

MEMORANDUM

S.P. 162-64-

To: 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 24, 1967

LAIR FILE REF.

IN REPLY TO

DEC 1 1967

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
Proposed Overpass at the Crossing of
The W.-N. & S. Ramp and the Q.E.W.
(Thompson Rd. Interchange)
District 4 (Hamilton)
W.J. 67-F-80 -- W.P. 162-64-2

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

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

AGS/MdeF
Attach.

cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
H. Greenland
G. K. Hunter (2)
K. S. Melinyshyn
T. J. Kovich
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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
The W.-N. & S. Ramp and the Q.E.W.
(Thompson Rd. Interchange)
District 4 (Hamilton)
W.J. 67-F-80 -- W.P. 162-64-2

1. INTRODUCTION:

The Foundation Section was requested to carry out an investigation for the proposed overpass at the crossing of the W.-N. & S. Ramp (Bertie St.) and the Q.E.W. at the future interchange of the Queen Elizabeth Way and Thompson Rd. 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 23, 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 about 1 mile west of the west limits of the town of Fort Erie and approximately 700 ft. west of the existing Thompson Rd. At this location, the Queen Elizabeth Way grade is some 4 ft. above 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 some 2 ft. below the surrounding ground surface elevation. The south drainage ditch is quite swampy with about 1 ft. of water lying in the ditch. The immediate area to the north and south of the Queen Elizabeth Way is heavily wooded and generally flat.

cont'd. /2 ...

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

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.

3. FIELD AND LABORATORY WORK:

Six boreholes and six dynamic cone penetration tests were carried out during the course of the recent field work. Boring was achieved by means of a conventional diamond drill adapted for soil sampling purposes, and a continuous flight auger. 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 pushed either manually or hydraulically 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 to determine the undrained shear strength of the cohesive strata. Bedrock was proven in four boreholes by obtaining AXT size rock core samples. In two borings, bedrock was assumed to be the level at which the Penn. Drill auger 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-80A, 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

cont'd. /3 ...

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

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
Atterberg Limits
Undrained Shear Strengths

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 generally consists of 28 to 33 ft. of firm to hard clayey silt with traces of sand and gravel, followed by a 6-inch to 5-ft. layer of till-like deposit overlying 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-F-80A, are based on this information. From ground level downwards, the different soil types are described in detail as follows:

cont'd. /4 ...

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

4.2) Clayey Silt with Traces of Sand and Gravel:

This deposit was encountered immediately below the highway fill material in B.H.'s 1 and 4, and below a thin layer (12") of topsoil in B.H.'s 2, 3, 5, and 6, and extended down to approximate elev. 603 - elev. 599 where the till-like deposit was encountered. The material is essentially cohesive in nature, consisting of clayey silt with traces of sand and gravel. In general, the upper 10 to 13 ft. of this material consists of a very stiff to hard desiccated crust of clayey silt with traces of sand and gravel. In this portion, the 'N' values range from 18 to 50 blows per ft. In B.H.'s 1 and 4, the fill material generally consists of a stiff layer (5 to 6 ft.) of clayey silt with some sand, gravel and organics.

Physical properties of the overall deposit of clayey silt with traces of sand and gravel, as determined from field and laboratory tests, are summarized below:

Bulk Density	125 - 143 p.c.f.
Liquid Limit	19% - 41%
Plastic Limit	13% - 19%
Moisture Content	11% - 32%
Undrained Shear Strength ..	805 - 2680 p.s.f.
'N' Values	8 - 50 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 stratum generally ranges from very stiff to hard, decreasing to very stiff below elev. 620, and stiff below elev. 610.

Underlying the clayey silt stratum in all boreholes except B.H. 4, a layer of till-like deposit 6 inches to 5 ft. thick was encountered. This till-like deposit consists mainly of a

cont'd. /5 ...

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

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

heterogeneous mixture of clayey silt, sand and gravel and, generally, the consistency is hard. 'N' values for this till deposit range from 55 to 90 blows per ft.

4.3) Limestone Bedrock:

Bedrock was established by drilling 9 to 11 ft. of AXT core in B.H.'s 1, 2, 3, and 4. In B.H.'s 5 and 6, the bedrock contact was established by drilling with a Penn. auger to refusal. The depth at which bedrock was encountered, ranged from elev. 595.5 to elev. 603.0, or some 30 to 36 ft. below the existing ground surface. Rock core samples obtained show the rock to be generally sound, medium-grained, grey limestone, highly fossiliferous, with thin seams of dark shale and nodules of dark brown chert. Recovery ranged from 80% to 100%.

5. GROUNDWATER:

Observations carried out during the time of the field investigation, indicate that the water level in general, ranged from elev. 628 to elev. 630, which is some 2 to 6 ft. below ground surface. The exact water levels observed during the time of the field investigation, are shown on the enclosed drawing as well as on the borehole logs (Appendix I).

6. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct an overpass structure to carry the Queen Elizabeth Way over the W.-N. & S. ramp to Bertie St. and Thompson Rd. Present proposals call for twin three-span (55'-80'-55') structures with approach cuts having a maximum depth of about 24 ft. below the revised Q.E.W. grade.

cont'd. /6 ...

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

Subsoil at the site consists generally of a deposit of hard to stiff clayey silt with traces of sand and gravel, followed by limestone bedrock at a depth of 30 to 36 ft. below the existing ground surface. In certain areas, a thin layer of till-like material overlies the limestone bedrock.

6.1) Structure Foundations:

The proposed abutments may be constructed within the approach cuts in the hard clayey silt crust. Spread footings placed at or below elev. 625, can be designed for an allowable bearing pressure of 3.0 t.s.f.

The grade of the proposed ramp will be at elev. 614 ±. For frost protection, the pier footings should be located at least 4 ft. below the proposed grade of the ramp. At this elevation the clayey silt deposit is mainly stiff to very stiff, and the bedrock surface ranges from elev. 595.5 to elev. 603.0.

For the pier foundations, one of the following proposals is recommended:

The piers can be founded on spread footings placed in the stiff clayey silt stratum at elev. 610.0 with an allowable bearing pressure of 2.0 t.s.f. Settlement of pier footings designed for a bearing pressure of 2.0 t.s.f., is estimated to be about 1 inch.

As an alternative, the piers can be founded directly on the sound bedrock with a safe bearing pressure of up to 15 t.s.f.

cont'd. /7 ...

