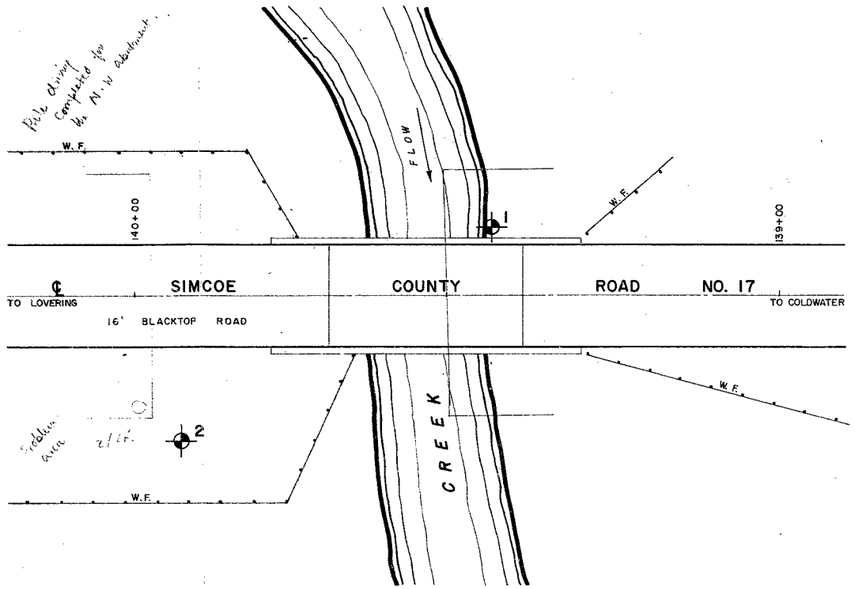
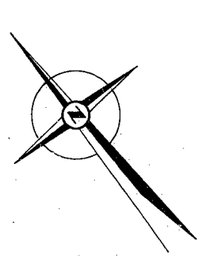
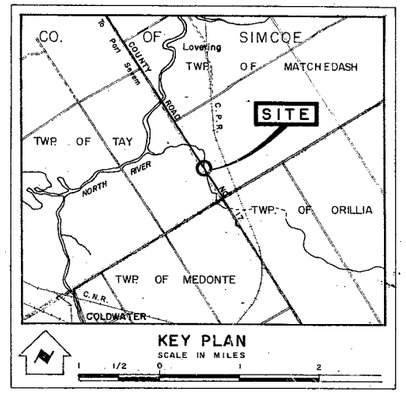
62-F-73

COUNTY RD. #17

SIMCOE





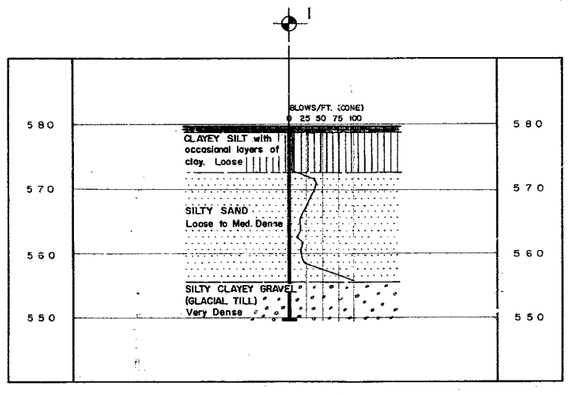


LEGEND

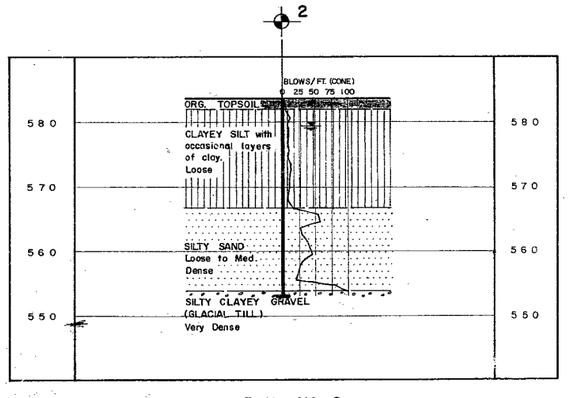
- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation.

