

60-F-7-1

W.P. # 306-60-#18#2

Hwy # 403

MACKLIN ST

EXTENSION

OVERPASS

Mr. C. E. Foye,
Bridge Engineer.
Materials & Research Section.

September 4, 1960.

B.H.C. FOUNDATION INVESTIGATIONS
*J. 60-7-7a *P. 300-60-1 &
*P. 300-60-2.

ATTENTION: Mr. E. A. Schuchman.

Re: Proposed Overpass to Macklin Street Extension,
Chedoke Expressway -- District No. 4, Hamilton.

This memo accompanies our detailed foundation
report on the subsoil conditions existing at the above site.

The conclusions and recommendations to be followed
in your future design work, are summarized in the report, and
are self-explanatory.

If we can be of further assistance in connection
with this project, please feel free to contact our office.

A. C. GREGG,
Principal Geotechnical Eng.
Per.

A. C. Gregg

(A. C. GREGG,
Principal Geotechnical Eng.)

cc: Encl.
Attach.

cc: Messrs. C. E. Foye (2)
R. A. Gregor
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FOUNDATION INVESTIGATION

For

The Proposed Overpass to Macklin Street Extension
Dist. A, Bay: Chadoks Expressway.
W.P.'s. 306-60-14306-60-2 -- W.J. 60-F-7A

1. INTRODUCTION:

Presented in this report are the results of a subsoil investigation carried out at a structure location where the proposed Chadoks Expressway (at Sta. 411+75) crosses the Macklin Street Extension. At this location the elevation of the proposed Chadoks Expressway is slightly higher than the existing ground level whereas Macklin Street will be in an earth cut approximately 25ft. deep.

An initial subsoil investigation was carried out between April 26th, 1960 and May 5th, 1960, approximately 175ft. north of the above mentioned location. After completion of this investigation, and careful study of subsoil stratigraphy, it was decided to move the structure location to Sta. 411+75. Results of the initial investigation are not presented in this report but are kept for references.

The site is located in the western part of Hamilton between King St. and Longwood Road which is known at present as the sanitary fill area, owned by the City of Hamilton.

2. DESCRIPTION OF THE SITE:

Rolling topography and smooth slopes are well illustrated in the surrounding area of the structure site. The low-lying plain in this vicinity might be the bottom of an old creek which used to wander in this plain. The area is generally covered with thick vegetation.

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

At the proposed structure site the existing open sewer runs parallel to and on the east side of the proposed expressway. The water level in the open sewer observed at the time of investigation, was at approx. Elev. 245.0.

The site under consideration is generally underlain by a stratum of dense sand, overlain by topsoil only.

3. FIELD INVESTIGATION PROCEDURE:

The field work associated with this investigation was carried out on 2 separate occasions. An initial boring program consisting of 4 sampled boreholes and a second investigation consisting of 3 sampled boreholes for the changed structure location, were carried out by using Standard Skid-mounted diamond drills. Boreholes were advanced by conventional wash boring procedures and samples were recovered at depths required. In the granular material, samples were recovered by means of a 2" O.D. split-barrelled spoon sampler and in cohesive material by means of a 2" I.D. thin-walled Shelby tube sampler. The dimensions of the spoon sampler and the energy in driving it, conform to the requirements of the standard penetration test. In the case of the Shelby tubes were pushed by hand.

Dynamic cone penetration tests were carried out adjacent to each hole prior to the boring operations. Driving energy to advance the cone was 350 ft. lbs. per blow.

Water level observations were taken in each hole as the work progressed and the water level recorded at the end of the boring.

The locations and elevations of these test stations on the site plan, Drawing 64-2-7A, were established by the U.S. Army Corps of Engineers Survey Crew.

4. LABORATORY INVESTIGATION:

Samples were visually examined and classified at the site as well as in the laboratory.

Tests were carried out in the Laboratory on a selection of both disturbed, and undisturbed samples to determine:

- 1) Atterberg Limits
- 2) Natural Moisture contents
- 3) Bulk Densities
- 4) Undrained Triaxial Compression Strengths

Complete results of the laboratory tests are shown in Appendix #1 of this report.

5. SUBSOIL CONDITIONS:

5.1 General

Detailed descriptions of the various soil types encountered in each boring are shown in Appendix #1 of this report. The estimated stratigraphical profile of Drawing 60-P-7A, is based upon this information.

