

DOCUMENT MICROFILMING IDENTIFICATION

G.I-30 SEPT 1976

GEOCRES No. 40I14-87

DIST. 2 REGION Southwestern

W.P. No. 41-66-10

CONT. No. 78-66

W. O. No. \_\_\_\_\_

STR. SITE No. 19-542

HWY. No. \_\_\_\_\_

LOCATION Con. IV Road Underpass

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 4

REMARKS: documents to be unfolded  
before microfilming  
photos enclosed

# FOUNDATION INVESTIGATION REPORT

for

CON IV ROAD UNDERPASS, HWY. 402  
TWP. OF DELAWARE, DISTRICT 2, LONDON  
W.P. 41-66-10 SITE 19-542  
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## 1. INTRODUCTION

A request for a foundation investigation at the above mentioned site was received from Mr. A. P. Watt, Regional Structural Planning Engineer, Southwestern Region, London.

A field investigation was subsequently carried out by the Soil Mechanics Section to determine the subsoil conditions existing at the site. This report contains the results of our field and laboratory investigations, together with our recommendations relating to the design of the proposed structure foundations.

## 2. DESCRIPTION OF THE SITE

The proposed underpass is located 3 miles west of Hwy. 4 where Hwy. 402 crosses an existing gravel twp road at a skew angle of 49 degrees. The site is situated in an area of gently rolling cultivated farmland.

Physiographically, the surrounding area is referred to as the Mount Elgin Ridges.

## 3. FIELD AND LABORATORY INVESTIGATION PROCEDURES

Field work consisted of three sampled boreholes advanced employing 2-3/4 inch hollow stem augers, as well as three dynamic cone penetration tests.

Disturbed samples were obtained using a 2-inch O.D. split-spoon sampler driven according to the specifications for the Standard Penetration Test. 'Undisturbed' samples were recovered using 2-inch I.D. Shelby tubes advanced into the soil hydraulically.

Field vane tests were attempted, none, however, failed under a value in excess of 2200 lbs. per sq. ft.

All boreholes were surveyed in the field by personnel from London Region Engineering Surveys Section. The locations and elevations of the boreholes are shown on Drawing No. 416610-A which accompanies this report.

All samples were visually examined and classified at the site as well as in the laboratory. Following this inspection, laboratory tests were carried out on selected representative samples to determine the following physical properties:

Atterberg Limits  
Natural Moisture Content  
Grain-size Distribution  
Undrained Shear Strength

The test results are summarized on the Record of Borehole sheets contained in the appendix of this report.

#### 4. SUBSOIL CONDITIONS

Subsoil at this site consists of a deposit of silty clay to clayey silt which extends from immediately below the ground surface to a depth in excess of 100 ft.

The deposit may be divided into three zones according to strength characteristics. The upper zone with a thickness of approximately 15 ft. represents the desiccated crust. It is brown in colour and apart from the upper 3 to 5 ft., which is affected by frost action, has a very stiff to hard consistency. Based on Standard Penetration Test results, which range from 20 to 66, and on unconfined compression tests, it is estimated that the undrained shear strength of this layer varies with depth from in excess of 10,000 p.s.f. to 3,000 p.s.f.

The second zone, found from approximately 15 to 35 ft. below the ground surface, has a stiff to very stiff consistency. Standard Penetration 'N' values range from 13 to over 20 blows per foot. Based on these values, and on field vane tests, the undrained

shear strength of the soil is estimated to be in excess of 2000 p.s.f.

The third and deepest zone penetrated extends from a depth of approximately 35 ft. to over 100 ft. Standard Penetration 'N' values for this zone range from 40 to in excess of 50 blows per foot, indicating a hard consistency.

## 5. DISCUSSION AND RECOMMENDATIONS

### 5.1) General

The proposed structure will cross Hwy. 402 at a skew angle of 49° and will consist of two spans, each of which will be 130 feet in length if skewed abutments are employed. If squared abutments are used, the spans will be in excess of 140 feet in length. The approach fills will be approximately 22 feet in height.

### 5.2) Structure Foundations

CENTER PIER - It is recommended that the center pier be supported on a spread footing type foundation at approximate elevation 785.0. A net safe bearing pressure of 4 tons per sq. ft. may be used for design purposes. Resistance to sliding may be determined using an adhesion design value of 2000 p.s.f.

PERCHED ABUTMENTS ON SHORT PILES - The abutments may be constructed within the approach fills supported on steel tube piles (12-3/4" x 1/4") driven to elevation 783.0 for the north abutment and 787.0 for the south abutment. The piles must not be driven below this elevation as the undrained shear strength decreases with depth. A safe load of 25 tons per pile should be assumed for design purposes. Any horizontal loading should be resisted by battered piles.

