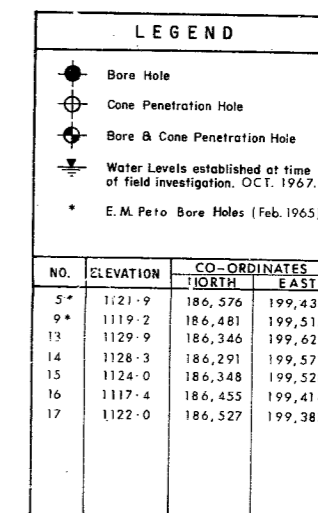
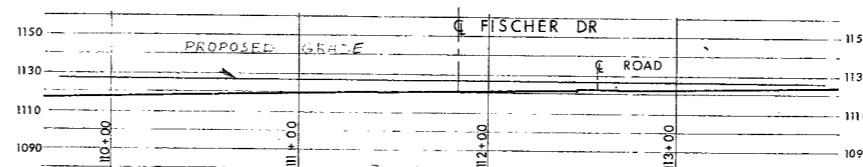
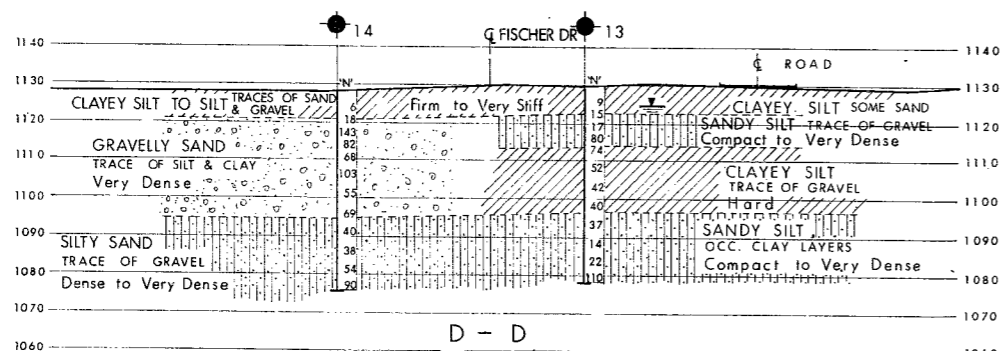


#67-F-103
W.P.#629-64
KITCHENER-
WATERLOO Exp.
FISCHER DRIVE
UNDERPASS



- 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.

[illegible]

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

FISCHER DRIVE

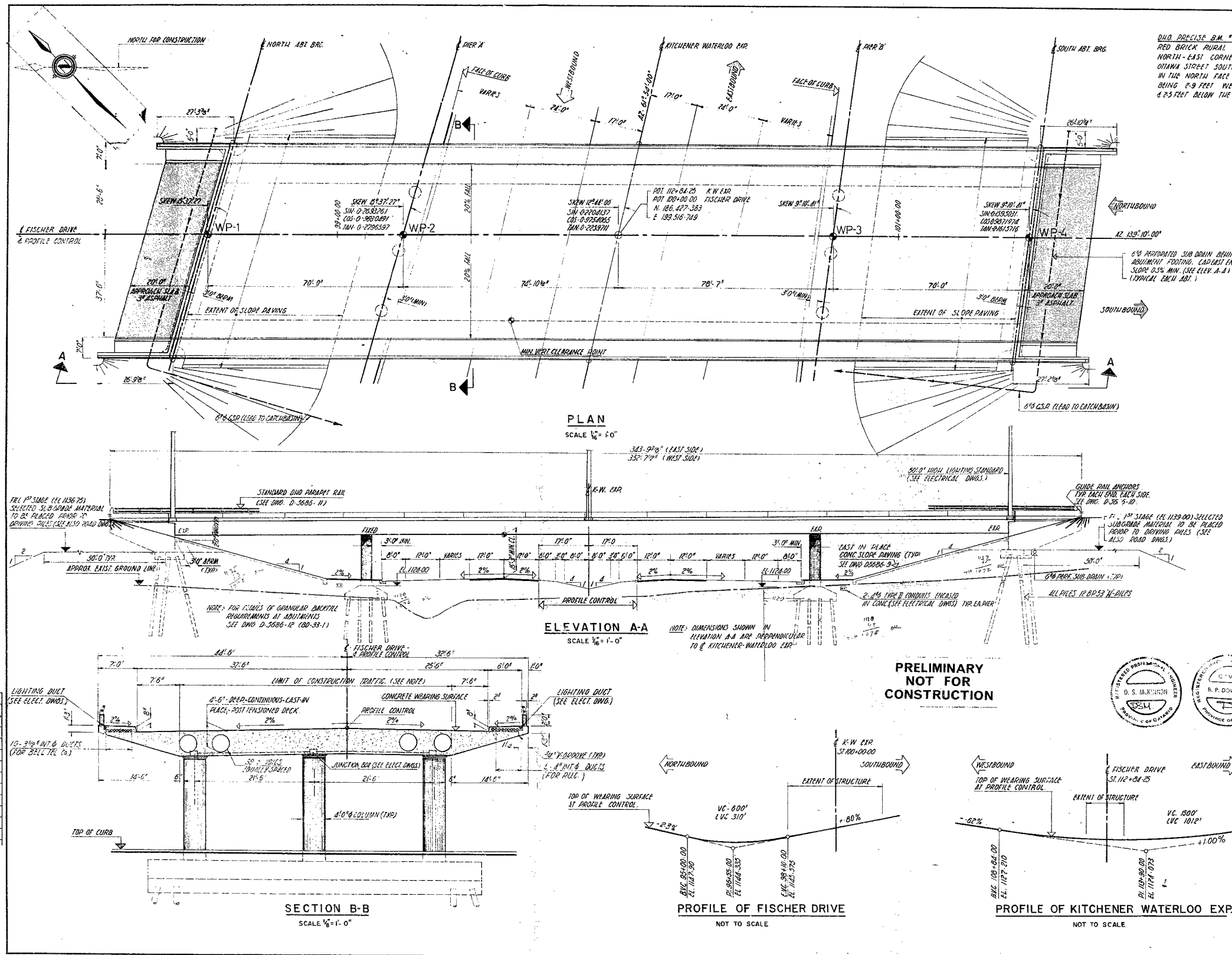
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CO. WATERLOO
TWP. WATERLOO LOT _____ CON. _____

BORE HOLE LOCATIONS & SOIL STRATA

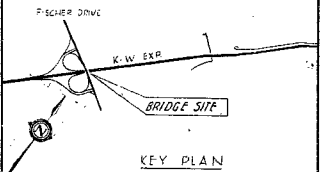
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DRAWN A.B.	CHECKED <i>JS</i>	JOB NO. 67-F-103	67-F-103A
DATE DEC. 19, 1967.		SITE NO.	BRIDGE DRAWING NO.
APPROVED <i>A. B. Thomas</i>		CONT. NO.	

REF. N° 5962-44-M243 M.M. DILLON LTD

PRINT RECORD		
NO	FOR	DATE



OLD PRECISE B.M. #64-86 EL. 1165.613
RED BRICK RURAL SCHOOLHOUSE S.S. #23 AT THE
NORTH-EAST CORNER OF FISCHER DRIVE AND
OTTAWA STREET SOUTH. TABLET IS SET HORIZONTALLY
IN THE NORTH FACE OF CONCRETE FOUNDATION,
BEING 2-9 FEET WEST OF THE NORTH-EAST CORNER
& 2-5 FEET BELOW THE FIRST COURSE OF BRICKWORK.



DWG. NO.	TITLE
D-5686-1	GENERAL ARRANGEMENT
D-5686-2	BOREHOLE LOCATION & SOIL STRATA
D-5686-3	FOOTING LAYOUT & PIER REINFORCEMENT
D-5686-4	NORTH ABUTMENT - DETAILS & REINFORCEMENT
D-5686-5	SOUTH ABUTMENT - DETAILS & REINFORCEMENT
D-5686-6	LAYOUT OF SUPERSTRUCTURE & POST TENSIONING TENDONS
D-5686-7	DECK REINFORCEMENT
D-5686-8	APPROACH SLABS
D-5686-9	SLOPE PAVING
D-5686-10	PARAPET WALL DETAILS
D-5686-11	STANDARD STEEL PARAPET RAIL
D-5686-12	STANDARD DETAILS (SHEET-1)
D-5686-13	STANDARD DETAILS (SHEET-2)

- MAXIMUM CONSTRUCTION EQUIPMENT LOADINGS:**
- | AXLE | LOAD (KIPS) |
|-----------------|-------------|
| MAX. FRONT AXLE | 25.0 |
| MAX. REAR AXLE | 40.0 |
- CONSTRUCTION TRAFFIC ON THE STRUCTURE WILL BE RESTRICTED TO THE ABOVE LOADING LIMITS & WILL BE PERMITTED ONLY ON DESIGNATED AREAS OF THE STRUCTURE.**
- MAXIMUM SPEED OF CONSTRUCTION VEHICLES SHALL BE 10 MPH & ONLY ONE VEHICLE WILL BE PERMITTED ON THE STRUCTURE AT ANY ONE TIME.**

- NOTES:**
- CLASS OF CONCRETE:
 - DECK, CURBS, PARAPET & COLUMNS: 5000 PSI
 - ELSEWHERE: 3000 PSI
 - COVER TO REINFORCEMENT:
 - FOOTINGS: 3"
 - PIER COLUMNS (TO OUTSIDE OF SPIRAL): 2"
 - ABUTMENTS & WHARF WALLS (EXPOSED FACES): 2"
 - CONCRETE FACETS: 3"
 - DECK: TOP: 1 1/2"
 - BOTTOM, PARAPET: 1 1/2"
 - CURBS: 2"
 - APPROACH SLABS (TOP & BOTTOM): 2"
 - THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ± 1/8".
 - NO CONCRETE SHALL BE PLACED ABOVE THE BEARING SEATS UNTIL STRESSING & JACKING OF DECK IS COMPLETE.

REVISIONS	DATE	BY	DESCRIPTION

67-F-143

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

M. M. DILLON LIMITED
CONSULTING ENGINEERS

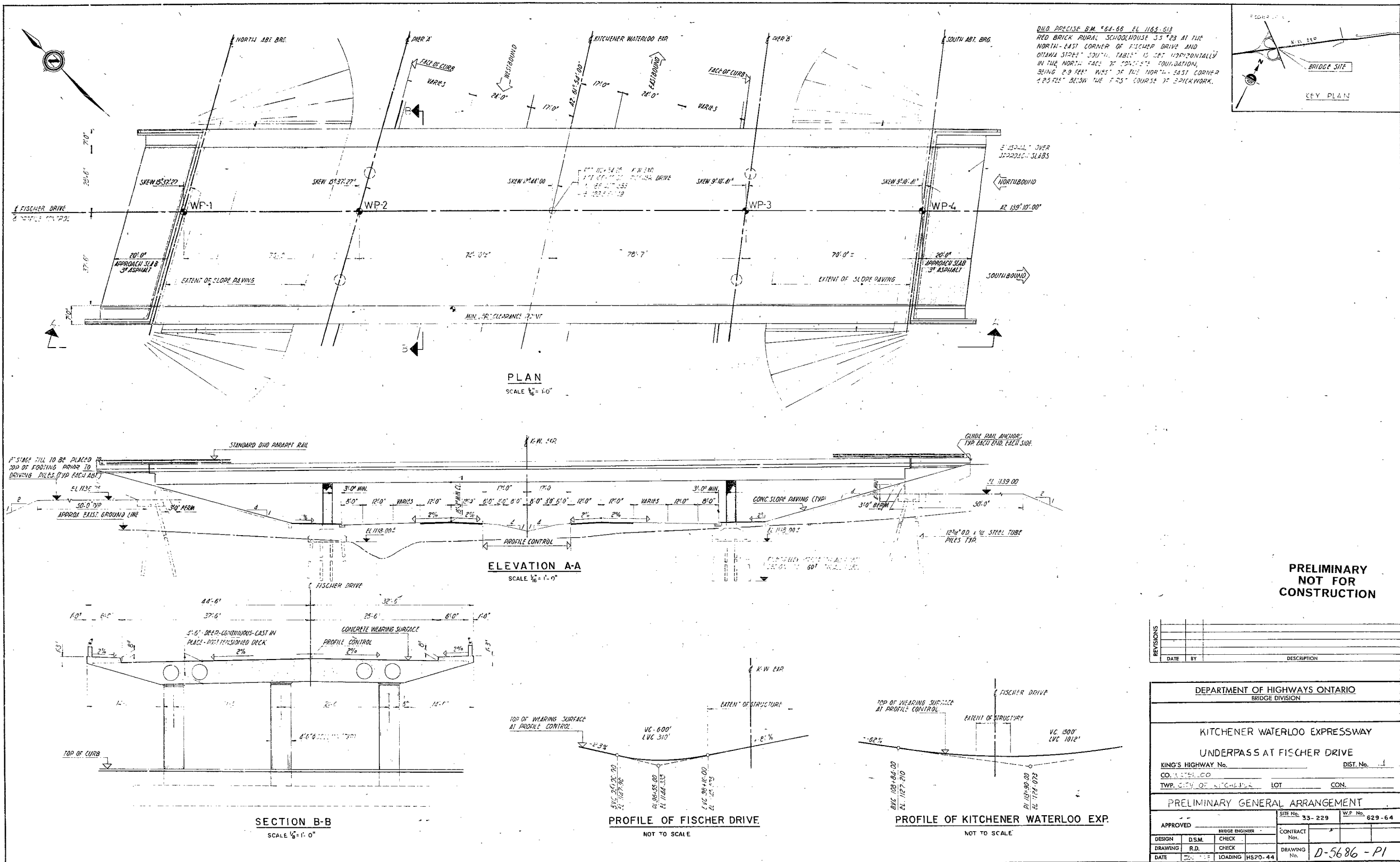
KITCHENER WATERLOO EXPRESSWAY
FISCHER DRIVE UNDERPASS

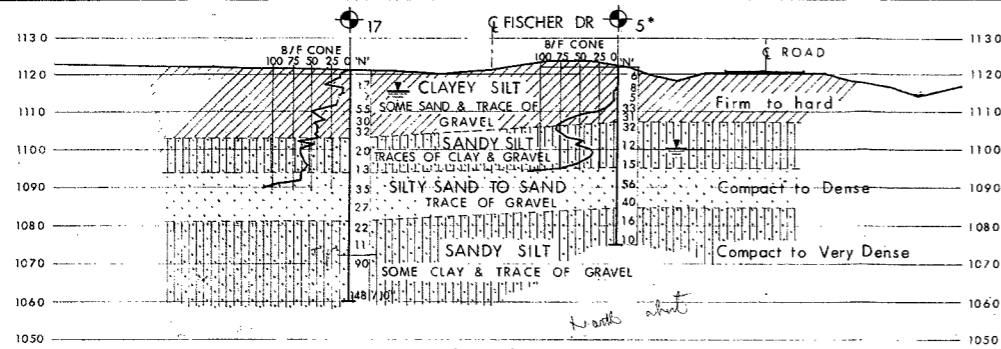
KING'S HIGHWAY HENRY STURM BLVD. DIST. No. 4
CO. WATERLOO
CITY OF KITCHENER LOT CON.

