

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 40I14-113

DIST. 2 REGION

W.P. No. 68-85-02

CONT. No. 90-10

W. O. No.

STR. SITE No. 19-341

HWY. No. 4

LOCATION Dingman Creek

Bridge Replacement

No of PAGES -

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

# METRIC

DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

DIST No 2  
CONT No  
WP No 68-85-02



DINGMAN CREEK BRIDGE  
GENERAL ARRANGEMENT

SHEET



NOTE:  
FOR DETAIL DETAILS  
SEE DWG #19 & 20

EXISTING STRUCTURE  
TO BE REMOVED

APPROACH SLAB  
WITH 80 mm ASPHALT  
(TYPICAL)

HIGHWAY No 4  
PROFILE CONTROL

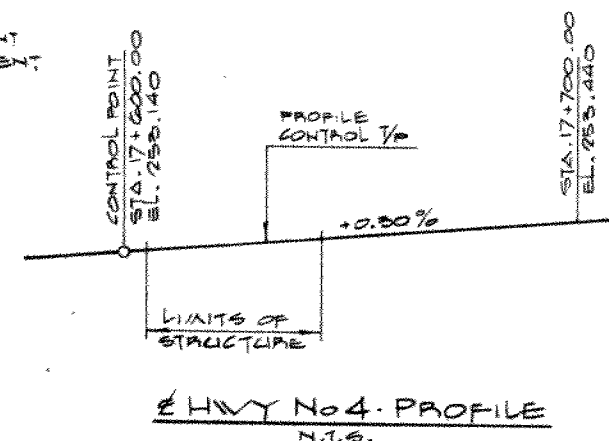
W.P.#2  
STA. 17+663.70  
T/P EL. 253.331

## GENERAL NOTES

- CLASS OF CONCRETE
  - PRESTRESSED GIRDERS 40 MPa
  - REMAINDER 30 MPa
- CLEAR COVER TO REINFORCING STEEL
  - FOOTINGS 100 ± 25 mm
  - ABUTMENT AND WINGWALL FRONT SURFACES 80 ± 20 mm
  - ABUTMENT AND WINGWALL BACK SURFACES 70 ± 20 mm
  - DECK - TOP 70 ± 20 mm
  - DECK - BOTTOM 40 ± 10 mm
- REINFORCING STEEL
  - REINFORCING STEEL SHALL BE GRADE 400
  - BAR MARKS WITH SUFFIX 'C' DENOTE COATED BARS
- CONSTRUCTION NOTES
  - BEARING SEATS SHALL BE FINISHED LEVEL AND TO THE SPECIFIED ELEVATIONS

## LIST OF DRAWINGS

- GENERAL ARRANGEMENT
- BOREHOLE LOCATIONS AND SOIL STRATA
- FOOTING LAYOUT & DETAILS
- SOUTH ABUTMENT DETAILS
- NORTH ABUTMENT DETAILS
- SOUTH & NORTH WINGWALL DETAILS
- PRESTRESSED GIRDER DETAILS
- DECK LAYOUT & SKEED ELEVATIONS
- DECK REINFORCING DETAILS
- BEARING LAYOUT & DETAILS
- JOINT ANCHORAGE AND ARMOURING
- BARRIER WALL ON SIDEWALK
- EMBEDDED WORK IN STRUCTURE
- RAILING FOR BARRIER WALL
- 6000 mm APPROACH SLAB
- BRIDGE DATE & SITE NUMBER DATA
- AS CONSTRUCTED ELEV. & DIM.
- PILE DRIVING - STEAM & DIESEL HAMMERS
- BAILEY BRIDGE - SHT. 1
- BAILEY BRIDGE - SHT. 2
- QUANTITIES - SHT. 1
- QUANTITIES - SHT. 2



## APPLICABLE STANDARD DRAWINGS

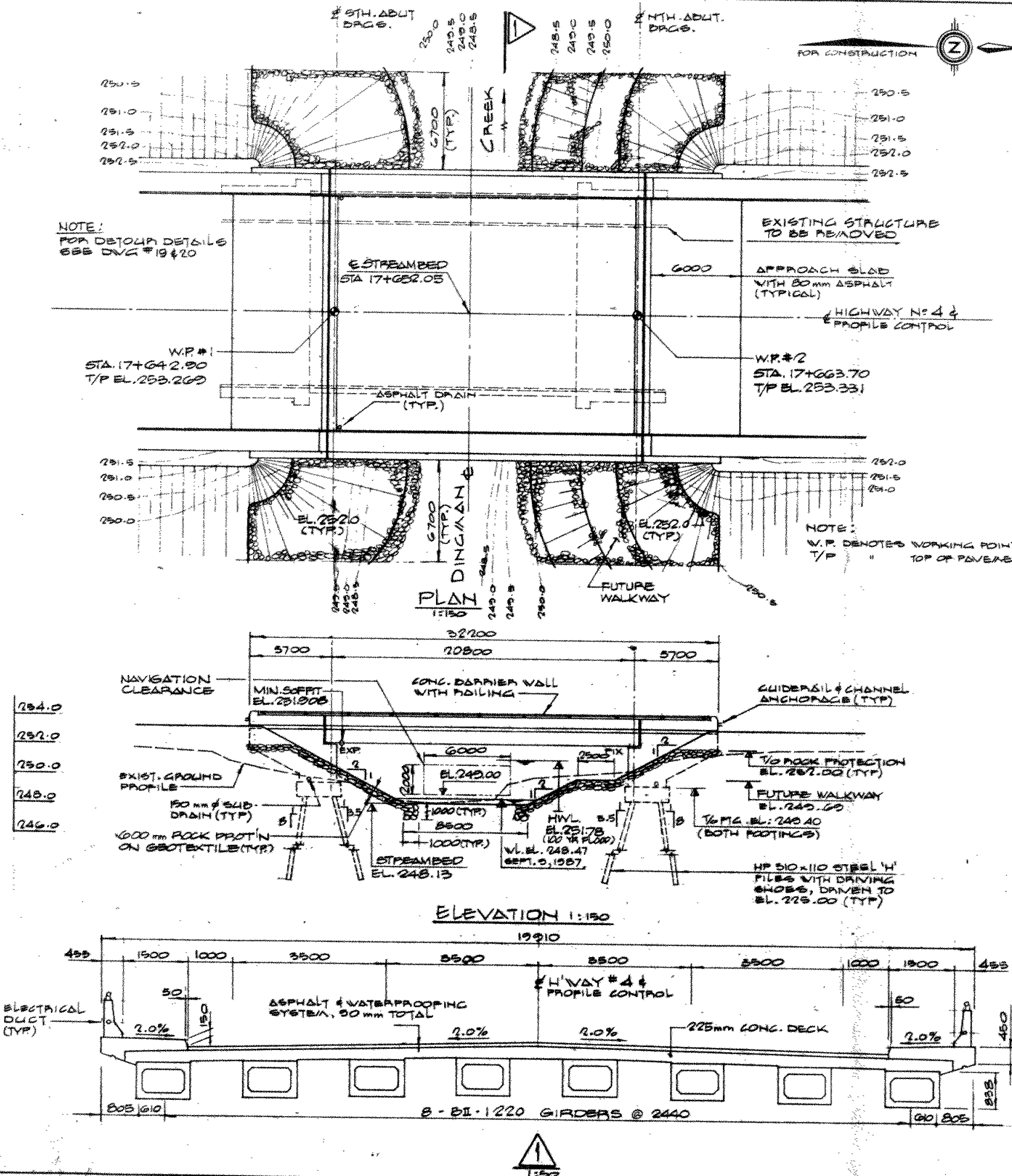
- OPSD 508.02 - BRIDGE DECK WATERPROOF.
- OPSD 508.03 - GRANULAR BACKFILL REQUIREMENTS
- OPSD 902.09 - STRUCTURE CONNECTION BARRIER WALL

