GEOTECHNICAL ENGINEERING REPORT

TAIT CUMMINS CONCESSION BUILDING
CEDAR RAPIDS, IOWA

JOB NO. 06005108.01
July 28, 2000

Prepared For:

CITY OF CEDAR RAPIDS PARKS DEPARTMENT
Cedar Rapids, Iowa 52401

Prepared By:

TERRACON
Cedar Rapids, Iowa 52404

Terracon

July 28, 2000

Terracon
5855 Willow Creek Drive SW
Cedar Rapids, Iowa 52404-4312
(319) 366-8321 Fax: (319) 366-0032

City of Cedar Rapids Parks Department
City Hall 2nd Avenue
Cedar Rapids, Iowa 52401

Attention: Mr. Dave Kramer

RE: Geotechnical Engineering Report
Tait Cummins Concession Building
Cedar Rapids, Iowa
Terracon Job No. 06005108.01

Dear Mr. Kramer:

We have completed the subsurface exploration for the referenced project per our proposal dated May 22, 2000. Existing variable fill associated with a landfill previously operated on the project site was encountered in the borings, and we understand the owner is aware of the risks associated with supporting the building on the existing random fill. These risks are discussed in this report. Also, recommendations regarding design and construction of foundations, including general earthwork recommendations are contained in this report.

We appreciate the opportunity to be of service to you on this project, and look forward in assisting you during the construction phase. If you have any questions, or if we may be of further service, please contact us.

Sincerely,
TERRACON

Jeffrey L. Magner/AD

Jeffrey L. Magner, P.E.
Senior Project Engineer

André M. Gallet, P.E
Principal

JLM:AMG:amd/reports\06005108.01

Attachments
Copies to: Addressee (1)
Mr. Todd Gabryszewski, P.E., Howard R. Green (1)
Mr. Gerry Kneeland, AIA, Brown Heely Stone and Sauer P.C. (1)

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CEDAR RAPIDS, IOWA

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INTRODUCTION

Subsurface exploration for the proposed Concession Building at Tait Cummins Park in Cedar Rapids, Iowa has been completed. Three soil borings were drilled on the project site. The borings were extended to depths of approximately 11 to 45.5 feet below the existing ground surface. Individual boring logs and a Boring Location Diagram are included with this report. The purposes of this report are to describe the subsurface conditions encountered in the borings, analyze and evaluate the test data, and provide recommendations concerning earthwork and the design and construction of foundations for the proposed building.

PROJECT DESCRIPTION

The proposed concession building will be constructed following the removal of the existing building. The existing concession building is identified on the attached drawing, and we understand an overexcavation and backfill procedure was performed below the existing building prior to its construction in 1978. Based on the soils encountered in Boring 1A, it appears the overexcavation and backfill procedure was performed to a depth of about 9.5 feet. The soil used as backfill below the existing building consisted of silty clay, trace sand. Based on the thin-walled tube obtained in the existing fill at a depth of about 5.5 feet in Boring 1A, this fill material was compacted to about 91% of the material's maximum standard Proctor dry density. It should be understood the overall extent and level of compaction of the backfill placed below the existing building is not known.

Since construction of the existing concession building, we understand the ground surface around the building, including the building's structure, has settled. City personnel think that the building settlement could be on the order of 1 inch. In addition, we understand the surrounding grades within the softball fields have been raised, and surface runoff from rainfall collects in depressional areas around the existing building's foundation walls.

The proposed concession building will have plan dimensions of about 32 feet by 35 feet, and will be supported at grade. We understand preliminary plans was to construct a one story, masonry, load bearing wall structure; however, consideration is being given to using wood framing to reduce the structure's weight. We estimate that maximum continuous wall loads will be on the order of 2 kips per linear foot or less. A canopy will be constructed on the east side of the concession building, and will extend about 15 feet beyond the building's east edge. The canopy will be supported by the east building wall and two exterior columns. We estimate that maximum column loads will be on the order 10 to 15 kips. Maximum floor loads are not expected to exceed about 50 psf. We understand construction of the proposed building will require raising grade about 2 to 3 feet in the building area. In addition, the building will not be heated during the winter months.

SITE EXPLORATION PROCEDURES

Field Exploration

As proposed, the field exploration consisted of performing two soil borings to depths of between about 40.5 and 45.5 feet below grade at the locations illustrated on the attached diagram. An additional boring (Boring 1A) was performed near the existing building to a depth of about 11 feet below grade in order to help better define the extent, thickness and compaction of structural fill placed below the existing building. The borings were laid out on the site by the drill crew using a scaled drawing provided by the City of Cedar Rapids. The drill crew used a cloth tape and estimated right angles in the boring layout. The elevations indicated on the boring logs are approximate (rounded to the nearest ½ foot), and were obtained by the drill crew using a surveyor's level and rod. These elevations were referenced to the finished floor elevation of the existing building. An elevation of 100 feet was assumed for this datum. The locations and elevations of the borings should be considered accurate only to the degree implied by the means and methods used to define them.

The borings were drilled with a truck-mounted rotary drilling rig. The borings were advanced using continuous flight hollow-stemmed augers. Representative samples were obtained using thin-walled tube and split-barrel sampling procedures. In the thin-walled tube sampling procedure, a thin-walled, seamless steel tube with a sharp cutting edge is pushed hydraulically into the ground to obtain relatively undisturbed samples of cohesive or moderately cohesive soils. In the split-barrel sampling procedure, a standard 2-inch O.D. split-barrel sampling spoon is driven into the ground with a 140-pound hammer falling a distance of 30 inches. The number of blows required to advance the sampling spoon the last 12 inches of a normal 18-inch penetration is recorded as the standard penetration resistance value. These values are indicated on the boring logs at the depths of occurrence. The samples were sealed and returned to the laboratory for testing and classification.

