

MEMORANDUM

To: Mr. B. R. Davis,
Bridge Engineer,
Bridge Office,
Admin. Bldg.

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

Attention: Mr. S. McCombie

DATE: July 8, 1969

OUR FILE REF.

IN REPLY TO

JUL 10 1969

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For

Proposed Overhead Structure at the
Crossing of Hwy. #7 'Line 'E' and
The C.N.R., Lot 12 Concessions 3 & 4
District N (Port Hope)
W.J. 69-F-22 W.P. 913-65-02

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 do not hesitate to contact our Office.

AGS/WdeF
Attach.

cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
G. K. Hunter (2)
D. P. Collins
W. S. Melnyshyn
T. J. Kovich
B. A. Singh

Foundations Files
Gen. Files

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

TABLE OF CONTENTS

1. INTRODUCTION.
 2. DESCRIPTION OF THE SITE AND GEOLOGY.
 3. FIELD AND LABORATORY WORK.
 4. SUBSOIL CONDITIONS:
 - 4.1) General.
 - 4.2) Fill Material.
 - 4.3) Fine Sand to Silt.
 - 4.4) Glacial Till (Clayey Silt with Some Sand and Traces of Gravel).
 - 4.5) Silt to Sand with Traces of to Some Gravel.
 5. GROUNDWATER CONDITIONS.
 6. DISCUSSION AND RECOMMENDATIONS:
 - 6.1) General.
 - 6.2) Structure Foundations.
 - 6.3) Approach Embankments.
 7. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT
For
Proposed Overhead Structure at the
Crossing of Hwy. #7 (Line 'E') and
The C.N.R., Lot 13, Concessions 3 & 4
District No. 7 (Port Hope)
W.J. 69-F-22 -- W.P. 913-65-02

1. INTRODUCTION:

The Foundation Section was requested to carry out an investigation at the site of the crossing of the C.N.R. tracks and Hwy. #7, Twp. of Emily, County of Victoria. The request was contained in a memo from the Bridge Planning Section - (Mr. W. S. Melinyshyn, Regional Bridge Location Engineer), dated April 2, 1969.

An investigation was subsequently carried out by this Section to determine the subsoil conditions at the site. This report contains the results of the investigation, together with our recommendations pertaining to the design of foundations and stability of approaches for the proposed structure.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located about 2 miles east of the Village of Omamee, where Hwy. #7 crosses a single C.N.R. track at a level crossing. Hwy. #7 is a two-lane, paved highway with associated gravel shoulders. The existing highway is elevated above the surrounding terrain. Shallow ditches some 5 ft. deep are located along either side of the roadway. The C.N.R. tracks are carried on an embankment approximately 2 to 3 feet above the natural ground. Ditches also run along both sides of the embankment. The crossing is protected by a signal system.

The area in the immediate vicinity of the site is flat lying to gently undulating in relief between elevations 883 and 887. The surrounding land is presently being used for agricultural purposes.

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

Physiographically the site is situated in the "Peterborough Drumlin Field". Based on available geological information, it is known that this area is characterized by rolling glacial till plains on which numerous northeast to southwest tending drumlins have been superimposed. In addition, a few well defined eskers are present. The till is primarily composed of highly calcareous cohesive material, while unsorted granular soil is often encountered within the drumlins and eskers. The overburden, which is quite extensive in the vicinity of the site, is underlain by limestone bedrock of the Trenton Formation, Ordovician Period.

3. FIELD AND LABORATORY WORK:

A total of 4 boreholes was put down during the course of the field investigation. The borings were advanced by means of a conventional diamond drill rig adapted for soil sampling purposes. Three of the boreholes were accompanied by a dynamic cone penetration test.

Samples were recovered at required depths in a 2-inch split-spoon sampler which was hammered into the soil in accordance with the specifications for the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests.

The locations and elevations of the boreholes were surveyed in the field by personnel from the Central Region Engineering Surveys Section, and are shown on Drawing 69-P-22A, together with the estimated stratigraphical profile. All elevations in the report are referenced to a Geodetic datum.

All samples were visually examined and identified in the field and later in the laboratory. Laboratory tests were carried out on selected representative samples to determine the following physical properties:

Natural Moisture Contents
Atterberg Limits
Grain-Size Distributions

On completion of these tests, the various soil samples were classified as to type and consistency in accordance with the

3. FIELD AND LABORATORY WORK: (cont'd.) ...

Unified Soil Classification System (October 1963).

The results of the laboratory tests are plotted on the Record of Borelog sheets and summarized on the Figures in the Appendix of the report.

4. SUBSOIL CONDITIONS:

4.1) General:

Subsoil at the site generally consists of 15 to 21 ft. of fine sand to silt, followed by a 16 to 22 ft. thick glacial till (clayey silt, some sand, traces of gravel) deposit underlain by a silt to sand with some gravel stratum at least 31 ft. thick. In certain areas the natural overburden is overlain by roadway embankment fill some 7 to 8 ft. thick.

From ground level downwards, the different soil types encountered are described in detail as follows:

4.2) Fill Material:

In B.H.'s #2, 3 and 4 carried out on the shoulder of the existing road, up to 8 ft. of fill material was encountered. This material is predominantly a silty fine sand with a trace of clay and gravel. Occasional clayey silt zones were encountered within the fill and a thin layer of organic topsoil was observed at the boundary between the fill and the natural subsoil. Typical grain-size distribution curves for the fill material are plotted on Fig. No. 1.

Standard penetration resistance values, carried out within the fill, gave 'N' values ranging from 2 to 6 blows per foot, indicating that the fill material is not well compacted.

4.3) Fine Sand to Silt:

Underlying the fill material in B.H.'s #2, 3 and 4, or a thin layer of topsoil in B.H. #1, a granular deposit ranging from fine sand to silt was encountered. In B.H. #1 a 2-ft. sand and gravel layer was encountered within the lower portion of the

4. SUBSOIL CONDITIONS:

4.3) Fine Sand to Silt: (cont'd.) ...

stratum, about elevation 863. The overall thickness of the deposit varied between 15 and 21 ft. Typical grain-size distribution curves are plotted on Fig. No. 2 in the Appendix of the report.

Standard penetration resistance tests carried out within the stratum, gave 'N' values ranging from 9 to 43 blows per foot. These results indicate that the relative density varies from loose to dense, generally being in the compact range.

4.4) Glacial Till (Clayey Silt with Some Sand and Traces of Gravel):

Underlying the granular fine sand to silt stratum is a cohesive glacial till deposit (some 16 to 22 ft. thick), composed of clayey silt with some and traces of gravel. The 'N' values ranged from 30 to 116 blows per foot, indicating a hard consistency.

The physical properties of the glacial till summarized below, are plotted on the Record of Borelog sheets, the Plasticity Chart - Fig. No. 4, and the Grain-Size Distribution Curves - Fig. No. 3.

Moisture Content	12% - 20%
Liquid Limit	18% - 31%
Plastic Limit	12% - 17%

Grain-Size Distribution -

- Gravel	1% - 8%
- Sand	4% - 14%
- Silt	41% - 72%
- Clay	23% - 37%

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

4.5) Silt to Sand with Traces of to Some Gravel:

Underlying the glacial till deposit is an extensive stratum of silt to sand with traces of gravel. The borings were terminated within this deposit after penetrating to a depth of 16 to 31 ft. In B.H.'s #1 and 3 below elevation 823 and 827 respectively, boulders up to 1 ft. in size were encountered throughout the deposit. Typical grain-size distribution curves for the silt to sand deposit are plotted on Figure No. 2. 'N' values, obtained within this stratum, ranged from 61 to over 100 blows per foot, indicating that the relative density is very dense.

5. GROUNDWATER CONDITIONS:

Groundwater level observations were made in the open holes during the period of the investigation. These observations which are recorded on the borelog sheets and summarized on Drawing 69-F-22A, indicate that the groundwater level, during the period of the investigation, was about elevation 881 to 882, or some 1 to 5 ft. below ground level.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

It is proposed to construct a 40-ft. wide, three-span overhead structure (40'-40'-40') at the crossing of Hwy. #7 - (Line 'E') and the C.N.R. tracks. The centre-line of the highway will have the same alignment as the existing highway at this site. The proposed profile grade will be about elev. 914 with approach fill heights in the order of 27 to 30 ft.

The subsoil at the site, generally consists of a 15 to 21 ft. layer of compact fine sand to silt, followed by a 16 to 22 ft. deposit of hard glacial till (clayey silt with some sand and traces of gravel) which, in turn, is underlain by a very dense silt to sand with some gravel at least 31 ft. thick. In certain areas

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

6.1) General: (cont'd.) ...

the natural overburden was overlain by roadway fill material some 7 to 8 ft. thick.

6.2) Structure Foundations:

The subsoil conditions are not favourable for a spread footing type of foundation at a relatively shallow depth. It is recommended, therefore, that the entire structure be supported on end-bearing steel H-piles driven to practical refusal within the lower dense to very dense granular deposits. The allowable capacity of the pile will be dependent on the pile section chosen - for example, 12 BP 73 steel H-piles may be designed for an allowable load of 90 tons per pile. Pile driving, during construction, should be controlled by the use of the Hiley formula, as per current D.H.O. Standards DD-1218 and DD-1219. For estimating purposes, it can be assumed that the piles will meet refusal at approximate elev. 835 - elev. 825. A temporary dewatering scheme may be required if pile caps are situated below groundwater level in granular subsoil.

6.3) Approach Embankments:

No stability problems are anticipated for the proposed approach fills with standard slopes of 2 horizontal to 1 vertical. No settlement problems are anticipated for the approach fills. Any settlement will be of an elastic nature and should take place during or immediately after construction.

7. MISCELLANEOUS:

The field work, performed during the period of April 16 to May 1, 1969, was supervised by Mr. H. Szymanski, Foundation Technician.

7. MISCELLANEOUS: (cont'd.) ...

The report was prepared by Mr. W. Hutton, Project Foundation Engineer.

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

Equipment used was owned and operated by Master Soil Investigations Ltd.

July 1969

APPENDIX 1

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 69-F-22 LOCATION Sta. 259 + 36.22' Rt. Line 'E' ORIGINATED BY HS
 W.P. 913-65-02 BORING DATE April 22, 1969 COMPILED BY SO
 DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					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		20	40	60	80	100	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE				
882.8	Ground Level														
0.0	Silt trace to some sand Compact		1	SS	17										
			2	SS	15										
			3	SS	15										
			4	SS	11										
			5	SS	9										
862.3	Sand & gravel layer		6	SS	36										
20.5	Clayey silt, some sand, trace of gravel Hard (Glacial Till)		7	SS	55										
			8	SS	30										
845.3			9	SS	75										
37.5	Sand trace of gravel Very dense		10	SS	70										
			11	SS	106										
			12	SS	84										
			13	SS	81										
			14	SS	100/2"										
817.8	(Boulders up to 1' in size)		15	AXT	20%										
65.0	End of Borehole														

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 69-F-22 LOCATION Sta. 258 + 20 12.5' Rt. Line 'E' ORIGINATED BY HS
 W.P. 913-65-02 BORING DATE April 29, 1969 COMPILED BY SO
 DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY *AK*

SOIL PROFILE		STRAT PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY Y P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	w_p	w	w_L		
886.9	Ground Level															
0.0	Fill Silty sand, trace of slay & gravel.		1	SS	4											
879.4	Loose		2	SS	6	880										6 50 39 5
7.3	Fine sand to silt Compact		3	SS	30											
			4	SS	12											0 7 90 3
			5	SS	11	870										0 13 80 7
			6	SS	14											
862.9	Clayey silt, some sand, trace of gravel Hard (Glacial Till)		7	SS	46	860										
24.0			8	SS	46											
			9	SS	92	850										
			10	SS	72											
841.6	Silt to sand, trace to some gravel Very dense		11	SS	88	840										0 58 36 6
45.3			12	SS	117											0 54 42 4
			13	SS	111	830										0 90 (10)
825.9			14	SS	95 1/2"											
61.0	End of Borehole					820										

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 69-F-22 LOCATION Sta. 250 + 76 20' Lt. Line 'E' ORIGINATED BY HS
 W.P. 913-65-02 BORING DATE April 25, 1969 COMPILED BY SO
 DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY HL

SOIL PROFILE		STRAT. PLOT	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		NUMBER	TYPE	BLOWS/FOOT		BLOWS/FOOT					SHEAR STRENGTH P.S.F.					WATER CONTENT % 10 20 30
							20	40	60	80	100	P.S.F.					
						○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE					w_p — w — w_L						
886.9	Ground Level																
0.0	Fill																
	Silty sand, trace of clay & gravel		1	SS	2												
878.7	Loose		2	SS	3	880									4 66 (30)		
8.2			3	SS	14												
	Fine sand to silt		4	SS	23												
	Compact		5	SS	23	870									0 69 30 1		
			6	SS	11												
863.9																	
23.0	Clayey silt, some sand, trace of gravel		7	SS	42	860											
	Hard		8	SS	85												
	(Glacial Till)		9	SS	160	850											
847.9																	
39.0			10	SS	61												
	Silt to sand, trace of some gravel		11	SS	156	840											
	Very dense		12	SS	139												
			13	S	103	830									0 99 (1)		
	Boulders up to 1' in size.		14	SS	75												
			15	SS	102 6"	820											
817.0			16	AXT	20%												
69.9	End of Borehole					810											

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

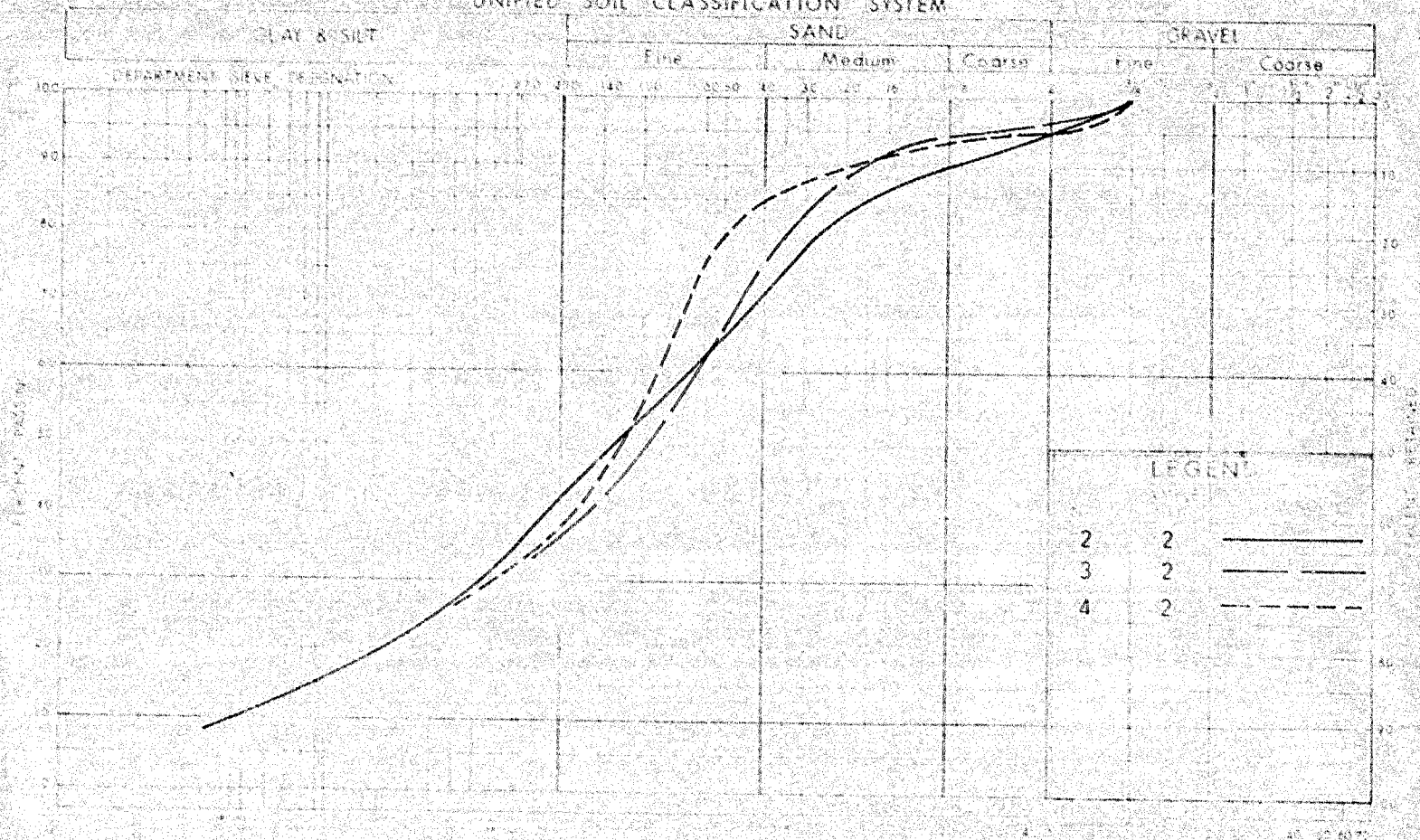
RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 69-F-22 LOCATION Sta. 257 + 87 18' Lt. Line 'E' ORIGINATED BY HS
 W.P. 913-65-02 BORING DATE April 17, 1969 COMPILED BY SO
 DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing CHECKED BY *HL*

SOIL PROFILE		STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.					WATER CONTENT %				
							○ UNCONFINED		+ FIELD VANE			● QUICK TRIAXIAL				
886.7	Ground Level															
0.0	Fill															
879.7	Silty sand, trace of clay and gravel.		1	SS	5											881.7
7.0	Loose		2	SS	7											5 59 32 4
	Fine sand to silt Compact		3	SS	43											
			4	SS	27											
			5	SS	16											
			6	SS	9											
			7	SS	20											
			8	SS	47											
863.7	Clayey silt, some sand, trace of gravel		9	SS	67											
23.0			10	SS	50											
			11	SS	116											
			12	SS	91											
847.7		Hard (Glacial Till)		13	SS	71										
39.0	Silt to sand Very dense															
			14	WS												
828.6			15	SS	174											0 95 (5)
58.1	End of Borehole															

