

G.I.-30 SEPT. 1976

GEOCRES No. 41P-2aDIST. 14 REGION W.P. No. 200-88-02CONT. No. W. O. No. STR. SITE No. 47-41HWY. No. 560LOCATION Hwy 560 & East
Montreal RiverNo of PAGES - =====OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:



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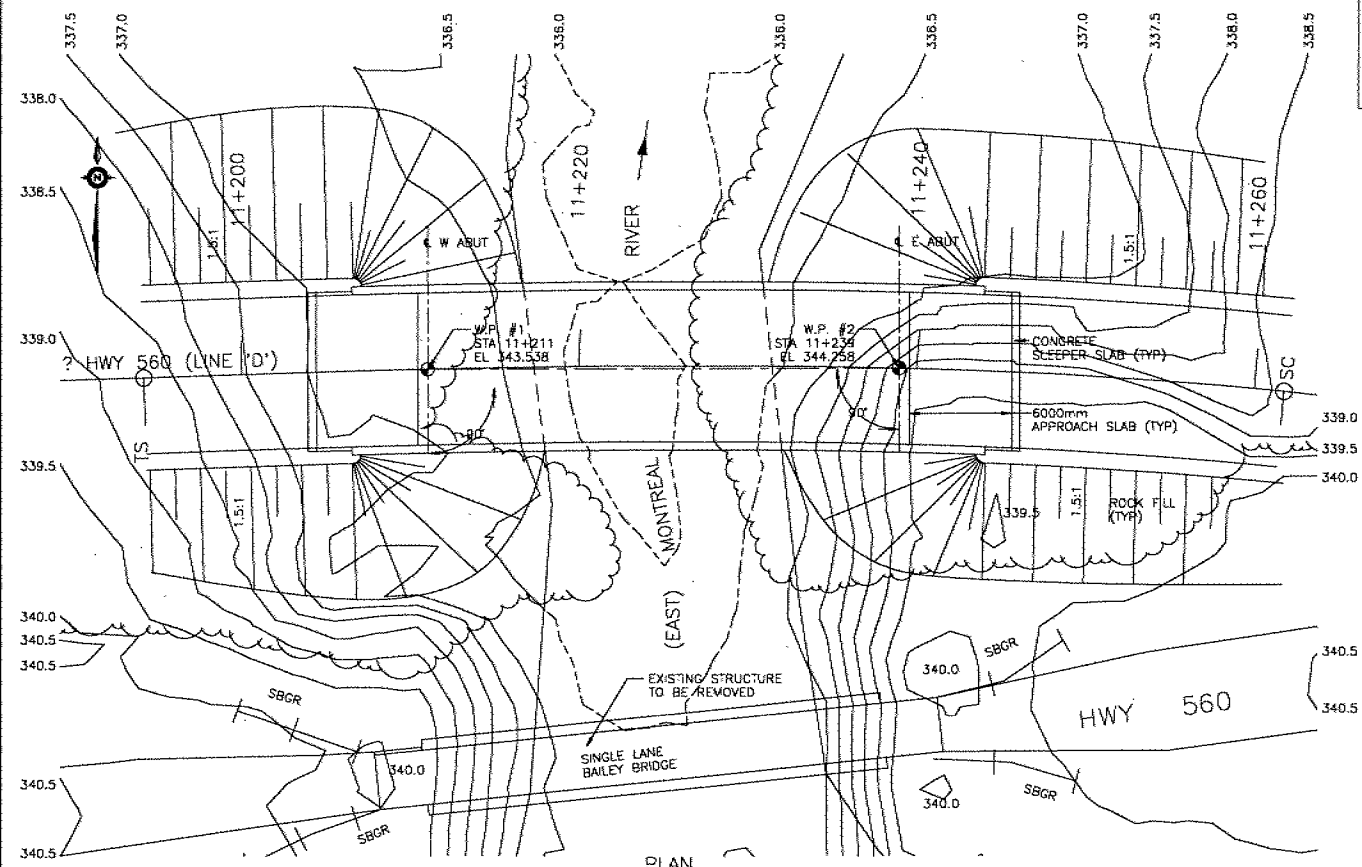
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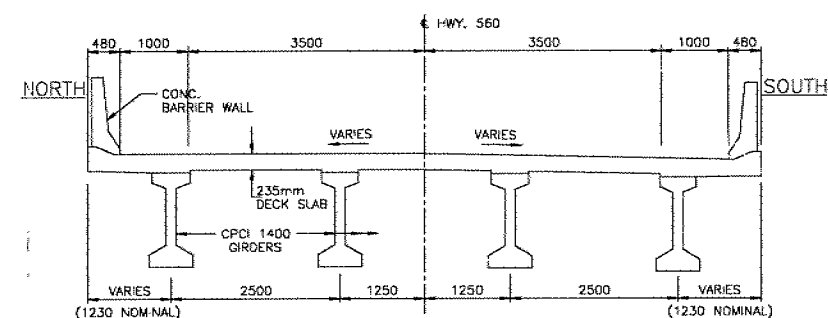


revised
63

From P.E. Jones,
Jan 7/98



PLAN
SCALE 1:200



TYPICAL SECTION
SCALE 1:50

GENERAL NOTES

- CLASS OF CONCRETE:
-GIRDERS.....45 MPa
-REMAINDER.....30 MPa
- CLEAR COVER TO REINFORCING STEEL:
-ABUTMENTS AND WINGWALLS.....70±20
-DECK: TOP.....80±20
 BOTTOM.....40±10
-REMAINDER.....70±20
UNLESS OTHERWISE NOTED
- REINFORCING STEEL SHALL BE GRADE 400 UNLESS OTHERWISE SPECIFIED. BAR MARKS WITH PREFIX C DENOTE COATED BARS.

CONSTRUCTION NOTES

- THE CONTRACTOR SHALL ESTABLISH THE BEARING SEAT ELEVATIONS BY DEDUCTING THE ACTUAL BEARING THICKNESSES FROM THE TOP OF THE BEARING ELEVATIONS. IF THE ACTUAL BEARING THICKNESSES ARE DIFFERENT FROM THOSE GIVEN WITH THE BEARING DESIGN DATA, THE CONTRACTOR SHALL ADJUST THE BEARING SEAT ELEVATIONS AND THE REINFORCING STEEL TO SUIT THE ACTUAL HEIGHTS.
- NO BACKFILL SHALL BE PLACED UNTIL DECK CONCRETE HAS REACHED 75% OF ITS SPECIFIED STRENGTH.
- BACKFILL SHALL BE PLACED SIMULTANEOUSLY BEHIND BOTH ABUTMENTS KEEPING THE HEIGHT OF BACKFILL APPROXIMATELY THE SAME. AT NO TIME SHALL THE DIFFERENCE IN ELEVATION BE GREATER THAN 0.5m.