An automatic SPT hammer was used to advance the split-barrel sampler in the borings performed for this site. A significantly greater efficiency is achieved with the automatic hammer compared to the conventional safety hammer operated with a cathead and rope. This higher efficiency has an appreciable effect on the standard penetration resistance blow count (N) values. The effect of the automatic hammer's efficiency has been considered in the interpretation and analysis of the subsurface information for this report.

Field logs of each boring were prepared by the drill crew. These logs included visual classifications of the materials encountered during drilling as well as the driller's interpretation of the subsurface conditions between samples. The boring logs included with this report represent an interpretation of the field logs and include modifications based on laboratory observation and tests of the samples.

Laboratory Testing

Soil samples were tested in the laboratory to measure their natural water contents. Dry unit weight measurements were performed on representative portions of intact thin-walled tube samples obtained in Boring 1A. A calibrated hand penetrometer was used to estimate the unconfined compressive strength of some cohesive or relatively cohesive samples. The calibrated hand penetrometer has been correlated with unconfined compression tests and provides a better estimate of soil consistency than visual examination alone. The test results are provided on the attached boring logs.

A standard Proctor test (ASTM D-698) was performed on a representative sample of the existing fill material encountered in Boring 1A between the depths of about 2 and 9.5 feet below grade. The resulting moisture-density relationship curve is attached to this report.

The samples were classified in the laboratory based on visual observation of grain-size, texture and plasticity. The descriptions of the soils indicated on the boring logs are in accordance with the enclosed General Notes and the Unified Soil Classification System. Estimated group symbols according to the Unified Soil Classification System of the native soils are given on the boring logs.

SUBSURFACE CONDITIONS

Soil Conditions

Subsurface conditions encountered at each boring location are indicated on the individual boring logs. Stratification boundaries on the boring logs represent the approximate depth of changes in soil types; in-situ, the transition between materials may be gradual. Based on the results of the borings, subsurface conditions at the project site can be generalized as follows.

The borings encountered about 10 inches of crushed stone at the ground surface, underlain by existing fill consisting of landfill trash extending to depths of about 14 to 17 feet below grade. Boring 1A encountered existing fill consisting of silty clay with traces of sand and sand seams to a depth of about 9.5 feet below grade underlain by landfill trash to its termination depth at about 11 feet below grade. Below the landfill trash, Boring 1 encountered stiff to very stiff clay soils to a depth of about 22 feet below grade underlain by loose to medium dense sand to a depth of about 33.5 feet below grade. Boring 1 terminated in stiff to very stiff clay soils at a depth of about 40.5 feet below grade. Below the landfill trash, Boring 2 encountered loose to medium dense sand to a depth of about 27.5 feet below grade underlain by medium consistency clay to a depth of about 33 feet below grade. Boring 2 terminated in stiff clay soils at a depth of about 45.5 feet below grade.

For a more detailed description of the subsurface conditions encountered, please refer to the individual boring logs in the appendix.

Groundwater Conditions

The borings were monitored while drilling and sampling for the presence and level of groundwater. At these times, groundwater was observed in Borings 1 and 2 at a depth of about 14 feet below grade. Following completion, the boreholes were backfilled with bentonite hole plug. City of Cedar Rapids personnel backfilled about the upper 6 inches of the boreholes with crushed stone. Longer term monitoring in cased holes or piezometers would be required for a more accurate evaluation of the groundwater conditions.

It should be recognized that fluctuations of the groundwater levels will occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the borings were performed. In addition, perched water can develop within less permeable soils overlying lower permeability clay soils following periods of heavy or prolonged precipitation. Therefore, groundwater levels during construction or at other times in the life of the structure may be higher or lower than the levels indicated on the boring logs. The possibility of groundwater level fluctuations should be considered when developing design and construction plans for the project.

ENGINEERING RECOMMENDATIONS

Geotechnical Considerations

A project meeting was held on July 12 at the offices of Brown Heely Stone and Sauer to discuss foundation options for the proposed building. The existing landfill trash encountered in the borings proposes two problems for the project. Structures supported on the landfill trash are at risk to experience larger than normal settlements due to long-term consolidation of the garbage fill. In addition, the garbage fill proposes environmental risks both during and after construction of the proposed facility.

We understand the City of Cedar Rapids has visually monitored the ground surface at Tait Cummins Park since its construction in the mid-1970's. Some isolated areas where thick deposits of organics are known to exist have experienced significant settlement under their own weight and due to the breakdown of organic material. However, we understand the general area around the existing building has been relatively stable since its construction in 1978. The following foundation alternatives were discussed at the project meeting:

- Deep foundations (i.e., auger-cast piles, drilled shafts, driven steel piles),
- Geopiers,
- Overexcavation and replacement, and
- Mat foundation.

After considering budgetary constraints, concerns regarding handling of the garbage fill, and the degree of risk acceptable to the City of Cedar Rapids, a decision was made to construct the new building on a mat foundation. The owner is aware of the potential for long-term settlement of the garbage fill; however, based on their past experience with the previous building, we understand Mr. Kramer feels comfortable with placing the proposed building on the garbage fill. If desired, discussions on the other alternative foundation support systems can be provided.

