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G.I.-30 SEPT. 1976

GEOCRES No. 30M15-31

DIST. 6 REGION Central

W.P. No. 44-71-09

CONT. No. 77-133

W.O. No. 73-11051

STR. SITE No. 22-179

HWY. No.

LOCATION Widening of Existing Overpass Structure at Hwy 401 and Ritson Road

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS: documents to be unfolded before microfilming

FOUNDATION INVESTIGATION REPORT

For

Proposed Widening of Existing Overpass Structure at the Crossing of Hwy. #401 and Ritson Road, City of Oshawa, County of Ontario
District #6 (Toronto) Site #22-179
W.O. 73-11051 W.P. 44-71-09

1. INTRODUCTION

The Foundations Office was requested to carry out a subsurface investigation at the crossing of Hwy. #401 and Ritson Road in the City of Oshawa, County of Ontario. This investigation is related with the proposed widening of the Ritson Road overpass structure to accommodate six-lane traffic on Hwy. #401. The request was contained in a memo to this office from Mr. G.C.E. Burkhardt, Regional Structural Planning Engineer, Central Region, dated December 11, 1972. Subsequently, this office carried out an investigation to determine the sub-soil and groundwater conditions at this site.

This report presents the factual information obtained from this investigation together with recommendations pertaining to the design of the foundation widening and the stability considerations associated with the approach embankments.

.../2

2. DESCRIPTION OF SITE

The site under investigation is located at the crossing of Hwy. #401 and Ritson Road in the City of Oshawa, County of Ontario. This area is flat to undulating in relief between elevations 320 and 334, with the exception of Hwy. #401 which is carried on an embankment approximately 10 feet above the surrounding terrain. This area has been developed for residential and commercial purposes.

Physiographically, the site is located with the region known as "Iroquois Plain". This region was inundated in late Pleistocene times by a body of water, known as Lake Iroquois. Across Ontario County, the Iroquois Plain has a fairly constant pattern of drumlins and clay plains. The old shoreline of Lake Iroquois is marked by cliffs cut in the till plain or gravel bars across the valleys.

3. FIELD AND LABORATORY WORK

Four sampled boreholes each accompanied by a dynamic cone penetration test, were put down at this site. The borings were advanced by means of a continuous flight auger machine adopted for soil sampling purposes.

Samples of the subsoil were recovered at required depths in a 2" O.D. split-spoon sampler which was hammered into the soil in accordance with the specifications for the Standard Penetration Test. The same method was used

.../3

to advance the dynamic cone penetration tests.

The locations and elevations of all the borings were surveyed in the field by personnel from this Office; they are shown on Drawing No. 73-11051A, together with estimated stratigraphical sections across the site.

All samples were visually examined and identified in the field and subsequently in the laboratory. Following this laboratory testing was carried out on selected representative samples to determine the various physical properties; namely,

Atterberg Limits

Natural Moisture Contents

Grain-Size Distrubitions

The results of the laboratory testing are plotted on the Record of Borelog sheets and summarized on Figures 1 and 2, all contained in the Appendix of this report.

4. SUBSOIL CONDITIONS

4.1) General

The predominant stratum at the site is a heterogeneous mixture of silty sand to sandy silt, gravel and clay of glacial origin, which is found underlying a thin layer of fill material or topsoil cover. Its thickness ranges from 28 to 32 feet. Underlying the glacial till is a deposit of silty clay up to 14 feet thick, followed by a stratum of sand with traces of silt.

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The boundaries of the various deposits are shown on the accompanying Record of Borehole sheets. The stratigraphical sections shown on Drawing No. 73-11051A have been inferred from this data. From ground surface downward, the various deposits are discussed in detail in the sub-sections to follow.

4.2) Fill Material

Fill material was encountered at B.H. #4. Its thickness is 4.5 feet. The fill material is a brown clayey silt to silt with some sand and gravel and traces of organics. It is believed that it is the backfill material to the footing excavation for the existing bridge. The standard Penetration Testing carried out within the fill material gave 'N' values ranging from 2 to 8 blows per foot. Based on these values, it is estimated that the fill material was not well compacted.

4.3) Heterogeneous Mixture of Sandy Silt to Silty Sand, Gravel and Clay (Glacial Till)

Directly beneath the fill material where it exists, or below a thin topsoil cover (approximately 8 inches thick) elsewhere, is the predominant stratum. It consists of a heterogeneous mixture of sandy silt to silty sand, gravel and clay of glacial origin. The thickness of this deposit ranges from 27 feet (B.H. #3) to 32 feet (B.H. #4). The grain size distribution curves for samples of this stratum

.../5

are plotted in envelope form on Figure No. 1.

Standard Penetration Testing carried out within this stratum gave 'N' values ranging from 57 blows/foot to 100 blows for 3 inches. It is estimated that the glacial till is in a very dense state.

4.4) Silty Clay with Traces of Sand

This cohesive deposit was found underlying the glacial till stratum at all of the boring locations. It was fully penetrated at only two boreholes (B.H.s #2 and #4), where its thickness was found to be up to 12 feet. Atterberg Limit testing was performed on samples of this deposit. The results, which are shown on the individual Record of Borehole sheets as well as plotted on the Plasticity chart (Figure No. 2), are tabulated below:

		Range	Average
Liquid Limit (W_l)	%	35--42	(37)
Plastic Limit (W_p)	%	18--24	(21)
Natural Moisture Contents (W)	%	15--24	(19)

Based on these results, it is inferred that this cohesive deposit is inorganic and of intermediate plasticity.

Standard Penetration Testing carried out within this stratum gave 'N' values from 56 to over 100 blows/foot. It is estimated that the consistency of the silty clay is hard.

.../6

4.5) Sand with Traces of Silt and Gravel

This granular deposit was encountered at B.H.s #2 and #4, underlying the silty clay stratum. It was not fully penetrated at either of the boring locations. The grain size distribution curves for samples of this granular deposit are plotted on Figure #3. Standard Penetration Testing was carried out within this stratum. The results, which are plotted on the Record of Borehole sheet, gave 'N' values ranging from 62 to more than 100 blows/foot. It is estimated that the relative density of this granular deposit is very dense.