The subsoil consists of three main Strata:

- 1) From ground level (approx. Elev. 270.0) to about 10 to 15ft.-
Fine sand, Loose to Med. Dense, with fine to coarse gravel and occasional layers of Silty clay, brown in colour.
- 2) Below the above stratum a thick layer (approximately 20' to 30ft) consisting of Fine to Med. Sand to Silty Sand, dense to very dense with Sandy Silt Laminas.
- 3) Immediately below the sand stratum a layer of fine Sandy Silt, dense, gray was encountered.

5.1.1 FINE SAND

This material extends from ground level and varies in depth from 10 to 15 ft. The density of this layer varies from loose to Med. Dense.

5. GENERAL COMMENTS:

5.2 FINE SAND

Fine to coarse gravel is contained within this deposit in B.H. #621, and in B.H. #622 & 623, with thin seams of silty clay. In B.H. #623 a thin layer (approximately 4ft) of sandy clay, stiff, brown, is encountered below ground level.

Values of some of the physical properties are as follows:

Natural Moisture content	10 - 18% Dry weight
Penetration Resistance	5 - 19 blows/ft 120 - 130 p.c.f.

5.3 FINE TO MED. SAND TO SILTY FINE SAND

This material immediately underlies the oxidized layers and is part of the same original deposit. It varies in thickness from 30ft in B.H.#621 to 25ft in B.H.#623. This deposit is very silty in B.H. #621&623, but the content of silt is very low in B.H.#622. The lower part of this deposit contains occasional layers of sandy silt. In general, the density of this deposit varies from dense to very dense. Values of some physical properties are as follows:

Natural Moisture	11 - 22% Dry wt.
Penetration Resistance	34 - 101 blows/ft
Bulk Density	120 - 125 p.c.f.

5.4 SANDY SILT

This material immediately underlies the dense sand stratum and is observed in every boring with a varying depth of 10ft to 20ft. In general it consists mainly of coarse silt with fine sand. Pockets of sand are also present. Values of some of the physical properties of this material are as follows:

Natural Moisture	18-23% Dry wt.
Bulk Density	125 p.c.f.
Penetration Resistance	13-77 blows/ft

6. GROUND WATER OBSERVATIONS

Field observations and measurements carried out during the exploration programme, indicate that the ground water was approximately at Elev. 252.0, which is slightly higher than the water level in the open sewer. No artesian water conditions nor water bearing sand seams were encountered during the time of investigation.

Based on the borehole observations, the seepage inflow during construction, over the entire site, should be of minor quantity, and readily handled by low-capacity pumps.

7. DISCUSSION & RECOMMENDATIONS:

The profile grade of the Macklin Street Extension proposed by C. C. Parker's, is at Elev. 255.0. This is approximately 25 ft below the profile grade of the expressway. To provide for frost protection, the footings for the overpass should be placed at least 5 ft below the above mentioned elevation. Thus, the dense silty fine sand or fine to med. sand will provide adequate footing support for the proposed structure.

Based upon the average 'N' value of 40 blows/ft and the properties of the dense sand layer, it was determined that this stratum would be competent to provide sufficient bearing pressure for the support of spread footings. An allowable bearing pressure of 3 t.s.f., incorporating a factor of safety of 3, can be used for footings 6 to 8' wide.

The excavation must be carried down to 25 ft in order to place the footings, and, therefore, it is recommended that the side slopes should be 1 horizontal to 1 vertical. In this case no stability problems for side slopes are anticipated.

The water table is approximately at the same elevation as for the footings, and seepage inflow during construction can be anticipated over the entire site, depending upon the seasonal variation of water table.

7. SEEPAGE AND SETTLEMENTS: (cont'd.) ...

The quantity of seepage inflow should be small and readily handled by low-capacity pumps.

Settlements, consequent to the above footing pressure, will be within tolerable limits.

8. SUMMARY:

The strength and compressibility characteristics of the dense sand stratum are such that spread footing support can be obtained in this layer at a recommended depth of 5 ft. below profile grade of the Service Road.

For footings an allowable bearing pressure of 3 t.s.f., incorporating a factor of safety of 3, can be used. Footings should have at least a width of 6ft.

Settlements anticipated will be within tolerable limits.

Ground water conditions are such that excavations for the footings at the above recommended depth may not be dry. However any seepage inflow could be readily handled by low-capacity pumps.

It is recommended that excavations have side slopes of 2 horizontal to 1 vertical. In this case no stability problems for side slopes are anticipated.

