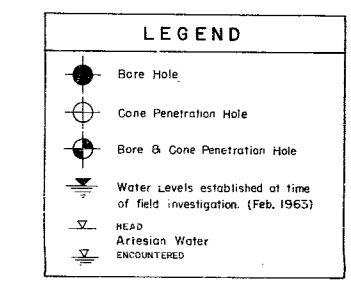
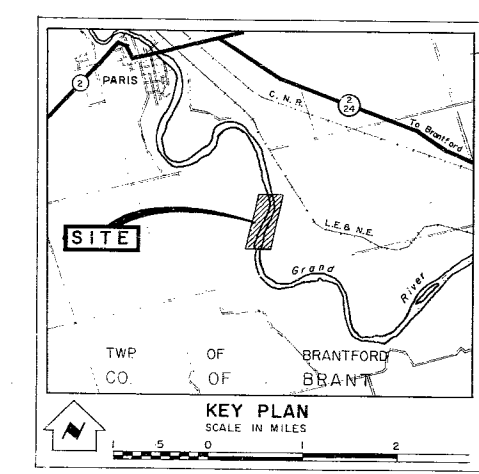
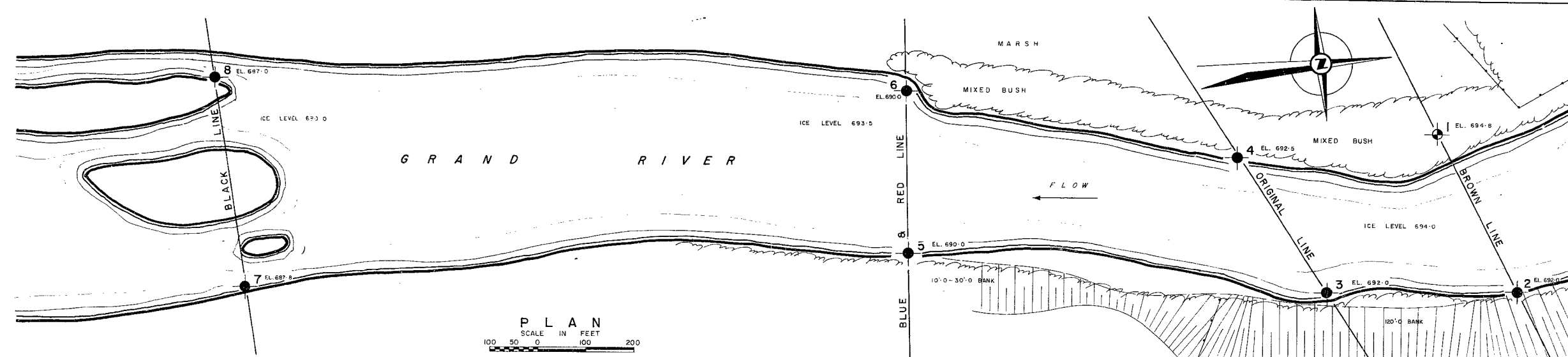


63-F-14

W.P. 159-60

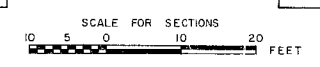
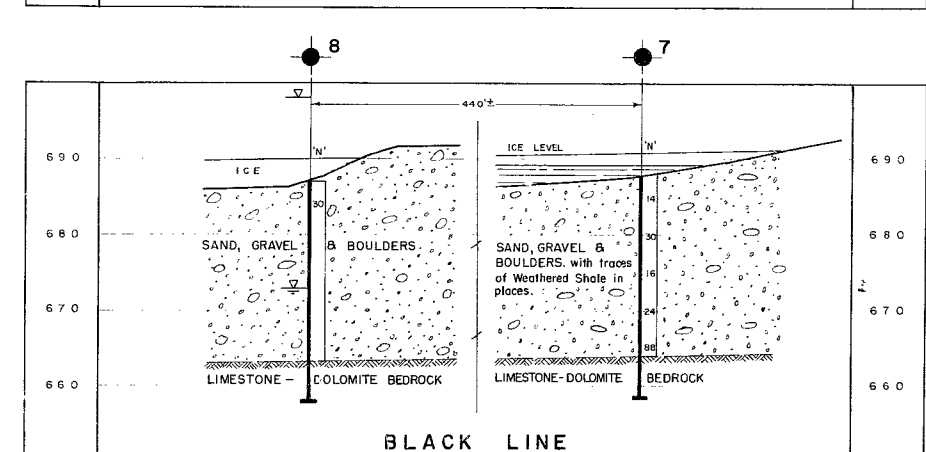
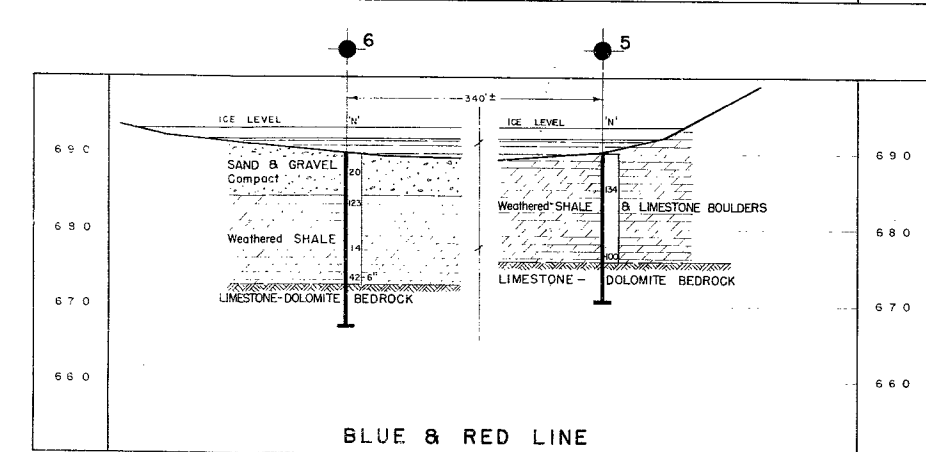
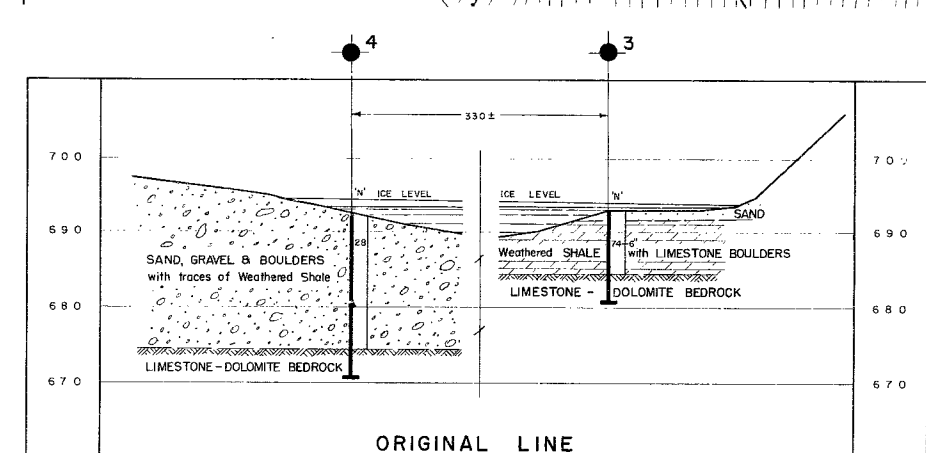
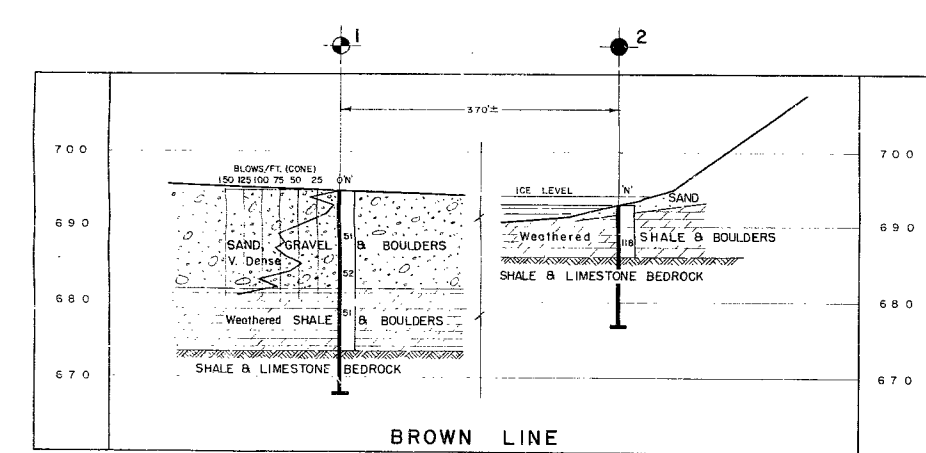
Hwy. 403

GRAND RIVER
CROSSING



NOTE
The complete soil investigation report for this structure may be examined at the Bridge Office and Foundation Office, Downsview, and at the London District Office. The Department does not guarantee the accuracy of this report or the abridged version shown on these plans.

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.



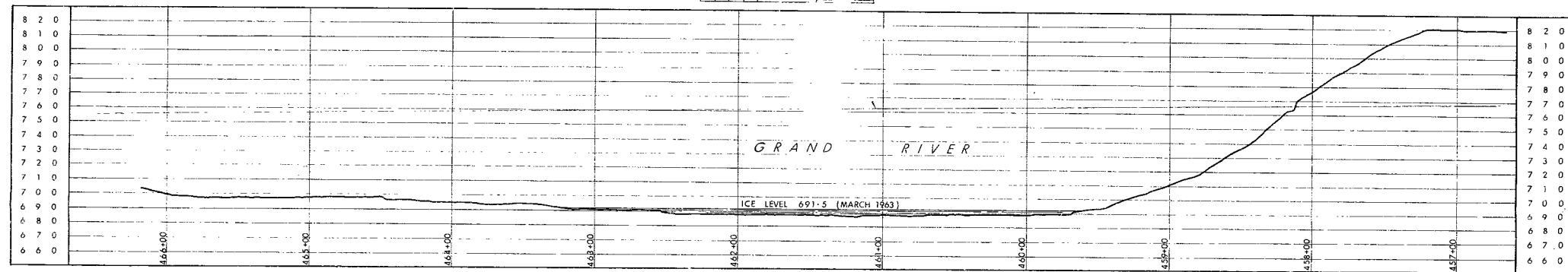
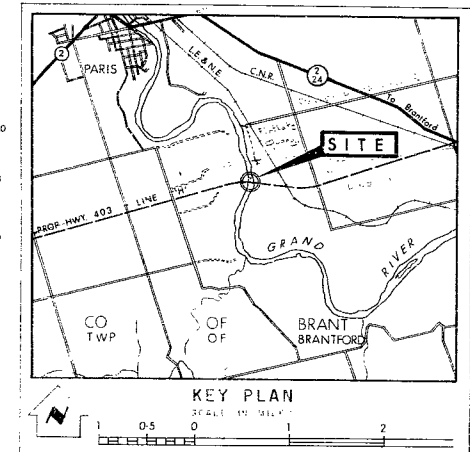
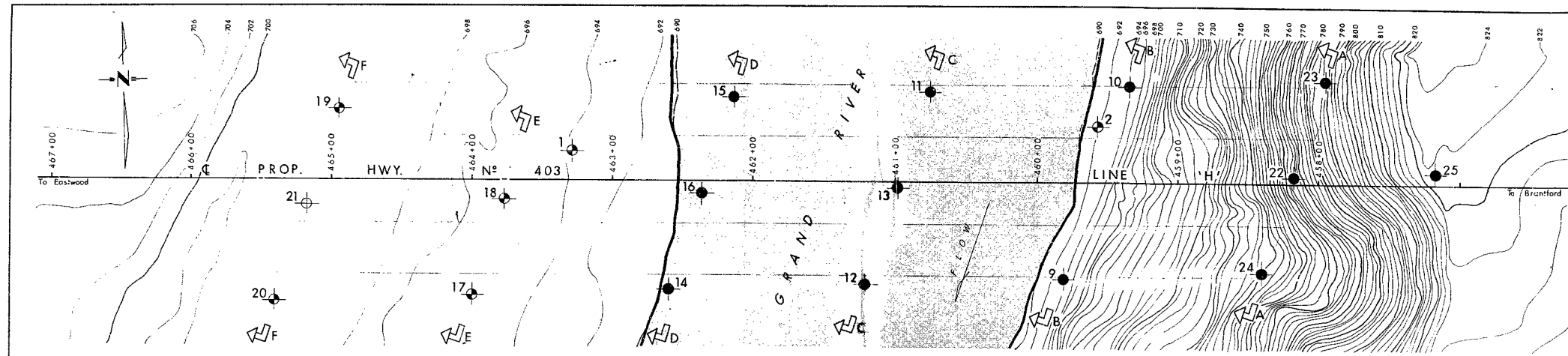
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH SECTION

