

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

401-183

TO: Mr. A. P. Watt, (2)
Regional Structural Planning Eng.,
Southwestern Region,
London, Ontario.

FROM: Foundations Office,
Design Services Branch,
West Bldg., Downsview.

ATTENTION:

DATE: August 13, 1973.

OUR FILE REF.

IN REPLY TO

AUG 28 1973

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
Proposed Crossing at St. Thomas
Expressway and County Road #52
Twp. of Southwold, Co. of Elgin
District #2 (London)
W.O. 73-11021 -- W.P. 89-69-07

40114-35
GEOCRE No.

Attached we are forwarding to you our detailed foundation investigation report on the subsoil conditions existing at the above-mentioned site.

We believe that the factual data and recommendations contained therein will prove adequate for your design requirements. Should additional information be required, please do not hesitate to contact our Office.

AGS/ao
Attch.

c.c. E. J. Orr
B. R. Davis
A. Rutka
A. Wittenberg
L. E. Walker
B. J. Giroux
J. R. Roy
G. A. Wrong
B. A. Singh

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATIONS ENGINEER.

Foundations Files ✓
Documents

TABLE OF CONTENTS

1. INTRODUCTION
2. DESCRIPTION OF THE SITE AND GEOLOGY
3. FIELD AND LABORATORY INVESTIGATION PROCEDURES
4. SUBSOIL CONDITIONS
 - 4.1) General
 - 4.2) Clayey Silt to Silty Clay, Some Sand and Traces of Gravel
5. GROUNDWATER CONDITIONS
6. DISCUSSIONS AND RECOMMENDATIONS
 - 6.1) General
 - 6.2) Foundations
 - a) Spread Footings in Original Ground
 - b) Spread Footings on Compacted Fill
 - c) Perched Abutments on Short Piles
 - 6.3) Approach Embankments
7. MISCELLANEOUS

FOUNDATION INVESTIGATION REPORT

For

Proposed Crossing at St. Thomas
Expressway and County Road #52
Twp. of Southwold, County of
Elgin
District #2 London
W.O. 73-11021 W.P. 89-69-07

1. INTRODUCTION

A request for a foundation investigation at the crossing of the proposed St. Thomas Expressway and Elgin County Road #52 was received from Mr. A.P. Watt, Regional Structural Location Engineer, Southwestern Region, in a memo dated March 29, 1973. Subsequently, the Foundations Office carried out a field investigation to determine the subsoil and groundwater conditions existing at the site.

This report contains all the factual data from this investigation, together with recommendations pertaining to the design of the proposed structure foundations and approach embankments.

2. DESCRIPTION OF THE SITE AND GEOLOGY

The site of the proposed structure is some 2.5 miles northwest of the City of St. Thomas and approximately 1 mile east of Talbotville and near the present intersection of Elgin County Roads #52 and #26 in the Township of Southwold.

Topographically, the proposed bridge site is in a flat mainly cultivated agricultural area. In the immediate

vicinity of the site the land has been left to fallow grass.

Physiographically, the site is located in the region referred to as the Mount Elgin Ridges.

3. FIELD AND LABORATORY INVESTIGATION PROCEDURES

A total of three sampled boreholes and six dynamic cone penetration tests were carried out during the course of the field work. One sampled borehole and two cone penetration tests were put down at each of the proposed structure footing locations. Boring was achieved by means of a CME 750 hollow stem auger machine which was adapted for soil sampling purposes. During the field work, disturbed samples were obtained by means of a standard 2 inch O.D. split-spoon sampler; the energy used in driving it, conformed to the requirements of the Standard Penetration Test. Driving energy to advance the cones was 350 ft. lbs. per blow.

All boreholes were surveyed in the field by personnel from London Region's Engineering Surveys Section. The locations and elevations of the borings and cone tests are shown on Drawing No. 73-11021A which accompanies this report.

All borehole samples were subjected to a careful visual examination and classification in the field and subsequently in the laboratory. Following this inspection, laboratory tests were carried out on selected samples to determine the following physical properties:

Atterberg Limits

Moisture Content

Grain Size Distribution

The results of the field and laboratory tests are summarized on the Record of Borehole sheets contained in the Appendix of this report.

4. SUBSOIL CONDITIONS

4.1) General

Generally, uniform subsoil conditions were found to prevail over the site area. The subsoil consists of a deep deposit of clayey silt to silty clay containing small amounts of sand and traces of gravel. Drawing 73-11021A shows the general stratigraphical profile in this area based on information contained in the Record of Borehole sheets. A more detailed description of the subsoil with regards to soil properties follows.

4.2) Clayey Silt to Silty Clay, Some Sand
and Traces of Gravel

This was the only deposit encountered at all borehole locations. The lower boundary was not determined since the borings were terminated in this stratum, but extends to a minimum depth of 82 ft. (EL 698.0).

The material consists of clayey silt to silty clay with some sand and traces of gravel. Occasional pockets and/or thin seams of silt (1/16" - 1/4" thickness) were also discovered within the main deposit. Although no conspicuous

sand layers were intersected, it is possible that some randomly distributed sand partings could be present. It should be noted that these randomly distributed silt seams and sand partings could possibly act as water bearing seams. The upper four to six feet portion of the stratum is brown in colour, due probably to oxidation. Below this zone the colour changes to grey-brown, to grey and the natural moisture content, in general, is at or below the plastic limit.

Standard Penetration test 'N' values obtained within the stratum ranged from 15 blows/ft. to 48 blows/ft., indicating a very stiff to hard consistency for the deposit. Based on these 'N' values, the undrained shear strength of the stratum appears to be everywhere greater than 2,000 p.s.f. and as high as 5,000 p.s.f. with an average strength of 3,000 p.s.f. Laboratory tests on similar soil samples recovered in the same vicinity under another project (W.P. 89-69-05 & 06) tend to confirm the undrained shear strength of the deposit as being between 2,000 p.s.f. to 5,000 p.s.f. with an average of 3,000 p.s.f.

Physical properties of the overall deposit, as determined from field and laboratory tests, are as follows:

		<u>Average</u>
Natural Moisture Content	12 - 19 %	15%
Liquid Limit	29 - 42 %	36%
Plastic Limit	13 - 22 %	18%

A plot of Plasticity Index vs. Liquid Limit taken from the above data is given as Figure 1 and shows the majority of points plotted to fall within the clayey silt zone.

