

MEMORANDUM

W.P. 161-64

Mr. B. R. Davis,
Bridge Engineer,
Bridge Division,
Admin. Bldg.

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

Attention: Mr. S. McCombie

DATE: October 6, 1967

OUR FILE REF.

IN REPLY TO OCT 11 1967

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For

Proposed Overpass at the Crossing of
Concession Road (Erie St.) and Q.E.W.
District No. 4 (Hamilton)

W.J. 67-F-70 -- W.P. 161-64

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

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

AGS/MdeF
Attach.

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

Foundations Files
Gen. Files

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

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FOUNDATION INVESTIGATION REPORT

For

Proposed Overpass at the Crossing of
Concession Road (Erie St.) and Q.E.W.
District No. 4 (Hamilton)

W.J. 67-P-70 -- W.P. 161-64

1. INTRODUCTION:

The Foundation Section was requested to carry out an investigation at the proposed crossing of the Queen Elizabeth Way and Concession Road (Erie Street) in the Twp. of Bertie, County of Welland, Ontario. The request was contained in a memo from the Bridge Location Section (Mr. W. S. Melinyshyn, Regional Bridge Location Engineer), dated August 3, 1967. An investigation was subsequently carried out by this Section to determine the subsoil conditions existing at the site. This report contains the results of the investigation, together with recommendations pertaining to the foundations of the new structure and the stability of the approaches.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located at the north limits of the town of Fort Erie. At this location, the Queen Elizabeth Highway grade is about the surrounding ground surface elevation. The highway itself, consists of four paved lanes with median strip and associated gravel shoulders. Along each side of the highway, there is a drainage ditch which is about 10 ft. wide and 3 ft. deep. The grade of the existing crossroad (Erie St) is about the surrounding ground elevation. The immediate area is generally flat.

Physiographically, the site is situated in the "Haldimand Clay Plain". Based on available geological information, it is known that the overburden of this region consists of lacustrine clay deposited in glacial Lake Warren formed during the retreat of the last continental glacier.

cont'd. /2 ...

3. FIELD AND LABORATORY WORK:

Seven boreholes and six dynamic cone penetration tests were carried out during the course of the recent field work. In addition, two boreholes and two dynamic penetration tests were carried out by H. Q. Golder and Associates Ltd., for preliminary investigation purposes. Boring was achieved by means of a conventional diamond drill adapted for soil sampling purposes. Samples were recovered at required depths in 2-inch O.D. split-spoon samplers which were hammered into the soil, or in 2-inch I.D. Shelby tubes which were manually pushed into the soil. The method of driving the split-spoon samplers conformed to the requirements of the Standard Penetration Test. The same method was used to advance the cone in the dynamic cone penetration tests. Where possible, field vane tests were carried out at various depth intervals in order to determine the undrained shear strength of the cohesive strata. Bedrock was proven in four boreholes by obtaining AXT size rock core samples. In five borings, bedrock was assumed to be the level at which the borehole casing met refusal. During sampling and drilling operations, detailed logs of the borings were made which described drilling and sampling techniques, soil types encountered, and groundwater observations.

The locations and elevations of all borings were surveyed in the field by personnel from the Foundation Section, and are shown on Dwg. #67-F-70A, together with the estimated stratigraphical profile.

All samples were subjected to a careful visual inspection in the laboratory prior to any tests being carried out. Following this inspection, tests were carried out on certain samples to determine the following physical properties of the various soil types:

- Natural Moisture Contents
- Bulk Densities
- Grain-Size Distributions
- Consolidation Characteristics
- Atterberg Limits
- Undrained Shear Strengths

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

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

On completion of laboratory testing, the various soil samples were classified as to type and consistency, or relative density, in general, according to the Unified Soil Classification System (Oct. 1963).

4. SOIL TYPES AND SOIL CONDITIONS:

4.1) General:

Subsoil at the site consists of 30 to 37 ft. of stiff to hard clayey silt with sand and traces of gravel, followed by dolomitic limestone bedrock. The boundaries between the various soil strata are shown on the Record of Borelog sheets contained in the Appendix of the report. The estimated stratigraphical profiles shown on Dwg. #67-P-70A, are based upon this information. From ground level downwards, the different soil types are described in detail as follows:

4.2) Clayey Silt with Sand and traces of Gravel:

This deposit was encountered in all the boreholes, immediately below the ground surface, and extends for a total thickness of 30 to 37 ft. This material is essentially cohesive in nature, consisting of clayey silt with sand and traces of gravel.

Physical properties of the material as determined from field and laboratory tests, are summarized as follows:

cont'd. /4 ...

4. SOIL TYPES AND SOIL CONDITIONS: (cont'd.) ...

4.2) Clayey Silt with Sand and traces of Gravel: (cont'd.) ...

Bulk Density	134 - 146 p.c.f.
Liquid Limit	17% - 27%
Plastic Limit	11% - 14%
Moisture Content	11% - 18%
Undrained Shear Strength	850 - 2750 p.s.f.
'N' Values	10 - 64 blows/ft.

Based on standard penetration test results, together with the undrained shear strength measurements, the consistency of the upper desiccated portion of the clayey silt is hard, decreasing to stiff below about elev. 620.

Underlying the clayey silt in B.H.'s 3, 4, and 6, a thin layer of till-like deposit less than 2 ft. thick was encountered. This till-like deposit mainly consists of a heterogeneous mixture of clay, silt, sand and gravel.

4.3) Dolomitic Limestone Bedrock:

Bedrock was established by drilling 7 to 9.5 ft. of AXT core in B.H.'s 2, 3, 4, and 6. In B.H.'s 1, 7, 8, and 9, the bedrock contact was established by drilling with a Penn. auger to refusal. The depth at which bedrock was encountered, ranged from elev. 598.5 to elev. 603.5, or some 30 to 37 ft. below the existing ground surface. Rock core samples obtained, show the rock to be generally sound dolomite right from the surface, with recovery ranging from 80 to 100%.

5. GROUNDWATER CONDITIONS:

Observations carried out during the time of the field investigation, indicate that the water level, in general, is approximately 1 to 4.5 ft. below the existing ground surface. The exact water levels observed during the time of the field investigation, are shown on the enclosed drawing as well as borehole logs (Appendix I).

cont'd. /5 ...

6. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct an interchange with an overpass structure to carry Concession Road (Erie Street) under the Queen Elizabeth Way. Present proposals call for twin three-span (65'-85'-65') structures with approach cuts having a maximum height of about 23 ft. below the Q.E.W. grade.

Subsoil at the site consists generally, of a deposit of hard to stiff clayey silt with sand and occasional gravel, followed by dolomitic limestone bedrock at a depth of 30 to 37 ft. below the ground surface.

6.1) Structure Foundations:

The proposed abutments may be constructed within the approach cuts in the hard clayey silt stratum. Spread footings placed at or below elev. 632.0, can be designed for an allowable bearing pressure of 2.5 t.s.f.

The proposed grade of Erie St. (Concession Rd.) will be at elev. 618 ⁺. For frost protection purposes, the pier footings should be located at least 4 ft. below the proposed grade of Erie Street. At this elevation, the clayey silt deposit is mainly stiff and the bedrock is at approximate elev. 602 - elev. 600. For the pier foundations, one of the following two proposals is recommended.

In order to avoid differential settlements, the piers can be founded on short end-bearing piles driven to bedrock. The pile capacity in such a case, would depend upon the pile and section chosen (e.g., 12 BP 74 H-piles will support 90 tons per pile).

As an alternative, the piers can be founded on strip footings placed in the stiff clayey silt stratum at or below elev. 614.0, with an allowable bearing pressure of 1.5 t.s.f. Settlement of pier footings designed for a bearing pressure of 1.5 t.s.f., is estimated to be about 1 inch.

In the computation of sliding resistance between a rough concrete footing and undisturbed clayey silt subsoil, a cohesion value of about 1500 p.s.f., which is a limiting value, may be used in design.

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

Due to the relatively impermeable nature of the subsoil, no dewatering problems are anticipated for any excavations for the footings.

There should be no overall stability problems for the proposed 23-ft. approach cuts, provided cut slopes of standard 2 horizontal to 1 vertical, are used.

7. SUMMARY:

The results of a foundation investigation for the proposed overpass at the crossing of Erie St. (Concession Rd.) and the Q.E.W. are presented.

The subsoil at the site generally consists of some 30 to 37 ft. stiff to hard clayey silt with sand and occasional gravel underlain by sound dolomitic limestone bedrock.

The proposed abutment and pier footings can be founded within the clayey silt stratum at or below elev. 632 and 614, with safe bearing pressures of 2.5 t.s.f. and 1.5 t.s.f., respectively. Alternatively, the piers can also be founded on end-bearing piles driven to bedrock.

No dewatering or stability problems are anticipated.

8. MISCELLANEOUS:

The field work, performed during the period August 10 to 18, 1967, was undertaken by Mr. Z. Ozden, Project Foundation Engineer. The investigation was carried out under the general supervision of Mr. M. Devata, Supervising Foundation Engineer, who also prepared this report.

Equipment used was owned and operated by Johnston Drilling Co. Ltd.

October 1967

APPENDIX I

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 67-F-70

LOCATION Sta. 331 + 70 @ .Q.E.W. and 76' o/s to Rt.

