EMPIRE
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GEOTECHNICAL EVALUATION
PROPOSED MCDONALD'S RESTAURANT
ONTARIO SERVICE AREA
NEW YORK STATE THRUWAY

Prepared For:

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STATE OF NEW YORK
LICENSED PROFESSIONAL ENGINEER

Prepared By:

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GEOTECHNICAL EVALUATION
PROPOSED MCDONALDS RESTAURANT
ONTARIO SERVICE AREA
NEW YORK STATE THRUWAY

I. INTRODUCTION

An investigation and evaluation of the proposed McDonald's Restaurant site at the New York State Thruway Ontario Service Area was conducted as authorized by C.T. Male Associates, P.C.. The purpose of our work was to evaluate the existing subsurface conditions and provide recommendations for the design and construction of building and sign foundations, and surrounding pavements. Topographic site survey and general layout information was provided by C.T. Male Associates, P.C. The final location of the new restaurant building has not been established at the time of the report. However, the general layout provided shows the new building to be in close proximity to the existing restaurant.

II. PROJECT AND SITE DESCRIPTION

?

We understand that the existing restaurant building and adjacent pavements located at this site will be demolished and replaced with a new two-story McDonald's Restaurant building, with surrounding parking areas. We also understand that the existing restaurant building contains a partial basement area. It is assumed that the proposed new McDonald's building will not require a basement and will be constructed with typical slab on grade construction at the same approximate elevation as the existing building's finished floor. The proposed new building will also require a higher than normal column load capacities due to its special architectural features. For the purpose of computing foundation settlements a maximum column load of 100 kips was assumed.

The site is relatively flat in the vicinity of the proposed building location and adjacent parking area. The entire service area site is approximately two (2) to five (5) feet higher in elevation than the adjacent west bound lane of the NYS Thruway.

III. METHOD OF INVESTIGATION

The site's subsurface conditions were investigated through the advancement of test borings and visual classification of the recovered soil samples. A total of six (6) test borings were advanced from 6 to 20 feet of depth below existing grades. A technician from our staff established their locations in the field through tape measurements from the existing building and structures. The locations of these borings were also established to be in close proximity to the proposed building and adjacent parking areas. Their locations are illustrated on the Subsurface Investigation Plan contained in Appendix A.

Soil samples were recovered on a nearly continuous basis to a depth of ten (10) feet and at intervals of five (5) feet or less thereafter. The samples were obtained according to ASTM D-1586, Standard Method for Penetration Test and Split-Barrel Sampling of Soils. A truck mounted drill rig equipped with hollow stem augers was used to advance the test borings.

Representative portions of the soil samples recovered in the field were placed in jars and transported to our office for visual classification by a geotechnical engineer. On the basis of these classifications and the driller's field records and observations, a log was prepared for each test boring. The logs are presented in Appendix B together with a sheet which explains the terms and symbols used in their preparation.

VI. RESULTS OF INVESTIGATION

Test borings B-1 through B-4, located adjacent to the proposed structure, each penetrated through asphalt pavements followed by a firm to compact sand and gravel fill. Native soils were disclosed at depths of 2 to 4 feet. They typically consisted of a 2 to 3 foot layer of loose to firm silt and fine sand followed by compact sand and gravel.

In test borings B-5, native soils consisting of firm to compact silt, sand, and gravel were disclosed beneath a thin topsoil layer. Compact sand and gravel was then revealed at a depth of 4 feet. In test boring B-6 the sand and gravel stratum was found at a depth of 2 feet lying beneath a 1.5 foot layer of crushed stone fill and approximately 0.5 feet of sandy clayey silt.

No measurable groundwater was found within the augers upon completion of drilling and the recovered soil samples were typically moist. Test boring B-1 may have been terminated near the surface of the groundwater table at a depth of 20 feet since the tip of the final soil sample was wet.

V. CONCLUSIONS

The fill and native soils which mantle the project site are considered suitable for the planned development using conventional spread foundations and slab-on-grade construction. The groundwater table is well below the depth where it will influence design and construction of foundations. Except for thin seams of silt, the excavated native and fill soils are generally considered suitable for reuse as structural fill. They should, however, be tested to verify that they meet the gradation requirements specified for Select Granular material in Section VI.E of this report.