LIST OF ABBREVIATIONS

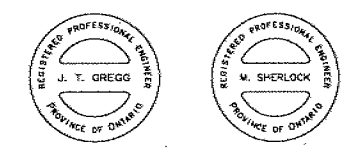
BVC DENOTES BEGINNING OF VERTICAL CURVE
EVC DENOTES END OF VERTICAL CURVE
W.P. DENOTES WORKING POINT

LIST OF DRAWINGS

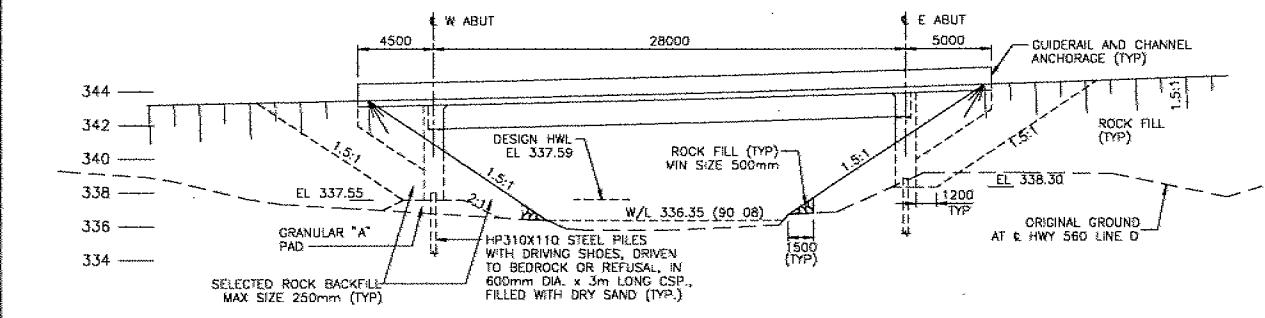
- GENERAL ARRANGEMENT
- BOREHOLE LOCATIONS & SOIL STRATA
- WEST ABUTMENT & WINGWALLS - PLANS & SECTIONS
- WEST ABUTMENT & WINGWALLS - ELEVATIONS
- EAST ABUTMENT & WINGWALLS - PLANS & SECTIONS
- EAST ABUTMENT & WINGWALLS - ELEVATIONS
- PILE DRIVING - STEAM & DIESEL HAMMERS
- PRESTRESSED GIRDERS
- DECK REINFORCING & SCREED ELEVATIONS
- BARRIER WALL W/O RAILING
- 6000mm APPROACH SLAB
- AS CONSTRUCTED ELEVATIONS AND DIMENSIONS
- STANDARD DETAILS
- QUANTITIES - STRUCTURE

APPLICABLE STANDARD DRAWINGS

OPSD-3505.00 (MODIFIED) ROCK BACKFILL REQUIREMENTS ABUTMENTS
OPSD-4010.00 GUIDERAIL AND CHANNEL ANCHORAGES



DRAWING NOT TO BE SCALED
100 mm ON ORIGINAL DRAWING



ELEVATION
SCALE 1:200

B.M. 337.843
DRILL BIT IN ROCK
44.5 RT. STA 11+227.0

REVISIONS	DESCRIPTION
DESIGN JTG.	CHK MGS. CODE OHBDC'91
DRAWN V.Z.	CHK MAN. SITE 47-41
	STRUCT
	SCHEME
	DWG 1

FILE COPY



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FOUNDATION DESIGN SECTION

**foundation
investigation and
design report**

ENGINEERING MATERIALS OFFICE
FOUNDATION DESIGN SECTION

WP 200-88-02

DIST 14

HWY 560

STR SITE 47-41

Hwy. 560 and East Montreal River

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FOUNDATION INVESTIGATION REPORT
For
Hwy. 560 and East Montreal River
W.P. 200-88-02, Str. Site 47-41
Hwy. 560, District 14, New Liskeard

INTRODUCTION

This report summarizes the results of a foundation investigation conducted at the aforementioned site between 91 11 20 and 91 11 25. A two lane one span structure has been proposed located approximately 25 m west of the existing one lane Bailey Bridge which currently carries Hwy. 560 over the East Montreal River.

A total of six sampled boreholes were advanced as part of this project by means of 82 mm I.D. hollow stem augers. These boreholes were extended down to depths of 5.0 m to 9.6 m.

SITE DESCRIPTION

The site is located just west of the Hamlet of Gowganda (45 km west of the Town of Elk Lake) along Hwy. 560 in the Geographic Township of Nicol, Timiskaming District.

Hwy. 560 is a narrow two lane road paved from Elk Lake to the East Montreal River Bridge, which consequently then turns into gravel westward towards Shinning Tree. The terrain surrounding the site is heavily forested with rolling hills and randomly placed boulder outcrops. The river is approximately 15-20 m wide with shallow but rapid movement of water flowing northward.

There is no noticeable land-use activity on site probably due to its remote location.

The area is part of the Canadian Shield and the rock formation is classified as precambrian. The bedrock is mostly covered with a thin mantle of drift which includes ground moraine and silt. The glaciolacustrine deposits in the river bed consist of sand, gravels and silt and have been deposited following the last glaciation. (Chapman and Putnam)

INVESTIGATION PROCEDURES

Soil data and inherent properties were obtained by in situ and laboratory

testing. The procedures employed are discussed below.

Field Investigation

The field work for the investigation was carried out between 91 11 20 and 91 11 25 and consisted of a total of 6 sampled boreholes which were advanced to depths of up to 9.6 m below natural ground surface. Bedrock was rock cored in one borehole (BH 3). Four boreholes were advanced at the east and west abutments and two at the approaches. Ground surface elevations of the boreholes ranged from 336.8 m to 339.1 m, the ground surface elevation increased east and west away from the East Montreal River.