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

6.2) Approach Cuts:

There should be no overall stability problems for the proposed 24-ft. approach cuts, provided cut slopes of standard 2 horizontal to 1 vertical are used.

6.3) Dewatering:

Due to the relatively impermeable nature of the subsoil, no major dewatering problems are anticipated for any excavations for the footings. In order to prevent softening of the excavation base by surface run-off, a working slab should be cast as soon as the desired excavated elevation is reached.

7. SUMMARY:

The results of a foundation investigation for the proposed overpass ramp structure at the site of the Q.E.W. - Bertie St. - Thompson Rd. interchange are presented.

The subsoil at the site generally consists of some 28 to 33 ft. of stiff to hard clayey silt with traces of sand and gravel underlain by sound limestone bedrock. In certain areas, the limestone bedrock is overlain by a thin layer of till-like material.

The proposed abutment and pier footings can be founded within the clayey silt stratum at elev. 625.0 and elev. 610.0 with a safe bearing pressure of 3.0 t.s.f. and 2.0 t.s.f., respectively. Alternatively, the piers can also be founded directly on the sound bedrock, with a safe bearing pressure of 15 t.s.f.

No dewatering or stability problems are anticipated.

cont'd. /8 ...

8. MISCELLANEOUS:

The field work was carried out during August 31 to September 11, 1967, by Mr. W. Hutton, Project Foundation Engineer, who also prepared this report. The work was carried out under the general supervision of Mr. M. Devata, Supervising Foundation Engineer, who reviewed this report.

The field equipment was owned and operated by Johnston Drilling Co. Ltd., Toronto.

October 1967.

APPENDIX I

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

LOCATION Sta. 293 + 35 @ Q.E.W. and o/s 51' Lt.

ORIGINATED BY _____ WH

BORING DATE August 31, Sept. 1 & 6, 1967

COMPILED BY _____ AMS

BOREHOLE TYPE Cont. Flight Auger and Core Drill

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— w _L PLASTIC LIMIT ——— w _p WATER CONTENT ——— w		BULK DENSITY P.C.F.	REMARKS			
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT %		
							20	40	60	80				100	Unconfined
							500	1000	1500	2000				2500	10
634.3	Ground Level														
0.0	Fill material. Clayey silt with traces of sand gravel & org. Stiff		1	SS	12	630						Org. 7.7%			
628.3			2	SS	21							628.3			
6.0	Clayey silt with traces of sand and gravel (desiccated). Very stiff to hard.		3	SS	43										
			4	SS	50										
618.0			5	SS	31	620									
16.3	Clayey silt with traces of sand and gravel. Stiff to very stiff		6	SS	25										
			7	TW	PH							141			
			8	SS	5	610						138			
			9	TW	PH							128			
			10	SS	14										
			11	TW	PH										
			12	SS	26										
601.8			13	TW	PH/16"										
32.5	Sound Limestone Bedrock with thin seams of shale.		14	AXT RC	Rec 88%	600									
592.5			15	AXT RC	Rec 92%										
41.8	End of Borehole					590									
							0 15 0.5	% Strain							

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 67-F-80

LOCATION Sta. 291 + 23 @ Q.E.W. and o/s 61' Rt.

ORIGINATED BY WH

W.P. 162-64-2

BORING DATE Sept. 1 & 5, 1967

COMPILED BY AMS

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY

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	W	WL										
							SHEAR STRENGTH P.S.F.																	
							o Unconfined																	
							500	1000	1500	2000	2500	WATER CONTENT %												
							10	20	30	40	50													
631.1	Ground Level															Gr. Sa. Si. Cl.								
630.1	Clayey silt, Topsoil					630										629.1								
1.0	Clayey silt with traces of sand and gravel (desiccated)		1	SS	26																			
	Very stiff to hard		2	SS	41	620										13 18 45 24								
617.1			3	SS	27																			
14.0	Clayey silt with traces of sand and gravel.		4	TW	PH 22																			
			5	SS	26																			
			6	TW	PH	610										143								
			7	SS	17																			
			8	TW	PH											130								
	Firm to very stiff		9	SS	8											134								
603.3			10	TW	PH																			
27.8	Het. mix of clayey silt		11	SS	55																			
600.4	sand and gravel.		12	SS	22											12 49 31 8								
30.7	Sound Limestone Bedrock with thin seams of shale		13	AXT	Red	600																		
			14	RC	80%																			
			15	RC	94%																			
589.8			16	RC	100%	590																		
41.3	End of Borehole						0	15-5	10	% Strain														

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 67-F-80

LOCATION Sta. 292 + 15 @ Q.E.W. and o/s 53' Lt.

ORIGINATED BY 20

W. P. 162-64-2

BORING DATE Sept. 5 & 7, 1967

COMPILED BY AMS

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger & Core Drill

CHECKED BY

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

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	WATER CONTENT % WP W WL		
							20 40 60 80 100			
634.2	Ground Level						500 1000 1500 2000 2500	10 20 30		Gr. Sa. Si. Cl.
0.0	Fill material (clayey silt with traces of sa., gr. & org. Stiff)	[X]	1	SS	24	630				Org. 3.2% 630.4
5.0	Clayey silt with traces of sand & gravel (desiccated.)	[Hatched]	2	SS	35					3 17 51 29
	Hard	[Diagonal Lines]	3	SS	46	620				
617.2			4	SS	40					
17.0	Clayey silt with traces of sand and gravel.	[Hatched]	5	SS	28					
			6	TW	PH/3"					139
			7	SS	38	610				137
			8	TW	PH					
			9	SS	15					
603.0	Stiff to hard.	[Hatched]	10/11	TW/SC	Last					125
31.2	Sound Limestone Bedrock with thin seams of shale	[Horizontal Lines]	12	TW	PH/10"					
			13	AXT	Rec.	600				
				RC	93%					
			14	AXT	Rec.					
				RC	100%					
594.4			15	RC	100%					
39.8	End of Borehole					590				

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 67-F-80

LOCATION Sta. 290 + 45 @ Q.E.W. and o/s 61' Rt.

ORIGINATED BY ZC

W. P. 162-62-2

BORING DATE Sept. 6 & 7, 1967

COMPILED BY AMS

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 67-F-80

LOCATION Sta. 292 + 83 @ Q.E.W. and o/s 54' to Lt.