Grain size analyses on the same samples indicate the following distribution (See Figure 2):

	<u>Min.</u>	<u>Max.</u>	<u>Average</u>
Gravel %	0	4	2
Sand %	9	32	20
Silt %	40	56	48
Clay %	25	40	33

5. GROUNDWATER CONDITIONS

Due to the relatively impermeable nature of the subsoil and short duration of the field work, groundwater levels at the site could not be established conclusively. However, it is felt that the natural water table in the area is well below the elevation of the proposed structure footings. It should be pointed out that the randomly distributed silt seams and/or sand partings could act as water bearing seams.

6. DISCUSSIONS AND RECOMMENDATIONS

6.1) General

It is proposed to construct a two-span (99.0' - 95.0') structure to carry Elgin County Road #52 over the new St. Thomas Expressway. The general ground elevation

in the area is at the 779 ft. level with centerline profile grades of approximately 806.0 ft. and 785.0 ft. for County Road #52 and the St. Thomas Expressway respectively. As such the approach embankments will be some 27 ft. high.

As described previously, the subsoil in the area consists of a deep deposit of very stiff to hard clayey silt to silty clay with small amounts of sand and gravel. This subsoil appears to be suitable for a spread footing type of foundation.

Because of the compressible nature of the subsoil it is inevitable that some consolidation settlements will occur over a long-term period of time due to the imposed footing and embankment loads. Past experience indicates however, that these settlements will be of a minor nature.

6.2) Foundations

a) Spread Footings in Original Ground

The entire structure may be supported on spread footings placed within the very stiff to hard clayey silt to silty clay deposit. A safe bearing pressure of 3.0 TSF may be assumed for design purposes.

b) Spread Footings on Compacted Fill

As an alternative, the abutments may be supported on well compacted, granular material within the approach fills. A safe design load of 2.5 TSF may be assumed. The

granular material should consist of granular 'A' and should be fully compacted according to the current Standards. A detailed construction scheme is outlined on Figure 3 in the Appendix.

c) Perched Abutments on Short Piles

As a second alternative, the abutments may be constructed within the approach fills and supported on short piles driven through the fill to approximately elevation 771.0 (i.e. 8.0 ft. into original ground). In the case of 12 $\frac{3}{4}$ " O.D. and $\frac{1}{4}$ " thick wall steel tube piles, a safe design load of 25 tons per pile may be used.

It is estimated that the following maximum settlements will occur in the subsoil at various locations over a long period of time following the end of construction.

Pier	- Spread footings in original ground	} - 1.0 - 1.5 in.
Abutment	- Spread footings in original ground	
	- Spread footings on compacted fill	} - 2.5 - 3.5 in.
	- Perched abutments on short piles	

Regardless of which of the above methods is adopted, the structure should be designed to accommodate the possible 2.0 to 2.5 inches differential settlements between the abutments and the pier.

All foundations and pile caps should be protected against frost action by at least 4.0 feet of earth cover.

6.3) Approach Embankments

The subsoil shear strength is such that 27 ft. high embankments with 2:1 side slopes will be safely supported. The till should consist of well compacted acceptable material. Care should be taken not to place any bouldery fill within the approaches in the area through which piles may have to be driven, and it is recommended that this portion of the fill contain grain sizes no larger than 3 inches.

Based on the performance of structures and embankments built in the same general area under somewhat similar subsoil conditions, the maximum settlement due to consolidation of the subsoil directly beneath the abutment footings caused by embankment loading is estimated to be in the order of 3 inches.

To minimize differential settlements between the abutments and centre pier it is recommended that the approach fills be built in advance of the structure by as long a period as possible.

Topsoil and any soft organic material should be removed, prior to placing approach fills, in accordance with the pertinent standards within the construction area.

7. MISCELLANEOUS

The field investigation was carried out during the period of May 18 - May 22, 1973, under the supervision of Mr. L.J. Hodge, Project Foundations Engineer, who also

prepared this report. The entire project was under the supervision of Mr. A. Prakash, Senior Foundations Engineer.

The equipment used was owned and operated by Dominion Soils Investigations Co. Ltd.

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

L. J. Hodge

L. J. Hodge

K. G. Selby

K. G. Selby, P. Eng.

LJH/jf
Aug. 13, 1973.

APPENDIX I

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1

JOB 73-11021

LOCATION Co-ords. 15,556,624 N; 1,340,915 E.

ORIGINATED BY LJH

W.P. 89-69-07

BORING DATE May 18, 1973

COMPILED BY LJH

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger & Cone

CHECKED BY ML

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w w_p — w — w_L	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT					
777.7	Ground Level									
0.0										
	Brown Grey		1	SS	27	770				0 13 47 40
			2	SS	27					
			3	SS	36	760				
	Clayey silt to silty clay, some sand, traces of gravel.		4	SS	33					4 15 48 33
	Occasional thin seams or pockets of silt.		5	SS	33	750				
			6	SS	43					
	Very Stiff to Hard		7	SS	33	740				
			8	SS	31					
			9	SS	30	730				
			10	SS	40					
			11	SS	26	720				Hole Dry
716.2			12	SS	24					1 19 45 35
61.5	End of Borehole					710				

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2

JOB 73-11021 LOCATION Co-ords. 15,556,715 N; 1,340,955 E.
W.P. 89-69-07 BORING DATE May 18, 1973
DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger & Cone

ORIGINATED BY LJH
COMPILED BY LJH
CHECKED BY MS

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT w_L		BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT	BLOWS / FOOT	PLASTIC LIMIT w_p	WATER CONTENT w			
777.8	Ground Level										
			1	SS	31						
			2	SS	26						
			3	SS	27						
			4	SS	25						
			5	SS	26						
			6	SS	25						
			7	SS	36						
			8	SS	37						
			9	SS	36						
			10	SS	45						
726.3											
51.5	End of Borehole										

OFFICE REPORT SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 3

JOB 73-11021

LOCATION Co-ords. 15,556,767 N; 1,341,045 E

ORIGINATED BY L.J.H.

W.P. 89-69-07

BORING DATE May 22, 1973

COMPILED BY L.J.H.

