

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

September 16, 1954.

REVIEW OF PRELIMINARY PLAN - by
Foundations Office.

Attention: Mr. S. McCombie.

Re: Bridge No. 6, Southwold Twp.,
Hwy. 401, Lots 1 & 18, Con. III,
W.P. 63-59 -- District 2.

TR 112 - 220

We have reviewed the preliminary plan for the above-noted structure. We understand that the bridge is a simply-supported, multi-span structure and, therefore, will be able to take care of differential settlements which are going to take place. The fact that the footings are placed two feet above the elevation proposed in the Soils Report, does not influence the bearing capacity value of 2 tons/ft.² and the design is therefore considered to be satisfactory.

Should there be any further queries, please do not hesitate to contact our Office.

L. G. Soderman,
PRINCIPAL FOUNDATIONS ENGR.

Per:

(Stermac)

(A. Stermac,
FOUNDATIONS OFFICE ENGR.)

AS/MdeF

cc: Foundations Office ✓
Gen. Files.

Mr. P. J. Harvey

May 24, 1960.

Location Plans Engineer

Materials & Research

Re: WP63-59, Hwy 401, Cty Rd Btwn Lots 1&18, Southwold Twp.,
Plan F3530-1, Profile F3530-2, Sta. 127 approx.

Further to your memorandum of Sept. 10, 1959, this will confirm our earlier statement that the alignment and grade at this structure site, as shown on the above plan and profile, appear to be satisfactory.

A foundation investigation has been completed by Consultants, Wm. A. Trow & Associates, and their report was submitted May 13, 1960. The material was determined to be predominantly stiff to very stiff clay with some medium sand underlying the South West portion of the proposed structure. No approach fill stability problems were anticipated, and spread footings were recommended.

SDS/tt

Copies to: S. McCombie
R. Strain
K. Peaker ✓
J. Roy (2)
Files
A. D. Smith

L. C. Soderman
Principal Soils & Foundation Engr.


Per:
A. D. Smith

Mr. A. Oye,
Bridge Engineer.
Materials & Research Section.

May 19, 1960.

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

Attention: Mr. S. McCombie.

Re: Proposed County Road Underpass
Hwy. 401, Southwold Township,
S.P. 63-59 -- District No.2.

We have reviewed the above-mentioned report submitted by W. A. Trow & Associates, Ltd., and have found the conclusions and recommendations contained therein, adequate for your future design work. For your convenience, we are summarizing, below, once again, the recommendations you should follow:-

1. The site of this Underpass is underlain, generally, by stiff to very stiff clay. Medium dense sand has been encountered within the first 30 feet, and the abutments of the structure will bear, for the most part, in this soil.
2. Because of the above-mentioned fact, it is recommended that a rigid frame, single-span structure for the Underpass should be used. The rigidity of the structure would compensate the small differential settlements due to the heterogeneity of the foundation ground.
3. The footings should be placed 8 feet below ground level - i.e. - at elevation 738.0 ft. This depth is required because of the existing drainage ditch.
4. At this elevation, spread footings can be designed with a safe load of 2.0 t/sq.ft.
5. Settlements due to the structure and the approach embankment, will be in the order of about 4 inches and will develop during a longer period of time, and should, therefore, not be considered harmful to the structure.

cont'd. 1/2 ...

Recommendations: (cont'd.) ...

6. It is recommended that the fill be placed before the structure in order to allow for the settlements in the sand layer to take place. Thus, the overall settlements of the Underpass structure could be reduced.
7. No stability problems of the approach embankment are foreseen.
8. Depending on the time of the execution of works, dewatering problems could be encountered. If necessary, the water table could be lowered by pumping water out of sumps located outside the limits of the excavation.

We believe that with the above stated, all your questions have been answered; however, should there be any further queries, please do not hesitate to contact our Office.

L. C. Soderman,
PRINCIPAL SOILS & FOUNDATIONS ENGR.

Per:

AS/ndef
Attach.

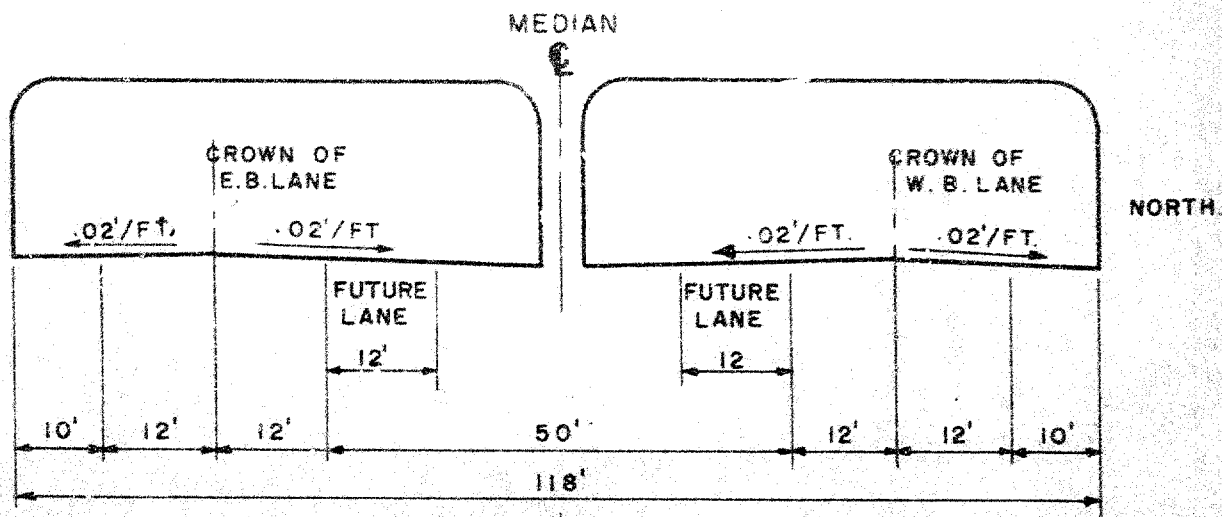

(A. Sternac,
FOUNDATIONS OFFICE ENGR.)

cc: Messrs. A. H. Teye (2)
H. A. Fregasken
D. C. Ramsay
A. Cater
W. L. Fraser
J. Roy
A. Watt
Foundations Office
Gen. Files.

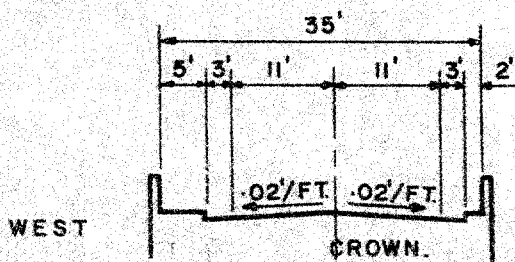
HWY. #401. DIST. #2.



15'-3" VERTICAL CLEARANCE OVER TRAVEL LANES.



CROSS SECTION HWY. #401 UNDER CO. RD.



CROSS SECTION CO. RD OVER HWY. #401.

PROFILE GRADE — 0.75' BELOW FINISHED GRADE AT CROWN

HANDRAIL — D. H. O. STD. STEEL.

COPY

the information of:

Copy to Designer

Bridge Division,

May 25, 1960.

MEMORANDUM:

RE: W.P. 63-59,
Southwold Twp. Br. #6,
Proposed Underpass @ County Rd. To Southwold Junction,
C.A.H. 401, District #2.

Location:

15 miles south west of London	
County	Elgin
Township	Southwold
Concession	III
Lots	1 / 18

Survey Drawings:

Plan	F 3530-1
Profile	F 3530-2
Site Plan	E 3627-1

Design Criteria:

Refer to sheet W.P. 8-59 dated April 7th, 1960.

The following notes abstracted from that sheet refer to highway 401 at this site.

Pavement Width	2 @ 24
Shoulder Width	10 & 3
Shoulder Rounding	3
Median Width	50' min.

Remarks

1. Exact limits and contents of project are to be set by R.D.O. They are also to recommend and get decisions re which structures are to be included with the grading.
3. Exact median widths to be determined by R.D.O. and Intersection Design.
5. Structures to be built according to the program and schedule, and to cross-sections as approved by the Planning Engineer.
6. Future widening to 6 lanes is not anticipated within 20 years, it should be assumed that the additional lanes will be added on the outside except through underpasses.

