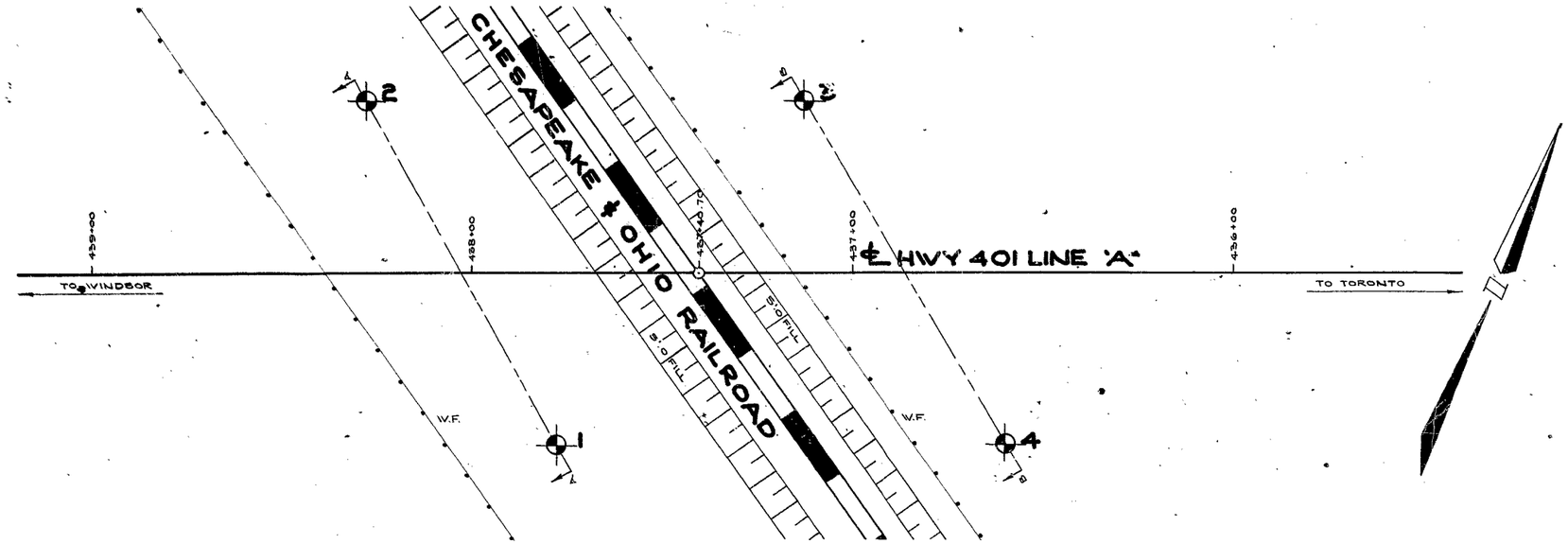
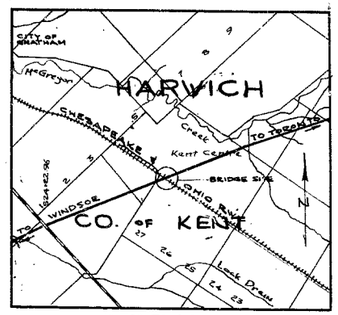
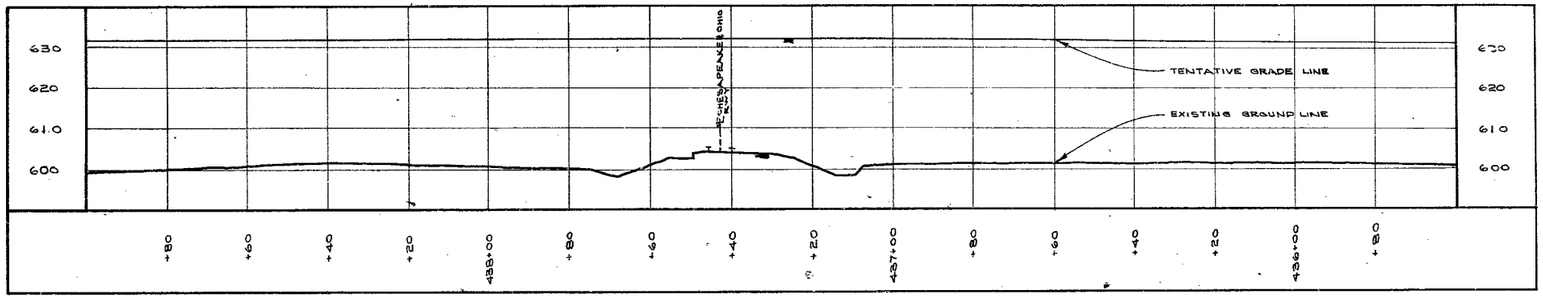
59-F-3
W.P.# 15-59
Hwy.# 401 &
CHESAPEAKE &
OHIO RWY.
CROSSING,
2½ MILES S.E.
OF CHATHAM



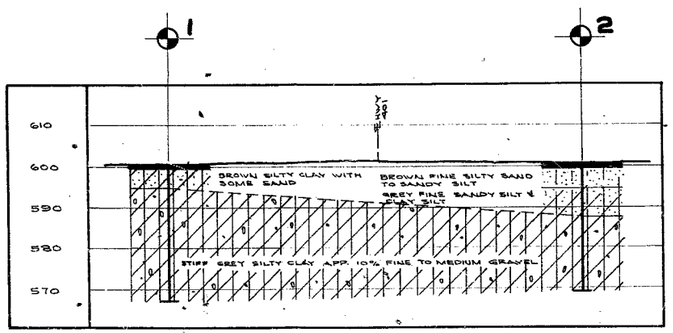
PLAN



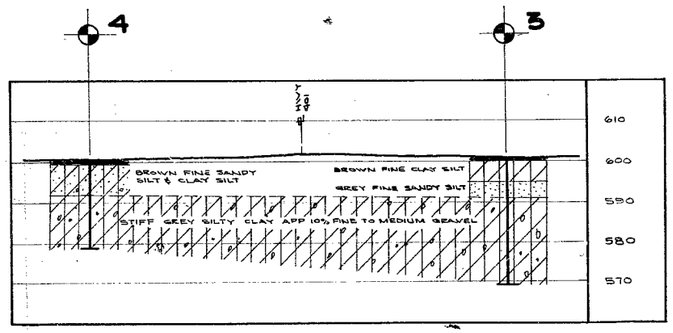
KEY PLAN
SCALE 1"=1MI.



PROFILE



A-A



B-B

LEGEND

BORE HOLE

PENETRATION HOLE

BORE & PENETRATION HOLE

HOLE NO.	ELEVATION	STATION	DISTANCE FROM ℄
1	600.3'	457+78	45' LT
2	600.7'	458+28	45' RT.
3	601.0	437+13	45' RT.
4	601.0'	436+60	45' LT.

- 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

CHESAPEAKE & OHIO RWY. PROPOSED CROSSING

SHOWING POSITIONS & ELEVATIONS OF HOLES

HWY. 401 DISTRICT 1 COUNTY KENT
TOWNSHIP HARWICH LOT 27 CON II
LOCATION 2½ MI. S.E. of CHATHAM

DRAWN BY: T. MELLORS	CHECKED BY:	W.P. 15-59
DATE APR. 8, 1959.	APPROVED BY	DRAWING NO. F59-3A
SCALE 1"=20'		

cc: Mr. A. M. Toye BA PHP

Mr. A. M. Toye,

Bridge Engineer.

Materials & Research Section.

May 26, 1959.

Foundation Report - Hwy. 401, Line A and Chesapeake & Ohio Rwy. (Piere Marquet) Crossing, Lot 27, Con.II, Twp. Harwich - W.P. 15-59.

Attention: Mr. S. McCombie.

Enclosed herewith is our Foundation Report on the subsoil conditions existing at the above noted site. For your convenience, the principal recommendations contained in this report, are as follows:-

(1) Subsoil conditions consist of an upper layer of glacio-fluvial deposits which exhibit low shear strength and high compressibility characteristics. This upper layer exists to a depth of 15 to 18 feet below the existing ground surface. Underlying this upper stratum, is a relatively stiff glacial till formation which exhibits high shear strength and low compressibility characteristics. The vertical extent of this deposit was not proven beyond a depth of 33 1/2 feet.

(2) It is recommended that a pile supported footing be designed to support the abutments for this structure. Large displacement type end bearing piles should be specified. Either low capacity timber piles or higher capacity monotube or Franki caissons will meet practicable refusal at an estimated elevation of 574. If timber piles are used, cut-off elevation should be at or below Elev. 594. Steel "H" piles are not recommended.

(3) An alternative to a pile supported foundation would be to use spread footings founded on the underlying till stratum at an approximate elevation of 584. Founding footings at this elevation would necessitate expensive shoring and dewatering operations during construction, and a pile supported foundation appears to be more economical.

cont'd. /2 ...

(4) Embankment slopes should not be steeper than 2:1, and fill material should consist of either: (a) well-compacted cohesive material; or (b) compacted well-graded granular material. Horizontal thrust induced by the weight of backfill acting on the abutments should be taken entirely by batter piles.

If we can be of further assistance in connection with foundation conditions at the above site, please contact our office.

L. G. Soderman

L. G. Soderman,
PRINCIPAL SOILS & FOUNDATION ENGINEER.

LGS/MdeF
Encl.

cc: Messrs. A. M. Toye
H. A. Tregaskes
D. G. Ramsay
H. Orlando
G. U. Howell
J. Roy
Dr. P. Karrow

Foundations Office

File.

FOUNDATION REPORT

on

Hwy. 401, Line 'A' and Chesapeake
and Ohio Rwy. (Piere Marquet) Crossing,
Lot 27, Con. II, Township of Harwich,
Approximately 2 1/2 Miles S.E. of Chatham.

Plan No: F-3532-5
Profile No: F-3532-4
Chainage: Sta. 437+40.70.

Distribution:

Mr. A. M. Toye,
Bridge Engineer. (2)

Mr. H. A. Tregaskes,
Construction Engineer. (1)

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

Mr. H. Orlando,
Project Design Engineer. (1)

Mr. G. U. Howell,
District Engineer,
Chatham, Ontario. (1)

Mr. J. Roy,
Regional Soils Engr.,
London Regional Office. (1)

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

Foundation Section. (1)

File. (1)

W.P. 15-59.
W.J. F-59-3.

INTRODUCTION:

Presented in this report are the results of a subsoil investigation carried out at a structure location approximately 2 1/2 miles S.E. of Chatham where proposed Hwy. 401, Line 'A' overpasses the Chesapeake & Ohio Railway (Piere Marquet) in Lot 27, Con. II, Township of Harwich. This report contains the field and laboratory findings and recommendations for the foundation of the proposed structure.

The field work commenced on January 16, 1959, and was completed on January 28, 1959.

