

MEMORANDUM

To: Mr. B. S. Davis,
Bridge Design Engineer,
Bridge Division.

FROM: Mr. A. G. Stermac,
Principal Foundation Engr.,
Foundation Section,
Materials & Research Division.

Attention: Mr. J. Keen

DATE: December 23, 1963

OUR FILE REF.

IN REPLY TO

SUBJECT:

Proposed Hwy. No. 21 Interchange, Hwy. 401,
North of Ridgetown - District No. 1 - W.P. 88-59.

At the above-mentioned location, it is proposed to construct a four-span, simply supported structure with perched abutments. The Bridge Division recently requested us to give recommendations as to the type and tip elevation of the piles for the abutment foundations.

We have reviewed the subsoil conditions described in the report by Wm. A. Trow and Associates Ltd., and submit the following comments pertaining to the abutment foundations:

1) The abutments for the structure may be supported on piled foundations. A safe design load of 25 tons/pile may be used for 12 $\frac{3}{4}$ " O.D. steel tubular piles driven to elev. 622.0. It should be noted that the piles should not be penetrated beyond the above-mentioned elevation.

2) As an alternative, the abutments may be supported on spread footings placed within the approach fills. The fill material below the tops of the footings should consist of well-compacted granular material and should extend for a horizontal distance of at least 10 ft. from the footing edges in the plane of the footing tops. This portion of the fill should be built with side slopes 2:1. The remainder of the fill should be completed to about profile grade for a distance of about 50 ft. behind the abutments before re-excavating for the abutment footings. A design load of 2 t.s.f. may be used for the abutment foundations.

MD/MdeF

cc: Foundations Office
Gen. Files

M. Devata
M. Devata,
SENIOR FOUNDATION ENGR.
For:
A. G. Stermac, D.H.O.
PRINCIPAL FOUNDATION ENGR.

RECEIVED

DEC 24 1963

BRIDGE
OFFICE



ONTARIO
DEPARTMENT OF HIGHWAYS

Memo to Mr. A. M. Toye, **Date** April 4, 1960.
Bridge Engineer. **Subject** FOUNDATION INVESTIGATION -- by
From Materials & Research Section. W.A. Trow & Associates, Ltd.

Attention: Mr. S. McCombie.

Re: Proposed Hwy. No. 21 Interchange,
Hwy. 401 - Ridgetown, Ont., Dist. #1
W.P. 88-59.

The detailed foundation investigation for the above site, prepared by W. A. Trow & Associates, has been reviewed by this Section. We are in agreement with the conclusions and suggestions given in this report, except that we consider the coefficient of compressibility to be a little conservative. Consequently, we think that the settlements are going to be smaller than the ones quoted in this report.

If any queries arise concerning the foundations for the proposed structure, please contact the Foundation Section.

L. G. Soderman,
PRINCIPAL SOILS & FOUNDATIONS ENGR.
Per:

A. Stermac

(A. Stermac,
FOUNDATIONS OFFICE ENGR.)

AS/MdeF
Attach.

cc: Messrs. A. M. Toye (2)
H. A. Tregaskes
D. G. Ramsay
A. Gater
G. U. Howell
J. Roy
A. Watt
Foundations Office
Gen. Files.

Mr. B. R. Davis,
Bridge Design Engineer,
Bridge Division.

Attention: Mr. J. Keen

Mr. A. G. Stermac,
Principal Foundation Engr.,
Foundation Section,
Materials & Research Division.

December 23, 1963

Proposed Hwy. No. 21 Interchange, Hwy. 401,
North of Ridgetown - District No. 1 - W.P. 88-59.

At the above-mentioned location, it is proposed to construct a four-span, simply supported structure with perched abutments. The Bridge Division recently requested us to give recommendations as to the type and tip elevation of the piles for the abutment foundations.

We have reviewed the subsoil conditions described in the report by Wm. A. Trow and Associates Ltd., and submit the following comments pertaining to the abutment foundations:

1) The abutments for the structure may be supported on piled foundations. A safe design load of 25 tons/pile may be used for 24" O.D. steel tubular piles driven to elev. 622.0. It should be noted that the piles should not be penetrated beyond the above-mentioned elevation.

2) As an alternative, the abutments may be supported on spread footings placed within the approach fills. The fill material below the tops of the footings should consist of well-compacted granular material and should extend for a horizontal distance of at least 10 ft. from the footing edges in the plane of the footing tops. This portion of the fill should be built with side slopes 2:1. The remainder of the fill should be completed to about profile grade for a distance of about 50 ft. behind the abutments before re-excavating for the abutment footings. A design load of 2 t.s.f. may be used for the abutment foundations.

MD/MdeP

cc: Foundations Office ✓
Gen. Files

M. Devata

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

Bridge Division,
August 12, 1960.

DIST I

MEMORANDUM TO:

Mr. L. G. Soderman,
Principal Soils & Foundations Engineer,
Room #121,
Downsview, Ontario.

To confirm our conversation from August 11, 1960,
we are continuing designs of Howard 3 & 6 Twp. Bridges
on the following bases:

Howard 3 W.P. 88-59 (BA 1023)

Ftng. bottom EL. of pier B was lowered to EL. 618

Howard 6 W.P. 87-59 (BA 1026)

Ftng. bottom EL. of piers A & C are as EL 617 and no
piles used; pressure not to exceed 2 tons/ sq. ft.

We use tube piles for the Abutments Footings, with
design load of 20 tons, which should go to EL. 604.

FG/dd

F. Gornek,
Supervisory Engineer,
Bridge Office.



ONTARIO

DEPARTMENT OF HIGHWAYS

335 Saskatoon Street,
LONDON, Ontario,
July 28, 1960.

MEMORANDUM FOR-
Mr. A. Toye,
Bridge Engineer.
Department of Highways,
Parliament Buildings,
TORONTO, Ontario.

Attention: Mr. S. McCombie,

RE; W.P. 87-59 Howard Twp.
Bridge #6 Highway #401.

We have received the preliminary bridge drawing D-4627-P1
from G. Scott and have the following comments:-

1. Alignment is correct.
2. Grade has been raised 1 foot and Road Design Office has changed the "F" profile accordingly.
3. Two 24' pavements, 10' side clearance and 50' median provided on Highway #401 is correct.
4. 28' driving surface provided on the county road is adequate.
5. Earth grading, granular and paving of the approaches will be included with the structure contract.
6. Drainage of the bridge deck will be handled by curb and gutter on the approaches.
7. Drainage on Highway #401 will flow both ways from the structure.

J.A. KNOWLES,
Project Design Engineer.

JAK-nc

Mr. A. M. Teye,
Bridge Engineer.
Materials & Research Section.

April 4, 1960.

FOUNDATION INVESTIGATION -- by
W.A. Trow & Associates, Ltd.

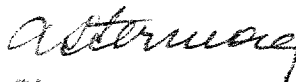
Attention: Mr. E. McCombie.

Re: Proposed Hwy. No. 21 Interchange,
Hwy. 401 - Ridgeway, Ont., Dist. #1
W.P. 88-59.

The detailed foundation investigation for the above site, prepared by W. A. Trow & Associates, has been reviewed by this Section. We are in agreement with the conclusions and suggestions given in this report, except that we consider the coefficient of compressibility to be a little conservative. Consequently, we think that the settlements are going to be smaller than the ones quoted in this report.

If any queries arise concerning the foundations for the proposed structure, please contact the Foundation Section.