**GRAND RIVER
AND
HIGHWAY 403 PROPOSED CROSSINGS**

ORIGINATED G. MIERZYNSKI	DISTRICT NO. 2	DATE 28 FEB. 1963
DRAWN D. MUMFORD	W. NO. 159-60	NOTES 63-F-14
CHECKED	SCALE	DRAWING NO.
APPROVED	AS SHOWN	63-F-14 A

SOME DEFECTS IN NEGATIVE DUE
TO CONDITION OF ORIGINAL DOCUMENTS

552750 E
4779250 N
40 PIW



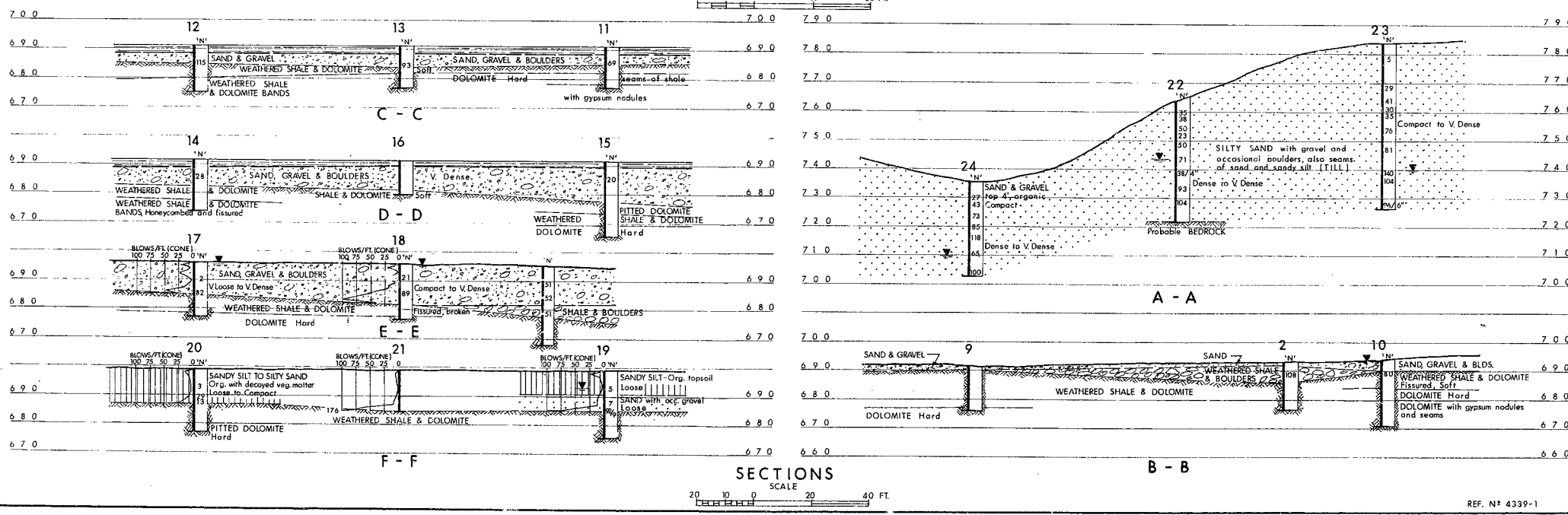
LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation (Mar. 1963)		

NO.	ELEVATION	STATION	OFFSET
1	694.8	463+29	20' RT.
2	694.0	459+58	39' RT.
9	691.5	459+81	68' LT.
10	694.0	459+36	67' RT.
11	691.5	460+76	63' RT.
12	691.5	461+23	72' LT.
13	691.5	460+98	5' LT.
14	691.5	462+59	77' LT.
15	691.5	462+14	59' RT.
16	691.5	462+37	9' LT.
17	696.0	463+99	81' LT.
18	695.5	463+76	14' LT.
19	699.0	464+95	50' RT.
20	699.0	465+40	85' LT.
21	699.0	465+17	17' LT.
22	704.0	458+18	4' RT.
23	784.0	457+95	77' RT.
24	736.0	458+40	63' LT.
25	821.0	457+17	81' 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.

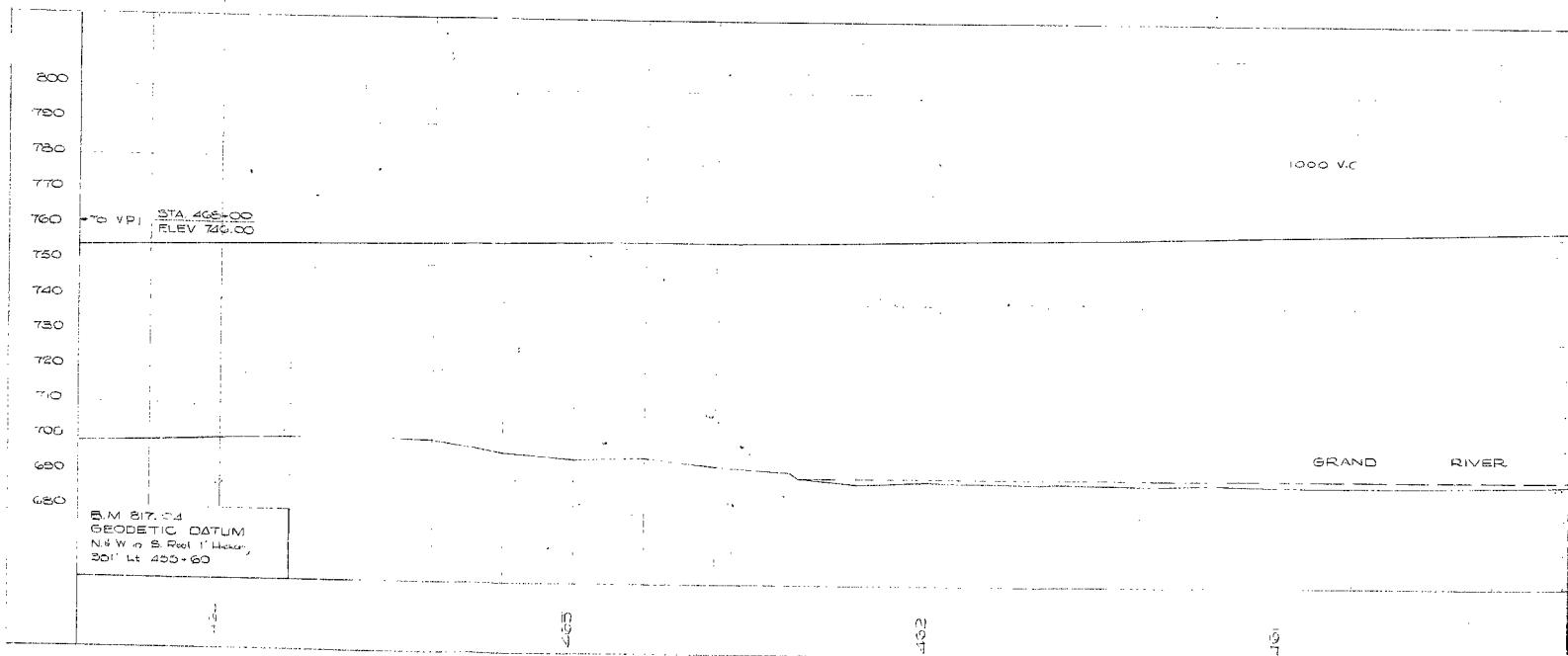
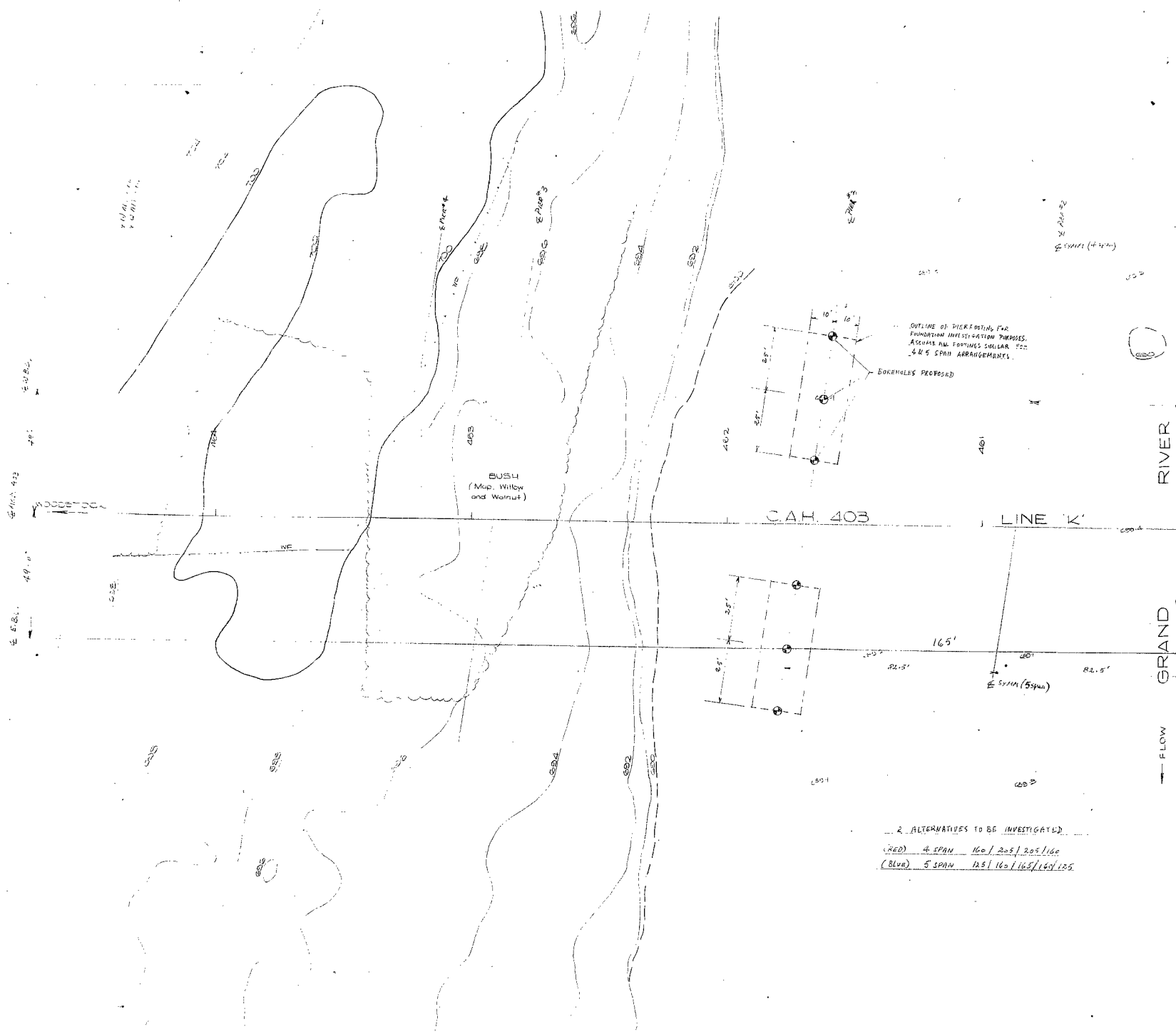
REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & TESTING DIVISION - FOUNDATION SECTION			
GRAND RIVER			
KING'S HIGHWAY NO. 403 LINE 'H'		DIST. NO. 4	
CO. BRANT		TWP. BRANTFORD LOT 16 CON. 11	
BORE HOLE LOCATIONS & SOIL STRATA			
SUBM'D. A.B.	CHECKED	W.P. NO. 159-60	M.B.T. DRAWING NO.
DRAWN D.A.M.	CHECKED	JOB NO. 63-F-14B	63-F-14 B
DATE 15 MAR. 1965	SITE NO.	BRIDGE DRAWING NO.	
APPROVED	CONT. NO.		



