

61-20 SEPT 1976

GEOCRES No. 30M12-65DIST. 6 REGION CentralW.P. No. 127-56-60CONT. No. 78-60W. O. No. 73-11072STR. SITE No. 24-RW1HWY. No. 401/410/403LOCATION Retaining Wall #1
between structure #27 &
#43OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. ~~5~~ 5REMARKS: documents to be unfolded
before microfilming

memorandum



To: Mr. R. Dorton
Manager, Structural Office

Date: 80 01 21

Mr. G.A. Wrong
Head, Pavement & Foundation
Design Section

RE: Contract 78-60 - Installation of Liner Inside Culvert E-9

Culvert E-9 on the above contract is a 946' long, 10'2" X 6'6" steel multi-plate pipe. The culvert was installed in very poor ground conditions and following installation buckling occurred in the roof over a section about 240' long. A temporary bracing system was installed and the culvert was later repaired by installing a grouted tunnel liner. The liner was designed by the pipe manufacturer. During installation the liner also failed over a short 8' section and the failure again took the form of buckling of the roof. After this failure the contractor's grouting methods were changed and no further failures took place. The buckled plates were later removed and new plates were installed in this short section. During this repair it was obvious that there had been no physical contact between the original pipe and the new liner however, the buckling did occur adjacent to a wooden block which had been installed as bracing between the tunnel and the liner.

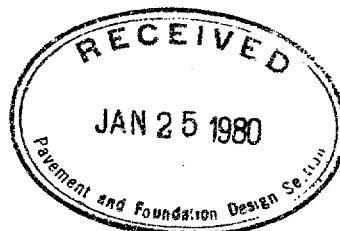
The contractor contends that the failure of the liner was caused by failure of the original pipe. We contend that the failure was caused by the method of installation.

I am enclosing correspondence regarding this problem for your review, and would appreciate the opinion of one of your expert staff on the relative merits of the two arguments, as this will assist in the decision on payment of the contractor's repair costs. Please call me if you require any further information on the problem, I will be happy to supply any details you need. If necessary, we can arrange a meeting to discuss this matter.

R.P. Northwood

R.P. Northwood
Area Construction Engineer

cc: I. Tremain





PITTS ENGINEERING CONSTRUCTION LIMITED

30 COMMERCIAL ROAD, - TORONTO, ONTARIO, M4G 1Z6

Telephone: 421-7373 Telex: 05-23137

January 11, 1980

Ministry of Transportation & Communications,
Construction Office,
Central Region,
3501 Dufferin Street,
Downsview, Ontario,
M3K 1N6

ATTENTION: Mr. R.P. Northwood, P. Eng.,
Area Construction Engineer.

Dear Sir:

Re: MTC Contract 78-60,
Intent to Claim No.3,
Grouting of Tunnel Liner in Culvert E9.

Further to our intent to claim No. 3 on Contract 78-60 we offer the following:

In an examination of our claim for additional costs for installation of the Tunnel Liner in Culvert E9, it is important to note some of the details involved in the construction of the culvert.

The initial design of E9 called for 946 L.F. of 10'2" x 6'6" SPCSPA 12 gauge culvert placed with a normal type bedding.

Artesian conditions were encountered as construction progressed and consequently, the MTC on September 27, 1978 instructed Pitts (see instruction letters G22931, 32 & 33) to modify the bedding in an attempt to alleviate the problem.

In spite of the extra precautions taken, buckling of the culvert occurred. This could only be attributed to failure of the pipe bedding to adequately support the pipe. At the site meeting of October 27, 1979, Pitts were instructed that shoring of culvert E9 was necessary and the work would be paid under force account. The shoring was to be left in place until grading in the area was completed.

Cont'd.....

R.P. Northwood, P. Eng.

- 2 -

January 11, 1980

On December 14, 1978 Pitts were issued further instructions by the MTC (see letter G 42386) to supply and install additional shoring and bracing in E9 as a means of preventing further distortion. This shoring and bracing was to be left in place until remedial action on the pipe was determined.

MTC decided that a 113" x 61" grouted tunnel liner was required inside E9 as a means of strengthening the pipe against failure. Pitts submitted a price based on the quotation request as provided by the MTC.

There can be no doubt from the foregoing facts that the bedding support of culvert E9 was very questionable and beyond any control of the contractor.

