GEOCRES No. _52E-32_

DIST. _20_ REGION _____

W.P. No. _47-89-01_

CONT. No. _____

W. O. No. _____

STR. SITE No. _____

HWY. No. _17W_

LOCATION _Various Locations_
Kenora By-Pass Sign Supports
No of PAGES - ____

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT._____

REMARKS: _____

_____

_____

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FOUNDATION   DESIGN   SECTION

foundation
investigation   and
design   report

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP   47-89-01   DIST 20

HWY 17   STR SITE

Sign Support Structures
Hwy. #17 N & Kenora By-Pass

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FOUNDATION INVESTIGATION REPORT

For

Sign Support Structures

Hwy. #17 N & Kenora By-Pass

W.P. 47-89-01

District #20, Kenora

INTRODUCTION

This report contains the results of a site investigation carried out at various locations in the vicinity of Hwy. #658 approach to Hwy. #17 N and Kenora By-Pass to provide information for the foundation design and construction of Sign Support Structures.

The field work for this project was carried out between 89:06:20 and 89:06:28, and on 89:07:08, and comprised of nine sampled boreholes accompanied with Dynamic Cone Penetration Tests. Seven of the nine boreholes were taken in to the bedrock and rock cores were obtained using AX-size diamond bits.

DESCRIPTION OF THE SITE

The project sites are located at the following approaches to Hwy. 17 N.

1) Hwy. 658 West Approach
2) Hwy. 658 East Approach
3) Kenora-By-Pass West End
4) Kenora-By-Pass East End

The Hwy. 658 approach to Hwy. 17 N is located about 1 km north of Kenora. The West End of Kenora-By-Pass is located about 13 km West of Hwy. 658 in the vicinity of Paddy Lake Road. The project site at the east end of Kenora-By-Pass is located about 3 km east of Longbow Lake.

SUBSOIL AND GROUNDWATER CONDITIONS

General

The subsoil condition was observed to vary from site to site and the soils encountered during the course of the investigation together with the field test results are shown on the Record of Borehole sheets contained in the Appendix of this report. The description of the bedrock encountered is also included in the Appendix. Considering the variations in subsoil conditions, these are discussed separately.

Subsurface Conditions – Overhead Truss Signs

Hwy. 658 West Approach

Borehole No. 28 was advanced at the preferred location (Ch. 17+046) and indicates presence of rock fill to a depth of 1.2 m below the existing ground level. This is underlain by 30 cm thick organic silt and sand which overlies the bedrock. The bedrock at this location is identified as biotite quartz gneiss of Early Precambrian Age. The ground water level was observed at about 1.5 m below the existing ground level (El. 331.2).

Borehole No. 30 was advanced at the alternate site (Ch. 16+970) and indicates presence of 90 cm deep rock fill underlain by about 3.1 m thick very hard clayey silt, some sand. The silty deposit is underlain by 90 cm thick compact to very dense silty sand which is followed by very dense sandy gravel which extends to the depth probed (i.e. 6.1 m below the existing ground level). The ground water level was observed 90 cm below the existing ground level (El. 331.9).

Hwy. 658 East Approach

Borehole No. 22 was advanced at the preferred location (Ch. 10+285) for the sign support structure. This borehole indicates presence of 90 cm deep rock fill underlain by the bedrock. This area is underlain by biotite

quartz gneiss bedrock of Early Precambrian Age. The ground water level was observed at about 90 cm below ground level (El. 341.3).

East End of By-Pass

Borehole Nos. 4 & 5 were advanced at the preferred site (Ch. 17+460) and these boreholes indicate presence of 1.7 m to 2.5 m thick firm to stiff silty clay, trace of sand and gravel. However, in borehole 4, 1.2 m thick gravelly sandy layer overlies the clay stratum. The clayey layer is underlain by cobbles and sand with varying proportions of silt and gravel sized particles. This layer which overlies the bedrock extends to a depth of 4.6 m below the ground level (El. 333.9). The bedrock was encountered about 5.6 m below the ground level and it is identified as granite gneiss of Early Precambrian Age. The ground water level wa observed at the ground level (El. 338.5).

West End of By-Pass

Borehole No. 13 was advanced at the preferred site (Ch. 10+520) and this borhole indicates presence of about 1.1 m of rock fill underlain by the bedrock. The bedrock at this location is identified as amphibolite gneiss of Early Precambrian Age. Ground water level was not encountered during the course of our investigation.

SUBSURFACE CONDITIONS - GROUND MOUNTED SIGNS

East End of By-Pass

The borehole (#1) advanced at the preferred site (Ch. 18+160) indicates presence of about 2.2 m of organic clay and clayey silt underlain by bedrock which was encountered at about 3.4 m below the ground level (El. 332.0). This area is underlain by granite gneiss bedrock of Early Precambrian Age. The ground water level was observed at 1.1 m below the ground level (El. 334.3).

West End of By-Pass

Borehole 22W was advanced at Ch. 10+285 (close to preferred site Ch. 10+320) and indicates presence of rock fill to a depth of 2.0 m below the existing ground level (El. 347.7). The rock fill is underlain by bedrock. The bedrock at this location is identified as amphibolite gneiss of Early Precambrian Age.

Borehole 26W was advanced at Ch. 17+345 and this borehole indicates about 1.4 m thick rock fill underlain by bedrock. This area is underlain by hornblende gneiss bedrock of Early Precambrian Age.

DISCUSSION AND RECOMMENDATIONS

We understand that the overhead sign support as well as ground mounted structures will be very light and expected to resist the uplift forces induced by the wind loads.

Overhead truss sign support structures are proposed at Hwy. 658 approach to Hwy. 17 N as well as at the east and west-ends of Kenora By-Pass. In addition Ground Mounted Sign Support Structures are proposed at these two locations along Kenora By-Pass.