GENERAL ARRANGEMENT

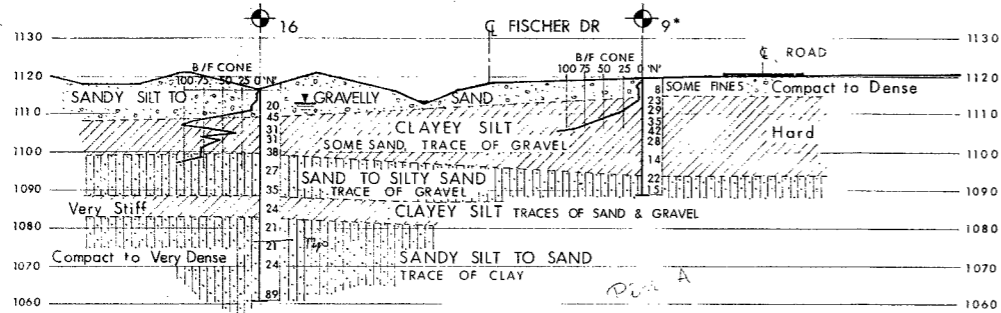
APPROVED: BRIDGE ENGINEER
DESIGN: D.S.M. CHECK: B.P.D.
DRAWING: R.D. CHECK: R.A.P.
DATE: FEB. 68 LOADING: HS20-44

SITE No. 33-229 W.P. No. 629-64
CONTRACT No. 70-17
DRAWING No. D-5686-1

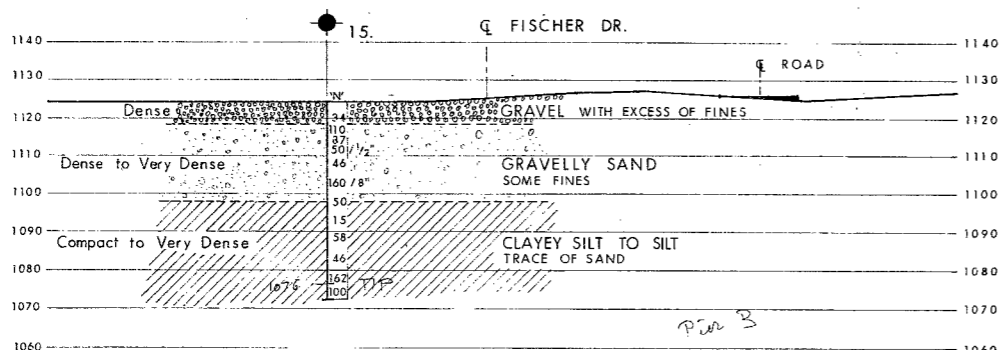




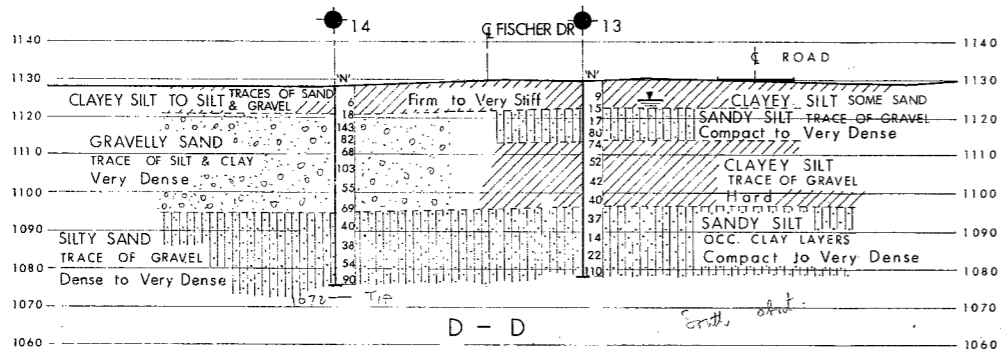
A - A



B - B

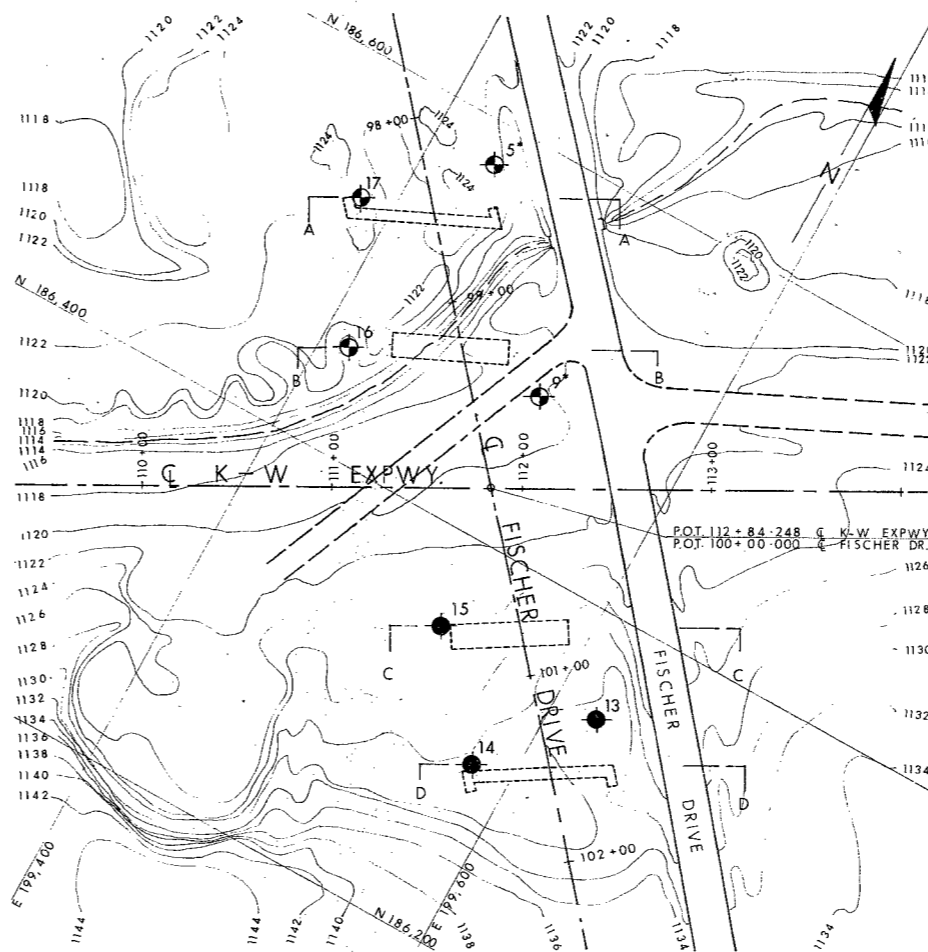


C - C



D - D

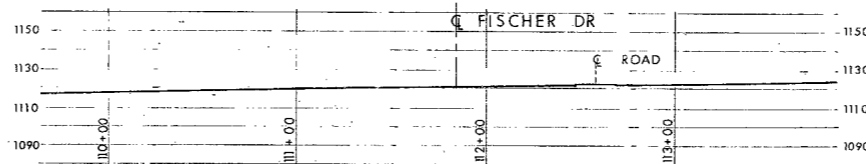
SECTIONS



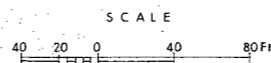
PLAN



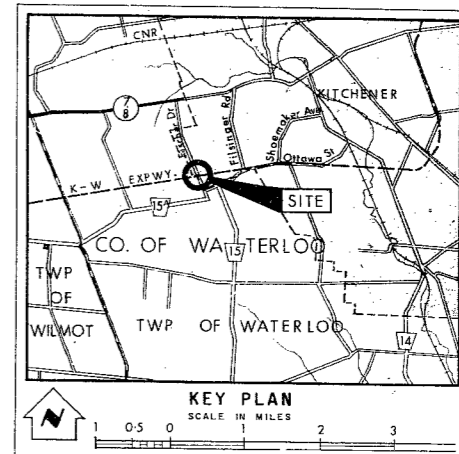
PRELIMINARY
NOT FOR
CONSTRUCTION



PROFILE



NOTE
The complete soil investigation report for this structure may be examined at the Bridge Office and Foundation Office, Downsview, and at the Hamilton District Office.



LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- W Water Levels established at time of field investigation, OCT. 1967.
- * E.M. Peto Bore Holes (Feb. 1965)

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
5*	1121.9	186,576	199,435
9*	1119.2	186,481	199,515
13	1129.9	186,346	199,624
14	1128.3	186,291	199,577
15	1124.0	186,348	199,528
16	1117.4	186,455	199,414
17	1122.0	186,527	199,382

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

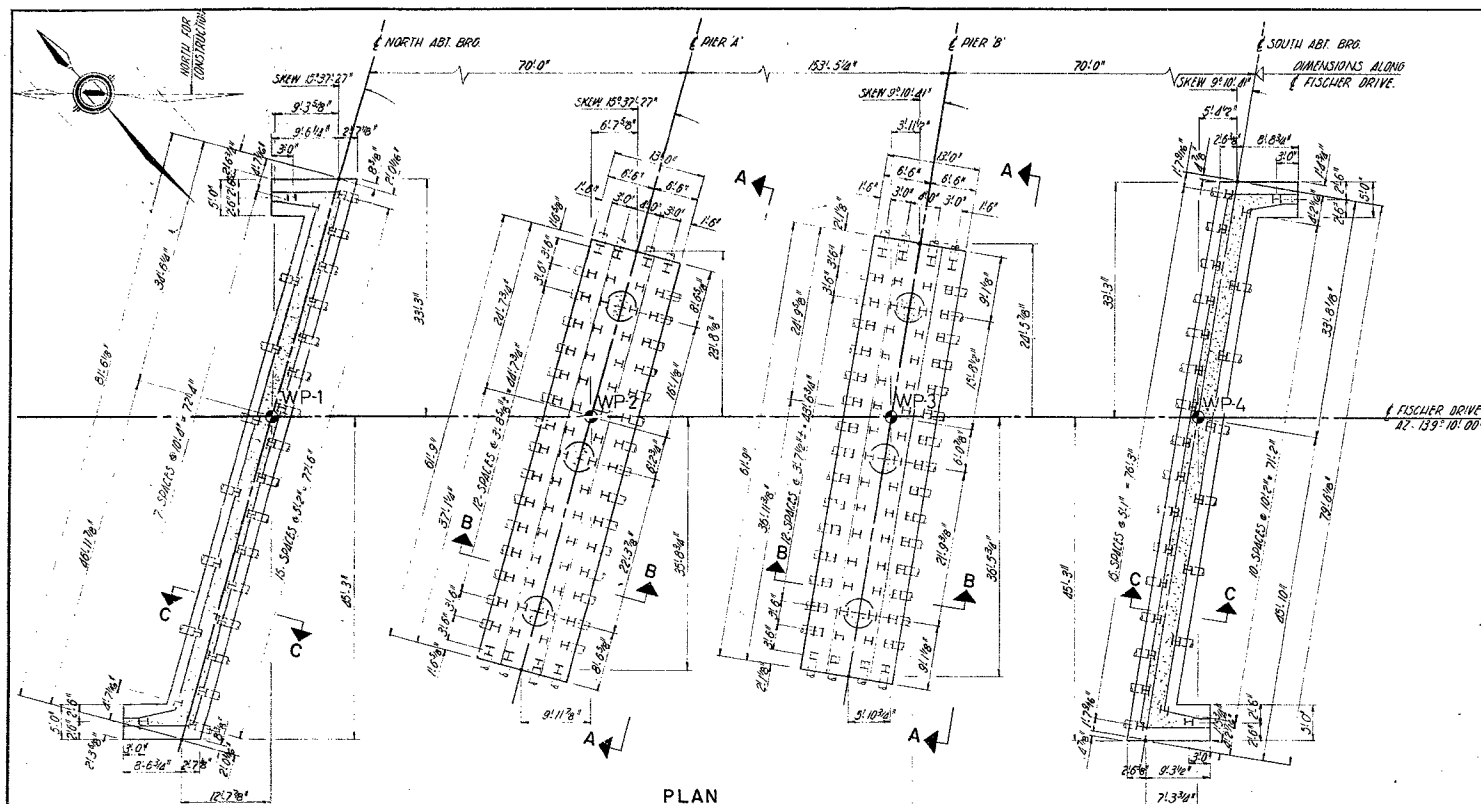
FISCHER DRIVE

KING'S HIGHWAY NO. K-W EXPWY. DIST. NO. 4
CO. WATERLOO
TWP. WATERLOO LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

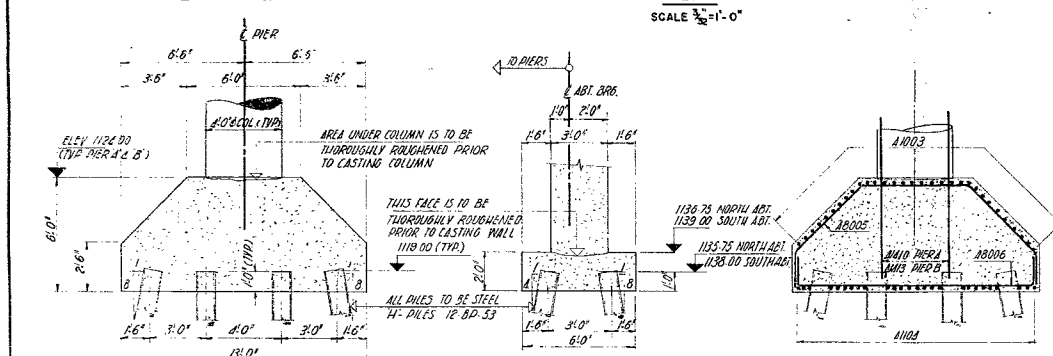
SUBM'D. A.S. CHECKED	W.P. NO. 629-64	M.B.T. DRAWING NO.
DRAWN A.B. CHECKED	JOB NO. 67-F-103	67-F-103 A
DATE DEC. 19, 1967.	SITE NO. 33-229	BRIDGE DRAWING NO.
APPROVED <i>A.B. Thomas</i>	CONT. NO.	D-5686-2

REF. No. 5962-44-M243 M.M. DILLON LTD.



PLAN
SCALE 1/4" = 1'-0"

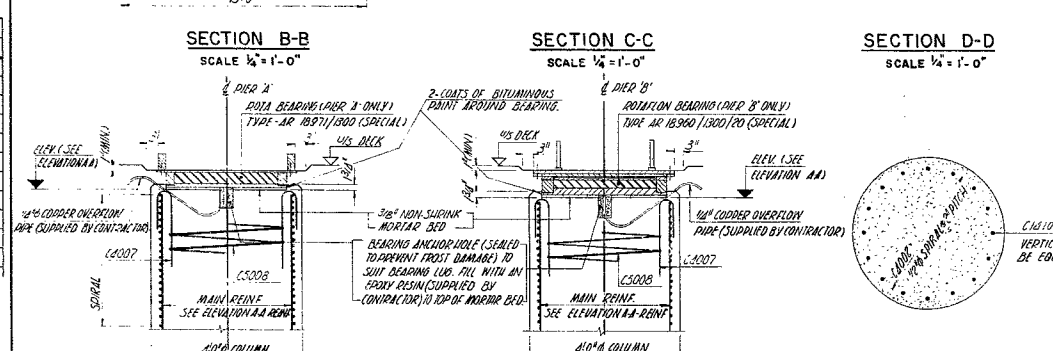
TABLE OF WORKING POINT CO-ORDINATES.			
WP-1	N. 186,536-982 E. 199,422-034	WP-2	N. 186,484-019 E. 199,467-804
WP-3	N. 186,367-926 E. 199,568-131	WP-4	N. 186,314-963 E. 199,613-901



SECTION B-B
SCALE 1/4" = 1'-0"

SECTION C-C
SCALE 1/4" = 1'-0"

SECTION D-D
SCALE 1/4" = 1'-0"

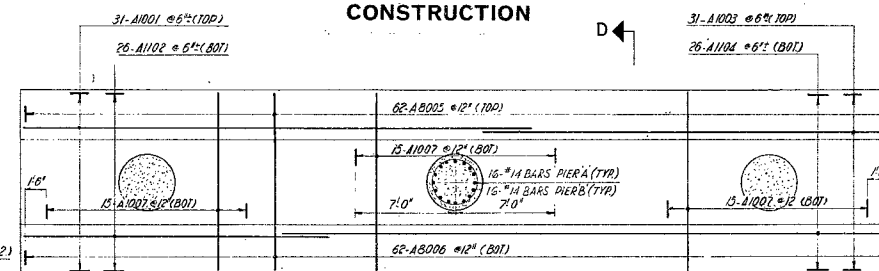


DETAIL-1 (PIER 'A' ONLY)
SCALE 1/2" = 1'-0" (3-REQ.)

DETAIL-2 (PIER 'B' ONLY)
SCALE 1/2" = 1'-0" (3-REQ.)

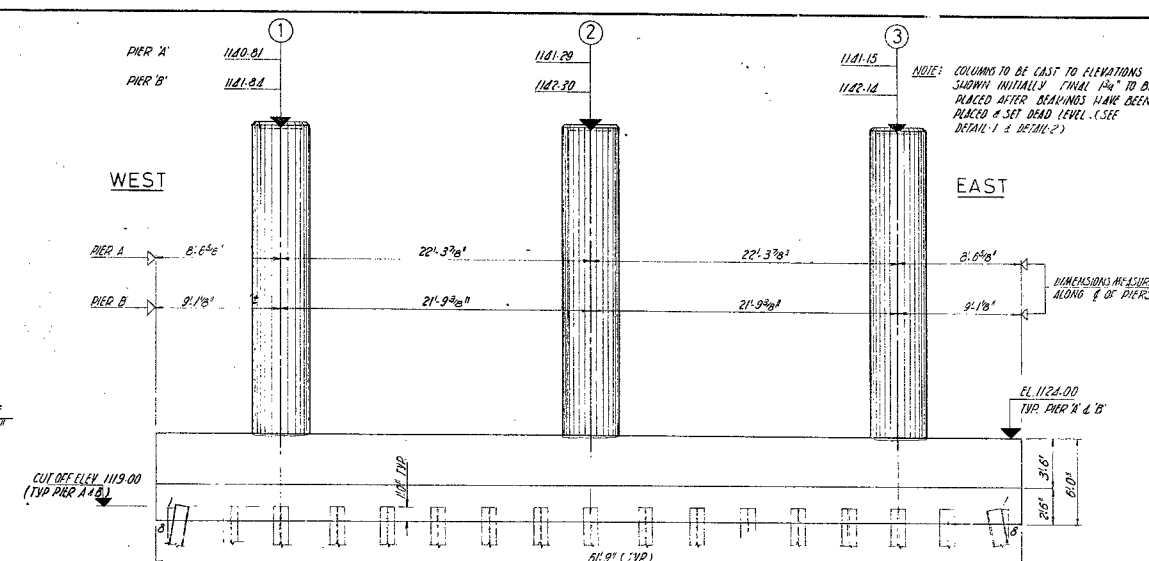
SECTION E-E
SCALE 1/2" = 1'-0"

REINFORCEMENT IS TO BE PLACED TO AVOID PILES.

