

MEMORANDUM

J.P. 159-64

TO: Mr. B. R. Davis,  
Bridge Engineer,  
Bridge Division,  
Admin. Bldg.

FROM: Foundation Section,  
Materials & Testing Div.,  
Room 107, Lab. Bldg.

Attention: Mr. S. McCombie

DATE: November 22, 1967

OUR FILE REF.

IN REPLY TO

NOV 28 1967

SUBJECT:

FOUNDATION INVESTIGATION REPORT  
For  
Proposed Sodom Road Underpass  
Queen Elizabeth Way  
Site 34-189  
District #4 (Hamilton)  
W.J. 67-F-87 -- W.F. 59-64

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

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

AGS/M  
Attach.

cc: Messrs. B. R. Davis (2)  
H. A. Tregaskes  
D. W. Farren  
G. K. Hunter (2)  
H. Greenland  
W. S. Melinyshyn  
T. J. Kovich  
B. A. Singh  
Foundations Files  
Gen. Files

*A. G. Sternac*  
A. G. Sternac  
PRINCIPAL FOUNDATION ENGINEER

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FOUNDATION INVESTIGATION REPORT  
For  
Proposed Sodom Road Underpass  
Queen Elizabeth Way  
Site 34-189  
District #4 (Hamilton)  
W.J. 67-F-87 -- W.P. 159-64

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1. INTRODUCTION:

The Foundation Section was requested to carry out an investigation at the crossing of the Q.E.W. and Sodom Road, about 9 miles north of Fort Erie, Ontario. The request was contained in a memo from the Bridge Division (Mr. W. S. Melinyshyn, Regional Bridge Location Engineer), dated September 7, 1967. An investigation was subsequently carried out by this Section to determine the subsoil conditions at this site.

This report contains the results of the investigation, together with recommendations pertaining to the foundations of the proposed structure as well as the stability of the approach embankments.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The site is located about 9 miles north of Fort Erie, Ontario. At this location, the Q.E.W. and Sodom Road intersect each other at a level crossing. The topography at the site is generally flat-lying.

Physiographically, the site is situated in the "Haldimand Clay Plain". Based on available geological information, it is known that the overburden of this region consists of lacustrine clay deposited in glacial Lake Warren, formed during the retreat of the last continental glacier. Underlying the lacustrine clay, which may reach a depth of 50 ft. or greater, there is a basal till deposit. The till, in turn, is underlain by interbedded calcareous shale, dolomite and dolomitic shale with some gypsum inclusions; this bedrock is of the Salina formation.

### 3. FIELD AND LABORATORY WORK:

Three boreholes, each with an accompanying dynamic cone penetration test, were carried out during the course of the field investigation. In addition, two boreholes (No's 3 and 4), put down previously at this site by H. Q. Golder and Associates Ltd., for preliminary investigation purposes, have been incorporated in determining the subsoil stratigraphy across the site. The borings were advanced by a conventional diamond drill rig adapted for soil sampling purposes or, alternatively, by a Penn. drill auger machine.

Samples were recovered at required depths in a 2" O.D. split-spoon sampler, which was hammered into the soil; or, in 2" I.D. Shelby tubes which were manually pushed into the soil. The method of driving the split-spoon sampler conformed to the specifications for the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests. Field vane tests were carried out, where possible, in the cohesive portion of the overburden, to determine the undrained shear strength of the stratum. Bedrock was proven in four boreholes by obtaining AXT size rock core samples.

The locations and elevations of all borings are shown on Drawing 67-F-87A, together with the estimated stratigraphical profile across the site.

All samples were subjected to a careful visual examination in the field and subsequently in the laboratory. Following this examination, laboratory testing was carried out on selected representative samples to determine the following engineering properties of the overburden:

- Bulk Densities
- Natural Moisture Contents
- Atterberg Limits
- Grain-Size Distributions
- Consolidation Characteristics

The results of this testing is plotted on the Record of Borelog sheets contained in Appendix I of this report.

cont'd. /3 ...

#### 4. SUBSOIL CONDITIONS:

##### 4.1) General:

The surficial stratum across the site is a firm to hard grey-brown silty clay with a trace of sand and gravel, varying in thickness from 38 ft. to 47 ft. The upper 18 to 27 ft. of this stratum has been desiccated to a hard crust. The silty clay is underlain by a deposit of very hard clayey silt to sandy silt till. Interbedded shale and dolomitic shale bedrock, the surface of which varies from elevation 523 to 527, was encountered directly beneath the till. The boundaries of the various deposits, as determined in the boreholes, are shown on the accompanying borehole sheets. The stratigraphical profile, shown on Drawing 67-F-87A, is inferred from this boring data.

From ground surface downwards, the various soil types encountered, are as follows:

##### 4.2) Silty Clay to Clayey Silt:

Underlying a surficial mantle of topsoil some 6 to 9 inches thick, is the predominant stratum across the site, a grey-brown silty clay to clayey silt with a trace of sand and gravel. The total thickness of this stratum ranges from 38 to 47 ft. The upper 18 to 27 ft. of the silty clay is mottled brown to grey-brown in colour, indicating that this zone has been desiccated. Occasional partings and seams of silt up to 1/4 inch thick were encountered throughout the stratum. Grain-size distribution curves for samples of the silty clay are shown in the appendix to this report.

The engineering properties of the stratum, as determined by field and laboratory testing, are as follows:

cont'd. /4 ...

4. SUBSOIL CONDITIONS: (cont'd.) ...

4.2) Silty Clay to Clayey Silt: (cont'd.) ...

		Desiccated Crust Range (Average)	Lower Zone Range (Average)
Liquid Limit (%)	(W <sub>L</sub> )	37 to 48 (43)	32 to 58 (40)
Plastic Limit (%)	(W <sub>P</sub> )	18 to 23 (21)	18 to 27 (22)
Natural Moisture Content (%)	(W)	21 to 26 (24)	27 to 44 (35)
Liquidity Index	(I <sub>L</sub> )	0 to 0.5 (0.2)	0.6 to 1.0 (0.7)
Undrained Shear Strength (p.s.f.)	(C <sub>u</sub> )	>2,000	600 to 2,000 (1,100)
'N' Values (Blows/ft.)		10 to 47 (29)	7 to 15 (10)
Bulk Density (p.c.f.)	(γ)	-	114 to 126 (120)

The Atterberg limits, summarized above, are also plotted on the Plasticity Chart. These results indicate that, in general, the silty clay is inorganic and of intermediate plasticity. The undrained shear strength testing carried out, is also summarized on the Undrained Shear Strength versus Elevation profile. Based on this, it is considered that the consistency of the silty clay ranges from stiff, immediately below the crust, to firm with depth. The consistency of the crust ranges from very stiff to hard. The standard penetration resistance or 'N' values recorded, corroborate the consistency pattern given above. The consolidation characteristics of the stratum were determined by carrying out two laboratory tests, the results of which are shown as Void Ratio vs. Pressure plots. The figures referred to are all contained in the appendix of this report.

cont'd. /5 ...

4. SUBSOIL CONDITIONS: (cont'd.) ...

4.3) Glacial Till:

This deposit, which is some 9 to 15 feet thick, directly underlies the silty clay stratum. The matrix of this till is, in general, composed of a clayey silt binding sand and gravel; there are zones within this deposit, however, where the matrix is predominantly a sandy silt. The 'N' values in this deposit range from 22 to greater than 100 blows/ft., generally being greater than 100 blows/ft.; the consistency of the cohesive till is, therefore, very hard and the relative density of the granular till is very dense.

Typical grain-size distribution curves obtained from samples of the deposit are shown in the appendix of this report.

4.4) Bedrock - Interbedded Shale and Dolomitic Shale:

Bedrock was established in all the borings, except B.H. #4, by drilling 4 to 10 ft. of AXT core. The depth at which bedrock was encountered ranged from about 52 to 56 ft. below existing ground surface, corresponding to elevations 523 to 527.

The bedrock is composed of interbedded shale and dolomitic shale with numerous gypsum inclusions throughout. In general, the upper 5 to 7 ft. of the bedrock is in a rubbly or fractured state.

5. GROUNDWATER CONDITIONS:

Water level observations were carried out in the borings during the period of the investigation. These observations, which are recorded on the borehole logs and summarized on Drawing No. 67-F-87A, indicate that the groundwater level ranges from about elevation 564 to 576 - i.e., some 4 to 16 ft. below ground surface. The groundwater level was encountered at greater depth in boreholes 1, 2, and 5. It is pertinent to note that at these locations, the

cont'd. /6 ...

5. GROUNDWATER CONDITIONS: (contd.) ...

borings were terminated within the interbedded shale bedrock. From past experience in the area, it is known that the upper 5 to 10 ft. of the bedrock is often fractured, or contains interconnected solution cavities; this upper zone is often more permeable than the lower bedrock. It is, therefore, considered that the groundwater level in these borings may be at a lower elevation due to downward drainage which occurs once the more pervious zones are intersected. At boreholes 3 and 4, the groundwater level was within 8 feet of ground surface; it is considered that this level is indicative of the piezometric groundwater level within the upper impervious silty clay stratum.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

It is proposed to construct an underpass structure to carry Sodom Rd. over the Queen Elizabeth Way. Present proposals call for a four-span (72'-124'-124'-72') structure with approach fills having a maximum height of about 25 ft. above the existing Q.E.W. grade.

Subsoil at the site consists of a stratum of hard (desiccated crust) to firm silty clay with traces of sand and gravel, followed by a glacial till deposit. The overburden is underlain by an interbedded shale and dolomitic shale bedrock at depths of between 52 and 56 ft. below ground surface.

6.2) Structure Foundations:

Since the upper 18 to 27 ft. of the subsoil consists of a hard to stiff silty clay, conditions are favourable for spread footing support and, in the case of the proposed piers, it is recommended that the footings be founded some 4 ft. below

cont'd. /7 ...

6. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

6.2) Structure Foundations: (cont'd.) ...

the existing ground surface so as to satisfy the frost protection requirements in the area. For footings founded at this depth, an allowable bearing pressure of 2.5 t.s.f. can be used for design.

The proposed abutments may be constructed within the approach fills; two alternative methods are given for the foundation support of the abutments:

a) The abutments may be supported on spread footings placed within the approach fills. The fill material, below the tops of the footings, should consist of well compacted G.B.C. Class 'A' material, and should extend to a horizontal distance of at least 10 ft. from the footing edges in the plane of the footing tops. This portion of the fill should be constructed with side slopes no steeper than 2:1. The remainder of the fill should be completed to about profile grade for a distance of about 50 ft. behind the abutments before re-excavating for the abutment footings. An allowable bearing value of 2.0 t.s.f. may be used in footing design.

b) The abutments for the structure may be supported on 12-3/4" O.D. tubular piles driven about 10 ft. into the upper desiccated zone of the silty clay stratum - i.e., to about elevation 569. A 12-3/4" O.D. pile could carry an allowable load of about 20 tons/pile. Care should be taken to ensure that no bouldery fill is placed at the locations through which piles have to be driven.

cont'd. /8 ...

6. DISCUSSION AND RECOMMENDATIONS. (cont'd.) ...

6.2) Structure Foundations: (cont'd.) ...

Analyses, based on Schmertmann's\* method, have been made to estimate the consolidation settlement of the foundation subsoil due to the pier footing and embankment loading.

Results of the analyses are summarized below:

- |   |                |
|---|----------------|
| 1) Ultimate settlements at the end pier location -                        |                |
| Induced by the footing pressure of 2.5 t.s.f. (footing size 95' x 6')     | ≈ 2-1/2"       |
| (Induced by embankment loading - 25-ft. height)                           | ≈ 1"           |
|   | <hr/>          |
|   | Total ≈ 3-1/2" |
| 2) Ultimate settlement at the centre pier location.                       | ≈ 2-1/2"       |
| 3) Ultimate settlement at the abutment locations -                        |                |
| (Induced by embankment loading - crest width 72 ft. with 2:1 side slopes) | ≈ 6-1/2"       |

These values represent the total long-term consolidation settlement, the majority of which should occur within about 10 years. Fifty percent of the above mentioned settlement should take place within a 2-year period.

In addition to the aforementioned consolidation settlements, there will be elastic or immediate settlements. It can be assumed that the elastic settlements will take place during and immediately after construction.

\* Schmertmann, J. H. -  
"The Undisturbed Consolidation Behavior of Clay" -  
American Society of Civil Engineers - 1955.

6. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

6.2) Structure Foundations: (cont'd.) ...

If the footings and approach embankments are constructed at the same time, the maximum differential settlements between the end and centre piers will be of the order of 1 inch. The maximum differential settlements between the end piers and the abutments founded in the approach fill, will be of the order of 3 inches. The differential settlement between the end piers and abutments could be reduced by constructing the approach embankments well in advance of the construction of the structure foundations. For example, if the embankment was constructed 6 months prior to the construction of the foundations, about 20 to 25 percent of the total consolidation settlement of the foundation subsoil will take place during this period. The differential settlement between the end piers and abutments would consequently be reduced from 3 inches to about 1-1/2 to 2 inches. The order of magnitude of the differential settlements expected between the end piers and abutments, founded in the approach fill, dictate that the end approach spans of the bridge be simply supported.

The total and differential settlements between the pier and abutment foundations could be eliminated by supporting the foundations of the entire structure on end-bearing piles driven to bedrock. Such piles would be of the order of 53 to 57 ft. long at the pier locations. The load carrying capacity of the piles will be dependent on the pile section used; for example, a 14 BP 74 steel H-pile could be designed for 90 tons/pile.

No major dewatering problems are anticipated during construction of footings in view of the impermeable nature of the subsoil. Care should be taken to prevent softening of the subsoil at the footing levels due to minor groundwater seepage or surface run-off. In this regard, it is recommended that the foundation base be protected by pouring a mat of lean concrete as soon as subgrade level is reached.

cont'd. /10 ...

6. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

6.3) Approach Embankments:

The proposed approach embankments will be of the order of 25 ft. above existing ground surface. No stability problems are anticipated for embankments constructed of properly compacted fill and with standard 2:1 slopes.

7. SUMMARY:

A foundation investigation for the proposed structure at the crossing of Sodom Rd. and the Q.E.W. is reported.

Subsoil at the site consists of a stratum of hard to firm silty clay, some 38 to 47 ft. thick, followed by a competent glacial till. The glacial till is, in turn, underlain by interbedded shale and dolomitic shale bedrock, the surface of which is some 52 to 56 ft. below ground surface.

Pier foundations for the structure should be supported on spread footings located at least 4 ft. below the ground surface; a safe bearing pressure of 2.5 t.s.f. can be applied.

The abutments can be founded within the approach fill 1) within a zone composed of properly compacted granular fill, using an allowable bearing pressure of 2.0 t.s.f., or 11) on 12-3/4" O.D. closed-end pipe piles driven about 10 ft. into the hard silty clay; the allowable load per pile will be in the order of 20 tons. The anticipated settlement of the structure foundations and approach fills are discussed in the section "Discussion and Recommendations". The magnitude of the differential settlements contemplated between the end piers and abutments dictate that the end approach spans of the structure be simply supported. As an alternative, the entire structure can be supported on steel H-piles driven to bedrock, as discussed in the report.

contd. /11 ...

7. SUMMARY: (cont'd.) ...

No major dewatering problems are anticipated for the pier footing excavations.

No stability problems are anticipated for the approach fills provided 2:1 slopes are employed.

8. MISCELLANEOUS:

The field work, performed during September 26 to October 4, 1967, was supervised by Mr. V. Korlu, Project Foundation Engineer.

The preparation of this report was undertaken by Mr. B. T. Darch, Senior Foundation Engineer.