PERCHED ABUTMENTS ON COMPACTED FILL - As an alternative, the abutments may be supported on spread footings placed on well compacted G.B.C. Class 'A'. A net safe design load of 2.5 t.s.f. may be assumed. For calculations of sliding resistances, a friction

coefficient of 0.6 may be assumed to apply between the footing and G.B.C. Class 'A'. A detailed construction scheme is outlined on Fig. 1 of the appendix.

SETTLEMENTS - Long term settlements of 3 inches at the abutments and 1-1/2 inches under the center pier are anticipated. Any bridge design should, therefore, have the ability to tolerate the resulting differential settlements. To minimize these differential settlements between the abutments and the center pier footings, it is recommended that the approach embankments be built in advance of the structure by as long a period as possible.

DEWATERING - No dewatering problems are anticipated during excavations for footings due to the relatively impervious nature of the subsoil.

#### 5.3) Approach Embankments

No stability problems are anticipated with 22 ft. embankment fills if 2:1 slopes are employed. Care, however, should be taken that no material exceeding 3" grain size is placed in the fills through which piles have to be driven.

#### 5.4) Frost Protection


All pile caps or spread footings should be protected against frost action by a minimum 4 ft. of cover.

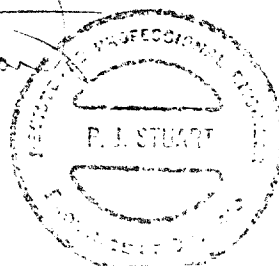
### 6. MISCELLANEOUS

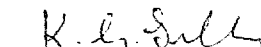
The field work on the project was carried out March 21st and March 24th, 1975 under the supervision of Mr. P.J. Stuart, Project Foundation Engineer, who also prepared this report.

The equipment used was owned and operated by P.V.K. Drilling.

This report was reviewed by Mr. K. G. Selby, Supervising Foundation Engineer.

  
P.J. Stuart  
Project Engineer



  
K.G. Selby  
Supervising Engineer

April 1975

CHECKED BY   CJ  .

15  $\phi$  5 % STRAIN AT FAILURE  
20  
10

## ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

## RECORD OF BOREHOLE NO 2

W.P. 41-66-10

LOCATION CO-ORDS. 15,584,623N; 1,308,379E.

ORIGINATED BY PJS

DIST. 2 HWY. 402

BORING DATE March 24, 1975

COMPILED BY PJS

DATUM GEODETIC

BOREHOLE TYPE 2 3/4" HOLLOW STEM AUGER

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — W <sub>L</sub> PLASTIC LIMIT — W <sub>P</sub> WATER CONTENT — W			UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	W <sub>P</sub>	W	W <sub>L</sub>		
791.9	GROUND LEVEL															
0.0	Silty Clay to Clayey Silt  some Sand  Stiff  to  Hard		1	SS	17	790										0 9 45 46
			2	SS	32											
			3	SS	66											
			4	SS	46											
			5	SS	27	780										
			6	SS	11											
			7	SS	13											
			8	SS	13	770										
760.4			9	SS	18											0 2 41 57
31.5	End of Borehole  NOTE: Water level not established.															

