DOCUMENT MICROFILMING IDENTIFICATION

G.I.-30 SEPT. 1976

GEOCRES No. 30M13-137

DIST. 6 REGION

W.P. No. 528-91-01
(formerly 62-89-00)

CONT. No. 93-72

W. O. No.

STR. SITE No.

HWY. No. 400

LOCATION Hwy 400 from Hwy 7 to N of Langstaff Rd. — H.M.L Poles

No of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

memorandum

Ontario

FILE COPY

To: Mr. V. F. Boehnke
Head, Structural Section
4th Floor, Atrium Tower
Central Region

Date: 1992 03 09

Att: Mr. Dennis Wong

From: Foundation Design Section
Room 315, Central Building
Downsview, Ontario

Re: Proposed High Mast Lighting
Highway 400/Highway 7 to North of Langstaff Road
W.P. 528-91-01
Central Region
District 6, Toronto CONT 93-72

GEOCRES No 30M13-137

The attached report provides recommendations for the 22 proposed high mast light poles (P2 through P23) to be located at the above-captioned site.

We believe that this report is adequate for your present purposes. However, should you have any questions regarding it, please do not hesitate to contact this office.

John A. Blair

J. A. Blair, P.Eng.
Project Foundation Engineer

For

D.H. Dundas, P.Eng.
Sr. Foundation Engineer

Distribution

V.F. Boehnke (3)
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FOUNDATION INVESTIGATION REPORT
For
Proposed High Mast Lighting
Highway 400/Highway 7 to North of Langstaff Road
W.P. 528-91-01
Central Region
District 6, Toronto

GEOCRES No 30M13-137

INTRODUCTION

At the request of the Central Region, Structural Section, a foundation investigation was carried out at the above-captioned site between January 6 and 13, 1992 for 22 proposed high mast light poles (P2 through P23) to be located along Highway 400 between Highway 7 and Rutherford Road and shown on Drawing No. 5289101-A (Sheets 1 to 4).

SITE DESCRIPTION AND GEOLOGY

The site is located along Highway 400 between approximately 200 m north of Highway 7 to about 700 m north of Langstaff Road, in the Town of Vaughan, Regional Municipality of York. The topography of the area is generally flat with a slight increase in elevation towards the north. Drainage is generally towards the southeast.

Physiographically, the site is located in the Peel Plain which, consists of a level-to-undulating tract of clayey soils which covers parts of York, Peel and Halton counties. In this area, the soil is known to consist of glacial till. However, in much of the Peel Plain, the till has been modified by a veneer of clay which, when deep enough, is clearly seen to be varved. It is thought that the clay veneer was deposited in a temporary lake impounded between higher land to the north and the ice lobe in the Ontario basin (Reference: Chapman and Putnam, "The Physiography of Southern Ontario"; 3rd Edition, 1984).

PROCEDURES

The fieldwork was carried out between January 6 and 13, 1992 and consisted of a total of twelve (12) sampled boreholes (including 5 under Ref. No.'s W.P. 527-91-01(A) and W.P. 527-91-01(B)) which were advanced to depths of from 7.6 to 11.1 m. Most of the boreholes were advanced using continuous flight, solid stem augers driven by a bombardier-mounted drilling rig equipped with standard soil sampling equipment. However, one of the boreholes (BH7), was drilled along the centreline of the highway using a truck-mounted drilling rig.

Groundwater levels were measured in several of the open boreholes immediately upon completion of sampling and most were left open for subsequent measurements. Piezometers were installed in three of the boreholes, in order to measure the long term groundwater conditions.

Generally, the locations of the boreholes were staked in the field, and their elevations determined by the Central Region Surveys and Plans Office. However, since Borehole 7 was located close to the centreline of Highway 400, its location and elevation was determined by our field representative.

The soil samples, which were obtained in the field, were examined in the laboratory by visual and tactile methods. Moisture content and Atterberg Limits tests were carried out on selected soil samples.

SUBSURFACE CONDITIONS

The subsurface conditions, at the boreholes, generally consist of a surficial layer of topsoil and/or fill from 0.1 to 2.1 m thick, which, at most locations, is underlain by a layer (up to 3 m thick) of silty clay. The silty clay is, in turn, underlain by a heterogeneous mixture of clayey silt, some sand with a trace of gravel (glacial till). Silt to silty sand deposits occur in random zones within the till, although major ones appear to be confined to certain elevations. The groundwater table was found to be at or close to the original ground surface (ie. prior to construction of Highway 400) or elevations respectively ranging from 208.1 to 203.5 m at the north and south ends of the area of investigation.

Details of the subsurface information obtained from this investigation are included on the borehole logs at the back of this report. Selected borehole logs from two previous investigations (W.P. 164-79-04/05 and W.O. 89-11001) are included in the Appendix.

Brief descriptions of the individual soil strata and the groundwater conditions encountered in the boreholes are given below.

Topsoil

In the ditches or flatter areas adjacent to the Highway 400 embankment (ie. Boreholes 4, 6, 8, 10 and 11), a surficial layer of dark brown to black, soft to firm, topsoil, up to 0.5 m thick was encountered in the boreholes.

Distinct topsoil or organic silty clay layers, 0.8 and 0.3 m thick, were also found beneath the granular and other embankment fills at Boreholes 5 and 7, respectively.

Pavement Structure

A thin layer (230 mm thick) of asphalt was contacted at the ground surface at Borehole 7.

Sand to sand and gravel (Fill), from 0.2 to 0.9 m thick, was found beneath the asphalt at Borehole 7 and contacted at the ground surface at Boreholes 1 to 3, 5, 7, and 9. Penetration resistances or 'N-values' in this fill ranged from 5 to 11 blows/0.3 m, indicating generally loose, (although occasionally compact) conditions.

Silty Clay (Fill)

At several locations (Boreholes 1, 2, 3, 5, 7, 9, and 14) the granular fill was found to be underlain by a silty clay deposit containing topsoil enclosures from to .4 to 1.7 m thick (ie. to depths of 0.5 to 1.9 m). This material represents the lower portion of the embankment fills.

At Borehole 4, the surficial layer of topsoil noted above was found to be underlain by a thin (0.1 to 0.2 m thick) layer of a similar silty clay material containing topsoil enclosures. This material has also been referred to as fill, since it appears that these soils have been disturbed by past farming activity which has resulted in topsoil enclosures becoming entrained into it.

'N'-values of 2 to 10 blows/0.3 m indicate that the silty clay fills vary from soft to stiff consistency, although they can generally be considered firm.

Silty Clay

Beneath the fill materials described above, Boreholes 1 and 5 to 11 contacted a brown to grey, silty clay layer from 0.2 to 2.9 m thick. This layer extended to depths 1.4 of 3.7 m (or elevations of 202.3 to 206.2 m).

'N'-values measured in this silty clay layer ranged from 5 to 15 blows/0.3 m indicating soils of generally firm to stiff consistency.

Heterogeneous Mixture of Clayey Silt, some Sand, trace Gravel (Glacial Till)

A heterogenous mixture of brown to grey, clayey silt with some sand and a trace of gravel with occasional cobbles and boulders, from 5.0 m up to at least 8.2 m thick, was encountered in all of the boreholes, at depths of 0.6 to 3.7 m (or elevations of 201.7 to 207.4 m).

Visual examination of this soil indicates that it is likely to be of glacial origin and therefore, may be considered to be a glacial till.

'N'-values measured during Standard Penetration Testing ranged from 11 to 50 blows/0.08 m indicating soils of stiff to hard consistency.

Silt to Fine Sand

Cohesionless layers and zones of silt to fine sand were encountered within the clayey silt till at various depths. Although they were often found to be thin (ie. less than 0.5 m thick) and discontinuous, major ones appeared in several boreholes.

Major seams or zones of silt to fine sand with occasional clayey silt interbeds were generally found below elevations of 197 to 199 m south of Borehole 3, between elevations of 201 and 203 m at Boreholes 5 to 9, between elevations of 204 to 206 m at Boreholes 9 to 11 and below elevations of 199 to 202 m at Boreholes 10 and 11.

At Borehole 4, a major cohesionless zone (at least 6.0 m thick) was found below an elevation of 203 m and, with the exception of a small intrusion of clayey silt till, extended to the maximum depth explored in that borehole. Cohesionless zones, which were encountered at Boreholes 1, 3 and 10, at depths of 8.6 to 9.6 m, also extended to the maximum depth explored in those boreholes (ie. indicating thicknesses of greater than 1.5 to 2.5 m).

'N'-values ranged from to 11 to 53 blows/0.3 m indicating compact to very dense conditions in these cohesionless zones.

Groundwater Conditions

The groundwater levels, when measured in the open boreholes, immediately upon completion of sampling, were found to be from the ground surface to depths of 7.4 m. However, water levels, measured in the open boreholes at least 24 hours after completion of sampling ranged from the ground surface to depths of 2.2 m (or elevations of 203.5 to 208.1 m).

Groundwater levels, measured in the three piezometers installed at the site ranged from depths of about 0.1 to 0.4 m (or elevations of 205 to 207.3 m)

It appears that the groundwater table is at or slightly below the original ground surface (ie. prior to the construction of the Highway 400 embankment) and generally slopes with the ground surface towards the south from elevations of 208.1 at Borehole 9 to 203.5 m at Borehole 2, respectively.

DISCUSSIONS AND RECOMMENDATIONS

General

It is proposed to construct the 22 high mast light poles, listed in Table I, at the locations shown on Drawing No. 1228700-A.

During this investigation, seven (7) of the boreholes (Boreholes 1 to 5, 9 and 14), which were drilled under this reference number (ie. W.P. 528-91-01), provided information for 14 of the proposed high mast light poles. Information for two more proposed high mast lights was obtained from five (5) more boreholes (Boreholes 6 to 8, 10 and 11), which were drilled during the same time period, for two culverts under Ref. No.'s. W.P. 527-91-01(A) and W.P. 527-91-01(B).

Subsurface information for the remaining 6 high mast light poles was obtained from boreholes drilled during two previous investigations (ie. W.P. 164-79-04/05, dated September, 1985 and W.O. 89-11001, dated February, 1989).

Design

The loads from these high mast light poles may be transferred to the subsoil by means of a cast-in-place concrete caisson.

Caissons should be founded at the maximum elevation needed to provide the required lateral resistance. The design of the caissons should be in accordance with the method outlined in the following papers for both cohesive and cohesionless soils:

> Brohms, B. B. Lateral Resistance of Piles in Cohesive Soil Journal of the Soil Mechanics and Foundation Division, ASCE Vol. 90, No. SM2, Paper 3285, March 1964.
>
> Brohms, B. B. Lateral Resistance of Piles in Cohesionless Soil, Journal of the Soil Mechanics and Foundation Division, ASCE Vol. 90, No. SM3, Paper 3909, May 1964.

Based on the boreholes drilled during this and the previous investigations, the calculated parameters to be used for the design of each of the 22 high mast light poles are outlined in Table II and include:

For Cohesionless Soils: The Angle of Internal Friction ϕ (degrees)

For Cohesive Soils: The Unconfined Compressive Strength qu (KPa)

Bulk Unit Weight: γ (kN/m3)

It should be noted, that soils within 1.2 m of the finished ground surface are within the frost zone and should not be included in the calculation for lateral resistance.

It should also be noted that the stratigraphy at all of the proposed high mast light locations have been based on stratigraphical projections from surrounding boreholes drilled during this and previous investigations. Therefore, the elevations shown on Table II can only be considered approximate.

It appears that the grade at high mast pole P15, is to be raised by 1.5 m. In this and similar areas, it is recommended that the following design parameters may be applied to fill materials placed and compacted to at least 95 percent of its Standard Proctor Maximum Dry Density:

ϕ = 28 degrees

γ = 20 kN/m3

Construction Considerations

Caissons will encounter random, saturated cohesionless zones below the groundwater table. Although such conditions are likely to cause difficulties at any of the high mast pole locations, the following locations and elevations are likely to be the most susceptible to such problems:

High Mast Pole #	Elevation (m)
P2	Below 192
P5	Below 194.5
P6	Below 195
P9	Below 197.5

High Mast Pole #	Elevation (m)
P10	Below 199
P11	Below 201.5
P12	Between 200.5 and 203.0 and Below 199.5
P13	Below 199.0
P14	Below 199.5
P16	Below 199.0
P17	Between 203.5 and 201.5
P18	Between 203.5 and 201.3
P19	Between 203.5 and 201.5
P20	Between 202.5 and 201.5
P21	Between 206.5 and 205.5 and Between 203 and 201
P22	Between 206.5 and 205.5 (and possibly between 203.0 and 201.0)

A copy of the special provisions for the construction of the caisson foundations for the high mast light poles is provided in the Appendix.

MISCELLANEOUS

The field investigation was supervised by Mr. J. Blair using equipment owned and operated by Malone's Soil Samples Inc.

This report was written by Mr. J. Blair, Project Foundation Engineer, reviewed by Mr. D. Dundas, Senior Foundation Engineer and approved by Mr. M. Devata, Chief Foundation Engineer.

John A. Blair

J. A. Blair, P.Eng.
Project Foundation Engineer

M. Devata

M. Devata, P.Eng.
Chief Foundation Engineer

Table I

High Mast Light Pole Locations
Highway 400 and Langstaff Road

Pole #	Northing	Easting	Ground Surface Elevations Existing (m)	Proposed (m)
P2	4 850 270.2	301 556.9	201.0	200.9
P3	4 850 388.5	301 536.7	202.2	202.1
P4	4 850 516.6	301 514.7	203.5	203.5
P5	4 850 647.7	301 492.3	204.5	204.5
P6	4 850 785.7	301 468.7	205.1	205.1
P7	4 850 923.7	301 445.0	205.6	205.5
P8	4 851 060.7	301 421.5	206.1	206.0
P9	4 851 196.8	301 398.2	206.5	206.5
P10	4 851 331.8	301 375.1	207.1	207.0
P11	4 851 467.3	301 351.9	207.6	207.6
P12	4 851 604.3	301 328.4	207.9	207.9
P13	4 851 723.1	301 308.1	207.1	207.3
P14	4 851 860.1	301 284.7	206.9	206.9
P15	4 851 876.5	301 149.4	209.7	211.2
P16	4 851 807.4	301 379.9	205.1	205.1
P17	4 851 922.2	301 377.5	205.0	205.5
P18	4 851 970.9	301 170.3	205.8	205.8
P19	4 852 002.5	301 260.3	207.3	207.1
P20	4 852 145.0	301 235.9	207.6	207.6
P21	4 852 292.8	301 210.6	208.1	208.1
P22	4 852 439.7	301 185.4	208.8	208.8
P23	4 852 588.1	301 163.5	209.3	209.3

TABLE II
Design Parameters for
High Mast Light Poles
Highway 400 and Langstaff Road
W.P. 528-91-01

Pole #	Approximate Ground Surface Elev. Existing (m)	Ultimate (m)	Soil Boundary Elevation Upper (m)	Lower (m)	Cohesive/ Non-Cohesive	Design Parameters Degrees φ	kPa qu	kN/m3 γ	Assumed Water level	Closest Boreholes
P2	201.0	200.9	201.0	199.5	Non-Cohesive	30		20	199.5	C8, C10
			199.5	197.0	Cohesive		100	19.5		(WP 164-79-04/05)
			197.0	192.0	Cohesive		500	21.0		
			<192.0		Non-Cohesive	36		20		
P3	202.2	202.1	202.2	200	Non-Cohesive	30		20	200.0	C10,C11
			200	198.5	Cohesive		100	19.5		(WP 164-79-04/05)
			198.5	192.5	Cohesive		500	21		
			<192.5		Non-Cohesive	36		21		
P4	203.5	203.5	203.5	202.3	Non-Cohesive	30		20	201.0	C11
			202.3	201.0	Cohesive		50	17		(WP 164-79-04/05)
			201.0	198.5	Cohesive		200	19.5		
			<198.5		Cohesive		500	21.0		1
P5	204.5	204.5	204.5	203.5	Non-Cohesive	30		20	202.5	C11
			203.5	202.0	Cohesive		50	17		(WP 164-79-04/05)
			202.0	198.5	Cohesive		250	20		
			198.5	194.7	Cohesive		400	21.0		1
			<194.7		Non-Cohesive	36		21.0		
P6	205.1	205.1	205.1	204.0	Non-Cohesive	30		20	202.2	1, 2
			204.0	203.0	Cohesive		50	17		
			203.0	199.0	Cohesive		250	20		
			199	195.0	Cohesive		400	21		
			<195		Non-Cohesive	36		20		

TABLE II
Design Parameters for
High Mast Light Poles
Highway 400 and Langstaff Road
W.P. 528-91-01

Pole #	Approximate Ground Surface Elev. Existing (m)	Ultimate (m)	Soil Boundary Elevation Upper (m)	Lower (m)	Cohesive/ Non-Cohesive	Design Parameters Degrees ϕ	kPa qu	kN/m3 ϒ	Assumed Water level	Closest Boreholes
P7	205.6	205.5	205.5	204.5	Non-Cohesive	30		20	203.0	2, 1
			204.5	203.5	Cohesive		50	17		
			203.5	201.0	Cohesive		250	20		
			201.0	196.0	Cohesive		500	21		
			<196		Non-Cohesive	36		20		
P8	206.1	206.0	206.1	204.8	Non-Cohesive	30		20	204.0	2, 3
			204.8	203.8	Cohesive		50	17		
			203.8	201.5	Cohesive		250	20		
			201.5	196.5	Cohesive		500	21		
			<196.5		Non-Cohesive	36		20		
P9	206.5	206.5	205.5	205.0	Non-Cohesive	30		20	204.5	3, 2
			205.0	202	Cohesive		200	20		
			202	197.5	Cohesive		400	21		
			<197.5		Non-Cohesive	36		20		
P10	207.1	207.0	207.1	205.5	Non-Cohesive		30	20	205.0	3, 4
			205.5	202.5	Cohesive		250	20		
			202.5	199.0	Cohesive		400	21		
			<199.0		Non-Cohesive	36		20		
P11	207.6	207.6	207.6	206.4	Non-Cohesive	30		20	205.5	4, 3
			206.4	205.5	Cohesive		50	17		
			205.5	203.5	Cohesive		250	20		
			203.5	201.5	Cohesive		500	21		
			<201.5		Non-Cohesive	34		20		

TABLE II
Design Parameters for
High Mast Light Poles
Highway 400 and Langstaff Road
W.P. 528-91-01

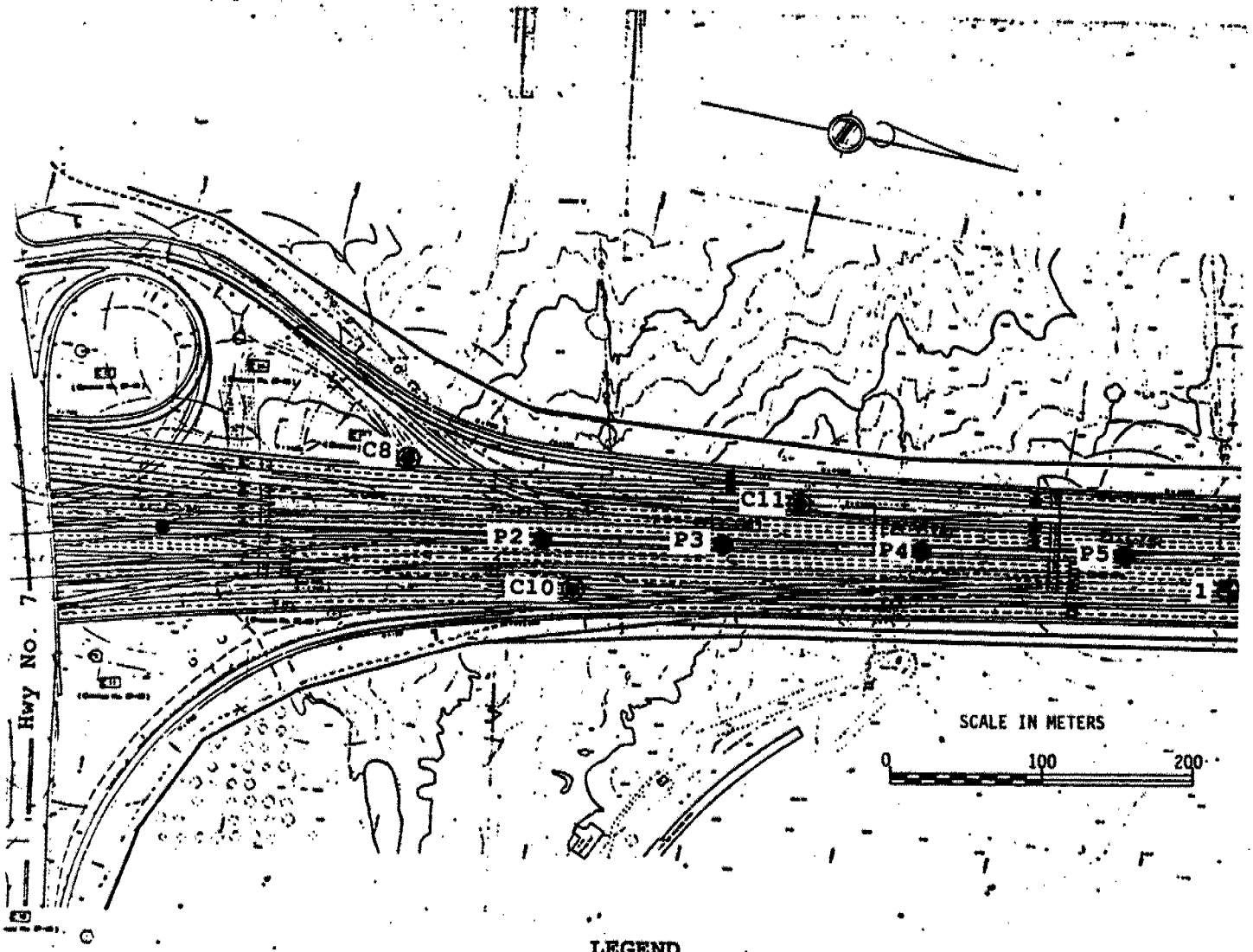
Pole #	Approximate Ground Surface Elev. Existing (m)	Ultimate (m)	Soil Boundary Elevation Upper (m)	Lower (m)	Cohesive/ Non-Cohesive	Design Parameters Degrees ϕ	kPa qu	kN/m3 ɣ	Assumed Water level	Closest Boreholes
P12	207.9	207.9	207.9	206.5	Non-Cohesive	30		20	205.5	4, 5
			206.5	205.0	Cohesive		50	13		
			205.0	203.0	Cohesive		250	20		
			203.0	200.5	Non-Cohesive	34		20		
			200.5	199.5	Cohesive		400	21		
			<199.5		Non-Cohesive	33		20		
P13	207.1	207.3	207.1	206.1	Non-Cohesive	30		20	205.5	5, 4
			206.1	205	Cohesive		20	10		
			205	204	Cohesive		150	19		
			204	202	Cohesive		250	20		
			202	199	Cohesive		400	21		
			<199		Non-Cohesive	33		20		
P14	206.9	206.9	206.9	206.5	Non-Cohesive	30		20	205.5	5, 7
			206.5	205	Cohesive		20	10		
			205.0	204	Cohesive		150	19		
			204	201.5	Cohesive		250	20		
			201.5	198.5	Cohesive		400	21		
			<198.5		Non-Cohesive	33		20		
P15	209.7	211.2	209.7	208.5	Non-Cohesive	30		20	205.0	1, 2 (W.O. 89-11001)
			208.5	206.5	Cohesive		50	17		
			206.5	203.5	Cohesive		150	20		
			203.5	201.5	Non-Cohesive	30		19		
			<201.5		Cohesive		500	21		