UNIFIED SOIL CLASSIFICATION SYSTEM

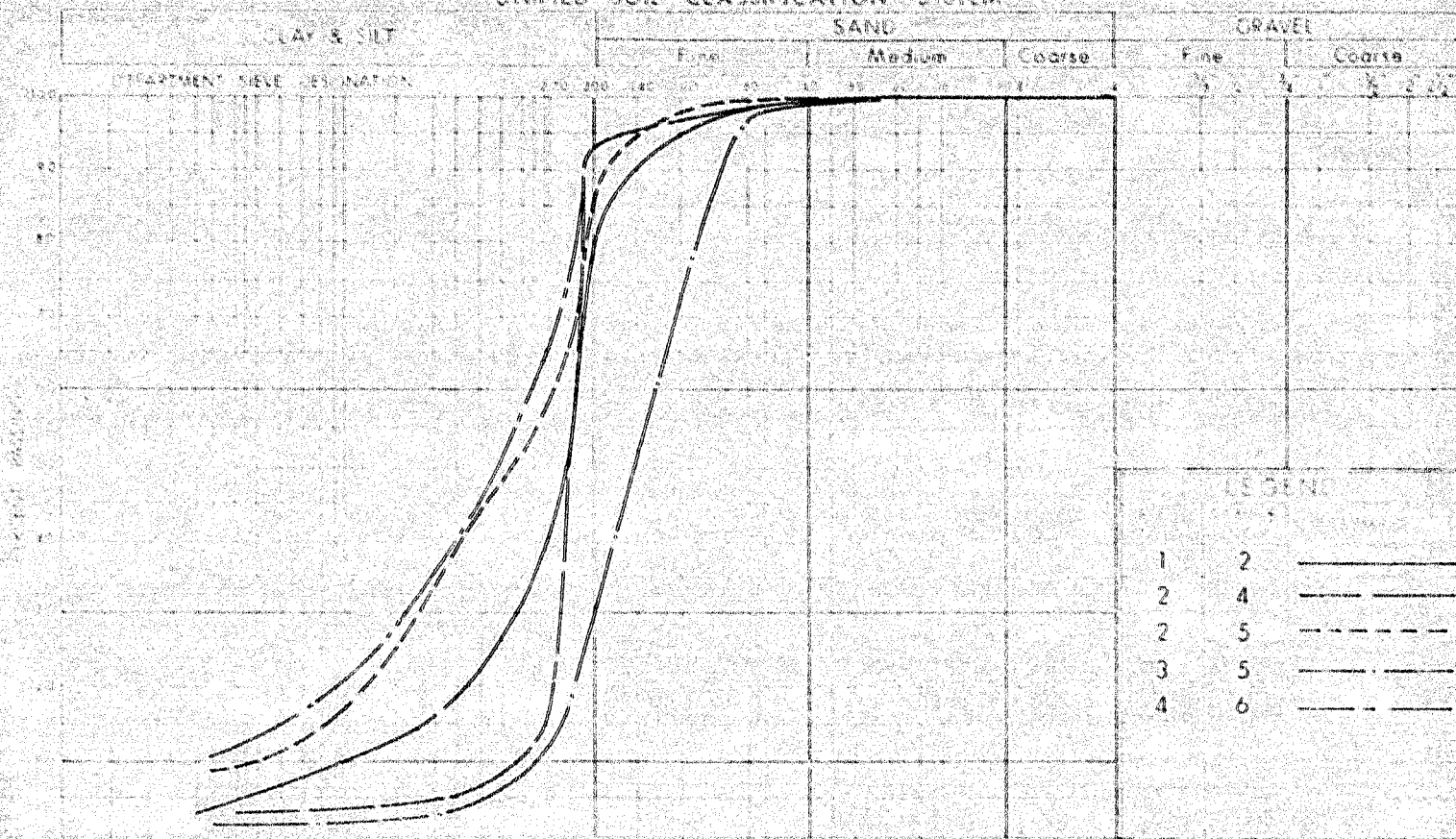


NATIONAL
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION
FILL

913-65-02
69-F-22
FIG 1

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION

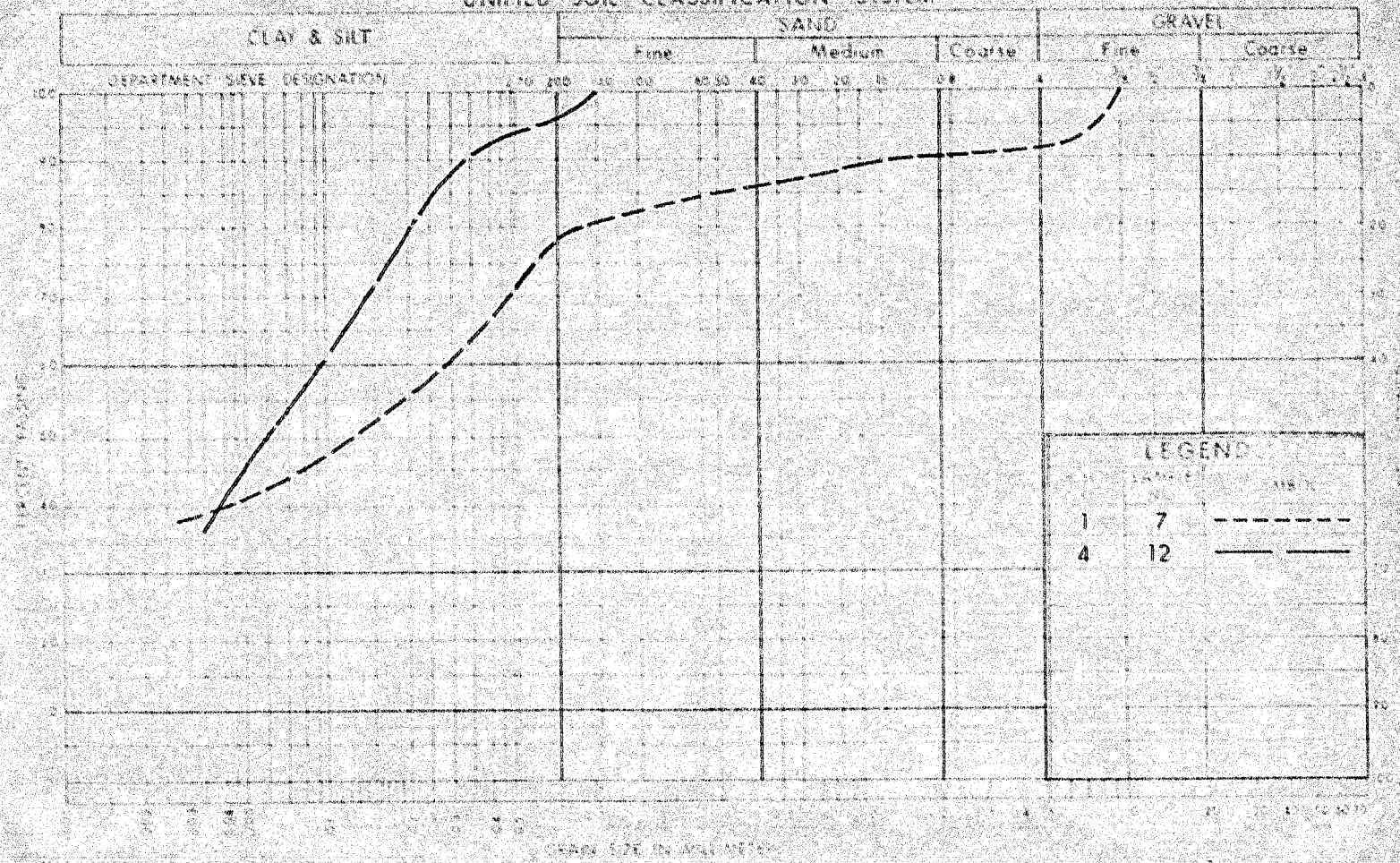
FINE SAND TO SILT

913-65-02

69-F-22

FIG. 2

UNIFIED SOIL CLASSIFICATION SYSTEM



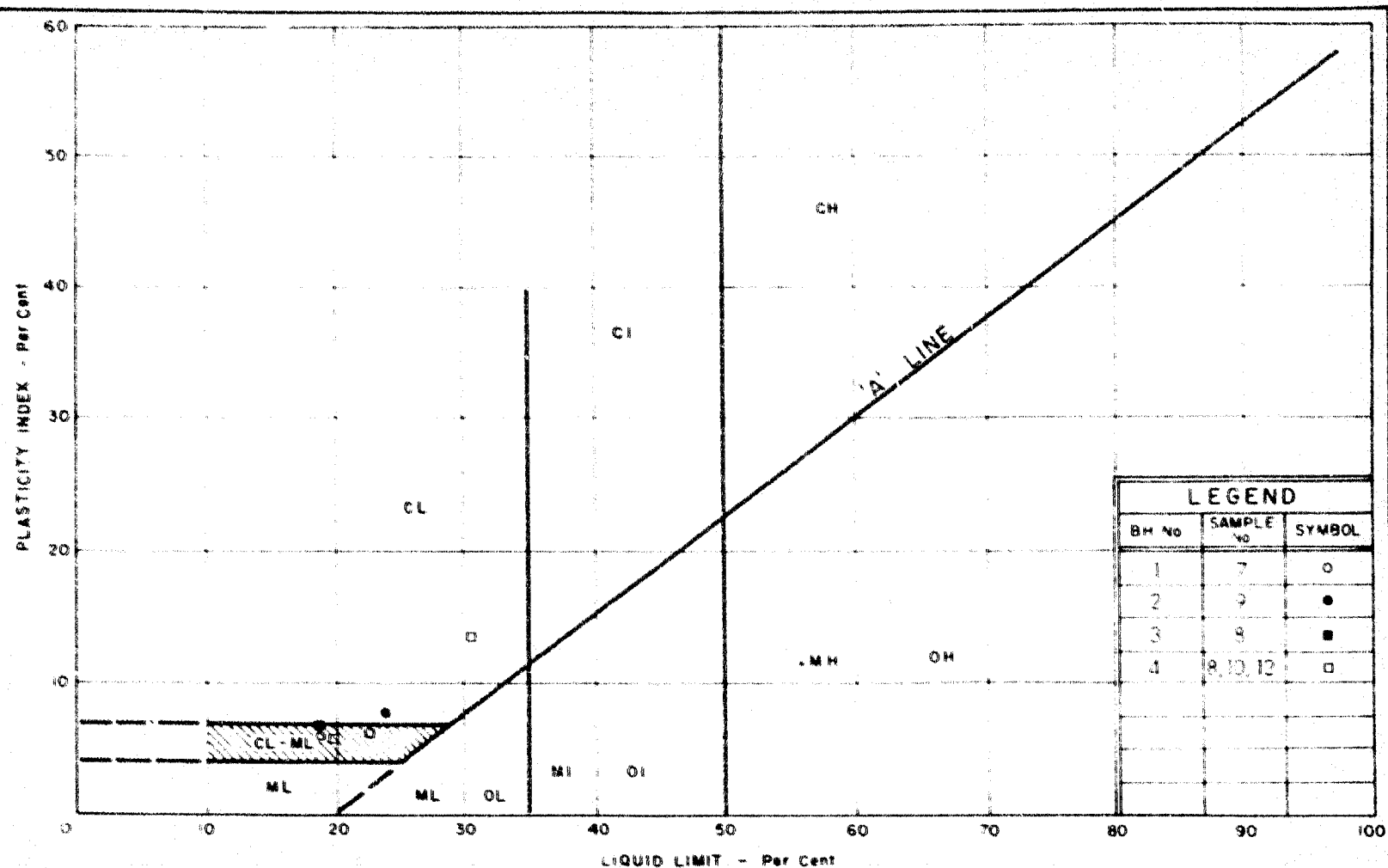
LEGEND	
1	7
4	12



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION
CLAYEY SILT
SOME SAND, TRACE OF GRAVEL
(GLACIAL TILL)

W.P. No. 913-65-02
JOB No. 69-F-22
FIG 3



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART
CLAYEY SILT
SOME SAND, TRACE OF GRAVEL
(GLACIAL TILL)

WP No. 913-65-02
JOB No. 69-F-22
FIG. 4

UNIFIED SOIL CLASSIFICATION SYSTEM

CLAY & SILT

SAND

GRAVEL

PERCENT PASSING

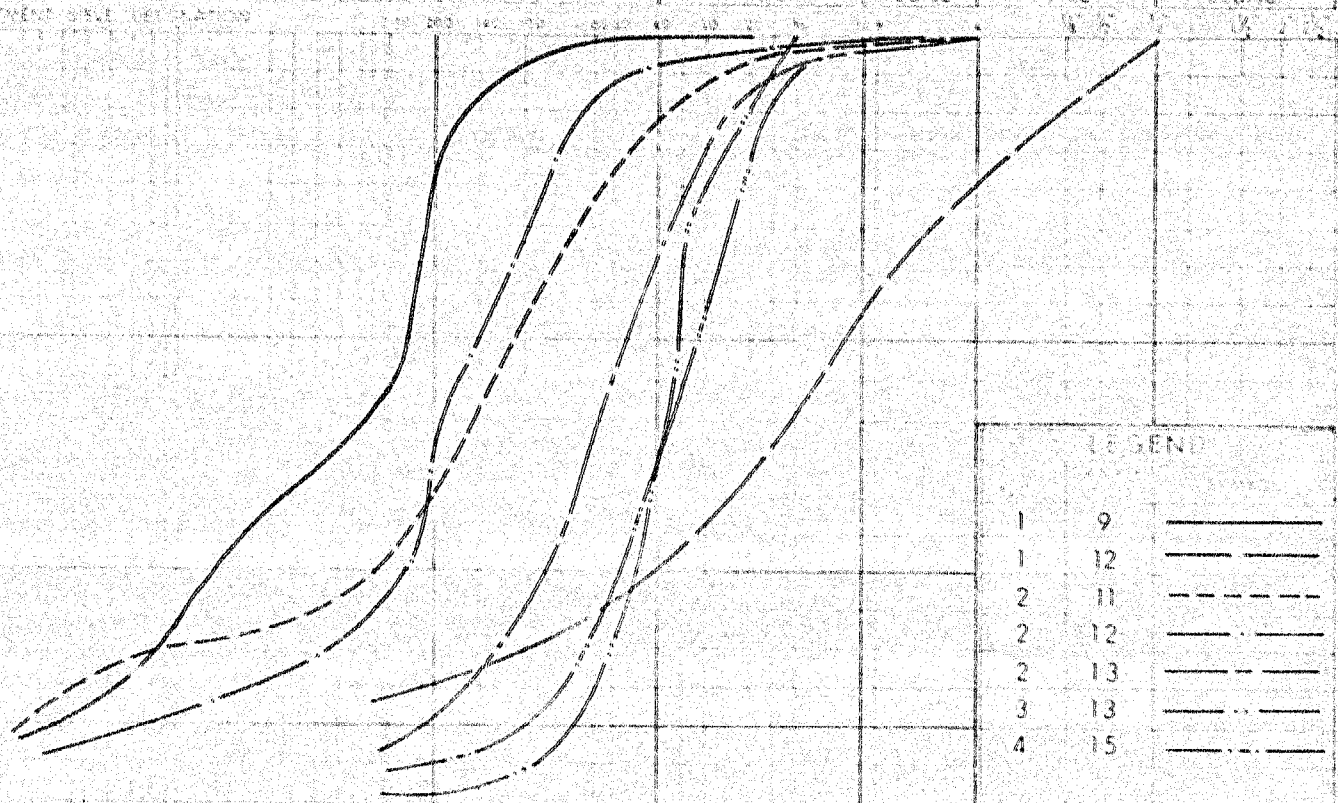
Fine

Medium

Coarse

Fine

Coarse



GRAIN SIZE DISTRIBUTION

SILT TO SAND

TRACE TO SOME GRAVEL

913-65-02

69-F-22

FIG 5

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

SS	SPLIT SPOON	TW	THINWALL OPEN
WS	WASHED SAMPLE	TP	THINWALL PISTON
SB	SCRAPER PISTON SAMPLE	OS	OESTERBERG SAMPLE
AS	AUGER SAMPLE	FS	FOIL SAMPLE
CS	CHUNK SAMPLE	RC	ROCK CORE
ST	SLOTTED TUBE SAMPLE		
	PH	SAMPLE ADVANCED HYDRAULICALLY	
	PM	SAMPLE ADVANCED MANUALLY	

SOIL TESTS

CU	UNCONFINED COMPRESSION	LIV	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	FV	FIELD VANE
QCU	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
QQ	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	SHEAR STRENGTH
c	EFFECTIVE COHESION
	INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c + \sigma' \tan \phi'$
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi_u$
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	$= 3.1416$
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e \sigma$ OR $\ln \sigma$	NATURAL LOGARITHM OF σ
$\log_{10} \sigma$ OR $\log \sigma$	LOGARITHM OF σ 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
λ	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

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

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

June 24, 1969

C.N.R. Overhead --
2 Mi. East of Onemee, Twp. of Emily,
Hwy. #7, District #7 (Port Hope)
W.J. 69-P-22 : Site 32-143 : W.P. 913-65-02

We have reviewed the Preliminary Bridge Drawing
No. D 6668-P1 for the above mentioned structure and submit
the following comment:

The piles should be driven to practical refusal
within the lower, very dense granular deposits, and the pile
driving should be controlled by the use of the Hiley Formula,
as per current D.H.O. Standards DD-1218 and DD-1219.

MD/wdeF

cc: Messrs. S. McCombie
W. S. Melnyshyn

Foundations Files ✓
Gen. Files

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

31D-42

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

*Copy
orig gone to micro
apr 10/74*

To: Mr. B. R. Davis,
Bridge Engineer,
Bridge Office,
Admin. Bldg.

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

Attention: Mr. S. McCombie

DATE: July 8, 1969

OUR FILE REF.

IN REPLY TO

JUL 10 1969

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For

Proposed Overhead Structure at the
Crossing of Hwy. #7 (Line 'E') and
The C.N.R., Lot 13, Concessions 3 & 4
District No. 7 (Port Hope)

W.J. 69-F-22 -- W.P. 913-65-02

cont 74-27



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 do not hesitate to contact our Office.

AGS/MdeF
Attach.

cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
G. K. Hunter (2)
D. P. Collins
W. S. Melinyshyn
T. J. Kovich
E. A. Singh

Foundations Files
Gen. Files

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

TABLE OF CONTENTS

1. INTRODUCTION.
 2. DESCRIPTION OF THE SITE AND GEOLOGY.
 3. FIELD AND LABORATORY WORK.
 4. SUBSOIL CONDITIONS:
 - 4.1) General.
 - 4.2) Fill Material.
 - 4.3) Fine Sand to Silt.
 - 4.4) Glacial Till (Clayey Silt with Some Sand and Traces of Gravel).
 - 4.5) Silt to Sand with Traces of to Some Gravel.
 5. GROUNDWATER CONDITIONS.
 6. DISCUSSION AND RECOMMENDATIONS:
 - 6.1) General.
 - 6.2) Structure Foundations.
 - 6.3) Approach Embankments.
 7. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT
For
Proposed Overhead Structure at the
Crossing of Hwy. #7 (Line 'E') and
The C.N.R., Lot 13, Concessions 3 & 4
District No. 7 (Port Hope)
W.J. 69-F-22 -- W.P. 913-65-02

1. INTRODUCTION:

The Foundation Section was requested to carry out an investigation at the site of the crossing of the C.N.R. tracks and Hwy. #7, Twp. of Emily, County of Victoria. The request was contained in a memo from the Bridge Planning Section - (Mr. W. S. Melinyshyn, Regional Bridge Location Engineer), dated April 2, 1969.

An investigation was subsequently carried out by this Section to determine the subsoil conditions at the site. This report contains the results of the investigation, together with our recommendations pertaining to the design of foundations and stability of approaches for the proposed structure.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located about 2 miles east of the Village of Omamee, where Hwy. #7 crosses a single C.N.R. track at a level crossing. Hwy. #7 is a two-lane, paved highway with associated gravel shoulders. The existing highway is elevated above the surrounding terrain. Shallow ditches some 5 ft. deep are located along either side of the roadway. The C.N.R. tracks are carried on an embankment approximately 2 to 3 feet above the natural ground. Ditches also run along both sides of the embankment. The crossing is protected by a signal system.

The area in the immediate vicinity of the site is flat lying to gently undulating in relief between elevations 883 and 887. The surrounding land is presently being used for agricultural purposes.

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

Physiographically the site is situated in the "Peterborough Drumlin Field". Based on available geological information, it is known that this area is characterized by rolling glacial till plains on which numerous northeast to southwest tending drumlins have been superimposed. In addition, a few well defined eskers are present. The till is primarily composed of highly calcareous cohesive material, while unsorted granular soil is often encountered within the drumlins and eskers. The overburden, which is quite extensive in the vicinity of the site, is underlain by limestone bedrock of the Trenton Formation, Ordovician Period.

