



DEPARTMENT OF HIGHWAYS

Memo to Mr. A. M. Toye, Date March 3, 1959.
Bridge Engineer. Subject Re: Hwy. 401, Michigan
Central Railway Crossing,
Conc. III, Southwold Twp. -
W.P. 20-59.

Attention: Mr. S. McCombie.

Enclosed herewith is our report on the subsoil conditions existing at the above noted overpass structure location.

For your convenience, the recommendations contained in the report are repeated as follows:-

- (1) The site is underlain by a deep deposit of stiff silty clay which is over consolidated.
- (2) It is recommended that spread footings be used to support the foundation members. A safe allowable bearing capacity of - 2 tons/sq.ft. can be applied to the clay stratum at or below elev. 740.0.
- (3) No excessive seepage problems are anticipated for excavations to place footings at the recommended elevation of 740.0.
- (4) The subsoil has adequate strength to safely support the proposed embankment loadings. To guard against the possibility of failure within the embankment itself, either a well compacted cohesive fill or well graded granular fill should be specified. For these fill material types, side slopes of 2:1 are adequate.

If we can be of further assistance in connection with the design of foundation members or embankments at this site, please contact our Office.

LGS/MdsF
 Encl.

A. Rutka,
 ACTING NAT'L S. & RESEARCH ENGR.
 per:

cc: Messrs. A. M. Toye
 H. A. Tregaskes
 D. G. Ramsay
 W. L. Fraser
 A. Watt
 Dr. P. Karrow

L. G. Soderman
 (L. G. Soderman,
 PRINCIPAL SOILS & FOUNDATION ENGR.)

Foundation Section

Files

FOUNDATION REPORT

on

Hwy. 401 and Michigan Railway
Crossing, 4 Miles N. of Shedden,
Conc. III, Township of Southwold.

Plan No: F-3530-1

Profile No: F-3530-2

Distribution:

Mr. A. Toye,
Bridge Engineer (2)

Mr. H. Tregaskes,
Construction Engr. (1)

Mr. D. G. Ramsay,
Design Engineer. (1)

Mr. W. L. Fraser,
District Engineer,
London, Ontario. (1)

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Dr. P. Karrow,
Department of Mines(1)

Foundation Section (1)

File (1)

W.P. 20-59

W.J. F-58-35

INTRODUCTION:

An investigation has been carried out to determine the competence of the subsoil layers for supporting the foundations of the proposed structure located approximately 4 miles north of Sheddah where proposed Hwy. No. 401 Line 'A' overpasses the Michigan Central Railway in Conc. III, Township of Southwold, (Sta. 93+52.79, Profile No. F-3530-2).

The field work commenced on Oct. 7, 1958 and was completed on Oct. 21, 1958.

DESCRIPTION OF THE SITE AND GEOLOGY:

Physiographically, the site under consideration is located on the Ekfrid Clay Plain, a small clay plain below the Whittlesey delta. The surface is generally level, and the area is presently under cultivation. From visual inspection and available geological information, it is known that the subsoil profile at this site consists of a homogeneous stratum of stiff silty clay extending to a considerable depth over bedrock.

DESCRIPTION OF FIELD & LABORATORY WORK:

Field work consisted of 5 sampled boreholes, carried out by a skid-mounted coredrill machine adapted for soil sampling. Boreholes were advanced by the conventional wash boring procedure and samples were recovered at depth intervals of five feet. In the cohesive stratum encountered, relatively undisturbed 2 inch I.D. thin walled shelby tube samples were used. In the granular material, samples were obtained by means of a 2 inch O.D. split barrelled spoon sampler. The dimensions of this sampler and the energy used in driving it conform to the requirements

DESCRIPTION OF FIELD & LABORATORY WORK: (cont'd.) ...

of the Standard Penetration Test. In addition to the sampled boreholes, dynamic cone penetration tests adjacent to Borings 1 & 2 were carried out. In-situ vane shear tests were also performed in Boring 3.

Upon receipt in the laboratory, samples were visually examined and identified. Routine index tests were performed on selected representative samples. Laboratory test results have been presented in the borehole logs and detailed in tabular form.

The location plan and subsoil profile are presented in Drawing No. F-58-35A.

SUBSOIL CONDITIONS:

Reference to the borehole logs shows that uniform subsoil conditions exist. The stratigraphy of the site is composed of a homogeneous stratum of stiff silty clay extending to a considerable depth over bedrock.