ORIGINATED BY 20

W.P. 162-64-2

BORING DATE Sept. 7 & 8, 1967

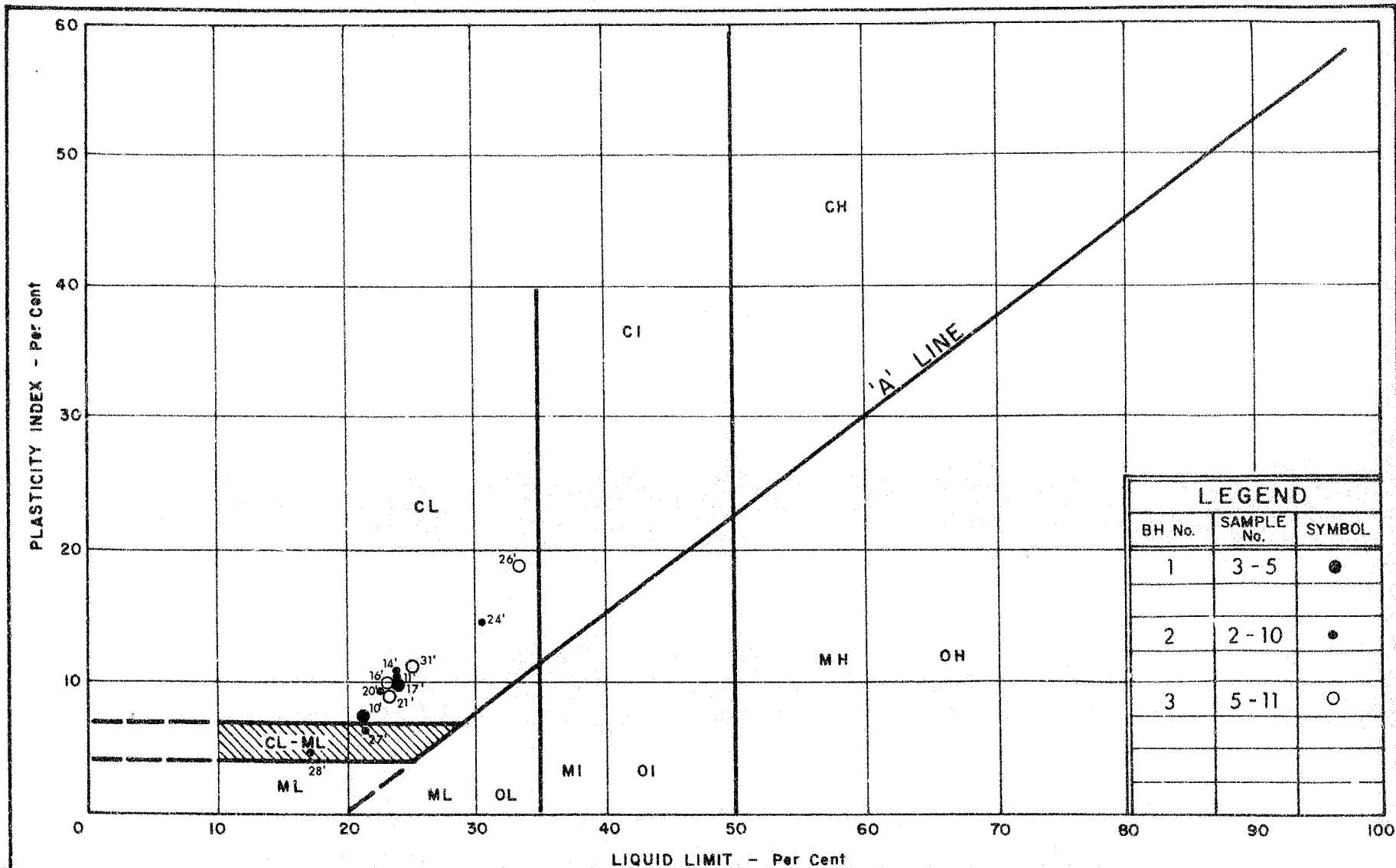
COMPILED BY AMS

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger

CHECKED BY AK

[illegible]