NO.	ELEVATION	STATION	OFFSET
1	579·8	139+45	10'·4 RT.
2	583·9	139+93	22'·6 LT.

PLAN
SCALE IN FEET
10 5 0 10 20



B. H. NO. 1
SCALE IN FEET
10 5 0 10 20



B. H. NO. 2
SCALE IN FEET
10 5 0 10 20

— 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 & RESEARCH SECTION

SIMCOE COUNTY ROAD NO. 17
BRIDGE SITE NO. 2
STATION 139+55

ORIGINATED W. KULMATICKAS	DISTRICT NO. 11	DATE 24 JULY 1962
DRAWN D. MUMFORD	W.P. NO.	JOB NO. 62-F-73
CHECKED	CONTRACT NO.	DRAWING NO. 62-F-73A
APPROVED K.A.Gill		

cc: Foundations Office (Rm. 110)

Dist. 28-6.

Mr. A. M. Toye,
Bridge Engineer.
Materials & Research Division,
(Foundation Section)

July 20, 1962.
D.H.C. FOUNDATION INVESTIGATION REPORT
W.J. 62-F-73 -- W.P. (Nil)
Municipal Job.

Attention: Mr. K. L. Kleinsteiber,
Municipal Bridge Liaison Engr.

Re: Proposed New Durnford Bridge,
Bridge Site No. 2, Simcoe Cty.
Road No. 17, District No. 4

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

We believe you will find the factual data and recommendations contained therein, adequate for your future design work. Should further information be required, please feel free to contact our Office.

K. Y. Lo,
SUPERVISING FOUNDATION ENGR.
For:

A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

KYL/MdeF
Attach.
cc: Messrs. A. M. Toye (3)
J. P. Howard
L. E. Clark
J. C. Tillcock
T. J. Kovich
McCormick & Rankin, Ltd.
A. Watt

Foundations Office
Gen. Files.

TABLE OF CONTENTS

FOUNDATION INVESTIGATION

For

Proposed New Durnford Bridge
Bridge Site No. 2
Simcoe County Road No. 17
District No. 6,
W.J. 62-F-73 -- W.P. (Nil)

1. INTRODUCTION:

A request for a foundation investigation at the site of the existing Durnford Bridge at Simcoe County Road No. 17, was received from the Toronto Regional Soils Engineer, Mr. T. J. Kovich, dated May 9, 1962.

It is proposed to erect a new bridge to carry Simcoe County Road No. 17 over a creek. The site of the proposed bridge is located in the Twp. of Tay. At this location, the chainage of the Simcoe County Road No. 17 is 139+55.

In order to determine the soil properties and decide on the type of foundations, an investigation was carried out by this Section. Results and the discussion of the field and laboratory investigations, as well as conclusions and recommendations for the future design work, are contained in the following paragraphs of this report.

2. DESCRIPTION OF SITE:

The area in which the structure site is located, is generally flat terrain.

Physiographically, the site is located in the so-called Simcoe Uplands.

cont'd. /2 ...

3. FIELD AND LABORATORY WORK:

In order to obtain sufficient information on the type and properties of the subsoil, two sampled boreholes, and two dynamic cone penetration tests, were carried out at this site.

Split-spoon and undisturbed samples were taken at various depth intervals. Samples recovered in the split-spoon and in the thin-walled containers were used to determine the following physical properties:

1. Natural Moisture Content
2. Grain Size Distribution
3. Liquid Limits
4. Plastic Limits
5. Undrained Shear Strength
6. Consolidation Curves

4. SUBSOIL CONDITIONS:

4.1) General:

The stratigraphy of the soil at the site was found to be generally uniform. A detailed description of various soil types encountered during the investigation, is shown in Appendix I of this report, and is also given in subsequent paragraphs. The estimated stratigraphical profile shown on Dwg. No. 62-F-73A is based upon this information.

cont'd. /3 ...

