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DIST. 6 REGION

W.P. No. 49-71-01

CONT. No. 83-27

W. O. No.

STR. SITE No. 37-1085

HWY. No. 427

LOCATION Morning Star Overpass

No of PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

G.I.-30 SEPT. 1976

CONT 83-27

Ontario

Ministry of
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foundation investigation and design report

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ENGINEERING MATERIALS OFFICE
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WP 49-71-01 DIST 6
HWY 427 STR SITE 37-1085

Finch Avenue over Humber River
(West Branch)

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GEOCRES 30M12-142 DATE SEP 21 1979

FOUNDATION INVESTIGATION REPORT
For
Finch Avenue over Humber River (West Branch),
W.P. 49-71-01, Site 37-1085,
Hwy. 427, District 6, Toronto.

INTRODUCTION

This report presents the results of our investigation of the subsurface conditions at the above mentioned site. Fieldwork was carried out in two stages. The earlier investigation, which was for feasibility study purposes, was done on October 16, 1978, consisting of one sampled borehole accompanied by a dynamic cone penetration test. The later investigation was done from August 1, 1979 to August 9, 1979, consisting of a total of eight sampled boreholes, five of which were accompanied by a dynamic cone penetration test. All the borings were advanced by means of an auger machine which was equipped with 3¼" I.D. hollow stem augers. The depth of the boreholes ranged from 14 to 50 feet below ground surface.

SITE AND GEOLOGY

The site is located approximately 1.5 miles north of Rexdale Boulevard and 0.5 miles east of Indian Line, in the Borough of Etobicoke, Metropolitan Toronto.

In this area, the West Humber River meanders in a valley which it has eroded into the surrounding terrain. The valley is about 30 to 35 feet deep and approximately 1000 feet wide from crest to crest. The valley walls are relatively flat with a slope of about 6:1, to as steep as 1:1, with the steeper walls generally located on the north side of the valley. From visual observations, the valley walls appear to be stable. The water in the West Humber River is controlled by a dam at the Claireville Conservation area, which is located about one mile upstream of the site. During the time of the recent investigation, the width of the river ranged from 25 feet to 50 feet and the water in the channel was about 2 to 3 feet deep. The bottom of the river is generally strewn with cobbles and boulders.

Geologically, the site is located in a physiographic region known as the "Peel Plain". Most of the overburden in this physiographic region generally consists of Pleistocene deposits laid down under great thickness of continental glaciers. At places, the glacial drifts were further modified with a clay mantle which was left over from the 'Peel Ponding' periods. The underlying bedrock in this area is a shale of the Dundas-Meadford formation. Within the river valley, some of the glacial drifts and the upper portion of the shale bedrock have been eroded away. At places, shale bedrock is exposed on the valley walls. Over the flood plain area, the river has left recent alluvial deposits of sands, silts and clays.

SUBSURFACE CONDITIONS

The locations and elevations of the boreholes, together with an estimated subsoil stratigraphy, are shown in Drawing 497101-A. In view of the significant difference in the subsurface conditions in the river valley and in the surrounding high grounds, the subsoil conditions will be described as follows:

River Valley

Because of erosion and deposition by the West Humber river, the subsurface conditions in the river valley are rather non-uniform. Not only the sequence of subsoil strata varies considerably, but also the bedrock surface, and hence the thickness of the overburden changes substantially. In this regard, reference should be made to the Borehole Record Sheets, which are appended to this report, for a detailed description of the subsurface conditions at the various locations.

In general, the overburden in the river valley ranges from one to 35 feet thick and consists of alluvium which is underlain either directly by shale bedrock or by glacial drift and interglacial deposits of clays and sands, then followed by bedrock. A description of the various subsoil types is as follows:

Alluvial Deposits: The river valley is covered with a layer of alluvial deposit which is about one to nine feet thick. This layer of alluvial origin generally consists of one to two feet of cobbles and boulders within the river channel, up to four feet of sand and gravel within the river banks, and up to nine feet of sandy silt over the floodplain area. Occasional pockets or inclusions, up to 5 feet thick, of gravelly sand and silty clay with partially decomposed wood were also encountered within the sandy silt layer. Typical grain size distribution curves of the sandy silt material are shown in Figure 1. Based on the 'N' values of 8 to 38 blows per foot, the relative density of the alluvium is classified as compact to dense, but generally in the compact range.

Glacial Till: The alluvial deposit is underlain either directly by shale bedrock or in certain locations by a stratum of glacial till up to about 11 feet thick. The glacial till is a heterogeneous mixture of clay, silt, sand and gravel. Typical grain size distribution curves for the glacial till are shown in Figure 2 in an envelope form. The Atterberg limits and the moisture content of the glacial till as determined in the laboratory from representative samples are tabulated below.

	Range
Moisture content (w%)	8 to 13
Plasticity limit (w_p%)	13 to 16
Liquid limit (w_L%)	19 to 38

The plasticity index and the liquid limit of the glacial till are plotted on a Plasticity Chart, Figure 3. All the plots are above the 'A' line in the CL and CI zones, indicating that the glacial till is inorganic and has a matrix with a low to intermediate plasticity.

This 'N' values of 26 to greater than 100 blows per foot indicate that the consistency of the glacial till is in the very stiff to hard range.

Silty Clay: This cohesive subsoil underlies the glacial till deposit or in certain places the surficial alluvium, and has a thickness of up to 10 feet. The silty clay has a low to intermediate plasticity, as evidenced by a plasticity limit of 14 to 18% and a liquid limit of 39 to 47%. According to the 'N' values ranging from 35 to 80 blows per foot, the consistency of the silty clay is classified as very stiff to hard.

Silty Fine Sand: Underneath the glacial till or the silty clay is a further granular deposit which is about 4 to 13 feet thick and is composed of silty fine sand. Representative grain size distribution curves of the silty fine sand are shown in Figure 4 in an envelope form. The 'N' values ranged from 20 to 85 blows per foot. Accordingly, the relative density of the silty fine sand is assessed as compact to very dense, but generally in the dense range. This granular stratum is a confined aquifer under an artesian pressure.

Surrounding Highgrounds

The overburden in the surrounding highgrounds is about 23 feet thick. From ground surface downward, it consists of an 8 foot thick layer of very stiff brown silty clay with intermediate plasticity, followed by a 6 foot thick stratum of very dense silty fine sand, which in turn is underlain by a 9 foot thick deposit of very stiff to hard glacial till composed of a heterogeneous mixture of clay, silt, sand and gravel with a matrix of low plasticity. The overburden is underlain by shale bedrock.

Bedrock Conditions

Because of substantial erosion by the river in the geological past, the bedrock surface at this site varies considerably. It ranges from elevation 532 ± in the surrounding highgrounds to as low as elevation 488 ± at some locations in the floodplain. The estimated bedrock elevations are shown in Drawing No. 497101-A. Bedrock at this site is a shale of the Dundas-Meadford formation. The shale is grey, soft, fine textured and fissile. It also contains occasional limestone bands. The upper portion of the shale bedrock is extensively weathered. The weathered zone was found to extend as deep as 35 feet below bedrock surface in certain locations.

Groundwater Conditions

The groundwater conditions were observed by measuring the water level in the open boreholes or in the plastic standpipes installed in the boreholes. The results of observation are shown in the Borehole Record Sheets and in Drawing No. 497101-A. Two artesian zones were encountered in the river valley; one zone being in the lower sand deposit which is sandwiched between the cohesive subsoils and the shale bedrock, and the other zones being located in the transition between the weathered and the sound portion of the shale bedrock. The artesian head in the confined granular deposit was found to be as high as 4.5 feet above ground surface, corresponding to an elevation 527.5 ±, whereas the artesian head in the shale bedrock was generally less than one foot i.e., elevation 522 ± above ground surface. The water level in the West Humber River during the time of fieldwork was at elevation 516 ±.

DISCUSSION AND RECOMMENDATIONS

In conjunction with the proposed construction of Hwy. 427 in this area, it is required to extend Finch Avenue westerly from Metro Toronto into the City of Mississauga. In addition, it is also proposed to rechannelize the West Humber River. At the crossing of Finch Avenue Extension and the realigned West Humber River, two structure schemes are being considered, one for a regional flood condition and the other for a 100 year flood condition. In each structure scheme, there is also an alternative location for the west abutment, subjected to the approval by the Municipality Office. All the structure scheme have the same profile grade (elevation 545 ±) and will utilize perched abutments because fills in the order of 30 feet are required. Our recommendations for the structure foundations and approaches in the two schemes are on the following pages.

It should be noted that the underside of the pile caps or the spread footings should have a minimum of 4 feet of earth cover for frost protection purposes. Because of the presence of artesian pressure in the underlying granular layer, footing excavation must not be carried out too close to the confined aquifer, otherwise basal heave will occur. In view of this, the west pier footings must not be placed lower than elevation 516. Further, should the underside of the pile caps at the west abutment locations be located below elevation 527, which is the observed artesian head, an 18 inch thick Granular 'A' pad should be provided at the underside of the pile cap to prevent loss of fines in the subsoil due to the artesian flow because piles will be driven through the confined aquifer. If the various footing elements are located as recommended previously, no major dewatering problems are anticipated; any seepage into the footing excavation can be removed by pumping from sumps. The shale is susceptible to weathering upon exposure to the atmosphere, therefore the footing formation level should be protected with a 4 inch thick mass concrete working slab once the excavation is completed. In certain places, the shale is badly weathered and it could behave very much like a cohesive soil.

Scheme for Regional Flood Condition (span 80'-90'80')

Footing Location	℄ Station	Ref. B.H.	Type of Foundations	Allowable Capacity
West Abutment	109 + 92	6	A) Perched abutment on compacted Granular 'A' pad.	A) Allowable bearing pressure up to 2½ tsf for vertical load and a coefficient of friction of 0.7 for sliding resistance.
			B) Perched abutment on end-bearing H pile driven into shale bedrock. Approximate tip elevation 485 ±.	B) Maximum allowable structural capacity of the piles.
West Pier	110 + 72	4	Spread footings at elevation 516.	3½ tsf for vertical load and 2000 psf sliding resistance.
East Pier	111 + 62	3 & 3A	Spread footings on shale bedrock at or below elevation 512.	5 tsf for vertical load and 2000 psf sliding resistance.
East Abutment	112 + 42	1	A) Perched abutment on compacted Granular 'A' pad.	A) Up to 2½ tsf for vertical load and a coefficient of friction of 0.7 for sliding resistance.
			B) Perched abutment on end-bearing H piles driven into shale bedrock. Approximate tip elevation 510 ±.	B) Maximum allowable structural capacity of the piles.
Alternative West Abutment location	109 + 12	7	(Same as for West Abutment)	

Scheme for 100 Year Flood Conditions (span ratio 50'-65'-50')

Footing Location	℄ Station	Ref. B.H.	Type of Foundations	Allowable Capacity
West Abutment	110 + 44	5	A) Perched abutment on compacted Granular 'A' pad. B) Perched abutment on end-bearing H piles driven into shale bedrock. Approximate tip elevation 498 ±.	A) Up to 2.5 tsf for vertical load and a coefficient of friction of 0.7 for sliding resistance. B) Maximum allowable structural capacity of the piles.
West Pier	110 + 94	4	Spread footing at elevation 516.	3½ tsf for vertical load and 2000 psf for sliding resistance.
East Pier	110 + 59	3 & 3A	Spread footing on shale bedrock at or below elevation 512.	5 tsf for vertical load and 2000 psf for sliding resistance.
Wast Abutment	112 + 09	2	A) Perched abutment on compacted Granular 'A' pad. B) Perched abutment on end-bearing H piles driven into shale bedrock. Approximate tip elev elevation 510 ±.	A) Up to 2.5 tsf for vertical load and a coefficient of friction of 0.7 for sliding resistance. B) Maximum allowable structural capacity of the piles.
Alternative West Abutment location	109 + 94	6	A) Perched abutment on compacted Granular 'A' pad. B) Perched abutment on end-bearing H pile driven into shale bedrock. Approximate elevation 485 ±.	A) Up to 2.5 tsf for vertical load and a coefficient of friction of 0.7 for sliding resistance. B) Maximum allowable structural capacity of the piles.

