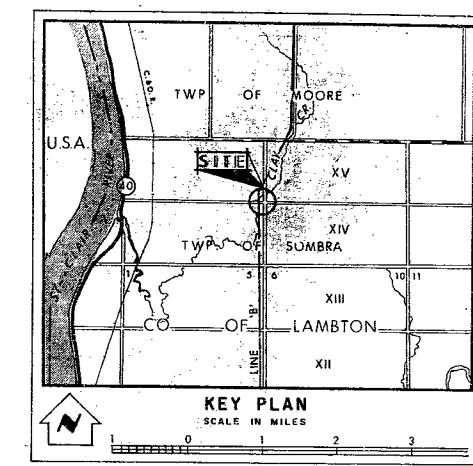
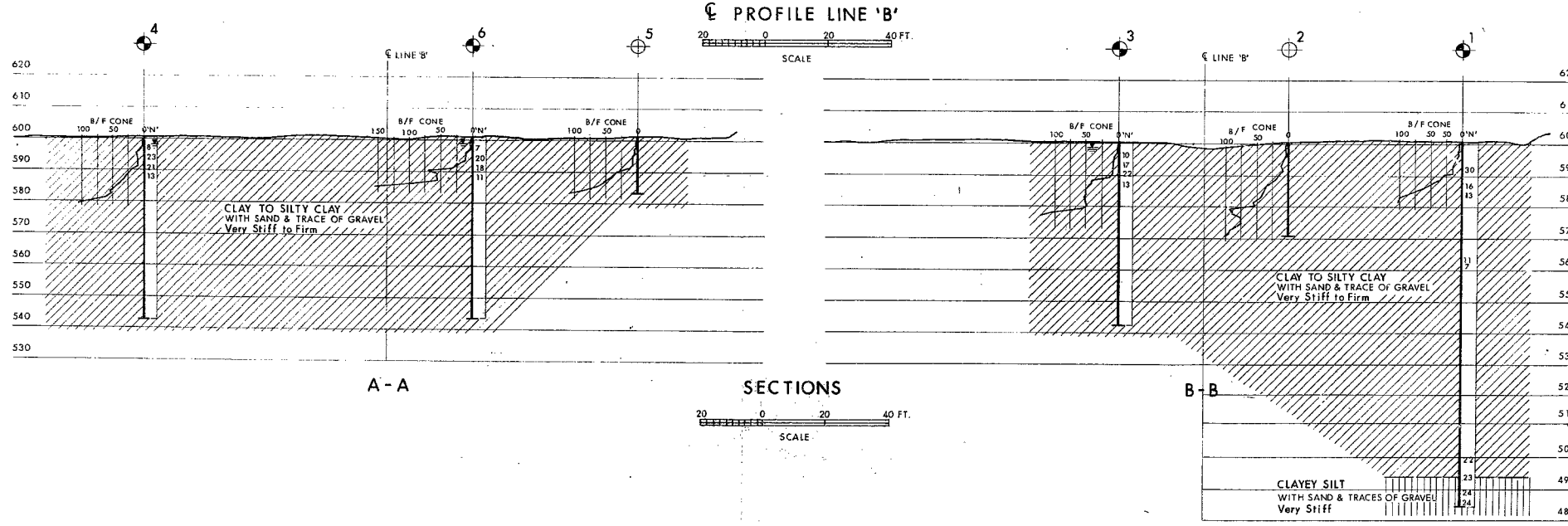
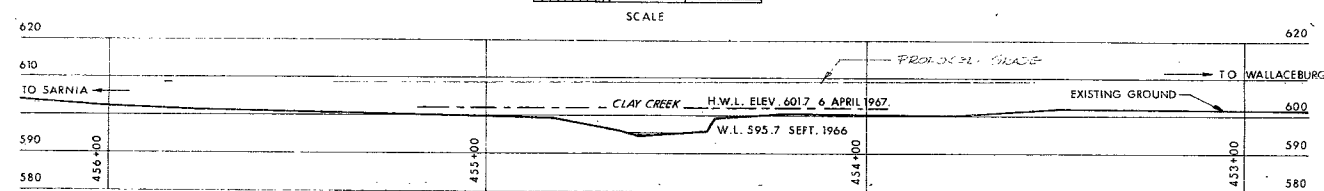
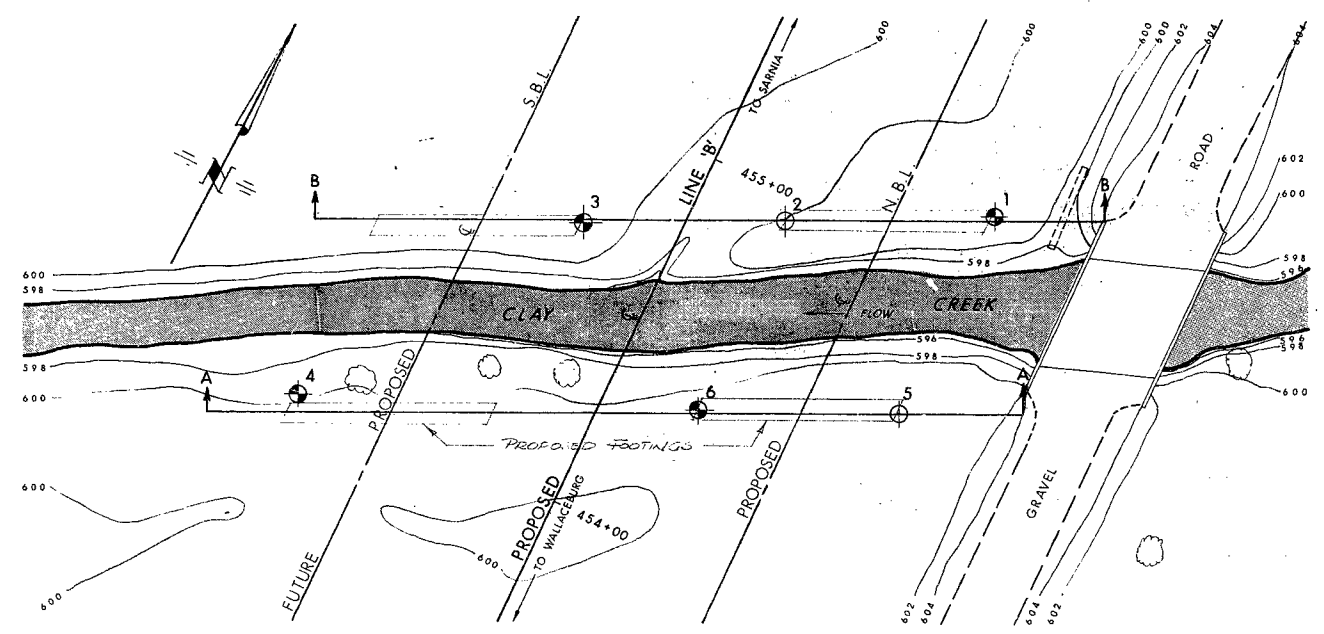


#67-F-24

W.P. #42-67

HWY #40

CLAY CREEK



LEGEND			
	Bore Hole		
	Cone Penetration Hole		
	Bore & Cone Penetration Hole		
	Water Levels established at time of field investigation. APRIL 67.		

NO.	ELEVATION	STATION	OFFSET
1	601.1	455+18	73' RT.
2	600.6	454+93	24' RT.
3	601.1	454+70	24' LT.
4	600.7	453+97	73' LT.
5	601.7	454+60	73' RT.
6	600.6	454+38	24' RT.

NOTE

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

REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION - FOUNDATION SECTION

CLAY CREEK

KING'S HIGHWAY NO. 40 LINE 'B' DIST. NO. 1

CO. LAMBTON

TWP. SOMBRA LOT 5 CON. 15

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D. J.M. CHECKED <i>[initials]</i> W.P. NO. 42-67	M.B.T. DRAWING NO.
DRAWN B.S. CHECKED <i>[initials]</i> JOB NO. 67-F-24	67-F-24A
DATE 19 MAY 1967	SITE NO.
APPROVED <i>[signature]</i> CONT. NO.	BRIDGE DRAWING NO.

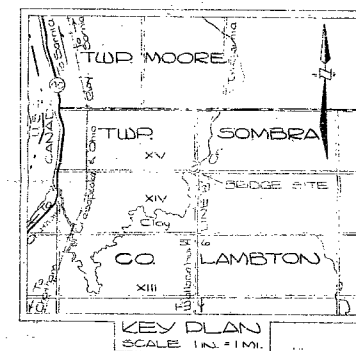
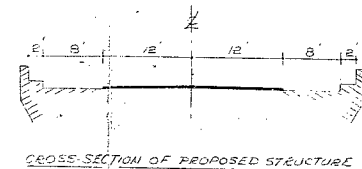
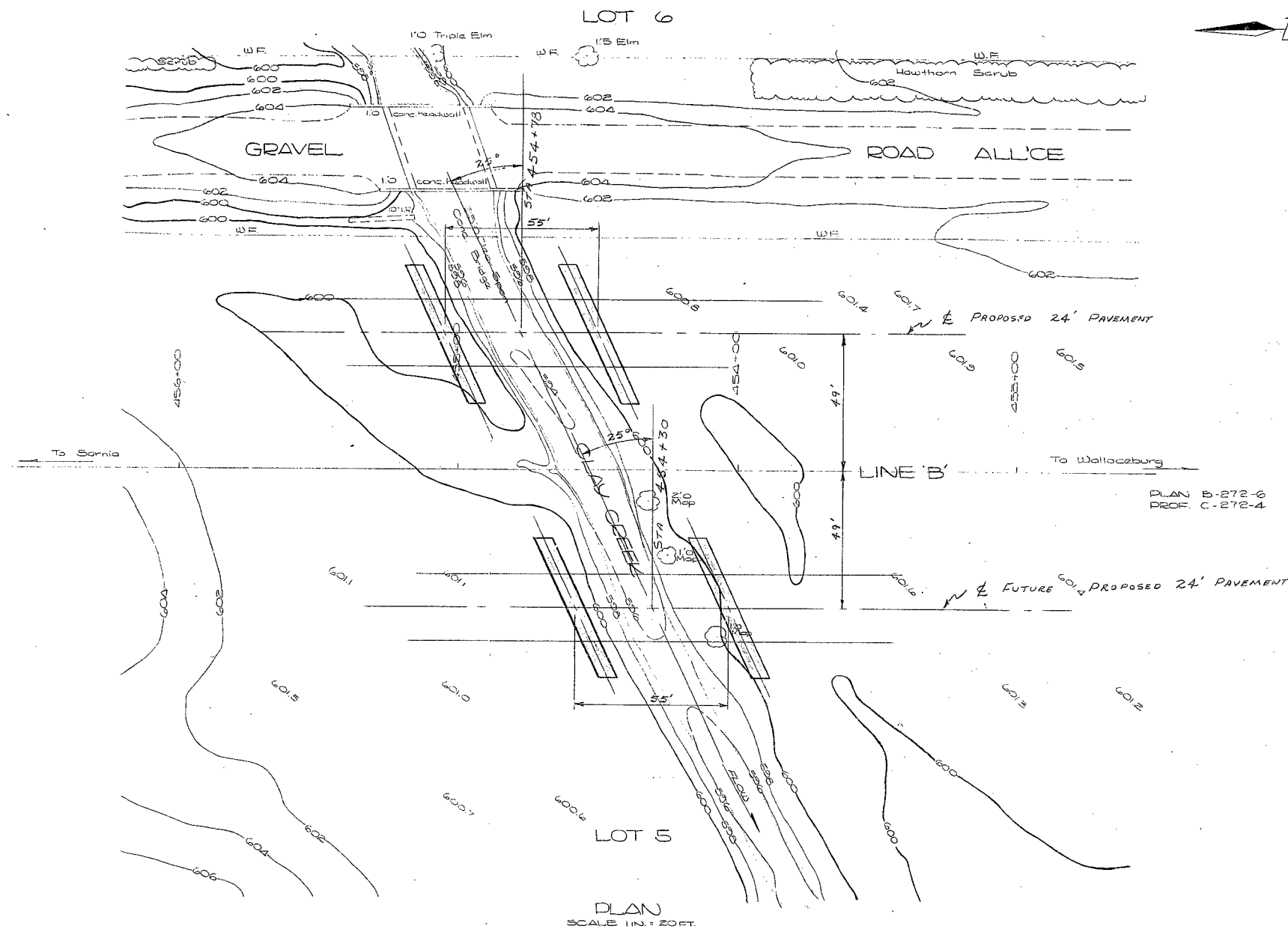
PRINT RECORD	NO.	FOR	DATE

