

DOCUMENT MICROFILMING IDENTIFICATION

G.I-30 SEPT. 1976

GEOCRES No. 40P2-27

DIST. 4 REGION

W.P. No. 162-60-01

CONT. No. 81-43

W. O. No.

STR. SITE No.

HWY. No. 403

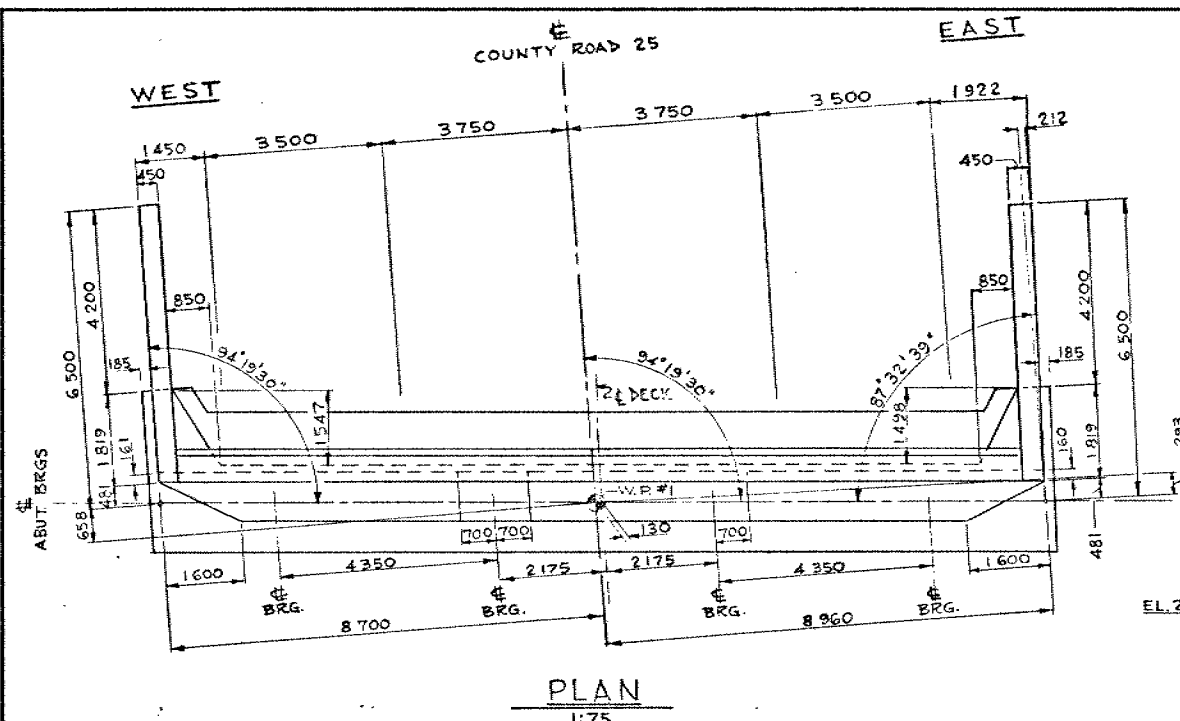
LOCATION Hwy 403 & Brantco Rd #25
underspan

No. of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

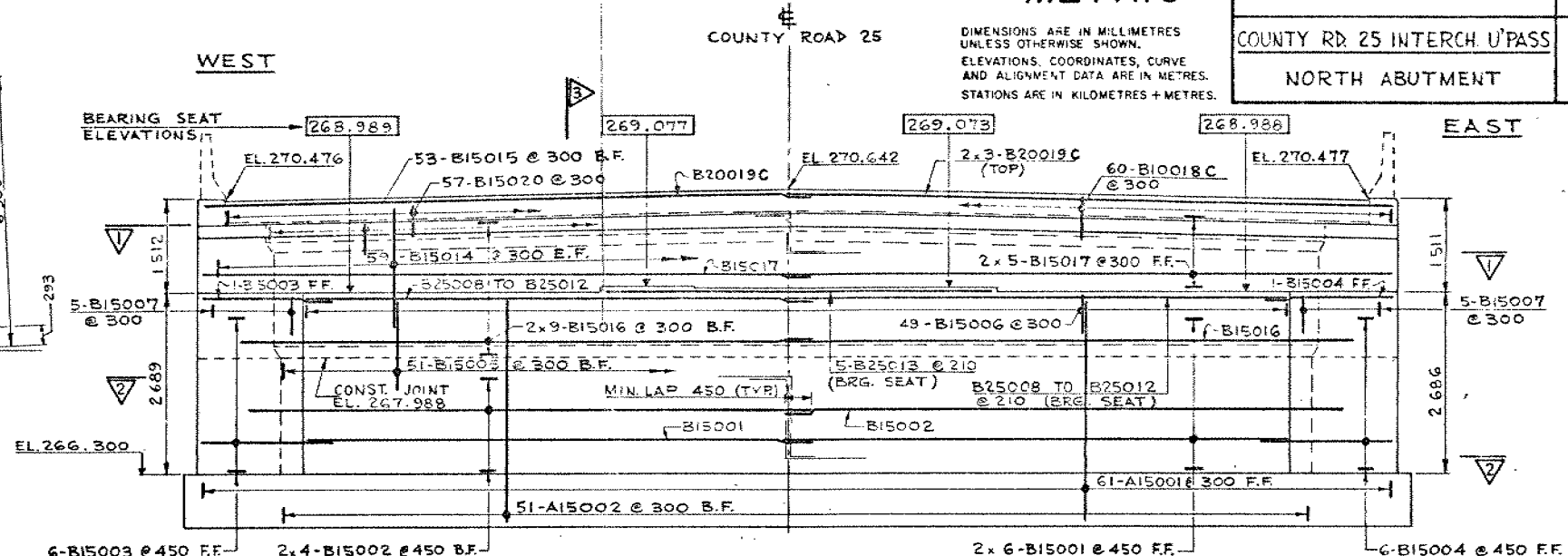


NOTES :

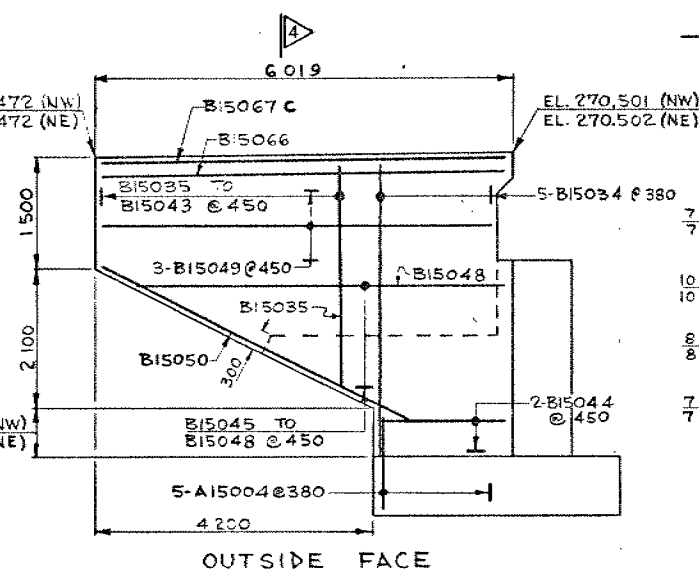
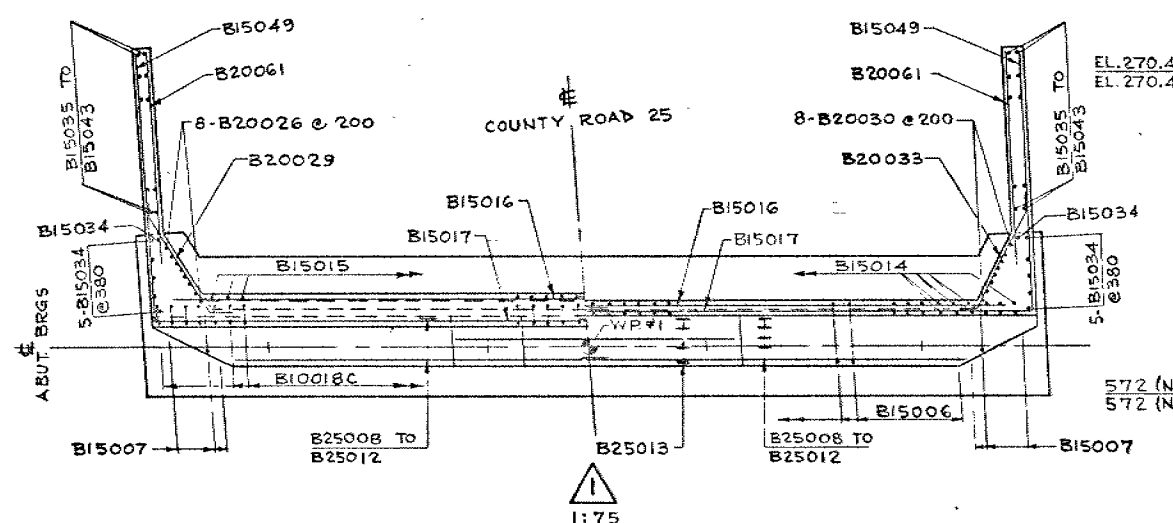
- F.F. DENOTES FRONT FACE.
- B.F. DENOTES BACK FACE.
- E.F. DENOTES EACH FACE.

METRIC

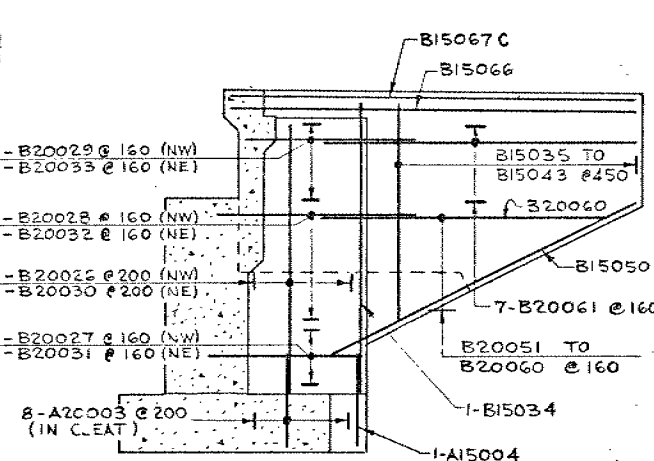
DIMENSIONS ARE IN MILLIMETRES
UNLESS OTHERWISE SHOWN.
ELEVATIONS, COORDINATES, CURVE
AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES.