Overhead Truss Signs

Hwy. 658 West Approach

The bedrock at the preferred site (Ch. 17+046) was encountered 1.5 m below the ground level, and was observed to be medium strong. It may be classified as very poor quality rock (RQD = 0 to 22%) up to the depth of drilling. If the proposed structure is located at this site, it is recommended that the structure be bolted to the mass concrete placed on sound bedrock. The mass concrete should be placed to the required depth after removing all the weathered part of the bedrock.

Alternatively, the structure may be supported on a spread footing placed on the bedrock (El. 331.2±). The footing should be anchored or bolted to the bedrock to resist the uplift forces induced by the wind loads and frost heave (depth of frost penetration 2.4 m). A safe bond stress value of 750 kPa is recommended for the design of the bolt or anchor.

If the alternate location (Ch. 16+970) is selected for the sign support structure, the high ground water level may impose construction difficulties and also, the footing should be located at least 2.4 m below the finished grade to protect against the frost penetration. In view of these facts, it is recommended that the structure be supported on caissons founded at about 4.8 m below the ground level (El. 328±). The following bearing capacity values may be used for the design of the caissons.

	Pile	Diameter
	0.76 m	1.0 m
Factored Capacity at U.L.S.	260 kN	450 kN
Capacity at S.L.S. Type II	160 kN	275 kN

However, if Working Stress Method is adopted for the design of the caissons, a safe end bearing value of 350 kPa may be used for the design. The caissons may be constructed using liner and tremie concreting.

Hwy. 658 East Approach

It is recommended that the structure be bolted to the mass concrete placed on sound bedrock. The mass concrete should be placed to the required depth after removing all the weathered part of the bedrock.

If the weight of the mass concrete is not adequate to resist the uplift forces, the structure may be supported on a spread footing placed on the bedrock and the footing should be anchored or bolted to the bedrock. A safe bond stress value of 750 kPa is recommended for the design of the bolt or anchor.

East End of By-Pass

The foundation for the structures should be placed at least 2.4 m below the ground level to protect against the frost penetration. The high ground water level encountered at this site may impose greater difficulties for the construction of spread footing. In view of these facts, it is recommended that the structure be supported on caissons founded at about 4.5 m below the ground level (El. 334±). The following bearing capacity values may be used for the design of the caissons.

	Pile	Diameter
	0.76 m	1.0 m
Factored Capacity at U.L.S.	260 kN	450 kN
Capacity at S.L.S. Type II	160 kN	275 kN

However, if working stress approach is used for the design, a safe end bearing value of 350 kPa is recommended. The caissons may be constructed using liner and tremie concreting.

West End of By-Pass

The recommendations given for Hwy. 658 West approach preferred Site. (Ch. 17+046) may be used for the proposed structures at this location.

Ground Mounted Signs

East End of By-Pass

Considering the construction difficulties and the depth of frost penetration, it is recommended that the structure be supported on short caissons founded on bedrock (El. 332.0±).

West End of By-Pass

The bedrock at the preferred site (Ch. 10+285) as well as at the alternate location (Ch. 17+345) was encountered within 2.0 m below the existing ground level.

At both of these locations (Ch. 10+285 and Ch. 17+345), the recommendations given for Hwy. 658 east approach may be used for the proposed structures.

MISCELLANEOUS

The field work for this investigation was carried out under the supervision of Mr. M. Hopper. The equipment used was owned and operated by Kenora Soil Drilling Ltd. This report was prepared by Mr. M. Vasavithasan and reviewed by Mr. P. Payer, Senior Foundation Engineer and approved by Mr. Devata, Chief Foundation Engineer.

M. Vasavithasan, P.Eng.
Foundation Engineer

M. Devata, P.Eng.
Chief Foundation Engineer

APPENDIX

EXPLANATION OF TERMS USED IN REPORT

N VALUE: THE STANDARD PENETRATION TEST (SPT) N VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 51mm O.D SPLIT BARREL SAMPLER TO PENETRATE 0.3m INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WITH A MASS OF 63.5kg, FALLING FREELY A DISTANCE OF 0.76m. FOR PENETRATIONS OF LESS THAN 0.3m N VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED AVERAGE N VALUE IS DENOTED THUS $\bar{N}$.

DYNAMIC CONE PENETRATION TEST: CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (51mm O.D 60° CONE ANGLE) DRIVEN BY 475 J IMPACT ENERGY ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 0.3m ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

CONSISTENCY: COHESIVE SOILS ARE DESCRIBED ON THE BASIS OF THEIR UNDRAINED SHEAR STRENGTH (c_u) AS FOLLOWS:

c_u (kPa)	0 - 12	12 - 25	25 - 50	50 - 100	100 - 200	>200
	VERY SOFT	SOFT	FIRM	STIFF	VERY STIFF	HARD

DENSENESS: COHESIONLESS SOILS ARE DESCRIBED ON THE BASIS OF DENSENESS AS INDICATED BY SPT N VALUES AS FOLLOWS:

N (BLOWS/0.3m)	0 - 5	5 - 10	10 - 30	30 - 50	>50
	VERY LOOSE	LOOSE	COMPACT	DENSE	VERY DENSE

ROCKS ARE DESCRIBED BY THEIR COMPOSITION AND STRUCTURAL FEATURES AND / OR STRENGTH.