3. FIELD AND LABORATORY WORK:

A total of 4 boreholes was put down during the course of the field investigation. The borings were advanced by means of a conventional diamond drill rig adapted for soil sampling purposes. Three of the boreholes were accompanied by a dynamic cone penetration test.

Samples were recovered at required depths in a 2-inch split-spoon sampler which was hammered into the soil in accordance with the specifications for the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests.

The locations and elevations of the boreholes were surveyed in the field by personnel from the Central Region Engineering Surveys Section, and are shown on Drawing 69-F-22A, together with the estimated stratigraphical profile. All elevations in the report are referenced to a Geodetic datum.

All samples were visually examined and identified in the field and later in the laboratory. Laboratory tests were carried out on selected representative samples to determine the following physical properties:

Natural Moisture Contents
Atterberg Limits
Grain-Size Distributions

On completion of these tests, the various soil samples were classified as to type and consistency in accordance with the

3. FIELD AND LABORATORY WORK: (cont'd.) ...

Unified Soil Classification System (October 1963).

The results of the laboratory tests are plotted on the Record of Borelog sheets and summarized on the Figures in the Appendix of the report.

4. SUBSOIL CONDITIONS:

4.1) General:

Subsoil at the site generally consists of 15 to 21 ft. of fine sand to silt, followed by a 16 to 22 ft. thick glacial till (clayey silt, some sand, traces of gravel) deposit underlain by a silt to sand with some gravel stratum at least 31 ft. thick. In certain areas the natural overburden is overlain by roadway embankment fill some 7 to 8 ft. thick.

From ground level downwards, the different soil types encountered are described in detail as follows:

4.2) Fill Material:

In B.H.'s #2, 3 and 4 carried out on the shoulder of the existing road, up to 8 ft. of fill material was encountered. This material is predominantly a silty fine sand with a trace of clay and gravel. Occasional clayey silt zones were encountered within the fill and a thin layer of organic topsoil was observed at the boundary between the fill and the natural subsoil. Typical grain-size distribution curves for the fill material are plotted on Fig. No. 1.

Standard penetration resistance values, carried out within the fill, gave 'N' values ranging from 2 to 6 blows per foot, indicating that the fill material is not well compacted.

4.3) Fine Sand to Silt:

Underlying the fill material in B.H.'s #2, 3 and 4, or a thin layer of topsoil in B.H. #1, a granular deposit ranging from fine sand to silt was encountered. In B.H. #1 a 2-ft. sand and gravel layer was encountered within the lower portion of the

4. SUBSOIL CONDITIONS:

4.3) Fine Sand to Silt: (cont'd.) ...

stratum, about elevation 863. The overall thickness of the deposit varied between 15 and 21 ft. Typical grain-size distribution curves are plotted on Fig. No. 2 in the Appendix of the report.

Standard penetration resistance tests carried out within the stratum, gave 'N' values ranging from 9 to 43 blows per foot. These results indicate that the relative density varies from loose to dense, generally being in the compact range.

4.4) Glacial Till (Clayey Silt with Some Sand and Traces of Gravel):

Underlying the granular fine sand to silt stratum is a cohesive glacial till deposit (some 16 to 22 ft. thick), composed of clayey silt with some sand and traces of gravel. The 'N' values ranged from 30 to 116 blows per foot, indicating a hard consistency.

The physical properties of the glacial till summarized below, are plotted on the Record of Borelog sheets, the Plasticity Chart - Fig. No. 4, and the Grain-Size Distribution Curves - Fig. No. 3.

Moisture Content	12% - 20%
Liquid Limit	18% - 31%
Plastic Limit	12% - 17%

Grain-Size Distribution -

- Gravel	1% - 8%
- Sand	4% - 14%
- Silt	41% - 72%
- Clay	23% - 37%

- 5 -

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

4.5) Silt to Sand with Traces of to Some Gravel:

Underlying the glacial till deposit is an extensive stratum of silt to sand with traces of gravel. The borings were terminated within this deposit after penetrating to a depth of 16 to 31 ft. In B.H.'s #1 and 3 below elevation 823 and 827 respectively, boulders up to 1 ft. in size were encountered throughout the deposit. Typical grain-size distribution curves for the silt to sand deposit are plotted on Figure No. 2. 'N' values, obtained within this stratum, ranged from 61 to over 100 blows per foot, indicating that the relative density is very dense.

5. GROUNDWATER CONDITIONS:

Groundwater level observations were made in the open holes during the period of the investigation. These observations which are recorded on the borelog sheets and summarized on Drawing 69-F-22A, indicate that the groundwater level, during the period of the investigation, was about elevation 881 to 882, or some 1 to 5 ft. below ground level.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

It is proposed to construct a 40-ft. wide, three-span overhead structure (40'-40'-40') at the crossing of Hwy. #7 - (Line 'E') and the C.N.R. tracks. The centre-line of the highway will have the same alignment as the existing highway at this site. The proposed profile grade will be about elev. 914 with approach fill heights in the order of 27 to 30 ft.

The subsoil at the site, generally consists of a 15 to 21 ft. layer of compact fine sand to silt, followed by a 16 to 22 ft. deposit of hard glacial till (clayey silt with some sand and traces of gravel) which, in turn, is underlain by a very dense silt to sand with some gravel at least 31 ft. thick. In certain areas

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

6.1) General: (cont'd.) ...

the natural overburden was overlain by roadway fill material some 7 to 8 ft. thick.

6.2) Structure Foundations:

The subsoil conditions are not favourable for a spread footing type of foundation at a relatively shallow depth. It is recommended, therefore, that the entire structure be supported on end-bearing steel H-piles driven to practical refusal within the lower dense to very dense granular deposits. The allowable capacity of the pile will be dependent on the pile section chosen - for example, 12 BP 73 steel H-piles may be designed for an allowable load of 90 tons per pile. Pile driving, during construction, should be controlled by the use of the Hiley formula, as per current D.H.O. Standards DD-1218 and DD-1219. For estimating purposes, it can be assumed that the piles will meet refusal at approximate elev. 835 - elev. 825. A temporary dewatering scheme may be required if pile caps are situated below groundwater level in granular subsoil.

6.3) Approach Embankments:

No stability problems are anticipated for the proposed approach fills with standard slopes of 2 horizontal to 1 vertical. No settlement problems are anticipated for the approach fills. Any settlement will be of an elastic nature and should take place during or immediately after construction.

7. MISCELLANEOUS:

The field work, performed during the period of April 16 to May 1, 1969, was supervised by Mr. H. Szymanski, Foundation Technician.

7. MISCELLANEOUS: (cont'd.) ...

The report was prepared by Mr. W. Hutton, Project Foundation Engineer.

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

Equipment used was owned and operated by Master Soil Investigations Ltd.

July 1969

APPENDIX I

OVERSIZED DRAWINGS

record of B.H. 1
2
3
H

CLAY & SILT

SAND

GRAVEL

Fine

Medium

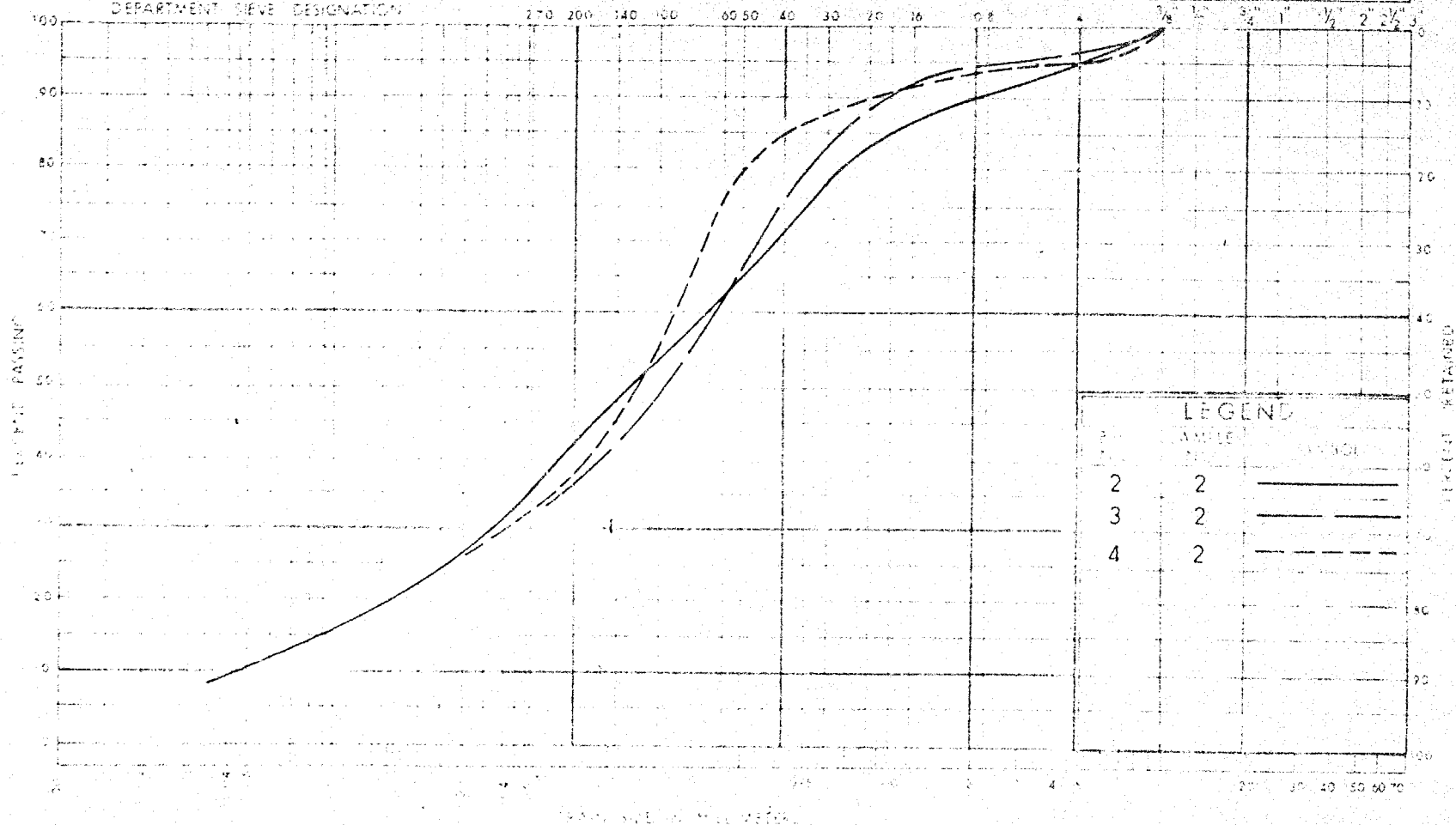
Coarse

Fine

Coarse

DEPARTMENT SIEVE DESIGNATION

270	200	140	100		60	50	40	30	20	10	0°		$\frac{3}{8}$ "	$\frac{1}{2}$ "	$\frac{3}{4}$ "	1"	$\frac{1}{2}$ "	2"	$2\frac{1}{2}$ "	3"
-----	-----	-----	-----	--	----	----	----	----	----	----	----	--	-----------------	-----------------	-----------------	----	-----------------	----	------------------	----