VI. RECOMMENDATIONS

A. Site Preparation

The existing building structure should be demolished and all demolition debris removed together with foundation walls to a minimum of two (2) feet below grade level in existing slab areas and to top of existing footing levels. Existing pavements should be broken and removed to below the base course levels at a minimum. The finished floor elevation for the new restaurant should be approximately equal to the existing building's elevation or a minimum of six (6) inches above abutting pavements. A select granular material as specified in paragraph E should be used to complete any grade increases and backfill areas where foundations were removed. In areas where loose fills are encountered below foundation grade, they should be removed and backfilled with a select granular material according to specifications outlined in paragraph E.

B. Foundation Design and Construction

Conventional spread foundations proportioned according to the McDonald's standard net allowable bearing pressure of 2000 pounds per square foot may be used to support the structure. A maximum net allowable bearing pressure of 4,500 pounds per square foot, however, may be used in the interest of economy. All foundations should have a minimum width of twenty four (24) inches even if this results in a bearing pressure less than the recommended allowable. Exterior foundations should be seated at least four (4) feet below final exterior grades to provide frost protection. Interior foundations may bear at two (2) feet below the top of the floor slab if permitted by local building codes.

The sliding and overturning stability of foundations for any retaining walls, road signs or utility poles should be determined. Assuming adequate drainage provisions and a level backfill, the following parameters may be used for the stability analyses together with a factor of safety of 1.50.

- o Maximum Allowable Foundation Edge Pressure 5000 psf
- o Equivalent Fluid Weight of Level Backfill

  Active Pressure = 30 pcf

  Passive Pressure = 250 pcf
- o Coefficient of Sliding Friction
  Along Base of Foundation = 0.45

Depth of embedment for pole foundations may be analyzed utilizing the following parameters:

- o Maximum allowable Lateral Soil Bearing Capacity = 300 psf/ft. of depth
- o Allowable Horizontal subgrade reaction constant (n_h) = 20 tons/ft^3

Foundation bearing grades are expected to vary from sand and gravel to sandy silt. If any soft or organic matter is encountered at bearing grade elevation, they should be undercut to a firm and stable subgrade and backfilled with Select Granular Material compacted to the 95 percent density specification, ASTM D-1557. The loosened foundation bearing grades should be compacted to a density similar to their undisturbed state. The final bearing grades should be firm, stable, and free of any loose soil, mud, water and frost.

The foundations should be backfilled with Select Granular Material as specified in paragraph E. Backfilling should be performed simultaneously on either side of foundation walls to prevent creating any unbalanced lateral earth pressures.

Foundation settlements are not expected to exceed one (1) inch. The settlements should occur quickly as each load increment is applied.

C. Floor Slab Design and Construction

The building's floor slabs should be constructed over a base course of processed sand and gravel which conforms to the gradation requirements specified for Type 4 material in Section 304-2.02 of the NYSDOT Standard Specifications. The base course layer should be at least six (6) inches in depth and compacted according to the 95 percent density specification, ASTM D-1557.

The slabs on grade may be designed and constructed following the procedures of the American Concrete Institute or Portland Cement Association using 300 pounds per cubic inch as the vertical modulus of subgrade reaction.

D. Pavement Design

The entrance drive and parking lot for the new restaurant may be constructed as flexible pavements. Assuming any truck traffic is confined to a specific area and will not cross parking lot areas, two pavement sections may be employed; a light section for areas restricted to automobile parking and a heavy section for areas subject to truck traffic.