A thickness of structural fill was placed below the existing building as illustrated in Boring 1A. We recommend this thickness of structural fill be extended to encompass the proposed building area by removing the garbage fill to a depth similar to the original building (elevation 90.5 feet based on Terracon's site datum), and replacing it with similar structural fill in order to provide as much of an uniform thickness of structural fill below the proposed building area. This overexcavation and structural fill replacement procedure should extend beyond the edges of the mat foundation at least 8 inches for every foot removed below the foundation's bearing level. For safety reasons, we understand that construction personnel will not enter the excavation into the garbage fill. We recommend a similar cohesive fill material as existing be used for structural fill. The fill material should be monitored for moisture content prior to placing and compacting in maximum 9-inch loose lifts. The fill material should be moisture conditioned to within –2 to +3% of the material's optimum moisture content (ASTM D-698). The overexcavation and backfill procedure below the mat foundation is described in more detail in the **Foundation Systems** section of this report.

To reduce the potential for settlement from consolidation of the garbage fill under the weight of the new building and proposed 2 to 3 feet of new fill, consideration could be given to preloading the building area in advance of building construction. Preloading would consist of placing the proposed height of new fill as far in advance of foundation construction as practical. Settlement of the surface of the new fill should be monitored by observing surface monuments, and foundation construction could begin once the fill has stabilized. The settlement data should be reviewed by the geotechnical engineer. Consideration could be given to using light-weight flowable fill to reduce the stress increase on the underlying garbage fill.

To further help consolidate the underlying garbage fill, the owner could consider placing a surcharge fill thickness of 5 feet over the proposed building area. Surcharge fill consists of temporary fill placed above the finished floor elevation and does not have to be compacted (i.e. "wheel rolled" or "tracked" into place with construction equipment). The thickness of surcharge fill should extend a minimum of 5 feet beyond the edges of foundations. Settlement due to the weight of the temporary fill and possible rebound following temporary fill removal should be monitored and reviewed by the geotechnical engineer prior to the start of foundation construction. We understand that this consideration will probably not be possible due to time constraints.

Construction of the new building on a mat foundation will help to reduce any distress to the building's superstructure from larger total and differential settlement. Consideration should be given to installing utility services to the proposed building with flexible connections to help tolerate higher than normal differential settlements. Masonry walls should be constructed with frequent control joints. In addition, the proposed canopy supports should be designed to tolerate differential movement, and consideration could be given to bearing the supports on the planned mat foundation.

Foundation Systems

As discussed in the **Geotechnical Considerations** section of this report, the mat foundation supporting the proposed building should bear on structural fill extending down to similar depths as the existing building, and compacted as described below. We recommend the upper 1-foot of structural fill directly beneath the mat foundation consist of dense-graded crushed limestone (maximum 1-inch size). This layer of crushed stone will help to provide a stable base for foundation construction, and help to expedite the construction process. We recommend the mat foundation be designed for a maximum net allowable soil bearing pressure of 500 psf or less. The net allowable soil bearing pressure is the pressure in excess of the minimum surrounding overburden pressure. We understand the surface of the mat foundation will serve as the building's floor slab.

Settlements are possible in the existing fill from long-term consolidation of the garbage, and determining the magnitude of total and differential settlement is not possible due to the extreme variability of the fill material. The planned overexcavation and structural fill replacement procedure and support of the proposed building on a mat foundation should help to reduce structural distress from possible settlement. The mat foundation should be designed as rigid as practical. Flexible utility connections should be provided to accommodate total and differential settlements.

To help prevent the potential for frost heave, the base of the foundation should extend at least 3.5 feet below the lowest adjacent finished grade. Alternatively, the foundation could be supported on non-frost susceptible fill materials such as dense-graded crushed stone or light-weight flowable fill extending below the frost depth.

The removal of garbage fill from below the proposed mat foundation should extend to an elevation of about 90.5 feet, and laterally beyond all edges of the foundation at least 8 inches per foot of overexcavation depth below the foundation base elevation. Overexcavations should then be backfilled up to the foundation base elevation with approved cohesive fill material placed in lifts of 9 inches or less in loose thickness and compacted to at least 95% of the material's maximum standard Proctor dry density (ASTM D-698).

The base of the mat foundation excavation should be free of water and loose soils prior to placement of reinforcing steel and concrete. Should the soils at the bearing level become disturbed, the affected soil should be removed or recompacted prior to placement of concrete. Concrete should be placed as soon as possible after excavating to minimize disturbance of the bearing soils.

Earthwork

It should be noted that the clayey soils planned for structural fill below the mat foundation are susceptible to disturbance from construction activities, particularly if the soil has a high natural moisture content or is wetted by surface water or seepage. Care should be taken during construction to minimize disturbance of the bearing soils. Heavy equipment traffic directly on saturated bearing surfaces should be avoided. In unstable areas, it may be necessary to place a layer of crushed stone to stabilize the subgrade and help expedite construction.

All fill materials should consist of approved materials, free of organic matter and debris. The fill should be a low plasticity cohesive soil with a liquid limit less than 45% and a plasticity index less than 20%. The soil's water content at the time of compaction should be at -1 to +3% of the soil's optimum moisture value as determined by the standard Proctor test (ASTM D-698) for cohesive soils.

All fill material placed for building support should be compacted to at least 95% of the soil's maximum standard Proctor dry density (ASTM D-698). The degree of fill compaction below the building should extend laterally beyond the exterior edges of the mat foundation for at least 8 inches per foot of fill thickness below the foundation base elevation.

