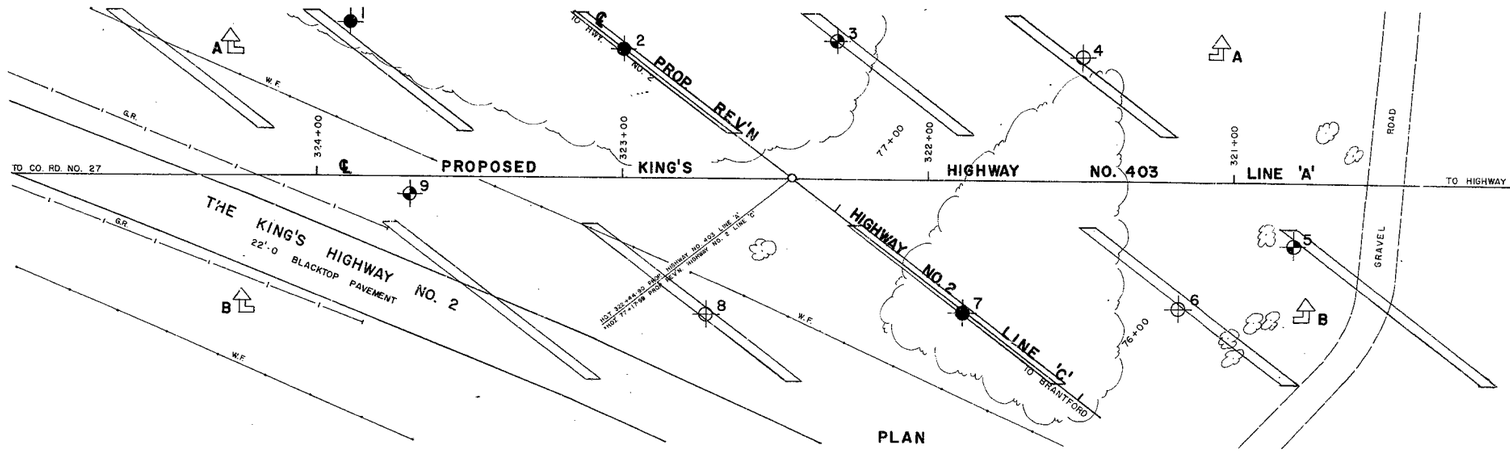
61-F-76

W.P. #153-60

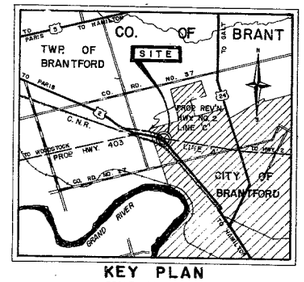
Hwy #2 &

Hwy #403

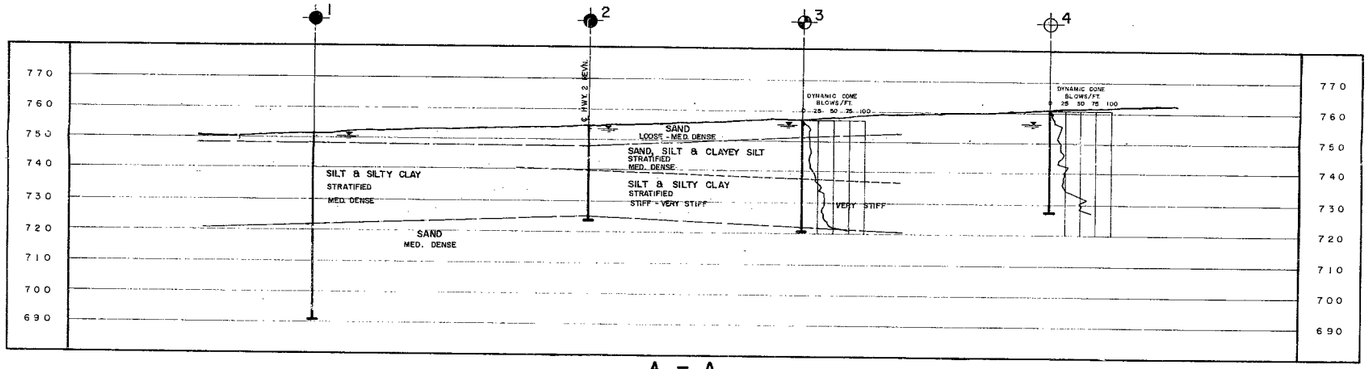
CROSSING



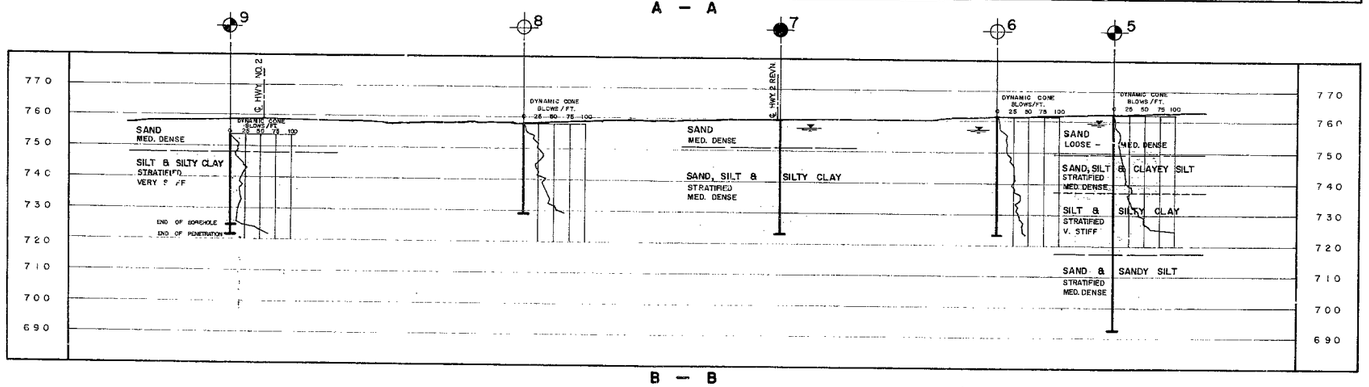
PLAN



KEY PLAN
SCALE: 1 in. = 1 mi.



A — A



B — B

LEGEND

- BORE HOLE
- BORE & PENETRATION HOLE
- PENETRATION HOLE
- WATER LEVELS established at time of investigation. (AUGUST 1961)

HOLE	ELEVATION	STATION	OFFSET
1	751·4	323+90	50' RT.
2	754·9	323+00	42' RT.
3	757·1	322+30	45' RT.
4	760·5	321+50	40' RT.
5	762·6	320+80	20' LT.
6	761·2	321+18	41' LT.
7	759·5	321+88	43' LT.
8	758·0	322+72	44' LT.
9	753·4	323+69	6' 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.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH SECTION

HIGHWAY NO. 2 REVISION LINE 'C'
AND
PROPOSED HIGHWAY NO. 403
LINE 'A'

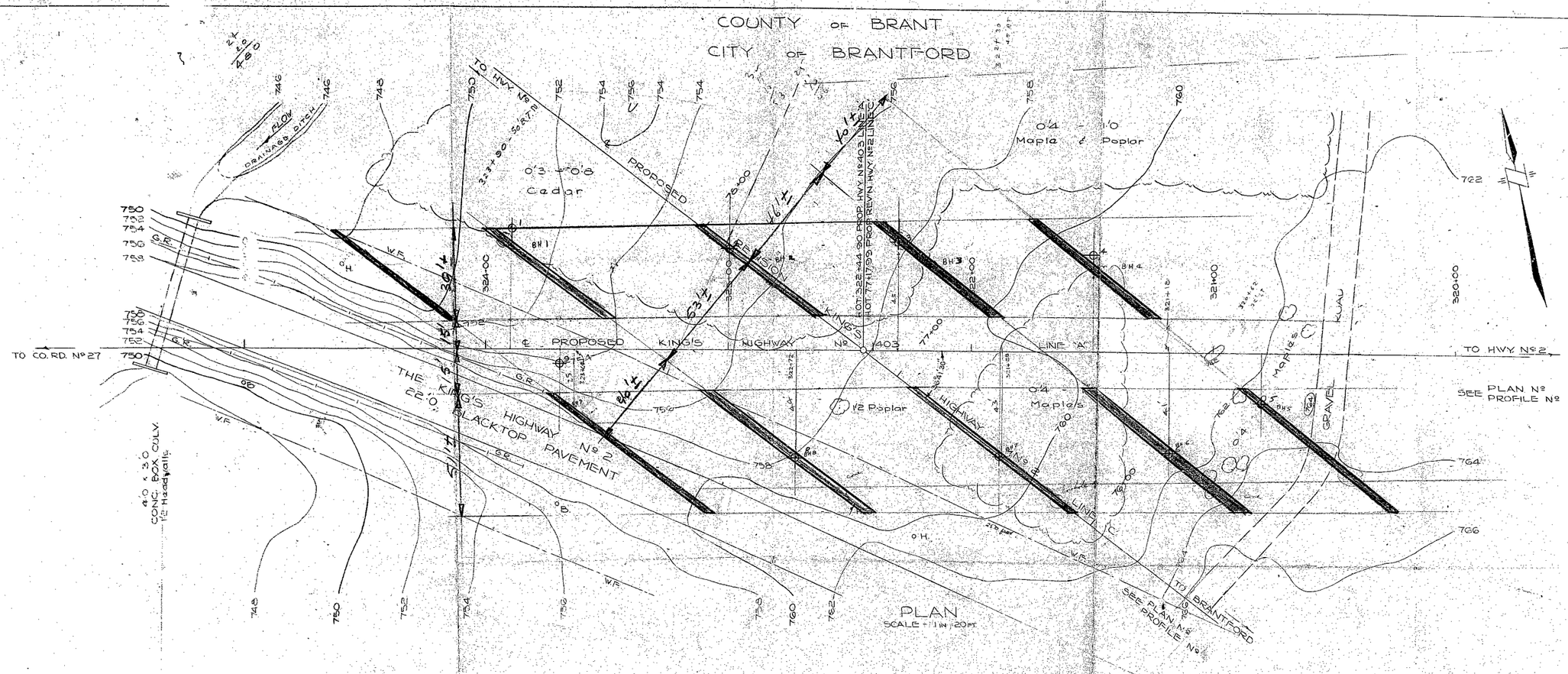
ORIGINATED R. SALVAS	DISTRICT NO. 4	DATE 19 OCT. 1961
DRAWN D. MUMFORD	W.P. NO. 153-60	JOB NO. 61-F-76
CHECKED	SCALE	DRAWING NO.
APPROVED K. A. Gill	1 INCH = 20 FEET	61-F-76A

JIM REAGAN
ALF CAMILOTTI

REF. NO. E-3977-1

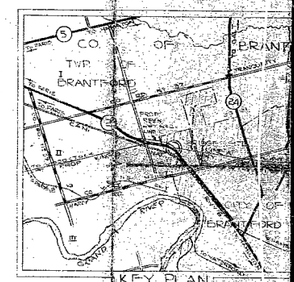
COUNTY OF BRANT

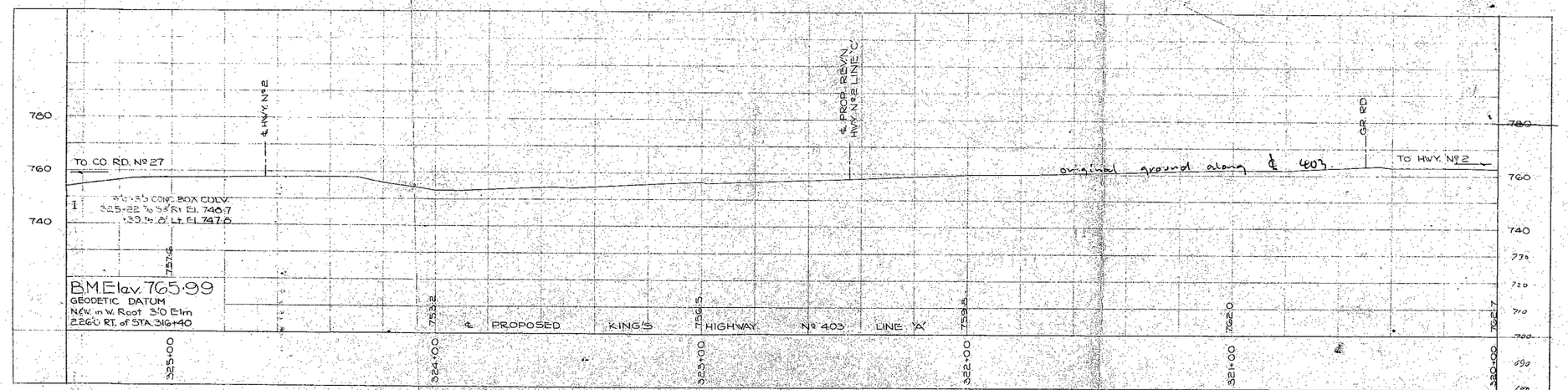
CITY OF BRANTFORD



PLAN

SCALE - 1 IN = 20 FT.