Approaches

In order to achieve the proposed profile grade, fills up to feet high and cuts up to 10 feet deep will be required for the west approach and the east approach respectively. The subsurface conditions are competent that such fills and cuts will be stable if they are constructed not steeper than a 2:1 slope angle.

In the areas where piles are to be driven, any existing surficial cobbles and boulders in the ground should be completely removed prior to placing the embankment and the fill material should be free of particles larger than 3 inch in sizes.

Other Considerations

Backfill to the abutment walls should be composed of free draining granular type of material placed and compacted according to current MTC practice. It should be noted that heavy vibratory compacting equipment should not be used within the zone drawn with a line from the heel of the retaining wall stem at an angle of 1H to 1½V. Compaction of backfill within this restircted zone should be done by means of light, hand operated equipment.

To estimate the lateral earth pressure imposed by the weight of the backfill material and the surcharge, a coefficient of lateral earth pressure equal to 0.35 and a unit weight of 135 pcf for the granular backfill should be assumed.

Rechannelization of the West Humber River

Pertinent information about the proposed rechannelization of the West Humber River are not available to us at this stage. However, for preliminary purposes, the sides of the channel should be constructed not steeper than 2:1, and whenever cohesionless subsoils are encountered the sides and the bottom of the channel should be protected against erosion. Further, the bottom of the channel must not be located too close to the artesian zone otherwise construction porblems can be anticipated.

From a construction point of view, the following sequences are suggested:

- Construct the pier footings first.
- Relocate the West Humber River.
- Construct the East Abutment foundations.

B. Ly

LY

B. Ly, P. Eng.
Foundation Engineer.

M. Devata

M. Devata, P. Eng.
Senior Foundation Engineer.

September, 1979.

APPENDIX

Transportation and
Communications
Ontario

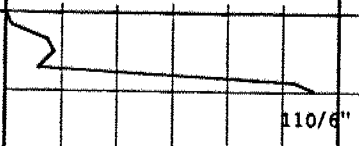
HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 1

W P 49-71-01
DIST 6 HWY 427
DATUM Geodetic
LOCATION Co-ords. N 15 891 368; E 967 485
BOREHOLE TYPE Hollow Stem Auger & Cone Test
DATE August 8, 1979
ORIGINATED BY BRL
COMPILED BY BRL
CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES		
515.7	Ground Level					∇Head	
514.7	Top Soil - Organic	~~					
1.0	Shale bedrock grey, and fissile with occasional thin limestone bands		1	SS	134/9"		
			2	SS	110/6"		510
			3	SS	140/10"		
			4	SS	147/9"		
			5	SS	153/8"		500
						Artesian water	
			6	SS	190/8"		
			7	SS	110/3"		
							490
	Weathered and soft		8	SS	110/3"		
	sound		9	RC	REC 90%	Encountered	480
478.2 / 37.5	End of Borehole						

DYNAMIC CONE PENETRATION RESISTANCE PLOT



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

PLASTIC LIMIT W_p — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L

WATER CONTENT (%)

UNIT WEIGHT γ

REMARKS & GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

Note:

The sound portion of the shale bedrock was under a low artesian pressure. The artesian head was about 6" above ground surface.

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

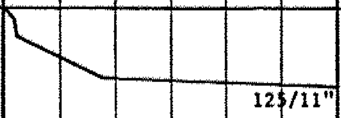
$15 \overset{20}{\underset{10}{\diamond}} 5$ (%) STRAIN AT FAILURE

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2

W P 49-71-01
LOCATION Co-ords. N 15 891 352; E 967 448
ORIGINATED BY BRL
DIST 6 HWY 427
BOREHOLE TYPE Hollow Stem Auger & Cone Test
COMPILED BY BRL
DATUM Geodetic
DATE August 7, 1979
CHECKED BY



SOIL PROFILE			SAMPLES					DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH ○ UNCONFINED ✚ FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT W_P NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L / WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV / DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE				
520.0	Ground Level										
0.0 515.0	Sand, dense		1	SS	38						39 39 (22)
5.0	Shale bedrock, grey and fissile with occasional limestone bands		2	SS	129						
			3	SS	75/9"						
			4	SS	99/9"		510				
			5	SS	185/9"						
			6	SS	181/9"						
	limestone		7	SS	142/9"		500				
			8	SS	100/5"						
	Weathered and soft		9	SS	125/5"		490				
	sound		10	SS	100/3"						
480.0			11	RC	REC	100%	480				
40.0	End of Borehole										

Note:

The sound portion of the shale bedrock was under a low artesian pressure. The borehole caved in to elevation 495 ± one day after completion, which stopped the light artesian flow.

+3, x5 : Numbers refer to Sensitivity

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

RECORD OF BOREHOLE No 3

W P 49-71-01
LOCATION Co-ords. N 15 891 344; E 967 413
ORIGINATED BY BRL
DIST 6 HWY 427
BOREHOLE TYPE Hollow Stem Augers & Cone Test
COMPILED BY BRL
DATUM Geodetic
DATE August 7, 1979
CHECKED BY

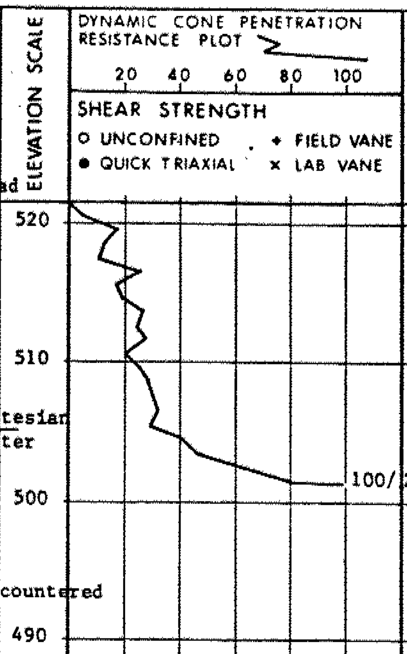
SOIL PROFILE

ELEV / DEPTH	DESCRIPTION	STRAT PLOT
521.5	Ground Level	
0.0 517.5	Sand compact	⁘
4.0 512.5	Sand and gravel with cobbles, dense	⁘
9.0	Shale bedrock, grey. badly weathered and cohesive weathered and fissile with occasional limestone bands	▨
480.9		
40.6	End of Borehole	

SAMPLES

NUMBER	TYPE	'N' VALUES	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	16	10 61 (29)
2	SS	100/4"	
3	SS	47	
4	SS	33	
5	SS	40	
6	SS	53	
7	SS	77	
8	SS	153	
9	SS	174/7"	
10	SS	150/6"	
11	SS	140/9"	
12	SS	165/7"	

GROUND WATER CONDITIONS: ▽ Head; Artesian Water; ▽ Encountered



PLASTIC LIMIT W_p — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L

WATER CONTENT (%)

UNIT WEIGHT γ

Note:

The lower portion of the shale bedrock was under a low artesian pressure. The artesian head was about 6" about ground surface.

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

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

Transportation and
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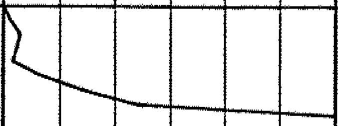
HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 3A

(Formerly B.H. No. 3
W.P. 88-78-00)

W P 49-71-01
LOCATION Co-ords. N 15 891 330; E 967 445
ORIGINATED BY MM
DIST 6 HWY 427
BOREHOLE TYPE Hollow Stem Auguers & BXL Rock Coring & Cone Test
COMPILED BY MM
DATUM Geodetic
DATE October 16, 1978
CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	PLASTIC LIMIT W_p NATURAL MOISTURE CONTENT W LIQUID LIMIT W_L WATER CONTENT (%)	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES						
519.7	Ground Level										
0.0 515.7	Sandy gravel, loose										
4.0 512.7	Glacial Till, hard		1 2	SS SS	5 48						
7.0 505.7	Bedrock, layers of limestone and weathered shale		3 4	BXL RC BXL RC	REC= RQD= REC= RQD=	60% 0% 60% 0%	510				
14.0	End of Borehole Note: Groundwater not established. Borehole was relatively dry upon completion of augering										

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

20
15 ✧ 5 (%) STRAIN AT FAILURE
10

Ministry of Transportation and Communications
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HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 4

W P 49-71-01
LOCATION Co-ords. N 15 891 310; E 967 336
ORIGINATED BY BRL
DIST 6 HWY 427
BOREHOLE TYPE Hollow Stem Auger
COMPILED BY BRL
DATUM Geodetic
DATE August 3, 1979
CHECKED BY

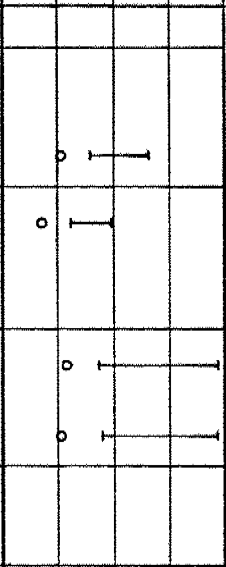
DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100
SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE
PLASTIC LIMIT Wp — NATURAL MOISTURE CONTENT W — LIQUID LIMIT W_L — WATER CONTENT (%) 10 20 30

ELEV / DEPTH	DESCRIPTION
523.0	Ground Level
0.0 517.0	Sand compact to dense
6.0 506.0	Glacial Till: Heterogeneous mixture of clay, silt, sand and gravel, very stiff to generally hard
17.0 502.0	Sand, medium gravel, very dense
21.0 483.0	Shale bedrock weathered, grey and fissile with occasional limestone bands
40.0	End of Borehole

SAMPLES NUMBER	TYPE	'N' VALUES	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
1	SS	11	520	0 57 (43)
2	SS	49		
3	SS	43		
4	SS	26		16 23 (61)
5	SS	109/10"	510	
6	SS	85		50 29 (21)
7	SS	48		
8	SS	144/10"	500	
9	SS	139/11"		
10	SS	171/11"	490	
11	SS	110/4"		
12	SS	Bouncing		

GROUND WATER CONDITIONS: Standpipe

UNIT WEIGHT γ



Note:

Artesian pressure was encountered in the lower sand layer. The artesian head rose to about 1.5 feet (corresponding to elevation 524.5 ±) above the ground surface.