TABLE II
Design Parameters for
High Mast Light Poles
Highway 400 and Langstaff Road
W.P. 528-91-01

Pole #	Approximate Ground Surface Elev. Existing (m)	Ultimate (m)	Soil Boundary Elevation Upper (m)	Lower (m)	Cohesive/ Non-Cohesive	Design Parameters Degrees ϕ	kPa qu	kN/m3 ɣ	Assumed Water level	Closest Boreholes
P16	205.1	205.1	205.1	203.9	Cohesive		100	20	204.5	5 (W.O. 89-11001)
			203.9	199.0	Cohesive		250	20		5
			<199		Non-Cohesive	32		20		
P17	205.0	205.5	205.0	203.5	Cohesive		100	19	203.5	5 (W.O. 89-11001)
			203.5	201.5	Non-Cohesive	32		19		5
			<201.5		Non-Cohesive	34		20		
P18	205.8	205.8	205.8	203.5	Cohesive		150	19	205.5	2 (W.O. 89-11001)
			203.5	201.3	Non-Cohesive	34		20		5
			<201.3		Cohesive		400	21		
P19	207.3	207.1	207.3	206.0	Non-Cohesive	29		18	205.0	4 (W.O. 89-1001)
			206.0	204.5	Cohesive		50	17		7
			204.5	203.5	Cohesive		150	19		
			203.5	201.5	Non-Cohesive	34		20		
			<201.5		Cohesive		400	21		
P20	207.6	207.6	207.6	206.5	Non-Cohesive	30		18	205.5	7, 9
			206.5	205.0	Cohesive		50	17		
			205.0	204.0	Cohesive		100	19		
			204.0	202.5	Cohesive		250	20		
			202.5	201.5	Non-Cohesive	35		21		
			<201.5		Cohesive		400	21		

TABLE II
Design Parameters for
High Mast Light Poles
Highway 400 and Langstaff Road
W.P. 528-91-01

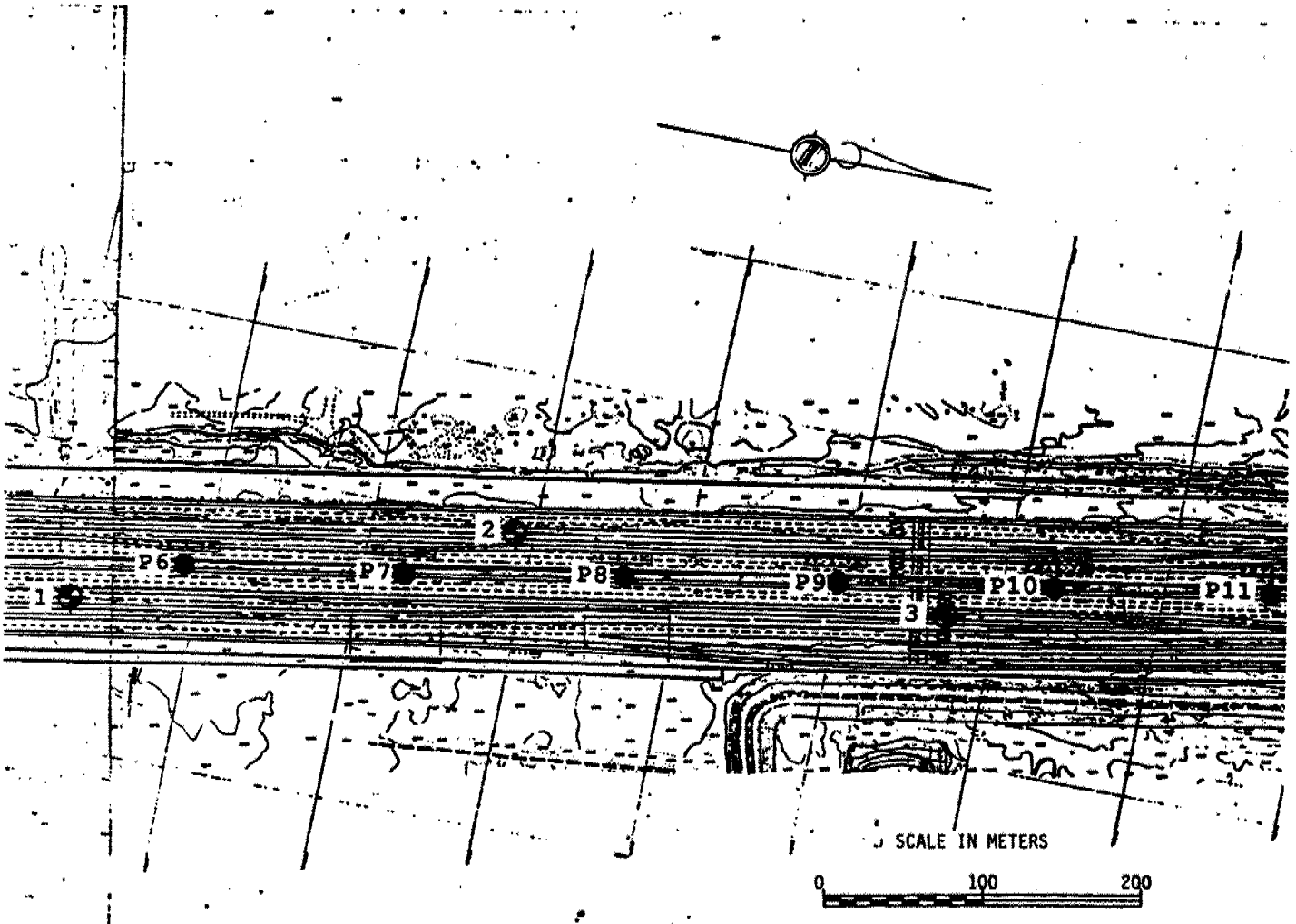
Pole #	Approximate Ground Surface Elev. Existing (m)	Ultimate (m)	Soil Boundary Elevation Upper (m)	Lower (m)	Cohesive/ Non-Cohesive	Design Parameters Degrees ϕ	kPa qu	kN/m3 γ	Assumed Water level	Closest Boreholes
P21	208.1	208.1	208.1	207	Non-Cohesive	30		20	207.0	9, 7
			207.0	206	Cohesive		50	17		
			206	203	Cohesive		250	21		
			203	201	Non-Cohesive	30		19.5		
			<201		Cohesive		400	21		
P22	208.8	208.8	208.8	207.8	Non-Cohesive	30		20	207.0	9, 14
			207.8	207.0	Cohesive		50	17		
			207.0	206.5	Cohesive		150	19		
			206.5	201.5	Cohesive		250	20		
			<201.5		Cohesive		500	21		
P23	209.3	209.3	209.3	207.5	Non-Cohesive	28		20	207.5	14, 9
			207.5	206.5	Cohesive		150	19		
			206.5	203.0	Cohesive		250	21		
			<203.0		Cohesive		400	21		



LEGEND

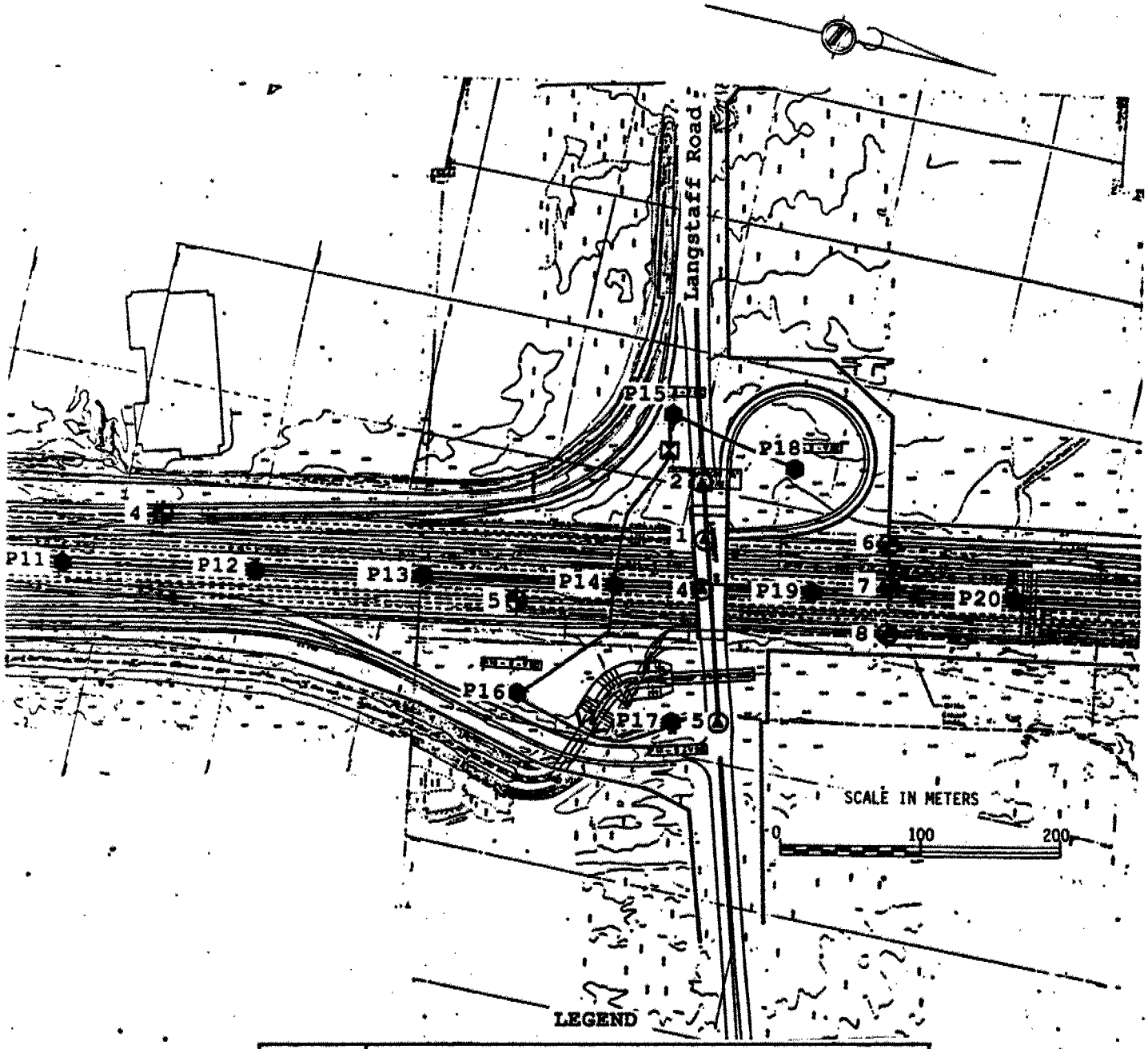
●	Borehole (This Investigation)
⊕	Borehole + Cone (This Investigation)
⊕	Borehole + Cone (W P 527-91-01)
◉	Borehole (W P 164-79-04/05)
⊙	Borehole (W O 89-11001)
⬢	Proposed High Mast Light Poles

Dwg: 5289101-A (Sheet 1)

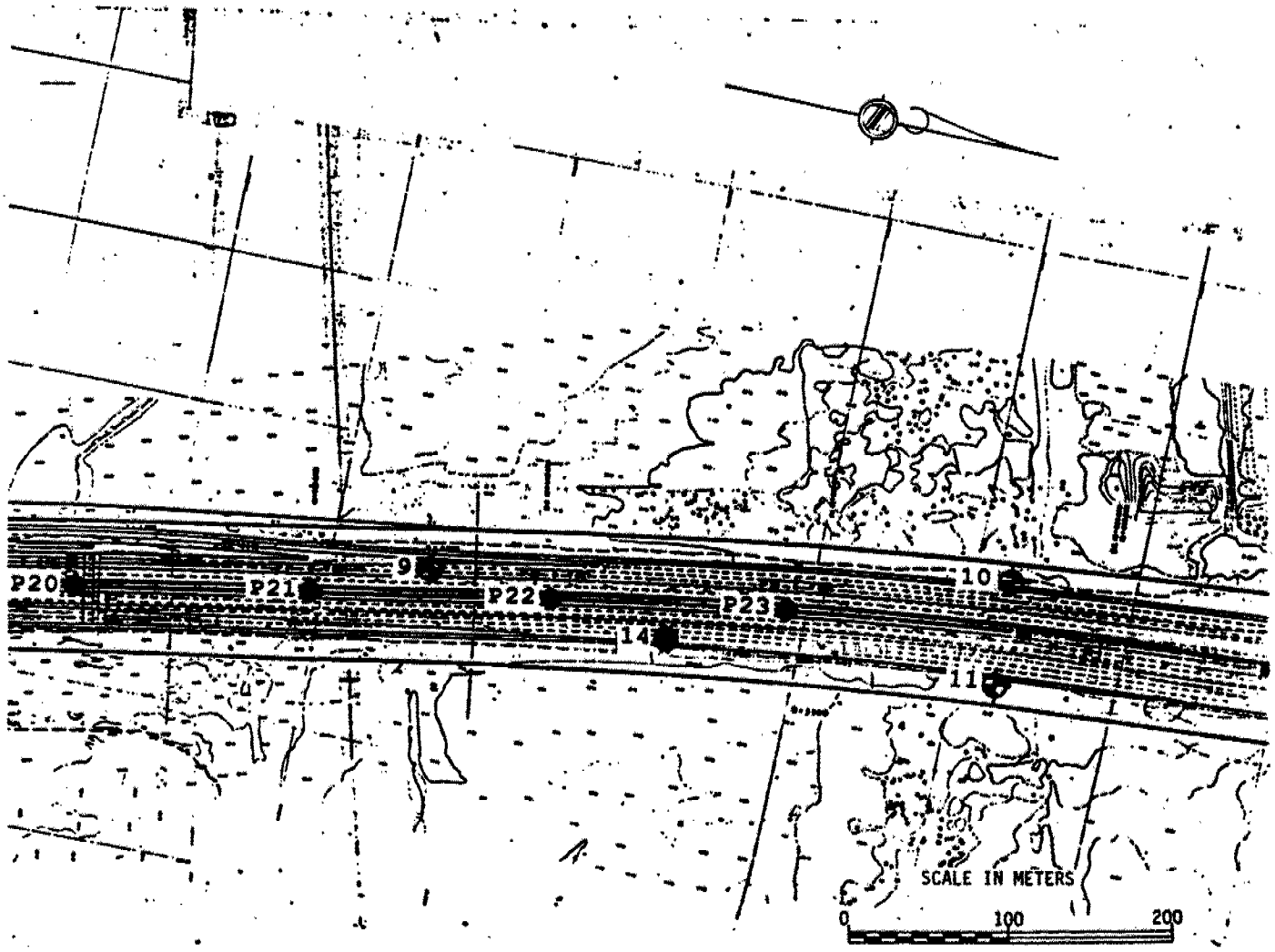


LEGEND

●	Borehole (This Investigation)
⊕	Borehole + Cone (This Investigation)
⊕	Borehole + Cone (W P 527-91-01)
◉	Borehole (W P 164-79-04/05)
◉	Borehole (W O 89-11001)
●	Proposed High Mast Light Poles



Dwg: 5289101-A (Sheet 3)



LEGEND

●	Borehole (This Investigation)
⊕	Borehole + Cone (This Investigation)
⊕	Borehole + Cone (W P 527-91-01)
◉	Borehole (W P 164-79-04/05)
◉	Borehole (W O 89-11001)
⬢	Proposed High Mast Light Poles

RECORD OF BOREHOLE No 1 — 1 OF 1 — METRIC

W.P. 528-91-01(Formerly 612-89-00) LOCATION Co-ords: N 4 850 724.9; E 301 501.2 ORIGINATED BY JB

DIST 6 HWY 400 BOREHOLE TYPE Solid Stem COMPILED BY JB

DATUM Geodetic DATE 92 01 13 CHECKED BY DD

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS
204.3	Ground Surface					
0.0	Gravelly Sand Loose, Dark Grey (Fill)		1	SS	5	
203.4	Silty Clay – Organic, Dark Grey, Stiff, (Fill)		2	SS	15	
0.9	Silty Clay Trace Sand Brown V. Stiff		3	SS	19	
202.6						
1.7	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel Occasional Cobbles and Boulders Brown		4	SS	18	
			5	SS	20	
	Grey		6	SS	36	
			7	SS	16	
	Very Stiff to Hard (Glacial Till)		8	SS	35	
	Very Sandy		9	SS	44	
	Silty Clay Layer		10	SS	40	
194.7						
9.6	Sandy Silt to Silty Sand Occ. Clayey Silt Layers Very Dense		11	SS	53	
193.2						
11.1	End of Borehole					

• W.L. Not Stabilized

ELEVATION SCALE: 204, 203, 202, 201, 200, 199, 198, 197, 196, 195, 194

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

126

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%) 10 20 30

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

$+^3$, $\times^3$: Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 2 1 OF 1 METRIC

W.P. 528-91-01 (Formerly 612-89-00) LOCATION Co-ords: N 4 850 990.0; E 301 414 ORIGINATED BY JB

DIST 6 HWY 400 BOREHOLE TYPE Solid Stem COMPILED BY JB

DATUM Geodetic DATE 92 01 10 CHECKED BY DD

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS
205.7	Ground Surface				
0.0	Gravelly Sand (Fill)				
	Silty Clay Contains Topsoil Brown to Dark Brown (Fill)	1	SS	8	
203.9		2	SS	10	
1.8	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel; Occasional Cobbles and Boulders	3	SS	14	▼*
		4	SS	17	
	Sandy Silt, Brown, Stiff to Very Stiff Grey, Hard (Glacial Till)	5	SS	26	
		6	SS	66	/27cm
		7	SS	55	
		8	SS	50	
	Silty Sand Layer				
	Random Silty Sand Layers	9	SS	58	/15cm
196.4		10	SS	70	/13cm
9.3	End of Borehole				

* W.L. on 92 01 13

ELEVATION SCALE: 205, 204, 203, 202, 201, 200, 199, 198, 197

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa: ○ 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

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 3 1 OF 1 METRIC

W.P. 528-91-01 (Formerly 612-89-00) LOCATION Co-ords: N 4 851 269.3; E 301 406.2 ORIGINATED BY JB

DIST 6 HWY 400 BOREHOLE TYPE Solid Stem COMPILED BY JB

DATUM Geodetic DATE 92 01 13 CHECKED BY DD

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
206.6	Ground Surface						
0.0	Sand, Some Gravel Brown, Loose to Compact (Fill)		1	SS	11		
205.2	Silty Clay - Organic Dark Brown, Firm, (Fill)		2	SS	7		
1.4	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel Occasional Cobbles and Boulders		3	SS	16		
			4	SS	17		
			5	SS	21		
			6	SS	22		
	Brown Grey Very Stiff to Hard		7	SS	36		
	(Glacial Till)		8	SS	29	▼*	
198.0			9	SS	52		
8.6	Silt Trace of Clay Dense to Very Dense		10	SS	57		
195.5			11	SS	36		
11.1	End of Borehole * W.L. Not Stabilized						

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

+³, ×³: Numbers refer to Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 4 1 OF 1 METRIC

W.P. 528-91-01(Formerly 612-89-00) LOCATION Co-ords: N 4 851 528.5; E 301 300.6 ORIGINATED BY JB

DIST 6 HWY 400 BOREHOLE TYPE Solid Stem COMPILED BY JB

DATUM Geodetic DATE 92 01 10 CHECKED BY DD

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
206.1	Ground Surface						
0.0 / 205.5	0.5 m Topsoil Silty Clay Occasional Root Fibres (Fill)		1	SS	6	▼*	
0.6	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel (Glacial Till) Very Stiff Hard Brown Grey		2	SS	16		205
			3	SS	17		204
			4	SS	80		
202.6	Occasional Cobbles and Boulders		5	SS	43		203
3.5	Sandy Silt to Silty Fine Sand						202
	Compact to Dense		6	SS	31		
200.2			7	SS	18		201
5.9	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel Occasional Cobbles and Boulders Hard (Glacial Till)		8	SS	71	/17cm	200
199.1							199
7.0	Sand and Silt to Silty Fine Sand		9	SS	26		
	Compact						198
196.5			10	SS	14		197
9.6	End of Borehole * W.L. on 92 01 13						

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

+³, ×⁵: Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 5 1 OF 1 METRIC

W.P. 528-91-01(Formerly 612-89-00) LOCATION Co-ords: N 4 851 794.8; E 301 313.6 ORIGINATED BY JB

DIST 6 HWY 400 BOREHOLE TYPE Solid Stem COMPILED BY JB

DATUM Geodetic DATE 92 01 06 CHECKED BY DD

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
206.9	Ground Surface						206
0.0	Gravelly Sand Brown, Loose, (Fill)						
	Silty Clay Containing Traces of Topsoil Dark Brown, Stiff, (Fill)		1	SS	10		
205.8							205
1.1	Topsoil						
205.0	Brownish Grey to Dark Brown		2	SS	8		
1.9	Greenish Grey to Brown						204
	Silty Clay, Trace Sand Stiff		3	SS	8		
203.9							
3.0			4	SS	13		203
	Sand Layer		5	SS	24		
	Brown Grey		6	SS	15		202
	Occasional Sandy Silt Layers		7	SS	15		
	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel Occasional Cobbles and Boulders Very Stiff to Hard (Glacial Till)		8	SS	20		201
198.9			9	SS	37		200
8.0	Silty Sand to Sandy Silt Compact to Dense						199
197.3			10	SS	17		198
9.6	End of Borehole						

• W.L. on 92 01 07

> Greater Than

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

>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

$+^3$, $\times^5$; Numbers refer to Sensitivity

$\frac{20}{15}\diamond\frac{5}{10}$ (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 6 1 OF 1 METRIC

W.P. 527-91-01(A)(prev. 612-89-00) LOCATION Co-ords: N 4 852 049.1; E 301 208.7 ORIGINATED BY JB

DIST 6 HWY 400 BOREHOLE TYPE Solid Stem COMPILED BY JB

DATUM Geodetic DATE 92 01 09 CHECKED BY DD

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ kN/m³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
205.7									
0.0 / 205.2	Topsoil Dark Brown to Black Soft		1	SS	2		205		
0.5	Root Fibres		2	SS	5				
	Silty Clay to Clayey Silt Some Sand, Trace Gravel		3	SS	11		204	20.4	
	Firm to Very Stiff		4	SS	7		203		
202.3	Silty Sand Layer Brown		5	SS	34		202		
3.4	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel Grey Sandy		6	SS	45	P1			
	Occasional Cobbles and Boulders		7	SS	39		201		1 29 50 20
	Very Stiff to Hard		8	SS	25		200		
	(Glacial Till)		9	SS	28		199		
	Occasional Silty Clay Zones		10	SS	33		198		
	Sandy		11	SS	76		197		
194.6			12	SS	38		196		
11.1	End of Borehole						195		