The tunnel liner was installed by Pitts forces in September 1979 and grouting was commenced by BBR on October 9, 1979 in accordance with the methods and equipment as submitted in our letter of October 4, 1979.

In your letter of October 15th, 1979 you indicated that the MTC approved the grout design as submitted in our letter of October 4, but not the method of grouting. We suggest that the Grout mix design was discussed in detail due to the fact that when our proposal was reviewed there was some question regarding its adequacy. At no time was there any question raised about our proposed method of grouting and we could only construe this as an approval of our procedures. *let*

As for the buckling of the tunnel liner, we still maintain that the lack of support at the haunch points of E9, as witnessed by the measures taken throughout construction, was the principal cause. We base our argument on the following:

1. The history of the installation of culvert E9 indicates that the soil conditions were less than desirable as a foundation for CSP pipe installation. Inadequate support was the cause of the initial problem, and since this condition was not changed, it would appear to be the cause of subsequent problems.

Cont'd.....

R.P. Northwood, P. Eng.,

- 3 -

January 11, 1980

2. The localized buckling in the 6 to 8 foot section of pipe took place after the grouting operations had ceased for the day. If the damage was caused by upward forces due to the tunnel liner floating, then this should have occurred when the grout was in its most liquid state, not after the pumping had stopped.

3. The area of localized buckling was not subjected to point loading as was suggested in your letter of October 15, 1979. When the damaged section was repaired, there was no blocking found which would induce a point load at this location. Since the liner was supported against upward movement on either side of the buckled section, only a downward force could have caused the damage. This downward force would have to come from culvert E9 buckling down.

4. In order for the liner to float in the grout, the grout would have to be in a liquid state. If the grout were liquid, then it would be forced in the path of least resistance. Since the buckling took place only some 15-20 feet behind the front line of flow. The forces would surely have caused the front line of flow to move out rather than buckle the top of the tunnel liner.

In conclusion we suggest that the extra work required to install and grout the liner in culvert E9 was caused by circumstances totally beyond our control. Since the MTC specified the corrective action required for culvert E9, we do not feel that the contractor (as indicated at site meeting #23) can be held responsible for all unforeseen circumstances & risk involved in installation.

With this in mind we submit our documented costs of \$4,839.69 along with our request for payment of these extra costs.

Trusting this meets with your approval.

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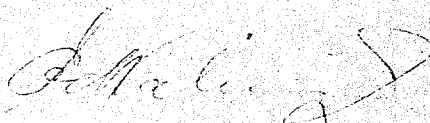
R.P. Northwood, P. Eng.,

- 4 -

January 11, 1980

Yours very truly,

PITTS ENGINEERING CONSTRUCTION LIMITED



for Sherman Ladner,
Project Engineer.

SL/cd

c.c. F. Pahapill - Canadian BBR
E. Kalnins

SOLD TO

SHIPPED TO

INVOICE NO.

Ministry of Transportation & Comm.,
 District 6, Construction,
 1201 Wilson Avenue,
 Downsview, Ontario.

SAME

Claim #3

M.T.C. Contract 78-60

INVOICE DATE	YOUR ORDER NO.	COL.	SHIPPED VIA	PPD.	DATE SHIPPED	PACK SLIP NO.	TERMS
Nov. 23/79		<input type="checkbox"/>		<input type="checkbox"/>			

Labour

Foreman - 61 hours @ \$10.64/hour	\$649.04
Labourers - 162 " @ \$10.14/hour	1642.68

2291.72

Plus 22% Payroll Burden	504.18
-------------------------	--------

2795.90

Plus 35% Overhead & Profit On 1st. \$1000.00	350.00
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Plus 20% on \$1795.90	359.18
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3505.08

Plus 223 hrs. travel time @.40¢/hr.	99.20
--	-------

\$3604.28

Equipment

Generator - 51.5 hours @ \$4.05/hr.	\$208.58
Demolition Hammer -	156.00

Plus 5% on Demo Hammer	7.80
------------------------	------

\$372.38



PITTS ENGINEERING CONSTRUCTION LIMITED

INVOICE

30 COMMERCIAL ROAD - TORONTO, ONTARIO M4G 1Z6
TELEPHONE: 421-7373

SOLD TO

SHIPPED TO

INVOICE NO.