RECOVERY: SUM OF ALL RECOVERED ROCK CORE PIECES FROM A CORING RUN EXPRESSED AS A PERCENT OF THE TOTAL LENGTH OF THE CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE INTACT CORE PIECES, 100mm+ IN LENGTH EXPRESSED AS A PERCENT OF THE LENGTH OF THE CORING RUN. THE ROCK QUALITY DESIGNATION (R Q D), FOR MODIFIED RECOVERY, IS:

RQD (%)	0 - 25	25 - 50	50 - 75	75 - 90	90 - 100
	VERY POOR	POOR	FAIR	GOOD	EXCELLENT

JOINTING AND BEDDING:

SPACING	50mm	50 - 300mm	0.3m - 1m	1m - 3m	>3m
JOINTING	VERY CLOSE	CLOSE	MOD. CLOSE	WIDE	VERY WIDE
BEDDING	VERY THIN	THIN	MEDIUM	THICK	VERY THICK

ABBREVIATIONS AND SYMBOLS

FIELD SAMPLING

S S	SPLIT SPOON	T P	THINWALL PISTON	
W S	WASH SAMPLE	O S	OSTERBERG SAMPLE	
S T	SLOTTED TUBE SAMPLE	R C	ROCK CORE	
B S	BLOCK SAMPLE	P H	T W ADVANCED HYDRAULICALLY	
C S	CHUNK SAMPLE	P M	T W ADVANCED MANUALLY	
T W	THINWALL OPEN	F S	FOIL SAMPLE	

STRESS AND STRAIN

u_w	kPa	PORE WATER PRESSURE
r_u	1	PORE PRESSURE RATIO
σ	kPa	TOTAL NORMAL STRESS
σ'	kPa	EFFECTIVE NORMAL STRESS
τ	kPa	SHEAR STRESS
$\sigma_1, \sigma_2, \sigma_3$	kPa	PRINCIPAL STRESSES
ϵ	%	LINEAR STRAIN
$\epsilon_1, \epsilon_2, \epsilon_3$	%	PRINCIPAL STRAINS
E	kPa	MODULUS OF LINEAR DEFORMATION
G	kPa	MODULUS OF SHEAR DEFORMATION
μ	1	COEFFICIENT OF FRICTION

MECHANICAL PROPERTIES OF SOIL

m_v	kPa^{-1}	COEFFICIENT OF VOLUME CHANGE
C_c	1	COMPRESSION INDEX
C_s	1	SWELLING INDEX
C_α	1	RATE OF SECONDARY CONSOLIDATION
c_v	m^2/s	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
T_v	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
σ'_{vo}	kPa	EFFECTIVE OVERBURDEN PRESSURE
σ'_p	kPa	PRECONSOLIDATION PRESSURE
τ_f	kPa	SHEAR STRENGTH
c'	kPa	EFFECTIVE COHESION INTERCEPT
ϕ'	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
c_u	kPa	APPARENT COHESION INTERCEPT
ϕ_u	-°	APPARENT ANGLE OF INTERNAL FRICTION
τ_R	kPa	RESIDUAL SHEAR STRENGTH
τ_r	kPa	REMOULDED SHEAR STRENGTH
S_t	1	SENSITIVITY $= \dfrac{c_u}{\tau_r}$

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	e	1,%	VOID RATIO	e_{min}	1,%	VOID RATIO IN DENSEST STATE
γ_s	kN/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1,%	POROSITY	I_D	1	DENSITY INDEX $= \dfrac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m^3	DENSITY OF WATER	w	1,%	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	kN/m^3	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	kN/m^3	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m^3	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m^3/s	RATE OF DISCHARGE
γ_d	kN/m^3	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX $= w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX $= \dfrac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	kN/m^3	UNIT WEIGHT OF SATURATED SOIL				k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	I_c	1	CONSISTENCY INDEX $= \dfrac{w_L - w}{I_p}$	j	kN/m^3	SEEPAGE FORCE
γ'	kN/m^3	UNIT WEIGHT OF SUBMERGED SOIL	e_{max}	1,%	VOID RATIO IN LOOSEST STATE			

ROCK CORE DESCRIPTION
WP 47-89-01

BH#	RC#	CORE RECOVERY DEPTH (m)	% CR*	% RQD*	CORE DESCRIPTION DEPTH (m)	DESCRIPTION
1	4	3.35-4.88	98	70	3.35-4.88	**GRANITE GNEISS**, light grey, spotted black; medium grained; strong to very strong rock; unweathered; close spaced fractures.
5	4	5.64-7.47	98	82	5.64-7.47	**GRANITE GNEISS**, light grey, spotted black; medium grained; strong to very strong rock; unweathered; close spaced fractures.
13	1	1.07-2.59	93	71	1.07-2.59	**AMPHIBOLITE GNEISS**, medium grey to medium dark grey; very fine grained; very closely foliated (banded); very strong rock; unweathered; close to moderately close spaced fractures.
22	1	0.91-1.50	96	33	0.91-2.65	**BIOTITE QUARTZ GNEISS**, very light grey to white, banded greyish black; medium to coarse grained; medium strong rock; slightly weathered to unweathered; very close to close spaced fractures.
	2	1.50-2.01	89	21		
	3	2.01- 2.65	90	45		

*CR = CORE RECOVERY
*RQD = ROCK QUALITY DESIGNATION

(NOTE: Depths are approximated where core recovery is less than 100%

Logged by: SAS, Soils and Aggregates Section.

ROCK CORE DESCRIPTION
WP 47-89-01

		CORE RECOVERY			CORE DESCRIPTION	
BH#	RC#	DEPTH (m)	% CR*	% RQD*	DEPTH (m)	DESCRIPTION
28	1	1.52-2.07	82	0	1.52-3.20	**BIOTITE QUARTZ GNEISS**, very light grey to white, banded greyish black; medium to coarse grained; very coarse grained pink (feldspar) vein from 2.36 - 2.67m; medium strong rock; slightly weathered to unweathered; very close to close spaced fractures.
	2	2.07-2.67	96	22		
	3	2.67-3.20	95	0		
22W	1	1.98-2.59	77	40	1.98-4.09	**AMPHIBOLITE GNEISS**, medium grey to medium dark grey; very fine grained; very closely foliated (banded); very strong rock; unweathered; close spaced fractures.
	2	2.59-4.09	98	80		
26W	1	1.42-2.90	91	67	1.42-2.90	**HORNBLENDE GNEISS**, medium grey to medium dark grey; medium to fine grained; strong to very strong rock; unweathered to slightly weathered; moderately close to close spaced fractures.