Upon completion of filling operations, care should be taken to minimize the subgrade disturbance and maintain the subgrade moisture content prior to construction of foundations. On-site subgrade soils are highly susceptible to disturbance from construction activity. Weather conditions such as freezing, thawing, rain, or dry weather can also contribute to subgrade disturbance. If the subgrade should become saturated, desiccated, or disturbed, the affected material should be removed or replaced, or these materials should be scarified, moisture conditioned as necessary, and recompacted prior to construction of foundations. If time elapses between subgrade preparation and further construction, subgrades should be reworked and retested prior to placement of structures.

Adequate drainage should be provided at the site in order to minimize wetting of the foundation and subgrade soils. Excessive moisture can significantly reduce the soil's bearing capacity and contribute to foundation settlement and soft subgrades. Thus, we recommend that an adequate storm water system be installed such that during heavy rainfall, water can be efficiently and rapidly drained. For protection of the foundation bearing soils, we recommend that the surrounding grades be sloped away from the structure on all sides. In addition, roof drainage should be collected by a system of gutters and downspouts and transmitted by pipe to the storm water drainage system or discharged a minimum of 5 feet away from the structure. As an alternative, splash blocks may be used as long as the ground surface is paved and slopes away from the structure.

ENVIRONMENTAL CONSIDERATIONS

Landfill Gas Potential - The site has previously received municipal solid waste and uncontrolled fill. Sporadic conditions for potential methane generation were identified in the subsurface exploration. While not acutely toxic, landfill gas warrants prudent consideration in designing and constructing structures over uncontrolled fills containing organic materials.

Landfill gas (LFG) is created when organic waste in a landfill or subsurface burial decomposes. At burial, the refuse is insulated from the atmosphere and waste decomposes from anaerobic bacteria (bacteria not requiring oxygen). However, some air is always present initially to begin the decomposition process and aerobic organisms also participate in the process. The amount of methane generation depends on the organic content and types of materials in the burial. Moisture content and pH are among the most important factors influencing the onset and rate of methane production. Wetting and drying by changing groundwater conditions can influence the degree of LFG generation.

The pH variations brought about during decomposition and influenced by materials within the fill have the potential for corrosive or degrading physical effects on some construction materials placed in the subsurface. LFG venting naturally through cover soils can significantly affect the ability of soils to support vegetation or trees.

LFG is typically about 50 percent methane (CH4) and 45 - 50 percent carbon dioxide (CO2). Less than 1 percent of other non-methane organic gases are also found in LFG. Municipal or industrial wastes may include other organic chemicals which can be stripped from the refuse during generation of methane and CO2. Although methane is odorless, LFG can include sulfur dioxide. This lends the “swamp gas” or “sewer odor” often associated with the presence of LFG.

The United States Environmental Protection Agency (USEPA)in considering potential adverse public effects by LFG include ground level ozone formation, cancer and non-cancer health effects from long-term exposure, odor nuisance and fire hazard potential. Concern as to the effects of exposure to the methane component of LFG stem from three (3) physical attributes of the material, and these issues should be made aware to the contractor prior to construction;

- Methane as a simple asphyxiant. Methane gas, can displace breathable atmosphere in confined or semi-confined conditions having little or no ventilation.

- Methane as a flammable or explosive material. Methane is flammable within a range of five to fifteen percent (5-15%) of the total gas mixture, at which the mixture of oxygen in breathable atmosphere to methane can produce an explosive and/or flammable gas mixture.

- Methane is essentially odorless and does not exhibit warning properties relative to its accumulation through flammable and asphyxiant concentrations. The odor often attributed to methane is provided by associated sulfur compounds or other impurities intermingled with the gaseous methane; odor nor its relative strength can be used as a measure of methane present from LFG.

Considerations For Construction - LFG gas may be produced in the old fills. Generation and migration of LFG to structures unprotected by vapor or venting systems cannot be estimated without specific design and operating building/structure parameters. Calculations in this context would be speculative and have not been pursued consistent within this scope of services.

However, general risk management would be prudent to include the considerations of LFG and methane for future construction and property risk management. These considerations might include the feasibility of enhanced vapor barrier designs, indoor air monitoring programs for a period following construction or design of passive or active venting for the structure.

With regard to the proposed building construction, the excavation of buried solid waste may be necessary during construction of structure's foundations and utilities. LFG will probably be present during excavation activities which may be in the breathing zone of construction workers and potential contractors should be informed prior to on-site work. Loss prevention might consider a contingent preventive program of on-site monitoring during construction.

Although geotechnical design and construction recommendations are included in this report, these recommendations do not address the potential effects of LFG and contamination on the proposed project. Possible effects include, but are not limited to, vapor accumulation in excavations and buildings areas. The designer and contractor of this project should be made aware of the information contained in this report.

The reported LFG encountered during this geotechnical investigation should not be construed as providing any level of environmental site assessment services. An environmental assessment of the site would require research of site use, more extensive field and analytical testing and other services that are beyond the scope of this investigation.

In order to help evaluate the potential for landfill gas generation relative to construction and future use, gas/vapor sumps (essentially small "wells" for collecting and sampling gas) could be constructed to sample vapor and gas. Samples could be analyzed for total volatile hydrocarbons, carbon monoxide, methane, carbon dioxide, oxygen and nitrogen constituents.

