EMPIRE
SOILS INVESTIGATIONS INC. 5 KNABNER ROAD • P.O. BOX 2199 • BALLSTON SPA, NY 12020 • 518/899-7491 FAX 518/899-7496

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

Prepared For:

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LATHAM, N.Y. 12110

Prepared By:

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FILE NO.: ATA-91-192
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GEOTECHNICAL EVALUATION
PROPOSED MCDONALDS RESTAURANT
MOHAWK SERVICE AREA

I. INTRODUCTION

An investigation and evaluation of the proposed McDonald's Restaurant site at the New York State Thruway Mohawk 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 higher than normal column load capacities (up to 100 kips) due to 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. Undeveloped areas to the south are generally higher in elevation than the project site and slope upwards in a southerly direction. The eastbound lane of the thruway is approximately 8 to 10 feet lower in elevation than is the service area.

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 4.5 to 22.0 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 positions of these borings were selected to be in close proximity to the proposed building and adjacent parking areas. Their approximate 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 nominal five (5) foot intervals thereafter. The samples were obtained according to ASTM D-1586, Standard Method for Penetration Test and Split-Barrel Sampling of Soils. A Failing Model F-10 drill rig equipped with hollow stem auger casing was used to advance the test borings.

Representative portions of the recovered soil samples 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.

IV. <u>RESULTS OF INVESTIGATION</u>

A. Subsurface Conditions

Each of the test borings first penetrated through 0.5 to 1.0 feet of asphalt or asphalt and concrete followed by a granular base course of fine to coarse sand and gravel. Beginning at a depth of 1.5 to 3.0 feet a firm to compact deposit of glacial till was disclosed. The glacial till was composed of varying mixtures of sand, silt and gravel. In some areas, particularly on the north side of the site, the surficial layers of till may have been reworked (i.e., placed as fill) during initial site development. The composition and density of these reworked soils was similar to the native undisturbed glacial till. In test boring B-2 shallow auger refusal was encountered within the reworked soils at a depth of 4.5 feet.

In test borings B-1 through B-5 no measurable groundwater was noted within the augers upon completion of drilling. After removing the augers from test boring B-6, however, the open hole filled with water perched within the pavements granular base course material.

V. CONCLUSIONS

Based on site topography and results of the test borings it appears that existing grades in the southerly portion of the site may have been established through cut, whereas several feet of well compacted fill may have been placed on the northerly side. From a geotechnical standpoint the possible fill and native soils are considered suitable for the proposed development using conventional spread foundations and slab on grade construction.

It is not expected that the permanent groundwater table will be encountered during foundation excavation. However, as disclosed in test boring B-6, groundwater perched within the pavement's granular base course materials may be found. The presence of perched groundwater should vary across the site and its quantity should be dependent on seasonal fluctuations in precipitation and runoff.

The native glacial till soils are expected to be too high in silt content to permit their use as Select Granular fill beneath the new structure.

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 levels. Existing pavements should be broken and removed to below the base course levels at a minimum. The finished floor elevations 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 2,000 pounds per square foot may be used to support the structure. A maximum allowable bearing pressure of 4,000 pounds per square foot may be used to proportion the foundations 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 finished floor 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:

- Maximum Allowable Foundation Edge Pressure = 4,000 psf
- Equivalent Fluid Weight of Level Backfill

  Active Pressure = 30 pcf
  Passive Pressure = 250 pcf

- Coefficient of Sliding Friction
  Along Base of Foundation = 0.45

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

- Maximum allowable Lateral Soil Bearing Capacity = 250 psf/ft. of depth

- Allowable Horizontal subgrade reaction constant (n_h) = 20 tons/ft^3

The foundation bearing grades compacted to a dry density similar to their undisturbed state. Any water which enters the excavations should be promptly removed using standard sump and pump methods of dewatering. The final bearing grades should be firm, stable, and free of any loose soil, mud, water or frost.

Select Granular Material, as specified in paragraph E, should be used to backfill the foundations. Backfilling should be performed simultaneously on either side of foundation walls to avoid creating any unbalanced lateral earth pressures.

Foundation settlements are not expected to exceed one (1) inch. The settlements should occur within a few hours after the application of each load increment. Accordingly, any long-term post construction settlement should be negligible.