*CR = CORE RECOVERY
*RQD = ROCK QUALITY DESIGNATION

(NOTE: Depths are approximated where core recovery is less than 100%

Logged by: SAS, Soils and Aggregates Section.

RECORD OF BOREHOLE No 1   1 OF 1   METRIC

W.P. 47 - 89 - 01	LOCATION STA. 18 + 160 O/S 15m LT. CL. HWY. 17N	ORIGINATED BY M.H.
DIST 20 HWY 17N	BOREHOLE TYPE NW CASING, AX CORING & CONE TEST	COMPILED BY M.H.
DATUM GEODETIC	DATE 89 06 26	CHECKED BY M.V.

ELEV/DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
335.4 Ground Level											
0.0	Organic Clay and Silt, trace of Sand, Soft to Firm		1	SS	3	▽					
							334				
			2	SS	6						
333.4											
2.0	Clayey Silt, trace of Sand, Very Stiff to Hard						333				
			3	SS	46						
332.0							332				
3.4	Note 1							120/10cm			
	Unweathered Gneiss Bedrock		4	RC AX	REC 98		331				RQD 70%
330.5											
4.9	End of Borehole										

Note 1: Gravel & Cobbles from 3.35m to 3.50m

RECORD OF BOREHOLE No 4 — 1 OF 1 — METRIC

W.P. 47 – 89 – 01	LOCATION STA. 17 + 460 O/S 9.0m RT CL. HWY. 17N — ORIGINATED BY M.H.
DIST 20 HWY 17N	BOREHOLE TYPE NW CASING & CONE TEST — COMPILED BY M.H.
DATUM GEODETIC	DATE 89 06 27 & 89 06 28 — CHECKED BY M.V.

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT wP — NATURAL MOISTURE CONTENT w — LIQUID LIMIT wL / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
338.5	Ground Level							20 40 60 80 100 / 20 40 60 80 100	10 20 30		
0.0	Sand Some Gravel Trace of Silt And Clay, Loose to Compact					*					
337.3			1	SS	12						
1.2	Clay, Some Silt, Trace of Sand, Very Stiff		2	SS	18		337				
			3	SS	18		336				
335.6											
2.9	Sand With Silt And Clay, Some Gravel, Very Dense		4	SS	72		335				
334.7			5	SS	70	/8cm					
3.8	End of Borehole										

* Water Level Not Established

RECORD OF BOREHOLE No 5   1 OF 1   METRIC

W.P. 47 – 89 – 01	LOCATION STA. 17 + 460 O/S 9.0m LT. CL. HWY. 17N	ORIGINATED BY M.H.
DIST 20 HWY 17N	BOREHOLE TYPE NW CASING, AX CORING & CONE TEST	COMPILED BY M.H.
DATUM GEODETIC	DATE 89 06 26 & 89 06 27	CHECKED BY M.V.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES					GR SA SI CL
338.5	Ground Level						20 40 60 80 100 / 20 40 60 80 100	10 20 30		
0.0	Clay With Silt, Trace of Sand and Gravel, Firm to Stiff		1	SS	7					
			2	SS	18		337			
336.0			3	SS	79 /23cm		336			
2.5 / 335.5	Cobbles									
3.0	Cobbles With Fine Sand and Silt						335			
333.9							334	120/28cm		
4.6	Boulders									
333.2 / 5.3	Weathered						333			
	Unweathered Gneiss Bedrock		4	RC AX	REC 98		332			RQD 82%
331.0 / 7.5	End of Borehole									

RECORD OF BOREHOLE No 11   1 OF 1   METRIC

W.P. __47 – 89 – 01__   LOCATION __STA. 17 + 490 O/S 9.0m LT. CL. HWY. 17N__   ORIGINATED BY __M.H.__

DIST __20__   HWY __17N__   BOREHOLE TYPE __CONE TEST__   COMPILED BY __M.H.__

DATUM __GEODETIC__   DATE __89 06 28__   CHECKED BY __M.V.__

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
341.5	Ground Level										
0.0											
340.2											
1.3	End of Cone Test							120/5cm			

RECORD OF BOREHOLE No 13   1 OF 1   METRIC

W.P. __47 – 89 – 01__   LOCATION ___STA. 10 + 520 O/S 9.0m LT. CL. HWY. 17N___   ORIGINATED BY _M.H._

DIST __20__ HWY _17N_   BOREHOLE TYPE _BW CASING & AX CORING_   COMPILED BY _M.H._

DATUM _GEODETIC_   DATE ____89 06 23 & 89 06 24____   CHECKED BY _M.V._

ELEV DEPTH	DESCRIPTION (Ground Level)	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Rock Fill					*					
1.1	Unweathered Gneiss Bedrock		1	RC AX	REC 93						RQD 71%
2.6	End of Borehole										
	* Water Level Not Established										

W.P.	47 - 89 - 01	LOCATION	STA. 16 + 552 O/S 15m RT. CL. HWY. 17N	ORIGINATED BY M.H.
DIST	20 HWY 17N	BOREHOLE TYPE	CONE TEST	COMPILED BY M.H.
DATUM	GEODETIC	DATE	89 06 24	CHECKED BY M.V.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 — SHEAR STRENGTH kPa o UNCONFINED + FIELD VANE • QUICK TRIAXIAL × LAB VANE 20 40 60 80 100		PLASTIC LIMIT w_P NATURAL MOISTURE CONTENT w LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30		UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION Ground Level	STRAT PLOT	NUMBER	TYPE	'N' VALUES								
0.0													
0.9	End of Borehole								120/25cm				