PROFILE

SCALE - HOR. 1 IN = 20 FT.
VER. 1 IN = 20 FT.

W.P. No 153-60

DEPARTMENT OF H
PLANNING & D

DISTRICT

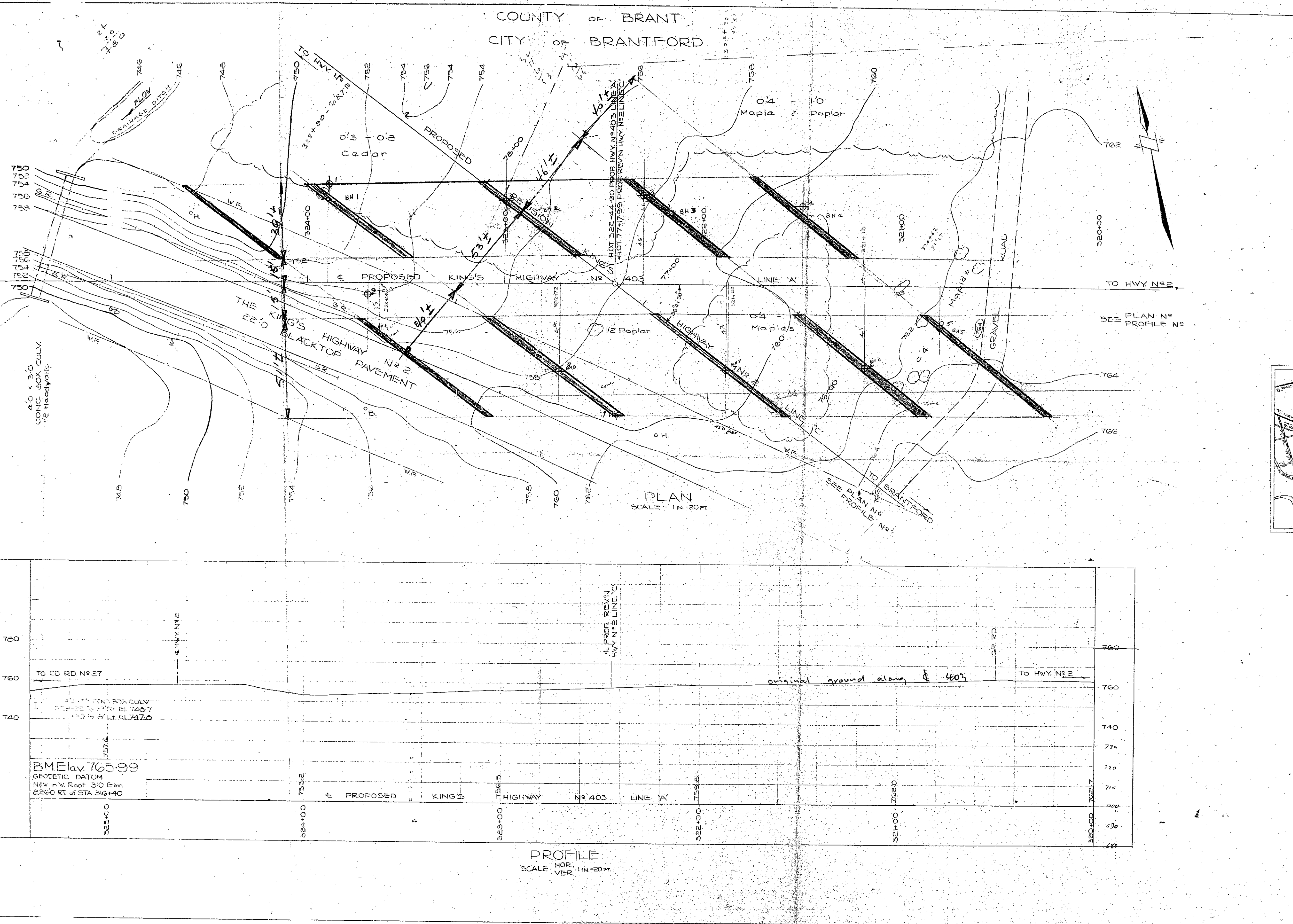
PROPOSED
AT TH
PROP. REV'N KING'S
&
AND
PROP. KING'S HIG
(IN THE CITY O
COUNTY

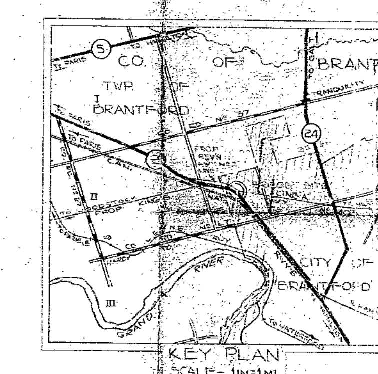
BRIDGE

SURVEY BY:
Chief of Party: H. GREGOR
Supervisor: K. PERSSON

DRAWN BY:
Draftsman: B. PARKINSON
Supervisor: J. UNDERDOWN

CHECKED BY:
Draftsman: B. STUKALO
Supervisor: I. PLEASANCE





W.P. Nº 153-60 61-F-76

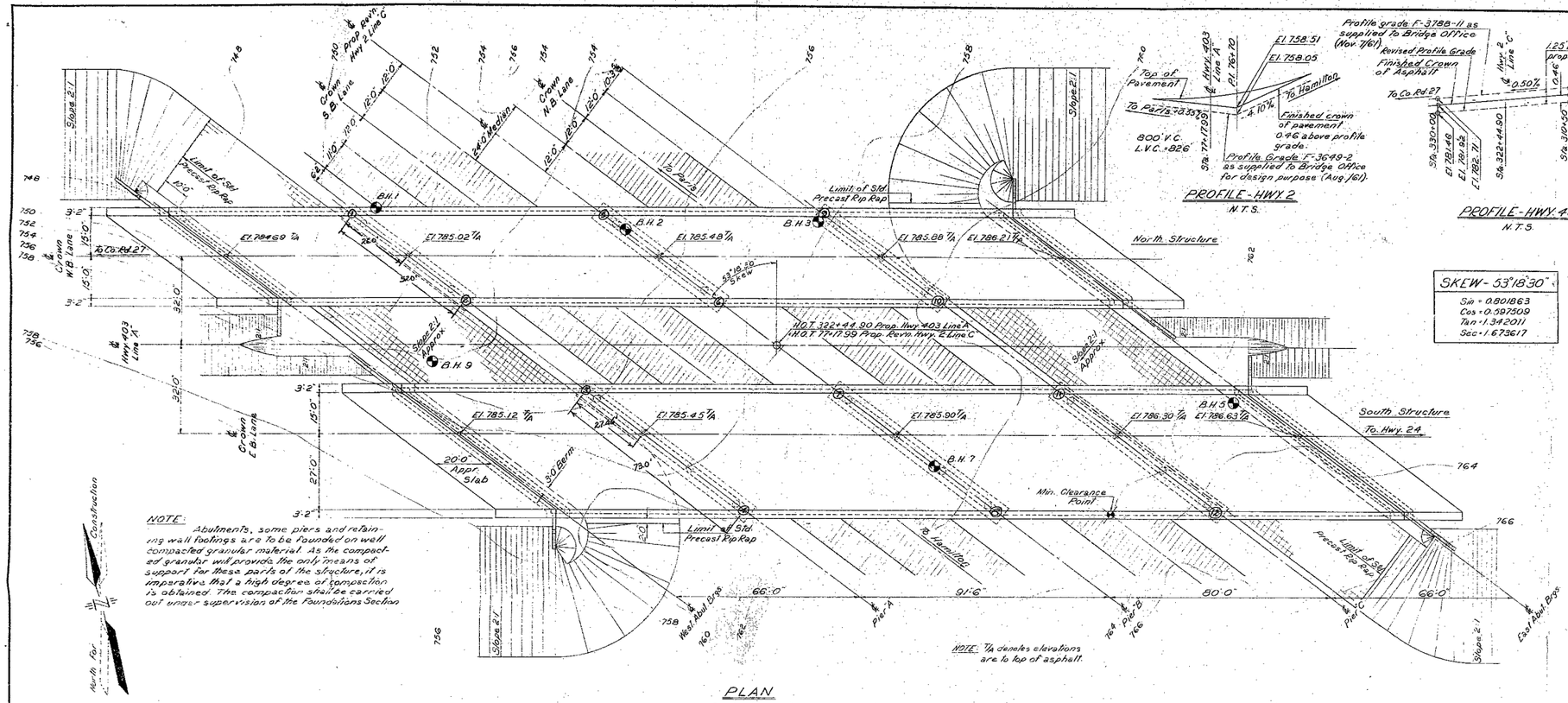
DEPARTMENT OF HIGHWAYS - ONTARIO
PLANNING & DESIGN BRANCH
DISTRICT Nº 4

PROPOSED CROSSING
AT THE
PROP. REV'N KING'S HWY. Nº 2 LINE 'C'
AND THE
PROP. KING'S HIGHWAY Nº 403 LINE 'A'
(IN THE CITY OF BRANTFORD)
COUNTY OF BRANT

BRIDGE SITE

SURVEY BY: Chief of Party: H. GREGOR; Supervisor: K. PERSSON	APPROVED ... Director of Planning & Design
DRAWN BY: Draftsman: B. PARKINSON; Supervisor: J. UNDERDOWN	SCALE - AS SHOWN DATE OF SURVEY - MARCH 1961 DATE OF PLAN - APRIL 1961
CHECKED BY: Draftsman: B. STUKALO; Supervisor: H. PLEASANCE	W.O. Nº 34-60-179 XING Nº PLAN E-3977-1

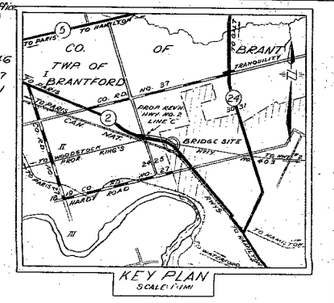
SHEET No.	TOTAL SHEETS



PLAN
Scale: 1" = 20'-0"

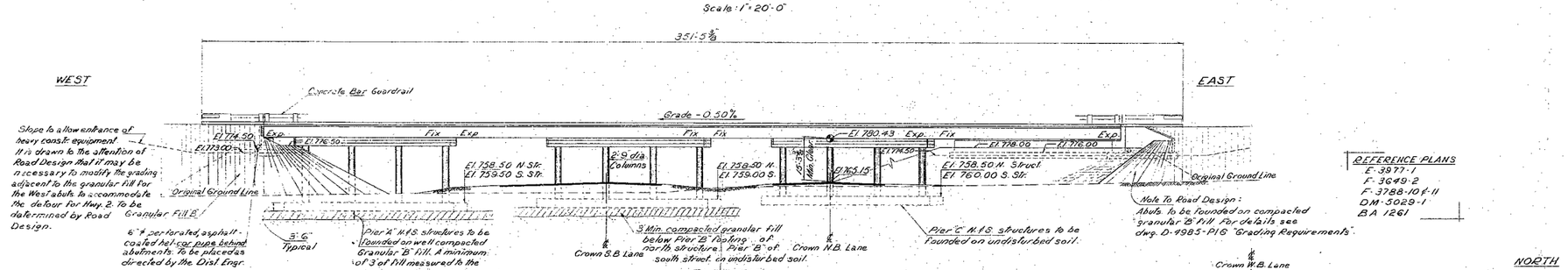
PROFILE - HWY 2
N.T.S.

PROFILE - HWY. 403
N.T.S.

