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DIST. 6 REGION

W.P. No. 27-66-15

CONT. No. 80-37

W. O. No.

STR. SITE No. 24-322

HWY. No. 403

LOCATION Hwy 403 & Hwy 10
Bridge #41

No OF PAGES -

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

CONT 80-37

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

30M12-69

TO: Mr. G.C.E. Burkhardt, (3)
Regional Structural Planning Eng.,
Central Region,
3501 Dufferin St., Downsview.

FROM: Foundations Office,
Design Services Branch,
West Bldg., Downsview.

ATTENTION:

DATE: December 20, 1973.

OUR FILE REF.

IN REPLY TO

DEC 27 1973

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
The Proposed Structure at the Crossing of
Hwy. #403 and Hwy. #10 (Bridge #41)
Town of Mississauga, County of Peel
District #6 (Toronto)
Site No. 24-322
W.O. 73-11086 -- W.P. 127-66-15

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

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

A. G. Stermac,
PRINCIPAL FOUNDATIONS ENGINEER.

AGS/ao
Attch.
c.c. E. J. Orr
B. R. Davis
A. Rutka
R. S. Pillar
H. Greenland
B. J. Giroux
C. Mirza
G. A. Wrong
B. A. Singh

Foundations Files
Documents

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FOUNDATION INVESTIGATION REPORT
For
The Proposed Structure at the Crossing of
Hwy. #403 and Hwy. #10 (Bridge #41)
Town of Mississauga, County of Peel
District #6 (Toronto)
Site No. 24-322
W.O. 73-11086 -- W.P. 127-66-15

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1. *INTRODUCTION:*

In conjunction with the proposed Hwy. #401/ Hwy. #403 complex, it is proposed to construct an interchange in the vicinity of Hwy. #10 and the proposed Hwy. #403. This will require an underpass structure to carry the traffic on Hwy. #10 over Hwy. #403.

A request for a foundation investigation at the site of the proposed Bridge #41 (Hwy. #10 over proposed Hwy. #403) was received from Mr. G. C. E. Burkhardt, Regional Structural Planning Engineer, in a memorandum dated October 18th, 1973.

Following this request a field investigation was carried out by the Foundations Office to determine the subsoil, bedrock and groundwater conditions existing at the site.

This report contains the results of this investigation and our recommendations pertaining to the design of the proposed structure foundations and the stability of the approach fills and cuts.

2. *DESCRIPTION OF THE SITE AND GEOLOGY:*

The site of the proposed structure is located about

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3/4 of a mile south on Hwy.#10 of the intersection of Eglinton Avenue and Hwy.#10.

Topographically, the general area is flat to gently undulating. The land is utilized for farming purposes.

Physiographically, the site is located in the region referred to as the "Peel Plain". Across this plain rivers and streams have cut deep valleys and consequently there are no large undrained depressions, swamps or bogs, although in many of the interstream areas the drainage is imperfect.

The characteristic geological material of this region is a glacial till containing large amounts of shale and limestone. The overburden is underlain by dark grey shale bedrock of the Meaford-Dundas Formation.

3. *FIELD AND LABORATORY INVESTIGATION PROCEDURES:*

A total of ten sampled boreholes was carried out during the course of the field work. Boring was achieved by means of a C.M.E. Hollow Stem Auger adapted for soil sampling purposes. During the field work, disturbed samples were obtained by means of a standard split-spoon sampler; the energy used in driving it conformed to the requirements of the Standard Penetration Test (SPT).

Dynamic Cone Penetration Test was carried out adjacent to one borehole (B.H.#2). Driving energy to advance the cone was 350 ft./lbs. per blow.

The bedrock was proven at all borehole locations using BXL rock coring equipment.

All boreholes were surveyed in the field by District #6 (Toronto) Construction Personnel. The locations referenced to a coordinate system and elevations referenced to Geodetic Datum and are shown on Drawing No. 73-11086A which accompanies this report.

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All samples were visually examined and classified at the site as well as in the laboratory. Following this inspection laboratory tests were carried out on selected samples to determine the following engineering properties:

Natural Moisture Content
Atterberg Limits
Grain-Size Distribution

The test results are summarized on the Record of Borehole sheets contained in the Appendix of this report.

4. *SOIL TYPES AND SOIL CONDITIONS:*

4.1) *General:*

Generally uniform subsoil conditions were found to prevail over the site area. The subsoil consists of a relatively shallow deposit ranging in thickness from 2 to 5 ft. of glacial till which is a heterogeneous mixture of clayey silt to silty clay, some sand and trace of gravel, followed by shale bedrock. The only exception was in Borehole #2 where Fill Material (5 feet) was encountered.

The boundaries of the different deposits are shown on the Record of Borehole sheets attached to the Appendix. The estimated stratigraphical profile of Drawing No. 73-11086A is based upon this information.

From ground level downward, the various strata are described in some detail with regard to soil types and physical properties as follows:

4.2) *Fill Material:*

This deposit was intersected in Borehole #2 and extends from immediately below a thin layer of topsoil down to 5.0 feet. The lower boundary was found to be at elevation 520.

The material in the stratum consists of silty

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sand to clayey silt with sand and gravel.

Standard Penetration Test carried out within this cohesive deposit gave an 'N' value of 23 blows per foot. The consistency of this deposit is estimated to be very stiff.

4.3) *Heterogeneous Mixture of Silty Clay, Sand and Gravel*

This deposit was intersected in all borings and extends from immediately below a thin layer of topsoil or the fill material down to the bedrock surface. The thickness of the zone ranges from 2(B.H.#10) to 5(B.H.#3) feet. The lower boundary was found to vary between elevation 518.2 (B.H.#4) and elevation 523(B.H.#10).

The material in the stratum consists of silty clay, sand and gravel.

Laboratory tests carried out on a limited number of samples indicate the following physical properties:

	Min.-Max.	*Average*
Natural Moisture Content (W) %	10 - 21	17
Liquid Limit (W_L) %	36 - 45	40
Plastic Limit (Wp) %	20 - 26	22

Grain-size distribution curves are included in the Appendix of this report (Fig.1).

Standard Penetration Tests carried out within this cohesive deposit gave "N" values ranging from 23 to over 100 blows per foot.

The consistency of the overall deposit is estimated to range from very stiff to hard.

4.4) *Bedrock:*

With the exception of Boreholes #9 and #10, the glacial till deposit is underlain by a shale bedrock at all the boring locations. The upper boundary of the bedrock

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varies between elevation 518(B.H.#4) and elevation 523(B.H.#10).

The bedrock core samples were examined by Mr. B.G. Glassford, Geologist, Ministry of Transportation and Communications. Mr. Glassford presented the results of his bedrock description as well as an interpretation of geologic conditions existing at this site, in a letter to this Office, dated November 1973 and enclosed in Appendix of this report.

The dominant type of bedrock encountered across the site is a dark grey shale with occasional bands of limestone.

5. *GROUNDWATER CONDITIONS:*

Groundwater level observations were carried out during the period of the field investigation (November), in open boreholes. The observed water levels are presented on the individual Record of Borehole sheets as well as on Drawing No. 73-11086A. The results indicate that the groundwater level varies between elevation 518(B.H.#1) and elevation 524(B.H.#10) which correspond to levels ranging from 1 to 6 feet below the existing ground surface.

No artesian or downward drainage conditions were encountered.

6. *DISCUSSION AND RECOMMENDATIONS:*

6.1) *General:*

It is proposed to construct a four-span (122'-120'-120'-122') underpass structure at this location. This structure (Bridge #41) will carry traffic over the proposed Hwy.#403.

The proposed profile grade of Hwy.#403 in the vicinity of the structure will be at approximate elevation 516. The proposed profile grade of Hwy.#10 varies between elevation 535 and elevation 544. The elevation of the

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existing ground level ranges from elevation 525 to elevation 530. In order to accommodate these grades fills up to 14' and cuts up to 12 will be required.

As described in the previous paragraphs of this report, the subsoil at the site consists of a relatively shallow deposit of glacial till, followed by shale bedrock.

6.2) Foundations:

6.2.1) Abutments:

The abutments of the proposed structure may be supported on spread footings placed on well compacted, suitable granular material within the approach fills. A safe design load of 2.5 t.s.f. may be assumed. The granular material should consist of Granular 'A' and should be fully compacted according to current standards. A detailed construction scheme is outlined on Figure 2 of the Appendix.