張

RESEARCH DIVISION
MATERIALS DIVISION
TESTING DIVISION
DESIGN DIVISION

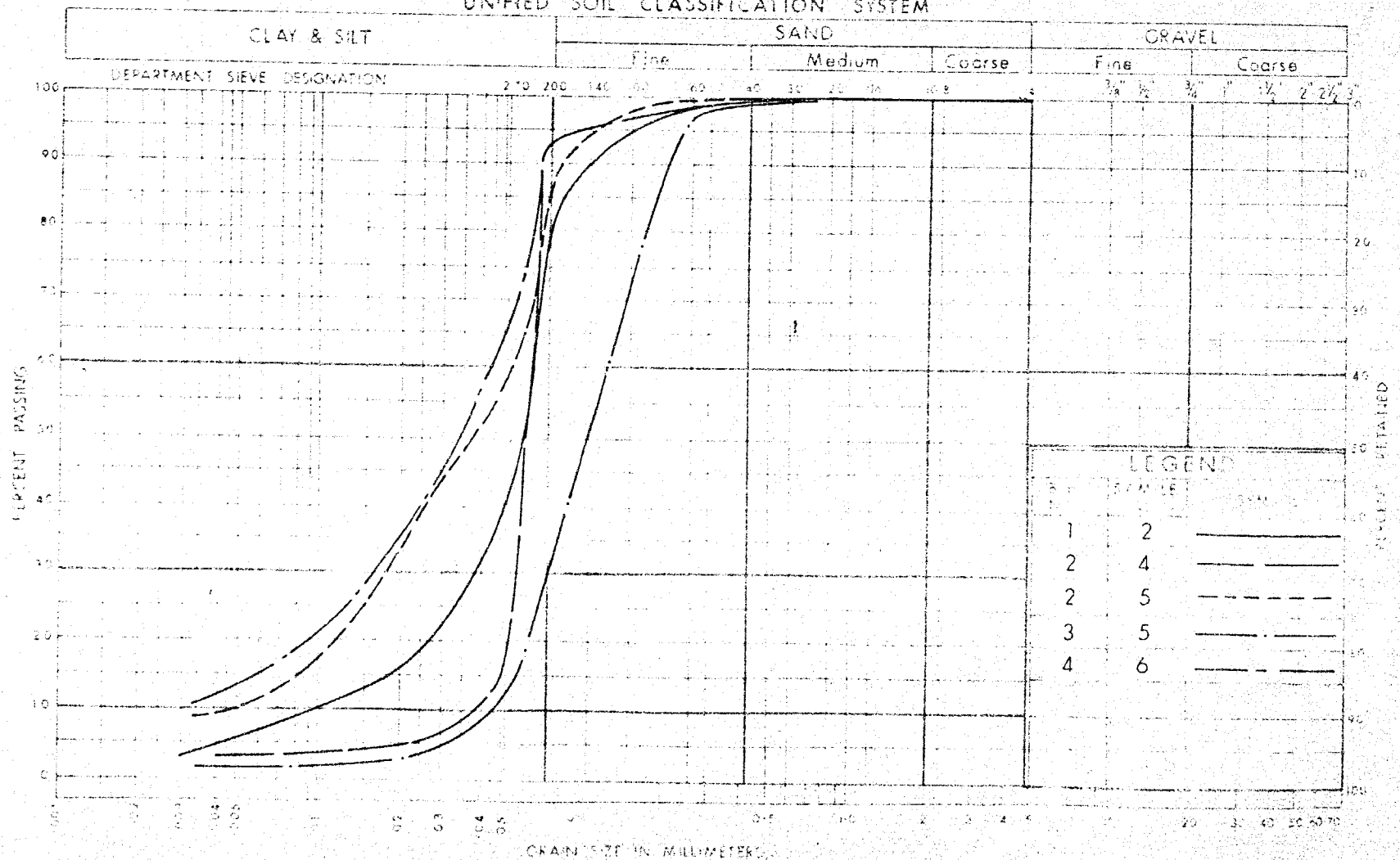
GRAIN SIZE DISTRIBUTION

913 - 65 - 02

69-F-22

FIG. 1

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION

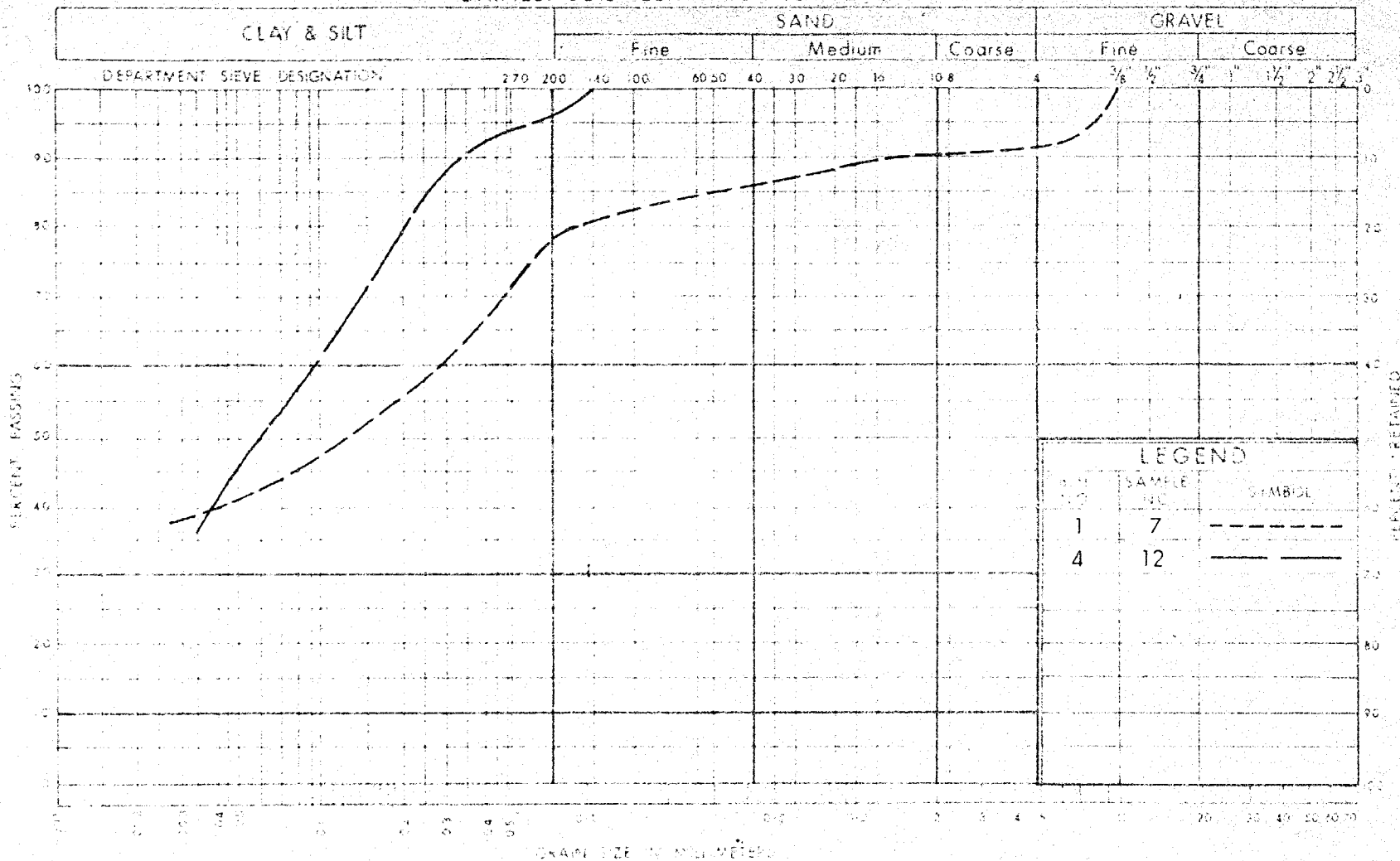
FINE SAND TO SILT

WP. No. 913-65-02

JOB No. 69-F-22

FIG. 2

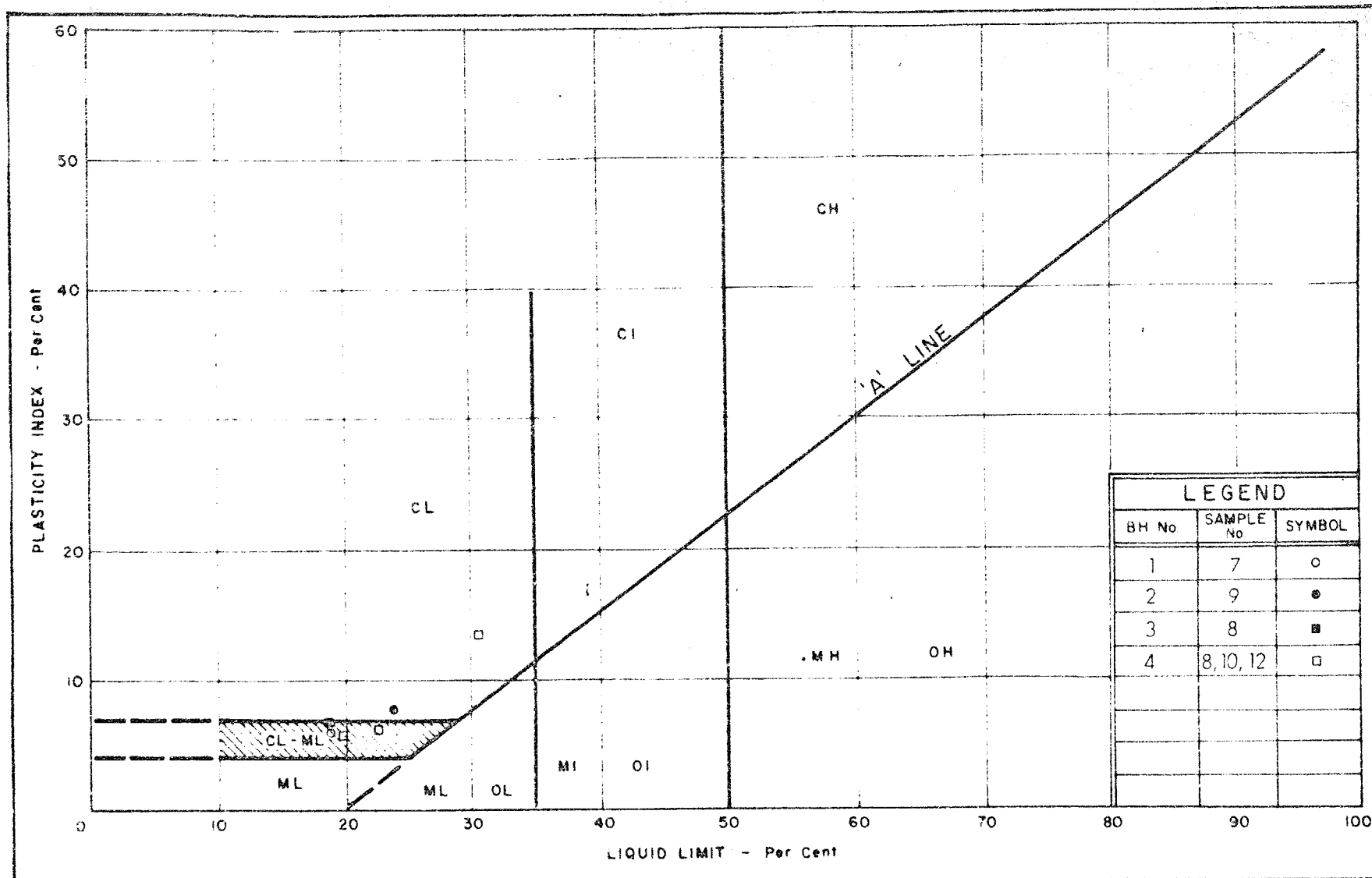
UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS AND
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION
CLAYEY SILT
SOME SAND, TRACE OF GRAVEL
(GLACIAL TILL)

W.P. No. 913-65-02
JOB No. 69-F-22
FIG 3

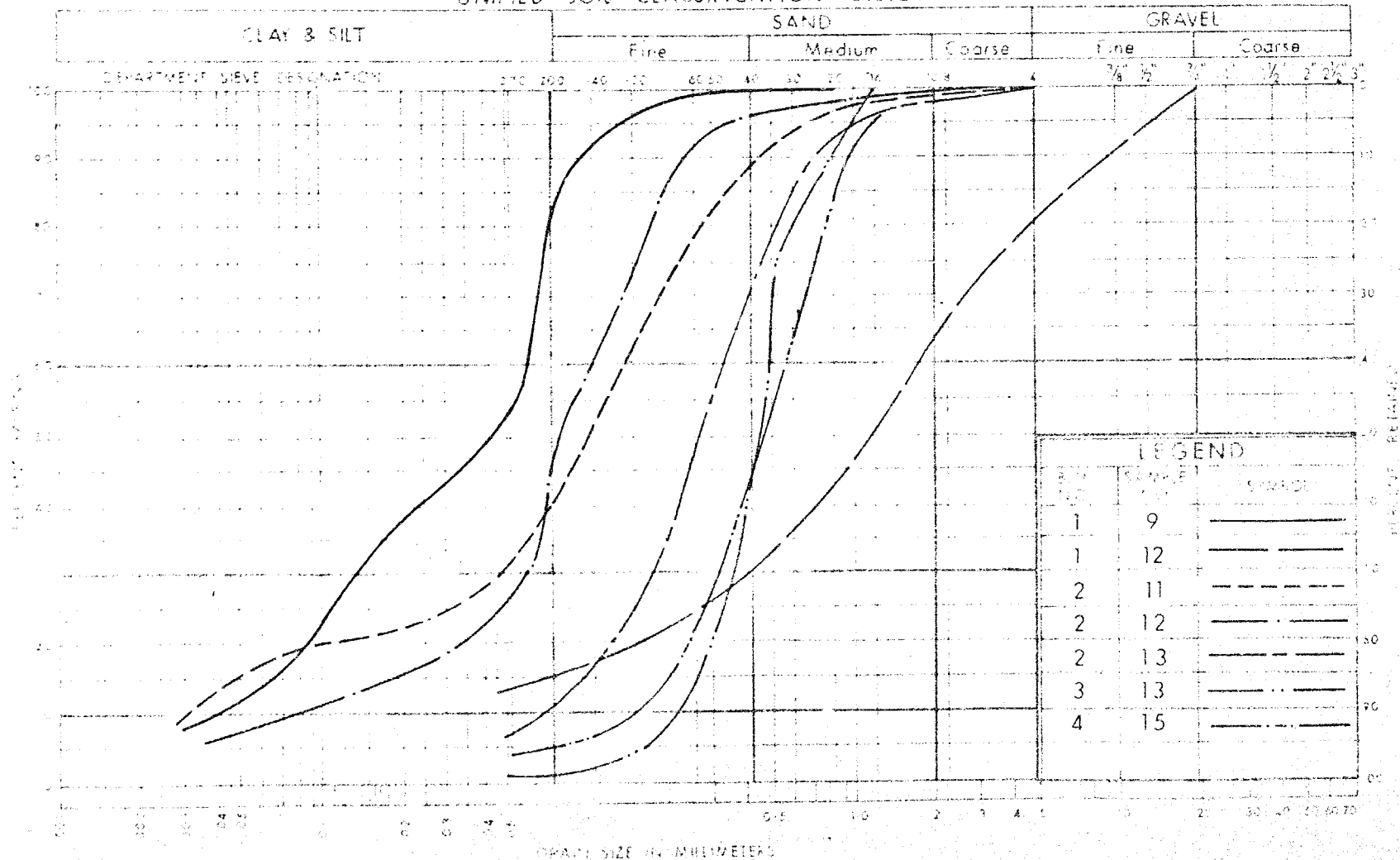


DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART CLAYEY SILT SOME SAND, TRACE OF GRAVEL (GLACIAL TILL)

WP No. 913-65-02
JOB No. 69-F-22
FIG. 4

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS AND
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION
SILT TO SAND
TRACE TO SOME GRAVEL

W.P. No. 913-65-02
JOB No. 69-F-22
FIG. 5

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. / 50 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

SS	SPLIT SPOON	TW	THINWALL OPEN
WS	WASHED SAMPLE	TP	THINWALL PISTON
SB	SCRAPER BUCKET SAMPLE	OS	OESTERBERG SAMPLE
AS	AUGER SAMPLE	FS	FOIL SAMPLE
CS	CHUNK SAMPLE	RC	ROCK CORE
ST	SLOTTED TUBE SAMPLE		
	PH	SAMPLE ADVANCED HYDRAULICALLY	
	PM	SAMPLE ADVANCED MANUALLY	

SOIL TESTS

Qu	UNCONFINED COMPRESSION	LV	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	FV	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	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	$= 3.1416$
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
$\bar{\sigma}$	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

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

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

June 24, 1969

C.N.R. Overhead --
2 Mi. East of Oransee, Twp. of Emily,
Hwy. #7, District #7 (Port Hope)
M.J. 69-P-22 : Site 32-143 : W.P. 913-65-02

We have reviewed the Preliminary Bridge Drawing
No. D 6668-P1 for the above mentioned structure and submit
the following comment:

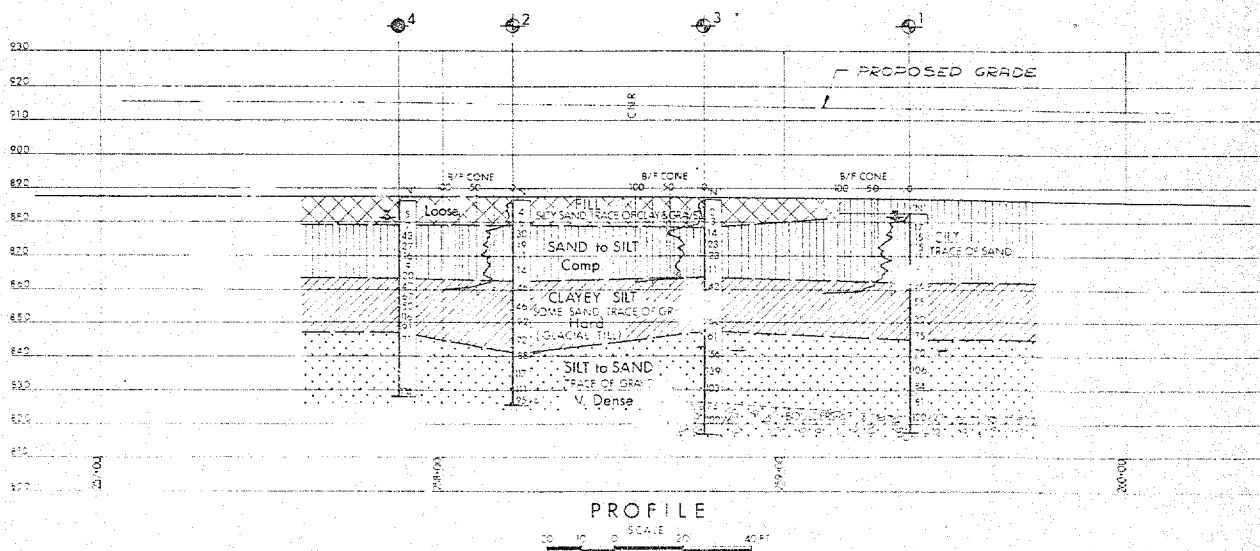
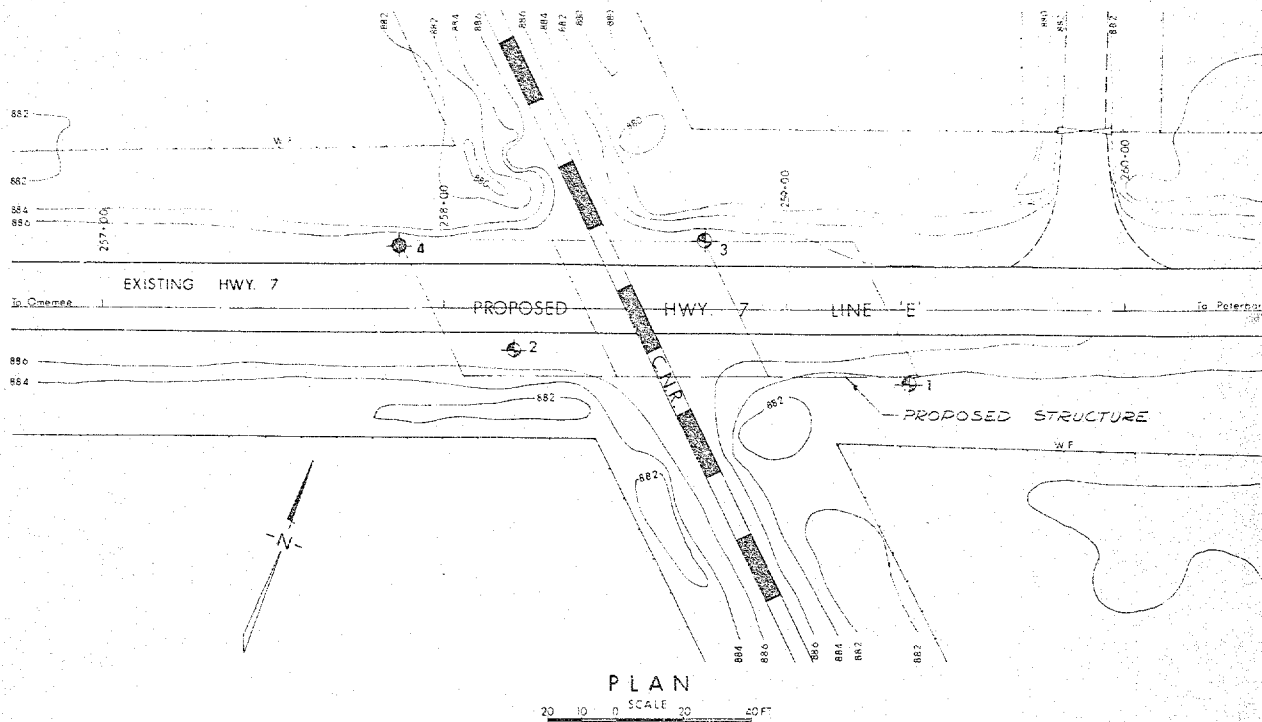
The piles should be driven to practical refusal
within the lower, very dense granular deposits, and the pile
driving should be controlled by the use of the Hiley Formula,
as per current D.H.C. Standards DD-1218 and DD-1219.

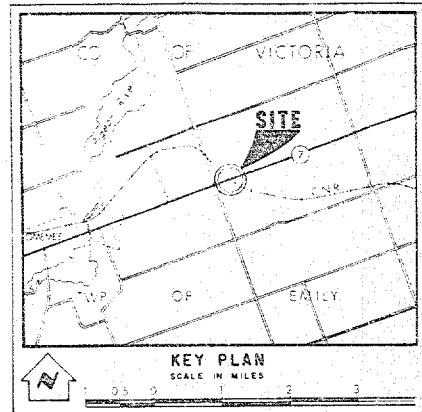
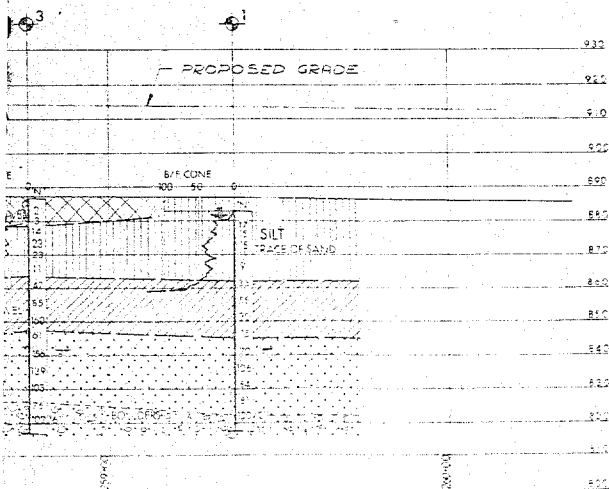
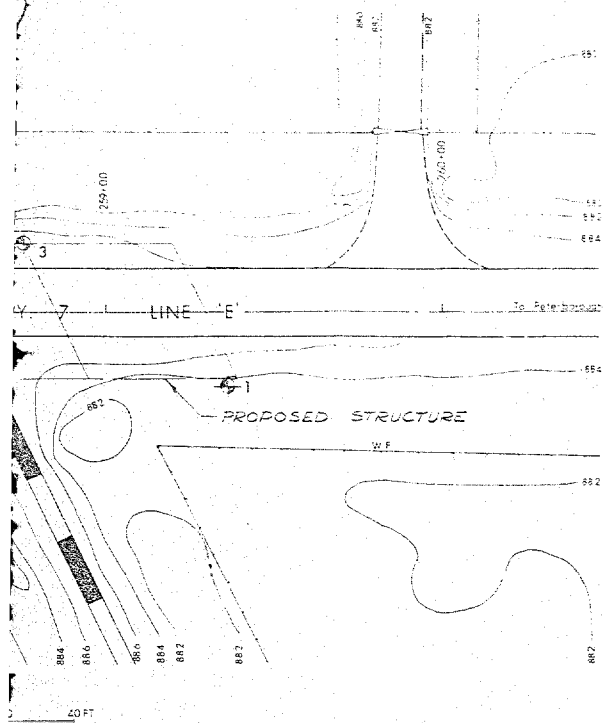
MD/mdeF

cc: Messrs. S. McCombie
W. S. Melnychyn

Foundations Files ✓
Gen. Files

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





LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation. APRIL 1969		

NO.	ELEVATION	STATION	OFFSET
1	882.8	259+36	22' RT
2	886.9	258+20	12.5' RT.
3	886.9	258+76	20' LT.
4	886.7	257+87	18' LT.

- 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.

REVISIONS	DATE	BY	DESCRIPTION

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

CANADIAN NATIONAL RAILWAY
(2 MILES EAST OF OMBEECE)

KING'S HIGHWAY NO. 7 LINE 'E' DIST. NO. 7
CO. VICTORIA
TWP. EMILY LOT 13 CON. 3 & 4

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD - 5	CHECKED -	WP NO. 913-10-100	M.B.T. DRAWING NO.
DRAWN - 10	CHECKED -	JOB NO. 69-F-22	69-F-22A
DATE 22 MAY 1969	SITE NO.		BRIDGE DRAWING NO.
APPROVES <i>[Signature]</i>	CONT NO.		

Mr. J.H. Peer,
District Engineer,
District 7, Port Hope.

Construction office,
Third Floor, Central Bldg.

Mr. J.J. MacNamee,
Construction Engineer.

December 6, 1974.

Contract 74-27, W.P. 913-65-92, C.N.R. O'Head
near Omamee, Site 32-143, Hwy. 7, District 7.

This will confirm verbal recommendation of December
3, 1974, given to Mr. J. McCulloch of your field
office regarding the piling for the above bridge.

During driving of the 12 BP 74 piles (50' long) for
Pier No. 2, the contractor was getting only 5 blows/
inch using a D 12 Diesel Hammer. Since 5 blows/inch
is insufficient to achieve the design load of 95 tons,
it was recommended that an additional length be spliced
on and driven a further 15' or to an acceptable
resistance of 16 blows/inch whichever occurred first.

We were advised by Mr. McCulloch that resistance of
16 blows/inch was obtained at the 71 foot level
(additional 11') not only on the first pile that
was driven on a trial basis but also on the remainder
of the piles. The two piles at the northwest corner
which met resistance of 10 blows/inch at the 60'
level will be acceptable without any further splicing
and driving.

We have made arrangements with Mr. R. Howe of the
Structural office, to have approximately 528 linear
feet of additional 12 BP 74 piling (44 piles @ 12'
= 528') ordered and shipped to the site from Central
Stores in Downsview.