5. GROUNDWATER CONDITIONS

The groundwater conditions across the site during the period of the investigation (July, 1973) were observed by taking water level readings in the open boreholes. These readings are plotted on the Record of Borehole sheets and Drawing No. 73-11051A. The observations indicated that the groundwater level in the open boreholes varies between elevations 320.7 and 321.7, corresponding to levels of from 1.5 to 2 feet below the existing ground surface.

6. DISCUSSIONS AND RECOMMENDATIONS

6.1) General

It is proposed to widen the existing overpass structure at the crossing of Hwy. #401 and Ritson Road, in the City of Oshawa as part of the planned widening of Hwy. #401 in this area. This construction will require that the

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existing overpass structure be extended by some 19.5 feet on each side of the structure.

The existing bridge, which was constructed some 30 years ago, is a 97 foot-wide single span (42 feet) rigid frame structure. According to available information, this structure is supported on spread footings founded on elevation 317.4. The profile grade of Hwy. #401, in the vicinity of the crossing will be at approximately elevation 341. The approaches are up to 19 feet above the existing grade of Ritson Road.

Visual observations indicate that the structure and the approaches are performing satisfactorily.

The subsoil at the site consists of up to 32 feet of very dense glacial till underlying by a silty clay stratum which is, in turn, underlain by a deposit of sand.

The recommendations pertaining to the design of the footing extensions and the stability considerations associated with the approach embankments widening will be discussed in the subsections to follow.

6.2) Foundations - Abutment Extensions

The proposed abutment extensions may be founded on spread footings located within the very dense glacial till deposit at the same founding elevation of the existing abutments (317.4). At localized areas within the proposed abutment extension, backfill material to the excavation for

the existing abutments may extend below the above-mentioned founding elevation. If such is the case, it is recommended that the fill material be completely sub-excavated. The sub-excavation so formed should then be brought up to footing foundation level by placing mass concrete. Spread footings founded as recommended may be designed using an allowable bearing values of up to 4 t.s.f.

The base of the footing excavations will be below the groundwater level recorded during the period of the field investigation (July, 1973). Groundwater seepage into the excavations can be anticipated. The subsoil is of glacial origin and the matrix contains some clay binder. It is believed that the seepage can be handled by employing ordinary pumping methods.

Settlement of the subsoil induced due to the footing pressure will be elastic in nature. This settlement should not exceed one half of an inch and should take place during or immediately following the construction period. In order to accommodate any possible differential settlements between the existing abutment footing and the extension, it is recommended that an expansion joint be provided between these two elements.

The rigid walls of the extended portion of the abutments should be designed using a coefficient of earth pressure at rest (Ko) of 0.5 for the granular backfill material placed behind the walls.

../9

In determining the lateral resistance of the footings, a coefficient of friction of 0.7 between the rough concrete surface and the granular glacial till may be used.

In order to relieve the buildup of excess hydrostatic pressure behind the abutment extensions suitable drainage measures should be provided. Backfill behind the wall should be carried out in accordance with current M.T.C. practices.

6.3) Approach Embankments

The approach embankments will be widened by approximately 20 feet on both sides. The widened portions of the fills will be stable provided that:

i) standard 2:1 slopes are employed, and

ii) the topsoil along the slopes of the existing embankment be stripped and the new fill be properly keyed to the existing embankment in accordance with current M.T.C. Standard No. DD-414.

The foundation subsoil is competent, therefore no long term settlement is anticipated due to the induced loads of the approach fills. However, compacted fill material may settle due to its own weight. For estimating purposes, it may be assumed that the new fill will settle as much as ½ per cent of the total height. It is believed that the majority of this settlement will take place shortly

.../10

after the placement of the fill.

7. MISCELLANEOUS

The field work was carried out between July 12 - 16, 1973, under the supervision of Mr. C. S. Poon, Project Foundations Engineer, who also prepared this report.

Drilling equipment used was owned and operated by Dominion Soil Investigation Ltd., Toronto.

This project was carried out under the general supervision of Mr. M. Devata, Supervising Foundations Engineer, who reviewed this report.

C. S. Poon, P. Eng.

REGISTERED PROFESSIONAL ENGINEER
C. S. L. POON
PROVINCE OF ONTARIO

M. Devata, P. Eng.

CSP/jf
Aug. 13, 1973.

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 1

JOB 73-11051 — LOCATION Co-ords. 15,946,142 N; 1,172,281 E. — ORIGINATED BY CSP

W.P. 44-71-09 — BORING DATE July 12, 1973 — COMPILED BY CSP

DATUM Geodetic — BOREHOLE TYPE Auger and Cone Test — CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE
323.2	Ground Level					
	— — Topsoil — —					320
	Het.mixture of sandy silt to silty sand, gravel and clay.		1	SS	57	
			2	SS	108	
			3	SS	127	
			4	SS	140	310
	(Glacial Till)		5	SS	63	
			6	SS	70	
	Brown-Grey Very Dense		7	SS	71	300
295.2						
28.0	Silty clay, traces of sand.		8	SS	71	
			9	SS	56	290
	Grey Hard					
281.7			10	SS	58	
41.5	End of Borehole					280

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 20 40 60 80 100

SHEAR STRENGTH P.S.F. — ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE

LIQUID LIMIT W_L — PLASTIC LIMIT W_P — WATER CONTENT W — W_P W W_L

WATER CONTENT % — 10 20 30

BULK DENSITY γ P.C.F.

REMARKS — GR. SA. SI. CL.

▼ 321.4

9 44 38 9

25 42 28 5

20 / 15 ◇ 5 / 10 % STRAIN AT FAILURE

OFFICE REPORT — SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 2

JOB 73-11051 — LOCATION Co-ords. 15,946,261 N; 1,172,246 E. — ORIGINATED BY CSP

W.P. 44-71-09 — BORING DATE July 13, 1973 — COMPILED BY CSP

DATUM Geodetic — BOREHOLE TYPE Auger and Cone Test — CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (20 40 60 80 100); SHEAR STRENGTH P.S.F. o UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE	LIQUID LIMIT W_L — PLASTIC LIMIT W_P — WATER CONTENT W (W_P — W — W_L); WATER CONTENT % (10 20 30)	BULK DENSITY γ P.C.F.	REMARKS / GR. SA. SI. CL.
323.3	Ground Level									▼ 321.3
	Topsoil									
	Het.mix.of sandy silt to silty sand, gravel and clay. (Glacial Till) Brown-Grey Very Dense		1	SS	92	320	168	o		9 39 42 10
			2	SS	100/5"					
			3	SS	82			o		
			4	SS	165	310				
			5	SS	100/5"			o N.P.		
			6	SS	100/3"			o		6 44 36 14
294.8			7	SS	100/4"	300				
28.5	Silty clay, traces of sand. Grey Hard		8	SS	154			o		
288.3						290				
35.0	Sand, traces of silt and gravel. Grey Very Dense		9	SS	97	280				
271.8			10	SS	62			o		1 93 (6)
51.5	End of Borehole					270				

