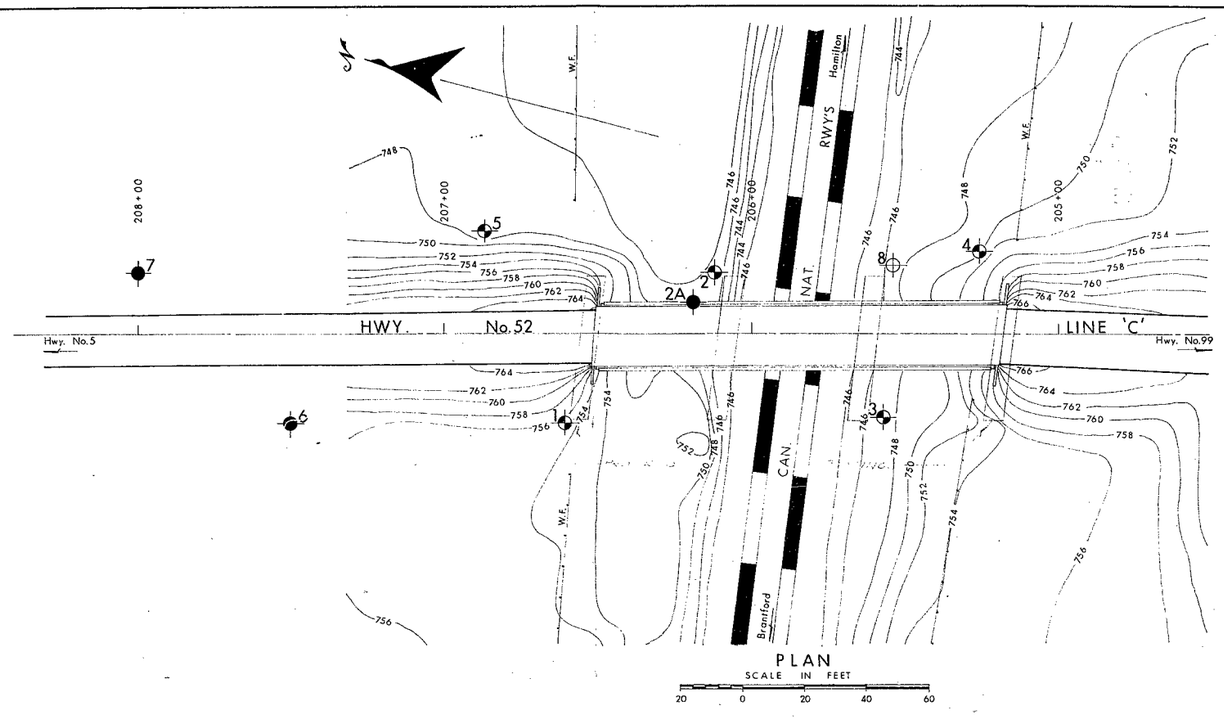
#66-F-94

W.P. #341-64

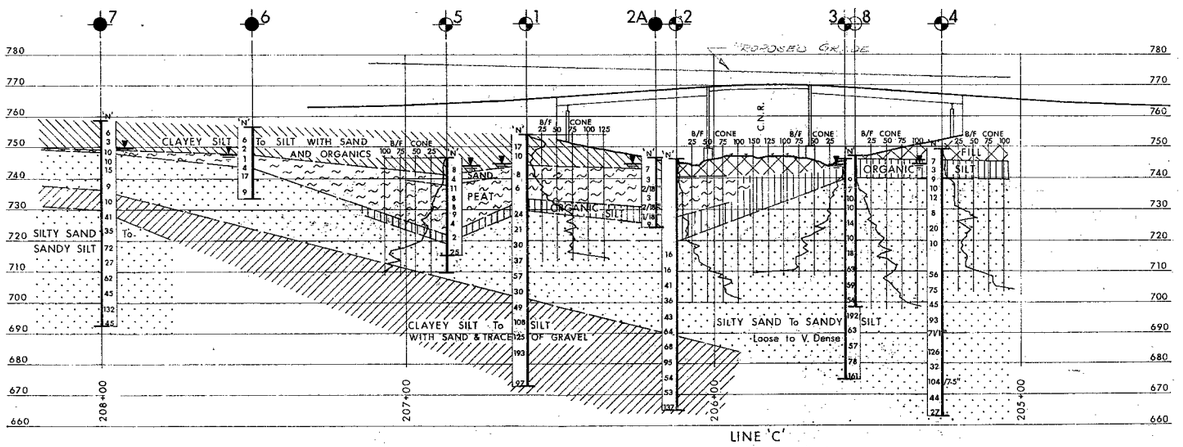
Hwy. # 52 &

C. N. R.

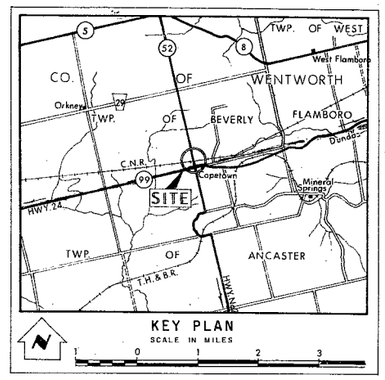
OVERHEAD



PLAN
SCALE IN FEET
20 0 20 40 60



LINE 'C'
℄ PROFILE
SCALE IN FEET
20 0 20 40 60



KEY PLAN
SCALE IN MILES
1 0 1 2 3

LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation. Nov. 1966

NO.	ELEVATION	STATION	OFFSET
1	754.2	206+61	29'LT.
2	746.6	206+12	20'RT.
2A	746.7	206+19	10'RT.
3	746.6	205+57	27'LT.
4	749.9	205+26	27'RT.
5	747.0	206+87	33.5'RT
6	756.6	207+50	29'LT.
7	758.9	208+00	20'RT.
8	747.8	205+54	22.5'RT.

- 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.

PRINT RECORD		
NO.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION - FOUNDATION SECTION

CANADIAN NATIONAL RAILWAYS

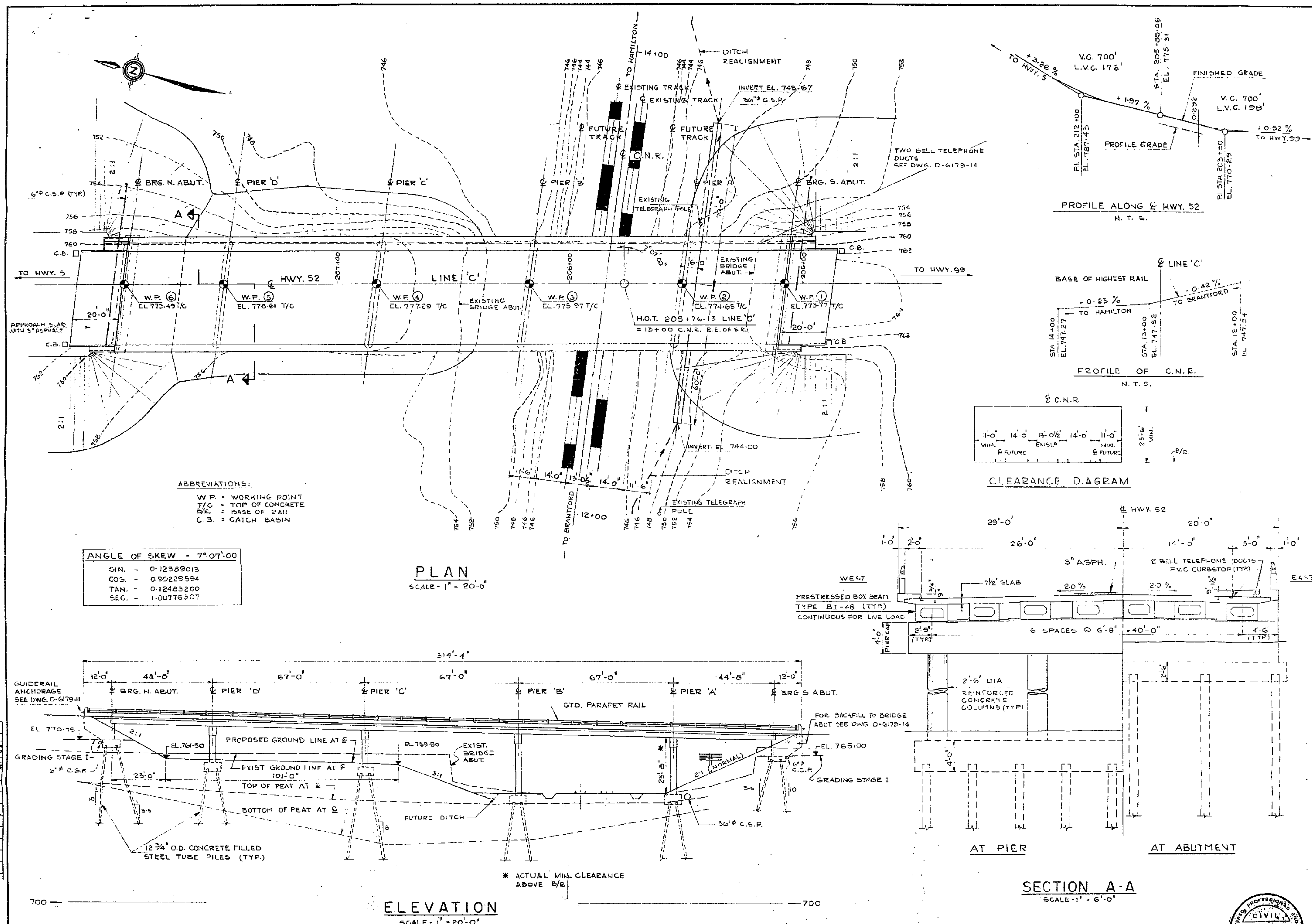
KING'S HIGHWAY NO. 52 LINE 'C' DIST. NO. 4
CO. WENTWORTH COPETOWN
TWP. BEVERLY LOT 30&31 CON. I

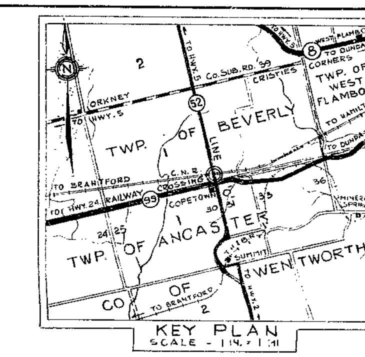
BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D J.M.	CHECKED	W.P. NO. 341-64	M.B.T. DRAWING NO. 66-F-94A
DRAWN DBH	CHECKED	JOB NO. 66-F-94	
DATE 19 DEC. 1966		SITE NO.	BRIDGE DRAWING NO.
APPROVED		CONT. NO.	

PRINCIPAL FOUNDATION ENGINEER

REF. No. E4753-1





NOTES

CLASS OF CONCRETE:

PRESTRESSED BOX BEAMS	5000 P.S.I.
DECK SLAB, DIAPHRAGMS, CURB SIDEWALKS; PARAPET WALLS	4000 P.S.I.
REMAINDER	3000 P.S.I.