A report could then be prepared that evaluates the chemical concentrations of compounds in the soil and vapor samples as they relate to future construction, use and worker safety. Discussions could be made relative to detected concentrations, risk-based chemical thresholds, human odor thresholds, and Chemical Hazards Response Information System data. A discussion of the analysis results used for waste characterization could also be completed to set forth the proper disposal options for fill material that may be removed during construction.

The report can also discuss, based on findings, recommendations for abating or preventing future exposure through design changes. A document can be created for inclusion with contractor documents for future construction activities. It can summarize, in lay terms, waste disposal, hazard recognition, possible hazards at the site, and a discussion of the possible exposure routes of compounds that are shown to be present at levels in excess of the laboratory reporting limit. The manual can include an example Health and Safety Plan for use by contractors. We would be pleased to perform these additional services upon your request.

GENERAL COMMENTS

Terracon should be retained to review the final design plans and specifications so comments can be made regarding interpretation and implementation of our geotechnical recommendations in the design and specifications. Terracon also should be retained to provide testing and observation during excavation, foundation and construction phases of the project.

Support of foundations on and above existing fill soils is discussed in this report. However, even with the recommended design and construction procedures, there is a risk for the owner that long-term consolidation of the garbage fill will occur and lead to settlement of the proposed structure. This risk cannot be eliminated without removing the fill or supporting the proposed structure on deep foundations bearing in the underlying suitable native soils. Deep foundation recommendations can be provided upon request; however, further subsurface exploration and laboratory testing may be required.

The analysis and recommendations presented in this report are based upon the data obtained from the borings performed at the indicated locations and from other information discussed in this report. This report does not reflect variations which may occur between borings or across the site. The nature and extent of such variations may not become evident until construction. If variations appear, it will be necessary to reevaluate the recommendations of this report.

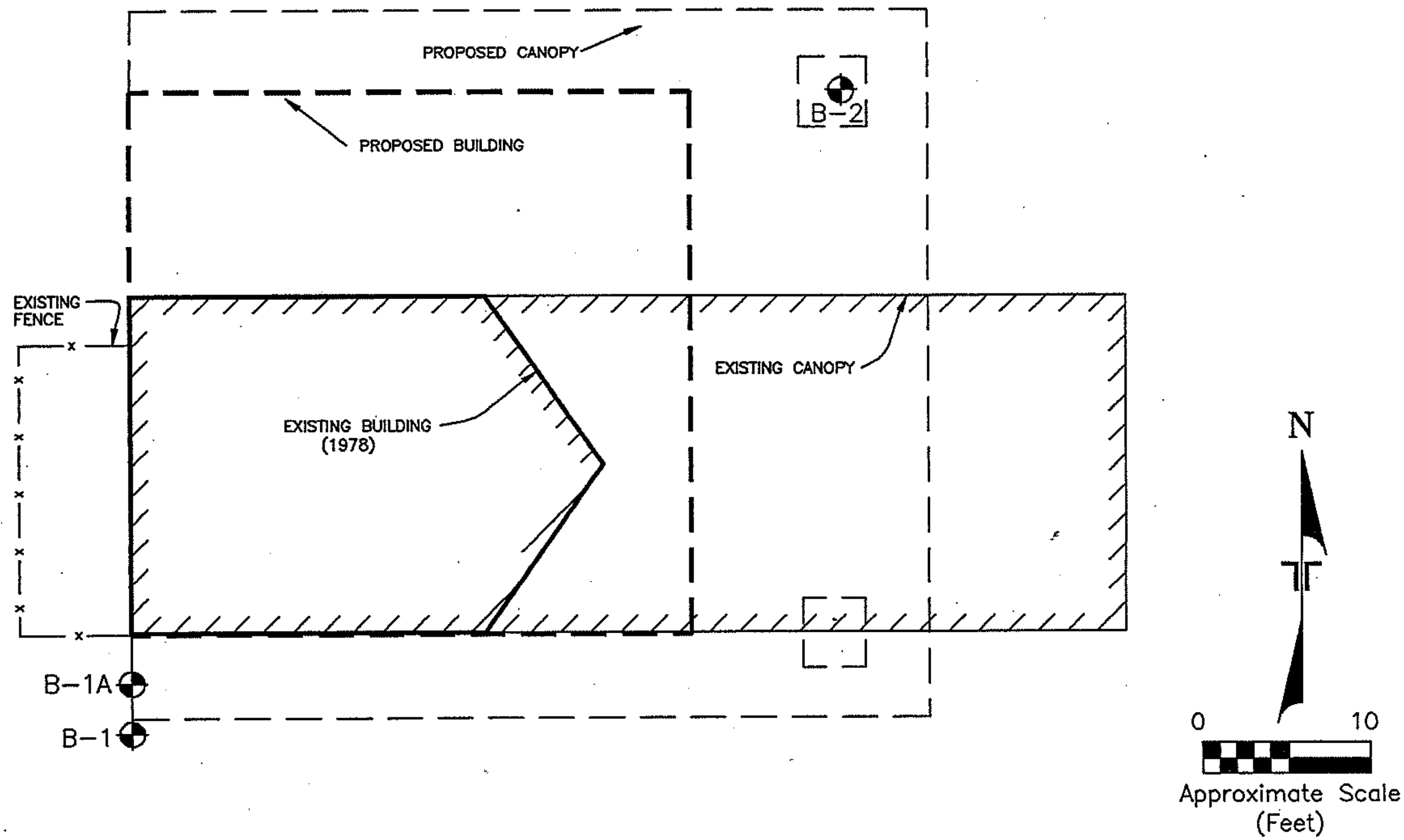
This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. In the event that changes in the nature, design, or location of the project as outlined in this report, are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Terracon reviews the changes, and either verifies or modifies the conclusions of this report in writing.