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 250 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 route and will not cross automobile parking 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 and 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 and 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 density specification, ASTM D-1557. 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 (See Note 1)	Under and adjacent to structure.	Compact in maximum 6" lifts to 95% ASTM D-1557
Select Granular Fill NYSDOT Section 203-2.02C (See Note 2)	Under grassed areas.	Compact in maximum 12" lifts to 90% ASTM D-1557
Select Granular Fill NYSDOT Section 203-2.02C (See Note 1)	Under pavements and building floor slabs.	Compact in maximum 8" lifts to 95% ASTM D-1557

Notes:

1) Granular base course from demolished pavement and building slab areas is likely to be suitable for foundations and pavement backfill. It should be tested and meet the gradation requirements for Select Granular Fill.

2) Excavated on-site glacial till soils may be considered for use in backfilling foundations under exterior grassed areas. The material used should be free of organics and particles larger than 4 inches. It will be necessary to control the as-compacted moisture content to achieve the required density due to the soil's high silt content.

VII. CLOSURE

This report has been prepared to assist in the design and construction of a McDonald's Restaurant at the NYS Thruway's Mohawk Service Area. 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 recommendations 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 /ks

Edward C. Gravelle, P.E.
Geotechnical Engineer

Reviewed by:

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

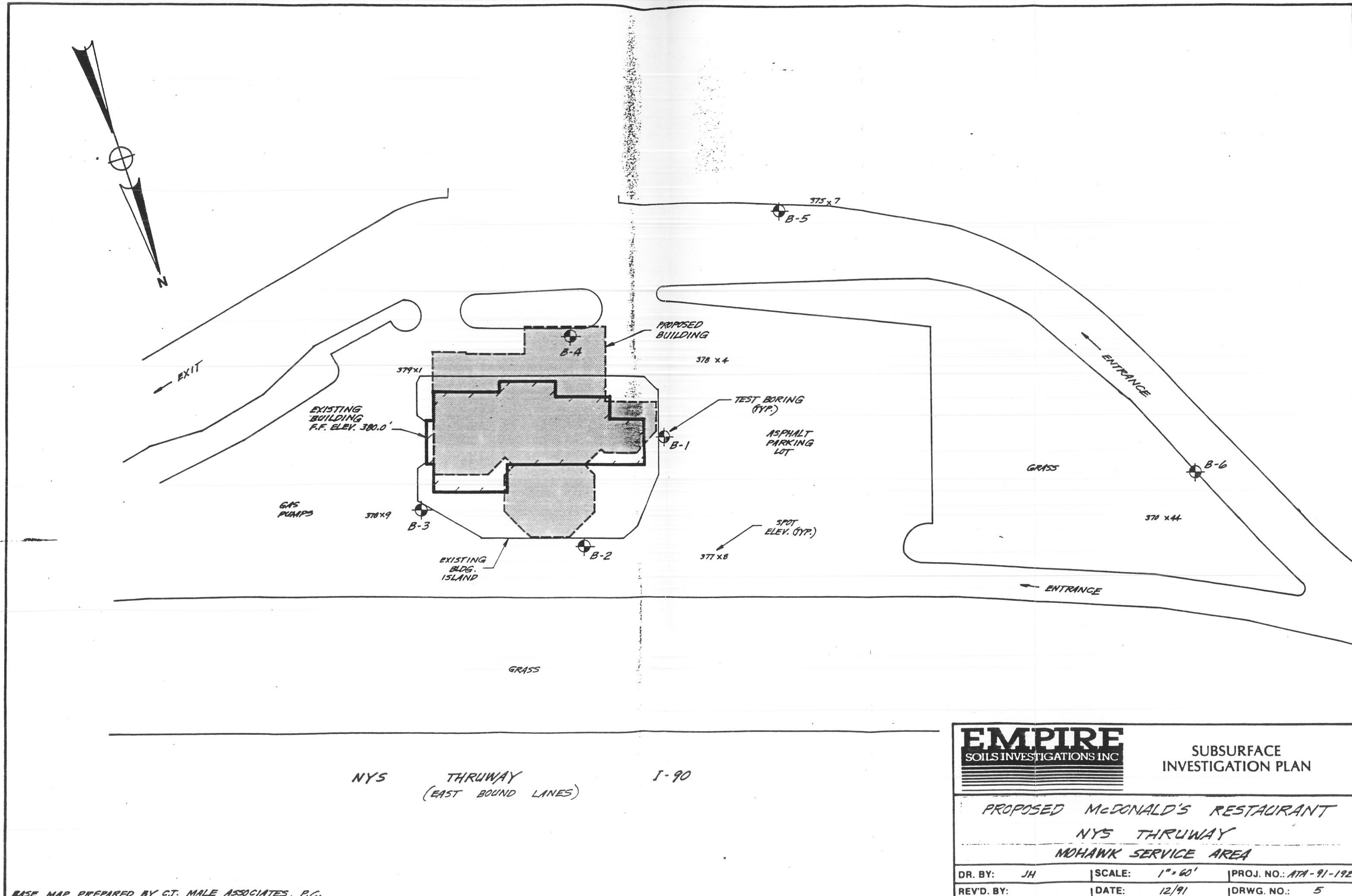
ECG:PD:ks

1218moha

SUBSURFACE INVESTIGATION PLAN

MOHAWK S.A.

Appendix A


N
EXIT
ENTRANCE
ENTRANCE
PROPOSED BUILDING
B-4
B-5
375 x 7
378 x 4
379 x 1
TEST BORING (TYP.)
ASPHALT PARKING LOT
EXISTING BUILDING F.F. ELEV. 380.0'
B-1
GRASS
B-6
GAS PUMPS
378 x 9
B-3
