

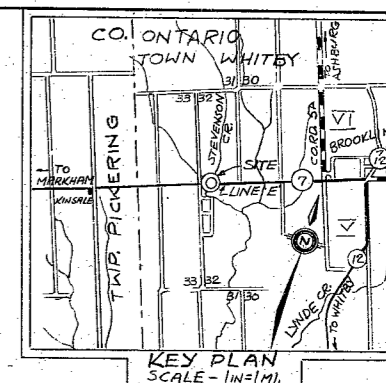
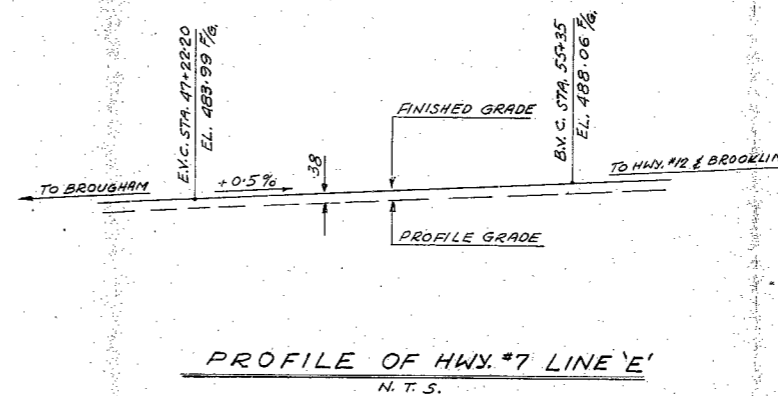
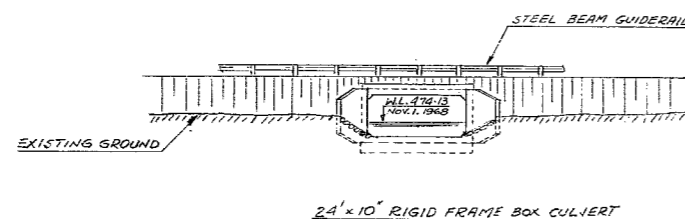
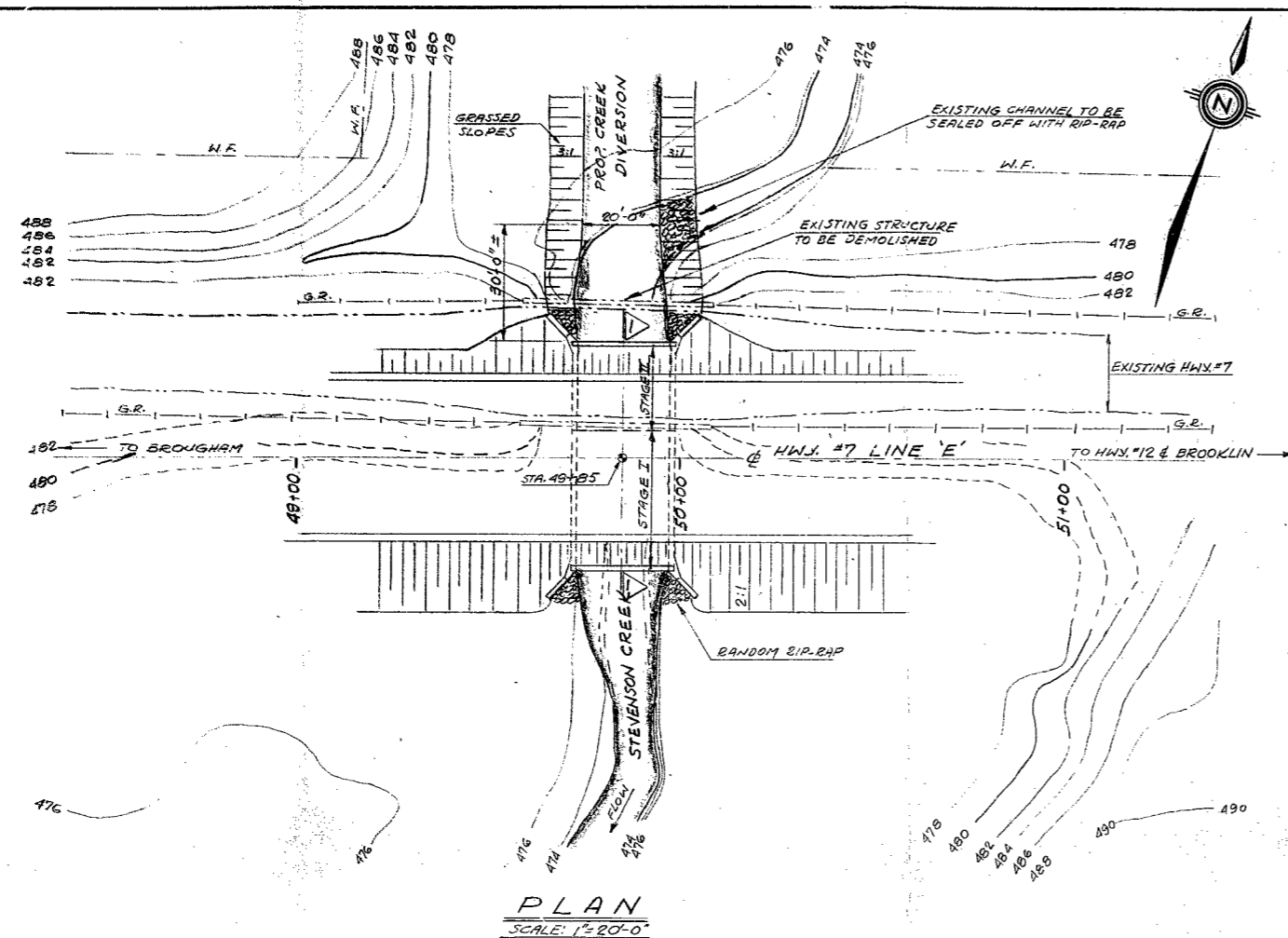
# 69-F-17