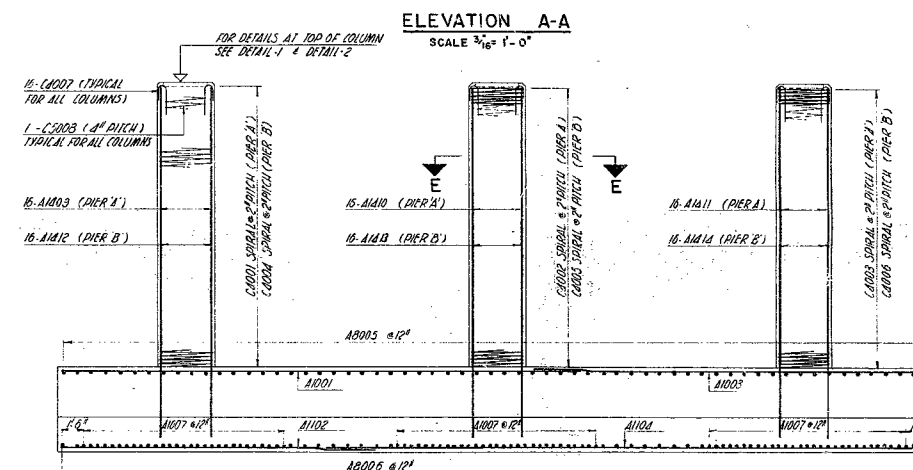


PLAN ON FOOTING (TYPICAL EACH PIER)
SCALE 3/16" = 1'-0"

PRELIMINARY
NOT FOR
CONSTRUCTION



ELEVATION A-A
SCALE 3/16" = 1'-0"

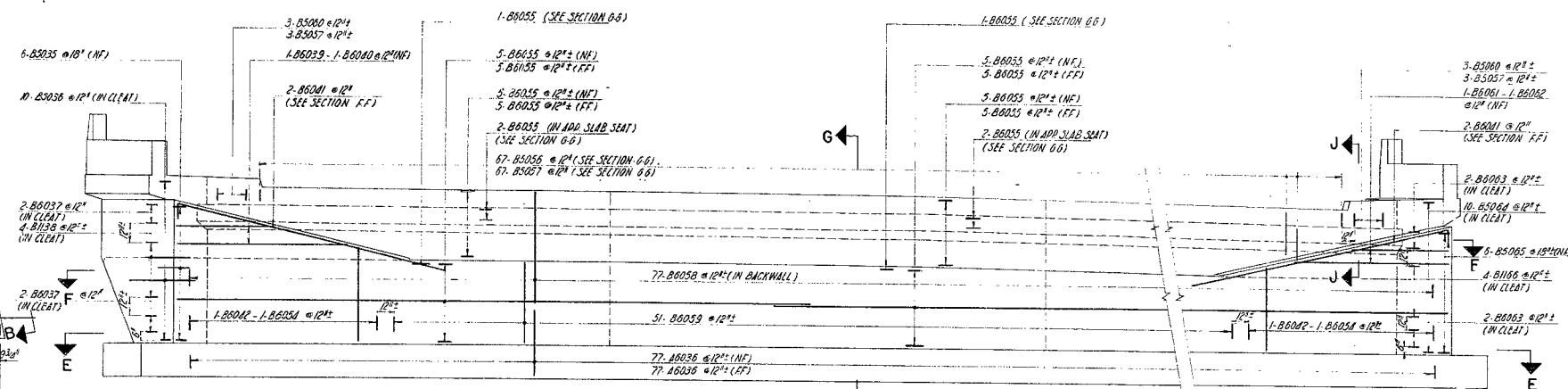


ELEVATION A-A - REINFORCEMENT
SCALE 3/16" = 1'-0"

- NOTES:-
- FOR GENERAL NOTES SEE DWG D-5686-1
 - VERTICAL PILES SHOWN 100% - 14" (FOR BATTER SEE DETAILS)
 - BATTERED PILES SHOWN 100% - 14" (FOR BATTER SEE DETAILS)
 - APPROXIMATE LENGTH OF PILES & NUMBER OF:
 - NORTH ABT. - 20 PILES - LENGTH 65'-0"
 - SOUTH ABT. - 20 PILES - LENGTH 65'-0"
 - PIER A - 8 PILES - LENGTH 44'-0"
 - PIER B - 8 PILES - LENGTH 44'-0"
 - THE WORKING LOAD ON THE PILES (60T) SHALL BE CHECKED ACCORDING TO THE HULLY FORMULA. (DWD STANDARD D-1210B-1210)
 - FOR LOCATION & DETAILS OF CONDUITS SEE ELECTRICAL DWG 5.

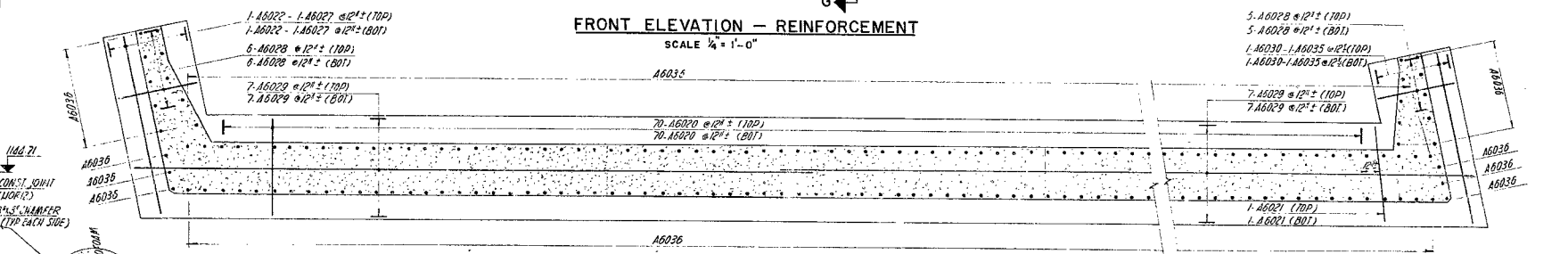
REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO BRIDGE DIVISION			
M. M. DILLON LIMITED CONSULTING ENGINEERS			
KITCHENER-WATERLOO EXPRESSWAY FISCHER DRIVE UNDERPASS			
KING'S HIGHWAY HENRY STURM BLVD		DIST. No. 4	
CO. WATERLOO		CON.	
CITY OF KITCHENER		LOT	
FOOTING LAYOUT & PIER REINFORCEMENT			
SITE No. 33-229		W.P. No. 629-64	
APPROVED		DESIGN ENGINEER	
DESIGN	D.S.M.	CHECK	B.P.D.
DRAWING	R.D.	CHECK	R.A.P.
DATE	FEB 88	LOADING	HS20-44
CONTRACT No.		DRAWING No.	
		D-5686-3	



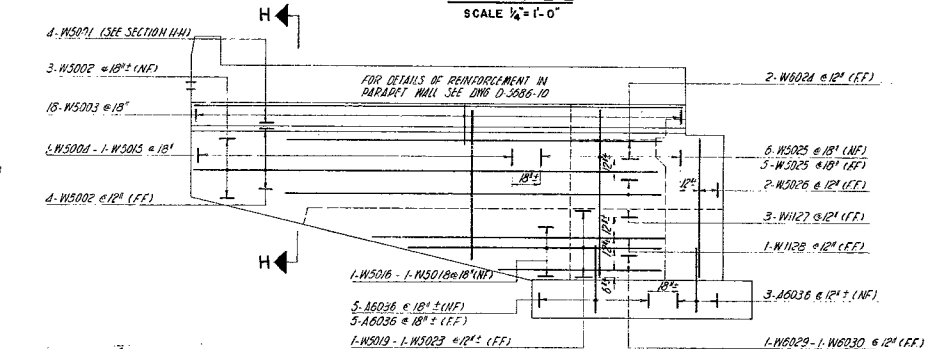
PLAN
SCALE $\frac{1}{8}'' = 1'-0''$

FRONT ELEVATION - REINFORCEMENT



FRONT ELEVATION
SCALE $\frac{1}{8}" = 1'-0"$

SECTION E-E
SCALE $\frac{1}{4}" = 1'-0"$

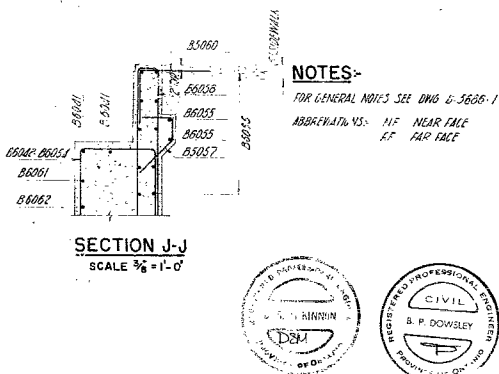


ELEVATION A-A
SCALE $\frac{1}{2}" = 1'-0"$

ELEVATION B-B
SCALE $\frac{1}{8}'' = 1'-0''$

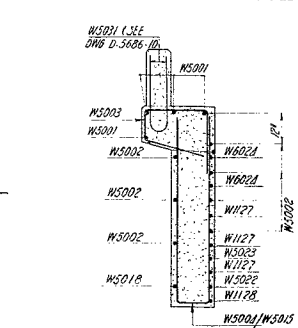
**PRELIMINARY
NOT FOR
CONSTRUCTION**

ELEVATION A-A - REINFORCEMENT (ELEVATION B-B SIMILAR)
SCALE $\frac{1}{4}" = 1'-0"$



NOTES:-

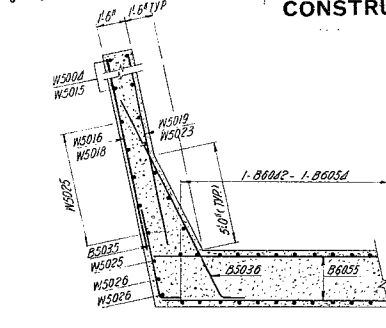
FOR GENERAL NOTES SEE DWG 6-5666-1
ABBREVIATIONS: NF NEAR FACE
EF FAR FACE



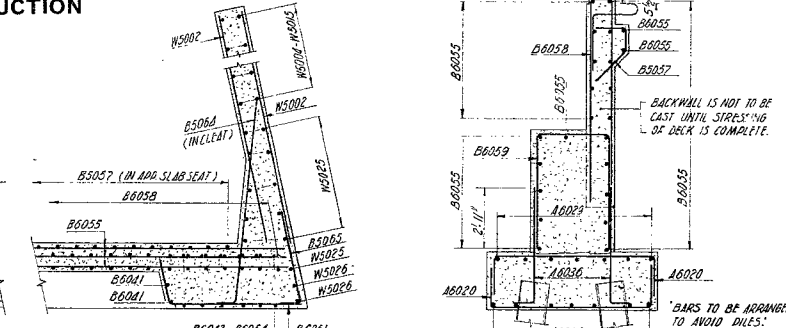
SECTION D-D
SCALE $\frac{3}{8}" = 1' - 0"$

DETAIL - 1
SCALE $\frac{3}{4}" = 1' - 0"$

SECTION H-H
SCALE $\frac{3}{8}'' = 1' - 0''$



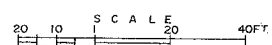
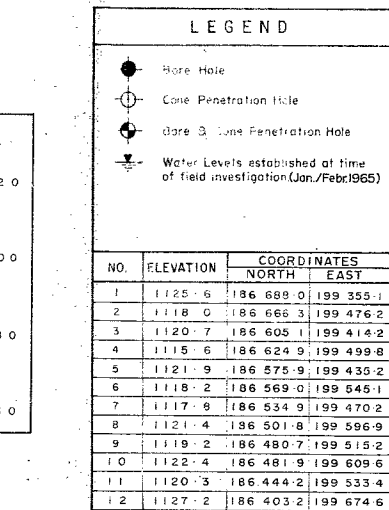
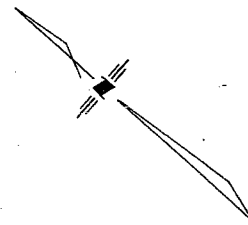
SECTION F-F
SCALE $\frac{1}{4}" = 1'-0"$



SECTION G-G

[illegible]

#65-F-251
W.P. #629-64
KITCHENER-
WATERLOO EXPWY.
FISCHER DR.
& HENRY STORM
BLVD.

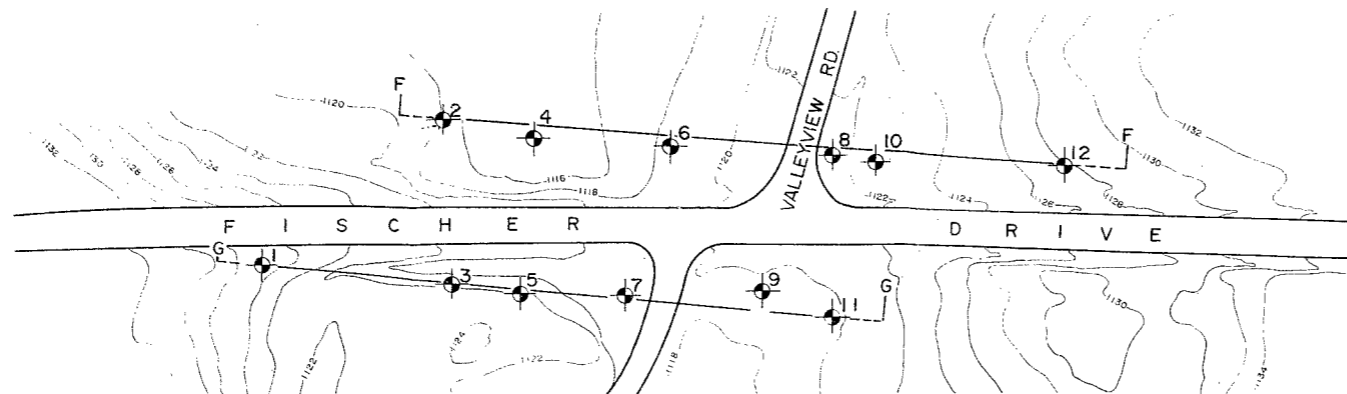


NOTE

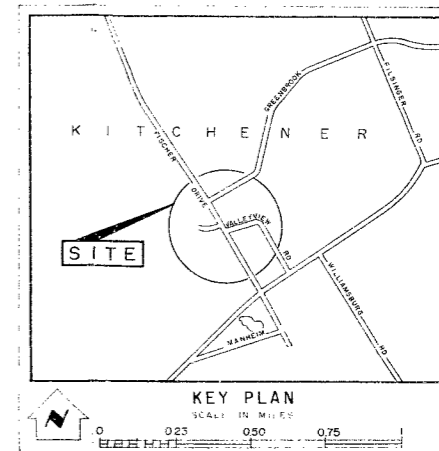
THE TESTHOLES AND PROBES HAVE BEEN LOCATED IN ACCORDANCE WITH CO-ORDINATES GIVEN IN THE TABLE, WHICH HAS BEEN SUPPLIED BY THE DEPARTMENT.

[illegible]

REVISIONS					
DATE	BY	DESCRIPTION			
E. M. PETO ASSOCIATES LTD.					
DEPARTMENT OF HIGHWAYS - ONTARIO MATERIALS & RESEARCH DIVISION - FOUNDATION SECTION					
KITCHENER-WATERLOO EXPRESSWAY FISCHER DR. UNDERPASS, HENRY STURM BLVD.					
KING'S HIGHWAY NO.		DIST. NO. <u>4</u>			
CO. <u>WATERLOO</u>					
TWP. <u>WATERLOO</u>		LOT		CON.	
BORE HOLE LOCATIONS & SOIL STRATA					
SUBM. B. L.	CHECKED <input checked="" type="checkbox"/>	W. P. NO.	DRAWING NO.		
		6 2 9 - 6 4	1		
DRAWN C. K.	CHECKED <input checked="" type="checkbox"/>	JOB NO.			
		6 5 0 3			
DATE	FEB 1966	SITE NO.	BRIDGE DRAWING NO.		
APPROVED	<i>A. Hoffman</i>	SENT NG			