+3, ×5 : Numbers refer to Sensitivity

15 ⌖ 5 (%) STRAIN AT FAILURE (20 above, 10 below)

Ministry of Transportation and Communications
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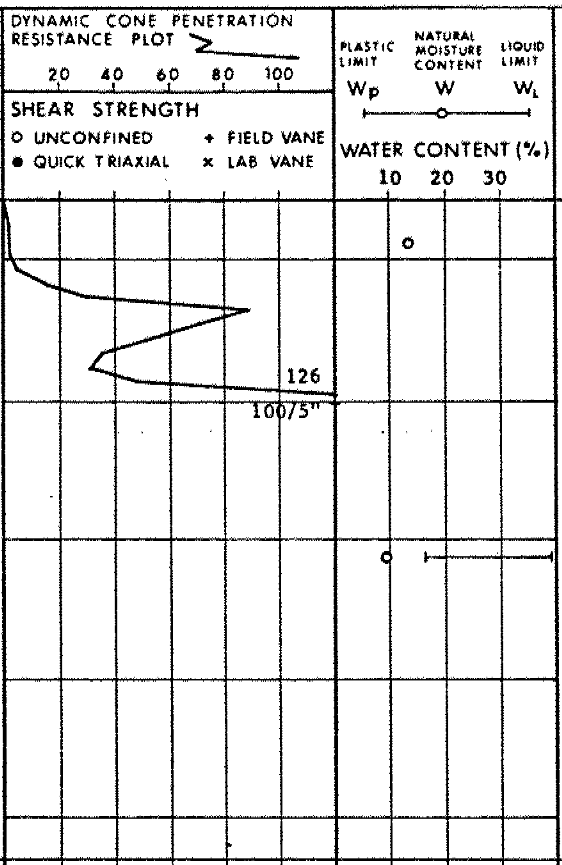
HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 5

W P 49-71-01
LOCATION Co-ords. N 15 891 280; E 967 303
ORIGINATED BY BRL
DIST 6 HWY 427
BOREHOLE TYPE Hollow Stem Augers & Cone Test
COMPILED BY BRL
DATUM Geodetic
DATE August 2, 1979
CHECKED BY

ELEV / DEPTH	SOIL PROFILE — DESCRIPTION	SAMPLES — NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
524.2	Ground Level						
0.0	Sandy silt with trace of clay, brown, compact	1	SS	9	▽	520	0 38 (62)
519.2 5.0	Glacial Till: Heterogeneous mixture of clay, sand & gravel. light brown, very stiff — gray, hard containing coarse gravel	2 3 4 5 6	SS SS SS SS SS	30 55 93 159/11" 100/5"		510	17 46 (37)
507.7 16.5	Silty sand, dense to very dense	7 8	SS SS	38 83			3 71 (26)
502.2 22.0	Shale bedrock badly weathered weathered soft and fissile with occasional limestone bands	9 10 11 12 13 14	SS SS SS SS SS SS	100/6" 120/6" 100/5" 140/6" 100/5" 110/3"		500 490 480	
477.0 47.2	End of Borehole						



UNIT WEIGHT γ

Note:

1. Slight artesian flow was encountered in the lower sand stratum.
2. The borehole caved in to elevation 507 ± one day after completion. This stopped the artesian flow.
3. The GWL in the caved borehole was about one foot below the ground surface.

+3, x5 : Numbers refer to Sensitivity

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

Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION - ENGINEERING MATERIALS OFFICE - SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 6

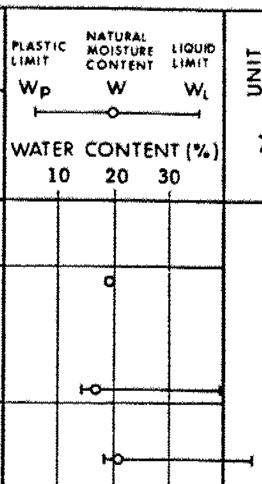
W P 49-71-01
LOCATION Co-ords. N 15 891 290; E 967 250
ORIGINATED BY BRL
DIST 6 HWY 427
BOREHOLE TYPE Hollow Stem Auger
COMPILED BY BRL
DATUM Geodetic
DATE August 2, 1979
CHECKED BY

ELEV / DEPTH	SOIL PROFILE: DESCRIPTION	SAMPLES: NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
524.8	Ground Level				∇ Heads		
0.0	Sandy silt, some clay, compact, brown	1	SS	10		520	
517.8		2	SS	9			0 33 (67)
7.0	Gravelly sand, compact to dense	3	SS	27			
512.8		4	SS	46	Artesian water		47 43 (10)
12.0	Clay, low to intermediate plasticity. Very stiff to hard; brown / grey	5	SS	80		510	
		6	SS	54			
		7	SS	43			
502.8		8	SS	52			
22.0	Sand, fine to medium grey, compact to generally very dense	9	SS	70		500	
		10	SS	28			
					∇ Encountered		
		11	SS	70			0 83 (17)
489.8						490	
35.0	Shale bedrock, occasional limestone bands	12	SS	136/11"			
		13	SS	100/4"			
	weathered / sound					480	
475.0		14	SS	REC 95%			
49.8	End of Borehole						

DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100

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

UNIT WEIGHT γ



Note:

The lower sand stratum was under artesian pressure with a head of about 1 foot above the ground surface.

+3, ×5 : Numbers refer to Sensitivity

20
15 ◇ 5 (%) STRAIN AT FAILURE
10

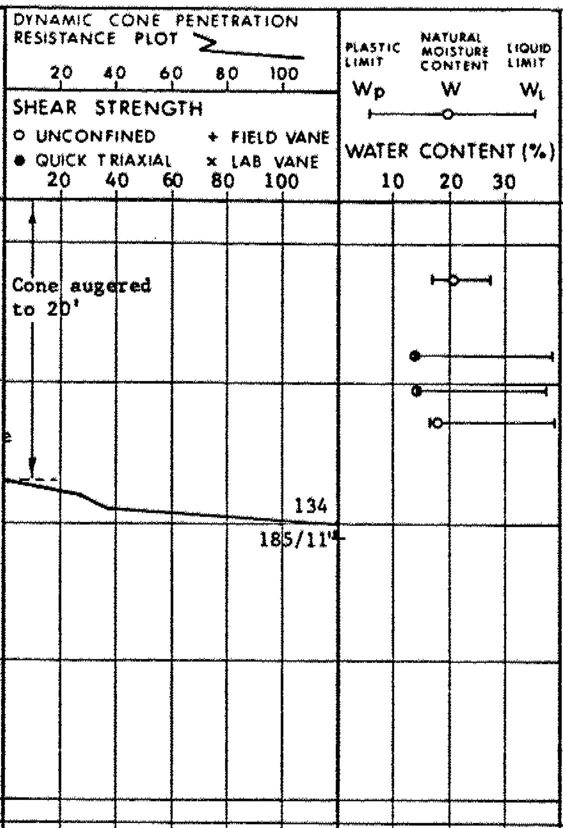
Ministry of Transportation and Communications
Ontario

HIGHWAY ENGINEERING DIVISION-ENGINEERING MATERIALS OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 7

W P 49-71-01	LOCATION Co-ords. N 15 891 255; E 967 183		ORIGINATED BY BRL
DIST 6 HWY 427	BOREHOLE TYPE Hollow Stem Auger & Cone Test		COMPILED BY BRL
DATUM Geodetic	DATE August 1, 1979		CHECKED BY

SOIL PROFILE		SAMPLES						
ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	UNIT WEIGHT γ	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
523.0	Ground Level							
0.0 518.5	Sandy silt, loose to compact	1	SS	5		520		0 30 (70)
4.5 513.5	Silty clay, low plasticity firm. organic matters and wood fibres	2	SS	6				
		3	SS	5			Om 3.5%	
9.5 508.0	Glacial Till: very stiff to hard	4	SS	37				
		5	SS	49		510		
15.0 501.0	Silty clay, low to intermediate plasticity, very stiff to hard	6	SS	44				
		7	SS	41	Standpipe			
		8	SS	35				
22.0 488.0	Sand to sand and gravel, compact to generally dense	9	SS	45		500		1 74 (25)
		10	SS	23				1 94 (5)
		11	SS	57				
		12	SS	47				
		13	SS	-		490		
35.0 478.7	Shale bedrock	14	SS	147				
		15	SS	100/5"				
	weathered	16	SS	100/4"				
	sound	17	RC	REC 80%				
		18	RC	REC 100%		480		
44.3	End of Borehole							



Note:

The lower sand deposit is under artesian pressure with a head of about 4 feet above ground surface. (corresponding to elevation 527 ±)

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

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

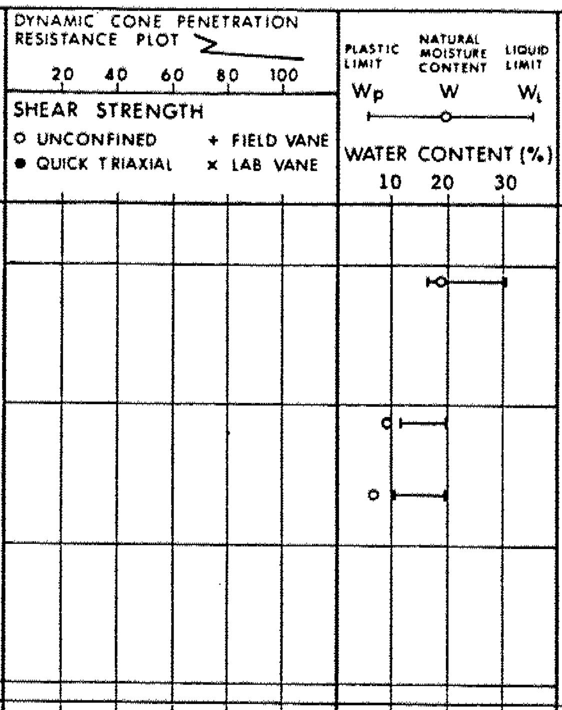
RECORD OF BOREHOLE No 8

W P 49-71-01
LOCATION Co-ords. N 15 891 360; E 967 623
ORIGINATED BY BRL
DIST 6 HWY 427
BOREHOLE TYPE Hollow Stem Auger
COMPILED BY BRL
DATUM Geodetic
DATE August 9, 1979
CHECKED BY

ELEV / DEPTH	SOIL PROFILE DESCRIPTION	SAMPLES NUMBER	TYPE	'N' VALUES	GROUND WATER CONDITIONS	ELEVATION SCALE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
554.2	Ground Level						
0.0	Silty clay, brown, very stiff, with intermediate plasticity.					550	
546.2		1	SS	29			
8.0	Silty sand, very fine, dense	2	SS	41			0 47 (53)
540.2						540	
14.0	Glacial Till: Heterogeneous mixture of clay, silt, sand and gravel Hard	3	SS	33			
		4	SS	128/11"			
531.2						530	
23.0	Shale bedrock weathered and fissile	5	SS	154			
		6	SS	110/6"			
518.5		7	SS	180/9"		520	
35.7	End of Borehole						

Note:

The borehole was dry and open.