9. MISCELLANEOUS:

The field investigation was carried out initially, by using a Dept. of Highway's skid-mounted diamond drill, and also Johnston Drilling Co. Later on, the investigation for the relocated structure was carried out using Johnston Drilling equipment during the period of June 26th to 28th, 1960.

The field investigation was supervised by M. Davara of the Foundation Section of D.H.O.

10. REFERENCES:

- 1) FOUNDATION ENGINEERING by Peck, Hanson & Thornburg

Chapter 14

Report Prepared by:

M. Davata
Project Foundation Engineer

Report Approved by:

A. Sternac
A. Sternac
Foundation Office Engineer

APPENDIX I.

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-P-7 (A)

W.P. ~~31-10-72~~ 306-60-1
546 60-2

SOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENETR RESIST. BLOWS/FT	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH PSI	UNIT WEIGHT PCF	REMARKS
21	S1	3'-4.5'	Med sand with fine to coarse gravel - loose	7	17.3	-	-	-	-	
	S2	5'-7.5'	Fine sand with traces of fine gravel - loose	5	15.9	-	-	-	-	
	S3	10'-11.5'	Silty fine sand - Med dense	19	23.2	-	-	-	-	
	S4	23'-26.5'	Silty fine sand - Dense	34	17.9	-	-	-	-	
	S5	30'-31.5'	" " " - very dense	71	20.0	-	-	-	-	
	S6	25'-26.5'	Silty fine sand with thin seams of silt - Dense	42	20.6	-	-	-	-	
	S7	30'-31.5'	Fine sand - Very dense	79	16.7	-	-	-	-	
	S8	35'-36.5'	" " "	68	17.0	-	-	-	-	
	S9	40'-41.5'	" " "	44	23.3	-	-	-	-	
	S10	45'-46.5'	Sandy silt - Med dense	18	19.5	-	-	-	-	
	S11	50'-51.5'	Fine sand with thin seams of silt - dense	30	19.3	-	-	-	-	
	S12	55'-56.5'	Fine sand and clayey silt in alternate layers	20	23.8	-	-	-	-	
	S13	60'-61.2'	Silty clay of low compressibility, stiff, grey	P	22.8	16.2	27.2	-	129.0	
	S14	65'-66.5'	Layers and laminae of silt, silty clay and fine sand	16	23.2	-	-	-	-	
	S15	70'-71.5'	Silty clay of low compressibility, stiff, grey	24	22.6	17.8	34.0	-	-	

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-E-7 (A)

W.P. ~~271-8-2~~ 904 6012

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET. RESIST. BLOWS/FT	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH P.S.F.	UNIT WEIGHT P.C.F.	REMARKS
622	81	3'-4.5'	Fine sand with sandy clay layers - loose	7	18.3	-	-	-	-	
	82	6'-7.5'	Fine to med sand - med dense	17	11.0	-	-	-	-	
	83	10'-11.5'	Layers of med sand of dense and silty clay	91	19.2	-	-	-	-	
	84	15'-16.5'	" " " "	38	23.5	-	-	-	-	
	85	20'-21.5'	Fine sand, dense	35	19.3	-	-	-	-	
	86	25'-26.5'	Fine sand, dense	35	21.2	-	-	-	-	
	87	30'-31.5'	" " very dense	78	16.4	-	-	-	-	
	88	35'-36.5'	" " "	75	18.4	-	-	-	-	
	89	40'-41.5'	" " - dense	38	21.8	-	-	-	-	
	910	45'-46.5'	Sandy silt - very dense	50	19.5	-	-	-	-	
	911	50'-51.5'	" " "	77	18.0	-	-	-	-	

SUMMARY OF FIELD & LABORATORY TESTS

JOB 60-P-7 (A)