1-066A-3

1-066A-3

COUNTY OF LAMBTON
TOWNSHIP OF SOMBRA
CON. 15

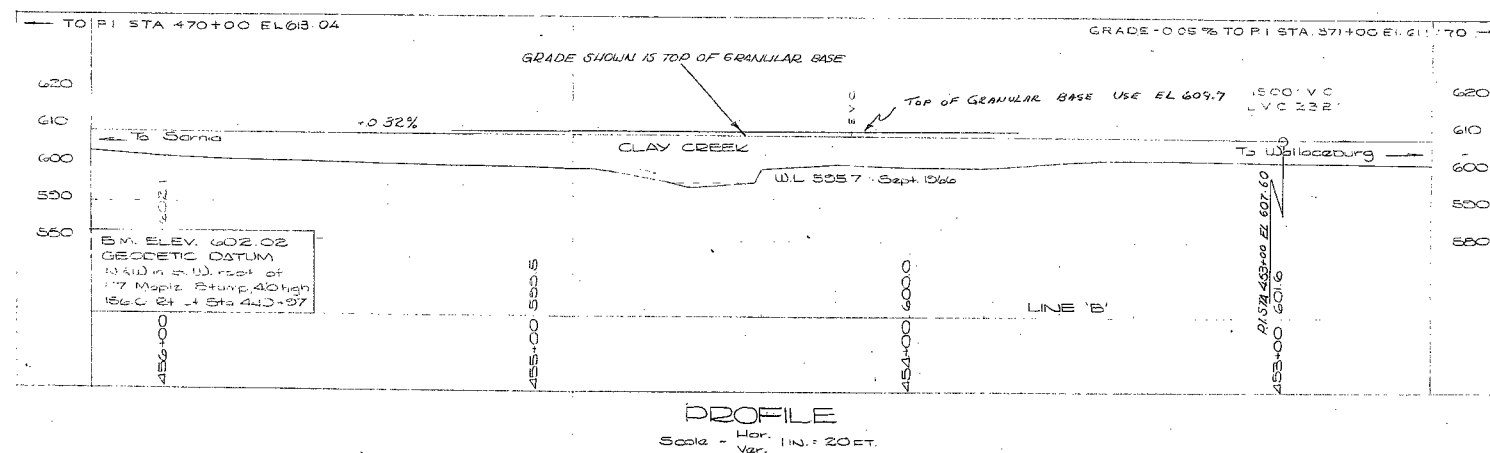
PROBABLE FOOTING LOCATIONS



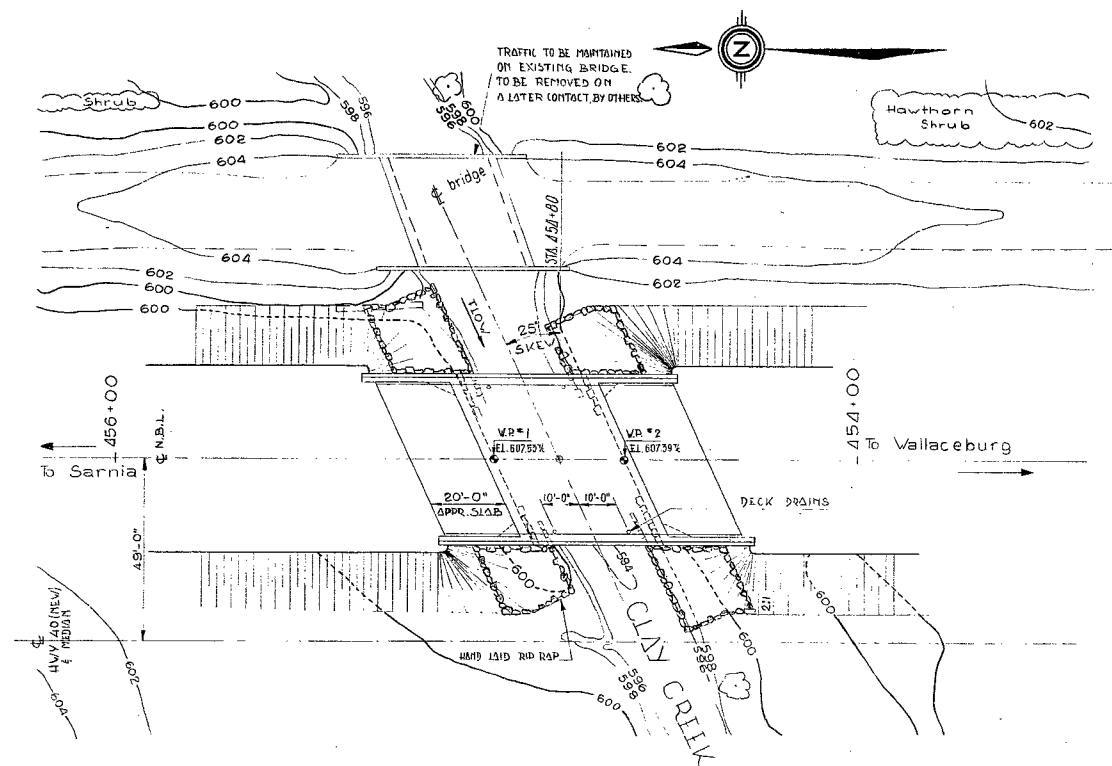
GBM. N° MMMCCLXII ELEV. 590388
International Boundary Commission concrete
monument N° 50, at east side of River
road, 4 miles north of Ferry landing and about 1,500
feet south of Sombra-Moore township line. Belt set
horizontally, facing south.
PUBLICATION N° 19, 'SOMBRA'

67-F-24

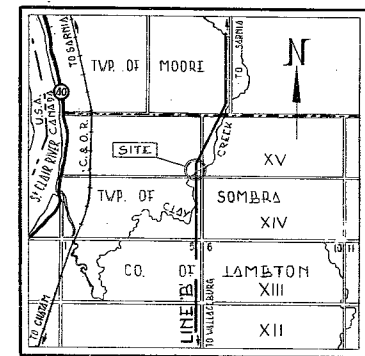
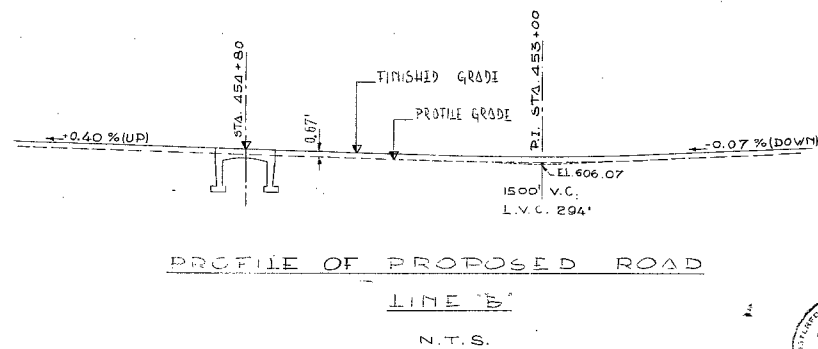
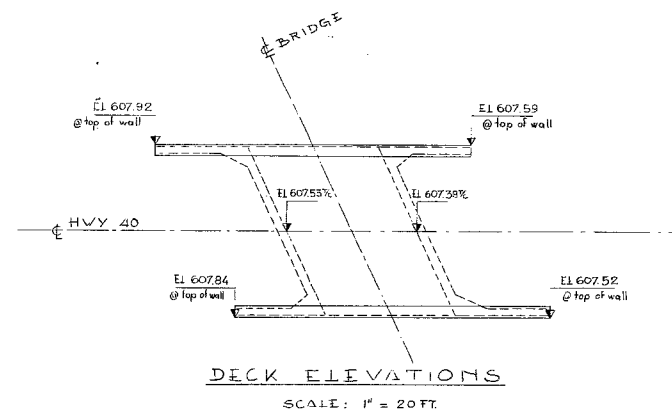
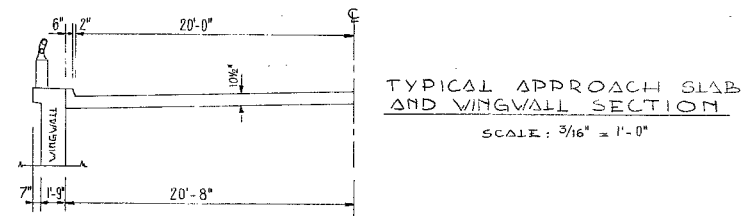
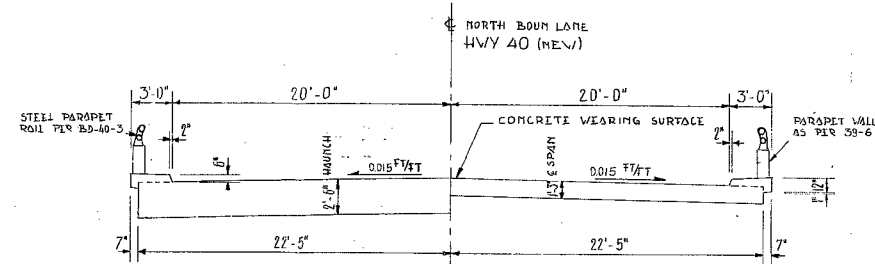
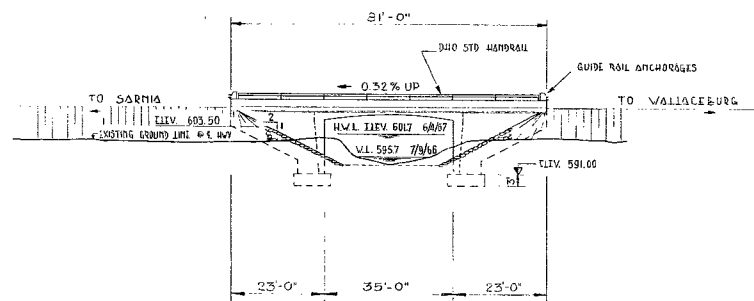
W.P. 42-67



DATE	REVISIONS (ADDITIONS)	BY	CHKD
DEPARTMENT OF HIGHWAYS ONTARIO			
DESIGN BRANCH			
ENGINEERING SURVEYS DIVISION			
BRIDGE SITE			
PROPOSED CROSSING			
AT			
CLAY CREEK			
AND			
PROP. KING'S HWY. 40 LINE 'B'			
LOT 5 CON. 15			
TOWNSHIP OF SOMBRA COUNTY OF LAMBTON			
SCALE AS SHOWN	DISTRICT CHATHAM	REGION S. WESTERN	
W.O.N. 5302-66/6 Date of Survey Sept. 66	Plan Nov. 66	SITE N°	
SURVEY BY Chief of Party - C. McDermid Supervisor - W. Smyth		DRAWN BY Draftsman - J. Thorogood Supervisor - J. Camillari	
CHECKED BY Draftsman - J. Camillari Supervisor - J. Camillari		PLAN N° E-4390-1	



FUNCTION OF 25°	
SIN	0.42262
COS	0.90631
TAN	0.46631
SEC	1.10338



G.B.M. N° MMMCCLXII ELIV. 590388

INTERNATIONAL BOUNDARY COMMISSION CONCRETE
REFERENCE MONUMENT N° 39, AT EAST SIDE OF RIVER
ROAD, 4 MILES NORTH OF TERRY LANDING AND
ABOUT 1,500 FEET SOUTH OF SOMBRAS-MOORE
TOWNSHIP LINE, BOLT SET HORIZONTALLY,
FACING SOUTH
PUBLICATION N° 19 'SOMBRA'

CLASS OF CONCRETE
DECK, CURB & PARAPET WALL - 4000 P.S.I.
REINFORCER - 3000 P.S.I.

CLEAR COVER ON REINFORCING STEEL
FOOTING 3" DECK TOP 2 1/2"
ABUTMENT 3" DECK BOTTOM 2"
CURBS AND POSTS 2"

REVISIONS	DATE	BY	DESCRIPTION
2/10/67	W.T.H.		PROFILE CHANGED DECK ELEVATIONS REVISED WINGWALLS SHORTENED 2'-0"

DEPARTMENT OF HIGHWAYS ONTARIO BRIDGE DIVISION			
CLAY CREEK BRIDGE 0.8 MILE SOUTH OF THE MOORE-SOMBRA TWP. RD.			
KING'S HIGHWAY No. 40 NEW		DIST. No. 1	
CO. LAMBTON		CON. 15	
TWP. SOMBRAS		LOT 5	
PRELIMINARY PLAN			
APPROVED		SITE No. 10-177 W.P. No. 42-67	
DESIGN	W.T.H.	CHECK	CONTRACT
DRAWING	J.B.M.	CHECK	No.
DATE	SEP 67	LOADING	H570-44
		DRAWING No. D-6276-P2	

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

TO: Mr. B. R. Davis,
Bridge Engineer,
Bridge Division,
Admin. Bldg.
Attention: Mr. S. McCombie
OUR FILE REF.