DESCRIPTION OF THE SITE AND GEOLOGY:

The site and its surrounding areas are generally flat land; the areas on both sides of the railway track are presently in pasture and woods. At the time of the investigation, the area was covered with ice and snow.

Physiographically, the site is located on the bevelled portion of the Bothwell Sand Plain, which according to available geological information, is composed basically of clay till overlain by shallow deposits of sand. At this site, a surface veneer of silts, sands and clays, believed to be of glacio-fluvial origin, overlies the dense till stratum.

DESCRIPTION OF FIELD AND LABORATORY WORK:

Field work consisted of 4 sampled boreholes carried out by means of a coredrill machine adapted for soil sampling. Boreholes were advanced by conventional wash boring procedures and samples were recovered at depths required. Samples were obtained by means

cont'd. /2 ...

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

of 2" I.D. thin walled shelby tube samplers or a 2" O.D. split spoon sampler. The dimensions of this split spoon sampler and the energy used in driving it, conform to the requirements of Standard Penetration Test. In addition, a dynamic cone penetration profile was obtained adjacent to each sampled borehole.

Upon receipt in the laboratory, samples were visually examined and identified. Routine index tests were performed on selected representative samples. Field and 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-59-3A.

SUBSOIL CONDITIONS:

The site is covered by glacio-fluvial deposits of silts, sands and clays underlain by the dense clay till stratum.

In each of the sampled boreholes, the frozen topsoil was found to be underlain by the glacio-fluvial deposits of silts, sands and clays, ranging from 5 ft. in thickness in Boring 1, to 13 ft. in thickness in Boring 2. Underneath the glacio-fluvial deposits, the stratum of dense clay till was encountered. In general, the soil types encountered are as follows:-

1. Glacio-fluvial deposits:

This formation of silty clay, clay silt, sandy silt and silty sand, believed to be of glacio-fluvial origin, was encountered immediately below the topsoil in all 4 borings. The material

cont'd. /3 ...

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

1. Glacio-fluvial deposits: (cont'd.) ...

contains predominantly silt and sand with various percentages of clay. Its colour is predominantly brown. Its thickness ranges from 5 ft. in Boring 1, to 13 ft. in Boring 2. The unit weight and moisture content were found to be ranging from 115 p.c.f. to 130 p.c.f. and 18% to 30%, respectively. It is of low plasticity. Laboratory shear strength tests indicate an average value of 1000 p.s.f. to be representative for the formation. A plot of shear strength versus depth has been presented and is included in this report under Appendix I.

2. Glacial Till of Stiff Silty Clay:

This stratum of stiff silty clay, believed to be the result of glaciation, was encountered underneath the glacio-fluvial deposits. The stiff clay contains 25% silt, 20% sand, and 10% fine to medium gravel. Its colour is predominantly grey. The average unit weight and moisture content were found to be 135 p.c.f. and 17%, respectively. Liquid and plastic limits averaged 28% and 16%. Laboratory shear strength tests show that the stiff clay has a minimum value of 2000 p.s.f. This stratum was explored to a depth of 34 ft. below the existing ground surface (i.e., Elev. 567') to confirm its stiff condition. Judging from its moisture content and Atterberg limits, the stiff clay appears to be heavily over-consolidated.

Laboratory and field test results have been summarized in Table No. 1 and are included in this report under Appendix I.

cont'd. /4 ...

WATER CONDITIONS:

Observations and measurements carried out during the boring programme indicate that the ground water table is at or close to the ground surface and appears to be seasonal. The lowest seasonal ground water table, as recorded during the time of boring, was found to be located at approximately Elev. 594'. In view of the permeable nature of the upper glacio-fluvial deposits of silts, sands and clays, shoring and pumping operations during excavation of footings when carried below these deposits, appears to be necessary.

FOUNDATION CONSIDERATIONS:

The upper glacio-fluvial deposits of silts, sands and clays cannot be relied upon to provide adequate foundation support for the proposed structure. Satisfactory foundation support can be obtained in the underlying stratum of stiff grey silty clay. Strength and compressibility characteristics are such that at Elev. 582' or below, for footings of 7' to 10' in width, an allowable bearing pressure of at least 2 1/2 t.s.f. can be used for spread footing design. Since this will involve some 18 ft. of excavation necessitating dewatering or shoring and pumping operations, spread footing foundations may appear to be uneconomical. An alternative design is to use large displacement type end-bearing piles, driven to refusal in the stratum of stiff silty clay. Practicable refusal for large displacement piles is estimated to be at Elev. 575'. Treated timber piles driven to practicable refusal at this elevation can safely carry a design load of 20 tons per pile. If higher

cont'd. /5 ...

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

pile-load capacity is desired, steel monotubes or Franki Caissons each of which can carry design loads of 50 to 100 tons per pile, may be used. If timber piles are used, pile cut-off should be below the lowest seasonal ground water table at approximately Elev. 594'. Settlements will be within tolerable limits.

Under the proposed grade line, the maximum height of fill is approximately 30 ft. In order to attain a satisfactory safety factor against sliding due to shear failure, as well as stability of the embankment fill itself, embankment slopes should not be steeper than 2:1 and should be constructed of well-compacted cohesive or well-graded granular fill material. In addition, in order to avoid endangering of stability of the railway embankment, batter piles should be designed to take all horizontal thrusts induced by the weight of 30 ft. of embankment fill.

CONCLUSIONS & RECOMMENDATIONS:

(1) The site is covered by glacio-fluvial deposits of silts, sands and clays underlain by glacial till of stiff grey silty clay.

(2) Spread footing foundations are not recommended because of the shoring and pumping operations necessitated by the deep excavations for spread footings.

cont'd. /6 ...

CONCLUSIONS & RECOMMENDATIONS: (cont'd.) ...

(3) Large displacement type end-bearing piles, driven to refusal in the dense till stratum, appear to be the obvious means of obtaining satisfactory footing support. Practicable refusal is believed to be met at approximately Elev. 575'. Timber piles, driven to this elevation, can safely carry design loads of 20 tons per pile. If higher pile-load capacity is desired, steel monotube or Franki Caissons may be resorted to. For timber piles, cut-off should be below the lowest seasonal ground water table at approximately Elev. 594'.

(4) Total and differential settlements will be within tolerable limits.

(5) Batter piles should be designed to take all horizontal thrusts induced by the weight of 30 ft. of embankment fill.

(6) Embankment slopes should not be steeper than 2:1, and embankment fill should be built of either -

(a) Well-compacted cohesive material;

or

(b) Well-graded granular material.

Abraham Loh

A. Loh,
Foundation Engineer.

APPENDIX I.

TABLE NO. I.

SUMMARY OF FIELD & LABORATORY TESTS

JOB F-59-3
W.P. 15-59.

HOLE NO.	SAMP. NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
1	T1	5'-7'	Soft brown silty clay.	8	30.5	20.7	41.5	648	115.8	Approximately 10% fine to medium gravel in the stiff grey silty clay throughout in all holes.
1	T2	10'-12'	Stiff grey silty clay - (glacial till)	25	16.6	-	-	1650	133.6	
1	T3	15'-17'	" " " "	20	16.2	14.7	22.6	1512	128.2	
1	T4	20'-22'	" " " "	45	16.5	-	-	3640	135.2	
1	S5	26'-27'6"	" " " "	55	16.5	-	-	7000	126.8	
1	S6	32'-33'6"	" " " "	49	16.5	16.0	30.6	-	128.1	
2	T1	5'-7'	Medium brown fine silty sand to sandy silt.	25	19.8	-	-	1900	129.0	
2	T2	10'-12'	Medium grey fine sandy silt & Clay silt.	11	18.1	-	-	-	-	
2	T3	15'-17'	Soft to med. grey silty clay.	8	16.9	14.6	26.9	720	121.8	
2	T4	20'-22'	Stiff grey silty clay - (glacial till).	37	17.1	15.4	29.9	3090	134.0	
2	T5	25'-27'	" " " "	52	17.1	13.9	27.6	2880	132.5	
2	S6	30-'31'6"	" " " "	51	16.3	-	-	-	140.0	
3	T1	2'-6"-4'6'	Med. brown fine clay silt.	9	25.0	18.1	38.0	1455	117.0	
3	T2	5'-7'	Med. grey fine sandy silt.	14	18.7	-	-	-	131.2	
3	T3	7'6"-9'6"	Med. grey clay silt.	12	23.2	16.8	19.9	1310	130.0	
3	T4	10'-12'	Soft to med. grey silty clay.	5	33.5	-	-	636	114.8	
3	T5	15'-17'	Stiff grey silty clay - (glacial till).	36	13.6	16.0	28.0	-	130.5	
3	T6	20'-22'	" " " "	44	16.7	16.0	29.4	3020	129.5	
3	S7	25'-27'	" " " "	44	16.2	-	-	-	138.3	
3	S8	30'-31'6"	" " " "	48	16.4	-	-	-	129.2	

(cont'd.) /2 ...

SUMMARY OF FIELD & LABORATORY TESTS

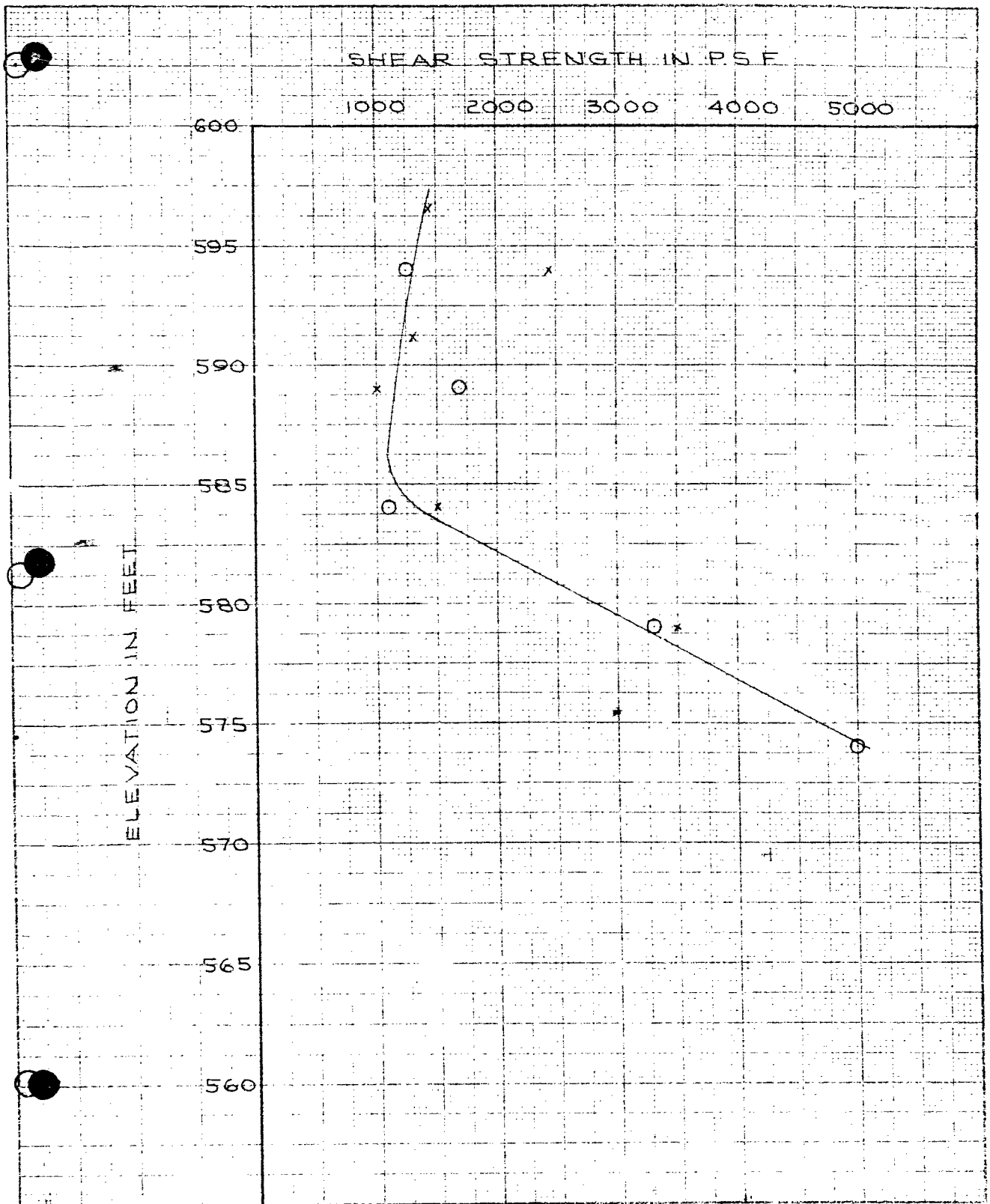
JOB F-59-3.
W.P. 15-59.