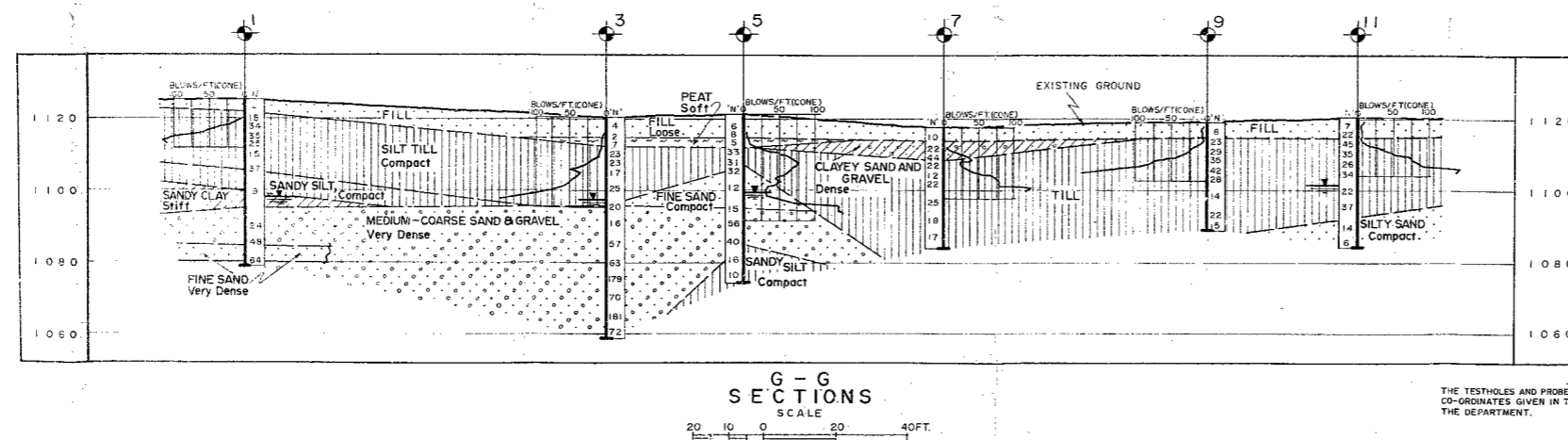
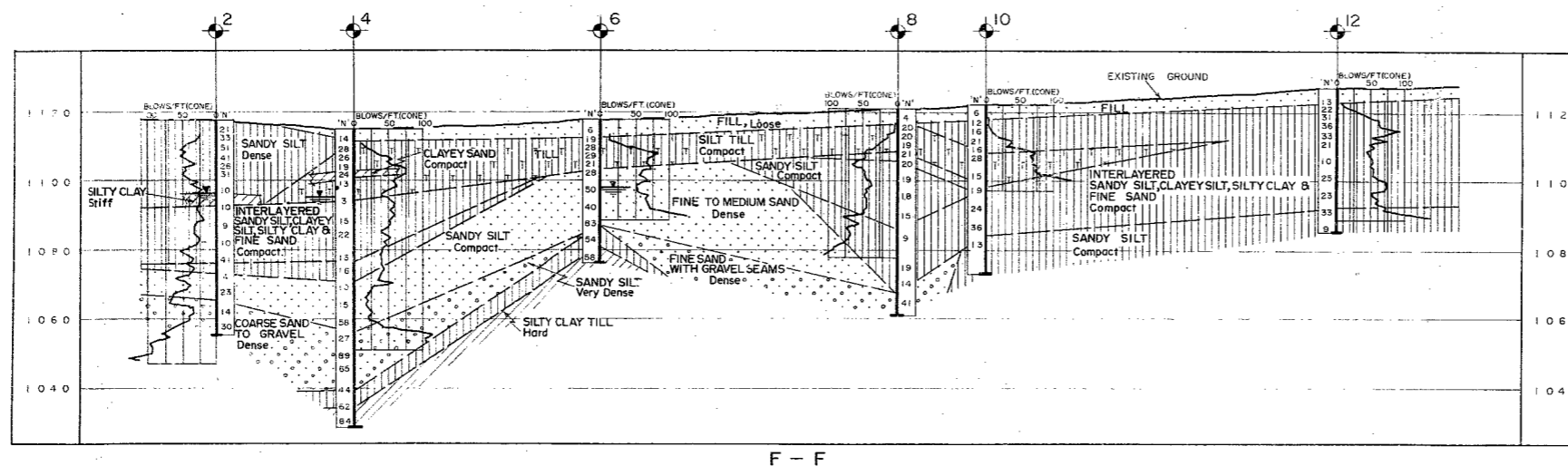
PLAN
SCALE 40 20 0 20 40 80 FT



- LEGEND
- Bore Hole
 - Cone Penetration Test
 - Bore & Cone Penetration Hole
 - Water Levels established at time of field investigation (Jan./Febr. 1965)

NO.	ELEVATION	COORDINATES	
		NORTH	EAST
1	1125.6	186 688.0	199 355.1
2	1118.0	186 666.3	199 476.2
3	1120.7	186 605.1	199 414.2
4	1115.6	186 624.9	199 499.0
5	1121.9	186 575.9	199 435.2
6	1118.2	186 569.0	199 545.1
7	1117.8	186 534.9	199 470.2
8	1121.4	186 501.8	199 596.9
9	1119.2	186 480.7	199 515.2
10	1122.4	186 481.9	199 609.6
11	1120.3	186 444.2	199 533.4
12	1127.2	186 403.2	199 674.6

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.



NOTE
THE TESTHOLES AND PROBES HAVE BEEN LOCATED IN ACCORDANCE WITH CO-ORDINATES GIVEN IN THE TABLE, WHICH HAS BEEN SUPPLIED BY THE DEPARTMENT.

E.M. PETO ASSOCIATES LTD.	
DEPARTMENT OF HIGHWAYS - ONTARIO	
WATERLOO RESEARCH DIVISION - CO-ORDINATE UNIT	
KITCHENER-WATERLOO EXPRESSWAY FISCHER DR. UNDERPASS, HENRY STURM BLVD.	
KING'S HIGHWAY NO.	DIST. NO. 4
CO. WATERLOO	
TWP. WATERLOO	LOT CON.
BORE HOLE LOCATIONS & SOIL STRATA	
SUBMIT B.L. CHECKED 11	W.P. NO. 629-64
DRAWN C.K. CHECKED 11	JOB NO. 6503
DATE FEBR. 1965	SITE NO.
APPROVED <i>A.P. Peto</i>	BRIDGE DRAWING NO.
DRAWING NO. 2	

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

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

Attention: Mr. S. McCombie

DATE: January 2, 1968

OUR FILE REF.

IN REPLY TO

JAN - 8 1968

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For

Fischer Drive Underpass
Kitchener-Waterloo Expressway
District No. 4 (Hamilton)
W.J. 67-F-103 -- W.P. 629-64

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

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

AGS/MdeF
Attach.

cc: Messrs. B. R. Davis (2)
H. A. Tregaskes
D. W. Farren
W. Zonnenberg
H. Greenland
W. S. Melinyshyn
J. Roy
W. D. Bradley
University of Waterloo
M. M. Dillon Ltd.
Foundations Office
Gen. Files ✓

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

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1. INTRODUCTION.
 2. DESCRIPTION OF SITE.
 3. FIELD WORK.
 4. LABORATORY TESTING.
 5. SOIL TYPES AND SOIL CONDITIONS:
 - 5.1) General.
 - 5.2) Sandy Silt.
 - 5.3) Clayey Silt to Silt.
 - 5.4) Gravelly Sand - some fines.
 - 5.5) Silty Sand to Sand.
 6. GROUNDWATER.
 7. DISCUSSION AND RECOMMENDATIONS.
 8. SUMMARY.
 9. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT
For
Fischer Drive Underpass
Kitchener-Waterloo Expressway
District No. 4 (Hamilton)
W.J. 67-F-103 -- W.P. 629-64

1. INTRODUCTION:

The Foundation Section was requested to carry out a foundation investigation at the above site. The request was contained in a memorandum dated October 19, 1967, from Mr. W. S. Melinyshyn, Regional Bridge Location Engineer. E. M. Peto Associates carried out a foundation investigation during the period January 19 and February 18, 1965. Since then, the centre-line of the structure has been moved westward, so that additional boreholes are necessary.

This Section subsequently carried out a field investigation to determine the subsoil conditions.

Presented in this report are the results of our field and laboratory investigations, together with our recommendations pertaining to the foundations of the new structure.

2. DESCRIPTION OF SITE:

The site is located 0.5 mile north of the intersection of Ottawa Street and Fischer Drive on Fischer Drive, which is a gravel road. On the west side the land is chiefly undeveloped, while on the east side it is partially residential and partly farmland. A small creek flows from west to east under Fischer Drive. A gravel pit is located in the south-west quadrant. The topography is generally flat to gently rolling.

Physiographically, the site is located in the area referred to as 'Waterloo Hills'.

3. FIELD WORK:

A total of five sampled boreholes along with two dynamic cone penetration tests, was carried out during the course of the field work. Drilling equipment consisted of a conventional diamond drill adapted for soil sampling purposes. Disturbed samples were recovered at required depths by means of a split-spoon sampler driven into the soil by means of a 140-lb. hammer imparting an energy of 350 ft.-lbs. per blow according to the specifications of the Standard Penetration Test. All samples were visually examined in the field before being transported to the laboratory.

The locations and elevations of all borings were surveyed by personnel from M. M. Dillon, Consulting Engineers, and are shown on Drawing 67-F-103A, together with the estimated stratigraphical profiles in the Appendix of this report.

4. LABORATORY TESTING:

All samples were subjected to a careful visual inspection in the laboratory. Laboratory tests were then taken on selected representative samples to determine:

- i) Natural Water Content
- ii) Grain-Size Distribution
- iii) Atterberg Limits

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

cont'd. /3 ...

5. SOIL TYPES AND SOIL CONDITIONS:

5.1) General:

Subsoil conditions over the site area were found to be generally variable, although a gravel pit had a marked influence on boreholes 14 and 15. Four main soil types were encountered, namely, sandy silt, clayey silt, gravelly sand, and silty sand. For estimated boundaries, refer to Drawing 67-F-103A.

5.2) Sandy Silt:

This deposit consisted of sandy silt, traces of gravel, and occasional layers of clay, and was encountered in boreholes 13, 16 and 17. The 'N' values from Standard Penetration tests varied from 11 to 110 blows per foot, indicating a relative density from compact to very dense. The moisture content ranged between 8% and 22%. The thickness of this layer varies from 9 to 22 feet. The average grain-size distribution is as follows: gravel 1%, sand 38%, silt 43%, and clay 8%. These are plotted on Figure 1 in the Appendix of this report.

5.3) Clayey Silt to Silt:

This deposit consisted of clayey silt to silt and contains some sand and traces of gravel. The thickness of the stratum ranged from 5 to 25 feet, and it was encountered in all five boreholes. In boreholes 13, 16 and 17, this deposit consisted of clayey silt, while in boreholes 14 and 15, it consisted of clayey silt to silt. 'N' values ranged from 7 to 162 blows per foot, indicating a consistency from firm to hard. The natural moisture content ranged from 13% to 24%. Atterberg Limit tests gave the following results:

Liquid Limit	:	17% - 35%
Plastic Limit	:	12% - 18%

The above results indicate a CL - ML material or clayey silt to silt, and they are plotted on Figure 2 in the Appendix of this report.

cont'd. /4 ...

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

5.4) Gravelly Sand - some fines:

This deposit was encountered only in boreholes 14 and 15 which were situated in the vicinity of the gravel pit. The thickness of this deposit varied from 21 to 25 feet. 'N' values ranged from 46 blows per foot to 160 blows per 8 inches, indicating a dense to very dense relative density. The moisture content varied between 6% and 15%. The average grain-size distribution is as follows: gravel 50%, sand 35%, and fines (silt and clay) 15%. These are plotted on Figure 3 in the Appendix of this report.

5.5) Silty Sand to Sand:

This deposit was encountered in boreholes 14, 16 and 17, and it consisted of silty sand to sand with traces of clay and gravel. In borehole 14 this deposit consisted of silty sand, while in boreholes 16 and 17 it consisted of silty sand to sand. 'N' values ranged from 27 to 90 blows per foot, indicating a compact to very dense relative density. The moisture content ranged between 11% and 19%.

6. GROUNDWATER:

The groundwater level ranged generally between elevations 1105.0 and 1095.0 during the field investigation.

7. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct an underpass structure, with spans of 75, 154 and 75 feet, at the above site.

A spread footing type foundation is recommended at the location of the north and south piers. An allowable load of 2 tons per sq. ft. can be achieved if the south pier is founded at elevation 1120 and the north pier is founded at elevation 1113. A settlement of up to 1 inch can be anticipated.

cont'd. /5 ...

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

A pile type foundation is recommended as an alternative, for the entire structure, or for perched abutments only. An allowable load of 60 tons per pile can be achieved if the north and south abutments are founded on 12-3/4" O.D. x 1/4" walled steel tube piles driven to an elevation of 1075[±].

All the footings should be at least 4.0 feet below the finished grade for frost protection purposes.

No major dewatering problems are anticipated.

No stability problems are anticipated provided standard 2:1 slopes are maintained.

Differential settlements are anticipated to be of a negligible order in the case of the whole structure on piles. In the case of the piers being on spread footings, a maximum settlement of 1.0 inch can be anticipated.

8. SUMMARY:

A foundation investigation at the above site of the proposed underpass structure is reported.

Subsoil at the above site consists of four soil types, namely, sandy silt, clayey silt, gravelly sand, and silty sand.

It is recommended to found the north and south piers on spread footings at elevations 1113 and 1120, respectively. The north and south abutments should be founded on 12-3/4" O.D. x 1/4" walled steel tube piles driven to elevation 1075[±]. The piers may also be supported on piles as an alternative to spread footings.

No major dewatering problems are anticipated.

No stability problems are anticipated provided standard 2:1 slopes are maintained.

cont'd. /6 ...

9. MISCELLANEOUS:

The field work for this report was carried out during the period October 31 to November 7, 1967, under the supervision of Mr. A. M. Seppala, Project Foundation Engineer, who also wrote this report.

Equipment was owned and operated by Canadian Longyear Limited.

Mr. K. G. Selby, Supervising Foundation Engineer, reviewed this report.

January 1968

APPENDIX I

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

67-F-103

629-64

DATUM Geodetic

RECORD OF BOREHOLE NO. 13

LOCATION Co-ord. N 186,346; E 199,624

BORING DATE Nov. 2 & 3, 1967

BOREHOLE TYPE BX Casing & Washboring

FOUNDATION SECTION

ORIGINATED BY AMS

COMPILED BY AMS

CHECKED BY

[illegible]

FOUNDATION SECTION

JOB 67-F-103 LOCATION Coard. N 186,291; E 199,577 ORIGINATED BY AMS
W.P. 629-64 BORING DATE November 1 & 2, 1967 COMPILED BY AMS
DATUM Geodetic BOREHOLE TYPE BX Casing & Washboring CHECKED BY [Signature]

[illegible]

FOUNDATION SECTION

CHECKED BY

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

JOB 67-F-103

LOCATION Co-ord. N 186,455; E 199,414

ORIGINATED BY AMS

W.P. 629-64

BORING DATE Nov. 8 & 9, 1967

COMPILED BY AMB

DATUM Geodetic

BOREHOLE TYPE BX Casing, Washboring & Cone Test

CHECKED BY

[illegible]

MATERIALS & TESTING DIVISION

FOUNDATION SECTION

JOB 67-F-103

LOCATION Co-ord. N 186,527; E 199,382

ORIGINATED BY AMS

W.P. 629-64

BORING DATE Nov. 6 & 7, 1967

COMPILED BY _____ AMS

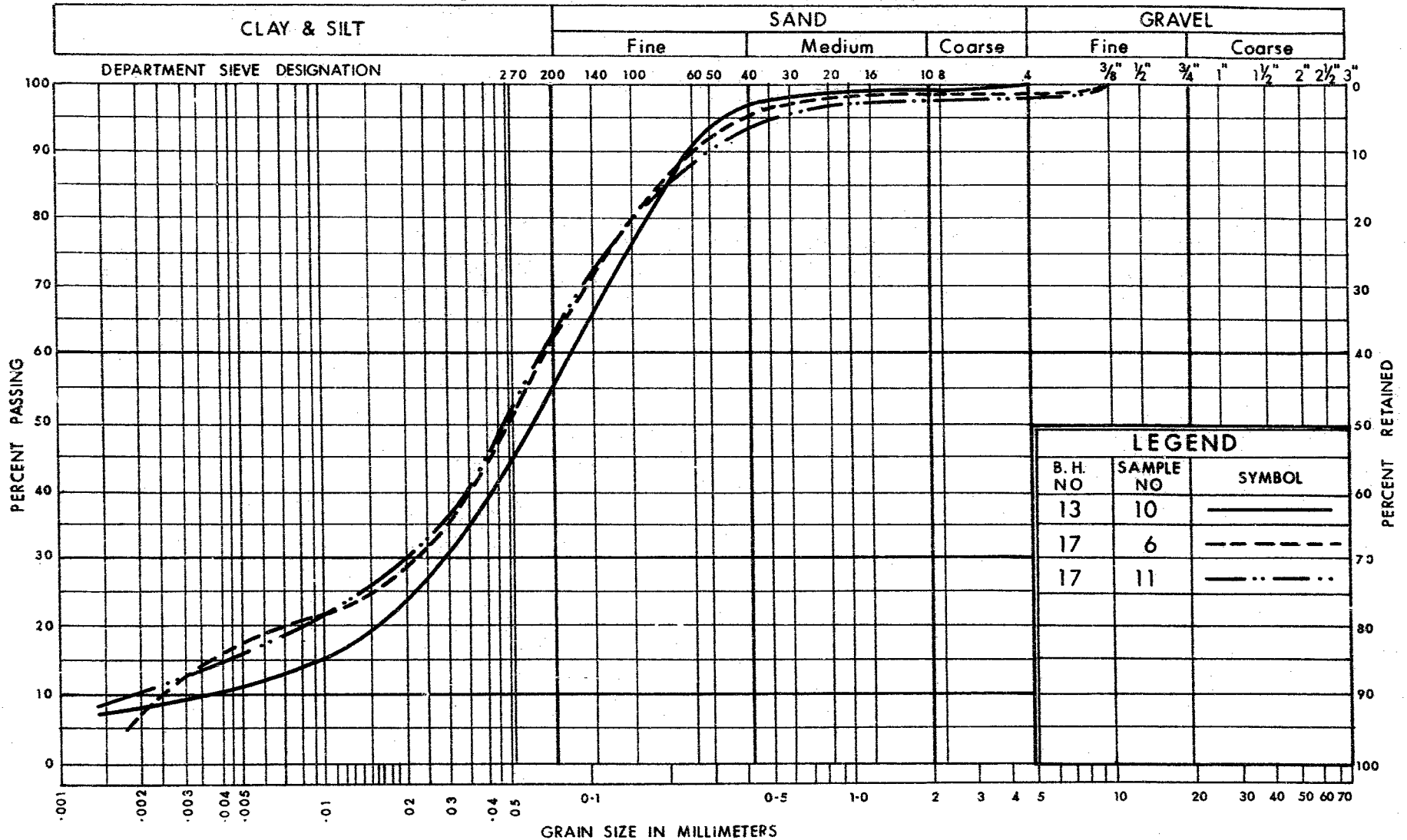
DATUM Geodetic

BOREHOLE TYPE BX Casing, Washboring & Cone Test

CHECKED BY AK

SOIL PROFILE			SAMPLES			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	ELEV. SCALE	SHEAR STRENGTH P.S.F.	WATER CONTENT % 10 20 30			
1122.0	Ground Level										
0.0	Clayey silt, some sand and trace of gravel. Firm to hard.		1	SS	17	1120					
			2	SS	7						
			3	SS	55						
			4	SS	30	1110					
			5	SS	32						
1103.0											
19.0	Sandy silt, traces of clay and gravel.		6	SS	20	1100					
			7	SS	19						
1094.0											
28.0	Silty sand to sand, trace of gravel. Compact to dense.		8	SS	35	1090					
			9	SS	27						
			10	SS	22	1080					
1081.0											
41.0	Sandy silt, some clay and trace of gravel. Compact to very dense.		11	SS	11						
			12	SS	90	1070					
1060.7											
61.3	End of Borehole		13	SS	148/10"	1060					