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

DATE: May 26, 1967

IN REPLY TO MAY 30 1967

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
Proposed Crossing At
Clay Creek and Hwy. #40, Line 'B'
District #1 (Chatham)
W.J. 67-F-24 -- W.P. 42-67

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

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

AGS/MdeF

Attach.

cc: Messrs. B. R. Davis (2)

H. A. Tregaskes

D. W. Farren

A. Cater

F. C. Brown

A. P. Watt

J. Roy

B. A. Singh

Foundations Files ✓
Gen. Files

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

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 2. DESCRIPTION OF SITE AND GEOLOGY.
 3. FIELD AND LABORATORY INVESTIGATION.
 4. SUBSOIL CONDITIONS:
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 - 4.2) Clay to Silty Clay with Sand and traces of Gravel.
 - 4.3) Clayey Silt with Sand and traces of Gravel.
 - 4.4) Bedrock.
 5. WATER LEVEL OBSERVATIONS.
 6. DISCUSSION AND RECOMMENDATIONS.
 7. SUMMARY.
 8. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT
For
Proposed Crossing at
Clay Creek and Hwy. #40, Line 'B'
District #1 (Chatham)
W.J. 67-F-24 -- W.P. 42-67

1. INTRODUCTION:

The Foundation Section was requested to carry out a foundation investigation for the proposed crossing of Clay Creek and new Highway #40. The proposal is to build the northbound lanes now, with provision to construct the southbound lanes in the future. The request was contained in a memo from Mr. A. P. Watt, Regional Bridge Location Engineer, dated March 29, 1967, stating that the investigation for both north and southbound structures could be made at the same time.

An investigation was subsequently carried out by this Section to determine the subsoil conditions at the site of the proposed structures. Presented in this report are the results of our investigation, together with the recommendations pertaining to the design of the bridge foundations and approach embankments.

2. DESCRIPTION OF SITE AND GEOLOGY:

The site lies within the general physiographic area known as the "St. Clair Clay Plain". Most of Lambton County is essentially till plains bevelled by shallow deposits of lacustrine clay which settled in the depressions while the knolls were being lowered by wave action of both Lake Whittlesey and Lake Warren.

The proposed crossing is located approximately four miles in a north-easterly direction from the town of Sombra. At this location, Clay Creek flows from northeast to southwest, and it meanders through fairly flat terrain towards the St. Clair River. The general topography is flat to undulating, covered with pasture.

cont'd. /? ...

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

There is an existing 27-ft. single-span concrete arch structure over Clay Creek on the road between Lots 5 and 6 in Sombra Township, located some 115 ft. west of the proposed Hwy. #40 centre-line. The approach fills for this structure are in the order of 5 to 7 ft. above the existing ground surface. Clearance between T/O and bottom of creek is $9\frac{1}{2}$ feet (April 13/67). The existing structure appears to be founded on spread footings and is generally in sound condition.

During the process of the field investigation, the creek overflowed its banks on both the east and west sides of the existing bridge. The high water level on the west side of the structure was found to be elevation 601.7, on April 6, 1967.

3. FIELD AND LABORATORY INVESTIGATION:

Using conventional diamond drilling equipment adapted for soil sampling purposes, four sampled boreholes and six dynamic cone penetration tests were carried out at the site. A driving energy of 350 ft.-lbs. per blow was used for the dynamic cone penetration tests. In cohesive materials, 2-inch I.D. Shelby tube samples were obtained by manually pushing the tubes into the soil, where possible. Otherwise, samples of cohesive and non-cohesive materials were obtained using a 2" O.D. split-spoon sampler driven according to the specifications of the Standard Penetration Test. The in situ shear strength was measured, where possible, with a field vane.

Samples were visually examined in the field and subsequently identified in the laboratory. Laboratory tests on selected representative samples were the following: Atterberg limits, natural moisture content, bulk density, grain-size distribution, shear strength, consolidation and organic content.

Results of the laboratory and field tests, together with the location and elevations of the boreholes, are presented in the appendix of this report.

cont'd. /3 ...

4. SUBSOIL CONDITIONS:

4.1) General:

The subsoil at the site mainly consists of a deep deposit of clayey silt to clay. According to available information, this deposit is underlain by bedrock some 150 feet below the ground surface. The boundaries between different deposits, together with detailed descriptions of the material in the deposits, are shown on the borelog sheets attached to this report. The estimated stratigraphical profile shown on Dwg. 67-F-24A, is based on this information. From ground level downward, the different soils types encountered, are as follows:

4.2) Clay to Silty Clay with Sand and traces of Gravel:

This deposit was encountered immediately below the ground surface and extends to a depth of 108 feet in B.H. #1. The upper part of this layer is brown due to oxidation and has an increased shear strength due to desiccation. The thickness of the crust is about 15 - 20 feet. The physical properties of the overall deposit are summarized as follows:

Liquid Limit	($W_L\%$)	--	27	-	56%
Plastic Limit	($W_P\%$)	--	15	-	30%
Moisture Content	($W\%$)	--	19	-	39%
Bulk Density	γ	--	114	-	130 p.c.f.
'N' Values		--	7	-	30 blows/foot

Undrained Shear Strengths -

Unconfined Compression	--	820	-	2430	p.s.f.
Quick Triaxial	--	870	-	2130	p.s.f.
In Situ Field Vane	--	1040	-	>2000	p.s.f.
Sensitivity	--	1.8	-	3.2	

cont'd. /4 ...

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

4.2) Clay to Silty Clay with Sand and traces of Gravel: (cont'd.)

A shear strength vs depth plot may be found in the appendix. The shear strength may be summarized as follows:
0 - 20 feet \geq 2000 p.s.f., 20 - 60 feet 2000 - 800 p.s.f., and
60 - 90 feet 800 - 2000 p.s.f. The consistency of the material is very stiff in the crust, reducing to firm with depth and increasing again to very stiff.

Three consolidation tests were carried out on relatively undisturbed samples of the clay to silty clay. The results of these tests are presented as pressure-void ratio curves in the appendix of this report. Consolidation test results indicate that the upper 60 ft. is overconsolidated.

4.3) Clayey Silt with Sand and traces of Gravel:

This deposit was proved only in B.H. #1 for a depth of 9 ft. (elev. 493 - elev. 484) and is classified as clayey silt with sand and traces of gravel. 'N' values range from 22 to 24 blows/ft., indicating a very stiff consistency. Physical properties of this material are as follows:

Liquid Limit	($W_L\%$)	--	20	-	24%
Plastic Limit	($W_P\%$)	--	12	-	16%
Moisture Content	($W\%$)	--	13	-	15%

A typical grain-size distribution test showed the clayey silt stratum to consist of the following particle sizes:

Clay 18%, silt 44%, sand 35%, gravel 3%.

4.4) Bedrock:

The bedrock elevation was not determined during the course of this investigation. However, according to available information, the bedrock was observed at the following elevations at certain locations in the vicinity of the bridge site:

cont'd. /5 ...

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

4.4) Bedrock: (cont'd.) ...

Sombra Township		Port Lambton Shale Bedrock Elevation	Source of Information
Lot	Con.		
2	XV	451.3 Ft.	Warnock Hersey S 64-272 B.H. #4
2	Sombra-Moore	447 Ft.	Warnock Hersey
2	XV	450 Ft.	Gas Hole C.I.L. Prop.
3	XIV	420 Ft.	Dept. of Mines
6	XIV	414 Ft.	Dept. of Mines

5. WATER LEVEL OBSERVATIONS:

During the field work, the boreholes remained dry. After being filled with water, the water table in the boreholes remained more or less at the creek water elevation. It is believed that this is the true groundwater table, but which is very difficult to establish due to:

- (a) the relatively impermeable nature of the subsoil; and
- (b) the short observation period.

6. DISCUSSION AND RECOMMENDATIONS:

It is proposed to construct twin single-span structures to carry new Hwy. #40 over Clay Creek. According to available information, the northbound lanes only, will be constructed now and the southbound lanes in the future. However, our recommendations will be applicable for both the structures. The proposed embankments

cont'd. /6 ...

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

will be about 10 feet higher than original ground on the approaches to the bridge, but the maximum height in the longitudinal direction will be about 15 ft. since the creek bed is about 5 ft. deep.

Subsoil at the site consists of a deep deposit of clay to clayey silt with sand and traces of gravel extending at least 116 ft. below the ground surface.

Structure Foundations - The proposed abutments may be constructed on spread footing type of foundations within the hard clay crust some 4 ft. below the creek bed. At the proposed structure site, the creek bed is at approximate elev. 594.0 and, therefore, it is recommended that the spread footings be located at or below elev. 590.0 with a safe bearing pressure of 2 t.s.f.

Calculations were performed in order to estimate the consolidation settlements below the proposed abutment footings. The estimated settlements at each abutment location induced by the footing pressure of 2 t.s.f. on a footing area 55 x 10 sq. ft. will be in the order of 3.5 inches. No differential settlements between the abutments are expected since the footings will settle uniformly for the proposed single-span structures.

Because of the relatively impermeable nature of the subsoil, no dewatering problems are expected. Due to the fact that the ground in the area is very flat and that the creek floods occasionally, precautions should be taken to prevent flooding of the excavation.

Any seepage into the excavation should be handled by a sump pump. Care should be taken to prevent softening of the bottom of the excavation. As soon as the required excavation level is reached, a thin layer of concrete should be poured to prevent any damage or softening of the soil.

cont'd. /7 ...

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

Approach Fills - The proposed approach fills will be in the order of 10 to 15 ft. above the ground surface or creek bed. No stability problems are anticipated for the 2 to 1 slopes. The underlying clay to clayey silt will undergo settlements due to consolidation under the weight of the approach embankments. It is estimated that the magnitude of this settlement will be in the order of 4 to 5 inches.

7. SUMMARY:

It is proposed to construct two separate single-span structures over Clay Creek on new Hwy. #40.

Subsoil at the site consists of an extensive deposit of clay to clayey silt extending at least 116 ft. below ground surface.

It is recommended that the abutments be supported on spread footings at or below elev. 590, with a safe bearing pressure of 2 t.s.f. No differential settlements are anticipated for the proposed single-span structures.

A dewatering scheme may be required for the construction of abutment footings below the creek water level. Care should be taken to prevent softening of the foundation material by surface run-off.

No embankment stability problems are anticipated for the standard 2:1 slopes.

8. MISCELLANEOUS:

The field investigation was carried out during the period April 5 - 19, inclusive, 1967. Equipment used was owned and operated by Canadian Longyear Drilling Co. Ltd. Field investigation was carried out by Mr. J. I. McDougall, Project Foundation Engineer, who also prepared this report, under the general supervision of Mr. M. Devata, Supervising Foundation Engineer, who also reviewed this report.

