DEPARTMENT OF HIGHWAYS ONTARIO

W.P. 160-64

MEMORANDUM

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

Attention: Mr. S. McCombie

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

DATE: November 7, 1967

OUR FILE REF.

IN REPLY TO

NOV 16 1967

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
Proposed Underpass at the
Crossing of North Street Revision
And the Q.E.W. (Fort Erie)
District No. 4 (Hamilton)
W.J. 67-F-85 -- W.P. 160-64

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 requirements. Should additional information be required, please do not hesitate to contact our Office.

A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

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

TABLE OF CONTENTS

FOUNDATION INVESTIGATION REPORT
For
Proposed Underpass at the
Crossing of North Street Revision
And the Q.E.W. (Port Erie)
District No. 4 (Hamilton)
W.J. 67-F-85 -- W.P. 160-64

1. INTRODUCTION:

The Foundation Section was requested to carry out an investigation for the proposed underpass at the crossing of the proposed North St. revision and the Queen Elizabeth Way, in the Town of Port Erie, 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 September 12, 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 foundation design of the proposed structure. In addition, the stability of the approach embankments is discussed.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located in the Town of Port Erie about 1700 ft. west of the Peace Bridge over the Niagara River. At this location the Q.E.W. is entering a cut section approximately 6 to 10 ft. below the surrounding ground surface elevation. The highway slopes towards the Niagara River, and consists of three westbound lanes (two leading from the bridge and one from Port Erie), and two eastbound lanes which branch off on an embankment towards the south. The highway has a gravel shoulder on the north side of the westbound lane, with curb and gutter elsewhere. The area surrounding the highway is grass-covered, with a shallow drainage ditch on the north side and a deeper one

cont'd. /2 ...

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

starting east of the eastbound lane embankment. The surrounding terrain is generally level with a gradual slope towards the river. Approximately 100 ft. east of the site the ground slopes steeply towards the river. The immediate area to the north of the Q.E.W. is about 10 ft. above the Q.E.W. centre-line grade; the slopes of these cuts are approximately 2:1. A frame house is located about 100 ft. north of the top of the bank, while the remainder of the area is covered with evergreens. The immediate area to the south of the Q.E.W. is about 6 ft. above the Q.E.W. centre-line grade; the associated embankment slopes are flatter than above. This area is clear except for Main Street which runs in an east-west direction. This street has been abandoned east of the Q.E.W. eastbound lane.

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 which was formed during the retreat of the most recent continental glacier.

3. FIELD AND LABORATORY WORK:

Five boreholes and five dynamic cone penetration tests were carried out during the course of the recent field work. In addition, two boreholes, one of which was accompanied by a dynamic cone penetration test, were carried out on Aug. 11 - 15, 1966, 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

cont'd. /3 ...

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

tests were carried out at various depth intervals in order to determine the undrained shear strength of the cohesive strata. Bedrock was proven in five boreholes by obtaining AXT size rock core samples. In two borings, bedrock surface was assumed to be the level at which the practical refusal to augering occurred. 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 Central Region Engineering Surveys Section, and are shown on Dwg. #67-F-85A, 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
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).

contd. /4 ...

4. SUBSOIL CONDITIONS:

4.1) General:

Subsoil at the site generally consists of 1 to 4 ft. of topsoil or fill material followed by 18 to 34 ft. of firm to hard clayey silt with some sand and traces of gravel, the upper 4 to 15 ft. of which has been desiccated to a hard crust. The clayey silt stratum directly overlies 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 inferred stratigraphical profiles shown on Dwg. #67-F-85A are based on this information. From ground surface downwards, the different soil types are described in detail as follows:

4.2) Clayey Silt with Some Sand and Traces of Gravel:

The surficial cover over the majority of the site is a clayey silt topsoil about 1 to 2 feet thick. However, at boreholes 1 and 2, a surficial layer of fill some 3 to 4 feet thick was encountered. This fill is composed of a stiff clayey silt with some sand and gravel.

Underlying the surficial deposits across the site is the predominant overburden stratum consisting of greyish to reddish-brown clayey silt with some sand and traces of gravel. The upper 3 to 15 ft. of this deposit has been desiccated to a hard crust. The overall thickness varies from 18 feet at borehole 2, to 34 feet at borehole 5, being typically about 30 feet. At some of the boring locations, occasional thin seams of clay and silt were encountered between elevations 581 and 587. Grain-size distribution curves obtained from typical samples of the clayey silt stratum are shown in the Appendix of this report.

The engineering properties of the stratum as determined from field and laboratory testing, are summarized in tabular form as follows:

cont'd. /5 ...

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

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

	Upper Desiccated Zone Range (Average)	Lower Zone Range (Average)
Bulk Density (lb./cu.ft.)	-	127 to 143 (135)
Liquid Limit	27 to 33 (30)	20 to 36 (27)
Plastic Limit	15 to 17 (16)	12 to 21 (16)
Moisture Content (Percent)	12 to 15 (13)	12 to 27 (19)
Liquidity Index	1% to 4% below Plastic Limit	0 to 0.7 (0.4)
Undrained Shear Strength (lb./cu.ft.)	-	771 to 3,845
'N' Values (Blows/ft.)	35 to >100 (55)	16 to 33 (25)

The Atterberg limit tests listed above are summarized on the plasticity charts appended to this report. These results indicate that the clayey silt is inorganic and generally of low plasticity.

The undrained shear strength results indicate that the consistency of the stratum varies from very stiff, immediately below the desiccated crust, changing to firm with depth. The consistency of the crust is hard. The standard penetration tests carried out corroborates the consistency pattern given above. Underlying the clayey silt stratum is a thin layer (6") of basal till with a matrix of clayey silt binding some sand and gravel.

cont'd. /6 ...

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

4.3) Limestone Bedrock:

Bedrock directly underlies the clayey silt stratum. Bedrock was established by drilling 5 to 11 ft. of AXT core in B.H.'s 1, 2, 4, 6 and 7. In B.H.'s 3 and 5, bedrock surface was established by drilling with auger to refusal. The depth at which bedrock surface was encountered ranged from elev. 579.1 to elev. 581.9, i.e., some 22 to 36 ft. below the existing ground surface. The rock core obtained, shows the rock t[illegible] generally grey limestone with dark brown chert nodules and some chertified patches. The bedrock is generally sound as indicated by the relatively high core recovery of 70% to 100%.

5. GROUNDWATER CONDITIONS:

Groundwater level observations carried out during the period of the field investigation, indicate that the water level in the borings generally ranged from elev. 595.8 to elev. 610.8, which is some 3 to 10 ft. below existing 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:

6.1) General:

It is proposed to construct an underpass structure to carry the proposed North St. Revision over the Queen Elizabeth Way. Present proposals call for a single four-span (50'-110'-110'-70') structure with approach fills having a maximum height of about 25 ft. above the revised Q.E.W. grade, or some 8 to 10 ft. above the existing Q.E.W. roadway cut slopes.

Subsoil at the site consists generally of a deposit of firm to hard clayey silt with some sand and traces of gravel, followed by limestone bedrock at a depth of 22 to 36 ft. below the existing ground surface.

cont'd. /7 ...

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

6.2) Structure Foundations:

The proposed abutments may be founded on spread footings in the hard clayey silt crust, with a safe bearing pressure of 3.0 t.s.f. The south abutment foundation can be placed at elev. 607.0, and the north abutment foundation at elev. 612.0. The total settlement of footings founded high up in the crust and imposing the above bearing pressure, should not exceed 1 inch.

The abutment footings may, however, be located at a higher elevation within the approach fills provided the fill material consists of well compacted G.B.C. Class 'A' material below the tops of the footings. This granular fill should extend for a horizontal distance of at least 10 ft. from the footing edge in the plane of the footing top. This portion of the fill should be constructed with side slopes of 2:1. The remainder of the fill should be completed to above profile grade for a distance of about 50 feet behind the abutments before re-excavating for the abutment footings. For footings founded as discussed above, a safe load of 2.0 t.s.f. may be used in the design of the abutment foundations.

The revised grade of the Q.E.W. will be at elev. 597 ±. For frost protection the pier footings should be located at least 4 ft. below the proposed grade - i.e., the footings would be founded at about elevation 593. At this elevation the clayey silt deposit has a stiff consistency, with the average undrained shear strength being about 1,500 p.s.f. Based on this, it is recommended that the piers be founded on spread footings placed in the clayey silt stratum at the above elevation using 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.

cont'd. /8 ...

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

6.2) Structure Foundations: (cont'd.) ...