W.P. 72-65-1

H.W.Y. #7, LINE 'E'

STEVENSON CREEK

STRUCTURE



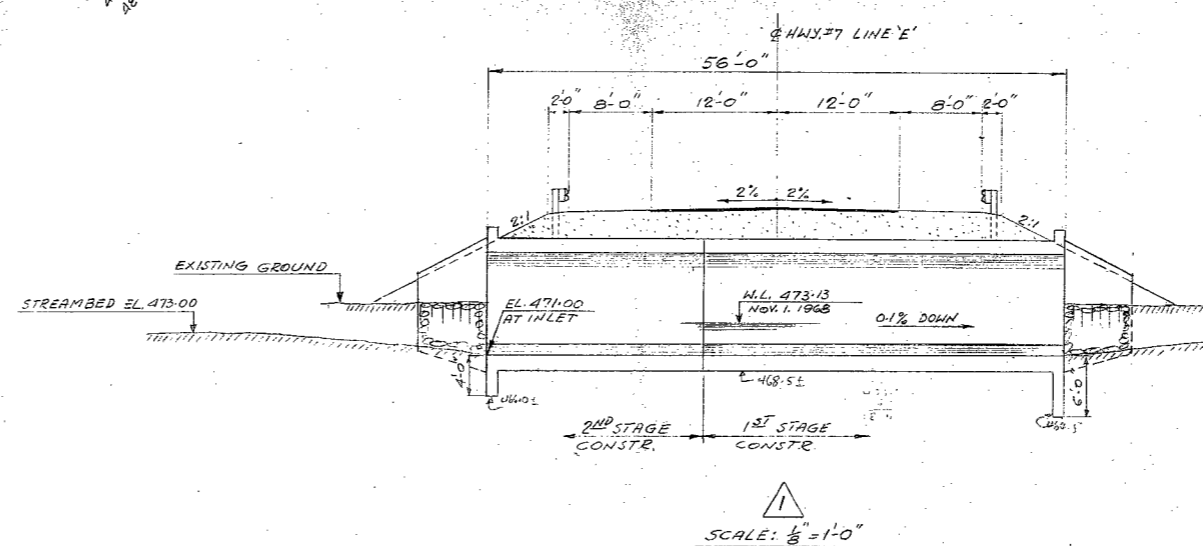
NOTES:

ALL EXPOSED CORNERS TO BE CHAMFERED 1"  
NO CONCRETE IS TO BE PLACED FOR ANY FOOTING,  
UNTIL THE DEPTH OF THE EXCAVATION AND CHARACTER  
OF THE FOUNDATION MATERIAL HAVE BEEN APPROVED  
BY THE ENGINEER.

FILL MUST BE PLACED AT BOTH SIDES OF THE CULVERT SIMULTANEOUSLY.

ALL STEEL TO BE HARD GRADE  
STRENGTH OF CONCRETE: -3000 P.S.I.

TO BE BUILT IN ACCORDANCE WITH D.H.O. FORM 9

[illegible]DEPARTMENT OF HIGHWAYS ONTARIO  
BRIDGE DIVISION

69-15-17

STEVENSON CREEK STRUCTURE

APPROXIMATELY 2 MI. WEST OF HWY. #12

KING'S HIGHWAY No 7 DIST No 1

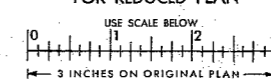
CO. ONTARIO

TWP. WHITBY LOT 32 CON. 5 & 6

PRELIMINARY

APPROVED _____		BRIDGE ENGINEER		22-112		72-65	
DESIGN	ADAPTED	CHECK		CONTRACT			
DRAWING	G. P.	CHECK		No.			
DATE	SEPT. 69	LOADING	H520-44	DRAWING			
				No.	D-6696-F1		

FOR REDUCED PLAN



MEMORANDUM

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

From: Foundation Section,  
Materials & Testing Office,  
Room 107, Lab. Bldg.

Date: June 25, 1969

Our File Ref.

In Reply To

JUL - 4 1969

SUBJECT:

FOUNDATION INVESTIGATION REPORT  
For  
Proposed Structure at the Crossing of  
Stevenson Creek & Hwy. #7 (Line 'E')  
Lot 32 -- Concessions 5 & 6  
Twp. of Whitby -- County of Ontario  
District No. 6 (Toronto)  
W.J. 69-F-17 -- W.P. 72-65-1

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 do not hesitate to contact our Office.

AGS/MdeF  
Attach.

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

cc: Messrs. B. R. Davis (2)  
H. A. Tregaskes  
D. W. Farren  
G. K. Hunter (2)  
F. G. Allen  
W. S. Melinyshyn  
T. J. Kovich  
B. A. Singh  
Foundations Files ✓  
Gen. Files

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FOUNDATION INVESTIGATION REPORT  
For  
Proposed Structure at the Crossing of  
Stevenson Creek & Hwy. #7 (Line 'E')  
Lot 32 -- Concessions 5 & 6  
Twp. of Whitby -- County of Ontario  
District No. 6 (Toronto)  
W.J. 69-F-17 -- W.P. 72-65-1

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1. INTRODUCTION:

The Foundation Section was requested to carry out an investigation at the site of the existing crossing of Stevenson Creek and Hwy. #7, Twp. of Whitby, County of Ontario. The request was contained in a memo from the Bridge Planning Section - (Mr. W. S. Melinyshyn, Regional Bridge Location Engineer), dated February 27, 1969.

At this location the existing single-span structure will be demolished and replaced with a new, wider single-span structure. The centre-line of Hwy. #7 will be relocated about 23 ft. south of the existing centre-line. Subsequently an investigation was carried out by this section to determine the subsoil conditions at the site.