SPOT ELEV. (TYP.)
370 x 44
B-2
377 x 8
EXISTING BLDG. ISLAND
GRASS
NYS THRUWAY I-90
(EAST BOUND LANES)
BASE MAP PREPARED BY C.T. MALE ASSOCIATES, P.C.
EMPIRE
SOILS INVESTIGATIONS INC
SUBSURFACE INVESTIGATION PLAN
PROPOSED McDONALD'S RESTAURANT
NYS THRUWAY
MOHAWK SERVICE AREA
DR. BY: JH
SCALE: 1" = 60'
PROJ. NO.: ATA-91-192
REV'D. BY:
DATE: 12/91
DRWG. NO.: 5

SUBSURFACE LOGS

APPENDIX B

DATE
STARTED 12/9/91
FINISHED 12/9/91
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-1
SURF. ELEV. ±379.5'
G. W. DEPTH See Note

PROJECT Proposed McDonald's Restaurant

LOCATION Mohawk 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							1.0' ASPHALT	No measurable groundwater in augers upon completion of drilling
	1	5	5				FILL: Dark Gray fine to coarse SAND, Some fine Gravel, little silt	
	2	6	15		36		(Moist-Loose)	
		21	25					
	3	10	18		39			
5		21	23				Brown fine to coarse SAND, Some Gravel, Some Silt	
	4	23	38		83			
		45	58				(Moist-Compact to Very Compact)	
	5	10	17		35		Gray SILT, SAND and GRAVEL	
		18	21					
10								
15	6	8	10		22			
		12	11					
20	7	10	12		24			
		12	15				(Moist to Damp-Compact to Firm)	
							Boring Terminated @ 22.0'	
25								

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 4¼" I.D. Hollow Stem Augers

DATE
STARTED 12/10/91
FINISHED 12/10/91
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-2
SURF. ELEV. ±379.0'
G. W. DEPTH See Note

PROJECT Proposed McDonald's Restaurant

LOCATION Mohawk 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		23		0.5' ASPHALT	No measurable ground-water in augers upon completion of drilling
			11	12				FILL: Brown fine to coarse SAND, trace silt (Moist-Firm)	
		2	8	10		22			
			12	11					
5								Possible FILL: Brown fine to coarse SAND, Some Silt, Some Gravel (Moist-Firm)	
								Boring Terminated @ 4.5' (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 4¼" I.D. Hollow Stem Augers

DATE			
STARTED 12/10/91	**EMPIRE** SOILS INVESTIGATIONS INC.	**SUBSURFACE LOG**	HOLE NO. B-3
FINISHED 12/10/91			SURF. ELEV. ±380.0'
SHEET 1 OF 1			G. W. DEPTH See Notes