As an alternative, the piers can be founded on end-bearing piles driven to bedrock. The allowable design load will depend upon the pile section chosen. For example, a safe design load of 90 tons/pile may be used for a 14 BP 73 steel H-pile section.

6.3) Embankments:

As discussed above, the abutments may be founded on spread footings located within the approach fills. If this is the case, it is recommended that all topsoil be removed from beneath the specified granular fill portion of the embankment in the vicinity of the abutments. There should be no overall stability problem with the approach embankments, provided that standard slopes of 2 horizontal to 1 vertical are used.

6.4) Dewatering:

Due to the relatively impermeable nature of the subsoil, no major dewatering problems are anticipated in any of the footing excavations. Any seepage or surface run-off could readily be handled by pumping from sumps. 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 underpass structure to carry North St. over the Q.E.W., are presented.

The subsoil at the site generally consists of some 26 to 34 ft. of hard to firm clayey silt with some sand and traces of gravel. The upper 10 to 15 feet of the stratum has been desiccated to a hard crust. The clayey silt stratum is directly underlain by sound limestone bedrock.

cont'd. /9 ...

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

The proposed abutments can be founded on spread footings in the hard clayey silt crust using a safe bearing pressure of 3.0 t.s.f. or, alternatively, within the approach fills constructed with granular material, with a safe bearing pressure of 2.0 t.s.f. The piers can be founded on spread footings in the clayey silt stratum (below the crust) using a safe bearing pressure of 1.5 t.s.f., or on short end-bearing piles driven to bedrock.

Embankments of the height contemplated, will be stable. Groundwater seepage into open excavations should be minor and should cause no serious construction problems.

8. MISCELLANEOUS:

The field work was carried out during September 27 to October 3, 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 equipment was owned and operated by Johnston Drilling Co. Ltd., Toronto.

November 1967

APPENDIX I

FORM 08-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 67-F-85 LOCATION Sta. 363 + 73 ℄ Q.E.W. o/s 200' Rt. ORIGINATED BY ZO

W.P. 160-64 BORING DATE Sept. 27 - Oct. 2, 1967 COMPILED BY WH

DATUM Geodetic BOREHOLE TYPE Cont. Flight Auger & DIamond Drill CHECKED BY

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
607.9	Ground Level					
0.0 / 604.9	Fill Material (clayey silt with some sa.& gr					
3.0	Desiccated (Brown) Hard.		1	SS	38	
			2	SS	56	600
596.9			3	SS	35	
11.0	Clayey silt with some sand and trace of gravel (occ. thin clay & silt seams) Greyish to Reddish Brown. Firm to very stiff.		4	TW	PH	
			5	SS	30	
			6	TW	PM	
			7	SS	19	590
			8	TW	PM	
581.9			9	TW	PH12"	
26.0	Sound Limestone Bedrock with some chertified patches.		10	AXT	85%	580
			11	AXT RC	90% Rec	
573.5			12	AXT RC	70% Rec	
35.4	End of Borehole					570

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100

SHEAR STRENGTH P.S.F.
o Unconfined
+ Field Vane
500 1000 1500 2000 2500

+ S=3.3

20 15 10 5 % Strain

LIQUID LIMIT ——— w_L
PLASTIC LIMIT ——— w_P
WATER CONTENT ——— w

w_P w w_L

WATER CONTENT %
10 20 30

BULK DENSITY γ P.C.F.	REMARKS
	Gr.Sa.Si.Cl
	3 15 53 29
	▽ 601.
136	
134	
130.5	
143	

FORM DB-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

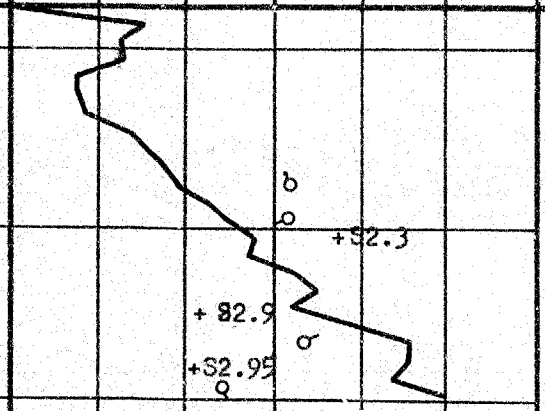
RECORD OF BOREHOLE NO. 2

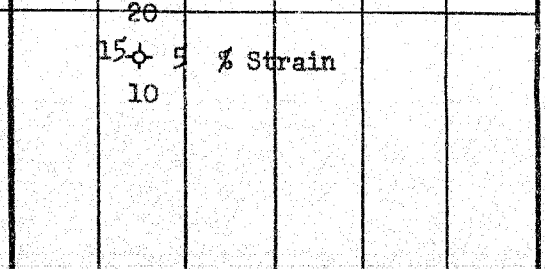
FOUNDATION SECTION

JOB 67-F-85 LOCATION Sta. 363 + 22 ℄ Q.E.W. o/s 7' Rt. ORIGINATED BY ZO
W.P. 160-64 BORING DATE Sept. 27 - Sept. 29, 1967 COMPILED BY WH
DATUM Geodetic BOREHOLE TYPE Diamond Drill CHECKED BY

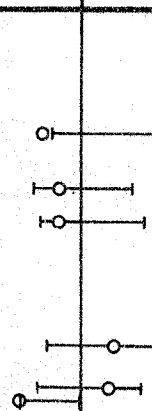
SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
602.3	Ground Level					
0.0	Fill material					600
598.3	Silty clay with sa.& gr.		1	SS	21	
4.0	Desiccated (Brown)					
595.3	... Very stiff. ...		2	SS	20	
7.0	Clayey silt with some sand and trace of gra		3	TW	PM	
			4	SS	16	
			5	TW	PM	590
	(occ. thin clay and silt seams.)		6	TW	PM	
	Greyish Brown		7	TW	PM	
580.0	Stiff to very stiff		8	TW	PM16'	580
22.3	Sound Limestone Bedrock with some chetified		9	AXT	85%	
			10	AXT	98% Rec	
571.8	patacheS.		11	AXT	98% Rec	
30.5	End of Borehole					570

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





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



BULK DENSITY γ P.C.F.	REMARKS Gr.Sa.Si.Cl
	595.8 ▼
138	3 14 52 31
134	
128	
132	1 3 61 35
	6 32 46 16

FORM SUBMITTED

66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 3

FOUNDATION SECTION

JOB 67-F-85 LOCATION Sta. 262 + 54 ℄ Q.E.W. o/s 121' Rt. ORIGINATED BY ZO

W.P. 160-64 BORING DATE Sept. 29, 1967 COMPILED BY WH

DATUM Geodetic BOREHOLE TYPE Cont. Flight Auger CHECKED BY

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
609.5	Ground Level					
607.5	Clayey silt topsoil					
2.0	Desiccated (Brown) Hard.		1	SS	46	
			2	SS	56	600
598.5			3	SS	61	
11.0	Clayey silt with some sand and trace of gravel. (occ. thin clay & silt seams) Greyish Brown Stiff to hard.		4	TW	PM 6"	
			5	SS	33	
			6	TW	PM	590
			7	TW	PM	
			8	TW	PM	
			9	TW	PM	
580.2			10	TW	PM 4"	580
29.3	End of Borehole Probable Bedrock					

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

SHEAR STRENGTH P.S.F.

o Unconfined

+ Field Vane

500 1000 1500 2000 2500

boucing

3845

+ S1.8

+ S1.93

+S3.0

+ S3.36

20 15 5 10 % Strain

LIQUID LIMIT —— w_L

PLASTIC LIMIT —— w_P

WATER CONTENT —— w

w_P w w_L

WATER CONTENT % 10 20 30

BULK DENSITY γ P.C.F.	REMARKS
	Gr.Sa.Si.Cl
	601.
136	
136	
127	
	8 28 45 19

FORM DB-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 67-F-85 LOCATION Sta. 362 + 97 ℄ Q.E.W. o/s 145' Lt. ORIGINATED BY AO ZO
W.P. 160-64 BORING DATE Sept. 29 - Oct. 3, 1967 COMPILED BY WH
DATUM Geodetic BOREHOLE TYPE Cont. flight auger & diamond drill CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
614.6	Ground Level					
611.6	Clayey silt, topsoil and fill.					
3.0	Desiccated Brown Hard		1	SS	36	610
			2	SS	64	
			3	SS	90/6"	
600.6			4	SS	63	600
14.0	Clayey silt with some sand and trace of gravel, (occ. thin clay seams)		5	TW	PM5" PM13"	
			6	TW	PM	
			7	TW	PM	
			8	SS	23	
	Greyish Brown		9	TW	PM	590
			10	SS	19	
			11	TW	PM	
			12	SS	17	
	Firm to very stiff		13	TW	PM	
			14	TW	PM	
579.1			15	SS	87/4" bouncing	580
35.5	Sound Limestone Bedrock with some chertified patches		16	AXT RC	92% Rec	
			17	AXT RC	100% Rec	570
568.8						
45.8	End of Borehole					