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH kPa
○ 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

120/28cm

92 01 13
* GROUND WATER CONDITIONS

PIEZO. NO.	GROUND WATER ELEVATION (Metres)
1	205.4

> Greater Than

+3, ×5 ; Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 7 1 OF 1 METRIC

W.P. 527-91-01(A)(Prev. 612-89-00) LOCATION Co-ords: N 4 852 057; E 301 248.5 ORIGINATED BY JB

DIST 6 HWY 400 BOREHOLE TYPE Solid Stem COMPILED BY JB

DATUM Geodetic DATE 92 01 06 CHECKED BY DD

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	UNIT WEIGHT γ kN/m^3	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
207.3	Ground Surface						
0.0	230 mm Asphalt 130 mm Granular 'A'						
	Sand Brown, Loose, (Fill)	1	SS	7			
	Silty Clay Containing Topsoil Grey to Black, Firm, (Fill)	2	SS	7		17.6	
205.2	Topsoil, Black, Firm						
2.1	Silty Clay Traces of Organics Brownish Grey to Grey Soft to Stiff	3	SS	3	▼*	19.0	
203.6		4	SS	9		22.1	
3.7	Brown to Brownish Grey Grey	5	SS	12			
	Sandy	6	SS	23			
		7	SS	49			
	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel Occasional Cobbles and Boulders Hard	8	SS	50		22.8	
		9	SS	35			
	(Glacial Till)						
197.7		10	SS	39			
9.6							

ELEVATION SCALE: 207, 206, 205, 204, 203, 202, 201, 200, 199, 198

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

120/ 28cm

• W.L. not stabilized

+^{3}, x^5: Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 8 1 OF 1 METRIC

W.P. 527-91-01(A)(Prev. 612-89-00) LOCATION Co-ords: N 4 852 064.0; E 301 285.5 ORIGINATED BY JB

DIST 6 HWY 400 BOREHOLE TYPE Solid Stem COMPILED BY JB

DATUM Geodetic DATE 92 01 07 CHECKED BY DD

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
205.4	Ground Surface						
0.0	130 mm Topsoil						
	Silty Clay Some Sand						
	Stiff to Very Stiff		1	SS	9		
	Sandy		2	SS	15		
203.3							
2.1	Sandy Silt to Silty Sand Occ. Clayey Silt Layers		3	SS	14	P1	
	Brown to Brownish Grey Grey						
	Compact		4	SS	18		
201.7							
3.7			5	SS	30	/8cm	
	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel		6	SS	48		
			7	SS	38		
	Occasional Cobbles and Boulders		8	SS	21		
	Very Stiff to Hard		9	SS	21		
	(Glacial Till)						
			10	SS	44		
	Sandy		11	SS	60	/13cm	
194.5			12	SS	50	/8cm	
10.9	End of Borehole						

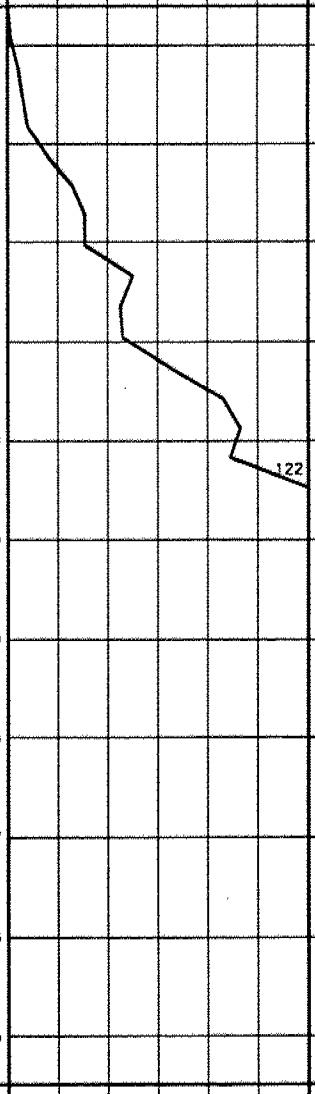
DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

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



92 01 13
* GROUND WATER CONDITIONS

PIEZO. NO.	GROUND WATER ELEVATION (Metres)
1	205

+³, ×³: Numbers refer to Sensitivity

20 / 15 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 9 1 OF 1 METRIC

W.P. 528-91-01(Formerly 612-89-00) LOCATION Co-ords: N 4 852 363.7; E 301 181.9 ORIGINATED BY JB

DIST 6 HWY 400 BOREHOLE TYPE Solid Stem COMPILED BY JB

DATUM Geodetic DATE 92 01 06 CHECKED BY DD

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
208.4	Ground Surface						
0.0	Gravelly Sand, Brown, Loose, (Fill)						208
	Silty Clay Containing Topsoil Dark Brown to Black, Stiff (Fill)		1	SS	10		
			2	SS	10		207
206.2	Silty Clay, Trace Sand, Brown, Stiff						
2.2	Silty Fine Sand Brown Compact		3	SS	19		206
205.4							
3.0	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel Occasional Cobbles and Boulders Brown		4	SS	18		205
	Grey Occasional Sandy Silt Layers		5	SS	21		
	Very Stiff (Glacial Till)		6	SS	22		204
203.2							
5.2	Silty Fine Sand to Sand, Some Silt Compact		7	SS	11		203
			8	SS	15		202
201.1							
7.3	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel Occasional Cobbles and Boulders Very Stiff to Hard (Glacial Till)		9	SS	23		201
			10	SS	79		200
198.8							199
9.6	End of Borehole						

▲ W.L. immediately upon completion of sampling

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
○ 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

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 / 10 (%) STRAIN AT FAILURE

RECORD OF BOREHOLE No 10 1 OF 1 METRIC

W.P. 527-91-01(B)(Prev. 612-89-00) LOCATION Co-ords: N 4 852 722.7; E 301 111.5 ORIGINATED BY JB

DIST 6 HWY 400 BOREHOLE TYPE Solid Stem COMPILED BY JB

DATUM Geodetic DATE 92 01 09 CHECKED BY DD

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS
207.4	Ground Surface					
0.0 / 206.9	Topsoil/Silty Clay (Fill) Black to Brownish Grey, Soft		1	SS	2	
	Root Fibres					
0.5 / 205.6	Silty Clay, Trace Sand Brown Firm to Stiff		2	SS	8	
			3	SS	13	
1.8	Occasional Sandy Silt Layers Brown Grey Silty Clay Layer		4	SS	18	
	Heterogeneous Mixture of Clayey Silt, Some Gravel, Trace Clay		5	SS	25	
			6	SS	19	
	Silty Clay Layer		7	SS	17	
	Occasional Cobbles, Boulders and Silty Clay Layers		8	SS	14	
			9	SS	18	
	Very Stiff (Glacial Till)					
198.8			10	SS	21	
8.6	Sandy Silt to Silty Fine Sand		11	SS	23	
	Compact					
196.3			12	SS	13	
11.1	End of Borehole					

92 01 13
* GROUND WATER CONDITIONS

PIEZO. NO.	GROUND WATER ELEVATION (Metres)
1	207.3

> Greater Than

ELEVATION SCALE: 207, 206, 205, 204, 203, 202, 201, 200, 199, 198, 197

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

SHEAR STRENGTH kPa
o UNCONFINED + FIELD VANE
● QUICK TRIAXIAL x 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

+3, x5 ; Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 11 1 OF 1 METRIC

W.P. 527-91-01(B)(Prev. 612-89-00) LOCATION Co-ords: N 4 852 729.9; E 301 179.6 ORIGINATED BY JB

DIST 6 HWY 400 BOREHOLE TYPE Solid Stem COMPILED BY JB

DATUM Geodetic DATE 92 01 08 CHECKED BY DD

ELEV / DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES 'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE
207.5	Ground Surface						
0.0	100 mm Topsoil						
	Silty Clay, Some Sand						
	Traces of Root Fibres						
	Brown, Firm to Stiff		1	SS	8		
206.1							
1.4							
	Brown to Brownish Grey		2	SS	45		
	Grey						
	Occasional Silty Sand to Sandy Silt Layers		3	SS	33		
	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel		4	SS	29		
	Occasional Cobbles and Boulders		5	SS	24		
	Very Stiff to Hard		6	SS	26		
	(Glacial Till)		7	SS	33		
201.6							
5.9							
	Sandy Silt to Sand and Silt		8	SS	13		
	Compact		9	SS	13		
198.9							
8.6	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel						
	Hard (Glacial Till)		10	SS	45		
197.9							
9.6	End of Borehole						
	* W.L. on 92 01 13						

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/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

+^{3}, ×^{5} : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 14 1 OF 1 METRIC

W.P. 528-91-01(Formerly 612-89-00) LOCATION Co-ords: N 4 852 517.0; E 301 190.7 ORIGINATED BY JB

DIST 6 HWY 400 BOREHOLE TYPE Solid Stem COMPILED BY JB

DATUM Geodetic DATE 92 01 07 CHECKED BY DD

SOIL PROFILE ELEV/DEPTH	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH kPa ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × 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
208.8											
0.0	Gravelly Sand, Brown, Compact, (Fill)					*					
	Silty Clay, Traces of Topsoil						208				
	Soft to Firm, (Fill)										
207.4	Dark Brown										
1.4	Brown		1	SS	11		207				
	Traces of Organics										
	Heterogeneous Mixture of Clayey Silt, Some Sand, Trace Gravel		2	SS	23		206				
	Brown Grey						205				
	Occasional Cobbles and Boulders		3	SS	16		204				
	Stiff to Hard						203				
	(Glacial Till)		4	SS	38		202				
201.2			5	CS							
7.6	End of Borehole										

* W.L. not established

+³, ×⁵ : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

Ministry of Transportation
Ontario

NON-STANDARD SPECIAL PROVISION

Sheet _____ of _____

DATE _____

WP NO _____ CONTRACT NO _____ DISTRICT NO _____ HWY NO _____

LOCATION _____ TYPE OF WORK _____

1. This S P is new (√) [ ]

This S P replaces No _____

Remarks:

Explanation of Intent:

2.

Item No	Spec No	Title or Item Description
		CONCRETE FOOTINGS FOR HIGH MAST POLES

High Mast Pole Lighting foundations will consist of caissons as detailed in the Contract.

The Contractor shall refer to the Foundation Investigation and Design Report in the Contract Package for subsurface information for this project.

The Contractor is advised that zones of non-cohesive soil and near-surface groundwater levels should be anticipated and addressed in his construction proposal and costs. The Contractor is cautioned that non-cohesive soil is susceptible to disturbance under conditions of unbalanced hydrostatic head.

The Contractor is advised that occasional cobbles and boulders should be anticipated and addressed in his construction proposal and costs.

The Contractor is responsible for constructing caissons without disturbing the sides or bases of the caisson excavations. A fully detailed proposal, signed and sealed by a Professional Engineer licensed by the Association of Professional Engineers of Ontario is to be submitted to the Engineer a minimum of 4 weeks prior to commencement.

3.

Structural Section	Structural Section	
Initiated by	Detailed by	Approved by

PH-D-358 88-03

Ministry of Transportation and Communications
Ontario

RECORD OF BOREHOLE No C 8 METRIC

W P 164-79-04/05 LOCATION Co-ords. N 4 850 173; E 301 521 ORIGINATED BY FS

DIST 6 HWY 400 BOREHOLE TYPE Solid Stem Augers, Cone Test COMPILED BY FS

DATUM Geodetic DATE 85 06 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 ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT W_p — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
198.1	Ground Surface										
0.0	Silty Clay trace to with Sand trace Gravel					*	198				
	Very Stiff		1	SS	17		197				
			2	SS	25						
							196				
			3	SS	30						
	Hard		4	SS	34		195				
							194				
			5	SS	72						
							193				
	Silty Sand to Sandy Silt Very Dense		6	SS	189	/15 cm	192				
							191				
			7	SS	120		190				
189.1											
9.0	Sand some Silt trace Clay, Gravel						189				
188.5	Very Dense		8	SS	185						
9.6	End of Borehole										
	*groundwater level not established										

OFFICE REPORT ON SOIL EXPLORATION

$\bullet^3$, $\times^3$: Numbers refer to Sensitivity

$15 \frac{20}{10} 5$ (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE No C 10 METRIC

W P 164-79-04/05 LOCATION Co-ords. N 4 850 297; E 301 587 ORIGINATED BY FS
DIST 6 HWY 400 BOREHOLE TYPE Solid Stem Auger, Cone Test COMPILED BY FS
DATUM Geodetic DATE 85 06 14 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL ◆ FIELD VANE ■ LAB VANE	PLASTIC LIMIT Wp — NATURAL MOISTURE CONTENT W — LIQUID LIMIT Wl — WATER CONTENT (%) (10 20 30)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
200.0 0.0	Ground Surface Silty Clay trace to with Sand trace Gravel					*					
	Firm		1	SS	7		199				
			2	TW	PH		198				5 29 41 25
	Hard		3	SS	37						
			4	SS	69		197				4 17 54 25
							196				
			5	SS	126		195				
							194				
			6	SS	105						1 19 55 25
							193				
	Silty Sand to Sandy Silt										
192.2	Very Dense		7	SS	80	/15cm					
7.8	End of Borehole										

*groundwater level not established

s^3, w^3 : Numbers refer to Sensitivity

$\frac{20}{15}$ s (%) STRAIN AT FAILURE
$\frac{}{10}$

Ministry of Transportation and Communications Ontario

RECORD OF BOREHOLE No C 11 METRIC

W P 164-79-04/05 LOCATION Co-ords N 4 850 432; E 301 498 ORIGINATED BY FS

DIST 6 HWY 400 BOREHOLE TYPE Solid Stem Augers, Cone Test COMPILED BY FS

DATUM Geodetic DATE 85 06 10 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	PLASTIC LIMIT W_p / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
199.9	Ground Surface										
0.0	Silty Clay trace to with Sand trace Gravel										GR SA SI CL
	Very Stiff		1	SS	17		199				
	Hard		2	SS	60		198				
			3	SS	90		197				
			4	SS	100		196				
			5	SS	88		195				
			6	SS	100	/15cm	194				
192.4							193				
7.5	Refusal due to probable boulder End of Borehole										

+3, ×5 : Numbers refer to Sensitivity

20 / 15 ◇ 5 (%) STRAIN AT FAILURE / 10

OFFICE REPORT ON SOIL EXPLORATION

RECORD OF BOREHOLE

SHEET 1

LOCATION SEE FIGURE 2

BORING DATE JAN.19,1989

DATUM GEODETIC

SAMPLER HAMMER, 63.5kg, DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg, DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V.- + O.- ● rem.V.- ● U.- O)	HYDRAULIC CONDUCTIVITY, k, CM/SEC; WATER CONTENT, PERCENT (Wp, W, Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	CMES5 POWER AUGER BORING; 200mm DIA. HOLLOW STEM AUGER	GROUND SURFACE		205.15							
		Soft to firm, mottled grey-brown SILTY CLAY, trace sand, occ. organics.		0.00	1	50 DO	1				Backfill
					2	50 DO	8				
				203.55							
		Firm to stiff, grey inter-layered SILTY CLAY, trace sand (TILL) and SILTY CLAY; some seams of silt, sandy silt and silty sand.		1.60	3	50 DO	11				
					4	50 DO	7				
				202.25							
		Compact, grey SANDY SILT, trace clay and gravel. TILL. Boulder at 2.9m depth.		2.90	5	50 DO	23				
				201.45							
				3.70	6	50 DO	19				Bentonite Seal
					7	50 DO	41			MH	Backfill
5		Stiff to hard, grey CLAYEY SILT, some sand, trace gravel. TILL.									
					8	50 DO	28				
					9	50 DO	14				
				196.35							
		Stiff, grey CLAYEY SILT, trace sand with interlayers of SANDY SILT, trace clay and gravel.		8.80	10	50 DO	12				
10				194.75							
		Compact grey SANDY SILT, trace sand and gravel. TILL. Seam of silty clay.		10.40	11	50 DO	29				
				193.55							
		Dense, grey SILTY SAND, trace gravel with interlayers of CLAYEY SILT, some sand.		11.60	12	50 DO	31				
				192.05							
		Hard, grey stratified SILTY CLAY, CLAYEY SILT and SILT, fine sand partings throughout.		13.10	13	50 DO	44				
15					14	50 DO	30				Granular Filter
				188.95							Caved
		Very loose, grey SILT, trace clay and sand.		16.20	15	50 DO	WH			MH	
				187.45							
		Compact, to dense grey SAND, trace silt to SILTY SAND. (Sands blowing; 1.8m to 3m up augers at each sample depth prior to washing.)		17.70	16	50 DO	14				
20				185.15							
		CONTINUED ON NEXT PAGE		20.00	17	50 DO	17				

9 / 14 / 19 ◆ 6 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 100

Golder Associates

LOGGED RF

CHECKED ASP

RECORD OF BOREHOLE 1

SHEET 2

LOCATION SEE FIGURE 2

BORING DATE JAN.19,1988

DATUM GEODETIC

SAMPLER HAMMER, 63.5kg, DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg, DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (36, 72, 108, 144) / SHEAR STRENGTH Cu, kPa (nat.V.- + O.- ● rem.V.- ⊕ U.- O)	HYDRAULIC CONDUCTIVITY, k, CM/SEC / WATER CONTENT, PERCENT (Wp, W, Wl; 10, 20, 30, 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
20	CME55 POWER AUGER BORING 200mm DIA. HOLLOW STEM AUGER	CONTINUED FROM PREVIOUS PAGE		185.16							
		Compact to dense grey SAND, trace silt to SILTY SAND. (Sands blowing; 1.5m to 3m up augers at each sample depth prior to washing.)		20.00	18	50 DO	43				Caved
					19	50 DO	26				
				180.85							
25		Very stiff to hard, grey SILTY CLAY, trace fine sand partings.		24.30	20	50 DO	62				
					21	50 DO	27			MH	
				178.05							Water level in piezometer at elevation 204m. on Jan.26,1989.
		Hard, grey SILTY CLAY, trace sand, occ. fine gravel.		27.10	22	50 DO	52				
30					23	50 DO	46				
				174.84							
		END OF HOLE		30.81							
35		NOTE: Borehole continued below elevation 178.8m. at location of Borehole 1A; 7.6m. west of initial borehole; ground surface elevation 205.32m. Noted increase in auger resistance at about elevation 178.8 m.									
40											

0 10 15 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE 1 : 100

Golder Associates

LOGGED RF

CHECKED ASP

RECORD OF BOREHOLE 2

SHEET 1

LOCATION SEE FIGURE 2

BORING DATE JAN.20.1989

DATUM GEODETIC

SAMPLER HAMMER, 63.5kg, DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg, DROP, 760mm

DEPTH SCALE METRES	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V.- + Q.- ● rem.V.- ⊕ U.- O)	HYDRAULIC CONDUCTIVITY, k, CM/SEC; WATER CONTENT, PERCENT (Wp W WL, 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	GROUND SURFACE		205.77							
	Stiff, mottled grey-brown SILTY CLAY, trace sand, occ. gravel, trace organics.		0.00	1	50 DO	16				Bentonite seal / Backfill
				2	50 DO	11				
				3	50 DO	10				
			203.87							
	Loose to compact, brown to grey SANDY SILT, trace clay and gravel. TILL.		2.10	4	50 DO	9				
				5	50 DO	16				
			202.07							
	Hard, interlayered CLAYEY SILT and SANDY SILT, numerous silt partings.		3.70	6	50 DO	30				
			201.37							
5	Hard, grey CLAYEY SILT, some sand, trace gravel. TILL.		4.40	7	50 DO	58				
				8	50 DO	33				
				9	50 DO	33				Bentonite seal / Backfill
			197.27							
	Very stiff, grey stratified SILTY CLAY and CLAYEY SILT.		8.50	10	50 DO	20				
10			196.07							
	Dense to very dense, grey SANDY SILT, trace clay and gravel. TILL.		10.70	11	50 DO	21				
				12	50 DO	77				
				13	50 DO	73				Granular Filter
			190.87							Caved
15	Hard, stratified SILTY CLAY, trace sand, occ. gravel.		14.90	14	50 DO	32				
			190.07							
	END OF HOLE		15.70							
20										

CME55 POWER AUGER BORING 200mm DIA. HOLLOW STEM AUGER

0 10 15 19 % PERCENT AXIAL STRAIN AT FAILURE

Water level in piezometer at elev. 204 m. on Jan. 26, 1989

DEPTH SCALE 1 : 100

Golder Associates

LOGGED RF

CHECKED ASP

RECORD OF BOREHOLE 4

SHEET 1

LOCATION SEE FIGURE 2 | BORING DATE JAN.23,1989 | DATUM GEODETIC

SAMPLER HAMMER, 63.5kg, DROP, 760mm | PENETRATION TEST HAMMER, 63.5kg, DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	SHEAR STRENGTH Cu, kPa (nat.V.- + O.- ● rem.V.- ⊕ U.- ○)	HYDRAULIC CONDUCTIVITY, k, CM/SEC	WATER CONTENT, PERCENT (WP, W, WL; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	CME55 POWER AUGER BORING 200mm DIA. HOLLOW STEM AUGER	GROUND SURFACE		208.97									
		ASPHALT		208.68									
		Sand and gravel, FILL.		206.44	1	50 DO	15						
		Loose to compact, brown sand, trace silt and gravel, FILL.		0.53	2	50 DO	10						
					3	50 DO	5						
				204.97	4	50 DO	3						
		Soft, mottled brown silty clay, some organics, FILL.		2.00									
				204.27	5	50 DO	4						
		Stiff, grey-brown SILTY CLAY, trace sand, occ. organics.		2.70	6	50 DO	14						
				203.27									
5		Compact to dense, grey SANDY SILT, trace clay and gravel, TILL.		3.70	7	50 DO	11						
					8	50 DO	31					MH	
				201.47									
		Dense, grey SILT, some sand, trace clay.		6.50	9	50 DO	32						
				199.67									
		Very stiff, grey CLAYEY SILT, some sand, trace gravel, TILL, interlayers of stratified silt and clayey silt below 9.4m depth.		7.30	10	50 DO	25						
					11	50 DO	20						
				198.27									
		Compact, grey SILTY SAND to SAND, trace silt. (Sands blowing.)		10.70	12	50 DO	3						
					13	50 DO	22						
15													
20		CONTINUED ON NEXT PAGE		188.97 20.00	14	50 DO	2						

0 10 15 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE 1 : 100

Golder Associates

LOGGED RF

CHECKED ASP

RECORD OF BOREHOLE 4

SHEET 2

LOCATION SEE FIGURE 2

BORING DATE JAN.23,1989

DATUM GEODETIC

SAMPLER HAMMER, 63.5kg, DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg, DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (M)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V.- + Q.- ● rem.V.- ● U.- O)	HYDRAULIC CONDUCTIVITY, k, CM/SEC; WATER CONTENT, PERCENT (Wp W Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
20	CME65 POWER AUGER BORING 200mm DIA. HOLLOW STEM AUGER	CONTINUED FROM PREVIOUS PAGE.		186.97							
		Very loose to compact, grey SILTY SAND to SAND, trace silt.		20.00							
				182.87							
		Hard, grey CLAYEY SILT to SILTY CLAY, some sand, trace gravel. TILL		24.10	15	50 DO	98			MH	Water level in open hole at elevation 204.8m on completion of drilling.
25					16	50 DO	86				
				180.45							
		END OF HOLE		26.52							
		NOTE: Soil description between elevation 194m and 183m based on recovery from augers									
30											
35											
40											

PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE

1 : 100

LOGGED RF

CHECKED ASP

Golder Associates

RECORD OF BOREHOLE

SHEET 1

LOCATION SEE FIGURE 2

BORING DATE JAN.25,1989

DATUM GEODETIC

SAMPLER HAMMER, 63.5kg, DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg, DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (M)	SAMPLES: NUMBER	TYPE	BLOWS/0.3M	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH Cu, kPa (nat.V.- + Q.- ● rem.V.- ● U.- O)	HYDRAULIC CONDUCTIVITY, k, CM/SEC; WATER CONTENT, PERCENT (Wp W Wl)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0		GROUND SURFACE		205.68				20 40 60 80	10 20 30 40		
	CME55 POWER AUGER BORING 200mm DIA. HOLLOW STEM AUGER	Clayey TOPSOIL		0.00 / 205.22	1	50 DO	10				Backfill
		Firm to very stiff, mottled grey-brown SILTY CLAY, trace sand.		0.46 / 203.38	2	50 DO	6	+		MH	
		Compact, grey SANDY SILT, trace clay and gravel. TILL.		2.30 / 202.06	3	50 DO	13				Bentonite Seal
					4	50 DO	13				Backfill
		Compact, grey stratified SILTY SAND and SANDY SILT.		3.60 / 201.28	5	50 DO	19				
5		Compact, grey SANDY SILT, trace clay and gravel (clay content increasing with depth) TILL.		4.40 / 199.13	6	50 DO	16				
					7	50 DO	28				Granular Filter
		END OF HOLE		6.55							
10											
15											
20											

Water level in piezometer at elevation 203.1m on Jan.28,1989.