DATUM GEODETIC

BOREHOLE TYPE HOLLOW STEM AUGER AND CONE

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			BULK DENSITY γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	w_p	w	w_L	
779.3	GROUND LEVEL														
0.0	Brown Grey		1	SS	45										2 31 53 32
			2	SS	48	770									
	Clayey silt to silty clay, some sand, traces of gravel		3	SS	31										1 18 47 34
			4	SS	25	760									
			5	SS	15										
			6	SS	26	750									
	occasional thin seams or pockets of silt.		7	SS	43										
			8	SS	26	740									
	Very Stiff to Hard		9	SS	26										3 9 56 32
			10	SS	19	730									
			11	SS	18										
			12	SS	27	720									
			13	SS	26	710									
697.8			14	SS	30	700									HOLE DRY.
81.5	END OF BOREHOLE														3 32 40 25
						690									

FOUNDATIONS OFFICE

JOB 73-11021

LOCATION _____ Co-ords. 15,556,642 N; 1,340,891 E

ORIGINATED BY L.J.H.

W.P. 89-69-07

BORING DATE May 22, 1973

COMPILED BY L.J.H.

DATUM GEODETIC

BOREHOLE TYPE CONE TEST

CHECKED BY AK

[illegible]

20
15 ϕ 5 % STRAIN AT FAILURE
10

FOUNDATIONS OFFICE

JOB 73-11021

LOCATION Co-ords.. 15556694.38N; 1340978.19E

ORIGINATED BY L.J.H.

W.P. 89-69-07

BORING DATE May 22, 1973

COMPILED BY L.J.H.

DATUM GEODETIC

BOREHOLE TYPE CONE TEST

CHECKED BY 17

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ———— w_L	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS/FOOT	20 40 60 80 100		
						SHEAR STRENGTH P.S.F.	WATER CONTENT ———— w		
						○ UNCONFINED + FIELD VANE	w_p ———— w ———— w_L		
						● QUICK TRIAXIAL × LAB VANE	WATER CONTENT %		
778.2 0.0	GROUND LEVEL								P.C.F. GR. SA. SI. CL.
763.3 14.9	END OF CONE TEST								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 6

JOB 73-11021

LOCATION Co-ords. 15556788.65N; 1341022.06E

ORIGINATED BY L.J.H.

W.P. 89-69-07

BORING DATE May 18, 1973

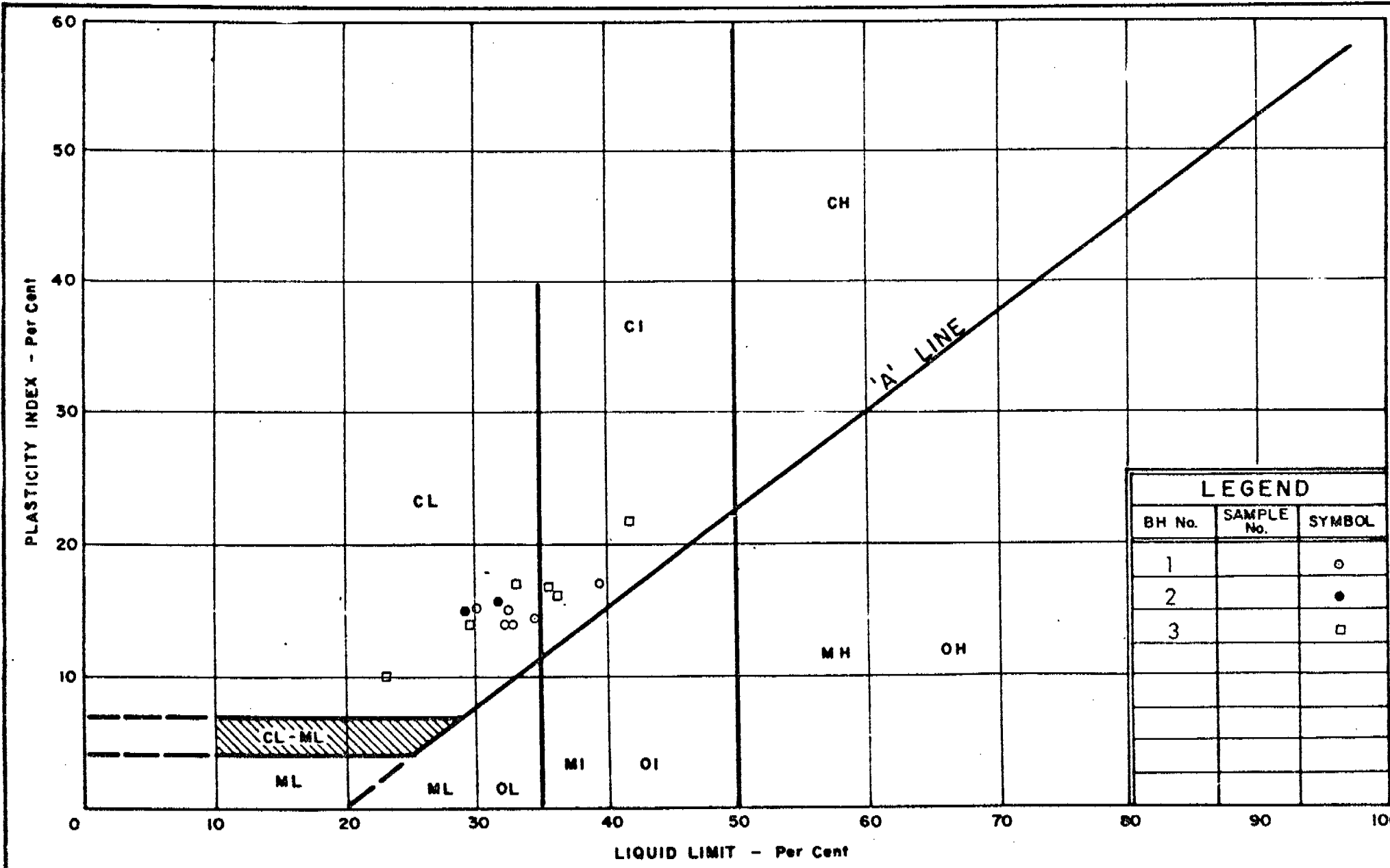
COMPILED BY L.J.H.