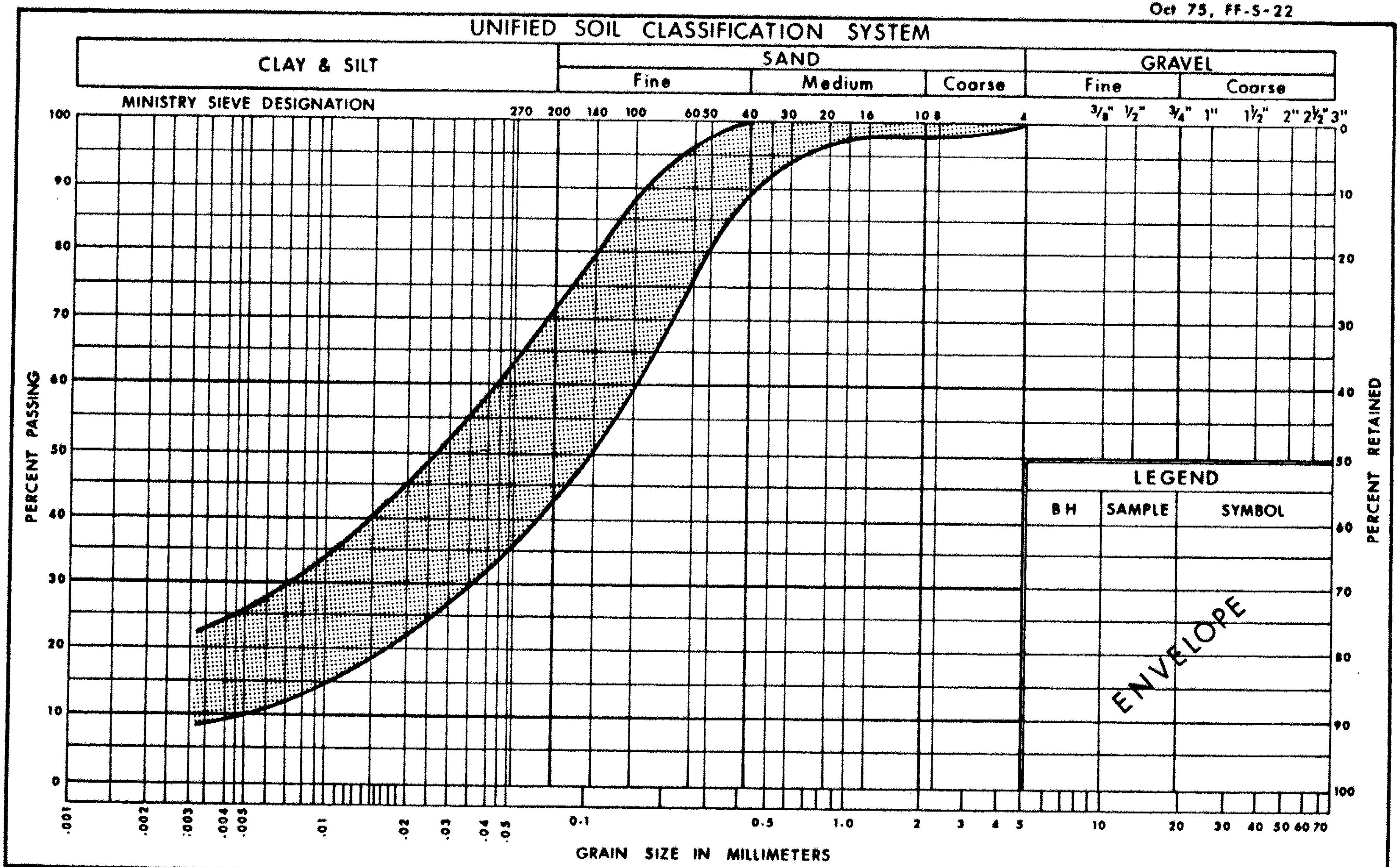


UNIT WEIGHT γ

$^{+3}$, $^{\times 5}$: Numbers refer to Sensitivity

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

Oct 75, FF-S-22



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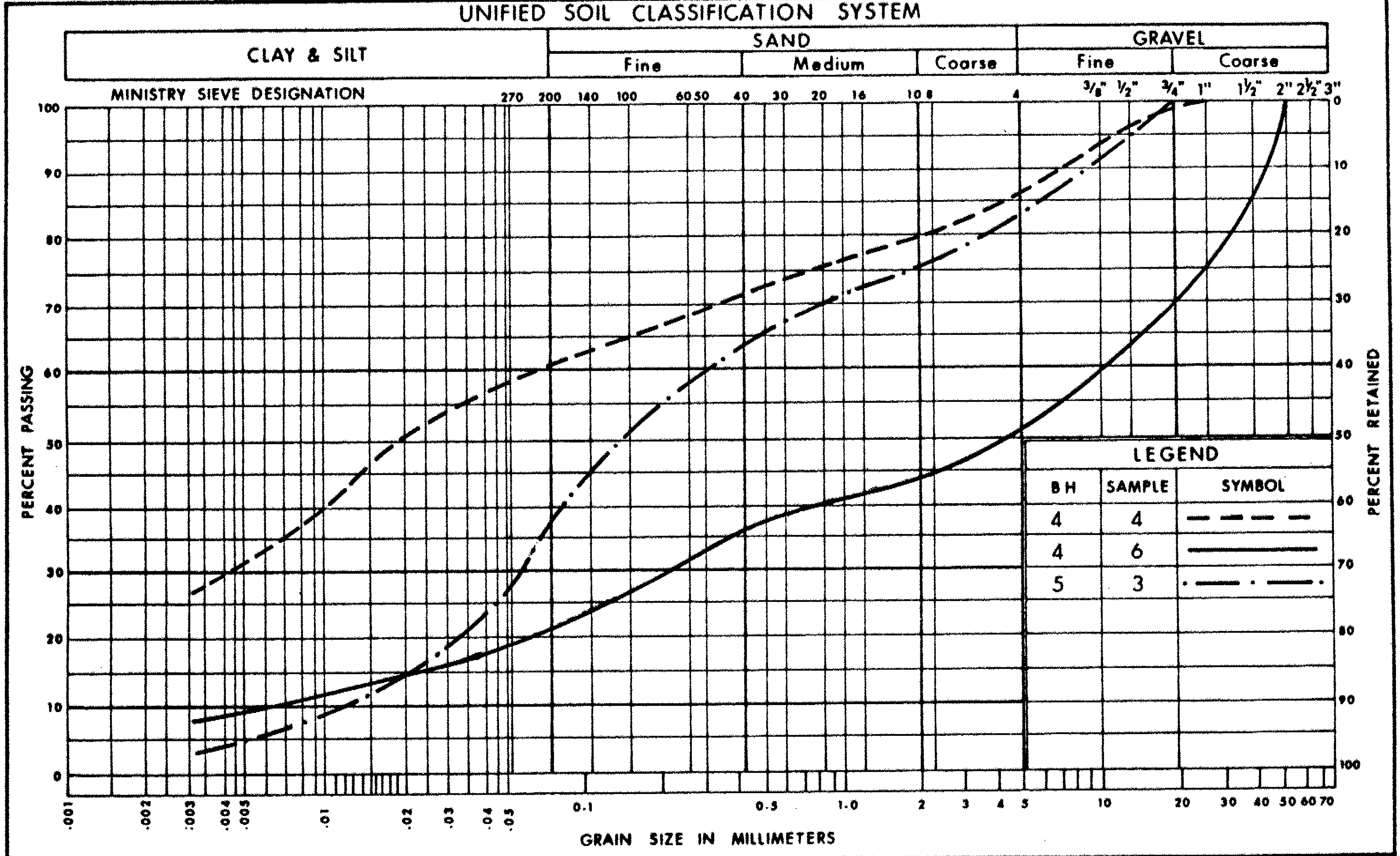
GRAIN SIZE DISTRIBUTION
SANDY SILT

FIG No 1

W P 49 - 71 - 01



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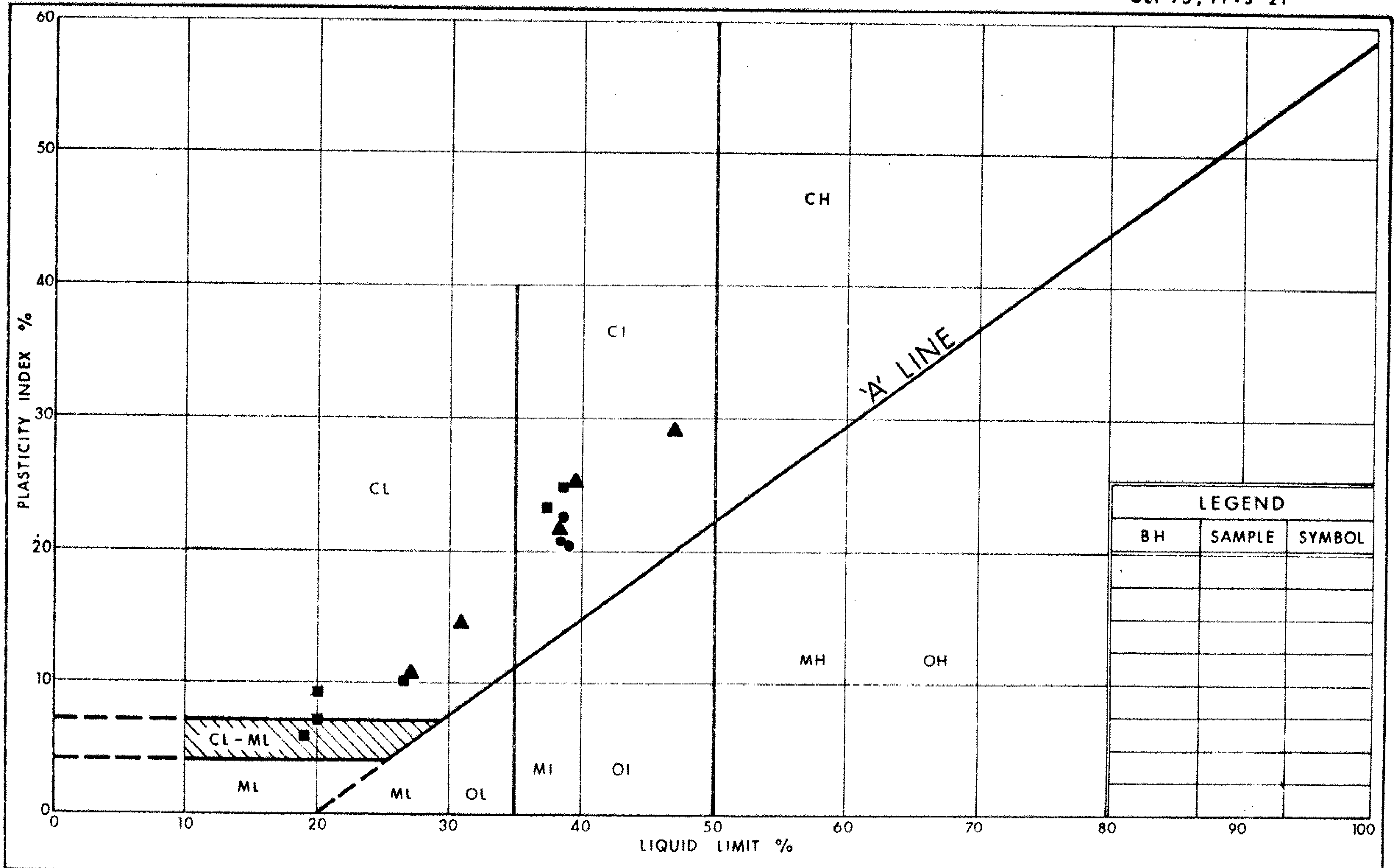
GRAIN SIZE DISTRIBUTION
GLACIAL TILL