RECORD OF BOREHOLE No 22   1 OF 1   METRIC

W.P. __47 – 89 – 01__   LOCATION __STA. 10 + 285 O/S 9.0m LT. CL. HWY. 17N__   ORIGINATED BY __M.H.__

DIST __20__   HWY __17N__   BOREHOLE TYPE __AX CORING__   COMPILED BY __M.H.__

DATUM __GEODETIC__   DATE __89 06 22__   CHECKED BY __M.V.__

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100 (o UNCONFINED + FIELD VANE, • QUICK TRIAXIAL × LAB VANE) 20 40 60 80 100	10 20 30		GR SA SI CL
342.2	Ground Level										
0.0	Rock Fill					▼					
341.3											
0.9	Unweathered Gneiss Bedrock		1	RC AX	REC 96		341				RQD 33%
			2	RC AX	REC 89						RQD 21%
			3	RC AX	REC 90		340				RQD 45%
339.5											
2.7	End of Borehole										

$+^3$, $\times^5$: Numbers refer to Sensitivity $15\diamond5$ $^{20}_{10}$ (%) STRAIN AT FAILURE

W.P. 47 – 89 – 01   LOCATION STA. 10 + 285 O/S 7.6m LT. CL. HWY. 17N   ORIGINATED BY M.H.

DIST 20   HWY 17N   BOREHOLE TYPE BW CASING, AX CORING & CONE TEST   COMPILED BY M.H.

DATUM GEODETIC   DATE 89 06 22 & 89 06 23   CHECKED BY M.V.

ELEV DEPTH	SOIL PROFILE DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT — WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
349.7 Ground Level								20 40 60 80 100 / 20 40 60 80 100	10 20 30		
0.0	Rock Fill With Boulders					*		120/15cm			
347.7							348				
2.0	Unweathered Gneiss Bedrock		1	RC AX	REC 77		347				RQD 40%
			2	RC	REC		346				RQD 80%
345.6				AX	98						
4.1	End of Borehole										
	* Water Level Not Established										

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

RECORD OF BOREHOLE No 23W   1 OF 1   METRIC

|	
W.P. 47 - 89 - 01	LOCATION STA. 10 + 261 O/S 5.6m RT. CL. HWY. 17N ORIGINATED BY M.H.
DIST 20 HWY 17N	BOREHOLE TYPE CONE TEST COMPILED BY M.H.
DATUM GEODETIC	DATE 89 06 24 CHECKED BY M.V.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT — WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100 — o UNCONFINED + FIELD VANE — • QUICK TRIAXIAL × LAB VANE — 20 40 60 80 100	w_P 10 20 30 w_L		GR SA SI CL
348.7											
0.0											
347.8 0.9	End of Cone Test										

RECORD OF BOREHOLE No 26W   1 OF 1   METRIC

W.P. 47 – 89 – 01	LOCATION STA. 17 + 345 O/S CL. HWY. 17N	ORIGINATED BY M.H.
DIST 20 HWY 17N	BOREHOLE TYPE BW CASING & AX CORING	COMPILED BY M.H.
DATUM GEODETIC	DATE 89 07 08	CHECKED BY M.V.

ELEV DEPTH	DESCRIPTION (Ground Level)	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION / SHEAR STRENGTH kPa	WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
0.0	Sand, Boulders, Some Silt And Gravel (Fill)		1A	SS	13	*					
1.4	Unweathered Gneiss Bedrock		1	RC AX	REC 91						RQD 67%
2.9	End of Borehole										

* Water Level Not Established

W.P. 47 - 89 - 01   LOCATION STA. 17 + 046 O/S 9.0m LT. CL. HWY. 17N   ORIGINATED BY M.H.

DIST 20   HWY 17N   BOREHOLE TYPE AX CORING   COMPILED BY M.H.

DATUM GEODETIC   DATE 89 06 20   CHECKED BY M.V.

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT wP — NATURAL MOISTURE CONTENT w — LIQUID LIMIT wL / WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
332.7	Ground Level										
0.0	Rock Fill										
331.5											
331.2	Organic Silt and Sand				▼						
1.5	Unweathered Gneiss Bedrock		1	RC AX	REC 82		331				RQD 0%
			2	RC AX	REC 96						RQD 22%
							330				
329.5			3	RC AX	REC 95						RQD 0%
3.2	End of Borehole										

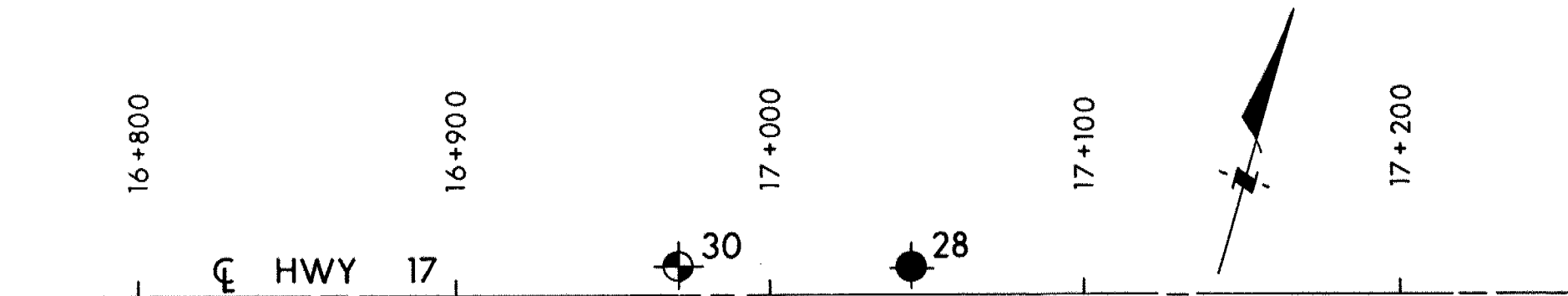+³, ×⁵ : Numbers refer to Sensitivity   15◇5 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 30   1 OF 1   METRIC