The investigation was carried out under the general supervision of Mr. M. Devata, Supervising Foundation Engineer, who reviewed the report.

Equipment used was owned and operated by Canadian Longyear Limited.

November, 1967

APPENDIX I

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

## RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 67-F-87 LOCATION Sta. 32 + 30 30.5' Lt. ORIGINATED BY VK  
W.P. 159-64 BORING DATE Sept. 26, 1967 COMPILED BY BTD  
DATUM Geodetic BOREHOLE TYPE Diamond Drill, NX Casing, ATT Core CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — WL PLASTIC LIMIT — WP			BULK DENSITY P.C.F.	REMARKS		
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT	SHEAR STRENGTH P.S.F.					WATER CONTENT %						
579.0	Ground Level																
0.0	Mottled silty clay with a trace of sand and gravel (desiccated)  (reddish brown to brown)																
				1	SS	36											0 1 42 57
				2	SS	46											
				3	SS	34											
				4	SS	22											
	Very stiff to hard.		5	SS	12												
561.0																	
18.0	Silty clay to clayey silt with a trace of sand and gravel (occasional seams & partings of silt up to 1/4" thick through- out)  Grey-Brown		6	TW	P										123	Consol.	
			7	TW	P												
			8	TW	P										115	Consol.	
			9	TW	P										114		
537.0	Firm to stiff		10	SS	27												
42.0	Clayey silt with some sand and gravel (till) (grey)  Hard		11	SS	100/5"												
			12	SS	100/4"											9 20 53 18	
523.0																	
56.0	Interbedded shale and dolomitic shale bedrock with gypsum inclusions (Grey) (Fractured)		13	AXT	90%												
517.0	(Sound)		14	AXT	50%												
514.0			15	AXT	100%												
65.0	End of Borehole																

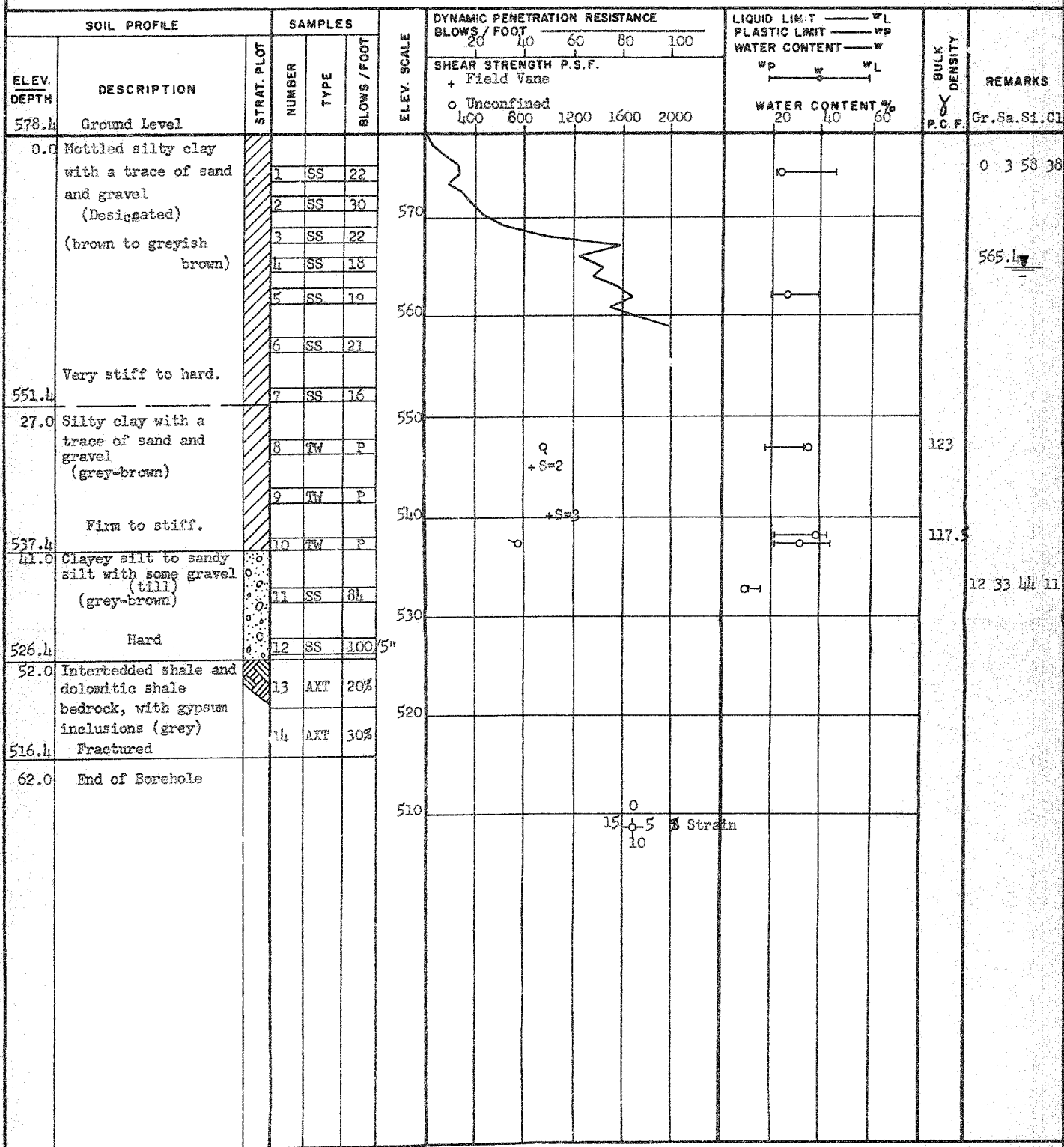
DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

## RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 67-F-87 LOCATION O.E.W. & Bodom Rd. Sta. 28 + 50; 36' Lt. ORIGINATED BY VE  
W.P. 159-64 BORING DATE Oct. 3, 1967 COMPILED BY BTD  
DATUM Geodetic BOREHOLE TYPE Diamond Drill, NX Casing, AXT Core CHECKED BY AK



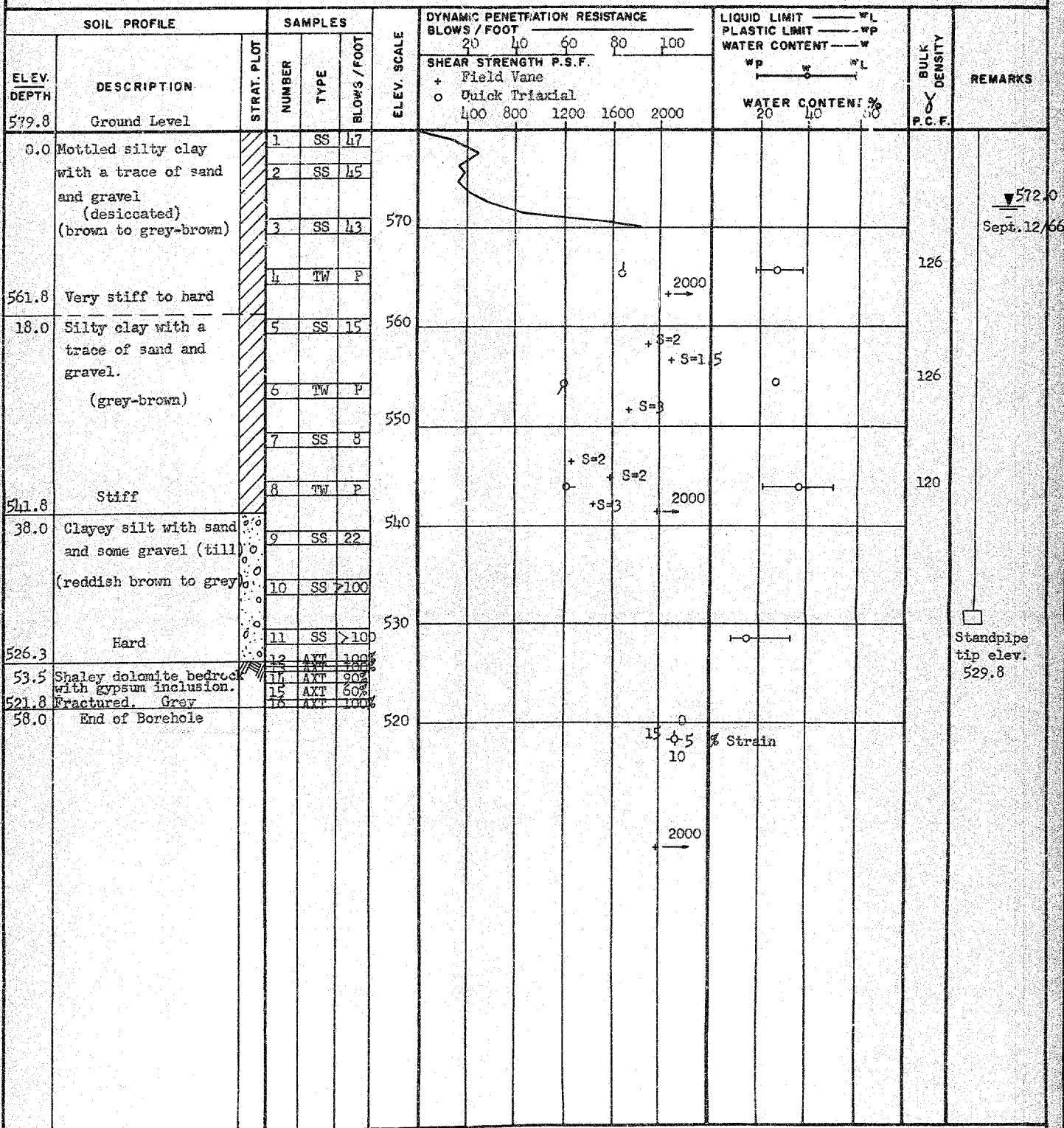
DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 3 (Golder)

FOUNDATION SECTION

JOB 67-F-87 LOCATION Q.E.W. & Sodom Rd., Sta. 30 + 57 47' Rt. ORIGINATED BY VK  
W.P. 159-64 BORING DATE August 15, 1966 COMPILED BY BTD  
DATUM Geodetic BOREHOLE TYPE Penn Drill - BX Casing, AXT Core CHECKED BY ML



DEPARTMENT OF HIGHWAYS - ONTARIO

## MATERIALS &amp; TESTING DIVISION

JOE 67-F-87

W.P. 159-64

DATUM Gordatic

## RECORD OF BOREHOLE NO. 4(Golder)

LOCATION Q.E.W. & Sodom Rd. Sta. 28 + 70, 32° Rt

BORING DATE August 17, 1966

BOREHOLE TYPE Penn Drill

ORIGINATED BY VK

COMPILED BY                      BTD

CHECKED BY

FOUNDATION SECTION

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT			BULK DENSITY P.C.F.	REMARKS			
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT					PLASTIC LIMIT							
							20	40	60	80	100	WATER CONTENT							
SHEAR STRENGTH P.S.F. + Field Vane												Wp      W      Wl			WATER CONTENT %				
							400	800	1200	1600	2000								
579.6	Ground Level																		
0.0	Mottled silty clay with a trace of sand and gravel (layered above elev. 568.5) (desiccated)		1	SS	10														
	(brown to grey-brown)		2	SS	29														
			3	TW	P														
			4	TW	F														
			5	SS	28														
	hard to very stiff		6	SS	19														
553.6																			
26.0	Silty clay with a trace of sand and gravel (grey-brown)			7	SS	7													
				8	TW	P													
				9	SS	15													
	Firm to stiff		10	SS	15														
532.6																			
47.0	Clayey silt to sandy silt with some gravel (till)		11	SS	>100														
525.1	Hard.		12	SS	>100														
54.5	End of Borehole																		

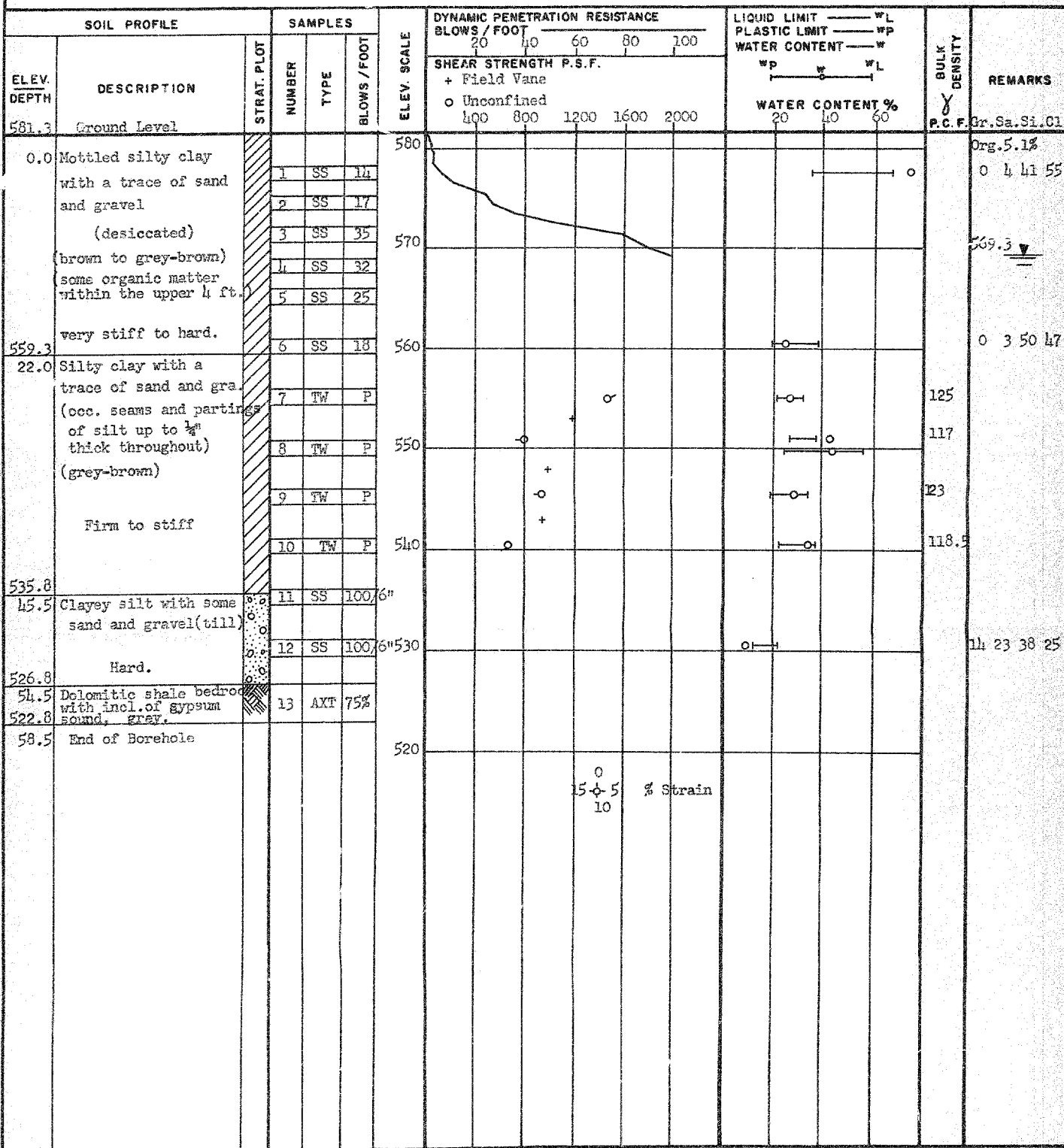
DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS &amp; TESTING DIVISION

