

BA 3013
Dte 37-101



TORONTO & YORK ROADS COMMISSION
BOX 296
NEWMARKET, ONTARIO

FOUNDATION INVESTIGATION
PROPOSED GRADE SEPARATION
C.N.R. - MILEAGE 19.55 AND KEELE STREET
NORTH OF MAPLE, ONTARIO

Project: J3085

July, 1966

William Trow Associates Limited

90 Milvan Drive
Weston, Ontario
749-1290

William Trow

Project: J3085

Soil Mechanics
Consultants
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Associates Ltd.

Toronto & York Roads Commission,
Box 296,
Newmarket, Ontario.

July 21, 1966

Attention: Mr. J. Cox, P.Eng.

Foundation Investigation
Proposed Grade Separation
C.N.R. - Mileage 19.55 and Keele Street
North of Maple, Ontario

Dear Sirs:

In conformance with your authorization of mid-June
a subsoil investigation has been completed at the above site
for a proposed grade separation.

We understand that an overhead type grade separation
is contemplated for this railway crossing although decisions
on this matter have not been finalized. Therefore our appraisal
of foundation requirements therefore will be based on the
assumption that either an overhead or subway will be considered.

Our findings and recommendations resulting from the
field work are briefly summarized in the following paragraphs.

1) The site is underlain generally by very dense silt till to
a depth of 30 to 40 feet which in turn is underlain by dense
sand to a proven depth of 50 feet (approximate El 840 feet).



The till is overlain by comparatively loose silt and sand to a depth of about 5 feet in areas outside the roadway embankment and by up to 15 feet of loose cohesive sandy silt in the area of this embankment. The upper few inches of natural silt till below this embankment was found to be softened somewhat by seepage from the loose fill above.

2) No ground water of consequence was encountered within the proposed construction area. Some minor seepage from thin sand seams at depths of from $4\frac{1}{2}$ to 36 feet was noted but no problems during construction are envisaged. The ground water table exists in the dense sand stratum at approximate El 845 feet.

OVERHEAD STRUCTURE

3) The approach embankments for an overhead structure will reach a height of approximately 26 feet above the present track level, and some 34 feet or more above the ground surface to the north and south of the railway. Considering the existence of the very dense silt till at shallow depth, no stability problem exists in the construction of the approach embankments if side slopes of 2 horizontal to 1 vertical are used.

4) Settlement will be due, mainly, to the elastic compression of the till. Total settlement will be well within the tolerances



of the structure (i.e. less than 1 inch).

5) It is recommended that a safe net bearing pressure of 4 tsf be used for footings founded in the dense silt till about 2 to 3 feet below the overlying fill. Alternatively because the loose fill over the till, extends to a depth of about 11 feet at the existing crossing, support of the abutments on piles driven through the embankment fill and existing fill may be desired. Refusal to cylindrical piles should be reached after shallow penetration into the silt till. The safe load per pile will equal its permissible structural capacity when considered as a short column.

6) The earth pressure, p , exerted at any depth, h , against the backs of closed abutments or wing walls, by the fill, assuming free-draining material, will be given approximately by the expression:

$$p = 0.25 \gamma h$$

where: γ = 120 pcf is the unit weight of drained granular backfill

and 0.25 is the estimated earth pressure coefficient believed to be applicable for this situation

In computing the resistance to sliding under this horizontal loading a sliding resistance on the underside of



the footing of:

$$R = 0.7 N$$

should be assumed where N is the normal reaction. By extending the footing under the fill the value of N can be increased by the weight of the fill.

SUBWAY STRUCTURE

- 7) If a subway type grade separation is decided upon the footings for it may be supported on the dense till and designed for a safe net bearing stress of 4 tsf in the natural silt till.
- 8) Excavations in the silt till to the depths required for a subway type grade separation should be relatively straightforward, with only a few wet sand seams being encountered. The flow from these layers should be quite minor and will probably cease within a day or so after the excavation has been opened.
- 9) The sides of any excavation may be safely sloped at an angle of 60 degrees with the horizontal. Some minor sloughing of the sides may occur in the vicinity of the wet seams but the slopes will stabilize once this flow has stopped. Temporary



shoring may be used as an alternative to sloped sides if they are designed for the lateral pressure as estimated from the expression given above.