DATUM GEODETIC

BOREHOLE TYPE CONE TEST

 CHECKED BY *HS*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w w_p — w — w_L WATER CONTENT %	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS / FOOT					
779.4	GROUND LEVEL									
768.5						770				
10.9	END OF CONE TEST					760				



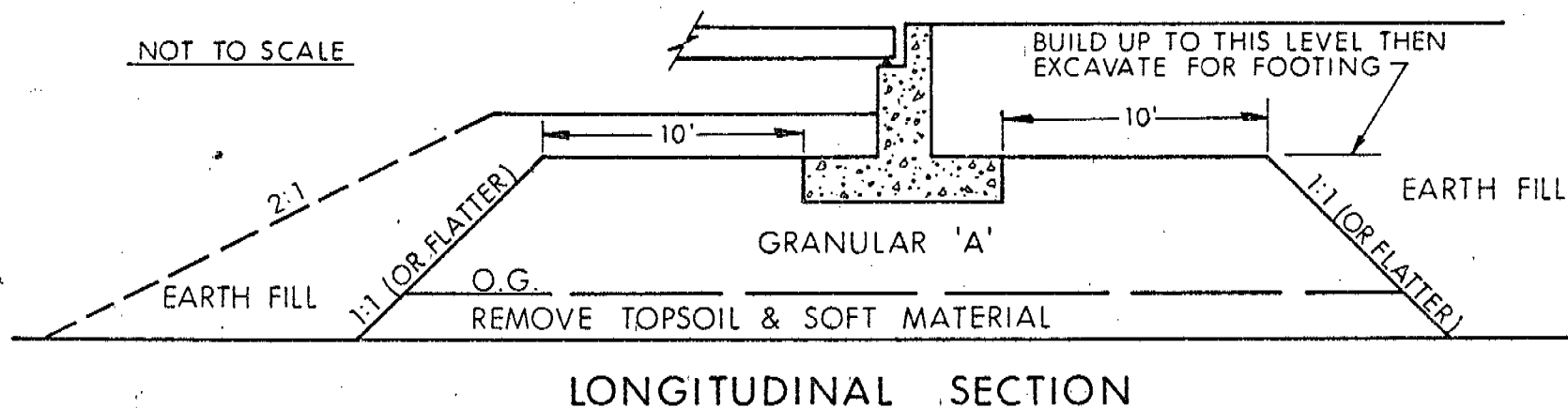
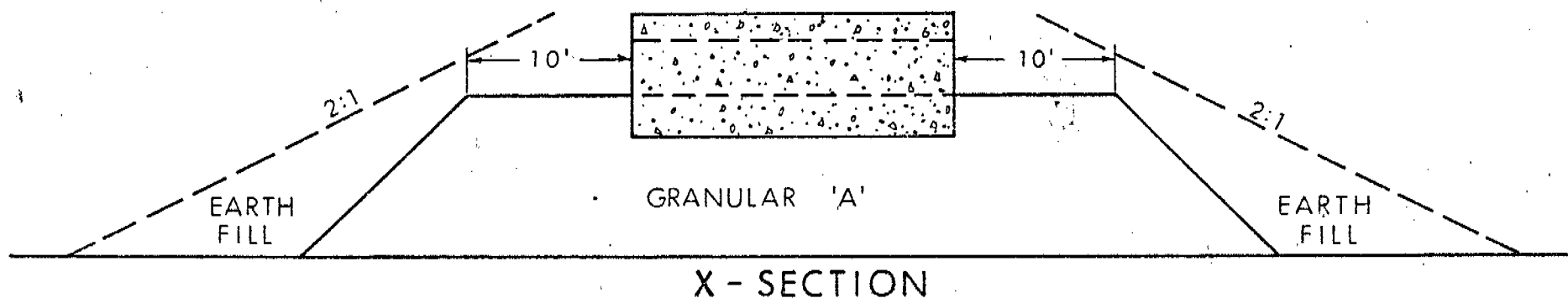
DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART

CLAYEY SILT TO SILTY CLAY

WP. No. 89-69-07
JOB No. 73-11021
FIG. 1

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.

ABBREVIATIONS & SYMBOLS USED IN THIS REPORTPENETRATION RESISTANCE

'N' STANDARD PENETRATION RESISTANCE : - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE :- THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

<u>CONSISTENCY</u>	<u>c LB./SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 250	VERY LOOSE	0 - 4
SOFT	250 - 500	LOOSE	4 - 10
FIRM	500 - 1000	COMPACT	10 - 30
STIFF	1000 - 2000	DENSE	30 - 50
VERY STIFF	2000 - 4000	VERY DENSE	> 50
HARD	> 4000		

TERMS TO BE USED IN DESCRIBING SOILS:-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC.

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

U	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V.	FIELD VANE
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
I_p	PLASTICITY INDEX
w_s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_C	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
c_v	COEFFICIENT OF CONSOLIDATION
C_a	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
T_v	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
$\bar{\sigma}$	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