W.P. __47 – 89 – 01__   LOCATION __STA. 16 + 970 O/S 9.0m LT. CL. HWY. 17N__   ORIGINATED BY __M.H.__

DIST __20__   HWY __17N__   BOREHOLE TYPE __NW CASING & CONE TEST__   COMPILED BY __M.H.__

DATUM __GEODETIC__   DATE __89 06 20__   CHECKED BY __M.V.__

ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH kPa	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT — WATER CONTENT (%)	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
332.8	Ground Level										
0.0	Rock Fill										
331.9						▽					
0.9											
	Silt With Clay, Some Sand, Dense to Very Dense		1	SS	51		331				
			2	SS	61		330				
			3	SS	47		329				
328.8											
4.0	Silty Sand, Trace of Gravel, Compact to Very Dense		4	SS	28						
328.0			5	SS	68		328				
4.8	Sandy Gravel, Trace of Silt, Very Dense							120/28cm			
			6	SS	78		327				
326.7											
6.1	End of Borehole										

SHEAR STRENGTH kPa
○ UNCONFINED   + FIELD VANE
● QUICK TRIAXIAL   × LAB VANE

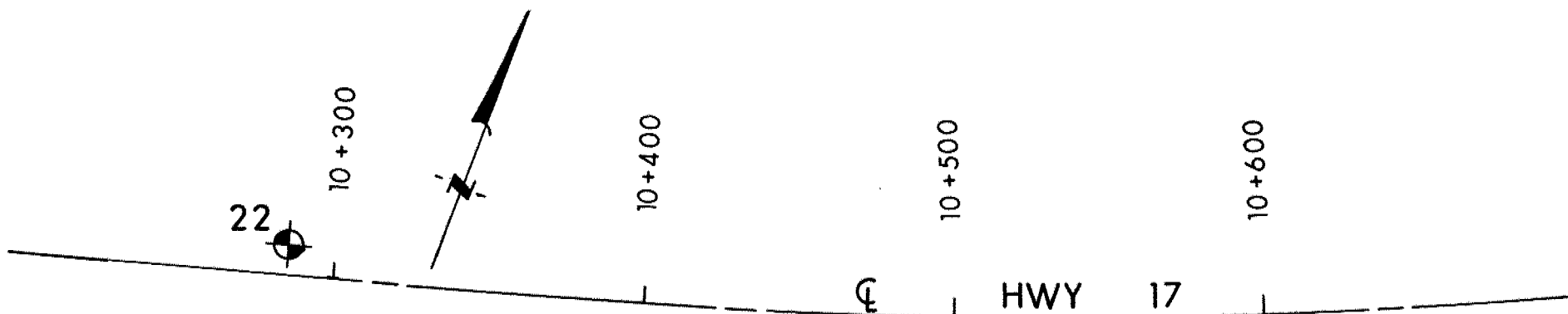16+800 16+900 17+000 17+100 17+200

℄ HWY 17

30

28

PREFERRED SITE   STA 17+046
ALTERNATE SITE   STA 16+970

PROPOSED OVERHEAD TRUSS SIGN
at WEST APPROACH TO HWY 568

PLAN
SCALE
1:2000

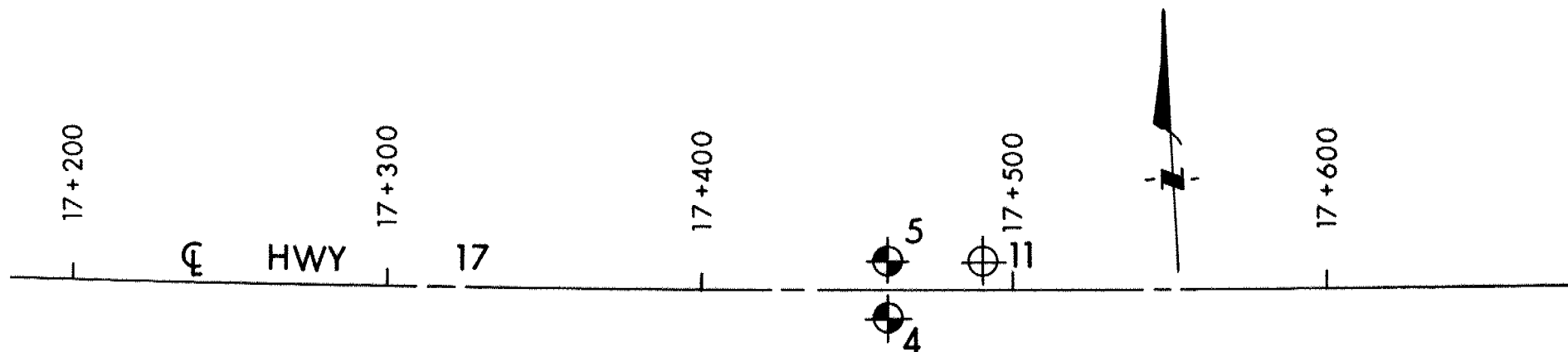Geocres No 52E-32
WP 47-89-01
Dist 20
Figure No 1