PRINT RECORD	NO.	FOR	DATE

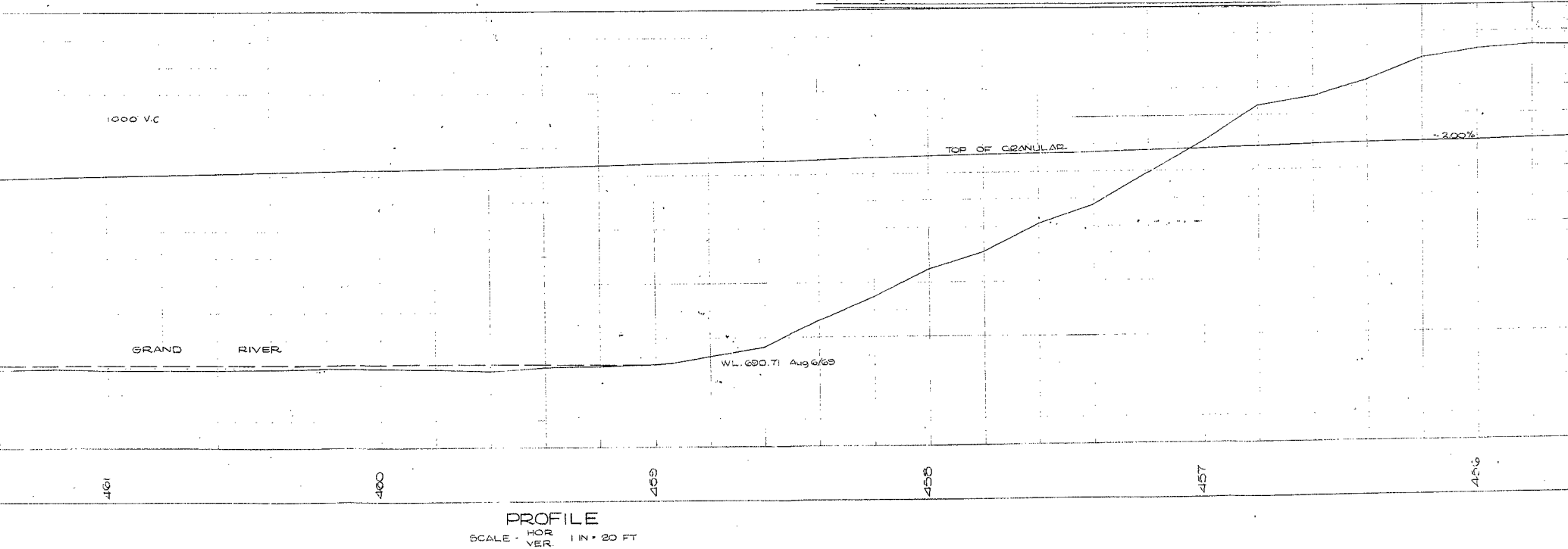
REF. N° 4339-1

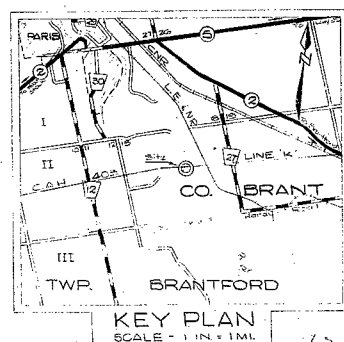
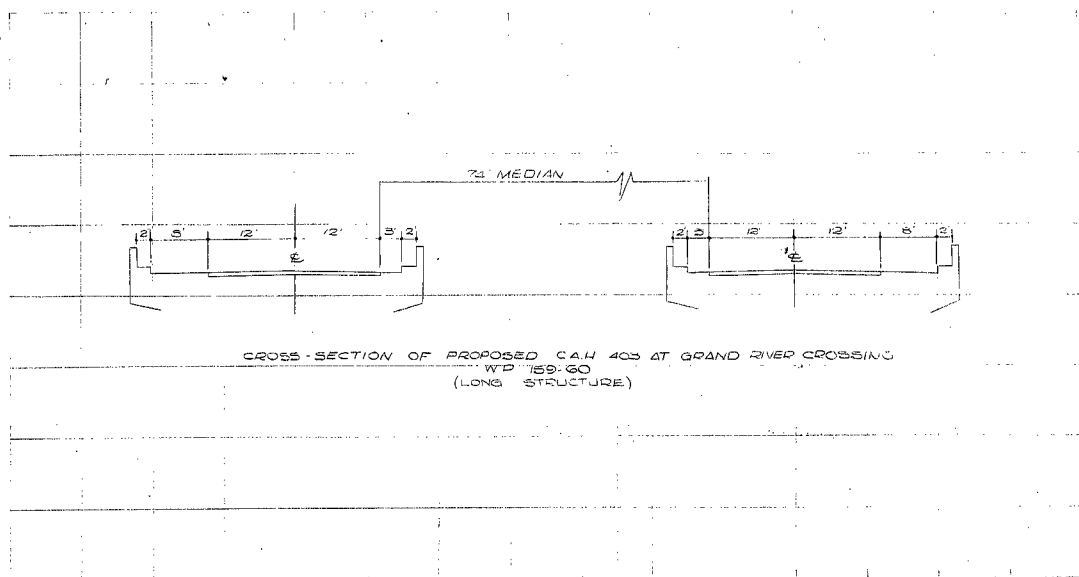
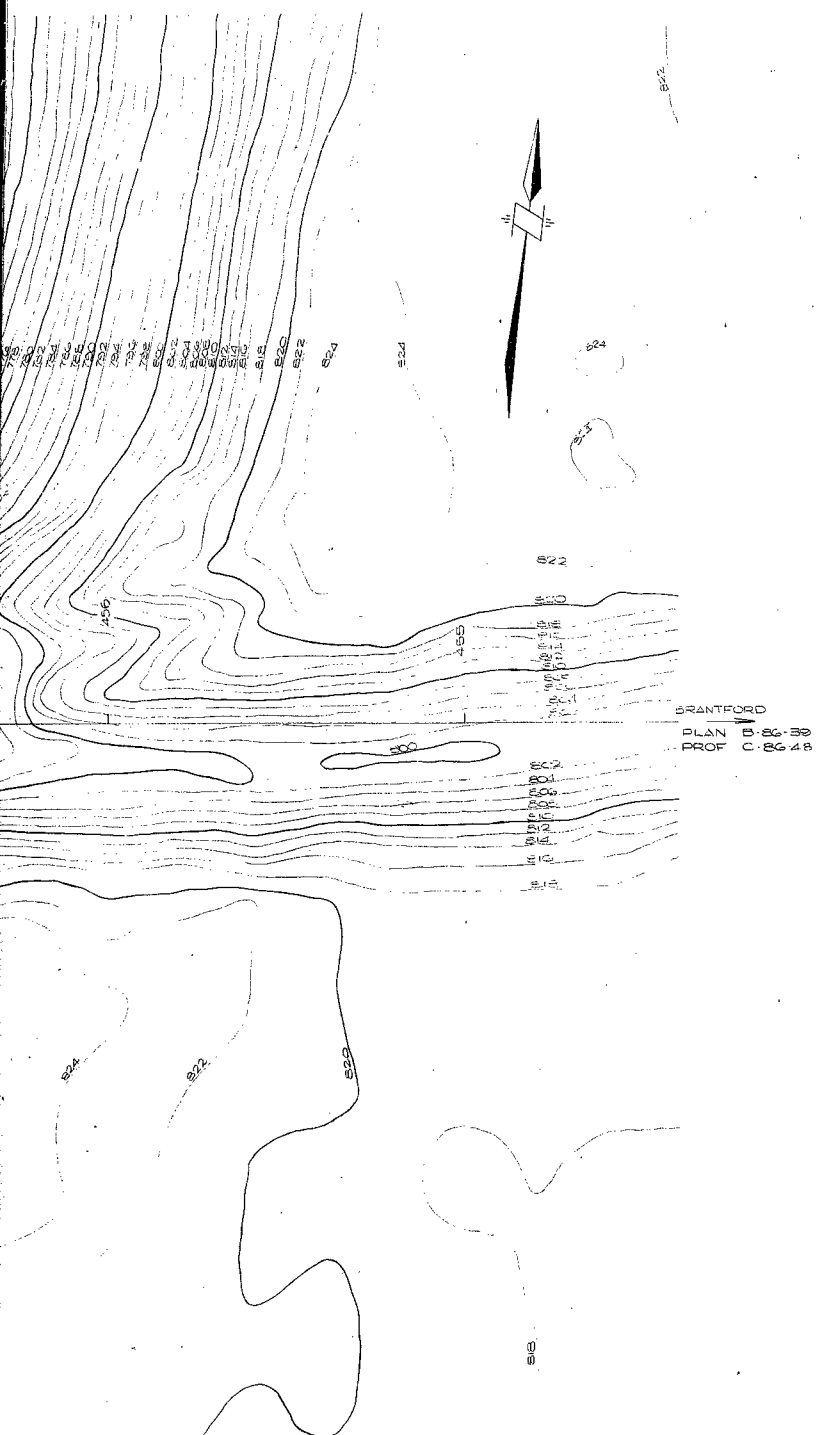