L. G. Soderman,
PRINCIPAL SOILS & FOUNDATIONS ENGR.
Per:



(A. Sternac,
FOUNDATIONS OFFICE ENGR.)

AS/MdeF
Attach.

cc: Messrs. A. M. Teye (2)
H. A. Tregaskes
D. C. Ramsay
A. Cater
C. U. Howell
J. Roy
A. Watt
Foundations Office
Gen. Files.

BA1023

WILLIAM A. TROW AND ASSOCIATES LTD.

SITE INVESTIGATIONS
AND
SOIL MECHANICS CONSULTATION

W. A. TROW, M.A.S.C., M.E.I.C., P.ENG.

884 WILSON AVE.,
DOWNSVIEW, ONT.
ME. 5-5921

Project: J 484

March 25, 1960.

Mr. A. Rutka,
Acting Materials and Research Engineer,
Materials and Research Section,
Dept. of Highways of Ontario,
Parliament Bldgs., Toronto, Ont.

Attention: Mr. L. G. Soderman

Foundation Investigation
Proposed Interchange & Associated Culverts
Hwy. 401 and Hwy. 21, North of Ridgeway.

Dear Sirs:

The enclosed report describes the soil conditions encountered at the interchange and culvert sites noted above.

The soil at this location is quite competent to support the overpass structure proposed although some long term settlement will occur because at least 50 feet of relatively compressible clay will underlie the abutments and approach fill. A safe bearing value, for abutment footings, of 8000 p.s.f. has been indicated and a foundation depth at Elev. 623 feet, or about 7 feet below ground surface has been suggested.

If there are any queries concerning the physical properties or general foundation conditions at this location, we shall be pleased to discuss them with you.

Yours very truly,

W. A. Trow

William A. Trow (P. Eng.)

WAT/lt
Encl.

DEPARTMENT OF HIGHWAYS OF ONTARIO
MATERIALS AND RESEARCH SECTION
PARLIAMENT BUILDINGS, TORONTO, ONT.

FOUNDATION INVESTIGATION
PROPOSED INTERCHANGE AND ASSOCIATED CULVERTS
HWY. 401 AND HWY. 21, NORTH OF RIDGETOWN.

Project: J 484

William A. Trow & Associates L'd.

March 25, 1960.

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FOUNDATION INVESTIGATION
PROPOSED INTERCHANGE & ASSOCIATED CULVERTS
HWY. 401 AND HWY. 21, NORTH OF RIDGETOWN.

This report describes the soil conditions encountered at the proposed interchange site noted above. A discussion of the foundation requirements for this underpass structure has been given and the capacity of the soil at two creek-diversion culvert sites to the south and west of the interchange is also considered. Details of field investigation methods are given in the Appendix.

Site Description

The site of the proposed underpass structure lies adjacent to the T-intersection of a drainage ditch which carries away the surface water from the surrounding flat countryside. The location of this ditch and the path of its proposed diversion is indicated in Dwg. 1. The water in the ditch at this point was 7 feet below the top of the culvert or about 8 feet below the surface of Hwy. 21. The water was 2 feet deep.

A ridge of slightly higher ground lies about 100 yards to the north of the interchange. The area was snow covered at the time of the investigation.

Subsoil Description

Four borings were made at the interchange site, two of which were carried to refusal or assumed bedrock, 83 and 88 feet below ground surface respectively. These deep borings were made at the south-west and north east corners of the proposed structure. Two shallow borings to 25 feet indicated the soil conditions at the other two corners. In addition, one shallow boring was made at the site of a culvert for the proposed creek diversion under Hwy. 21, about 700 feet to the south, and 2 borings were made at the point where this creek will underpass Hwy. 401, about 1100 feet to the south-west.

The soil at these culvert locations was in a very stiff to hard condition and conformed closely to the materials at the bridge site. Descriptions are given in the borehole logs, Dwgs. 6 to 8 of this report.

A general indication of the subsoil stratigraphy at all locations can be obtained by reference to the profile shown in Dwg. 1. This profile is based upon the information obtained from Holes 2 and 4. The following soil types are indicated:

a) Brown clay: This stratum extends to approximate Elev. 622 feet and therefore is about 8 feet thick below ground surface. It exists in a very stiff to hard condition with a shear strength in the order of 5000 p.s.f.,

and a moisture content close to the plastic limit. The liquid and plastic limits of this material are approximately 42 and 19 percent respectively. Some loose sandy fill with organics was noted to a depth of about 8 feet in holes 1 and 3, and 3 feet of wet clayey sand covered the clay in hole 4.

b) Upper silty clay till: This glacial deposit underlies the clay described above and it extends to approximate Elev. 601 feet. It exists in a very stiff to stiff condition with a shear strength in the order of 1800 p.s.f. Its moisture content is slightly above the plastic limit and, with Atterberg limits of LL = 40% and PL = 18.5%, it is slightly less plastic than the overlying clay.

c) Faintly stratified silty clay: Although the physical properties of this stratum differed very little from the overlying till, it appeared to be somewhat more plastic and, - as the sub-title suggests, - faintly stratified. It contained fewer gravel sizes than the overlying till.

d) Lower silty clay till: The above-noted stratum separates the glacial till described under subsection (b). This glacial deposit continues to a depth of 58 feet, or to approximate Elev. 572 feet.

e) Reddish grey clay and fine sand: This stratum begins 58 feet below the ground surface and consists of alternate layers of stiff adhesive reddish grey clay and fine sand. The clay is predominant for the first 2 or 3 feet and it contains partings of coarse silt. However, the clay layers become more prominent with depth. At 66 feet below the surface in Hole 4, the sand graded into gravel.

f) Dense dark grey silty sand with gravel: This stratum was encountered 75 feet below the ground surface and it extended to assumed bedrock which was found in Hole 2 at Elev. 541.3 or about 90 feet below the road surface. This material was very difficult to auger through and it was not possible to auger to bedrock in Hole 4 because of the resistance offered.

Discussion of Foundation Requirements

1) Culvert Sites: Very stiff impermeable clay till was encountered at both culvert locations and, as a consequence, no foundation problem exists. The soil at and above a depth of about 10 feet has a safe bearing value of 8000 p.s.f. and no ground water difficulties will be encountered when excavating to this depth for the culvert footings.

2) Interchange structure site: Since it is proposed to divert the existing drainage ditch, excavations for the bridge structure need be taken only to the depth where satisfactory bearing conditions exist. This level will vary depending upon the extent of fill encountered. In Holes 2 and 4, very stiff clay begins about 5 feet below the ground surface, while in Holes 1 and 3, at the north-west and south-east corners of the site, loose

sandy fill extends at least to this level and good bearing conditions are not found until Elev. 623 feet. In view of the variation, it is suggested that all footings be taken down to this latter level.

The shear strength of the soil at this depth ranges from 4700 to 6900 p.s.f., and therefore a net bearing value of 8000 p.s.f. can be applied quite safely. Some ground water may be encountered when excavating to Elev. 623 feet for the abutment and pier footings, but the amount of water will not cause any construction difficulty.

Approach embankments of the order of 20 feet high will be required at this crossing of Hwy. 401. As stated in recent reports for investigations at adjacent county road underpass sites, the weight of this fill will cause the underlying clay to consolidate. The amount and duration of this movement will depend upon the thickness of the clay.