This report contains the results of the investigation together with recommendations pertaining to the foundations of the proposed structure and the stability of the approach fills.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located about 2 miles west of the Village of Brooklin where Hwy. #7 crosses Stevenson Creek. At this location the creek flows southerly in a shallow valley about 15 ft. deep with a flat valley floor about 200 to 300 ft. wide. The creek, which is about 10 to 15 ft. wide, meanders through the valley floor in a 2 to 3 ft. deep channel. The creek bottom is gravelly with boulders up to 12 inches in diameter. At the

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

time of the field investigation the water in the creek was about 18 inches deep. South of the highway the area is heavily wooded, while north of the highway, the land is open with occasional trees; this area is used mainly for agricultural purposes.

The existing Hwy. #7 is a two-lane paved road about 20 ft. wide with associated gravel shoulders. The roadway, which is in cut along the valley banks, crosses the valley floor on an embankment about 6 ft. high.

The existing structure over Stevenson Creek is a single-span (27') concrete bridge in poor condition. Metal railings have been put on the bridge and the original structure has been widened by an extension to the south. Most of the exposed concrete surfaces have been patched up and pargeted; however, some cracking and flaking of the concrete can be seen, especially beneath the bridge. There is no noticeable differential settlement or movement of the bridge.

Physiographically the site is situated in the "Iroquois Plain". Based on available geological information, it is known that the site is located at or near the northern shoreline of glacial Lake Iroquois. The overburden in the area is composed of glacial till sheets. Lacustrine clay deposited by Lake Iroquois, is often encountered between the till sheets. The bedrock is composed of limestone of the Trenton formation.

3. FIELD AND LABORATORY WORK:

Four boreholes, each with an accompanying dynamic cone penetration test, were carried out during the course of the field investigation. The borings were advanced by means of a conventional diamond drill rig adapted for soil sampling purposes.

Samples were obtained at required depths in a 2-inch O.D. split-spoon sampler, which was hammered into the soil in accordance with the specifications for the Standard Penetration Test. In addition, field vane tests were carried out, where possible, to determine the undrained shear strengths.

### 3. FIELD AND LABORATORY WORK:

Two test pits were excavated to expected footing elevation by means of a backhoe, in order to determine whether the subsoil is susceptible to 'boiling' due to an unbalanced hydrostatic head.

The locations and elevations of the boreholes were surveyed in the field by personnel from the Foundation Section and are shown on Drawing 69-F-17A, together with the estimated stratigraphical profile. All elevations in the report are referenced to a Geodetic datum.

All samples were visually examined and identified in the field and later in the laboratory. Following this, laboratory tests were carried out on selected representative samples to determine the following physical properties:

- Natural Moisture Contents
- Atterberg Limits
- Grain-Size Distributions
- Organic Matter Content

On completion of these tests, the various soil samples were classified as to type and consistency in accordance with the Unified Soil Classification System (Oct. 1963).

The results of the laboratory tests are plotted on the Record of Borelog sheets and summarized on the Figures in the Appendix of the report.

### 4. SUBSOIL CONDITIONS:

#### 4.1) General:

Subsoil at the site consists of an extensive glacial till (heterogeneous mixture of gravel, sand and silt with traces of clay) deposit at least 41 ft. thick. On the west side of the creek the glacial till is overlain by 3 to 4 ft. of sand to gravelly sand, whereas east of the creek, the glacial till is overlain by 3 to 6 ft. of clayey silt and sand with some gravel and organics. In

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

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

certain areas the overburden is overlain by road fill up to 7 ft. in thickness.

From ground level downwards, the different soil types are described in detail as follows:

4.2) Fill Material:

In B.H.'s #2 and #3, carried out on the shoulder of the existing highway, up to 7 ft. of fill material was encountered. This material is predominantly a brown clayey silt with sand. Occasional traces of organics were encountered within the fill material in B.H. #3.

One Atterberg limit test was carried out on a sample of the fill and is plotted on the Record of Borelog sheets and on the Plasticity Chart, Figure 1. This test gave values for the liquid and plastic limit of 30% and 19% respectively, with a corresponding natural moisture content of 26%.

Standard penetration resistance values, carried out within the fill, gave 'N' values of 3 to 4 blows per foot. Two field vane tests were performed within the fill, giving undrained shear strengths of 880 and 1200 p.s.f. Based on these results, it is estimated that the consistency of the fill material ranges from soft to firm.

4.3) Surficial Deposits:

West of the creek a deposit of brown sand to gravelly sand was encountered underlying the fill material (B.H. #2) or a thin layer of topsoil (B.H. #1). The thickness of this stratum varies between 2 and 4 ft. In B.H. #2 the deposit contains more silt and less gravel. 'N' values obtained within this deposit, ranged from 6 to 23 blows/ft., indicating a relative density in the loose to compact range.

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

4.3) Surficial Deposits: (cont'd.) ...

East of the creek the natural surficial layer is a cohesive deposit composed of clayey silt with sand whose thickness ranges from 3 to 6 feet. Occasional organic inclusions were encountered throughout the deposit. The colour of this stratum is basically brown, changing to black where the organics were encountered.

Atterberg limit tests, carried out on samples of the deposit, gave values for the liquid and plastic limits ranging from 24% to 28% and 20% to 22%, respectively, with the corresponding natural moisture content between 24% and 28%.

Standard penetration resistance values, carried out within the deposit, gave 'N' values of 13 to 14 blows per foot. From these values, it is estimated that the consistency of the deposit is stiff.

4.4) Glacial Till (Heterogeneous Mixture of Gravel, Sand and Silt, with traces of Clay):

Underlying the surficial layers, an extensive deposit of glacial till at least 41 ft. thick was encountered. This material was generally a grey, heterogeneous mixture of gravel, sand and silt with traces of clay. Occasional random zones or layers of clayey silt were found throughout the deposit. The 'N' values for the glacial till ranged from 36 blows per foot up to 100 blows for 1 inch, indicating that the relative density of the non-cohesive portions of the deposit is in the dense to very dense range, while the consistency of the cohesive portions of the deposit can be considered to be hard.