As an alternative the abutments for this structure may be perched within the approach fills and supported on end-bearing steel 'H' piles driven to bedrock. The allowable capacity of a pile will be dependent on the pile section chosen. For example, 12 BP 74 steel 'H' piles may be designed for a safe design load of 95 tons. For estimating purposes, it can be assumed that the piles will meet the bedrock surface at the following elevations:

South Abutment: El. 520 - El. 518 (B.H.#1 & #2)
North Abutment: El. 523 (B.H.#9 & #10)

Since the pile caps of the perched abutments will be formed within the approaches, no dewatering problems are anticipated.

No boulder or rock fill material should be placed in that portion of the approaches through which piles are to be given.

At the time of preparation of this report it was not clear whether perched or closed-end abutments will be

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considered at this location. If closed-end abutments are considered for this structure, these may be constructed on sound shale bedrock as discussed elsewhere for spread footing type of pier foundations.

6.2.2) Piers:

The excavation for the constructed Hwy.#403 in the vicinity of the pier locations will be carried out into the shale bedrock.

The footings of the proposed piers may be founded on the sound bedrock. The base of the footing excavations should be carefully inspected to ensure that all the probable weathered or fractured part of the shale bedrock is removed. Frost protection (minimum 4 feet) should be provided for the underside of the footings, since the shale is considered susceptible to frost action. To prevent the shale from being softened by uncontrolled surface runoff water at foundation level it may be advantageous that a concrete working slab be poured immediately after the excavation reached the required foundation level. If these procedures are followed, safe design loads up to 10 t.s.f. may be used for design purposes.

A coefficient of friction of 1.0 between the rough concrete surface and sound shale may be assumed in order to compute the horizontal resistance of the footings.

The settlement of the footings will be negligible in magnitude.

The level of the groundwater in the overburden as established during the field investigation is well above the footing excavation bases. This condition, however, should not present any major dewatering problems, due to the relatively impervious nature of the subsoil. Any seepage into the excavations could be easily handled by employing conventional techniques, such as pumping from sumps.

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6.3) Approaches:

As described previously the approaches will consist of partial fill and cut sections. The maximum fill height is about 14 feet and the deepest portion of the cut is in the order of 12 feet.

6.3.1) Fills:

The underlying subsoil (Glacial Till) is competent to support the proposed 14 ft. high embankment constructed with 2:1 forward and side slopes.

The settlement due to consolidation of the subsoil caused by embankment loading will be negligible in magnitude and it is assumed that major portion of the settlement will take place immediately following the completion of the fill placement.

The fill should consist of well compacted acceptable material.

The topsoil and any soft surficial material should be removed in accordance with the pertinent standards within the construction area.

6.3.2) Cuts:

The cuts for Hwy.#403, up to 12 feet deep will be made through the glacial till and into the shale bedrock. Since the shale when it is exposed to air, frost action and weathering tends to erode and disintegrate quickly, should be treated as earth cut incorporating 2:1 overall slopes.

It is also recommended, that the cut slopes be protected with an adequate cover of topsoil and sodded.

7. MISCELLANEOUS:

The field investigation was carried out during the period of October 31st to November 5th, 1973, under the

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supervision of Mr. V. Korlu, Project Foundations Engineer.

Equipment was owned and operated by P.V.K. and Sons, Burford.

This report was written by Mr. J. T. Bangs, Project Foundations Engineer.

The entire project was under the general supervision of Mr. M. Devata, Supervising Foundations Engineer, who also reviewed this report.

J. T. Bangs, P. Eng.,

M. Devata, P. Eng.,

JTB/ji
Dec. 18th, 1973.

APPENDIX I

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 1

JOB 73-11086 LOCATION Co. Ord's 15,842,131 N; 961,842 E ORIGINATED BY VK

W.P. 127-66-15 BORING DATE November 2nd, 1973 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and Core with C.M.E.-55 CHECKED BY

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT; SHEAR STRENGTH P.S.F. (○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE)	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W (W_P W W_L) WATER CONTENT % (20 30 40)	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
524.2	Ground Level									
0.0	Clayey silt, sand & gravel									
520.7	Hard Brown		1	SS	74			○		9 18 43 30
3.5	Weathered Grey		2	BXL	50% Rec.	520				▼ 518.3
	Sound Shale Bedrock, occasional interbedded limestone layers *		3	BXL	100% Rec.	510				
499.0			4	BXL	100% Rec.	500				
25.2	End of Borehole					490				

OFFICE REPORT ON SOIL EXPLORATION

* Detailed description in Appendix of Report.

20 15 ○ 5 10 % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 2

JOB 73-11086 LOCATION Co. Ord's 15,842,218 N; 961,903 E ORIGINATED BY VK

W.P. 127-66-15 BORING DATE April 12th, 1972 COMPILED BY AT

DATUM Geodetic BOREHOLE TYPE Auger and Cone Test CHECKED BY

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	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 / w_P w w_L / WATER CONTENT % 20 30 40	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
525.4	Ground Level									
0.0	Fill Material(silty sand to clayey silt, with sand & gravel)		1	SS	23					▼522.2
520.4			2	SS	100/1"	520				
5.0	Clayey silt with sand &gr.(glacial till)hard									
517.9										
7.5	Shale bedrock, occasional limestone layers.*		3	BXL RC	Rec 65%					
			4	BXL RC	Rec 100%	510				
509.9										
15.5	End of Borehole					500				

OFFICE REPORT ON SOIL EXPLORATION

* Detailed description in Appendix of Report.

20 / 15 ◇ 5 / 10 % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 3

JOB 73-11086 — LOCATION Co. Ord's 15,842,223 N; 961,761 E — ORIGINATED BY VK

W.P. 127-66-15 — BORING DATE November 1st, 1973 — COMPILED BY VK

DATUM Geodetic — BOREHOLE TYPE Auger and Core with C.M.E.-55 — CHECKED BY

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT; SHEAR STRENGTH P.S.F. o UNCONFINED + FIELD VANE • QUICK TRIAXIAL × LAB VANE	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W WATER CONTENT % 20 30 40	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
523.7	Ground Level									
0.0	Clayey silt, sand and gravel		1	SS	63			o		4 16 50 30
518.7	Hard Brown		2	SS	134	520				▼ 521.3
5.0	Grey Shale bedrock occasional interbedded limestone layers*		3	BXL	100% rec					
			4	BXL	100%					
			5	BXL	100% rec					
			6	BXL	40% rec	510				
	Sound		7	BXL	100% rec					
504.2										
19.5	End of Borehole					500				

* Detailed description in Appendix of Report.

15 20 10 5 % STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 4

JOB 73-11086 LOCATION Co.Ord's 15,842,318N; 961,834 E ORIGINATED BY VK

W.P. 127-66-15 BORING DATE November 6th, 1973 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and Core with C.M.E.-55 CHECKED BY

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT / SHEAR STRENGTH P.S.F. (o UNCONFINED, • QUICK TRIAXIAL, + FIELD VANE, × LAB VANE)	LIQUID LIMIT W_L, PLASTIC LIMIT W_P, WATER CONTENT W; WATER CONTENT % 20 30 40	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
523.2	Ground Level									
0.0	Clayey silt, sand and gravel.		1	SS	20	520				▽ 522.2
518.2	Hard Brown		2	SS	119/10"					3 24 47 26
5.0	Weathered Grey Sound		3	BXL	75% Rec.					
	Shale bedrock with occasional inter-bedded limestone layers*		4	BXL	95% Rec.	510				
			5	BXL	100% Rec.					
498.7						500				
24.5	End of Borehole					490				

* Detailed description in Appendix of Report.

15 ◇ 5 (20, 10) % STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 5

JOB 73-11086 LOCATION Co.Ord's 15,842,306 N; 961,674 E ORIGINATED BY VK

W.P. 127-66-15 BORING DATE November 1st, 1973 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and Core with C.M.E.-55 CHECKED BY

SOIL PROFILE ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT — 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 % 20 30 40	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
523.8	Ground Level									
0.0	Clayey silt, sand and gravel Brown		1	AS	-					▼ 520.8 18 13 42 27
520.3			2	BXL	100% rec.	520				
3.5	Grey Shale with inter-bedded limestone layers*		3	BXL	60 % rec.					
			4	BXL	100% rec.	510				
	Sound		5		90% rec.					
498.8						500				
25.0	End of Borehole					490				

* Detailed description in Appendix of Report.