The boreholes were advanced using conventional hollow stem augers together with wash boring and rock coring techniques. Due to the rough terrain and forested condition of the site a dozer was utilized to clear and make a path for the drill. Some surficial material was relocated to flatten the area. A track mounted continuous flight auger drill rig was employed for the operation. Conventional rock coring methods were applied in retrieving rock core samples and to penetrate through boulders. Standard BXL core barrels within BW casing was used. In general, subsoil samples were retrieved at 0.7 m intervals for the surficial 3.0 m and at 1.5 m intervals, thereafter. Disturbed subsoil samples were retrieved by a split spoon sampler in accordance with the Standard Penetration Test (ASTM D1586).

All subsoil samples were identified in the field and returned to the laboratory for further examination and applicable testing.

Groundwater levels monitored throughout the duration of the investigation were obtained in the open boreholes. All boreholes were backfilled upon completion of the field work.

Survey information related to the location and elevation of boreholes was provided by the Northern Region, Surveys and Plans.

Laboratory Analysis

Laboratory test results carried out on select soil samples are given in the following section of this report and are illustrated on figures and borehole logs included in the Appendix.

SUBSURFACE CONDITIONS

General

The subsoil stratigraphy at the site consists of a heterogeneous mixture of silt, sand and gravel, trace clay (Glacial Till) which contained numerous boulders particularly at the ^{EAST} north abutment (BH7). This deposit was encountered throughout the site and extended down to auger refusal in all boreholes. In one of the boreholes located at the ^{NORTH} north abutment area (BH 8) about 2 m thick sand and gravel fill was encountered. At the ground surface within the flood plain area a thin layer of organics was encountered. In one borehole at the ^{WEST} south abutment, bedrock was encountered and drilled from a depth of 6.2 m. It is considered that bedrock or boulders are present at the refusal depth in the remaining boreholes. The groundwater level was found to be at the approximate elevation of the East Montreal River.

The locations of borings and the stratigraphical profile are shown on Dwg. No. 2008802-A in the attached Appendix. The field and laboratory test results are plotted on the record of borehole sheets also in the Appendix of this report. A brief description of the different soil types are given below.

Sand and Gravel, trace Silt (Probable Fill)

In one borehole located in the ^{EAST} north abutment area (BH 8), a probable fill layer composed of sand and gravel, trace silt was encountered to a depth of about 2.1 m below grade. The composition of this material is made up of 42% gravel, 51% sand and 7% silt. The results are shown on Figure 1 in the Appendix.

The 'N' values obtained within this layer range between 3 and 5 blows/0.3 m, indicating a very loose state of denseness.

Heterogeneous Mixture of Silt, Sand and Gravel, trace Clay (Glacial Till)

Below the probable fill layer in one borehole (BH8) and from the ground surface in the remaining boreholes is a non-cohesive deposit composed of a heterogeneous mixture of silt, sand and gravel (Glacial Till) with numerous boulders and cobbles was encountered to depths of 5.0 m to 9.6 m. A thin layer of organics was encountered at the abutment locations adjacent the river.

Results of Grain Size Distribution tests carried out on select samples are shown on Figure 2 in the Appendix, in envelope form. The material contained 5-61% gravel, 22-60% sand, 14-40% silt and clay sizes. One sample (BH 7, SS 7) contained 75% gravel and 3% silt and clay sizes. Boulders were encountered

throughout the site.

In this stratum the 'N' values ranged from 3 blows/0.3 m to >120 blows/0.3 m, but generally between 9 and 63 blows/0.3 m, indicating a compact to very dense state of denseness. Some low 'N' values were encountered within the top 1 -2 m depths whereas some relatively high 'N' values were obtained where boulders and/or bedrock was present.

Bedrock

The above stratum is underlain by arkose bedrock of the Southern Province. Bedrock was encountered and cored in one borehole (BH 3) at a depth of 6.2 m. A 1.5 m long bedrock sample was retrieved utilizing BXL rock core. Detailed descriptions of the rock are attached in the Appendix entitled "Rock Core Description".

Core Recovery (CR) and Rock Quality Designation (RQD) were determined in situ to evaluate the competence and integrity of the rock. For the one sample retrieved it had a recovery of 87% and Rock Quality Designation of 44%. Based on these results, the arkose bedrock can be classified as strong, slightly weathered to unweathered with fractures close to very closely spaced. Laboratory evaluations were conducted by D. A. Williams, Petrographer.

GROUNDWATER CONDITIONS

Observation of the groundwater level was carried out by measuring the water table in open boreholes. The water table varied from 25 cm to 1.8 m below the ground surface which generally corresponded to the elevation of the East Montreal River. These readings were taken upon completion of the investigation.

Groundwater levels in general are subject to seasonal fluctuations and hence can vary from the values given in this report.

DISCUSSION AND RECOMMENDATIONS

It is proposed to construct a bridge structure and related approaches that will carry the realigned Hwy. 560 over the East Montreal River. The proposed structure is a single span having approximate span length and width of 32.5 m and 10 m respectively. The proposed profile grade of Hwy. 560 is approximately 344 m which is equivalent to approach fill heights of 5-7 m. The elevation of the natural ground surface at the bridge site is approximately 337 m, however due to the river being located in a valley the ground elevation rises quickly to the north and south and the fill heights taper off. The approaches to the existing bailey bridge appear to be performing adequately with no signs of instability.

To facilitate the design and construction of the proposed structure foundations and related earthworks for the approach ramps, the following foundation and geotechnical recommendations are provided in the scope of this report.

- 1) Structure Foundation
- 2) Lateral Earth Pressure
- 3) Slope Stability
- 4) Construction Considerations

- 1) Structure Foundation

The surficial 1 to 2 m of the glacial till or probable fill is in a loose state locally which is not considered suitable to support shallow spread footings. Locating the abutment footings below 2 m +/- depth would involve excavations below the river water level and therefore is not favoured.

It is therefore recommended that the abutment footings be designed as perched footings, located on rockfill as shown on Figure 3. With this option, it is recommended that the fill encountered in the north abutment area should be excavated and replaced by rockfill. In addition to the above the top 1 m of the rockfill, immediately below the footing shall consist of select well graded rockfill with maximum particle size of 0.3 m or less. Provision should also be made to 'Chink' with low slump concrete before constructing the footings. Footings constructed as above shall be designed using an S.L.S capacity of 250 KPa, with an associated differential settlement of 50 mm between the two abutments. Total settlements of footings located on rockfill will depend upon the type, composition, thickness and method of placement of the rockfill. For design purposes a factored U.L.S. capacity of 400 KPa shall be used for footings on rockfill as discussed above.

The lateral resistances may be calculated using an unfactored ϕ value of 30° for footings on rockfill.