4. SUBSOIL CONDITIONS: (cont'd.) ...

4.2) Loose Clayey Silt with Occasional Layers of Clay:

This stratum, which extends to approx. El. 566.0 for a depth of about 17'-0", was found below the topsoil. It may be classified as loose with an average "N" value of 4 blows/foot.

A thin layer of clay was encountered at 5'-0" below ground elevation in B.H. #1 and at the same depth in B.H. #2. The percentage of silt in this layer is 50%, clay 47% and the rest of 3%, is formed by sand. To determine the shear strength of this stratum, in-situ vane and undrained compression tests were carried out. The shear strength obtained in the laboratory agree closely with the field vane tests. The undrained shear strength of this material varies from 800 lbs./sq.ft. to 1200 lbs./sq.ft.

4.3) Loose to Med. Dense Silty Sand:

This stratum which extends to approx. elev. 553.0 for a depth of about 13'-0", may be classified as loose to med. dense with an average "N" value of 16 blows/foot.

The percentage of sand in this layer is 66%, silt forms 33% and the rest of 1% is clay.

4.4) Very Dense Silty Clayey Gravel (Glacial Till):

Following the stratum of loose to med. dense silty sand is a containing layer of very dense silty clayey gravel (glacial till). The overall stratum is in a very dense state with an average "N" value in excess of 150 blows/foot.

cont'd. /4 ...

5. GROUND WATER CONDITIONS:

The ground water level, at the time of the investigation, was found to be at El. 579.0.

No artesian water conditions were encountered.

6. DISCUSSION AND RECOMMENDATIONS:

As can be seen from previously described soil stratigraphy, the soil consists of loose clayey silt, underlain by loose to med. dense silty sand, followed by very dense silty clayey gravel (glacial till). The upper layers cannot provide adequate support for spread footings. The future structure should be supported on piles. End bearing timber piles are recommended. For timber piles (treated if not completely below the lowest established water table), a design load of 20 tons per pile may be used. It is estimated that the piles should reach practical refusal at, or below El. 553.0 within one or two feet. A dewatering scheme will be necessary as excavations will be carried out below creek or ground water table levels. The bottom elevation of the abutment footings should be at approx. El. 574.0 for frost protection.

Footings for falsework may be placed on the surface of the loose clayey silt. A safe load of 0.5 tons per sq. ft. may be employed.

cont'd. /5 ...

7. SUMMARY:

(1) The stratification of the soil is quite uniform. The relative density of the materials encountered varies from loose to very dense.

(2) Because of the loose density of the upper layers, piled footings are recommended for the structure. End bearing timber piles should be driven down to El. 553.0. The design load for timber piles should be 20 tons/pile.

(3) Bottom of the footings should be at approx. Elev. 574.0 to provide sufficient cover for frost protection.

(4) A dewatering scheme will be necessary as excavations will be carried out below creek or ground water table levels.

(5) Footings for falsework may be placed on the surface of the loose clayey silt. A safe load of 0.5 tons per sq. ft. may be employed.

8. ACKNOWLEDGEMENT:

The field work, performed June 27 and 28, 1962, together with the preparation of this report, was undertaken by Mr. W. W. Kulmatickas. The investigation was carried out under the general supervision of Mr. K. G. Selby, who reviewed this report.

July 1962.

APPENDIX I.

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 :-

CONSISTENCY	'N' BLOWS/FT.	c LB./SQ.FT.	DENSENESS	'N' BLOWS/FT.
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 — IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION — IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION — IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION — IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3·1416
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
σ'	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 (YOUNGS 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_o	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

FORM OB-ML-126 REV '961

61-4391

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 62-F-73 LOCATION Simcoe County Road No. 17, Durnford Bridge ORIGINATED BY W.W.K.