May 1967

APPENDIX I

[illegible]

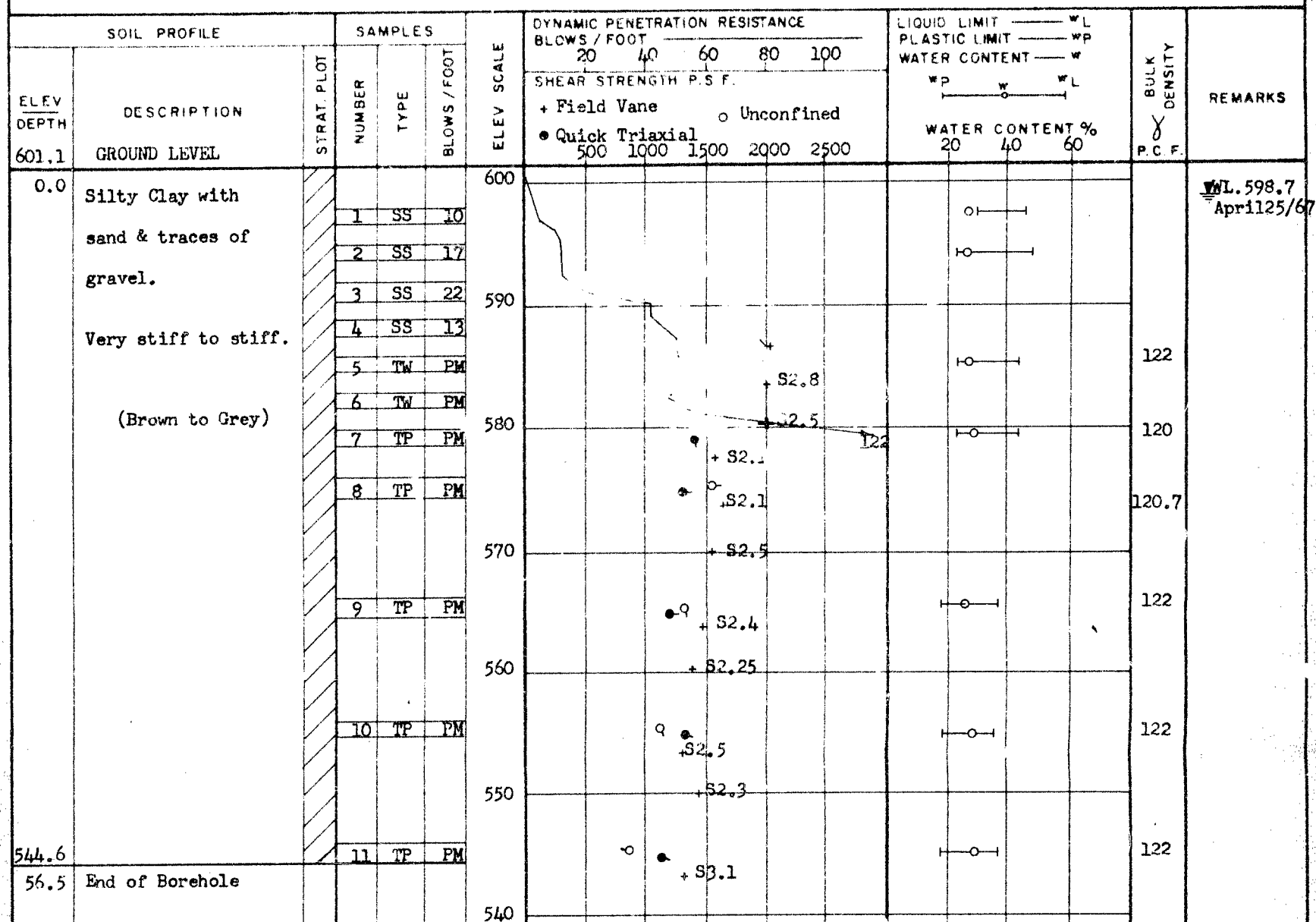
DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO 3

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 67-F-24 LOCATION Hwy. 40 Line 'B' Stn. 454 ± 70 o/s 24.0' Lt. ORIGINATED BY JM
 W.P. 42-67 BORING DATE April 12, 13, 1967 COMPILED BY JM, RT
 DATUM Geodetic BOREHOLE TYPE Washboring NX cased CHECKED BY AK



WL 598.7
April 25/67

DEPARTMENT OF HIGHWAYS - ONTARIO

RECORD OF BOREHOLE NO. 4

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

JOB 67-F-24

LOCATION Hwy. 40 Line 'B' Sta. 453 + 97, 73' Lt.

ORIGINATED BY JM

W P 42-67

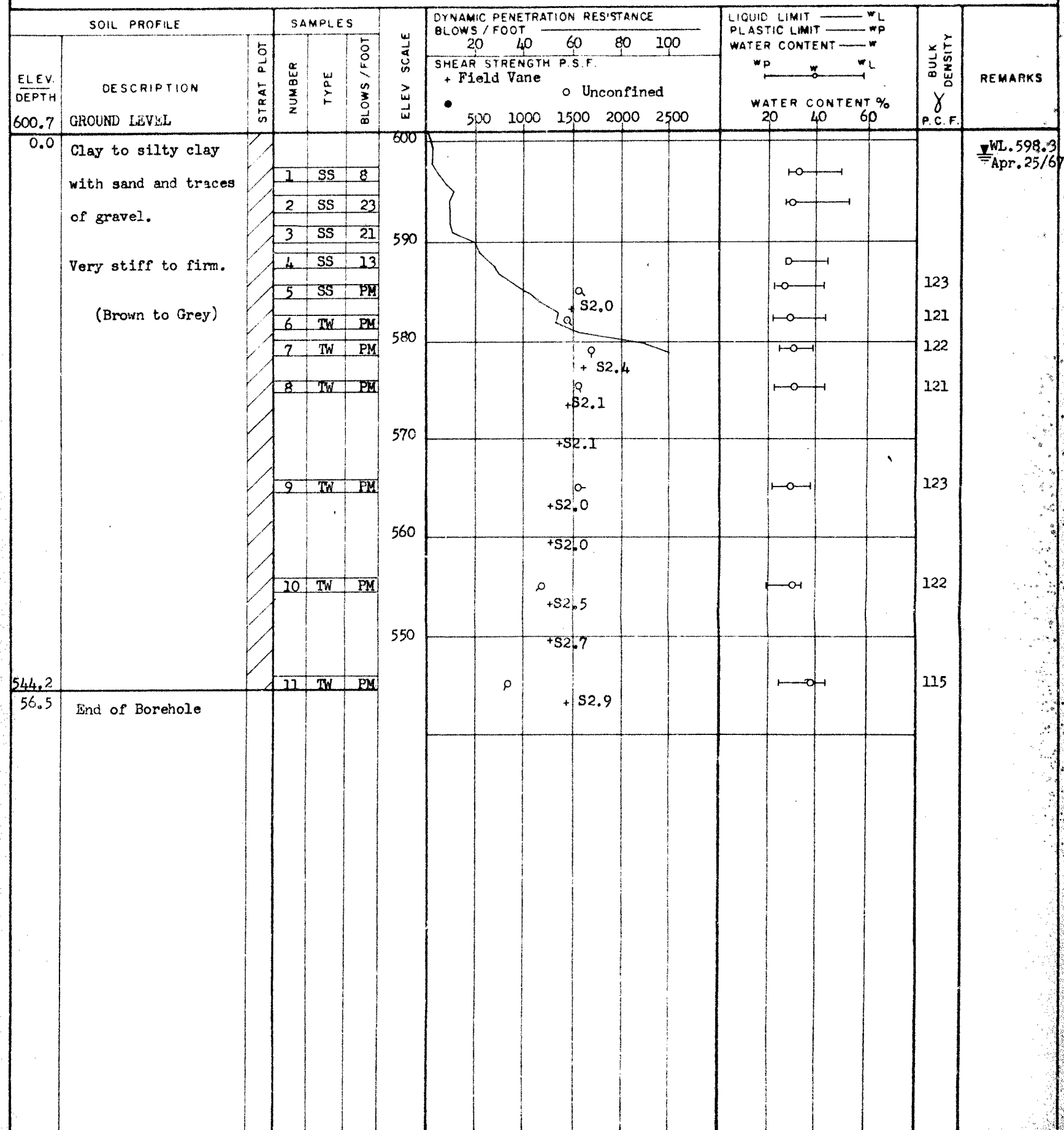
BORING DATE April 18, 19, 1967

COMPILED BY RT; JM

DATUM Geodetic

BOREHOLE TYPE Washboring, NX Cased

CHECKED BY



DEPARTMENT OF HIGHWAYS - ONTARIO		RECORD OF BOREHOLE NO. 5		FOUNDATION SECTION	
MATERIALS & TESTING DIVISION					
JOB	67-F-24	LOCATION	Hwy. 40 Line 'B' Stn. 454 + 60 o/s 73.0' Rt.	ORIGINATED BY	JM
W.P.	42-67	BORING DATE	April 14, 1967	COMPILED BY	JM; RT
DATUM	Geodetic	BOREHOLE TYPE	Dynamic Cone Penetration Test	CHECKED BY	RT

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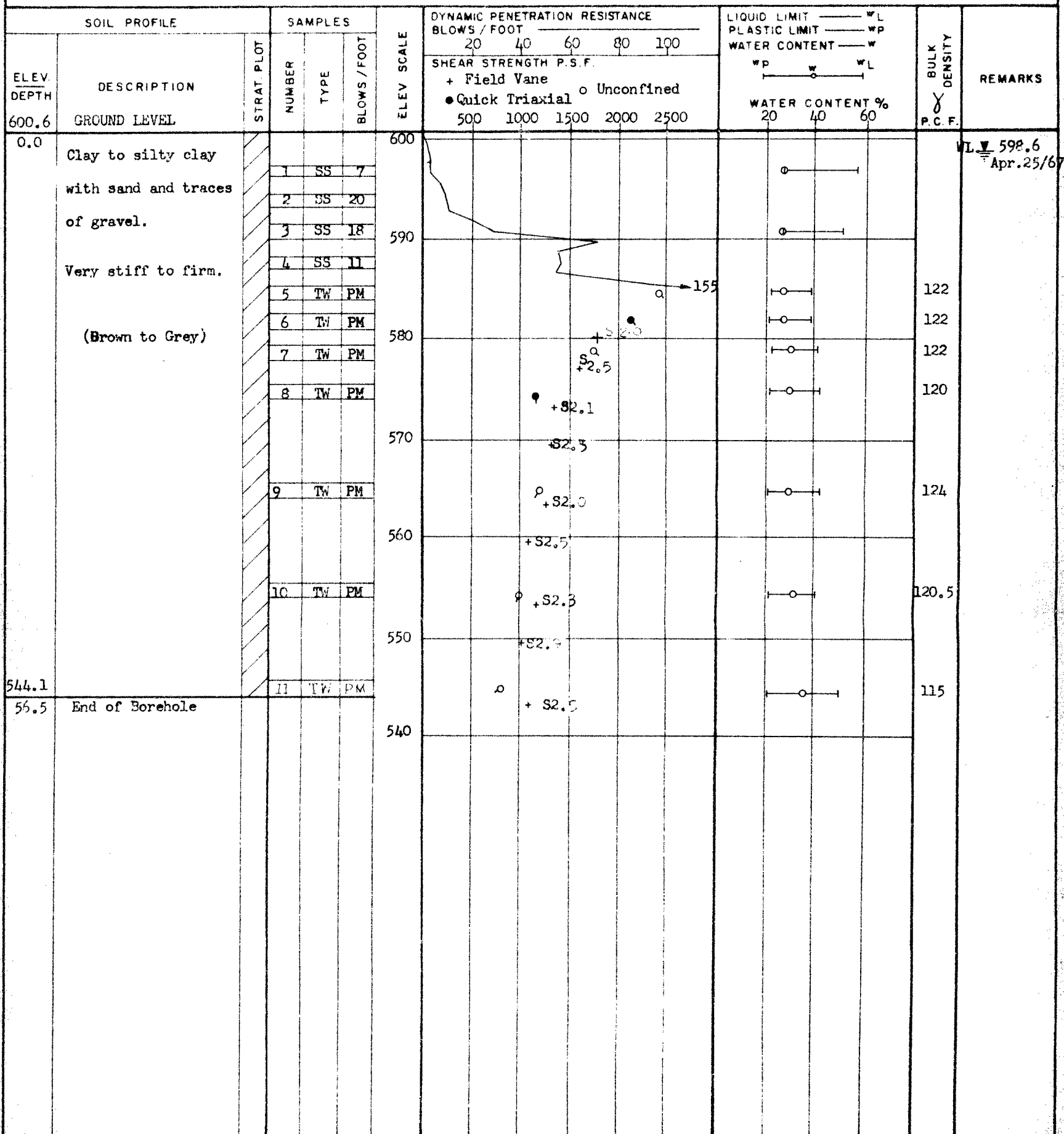
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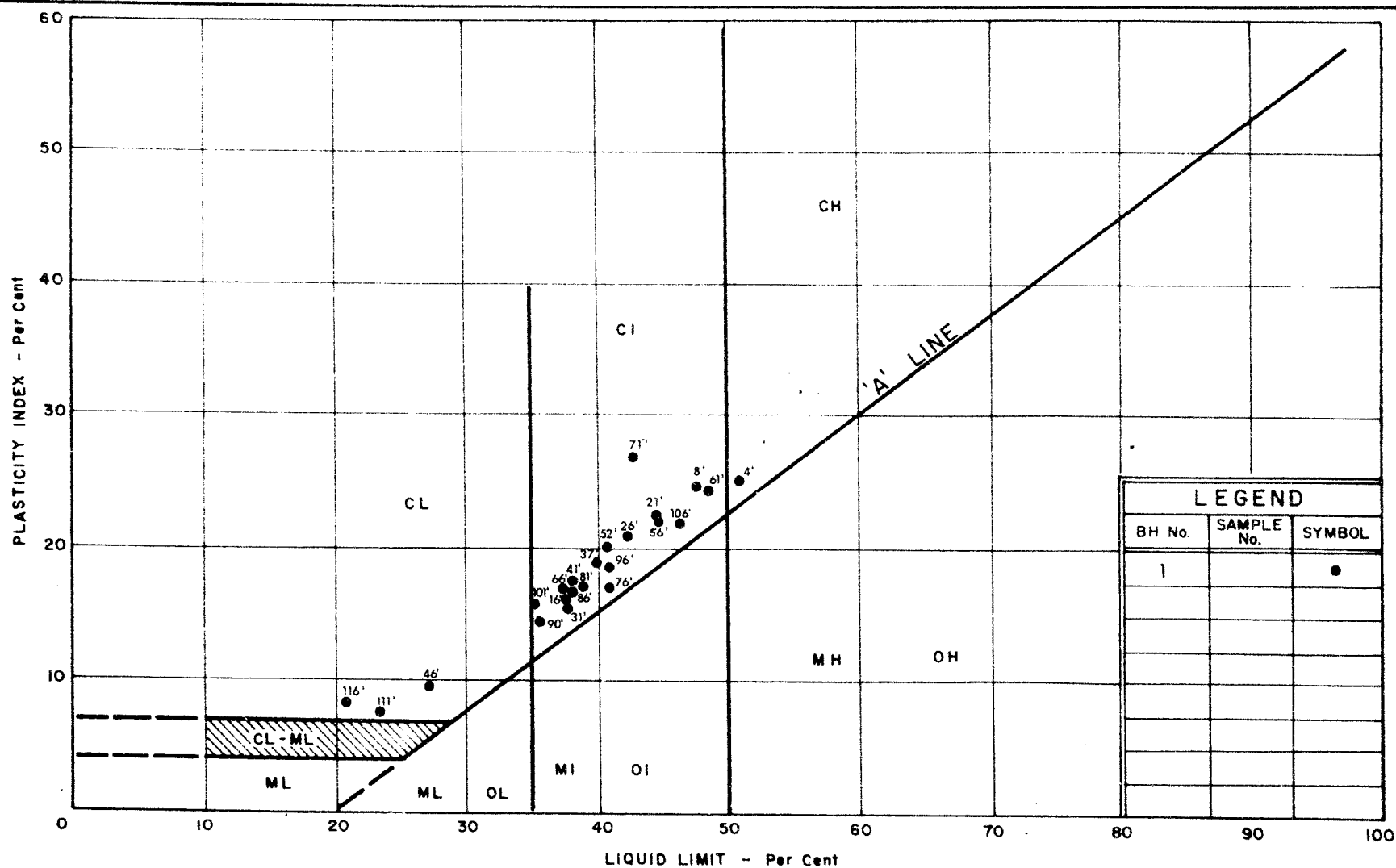
RECORD OF BOREHOLE NO. 6