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

SHEAR STRENGTH P.S.F.
o Unconfined
+ Field Vane
500 1000 1500 2000 2500

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

BULK DENSITY P.C.F.	REMARKS
	610. ▽ 4 14 60 22
139	
136	3 17 49 31
138.5	
127	
130	17 24 42 17

15 20 5 % Strain

FORM 08-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 5

FOUNDATION SECTION

JOB 67-F-85 LOCATION Sta. 361 + 98 ℄ Q.E.W. o/s 151' Lt. ORIGINATED BY ZO
W.P. 160-54 BORING DATE Oct. 2, 1967 COMPILED BY WH
DATUM Geodetic BOREHOLE TYPE Cont. Flight Auger CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
615.5	Ground Level					
614.5	Clayey Topsoil					
1.0			1	SS	39	610
	Desiccated Brown		2	SS	48	
			3	SS	52	
	Hard		4	TW	PH 8"	
601.5			5	SS	44	
14.0			6	TW	PH 8"	600
	Clayey silt		7	SS	28	
	Some sand and trace of gravel (occ. thin clay seams)		8	TW	PM	
			9	TW	PM	590
	Greyish Brown		10	TW	PM	
	Firm to very stiff		11	TW	Lost	
580.1			12	SS	43/3"	580
35.4	End of Borehole Probable Bedrock					

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

SHEAR STRENGTH P.S.F.
o Unconfined
+ Field Vane
500 1000 1500 2000 2500

+ S=1.94
+ S=2.19

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

BULK DENSITY γ P.C.F.
140
138
130

REMARKS
610.8 ▽
14 13 47 26
1 4 59 36
Gr.Sa.Si.Cl

20
15 ⊕ 5 % Strain
10

FORM DB-MT-126
66-4846

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 6 (Former Golder & Assoc. BH.#9)

FOUNDATION SECTION

JOB 67-F-85 LOCATION Sta. 362 + 57 ℄ Q.E.W. o/s 111' Lt. ORIGINATED BY HCG
W.P. 160-64 BORING DATE August 11-12, 1966 COMPILED BY PBS
DATUM Geodetic BOREHOLE TYPE Cont. Flight Auger CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES: NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
613.8	Ground Level					
0.0	Hard Brown Clayey Tops		1	SS	33	610
2.0	Desiccated Brown Very stiff to hard		2	SS	80	
			3	SS	81	600
596.8			4	SS	35	
17.0	Clayey silt with some sand, trace of gravel. Greyish Brown Firm to stiff		5	TW	PH	
			6	SS	18	590
			7	TW	PH	
579.5			8	SS	100	580
34.3	Sound Limestone Bedrock		9	AXT	100%	
			10	RC	80% Rec	
568.8			11		97% Rec	570
45.0	End of Borehole					

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

SHEAR STRENGTH P.S.F.
○ Unconfined
● Quick Triaxial
+ Field Vane
500 1000 1500 2000 2500

+2
+2
+3

LIQUID LIMIT — w_L
PLASTIC LIMIT — w_p
WATER CONTENT — w
w_p w w_L

WATER CONTENT % 10 20 30

BULK DENSITY γ P.C.F.: 128

REMARKS: 610.8 ▽

FORM 08-MT-126
66-4546

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 7 (former Golder BH#10)

FOUNDATION SECTION

JOB 67-F-85 LOCATION Sta. 363 + 16 ℄ Q.E.W. o/s 128' Rt. ORIGINATED BY HQG
W.P. 160-64 BORING DATE August 13-15, 1966 COMPILED BY PBS
DATUM Geodetic BOREHOLE TYPE Power Auger Boring CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV. SCALE
610.8	Ground Level					610
0.0	Desiccated Brown Hard		1	SS	4	
			2	SS	94	
			3	SS	>100	600
			4	SS	49	
593.8						
17.0	Clayey silt with some sand and trace of gravel. Firm to Stiff		5	TW	PH	590
			6	SS	9	
581.3			7	SS	PH	
			8		71%	580
29.5	Sound Limestone Bedrock		9	AXT	63%	
			10	RC	90%	
576.3			11		83%	
34.5	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

SHEAR STRENGTH P.S.F.

● Quick Triaxial
+ Field Vane

500 1000 1500 2000 2500

+2 +1.4 + 2.3 + 1.7

0 5 10 15 % Strain

LIQUID LIMIT — w_L
PLASTIC LIMIT — w_P
WATER CONTENT — w

w_P w w_L

WATER CONTENT %
10 20 30

BULK DENSITY γ P.C.F.