20
15 ☼ 5 % STRAIN AT FAILURE
10

OFFICE REPORT — SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 3

JOB 73-11051 — LOCATION Co-ords. 15,946,244 N; 1,172,190 E. — ORIGINATED BY CSP

W.P. 44-71-09 — BORING DATE July 13, 1973 — COMPILED BY CSP

DATUM Geodetic — BOREHOLE TYPE Auger and Cone Test — CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100 / SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	LIQUID LIMIT W_L / PLASTIC LIMIT W_P / WATER CONTENT W / WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS GR. SA. SI. CL.
323.2	Ground Level									
	~~Topsoil~~					320				▼321.7
	Het.mix.of sandy silt to silty sand, gravel and clay.		1	SS	95					
			2	SS	60					
			3	SS	112					
	(Glacial Till)		4	SS	115	310				17 42 33 8
	Brown-Grey		5	SS	180					
			6	SS	154					26 39 29 6
	Very Dense					300				
296.2			7	SS	105					
27.0	Silty clay, traces of sand.		8	SS	121					
	Grey					290				
286.7	Hard		9	SS	124					
36.5	End of Borehole					280				

20
15 ◇ 5 % STRAIN AT FAILURE
10

OFFICE REPORT — SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE Nº 4

JOB 73-11051 LOCATION Co-ords. 15,946,124 N; 1,172,233 E. ORIGINATED BY CSP

W.P. 44-71-09 BORING DATE July 16, 1973 COMPILED BY CSP

DATUM Geodetic BOREHOLE TYPE Auger and Cone Test CHECKED BY

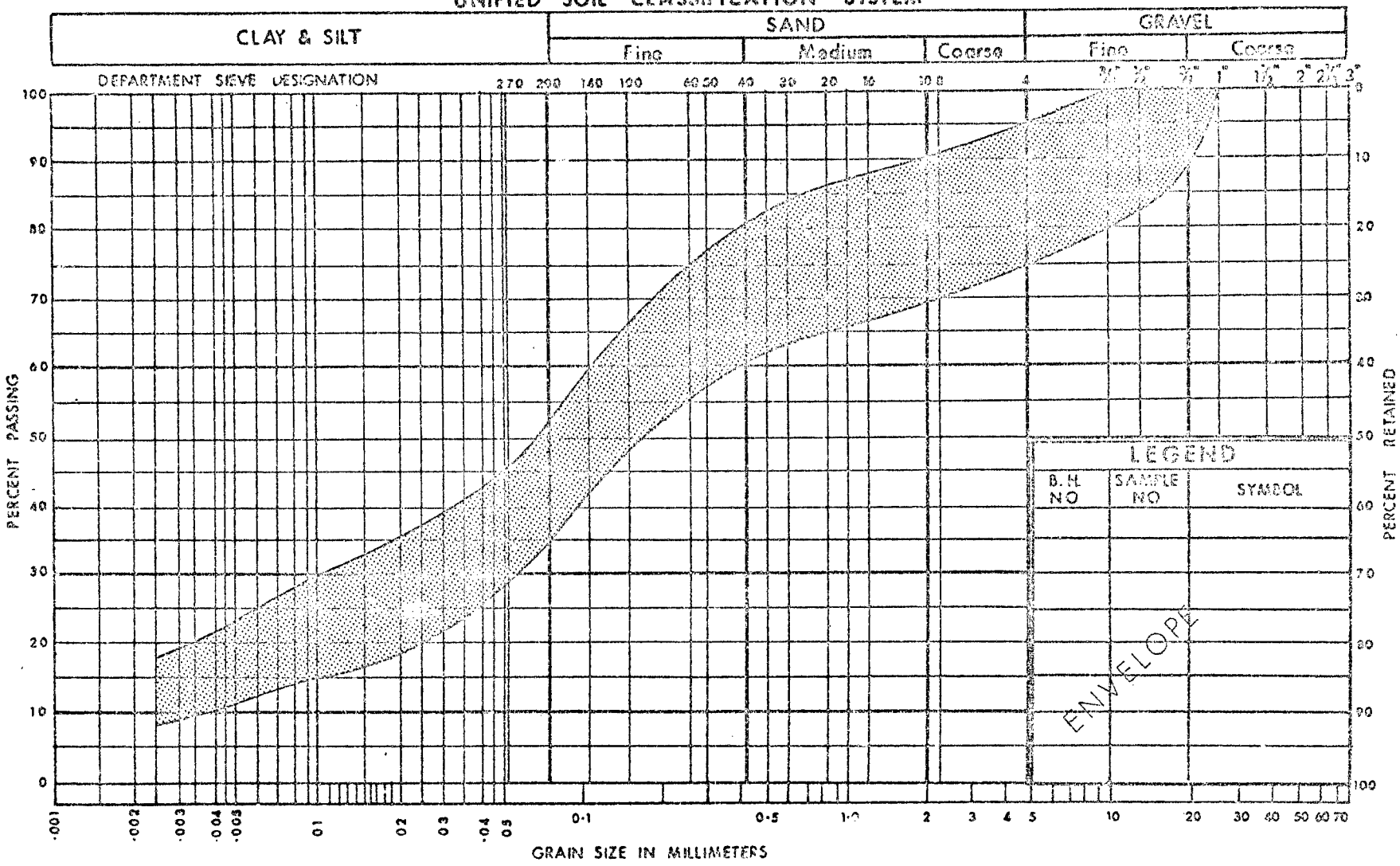
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100; SHEAR STRENGTH P.S.F. o UNCONFINED + FIELD VANE • QUICK TRIAXIAL × LAB VANE	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P W W_L WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
322.7	Ground Level									
	Topsoil									
	Fill Material									
	Clayey silt, sand & gr									▼320.7
318.2	Brown Soft		1	SS	4	320		o ⊢		
4.5			2	SS	58					
	Het.mix.of sandy silt		3	SS	69					
	to silty sand, gravel		4	SS	100/3"	310	bouncing	o		6 43 39 12
	and clay.		5	SS	85					
	(Glacial Till)		6	SS	90					
	Brown-Grey					300				
	Very Dense		7	SS	59			o ⊢		14 40 36 10
290.7			8	SS	116					
32.0	Silty clay, traces of sand.					290				
	Grey Hard		9	SS	159			⊢ o		
278.7						280				
44.0	Sand, traces of silt and gravel.									
	Grey									
271.2	Very Dense		10	SS	130			o		0 94 (6)
51.5	End of Borehole					270				