CLEAR COVER TO REINFORCING STEEL:

SURFACES IN CONTACT WITH EARTH	3"
TOP OF DECK SLAB	1 1/2"
BOTTOM OF DECK SLAB	1 1/2"
PRESTRESSED BOX BEAMS	1" — EXCEPT AS NOTED
PARAPET WALLS	1 1/2"
PIER CAPS	2"
COLUMNS	2 1/2"
REMAINDER	2"

CONSTRUCTION NOTES:

THE CONTRACTOR IS RESPONSIBLE FOR FINISHING ALL BEARING SEATS TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ± 1/8".

LIST OF DRAWINGS

D-6179 - 1	GENERAL ARRANGEMENT
D-6179 - 2	BOREHOLE LOCATIONS & SOIL STRATA
D-6179 - 3	FOUNDATION LAYOUT & REINFORCEMENT
D-6179 - 4	ABUTMENTS & WINGWALL LAYOUT
D-6179 - 5	NORTH ABUTMENT
D-6179 - 6	SOUTH ABUTMENT
D-6179 - 7	PIERS & PIER CAP DETAILS
D-6179 - 8	DECK LAYOUT AND DETAILS
D-6179 - 9	DECK REINFORCEMENT
D-6179 - 10	PRESTRESSED CONCRETE BOX BEAMS
D-6179 - 11	PARAPET WALL DETAILS
D-6179 - 12	STANDARD STEEL PARAPET RAIL
D-6179 - 13	APPROACH SLAB
D-6179 - 14	STANDARD BRIDGE DETAILS
D-6179 - 15	STANDARD BRIDGE DETAILS

B.M. EL. 770.07 GEODETIC DATUM
CUT "X" IN W. END OF CONC. GAS ISLE. 58' LT. OF STA. 202+91

PRINT RECORD		
No.	FOR	DATE
1	CS	3/1/67
15	RLW	17/1/68

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

Giffels ASSOCIATES LIMITED

C.N.R. OVERHEAD AT COPETOWN

0.05 MILES NORTH OF HWY. 99

KING'S HIGHWAY No. 52 — DIST. No. 4
CO. WENTWORTH — MILE 9.33 DUNDAS SUBDIVISION
TWP. BEVERLY — LOT 30 & 31 — CON. I

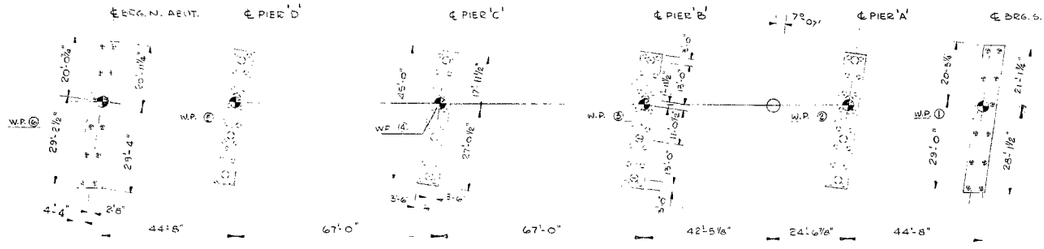
GENERAL ARRANGEMENT

APPROVED (BRIDGE ENGINEER)		SITE No. 36-82	W.P. No. 341-64
DESIGN R.Gm.	CHECK G.R.T.	CONTRACT Nos.	
DRAWING I. H.	CHECK R.Gm.	DRAWING No.	D-6179-1
DATE NOV. 1967	LOADING HS20-44		

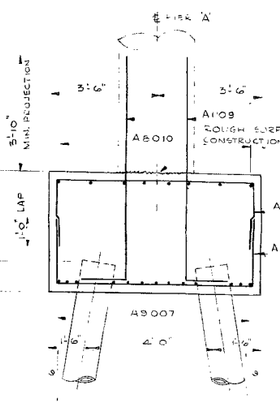
NOTE:
LAYOUT DIMENSIONS FOR PIER 'B' & 'C'
ARE TYPICAL FOR ALL OTHER PIERS.

H.O.T. 208+76.13 LINE 'C'
+ 13+00 C.N.R. RE. OF S.R.

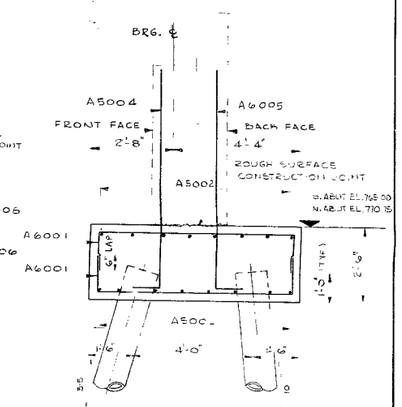
PIER 'A' EL. 746.30
PIER 'B' EL. 746.00
PIER 'C' EL. 758.76
PIER 'D' EL. 760.00



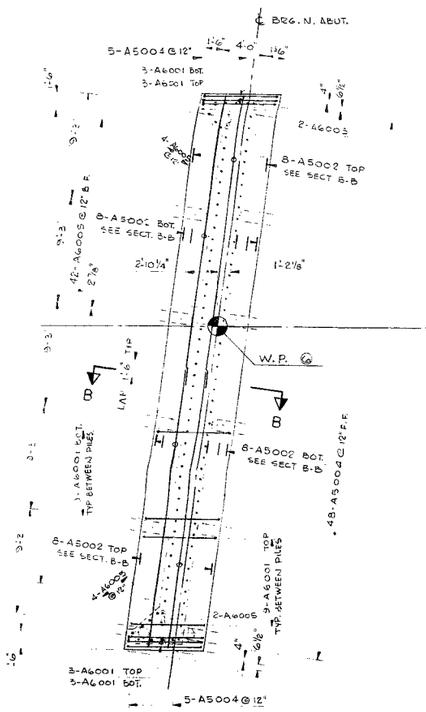
PLAN
SCALE: 1" = 50'

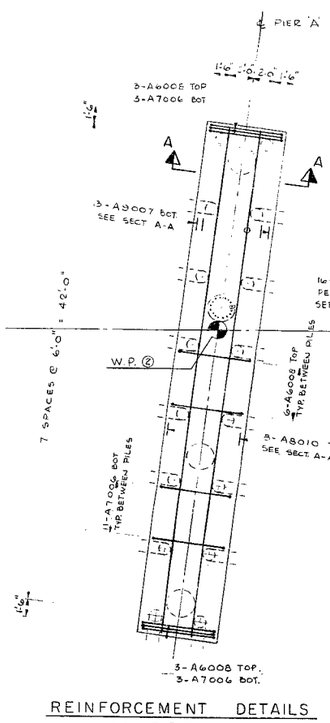


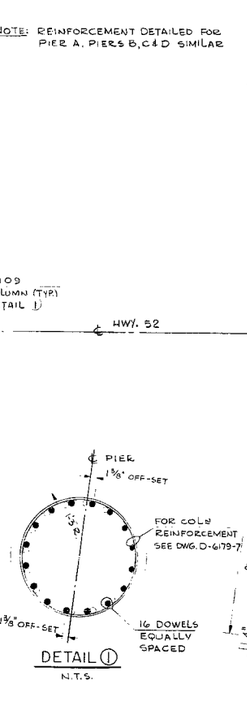
SECTION A-A
SCALE: ½" = 1'-0"



SECTION B-B
SCALE: ½" = 1'-0"







REINFORCEMENT DETAILS
SCALE: 3/16" = 1'-0"

NOTE: REINFORCEMENT DETAILED FOR PIER A. PIERS B, C & D SIMILAR

DETAIL ①
N.T.S.

NOTE
IN DETAIL ① 1⅜" OFF-SET FROM ℄ PIER MUST BE MAINTAINED.

PILE DATA

LOCATION	SUPPLIED LENGTH	NO. REQ'D.	BATTER*
SOUTH ABUTMENT	74-0'	6	1:10
	77-0'	6	1:3.5
PIER A	54-0'	16	1:6
PIER B	54-0'	16	1:6
PIER C	67-0'	16	1:6
PIER D	68-0'	16	1:6
NORTH ABUTMENT	80-0'	6	1:3.5
	83-0'	6	1:10

* BATTER IN DIRECTION PERPENDICULAR TO AXIS OF FOOTINGS

PILES: ALL PILES ARE CONCRETE FILLED STEEL TUBE PILES 12¾" O.D., 0.25" WALL THICKNESS.
PILE DESIGN LOAD = 60 TONS, F.S.
PILES TO BE DRIVEN USING HILEY FORMULA AS GIVEN IN DD-1218 OR DD-1219 ON DWG. D-6178-15.

ABBREVIATIONS
W.P. = WORKING POINT
F.F. = FRONT FACE
B.F. = BACK FACE
BOT. = BOTTOM

PRINT RECORD

No.	FOR	DATE
1	TO	24/2/67
2	REVISION	17/11/67

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

Giffels ASSOCIATES LIMITED

C.N.R. OVERHEAD AT COPETOWN

0.05 MILES NORTH OF HWY. 99

KING'S HIGHWAY No. 52 — DIST. No. 4
CO. WENTWORTH — MILE 9.35 DUNDAS SUBDIVISION
TWP. BEVERLY — LOT 30 & 31 — CON. I

FOUNDATION LAYOUT & REINFORCEMENT

APPROVED _____ BRIDGE ENGINEER

SITE No. 36-92 — W.P. No. 341-64

DESIGN	R.P.	CHECK	G.R.T.
DRAWING	M.C.Z.	CHECK	R.P.
DATE	NOV. 1967	LOADING	HS20-44

CONTRACT Nos.

DRAWING No. D-6179-3

ENGINEERED PROFESSIONAL ENGINEERS CIVIL G. N. FARANTATOS PROVINCE OF ONTARIO

General Files

W.P. 341-64.

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. B. R. Davis
Bridge Engineer
Bridge Division
Attn: Mr. S. McCombie

From: Foundation Section
Materials & Testing Division
Room 107, Lab. Bldg.

Date: December 20, 1966

Our File Ref.

In reply to:

DEC 21 1966

Subject: FOUNDATION INVESTIGATION REPORT
FOR
C.N.R. OVERHEAD
HWY. #52, LINE "C" REVISION
DISTRICT #4, Hamilton
W.J. 66-F-94 ---- W.P. 341-64

Attached we are forwarding to you, our detailed foundation investigation report on the subsoil conditions existing at the above structure site.
We believe that you will find the factual data and recommendations contained therein, adequate for your design requirements.
Should additional information be required, please feel free to contact our Office.