2) Lateral Earth Pressure

Free draining material such as Granular 'A', Granular 'B' backfill or Rockfill in accordance with special provision No. 109F03 (Latest Revision) shall be used within a wedge behind the abutments and retaining walls bounded by a plane rising at 60° to the horizontal as shown in the Figure 6-9.6.1 of the O.H.B.D.C. The application of granular material combined with weep holes in the abutment walls to drain any accumulation of water in the backfill will prevent hydrostatic pressure build-up. In the case of rockfill special care will be required to avoid damage of the abutments. It would be preferable to place a 0.5+/- m cushion of smaller diameter (Less than 0.3m diameter) rockfill between the structure and the main mass of rockfill.

Design parameters of the soil are given below for purposes of the O.H.B.D.C..

	<u>Granular 'A'</u>	<u>Granular 'B'</u>	<u>Rock Fill</u>
Angle of Internal Friction (ϕ)	35°	30°	35°
Unit Weight (kN/m^3) γ	22.8	21.2	17.5
*Coefficient of Active Earth Pressure (K_a)			
- S.L.S.	0.27	0.33	0.27
- U.L.S.	0.33	0.4	0.33
*Coefficient of Earth Pressure at Rest (K_o)			
- S.L.S.	0.43	0.5	0.43
- U.L.S.	0.5	0.58	0.5

*Horizontal surface backfill only. Appropriate consideration must be given to sloping backfill.

Flexible designed abutments would utilize active earth pressure coefficients while rigid abutments would utilize earth pressure at rest coefficients.

3) Slope Stability

Rockfills shall be constructed using a 1.5H:1V slope, along the forward and transverse directions. For the heights exceeding 6 m, a 2 m mid-height berm should be utilized.

Settlement of approach embankments constructed of rock fill will undergo an immediate settlement of the order of 60 to 120 mm. However settlements will continue over a long period of time due to degradation and/or reorientation of the rockfill.

4) Construction Considerations

Any topsoil or organic material should be removed within the plan limits of the approach embankments.

The footings require an equivalent minimum of 2.2 m of soil cover for frost protection. The insulation value of rock fill is half of soil cover.

Except for the removal of the fill and organic layers the construction as proposed herein will not extend below groundwater or river water level. These excavations are to be backfilled with rockfill, and therefore no major dewatering would be required at this site.

MISCELLANEOUS

The fieldwork for this investigation was carried out under the supervision of M. Michalek, Junior Foundation Engineer. The equipment was owned and operated by Master Soil Investigation Limited.

The report was written by M. Michalek, under the general supervision of B. Iyer, Senior Foundation Engineer and reviewed by M. Devata, P.Eng., Chief Foundation Engineer.



A handwritten signature in cursive script, appearing to read "M. Michalek".

M. Michalek
Junior Foundation Engineer

A handwritten signature in cursive script, appearing to read "M. Devata".

M. Devata, P.Eng.
Chief Foundation Engineer

APPENDIX

EXPLANATION OF TERMS USED IN REPORT

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

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

SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSENESS.