PROJECT Proposed McDonald's Restaurant

LOCATION Mohawk 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		14		29		0.5' ASPHALT	No measurable groundwater in augers upon completion of drilling
			15	8				FILL: Dark Gray SAND & GRAVEL, trace silt (Moist-Firm)	
		2	6	6		20			
			14	20				Brown fine to coarse SAND, SILT and GRAVEL	
5		3	12	19		64			
			45	35				(Moist-Firm to Very Compact)	
		4	28	37		82			
			45	38					
		5	8	14		34		No sample 5 recovered	
			20	25					
10									
								No sample 6 recovered	
		6	50/.1'						
								Boring Terminated @ 12.6' (Auger Refusal @ 12.5')	
15									

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 4¼" I.D. Hollow Stem Augers

DATE
STARTED 12/11/91
FINISHED 12/11/91
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-4
SURF. ELEV. ±379.7'
G. W. DEPTH See Note

PROJECT Proposed McDonald's Restaurant

LOCATION Mohawk 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								0.2' ASPHALT & 0.3' CONCRETE	No measurable ground-water in augers upon completion of drilling
		1	8	12				FILL: Brown SAND and GRAVEL, little silt (Moist-Firm)	
		2	10	8		14			
			6	7				Dark Gray fine to coarse SAND, Some Silt, Some Gravel (Moist-Firm)	
5		3	8	10		24			
			14	14					
		4	16	14		29			
			15	15					
		5	6	8		16		Grades to Dark Gray SAND, SILT and GRAVEL (Damp-Firm)	
10			8	7					
15									
		6	7	11		111/.8'		Same	
			100/.3'						
								Boring Terminated @ 16.3'	

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 4¼" I.D. Hollow Stem Augers

DATE
STARTED 12/11/91
FINISHED 12/11/91
SHEET 1 OF 1

EMPIRE SOILS INVESTIGATIONS INC.

SUBSURFACE LOG

HOLE NO. B-5
SURF. ELEV. ±376.2'
G. W. DEPTH See Note

PROJECT Proposed McDonald's Restaurant

LOCATION Mohawk 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		10		22		0.5' ASPHALT	No groundwater noted upon completion
			12	8				Possible FILL: Dark Brown fine to coarse SAND and fine GRAVEL, little silt (Moist-Firm)	
		2	7	12		23			
			11	11					
5		3	9	12		26		Dark Brown to Gray SAND, SILT and GRAVEL, trace organics in Sample 2 (Moist-Firm)	
			14	12					
								Boring Terminated @ 6.0'	
10									

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 4¼" I.D. Hollow Stem Augers

DATE			
STARTED 12/11/91	**EMPIRE** SOILS INVESTIGATIONS INC.	**SUBSURFACE LOG**	HOLE NO. B-6
FINISHED 12/11/91			SURF. ELEV. ±369.5'
SHEET 1 OF 1			G. W. DEPTH See Note

PROJECT Proposed McDonald's Restaurant

LOCATION Mohawk 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								0.3' ASPHALT & 0.7' CONCRETE	Open hole full of water upon completion
		1	12	8				FILL: Brown fine to coarse SAND and GRAVEL, little silt	
		2	12	4		14		(Moist to Wet-Firm)	
			10	10					
5		3	8	8		15		Gray fine to coarse SAND and SILT, Some Gravel (Damp-Firm)	
			7	7					
								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 4¼" I.D. Hollow Stem Augers

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

Project ______ LOCATION ______

DEPTH-FT (1)	SAMPLES (2)	SAMPLE NO (3)	BLOWS ON SAMPLER 0/6 (4)	6/12 (4)	12/18 (4)	N (4)	BLOW ON CASING C (5)	(6)	SOIL OR ROCK CLASSIFICATION (7)	(8)	(9)	NOTES (10)
0		1	2	2	3	5	10		TOPSOIL 3"			NOTE #1
							15		Brown SILT, some Sand, trace clay (Moist - Loose)			G.W. at 2.0' completion G.W. at 2.2' 24 hrs. after completion
							50/.5'					
5									Gray SHALE, medium hard weathered, thin bedded some fractures			Run #1, 2.5' - 5.0' 95% Recovery 50% RQD

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

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 ⅛" 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 CONCERNING
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.*