In each of the sampled boreholes, the topsoil was found to be underlain by a stiff silty clay stratum. The upper zone (8 to 9 ft.) of the clay stratum, has been subjected to oxidation resulting in its present brownish color. Below the oxidized zone, the color is predominantly grey. In Boring 5, however, a layer of gravel-sand approximately 5 ft. in thickness, was intersected between Elevations 738.7 and 733.7. This layer was not encountered in any of the other boreholes.

In general, the stiff clay contains approximately 20% to 25% silt and 10% fine to medium gravel. The average density and moisture content were found to be 130 p.c.f. and 195%, respectively. Liquid and plastic limits averaged 31% and 16%.

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

The laboratory shear strength tests show an average value of 1600 p.s.f. to be representative for the upper 20 ft. The results of field and laboratory tests have been summarized in Table I and are included in this report. Judging from its moisture content and Atterberg limits, the stiff clay appears to be fully saturated and over consolidated.

WATER CONDITIONS:

Observations and measurements carried out during the boring and sampling operations indicate that the ground water table corresponds to existing ground surface. No artesian conditions were encountered.

FOUNDATION SUPPORT:

Spread footing support can be obtained at Elev. 740 ft. (6' to 7' below ground surface) or below. At this elevation, laboratory shear strength measurements and field penetration resistance are such that an allowable bearing capacity of about 2 T.s.f. can be provided by the stiff clay. This allowable bearing pressure incorporates a safety factor of 3. Settlement consequent upon application of this bearing pressure will be of the order of 1 inch.

No excessive seepage problems with respect to shallow footing excavations are anticipated since no water-bearing sand seams were encountered in the upper 25' to 30' below the ground surface.

Under the proposed grade line, the maximum height of fill is some 30 ft. The subsoil is competent to support this proposed embankment loadings. In order to attain a sufficient factor of

FOUNDATION SUPPORT: (cont'd.) ...

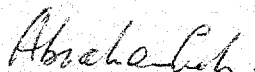
safety for the stability of the approach fills, side slopes of 2:1 can be used provided that good quality fill material is used and that compaction control is carried out.

CONCLUSIONS & RECOMMENDATIONS:

From the foregoing discussion, it follows that:-

1. The stratigraphy of the site is composed of a homogeneous stratum of stiff silty clay, the upper 8 to 9' of which is oxidized.
2. Subsoil conditions are such that an allowable bearing capacity of about 2 t.s.f. can be provided by the stiff clay for spread footing support at Elev. 740 (6' to 7' below ground surface) or below. Settlement consequent upon application of this load will be within tolerable limits.
3. No excessive seepage problems with respect to shallow footing excavations are anticipated.
4. Embankment fill should consist of either -
 - (a) well graded granular material; or
 - (b) well compacted cohesive material.

Side slopes of 2:1 will be adequate.


A. Loh,
Foundation Engineer.

APPENDIX I.

SUMMARY OF FIELD & LABORATORY TESTS

JOB F-58-35

W.P. 20-59

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT	MOIST CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH PSI	UNIT WEIGHT P.C.F.	REMARKS
1	T1	5 - 7	Stiff brown silty clay.	29	22.0	20.3	37.2	3500	125.8	Approximately 7% fine to medium gravel throughout.
1	T2	10 - 12	Stiff grey silty clay.	17	20.9	16.4	32.7	2200	129.5	
1	T3	15 - 17	" " " "	14	22.0	17.3	32.7	1350	131.0	
1	T4	20 - 22	" " " "	15	22.2	17.5	33.2	1600	130.8	
1	T5	25 - 27	" " " "	27	19.8	16.2	31.0	2750	130.8	
1	T6	30 - 32	" " " "	24	20.8	14.0	30.2	2750	130.0	
1	T7	35 - 37	" " " "	25	19.4	14.3	29.8	1550	123.0	
1	T8	40 - 42	" " " "	43	20.0	13.7	30.0	-	-	
1	T9	45 - 47	" " " "	32	18.5	14.7	29.5	2250	132.0	
2	T1	5 - 7	Stiff brown silty clay.	27	24.2	22.5	38.9	4400	126.7	Approximately 10% fine to medium gravel throughout.
2	T2	10 - 12	Stiff grey silty clay.	17	18.4	15.3	31.0	1300	132.0	
2	T3	15 - 17	" " " "	16	21.7	15.8	31.2	1200	131.3	
2	T4	20 - 22	" " " "	14	21.7	14.3	29.8	1300	128.5	
2	T5	25 - 27	" " " "	15	21.3	16.8	30.6	1350	129.3	
2	T6	30 - 32	" " " "	20	20.3	15.1	30.8	-	-	
2	T7	35 - 37	" " " "	26	19.1	15.5	30.0	-	-	
2	T8	40 - 42	" " " "	35	16.7	15.4	28.9	-	-	
2	T9	43 - 45	" " " "	28	18.3	14.9	30.1	2500	133.0	

cont'd. /2 ...

