thin-Walled Tube Sample
3ST – 3" Dia. Thin-Walled Tube Sample
PT – 3" Dia. Piston Tube Sample
AS – Auger Sample
WS – Wash Sample
PTS – Peat Sample
PS – Pitcher Sample
NR – No Recovery
S – Sounding
PMT – Borehole Pressuremeter Test
VS – Vane Shear Test
WPT – Water Pressure Test

Laboratory Tests

q_a – Penetrometer Reading, tons/sq ft
q_a – Unconfined Strength, tons/sq ft
W – Moisture Content, %
LL – Liquid Limit, %
PL – Plastic Limit, %
SL – Shrinkage Limit, %
LI – Loss on Ignition
D – Dry Unit Weight, lbs/cu ft
pH – Measure of Soil Alkalinity or Acidity
FS – Free Swell, %

Water Level Measurement

▽- Water Level at Time Shown
NW – No Water Encountered
WD – While Drilling
BCR – Before Casing Removal
ACR – After Casing Removal
CW – Cave and Wet
CM – Caved and Moist

Note: Water level measurements shown on the boring logs represent conditions at the time indicated and may not reflect static levels, especially in cohesive soils.

CGC, Inc.

Madison - Milwaukee

UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOILS
(more than 50% of material is larger than No. 200 sieve size.)

GRAVELS More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravels (Less than 5% fines)		
		GW	Well-graded gravels, gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)		
		GM	Silty gravels, gravel-sand-silt mixtures
		GC	Clayey gravels, gravel-sand-clay mixtures
SANDS 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sands (Less than 5% fines)		
		SW	Well-graded sands, gravelly sands, little or no fines
		SP	Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)		
		SM	Silty sands, sand-silt mixtures
		SC	Clayey sands, sand-clay mixtures

FINE-GRAINED SOILS
(50% or more of material is smaller than No. 200 sieve size.)

SILTS AND CLAYS Liquid limit less than 50%	ML	Inorganic silts and very fine sands, rock flour, silty of clayey fine sands or clayey silts with slight plasticity
	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	OL	Organic silts and organic silty clays of low plasticity
SILTS AND CLAYS Liquid limit 50% or greater	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 medium to high plasticity, organic silts
HIGHLY ORGANIC SOILS	PT	Peat and other highly organic soils

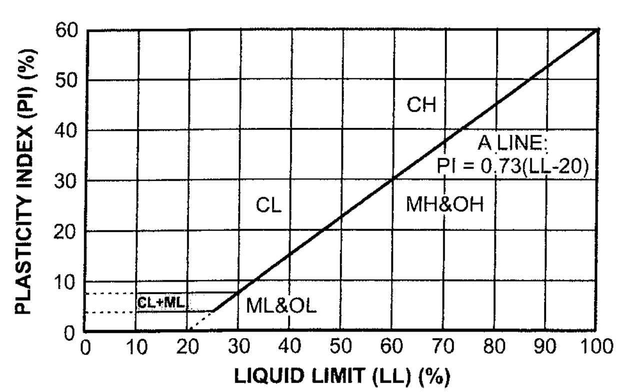
LABORATORY CLASSIFICATION CRITERIA

GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel 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 percent .... GW, GP, SW, SP
More than 12 percent .... GM, GC, SM, SC
5 to 12 percent .... Borderline cases requiring dual symbols

PLASTICITY CHART



APPENDIX C

DOCUMENT QUALIFICATIONS

APPENDIX C
DOCUMENT QUALIFICATIONS

I. GENERAL RECOMMENDATIONS/LIMITATIONS

CGC, Inc. should be provided the opportunity for a general review of the final design and specifications to confirm that earthwork and foundation requirements have been properly interpreted in the design and specifications. CGC should be retained to provide soil engineering services during excavation and subgrade preparation. This will allow us to observe that construction proceeds in compliance with the design concepts, specifications and recommendations, and also will allow design changes to be made in the event that subsurface conditions differ from those anticipated prior to the start of construction. CGC does not assume responsibility for compliance with the recommendations in this report unless we are retained to provide construction testing and observation services.

This report has been prepared in accordance with generally accepted soil and foundation engineering practices and no other warranties are expressed or implied. The opinions and recommendations submitted in this report are based on interpretation of the subsurface information revealed by the test borings indicated on the location plan. The report does not reflect potential variations in subsurface conditions between or beyond these borings. Therefore, variations in soil conditions can be expected between the boring locations and fluctuations of groundwater levels may occur with time. The nature and extent of the variations may not become evident until construction.

II. IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. *No one except you* should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one - not even you* - should apply the report for any purpose or project except the one originally contemplated.

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, *do not rely on a geotechnical engineering report* that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or project ownership.

As a general rule, , *always* inform your geotechnical engineer of project changes - even minor ones - and request an assessment of their impact. *CGC cannot accept responsibility or liability for problems that occur because our reports do not consider developments of which we were not Informed.*

SUBSURFACE CONDITIONS CAN CHANGE

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

MOST GEOTECHNICAL FINDINGS ARE PROFESSIONAL OPINION

Site exploration identifies subsurface conditions only at those points where surface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgement to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ - sometimes significantly - from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A REPORT'S RECOMMENDATIONS ARE NOT FINAL

Do not over-rely on the construction recommendations included in your report. *Those recommendations are not final*, because geotechnical engineers develop them principally from judgement and opinion, geotechnical engineers can finalize their recommendations only by observing actual subsurface conditions revealed during construction. *CGC cannot assume responsibility or liability for the report's recommendations if we do not perform construction observation.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having CGC participate in prebid and preconstruction conferences, and by providing construction observation.