RE: W.P. 63-59

Design Criteria: Cont'd.

Addition April 7th, 1960

1. Structures to be done in conjunction with this grading and culverts project for the 1960-61 Program are as follows:

W.P. 21-59 Dodd's Creek

W.P. 19-59 C.N.R. O'Head Twp. Southwold

2. It is proposed to pave north 2 lanes only after grading is completed to Hwy. 76. Probably the only road structure that will go in when the paving is called is W.P. 64-59 due to the severe crossing angle. It is intended to leave all other crossings as level crossings and to close all roads that have been closed by O.M.B. Therefore approaches are not required for future road structures under this project. Service Road work will be done under the paving project.

Proposed Sections at Structure:

Hwy. 401 under Co. Rd. 10'+24'+12' future lane +13' to centre line median.

Co. Rd. over Hwy. 401 west 5'+3'+11'+11'+3'+2' East
Typical shoulder for County Road 8' + 2' rounding

Proposed Line:

Hwy. 401 Line A is on tangent through the intersection, the intersection chainage reads 127 + 35.55.

The county road is on tangent and the proposed line follows the existing roadway. The intersection chainage is 15 + 53.20 with an angle of 90°-15'-30" in the S.E. quadrant.

Proposed Grade:

Hwy. 401 profile grade reads 748.2 and dips 0.2% towards the west.

The present county road elevation is 746.5. The proposed profile grade reads 768.0 and crosses Hwy. 401 using a 600' V.C. with 5% approach grades.

Services:

A 2-wire electric service pole line parallels the county road on the east side of the roadway. A 2-wire telephone service is fastened to the same poles.

The Bell Telephone Co. have requested permission to place conduit in the structure.

No underground service lines were located after a thorough search.

RE: W.P. 63-59

Foundation Soils:

Refer to Report BA 1047 issued by William A. Trow and Associates Ltd.

The following is a precis of the covering letter to that report.
The letter signed by A. Stermac is dated May 19, 1960.

The conclusions and recommendations in the report are adequate for the future design work.

1. The site is underlain generally by stiff to very stiff clay. Medium dense sand has been encountered within the first 30 feet and the abutments will bear for the most, in this soil.
2. Because of the above fact, a rigid frame single-span structure should be used. The rigidity of the structure would compensate for the small differential settlements due to the heterogeneity of the foundation ground.
3. Footings should be placed 8 feet below ground level (i.e. elev. 738). This depth is required because of the existing drainage ditch.
4. Spread footings, at this elevation, can be designed with a safe load of 3.0 t.s.f.
5. Settlements, due to the structure and the approach embankment, will be in the order of about 4 inches and will develop during a longer period of time, and should, therefore, not be considered harmful.
6. Fill should be placed before the structure to allow for the settlements in the sand layer. Thus the overall settlements of the structure could be reduced.
7. No stability problems of the approach embankment are foreseen.
8. Depending on the time of the execution of works, dewatering problems could be encountered. If necessary, water table could be lowered by pumping from sumps outside the limits of excavation.

Additional Factors Likely to Affect Design or Construction:

Hwy. 401 has not been constructed at this date.

The Design Criteria indicates the possibility that the road will be paved before the structure is built.

The site is readily accessible.

A drainage channel on the east side of the county road will require diversion clear of the proposed embankment.

The drain passes below the county road in a 9' x 8' culvert about 260 feet north of the intersection.

RE: W.P. 63-59

Additional Factors Likely to Affect Design or Construction: Cont'd.

The height of fill over the present culvert would be 18 feet.
A detour for the county road traffic can be constructed on either side of the county road.

Photographs on File:

1. General view to North
2. General view to East
3. General view to South
4. General view to West

GS:go
c.c. S. McCombie
G. Scott
Designer



G. Scott,
Bridge Location Engineer.



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. 63-59 Southwold Twp.
Bridge #6 Highway #401.

We have received the preliminary bridge plan D-4637-P1
from G. Scott and have the following comments:-

1. Alignment is correct.
2. Grade on county road has been raised 1'-3". Road Design Office will alter the "F" profile. The grade on #401 and the county road are correct.
3. Roadway cross-sections on #401 and the county road are correct.
4. Deck drainage will be handled by curb and gutter on the approaches.
5. Limits of granular backfill are not shown but R.D.O. will calculate granular only from the bottom of the wingwall up to grade as suggested on other structures of this type.

A handwritten signature in cursive script, reading "J.A. Knowles".

J.A. Knowles,
Project Design Engineer.

JAK-nc

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.

Project: J 492

May 13, 1960. ME. 5-5921

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

Attention: Mr. L. G. Soderman, P. Eng.,
Principal Soils & Foundations Engineer

Foundation Investigation
Proposed County Road Underpass, Hwy. 401,
Southwold Twp., WP -63-59

Dear Sirs:

The attached report indicates the soil conditions existing at this underpass site and considers the soil mechanics problems associated with the construction of a bridge and embankment fill at this location.

The soil here consists for the most part of stiff to very stiff clay which was proven to a depth of 100 feet and probably extends to 300 feet. A glacio-fluvial deposit of medium sand has been deposited under the south-western portions of the structure and this material produces a slight non-uniformity in foundation conditions. Because of it, somewhat more settlement will ultimately occur under the north-east parts of the bridge. A total long term settlement of about $3\frac{1}{2}$ inches and 5 inches respectively, has been estimated for these two locations.

Footings can be placed at a depth of 8 feet; the net permissible increase in pressure, in excess of present over-burden, at this depth is 3000 p.s.f. The embankment foundations are stable.

We hope that the contents of this report are sufficiently detailed to permit you to appraise the conditions at this site and to proceed with foundation design for the required overpass. Please contact us if amplification of any remarks is required.

Yours very truly,

W. Trow

William A. Trow (P. Eng.)

WAT/lt
Encl.

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

FOUNDATION INVESTIGATION
PROPOSED COUNTY ROAD UNDERPASS, HWY.401
SOUTHWOLD TWP., WP-63-59

Project: J 492

William A. Trow & Associates Ltd.

May 13, 1960.

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FOUNDATION INVESTIGATION
PROPOSED COUNTY ROAD UNDERPASS, HWY. #401
SOUTHWOLD TWP., WP-63-59

This report considers the foundation problems associated with the construction of a bridge and embankments at the county road intersection noted above. A description of subsoil conditions has been given and recommended bearing pressures and foundation depths have been submitted.

Site Description

The site of this crossing is flat to gently rolling. The land immediately to the west is cultivated and the ground to the east has been left as pasture. The route of Hwy. 401 cuts through wood lots farther to the east and west. A drainage ditch about 6 feet deep bounds the east side of the county road. A short distance north of the Hwy. 401 centre line this ditch passes through a concrete box culvert to the west side of the road. It was carrying spring run-off about one foot deep at the time of the investigation.

The ground was thawing during the period of the field work, and, as a consequence, movement of the drilling equipment was somewhat difficult. It is understood that some portions of the pastureland to the east are permanently wet and tractor equipment has become mired in these areas even during dry summer months.

Subsoil Description

A total of six borings were made at this site in order to establish the soil conditions that exist here. Two of these, Nos. 2 and 4, were taken to a depth of 100 feet below the ground and the remainder were terminated at shallower depths of 20 to 30 feet. The field descriptions and results of laboratory and field tests for these borings are indicated in Dwg. 2 to 6, and the estimated stratigraphy under the site is shown in Dwg. 1.

Reference to the logs for deep holes 2 and 4 indicates that the soil, below a depth of about 30 feet, exists in a very stiff stable state, close to the plastic limit. It has been described as grey clay with gravel sizes down to 70 feet, and then as silty clay with considerable gravel below this level.

Above the 30 foot depth, soil conditions vary rather sharply between borehole locations. Three distinct soil strata were noted in these upper levels. For the first approximately 4 feet below the surface, the soil consists of a very stiff and very plastic brown clay which contains some layers or pockets of sand and silt. The lower levels of this stratum grade into brown medium sand which exists in a medium dense state. The water table lies in this sand at approximate Elev. 740 to 741 feet, which is at or just above the free water level in the adjacent drainage ditch. This stratum of sand varies appreciably in thickness across the site. In the north-east

corner, Hole 1, it terminates in very stiff grey clay with interbedded seams of silt at a depth of 8 feet, or Elev. 740 feet. In the diagonally opposite Hole 3, the sand extends to a depth of 22 feet, or to Elev. 723 feet, although it contains one thin layer of clay at approximate Elev. 735 feet. A few feet to the east of Hole 3, in Hole 2B, the sand extends even to greater depths with random intrusions and layers of clay noted below 19 feet. In the other holes, the sand terminates at levels midway between the limits indicated in Holes 1 and 3. This random arrangement of the sand suggests that it is the fluvial deposit of a glacial stream which eroded into the surface of the underlying stiff clay.