ORIGINATED BY ZSO

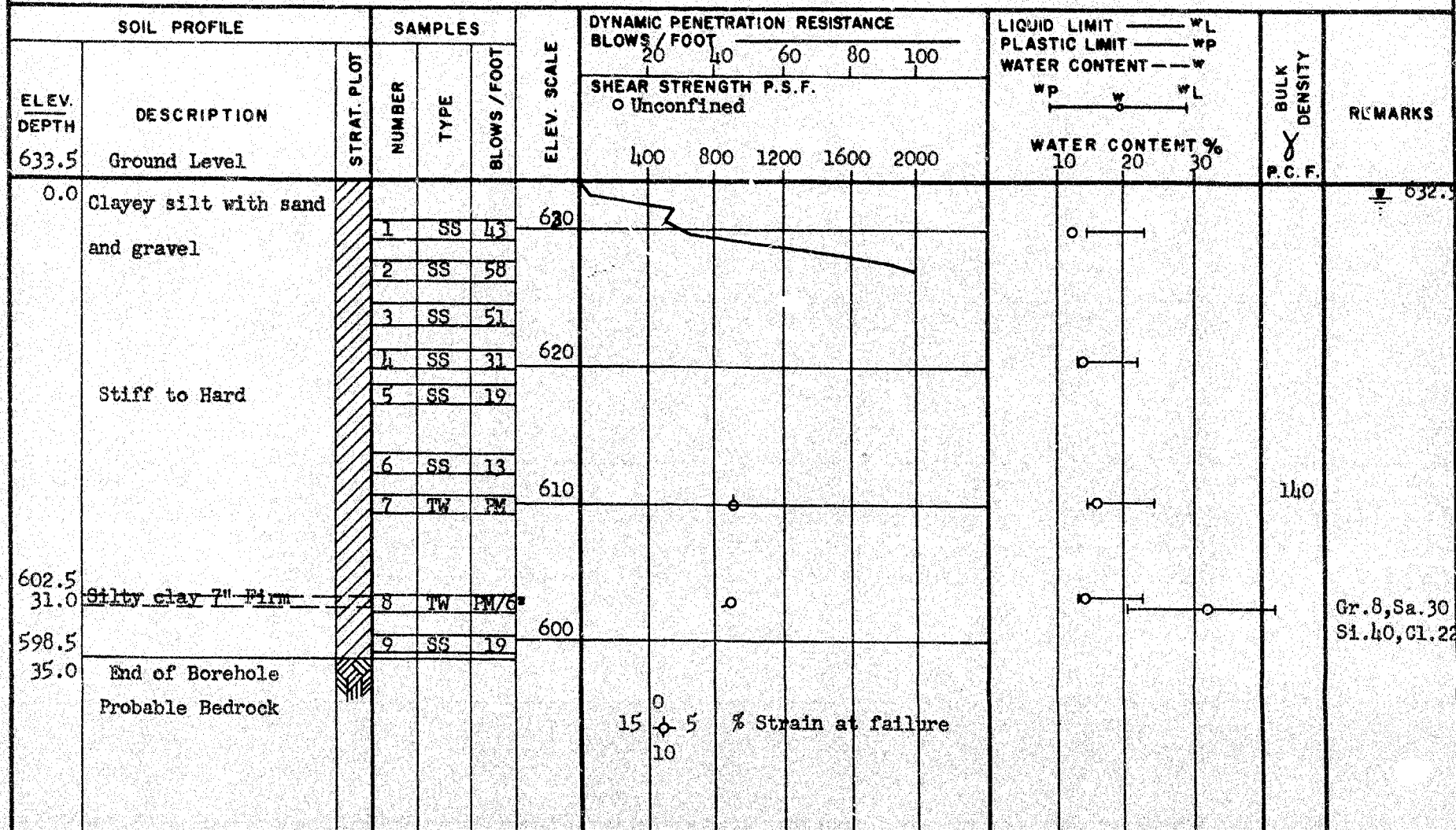
W.P. 161-64

BORING DATE August 10, 1967

COMPILED BY AMS

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY *HR*

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 67-F-7C

LOCATION Sta. 322 + 42 @ Q.E.W. and 75' o/s to Rt.

ORIGINATED BY ZO

W.P. 161-64

BORING DATE August 11, 14, 1967

COMPILED BY AMS

DATUM Geodetic

BOREHOLE TYPE NX Casing, Washbore & AXT R.C.

CHECKED BY SL

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F. o Unconfined					WP	W	WL		
634.2	Ground Level						400	800	1200	1600	2000	10	20	30		
0.0	Clayey silt with sand and gravel.					630										631.8
	Stiff to hard.		1	SS	63											
			2	SS	48	620										
			3	SS	22											
			4	TW	PM 10"											
			5	SS	18											
			6	TW	PM	610										
			7	SS	10											
			8A	SS	PM											
			9	TW	PM											
601.0	Silty Clay		10	SS	15 1/2"	600										138 Gr. 4, Sa. 17 Si. 51. Cl. 28
33.2	Dolomitic Limestone		11	AXT Rec	86%											
	Bedrock			R.C												
592.5			12	AXT Rec	98%											
				RC												
41.7	End of Borehole															
							0 15 5 10	% Strain								

FOUNDATION SECTION

CHECKED BY S. J. [Signature]

[illegible]

FOUNDATION SECTION

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 67-F-70

LOCATION Sta. 333 + 60 75' Lt. Q.E.W. of

ORIGINATED BY W.H.

W. P. 161-64

BORING DATE August 17, 1967

COMPILED BY AMS

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

JOB 67-F-70

LOCATION Sta. 333 + 96 91' Rt. Q.E.W. 0

ORIGINATED BY WH

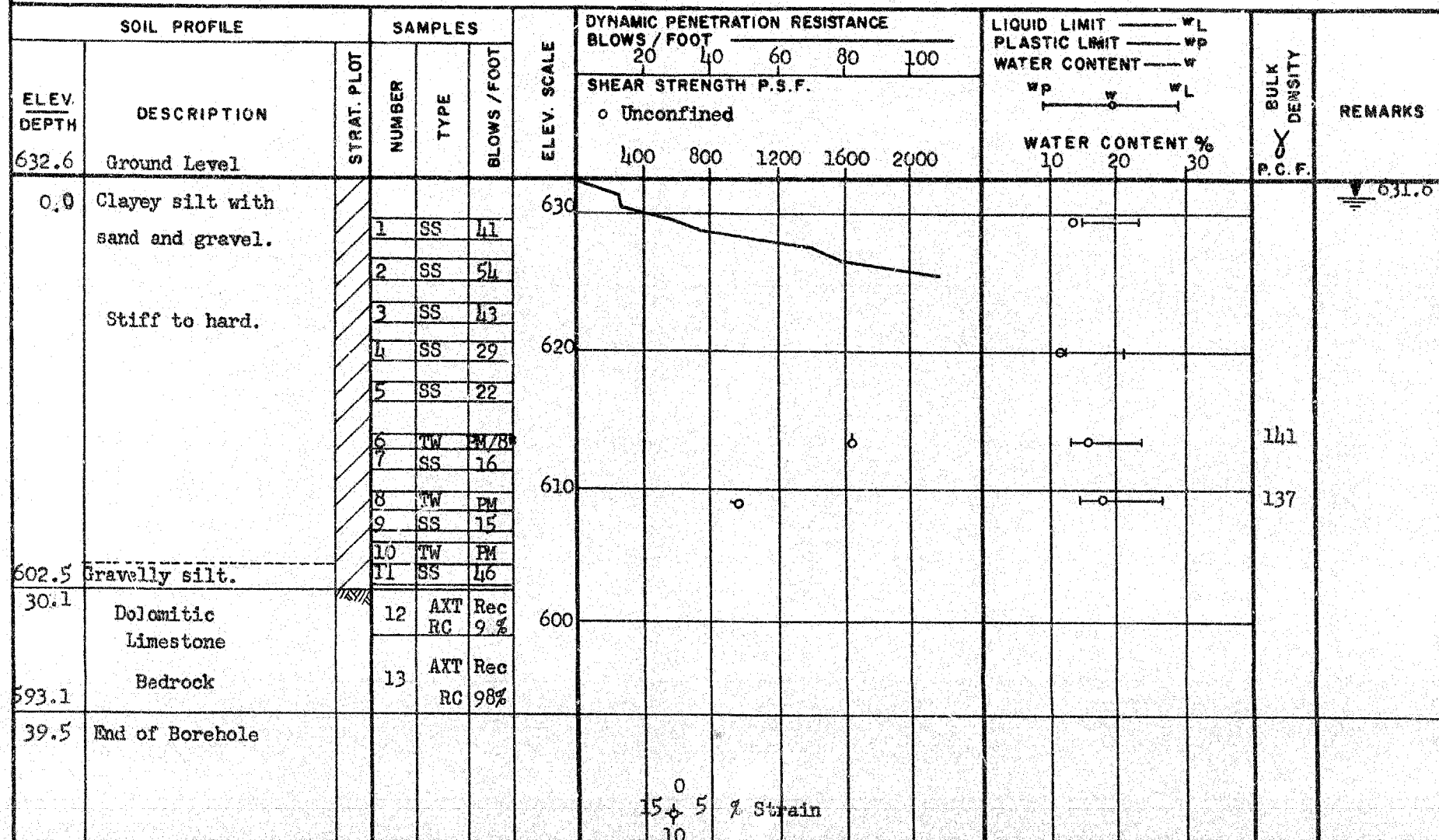
W.P. 161-64

BORING DATE August 17, 18, 1967

COMPILED BY AMS

DATUM Geodetic

BOREHOLE TYPE NX Casing, Washbore and AXT R.C.