UNIFIED SOIL CLASSIFICATION SYSTEM



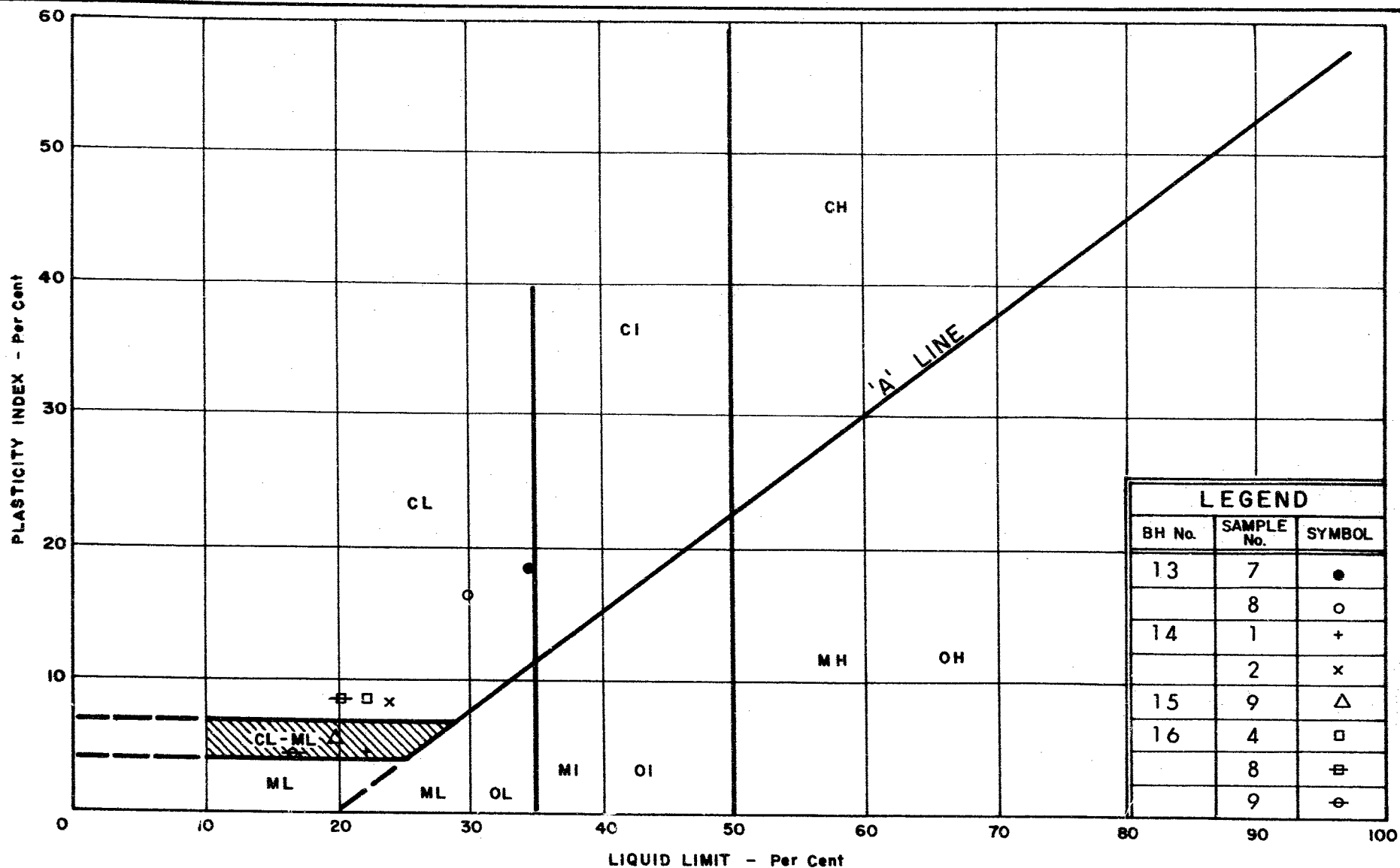
DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION
SANDY SILT
TRACES OF CLAY & GRAVEL

W.P. No. 629 - 64

JOB No. 67-F-103

FIG. 1



LEGEND		
BH No.	SAMPLE No.	SYMBOL
13	7	●
	8	○
14	1	+
	2	x
15	9	△
16	4	□
	8	⊗
	9	⊕



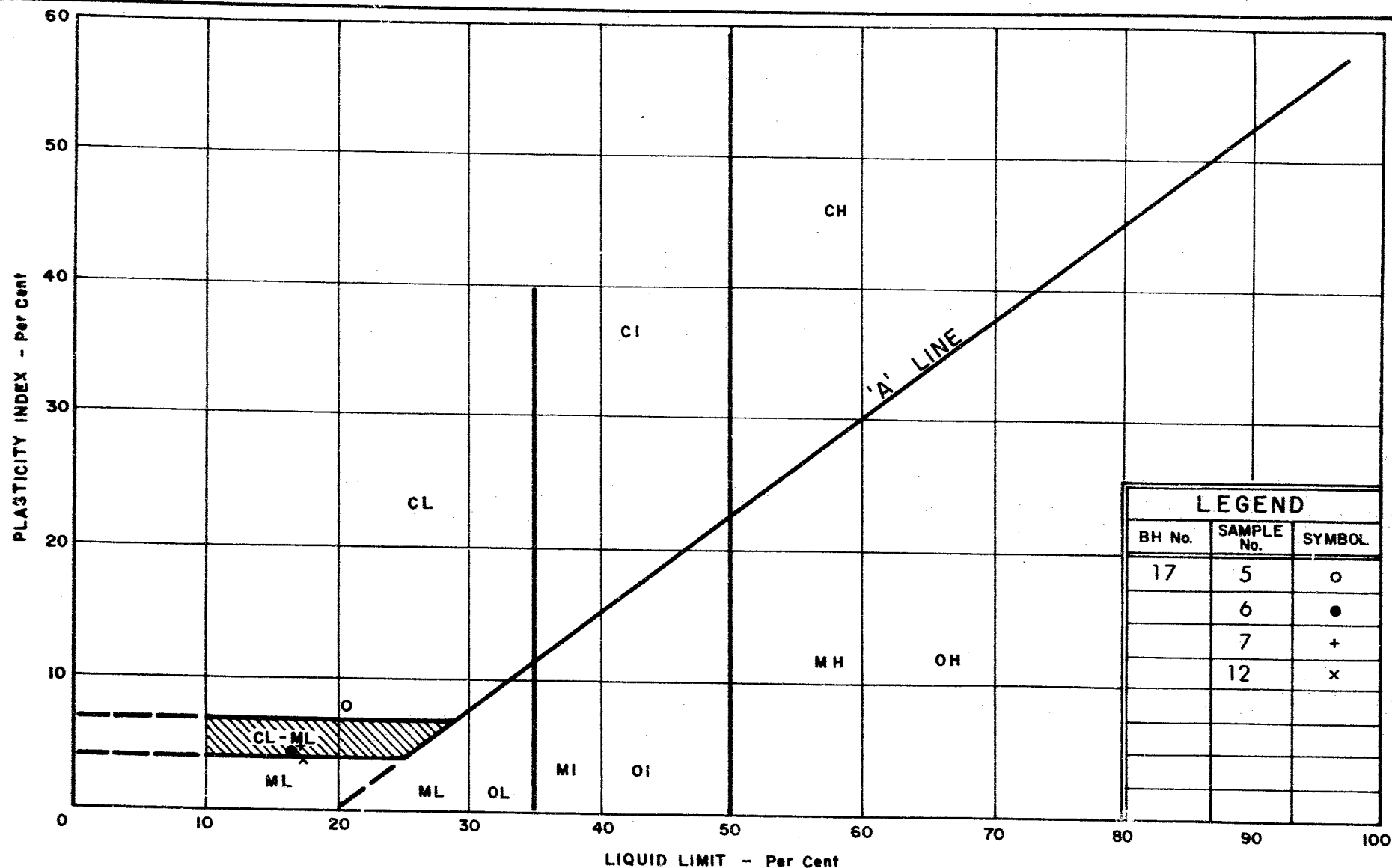
DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART CLAYEY SILT TO SILT

WP. No. 629-64

JOB No. 67-F-103

FIG. 2A



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

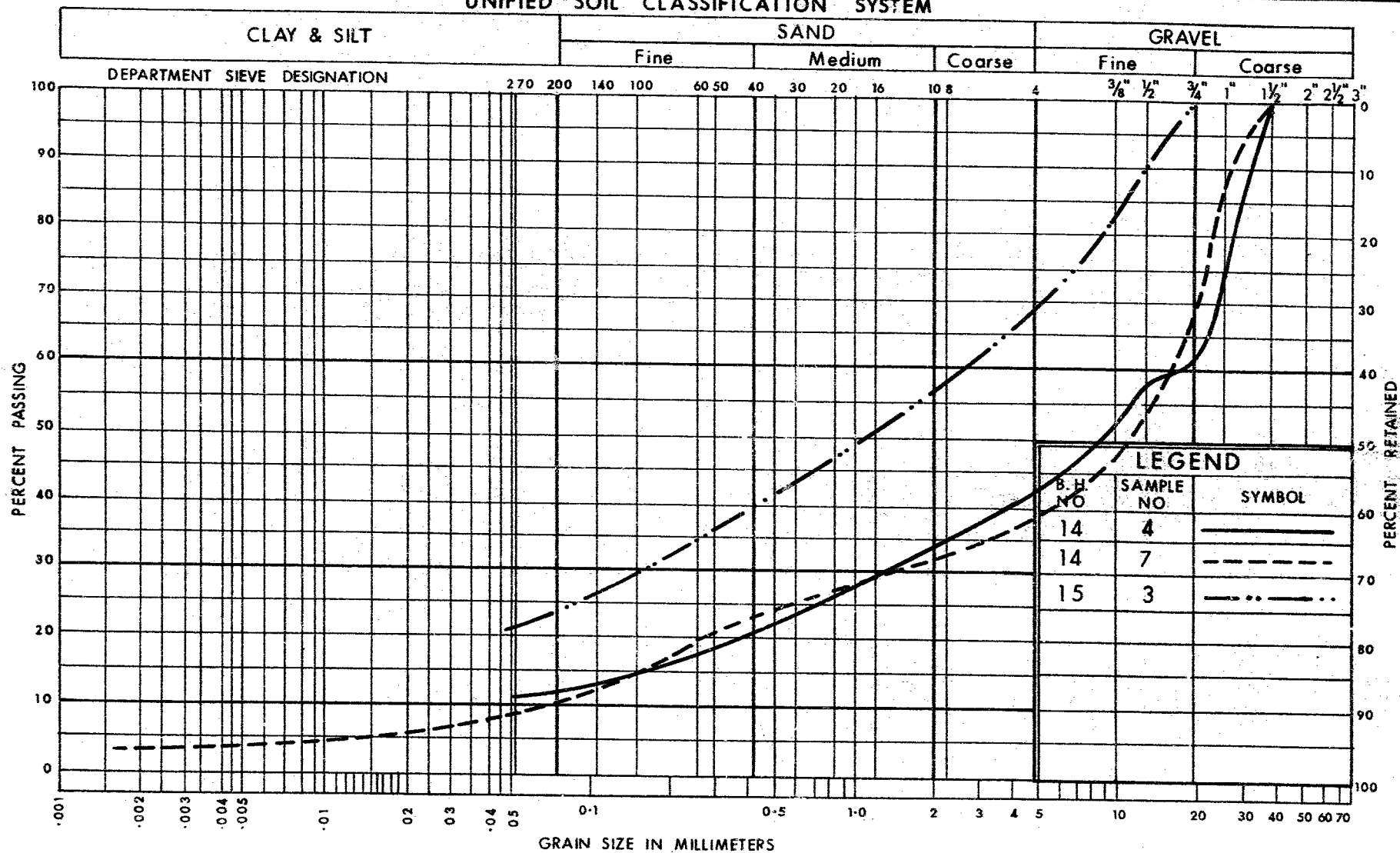
PLASTICITY CHART CLAYEY SILT TO SILT

W.P. No. 629-64

JOB No. 67-F-103

FIG. 2 B

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

GRAIN SIZE DISTRIBUTION
GRAVELLY SAND
SOME FINES

W.P. No. 629 - 64

JOB No. 67 - F - 103

FIG. 3

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

401 & Keele Street
Downsview, Ontario

October 31, 1967

Canadian Longyear Limited
35 Brydon Drive
Rexdale, Ontario

Dear Sirs:

This is to confirm our request of October 27, 1967 for the supply of a Diamond Drill together with all necessary equipment, as specified under the terms of our Contract Agreement, at Fischer Drive and Kitchener-Waterloo Expressway, Kitchener, Ontario, on October 30, 1967.

This project bears Job Number 67-F-103.

Yours truly,

K. G. Selby

KGS:mt

K. G. Selby
Supervising Foundation Engineer
for: A. G. Stermac
Principal Foundation Engineer

cc: H. Konings
Foundation Files 110
General File

67-1-185
Department of Highways Ontario

Copy for the information of

Mr. A. Stermac

Mr. W. Malingshyn,
Reg. Bridge Location Engineer,
Central Region,
Administration Building

Bridge Division,
Downsview, Ontario

January 16, 1968

Kitchener-Waterloo Expressway
Underpass at Fischer Drive,
W.P. 629-64, Site 33-229
District No. 4 - Hamilton

Attached herewith are prints of the Preliminary Bridge Plan
Drawing D-5686-F1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$434,000.
This cost includes tender, materials, engineering and sundry
construction.

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

CSG:rd

C.S. Groski,
Bridge Design Engineer

Attach.

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

FOUNDATION REPORT NOW AVAILABLE
NO COMMENTS.

JAN. 19TH 1968 12.4.8-44

Department of Highways Ontario

Copy for the information of

MR. A. STERMAC

Bridge Division,
Downsview, Ontario.
March 26, 1968.

M.M. Dillon Limited,
Consulting Engineers,
Box 219, Station "K",
50 Holly Street,
Toronto, Ontario.

Attention: Mr. B.N. Medicky, P.Eng.

Dear Sir:

RE: Fischer Drive Underpass
Kitchener-Waterloo Expressway
W.P. 629-64, Site 33-229
Dist. 4

67-F-103

Enclosed with this letter is one set of progress prints D5686-1 to -12 returned with our comments marked on them. Please make the necessary alterations to the tracings and forward the complete work of the tracings, D4, Special provisions, etc. to this office.

Please note our comments on drawing D5686-3 concerning the piles. In the vicinity of Holes 14 and 15 large N values are indicated from about elevation 1120 downwards. With such large N values, it is our opinion that considerable difficulty could be experienced in attempting to obtain the penetration for the pile lengths shown. Perhaps consideration should be given to the use of H piles (12HP53) which are generally easier to drive than tubes, or possibly some other alternative such as Franki-type caissons or drilled in caissons. I realize that your design is in accordance with the Foundation Report, however, in view of the above considerations, would you kindly review the type and installation of the piles with the D.H.O. Foundation Section. (Mr. A.

Department of Highways Ontario

- 2 -

Copy for the information of

**Re: Fischer Drive Underpass
Kitchener-Waterloo Expressway
W.P. 629-64, Site 33-229
Dist. 4**

Stermac, R.Eng., Principal Foundation Engineer, phone 248-3782).

If we can be of further assistance, please do not hesitate to call us.

Yours truly,

JLK

JLK:ts
Enc.

J.L. Keen, P.Eng.,
Regional Bridge Project Engineer.

c.c. Mr. A. Stermac

Department of Highways Ontario

Copy for the information of
Mr. K. Selby, P.Eng.
Foundations Section

Ken
Please file with report
Tom

Bridge Division,
Downsview, Ontario.
April 1, 1968.

M.M. Dillon Limited,
Consulting Engineers,
Box 219, Station "K",
50 Holly Street,
Toronto, Ontario.

Att: Mr. B. Dowalec, P.Eng.

Dear Sir:

RE: Fischer Drive U'pass
Kitchener-Waterloo Expressway
W.P. 629-64, Site 33-229
Dist. 4

67F-103

This letter will serve to confirm the piling changes for the above project as discussed during our telephone conversation on March 28, 1968. The changes are as follows:-

- (1) Pile type to be changed from tube piles to 12EP53 H-piles.
- (2) The design load will remain the same, i.e. 60 ton per pile.
- (3) The number and length of piles will remain the same.
- (4) The working load will be checked by the Hilley Formula, as per B.H.O. standards DD1218-19.