The estimates of settlement for the other sites have been based upon tests on 3 samples of clay believed to be representative of the soil along this portion of the Hwy. 401 route between Ridgetown and Blenheim. Adjustments have been made to all settlement calculations, for the structures along this route, because the soil in its natural state is felt to be less compressible than laboratory tests would indicate.

The thickness of compressible clay below recommended footing level at this location is only about 55 feet and therefore the long term settlement should be somewhat less than the estimates for the other structures referred to above. Using the assumptions and reasoning applied in the analysis of those structures, it can be shown that the total settlement of abutments to be expected at this site will be in the order of $3\frac{1}{2}$ inches. Since drainage will definitely take place at the two boundaries of the clay, this settlement should be essentially complete in about 16 years with 50% of the movement taking place in about 4 years. If centre piers are to be utilized, they should settle about one inch under the 8000 p.s.f. pressure recommended.

Summary of Comments and Conclusions

1) The site of this interchange is underlain by hard to stiff clay deposits which are of glacial origin. The materials for the first approximately 15 feet has a very high strength but below this level a somewhat less stiff condition exists. Loose sandy fill was found for the first few feet in two of the holes adjacent to the existing culvert. Bedrock lies about 90 feet below the centre line of Hwy. 21 and it is overlain by about 13 feet of very dense silty sand and gravel.

2) Footings for the bridge structure can be placed at Elev. 623 feet, or about 8 feet below the present ground surface. The recommended safe bearing value at this level is 8000 p.s.f. No ground water problems of consequence should be experienced when digging to this depth.

- 3) Long term settlement in the order of $3\frac{1}{2}$ inches has been estimated for the abutment footings. This will result, in large part, from the weight of the adjacent embankment approaches.
- 4) No stability problem of these embankments exists at this location.
- 5) The foundation conditions for the culvert sites to the south and west of this crossing are excellent. The footing excavations will remain dry during construction.

WAT/lt
J 484
March 25, 1960.



W. Trow

William A. Trow (P. Eng.)

A. PENDIXFIELD INVESTIGATION METHODS

Seven borings were carried out at this site, four of which were made at the proposed interchange structure location. Two of these latter ones, at the south-west and north east corners of the proposed bridge were taken to, or close to, bedrock, located about 90 feet below the road surface; the other holes were terminated generally at 25 feet.

The holes were made by a continuous flight auger 5 inches in diameter; no casing was used. Samples were taken generally at 5 foot intervals of depth starting 3 feet below the surface. Both split-spoon and thin-walled shelly tube samples were recovered. In the former instance, the sampler was driven into the ground using an energy of 350 ft.lbs. per blow. The shelly tubes were pushed or levered into the ground in most instances. Field vane tests were attempted but in all cases the ground was too stiff. Cone penetration tests were made to a depth of 10 feet in one hole.

The elevation of each hole was obtained using the bench mark indicated in Dwg. 1 as reference.

PROJECT NO.

J 424

WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT Hwy. #1 Interchange, KP 90-50

LOCATION North of Ridgeway, Ont.

HOLE LOCATION See Dwg. 1

HOLE ELEVATION AND DATUM 631.4 BM see Dwg. 1

BOREHOLE NO. 1

FIELD SUPERVISOR

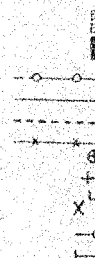
DRILLER

PREP.

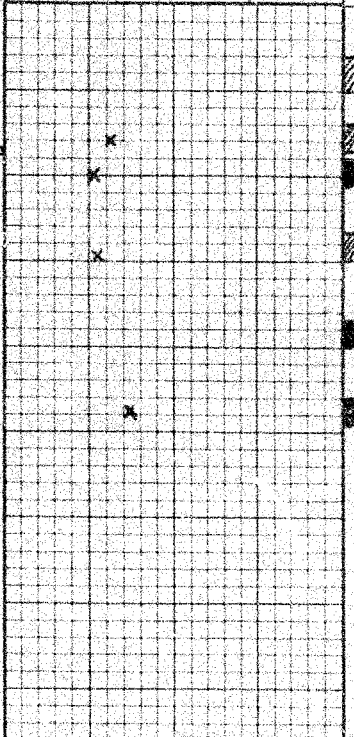
DRAWING NO. 2

LEGEND

2" DIA. SP. IT. TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 CASING
 2" SHELBY
 1/2 UNCONFINED COMPRESSION (Qu)
 VANE TEST (C) AND SENSITIVITY (S)
 NATURAL MOISTURE AND
 LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT



SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				BLOWS/FT.	P.S.F.
	Ground surface	631.4	0		
	Loose dry brown sand - some top-soil 0 to 5 ft.; moist to wet below 5 ft.				
	Stiff br. clay with some grav. sines	624.0			
	Very stiff brown silty clay with gravel sines (Glacial Till)	622.5	10		
	Becomes gray below 13 feet		20		
	End of bore.	607	30		
NOTES: 1) Boring by continuous flight auger; hole uncased to full depth. 2) Sample driven under energy of 350 ft. lbs. per blow. 3) Water level after 10 hrs. 15.2 ft. and rising slowly. 4) Level of water in adjacent ditch = 623.2 ft. Creek 2 ft. deep to hard soil.					

CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT--% DRY WT.			
20	30	40	
			
			130
			lost
			lower 131

WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT Hwy.#21 Interchange WP 80-59
LOCATION North of Ridgeton, Ont.
HOLE LOCATION See Dr. 1
HOLE ELEVATION AND DATUM 529.4

BOREHOLE NO. 2
FIELD SUPERVISOR.
DRILLER.
PREP.

LEGEND

- 2" DIA. SPLIT TUBE
2" SHELBY TUBE
2" SPLIT TUBE
2" DIA. CONE
CASING
2" SHELBY
1/2 UNCONFINED COMPRESSION (Qu)
VANE TEST (C) AND SENSITIVITY (S)
NATURAL MOISTURE AND
LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE			
				Shear Stress	1000	2500	P.S.F. BLOWS/FT.
	Ground surface approx. 1 ft. topsoil. Stiff to very stiff brown clay with occasional pebbles.	552.4	0				
	Stiff gray silty clay with gravel sides (Glacial Till)	552.4	10				
	Stiff plastic relatively clean clay faintly stratified and with tiny pockets of silt as well as sand and gravel.	551	30				
	Very stiff gray silty clay with gravel sides (glacial till)	551	40				
	Alternate layers of silt and stiff reddish gray clay with small pockets of sandy gravel.	551	60				
	Auger ahead to bedrock after sample at 60 ft.; hard augering below 75 feet.	554	70				
	Silty sand and gravel on augers below 75 ft.	554	80				
	Refusal and measured bedrock at 1 ft. (Augers did not penetrate)	541.3	20				

CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.			
20	30	40	

NOTES: 1) See 2) on page 1.

STANDARD FORM NO. 64

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

BOREHOLE NO. 3
FIELD SUPERVISOR
DRILLER
PREP.

2 1/2" DIA. SPLIT TUBE
2 1/2" SHELBY TUBE
2 1/2" SPLIT TUBE
2 1/2" DIA. CONE
CASING
2 1/2" SHELBY
1/2 UNCONFINED COMPRESSION (QU)
VANE TEST (C) AND SENSITIVITY (SI)
NATURAL MOISTURE AND
LIQUIDITY INDEX
LIQUID LIMIT
PLASTIC LIMIT

CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST CONTENT - % DRY WT.			
20	30	40	
			lost

WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT: Hwy. #21 Interchange WP 88-59

LOCATION: North of Ridgeway, Ont.