SUMMARY OF FIELD & LABORATORY TESTS

JOB P-58-35

W.P. 20-59

HOLE NO	SAMP NO	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET N RESIST BLOWS/FT	MOIST CONT %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH psi	UNIT WEIGHT pcf	REMARKS
3	T1	5 - 7	Stiff brown silty clay.	34	23.4	18.1	39.8	5150	125.3	Approximately 7% fine to medium gravel throughout.
3	T2	10 - 12	Stiff grey silty clay.	19	24.2	17.0	31.8	1400	127.8	
3	T3	15 - 17	" " " "	12	21.8	14.4	29.8	-	-	
3	T4	20 - 22	" " " "	11	20.6	16.8	32.0	1450	129.0	
3	T5	25 - 27	" " " "	20	20.4	-	-	-	-	
3	T6	30 - 32	" " " "	23	20.7	15.9	31.2	1400	130.8	
3	T7	35 - 37	" " " "	28	19.7	16.9	29.5	2650	133.0	
3	T8	40 - 42	" " " "	26	19.5	16.2	31.8	1550	130.2	
3		9' 6"	Stiff grey silty clay.	-	-	-	-	1820	-) In-Situ Vane Test.
3		11' 0"	Stiff grey silty clay.	-	-	-	-	1550	-	
4	T1	5 - 7	Stiff brown silty clay.	21	18.0	18.4	39.1	4700	125.5	Approximately 10% fine to medium gravel throughout.
4	T2	10 - 12	Stiff grey silty clay.	15	14.2	15.7	32.0	1400	126.0	
4	T3	15 - 17	" " " "	17	16.5	17.7	32.4	1450	130.5	
4	T4	20 - 22	" " " "	12	14.3	15.2	30.8	1200	131.0	
4	T5	25 - 27	" " " "	21	14.3	15.3	31.7	2400	131.0	
4	T6	30 - 32	" " " "	24	16.3	15.2	29.6	2200	131.0	
4	T7	35 - 37	" " " "	26	17.8	16.4	31.2	2400	131.8	
4	T8	40 - 42	" " " "	28	19.5	15.3	29.5	1500	133.3	

cont/ 3 ...

SUMMARY OF FIELD & LABORATORY TESTS

JOB 1-38-35

WR 20-59.

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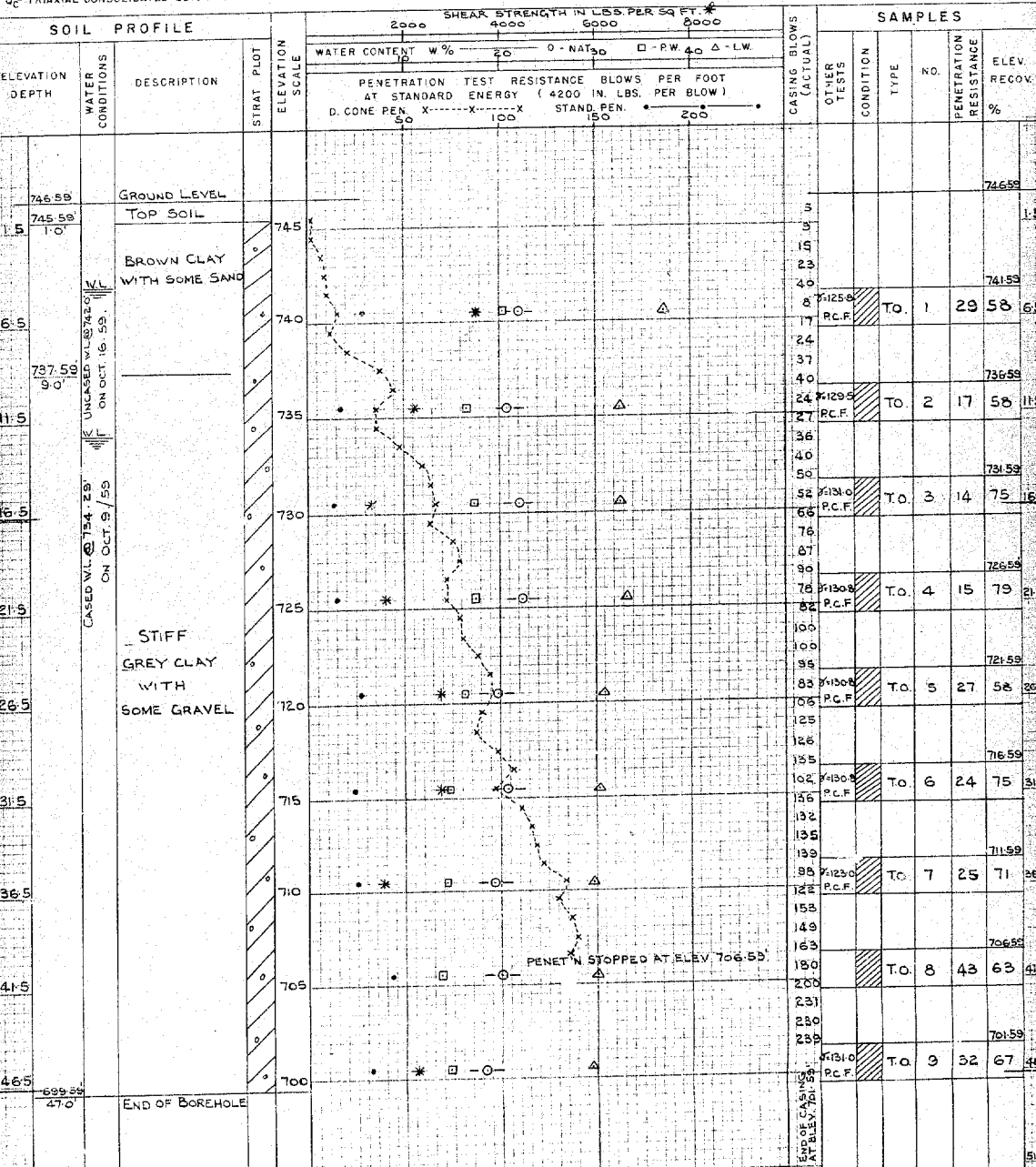
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW
OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BORE & PENETN JOB F-58-35 WP 20-59 BORING 1 STA 93+45 (S&RT)
CASING 5X (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT JAN 1959
SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 7 OCT. 1958