20
15 ⊹ 5 % STRAIN AT FAILURE
10

OFFICE REPORT – SOIL EXPLORATION

FORM CD-MT-17
REV. AUG. 1971

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
ONTARIO
DESIGN SERVICES BRANCH

GRAIN SIZE DISTRIBUTION

GLACIAL TILL

HET. MIXTURE OF SANDY SILT TO SILTY SAND, GRAVEL & CLAY

W.P. No. 44-71-09

JOB No. 73-11051

FIG. 1

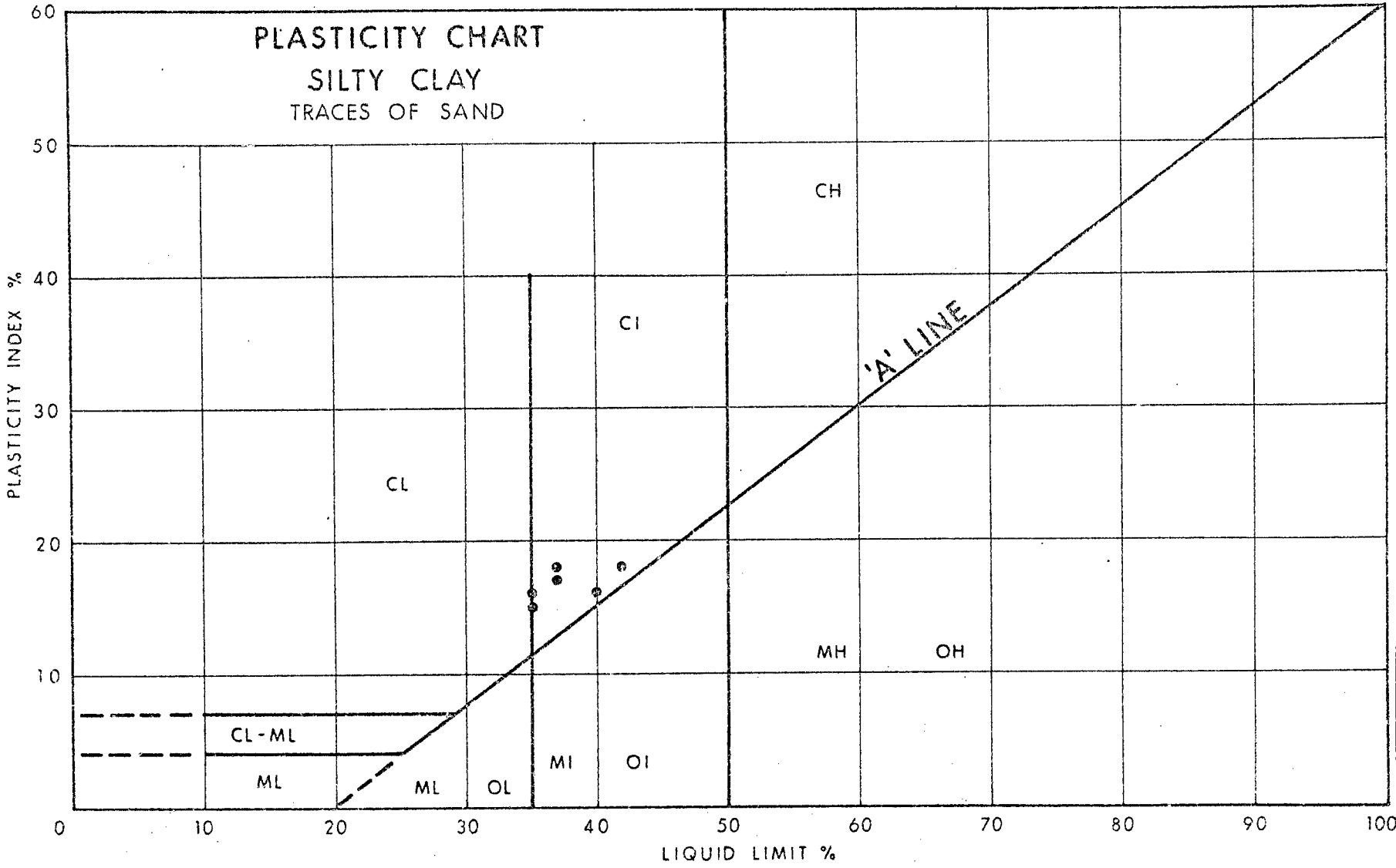
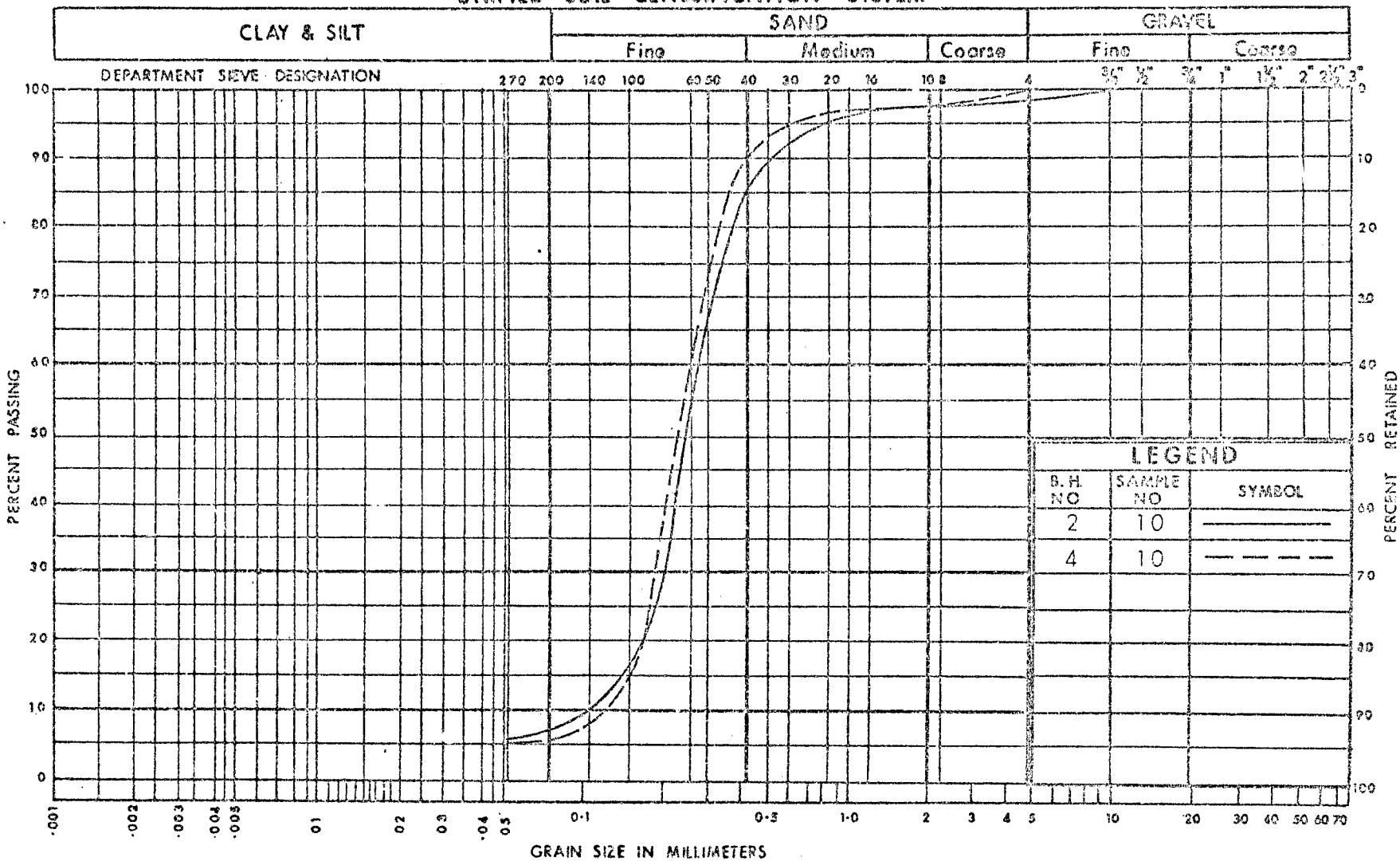