This latter material exists in a stiff condition with a moisture content more or less midway within the plastic range. This soil is more plastic than the underlying glacial till, but it is much leaner than the surface veneer of clay. It is relatively free of gravel sizes but contains thin interbeds, pockets and intrusions of silt and fine sand.

Discussion of Foundation Requirements

The route of Hwy. 401 crosses this county road almost at right angles. The existing drainage ditch lies very close to the east side of this road and as a consequence, the footings of the bridge abutments must be carried below it. The highest footing level permissible, therefore, is at a depth of about 8 feet below the existing county road surface, or at Elev. 738 feet.

In all locations, except Hole 1, at the north-east corner, medium dense sand exists at and for some depth below Elev. 738 feet. The penetration resistance of the sand at and just below this level is in the order of 20 blows per foot. According to empirical relationships with the standard penetration test, the safe net bearing pressure, or net addition of load to the soil in excess of overburden pressure is equal approximately to 4500 psf.* In order to make allowance for the high water table and for the depth of the footing below the surface, this net value must be reduced to 3000 psf. The surcharge weight of soil above footing level can be added. The pressure exerted by the abutment reaction, including the weight of the footing, should not be greater than this allowable pressure. The settlement associated with its application should not exceed one inch and the movement should be instantaneous with load application.

In the vicinity of Hole 1, footings at Elev. 738 ft. will bear on stiff clay having a bearing strength of approximately 1500 psf. The safe bearing pressure in this instance is equal to:

$$q = \frac{CN}{F} + P \quad **$$

* - Foundation Engineering - Peck, Hanson, Thornburn, P.225

** - The Bearing Capacity of Clays - A.W. Skempton, Building Research Congress, 1951.

where $C = 1500$ psf
 N is a bearing capacity factor equal approximately to 6.5
 for a rectangular footing founded at the depth indicated.
 F is the required factor of safety for a limiting settlement of
 one inch. A value of 3 is suggested.
 P is the total overburden weight above footing level.

For the conditions applying here, $q = 3250 + 1000 = 4250$ psf.

Therefore the recommended safe bearing value to apply at all locations is 4000 psf. The safe net pressure at footing level or net addition of load, - including the weight of embankment fill over footing extensions and the friction forces of fill on the abutment wall, - in excess of existing overburden pressure is 3000 psf.

The settlement to be anticipated under this bearing pressure should not exceed one inch, either for support on the sand or in the clay. As suggested above, however, any adjustment to load of the sand will be very rapid while the settlement of the clay will be more gradual. As a consequence, it is conceivable that a slight temporary tilting of the structure could occur if one corner bears on clay and the rest of the bridge rests on sand. This possibility may be of academic interest only, if a rigid abutment footing is used since more load will be carried by the clay temporarily until it compresses to the levels of the adjoining sand.

Long term settlement of this bridge structure will occur because it is founded over a deep deposit of clay and the weight from the embankment will be felt over a considerable portion of this depth. Two consolidation tests have been performed in order to ascertain the magnitude of settlement to be anticipated. One of these tests was carried out on a sample from a depth of 21 feet in Hole 2; it is considered to be representative of the upper plastic clay. The other test was performed on a typical sample of the underlying clay glacial till taken from a depth of 49 feet in Hole 4. The results of these measurements are indicated in Dwg. 8.

For the range of pressures applicable in this problem, the coefficient of compressibility, M_v , of these materials was found to be 0.00938 sq.ft.per kip, and 0.00524 sq.ft.per kip, respectively, for the shallow and deep deposits. The latter value applies below a depth of about 30 feet and the former measurement is applicable for the more plastic material above this level.

Settlement of any increment of depth, H , is determined from the expression:

$$S = HM_v \Delta p$$

where Δp is the increase of pressure at the mid-point of this increment.

Computations have been made of the settlement to be anticipated under the weight of an embankment and bridge abutment scheme similar to the arrangement required here*. The value of M_v used on that occasion was 0.00622 sq.ft. per kip. The computed settlement below a depth of 30 feet on that occasion was of the order of $4\frac{1}{2}$ inches and this value was reduced by 50 percent to allow for sample disturbance and for other errors involved in testing heavily over-consolidated clays.

The coefficient of compressibility below 30 feet at this site has been computed to be 0.00524 sq.ft. per kip and therefore the settlement for the same depth range should be less. A movement of the order of 2 inches probably will be experienced.

Above 30 feet, the clay is somewhat more plastic and in addition it is not uniform in thickness. At the north-east corner, the clay extends directly from footing level and therefore a thickness of the order of 22 feet is involved. In the vicinity of Holes 3 and 2B, less compressible sand predominates at least to a depth of about 22 feet and therefore less settlement should be experienced in this area.

The pressure transmitted from the bridge and fill at a depth of 19 feet, or midway between footing level and 30 feet, is approximately equal to 2300 p.s.f. directly below the abutment. The settlement resulting from the compression of this soil is:

$$s = (22 \times 12) \times 2.3 \times 0.00938 = 5.7 \text{ inches.}$$

In keeping with the reasoning of the foregoing paragraphs, this settlement should be reduced to a value of $2\frac{3}{4}$ inches.

The compression of the sand under the south abutment probably will be in the order of 1 to $1\frac{1}{2}$ inches, and the movement will be immediate. Accordingly, there will be a long term tendency for tipping of the structure toward the north.

If this magnitude of tipping is considered to be significant, then measures should be taken to place the embankment fill well before the construction of the bridge has begun. Settlement of this upper clay should occur at a reasonably fast rate since it contains horizontal drainage layers of silt and fine sand. However, the exact rate of movement can be determined only by field measurement after the fill has been placed.

The total movement of the bridge is seen to be in the order of 5 inches and $3\frac{1}{2}$ inches respectively. The settlement of a central pier, if used, will only be in the order of 1 inch. Therefore, with this arrangement, some long term tendency for differential movement exists.

Excavations for the abutment footings will be at or just below ground water level depending upon the season of the year. The sand at footing

* - Foundation Investigation, Proposed County Rd. Underpass WP 83-59
William A. Trow & Assoc. Ltd.

level is relatively permeable and therefore it should be possible to depress the water table by pumping from sumps placed adjacent to the footing beds. Digging to footing level can proceed as soon as the water table has been depressed sufficiently.

Conclusions

The remarks of the foregoing paragraphs can be summarized briefly as follows:

- 1) The site of this overpass of Hwy. 401 is underlain for the most part by stiff to very stiff clay. Medium dense sand has been encountered within the first 30 feet and the abutments of the structure will bear for the most part in this soil.
- 2) The recommended foundation depth for abutment footings is at Elev. 738 feet, or about 8 feet below the surface. Support at this depth is required in order to get below the level of a drainage ditch which bounds the east side of the county road.
- 3) The safe net addition of pressure at this level, in excess of present overburden weight, for a limiting settlement of 1 inch, is 3000 p.s.f.
- 4) Excavations to this level will be at or just below the water table depending upon the season of the year. Construction difficulties resulting from this situation will not be great because the sand is free-draining and, as a consequence, the ground water can be depressed by pumping from sumps located outside the limits of the excavation.
- 5) Long term settlement will follow the application of embankment fill at this site. A total settlement, ranging from about $3\frac{1}{2}$ inches at the south-west corner, to 5 inches under the north-east portions of the structure, has been estimated.
- 6) The shear strength of the soil at this location is sufficiently high to support the weight of the embankment fill without concern for its stability.
- 7) Arrangements must be made for a new drainage ditch and culvert under Hwy. 401 to replace the facilities presently bounding the east side of the county road.

WAT/lt
May 13, 1960
J 492



W. A. Trow
William A. Trow (P. Eng.)

APPENDIXField Investigation Methods

The borings of this investigation were performed using continuous flight auger equipment. Casing was used to support the running sand at upper levels but the holes were unlined below this material.