HOLE NO.	SAMP NO.	SAMPLE DEPTH (FEET)	MATERIAL DESCRIPTION	PENET'N RESIST. BLOWS/FT.	MOIST. CONT. %	PLASTIC LIMIT %	LIQUID LIMIT %	SHEAR STRENGTH p.s.f.	UNIT WEIGHT p.c.f.	REMARKS
4	T1	2'6"-4'6"	Med. brown fine sandy silt & clay silt.	9	22.9	19.2	33.2	1440	125.0	
4	T2	5'-7'	" " " "	14	20.7	-	-	2450	130.0	
4	T3	7'6"-9'6"	Stiff grey silty clay - (glacial till)	24	20.4	-	-	-	135.0	
4	T4	10'-12'	" " " "	28	13.9	10.0	20.5	2450	132.4	
4	T5	15'-17'	" " " "	25	18.1	15.6	28.4	2330	132.5	
4	T6	20'-22'	" " " "	59	15.4	16.2	22.4	4030	134.2	

T1 - denotes thin walled shelby samples.

S1 - denotes split spoon samples.

W.P. 15-59 JOB F-59-3



FORM OB-ML-126 H.D.R.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW

OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BORE & PENET'N JOB F-59-3 W.P. 15-59 BORING 1 STA. 437+78 (45' LT.)

CASING BX & AX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT FEB. 1959

SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 20 JAN. 1959

ABBREVIATIONS

V - INSITU VANE SHEAR TEST; M - MECHANICAL ANALYSIS; U - UNCONFINED COMPRESSION; Q_c - TRIAXIAL CONSOLIDATED QUICK; Q - TRIAXIAL QUICK; S - TRIAXIAL SLOW; W.L. - WATER LEVEL IN CASING; W.T. - 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; S.S. - SLEEVE SAMPLE; P.S. - PISTON SAMPLE; W.S. - WASHED SAMPLE; R.C. - ROCK CORE

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SOIL PROFILE

ELEVATION DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT
600.3'		GROUND LEVEL	
0.5 / 599.6'		TOP SOIL (FROZEN)	
0.7'		BROWN SILTY CLAY WITH SOME SAND	
5.5 / 594.8'			
5.5'		STIFF GREY SILTY CLAY APPROXIMATELY 10% FINE TO MEDIUM GRAVEL.	
10.5			
15.5			
20.5			
25.5			
30.5			
566.8'			
33.5'		END OF BOREHOLE	
35.5			

ELEVATION SCALE: 600, 595, 590, 585, 580, 575, 570, 566

SHEAR STRENGTH IN LBS. PER SQ. FT. * 2000 4000 6000 8000

WATER CONTENT W % 10 20 O - NAT 30 □ - P.W. 40 Δ - L.W.

PENETRATION TEST RESISTANCE BLOWS PER FOOT AT STANDARD ENERGY (4200 IN. LBS. PER BLOW)

D. CONE PEN. X-------X-------X STAND. PEN. • 50 100 150 200

CASING BLOWS (ACTUAL): 22 6 11 4 5 5 7 8 14 22 17 20 24 35 44 40 46 66 81 100

REFUSAL AT ELEV. 575.8' 115 BLOWS FOR 6"

END OF CASING AT ELEV. 568.3'

AX CASING SHOE

SAMPLES

OTHER TESTS	CONDITION	TYPE	NO.	PENETRATION RESISTANCE	ELEV. RECOV. %
					600.5
					0.5
					585.5'
γ=115.8 P.C.F.		T.O.	1	8	50
					5.5
					596.3'
γ=133.6 P.C.F.		T.O.	2	25	50
					10.5
					585.8'
γ=128.2 P.C.F.		T.O.	3	20	71
					15.5
					680.5'
γ=135.2 P.C.F.		T.O.	4	45	79
					20.5
					574.5'
γ=126.8 P.C.F.	X	D.O. A.X.	5	55	100
					25.5
					568.5'
γ=128.1 P.C.F.	X	D.O. A.X.	6	49	100
					30.5

FORM OB-ML-706

H.D.R.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW

OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BORE & PENET'N JOB F-59-3 W.P. 15-59 BORING 2 STA. 438+28 (45' RT)

CASING Bx & Ax (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT FEB. 1959

SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 22 JAN. 1959

ABBREVIATIONS

V - INSITU VANE SHEAR TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
Q_c - TRIAXIAL CONSOLIDATED QUICK
Q - TRIAXIAL QUICK
S - TRIAXIAL SLOW
W.L. - WATER LEVEL IN CASING
W.T. - 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
S.S. - SLEEVE SAMPLE
P.S. - PISTON SAMPLE
W.S. - WASHED SAMPLE
R.C. - ROCK CORE

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SOIL PROFILE

ELEVATION DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE
600.7'		GROUND LEVEL		
599.7' / 1.0'		TOP SOIL (FROZEN)		600
		BROWN FINE SILTY SAND TO SANDY SILT.		595
594.7' / 6.0'		GREY FINE SANDY SILT & CLAY SILT.		590
587.7' / 13.0'		STIFF GREY SILTY CLAY APPROXIMATELY 10% FINE TO MEDIUM GRAVEL.		585
				580
				575
				570
569.2' / 31.5'		END OF BOREHOLE		568

SHEAR STRENGTH IN LBS. PER SQ. FT. * 2000 4000 6000 8000

WATER CONTENT W % 10 20 30 40 O - NAT. □ - P.W. △ - L.W.

PENETRATION TEST RESISTANCE BLOWS PER FOOT AT STANDARD ENERGY. (4200 IN. LBS. PER BLOW)

D. CONE PEN. X------X------X 50 100 150 STAND. PEN. • 200

REFUSAL @ 575.1' 13 BLOWS FOR 1"

END OF CASING AT ELEV. 570.7'

CASING BLOWS (ACTUAL): 17 13 10 12 30 | 8 14 26 15 16 | 8 7 10 10 12 | 19 20 29 37 45 | 45 60 85 98 120 | 120

AX CASING SHOE

SAMPLES

OTHER TESTS	CONDITION	TYPE	NO	PENETRATION RESISTANCE	ELEV. RECOV. %
					600.7'
					595.7'
γ=129.0 P.C.F.		T.O.	1	25	100
					590.7'
	X	T.O.	2	11	POOR
					585.7'
γ=121.8 P.C.F.		T.O.	3	8	88
					580.7'
γ=134.0 P.C.F.		T.O.	4	37	75
					575.7'
γ=132.5 P.C.F.		T.O.	5	52	100
					570.7'
γ=140 P.C.F.	X	D.O. A.X.	6	51	83

FORM OB-ML-[illegible]

H.D.R.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW

OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BORE & PENET'N. JOB F-59-3 W.P. 15-59 BORING 3 STA. 437+13 (45' RT.)

CASING Bx & Ax (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT FEB. 1959

SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 26. JAN. 1959.

ABBREVIATIONS

V - INSITU VANE SHEAR TEST; M - MECHANICAL ANALYSIS; U - UNCONFINED COMPRESSION; Q_C - TRIAXIAL CONSOLIDATED QUICK; Q - TRIAXIAL QUICK; S - TRIAXIAL SLOW; W.L. - WATER LEVEL IN CASING; W.T. - WATER TABLE IN SOIL; K - PERMIABILITY; C - CONSOLIDATION; CA. - CASING; γ - UNIT WEIGHT

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SAMPLE CONDITION

D - DISTURBED; F - FAIR; G - GOOD; L - LOST

SOIL PROFILE

ELEVATION / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE
601.0'		GROUND LEVEL		
600.0' / 1.0'		TOPSOIL (FROZEN)		600
		BROWN FINE CLAY SILT		
595.0' / 6.0'	W.L. @ 593.5' ON JAN 27/59	GREY FINE SANDY SILT		595
591.0' / 10.0'		STIFF GREY SILTY CLAY APPROXIMATELY 10% FINE TO MEDIUM GRAVEL.		590 / 585 / 580 / 575 / 570
569.5' / 31.5'		END OF BOREHOLE		565

SHEAR STRENGTH IN LBS PER SQ. FT. (2000, 4000, 6000, 8000)

WATER CONTENT W % (10, 20, 30, 40) 0 - NAT. □ - P.W. △ - L.W.

PENETRATION TEST RESISTANCE BLOWS PER FOOT AT STANDARD ENERGY (4200 IN. LBS. PER BLOW)

D. CONE PEN. X-------X-------X (50, 100, 150) STAND. PEN. •——•——• (200)

CASING BLOWS (ACTUAL)

13 / 4 / 5 / 7 / 16 / 8 / 12 / 8 / 7 / 9 / 13 / 13 / 14 / 14 / 18 / 21 / 30 / 52 / 84 / 88

AX CASING SHOE

REFUSAL AT ELEV. 576.5' 115 BLOWS FOR 6"

END OF CASING AT ELEV. 571.0'

SAMPLES

OTHER TESTS	CONDITION	TYPE	NO.	PENETRATION RESISTANCE	ELEV. RECOV. %
					601.0'
					598.5'
γ=117.0 P.C.F.		T.O.	1	9	50
					596.0'
γ=131.2 P.C.F.		T.O.	2	14	100
					593.5'
γ=130.0 P.C.F.		T.O.	3	12	96
					591.0'
γ=114.8 P.C.F.		T.O.	4	5	67
					586.0'
γ=130.5 P.C.F.		T.O.	5	36	71
					581.0'
γ=120.5 P.C.F.		T.O.	6	44	63
					576.0'
γ=138.3 P.C.F.	X	D.O. A.X.	7	44	100
					571.0'
γ=129.2 P.C.F.	X	D.O. A.X.	8	48	89

FORM OB-ML-56 H.D.R.