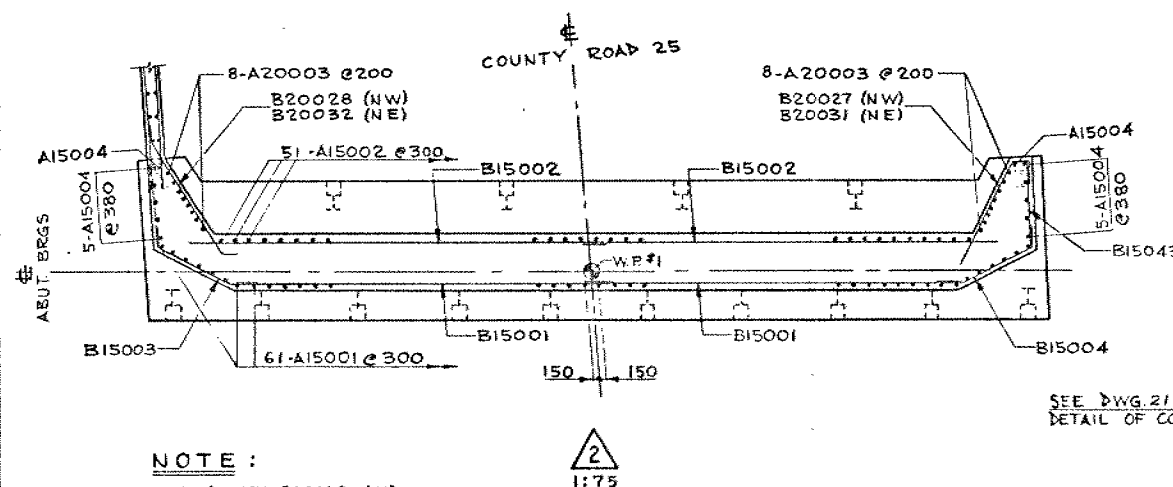
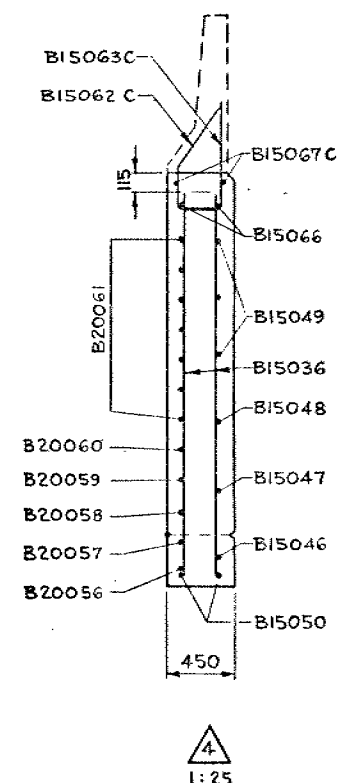
ELEVATION
1:50



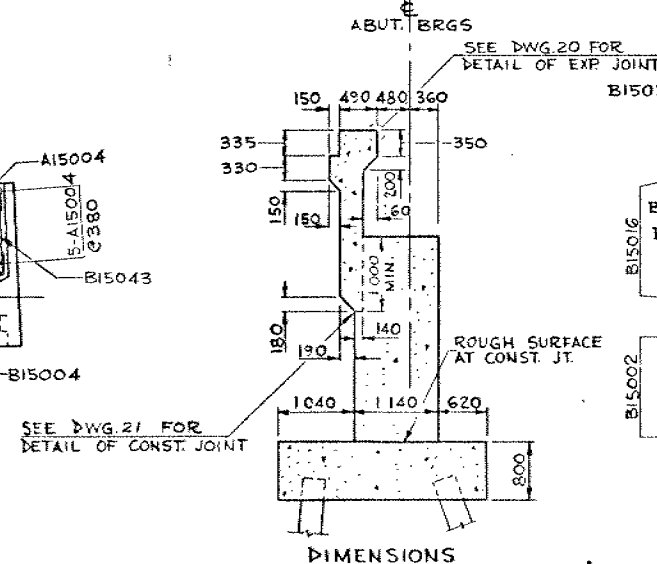
OUTSIDE FACE



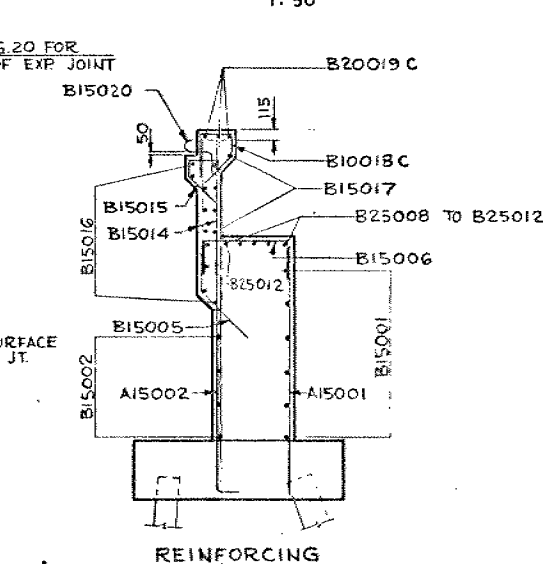
INSIDE FACE



NOTE :
FOR DIMENSIONS AND
REINFORCING OF FOOTING
SEE DWG. 3.



DIMENSIONS



REINFORCING

NOTE:

TOP OF BALLAST WALL TO BE CAST
TO SUIT PAVEMENT PROFILE.

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS						
	DATE	BY	DESCRIPTION			
DESIGN K Z S.		CHECK	LOADING H520-44		DATE	
DRAWING CFW		CHECK K A	SITE No 1-1-75		GWG	4

METRIC

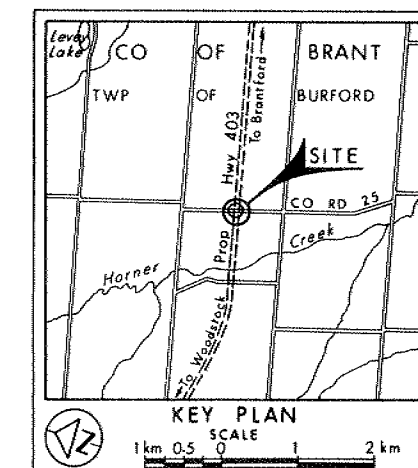
DIMENSIONS ARE IN METRES
AND OR MILLIMETRES UNLESS
OTHERWISE SHOWN.
STATIONS ARE IN
KILOMETRES + METRES.

CONT No 81-43
WP No 162-60-01

COUNTY RD 25 UNDERPASS
(11.4 km West of Hwy 24A)
BORE HOLE LOCATIONS & SOIL STRATA



SHEET
179



LEGEND

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W L at time of investigation 1972.03

No	ELEVATION	STATION	OFFSET
1	263.3	9+956.4	8.5 m Rt
2	262.9	9+957.7	8.5 m Lt
3	263.2	9+965.1	8.5 m Rt
4	263.0	9+966.4	8.5 m Lt
5	263.4	9+988.0	8.5 m Rt
6	262.9	9+989.4	8.5 m Lt
7	263.0	9+999.4	8.5 m Rt
8	262.9	10+000.7	8.5 m Lt
9	263.2	10+010.8	8.5 m Rt
10	262.8	10+012.2	8.5 m Lt
11	263.2	10+033.7	8.5 m Rt
12	262.7	10+035.0	8.5 m Lt
13	263.1	10+042.4	8.5 m Rt
14	262.9	10+043.7	8.5 m Lt