CHECKED BY *SR*

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 7

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 67-F-70 LOCATION Sta. 333 + 17 84' Rt. .Q.E.W. % ORIGINATED BY ZO
 W.P. 161-64 BORING DATE August 17, 18, 1967 COMPILED BY _____
 DATUM Geodetic BOREHOLE TYPE Cont. Flight Auger CHECKED BY HR

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	WP	WL	W		
634.1	Ground Level						400	800	1200	1600	2000	10	20	30		633.6
0.0	Clayey silt with sand and gravel. Stiff to hard.		1	SS	25	630										
			2	SS	42											
			3	SS	63											
			4	SS	29	620										
			5	TW	PM/20											
			6A	SS	25											
			7	TW	PM/12"											
			8	SS	13	610										
			9	TW	PM											
			10	SS	11											
			11	TW	PM											
602.7			12	SS	67/1"											
31.4	End of Borehole Probable Bedrock															

0
15 5 % Strain
10

104/10"

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 67-F-70

W. P. 161-64

DATUM Geodetic

LOCATION Sta. 331 + 96 @ Q.E.W. 103' o/s Lt.

BORING DATE August 23, 1967

BOREHOLE TYPE Cont. Flight AugerRECORD OF BOREHOLE NO. 9 (Formerly B.H.#8
Golder & Assoc.) FOUNDATION SECTION

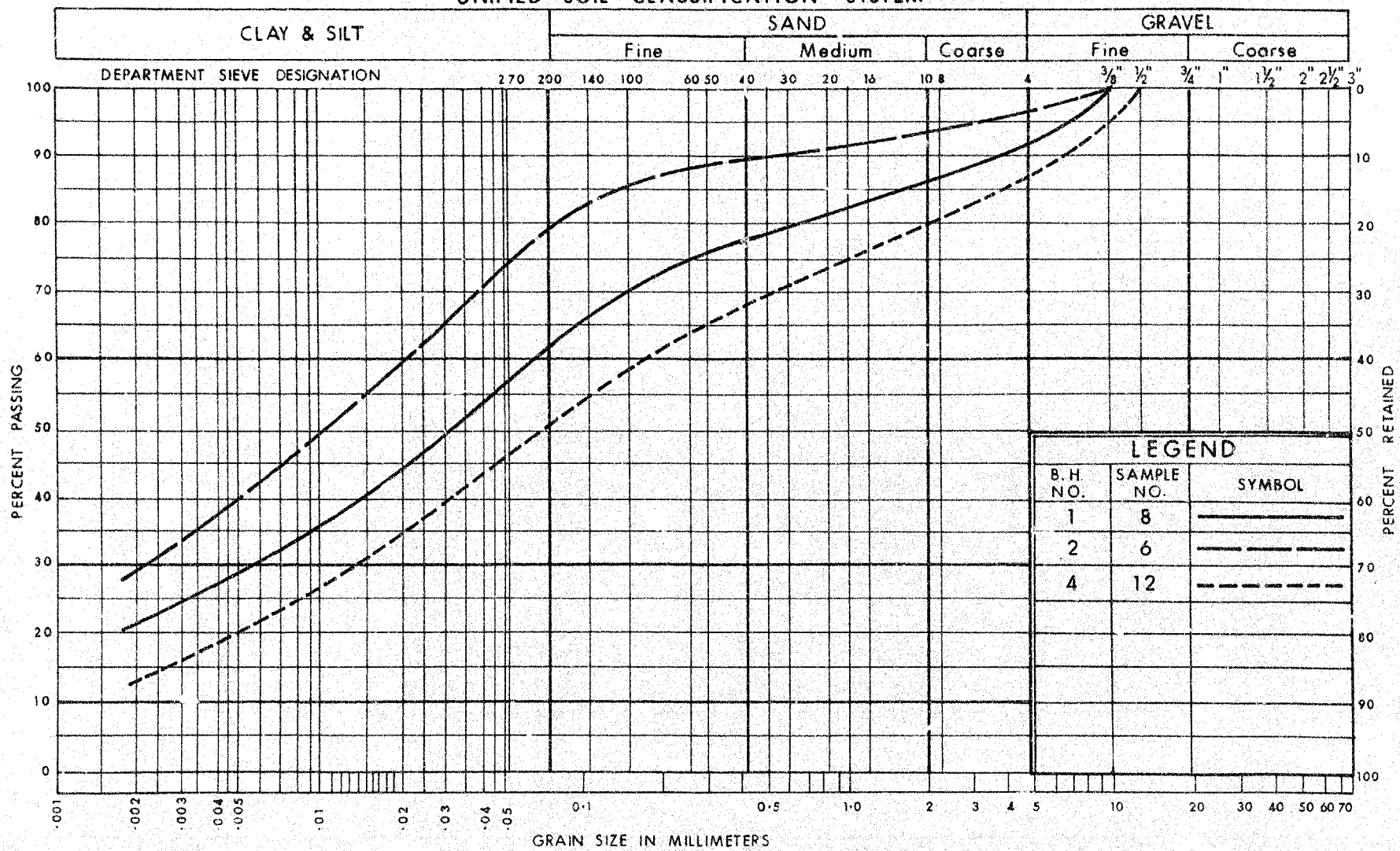
ORIGINATED BY JBD

COMPILED BY MW

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		BULK DENSITY Y P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE	BLOWS / FOOT 20 40 60 80 100	SHEAR STRENGTH P.S.F.	WATER CONTENT % 10 20 30		
637.2	Ground Level										
0.0	Clayey silt with sand trace of gravel. Hard to stiff.		1	SS	73	630					633.7
			2	SS	49						
			3	SS	45						
			4	SS	28						
			5	SS	21						
			6	SS	17						
			7	SS	11						
			8	SS	12						
600.0						610					
37.2	End of Borehole Probable Bedrock					600					