D. Devata
for A. G. Stermac
Principal Foundation Engineer

AGS:mt
Attach.

cc.: Messrs. B.R.Davis (2)
H.A.Tregaskes
D.W.Farren
G.K.Hunter (2)
H.Greenland
T.J.Kovich
A. Watt B.A. Sinclair
W.S.Melinyshyn

Foundation Office
General Files

TABLE OF CONETENTS

FOUNDATION INVESTIGATION REPORT
FOR
C.N.R. OVERHEAD
HWY. #52, LINE "C" REVISION
DISTRICT #4, HAMILTON
W.J. 66-F-94 -- W.P. 341-64

1. INTRODUCTION:

The Foundation Section was requested to carry out a foundation investigation at the site of the existing C.N.R. overhead on Hwy. #52. The proposed new structure will be on Hwy.#52, Revision Line "C". The request was contained in a memo from Mr. W. S. Melinyshyn, Regional Bridge Location Engineer, dated October 24, 1966. An investigation was subsequently carried out by this Section to determine the subsoil conditions existing at the site. This report contains the results of the investigation together with recommendations pertaining to the foundations of the new structure and the stability of the approaches.

2. DESCRIPTION OF SITE:

The site is located at Copetown just north of the Hwy.#52 & Hwy.#99 intersection. At this location Hwy.#52 crosses the C.N.R. tracks over an old Railway-built overhead. The existing bridge is a three span steel bridge with steel, wood and concrete deck. The condition of the existing bridge is poor.

Sheet piling holds the approach embankments and hence little or no forward slopes are present. The existing approach embankments are in the order of 10-15 feet high. The trees which are growing on the embankment slopes show signs of embankment movement.

cont'd. /2.....

The Railway is in a small cut (2'-6') on the West Side of the existing structure and a slight fill on the east side (2'-4'). One can physically observe large amplitude vibrations under the bridge between the N.Pier footings and the N.Sheet piling when a heavy truck crosses the bridge..

The general physiographic area of the site is the Norfolk Sand Plain. During the Pleistocene ice age the ice lobe called the Ontario lobe pressed against the Niagara escarpment and became parted along the interlobate moraine. The melt water from both lobes piled sand on the crest of the existing moraine. The melt water then flowed over the top of the escarpment and then met Lake Warren. The sand and gravel beds in the Flamborough Township and the fine sand, silt and clay between Dundas and Brantford were deposited at this time. The site lies in a sand moraine area and not too far from an area designated as swamp. The organic material found at the site could very well be an extension of this same swamp area.

3. FIELD AND LABORATORY WORK:

Using conventional diamond drilling equipment adapted for soil sampling purposes 8 sampled boreholes and 6 dynamic cone penetrations were carried out at the site. A driving energy of 350 ft.-lbs. per blow was used for the dynamic cone penetration tests.

In cohesive materials (also in organic mat'l. @ BH#s 1 & 2) 2-inch I.D.Shelby tube samples were obtained by manually pushing the tubes into the soil where possible.

cont'd. /3.....

Otherwise samples of cohesive and non-cohesive materials were obtained using a 2 inch O.D. split spoon sampler driven according to the specifications of the Standard Penetration Test. The insitu shear strength was measured where possible with a field vane test.

Samples were visually examined and identified in the field and subsequently in the laboratory. Laboratory tests were conducted on selected representative samples to determine, where applicable, atterburg limits , bulk density, grain size distribution, natural moisture content, shear strength and organic content. The shear strength was determined by means of quick triaxial and unconfined compression tests.

Results of the laboratory and field tests together with the location and elevations of the boreholes are presented in the appendix of this report.

4. SUBSOIL CONDITIONS:

4.1) General:

The natural subsoil at the site consists of deposits of clayey silt to silt with traces of sand and gravel, organic material (peat), organic silt-clay, silty fine sand to silt and clayey silt to silt. The boundaries of the deposits as determined in the boreholes, are shown on the accompanying borelog sheets, and the estimated stratigraphical profile contained in Drawing 66-F-94A, is based on this information.

cont'd. /4.....

4.2) Clayey Silt to Silt with traces of Sand, Gravel and Organics

A surface deposit of clayey silt to silt with traces of sand, gravel and organics was observed in all the boreholes except #3. The thickness ranged from 3.5ft. in BH #4 to 10.0ft. in BH #1. In general the deposit is cohesive in Boreholes 1, 4 & 5 and may be described as clayey silt with traces of sand and gravel and containing variable amounts of organics. In Boreholes 2, 6 & 7 this surface deposit is essentially non-cohesive and may be described as silt with sand and traces or pockets of organics. Some variation in physical properties was observed to occur in a random fashion. These physical properties as determined from field and laboratory tests summarized as follows:

'N' Values	2 - 7 blows / Ft.
Liquid Limited	20 - 41 %
Plastic Limited	18 - 32 %
Moisture Content	9 - 93 %
Organic Content	0 - 17 %
Bulk Density	84 - 127 p.c.f.
Undrained Shear Strength	
Range	470 - 830 p.s.f.

4.3) Organic Material (Peat) with traces of Sand & Fragments of Wood.

This organic (Peat) deposit was observed immediately below the clayey silt to silt deposit or ground level in all the boreholes. On the south side of the railway this deposit is only 6 feet in thickness and contains a considerable amount of sand size particles. The organic deposit on the north side of the Railway tracks has a maximum thickness of 15.5 ft. in

cont'd. /5.....

Borehole #5 to a minimum of 0.5 ft. in Borehole #7.

In general the 'N' values vary at random from 1 to 11 blows/ft. The undrained shear strength of this deposit obtained from in-situ Vane tests ranges from 480 to 720 p.s.f. The moisture content varies from 108% to 563% and organic contents range between 19% and 87%.

4.4) Organic Silt-Clay with traces of Sand Seams.

This deposit was encountered in boreholes 1, 2 and 5 immediately below the organic material (peat). The thickness varies from 3 to 8 ft.. It is mainly a cohesive deposit and can be described as organic silt-clay (OI-OH) of soft to firm consistency. The physical properties of the material are as follows:

'N' Values	1 - 2 blows/ft.
Liquid Limited	54%
Plastic Limited	43%
Moisture Content	21 - 108%
Bulk Density	103 - 122 P.C.F.
Organic Content	1 - 25%

UNDRAINED SHEAR STRENGTHS

	Min.	Max.
Field Vane	720	2240
Quick Triaxial	280	770 P.S.F.

4.5) Silty Fine Sand to Silt

In all boreholes this fine grained granular deposit was observed immediately below the organic deposit (peat) or below the organic silt-clay. In boreholes 1 and 2 this deposit has a maximum thickness of 28.5 and 30 feet respectively and the

cont'd. /6.....

lower boundary being elevation 701.2 and 689.6. Immediately below this the stratum of clayey silt to silt was encountered. However, in boreholes 3 and 4 this deposit was proved to elevation 675 and 663 ft. respectively. In borehole 7 this layer was interrupted between elevation 737 and 730 by a layer of clayey silt to silt but below this the layer was proven to elevation 692.

Standard penetration tests carried out in the field gave 'N' values ranging from 7 to in excess of 100 blows/ft generally increasing with depth indicating a loose to very dense relative density.

4.6) Clayey Silt to Silt

This deposit was encountered only in boreholes 1, 2 & 7 extending at least to elevation 665.0. Standard penetration tests gave values which ranged from 49 to in excess of 100 blows per foot indicating a hard consistency.

Physical properties of this material as determined from the laboratory tests are as follows:

Liquid Limit	18 - 24%
Plastic Limit	12 - 17%
Moisture Content	11 - 22%

5. WATER CONDITIONS:

Observations carried out during and after drilling operations, indicated the ground water elevations to be as shown on the borelog sheets (see appendix).

cont'd. /7.....

6. DISCUSSION & RECOMMENDATIONS:

It is proposed to construct a new bridge at this location to replace the existing three span steel structure. The centre line of the new bridge will be located some 4.5 ft. left of the present centre line and the new total span will be in the order of 135 feet. According to available information the C.N.R. overhead on Hwy. 52 was built some 25 or more years ago. The approach fills of the existing road are supported in the forward direction by means of steel sheet piles driven into the ground and anchored back in the approach fill. No information is available regarding the depth of the sheet piles or the type of structure foundation. The existing structure is three span (45' - 35' - 45') two lane bridge with a width of 20 feet.

The new grade will be raised to elevation 774± which will result in a maximum height of fill in the order of 28 feet in the forward slopes of the approach embankments.

Since the subsoil at the north approach embankment consists of soft deposits of organic peat and organic silt-clay, it will be necessary to stabilize the approach embankments, either by designing suitable sections with berm or by sub-excavating some or all of the soft organic material and replacing it with suitable fill. Significant movements of abutments have occurred elsewhere when structures were built on similar subsoil conditions. In order to eliminate this possibility the following recommendations are made:

Sub-excavation should be carried out with the purpose of removing all the organic material within the area between the north pier and north abutment together for the full width

cont'd. /8.....

of the bridge + 10 feet on each side, and replace this material with suitable fill. Granular type of backfill should be used below the water table. The final side slopes of the excavation should not be steeper than 1:1.

To ensure lateral stability of the fill, sub-excavation should be carried out longitudinally in 12 foot widths and immediately replaced with suitable fill material as specified by the Regional Materials Section. Temporary sheeting will be required to protect the railway tracks on the south face of the excavation. For estimating purposes sheeting should be driven at least 10 feet into the granular subsoil below the bottom of the organic layers. In order to ensure the stability of the proposed north approach fills certain sub-excavation methods are required especially in the transverse direction. Specific recommendations pertaining to this will be discussed in the Soils Report of the Regional Materials Section.

No stability problems are anticipated for the south approach embankments if standard 2:1 slopes are used. The north approaches can be constructed to its full height after completion of the sub-excavation and backfilling operations.

Structure Foundation:

The organic deposit at this site cannot satisfactorily support spread footings and it is therefore recommended that the bridge piers and abutments be supported on large displacement steel tube piles driven to estimated tip elevation 690 - 700.

cont'd. /9.....

Pile capacity should be established in the field using the Hiley Formula in accordance with D.H.O. Standards DD1218 and DD1219.

In such a case a safe design load of 60 tons per pile may be used for design purposes.

Settlement of the approach fills:

Organic soils such as peat and organic silt-clay at this site are known to consolidate considerably under load. The sub-excavation procedures outlined elsewhere in this report will reduce the settlement problems considerably, however, it is not practical to remove all the organic material over the entire area of the approach embankments. Therefore, some settlements will be inevitable.

7. MISCELLANEOUS:

The field investigation was carried out during the period November 1 - December 5, 1966. Equipment used was owned and operated by Canadian Longyear Co. Ltd.. Field investigation was carried out by Mr. J. McDougall, Project Foundation Engineer who also prepared this report, under the general supervision of Mr. M. Devata, Supervising Foundation Engineer.

December 1966.