SAME Claim# 3

INVOICE DATE	YOUR ORDER NO.	COL.	SHIPPED VIA	PPD.	DATE SHIPPED	PACK SLIP NO.	TERMS
Nov. 28/79		<input type="checkbox"/>		<input type="checkbox"/>			

Material

Liner Plates - 7 each

$7/4 \times 1.5 \text{ ft.} / 4 \text{ plates} = 2.625 \text{ l.f.}$

$2.625 \text{ l.f.} \times \$237.00/\text{l.f.} =$

\$622.13

Grout Fitting- 1 @ \$18.00

18.00

640.13

Plus 5% FST

32.01

672.14

Plus 7% PST

47.05

719.19

Plus 20% Overhead & Profit

143.84

\$863.03

Total Amount of This Claim

\$ 4839.69

Mr. J. W. MacDougall,
Claims Engineer,
Engineering Claims Office.

79 10 29

RE: Claim on Contract # 78-60,
Pitts Engineering Construction Ltd.,
Toronto area.

Attached please find, for your information, copy of Notification
of Intent to Claim dated October 17, 1979 from Pitts Engineering
Construction Limited regarding the above contract.

ORIGINAL SIGNED
J. A. LELLIOTT

J. A. Lelliott,

Construction Analyst.

For: D. E. Thrasher,
Manager,
Construction Office.

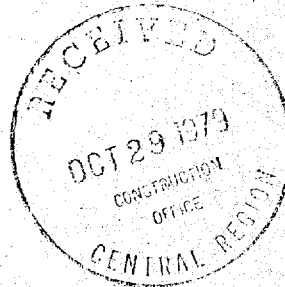
JAL:pv

c.c. J. B. Wilkes,
A. C. Lennox,
R. P. Northwood. ✓



PITTS ENGINEERING CONSTRUCTION LIMITED

30 COMMERCIAL ROAD, - TORONTO, ONTARIO, M4G 1Z6 Telephone: 421-7373 Telex: 06-23137



OCTOBER 9/1979

MAIN SITE OFFICE

CONTRACT 78-60

ATTENTION: R. BURLINGTON

ON TUESDAY OCTOBER 9, 1979 WE ATTEMPTED TO GROUT THE TUNNEL LINER INSIDE CULVERT E9 AS PER OUR PROPOSAL OF OCT 3/79.

AS YOU ARE AWARE PROBLEMS WERE ENCOUNTERED WITH BUCKLING OF THE INSIDE TUNNEL LINER AND WE HAD TO DEViate FROM OUR PLANNED PATTERN. VERTICAL BRACES WERE INSTALLED AT APPROXIMATE 100' CENTRES THROUGHOUT THE LENGTH OF THE PIPE IN AN ATTEMPT TO PREVENT BUCKLING. AS WELL A NUMBER OF DIFFERENT GROUTING CONNECTIONS WERE MADE IN ORDER TO REDUCE THE FLOW PATH OF THE GROUT.

IN SPITE OF THESE ADDITIONAL MEASURES BEING TAKEN, LOCALIZED BUCKLING OCCURRED IN A 6 TO 8 FOOT SECTION OF THE PIPE. (THE TOP OF THE LINER BUCKLED DOWN)

1 PRIOR TO THIS BUCKLING TAKING PLACE, ONE OF THE PLUGS ON THE SIDE OF THE LINER HAD BEEN REMOVED AND WHEN THE GROUT STARTED TO GUSH OUT, THE HOLE WAS PLUGGED BY A WORKER PLACING THE PALM OF HIS HAND OVER IT, THEN BY PLACING A WOODEN WEDGE IN THE HOLE. THIS INDICATES THAT THERE WAS MINIMAL PRESSURE AT THIS POINT. ALSO AT THE TIME OF OCCURANCE GROUTING PROCEDURES HAD STOPPED FOR THE DAY.

WE CAN ONLY DEDUCE THAT THE BUCKLING IS BEING CAUSED BY A FORCE NOT ACCOUNTED FOR IN THE DESIGN OF THIS STRUCTURE.

CONT'D.....