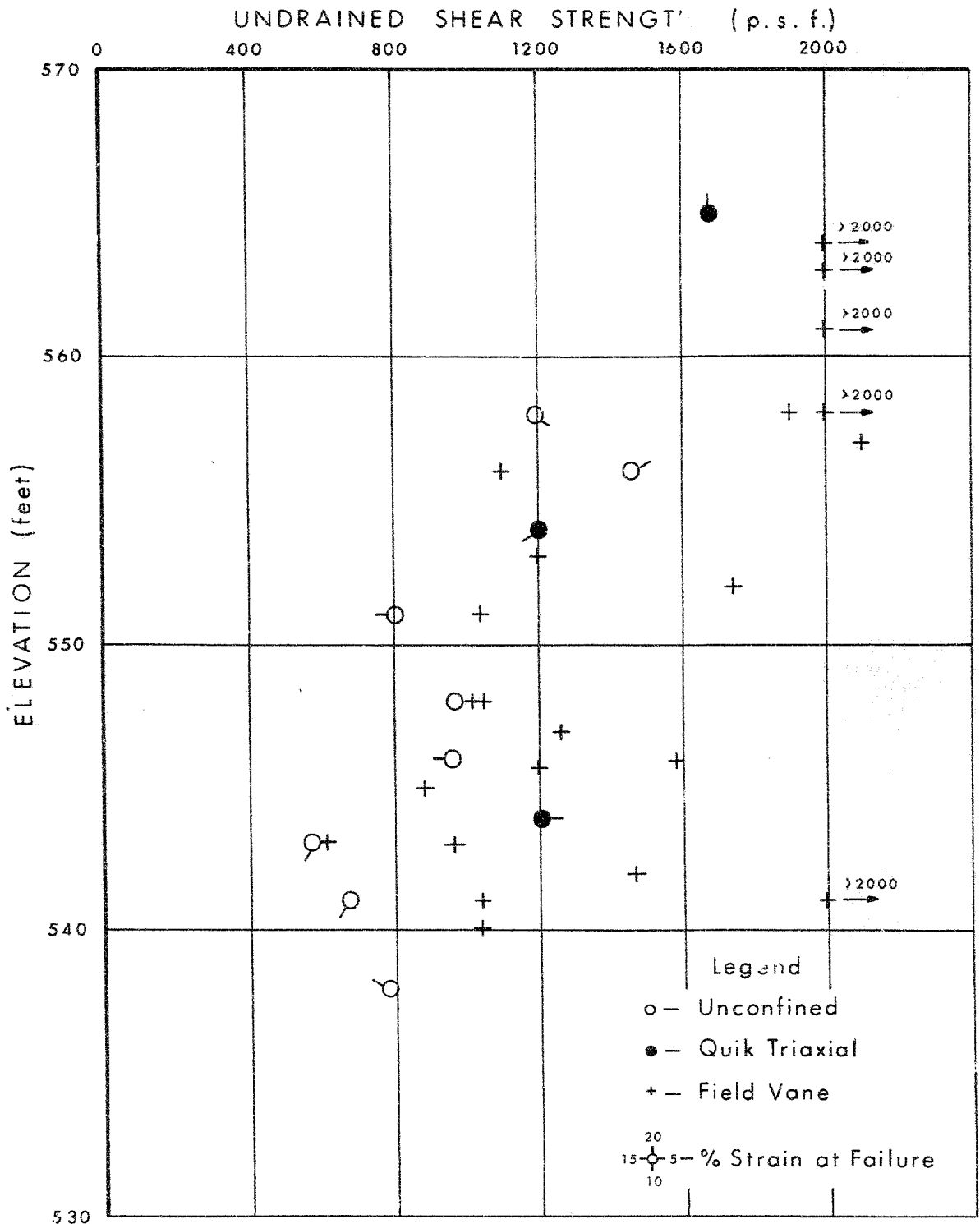
## RECORD OF BOREHOLE NO. 5

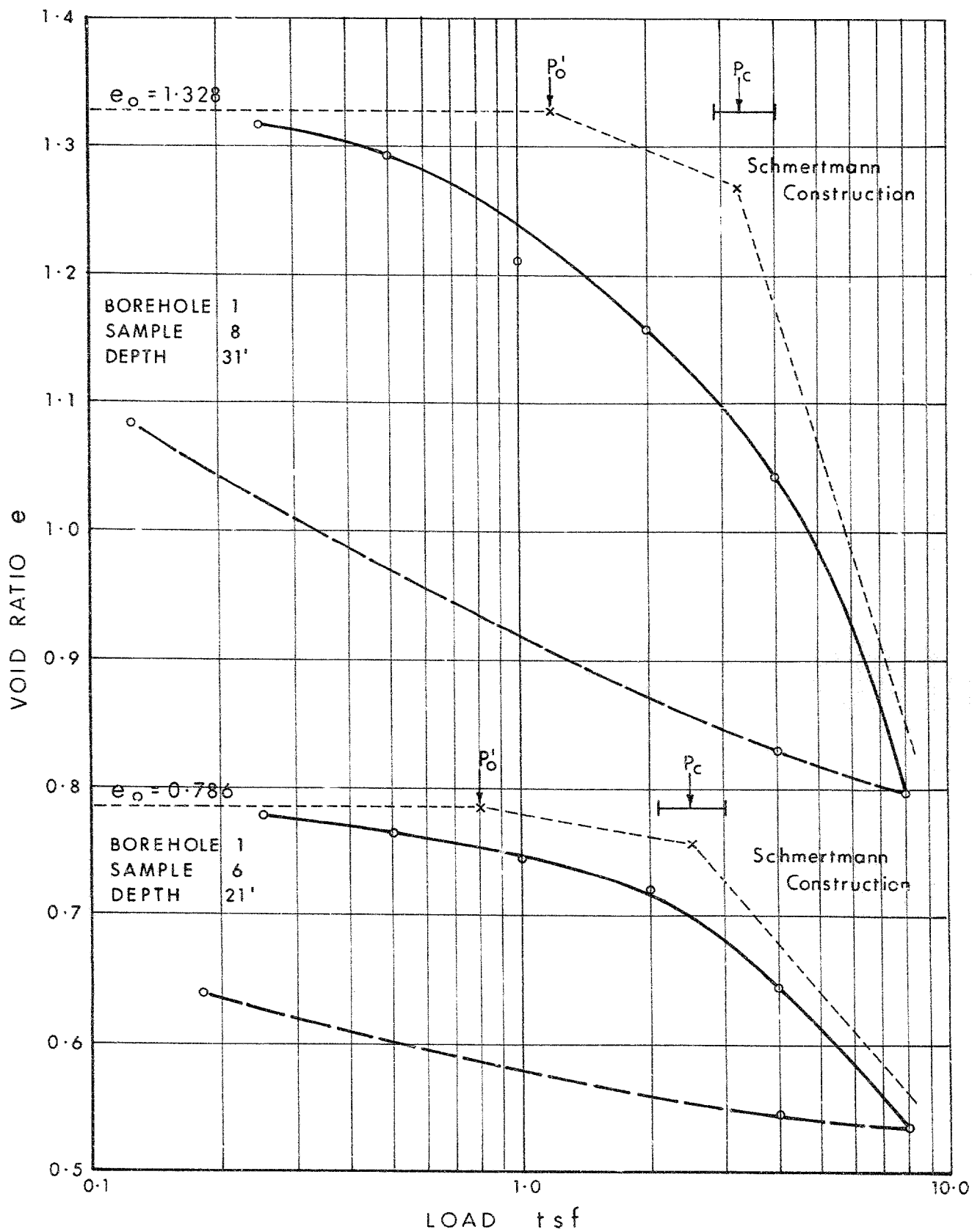
FOUNDATION SECTION

JOB 67-F-87 LOCATION Q.E.W. & Sodom Rd. Sta. 30 + 43 38' Lt. ORIGINATED BY VK  
W.P. 159-64 BORING DATE Oct. 3, 1967 COMPILED BY BTD  
DATUM Geodetic BOREHOLE TYPE Penn Drill, AXT Core CHECKED BY SL



# SHEAR STRENGTH vs DEPTH

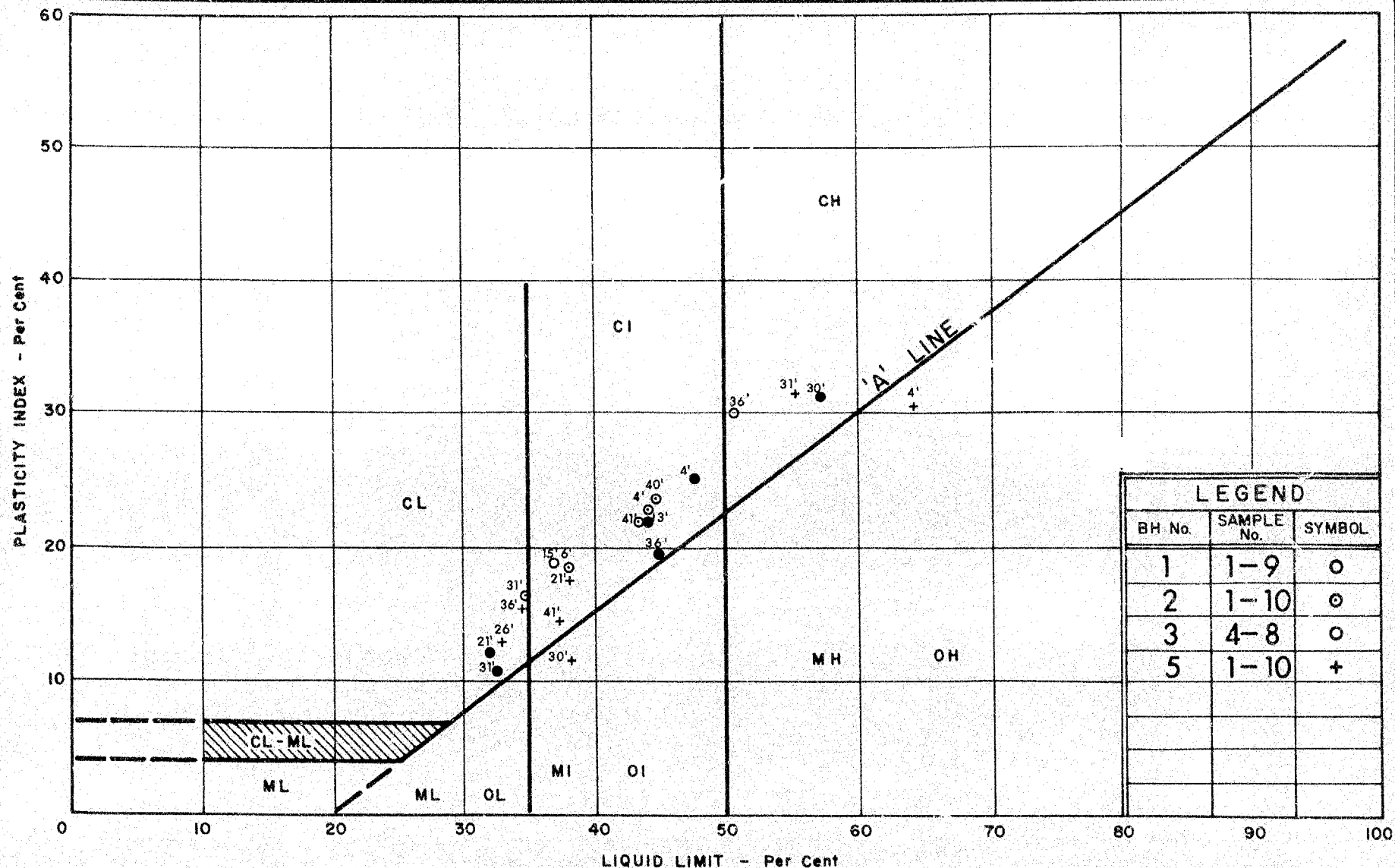




$P'_o$  - Effective Overburden Pressure

$P_c$  - Preconsolidation Pressure

67-F-87



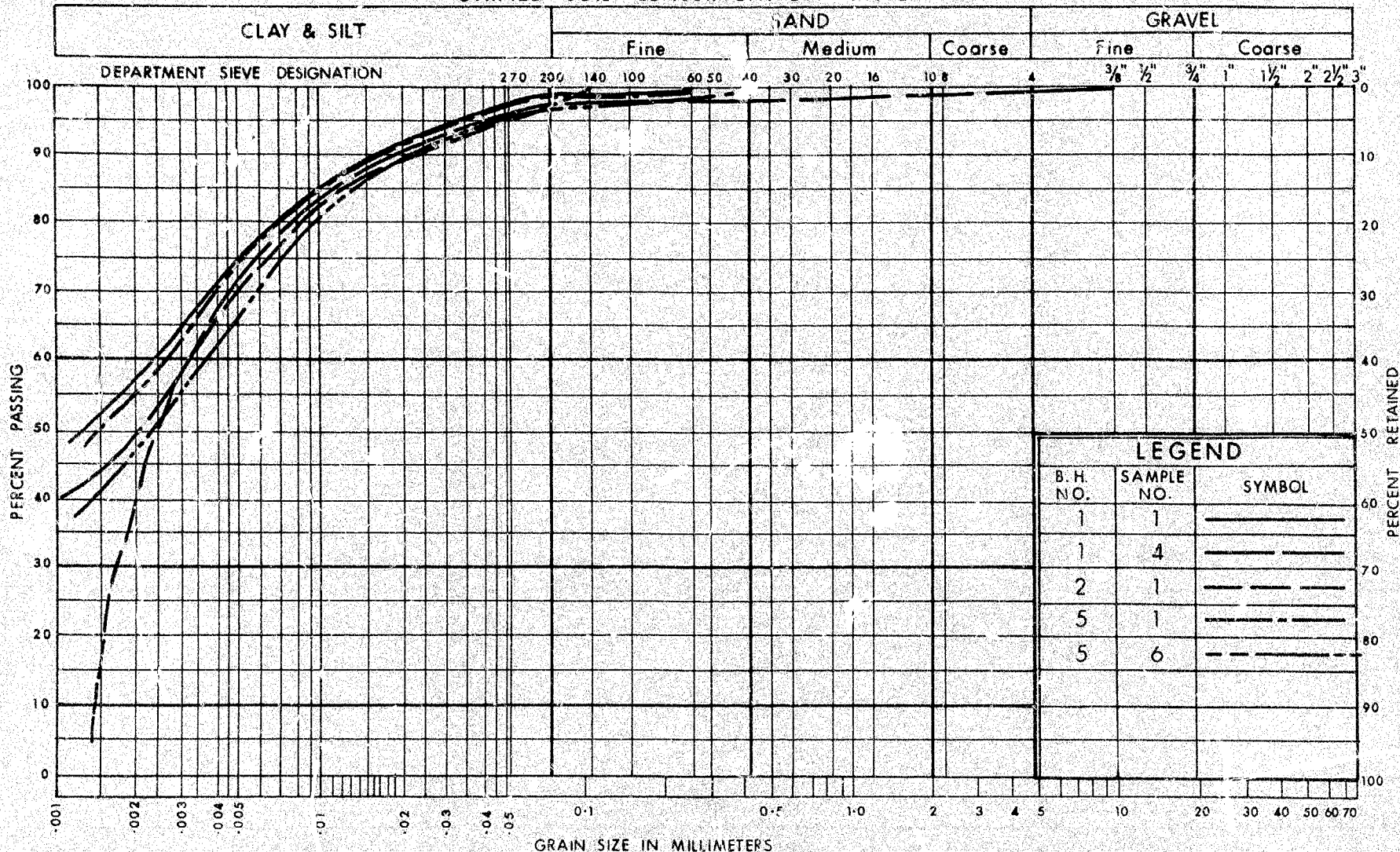
DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

# PLASTICITY CHART SILTY CLAY TO CLAYEY SILT

W.P. No.