W. J. MacNamee
W.J. MacNamee,
Regional Construction Engineer,
Structures.

WJM/SC

c.c. B.R. Davis
R. Howe



Mr. H. Jove,
Structural Materials Officer,
Structural Office.

Construction Office,
Third Floor, Central Bldg.


December 6, 1974.

Contract 74-27, W.P. 913-65-02, C.N.R. O'Head
near Omance, Site 32-143, Hwy. 7, District 7.

This will confirm our telephone conversation of
5th December 1974, regarding the piling for the
above bridge.

Could you please arrange to have approximately 528
lineal feet of 12 HP 74 steel piling ordered and
delivered from Central Stores. Each length of pile
should approximate a multiple of 12 ft.

Please refer to your copy of our memo dated 6th
December, 1974 for further details.


W.T. Hashizume,
Regional Construction Engineer,
Structures.

WTH/JC

C.C. D.R. Davis ✓
J.H. Peck

MEMORANDUM

TO: Mr. J.H. Peer,
District Engineer,
District 7, Port Hope.

FROM: Construction office,
Third Floor, Central Bldg.

ATTENTION: Mr. J.J. MacNamee,
Construction Engineer.

DATE: December 6, 1974.

OUR FILE REF: IN REPLY TO

SUBJECT:

Contract 74-27, W.P. 913-65-02, C.N.R. O'Head
near Omemee, Site 32-143, Hwy. 7, District 7.

This will confirm verbal recommendation of December 3, 1974, given to Mr. J. McCulloch of your field office regarding the piling for the above bridge.

During driving of the 12 BP 74 piles (60' long) for Pier No. 2, the contractor was getting only 5 blows/inch using a D 12 diesel hammer. Since 5 blows/inch is insufficient to achieve the design load of 95 tons, it was recommended that an additional length be spliced on and driven a further 15' or to an acceptable resistance of 16 blows/inch whichever occurred first.

We were advised by Mr. McCulloch that resistance of 16 blows/inch was obtained at the 71 foot level (additional 11') not only on the first pile that was driven on a trial basis but also on the remainder of the piles. The two piles at the northwest corner which met resistance of 10 blows/inch at the 60' level will be acceptable without any further splicing and driving.

We have made arrangements with Mr. K. Howe of the Structural office, to have approximately 528 linear feet of additional 12 BP 74 piling (44 piles @ 12' = 528') ordered and shipped to the site from Central Stores in Downsview.

W.T. Hashizume
W.T. Hashizume,
Regional Construction Engineer,
Structures.

WTH/JC

c.c. B.R. Davis
K. Howe

1. Instructions were left at the site that if driving is not satisfactory (16 blows/in), Bill should be immediately informed.
2. There is a boulder stratum about 10' below the 60' long pile tips.
3. Rebound was already $\frac{1}{2}$ inch above 60' level. Therefore 16 blows would produce the necessary resistance.

Mr. J.H. Peer,
District Engineer,
District 7, Port Hope.

Construction Office,
Third Floor, Central Bldg.

Mr. J.J. MacNamee,
Construction Engineer.

December 6, 1974.

Contract 74-27, W.P. 913-65-92, C.M.R. O'Head
near Onemee, Site 32-143, Hwy. 7, District 7.

This will confirm verbal recommendation of December 3, 1974, given to Mr. J. McCulloch of your field office regarding the piling for the above bridge.

During driving of the 12 BP 74 piles (60' long) for Pier No. 2, the contractor was getting only 5 blows/inch using a D 12 diesel hammer. Since 5 blows/inch is insufficient to achieve the design load of 95 tons, it was recommended that an additional length be spliced on and driven a further 15' or to an acceptable resistance of 16 blows/inch whichever occurred first.

We were advised by Mr. McCulloch that resistance of 13 blows/inch was obtained at the 71 foot level (additional 11') not only on the first pile that was driven on a trial basis but also on the remainder of the piles. The two piles at the northwest corner which met resistance of 10 blows/inch at the 60' level will be acceptable without any further splicing and driving.

We have made arrangements with Mr. K. Howe of the Structural office, to have approximately 528 linear feet of additional 12 BP 74 piling (44 piles @ 12' = 528') ordered and shipped to the site from Central Stores in Downsview.

W.T. Hashizume
W.T. Hashizume
Regional Construction Engineer,
Structures.

WTH/RC

C.C. E.R. Davis ✓
K. Howe

FOUNDATIONAL REPORT
BY W. LUTTRELL
SUPERVISOR - M. DEWITT



Mr. M. Devata,
Supervising Engineer,
Soil Mechanics Section,
West Bldg., Downsview.

Soil Mechanics Section,
Geotechnical Office,
West Bldg., Downsview.

January 8th, 1975.

Contract 74-27 (W.P. 913-65-02),
C.N.R. O'Head, Omamee,
Site No. 32-143, Highway 7,
District #7, Port Hope.

Mr. B.R. Davis was kind enough to send me the attached copies of memos, each dated December 6th, 1974, from Mr. W.T. Hashizume to Mr. J.J. MacNamee and to Mr. K. Howe.

Mr. Hashizume was called in by the District Construction forces to comment on pile driving operations on the above contract. He has made some recommendations to the District and followed through with a material requisition for 528 additional feet of piling.

I would like to draw your attention to the fact that pile driving and installation appears to be controlled by the number of blows/inch on this Contract. If the Contractor had used a lighter drop hammer, the blows/inch might have been higher, or if he had used a heavier hammer than a D12, the blows/inch may have been even smaller than 5. I am therefore, hoping that some sort of pile driving formula was used in arriving at the decision to lengthen the piles. If the decision was not based on principles put forward by this Section in its reports, you should find out what alternate methodology is being used to control pile driving. It makes no sense on the one hand to recommend the Riley Formula, and then on the other to have it ignored, all within the same Ministry!

C. Mirza,
Head, Soil Mechanics Section.

CM/ma

c.c.	B.R. Davis	
	W.T. Hashizume	
	J.J. MacNamee	K.G. Selby
	A.E. McKim	Files
	A. Rutka	Documents



Memorandum

To: Mr. C. Mirza,
Head, Soil Mechanics Section,
Geotechnical Office.

From: Construction office,
Third Floor, Central Bldg.

Attention: Mr. M. Devata,
Supervising Foundation Engr.

Date: January 13, 1975.

Our File Ref.

In Reply to

Subject:

Contract 74-27, W.P. 913-65-02, C.N.R. Overhead near
Omeme, Site 32-143, Hwy. 7, District 7.

This will confirm our discussion of 9th January 1975
regarding my memo of December 6, 1974, to Mr. J.H. Peer,
District Engineer, Port Hope.

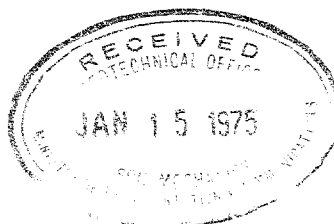
During the pile driving for Pier No. 2, the Contractor,
using a D12 diesel hammer, was getting only 5 blows/inch
at cut-off level. The measured rebound was approximately
0.3". The above data according to the Hiley Formula,
yields an ultimate bearing capacity of 160 tons. The
desired ultimate bearing capacity with a factor of safety
of 3 is 285 tons.

The tip of the 60' pile (battered 4:1) will be at elev.
823. According to the bore hole drawings, the pile tip
will be in the very dense silt to sand with boulders"
layer.

A decision had to be made here without unduly delaying
the contractor's operation. It was decided that an additional
length of pile (30') will be spliced and driven a further 15',
or to a resistance of 16 blows/inch whichever occurred first.
In the event the blow count was unsatisfactory at this 15'
level, this office was to be advised. With regard to driving
the pile an additional 15', it was my intention to assess the
set (blows/inch) and measured rebound (inches) at the 15'
level, and discuss the situation with your office.

Regarding the 16 blows/inch, the following are the reasons
why I considered the above to be acceptable regardless of
the amount of rebound.

- A. Using the Hiley Formula and D12 hammer, and to achieve
an ultimate of 285 tons, $S + C/2$ for a 90' long pile
should be a maximum of 0.163". The combination of S
and $C/2$ values will always be in excess of 0.163".



cont...../2

- B. On Contract 70-233, an 80' long HP 12 x 74 was driven with a D12. 16 blows/inch was registered. The same pile was re-driven with a drop hammer (hammer 10,000 lbs, drop height, 6 ft.) and found to have ultimate bearing capacity of 300 tons per the Hiley Formula.
- C. Highway Research Record No. 333, Pile Foundations. On page 29, a steel pile 120' long driven with Raymond 2-0 steam hammer achieves ultimate bearing capacity at 20 blows/inch according to the Hiley Formula. The same pile achieves ultimate bearing capacity of 300 tons at 3 to 6 blows/inch using the one dimensional wave theory.

Regarding the wave theory:

On page 23, Mosley and Raamot states as follows:

"It is the writer's opinion that, of the solutions currently available, this (wave-equation) one is the only reliable method for calculating the response of any particular cap block-cusion, pile, and soil system resulting from the impact of a pile hammer."



W.T. Hashizume,
Regional Construction Engineer,
Structures.

WTH/JC

c.c. B.R. Davis

Mr. C. Mirza,
Head, Soil Mechanics Section,
Geotechnical Office,
West. Bldg.

Construction office,
Third Floor, Central Bldg.

January 14, 1975.

Contract 74-27, C.N.R. Overhead at Omamee, Site 32-143,
W.P. 913-65-02, Highway 7, District 7.

I have received a copy of your memo to Mr. M. Devata concerning the use of some sort of pile driving formula to determine the blows/inch and therefore the length of the piles driven for this structure.

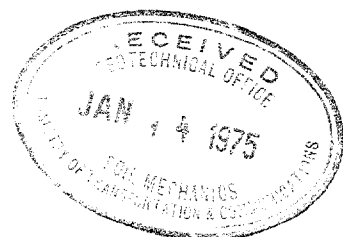
Structure drawing D 6668-11 includes standard number DD 1219, dated August 4, 1959, which is a chart of the Hiley Formula for steam and diesel hammers. In addition, Section 9.03.11 of M.T.C. Form 9 which is included in this contract says in part: "the bearing capacities of piles shall be estimated by the use of the Hiley formula according to Highway Standard..... DD 1219 for mechanical hammers".

I assure you that my staff and District Construction staff have the highest regard for the contract documents, and that the blows/inch on this and all contracts is controlled by the Hiley formula, interpreted by sound engineering judgement based on experience gained on many pile driving contracts.

While on the subject of pile driving I would like to draw your attention to an apparent conflict between Form 9 and the Hiley Formula.

Section 9.03.09 gives the minimum permissible weight of various kinds of hammers. However, hammers meeting these criteria do not always give meaningful results in the Hiley formula, especially with long, heavy piles. Attached are calculations indicating a negative refusal for A D12 hammer, a 95 ton capacity 12 BP 74 pile 84 ft. long, a rebound of 1/2 inch, and a factor of safety of 3.

cont...../2



We would be pleased to discuss this matter with you or your staff at your convenience, to determine if any action is required to eliminate this conflict.



A.E. McKim,
Asst. Construction Engineer,
Structures.

AEM/JC

c.c. B.R. Davis
J.J. McNamee
A. Rutka
M. Devata ✓
K. Selby

PILES 12 BP 1. 84' long Capacity 95 Tons. 192.15'

HAMMER D12

$$wh = 22,600 \text{ ft} = 135.6 \text{ ft}$$

$$\text{Ramt. } 2,750 \text{ ft}$$

$$\text{Helmet. } 500 \text{ ft}$$

HIKE FORMULA

$$R = \frac{n wh}{5 + \frac{c}{2}}$$

$$n = \frac{W + P}{W + P} = .36$$

$$W = (2,750 \div 2000) = 1.375$$

$$n = \frac{W + P}{W + P}$$

$$P = \frac{84 \times 74 + 500}{2000} = \frac{6216}{2000} = 3.108$$

$$C = .32 \quad C^2 = .102$$

$$285 = \frac{.36 \times 135.6}{5 + \frac{C}{2}}$$

$$5 + \frac{C}{2} = \frac{.36 \times 135.6}{285} = .17$$

$$C = .25" \quad S = .05 \text{ "/blow} = 20 \text{ blows/ft}$$

$$C = 0.50" \quad S = -.08 \text{ "/blow} = ?$$

A.E.H.
Jan. 14/75.

VISUAL CLASSIFICATION SHEET

PROJECT <u>60-5-22</u>		SITE _____		BOREHOLE No. <u>1</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								
1	0'-0" to 1'-0"	-	-	0	100	Nil	Nil	Quick	Nil	Earth Grey	Nil		Silt traces of sand	ML
2	1'-0" to 1'-6"	-	-	5	95	Nil	Nil	"	Nil	Earth Grey	"		Silt, traces of sand	ML
3	1'-6" to 1'-10"	-	-	20	80	Nil	Nil	"	"	"	"		Silt, Some Sand	ML
4				10	90	Nil	Nil	"	"	"	"			
5	1'-10" to 2'-0"	-	-	20	80	Nil	Nil	Quick	Nil	Earth Grey	Nil		Silt, Some Sand	ML
6	2'-0" to 2'-6"	Sub Angular	-	15	80	Med	Dull	Nil to Slow	Med	Earth Grey	"		Clayey Silt, Traces Gravel Some Sand	CL
7	2'-6" to 3'-0"	Sub Angular	-	10	90	"	"	"	"	"	"		Clayey Silt-Traces Gravel Some Sand	CL
8	3'-0" to 3'-6"	-	-	10	90	"	"	Slow	Low	"	"		Clayey Silt Traces Sand	CL
9	3'-6" to 3'-10"	-	-	10	90	Low	Dull	Quick	Low	"	"		Silt Traces 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:-

VISUAL CLASSIFICATION SHEET

PROJECT <u>69-F22</u>		SITE _____		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									
10		3/8"	Sub Round	5	85	10	1	1	Quick	-	Earthy Grey	Strong		Well Graded Sand Traces of Gravel & Fines	SW
11	45-46"				70	10	-	-	"	-	"	"		" " " " " " " "	SW
12	50-51"	2"	Sub Angular	10	70	20	1	1	"	-	"	"		" " " " " " Gravel Some Fines	SW
13	58-59"	3/8"	Sub Angular	5	70	25	-	-	"	-	"	"		Poorly Graded Fine Sand Traces Gravel Some Fines	SP

NOTES:- VISUAL CLASSIFICATION MUST BY 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 DIVISION

VISUAL CLASSIFICATION SHEET

PROJECT 69-122 SITE BOREHOLE No. 2 GROUND ELEVATION

SAMPLE No.	DEPTH	GRAIN SIZE DISTRIBUTION					DRY STRENGTH	SHINE	DIALTANCY	TOUGHNESS	ODOR	COLOUR	ACID TEST	CONSISTENCY OR UNDRAINED SHEAR STRENGTH	CLASSIFICATION WITH DESCRIPTION	SYMBOL
		LARGEST GRAIN SIZE	SHAPE	PERCENTAGE												
				GRAVEL	SAND	SILT & CLAY										
1	3-4 1/2"	3/4"	Sub Round	10	60	30	-	-	Quick	Nil	Drainage	Dark Brown	Strong		Poorly Graded Fine Sand Traces Gravel Some Fines	SP
2	6-7 1/2"	3/8"	Sub Round	5	50	45	Low	Nil	"	Nil	"	Brown	"		" " " " - Traces Gravel and Fines	SP
3	9-10 1/2"	#20	-	-	90	10	-	-	"	-	Fairly	Brown	"		Uniform Fine Sand Trace of Fines	SU
4	12-13 1/2"	#20	-	-	90	10	-	-	"	-	"	Grey	"		" " " " " "	SU
5	15-16 1/2"	#100	-	-	10	90	-	-	"	-	"	"	"		Silt Traces Sand	ML
6	20-21 1/2"	#100	-	-	"	"	-	-	"	-	"	"	"		" " "	ML
7	22-23 1/2"	#8			10	90	Med	Dull	Slow	Low	Fairly	Grey	"		Clayey Silt Traces Sand	CL
8	30-31 1/2"	#8			10	90	"	"	"	"	"	"	"		" " " "	CL
9	35-36 1/2"	#8			"	"	"	"	"	"	"	"	"		" " " "	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:-

DEPARTMENT OF HIGHWAYS — ONTARIO
MATERIALS AND TESTING DIVISION

VISUAL CLASSIFICATION SHEET

PROJECT 69-F22 SITE 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										
10	40-41"	-	-	10	90	Low	Dull	Slow to Quick	Low	Earthy	Grey	Strong		Silt to Clayey S.H. - Traces Sand	CL	
11	45-46"	#60	-	-	90	10	-	-	Quick	-	"	"	"	Uniform Fine Sand - Traces Fines	SV	
		#100		10	90	Med	Dull	Slow to Quick	Low	"	"	"	Clayey S.H. - Traces Sand	CL		
12	50-51"	#100	-	-	25	75	Low	None	Quick	Low	"	"	"	Silt - Some Sand	ML	
13	55-56"	#100	-	-	95	5	-	-	"	-	"	"	"	Uniform Medium Sand	SV	
14	60-61"	#14	Angular	70	20	10	-	-	"	-	"	"	"	Well Graded Gravel - Some Sand - Traces Fines	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:-

VISUAL CLASSIFICATION SHEET

PROJECT 69-F-22 SITE _____ 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										
1	3'-4 1/2'	1/2"	Angular	5	90	5	-	-	Quick	-	Slightly Organic	Brown	Strong		Poorly Graded Fine Sand / Traces Gravel & Fines	SP
2	6'-16'	1/2"	Sub-Round	5	80	15	-	-	"	-	"	"	"		" " " " to Med Sand / Traces Gravel Some Fines	SP
3	9'-10 1/2'	60	-	-	60	40	-	-	"	-	Earthy	"	"		Sand with silt	SF
4	12'-13 1/2'	60	-	-	60	40	-	-	"	-	"	"	"		" " "	SF
5	15'-16 1/2'	60	-	-	90	10	-	-	"	-	"	"	=		Uniform Fine Sand / Traces of Fines	SU
6	20'-21 1/2'	70	-	-	10	90	-	-	"	-	"	"	+		Silt Trace Sand	ML
7	25'-26 1/2'	14	-	-	15	85	Med	Dull	Med	Med	"	Grey	"		Clayey silt some sand	CL
8	30'-31 1/2'	100	-	-	10	90	"	"	"	"	"	"	"		" " Traces Sand	CL
9	35'-36 1/2'	100	-	-	10	90	Low	"	Quick	Low	"	"	"		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:—

VISUAL CLASSIFICATION SHEET

PROJECT 69 FRR SITE 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										
10	40'-41.5'	# 100	-	-	10	90	Low	Dull	Quick	Low	Earthy Grey	Strong		Silt Traces Sand	ML	
11	45'-46.5'	# 60	-	-	30	70	"	"	"	"	"	"		Silt with Sand	ML	
12	50'-55'	# 28	-	-	95	5	-	-	"	-	"	"		Poorly Graded Sand - Fine to Med	SP	
13	55'-56.5'	# 8	-	-	90	10	-	-	"	-	"	"		Poorly Graded - Fin to Med Sand - Traces Silt	SP	
14	60'-61.5'	# 28	-	-	90	10	-	-	"	-	"	"		Uniform Fine Sand - Traces Fines	SV	