15 ◇ 20 5 10 % STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 6

JOB 73-11086 LOCATION Co.Ord's 15,842,397 N; 961,745 E ORIGINATED BY VK

W.P. 127-66-15 BORING DATE November 6th, 1973 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and Core with C.M.E.-55 CHECKED BY

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT / 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 % (20 30 40)	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
523.8	Ground Level									
0.0	Clayey silt, sand & gravel									
520.4	hard brown		1	SS	100	4" 520		○		▼ 521.4
3.4	Weathered grey		2	BXL	56% rec					
	Sound Shale bedrock with occasional inter-bedded limestone		3	BXL	72% rec	510				
509.8	layers*									
14.0	End of Borehole					500				

* Detailed description in Appendix of Report.

15 20 5 10 % STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 7

JOB 73-11086 LOCATION Co.Ord's 15,842,394 N; 961,592 E ORIGINATED BY vk

W.P. 127-66-15 BORING DATE October 31st, 1973 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and Core with C.M.E.-55 CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w	BULK DENSITY	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	WATER CONTENT % 20 30 40	γ P.C.F.	GR. SA. SI. CL.
523.7 0.0	Ground Level									
521.7 2.0	Topsoil Brown		1	AS	-			○		▼ 522.7 3 16 44 37
	Weathered					520				
	Sound		2	BXL	70% Rec.					
	Shale bedrock with occasional inter-bedded limestone layers*		3	BXL	95% Rec.					
509.2 14.5	End of Borhole					510				
						500				

OFFICE REPORT - SOIL EXPLORATION

* Detailed description in Appendix of Report.

20 15 ◇ 5 10 % STRAIN AT FAILURE

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 8

JOB 73-11086 LOCATION Co.Ord's 15,842,483 N; 961,661 E ORIGINATED BY VK

W.P. 127-66-15 BORING DATE November 5th, 1973 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and Core with C.M.E.-55 CHECKED BY

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT / 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 % 20 30 40	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
525.8	Ground Level									
0.0 / 522.3	Clayey silt, sand & gravel hard, brown		1	SS	119/10"			○		8 13 47 32
3.5	Weathered — — grey		2	BXL	65% Rec.	520				▼ 520.4
	Sound Shale bedrock with occasional inter-bedded limestone layers*		3	BXL	90% Rec.					
			4	BXL	100% Rec.	510				
500.8			5	BXL	100% Rec.					
25.0	End of Borehole					500				

* Detailed description in Appendix of Report.

15 20 5 10 % STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH — FOUNDATIONS OFFICE

RECORD OF BOREHOLE No 9

JOB 73-11086 LOCATION Co.Ord's 15,842,478 N; 961,503 E ORIGINATED BY VK

W.P. 127-66-15 BORING DATE October 31st, 1973 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and Core with C.M.E.-55 CHECKED BY

SOIL PROFILE ELEV./DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS/FOOT	ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT / 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 %	BULK DENSITY γ P.C.F.	REMARKS GR.SA.SI.CL.
524.6 Ground Level										
0.0 / 522.6	Topsoil Brown		1	SS						0 18 55 27
2.0	Weathered									▼ 520.6
	Sound Grey		2	BXL	70% Rec	520				
	Shale bedrock with occasional inter-bedded limestone layers*		3	BXL	30% Rec					
			4	BXL	60% Rec	510				
			5	BXL	100% Rec					
497.6						500				
27.0	End of Borehole					490				

* Detailed description in Appendix of Report.

15 20 10 5 % STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS – ONTARIO

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE Nº 10

FOUNDATIONS OFFICE

JOB 73-11086 LOCATION Co.Ord's 15,842,582 N; 961,585 E ORIGINATED BY VK

W.P. 127-66-15 BORING DATE November 5th, 1973 COMPILED BY VK

DATUM Geodetic BOREHOLE TYPE Auger and Core with C.M.E.-55 CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT w_L / PLASTIC LIMIT w_P / WATER CONTENT w	BULK DENSITY γ	REMARKS
ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE	w_P w w_L WATER CONTENT % 20 30 40	P.C.F.	GR.SA.SI.CL.
525.0	Ground Level									
0.0 / 523.0	Topsoil Brown									▽ 524.0
2.0	Weathered Grey		1	BXL	60% Rec	520				
	Sound Shale bedrock with occasional inter-bedded limestone layers*		2	BXL	100% Rec.					
510.5			3	BXL	100% Rec.					
14.5	End of Borehole					510				

* Detailed Description in Appendix of Report.

20 / 15 ◇ 5 / 10 % STRAIN AT FAILURE

OFFICE REPORT ON SOIL EXPLORATION

GRAIN SIZE DISTRIBUTION

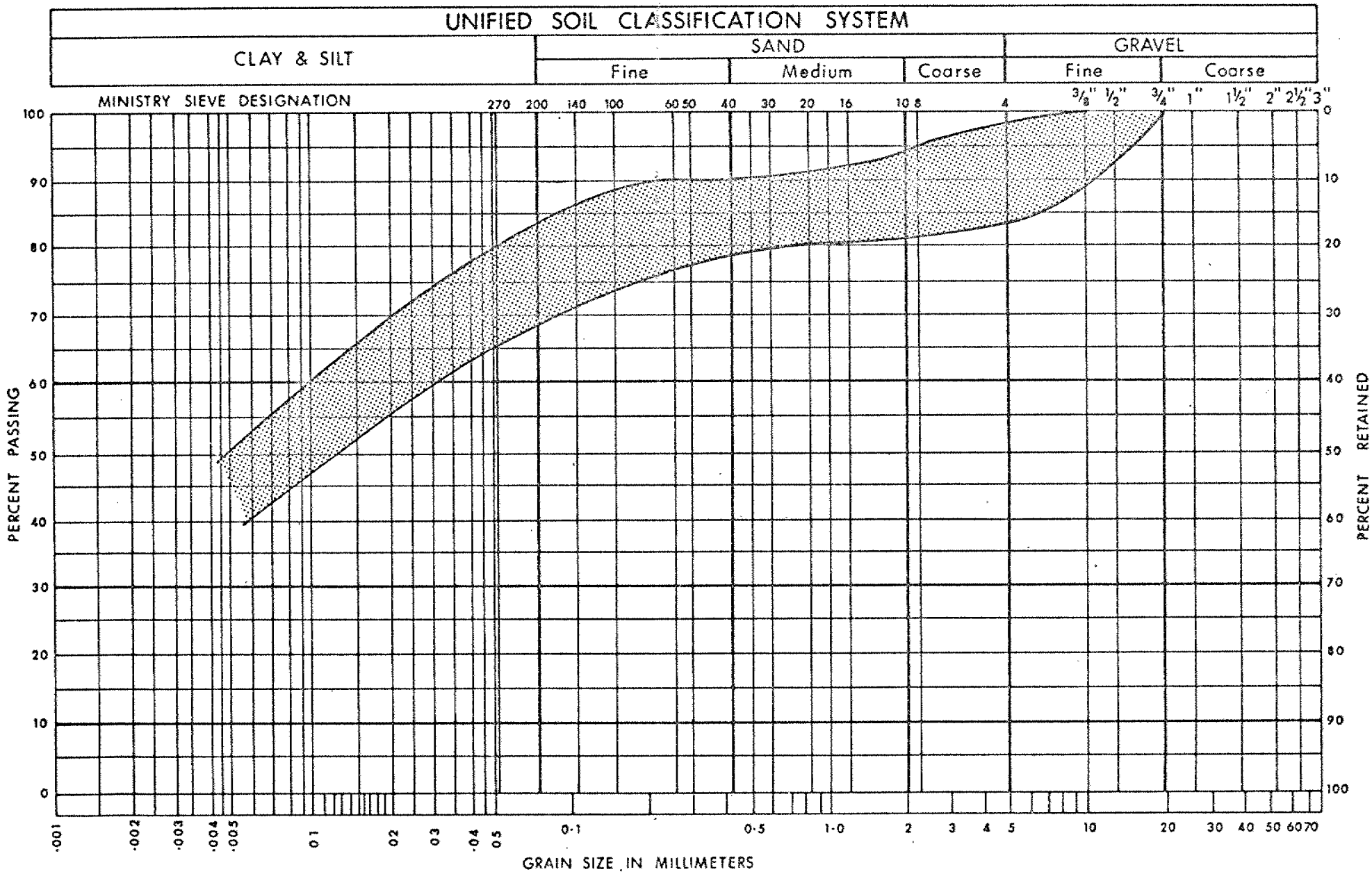
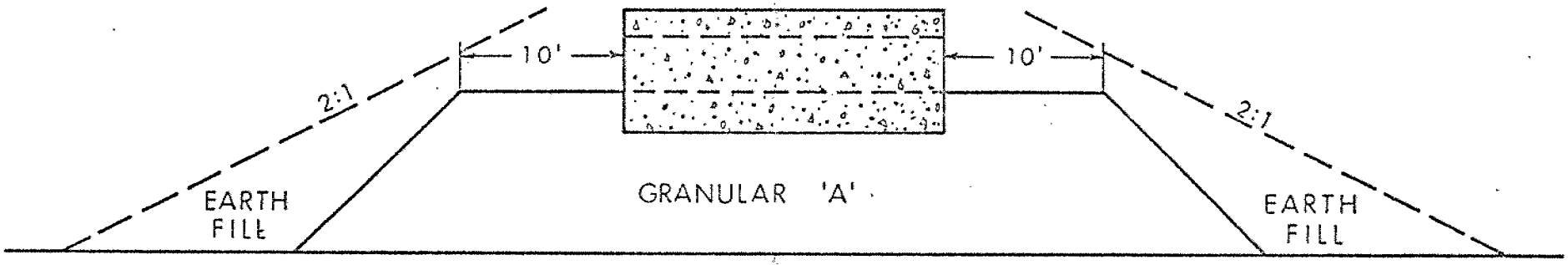