ABBREVIATIONS
V - INSITU VANE SHEAR TEST Q - TRIAXIAL QUICK K - PERMIABILITY CS - CHUNK
M - MECHANICAL ANALYSIS S - TRIAXIAL SLOW C - CONSOLIDATION DO - DRIVE OPEN
U - UNCONFINED COMPRESSION WL - WATER LEVEL IN CASING CA - CASING D.F. - DRIVE FOOT VALVE PS - PISTON SAMPLE
QC - TRIAXIAL CONSOLIDATED QUICK WT - WATER TABLE IN SOIL γ - UNIT WEIGHT T.O. - THIN WALLED OPEN R.C. - ROCK CORE

SAMPLE TYPES
S.S. - SLEEVE SAMPLE
PS - PISTON SAMPLE
W.S. - WASHED SAMPLE
R.C. - ROCK CORE

SAMPLE CONDITION
- DISTURBED
- FAIR
- GOOD
- LOST



DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW
OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BORE & PENETN JOB F-58-35 WP 20-58 BORING 2 STA. 33+07.46 LT
CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT JAN. 1958
SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 14 OCT. 1958

ABBREVIATIONS

V - INSITU VANE SHEAR TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
Q_c - TRIAXIAL CONSOLIDATED QUICK
Q - TRIAXIAL QUICK
S - TRIAXIAL SLOW
WL - WATER LEVEL IN CASING
WT - WATER TABLE IN SOIL
K - PERMIABILITY
C - CONSOLIDATION
CA - CASING
γ - UNIT WEIGHT

SAMPLE TYPES

C.S. - CHUNK
D.O. - DRIVE OPEN
D.F. - DRIVE FOOT VALVE
T.O. - THIN WALLED OPEN
SS - SLEEVE SAMPLE
PS - PISTON SAMPLE
WS - WASHED SAMPLE
R.C. - ROCK CORE