NOTE

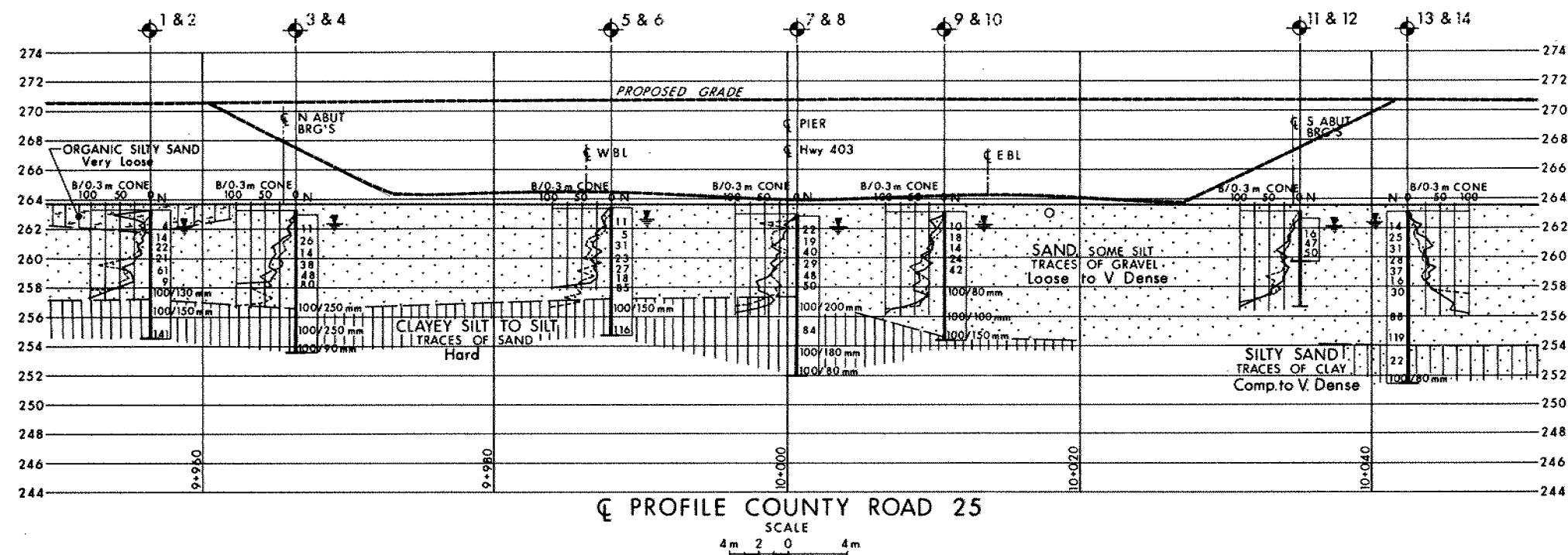
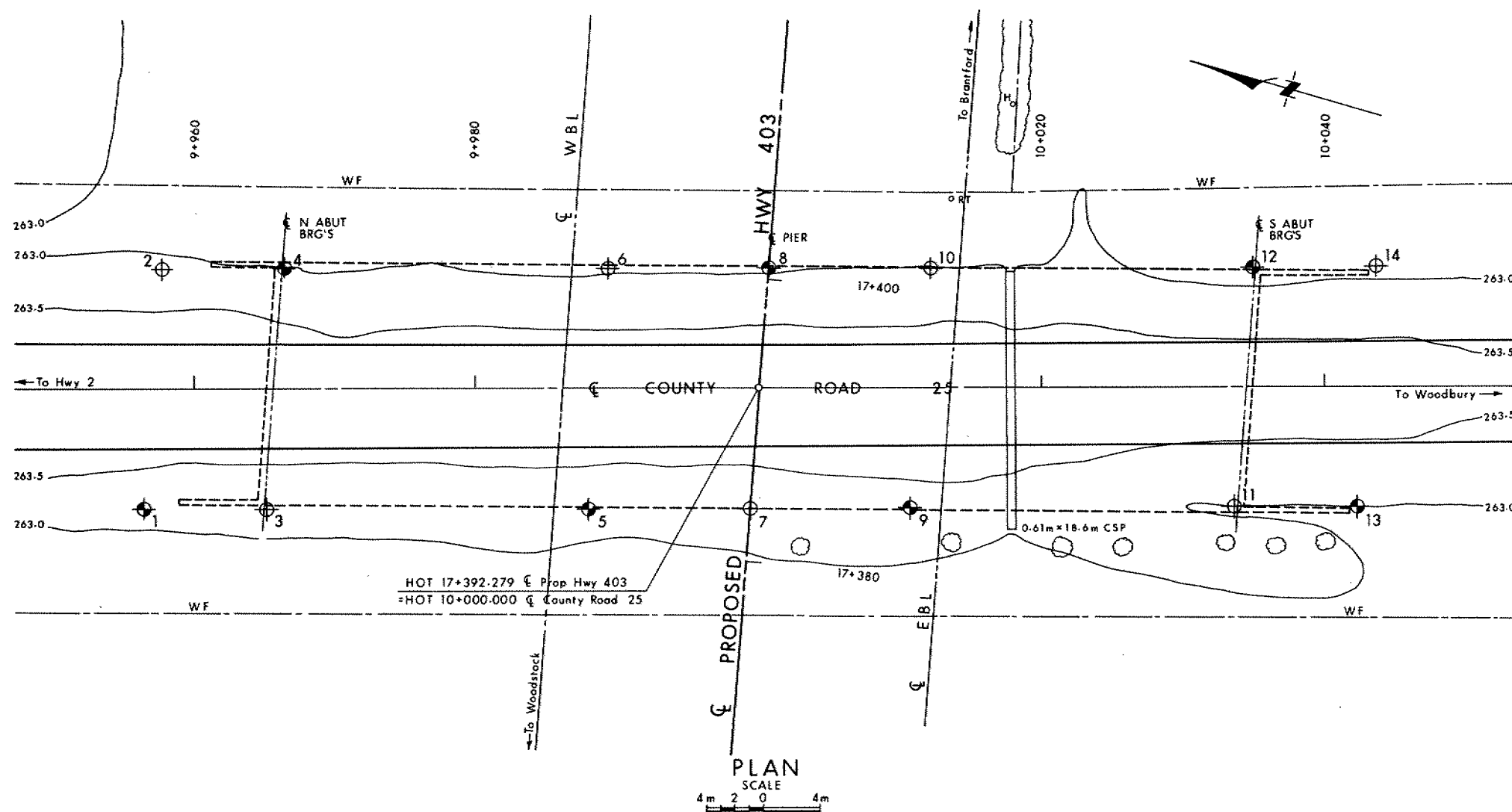
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

REVISIONS	DATE	BY	DESCRIPTION

Geocres No 40P2-27

HWY No Prop 403	DIST 4
SUBMD K5 CHECKED DATE 1981 02 24 SITE 1-156	
DRAWN 2 CHECKED 2 APPROVED	DWG 1-156-2

REF No E-5548-1 ; 1979 04



DIST. 4 HWY. 403

CONT No 81-43
WP No 162-60-01CO. RD. 25 INTERCH. U'PASS
11.4 KM. WEST OF HWY. 24A
GENERAL ARRANGEMENTSHEET
178

METRIC

DIMENSIONS ARE IN MILLIMETRES
UNLESS OTHERWISE SHOWN.
ELEVATIONS, COORDINATES, CURVE
AND ALIGNMENT DATA ARE IN METRES.
STATIONS ARE IN KILOMETRES + METRES.

NOTES

CLASS OF CONCRETE

DECK & PIER COLUMN 35 MPa
BARRIER WALLS 30 MPa
REMAINDER 20 MPa
OR AS NOTED ON THE DRAWING

REINFORCING STEEL GRADE 400

BAR MARK WITH SUFFIX C DENOTES
COATED BAR.

CLEAR COVER TO REINFORCING STEEL

FOOTINGS, ABUTMENTS & PIER COLUMNS 75 mm
DECK TOP 50 mm
DECK BOTTOM 40 mm
OR AS NOTED ON THE DRAWINGS.

CONSTRUCTION NOTES

THE CONTRACTOR IS RESPONSIBLE FOR
FINISHING THE BEARING SEATS DEAD LEVEL TO
THE SPECIFIED ELEV. WITH A TOLERANCE OF ± 3 mm.
NO CONCRETE SHALL BE PLACED ABOVE THE
ABUT. BEARING SEATS UNTIL THE CONCRETE IN
THE DECK HAS BEEN PLACED, STRESSED & GROUTED.
TO ACHIEVE THE MIN. CLEAR COVER OF 50 mm
SPECIFIED AT TOP OF DECK, THE TOP LAYER OF
REINFORCEMENT SHALL BE PLACED
PRIOR TO CONCRETING, WITH A CLEAR COVER
OF 65 mm, ± 15 mm TOLERANCE.

CONCRETE QUANTITIES

CONCRETE QUANTITIES ARE LISTED BELOW
FOR THE APPROPRIATE CONCRETE LUMP
SUM TENDER ITEMS:CONCRETE IN ABUTMENTS & PIER COLUMNS 176 m³
WINGWALLS 16 m³
CONCRETE IN PIER 16 m³
PRESTRESSED CONCRETE BRIDGE DECK 1129 m³
CONCRETE IN BARRIER WALLS 42 m³
CONCRETE IN APPROACH SLABS 51 m³
CONCRETE IN SLOPE PAVINGS 38 m³