## RECORD OF BOREHOLE NO 3

W.P. 41-66-10

LOCATION CO-ORDS. 15,584,488N; 1,308,425E

ORIGINATED BY PJS


DIST. 2 HWY. 402

BORING DATE March 25, 1975

COMPILED BY PJS

DATUM GEODETIC

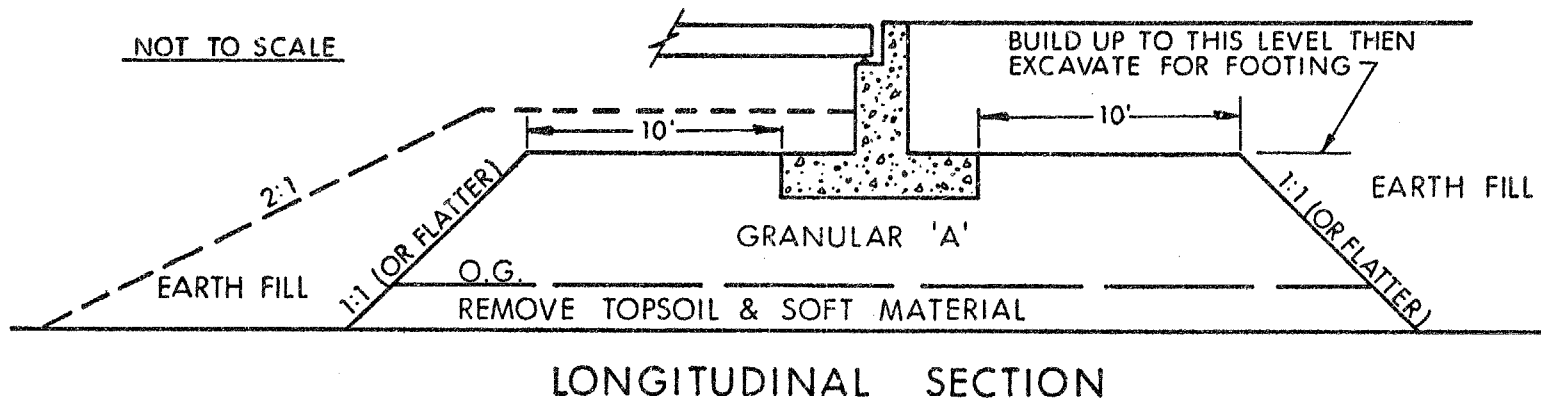
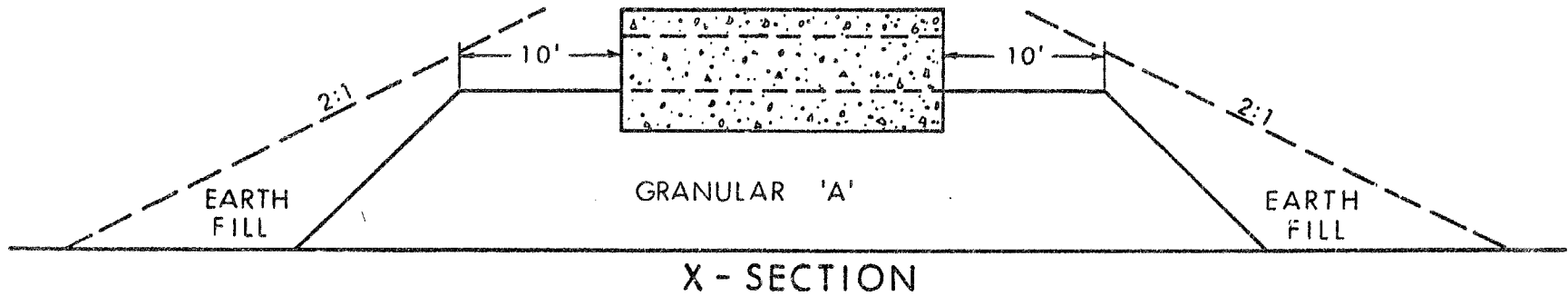
BOREHOLE TYPE 2 3/4" HOLLOW STEM UGER

CHECKED BY 

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	LIQUID LIMIT $w_L$ PLASTIC LIMIT $w_p$ WATER CONTENT $w$ $w_p$ — $w$ — $w_L$ WATER CONTENT % 10 20 30	UNIT WEIGHT $\gamma$ P.C.F.	REMARKS % GR. SA. SI. CL.
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES					
793.6	GROUND LEVEL									
0.0										
	Silty Clay to Clayey silt  Some Sand  Very stiff to Hard		1	SS	50	790				
			2	SS	66					
			3	SS	53					
			4	SS	23					
			5	TW	PH					
			6	SS	20					
			7	TW	PH					
			8	SS	19					
754.6			9	SS	37					
39.0	End of Borehole									
	NOTE: Water level not established.									