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

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

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

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

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

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

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

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

MECHANICAL PROPERTIES OF SOIL

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

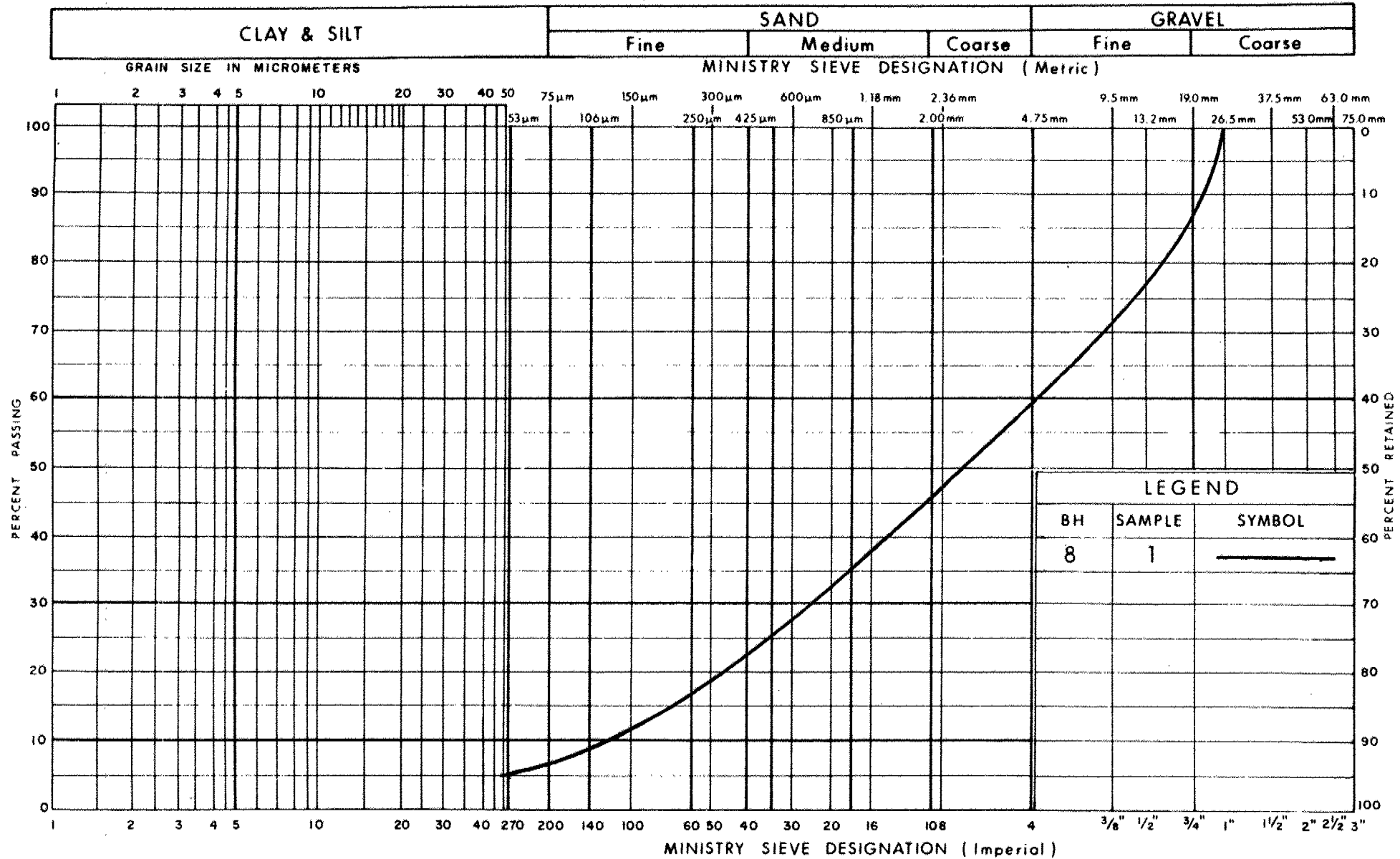
STRESS AND STRAIN

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

PHYSICAL PROPERTIES OF SOIL

ρ_s	kg/m^3	DENSITY OF SOLID PARTICLES	e	1, %	VOID RATIO	e_{min}	1, %	VOID RATIO IN DENSEST STATE
γ_s	KN/m^3	UNIT WEIGHT OF SOLID PARTICLES	n	1, %	POROSITY	I_D	1	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
ρ_w	kg/m^3	DENSITY OF WATER	w	1, %	WATER CONTENT	D	mm	GRAIN DIAMETER
γ_w	KN/m^3	UNIT WEIGHT OF WATER	S_r	%	DEGREE OF SATURATION	D_n	mm	n PERCENT - DIAMETER
ρ	kg/m^3	DENSITY OF SOIL	w_L	%	LIQUID LIMIT	C_u	1	UNIFORMITY COEFFICIENT
γ	KN/m^3	UNIT WEIGHT OF SOIL	w_p	%	PLASTIC LIMIT	h	m	HYDRAULIC HEAD OR POTENTIAL
ρ_d	kg/m^3	DENSITY OF DRY SOIL	w_s	%	SHRINKAGE LIMIT	q	m^3/s	RATE OF DISCHARGE
γ_d	KN/m^3	UNIT WEIGHT OF DRY SOIL	I_p	%	PLASTICITY INDEX = $w_L - w_p$	v	m/s	DISCHARGE VELOCITY
ρ_{sat}	kg/m^3	DENSITY OF SATURATED SOIL	I_L	1	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$	i	1	HYDRAULIC GRADIENT
γ_{sat}	KN/m^3	UNIT WEIGHT OF SATURATED SOIL	I_C	1	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$	k	m/s	HYDRAULIC CONDUCTIVITY
ρ'	kg/m^3	DENSITY OF SUBMERGED SOIL	e_{max}	1, %	VOID RATIO IN LOOSEST STATE	j	KN/m^2	SEEPAGE FORCE
γ'	KN/m^3	UNIT WEIGHT OF SUBMERGED SOIL						

UNIFIED SOIL CLASSIFICATION SYSTEM



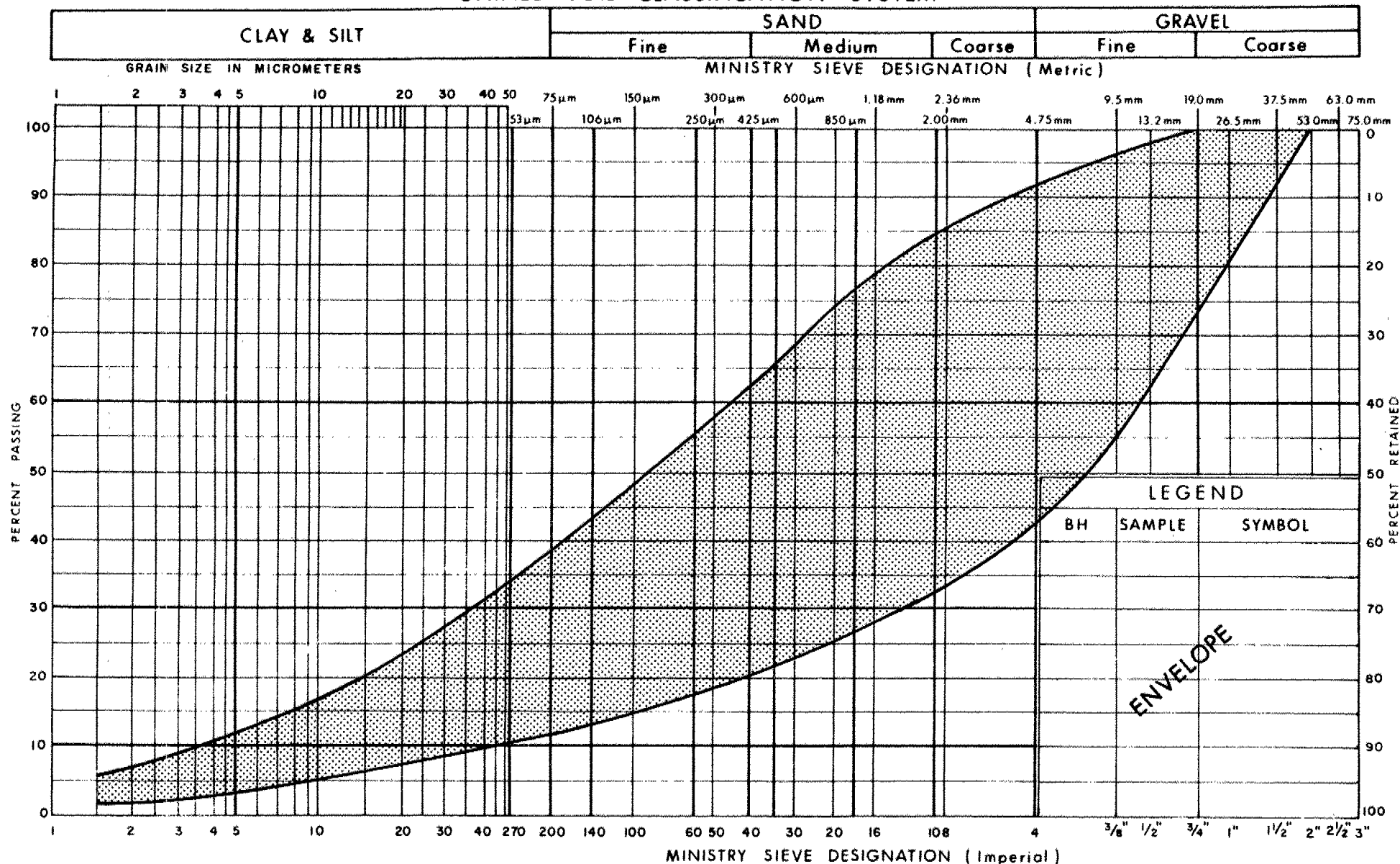
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**GRAIN SIZE DISTRIBUTION
SAND & GRAVEL
TRACE SILT (PROBABLE FILL)**