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW

OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BORE & PENET'N JOB F-59-3 W.P. 15-59 BORING 4 STA. 436+60 (45' LT.)

CASING Bx (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT FEB. 1959

SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 28, JAN. 1959

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
δ - UNIT WEIGHT

SAMPLE TYPES

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

SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SOIL PROFILE

ELEVATION DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT
601.0'		GROUND LEVEL	
600.50 / 0.5'		TOPSOIL (FROZEN)	
		BROWN FINE SANDY SILT & CLAY SILT	
592.5' / 8.5'		STIFF GREY SILTY CLAY APPROXIMATELY 10% FINE TO MEDIUM GRAVEL.	
579.0' / 22.0'		END OF BOREHOLE	

ELEVATION SCALE: 600, 595, 590, 585, 580, 575

SHEAR STRENGTH IN LBS. PER SQ. FT. * 2000 4000 8000

WATER CONTENT W % 10 20 80 40 O - NAT □ - P.W. △ - L.W.

PENETRATION TEST RESISTANCE BLOWS PER FOOT AT STANDARD ENERGY (4200 IN. LBS. PER BLOW)

D. CONE PEN. X------X------X 50 100 150 STAND. PEN. • 200

REFUSAL AT ELEV. 579'

CASING BLOWS (ACTUAL): 9, 3, 4, 2, 2, 4, 6, 7, 9, 7, 12, 20, 31, 44, 55, 49, 72, 92, 97, 123

END OF CASING AT ELEV. 581.0

SAMPLES

OTHER TESTS	CONDITION	TYPE	NO.	PENETRATION RESISTANCE	ELEV. RECOV. %
					601.0'
γ=125.0 P.C.F.					598.5'
		T.O.	1	9	63
					596.0'
γ=130.0 P.C.F.		T.O.	2	14	92
					593.5'
γ=135.0 P.C.F.		T.O.	3	24	46
					591.0'
γ=132.4 P.C.F.		T.O.	4	28	50
					586.0'
γ=132.5 P.C.F.		T.O.	5	25	50
					581.0'
γ=134.2 P.C.F.		T.O.	6	59	54

FORM OB-[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW

OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BORE & PENET'N JOB F-59-3 WP 15-59 BORING 1 STA 457+78 (45'LT.)

CASING BX & AX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT FEB. 1959

SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H. CHECKED BY A.L. DATE BORING 20 JAN. 1959

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 - PERMEABILITY; C - CONSOLIDATION; CA. - CASING; γ - UNIT WEIGHT

SAMPLE TYPES

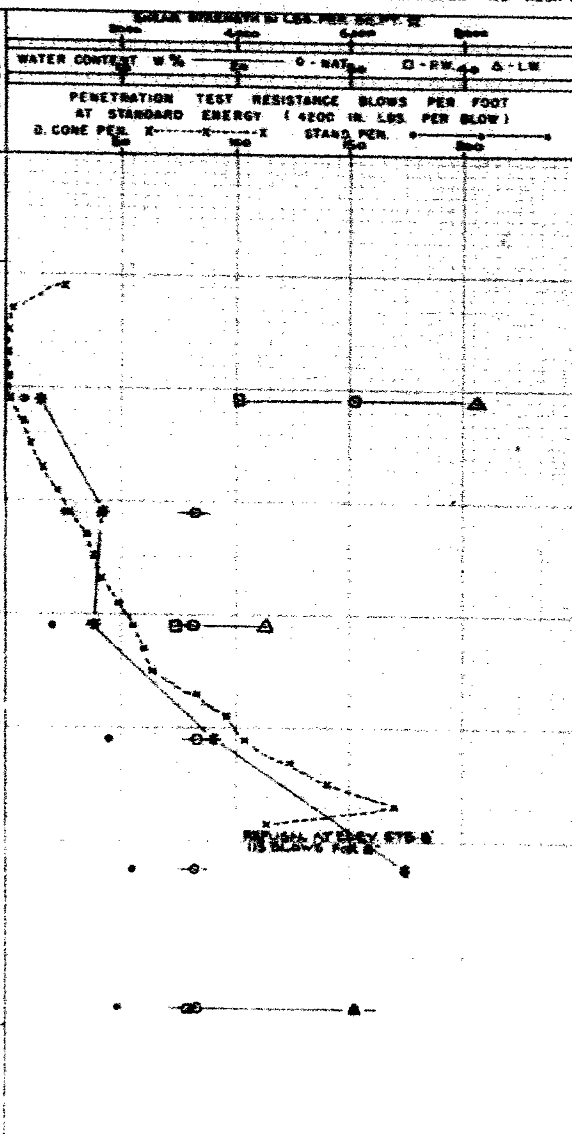
C.S. - CHUNK; D.O. - DRIVE OPEN; D.F. - DRIVE FOOT VALVE; T.O. - THIN WALLED OPEN; S.S. - SLEEVE SAMPLE; P.S. - PISTON SAMPLE; W.S. - WASHED SAMPLE; R.C. - ROCK CORE

SAMPLE CONDITION

DISTURBED; FAIR; GOOD; LOST

SOIL PROFILE

ELEVATION DEPTH		DESCRIPTION
	600.[illegible]'	GROUND LEVEL
0.5	[illegible] / 0.7	TOP SOIL (FROZEN)
5.5	594.[illegible] / 5.[illegible]	BROWN SILTY CLAY WITH SOME SAND
10.5, 15.5, 20.5, 25.5, 30.5		STIFF GREY SILTY CLAY APPROXIMATELY 10% FINE TO MEDIUM GRAVEL
	566.6 / 33.5	END OF BOREHOLE
35.5		



ELEVATION SCALE: 600, 595, 590, 585, 580, 575, 570, 566

CASING BLOWS (ACTUAL): XX, 6, 9, 6, 5, 6, 7, 8, 14, 22, 17, 20, 24, 35, 44, 60, 48, 66, 81, 100

AX CASING SHOE; END OF CASING AT ELEV. [illegible]

SAMPLES

OTHER TESTS	CONDITION	TYPE	NO.	PENETRATION RESISTANCE	ELEV. RECOV. %
[illegible] P.C.F.		T.O.	1	8	50
[illegible] P.C.F.		T.O.	2	25	50
[illegible] P.C.F.		T.O.	3	20	71
[illegible] P.C.F.		T.O.	4	45	79
[illegible] P.C.F.		D.O. A.X.	5	55	574.5' / 100
[illegible] P.C.F.		D.O. A.X.	6	49	568.5' / 100

FORM GB-ML-126 42-01-59-4 HOR

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW

OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BORE & PENET'N JOB F-59-3 WP 15-59 BORING 2 STA 400+28(45'RT)

CASING BX & AX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT FEB 1959

SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 22 JAN 1959

ABBREVIATIONS

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

SAMPLE TYPES

CS - CHUNK; SS - SLEEVE SAMPLE; DO - DRIVE OPEN; PS - PISTON SAMPLE; DF - DRIVE FOOT VALVE; WS - WASHED SAMPLE; TO - THIN WALLED OPEN; RC - ROCK CORE

SAMPLE CONDITION

DISTURBED; FAIR; GOOD; LOST

SHEAR STRENGTH IN LBS PER SQ FT: 2000, 4000, 6000, 8000

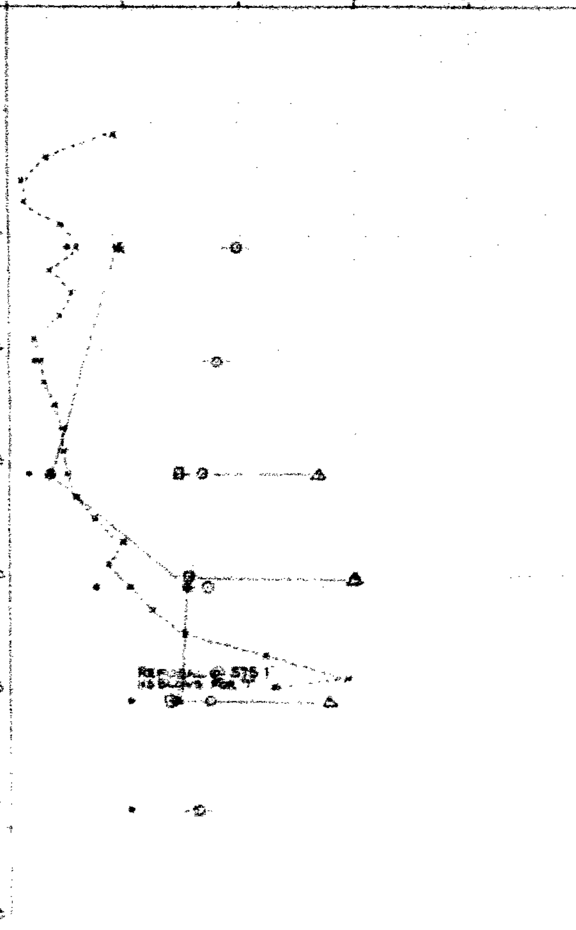
WATER CONTENT W%: 10, 20, 30, 40 (O - NAT, □ - P.W., ○ - L.W.)