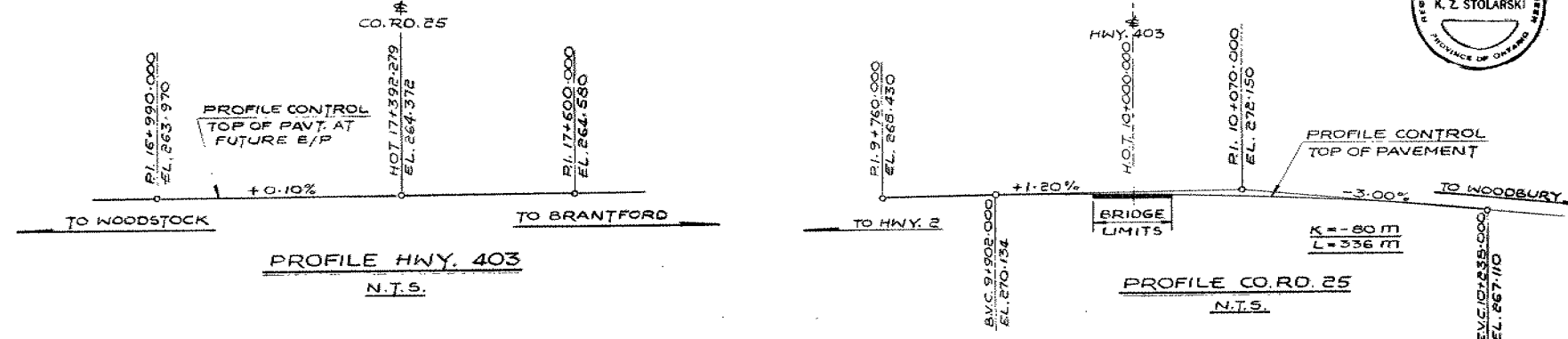
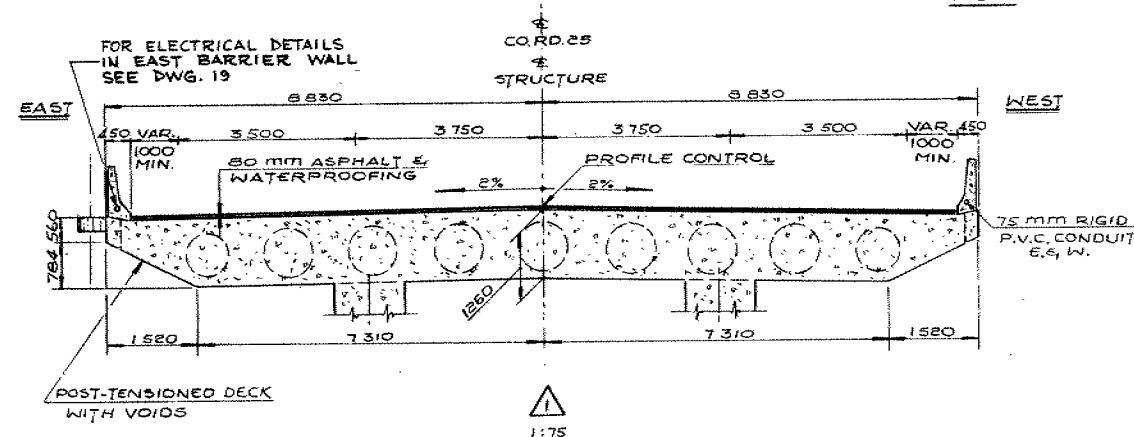
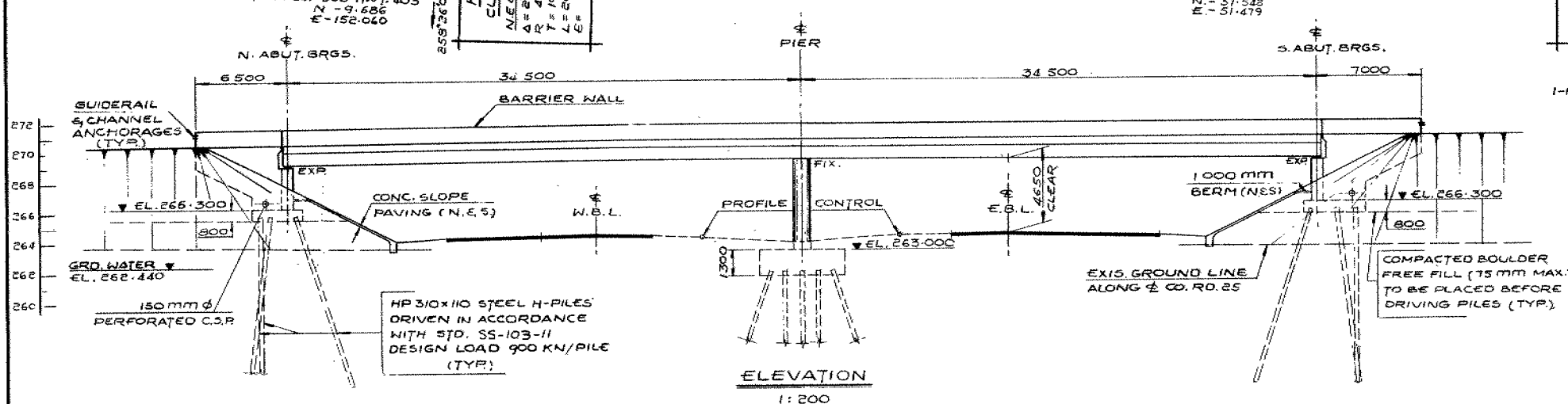
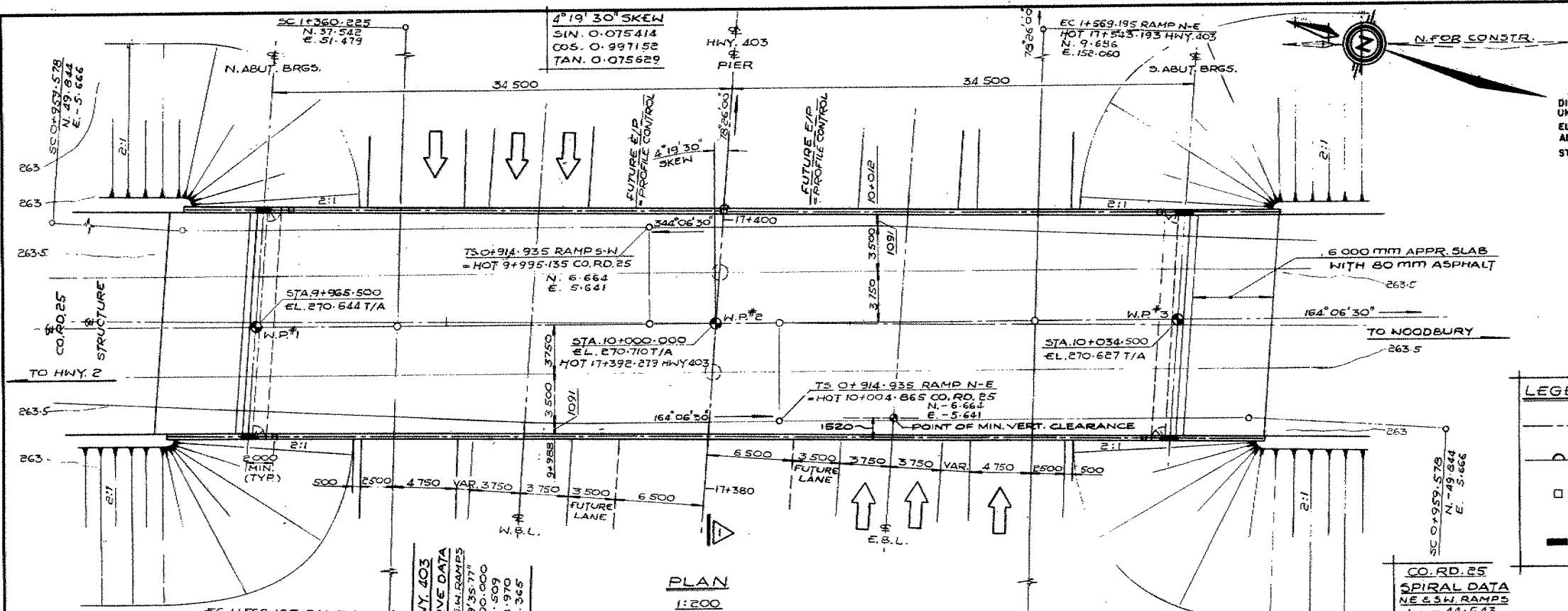
LEGEND

- 75 mm RIGID P.V.C. CONDUIT EMBEDDED IN STRUCTURE.
- LIGHTING POLE BASE.
- RIGID P.V.C. JUNCTION BOX EMBEDDED IN STRUCTURE.
- EXPANSION AND DEFLECTION FITTING ASSEMBLY.