The following materials and specifications are recommended for each:

COURSE	MATERIAL DESCRIPTION	THICKNESS	NYSDOT SPECS
Truck Traffic - Entrance Drives			
Top	Asphaltic Concrete	1 1/2"	Section 401 Type 6
Binder	Asphaltic Concrete	3"	Section 401 Type 3
Base	Crusher-Run Stone	6"	Section 304 Type 2
Subbase	Processed Sand & Gravel	12"	Section 304 Type 4
Auto Traffic - Parking Lot			
Top	Asphaltic Concrete	1 1/2"	Section 401 Type 6
Binder	Asphaltic Concrete	2 1/2"	Section 401 Type 3
Base	Processed Sand & Gravel	12"	Section 304 Type 4

Prior to constructing the pavement sections the subgrade should be regraded to remove ruts and any loose soil. The base and subbase courses should be compacted to the 95 percent ASTM D-1557 density specification. Placement and compaction of the asphaltic concrete should be in accordance with the requirements of Section 400 of the NYSDOT Standard Specifications.

E. Site Fill and Backfill Requirements

Fill and backfill for the site should meet the following specifications:

Type	Application	Compaction
Select Granular Fill NYSDOT Section 203-2.02C	Under foundations and adjacent to structure.	Compact in maximum 6" lifts to 95
Select Granular Fill NYSDOT Section 203-2.02C	Under grassed areas.	Compact in maximum 12" lifts to 90% ASTM D-1557
Select Granular Fill NYSDOT Section 203-2.02C	Under pavements and building floor slabs	Compact in maximum 8" lifts to 95% ASTM D-1557

Notes:

1) Excavated on-site soils and base course materials may be considered for use as Select Granular Fill provided they meet the gradation requirements specified in NYSDOT Section 203-2.02C.

VII. CLOSURE

This report has been prepared to assist in the design and construction of a McDonald's Restaurant at the Ontario Service Area of the NYS Thruway. The recommendations are presented on the basis of our understanding of the project as described herein and through the application of generally accepted soil and foundation engineering practices. No other warranties, expressed or implied, are made. Should there be any modifications in the building location as presented on the Subsurface Investigation Plan, we should be notified so that we may review the changes and modify our recommendations as required.

It is recommended that the Geotechnical Engineer by provided the opportunity to review the final design and specification to ascertain that the recommendation presented herein have been properly interpreted and applied.

Important information which should be reviewed concerning the use and interpretation of this report is contained in Appendix C.

Submitted by:

EMPIRE SOILS INVESTIGATIONS, INC.

Edward C. Gravelle / 1ks

Edward C. Gravelle, P.C.
Geotechnical Engineer

Reviewed by:

Paul DeStefano, P.E.
Geotechnical Engineering Manager
Eastern Region

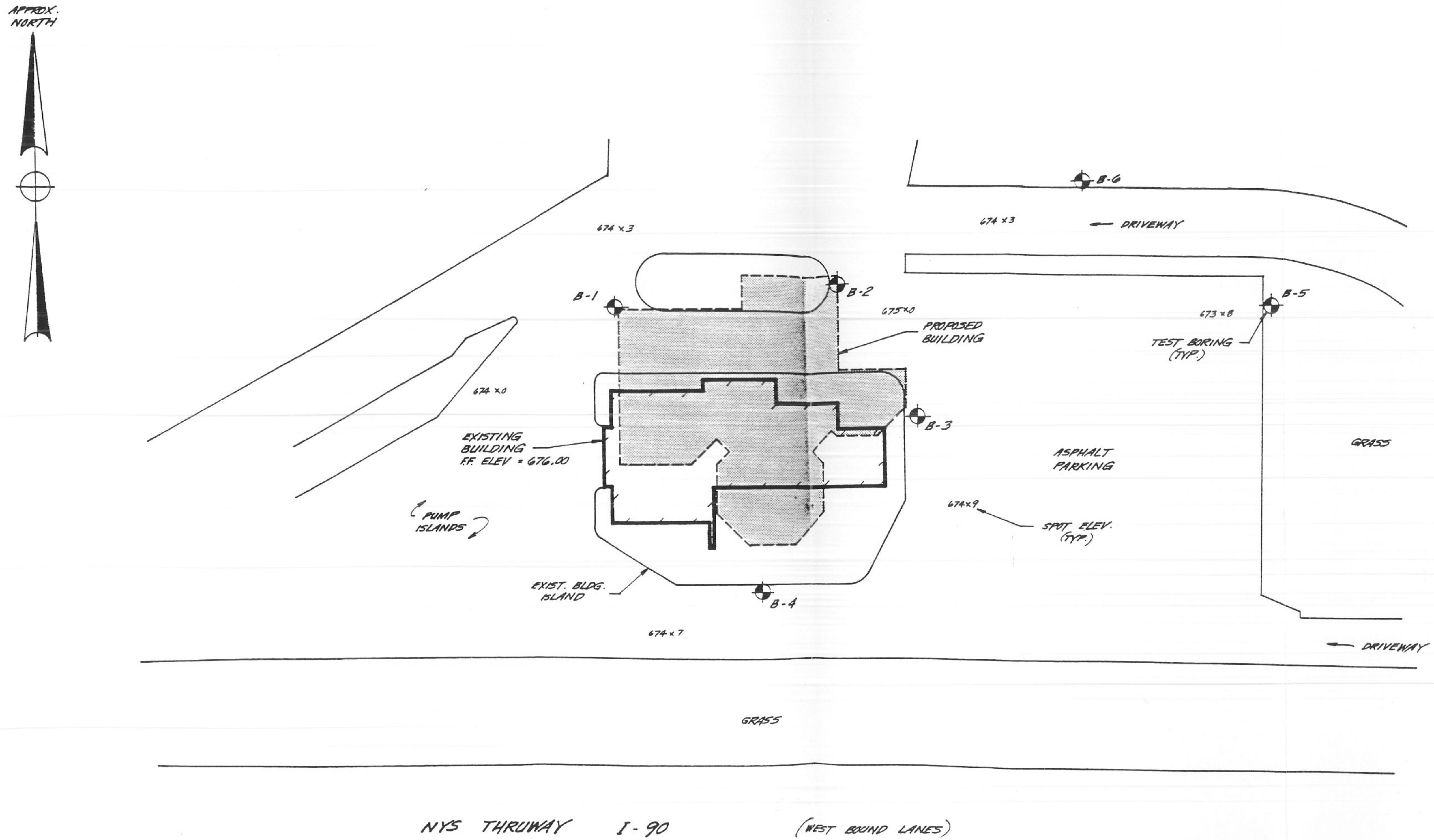
ECG:PD:ks

1226onta

SUBSURFACE INVESTIGATION PLAN

ONTARIO S.A.

APPENDIX A



EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE INVESTIGATION PLAN

PROPOSED McDONALD'S RESTAURANT
NYS THRUWAY
ONTARIO SERVICE AREA

DR. BY: JH	SCALE: 1" = 60'	PROJ. NO.: ATA-91-192
REV'D. BY:	DATE: 12/91	DRWG. NO.: 7

BASE MAP PREPARED BY C.T. MALE ASSOCIATES, P.C.

SUBSURFACE LOGS

APPENDIX B

DATE STARTED 12/17/91
FINISHED 12/17/91
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-1
SURF. ELEV. ±674.5'
G. W. DEPTH See Notes

PROJECT Proposed McDonald's Restaurant

LOCATION Ontario Service Area NYS Thruway (I-90)

DEPTH-FT.	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0	1	-	10		30		0.5' ASPHALT	No measurable groundwater in augers 1/2 hour after completion of drilling
		20	18				FILL: Brown fine to coarse SAND, Some Gravel, trace silt (Moist-Firm)	
	2	11	6		11		Reddish Brown SAND, Some Silt (Moist-Firm)	
		5	7					
5	3	6	14		30			
		16	8				Brown fine to coarse SAND, Some Gravel, little to trace silt	
	4	14	16		55			
		39	32					
	5	21	19		38		Grades to GRAVEL and SAND, trace silt	
10		19	13					
	6	100/.1'			-			
15	7	43	33		100			
		67						
	8	45	28		52		(Dry-Firm to Very Compact)	
20		24	60				Tip of Sample 8 wet	
							Boring Terminated @ 20.0'	

N - No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 " per blow. CLASSIFICATION Visual by Geotechnical Engineer
C - No. blows to drive ____ " casing ____ " with ____ lb. weight falling ____ " per blow.
METHOD OF INVESTIGATION 3¼" I.D. Hollow Stem Augers