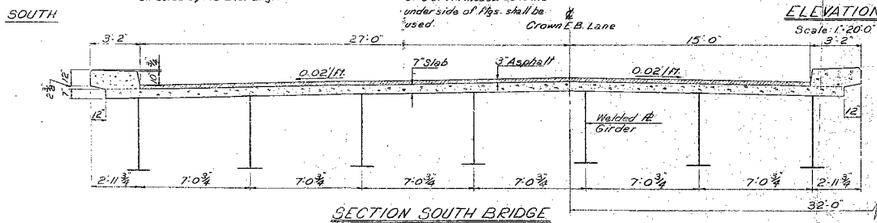


SKEW - 53°18'30"
Sin = 0.801863
Cos = 0.597509
Tan = 1.342011
Sec = 1.673617

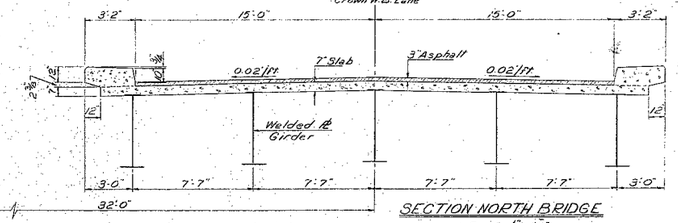
NOTE: Abutments, some piers and retaining wall footings are to be founded on well compacted granular material. As the compacted granular will provide the only means of support for these parts of the structure, it is imperative that a high degree of compaction is obtained. The compaction shall be carried out under supervision of the Foundations Section



ELEVATION
Scale: 1" = 20'-0"



SECTION SOUTH BRIDGE
Scale: ½" = 1'-0"



SECTION NORTH BRIDGE
Scale ½" = 1'-0"

REFERENCE PLANS
E-3977-1
F-3649-2
F-3788-10 & 11
DM-5029-1
BA 1261

PRINT RECORD		
No.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

HWY 2 OVERPASS
AT WEST END of BRANTFORD BY-PASS

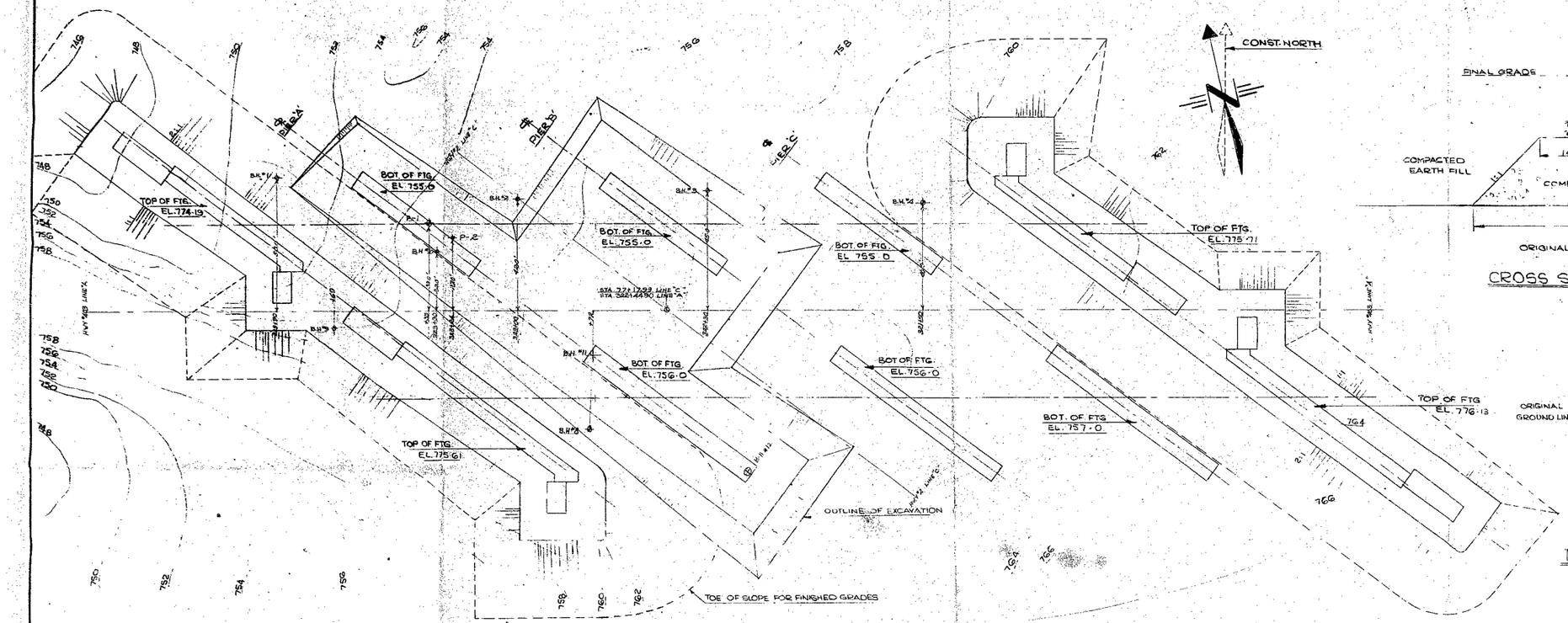
KING'S HIGHWAY No. 403 — DIST. No. 4
CO. Brant
TWP. City of Brantford — LOT — CON.

PRELIMINARY

APPROVED _____ BRIDGE ENGINEER

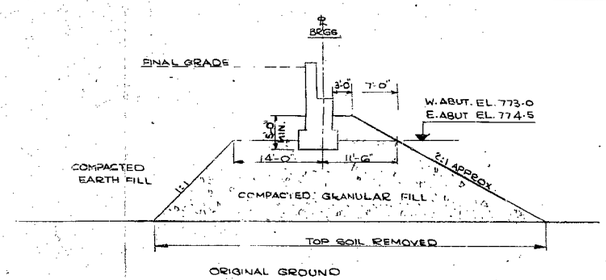
DESIGN	B. R.	CHECK		SITE No. E-3977-1	W.P. No. 153-60
DRAWING	F. J. W.	CHECK	B.R.	CONTRACT Nos.	
DATE	Jan. 1962	LOADING	H 20-S 16	DRAWING No.	D-4985-P1

SHEET No.	TOTAL SHEETS



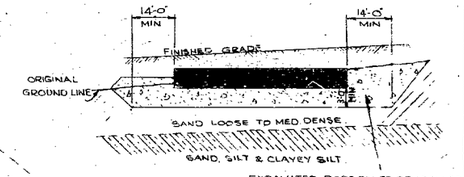
PLAN

SCALE 1" = 20'-0"



CROSS SECTION THROUGH ABUTMENT

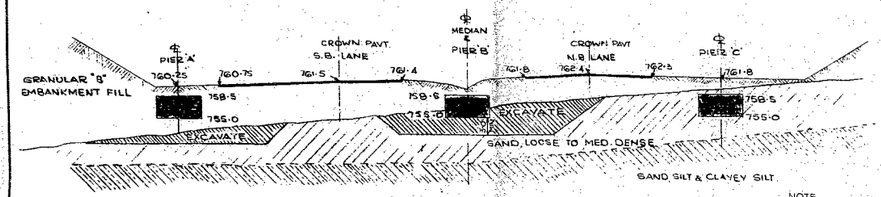
SCALE 1" = 10'-0"



TYP. LONGITUDINAL SECTION THROUGH PIER FOOTINGS ON FILL

SECTION OF PIER & FOOTING N. STRUCTURE

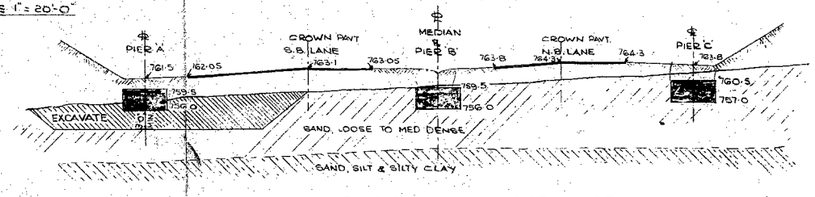
SCALE HOR. = 1" = 20'-0"
VERT. = 1" = 10'-0"



SECTION ALONG NORTH FACE

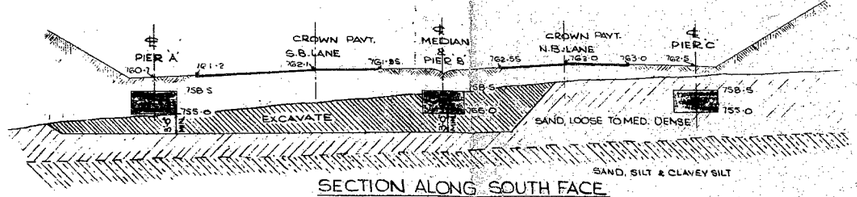
NORTH STRUCTURE

NOTE:
EXCAVATED PORTION TO BE REFILLED & BROUGHT UP TO GRADE USING GRANULAR 'B'. THE GRANULAR SHALL BE WELL COMPACTED TO 100 % OF THE PRESENT D.H.O. STANDARD METHOD. THE EXCAVATION SHALL BE INSPECTED BY THE FOUNDATION SECTION PRIOR TO PLACING OF ANY FILLS AND THE PLACING AND COMPACTION OF THE FILLS SHALL BE SUPERVISED BY THE FOUNDATION SECTION.



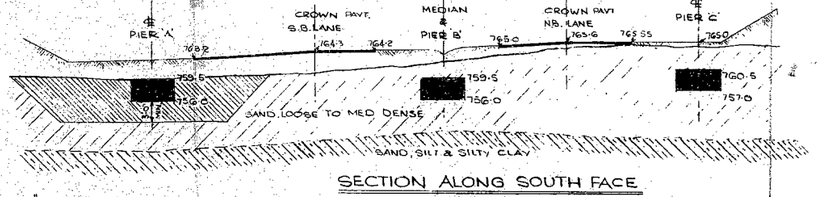
SECTION ALONG NORTH FACE

SOUTH STRUCTURE



SECTION ALONG SOUTH FACE

NORTH STRUCTURE



SECTION ALONG SOUTH FACE

SOUTH STRUCTURE

SCALE HOR. = 1" = 20'-0"
VERT. = 1" = 10'-0"

NOTE

THIS PLAN TO BE READ IN CONJUNCTION WITH PRELIMINARY PLAN D-4985-P1

REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

HWY #2 OVERPASS

AT WEST END OF BRANFORD BY-PASS

KING'S HIGHWAY No. 403 DIST. No. 4

CO. BRANT

TWP. CITY OF BRANTFORD LOT CON.

GRADING REQUIREMENTS

APPROVED _____ BRIDGE ENGINEER				SITE No.	W.P. No.	153/60
DESIGN	B.R.	CHECK		CONTRACT Nos.		
DRAWING	P.T.	CHECK	B.R.			
DATE	JAN 62	LOADING	H-20 S-16	DRAWING No.	D-4985-P1G.	

DOCUMENT DESCRIPTIVE IDENTIFICATION

GEOCRES No. 40P01-8A

DIST 4 REGION CENTRAL

W.P. No. 5-69-02 (see 152-60)

CONT. No. 77-127

W. O. No.

STR. SITE No.

HWY. No. 2

LOCATION HWY 2 INTERCHANGE
(widening HWY 403)

DRAWINGS OR DATA TO BE INCLUDED WITH THIS REPORT 5

REMARKS:

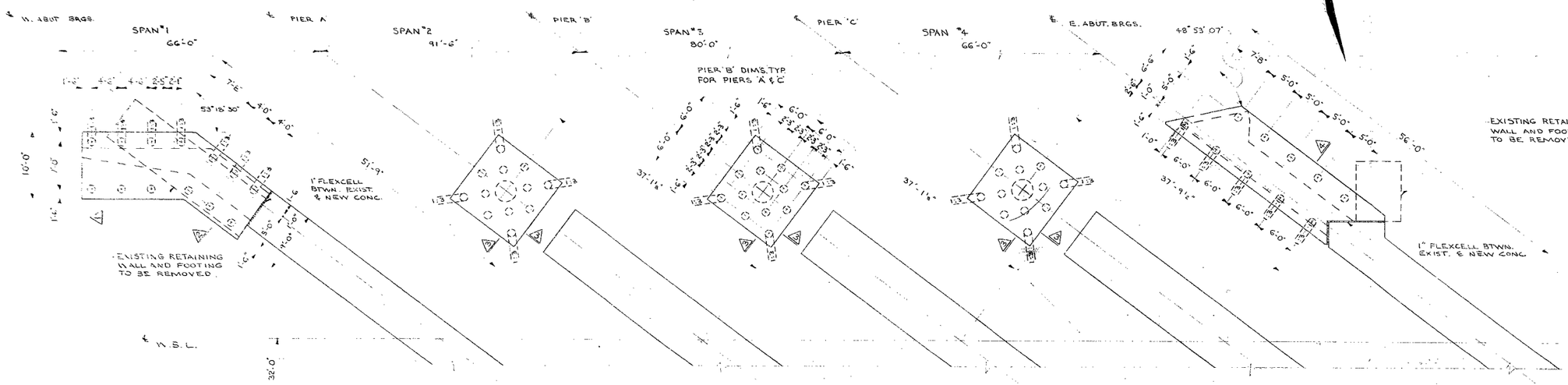
40P01-8A

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO 3115 DEBRIS 4-75

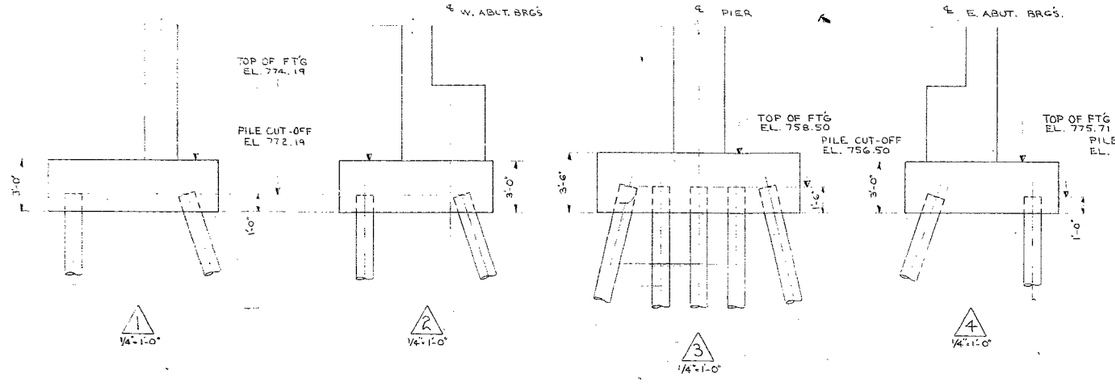
DIST. No. 4 HWY. 403
CONT No
WP No 5-69-02

HWY 2. INTERCH. O'PASS
NORTH STRUCTURE WIDENING
AT WEST END OF BRANTFORD
FOOTINGS

SHEET



PLAN
1/8" = 1'-0"



NOTES:

ALL PILES TO BE 12¾" O.D. x 0.250" WALL STEEL TUBE PILES. PILES TO BE FILLED WITH 3000 p.s.i. CONCRETE AFTER INSTALLATION AND INSPECTION.