10) The subgrade surface of the roadway should be crowned with a centre-to-edge slope in the order of 4 inches in 10 feet. Drainage tile, covered top and sides first by 6 inches of pea gravel and then by 12 inches of concrete sand, and laid on a 2 inch thick bed of pea gravel, should be placed in shallow ditches along each side of the roadway. The tile should lead to a positive frost-free sump or catch basin.

11) The earth pressure against the walls of the subway and the sliding resistance available along the base will be similar to the values indicated in item 6 for the overhead structure.

Details regarding investigation methods are indicated in the paragraphs which follow.

FIELD WORK AND SUBSOIL STRATIGRAPHY

The field work consisted of 5 sampled borings, taken to depths of 35 to 50 feet, and advanced with continuous flight auger equipment. The locations of the boreholes, relative to the existing level crossing are shown on Dwg. 1. Samples of



the subsoil were obtained with a split-spoon sampler at regular intervals as the boreholes were advanced. The split spoon sampler was driven into the subsoil with an energy which conforms to the requirements of the standard penetration test. A dynamic penetration cone was driven near Borehole 2 to further determine the depth of existing roadway fill. Water levels were observed on completion of the boreholes and after some time.

The subsoil at the site consists of a deposit of dense silt till some 30 to 40 feet thick which is underlain by dense fine sand. The dense till is overlain by relatively loose deposits of sand and silt to a depth of about 5 feet outside the existing roadway embankment. The boreholes located at the shoulder of the roadway revealed loose cohesive sandy silt till to a depth of up to 15 feet overlying the silt till. This fill was quite moist from surface runoff, and the natural silt till below was also moist and somewhat loosened for a depth of about 5 feet below the fill. The detailed results of the field work are contained in the boring logs, Dwg. 2 to 6, and also on an interpreted subsoil stratigraphy included on Dwg. 1.

Some perched ground water was encountered in various sand seams to a depth of about 36 feet. The flow from these wet seams should be minor during excavation and should cease after about a day or less. The ground water table is located in the



dense sand at a depth of about 45 feet (approximate El
845 feet).

The borehole elevations are referred to a benchmark
supplied, having an El of 893.01 feet and described on Dwg. 1.

If you have any queries regarding the contents of
this report, please do not hesitate to contact this office.

Yours very truly,

William L. White, M.Eng.

WLW/bs

Encls.

Dist:- Toronto & York Roads (3)

Bwhank, Pillar and Assocs.

Ltd., (2)

120 Eglinton Ave.E.,

Tor.12, Ont.


Att: Mr.Bemrose


17 1000
William A. Trow, P.Eng.


LEGEND

BOREHOLE NO. 1.
PROJECT PROPOSED GRADE SEPARATION
LOCATION KEELE STREET NORTH OF MAPLE
HOLE LOCATION See Dwg. 1
HOLE ELEVATION 889.4 ft.
DATUM See Dwg. 1


PENETRATION RESISTANCE


2" O.D. SPLIT TUBE 


2" I.D. SHELBY TUBE 

2" DIA. CONE 

SHEAR STRENGTH

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 

UNCONFINED COMPRESSION 

VANE TEST AND SENSITIVITY 

NATURAL MOISTURE CONTENT
AND LIQUIDITY INDEX

ATTENDING LIMITS

LIQUID LIMIT

PLASTIC LIMIT

SAMPLE TYPE

2 Q D SPLIT TUBE
2 Q D SHELBY TUBE
1 Q D SHELBY TUBE

SYMBOL	SOIL DESCRIPTION	ELEV FEET	DEPTH FEET	PENETRATION RESISTANCE		350 FT. LB BLOWS FT 80	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO	NATURAL UNIT WEIGHT P.C.F.
				2	40				
	TOPSOIL - 6 INCHES	889.4	0						
	SANDY SILT-slightly cohesive, loose, brown, some topsoil stains & roots, 1" sand seam at 4 1/2 ft., wet.	883.9							
	SILT TILL-slightly cohesive, numerous sand and fine to medium gravel sizes, very dense, brown, dry becoming slightly moist with depth.		10						
	-SAND layer at approx. 15-17 ft. dry, dense.		20						
		859.4	30						
	SAND-silty, fine, brown, very dense, slightly moist to 46 1/2 ft. then wet.		40						
		843.	50						
	End of Borehole	838.4	60						
Notes:	1) Hole uncased for full depth and advanced by continuous flight augering methods.		70						
	2) Hole open to 47.0 ft. on completion, water level at 47.0 ft.		80						
	3) Hole open to 47.2 ft. and water level at 46.3 ft. after 15 hrs. Caved and dry at 48 ft. after weeks.		90						
			100						
			110						