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

REMARKS:-

VISUAL CLASSIFICATION SHEET

PROJECT 69-F-2-2 SITE BOREHOLE No. 4 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	3'-4.5'	# 8	Sub Angular	-	30	70	Low	Dull	Slow	Low	Earthy	Brown	Strong		Silt to Clayey Silt - Some Sand	
2	6'-7.5'	# 8	Sub Round	5	55	40	-	-	Quick	-	Slightly Angular	"	"		Fine Grained Uniform Sand and Silt	SF
3	8'-10.5'	# 100	-	-	60	40	-	-	"	-	Earthy	"	"		Very Uniform Sand and Silt.	SU
4	12'-13.5'	# 60	-	-	90	10	-	-	"	-	"	Grey	"		Very Uniform Sand - Traces of Silt	SU
5	15'-16.5'	# 100	-	-	15	85	-	-	"	-	"	"	"		Sandy Silt	ML
6	18'-19.5'	# 4	Angular	-	10	90	-	-	"	-	"	"	"		Sandy Silt	ML
7	21'-22.5'	# 4	"	-	10	90	-	-	"	-	"	"	"		"	ML
8	24'-25.5'	# 100	-	-	10	90	Low	Dull	Slow to Quick	Low	"	"	"		Clayey Silt - Traces Sand	CL
9	27'-28.5'	# 100	-	-	10	90	"	"	"	"	"	"	"		"	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:-

DEPARTMENT OF HIGHWAYS — ONTARIO
MATERIALS AND TESTING DIVISION

VISUAL CLASSIFICATION SHEET

PROJECT 69 F22 SITE BOREHOLE No. 4 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										
10	30-31.5	# 100	-	-	10	90	Low	Dull	Slow to Quick	Low	Earthy Grey	Strong			Clayey Silt. Traces Sand	CL
11	33-34.5	# 100	-	-	10	90	"	"	"	"	"	"			Clayey Silt. " "	CL
12	36-37.5	# 100	-	-	10	90	"	"	"	"	"	"			" " " "	CL
13	40-41.5	# 14	Sub Round	50	40	10	-	-	Quick	-	"	"	"		Well Graded Gravel. Traces of Fines	GW
14	50-55	# 20	-	-	95	5	-	-	"	-	"	"	"		Poorly Graded Med. Sand. Trace of Fines	SP
15	56-58	# 3/4	Sub Round	20	60	20	Low	-	Quick	-	"	Brown	"		Well Graded Sand. Some Gravel. Some Fines	SW

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

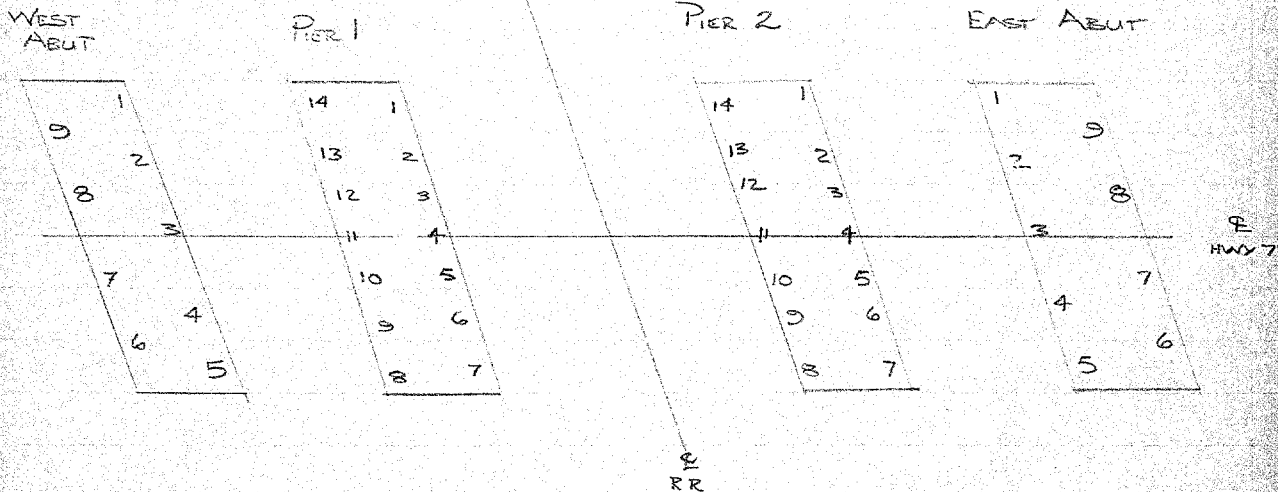
REMARKS:—

P.L.E. DRIVING

CONT 74-27

CHMEMEE

WP. 713-65-01, 02, 03



	LENGTH DRIVEN ft.	DESIGN LENGTH ft.
PIER 1	363°	340°
PIER 2	360°	340°
EAST ABUT.	845'	756°
WEST ABUT.	722 ⁵	756°
TOTAL	3490 ⁶	3192

DIFF. = 298.6 ft.

	Cut off ELEV.	LENGTH DRIVEN ft	BATTER	VERTICAL DISTANCE ft.	TIP ELEV	FINAL BLW/in	DESIGN LENGTH ft
WEST ABUT							
1	902.00	91.5	1:3½	88°	814°	22	84
2	902.0	58.6	1:3½	57.4	844.6	26	84
3	902.0	75.6	1:3½	72.7	829.3	21	84
4	902.0	90.6	1:3½	87.1	814.9	22	84
5	902.0	90.3	1:3½	86.1	815.1	21	84
6	902.0	88.3	1:10	87.9	814.1	21	84
7	902.0	87.3	1:10	86.8	815.2	24	84
8	902.0	52.3	1:10	52.0	850.0	28	84
9	902.0	87.0	1:10	86.6	815.4	21	84
TOTAL WEST ABUT		722.5					756°

PIER 1							
1	881.0	60	4:1	67°	814°	20	60
2	881.0	60	4:1	67°	814°	20	60
3	881.0	68	4:1	66.1	814.9	18	60
4	881.0	68	4:1	66.1	814.9	13	60
5	881.0	68	4:1	66.1	814.9	18	60
6	881.0	70	4:1	67.9	813.1	18	60
7	881.0	68	4:1	66.1	814.9	20	60
8	881.0	67	4:1	65.1	815.9	20	60
9	881.0	68	4:1	66.1	814.9	20	60
10	881.0	70	4:1	67.9	813.1	16	60
11	881.0	70	4:1	67.9	813.1	20	60
12	881.0	70	4:1	67.9	813.1	20	60
13	881.0	68	4:1	67.0	814.0	16	60
14	881.0	68	4:1	67.0	814.0	16	60
TOTAL PIER #1		963					840°

	Cut off Elev.	Length Driven ft	BATER	VERTICAL DIST ft.	TIP ELEVATION	FINAL BLOWS/IN	DESIGN LENGTH ft
EAST							
Abut							
1	901°	88 ¹	1:3½	84 ⁷	816 ³	21	84
2	901°	90 ³	1:3½	86 ⁸	814 ²	22	84
3	901°	89 ⁴	1:3½	86°	815°	29	84
4	901°	91 ⁷	1:3½	88 ²	812 ³	27	84
5	901°	132 ⁶	1:3½	127 ⁵	773 ⁵	22	84
6	901°	87 ⁹	1:10	87 ⁵	813 ⁵	21	84
7	901°	88 ¹	1:10	87 ⁷	813 ³	25	84
8	901°	88 ⁴	1:10	87 ⁹	813 ¹	30	84
9	901°	88 ⁶	1:10	88 ¹	812 ⁹	30+	84
TOTAL EAST ABUT.		845 ¹					756°
PIER #2							
1	881°	70	4:1	67 ⁹	813 ¹	20	60
2	881°	69	4:1	67°	814°	18	60
3	881°	69	4:1	67°	814°	16	60
4	881°	70	4:1	67 ⁹	813 ¹	16	60
5	881°	70	4:1	67 ⁹	813 ¹	18	60
6	881°	71	4:1	68 ⁹	812 ¹	16	60
7	881°	71	4:1	68 ⁹	812 ¹	18	60
8	881°	71	4:1	68 ⁹	812 ¹	18	60
9	881°	70	4:1	67 ⁹	813 ¹	17	60
10	881°	69	4:1	67°	814°	16	60
11	881°	70	4:1	67 ⁹	813 ¹	18	60
12	881°	60	4:1	58 ²	822 ⁸	20	60
13	881°	60	4:1	58 ²	822 ⁸	16	60
14	881°	70	4:1	67 ⁹	813 ¹	18	60
TOTAL PIER #2		960					840°

The following conclusions were drawn regarding pile driving for Pier 2:

(116 batter)

1. For 60 ft long piles the tip elevation was calculated to be at approx. elev. 82.3 in very dense silt to sand stratum

2.

722
25
65 1/4

850 ANVIL

60x70

4440
850

$$W_p = \frac{5290}{}$$

$$W = 2750$$

$$\frac{W_p}{W} = 1.924$$

$$\frac{1}{0.12}$$

$$C_D = \frac{W_p}{W} \times 0.15 + 0.75 = .75 + 0.29 = 1.04$$

$$k_u = C_D \left[1 + \sqrt{1 + \frac{1}{C_D} \lambda_e} \right]$$

$$\lambda_e = \frac{WHL}{AEs^2} = \frac{22,500 \times 12 \times 60 \times 12}{21.76 \times 29 \times 10^6 \times 0.2 \times 0.2} = 7.70$$
$$\frac{22.5 \times 8.64 \times 10^6}{21.76 \times 29 \times 10^6 \times 0.04}$$

$$k_u = 1.04 \left[\right]$$

$$k_u = 1$$

$$Q_u = \frac{1}{4} \frac{22,500 \times 12}{5.2} = 337,500 \text{ LBS}$$
$$= 168 \text{ TONS}$$

$$JANBU \quad S = 0.0625''$$

$$C_D = 1.04$$

$$\lambda_e = \frac{22.5 \times 8.64 \times 10^6}{21.76 \times 29 \times 10^6 \times 0.00391} = 78.79$$

$$k_{cu} = 10$$

$$Q_v = \frac{1}{10} \frac{22,500 \times 12}{0.0625} = 432,000$$

$$= 216 \text{ TONS}$$

310-42

RECORD OF BOREHOLE No. 310-42

DEPARTMENT OF HIGHWAYS - DIVISION OF MATERIALS & TESTING OFFICE

LOCATION: Sta. 271 + 37.13, 130 + 12

DATE: April 17, 1959

BOREHOLE TYPE: Hand-dug, RT. Curing

ORIGINATED BY: MS

COMPLETED BY: MS

CHECKED BY: MS

ELEV. (FEET)	SOIL PROFILE DESCRIPTION	SAMPLE NUMBER	TYPE	DEPTH (FEET)	UNIFORM PENETRATION RESISTANCE			STRAIN (INCHES)	WATER CONTENT (%)	REMARKS
					20	50	100			
656.7	Ground Level									
656.7	Silt, trace of clay and gravel.	1	SS	5						0.80 (7)
656.7	Same	2	SS	7						0.59 (2)
656.7	Thin sand to silt	3	SS	13						
656.7	Coarse	4	SS	14						0.43 (7)
656.7		5	SS	16						
656.7		6	SS	18						
656.7		7	SS	20						
656.7	Clayey silt, some sand, trace of gravel	8	SS	22						
656.7	Same	9	SS	24						
656.7	Same	10	SS	26						
656.7	Same	11	SS	28						
656.7	Same	12	SS	30						
656.7	Same	13	SS	32						
656.7	Same	14	SS	34						
656.7	Same	15	SS	36						
656.7	Same	16	SS	38						
656.7	Same	17	SS	40						
656.7	Same	18	SS	42						
656.7	Same	19	SS	44						
656.7	Same	20	SS	46						
656.7	Same	21	SS	48						
656.7	Same	22	SS	50						
656.7	Same	23	SS	52						
656.7	Same	24	SS	54						
656.7	Same	25	SS	56						
656.7	Same	26	SS	58						
656.7	Same	27	SS	60						
656.7	Same	28	SS	62						
656.7	Same	29	SS	64						
656.7	Same	30	SS	66						
656.7	Same	31	SS	68						
656.7	Same	32	SS	70						
656.7	Same	33	SS	72						
656.7	Same	34	SS	74						
656.7	Same	35	SS	76						
656.7	Same	36	SS	78						
656.7	Same	37	SS	80						
656.7	Same	38	SS	82						
656.7	Same	39	SS	84						
656.7	Same	40	SS	86						
656.7	Same	41	SS	88						
656.7	Same	42	SS	90						
656.7	Same	43	SS	92						
656.7	Same	44	SS	94						
656.7	Same	45	SS	96						
656.7	Same	46	SS	98						
656.7	Same	47	SS	100						
656.7	Same	48	SS	102						
656.7	Same	49	SS	104						
656.7	Same	50	SS	106						
656.7	Same	51	SS	108						
656.7	Same	52	SS	110						
656.7	Same	53	SS	112						
656.7	Same	54	SS	114						
656.7	Same	55	SS	116						
656.7	Same	56	SS	118						
656.7	Same	57	SS	120						
656.7	Same	58	SS	122						
656.7	Same	59	SS	124						
656.7	Same	60	SS	126						
656.7	Same	61	SS	128						
656.7	Same	62	SS	130						
656.7	Same	63	SS	132						
656.7	Same	64	SS	134						
656.7	Same	65	SS	136						
656.7	Same	66	SS	138						
656.7	Same	67	SS	140						
656.7	Same	68	SS	142						
656.7	Same	69	SS	144						
656.7	Same	70	SS	146						
656.7	Same	71	SS	148						
656.7	Same	72	SS	150						
656.7	Same	73	SS	152						
656.7	Same	74	SS	154						
656.7	Same	75	SS	156						
656.7	Same	76	SS	158						
656.7	Same	77	SS	160						
656.7	Same	78	SS	162						
656.7	Same	79	SS	164						
656.7	Same	80	SS	166						
656.7	Same	81	SS	168						
656.7	Same	82	SS	170						
656.7	Same	83	SS	172						
656.7	Same	84	SS	174						
656.7	Same	85	SS	176						
656.7	Same	86	SS	178						
656.7	Same	87	SS	180						
656.7	Same	88	SS	182						
656.7	Same	89	SS	184						
656.7	Same	90	SS	186						
656.7	Same	91	SS	188						
656.7	Same	92	SS	190						
656.7	Same	93	SS	192						
656.7	Same	94	SS	194						
656.7	Same	95	SS	196						
656.7	Same	96	SS	198						
656.7	Same	97	SS	200						
656.7	Same	98	SS	202						
656.7	Same	99	SS	204						
656.7	Same	100	SS	206						
656.7	Same	101	SS	208						
656.7	Same	102	SS	210						
656.7	Same	103	SS	212						
656.7	Same	104	SS	214						
656.7	Same	105	SS	216						
656.7	Same	106	SS	218						
656.7	Same	107	SS	220						
656.7	Same	108	SS	222						
656.7	Same	109	SS	224						
656.7	Same	110	SS	226						
656.7	Same	111	SS	228						
656.7	Same	112	SS	230						
656.7	Same	113	SS	232						
656.7	Same	114	SS	234						
656.7	Same	115	SS	236						
656.7	Same	116	SS	238						
656.7	Same	117	SS	240						
656.7	Same	118	SS	242						
656.7	Same	119	SS	244						
656.7	Same	120	SS	246						
656.7	Same	121	SS	248						
656.7	Same	122	SS	250						
656.7	Same	123	SS	252						
656.7	Same	124	SS	254						
656.7	Same	125	SS	256						
656.7	Same	126	SS	258						
656.7	Same	127	SS	260						
656.7	Same	128	SS	262						
656.7	Same	129	SS	264						
656.7	Same	130	SS	266						
656.7	Same	131	SS	268						
656.7	Same	132	SS	270						
656.7	Same	133	SS	272						
656.7	Same	134	SS	274						
656.7	Same	135	SS	276						
656.7	Same	136	SS	278						
656.7	Same	137	SS	280						
656.7	Same	138	SS	282						
656.7	Same	139	SS	284						
656.7	Same	140	SS	286						
656.7	Same	141	SS	288						
656.7	Same	142	SS	290						
656.7	Same	143	SS	292						
656.7	Same	144	SS	294						
656.7	Same	145	SS	296						
656.7	Same	146	SS	298						
656.7	Same	147	SS	300						
656.7	Same	148	SS	302						
656.7	Same	149	SS	304						
656.7	Same	150	SS	306						
656.7	Same	151	SS	308						

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRÉS No. 31D-42

DIST. 7 REGION CENTRAL

W.P. No. 913-48-02

CONT. No. 74-27

W. O. No. 69-F-22

STR. SITE No. 32-43

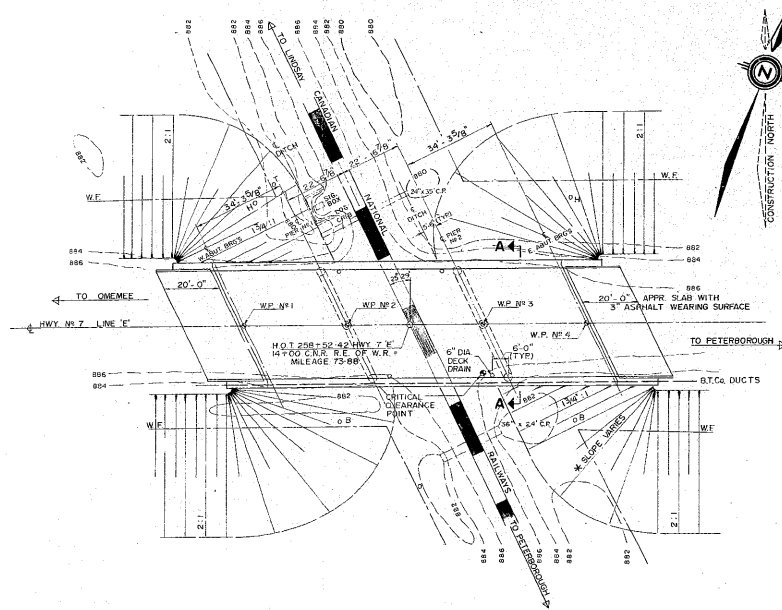
HWY. No. 7

LOCATION THE C.N.R. LOT 13

CONCESSIONS 3 & 4

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT 4

REMARKS: a) to be added to already existing
microfilm.
b) documents to be unfolded before
microfilmed

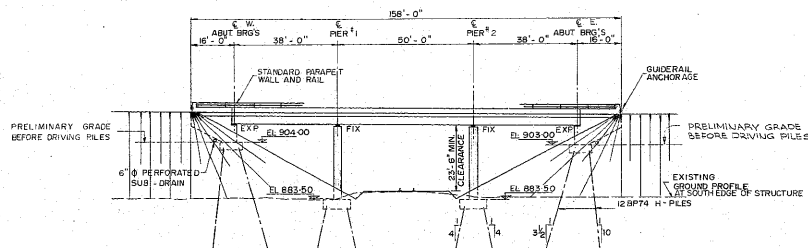


NOTE
W.P. DENOTES WORKING POINT
* SLOPE VARIES 1 1/4% TO 2%

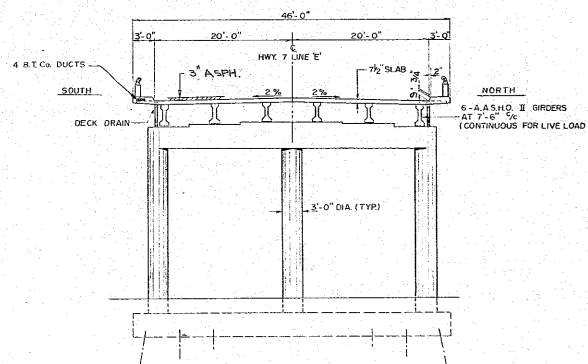
PLAN
SCALE 1" = 20'-0"

FUNCTION OF 25°29'0"

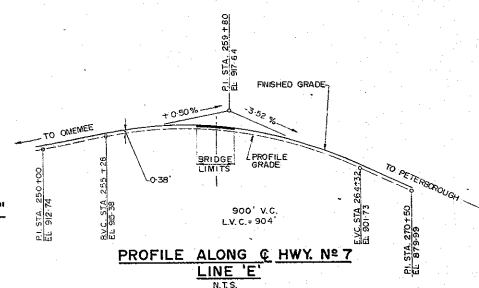
SIN - 0.43025
COS - 0.90271
TAN - 0.47662
SEC - 1.10777



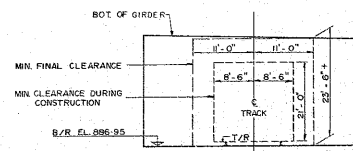
ELEVATION
SCALE 1" = 20'-0"



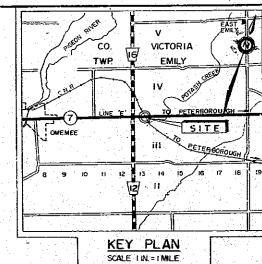
SECTION A-A
SCALE 1/2" = 1'-0"



PROFILE ALONG C HWY. NO. 7
LINE 'E'
N.T.S.