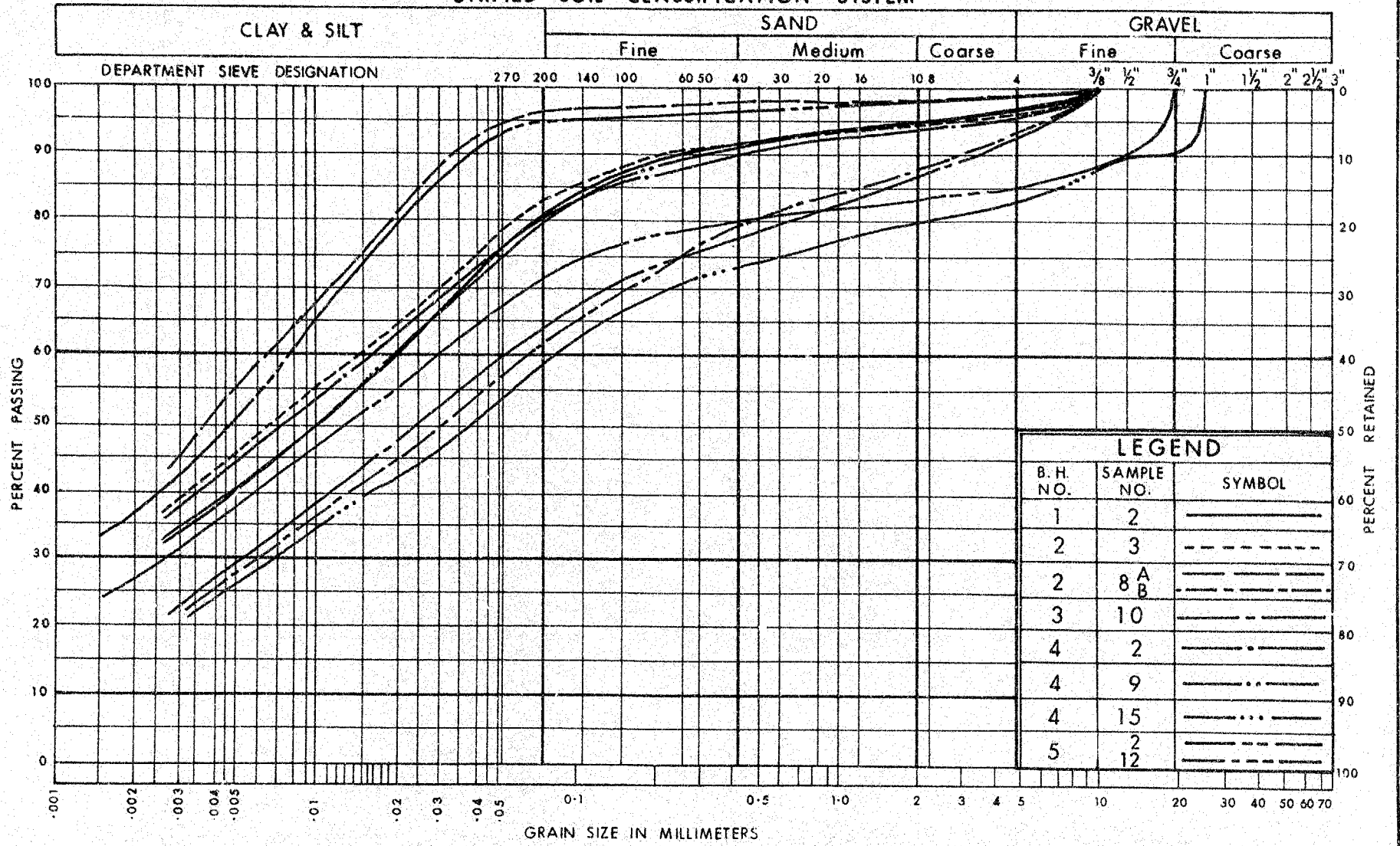
135

REMARKS

601. ▽

FORM 08 MT - 17
REV. APR. 1965
65-414

UNIFIED SOIL CLASSIFICATION SYSTEM

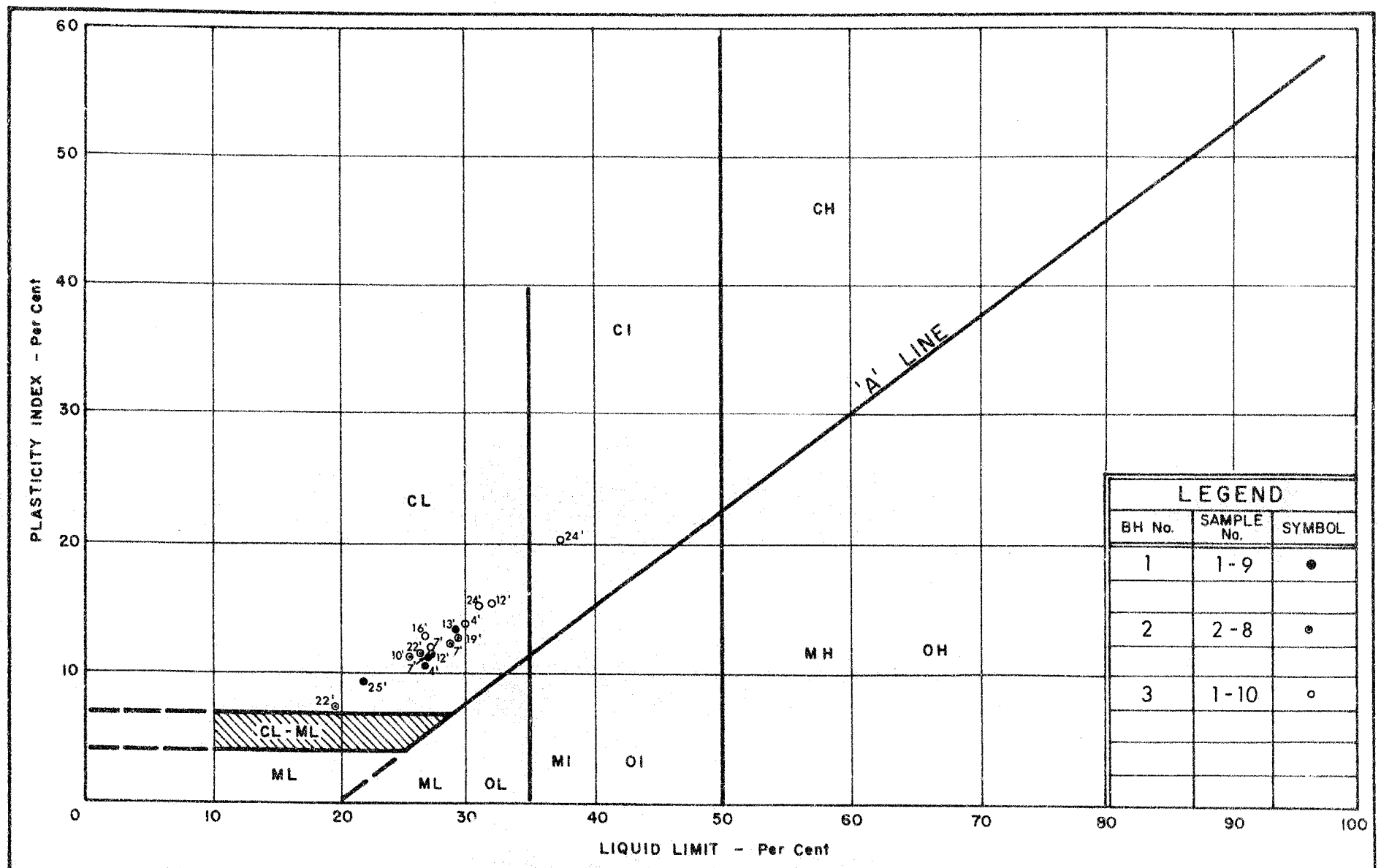


DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION
ONTARIO

GRAIN SIZE DISTRIBUTION

W.P. No. 160 - 64
JOB No. 67-F-85

FORM CB-MT-25a
(REV. JUNE 1965)
65-1624

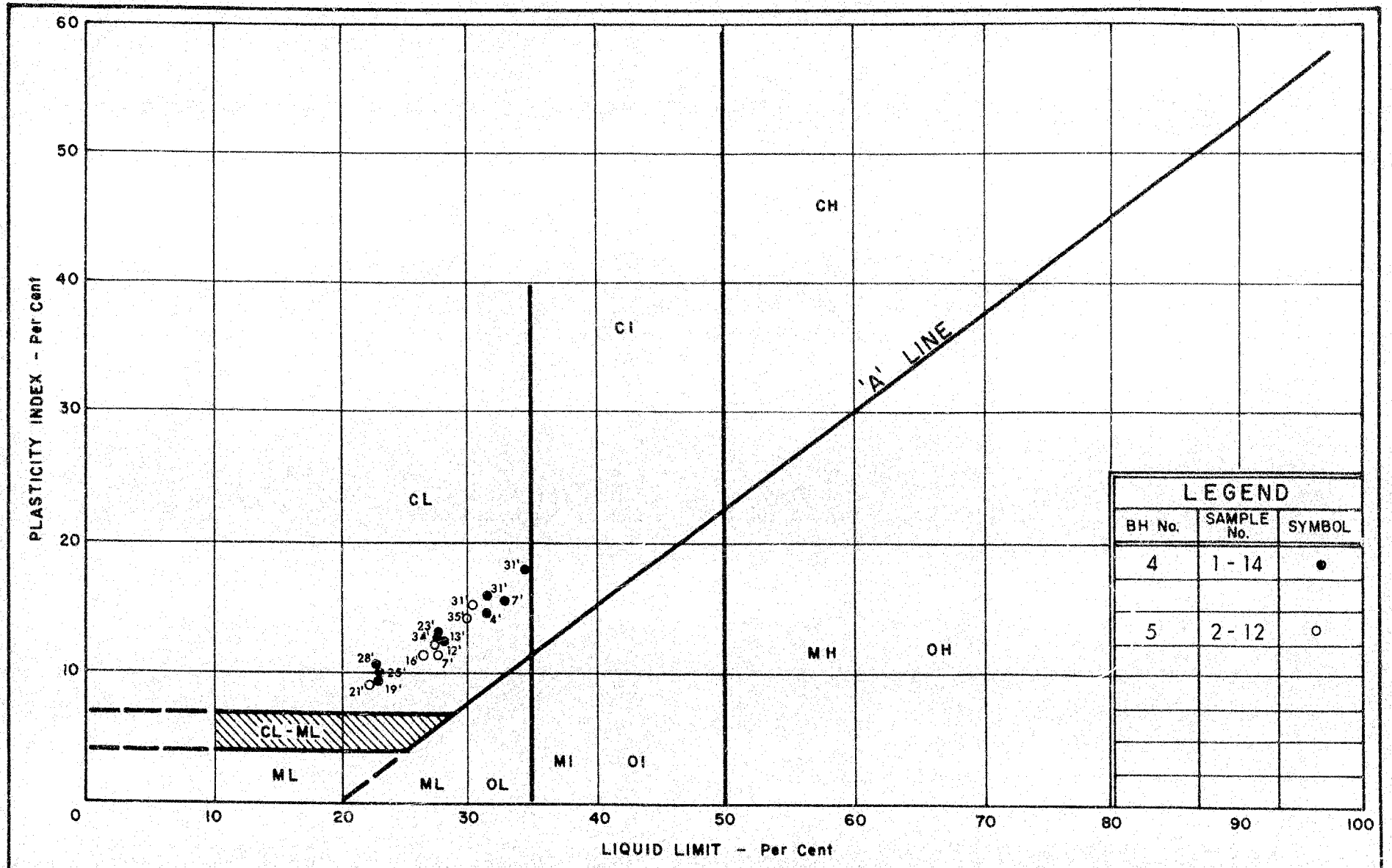


DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION
ONTARIO

PLASTICITY CHART

W.P. No. 160 - 64
JOB No. 67 - F - 85

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



DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION
ONTARIO

PLASTICITY CHART

W.P. No. 160 - 64
JOB No. 67 - F - 85

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

CONSISTENCY	'N' BLOWS / FT.	c LB. / SQ. FT.
VERY SOFT	0 - 2	0 - 250
SOFT	2 - 4	250 - 500
FIRM	4 - 8	500 - 1000
STIFF	8 - 15	1000 - 2000
VERY STIFF	15 - 30	2000 - 4000
HARD	> 30	> 4000

DENSENESS	'N' BLOWS / FT.
VERY LOOSE	0 - 4
LOOSE	4 - 10
COMPACT	10 - 30
DENSE	30 - 50
VERY DENSE	> 50

TYPE OF SAMPLE

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

SOIL TESTS

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

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

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

GENERAL

π	= 3·1416
e	BASE OF NATURAL LOGARITHMS 2·7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ε	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL

401 & Keele Street
Downsview, Ontario

October 31, 1967

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

Dear Sirs:

This is to confirm our request of September 25, 1967 for the supply of a Diamond Drill and Penn Drill together with all necessary equipment, as specified under the terms of our Contract Agreement, at North St. & Q.E.W., Port Erie, Ont. on September 27, 1967.