10+300

10+400

10+500

10+600

22

₵   HWY   17

PREFERRED SITE   STA 10+285

PROPOSED OVERHEAD TRUSS SIGN
at EAST APPROACH TO HWY 568

PLAN
SCALE
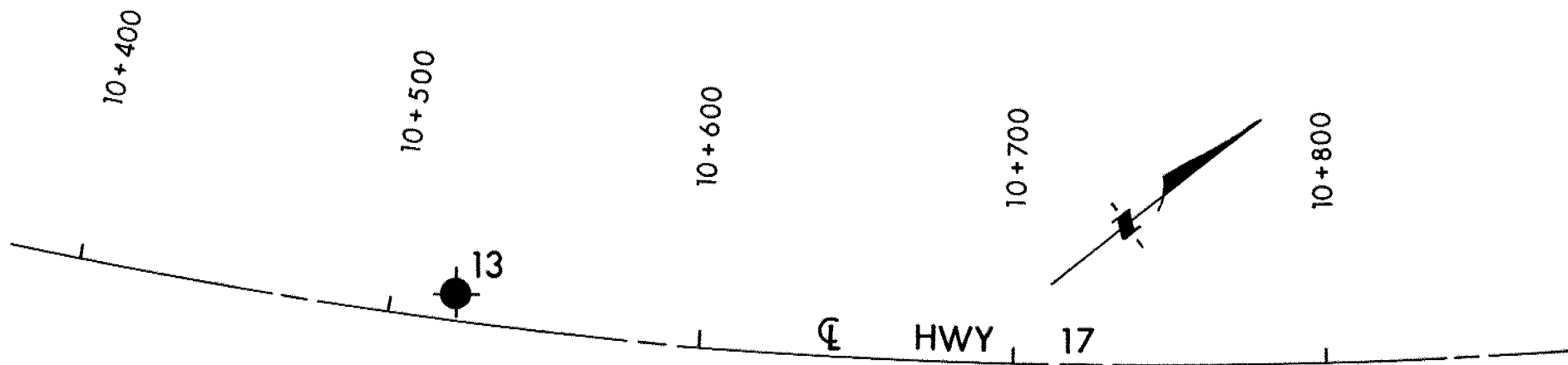1:2000

Geocres No 52E-32
WP 47-89-01
Dist 20
Figure No 2

17+200

17+300

17+400

17+500

17+600

Ȼ HWY 17

5

11

4

PREFERRED SITE STA 17+460
PREFERRED SITE STA 17+460

PROPOSED OVERHEAD TRUSS SIGN
at EAST END OF BY-PASS

PLAN
SCALE
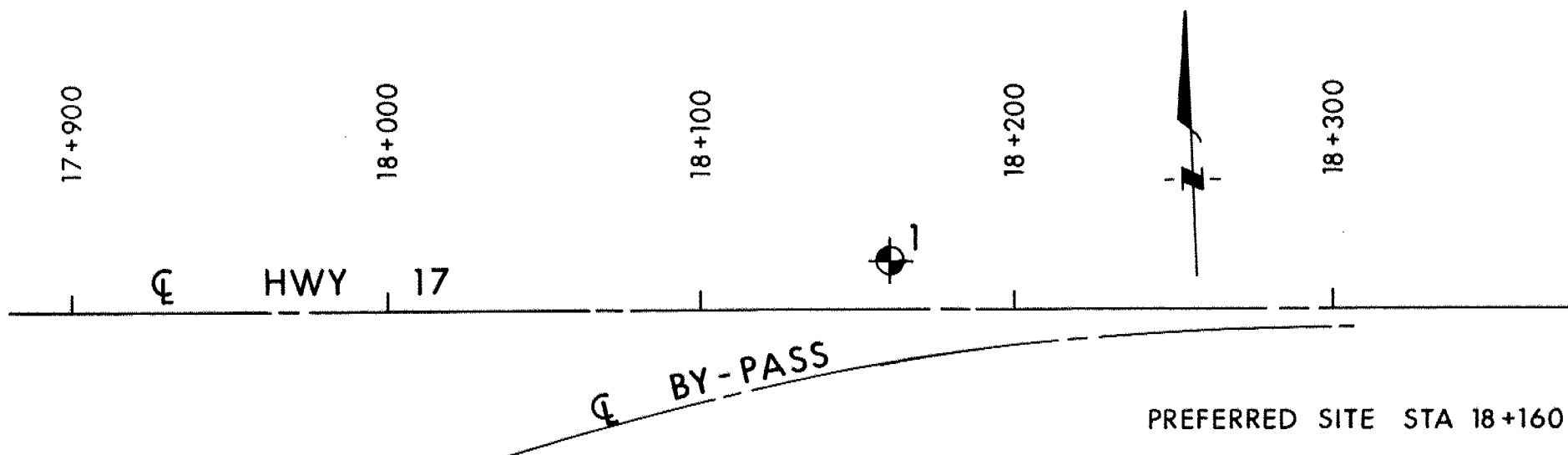1:2000

Geocres No 52E-32
WP 47-89-01
Dist 20
Figure No 3

10+400

10+500

10+600

10+700

10+800

13

₵   HWY   17

PREFERRED SITE   STA 10+520

PROPOSED   OVERHEAD   TRUSS   SIGN
at   WEST   END   OF   BY-PASS

PLAN
SCALE
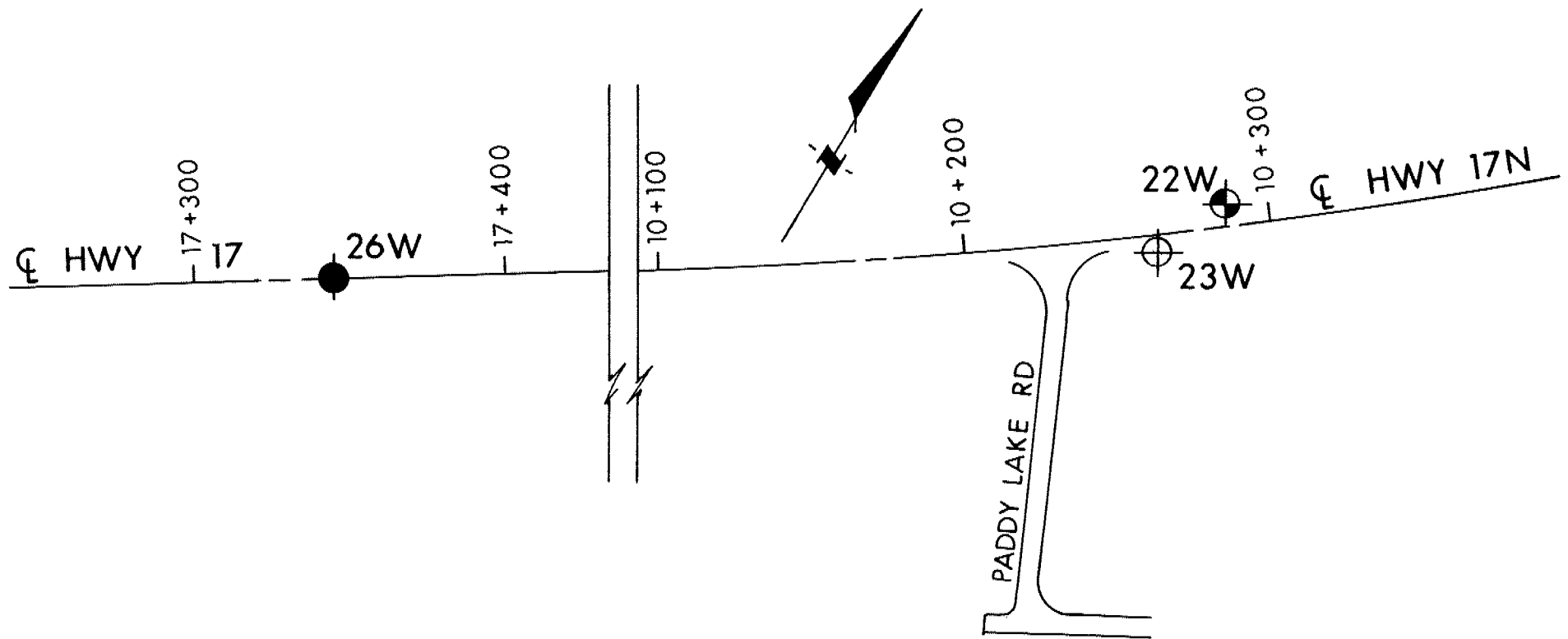1:2000