9
15 ⊕ 6 PERCENT AXIAL STRAIN AT FAILURE
10

DEPTH SCALE

1 : 100

Golder Associates

LOGGED RF

CHECKED ASP

MEMORANDUM

(416)235-3731

To: V.F. Boehnke, P. Eng.
Head, Structural Section
Central Region

Attn.: Dennis Wong, P. Eng.

1994 07 04

From: Foundation Design Section
Room 315, Central Building
Downsview, Ontario

Re: Caisson Installation Procedures for
High Mast Lights (HML) Foundations
Hwy 400 from Hwy 7 to North of Langstaff Rd.
W.P. 612-89-00, Contract 93-72
Hwy 400, District 6, Toronto

We have reviewed the procedures for caisson installations in different types of soils, submitted by Anchor Shoring & Caissons Ltd. to Fellmore Electrical Contractors Ltd. for the above mentioned site.

The procedures in general is acceptable. Although, in HML foundations the sides of the caissons are more critical for the HML support than the base of the caissons, it is desirable that the loose material from the base of the caisson is properly removed.

The contractor has proposed that in case of high water table in non-cohesive soils a positive hydrostatic head will be maintained. Occasionally, bentonite slurry is used to effectively prevent any boiling at the base of the caisson. However, if required, this matter would be dealt at the time of construction.

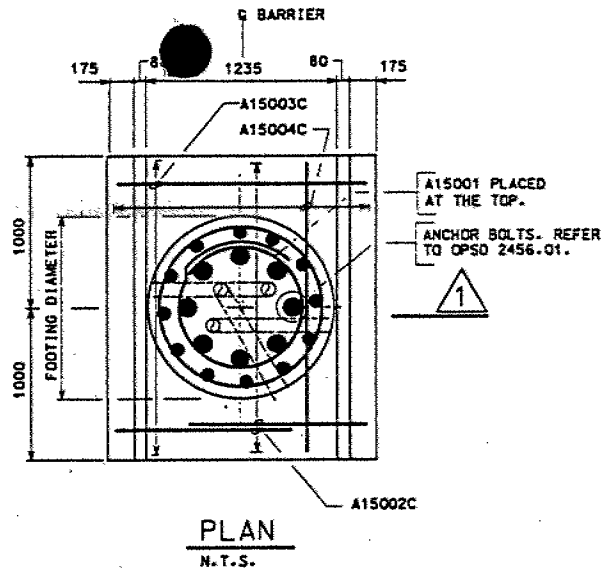
K.S.Q. Ahmad, P. Eng.
Foundation Engineer

For

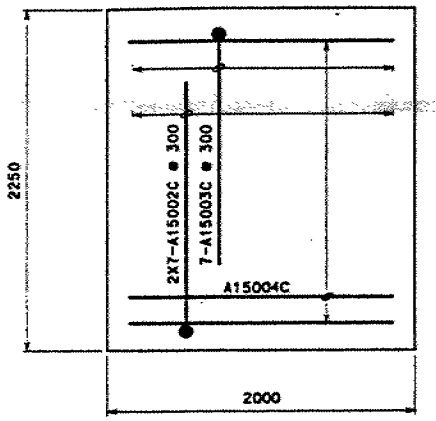
D. Dundas, P. Eng.
Chief Foundation Engineer (Acting)

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No 93-72
WP No 612-89-00
HWY 400/HWY7 TO LANGSTAFF RD.
HIGH MAST LIGHTING POLE FOOTINGS
SHEET 229

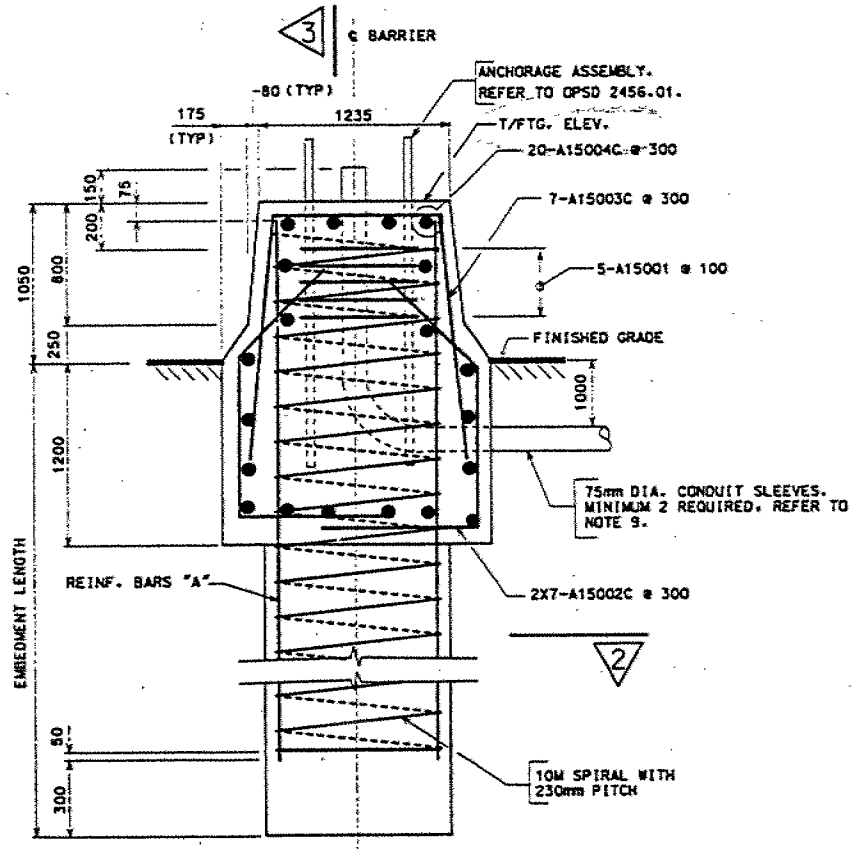


PLAN
N.T.S.

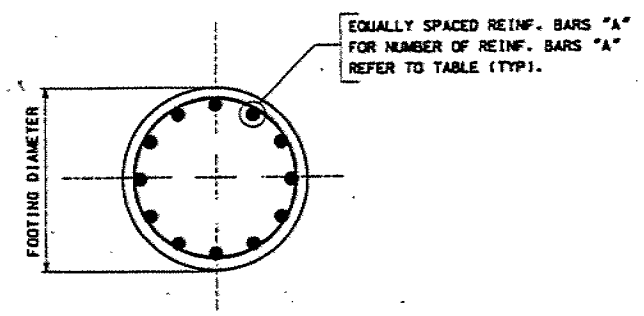


NOTE: FOOTING NOT SHOWN FOR CLARITY.

SECTION 3



SECTION 1
N.T.S.



SECTION 2
N.T.S.

QUANTITIES:

TOTAL MASS OF REINF.STEEL =	16.33 (tonne)
TOTAL VOLUME OF CONCRETE =	276.49 (m^3)

FOOTING DATA

POLE No.	POLE LENGTH (m)	FOOTING DIA. (m)	EMBEDMENT LENGTH (m)	REINF. BARS "A"			SPIRAL		No. OF BOLTS	TOTAL MASS OF STEEL (t)	VOLUME OF CONCRETE (m^3)	T/FTG ELEVATION
				LENGTH (m)	SIZE (M)	No.REQ'D	HEIGHT (m)	O. DIA.(m)				
P2	30	1.22	8.200	8.875	30	12	8.775	1.080	8	0.90	15.26	202.000
P3	30	1.22	8.200	8.875	30	12	8.775	1.080	8	0.90	15.26	201.180
P4	30	1.22	8.200	8.875	30	12	8.775	1.080	8	0.90	15.26	204.530
P5	30	1.22	8.450	9.125	30	12	9.025	1.080	8	0.92	15.55	20. 520
P6	30	1.22	7.950	8.625	30	12	8.525	1.080	8	0.88	14.97	206.0 0
P7	30	1.22	7.950	8.625	30	12	8.525	1.080	8	0.88	14.97	206.440
P8	30	1.22	8.200	8.875	30	12	8.775	1.080	8	0.90	15.26	207.060
P9	30	1.22	7.700	8.375	30	12	8.275	1.080	8	0.86	14.68	207.540
P10	30	1.22	7.700	8.375	30	12	8.275	1.080	8	0.86	14.68	208.070
P11	30	1.22	8.200	8.875	30	12	8.775	1.080	8	0.90	15.26	208.660
P12	30	1.22	8.950	9.625	30	12	9.525	1.080	8	0.96	16.14	208.890
P13	30	1.22	8.700	9.375	30	12	9.275	1.080	8	0.94	15.84	208.350
P14	30	1.22	8.450	9.125	30	12	9.025	1.080	8	0.92	15.55	207.850
P19	30	1.22	9.200	9.875	30	12	9.775	1.080	8	0.98	16.43	208.130
P20	30	1.22	8.700	9.375	30	12	9.275	1.080	8	0.94	15.84	208.610
P21	30	1.22	9.000	9.675	30	12	9.575	1.080	8	0.96	16.20	209.150
P22	30	1.22	7.700	8.375	30	12	8.275	1.080	8	0.86	14.68	209.930
P23	30	1.22	7.700	8.375	30	12	8.275	1.080	8	0.86	14.68	210.480

NOTES:
1. REINFORCING STEEL SHALL BE GRADE 400.
2. BAR MARKS WITH SUFFIX "C" DENOTE COATED BARS.
3. EACH ANCHORAGE ASSEMBLY SHALL BE PROVIDED WITH A WOODEN TEMPLATE.
4. ANCHOR RODS ARE ROUND BAR. QUENCHED AND TEMPERED MEDIUM CARBON STEEL WITH MIN. YIELD OF 517 MPa. (MIN TENSILE STRENGTH OF 725 MPa.) AND SHALL SATISFY CHARPY V-NOTCH REQUIREMENTS OF 20 JOULES AT MINUS 30° C.
5. ANCHOR BOLTS SHALL BE INSTALLED VERTICALLY. NO ADJUSTMENTS SHALL BE ALLOWED AFTER CONCRETE IS PLACED IN FOOTING.
6. CLASS OF CONCRETE SHALL BE 30 MPa.
7. FOR FINISHED GRADE ELEV.. REFER TO GRADING DRAWINGS.
8. CLEAR COVER TO REINFORCING STEEL SHALL BE 70 ± 20 mm.
9. FOR NUMBER & ORIENTATION OFSLEEVES. REFER TO ELECTRICAL DRAWINGS.

APPLICABLE OPSD DRAWINGS
OPSD 2456.01

REGISTERED PROFESSIONAL ENGINEER PROVINCE OF ONTARIO 92-11-10 H. N. WONG

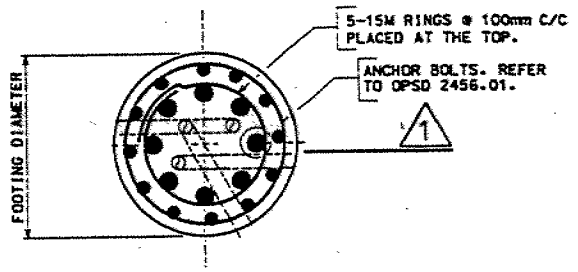
LICENCED PROFESSIONAL ENGINEER PROVINCE OF ONTARIO 92-11-10 S. HASSANZADEH

BAR MARK	NO. PER FOOTING	TOTAL NO.	BAR TYPE	LENGTH
A15001	5	90	400 LAP, DIA=880	3170
A15002C	14	252	560, 1050, 800, 1000	2850
A15003C	7	126	160 (TYP), 1080, 1400 (TYP)	4295
A15004C	20	360	STRAIGHT	1850

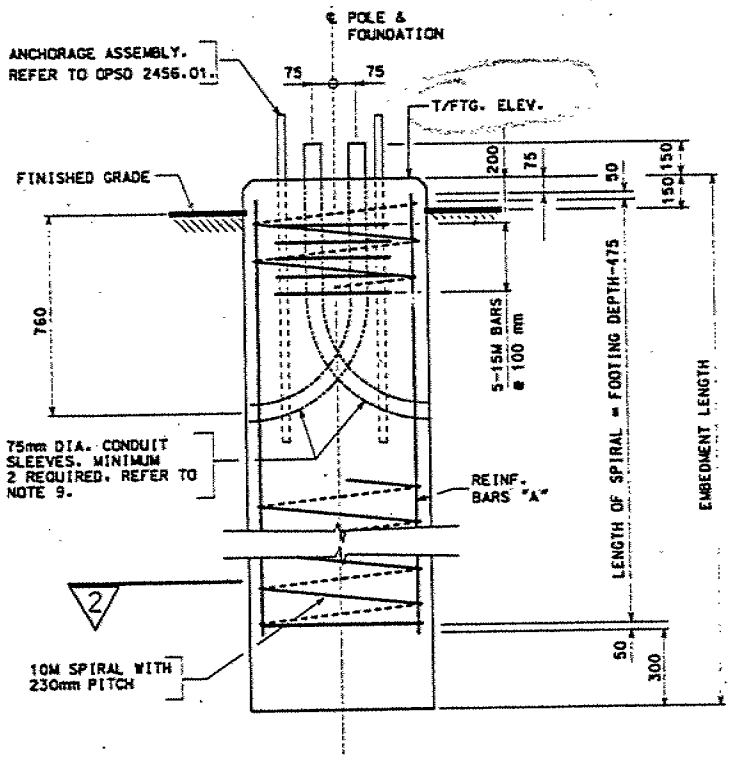
DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS		DESCRIPTION

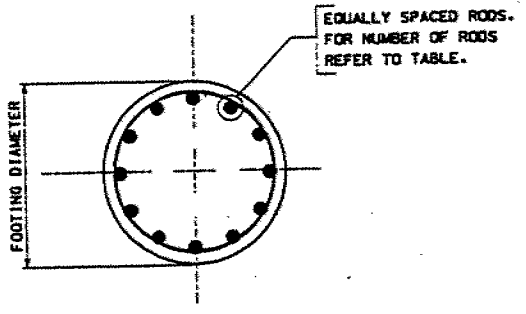
DESIGN D.W. CHK B.H. CODE OHBDC 83 LOAD DATE APRIL '93
DRAWN G.Y. CHK D.W. SITE STRUCT SCHEME DWG 1



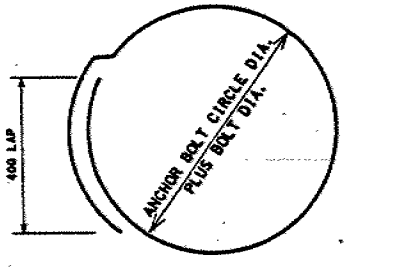
TOP VIEW
N.T.S.



SECTION 1
N.T.S.



SECTION 2
N.T.S.



DETAIL OF 15M RINGS PLACED AT THE TOP.
N.T.S.

QUANTITIES:

TOTAL MASS OF REINF.STEEL = 2.41 (tonne)

TOTAL VOLUME OF CONCRETE = 47.10 (m^3)

FOOTING DATA

POLE No.	POLE LENGTH (m)	FOOTING DIA. (m)	EMBEDMENT LENGTH (m)	REINF. BARS "A"			SPIRAL		No. OF BOLTS	TOTAL MASS OF STEEL (t)	VOLUME OF CONCRETE (m^3)	T/FTG ELEVATION
				LENGTH (m)	SIZE (M)	No.REQ'D	HEIGHT (m)	O. DIA. (m)				
P15	30	1.22	9.000	8.625	25	12	8.525	1.080	8	0.54	10.52	206.150
P16	30	1.22	6.500	6.125	25	12	6.025	1.080	8	0.39	7.60	205.250
P17	30	1.22	8.000	7.625	25	12	7.525	1.080	8	0.48	9.35	205.650
P18	30	1.22	7.500	7.125	25	12	7.025	1.080	8	0.45	8.77	205.950
P24	30	1.22	9.300	8.925	25	12	8.825	1.080	8	0.56	10.87	198.550

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

CONT No 93-72
WP No 612-89-00

HWY 400/HWY7 TO LANGSTAFF RD.

SHEET 230

HIGH MAST LIGHTING POLE FOOTINGS

NOTES:

1. REINFORCING STEEL SHALL BE GRADE 400.
2. BAR MARKS WITH SUFFIX "C" DENOTE COATED BARS.
3. EACH ANCHORAGE ASSEMBLY SHALL BE PROVIDED WITH A WOODEN TEMPLATE.
4. ANCHOR RODS ARE ROUND BAR, QUENCHED AND TEMPERED MEDIUM CARBON STEEL WITH MIN. YIELD OF 517 MPa. (MIN TENSILE STRENGTH OF 725 MPa.) AND SHALL SATISFY CHARPY V-NOTCH REQUIREMENTS OF 20 JOULES AT MINUS 30° C.
5. ANCHOR BOLTS SHALL BE INSTALLED VERTICALLY. NO ADJUSTMENTS SHALL BE ALLOWED AFTER CONCRETE IS PLACED IN FOOTING.
6. CLASS OF CONCRETE SHALL BE 30 MPa.
7. FOR FINISHED GRADE ELEV., REFER TO GRADING DRAWINGS.
8. CLEAR COVER TO REINFORCING STEEL SHALL BE TO ± 20 mm.
9. FOR NUMBER & ORIENTATION OFSLEEVES. REFER TO ELECTRICAL DRAWINGS.

APPLICABLE OPSD DRAWINGS

OPSD 2456.01

REGISTERED PROFESSIONAL ENGINEER H. M. WONG PROVINCE OF ONTARIO

LICENCED PROFESSIONAL ENGINEER B. HASSANZADEH PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DESCRIPTION					
DESIGN D.V.	CHK B.H.	CODE OHBDC 83	LOAD		DATE APRIL '9	
DRAWN G.Y.	CHK D.V.	SITE	STRUCT	SCHEME	DWG 1	

memorandum

Ontario

To: V.F. Boehnke
Head, Structural Section
4th Floor, Atrium Tower

Date: 1992 11 25

Attn: Dennis Wong

From: Foundation Design Section
Room 315, Central Bldg.

Re: Concrete Culvert Extension at St. 19+938
Hwy. 400 Widening from Hwy. 7 Northerly
to North of Langstaff Road
W.P. 612-89-00; W.P. 527-91-01(B)
District 6, Toronto

We have received the drawing for the concrete culvert extension at Station 14+938.

We have no comments to make at this time.