WP ~~60-P-7 (A)~~

HOLE NO	SAMP NO	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PERCEN RESIST BLOWS FT	MOIST CONT %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH PSI	UNIT WEIGHT PCF	REMARKS
623	S1	3'-4.5'	Clay with decayed vegetation-stiff	15	18.3	18.9	30.6	-	130.0	
	S2	6'-7.5'	Layers of fine sand and silty clay	31	17.2	-	-	-	-	
	S3	10'-11.5'	Fine to coarse sand with silt - dense	70	10.4	-	-	-	-	
	S4	15'-16.5'	Fine sand - very dense	106	11.4	-	-	-	-	
	S5	20'-21.5'	Layers of sandy silt and fine sand - very dense	88	15.7	-	-	-	-	
	S6	25'-26.5'	Silty fine sand - very dense	76	17.3	-	-	-	-	
	S7	30'-31.5'	Fine sand - very dense	101	15.5	-	-	-	-	
	S8	35'-36.5'	Silty fine sand, very dense	59	21.1	-	-	-	-	
	S9	40'-41.5'	" " "	82	18.1	-	-	-	-	
	S10	45'-46.5'	Fine sand, very dense	66	20.2	-	-	-	-	
	S11	50'-51.5'	" "	76	30.7	-	-	-	-	
	S12	55'-56.5'	" " " "	145.9"	-	-	-	-	-	
			S denotes split spoon sample							
			T " Shelby tube							

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

306-60-1

306-60-2

W.P. ~~291-70-2~~ BORE HOLE NO 621

JOB 60-7-7 (A) STATION 411/75 (70' L4)

DATUM G. S. C. COMPILED BY B. K.

BORING DATE June 20/60. CHECKED BY J. B.

2 1/4" SPLIT TUBE

2 1/4" SPLIT TUBE

2 1/4" SPLIT TUBE

2 1/4" SPLIT TUBE

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2 1/4" SPLIT TUBE

+ G. L. 269.0

Loose brown sand with fine to coarse gravel.

261.0

Medium to very dense brown silty fine sand with sandy silt laminae.

W.L. 250.0

227.0

Medium gray fine sandy silt.

216.0

Layers and laminae of silty clay silt and fine sand.

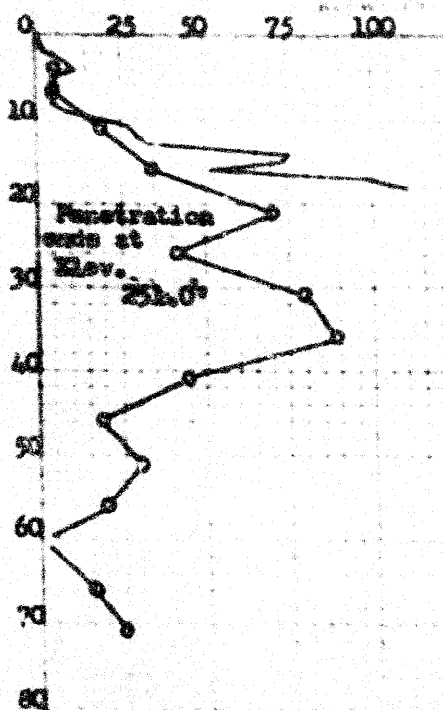
202.0

Stiff gray silty clay.

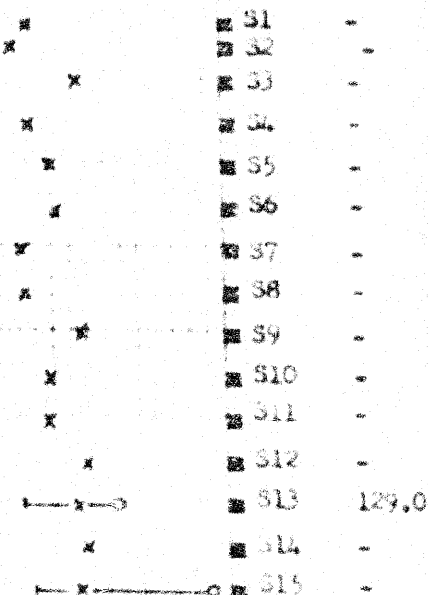
197.5

End of Borehole

Penetration Resistance Profile shown obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with energy equal to 150 ft./lbs. per blow.



10 20 30



DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

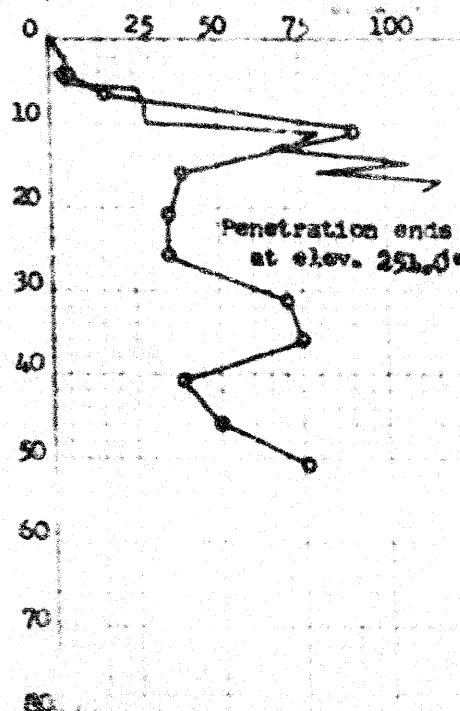
DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS AND RESEARCH SECTION