UNIFIED SOIL CLASSIFICATION SYSTEM

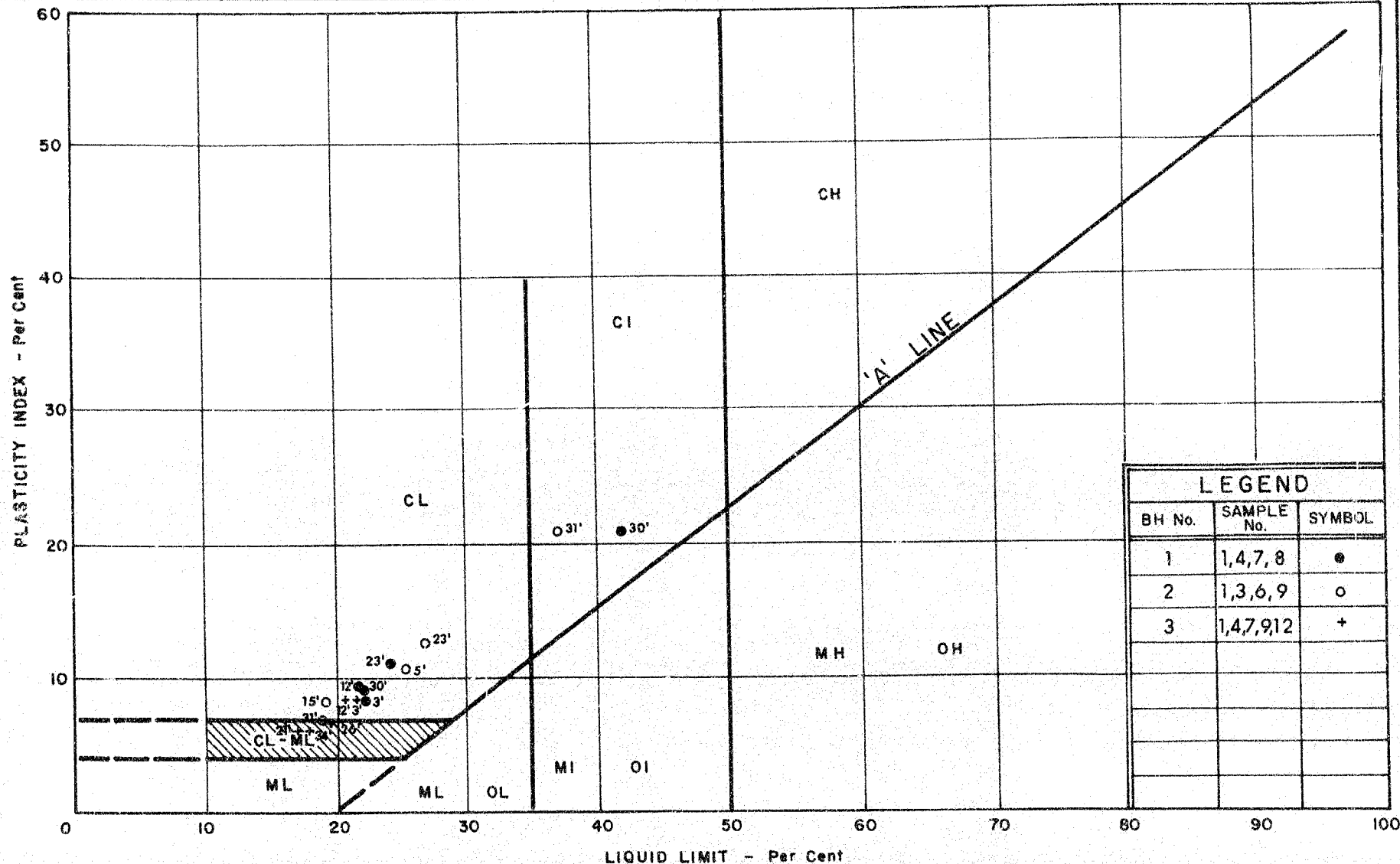


GRAIN SIZE DISTRIBUTION



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

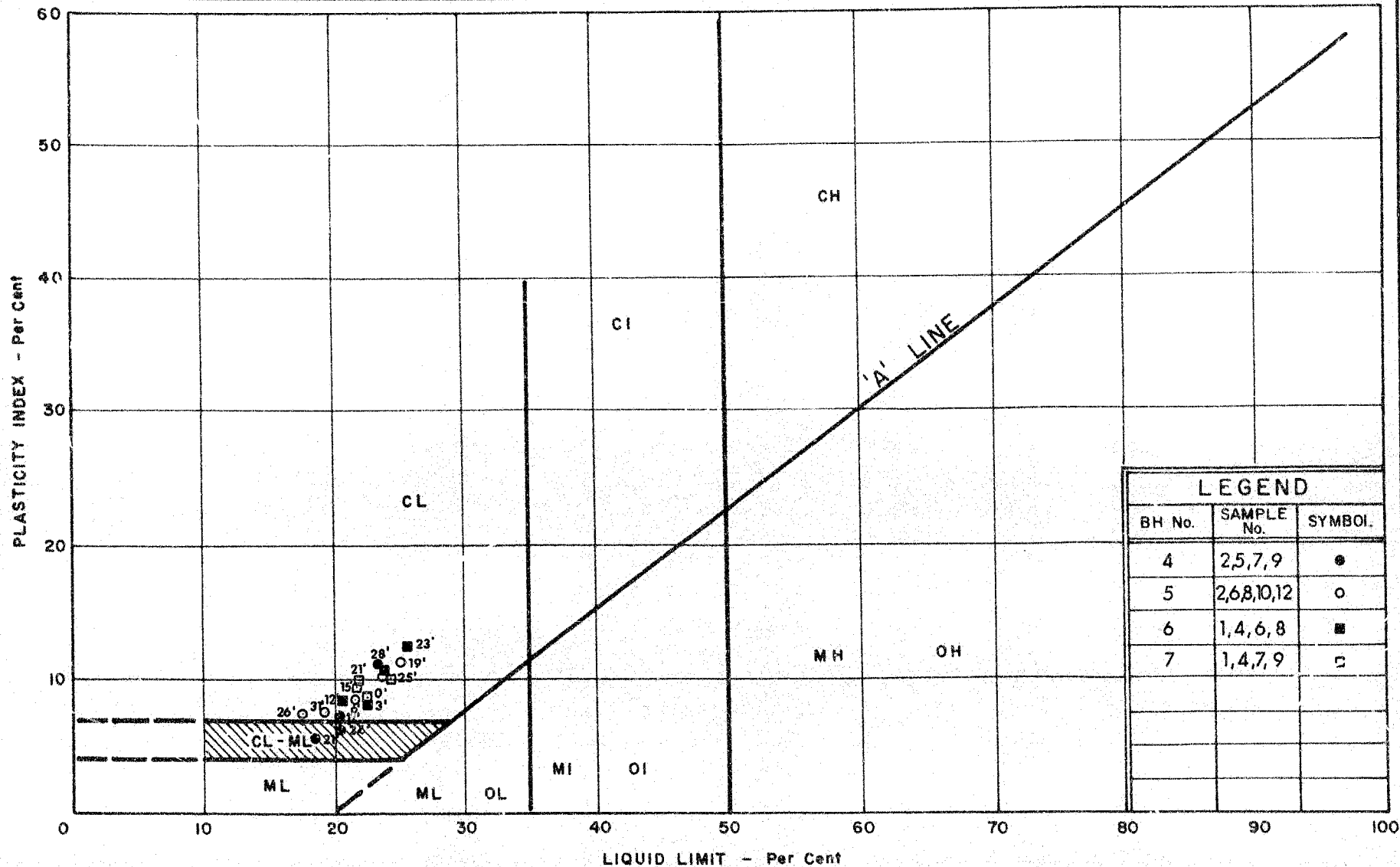
W.P. No. 161-64
JOB No. 67-F-70



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART

W.P. No. 161-64
JOB No. 67-F-70



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART

W.P. No. 161-64
JOB No. 67-F-70

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLE 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 -
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

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

SOIL TESTS

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

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

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

M. Devata

Telephone: 243-3446

Mr. W. Wigle,
Program Engineer,
Administration Bldg.

E.J. McCabe,
Toronto Regional Road Design.

March 13, 1968.

Re: Queen Elizabeth Way from
Highway 405 to Fort Erie,
District 4, Hamilton.

Your letter of February 12, 1968 requesting a program for placement of early fills as recommended by the Foundation Section has been passed on to me for comment.

This afternoon Mr. Devata, Foundations Section, Mr. Melinyshyn, Bridge Planning Section, and the writer met to consider our needs for early fill placement. It was determined that early fill would be placed:

- 1) If required for bridge construction.
- 2) If required for grading purposes. A 6" settlement or more was used as a basis to determine the need for early fill placement for grading purposes.

The following is a summary of our conclusions:

- 1) Mountain Road Interchange - W.P. 154-64.

Bridge Office to decide in one month whether early fill placement required for bridge purposes.

- 2) Thorold Stone Road - W.P. 155-64-03.

No early fill placement required.

- 3) McLeod Road - W.P. 156-64.
- 4) Northbound West Service Road - W.P. 157-64-2.

Both bridges will be on piles. An 8½" settlement is predicted. We propose delaying the final paving of the fill areas from one to two years.

Continued /2

March 13, 1968.

Mr. W. Wigle - Re: Queen Elizabeth Way.

- 5) Lyons Creek - W.P. 158-64-01.
- 6) Beck Road - W.P. 442-65.
- 7) Bossert Road - W.P. 443-65.
- 8) Sodom Road - W.P. 159-64.
- 9) Baker Road - W.P. 445-65.
- 10) Townline Road, Black Creek, Service Road - W.P. 167-64.
- 11) Ridgemount Road - W.P. 165-64.
- 12) Bowen Road
- 13) Sunset Drive - W.P. 447-65.
- 14) Gilmore Road - W.P. 448-65.

Considerable settlement can be anticipated for the above structure sites and approach thereto. We propose that early fill placement be considered two years in advance of the current construction program year.

- 15) West-North and South Ramp - W.P. 162-64-2.
 - 16) Thompson Road - W.P. 162-64-1.
 - 17) - W.P. 162-64-3.
 - ✓ 18) C.N.R. Widening - W.P. 162-64-05.
 - 19) Concession Road (Erie St.) - W.P. 161-64.
 - 20) North Street Revision - W.P. 160-64.
- 67-F-70

No early fill placement required at these sites.

E.J. McCabe

E.J. McCabe
Expressway Consultant Control Engineer
For:
G.K. Hunter
Regional Road Design Engineer

EJM/GB

c.c. H. Devata ✓
W. Melinyshyn
A.J. Fletcher
E.A. Fletcher

cc: Foundations Files (Rm. 110)

Hwy. 401 & Keele St.,
Downsview, Ontario.

Materials and Testing Division

August 11, 1967

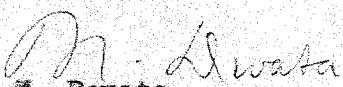
Johnston Drilling Co. Ltd.,
377 Munster Ave.,
Toronto, Ontario.

Dear Sirs:

This is to confirm our request of August 4, 1967,
for the supply of a Penn. Drill, together with all necessary
equipment, as specified under the terms of our Contract
Agreement, at Erie Street and Q.E.W., near Port Erie, Ont.,
on August 10, 1967.

This project bears Job Number 67-F-70.

Yours truly,


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

MD/MdeP

cc: Mr. H. Konings
Foundation Files (Rm. 110)
Gen. Files

1967 AUG 11 AM 9:18

00030

B

HAMN DOWN 1 AUG 11/67 920A VR

H GREENALND DIST ENGR

ATTN D WALLER MTCE ENGR

RE PROPOSED STRUCTURE AT ERIE STREET AND QEW LOT 2 CON 2 TOWN OF

FORT ERIE DIST 4 WP161-64 WJ67-F-70

FIELD INVESTIGATION WORK FOR THE ABOVE MENTIONED PROJECT STARTED

ON AUG 10/67. THIS IS FOR YOUR INFORMATION.

M DEVATA FOR A G STERMAC MAT AND TESTING

BB

T
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P
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MEMORANDUM

TO: Mr. A. G. Stermac,
Principal Foundation Engineer,
Room 107, Lab. Building.

FROM: Bridge Division,
Downsview, Ontario.

DATE: August 3, 1967.

OUR FILE REF.

IN REPLY TO

SUBJECT: Erie Street Overpass,
W.P. 161-64, Site 34-200,
Q.E.W., Dist. 4.

Herewith are two prints of the Bridge Site Plan E-4779-1 on which the probable location of footings have been marked in red.

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

Also attached is the preliminary structure site report.