FIG No 2

W P 49 - 71 - 01

Oct 75, FF-5-21



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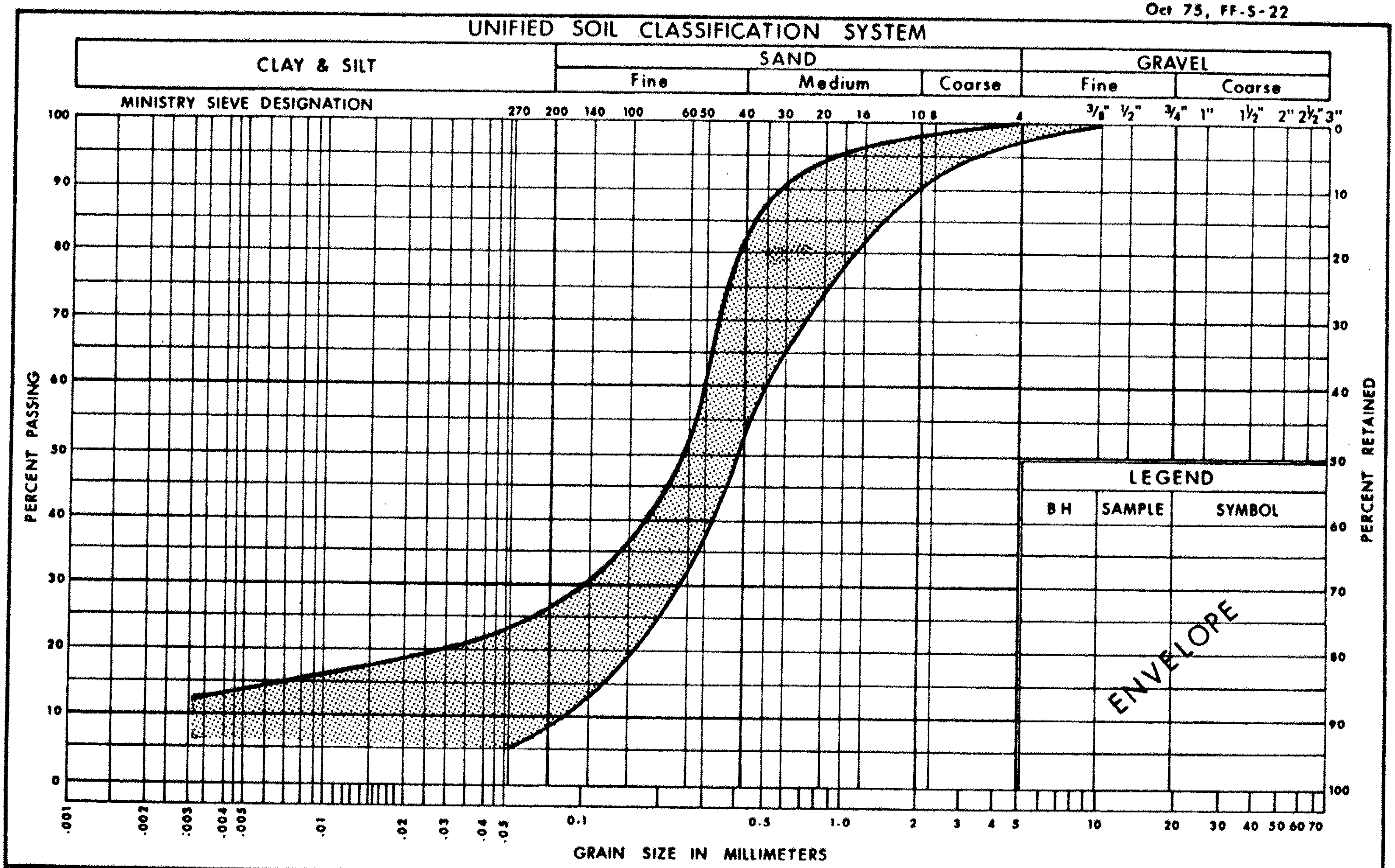
PLASTICITY CHART

▲ SILTY CLAY ■ GLACIAL TILL ● SHALE

FIG No 3

W P 49 - 71 - 01

Oct 75, FF-5-22



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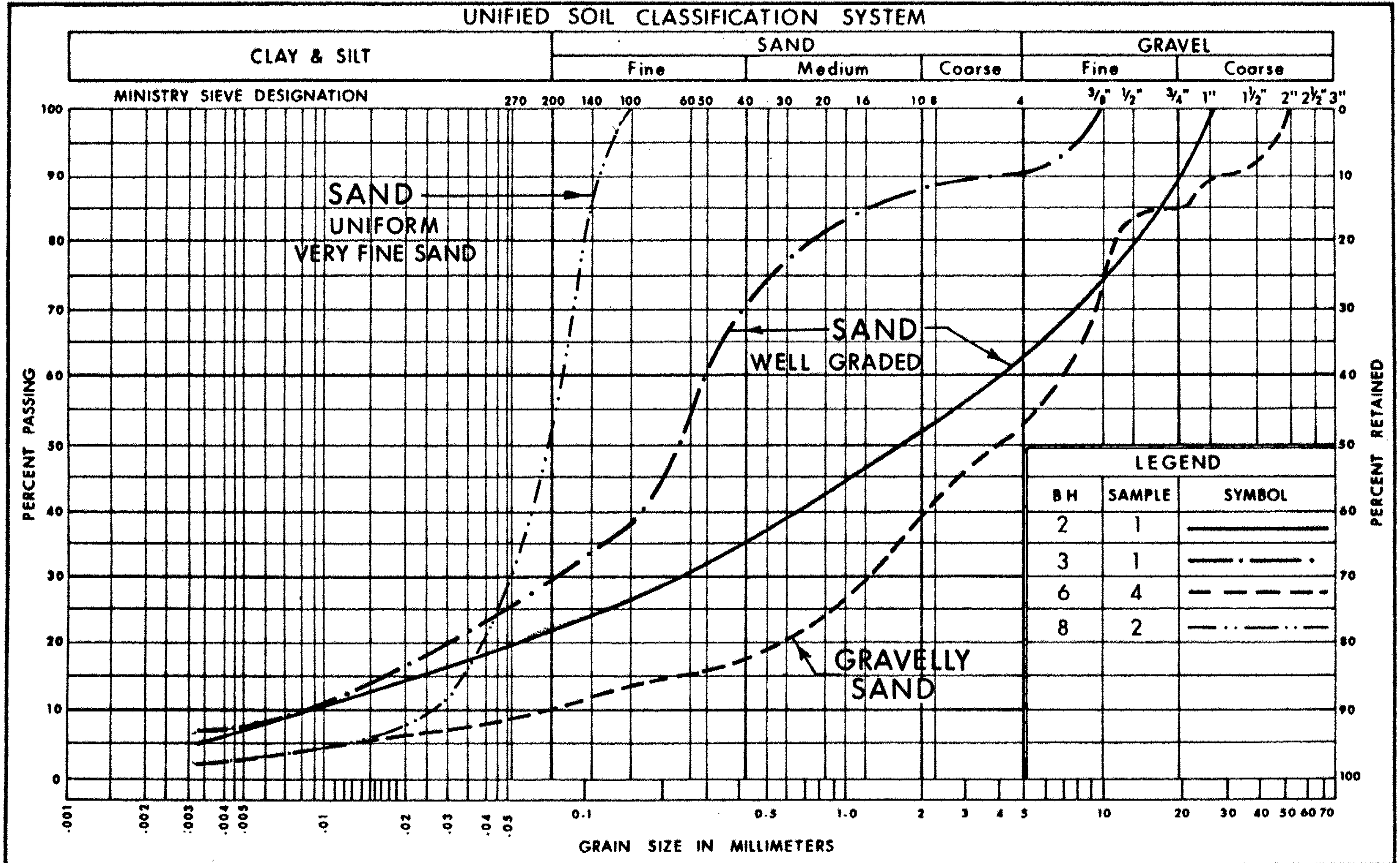
GRAIN SIZE DISTRIBUTION
SAND
FINE TO MEDIUM

FIG No 4

W P 49-71-01

Oct 75, FF-5-22



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GRAIN SIZE DISTRIBUTION

FIG No 5

W P 49 - 71 - 01

EXPLANATION OF TERMS USED IN REPORT

'N' VALUE: AN INDICATOR OF SUBSOIL QUALITY. IT IS OBTAINED FROM THE STANDARD PENETRATION TEST (CSA STD. A119.1). SPT 'N' VALUE IS THE NUMBER OF BLOWS REQUIRED TO CAUSE A STANDARD 2 INCH O.D. SPLIT-BARREL SAMPLER TO PENETRATE 12 INCHES INTO UNDISTURBED GROUND IN A BOREHOLE WHEN DRIVEN BY A HAMMER WEIGHING 140 POUNDS, FALLING FREELY A DISTANCE OF 30 INCHES. FOR PENETRATIONS OF LESS THAN 12 INCHES 'N' VALUES ARE INDICATED AS THE NUMBER OF BLOWS FOR THE PENETRATION ACHIEVED. 'N' VALUES CORRECTED FOR OVERBURDEN PRESSURE ARE DENOTED THUS $\overline{N}$.

DYNAMIC CONE PENETRATION TEST (CSA STD. A119.3): CONTINUOUS PENETRATION OF A CONICAL STEEL POINT (2" O.D. 60 CONE ANGLE) DRIVEN BY 350 FT-LB IMPACTS ON 'A' SIZE DRILL RODS. THE RESISTANCE TO CONE PENETRATION IS MEASURED AS THE NUMBER OF BLOWS FOR EACH 12 INCH ADVANCE OF THE CONICAL POINT INTO THE UNDISTURBED GROUND.

SOIL QUALITY: SOILS ARE DESCRIBED BY THEIR COMPOSITION AND CONSISTENCY OR DENSITY.

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

S_u (PSF)	0 - 250	250 - 500	500 - 1000	1000 - 2000	2000 - 4000	> 4000
	VERY SOFT	*SOFT*	*FIRM*	*STIFF*	*VERY STIFF*	*HARD*

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

'N' (BLOW/FT)	0 - 5	5 - 10	10 - 30	30 - 50	> 50
	VERY LOOSE	*LOOSE*	*COMPACT*	*DENSE*	*VERY DENSE*

ROCK QUALITY: 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 DRILLED IN THAT CORING RUN.