LEGEND

PENETRATION RESISTANCE

SHELLY TUBE

SHELLY TUBE

SHELLY TUBE

SHELLY TUBE

SHELLY TUBE

SHELLY TUBE

SHELLY TUBE

SHELLY TUBE

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SHELLY TUBE

NATURAL MOISTURE CONTENT
AND LIQUIDITY INDEX

ATTERBERG LIMITS

LIQUID LIMIT

PLASTIC LIMIT

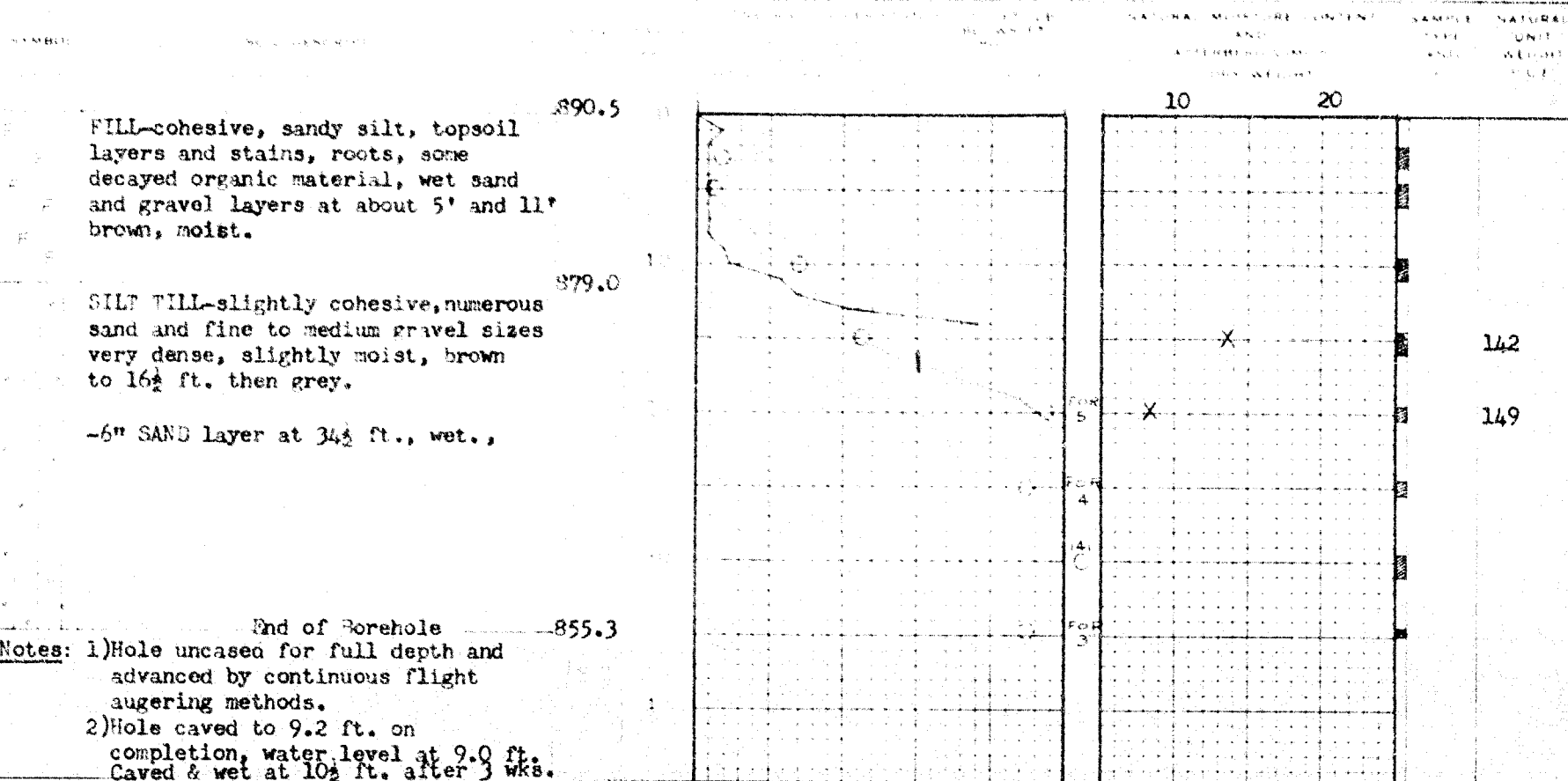
SAMPLE TYPE

2" D. SHELBY TUBE

2" D. SHELBY TUBE

2" D. SHELBY TUBE

2.
PROJECT PROPOSED GRADE SEPARATION
LOCATION KEELE STREET NORTH OF MAPLE
ELEVATION See Dwg. 1
ELEVATION 890.5 ft.
DATE See Dwg. 1