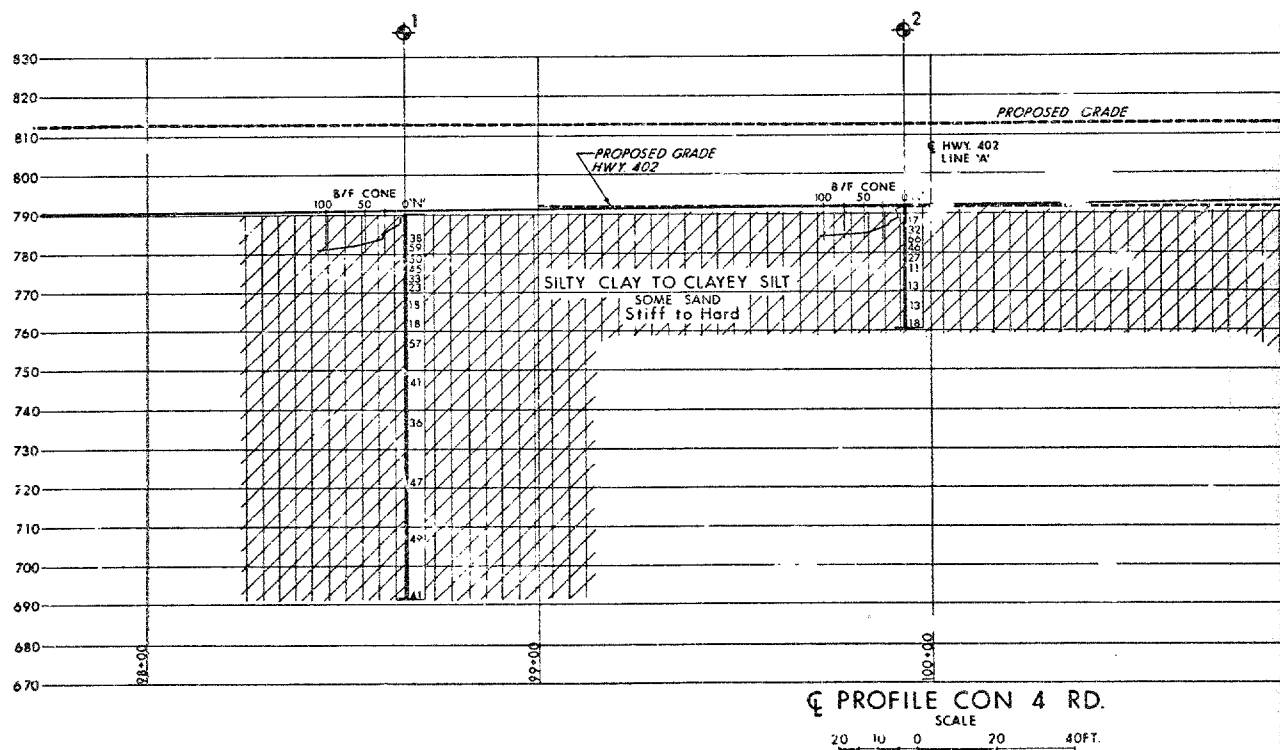
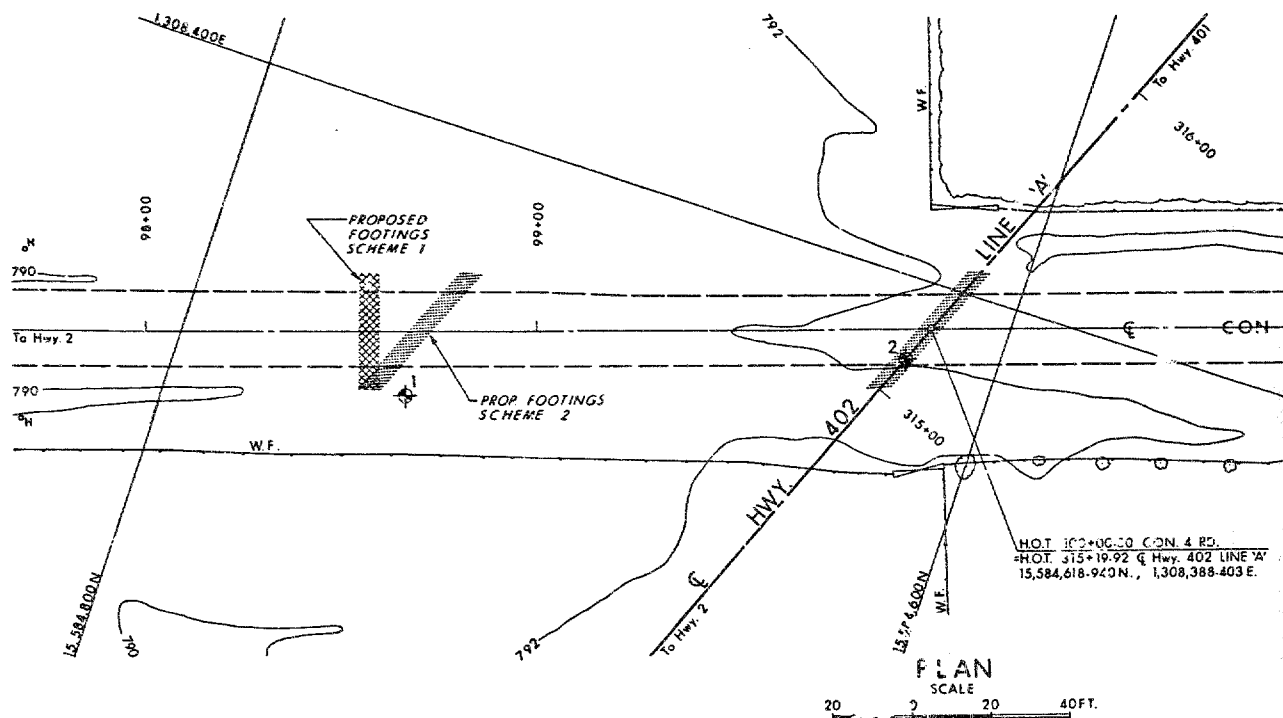