Press, Inc., East Aurora, NY — F0009

DATE
STARTED 12/17/91
FINISHED 12/17/91
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-2
SURF. ELEV. ±674.8'
G. W. DEPTH See Notes

PROJECT Proposed McDonald's Restaurant

LOCATION Ontario Service Area NYS Thruway (I-90)

D	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0							1.25' ASPHALT + 0.5' Granular Base	No measurable groundwater in augers upon completion of drilling
	1	6	9		23		Brown fine to coarse SAND and GRAVEL, little silt	
		14	18					
	2	22	15		36			
		21	12					
	3	10	10		60		Grades to "trace" silt	
		50	20					
	4	45	32		54			
10		22	16					
	5	27	39		70		(Moist-Firm to Very Compact)	
15		31	78					
							Boring Terminated @ 15.0'	

N = No. blows to drive 2" spoon 12" with 140 lb. pin wt. falling 30" per blow. CLASSIFICATION Visual by Geotechnical Engineer

C = No. blows to drive ____" casing ____" with ____lb. weight falling ____" per blow.

METHOD OF INVESTIGATION 3¼" I.D. Hollow Stem Augers

DATE
STARTED 12/17/91
FINISHED 12/17/91
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-3
SURF. ELEV. ±675.4'
G. W. DEPTH See Notes

PROJECT Proposed McDonald's Restaurant

LOCATION Ontario Service Area NYS Thruway (I-90)

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0								0.75' ASPHALT	No measurable ground-water in augers upon completion of drilling
		1	26	18				FILL: Brown fine to coarse SAND and GRAVEL, trace silt (Moist-Compact)	
		2	20	23		39			
			16	12					
5		3	3	4		8		Dark Gray SILT, little sand, trace clay, Slight Organic Odor (Damp-Firm)	
			4	6					
		4	8	12		32		Brown SILT, Some Sand, little Gravel (Moist-Loose)	
			20	19					
		5	51	100/.3'		-		Brown fine to coarse SAND and GRAVEL, trace silt (Moist to Dry-Compact)	
10									
		6	100/0'			-			
15								Boring Terminated @ 13.2' (Auger Refusal)	

N - No. blows to drive 2 " spoon 12 " with 140 lb. pin wt. falling 30 " per blow. CLASSIFICATION Visual by Geotechnical Engineer

C = No. blows to drive ______ " casing ______ " with ______ lb. weight falling ______ " per blow.

METHOD OF INVESTIGATION 3¼" I.D. Hollow Stem Augers

DATE STARTED 12/18/91

FINISHED 12/18/91

SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-4

SURF. ELEV. ±675.1'

G. W. DEPTH See Notes

PROJECT Proposed McDonald's Restaurant

LOCATION Ontario Service Area NYS Thruway (I-90)

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	-	16		26		0.6' ASPHALT	No measurable groundwater in augers upon completion of drilling
			10	23				FILL: Brown fine to coarse SAND and GRAVEL, trace silt	
		2	22	24		40			
			16	9				(Moist-Firm to Compact)	
		3	3	4		8		Dark Brown SILT, little to Some Sand, trace gravel, trace clay	
5			4	8					
		4	12	15		37		(Moist-Loose)	
			22	23				Brown fine to coarse GRAVEL and SAND, trace silt	
		5	32	22		122/.7'			
			100/.2'						
10									
		6	28	48		99			
			51	100/.2'				(Moist-Very Compact)	
15								Boring Terminated @ 14.7'	
20									

No. blows to drive 2" spoon 12" with 140 lb. pin wt. falling 30" per blow. CLASSIFICATION Visual by Geotechnical Engineer

= No. blows to drive ____" casing ____" with ____ lb. weight falling ____" per blow.