PITTS ENGINEERING CONSTRUCTION LIMITED

30 COMMERCIAL ROAD, - TORONTO, ONTARIO, M4G 1Z6 Telephone: 421-7373 Telex: 66-23137

IT IS A DOCUMENTED FACT THAT SOIL CONDITIONS AT THIS LOCATION (CULVERT E-9) ARE NOT VERY STABLE AND INDEED THE ORIGINAL CULVERT HAD UNDERGONE CONSIDERABLE DEFORMATION DUE TO LACK OF SUPPORT (CAUSED BY SETTLEMENT) UNDER THE HAUNCHES OF THE PIPE. WE ARE OF THE OPINION THAT THE ADDITIONAL WEIGHT OF THE GROUT, WHICH MUST INITIALLY BE CARRIED BY THE OUTSIDE CULVERT IS CAUSING FURTHER DEFORMATION OF THE OUTSIDE PIPE. (SEE ATTACHED DIAGRAM) THIS DEFORMATION WOULD BE IN THE FORM OF OUTWARD & DOWNWARD MOVEMENT AT THE HAUNCH POINTS AND DOWNWARD AT THE TOP CENTRE OF THE PIPE. THIS PUTS CONSIDERABLE PRESSURE ON THE TOP OF THE INSIDE LINER CAUSING IT TO DEFORM DOWN ALSO.

PITTS ENGINEERING AND OUR SUBCONTRACTOR B.B.R. HAVE INCURRED "EXTRA COSTS" (AND WILL CONTINUE TO DO SO) IN CARRYING OUT THE GROUTING OF CULVERT E-9. THIS CAN BE WITNESSED BY THE FACT THAT 2 DAYS WILL BE UTILIZED TO DO THE WORK ORIGINALLY SCHEDULED FOR ONE DAY.

WE CONTEND THAT THE REASONS FOR THESE "EXTRA COSTS" WERE BEYOND OUR CONTROL AND APPEAL TO THE M.T.C. FOR REIMBURSEMENT OF THE FOLLOWING :

1. COSTS FOR INSTALLATION AND REMOVAL OF VERTICAL BRACING INSIDE THE TUNNEL LINER.
2. REPAIRS TO THE 6 TO 8 FOOT SECTION WHICH HAS UNDERGONE EXCESSIVE BUCKLING.
3. COSTS OF ANY ADDITIONAL MEASURES THE MTC MAY DEEM NECESSARY TO ENSURE PROPER COMPLETION OF THIS WORK.



PITTS

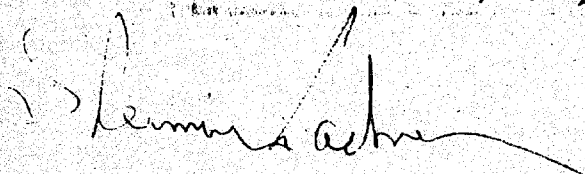
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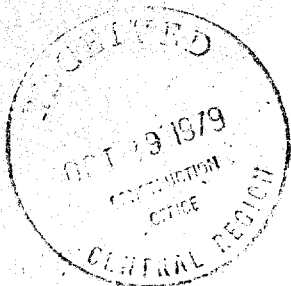
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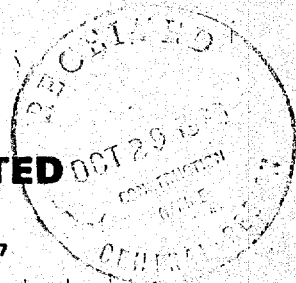
WE SUGGEST THAT IN AN ATTEMPT TO PREVENT FURTHER
BUCKLING, VERTICAL BRACING WITH TOP AND BOTTOM HEADERS BE
USED ON THE REMAINDER OF THE PIPE AND GRDUTING OPERATION
BE CARRIED OUT SIMILAR TO THOSE USED ON OCT. 9/79.

HOPING THIS MEETS WITH YOUR APPROVAL.