JOB No. 67-F-87

# UNIFIED SOIL CLASSIFICATION SYSTEM



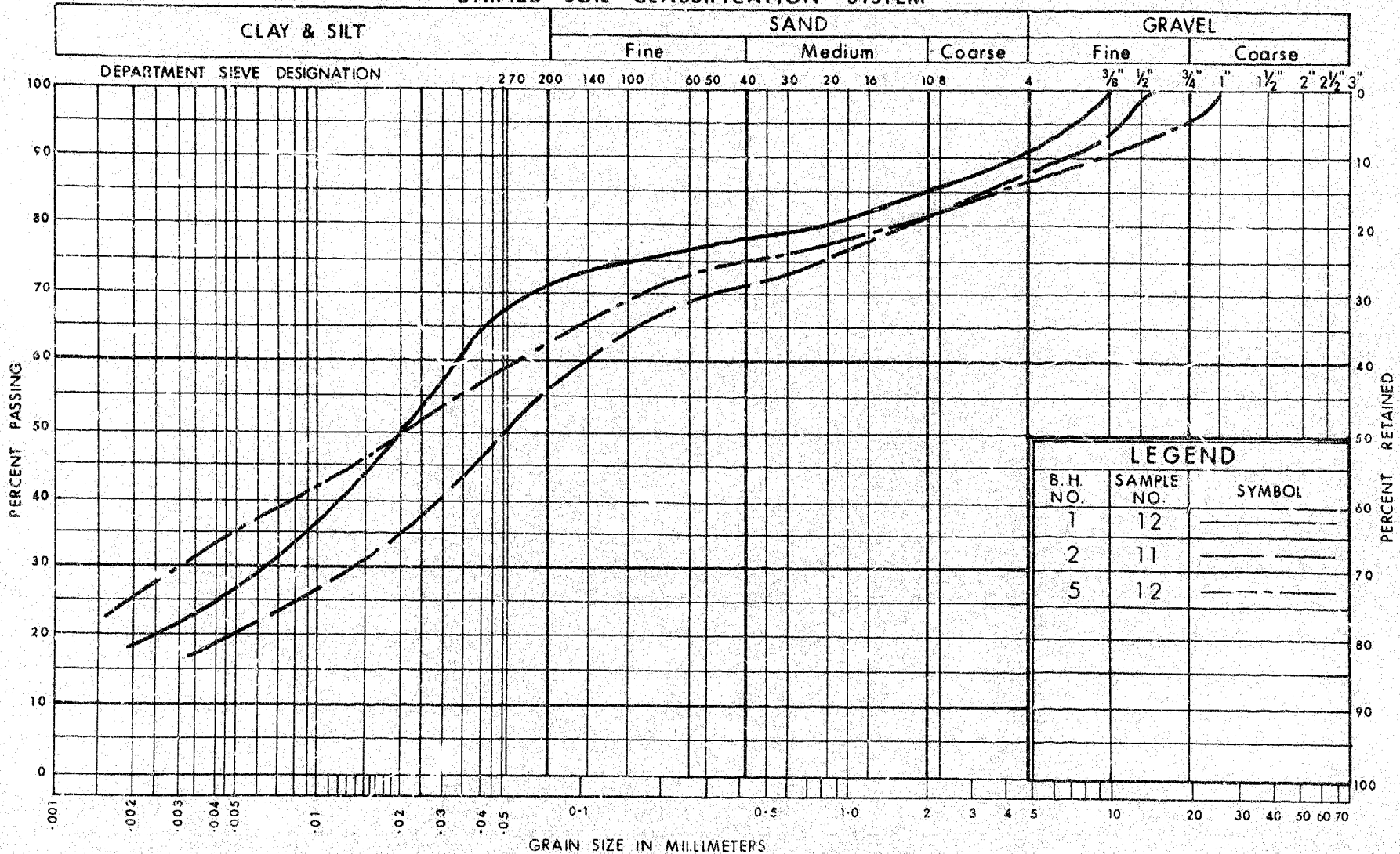
DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

GRAIN SIZE DISTRIBUTION  
SILTY CLAY

W.P. No.

JOB No. 67-F-87

# UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF HIGHWAY  
MATERIALS and  
TESTING  
DIVISION

GRAIN SIZE DISTRIBUTION  
TILL

W.P. No.

JOB No. 67-F-87

## ABBREVIATIONS USED IN THIS REPORT

### PENETRATION RESISTANCE

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

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

### DESCRIPTION OF SOIL

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

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

### TYPE OF SAMPLE

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

### SOIL TESTS

Q <sub>u</sub>	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Q <sub>cu</sub>	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Q <sub>d</sub>	DRAINED TRIAXIAL	S	SENSITIVITY

# ABBREVIATIONS USED IN THIS REPORT

## SOIL PROPERTIES

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

## GENERAL

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

## STRESS AND STRAIN

u	PORE PRESSURE
$\sigma$	NORMAL STRESS
$\bar{\sigma}$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

## EARTH PRESSURE

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

## FOUNDATIONS

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

## SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
$\beta$	ANGLE OF SLOPE TO HORIZONTAL

*File Rm 110*

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HAMN DOWN 1 SEPT 26/67 846A VR

D A WALLER MTCE ENGR

RE SODOM ROAD UNDERPASS WP15964 SITE 34-189 WJ67-F-87

FIELD WORK INVESTIGATION WILL COMMENCE ON SEPT 26/67 FOR THE ABOVE  
MENTIONED PROJECT. THIS IS FOR YOUR INFORMATION.

M DEVATA MAT AND TEST DIV

BB

401 & Keele Street  
Downsview, Ontario

September 26, 1967

Canadian Longyear Ltd.  
35 Brydon Drive  
Bexdale, Ontario

Dear Sirs:

This is to confirm our request of September 25, 1967 for the supply of a Diamond Drill together with all necessary equipment, as specified under the terms of our Contract Agreement, at Sodom Rd. & Q.E.W. near Niagara Falls, Ont., on September 26, 1967.

This project bears job number 67-P-87.

Yours truly,

MD:mt



M. Devata  
Supervising Foundation Engineer  
for: A. G. Stermac  
Principal Foundation Engineer

cc: H. Konings  
Foundation Files 110  
General File

Department of Highways Ontario

Copy for the information of

Mr. A. G. Stermac,  
Principal Foundation Engineer,  
Room 107,  
Lab. Bldg.

Mr. D. A. Barr,  
Advance Program Engineer,  
Program Section,  
Admin. Bldg.

Bridge Division,  
Downsview, Ontario.

January 10th. 1968.

Q.E.W. - Welland River to Port Erie,  
District #4.

The Foundation Section of the Materials and Testing Division has carried out subsoil investigations at the following structure locations:

W.P. 158-64-1	Lyons Creek Road Interchange
W.P. 442-65	Beck Road Underpass
W.P. 443-65	Bossert Road Underpass
67F-87 W.P. 159-64	Sodom Road Interchange
W.P. 445-65	Baker Road Underpass

The reports indicate that a substantial amount of consolidation settlement will occur due to the approach fills. In order to reduce the effect of this on the structures they recommend that consideration should be given to constructing the approach embankments well in advance of the construction of the bridges.

It should however, be borne in mind that these structures, except for Lyons Creek Road, are on existing road alignments and consequently some detouring arrangement would have to be provided during the consolidation period.

RE: Q.E.W. - Welland River to Fort Erie,  
District #4.

Investigations for the structures from Townline Road (W.P. 167-64-1) through to Gilmore Road (W.P. 448-65) have not yet been carried out. The need for pre-grading of the approaches is therefore not known at this time. However, settlement problems seem to diminish as we approach Fort Erie.

We would recommend that consideration be given to implementing the recommendations of the Foundation Section with regards to the calling of a grading contract approximately 12 months prior to the bridge construction.

JFW:ss

cc. G. K. Hunter  
A. G. Sternac  
E. Cross

*Joseph F. Walshe*  
J. F. Walshe,  
for W. S. Melinyshyn,  
Reg. Bridge Location Engineer.

*M. Devata*

Telephone: 246-3446

Mr. W. Wigle,  
Program Engineer,  
Administration Bldg.

E.J. McCabe,  
Toronto Regional Road Design.

March 13, 1968.

Re: Queen Elizabeth Way from  
Highway 405 to Fort Erie,  
District 4, Hamilton.

Your letter of February 12, 1968 requesting a program for placement of early fills as recommended by the Foundation Section has been passed on to me for comment.

This afternoon Mr. Devata, Foundations Section, Mr. Melnychyn, Bridge Planning Section, and the writer met to consider our needs for early fill placement. It was determined that early fill would be placed:

- 1) If required for bridge construction.
- 2) If required for grading purposes. A 6' settlement or more was used as a basis to determine the need for early fill placement for grading purposes.

The following is a summary of our conclusions:

- 1) Mountain Road Interchange - W.P. 154-64.  
Bridge Office to decide in one month whether early fill placement required for bridge purposes.
- 2) Thorold Stone Road - W.P. 155-64-03.  
No early fill placement required.
- 3) McLeod Road - W.P. 156-64.
- 4) Northbound West Service Road - W.P. 157-64-2.

Both bridges will be on piles. An 8½' settlement is predicted. We propose delaying the final paving of the fill areas from one to two years.

March 13, 1968.

Mr. W. Wigle - Re: Queen Elizabeth Way.

- 5) Lyons Creek - W.P. 158-64-01.
- 6) Beck Road - W.P. 442-65.
- 7) Dessert Road - W.P. 443-65.
- 8) Sodom Road - W.P. 159-64 67-F-87
- 9) Baker Road - W.P. 445-65.
- 10) Townline Road, Black Creek, Service Road - W.P. 167-64.
- 11) Ridgemount Road - W.P. 165-64.
- 12) Bowen Road
- 13) Sunset Drive - W.P. 447-65.
- 14) Gilmore Road - W.P. 448-65.

Considerable settlement can be anticipated for the above structure sites and approach thereto. We propose that early fill placement be considered two years in advance of the current construction program year.

- 15) West-North and South Ramp - W.P. 162-64-2.
- 16) Thompson Road - W.P. 162-64-1.
- 17) - W.P. 162-64-3.
- 18) C. P. Widening - W.P. 162-64-05.
- 19) Concession Road (Erie St.) - W.P. 161-64.
- 20) North Street Revision - W.P. 160-64.

No early fill placement required at these sites.

*E.J. McCabe*

E.J. McCabe  
Expressway Consultant Control Engineer  
For:  
G.K. Hunter  
Regional Road Design Engineer

EJM/GB

c.c. H. Devata  
W. Melinyshyn  
A.J. Fletcher  
E.A. Fletcher

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac

Kr. W. Melnychyn,  
Reg. Bridge Location Engineer,  
Central Region,  
Admin. Building

C.S. Grehski

April 1, 1969

Sedon Road Underpass  
8.3 Miles South of Hwy. 20  
W.F. 159-64-03, Site 34-189  
Q.E.W., District No. 4

67-F-87

Attached herewith are prints of the Preliminary Bridge  
Plan Drawing B-6408-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$480,000.  
This cost includes tender, materials, engineering and sundry  
construction.

Any comments or revisions you may have should be submitted  
within three weeks.

CSG:rd

C.S. Grehski,  
Bridge Design Engineer

Attach.

c.c. S. McCombie  
A. Stermac (2)  
J. Anderson

no comments  
AP 10/4/69

Department of Highways Ontario

Copy for the information of

Foundation Section

Mr. A. Stermac,  
Principal Foundation Engineer,  
Room 107, Lab. Building

C.S. Grebski,  
Bridge Office

September 4, 1969

Sodom Road Underpass  
8.3 Miles South of Hwy. 20  
W.P. 159-64-03, Site 34-189  
Q.E.W., District No. 4

67-F-87

Attached herewith we are submitting the final  
bridge drawings which show the foundation design for  
this structure.

Kindly give us your comments at your earliest  
convenience.

CSG:rd

C.S. Grebski,  
Bridge Design Engineer

Attach.

c.c. Foundation Section

no comments

M. Derata

Sept 9/69

Mr. E.J. McCabe,  
Sr. Project Planning Engineer,  
Functional Planning Office,  
Central Building.

G. McMillan,  
Toronto Regional Road Design.

December 1, 1969.

RE: W.P. 159-64, Q.E.W.-Sodom Road  
Interchange, District 4, Hamilton.

Further to your letter of November 27th, 1969 and your discussion November 28th with Mr. Friedmann, we wish to request Functional Planning to review our recommendation re: the treatment of the Sodom Road Interchange.

Plate 26 of the Functional Report shows a four lane section on Sodom Road South and as explained on Page 30 of the same report, this main North South Artery will warrant four lane construction in advance of 1980. This project is presently on the 1972 program and since construction will take approximately 2 years, it is obvious that the four lane section should be built at this time.

As you are aware, the Soils Investigation has indicated a serious settlement problem at this location and in fact an advance fill project has been set up to allow the major settlement to take place prior to full construction of the interchange. If only two lanes are constructed at this time, the widening of the section in the future will pose almost impossible construction problems due to the excessive settlement.

For the above reasons and since the present geometrics of the structure allow for four lanes we propose to construct four lanes between the two service road connections, tapering back to two lanes beyond these points.

We will be pleased to discuss this with you in greater detail at your convenience.

G. McMillan  
Consultant Projects Co-Ordinator  
For:  
W.C. Friedmann  
Expressway Construction Control Engineer

GM/mj:1  
c.c. E. Cross

*H. Greenland*  
*T. Kovich*  
*T. Sterman*

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac

Mr. W. Melnychyn,  
Reg. Bridge Planning Engineer,  
Central Region

C.S. Grebski,  
Bridge Office

April 10, 1970

W.P. 159-64-03, Site 34-189  
Sedon Rd. Underpass  
8.3 Miles South of Hwy. #20  
Q.E.W., District No. 4

67-F-87

Attached herewith are prints of the Preliminary Bridge Plan Drawing D-6793-P1 for the re-design of the above-mentioned structure.

The estimated cost of the proposed structure is \$380,000. This cost includes tender, materials, engineering and sundry construction.

Any comments or revisions you may have should be submitted within three weeks.

CSG:rd

C.S. Grebski,  
Bridge Design Engineer

Attach.

c.c. S. McCombie  
A. Stermac (2)  
J. Anderson

No comments.

M. Lwiza

April 24/70

April 24/70  
comments  
- Piles may require reinforced tips to reach bedrock?  
- capacity of 12BP74 steel H piles quoted as 95 tons/pile, maybe we should recommend 90 tons/pile B.D.

A Stermac

67-F-87

492

QEW/SODOM ROAD INTERCHANGE  
W.P. 159-64

MINUTES OF THE 7TH MEETING

BETWEEN: The Department of Highways, Ontario and  
Proctor & Redfern

HELD AT: The office of Proctor & Redfern  
75 Eglinton Avenue East, Toronto 315, Ontario

ON: Wednesday, September 16, 1970 at 9:00 a.m.

PRESENT: For the Department of Highways

Mr. G.K. Hunter  
Mr. W.C. Friedmann  
Mr. G. McMillan  
Mr. M.W. Robinson  
Mr. F. Walshe  
Mr. P.F. Weber  
Mr. R. Fitzgibbon

For Proctor & Redfern

Mr. G. Smith  
Mr. R. Baird

DETOURS FOR STRUCTURE

Mr. Walshe said that detours would be required around the centre portion of the structure to provide sufficient working area in order to place the piles and footings for the centre piers. One lane traffic was suggested but this was rejected due to the heavy volume of traffic during the tourist season. Mr. Friedmann recommended that a portion of the ramps and shoulders under the structure be constructed to the existing elevation of the Q.E.W. and be used to detour traffic during the placing of the footings. It was recommended that 60 m.p.h. curves be used on the detours.