The physical properties of the glacial till, summarized on the following page, are plotted on the Record of Borelog sheets, the Plasticity Chart, Figure 2, and the Grain-size Distribution Curves, Figure 3.

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

4.4) Glacial Till (Heterogeneous Mixture of Gravel, Sand and Silt, with traces of Clay): (cont'd.) ...

Moisture Content (W)	:	5 - 9%
Liquid Limit (W <sub>L</sub> )	:	12 - 17%
Plastic Limit (W <sub>P</sub> )	:	10 - 12%

Grain-Size Distribution -

- Gravel	:	3 - 32%
- Sand	:	34 - 50%
- Silt	:	29 - 50%
- Clay	:	1 - 14%

5. GROUNDWATER CONDITIONS:

Groundwater level observations were carried out during the period of the field investigation in the open boreholes. These observations, which are summarized on Drawing No. 69-F-17A, show that the water levels in the boreholes were found to be about elev. 475 - i.e., the same as the water level in the creek during the time of the field investigation.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

It is proposed to realign Hwy. #7 some 20 ft. south of the existing centre-line. A new single-span (40') bridge is proposed to replace the existing single-span (27') structure over Stevenson Creek. The new highway grade will be about 3 ft. higher than the existing Hwy. #7 grade - i.e., some 10 ft. above natural ground level.

The subsoil below the existing fill material at the site generally consists of a thin layer (3 to 6 ft. thick) of either sand or gravelly sand or clayey silt with sand, followed by an extensive competent glacial till deposit at least 41 ft. thick.

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

6.2) Structure Foundations:

In view of the presence of an extensive competent glacial till deposit at a relatively shallow depth, it is recommended that the abutment footings for the proposed structure be founded on spread footings located within this deposit. The footings should be founded at least 4 feet below the creek invert for frost protection purposes. A safe bearing pressure of up to 5 t.s.f. may be used for design purposes.

Since the excavations for the footings will have to be carried out below creek water level, a dewatering scheme may be required. Due to the pervious nature of the subsoil, groundwater seepage will occur in the excavations. Further, there is a possibility that the base of the excavations will 'boil' because of the 'unbalanced hydrostatic water pressure head existing. To study this phenomenon, two test pits were put down by a backhoe. The two excavations were carried out in the vicinity of the proposed structure footing locations. The holes, which were located on opposite sides of the creek, were excavated to a depth 4 ft. below the creek invert; the depth was then increased in one-foot increments until the pits extended to a maximum ten feet below ground level.

No 'piping' or 'boiling' of the glacial till subsoil was observed at the time of the investigation. In excavating through the overburden, above the glacial till, a 6" to 18" water-bearing gravel layer was encountered about elevation 472.5. West of the creek the seepage through this layer was slight; however, east of the creek a moderate inflow occurred. Pumping was not required to keep the east pit dry, the backhoe being able to remove most of the water with its bucket.

Based on the above observations, no major dewatering problems are anticipated for the footing excavations, provided no appreciable rise in the creek water level occurs during the construction period.

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

6.3) Approach Fills:

The proposed approach fill will be about 3 ft. higher than the existing highway grade and extend about 30 ft. south of the existing embankment. Here the proposed fills will be some 10 ft. above the existing ground surface. No stability problems are anticipated for the proposed widening, with standard slopes of 2 horizontal to 1 vertical, provided all organic material located within the plan limits of the approaches is excavated. The south slope of the existing embankments should be stripped of all superficial organic cover prior to placement of the new fill.

7. MISCELLANEOUS:

The field work, performed during the period of March 25 to April 1, 1969, was supervised by Mr. W. G. Hutton, Project Foundation Engineer, who also wrote this report.

The equipment used was owned and operated by Canadian Longyear Ltd., Rexdale.

The two open test pits, carried out on June 19, 1969, were also under the supervision of Mr. Hutton.

The investigation was carried out under the general supervision of Mr. M. Devata, Supervising Foundation Engineer.

June 1969

APPENDIX I

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB	69-F-17	LOCATION	Sta. 49 + 66 @ Hwy.#7, Line 'E' o/s 26' Rt.	ORIGINATED BY	WH
W.P.	72-65-1	BORING DATE	March 25 - 27, 1969	COMPILED BY	WH
DATUM	Geodetic	BOREHOLE TYPE	Diamond Drill - Washboring	CHECKED BY	<i>[Signature]</i>

SOIL PROFILE			SAMPLES			ELEV SCALE	DYNAMIC PENETRATION RESISTANCE	LQUID LIMIT ——— w <sub>L</sub>	BULK DENSITY Y	REMARKS	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	PLASTIC LIMIT ——— w <sub>p</sub>			WATER CONTENT %
							20    40    60    80    100	— w			
							SHEAR STRENGTH PS F.	w <sub>p</sub> ——— w ——— w <sub>L</sub>	P.C.F	GR.SA.SI.CL	
							○ UNCONFINED    + FIELD VANE ● QUICK TRIAXIAL    x LAB. VANE				
476.7	Ground Level										
0.0	Sand to gravelly sand										
473.0	Brown to Grey. Compact									<u>474.7</u>	
3.7	Glacial Till		1	SS	23						
			2	SS	95/9"	470		○	I		
			3	SS	100/4"					5 50 30 6	
	Het.mix of gravel,		4	SS	95/6"			○			
	sand & silt, trace of		5	SS	103/9"	460		○	I	32 34 29 5	
	clay										
	occ. clayey silt layers		6	SS	54						
			7	SS	145	450		○	I		
	Grey		8	SS	108						
	Very dense		9	SS	150/3"	440		○		3 40 50 7	
			10	SS	100/1"						
431.6			11	SS	100/1"						
45.1	End of Borehole					430					