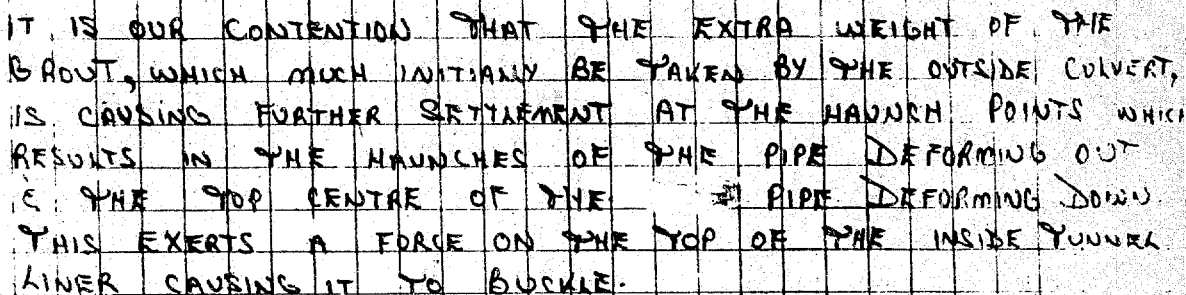
PITTS ENGINEERING CONSTRUCTION LTD.


SHERMAN LADNER
PROJECT ENGINEER.





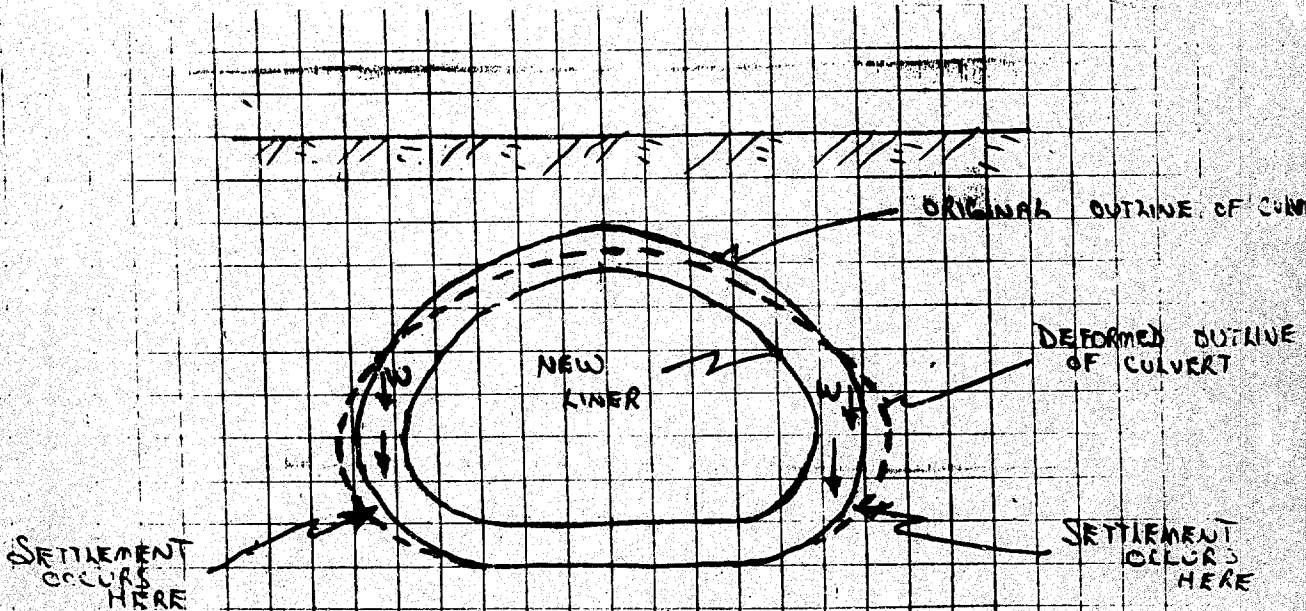
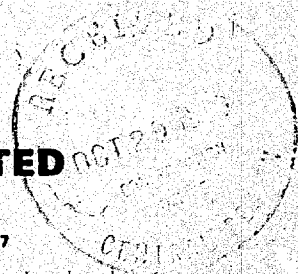
30 COMMERCIAL ROAD, - TORONTO, ONTARIO, M4G 1Z8 Telephone: 421-7373 Telex: 06-23137



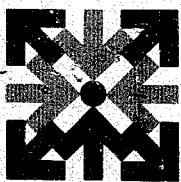
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PITTS ENGINEERING CONSTRUCTION LIMITED