DND PRECISE ON 64-11  
Lat. 42-53.8 Long. 81-17.4 ELEV. 256.904 m  
Two storey brick and frame house on the west side of Hwy. 4, 1.6 km south of intersection of Hwys. 4 and 2 in Lambeth, 1.1 km north of cemetery in Scottsville, 0.3 km south of Dingman's Creek and 122 m north of Hydro transmission lines. Tablet is set horizontally in the south face of concrete foundation, 3.51 m east of the southwest corner and 28 cm below the first course of brickwork.

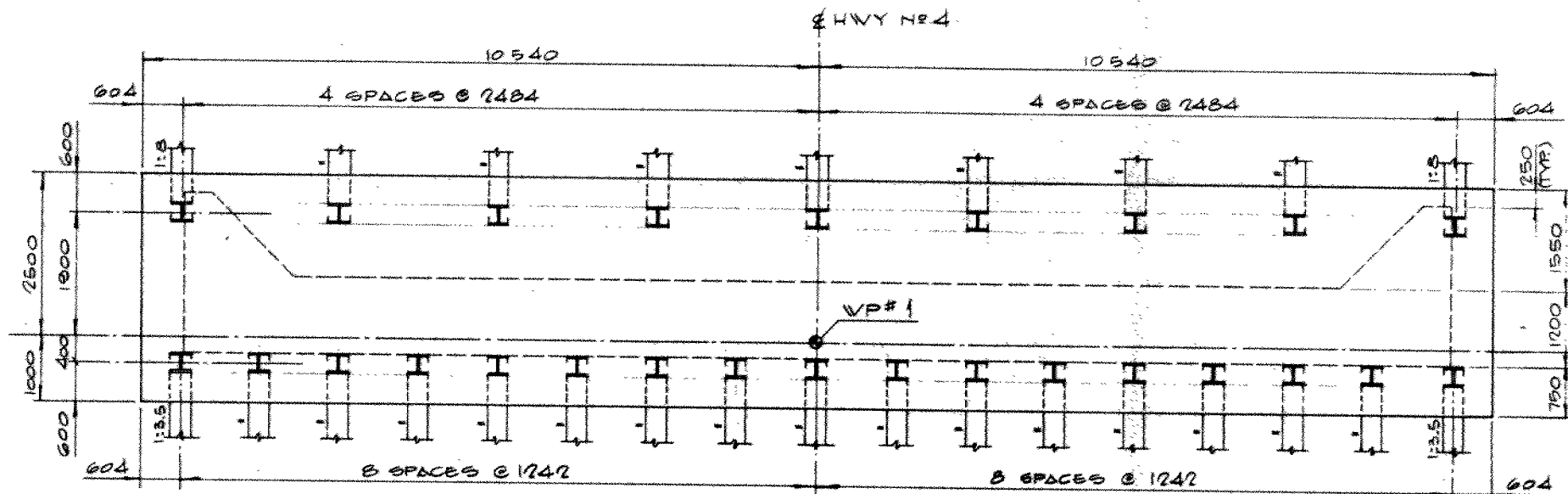


DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING

REVISIONS	DATE	BY	DESCRIPTION
DESIGN J.C.S. CHK T.Z. CODE OHBOC-83	LOAD	CL. A	DATE DEC. 1988
DRAWN G.S. CHK J.C.S. SITE 19-341	STRUCT	SCHEME	DWS: 1



PL-8-1118 87-04



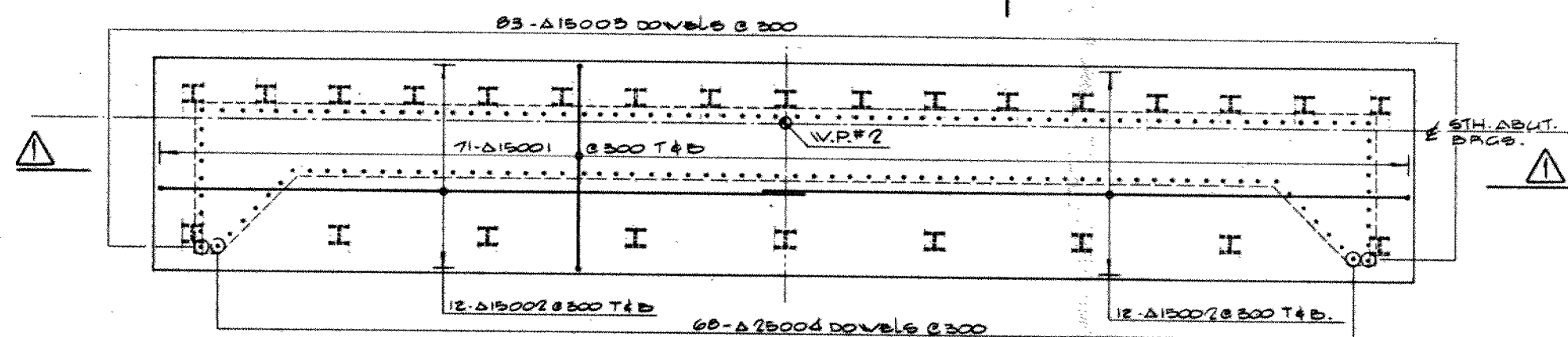
PILE LAYOUT (Sth. Abutment Footing Similar)  
1:50

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

CONT No WP No 68-85-02	
DINGMAN CREEK BRIDGE	
FOOTING LAYOUT & DETAILS	
<b>Wyllie &amp; Ufnal</b> consulting engineers	

