

71-F-3

101-70-01

Hwy. 34 Patrol Yard

31G-65

W.O.

W.P.

LOCATION

GEOCRES NO.

● DATA ON FILE IN SOIL MECHANICS SECTION

REFER TO: Contract 72-196

REMARKS

GEOCRES

INDEXING CARD FOR REPORTS NOT MICROFILMED

G1-20 AUG. 74

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MEMORANDUM

TO: Mr. A. G. Stermac
Principal Foundations Engineer
Materials and Testing Office
Downsview

FROM: Materials and Testing Office
Kingston

ATTENTION:

DATE: January 8, 1971

OUR FILE REF.

IN REPLY TO

SUBJECT:

W.P. 101-70-01, Proposed Patrol Yard,
at Hwy. 34 and Hwy. 417.
District 9, Ottawa

As discussed with Barry Darch on January 7, 1971, we would appreciate you carrying out investigation sufficient to determine foundation conditions at the garage and stockpile sites of the above proposed patrol yard at your earliest convenience. Foundation treatments for the garage site and limits of stockpile heights are necessary for completion of the patrol yard design.

A copy of the proposed patrol yard layout is attached and a copy of the same, showing our surface borings with 3 boreholes placed to 15 feet, will be made available to Mr. Wiebe on January 11, 1971.

Thank you for your assistance with this project which is rushed owing to the desirability of including the grading of the patrol yard with the grading of the adjacent Hwy. 417 project east of Hwy. 34.

A. M. Batten

A. M. Batten
Senior Soils Supervisor

AMB:mgm
Attn.

cc: S. J. Markiewicz
L. M. Fraser

71-11003

AGS

MATERIALS & TESTING OFFICE
EASTERN REGION

Hwy. 417, W.P. 100-70-01,
Patrol Yard at Carlsbad Springs
District 9, Ottawa

DISTRIBUTION

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Regional Materials Engineer.

A. M. Batten
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A. M. Batten,
Senior Soils Supervisor.

January 28, 1971
.....
Date

SOILS DESIGN REPORT

Hwy. 417

Patrol Yard at Carlsbad Springs

W.P. 100-70-01

Proposed Grading, Granular Base, Paving and Garage

Soils Plan

Township

K9PY-8

Cumberland

GENERAL DATA:

This proposed new patrol yard is located on the east side of Boundary Road approximately 3,000 feet north of Hwy. 417.

The grading and paving of this patrol yard is to be included with W.P. 34-66-04, the paving project on Hwy. 417, from Eighth Line Road Easterly to Vars.

The recommendations in this Soils Design Report pertain to the grading, drainage, and paving of the patrol yard only.

A Foundation Report will be issued, in the near future, with recommendations for the building foundations, and the stockpile areas.

INVESTIGATION:

A soils investigation was carried out in December, 1970. A truck mounted power auger was used as much as possible to recover samples. Hand auger borings were placed in areas inaccessible to the power auger due to low, wet conditions or bush cover.

All of the power auger and hand auger borings have been recorded on the soils plan.

PHYSICGRAPHY AND SOILS DATA

This patrol yard site is located on the Prescott and Russell Sand Plain.

Borings carried out with the power auger indicated acceptable fine sand up to a depth of 15'. The water table remains high in the sand mantle due to the lack of substantial drainage channels.

EARTH BORROW

Earth borrow, if required will likely consist of silty fine sand, similar to the samples recovered in the investigation. This material is uniformly graded and compaction will be difficult to maintain during and after placing. It is expected that the depth of excavation in borrow pits will be limited to about 4' due to the high water table. An average haul distance of 1/2 mile should be assumed for estimating purposes.

GRANULAR MATERIALS

Deposits consisting of sand to coarse granular are located to the north-east of Vars and along Hwy. 31 at South Gloucester. These materials are suitable for use as Granular 'C' but unsuitable for use as Granular 'A' due to poor stone quality. Granular 'A' and asphalt aggregates will likely be acquired from commercial quarries located along Hwy. 31 at South Gloucester. All of the abovenoted granular deposits and quarries are at an average haul distance of 8 miles.

GRADELINE

No grades have been received at this time. It is recommended that a minimum height of grade be set and still provide drainage to a depth of $3\frac{1}{2}$ ' below the top of finished grade.

RECOMMENDATIONS AND CONSTRUCTION FEATURES

1.1 Type of Granular Materials

It is recommended that the granular materials consist of Granular 'A' and Granular 'C', similar to W.P. 34-66-04.

1.2 Depth and Width of Granular Materials

Granular materials should be placed to the full width of roadways and to a minimum of three feet beyond the edge of new pavement in other paved areas. The granular materials in all sections, except the garage area, should consist of 6" Granular 'A' over 9" Granular 'C'.

1.3 Culvert Backfill

Granular material required for culvert backfill within the zone of frost penetration should consist of Granular 'C'.

2.1 Types and Depths of Asphalt Pavement

Pavement for this patrol yard should consist of the following:

H.L. 8 Binder Course	-	1 $\frac{3}{4}$ "
H.L. 4 Surface Course	-	<u>1 $\frac{1}{2}$"</u>
Total		<u><u>3 $\frac{1}{4}$"</u></u>

2.2 Treatment of Sand Stockpile Area

An R.S.1 emulsified asphalt seal coat should be applied to those areas where salt water seepage may occur.

3.1 Drainage

It is recommended that drainage be provided to a minimum of $3\frac{1}{2}$ ' below the top of finished grade.

4.1 Topsoil

For design estimating purposes, the average depth of topsoil can be assumed to be 9". The actual depth of topsoil can be obtained from the boreholes shown on the soils plan.