PENETRATION TEST RESISTANCE BLOWS PER FOOT AT STANDARD ENERGY (4200 IN. LBS. PER BLOW): O CONE PEN. x---x; STAND PEN. •—•; 50, 100, 150, 200

SOIL PROFILE

ELEVATION DEPTH	DESCRIPTION	ELEVATION SCALE
600.7	GROUND LEVEL	
599.7 / 1.0	TOP SOIL (FROZEN)	600
594.7 / 6.0	BROWN FINE SILTY SAND TO SANDY SILT	595
587.7 / 15.0	GREY FINE SANDY SILT & CLAY SILT	590
	STIFF GREY SILTY CLAY APPROXIMATELY 10% FINE TO MEDIUM GRAVEL	585, 580, 575, 570
568.2 / 32.5	END OF BOREHOLE	565

Depth marks: 0.5, 5.5, 10.5, 15.5, 20.5, 25.5, 30.5, 35.5



CASING BLOWS (ACTUAL): 17, 15, 10, 12, 30, 8, 14, 26, 15, 16, 8, 7, 10, 10, 12, 19, 20, 29, 37, 45, 55, 60, 85, 98, 125

AX CASING, BX CASING TO... (casing note, partly illegible)

SAMPLES

ELEV	OTHER TESTS	CONDITION	TYPE	NO	PENETRATION RESISTANCE	RECOV %
595.7	γ=... PCF		TO	1	25	100
590.7			TO	2	11	POOR
585.7	γ=... PCF		TO	3	8	88
580.7	γ=134 PCF		TO	4	37	75
575.7	γ=130 PCF		TO	5	52	100
570.7	γ=140 PCF		DO AX	6	51	88

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW

OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION BORE & PENET'N JOB F-59-9 W.P. 15-59 BORING 3 STA 437+16 (46'RT)

CASING BX & AX (standard samplers to fit unless noted) DATUM GEODETIC DATE REPORT FEB 1959

SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 26 JAN 1959

ABBREVIATIONS

V - INSITU VANE SHEAR TEST
M - MECHANICAL ANALYSIS
U - UNCONFINED COMPRESSION
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
S.S. - SLEEVE SAMPLE
P.S. - PISTON SAMPLE
W.S. - WASHED SAMPLE
R.C. - ROCK CORE

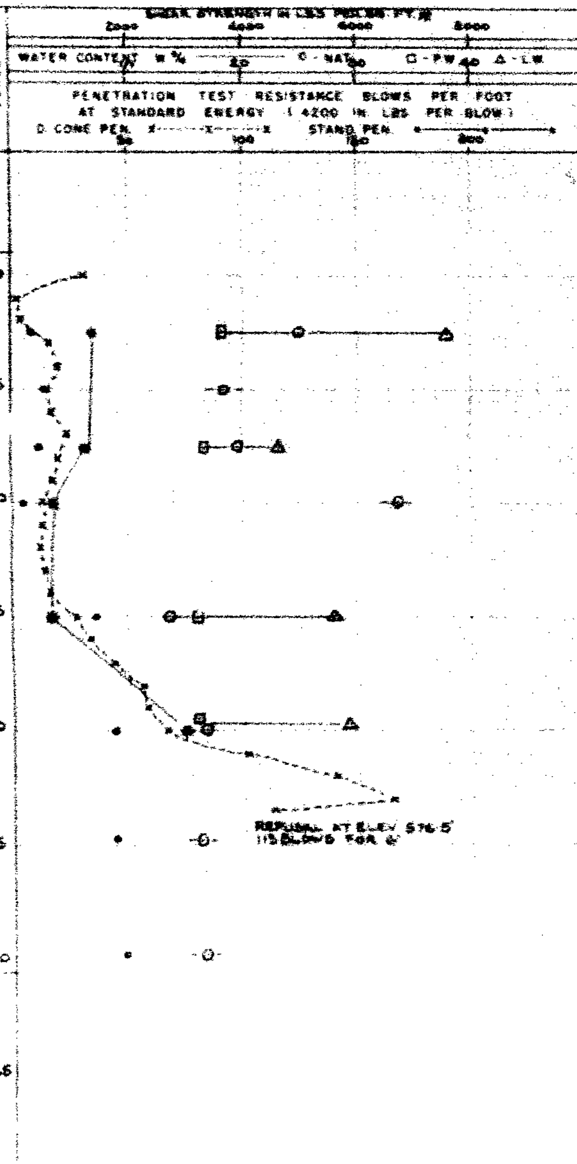
SAMPLE CONDITION

- DISTURBED
- FAIR
- GOOD
- LOST

SOIL PROFILE

ELEVATION DEPTH	WATER CONDITIONS	DESCRIPTION	ELEVATION SCALE
601.0'		GROUND LEVEL	
600.0' 1.0'		TOPSOIL (FROZEN)	600
		BROWN FINE CLAY SILT	
595.0' 6.0'		GREY FINE SANDY SILT	595
591.0' 10.0'	W.L. @ 595.9' ON JAN 27/59	STIFF GREY SILTY CLAY APPROXIMATELY 10% FINE TO MED. 3/4" GRAVEL	590
			585
			580
			575
569.5 31.5'		END OF BOREHOLE	570
			565

Depth marks: 1, 6, 11, 16, 21, 26, 31, 36



CASING BLOWS (ACTUAL): 13, 4, 5, 7, 16, 8, 12, 8, 7, 9, 13, 13, 14, 14, 18, 21, 30, 52, 84, 88

AX CASING SHOE

END OF CASING AT ELEV 571.5'

SAMPLES

OTHER TESTS	CONDITION	TYPE	NO.	PENETRATION RESISTANCE	ELEV. RECOV. %
					601.0'
γ 117		T.O.	1	9	50
γ 131 P.C.F.		T.O.	2	14	100
γ 130 P.C.F.		T.O.	3	12	96
γ 148 P.C.F.		T.O.	4	5	67
					586.0'
γ 135 P.C.F.		T.O.	5	36	71
					581.0'
γ 136 P.C.F.		T.O.	6	14	68
					576.0'
γ 135 P.C.F.		D.O. AX	7	44	100
					571.0'
γ 136 P.C.F.		D.O. AX	8	48	89

FORM 08-ML-126

73-61-81-6

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & RESEARCH BRANCH - FOUNDATIONS SECTION - DOWNSVIEW

OFFICE REPORT ON SOIL EXPLORATION

DRILL RIG 54-5 OPERATION Bore & Penet'n. JOB F-59-5 W.P. 15-59 BORING 4 STA 436+60 (45' LT)

CASING BX (standard samplers to fit unless noted) DATUM Geodetic DATE REPORT Feb. 1959

SAMPLER HAMMER WT. 250 LBS. DROP 19 INCHES COMPILED BY H.S. CHECKED BY A.L. DATE BORING 28 JAN. 1959

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

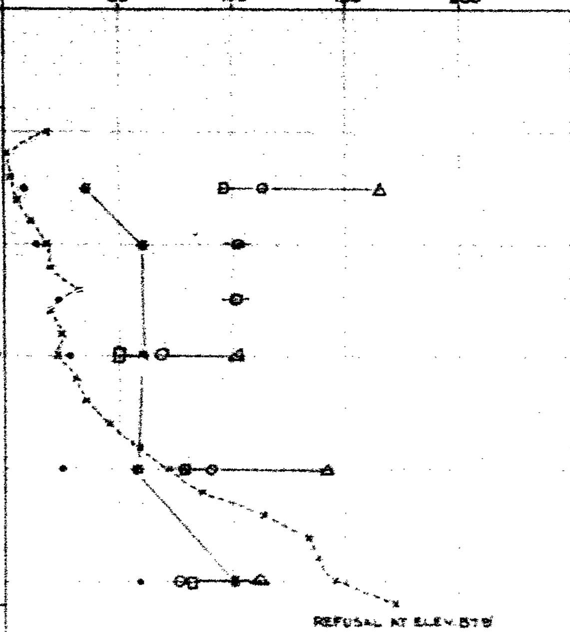
ELEVATION / DEPTH	WATER CONDITIONS	DESCRIPTION	STRAT PLOT	ELEVATION SCALE
601.0' / 0.0		GROUND LEVEL		
600.5 / 0.5		TOPSOIL (FROZEN)		600
		BROWN FINE SANDY SILT & CLAY SILT		595
592.5' / 8.5'		STIFF GREY SILTY CLAY APPROXIMATELY 10% FINE TO MEDIUM GRAVEL		590, 585, 580
579.0' / 22.0'		END OF BOREHOLE		575

Depth marks: 1, 6, 11, 16, 21, 26

SHEAR STRENGTH IN LBS PER SQ FT: 2000, 4000, 6000, 8000

WATER CONTENT W %: 10, 20, 30, 40 — O - NAT, □ - PW, △ - LW

PENETRATION TEST RESISTANCE BLOWS PER FOOT AT STANDARD ENERGY (4200 IN. LBS PER BLOW)
D. CONE PEN. x------x------x STAND PEN. •———•———• 50, 100, 150, 200

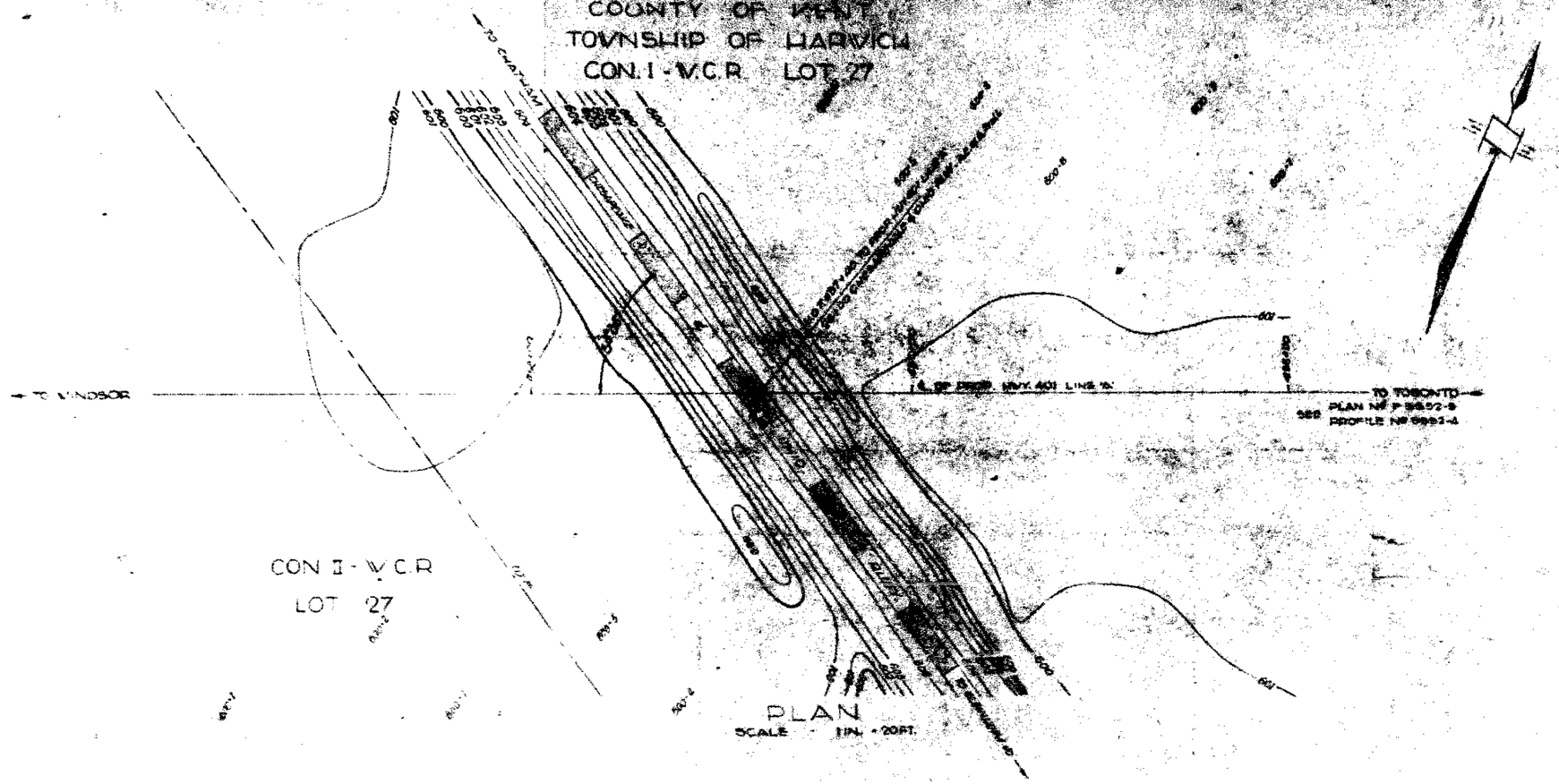


CASING BLOWS (ACTUAL): 9, 3, 4, 2, 2, 4, 4, 7, 9, 7, 12, 20, 31, 44, 55, 49, 72, 92, 97, 123; END OF CASING AT ELEV. 581.0