APPENDIX I

FORM 08-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

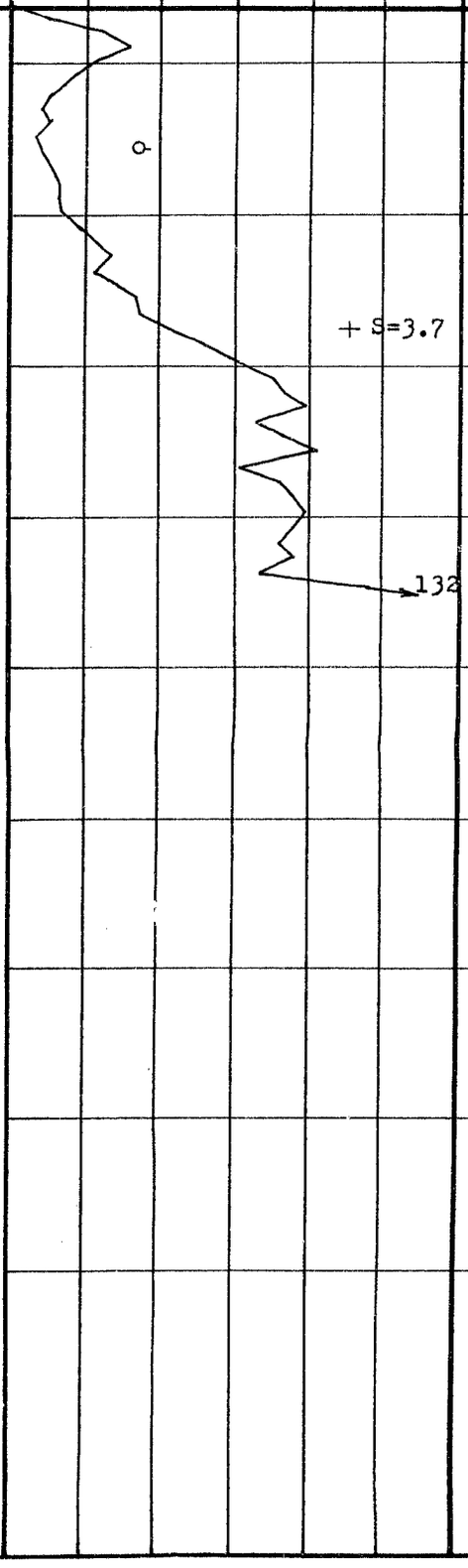
RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

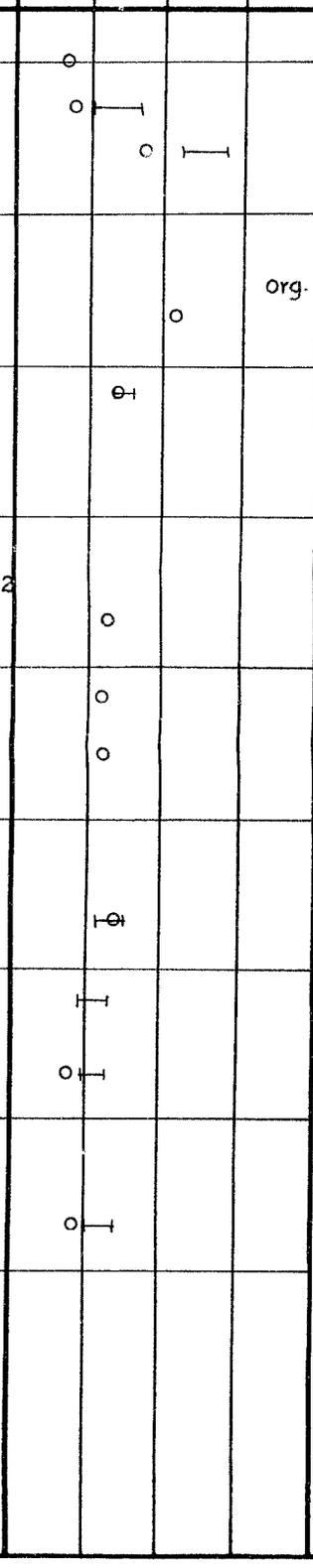
JOB 66-F-94 LOCATION Hwy. 52 & C.N.R. 29' Lt. of Stn.206 + 61 ORIGINATED BY J.M.
W.P. 341-64 BORING DATE November 2, 3, 4, & 8/66 COMPILED BY J.M.
DATUM Geodetic BOREHOLE TYPE Washboring, NX & BX Cased CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
754.2	GROUND LEVEL					
0.0	Clayey silt with traces of sand & gravel and organics Stiff.		1	SS	17	750
			2	SS	10	
744.2			3	TW	P	
10.0	Brown organic matl (peat) with traces of sand & fragments of wood		4	SS	8	740
			5	TW	P	
			6	SS	6	
			7	WS	P	
733.5			8	TW	P	
20.7	Dark Grey Organic silt with trace of sand.					730
729.7			9	SS	24	
24.5	Grey sandy silt to Silty fine sand with occ. clayey silt seams. Compact to dense		10	SS	21	720
			11	SS	30	
			12	SS	37	
			13	SS	57	710
			14	SS	30	
701.2						700
53.0	Grey Clayey Silt to silt with sand and traces of gravel. Hard		15	SS	49	
			16	SS	108	690
			17	SS	125	
			18	SS	193	680
672.7			19	SS	97	
81.5	End of borehole					670

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100
SHEAR STRENGTH P.S.F. + Field Vane o Quick Triaxial 500 1000 1500 2000 2500



LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT % 15 30 45



BULK DENSITY γ P.C.F.

19.4%

REMARKS

Org. 3.1%
El.744.7
▼ W.L.
Org.20%
W. 201%
Org.26.7%
Org.80.0%
W.107.8%
Sa.67%)
Si.31%) Seam
Cl. 2%)

Sa.23%
Si.72%
Cl.5%

Sa. 6%
Si.73%
Cl.21%

FORM 08-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 1A

FOUNDATION SECTION

JOB 66-F-94
W.P. 341-64
DATUM Geodetic

LOCATION Hwy.#52 & C.N.R., 29' Lt. of Stn. 206 + 59
BORING DATE Nov. 4 & 7, 1966
BOREHOLE TYPE Washboring NX Cased

ORIGINATED BY J.M.
COMPILED BY J.M.
CHECKED BY [illegible]

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — SHEAR STRENGTH P.S.F. + Field Vane ● Unconfined Comp ○ Quick Triaxial (500 1000 1500 2000 2500)	LIQUID LIMIT w_L — PLASTIC LIMIT w_P — WATER CONTENT w — WATER CONTENT % (10 20 30)	BULK DENSITY γ P.C.F.	REMARKS
754.0 GROUND LEVEL										
0.0	Brown Clayey silt with traces of organics, sand and gravel. Firm to stiff		1	TW	P	750	+ S=2		125	Org.2.67% El.744.7
744.3			2	TW	P				127	
9.7	Dark Brown organic mat'l. (peat)		3	TW	P	740	+ >2000, S=3+			Or.1.77% Cc.0.072 W.314.1% Org.79.4%
737.5			4	TW	P		+ >2000, S=3+			W.340% Org.87.25%
16.5	End of borehole					730				

FORM DB-MT-126
66-4846

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 66-F-94 LOCATION Hwy. 52 & C.N.R., 20' Rt. of Stn. 206 +12 ORIGINATED BY J.M.
W.P. 341-64 BORING DATE Nov. 9, 10, 14 & 15/66 COMPILED BY J.M.
DATUM Geodetic BOREHOLE TYPE Washbore, NX & BX Cased CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT
746.6	GROUND LEVEL				
0.0 / 740.6	Dark brown silt & organics, traces of sand, gravel & shells		1	TW	P
6.0 / 727.6	Dark brown organic mat'l. (peat) with fragments of wood.		2	SS	P
			3	SS	P
			4	TW	P
			5	TW	P
19.0 / 719.6	Dark grey organic silt-clay with sand seams, Soft to Firm		6	TW	P
			7	TW	P
27.0 / 689.6	Fine sand to sandy silt with traces of gravel. Compact to dense		8	SS	16
			9	SS	16
			10	SS	41
			11	SS	36
			12	SS	43
			13	SS	64
57.0 / 665.1	Grey clayey silt to silt with traces of sand & gravel. Hard		14	SS	68
			15	SS	95
			16	SS	54
			17	SS	53
			18	SS	137
81.5	End of Borehole				

ELEV. SCALE: 740, 730, 720, 710, 700, 690, 680, 670, 660

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT: 20 40 60 80 100
SHEAR STRENGTH P.S.F. + Field Vane ● Unconfined Comp. ○ Quick Triaxial: 200 400 600 800 1000
+S-2 +S-2 +S-2.8 +S-2.7 +S-3

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT %: 20 40 60

BULK DENSITY γ P.C.F.: 84.5 | 103.5 | 122

REMARKS
El. 744.4
Org. 16.6
W.L.
W.93.2%
Cc.0.34
W.166%
Org. 28.3%
W.467.3%
WL.374.0 Org.74.2%
W. 563%
Org.86&64%
W.378%
Org.5.7 & 1.1% (Seam)
Sa.57%,Si40%
Cl.3%(seam)
Cc. 0.129
W.282%
Org. 2.29 & 7.79%
Gr.6%,Sa82%
Sl.&Cl. 12%
Sa.43%
Si.57%

FORM DB-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2A

FOUNDATION SECTION

JOB 66-F-94 LOCATION Hwy. 52 & C.N.R. 10'Rt. of Stn. 206 + 19 ORIGINATED BY J.M.
W.P. 341-64 BORING DATE November 15 & 16, 1966 COMPILED BY J.M.
DATUM Geodetic BOREHOLE TYPE Washboring, NX Cased CHECKED BY

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w	BULK DENSITY	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	SHEAR STRENGTH P.S.F.	WATER CONTENT % (15, 30, 45)	Y P.C.F.	
746.7	GROUND LEVEL									
0.0 / 743.2	Brown organic silt-clay with trace of sand									
3.5	Dark Brown organic material (Peat)		1	SS	7					▼El.744.4 W.L. w. 158.5% Org.24.4%
			2	SS	3	740				W. 472.2% Org.76.3%
			3	SS	2/18"					W. 550.0% Org.86.2%
730.7			4	SS	3					W. 392.0% Org.69.0%
16.0	Grey fine sand & organics to organic silt		5	SS	2/18"	730				
725.2			6	SS	1/18"					Org. 2.1% Sa. 68% Si.32%
724.2	Grey sandy silt		7	SS	9					
22.5	End of Borehole					720				

FORM OB-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 66-F-94 LOCATION Hwy. 52 & C.N.R., 27' Lt. of Stn. 205 + 57 ORIGINATED BY J.M.
W.P. 341-64 BORING DATE November 16, 17 & 18, 1966 COMPILED BY J.M.
DATUM Geodetic BOREHOLE TYPE Washboring, NX & BX Cased CHECKED BY MR.