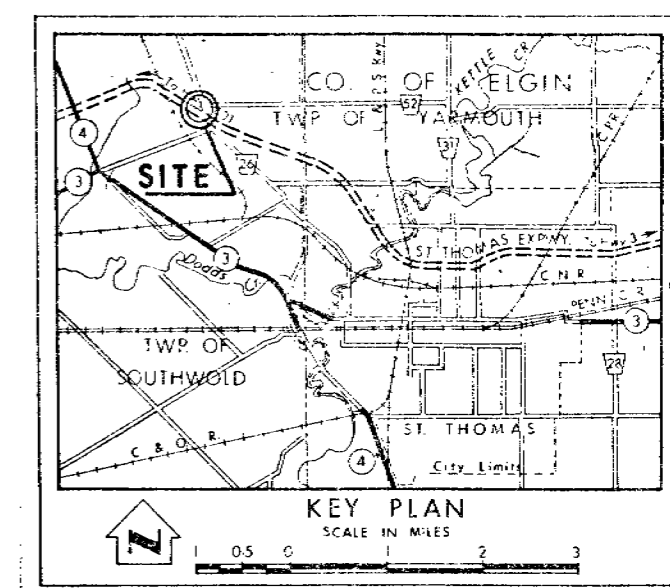
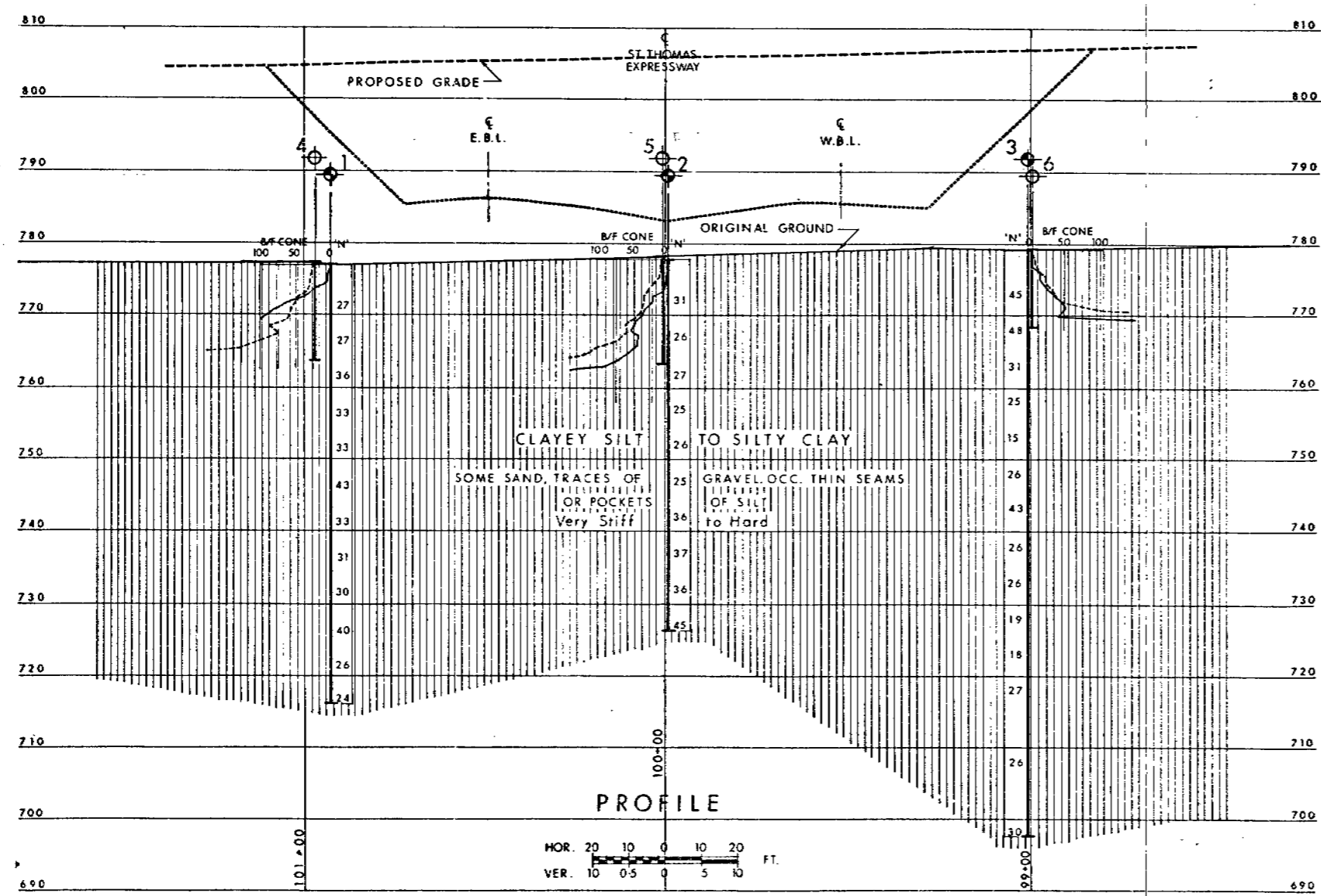
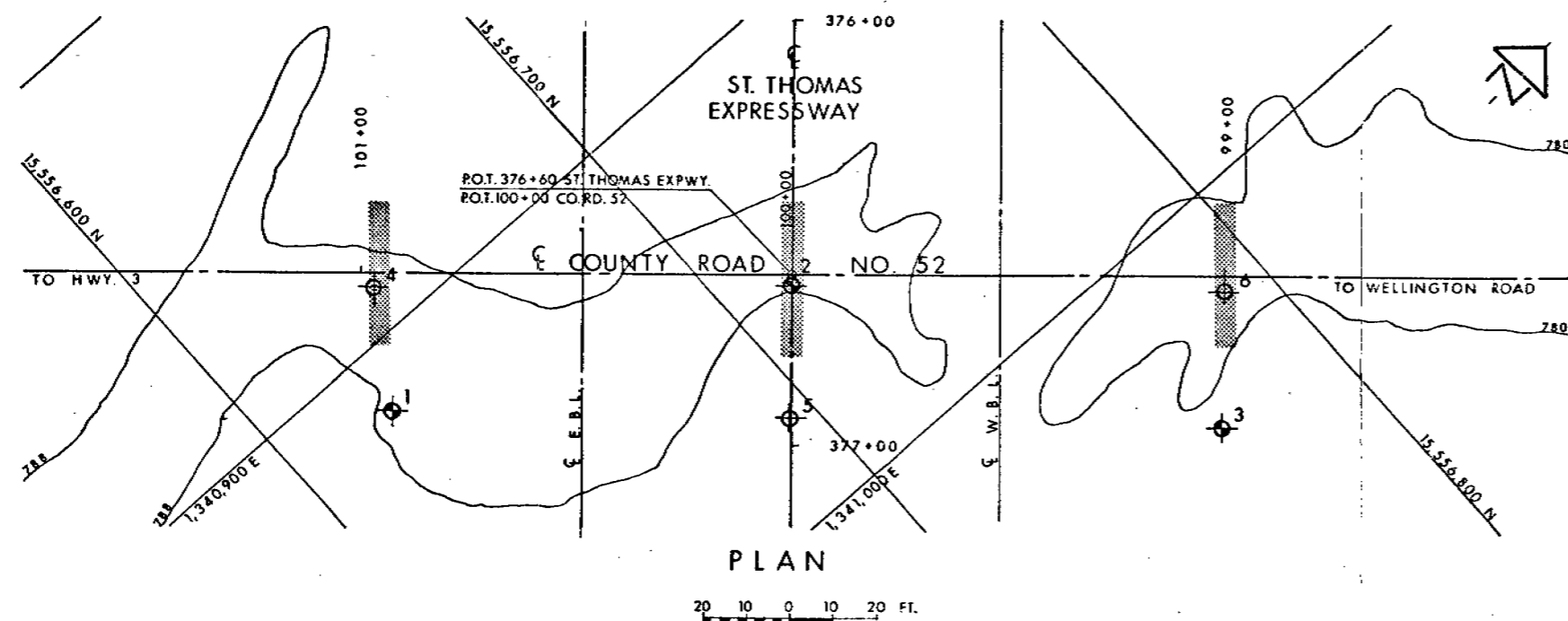
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



LEGEND			
	Bore Hole		
	Cone Penetration Test		
	Bore Hole & Cone Test		
	Water Levels established at time of field investigation.		
	Holes Dry May 1973		

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	777.7	15,556,624	1,340,915
2	777.8	15,556,715	1,340,955
3	779.3	15,556,767	1,341,045
4	777.3	15,556,642	1,340,891
5	778.2	15,556,694	1,340,978
6	779.4	15,556,789	1,341,022