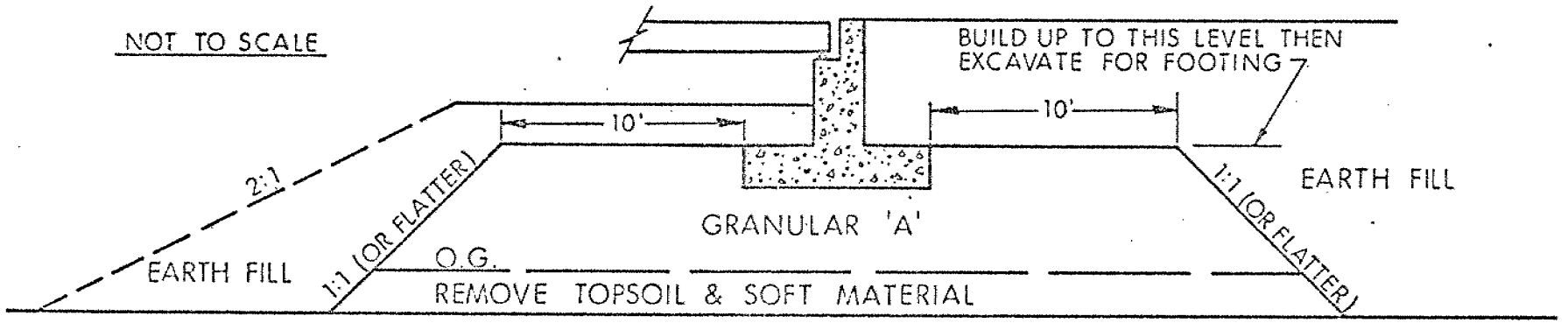
FIG. 1

W.O. 73-11086

ABUTMENT ON COMPACTED FILL SHOWING GRANULAR 'A' CORE



X - SECTION



LONGITUDINAL SECTION

NOTES

1 - REMOVE TOPSOIL &/OR SOFT SUBSOIL UNDER AREA OF COMPACTED GRANULAR 'A'.

2 - PLACE GRANULAR 'A' TO TOP OF FOOTING LEVEL, COMPACTED ACCORDING TO CURRENT M.T.C. STANDARDS.

3 - EXCAVATE COMPACTED GRANULAR 'A' MATERIAL FOR FOOTING.

FIG. 2

W.O. 73-11086

FD-9 (Rev. Jan. 73)

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

PENETRATION RESISTANCE

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

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

DESCRIPTION OF SOIL

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

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

TERMS TO BE USED IN DESCRIBING SOILS:-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC.

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

U	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V.	FIELD VANE
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

FD-9b (Rev. 73)

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

SOIL PROPERTIES

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

GENERAL

π	= 3·1416
e	BASE OF NATURAL LOGARITHMS 2·7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ε	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

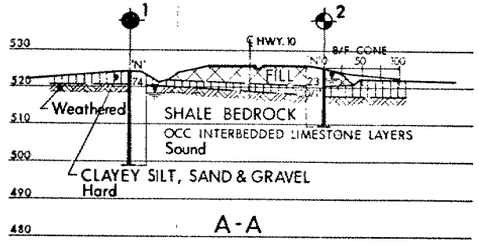
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

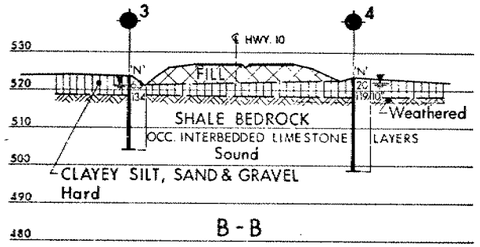
B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

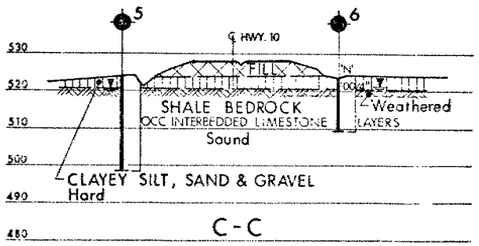
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