Samples were taken at about 5 foot intervals of depth, although somewhat closer sampling was carried out in order to establish the stratigraphy in the variable soil strata found above 30 feet. Samples were recovered either using a 2 inch O.D. split spoon or a 2 inch I.D. shelly tube. In the latter instance, the soil was recovered by pressing these tubes into the ground wherever possible. However, when this was not feasible the samples were driven using the same energy as required for the split spoon, i.e., 350 ft.lbs.per blow.

Field vane tests were performed in the more plastic soil found above 30 feet. Cone penetration tests were also made adjacent to the borings in order to confirm the relative density of the sand materials. The same driving energy, indicated above, was used.

A total of 6 main borings were made at this site, 2 of which were taken to a depth of 100 feet. In one or two instances, additional holes were put down in order to confirm where the change from sand to clay began.

The elevations of all borings were referred to the reference shown in Dwg. 1.

WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

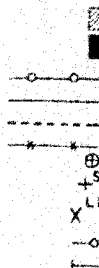
County Rd. Underpasses Hwy. 401 WP63-50
PROJECT
LOCATION bays 1 and 10 T.p. of Southold
HOLE LOCATION Sec Div. 1
HOLE ELEVATION AND DATUM 747.9

BOREHOLE NO. 1
FIELD SUPERVISOR
DRILLER
PREP.

DRAWING NO. 2

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	
				STRENGTH P.S.F.	PENETRATION BLOWS/FT.
	Ground Surface (Approx. 12" topsoil)	747.9	0		
	Very stiff brown clay, some fine gravel; layers of coarse sand, fine gravel; intrusions grey silt	743.3			
	Dense brown med. sand.	741.4			
	Very stiff grey brown clay; thin interbeds of coarse silt of varying frequency	740.0			
	Stiff grey clay with some fine gravel	733			
	End of bore	723			

NOTES: 1) Boring by continuous flight auger; hole uncased to full depth.
 2) Sampler driven under energy of 350 ft.lbs. per blow except where noted.
 3) Cone driven 11 ft. north of hole.

CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.			
20	30	40	
			<i>hand pressed</i> 125
			128

WILLIAM A. TROW & ASSOCIATES LTD.

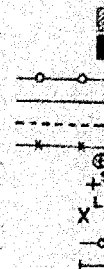
SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT County Rd. Underpass WP 63-59
LOCATION Lots 1 and 18 Twp. of Southold
HOLE LOCATION See Des. 1
HOLE ELEVATION AND DATUM 746.7

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 (Q_u)
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 Str.	1000	2000 P.S.F.
	Ground surface Approx. 2' clay topsoil	746.7	0	20	40	60
	Brown clayey silty sand with gravel, some grass roots & slight organic stain	742.0				
		740.7				
	Med. dense brown medium sand	734				
	Very stiff grey clay; occasional small gravel below 20 feet; becoming more frequent below 34 f..					
		675				
	Very stiff grey silty clay with numerous small gravel.					
		647				
	End of bore.		100			

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

End of bore. 647 10
NOTES: As in Hole 1 except hole cased to 14 ft;
cone driven 12 ft. north of hole.

PROJECT NO. J 492

WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

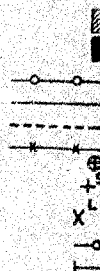
PROJECT County Rd. Underpass WP 62-59
 LOCATION Lot 1 and 10 Trp. of Southwold
 HOLE LOCATION See Plan
 HOLE ELEVATION AND DATUM 745.8

BOREHOLE NO. 23
FIELD SUPERVISOR
DRILLER
PREP.

DRAWING NO. 3B

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 Str.	P. S. F. BLOWS/FT.
	Road Surface	745.8	0	1000	2000
	Med. stiff brown sandy clay	740	0	20	40
	Med. dense medium sand	726	10	40	50
	Stiff grey brown clay with interbeds intrusions and pockets of fine wet sand; sand predominates between 22 and 30 ft. Clear stiff grey brown	709	20	40	50
	End of clay below 30 ft. bore.		30		

NOTES: 1) Hole augered to 20 ft.
for identification of soil types;
cased below this depth.
2) Cone driven 2 ft. north of
hole before boring made.

CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.F.
MOIST. CONTENT - % DRY WT.			
20	30	40	
			128.2 131.8 127.5

PROJECT NO. J 492

WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

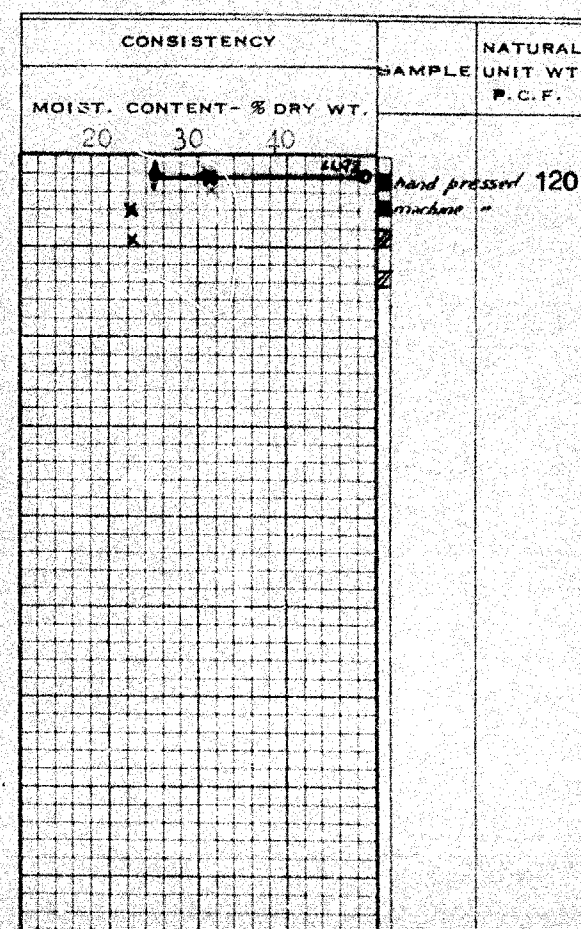
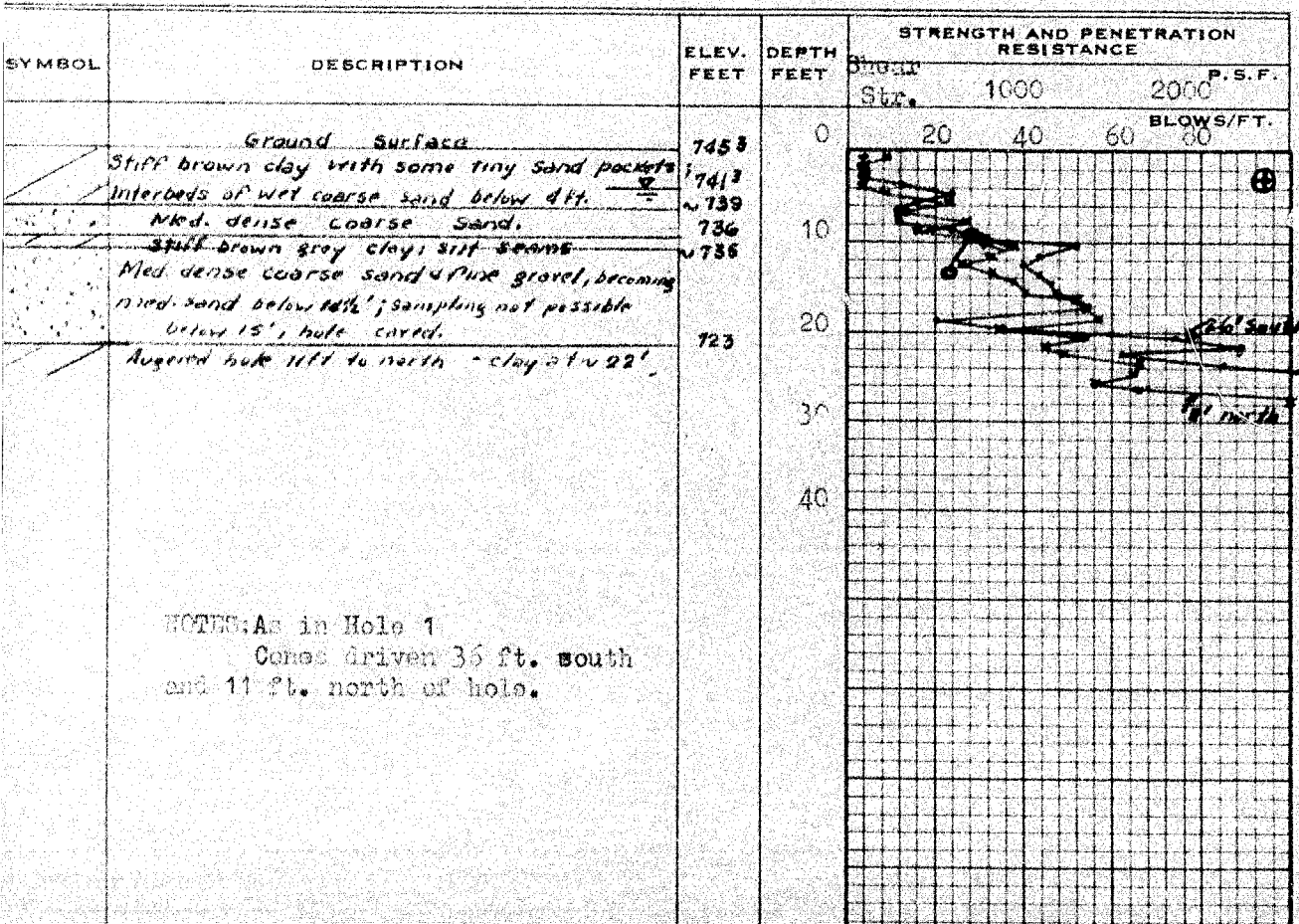
PROJECT County Rd. Underpass Hwy. 401 WP63-59
 LOCATION Lots 1 and 13 Twp. of Southwold
 HOLE LOCATION See Dwg. 1
 HOLE ELEVATION AND DATUM 745.3