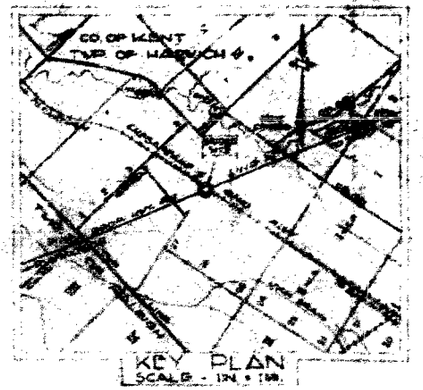
SAMPLES

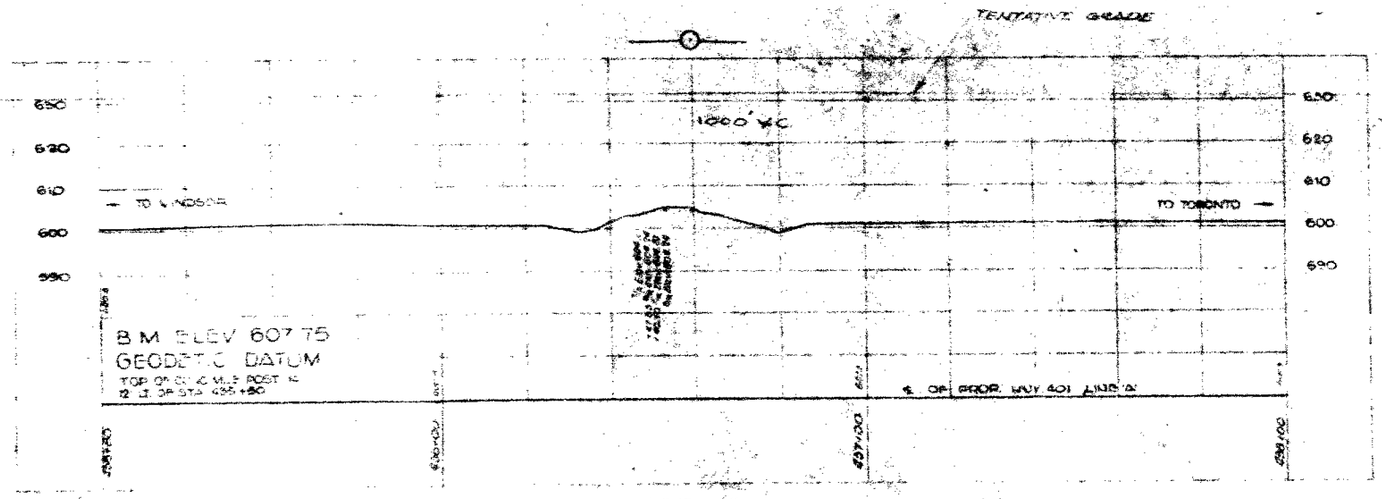
OTHER TESTS	CONDITION	TYPE	NO	PENETRATION RESISTANCE	ELEV RECOV %
γ-125.0 PCF					601.0
		T.O.	1	9	63
γ-130.0 PCF		T.O.	2	14	92
γ-135.4 PCF		T.O.	3	24	46
γ-132.4 PCF		T.O.	4	28	30
γ-135.5 PCF		T.O.	5	28	50
γ-134.6 PCF		T.O.	6	59	54

COUNTY OF KENT
TOWNSHIP OF HARWICH
CON. I - W.C.R. LOT 27



PLAN
SCALE - 1 IN. = 20 FT.





PROFILE
LOT 437+40 TO HWY 401 LINE 'A' +96+90 CHESAPEAKE & OHIO RWY.
SCALES - HOR. 1 IN = 20 FT.
VER. 1 IN = 20 FT.

HARWICH TWP. #14

W.P. 15-59
DEPARTMENT OF HIGHWAYS - ONTARIO
DISTRICT Nº 1
PROPOSED CROSSING
AT
THE CHESAPEAKE & OHIO RAILWAY
AND
THE KING'S HIGHWAY Nº 401
LINE 'A'

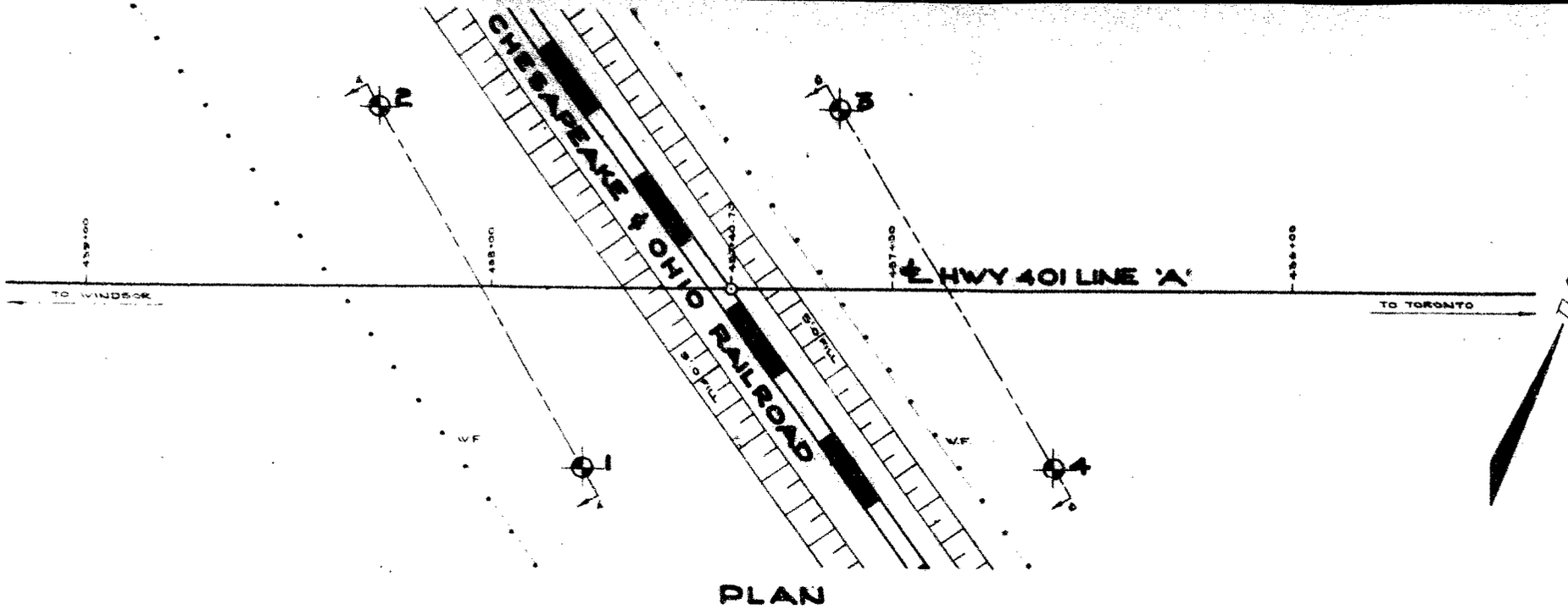
LOT 27 — TOWNSHIP OF HARWICH
CON. W.C.R. — COUNTY OF KENT

BRIDGE SITE

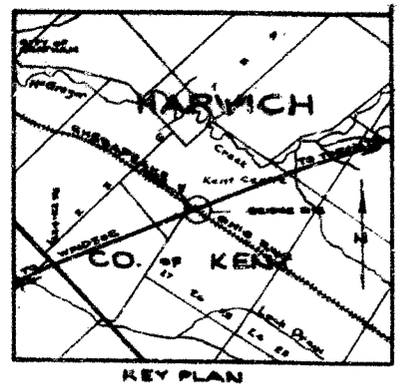
SURVEY BY
CHIEF OF PARTY - J.G. LES
SUPERVISOR - J. BOULHER
DRAWN BY
DRAFTSMAN - R. BUDD, K. GRUNDL
SUPERVISOR - A.E. GAY, G. BAROUSKY
CHECKED BY
DRAFTSMAN - K. GRUNDL
SUPERVISOR - G. BAROUSKY

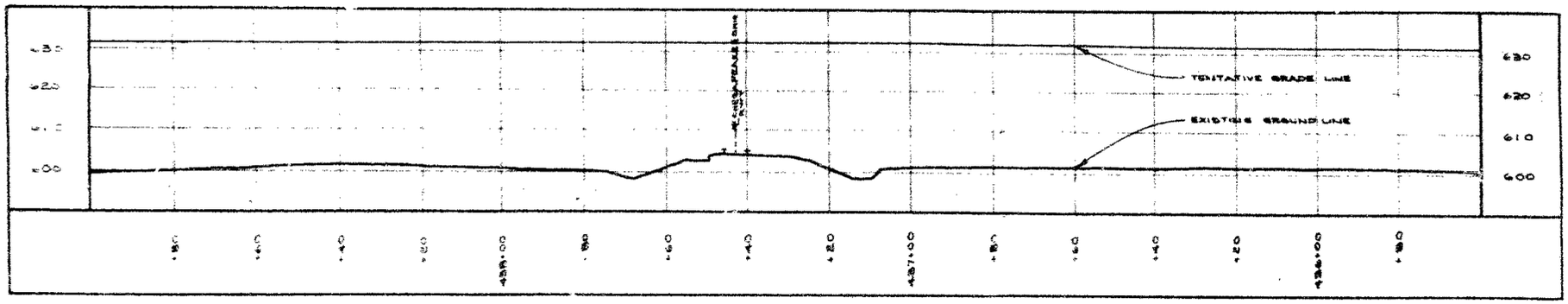
APPROVED
DIRECTOR OF INVESTIGATION & CONTROL
SCALE - AS SHOWN
DATE OF SURVEY - JAN. 1959
DATE OF PLAN - FEB. 1959
PLAN - 1 OF 1
PLAN - E 3591-1