HOLE LOCATION: See Map 1

HOLE ELEVATION AND DATUM: 630.3

BOREHOLE NO.

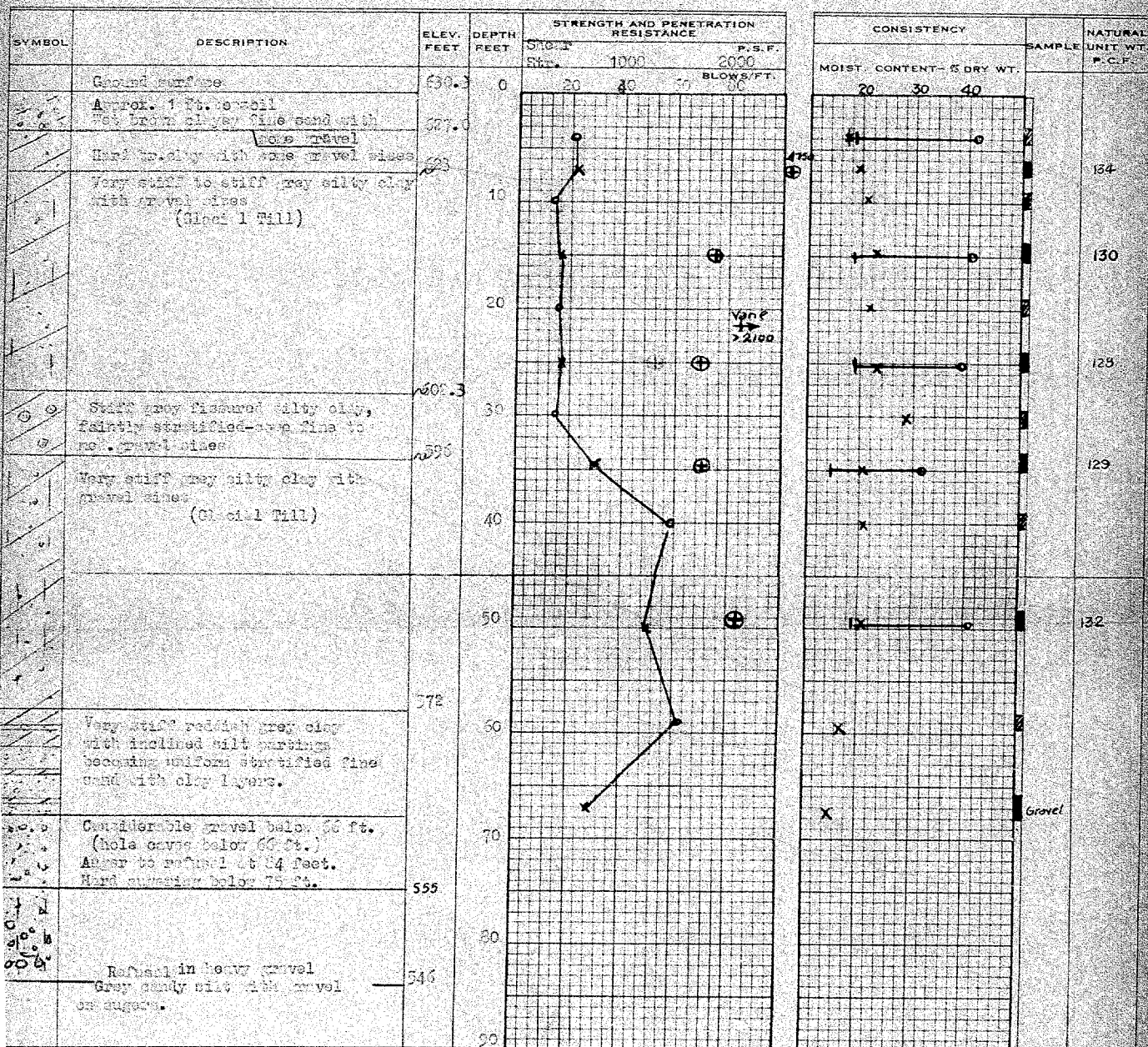
FIELD SUPERVISOR

DRILLER

PREP.

LEGEND

- 2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 CASING
 2" SHELBY
 1/2 UNCONFINED COMPRESSION (QU)
 VANE TEST (C) AND SENSITIVITY (S)
 NATURAL MOISTURE AND
 LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT



PROJECT NO. J 484

DRAWING NO. 6

WILLIAM A. TROW & ASSOCIATES LTD.

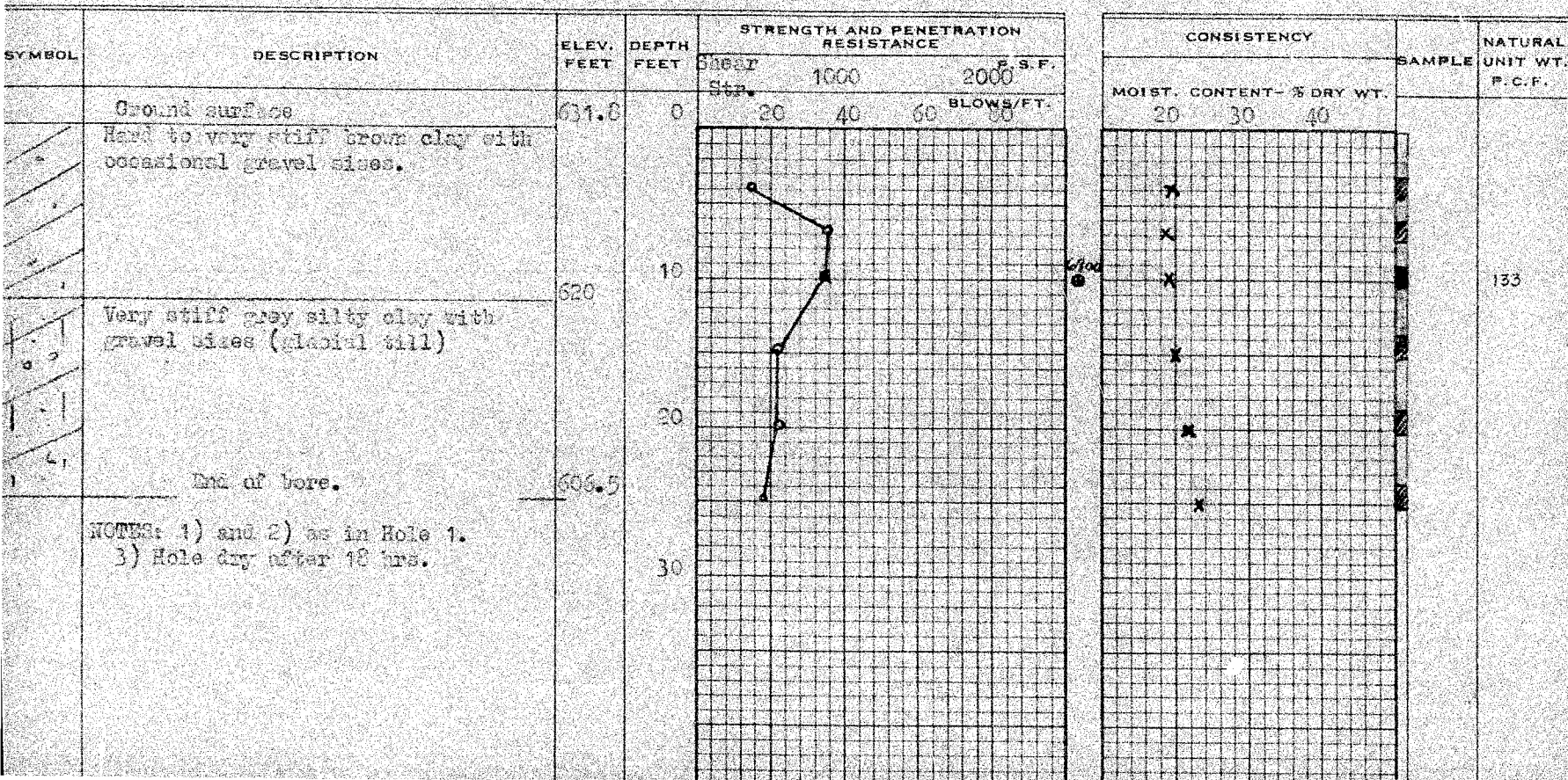
SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT Hwy. #21 Interchange KP 02-39
 LOCATION North of Ridgeway, Ont.
 HOLE LOCATION See Dig. 1
 HOLE ELEVATION AND DATUM 631.8