BOREHOLE NO. 3
 FIELD SUPERVISOR
 DRILLER
 PREP.

DRAWING NO. 4

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



NOTES: As in Hole 1
 Cones driven 36 ft. South
 and 11 ft. North of hole.

WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT County Road Underpass WP 63-59

LOCATION Lots 1 and 12 Twp. of Southwold

HOLE LOCATION See Dwg. 1

HOLE ELEVATION AND DATUM 745.5

BOREHOLE NO. 4

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		CONSISTENCY	SAMPLE	NATURAL UNIT WT P.C.F.
				Shear Str.	P.S.F. BLOWS/FT.			
	Ground surf. on	745.5	0					
	Stiff brown clay with frequent interbeds & pockets of coarse sand below 4'	740.5						
	Med. dense brown med. sand wet below about 8½'; grey below & interbeds of stiff clay below 12'	739.5	10					128
	Stiff grey clay with some pockets and partings of dry to moist silt & fine sand	731.5	20					128
		723	30					127
			40					124
	Very stiff grey clay; small gravel sizes below 28 feet.		50					130
			60					
			70					
		715.5	80					131.8
	Very stiff grey silty clay with numerous small gravel.		90					
			100					139

NOTES: 1) Hole cased to 14 ft., uncased below: 2) Cone driven 10 ft. south of hole

PROJECT NO. J 492

WILLIAM A. TROW & ASSOCIATES LTD.

SITE INVESTIGATIONS AND SOIL MECHANICS CONSULTATION

PROJECT County Rd. Underpass Hwy. 401 WP 63-59

LOCATION Lots 1 and 12 Twp. of Southwold

HOLE LOCATION See Dwg. 1

HOLE ELEVATION AND DATUM 745.7

BOREHOLE NO. 5

FIELD SUPERVISOR

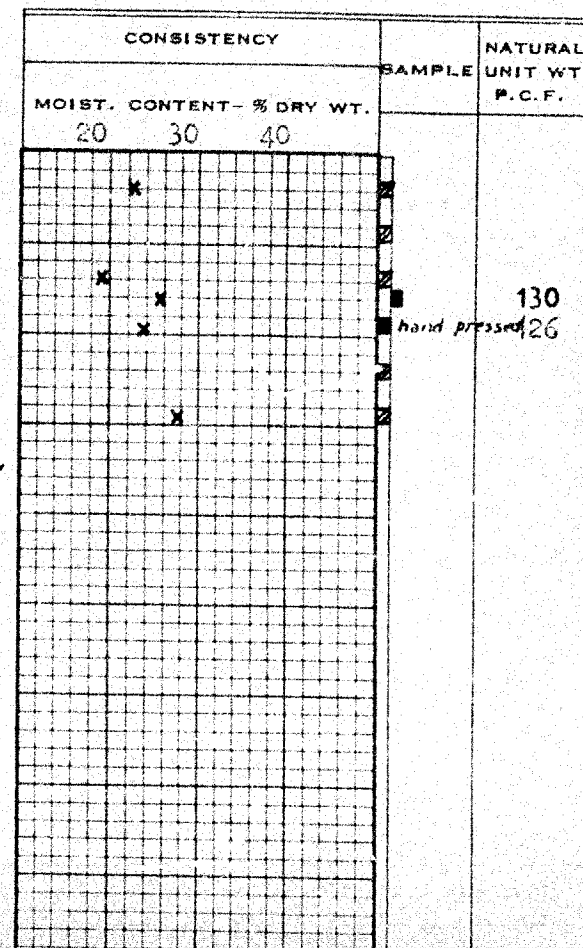
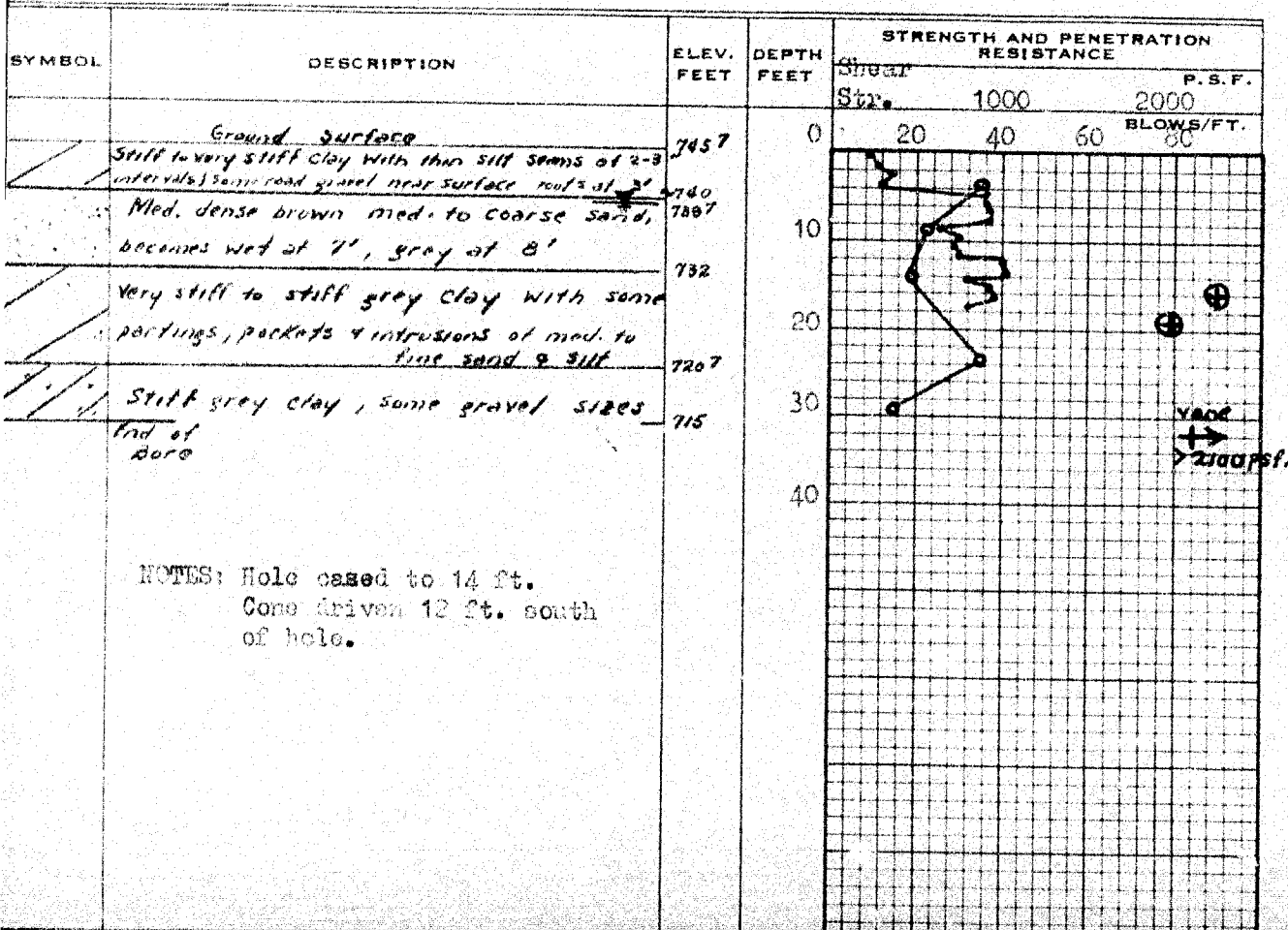
DRILLER

PREP.