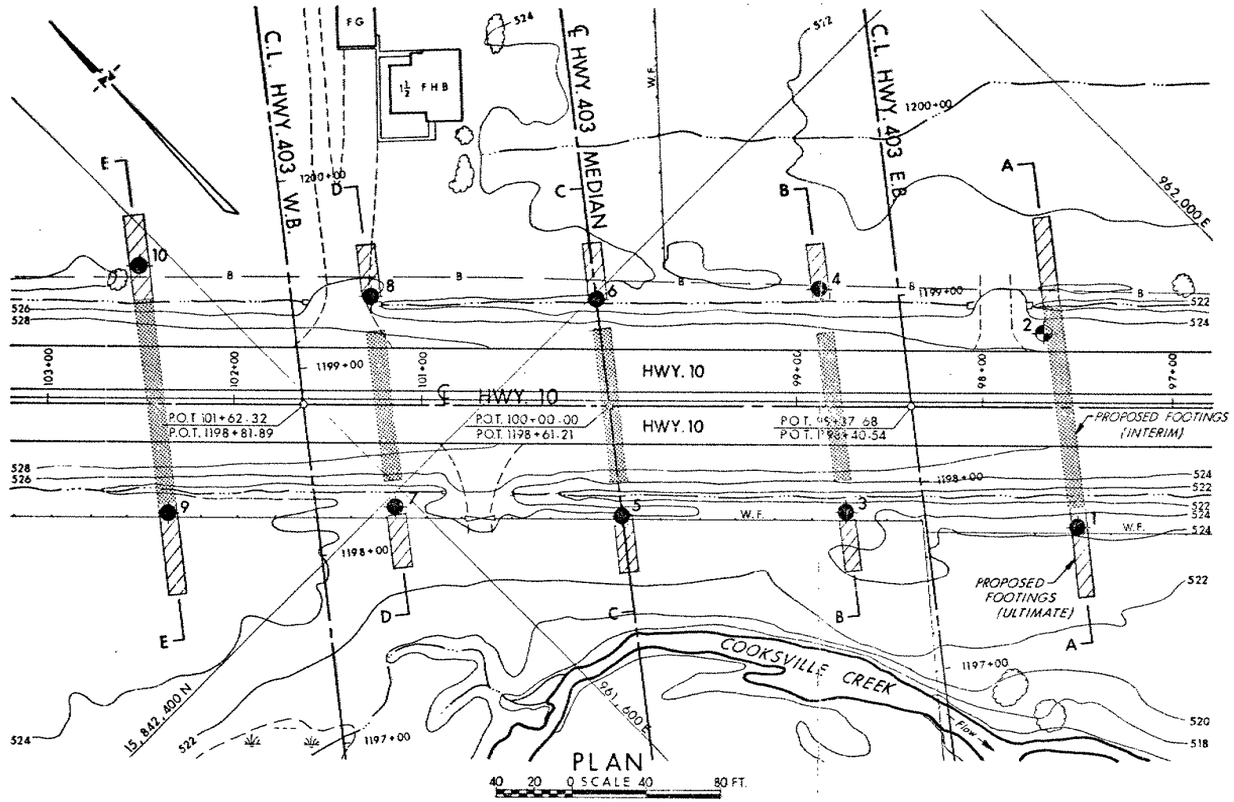
A-A



B-B

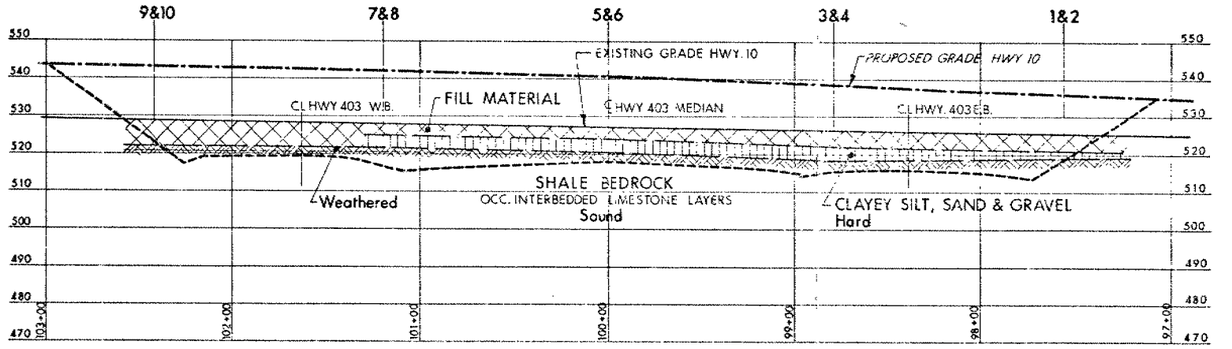


C-C



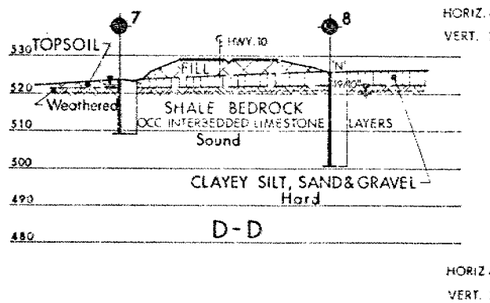
PLAN

40 20 0 SCALE 40 80 FT.

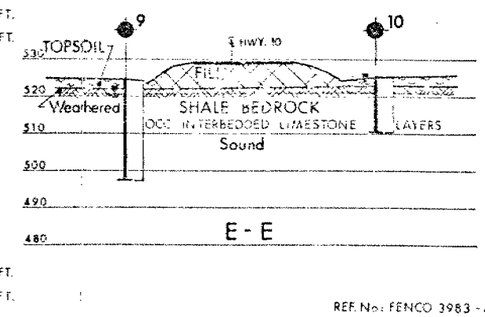


PROFILE - HWY. 10

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



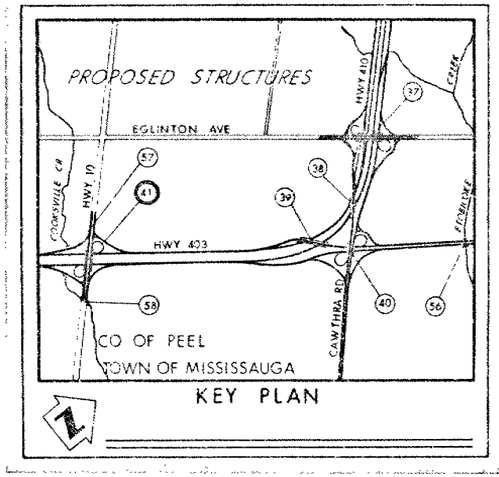
D-D



E-E

SECTIONS

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



KEY PLAN

LEGEND

- Bore Hole
- Cone Penetration Test
- Bore Hole & Cone Test
- Water Levels established at time of field investigation. April 1972, Oct & Nov. 1973.

NO.	ELEVATION	CO-ORDINATES NORTH	CO-ORDINATES EAST
1	524.2	15,842,131	961,842
2	525.4	15,842,218	961,903
3	523.7	15,842,223	961,761
4	523.2	15,842,318	961,834
5	523.8	15,842,306	961,674
6	523.8	15,842,397	961,745
7	523.7	15,842,394	961,592
8	525.8	15,842,483	961,661
9	524.6	15,842,478	961,503
10	525.0	15,842,582	961,585

NOTE FOR CONTRACT DOCUMENT:
The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview, and at the TORONTO District Office.

— 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

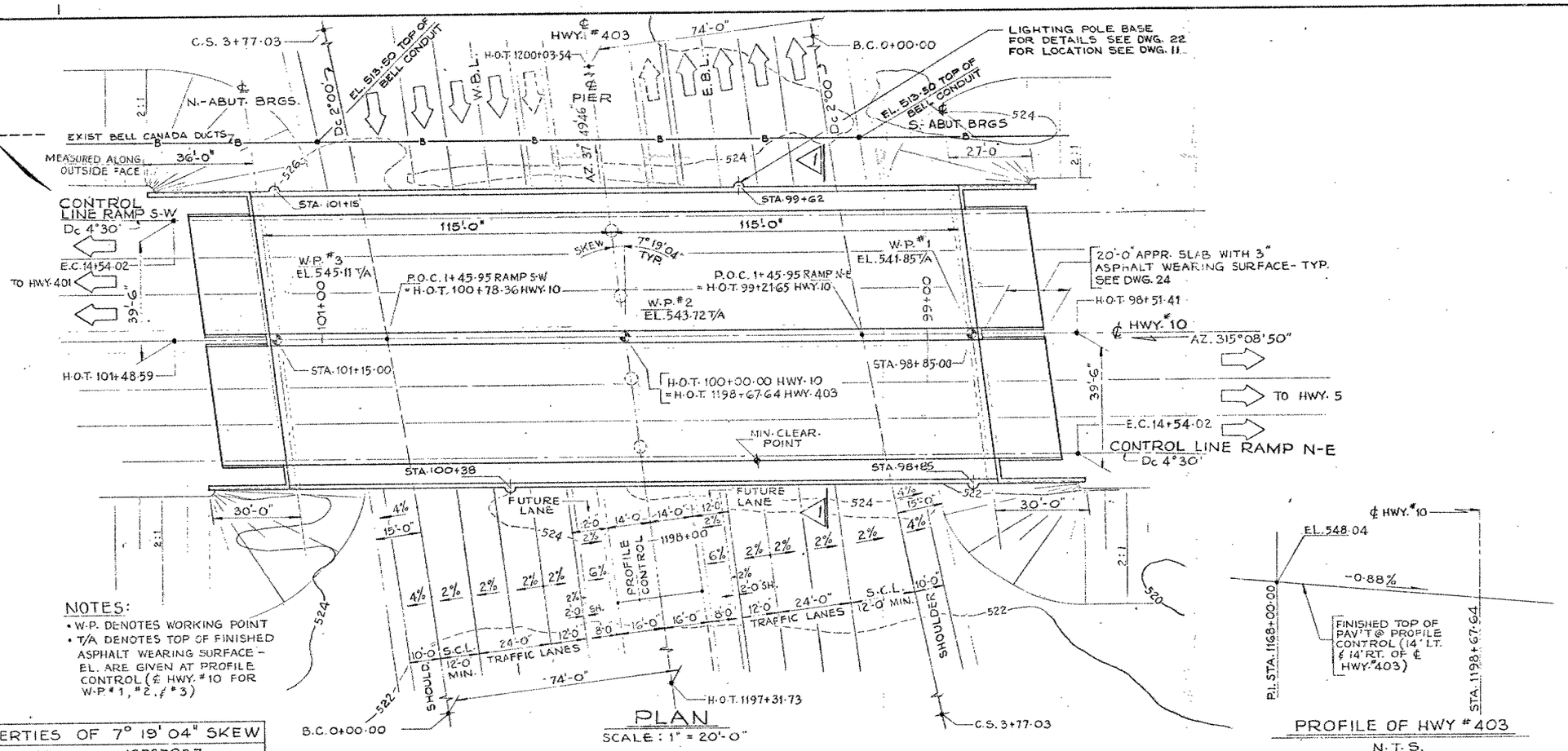
BRIDGE No.41
(HWY. 10 UNDERPASS)

HIGHWAY NO 10 & 403 DIST NO. 6
CO. PEEL
TOWN OF MISSISSAUGA LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD V.K	CHECKED V.V	W.P NO 127-66-15	DRAWING NO. 73-11086 A
DRAWN S.R	CHECKED	W.O NO 73-1086	
DATE NOV 15, 1973		SITE NO	BRIDGE DRAWING NO
APPROVED		CONT NO	