John A. Blair

John A. Blair, P. Eng.
Project Foundation Engineer

for

D. Dundas, P. Eng.
Senior Foundation Engineer

DD/JAB/jb

METRIC

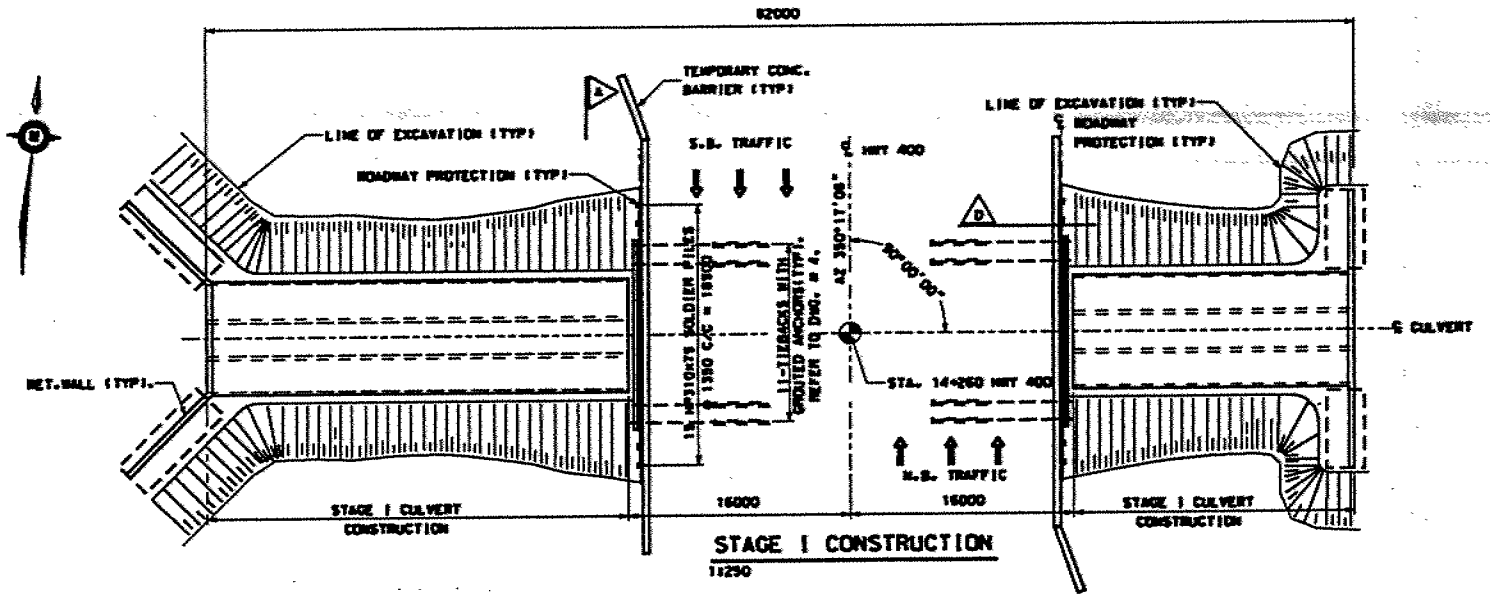
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

DISTRICT : 6
CONT No
WP No 527-91-01

HWY 400 CULVERT
AT STA. 14+260

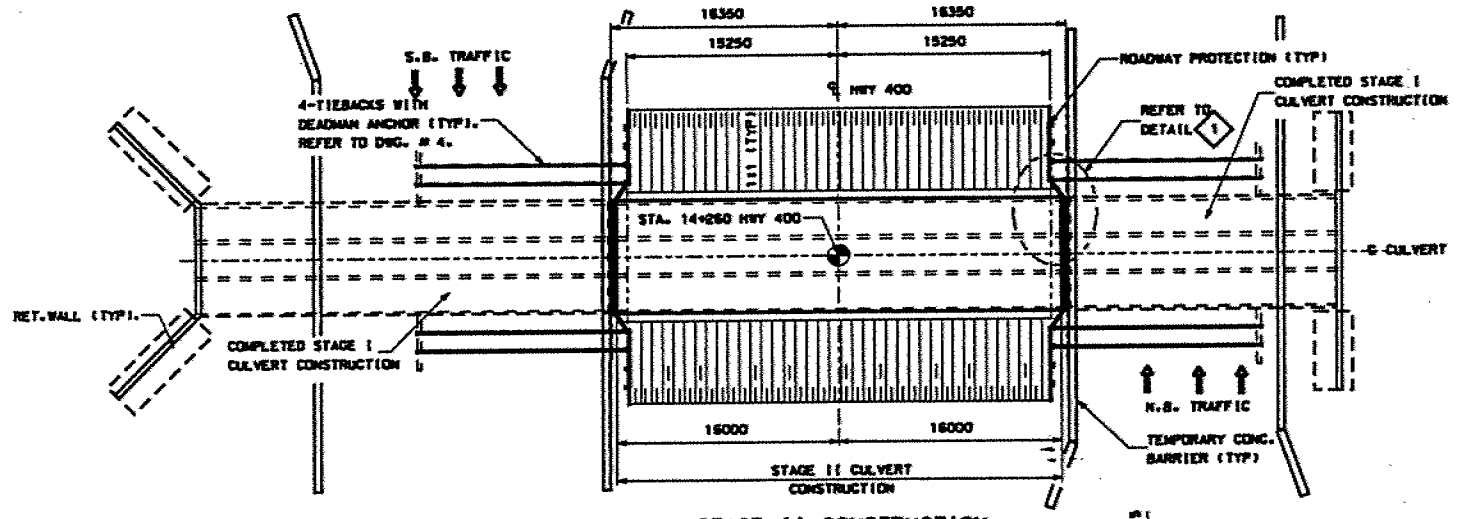
ROADWAY PROTECTION I

SHEET



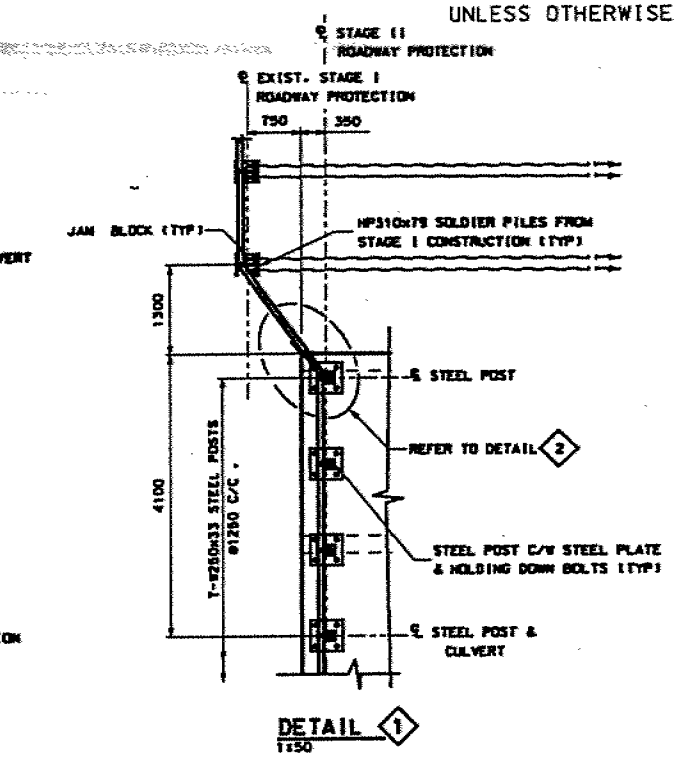
STAGE I CONSTRUCTION

1:250



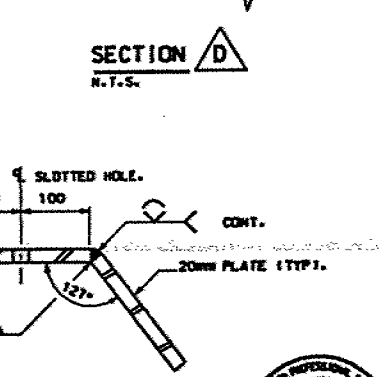
STAGE II CONSTRUCTION

1:250



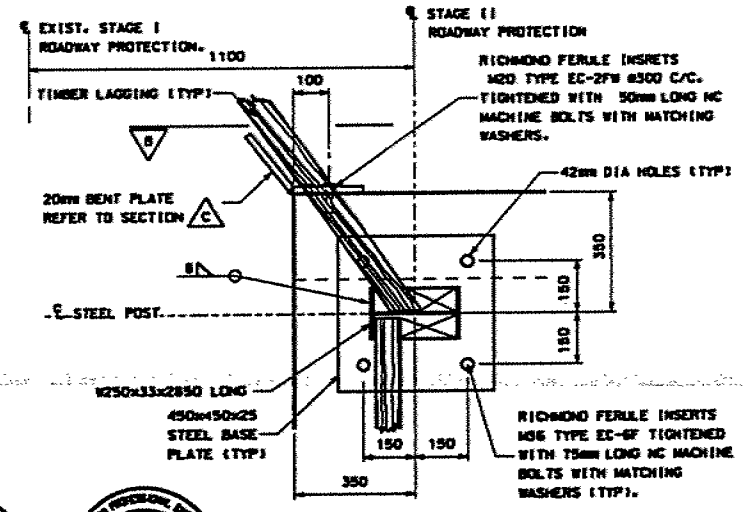
DETAIL 1

1:50



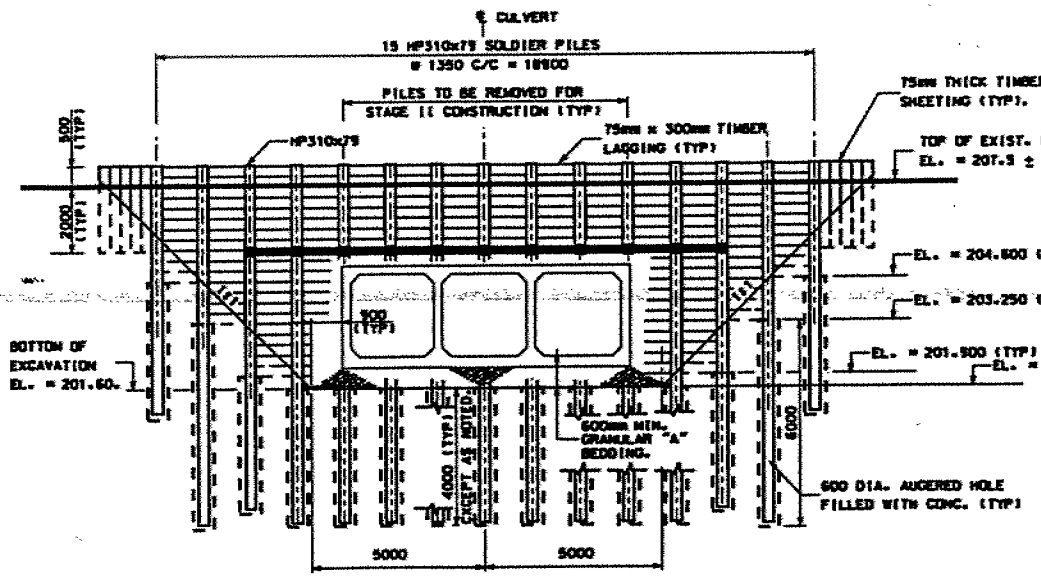
SECTION D

N.T.S.



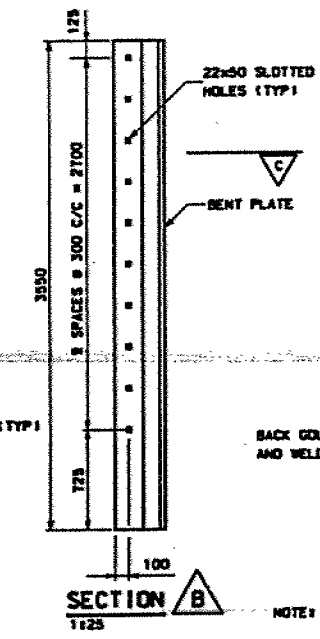
DETAIL 2

1:10



SECTION A

1:100



SECTION B

1:25

NOTE: LAGGING NOT SHOWN FOR CLARITY.

SECTION C

1:5

BENT PLATE FABRICATION DETAILS

NOTES:

1. STRUCTURAL STEEL SHALL CONFORM TO CSA STANDARD CAN3-G40.21-M81 GRADE 300W.
2. BOLTS SHALL CONFORM TO ASTM A325. BOLT THREADS SHALL BE COMPATIBLE WITH THE FERULE INSERTS EMBEDDED IN THE CONCRETE.
3. WELDING SHALL BE ACCORDING TO CSA STANDARD W59-M1984 ANDPERFORMED BY WELDERS QUALIFIED UNDER CSA STANDARD W47.1-1983.
4. TIMBER LAGGING AND SHEETING SHALL BE CONSTRUCTION GRADE FIR (GROUP B).

SUGGESTED SEQUENCE OF CONSTRUCTION:

STAGE I

1. PLACE TEMPORARY CONCRETE BARRIERS AS SHOWN ON GRADING DRAWINGS.
2. INSTALL SOLDIER PILES AND STAGE I RADDWAY PROTECTION.
3. EXCAVATE AND CONSTRUCT CULVERT AND RETAINING WALLS.
4. INSTALL STEEL POSTS, BENT PLATES, DEADMAN AND ROADWAY PROTECTION IN PREPARATION FOR STAGE II CONSTRUCTION AND BACKFILL.

STAGE II

1. DIVERT TRAFFIC TO DETOURS 1 & 2 WITH TEMPORARY CONCRETE BARRIERS AS SHOWN.
2. EXCAVATE AND REMOVE THE DESIGNATED PORTION OF ROADWAY PROTECTION AND SOLDIER PILES FROM STAGE I.
3. CONSTRUCT CULVERT AND BACKFILL.
4. REMOVE ROADWAY PROTECTION AND COMPLTE ROADWAY CONSTRUCTION.

PROFESSIONAL ENGINEER
B. N. WONG
PROVINCE OF ONTARIO

PROFESSIONAL ENGINEER
B. MASSINZADEH
PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DESCRIPTION				
DESIGN D.W.	CHK B.M.	CODE OHBDC 83	LOAD	DATE APRIL '92	
DRAWN G.Y.	CHK D.W.	SITE 37-1400	STRUCT	SCHEME	DWG 3

c:/dgn/dw12-cul.dgn Aug. 19, 1992 07:55:53

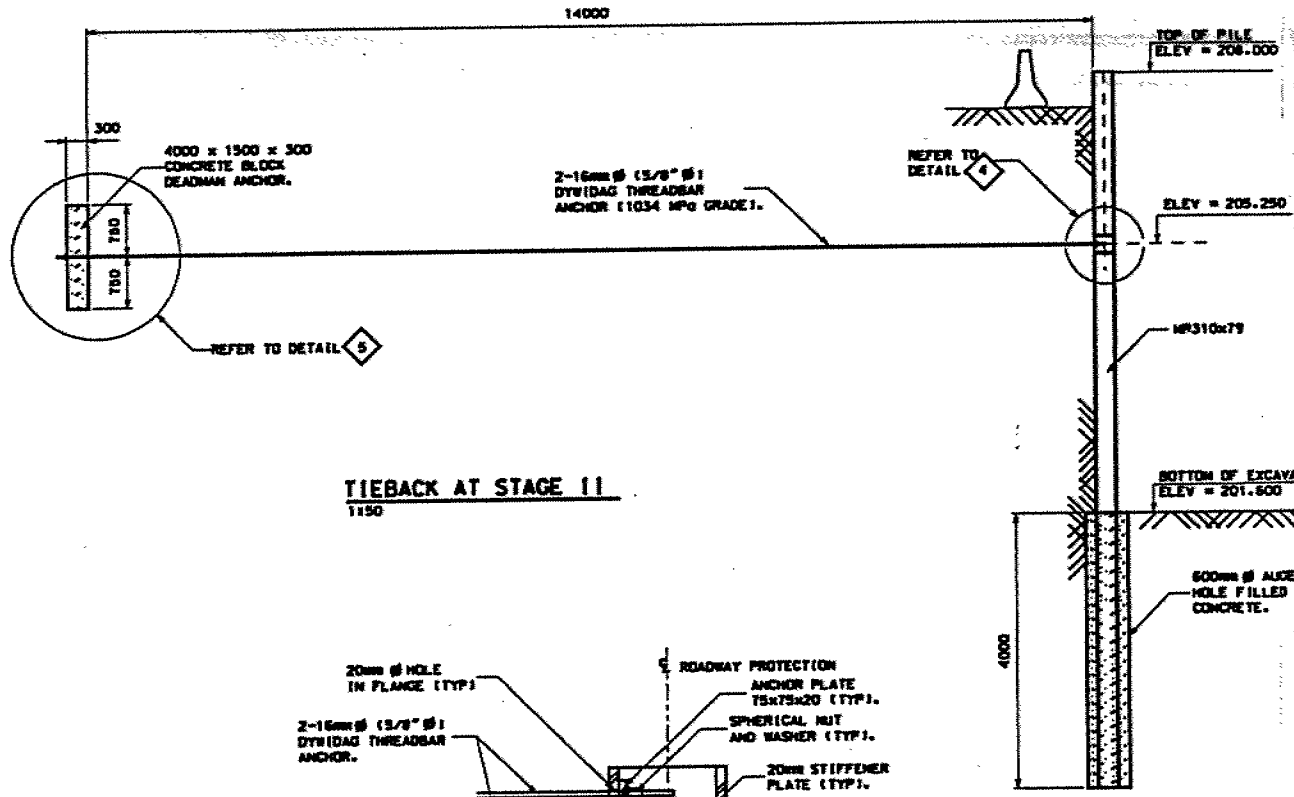
METRIC
DIMENSIONS ARE IN METRES
AND/OR MILLIMETRES
UNLESS OTHERWISE SHOWN

DISTRICT : 6
CONT No
WP No 527-91-01

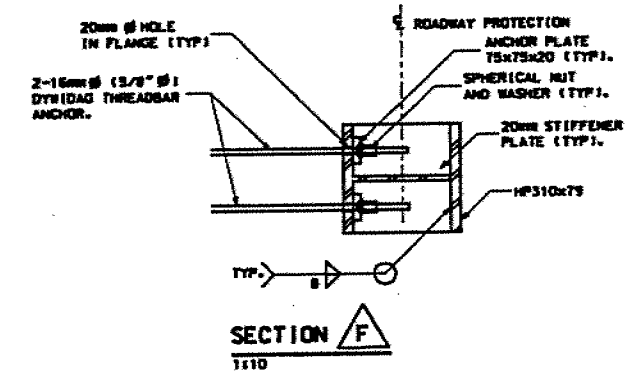
HWY 400 CULVERT
AT STA. 14+260

ROADWAY PROTECTION II

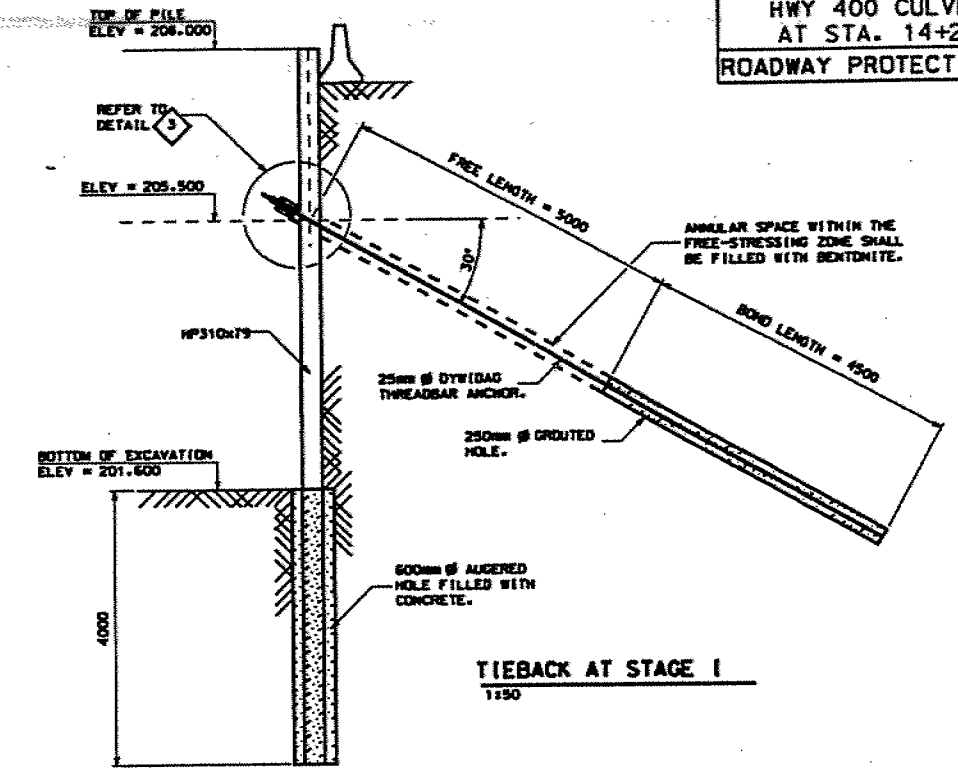
SHEET



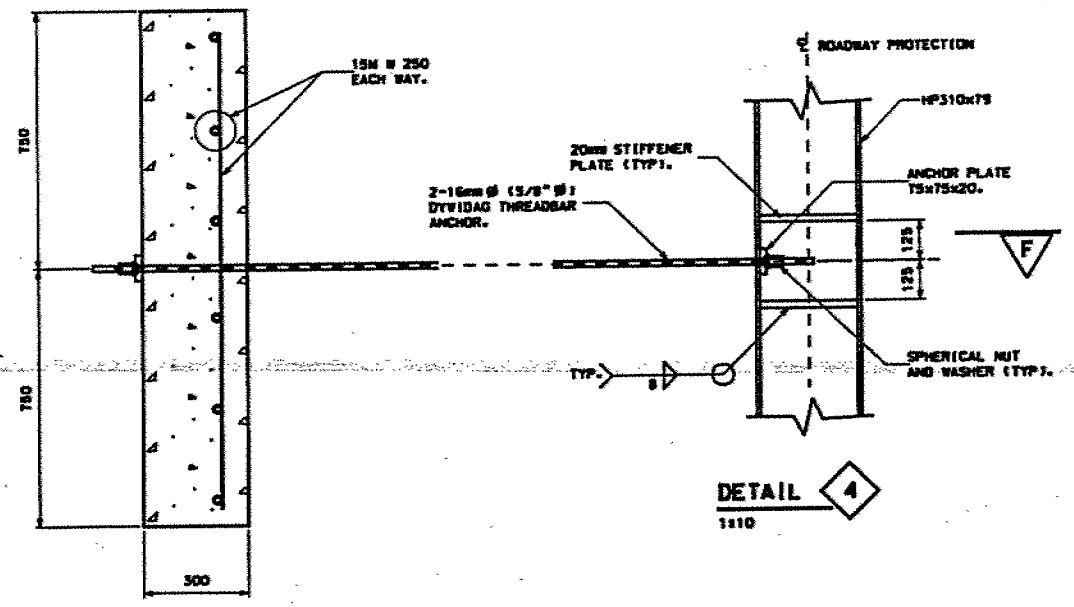
TIEBACK AT STAGE II
1:50



SECTION F
1:10

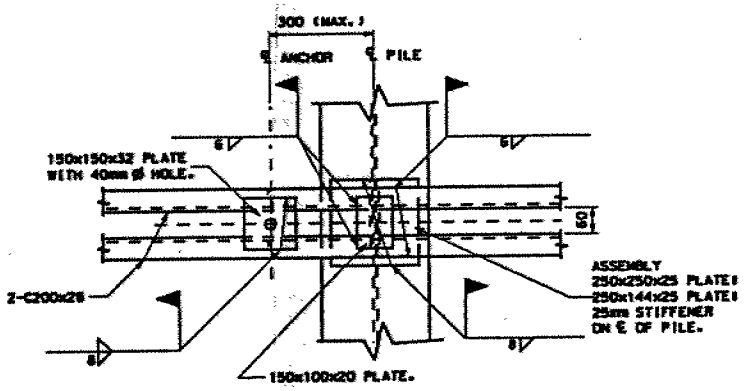


TIEBACK AT STAGE I
1:50

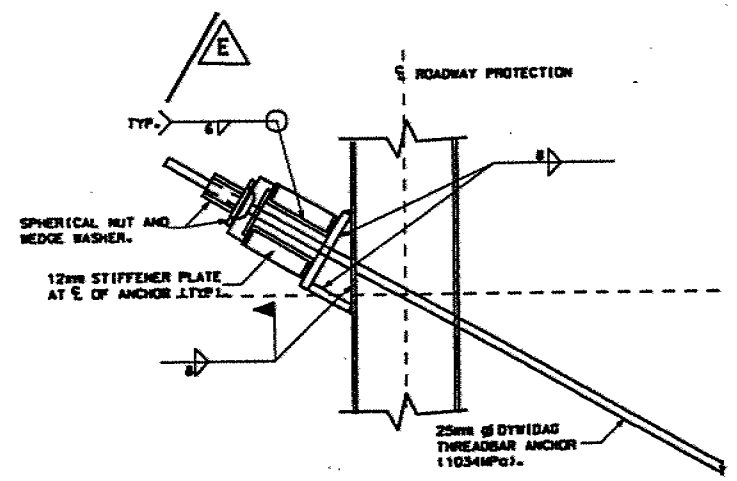


DETAIL 5
1:10

DETAIL 4
1:10



SECTION E
1:10



DETAIL 3
1:10

R. B. WONG
PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

B. NASSAMZADEH
LICENCED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING

REVISIONS	DESCRIPTION	
DESIGN D.W.	CHK B.H.	CODE OHBDC 83 LOAD — DATE APRIL '92
DRAWN G.Y.	CHK D.W.	SITE 37-1400 STRUCT — SCHEME — DRG 4

c:/dgn/dw13-cul.dgn Aug. 19, 1992 07:58:09

Structural Section
Central Region
1201 Wilson Avenue
Atrium Tower, 4th Floor
Downsview, Ontario, M3M 1J8

MINISTRY OF TRANSPORTATION Telephone: 235-5512

m e m o r a n d u m

TO: Mr. M. Devata **DATE:** September 30, 1992
Head, Foundation Design Section

Attn. Mr. D. Dundas, Sr. Foundation Engr.