30 COMMERCIAL ROAD, - TORONTO, ONTARIO, M4G 1Z6 Telephone: 421-7373 Telex: 06-23137

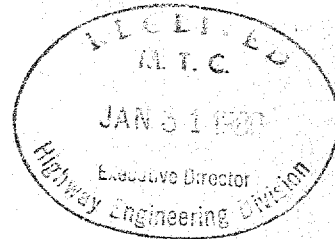


IT IS OUR CONTENTION THAT THE EXTRA WEIGHT OF THE
BROUT, WHICH MUST INITIALLY BE TAKEN BY THE OUTSIDE CULVERT,
IS CAUSING FURTHER SETTLEMENT AT THE HAUNCH POINTS WHICH
RESULTS IN THE HAUNCHES OF THE PIPE DEFORMING OUT
AT THE TOP CENTRE OF THE PIPE DEFORMING DOWN
THIS EXERTS A FORCE ON THE TOP OF THE INSIDE TUNNEL
LINER CAUSING IT TO BUCKLE.



The Proctor & Redfern Group

Proctor & Redfern Limited
Consulting Engineers and Planners
75 Eglinton Avenue East
Toronto, Ontario M4P 1H3
Telephone (416) 486-5225 Telex 06-22506



28 January 1980

Mr. J.B. Wilkes, P.Eng.
Executive Director
Highway Engineering Division
Ministry of Transportation
and Communications
Room 234, Central Building
1201 Wilson Avenue
Downsview, Ontario
M3M 1J8

Dear Mr. Wilkes

Geotechnical Services Agreement

Further to our meeting of January 3, 1980, I am responding to your request for comments on the proposed changes in the Ministry's Agreement for Geotechnical Services. The following points are made for your serious consideration and reflect the opinions of a cross-section of our members as gathered by John Gartner, P.Eng. of Gartner Lee Associates Limited:

1. Geotechnical drilling is a very specialized form of contracting. One of the advantages of utilizing consultants is that they can exercise their judgement and choose a driller who best meets their needs for that particular project.
2. The choice of a drilling contractor is one of the first professional acts that a geotechnical engineer makes on a projectand this choice is a professional judgement.
3. The expertise exhibited by different contractors will vary. As an example, one contractor may have developed a special ability in the diamond drilling of shale. Another might be expert in the installation of multiple piezometers. Yet another might have the experience and knowledge to produce drilling for soils design projects much more cost effectively than a competitor.
4. The knowledgeable geotechnical consultant will be familiar with these contractors and he will make his choice accordingly. In fact, many consultants not only choose the drilling company, but they request a specific driller.

2...../

5. Thus, the choice of the drilling contractor by the Ministry method denies the consultant the exercise of his professional judgement over a most crucial part of the project, the collection of samples and evaluation of sub-surface conditions.
6. Under the proposed method, the Ministry is asking the consultant to assume the contractual liability, and thus the legal and professional liability for the retention of a drilling contractor, yet the consultant has little significant say in the choice of that drilling contractor. It is suggested that there is a point of legal liability here that requires careful scrutiny.

It would be of interest to know how wide a variance exists in the rates for equipment supplied by contractors and by consultants who own and operate similar equipment. It is suggested, however, that if any firm is not working in the best interests of the Ministry then there may be more effective methods of control rather than the modifications to the Agreement as proposed by the Ministry.

Respectfully submitted

The Proctor & Redfern Group



K.G. Smith, P.Eng.
Chairman
CEO/MTC Advisory Committee

KGS/eas

cc: Mr. John F. Gartner



Memorandum

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

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

Attention: Date: September 26, 1973

Our File Ref. In Reply to

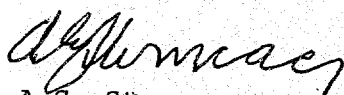
Subject:

FOUNDATION INVESTIGATION REPORT
For
The Proposed Retaining Wall No. 1
for Ramp "E-S"
Between Structures No. 27 and No. 43
Hwy. 401/410/403 Interchange
City of Mississauga
Reg. Mun. of Peel
District No. 6 (Toronto)
W.O. 73-11072 - W.P. 127-66-60

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.

AGS/zh
Attch.


A.G. Stermac,
PRINCIPAL FOUNDATIONS ENGINEER.

cc: E.J. Orr
B.R. Davis
A. Rutka
R.S. Pillar
D.P. Collins
B.J. Giroux
C. Mirza
G.A. Wrong
B.A. Singh

Foundations Files ✓
Documents.