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
DESIGN SERVICES BRANCH—FOUNDATIONS OFFICE

COUNTY ROAD NO. 52

HIGHWAY NO. PROP. ST. THOMAS EXPWY. DIST. NO. 2
CO. ELGIN
TWP. SOUTHWOLD LOT CON

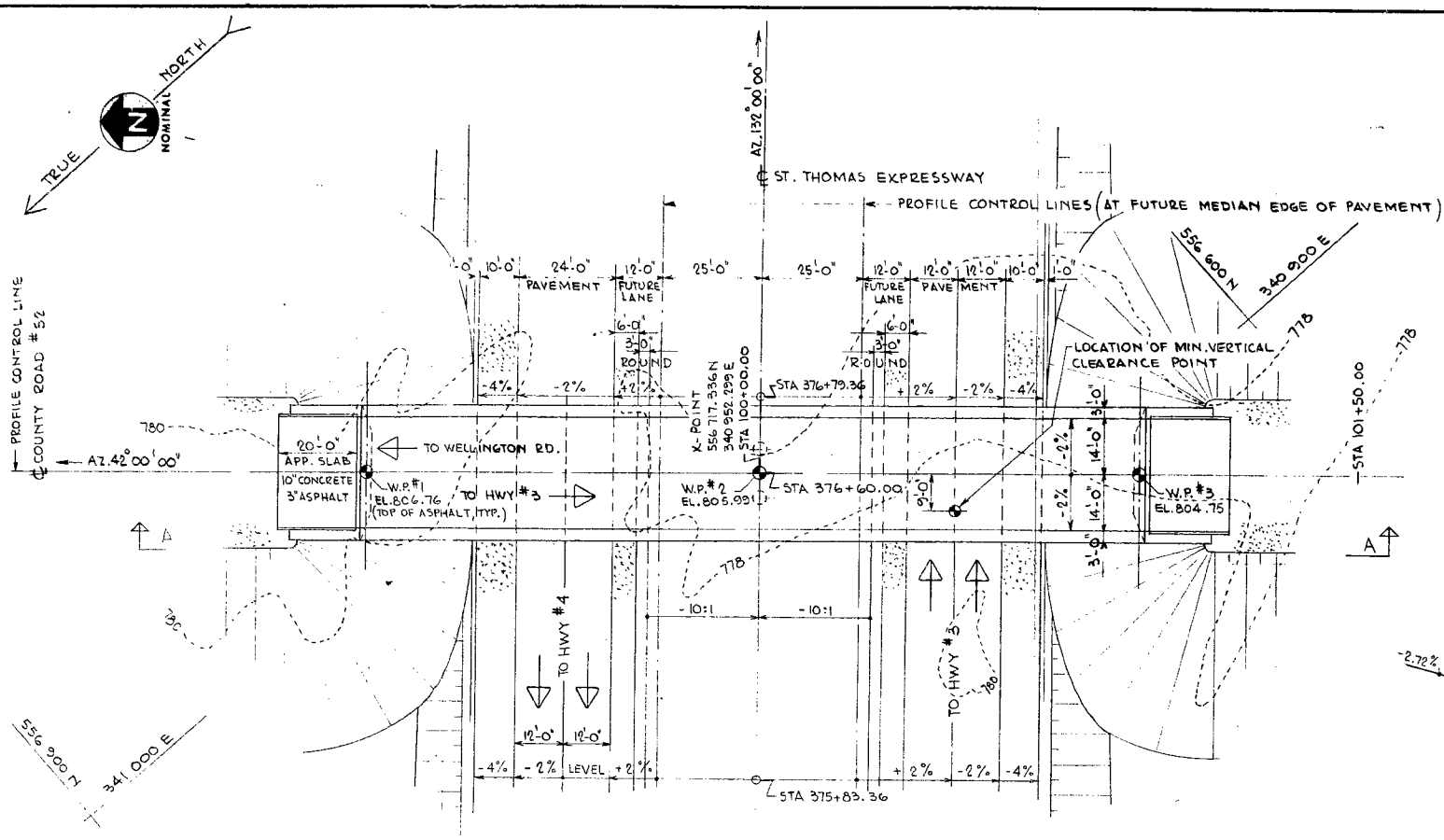
BORE HOLE LOCATIONS & SOIL STRATA

SUBWD. A. P. CHECKED	WP. NO. 89-69-4	DRAWING NO.
DRAWN OL. J. CHECKED	WO. NO. 73-11021	73-11021A
DATE 20 AUG 1973	SITE NO.	BRIDGE DRAWING NO.
APPROVED <i>[Signature]</i>	CONT. NO.	