RE: Hwy. 400 Widening
From Hwy 7 to north of Langstaff Road
High Mast Pole Foundations, WP 528-91-01
GWP 612-89-00, District 6

In the latest design from the consultant, the location for pole P15 has been changed. The old and new locations with relevant information are listed here for your reference:

Pole # and Sta. Hwy 400	Offset ℄ Hwy 400	coordinates Northing	Easting
Old P15 Sta. 14+100	130.5 Lt	4851,876.523	301,149.444
New P15 Sta. 14+090.5	**107 Lt**	**4851,871.124**	**301,174.209**

Pole # and Sta. Hwy 400	Original Ground	Final Ground	T/Footing Elev.
Old P15 Sta. 14+100	209.7	211.2	213.35
New P15 Sta. 14+090.5	**206**	**206**	**206.15**

The 2 locations were also plotted on a scale 1:100 design plate to show their relative positions in the field. In this area, apart from the foundation investigation for the original location for HMP# P15, there had been foundation investigations for the construction of Langstaff Road Underpass under Contract 87-60, WP 164-79-05. Copies of the Bore Hole Locations and Soil Strata are attached for your information.

I would appreciate you reviewing the situation as you may wish to update your recommendations.

Please call me if you need any further information or clarification. Thanks.

Dennis Wong
Sr. Structural Engineer
for:
V. F. Boehnke
Head, Structural Section

cc. Mr. J. Blair, FDS

METRIC

DIMENSIONS ARE IN METRES AND/OR MILLIMETRES UNLESS OTHERWISE SHOWN

PLATE No

CONT No

WP No 612-89-00

REMOVALS

STA 14+000 TO STA 14+350

Survey _____ Revised _____

SHEET 28

McCORMICK RANKIN
CONSULTING ENGINEERS

P15, OLD LOCATION

P15, NEW LOCATION

CON 5
LOT 10

CON 5
LOT 11

LIMIT OF CONSTRUCTION
STA. 0+509

LIMIT OF CONSTRUCTION
STA. 0+140

W-S RAMP

E-S RAMP

R=1000

0+450

14+000

14+100

14+200

14+300

14+350

PAVEMENT TO BE REINSTATED
WITH 40mm OFC
50mm HDBC
150mm HLB
150mm GRANULAR 'A'
650mm GRANULAR 'B' TYPE I
PLACED FLUSH WITH EXIST. SURFACE

℄ SBC

"E" MEDIAN, HWY. 400

PLUS 460 CSP

PLUS 420 CSP

N.O.T. 14+150.654 HWY 400
+N.O.T. 10+000.000 LANGSTAFF RD

3 x 2.40m x 2.40m
PRECAST BOX CULVERT

REMOVE GABIONS

LOT 10
CON 5

LOT 11
CON 5

N 4,851,800

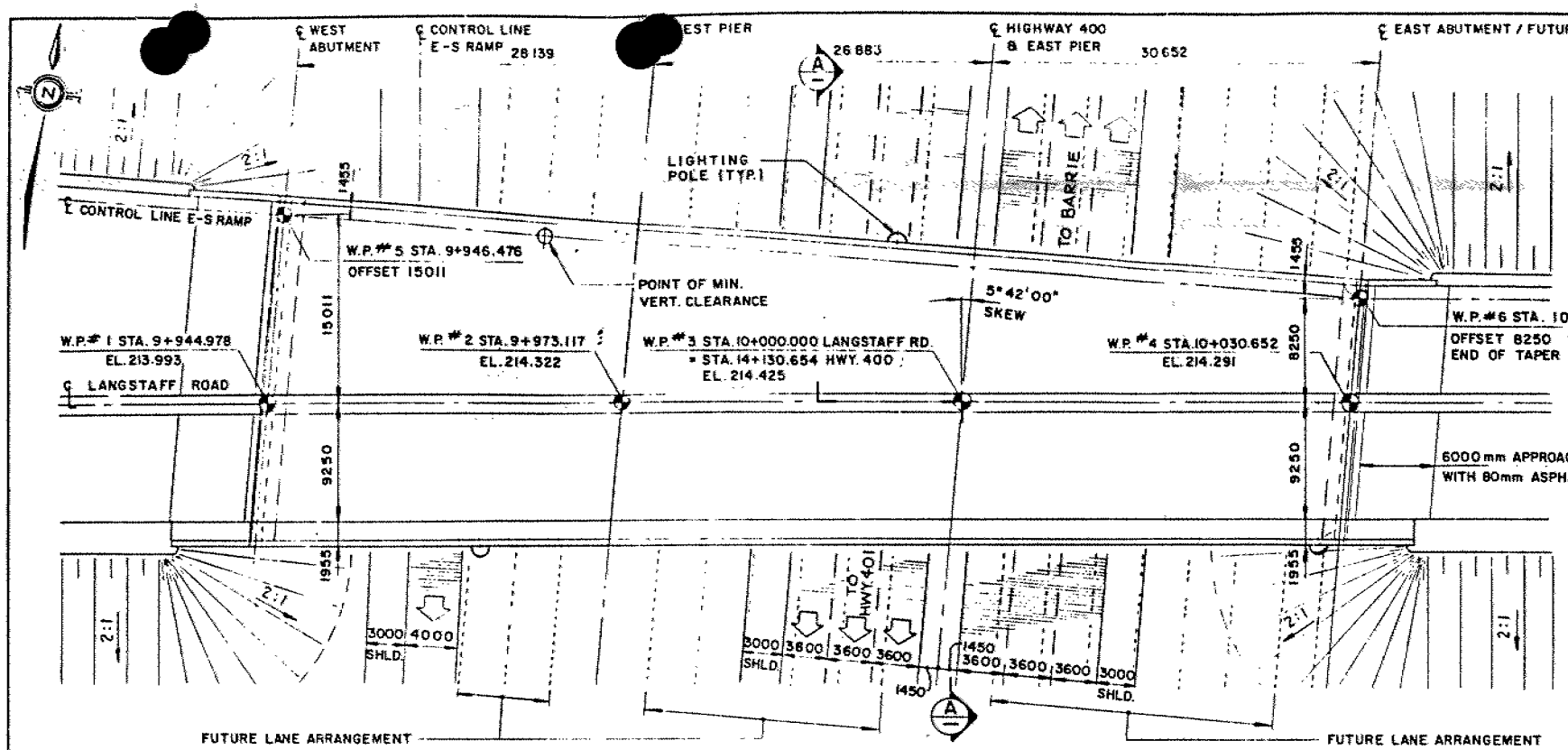
N 4,852,000

N 4,852,100

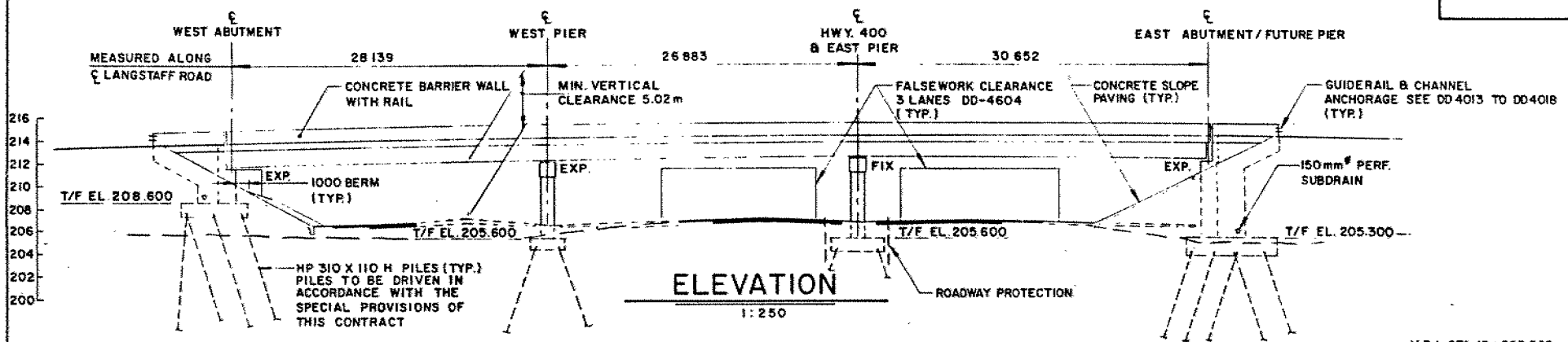
E 301,200

E 301,300

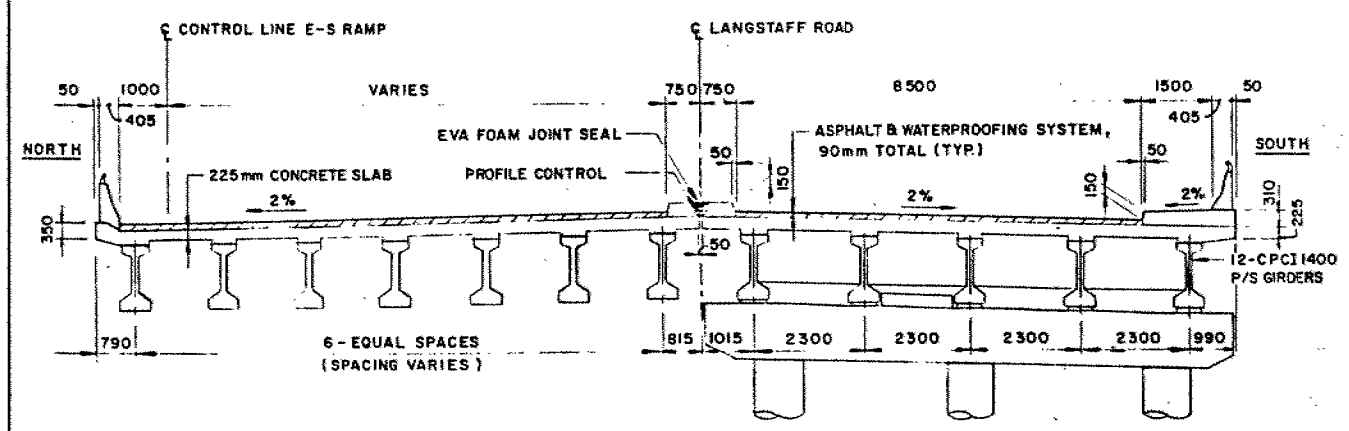
SCALE
5m 0 10m



PLAN
1:250

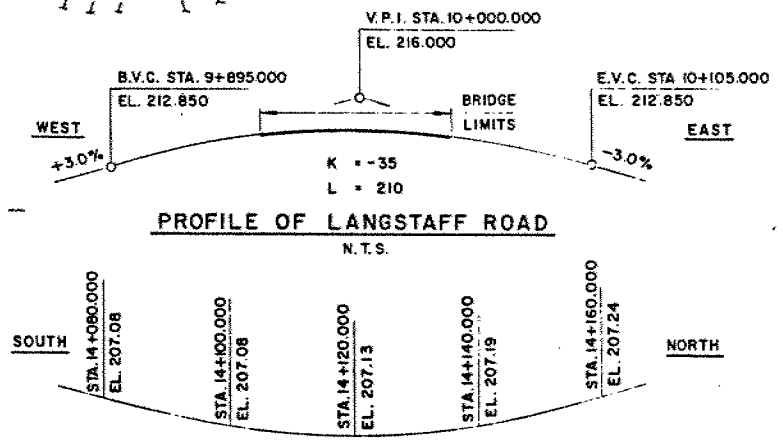


ELEVATION
1:250



SECTION
1:75

ALL HORIZONTAL DIMENSIONS ⊥ TO ℄ OF LANGSTAFF ROAD



PROFILE OF LANGSTAFF ROAD
N.T.S.

PROFILE OF HIGHWAY 400
CROWN OF N.B. & S.B. LANES
N.T.S.

CONCRETE QUANTITIES FOR LUMP SUM TENDER ITEMS

SUBSTRUCTURE	538	m^3
DECK & DIAPHRAGM	640	m^3
BARRIER WALLS	43	m^3
APPROACH SLABS	70	m^3
SLOPE PAVING	58	m^3

⚠

GENERAL NOTES

1. CLASS OF CONCRETE

FOOTINGS	30 MPa
REMAINDER (UNLESS OTHERWISE SHOWN)	30 MPa

2. CLEAR COVER TO REINFORCING STEEL

FOOTINGS	100±25	
ABUTMENTS AND WINGWALLS		
FRONT FACE	80±20	
BACK FACE	70±20	
PIERS	80±20	
DECK		
TOP	70±20	
BOTTOM	40±10	
MEDIAN & SIDEWALK	70±20	
REMAINDER	70±20	UNLESS OTHERWISE NOTED

3. REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH SUFFIX C DENOTE COATED BARS.
4. DESIGN LOADING - O.H.B.D.C. - A-83.
5. STATION & ELEVATIONS ARE GIVEN IN METRES ALL OTHER DIMENSIONS ARE GIVEN IN MILLIMETRES.
6. CONSTRUCTION NOTES
   - BEARING SEATS SHALL BE FINISHED LEVEL AND TO THE SPECIFIED ELEVATIONS.
   - COMPACTED FILL, MAXIMUM GRAIN SIZE 75 mm SHALL BE PLACED UP TO THE BOTTOM OF FOOTING ELEVATION AT ABUTMENTS AND WEST PIER PRIOR TO DRIVING PILES.

LIST OF DRAWINGS

ISSUED FOR CONSTRUCTION

REGISTERED PROFESSIONAL ENGINEER K. WOON-FAT PROVINCE OF ONTARIO

REGISTERED PROFESSIONAL ENGINEER R. SKELTON PROVINCE OF ONTARIO

McCORMICK RANKIN
CONSULTING ENGINEERS

NO	DATE	REVISIONS	BY
⚠	AUG.90	LUMP SUM ITEMS ADDED	

Town of Vaughan
DEVELOPMENT ENGINEERING DEPARTMENT

DESIGNED BY K.W.F.	CHECKED BY R. S.	TOWN OF VAUGHAN
DRAWN BY J.W.B.	CHECKED BY R. S.	HIGHWAY 400 UNDERPASS AT LANGSTAFF ROAD
DATE MAY 1989		GENERAL ARRANGEMENT

DWG. NO 1
CONT NO
SITE NO. 37-1298
SHEET NO. 27

MEMORANDUM

(416)235-3731

To: Volker Boehnke
Head, Structural Section
4th Floor, Atrium Tower
1201 Wilson Avenue

1992 09 28

Attn: Dennis Wong

From: Foundation Design Section
Room 315, Central Building
Downsview, Ontario

Re: Triple Cell Concrete Culvert at Sta. 14 + 260
Hwy 400 Widening From Hwy 7 northerly to
North of Langstaff Road
GWP 612-89-00; W.P. 527-91-01
Highway 400, District 6, Toronto

This is in response to your memo dated August 31, 1992. We have reviewed the drawings showing a plan and typical cross sections for the erosion protection design at the above captioned site.

The design of erosion protection in general meet our recommendations. However, as recommended in our Foundation report, the thickness of rip-rap between station 9+848.8 to station 9+945 should be revised to 600mm.

In our opinion, erosion protection consisting of 600mm rip-rap could be used instead of concrete slabs between station 10+040.6 to Station 10+134.5.

K. Ahmad, P. Eng.
Foundation Engineer

For

D.H. Dundas, P. Eng.
Sr. Foundation Engineer

memorandum

Ontario

To: V. Boehnke
Head, Structural Section
Central Region

Date: September 2, 1992

Attn: Mr. Dennis Wong

From: Foundation Design Section
Room 315, Central Building
Downsview, Ontario

Re: High Mast Pole Foundations for Hwy 400 Widening
From Hwy 7, Northerly to North of Langstaff Road
W.P. 612-89-00 (W.P. 528-91-01)

This memorandum is written in response to your letter of August 18, 1992.

We understand that it is now proposed to relocate one of the high mast light poles, installed under Contract No. 87-60 (W.P. 164-79-04). It appears that light pole EP10 will be moved about 33 m to the west of the existing location.

We have reviewed the information available to us and feel that the design information which was given in our report (Ref. No. W.P. 164-79-04 - dated September 13, 1990) for the original location would also be suitable for the revised one.

Should you have any questions regarding this letter, please do not hesitate to contact this office.

John A. Blair

John A. Blair, P.Eng.
Project Foundation Engineer

for:

Dave Dundas, P.Eng.
Senior Foundation Engineer

Structural Section
Central Region
1201 Wilson Avenue
Atrium Tower, 4th Floor
Downsview, Ontario, M3M 1J8
Telephone: 235-5512

MINISTRY OF TRANSPORTATION

m e m o r a n d u m

TO: Mr. J. Reiffenstein
McCormick Rankin

DATE: August 18, 1992

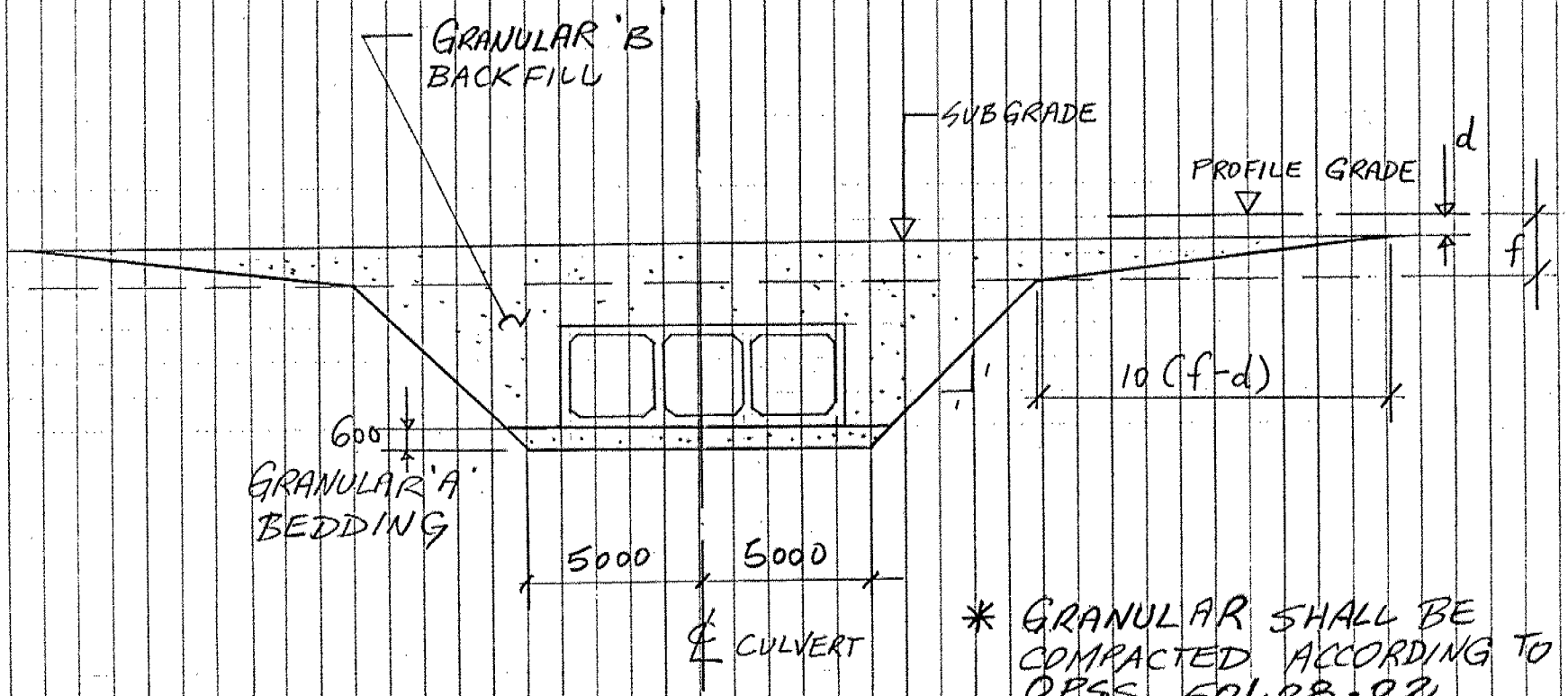
RE: Culvert at Sta. 14 + 260
Granular Backfill Requirement
Hwy. 400 Widening From Hwy 7 to north of Langstaff Road
G.W.P. 612-89-00, District 6

The attached sketch shows the granular backfill requirement for the above mentioned culvert as per your request.

Please call me if you need any clarification or information.

Dennis Wong
Sr. Structural Engineer
for:
V. F. Boehnke
Head, Structural Section

cc. Mr. J. Blair, FDS



* GRANULAR SHALL BE COMPACTED ACCORDING TO OPSS 501.08.02

Structural Section
Central Region
1201 Wilson Avenue
Atrium Tower, 4th Floor
Downsview, Ontario, M3M 1J8
Telephone: 235-5512

MINISTRY OF TRANSPORTATION

memorandum

TO: Mr. M. Devata
Head, Foundation Design Section

DATE: August 18, 1992

Attn. Mr. D. Dundas, Sr. Foundation Engr.

RE: High Mast Pole Foundations for Hwy. 400 Widening
From Hwy 7 northerly to north of Langstaff Road
W.P. 528-91-01
G.W.P. 612-89-00, District 6

The design of the highway illumination system for the above project calls for the relocation of the last High Mast Pole which was installed in Contract 87-60 (WP 164-79-04) for the Hwy 400/7 Interchange.

Reasons for the proposed relocation were explained in a memorandum from the consultant, McCormick Rankin, to Mr. A. Silbiger, Head, Electrical Design, and copied to me. Copies of this memorandum and relevant drawings from the previous contract are attached with this memorandum for your easy reference.

I would appreciate if you could look into this situation and advise us as to the possible foundation conditions in the proposed location so that we can design the HMP Foundation and be included in the new contract for the above mentioned project.

Please call me if you need any clarification or information.

Dennis Wong
Sr. Structural Engineer
for:
V. F. Boehnke
Head, Structural Section

cc. Mr. J. Blair, FDS
Mr. B. Mondesir, Electrical design
Mr. M. Tedesco, McCormick Rankin

memorandum

Ontario

To: Mr. V. F. Boeknke
Head, Structural Section
4th Floor, Atrium Tower
Central Region

Date: 1992 07 21

Att: Mr. Dennis Wong

From: Foundation Design Section
Room 315, Central Building
Downsview, Ontario

Re: Highway 400 Widening
From Hwy 7 to North of Langstaff Road
Roadway Protection Scheme For Culvert Construction
W.P. 612-89-00 / 527-91-01
District 6, Toronto

This letter summarizes our comments regarding the drawings for the above-captioned project, which were received by this office on July 7, 1992.

1) Drawing No. 1 - W.P. 527-91-01

Under Construction Notes:

It should be noted that, once the Engineer has approved the foundation soils, it is desirable to place a skim coat of concrete, wherever the soils are likely to be disturbed. This particularly refers to the retaining wall footings or any other foundations which are being placed directly on soil.

2) Drawing No. 3 - W.P. 527-91-01

For tiebacks, within the free-stressing zone, a note should be included which indicates that a bentonite slurry should be used to fill the annular space between the dywidag bar and the perimeter of the hole. This as well as the requirements for the bond zone and the testing of the installed anchors are shown in our Non-Standard Special Provision, which has been included with this letter.