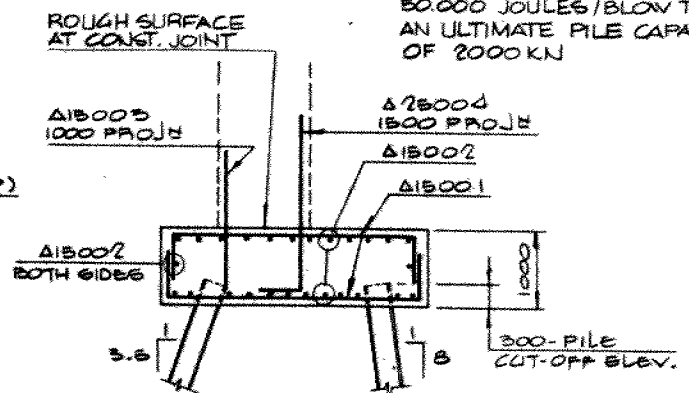
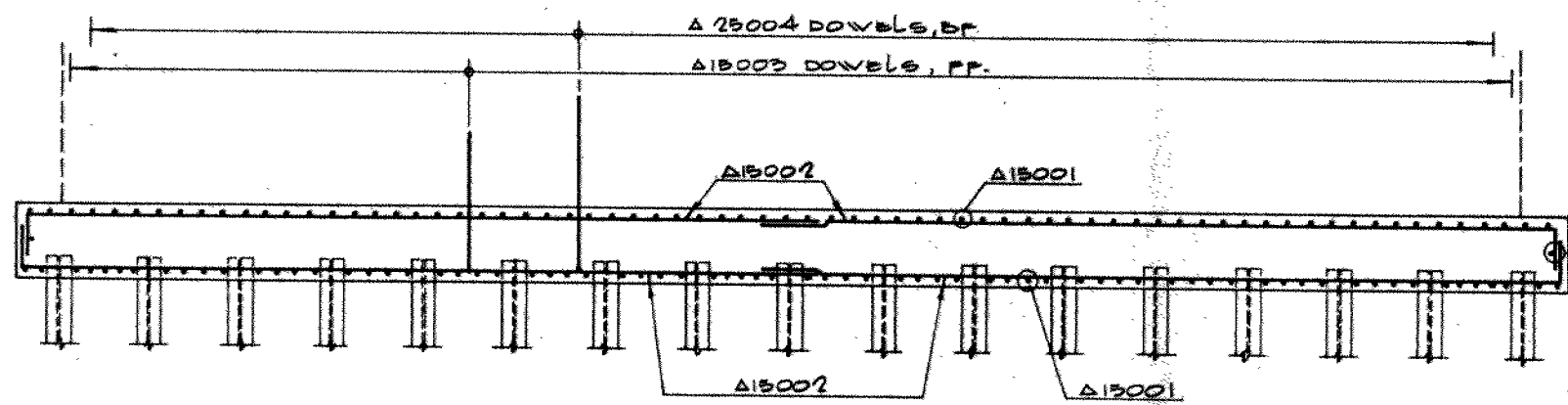
PILE DESIGN DATA		
LOCATION	LOAD & ELS TYPE II	FACTORED CAPACITY @ U.L.S.
SOUTH & NORTH ABUTMENTS	670 kN/PILE	1800 kN/PILE ✓

PILE DATA					
LOCATION	TYPE	BATTER	NO REQ'D	CUT-OFF ELEVATION	LENGTH
SOUTH ABUT.	HP 310 x 110	1:3.5 1:8	17 9	248.700	246502 239002.3
NORTH ABUT.	HP 310 x 110	1:3.5 1:8	17 9	248.700	246500 239000



REINFORCING (Nth. Abutment Footing Similar)  
1:50

- NOTES:**
- THIS DWG. TO BE READ IN CONJUNCTION WITH DWG. #4 & #5
  - T - DENOTES TOP  
B - BOTTOM  
FF - FRONT FACE  
BF - BACK FACE
  - PILE SPACING IS MEASURED AT UNDERSIDE OF FOOTINGS.
  - PILE LENGTHS SHOWN IN TABLE ARE THE THEORETICAL LENGTHS BELOW CUT-OFF.
  - PILES SHALL BE DRIVEN TO ELEV. 225.00
  - ALL PILES SHALL HAVE REINFORCED TIPS.
  - PILE DRIVING SHOULD BE PERFORMED IN ACCORDANCE WITH OPS. 903
  - PILES SHOULD BE DRIVEN WITH A MINIMUM HAMMER ENERGY OF 50,000 JOULES/BLOW TO ACHIEVE AN ULTIMATE PILE CAPACITY OF 2000 KN



PLACE BOTTOM REINP. TO SUIT PILE LAYOUT

APPLICABLE STD. DRAWINGS:  
DD-3301 - SPLICE AND DRIVING SHOE DETAILS FOR STEEL 'H' PILES.



DRAWING NOT TO BE SCALED  
100 mm ON ORIGINAL DRAWING



REVISIONS	DATE	BY	DESCRIPTION
DESIGN JC	CHK T2	CODE CHD	3301 LOAD CL 3
DRAWN JC	CHK JC	SITE 13-341	STRUCT SCHEME DWG 35



Ministry of  
Transportation and  
Communications

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## **FOUNDATION DESIGN SECTION**

**foundation  
investigation and  
design report**

ENGINEERING MATERIALS OFFICE  
FOUNDATION DESIGN SECTION

WP 68-85-02

DIST 2

HWY 4

STR SITE 19-341

Dingman Creek Structure

DISTRIBUTION

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FOUNDATION INVESTIGATION FOR  
For  
Dingman Creek Structure  
W.P. 68-85-02  
SITE 19-341, Hwy. 4  
DISTRICT 2, LONDON

Introduction

This report contains the results of a foundation investigation at the abovementioned site during the period of 87 12 01 and 88 01 11. The fieldwork consisted of 7 sampled boreholes and nine dynamic cone penetration tests. The borings were advanced by NW casing using a diamond drill mounted on skids. Sampling was performed to a maximum depth of 30.5 m to elevation 219.8 m and the cone tests to a maximum depth of 8 m and to elevation 244.3 .

Site Description

The site is located 1 km south of Lambeth at the crossing of Hwy. 4 and Dingman Creek. The terrain in the immediate vicinity of the proposed structure is flat, wet and marshy with light brush cover and some willow trees. Dingman creek is situated on a glacial spillway formed by a late stage of Lake Maumee. The spillway drains a broad valley floored with clay, silt, and sand or gravel and this accounts for the variance of material encountered in this investigation.

Subsurface Conditions

General

The surficial deposit varied from silty sand to sandy silt with pockets of silt to silty clay and organic silt. The surficial deposits extended 2-4 m and were underlain by silty clay with layers of silt and traces of sand and gravel. BH #3 was sampled through the approach fill and contained sand, some gravel and some silt.

The boundaries of the different strata, together with the field and laboratory test results are shown on the Record of Borehole sheets contained in the Appendix of this report. A stratigraphical profile is shown on Drawing No.

688502-A. A description of the different strata encountered is given below.

Silty sand to sandy silt, pockets of  
silt to silty clay and organic silt

This stratum was encountered in all the sampled borings except BH #3 immediately below the original ground level and extended for 2 to 4 m. The material was predominantly non-cohesive with a denseness of very loose to compact. The composition varied between the boreholes with BH #2 containing sandy silt to silt overlain by a 1 m surficial layer of silty clay.

Sand, some gravel and some silt

A 4 m thick sand with trace to some gravel and some silt was encountered in BH #3. This is the approach fill of the existing structure and had a denseness of very loose to compact.

Silty clay

Silty clay extended from approximate elev. 246 m to elev. 219.8 m and contained some sand and gravel layers and traces of sand throughout the silty clay. The consistency was firm to hard. The lower boundary of this stratum was not determined as all the borings were terminated in this stratum. Physical properties of the material as determined from laboratory tests are as follows:

	<u>Range</u>
Natural Moisture Content (%)	7-24
Liquid Limit (%)	12-31
Plastic Limit (%)	8-16

Groundwater conditions

The groundwater level is 0.5 m below the ground level at approximate elevation 249.9 m at the time of the field investigation. The groundwater level is subject to rapid variations due to surface runoff. The creek water level fluctuated over 1.0 m height in 24 hours during the investigation.