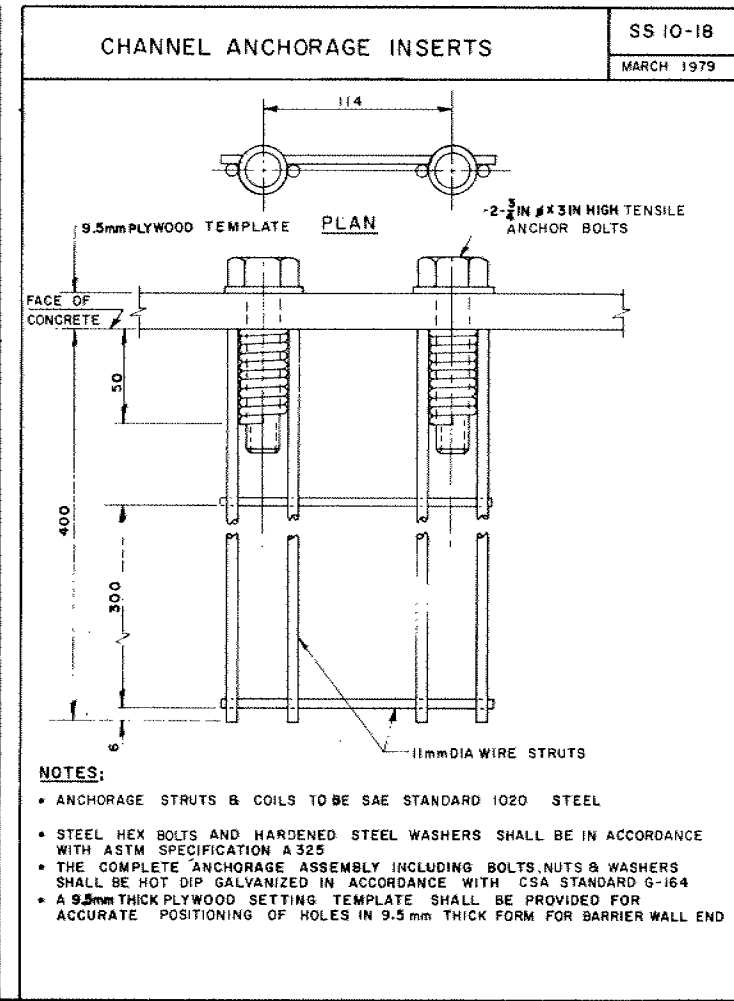
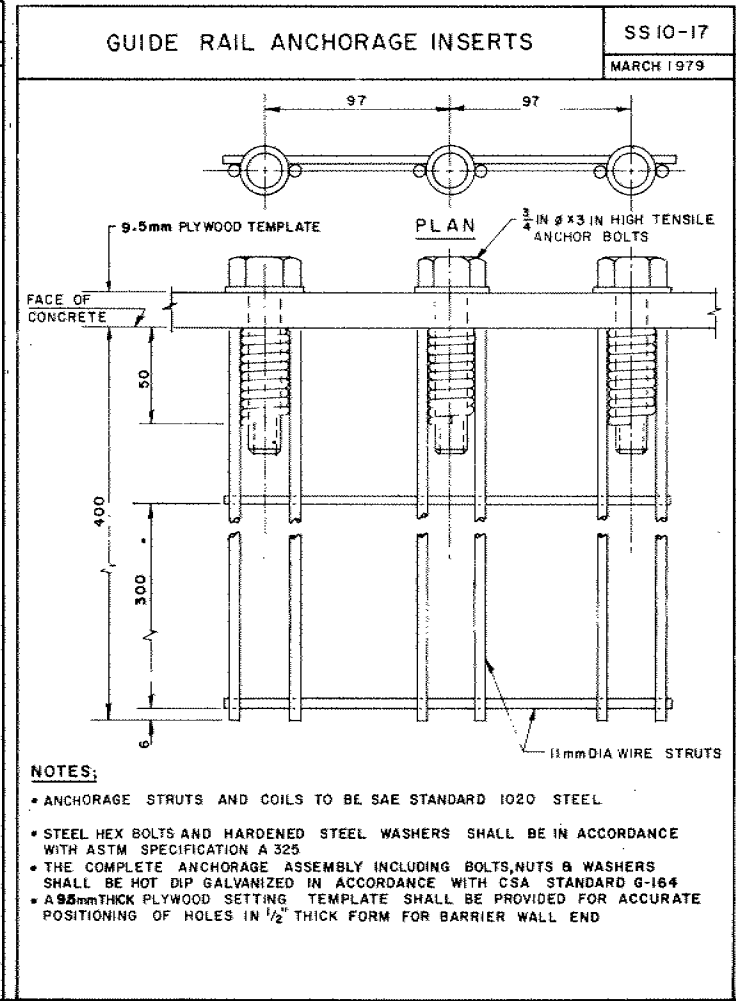
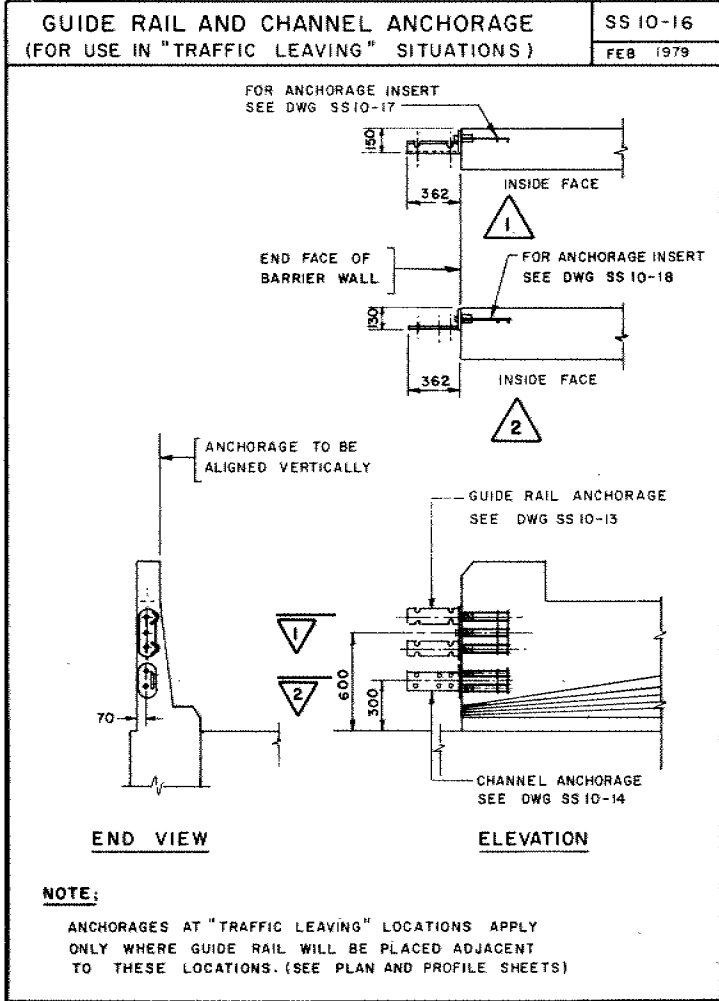
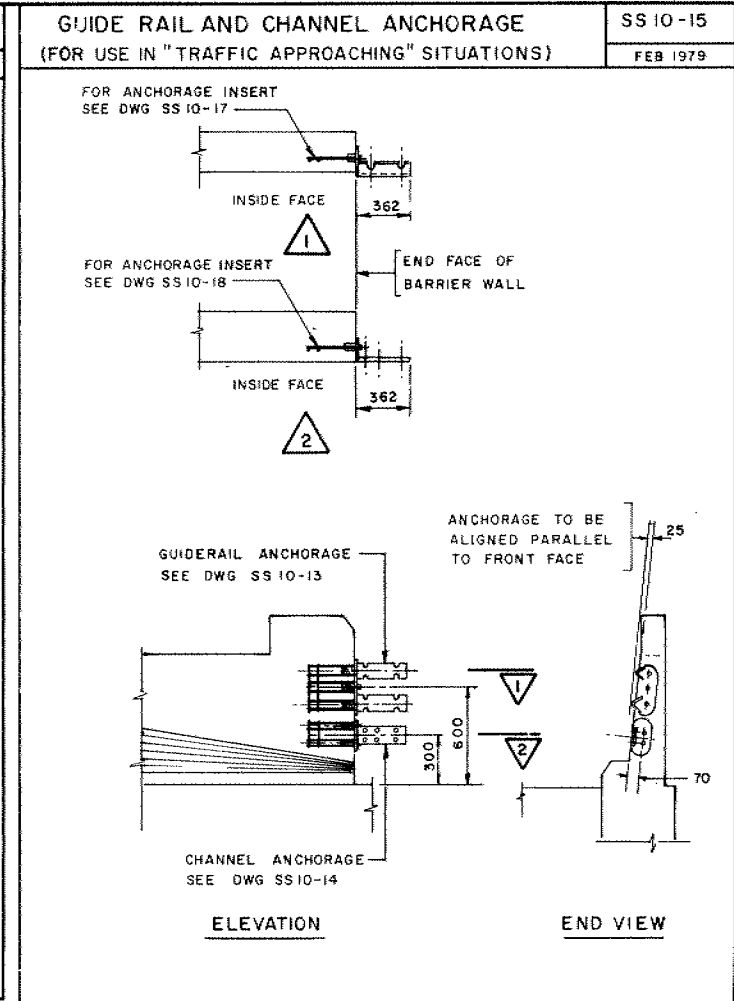
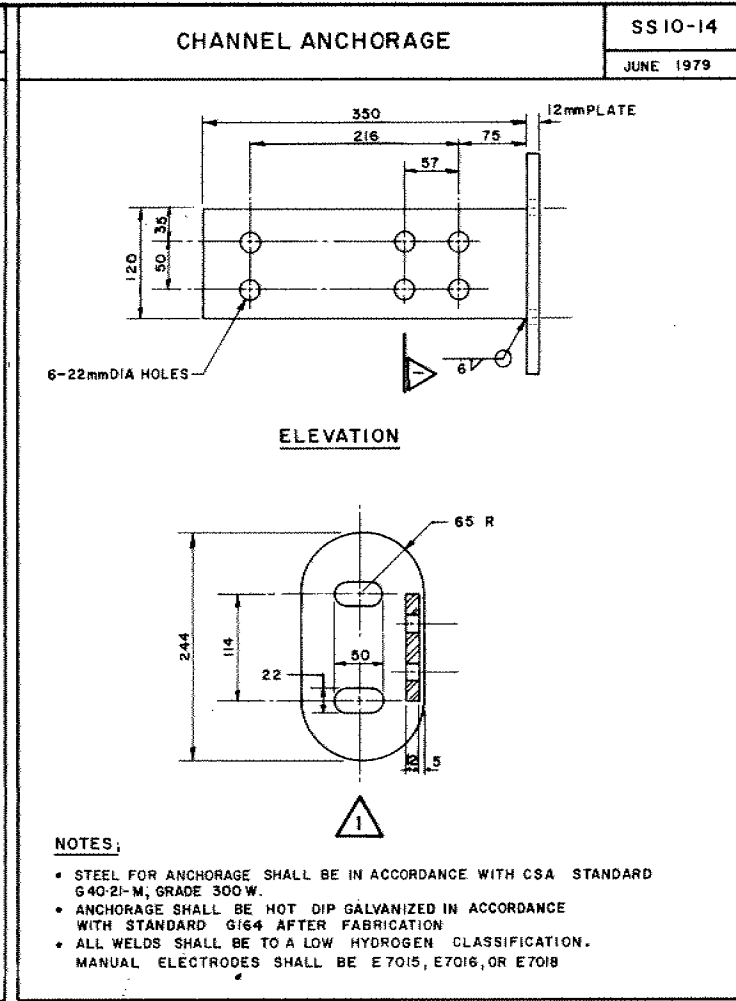
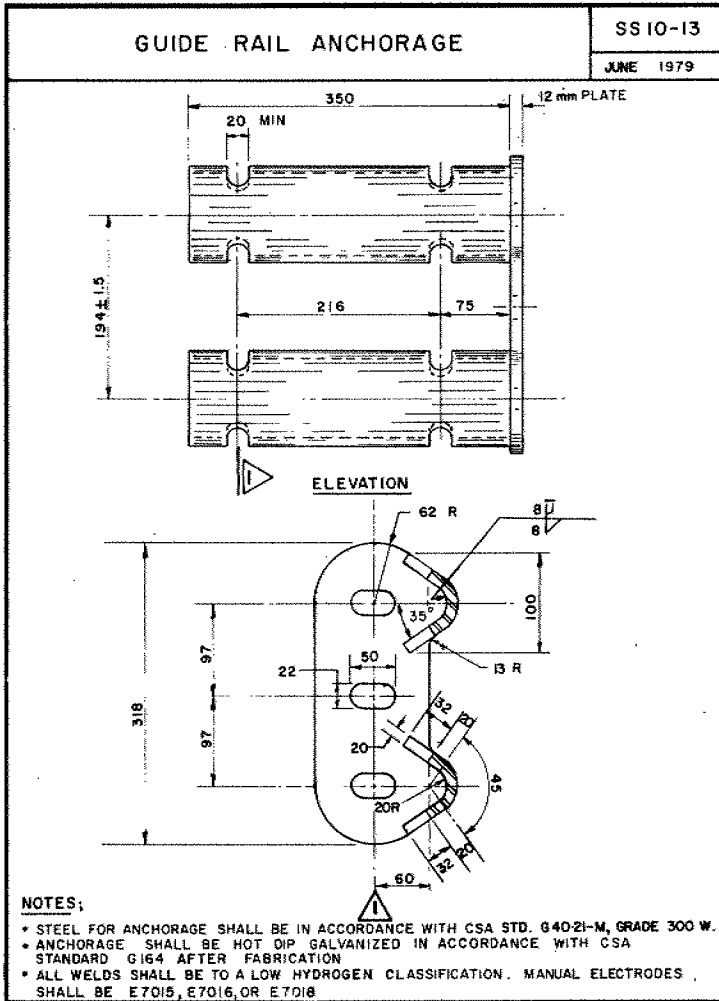
CO. RD. 25
SPIRAL DATA
NE & SW RAMP
Ls = 44.643
Ds = 3°39'14.69"
LT = 29.768
ST = 14.887