406-60-1
 306-60-2
 W.P. ~~231-50-2~~ BORE HOLE NO. 622
 JOB 60-P-7 (A) STATION 412+00 E
 DATUM G. S. C. COMPILED BY B. K.
 BORING DATE June 22/60. CHECKED BY J. B.

DEPTH FEET	DESCRIPTION	ELEVATION FEET
0	↓ G. L.	269.0
	Sandy clay stiff, brown	265.0
	Fine sand with layers of silty clay. Med. to dense, brown.	
		252.0
	Fine sand. Dense to v. dense, br.	
		226.0
	Silty sand, very dense, grey.	
		217.5
	End of Borehole.	

Penetration Resistance Profile shown
 obtained by driving a 2" dia. cone
 from ground surface to depth noted.
 Cone driven with energy equal to
 350 ft./lbs. per blow.



10 20 30

51	-
52	-
53	-
54	-
55	-
56	-
57	-
58	-
59	-
60	-
61	-

DEFECTS IN NEGATIVE DUE TO
 CONDITION OF ORIGINAL DOCUMENT

DEPARTMENT OF HIGHWAYS - ONTARIO
 MATERIALS AND RESEARCH SECTION

W.P. ~~201-1002~~ ²⁰⁶⁻⁶⁻¹ ~~306-6-2~~ BORE HOLE NO. 623
 JOB 60-P-7 (A) STATION 411+75 (65' R.L.)
 DATUM G. S. C. COMPILED BY B. K.
 BORING DATE June 23/60. CHECKED BY J. B.

2" DIA. SPLIT TUBE
 2" SHEATH TUBE
 2" SPLIT TUBE
 2" SPLIT TUBE
 2" SHEATH
 CASING

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	60. L.	272.0	0
	Brown fine sand with layers brown silty clay.	264.0	10
	Very dense brown silty sand with sandy silt, and silty clay laminae.		
	M.L. $\frac{1}{2}$	250.0	20
		247.0	
	Very dense grey-brown fine sand becoming silty fine sand.		
		220.0	50
	Grey silty sand with clay layers.	215.5	60

End of Borehole.

Penetration Resistance Profile shown obtained by driving a 2" dia. cone from ground surface to depth noted. Cone driven with energy equal to 350 ft.-lbs. per blow.

STRENGTH AND PENETRATION RESISTANCE

25 50 75 100

10 20 30

Penetration ends at elev. 254.7'