BOREHOLE NO. 5
 FIELD SUPERVISOR
 DRILLER
 PREP.

LEGEND

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
 2" SPLIT TUBE
 2" DIA. CONE
 CASING
 2" SHELBY
 1/2 UNCONFINED COMPRESSION (Qu)
 VANE TEST (C) AND SENSITIVITY (S)
 NATURAL MOISTURE AND
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 LIQUID LIMIT
 PLASTIC LIMIT



WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT: NY #21 Intelligence WP 10-50

LOCATION March at Ridgeway, Ont.

HOLE LOCATION See Fig. 1

HOLE ELEVATION AND DATUM 622.1

BOREHOLE NO. 5

FIELD SUPERVISOR

DRILLER

PREP.

DRAWING NO. 7

LEGEND

2" DIA. SPLIT TUBE

2.1 SHELBY TUBE

2" SPLIT TUBE

2" DIA. CONE

CASING

21 SHELBY

1/2 UNCONFINED COMPRESSION [Qu]

VANE TEST (C) AND SENSITIVITY (S)

NATURAL MOISTURE AND

LIQUIDITY INDEX

LIQUID LIMIT

PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE	
				P. S. F. BLOWS/FT.	
	Ground surface	628.1	0	20	40
	Ap. 102. 1 ft. topsoil			60	80
	Very stiff brown silty clay with gravel sizes - Glacial Till				
	(fissured at 3-5 Ft.)		10		
			20		
	End of bore	603	30		
NOTES: 1) and 2) as in H.1					

[illegible]

PROJECT NO. J 484

WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT INT. #21 Interchange WP 80-30

LOCATION North of Andover, Ont.

HOLE LOCATION See Map 1

HOLE ELEVATION AND DATUM 625.0

BOREHOLE NO. 7

FIELD SUPERVISOR

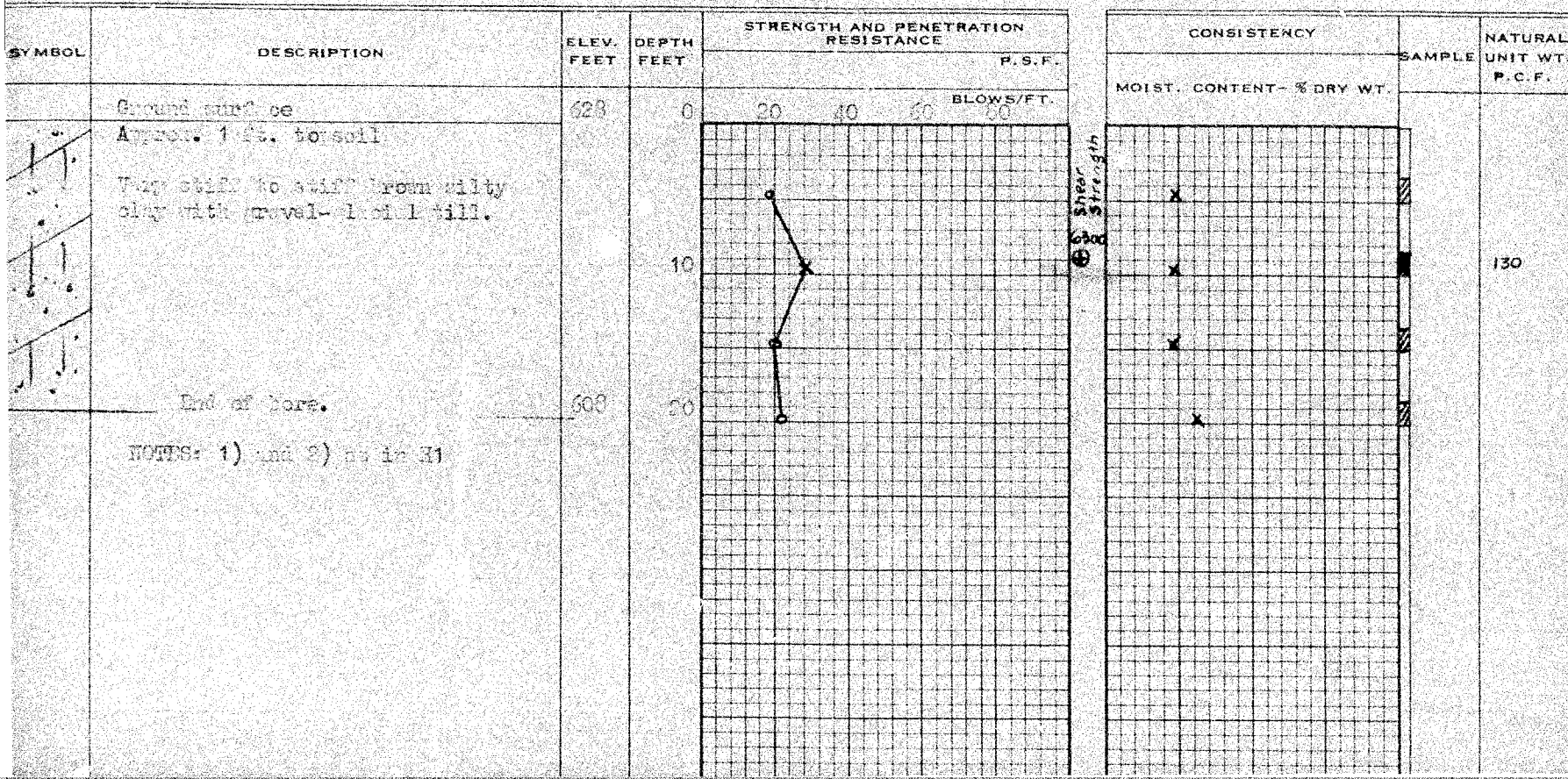
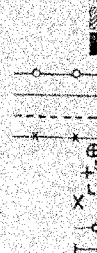
DRILLER

PREP.