W.P Nil BORING DATE June 27, 1962. COMPILED BY W.W.K.

DATUM 579.8 BOREHOLE TYPE Wash Boring - BX Casing. CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT
579.8	Ground Elevation				
	Org. Topsoil				
579.0					
0.8	Loose clayey silt with occasional layers of clay.		1	SS	2
			2	TW	P
572.8			3	SS	22
7.1					
	Loose to medium dense silty sand.		4	SS	20
			5	SS	11
			6	SS	21
555.8					
24.0	Very dense silty clayey gravel (Till)		7	SS	70 for 2"
549.8					
30.0	End of Borehole.		8	SS	100 for 1"

ELEV SCALE: 580, 570, 560, 550, 540

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT — 20 40 60 80 100

SHEAR STRENGTH P.S.F.
Field Vane Tests x
200 400 600 800 1000

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT %
10 20 30

BULK DENSITY γ P.C.F.

REMARKS

▽ W.T.

El. 579.0 Observed in casing.

Gravel 2%
Sand 63%
Silt 34%
Clay 1%

FORM OB-ML-126 REV (1961)

61-4391

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

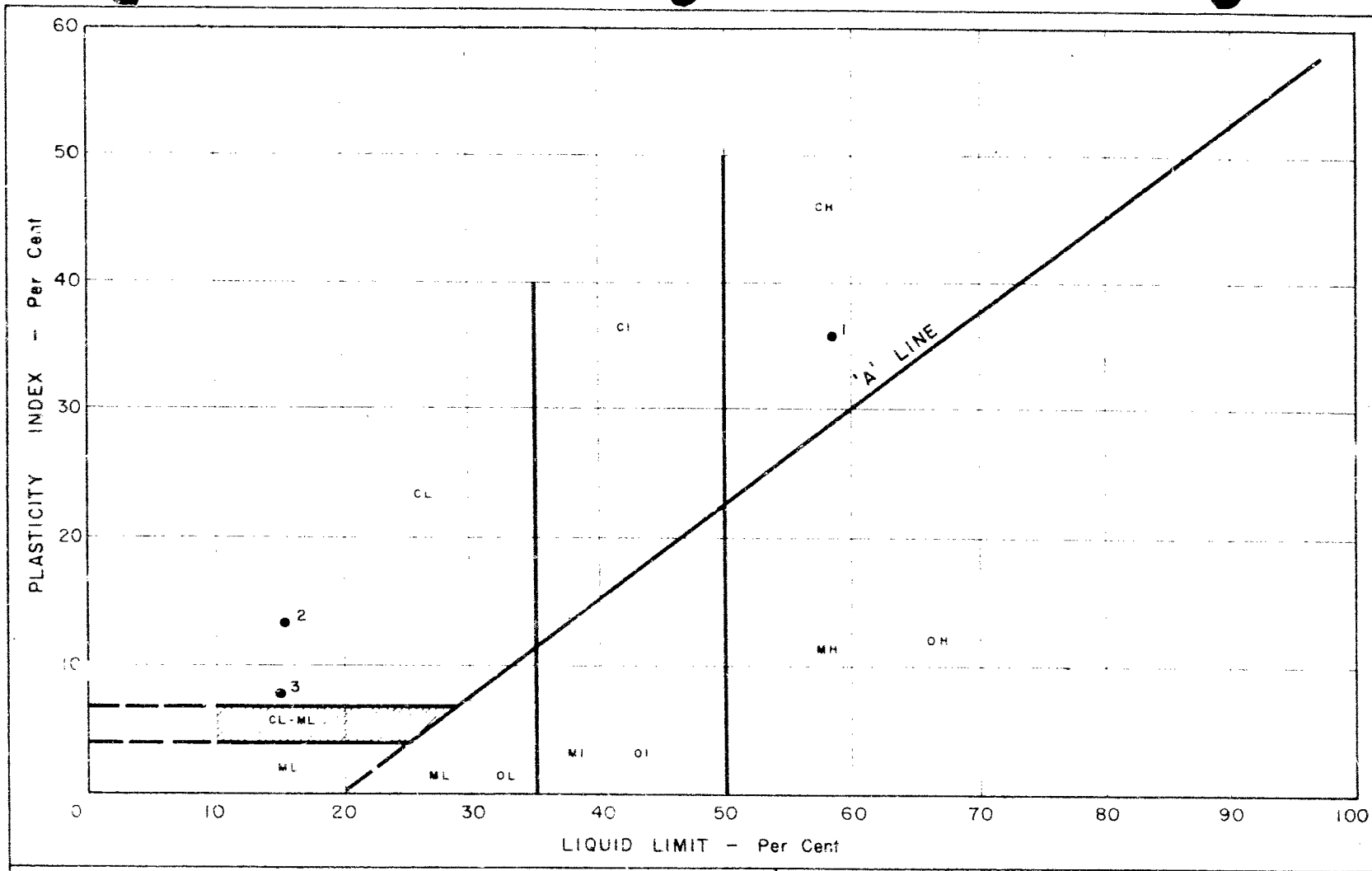
JOB 62-F-73 LOCATION Simcoe County Rd. No. 17 Durnford Bridge ORIGINATED BY W.W.K.