CO. BRANT
TWR. BRANTFORD
CON. 2
LOT 16

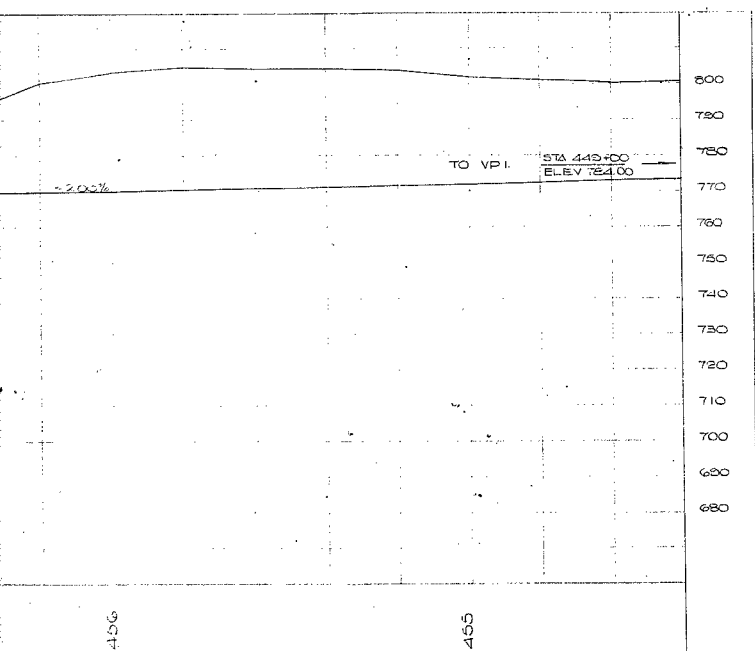


PROBABLE FOOTING LOCATIONS





63-F-14



STR WP 159-60

DATE	REVISIONS & ADDITIONS	BY	CHKD
DEPARTMENT OF HIGHWAYS ONTARIO DESIGN BRANCH ENGINEERING SURVEYS OFFICE BRIDGE SITE PROPOSED CROSSING AT GRAND RIVER AND C.A.H. 403 LINE 'K' LOT 10 CON 2 TOWNSHIP OF BRANTFORD COUNTY OF BRANT			
SCALE AS SHOWN		DISTRICT 4 HAMILTON	REGION SOUTH WESTERN
W.O. 9392-155-6001 Date of Survey - Aug 68		SITE 1-147	
SURVEY BY		DRAWN BY	
Chief of Party - R. SCHAEFER		Draftsman - S. ROY & J. THOMPSON	
Supervisor - G. AGNEW		Supervisor - P.J. RULE	
CHECKED BY		PLAN E-4864-1	
Draftsman - B. OMYTRENKO			
Supervisor - P.J. RULE			

Mr. A. M. Toye,
Bridge Engineer,
Bridge Division.

Attention: Mr. S. McCombie.

Mr. A. G. Stermac,
Principal Foundation Engr.,
Foundation Section,
Materials & Research Division.

February 27, 1963

D.H.O. PRELIMINARY FOUNDATION INVESTIGATION REPORT -
Proposed Grand River Crossing, Hwy. #403, Paris, Ont.,
W.J. 63-F-14 -- District #2 -- W.P. 159-60.

As requested, attached we are forwarding to you, the results of our foundation investigation carried out at the above site on four separate lines, in order to establish the most favourable crossing location.

This report contains, under separate headings, a description of the existing subsoil conditions found at each of the four lines, as well as borelogs and Dwg. No. 63-F-14A.

We believe the information contained therein, will serve your immediate needs; however, if there are any queries in connection with this project, please do not hesitate to contact our Office.

AGS/MdeF
Attach.

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

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
H. D. McMillan
A. Gater
W. L. Fraser
J. Roy
A. Watt
W. Kinnear - Functional Planning Engr.,
London Region.
Foundations Office
Gen. Files.

PRELIMINARY FOUNDATION INVESTIGATION

For

Proposed Grand River Crossing,
Hwy. #403, Paris, Ont., District #2.
W.J. 63-F-14 -- W.P. 159-60.

A memorandum, dated January 31, 1963, was received from the Bridge Location Section, requesting a preliminary subsoil investigation at the site, on four separate lines, in order to establish the most favourable crossing location.

The field investigation consisted of 8 sampled boreholes, two on each line, and on opposite banks of the river. Samples were recovered by means of a split-spoon sampler, driven into the soil with an energy of 550 foot-pounds per blow. Rock samples were obtained using 5-foot long AXT and BXL core barrels.

The locations and elevations of all boreholes are shown on the attached Drawing No. 63-F-14A, and were established by a D.H.O. survey crew prior to the drilling operations. All elevations are of geodetic origin.

The subsoil conditions, as plotted on the Drawing No. 63-F-14A and on the attached borehole logs, were found to be as follows:

Brown Line:

On the west side of the river, a very dense brown sand and gravel with boulders was found to a depth of 13.0 feet below ground level, or to elevation 682.0. Underlying this granular

cont'd. /2 ...

Brown Line: (cont'd.) ...

overburden, a weathered green shale with boulders extends to 21.5 feet, or elevation 673 ± where an interbedded bedrock of irregular shale and limestone bands was found, alternately grey and green in color.

On the east side of the river, no overburden was found above the weathered green shale at elevation 692.0, save for a foot of ice and loose sand. The weathered zone extended to elevation 686.0 where, again, interbedded shale and limestone bands, alternately green and grey, were found.

In general, the bedrock consists of softer and relatively harder bands, with some of the softer portion washing and grinding up while coring, as indicated by a poor recovery of only 40% - 60%.

Original Line:

In borehole #4, on the west bank of the river, a compact to very dense deposit of sand and gravel with numerous boulders was found from ground level, elevation 692.5, to elevation 674.5, some 18 feet below the ground. Traces of weathered green shale were also encountered in places. Below this overburden, a grey limestone - dolomite bedrock, was encountered.

In borehole #3, located on the east side, weathered green shale with grey limestone boulders, was found from ground level, elevation 692.0, to elevation 684.5 where grey limestone-dolomite was again encountered.

cont'd. /3 ...

Red and Blue Line:

Similar subsoil conditions as on the previous lines were encountered on this line. On the west side, a compact, brown sand and gravel was found from ground level, between elevations 690.0 and 684.5, from where weathered green shale, completely decomposed in places, extended to elevation 672.5.

The above strata were underlain by dolomite - limestone bedrock with gypsum seams. The bedrock was sound, but fissured, and was grey to white in color.

On the east side, the weathered green shale starts at ground level and extends from elevation 690.0 to 676.0, where the dolomite - limestone bedrock was encountered.

Black Line:

This was the most southerly line investigated, and the subsoil conditions were found to be considerably different from the other lines.

On both sides of the river, sand, gravel and boulders comprised the overburden between elevations 687.0 and 663.0. Dolomite - limestone bedrock, with gypsum seams was found at elevation 663.0, in both cases, and 100% recovery was achieved in a 5-foot, BXL core barrel.

No shale stratum was encountered on this line, save for traces of weathered green shale in borehole #7 on the east side of the river. In borehole #8, on the west side, numerous boulders consisting of shale, limestone, dolomite, conglomerate and occasional

- 4 -

Black Line: (cont'd.) ...

igneous fragments were found in the overburden. At elevation 673.0, some 17 feet below the ice level, and 14 feet below ground level, artesian water was found, rising to 8 feet above the ice, or to elevation 698.0.

Summary:

Sound shaley - limestone and dolomitic - limestone was found on all lines investigated. Varying depth of sand, gravel and boulders, or a badly weathered shale, or both, comprises the overburden.

In general, sound bedrock was found at elevations 685 \pm and 674 \pm and the east and west banks of the river, respectively, on the Brown and Originally proposed lines.

On the Red and Blue lines, sound bedrock was encountered at elevations 676 \pm and 672 \pm , on the east and west sides, respectively.

Bedrock on the Black line, was found at elevation 663 \pm . The depth of overburden was the greatest on this line, and artesian water was encountered on the west side.

From the above, it is evident that the bedrock is generally deeper on the west side of the river and dips in a southerly direction. Depth to bedrock, from ice level varies from 8 to 27 feet at boreholes #1 and #8, respectively.

Further investigation will be required for the proposed structure once the most suitable crossing is chosen.

cont'd. /5 ...

Miscellaneous:

The field work, carried out during the period of January 31, 1963 to February 14, 1963, together with the preparation of this report, was performed by Mr. G. Mierzynski under the general supervision of Mr. K. Selby of the Foundation Section. Equipment was owned and operated by the Johnston Drilling Co. of Ottawa.

February 1963

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 360 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

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

<u>CONSISTENCY</u>	<u>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

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
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_i	SENSITIVITY

GENERAL

π	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

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

EARTH PRESSURE

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

FOUNDATIONS

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

SLOPES

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

Mr. S. McCombie,
Bridge Planning Engr.,
Bridge Division.

Attn: Mr. G. Scott

Mr. A. G. Stermac,
Principal Foundation Engr.,
Foundation Section,
Materials & Research Division.
December 9, 1963

Proposed Grand River Crossing,
Hwy. #403, Dist. #2, London.
W.J. 63-F-14 -- W.P. 159-60

As you are aware, we are awaiting survey
information from the above project which is necessary
before we can complete our foundation report.

Could you please advise us of the date
on which we can expect to have this information.

KGS/MdeF

cc: Foundations Office ✓
Gen. Files

K. G. Selby
K. G. Selby,
SENIOR FOUNDATION ENGR.
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

Department of Transportation & Communications

XXXXXXXXXXXXXXXXXXXXXXXXXXXX

AGS
K82

Mr. F. E. Loscombe,
Reg. Super't of Eng. Surveys,
Southwestern Region,
LONDON, Ontario.

P. J. Rule

Mr. D. R. Fusee,
Field Supervisor,
Engineering Surveys,
LONDON, Ontario.
November 1, 1971.

RE: W.P. 159-60-00, Group W.P. 155-60-01
Job 104-71, Bridge site for Hwy. 403 crossing
at Grand River, Twp. Brantford, Co. Brant,
District 4, Hamilton

This letter is to inform you that the field work as per request from Foundations Section has been completed by R. J. Schaefer's party on October 27, 1971.

On Monday, October 25, 1971, I met with Mr. D. Townsend and Mr. W. Freeman of Golder Associates at the Grand River site to discuss the locating of the bore-holes by a Department of Transportation and Communications survey party. On October 27 and 28, these bore holes were located as shown on plan E-4864, and the elevations were obtained. No elevations were obtained for the bore holes at Sta 460+04.5, 460+87 and 461+69.5 as these locations are in the river bed.

The following information was turned in to this office:

1 Book loose leaf notes showing calculations for
bore hole locations and elevations

D. R. Fusee

D. R. Fusee,
Field Supervisor.

DRF:ww

c.c./Mr. K. Selby, Foundations,
Mr. A. P. Watt,
Mr. A. Crowley.

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

W.P. 159-60.

TO: Mr. A. M. Toye,
Bridge Engineer,
Bridge Division.

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

Attention: Mr. S. McCombie

DATE: May 20, 1965

OUR FILE REF.

IN REPLY TO

SUBJECT:

FOUNDATION INVESTIGATION REPORT

For
Grand River and Hwy. #403, Line 'H',
Co. of Brant, Twp. of Brantford,
Lot 16, Con. II, District #2 (London)
W.J. 63-F-14B -- W.P. 159-60

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

We believe that you will find the factual data and recommendations contained therein, adequate for your design requirements. Should further information be required, please do not hesitate to contact our Office.

KYL/MaeF
Attach.