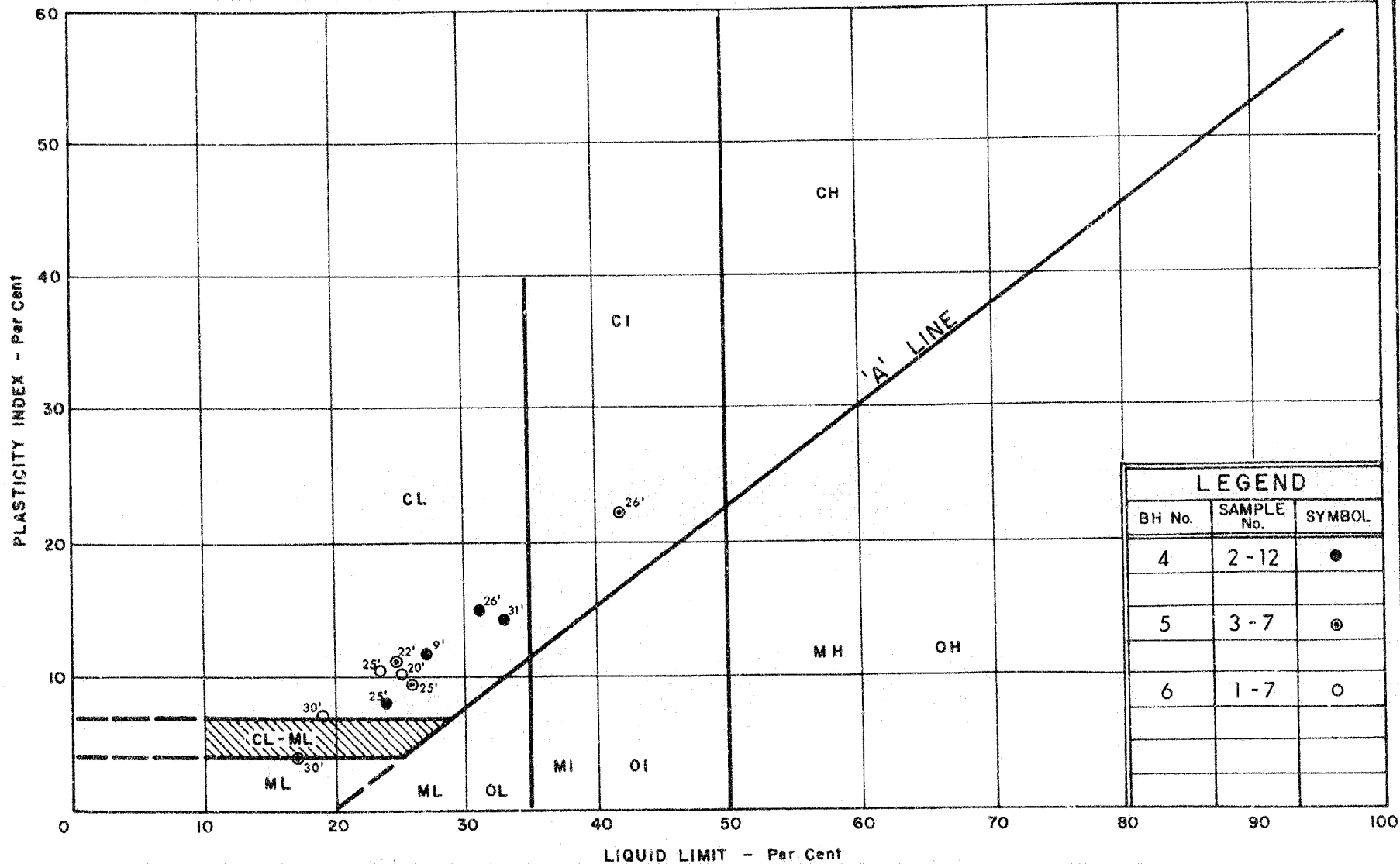


DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART

W.P. No. 162-64-2

JOB No. 67-F-80



LEGEND		
BH No.	SAMPLE No.	SYMBOL
4	2-12	●
5	3-7	⊙
6	1-7	○



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART

W.P. No. 162-64-2
JOB No. 67-F-80

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>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 BUCKET SAMPLE	OS	GESTERBERG 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_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_r	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

MEMORANDUM

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

From: Bridge Division,
Downsview, Ontario.

Date: August 23rd. 1967.

Our File Ref.

In Reply To

SUBJECT: Thompson Road Interchange
Off Ramp to Bertie St. and
Thompson Road, W.P. 162-64-2, ✓
Site 34-223.
Off Ramp to Thompson Road and Hwy. #3,
W.P. 162-64-3, Site 34-224,
Q.E.W., District #4.

This will confirm having given you today two prints of DM 4735 showing the probable location of piers and abutments in green and red. The profiles have been taken from the functional report.

Please arrange for a Foundation Investigation of sufficient scope to enable us to proceed with the design.

Bridge Site Plans will be forwarded to you as soon as they are available. No Preliminary Site Investigation has been made as yet.

Joseph F. Walshe

JFW/ss

cc. R. Forrest
A. Crowley

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

1967 AUG 24 PM 3:12

00272

B

HANN DOWN 5 AUG 24/67 301P VR

M GREENLAND DIST ENGR

ATTN D A WALLER MTCE ENGR

COPY TO T J KOVICH MAT AND TESTING DIV DOWNSVIEW

RE THOMPSON ROAD INTERCHANGE OFF RAMP TO THOMPSON ROAD AND HWY 3

WP162-64-3 WJ67-F-79 SITE 34-224.

OFF RAMP TO BURTIE STREET AND THOMPSON ROAD WP162-64-2

WJ67-F-80 SITE 34-223

THE FIELD WORK FOR THE ABOVE MENTIONED STRUCTURES WILL COMMENCE ON
AUG 25/67. THIS IS FOR YOUR INFORMATION.

M DEVATA FOR A G STERMAC MAT AND TEST DIV

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101 & Keele Street
Downsview, Ontario

August 25, 1967

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

Dear Sirs:

This is to confirm our request of August 23, 1967 for the supply of a Diamond Drill and a Penn Drill together with all necessary equipment, as specified under the terms of our Contract Agreement, at Fort Erie, Ontario - after the completion of our present project 67-P-76.

These projects bear Job Numbers 67-P-79 and 67-P-80.

Yours truly,

M. Devata

M. Devata
Supervising Foundation Engineer
for: A. G. Sternac
Principal Foundation Engineer

cc: H. Marings

Foundation Files 110
General File

401 & Keele Street
Downsview, Ontario

September 26, 1967

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

Dear Sirs:

This is to confirm our request of August 29, 1967 for the supply of a Diamond Drill and a Penn Drill together with all necessary equipment, as specified under the terms of our Contract Agreement, at Thompson Rd. & Bertie St, Fort Erie, Ont., on August 31, 1967.

This project bears job number 67-P-30.

Yours truly,



M. Devata
Supervising Foundation Engineer
for: A. G. Stermac
Principal Foundation Engineer

MD:mt

cc: H. Konings
Foundation Section / 10
General File

MEMORANDUM

To: Mr. M. Devata,
Supervising Foundation Engineer.

FROM: Z. Koniuszy

DATE: October 23, 1967.

OUR FILE REF.

IN REPLY TO

SUBJECT: Foundation Projects No. 67-F-79
67-F-80

The bore holes of the projects 67-F-79 and 67-F-80 from the Thompson Rd., - Hwy. 3 area were drilled in Bois Blanc Formation of Middle Ordovician Age.

Both drilling samples consist of grey to brownish-grey, medium grain, highly fossiliferous, cherty limestone. Amount of chert averages to about 15%, some patches of chertified limestone visible. Very thin irregular seams of dark grey to grey-brown shale.

Rock is sound with no weathering or underground water erosion signs.

ZK/ss

Z. Koniuszy
Z. Koniuszy,
Geologist.

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

Telephone: 248-3446

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. Melnyshyn, 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.

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 67-F-80
- 16) Thompson Road - W.P. 162-64-1.
- 17) - W.P. 162-64-3.
- 18) C.M.R. Widening - W.P. 162-64-05.
- 19) Concession Road (Erie St.) - W.P. 161-64.
- 20) North Street Revision - W.P. 160-64.

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. M. Devata
W. Melinyshyn
A.J. Fletcher
E.A. Fletcher

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac

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

Bridge Office,
Downsview, Ontario

January 15, 1969

Bertie Road Ramp Overpass
W.F. 162-44-02, Site 34-223
C.E.W. District No. 4

67-F-80

Attached herewith are prints of the Preliminary Bridge Plan
Drawing D-6411-F1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$236,000.
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

No comments.