45

60

70

80

90

100

110

120

130

140

150

160

170

180

190

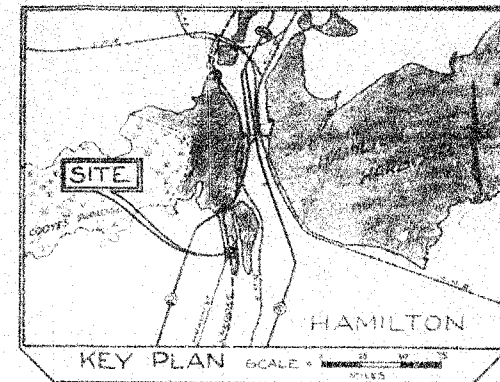
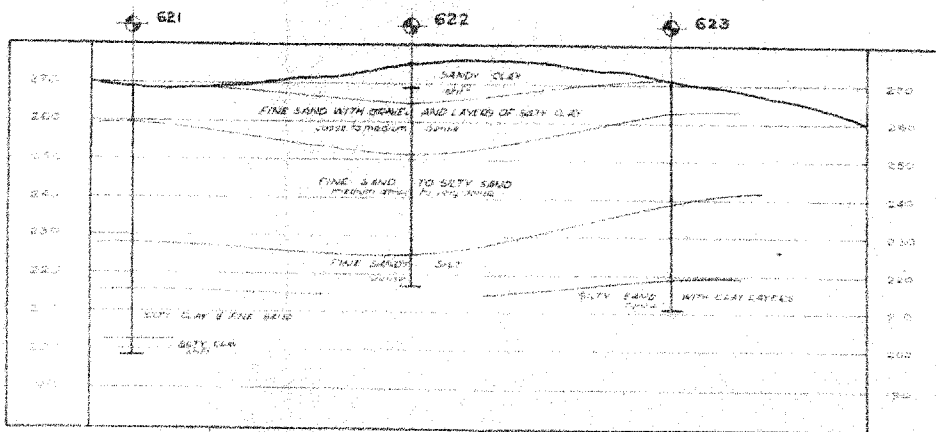
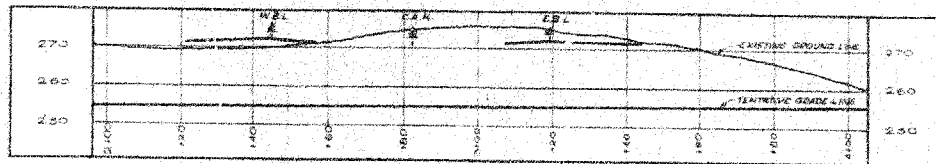
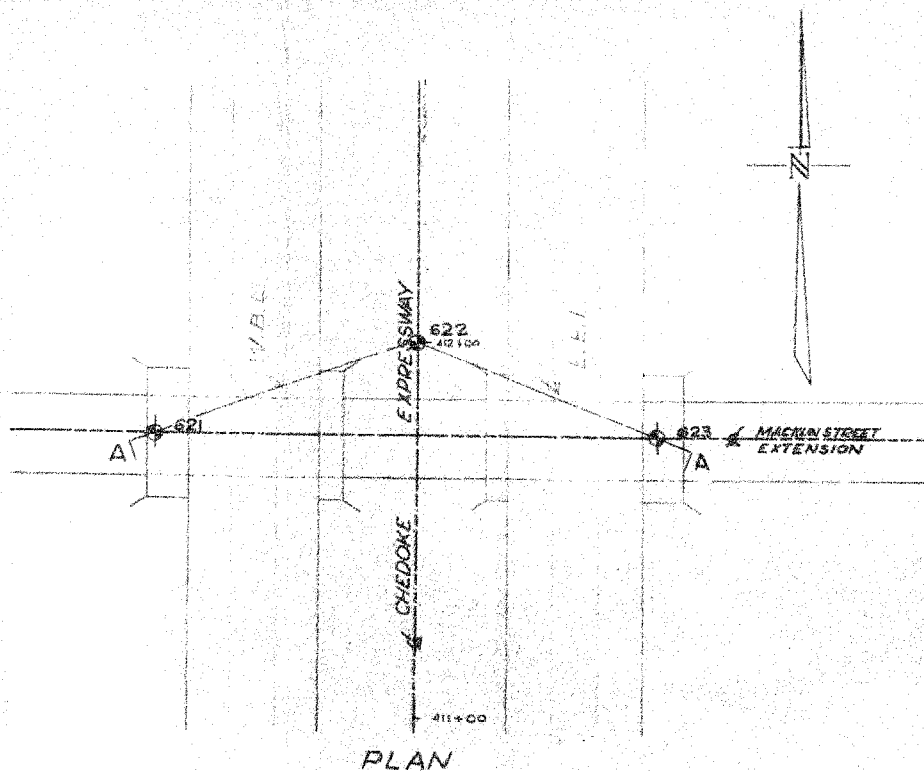
200

210

220

230

DEFECTS IN NEGATIVE DUE TO CONDITION OF ORIGINAL DOCUMENT.



LEGEND				
BORE & PENETRATION HOLE				
NO.	ELEVATION	STATION	CHANCE POINT	
621	2690	411+75	70' LT	
622	2690	412+00	¢	
623	2720	413+75	66' RT	

NOTE:
THE BOUNDARY BETWEEN SOIL STRATA MUST BE ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLE THE SUBSTRATA ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE CHANGE.

DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & MEMORANDUM SECTION			
MACKLIN STREET EXTENSION			
INDICATING POSITIONS & ELEVATIONS OF HOLES			
NO. 405	DATE 4	BY WENTWORTH	
LOCATION HAMILTON	CHANGED BY	DATE 23-5-7	
APPROVED BY	DATE 23-5-7	APPROVED BY	
SCALE 1 INCH = 100 FEET			