



FOUNDATION TECHNICAL MEMORANDUM

for

KERWOOD ROAD UNDERPASS

HIGHWAY 402

MTO WEST REGION 59 STRUCTURE REHABILITATIONS

SITE 19-519, CONTRACT 9

GWP 3098-12-00

TOWNSHIP OF ADELAIDE

MIDDLESEX COUNTY, ONTARIO

PETO MacCALLUM LTD.
165 CARTWRIGHT AVENUE
TORONTO, ONTARIO
M6A 1V5
Phone: (416) 785-5110
Fax: (416) 785-5120
Email: toronto@petomacallum.com

Distribution:

- 1 cc: WSP Canada for distribution to MTO + 1 digital copy (PDF)
Electronic Copy to MTO (David.Staseff@ontario.ca)
- 1 Electronic Copy to MTO (maha.almassri@ontario.ca)
- 1 Electronic Copy to WSP Canada
(Scott.Leitch@wsp.com) + 1 digital copy (PDF)
- 1 cc: PML Kitchener
- 1 cc: PML Toronto

PML Ref.: 13KF006J-KR
Index No.: 406FTM
GEOCRES No.: 40113-40
February 26, 2018



TABLE OF CONTENTS

1. INTRODUCTION	1
2. PROJECT SITE BACKGROUND AND GEOLOGY	2
3. SOURCE OF INFORMATION	2
4. SITE RECONNAISSANCE	3
5. PREVIOUS INVESTIGATION AND SUMMARIZED SUBSURFACE CONDITIONS	4
5.1 Subsurface Conditions Summary	5
5.1.1 Clayey Silt Fill.....	5
5.1.2 Upper Clayey Silt	5
5.1.3 Silt to Sandy Silt.....	5
5.1.4 Lower Clayey Silt	6
5.2 Groundwater	6
6. FOUNDATION	7
6.1 Previous Foundation Discussion and Recommendations.....	7
6.1.1 Foundation	7
6.1.1.1 Spread Footings.....	7
6.1.1.2 Piles.....	8
6.1.2 Frost Protection.....	8
6.1.3 Settlement	8
6.1.4 Construction Considerations.....	8
6.2 Assessment of Foundation Parameters	8
7. DISCUSSION	10
8. CLOSURE	11

Table 1 – List of Standard Specifications

Figure 1 – Key Plan

Appendix A – Previous Foundation Investigation Reports (GEOCREC No. 40I13-40)

- Reference 1. Foundation Investigation Report, for County Road 6 Interchange Underpass
 5.8 Miles West of Hwy 81. (North of Strathroy), Hwy. 402, District 2, London,
 W.P. 41-66-29, dated December 1976.



- Reference 2. Foundation Investigation Report, For Middlesex County Road 6 Bridge, Hwy. 402, Twp. of Adelaide, Dist 2, London, W.P. 41-66-29, Site 19-519, dated July 1975.
- Reference 3. General Layout DWG 1, Sheet 167, County Rd. 6 Interchange U'pass, 5.8 mi west of hwy 81, (north of Strathroy), WP No. 41-66-29, CONT No 76-122, dated June 1976.
- Reference 4. Footing Layout DWG. 3, Sheet 169, County Rd. 6 Interchange U'pass, WP No. 41-66-29, CONT No 76-122, dated June 1976.

Appendix B – Site Photographs

FOUNDATION TECHNICAL MEMORANDUM

For

Kerwood Road Underpass, Highway 402
MTO West Region 59 Structure Rehabilitations
Site 19-519, Contract 9,
GWP 3098-12-00
Township of Adelaide
Middlesex County, Ontario

1. INTRODUCTION

The Foundation Engineering Services for the present project involve the detail foundation investigation and design for rehabilitation of 59 structures in the MTO West Region along Highways 4, 6, 401, 402 and 403. Ten (10) Group Work Projects (GWP) are contemplated to be completed between 2014 and 2020.

This technical memorandum summarizes the factual results of the geotechnical data based on the review and compilation of existing subsurface information from relevant reports in the MTO GEOCREST Library for the Highway 402 Kerwood Road Underpass in the Township of Adelaide, Middlesex County, Ontario. The Foundation Engineering recommendations from the original foundation reports are summarized with reference to the "Canadian Highway Bridge Design Code, 2014 Edition" (CHBDC) and follow in general the "Guidelines for Professional Engineers providing Geotechnical Engineering Services".

Rehabilitation Kerwood Road at Highway 402 Underpass (Site No. 19-519) will include: remove existing asphalt and waterproofing, patch repair deck top, waterproof and pave; reconstruct existing deck cantilever and partial depth of the deck sides; remove barrier wall with railing and construct new parapet wall with railing; remove and reconstruct ballast wall, cleat and tops of wingwalls, and convert to semi-integral abutment details; replace approach slabs and install new sleeper slab expansion joints at the end of the new approach slabs; replace flexible link slab; patch repair deck soffit, abutments and wingwalls; remove light pole base on east side; replace bearings; and, clean and coat all structural steel 5000 mm from front face of abutment and 2000 mm from centre of pier.

The purpose of this technical memorandum is to summarize the subsurface and groundwater conditions and foundation recommendations based on available reports for the design project team's reference. The elevations in this report are expressed in meters, unless otherwise noted.



2. PROJECT SITE BACKGROUND AND GEOLOGY

The Kerwood Road (County Road 6) Underpass is located on Highway 402, about 9.3 km west of the Highway 81 and Highway 402 Interchange in Adelaide Township, Middlesex County, Ontario. A Key Plan is shown on Figure 1.

The land use surrounding the underpass site is gently rolling farmland. The terrain in the vicinity of the site slopes down gently to the north towards a shallow local watercourse.

Physiographically, the site is situated in the region known as the Caradoc Sand Plains. The Caradoc Sand Plains comprise large water-laid alluvial beach deposits. This plain was formed when the early Thames River discharged into Glacial Lake Warren forming a sand gravel deltaic deposit. Clay plains occur in association with the sand plains and represent the sediment that was deposited in deeper water further off than the alluvial beach deposits (sand plains). The limestone, dolostone or shale bedrock in the area belongs to the Hamilton Group of Middle Devonian period. Based on the Bedrock Topography Series, Strathroy Area (1978) prepared by the Ontario Geological Survey, the bedrock elevation in the vicinity of the underpass is at elevation 174.0 (571.0 ft.), about 68 m (223.0 ft.) below existing ground surface.

3. SOURCE OF INFORMATION

The following reports, documents and plans were available for review and information for the Kerwood Road Underpass and are included in Appendix A. References 1 and 2 below represents the foundation investigation reports for the final underpass alignment.

1. Foundation Investigation Report, for County Road 6 Interchange Underpass 5.8 Miles West of Hwy 81. (North of Strathroy), Hwy. 402, District 2, London, W.P. 41-66-29 by Soil Mechanics Section Geotechnical Office, Ministry of Transportation and Communications, Ontario, dated December 1976. GEOCREs No. 40I13-40. (Reference 1)



2. Foundation Investigation Report, For Middlesex County Road 6 Bridge, Hwy. 402, Twp. of Adelaide, Dist. 2, London, W.P. 41-66-29, Site 19-519, by Soil Mechanics Section Geotechnical Office, Ministry of Transportation and Communications, Ontario, dated July 1975. GEOCRE No. 40113-40. (Reference 2)
3. General Layout DWG 1, Sheet 167, County Rd. 6 Interchange U'pass, 5.8 mi west of hwy 81, (north of Strathroy), WP No. 41-66-29, CONT No 76-122, dated June 1976. (Reference 3)
4. Footing Layout DWG. 3, Sheet 169, County Rd. 6 Interchange U'pass, WP No. 41-66-29, CONT No 76-122, dated June 1976. (Reference 4)

4. SITE RECONNAISSANCE

As part of the current foundation engineering assessment study, a site reconnaissance of the Highway 402/Kerwood Road Underpass was carried out on September 2, 2015. A photographic record of the site visit is included in Appendix B.

The site photographs present the current condition of the Kerwood Road Underpass including appearance of structure abutments and central pier, visual abutment slope assessment, apparent areas of soil erosion and type of slope cover.

The east and west slopes of the north and south abutments were grass covered during the site reconnaissance. The slope surface showed no sign of erosion (Photographs 1 and 2). The central abutment slopes facing the road were covered with rip-rap (Photograph 2). Based on a visual assessment, the central pier is in good condition (Photograph 3). Minor cracking was observed on the wingwalls (Photograph 5).

Based on the General Layout drawing (Reference 3), 150 mm (6 in.) diameter perforated Corrugated Steel Pipes (CSP) were placed behind the north and south abutment walls. The condition of the CSP could not be assessed during the site reconnaissance. No water ponding was observed in the immediate vicinity of the abutment walls during the site reconnaissance.



5. PREVIOUS INVESTIGATION AND SUMMARIZED SUBSURFACE CONDITIONS

Foundation investigation reports were prepared by Soil Mechanics Section Geotechnical Office, Ministry of Transportation and Communications, Ontario dated July 1975 and December 1976. The purpose of the investigation was to establish the subsoil and groundwater conditions at the proposed underpass location.

The field work included three sampled boreholes (boreholes 1, 2, 3), accompanied with dynamic cone penetration tests. The field investigation was carried out during the period of June 25 to 27, 1975. The three boreholes were drilled to 17.0 to 18.7 m (55.9 to 61.5 ft.) elevation 223.8 to 226.0 (734.1 to 741.6 ft.).

The boreholes were advanced using hollow stem augers. Soil samples were recovered from the boreholes using the standard penetration test (SPT) method.

The borehole locations and elevations were surveyed by personnel from the London Region Engineering Surveys Section. All the borings completed for the project were shown on Drawing No. 416629-A, Bore Hole Locations & Soil Strata, included in the Appendix (Reference 2).

Samples were visually examined in the field and subsequently in the laboratory. Selected samples were subjected to laboratory tests to determine the physical properties of the various soil types. The results of the field and laboratory tests were presented in the Record of Borehole Sheets, appended to the original report (References 1 and 2).

The subsoil conditions have been referenced from boreholes included and inferences made within the available reports and drawings.



5.1 Subsurface Conditions Summary

The subsurface conditions encountered in the boreholes are summarized in the following sections of this report.

5.1.1 Clayey Silt Fill

A surficial 1.8 m (6.0 ft.) thick, loose to compact clayey silt fill layer was encountered in borehole 1 and extended to elevation 240.7 (789.6 ft.). N values recorded in this layer were 6 and 12. Moisture content determination of one sample in this layer was 20%. An organic content test conducted on one sample from this stratum indicated an organic content of 3.12%.

5.1.2 Upper Clayey Silt

Below the clayey silt fill in borehole 1 and from the ground surface in boreholes 2 and 3, an upper 10.1 to 13.1 m (33.0 to 43.0 ft.) thick, very stiff to hard clayey silt stratum was encountered which extended to 11.9 to 13.1 m (39.0 to 43.0 ft.), elevation 230.4 to 230.6 (756.0 to 756.6 ft.).