MODIFIED RECOVERY: SUM OF THOSE NATURALLY FRACTURED CORE PIECES, 4"+ 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	2"	2" - 12"	1' - 3'	3' - 10'	> 10'
JOINTING	*VERY CLOSE*	*CLOSE*	*MOD. CLOSE*	*WIDE*	*VERY WIDE*
BEDDING	*VERY THIN*	*THIN*	*MEDIUM*	*THICK*	*VERY THICK*

ABBREVIATIONS & SYMBOLS

LABORATORY TESTING

TRIAXIAL TESTS ARE DESCRIBED IN TERMS OF WHETHER
THEY ARE CONSOLIDATED (C) OR NOT (U)
ISOTROPICALLY (I) OR NOT (A)
AND SHEARED DRAINED (D) OR UNDRAINED (U)
WITH PORE PRESSURE MEASUREMENTS (BAR OVER SYMBOLS)
EG. $\overline{\mathrm{CIU}}$ = CONSOLIDATED ISOTROPIC UNDRAINED
TRIAXIAL WITH PORE PRESSURE MEASUREMENT
UNLESS OTHERWISE SPECIFIED IN REPORT ALL TESTS
ARE IN COMPRESSION

FIELD SAMPLING

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

EARTH PRESSURE TERMS

μ	COEFFICIENT OF FRICTION
δ	ANGLE OF WALL FRICTION
k_o	COEFFICIENT OF EARTH PRESSURE AT REST
k_A	COEFFICIENT OF ACTIVE EARTH PRESSURE
k_p	COEFFICIENT OF PASSIVE EARTH PRESSURE
i	ANGLE OF INCLINATION OF SURCHARGE 
ω	SLOPE ANGLE-BACKFACE OF WALL 
β	ANGLE OF SLOPE 
N_γ, N_q, N_c	BEARING CAPACITY FACTORS
D_f	DEPTH OF FOOTING
B, L	FOOTING DIMENSIONS

INDEX PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G_s	SPECIFIC GRAVITY OF SOLIDS
e	VOIDS RATIO
e_o	INITIAL VOIDS RATIO
e_{max}	e IN LOOSEST STATE
e_{min}	e IN DENSEST STATE
D_r	RELATIVE DENSITY = $\frac{e_{max} - e}{e_{max} - e_{min}}$
n	POROSITY
w	WATER CONTENT
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
w_s	SHRINKAGE LIMIT
I_p	PLASTICITY INDEX = $w_l - w_p$
I_L	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_c	CONSISTENCY INDEX = $\frac{w_l - w}{I_p}$
A_c	ACTIVITY = $\frac{I_p \text{ of soil}}{\% < 2\mu m \text{ Soil Fraction}}$
Om	ORGANIC MATTER CONTENT
S_r	DEGREE OF SATURATION
S	SENSITIVITY = $\frac{S_u \text{(undisturbed)}}{S_u \text{(remoulded)}}$

STRENGTH PARAMETERS

ϕ	ANGLE OF SHEARING RESISTANCE
τ_f	PEAK SHEAR STRENGTH
τ_R	RESIDUAL SHEAR STRENGTH
c	COHESION INTERCEPT
$\sigma_1, \sigma_2, \sigma_3$	NORMAL PRINCIPAL STRESSES
u	PORE WATER PRESSURE
u_e	EXCESS u
r_u	PORE PRESSURE RATIO
q_u	UNCONFINED COMPRESSIVE STRENGTH
s_u	UNDRAINED SHEAR STRENGTH
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO
E	MODULUS OF ELASTICITY
G	MODULUS OF SHEAR DEFORMATION
k_s	MODULUS OF SUBGRADE REACTION
m, n	STABILITY COEFFICIENTS
A, B	PORE PRESSURE COEFFICIENTS

NOTE: EFFECTIVE STRESS PARAMETERS ARE DENOTED BY USE OF APOSTROPHE ABOVE THE SYMBOL, THUS:
ϕ' = EFFECTIVE ANGLE OF SHEARING RESISTANCE;
σ' = EFFECTIVE NORMAL STRESS

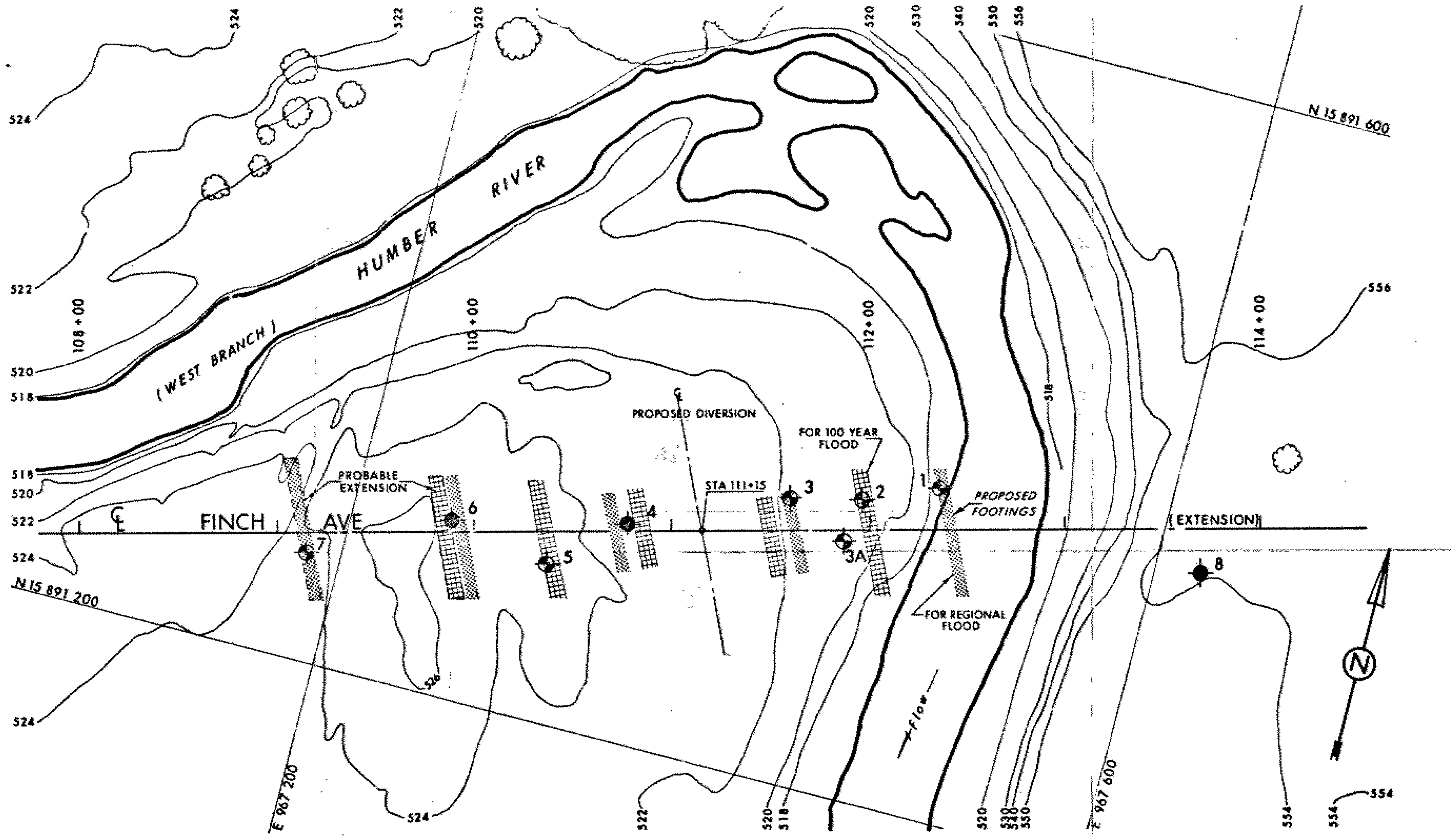
HYDRAULIC TERMS

h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
j	SEEPAGE FORCE PER UNIT VOLUME
η	COEFFICIENT OF VISCOSITY
k	COEFFICIENT OF HYDRAULIC CONDUCTIVITY
k_h	k IN HORIZONTAL DIRECTION
k_v	k IN VERTICAL DIRECTION
m_v	COEFFICIENT OF VOLUME CHANGE
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX
C_r	RECOMPRESSION INDEX
d	DRAINAGE PATH DISTANCE
T_v	TIME FACTOR
U	DEGREE OF CONSOLIDATION
O_r	OVERCONSOLIDATION RATIO (OCR)

CONT No
WP No 49-71-01

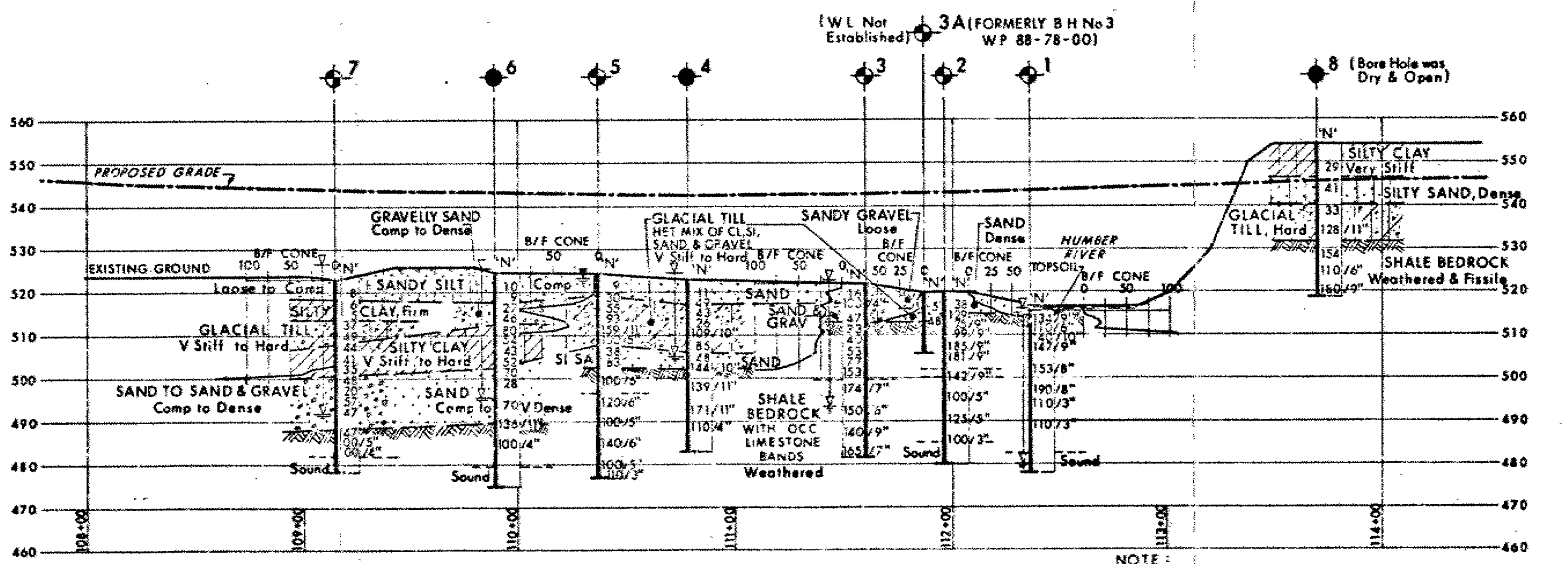
FINCH AVE OVER
HUMBER RIVER (WEST BRANCH)
BORE HOLE LOCATIONS & SOIL STRATA

SHEET



PLAN

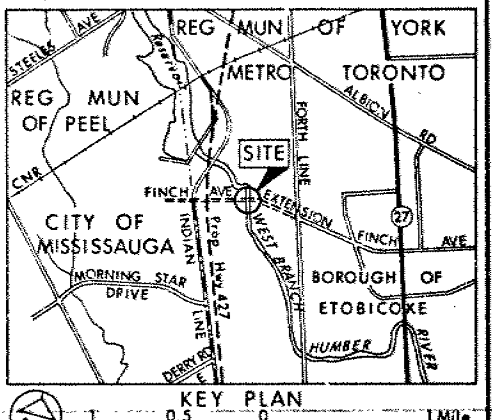
SCALE
40 20 0 40 FT



℄ PROFILE - FINCH AVE

SCALE
HOR 40 20 0 40 FT
VERT 20 10 0 20 FT

NOTE:
SEE BOREHOLE LOGS FOR
COMPLETE SOIL DETAILS



KEY PLAN
1 0.5 0 1 Mile

LEGEND

- ● Bore Hole
- ⊕ Dynamic Cone Penetration Test (Cone)
- ◆ Bore Hole & Cone
- 'N' Blows/ft (Std Pen Test 350 ft lbs energy)
- CONE Blows/ft (60° Cone, 350 ft lbs energy)
- ▼ WL at time of investigation Aug 1979, Bore Hole 3A WL Not established, Bore Hole 8 was Dry & Open
- Head ARTESIAN WATER Encountered

No	ELEVATION	CO-ORDINATES NORTH	CO-ORDINATES EAST	
1	515.7	15 891 368	967 485	
2	520.0	15 891 352	967 448	
3	521.5	15 891 344	967 413	
3A	519.7	15 891 330	967 445	B H No 3 WP 88-78
4	523.0	15 891 310	967 336	
5	524.2	15 891 280	967 303	
6	524.8	15 891 290	967 250	
7	523.0	15 891 255	967 183	
8	554.2	15 891 360	967 623	

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

REVISIONS DATE	BY	DESCRIPTION

GEOCRES No 30M12-142

HWY No 427			DIST 6
SUBM'D B L	CHECKED E	DATE Aug 31, 1979	SITE 37-1085
DRAWN R S	CHECKED	APPROVED	DWG 497101-A

REF: DRWG No X-78462-G3, May 1979, PROCTOR & REDFERN LIMITED

Underwood McLellan Ltd.