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
H. D. McMillan
~~A. Gater~~
~~H. C. Dernier~~
~~J. Roy~~
A. Watt

KYL
K. Y. Lo,
SUPERVISING FOUNDATION ENGINEER

Foundations Office
Gen. Files ✓

TABLE OF CONTENTS

1. INTRODUCTION.
 2. DESCRIPTION OF SITE:
 - 2.1) Topography.
 - 2.2) Geology.
 3. FIELD WORK.
 4. SOIL TYPES AND SOIL CONDITIONS.
 5. DISCUSSION AND RECOMMENDATIONS:
 - 5.1) General.
 - 5.2) West Abutment (Section F - F).
 - 5.3) Piers.
 - 5.4) East Abutment (Section A - A).
 - 5.5) Structure Approaches.
 - 5.6) Ground Water.
 6. SUMMARY.
 7. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT

For

Grand River and Hwy. #403, Line 'H',
Co. of Brant, Twp. of Brantford,
Lot 16, Con. II, District #2 (London).
W.J. 63-F-14B -- W.P. 159-60

1. INTRODUCTION:

A preliminary foundation investigation was carried out during January 1963, at the site of the proposed Grand River and Hwy. #403 crossing near Paris, Ontario. Four possible lines were under consideration at the time and the subsoil conditions existing at each line were subsequently reported in Foundation Report No. W.J. 63-F-14.

Following this investigation, it was decided by the Bridge Office that the most suitable line, taking into account foundation and other considerations, would be the line referred to as the 'Brown Line', which is now designated Line 'H'. The Foundation Section were then requested to carry out a complete investigation to determine in detail, the subsoil conditions existing at this location.

The present report contains the results of the complete field investigation for the 'Brown Line', together with recommendations pertaining to the foundations for the proposed new structure to be built at this location.

cont'd. /2 ...

2. DESCRIPTION OF SITE:

2.1) Topography:

The site is located in Lot 16, Con. II, Brantford Twp. in the County of Brant. At this location the Grand River flows in a north to south direction being some 300 feet wide and one to two feet deep under normal conditions. During flood conditions, however, levels ten feet above normal have been recorded.

On the west side the nature of the terrain may be described as rolling with a general slope downwards to the river. On the east side, an embankment some 120 feet high, rises at an approximate angle of 25° immediately from the river's edge. The face of the embankment is intersected by numerous gulleys and waterways and the whole area is covered with thick bush.

2.2) Geology:

A description of the site geology has been made by Mr. B. K. Glassford, Materials and Testing Geologist, after examination by him of all the rock core samples and a visit to the bridge site on April 5, 1963. This description is as follows:

"The bedrock encountered in the drilling for this job belongs to the top of the Salina formation of the Silurian (age) system. Part of this section may be seen in the river bed of Paris and at several places upstream above that town. This rock may be described as follows:

cont'd. /3 ...

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

"The top of the Salina formation consists of grey and greenish, thin and irregular bedded, soft calcareous and argillaceous shale which weathers conchoidally. Interbedded with the shale are thin beds of brown and grey, hard dense dolomite. Some of the beds show traces of gypsum and white anhydrite. The brown beds consist of fine grained to dense dolomite with some bituminous streaks present whereas the grey beds may be described as a dolomitic shale or an argillo-calcareous mud rock."

"The rock at this location is, therefore, more or less calcareous with true shale being in the grey greenish zones of the soft argillaceous rock. This type of rock appears to weather badly on exposure, and as shown in the drill core recovery breaks up and disintegrates rapidly under abrasion".

3. FIELD WORK:

A total of nineteen boreholes was carried out during the course of this investigation. Boring was achieved by means of a conventional diamond drill adapted for soil sampling purposes. Soil samples were obtained by means of 2-inch O.D. split-spoon samplers driven into the soil by a 140-lb. hammer having a free fall of 30 inches. Rock core samples were recovered in BXL type core barrels.

The entire investigation was completed just prior to the spring thaw, thus enabling the borings in the river to be carried out from the ice.

cont'd. /4 ...

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

The locations and elevations of all boreholes were established in the field by London Region Engineering Surveys Section. These are shown on the accompanying Drawing 63-F-14B, which is included in the Appendix of this report.

4. SOIL TYPES AND SOIL CONDITIONS:

Subsoil at the site consists of deposits of river alluvium and glacial till overlying shale and dolomite bedrock.

West of approximate Station 459+50, the overburden consists wholly of alluvial deposits of sand, silt, gravel and boulders directly overlying the bedrock, and ranging in depth from zero to 25 feet. These deposits have a relative density which varies from loose to very dense, but are generally in a compact state.

East of Station 459+50, the subsoil consists of a dense to very dense deposit of glacial till of a predominantly granular nature with a maximum depth in excess of 60 feet. This material is mainly a silty sand with some gravel and occasional boulders with 'N' values ranging from 27 to more than 100 blows per foot.

* Bedrock encountered in the drilling for this bridge site belongs to the top of the Salina formation of the Silurian (age) system.

The drill holes in rock encountered the same types of formations in all holes; all closely related as to elevations, classifications, thickness and descriptions. The exception to this was hole no. 10, which did not correlate with the other holes with

* Description by B. K. Glassford, Geologist.

cont'd. /5 ...

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

with respect to elevations of specific formations. Reasons for this might possibly be folding or faulting in the bedding strata in this immediate vicinity. The first rock type in the holes shows a weak interbedded shale, shaley dolomite and dolomite horizon. This appears to be irregularly bedded, thin layered, soft argillaceous greenish-grey coloured shale and shaley dolomite. Some of the dolomite interbedded stratum are quite hard, but thin bedded. Drilling has broken up the strata so that recovery of core has been limited, broken and missing sections, thus making the section disjointed. Small nodules of gypsum are present. Some of the shale and shaley dolomite beds resemble a calcareous mud stone. The type of rock in this section weathers badly and would probably have a poor bearing capacity. Below this horizon as described above, approximately at or near the 680.0 elevation mark, the rock type is a hard dolomite, pitted in texture, buff to light grey colouring and appears to have a homogeneous structure and thick bedding. This rock type has good physical properties and should have excellent bearing capacities.

Ground water level in all borings located on the west bank of the river was observed, to range from el. 693.0 to el. 698.0 and on the east bank, the corresponding range was el. 710.0 to el. 744.0.

cont'd. /6 ...

5. DISCUSSION AND RECOMMENDATIONS:

5.1) General:

It is proposed to construct a multi-span twin structure to carry C.A.H. #403 over the Grand River at this site. The total length of the new bridge will be in the order of 700 feet and the height about 70 feet above river water level. The west approach to the structure will involve the construction of a 60-foot high embankment and the east approach will be formed within a cut some 50 - 55 feet in depth. For reference purposes, the proposed piers of the structure are designated, from west to east, as Pier #1 - Pier #4, and for convenience, the various aspects of the proposed project are discussed below under appropriate headings.

5.2) West Abutment (Section F - F):

At this location about 15 feet of loose to compact silty sand and sandy silt overlies bedrock. The abutment should be constructed within the approach fill and should be supported on steel H-piles driven to bedrock. Design loads are dependent on the pile section and may be as high as 75 ton/pile in the case of 12 BP at 74 H-piles.

5.3) Piers:

Up to 15 feet of loose to compact sand, gravel and boulders overlies bedrock which consists of weathered shale and dolomite underlain by hard dolomite. It is recommended that the proposed footings be founded within the hard dolomite stratum in which case, an allowable bearing pressure of 10 t.s.f. may be assumed for design purposes. The recommended footing base elevations

cont'd. /7 ...

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

5.3) Piers: (cont'd.) ...

are as follows:

Pier #1	(Section E - E)	--	El. 678.0
Pier #2	(Section D - D)	--	El. 670.0
Pier #3	(Section C - C)	--	El. 679.0
Pier #4	(Section B - B)	--	El. 677.0

Although the surface rock has been described as 'weathered', it will be necessary to use blasting techniques in order to excavate down to the recommended foundation levels. Local conditions may show some variation from the general picture and provision should be made in the contract for mass concrete to replace any inferior rock material which is encountered below the recommended levels.

It will be necessary to dewater the excavations in order to place concrete in the 'dry'. In consideration of any dewatering scheme, it should be borne in mind that the overburden is highly permeable and that the rock, itself, is likely to contain water-bearing fissures.

5.4) East Abutment (Section A - A):

At this location, the south end of the abutment will be located in a fill section and the north end in a cut section. Subsoil consists of up to 60 feet of compact to very dense glacial till overlying bedrock. It is recommended that the abutment be perched within the partial cut - fill section and be founded on steel H-piles driven either to bedrock or to practical refusal in the very dense till stratum. For estimation purposes, it can be assumed that the final tip elevations of the piles will range

cont'd. /8 ...

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

5.4) East Abutment (Section A - A): (cont'd.) ...

from el. 700.0 on the south end of the abutment to el. 725.0 on the north end. In view of the hard driving conditions, it is recommended that 12 BP at 74 steel H-piles be adopted and be fitted with standard reinforced tips. Driving should be carried out by means of a Delmag D 22 hammer or equivalent, and in the event that some piles do not reach bedrock, driving should be continued for at least 4 feet with the condition that the penetration resistance is in excess of 200 blows/foot. The capacity of the pile should be checked finally by means of the Hiley Formula according to D.H.O. Standards DD 1218 and DD 1219, utilizing a safety factor of 3.0. A design load of 75 tons per pile is recommended if the above conditions are complied with.

5.5) Structure Approaches:

No stability problems are anticipated with regard to the proposed cut and fill sections in the immediate vicinity of the abutments provided standard D.H.O. procedures are followed, utilizing 2:1 side slopes for both types of section. It will be necessary to provide surface protection against run-off water and scour protection up to high water level.

5.6) Ground Water:

Attention is drawn to the fact that ground water in the vicinity of the proposed structure might possibly have a high sulphate content due to the gypsum and anhydrite minerals present in the sedimentary rocks underlying the area. This might influence

cont'd. /9 ...

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

5.6) Ground Water: (cont'd.) ...

the type of concrete and cement to be used to avoid sulphate reaction on the footings.

6. SUMMARY:

A foundation investigation at the site of the proposed C.A.H. #403 and Grand River crossing near Paris, Ontario, is reported. Within the river bed and on the west bank of the river, subsoil consists of shallow (zero to 25 ft.) alluvial deposits of silt, sand, gravel and boulders, overlying shale and dolomite bedrock. On the east bank of the river, subsoil consists of up to 60 feet of dense to very dense granular type glacial till overlying shale and dolomite bedrock.

It is recommended that the pier footings be founded within the hard dolomite bedrock with an allowable pressure of 10 t.s.f. Dewatering may present some construction problems due to the permeability of the overburden and the possibility of water-bearing fissures in the bedrock.

For the abutments, piled foundations are recommended, utilizing 12 BP at 74 steel H-piles driven to bedrock or to practical refusal in the till stratum. In this case, a design load of 75 tons/pile is recommended. Further details are given in Section 5 above.

No stability problems are anticipated for the proposed cuts and fills in the immediate vicinity of the abutments. Protection against scour and run-off water will be necessary.

cont'd. /10 ...