## Discussion and Recommendations

### General

The existing 2 lane structure at the site is to be replaced with a 4 lane, 19.8 m wide structure. The grade will be raised by less than 0.5 m and the new structure will be one of the following two alternatives:

- (1) Single span concrete rigid frame with span length of 19.0 m± and height of 4.5 m±.
- (2) A three-span beam type structure with span lengths of approximately 8.5 m - 18.0 m - 8.5 m.

A 40.0 m long Bailey Bridge supported on timber mats is proposed for the detour, 28 m left of the existing Highway 4 centreline. The proposed profile grade of the detour is elevation 252.7 m, resulting in up to 3 m of fill.

### Structure Foundations

In view of the encountered subsurface conditions, the following foundation recommendation is being made:

The new structure may be supported on steel 'H' piles driven to elevation 225 m, at which depth it is estimated that a design load of 670 kN will be achieved for H.P. 310 x 110 steel 'H' piles. Pile driving should be in accordance with Standards SS-103-10/11. For purposes of the O.H.B.D.C. the following design values are recommended:

Factored Capacity at U.L.S.	1300 kN
Capacity at S.L.S. Type II	670 kN

Earth pressures should be computed as per Subsection 6.6.1.2 of the O.H.B.D.C. A yielding foundation condition may be assumed. Backfill to the structures should be Granular 'A' or Granular 'B' for which following properties may be

assumed:

Granular 'A'  $\gamma = 22.8 \text{ kN/m}^3$ ,  $\phi = 35^\circ$ ,  $K_a = 0.271$

Granular 'B'  $\gamma = 21.3 \text{ kN/m}^3$ ,  $\phi = 30^\circ$ ,  $K_a = 0.333$

#### Proposed Detour Structure

The abutments for the single span Bailey Bridge detour structure can be supported on timber mats placed on granular pads. Subexcavate to remove all topsoil and soft or loose material. A minimum 1 m thick pad of well compacted Granular 'A' should be placed to the required level, onto which the timber mats can be placed. The granular pad should be a minimum of 1 m larger all around in the plan area than the bearing area. The recommended design load for the timber mat is 100 kPa and for the purposes of the O.H.B.D.C. the following design values are recommended:

Factored Capacity at U.L.S.	150 kPa
Capacity at S.L.S. Type II	100 kPa

For the purposes of computing resistance to lateral forces the coefficient of friction between the underside of the timber mat and the well compacted granular pad may be assumed to be  $\tan 30^\circ$ .

#### Approaches

Topsoil and soft or loose material should be removed prior to placing any fill. The fill should consist of well compacted acceptable material, and should be non-cohesive up to 0.3 m above the high water level. Care should be taken to ensure that no bouldery fill is placed within the approaches at locations through which piles have to be driven, and it is recommended that this portion of the fill contain no larger grain sizes than 75 mm.

Embankments should be constructed with forward and side slopes not steeper than 2 horizontal to 1 vertical.

### Settlements

Settlements will occur due to consolidation of the cohesive soil in the original ground due to the weight of the new approach embankments. This settlement is not anticipated to be significant, and after completion should not exceed 25 mm over a long period of time.

### Other Considerations

#### Dewatering

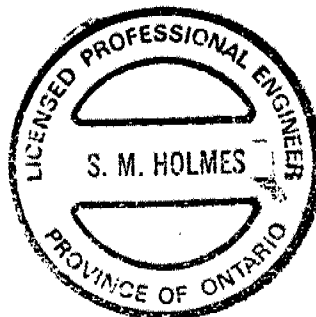
Concrete should be placed in the "dry". Excavation carried out below the creek or ground water level will require a dewatering scheme. The upper subsoil layers contain silty clay and silt layers in random occurrence. The silt layers are subject to boiling due to hydrostatic head. The most suitable dewatering scheme would be construction of a suitable sheet pile coffer dam, with the sheet piles driven to a suitable depth depending on the location of the pile cap. The sheeting should be driven below the base of the excavation a distance equal to the head of water above the base of the excavation.

#### Rip Rap

The slopes must be protected from scour with rip rap. The rip rap should be placed according to the hydrological requirements with the minimum slope protection required extending from 0.3 m above the high water level to 2 m beyond the toe of slope in the flood plain and the creek.

### Miscellaneous

The fieldwork for this investigation was carried out under the supervision of Mr. D. Morch, Student Engineer, and Messrs S. Holmes and M. Dettweiler, Foundation Design Section. The equipment used was owned and operated by Master Soil Investigation Ltd. This report was written by Mrs. P. Marks and Mr. S. Holmes and reviewed by Mr. P. Payer and Mr. K. Selby.



*[Signature]*  
S. Holmes, P.Eng.  
Foundation Engineer

*[Signature]*  
K. Selby, P.Eng.  
Chief Foundation Engineer  
(West)

## **APPENDIX**

## EXPLANATION OF TERMS USED IN REPORT

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

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

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

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

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

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

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

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

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

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

**JOINTING AND BEDDING:**

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

## ABBREVIATIONS AND SYMBOLS

### FIELD SAMPLING

SS	SPLIT SPOON	TP	THINWALL PISTON
WS	WASH SAMPLE	OS	OSTERBERG SAMPLE
ST	SLOTTED TUBE SAMPLE	RC	ROCK CORE
BS	BLOCK SAMPLE	PH	TW ADVANCED HYDRAULICALLY
CS	CHUNK SAMPLE	PM	TW ADVANCED MANUALLY
TW	THINWALL OPEN	FS	FOIL SAMPLE

### MECHANICAL PROPERTIES OF SOIL

$m_v$	$\text{kPa}^{-1}$	COEFFICIENT OF VOLUME CHANGE
$C_c$	1	COMPRESSION INDEX
$C_s$	1	SWELLING INDEX
$C_\alpha$	1	RATE OF SECONDARY CONSOLIDATION
$c_v$	$\text{m}^2/\text{s}$	COEFFICIENT OF CONSOLIDATION
H	m	DRAINAGE PATH
$T_v$	1	TIME FACTOR
U	%	DEGREE OF CONSOLIDATION
$\sigma'_{vo}$	kPa	EFFECTIVE OVERBURDEN PRESSURE
$\sigma'_p$	kPa	PRECONSOLIDATION PRESSURE
$\tau_f$	kPa	SHEAR STRENGTH
$c'$	kPa	EFFECTIVE COHESION INTERCEPT
$\phi'$	-°	EFFECTIVE ANGLE OF INTERNAL FRICTION
$c_u$	kPa	APPARENT COHESION INTERCEPT
$\phi_u$	-°	APPARENT ANGLE OF INTERNAL FRICTION
$\tau_R$	kPa	RESIDUAL SHEAR STRENGTH
$\tau_r$	kPa	REMOULDED SHEAR STRENGTH
$S_t$	1	SENSITIVITY = $\frac{c_u}{\tau_r}$