SAMPLE CONDITION



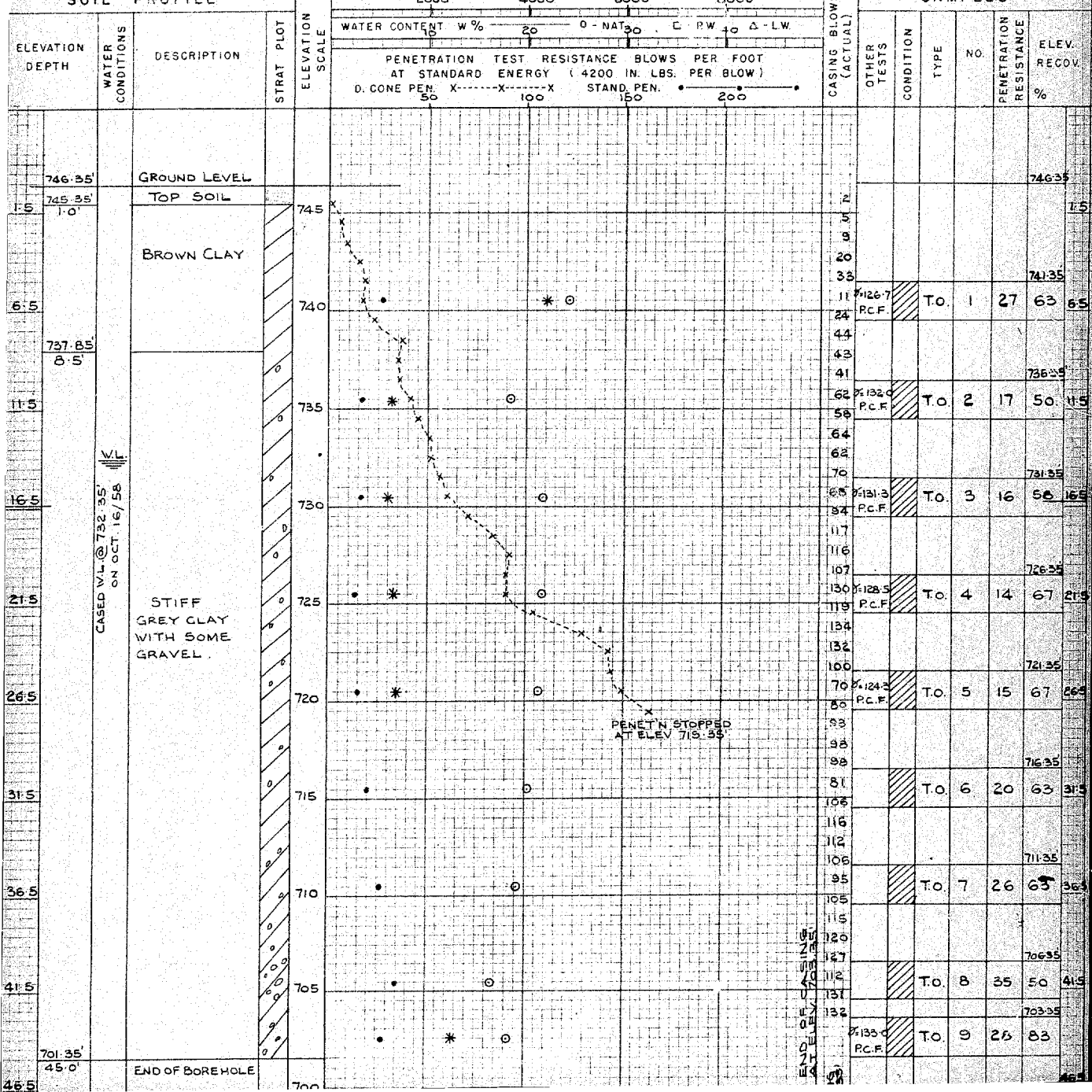
- DISTURBED
- FAIR
- GOOD
- LOST

SOIL PROFILE

SHEAR STRENGTH IN LBS. PER SQ. FT. %

WATER CONTENT W % 20 30 40 Δ - LW
PENETRATION TEST RESISTANCE BLOWS PER FOOT
AT STANDARD ENERGY (4200 IN. LBS. PER BLOW)
D. CONE PEN. X-----X STAND. PEN. 50 100 150 200

SAMPLES



DRILL RIG 54-5 OPERATION BORE JOB F-56-35 WP 20-59 BORING 3 STA. 93+60 (BOLT)
CASING BX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT JAN. 1959
SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 16 OCT. 1958

SAMPLE TYPES

SAMPLE CONDITION



SOIL PROFILE				SHEAR STRENGTH IN LBS. PER SQ. FT. *										CASING BLOWS (ACTUAL)	SAMPLES					
ELEVATION DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT. PLOT	ELEVATION SCALE	WATER CONTENT W %										OTHER TESTS	CONDITION	TYPE	NO.	PENETRATION RESISTANCE	ELEV. RECOV %
					PENETRATION TEST RESISTANCE BLOWS PER FOOT AT STANDARD ENERGY (4200 IN. LBS. PER BLOW)															
					D. CONE PEN. X-----															

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW
OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION Bore JOB F-58-35 WP 20-59 BORING 4 STA. 93+98 (38 RT)
CASING 8x (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT JAN 1959
SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 18 OCT 1958