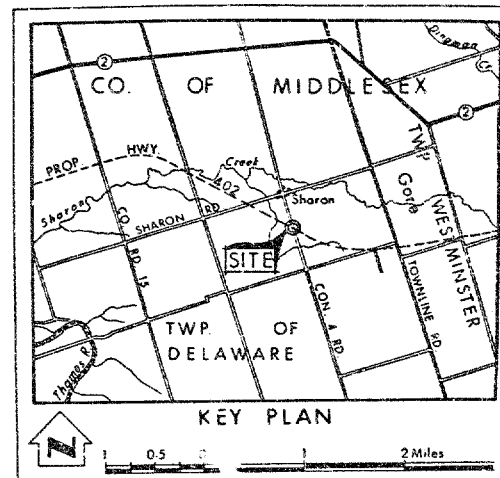
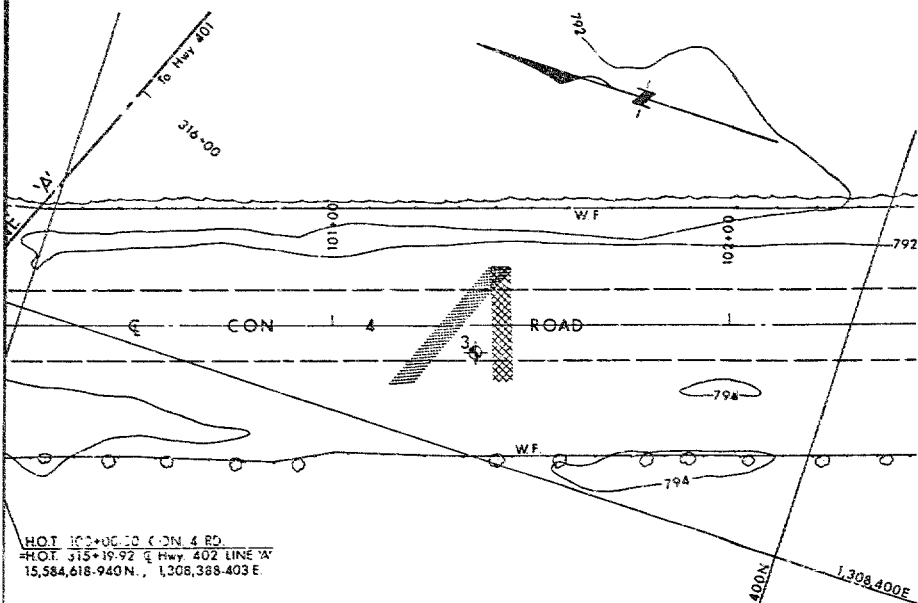
## ABUTMENT ON COMPACTED FILL SHOWING GRANULAR 'A' CORE



### NOTES

- 1 - REMOVE TOPSOIL &/OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A'.
- 2 - PLACE GRANULAR 'A' TO TOP OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT M.T.C. STANDARDS.
- 3 - EXCAVATE COMPACTED GRANULAR 'A' MATERIAL FOR FOOTING.





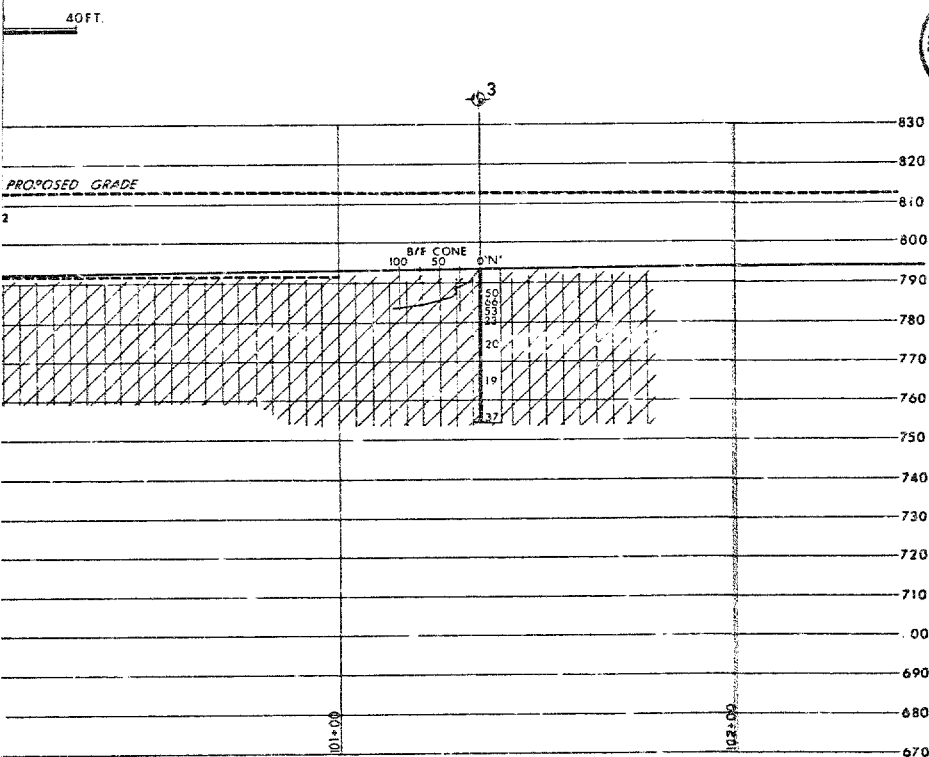
LEGEND			
	Bore Hole		
	Dynamic Cone Penetration Resistance Test		
	Bore Hole & Cone Test		
	Water Levels established at time of field investigation.		
	Water Levels NOT established at time of field investigation.		
NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	790.1	15,584,741	1,308,330
2	791.9	15,584,623	1,308,379
3	791.1	15,584,438	1,308,425

#### NOTE: FOR CONTRACT DOCUMENT

The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview, and at the LONDON District Office.