The average liquid and plastic limit of the clayey silt was about 35% and 16%, respectively. The report estimated the undrained shear strength of the deposit based on N values to range from about 480 kPa (10,000 psf) in the desiccated 2.1 m to 3.0 m (7.0 to 10.0 ft.) thick upper zone to about 168 kPa (3,500 psf) at the base of the deposit, generally decreasing with depth.

Four grain size distributions conducted on representative samples recovered from this stratum indicated 33 to 44% clay, 55 to 67% silt, up to 5% sand and up to 1% gravel sized material. Moisture content determinations conducted on recovered samples ranged from 15 to 21%.

5.1.3 Silt to Sandy Silt

Below the upper clayey silt, a 4.6 to 5.8 m (15.0 to 19.0 ft.) thick compact to very dense silt to sandy silt stratum was encountered at 11.9 to 13.1 m (39.0 to 43.0 ft.), elevation 230.5 to 230.7 (756.0 to 756.6 ft.) and extended to 17.7 m (58.0 ft.), elevation 224.8 to 225.9 (737.6 to 741.0 ft.) in boreholes 1 and 3. Borehole 2 was terminated in this stratum at 17.0 m (55.9 ft.),



elevation 226.0 (741.6 ft.). N values ranged from 24 to over 100, but were generally greater than 100 blows.

Three grain size distributions conducted on representative samples indicated 65 to 95% silt, up to 32 % sand, 3 to 5% clay sized material and no gravel. Moisture content determinations obtained ranged from 16 to 23%.

5.1.4 Lower Clayey Silt

Below the silt to sandy silt, a lower clayey silt was encountered in boreholes 1 and 3, at 17.7 m (58.0 ft.), elevation 224.9 and 225.9 (737.6 and 741.0 ft.) and extended to the borehole termination depth of 18.75 m (61.5 ft.), elevation 223.8 and 224.8 (734.1 and 737.5 ft.).

One grain size analysis conducted on a representative sample of this stratum indicated 65% silt, 32% clay and 3% sand sized material. Moisture content determination conducted on one sample indicated 18% moisture.

The undrained shear strength of this deposit was estimated to be 192 kPa (4000 psf).

5.2 Groundwater

Groundwater was observed in boreholes 1 and 2 during the field investigation at 2.3 m (7.6 ft.) and 5.9 m (19.5 ft.), elevation 240.2 and 237.1 (788.0 and 778.0 ft.), respectively. The groundwater level was not established in borehole 3.

The report indicated that the stabilized groundwater level was at about 2.1 to 3.0 m (7.0 to 10.0 ft.) below ground surface. Because of the low permeability of the subsoil, the duration of the fieldwork was too short to permit stabilization of the groundwater in the borings.



6. FOUNDATION

6.1 Previous Foundation Discussion and Recommendations

An underpass structure was proposed to carry Middlesex County Road 6 (Kerwood Road) over Highway 402. Embankments approximately 8.5 m (28.0 ft.) in height were proposed at the abutments. A two span bridge, with each span of about 42.7 m (140.0 ft.) in length was proposed.

The subsurface soils encountered at the borehole locations varied in type, consistency and extent. The observed groundwater level was 2.3 and 5.9 m (7.6 and 19.5 ft.) below existing ground level at the time of the investigation, elevations 240.2 and 237.2 (788.0 and 778.0 ft.). However it was believed that the stabilized groundwater level was at about 2.1 to 3.0 m (7.0 to 10.0 ft.) below ground surface.

6.1.1 Foundation

The report considered two types of foundation for the underpass structure - spread footings and piles.

6.1.1.1 Spread Footings

Based on the subsurface factual data, it was recommended that abutment spread footings be constructed within the approach fills and supported on well compacted granular 'A'. A safe design load of 240 kPa (2.5 tsf) was recommended for spread foundation design. For calculation of sliding resistance, a friction coefficient of 0.55 was recommended for the granular-concrete interface.

A central pier spread footing foundation was recommended at approximate elevation 240.8 (790.0 ft.). A net safe bearing pressure of 384 kPa (4 tsf) was recommended for footing design. An adhesion value of 96 kPa (2000 psf) was recommended for sliding resistance determination.



6.1.1.2 Piles

As an alternative, it was recommended that the abutments be supported on steel tube piles (12 ¾ in. X ¼ in.) driven into the desiccated crust to elevation 241.4 (792.0 ft.) for the south abutment and elevation 239.0 (784.0 ft.) for the north abutment. It was recommended that the piles not be driven below these elevations as undrained shear strength decreases with depth. A safe design load of 222 kN (25 tons) per pile was recommended for design purposes. Battered piles were recommended for horizontal loading resistance.

6.1.2 Frost Protection

The report recommended a frost protection of 1.2 m (4.0 ft.) earth cover for all spread footings and the pile caps of the structure.

6.1.3 Settlement

Total short and long term settlements of approximately 50 mm (2 in.) at the abutments and 38 mm (1.5 in.) at the central pier were anticipated.

6.1.4 Construction Considerations

The report stated that no dewatering problems were anticipated at the site due to the relatively impervious nature of the upper layers of the subsoil. Further it was stated that no stability problems are anticipated with the embankment fills, (8.5 m (28.0 ft.) in height), if 2H:1V slopes were employed. It was recommended that cobbles exceeding 75 mm (3 in.) in diameter be removed from the fill placed at locations through which piles have to be driven.

6.2 Assessment of Foundation Parameters

Reference 3 indicated that the bridge abutments were supported on battered concrete filled steel tubes piles, 12 ¾ in. O.D with a ¼ in. wall thickness. The concrete pile cap was supported at elevation 245.0 (803.7 ft.) while the pile lengths ranged from 4.6 to 7.0 m (15.0 to 23.0 ft.).



The central pier was supported on a shallow spread footing bearing at approximate elevation 240.8 (790.0 ft.) on hard clayey silt.

Based on the previous investigation and subsurface conditions encountered, the following table summarizes the foundation design parameters that were recommended in the previous report and the updated geotechnical reaction at SLS and factored geotechnical resistance at ULS are provided.

FOUNDATION DESIGN PARAMETERS

FOUNDATION	FOUNDING ELEVATION ¹		PREVIOUS WORKING STRESS VALUES ²	PREVIOUS EQUIVALENT LIMIT STATE DESIGN VALUES		LIMIT STATE DESIGN VALUES UPDATED TO CURRENT INDUSTRY PRACTICE ³	
	(ft.)	(m)	SAFE BEARING RESISTANCE / LOAD	SLS BEARING REACTION / LOAD	ULS FACTORED GEOTECHNICAL RESISTANCE / LOAD	SLS BEARING REACTION / LOAD	ULS FACTORED GEOTECHNICAL RESISTANCE / LOAD
North Abutment on 12 ¾ in. concrete filled steel tube piles bearing within hard clayey silt	Not below 784.0	Not below 238.95	25 tons	222 kN	---	240 kN	360 kN
South Abutment on 12 ¾ in. concrete filled steel tube piles bearing within hard clayey silt	Not below 790.0	Not below 240.8	25 tons	222 kN	---	240 kN	360 kN
Central Pier on Spread footing supported on upper very stiff to hard clayey silt crust	790.0	240.8	4.0 tsf	384 kPa	576 kPa	380 kPa	570 kPa

- Notes:**
1. Refer Pile Data Table and notes shown on Reference 4 (Footing Layout. Drawing 3, Sheet 169) included in Appendix A.
 2. Working stress design values. The Serviceability Limit State design values are based on the working stress. No field verifications were made.
 3. Resistance Factor = 0.5 for shallow foundation (CFEM 4th edition).
Resistance Factor = 0.4 for deep foundations (CFEM 4th edition)
Assumed Factor of Safety is 3 (CFEM 4th edition).



The Peak Ground Acceleration (PGA) for the site is 0.056 (National Building Code of Canada, 2015). The soil classification for seismic design should be in accordance with Clause 4.4.3.2 of the CHBDC (2014).

The bearing resistance for inclined loads should be reduced in accordance with the requirements of clause 6.10.4 of the CHBDC 2014 Edition.

The foundation frost penetration depth at the site is 1.2 m according to OPSD 3090.101.

7. DISCUSSION

Rehabilitation of the Kerwood Road Underpass is planned for construction in 2018. It is understood that for the Highway 402 Kerwood Road Underpass, the rehabilitation will include conversion to semi-integral abutments. From a geotechnical point of view, at the present time, foundation work for the underpass structure is not expected provided that the total load on the structure does not increase or decrease by more than 10%.

A temporary support system will be required for the rehabilitation of the underpass structure and the construction for temporary support system should conform to OPSS 404 and 539. The contractor is responsible for the selection, detailed design and performance of the roadway protection scheme. The contractor should monitor the movement of the roadway protection system.

The slopes adjacent to both abutments are visually stable without signs of erosion. However, the embankments which are greater than 8.0 m in height were not constructed with a 2H:1V slope and benched as per current practice (OPSD 202.010).

Groundwater control is not anticipated during construction due to the presence of low permeability soil to the proposed foundation depths. It should be noted that the groundwater levels are subject to seasonal fluctuations and precipitation patterns.

After construction, the faces of the adjacent slopes to the abutments should be rehabilitated with rock protection, rip-rap or equivalent materials to mitigate erosion effects. Revegetation and maintenance of grass areas around the central pier may be required. The aggregate materials should conform to OPSS.PROV 1004 and the construction of the rock protection, rip-rap or equivalent should conform to OPSS 511.



8. CLOSURE

This technical memorandum was prepared by Mr. H. Gharegrat, P.Eng, and was reviewed by Mr. B. R. Gray, MEng, P.Eng., Principal Consultant. Mr. R. Ng, PhD, P.Eng., MTO Designated Principal Contact conducted an independent review of the report.

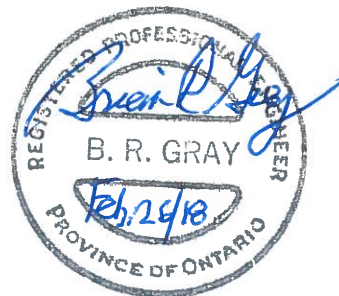
We trust this memo is sufficient for your immediate needs. Please, do not hesitate to contact us if you have any inquiries and/or comments.

Yours truly,

Peto MacCallum Ltd.



Harry Gharegrat, MS., P.Eng.
Senior Engineer, Geotechnical Services



Brian R. Gray, M.Eng, P.Eng.
Principal Consultant



Robert Ng, MBA, PhD, P.Eng.
MTO Designated Principal Contact

HG/RN/BRG:jk-nk



TABLE 1

LIST OF STANDARD SPECIFICATIONS REFERENCED IN REPORT

DOCUMENT	TITLE
OPSS 404	Construction Specification for Support Systems
OPSS 511	Construction Specification for Rip-Rap, Rock Protection, and Granular Sheeting
OPSS 539	Construction Specification for Temporary Protection Systems
OPSS.PROV 1004	Material Specification for Aggregates - Miscellaneous
OPSD 3090.101	Foundation Frost Depth for Southern Ontario
OPSD 202.010	Slope Flattening Using Surplus Excavated Material On Earth or Rock Embankment

Figure 1 – Key Plan





APPENDIX A

Previous Foundation Investigation Reports (GEOCRES 40113-40)

- Reference 1. Foundation Investigation Report, for County Road 6 Interchange Underpass 5.8 Miles West of Hwy 81. (North of Strathroy), Hwy. 402, District 2, London, W.P. 41-66-29, dated December 1976.
- Reference 2. Foundation Investigation Report, For Middlesex County Road 6 Bridge, Hwy. 402, Twp. of Adelaide, Dist 2, London, W.P. 41-66-29, Site 19-519, dated July 1975.
- Reference 3. General Layout DWG 1, Sheet 167, County Rd. 6 Interchange U'pass, 5.8 mi west of hwy 81, (north of Strathroy), WP No. 41-66-29, CONT No 76-122, dated June 1976.
- Reference 4. Footing Layout DWG. 3, Sheet 169, County Rd. 6 Interchange U'pass, WP No. 41-66-29, CONT No 76-122, dated June 1976.