### STRESS AND STRAIN

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

### PHYSICAL PROPERTIES OF SOIL

$\rho_s$	$\text{kg}/\text{m}^3$	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	$e_{\min}$	1, %	VOID RATIO IN DENSEST STATE
$\gamma_s$	$\text{kN}/\text{m}^3$	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	$I_D$	1	DENSITY INDEX = $\frac{e_{\max} - e}{e_{\max} - e_{\min}}$
$\rho_w$	$\text{kg}/\text{m}^3$	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
$\gamma_w$	$\text{kN}/\text{m}^3$	UNIT WEIGHT OF WATER	$S_r$	%	DEGREE OF SATURATION	$D_n$	mm	n PERCENT - DIAMETER
$\rho$	$\text{kg}/\text{m}^3$	DENSITY OF SOIL	$w_L$	%	LIQUID LIMIT	$C_u$	1	UNIFORMITY COEFFICIENT
$\gamma$	$\text{kN}/\text{m}^3$	UNIT WEIGHT OF SOIL	$w_p$	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
$\rho_d$	$\text{kg}/\text{m}^3$	DENSITY OF DRY SOIL	$w_s$	%	SHRINKAGE LIMIT	q	$\text{m}^3/\text{s}$	RATE OF DISCHARGE
$\gamma_d$	$\text{kN}/\text{m}^3$	UNIT WEIGHT OF DRY SOIL	$I_p$	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
$\rho_{\text{sat}}$	$\text{kg}/\text{m}^3$	DENSITY OF SATURATED SOIL	$I_L$	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
$\gamma_{\text{sat}}$	$\text{kN}/\text{m}^3$	UNIT WEIGHT OF SATURATED SOIL	$I_C$	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
$\rho'$	$\text{kg}/\text{m}^3$	DENSITY OF SUBMERGED SOIL	$e_{\max}$	1, %	VOID RATIO IN LOOSEST STATE	j	$\text{kN}/\text{m}^2$	SEEPAGE FORCE
$\gamma'$	$\text{kN}/\text{m}^3$	UNIT WEIGHT OF SUBMERGED SOIL						



# RECORD OF BOREHOLE No 1

METRIC

W P 68-85-02 LOCATION Sta. 17 + 6631.1, O/S 26.1 m Lt. 4 Hwy. 4 ORIGINATED BY DM  
DIST 2 HWY 4 BOREHOLE TYPE Washbore, NW Casing COMPILED BY BB  
DATUM Geodetic DATE 87 12 01 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
249.8	Ground Surface										
0.0	Silty Clay, Trace Organics, Some Sand, Firm		1	SS	6						
248.8			2	SS	6						
1.0	Organic Silt With Sand, Firm		3	SS	5						
248.0			4	SS	6						
1.8	Silty Clay With Layers of Silt		5	SS	16						
			6	SS	10						
			7	SS	21						
			8	SS	21						
			9	SS	24						
	Trace of Sand		10	SS	22						
			11	SS	25						
	Stiff to Hard		12	SS	36						
			13	SS	30						
243.2			14	SS	31						
6.6	End of Borehole										

OFFICE REPORT ON SOIL EXPLORATION

Ministry of  
Transportation  
Ontario

## RECORD OF BOREHOLE No 2

METRIC

W P 68-85-02 LOCATION Sta. 17 + 689.5 O/S 26.1 m Lt. 4 Hwy. 4 ORIGINATED BY DM  
DIST 2 HWY 4 BOREHOLE TYPE Washbore, NW Casing COMPILED BY BB  
DATUM Geodetic DATE 87 12 01 - 03 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT	NATURAL MOISTURE CONTENT	LIQUID LIMIT	UNIT WEIGHT $\gamma$ KN/M <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100		W <sub>p</sub>	W	W <sub>L</sub>		
250.3	Ground Surface						250							
0.0	Silty Clay, Some Sand,													
249.0	Trace Organics, Firm		1	SS	5									
1.3	Silty Sand, Trace													
248.3	Organics, Very Loose		2	SS	2									0 58 (42)
2.0	Sandy Silt to Silt		3	SS	5									0 36 (64)
246.8	Trace Gravel, Occ. Silty Clay Layers, Loose to Compact		4	SS	15									40 10 (50) 2 24 (74)
3.5	Silty Clay With Layers of Silt Trace Sand Stiff to Hard		5	SS	18									
			6	SS	16									
			7	SS	46									
			8	SS	12									
			9	SS	PM									
			10	SS	35									
			11	SS	29									
			12	SS	40									
			13	SS	30									
			14	SS	31									
	With Sand Trace Gravel		15	SS	17									0 0 (100)
			16	SS	43									9 32 (59)
			17	SS	50									
			18	SS	105									6 35 (59)
225.5	End of Borehole						226							
24.8														

+3, x5: Numbers refer to  
Sensitivity

20  
15 5 (%) STRAIN AT FAILURE  
10



## RECORD OF BOREHOLE No 3

METRIC

W P 68-85-02 LOCATION Sta. 17 + 667.3; O/S 6.5 m Lt. Q Hwy. 4 ORIGINATED BY DM  
DIST 2 HWY 4 BOREHOLE TYPE Washbore, NW Casing COMPILED BY BB  
DATUM Geodetic DATE 87 12 4, 7, 8, 9 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							WATER CONTENT (%) 20 40 60
252.9 0.0	Ground Surface														GR SA SI CL	
	Sand Some Silt Trace/Some Gravel Very Loose to Compact (Fill Material)		1	SS	20		252								23 64 (13)	
			2	SS	6											
			3	SS	5											
			4	SS	3											
249.2 3.7	Silt Trace Sand Trace/Some Gravel Trace Organics Very Loose to Compact		5	SS	2		250								7 43 (50)	
			6	SS	13											
			7	SS	11											
			8	SS	11											
247.0 5.9	Silty Clay With Layers of Silt  Trace of Sand  Stiff to Hard		9	SS	20		248								24 13 (63)	
			10	SS	60											0 2 (98)
			11	SS	9											0 4 (96)
			12	SS	64											
			13	SS	18											0 7 (93)
			14	SS	30											0 1 (99)
			15	SS	34											
			16	SS	18											
			17	SS	45											8 35 (57)
			18	SS	34											
225.9 27.0	End of Borehole		19	SS	N/A		226									

OFFICE REPORT ON SOIL EXPLORATION

+3, x5: Numbers refer to  
Sensitivity20  
15 5 (%) STRAIN AT FAILURE  
10





Ministry of Natural Resources  
Ontario

# RECORD OF BOREHOLE No 4

METRIC

W P 68-85-02 LOCATION Sta. 17 + 660 O/S 10.0 m Rt. 4 Hwy. 4  
DIST 2 HWY 4 BOREHOLE TYPE Washbore, NW Casing  
DATUM Geodetic DATE 87 12 10 - 11  
ORIGINATED BY DM  
COMPILED BY BB  
CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT			PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa								WATER CONTENT (%)
								○ UNCONFINED	+ FIELD VANE	● QUICK TRIAXIAL						
250.3	Ground Surface							20 40 60 80 100		20 40 60				GR SA SI CL		
0.0	Silty Clay, Trace Sand, Trace Gravel, Trace Organics Stiff		1	SS	8									12 33 (55)		
248.9			2	SS	23									0 8 (92)		
1.4	Silt to Organic Silt With layers of Sand & Gravel, Compact		3	SS	26									0 2 (98)		
247.4			4	SS	21									0 2 (98)		
2.9	Silty Clay with Layers of Silt Trace of Sand Stiff to Hard		5	SS	10									0 1 (99)		
			6	SS	11									0 2 (98)		
			7	SS	47											
			8	SS	43											
			9	SS	13											
			10	SS	17											
			11	SS	27									1 5 (94)		
			12	SS	46											
			13	SS	17											
			14	SS	15											
			15	SS	21											
			16	SS	29									3 54 (43)		
			17	SS	25									1 16 (83)		
			18	SS	42									15 46 (39)		
			19	SS	64/8 cm									35 29 (36)		
19.8																
30.5	End of Borehole															