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
746.6	GROUND LEVEL					
0.0 / 740.6	Black Organic Topsoil changing to dark grey org. silt below el. 743		1	TW	PM	740
6.0	Silty sand.- Silt with traces of gravel and occasional layers of clayey silt. Loose to very dense		2	SS	9	
			3	SS	7	
			4	SS	10	
			5	SS	10	730
			6	SS	14	
			7	SS	10	720
			8	SS	18	
			9	SS	63	710
			10	SS	59	
			11	SS	54	700
			12	SS	192/11"	
			13	SS	63	690
			14	SS	57	
			15	SS	78	680
675.1			16	SS	161	
71.5	End of borehole					670

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT 20 40 60 80 100
SHEAR STRENGTH P.S.F.
○ Quick Triaxial
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.: 101

REMARKS
El. 744.4
W.L.
Org. 12.6%
W. 67.2%
Wl. 56.4%
Wp. 46.5%
Gr. 15%,
Sa. 70%
Si. & Cl. 15%

FORM 08-MT-126
66-4646

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 66-F-94 LOCATION Hwy. 52 & C.N.R., 27' Rt. of Stn. 205 + 26 ORIGINATED BY J.M.
W.P. 341-64 BORING DATE Nov. 21 - 24/66 COMPILED BY J.M.
DATUM Geodetic BOREHOLE TYPE Washboring, NX & BX Cased CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
749.9	GROUND LEVEL					
0.0 / 746.4	Brown clayey silt with sand & gravel. (Fill mt		1	SS	7	
3.5	Organic silt.		2	SS	3	
740.6			3	SS	9	740
9.3	Grey		4	SS	10	
	Silty fine sand to silt with traces of gravel with occassional layers of clayey silt.		5	SS	12	
			6	SS	8	730
			7	SS	20	
	Very		8	SS	10	720
	Loose to very dense		9	TW	P	
			10	SS	56	710
			11	SS	75	
			12	SS	45	700
			13	SS	93	
			14	SS	71/1"	690
			15	SS	126	
			16	SS	32	680
			17	SS	104/7½"	
			18	SS	44	670
663.4			19	SS	27	
86.5	End of Borehole					660

DYNAMIC PENETRATION RESISTANCE
BLOWS / FOOT 20 40 60 80 100
SHEAR STRENGTH P.S.F.

LIQUID LIMIT — w_L
PLASTIC LIMIT — w_P
WATER CONTENT — w
w_P w w_L
WATER CONTENT % 15 30 45

BULK DENSITY γ P.C.F.

REMARKS

El. 744.9
W.L.
Org. 31.6 & 25.0%
Gr. 7%
Sa. 80%
Si. & Cl. 13%

Sa. 25%
Si. 65%
Cl. 10%

Gr. 1%
Sa. 39%
Si. 50%
Cl. 10%

FORM 08-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 5 & 5B

FOUNDATION SECTION

JOB 66-F-94 LOCATION Hwy. 52 & C.N.R, 33.5' Rt. of 206 ∠ 88.5 ORIGINATED BY J.M.
W.P. 341-64 BORING DATE Nov. 24, 28-30/66 COMPILED BY J.M.
DATUM Geodetic BOREHOLE TYPE Washboring, NX Cased CHECKED BY HR

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT
747.0	GROUND LEVEL				
0.0 / 741.5	Brown Clayey silt traces of sand & org.		1	SS	8
5.5 / 738.0	Grey fine sand with trace org.(dark grey)		2	SS	4
9.0	Black Organic Mat'l. (Peat) with occassional large wood		3	SS	11
			1B	SS	8
			2B	SS	8
			3B	SS	4
722.5					
24.5 / 719.5	Dark Grey Org.Silt		4B	SS	2
27.5 / 715.5	Grey Silt Compact		5B	SS	25
31.5	End of Borehole				

ELEV. SCALE: 740, 730, 720, 710

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT: 20 40 60 80 100
SHEAR STRENGTH P.S.F. + Field Vane: 500 1000 1500 2000 2500
+S-3.3
+ S-2.5

LIQUID LIMIT —— w_L
PLASTIC LIMIT —— w_P
WATER CONTENT —— w
w_P w w_L
WATER CONTENT %: 15 30 45

BULK DENSITY γ P.C.F.

REMARKS

El. 743.8
▽ W.L.
Org. 2.34%
Org. 0.91%
W. 120.9%
Org. 14.5%
W. 344.1%
Org. 43.4%
W. 472.5%
W. 474.4%
Org. 67.5%

FORM DB-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

JOB 66-F-94 LOCATION Hwy. 52 & C.N.R., 29'Lt. of Stn. 207 + 50 ORIGINATED BY J.M.
W.P. 341-64 BORING DATE Nov. 30 & Dec. 1/66 COMPILED BY J.M.
DATUM Geodetic BOREHOLE TYPE Washboring, NX Cased CHECKED BY [illegible]

SOIL PROFILE ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT / SHEAR STRENGTH P.S.F.	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w — WATER CONTENT % (10 30 30)	BULK DENSITY γ P.C.F.	REMARKS
756.6	GROUND LEVEL									
0.0	Brown Silt with sand & pockets of organics		1	SS	6					Org. 0.8%
			2	SS	2	750				El. 748.0 ▽ W.L.
747.6										
9.0	Black Organic material (peat)		3	SS	1					W. 309.0%
743.6										Org. 37.1%
			4	SS	4					W. 77.1%
13.0	Grey fine sandy silt to silt with trace of organics Loose to Compact		5	SS	17	740				Org. 6.26%
735.1			6	SS	9					
21.5	End of Borehole					730				

FORM OB-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 7

FOUNDATION SECTION

JOB 66-F-94 LOCATION Hwy. 52 & C.N.R. 20' Rt. of Stn. 208 + 00 ORIGINATED BY J.M.
W.P. 341-64 BORING DATE Dec. 1, 2 & 5, 1966 COMPILED BY J.M.
DATUM Geodetic BOREHOLE TYPE Washboring, NX & BX Cased CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS / FOOT	ELEV. SCALE
758.9	GROUND LEVEL					
0.0	Light brown silt with sand & trace of org.		1	SS	6	
			2	SS	3	
749.4						750
~~748.9~~	~~Brown Organic~~		3	SS	10	
10.0	Grey silty find sand to sandy silt with clayey silt & layer between elevation 737.0 & 730.0		4	SS	10	
			5	SS	15	740
			6	SS	9	
			7	TW	P	
			8	SS	10	
			9	SS	41	730
			10	SS	35	
			11	SS	72	720
			12	SS	27	
			13	SS	62	710
			14	SS	45	
			15	SS	132	700
692.4			16	SS	45	
66.5	End of Borehole					690

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT
SHEAR STRENGTH P.S.F.
+ Field Vane
● Unconfined
500 1000 1500 2000 2500

+ S 1.6

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.

129

REMARKS

Org. 0.34%
El. 749.9
W.L.
W. 111.2%

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 8

FOUNDATION SECTION

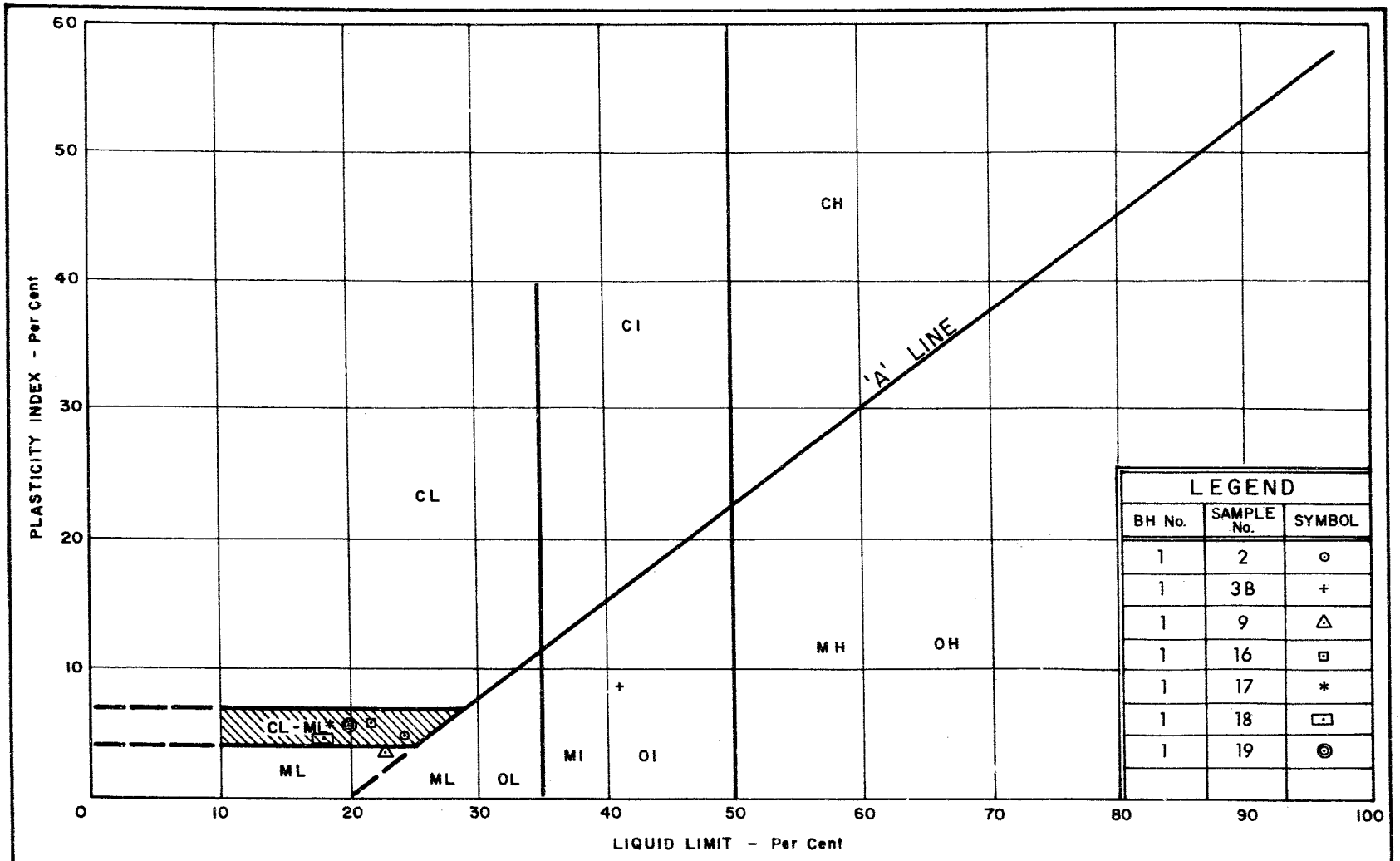
JOB 66-F-94 LOCATION Hwy. 52 & C.N.R., 22.5' Rt. of Stn. 205 + 54 ORIGINATED BY J.M.

W.P. 341-64 BORING DATE Nov. 18, 1966 COMPILED BY J.M.