PILES SHALL BE DRIVEN IN ACCORDANCE WITH STD SS3-11 (DWG NO. 18) USING A DESIGN LOAD OF 40 TON/PILE.

FOR PILE SPLICING AND SHOE PLATE DETAILS SEE DWG NO. 18.

THE QUANTITY OF CONCRETE IN THE PILES IS CU.YD. CONTRACTOR TO SUPPLY THE CEMENT.

PILE SPACING TO BE MEASURED AT UNDERSIDE OF FOOTING.

PILE DATA

LOCATION	NO. REQ'D	BATTER	LENGTH
WEST ABUT.	6 7	– 1:3	63' 67'
PIER 'A'	8 4	– 1:3	47' 50'
PIER 'B'	8 4	– 1:3	47' 50'
PIER 'C'	8 4	– 1:3	47' 50'
EAST ABUT.	5 5	– 1:3	65' 68'

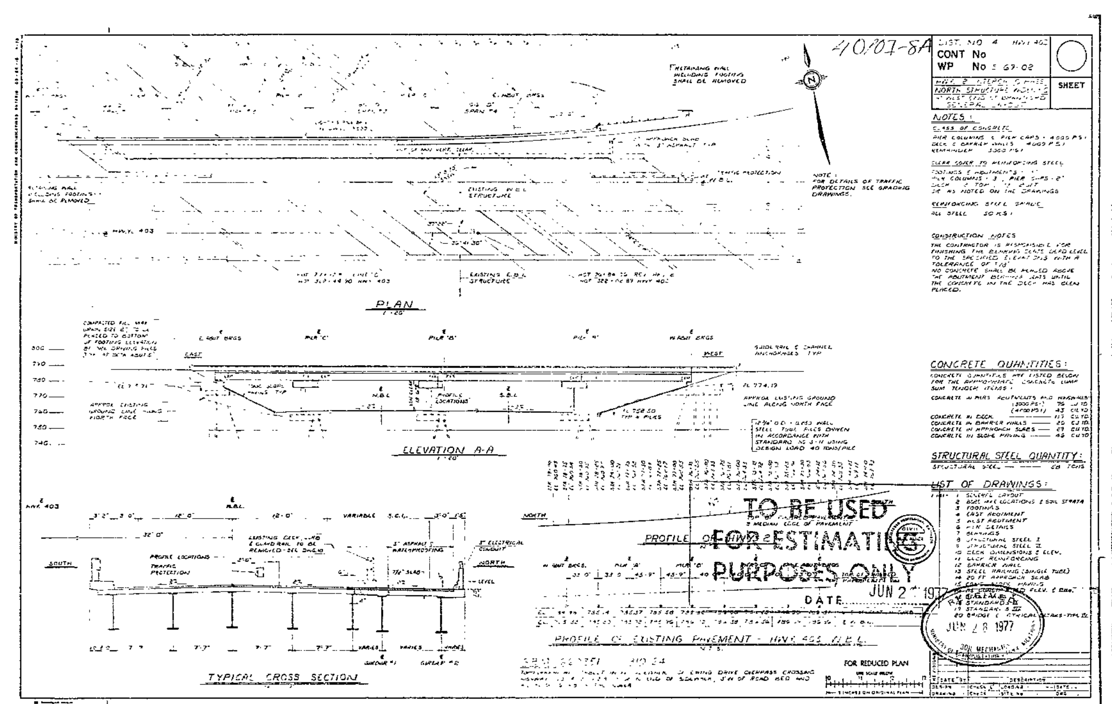
RECEIVED
JUN 09 1977
CIVIL MECHANICAL
ELECTRICAL TRANSPORTATION & COMMUNICATIONS

REGISTERED PROFESSIONAL ENGINEER
CIVIL
M. A. ALMER
PROVINCE OF ONTARIO

FOR REDUCED PLAN
USE SCALE BELOW
10 11 12 13
3 INCHES ON ORIGINAL PLAN

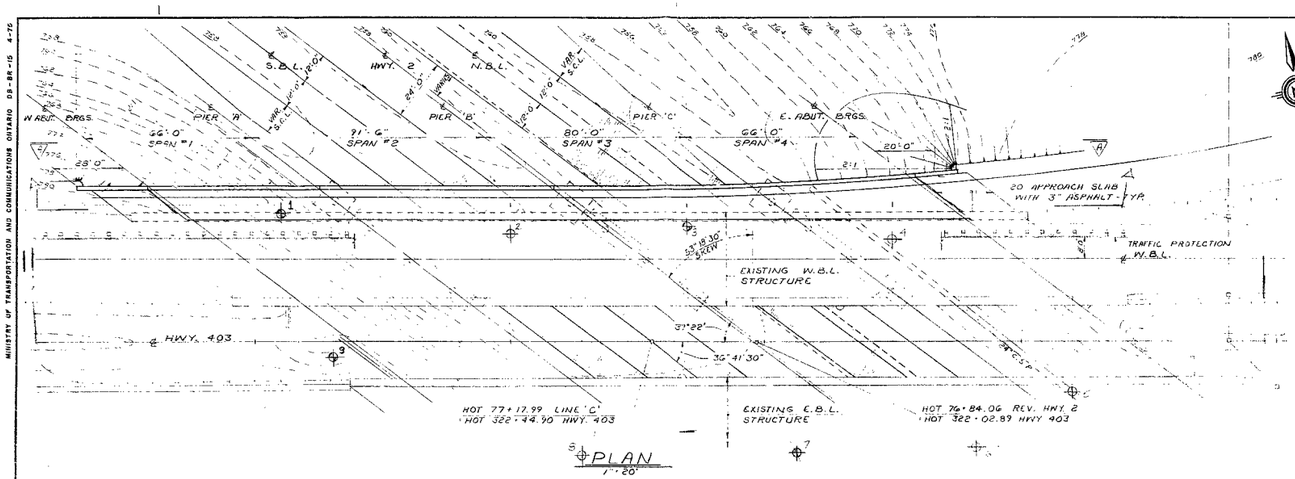
REVISIONS			
DATE	BY	DESCRIPTION	
DESIGN LFM.	CHECK	LOADING HS20-44	DATE MAY '77
DRAWING WMM	CHECK	SITE No 1-141	DWG 3

TRANSLAR 380-3-77

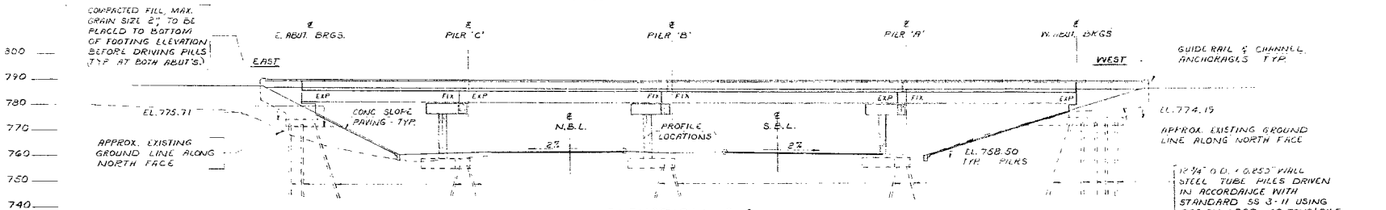

40707-8A
CONT No
WP No
SHEET
NOTES :
CLASS OF CONCRETE
CONSTRUCTION NOTES
NOTE :
FOR DETAILS OF TRAFFIC PROTECTION SEE GRADING DRAWINGS.
PLAN
ELEVATION A-A
TYPICAL CROSS SECTION
CONCRETE QUANTITIES:
STRUCTURAL STEEL QUANTITY:
LIST OF DRAWINGS:
TO BE USED FOR ESTIMATING PURPOSES ONLY
DATE
JUN 2 1977
JUN 28 1977
FOR REDUCED PLAN

10POI-5A

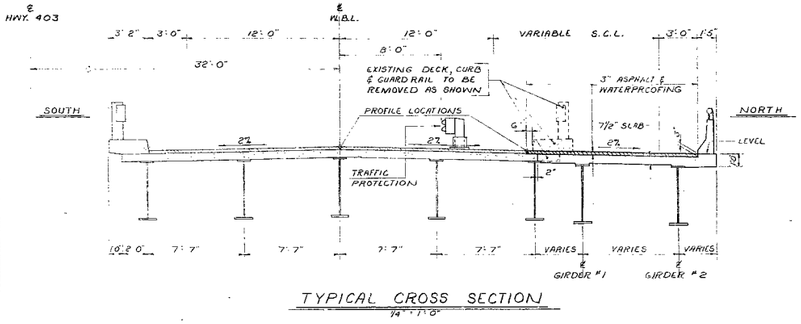
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO 08-BR-15 4-75



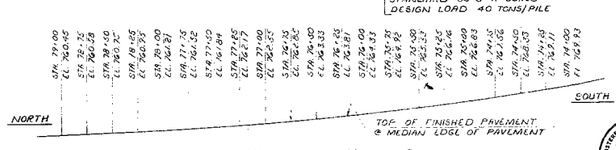
PLAN
1" = 20'



ELEVATION A-A
1" = 20'



TYPICAL CROSS SECTION
3/4" = 1'-0"



PROFILE OF HWY. 2
N.T.S.

	E W. ABUT. BRGS.	E PIER 'A'	E PIER 'B'	E PIER 'C'	E E. ABUT. BRGS.	
	33'-0"	33'-0"	45'-9"	45'-9" 40'-0"	40'-0" 33'-0"	33'-0" TOP OF FINISHED PAVEMENT
EL.	784.98	785.14	785.37	785.58	785.82	786.00	786.22	786.38	786.51	6" S. OF EXIST. N. CURB
EL.	785.33	785.50	785.72	785.96	786.20	786.38	786.56	786.69	786.86	℄ W.B.L.

PROFILE OF EXISTING PAVEMENT - HWY. 403 W.B.L.
N.T.S.

GBM 660351 810.64

TOPOGRAPHICAL TABLET IN W SIDEWALK OF EW.NG DRIVE OVERPASS CROSSING HIGHWAY NO. 403, 113.8' S OF N END OF SIDEWALK, 3'W OF ROAD BED AND 4.2' N OF 6" x 8" METAL COVER.

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

DIST. NO. 4	HWY. 403	
CONT No		
WP No 5-69-02		
HWY. 2 INTERCH. O'PASS. NORTH STRUCTURE WIDENING AT WEST END OF BRANTFORD GENERAL LAYOUT		SHEET

NOTES:

GLASS OF CONCRETE

PIER, DECK & BARRIER WALLS - 4000 P.S.I.
REMAINDER - 3000 P.S.I.

CLEAR COVER TO REINFORCING STEEL

FOOTINGS & ABUTMENTS - 3"
PIER CAPS - 2"
DECK - 2" TOP ; 1" BOT.
OR AS NOTED ON THE DRAWINGS.

REINFORCING STEEL GRADE

ALL STEEL - 50 K.S.I.

CONSTRUCTION NOTES

THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ± 1/8"
NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.

CONCRETE QUANTITIES:

CONCRETE QUANTITIES ARE LISTED BELOW FOR THE INFORMATION OF CONCRETE LUMP SUM TENDER ITEMS:

CONCRETE IN PIERS, ABUTMENTS AND WINGWALLS (3000 PSI)	CU.YD.
(4000 PSI)	CU.YD.
CONCRETE IN DECK	CU.YD.
CONCRETE IN BARRIER WALLS	CU.YD.
CONCRETE IN APPROACH SLABS	CU.YD.
CONCRETE IN SLOPE PAVING	CU.YD.