FIG No 1

W P 200-88-02

UNIFIED SOIL CLASSIFICATION SYSTEM



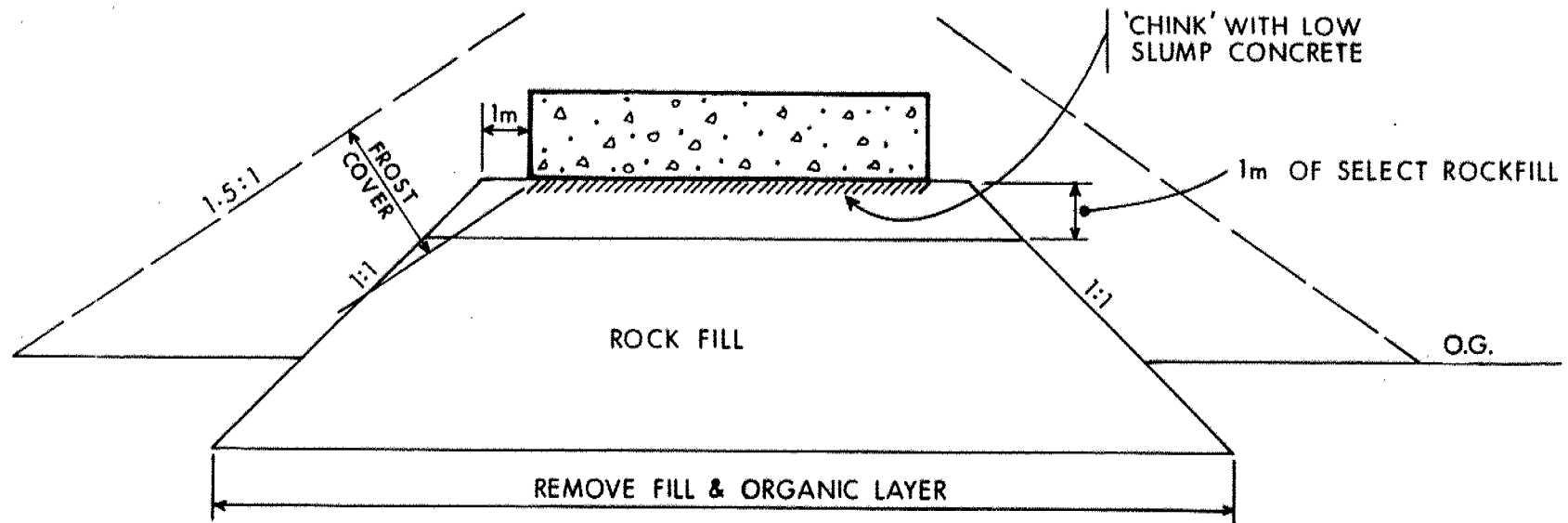
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GRAIN SIZE DISTRIBUTION
HETEROGENEOUS MIXTURE OF SILT, SAND & GRAVEL
TRACE CLAY (GLACIAL TILL)

FIG No 2

W P 200-88-02



NOTES:

- 1- REMOVE VERY LOOSE FILL & ORGANIC LAYER WITHIN THE LIMITS SHOWN OF THE FIGURE.
- 2- PLACE ROCKFILL TO THE UNDERSIDE OF SELECT ROCKFILL LAYER
- 3- PLACE MINIMUM 1m THICK LAYER OF SELECT WELL GRADED ROCKFILL, WITH MAXIMUM PARTICLE SIZE OF 0.3m OR LESS.
- 4- 'CHINK' WITH LOW SLUMP CONCRETE BEFORE POURING CONCRETE FOOTING.

FIG-3
WP 200-88-02

1 OF 1

METRIC

+3, x5: Numbers refer to Sensitivity

RECORD OF BOREHOLE No 3

1 OF 1 METRIC

W.P. 200-88-02 LOCATION Sta. 11+204.5; g/s 2.5m Lt. CL Hwy 560 ORIGINATED BY M.M.
 DIST 14 HWY 560 BOREHOLE TYPE Hollow Stem Auger, Wash Boring COMPILED BY M.M.
 DATUM Geodetic DATE 91/11/21 CHECKED BY B.L.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL			
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa										WATER CONTENT (%)		
								○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE												
336.8	Ground Surface							20	40	60	80	100								
0.0	Trace Organics																			
	Loose		1	SS	7		336													
			2	SS	5		335										19 54 25 2			
			3	SS	37		334													
	Heterogeneous Mixture of Silt, Sand and Gravel Trace Clay [Glacial Till] Compact to Very Dense		4	SS	53		333													
			5	SS	20		332													
330.6			6	SS	120	/15cm	331													
6.2	Arkose Bedrock Strong, Weathered to Slightly Weathered		7	RC BXL	REC 87%		330										RQD 44%			
329.0																				
7.8	End of Borehole																			

RECORD OF BOREHOLE No 4

1 OF 1

METRIC

W.P. 200-88-02 LOCATION Sta. 11+208.5; o/s 4.75m Rt CL Hwy 560 ORIGINATED BY M.M.
DIST 14 HWY 560 BOREHOLE TYPE Hollow Stem Auger, Wash Boring COMPILED BY M.M.
DATUM Geodetic DATE 91/11/21 CHECKED BY B.J.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			SHEAR STRENGTH kPa ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL * LAB VANE									
							20	40	60	80	100						
336.9	Ground Surface																
0.0	Trace Organics																
			1	SS	18												
			2	S	12												
			3	SS	63												
			4	SS	32												
	Heterogeneous Mixture of Silt, Sand and Gravel Trace Clay [Glacial Till] Compact to Very Dense																
			5	SS	45												
330.3			6	SS	82											16 54 25 5	
330.2	End of Borehole																
6.7	End of Cone Test											120/	13cm				
	Probable Bedrock or Boulder																