FOUNDATION SECTION

MATERIALS & TESTING DIVISION

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 W.P. 42-67 BORING DATE April 14 - 18, 1967 COMPILED BY JM, RT
 DATUM Geodetic BOREHOLE TYPE Washboring, NX Cased CHECKED BY JK





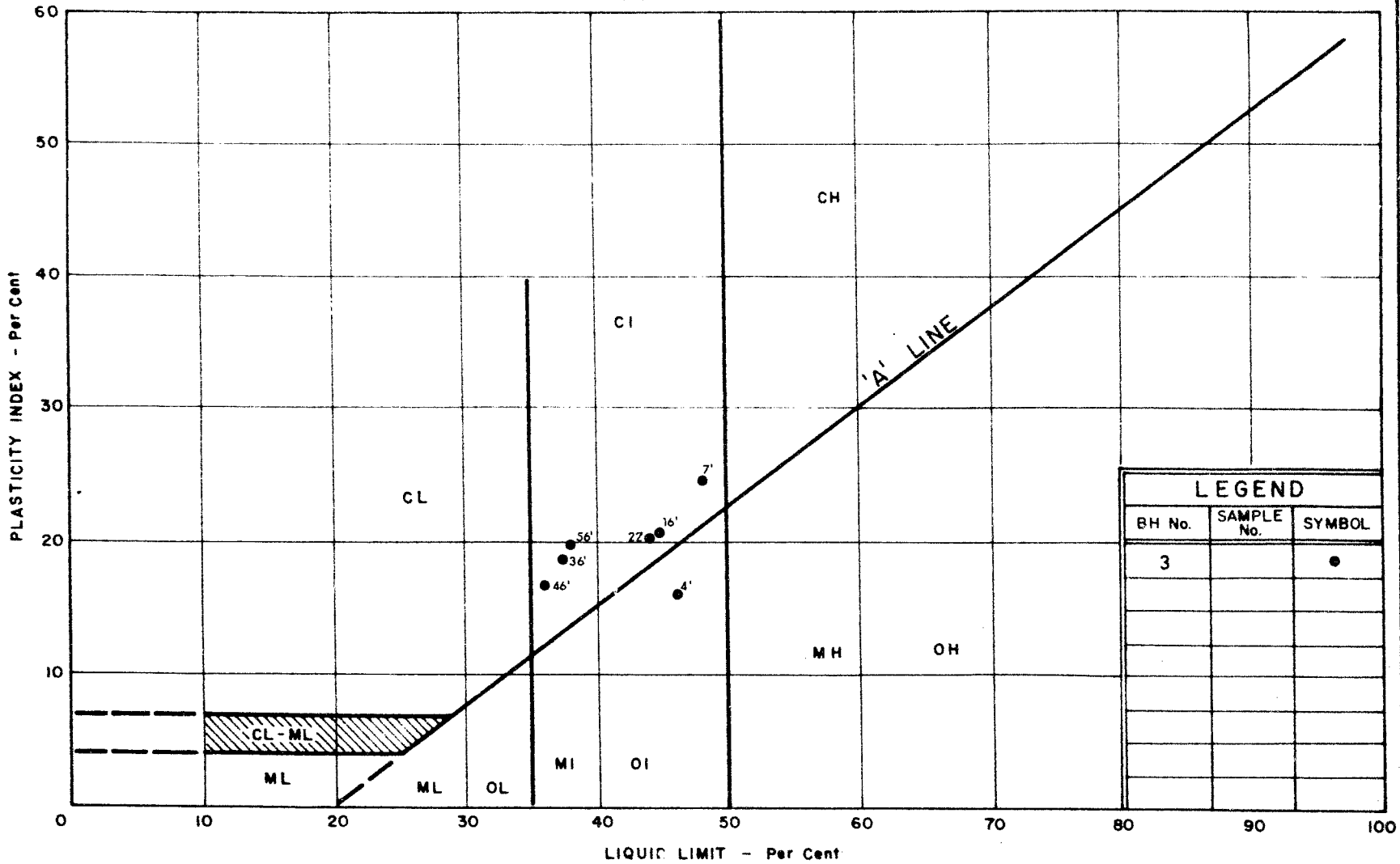
DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART

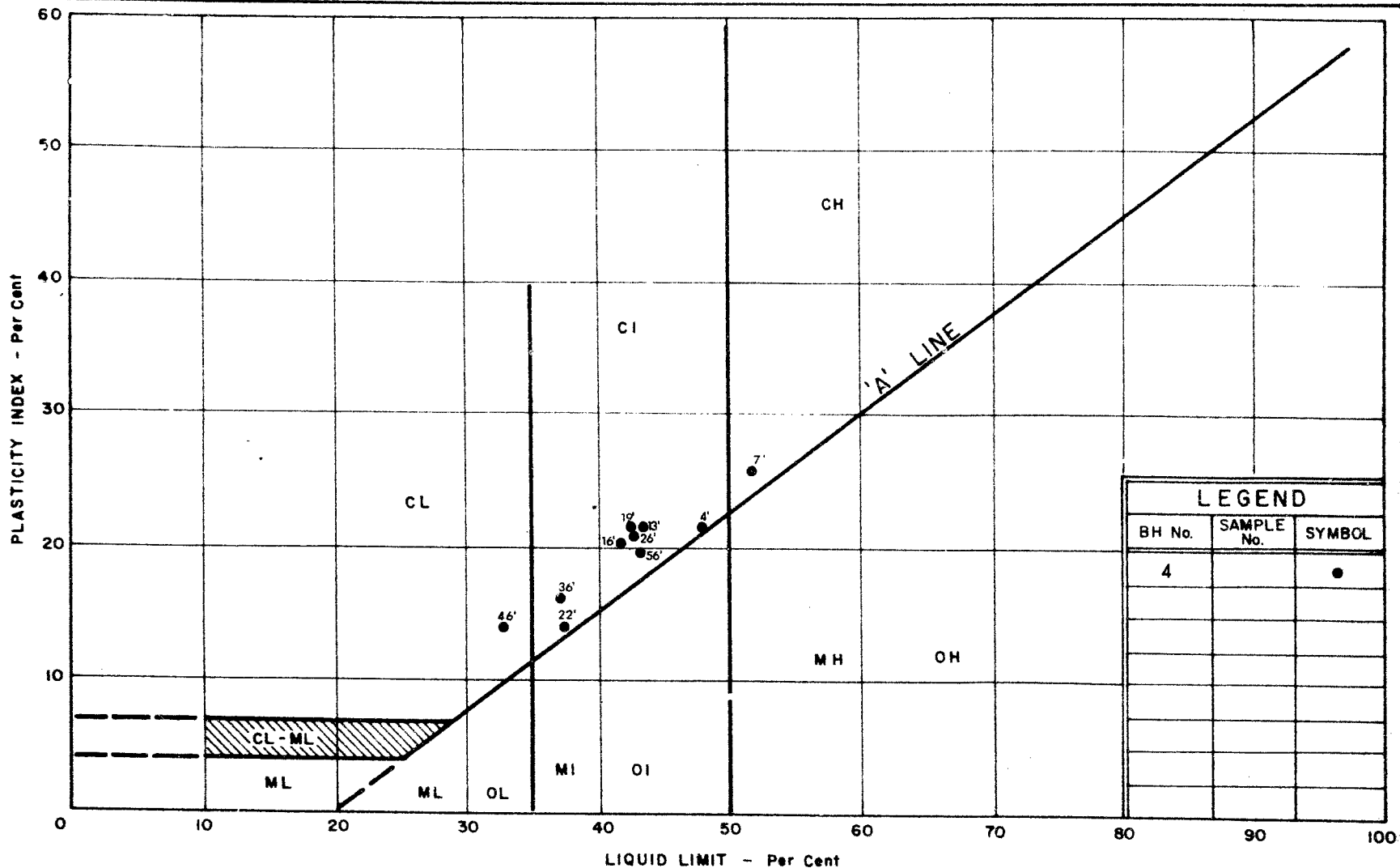
SAMPLE DEPTH AS SHOWN

W.P. No. 42 - 67

JOB No. 67 - F - 24



LEGEND		
BH No.	SAMPLE No.	SYMBOL
3		•



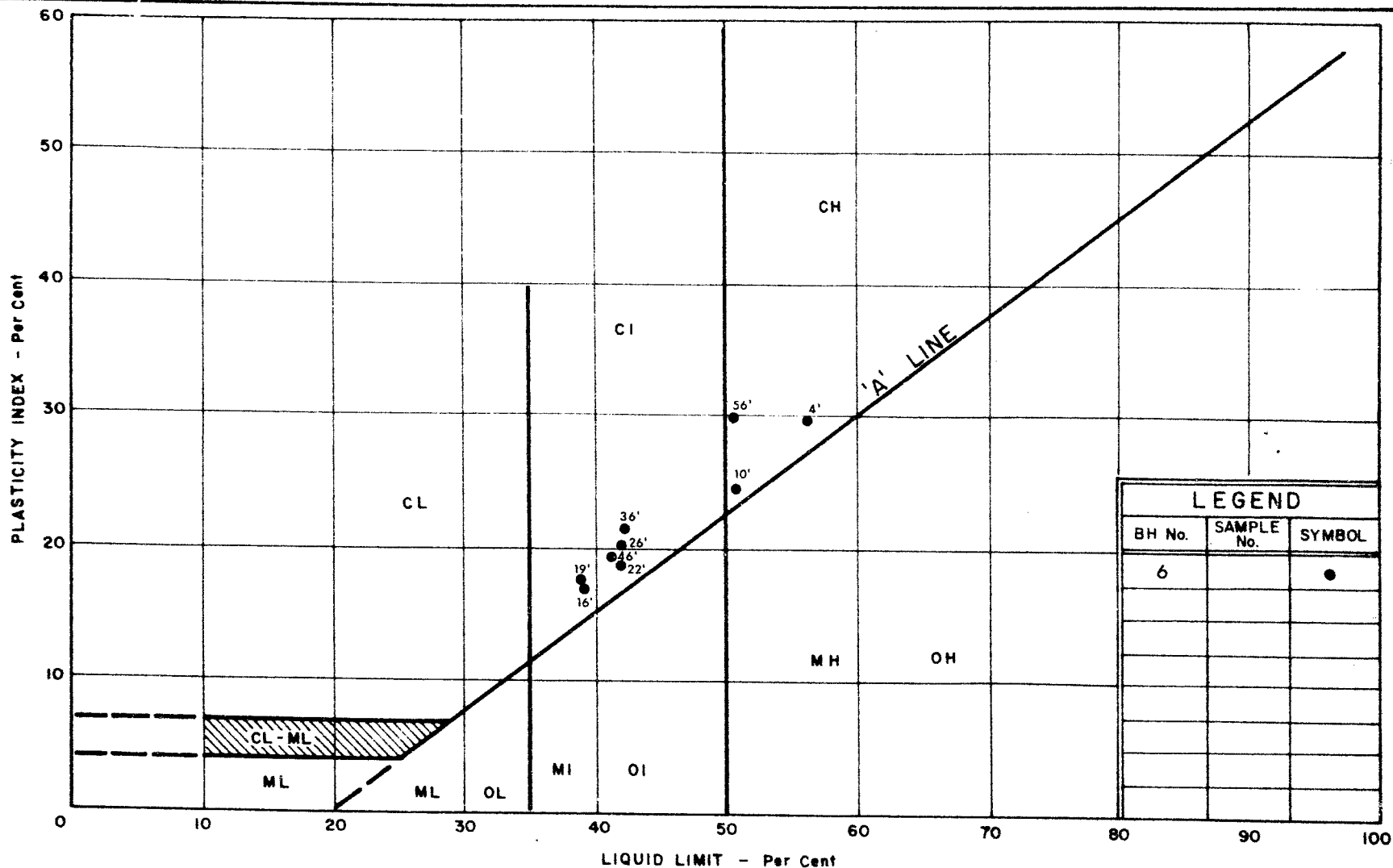
DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART

SAMPLE DEPTH AS SHOWN

W.P. No. 42-67

JOB No. 67-F-24

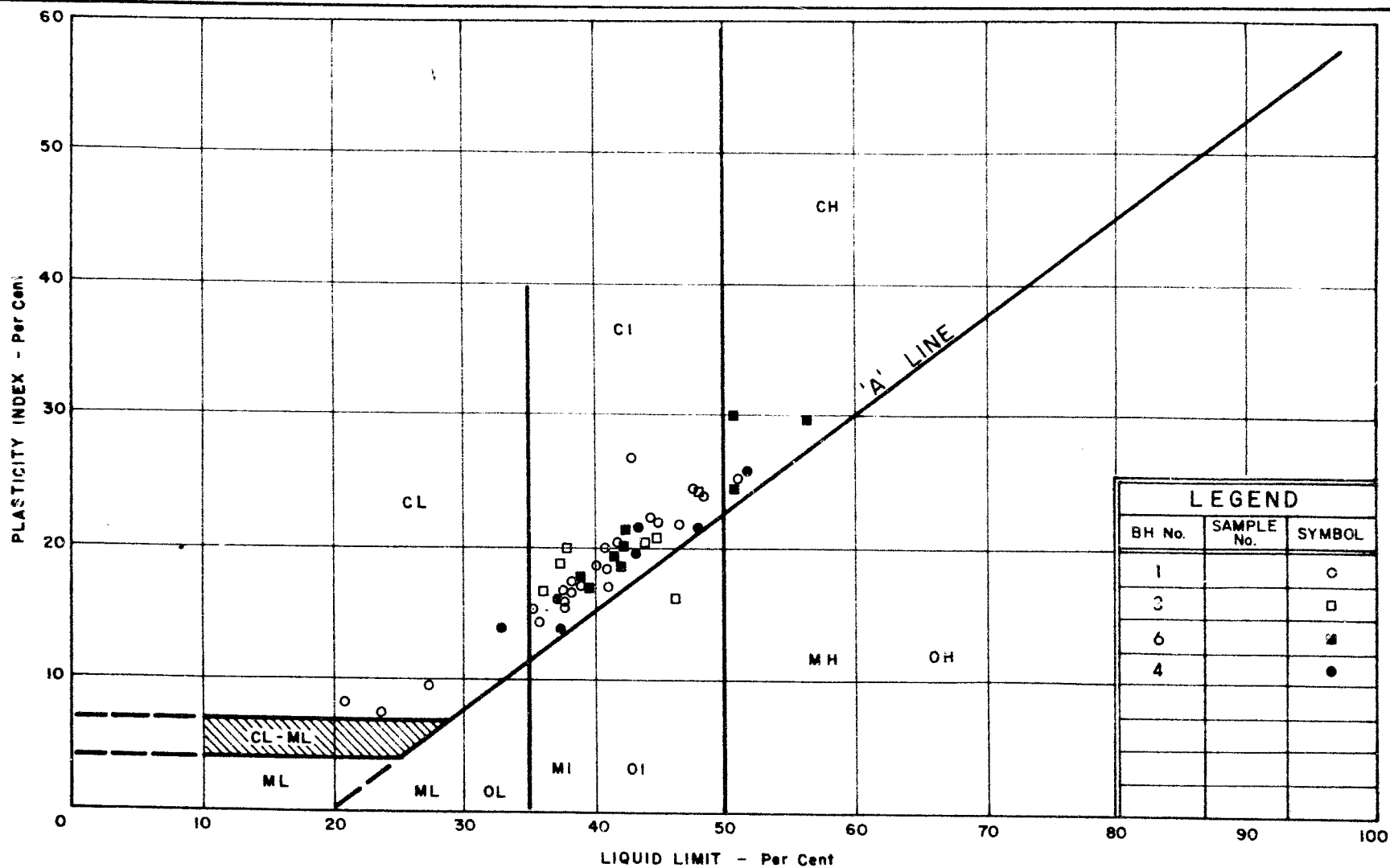


DEPARTMENT OF HIGHWAYS
**MATERIALS and
TESTING
DIVISION**

PLASTICITY CHART SAMPLE DEPTH AS SHOWN

W.P. No. 42-67

JOB No. 67-F-24



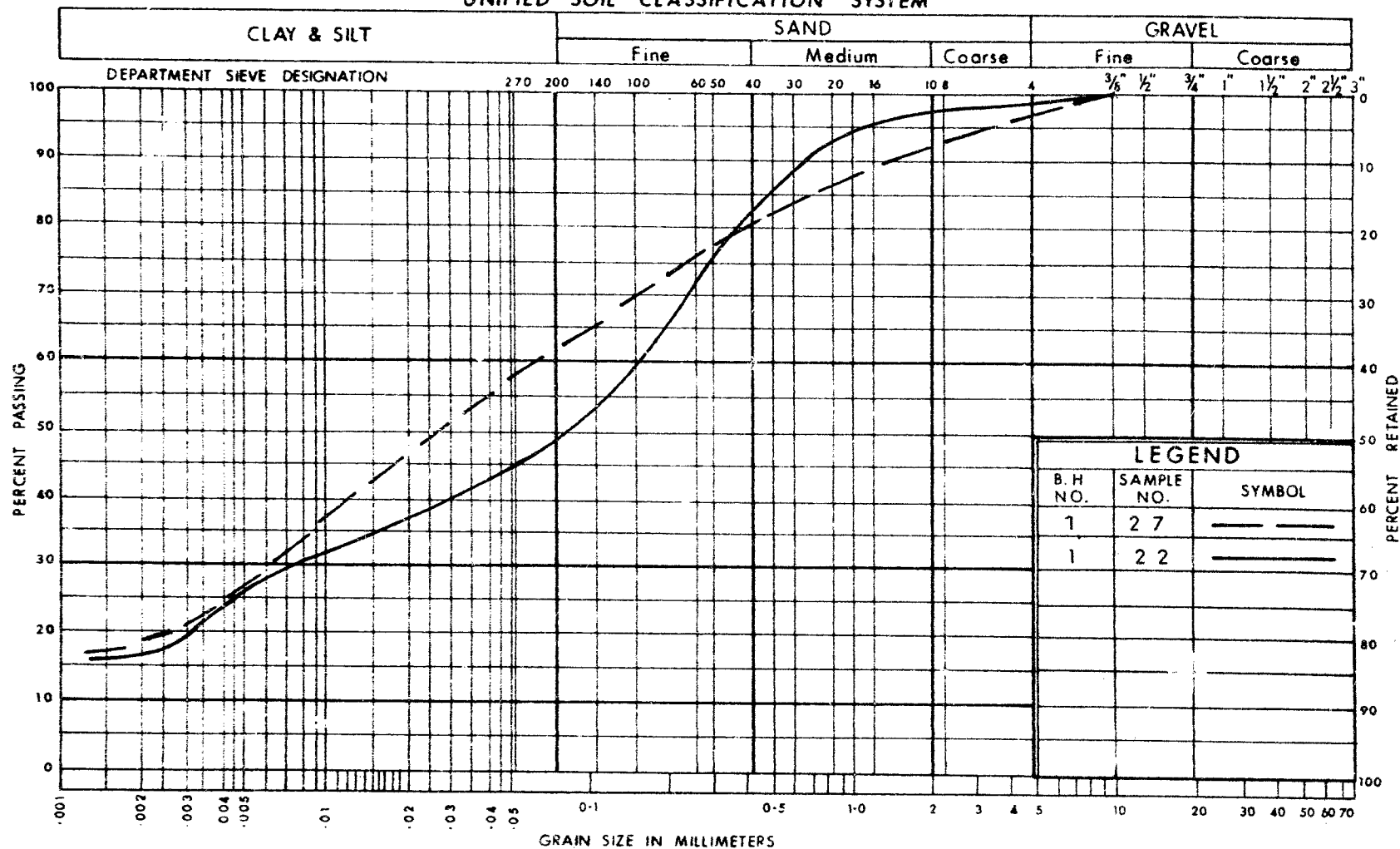
DEPARTMENT OF HIGHWAYS
**MATERIALS and
TESTING
DIVISION**