DRAWING NO. 8

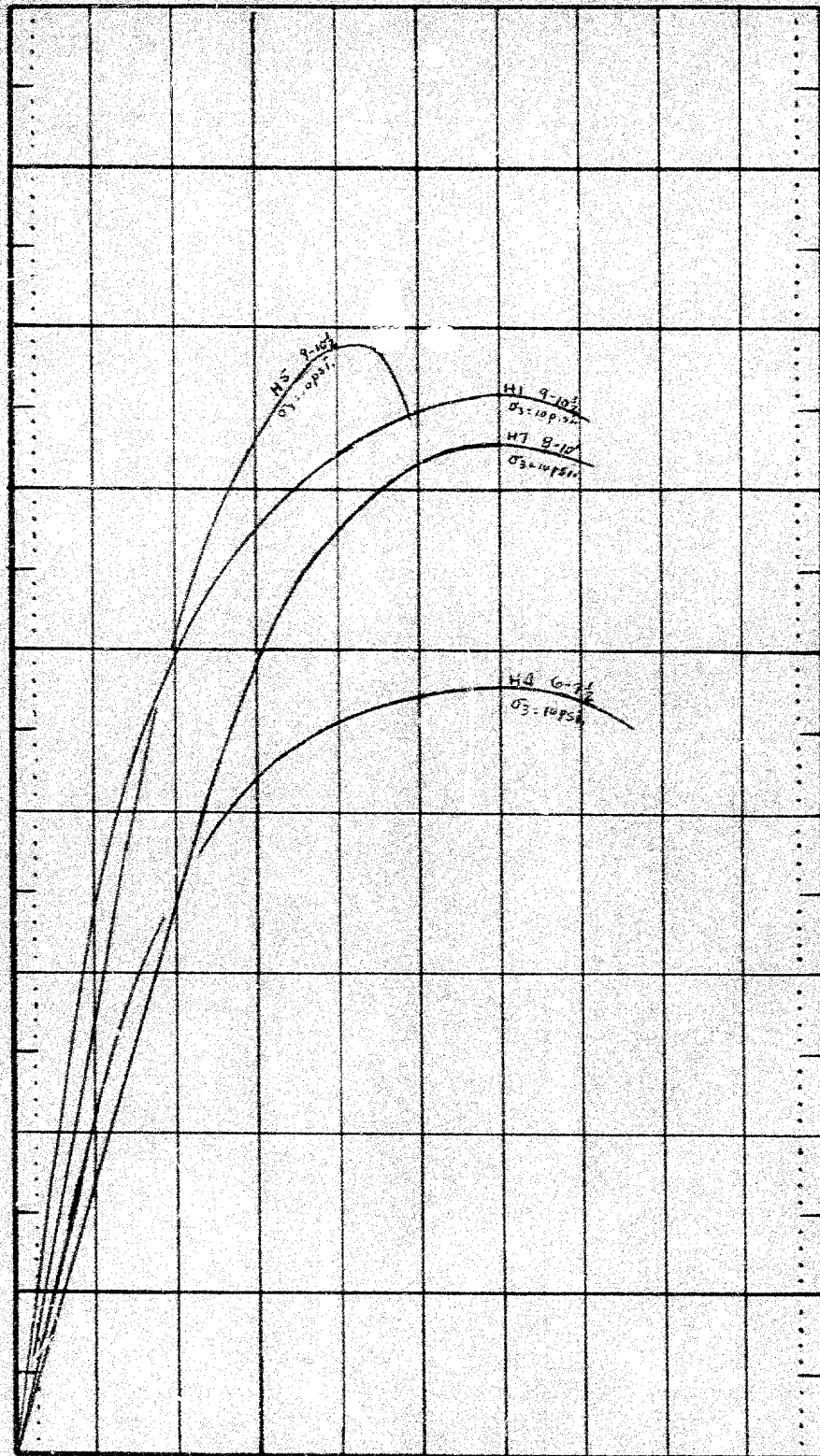
LEGEND

2" DIA. SPLIT TUBE
 2" SHELBY TUBE
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 VANE TEST (C) AND SENSITIVITY (S)
 NATURAL MOISTURE AND
 LIQUIDITY INDEX
 LIQUID LIMIT
 PLASTIC LIMIT