#### — NOTE —

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.



DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO  
ENGINEERING SERVICES BRANCH—GEOTECHNICAL OFFICE—SOIL MECHANICS SECTION

#### CON. 4 ROAD

HIGHWAY NO. Prop. 402 LINE 'A' DIST NO. 2  
CO. MIDDLESEX  
TWP. DELAWARE LOT 11 & 12 CON. III & IV

#### BORE HOLE LOCATIONS & SOIL STRATA

SUBMITTAL 15 (CHECKED)	WP NO. 41-66-10	DRAWING NO.
DRAWN (CHECKED)	AD NO.	416610-A
DATE April 22, 1975	SITE NO. 19-542	BRIDGE DRAWING NO.
APPROVED	CONT NO.	



Memorandum

To: Mr. A. Wittenberg,  
Regional Manager,  
Regional Planning & Design,  
Southwestern Region, London.

From: Structural Office,  
West Building, Downsview.

Attention:

Date: May 20, 1977.

Our File Ref.

In Reply to

Subject: Concession Road 4 Underpass,  
W. P. 41-66-10, Site 19-542,  
Highway 402, District 2.

Based on the information supplied by Mr. R. W. Bratty, Project Manager of Giffels, Davis & Jorgensen, the General Plan of contract drawing sheet one has been revised to show the location of culverts, storm sewers and the grading contours. Consequently the bridge D4, Material List and Note to Regional Planning and Design Office should be revised as follows:

1. Note to Regional Planning and Design Office

Change Item (b) "Water for compaction....(The approximate quantity of Granular Backfill is to read 426 cu yd)".

2. Change D4 quantities

(a) "902 - Earth Excavation for Bridge Foundation cu yd  
to read 150".

(b) "904 - Concrete in Bridge Foundations - cu yd - to read 150".

3. Material List

Change - "Cement (Bridge) - ton - to read 275"  
delete - Protection Board for Bridge Deck Waterproofing

Enclosed for your record is the half size print of drawing no. 19-542-1, please supersede the previous print of sheet one.

One copy of the revised print is also being forwarded to each of the following offices:

Structural Contract Section  
Regional Structural Planning Engineer  
Regional Planning and Design Office  
Systems Design Project Review Section  
District Office



Estimating Office  
Assistant Construction Engineer (Structures)  
Structural Maintenance Engineer  
Soil Mechanics Section  
Giffels, Davis & Jorgensen

RK/cf  
Encl.

*R Kan*  
R. Kan,  
Structural Project Engineer.

c.c. J. Wear  
J. Keen  
K. Bassi  
D. Collins  
B. Giroux  
A. McKim  
E. Van Beilen  
C. Mirza  
A. Watt  
N. Zoltay  
R. W. Bratty, Giffels, Davis & Jorgensen



## Memorandum

To: Mr. S. Jants  
Structural Planning Supervisor  
Structural Planning Office  
Southwestern Region, London

From: Soil Mechanics Section  
Geotechnical Office  
West Building, Downsview

Attention:

Date: August 15, 1975

Our File Ref.

In Reply to

Subject:

DELAWARE CON. 4 ROAD UNDERPASS  
Hwy. 402, Dist. 2, London  
W.P. 41-66-10 Site 19-542

The lowering of the grade at this site will require the following changes in the foundation recommendations.

The center pier may be supported on a spread footing at elevation 781 with a safe net design load of 3 tons per sq. ft. Settlement in this case is predicted to be approximately 1-1/2 inches.

The abutments may be supported on spread footings with a safe net design load of 4 tons per sq. ft. The north abutment should be founded at elevation 785 and the south abutment at elevation 788. Settlements of approximately 2 inches are anticipated at the abutments.

P.J. Stuart  
Project Engineer

For

K.G. Selby  
Supervising Engineer

c.c. E.J. Orr  
B.R. Davis  
B.J. Giroux  
G.A. Wrong  
A.P. Watt  
A. Wittenberg  
J.R. Roy  
L.E. Walker  
R. Hore  
J. Anderson)  
A. Crowley ) memo only  
G. Sloan )  
Files  
Record Services