This project bears Job Number 67-F-85.

Yours truly,

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

MD:mt

cc: H. Konings
Foundation Files
General File

Mr. Devata

Telephone: 248-3446

Mr. W. Migle,
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) Iherold 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-85

No early fill placement required at these sites.

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. Melinyshyn,
Reg. Bridge Location Engineer,
Central Region,
Admin. Building

Bridge Office,
Downsview, Ontario

January 16, 1969

North St. Underpass
W.P. 160-64, Site 34-188
O.E.W., District No. 4

67-F-85

Attached herewith are prints of the Preliminary Bridge Plan Drawing B-6401-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is $411,000. This cost includes tender, materials, engineering and sundry construction.

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

C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

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

cc: Foundations Files (Rm. 110)

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

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

January 24, 1969

-- NORTH STREET UNDERPASS --
W.P. 160-64 -- Site 34-188 -- W.J. 67-?-85
Q.E.W., District No. 4 (Hamilton)

We have reviewed the Preliminary Drawing No. D-6401-P1 for the above mentioned structure and submit the following comments:

1. The abutment footings are shown located at elevation 601± on the Preliminary Drawing, which is some 6 to 11 ft. lower than the elevation recommended in the foundation report. At this elevation a safe bearing pressure of 3.0 TSF may be used for design purposes.

2. For the design of pier footings located at elevation 592, the safe bearing pressure should not exceed 1.5 TSF.

ND/MdeF

cc: Messrs. S. McCombie
W. S. Melinyshyn
J. Anderson

Foundations Files
Gen. Files

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

Department of Highways Ontario
Copy for the information of
Mr. A. Stermac

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

Bridge Office,
Downsview, Ontario

January 16, 1969

North St. Underpass
W.P. 160-64, Site 34-188
O.E.W., District No. 4

67-F-85

Attached herewith are prints of the Preliminary Bridge Plan Drawing D-6401-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is $411,000. This cost includes tender, materials, engineering and sundry construction.

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

C.S. Grabski,
Bridge Design Engineer

CSG:rd

Attach.

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

Department of Highways Ontario
Copy for the information of
Mr. A. Stermac

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

C.S. Grebski

June 13, 1969

Central Ave. ~~Overpass~~ Underpass
W.P. 160-64, Site No. 34-138
G.E.W., District No. 4

67-F-55

Attached herewith are prints of the revised Preliminary Bridge Plan Drawing D-6401-P2 for the above-mentioned structure.

The estimated cost of the proposed structure is $347,000. 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

RM D.

Department of Highways Ontario
Copy for the information of
Foundation Office

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

C.S. Grebski,
Bridge Office

March 13, 1970

Central Ave. Underpass
W.P. 160-64, Site 34-186
O.E.W., District No. 4

67-F-85

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

Kindly give us your comments at your earliest convenience.

C.S. Grebski,
Bridge Design Engineer

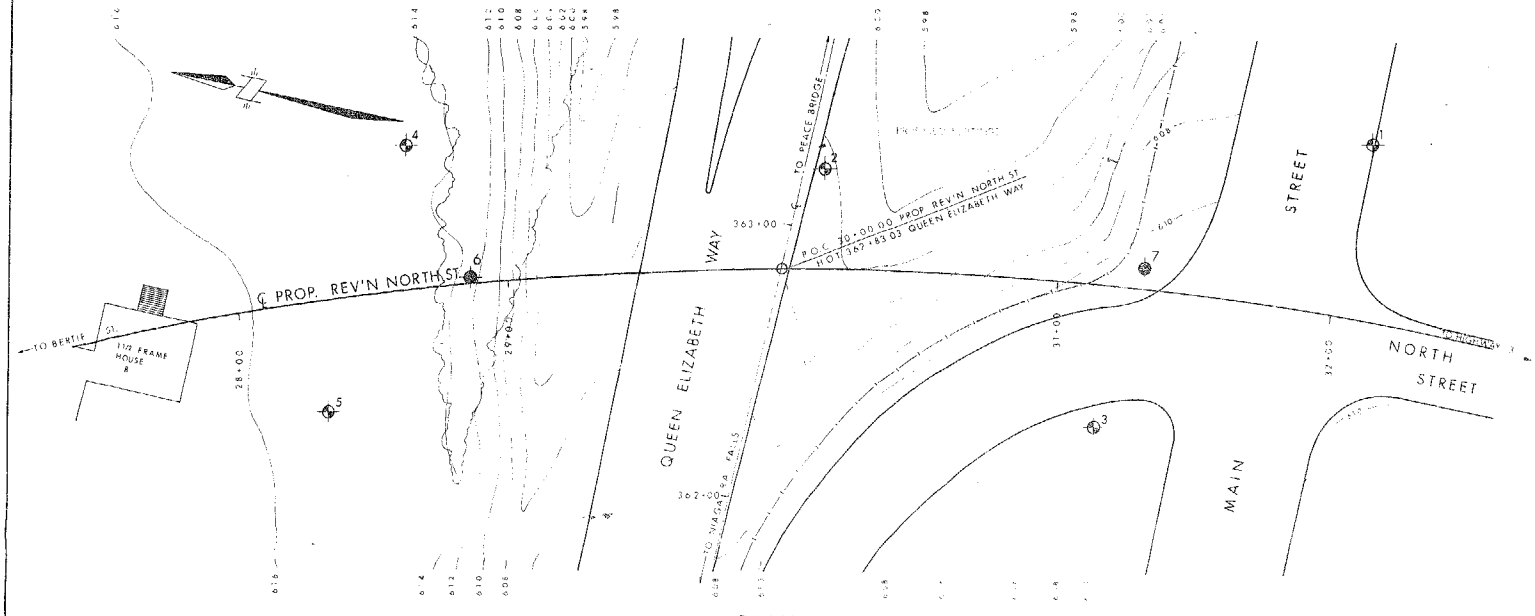
CSG:rd

Attach.

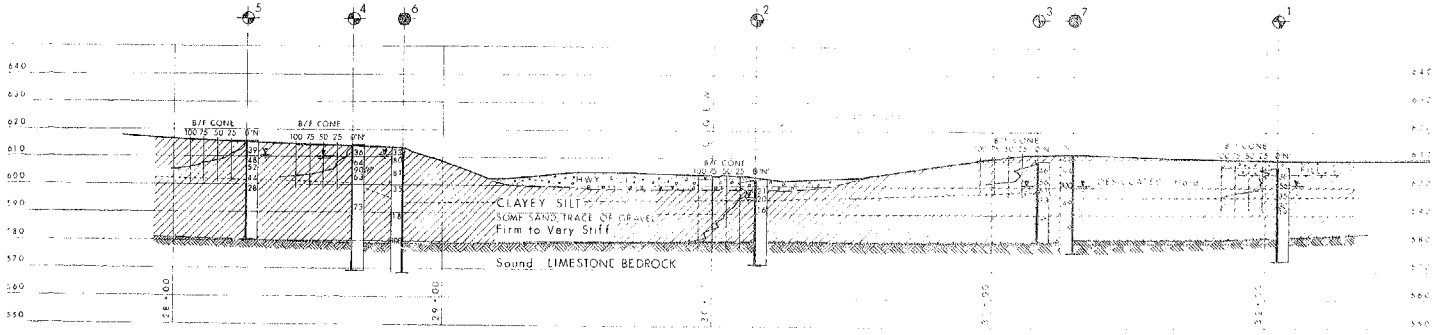
c.c. Foundation Office

We have been advised settlement of 1" is not the reason for changing abutment foundations to piles. It appears from the designers comment that pile foundations are more economical than spread footings with 30 t.s.f. In view of this we have no comments.