DO NOT REDRAW THE ENGINEER'S LOGS

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

GIVE CONTRACTORS A COMPLETE REPORT AND GUIDANCE

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

READ RESPONSIBILITY PROVISIONS CLOSELY

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce such risks, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineer's responsibilities begin and end, to help others recognize their own responsibilities and risks. Read these provisions closely. Ask questions. Your geotechnical engineer should respond fully and frankly.

GEOENVIRONMENTAL CONCERNS ARE NOT COVERED

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

OBTAIN PROFESSIONAL ASSISTANCE TO DEAL WITH MOLD

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

RELY ON YOUR GEOTECHNICAL ENGINEER FOR ADDITIONAL ASSISTANCE

Membership in ASFE exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with CGC, a member of ASFE, for more information.

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ASFE/The Best People on Earth
881 Colesville Road, Suite G 106
Silver Spring, MD 20910

APPENDIX D

RECOMMENDED COMPACTED FILL SPECIFICATIONS

APPENDIX D

CGC, INC.

RECOMMENDED COMPACTED FILL SPECIFICATIONS

General Fill Materials

Proposed fill shall contain no vegetation, roots, topsoil, peat, ash, wood or any other non-soil material which by decomposition might cause settlement. Also, fill shall never be placed while frozen or on frozen surfaces. Rock, stone or broken concrete greater than 6 in. in the largest dimension shall not be placed within 10 ft of the building area. Fill used greater than 10 ft beyond the building limits shall not contain rock, boulders or concrete pieces greater than a 2 sq ft area and shall not be placed within the final 2 ft of finish subgrade or in designated utility construction areas. Fill containing rock, boulders or concrete pieces should include sufficient finer material to fill voids among the larger fragments.

Special Fill Materials

In certain cases, special fill materials may be required for specific purposes, such as stabilizing subgrades, backfilling undercut excavations or filling behind retaining walls. For reference, WisDOT gradation specifications for various types of granular fill are attached in Table 1.

Placement Method

The approved fill shall be placed, spread and leveled in layers generally not exceeding 10 in. in thickness before compaction. The fill shall be placed at moisture content capable of achieving the desired compaction level. For clay soils or granular soils containing an appreciable amount of cohesive fines, moisture conditioning will likely be required.

It is the Contractor's responsibility to provide all necessary compaction equipment and other grading equipment that may be required to attain the specified compaction. Hand-guided vibratory or tamping compactors will be required whenever fill is placed adjacent to walls, footings, columns or in confined areas.

Compaction Specifications

Maximum dry density and optimum moisture content of the fill soil shall be determined in accordance with modified Proctor methods (ASTM D1557). The recommended field compaction as a percentage of the maximum dry density is shown in Table 2. Note that these compaction guidelines would generally not apply to coarse gravel/stone fill. Instead, a method specification would apply (e.g., compact in thin lifts with a vibratory compactor until no further consolidation is evident).

Testing Procedures

Representative samples of proposed fill shall be submitted to CGC, Inc. for optimum moisture-maximum density determination (ASTM D1557) prior to the start of fill placement. The sample size should be approximately 50 lb.

CGC, Inc. shall be retained to perform field density tests to determine the level of compaction being achieved in the fill. The tests shall generally be conducted on each lift at the beginning of fill placement and at a frequency mutually agreed upon by the project team for the remainder of the project.

Table 1
Gradation of Special Fill Materials

Material	WisDOT Section 311	WisDOT Section 312	WisDOT Section 305			WisDOT Section 209		WisDOT Section 210
	Breaker Run	Select Crushed Material	3-in. Dense Graded Base	1 1/4-in. Dense Graded Base	3/4-in. Dense Graded Base	Grade 1 Granular Backfill	Grade 2 Granular Backfill	Structure Backfill
Sieve Size	Percent Passing by Weight							
6 in.	100							
5 in.		90-100						
3 in.			90-100					100
1 1/2 in.		20-50	60-85					
1 1/4 in.				95-100				
1 in.					100			
3/4 in.			40-65	70-93	95-100			
3/8 in.				42-80	50-90			
No. 4			15-40	25-63	35-70	100 (2)	100 (2)	25-100
No. 10		0-10	10-30	16-48	15-55	75 (2)		
No. 40			5-20	8-28	10-35	15 (2)	30 (2)	
No. 200			2-12	2-12	5-15	8 (2)	15 (2)	15 (2)

Notes:
1. Reference: Wisconsin Department of Transportation *Standard Specifications for Highway and Structure Construction.*
2. Percentage applies to the material passing the No. 4 sieve, not the entire sample.
3. Per WisDOT specifications, both breaker run and select crushed material can include concrete that is 'substantially free of steel, building materials and other deleterious material'.

Table 2
Compaction Guidelines

Area	Percent Compaction (1) Clay/Silt	Percent Compaction (1) Sand/Gravel
Within 10 ft of building lines		
Footing bearing soils	93 - 95	95
Under floors, steps and walks		
- Lightly loaded floor slab	90	90
- Heavily loaded floor slab and thicker fill zones	92	95
Beyond 10 ft of building lines		
Under walks and pavements		
- Less than 3 ft below subgrade	92	95
- Greater than 3 ft below subgrade	90	90
Landscaping	85	90

Notes:
1. Based on Modified Proctor Dry Density (ASTM D 1557)