W.P. 41-66-10

Con. Road 4 Underpass

Hwy. 402

Site 19-542

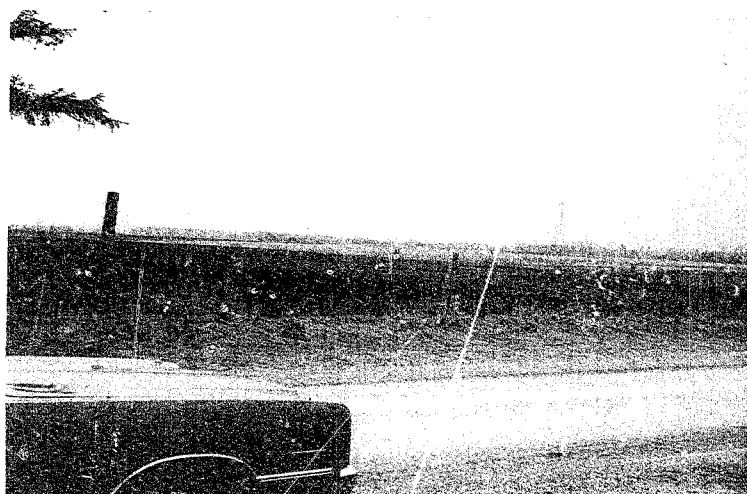


looking east along Hwy. 402



looking north on Twp. Rd.