E 3591-1



PLAN

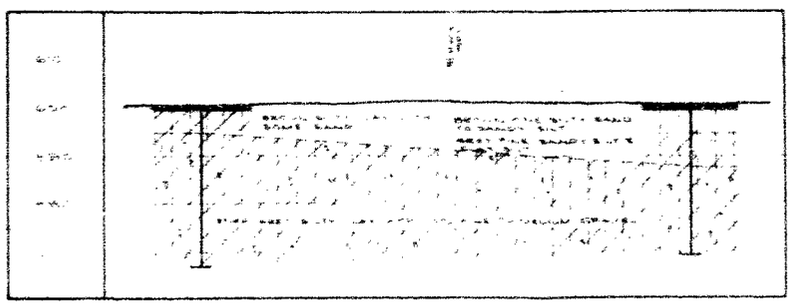




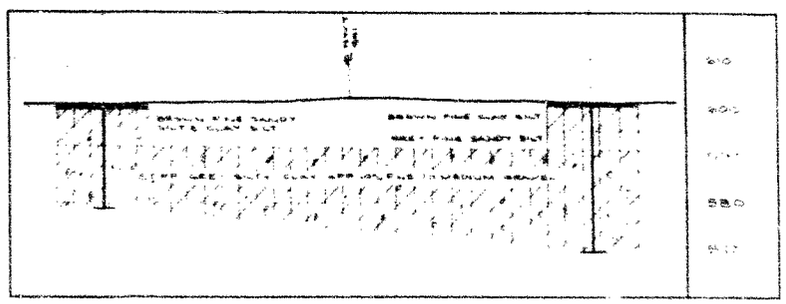
PROFILE

LEGEND	
BORE HOLE	●
PENETRATION HOLE	⊙
BORE & PENETRATION HOLE	◉

HOLE NO	ELEVATION	STATION	DISTANCE FROM ℄
1	600.8'	457+78	45' LT
2	600.7	458+28	45' RT
3	601.0	457+18	45' RT
4	601.0'	456+60	45' LT