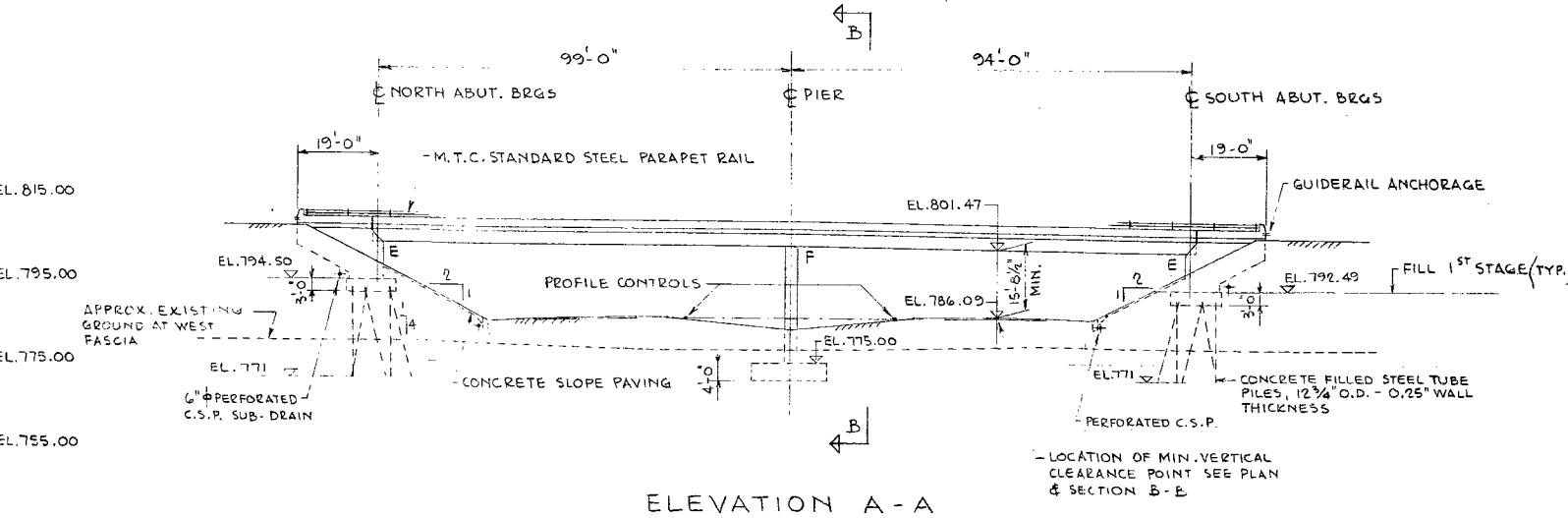
PRINCIPAL FOUNDATION ENGINEER



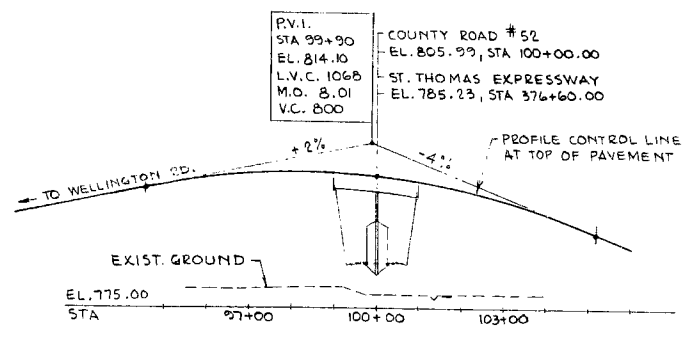
REF. No. FENCO 3802-87-03



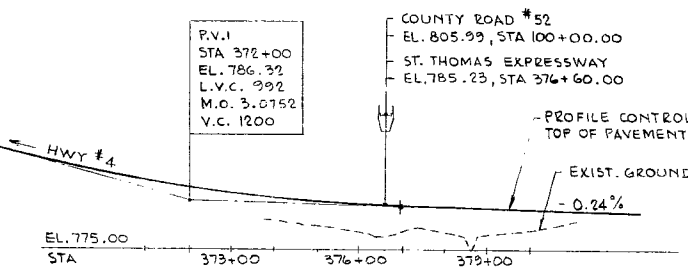
PLAN
SCALE 1" = 20'



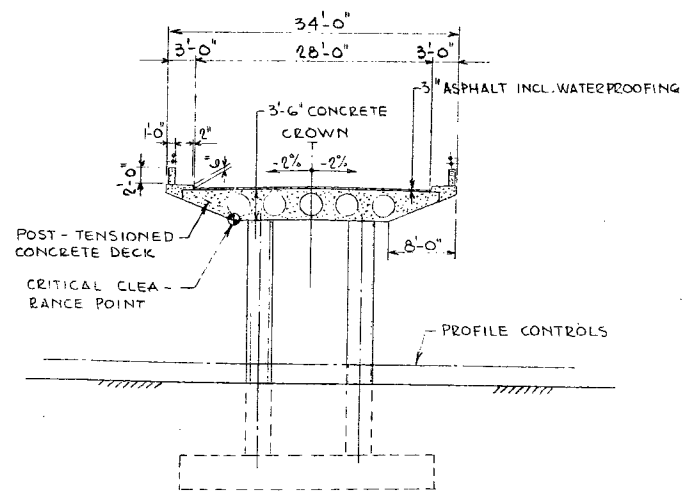
ELEVATION A-A
SCALE 1" = 20'



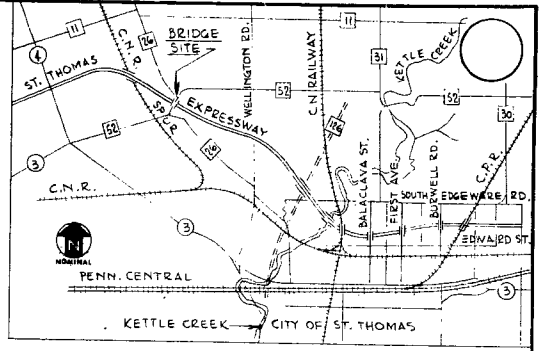
PROFILE OF COUNTY ROAD #52
SCALE VERT. 1" = 20'
HORIZ. 1" = 200'



PROFILE OF ST. THOMAS EXPRESSWAY
SCALE VERT. 1" = 20'
HORIZ. 1" = 200'



SECTION B-B
SCALE 1" = 10'



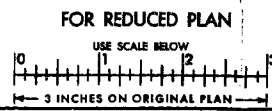
KEY PLAN
SCALE 1" = 1 MILE

GENERAL NOTES
CLASS OF CONCRETE
 DECK SLAB & DECK CURBS, SEE PRESTRESSING NOTES DWG 5-236-G.
 COLUMNS 5000 P.S.I.
 ABUTMENT CURBS, PARAPET WALLS & END POSTS 4000 P.S.I.
 ALL OTHERS INCL. APPROACH SLABS 5000 P.S.I.
CLEAR COVER TO REINFORCING STEEL
 FOUNDATIONS & SURFACES IN CONTACT WITH EARTH 3"
 FRONT FACE OF BALLAST WALLS, COLUMNS, DECK TOP
 AND APPROACH SLABS 2" - ALL OTHERS 1 1/2".
CONSTRUCTION NOTES
 THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE
 BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS
 WITH TOLERANCE OF ± 1/8 INCH.
 NO CONCRETE SHALL BE PLACED ABOVE THE BEARING
 SEATS UNTIL THE DECK CONCRETE HAS BEEN STRESSED & GROUTED.
PRESTRESSING NOTES
 FOR PRESTRESSING NOTES SEE DWG 5-236-G.