FOUNDATION INVESTIGATION REPORT
For
The Proposed Retaining Wall No. 1
for Ramp "E-S"
Between Structures No. 27 and No. 43
Hwy. 401/410/403 Interchange
City of Mississauga
Reg. Mun. of Peel
District No. 6 (Toronto)
W.O. 73-11072 - W.P. 127-66-60

1. INTRODUCTION:

In conjunction with the proposed Hwy. 401/403/410 interchange complex, it is proposed to construct a retaining wall for Ramp "E-S" between Structures No. 43 and No. 27, in the City of Mississauga, District No. 6, Toronto.

The foundation office was requested to carry out a sub surface investigation at the site of the above mentioned structure. The request was contained in a memo from Mr. G.C.E. Burkhardt, Regional Structural Planning Engineer, Central Region, dated August 16, 1973.

Subsequently, an investigation was carried out by this office to determine the subsoil and groundwater conditions at this site. This report contains all the factual data obtained from this investigation, together with recommendations pertaining to the foundation design of the proposed retaining structure.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The area under investigation is located approximately 1/2 mile west of Heart Lake Road immediately south of Hwy. 401, in the City of Mississauga, Reg. Mun. of Peel. The terrain is flat to

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 - 4.3) Bedrock - Shale with Occasional Limestone Layers.
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 - 6.3) Parapet Walls.
 - 6.4) Related Considerations.
 7. MISCELLANEOUS.
-

gently undulating in relief. The land is developed for farming purposes.

The site is located in the physiographic region known as the "Peel Plain". The characteristic deposit in the vicinity of the area under investigation, is composed of a cohesive glacial till underlain by shale bedrock.

3. FIELD AND LABORATORY WORK:

Four sampled boreholes were put down in the vicinity of the proposed retaining structure. The borings were advanced by means of an auger machine (C.M.E. #750) adapted for soil sampling purposes.

Samples of the subsoil were recovered at required depths with a 2 inch O.D. split-spoon sampler, which was hammered into the soil in accordance with the specifications for the Standard Penetration Test. The bedrock was proven by obtaining BXL size core samples.

The locations and elevations of all the borings were surveyed in the field by construction personnel from the Toronto District office, and are shown on Drawing No. 73-11072A, together with an inferred stratigraphical profile. Across the site all elevations in the report are referenced to a Geodetic Datum.

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

- Natural Moisture Contents
- Atterberg Limits
- Grain-Size Distributions

The results of this testing are plotted on the Record of Borehole sheets and summarized on Figure No. 1 and Figure No. 2, all of which are contained in the Appendix to this report.

4. SUBSOIL AND BEDROCK CONDITIONS:

4.1) General:

The predominant stratum across the site is a heterogeneous mixture of clayey silt to silty clay, sand and gravel (glacial till), underlain by shale bedrock at depths ranging from 4.5 to 7.5 feet.

4.2) Heterogeneous Mixture of Clayey Silt to Silty Clay With Some Sand and Gravel (Glacial Till):

The predominant stratum across the site is a deposit of heterogeneous mixture of clayey silt to silty clay with some sand and gravel (glacial till). The thickness of this deposit varies from 4.5 ft. (Borehole No. 4) to 7.5 ft. (Borehole No. 1).

Atterberg Limit tests were carried out on representative samples of the glacial till. The results, which are shown on the Record of Borehole sheets and on the Plasticity Chart (Figure No. 1) are tabulated below:

		<u>Range</u>	<u>Average</u>
Liquid Limit W_L	(%)	30-46	38
Plastic Limit W_P	(%)	18-26	22
Natural Moisture Content W	(%)	10-16	13

Based on these values it is estimated that the cohesive deposit has a matrix which is inorganic with low to intermediate plasticity.

Grain-size distribution curves for typical samples of the cohesive stratum are shown in an envelope form on Figure No. 2 of the Appendix.

Standard Penetration tests, carried out within this glacial deposit, are plotted on the Record of Borehole sheets. The testing gave 'N' values ranging from 37 blows/ft. to in excess of 100 blows per foot. It is estimated that the consistency of the glacial till is generally hard.

4.3) Bedrock - Shale with Occasional Limestone Layers:

The glacial till is underlain by bedrock which was proven at four of the boring locations by obtaining BXL size core samples. Over the site, the bedrock surface was found to vary between elevations 586.7 and 589.4. The bedrock is found to be shale with occasional interbedded limestone layers. The upper 4 inches (Borehole No. 3) to 18 inches (Borehole No. 2) of the bedrock was found to be in a weathered condition.