My reasons for changing to H-piles are as follows:-

- (1) It is my opinion that difficult driving could be encountered in the vicinity of the south pier and abutment. Boreholes 14 and 15 indicate extremely high "N" values from elevation 1120 downwards. H-piles are generally more convenient and easier to drive than tube piles and the overall driving time could be appreciably reduced.
- (2) The amount of piling to be supplied will not be more than for tube piles.

Re: Fischer Drive U'pass
Kitchener-Waterloo Expressway
W.P. 629-64, Site 33-229
Dist. 4

- (3) The soil conditions appear suitable to support a design load of 60 tons on an H-pile. Results of recent tests undertaken by our D.H.O. Foundation Section show that H-piles can be used with equal success for sites where displacement friction type piles have often and traditionally been recommended in the past.

I trust this meets with your satisfaction.

Yours truly,



J.L. Keen,
Regional Bridge Project Engineer.

JLK:ts

c.c. K. Selby, P.Eng.,
D.H.O. Foundations Section

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

FROM: Bridge Division,
Downsview, Ontario.

ATTENTION:

DATE: October 10th, 1968.

OUR FILE REF:

IN REPLY TO


SUBJECT: Kitchener-Waterloo Expressway,
Fischer Drive Underpass,
W.P. 629-64, Site 33-229,
Henry Sturm Blvd., District 4.

67-F-103

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

Kindly give us your comments at your earliest convenience.

CSG/co
Attach.


C.S. Grebski,
Bridge Design Engineer.

c.c. Foundation Section

OCT. 14 / 68.

NO COMMENTS

A.K.B.



MEMORANDUM

TO: Mr. C. R. Robertson
District Engineer
Hamilton, Ontario

ATTENTION: D. Waller
Construction Engineer

OUR FILE REF.

FROM: Materials & Testing Division
Foundation Section
Room 107, Lab. Bldg.
Downsview, Ontario

DATE: August 26, 1970

IN REPLY TO

SUBJECT:

Fischer Drive Underpass, K/W Expy.
Contract 70-17 W.O. 67-11103

The abovementioned site was visited by the writer on Thursday August 13, 1970 following a request by Mr. T. Davis, Project Supervisor.

During pile driving for the north pier, the piles (12BP @ 53) were penetrating to a much greater depth than that originally estimated to achieve the required design capacity according to the Hiley Formula. Following is a summary of discussions held on site with Mr. Davis: --

Subsoil at the north pier and other locations consists of deposits of fine sand and silt which tend to liquify during pile driving. This effect occurs during dynamic loading but the soil stabilizes afterwards and does not re-occur under static loading. Thus the driving resistance after prolonged driving may indicate a much lower pile capacity under static conditions than is actually the case. In most cases when pile driving has been terminated for an hour or two then recommenced, it will be found that a considerable increase in driving resistance occurs for a few inches of penetration before liquifaction of the soil takes place again.

For the remainder of this project it is suggested that the following procedure be followed for each pile.

- (1) Drive piles to length originally estimated and record blows per inch for the last 2 inches of driving.
- (2) If the capacity according to the Hiley Formula is not achieved then redrive after a suitable interval (2 hrs.) and record again the blows/inch for the first 2 inches of redriving.
- (3) If an increase in penetration resistance takes place the capacity may now be compiled again accordingly.
- (4) If a sufficient increase in penetration resistance does not take place the pile must be driven to a lower depth and the abovementioned steps (2) & (3) repeated.

By following the foregoing steps it is believed that some saving in pile lengths will be effected.

K. G. Selby

KGS/lm

K. G. Selby
SUPERVISING FOUNDATION ENGINEER

For:

cc:

Messrs. H. A. Tregaskes
J. Keen
A. McKim
D. Hopper

A. G. Stermac
PRINCIPAL FOUNDATION ENGINEER

Foundation Files ✓
General Files

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

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

Attention: Mr. G. McCosbie

March 10, 1965

FOUNDATION INVESTIGATION REPORT BY:
E. M. Peto Associates, Ltd., Toronto.
Kitchener-Waterloo Expressway --
Fischer Drive Underpass, Henry Sturtz Blvd.
W.P. 629-64 -- District No. 4.

Attached, please find the above-mentioned report submitted by the Consultant, E. M. Peto & Associates Ltd.

We have reviewed the report and find the factual information well presented and adequate. Due to the relatively favourable subsoil characteristics, no problems are foreseen.

Should there be any questions in connection with this project that you would like to discuss, please feel free to call on our Office.

AGS/Wdef
Attach.

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
H. D. McMillan

A. Gater

M. Greenland

J. Gray

G. A. Wrong

W. L. Bradley, Cit. Engr., Kitchener

M. M. Dillon & Co. Ltd.

Foundations Office

Gen. Files

A. G. Sternac,
A. G. Sternac,
PRINCIPAL FOUNDATION ENGINEER

N.P. 629-64

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

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

Attention: Mr. E. McCombie

March 10, 1965

FOUNDATION INVESTIGATION REPORT BY:
E. M. Peto Associates, Ltd., Toronto.
Kitchener-Waterloo Expressway --
Fischer Drive Underpass, Henry Stora Blvd.
W.P. 629-64 -- District No. 4.

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We have reviewed the report and find the factual information well presented and adequate. Due to the relatively favourable subsoil characteristics, no problems are foreseen.

Should there be any questions in connection with this project that you would like to discuss, please feel free to call on our Office.

AGS/MdeF
Attach.

cc: Messrs. A. M. Toys (2)

H. A. Tregaskes

H. D. McMillan

A. Gater

H. Greenland

J. Roy

C. A. Wrong

W. L. Bradley, City Engr., Kitchener

M. M. Dillen & Co. Ltd.

Foundations Office

Gen. Files ✓

A. G. Sternac
A. G. Sternac,
PRINCIPAL FOUNDATION ENGINEER

E. M. PETO ASSOCIATES LIMITED

Job Number 6503

1287 Caledonia Road,
Toronto 19, Ontario.
789 - 1126

March 8th, 1965.

Mr. A. Rutka, P. Eng.
Materials and Testing Engineer,
Department of Highways, Ontario,
Downsview, Ontario.

Re: Foundation Investigation for W.P. 629-64
Fischer Drive and Henry Sturm Boulevard Structure

Dear Sir:

The enclosed report outlines the subsoil conditions and gives foundation recommendations for the above site.

The subsoil stratigraphy is extremely complicated and consists of inter-layered silts, clays and sands intermixed with glacial till soils. A groundwater table was established about 20 feet below existing grade; this is at least 10 feet beneath the recommended foundation levels.


Recommended allowable bearing values of 3.0 ton/sq.ft. for footings up to 25 feet wide and 2.5 tons/sq.ft. for larger footings are suggested at elevations ranging from 1111.5 to 1114.5.

We believe this report to be complete within our terms of reference, but should you have any questions, please contact us.

Yours very truly,

E. M. PETO ASSOCIATES LIMITED,



 E. M. Peto, P. Eng.

CFF/dc

E. M. PETO ASSOCIATES LIMITED

SUBSOIL FOUNDATION INVESTIGATION
FOR
FISCHER DRIVE - HENRY STURM BLVD. STRUCTURE
KITCHENER-WATERLOO EXPRESSWAY
W.P. 629-64
DEPARTMENT OF HIGHWAYS, ONTARIO

Distribution:

12cc - Client
1cc - File

Job Number 6503

March, 1965

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1. INTRODUCTION

1.1 Authority and Proposal: At the request of the Department of Highways, Ontario, (letter dated January 6th, 1965) a foundation investigation has been carried out at the future intersection of Henry Sturm Boulevard and Fischer Drive (W.P. 629-64).

The City of Kitchener plans to reconstruct the present Fischer Drive prior to the construction of the Expressway, and the Department intends to build the structure during the reconstruction of the Fischer Drive. The proposed Henry Sturm Blvd. will be at about present grade (elevation 1120), and Fischer Drive will be an overpass with approach embankments of about 20 ft. in height.

1.2 Site and Geology: The site is located near the intersection of Fischer Drive and Valley View Road. At this point which is a gravelled surfaced road, Fischer Drive is at the lowest elevation and rises both to the north and south.

Glacio-fluvial and lacustrine action has deposited a highly complicated series of strata which range from gravels through silts and clays. The materials tend to get coarser with depth.

Two till sheets have been established at this site, the upper one which dips and increases in thickness in the westerly direction and the lower encountered at considerable depth and only in isolated locations.

2. SUBSOIL CONDITIONS

2.1 General: The inter-stratification is extremely complicated. A very general stratification which involves a considerable simplification is given on the attached soil profiles. More detailed information is given on the borehole logs.

The following is a very brief and general description of each of the soil layers encountered:

2.2 Topsoil and Fill: This stratum represents combined topsoil and fill and is described as fill on the attached soil profile. The maximum depth is about 6 feet and the average depth is estimated to be about 4.5 feet. It is generally composed of granular materials with local variations containing more cohesive soils and organic matter.

2.3 Peat: This deposit is located in the area of testhole 3 and 5. At testhole 3 it is interlayered with fine sand and generally, it is soft.

2.4 Interlayered Sandy Silt, Clayey Silt, Silty Clay and Fine Sand: This stratum is very heterogeneous. The inter-stratification between the individual soil types is highly obscured. The interlayered deposit could be sub-divided into a brown and a grey deposit. No distinction is shown on the attached soil profile; however, this distinction is made on the borehole logs.

The upper, brown, interlayered deposit is denser than the grey. The following are the geotechnical soil properties:

N-Values (Average) - Brown - 27, Grey - 17
Water Content - 13% to 38% - Average - 19%
Liquid Limit - 19% to 24% - Average - 22%
Plastic Limit - 13% to 14% - Average - 13%
Plasticity Index - 6 to 11 - Average - 9
The undrained shear strength values are given on the Borehole Logs. In general they vary between 940 and 3,600 lbs/sq.ft.
Bulk Density (average value) - 134 lbs/cu.ft.
Dry Density - 114 lbs/cu.ft.
The shear parameters in terms of effective stresses are:
Cohesive Intercept - 280 lbs/sq.ft.
Angle of Internal Friction - 35°
Typical grading curves are given of Fig. 1.

SUBSOIL CONDITIONS - Cont'd.

2.5 Silt Till: This is the upper of the till deposits encountered at this site. Typical grading curves are given on Figure 2, and the Geotechnical properties are as follows:

Average N-value	24
Average Water Content	14%
Liquid Limit	24% to 29%
Plastic Limit	13% to 15%
Plasticity Index	9 to 14

The values of the Atterberg Limits are plotted on the Plasticity chart given on Figure 3.

The following properties may be assumed:

Bulk Density	135 lbs/cu. ft.
Angle of internal friction	30°

2.6 Sandy Silt and Silt: This is a compact deposit with an average N-value of 27. The water contents vary between 13% and 22%, with an average value of 17%. The values of density and the angle of internal friction are similar to the silt till discussed previously.

2.7 Fine to Medium Sand: This deposit arises in the area of testholes 2, 4, 5, 6 and 11; with an average N-value of 20, it is a compact deposit. The variation in the water content is considerable, depending on the location above or below the ground water table. The average water content for the whole deposit is about 14%.

SUBSOIL CONDITIONS - Cont'd.

2.8 Coarse Sand and Gravel: This deposit contains very dense coarse sand and gravel, with an average N-value of 60.

2.9 Silty Clay Till: This glacial deposit of silty clay till was encountered at the lower depth of testholes 4 and 6. It is hard with N-values well over 50 and water contents of about 20%.

3. GROUND WATER CONDITIONS

The water levels established during this investigation are shown on the attached soil profiles and borehole logs. The ground water table varies between elevations 1096 to 1101, and thus for practical purposes it may be assumed to be horizontal.

No water under artesian pressure has been established at this site. Some perched water existed at the top of the impermeable layers forming isolated wet areas.

4. RECOMMENDATIONS

4.1 Bridge Structure: This structure will carry Fischer Drive over Henry Sturm Blvd. The deposits encountered at this site are capable of supporting it on spread footings. The following are the recommended minimum foundation elevations:

<u>Area of Testholes</u>	<u>Foundation Elevation</u>
2 & 3	1112.5
4 & 5	1111.5
6 & 7	1113.0
8 & 9	1114.5
10 & 11	1114.5

4.1 Bridge Structure - Cont'd.

The recommended allowable bearing value for footings up to 25 feet wide and 70 feet long is 3 tons per sq. ft. For larger footings (30 ft. wide) the allowable bearing value should be decreased to 2.5 tons per sq. ft.

The above given allowable bearing values may cause settlement slightly in excess of 1 inch, but in no instance should the settlement exceed 1.5 inches. The settlements in the majority of instances will be of a short term nature.

4.2 Embankment: The approach embankments will be about 20 ft. high. The recommended side slope is 1 vertical to 2 horizontal and the estimated settlement resulting from placing such an embankment on this soil is about 1.5 inches.

4.3 Construction Consideration: If the foundations are placed at the recommended elevations as given in section 4.1 of this report, then no serious water control measures will be necessary. Excavations may be made with sloping sides of 1 vertical to 1 horizontal for the duration of the construction period. Any seepage water may be dealt with satisfactorily by gravity drainage.

The existing fill is relatively shallow and loose, however, since it is basically of a granular nature, it is considered that surface compaction followed by placing the fill will be adequate for an embankment of this height.

Prepared by:

E. M. PETO ASSOCIATES LTD.,

B. Lewicki

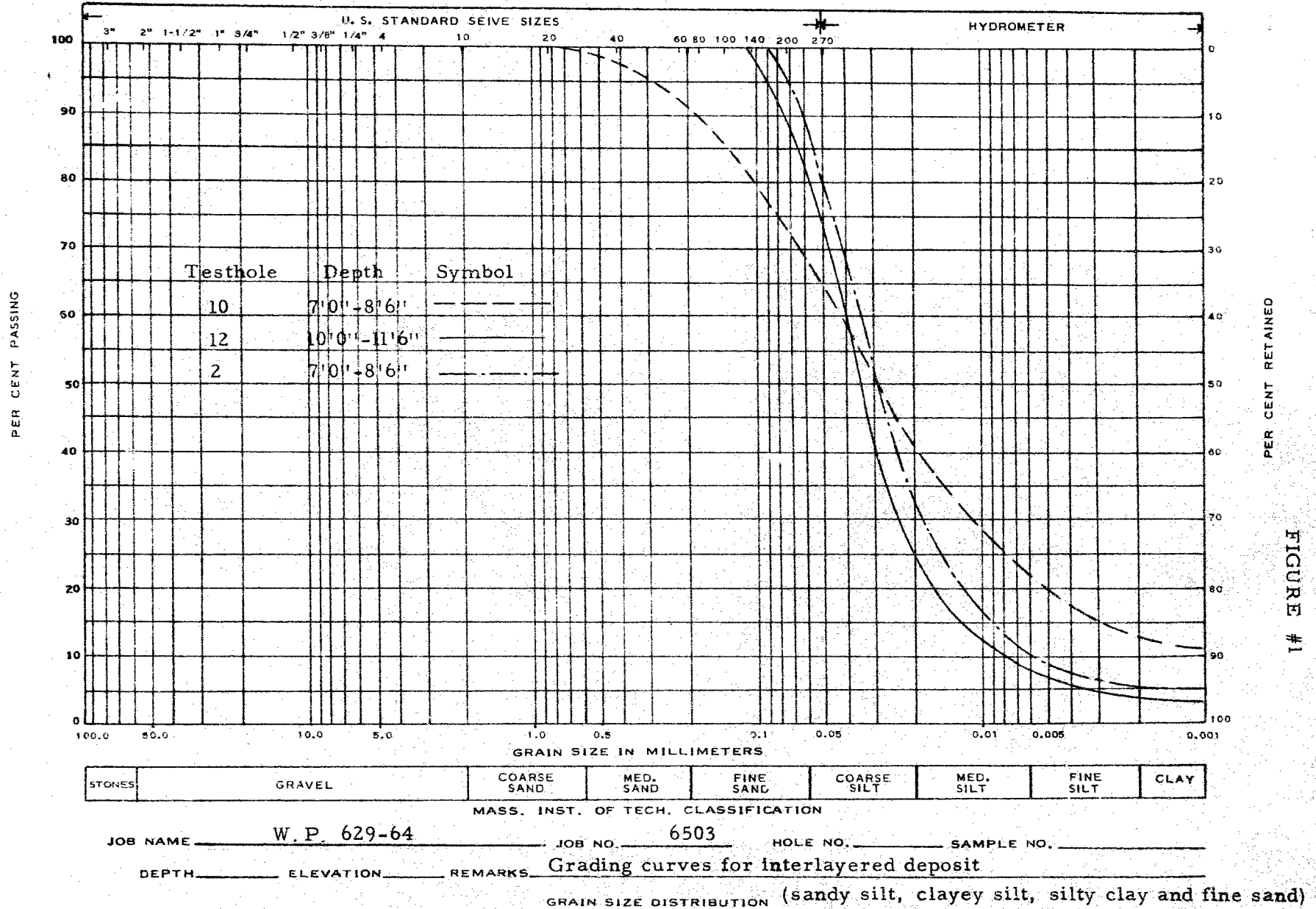
B. Lewicki, P. Eng.
Senior Soils Engineer.