REF. No.: FENCO 3983-4K-5



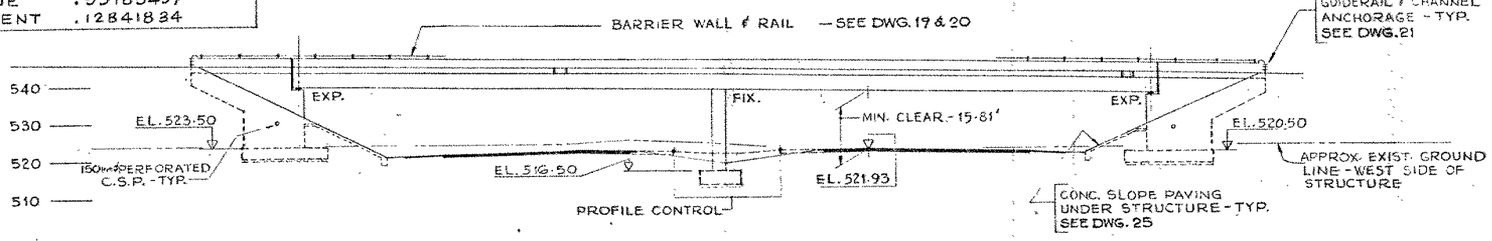
PLAN

SCALE : 1" = 20'-0"

NOTES:

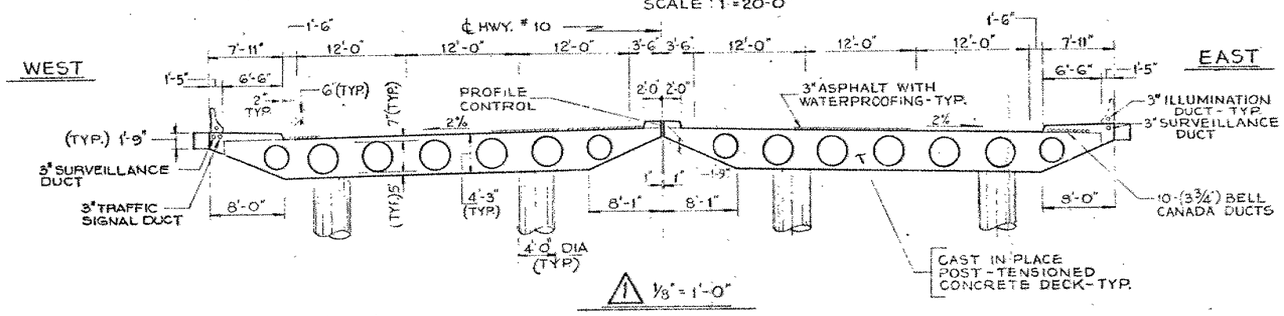
- W.P. DENOTES WORKING POINT
- T/A DENOTES TOP OF FINISHED ASPHALT WEARING SURFACE - EL. ARE GIVEN AT PROFILE CONTROL (℄ HWY. #10 FOR W.P. #1, #2, & #3)

PROPERTIES OF 7° 19' 04" SKEW	
SINE	.12737237
COSINE	.99185497
TANGENT	.12841834



ELEVATION

SCALE : 1" = 20'-0"



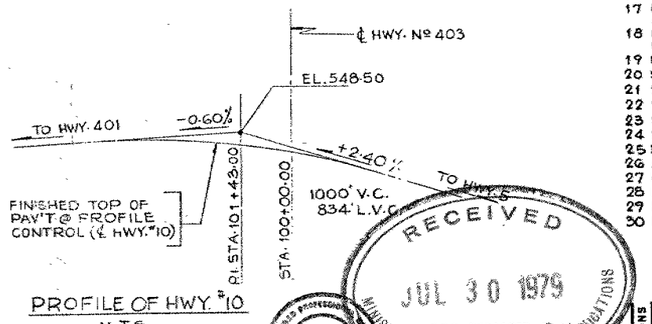
1 1/8" = 1'-0"

PROFILE OF HWY # 403

N.T.S.

CONCRETE QUANTITIES ARE LISTED BELOW FOR THE APPROPRIATE CONCRETE LUMP SUM TENDER ITEMS.

CONCRETE QUANTITIES	CU.YD.
CONCRETE IN PIERS, ABUTMENTS & WING WALLS	796
PRESTRESSED CONCRETE BRIDGE DECK	2500
CONC. IN BARRIER WALLS	44
CONC. IN APPROACH SLABS	102
CONC. IN SLOPE PAVING	72



PROFILE OF HWY. #10

N.T.S.

GENERAL NOTES:

CLASS OF CONCRETE

PIERS AND DECK	- 35 M Pa
FOOTINGS	- 30 M Pa
ABUTMENTS AND WING WALLS	- 30 M Pa
BARRIER WALLS	- 30 M Pa
REMAINDER	- 20 M Pa

REINFORCING STEEL

GRADE OF STEEL - GRADE 400

REINFORCING BARS WITH THE DESIGNATION 'C' AT THE END OF BAR MARKS SHALL BE COATED BARS.

REINFORCING STEEL CLEAR COVER

FOOTINGS	ABUTMENTS	COLUMNS	DECK
3"	3"	2½"	2" TOP, 1½" BOT.

BARRIER WALLS	APPROACH SLABS
AS NOTED	2"

TO ACHIEVE THE MIN. CLEAR COVER OF 2" SPECIFIED THE TOP LAYER OF DECK REINF. SHALL BE PLACED PRIOR TO CONCRETING, WITH A CLEAR COVER OF 2½" ± ½" TOLERANCE.

CONSTRUCTION NOTES

CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ± ⅛".

NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED, STRESSED AND GROUTED.

LIST OF DRAWINGS:

RECEIVED
JUL 30 1979
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS
SOIL MECHANICS SECTION

Q. M. ISLAM

FOR REDUCED PLAN SEE SCALE BELOW

0 6 12 18

3 INCHES ON ORIGINAL PLAN

DISTRICT 6	
CONT No	
WP No 127-66-15	
HIGHWAY 10 UNDERPASS BRIDGE 41 GENERAL ARRANGEMENT	SHEET

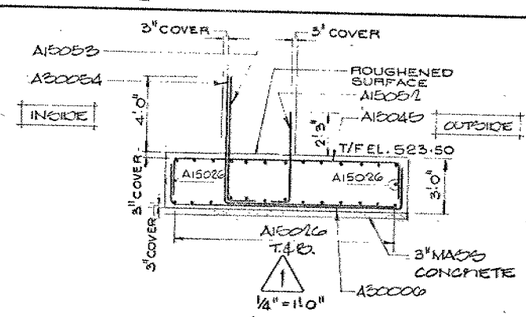
C.C. PARKER & ASSOCIATES LTD.
CONSULTING ENGINEERS — HAMILTON

REVISIONS			
DATE	BY	DESCRIPTION	
DESIGN S.B.	CHECK Q.I.	LOADING HS20-44	DATE 79-06-20
DRAWING D.G.	CHECK Q.I.	SITE No 24-322	DWG 1

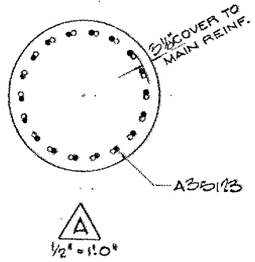
NORTH FOR CONSTRUCTION

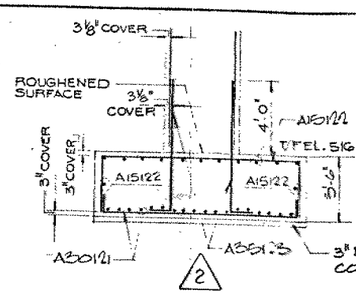
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO

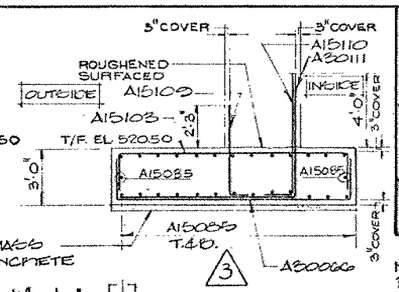
AU TRANSLAT. 1906-71-24



BAR SPACING TO BE MEASURED ALONG FACE OF ABUTMENT



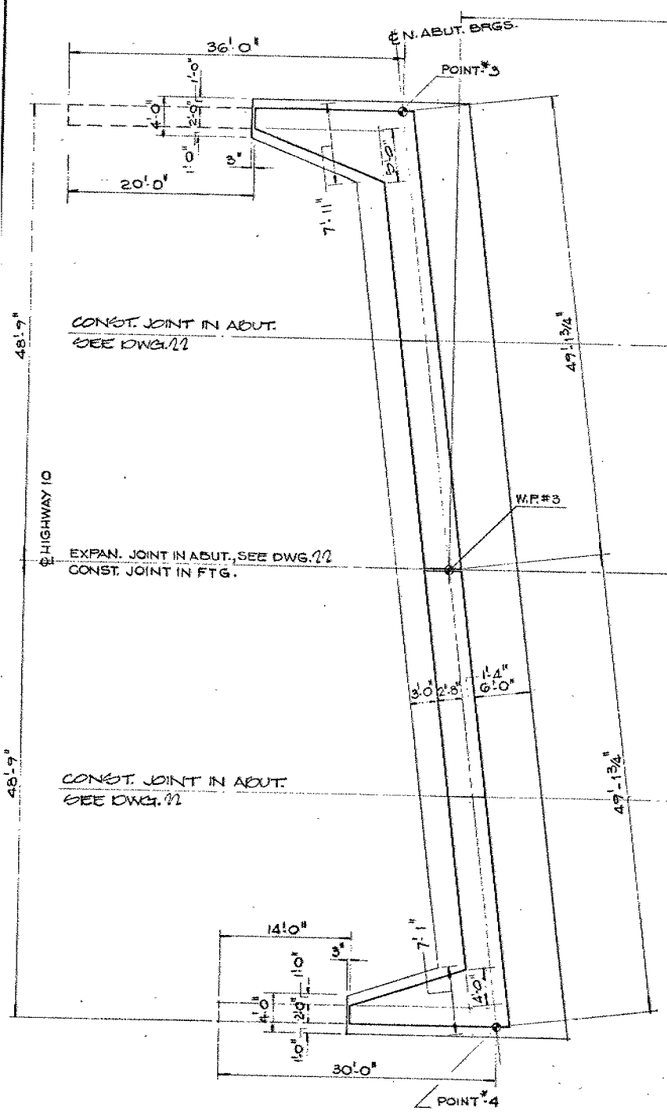


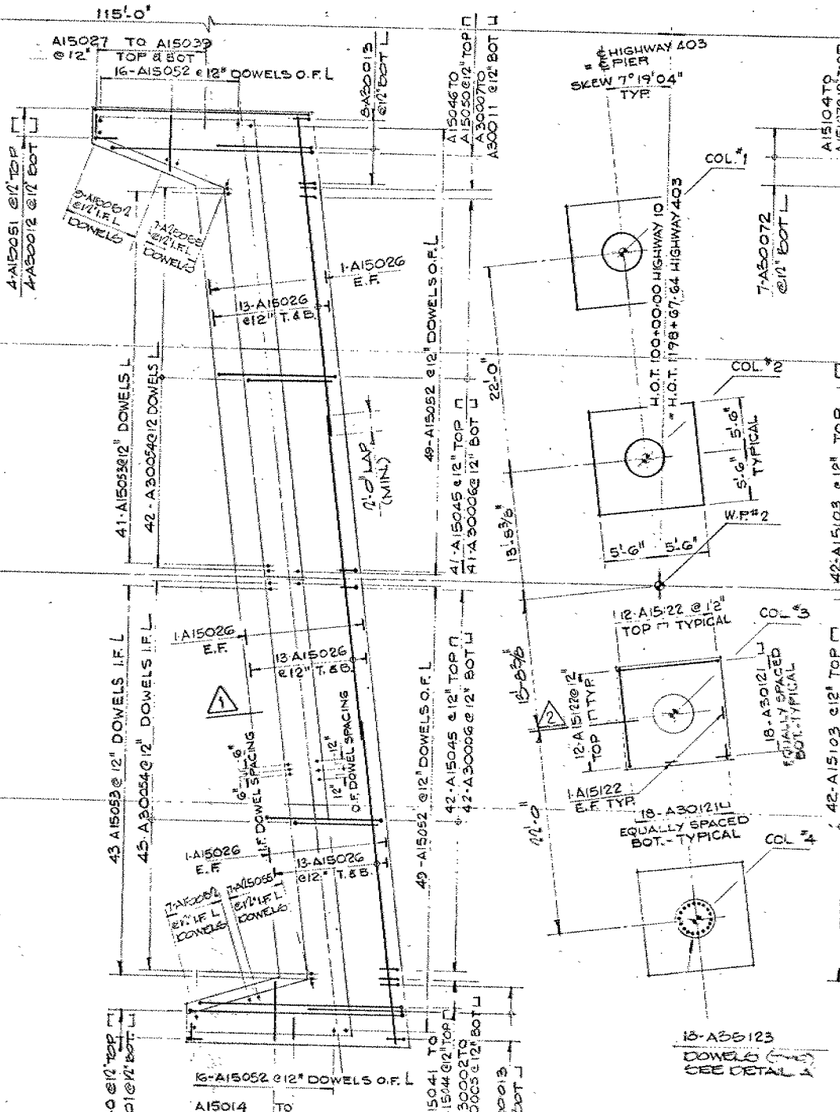


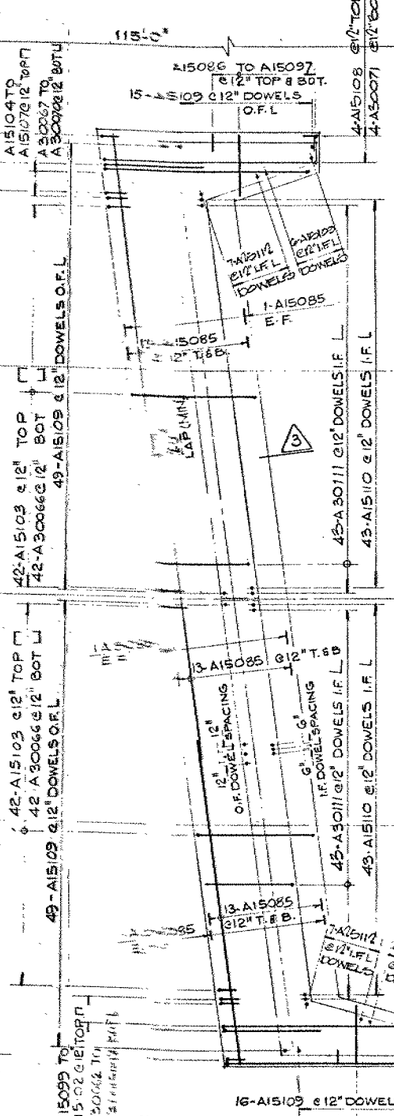
DISTRICT 6	
CONT No	
WP No 127-66-15	
HIGHWAY 10 UNDERPASS BRIDGE 41	SHEET
FOUNDATION LAYOUT & REINFORCING	

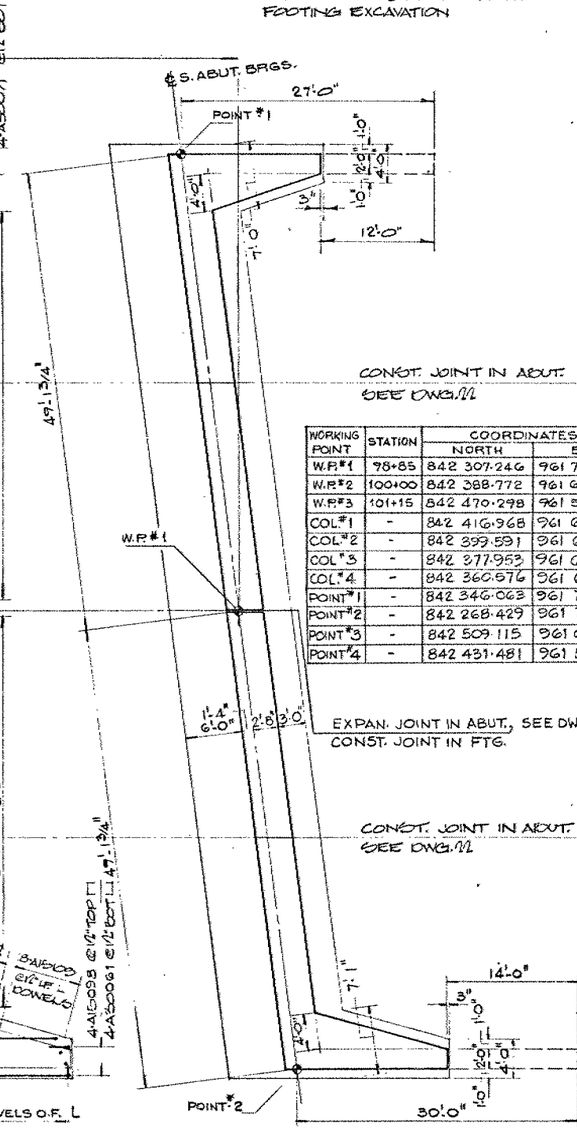
C.C. PARKER & ASSOCIATES LTD.
CONSULTING ENGINEERS — HAMILTON

NOTE:
3" MASS CONCRETE TO BE CAST WITHIN 3 HOURS AFTER FOOTING EXCAVATION









WORKING POINT	STATION	COORDINATES NORTH	COORDINATES EAST
W.P. #1	98+85	842 307.246	961 756.132
W.P. #2	100+00	842 388.772	961 675.024
W.P. #3	101+15	842 470.298	961 593.916
COL. #1	-	842 416.968	961 696.918
COL. #2	-	842 399.591	961 683.425
COL. #3	-	842 377.953	961 666.623
COL. #4	-	842 360.676	961 653.130
POINT #1	-	842 346.063	961 786.274
POINT #2	-	842 268.429	961 725.990
POINT #3	-	842 509.115	961 624.058
POINT #4	-	842 431.481	961 563.774