DOCUMENT MICROFILMING IDENTIFICATION

REFERENCE 1

G.I.-30 SEPT. 1976

GEOCRES No. 40I13-40
DIST. 2 REGION Southwestern
W.P. No. 41-66-29
CONT. No. 76-122
W. O. No. _____
STR. SITE No. 19-519
HWY. No. 402

LOCATION Middlesex County Road
6 Bridge, Twp. of Adelaide

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 4

REMARKS: documents to be unfolded
before microfilming
→ photos enclosed

FOUNDATION INVESTIGATION REPORT

For

County Road 6 Interchange Underpass
5.8 Miles West of Hwy. 81 (North of Strathroy)
Hwy. 402, District 2, London
W.P. 41-66-29

INTRODUCTION

This report contains the results of a foundation investigation carried out at the site of the above mentioned project. Field work was done during the period June 25th to 27th, 1975, utilizing a continuous flight auger machine equipped with 3¼ inch I.D. hollow stem augers.

SITE DESCRIPTION

The site is located some 5.8 miles west of Hwy. 81 in Lots 6 and 7, Con. 1 and 2, Township of Adelaide, County of Middlesex, at the intersection of Hwy. 402 Line 'A', and existing Middlesex County Road 6 which is a surface treated gravel road. The surrounding area is gently rolling arable land engaged in mixed farming. In the immediate vicinity of the site the terrain slopes gently to the north towards a shallow watercourse.

SUBSURFACE CONDITIONS

General

Subsoil at the site consists of about 40 feet of stiff to hard clayey silt followed by about 15 to 20 feet of very dense silt to sandy silt followed by a deposit of hard clayey silt in which the borings penetrated only 3.5 feet before being terminated. Reference should be made to the Record of Borehole sheets contained in the report Appendix on which are shown the boundaries between the different soil types and summarized results of all field and laboratory testing carried out during the investigation. Reference should also be made to Drawing 19-519-2 of the Contract Drawings on which is shown the locations and elevations of all borings, together with the inferred subsoil stratigraphy. A detailed description of the soil types and conditions in order of occurrence from ground level downward is as follows.

Clayey Silt

This material occurs everywhere below the topsoil and the existing road and extends for about 40 feet below ground level to approximate elev. 756. On the basis of Atterberg Limit tests the soil is classified as clayey silt, the average liquid limit and plastic limit being about 35 and 16 percent respectively. The natural moisture content ranges from about 15 to about 21 percent, with a weighted average of about 20%. The undrained shear strength of the deposit based on Standard Penetration Test 'N' values is estimated to range from about 10,000 p.s.f. in a desiccated 7 to 10 foot thick upper zone (below elev. 794 and above elev. 778) to about 3500 p.s.f. at the base of the deposit, generally decreasing with depth. In borehole No. 1 a 6 foot thick deposit of essentially the same clayey silt material appeared to be fill material with a much lower undrained shear strength (1000 to 1500 p.s.f.) than elsewhere.

Silt to Sandy Silt

This material underlies the clayey silt and extends for further depths of 15 to 19 feet. On the basis of grain size distribution tests the soil is classified as silt to sandy silt. The natural moisture content ranges from 18 to about 20 percent. Standard Penetration test 'N' values were everywhere in excess of 100 blows/foot and on this basis the soil is classified as 'very dense'.

Clayey Silt

This deposit underlies the silt to sandy silt and was penetrated only 3.5 feet. The material is similar to the upper clayey silt deposit and the undrained shear strength is estimated to be about 4000 p.s.f.

Groundwater

Groundwater was observed in two borings only at elevations 788 and 778. Because of the low permeability of the subsoil the duration of the field work was too short to permit stabilization of the groundwater in the borings. It is believed that groundwater would have stabilized eventually at about 7 to 10 feet below the ground surface.

K. G. Selby

K.G. Selby, P. Eng.
Supervising Engineer

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1

W.P. 41-66-29

LOCATION Co-ords. 15,621,674 N; 1,202,292 E.

ORIGINATED BY RD

DIST. 2 HWY. 402

BORING DATE June 25, 1975

COMPILED BY PJS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, Tricone & Cone Test

CHECKED BY 10

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
795.6	Ground Level															GR SA. SI. CL.
0.0	Clayey Silt Fill, loose to compact		1	SS	6											
789.6			2	SS	12											
6.0	Clayey Silt very stiff to hard		3	SS	16											
			4	SS	53											
			5	SS	82											
			6	SS	54											
			7	SS	31											
			8	SS	35											
			9	SS	31											
756.6																
39.0	Silt to sandy silt trace of clay compact to very dense		10	SS	24											
			11	SS	100/4"											
			12	SS	100/4"											
737.6																
58.0	Clayey Silt															
734.1	Very Stiff		13	SS	28											
61.5	End of Borehole															

20
15 \diamond 5 % STRAIN AT FAILURE
10

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 2

W.P. 41-66-29 LOCATION Co-ords. 15,621,545 N; 1,202,296 E. ORIGINATED BY SD
 DIST. 2 HWY. 402 BORING DATE June 26, 1975 COMPILED BY PJS
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger, Tricone & Cone Test CHECKED BY SD

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ P.C.F.	REMARKS % GR. SA SI. CL.
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
797.5	Ground Level															
0.0	Clayey Silt															
	Very Stiff to Hard		1	SS	19											
			2	SS	50											
			3	SS	45											
			4	SS	32											
			5	SS	20											
			6	SS	24											
			7	SS	29											
			8	SS	29											
756.5			9	SS	58											
41.0	Silt to Sandy Silt															
	Trace of clay		10	SS	135											
	Very Dense		11	SS	100/4"											
741.6			12	SS	100/4"											
55.9	End of Borehole															

20
15 5 % STRAIN AT FAILURE
10

ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 3

W.P. 41-66-29

LOCATION Co-ords. 15,621,387 N; 1,202,329 E.

ORIGINATED BY RD

DIST. 2 HWY. 402

BORING DATE June 27, 1975

COMPILED BY PJB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger, Tricone & Cone Test

CHECKED BY LD

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	w_p	w	w_L		
799.0	Ground Level															GR. SA. SI. CL.
0.0	Clayey Silt															
	Very stiff to Hard		1	SS	32											0 0 67 33
			2	SS	52											
			3	SS	46											
			4	SS	28											
			5	SS	26											
			6	SS	27											0 0 58 42
			7	SS	32											
			8	SS	33											0 0 56 44
756.0																
43.0	Silt to Sandy Silt		9	SS	148											
	trace of clay															
	very dense		10	SS	110	6"										
			11	SS	150	6"										0 32 65 3
741.0																
58.0	Clayey Silt															
737.5	Hard		12	SS	33											0 3 65 32
61.5	End of Borehole															
	Note:- Water Level															
	not recorded															

20
15 \diamond 5 % STRAIN AT FAILURE
10

REFERENCE 2

FOUNDATION INVESTIGATION REPORT

For

Middlesex County Road 6 Bridge, Hwy. 402
Twp. of Adelaide, Dist. 2, London
W.P. 41-66-29, Site 19-519

1. INTRODUCTION

A request for a foundation investigation at the above 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 5.8 miles west of Hwy. 81 and approximately 1 mile south of Hwy. 22. The surrounding area is gently rolling arable land engaged in mixed farming. In the immediate vicinity of the site the land slopes gently to the north toward a shallow watercourse.

3. FIELD AND LABORATORY INVESTIGATION PROCEDURES

Field work consisted of three sampled boreholes advanced employing 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.

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. 416629-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

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 approximately 40 feet of very stiff to hard clayey silt with Standard Penetration 'N' values ranging from 12 to 82. Underlying this stratum 15 to 20 feet of very dense silt to sandy silt is found. Standard Penetration 'N' values for this layer are generally in excess of 100. Beneath this is a deposit of very stiff clayey silt.

5. DISCUSSION AND RECOMMENDATIONS

5.1 General

An underpass is proposed to carry Middlesex County Road 6 over Hwy. 402. This will involve the construction of embankments approximately 28 feet in height and a bridge of two spans each of which will be 140 feet in length.

5.2 Center Pier

It is recommended that the center pier be supported on spread footings at approximate elevation 790.0. 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.

5.3 Perched Abutments

The abutments may be constructed within the approach fills supported on well compacted granular 'A'. A net safe design load of 2.5 t.s.f. may be assumed. For calculations of sliding resistance, a friction coefficient of .55 may be assumed to apply between the footing and granular 'A'. A detailed construction scheme is outlined in Fig. 1 of the Appendix.

As an alternative, the abutments may be supported on steel tube piles (12-3/4" X 1/4") driven into the dessicated crust. These piles should be driven to elevation 792 for the south abutment and 784 for the north abutment. The piles must not be driven below these elevations as undrained shear strength decreases with depth. A safe design load of 25 tons per pile should be assumed for design purposes. Any horizontal loading should be resisted by battered piles.

5.4 Settlements

Total short and long term settlements of approximately 2 inches at the abutments and 1-1/2 inches at the center pier are anticipated.

5.5 Dewatering

No dewatering problems are anticipated due to the relatively impervious nature of the upper layers of the subsoil.

5.6 Approach Embankments

No stability problems are anticipated with embankment fills (28 ft.) if 2:1 slopes are employed. Cobbles exceeding 3" diameter should be removed from fill placed at locations through which piles have to be driven.


5.7 Frost Protection

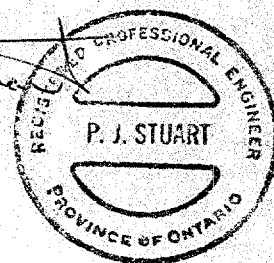
All pile caps or spread footings should be protected against frost action by a minimum 4 feet of cover.

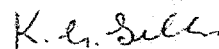
6. MISCELLANEOUS

The field work on this project was carried out June 25, 26 and 27, 1975 under the supervision of Mr. R. Donnelly, Student Technician. This report was written by Mr. P.J. Stuart, Project Engineer and reviewed by Mr. K.G. Selby, Supervising Engineer.

The equipment used was owned and operated by Master Soils Investigation Limited.