Mr. Weber recommended the use of 2" of H.L. 6 for detours placed on the existing shoulders of the Q.E.W. Mr. Weber said that he would check to see how much granular would be required.

PROPERTY

Mr. Robinson said that he would send Proctor & Redfern 'P' plans showing the existing property limits on Church Road and Seifert Road which were not clearly defined on the property request drawing.

CONTOURS FOR INNER RAMPS

Contours vs. 4:1 slopes on the inner ramps was discussed. It was estimated at an early date that an extra 50,000 yards of earth would be required to contour the inner ramps as opposed to using 4:1 slopes. This would constitute an extra \$50,000.00. Mr. Friedmann & Mr. McMillan said they did not feel that the extra cost warranted contours.

COMPLETION DATE

Mr. Fitzgibbon said that the completion date for Proctor & Redfern is February 17, 1971.

Mr. Robinson said that the property should be available by May 1, 1971 provided there is no hearing. Mr. Robinson asked for a plan showing the pre-loading on the first Contract in order to concentrate on these properties.

SEEDING AND SODDING

Mr. McMillan requested marked-up drawings (40' = 1") showing areas to be seeded and sodded. It was agreed that sod would be placed on the bottom of ditches, on lawns and slopes 3:1 or steeper and seeding used on slopes 3:1 or flatter.

CULVERTS

Mr. Friedmann requested that headwalls be used on all concrete culverts. It was agreed that culverts less than 48" in diameter would be corrugated steel pipe. Culverts larger than 48" in diameter to be concrete.

RAMP ALIGNMENT

Mr. Friedmann requested that the E-N-S and W-N-S ramps be widened from 16' to 24' starting around Station 20+00. This is required to allow right turn traffic to proceed without excessive obstruction from traffic waiting to make a left turn at Sodom Road.

MINUTES OF THE 7TH MEETING  
OCTOBER 19, 1970

This will require the realignment of the right turn lane for the E-N-S and W-N-S ramps.

MINUTES PREPARED BY

Robert W. Baird  
Proctor & Redfern

cc: Mr. G.K. Hunter  
Mr. W.C. Friedmann  
Mr. G. McMillan  
Mr. M.W. Robinson  
Mr. F. Walshe  
Mr. P.F. Weber  
Mr. R. Fitzgibbon  
Mr. G.E. Smith  
Mr. R.W. Baird  
File

Project E.O. 67100

## MEMORANDUM

TO: Mr. A. Stermac,  
Principal Foundation Engineer,  
Room 107, Lab. Bldg.

FROM: C.S. Grebski,  
Bridge Office

ATTENTION:

DATE: November 20, 1970

OUR FILE REF.


IN REPLY TO

SUBJECT: Sodom Road Underpass  
W.P. 159-64-03, Site 34-189  
Q.E.W., District No. 4

67-F-87

Attached herewith we are submitting the final bridge drawings which show the foundation design for this structure.

Kindly give us your comments at your earliest convenience.

  
C.S. Grebski,  
Bridge Design Engineer

CSG:rd

Attach.

c.c. Foundation Office

No comment  
M. Devata  
Nov 26/70

~~files may require reference to~~

~~to road book~~

HN

Nov 26/70



50-15-35  
Proposed Sodus Road Underpass

W-J 67-F-87

Jan. 22/71  
W.P. 159-64

A Pier and Abutments - end-bearing  
steel-H piles to bedrock.  
(12 BP 74)

i.e. no differential settlement between structure elements.

B APPROACHES

FILL - 25' high  
Congol. Settlement predicted -  $6\frac{1}{2}"$  ~~IF~~  
~~Bob Thompson~~

Time Rate - 50% - 2 years.  
100% - 10 years.

← " →  
Bob Thompson - requested a recommendation  
regarding the length of time for staging  
(i.e. length of time between building the  
fills and constructing the structure)

Reply: since the abutments and piers are  
supported on end-bearing piles driven to  
~~firm~~ bedrock (no differential settlement)  
there is no need to adopt stage  
construction.

BTD

*G. Steiner*  
*File Photo M.P.*

67-F-87

MINUTES OF THE 10TH MEETING

BETWEEN: The Department of Highways, Ontario and  
Proctor & Redfern

HELD AT: The office of Proctor & Redfern  
7, Eglinton Avenue East,  
Toronto 315, Ontario

ON: Wednesday, February 17, 1971 at 9:00 A.M.

PRESENT: For the Department of Highways  
Mr. N.D. Smith  
Mr. R. Strain  
Mr. R.E. Thompson  
Mr. M. Devata  
Mr. M.W. Robinson  
Mr. G. Burkhardt  
Mr. P. Penev  
Mr. M. Lojkasek

For Proctor & Redfern  
Mr. G. Smith  
Mr. R. Baird

PRE-LOADING FILLS

During the previous meeting, the time element between the completion of the placement of the fills and the construction of the structure was discussed. It was determined that five months would be available and might be satisfactory, and that the two Contracts could be combined into one. As a result of later discussion, the consultants were instructed to combine the Contracts.

At this meeting, Mr. Devata expressed the opinion that it is always beneficial to construct the approach fills as early as possible. At this location it was estimated that consolidation settlements in the order of seven inches can be anticipated at the approaches. It is also estimated

MINUTES OF THE 10TH MEETING  
MARCH 18, 1971

that 50% of these settlements will take place in the first twelve to eighteen months. As a result of this and also to minimize post construction maintenance problems for Sodom Road, it was agreed that two separate Contracts should again be considered.

The program section agreed that this method of constructing the approaches in one Contract and the structure in another will not interfere with the overall scheduling nor any major revisions for any work in this area. In view of the additional benefits that can be derived by constructing the fills well in advance of the structure Contract, it was agreed that this should be done.

Mr. R. Thompson agreed that he can modify the scheduling without any major revisions, so that there will be a gap of at least twelve months between construction of the fills and the structure foundation.

PROPERTY

Mr. Robinson said that all the property will be acquired by the award date.

DRAINAGE

The proposed storm sewer and surface drainage was discussed. It was pointed out that the drainage within the loops could be carried by means of culverts. A small quantity of sewer will be required on Sodom Road to pickup roadway runoff. These sewers will empty into the surface drainage system. Mr. P. Penev requested that rip-rap be used at the ends of the sewer outlets with steep slopes.

UTILITIES

Mr. D. Smith said that he would contact the utility companies involved.

PAVEMENT TRANSITION - SODOM ROAD

Mr. P. Penev requested that the pavement removal at the north and south ends of Sodom Road be kept to a minimum. Mr. R. Baird asked Mr. P. Penev to supply a pavement transition treatment for the north and south ends of Sodom Road. Prints of the existing and proposed cross-sections for Sodom Road were supplied to Mr. P. Penev.

QEW/SODOM ROAD INTERCHANGE  
W.P. 159-64

ESTIMATES

Mr. R. Strain requested that Proctor & Redfern submit cost estimates for the two Contracts.

ILLUMINATION

Illumination of the interchange was discussed. No illumination will be required in the interchange area. Lights will be required on the bridge. These lights will be included in the Bridge Office Design. Mr. G. Burkhardt said that he would check into it.

MINUTES PREPARED BY

Robert W. Baird  
Proctor & Redfern

cc: Mr. G.K. Hunter  
Mr. W.C. Friedmann  
Mr. N.D. Smith  
Mr. R. Strain  
Mr. R.E. Thompson  
Mr. M. Devata  
Mr. M.W. Robinson  
Mr. G. Burkhardt  
Mr. P. Penev  
Mr. M. Lojkasek  
Mr. G. Smith  
Mr. R. Baird  
File

Project E.O. 67100

MINUTES OF THE 11TH MEETING

BETWEEN: The Department of Highways, Ontario and  
Proctor & Redfern

HELD AT: The office of Proctor & Redfern  
75 Eglinton Avenue East, Toronto 315, Ontario

ON: Wednesday, March 17, 1971 at 9:30 A.M.

PRESENT: For Department of Highways:

Mr. N.D. Smith	-	Road Design
Mr. R. Strain	-	Program Section
Mr. P. Penev	-	Materials and Testing
Mr. G. Burkhardt	-	Bridge Planning
Mr. F. Walshe	-	Bridge Office
Mr. M.W. Robinson	-	Property

For Proctor & Redfern:

Mr. G.E. Smith

MINUTES OF PREVIOUS MEETING

It was noted that minutes for the previous meeting had not been received. Mr. G.E. Smith will check and have copies sent out.

Contract Drawings

Mr. G.E. Smith noted that March 17th was the completion date for the first Contract. The work had been completed and the drawings had been sent out for printing, and would be back at lunch and the Contract Documents were being typed. The first Contract would be delivered to the Department on Thursday morning March 18th.

Typical Sections

Mr. Penev asked about the Typical Cross-section for pavement on Sodom Road. Mr. Smith noted that this had been added to the drawings.

MINUTES OF THE 11TH MEETING  
MARCH 18, 1971

Lights on Bridge

Mr. G.E. Smith noted that a letter had been received from the bridge office noting that two additional drawings had been added for lighting.

Guide Rail

Mr. G.E. Smith of Proctor & Redfern to check on requirements for Guide Rail.

Cost Estimates

Cost estimates for both Contracts to be sent to Program Section.

First Contract

The first Contract is to be advertized on May 19th, 1971 and awarded on June 23, 1971.

Critical Path Staging

- Stage 1. Service Roads and Detours complete by August 19, 1971
- Stage 2. Approach Fills complete by September 29, 1971
- Stage 3. Contract to be completed by December 10, 1971

Illumination

Mr. N.D. Smith to check on the illumination requirements at the Sodom Road Intersection.

District Review

The District Review is to be held as soon as possible.

Second Contract

The second Contract is to be completed by Proctor & Redfern by April 14, 1971.

Property and Utilities

Mr. N.D. Smith is to follow up on the status of property and utilities.

Gordon E. Smith  
Proctor & Redfern

GES/lb

Distribution

Mr. G.K. Hunter	(1)
Mr. W.C. Friedmann	(1)
Mr. N.D. Smith	(1)
Mr. M.W. Robinson	(1)
Mr. P. Penev	(1)
Mr. F. Walshe	(1)
Mr. R. Strain	(1)
Mr. G.E. Smith	(1)
Mr. R. Baird	(1)
File	(1)

Project E.O. 67100

MINUTES OF THE 9TH MEETING

BETWEEN: The Department of Highways, Ontario and  
Proctor & Redfern

HELD AT: The office of Proctor & Redfern  
75 Eglinton Avenue East, Toronto 315, Ontario

ON: Thursday, January 21, 1971 at 9:00 A.M.

PRESENT: For Department of Highways:

Mr. G.K. Hunter	-	Road Design
Mr. W.C. Friedman	-	" "
Mr. N.D. Smith	-	" "
Mr. R. Strain	-	Program Section
Mr. P. Penev	-	Materials and Testing
Mr. G. Burkhardt	-	Project Planning

For Proctor & Redfern:

Mr. G.E. Smith

MINUTES

The Minutes of Meeting No. 8 were read and discussed and the following items were discussed at this meeting:

Drawings

The preliminary drawings were reviewed and the system of cross-referencing was discussed.

Award Date

There was a brief discussion on award dates. The second Contract is to be awarded in April, 1972.

Drawing

Mr. Friedmann suggested that Gunthor would visit our office next week and review the drawings and discuss what is required.

Settlement of Fills

It was agreed that the foundation section should be contacted regarding the settlement of the fills on the approaches to the structure. As the time required for the settlement of the fills to take place will decide the date for the award of the second Contract.

Fill Material

The question was asked where the borrow for the fills was to be obtained. No one knew where it would be acquired. It was agreed that it probably would not be close to the work site due to the high water table in the area. The Program Section indicated that the location of borrow would influence the price and the time required for construction.

Property

It was indicated that the property acquisition was in good shape all would be cleared except three by March 24, 1971.

Traffic Lights

It was agreed that traffic lights would be installed where the detour for Sodom Road crosses the Q.E.W. It was also agreed that advance warning lights should be installed in conjunction with these traffic lights.

Gordon E. Smith  
Proctor & Redfern

GES/lb

Distribution

Mr. G.K. Hunter	(1)	Mr. P. Penev	(1)
Mr. W.C. Friedmann	(1)	Mr. R. Strain	(1)
Mr. N.D. Smith	(1)	Mr. G.E. Smith	(1)
Mr. M.W. Robinson	(1)	Mr. R. Baird	(1)
Mr. F. Walshe	(1)	File	(1)

Project E.O. 67100

MEMORANDUM

W.P. 159-64-1

Re: 20th, Sodom,  
Rd. Ont. N. District

Telephone: 248-3446

To be discussed on  
basis of two separate  
contracts.

To: Mr. W.G. Wigle,  
Program Engineer,  
Administration Bldg.

FROM: W.C. Friedmann,  
Toronto Regional Road Design.

ATTENTION:

DATE: February 23, 1971.

OUR FILE REF.

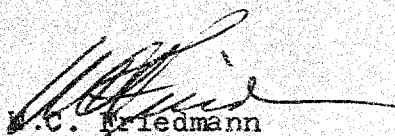
IN REPLY TO

SUBJECT: Re: W.P. 159-64-1, Queen Elizabeth Way,  
Sodom Road Interchange,  
District 4, Hamilton. W.J. 67-F-87

Further to our telephone conversation concerning the above detailed project, we are presently designing this work on the basis of two separate contracts.

This was discussed in considerable detail at the monthly progress review meeting on February 17, 1971, with representatives present from the Foundations, Soils, Scheduling, Property, and Construction Applications offices. It was agreed that two separate contracts would provide the most satisfactory construction from the point of view of soil conditions and that this would minimize the settlement problems inherent in the 7" of anticipated settlement. It was also determined that there are no problems expected as far as property clearances are concerned and that the construction staging could be satisfactorily worked out.

Since the consultants had been working on this project on the basis of two contracts and since this is the best way of minimizing any settlements, it was agreed that this should be done and the consultants were instructed to proceed accordingly.

  
W.C. Friedmann

Expressway Consultant Control Engineer

For:

G.K. Hunter

Regional Road Design Engineer

WCF/GB

c.c. A. Rutka  
T. Kovich  
A. Stermac  
M.W. Robinson  
D.W. Farren

OK  
1

Mr. D. A. Barr, ✓  
Scheduling & Systems Engineer,  
Program Office.

W.O. 67-F-87  
R. E. Thompson,  
Systems Application Engineer,  
Program Office.

January 27, 1971.

W.F.'s 159-64-01, 02, 03  
Sodom Rd. Interchange.  
W.O. 67-F-87.

At a recent progress meeting on the above Work Projects, the question was raised as to how long the advance fill should sit before construction of the structure. Research into the matter has shown that there is no necessity to break the construction of this interchange into two contracts. The Bridge plans show that the structure is to be supported on end-bearing piles and the Foundation Investigation Report says of the approach embankment for the Sodom Road Underpass, "No stability problems are anticipated for embankments constructed of properly compacted fill and with standard 2:1 slopes". Mr. B. Darch of the Foundations Section said that as far as his Section was concerned, he could see no reason for having two contracts.

On the strength of this information, and because placement of early embankment fills was the primary reason for splitting W.F. 159-64, it is recommended that the above work projects be combined and awarded under one contract.