STRUCTURAL STEEL QUANTITY:

STRUCTURAL STEEL ——— TONS

LIST OF DRAWINGS:

1-141-
1 GENERAL LAYOUT
2 BORE HOLE LOCATIONS & SOIL STRATA
3 FOOTINGS ~~CONCRETE~~
4 EAST ABUTMENT
5 WEST ABUTMENT
6 PIER DETAILS
7 BEARINGS
8 STRUCTURAL STEEL I
9 STRUCTURAL STEEL II
10 DECK DIMENSIONS & ELEV.
11 DECK REINFORCING
12 BARRIER WALL
13 STEEL RAILING (SINGLE TUBE)
14 20 FT. APPROACH SLAB
15 CONC. SLOPE PAVING
16 AS CONSTRUCTED ELEV. & DIM.
17 STANDARDS I
18 STANDARDS II

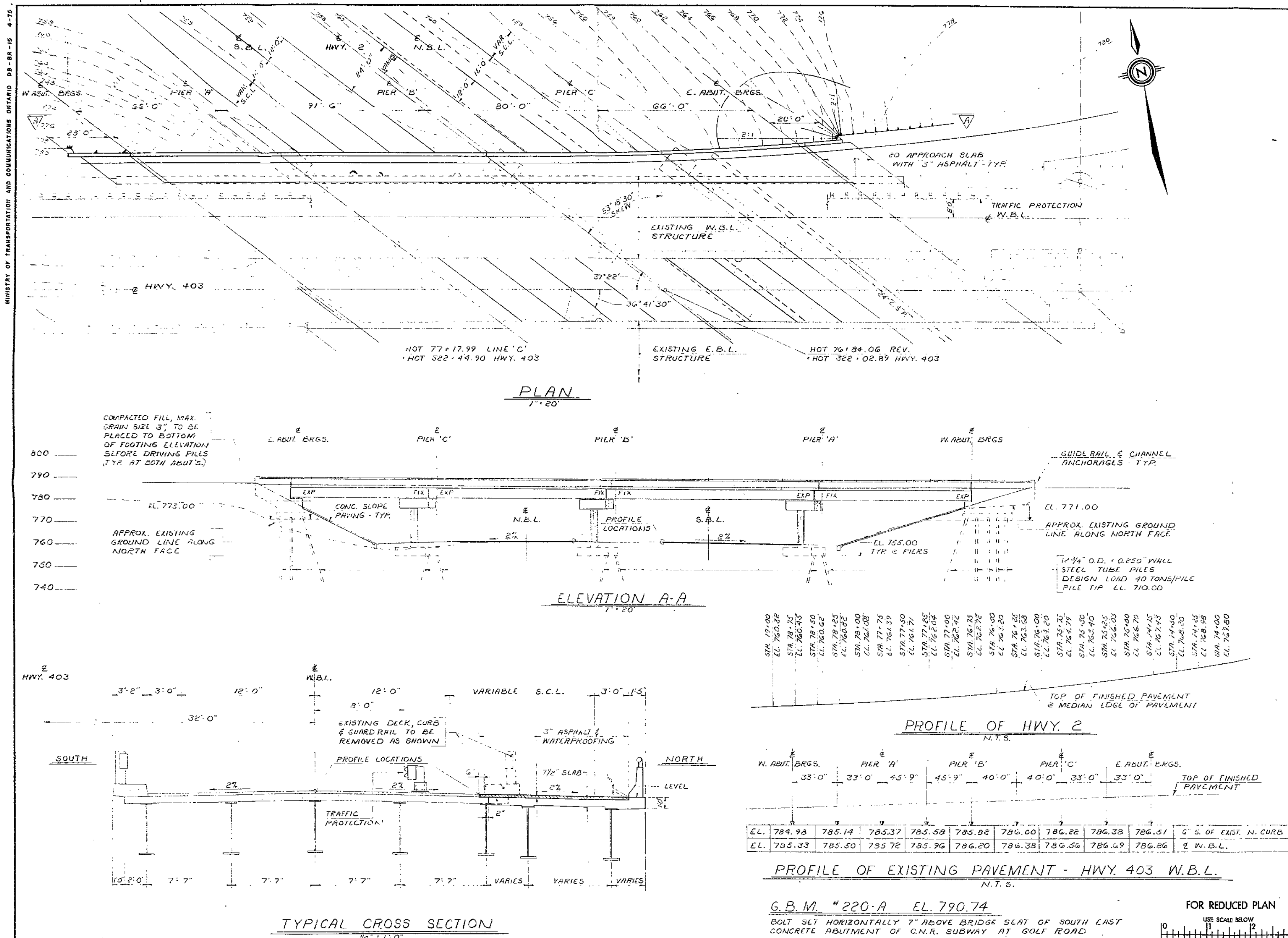
REGISTERED PROFESSIONAL ENGINEER CIVIL M.A. ALMER PROVINCE OF ONTARIO

RECEIVED JUN 09 1977 THE ASSOCIATION OF PROFESSIONAL ENGINEERS OF ONTARIO

REVISIONS	DATE	BY	DESCRIPTION
DESIGN	CHECK		LOADING HS 20-44 DATE MAY '77
DRAWING JFM	CHECK		SITE No 1-141 DWG 1

TRANSLAM 1-M-0-25

40P01-8A



PROFILE OF EXISTING PAVEMENT - HWY. 403 W.B.L.

N.T.S.

EL.	784.98	785.14	785.37	785.58	785.82	786.00	786.22	786.38	786.51	6" S. OF EXIST. N. CURB
EL.	785.33	785.50	785.72	785.96	786.20	786.38	786.56	786.69	786.86	℄ W.B.L.

G.B.M. #220-A EL. 790.74

BOLT SET HORIZONTALLY 7" ABOVE BRIDGE SEAT OF SOUTH EAST CONCRETE ABUTMENT OF C.N.R. SUBWAY AT GOLF ROAD

FOR REDUCED PLAN
USE SCALE BELOW
3 INCHES ON ORIGINAL PLAN

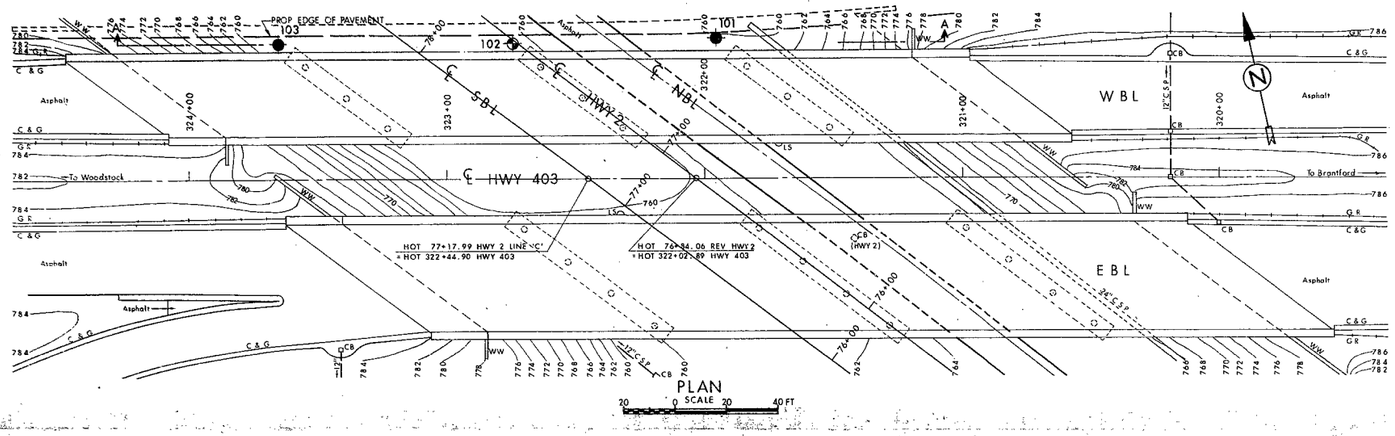
DIST. NO. 4
CONT No
WP No 5-69-02

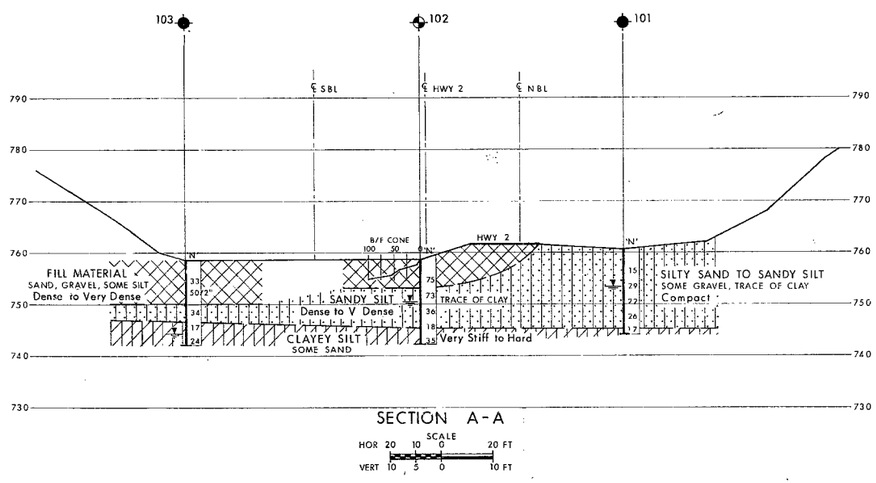
HWY. 2 INTERCH. O'PASS.
NORTH STRUCTURE WIDENING
AT WEST END OF BRANTFORD
PRELIMINARY

SHEET

REVISIONS DATE	BY	DESCRIPTION	
DESIGN	CHECK	LOADING HS20-44	DATE FEB.'77
DRAWING JFM	CHECK J.L.K	SITE No 1-141	DWG P1

40P07-8A

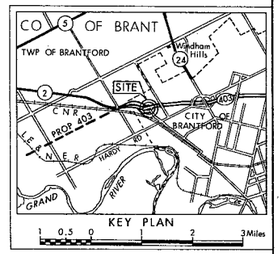




CONT No
WP No 5-69-02

HWY 403 & HWY 2
BRANTFORD
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



LEGEND

- Bore Hole
- Dynamic Cone Penetration Test (Cone)
- Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- W.L. at time of investigation Aug 1977

No	ELEVATION	STATION	OFFSET ℄ MED HWY 403
101	760.6	321+96	55' RT
102	758.7	322+75	53' RT
103	758.6	323+66	53' RT

NOTE:
The complete foundation investigation file for this project may be examined at the Engineering Materials Office, Downsview. Information contained in this file and any supplementary files is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

-NOTE-
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS			
	DATE	BY	DESCRIPTION

HWY No 403 & HWY 2		DIST 4
SUBMD P P	CHECKED	DATE Sept 28, 1977	SITE 1-141
DRAWN R S	CHECKED	APPROVED	DWG 1-141-2

REF NO E-5514-1 June 1976

cc: ~~Foundations Office~~
GENERAL FILES

D3-662-164

Mr. A. M. Foye,
Bridge Engineer,
Materials & Research Section,
(Foundations Office).

October 2, 1961.

D.H.L. FOUNDATION INVESTIGATION REPORT.
W.J. 61-F-76 -- W.P. 153-60.

Attention: Mr. A. Smythe.

Re: Highway 403 and Highway 2 Crossing,
North-west limits of Brantford, Ontario,
District #4.

Attached, we are forwarding to you, our detailed foundation report outlining the subsoil conditions at the above site.

We believe the conclusions and recommendations summarized therein, are self-explanatory and should prove adequate for your future design work.

If we can be of further assistance with respect to this project, please do not hesitate to contact our office.

G./ma
Attach.

A. G. Sternac,
MUNICIPAL FOUNDATION ENGINEER.

cc: Messrs. A. M. Foye (2)
H. A. Tregaskes
N. D. McMillan
I. G. Campbell
J. C. Thatcher
T. J. Kovich
J. Foy
J. R. Crumpler
S. L. Saint
F. Norman
A. Watt
Foundations Office ✓
Gen. Files.

TABLE OF CONTENTS

FOUNDATION INVESTIGATION

For

Highway 403 and Highway 2 Crossing,
North-west limits of Brantford, Dist. #4,
S.J. 61-F-76 -- W.P. 153-60

1. INTRODUCTION:

It is proposed to construct a structure, or two adjacent structures, to carry Highway #403, Line 'A', over relocated Highway #2, Line 'C', at the north-west limits of the City of Brantford.

A subsoil investigation was carried out by this Section for the purpose of determining the most suitable type of foundation support. The investigation was carried out within the limits of the layout for the footings as shown on Plan #E-3977-1. This report contains the results of the field work, as well as the discussions and recommendations required for design purposes.

2. DESCRIPTION OF SITE AND GEOLOGY:

The proposed Highway #403 is approximately parallel to an abandoned railway embankment in the area of the proposed intersection with Highway #2.

The land in the vicinity of the crossing slopes in a westerly direction towards a recently constructed drainage ditch which crosses Line 'A', about Sta. 325+40. The area is poorly drained but there are indications that the drainage was much improved by the drainage ditch. Most of the area outside the present Highway #2 right of way is covered with trees and shrubs.

cont'd. /2 ...

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

The site lies in the northern extremity of the Norfolk Sand Plain. This sand plain is a large deltaic deposit laid down by glacial melt waters which drained into glacial Lakes Whittlesey and Warren.

The Norfolk Sand Plain consists of sand and silt beds up to 75 feet deep, but usually silt or clay strata occur within 30 ft. of the surface.