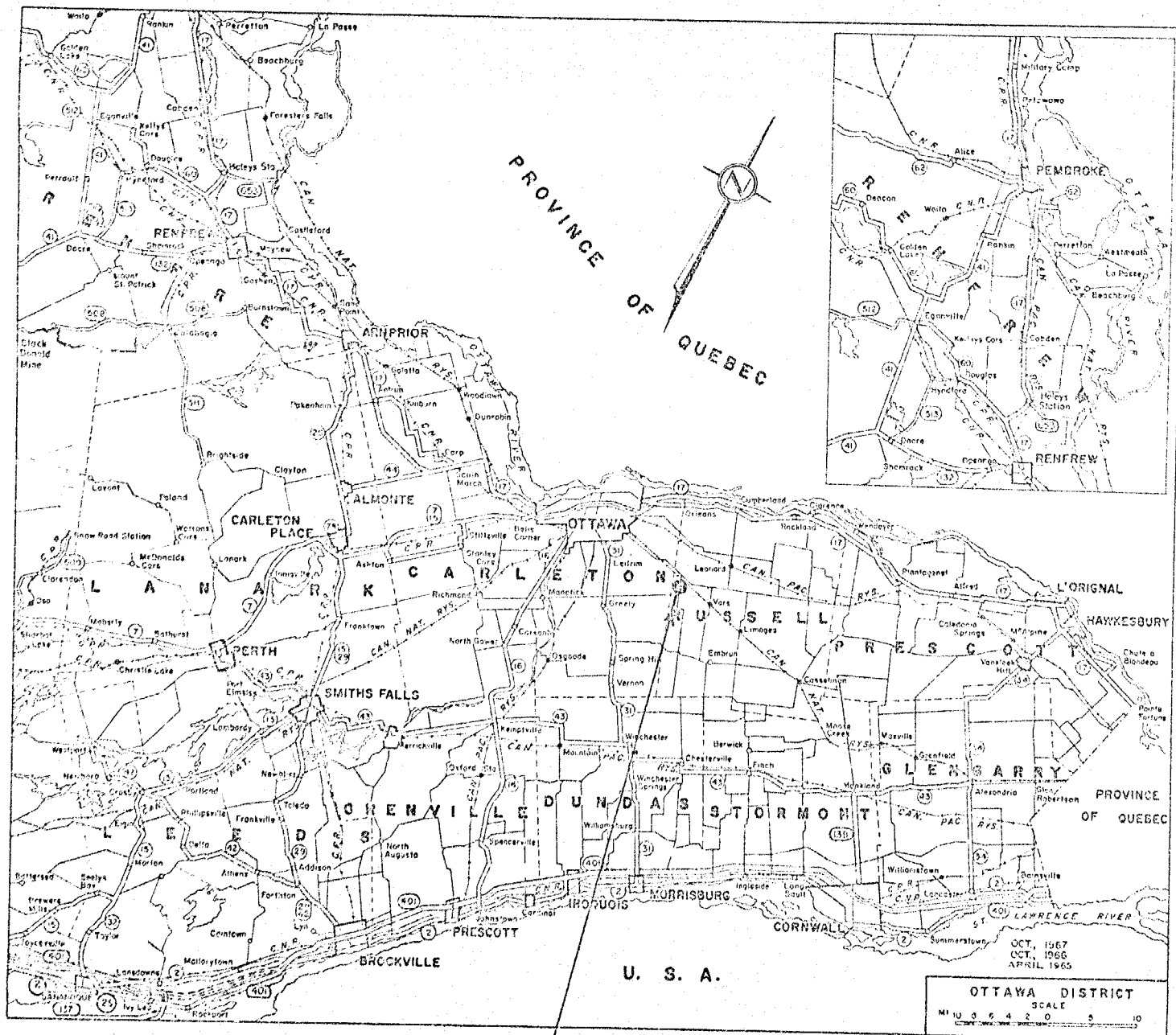
Stripping should be carried out on all areas where the fill height is 4' or less. At the proposed garage and stockpile areas, stripping should be carried out regardless of the height of fill to be place.

5.1 Garage and Stockpile Foundations

Foundation borings encountered a 12' to 15' depth of fine sand over 100'+ of soft silty clay with an undrained shear strength of 300 to 400 lbs. per square foot.

Preliminary calculations indicate that stockpile heights will probably be limited to approximately 15 feet. No bearing problems are anticipated for the dome and garage building construction.

A detailed foundation report will be issued in the very near future.



MEMORANDUM

72-196

31G-65

TO: Mr. J. E. Gruspier,
Regional Materials Engineer,
Regional Office,
KINGSTON, Ontario.

FROM: Foundation Section,
Materials & Testing Office,
Room 107, Lab. Bldg.

ATTENTION:

DATE: February 5, 1971

OUR FILE REF.

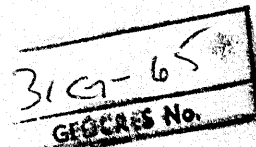
IN REPLY TO

FEB 17 1971

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For

Proposed Patrol Yard
Hwy.#34 (4 Mi. South of Vankleek Hill)
Twp. of Lochiel -- Co. of Glengarry
District No. 9 (Ottawa)
W.O. 71-11003 -- W.P. 101-70-01



Attached, we are forwarding to you our detailed foundation investigation report on the subsoil conditions existing at the above structure site.

We believe that the factual data and recommendations contained therein, will prove adequate for your design requirements. Should additional information be required, please feel free to contact our Office.

AGS/Mef
Attach.

A. G. Stermac
A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

cc: Messrs. S. J. Markiewicz(2) M. R. Ernesaks
D. W. Farren Z. L. Katona
F. G. Allen C. Fraser
T. C. Muir G. A. Wrong
W. Wible H. A. Aron
J. E. Callaghan (2) C. Moase
R. Forrest

Foundations Files
General Files

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FOUNDATION INVESTIGATION REPORT
For
Proposed Patrol Yard
Hwy. #34 (4 Mi. South of Vankleek Hill)
Twp. of Lochiel -- Co. of Glengarry
W.O. 71-11003 -- W.P. 101-70-01

1. INTRODUCTION:

The Foundation Section was requested to carry out an investigation sufficient to determine foundation conditions at a proposed garage and two proposed stockpiles at the above site. The Eastern Region Materials and Testing Office - (Mr. A. M. Batten, Senior Soils Supervisor) made the request in a memo dated January 8, 1971. An investigation was subsequently carried out by the Foundation Section to determine subsoil, bedrock and groundwater conditions at the site.

This report presents all the factual information obtained in this investigation, together with recommendations for garage foundations, as well as stability and settlement considerations associated with the stockpiles which are to be placed within D.H.O. standard domes.

2. DESCRIPTION OF SITE AND GEOLOGY:

The site is located on the west side of Hwy. #34, 1/2 mile south of the Village of Vankleek Hill.

The site, which is presently unoccupied, is bush-covered with numerous small trees and stumps. The terrain rises gently in a northerly direction from an elevation of 224 to 230.