FIG. 2

W.O. 73-11051

FORM OD-MT-12
REV. AUG. 1971

UNIFIED SOIL CLASSIFICATION SYSTEM



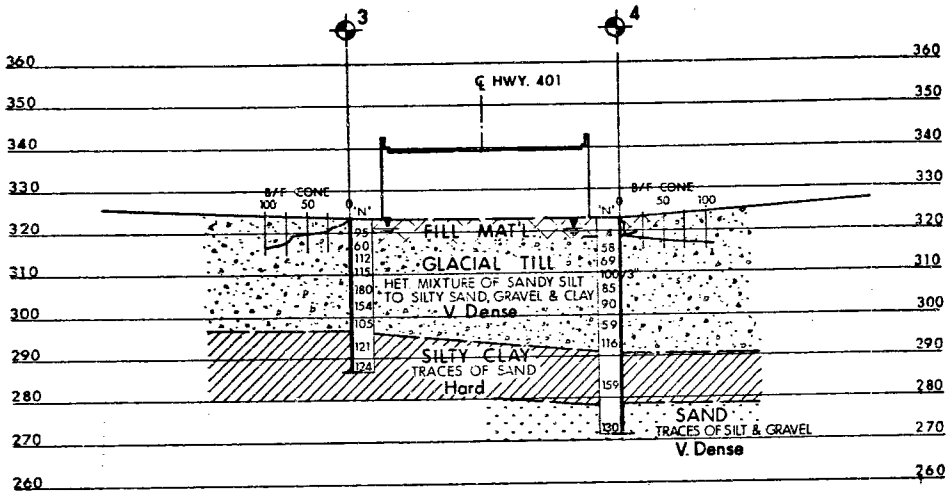
DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS
ONTARIO
DESIGN SERVICES BRANCH