- Notes: 1) Hole uncased for full depth and advanced by continuous flight augering methods.
2) Hole caved to 9.2 ft. on completion, water level at 9.0 ft. Caved & wet at 10 1/2 ft. after 3 wks.

3) Dynamic penetration cone driven 9' south of B.H. 2

BOREHOLE NO. 3.
PROJECT. PROPOSED GRADE SEPARATION
LOCATION. KEELE STREET NORTH OF MAPLE
HOLE LOCATION. See Dwg. 1
HOLE ELEVATION. 894.8 ft.
DATUM. See Dwg. 1

PENETRATION RESISTANCE
2.50 SPLIT TUBE $\circ - \circ - \circ - \circ$
2.50 SHELBY TUBE $\bullet \bullet \bullet \bullet$
DIA. CONE $\bullet \bullet \bullet \bullet$
SHEAR STRENGTH
UNDRAINED TRIAXIAL \oplus
AT OVERBURDEN PRESSURE \oplus
UNCONFINED COMPRESSION \oplus
VANE TEST AND SENSITIVITY \oplus

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX
ATTERBERG LIMITS
LIQUID LIMIT \circ
PLASTIC LIMIT \bullet
SAMPLE TYPE
2.50 SPLIT TUBE \circ
2.50 SHELBY TUBE \bullet
3.00 SHELBY TUBE \bullet

SYMBOL	SOIL DESCRIPTION	ELEV. FEET	DEPTH FEET	PENETRATION RESISTANCE 20 40 60 80 100 FT. LB BLOWS FT. RD SHEAR STRENGTH P.S.F.	NATURAL MOISTURE CONTENT AND ATTERBERG LIMITS % DRY WEIGHT	SAMPLE TYPE AND NO.	NATURAL UNIT WEIGHT P.C.F.
	TOPSOIL - 4 INCHES AFTER SOD	894.8	0		10 20		
	SAND-silty, some topsoil lumps and roots, brown, loose, moist.	890.0					135
	SILT TILL-slightly cohesive, numerous sand and fine to medium gravel sizes, very dense, dry, some sand inclusions at about 25 ft.		10				153
	-moist fine and medium SAND layer at 6 ft.		20				146
			30				142
			40				
	SAND-silty, fine, slightly moist, very dense.	852.8					
	End of Borehole	844.3	50				
Notes: 1) Hole uncased and advanced by continuous flight augering methods. 2) Borehole open and dry to 48.2 ft. on completion of boring. Caved & dry at 49 ft. after 3 wks. 3) No split spoon samples obtained between 31 and 49½ ft. Auger sample of sand obtained from 42 to 43 ft. Very difficult to advance auger below 15 ft.							
			60				
			70				
			80				
			90				
			100				
			110				

4 & 4A

PROPOSED GRADE SEPARATION

KEELE STREET NORTH OF MAPLE

See Dwg. 1

894.7 ft.

See Dwg. 1

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE —○—○—○—
 1" O.D. SHELBY TUBE —+—+—+—
 2" T.A. CONE ————

SHEAR STRENGTH

UNSATURATED TRIAXIAL
 AT EXTERIOR GROUND PRESSURE ⊙
 NORMAL AND COMPRESSION ⊙
 PLANE TEST AND SENSITIVITY ⊕

NATURAL MOISTURE CONTENT
AND LIQUIDITY INDEX

ATTERBERG LIMITS

LIQUID LIMIT ○

PLASTIC LIMIT —

SAMPLE TYPE

2" O.D. SPLIT TUBE

2" O.D. SHELBY TUBE

2" O.D. SHELBY TUBE

FILL—sand and gravel to 1½ ft., then
 cohesive sandy silt with some
 gravel sizes, some decayed organic
 material, brown, loose, moist.