C. F. Freeman

C. F. Freeman, P. Eng.
Chief Engineer.

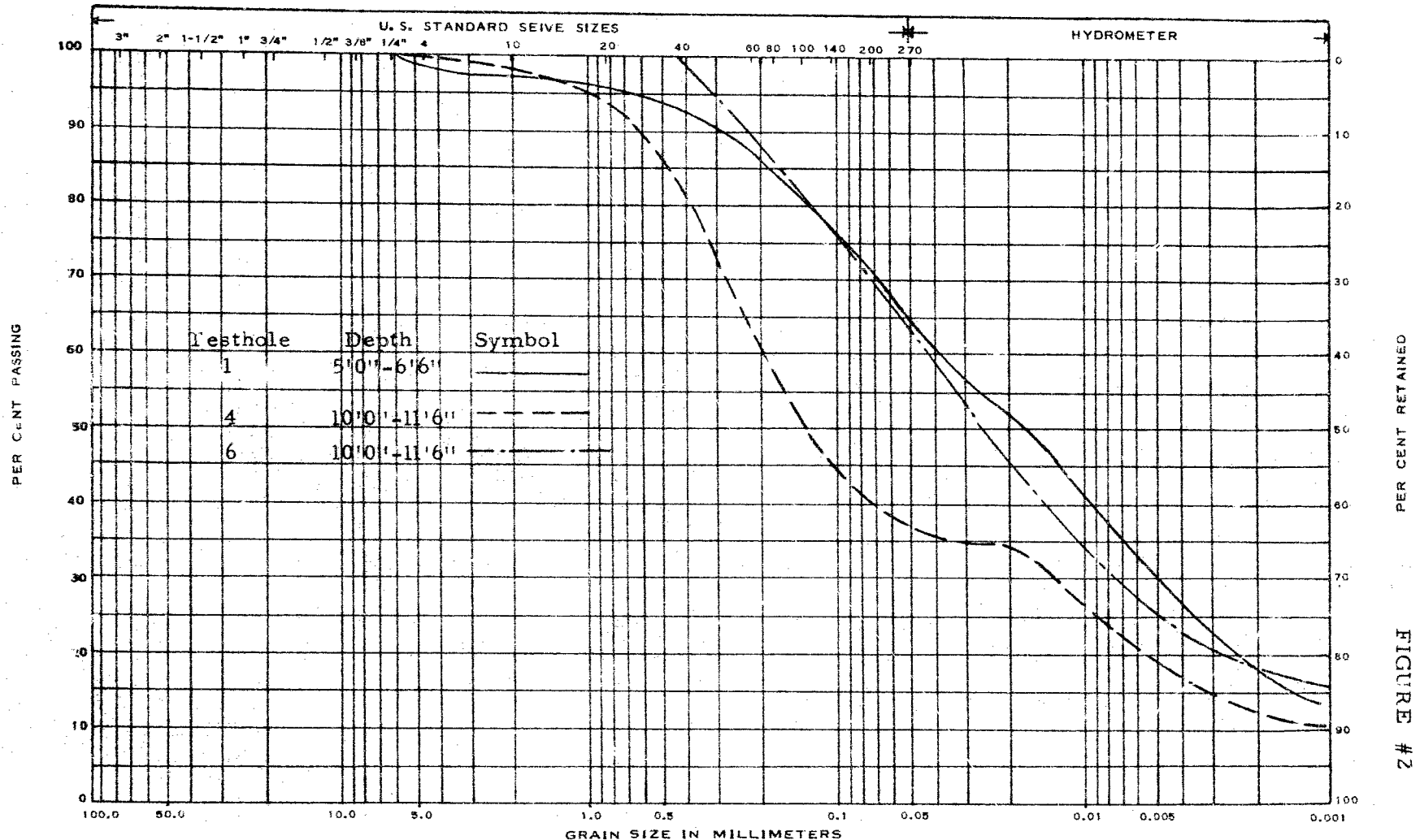
e. m. peto associates ltd.

Toronto 19, Ontario



e. m. peto associates ltd.

Toronto 19, Ontario



PER CENT RETAINED

FIGURE #2

STONES	GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
--------	--------	-------------	-----------	-----------	-------------	-----------	-----------	------

MASS. INST. OF TECH. CLASSIFICATION

JOB NAME W.P. 629-64

JOB NO. 6503

HOLE NO. _____ SAMPLE NO. _____

DEPTH _____ ELEVATION _____ REMARKS Grading curves for silt till

GRAIN SIZE DISTRIBUTION

UNCONFINED COMPRESSION TEST DATA SHEET

FIGURE 3

Borehole #	Sample #	Depth	M. C. %	Density, p. c. f. Wet Dry	Degree of Saturation %	Void Ratio c	% Strain At Failure	U/C Shear Strength psf
12	8	23'6"-24'	18.2	137.0 115.8	100	.500	20.0	3600
2	9	27'-29'6"	16.8	136.0 116.3	96.0	.448	15.0	960
2	11	32'-34'6"	15.4	132.0 114.2	88.0	.475	10.0	940
10	10	28'-29'6"	18.5	129.0 109.0	89.0	.543	5.0	2900
4	8	22'6"-24'6"	16.8	135.8 116.0	100	.455	20	1280 X

X Triaxial quick undrained test

PLASTICITY CHART

Job # G503
e.m. peto associates ltd

- INTERLAYERED SANDY SILT, CLAYEY
- SILT, SILTY CLAY & FINE SAND.
- SALT TILL

PLASTICITY INDEX

20

10

0

10

20

30

40

CL

CL

SF

ML

A-Line

LIQUID LIMIT

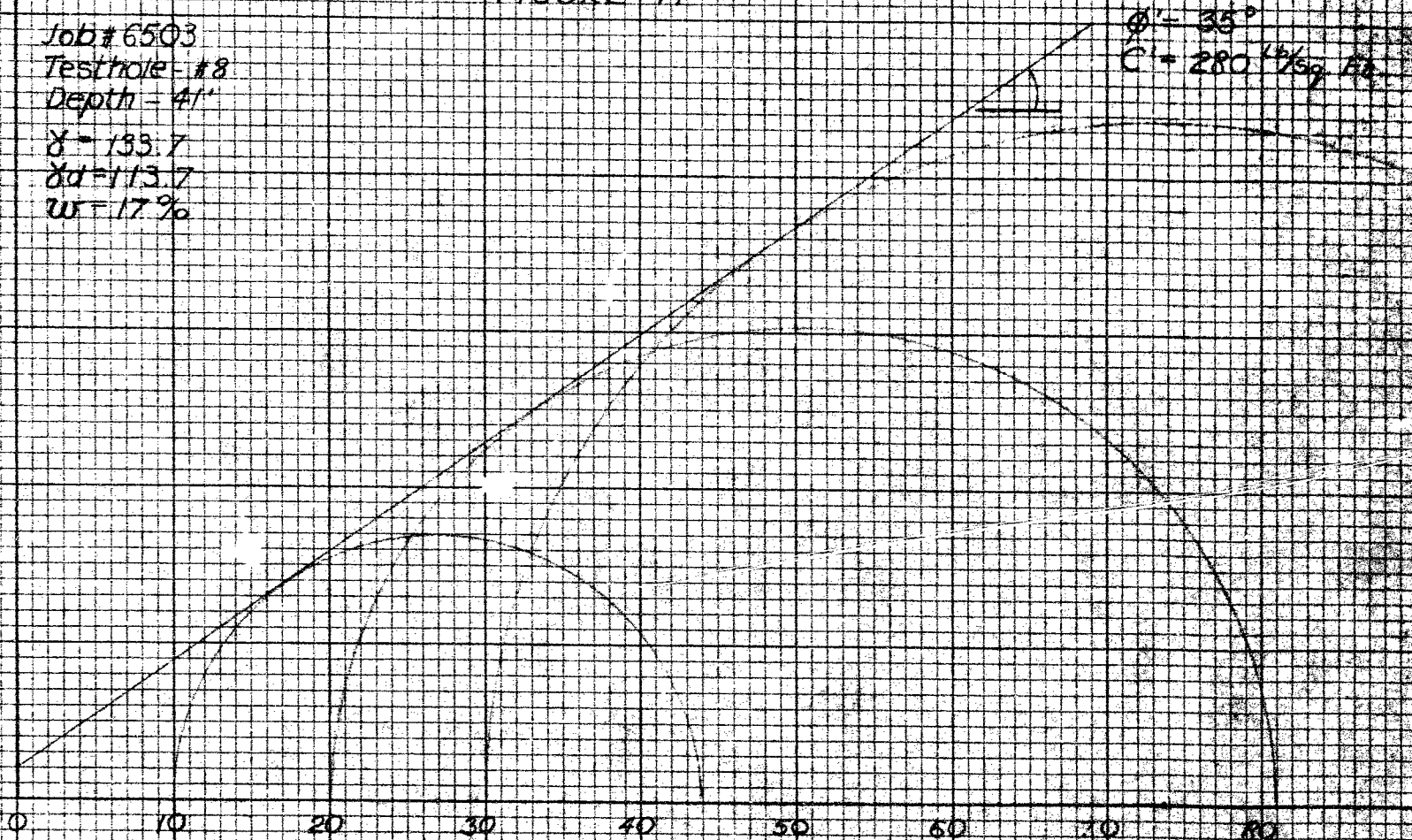
FIG. No 3A

TRIAXIAL COMPRESSION TEST
CONSOLIDATED DRAINED STAGE LOADING

FIGURE 4.

Job # 6503
Test hole - #8
Depth - 41'
 $\gamma = 133.7$
 $\gamma_d = 113.7$
 $w = 17\%$

$\phi' = 35^\circ$
 $C' = 280 \text{ lb/sq. ft.}$

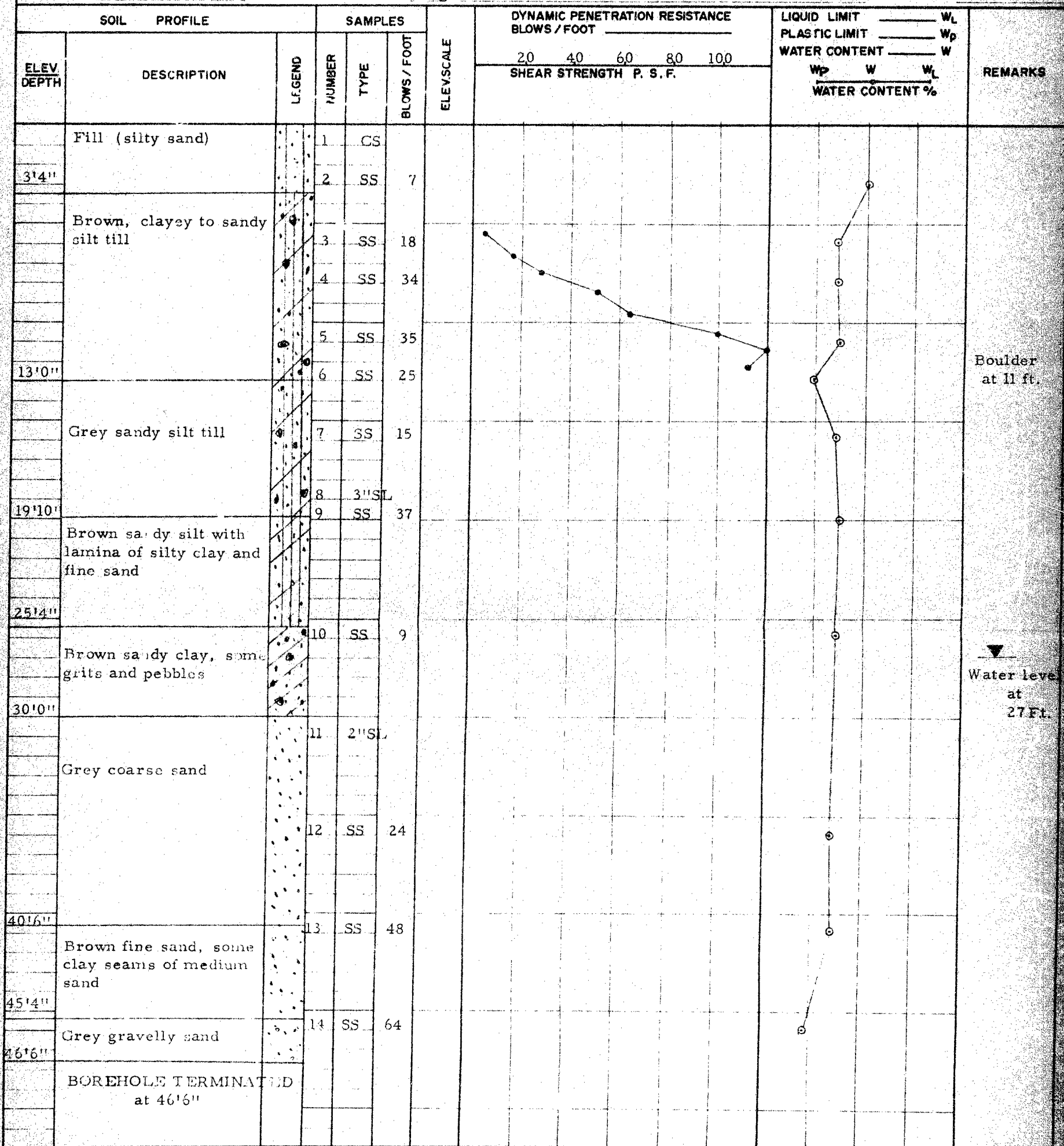


e. m. peto associates ltd.

RECORD OF BOREHOLE NO. 1

Consulting soil engineers

JOB NO. 6503 JOB NAME Kitchener- Waterloo Expressway System W. P. 629-64 TECHNICIAN
 BORING DATE Jan 19, 1965 CLIENT D. H. O. ENGINEER B. L.
 DATUM 1125.6 BOREHOLE TYPE Auger TYPED BY V. M.



e.m.peto associates ltd.

Consulting soil engineers

RECORD OF BOREHOLE NO. 2

JOB NO. 6503

JOB NAME Kitchener - Waterloo Expressway System W.P. 629-64

TECHNICIAN

BORING DATE Feb. 9-11/65

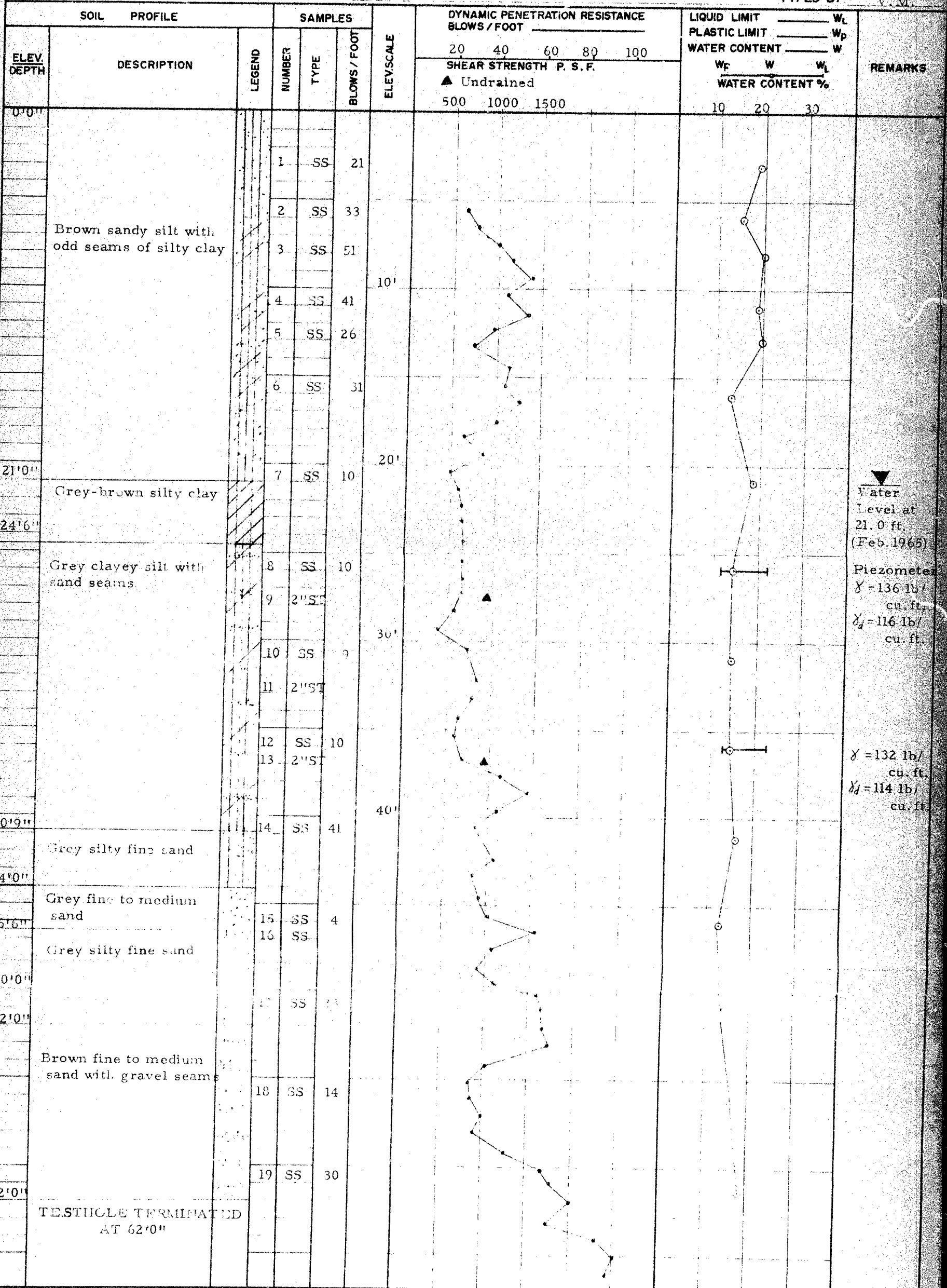
CLIENT D. H. O.