The site is situated on the southern boundary of the physiographic region known as the 'Winchester Clay Plains'. The predominant stratum throughout this region is composed of a marine clay deposited by the Champlain Sea. The clay, which is encountered at a shallow depth below ground surface, is generally of the order

2. DESCRIPTION OF SITE AND GEOLOGY: (cont'd.) ...

of 12 to 20 feet in thickness. The clay is underlain by a competent glacial till sheet.

These overburden deposits of clay and glacial till are underlain by black shale of the Collingwood formation, Ordovician Period.

3. SUBSURFACE CONDITIONS:

3.1) General:

The field work consisted of putting down five sampled boreholes by means of a conventional diamond drill rig adapted for soil sampling purposes.

Samples of the cohesive stratum were recovered in 2" I.D. Shelby tubes which were pushed manually into the soil. Where practical, field vane tests were carried out at various depths to determine the undrained shear strength and sensitivity of this stratum. Samples of the granular deposit were obtained in a 2" O.D. split-spoon sampler which was driven in accordance with the specifications for the Standard Penetration Test. Bedrock was proven in one hole by obtaining AXF size rock core samples.

The groundwater level conditions across the site were determined during the course of the investigation by taking readings in the open boreholes.

The subsoil and bedrock sequence encountered at the individual boring locations is shown on the Record of Borelog sheets appended to this report.

Location of boreholes was carried out by personnel from Ottawa District and are shown on Drawing No. 71-11003A, together with two estimated stratigraphical sections across the site.

A brief description of the deposits encountered at the site is presented in the following sub-sections.

3. SUBSURFACE CONDITIONS: (cont'd.) ...

3.2) Clay to Silty Clay:

The surficial material, which has a thickness of about 1/2 foot, is composed of topsoil. The topsoil is underlain by a stratum composed of grey silty clay to clay. The overall thickness of the clay varies from 12 to 15 feet thick in the garage area to 20 feet thick in the area of the stockpiles (domes). The upper 3 to 5 feet is brown to brownish-grey, indicating desiccation. This is further supported by vane testing. The material changes in the next few feet to a dark grey marine clay with small inclusions of organic matter (probably marine origin). The lower foot of this stratum has traces of silt and sand.

Undrained shear strengths were obtained by performing in situ vane tests. Vanes could not be turned in the desiccated zone, indicating that it is very stiff. The undesiccated zone is firm to stiff with undrained shear strengths varying from 520 to 1000 p.s.f. with an average of about 700 p.s.f.

3.3) Heterogeneous Mixture of Silt, Sand, Gravel, trace of Clay:

In the building area, the cohesive stratum is underlain by a compact to very dense ('N' values of 17 to 191 blows/ft.), basically granular glacial till. The glacial till is composed of a heterogeneous mixture of silt, sand and gravel with a trace of clay. This deposit was penetrated at B.H. #1 only; here it was found to have an overall thickness of 26 feet. At random locations the till was found to be cohesive in nature - i.e., to have a matrix of clayey silt binding sand and gravel. Occasional seams of sand and silt (up to one foot thick) were encountered throughout. Boulders are present in the lower 5 feet of the deposit at B.H. #1; the boulders were up to 6 inches in size.

In the vicinity of the stockpiles (domes), the clay is underlain by a deposit of compact ('N' values of 17 to 20 blows/ft.), silt to sand (refer to Record of Borelog sheets for boreholes 4 and 5). This deposit was not fully penetrated at either of the boreholes, but it was proven to extend for a depth of 3 feet.

3. SUBSURFACE CONDITIONS: (cont'd.) ...

3.4) Bedrock:

Bedrock was cored in B.H. #1 and was found to be a greyish-black shale, relatively sound with the top 2 feet weathered and fractured. Bedrock was encountered at elevation 187, corresponding to a depth of some 39 feet below ground surface.

4. GROUNDWATER CONDITIONS:

Observations of water levels in open boreholes were made during the investigation. These are shown on the borelog sheets as well as on Drawing 71-11003A. The groundwater level was found to be between elevation 224 and 226. This is within 1/2 to 2 feet of the ground surface.

5. DISCUSSION AND RECOMMENDATIONS:

5.1) General:

It is proposed to construct a patrol garage as well as stockpiles (domes) in the vicinity of Hwy. #34, specifically at a location about 4 miles south of Vankleek Hill.

It is proposed to grade the site with 2 feet of granular material prior to the construction of the aforementioned.

5.2) Patrol Garage:

The garage will be a steel frame, single storey, basementless structure - 40 feet by 180 feet in plan area. An 8-inch concrete floor slab is to be placed directly on the granular pad. Ten-inch thick, 3 feet wide key strip footings are to extend below the floor slab; the footings will be placed on 16-foot centres.

The subsoil will support a bearing load of 1500 p.s.f. on the footings. Total settlement on the footings will be in the order of 1 to 1-1/2 inches with the majority of it occurring in 6 to 8 months. The differential settlement between exterior and interior footings should be less than 3/4 inches.

5. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

5.2) Patrol Garage: (cont'd.) ...

The exterior footings should be protected with a minimum of four feet of earth cover for frost protection purposes.

5.3) Domes and Stockpiles:

The domes, which are of light frame construction, are 100 feet in diameter at the base and 51 feet high. The structures will be carried on a ring footing, 23 inches wide and 16 inches deep. Each footing will be placed on top of an asphalt mat which is supported by the previously mentioned 2 feet of granular fill. One dome will house a stockpile of granular material and the other will house salt.

The fill placed within the domes will be underlain by the firm to very stiff clay stratum. Stability computations were therefore carried out to determine the safe height of material that could be placed in these structures. The following assumptions were made for computational purposes:

1) Soil Properties

<u>Depth</u>	<u>Soil</u>	<u>Density</u> (p.c.f.)	<u>Strength Parameters</u> C_u (p.s.f.) ϕ ($^\circ$)	
	Material in dome	125	0	30
Original Ground Surface - 5'	Clay (desiccated)	112	2,000	0
5' - 23'	Clay	112	700	0
23'-	Sand to Silt	130	0	35

2) Side Slopes (material in dome) - 1-1/2:1

5. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

5.3) Domes and Stockpiles: (cont'd.) ...