\*3, x5: Numbers refer to Sensitivity

20  
15  
10  
5 (%) STRAIN AT FAILURE



Ontario

## RECORD OF BOREHOLE No 5

METRIC

W P 68-85-02 LOCATION Sta. 17 + 638.6 O/S 15.5 m Lt. Hwy 4 ORIGINATED BY MD  
DIST 2 HWY 4 BOREHOLE TYPE Washbore, NW Casing COMPILED BY  
DATUM Geodetic DATE 87 12 16 - 18 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
250.3	Ground Surface										
0.0	Silt to Silty Clay Some/With Sand Trace Gravel, Trace Organics, Firm		1	SS	5		250				0 35 (65)
			2	SS	4						2 49 (49)
248.2			3	SS	6						7 70 (23)
2.1	Silty Sand to Sandy Silt, Trace Gravel, Occ. Silty Clay Layers, Very Loose to Compact		4	SS	3						4 35 (61)
246.6			5	SS	27						
3.7			6	SS	11						
			7	SS	31						0 7 (93)
			8	SS	35						
			9	SS	72						
			10	SS	15						
	Silty Clay With Layers of Silt Trace Sand		11	SS	22						
			12	SS	19						
			13	SS	19						0 0 (100)
			14	SS	19						
	Stiff to Hard		15	SS	17						
			16	SS	18						0 0 (100)
			17	SS	57						17 17 (66)
	Trace to Some Sand Gravel		18	SS	29						
225.5			19	SS	64						
24.8	End of Borehole										

+3, x5: Numbers refer to  
Sensitivity

20  
15 ÷ 5 (%) STRAIN AT FAILURE  
10

OFFICE REPORT ON SOIL EXPLORATION



Ontario  
Department of Transportation

# RECORD OF BOREHOLE No 6

METRIC

W P 68-85-02 LOCATION Sta. 17 + 642 O/S 28.5 m Lt. 6 Hwy 4 ORIGINATED BY MD  
DIST 2 HWY 4 BOREHOLE TYPE Washbore, NW Casing COMPILED BY SMH  
DATUM Geodetic DATE 88 01 05 - 06 CHECKED BY -C

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT		PLASTIC LIMIT W <sub>p</sub>	NATURAL MOISTURE CONTENT W	LIQUID LIMIT W <sub>L</sub>	UNIT WEIGHT Y KN/m <sup>3</sup>	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20 40 60 80 100	20 40 60					
249.9	Ground Surface													GR SA SI CL
0.0	Sandy Silt to Silty Sand, Trace Organics Very Loose to Compact		1	SS	3		248							0 42 (58)
			2	SS	4									1 69 (30)
247.3			3	SS	12									0 6 (94)
2.6	Silty Clay With Layers of Silt Trace of Sand Very Stiff to Hard		4	SS	21									0 6 (94)
			5	SS	17									
			6	SS	16									
			7	LW	PM									
			8	SS	51									0 8 (92)
			9	SS	47									
			10	SS	18									0 0 (100)
			11	SS	20									
			12	SS	21									0 0 (100)
			13	SS	37									0 1 (99)
			14	SS	25									0 0 (100)
			15	SS	37									
			16	SS	25									
			17	SS	52									
228.1			18	SS	39									0 17 (83)
21.8	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION

+<sup>3</sup>, x<sup>5</sup>: Numbers refer to Sensitivity  
20  
15  $\phi$  5 (%) STRAIN AT FAILURE  
10



## RECORD OF BOREHOLE No 7

METRIC

W P 68-85-02 LOCATION Sta. 17 + 640.5 O/S 11.3 m Rt. 4 Hwy. 4 ORIGINATED BY MD  
DIST 2 HWY 4 BOREHOLE TYPE Washbore, NW Casing COMPILED BY SMN  
DATUM Geodetic DATE 88 01 07 - 08 CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%) 20 40 60	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
249.8	Ground Surface										
0.0	Silty Sand to Sandy Silt Occ. Silty Clay Layers Loose		1	SS	4		248				0 34 (65) 4 39 (57)
246.1			2	SS	4						
3.7			3	SS	5						
			4	SS	7						
	Silty Clay, With Layers of Silt Trace Sand		5	SS	23		246				19 35 (46) 0 3 (97)
			6	SS	21						
			7	SS	34		244				0 2 (98) 0 2 (98)
			8	SS	7						
			9	SS	18						
			10	SS	12		242				0 3 (97)
			11	SS	24						
			12	SS	26		240				
			13	SS	43		238				0 0 (100) 0 0 (100)
	Firm to Hard		14	SS	19		236				
			15	SS	25		234				
	Layers of Sand and Gravel		16	SS	65		232				5 50 (45) 23 29 (48)
	Hard						230				
228.0	End of Borehole		17	SS	35						
21.8											

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



# RECORD OF BOREHOLE No 8

METRIC

W P 68-85-01 LOCATION Sta. 17 + 630 O/S 13.5 m Rte. 4  
DIST 2 HWY 4 BOREHOLE TYPE Cone Test  
DATUM Geodetic DATE 88 01 11  
ORIGINATED BY MD  
COMPILED BY SMH  
CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 20 40 60 80 100	PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL	
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES							
250.3	Ground Surface						250					
0.0	Probable Silty Sand to Sandy Silt						248					
	Probable Silty Clay						246					
244.8	End of Cone Test											
5.5												