LICENSED PROFESSIONAL ENGINEER
ANDRÉ M. GALLET
13130
IOWA

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

André M. Gallet, P.E. — 7/28/00 — Date

My license renewal date is December 31, 2000.



BORING LOCATION DIAGRAM

TAIT CUMMINS CONCESSION BUILDING

CEDAR RAPIDS, IOWA
PROJECT NO. 06005108
FILE NO. 5108SBLD

LEGEND

⊕ – Approximate Location of Boring

Terracon
TJP 6/27/00

LOG OF BORING NO. 1

OWNER/CLIENT
City of Cedar Rapids Park Department

ARCHITECT/ENGINEER

SITE
Cedar Rapids, Iowa

PROJECT
Tait Cummins Concession Building

Approx. Surface Elev.: 100 ft

Depth (Elev.)	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	TYPE	RECOVERY, in.	SPT - N ** BLOWS / ft.	TESTS: WATER CONTENT, %	DRY UNIT WT pcf	UNCONFINED STRENGTH, psf
	10" Crushed Stone				HS					
				1	3"ST	8		15		
	FILL, SANDY LEAN CLAY WITH GRAVEL, WIRE, GLASS, WOOD & PLASTIC (Landfill Trash), Black and Gray			2	3"ST	17		17		
		5			HS					
				3	3"ST	14		19		
					HS					
	Strong odors encountered.	10		4	SS	8	18	23		
					HS					
14 (86) ∇										
15 (85)	**LEAN TO FAT CLAY, TRACE SAND & ORGANICS (Possible Buried Topsoil)**, Dark Gray, Stiff	15	CH/OH	5	SS	10	6	33		*4000
					HS					
	FAT CLAY, TRACE SAND, Brown Gray, Very Stiff	20	CH	6	SS	10	11	28		*6000
22 (78)					HS					
	FINE TO COARSE SAND, TRACE CLAY & GRAVEL WITH CLAY SEAMS, Gray, Loose to Medium Dense	25	SP/SW	7	SS	10	7	20		
					HS					
		30	SP/SW	8	SS	12	19	19		
33.5 (66.5)					HS					
	SANDY LEAN CLAY, Gray, Very Stiff	35	CL	9	SS	14	8	20		*6000
37 (63)					HS					
40.5 (59.5)	**SANDY LEAN CLAY, TRACE GRAVEL WITH SAND SEAMS**, Gray, Stiff	40	CL	10	SS	4	8	25		*3500
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	∇ 14	WS	▼
WL	▼		▼
WL			

Terracon

BORING STARTED	6-20-00		
BORING COMPLETED	6-20-00		
RIG	#14	FOREMAN	GAE
APPROVED	JLM	JOB #	06005108

BOREHOLE 06005108.GPJ TERRACON.GDT 7/28/00

LOG OF BORING NO. 1A

OWNER/CLIENT	ARCHITECT/ENGINEER
City of Cedar Rapids Park Department	
SITE	PROJECT
Cedar Rapids, Iowa	Tait Cummins Concession Building

Approx. Surface Elev.: 100 ft

GRAPHIC LOG	DESCRIPTION	DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, in.	SAMPLES: SPT - N ** BLOWS / ft.	TESTS: WATER CONTENT, %	TESTS: DRY UNIT WT pcf	TESTS: UNCONFINED STRENGTH, psf	% MAXIMUM STANDARD PROCTOR DRY DENSITY
	10" Crushed Stone				HS						
	2 **FILL, SILTY SAND**, Gray Brown — 98			1	3" ST	12		12	105		
				2	SS	12	5	20			
	FILL, SILTY CLAY, TRACE SAND WITH SAND SEAMS, Gray Brown	5			HS						
				3	3" ST	18		18	107		91
					HS						
	9.5 — 90.5										
	11 **FILL, LANDFILL TRASH** — 89	10		4	3" ST	2		16			
	BOTTOM OF BORING										

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft		
WL	▽ NONE	WD ▼
WL	▽	▽
WL		

Terracon

BORING STARTED	6-20-00		
BORING COMPLETED	6-20-00		
RIG	#14	FOREMAN	GAE
APPROVED	JLM	JOB #	06005108

LOG OF BORING NO. 2

OWNER/CLIENT
City of Cedar Rapids Park Department

ARCHITECT/ENGINEER

SITE
Cedar Rapids, Iowa

PROJECT
Tait Cummins Concession Building

GRAPHIC LOG	DESCRIPTION Approx. Surface Elev.: 100 ft	DEPTH, ft.	USCS SYMBOL	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: RECOVERY, in.	SAMPLES: SPT - N ** BLOWS / ft.	TESTS: WATER CONTENT, %	TESTS: DRY UNIT WT pcf	TESTS: UNCONFINED STRENGTH, psf
	10" Crushed Stone				HS					
	FILL, LANDFILL TRASH ▽									
	17 — 83									
	FINE TO COARSE SAND, TRACE CLAY & GRAVEL, Gray, Loose to Medium Dense	20	SP/SW	1	SS	10	11	17		
					HS					
		25		2	SS	0	8			
					HS					
	27.5 — 72.5									
	LEAN CLAY, TRACE SAND, Gray, Medium	30	CL	3	SS	10	6	25		*1500
					HS					
	33 — 67									
	FAT CLAY, TRACE SAND, Medium Gray, Stiff	35	CH	4	SS	12	6	27		*4000
					HS					
	37 — 63									
	SANDY LEAN CLAY, TRACE GRAVEL & OCCASIONAL SAND SEAMS, Gray, Stiff to Very Stiff	40	CL	5	SS	16	9	16		*3500
					HS					
	45.5 — 54.5	45	CL	6	SS	10	15	25		*5000
	BOTTOM OF BORING									

The stratification lines represent the approximate boundary lines between soil and rock types: in-situ, the transition may be gradual.