METHOD OF INVESTIGATION 3¼" I.D. Hollow Stem Augers

DATE

STARTED 12/17/91

FINISHED 12/17/91

SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-5

SURF. ELEV. +674.2'

G. W. DEPTH See Notes

PROJECT Proposed McDonald's Restaurant

LOCATION Ontario Service Area NYS Thruway (I-90)

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	3	6		16		0.3' TOPSOIL	No measurable groundwater in augers upon completion of drilling
			10	22				Dark Brown SILT, Some fine to coarse Sand & Gravel, Grades to SAND, SILT and GRAVEL (Moist-Firm to Compact)	
		2	20	17		34			
			17	16					
5		3	38	22		38		Brown fine to coarse SAND and GRAVEL, trace silt (Dry-Compact)	
			16	23					
								Boring Terminated @ 6.0'	

N = No. blows to drive 2" spoon 12" with 140 lb. pin wt. falling 30" per blow. CLASSIFICATION Visual by Geotechnical Engineer

C = No. blows to drive ___" casing ___" with ___ lb. weight falling ___" per blow.

METHOD OF INVESTIGATION 3½" I.D. Hollow Stem Augers

DATE STARTED 12/18/91
FINISHED 12/18/91
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-6
SURF. ELEV. ±673.6'
G. W. DEPTH See Notes

PROJECT Proposed McDonald's Restaurant

LOCATION Ontario Service Area NYS Thruway (I-90)

DEPTH-FT.	SAMPLES	SAMPLE NO.	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	12	20		39		FILL: Crushed Stone 1.5'	No measurable ground-water in augers upon completion of drilling
			19	10				Dark Brown SILT, Some Sand, little clay (Moist-Firm) 2.0'	
		2	14	14		35			
			21	50					
		3	25	12		24		Brown fine to coarse GRAVEL and SAND, little to trace silt (Moist-Compact to Firm)	
5			12	14					
								Boring Terminated @ 6.0'	

N = No. blows to drive 2" spoon 12" with 140 lb. pin wt. falling 30" per blow. CLASSIFICATION Visual by Geotechnical Engineer

C = No. blows to drive ___" casing ___" with ___ lb. weight falling ___" per blow.

METHOD OF INVESTIGATION 3¼" I.D. Hollow Stem Augers

DATE STARTED 5-1-86 FINISHED 5-1-86 SHEET 1 OF 1	EMPIRE SOILS INVESTIGATIONS INC **SUBSURFACE LOG**	HOLE NO. B-175 SURF. ELEV. 325.6 G. W. DEPTH See Note #1

Project ______________________ LOCATION ______________________

DEPTH-FT	SAMPLES	SAMPLE NO	BLOWS ON SAMPLER 0/6	6/12	12/18	N	BLOW ON CASING C	SOIL OR ROCK CLASSIFICATION	NOTES
0		1	2	2	3	5	10	TOPSOIL 3"	NOTE #1 G.W. at 2.0' completion G.W. at 2.2' 24 hrs. after completion
							15	Brown SILT, some Sand, trace clay (Moist - Loose)	
							50/.5'		
								Gray SHALE, medium hard weathered, thin bedded some fractures	Run #1, 2.5' - 5.0' 95% Recovery 50% RQD
5									

① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩

TABLE I

Split Spoon Sample
Shelby Tube Sample
Auger or Test Pit Sample
Rock Core

TABLE II

Identification of soil type is made on basis of an estimate of particle sizes, and in the case of fine grained soils also on basis of plasticity.

Soil Type	Soil Particle Size	
Boulder	> 12"	Coarse Grained (Granular)
Cobble	3" - 12"	
Gravel - Coarse	3" - ¾"	
- Fine	¾" - #4	
Sand - Coarse	#4 - #10	
- Medium	#10 - #40	
- Fine	#40 - #200	
Silt-Non Plastic (Granular) Clay-Plastic (Cohesive)	<#200	Fine Grained

TABLE III

The following terms are used in classifying soils consisting of mixtures of two or more soil types. The estimate is based on weight of total sample.

Term	Percent of Total Sample
"and"	35 - 50
"some"	20 - 35
"little"	10 - 20
"trace"	less than 10

(When sampling gravelly soils with a standard split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter.)

TABLE IV

The relative compactness or consistency is described in accord with the following terms.