LIST OF DRAWINGS

- 1-156-1 GENERAL ARRANGEMENT
- 2 BOREHOLE LOCATION & SOIL STRATA
- 3 FOOTING LAYOUT & REINFORCING
- 4 NORTH ABUTMENT
- 5 SOUTH ABUTMENT
- 6 PIER & PIER FOOTING
- 7 DECK DETAILS, SCREED ELEV. & ABUT. BRGS.
- 8 LONGITUDINAL CABLE DETAILS I
- 9 LONGITUDINAL CABLE DETAILS II
- 10 TRANSVERSE CABLE DETAILS I
- 11 TRANSVERSE CABLE DETAILS II
- 12 DECK REINFORCING I
- 13 DECK REINFORCING II
- 14 BARRIER WALL
- 15 6000 mm APPROACH SLAB
- 16 DETAILS OF CONC. SLOPE PAVING
- 17 AS CONSTRUCTED ELEV. & DIM.
- 18 BRIDGE DATE & SITE NUMBER DATA
- 19 BRIDGE ELECTRICAL DETAILS - TYPE IV
- 20 STANDARD DETAILS I
- 21 STANDARD DETAILS II
- 22 STANDARD DETAILS III
- 23 STANDARD DETAILS IV
- 24 PILE DRIVING - STEAM & DIESEL HAMMERS

W.P. = WORKING POINT
T/A = TOP OF ASPHALTBM 263.134
N.E.W. IN N. ROOT
OF O.G. MAPLE
92.4 RT. 17+381.4 HWY. 403DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	CHECK	DESCRIPTION
DESIGN K.Z.S.				LOADING Hs 20-44 DATE 8/3/07
DRAWING H.N.				SITE No 1-156 DWG 1



METRIC

DIMENSIONS ARE IN MILLIMETRES UNLESS OTHERWISE SHOWN.
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CONT No 31-43
WP No 161-60-01

COUNTY RD. 16 U'PASS

STANDARD DETAILS IV

SHEET

177

REVISIONS		DATE	BY	DESCRIPTION
DESIGN	CHECK	LOADING	HS20-44	DATE 8/6/09
DRAWING	KA	CHECK	P.K.	SITE No 1-155 DWG 23

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

TO: A. P. Watt (4)
Southwestern Region
London

FROM: Foundations Office
Design Services Branch

ATTENTION: Mr. S. Jants

DATE: May 24, 1972

OUR FILE REF.

IN REPLY TO June 9, 1972

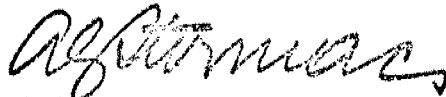
SUBJECT:

FOUNDATION INVESTIGATION REPORT
For the Proposed Underpass of Hwy. #403
At Brant County Rd. #25
11 mi. West of Brantford West Limits
District #4 Hamilton
W.O. 72-11034 W.P. 162-60-00

40 P2 - 27
GEOCREP 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.



A.G. Stermac
PRINCIPAL FOUNDATIONS ENGINEER

ACS/ht
Attach.

c.c. D.W. Farren
B.R. Davis
A. Rutka
M.A. Zonnenberg
C. Robertson
B.J. Giroux
L.R. Roy
G.A. Wrong
B.A. Singh
J. G. Tillcock
Foundations Files
Documents

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1. INTRODUCTION.
 2. DESCRIPTION OF THE SITE AND GEOLOGY.
 3. FIELD AND LABORATORY INVESTIGATION PROCEDURES.
 4. SUBSOIL CONDITIONS.
 5. GROUNDWATER CONDITIONS.
 6. DISCUSSION AND RECOMMENDATIONS.
 - 6.1) General.
 - 6.2) Foundations.
 7. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT
For the Proposed Underpass Of Hwy. #403
At Brant County Rd. #25
11 mi. West of Brantford West Limits
District #4 Hamilton
W.O. 72-11034 W.P. 162-60-00

1. INTRODUCTION:

A foundation investigation was requested by Mr. S. Jants, Bridge Planning Technician, Southwestern Region, for the proposed underpass structure of Hwy. #403 at Brant County Rd. #25. The request was dated Feb. 9, 1972.

The subsequent field and laboratory investigations were carried out under the supervision of this Office, while the boreholes were located in the field and surveyed by personnel of the Engineering Survey Office of Southwestern Region.

The investigations are now completed, the results of which are presented in this report, together with recommendations concerning foundations.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The immediate vicinity of the proposed crossing is fairly flat, occupied by farmlands. Along existing County Rd. #25, there are some brushes and shrubs. The farms are well cultivated, the prevailing crops appear to be tobacco.

Geologically, the area belongs to the Mount Elgin Ridges physiographic region, consisting of a succession of ridges and vales. The ridges are moraines of pale brown calcareous clay or silty clay, while in the vales it is common to find alluvium of gravel, sand or silt. The ridges are usually well drained, while poor drainage prevails in the hollows.

3. FIELD AND LABORATORY INVESTIGATION PROCEDURES:

The field investigation consisted of some seven sampled boreholes and fourteen dynamic cone penetration tests. One borehole and two cone penetration tests were placed at each proposed footing location as shown on attached Drawing #72-11034A. The estimated

stratigraphical profile, based on the boreholes are also presented on the above drawing. Boreholes were carried out by means of a Bombardier-mounted continuous hollow stem auger (C.M.E.) taking samples at regular intervals. Samples were taken by 2 inch diameter split spoon samplers. The split spoons were driven by a 140 pound hammer, falling freely a distance of 30 inches. The number of hammer blows required to advance the sampler 18 inches into the soils are marked as standard penetration resistances. ("N" = blows/foot)

All the soil samples were visually examined and identified right after recovery and again upon arrival in the laboratory. Basic physical properties of the various layers were determined by performing laboratory tests such as natural moisture contents, Atterberg Limits and grain size analyses. Laboratory and field test results are compiled on the borelogs appended to this report.

4. SUBSOIL CONDITIONS:

Soil stratigraphy was found to consist of fine to medium sands underlain by clayey silt to silt.

The surficial deposit, identified as fine to medium sand with traces of silt and clay is extending to Elevation 833-844 feet, a depth of some 18-28 feet. The relative density of this layer varies between loose to very dense, substantiated by penetration "N" values of 4 blows/foot to over 100 blows/ft. The relative density increases with depth. The laboratory determined natural moisture contents are fairly high, ranging from 16% to 21% and averaging 20% by dry weight. The grain size analyses yielded some 0-3% gravel, 68-97% sand, 1-29% silt and 2-4% clay size particles within the individual samples tested.

Underlying the brown sands a layer of grey clayey silt to silt with traces of sand was encountered, extending to the bottom of the boreholes, between Elevations 825 feet and 835 feet. At the location of the proposed south abutment the deposit contained some 61% fine sand particles, consequently it has been identified as silty sand with traces of clay. Very high penetration resistances characterize the stratum, most of the penetration tests yielded "N" values over 100 blows/ft. The consistency of the layer was thus specified to be generally hard.

Several Atterberg limit tests were carried out on typical samples, resulting in plastic limit moisture contents between 12% and 18% and liquid limits between 19% and 29%. The average sample contains more than 50% silt size particles.

5. GROUNDWATER CONDITIONS:

Groundwater level observations were undertaken during the field investigations. The established waterlevels are marked on the borelog sheets. The equilibrium water surface was found to lie at Elevation 860-861 feet, only a few feet below the general ground level.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

Two alternative proposals are submitted for the crossing of King's Hwy. #403 line "E" and Brant County Rd. #25. One proposal calls for a 2-span underpass structure, with span lengths of 140 feet each. The second alternative considers an underpass of 5 spans, having 30 feet long end spans, the three middle spans being 75 feet each. The design grade of Hwy. #403 is Elevation 866 feet, roughly at the existing ground level, while the proposed top of granular of County Rd. #25 is Elevation 886 feet. It is surmised that perched abutments will be constructed. Subsoil was found to consist of a 20-30 feet deep deposit of loose to very dense sand with traces of silt, followed by very stiff to hard clayey silts to silts.

6.2) Foundations:

On account of the loose to compact relative density of the uppermost portion of the sands, combined with the high groundwater level, the construction of spread footings for the structure appears to be uneconomical. Footings for both proposals should, therefore, be supported on piles, driven into the hard clayey silt to silt deposit. The use of steel H piles would seem the most practical, and design loads of such piles should be determined during pile driving by means of the Hiley formula. (M.T.C. Standard DD-1218 and DD-1219) It is believed that eg. 12 BP @ 74 H piles driven to approximate Elevation 835 feet - 840 feet will support safe loads of 90 tons/pile.

A minimum cover of four feet should be provided for the pile caps, for frost protection. Since the groundwater level was observed to be around Elevation 860 feet - 861 feet, excavations extending below these elevations might become unstable under the unbalanced hydrostatic heads. In order to prevent the excavation bottoms from "boiling" a dewatering scheme will be necessary for the excavations extending below the groundwater level.

Pile caps for the perched abutments may be formed within the approach fills. No bouldery material should be placed at the locations of the abutments in the event of driving piles through the fills.

No stability problems are anticipated for the proposed 20-22 feet high approach fills, provided that they are built with 2 horizontal to 1 vertical slopes.