Computations indicate that, in order to ensure stability, the height of material in the domes should not exceed **30** feet. Further computations reveal that, if the 30-foot high fills are placed, the subsoil can be expected to settle 12 inches, the majority of it taking place in 12 to 18 months. If settlement is considered critical, it is recommended to limit the stockpile to 20 ft. in height, thereby reducing the settlement to 3-1/2 inches.

6. MISCELLANEOUS:

The field work, performed between January 11 and 22, 1971, was supervised by Mr. J. D. Wiebe, Student Technician (Field), who also wrote this report, under supervision of Mr. B. T. Darch, Senior Foundation Engineer.

The equipment used was owned and operated by the F. E. Johnston Drilling Co. Ltd.

The investigation was carried out under the general supervision of Mr. M. Devata, Supervising Foundation Engineer, who also reviewed this report.

February, 1971.

APPENDIX I

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 71-11003 LOCATION _____ ORIGINATED BY JDW
 W.P. 101-70-01 BORING DATE Jan. 12-15, 1971 COMPILED BY JDW
 DATUM Geodetic BOREHOLE TYPE Washboring-NX, BX Casing, AXT Rock Core CHECKED BY JK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w					BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.					WATER CONTENT % w_p — w — w_L						
225.5	Ground Level						400	800	1200	1600	2000							
	Topsoil																	
0.1	Clay to silty clay		1	SS	3	220												
	Firm		2	TW	PM													
	Grey		3	TW	PM													
213.0			4	TW	PM	210												
12.5			5	SS	14													
	Het. mix. of silt, sand & gravel, trace of clay (Glacial Till)		6	SS	43													
	occasional layers of sand up to 2' thick		7	SS	36	200												
	Compact to Very Dense		8	SS	38													
	Grey		9	SS	135													
	Bouldery Zone (boulders up to 6" in size)		10	AXT	10%	190												
186.8			11	SS	191/10"													
38.7	Fractured		12	AXT	80%	180												
	Bedrock - Shale Greyish - Black		13	AXT	75%													
177.5	Sound		14	AXT	90%													
48.0	End of Borehole																	

224.8
in open BH
Jan. 20/71

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 71-11003

LOCATION

ORIGINATED BY JDW

W.P. 101-70-01

BORING DATE January 18 - 19, 1971

COMPILED BY JDW

DATUM Geodetic

BOREHOLE TYPE Washboring-NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — w_L				BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					PLASTIC LIMIT — w_p					
							SHEAR STRENGTH P.S.F.					WATER CONTENT — w					

GR SA SI CL
 224.1
 in open BH
 Jan. 21/71

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No.3

FOUNDATION SECTION

JOB 71-11003

LOCATION

ORIGINATED BY JDW

W.P. 101-70-01

BORING DATE Jan. 19, 20, 1971

COMPILED BY JDW

DATUM Geodetic

BOREHOLE TYPE Washboring-NX Casing

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w				BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.					WATER CONTENT % w_p ——— w ——— w_L					
226.0	Ground Level																
0.5	Topsoil Desiccated Zone Stiff to Very Stiff Brown		1	TW	PM	220											
	Clay to silty clay		2	TW	PM												
	Firm Brown to Grey		3	TW	PM												
214.0	Het. mix, silt, sand, trace gravel & clay (Glac. Till)		4	SS	28												
209.5	Compact. Grey		5	SS	26												
16.5	End of Borehole					210											
						200											

GR. SA. SI. CL.

224.3

in open BH
Jan. 21/71

FOUNDATION SECTION

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

JOB 74-11003

LOCATION

ORIGINATED BY JDW

W.P. 101-70-01

BORING DATE January 21-22, 1971

COMPILED BY JDW

DATUM Geodetic

BOREHOLE TYPE Washboring-NX Casing

CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.					w_p ——— w ——— w_L WATER CONTENT %				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE 400 800 1200 1600 2000									
228.6	Ground Level															
0.3	Topsoil															
	Desiccated Zone		1	SS	12	220									▼ 226.4 in open BH Jan.22/71	
	Stiff to Very Stiff Grey - Brown		2	TW	PM											
	Clay to silty clay Firm to S		3	TW	PM											
	Grey		4	TW	PM											
			5	TW	PM											
208.6						210										
20.0	Sand(uniform), trace															
205.6	silt. Compact. Grey		6	SS	20											
23.0	End of Borehole					200										

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

<u>CONSISTENCY</u>	<u>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
I_p	PLASTICITY INDEX
s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_C	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
T_v	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3.1415
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
$\bar{\sigma}$	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