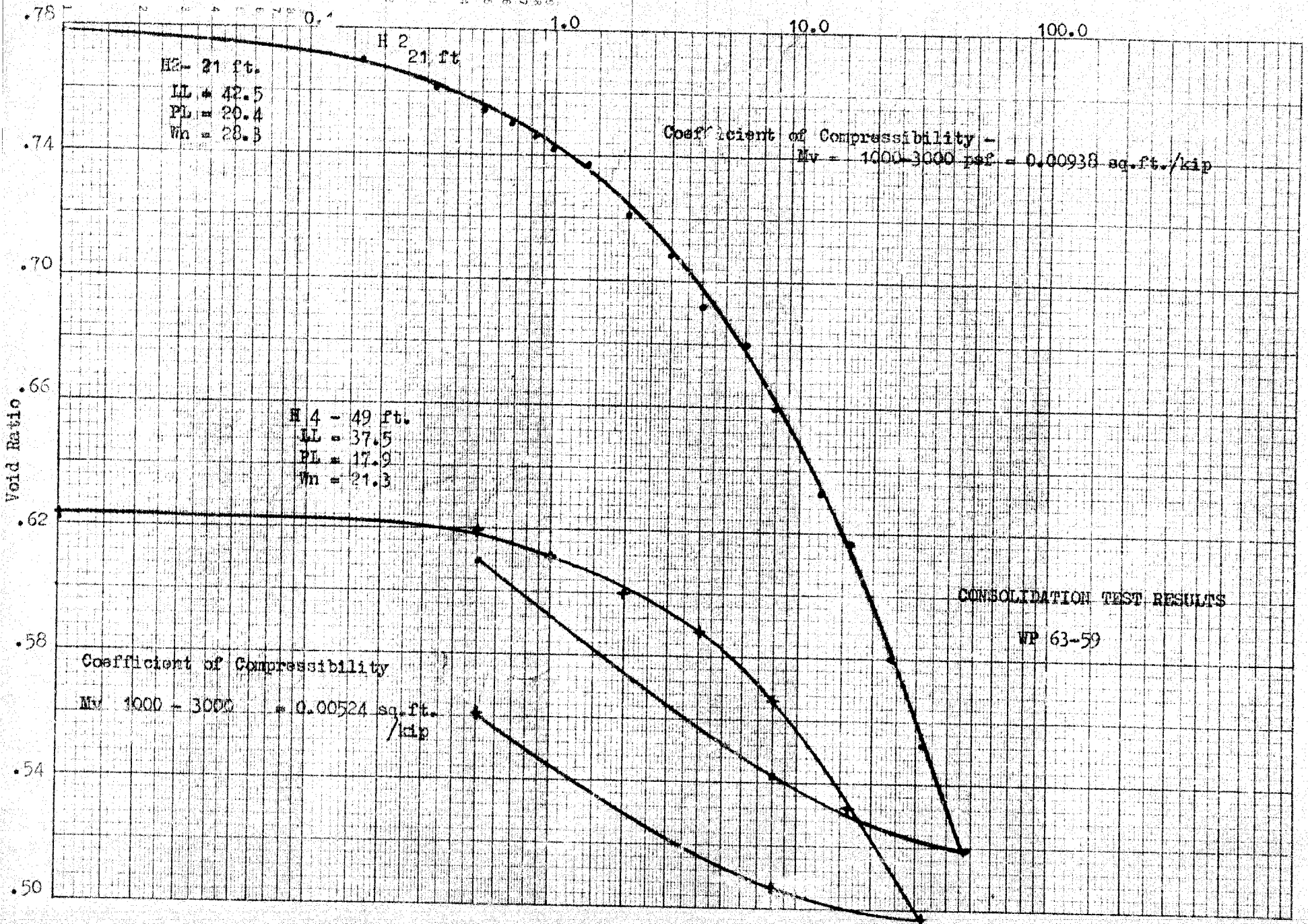
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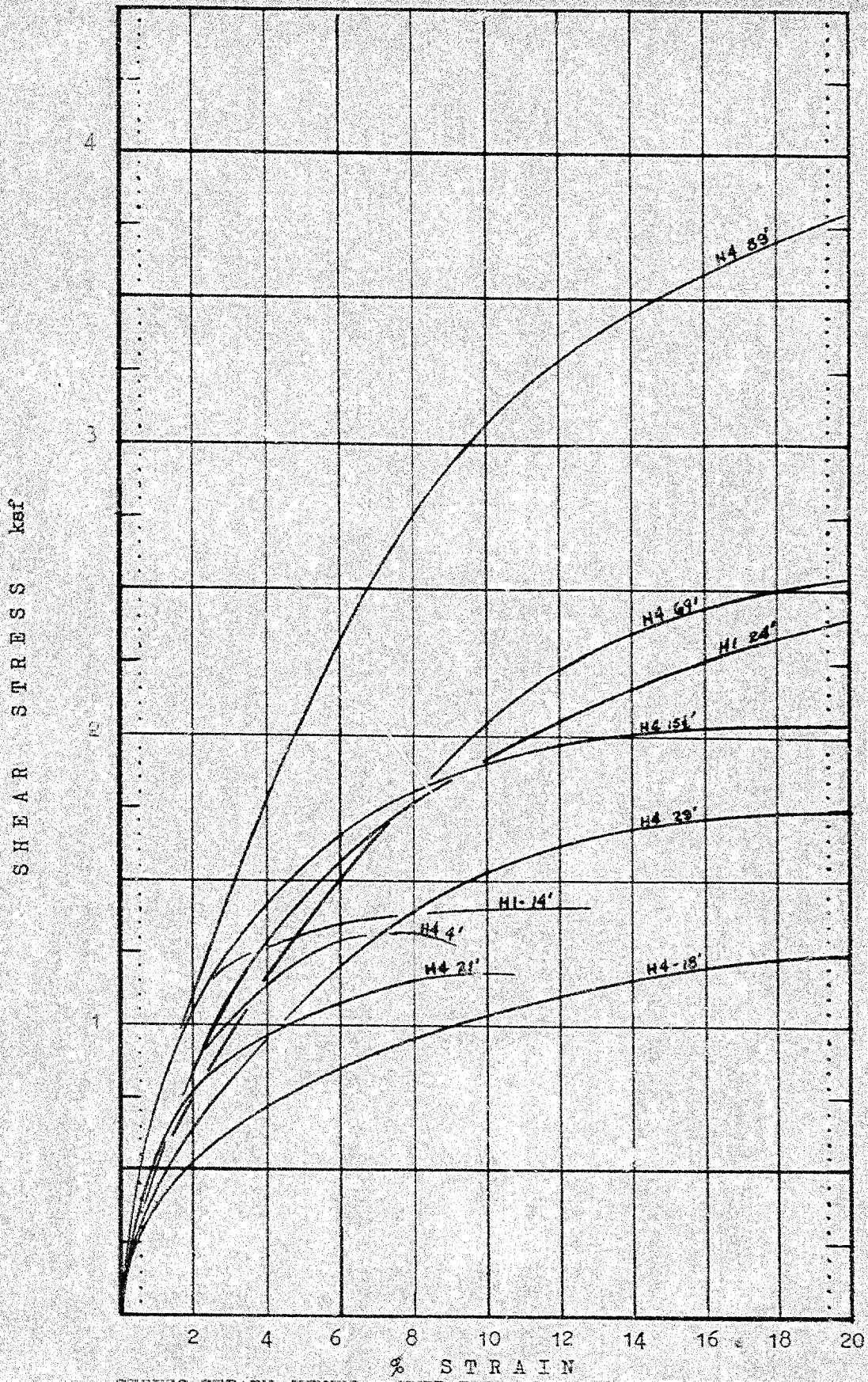
LEGEND