PLASTICITY CHART OVERALL RESULTS

W.P. No. 42-67

JOB No. 67-F-24

UNIFIED SOIL CLASSIFICATION SYSTEM

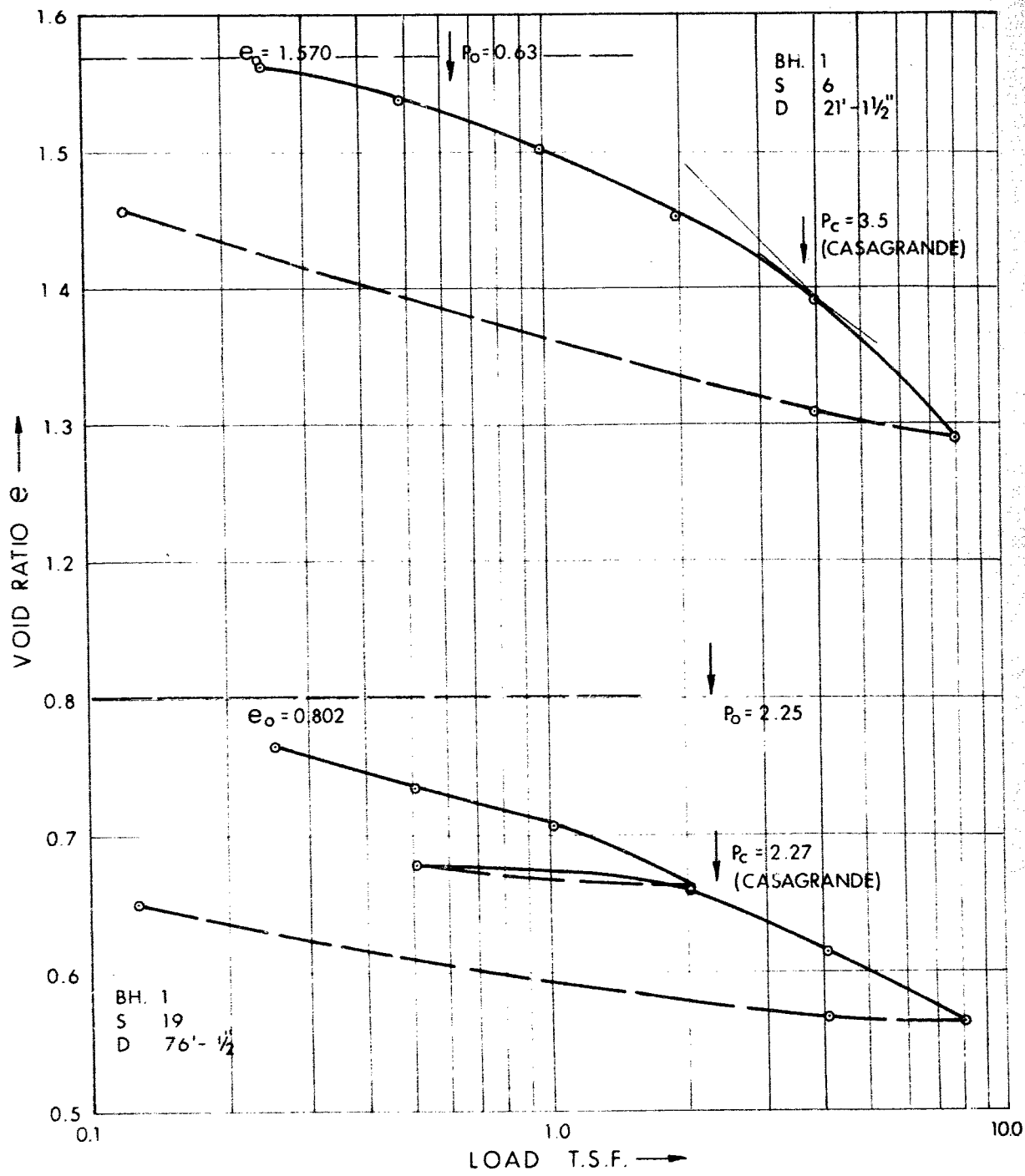


DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

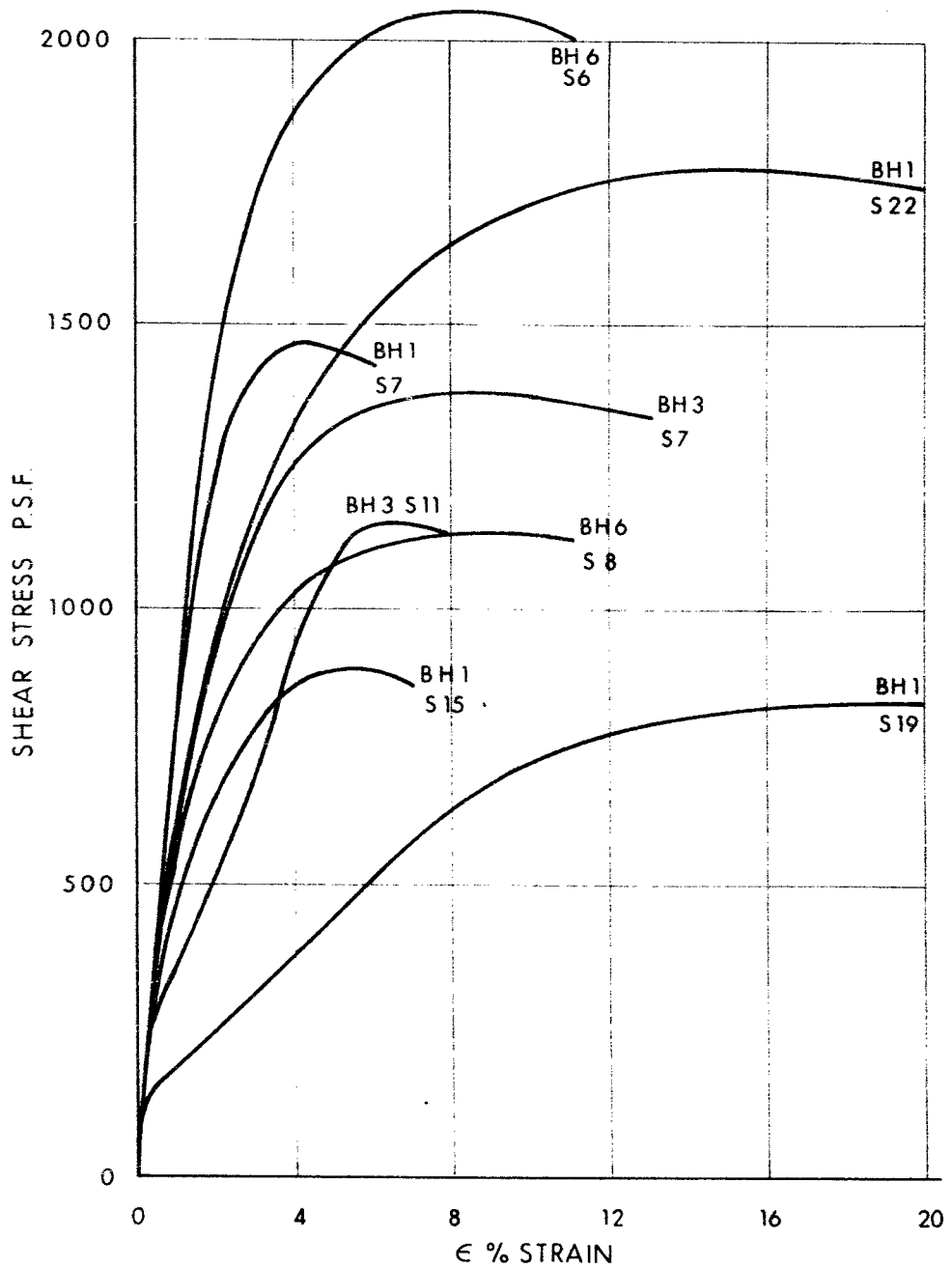
GRAIN SIZE DISTRIBUTION
CLAYEY SILT
WITH SAND & TRACES OF GRAVEL

W.P. No. 42-67

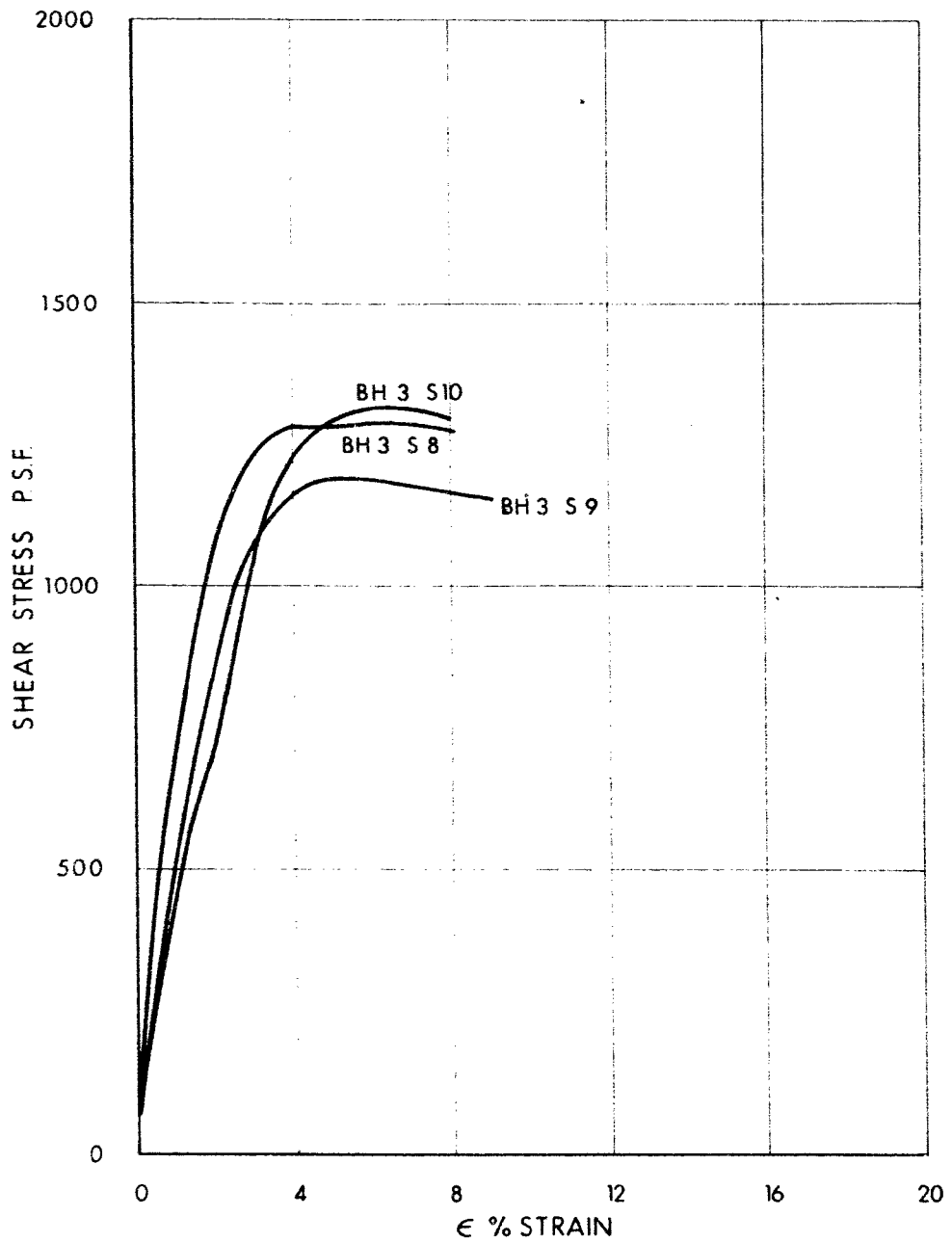
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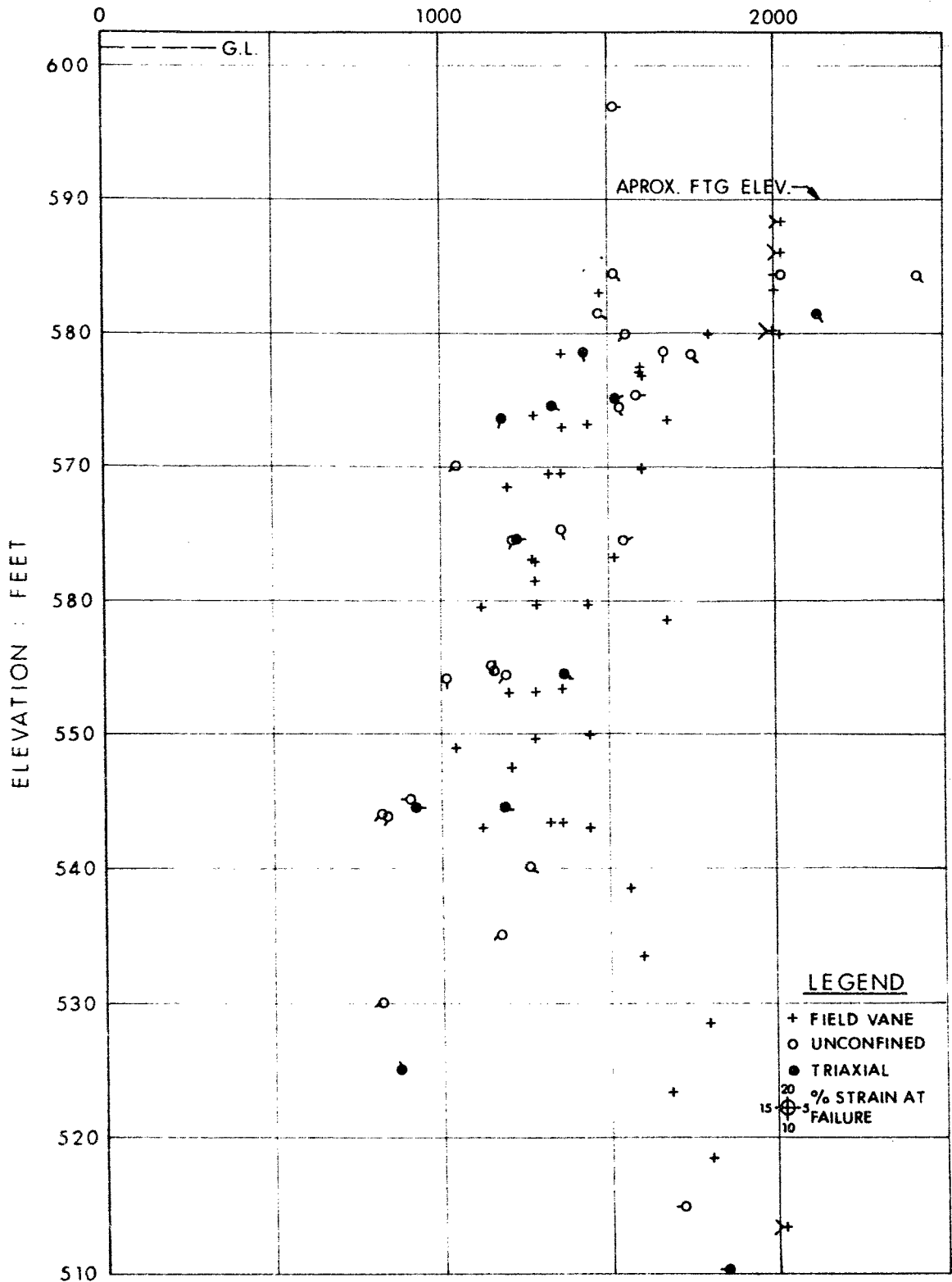
QUICK TRIAXIAL TEST STRESS — STRAIN CURVES