89 Carlingview Drive
Rexdale (Toronto), Ontario M9W 5E4
Telephone (416) 675-6484

Tom

Files

October 12, 1982

Pavement Design Section
RECEIVED
OCT 19 1982
File # 3199-007

Mr. A.A. Witecki, P. Eng.
Approvals Section
Ministry of Transportation and Communications
3501 Dufferin Street
Downsview, Ontario
M3K 1N6

Dear Mr. Witecki;

W.P. 49-71-01

Re: Finch Avenue West Bridge
Over West Humber River
MTC Site No. 37-1085

Further to our discussion of October 8, 1982, and in order to obtain preliminary approval, please, find attached four copies of one preliminary drawing and one copy of the approved design criteria. One copy of the soils report and one preliminary report have been shown to your office earlier. Possibly they are in your file.

The structure is scheduled for construction during the next season of 1983, and final drawings and specifications are scheduled to be ready for submission before the end of 1982.

The foundations of this structure, especially, the proposed use of caissons to support the pier has been brought to the attention of Mr. Naran Patel, P. Eng. earlier. On the basis of recommendations by Mr. Tom Karmiezowsky, P. Eng. and our soil consultant we have made arrangements for further substrata exploratory work at the location of the proposed pier caissons. This work has been delayed because the channel under the structure is now under construction.

Mr. Murty S. Devata, P. Eng. has expressed his willingness to take part in a meeting to discuss further the matter of caissons. As soon as we have the results of the exploratory work we shall inform both yourself and Mr. Devata, P. Eng. in order to call a meeting as you see fit.

The structure is to be designed according to DHBDC. The girder concrete strength is referred to as 40 Mpa however preliminary calculations indicate that it may be reduced to 35 Mpa.

Consulting Engineers and Planners

Your early attention, in view of the tight schedule, will be greatly appreciated.

Yours very truly,

UNDERWOOD McLELLAN LTD.

John E. Garyfalakis, P. Eng.,
Senior Project Engineer

JEG:jh

Attachment

cc: J. Tuck
Mr. M.S. Devata, P. Eng.
Mr. B.W.H. Crossland, P. Eng.

memorandum

Ontario

To: Mr. K.L. Kleinsteiber
Head, Approvals Section
Structural Office
3501 Dufferin Street

Date: 82 08 04

49-~~79~~71-01

Att'n: Naran Patel

From: Pavement & Foundation Design
Room 315, Central Building
Downsview, Ontario

Re: Finch Avenue over West Humber Bridge
Municipal Structure Review

We have reviewed the information forwarded to us on the above-mentioned structure and provide the following comments:

1. Although heavy section steel 'H' piles can be driven to bedrock using a high energy hammer, extreme difficulty may be encountered in attempting to unwater excavations for the pier pile caps due to the presence of artesian conditions and a highly permeable surficial granular deposit which is in direct communication with the river water.

2. The use of caissons extending up to the underside of the cap beam will eliminate the major unwatering concerns. These large diameter tube piles (75 cm +) should be equipped with a reinforced drive shoe with a chisel bit and socketed a minimum of 1 metre into competent bedrock. Artesian head within the caisson can be balanced using tremie concrete. Any artesian flow up the outside shaft of the caissons can be accommodated by an appropriately designed filter blanket which will prevent the loss of fines. Due to the fluctuating bedrock surface across the site, and the high cost of caisson installation, precise bedrock data will be required at each caisson location prior to construction operations.

This section has previously investigated the crossing and a report was issued on September 1, 1979 under W.P. 49-71-01. In addition, concern was documented regarding the effects of artesian conditions on the proposed channelization scheme. It may be beneficial to review this data.

Tom Kazmierowski, P. Eng.
Foundations Engineer

TK/jb
Attachments

[illegible]

(RETAIN THIS COPY FOR FOLLOW-UP)

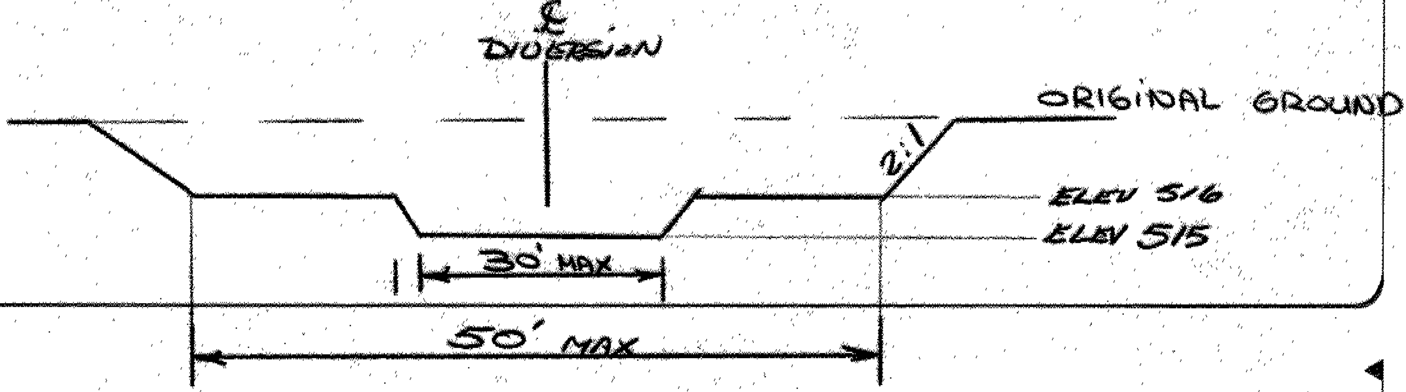
7540-1021

SEND TO Mr. V. Boehnke, Area Engineer
Structural Office, Central Region
3501 Dufferin St.

FROM M. MACLEAN BRANCH Pavement and Foundation Design DATE 80 04 15

SUBJECT Humber River Channel at Finch Ave. WP49-71-01

Further to our verbal recommendation of 80 04 14 concerning measures to be taken to eliminate the basal heave potential at the Finch Ave crossing ~~were~~ we hereby confirm the channel dimension recommendations to be as shown below.



REPLY

M. Maclean

c.c. P Penev

REPLY FROM

REPLY DATE

Ontario

Ministry of
Transportation
and
Communications

Engineering Materials Office
Pavement & Foundation Design Section
Room 313, Central Building
1201 Wilson Avenue
Downsview, Ontario
M3M 1J8

November 24, 1980

Proctor & Redfern Limited
Consulting Engineers and Planners
75 Eglinton Avenue East
Toronto, Ontario
M4P 1H3

Attention: Mr. E.A. Heinrichs, P. Eng.

Dear Sir:

Re: Proposed Check Dam for Humber River
Channel Diversion
Hwy. 427, W.P. 49-71-01, District #6

Further to your letter dated 80 11 14 regarding the above mentioned subject we have reviewed the available subsurface information in this area and submit the following comments.

Recommendations for the proposed diversion in the area of the structure (100 feet upstream and 100 feet downstream of the ¢ of the Finch Ave. Extension) were given in a memorandum dated 80 02 26 to Mr. R.D. Gunter, Regional Geotechnical Office, Central Region, and a copy is enclosed for your information.

In the area of the proposed check dam, we do not have any subsurface information and piezometric data. Our past experience indicates extreme variation in the subsurface and artesian conditions in this area. In view of this, it will be extremely difficult for us to provide any comments with regard to excavation to elev. 510.75 for installation of the gabions, without carrying out any subsurface investigations.

Yours very truly,

M. Devata
Senior Foundations Engineer

cc: B. Lankinen
R.D. Gunter
K. Pilgrim
Encl.

memorandum

Ontario

To: Mr. R.D. Gunter
Head, Geotechnical Office
Central Region

Date: 80-02-26

Attention: Mr. P. Penev

From: Pavement & Foundation Design Section
Room 313, Central Building
Downsview

Re: Proposed Diversion for Humber River West Branch
(Finch Avenue Over Humber River West Branch)
W.P. 49-71-01, Site 37-1085
Hwy. 427, District 6, Toronto

At the M.T.C. Consultant's Progress Meeting No. 80-02 for Hwy. 427 from Rexdale Boulevard to North of the Humber River concern was expressed regarding the effect of artesian conditions on the proposed diversion of the Humber River. As you requested at that meeting our comments relating to the artesian conditions are as follows.

The artesian conditions for the Humber River and Finch Avenue crossing are described in detail in our Foundation Investigation Report for Finch Avenue over Humber River, W.P. 49-71-01 dated 79 09 21. This report also contains detailed recommendations with regard to artesian conditions for the design and construction of the Finch Ave. Bridge. For the proposed diversion in the area of the structure (100 feet upstream and 100 feet downstream of the ℄ of the Finch Ave. Extension) we recommend the following:

1. The diversion invert level should be above elevation 516.0.

2. The base of the diversion should be provided with a filter mat placed directly on the prepared subgrade of the diversion covered with an interlocking concrete block system, Terrafix or equivalent.

   Any temporary excavations for installing the concrete block system or for other reasons, should not be carried out below elevation 515.0. The temporary excavations for the installation of the concrete block system should be carried out parallel to the channel cross section in longitudinal strips (parallel to the channel flow) not to exceed 75 feet in length.

The above recommendations are based on subsurface information and piezometer data in the area of the structure. This data reveals extreme variation in the subsurface and artesian conditions at this location. The design of the diversion outside the areas discussed above should be based on further piezometer installations and observations.

M Maclean

MM:MD:ea
cc: K. Worsley
K. Pilgrim

M. MacLean
For: M. Devata
Senior Foundations Engineer

WP 49-71-02

memorandum

Ontario

To: File

Date: 80-04-15

Central Region

RE: Proposed Diversion of Humber River (West Branch)
Near Future Finch Ave. Crossing, Site 37-1085,
W.P. 49-71-01, District 6

We would like to take reference to our earlier memo of 80-03-26 in regard to the adverse effects of the artesian conditions on the proposed channel invert. The profile of the West Humber Diversion channel (as per our Hydrology Report BW5023) puts the average channel invert at el. 516.5, assuming a check dam downstream of Finch Avenue. Therefore, the minimum channel invert would be at el. 515. which was indicated as being too low by the Foundations Office. This was based on the local artesian conditions with a 50'± wide low flow channel used in their calculations.