WJ Lunata
6th March 70

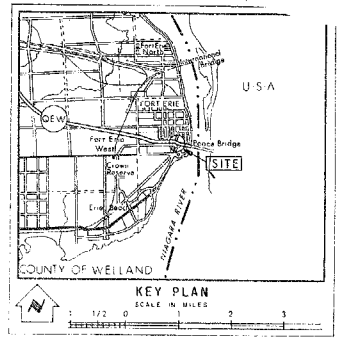


PLAN



℄ PROFILE PROPOSED REVISION NORTH STREET

SCALE 20 10 0 20 40 FT



KEY PLAN
SCALE IN MILES
1 1/2 0 1 2 3

LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation Sept-Oct 67

NO	ELEVATION	STATION	OFFSET
1	607.9	363+73	200'RT
2	605.3	363+22	℄ RT
3	609.3	362+54	121'RT
4	615.7	362+97	145'LT
5	616.4	363+98	131'LT
6	613.8	362+57	111'LT
7	610.8	363+16	128'RT

- NOTE -

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

PRINT RECORD		
NO	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

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

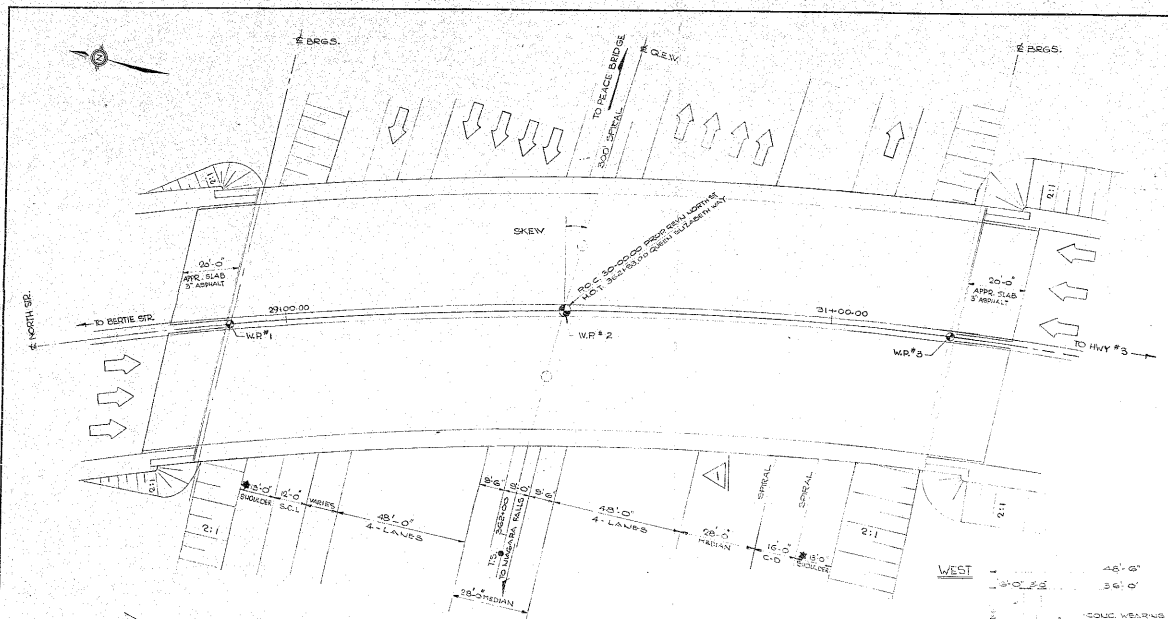
PROPOSED REVISION NORTH STREET

KING'S HIGHWAY NO. Q E W DIST. NO. 4
CO WELLAND NIAGARA TOWN OF FORT ERIE
TWP. LOT CON

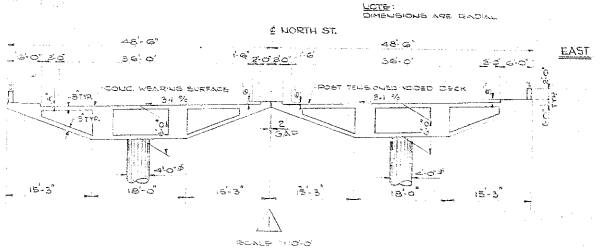
BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D W. H.	CHECKED	W.P. NO. 160-64	M.&T. DRAWING NO. 67-F-85A
DRAWN S. V.	CHECKED	JOB NO. 67-F-85	
DATE 13 NOV 1967		SITE NO.	BRIDGE DRAWING NO.
APPROVED		CONT NO.	

REF E 4793-1

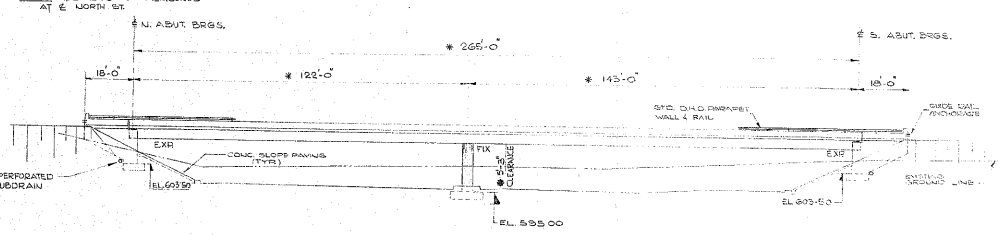


* SHOULDER DETAIL



SCALE 1"=10'-0"

NOTE: *DIMENSIONS MEASURED AT ℄ NORTH ST.



ELEVATION
SCALE 1"=20'-0"

* NO ALLOWANCE MADE FOR FALSEWORK. GRADE TO BE ADJUSTED TO OBTAIN CLEARANCE

CURVE DATA

Δ	=	33° 51' 15"
D	=	4° 30' Arc.
R	=	273.24
T	=	387.50
L	=	752.31
E	=	57.66

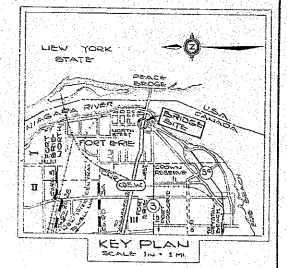
NOTES

CLASS OF CONCRETE

ABUTMENTS & ABUTMENT FOOTINGS	3,000 PSI
PIERS & PIER FOOTINGS	5,000 PSI
DECK CURBS & PARAPET WALL	6,000 PSI
APPROACH SLAB	3,000 PSI

CLEAR COVER TO REINFORCING STEEL

ABUTMENT & PIER FOOTINGS	3"
ABUTMENTS & PIERS	2"
DECK TOP	2½"
DECK BOTTOM	1"
CURBS	2"
PARAPET WALL	1½"
APPROACH SLABS	1½"



PRINT RECORD		
No.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

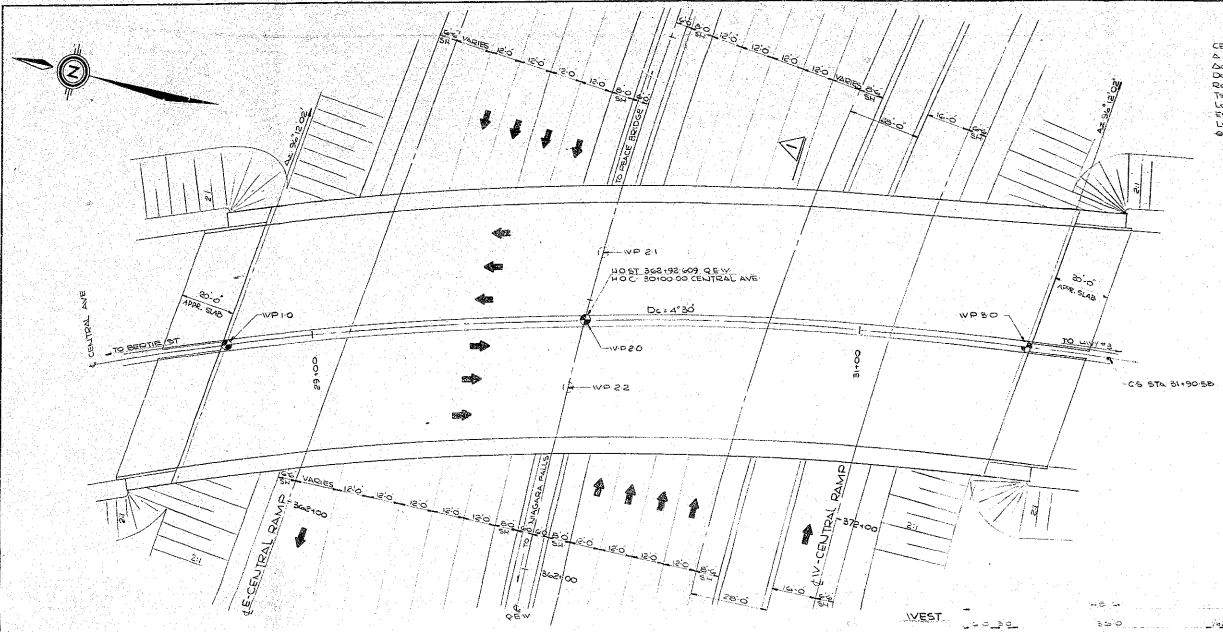
67-F-85

NORTH ST. UNDERPASS

KING'S HIGHWAY No. Q.E.W. DIST. No. 4
CO. OF WELLAND
TOWN OF FORT ERIE LOT CON.