7. MISCELLANEOUS:

The field work carried out during March 6-10, 1972, was supervised by Mr. J. Bangs, Project Foundation Engineer. Equipment used was owned and operated by P.V.K. Drilling Company, Burford, Ontario. This report was written by Mr. A.K. Barsvary, Senior Foundations Engineer and reviewed by Mr. K.G. Selby, Supervising Foundations Engineer.

AKB/ht

A. K. Barsvary

A.K. Barsvary, P. Eng.

K. G. Selby

K.G. Selby, P. Eng.



May 23, 1972.

APPENDIX I

CHECKED BY

RECORD OF BOREHOLE No. 1

[illegible]

CHECKED BY _____

[illegible]

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 72-11034 LOCATION Sta. 101 + 15 O/S 28' Lt. & Co. Rd. 25 ORIGINATED BY J.B.
W.P. 162-60 BORING DATE March 9, 1972 COMPILED BY A.K.B.
DATUM Geodetic BOREHOLE TYPE Cone Penetration only. CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w				BULK DENSITY γ P.C.F.	REMARKS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					SHEAR STRENGTH P.S.F.						WATER CONTENT %																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
							20	40	60	80	100	UNCONFINED		FIELD VANE				LAB. VANE		w_p ——— w ——— w_L																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						

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SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w_L PLASTIC LIMIT ——— w_p WATER CONTENT ——— w			BULK DENSITY γ P.C.F.	REMARKS			
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT	20	40	60	80	100	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE				WATER CONTENT % w_p ——— w ——— w_L		
862.4	Ground level.																		
0.0						860													
						850													
844.7																			
17.7	End of cone test.											100/9"							

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N': - 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>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS 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
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_c	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
$\log_e \sigma$ OR $\ln \sigma$	NATURAL LOGARITHM OF σ
$\log_{10} \sigma$ OR $\log \sigma$	LOGARITHM OF σ 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

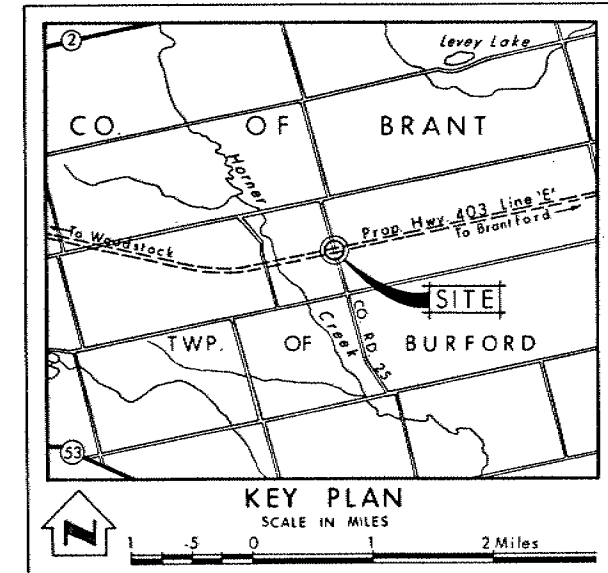
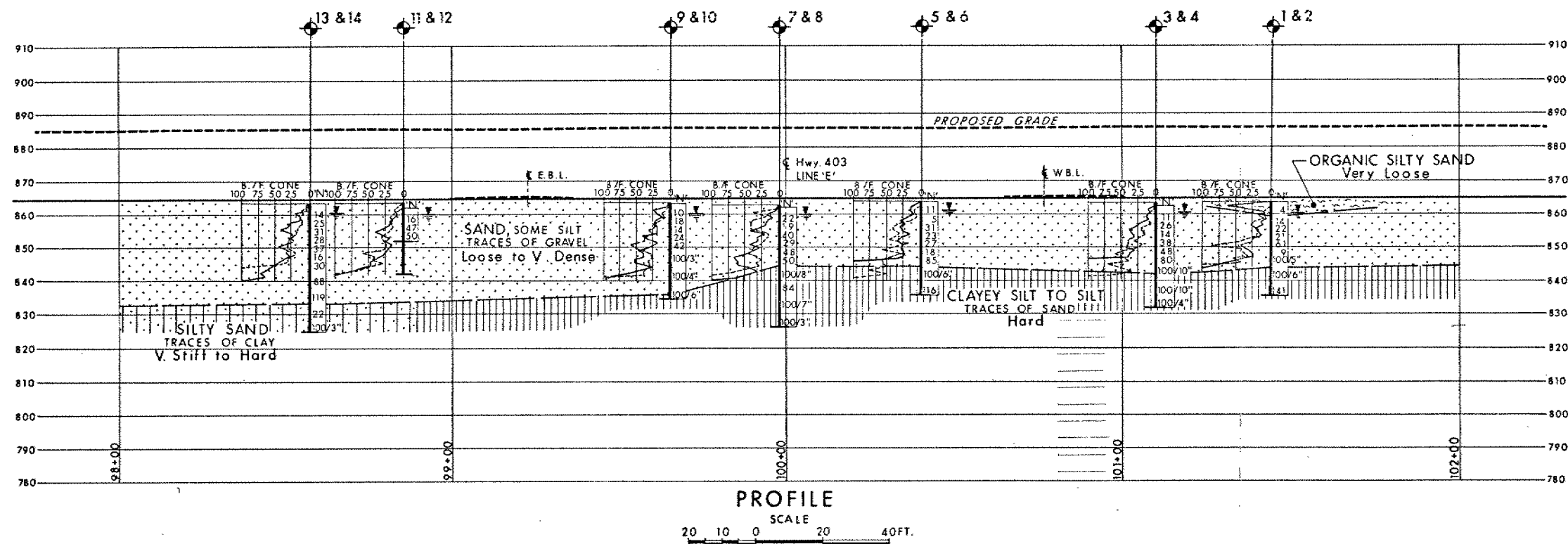
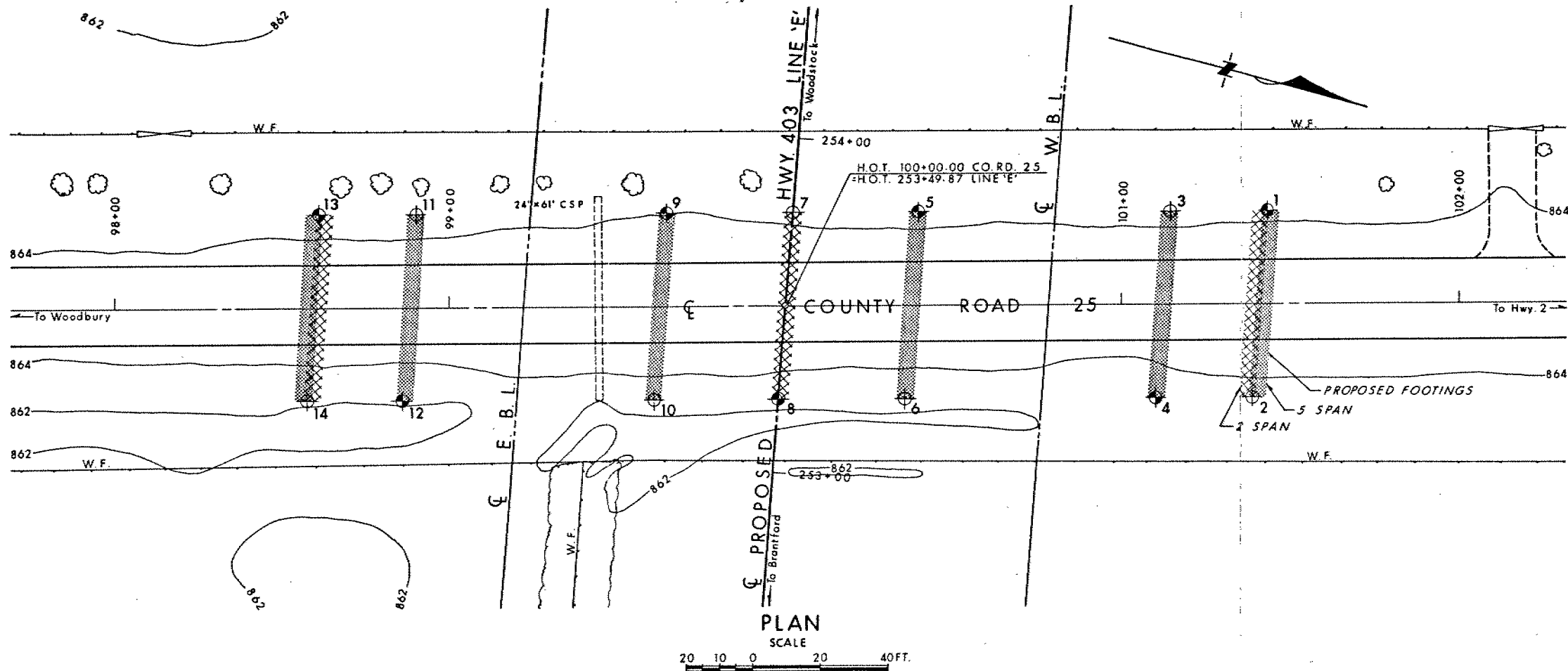
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

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, March 1972		

NO.	ELEVATION	STATION	OFFSET
1	864.0	101+44	28' LT.
2	862.4	101+39	28' RT.
3	863.4	101+15	28' LT.
4	862.8	101+10	28' RT.
5	864.3	100+40	28' LT.
6	862.4	100+35	28' RT.
7	863.0	100+03	28' LT.
8	862.5	99+98	28' RT.
9	863.6	99+65	28' LT.
10	862.3	99+60	28' RT.
11	863.5	98+90	28' LT.
12	861.9	98+85	28' RT.
13	863.3	98+62	28' LT.
14	862.4	98+57	28' RT.

— NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION & COMMUNICATIONS DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE			
COUNTY ROAD 25			
HIGHWAY NO. Prop. 403 LINE 'E'		DIST. NO. 4	
CO. BRANT		TWP. BURFORD	
LOT 12 & 13		CON. III	
BORE HOLE LOCATIONS & SOIL STRATA			
SUBMD. A.B.	CHECKED <input checked="" type="checkbox"/>	WP NO. 162-60	DRAWING NO.
DRAWN <input checked="" type="checkbox"/>	CHECKED <input checked="" type="checkbox"/>	JOB NO. 72-11034	72-11034A
DATE June 1, 1972		SITE NO.	
APPROVED <i>Altiman</i>		CONT. NO.	
PRINCIPAL FOUNDATION ENGINEER			



RECORD OF BOREHOLE No 1										METRIC					
W P 162-60-01		LOCATION Sta. 9+956.4 o/s 8.5 m RT of Ø Co. Rd. 25				ORIGINATED BY JB									
DIST 4 HWY 403		BOREHOLE TYPE Hollow Stem Auger & Cone Test				COMPILED BY PK									
DATUM Geodetic		DATE 1972 03 09				CHECKED BY <i>ep</i>									
SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH							
								20 40 60 80 100							
								○ UNCONFINED + FIELD VANE							
								● QUICK TRIAXIAL x LAB VANE							
263.3	Ground Level														
0.0	Organic Silty Sand Very Loose Black		1	SS	4		262								2 68 29 1
261.8			2	SS	14										0 81 (19)
1.5	Fine to Medium Sand With Some Silt		3	SS	22		260								
	Compact to Very Dense		4	SS	21										
			5	SS	61										1 90 (9)
	Brown		6	SS	9										
257.2			7	SS	100/	130 mm	258								
6.1	Silt, Traces of Sand and Clay		8	SS	100/	150 mm	256								
	Hard Grey														
254.6			9	SS	141										
8.7	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION

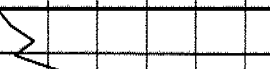
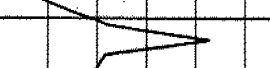
+³, x⁵: Numbers refer to Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



METRIC

W P 162-60-01 LOCATION Sta. 9+957.7 o/s 8.5 m LT of E Co. Rd. 25 ORIGINATED BY PK
DIST 4 HWY 403 BOREHOLE TYPE Cone Penetration Test COMPILED BY AKB
DATUM Geodetic DATE 1972 03 07 CHECKED BY CP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			
262.9 0.0	Ground Level						262						
257.9 5.0	End of Cone Test						260						
							258						
								100/130 mm					

+3, x5: Numbers refer to Sensitivity

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No 3

METRIC

W P 162-60-01 LOCATION Sta. 9+965.1 o/s 8.5 m RT of G Co. Rd. 25 ORIGINATED BY JB
DIST 4 HWY 403 BOREHOLE TYPE Cone Penetration Test COMPILED BY AKB
DATUM Geodetic DATE 1972 03 09 CHECKED BY GP

[illegible]

+3, x5: Numbers refer to Sensitivity



RECORD OF BOREHOLE No 4

METRIC

W P 162-60-01 LOCATION Sta. 9+966.4 o/s 8.5 m LT of E Co. Rd. 25 ORIGINATED BY PK
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY PK
DATUM Geodetic DATE 1972 03 07 CHECKED BY JP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
263.0	Ground Level																GR SA SI CL
0.0			1	SS	11		262										0 91 (9)
	Fine to Medium Sand		2	SS	26		260										1 93 (6)
	Traces of Silt		3	SS	14												1 93 (6)
	Compact to Very Dense		4	SS	38												
	Brown		5	SS	48												
			6	SS	80		258										1 93 (6)
256.6			7	SS	100/	250 mm	250										
6.4			8	SS	100/	250 mm	256										
	Clayey Silt to Silt																
	Traces of Sand																
	Hard Grey		9	SS	100/	90 mm	254										0 7 83 10
253.6																	
9.4	End of Borehole																

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 5

METRIC

W P 162-60-01 LOCATION Sta. 9+988.0 o/s 8.5 m RT of E Co. Rd. 25 ORIGINATED BY JB
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY PK
DATUM Geodetic DATE 1972 03 09 CHECKED BY CP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)				
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100							SHEAR STRENGTH		WATER CONTENT (%)	
															○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			
263.4	Ground Level													GR SA SI CL				
0.0	Silty Fine to Medium Sand to Sand, Traces of Gravel Compact to Very Dense Brown		1	SS	11		262							8 71 19 2				
			2	SS	5									0 87 (13)				
			3	SS	31													
			4	SS	23													
			5	SS	27													
			6	SS	18													
			7	SS	85													
257.3	Clayey Silt to Silt Traces of Sand Hard - Grey		8	SS	100/		150 mm	256										
6.1																		
254.7			9	SS	116													
8.7	End of Borehole																	

OFFICE REPORT ON SOIL EXPLORATION

+³, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

METRIC

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH		WATER CONTENT (%)			
263.0	Ground Level									<p>○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE</p>			

+3, x5: Numbers refer to Sensitivity



RECORD OF BOREHOLE No 8

METRIC

W P 162-60-01 LOCATION Sta. 10+000.7 o/s 8.5 m LT of E Co. Rd. 25 ORIGINATED BY PK
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY PK
DATUM Geodetic DATE 1972 03 06 CHECKED BY *CP*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100					
262.9	Ground Level												
0.0	Fine to Medium Sand With Some Silt, Traces of Gravel Compact to Very Dense Brown		1	SS	22		262						0 93 (7) 3 87 (10)
			2	SS	19								
			3	SS	40								
			4	SS	29								
			5	SS	48								
			6	SS	50								
257.4	Clayey Silt to Silt Traces of Sand Hard Grey		7	SS	100/	200 mm	256						
5.5			8	SS	84								
			9	SS	100/	180 mm	254						
			10	SS	100/	80 mm							
252.0	End of Borehole												
10.9													

+³, x⁵: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 9

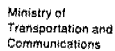
METRIC

W P 162-60-01 LOCATION Sta. 10+010.8 o/s 8.5 m RT of E Co. Rd. 25 ORIGINATED BY JB
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY FK
DATUM Geodetic DATE 1972 03 08 CHECKED BY CP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES									
263.2	Ground Level													
0.0	Fine to Medium Sand Some Silt Traces of Clay Loose to Dense Brown		1	SS	10		262							3 80 15 2
			2	SS	18		260							0 79 17 4
			3	SS	14									
			4	SS	24									
			5	SS	42									
			6	SS	100/		80 mm	258						
			7	SS	100/		100 mm	256						
			8	SS	100/		150 mm							
254.7	Clayey Silt to Silt													
254.4	End of Borehole Hard													
8.8														

+³, x⁵ : Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10



METRIC

W P 162-60-01 LOCATION Sta. 10+012.2 o/s 8.5 m LT of # Co. Rd. 25 ORIGINATED BY JB
DIST 4 HWY 403 BOREHOLE TYPE Cone Penetration Test COMPILED BY AKB
DATUM Geodetic DATE 1972 03 07 CHECKED BY Q.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT Y	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20	40					
262.8	Ground Level													GR SA SI CL
0.0							262							
							260							
							258							
256.5														
6.3	End of Cone Test									100/230 mm				

+3, x5: Numbers refer to Sensitivity

OFFICE REPORT ON SOIL EXPLORATION



RECORD OF BOREHOLE No 12

METRIC

W P 162-60-01 LOCATION Sta. 10+035.0 o/s 8.5 m LT of E Co. Rd. 25 ORIGINATED BY PK
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY PK
DATUM Geodetic DATE 1972 03 06 CHECKED BY OP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
262.7	Ground Level												
0.0	Fine to Medium Sand Traces of Silt Compact to Dense		1	SS	16		262						2 93 (5)
			2	SS	47		260						
259.7			3	SS	50								
3.0	End of Borehole						258						
256.7	End of Cone Test							100/250					
6.0													

+3, x⁵: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 11

METRIC

W P 162-60-01 LOCATION Sta. 10+033.7 o/s 8.5 m RT of E. Co. Rd. 25 ORIGINATED BY JB
DIST 4 HWY 403 BOREHOLE TYPE Cone Penetration Test COMPILED BY AKB
DATUM Geodetic DATE 1972 03 10 CHECKED BY GP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
263.2	Ground Level												
0.0													
							262						
							260						
							258						
256.9	End of Cone Test							100/250 mm					
6.3													

+³, x⁵: Numbers refer to Sensitivity 20
15 5 (%) STRAIN AT FAILURE
10



RECORD OF BOREHOLE No 13

METRIC

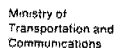
W P 162-60-01 LOCATION Sta. 10+042.4 o/s 8.5 m RT of E Co. Rd. 25 ORIGINATED BY JB
DIST 4 HWY 403 BOREHOLE TYPE Hollow Stem Auger & Cone Test COMPILED BY PK
DATUM Geodetic DATE 1972 03 08 CHECKED BY *CP*

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						
263.1	Ground Level															
0.0	Fine to Medium Sand, Traces of Silt Compact to Very Dense Brown		1	SS	14		262								0 92 (8) 1 90 (9)	
			2	SS	25											
			3	SS	31											
			4	SS	28											
			5	SS	37											
			6	SS	16											
			7	SS	30											
			8	SS	88											
			9	SS	119											
254.0	Silty Sand, Traces of Clay. Very Stiff to Hard		10	SS	22			254								
9.1																
251.5			11	SS	1007	80 mm	252								1 61 32 6	
11.6	End of Borehole															

+3, x5: Numbers refer to
Sensitivity

20
15
10

5 (%) STRAIN AT FAILURE



METRIC

W P 162-60-01 LOCATION Sta. 10+043.7 o/s 8.5 m LT of C Co. Rd. 25 ORIGINATED BY JB
DIST 4 HWY 403 BOREHOLE TYPE Cone Penetration Test COMPILED BY AKB
DATUM Geodetic DATE 1972 03 10 CHECKED BY GP

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT	PLASTIC LIMIT W _p	NATURAL MOISTURE CONTENT W	Liquid Limit W _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	WATER CONTENT (%)		
262.9	Ground Level												
0.0							262						
							260						
257.5							258						
5.4	End of Cone Test							100/230 mm					

+3, x5 : Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10