New calculations by the Foundations Office show that they would tolerate a low flow channel width of 30 ft. with invert down to el. 515.± .

As a result, we propose to vary the width of the bottom portion of the low flow channel (that, which is below el. 516.±) from 50' at the Highway 427 bridges to 30' width downstream of station 1000. The taper will be smooth and gradual. This channel width will be continued at the 30' width further downstream through the proposed bridge site to approximately 200' downstream of Finch Avenue. A short 25' transition section is required here where the diversion meets the existing channel.

Similar as in our earlier memo, the low flow channel should be protected with filter cloth and 4" to 6"Ø stone. The 4"-6"Ø stone may also be placed in the 30' wide low flow channel beneath the future structure.

V. F. Boehnke

VFB:gj

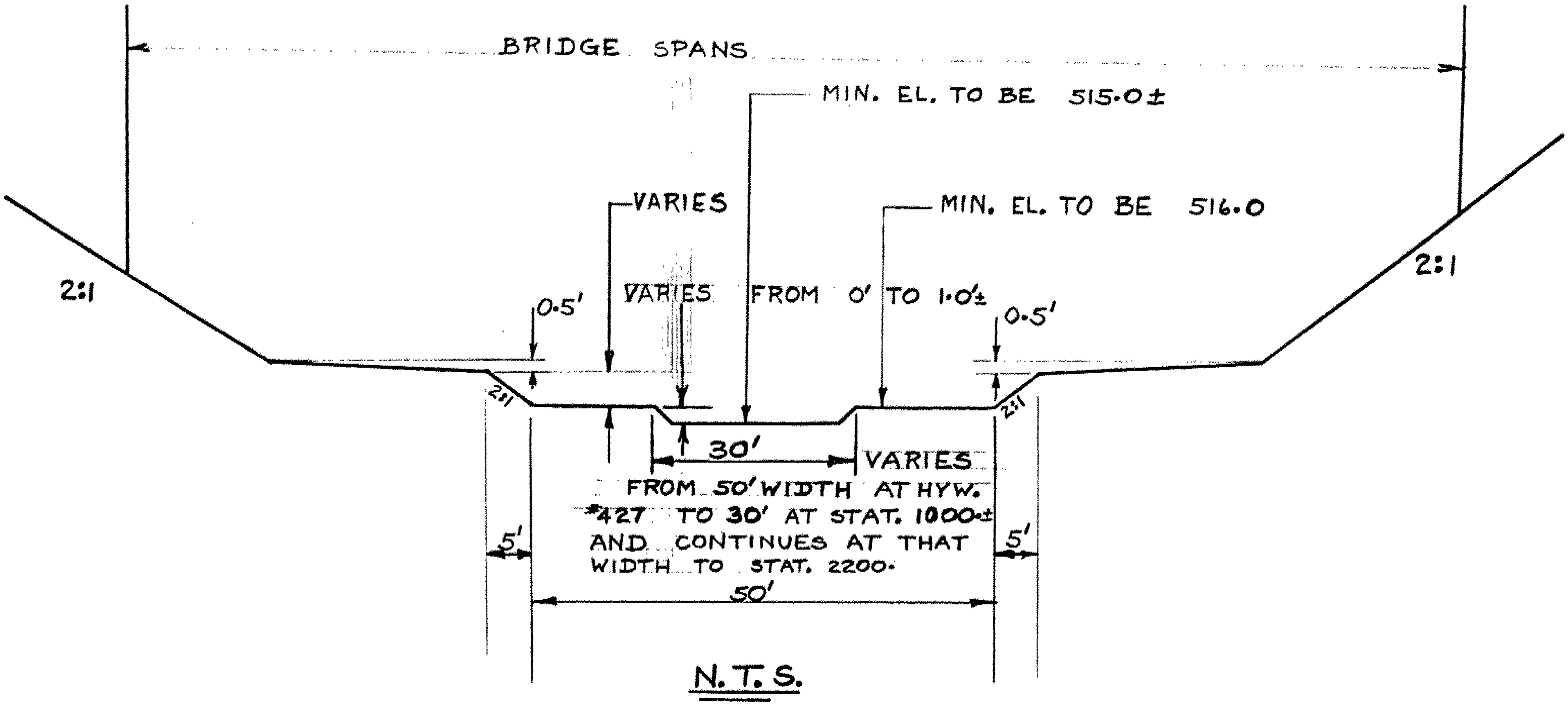
V.F. Boehnke,
Area Engineer-Structures,
for:
G.C.E. Burkhardt,
Head, Structural Section.

c.c. K. Worsley
E. Heinrichs (Proctor&Redfern)
M. Devata ✓
J. Carter
P. Penev

M.D → M.M
↓
File.

7540-1318 (10/78)

CHANNEL X-SECTION NEAR FINCH AVE.

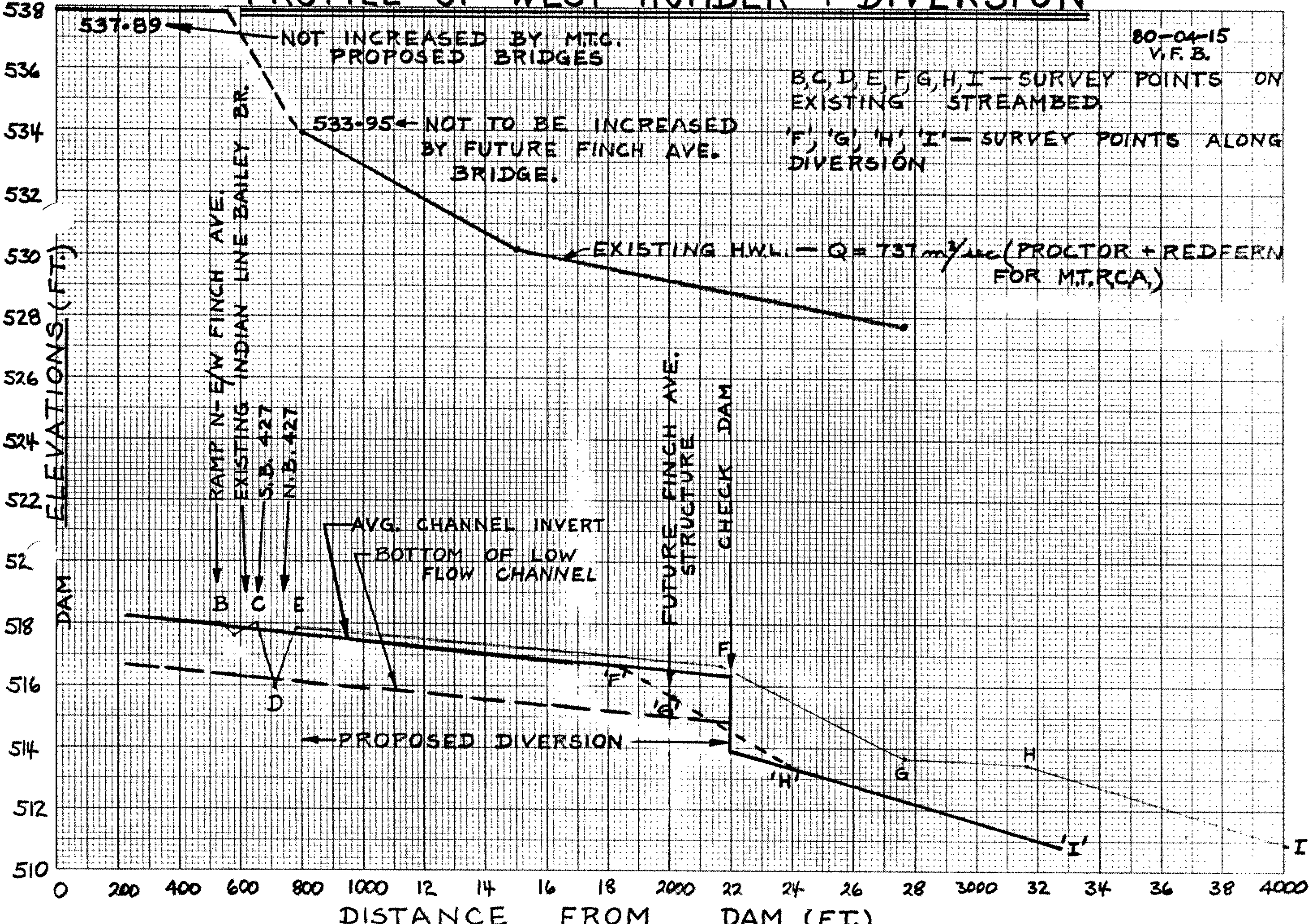


a) STAT. REFER TO NUMBER OF FEET DOWNSTREAM OF DAM.

b) ℄ FINCH AVE. ASSUMED AT STAT. 2000.

KEUFFEL & ESSER CO. MADE IN U.S.A. 46 1320

PROFILE OF WEST HUMBER + DIVERSION



Mr. MacLean

Regional Geotechnical Section,
Central Region,
3501 Dufferin Street,
Downsview, Ontario.
M3K 1N6
Telephone: 248-3252

March 5, 1980

The Proctor and Redfern Group,
Consulting Engineers,
75 Eglinton Avenue East,
Toronto, Ontario.
M4P 1H3

Attention: Mr. E. Heinrichs

Dear Sir:

Re: W.P. 49-71-01, Highway 427
From just North of Rexdale Blvd. N'ly to
just North of the Humber River.
Erosion protection of Humber River
channel diversion.

A test pits placed along the proposed Humber River channel diversion and Foundation investigation for the Finch Avenue extension revealed that the entire flood plain area of the Humber River at this location is under artesion condition. This was discussed with Mr. M. MacLean (Foundation Design Section) and upon reviewing the subsurface information and piezometer data in the area of the structure, Mr. MacLean recommended the following treatment of the channel diversion.

(1) The new channel (the side slopes and the bottom) in the area of the structure (100 feet upstream and 100 feet downstream of the C of the Finch Avenue extension over Humber River) should be lined with an interlocking concrete block system, (Terrafix or equivalent) placed over filter fabric.

(2) The diversion invert level (bottom of the new channel) at this location should be above elevation 516.0.

This recommendation was further discussed in detail with Mr. MacLean and an agreement has been reached that the equivalent and more economical treatment is to be used, consisting of 18" random rip-rap placed over filter fabric in the location as mentioned above.

.... 2

For the remaining portion of the new channel diversion the treatment is to be the same except that the depth of the rip-rap should be reduced to 12".

For the alternative type of the filter fabric refer to this office's memo of February 25, 1980.

The quality of the crushed rock used for rip-rap shall be quarried stone conforming to the requirement of M.T.C. Form 511.

All joints in the filter fabric shall be overlapped 3 feet.

The rock material shall not be dropped on the filter fabric from height greater than 18 inches.

PP:lc

P. Penev,

for: R. D. Gunter,
Head, Geotechnical Section.

c.c. K. Worsley, Planning & Design

NOTE: Refer to this office's memorandum dated February 25, 1980. Carpet seal (H.L. 1 O.F.C. Mix) will not be placed on the bridge deck of 427 structure crossing the Humber River. The surface coarse on this bridge deck should be H.L. 1 D.F.C. Mix.