ABBREVIATIONS

V - INSITU VANE SHEAR TEST Q - TRIAXIAL QUICK K - PERMIABILITY
M - MECHANICAL ANALYSIS S - TRIAXIAL SLOW C - CONSOLIDATION
U - UNCONFINED COMPRESSION WL - WATER LEVEL IN CASING CA - CASING
Q_c - TRIAXIAL CONSOLIDATED QUICK WT - WATER TABLE IN SOIL γ - UNIT WEIGHT

SAMPLE TYPES

C.S. - CHUNK S.S. - SLEEVE SAMPLE
D.O. - DRIVE OPEN P.S. - PISTON SAMPLE
D.F. - DRIVE FOOT VALVE W.S. - WASHED SAMPLE
T.O. - THIN WALLED OPEN R.C. - ROCK CORE

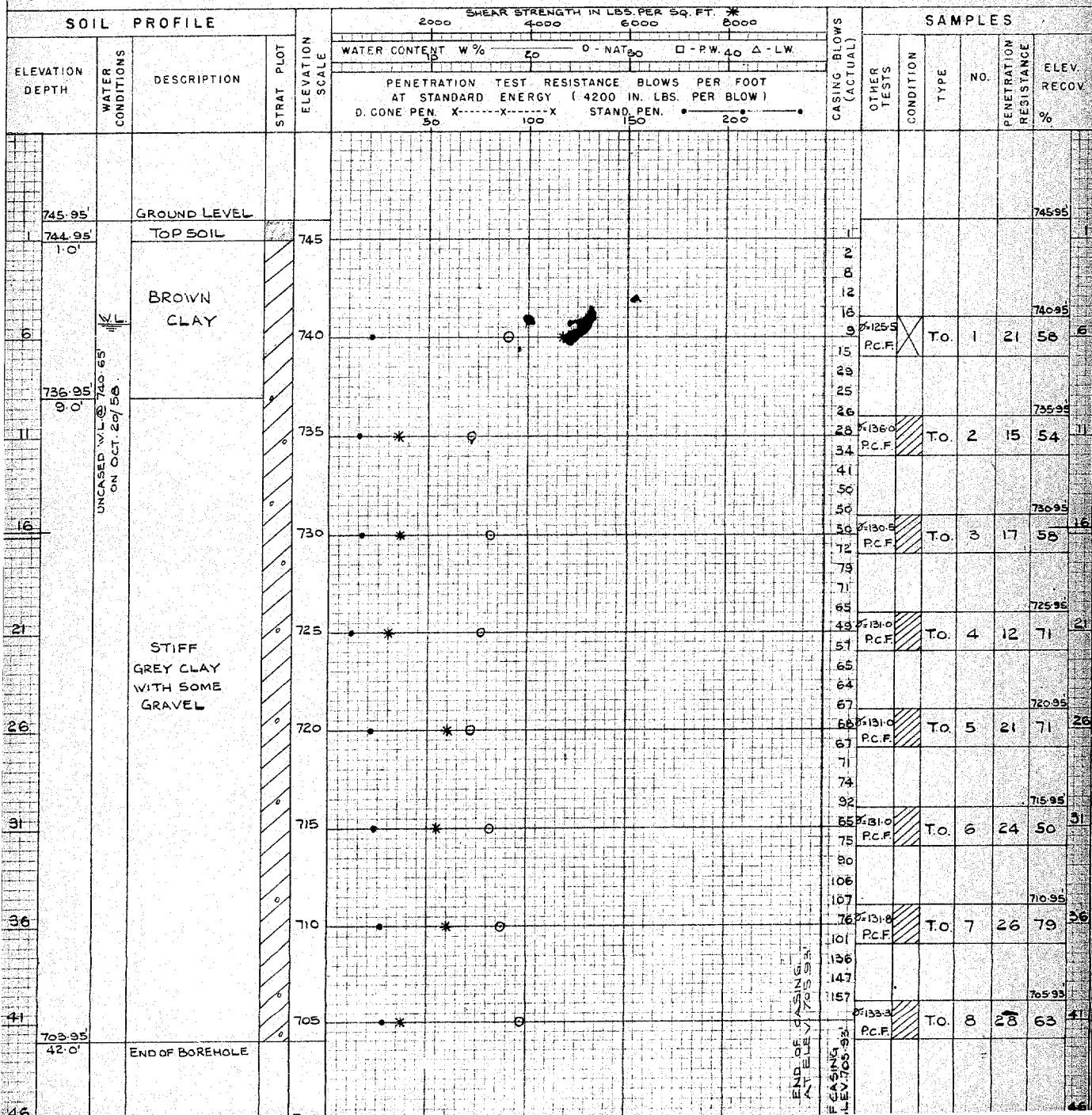
SAMPLE CONDITION



- DISTURBED
- FAIR
- GOOD
- LOST

SOIL PROFILE

SAMPLES



DRILL RIG 54-5 OPERATION BORE JOB F-58-35 WP 20-50 BORING 5 STA. 92+13 1/2
CASING BK (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT JAN 1959
SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 21 OCT. 1958