RECORD OF BOREHOLE No 7

1 OF 1

METRIC

W.P. 200-88-02 LOCATION Sta. 11+242.6; o/s 6.2m Lt of Hwy 560 ORIGINATED BY M.M.
 DIST 14 HWY 560 BOREHOLE TYPE Hollow Stem Auger, Wash Boring COMPILED BY M.M.
 DATUM Ceodetic DATE 91/11/21 CHECKED BY B.I.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
337.1	Ground Surface																
0.0	Organics																
			1	SS	70		336										
	Boulders		2	RC	REC 44%		335										RQD 25%
			3	RC	REC	67%											RQD 67%
	Heterogeneous Mixture of Silt, Sand and Gravel Trace Clay [Glacial Till] Compact to Very Dense		4	SS	45		334										40 37 18 5
			5	SS	53		333										
			6	SS	24		332										
			7	SS	120	/8cm	331										75 22 2 1
330.5	Cobbles and Boulders																
6.6	End of Borehole Probable Bedrock or Boulder																

+3, x5: Numbers refer to
Sensitivity

20
15-5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 8

1 OF 1

METRIC

W.P. 200-88-02 LOCATION Sta. 11+248.5; o/s 4.5m Rt of Hwy 560 ORIGINATED BY M.M.
 DIST 14 HWY 560 BOREHOLE TYPE Hollow Stem Auger COMPILED BY M.M.
 DATUM Geodetic DATE 91/11/21 CHECKED BY B.I.

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC LIMIT w _p	NATURAL MOISTURE CONTENT w	LIQUID LIMIT w _L	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%)
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES			20	40	60	80	100					
339.1	Ground Surface																
0.0	Sand and Gravel Trace Silt (Probable Fill) Very Loose		1	SS	5		338										42 51 7 0
337.0			2	SS	3		337										
2.1	Boulders and Cobbles Trace Organics, Dark Brown		3	SS	27		336										61 25 13 1
			4	SS	23		335										
	Heterogeneous Mixture of Silt, Sand and Gravel Trace Clay [Glacial Till] Compact to Very Dense		5	SS	41		334										
			6	SS	66	/23cm	333										
			7	SS	12		332										
							331										
329.5			8	SS	90	/13cm	330										13 53 28 6
9.6	End of Borehole Probable Boulder or Bedrock																

RECORD OF BOREHOLE No 10

1 OF 1

METRIC

W.P. 200-88-02 LOCATION Sta. 11+260.8; CL Hwy 560 ORIGINATED BY M.M.
 DIST 14 HWY 560 BOREHOLE TYPE Hollow Stem Auger COMPILED BY M.M.
 DATUM Geodetic DATE 91/11/21 CHECKED BY B.I.

SOIL PROFILE		SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT					PLASTIC NATURAL LIQUID LIMIT MOISTURE CONTENT			UNIT WEIGHT 7 kN/m ³	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE			'N' VALUES	SHEAR STRENGTH kPa 20 40 60 80 100 ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE 10 20 30 40 50					WATER CONTENT (%) W _p W W _L 20 40 60			
338.8	Ground Surface															
0.0	Heterogeneous Mixture of Silt, Sand and Gravel Trace Clay [Glacial Till] Compact to Dense ----- Loose -----		1	SS	26											5 55 30 10
			2	SS	20											
			3	SS	9											
			4	SS	36											
333.8			5	SS	93	/25cm										
5.0	End of Borehole Probable Boulder or Bedrock															