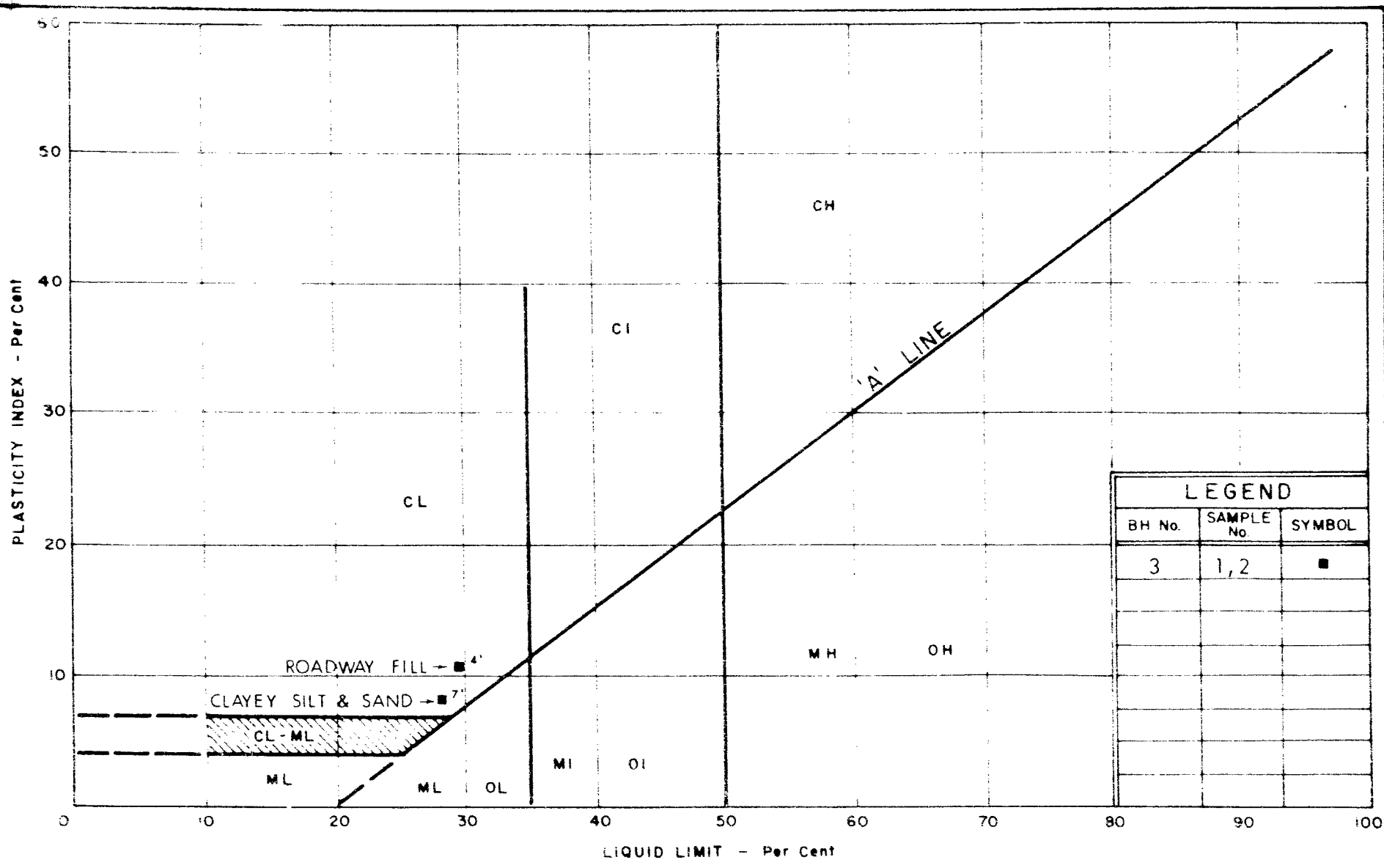


FOUNDATION SECTION

JOB	69-F-17	LOCATION	Sta. 50+19 @ Hwy. 7 Line 'E' o/s 5.5' Lt.	ORIGINATED BY	WH
W.P.	72-65-1	BORING DATE	March 28 - April 1, 1969	COMPILED BY	WH
DATUM	Geodetic	BOREHOLE TYPE	Diamond Drill - Washboring	CHECKED BY	

[illegible]