SILT TILL—slightly cohesive,
 numerous sand and fine to medium
 gravel sizes, slightly moist, brown
 medium dense to 15 ft. then very
 dense.

—moist 4" SAND layer at 25½ ft.

End of Borehole

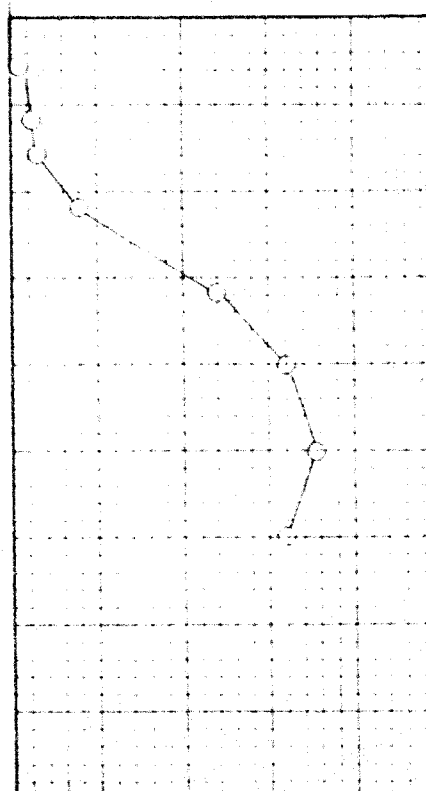
858.7

Notes: 1) Hole uncased and advanced by
 continuous flight augering
 methods.

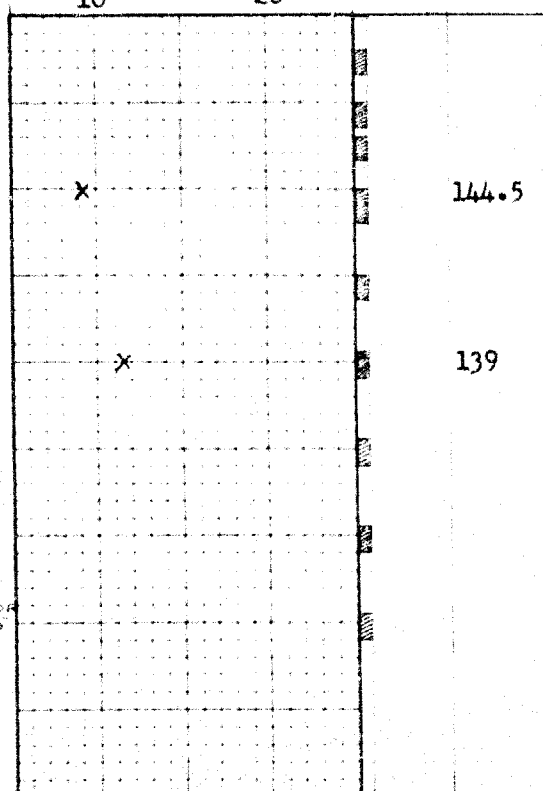
2) Hole open and dry to 33.8 ft. on
 completion of boring, and after 4 hrs.

894.7

886.3












































































NATURAL MOISTURE CONTENT
AND
ATTERBERG LIMITSSAMPLE
TYPE
NATURAL
UNIT
WEIGHT

10 20



144.5

139

PENETRATION RESISTANCE
 1. JENKINS SPEED TUBE 
 2. CONSUMERBY TUBE 
 3. CONSUMERBY TUBE 
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 76. CONSUMERBY TUBE