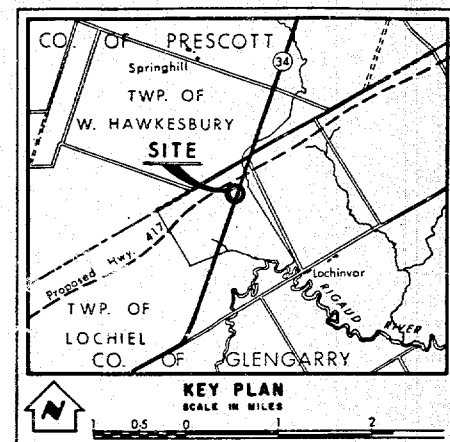
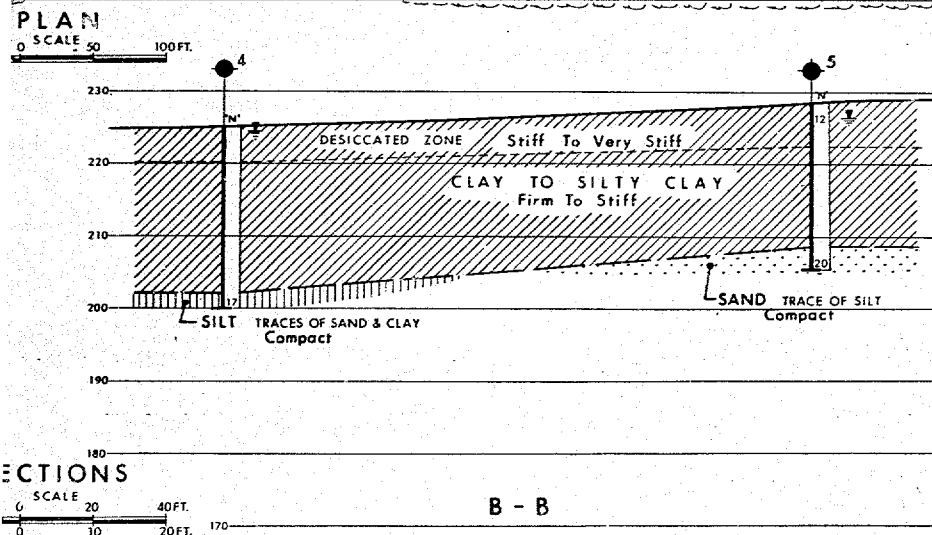
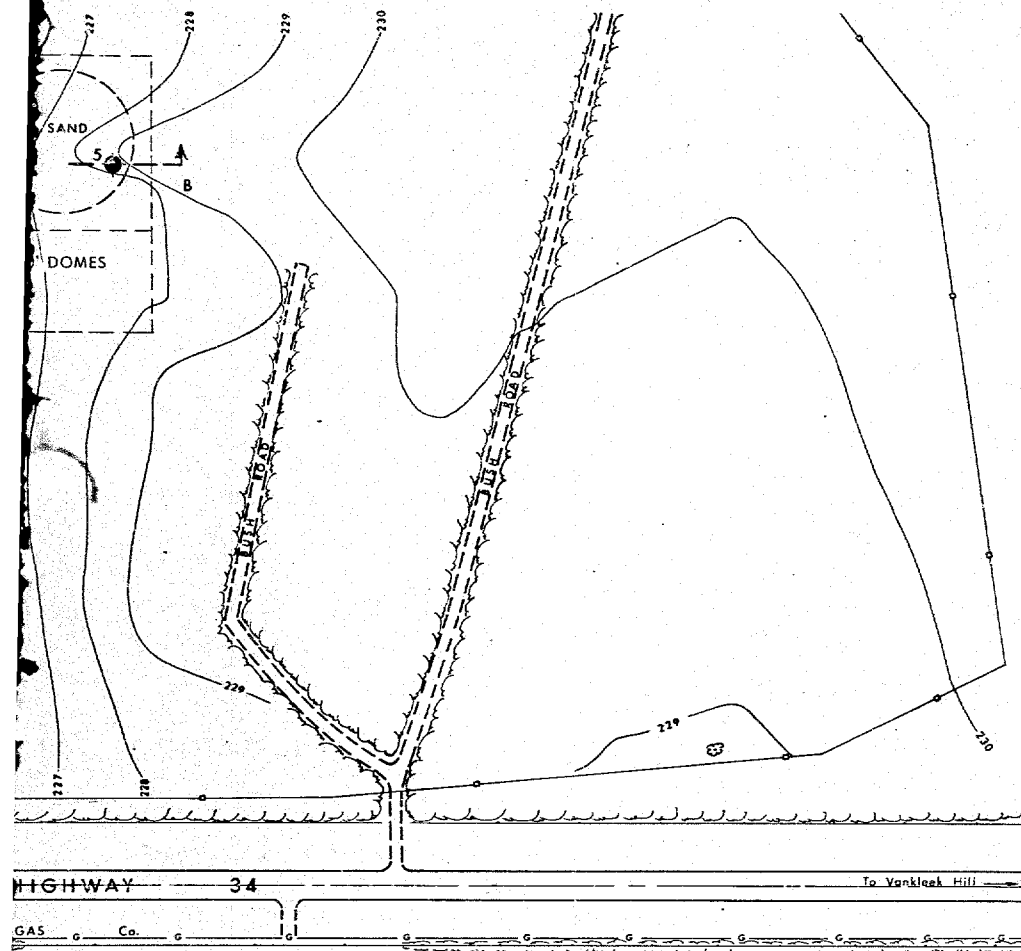
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



LEGEND

- Bore Hole
- ⊕ Cone Penetration Hole
- ⊕ Bore & Cone Penetration Hole
- Water Levels established at time of field investigation, JAN., 1971

NO.	ELEVATION	STATION	OFFSET
1	225.5		
2	224.8		
3	226.0		
4	225.0		
5	228.6		

- NOTE -

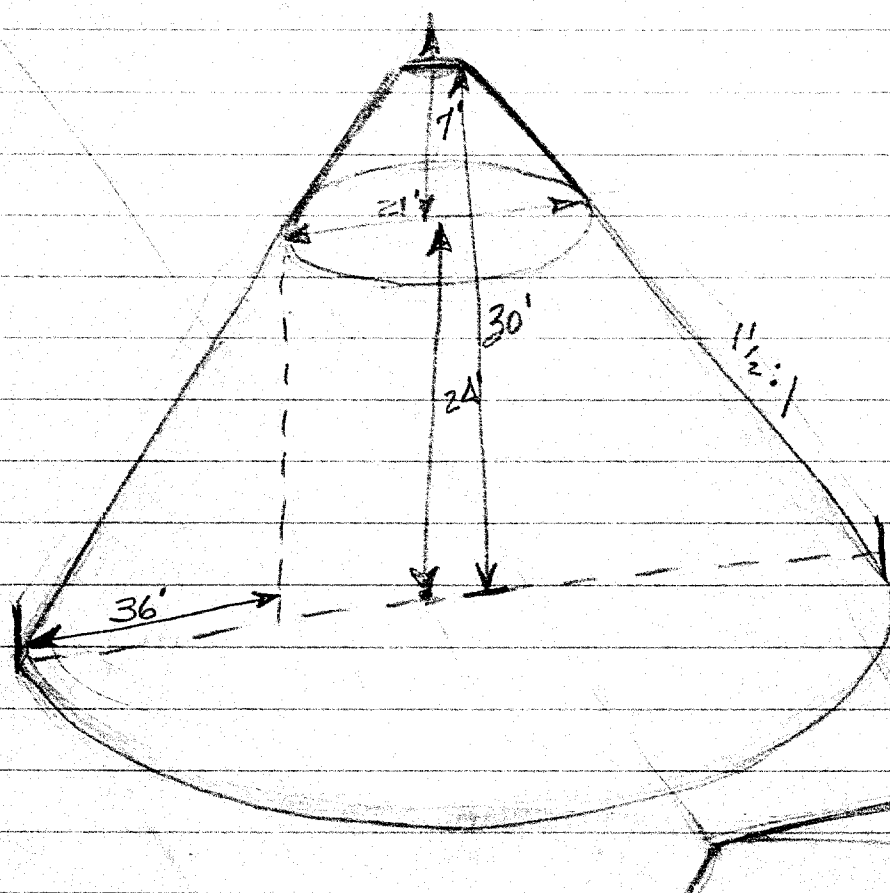
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & TESTING OFFICE - FOUNDATION SECTION			
PROPOSED PATROL YARD (4 MILES SOUTH OF VANKLEEK HILL)			
KING'S HIGHWAY NO. 34		DIST. NO. 9	
CO. GLENGARRY		TWP. LOCHIEL	
LOT		CON.	
BORE HOLE LOCATIONS & SOIL STRATA			
SUBMITTAL CHECKED	W.P. NO. 101-70-01	M.S.T. DRAWING NO.	
DATE FEB. 10, 1971	JOB NO. 71-11003	71-11003A	
APPROVED		BRIDGE DRAWING NO.	
CONT. NO.			