LEGEND		
BH No.	SAMPLE No.	SYMBOL
3	1,2	■



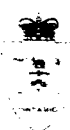
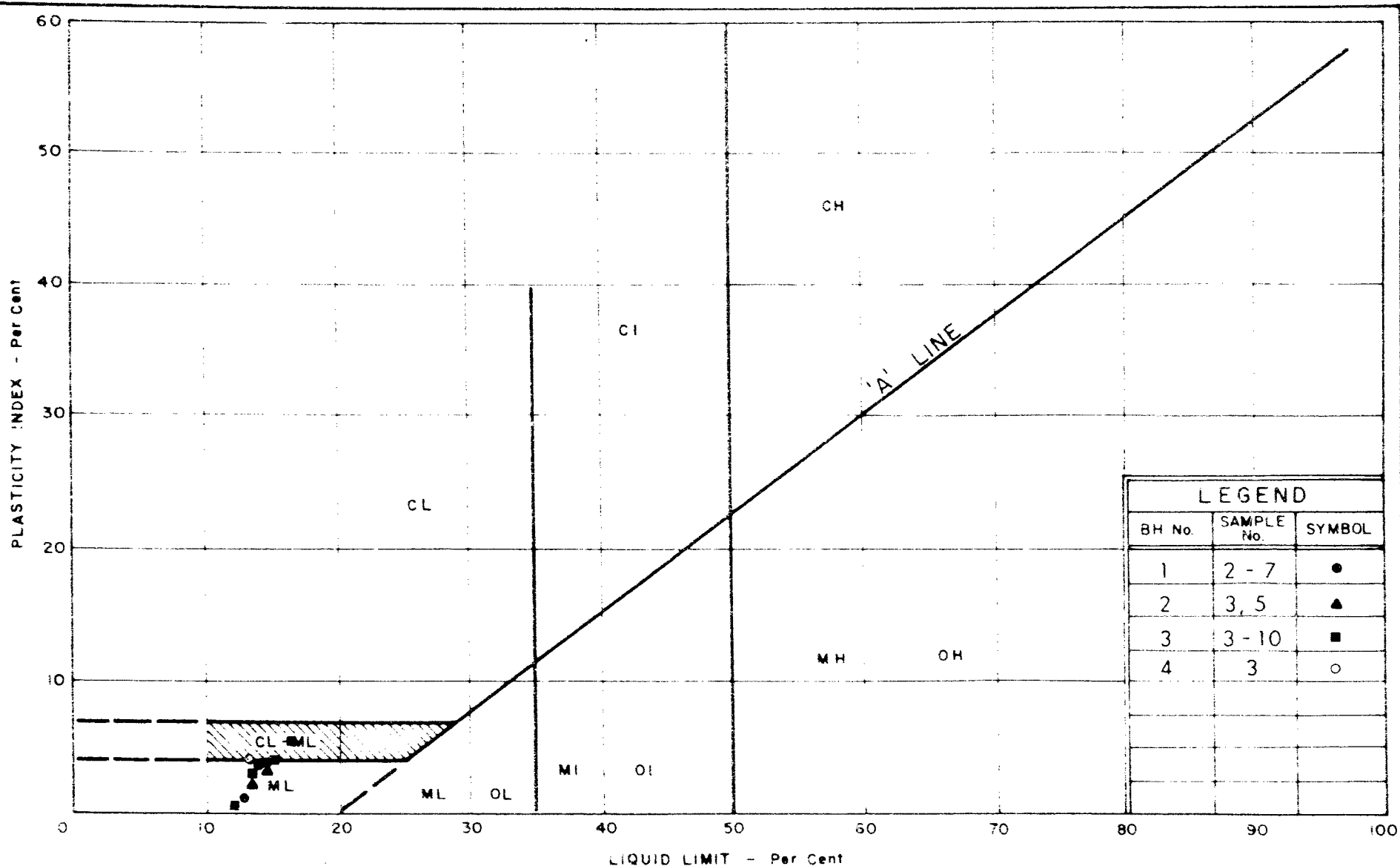
DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