Geocres No 52E-32
WP 47-89-01
Dist 20
Figure No 4

17+900

18+000

18+100

18+200

18+300

℄ HWY 17

℄ BY-PASS

PREFERRED SITE STA 18+160

PROPOSED GROUND MOUNTED SIGN LOCATIONS
at EAST END OF BY-PASS
(APPROX SIZE = 3m × 6m)

PLAN
SCALE
1:2000

₵ HWY 17

17 + 300

26W

17 + 400

10 + 100

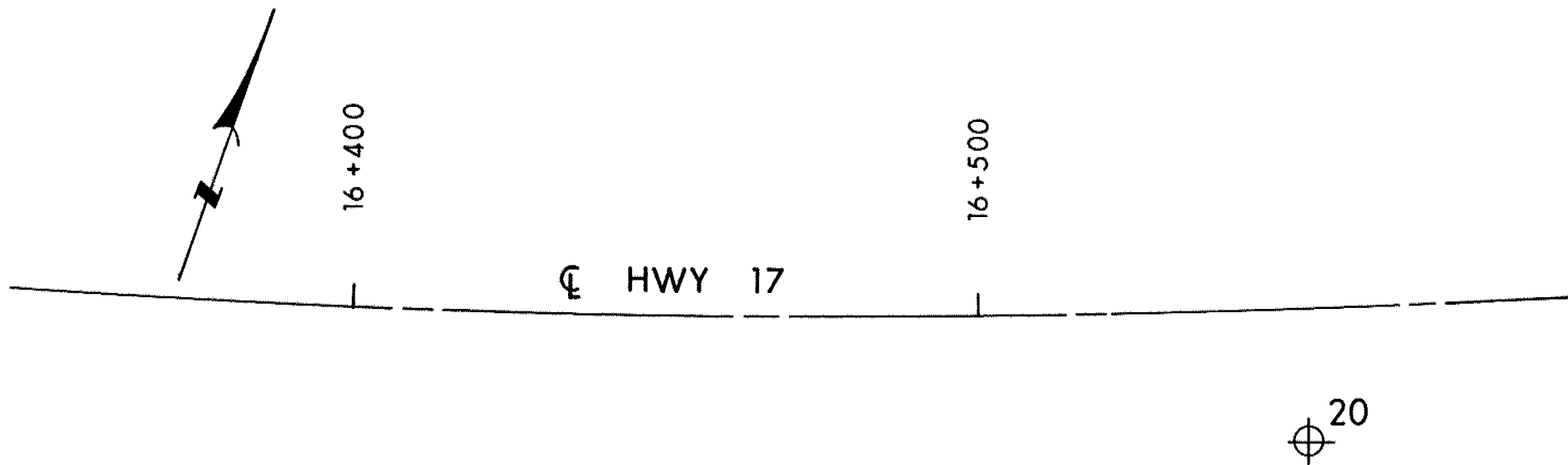10 + 200

22W

10 + 300

23W

₵ HWY 17N

PADDY LAKE RD

PROPOSED GROUND MOUNTED SIGN LOCATIONS
at WEST END OF BY-PASS
(APPROX SIZE = 3m × 6m)

PLAN

SCALE
1:2000

Geocres No 52E-32
WP 47-89-01
Dist 20
Figure No 6

16+400

16+500

₵ HWY 17

⊕20

ALTERNATE SITE-2 STA 16+552

PROPOSED GROUND MOUNTED SIGN LOCATIONS
at WEST END OF BY-PASS
(APPROX SIZE =3m × 6m)

PLAN
SCALE
1:2000