NATURAL MOISTURE CONTENT
AND LIQUIDITY INDEX

ATTERBERG LIMITS

LIQUID LIMIT

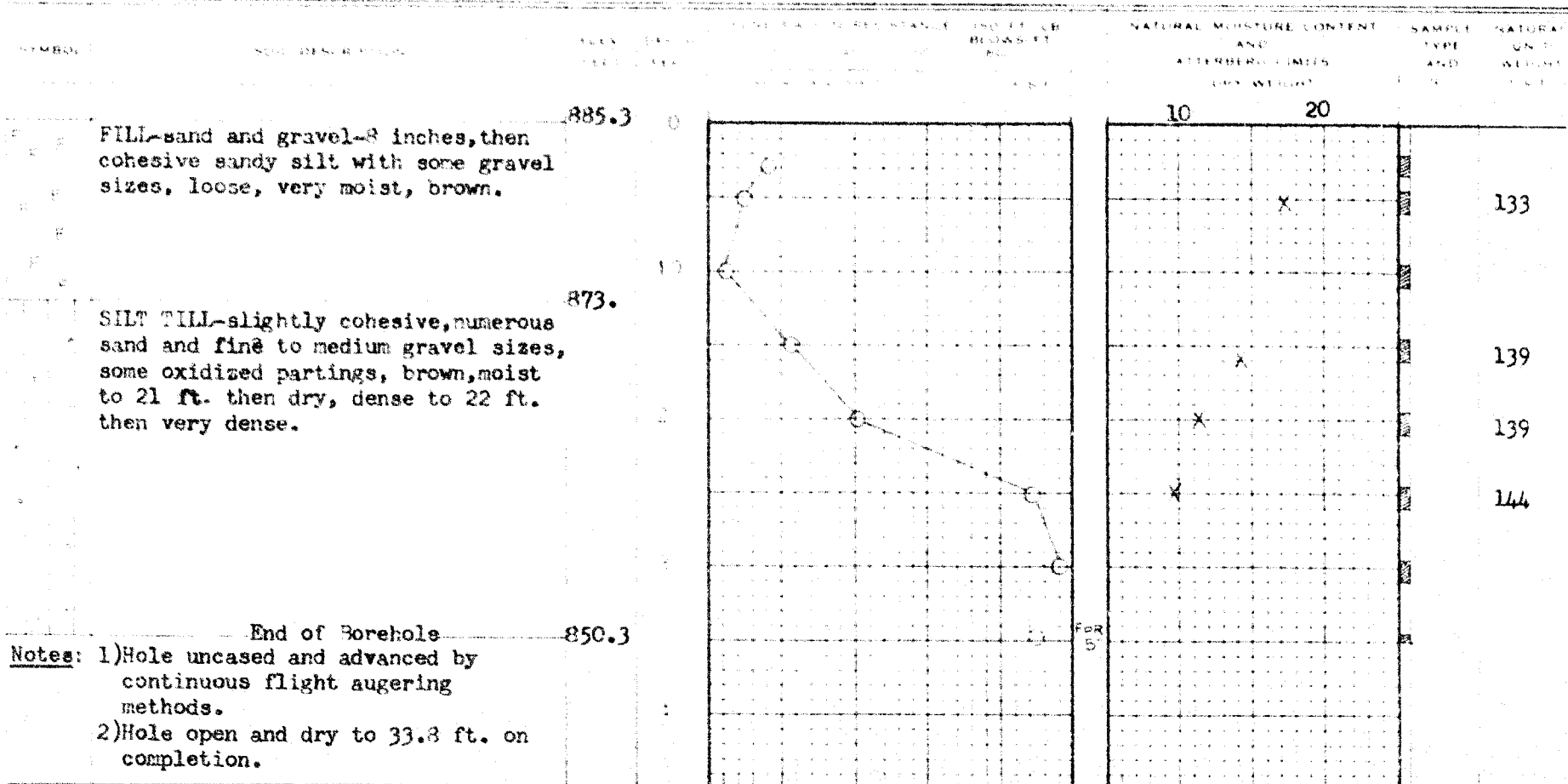
PLASTIC LIMIT

SAMPLE TYPE

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

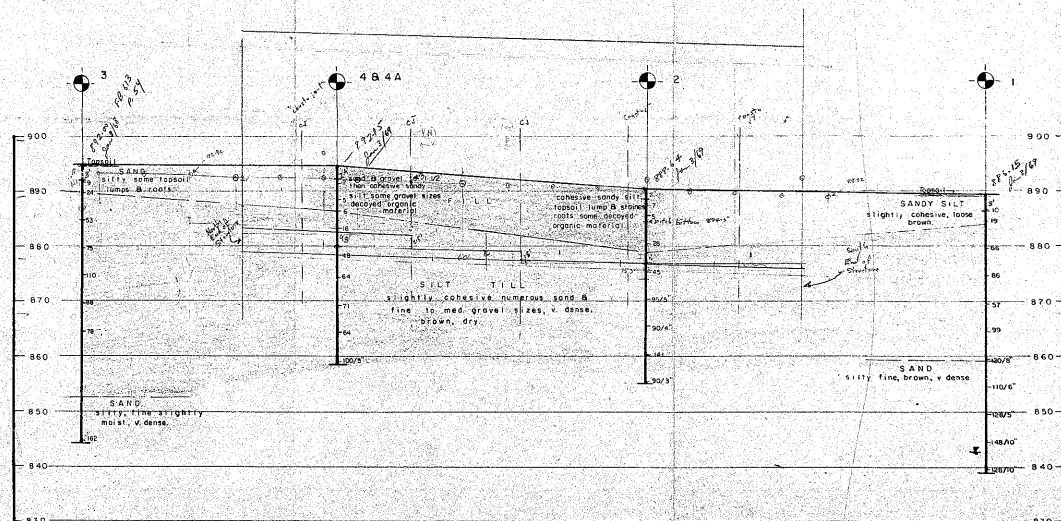
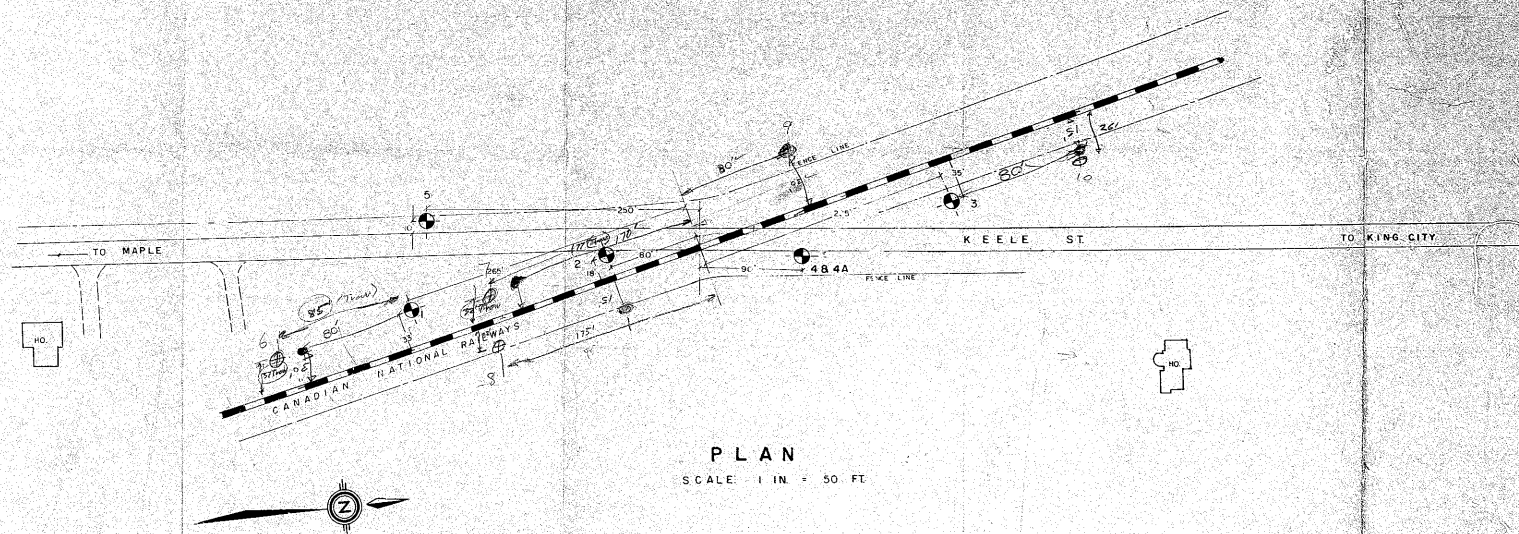
3" O.D. SHELBY TUBE



#66-F-296M

KEELE ST.

C.N.R. CROSSING



INTERPRETED SUBSOIL STRATIGRAPHY

HOR. 1 IN. = 30 FT.
SCALE: VERT. 1 IN. = 10 FT.

BENCH MARK 27.6 ELEV. 893.01
Cut X in S.E. stat of Conc. Base for Hwy.
warning signal 22' west of Sta. 352+07.

NOTE
Samples will be kept for 3 months from the date of this report unless otherwise directed.

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.

William Trow & Associates Ltd.
FOUNDATION INVESTIGATION

PROPOSED C.N.R. CROSSING
KEELE STREET

NORTH OF MAPLE ONTARIO
PROJ. 3085 DATE JULY, 1966 DWG. N4.1