Granular Soils Term	Blows per Foot, N	Cohesive Soils Term	Blows per Foot, N
Loose	< 11	Very Soft	< 3
Firm	11 - 30	Soft	3 - 5
Compact	31 - 50	Medium	6 - 15
Very Compact	> 51	Stiff	16 - 25
		Hard	> 26

(Large particles in the soils will often significantly influence the blows per foot recorded during the Penetration Test.)

TABLE V

Varved	- Horizontal uniform layers or seams of soil(s).
Layer	- Soil deposit more than 6" thick
Seam	- Soil deposit less than 6" thick
Parting	- Soil deposit less than 1/8" thick
Laminated	- Irregular, horizontal and angled seams and partings of soil(s)

TABLE VI

Rock Classification Terms — Term		Meaning
Hardness	Soft	Scratched by fingernail
	Medium Hard	Scratched easily by penknife
	Hard	Scratched with difficulty by penknife
	Very Hard	Cannot be scratched by penknife
Weathering	Very Weathered Weathered Sound	Judged from the relative amounts of disintegration iron staining, core recovery, clay seams, etc.
Bedding	Laminated	Natural breaks in Rock Layers (<1")
	Thin bedded	(1" - 4")
	Bedded	(4" - 12")
	Thick bedded	(12" - 36")
	Massive	(>36")

(Fracturing refers to natural breaks in the rock oriented at some angle to the rock layers.)

GENERAL INFORMATION & KEY TO SUBSURFACE LOGS

The Subsurface Logs attached to this report present the observations and mechanical data collected by the driller at the site, supplemented by classification of the material removed from the borings as determined through visual identification by technicians in the laboratory. It is cautioned that the materials removed from the borings represent only a fraction of the total volume of the deposits at the site and may not necessarily be representative of the subsurface conditions between adjacent borings or between the sampled intervals. The data presented on the Subsurface Logs together with the recovered samples will provide a basis for evaluating the character of the subsurface conditions relative to the project. The evaluation must consider all the recorded details and their significance relative to each other. Often analyses of standard boring data indicate the need for additional testing or sampling procedures to more accurately evaluate the subsurface conditions. Any evaluation of the contents of this report and the recovered samples must be performed by Professionals. The information presented in the following defines some of the procedures and terms used on the Subsurface Logs to describe the conditions encountered.

1. The figures in the Depth column defines the scale of the Subsurface Log.

2. The sample column shows, graphically, the depth range from which a sample was recovered. See Table 1 for a description of the symbols used to signify the various types of samples.

3. The Sample No. is used for identification on sample containers and/or Laboratory Test Reports.

4. Blows on Sampler — shows the results of the "Penetration Test", recording the number of blows required to drive a split spoon sampler into the soil. The number of blows required for each six inches of penetration is recorded. The first 6 inches of penetration is considered to be a seating drive. The number of blows required for the second and third 6 inches of penetration is termed the penetration resistance, N. The outside diameter of the sampler, the hammer weight and the length of drop are noted at the bottom of the Subsurface Log.

5. Blows on Casing — shows the number of blows required to advance the casing a distance of 12 inches. The casing size, the hammer weight and the length of drop are noted at the bottom of the Subsurface Log. If the casing is advanced by means other than driving, the method of advancement will be indicated in the Notes column or under the Method of Investigation at the bottom of the Subsurface Log.

6. All recovered soil samples are reviewed in the laboratory by an engineering technician, geologist or geotechnical engineer, unless note otherwise. The visual descriptions are made on the basis of a combination of the driller's field descriptions and observations and the sample as received in the laboratory. The method of visual classification is based primarily on the Unified Soil Classification (ASTM D 2487-83) with regard to the particle size and plasticity. (See Table No. II) Additionally, the relative portion, by weight, of two or more soil types is described for granular soils in accordance with "Suggested Methods of Test for Identification of Soils" by D. M. Burmister, ASTM Special Technical Publication 479, June 1970. (See Table No. III) The description of the relative soil density or consistency is based upon the penetration records as defined on Table No. IV. The description of the soil moisture is based upon the relative wetness of the soil as recovered and is described as dry, moist, wet and saturated. Water introduced in the boring either naturally or during drilling may have affected the moisture condition of the recovered sample. Special terms are used as required to describe materials in greater detail; several such terms are listed in Table V. When sampling gravelly soils with a standard two inch diameter split spoon, the true percentage of gravel is often not recovered due to the relatively small sampler diameter. The presence of boulders and large gravel is sometimes, but not necessarily, detected by an evaluation of the casing and samplers blows or through the "action" of the drill rig as reported by the driller.