(PRELIMINARY) GENERAL PLAN

APPROVED				SITE No. 34-N-88	W.P. No. 160-64
BRIDGE ENGINEER				CONTRACT No.	
DESIGN	L.N.F.	CHECK			
DRAWING	B.A.	CHECK	M.F.	DRAWING No.	D-6401-P1
DATE	JAN. '68	LOADING	HS 20-44		

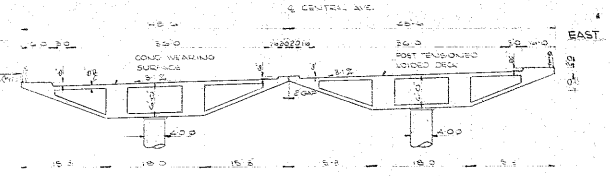


PLAN
SCALE 1" = 80'-0

CURVE DATA

CENTRAL AVE	Q.E.W.
Δ = 31° 56' 05"	Δ = 38° 02' 29"
Δc = 25° 11' 05"	Δc = 6° 02' 29"
Dc = 4° 30' 00"	Dc = 10° 00' 00" RT
Rc = 1273.240	Rc = 572.958
Tc = 439.512	Tc = 349.426
Lc = 559.960	Lc = 80.414
Es = 51.860	Es = 39.996
Ls = 150.00	Ls = 300.00
Φs = 3° 22' 30"	Φs = 15° 00' 00"

NOTE:
DIMENSIONS GIVEN ARE MEASURED RADIALLY



SCALE 1" = 10'-0

NOTES:

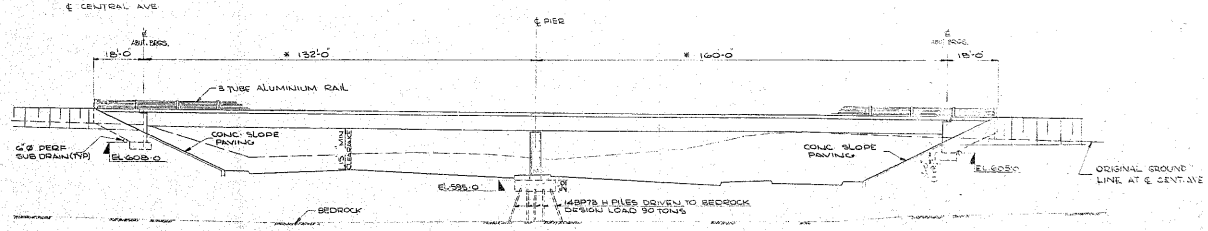
CLASS OF CONCRETE

ABUTMENTS & ABUTMENT FOOTINGS	3000 P.S.I.
PIERS & PIER FOOTINGS	5000 P.S.I.
DECK, CURBS & PARAPET WALLS	5000 P.S.I.
APPROACH SLABS	3000 P.S.I.

CLEAR COVER TO REINFORCING STEEL

FOOTINGS, ABUTMENTS & PIERS			3"
DECK	TOP 2"	BOTT.	1"
PARAPET WALLS			1½"
CURBS & APPROACH SLABS			1½"

NOTE:
* DIMENSIONS MEASURED ALONG ℄ CENTRAL AVE



ELEVATION
SCALE 1" = 20'-0

PRINT RECORD		
No.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

67-F-85

CENTRAL AVE. OVERPASS

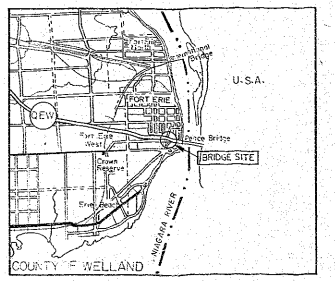
KING'S HIGHWAY No. Q.E.W. — DIST. No. 4
CO. WELLAND
TWP. SEC. T.S. — LOT — CON.

PRELIMINARY PLAN

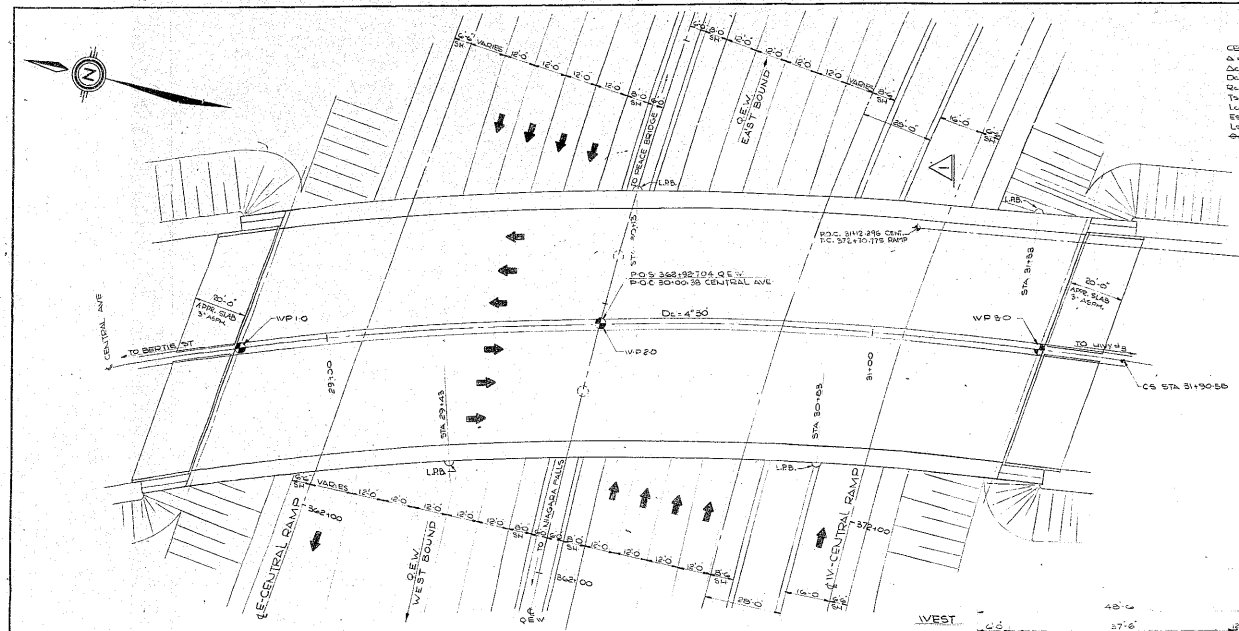
APPROVED		SITE No.	W.P. No. 160-68
BRIDGE ENGINEER		CONTRACT Nos.	
DESIGN	CHECK		
DRAWING RD	CHECK	DRAWING No.	D-6401 + P2
DATE	LOADING H-S20-44		

CURVE DATA

CENTRAL AVE		Q.E.W.	
Δ =	31° 54' 05"	Δ =	36° 08' 29"
Dc =	25° 11' 05"	Dc =	8° 08' 29"
Dc =	47' 30" RT	Dc =	10' 00" RT
Rc =	1273.240	Rc =	572.958
Ts =	439.512	Ts =	349.428
Lc =	559.660	Lc =	80.414
Es =	51.860	Es =	33.996
Ls =	150.000	Ls =	300.00
θs =	5° 22' 30"	θs =	15° 00' 00"

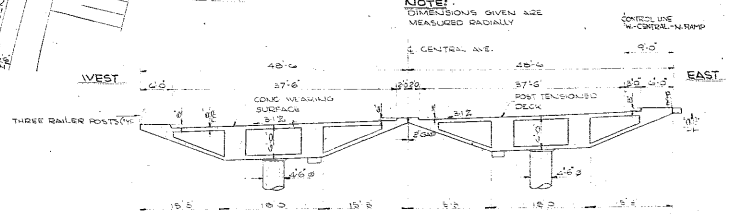


KEY PLAN
SCALE: 1" = 1 MILE



PLAN
SCALE: 1" = 20'-0"