3. FIELD INVESTIGATION PROCEDURE:

The field work consisted of six sampled boreholes and six dynamic penetration tests. Three of the dynamic penetration tests were at the borehole locations. Samples were recovered using a 2" O.D. split-spoon sampler driven into the soil by means of a 140-lb. hammer falling 30 inches. In the upper 15 ft., the subsoil was sampled at approximately 3-ft. intervals. Below 15 ft., the sampling interval was extended.

Upon recovery, the samples were visually examined, classified and placed in glass jars.

The dynamic penetration tests were performed by driving a 2" diameter steel cone on A-rods by means of a 140-lb. hammer falling 30 inches.

4. SUBSOIL CONDITIONS:

4.1) General:

The site is underlain by brown, fine sand over stratified silt and silty clay. The silty clay layers are underlain by fine sand and sandy silt at approximately elevation 715.0'. The relative density

cont'd. /3 ..

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

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

of the sand near the surface is loose to medium dense. The average relative density of the stratified soils can be regarded as medium dense.

A detailed description of the soils encountered is presented in Appendix I of this report. An approximation of the soil stratigraphy is shown on Drawing 61-P-76A, attached to this report.

The subsoil consists of the following types of soil:-

1) Fine sand;
2) Stratified sand, silt, clayey silt and silty clay;
3) Stratified fine sand and sandy silt.

4.2) Fine Sand:

Brown fine sand which has been partially oxidized, covers the site. The thickness of the fine sand varies from about 6 ft. to a maximum of 13 ft. in borehole 5. The relative density of this sand can be described as loose to medium dense.

4.3) Stratified Sand, Silt, Clayey Silt and Silty Clay:

The upper and lower limits of this stratum are not very distinct. The soils are stratified haphazardly and the layers vary in thickness. The relative density of the stratum is approximately medium dense, although there are widespread variations within the stratum. The silty clay is of low plasticity and the consistency is very stiff.

cont'd. /4 ...

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

4.4) Stratified Fine Sand and Sandy Silt:

This was the deepest stratum intersected by the two deepest boreholes. The upper limit of this stratum is approximately elevation 720'. The lower limit was not determined, but it is known from previous investigations that this stratum, or a stratum consisting of similar soils, extends to a much greater depth.

The sand and silt is stratified and the relative density can be described as medium dense.

5. GROUND WATER CONDITIONS:

After the first borehole was completed, the BX casing was left in place and the water was bailed out of the hole. Water levels were taken during the next week and it was apparent that the water table was very close to the surface. At the end of each day, the water levels were taken at each of the other completed boreholes. From these observations, the approximate position of the water table was established and is shown on Drawing 61-F-76A. The samples recovered within six feet of the surface were mottled and oxidized, indicating that the level of the ground water has not always been constant. Because of this, it is recommended that the exact water table be established prior to construction.

6. DISCUSSION AND RECOMMENDATIONS:

There are basically two means of footing support to be considered for this site. These are: a) spread footings; and b) piled foundations.

cont'd. /5 ...

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

a) Spread Footings:

Based on the results of Standard Penetration tests performed in the field, an allowable bearing capacity of approximately 1.5 T.S.F. has been computed. The settlement resulting from the application of this load to the subsoil will probably be less than one inch. However, there is no guarantee that this settlement will be uniform. Therefore, it is recommended that a simply supported structure be designed for this site with provision for jacking in the event of differential or excessive settlements.

It is thought that the ground water which will come into the excavations can be removed by sump pumping operations.

However, because of the possible high ground water table, quick sand conditions could develop. It is therefore recommended that sheet piling be used. The depth below the foundation elevation to which the sheet piling should be driven, should equal the distance of the water level above the foundation elevation. The exact water table should be therefore established prior to commencement of construction.

Spread footings may be placed on the approach fills for abutment support provided the fill consists of granular material which has been compacted to 100% of Proctor density as determined by the current Departmental practice. The fill should be brought up to final grade and fully compacted for a distance of at least 50 ft. behind the abutments, and 10 ft. beyond the other sides of the abutments. The fill should then be re-excavated for placing the footings. An allowable load of 2 T.S.F. may be used in design for footings placed on the compacted granular fill.

cont'd. /6 ...

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

a) Spread Footings: (cont'd.) ...

Both the pier footings and the abutment footings should have a width of 6 to 8 ft. and a minimum depth of cover of 5 ft.

b) Piled Foundations:

As an alternative to the use of spread footings, a piled foundation may be employed for footing support. Large displacement piles, preferably 12" tube piles, are recommended. These piles would act primarily as friction piles. Consequently, the length of a pile would depend upon the design load. The following formula can be used to correlate the length of pile with the design load for 12" diameter pipe piles:

$$Q = 15.7 + 0.314\ L$$

where Q is the allowable load per pile in tons and L is the embedded length of pile in feet. All piles should be driven to a specified elevation as determined by the formula given above.

There will be no stability problem with approach embankments less than 35 ft. in height and with side slopes of 2:1.

7. SUMMARY:

The area at the proposed crossing is part of the Norfolk Sand Plain. The fine sand at the surface is underlain by finer soils which are stratified and heterogeneous.

Foundation support can be obtained by two means, namely: spread footings and piled foundations. Using spread footings, the allowable bearing capacity is 1.5 T.S.F. for the piers, and 2.0 T.S.F. for the abutments placed on compacted fill. Differential settlement

cont'd. /7 ...

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

can be expected, and a simply supported structure with provision for jacking, should be designed.

Dewatering problems may be encountered, and measures as described in the report, should be taken.

8. MISCELLANEOUS:

The field work was started August 10 and completed August 18, 1961. The drilling was carried out by Dominion Soil Investigation, Limited, using a small core drill adapted for soil sampling. The field work was supervised by Mr. R. J. Salvas, for the Department of Highways, Ontario.

September 1961. REPORT PREPARED BY:

for R. J. Sallows,
PROJECT FOUNDATION ENGINEER.

REPORT APPROVED BY:

E. G. Selby,
SR. PROJECT FOUNDATION ENGINEER.

APPENDIX I.

SUMMARY OF FIELD & LABORATORY TESTS

JOB 61-F-76
W.P. 153-60

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
1	S1	3'-4.5'	Silt, loose, grey and mottled.	9	-	-	-	-	-	
	S2	5'-6.5'	Silt, medium dense, grey.	24	-	-	-	-	-	
	S3	8'-9.5'	Silt, medium dense, grey 1/4" layers silty clay.	21	-.	-	-	-	-	
	S4	12'-13.5'	Layered silt and silty clay medium dense, grey.	20	-	-	-	-	-	
	S5	15.6'-17.1'	Silty clay, very stiff, grey.	20	-	-	-	-	-	
	S6	20'-21.5'	Silty clay with gravel sized particles, very stiff, grey.	24	-	-	-	-	-	
	S7	25'-26.5'	Silt with layers fine sand, dense, grey.	35	-	-	-	-	-	
	S8	30'-31.5'	Fine sand and sandy silt medium dense, grey.	29	-	-	-	-	-	
	S9	40'-41.5'	Fine to medium sand, medium dense, Brown.	19	-	-	-	-	-	
	S10	50'-51.5'	Fine to medium sand, dense, brown.	30	-.	-	-	-	-	
2	S1	3'-4.5'	Fine sand with layers of silt medium dense, grey.	19	-	-	-	-	-	
	S2	5.5'-7'	"	10	-	-	-	-	-	
	S3	8'-9.5'	"	16	-	-	-	-	-	

SUMMARY OF FIELD & LABORATORY TESTS

JOB 61-F-76
W.P. 153-60

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
2	S4	13'-14.5'	Silt, medium dense, grey.	19	-	-	-	-	-	
	S5	20'-21.5'	Silty clay, stiff, grey.	13	-	-	-	-	-	
	S6	25'-26.5'	"	11	-	-	-	-	-	
	S7	30'-31.5'	Silty clay to 31'-0" Fine sand from 31'-0" to 31'-6"	20	-	-	-	-	-	
3	S1	3'-4.5'	Fine sand, medium dense, brown.	15	-	-	-	-	-	
	S2	5.5'-7'	Layers fine sand and silt medium dense, grey	13	-	-	-	-	-	
	S3	9'-10.5'	"	16	-	-	-	-	-	
	S4	13'-14.5'	Layers fine sand and silt Loose, brown to grey	6	-	-	-	-	-	
	S5	19'-20.5'	Layers of silt and silty clay stiff, grey	14	-	-	-	-	-	
	S6	25'-26.5'	"	14	-	-	-	-	-	
	S7	30'-31.5'	Silty clay, stiff, grey	8	-	-	-	-	-	
	S8	35'-36.5'	Silty clay to 35'-6" Fine sand to 36'-6"	32	-	-	-	-	-	
4	cone	penetration	only							

SUMMARY OF FIELD & LABORATORY TESTS

JOB 61-F-76
W.P. 153-60

HOLE NO.	SAMP. NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
5	S1	3'-4.5'	Fine sand with layers of silt loose, brown, mottled.	8						
	S2	5.5'-7'	Fine sand, medium dense, brown.	17						
	S3	9'-10.5'	Fine sand, loose brown.	9						
	S4	12'-13.5'	Fine sand, medium dense, brown.	16						
	S5	15'-16.5'	Fine sand and silt, medium dense Grey.	14						
	S6	20'-21.5'	Fine sand, medium dense, brown.	10						
	S7	25'-26.5'	Stratified silt and silty clay, stiff, grey.	13						
	S8	30'-31.5'	"	14						
	S9	35'-36.5'	Stratified silt and silty clay very stiff, grey.	16						
	S10	40'-41.5'	"	14						
	S11	45'-46.5'	Fine sand and silt medium dense, grey.	25						
	S12	50'-51.5'	"	15						
	S13	55'-56.5'	Silt with layers of silty clay, medium dense, grey.	11						
	S14	60'-61.5'	Silt and fine sand, medium dense, grey.	26						

SUMMARY OF FIELD & LABORATORY TESTS

JOB 61-F-76
W.P. 153-60

HOLE NO.	SAMP. NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
6	cone penetration only									
7	S1	3'-4.5'	Fine sand, medium dense, brown.	19						
	S2	5.5'-7'	"	11						
	S3	8'-9.5'	Stratified fine sand and silt, medium dense, brown.	21						
	S4	12'-13.5'	Fine sand and silt, medium dense, grey.	12						
	S5	15'-16.5'	Fine sand to 15'-4" silty clay to 16'-6", stiff, grey.	11						
	S6	20'-21.5'	Silty clay, very stiff, grey.	20						
	S7	25'-26.5'	Silty clay, stiff, grey.	9						
	S8	30'-31.5'	"	7						
	VANE	33'	"	-	-	-	-	1600	-	Sens: 3.3
	S9	35'-36.5'	Stratified sand, silt and silty clay, medium dense, grey.	17						
8	cone penetration only									
9	S1	3'-4.5'	Fine sand and silt, medium dense, grey.	12						
	S2	5.5'-7'	Silt and silty clay stiff, grey.	10						

SUMMARY OF FIELD & LABORATORY TESTS

JOB 61-F-76
W.P. 153-60

HOLE NO.	SAMP. NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
9	S3	9'-10.5'	Silt and silty clay, very stiff, grey.	18						
	S4	12.5'-14'	"	21						
	S5	18'-19.5'	"	26						
	S6	22'-23.5'	"	18						
	S7	27'-28.5'	"	24						
			S denotes split spoon sample.							

RM OB-ML-126A--60-1015

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 153-60 BORE HOLE NO. 1

JOB 61-F-76 STATION 323+90 (50' Rt.)

DATUM 751.4' COMPILED BY B.K.

BORING DATE Aug. 10/61 CHECKED BY R.J.S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) — O
VANE TEST (C) AND SENSITIVITY (S) — +S
NATURAL MOISTURE AND LIQUIDITY INDEX — LI / X
LIQUID LIMIT — O
PLASTIC LIMIT — |

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	751.4	0
	WL ▽	750.7	
	Fine sand, loose to medium	748.4	
	Stratified silt and silty clay Medium dense Grey		10 20
		721.4	30
	Stratified fine sand and sandy silt Medium dense Grey		40 50
		690.8	
	End of borehole.		60

STRENGTH AND PENETRATION RESISTANCE
P. S. F.
BLOWS / FT.
10 20 30 40 50

CONSISTENCY
MOIST. CONTENT - % DRY WT.

SAMPLE	NATURAL UNIT WT. P. C. F.
S1	-
S2	-
S3	-
S4	-
S5	-
S6	-
S7	-
S8	-
S9	-
S10	-

FORM OB-ML-126 (REV. 1959.) — 59-5008

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 153-60 BORE HOLE NO. 2

JOB 61-F-76 STATION 323+00 (42' Rt.)

DATUM 754.9' COMPILED BY B.K.

BORING DATE Aug. 14/61. CHECKED BY R.J.S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Groundlevel	754.9	0
	W.L. ▽	753.9	
	Fine sand with layers of silt, medium dense Grey		
		747.9	10
	Stratified sand, silt and clayey silt, medium dense, Grey.		
		739.9	
	Stratified silt and silty clay stiff to very stiff Grey		20
		724.0	30
	Fine sand, brown	723.4	
	End of borehole.		40

STRENGTH AND PENETRATION RESISTANCE P.S.F.