R. E. Thompson

R. E. Thompson,  
Systems Application  
Engineer.  
For  
E. J. McCaffigan,  
Systems Design &  
Application Engineer.

EJM/RET:me

c.c. A. G. Stermac ✓  
W. Friedmann

OK  
BTD.

ONTARIO

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MINISTER: HONOURABLE CHARLES MacNAUGHTON

DEPUTY MINISTER: A. T. C. McNAB

Box 279, Burlington  
September 20, 1971

MEMORANDUM TO:

C. R. Robertson  
District Engineer  
District #1-Hamilton

67-F-87

Subject:- W.P. 159-64-02, 03 - Highway Q.E.W.  
Grading, Drainage, Granular Base, Hot Mix Paving and Structures  
Soder Road Interchange Including Bowen Road Patrol Yard

Attending:

R. Vokes	Systems Design, Downsview
N. D. Smith	Systems Design, Downsview
P. Kinnear	Systems Design, Downsview
R. Minaker	Reg. Engineering Audit
✓ P. Penev ✓	Reg. M & T, Downsview
G.C.E. Burkhardt	Reg. Br. Planning
N. Zoltay	Reg. Br. Design
K. G. Carter	Reg. Br. Design
G. E. Smith	Proctor & Redfern
R. W. Baird	Proctor & Redfern
D. Waller	District Construction Engineer
J. Regan	District Construction Supervisor
E. Smith	District Project Supervisor
L. Fisher	District Engineering Office Supervisor
H. Lyons	District Services Supervisor
M. Devata	Supervising Foundation Engineer



This contract is for second of two contracts. Contract one is presently under construction.

- Sheet 1 - Note "and including Bowen road patrol yard" to be on cover sheet. G. Smith  
- Indicate location of patrol yard on key plan.  
- Possibly change Department of Highways to Department of Transportation and Communications.
- 11 - Show culvert as remove and salvage. G. Smith
- 15 - Place note to grade out, topsoil  
11 in area of detour removal - assure  
16 that quantities are allowed.
- 20 - Approach slabs 14" H.L.1 - 1 3/4" H.L.5.  
- Delete wor "padding".

al

- 2-
- Sheet 22 - Change shoulder paving to H.L.3. ✓
- 24 - Note "extend existing pipe" - (all sheets).
- 27 - Show dimensions and depths of rip-rap.
- 31 - Delete note "temporary easement".
- 32 - Show arrow inside creek.
- 35 - Include sheet numbered 35A to show zone painting - R. Vokes to supply limits to G. Smith. R. Vokes  
G. Smith
- 49 - Const. in field to erect delineators around centre piers.
- 51 - Islands - H.L.3 1½ not H.L.5. ✓ G. Smith
- 52 - Shoulder paving H.L.3
- 53 - Shoulder paving H.L.3  
- Correct arrows to shoulders.  
- J. Regan questioned allowance (15%) for fill shrinkage - experience indicates that for this area the allowance may be too high. }

Stds. - No comments.

Sheet 97 - Delete this sheet.

- 98 - Bowen Road patrol yard - Designed by D.T.C.  
- Set of drawings to be left with District for maintenance review - comments to be forwarded to W. Roters, Systems Design, Central Region as soon as possible. H. Potts  
- Renumber pipe numbers to eliminate confusion with Q.E.W. breakdown sheets.  
- Show location of pumps. *Design advised Sept 12/71*  
- Maintenance to check re need to refence. *design advised Sept 21/71* } *file*  
- Denote existing detail on typical section.  
- Elevation between garage floor and paved area to be reduced 1".  
- Change H.L. 6 to H.L. 5 ✓  
- Combine standards.

### Bridge Drawings

- D-6793-1 - Bridge Office to check re transverse stressing requirements. G. Burkhardt  
- Show existing ground line as per 1st contract (71-70) and any excavation necessary to drive piles and place footings and backfill. Include quantities on D4. G. Burkhardt  
- Include item in grading for guide rail shown to protect falsework - use guide rail on barrels SD947.  
- Falsework clearance - delete word median.
- D-6793-10 - Bridge Office to assure that skewed reinforcing is acceptable.  
- Remove pile driving std. as piles are to be driven to bedrock.

Dh

- Item 5 - delete S.P.  
include 421-F

G. Smith

Include item 9A - H.L.3

- Item 6 - adjust quantity as per earlier minutes.
- Item 10 - adjust quantity as Sodom Road concrete pavement to be removed under existing concrete.
- Item 20-21 - give alternate for precast units.
- Item 28 - District to supply guide rail - contr. to supply all other components. Write S.P.

G. Smith

Addition 30A to be nursery sod  
Item 30 to be field sod

- Item 32 - delete "imported" topsoil  
call topsoil  
adjust borrow quantities and breakdown sheets

- Item 33A - include item for seeding and mulching.

G. Smith

- Item 40 - change to "H.L. 5"

- Item 39 - change to "H.L. 3"

- Item 41 - delete word supply and application

- Item 43 - delete supply and erection

- Item 44 - delete supply and erection

- Item 45 - delete supply and erection

- Item 46 - designate as field sod

- Item 48 - delete "placing"

Sodom Road Underpass - show W.P. number

- Item 49:- check excavation quantity  
seems far too high (1,530 c.y.)  
should be 306 yards

G. Burkhardt

- addition for embedded work for lighting.

G. Burkhardt

- Item 64 - delete 1010

Materials

- check re supply of embedded electrical items.
- include supply of guide rail.

G. Burkhardt

G. Smith

Sundry

- include clearing as a tender item not sundry.
- seed and mulch to be tender item.

Special Provisions - delete S.P. 3402  
delete S.P. 3710  
include S.P. 6210

Breakdown Sheets:- make changes re borrow and topsoil, also asphalt types  
as per previous minutes.

Miscellaneous

- (1) Design to check re advance warning signals to be interconnected to traffic signals.
- (2) Property all available.
- (3) Speed zone approval received.
- (4) No borrow within R/W
- (5) Damage may occur to adjacent municipal roads.
- (6) Forward 15 sets of book plans to district.
- (7) Forward 6 sets of tender items & S.P. to district.
- (8) District to take X-sections for payment.
- (9) Working days - July 18, 1973 - fixed completion date.
- (10) No utility problems expected.
- (11) Include Bell ducts as recoverable item.
- (12) Attn: H. Potts - structures designed with voids.



L. D. Fisher  
Engineering Office Supervisor

C.C. H. Potts  
R. Reid  
F. G. Allen - Director, Construction  
D. Barr - Schedule Engineer  
B. Giroux 1 - Estimating Office  
D. Farren - Road Design, Head Office  
B. Wear - Road Design, Head Office

## MEMORANDUM Tel. 248-3446.

To: Mr. C.R. Robertson,  
District Engineer,  
District 4, Hamilton.

From: G.G. Pearce,  
Regional Systems Design,  
Downsview, Ontario.

ATTENTION:

DATE: July 16, 1971.

OUR FILE REF.

IN REPLY TO

SUBJECT:

RE: W.P. 159-64-02, Q.E.W.-  
Sodom Rd. Interchange,  
District 4, Hamilton.

Please be advised that the date for the review of Sodom Road has been changed to Monday, ~~August 9th~~, 1971. Time and location remain the same.

Thursday Sept 16th



G. G. Pearce,  
Assistant Projects Co-Ordinator,  
For: W.C. Friedmann,  
Expressway Consultant Control Engr.

GP/bk

c.c. R. Minaker  
T. Kovich  
A.G. Stermac ✓  
G.C.E. Burkhardt  
B. McGaffigan  
G. Smith (Proctor & Redfern Ltd.)

HURRY!

PLEASE NOTE SO YOU CAN

ATTEND.

JULY 19, 1971.

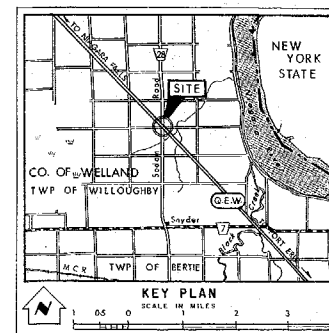
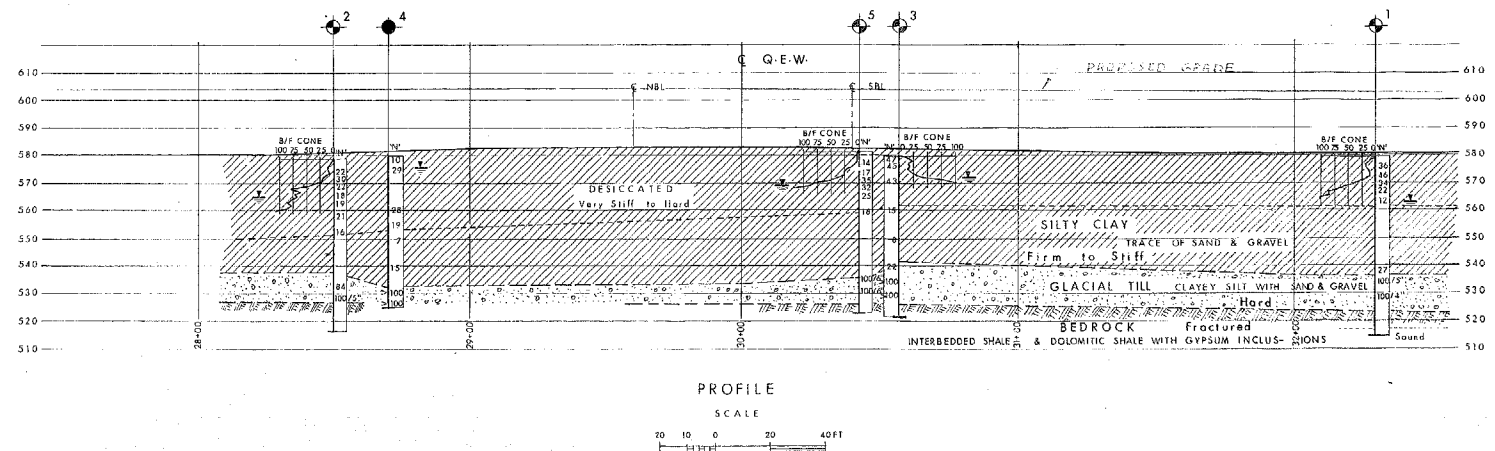
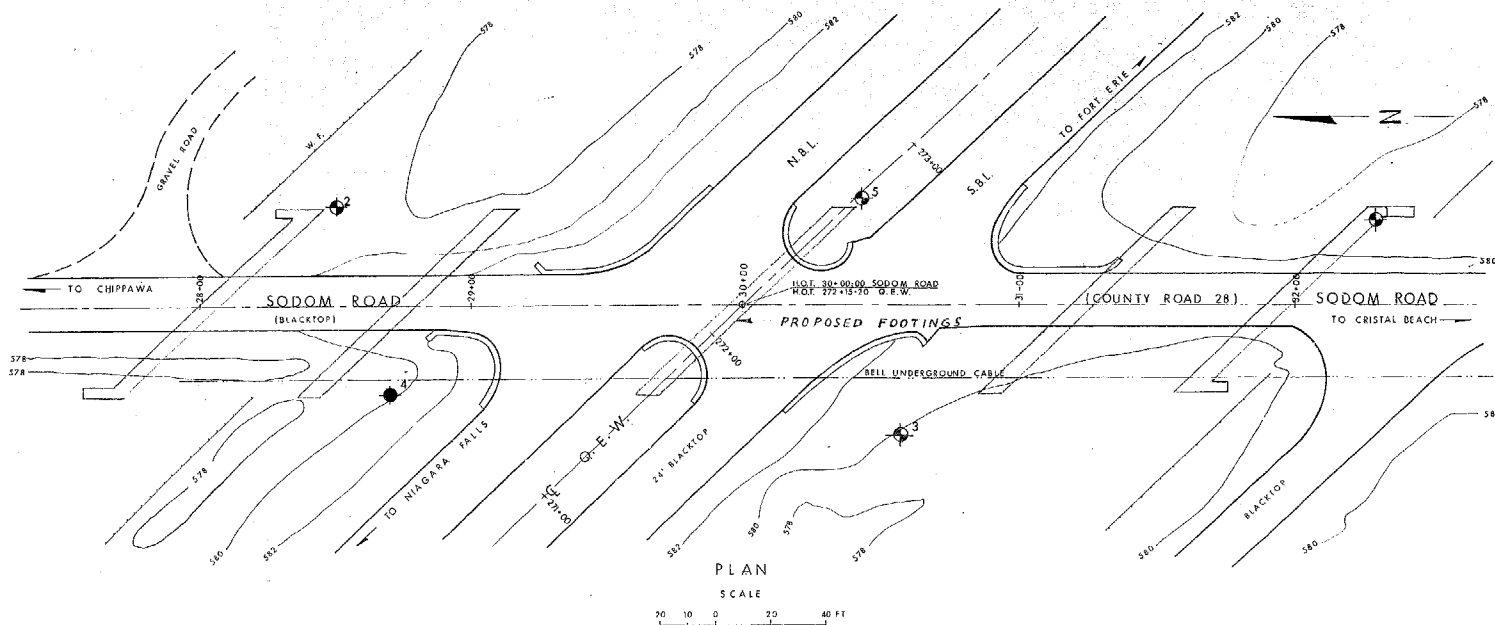
TONY

16<sup>th</sup> Sept/71.

Notes to file re Sodom Rd structure

Mr A. G. Stermac advised Mr Burkhardt that pre drilling will be only way to ~~for~~ remove the obstacle of concrete payment some 16 ft below ground. This will cost approximately \$ 2000 as per Western Contractors.