3) Drawing No. 3 - W.P. 527-91-01

Although the fill, where the deadman anchors are to be placed, should be well-compacted, it is imperative that

special care be taken to ensure that the fill, within at least 1.0 m of the anchors is compacted to at least 100 percent Standard Proctor Maximum Dry Density (SPMDD).

4) Drawing No's 1 and 3 - W.P. 527-91-01 - Typographical errors, as shown on the accompanying drawings.

We also have the following additional comments:

- Since parts of the excavation for the culvert will lie within cohesionless sandy silt to silty sands, below the groundwater table, disturbance is likely due to the unbalanced hydrostatic head. In view of this, some form of dewatering scheme, such as an oversized excavation, should be adopted.

- It appears that several of the High Mast Light Pole Foundations will be partially placed within or on cohesionless sandy silt to silty sand deposits. As noted in our Report, a special provision should be included for the construction of caisson foundations, to prevent excessive disturbance of these soils, and a consequent loss of their frictional properties.

- We assume that drawings showing the erosion protection for the proposed channel and the proposed culvert extensions will be available for our review.

Should you have any questions regarding this letter, please do not hesitate to contact this office.

John A. Blair

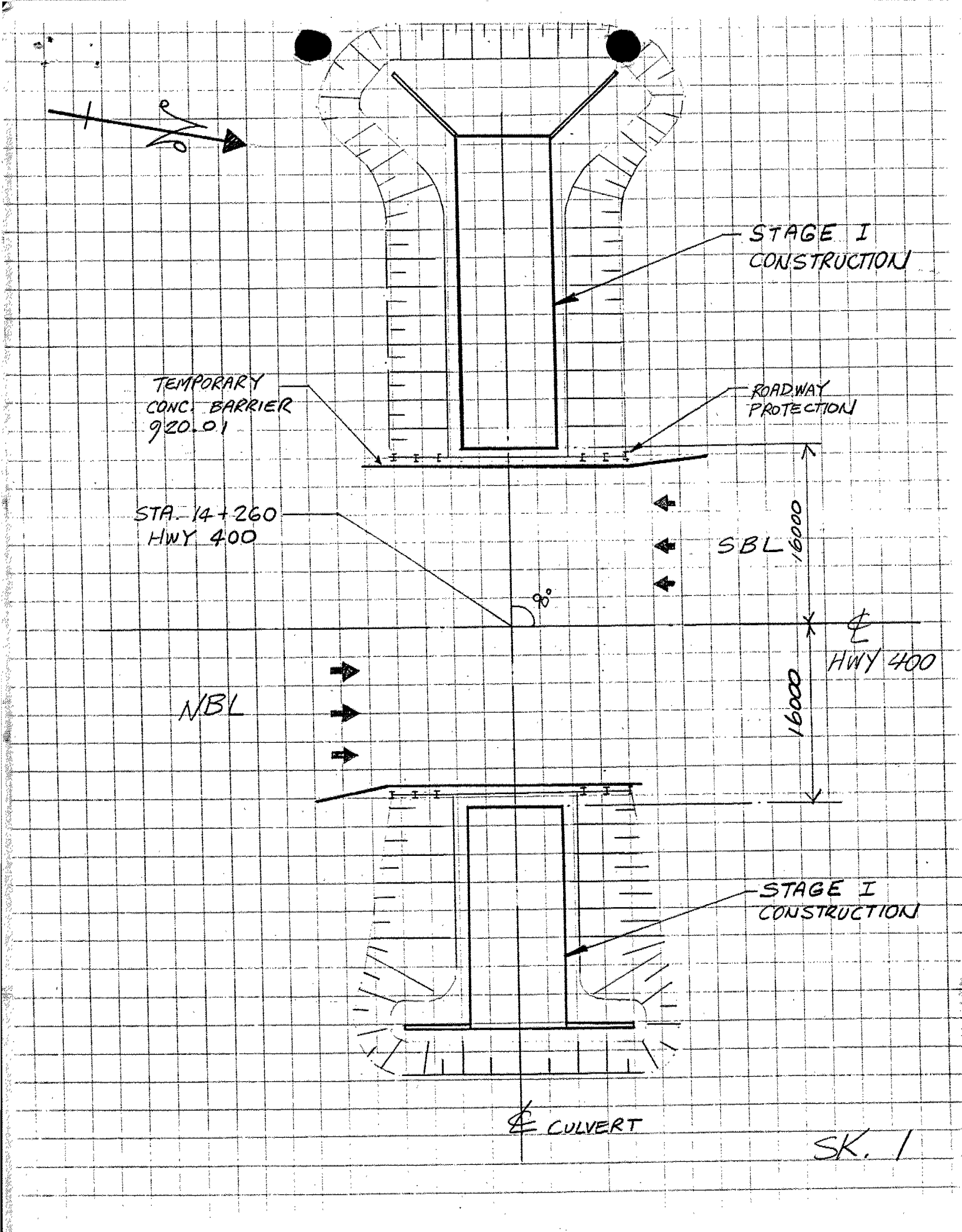
John A. Blair, P. Eng.
Project Foundation Engineer

For

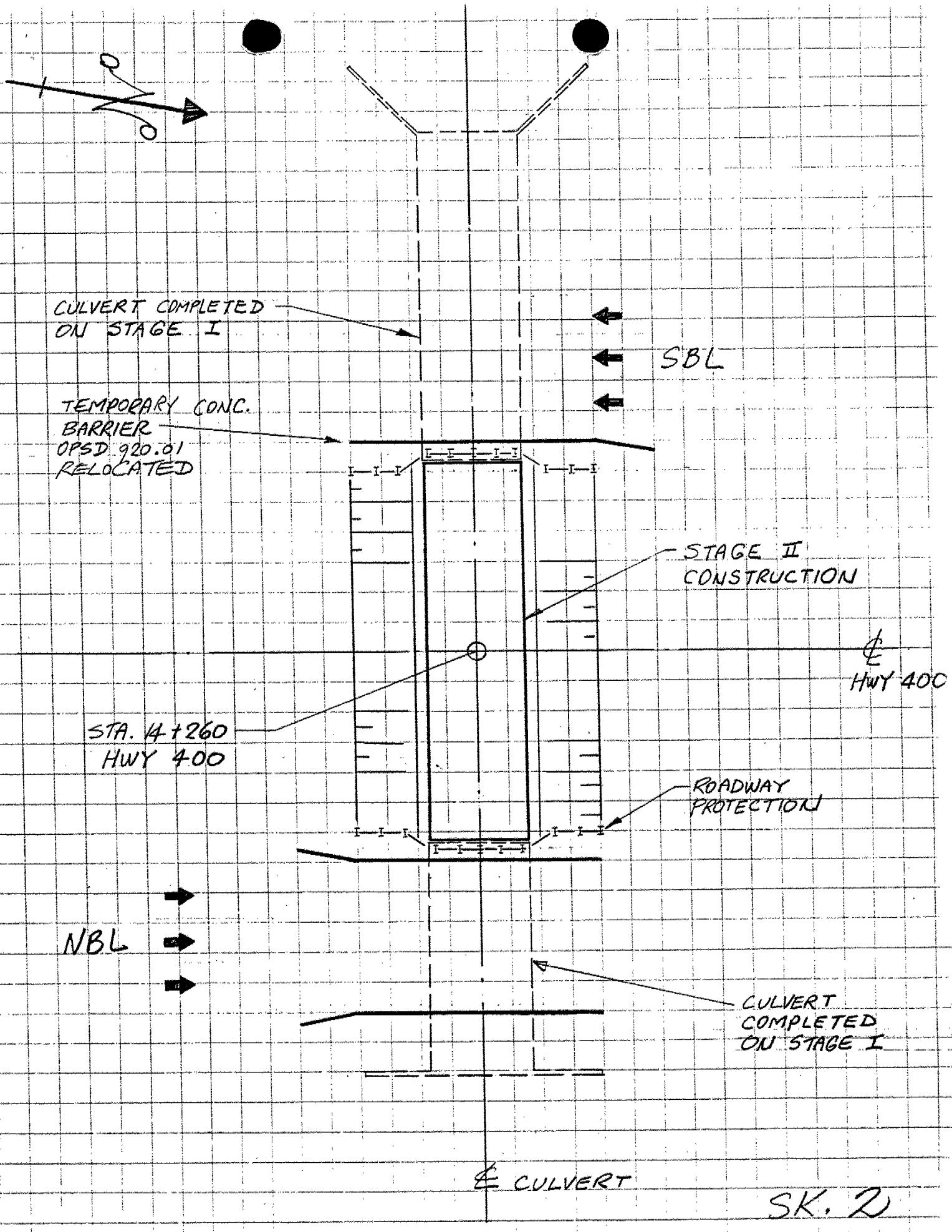
D. H. Dundas, P.Eng.
Sr. Foundation Engineer

Distribution

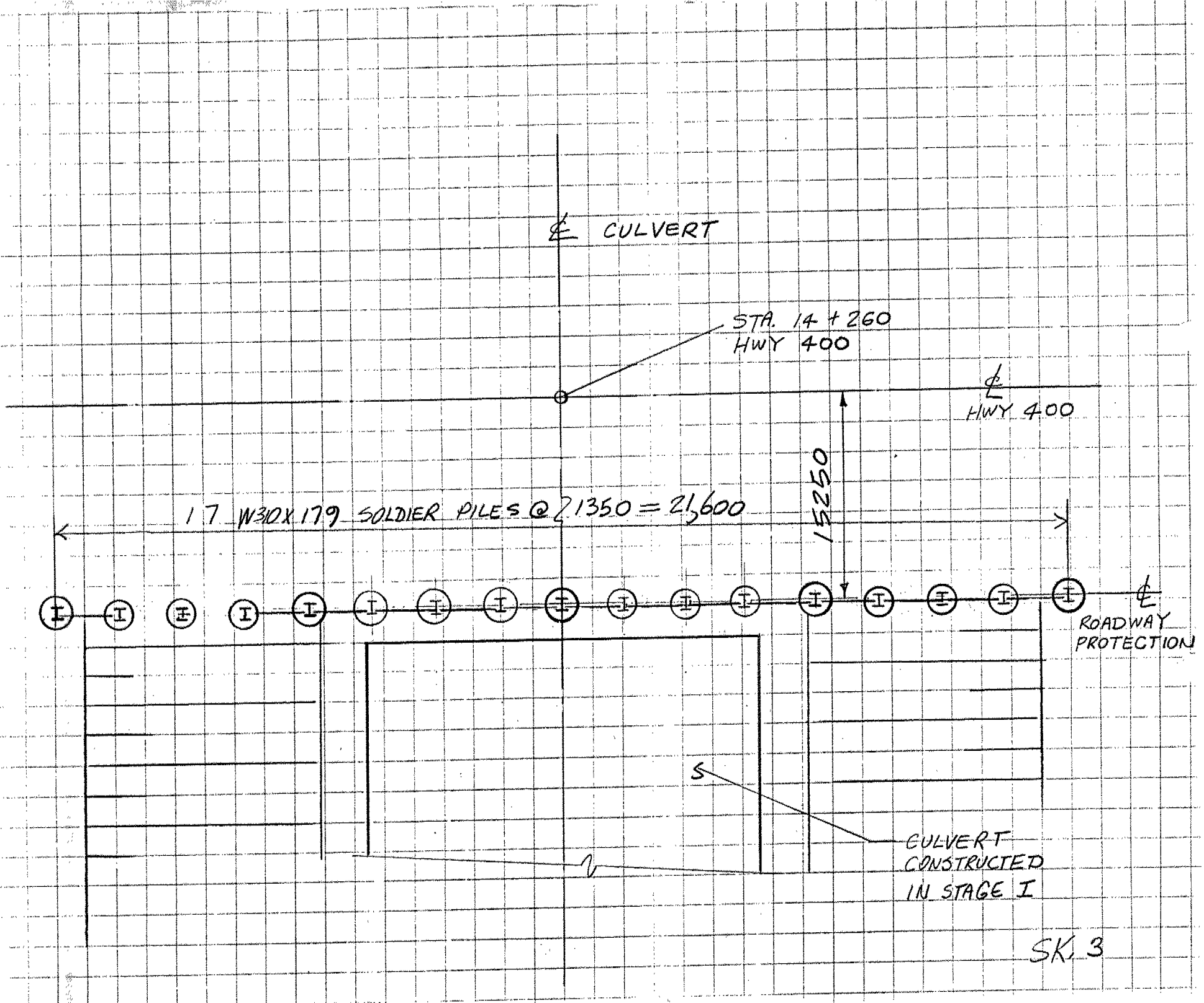
V. F. Boehnke (2)

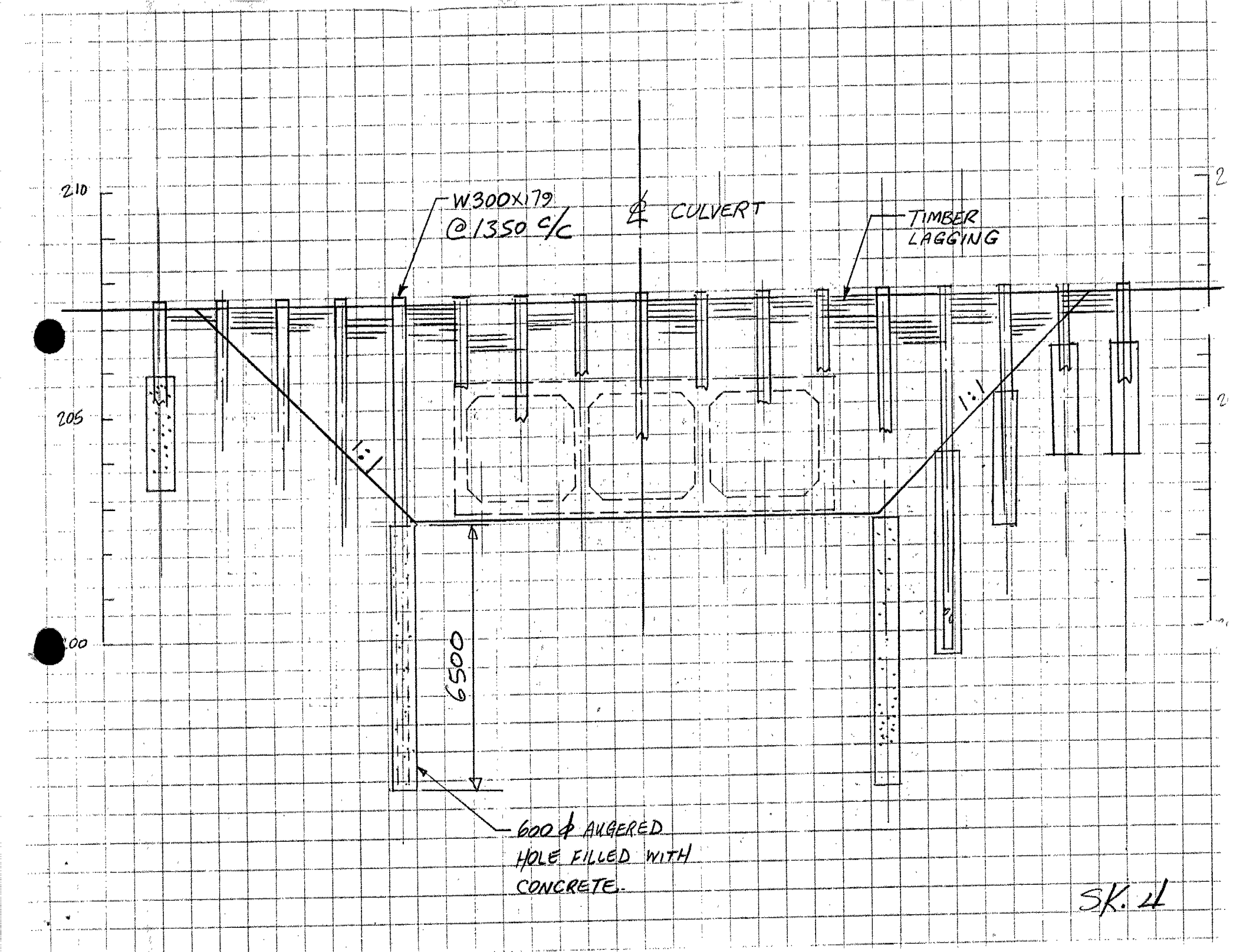

STAGE I
CONSTRUCTION
TEMPORARY
CONC. BARRIER
9.20.01
ROADWAY
PROTECTION
STA. 14+260
HWY 400
SBL
16000
90°
℄
HWY 400
NBL
16000
STAGE I
CONSTRUCTION
℄ CULVERT

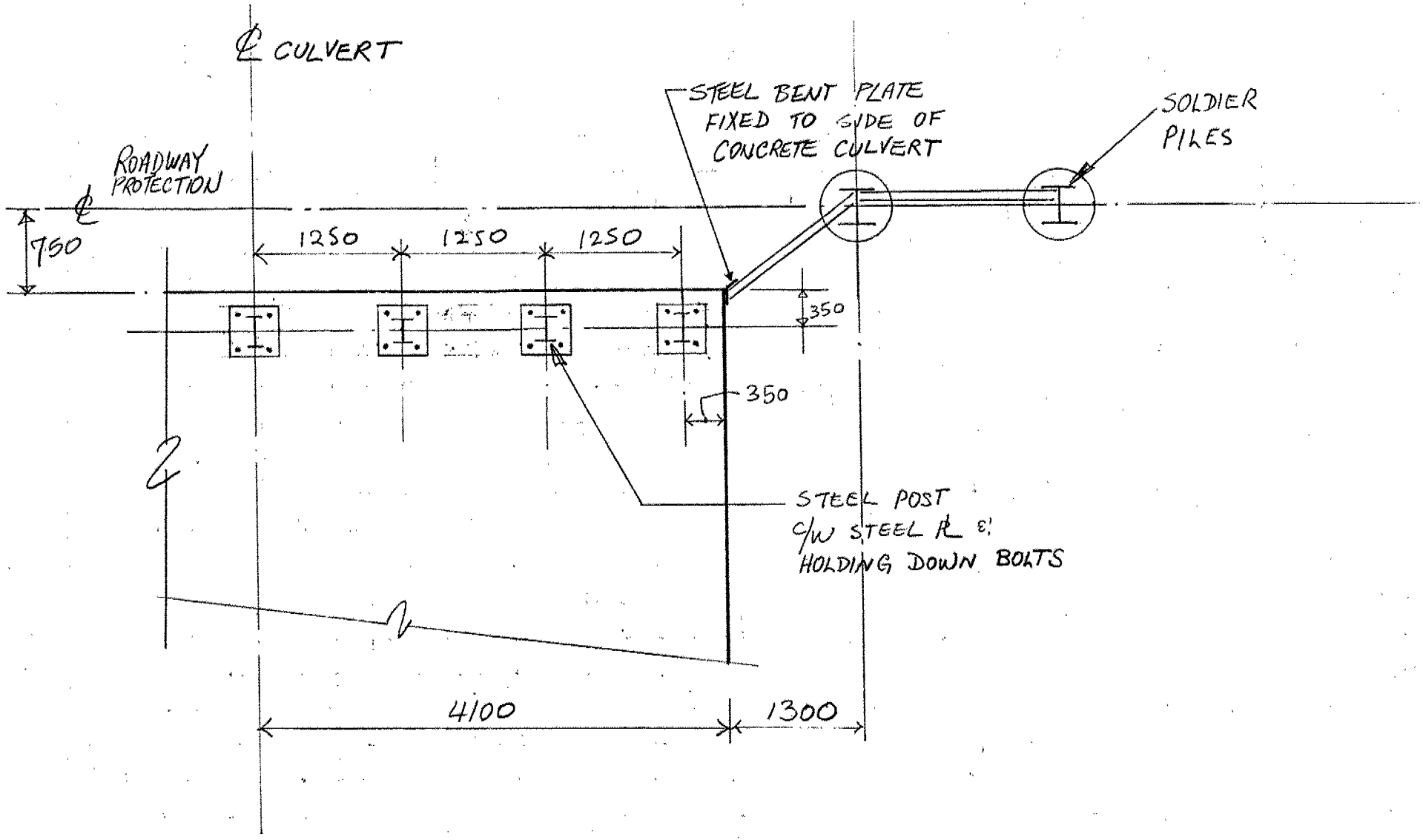
SK. 1


CULVERT COMPLETED ON STAGE I
SBL
TEMPORARY CONC. BARRIER OPSD 920.01 RELOCATED
STAGE II CONSTRUCTION
℄ HWY 400
STA. 14+260 HWY 400
ROADWAY PROTECTION
NBL
CULVERT COMPLETED ON STAGE I
℄ CULVERT

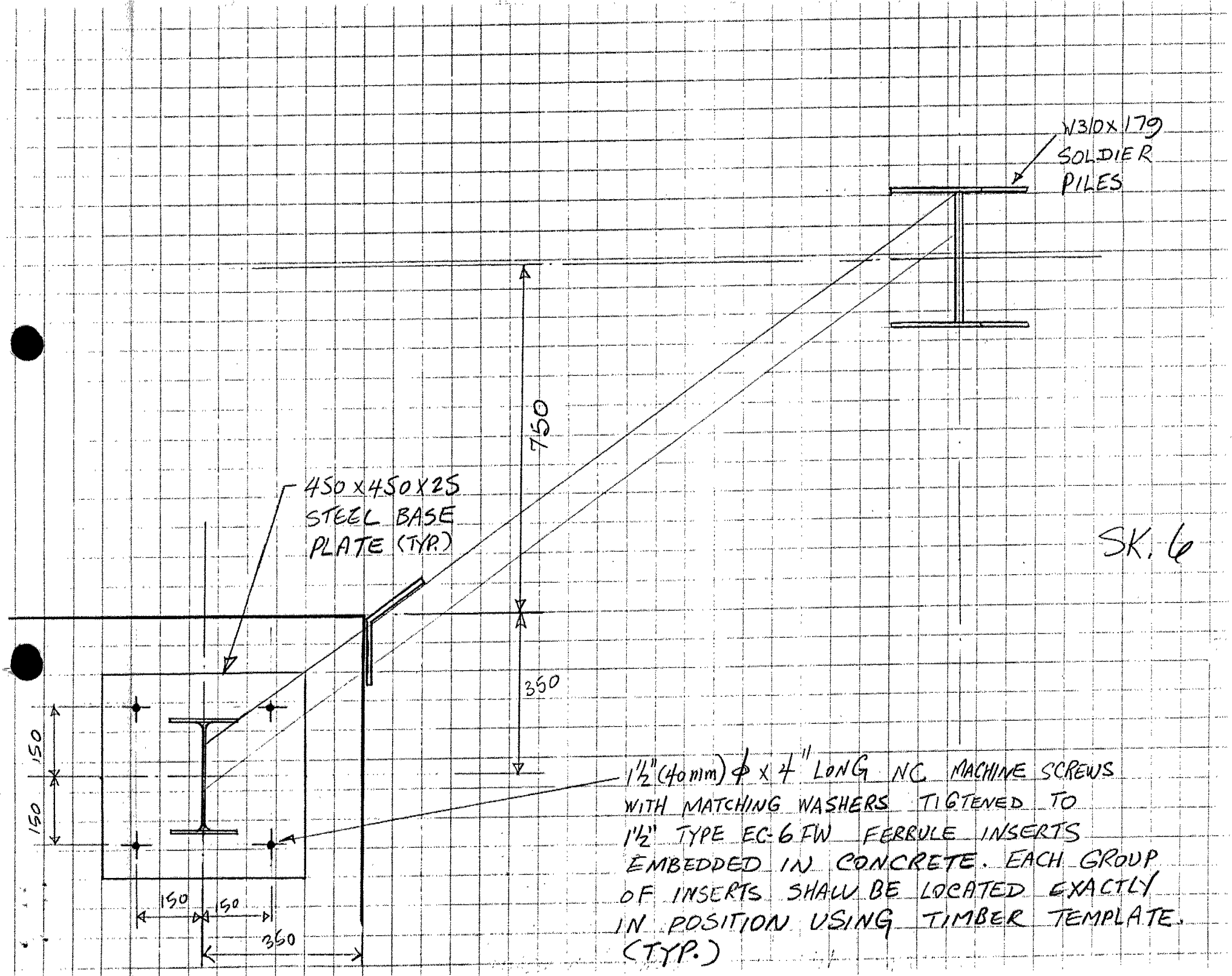
SK. 2


℄ CULVERT
STA. 14+260
HWY 400
℄
HWY 400
15250
17 W310X179 SOLDIER PILES @ 1350 = 21,600
℄
ROADWAY
PROTECTION
CULVERT
CONSTRUCTED
IN STAGE I
SK. 3


210
205
W300X179
@1350 c/c
℄ CULVERT
TIMBER
LAGGING
1:1
1:1
6500
600ϕ AUGERED
HOLE FILLED WITH
CONCRETE.
SK. 4


℄ CULVERT
STEEL BENT PLATE FIXED TO SIDE OF CONCRETE CULVERT
SOLDIER PILES
ROADWAY PROTECTION
℄
750
1250
1250
1250
350
350
STEEL POST C/W STEEL ℄ & HOLDING DOWN BOLTS
4100
1300

SK.5


W310x179
SOLDIER
PILES
750
450x450x25
STEEL BASE
PLATE (TYP.)
350
150
150
150
150
350
1½"(40mm)ϕ x 4" LONG NC MACHINE SCREWS
WITH MATCHING WASHERS TIGTENED TO
1½" TYPE EC-6FW FERRULE INSERTS
EMBEDDED IN CONCRETE. EACH GROUP
OF INSERTS SHALL BE LOCATED EXACTLY
IN POSITION USING TIMBER TEMPLATE.
(TYP.)