W.P. Nil BORING DATE June 28, 1962. COMPILED BY W.W.K.

DATUM 583.9 BOREHOLE TYPE Wash Boring - BX Casing. CHECKED BY

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT 20 40 60 80 100	SHEAR STRENGTH P.S.F. Field Vane Tests x 200 400 600 800 1000	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w WATER CONTENT % 20 40 60	BULK DENSITY γ P.C.F.	REMARKS
583.9	Ground Elevation										
582.0	Organic Topsoil										
1.9	Loose clayey silt, with occasional layers of clay.		1	TW	P	580				107	▽ W.T. El. 579.6 Observed in casing Sand 3% Clay 47% Silt 50%
			2	SS	1			x			
566.9			3	TW	P	570				128	
17.0	Loose to med. dense silty sand.		4	SS	18						Gravel 4% Sand 51% Silt 44% Clay 1%
			5	SS	16	560					
553.9											
30.0	V. dense silty clayey (gravel (Till).		6	SS	100 for 4"						
552.9						550					
31.0	End of borehole.										
						540					

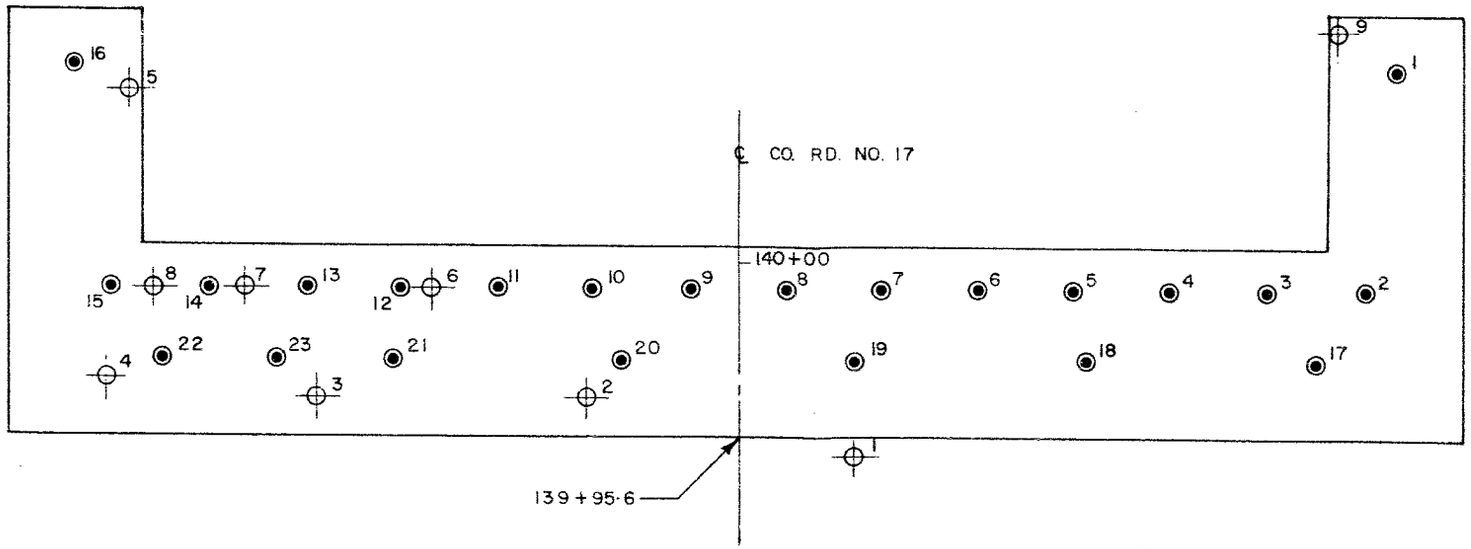
FORM OB-ML 252 (REV. MARCH 62)