JFW/md
Attach.
cc. R. Forrest
A. Crowley

Joseph F. Walshe
J. F. Walshe,
for W. S. Melinyshyn,
Regional Bridge Location Engineer.

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac

Mr. W. Melnychyn,
Reg. Bridge Location Engineer,
Central Region,
Admin. Building

Bridge Office,
Downsview, Ontario

January 16, 1969

Erie Street Overpass
N.P. 161-64, Site 34-206
G.E.W., District No. 4

67 F - 70

Attached herewith are prints of the Preliminary Bridge Plan Drawing D-6377-21 for the above-mentioned structure.

The estimated cost of the proposed structure is \$271,000. This cost includes tender, materials, engineering and sundry construction.

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

GSG:rd

C.S. Grebski,
Bridge Design Engineer

Attach.

c.c. S. McCombie
A. Stermac (2)
J. Anderson

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

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

January 27, 1969

-- Erie Street Overpass --
W.P. 161.64, Site 34-206, W.J. 67-P-70
Q.E.W., District No. 4 (Hamilton)

We have reviewed the Preliminary Drawing D-6377-P1
for the above mentioned structure and submit the following
comments:

The foundation investigation was carried out on the
assumption that a twin, three-span structure was contemplated
for the above site, whereas the Preliminary Drawing indicates
a twin, single-span structure. In such a case, the footings
will be located at approximately elevation 613. Footings at
this elevation should be designed for an allowable bearing
pressure of 1.5 tsf.

MD/MdeP

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

Foundations Files
Gen. Files

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

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac

Mr. W. Melnyshyn,
Reg. Bridge Location Engineer,
Central Region,
Admin. Building

Bridge Office,
Downsview, Ontario

January 16, 1969

Erie Street Overpass
M.P. 161-64, Site 34-206
O.E.W., District No. 4

67-F-70

Attached herewith are prints of the Preliminary Bridge Plan Drawing B-6577-21 for the above-mentioned structure.

The estimated cost of the proposed structure is \$271,000. This cost includes tender, materials, engineering and sundry construction.

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

CSG:rd

C.S. Grebski,
Bridge Design Engineer

Attach.

c.c. S. McCombie
A. Stermac (2)
J. Anderson

MEMORANDUM

TO: Mr. A. Stermac,
Principal Foundation Engineer,
Room 107, Lab. Building

FROM: C.S. Grebski,
Bridge Office

ATTENTION:

DATE: September 4, 1969

OUR FILE REF.

IN REPLY TO

SUBJECT: Erie Street Overpass
W.P. 161-64, Site 34-206
Q.E.W., District No. 4

67-F-70

Attached herewith we are submitting the final
bridge drawings which show the foundation design for
this structure.

Kindly give us your comments at your earliest
convenience.

CSG:rd

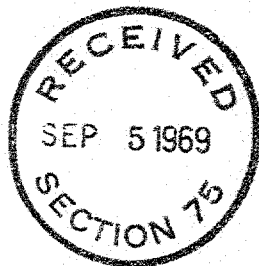
Attach.

c.c. Foundation Section

C.S. Grebski
C.S. Grebski,
Bridge Design Engineer

No comments

M. Nawata
Sept 12/69



MEMORANDUM

ago

To: Mr. B. B. Davis,
Bridge Engineer,
Bridge Division,

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

Attention: Mr. S. McCombie

Date: September 15, 1969.

Our File Ref.

In Reply To

SUBJECT:

-- Erie Street Overpass --
W.P. 161-64, Site 34-206, W.J. 67-F-70
Q.E.W., District No.4 (Hamilton)

In this memo the ground water conditions discussed in our Foundation Investigation Report W.J. 67-F-70 dated October 11th, 1967 will be elaborated upon.

The investigation revealed that the overburden across the site consists of 30 to 37 feet of hard to stiff clayey silt with sand and occasional gravel. This deposit is underlain by dolomitic limestone bedrock.

During the investigation it was noticed that, once the borings penetrated through the cohesive overburden into the upper portion of the bedrock the water in the boreholes rose to the levels recorded in the report, i.e. 1 to 4.5 ft. below the existing ground surface. Based on previous experience in the general area it is known that the upper surface of the dolomitic limestone bedrock is slightly fractured and jointed and often this zone is more pervious than the overlying cohesive overburden. Consequently the upper portion of the bedrock underlying the overburden forms a confined aquifer. If the aquifer was tapped then the water levels would rise to the prevailing hydrostatic head. It is inferred this, in fact, happened and, therefore, the water levels observed at the time of the investigation are indicative of hydrostatic head in the upper portion of the bedrock.

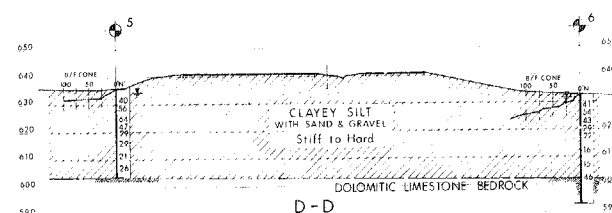
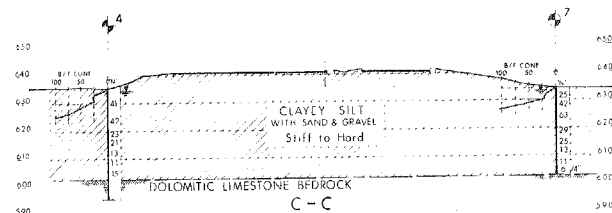
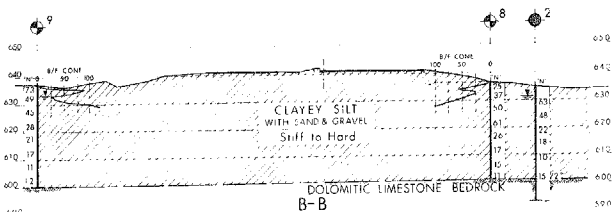
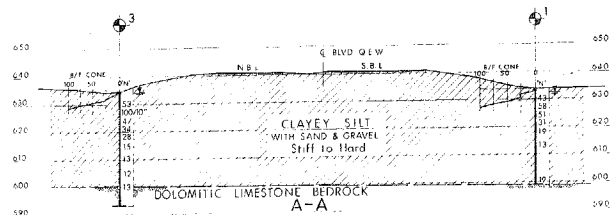
We believe that the aforementioned information may be of some value and should be included along with our foundation report.

MD/la

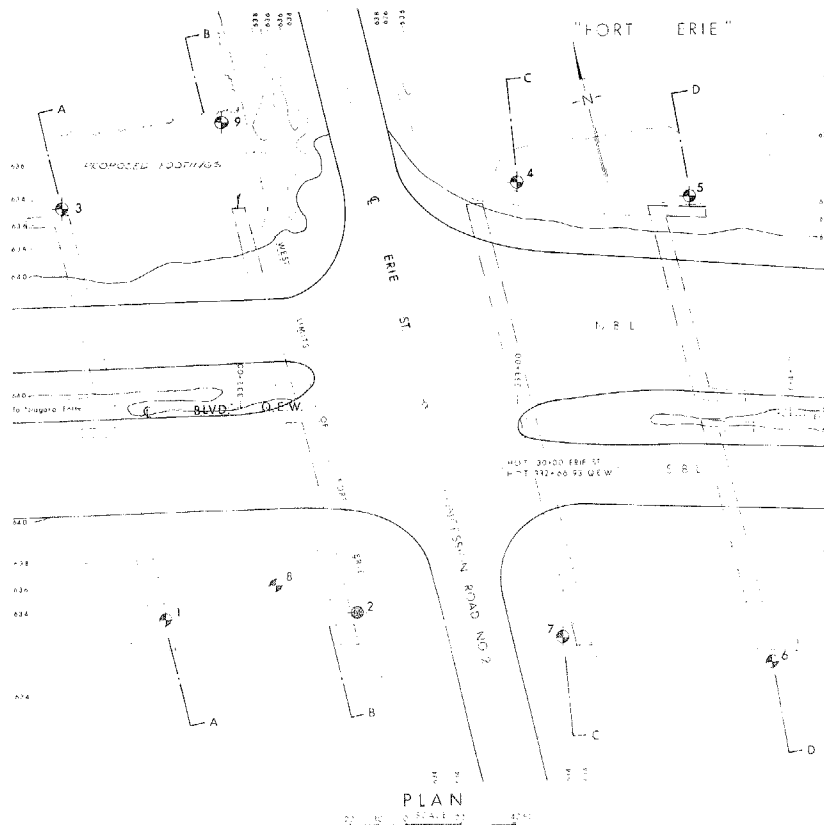
cc: Messrs. B. R. Davis (2)
A. Tregaskes
D. W. Farren
G. K. Hunter (2)
H. Greenland
W. S. Melinyshyn
T. J. Kovich
B. A. Singh

Foundation Files ✓
General Files.