ROCK CORE DESCRIPTION

WP 200-88-02

Page 1 of 1

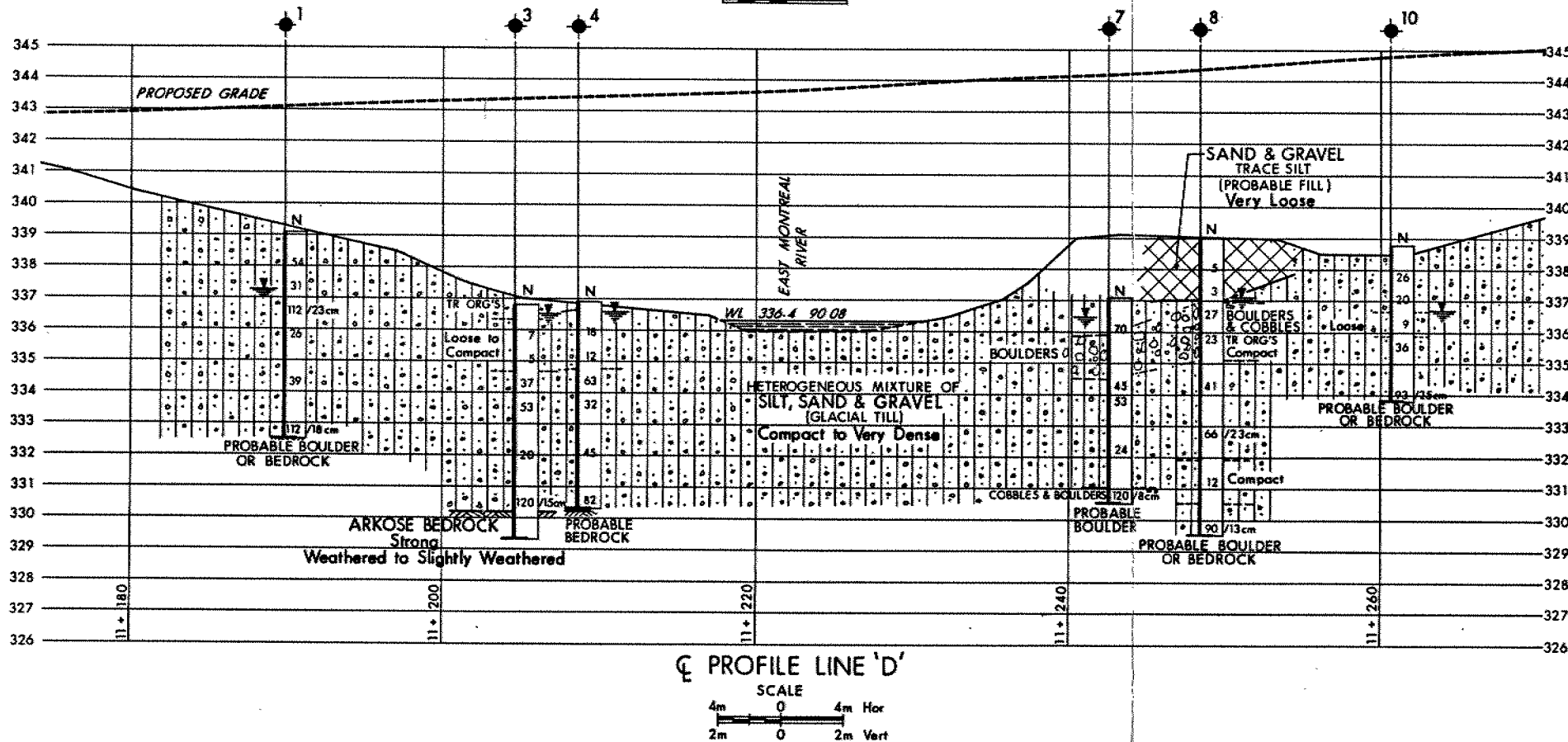
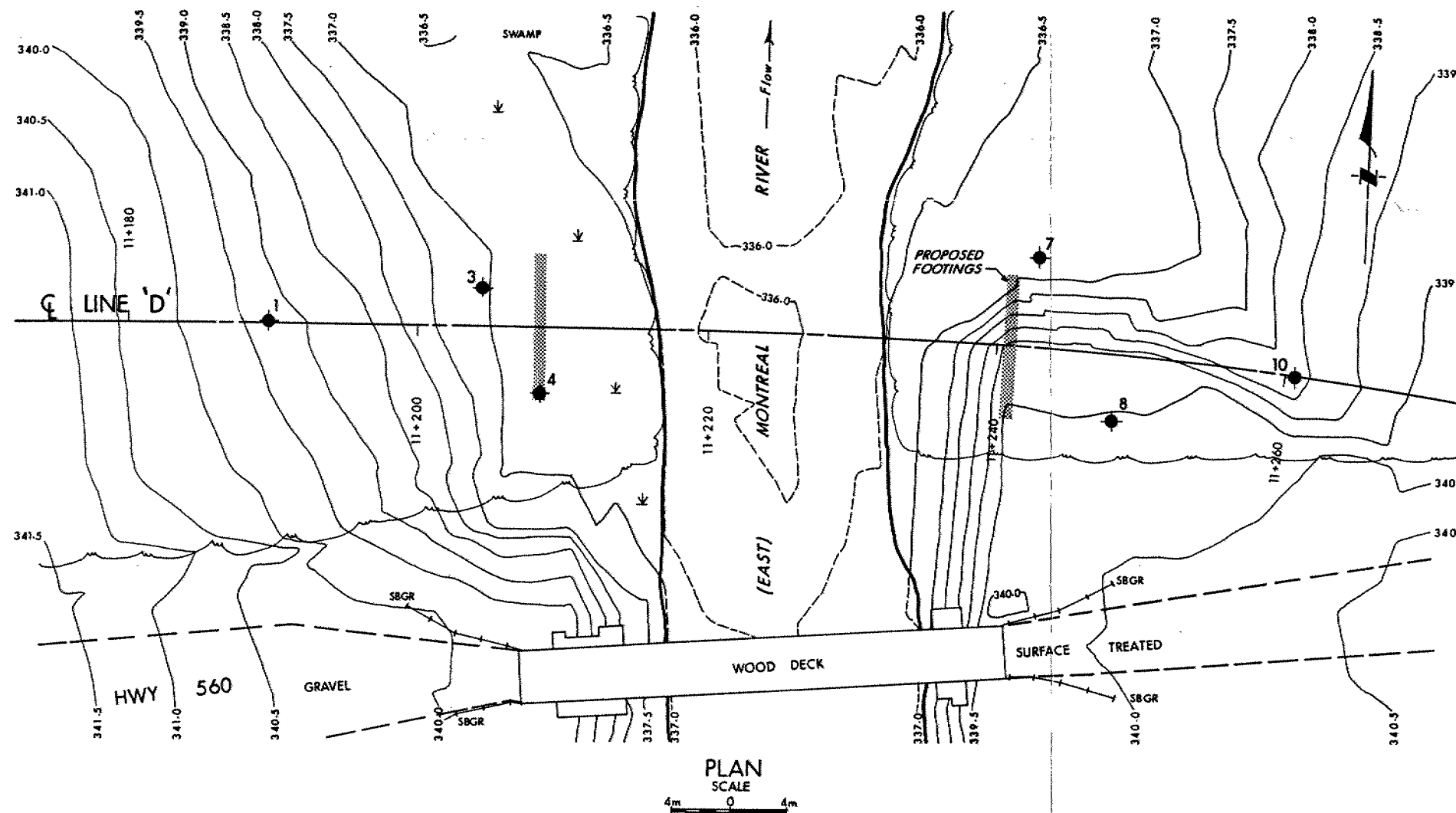
CORE RECOVERY					CORE DESCRIPTION	
BH#	RC#	DEPTH (m)	% CR*	% RQD*	DEPTH (m)	DESCRIPTION
3	7	6.20-7.87	87	44	6.20-7.87	ARKOSE, blackish red to light olive brown; medium to coarse grained; strong; unweathered to slightly weathered; fractures close to very close spaced, flat to near vertical, undulating to planar, rough to smooth.
7	2	1.22-2.44	44	25	1.22-2.59	OVERBURDEN (boulder till).
	3	2.44-2.59	67	67		

*CR = CORE RECOVERY

*RQD = ROCK QUALITY DESIGNATION

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

Logged by: DAW, Soils and Aggregates Section



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

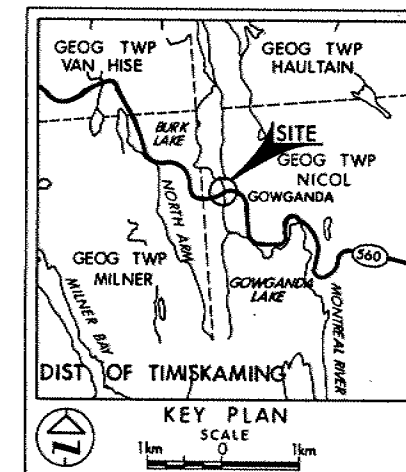
CONT No
WP No 200-88-02

EAST MONTREAL RIVER

BORE HOLE LOCATIONS & SOIL STRATA



SHEET



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)
- WL at time of investigation 91 11

No	ELEVATION	STATION	OFFSET
1	339.1	11+189.7	CL
3	336.8	11+204.5	2.5m LT
4	336.9	11+208.5	4.8m RT
7	337.1	11+242.6	6.2m LT
8	339.1	11+248.5	4.5m RT
10	338.8	11+260.8	CL

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.

DATE	BY	DESCRIPTION

Geocres No 41P-20

HWY No 560 (LINE 'D')	DIST 14
SUBAND MM CHECKED	DATE 92 03 10
DRAWN DT CHECKED	APPROVED
	SITE 47-41
	DWG 2008802-A