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

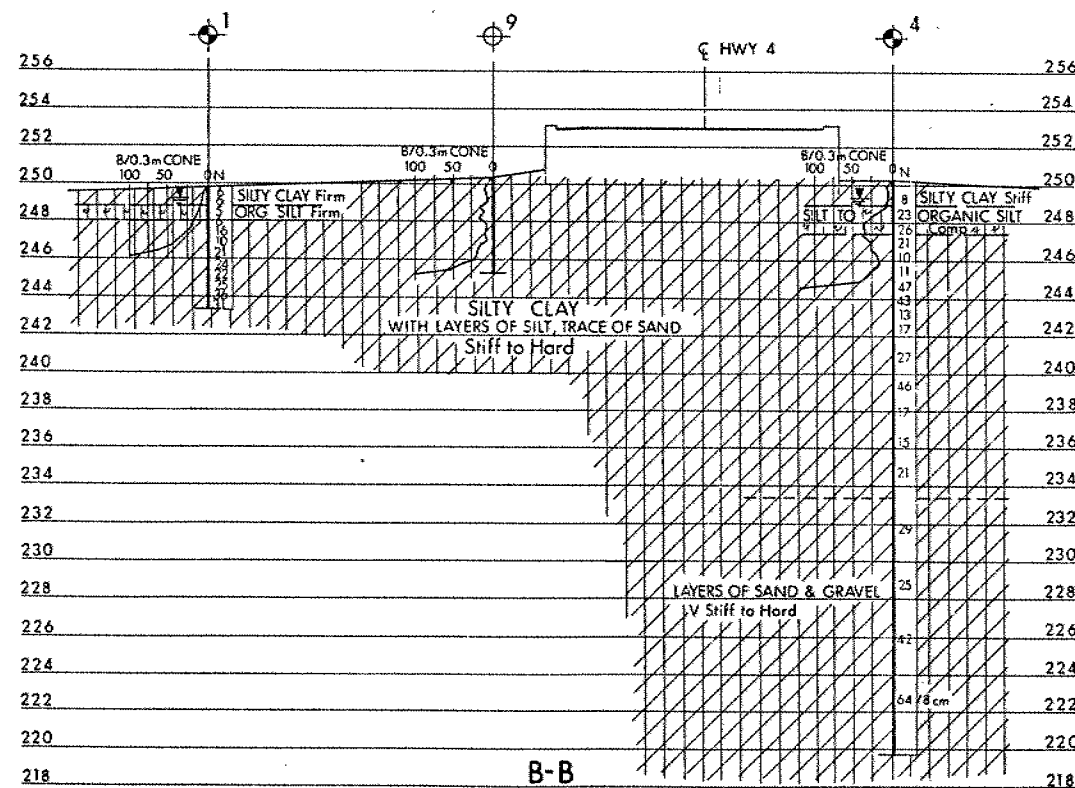
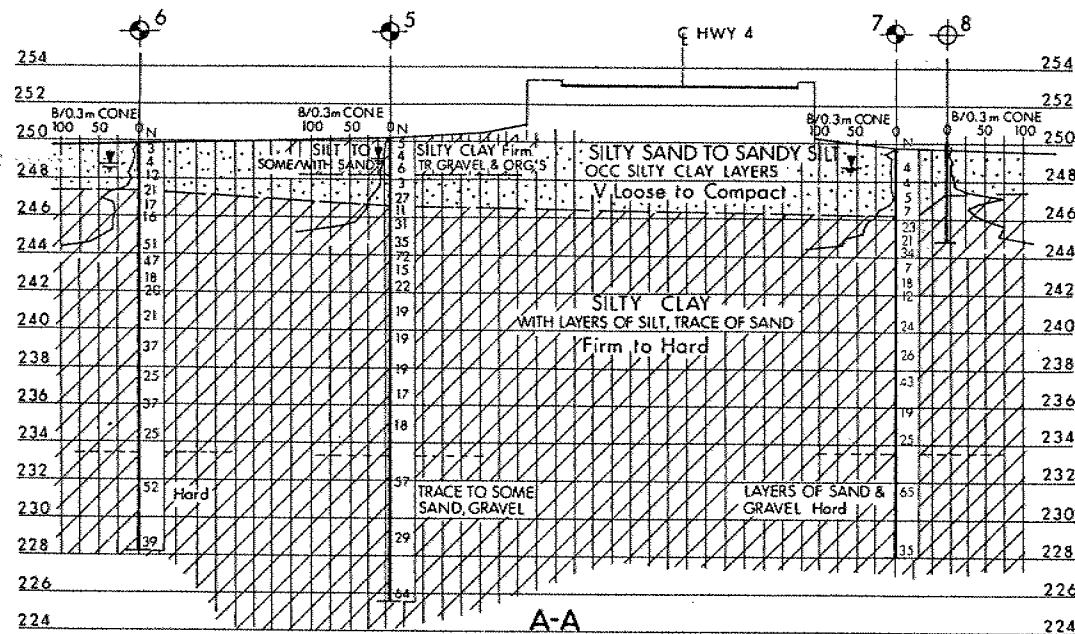
# RECORD OF BOREHOLE No 9