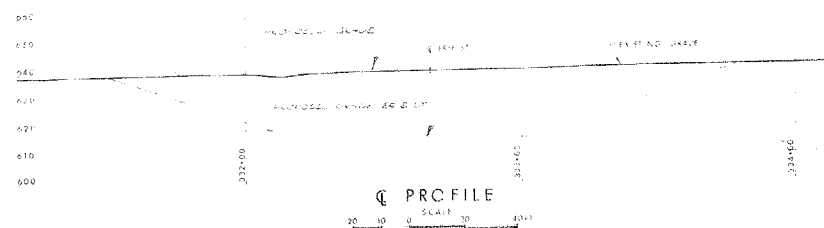
M. Devata
M. Devata
SUPERVISING FOUNDATION ENGINEER
Per: A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER



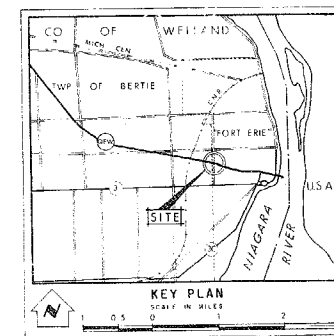
SECTIONS
20 10 0 SCALE 20 40 FT



PLAN
20 10 0 SCALE 20 40 FT



PROFILE
20 10 0 SCALE 20 40 FT



LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation AUG. 1967		

NO.	ELEVATION	STATION	OFFSET
1	613.4	231+7.0	76' RT
2	613.1	231+10.0	75' RT
3	613.1	231+17.8	78' LT
4	613.1	232+1.0	83' LT
5	612.7	231+0.0	75' LT
6	612.4	231+2.0	91' RT
7	612.1	231+1.7	84' RT
8	610.7	232+1.1	65' RT
9	617.2	231+9.6	103' 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.

EXTENSION	DATE	BY	DESCRIPTION

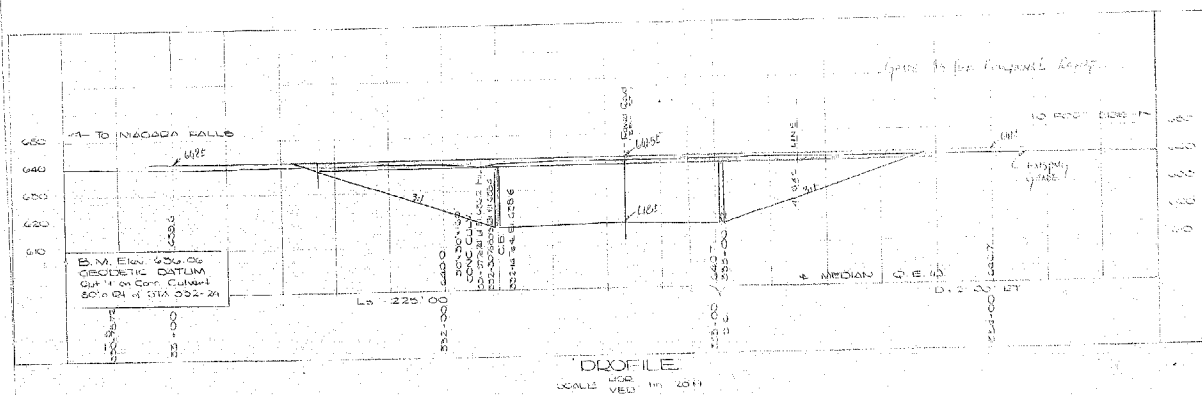
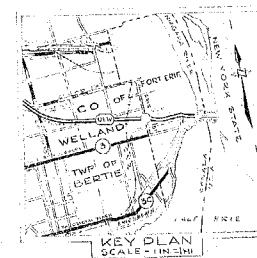
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION - FOUNDATION SECTION

ERIE STREET
(CONCESSION ROAD NO. 2)

KING'S HIGHWAY NO. 4 G.E.W. DIST. NO. 4
CO. WELLAND FORT ERIE
TWP. BERTIE LOT 2 CON. II

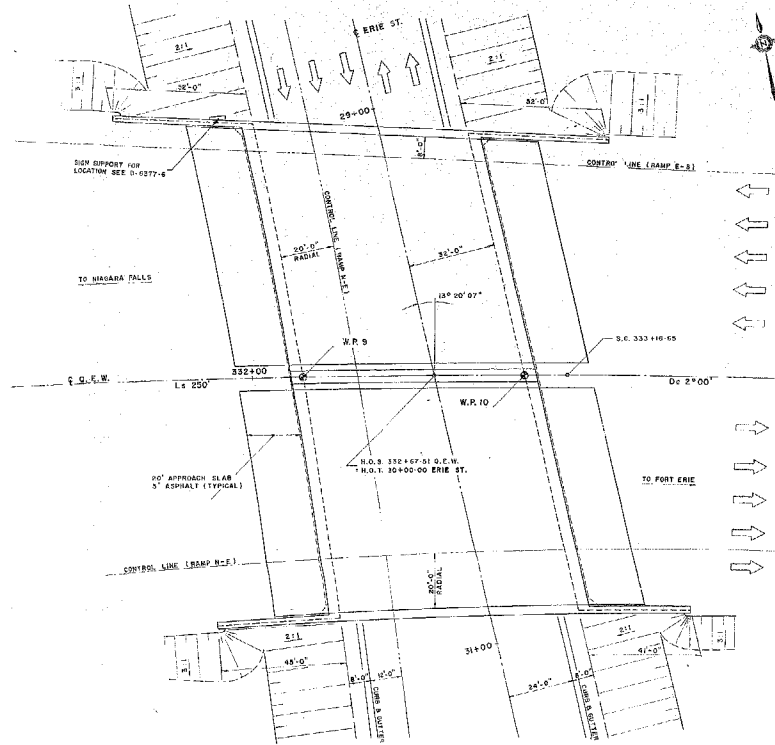
BORE HOLE LOCATIONS & SOIL STRATA

DRAWN BY: H. H. CHICKER	CHKD BY: H. H. CHICKER	DATE: 6 OCT 1967	APP. NO. 67-F-70A
DRAWN S. O. (CHECKED)	JOB NO. 67-F-70	DATE: 6 OCT 1967	DATE: 6 OCT 1967
DATE: 6 OCT 1967	DATE: 6 OCT 1967	DATE: 6 OCT 1967	DATE: 6 OCT 1967



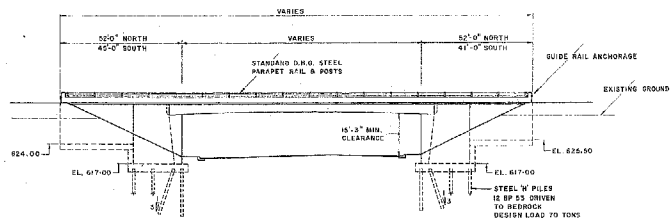
101-64 67-F 70
NH 160-64

DATE	REVISIONS & ADDITIONS	BY	CHECKED
DEPARTMENT OF HIGHWAYS ONTARIO DESIGN BRANCH ENGINEERING SURVEYS DIVISION			
BRIDGE SITE			
PROPOSED CROSSING OF EDIE STREET AND QUEEN ELIZABETH WAY			
LOT 2, CON 2 & TOWN OF FORT EDIE TOWN OF EDZBURG COUNTY OF WELLSAND			
SCALE AS SHOWN	DISTRICT HAMILTON	REGION CENTRAL	
DESIGNED BY G. W. GIBSON	DATE OF APPROVAL APR 1967	SITE NO. 34-100	34-100
CHECKED BY C. ANDERSON	DESIGNED BY C. ANDERSON	DRAFTSMAN J. D. GIBSON	CHECKED BY J. D. GIBSON
CHECKED BY C. ANDERSON	DESIGNED BY C. ANDERSON	PLAN R/LN	E4779-1



NOTE: LENGTHS OF RETAINING WALL & WINGWALL ARE MEASURED ALONG OUTSIDE FACE OF WALL

SEE 6377-3 FOR LOCATION AND CO-ORDINATES OF W.P.



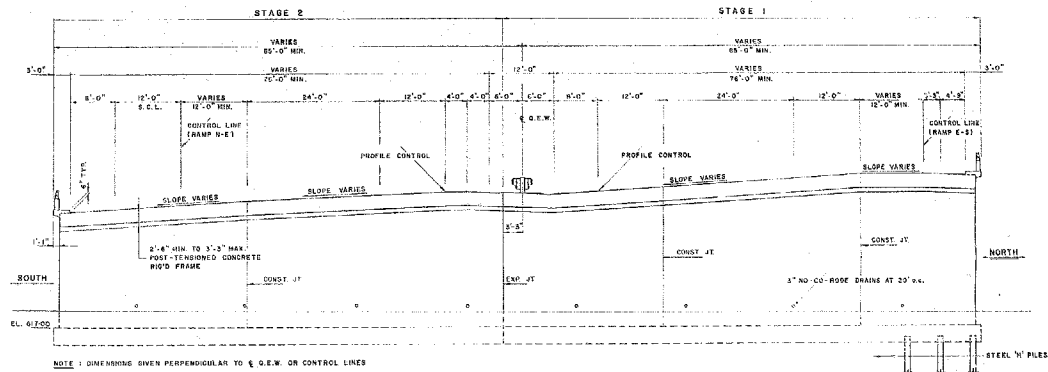
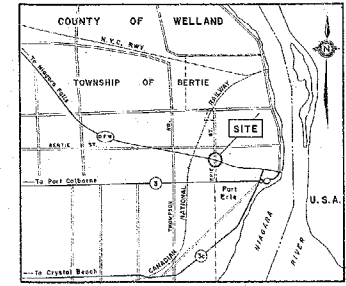
13° 20' 07" SKEW DATA