- 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



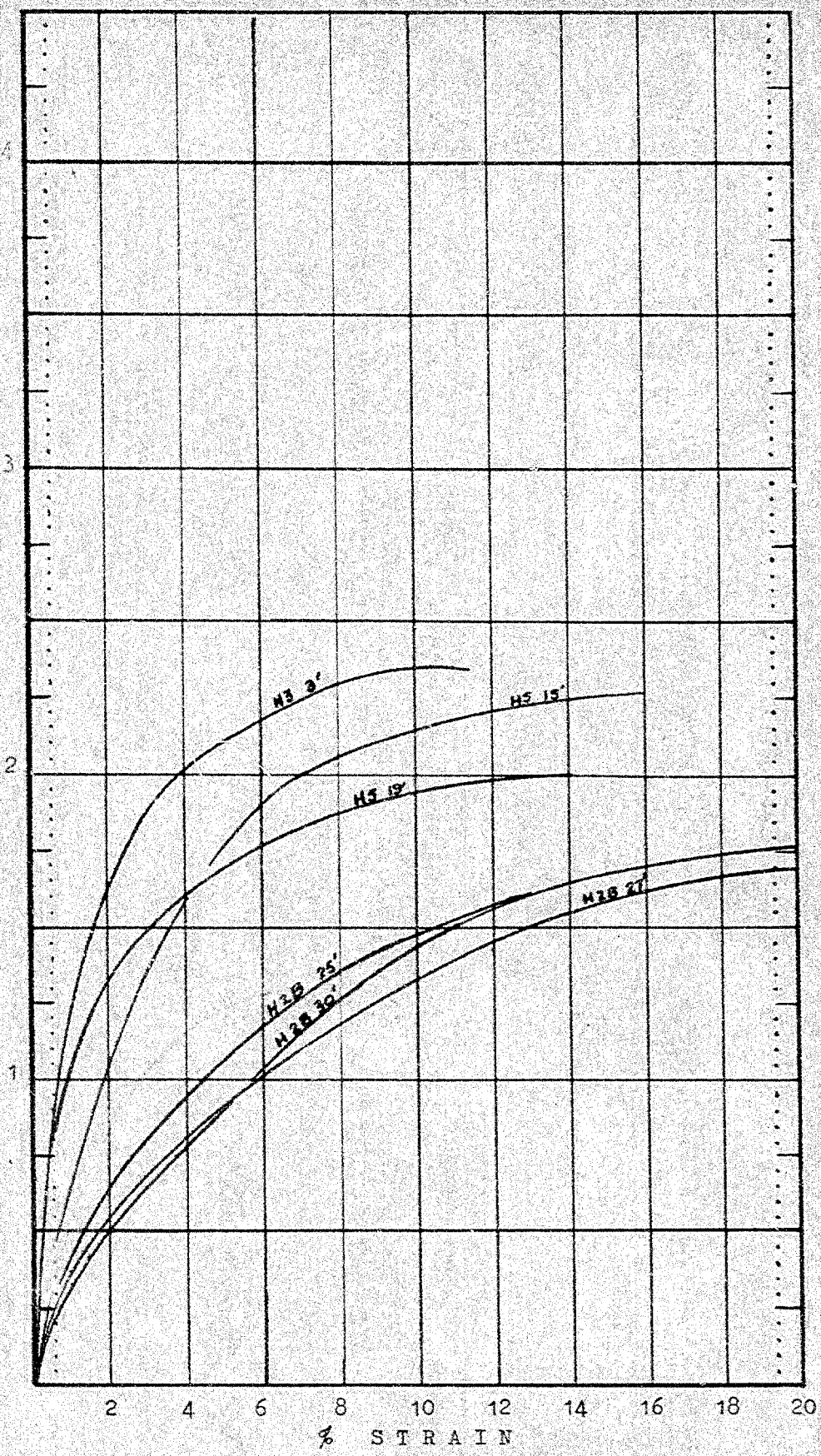
Pressure Ksf





STRESS STRAIN CURVES - UNDRAINED TRIAXIAL TEST RESULTS
Holes 1 and 4. All tests at total overburden pressure.

SHEAR STRESS ksf



STRESS STRAIN CURVES - UNDRAINED TRIAXIAL TEST RESULTS
 Holes 2E, 5 and 3. All tests at total overburden pressure.

#60-F-283-C

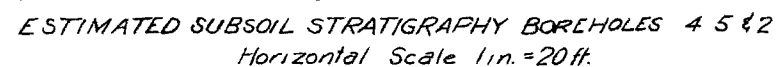
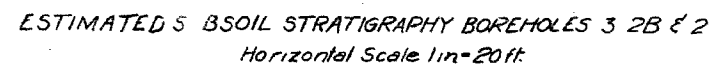
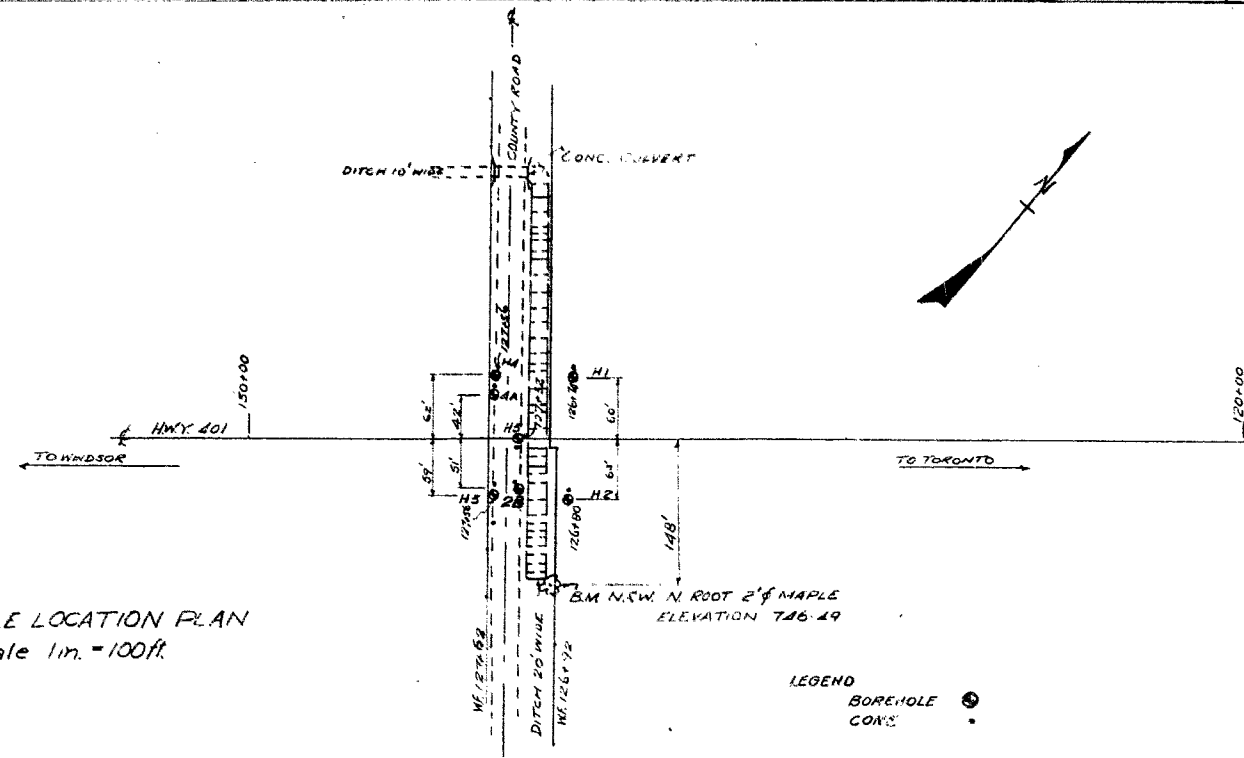
W.P. #63-59