M. Devata



LEGEND			
●	Bore Hole		
⊙	Cone Penetration Hole		
⊗	Bore & Cone Penetration Hole		
~	Water Levels established at time of field investigation, SEPT. 1966		

NO.	ELEVATION	STATION	OFFSET
1.	579.0	32 + 30	30.5' LT
2.	578.4	28 + 50	36.0' LT
3.	579.8	30 + 57	47.0' RT
4.	579.6	28 + 70	32.0' RT
5.	581.3	30 + 43	38.0' LT

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

DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION - FOUNDATION SECTION

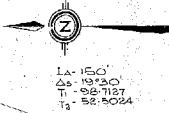
**SODOM ROAD**

KING'S HIGHWAY NO. Q.E.W. DIST. NO. 4  
CO. WELAND & NIAGARA  
TWP. WILLOUGHBY & BERTIE LOT 5 & 4 CON. II & III

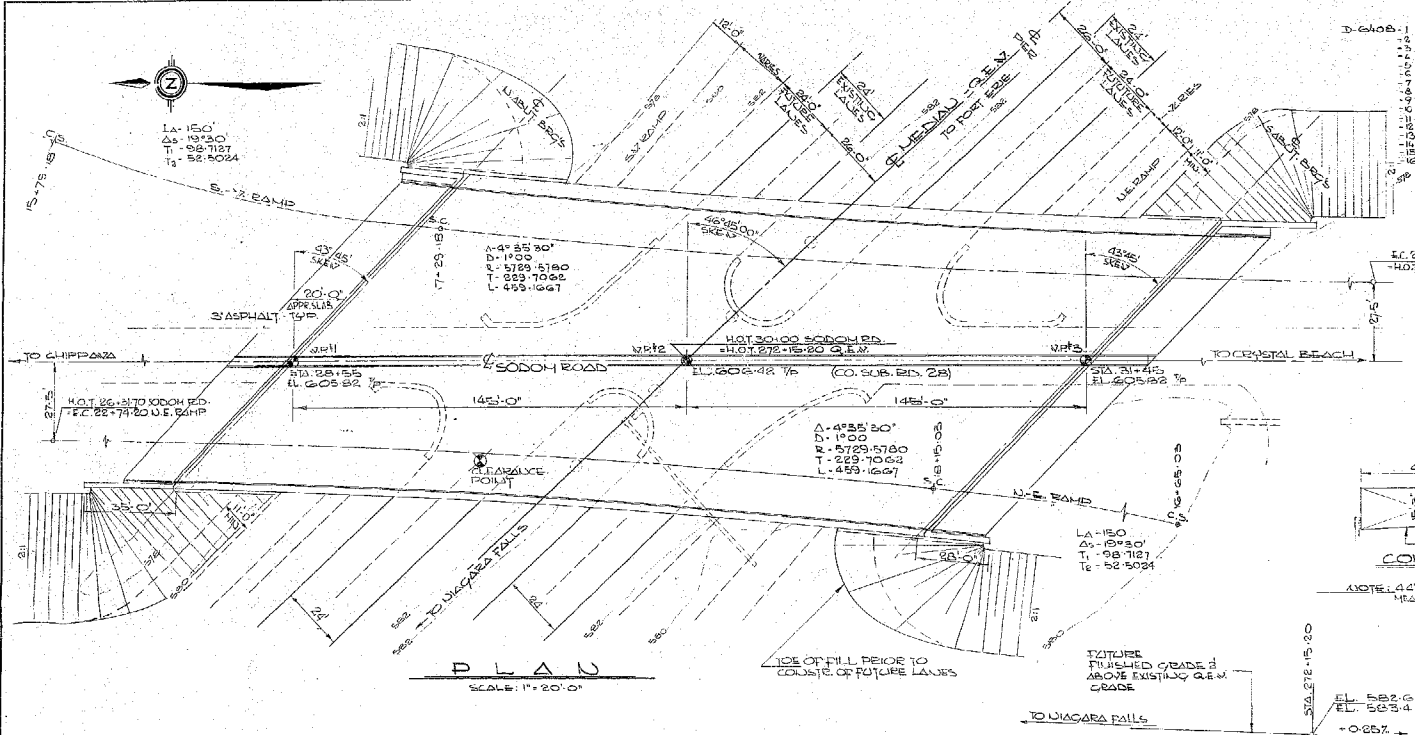
**BORE HOLE LOCATIONS & SOIL STRATA**

SUBV'D V.K.	CHECKED	W.P. NO. 159 - 64	N.B.T. DRAWING NO.
DRAWN A.B.	CHECKED	JOB NO. 57-F-87	67-F-87 A
DATE NOV. 23, 1967	SITE NO.	BRIDGE DRAWING NO.	
APPROVED	CONT. NO.		

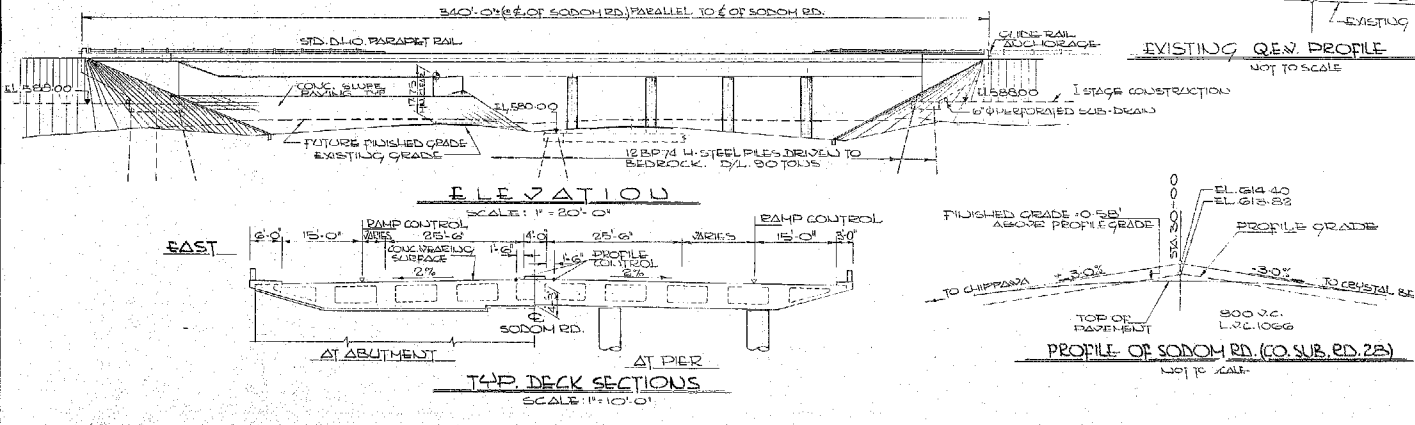
REF. NO. E 4791-1



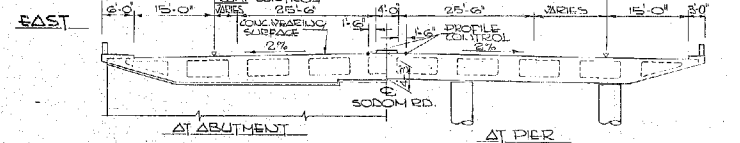
LA-150  
25-13-20  
T-98-7127  
L-52-5024



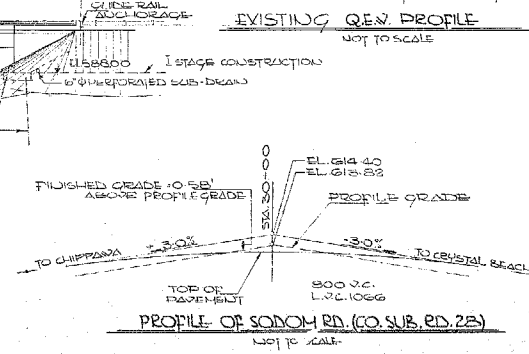
PLAN  
SCALE: 1" = 20'-0"



ELEVATION  
SCALE: 1" = 20'-0"



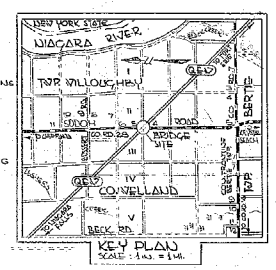
TYP. DECK SECTIONS  
SCALE: 1" = 10'-0"



PROFILE OF SODOM RD. (CO. SUB. RD. 28)  
NOT TO SCALE

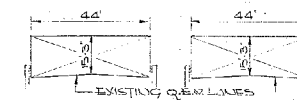
LIST OF DRAWINGS

- D-6408-1 GENERAL PLAN
- 2 BORE HOLE LOGS
- 3 FLOORING LAYOUT
- 4 BIER DETAILS
- 5 VANGUARD'S & EAST FOOTINGS
- 6 ABUTMENTS
- 7 DECK LAYOUT & DETAILS
- 8 DECK DETAILS
- 9 CABLE LAYOUT & DETAILS
- 10 DRAIN REINFORCEMENT
- 11 PIER WALL DETAILS
- 12 STD. STEEL PARAPET RAIL
- 13 APPROACH SLABS
- 14 STANDARD SETTING
- 15 DETAILS OF CONIC SLOPE PAVING



KEY PLAN  
SCALE: 1" = 1 M.

SKEW 46°45'		43°45'	
SWL = 0.755370	0.691531	SWL = 0.755370	0.691531
CSL = 0.000000	0.000000	CSL = 0.000000	0.000000
SL = 1.000000	0.000000	SL = 1.000000	0.000000
SLC = 1.459464	1.384343	SLC = 1.459464	1.384343



EXISTING G.E.N. LINES  
CONSTRUCTION CLEARANCE  
NOT TO SCALE

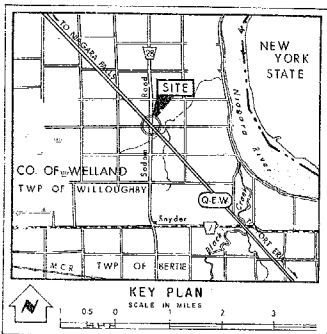
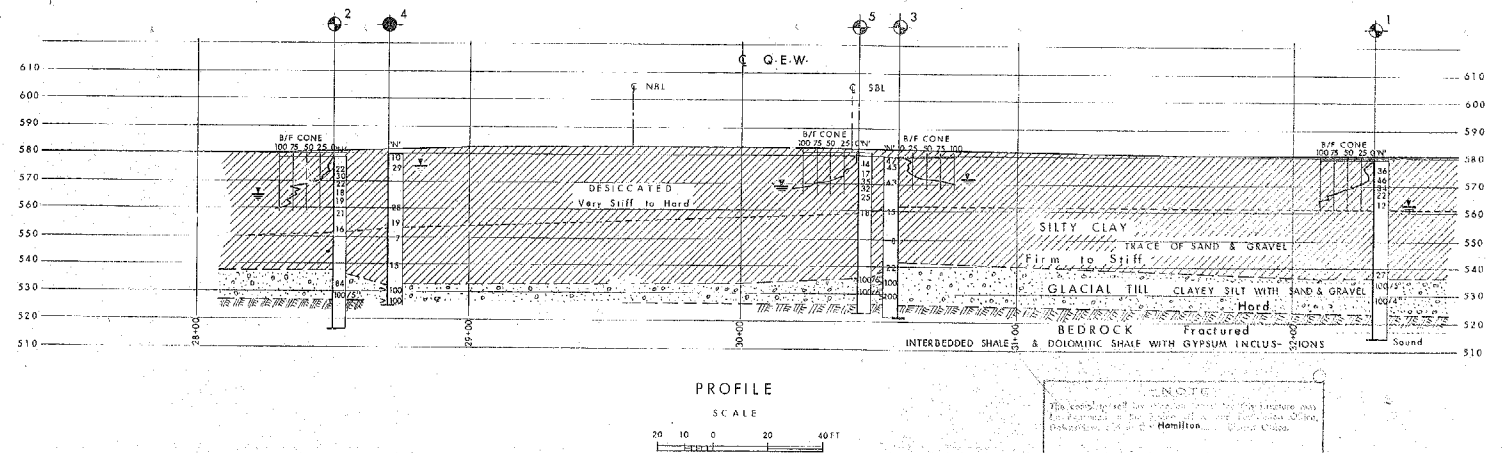
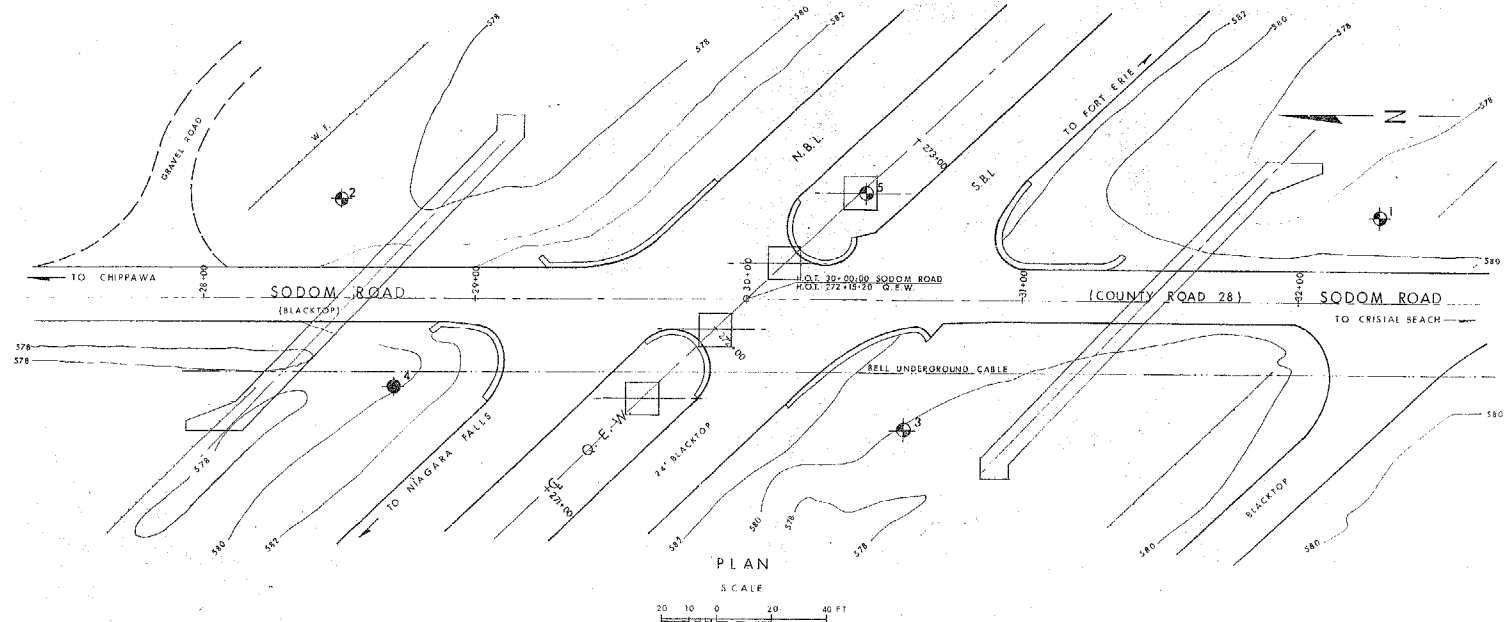
GENERAL NOTES  
CLASS OF CONCRETE  
CURBS CONC. ABOVE CURBS 4000 PSI  
PIER COLUMNS 4000 PSI  
DECK 5000 PSI  
CHAMBER 3000 PSI  
CLEAR COVER ON BRIDGE STEEL  
FOOTINGS - ABUTTS - COLUMNS - DECK  
CURBS - APPROX. 3" 3" 7" TOP  
PIERS - WALLS - EDDPOSTS  
1/2"





- CONSTRUCTION NOTES
- CONTRACTOR'S RESPONSIBILITY FOR FINISHING THE BRIDGE SEATS TO THE SPECIFIED ELEV. WITH A TOLERANCE OF ± 1/4"
- NO CONCRETE SHALL BE PLACED ABOVE THE BRIDGE SEATS UNTIL CONCRETE IN DECK HAS BEEN PLACED.
- BRIDGE DESIGNED FOR 3" ASPHALT

B.M. ELEV. 578.54  
GEOTIC DATUM  
4.0 IN. W. ROOT OF 0.6 ASH  
198' O.L. OF STA. 289+54

REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO	
ROAD DIVISION	
67-4-87	
SODOM ROAD UNDERPASS	
B'S HILLS SOUTH OF HWY. 20	
KING'S HIGHWAY No. 20 E.W.	DIST. No. 4
CO. WELLSLAND	CON. 8 x 3
TWP. WILLOUGHBY	LOT 4 & 5
GENERAL PLAN	
APPROVED	DESIGNED
BRIDGE	CONTRACT
DATE JULY 27	LOADING 1500-44
D-6408-1	



LEGEND			
	Bare Hole		
	Cone Penetration Hole		
	Bare & Cone Penetration Hole		
	Water Levels established at time of field investigation, SEPT., 1966		
NO.	ELEVATION	STATION	OFFSET
1	579.0	32 + 30	30.5' LT
2	578.4	24 + 00	36.0' LT
3	579.8	30 + 57	47.0' RT
4	579.6	28 + 00	32.0' RT
5	561.3	30 + 43	38.0' LT

- NOTE -

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

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION - FOUNDATION SECTION

SODOM ROAD  
3.2 MILES SOUTH OF HWY #20  
KING'S HIGHWAY NO. Q.E.W. DIST. NO. 4  
CO. WELLAND  
TWP. WILLOUGHBY LOT 5 & 6 CON. II & III