GRAIN SIZE DISTRIBUTION

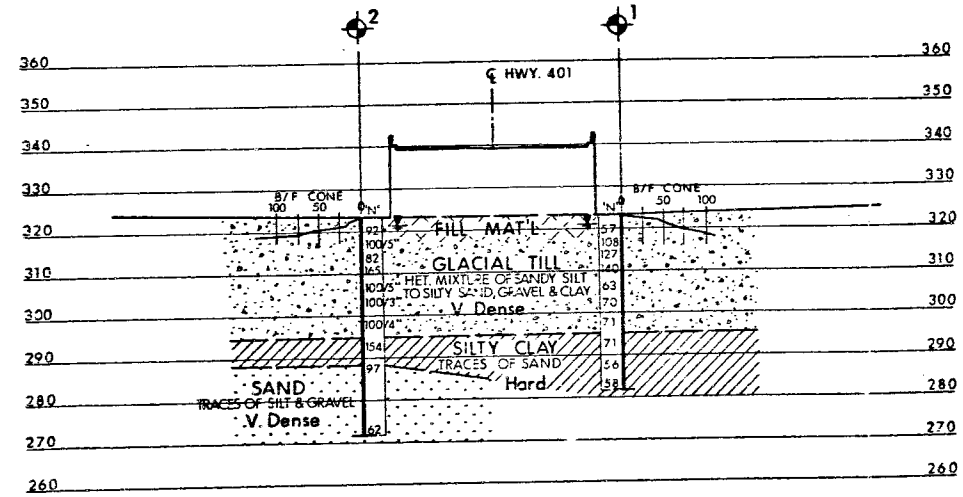
SAND

TRACES OF SILT & GRAVEL

W.P. No.	44-71-09
JOB No.	73-11051
	FIG. 3



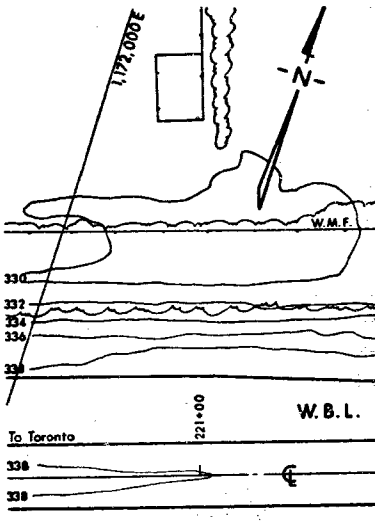
A-A

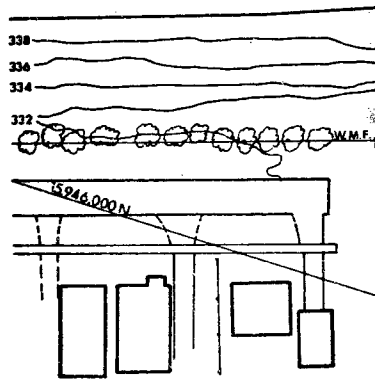


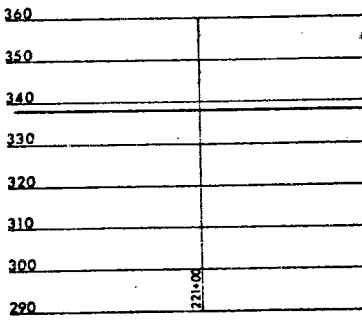
B-B

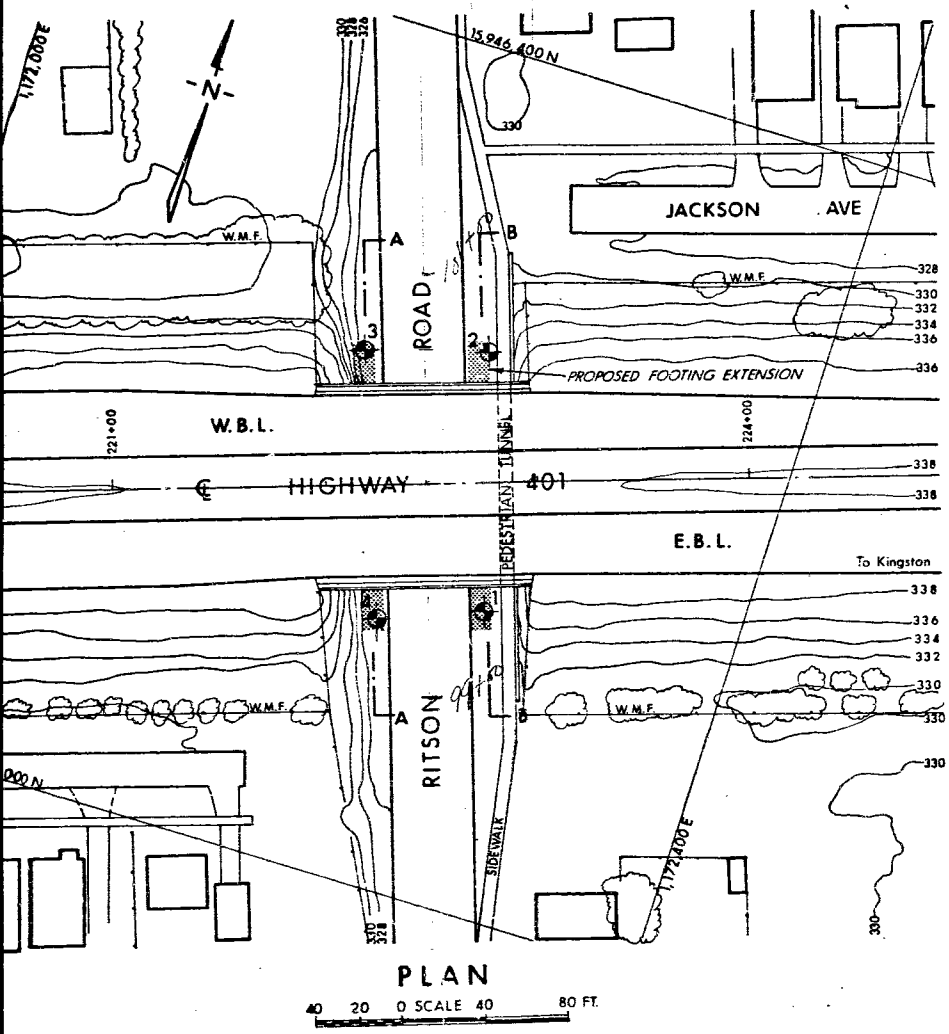
SECTIONS

VERT. 20 10 0 SCALE 20 40 FT.
HORIZ. 40 20 0 40 80



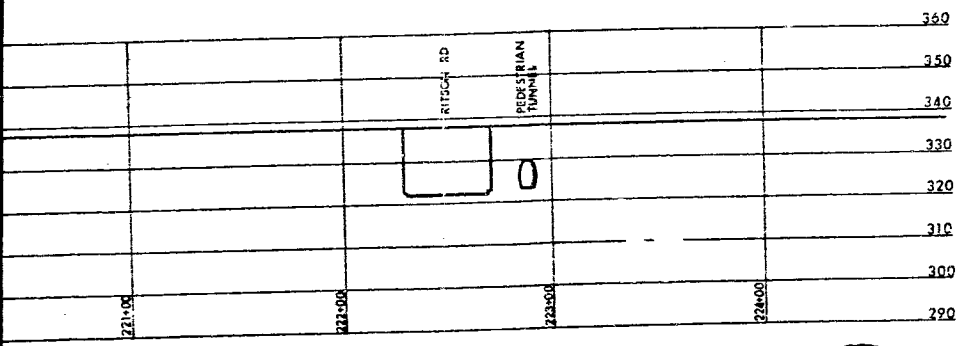






PLAN

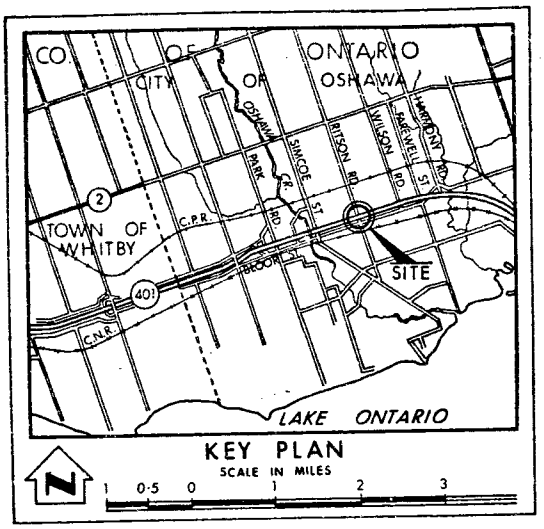
40 20 0 SCALE 40 80 FT.