DATUM Geodetic BOREHOLE TYPE Dynamic Cone CHECKED BY [illegible]

SOIL PROFILE			SAMPLES				DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 SHEAR STRENGTH P.S.F.	LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE				
747.8 0.0	Ground Level					740				
						730				
						720				
						710				
						700				
	End of Cone Test									

FORM CS 41-252
(REV. JUNE 1965)
65-1624

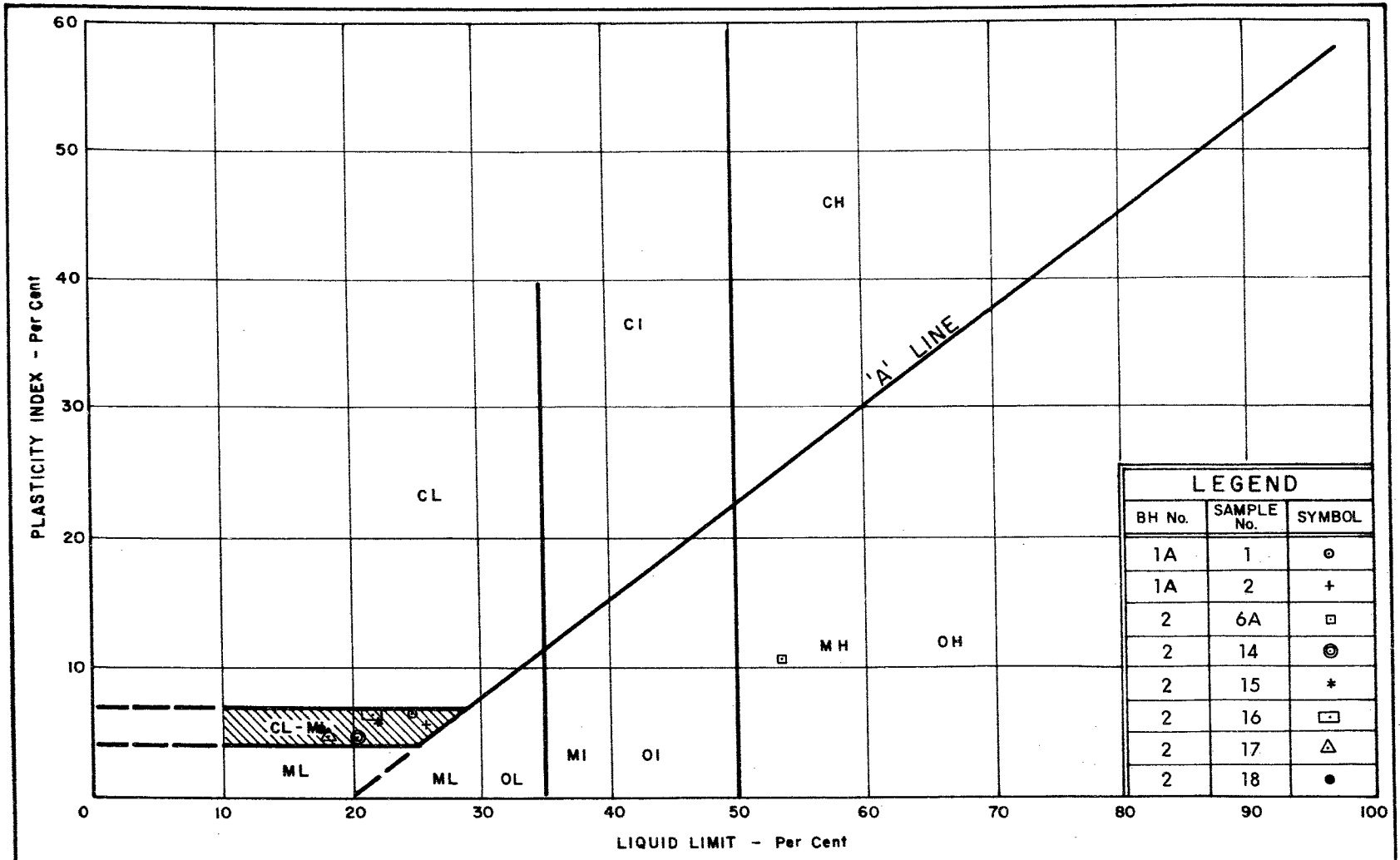


DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION
ONTARIO

PLASTICITY CHART

W.P. No. 341-64
JOB No. 66-F-94

FORM OB-MT-252
(REV. JUNE 1965)
65-1624

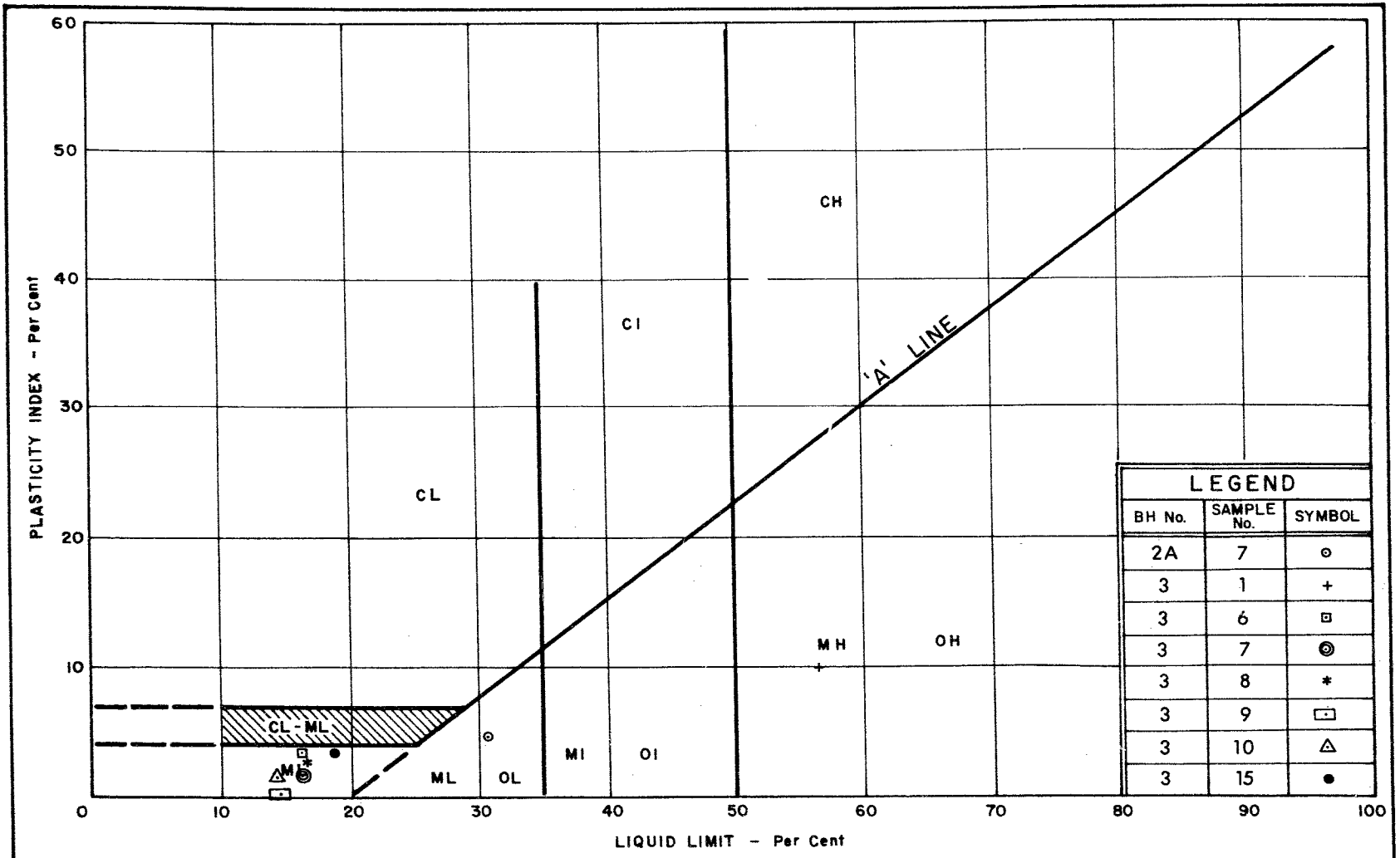


DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION
ONTARIO

PLASTICITY CHART

W.P. No. 341 - 64
JOB No. 66 - F - 94

(REV. JUNE 1965)
65-1624

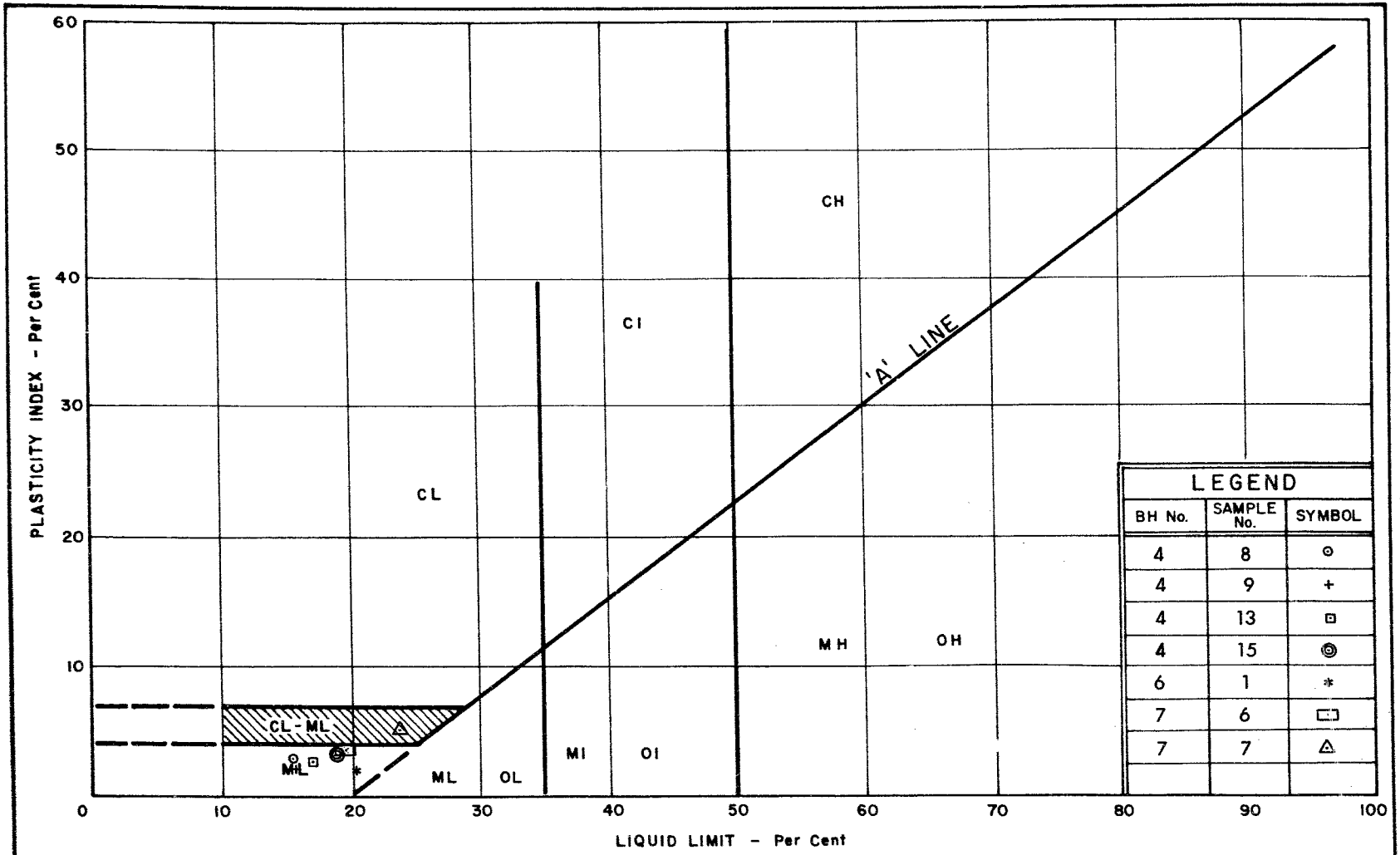


DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION
ONTARIO

PLASTICITY CHART

W.P. No. 341-64
JOB No. 66-F-94

FORM OB-MT-252
(REV. JUNE 1965)
65-1624



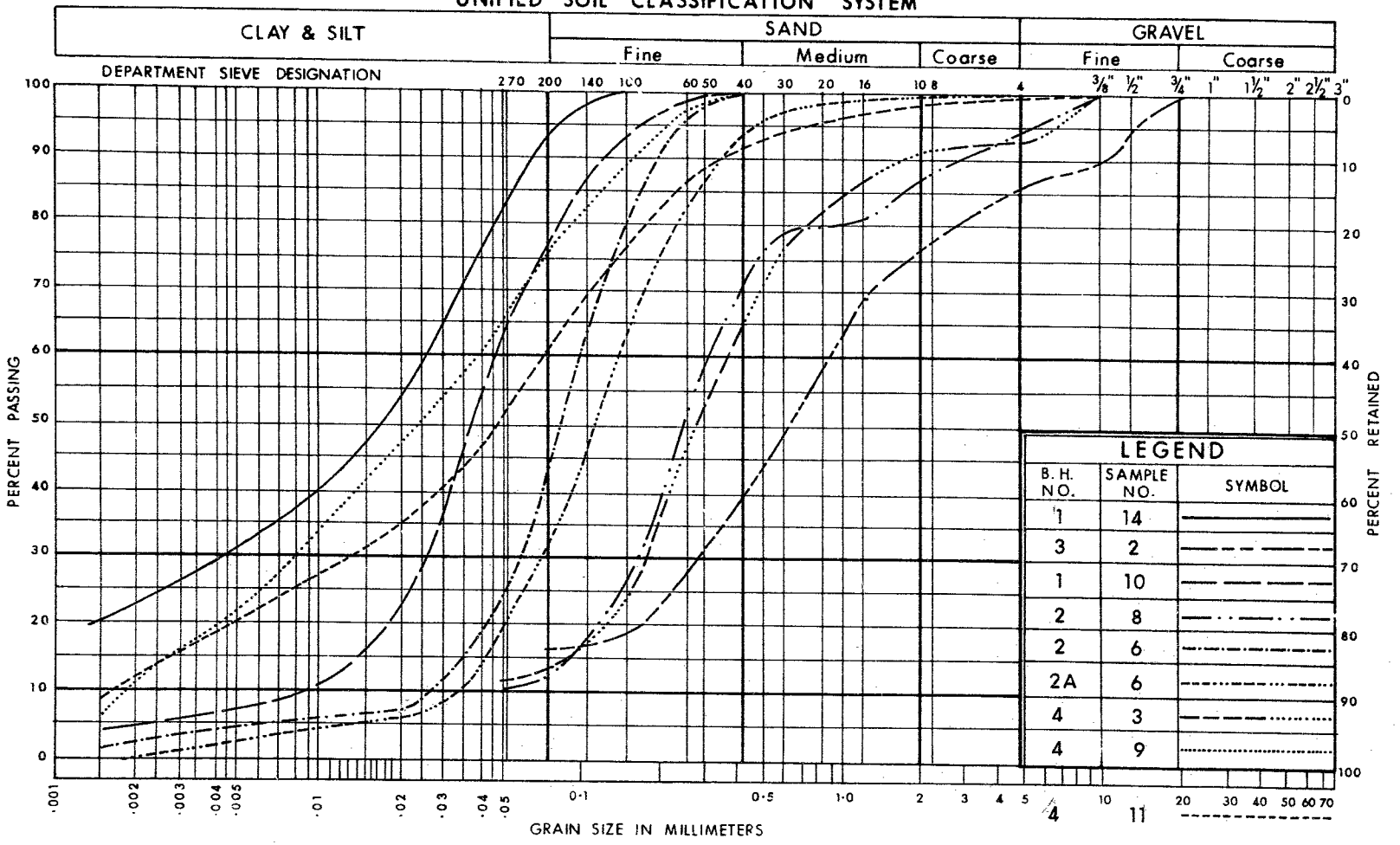
DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION
ONTARIO

PLASTICITY CHART

W.P. No. 341-64
JOB No. 66-F-94

65-414

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION
ONTARIO

GRAIN SIZE DISTRIBUTION

SILTY FINE SAND To SANDY SILT

W.P. No. 341-64

JOB No. 66-F-94

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

1966 NOV 4 AM 9:26

LA033

B

HAMN DOWN 1 NOV 4/66 909A VR

H GREENLAND DIST ENGR

ATTN W D HAM MTCE ENGR

66F-94
66-F-95

RE STURUCTURE AT HIGHWAY 52 AND C N R WJ66-F-94 AND STRUCTURE AT HIGHWAY 52 AND T.H. AND B. 4. WJ66-F-95

THE FIELD INVESTIGATION WORK IS IN PROGRESS FOR THE ABOVE MENTIONED PROJECTS THIS IS FOR YOUR INFORMATION.

M DEVATA FOR A G STERMAC MAT AND TESTING

BB

RECEIVED NOV 4 1966

TELETYPE

cc: Foundations File

Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Division,
Admin. Bldg.

Foundations Office,
Materials & Testing Div.,
Room 107, Lab. Bldg.

June 16, 1967

C.N.R. Overhead at Copetown,
0.05 Miles North of Hwy. 99,
W.P. 341-64, Site No. 36-82,
Hwy. 52, Dist. #4 (Hamilton).

The Preliminary Bridge Plan Drawing D 6179-P1 for the above mentioned structure has been reviewed, and it appears that the designer has complied with our recommendations.

MD/MdeF

M. Devata,
SUPERVISING FOUNDATION ENGR.
For:
A. C. Stermac,
PRINCIPAL FOUNDATION ENGR.

cc: Giffels and Associates Ltd.
S. McCombie
W. S. Melinyshyn

Foundations Files
Gen. Files

Department of Highways Ontario

Copy for the information of
Mr. A. Stermac, Principal Foundation Engineer,
Room 107, Lab. Building

Mr. W. Nelingshyn,
Reg. Bridge Location Engineer,
Central Region,
Administration Building

Bridge Division,
Downsview, Ontario

June 9, 1967

C.N.R. Overhead at Copetown
0.05 Miles North of Hwy. 99
W.P. 341-64, Site No. 36-82
Highway 52, District No. 4

Attached herewith are prints of the Preliminary Bridge Plan Drawing D6179-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is $209,000. This cost includes tender, materials, engineering and sundry construction.

Any comments or revisions you may have should be submitted within three weeks.

C.S. Grubski,
Bridge Design Engineer

CSG:rd

Attach.

c.c. S. McCombie
A. Stermac
R. Forrest
E. Cross

Form PL-ES-1
62-3863

DEPARTMENT OF HIGHWAYS ONTARIO

PLANNING AND DESIGN BRANCH – ENGINEERING SURVEYS DIVISION

SURVEY REQUEST

66-F-94

Job Name _____ TWP. _____

Hwy. No. 35 District 4A Region Central

W.P. No. 41-64 Work Schedule _____ Priority (If Not a W.P.) _____