7. MISCELLANEOUS:

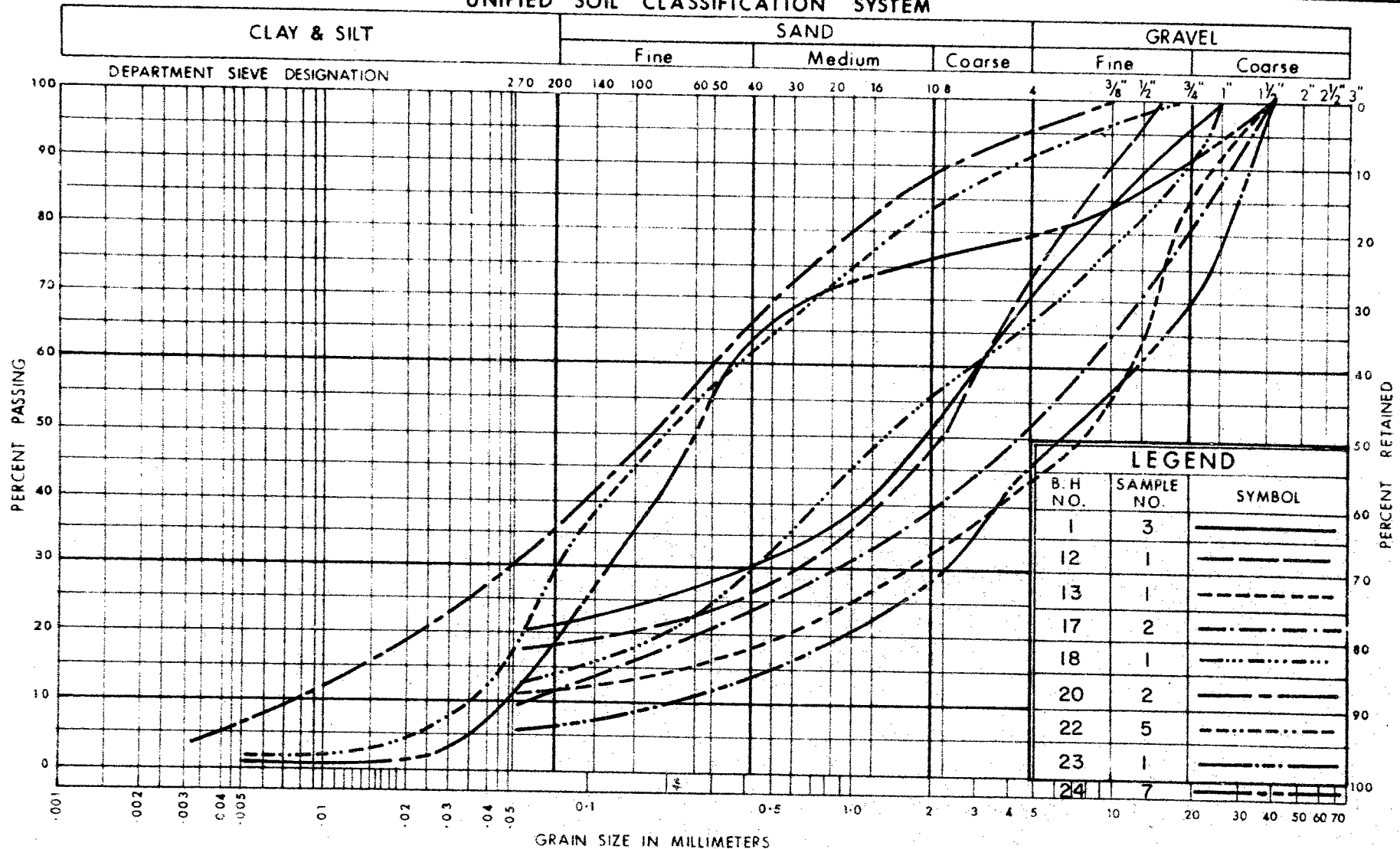
The field work for this project was carried out during the period January 31 to April 12, 1963, under the supervision of Mr. G. Mierzynski, Project Foundation Engineer, and Mr. B. Kliem of this Section.

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

This report was prepared by Mr. K. Selby, Senior Foundation Engineer, with the assistance of Mr. A. K. Barsvary, Project Foundation Engineer.

May 1965

UNIFIED SOIL CLASSIFICATION SYSTEM



GRAIN SIZE DISTRIBUTION



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

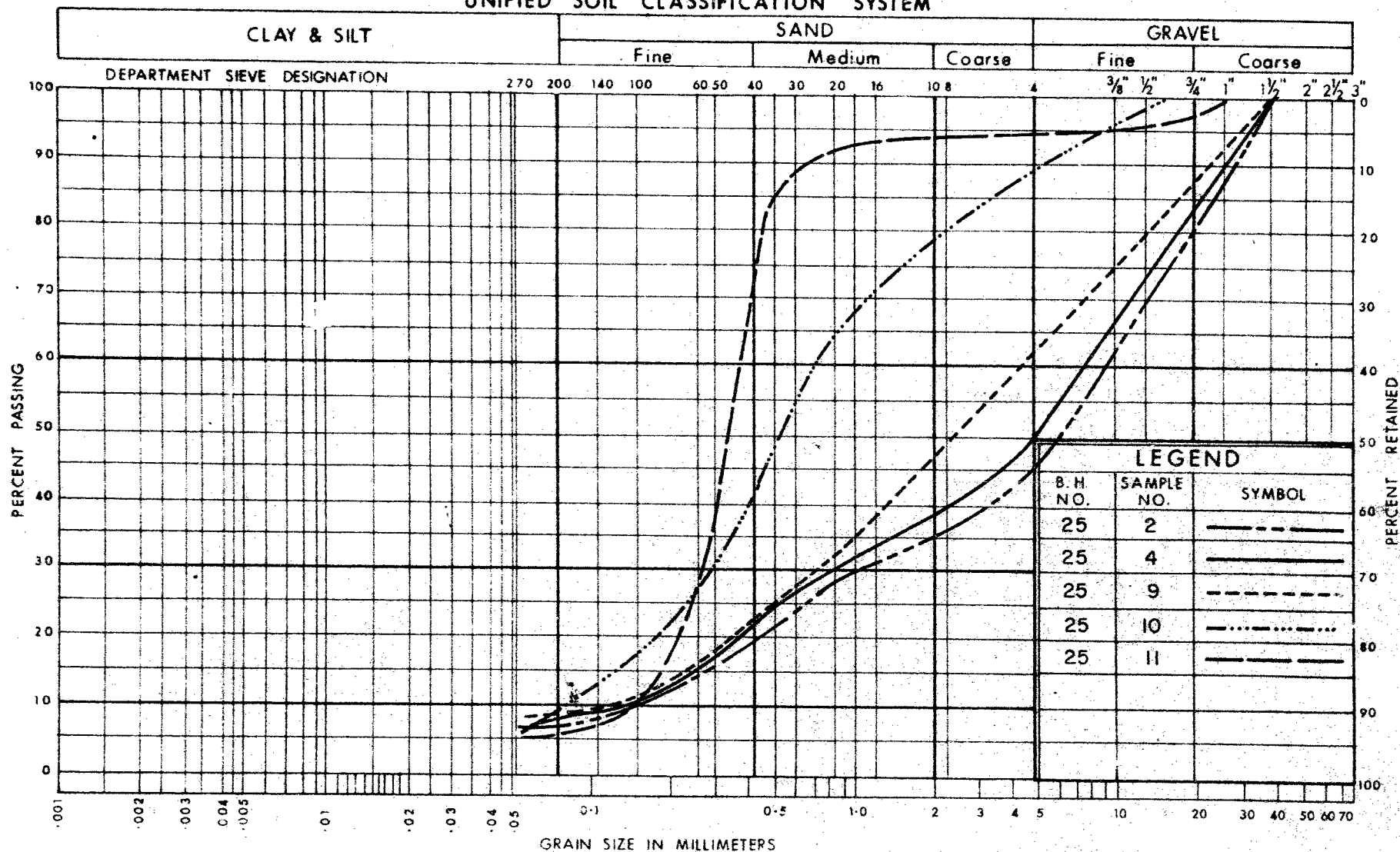
ONTARIO

W.P. No. 159 - 60

JOB No. 63 - F-14

GRAND RIVER & HWY. 403

UNIFIED SOIL CLASSIFICATION SYSTEM



LEGEND		
B.H. NO.	SAMPLE NO.	SYMBOL
25	2	-----
25	4	—————
25	9	- - - - -
25	10
25	11	—————



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION

W.P. No. 159-60

JOB No. 63-F-14

GRAND RIVER & HWY. 403

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

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

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

DESCRIPTION OF SOIL

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

<u>CONSISTENCY</u>	<u>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

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
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
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 (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

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

SLOPES

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

MEMORANDUM

TO: Mr. K. Selby,
Sr. Project Foundation Engineer,
Materials and Research,
Dept. of Highways Admin. Bldg.,
DOWNSVIEW, Ontario.

FROM: Mr. F.E. Loscombe,
Regional Superintendent
of Engineering Surveys,
LONDON, Ontario.

DATE: February 18, 1963.

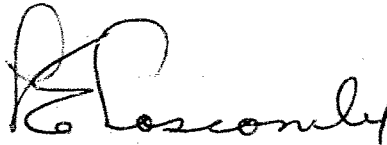
OUR FILE REF.

IN REPLY TO

SUBJECT: Grand River & Hwy. 403

Enclosed find lines (red, brown & pencil)
as established in field; plotted on portion
print (100' = 1") of plan B 86-39, also
a copy of the field notes.

Please excuse the delay in sending same.



F.E. Loscombe,
Regional Superintendent
of Engineering Surveys.

FEL:kb

Department of Highways

COPY

For the Information of

Mr. K. Selby,
Lab. Bldg.

Mr. W. Kinnear,
Regional Functional Planning Eng.,
LONDON Regional Office,

Gavin Scott

Attention: Mr. L. Schwable

January 15, 1964.

Bridge Site #147 - W.P. 159-60
Grand River Crossing
Hwy. #403 - District #2

The above project appears to have been left dormant since March 1963 at which time arrangements were made for a Foundations Soil Investigation.

The Foundation Engineer requires, and has requested some time ago, survey data for the line used. Lack of the survey data is delaying completion of their foundation report, and we would be pleased to know when it is planned to survey that line.

R.S.V.P.

CS/bm

c.c. J. Walter
S. McCombie
K. Selby
R. Fitzgibbon
N. D. Smith

Gavin Scott,
Bridge Location Engineer.

Department of Highways Ontario

Copy for the information of
Mr. K. Selby,
Sr. Foundation Engineer,
Lab. Bldg.

*Ren
Nov 18/64*

Mr. F. Lascombe,
Regional Superintendent of
Engineering Surveys,
1000 Regional Office.

Bridge Division,
Downsview, Ontario.

November 13, 1964.

A.P. 159-60
Bridge Site 1-147
Grand River Bridge
Hwy. 403 - Dist. 4

During March 1963, arrangements were made to
locate boreholes for the foundation investigation
at the above site.

These borings were located by 5 cross lines
set at intervals of 140' along the proposed projected
highway line. The cross lines were set at a skew
angle of 20° (Right) to the projected highway line.

Please arrange to send us a print of the Bridge
site plan showing the location of these cross lines
together with the then proposed projected centre
line of Highway.

GS/sp

G. Scott,
Regional Bridge Location Engineer.

cc. G. McCombie
K. Selby
G. B. Smith
E. Fitzgibbon

MEMORANDUM

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

FROM: Bridge Division,
Downsview, Ontario.

DATE: December 1, 1964.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 159-60
Bridge Site #1-147
Grand River Bridge
Hwy. #403 - District #2

We are sending you herewith one print of Bridge Site Plan E-4326-1 on which we have marked in red the proposed location of the above structure.