CLEARANCE DIAGRAM
N.T.S.
(CLEARANCES NORMAL TO C TRACK)



NOTES

CLASS OF CONCRETE
DECK, DIAPHRAGMS & PARAPET WALLS 4,000 P.S.I.
PRESTRESSED ORDERS 5,000 P.S.I.
PIERS 5,000 P.S.I.
REMAINDER 3,000 P.S.I.
CLEAR COVER ON REIN. STEEL
FOOTINGS, ABUTMENTS, WINGWALLS 3"
PIERS, DIAPHRAGMS, APPROACH SLABS 2"
DECK 1 1/2" TOP
1 1/2" BOT.
PARAPET WALLS

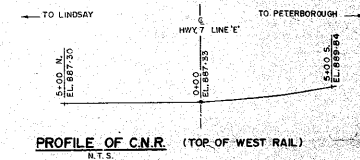
LIST OF DRAWINGS

- D-6668-1 GENERAL PLAN
- BORE HOLE LOCATIONS & SOIL STRATA
- FOOTINGS
- ABUTMENTS & WINGWALLS
- PIERS
- PRESTRESSED GIRDERS & BEARINGS
- DECK
- PARAPET WALL DETAILS
- STANDARD STEEL PARAPET RAIL
- APPROACH SLABS
- STANDARDS
- STANDARDS

B.M. ELEV. 882.59

GEODETIC DATUM

N & W IN S.W. ROOT OF 1° 8' EM 112° LT 256 + 78



PROFILE OF C.N.R. (TOP OF WEST RAIL)
N.T.S.

REVISIONS	DATE	BY	DESCRIPTION
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

DEPARTMENT OF HIGHWAYS ONTARIO			
BRIDGE DIVISION			
TOTTEN, SIMS, HUBBICK & ASSOCIATES LTD.			
CONSULTING ENGINEERS			
CORBORG KINCARDIN TORONTO WHITBY			
C.N.R. OVERHEAD			
CANADIAN NATIONAL RAILWAY			
AND KING'S HWY. NO. 7 LINE 'E'			
KING'S HWY. NO. 7 LINE 'E'		DIST. NO. 7	
CO. VICTORIA		CON. 3 B. 4	
TWP. EMILY		LOT 13	
GENERAL		PLAN	
APPROVED		SHE. NO. 32-143	
DRAWING		CONTRACT NO.	
DATE		DRAWING NO.	
JULY/69		D-6668-1	

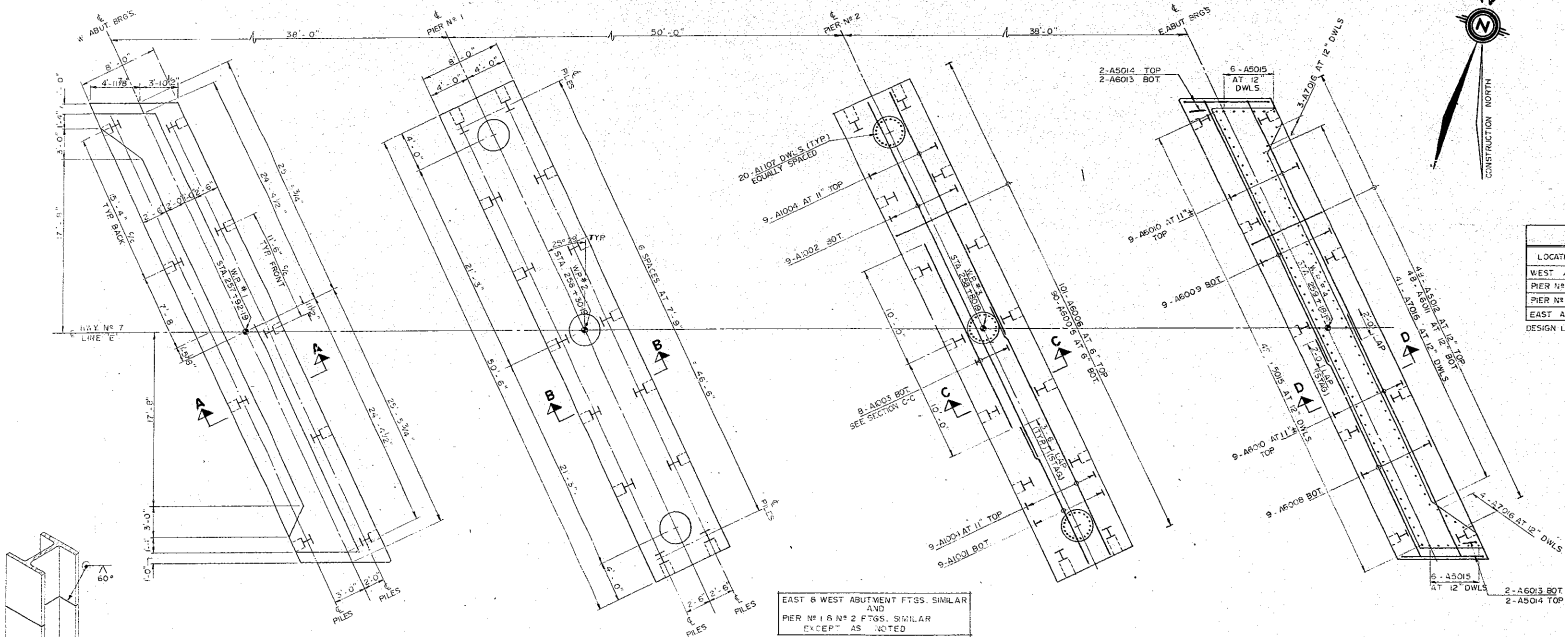


69-F-22



LIST OF PILES			
LOCATION	NR	LENGTH	TYPE
WEST ABUT	9	84'-0"	12 BP74
PIER #1	14	60'-0"	DO
PIER #2	14	60'-0"	DO
EAST ABUT	9	84'-0"	DO

DESIGN LOAD = 129P74 H-PILE: 95 TONS



PILE SPLICE

NOTE: THE PILE SPLICE SHALL BE A FULL BUTT WELD AS SHOWN, PERPENDICULAR TO L OF PILE.
WELDING SHALL CONFORM TO THE LATEST ISSUE OF C.S.A. SPEC. W59 AND SHALL BE DONE BY A WELDER QUALIFIED UNDER C.S.A. SPEC. W47.

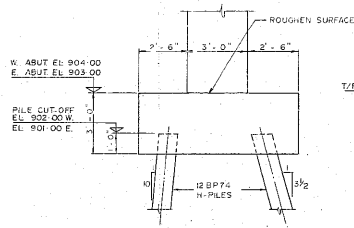
FOOTING DIMENSIONS

PLAN
SCALE 3/16"=1'-0"

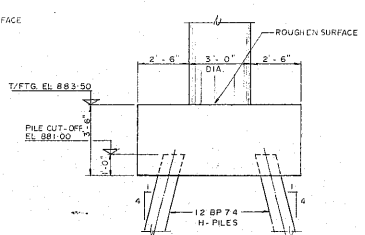
FOOTING REINFORCEMENT

SCALE 3/8"=1'-0" UNLESS NOTED.

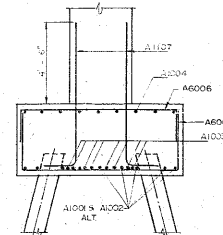
PRINT RECORD		
NO.	FOR	DATE
1	FOR AS BUILT	10/16/94
2	FOR AS BUILT	10/16/94



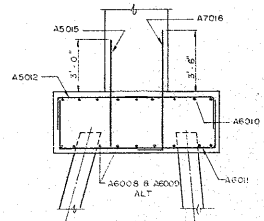
SECTION A-A



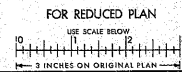
SECTION B-B



SECTION C-C



SECTION D-D



REVISIONS		DATE		BY	DESCRIPTION
69-F-22					
DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS ONTARIO					
TOTTEN, SIMS, HURICKI & ASSOCIATES LTD. CONSULTING ENGINEERS KINGSTON TORONTO WHITBY					
C.N.R. OVERHEAD AT CANADIAN NATIONAL RAILWAY AND KING'S HWY #7 LINE 'E'					
KING'S HIGHWAY No. 7 LINE 'E'		DIST. No. 7			
CO. VICTORIA		LOT 13		CON. 3 & 4	
TWP. EMILY					
FOOTINGS					
APPROVED		SITE No. 32-143		W.P. No. 913-65-02	
DESIGN M.V.T.		CHECK G.L.A.		CONTRACT No.	
DRAWING A.E.		CHECK P.Y.		DRAWING No.	
DATE JULY 7/99		LOADING H20-44			

69-F-22

12-7-5 20 % STRAIN AT FAILURE

STATEMENT OF WORKS/PROJECT OWNED				RECORD OF BOREHOLE No. 31D-42				FOUNDATION SECTION				
MATERIALS & TESTING OFFICE				LOCATION Sta. 250 + 20 12.0 Bl. 110e 70				DESIGNED BY: BS				
JOB 69-2-02				BORING DATE April 29, 1959				CHECKED BY: BS				
W/F 913-05-02				BOREHOLE TYPE Handborings, 110' casing				CHECKED BY: BS				
Notes: Guide												
ELEV. (DEPTH)	SOIL PROFILE DESCRIPTION	SAMPLE NUMBER	TYPE	DEPTH (FOOT)	TEST SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT			REMARKS
						100	60	100	PLASTIC LIMIT	WATER CONTENT %	SHRINKAGE	
						SHEAR STRENGTH PSF			FILL VALUE			
						a. UNCONFINED			WATER CONTENT %			
						b. QUICK TEST			30 50 100			
6.0	Fill	1	SS	0								
6.0	Very sandy areas of clay & gravel.	2	SS	0								6 50 10 5
7.5	Loose	3	SS	0								0 7 90 3
	Fine sand to silt	4	SS	0								0 15 80 7
	Coarsest	5	SS	0								
22.0		6	SS	0								
26.0		7	SS	0								
	Clayey silt, some sand, trace of gravel	8	SS	0								
	Hard	9	SS	0								
	(Oriental Tilt)	10	SS	0								0 52 35 4
33.6		11	SS	0								
35.0	Silt to sand, trace to some gravel	12	SS	0								0 53 32 4
	Very dense	13	SS	0								0 90 (10)
35.9		14	SS	0								
41.0	End of Borehole	15	SS	0								

10-15 % STERN AT FAILURE

DEPARTMENT OF HIGHWAYS, ONTARIO				RECORD OF BOREHOLE				FOUNDATION SECTION				
MATERIALS & TESTING OFFICE				LOCATION				ORIGINATED BY				
JOB No. 69-0-02				Sta. 218 + 75.80' 14.10' 15'				BY				
W.P. 913-65-02				BORING DATE April 25, 1959				CONFIRMED BY				
DATE 6-26-62				BOREHOLE TYPE Highway, H. 0-10				CHECKED BY				
ELEV. (FT.)	DEPTH (FT.)	SOIL PROFILE DESCRIPTION	SAMPLES		ELEV. (FT.)	DEPTH (FT.)	DYNAMIC PENETRATION RESISTANCE		WATER CONTENT %	PLASTIC LIMIT	LIQUID LIMIT	REMARKS
			NUMBER	TYPE			STANDARD	FIELD				
875.2	0.0	Ground Level	1	10	875.2	0.0						
		Fill	2	10								
		Stiff sand, trace of clay & gravel	3	10								
		Stone	4	10								
		Fine sand to silt	5	10								
		Gravel	6	10								
		Clayey silt, some sand, trace of gravel	7	10								
		Hard	8	10								
		(Blocky Till)	9	10								
		Silt to sand, trace of some gravel	10	10								
		Very dense	11	10								
		Reaches up to 1' in size.	12	10								
		End of Borehole	13	10								

10-10-5 % STRAIN AT FAILURE

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 31D-4a

DIST. 7 REGION CENTRAL

W.P. No. 913-65-02

CONT. No. 74-27

W. O. No. 69-F-22

STR. SITE No. 32-43

HWY. No. 7

LOCATION THE C.N.R. LOT. 13

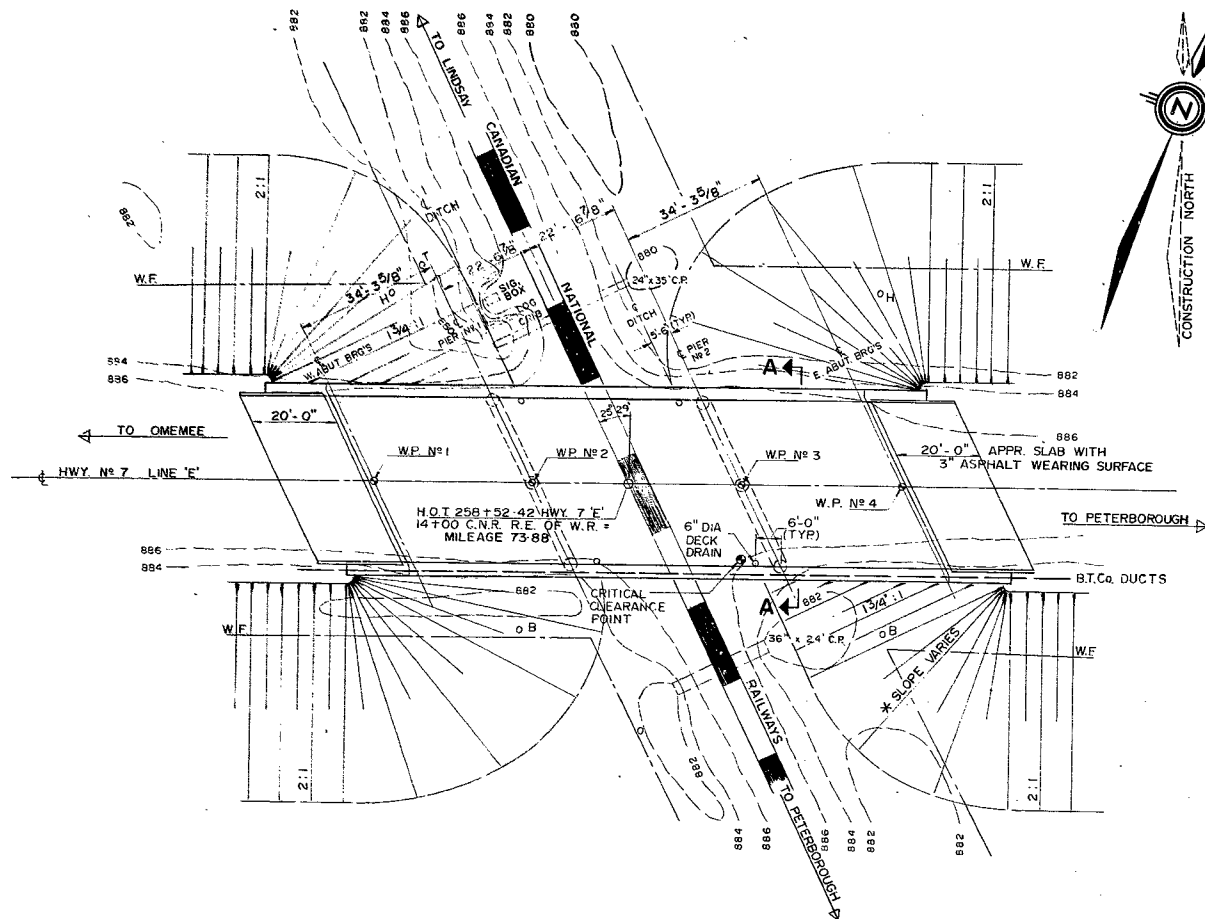
CONCESSIONS 3 & 4

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 4

REMARKS: a) to be added to already existing
microfiche.

b) documents to be unfolded before
microfilmed

G.I.P. 30 SEPT. 1976

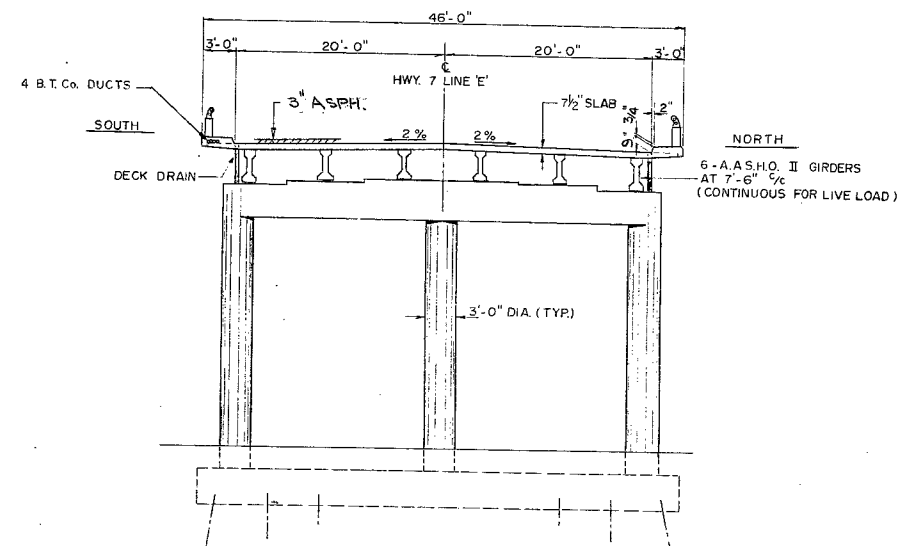


NOTE
WP. - DENOTES WORKING POINT
* - SLOPE VARIES $1\frac{3}{4}:1$ TO $2:1$

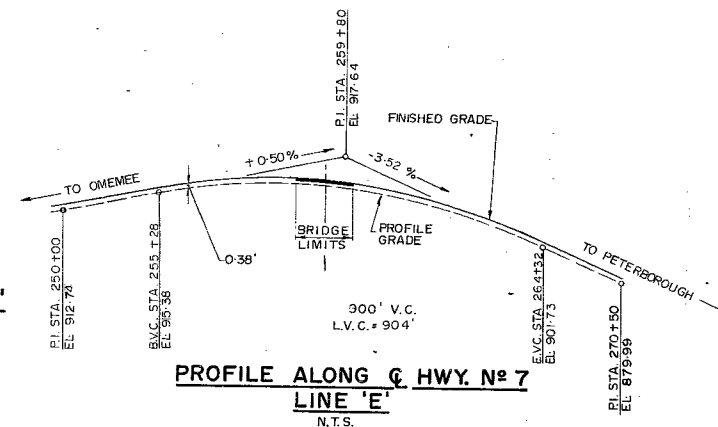
PLAN
SCALE 1" = 20' - 0"