NOTES **BOREHOLE NO. 2**

SAMPLE NO. 1 FROM 5' to 6'-6"
SAMPLE NO. 2 FROM 10' to 11'-6"
SAMPLE NO. 3 FROM 15' to 16'-6"

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION
PLASTICITY CHART
Job No. 62-F-73 W.P. No. ——
Location SIMCOE COUNTY RD. NO. 17 STA. 139+55



B.H. 2
CONE 10

WEST PIER

LEGEND	
⊕ – CONE	● – BORE HOLE
◉ – PILE	

PILE NO.	ELEVATION PILE TIP	CONE NO.	ELEVATION CONE REFUSAL
1	550·00	1	555·80
12	550·45	2	555·75
13	549·75	3	549·39
14	549·45	4	546·90
15	550·91	5	547·83
16	551·70	6	551·40
19	555·08	7	548·80
20	552·25	8	547·50
21	551·57	9	548·61
22	551·27	10	554·47

ORIGINATED: B. G.	DEPARTMENT OF HIGHWAYS – ONTARIO	SCALE: 1" = 4'
DRAWN: D. M.	MATERIALS & RESEARCH SECTION	W. P. NO. 111-61
CHECKED:	SIMCOE COUNTY ROAD NO. 17 AND BRIDGE SITE NO. 2	JOB NO. 62-F-73
APPROVED:		DWG. NO. 62-F-73 B
DATE: 22 JULY 1963		

cc: Gen. Files

Dist. 38-11, Huntsville

Mr. K. L. Kleinstaiber,
Municipal Bridge Liaison Engr.,
Bridge Division.

Mr. A. G. Stermac,
Principal Foundation Engr.,
Foundation Section,
Materials & Research Division.
July 23, 1963

Simcoe County Road No. 17,
Bridge Site No. 2, Sta. 139+55,
District #11 -- W.J. 62-F-73.

In June 1962, the Foundation Section carried out the investigation for the above structure and presented its findings together with the necessary recommendations in the report dated July 20, 1963. Piles driven to refusal in the very dense till stratum were recommended and elevation 553.0 was given as the one where refusal should be expected (within one or two feet).

During construction, it was observed that piles in the south portion of the west abutment did not meet refusal at the above-mentioned elevation, nor even a few feet deeper. This also applied to the pile in the very north corner of the same footing.

The Foundation Section immediately dispatched a crew under the direction of Mr. B. Ghadiali, Foundation Project Engineer, to investigate and determine the causes for this anomaly, and make the necessary recommendations.

Ten dynamic cone penetration tests were carried out within and around the problem area. The cones met refusal at different elevations, indicating the existence of a depression in the very dense till stratum. In this depression, the pile tips did not reach the till and, consequently, did not meet refusal. The location of the dynamic cone tests, the elevations of cone refusal, and the present elevations of the pile tips, are given on the attached drawing.