*Calibrated Hand Penetrometer
**CME 140 lb. SPT automatic hammer

WATER LEVEL OBSERVATIONS, ft			
WL	▽ 14	WD	▼
WL	▽		▽
WL			

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BORING STARTED			6-20-00
BORING COMPLETED			6-20-00
RIG	#14	FOREMAN	GAE
APPROVED	JLM	JOB #	06005108

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Laboratory Compaction Characteristics of Soil

5855 Willow Creek Drive SW
Cedar Rapids, Iowa 52404
(319) 366-8321

Client Name: City of Cedar Rapids Parks Department
Project Name: Tait Cummins Concession Building
Location: Tait Cummins Park
Cedar Rapids, Iowa

Project No.: 06005108

TEST RESULTS

Maximum Dry Unit Wt.: 117.5 pcf
Optimum Water Content: 13.0 %

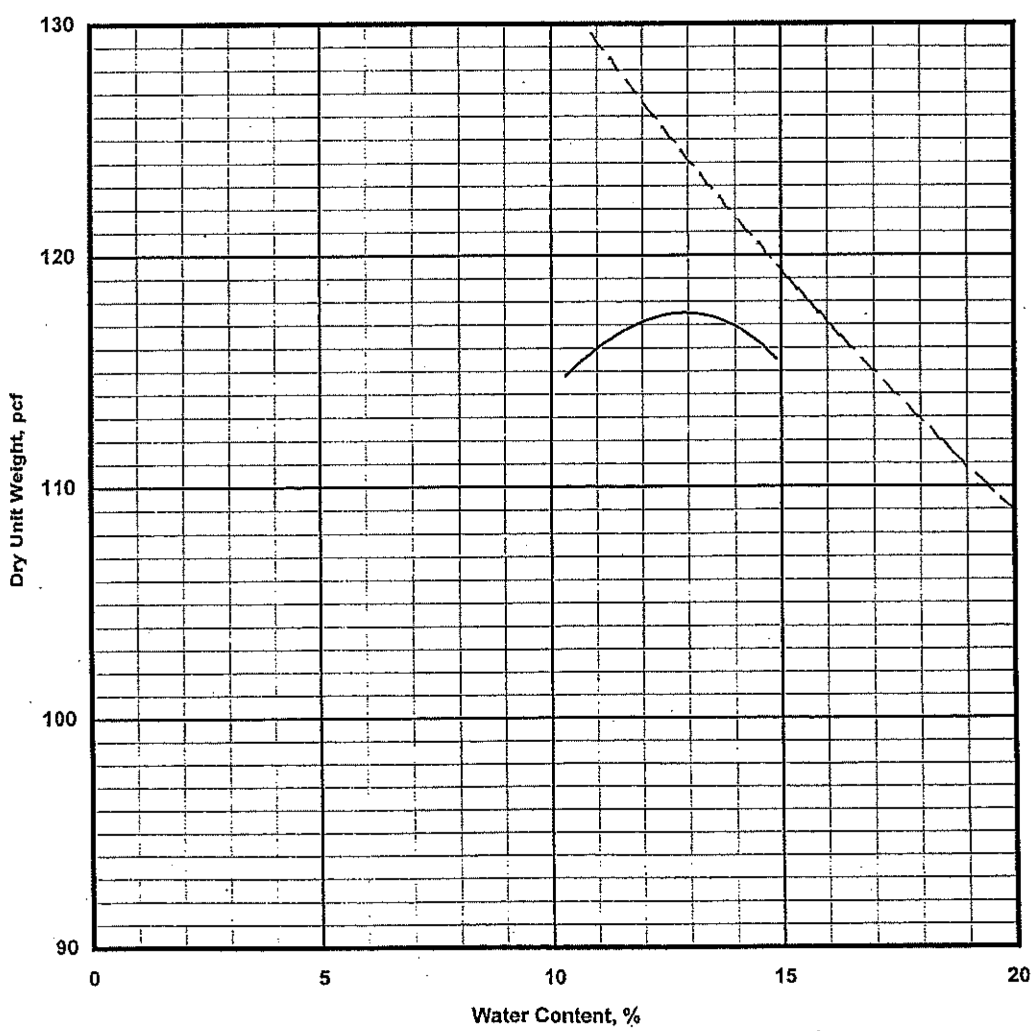
Source Material: Boring 1A, Depth 2 to 9 feet
Sample Description: Silty Clay with Sand, Brown

Material Designation: A Sample date: 6/20/00
Test Method: Method A
Test Procedure: ASTM D-698
Rammer: ____ Mechanical x Manual

Liquid Limit: N/A Plastic Limit: N/A
Plasticity Index: N/A
% passing # 200 sieve: N/A

Reviewed by: JLM

---------- Zero air voids for specific gravity of 2.68



GENERAL NOTES

DRILLING & SAMPLING SYMBOLS:

SS : Split Spoon - 1⅜″ I.D., 2″ O.D., unless otherwise noted
ST : Thin-Walled Tube - 2″ O.D., Unless otherwise noted
PA : Power Auger
HA : Hand Auger
DB : Diamond Bit - 4″, N, B
AS : Auger Sample
HS : Hollow Stem Auger
PS : Piston Sample
WS : Wash Sample
FT : Fish Tail Bit
RB : Rock Bit
BS : Bulk Sample
PM : Pressuremeter
DC : Dutch Cone
WB : Wash Bore

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

WATER LEVEL MEASUREMENT SYMBOLS:

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

Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of ground water levels is not possible with only short term observations.