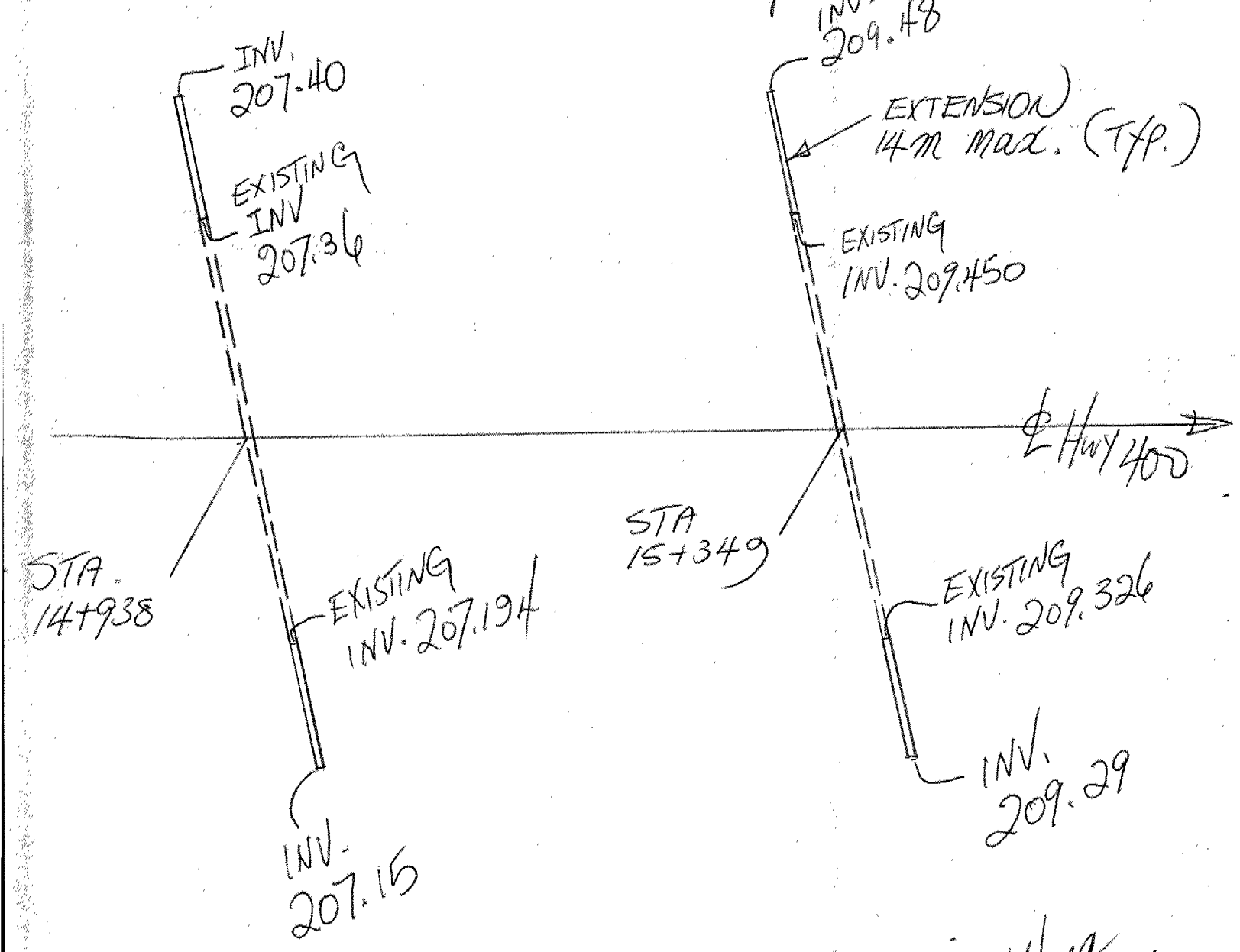
SK. 6

Memo

To: M. J. Blair
Foundation Design Section

Date 1992-01-28

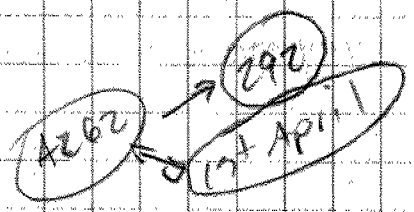
Re: Hwy 400 Widening from Hwy 7 to N. of Langstaff Rd
Culvert elevations at end of extension)



Dennis Wong

LOADS ON FOUNDATION

EB STRUCTURE



Structural Section
Central Region
1201 Wilson Avenue
Atrium Tower, 4th Floor
Downsview, Ontario, M3M 1J8
Telephone: 235-5512

MINISTRY OF TRANSPORTATION

memorandum

TO: Mr. M. Devata
Head, Foundation Design Section

DATE: December 11, 1991

Attn. Mr. D. Dundas, Sr. Foundation Engr.

RE: Hwy. 400 Widening
From Hwy 7 to north of Langstaff Road
G.W.P. 612-89-00, District 6

As requested, this memorandum will supplement the information you need regarding this project.

3-cell concrete box culvert:

About 80 m long to be constructed in two stages; on stage 1, traffic will be squeezed towards the centerline on the existing Hwy 400; two rows of roadway protection will be installed at locations shown on the E-plan; excavate and construct the two outside pieces of the culvert; backfill and complete the road surface to form the 'detour'; on stage 2, switch the traffic onto the 'detour' and excavate for the middle portion of the culvert using the roadway protection installed in stage 1 to retain earth; construct the middle portion of the culvert; backfill and complete the road construction.

Culvert extensions at Sta. 14+938 & 15+349:

Both existing culverts are 1.2 x .9 non-rigid type and the extensions are identical with the existing; extensions are on both sides of the culvert as a result of the road widening; normally granular backfill requirements as per OPSD 803.01; OPSD 803.01 is attached for your information; bedding, if required, will be according to Foundation Design Section's recommendations; extensions may be to a maximum of 14 m on either sides of the existing culvert depending on detail design; a plan showing existing road condition with marked up culvert extensions is attached for your information.

The foundation investigation work for the new culvert and culvert extensions mentioned above will be under WP 527-91-01 within the GWP 612-89-00.

High Mast Pole Foundations:

Generally, the pole heights are about 35 m; mostly located along centerline of Hwy 400; some located in the interchange areas to provide illumination to the interchange; previously, design of high mast pole foundations was according to B. Brom's paper as recommended by Foundation Design Section before; reinforced pored-in-place concrete caisson foundations of 1372mm (54") diam. will most likely be used for foundations; typical foundation depths for different subsoils are attached for your information; frost depth of 1.2 m will be added to these depths.

The above work will be under WP 528-89-01 within the GWP 612-89-00.

Memo reports will be sufficient for all the investigations mentioned above.

I hope the above memorandum will clarify some questions about this project. Please let me know if you need any further information.

Dennis Wong

Dennis Wong
Sr. Structural Engineer
for:
V. F. Boehnke
Head, Structural Section

cc. Mr. R. McCormick, McCormick Rankin
Mr. J. Blair, Foundation Design

Typical Foundation Depths

b) 35 m Pole with 12 Heads (1372 mm diameter)

Cohesionless Soils

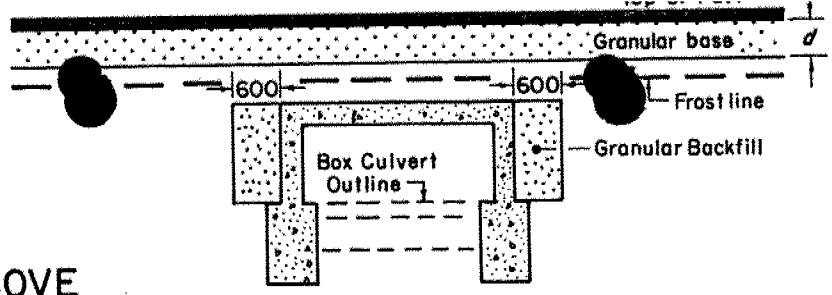
		Required Depth (m)
Loose Sand (ϕ = 30°)	Above Water Table	8.50
	Below Water Table	10.25
Medium Sand (ϕ = 35°)	Above Water Table	5.75
	Below Water Table	6.50
Dense Sand (ϕ = 40°)	Above Water Table	5.50 *
	Below Water Table	5.50 *

Cohesive Soils

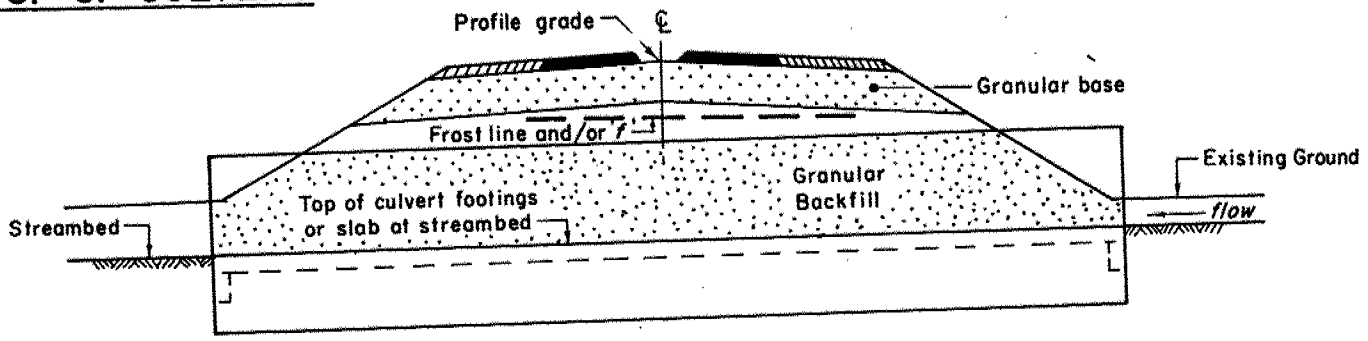
	Required Depth (m)
q_u = 40 kPa	14.50
60	10.75
80	8.75
100	7.50
120	6.75
140	6.00
160	5.50 *

* It is recommended that the length of the pile is at least greater than 4 times the diameter of the pile to satisfy the lower limit of short piles.

FROST LINE ABOVE TOP OF CULVERT

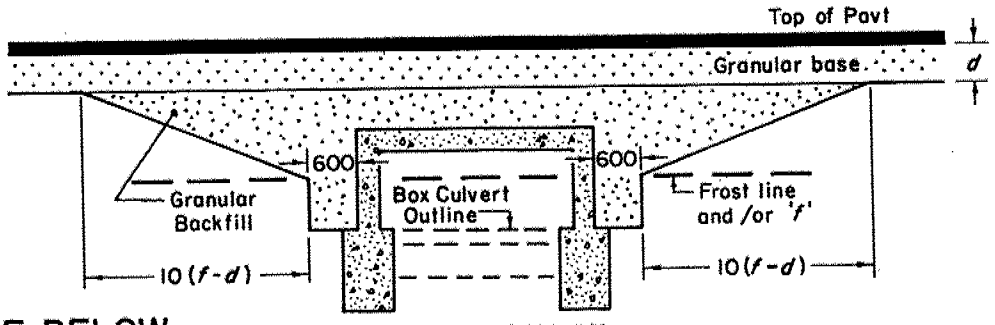


CROSS-SECTION

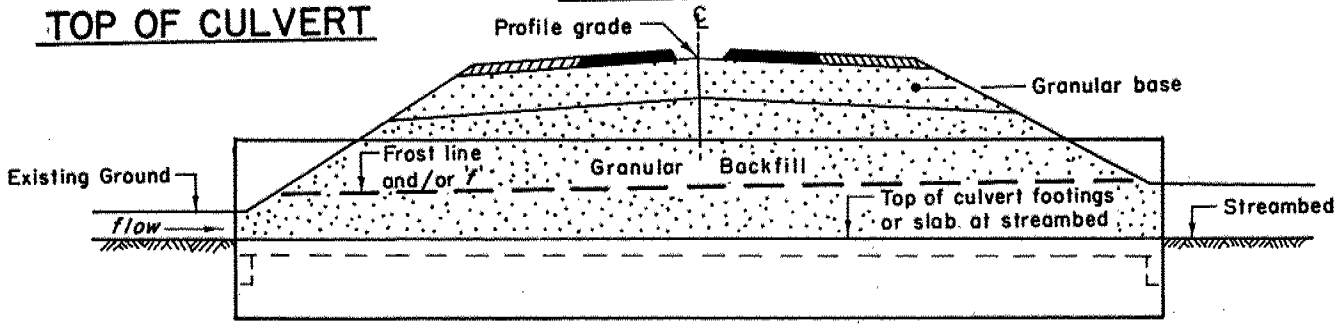


LONGITUDINAL SECTION

FROST LINE BELOW TOP OF CULVERT



CROSS-SECTION



LONGITUDINAL SECTION

NOTES:

A Backfill material to be granular as specified.

B All dimensions are in millimetres unless otherwise shown.

LEGEND:

d = Denotes depth of granular (roadbed)

f = Denotes depth of frost treatment = ____ (measured from profile grade)

ONTARIO PROVINCIAL STANDARD DRAWING

Date	1983 12 01	Rev	

GRANULAR BACKFILL

FOR NON RIGID FRAME OPEN OR BOX CONCRETE CULVERT

Date _____

OPSD-803.01

HWY 400 W[redacted]NING FROM HWY 7 TO N. OF [redacted]NGSTAFF RD.
WP 612-89-00

Hwy 7 Underpass, looking south

Hwy 400, looking north

Pg

HWY 400 WIDENING FROM HWY 7 TO N. OF LANGSTAFF RD.
WP 612-89-00

Langstaff Road Underpass underconstruction
City of Vaughan Contract T90-16

HWY 400 W[redacted]NING FROM HWY 7 TO N. OF [redacted]NGSTAFF RD.
WP 612-89-00

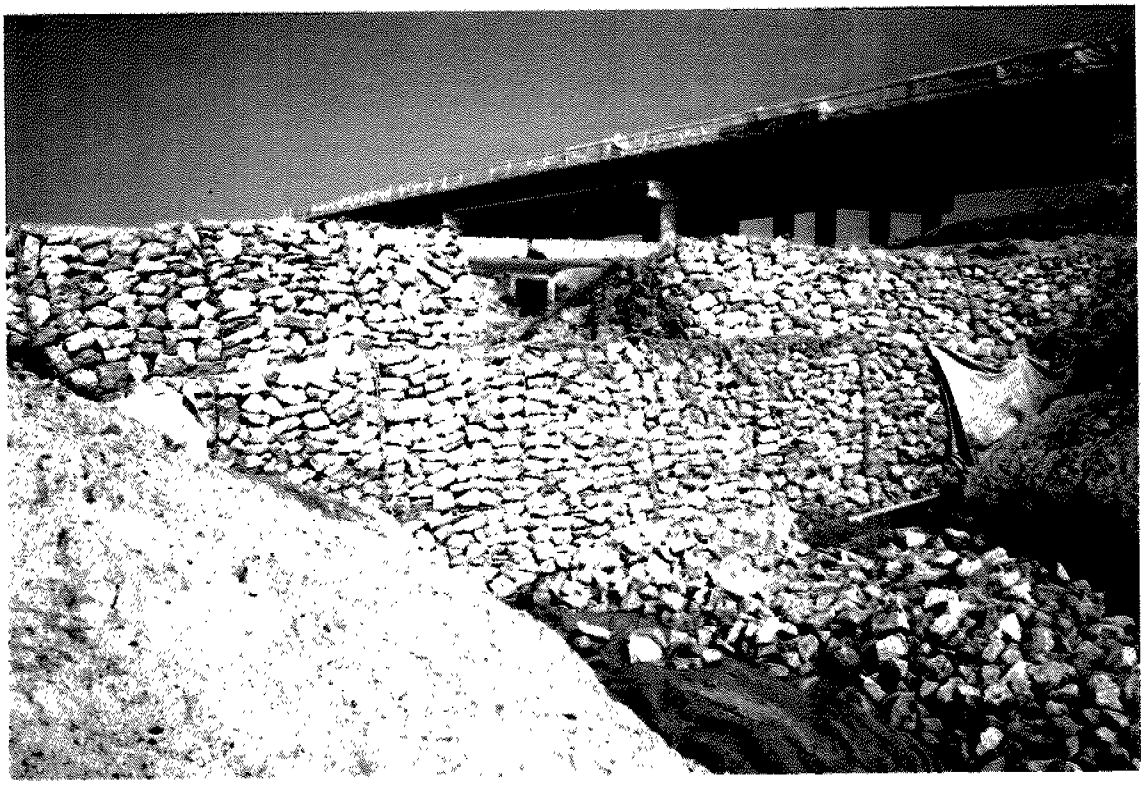
East Approach under construction

New 3-cell culvert under east approach

Pg 3

HWY 400 WI[redacted]NING FROM HWY 7 TO N. OF [redacted]GSTAFF RD.
WP 612-89-00

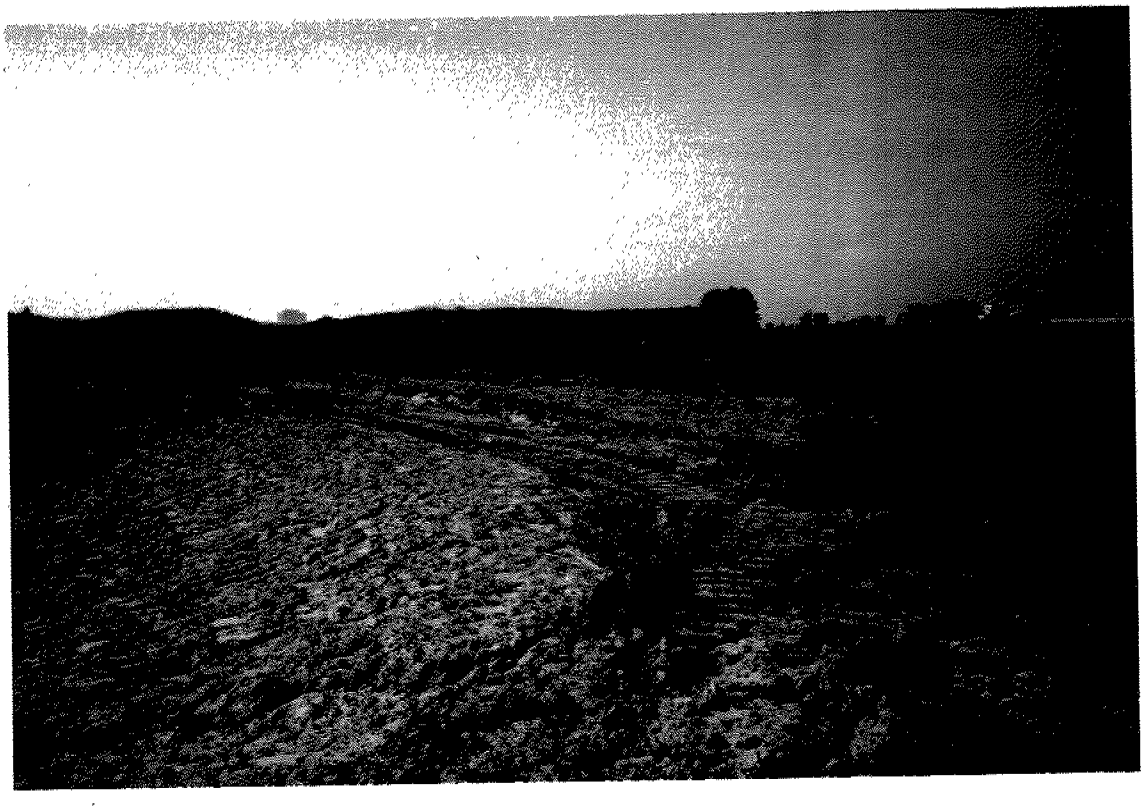
New 3-cell culvert under Ramp 400S-Langstaff Rd. E-W



Gabion protection at outlet of existing culvert s. of Lanstaff Rd

HWY 400 WI[redacted]NING FROM HWY 7 TO N. OF [redacted]GSTAFF RD.
WP 612-89-00

Outlet of existing culvert S. of Langstaff Rd.



Ramp 400S-Langstaff Rd. E-W under construction

HWY 400 WIDENING FROM HWY 7 TO N. OF LANGSTAFF RD.
WP 612-89-00

Close-up of existing culvert s. of Langstaff Rd.

Langstaff Rd. Underpass, looking south

HWY 400 WI[redacted]NING FROM HWY 7 TO N. OF [redacted]GSTAFF RD.
WP 612-89-00

Cuvert at Sta. 14+938, East end

Culvert at 14+938, West end

Pg 1

HWY 400 WI[redacted]NING FROM HWY 7 TO N. OF [redacted]GSTAFF RD.
WP 612-89-00

Cuvert at Sta. 15+349, East end

Culvert at 15+349, West end

Pg 2