P.J. STUART
Project Engineer




K.G. SELBY
Supervising Engineer

July 1975

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

RECORD OF BOREHOLE NO 1

W.P. 41-66-29 LOCATION Co-ords. 15,621,674 N; 1,202,292 E. ORIGINATED BY RD
DIST. 2 HWY. 402 BORING DATE June 25, 1975 COMPILED BY PJS
DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Tricone CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	w_p	w	w_L		
795.6	Ground Level															
0.0	Clayey Silt Fill, loose to compact		1	SS	6											
789.6			2	SS	12	790									Org.	3.12
6.0	Clayey Silt very stiff to hard		3	SS	16											
			4	SS	53											0 0 61 39
			5	SS	82											
			6	SS	54	790										
			7	SS	31											
			8	SS	35	770										
			9	SS	31											
						760										
756.6																
39.0	Silt to sandy silt trace of clay compact to very dense		10	SS	24											0 0 95 5
			11	SS	100/4"											
			12	SS	100/4"	740										0 1 95 4
737.6																
58.0	Clayey Silt															
734.1	Very Stiff		13	SS	28											
61.5	End of Borehole															

20
15
10
5
% STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE NO 2

W.P. 41-66-29

LOCATION Co-ords. 15,621,545 N; 1,202,296 E.

ORIGINATED BY RD

DIST. 2 HWY. 402

BORING DATE June 26, 1975

COMPILED BY PJS

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger & Tricone

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w			UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
797.5	Ground Level															
0.0	Clayey Silt															
	Very Stiff to Hard		1	SS	19											
			2	SS	50	790										1 5 55 39
			3	SS	45											
			4	SS	32											
			5	SS	20											
			6	SS	24	780										
			7	SS	29	770										
			8	SS	29											0 0 59 41
756.5			9	SS	58											
41.0	Silt to Sandy Silt															
	Trace of clay		10	SS	135											
	Very Dense		11	SS	100/4"	750										
741.6			12	SS	100/4"											0 5 91 4
55.9	End of Borehole															

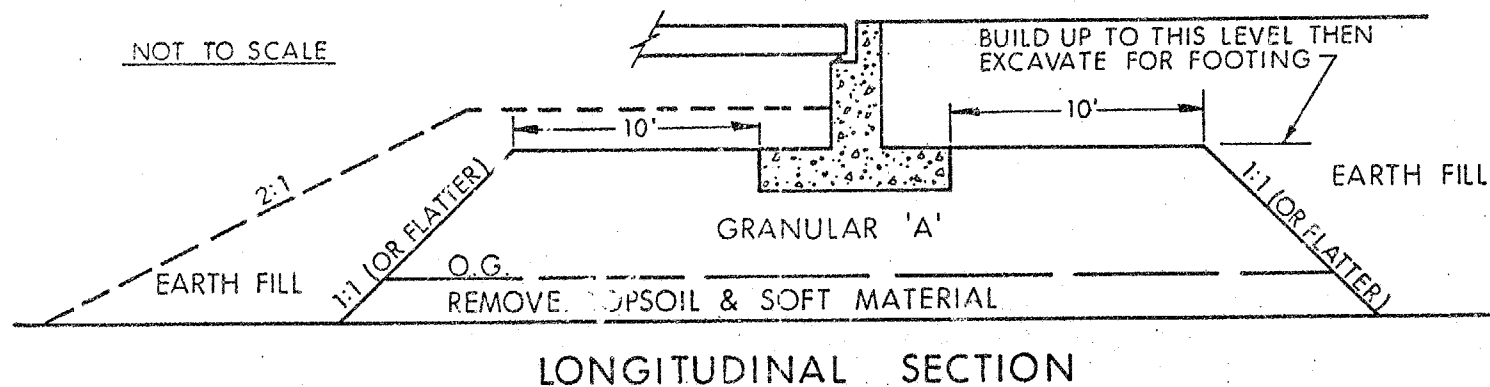
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 3

W.P. 41-66-29 LOCATION Co-ords. 15,621,387 N; 1,232,329 E. ORIGINATED BY RD
DIST. 2 HWY. 402 BORING DATE June 27, 1975 COMPILED BY PJS
DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Tricone CHECKED BY

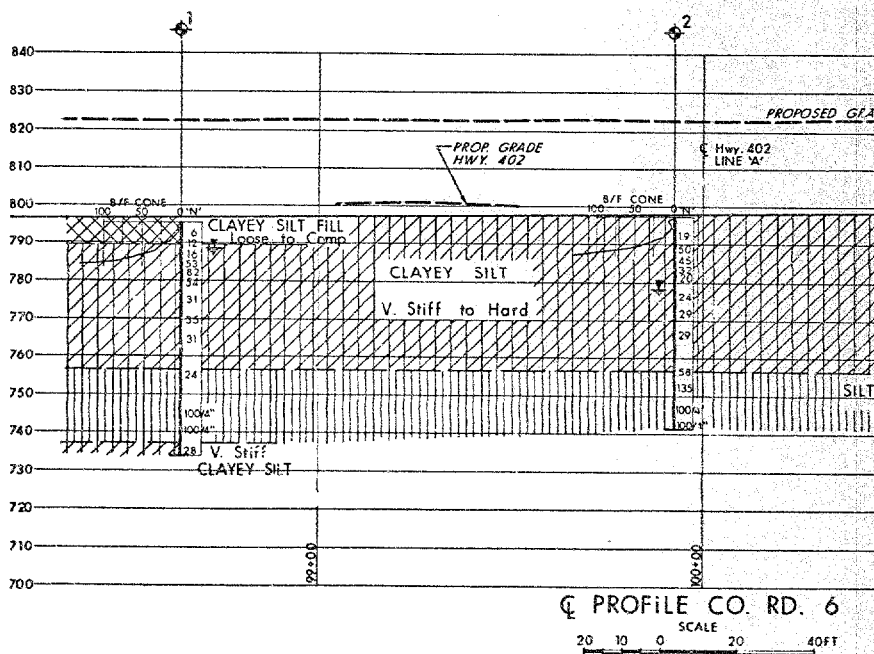
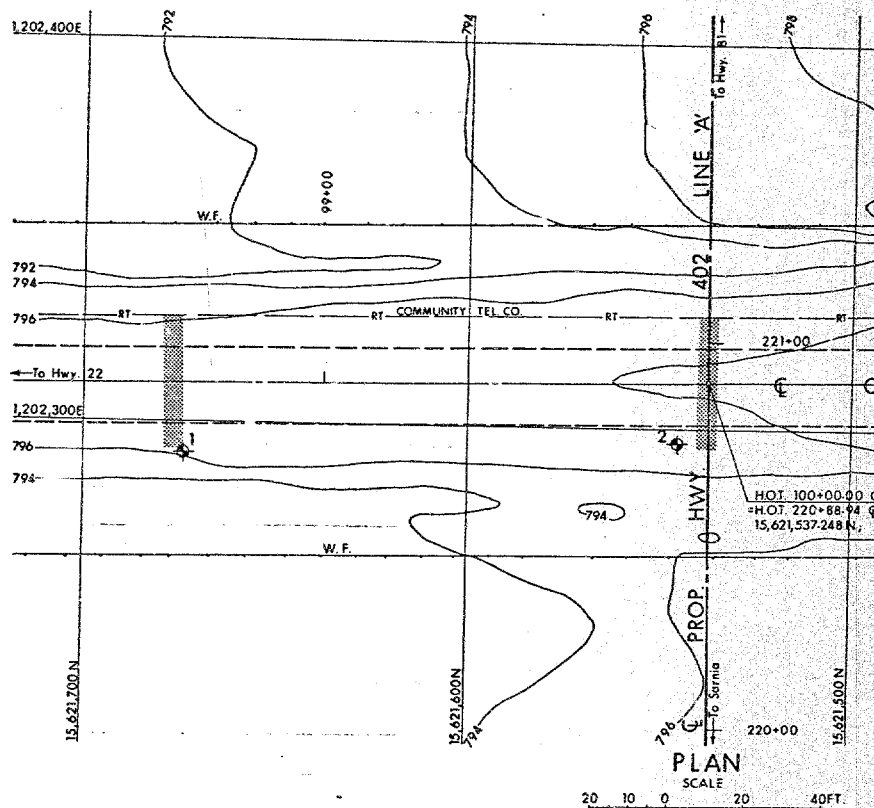
SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w WATER CONTENT % w_P w w_L	UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100			
799.0	Ground Level													
0.0	Clayey Silt													
	Very stiff to Hard		1	SS	32									
			2	SS	52									
			3	SS	46									
			4	SS	28									
			5	SS	26									
			6	SS	27									
			7	SS	32									
			8	SS	33									
756.0			9	SS	148									
43.0	Silt to Sand Silt		10	SS	110.6"									
	trace of clay		11	SS	150.6"									
	very dense													
741.0														
58.0	Clayey Silt		12	SS	33									
737.5	Hard													
61.5	End of Borehole													
	Note:- Water Level													
	not recorded													

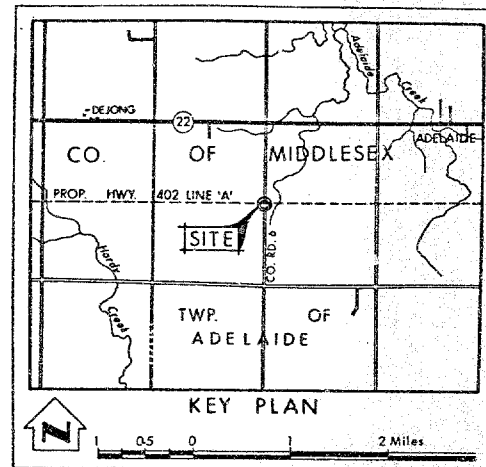
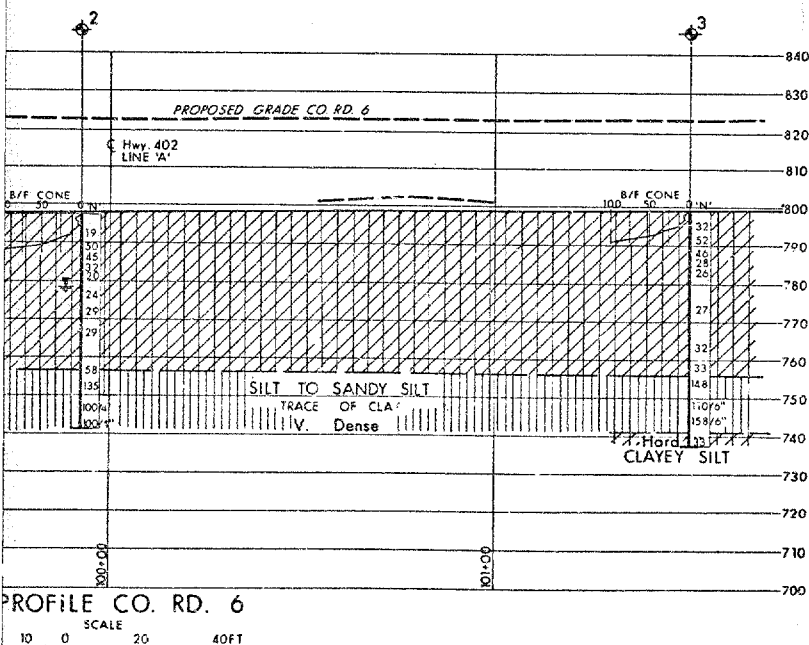
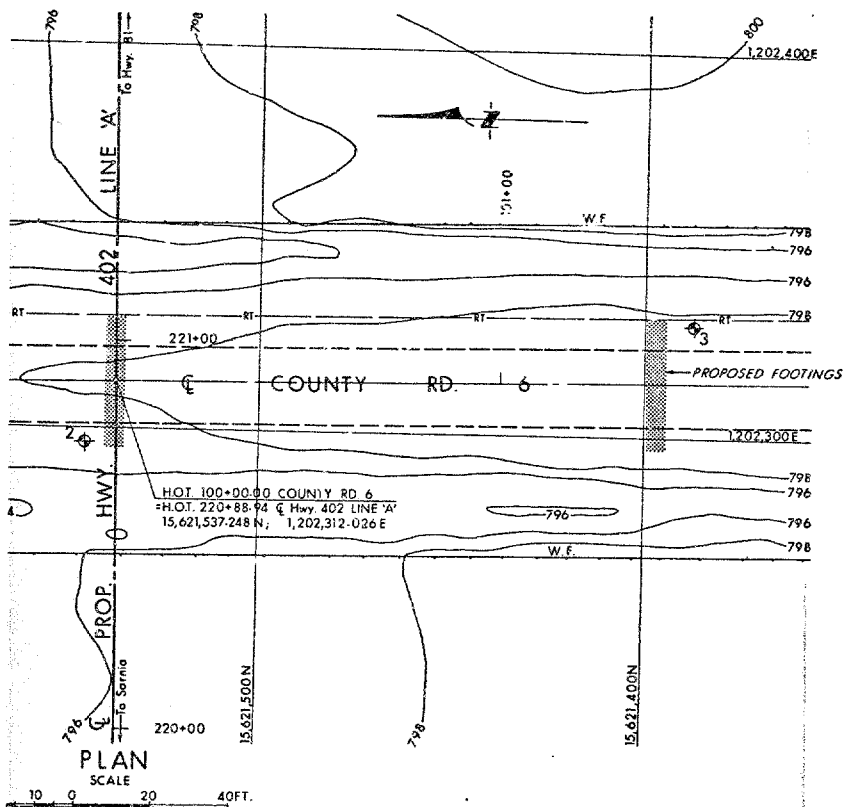
A cross-sectional diagram of an embankment. The embankment is composed of 'EARTH FILL' on both sides, with a slope of 2:1 indicated by dashed lines. In the center is a rectangular core of 'GRANULAR "A"'. The core has a width of 10' on each side, as indicated by arrows and the label '10''.