SHEAR STRESS ksf

7
6
5
4
3
2
1



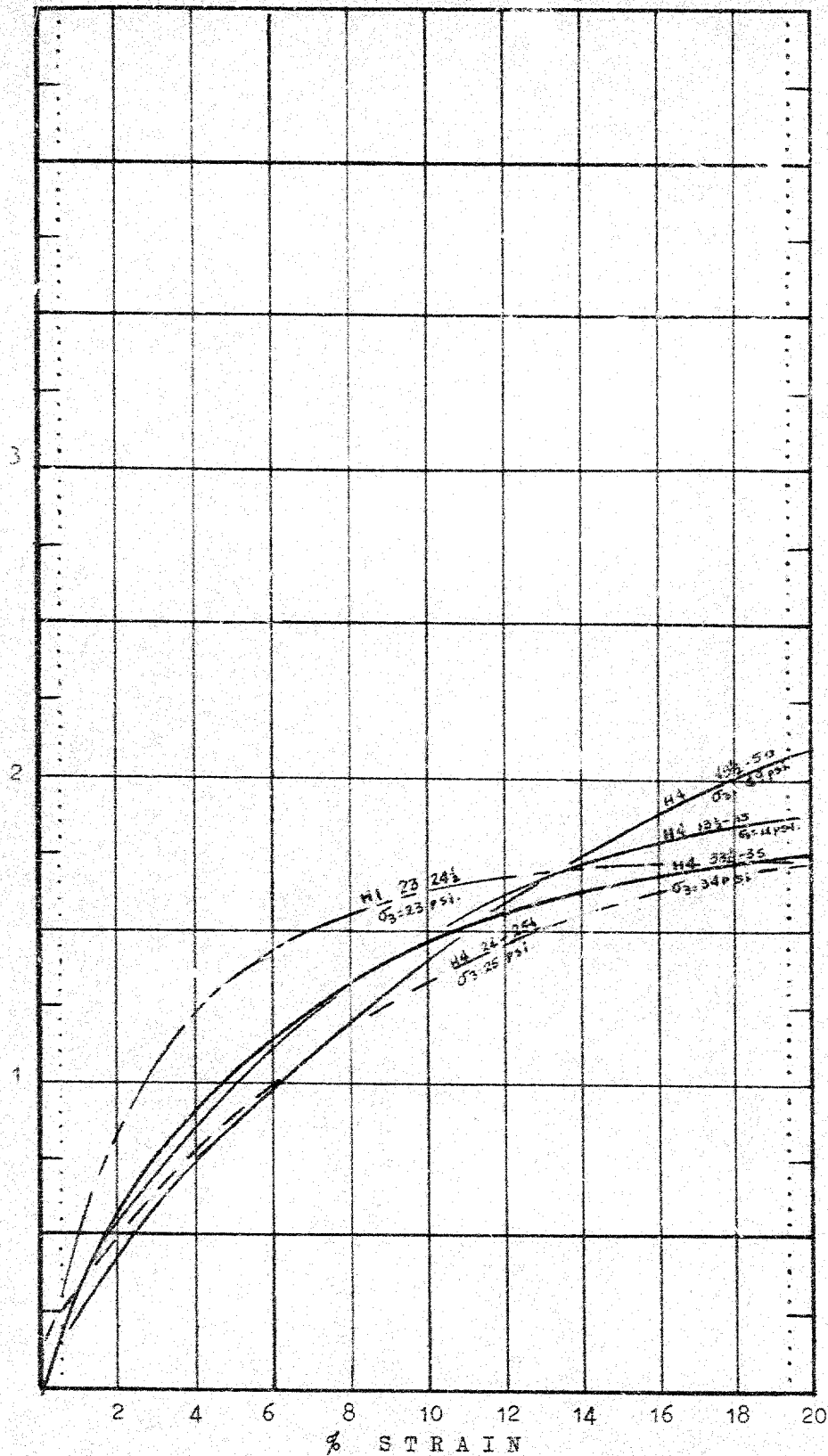
% STRAIN

STRESS STRAIN CURVES UNDRAINED TRIAXIAL TEST RESULTS

WILLIAM A. TROW AND ASSOCIATES

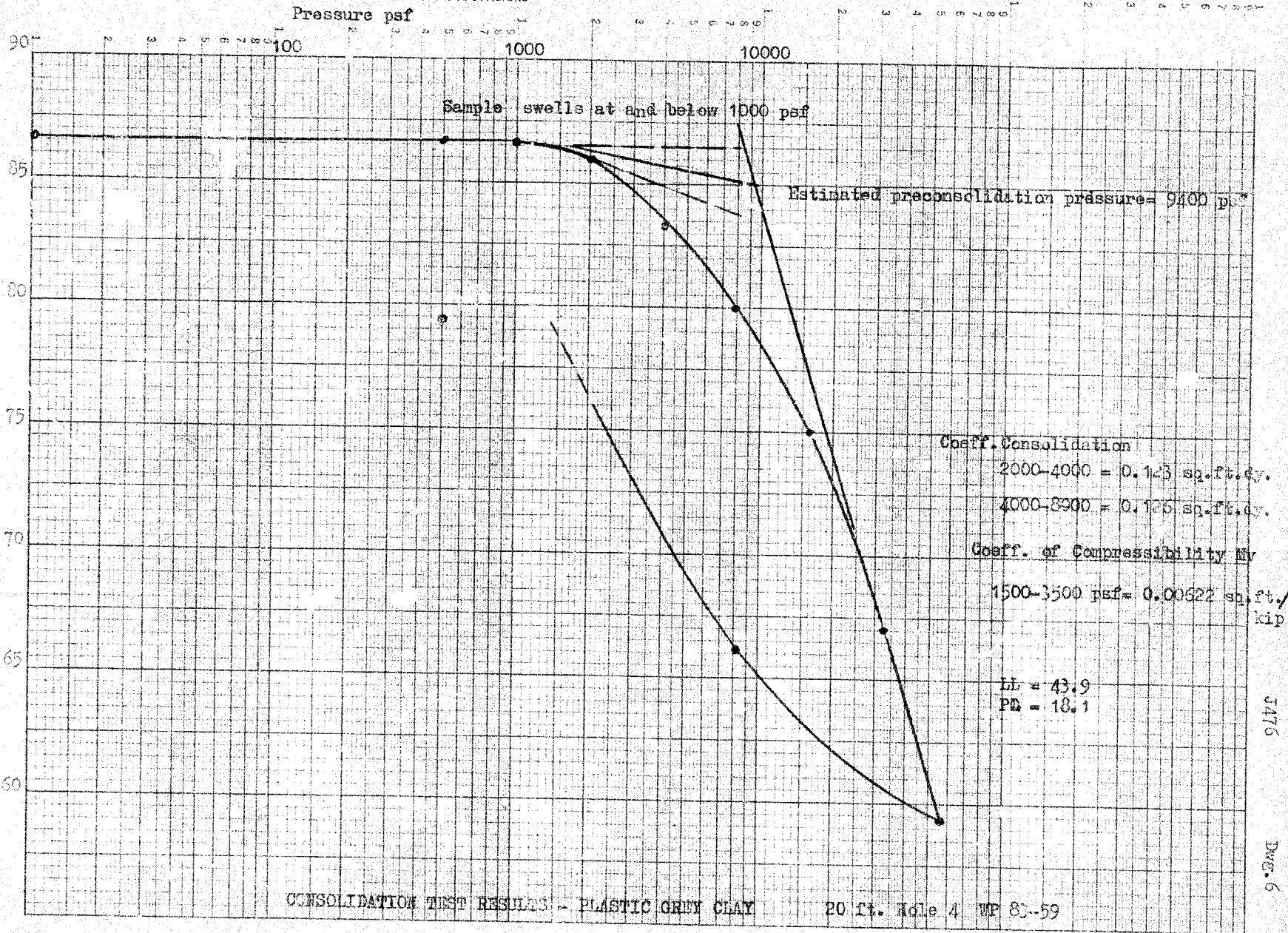
WB 8-59

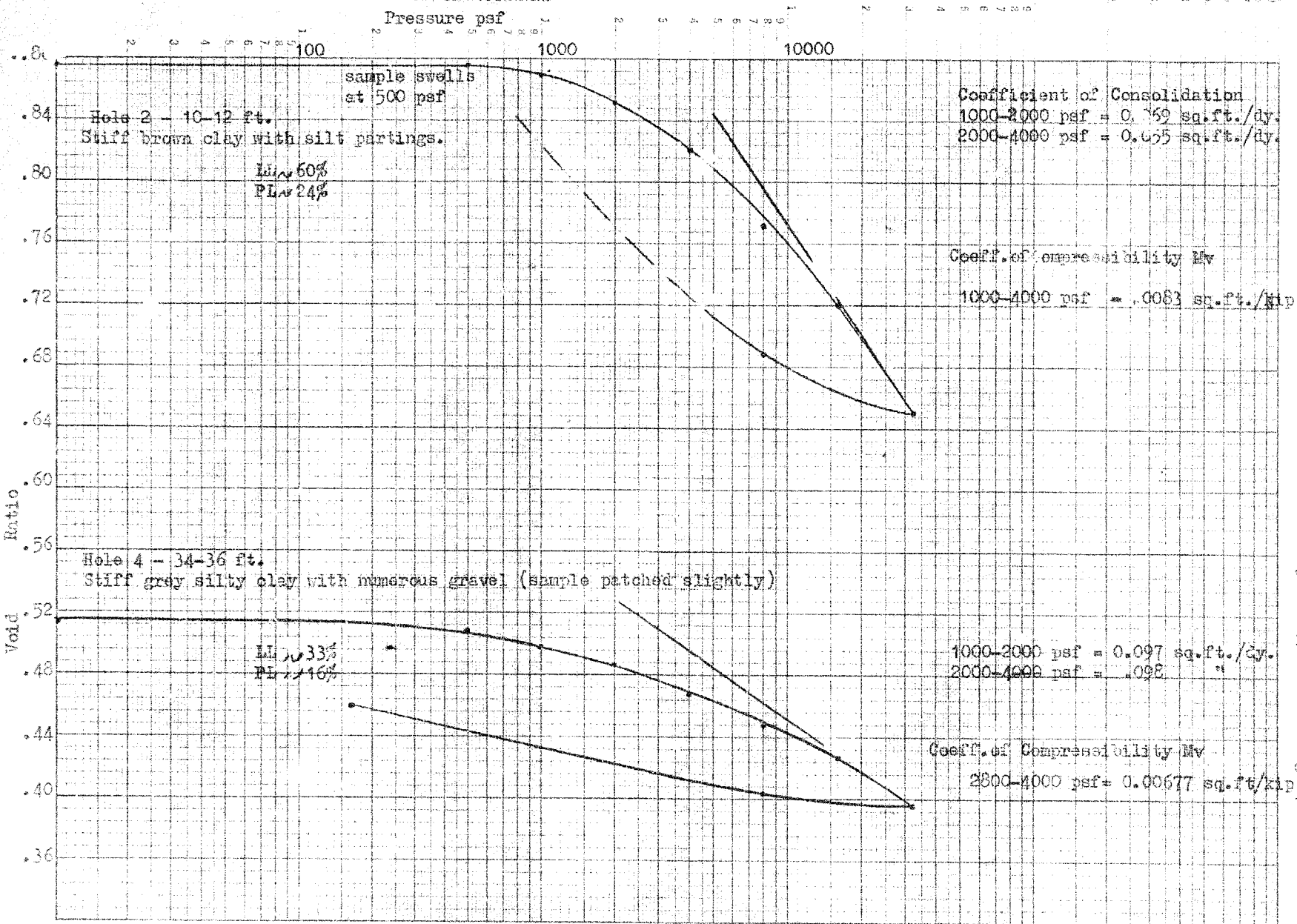
SHEAR STRESS ksf



STRESS STRAIN CURVES UNDRAINED TRIAXIAL TEST RESULTS WP 88-59

Pressure psf





60-F-287-C

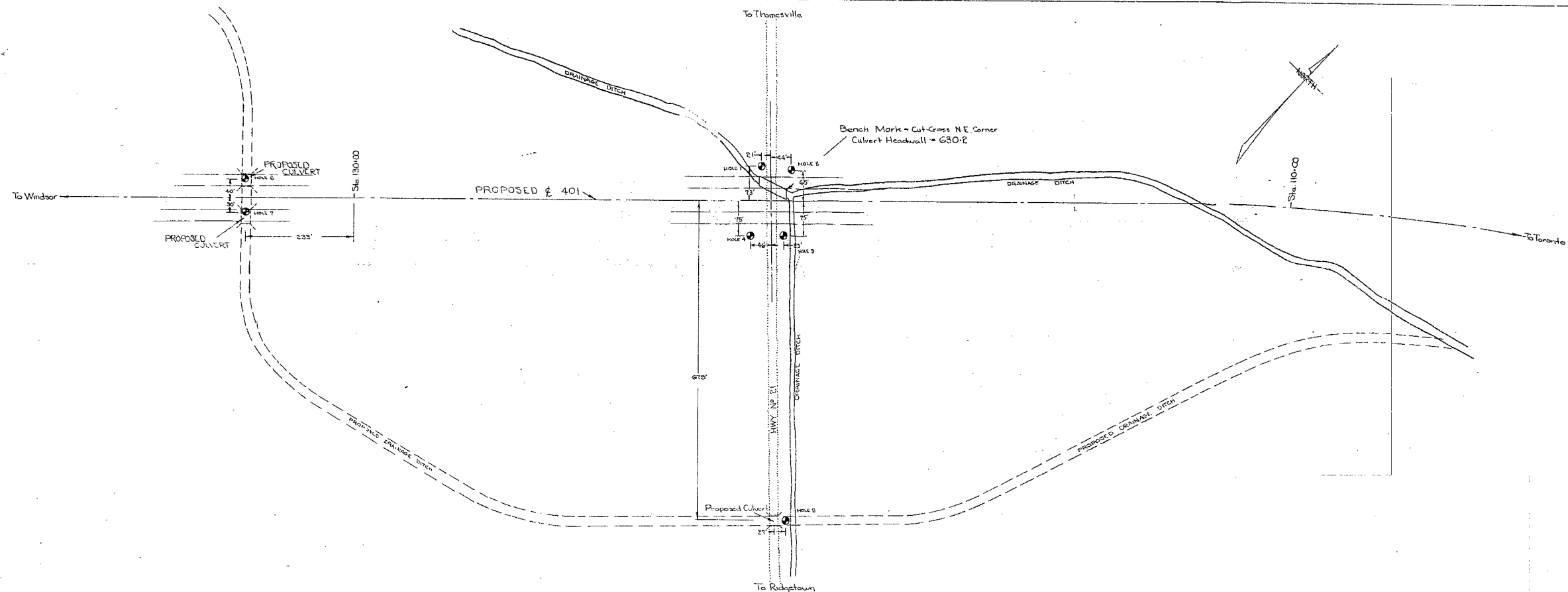
W.P. # 88-59

HWY. # 21

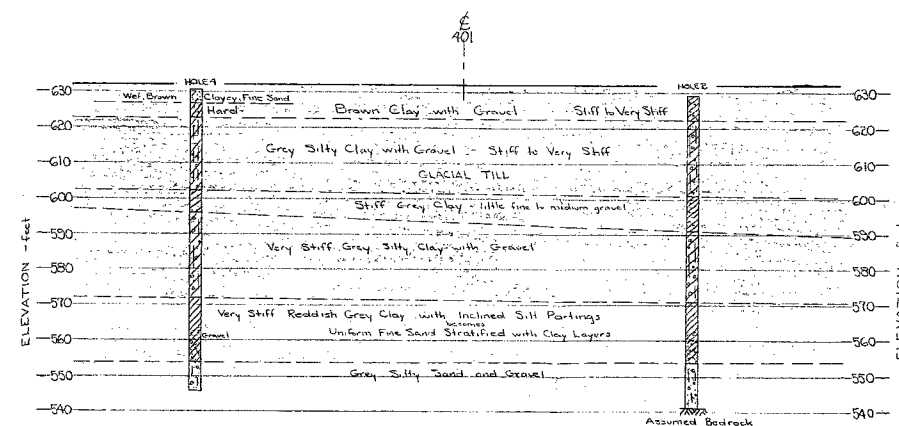
INTERCHANGE

HWY. # 401,

RIDGETOWN

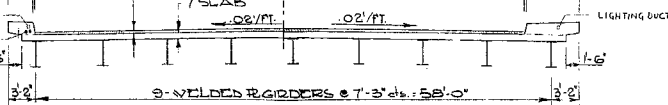
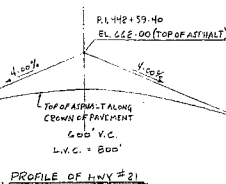
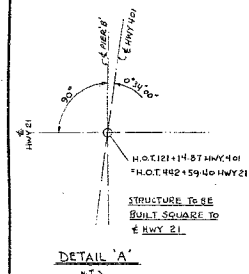


BOREHOLE LOCATION PLAN
SCALE 1"=100'



ESTIMATED SUBSOIL STRATIGRAPHY
SCALE 1"=20'

PROPOSED UNDERPASS
W.P. 88-59
FOUNDATION INVESTIGATION
Wm. A. TROW & ASSOCIATES, Ltd.

[illegible]

DEPARTMENT OF HIGHWAYS ONTARIO BRIDGE DIVISION			
<h1 style="margin: 0;">HWY. 21 INTERCHANGE</h1>			
KING'S HIGHWAY No. 401		DIST. No. 1	
CO. KENT		Howard TWP. SEGE # 2	
TWP. HOWARD		LOT 12619 CON. VI	
PRELIMINARY			

APPROVED _____		SITE No. 1-226	W.P. No. 88-591
BRIDGE ENGINEER			
DESIGN <input checked="" type="checkbox"/>	CHECK J L K	CONTRACT	Nos.
DRAWING <input checked="" type="checkbox"/>	CHECK J L K	_____	
DATE Nov/68	LOADING H 20 G	DRAWING No.	D 5102-P1