7. The description of the rock shown is based on the recovered rock core and the driller's observations. The terms frequently used in the description are included in Table VI.

8. The stratification lines represent the approximate boundary between soil types and the transition may be gradual. Solid stratification lines are based on the driller's field observations.

9. Miscellaneous observations and procedures noted by the driller are shown in this column, including water level observations. It is important to realize the reliability of the water level observations depends upon the soil type (water does not readily stabilize in a hole through fine grained soils), and that drill water used to advance the boring may have influenced the observations. The ground water level typically will fluctuate seasonally. One or more perched or trapped water levels may exist in the ground seasonally. All the available readings should be evaluated. If definite conclusions cannot be made, it is often prudent to examine the conditions more thoroughly through test pit excavations or water observation wells.

10. The length of core run is defined as the length of penetration of the core barrel. Core recovery is the length of core recovered divided by the core run. The RQD (Rock Quality Designation) is the total pieces of NX core exceeding 4 inches in length divided by the core run. The size core barrel used is also noted.

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL ENGINEERING REPORT

APPENDIX C

IMPORTANT INFORMATION
ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, due in large measure to programs and publications of ASFE/ The Association of Engineering Firms Practicing in the Geosciences.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

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

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration; the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities, and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of the report may affect its recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should not be used*:

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

Geotechnical engineers cannot accept responsibility for problems which may develop if they are not consulted after factors considered in their report's development have changed.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by geotechnical engineers who then render an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those inferred to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than a report indicates. Actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultants through the construction stage*, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

GEOTECHNICAL SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND PERSONS

Geotechnical engineers' reports are prepared to meet the specific needs of specific individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor, or even some other consulting civil engineer. Unless indicated otherwise, this report was prepared expressly for the client involved and expressly for purposes indicated by the client. Use by any other persons for any purpose, or by the client for a different purpose, may result in problems. *No individual other than the client should apply this report for its intended purpose without first conferring with the geotechnical engineer. No person should apply this report for any purpose other than that originally contemplated without first conferring with the geotechnical engineer.*

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy of their plans and specifications relative to geotechnical issues.

BORING LOGS SHOULD NOT BE SEPARATED FROM THE ENGINEERING REPORT

Final boring logs are developed by geotechnical engineers based upon their interpretation of field logs (assembled by site personnel) and laboratory evaluation of field samples. Only final boring logs customarily are included in geotechnical engineering reports. *These logs should not under any circumstances be redrawn* for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process. Although photographic reproduction eliminates this problem, it does nothing to minimize the possibility of contractors misinterpreting the logs during bid preparation. When this occurs, delays, disputes and unanticipated costs are the all-too-frequent result.

To minimize the likelihood of boring log misinterpretation, *give contractors ready access to the complete geotechnical engineering report* prepared or authorized for their use. Those who do not provide such access may proceed under the *mistaken* impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes which aggravate them to disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY

Because geotechnical engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against geotechnical consultants. To help prevent this problem, geotechnical engineers have developed model clauses for use in written transmittals. These are *not* exculpatory clauses designed to foist geotechnical engineers' liabilities onto someone else. Rather, they are definitive clauses which identify where geotechnical engineers' responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your geotechnical engineering report, and you are encouraged to read them closely. Your geotechnical engineer will be pleased to give full and frank answers to your questions.

OTHER STEPS YOU CAN TAKE TO REDUCE RISK

Your consulting geotechnical engineer will be pleased to discuss other techniques which can be employed to mitigate risk. In addition, ASFE has developed a variety of materials which may be beneficial. Contact ASFE for a complimentary copy of its publications directory.

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