M. Devata
Jan 19/69

Department of Highways Ontario

Copy for the information of

Foundation Section.

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

C.S. Grebski,
Bridge Office

September 5, 1969

Bertie Street Ramp Overpass
W.P. 162-64-02, Site 34-223
Q.E.W., District No. 4

67-F-80

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

C.S. Grebski,
Bridge Design Engineer

Attach.

c.c. Foundation Section

No comments.

M. Derzka

Sept 16/69

No comments

Sept 17/69

67-F-80

Ontario
Department of Transportation and Communications
~~CONFIDENTIAL~~

MEMORANDUM

TO: Mr. M. Devata,
Supervising Foundation Engineer,
Foundation Office,
Downsview, Ontario.

FROM: Foundations Office,
Design Services Branch,
Downsview, Ontario.

ATTENTION:

DATE: November 9, 1971.

OUR FILE REF.

IN REPLY TO

SUBJECT: Contract Review Meeting - W.P. 163-64-04
Q.E.W. Fort Erie
Gilmore Road to C.N.R.
District 4, Hamilton.

The meeting was held at the 'Estaminet' Restaurant, 2084 Lakeshore, Burlington on November 3 and 4, 1971. The structures were discussed on November 4, 1971.

✓ Thompson Rd. & Bertie St. Ramp
67-F-80

- The Pile Table was changed to read West Abutment where it showed East Abutment and vice versa.

Thompson Rd. & Q.E.W.
67-F-76

- It was suggested to G. Burkhardt that a working slab be shown under the spread footings.

E.S. Ramp to Thompson Rd.
67-F-79

- No Comments

C.N.R. Widening
67-F-77

- No Comments

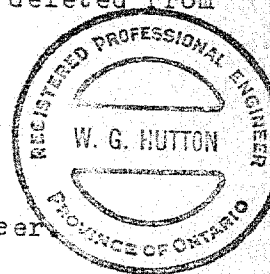
In both structures on piles 67-F-80 & 67-F-79 it was decided to show the pile lengths to the nearest foot \pm and delete the inches. Also the charts for the Hiley Formula were deleted from both contract drawings.

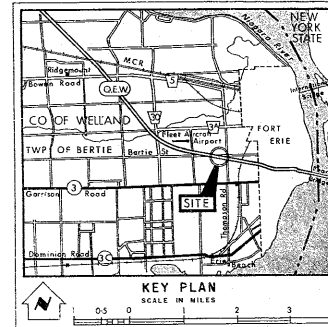
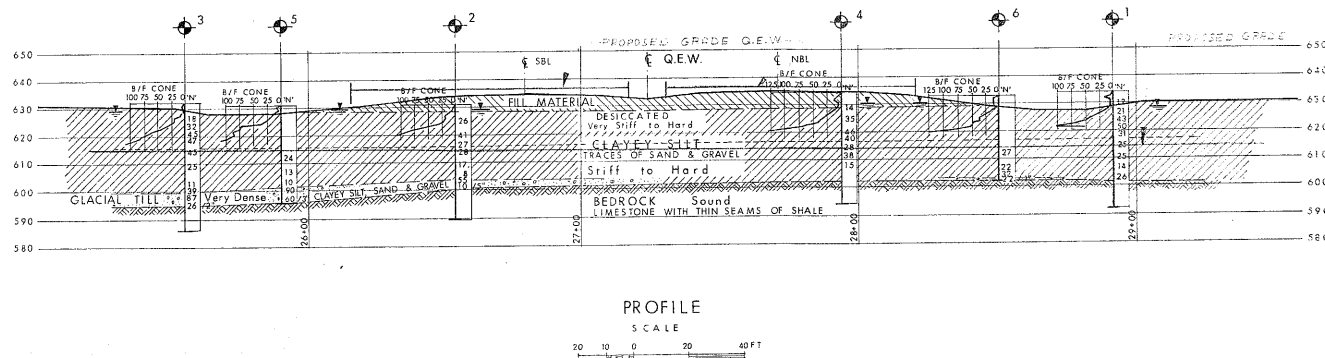
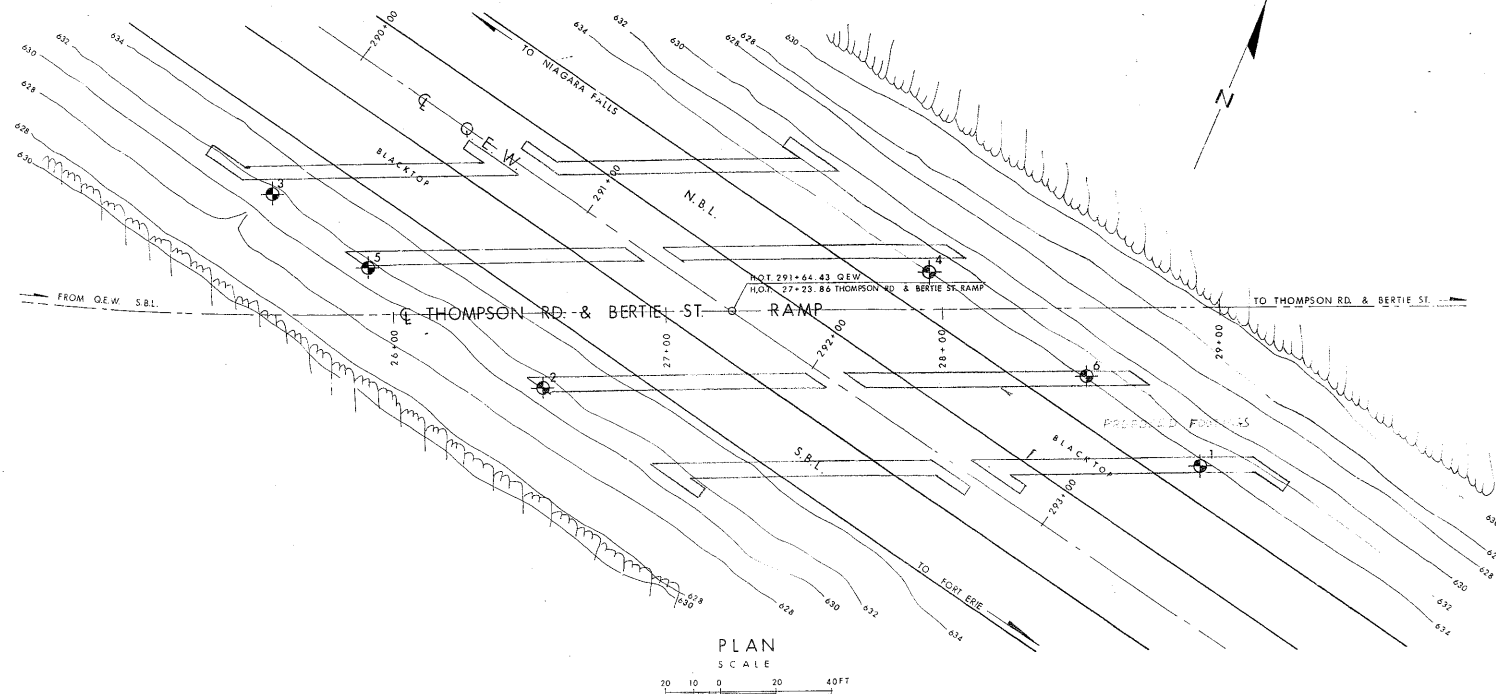
WH/ao