A-A

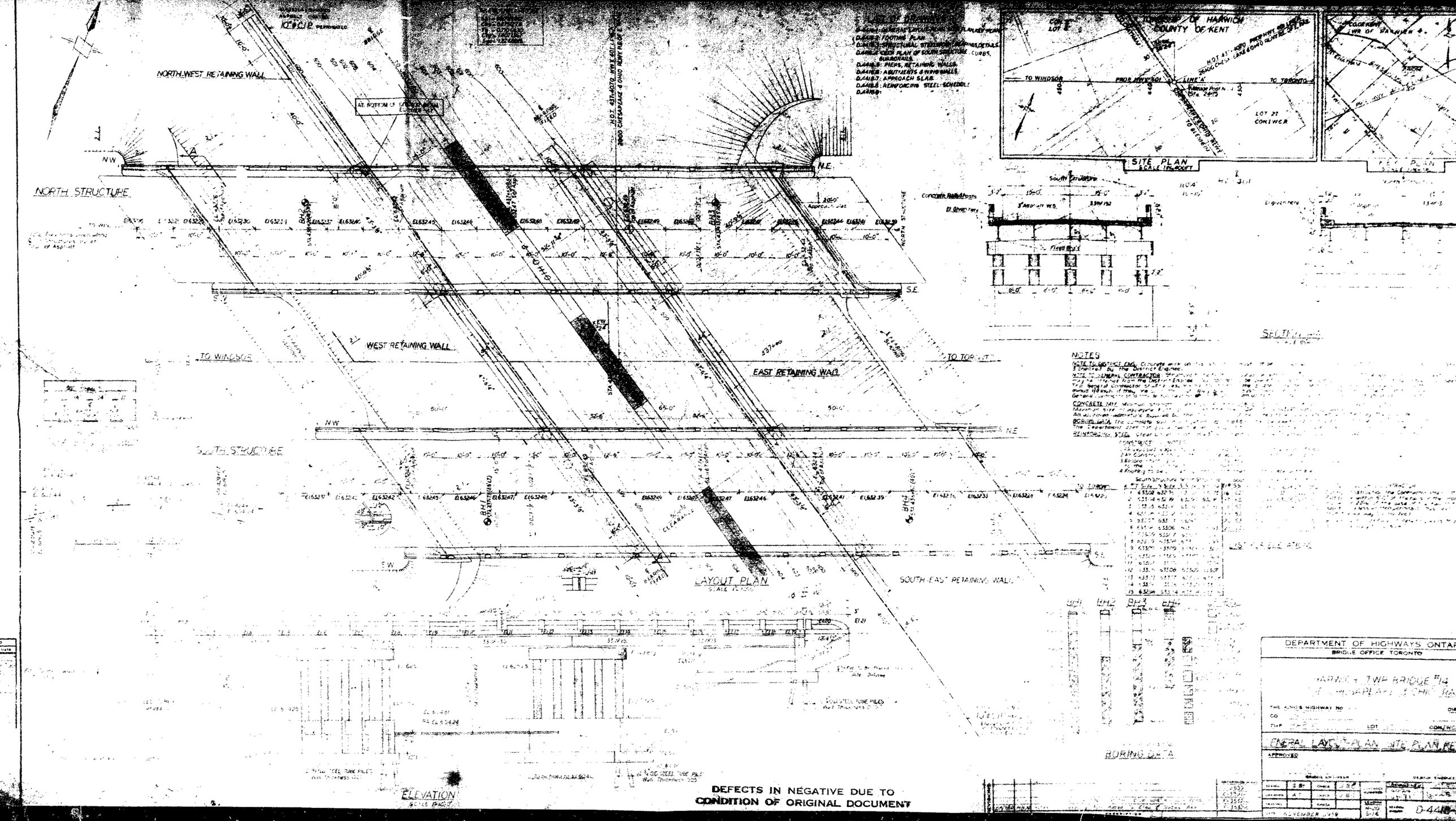


B-B

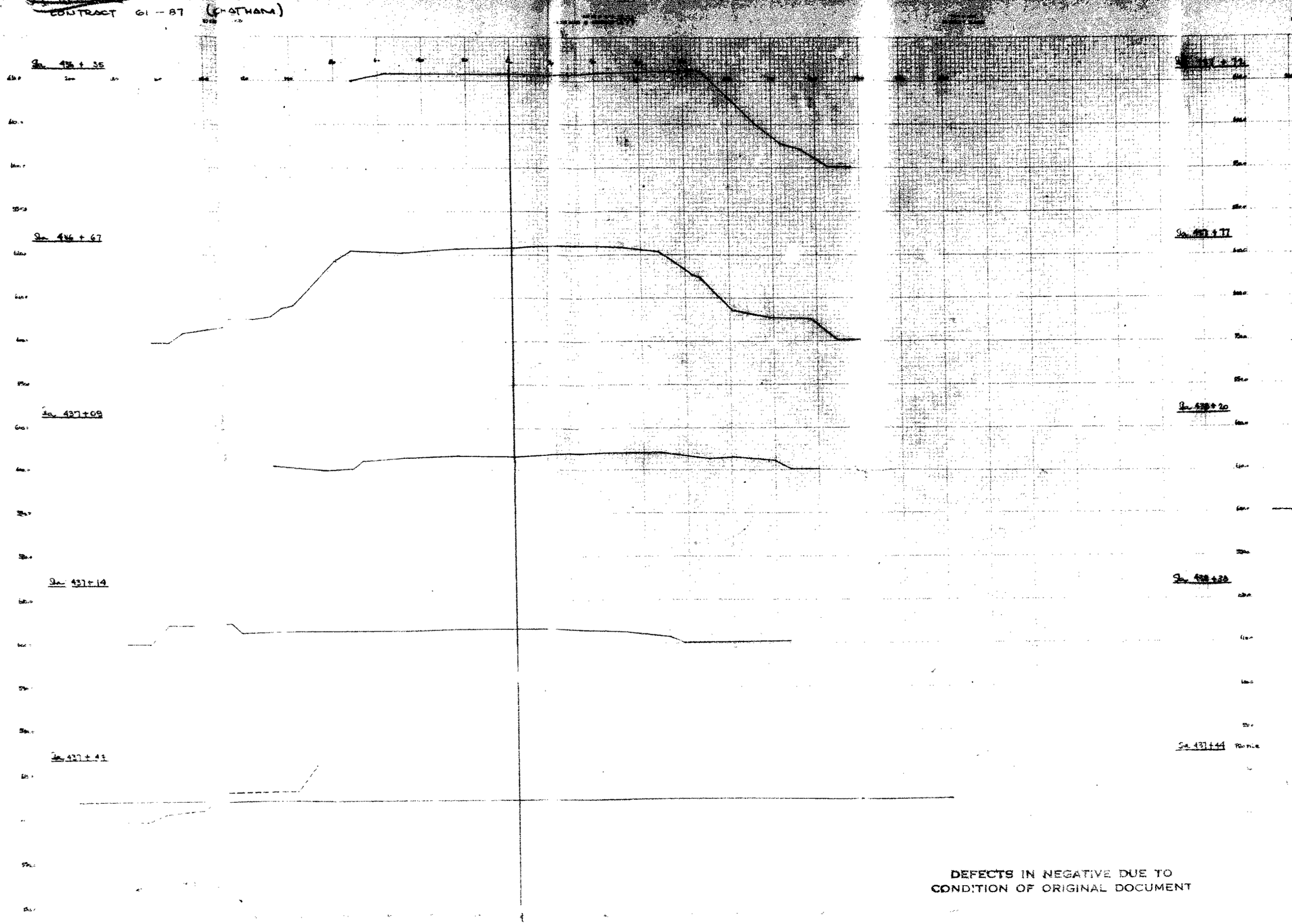
DEPARTMENT OF HIGHWAYS ONTARIO

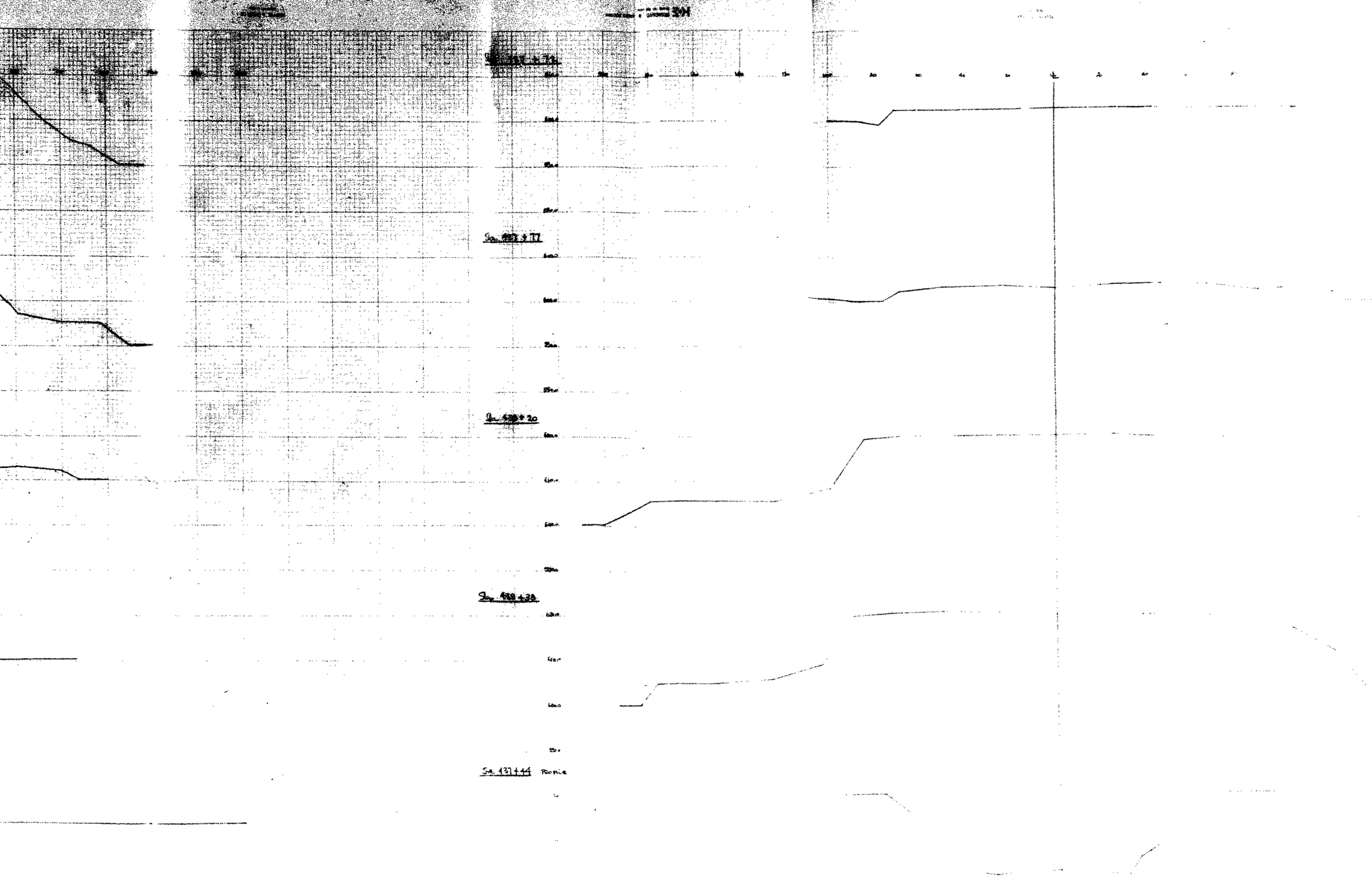
CHESAPEAKE & OHIO RWY. PROPOSED CROSSING

F 59-3A

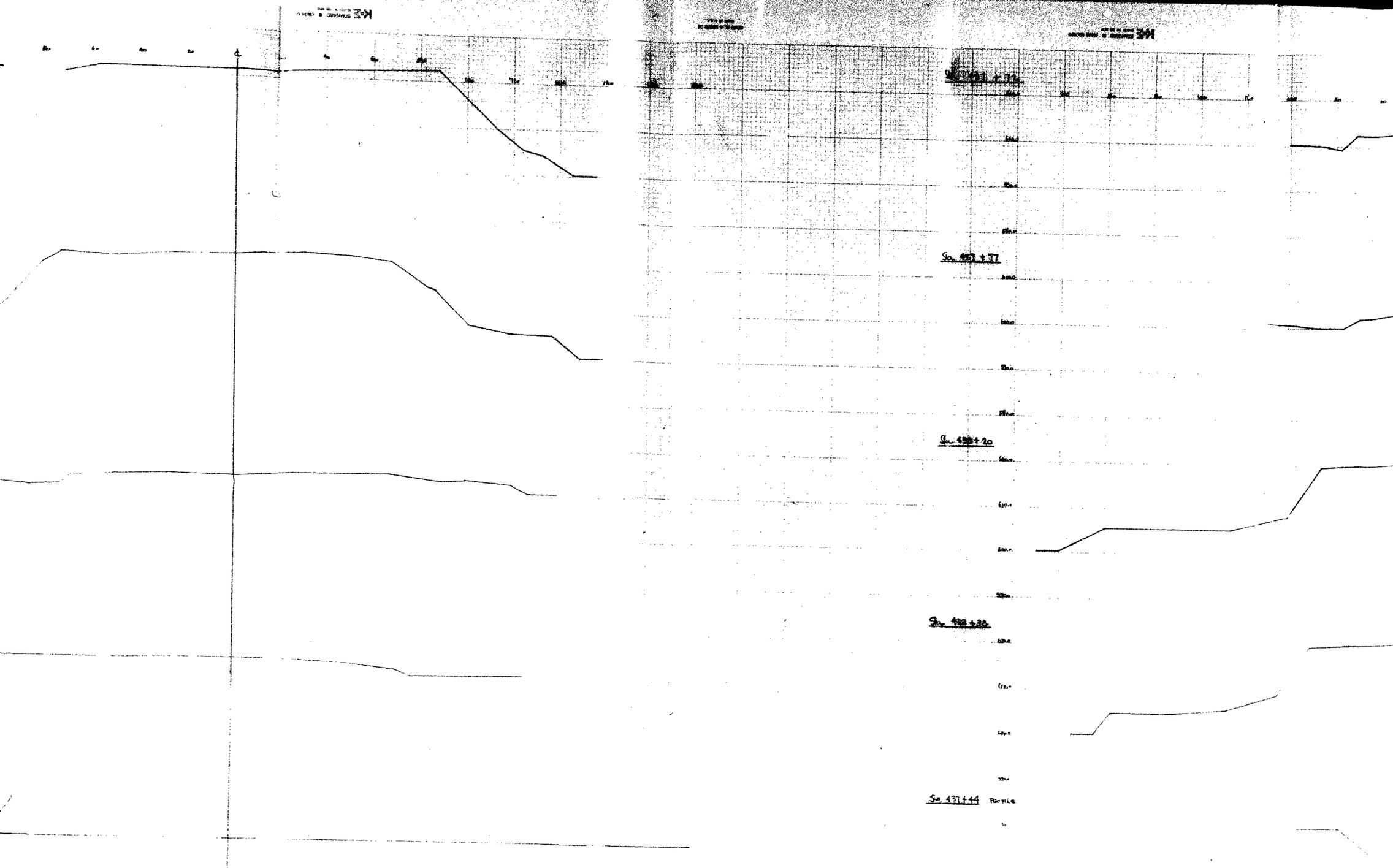

NORTH-WEST RETAINING WALL
NORTH STRUCTURE
WEST RETAINING WALL
SOUTH STRUCTURE
EAST RETAINING WALL
SOUTH-EAST RETAINING WALL
LAYOUT PLAN
SCALE 1"=10'-0"
SITE PLAN
SCALE 1"=40'-0"
KEY PLAN
ELEVATION
SCALE 1/8"=1'-0"
BORING DATA
TOWNSHIP OF HARWICH
COUNTY OF KENT
TO WINDSOR
TO TORONTO
LOT 27
CONCESSION
NOTES
DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT
DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE OFFICE TORONTO
GENERAL LAYOUT PLAN SITE PLAN
APPROVED
D-4488

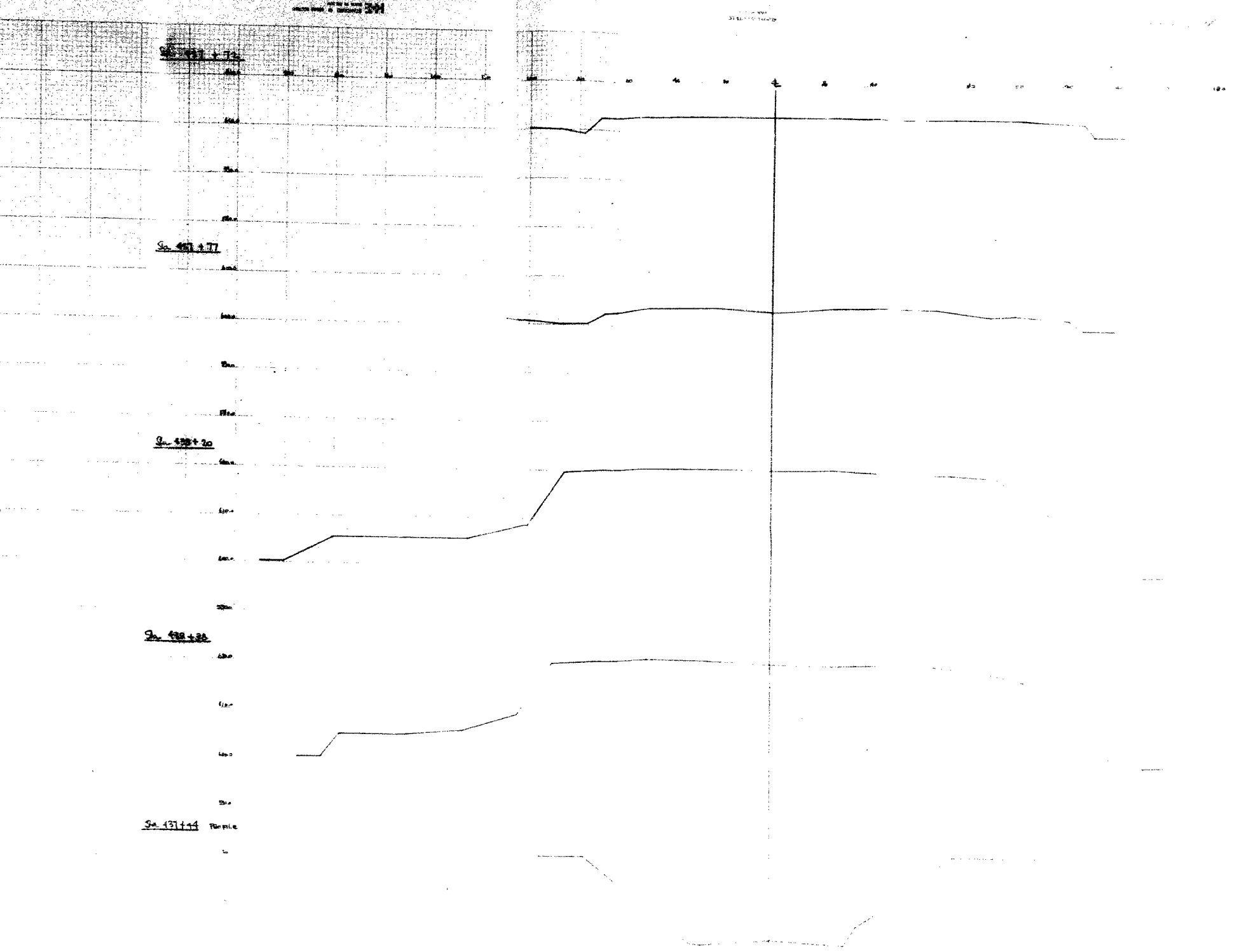
CONTRACT 61 – 87 (CHATHAM)





DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT





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OF ORIGINAL DOCUMENT