Two remedial measures are recommended:

(1) Lower the foundation south of Pile No. 11 (see drawing) by excavating an additional three feet and continue the driving of piles No's. 12, 13, 14 and 21. It is believed that refusal to driving will be met after these piles have penetrated approx. two to two and one-half feet further into the ground.

Do the same in the area of Pile No. 1.

@R

cont'd. /2 ...

(2) Adjacent to Piles No's 15, 16 and 22, drive new piles possibly, down to elevation 545.0. It is again believed that at this elevation, practical refusal to driving will be met.

Should the deepening of the foundation prove to be impractical, new piles replacing the ones that did not reach the dense stratum, will have to be driven. This will result in a widening of the footing, which is considered a minor and not too significant a change.

We believe that the investigation has clarified the problem and that the recommended measures will enable the successful completion of the job.

Should there be any additional clarification needed, please feel free to call on our office.

AGS/MdeF
Attach.
cc: Messrs. K. L. Kleinsteiber (5)
J. C. Tillcock (2)

Foundations Office
Gen. Files

A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

McCORMICK & RANKIN
LIMITED

CONSULTING ENGINEERS

E. D. McCORMICK, P. ENG.
G. A. RANKIN, P. ENG.

8 STAVEBANK ROAD
PORT CREDIT, ONTARIO
TELEPHONE 274-3477

R. C. McCORMICK, P. ENG., ASSOCIATE

September 18th, 1963.

Mr. A. Stermac,
Principal Foundation Engineer,
Materials & Research Section,
Ontario Department of Highways,
DOWNSVIEW, Ontario.

RE: SIMCOE COUNTY ROAD
CONTRACT NO. 6313B
OUR W.O. No. 111-62

Dear Sir:

On August 1st, 1963, Mr. Ghadiali of your staff 'phoned our field office, near Coldwater, requesting additional information on three timber piles which were driven in the north footing of Structure #84, on Simcoe County Road No. 17. He also requested "penetration at resistance" of a number of other piles which were "redriven".

The following is a table indicating the penetration at resistance and final cut-off elevations of all the piles in the north footing of Structure #84. For the location of each numbered pile, see the enclosed diagram.

Pile No.	Penetration (Blows/in.)	Elev. Bottom of Pile
Redriven 1	5	549.4
2	10	556.1
3	10	555.0
4	Solid	556.0
5	Solid	555.0
6	Solid	552.7
7	15	553.4
8	10	552.1
9	Solid	550.4
10	6	550.5
11	4	550.4
12	6	550.4
13	12	550.4
14	5	550.4
15	10	550.4
16	Solid	551.1
17	15	557.5
18	15	556.4
19	10	555.0
20	4	551.2

Mr. A. Stermac

Pile No.		Penetration (Blows/in.)	Elev. Bottom of Pile
Redriven	21	20	550.7
	22	5	551.0
Text Pile Extra	23	10	550.2
New Piles	(24)Creosoted 11"-14"	6	549.0
	(25)Jackpine Hydro	5	548.2
	(26)Poles (Original length 30'0")	8	550.1

Note: "Solid" - No penetration and no appreciable rebound after 5 blows.

Piles numbered 1, 12, 13, 14, 15 & 21 were redriven as required. Each of these piles received at least 15 to 20 blows with the D-5 hammer; then they were marked and blows per inch of penetration were recorded. The results are as indicated. Mr. Devata, who was at the site on July 16th and who assisted in one pile bearing test, felt that four blows per inch of penetration with the D-5 hammer were adequate for a safe bearing capacity of 20 tons per pil

We regret the delay in getting this information to your office and if there are further enquiries concerning this matter, do not hesitate to contact us.