Date _____ Date of Previous Request (If Any) _____

Req'd. By _____ Title _____ Section _____
Signature

Future Design Standards

Hwy. Class No. _____ Design Speed _____ Median Width _____ R/W Width _____

Survey Information

Limits of Survey _____

Bridge Site Plans Req'd. At _____

Railway Crossing Plans Req'd. At _____

Pipe Line Crossing Plans Req'd. At _____

Instructions (Note Any Special Requirements or Drafting Instructions)

(4.) Copy

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT

Giffels ASSOCIATES LIMITED
60 ADELAIDE STREET EAST, TORONTO 1, ONTARIO TEL. 366-3781

May 1, 1967,

Mr. M. B. Hansen, P.Eng.,
Area Engineer,
Canadian National Railway,
205 York Street,
London, Ontario.

Re: W.P.341-64 Hwy.52, CNR Overhead Structure North of Jct. Hwy.99, 0.2 Mi.

Our Job C605301

Dear Sir:

We wish to confirm the points discussed at the meeting held in your office on the morning of April 27, 1967.

The following were present:

M. B. Hansen	CNR Area Engineer
J. E. Troyer	CNR Maintenance Engineer
R. Draycott	DHO Regional Planning Supervisor
G. R. Tilly	Giffels Associates Project Manager.

One copy of the following documents were left with Mr. Hansen for use by the CNR:

1. Set of plans showing the proposed reconstruction of Highway 52, including the detour required during construction.

2. Foundation investigation report for the structure.

3. The preliminary drawing for the three-span structure Dwg. D6179-P dated April 1967.

4. A xerox copy of a possible extension of the structure to the north, the extension comprising two 44 ft. spans with a 4 to 1 slope of the fill towards the tracks. This proposal is under review by the Department of Highways and is not yet approved.

In order to complete the information, we are enclosing with this letter a copy of the proposed vertical profiles for Highways 52 and 99 in the vicinity of the structure.

The discussion included the following:

1. Request for general approval of the project by the CNR. The main points being:
   a) Two extra tracks one on each side of the existing tracks are provided in accordance with the letter from Mr.G.H.Workman dated May 11, 1966 (CNR File 4710-4).
   b) The detour proposal.
   c) The structure proposal.

2. Request for an estimate by the CNR for:
   a) CNT Temporary and Permanent Relocation
   b) Detour Costs comprising:
      i) Supply, placing and removal of crossing planks
      ii) Installation and removal of automatic protection for the detour, consisting of short arm gates with flashing lights and bell.
      iii) It is presumed that flagging protection cost will be borne by the Contractor, therefore no estimate of this item is required.

3. Removal of Existing Structure:
   a) The CNR did not wish to salvage the structure.
   b) The removal of the structure would presumably be done by the DHO Contractor.

4. Contribution to the Project by the CNR:
   Mr. Hansen mentioned that a formula for contribution has recently been proposed by the CNR and provisionally accepted by the Board. At this time it has been submitted to the DHO, but it was not known if it was acceptable to the DHO. Details of this formula would be obtained by Mr. Draycott with a view to its possible use on this project.
   The new structure would be owned and maintained by the DHO, therefore the CNR would obtain benefit of two extra track locations, would not have to replace the existing structure, and would not have to carry out any further maintenance on the structure.