METRIC

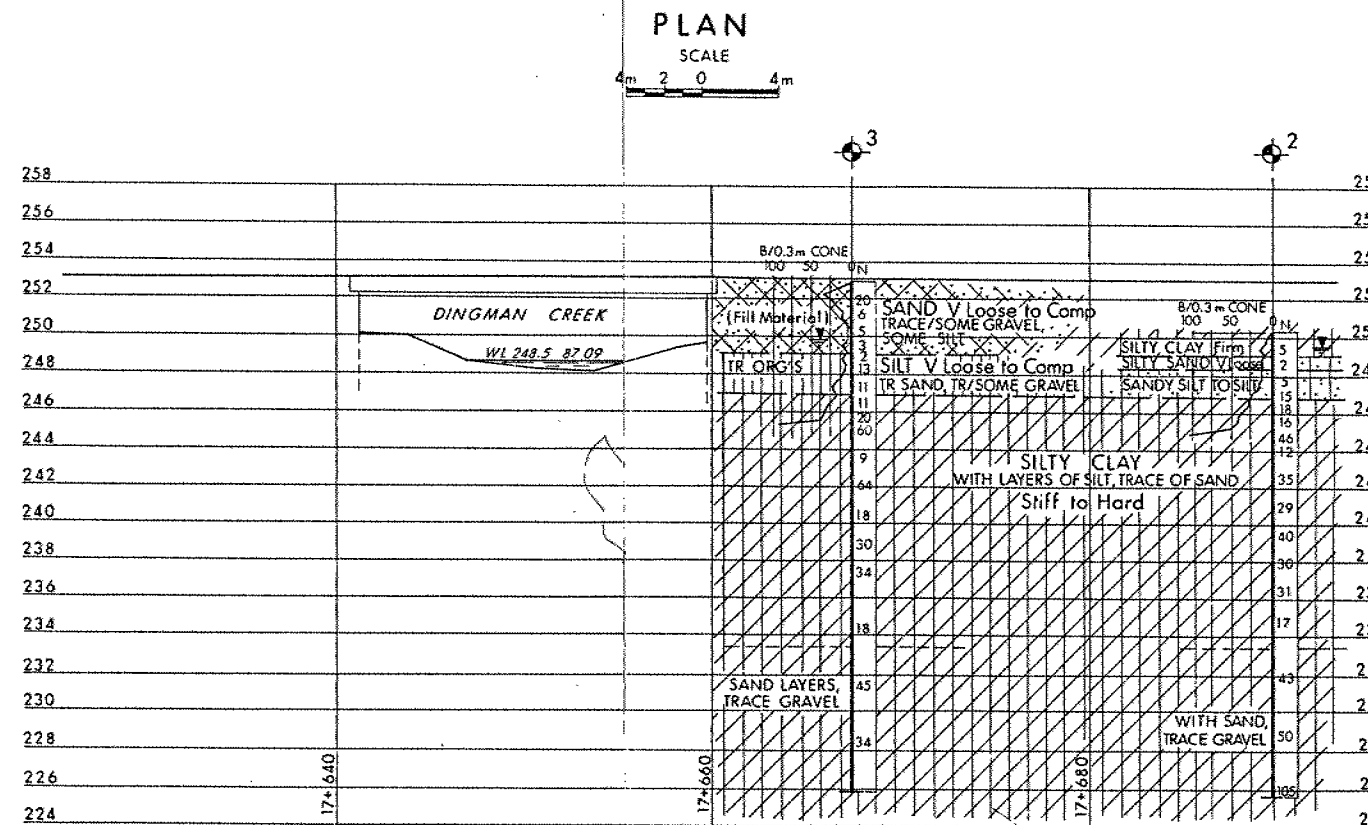
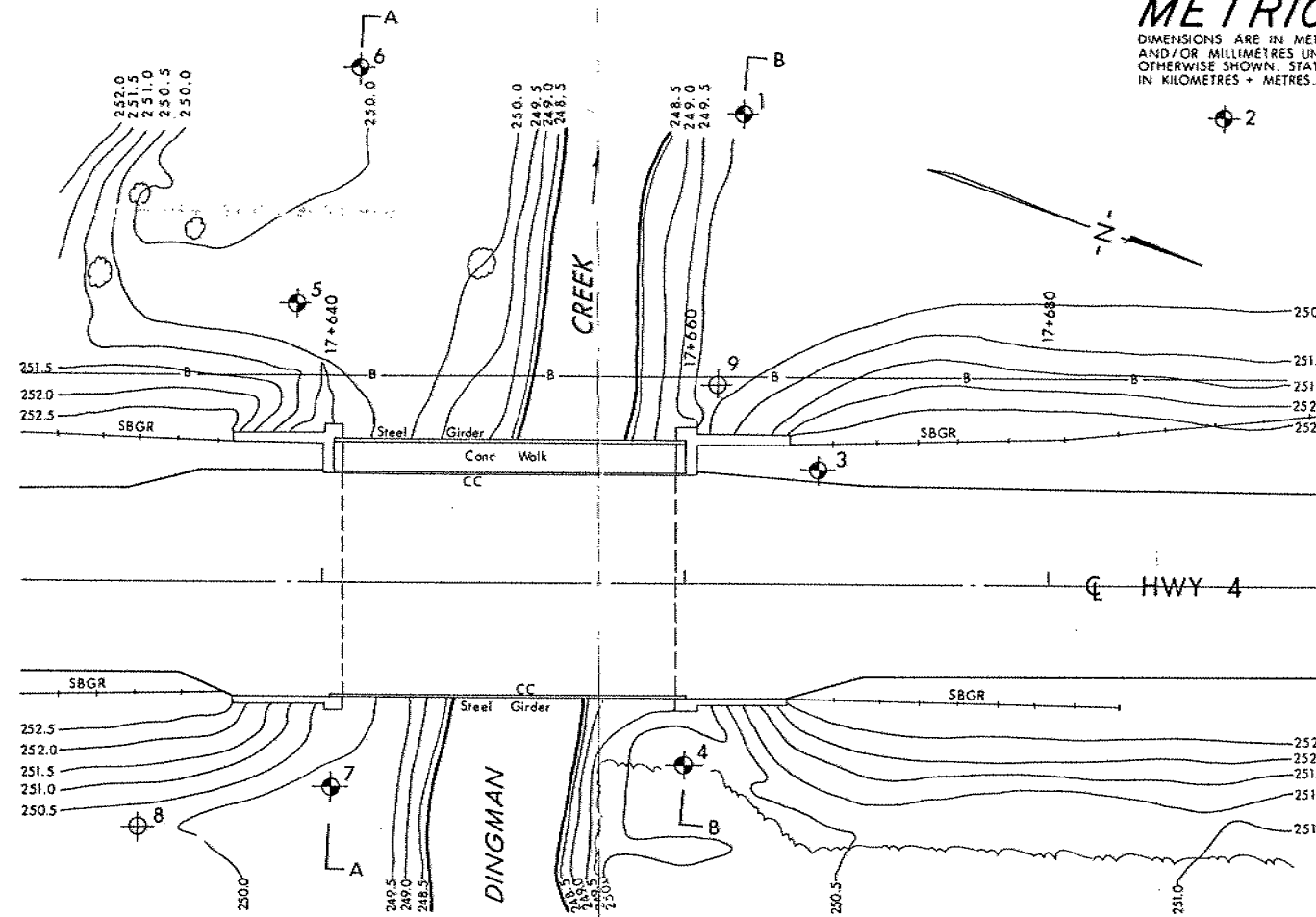
W P 68-85-02 LOCATION Sta. 17 + 661.7 O/S 11.2 m Lt. 4 Hwy. 4  
 DIST 2 HWY 4 BOREHOLE TYPE Cone Test  
 DATUM Geodetic DATE 88 01 11  
 ORIGINATED BY MD  
 COMPILED BY SMR  
 CHECKED BY

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE	PLASTIC LIMIT W <sub>p</sub> NATURAL MOISTURE CONTENT W LIQUID LIMIT W <sub>L</sub> WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE						
250.3	Ground Surface									
245.2	Probably Silty Clay with Layers of Silt					250 248 246	Frozen			
5.1	End of Cone Test						23 cm			

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

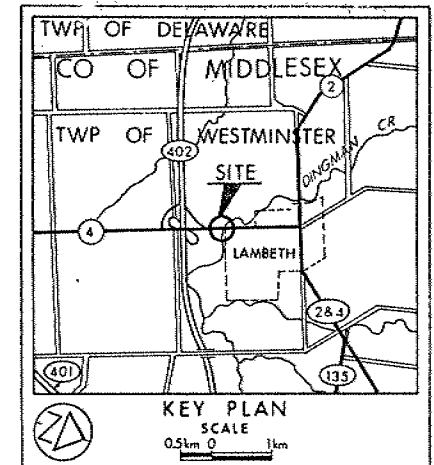


**SECTIONS**  
SCALE  
4m 2 0 4m



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

CONT No  
WP No 68-85-02  
DINGMAN CREEK  
BORE HOLE LOCATIONS & SOIL STRATA



**LEGEND**

- Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ⊕ Bore Hole & Cone
- N Blows/0.3m (Std Pen Test, 475 J/blow)
- CONE Blows/0.3m (60° Cone, 475 J/blow)
- W.L. at time of investigation  
87 12 & 88 01

No	ELEVATION	STATION	OFFSET
1	249.8	17+663.1	26.1 m LT
2	250.3	17+689.5	26.1 m LT
3	252.9	17+667.3	6.5 m LT
4	250.3	17+660.0	10.0 m RT
5	250.3	17+638.6	15.5 m LT
6	249.9	17+642.0	28.5 m LT
7	249.8	17+640.5	11.3 m RT
8	250.3	17+630.0	13.5 m RT
9	250.3	17+661.7	11.2 m LT

**NOTE**

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

NOTE: The complete foundation investigation and design report for this project and other related documents may be examined at the Engineering Materials Office, Downsview. Information contained in this report and related documents is specifically excluded in accordance with the conditions of Section 102-2 of Form 100.

REV.	DATE	BY	DESCRIPTION

Geotrac No 40114-113

HWY No 4	SUBMD 5H	CHECKED	DATE 1988 04 08	DIST 2
DRAWN 50	CHECKED	APPROVED	SITE 19-341	DWG 688502-2