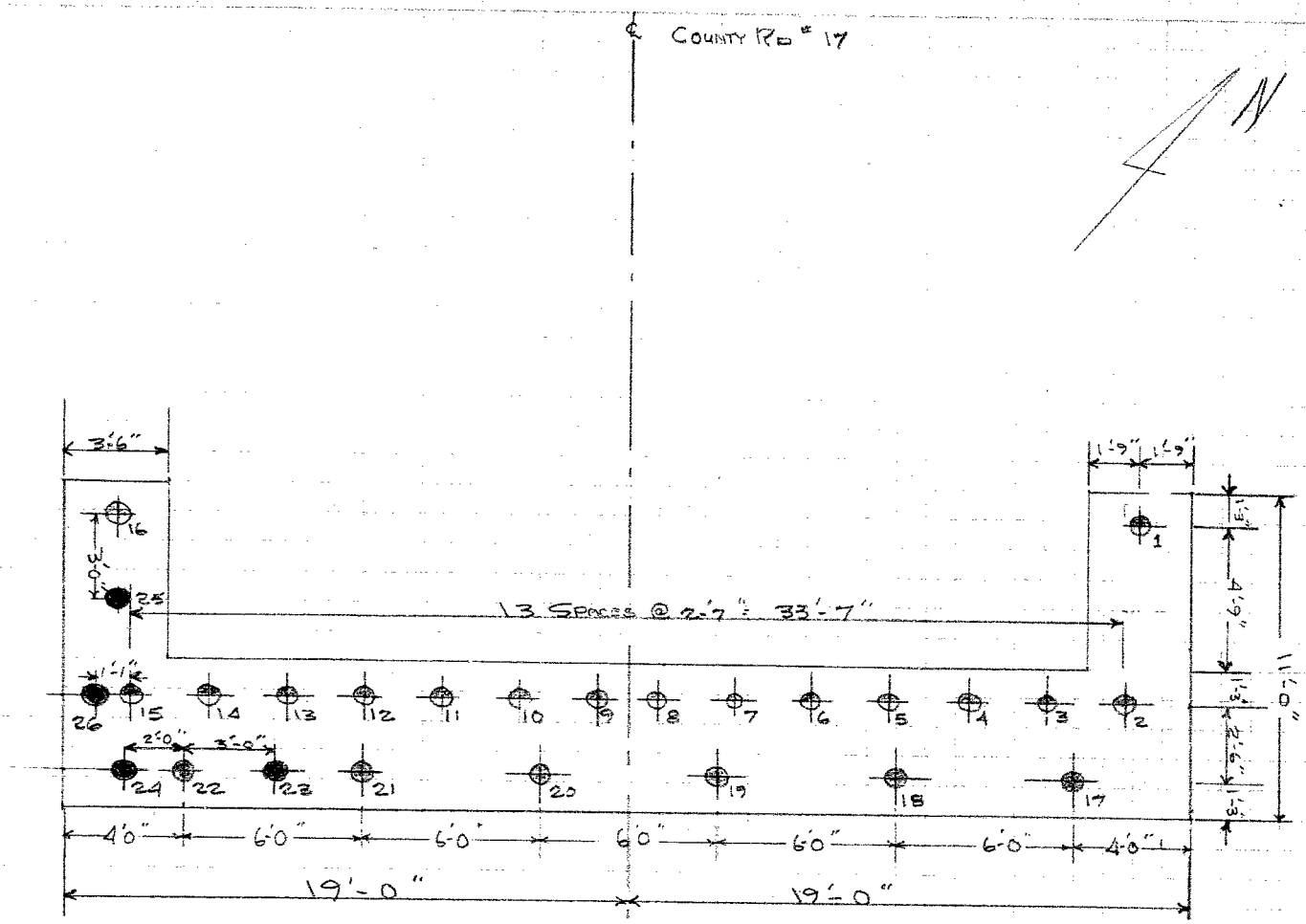
Yours very truly,
McCORMICK & RANKIN LIMITED

E. D. McCormick

E. D. McCormick, P. Eng.

EDM/AFS/MA

Encl.



● Battered 4:1

● Vertical

● Extra Piles

Location of Piles. - North Ftg. Struct. # 84
Simcoe County Contract No. 6313-B

Scale 1" = 5'