cc: Foundations Files
Documents

W. G. Hutton

W. Hutton,
Project Foundation Engineer





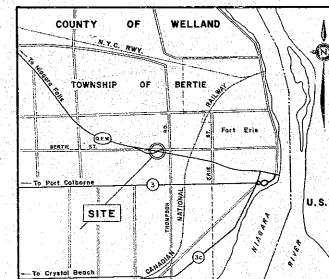
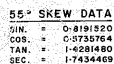
LEGEND				
	Bore Hole			
	Cone Penetration Hole			
	Bore & Cone Penetration Hole			
	Water Levels established at time of field investigation, SEPT. 1967			
NO.	ELEVATION	STATION	OFFSET	
1	634.3	293 + 35	51' LT	
2	631.1	291 + 23	61' RT	
3	631.6	290 + 01	59' RT	
4	634.2	292 + 15	53' LT	
5	631.0	290 + 45	61' RT	
6	633.5	292 + 83	54' 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.

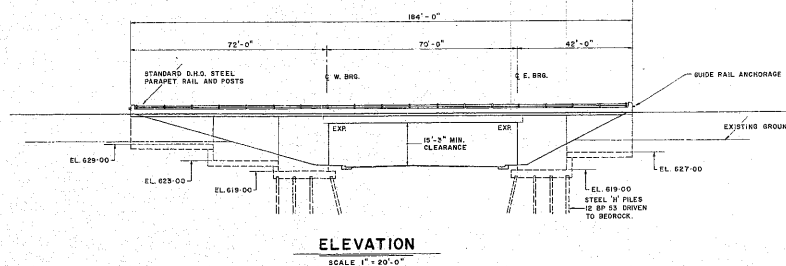
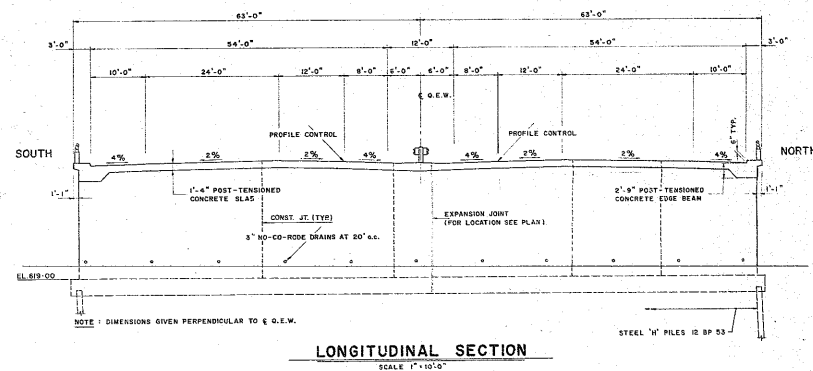
DATE	AT	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & TESTING DIVISION - FOUNDATION SECTION			
THOMPSON RD. & BERTIE ST. RAMP			
KING'S HIGHWAY NO.	Q. E. W.	DIST. NO.	4
CO. WELLAND			
TWP. BERTIE	LOT 2	CON.	III
BORE HOLE LOCATIONS & SOIL STRATA			
SIGNED W. H.	CHECKED <i>[Signature]</i>	WP NO. 163-64-2	M.S.T. DRAWING NO.
DRAWN A.B.	CHECKED <i>[Signature]</i>	JOB NO. 67-F-80	67-F-80A
DATE NOV. 28, 1967	SITE NO.	BRIDGE DRAWING NO.	
APPROVED <i>[Signature]</i>	CONT. NO.		

REF NP E-4796-1



KEY PLAN
SCALE 1" = 0.5 MILE



- ## LIST OF DRAWINGS
1. GENERAL ARRANGEMENT
 2. BORE HOLE LOCATIONS & SOIL STRATA
 3. FOUNDATIONS
 4. ABUTMENTS DIMENSIONS & REINFORCING
 5. DECK REINFORCING & STRESSING DETAILS
 6. DECK REINFORCING
 7. SCREEN ELEVATIONS
 8. RETAINING WALLS
 9. APPROACH SLABS
 10. PARAPET WALL DETAILS
 11. STANDARD STEEL PARAPET RAIL
 12. STANDARDS
 13. STANDARDS
 14. EMBEDDED WORK LAYOUT
 15. EMBEDDED WORK DETAILS.

CONSTRUCTION NOTES :

<u>CLASS OF CONCRETE</u>	
DECK, CURBS & PARAPET WALLS	5,000 R.S.I.
REMAINDER	3,000 R.S.I.

<u>CLEAR COVER ON REINFORCING STEEL</u>	
DECK SLAB	TOP 2" BOT. 1 1/2"
CURBS & APPROACH SLABS	2"
PARAPET WALLS	1 1/2"
REMAINDER	3"
GRANULAR BACKFILL BEHIND ABUTMENTS SHALL	
BE PLACED SIMULTANEOUSLY ON BOTH SIDES	
IN TWO FOOT LIFTS	

B.M. Elev. 630.53 (Geodetic Datum)
N. & W. in E. Root of 1'0 Stump
108'0 Rt. of Sta. 285+18 Q.E.W.