- 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.

W. P. 41-66-29





LEGEND			
	Bore Hole		
	Dynamic Cone Penetration Resistance Test B/F CONE - Blow/Ft. Cone Test (300 ft. lbs. energy/blow)		
	Bore Hole & Cone Test		
	Water Levels established at time of field investigation, June 1975 W.L. in Borehole 3 not established		
NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	795.6	15,621,674	1,202,292
2	797.5	15,621,545	1,202,296
3	799.0	15,621,387	1,202,329

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.

REVISIONS	DATE	BY	DESCRIPTION

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

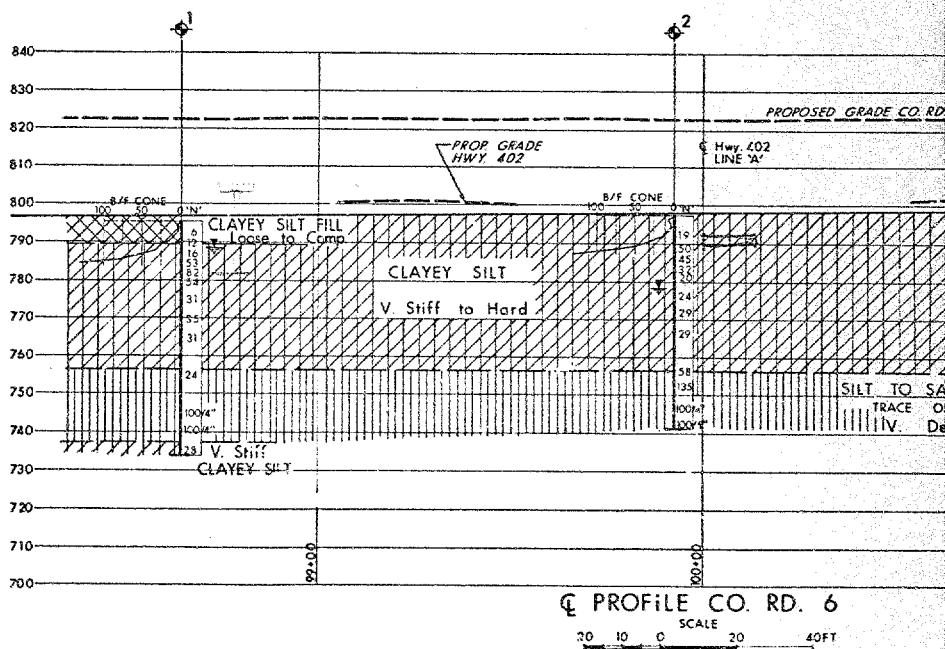
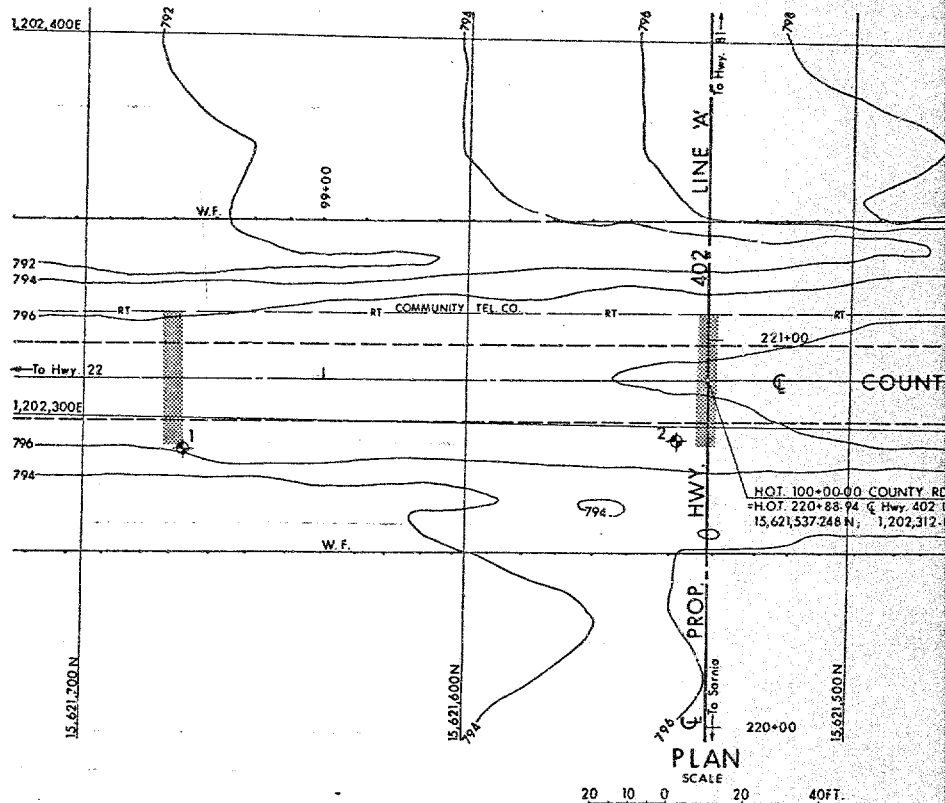
COUNTY ROAD 6

HIGHWAY NO. Prop. 402 LINE 'A' DIST. NO. 2
CO. MIDDLESEX
TWP. ADELAIDE LOT 6 & 7 CON. I & II

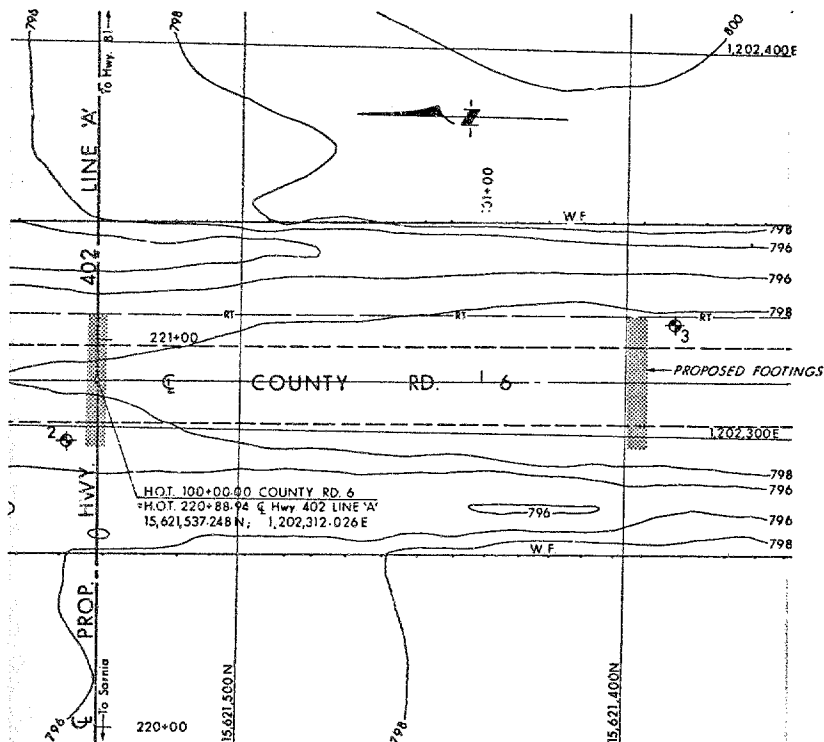
BORE HOLE LOCATIONS & SOIL STRATA

SUBMD PJS	CHECKED	WP NO 41-66-29	DRAWING NO
DRAWN	CHECKED	W.O. NO	416629-A
DATE	JULY 24, 1975	SITE NO 19-519	BRIDGE DRAWING NO
APPROVED		CONT NO	

REF. NO. E-5377-1; April 1975

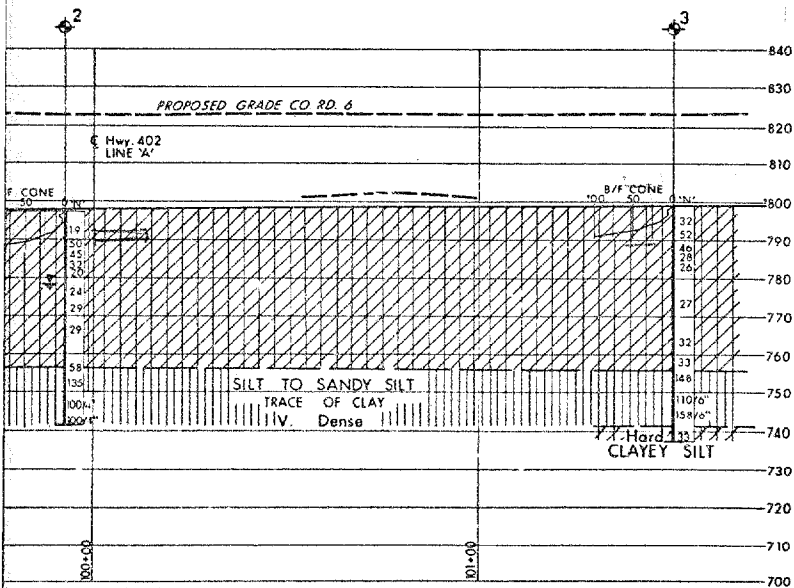


PROFILE CO. RD. 6



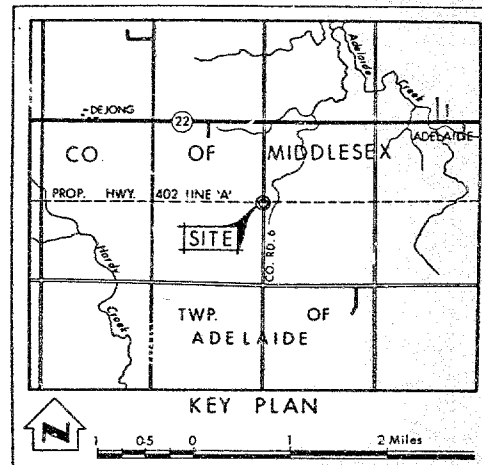
PLAN

SCALE
10 0 20 40FT.