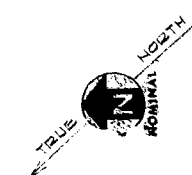
- LIST OF DRAWINGS**
- 5-236-1 GENERAL ARRANGEMENT
 - 2 BOREHOLE LOCATIONS & SOIL STRATA
 - 3 FOUNDATION LAYOUT
 - 4 ABUTMENTS
 - 5 PIER
 - 6 DECK CABLE DETAILS
 - 7 DECK REINFORCEMENT
 - 8 SCREED ELEVATIONS
 - 9 PARAPET WALL DETAILS
 - 10 STANDARD STEEL PARAPET RAIL
 - 11 STANDARD DETAILS I
 - 12 STANDARD DETAILS II
 - 13 20 FOOT APPROACH SLAB
 - 14 DETAILS OF CONCRETE SLOPE PAVING

REVISIONS	DATE	BY	DESCRIPTION

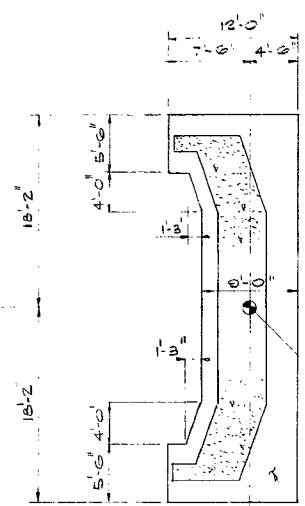
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO	
FOUNDATION OF CANADA ENGINEERING CORPORATION LIMITED.	
COUNTY ROAD #52 UNDERPASS ST. THOMAS EXPRESSWAY STA 376+60.00	
KING'S HIGHWAY No. 3N (ST. THOMAS EXPRESSWAY)	DIST. No. 2
CO. OF ELGIN	
TWP. OF SOUTHWOLD	LOT CON.
GENERAL ARRANGEMENT	
APPROVED	CONTRACT No.
DESIGN V.W. CHECK R.S.	W.P. No. 89-69-07
DRAWING V.W. CHECK R.S.	SITE No. 5-236 SHEET 1
DATE 1 DEC 1973	LOADING NS 20-44



PRINT RECORD	No.	FOR	DATE



COUNTY RD #52
PROFILE CONTROL LINE

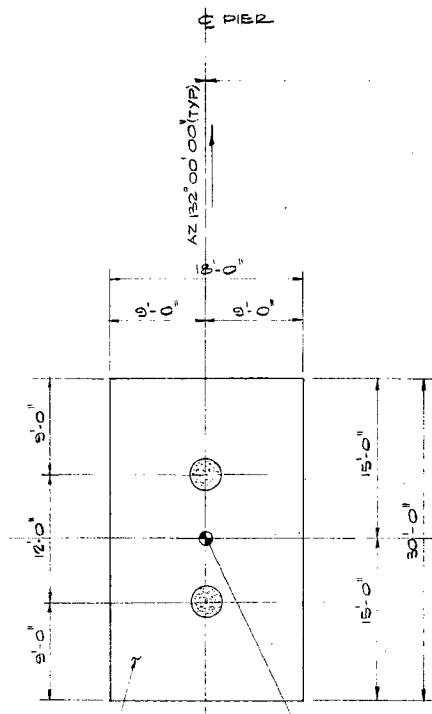


W.P. #1
STA 99+01.00
556,790.907 N.
341,018.543 E

EL. TOP OF FTG 794.50
FTG. THICKNESS 3'-0"

CL NORTH ABUT. BRGS.

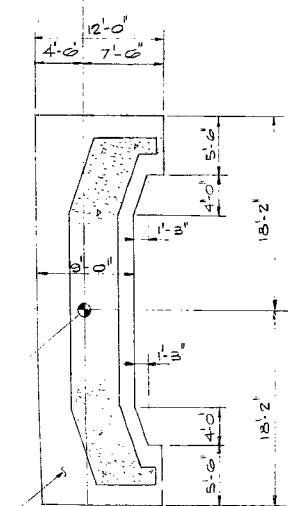
CL PIER



EL. TOP OF FTG 775.00
FTG. THICKNESS 4'-0"

W.P. #2
STA 100+00
556,717.336 N.
340,952.299 E

CL SOUTH ABUT. BRGS.



W.P. #3
STA 100+24.00
556,647.480 N
340,889.401 E

EL. TOP OF FTG 792.49
FTG. THICKNESS 3'-0"

FOUNDATION LAYOUT

SCALE 1/8" = 1'-0"

PILE DATA

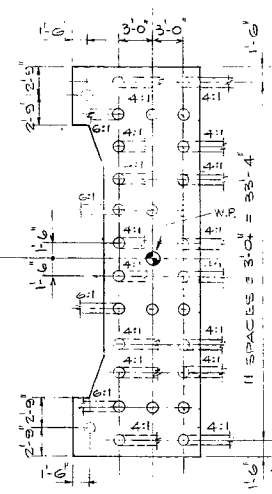
- DENOTES VERTICAL PILE
- ▤ DENOTES BATTERED PILE
- CONCRETE FILLED STEEL TUBE PILES, 12 3/4" O.D. - 0.25" WALL THICKNESS, 60 REQ'D N & S ABUTS
- 32 BATTERED 4:1, 8 BATTERED 3:1, 20 VERTICAL
- PILES TO BE DRIVEN TO ELEV 771.00.
- DESIGN LOAD 75 TONS PER PILE.

- PILE CUT-OFF ELEV'S: N. ABUT. 792.50
S. ABUT. 790.49
- TIP OF PILE ELEV'S: N. ABUT. 771.00
S. ABUT. 771.00

PILES REQUIRED

LOCATION	NUMBER	LENGTH	TYPE
NORTH ABUT. FOOTING	30	22'-0"	STEEL TUBE PILES 12 3/4" O.D., WALL 0.25"
SOUTH ABUT. FOOTING	30	22'-0"	STEEL TUBE PILES 12 3/4" O.D., WALL 0.25"

COUNTY RD #52
PROFILE CONTROL LINE

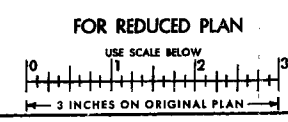


NORTH ABUTMENT
PILE LAYOUT
SOUTH ABUTMENT SIMILAR
SCALE 1/8" = 1'-0"

NOTE:
FOR GENERAL NOTES SEE DWG. 5-236-1

PRINT RECORD		
No.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO			
FOUNDATION OF CANADA ENGINEERING CORPORATION LIMITED			
COUNTY ROAD #52 UNDERPASS ST. THOMAS EXPRESSWAY STA 376+00.00			
KING'S HIGHWAY No. 3N (ST. THOMAS EXPRESSWAY), DIST. No. 2, CO. ELGIN			
TWP. SOUTHWOLD		LOT	CON.
FOUNDATION LAYOUT			
APPROVED		CONTRACT No.	
DESIGN	Z.S.	CHECK	K.K.
DRAWING	H.B.W.	CHECK	Z.S.
DATE	DEC. 1973	LOADING	H20-44
W.P. No.		89-28-07	
SITE No. 5-236		SHEET 3	

PCNCO NO 3302-SK-B