SAMPLE TYPES

SAMPLE CONDITION

V - INSITU VANE SHEAR TEST	Q - TRIAXIAL QUICK	K - PERMIABILITY	C.S. - CHUNK	S.S. - SLEEVE SAMPLE
M - MECHANICAL ANALYSIS	S - TRIAXIAL SLOW	C - CONSOLIDATION	D.O. - DRIVE OPEN	P.S. - PISTON SAMPLE
U - UNCONFINED COMPRESSION	WL - WATER LEVEL IN CASING	CA - CASING	D.F. - DRIVE FOOT VALVE	WS - WASHED SAMPLE
Q - TRIAXIAL CONSOLIDATED QUICK	WT - WATER TABLE IN SOIL	γ - UNIT WEIGHT	T.O. - THIN WALLED OPEN	R.C. - ROCK CORE



- DISTURBED
- FAIR
- GOOD
- LOST

SHEAR STRENGTH IN LBS. PER. SQ. FT. *

SAMPLES

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58-F-35

W.P. # 20-59

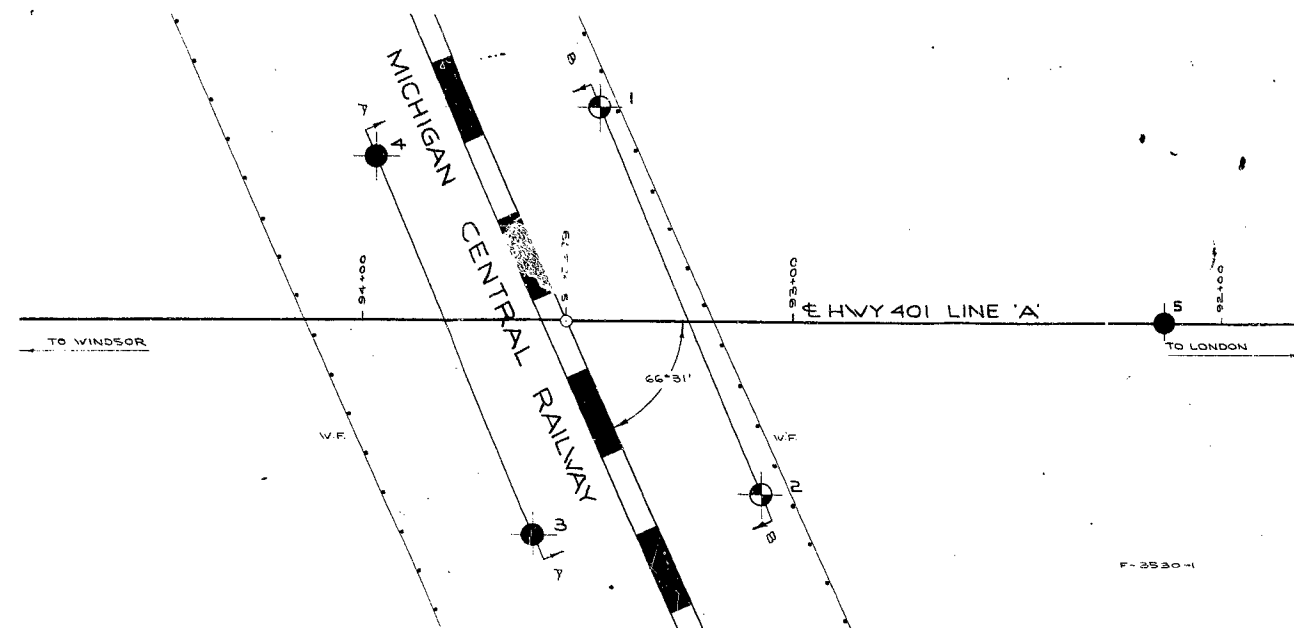
Hwy. # 401 :

MICHIGAN Rwy.