PROFILE CO. RD. 6

SCALE
10 0 20 40FT.



KEY PLAN

LEGEND			
	Bore Hole		
	Dynamic Cone Penetration Resistance Test		
	B/F CONE - Blows/Ft. Cone Test (350 ft. lbs. energy/blow)		
	Bore Hole & Cone Test		
	Water Levels established at time of field investigation, June 1975		
	W.L. in Borehole 3 not established		
NO.	ELEVATION	CO-ORDINATES NORTH	EAST
1	795.6	15,621,674	1,202,292
2	797.5	15,621,545	1,202,296
3	799.0	15,621,387	1,202,329

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.

REVISIONS	DATE	BY	DESCRIPTION

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

COUNTY ROAD 6

HIGHWAY NO Prop. 402 LINE 'A' DIST NO 2
CO MIDDLESEX
TWP ADELAIDE LOT 6 & 7 CON I & II

BORE HOLE LOCATIONS & SOIL STRATA

SUBMIT PJS	CHECKED	WP NO 41-66-29	DRAWING NO
DRAWN	CHECKED	W.O. NO	416629-A
DATE	JULY 24, 1975	SITE NO 19-519	BRIDGE DRAWING NO
APPROVED		CONT NO	



Memorandum

To: Mr. K. G. Selby, Head
Soil Mechanics Section
Geotechnical Office
West Bldg., Downsview

From: Structural Planning Office
Southwestern Region

Attention:

Date: May 16, 1975

Our File Ref.

In Reply to

Subject: W.P. 41-66-29, Bridge Site 19-519
County Road 6 Interchange Underpass
5.8 miles west of Hwy. 81 north of Strathroy
Highway 402
District 2, London

Would you kindly arrange to have a foundation investigation conducted at the above location.

Enclosed please find 2 prints of the bridge site plan E-5377-1 with the probable footing locations marked in red. Also enclosed is the Field Reconnaissance Report and pictures for the above location.

S. Jants

S. Jants
Structural Planning Supervisor

SJ:sm
Enc.