STOCKPILE SKETCHES

71-11003

ITEM 6

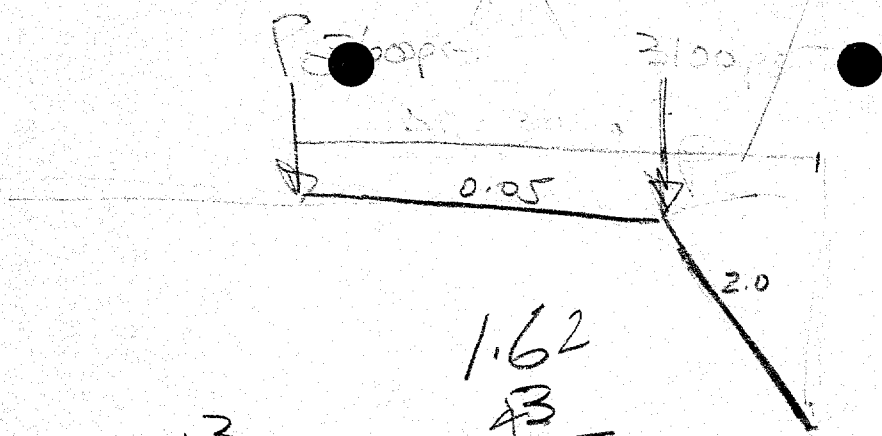


NOTE.

MAX. ALLOWABLE HEIGHT OF FILL IN STOCKPILE INCREASED FROM 24' TO 30' BECAUSE : 1) STABILITY ANALYSIS WAS CALCULATED FOR AN INFINITE LENGTH OF SECTION - NOT A CONE. 2) MATERIAL IS NOT PLACED ON A PERMANENT NATURE BUT IS CONTINUALLY BEING BUILT UP AND CARRIED OUT.

THE ABOVE DECISION IS THE RESULT OF A RECOMMENDATION FROM MR. A.G. STERNAC, PRINC. FDN. ENG., ON FEB. 18 / 71.

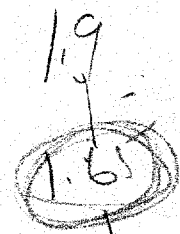
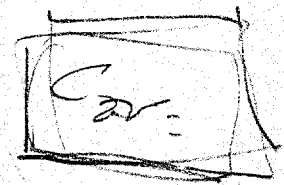
John W. White



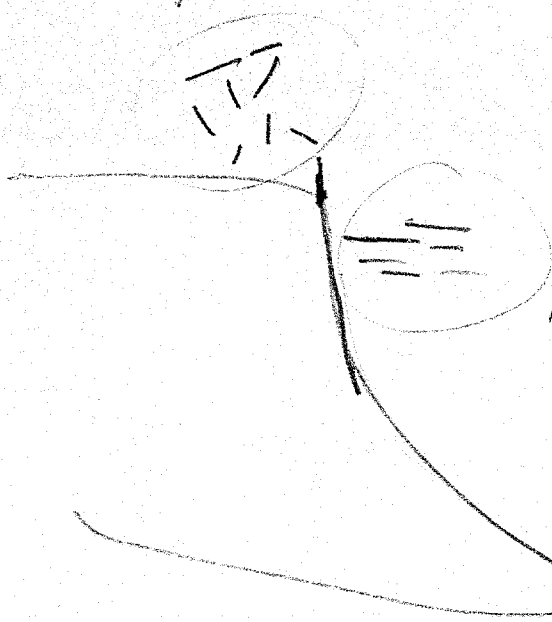
70-F-59

13

1.62
83

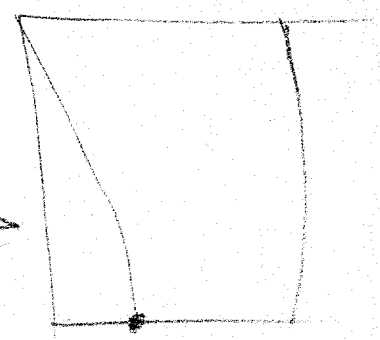


Value



970 lbs.

36



Mr. Bob. Seating 248-3541

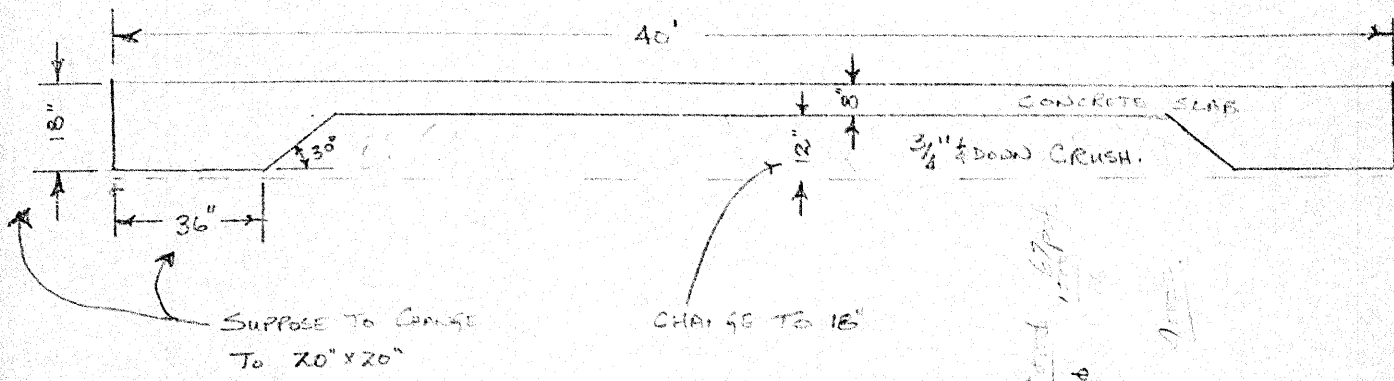
- garage - bldg load entirely on footings.
- design load of floor not less than 1 ton per sq. ft. (design)
 - heaviest load probably a 20-ton truck on an area 16' x 40'
 - underlain by 2' granular material.