ENGINEER B. L.

DATUM 1118.0

BOREHOLE TYPE 4" + BX

TYPED BY V.M.



e.m.peto associates ltd.

RECORD OF BOREHOLE NO. 3

Consulting soil engineers

JOB NO. 6503

JOB NAME Kitchener-Waterloo Expressway System

TECHNICIAN

BORING DATE Jan. 20-21/65

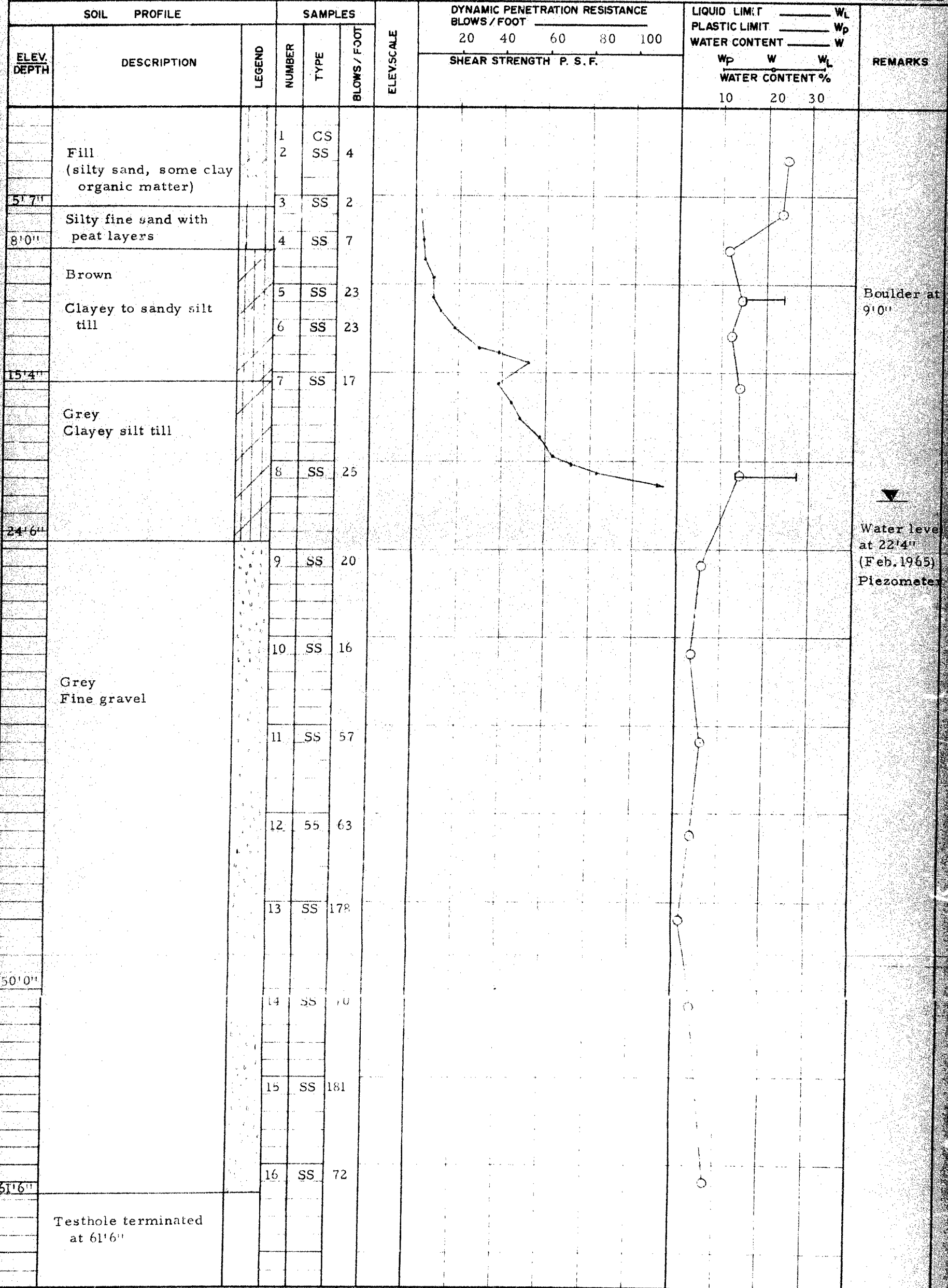
CLIENT Department of Highways, Ontario

ENGINEER B. L.

DATUM 1120.7

BOREHOLE TYPE Auger

TYPED BY H. F.



JOB NO. 6503

JOB NAME Kitchener-Waterloo Expressway System

TECHNICIAN

BORING DATE Jan. 22-29/65

CLIENT Department of Highways, Ontario

ENGINEER B. L.

DATUM 1115.6

BOREHOLE TYPE Auger

TYPED BY HF

SOIL PROFILE			SAMPLES			ELEVSCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT _____ W_L PLASTIC LIMIT _____ W_P WATER CONTENT _____ W			REMARKS
ELEV. DEPTH	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	W_P	W	W_L	
							SHEAR STRENGTH P. S. F.								
							▲ Triaxial quick undrained								
							500	1000	1500	2000	2500				
3'2"	Fill		1	SS	14										
	Grey brown Sandy silt till		2	SS	28										
7'6"			3	SS	26										
			4	SS	19										
12'0"	Grey brown		5	SS	24										
14'0"			6	SS	13										
	Grey Silty sand till		7	SS	3										
20'0"			8	3" ST											
	Grey Interlayered Silty clay, silt and fine sand		9	SS	15										
			10	SS	22										
			11	SS	13										
38'0"			12	SS	16										
	Grey brown sandy silt		13	SS	10										
44'0"			14	SS	15										
	Brown to grey-brown Fine to med. sand Odd seams of clayey silt		15	SS	58										
50'0"			16	SS	27										
			17	SS	89										
58'6"	Grey-brown medium to coarse sand with gravel layers		18	SS	65										
			19	SS	44										
75'3"			20	SS	62										
	Grey - brown sandy silt		21	SS	84										
80'6"															
	Grey silty clay till														
86'3"															
	Testhole terminated at 86'3"														

Water level
19'6"

$\gamma = 135 \text{ lb/cu ft}$
 $\gamma_s = 116 \text{ lb/cu ft}$

Water lev
19'6"
 $\gamma = 135 \text{ lb/cu.}$
 $\gamma_s = 116 \text{ lb/cu.}$

e. m. peto associates ltd.

RECORD OF BOREHOLE NO.

5

Consulting soil engineers

JOB NO. 6503

JOB NAME Kitchener-Waterloo Expressway System
WP 629-64

TECHNICIAN

BORING DATE Feb. 12, 13/65

CLIENT Department of Highways, Ontario

ENGINEER BL

DATUM 1121.9

BOREHOLE TYPE 4" + BX

TYPED BY HF

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT _____ W _L PLASTIC LIMIT _____ W _p WATER CONTENT _____ W			REMARKS
ELEV. DEPTH	DESCRIPTION	LEGEND	NUMBER	TYPE		20	40	60	80	100	W _p	W	W _L	
						SHEAR STRENGTH P. S. F.					WATER CONTENT %			
											10	20	30	
	Fill (fine sand with clay, organic content)		1	SS	6									
6'2"			2	SS	8									
	Dark brown Organic silt		3	SS	5									
9'0"			4	SS	33									
	Grey brown Clayey silt till		5	SS	31									
14'0"			6	SS	32									
	Grey Fine sand with silt seams		7	SS	12									
			8	2" ST										
26'0"			9	SS	15									
	Grey Medium to coarse sand Odd seams of clayey silt		10	SS	56									
			11	SS	40									
36'8"			12	SS	16									
	Grey Silty fine sand Odd grigs		13	SS	10									
40'6"														
	Grey sandy silt													
47'0"														
	Borehole terminated at 47'0"													

Water level

21'9"

RECORD OF BOREHOLE NO. 6

Consulting soil engineers

JOB NO. 6503

JOB NAME Kitchener-Waterloo Expressway System
WP 629 - 64

TECHNICIAN

BORING DATE Jan 29, Feb 1

CLIENT Department of Highways, Ontario


ENGINEER BL

DATUM 1, 118.2

BOREHOLE TYPE Auger

TYPED BY HF

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT _____ W _L PLASTIC LIMIT _____ W _P WATER CONTENT _____ W			REMARKS
ELEV. DEPTH	DESCRIPTION	LEGEND	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	W _P	W	W _L	
	Fill (sandy silt with grits and pebbles)		1	SS	6										
4'11"			2	SS	19										
	Brown sandy silt grits, pebbles with sand seams and layers of clay (till)		3	SS	28										
			4	SS	29										
			5	SS	21										
14'0"			6	SS	28										
	Brown Fine to medium sand		7	SS	50										
			8	SS	40										
30'4"			9	SS	83										
	Light grey Silty sand		10	SS	54										
36'2"															
	Grey, Silty clay till		11	SS	58										
41'6"															
	Borehole terminated at 41'6"														


 Water level
19'6"

TECHNICIAN

ENGINEER B. L.

TYPED BY HF

JOB NO. 6503

JOB NAME Kitchener-Waterloo Expressway System

WP-629 - 64

TECHNICIAN

BORING DATE Feb. 4/65

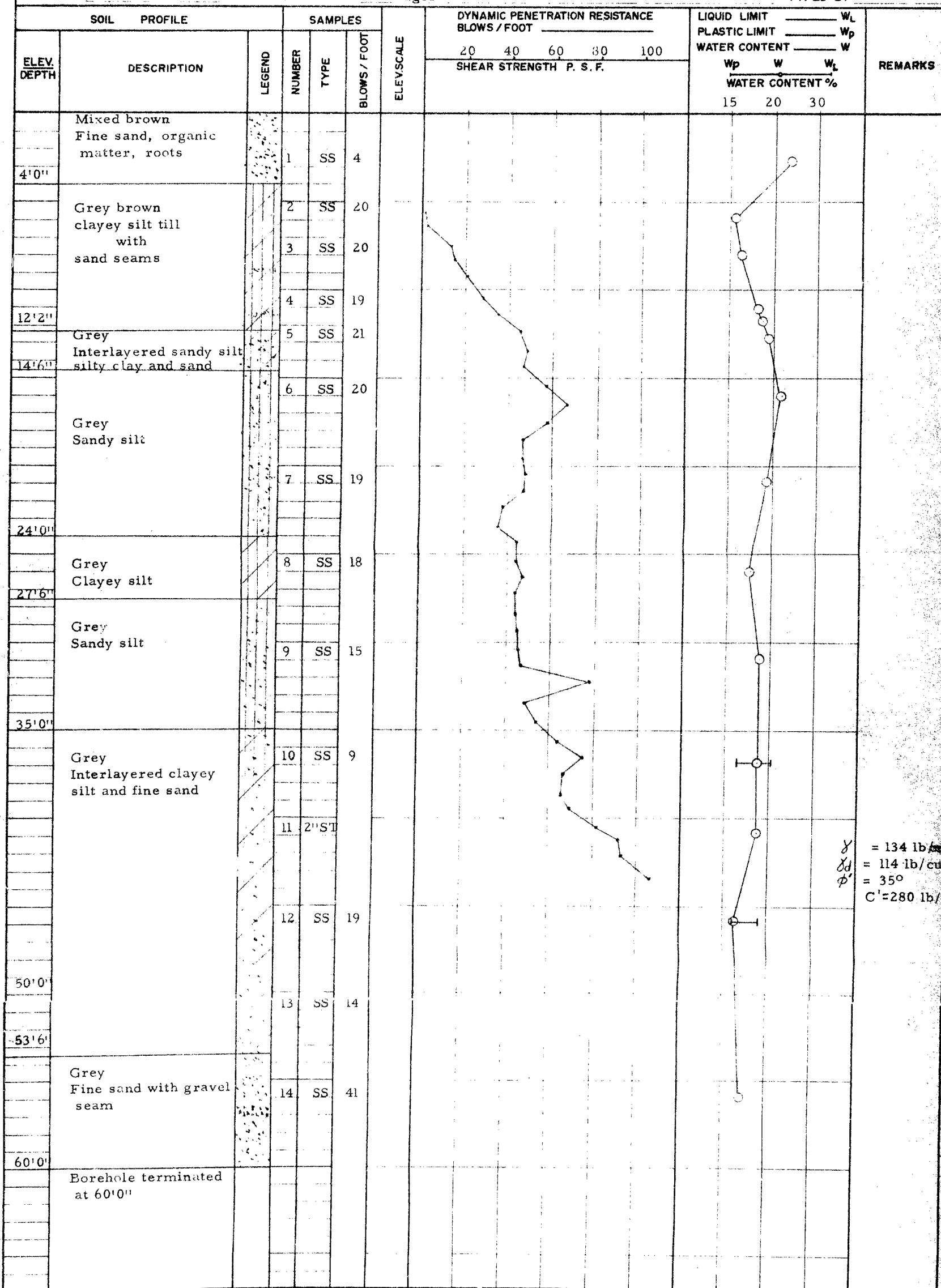
CLIENT Department of Highways, Ontario

ENGINEER BL

DATUM 1121.4

BOREHOLE TYPE Auger

TYPED BY HF



MEMORANDUM

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

FROM: Bridge Division,
Downsview, Ontario.

DATE: December 28, 1964.

OUR FILE REF.

IN REPLY TO

SUBJECT: Fischer Drive Underpass
Kitchener Waterloo Expressway
Henry Sturm Blvd.
W.P. 629-64
District 4

P 270

Enclosed please find an air photo of the site for the proposed structure with the probable line and location of footings marked in red.

The City of Kitchener plans to reconstruct Fischer Drive prior to the construction of the Expressway. It is intended to build the structure during the reconstruction of Fischer Drive. No plans are available for the Expressway, but, in the interval taken for the Foundation Investigation, plans will become available. The Bridge Office will then be able to complete the design of the bridge allowing its construction to be co-ordinated with the work done on Fischer Drive.

Would you kindly arrange a foundation investigation at the site and provide us with the information necessary to design the new bridge.

We would be pleased to assist in locating the site in view of the lack of plans. Mr. F. E. Loscombe of Engineering Survey, London Region, should be contacted in order that he tie down the boreholes, preferably, before the boring crew leaves the site.

W. S. Melinyshyn

WSM/sp

W. S. Melinyshyn,
Regional Bridge Location Engineer.

cc. R. Fitzgibbon
N. D. Smith

LOG GIVEN TO E. H. PETER ASSOC
JAN 5. 1965 REGISTERED
LETTER OF AUTHORITY

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

Materials and Testing Division

January 6, 1965

E. M. Fete Associates Ltd.,
1287 Caledonia Road,
Toronto 19, Ontario.

Attention: Mr. E. M. Fete

Re: W.F. 629-64, Kitchener-Waterloo Expressway, Fischer Drive
Underpass, Henry Sturt Blvd., District 4, Hamilton, Ont.

Dear Sir:

Please consider this your authority to carry out a foundation investigation at the above site. Plans and profiles were provided to your representative on January 5, 1965.

It is understood that a qualified Soils Engineer will be in charge of the field work at all times.

Twelve copies of the completed foundation report, with one additional copy of each subsoil profile, should be submitted to the Foundation Section as soon as possible. Previous requirements as to preliminary borehole information and laboratory testing program, should be followed.

Because the drawings accompanying the foundation reports, showing the location of borings, the inferred subsoil conditions, etc., are to become contract drawings, you are requested to prepare them in accordance with the D.E.C. standards. To enable you to do this, we are supplying you with sample drawings with all the necessary explanations, together with linen sheets for your drawings. You are also requested to provide the D.E.C. with Cronaflex copies of the drawings.

Charges for the work performed will be in accordance with your Schedule of Rates, dated December 1, 1963, and invoice to be addressed to the attention of the undersigned.

ND:/MdeF

cc: Mr. S. McCombie N. D. Smith (2)

A. Gater

E. Greenland Gen. Files

W. L. Bradley

J. Roy

Mrs. T. Tate

Yours very truly,

A. Autha,
MATERIALS & TESTING ENGINEER

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

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

Attention: Mr. E. McSweeney

March 10, 1965

FOUNDATION INVESTIGATION REPORT BY:
E. M. Peto Associates, Ltd., Toronto.
Kitchener-Waterloo Expressway --
Fischer Drive Underpass, Henry Sturt Blvd.
W.P. 629-64 -- District No. 4.

Attached, please find the above-mentioned report submitted by the Consultant, E. M. Peto & Associates Ltd.

We have reviewed the report and find the factual information well presented and adequate. Due to the relatively favourable subsoil characteristics, no problems are foreseen.

Should there be any questions in connection with this project that you would like to discuss, please feel free to call on our office.

ACS/MJEF
Attach.

cc: Messrs. A. M. Toye (2)

H. A. Tregaskes

H. D. McMillan

A. Gater

H. Greenland

J. Roy

C. A. Wong

W. L. Bradley, City Engr., Kitchener

H. M. Dillon & Co. Ltd.

Foundations Office ✓

Gen. Files

A. G. Sternac
A. G. Sternac,
PRINCIPAL FOUNDATION ENGINEER