FOUNDATION LAYOUT AND FOOTING REINFORCING
1/8" = 1'-0"

Q. M. ISLAM
REGISTERED PROFESSIONAL ENGINEER
PROVINCE OF ONTARIO

FOR REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

REVISIONS	DATE	BY	DESCRIPTION

DESIGN S.B.	CHECK K.	LOADING HS20-44	DATE 79-06-20
DRAWING GSN	CHECK K.	SITE No 24-322	DWG 3

TRANSLAN 1500-11-78

WP127-66-15

Ontario Ministry of Transportation and Communications

Memorandum

To: Mr. G. C. E. Burkhardt,
Head,
Structural Office,
Central Region.

Attention: Mr. T. Hewson

From: Pav't. & Foundation Design Section,
Engineering Materials Office,
Room 315, Central Building,
Downsview, Ontario.

Date: 79 11 13

Our File Ref.

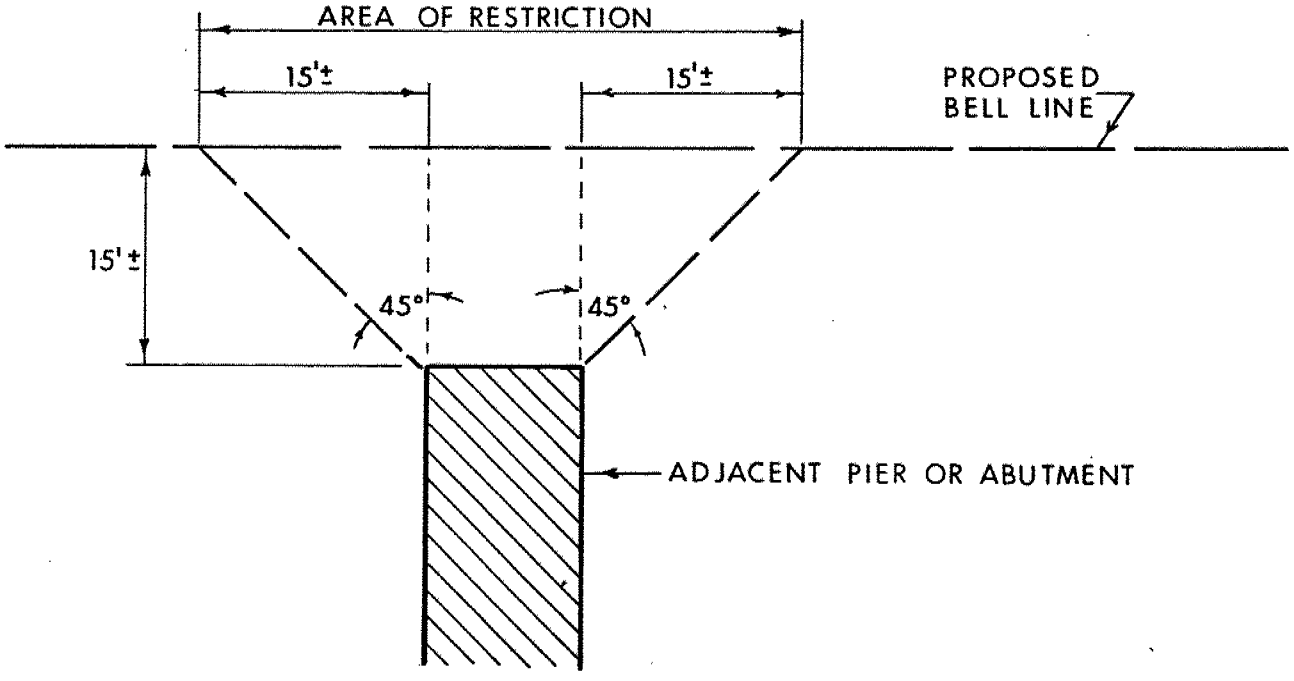
In Reply to

Subject: Re: Hwy. 403 and Hwy. 10,
W.P. 127-66-15, Site 24-322,
District 4, Hamilton.

This will confirm our verbal recommendations given to you over the telephone on 79 11 08 concerning the Bell duct construction adjacent to the above structure.

As discussed our recommendations are as follows:

For excavation, control blasting techniques should be employed in the area of the bell line as contained by a 45° angle from the corners of the adjacent abutment or pier. (See sketch below)



In this area, the excavation side slopes shall be no flatter than 1 horizontal to 1 vertical.

M MacLean

MM/MD/cy

c.c. Files

M. MacLean,
Project Foundations Engineer
For: M. Devata,
Senior Foundations Engineer.

Mr. C.S. Grebski
Head, Central Section
Structural Office
2nd Floor, West Building

Mr. W. Lin

Soil Mechanics Section
Engineering Materials Office
Room 315, Central Building

79 02 27

Re: Hwy. 403 and Hwy. 10
W.P. 127-66-15, Site 24-322
District 4, Hamilton

We have reviewed the Preliminary Design Drawing No. 24-322-P1 for the above structure.

The drawing indicates that the abutments and the centre pier will be supported by spread footings founded in shale bedrock. Since the shale in this area is susceptible to deterioration upon exposure, it would be advisable that a concrete working slab be poured immediately after the excavation has reached the required founding level. Further, prior to placing concrete, the base of the footing excavation should be inspected for any softened zones. If necessary, subexcavation would have to be carried out and backfilled to the footing formation level with mass concrete.

B. Ly
Senior Engineer

For: M. Devata
Supervising Engineer

BL/MD/gs

cc: G.C.E. Burkhardt
D. MacDonald
Files ✓

Mr. G.C.E. Burkhardt
Head, Structural Section
Central Region, 3501 Dufferin St.
Downsview

Soil Mechanics Section
Engineering Materials Office
Room 315, Central Building
Downsview

1978 06 07

Re: Hwy. 3 Underpass at Hwy. 10
W.P. 127-66-15, Site 24-322
District 6, Toronto

With reference to your above mentioned letter dated 1978 05 29, we have reviewed the changes made due to your new structural concept for the above mentioned crossing.

Our subsoil investigations at this crossing were carried out and submitted in our "Foundation Investigation Report" dated 1973 12 20. According to this information the subsoil at this site consists of a thin layer of fill and cohesive glacial till underlain by shale bedrock with occasional limestone layers. The established bedrock surface elevation varies between about 520.5 at the south and about 523.0 at the north side of the planned structure. According to the new plan (dated 1978 02) the foundation footings will be based at about elevation 516.0. If the foundations are placed at this elevation or below then the recommendations in our above mentioned Foundation Report should be sufficient and followed. As such we do not believe further soil investigation is necessary.

V. Korlu
Project Engineer

For: M. Devata
Supervising Engineer

VK/MD/gs

cc: Files ✓

Mr. C.S. Grebski,
Structural Design Engineer,
Structural Office,
West Building, Downsview.

Soil Mechanics Section,
Geotechnical Office,
West Building, Downsview.

August 9th, 1974.

RE: Review of Preliminary Plans,
Hwy. 10 Underpass (Bridge #41)
at Hwy. 403, District 6, Toronto,
W.P. 127-66-18, Site 24-322.

We have reviewed the preliminary plans of the abovementioned structure. The foundation design follows the recommendations of our Report and as such, we have no comments.

V. Korlu,
Project Engineer,
For: M. Devata,
Supervising Engineer.

VK/mj
c.c. Files
Documents