REVISIONS			
	DATE	BY	DESCRIPTION
			67-F-80

67-F-80

DEPARTMENT OF HIGHWAYS ONTARIO

McCORMICK, RANKIN & ASSOCIATES LIMITED
Port Credit CONSULTING ENGINEERS

BERTIE STREET RAMP OVERPASS

KING'S HIGHWAY No. Q.E.W. DIST. No. 4

CO. WELLAND FORT ERIE
TWP. BERTIE LOT 2 CON. 3

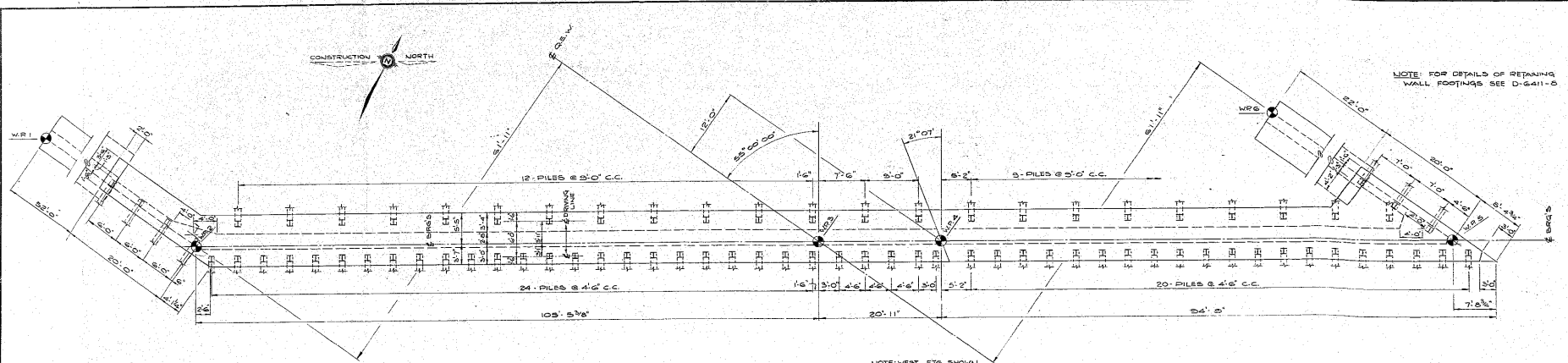
GENERAL ARRANGEMENT

SITE No. 14-223		W.P. No. 162-6
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APPROVED	34-225	162-0	CONFIDENTIAL

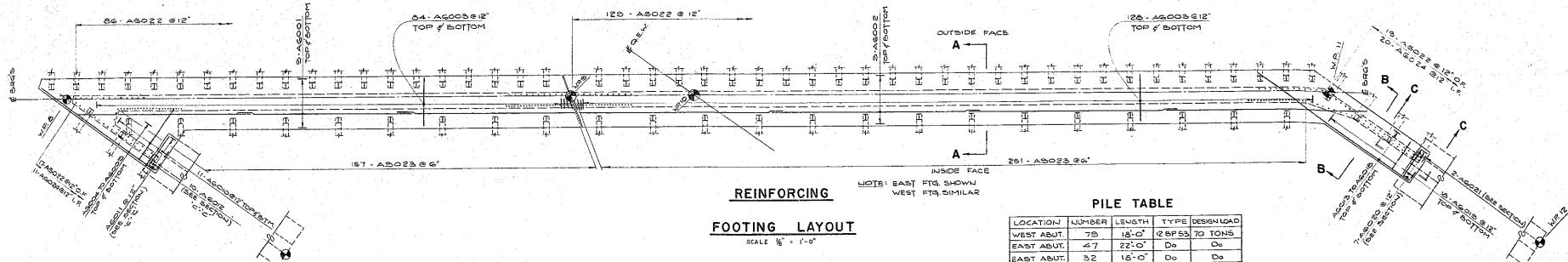
DESIGN	L. C. H.	CHECK	R. D. N.	CONF. ACT Nos.			
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DRAWING	R. M. T.	CHECK	L. C. H.	DRAWING	D-6411-
DATE	AUG. 1969	LOADING	HS20-44	No.	



DIMENSIONS

NOTE: VERT. FTG. SHOWN
EAST FTG. SIMILAR



REINFORCING

FOOTING LAYOUT

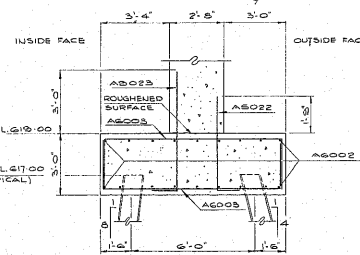
SCALE 1/8" = 1'-0"

PILE TABLE

LOCATION	NUMBER	LENGTH	TYPE	DESIGN LOAD
WEST ABUT.	79	18'-0"	26P53	70 TONS
EAST ABUT.	47	22'-0"	D6	D6
EAST ABUT.	32	16'-0"	D6	D6

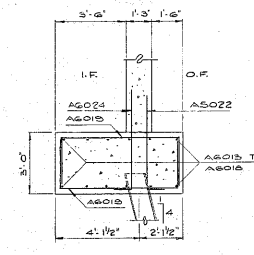
W.P. CO-ORDINATES

STATION	NORTH	EAST
WPI	31803.604	48904.147
2	31791.179	48976.067
3	31836.803	48972.846
4	31845.772	48981.737
5	31882.659	48910.825
6	31889.688	48929.255
7	31771.648	48985.412
8	31779.096	48944.042
9	31815.865	48922.871
10	31824.825	48941.821
11	31870.555	48939.601
12	31888.131	48910.821
13	31844.102	48910.821



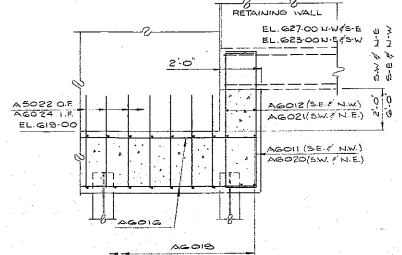
SECTION 'A-A'

SCALE 3/8" = 1'-0"



SECTION 'B-B'

SCALE 3/8" = 1'-0"