BORE HOLE LOCATIONS & SOIL STRATA

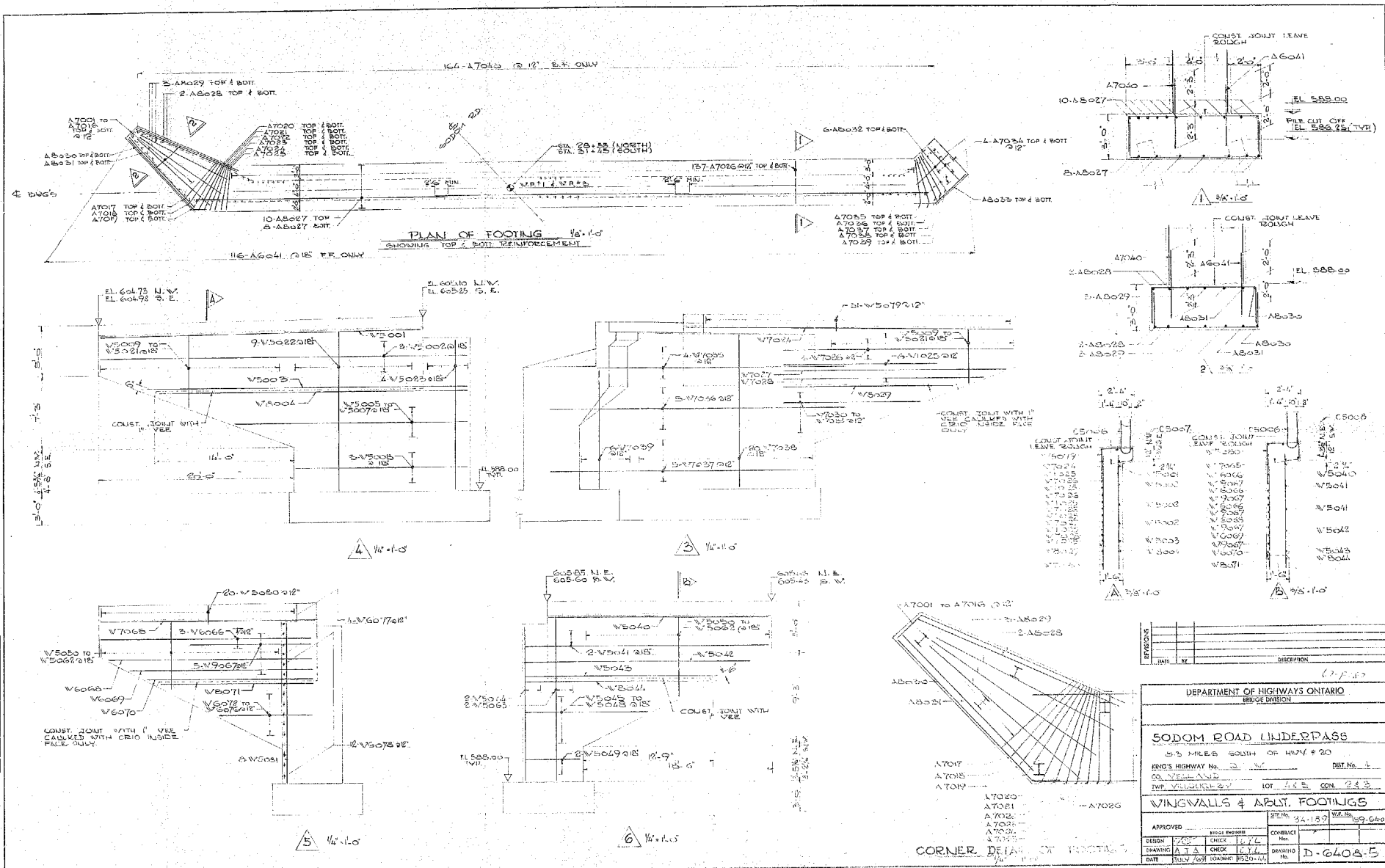
SUGAR'S HOLE CHECKED	W.P. NO. 159 - 44 - 03	W.P.T. DRAINING HOLE
SHOWN A.H. CHECKED	W.P. NO. 67 - F - 87	67 - F - 87 A
DATE NOV. 23, 1967	SITE NO. 34 - 189	BRIDGE DRAINING HOLE

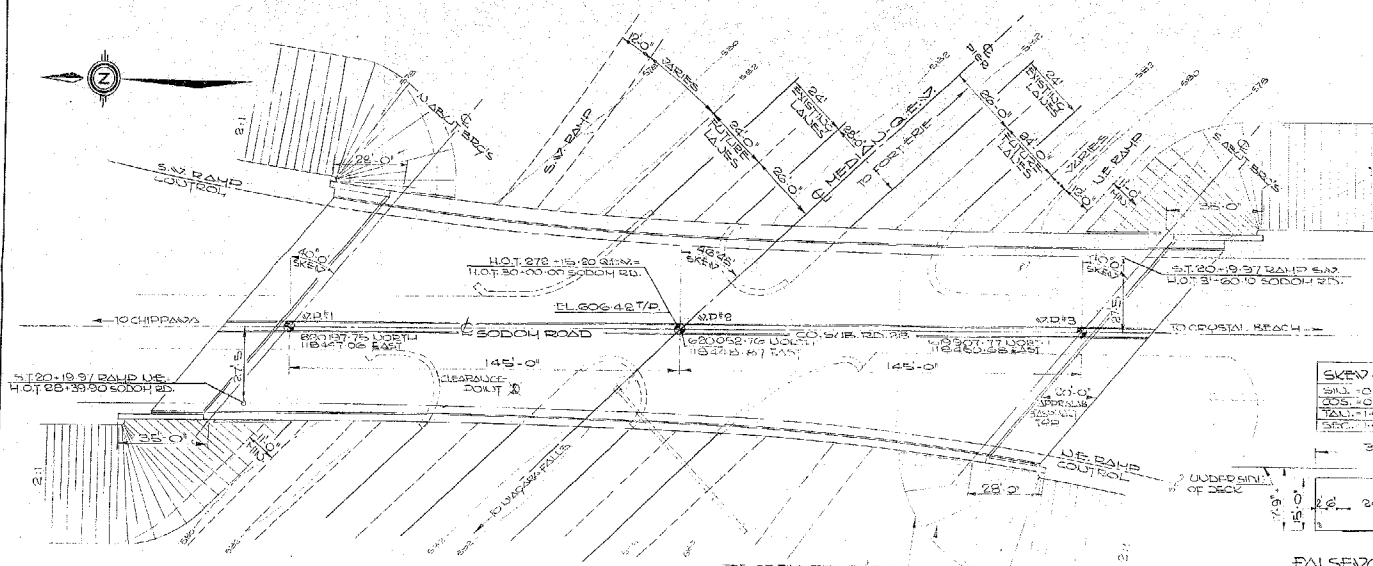
APPROVED FOR SUBMITTAL  
SODOM RD.

D6402-B

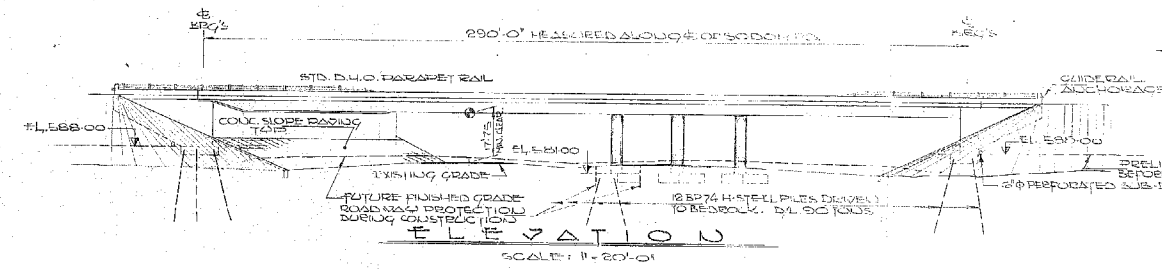




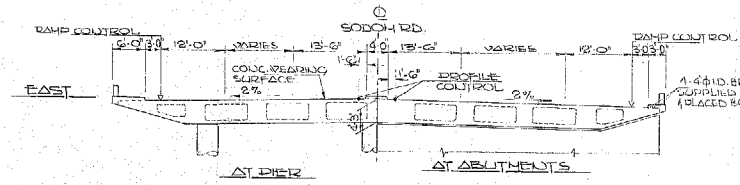




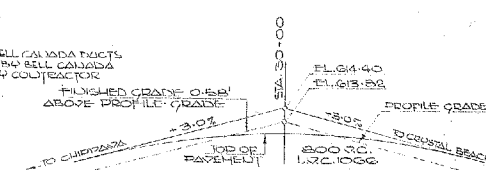
PLAN  
SCALE: 1" = 20'-0"



ELEVATION  
SCALE: 1" = 20'-0"



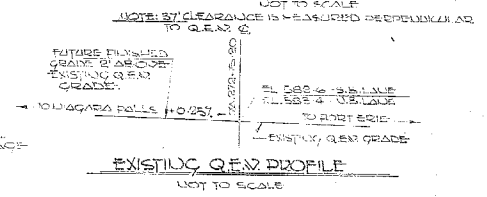
TWO DECK SECTIONS  
NOT TO SCALE



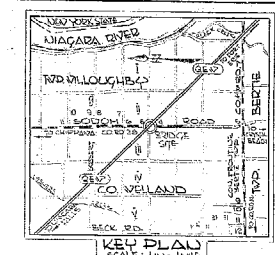
PROFILE OF SODOM RD. (CO. SUB. RD. 2A)  
NOT TO SCALE

SKEN 46°45'	SKEN 40°00'
BRIDGE 10.7263710	0.1726371
ROAD 0.0000000	0.0000000
TOTAL 10.7263710	0.1726371
AREA 14.04641	1.0000000

FALSEWORK CLEARANCE DIAGRAM  
NOT TO SCALE



EXISTING G.E.M. PROFILE  
NOT TO SCALE



- GENERAL NOTES
- CLASS OF CONCRETE
  - DECK CURB SIDEWALK
  - TRAFFIC WALLS
  - DECK COLOURS
  - REINFORCEMENT
  - CLEAR COVER ON REIN. STEEL
  - FOOTINGS: ABUTTS, COLUMNS - DECK
  - CURBS - APPRO. SLABS
  - RAILWAY WALLS - FILLINGS

- LIST OF DRAWINGS
- 1. GENERAL PLAN
  - 2. BRIDGE LAYOUT
  - 3. BRIDGE DETAILS
  - 4. BRIDGE DETAILS
  - 5. NORTH ABUTMENT & WINGWALLS
  - 6. SOUTH ABUTMENT & WINGWALLS
  - 7. BRIDGE LAYOUT & ELEVATIONS
  - 8. BRIDGE DETAILS
  - 9. CABLE LAYOUT DETAILS
  - 10. BRIDGE APPROACHMENT 1
  - 11. BRIDGE APPROACHMENT 2
  - 12. APPROACH SLABS
  - 13. BRIDGE WALL DETAILS
  - 14. BRIDGE WALL DETAILS
  - 15. BRIDGE DETAILS 1
  - 16. BRIDGE DETAILS 2
  - 17. BRIDGE DETAILS 3

B.M. ELEV. 576.54  
GEODETIC DATUM  
U.S.M. 10.0000 OF 0.254  
1984 C.U. OF STA. 209.54

REVISIONS	DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO  
BRIDGE DIVISION

61-1-97

**SODOM RD. UNDERPASS**  
0.3 MILES SOUTH OF HIGHWAY 120

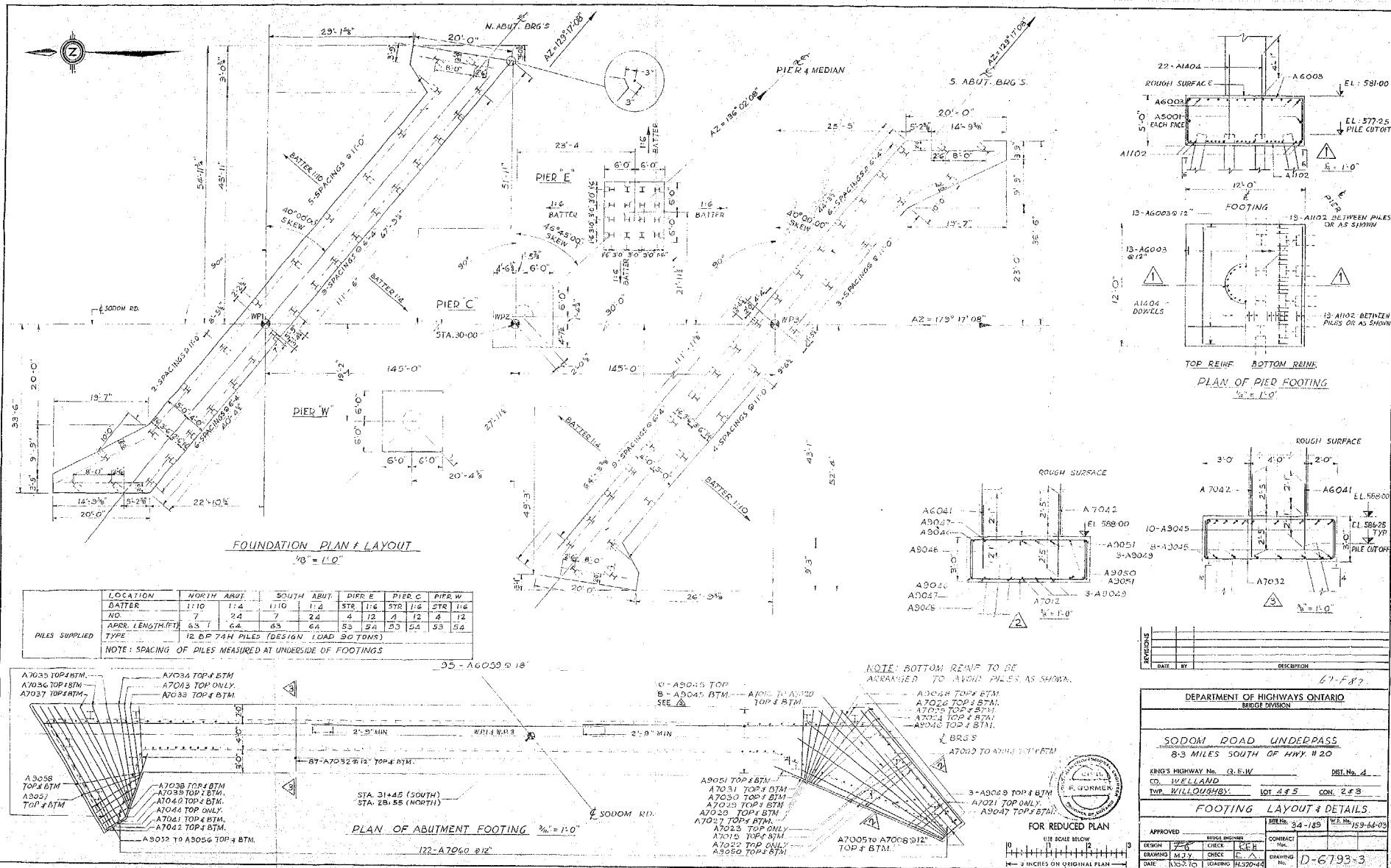
HWY 120 HIGHWAY No. 120  
CO. WELLSVILLE  
TWP. WILLOUGHBY

LOT 465 CON. 243

GENERAL PLAN

DESIGN: 24-1093  
CHECK: 12-1093  
DATE: 10-27-01

FOR REDUCED PLAN  
BY: 10-27-01  
DATE: 10-27-01

[illegible]