# PLASTICITY CHART

WP No. 72 - 65 - 1

JOB No. 69 - F - 17

FIG. 1



DEPARTMENT OF HIGHWAYS  
 MATERIALS and  
 TESTING  
 DIVISION

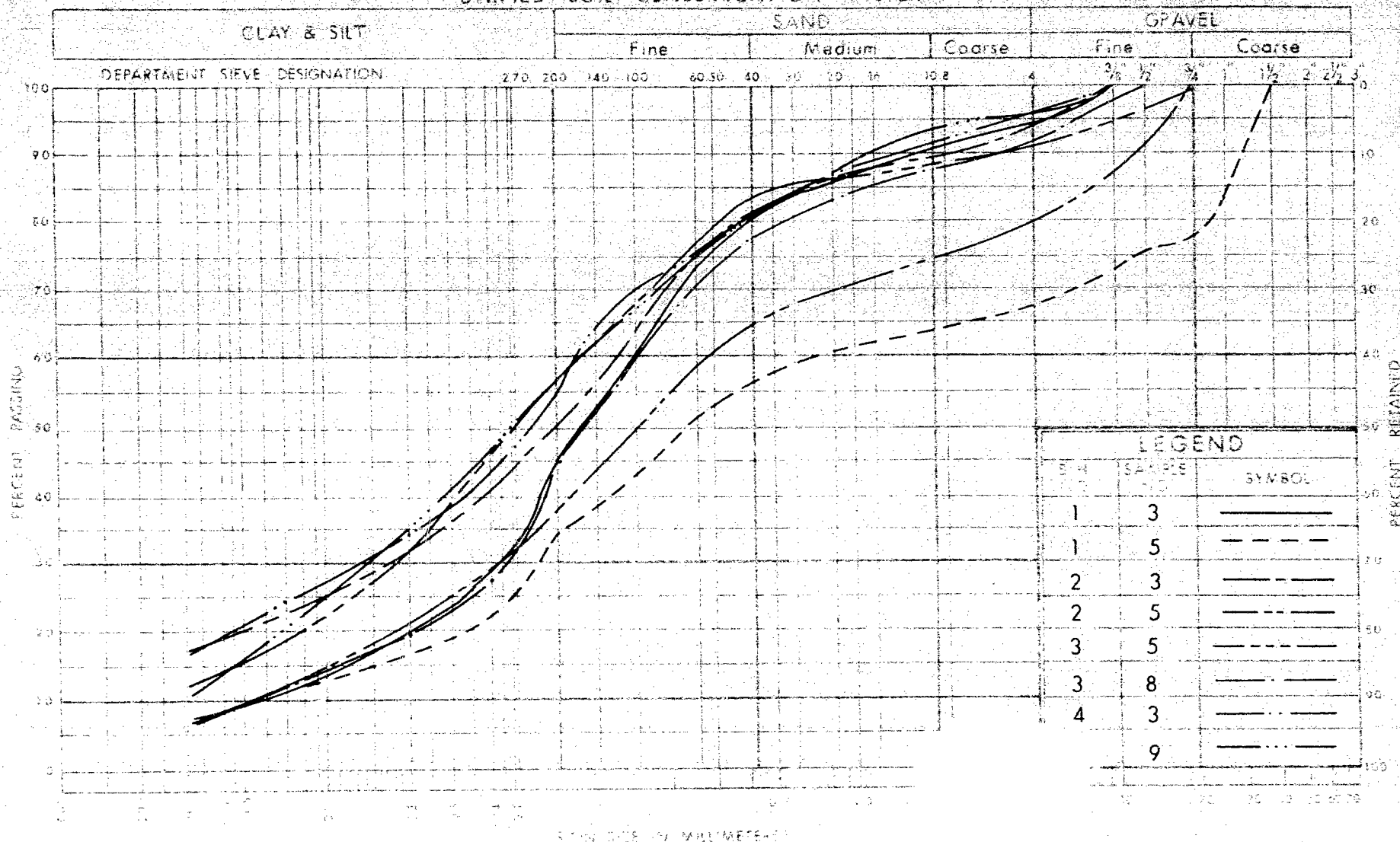
# PLASTICITY CHART GLACIAL TILL

WP No. 72 - 65 - 1

JOB No. 69 - F - 17

FIG. 2

# UNIFIED SOIL CLASSIFICATION SYSTEM



## GRAIN SIZE DISTRIBUTION

GLACIAL TILL  
HET. MIXTURE OF GRAVEL, SAND & SILT  
TRACE OF CLAY

WB No. 72-65-1

JOB No. 69-F-17

FIG. 3

DEPARTMENT OF HIGHWAYS  
MATERIALS AND  
TESTING  
DIVISION

## 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
WS	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

Q <sub>u</sub>	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V	FIELD VANE
Q <sub>cu</sub>	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q <sub>d</sub>	DRAINED TRIAXIAL	S	SENSITIVITY

## ABBREVIATIONS USED IN THIS REPORT

### SOIL PROPERTIES

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	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
$\tau_f$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION INTERCEPT
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_t$	SENSITIVITY

### GENERAL

$\pi$	= 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
$\sigma$	NORMAL STRESS
$\bar{\sigma}$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

### EARTH PRESSURE

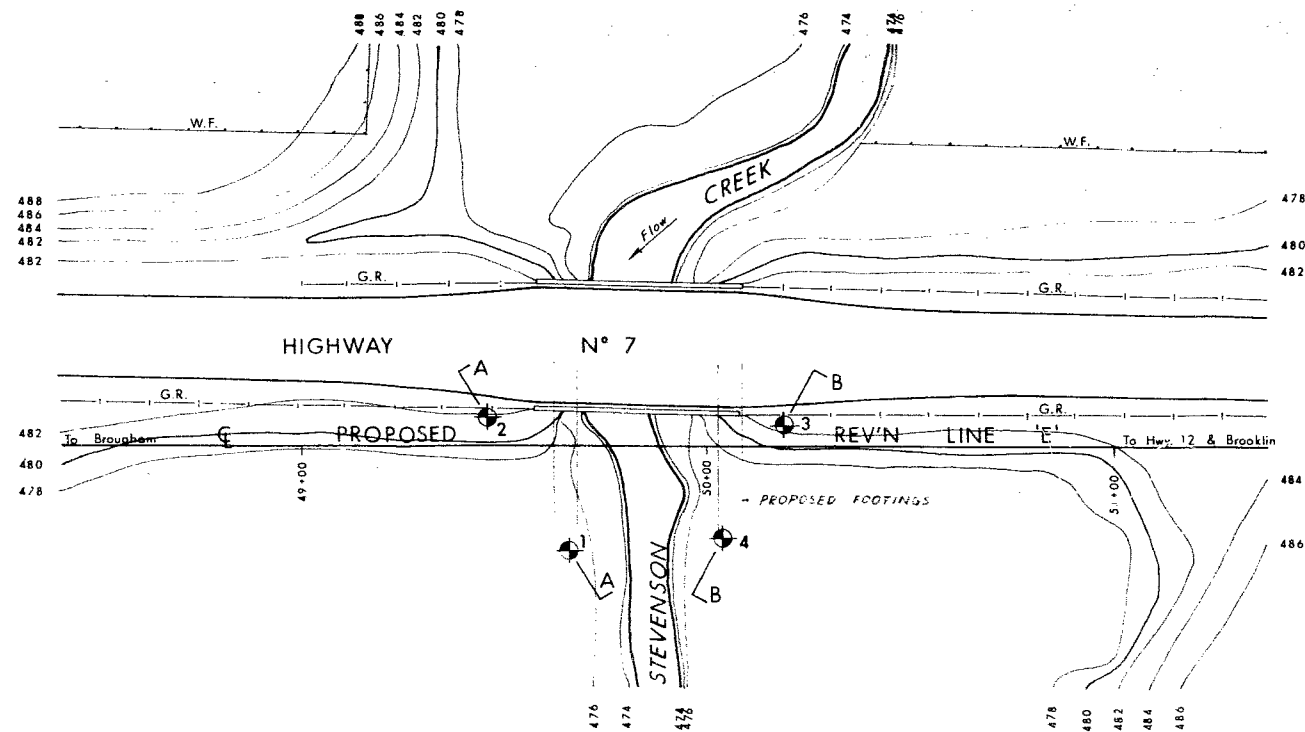
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