- dome - ring footings - some placed before asphalt.
- others on top of asphalt.
 - supports entire bldg. - very light.
 - height of storage - 40' approximately.
 - 15° angle of repose (1:1 slope).
 - also underlain by 2' granular material.

18

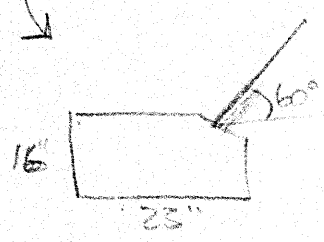
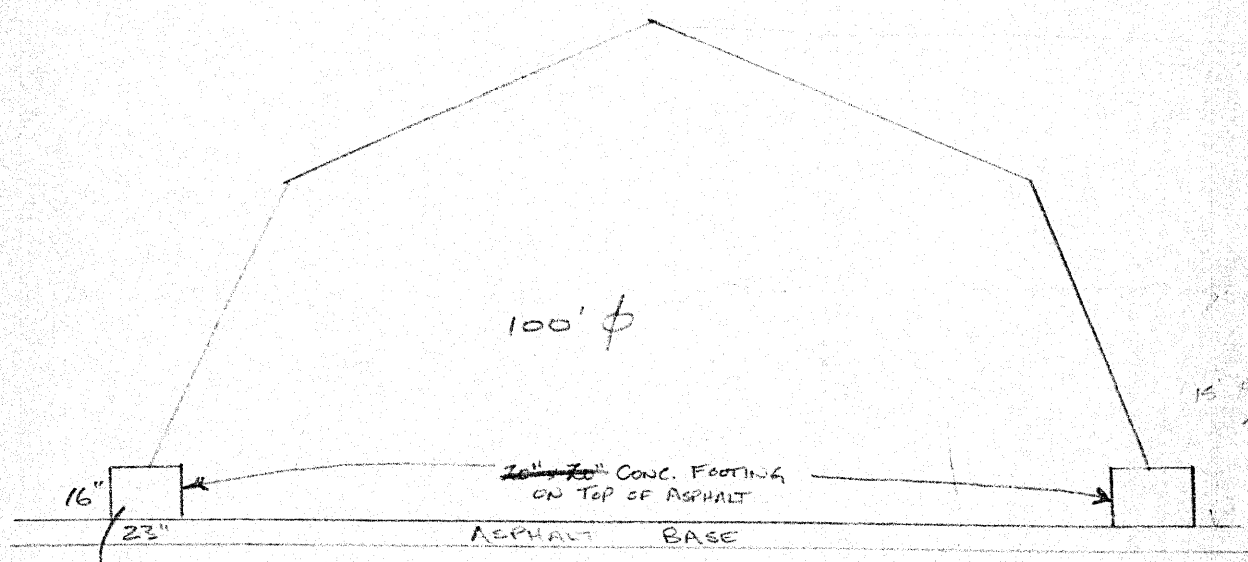
17