PROFILE

VERT. 20 10 0 SCALE 20 40 FT.

HORIZ. 40 20 0 40 80



KEY PLAN

SCALE IN MILES

LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation. JULY 1973

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	323·2	15,946,142	1,172,281
2	323·3	15,946,261	1,172,246
3	323·2	15,946,244	1,172,190
4	322·7	15,946,124	1,172,233

— 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

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO
DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RITSON ROAD

HIGHWAY NO. 401 DIST. NO. 6

CO. ONTARIO CITY OF OSHAWA

TWP. LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D C.P.	CHECKED	W.P. NO. 44-71-09	DRAWING NO. 73-11051A
DRAWN S.O.	CHECKED	W.O. NO. 73-11051	
DATE 2 AUG 1973		SITE NO.	BRIDGE DRAWING NO.
APPROVED PRINCIPAL FOUNDATION ENGINEER		CONT. NO.	

REGISTERED PROFESSIONAL ENGINEER C.S.L. POON PROVINCE OF ONTARIO

REF. NO. B 4 - 18

Ontario

Ministry of
Transportation and
Communications

Structural Section,
Central Region,
3501 Dufferin Street,
Downsview, Ontario.
M3K 1N6
Telephone: 248-3097

July 24, 1979

Mr. R. Dupuis, P. Eng.,
Design Engineer-Roads,
Works Department,
Regional Municipality of Durham,
Box 623, 105 Consumers Drive,
Whitby, Ontario.
L1N 6A3

Dear Sir:

RE: Ritson Road Overpass,
Proposed Lowering of Profile on Ritson Rd.,
W.P. 44-71-09, Site 22-179,
Highway 401, District 6

Further to our discussion, please find enclosed M.T.C. recommendations for frost protection of the abutment footings at the Ritson Road Overpass. This detail was prepared by the M.T.C. Soil Mechanics Section. They indicated to me that the layer of sand over the styrofoam could be substituted with granular 'A' if proper care is taken when placing the granular so as not to damage the styrofoam. They suggested placing a thin layer of sand over the styrofoam before the granular is placed.

When your Region prepares the contract documents for the lowering of the grade, would you please ensure that this detail is included. The detail will apply for the full length of the abutment footings.

If further information is required, please do not hesitate to contact this office.

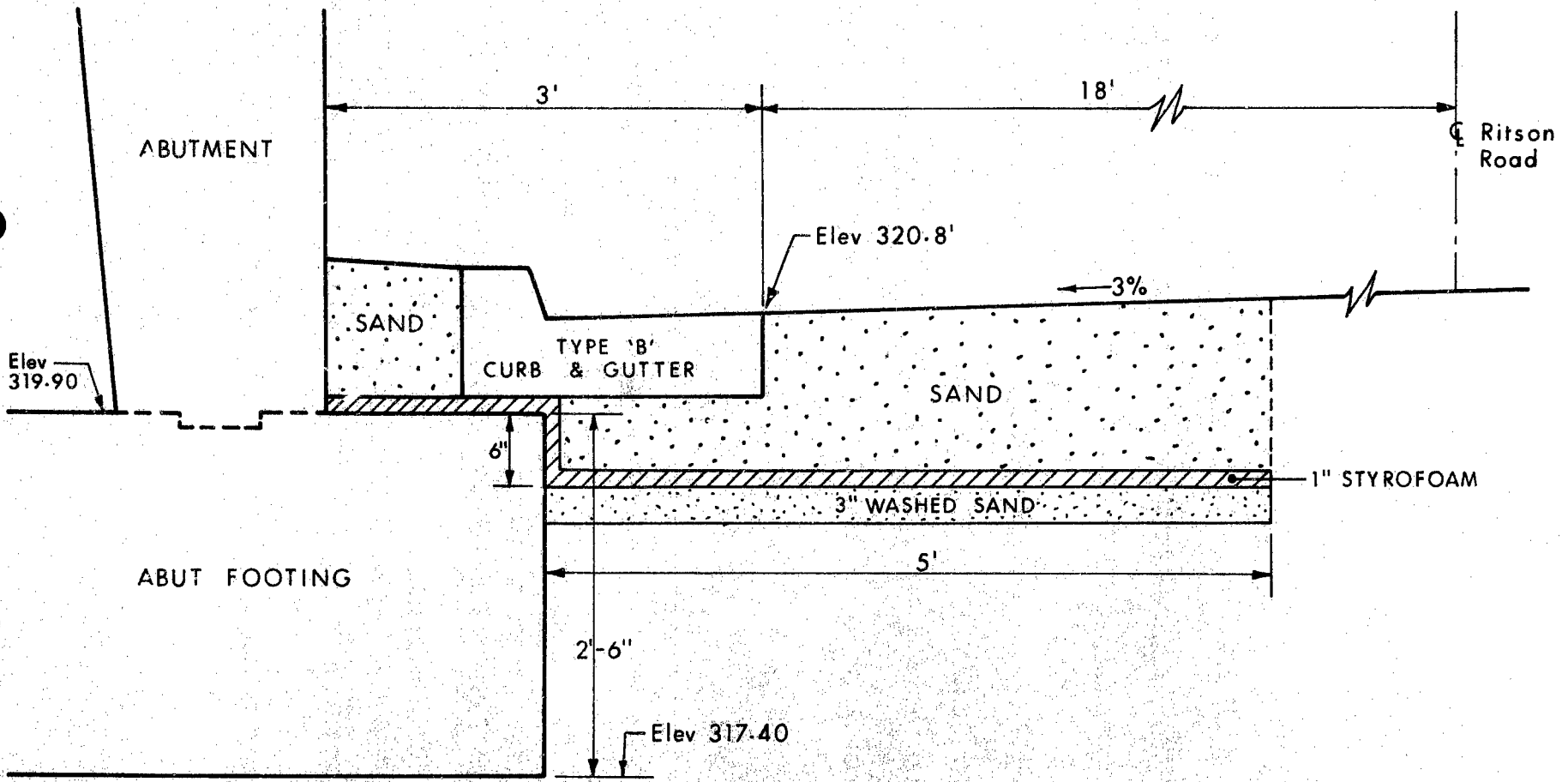
Yours truly,

D.H. Bye,
Structural Supervisor,
for:
G.C.E. Burkhardt,
Head, Structural Section.