looking west along Hwy. 402



DOCUMENT NO. \_\_\_\_\_

GEOCRES No. 40714-87

DIST 2 REGION Southwestern

W.P. No. 41-66-10

CONT. No. 78-66

W. O. No. \_\_\_\_\_

STR. SITE No. 19-542

HWY. No. \_\_\_\_\_

LOCATION Con. IV Road Underpass

\_\_\_\_\_

\_\_\_\_\_

OVERSEEN DRAWING NO. \_\_\_\_\_

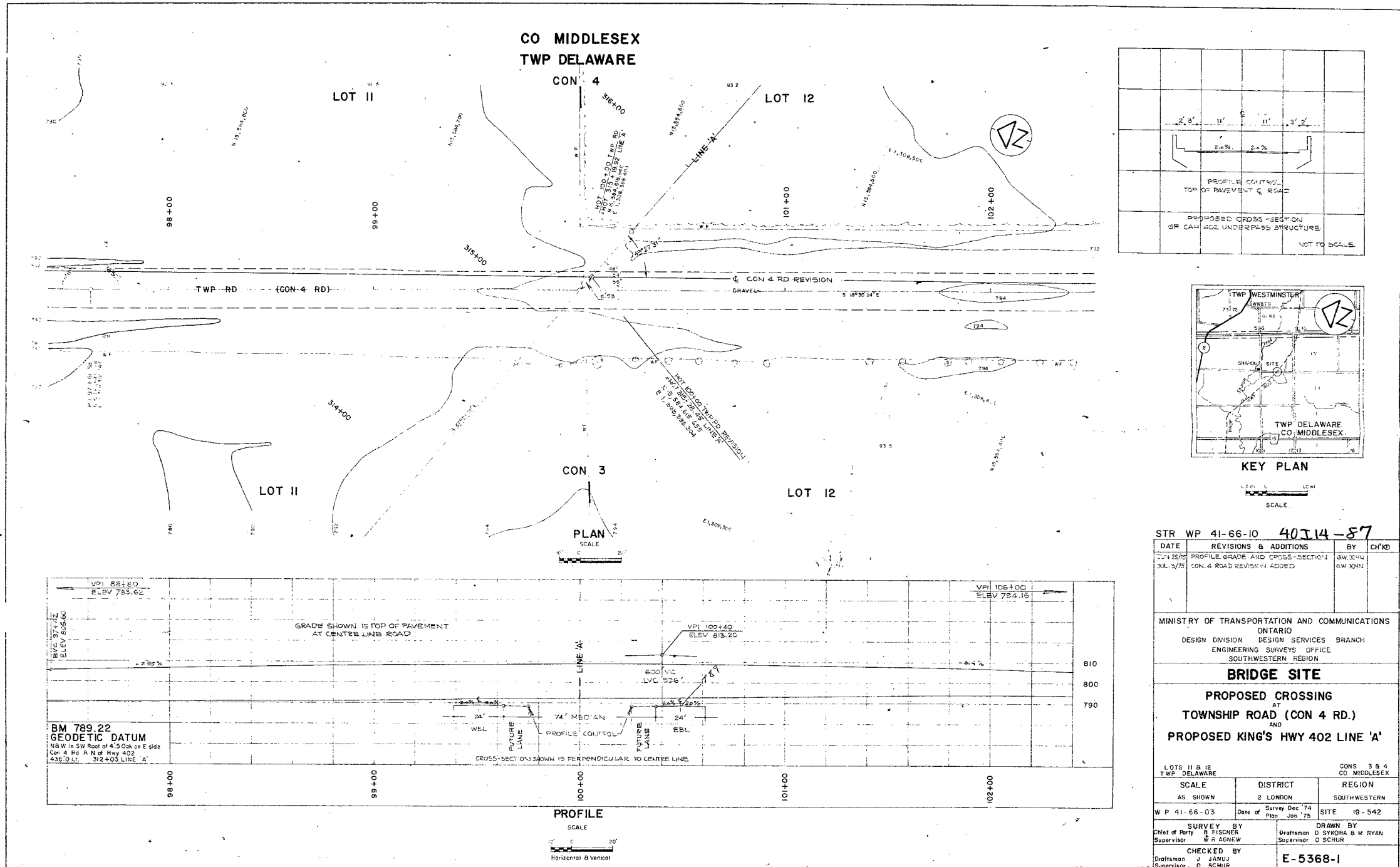
REMARKS: \_\_\_\_\_

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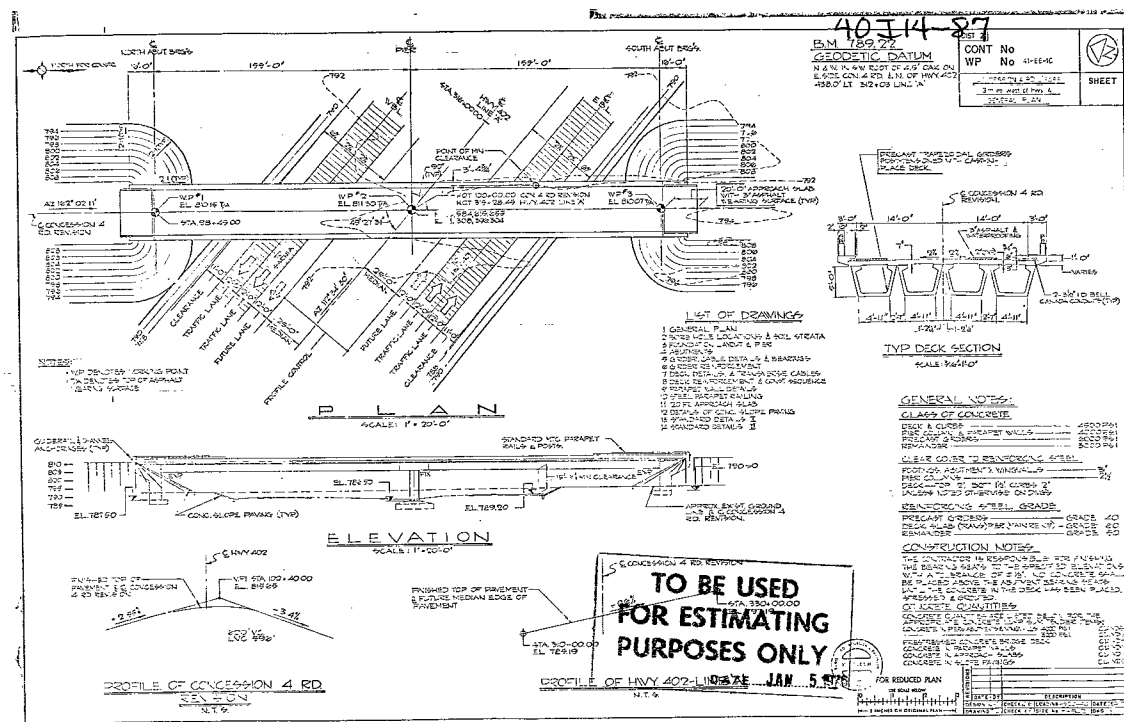


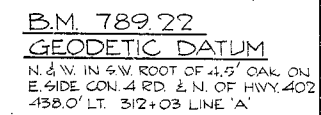
49-5380  
E-5368-1



E-5368-1

E-5368-1





40I14-87



SHEET



- GENERAL NOTES:

1. THEORY OF THE CASE  
 2. FACTS AND EVIDENCE  
 3. CONCLUSIONS

REINFORCING STEEL GRADES	
PRECAST CONCRETE	GRADE 40
STEEL DECK (WALZED OR ROLLED)	GRADE 50
REBAR/CHAINS	GRADE 60

CONSTRUCT ON CODE

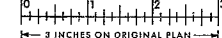
THE CONTRACTOR IS RESPONSIBLE FOR RIGGING THE BEARING BEAMS TO THE SPECIFIED ELEVATION WITH A TOLERANCE OF 1/4" OF CONCRETE SHALL BE PLACED ABOVE THE ABOVE BEARING BEAMS UNLESS THE CONCRETE AT THE DESIGN BEARING POINTS IS STRENGTHENED & GROUTED.

### CONCRETE QUANTITIES

CONCRETE QUALITIES ARE LISTED BELOW FOR THE APPROXIMATE SOLIDATE AND TYPICAL SUBSTR ITEMS	CC	1.00
CONCRETE IN PERMANENTLY EXPOSED AREA (C/P)	CC	1.00
PRESTRESSING CONCRETE IN BRIDGE DECK	CC	1.00
CONCRETE IN PAVING	CC	1.00
CONCRETE IN APPROACH SLABS	CC	1.00
CONCRETE IN SLOPE PAVING	CC	1.00



USE SCALE BELOW

[illegible]