SIN. = 0-230646889
COS. = 0-973037004
TAN. = 0-2370409
SEC. = 1-02771010

Q.E.W. ALIGNMENT DATA

CURVE
Δ 11° 55' 15"
Δα 6° 53' 15"
Dc 2° 00' 31"
Rc 2884-79'
Lc 344-30'
Ec 16-40'

SPIRAL
Ds 2° 30'
Ls 250-00'
Ts 425-35'



NOTE: DIMENSIONS GIVEN PERPENDICULAR TO Q.E.W. OR CONTROL LINES

LIST OF DRAWINGS

1. GENERAL ARRANGEMENT
2. BORE HOLE LOCATION & SOIL STRATA
3. FOUNDATION & PILING LAYOUT
4. FOUNDATION REINFORCING & DETAILS
5. FRAME LEG DIMENSIONS & DETAILS
6. WINGWALLS & RETAINING WALLS
7. DECK REINFORCING & STRESSING SEQUENCE
8. DECK SECTIONS
9. SKEWER ELEVATIONS & ANCHORAGE DETAILS
10. PARAPET WALL DETAILS
11. STANDARD STEEL PARAPET RAIL
12. APPROACH SLABS
13. STANDARDS
14. STANDARDS

CONSTRUCTION NOTES:

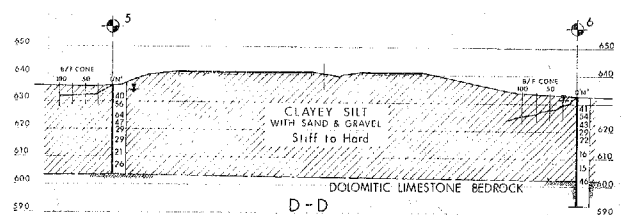
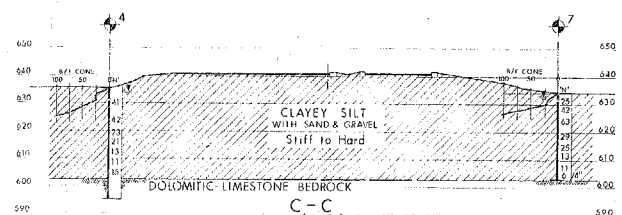
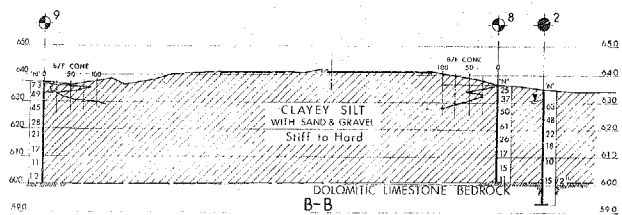
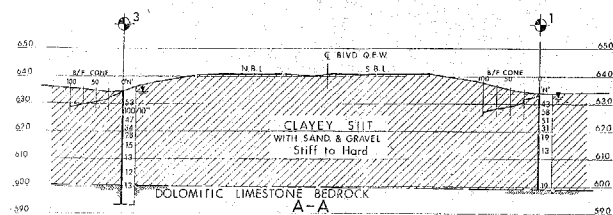
CLASS OF CONCRETE
DECK, CURBS & PARAPET WALLS 5,000 P.S.I.
REMAINDER 3,000 P.S.I.

CLEAR COVER ON REINFORCING STEEL
DECK SLAB TOP 3" BOT. 1 1/2"
CURBS & APPROACH SLABS 2"
PARAPET WALLS 5"
REMAINDER 3"

GRANULAR BACKFILL BEHIND ABUTMENTS SHALL BE PLACED SIMULTANEOUSLY ON BOTH SIDES IN 2 FT. LIFTS.

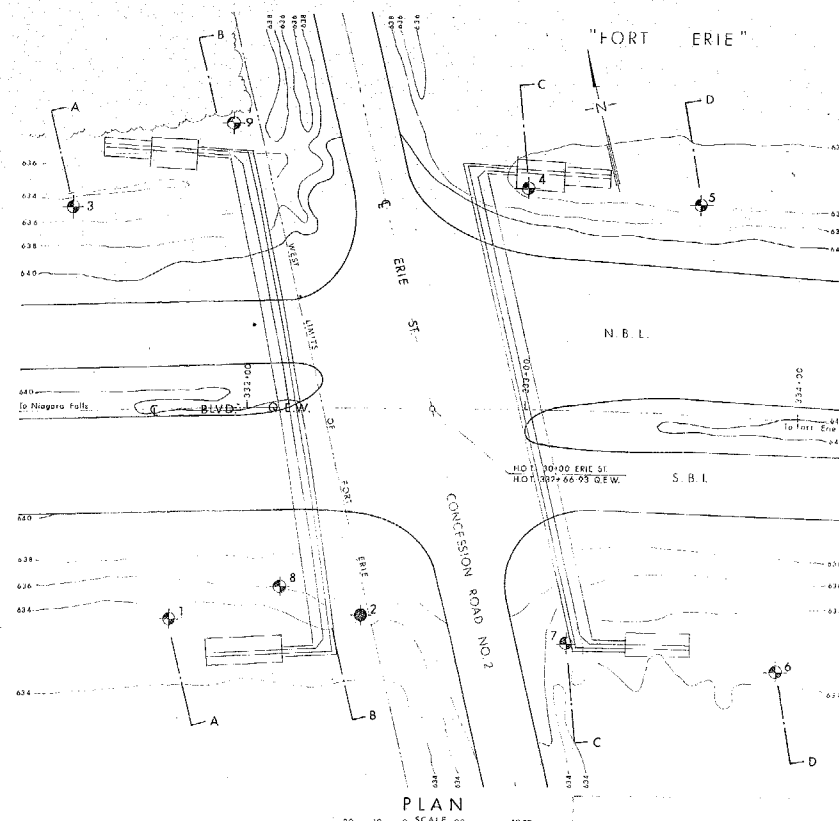
DEPARTMENT OF HIGHWAYS ONTARIO BRIDGE DIVISION	
McCORMICK, RANKIN & ASSOCIATES LIMITED CONSULTING ENGINEERS	
ERIE STREET OVERPASS	
KING'S HIGHWAY No. Q.E.W.	Dist. No. 4
CO. WELLAND	PORT ERIE
TWP. BERTIE	LOT 2 CON. 2
GENERAL ARRANGEMENT	
APPROVED	SITE No. 34-206
DESIGN J. W. T. CHECK R. D. N.	CONTRACT No.
DRAWING J. W. B. CHECK L. C. H.	DRAWING No.
DATE AUG/88	LOADING H920-44
D-6377-1	

B.M. Elev. 636-06 (Geodetic Datum)
Cut Cross on Concrete Culvert
80' 0" Rt. of Sta. 332+24



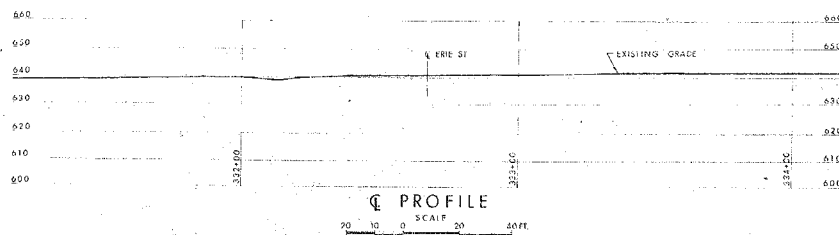
SECTIONS

20 0 20 40 FT.



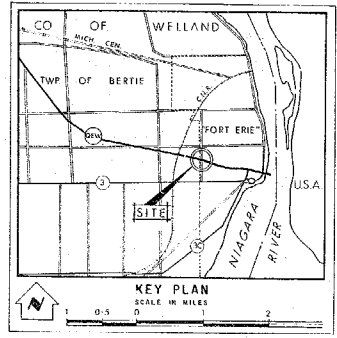
PLAN

20 0 20 40 FT.



PROFILE

20 0 20 40 FT.



KEY PLAN

SCALE IN MILES

0 0.5 1 2

LEGEND

- Bore Hole
- Cone Penetration Hole
- Hard & Cone Penetration Hole
- Water Levels established at time of field investigation, AUG. 1967

NO.	ELEVATION	STATION	OFFSET
1	633.5	331+7.0	76' RT.
2	634.2	322+4.2	75' RT.
3	635.5	331+3.8	74' LT.
4	635.6	331+0.0	63' LT.
5	636.3	333+6.0	75' LT.
6	632.6	333+9.6	91' RT.
7	634.1	333+1.7	84' RT.
8	636.0	332+1.1	65' RT.
9	637.2	331+9.6	103' 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.