NOTE:
DIMENSIONS GIVEN ARE MEASURED RADIALLY



SCALE 1:10:0

NOTES:

CLASS OF CONCRETE

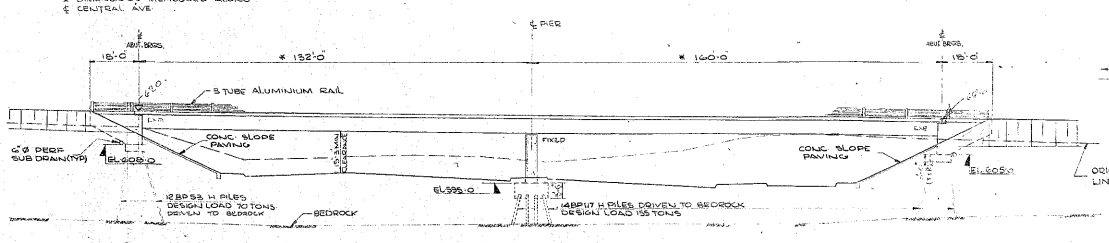
ABUTMENTS & ABUTMENT FOOTINGS	3000 PSI
PIERS & PIER FOOTINGS	5000 PSI
DECK, CURBS, & PARAPET WALLS	5000 PSI
APPROACH SLABS	3000 PSI

CLEAR COVER TO REINFORCING STEEL

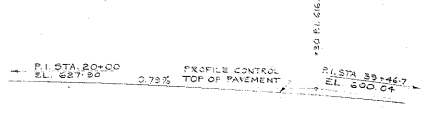
FOOTINGS, ABUTMENTS, & PIERS		
DECK	TOP 2"	BOTT 1"
PARAPET WALLS		1"
CURBS & APPROACH SLABS		1"

LIST OF DRAWINGS:

NOTE:
* DIMENSIONS MEASURED ALONG ℄ CENTRAL AVE.



ELEVATION
SCALE 1" = 20'-0"



PRINT RECORD

No.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

67-F-85

CENTRAL AVE. UNDERPASS

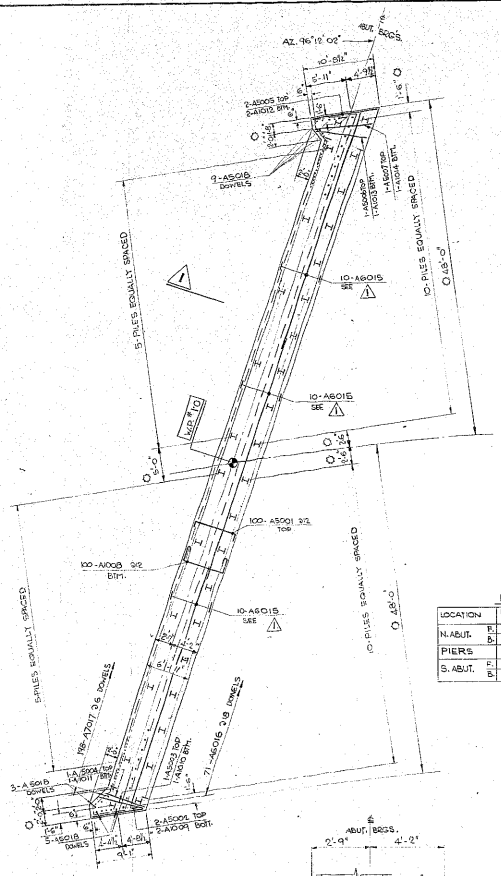
KING'S HIGHWAY No. QEW — DIST. No. 4
CO. WELLAND
TWP. BERTIE — LOT — CON.

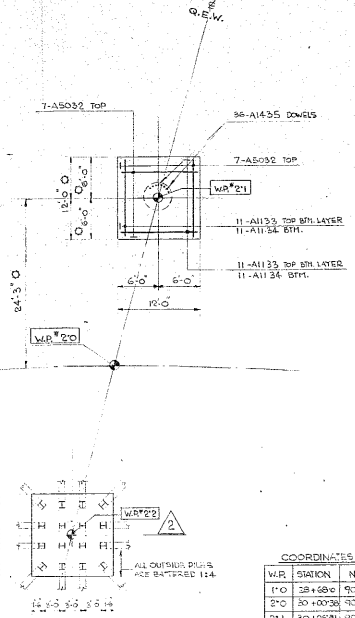
GENERAL PLAN

APPROVED — BRIDGE ENGINEER

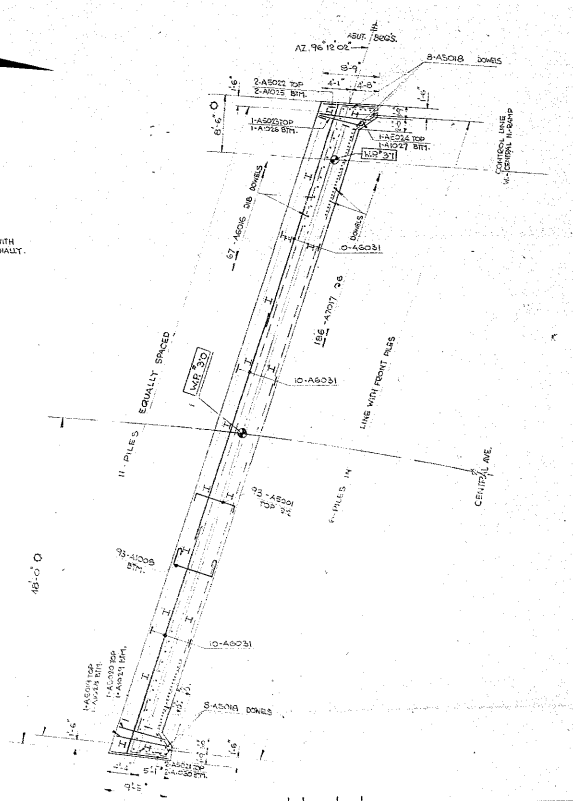
DESIGN	J.G.	CHECK	
DRAWING	R.D. &	CHECK	
DATE	FEB. 1975	LOADING	HS20-44

SITE No. 34-188 — W.P. No. 160-64
CONTRACT No.
DRAWING No. D-6401-1





NOTE:
○ ALL DIMENSIONS SHOWN WITH ASTERISKS ARE TAKEN RADIALLY.



LIST OF PILES

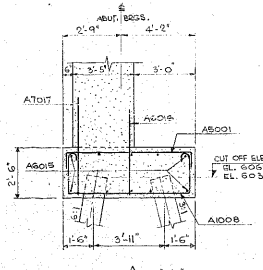
LOCATION		NO. OF PILES	LENGTH	TYPE	DESIGN LOAD
N. ABUT.	B.	20	29'-0"	12 B.P.	70 TONS
	P.	12	28'-0"	10	
PIERS	B.	32	12'-6"	14 B.P.	115 TONS
	P.	11	25'-0"	117	
S. ABUT.	B.	6			

COORDINATES FOR W.P.'S

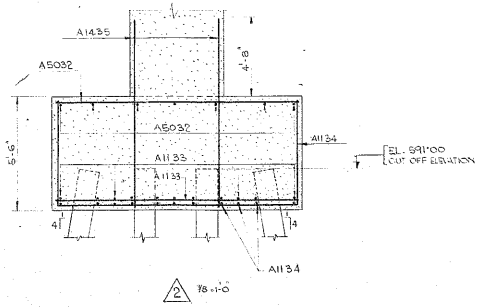
W.P.	STATION	NORTH	SOUTH
1*0	28+68·0	906 86·01	550 39·36
2*0	30+00·38	905 59·24	560 77·46
2*1	30+09·31	905 58·69	561 22·35
2*2	29+94·06	905 57·52	560 52·41
3*0	31+62·0	904 02·33	561 05·70
3*1	372+12·92	903 97·81	561 47·24

*STATION FOR W.P. 3*1 IS TAKEN CONTROL LINE W-CENTRAL N-RAMP.

PLAN
SCALE: 1/8"=1'-0"



1 1/8"=1'-0"



2 1/8"=1'-0"

FOR REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

67-F-85

CENTRAL AVE. UNDERPASS

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

FOOTINGS - DIMENSIONS AND REINFORCING

APPROVED	BRIDGE ENGINEER	SITE No.	W.P. No. 160-64
DESIGN JL	CHECK	CONTRACT Nos.	
DRAWING	CHECK	DRAWING No.	D-6401-3
DATE FEB. 1970	LOADING MS 20-44		

PRINT RECORD		
No.	FOR	DATE
1		