5. Details of proposed structure:
Mr. Hansen was concerned about any disturbance to the peat type muskeg. He mentioned that the CNR had over the years obtained a relatively stable condition through continuous maintenance and he considered that any removal of muskeg even at the north end of the longer structure might give rise to a flow in the material which could affect the track. As for the short structure which would require removal of the muskeg near the track, any movement of the sheet piling required to effect this removal might also affect the track. For this reason, he considered that the short span structure would be unacceptable to the CNR. He would forward the DHO foundation report to CNR soils section for their opinion on the proposals for the structure and hoped to have their comments within three weeks.

We would be grateful if you would let us know if there are any errors or omissions in the above.

Yours very truly,

GIFFELS ASSOCIATES LIMITED,

G. R. Tilly, P.Eng.,
Project Manager.

cc: R. Draycott - DHO
W. Melinyshyn - DHO
M. W. Booth - DHO
J. L. Keen - DHO
A. Stermac - DHO
T. Kovich - DHO
G. N. Farakatos

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

Telephone: 248-3415

To: Mr. W. Melinyshyn,
Reg. Bridge Locations Engineer,
Bridge Planning Section,
Administration Building

From: Mr. M.W. Booth,
Toronto Regional Road Design

Date: April 25th, 1967

Our File Ref.

In reply to

Subject: Re: Work Project 341-64, Highway 52,
C.N.R. Overhead Structure in Copetown,
District 4, Hamilton

We enclose for your study a report prepared by our Consultant, Giffels Associates Limited, in connection with the proposed structure over the C.N.R. in the Village of Copetown.

The report makes a comparison in cost between muck excavation on the north side of the C.N.R. tracks and the cost of lengthening the structure by 100' to avoid any muck excavation in the vicinity of the Railway. According to the report the difference in cost is very slight being only $1,030.00 more to construct the longer structure. The soils report recommended that the muck be excavated to avoid any slippage taking place from the new fill to the south in the direction of the C.N.R. tracks. We understand the rail traffic is quite heavy on this line and any damage to the track could result in considerable trouble and expense to the Department.

Further to the seven reasons outlined in the report by our Consultant for not excavating the muck, this office is at a loss to know how it will be possible to excavate muck some 28' deep adjacent to the track, without having the track shift toward the excavation.

Due to the foreseeable construction problems and possible future claims from the C.N.R. due to settlement in the track, we wish to recommend that the bridge be lengthened the required amount to avoid muck excavation in the vicinity of the tracks.

If further discussion is required by your office regarding the subject, we would be glad to attend. Also we feel the District should be represented.

M.W. Booth,
Office Project Design Supervisor,
for: C.K. Hunter,
Regional Road Design Engineer

MWB/bap

c.c. R. Britton
T. Kovich
G. Tilly

Giffels ASSOCIATES LIMITED
60 ADELAIDE STREET EAST, TORONTO 1, ONTARIO TEL. 366-3781

April 17, 1967,

Mr. G. K. Hunter, P.Eng.,
Regional Road Design Engineer,
Department of Highways, Ontario,
Downsview, Ontario.

Attention: Mr. M. W. Booth

Re: W.P.341-64 Hwy.52, CNR
Overhead Structure North of Jct.
Hwy. 99, 0.2 Mi.

Our Job C605301

Dear Sir:

With reference to your letter dated March 23, 1967, we enclose our estimate comparing the structure as presently proposed with a 100 ft. longer structure.

The longer structure shows a negligible increase in cost over the shorter structure due mainly to the savings caused by a considerable decrease in the quantities of earthfill and muskeg backfill required and also by elimination of the sheet piling necessary to carry out the muskeg excavation.

There are several problems associated with the sheet piling necessary for the muskeg excavation for the shorter structure; these are:

1. The sheet piles have to be at least 10 ft. from the centreline of the pier in order not to interfere with the driving of the pier piles. If placed on the track side of the pier, this would cause the ties of the future track to be half on the muskeg backfill and half on the compressible muskeg -- an undesirable situation for the CNR. In addition, the sheet piling would have to take railway surcharge load from the existing track.

2. The sheet piling has to be of cantilever construction since there is no practical way of anchoring it either by strutting or by deadmen.

3. The heaviest sheet piling available is not of sufficient strength to take railway surcharge for the required 25 ft. depth of excavation without anchorage.

4. Due to the above points the sheet piling would have to be placed on the abutment side of the pier.

5. The water table is only 3 ft. below the base of railway elevation and the railway ditches are the main watercourse in the area. Due to this, it would be impossible to dewater the excavation without sheet piling around the full perimeter of the excavation, even so boiling of the excavation might occur without the use of wellpoints.

6. Whilst dewatering is not necessary (and no allowance for dewatering has been made in this estimate), the presence of the water adds to the difficulties. It requires that the muskeg backfill be granular and is the reason why strutting is impracticable.

7. The main purpose of the muskeg excavation is to ensure that no slip circle failure, towards the tracks, takes place. Therefore it is imperative that not even a thin layer of poor material be left at the bottom of the excavation -- this is difficult with the presence of the water (24 ft. deep).

Due to the similar costs of the two proposals and bearing in mind the problems associated with the shorter structure, we would strongly recommend that the longer bridge proposal be adopted.

We should be pleased to discuss this question further at your request.

Yours very truly,

GIFFELS ASSOCIATES LIMITED,

G. R. Tilly, P.Eng.,
Project Manager.

Enclosure
cc: G. N. Farantatos

CNR COPETOWN

HWY. 52 W.P. 341-64 DIST. 4

ESTIMATE FOR LENGTHENING STRUCTURE

This estimate is prepared for comparison between the proposed three-span structure, which necessitates the removal of 25 ft. depth of muskeg adjacent to the tracks, and a possible lengthening of the structure on the north side by 100 ft. which would not need this deep muskeg excavation.

Increases in Cost for Long Structure

Structure 49' wide x 100' long (Two 50' spans and two extra piers)		$74,440

Decreases in Cost for Long Structure

Earth Cut (25% available for fill)	6,700 CY @$0.70	$ 4,690
Muskeg excavation	8,800 CY@$0.80	7,040
Muskeg backfill (placed under water)	13,800 CY@$1.30	17,940
Imported Fill (Borrow)	12,000 CY@$1.20	14,400
Granular A	90 Ton @$2.00	180
Granular B	290 Ton @$1.50	435
Asphalt	50 Ton @$8.00	400
Steel Beam Guiderail	200 LF @$3.50	700
Steel Sheet Piling (MZ38-50 ft.long)	6500 SF @$4.25	27,625
		$73,410

Extra Cost for Long Structure

$74,440 - 73,410 = $ 1,030

Department of Highways Ontario
Copy for the information of
Mr. A. Stermac,
Principal Foundation Engineer

Bridge Division,
Downsview, Ontario,
October 6, 1967

Giffels Associates Ltd.,
Consulting Engineers,
60 Adelaide Street East,
Toronto 1, Ontario

Attention: Mr. G.R. Tilly, P.Eng.

66F-94

RE: C.N.R. Overhead
0.5 Miles North of Hwy. 99
W.P. 341-64, Site 36-82
Highway 52, District No. 4

Dear Sir:

Further to my letter to you of October 2, 1967, I have received a reply from Mr. A. Stermac, P.Eng., Principal Foundation Engineer, regarding the possibility of track movement from driving closed end tube piles, as raised by Mr. Hansen, P.Eng., Area Engineer for the C.N.R.

Mr. Stermac doubts whether any significant disturbance of the peaty layer will result from driving closed end 12 inch tube piles, and whatever disturbance will occur it should not affect the railway tracks. The piers are some 20 feet away from the tracks. Also to be considered is the fact that to drive the tube piles open-ended would result in considerable extra expense.

We feel that closed end tube piles will be a satisfactory solution for the support of the piers and abutments, and do not anticipate making any changes to the present piling arrangement.

Yours truly,

J.L. Keen, P.Eng.,
Regional Bridge Project Engineer

JLK:rd

c.c. A. Stermac
A. Watt

DEPARTMENT OF HIGHWAYS ONTARIO

FORM SB-OS-62 66-5970

ACTION SLIP

DATE Sept 28/67

TO MR. A. STERMAC, FOUNDATIONS SECTION LAB BLDG.

FROM JIM KEEN BRIDGE DIV.

- ☐ NOTE AND FILE
- ☐ NOTE AND RETURN TO ME
- ☐ RETURN WITH MORE DETAILS
- ☐ NOTE AND SEE ME
- ☐ PLEASE ANSWER
- ☐ FOR YOUR APPROVAL
- ☐ RETURN WITH YOUR COMMENTS
- ☐ PREPARE REPLY FOR MY SIGNATURE
- ☐ TAKE APPROPRIATE ACTION
- ☐ PER YOUR REQUEST
- ☐ FOR YOUR SIGNATURE
- ☐ FOR YOUR INFORMATION
- ☐ INVESTIGATE AND REPORT
- ☐ _____

COMMENTS re WP 341-64 C.N.R. O'HEAD HWY 52

Tony – Please advise us if you feel that there is any possibility of the closed-end tubes causing any track displacement. If displacement consideration requires the use of driving open-end tubes for the piers adjacent the tracks then I think we should seriously consider driving H-piles, as a more suitable alternative.

66-F-94

To: Jim Keen, Bridge Division Oct 2. 1967

Re: W.P. 341-64: CNR O'HEAD - HW 452

The piers are some 20 ft away from the tracks. We doubt whether any significant disturbance of the peaty layer will result from driving closed-end 12 inch tube piles. Whatever disturbance will occur it should not affect the railway tracks.

Our objection to driving open-ended tube piles would be the added expence required to remove the organic material from the piles. It would appear that steel H-piles would be more appropriate, however, we cannot see anything wrong with closed-end tube piles, as stated above.

The material (peat) is quite soft and loose and possibly the piles will penetrate down to the underlying sandy layer with only very little energy required.

A J Stevenson

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A.G. Sternac,
Principal Foundation Engineer,
Room 107,
Lab. Bldg.

From: Bridge Division,
Downsview, Ontario.

Date: October 24, 1966.

66-F-94

Our File Ref.

In reply to

Subject: W.P. 341-64, Site 36-82, C.N.R. Overhead,
W.P. 99-66, Site 36-218, T.H. & B. Overhead,
Highway 52, District 4.

COMPLETION DATE DEC 21. 1966

COMPLETION DATE APRIL 2 1967

Herewith are two prints each of the site plans, B4753-1, B4759-1, for the above structures. The possible location of footings have been marked in red. Also enclosed are the preliminary structure site reports.

Please arrange for a foundation investigation of sufficient scope to enable us to proceed with the design.

At the recent scheduling meetings a date of December 21, 1966 was set for the foundation report on the C.N.R. Overhead structure.

W.S. Melinyshyn,
Regional Bridge Location Engineer.

JFW/aw

c.c. R. Forrest
A. Crowley