cc J. Anderson
A. Crowley
J. Forster





looking west



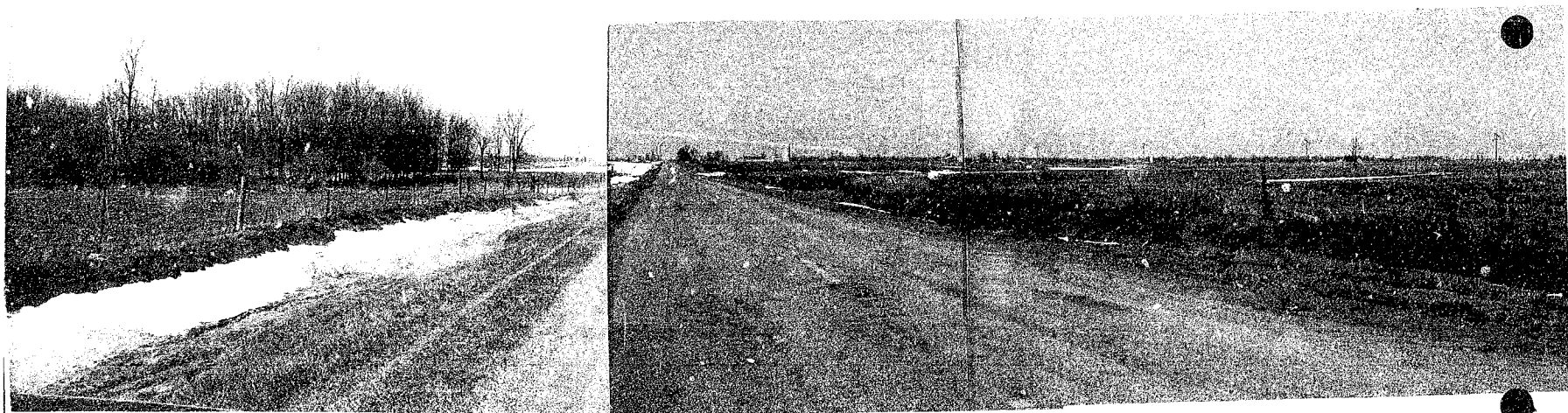
looking east

W.P. 41-66-29

Co. Rd. 6 Interchange U'Pass

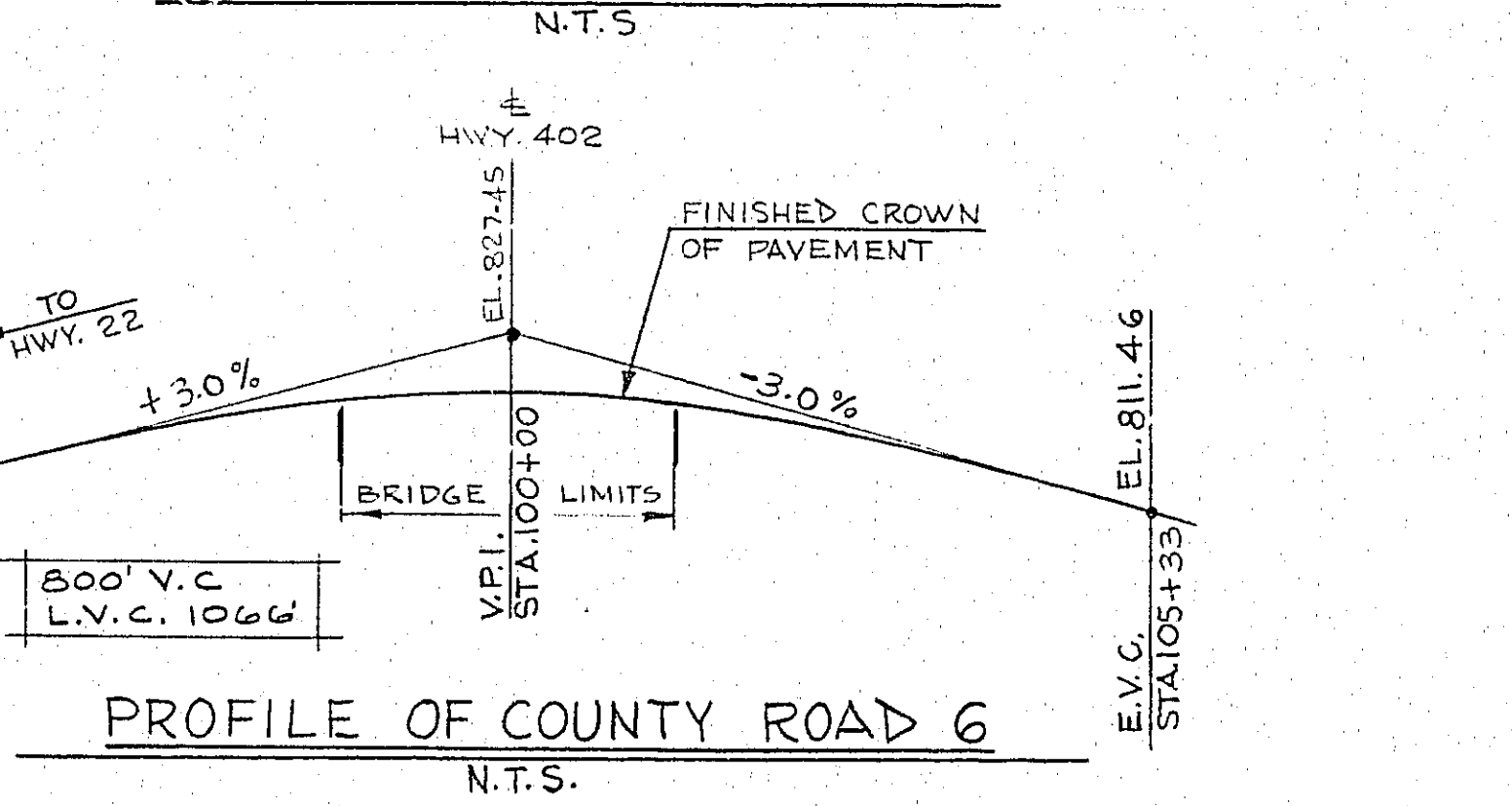
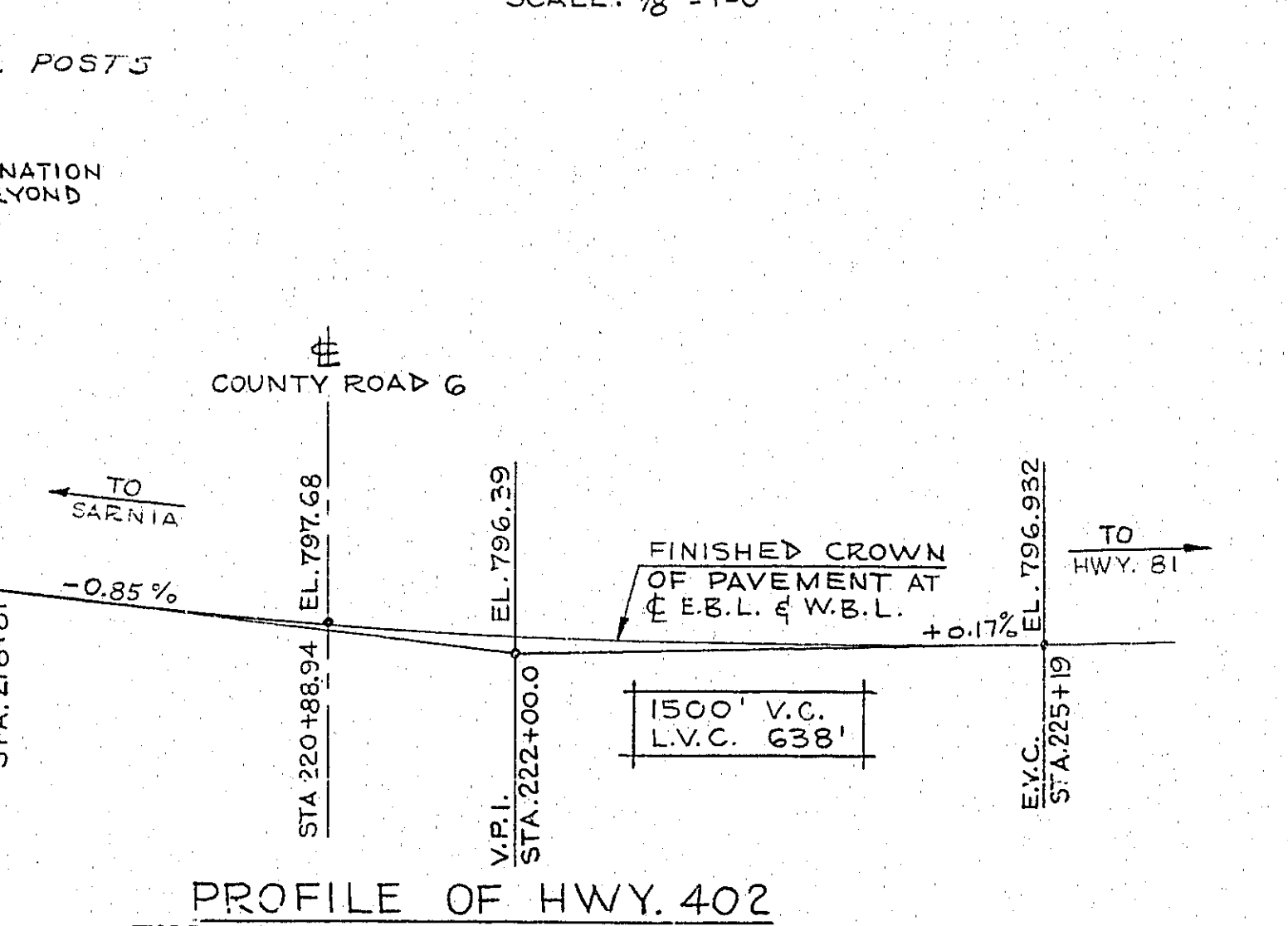
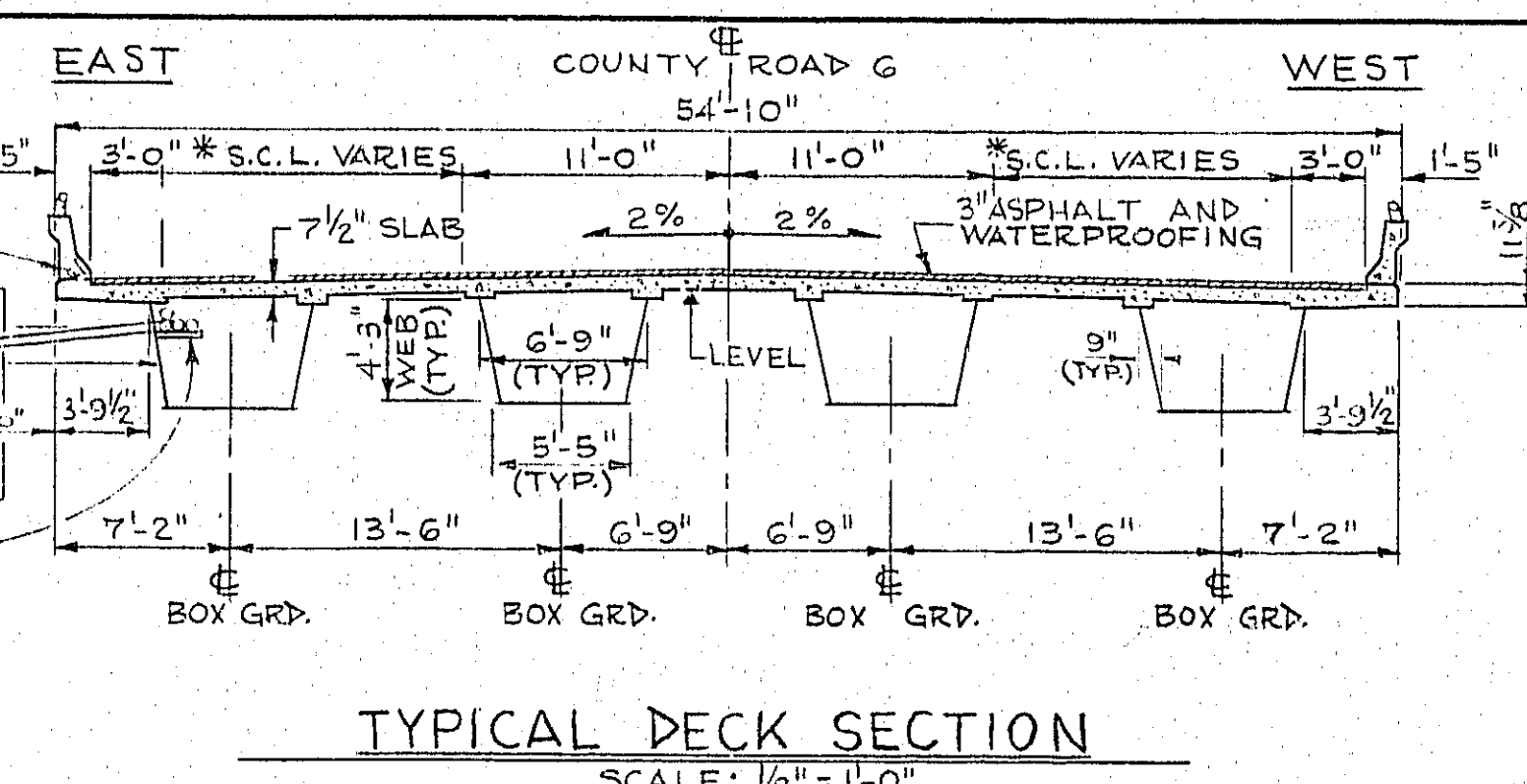
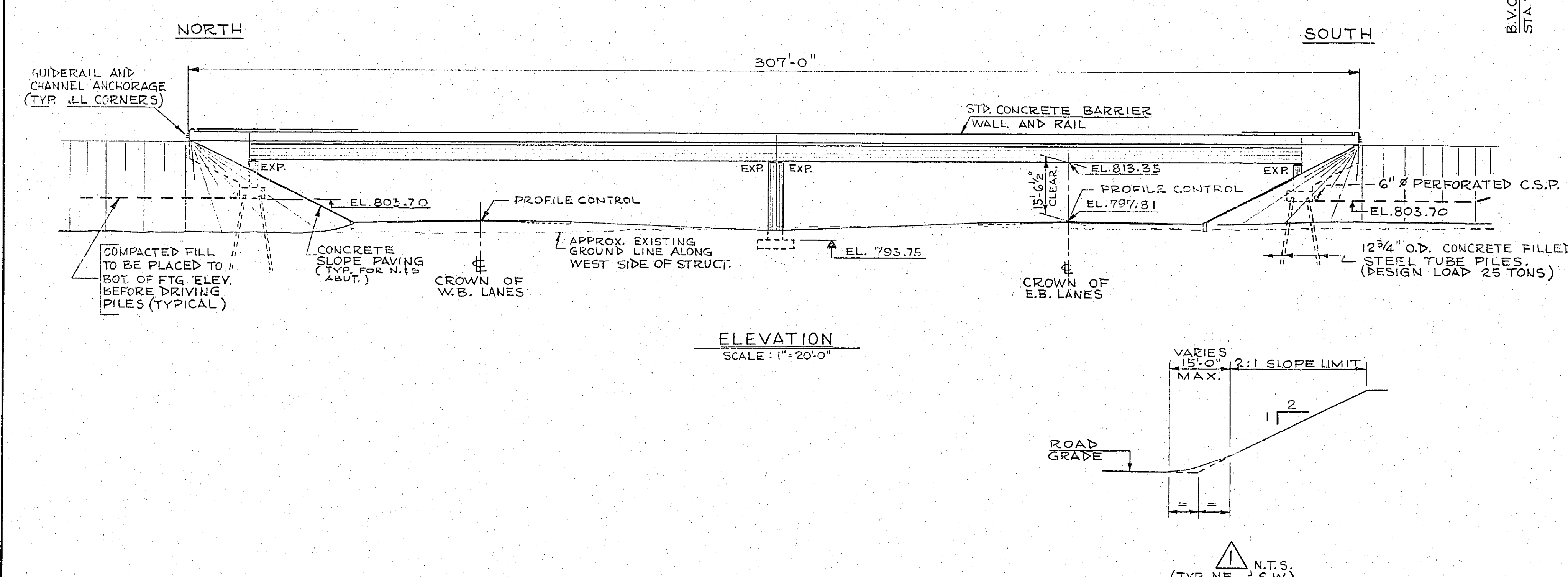
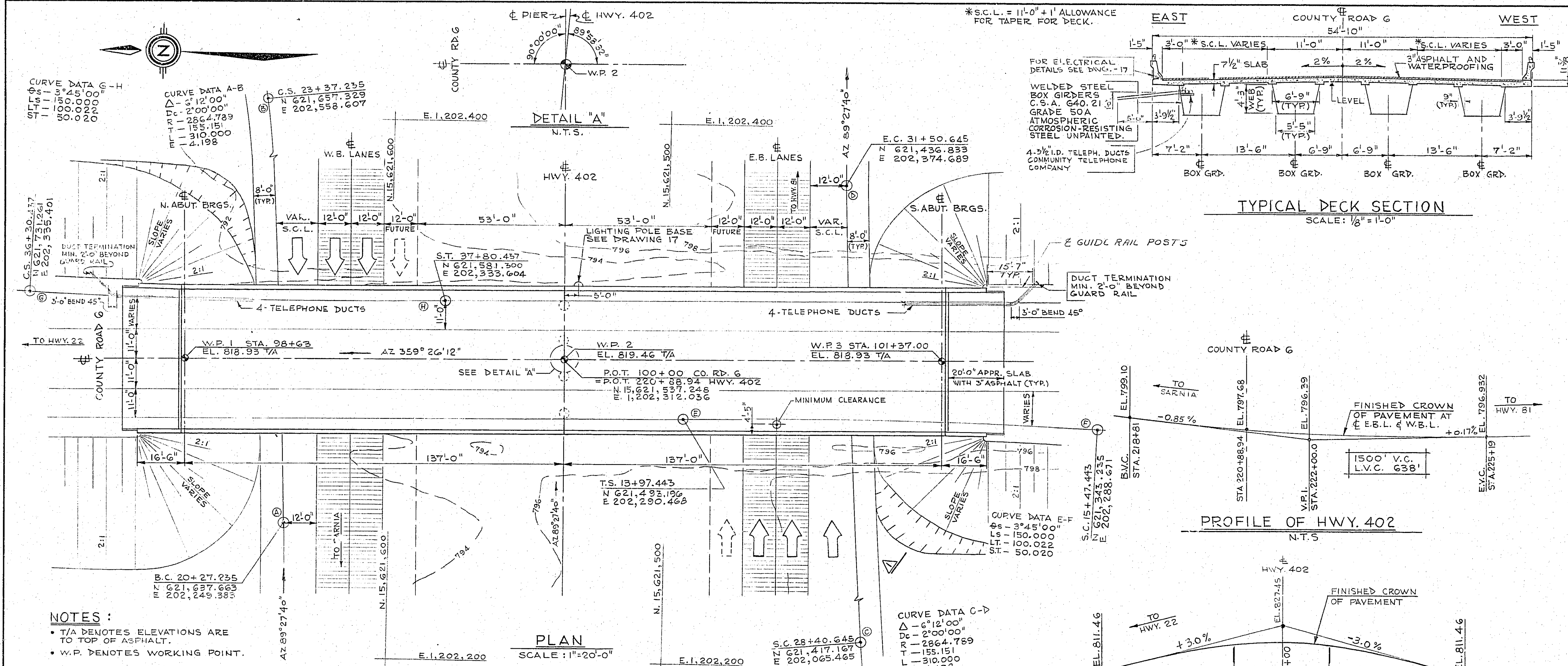
Hwy. 402