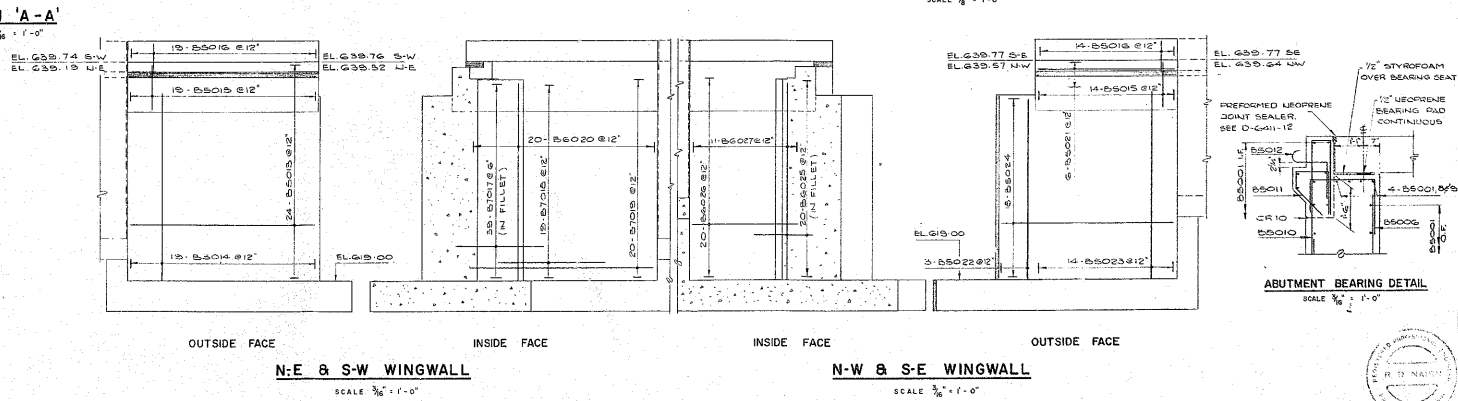
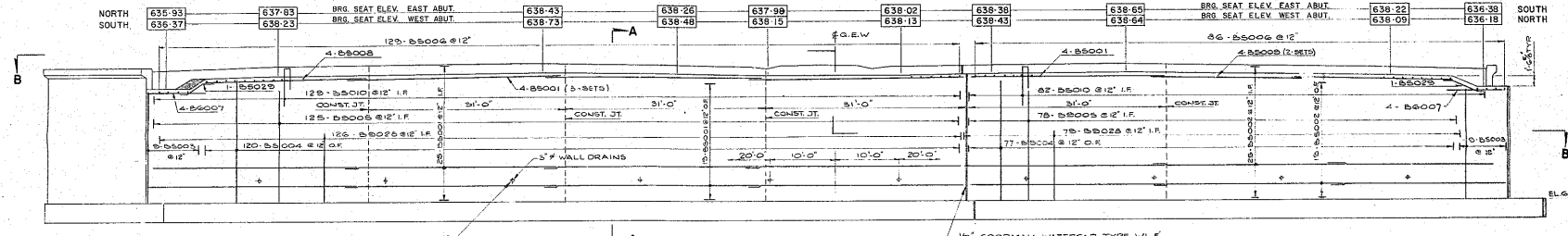
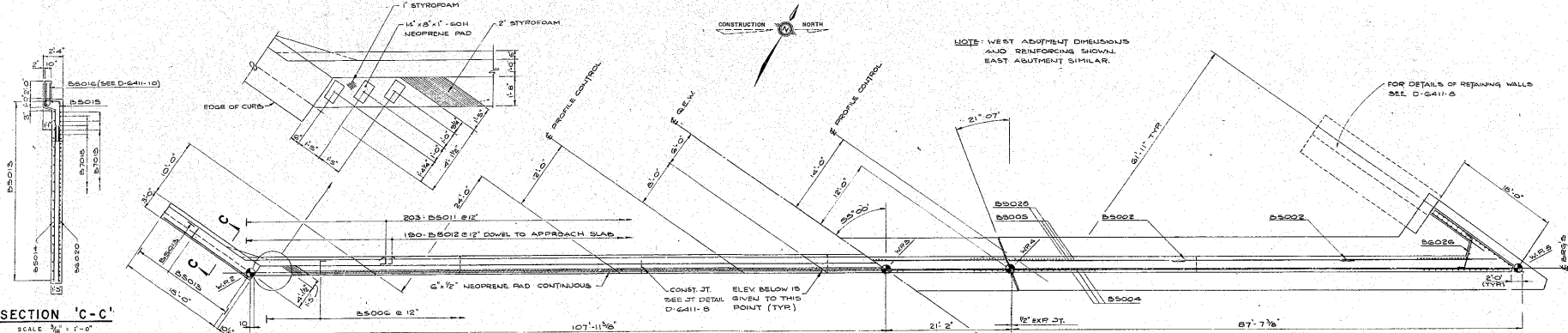


SECTION 'C-C'

SCALE 3/8" = 1'-0"

DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO			
McCORMICK, RANKIN & ASSOCIATES LIMITED CONSULTING ENGINEERS			
Bertie Street Ramp Overpass			
KING'S HIGHWAY NO. 4, Q.E.W.		DIST. No. 4	
CO. WELLAND		FORT ERIE	
TWP. BERTIE		LOT 2 CON. 3	
FOUNDATIONS			
SHEET No. 34-223		W.P. No. 162-64-02	
APPROVED		BRIDGE ENGINEER	
DESIGN		L. C. H. CHECK	
DRAWING		B. J. A. CHECK	
DATE		AUG. 1969	
LOADING		HS 20-44	
		D-6411-3	



PRINT RECORD		
No.	FOR	DATE

INVOICES		
DATE	BY	DESCRIPTION

67-1-F-50

DEPARTMENT OF HIGHWAYS ONTARIO

McCORMICK, RANKIN & ASSOCIATES LIMITED
Part Credit CONSULTING ENGINEERS Office

BERTIE STREET RAMP OVERPASS

KING'S HIGHWAY No. Q.E.W. DIST. No. 4
CO. WELLAND BRIDGE DIVISION FORT ERIE
TWP. BERTIE LOT 2 CON. 3

ABUTMENTS DIMENSIONS & REINFORCING

APPROVED: [Signature] SITE No. 34-223 WZ. No. 62-64-02
DESIGN: L. C. H. CHECK: R. D. H. CONTRACT No. []
DRAWING: S. J. A. CHECK: L. C. H. DRAWING No. []
DATE: AUG. 1969 LOADING: HS20-44

D-6411-4