DHB:gj
Encl.

c.c. M. Devata
W. Lankinen
A. McKillop

B-24
File



WP 44 - 71 - 09

PROPOSED CROSS SECTION

memorandum

Ontario

To: Mr. M. Devata,
Soil Mechanics Section,
Central Building, Downsview.

Date: 79-07-17

Central Region

RE: Ritson Road Overpass,
Proposed Lowering of Profile on Ritson Road,
Site 22-179, W.P. 44-71-09,
Highway 401, District 6

This will confirm our discussion of 79-07-16 regarding the above proposal.

As discussed, there is a problem to do with minimal vertical clearance through the above structure under Highway 401. The solution to the problem is to lower the grade of Ritson Road through the structure. When the grade is lowered the earth cover for frost protection at the abutment foundations will be reduced to something less than the desirable 4' minimum. In the worst situation the cover will be 3.25 ft. from base of foundation to top of concrete gutter.

You indicated that the reduced cover was acceptable, providing the foundations were insulated with a layer of styrofoam.

The contract for the lowering of Ritson Road will be prepared and administered by the Region of Durham. We will therefore have to provide them with the necessary details and specifications for the foundation protection scheme.

Could you please provide details showing the thickness of the styrofoam, the location where it should be placed and any specification that might be required either for the material or the method of installation. The information can then be forwarded to the Region of Durham.

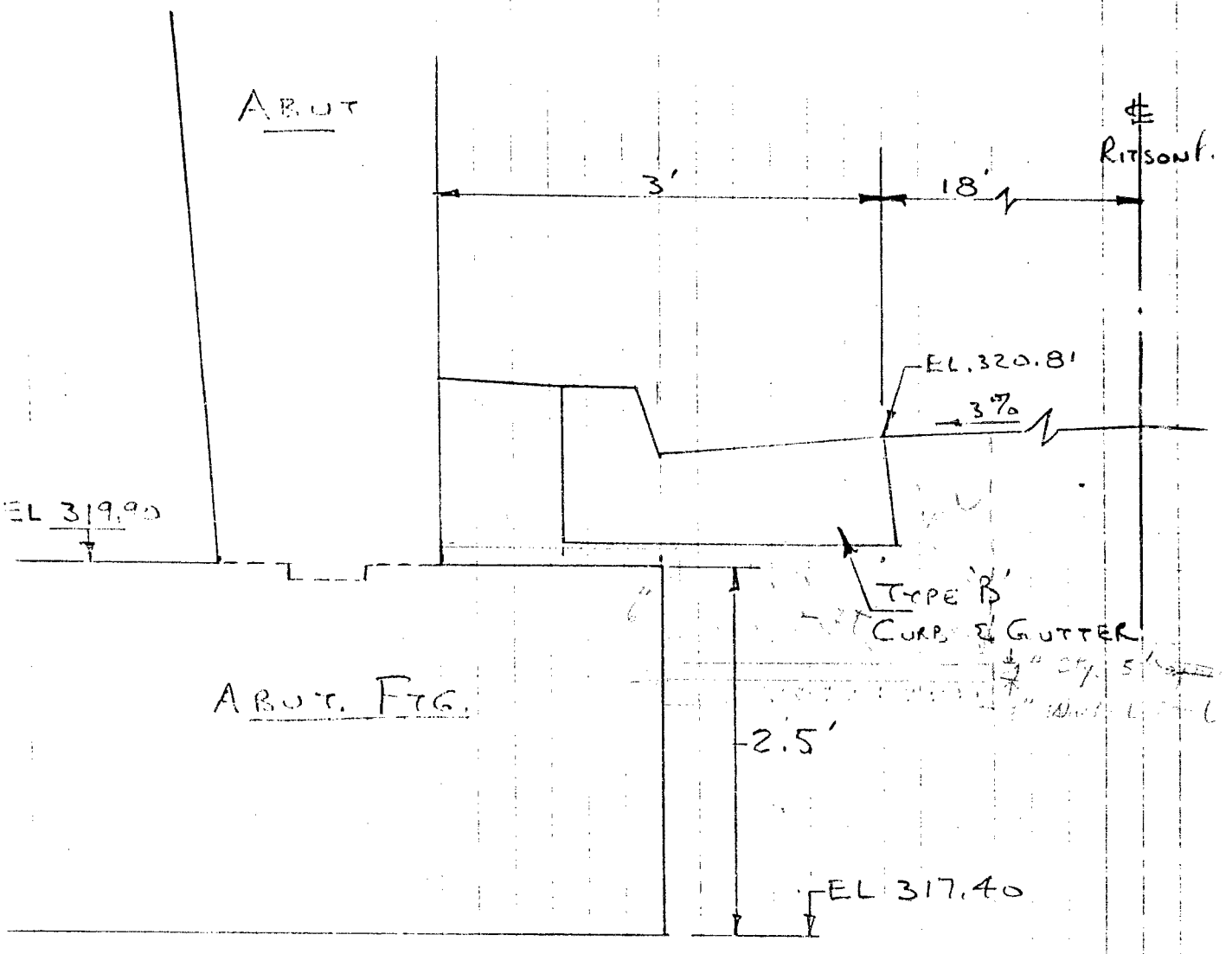
For your information I have enclosed a sketch showing the minimum cover situation.

Since the Region of Durham wish to call the contract this Fall, an early reply would be appreciated.

D.H. Bye,
Structural Supervisor,
for:
G.C.E. Burkhardt,
Head, Structural Section.

DHB:gj
Encl.

c.c. W. Lankinen



PROPOSED CROSS SECTION