Bridge Site 19-519



General view looking north

17/4/75



- LIST OF DRAWINGS**
- 19-519-1 GENERAL LAYOUT
 - 2 BOREHOLE LOCATIONS AND SOIL STRATA
 - 3 FOUNDATION LAYOUT
 - 4 ABUTMENTS
 - 5 PIER
 - 6 STRUCTURAL STEEL
 - 7 BEARING DETAILS
 - 8 DECK
 - 9 CONCRETE BARRIER WALL (2'-8" HIGH)
 - 10 STEEL PARAPET RAILING (SINGLE TUBE)
 - 11 20 FT. APPROACH SLAB (BARRIER WALL)
 - 12 DETAILS OF CONCRETE SLOPE PAVING
 - 13 STANDARD DETAILS I
 - 14 " " " " II
 - 15 " " " " III
 - 16 AS CONSTRUCTED ELEV. & DIM.
 - 17 BRIDGE ELECTRICAL DETAILS - TYPE IV

DIST. No. 2

CONT No 76-122

WP No 41-66-29

COUNTY RD. 6 INTERCHANGE U-PASS
5.8 mi. west of Hwy. 81 (north of Strathroy)

SHEET 167

GENERAL LAYOUT

NOTES:

CLASS OF CONCRETE

DECK AND BARRIER WALLS 4000 p.s.i.

PIER COLUMNS 4000 p.s.i.

REMAINDER 3000 p.s.i.

OR AS NOTED ON DRAWINGS.

CLEAR COVER ON REINFORCING STEEL

FOOTINGS, ABUTMENTS, PIER COLUMNS, DECK TOP 2"

3" 3" 2"

BARRIER WALLS, APPROACH SLABS 1 1/2"

OR AS NOTED ON DRAWINGS.

CONSTRUCTION NOTES

THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ± 1/8 INCH.

NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.

CONCRETE QUANTITIES

CONCRETE QUANTITIES ARE LISTED BELOW FOR THE APPROPRIATE CONCRETE LUMP SUM TENDER ITEMS:

1. CONCRETE IN PIERS, ABUTMENTS AND WINGWALLS 4000 p.s.i. 46.6 cu.yd.

3000 p.s.i. 132.4 cu.yd.

2. CONCRETE IN DECK 394.9 cu.yd.

3. CONCRETE IN BARRIER WALLS 53.4 cu.yd.

4. CONCRETE IN APPROACH SLABS 65.3 cu.yd.

5. CONCRETE IN SLOPE PAVING 57.8 cu.yd.

STRUCTURAL STEEL QUANTITIES

TOTAL 296.0 TONS

REINFORCING STEEL

GRADE 60 REINFORCING STEEL IS REQUIRED FOR SOME PARTS OF THE BRIDGE AS IDENTIFIED ON ON DRAWINGS AND IN THE REINFORCING STEEL SCHEDULE.

FORMWORK

EXPANDED POLYSTYRENE BETWEEN END OF DECK AND BALLAST WALL AND DECK EXPANSION JOINT OVER THE PIER SHALL BE REMOVED BY THE CONTRACTOR.

B.M. 786.43

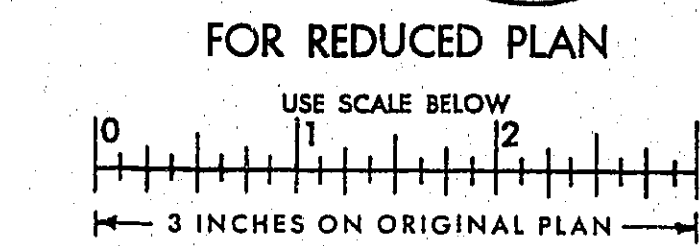
GEODETIC DATUM

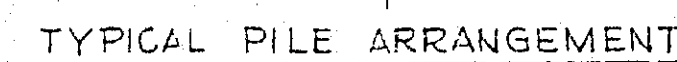
CUT CROSS ON SE CORNER OF CONC. C.B.
646' LT. 220+50

REVISIONS	DATE	BY	DESCRIPTION
1			
2			
3			

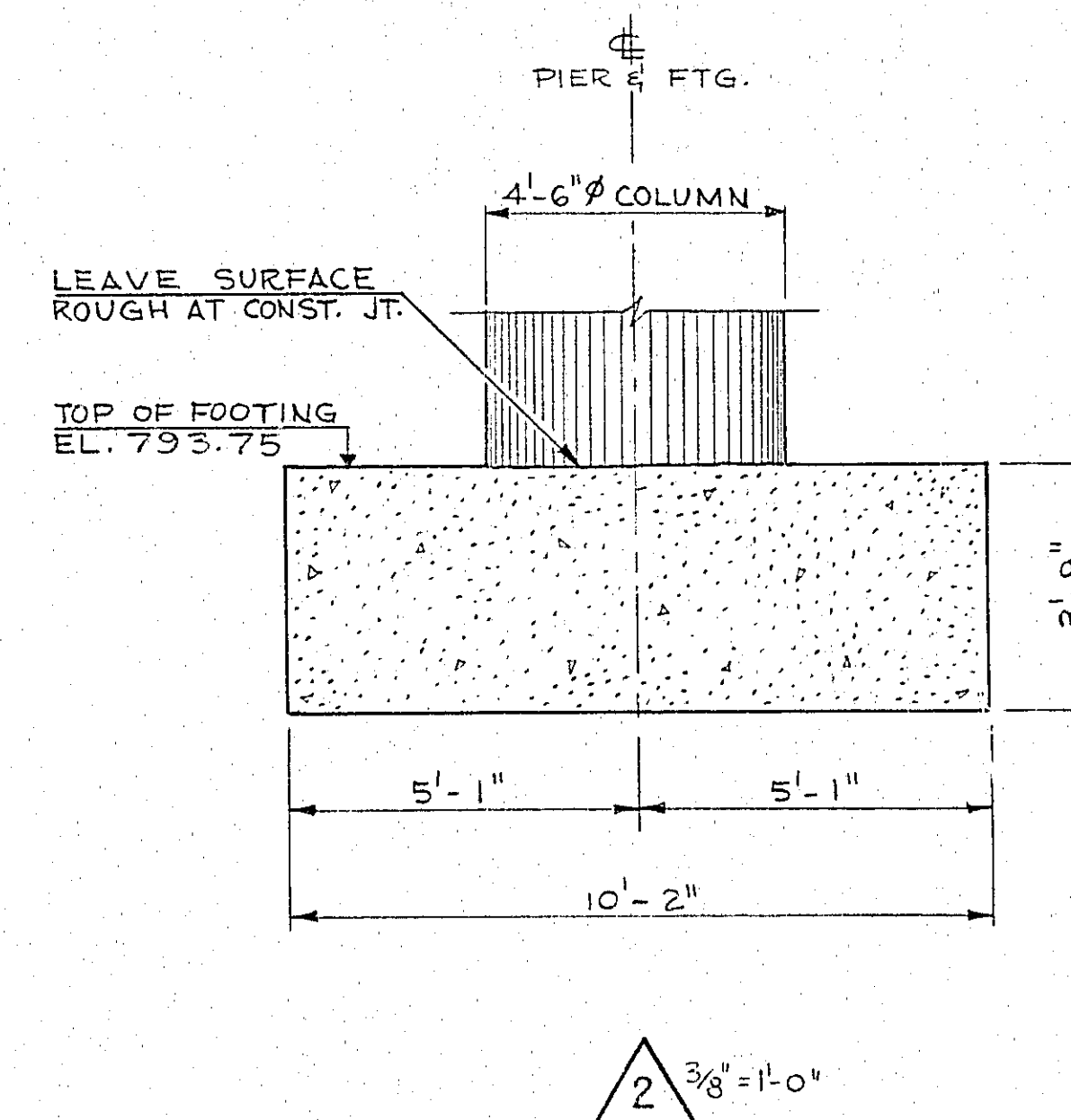
DESIGN K.Z.S. CHECK A.K. LOADING H520.44 DATE JUNE 78

DRAWING GFM CHECK K.Z.S. SITE No 19-519 DWG 1





TYPICAL DIMENSIONS



PILE DATA TABLE			
LOCATION	NO.	LENGTH	BATTER
NORTH ABUTMENT	20	23'-0"	3:1
	10	22'-0"	5:1
	8	22'-0"	8:1
	4	21'-0"	—
SOUTH ABUTMENT	20	16'-0"	3:1
	10	16'-0"	5:1
	8	16'-0"	8:1
	4	15'-0"	—

- ALL PILES ARE 12 3/4" O.D. X 0.25" WALL STEEL TUBE PILES.
- TUBE PILES TO BE FILLED WITH 3000 P.S.I. CONCRETE AFTER INSTALLATION AND INSPECTION.
- PILES SHALL BE DRIVEN IN ACCORDANCE WITH S.W. CR. 100.00, SECTION 100.00, PILE BUT NOT BELOW EL. 790.00 S.B., BUT. FOOTING AND EL. 784.00 N.B., BUT. FOOTING. WITHOUT APPROVAL OF THE ENGINEER.
- PILE LAYOUT GIVEN AT UNDERSIDE OF ABUTMENT FOOTINGS. DIMENSIONS AND PILE LOCATIONS SHOWN ON THE DRAWINGS.

CONCRETE IN TUBE PILES ——— 49 cu.yd.

3	REVISIONS						
	DATE	BY	DESCRIPTION				
	DESIGN K.Z.S	CHECK A.L	LOADING	H520-44	DATE	JUNE/7	
	DRAWING GEM	CHECK K.Z.S	SITE No	18-519	DWG.	3	

Twp # 213-519-3-A

FOR REDUCED PLAN

USE SCALE BELOW



APPENDIX B

Site Photographs



Photograph 1: North Abutment and West Wingwall of West Bound Lane. Abutment slopes are grass covered and no obvious signs of erosion observed on slope. Central portion covered with rip rap (September 2, 2015).



Photograph 2: South Abutment and East Wingwall of East Bound Lane. Central portion of abutment covered with rip rap (September 2, 2015).



Photograph 3: Central Pier Supports seem to be in good condition with no cracking observed on piers (September 2, 2015).



Photograph 4: South Abutment and East Wingwall. No obvious signs of cracking observed on the wall (September 2, 2015).



Photograph 5: North Abutment and East Wingwall. Minor cracks observed on this wall (September 2, 2015).