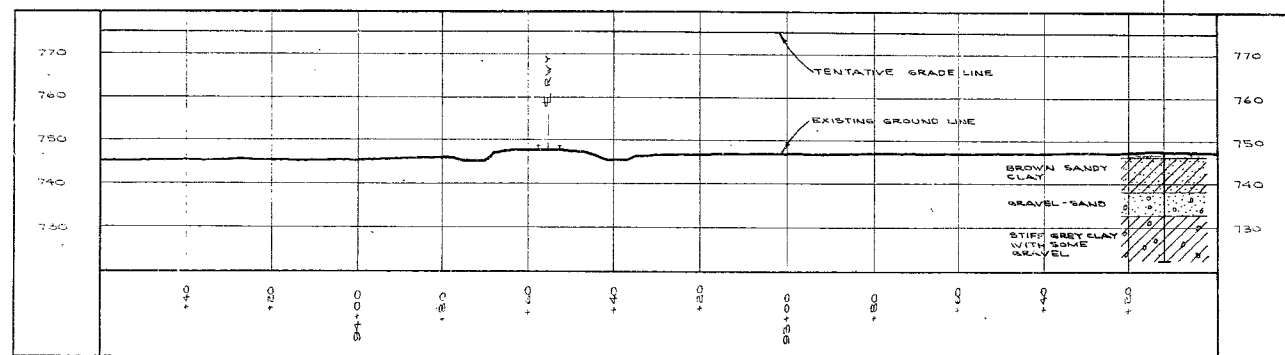
CROSSING, CON. #3

4 MILES N. OF

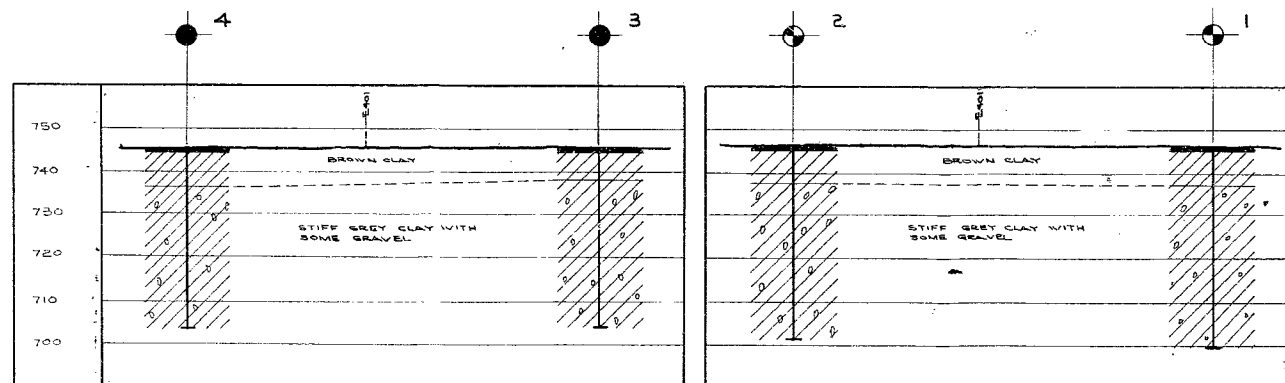
SHEDDEN



PLAN

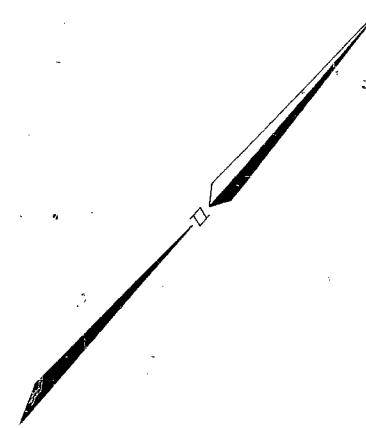


PROFILE



A-A

B-B



LEGEND			
BORE HOLE			
PENETIN HOLE			
BORE & PENETIN HOLE			
HOLE NO	ELEVATION	STATION	DISTANCE FROM E
1	746.593	93+45	50' RT.
2	746.353	93+07	40' LT.
3	746.033	93+60	50' LT.
4	745.953	93+98	35' RT.
5	747.713	912+13	E

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 & RESEARCH SECTION			
MICHIGAN CENTRAL RAILWAY			
PROPOSED CROSSING			
SHOWING POSITIONS & ELEVATIONS OF HOLES			
HWY. 401	DISTRICT 2	COUNTY ELSIN.	
TOWNSHIP SOUTHOLD	LOT 19	CON. III	
LOCATION APPROX. 4 MI. N. OF SHERBORN			
DRAWN BY: T. MELLORS	CHECKED BY:	V.P. 20-55	
DATE: 5 FEB. 58	APPROVED BY:	DRAWING NO.	
SCALE: 1" = 20'		F-58-35A	