BLOWS/FT. 10 20 30 40 50

CONSISTENCY

MOIST. CONTENT - % DRY WT.

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
S6	-
S7	-

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 153-60 BORE HOLE NO. 3

JOB 61-F-76 STATION 322+30 (45' Rt.)

DATUM 757.1' COMPILED BY B.K.

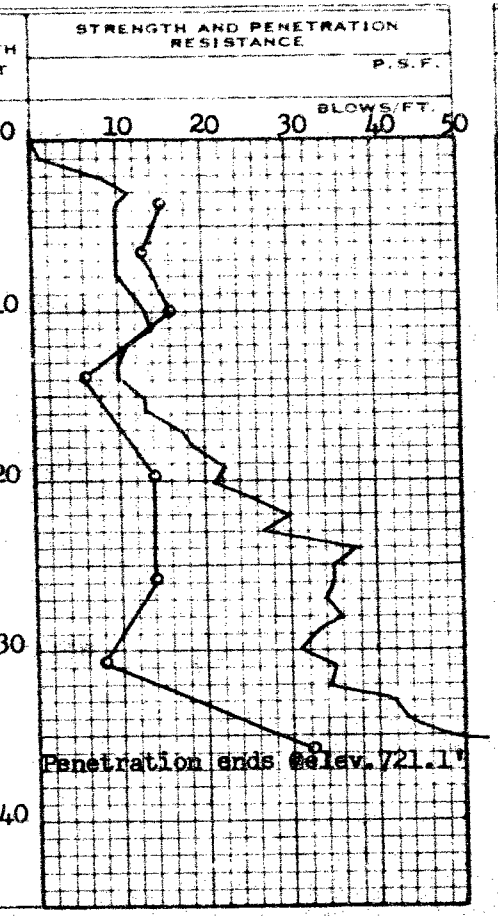
BORING DATE Aug. 14/61. CHECKED BY R.J.S.

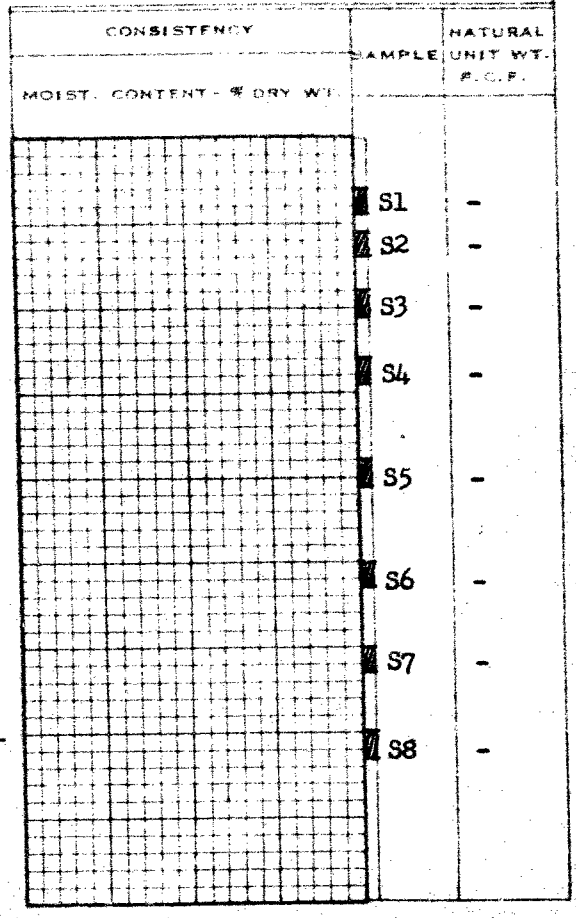
LEGEND

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Groundlevel	757.1	0
	Fine sand, loose to med. dense, Brown. W.L. ▽	755.5	
		751.6	
	Stratified sand, silt and clayey silt, Medium dense Grey		10
		738.1	20
	Stratified silt and silty clay Very stiff Grey		30
		721.6	
	Fine sand, Medium dense, Brown.	720.6	
	End of borehole. Penetration resistance profile shown; obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.		40





FORM OB-ML-126 (REV. 1959.) — 59-5008

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 153-60 BORE HOLE NO. 4

JOB 61-F-76 STATION 321+50 (40' Rt.)

DATUM 760.5' COMPILED BY B.K.

BORING DATE Aug. 15/61. CHECKED BY R.J.S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	760.5	0
	W.L. ▽	756.4	

Penetration resistance profile shown; obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.

STRENGTH AND PENETRATION RESISTANCE P.S.F.

BLOWS/FT. 10 20 30 40 50

42

Penetration ends @elev. 727.5'

0 10 20 30 40

CONSISTENCY

MOIST. CONTENT - % DRY WT.

SAMPLE

NATURAL UNIT WT. P.C.F.

FORM OB-ML-126A—60-1015

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS AND RESEARCH SECTION

W.P. 153-60 — BORE HOLE NO. 5

JOB 61-F-76 — STATION 320/80-20' Lt.

DATUM 762.6' — COMPILED BY B.K.

BORING DATE Aug. 15/61. — CHECKED BY R.J.S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) — Q
VANE TEST (C) AND SENSITIVITY (S) — +S
NATURAL MOISTURE AND LIQUIDITY INDEX — LI, X
LIQUID LIMIT — —O
PLASTIC LIMIT — |—

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	762.6	0
	Fine sand W.l. ▽ loose to medium dense mottled, brown and grey	759.4	
		749.3	10
	Stratified sand, silt and clayey silt Medium dense Grey		20
		737.6	
	Stratified silt and silty clay Very stiff Grey		30
		717.4	40
	Stratified sand and sandy silt Medium dense Grey		50
			60
		692.6	70
	End of borehole.		

Penetration resistance profile shown; obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.

STRENGTH AND PENETRATION RESISTANCE — P. S. F.

BLOWS / FT. — 10 20 30 40

Penetration ends @elev. 724.8'

CONSISTENCY

MOIST. CONTENT - % DRY WT.

SAMPLE	NATURAL UNIT WT. R. C. F.
S1	-
S2	-
S3	-
S4	-
S5	-
S6	-
S7	-
S8	-
S9	-
S10	-
S11	-
S12	-
S13	-
S14	-

FORM OB-ML-126 (REV. 1959.) — 59-5008

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 153-60 BORE HOLE NO. 6

JOB 61-F-76 STATION 321/18 (41' Lt.)

DATUM 761.2 COMPILED BY B.K.

BORING DATE Aug. 17/61. CHECKED BY R.J.S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +
NATURAL MOISTURE AND LIQUIDITY INDEX X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	761.2	0
	w.l. ▽	757.5	
			10
			20
			30
			40

STRENGTH AND PENETRATION RESISTANCE P.S.F.
BLOWS/FT. 10 20 30 40

Penetration ends @elev. 723.2'

CONSISTENCY
MOIST. CONTENT - % DRY WT.

SAMPLE

NATURAL UNIT WT. P.C.F.

Penetration resistance profile shown; obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.

FORM OBME-726 (REV. 1959.)—59-5008

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 153-60 BORE HOLE NO. 7

JOB 61-F-76 STATION 321/88 (43' Lt.)

DATUM 759.5' COMPILED BY B.K.

BORING DATE Aug. 17/61. CHECKED BY R.J.S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX LI X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Groundlevel	759.5	0
	w.l. ▽	757.9	
	Fine sand Medium dense Brown	751.2	10
	Stratified sand, silt & silty clay Medium dense Grey		20
			30
		723.0	
	End of borehole.		40

STRENGTH AND PENETRATION RESISTANCE

P.S.F. 500 1000 1500 2000

BLOWS/FT. 10 20 30 40

f 33

CONSISTENCY

MOIST. CONTENT - % DRY WT.

SAMPLE	NATURAL UNIT WT. P.C.F.
S1	-
S2	-
S3	-
S4	-
S5	-
S6	-
S7	-
S8	-
S9	-

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 153-60 BORE HOLE NO. 8

JOB 61-F-76 STATION 322+72 (44' Lt.)

DATUM 758.0' COMPILED BY B.K.

BORING DATE Aug. 18/61. CHECKED BY R.J.S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Groundlevel	758.0	0

Penetration resistance profile shown; obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.

STRENGTH AND PENETRATION RESISTANCE P.S.F.

BLOWS/FT. 10 20 30 40

0 10 20 30 40

Penetration ends Elev. 729.0'

CONSISTENCY

MOIST. CONTENT - % DRY WT.

SAMPLE

NATURAL UNIT WT. P.C.F.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

W.P. 153-60 BORE HOLE NO. 9

JOB 61-F-76 STATION 323+69 (6' Lt.)

DATUM 753.4' COMPILED BY B.K.

BORING DATE Aug. 18/61. CHECKED BY R.J.S.

2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
2" SHELBY
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O
VANE TEST (C) AND SENSITIVITY (S) +S
NATURAL MOISTURE AND LIQUIDITY INDEX LI / X
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	↓ Groundlevel	753.4	0
	Fine sand, medium dense, brown.	748.0	
	Stratified silt & silty clay Very stiff Grey	724.9	10 20 30
	End of borehole. Penetration resistance profile shown; obtained by driving a 2" dia. cone from groundlevel to depth noted with an energy of 350 ft. lb. per blow.		40

STRENGTH AND PENETRATION RESISTANCE P.S.F.

BLOWS/FT. 10 20 30 40

Penetration ends @elev. 721.4'

CONSISTENCY

MOIST. CONTENT - % DRY WT.

SAMPLE

NATURAL UNIT WT. P.C.F.

S1 S2 S3 S4 S5 S6 S7

cc: Foundations Office (Rm. 110)

Mr. H. Greenland,
District Engineer,
Hamilton, Ontario.

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

Attn: Mr. R. Britton,
Construction Engr.

July 17, 1964

Hwy. #2 -- Revision Line 'C'
and Proposed Hwy. 403, Line 'A',
District #4 -- W.P. 153-60.

In response to a verbal request from Mr. A. E. McKim, the above site was visited by staff of the Foundation Section on July 10, 1964. Difficulties were being encountered by the Contractor during sub-excavation where 'boiling' or 'quick' conditions were developing. Our memo, dated July 13, 1964, contains a summary of our field observations made during the site visit, together with our recommendations for controlling the above-mentioned 'quick' conditions.

Further site inspections were made on July 14 and July 15, 1964, during which time the necessary construction work, as recommended by us, was being carried out. It was observed that the perimeter drains successfully lowered the water table in the problem area so long as they remained open, but lost their effectiveness when being backfilled with granular material. As a result of this, further recommendations were given verbally to the District forces at the site. These are summarized as follows:

1) The perimeter drains should be constructed adjacent to and around the excavations for the pier footings to a depth of at least 3 ft. below the bottom of the footing excavations which have not yet been carried out. These drains should be left open without backfilling until such time as the concrete pier footings are installed. Care should be taken to maintain free flow in these drains so that the water can be drained out to the creek on the west side of the structure.

2) Before construction of the proposed bridge, all grading work except the areas where perimeter drains are constructed, should be completed on Hwy. #2 up to profile grade and also the approach embankments on Hwy. #403 to the limits shown on Drawing No. 61-F-76(B) contained in our original foundation report. The fill should be compacted to 100% of the current D.H.O. Standard method.

cont'd. /2 ...

3) At this stage, the footing excavations may be carried out and the pier footings installed.

4) When all the concrete work for the pier footings is completed, the perimeter drains may be backfilled with granular base course - Class 'B' material after installing perforated sub-drains in the trenches so that permanent drainage towards the creek is ensured.

We believe that the foregoing recommendations will suffice for your future work; however, should additional information be required, please do not hesitate to contact our Office.

M. Devata,
SENIOR FOUNDATION ENGR.
For
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

MD/MdeF

cc: Messrs. A. E. McKim (2)
H. A. Tregaskes
T. J. Kovich
D. M. Hopper

Foundations Office
Gen. Files

cc: Foundations Office (Fm. 110)

Mr. A. E. McKim,
Bridge Control Engineer,
Bridge Division.

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

July 13, 1964.

Highway No. 2 -- Revision Line 'C'
and Proposed Highway 403, Line 'A'
District No. 4 -- W.P. 153-60

(verbal request)

In response to your request to the Foundation Section, an inspection of the above site was made by Mr. K.Y. Lo and Mr. M. Devata, on July 10, 1964.

At Pier A, North Structure, the excavation has been completed to the required elevation, a maximum depth of approximately 4 ft. from the original ground surface.

In spite of the shallow depth of the excavation, boiling occurred in numerous spots and the entire bottom of the excavation was in a "quick" condition. The material consists mainly of fine sand and silt. Under this condition of instability, the soil has little supporting capacity unless the water table is lowered.