FUNCTION OF 25°29'0"

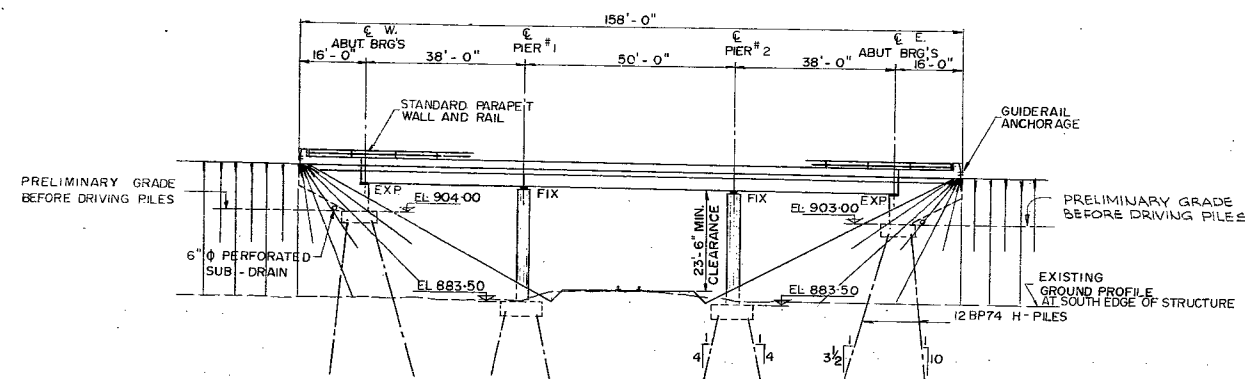
SIN - 0.43025
COS - 0.90271
TAN - 0.47662
SEC. - 1.10777



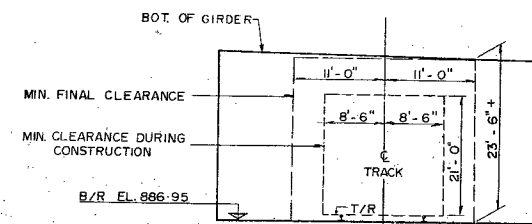
SECTION A-A
SCALE 1/8" = 1'-0"



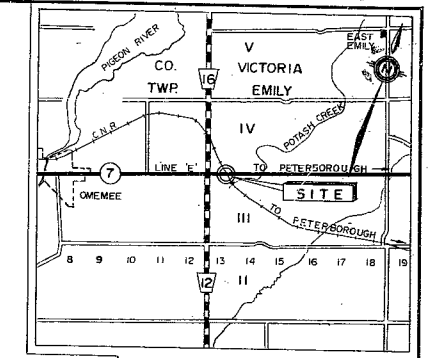
PROFILE ALONG C. HWY. N° 1
LINE 'E'
N.T.S.



ELEVATION
SCALE 1" = 20' - 0"



CLEARANCE DIAGRAM
N.T.S.
(CLEARANCES NORMAL TO & TRACK)



KEY PLAN
SCALE 1 IN. = 1 MILE

NOTES

CLASS OF CONCRETE

DECK, DIAPHRAGMS & PARAPET WALLS	4,000	P.S.I.
PRESTRESSED GIRDERS	5,000	P.S.I.
PIERS	4,000	P.S.I.
REMAINDER	3,000	P.S.I.

CLEAR COVER ON REINF. STEEL

FOOTINGS, ABUTMENTS, WINGWALLS	3"
PIERS, DIAPHRAGMS, APPROACH SLABS	2"
DECK	1 1/2" TOP

PARAPET WALLS

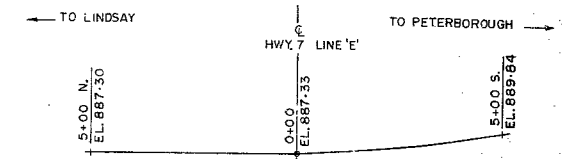
LIST OF DRAWINGS

- D-6668-1 GENERAL PLAN
2. BORE HOLE LOCATIONS & SOIL STRATA
3. FOOTINGS
4. ABUTMENTS & WINGWALLS
5. PIERS
6. PRESTRESSED GIRDERS & BEARINGS
7. DECK
8. PARAPET WALL DETAILS
9. STANDARD STEEL PARAPET RAIL
10. APPROACH SLABS
11. STANDARDS
12. STANDARDS

B.M. ELEV. 882.59

GEODETIC DATUM

N. & W. IN S.W. ROOT OF 1.8' ELM 112' LT. 256 + 76



PROFILE OF C.N.R. (TOP OF WEST RAIL)
N.T.S.

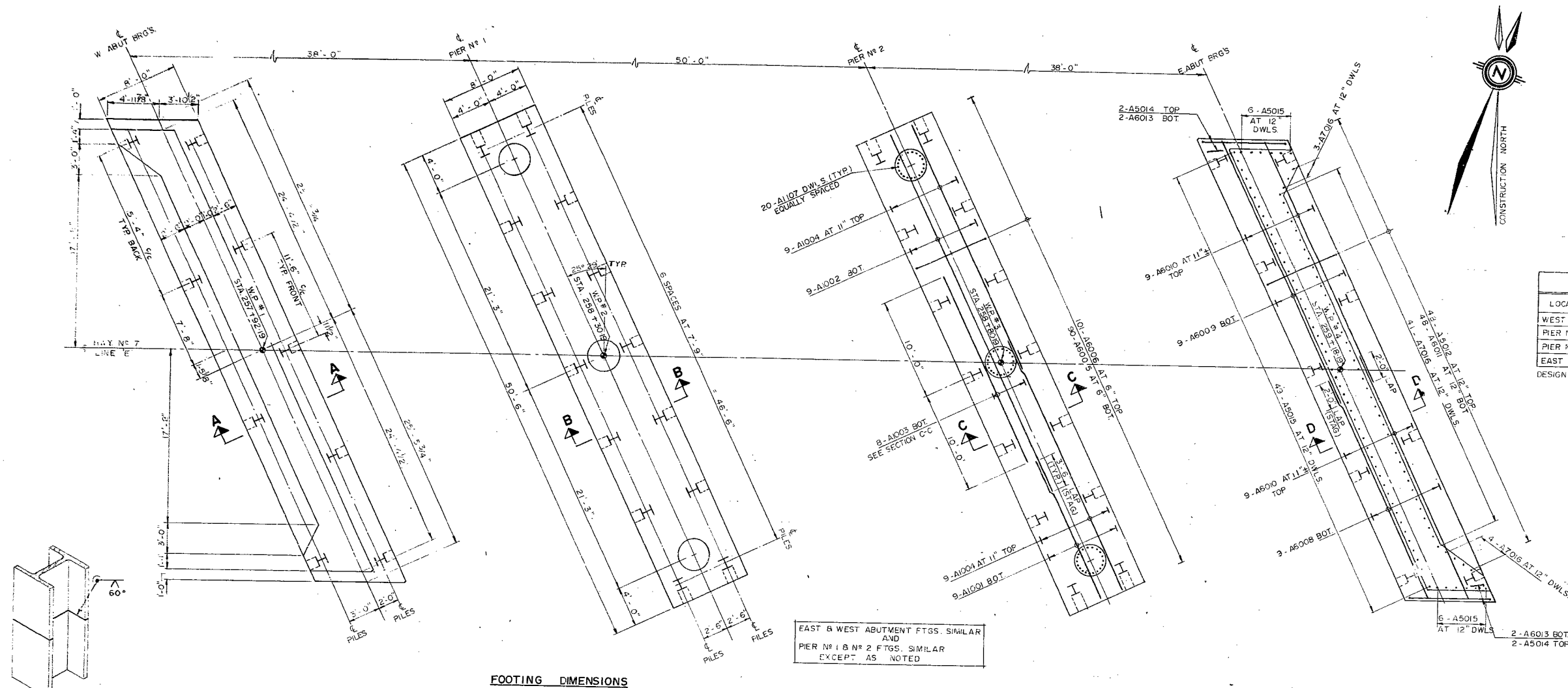
[illegible]

69-F-22

<div style="display: flex; justify-content: space-between;"> DEPARTMENT OF HIGHWAYS ONTARIO </div> <div style="text-align: center; font-weight: bold;">BRIDGE DIVISION</div>			
TOTTEN, SIMS, HUBICKI & ASSOCIATES LTD. CONSULTING ENGINEERS COBORG TORONTO WHITBY			
<h2 style="margin: 0;">C. N. R. OVERHEAD</h2> <p style="margin: 5px 0 0 0;">AT CANADIAN NATIONAL RAILWAY AND KING'S HWY. N° 7 LINE 'E'</p>			
KING'S HIGHWAY No. 7 LINE 'E'		DIST. No. 7	
CO. VICTORIA			
TWP. EMILY		LOT 13 CON. 3 & 4	



69-F-22



LIST OF PILES			
LOCATION	Nº	LENGTH	TYPE
WEST ABUT	9	84'-0"	12 BP74
PIER Nº 1	14	60'-0"	D0
PIER Nº 2	14	60'-0"	D0
EAST ABUT	9	84'-0"	D0

DESIGN LOAD OF 12BP74 H-PILE = 95 TONS

PILE SPLICE

N.T.S.

NOTE • THE PILE SPLICE SHALL BE A FULL BUTT WELD AS SHOWN, PERPENDICULAR TO C OF PILE.
• WELDING SHALL CONFORM TO THE LATEST ISSUE OF C.S.A. SPEC. W59 AND SHALL BE DONE BY A WELDER QUALIFIED UNDER C.S.A. SPEC. W47.

FOOTING DIMENSIONS

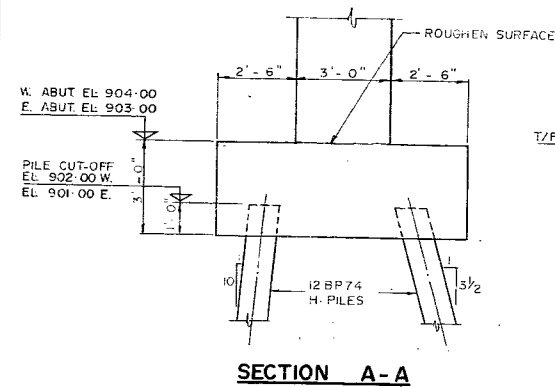
PLAN

SCALE $\frac{3}{16}'' = 1'-0''$

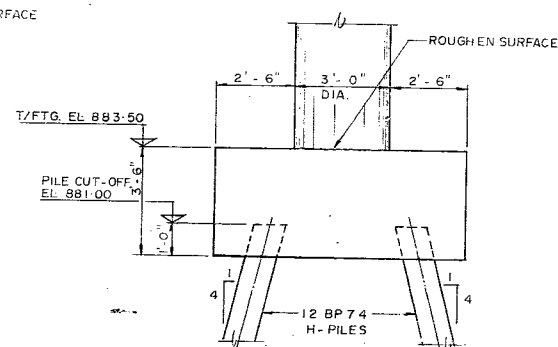
FOOTING REINFORCEMENT

SCALE $\frac{3}{8}'' = 1'-0''$ UNLESS NOTED.

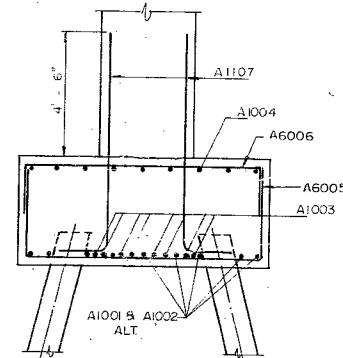
PRINT RECORD		
No.	FOR	DATE
1	REV. 05	12/6/69
2	REV. 06	9/19/69



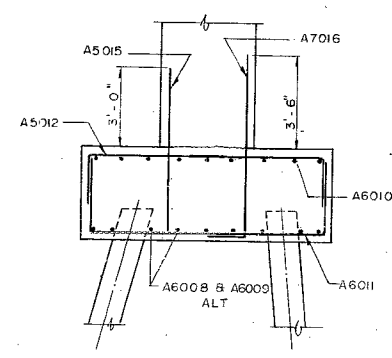
SECTION A-A



SECTION B-B



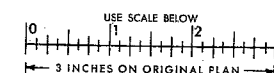
SECTION C-C



SECTION D-D



FOR REDUCED PLAN



REVISIONS		DATE		BY		DESCRIPTION	
69-F-22							
DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS ONTARIO							
TOTTEN, SIMS, HUBICKI & ASSOCIATES LTD. CONSULTING ENGINEERS COBOURG KINGSTON TORONTO WHITBY							
C.N.R. OVERHEAD AT CANADIAN NATIONAL RAILWAY AND KING'S HWY. Nº 7 LINE 'E'							
KING'S HIGHWAY No. 7 LINE 'E'				DIST. No. 7			
CO. VICTORIA				LOT 13 CON. 3 8 4			
TWP. EMILY							
FOOTINGS							
APPROVED		SITE No.		32-143		W.P. No.	
DESIGN		M.V.T.		CHECK		G.L.A.	
DRAWING		A. E.		CHECK		P. Y.	
DATE		JULY/69		LOADING		HS2C-44	
						DRAWING No.	
						D-6668-3	

69-F-22

DEPARTMENT OF HIGHWAYS - ONTARIO		RECORD OF BOREHOLE No. 1		31D-42		FOUNDATION SECTION	
MATERIALS & TESTING OFFICE		LOCATION		Sta. 259 + 36 22' Rt. Line 'E'		ORIGINATED BY HS	
JOB 69-F-22		BORING DATE		April 22, 1969		COMPILED BY SO	
W.P. 913-65-02		BOREHOLE TYPE		Washboring, NX Casing		CHECKED BY	
DATUM Geodetic							

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT		PLASTIC LIMIT		WATER CONTENT		SHEAR STRENGTH P.S.F.		REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	BLOWS/FOOT	W _L	W _P	W ₁	W ₂	W ₃	UNCONFINED	FIELD VANE	
													QUICK TRIAXIAL	LAB. VANE	
882.8	Ground Level														
0.0	Silt		1	SS	17	880									
	trace to some sand		2	SS	15										
	Compact		3	SS	15										
			4	SS	11										
			5	SS	9										
862.3	Sand & gravel layer		6	SS	36	860									
20.5	Clayey silt, some sand, trace of gravel		7	SS	55										
	Hard		8	SS	30										
	(Glacial Till)		9	SS	75										
845.3			10	SS	70										
37.5	Sand		11	SS	106										
	trace of gravel		12	SS	84										
	Very dense		13	SS	81										
			14	SS	100/2										
817.8	(Boulders up to 1' in size)		15	AXT	20%	820									
65.0	End of Borehole														

20
10-5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS & TESTING OFFICE				RECORD OF BOREHOLE No. <u>31D-42</u>				FOUNDATION SECTION								
JOB <u>69-F-22</u>		LOCATION <u>Sta. 258 + 20 12.5' Rt. Line 'E'</u>		ORIGINATED BY <u>HS</u>		COMPILED BY <u>SO</u>		CHECKED BY <u>HS</u>								
W.P. <u>913-65-02</u>		BORING DATE <u>April 29, 1969</u>														
DATUM <u>Geodetic</u>		BOREHOLE TYPE <u>Washboring, NX Casing</u>														
ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLT.	SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			BULK DENSITY γ	REMARKS	
			NUMBER	TYPE		20	40	60	80	100	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE					WATER CONTENT % 10 20 30
886.9	Ground Level															
0.0	Fill Silty sand, trace of slay & gravel.		1	SS	h											
879.4	Loose		2	SS	6	880										6 50 39 5
7.3	Fine sand to silt		3	SS	30											
	Compact		4	SS	19											0 7 90 3
			5	SS	11	870										0 13 80 7
862.9			6	SS	14											
24.0	Clayey silt, some sand, trace of gravel		7	SS	16	860										
	Hard		8	SS	16											
	(Glacial Till)		9	SS	92	850										
841.6			10	SS	72											
15.3	Silt to sand, trace to some gravel		11	SS	88	840										0 58 36 6
	Very dense		12	SS	117											0 54 42 4
			13	SS	111	830										0 90 (10)
825.9			14	SS	95/6											
61.0	End of Borehole					820										

20
10-5 % STRAIN AT FAILURE
10

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS & TESTING OFFICE				RECORD OF BOREHOLE		FOUNDATION SECTION	
JOB 69-F-22		LOCATION Sta. 258 + 76 20' Lt. Line 'E'		ORIGINATED BY HS			
W.P. 713-65-02		BORING DATE April 25, 1969		COMPILED BY SD			
DATUM Geodetic		BOREHOLE TYPE Washboring, NX Casing		CHECKED BY			
SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w_L	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	PLASTIC LIMIT — w_p
686.9	Ground Level						WATER CONTENT — w
0.0	Fill		1	SS	2		
878.7	Silty sand, trace of clay & gravel		2	SS	3		
8.2	Loose		3	SS	14		
	Fine sand to silt		4	SS	23		
	Compact		5	SS	23		
663.9			6	SS	11		
23.0			7	SS	42		
	Clayey silt, some sand, trace of gravel		8	SS	85		
	Hard		9	SS	160		
647.9	(Glacial Till)		10	SS	61		
39.0			11	SS	156		
	Silt to sand, trace of some gravel		12	SS	139		
	Very dense		13	SS	103		
	Boulders up to 1' in size.		14	SS	75		
			15	SS	162 1/2		
617.0			16	AXT	20 1/2		
69.9	End of Borehole						

20
10-5 % STRAIN AT FAILURE
10

310-42

DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS & TESTING OFFICE				RECORD OF BOREHOLE No. 4		FOUNDATION SECTION	
JOB 69-P-22		LOCATION Sta. 257 + 87 18' Lt. Line 'B'		ORIGINATED BY INS			
W.P. 913-65-02		BORING DATE April 17, 1969		COMPILED BY SD			
DATUM Geodetic		BOREHOLE TYPE Washboring, NX Casing		CHECKED BY			

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W _P			BULK DENSITY γ _B P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	ELEV. SCALE	20	40	60	80	100	10			20
886.7	Ground Level												
0.0	Fill												
	Silty sand, trace of clay and gravel.	1	SS	5									
879.7	Loose	2	SS	7	880								
7.0	Fine sand to silt	3	SS	13									
	Compact	4	SS	27									
		5	SS	16	870								
		6	SS	9									
863.7		7	SS	20									
23.0	Clayey silt, some sand, trace of gravel	8	SS	17	860								
	Hard	9	SS	62									
	(Glacial Till)	10	SS	50									
847.7		11	SS	116									
59.0	Silt to sand	12	SS	91	850								
	Very dense	13	SS	71									
		14	WS		840								
828.6		15	SS	174	830								
58.1	End of Borehole												
					820								

20
15-5 % STRAIN AT FAILURE
10