1



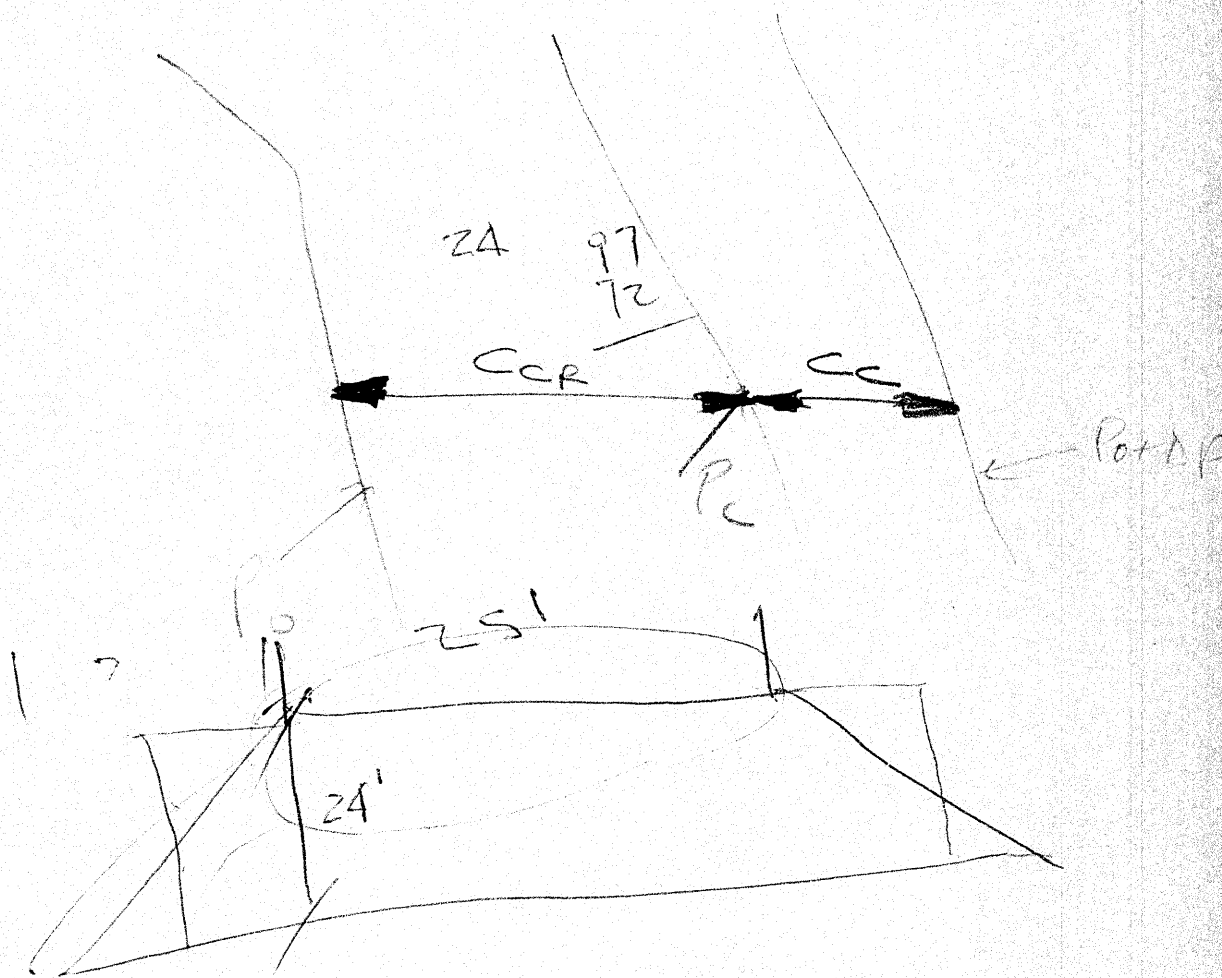
GARAGE

20 x 20 ft 16 ft
16 x 16



DOMES

NOT TO SCALE



ITEM 7-80

DEPARTMENT OF HIGHWAYS — ONTARIO
MATERIALS AND TESTING OFFICE
VISUAL CLASSIFICATION SHEET

PROJECT <u>71-11003</u>		SITE <u>PATROL YARD</u> ^{WAYS.} <u>#34 & #417</u>		BOREHOLE No. <u>1</u>		GROUND ELEVATION _____									
SAMPLE NO.	DEPTH	GRAIN SIZE DISTRIBUTION			DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL	
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE											
				GRAVEL	SAND	SILT & CLAY									
1	2' - 4'	#100		0	0	100	HIGH	SHINY	NONE	MED. TO HIGH	EARTHY	GREY-BROWN	NO REACTION	SILTY CLAY	CI
5	12' - 14'	1/2"	Sub-rounded	10	10	80	LOW	DULL	SLOW	NONE	EARTHY	GREY	STRONG	CLAYEY SILT, SOME SAND, SOME GRAVEL	CL
6	15' - 16'	5/8"	Sub-angular	15	50	35	NONE	DULL	QUICK	NONE	EARTHY	GREY	WEAK	GRAVELLY SAND WITH SILT	SF
7	20' - 21'	5/8"	Sub-angular	15	75	10	"	"	"	"	"	"	STRONG	SAND, SOME GRAVEL, TRACE SILT.	SW
8	25' - 26'	#50		0	80	20	"	"	"	"	"	"	STRONG	SAND, SOME SILT (sand, excess fines)	SF
9	30' - 31'	#3		5	80	15	"	"	"	"	"	"	"	SAND, SOME SILT, TRACE GRAVEL	SW
11	35' - 35.8'	#3		5	10	85	LOW-MED.	DULL	SLOW	LOW	"	"	"	CLAYEY SILT, TRACES GRAVEL & SILT	CL

NOTES:- VISUAL CLASSIFICATION MUST BE CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:-

clayey silt - silty clay
Net. mix of silt, sand and gravel (non-cohesive)
- trace of clay - occ. boulder encountered
Bedrock. up to 4" in size

DEPARTMENT OF HIGHWAYS — ONTARIO
MATERIALS AND TESTING OFFICE
VISUAL CLASSIFICATION SHEET

PROJECT 71-11003 SITE PATROL YARD HWY 34 & 17 BOREHOLE No. 2 GROUND ELEVATION _____

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
6	17'-18½'	¾"	Sub-angular.	10	10	80	Low	Dull	Slow	Low	Earthy	Grey	Strong		CLAYEY SILT, TRACES SAND & GRAVEL	CL
7	20'-21½'	¾"	"	15	75	10	None	"	Quick	None	"	"	"		GRAVELLY SAND, TRACE SILT.	SW

NOTES:- VISUAL CLASSIFICATION MUST BE CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:-

DEPARTMENT OF HIGHWAYS — ONTARIO
MATERIALS AND TESTING OFFICE
VISUAL CLASSIFICATION SHEET

PROJECT 71-11003 SITE PATROL YARD HWY #349 #17 BOREHOLE No. 3 GROUND ELEVATION _____

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION						DRY STRENGTH	SHINE	DIALATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE													
				GRAVEL	SAND	SILT & CLAY											
4	12'-13' ¹ / ₂	1 ¹ / ₂ "	Sub- rounded	10	50	40	ND	NE	Dull	Quick	None	Earth	Grey	Strong		SAND, WITH SILT, TRACE GRAVEL	SF
5	15'-16' ¹ / ₂	" 60		0	80	20	"	"	"	"	"	"	"	"		SAND, SOME SILT.	SF

NOTES:- VISUAL CLASSIFICATION MUST BE CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:-

DEPARTMENT OF HIGHWAYS — ONTARIO
MATERIALS AND TESTING OFFICE
VISUAL CLASSIFICATION SHEET

PROJECT <u>71-11003</u>		SITE <u>PATROL YARD Hwy 3A & 417</u>		BOREHOLE No. <u>4</u>		GROUND ELEVATION _____										
SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION			DRY STRENGTH	SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL		
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL											SAND	SILT & CLAY
7	21'-22½'	#100		0	5	95	high	shiny	none	high	earthy	gray	no	SILTY CLAY, TO CLAY, TRACE SAND	CI-CH	
8	23½'-25'	#100		0	5	95	low	dull	quicks	low-none	"	"	strong	SILT, TRACE SAND.	ML	

NOTES:- VISUAL CLASSIFICATION MUST BE CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:-

FF 22

DEPARTMENT OF HIGHWAYS — ONTARIO
MATERIALS AND TESTING OFFICE
VISUAL CLASSIFICATION SHEET

PROJECT 71-11003 SITE PATROL YARD #548417 BOREHOLE No. 5 GROUND ELEVATION _____

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION			DRY STRENGTH	SHINE	DILATANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE										
				GRAVEL	SAND	SILT & CLAY								
1	1½'-3'	#100		0	5	95	hard	dull	slow med	earthy brown	no		layered silt, trace sand	CL
6	21'-23'	#50		0	95	5	hard	"	quick hard	"	grey strong		uniform sand, trace silt	SU

NOTES:- VISUAL CLASSIFICATION MUST BE CARRIED OUT ON ALL SAMPLES BY THE ENGINEER AS SOON AS POSSIBLE AFTER THE SAMPLES REACH THE LABORATORY.

REMARKS:-