The following recommendations were made to Mr. J. Regan, Construction Supervisor:

A perimeter trench is to be constructed adjacent and around the excavation to a depth of 3 feet below the bottom of the excavation. The water is to be drained out to a creek on the west side. In case the trench may not stay open because of the high water table, it should be filled with granular material - (granular base course - Class 'A'). The surface water of the excavation should also be drained.

It has to be pointed out that the soil is a borderline material and that gravity drainage may or may not be successful. Other methods of dewatering such as vacuum well points will be too expensive. An alternative of using pile-supported foundations for the piers, has to be worked out in the event that the suggested scheme proves to be inadequate.

cont'd. /2 ...

The pier footings may be supported on 12" ø timber piles 45 ft. long, driven to an estimated tip elevation of 710.0 into the sand stratum with a design load of 20 T/pile.

The footings for the abutments should be constructed as outlined in the Foundation Report W.J. 61-F-76.

We believe that the foregoing recommendations will suffice for your future work; however, should additional information be required, please do not hesitate to contact our office.

K. Y. Lo,
SUPERVISING FOUNDATION ENGR.
For
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

KYL/MdeF
cc: Messrs. H. A. Tregaskes
H. Greenland
T. J. Kovich

Foundations Office ✓
Gen. Files

OFFICE LOCATION —
DOWNSVIEW AVE.,
KEELE ST. — HIGHWAY 401
TORONTO, ONTARIO.

ONTARIO
DEPARTMENT OF HIGHWAYS

POSTAL ADDRESS —
DEPARTMENT OF HIGHWAYS
PARLIAMENT BUILDINGS,
TORONTO 5, ONTARIO.

Bridge Division,
February 5, 1962.

MEMORANDUM TO:

Mr. A. G. Stermac,
Principal Foundation Engineer,
Department of Highways,
Room 107, Lab. Building,
Downsview, Ontario.

Liverty
Feb. 6. 1962
ABD

RE: W.P. 153-60
Hwy #2 Overpass at
West end of Brantford
By-pass Hwy #403
District #4

Enclosed please find one print of preliminary plan D 4985 - P1 for the subject structure.

Would you please let us have your comments.

F. DeVisser,
Bridge Location Engineer.

FDeV/zf

No comments

B.M.G
Feb. 15/62.

Boat Levels?

File with [illegible]

OFFICE LOCATION —
DOWNSVIEW AVE.,
KEELE ST. — HIGHWAY 401
TORONTO, ONTARIO.

ONTARIO
DEPARTMENT OF HIGHWAYS

POSTAL ADDRESS —
DEPARTMENT OF HIGHWAYS
PARLIAMENT BUILDINGS,
TORONTO 5, ONTARIO.

Bridge Division,
January 16, 1962.

61-F-76

MEMORANDUM TO:

Ken:

Jan 18. 1962. aqs

Mr. A. Stermac,
Principal Foundation Engineer,
Department of Highways,
Room 107 - Lab. Bldg.,
DOWNSVIEW, Ontario.

RE: Overpass bridges on Hwy. 403
in the vicinity of Brantford
District #4
W.P. 146-60 C.N.R. O'head
2.1 mi. East of Hwy. 24
W.P. 153-60 Hwy. 2 Interchange
W.P. 144-60 T.H. & B. Rlwy. O'head
0.1 mi. North of Hwy. #2

Please investigate the feasibility and economics of founding the piers for the above structures on cylindrical prestressed concrete piles of the 36" O.D. Raymond type. I believe such a scheme would offer the following advantages.

1. Elimination of footing excavation and cost of showing that would be required, particularly in the case of the railway overheads.

2. Minimum disturbance to the stability of abutment and railway embankments due to the elimination of footing excavation at the toe of embankment slopes.

3. The elimination of pier footings.

4. In the case of the Hwy. #2 overpass the necessity of using compacted fill on which to found the spread footings for the piers would be eliminated. Conventional fill material and placing methods could be used to simplify the grading operations.

5. Piles could be carried to the height of the pier caps to serve as columns.

.....2

RE: Overpass bridges on Hwy. 403
in the vicinity of Brantford
District #4
W.P. 146-60 - W.P. 153-60
W.P. 144-60

Enclosed with this memo is a copy of the Raymond Cataloque. The availability of this type of pile should be investigated before becoming too deeply involved.

As these three structures have early completion dates an early reply will be appreciated.

J.L. Keen

JLK/bm

J. L. Keen,
for B. Davis,
Bridge Design Engineer.

A meeting was held today with Bert Levy of Raymond Piles to discuss this project. It transpired that the quantity of piling required was far too small to be economically feasible for Raymond Piling Co. A minimum of 20,000 lin. ft is necessary to justify the construction of a plant for the production of the piles.

R.A. Selby

26/1/62.

Copy: Foundations Office

ONTARIO
DEPARTMENT OF HIGHWAYS

Memo to Mr. B. Davis, *Date* January 11, 1962.

Bridge Design Engineer. *Subject* D.H.O. FOUNDATION REPORT.

From Materials & Research Division. W.J. 61-F-76 -- W.P.153-60

(Foundation Section).

Attention: Mr. C. Bassi.

Re: Hwy. #2 Revision & Proposed
Hwy. #403, Brantford, Ontario.
District #4.

Our Foundation Report for this structure provides alternative recommendations based on spread footings and piled foundations. For spread footings a design load of 1.5 T.S.F. is recommended at a depth of 5.0' below the existing ground level. At the time of writing the report, it was not known that a grade raise for Hwy. #2 of approximately 10' was also proposed. In view of this fact it is our opinion that the most suitable method of supporting the structure is by means of spread footings placed on well compacted granular fill. All topsoil beneath this fill should be removed. At the pier locations the minimum depth of granular fill beneath the footings should be 2.0'. At some locations this latter provision might involve a small amount of additional excavation.

The granular fill should be placed as shown on the accompanying sketch and compacted to 100% of the present D.H.O. standard method. Before construction of the proposed bridge all grading work on Hwy. #2 up to profile grade should be completed, also the approach embankments for Hwy. #403 to the limits shown on our sketch. If this recommendation is

Cont'd. /2 ...

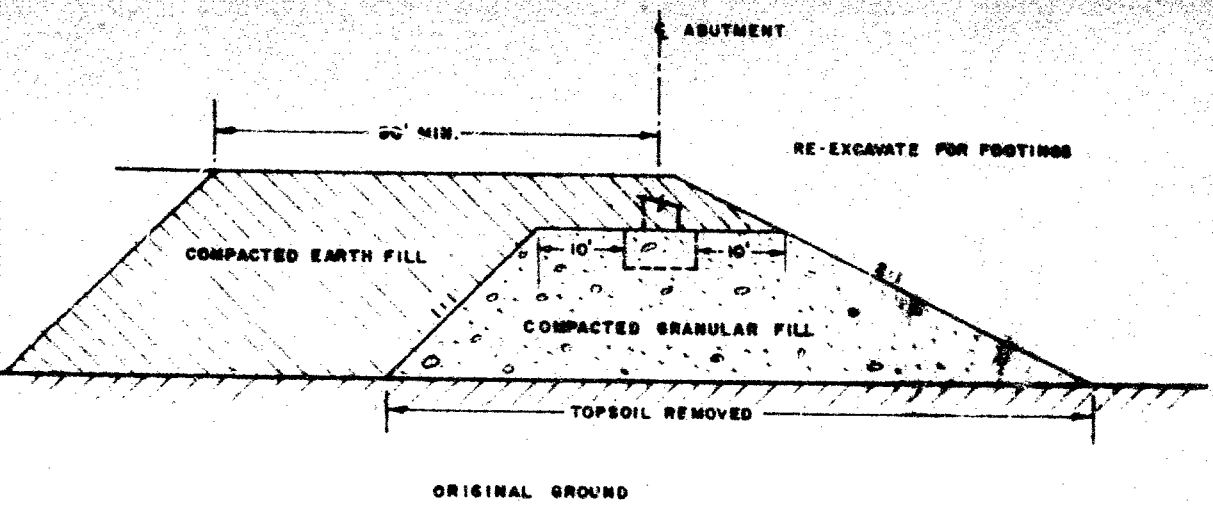
adopted a design load of 1.5 tons/sq. ft. may be used for all footings.

If you have any further queries in connection with this matter please do not hesitate to contact us.

K. G. Selby
Senior Project Foundation Engr.

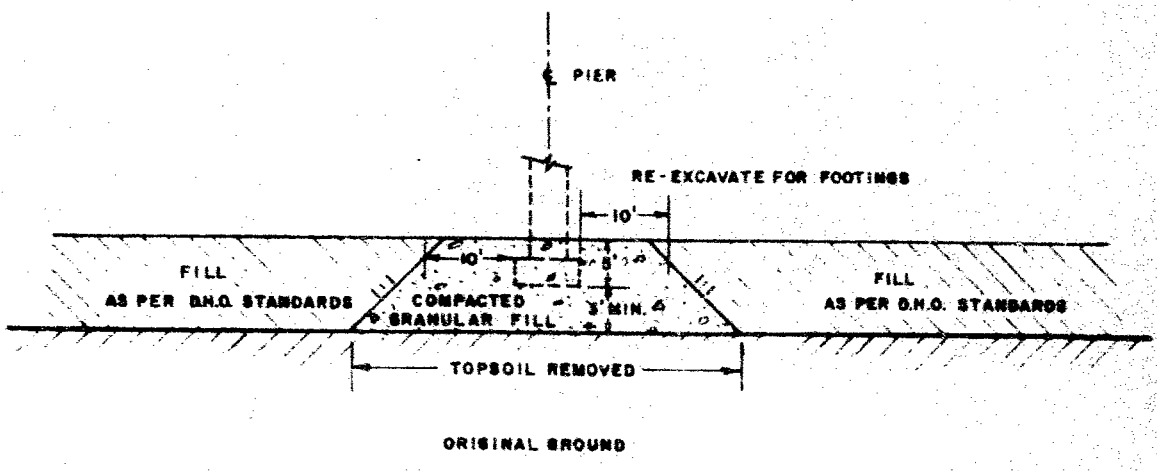
Per: A. C. Stermac
Principal Foundation Engineer.

KGS/tt
Attached Dwg. #61-F-76B
cc: Messrs. A. M. Toye (2)
H. A. Trepaskes
H. D. McMillan
A. Gater (London Region handling pre-engineering)
J. C. Thatcher
T. J. Kovich
J. Foy
J. F. Gruspier
E. P. Saint
F. Norman
A. Watt
Foundations Office ✓
General Files



ABUTMENTS

COMPLETE TO LIMITS SHOWN ABOVE BEFORE EXCAVATING FOOTINGS



PIERS

COMPLETE HIGHWAY 2 TO PROFILE GRADE BEFORE EXCAVATING FOOTINGS

ORIGINATED K. SELBY	DEPARTMENT OF HIGHWAYS - ONTARIO	SCALE 1 INCH = 20 FEET
DRAWN N. B. REED	MATERIALS & RESEARCH SECTION	W. P. NO. 153 - 60
CHECKED K. L. Selby	SUGGESTED EXTENT OF GRANULAR FILL AT FOOTING LOCATIONS HIGHWAY NO. 403 & HIGHWAY NO. 2	JOB NO. 61-F-76
APPROVED [illegible]		DWG. NO. 61-F-76 B
DATE 11 JAN. 1962		

TILE WITH Rep-

61-F-76A

Re:- Highway No #2 Revision Line 'C'
and proposed Highway No 403 (Line A)

Alternative scheme using timber piles

Borehole No	Elevation where Sand and Sandy silt encountered	Elevation - Cone Penn test refusal
# 1	Elev 721.4	—
# 2	Elev 724.0	—
# 3	Elev 721.6	Elev 721.1
# 4	(cone test only)	Elev 727.5
# 5	Elev 717.4	Elev 724.8
# 6	(cone test only)	Elev 722.0
# 7	not proved	—
# 8	(cone test only)	Elev 729.0
# 9	not proved	Elev 721.4

Lower boundary of sand & silt stratum — Elev 717.4

Lowest Elev - cone penn test refusal — Elev 721.1

Elev Bottom of footings — Elev 755.0

Length of piles — Elev 755.0 - Elev 710.0 (estimated) = 45 ft.

Standard Penn value (ave) at the tip of the pile = 15 (blows/ft)

Case i) 12" ϕ timber pile (12" ϕ butt and 8" ϕ tip).

N (along the shaft) = 10 blows/ft.

N (tip - average) ~ 15 blows/ft.

$$Q = 4 N A_p + \frac{\bar{N} A_s}{50}$$

$$= 4 \times 15 \times \frac{0.75^2 \times \pi}{4} + \frac{10 \times 45}{50} \left(\frac{10}{12}\right)^{\text{dia}} \times \pi$$

$$= \frac{60 \times .563 \times \pi}{4} + 9 \times \frac{10}{12} \times \pi$$

$$= 26.5 + 23.5$$

$$Q_a = \frac{50}{3} = \text{Say } \underline{17 \text{ tons}}$$

Case ii) Considering the material along the shaft is cohesive, but the pile tip is in granular material.