DESCRIPTIVE SOIL CLASSIFICATION:

Soil Classification is based on the Unified Soil Classification System and ASTM Designations D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

CONSISTENCY OF FINE-GRAINED SOILS:

Unconfined Compressive Strength, Qu, psf	Consistency
< 500	Very Soft
500 - 1,000	Soft
1,001 - 2,000	Medium
2,001 - 4,000	Stiff
4,001 - 8,000	Very Stiff
8,001 -16,000	Hard
> -16,000	Very Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS:

N-Blows/ft.	Relative Density
0-3	Very Loose
4-9	Loose
10-29	Medium Dense
30-49	Dense
50-80	Very Dense
80+	Extremely Dense

RELATIVE PROPORTIONS OF SAND AND GRAVEL

Descriptive Term(s) (of Components Also Present in Sample)	Percent of Dry Weight
Trace	< 15
With	15 - 29
Modifier	> 30

GRAIN SIZE TERMINOLOGY

Major Component Of Sample	Size Range
Boulders	Over 12 in. (300mm)
Cobbles	12 in. to 3 in. (300mm to 75mm)
Gravel	3 in. to #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75mm to 0.075mm)
Silt or Clay	Passing #200 sieve (0.075mm)

RELATIVE PROPORTIONS OF FINES

Descriptive Term(s) (of Components Also Present in Sample)	Percent of Dry Weight
Trace	< 5
With	5 - 12
Modifier	> 12

UNIFIED SOIL CLASSIFICATION SYSTEM

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

[A]Based on the material passing the 3-in. (75-mm) sieve.

[B]If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C]Gravels with 5 to 12% fines require dual symbols:
GW-GM well-graded gravel with silt
GW-GC well-graded gravel with clay
GP-GM poorly graded gravel with silt
GP-GC poorly graded gravel with clay

[D]Sands with 5 to 12% fines require dual symbols:
SW-SM well-graded sand with silt
SW-SC well-graded sand with clay
SP-SM poorly graded sand with silt
SP-SC poorly graded sand with clay

[E]$Cu = D_{60}/D_{10} \qquad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}}$

[F]If soil contains ≥ 15% sand, add "with sand" to group name.

[G]If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H]If fines are organic, add "with organic fines" to group name.

[I]If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J]If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K]If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel", whichever is predominant.

[L]If soil contains ≥ 30% plus. No. 200 predominantly sand, add "sandy" to group name.

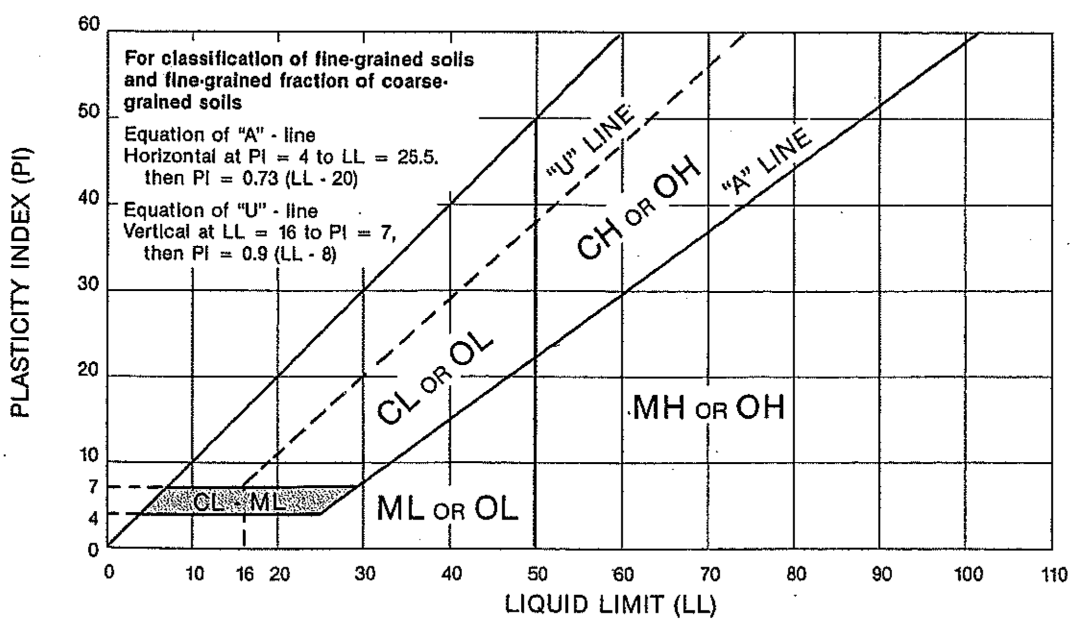
[M]If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N]PI ≥ 4 and plots on or above "A" line.

[O]PI < 4 or plots below "A" line.

[P]PI plots on or above "A" line.

[Q]PI plots below "A" line.



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