We anticipate some minor alignment changes, however we believe they can be adjusted in the preliminary plan stage.

In accordance with our letter, dated January 21st, 1963 the soil investigation has already been made, we would be pleased to have your report in due course.

N. Zoltay

NZ/im
cc. S. McCombie
cc. G. Scott
cc. R. Fitzgibbon

N. Zoltay,
for G. Scott,
Regional Bridge Location Engineer.

MEMORANDUM

To: Mr. A. Stermack,
Principle Foundation Eng.,
Room 107, Lab.Bldg.

FROM: Bridge Division,
Downsview, Ontario

DATE: February 15, 1965

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 159-60, Site #1-147,
Grand River Bridge
Hwy. #407, District #4

63-F-14

We are sending herewith one print of Bridge Site Plan E 4339-1 on which we have marked in red the proposed location of the above mentioned structure.

|| This plan supersedes Plan E 4326-1 sent to you ||
December 1, 1964.

Attached herewith is a copy of a letter giving our approval for the proposed location.

|| We would be pleased to have your report before ||
June 16, 1965.

N. Zoltay

NZ/m
a.c.c.

S. McCombie
G. Scott
R. Fitzibbon
U.D. SMITH

N. Zoltay,
for G. Scott,
Regional Bridge Location Engineer

Department of Highways Ontario

Copy for the information of

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

Mr. W.A. Ginnear,
Regional Functional Planning Eng.,
London Regional Office,
100-09, Ontario.

Bridge Division,
Brampton, Ontario.

February 15, 1963.

Attention: Mr. W. Schmidt

W.F. 193-60 Site #1-147
Grand River Bridge
HW. # 493 District # 4.

We have examined your revised plan and profile for location of the above structure on line A.

Our approval letter dated November 5th 1962 is hereby revised to the new location and grade for line A.

It should be noted that any change in elevation for W.F. 193-60 will require a proportionate change at the subject structure.

GS/m

C.C. A. McIntosh
B. Greenland
A.D. Smith
A. Stermac
A. Gabor
B. Fitzgibbon

A. Scott
Regional Bridge Location Engineer.

APPENDIX I.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 63-F-14 LOCATION Brown Line - West Side ORIGINATED BY G.M.
W.P. 159-60 BORING DATE Jan. 31 & Feb. 1, 1963. COMPILED BY G.M.
DATUM D.H.O. BOREHOLE TYPE Washboring - BX & NX Casing. CHECKED BY H.S.

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w _L PLASTIC LIMIT ——— w _P WATER CONTENT ——— w		BULK DENSITY γ _p P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	20	40	60	80	100	WATER CONTENT % w _P ——— w ——— w _L		
694.8 0.0	Groundlevel													W.L. in Borehole
	Sand, gravel and boulders	•												
	- Very dense	•	1	SS	51	690								692.8 2.0
	Brown	•												
		•	2	SS	52									
681.8 13.0		•												
	Weathered green shale and boulders.	•	3	SS	51	680								
		•												
		•	4	RC	-									
673.3 21.5	Interbedded shale and limestone bands. - green and grey.	•	5	RC	-	670								30% Recovery
		•												
		•												
667.8 27.0	End of borehole.	•												
		•												
		•				660								

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 63-F-14 LOCATION Brown Line - East Side ORIGINATED BY G.M.
W P 159-60 BORING DATE Feb. 4, 1963. COMPILED BY G.M.
DATUM D.H.O. BOREHOLE TYPE Washboring - BX Casing. CHECKED BY H.S.

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	SHEAR STRENGTH P.S.F.	LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W		BULK DENSITY P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER TYPE				WP ——— W ——— WL	WATER CONTENT %		
694.0	Ice Level									1.0' of Ice
693.0										
692.0	Sand									
2.0				690						
	Weathered green shale & boulders.		1 GS -							
			2 SS 118							
686.2			3 RC -							
7.8			4 RC -							
	Interbedded shale and limestone bands.									
	-Green and grey.		AXT Core							60% Recovery
			5 RC -	680						
			AXT Core							40% Recovery
676.7										
17.3	End of borehole.									
				670						

FOUNDATION SECTION

JOB	63-F-14	LOCATION	Original Line - east side	ORIGINATED BY	G.M.
W P	159-60	BOHRING DATE	Feb. 5, 1963.	COMPILED BY	G.M.
DATUM	D.H.O.	BOREHOLE TYPE	Washboring - BX Casing.	CHECKED BY	H.S.

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— % PLASTIC LIMIT ——— % WATER CONTENT ——— %		BULK DENSITY P C F	REMARKS
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	SHEAR STRENGTH P. S. F.			
694.0	Ice Level								1.0' of Ice
693.0									
692.0	Sand								
2.0									
	Weathered green	1	GS	-	690				35% Recovery
	shale with limestone	2	SS	74 for 6"					
	boulders.	3	RC	-					
684.5			BKL Core						100% Recovery
9.5	Limestone-dolomite	4	RC	-					
	- fissured - grey								
680.5			BKL Core		680				
13.5	End of borehole.								
					670				

DEPARTMENT OF HIGHWAYS
MATERIALS & RESEARCH DIVISION

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

JOB 63-F-14 LOCATION Original Line - West Side ORIGINATED BY G.M.
W.P. 159-60 BORING DATE Feb. 6 & 7, 1963. COMPILED BY G.M.
DATUM D.H.O. BOREHOLE TYPE Washboring - BX Casing. CHECKED BY H.S.

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— W _L		BULK DENSITY PCF	REMARKS
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	BLOWS / FOOT			
						SHEAR STRENGTH P.S.F.			
						WATER CONTENT ——— W			
		W _p ——— W _L		WATER CONTENT %					
694.5	Ice Level								1.0' of Ice
693.5	Water Level								
592.5	Ground level								
2.0									
	Sand, gravel and boulders with traces of weathered green shale.				690				
		1	SS	28					
		2	RC	-					40% Recovery
			BXL Core		680				
		3	RC	-					30% Recovery
			BXL Core						
674.5									
20.0	Limestone-dolomite								
	- fissured	4	RC	-					
	- grey								
670.5									100% Recovery
24.0	End of borehole.				670				

FOUNDATION SECTION

CHECKED BY H.S.

100% Recovery

FOUNDATION SECTION

CHECKED BY H.S.

SOIL PROFILE			SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	SHEAR STRENGTH P S F.	LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W ————— WP ——— W ——— WL WATER CONTENT %			BULK DENSITY PCF	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE								
693.5	Ice Level											1.0' of Ice
692.5												
1.0												
690.0	Groundlevel				690							
3.5	Sand and gravel Compact - brown		1	SS 20								100% Recovery
684.5			2	SS 123								
9.0	Weathered green shale - completely decomposed in places.		3	RC -	680							
			4	SS 14								
672.5			5	SS 42 for 6"								
21.0	Dolomite-limestone with gypsum seams - fissured - grey & white		6	RC -	670							
667.0	End of borehole.		BXL Core									
26.5					660							

FOUNDATION SECTION

CHECKED BY H.S.

100%
Recovery

FOUNDATION SECTION

SOIL PROFILE			SAMPLES		DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— % PLASTIC LIMIT ——— % WATER CONTENT ——— % <div style="text-align: center;">w_p w_L — o —</div>	BULK DENSITY PCF	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT	SHEAR STRENGTH P S F	WATER CONTENT %	
690.0 0.0	Ice Level				690			3'-0 of Ice
687.0 3.0	Groundlevel							
	Sand, gravel and boulders - Brown and grey.	1 SS 30	2 RC -	BXL Core	680			50% Recovery
	Boulders consist of shale, limestone, dolomite, conglomerate and occasional igneous fragments.	3 RC -	BXL Core		670			Artesian Water to 8'-0 above ice
663.0 27.0	Dolomite-limestone with gypsum seams - fissured - grey & white.				660			100% Recovery
58.0 32.0	End of borehole.							

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 63-F-14LOCATION Sta. 463/29, 20' Rt.ORIGINATED BY P.P.W P 159-60BORING DATE Jan. 31 to Feb. 1, 1963.

COMPILED BY _____

DATUM GeodeticBOREHOLE TYPE Washbore - NX & BX Casings.

CHECKED BY _____

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT ——— w _L PLASTIC LIMIT ——— w _p WATER CONTENT ——— w			BULK DENSITY P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.			w _p ——— w ——— w _L 10 20 30 WATER CONTENT %				
694.8 0.0	Groundlevel													
	Sand, gravel and boulders.					690								
	Very dense		1	SS	51									
	Brown.													
			2	SS	52									
681.8 13.0	Weathered green shale and boulders.					680								
			3	SS	51									
676.8 18.0	Weathered shale and dolomite bands.													
	Green and grey.		4	RC	-									
			5	RC	-	670								
667.8 27.0	End of borehole.													
										</				

54. 2000

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

63-F-14

LOCATION Sta. 459/58, 39' Rt.

ORIGINATED BY **P.F.**

W. P. 159-60

BOOKING DATE Feb. 4, 1963.

COMPILED BY

DATUM Geodetic

BOREHOLE TYPE Washbore - NX & HX Casings.

CHECKED BY

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			REMARKS
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE		SHEAR STRENGTH P.S.F.	wp	w	wL	
694.0	Icicle level								
693.0									
692.0	Sand								
686.2	Weathered, green shale and boulders.			690					
7.8	Weathered shale and dolomite Green and grey.	2	SS	108					
		3	RC	-					
		4	RC	-					
		5	RC	-					
676.6	End of borehole.			680					
17.4				670					

MATERIALS & TESTING DIVISION

FOUNDATION SECTION

ORIGINATED BY P.P.

COMPILED BY

CHECKED BY

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W		REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	wp — w — WL WATER CONTENT %	
691.5	Groundlevel							
0.0								
690.0	Sand and gravel			690				
1.5								
	Weathered shale and dolomite.		1 RC -					
	Green and grey		3 RC -	680				
677.2								
14.3	Dolomite							
675.7	Hard							
15.8	End of borehole.			670				

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 10

FOUNDATION SECTION

JOB 63-F-13LOCATION Pier No. 1 - North Corner, Sta. 459/36, 67' Rt.ORIGINATED BY P.P.W.P. 159-60BORING DATE Mar. 8, 1963.

COMPILED BY

DATUM GeodeticBOREHOLE TYPE Washbore - BX Casing.

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			BULK DENSITY P C F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLGT	NUMBER	TYPE		SHEAR STRENGTH P.S.F.				WP	W	WL		
694.0	Groundlevel													
0.0	Sand, gravel and Boulders.													
690.0	Grey and brown.				690									
4.0	Weathered shale and dolomite fissured.		1	SS	80									
	Green and grey		2	RC	-									
	Soft		3	RC	-									
684.0	Dolomite													
10.0	Hard		-	RC	-									
680.0					680									
14.0	Dolomite with gypsum nodules and seams.		-	RC	-									
			-	RC	-									
670.6														
23.4	End of borehole.				670									

WL694.0

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 11

FOUNDATION SECTION

JOB 63-F-14 LOCATION Pier No. 2 - North Side Sta. 460+76 63' Rt. ORIGINATED BY P.P.
W.P. 159-60 BORING DATE Mar. 11, 1963. COMPILED BY _____
DATUM Geodetic BOREHOLE TYPE Washbore - BK Casing. CHECKED BY _____

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— WL			BULK DENSITY P C F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	BLOWS / FOOT	PLASTIC LIMIT ——— WP	WATER CONTENT ——— W	WATER CONTENT %		
691.5	Waterlevel											
0.0						690						
689.0	Groundlevel											
2.5	Sand, gravel and boulders.											
685.0	Brown		1	SS	69							
6.5	Weathered shale & dolomite (Fissured, broken)											
682.0	Grey											
9.5	Dolomite. Hard.		2	RC	-	680						
	Seams of shale.											
678.5	Dolomite with gypsum nodules.											
677.0												
14.5	End of borehole.					670						

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 12

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 63-F-14

LOCATION Pier #2 - South Side Sta. 461423, 72' Lt.