### FOUNDATIONS

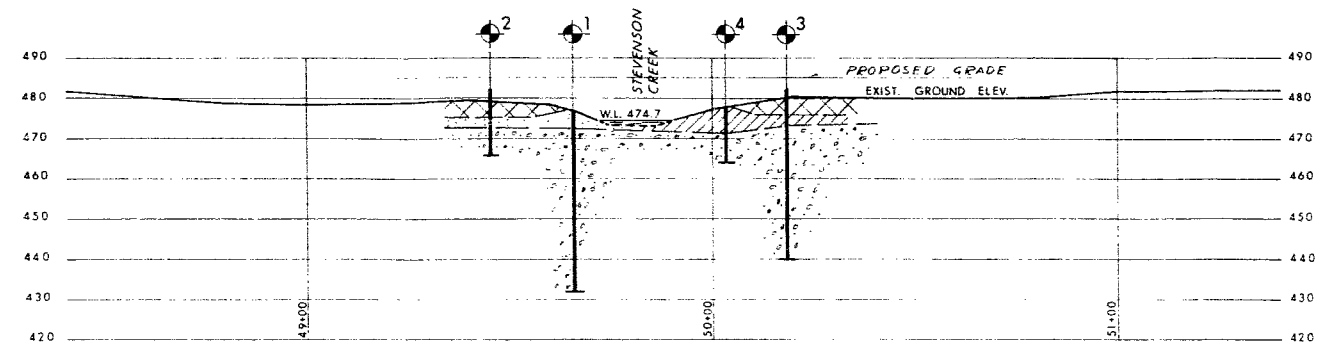
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
$k_s$	MODULUS OF SUBGRADE REACTION

### SLOPES

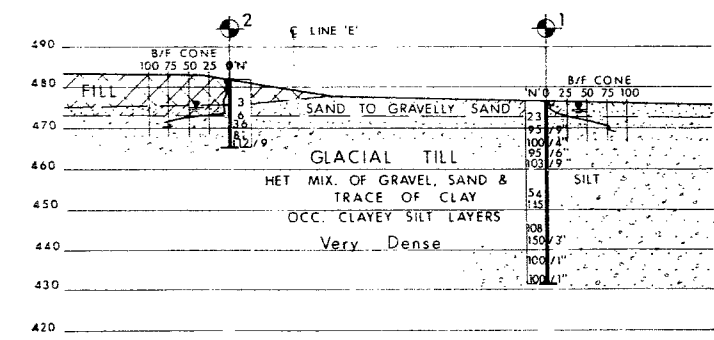
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
$\beta$	ANGLE OF SLOPE TO HORIZONTAL



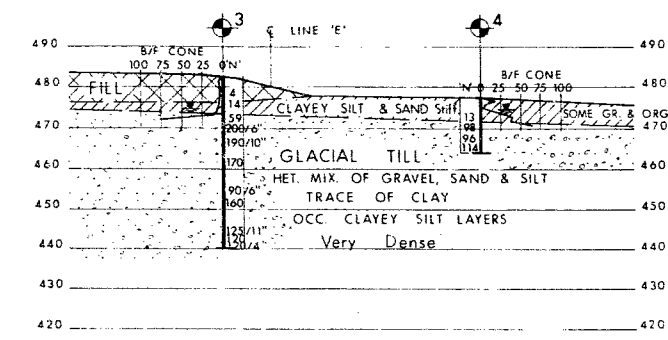
PLAN  
SCALE  
20 10 0 20 40 60 FT.



§ PROFILE LINE 'E'  
SCALE  
20 10 0 20 40 60 FT.



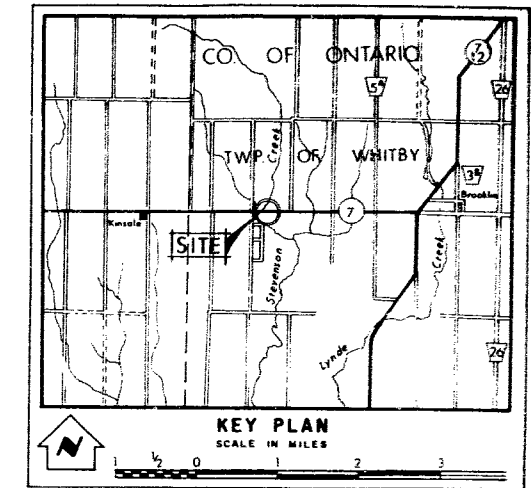
A - A



B - B

SECTIONS

SCALE  
HORIZ. 10 5 0 10 20 30 FT.  
VERT. 20 10 0 20 40 60 FT.



LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation. MAR 1969		

NO.	ELEVATION	STATION	OFFSET
1	476.7	49+00	26' RT.
2	482.0	49+46	7' LT.
3	482.4	50+19	5.5' LT.
4	477.7	50+04	23' RT.

- NOTE -  
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & TESTING OFFICE - FOUNDATION SECTION			
<b>STEVENSON CREEK</b>			
KING'S HIGHWAY NO. 7 REV'N LINE 'E' DIST. NO. 6			
CO. ONTARIO			
TWP. WHITBY		LOT 32	CON. 5 & 6
<b>BORE HOLE LOCATIONS &amp; SOIL STRATA</b>			
SUBM'D. W.H.	CHECKED	W.P. NO. 72-65-1	M.B.T. DRAWING NO.
DRAWN A.N.	CHECKED	JOB NO. 69-F-17	<b>69-F-17A</b>
DATE MAY 7, 1969	SITE NO.	BRIDGE DRAWING NO.	
APPROVED <i>A. J. Thomas</i>		CONT. NO.	

Ref N° 4929-1

69-F-17

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. Sternac,  
Principal Foundation Engineer,  
Room 107,  
Lab. Building.

From: W.S. Malinowsky,  
Bridge Office.

ATTENTION:

DATE: February 27th, 1969.

FOR FILE REF:

IN REPLY TO:

SUBJECT: Duffin Creek (West Branch) Bridge,  
H.P. 72-65-2, Site 22-96,  
Stevenson Creek Bridge,  
H.P. 72-65-1, Site 22-112,  
Box 7 (Line "R"), Dist. 6.

Herewith please find 2 bridge site plans for each of the above structures showing in red the probable footing locations.

Attached are also the relative field reconnaissance reports.

Could you kindly arrange to have a foundation investigation report for the above bridges completed by May 1969.

*M.D. Bandayan*

Very truly,  
Yours,

M.D. Bandayan,  
ASSISTANT BRIDGE DESIGN ENGINEER,  
for:  
W.S. Malinowsky,  
REGIONAL BRIDGE DESIGN ENGINEER.