DATE	BY	DESCRIPTION

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

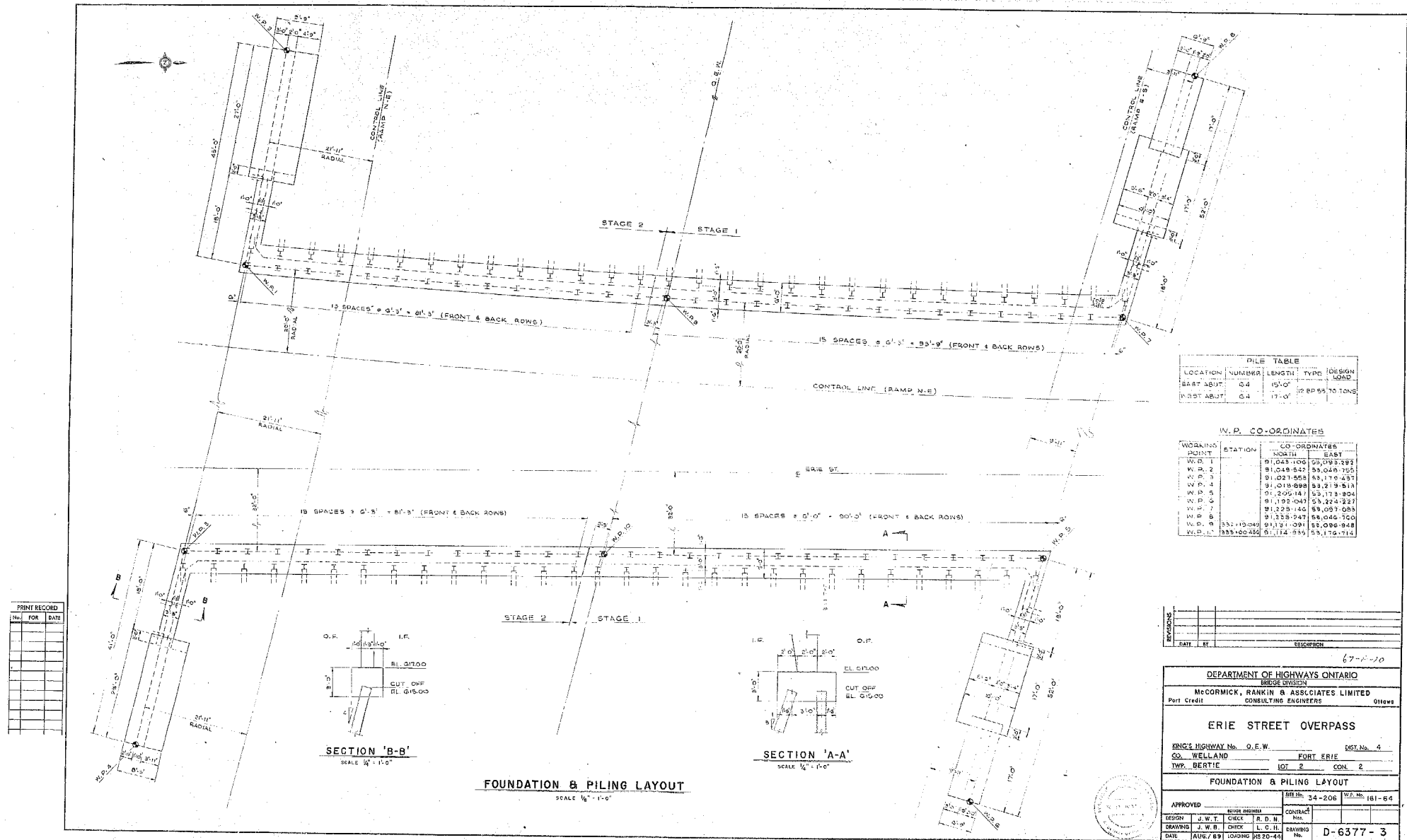
ERIE STREET
(CONCESSION ROAD NO. 2)

KING'S HIGHWAY NO. Q.E.W. DIST. NO. 4
CO. WELLAND TWP. BERTIE LOT 2 CON. II

BORE HOLE LOCATIONS & SOIL STRATA

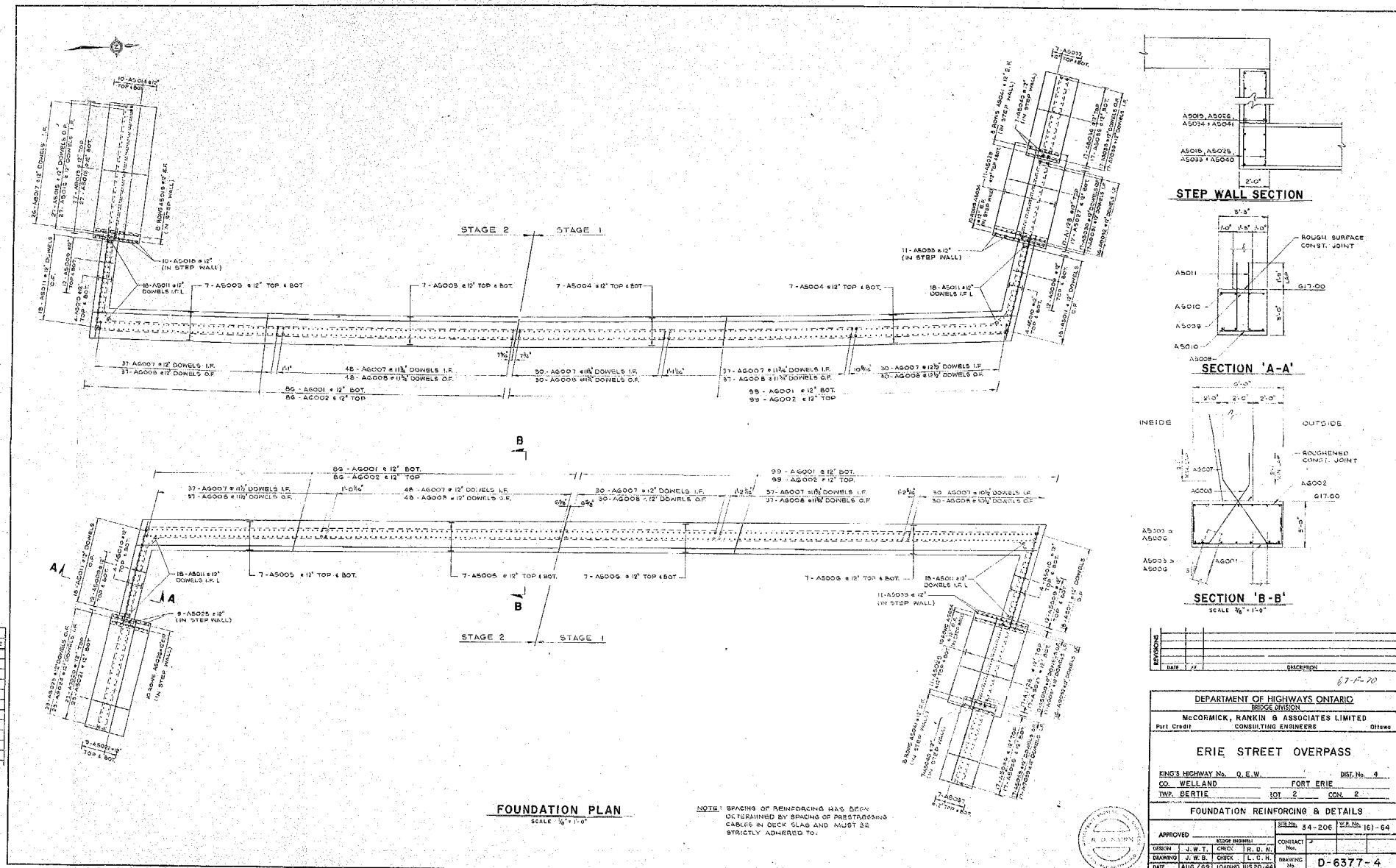
SUBD. W.H. CHECKED ✓ W.H. NO. 161-54 M.B.T. DRAWING NO. 67-F-70A
DRAWN S.C. CHECKED ✓ JOB NO. 67-F-70
DATE 6 OCT. 1967 SITE NO. 34-208 BRIDGE DRAWING NO. D-6377-2
APPROVED [Signature] FOR NO.

REF NO. E 4770-1



PILE TABLE				
LOCATION	NUMBER	LENGTH	TYPE	DESIGN LOAD
EAST ABUT	64	15'-0"		
WEST ABUT	64	17'-0"	12 BP 55	70 TONS

W. P. CO-ORDINATES			
WORKING POINT	STATION	CO-ORDINATES	
		NORTH	EAST
W. P. 1		91,043.100	55,093.255
W. P. 2		91,049.547	55,048.782
W. P. 3		91,021.558	55,170.457
W. P. 4		91,019.898	55,219.513
W. P. 5		91,205.147	55,173.804
W. P. 6		91,192.047	55,224.227
W. P. 7		91,225.146	55,097.085
W. P. 8		91,258.247	55,046.763
W. P. 9	552 19-049	91,131.091	55,096.948
W. P. 10	985 00-450	91,114.895	55,176.714

[illegible]

67-17-70

<p align="center">DEPARTMENT OF HIGHWAYS ONTARIO BRUCE ARDSON</p>			
<p align="center">McDOWICK, RANKIN & ASSOCIATES LIMITED Part Credit CONSULTING ENGINEERS Ottawa</p>			
<p align="center">ERIE STREET OVERPASS</p>			
<p>KING'S HIGHWAY No. Q.E.W.</p>		<p align="right">Dist. No. 4</p>	
<p>CO. WELLAND</p>		<p align="right">FORT ERIE</p>	
<p>TWP. BERTIE</p>	<p>LOT 2</p>	<p align="right">CON. 2</p>	
<p align="center">FOUNDATION REINFORCING & DETAILS</p>			
<p>APPROVED _____</p> <p align="center"><small>(ENGINEER)</small></p>		<p>CONTRACT No. _____</p>	
<p>DESIGN J.W.T. CHICK</p>	<p>REVISION H.G.Z.N.</p>	<p>DRAWING No. _____</p>	<p align="right">D-3377-4</p>
<p>DATE 10/18/67</p>	<p>DATE 10/20/67</p>		