ORIGINATED BY P.P.

W P 159-60

BORING DATE Mar. 11, 1963.

COMPILED BY

DATUM Geodetic

BOREHOLE TYPE Washbore - BX Casing.

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT ——— w_L		BULK DENSITY γ P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	BLOWS / FOOT			PLASTIC LIMIT ——— w_P			
							SHEAR STRENGTH P.S.F.			WATER CONTENT ——— w			
										w_P ——— w ——— w_L		WATER CONTENT %	
691.5	Waterlevel												
0.0						690							
688.5	Groundlevel												
3.0	Sand and gravel. Brown.												
685.0			1	SS	115								
6.5	Weathered shale and dolomite.. Green and grey.												
680.0			2	RC	-	680							
11.5	Weathered shale and dolomite bands. - Green and grey First 1.5'												
675.0													
16.5	End of borehole.												
						670							

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 13

FOUNDATION SECTION

JOB 63-F-14

LOCATION Pier No. 2 - E Sta. 460+98 5' Lt.

ORIGINATED BY P.P.

W.P. 159-60

BORING DATE Mar. 12, 1963.

COMPILED BY

DATUM Geodetic

BOREHOLE TYPE Washbore - RX Casing.

CHECKED BY

SOIL PROFILE		SAMPLES		ELEV SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— WL		BULK DENSITY	REMARKS
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT ——— WP	WATER CONTENT ——— W		
691.5	Waterlevel									
0.0				690						
688.5	Groundlevel									
3.0	Sand, gravel and boulders.									
	Brown.									
684.0		1	SS	93						
7.5	Weathered shale and dolomite.. Soft.									
682.0										
9.5	Dolomite.	2	RC	-						
	Hard			680						
676.9	Buff grey.									
14.6	End of borehole.									
				670						

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 14

FOUNDATION SECTION

JOB 63-F-14LOCATION Pier No. 3 - South (Rt.) Side. Sta 462+59 77' Lt.ORIGINATED BY P.P.W P 159-60BORING DATE Mar. 13, 1963.

COMPILED BY _____

DATUM GeodeticBOREHOLE TYPE Washbore - BX Casing.

CHECKED BY _____

SOIL PROFILE		SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — WL		BULK DENSITY	REMARKS
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT — WP	WATER CONTENT — W		
691.5	Waterlevel										
0.0					690						
689.0	Groundlevel										
2.5	Sand, gravel and boulders.										
	Brown.	1	SS	28							
682.5											
9.0	Weathered shale and dolomite.				680						
677.5		2	RC	-							
14.0	Weathered shale and dolomite bands. Honeycombed & fissured.										
673.5	Weathered seams at 14' & 15'										
18.0	End of borehole.				670						

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 15

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 63-F-14 LOCATION Pier No. 3 - North (Lt.) Side Sta. 462+14 59' Rt. ORIGINATED BY P.P.

W P 159-60 BORING DATE Mar. 14, 1963. COMPILED BY _____

DATUM Geodetic BOREHOLE TYPE Washbore - BX Casing. CHECKED BY _____

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT		LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W		BULK DENSITY P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.		Wp ——— W ——— WL WATER CONTENT %			
691.5	Waterlevel											
0.0						690						
688.5	Groundlevel											
3.0												
	Sand, gravel and boulders.		1	SS	20							
	Brown.											
	Very dense.											
677.5						680						
14.0	Pitted dolomite		2	RC	-							
673.5												
18.0	Weathered shale and dolomite. Soft.											
669.5						670						
22.0	Dolomite.											
	Hard.											
665.0												
26.5	End of borehole.											
						660						

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 16

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 63-F-14

LOCATION Pier #3 - C Sta. 462/37 9' Lt.

ORIGINATED BY P.P.

W. D. 159-60

BORING DATE Mar. 15, 1963.

COMPILED BY

DATUM Geodetic

BOREHOLE TYPE Washbore - BX Casing.

CHECKED BY

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT ——— WL			BULK DENSITY P C F.	REMARKS	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	BLOWS / FOOT			PLASTIC LIMIT ——— WP				
							SHEAR STRENGTH P.S.F.			WATER CONTENT ——— W				
							WP ——— W ——— WL			WATER CONTENT %				
691.5	Waterlevel													
0.0						690								
688.5	Groundlevel													
3.0	Sand, gravel and boulders. Brown.													
681.5			1	RC	-									
10.0	Shale & Dolomite					680								
679.5	Soft weathered													
12.0	End of borehole.													
						670								

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 17

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 63-F-14

LOCATION Pier No. 4 - South (Rt.) Side Sta. 463+99 81' Lt.

ORIGINATED BY P.P.

W 159-60

BORING DATE Mar. 18, 1964.

COMPILED BY

DATUM Geodetic

BOREHOLE TYPE Washbore - NX & BX Casings.

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— W _L		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	SHEAR STRENGTH P.S.F.	PLASTIC LIMIT ——— W _P	WATER CONTENT ——— W		
						10	20	30	40	50	
696.0	Groundlevel										WL-G.L.
0.0	Sand, gravel and boulders.										
	Very loose to very dense.										
	Brown.	1	SS	2	690						
685.0		2	SS	82							
11.0	Weathered shale and dolomite. Soft.										
678.5		3	RC	-	680						
17.5	Dolomite. Hard.										
677.0	Buff grey.										
19.5	End of borehole.				670						

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 18

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

63-P-14

LOCATION Pier No. 4 - E Sta. 463+76 14' Lt.

ORIGINATED BY P.P.

W. D. 259-60

WORKING DATE Mar. 19, 1963.

COMPILED BY

Datum Geodetic

BOREHOLE TYPE Washbore - NX & BX Casings.

CHECKED BY _____

SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT ——— W _L		BULK DENSITY	REMARKS
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT	BLOWS / FOOT	20 40 60 80 100	PLASTIC LIMIT ——— W _P	WATER CONTENT ——— W		
					SHEAR STRENGTH P.S.F.		WATER CONTENT %			
695.5	Groundlevel									
0.0										
	Sand, gravel and boulders.									
	Compact to very dense.									
	Brown.									
681.5		1	SS	21	690					
		2	SS	89						
677.5										
676.5	Weathered shale. Fissured, broken green.	3	RC	-	680					
676.5	Dolomite. Hard									
19.0	End of borehole.									
					670					

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 19

FOUNDATION SECTION

JOB 63-F-14 LOCATION West Abutment - North (Lt.) Side Sta. 464+95 50' Rt. ORIGINATED BY P.P.
W.P. 159-60 BORING DATE Mar. 19, 1963. COMPILED BY _____
DATUM Geodetic BOREHOLE TYPE Washbore - BX & NX Casings CHECKED BY _____

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT ——— WL PLASTIC LIMIT ——— WP WATER CONTENT ——— W			BULK DENSITY P.C.F.	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	WP	W	WL		
699.0 0.0	Groundlevel															
	Sandy silt. Organic topsoil. Dark brown. Loose.		1	SS	5											
691.0 8.0	Sand with occasional gravel. Loose		2	SS	7	690										
685.0 14.0	Weathered shale and dolomite. fissured and broken. Green and grey.		3	SS	92/9"											
			4	RC	-	680										
675.0 24.0	End of borehole.					670										

Refusal

WL 693.0

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 20

FOUNDATION SECTION:

MATERIALS & TESTING DIVISION

JOB 63-F-14

LOCATION West Abutment - South Side Sta. 465/40 85' Lt.

ORIGINATED BY P.P.

W D 159-60

BORING DATE Mar. 20, 1963.

COMPILED BY

DATUM Geodetic

BOREHOLE TYPE Washbore - BX & NX Casings.

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 21

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 63-F-14

LOCATION Sta. 465+17 17' Lt.

ORIGINATED BY G.M.

W P 159-60

BORING DATE Mar. 20, 1963.

COMPILED BY A.B.

DATUM G.S.C.

BOREHOLE TYPE Dynamic Cone

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 22

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 63-F-14

LOCATION Sta. 458/18 4' Rt.

ORIGINATED BY G.M.

W P 159-60

BORING DATE Mar. 26 & 27, 1963.

COMPILED BY A.B.

DATUM G.S.C.

BOREHOLE TYPE Washboring, BX Casing.

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY P.C.F.	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					SHEAR STRENGTH P.S.F.					WATER CONTENT % 10 20 30	
764.0	Groundlevel																	
0.0																		
	Silty sand with gravel and occasional boulders		1	SS	35	760												
	Also seams of sand and sandy silt.		2	SS	38													
	(Till)		3	SS	50													
	Dense to very dense.		4	SS	23	750												
	Brown and grey colored.		5	SS	50													
			6	SS	71													
			7	SS	38 1/4"	740												
			8	SS	93													
			9	SS	104	730												
722.0 @ 41.9'	Bedrock					720												
42.0	End of borehole.																	

WL 20'

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 23

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 63-F-14LOCATION Sta. 457+95 72' Rt.ORIGINATED BY G.M.W.P. 159-60BORING DATE Mar. 28 to Apr. 2, 1963.COMPILED BY A.B.DATUM G.S.C.BOREHOLE TYPE Washboring, NX Casing

CHECKED BY _____

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W			BULK DENSITY Y P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		SHEAR STRENGTH P.S.F.				wp	w	wL		
784.0	Groundlevel													
0.0														
	Sand, gravel and occasional boulders with silty clay and silty sand. (Till) Compact to very dense. Brown and grey coloured.				780									
			1	SS	26									
			2	SS	29									
			3	SS	41									
			3A	SS	30									
			3B	SS	35	760								
			4	SS	76									
						750								
			5	SS	81									
						740								
			6	SS	140									
			7	SS	104									
						730								
			8	CS										
726.5			9	SS	96/6"									
57.5	End of borehole													

WL = 44'

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 24

FOUNDATION SECTION

JOB 63-F-14 LOCATION Sta. 458+40 63' Lt. ORIGINATED BY G.M.
W P 159-60 BORING DATE April 3, 1963. COMPILED BY A.B.
DATUM G.S.C. BOREHOLE TYPE Washboring, BX Casing. CHECKED BY _____

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT ——— WL			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT				PLASTIC LIMIT ——— WP				
						SHEAR STRENGTH P.S.F.				WATER CONTENT ——— W					
										WP	W	WL			
										WATER CONTENT %					
										10	20	30	P.C.F.		
736.0	Groundlevel														
0.0	Sand and gravel Top 4' organic. Brown. Compact.														
			1	SS	27	730									
	Sand, silt and clay mixture with occasional gravel (Till)		2	SS	43										
			3	SS	73										
	Dense to very dense.		4	SS	85	720									
	Grey.		5	SS	118										
			6	SS	65	710									
			7	SS	100										
703.0	End of borehole.					700									
93.0															

Non Plastic

WL = 26'

ORIGINATED BY G.M.

COMPILED BY A.B.

CHECKED BY _____

[illegible]