QUICK TRIAXIAL TEST STRESS - STRAIN CURVES

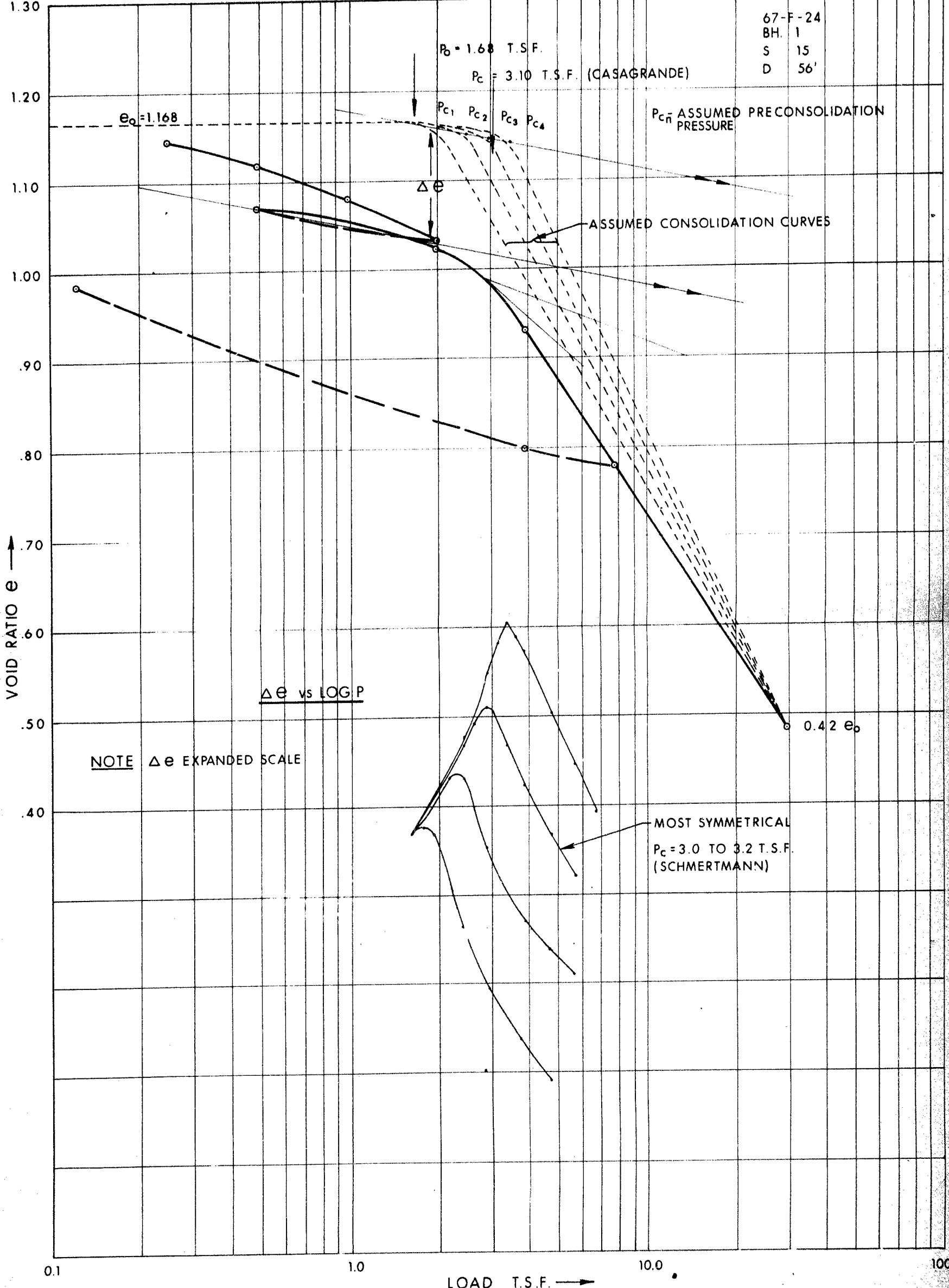


SHEAR STRENGTH P.S.F.



67-F-24
BH. 1
S 15
D 56'

$P_0 = 1.68$ T.S.F.
 $P_c = 3.10$ T.S.F. (CASAGRANDE)



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

Q _u	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Q _{cu}	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q _d	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
I_p	PLASTICITY INDEX
s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_c	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
C_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
T_v	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_i	SENSITIVITY

GENERAL

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

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
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

DEPARTMENT OF HIGHWAYS ONTARIO
PLANNING AND DESIGN BRANCH - ENGINEERING SURVEYS DIVISION
SURVEY REQUEST

67-F-24

Job Name C/O New Hwy #40 Line 8' over head TWP Chatham Gore of Chatham
Hwy. No. 40 Line 8' District 1 (Chatham) Region Central
W.P. No. 314-66 Work Schedule _____ Priority (If Not a W.P.) _____
Date 24th May 1967 Date of Previous Request (If Any) _____
Req'd. By J. J. Bivona Title Supervising Section Foundation Section
Signature Foundation Engineer

Future Design Standards

Hwy. Class No. _____ Design Speed _____ Median Width _____ R/W Width _____

Survey Information

Limits of Survey _____

Bridge Site Plans Req'd. At _____

Railway Crossing Plans Req'd. At _____

Pipe Line Crossing Plans Req'd. At _____

Instructions (Note Any Special Requirements or Drafting Instructions)

We have noted that cross sections are desired 150ft west
and 150ft east of the proposed alignment. For
additional analysis we request that the cross sections be
taken to 300ft east of the following stations

Ch 60+00

Ch 64+00

Ch 64+49

Ch 65+00

Ch 69+50

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

TO: Mr. A. Stermac,
Principal Foundation Engr.,
DOWNSVIEW, Ontario.

FROM: Mr. G. Baun,
Field Supvr.,
LONDON, Ontario.

Att'n: M. Devata

DATE: April 17, 1967.

OUR FILE REF.

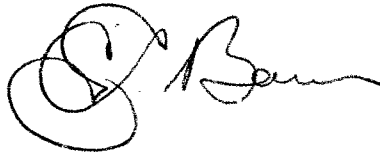
IN REPLY TO

SUBJECT:

Location of boreholes at Clay Creek (W.P. 42-67) ✓ 67-F-24
and Chesapeake and Ohio Railway (W.P. 314-66).
New Hwy. 40, Twp. Chatham, County Lambton.
W.O.'s 9392-67-4, 9392-67-5, Dist. 1, Chatham

This is to inform you your requests at
Clay Creek (April 4, 1967) and Chesapeake and Ohio
railway (April 5, 1967) have been filled by W. Evans
and party April 5, 1967 and April 11, 1967 respectively.

All information obtained at these locations
has been forwarded to the engineers on the site upon
completion of the request.



G. Baun,
Field Supervisor

GB:CB

401 & Keele Street
Downsview, Ontario

Materials and Testing Division

April 4, 1967

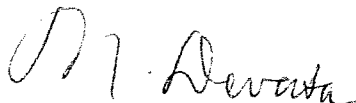
Canadian Longyear Limited
35 Brydon Drive
Lexdale, Ontario

Dear Sirs:

This is to confirm our request of April 3, 1967 for the supply of a Diamond Drill together with all necessary equipment, as specified under the terms of our Contract Agreement, at Sombra, on Hwy 40 at 12 noon on April 5, 1967.

This project bears Job Number 67-F-24.

Yours truly,



M. Devata
Supervising Foundation Engineer
for: A. J. Stermac
Principal Foundation Engineer

J.E:mb

cc: H. Konings
H. Gzywanski ✓

Foundation Files
General Files

CL

MX DOWN APRIL 4/67 337P VR

CHAT 2 F C BROWN DST ENGR ATTN R J LANGLANDS MICE ENGR

LOND 5 A ROY MAT AN TEST DIV

RE WP42-67 BRIDGE SITE 14-177 CLAY CRREK BRIDGE 0.8 MILES

NORTH OF MOORE - SOMBRA TWP ROAD NEW HIGHWAY 40 DIST 1 CHATHAM

THE FOUNDATION INVESTIGATION WORK WILL COMMENCE ON APRIL 5/67.

THIS IS FOR YOUR INFORMATION.

A G STERMAC MAT AND TESTING DIV

BB

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PRELIMINARY STRUCTURE SITE REPORT

67-F24

HWY. 40 W.P. 42-67 STATION _____ DISTRICT 1- CHATHAM

PLAN NO. B-272-6 PROFILE NO. C-272-1 SITE PLAN NO. E-4390-1

Purpose of Structure: River Crossing ☒ R.R.X
Grade Separation _____ Other _____

Is Structure located on D.H.O. right-of-way? No. If not, who owns property and was permission obtained to carry out necessary exploration work? _____

PERMISSION WAS NOT OBTAINED

Describe Soil Conditions at Site. This is to be determined chiefly from a visual observation and possibly a limited amount of hand exploration and should include the general geological formation, anticipated soil conditions, bedrock if visible, etc.

Is Structure Site readily accessible with Core Drill or Power Auger?

Yes

Would preliminary borings by Power Auger be advantageous?

No

Is water available at the site? Yes If not, where is closest source?

Should Approach Fills be investigated for stability?

Yes

REMARKS: _____

DATE MARCH 28, 1967

ENGINEER A.P. WATT

MEMORANDUM

67-F-24

To: Mr. A. G. Sternac
Principal Foundation Engineer
Lab Building
D O W N S V I E W

FROM: A. P. Watt

DATE: March 29, 1967

OUR FILE REF.

IN REPLY TO

SUBJECT:

W.P. 42-67, Bridge Site 14-177,
Clay Creek Bridge,
0.8 miles north of the Moore-Sombra Twp. Rd.
New Highway 40⁴⁰,
District 1, Chatham.

Would you kindly arrange to have a foundation investigation conducted at the above location. I have enclosed two copies of the bridge site plan E-4390-1 with the probable footing locations marked in red.

The north bound lanes are proposed now with the south bound lanes proposed in the future. It is felt that investigations could be conducted for both structures at this time.

Attached please find a copy of the preliminary structure site report for your use.

Accommodations can be obtained along Highway 40 west of the site.

A. P. Watt

A. P. WATT
REGIONAL BRIDGE LOCATION ENGINEER

APW:gt
ATT'D

c.c. Mr. S. McCombie
Mr. A. Crowley
Mr. R. Forrest

*(Mystic Lake)
B. P. Watt
Don West side
Canadian Industries Ltd.*

*Mr. J. J. Porter
Don Walker (4-30-5-00)
Don Walker
Regional Office*

Department of Highways Ontario

Copy for the information of
Mr. A. Stermac,
Principal Foundation Engineer

Mr. A.P. Watt,
Regional Bridge Location Engineer,
London Regional Office,
London, Ontario

Bridge Division,
Downsview, Ontario

September 1, 1967

Clay Creek Bridge
0.8 Miles South of the Moore-Sombra Twp. Rd.
W.P. 42-67, Site No. 14-177
Highway 40 (NEW), District No. 1

Attached herewith are prints of the Preliminary Bridge
Plan Drawing D-6276-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$51,500.
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. Grebaki,
Bridge Design Engineer

Attach.

c.c. S. McCombie
A. Stermac
R. Forrest
E. Cross

alp

Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Division,
Admin. Bldg.

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

September 5, 1967

-- CLAY CREEK BRIDGE --
0.8 Miles South of the Moore-Sombra Twp. Rd.
W.P. 42-67, Site 14-177, W.J. 67-P-24
Hwy. 40 (New) -- District #1 (Chatham)

The Preliminary Bridge Plan Drawing D 6276-P1 for
the above mentioned structure has been reviewed.

We have no comments pertaining to structure
foundations and approach embankments.

MD/MdeF

M. Devata

M. Devata,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

cc: Messrs. S. McCombie
A. P. Watt

Foundations Files ✓
Gen. Files

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac,
Principal Foundation Engineer

Mr. A. Watt,
Regional Bridge Location Engineer,
London Regional Office,
London, Ontario

Bridge Division,
Downsview, Ontario

October 3, 1967

Clay Creek Bridge
0.8 Mile South of Moore-Sombra Twp. Rd.
W.P. 42-67, Site No. 14-177
Highway 40 (New), District No. 1

7-F-24

Attached herewith are prints of the revised Preliminary Bridge
Plan Drawing D-6276-12 for the above-mentioned structure.

The cost will remain the same as previously submitted.

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

CSG:rd

C.S. Grebski,
Bridge Design Engineer

Attach.

c.c. S. McCombie
A. Stermac (2)
E. Forrest
E. Cross

No comments.

M. Devita

Oct 5/67.