HWY. #401

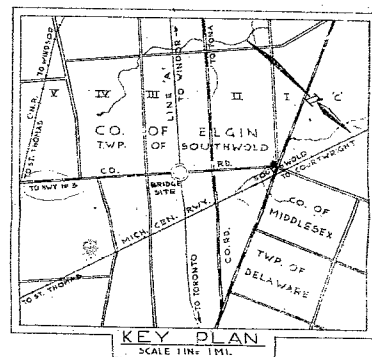
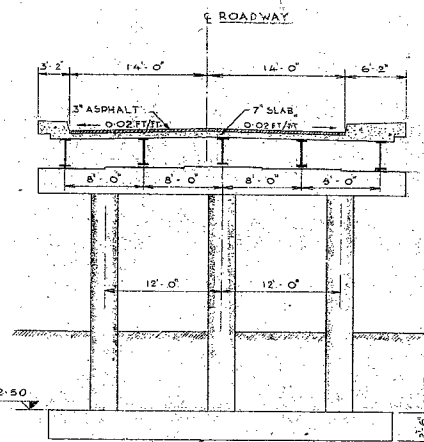
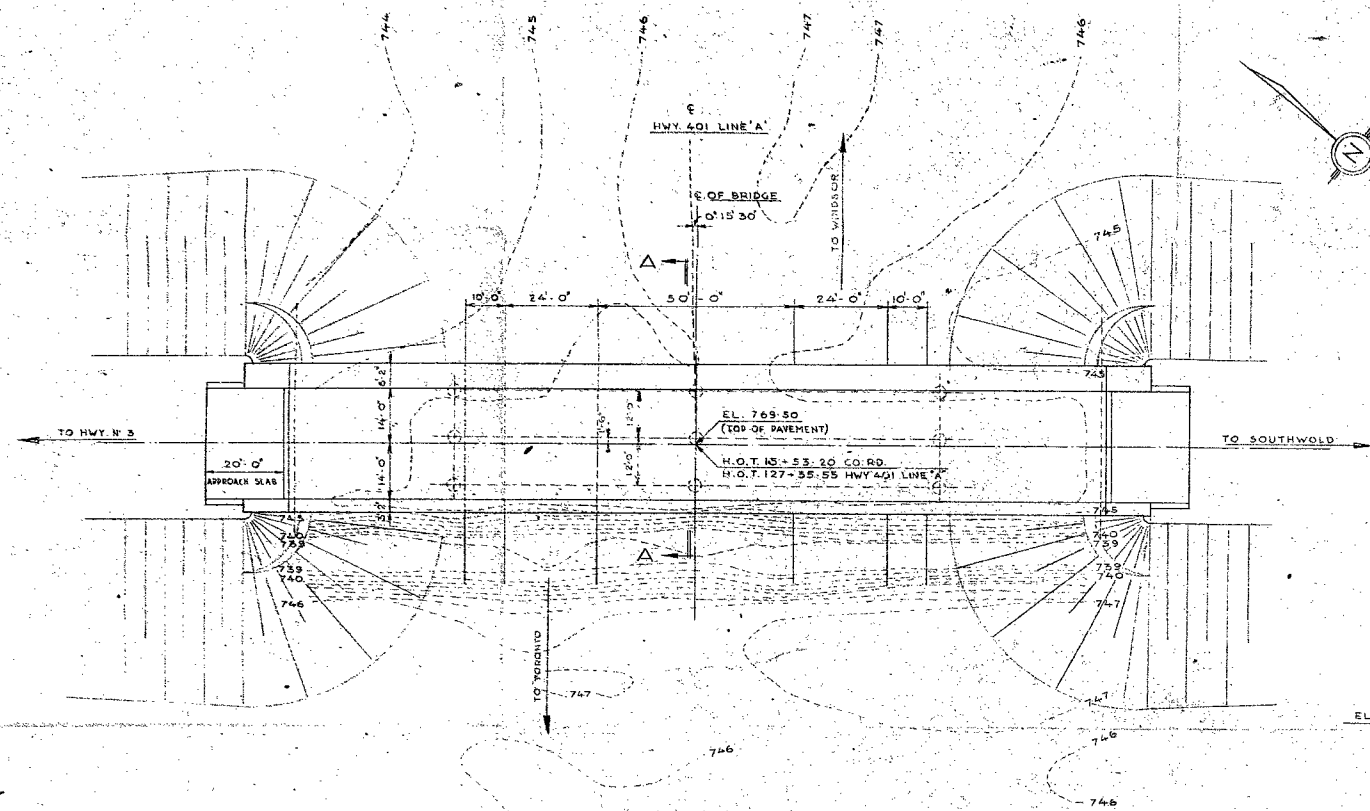
UNDERPASS, CTY.

RD. SOUTHWOLD

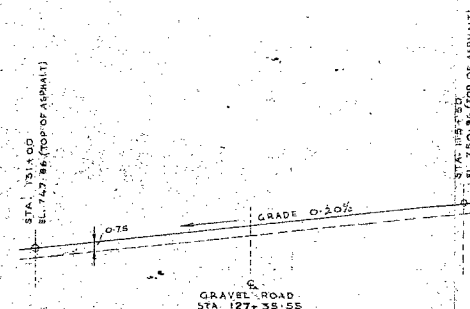
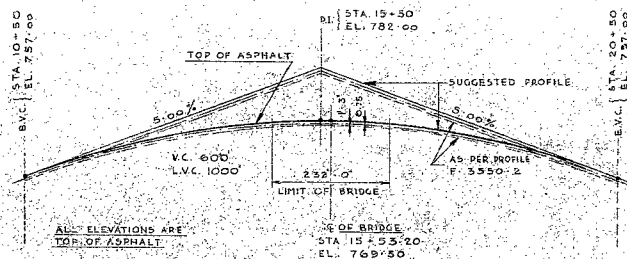
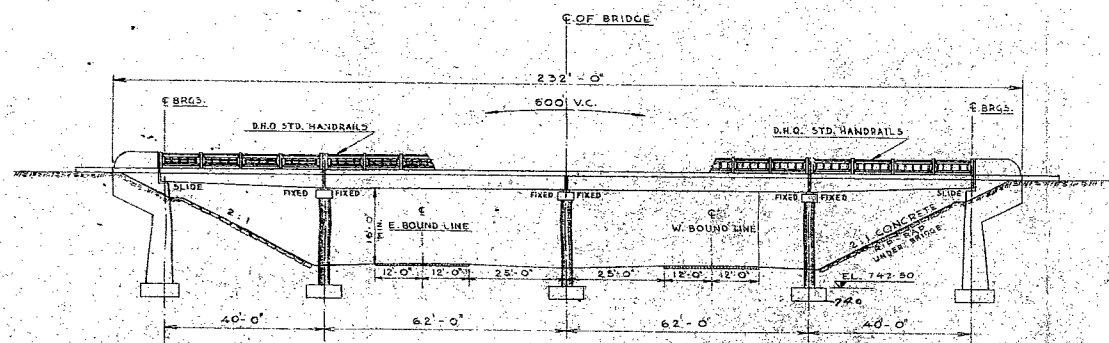
TWP.



COUNTY ROAD UNDERPASS HWY 401
WP 63-59
WILLIAM A TROW & ASSOCIATES LTD.
J 492 DRAWING "1"



Can footings be
at elev. 740.0
Report says at 738.0



W.P. 63-59
DEPARTMENT OF HIGHWAYS-ONTARIO
BRIDGE OFFICE-TORONTO

SOUTHWOLD TWP.
BRIDGE N° 6

THE KING'S HIGHWAY No. 401
CO. OF ELGIN
TWP. OF SOUTHWOLD
LOT 1 & 18
CON. III

PRELIMINARY PLAN

APPROVED

BRIDGE ENGINEER
DESIGN ENGINEER

REVISIONS

NO.	DATE	BY	DESCRIPTION
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

REFERENCE PLANS
S 3627-1
F 3530-1
F 3530-2

REVISION	DATE	BY	DESCRIPTION
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

DATE: JULY 15, 60

LOADING
420-516

DESIGN NUMBER
D 4637-P