5. GROUNDWATER CONDITIONS:

The groundwater level across the site during the period of the investigation (September, 1973) was observed by taking readings in the open boreholes. The results of the observations are shown on the Record of Borehole sheets, as well as on Drawing No. 73-11072A.

The observations indicate that the groundwater level across the site varies between elevations 589.4 and 590.2, i.e. 3.5 feet to 4.8 feet below existing ground surface.

6. DISCUSSION AND RECOMMENDATIONS:

6.1) General:

It is proposed to construct a retaining wall and parapet walls along Ramp "E-S" to accommodate Ramp "W-N" between structures No. 27 and No. 43. The pertinent details for the proposed retaining structure are as follows:

Approximate length	- 245 ft.
Proposed profile grade Ramp "E-S"	- elevation 593 to elevation 597
Clear height of wall (maximum)	- 23 ft.

Location (Refer to Drawing No. 73-11072A)

The predominant stratum across the site is a shallow deposit of 4.5 to 7.5 ft. thick competent cohesive glacial till, underlain by shale bedrock.

6.2) Retaining Structure Foundations:

The entire retaining structure can be founded on spread footing located within the glacial till or shale bedrock.

Footings founded within the glacial till could be designed using an allowable bearing pressure of 3 t.s.f. However, for footings founded in the shale bedrock an allowable bearing pressure of up to 10 t.s.f. may be used. In all cases, a minimum of 4 feet of cover should be provided above the underside of the footing for frost protection purposes. Care should be taken to ensure that the foundation base is not softened by uncontrolled surface run-off or groundwater seepage. It would be advantageous however, to protect the foundation base with a lean concrete working slab.

The excavation will be carried out in the relatively impervious glacial till or shale bedrock and in view of this no major dewatering problems are anticipated.

6.3) Parapet Walls:

The north parapet wall between the retaining structure and Structure No. 27 can be founded in the fill material using an allowable pressure of 1.0 t.s.f. In any case adequate frost cover should be provided to the base of the parapet wall.

The south parapet wall between the retaining structure and Structure No. 43 according to available information may be located with natural subsoil (glacial till). Recommendation given in sub section 6.2 will be applicable.

6.4) Related Considerations:

The wall will be inherently stable with respect to a deep-seated rotational type of failure within foundation subsoil.

In computing the sliding resistance between the base of the footing and the cohesive foundation subsoil (glacial till) an adhesive value of 2,500 p.s.f. should be used. If footings are located within the shale bedrock a coefficient of friction of 1.0 may be used.

If the structure is to be designed as a rigid wall, a coefficient of earth pressure at rest (K_c) of 0.5 should be assumed for the granular backfill behind the wall, when designing the wall section. If some movement at the top of the wall is permitted, a coefficient of active earth pressure (K_a) of 0.33 may be used.

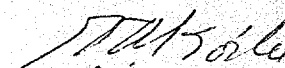
In order to relieve the build-up of excess hydrostatic pressure behind the retaining wall, suitable drainage measures should be provided. Backfill behind the wall should be carried out in accordance with current M.T.C. practices, specifically Standard No. S.D.4-58.


7. MISCELLANEOUS:

The field work, carried out during the period of September 7, 1973, was supervised by Mr. V. Korlu, Project Foundation Engineer, who also prepared this report.

Equipment used was owned and operated by Dominion Soils Company of Toronto.

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


V. Korlu, P. Eng.


M. Devata, P. Eng.



VK/zh
September 25, 1973.

APPENDIX I

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1

JOB 73-11072

LOCATION Co-ords. 15,855,930 N; 958,588 E.

ORIGINATED BY VK

W.P. 127-66-60

BORING DATE Sept. 7, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and core with CME 750

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. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.			WATER CONTENT %				
							w_p	w	w_L	15	30	45		
594.2	Ground Level													
0.0	Het. mix. of clayey sil. to silty clay with some sand & gravel.		1	SS	52	590								
586.7	Glacial Till Hard		2	SS	17									
7.5	weathered													
582.7	Shale Bedrock with occ. interbedded limestone		3	EXL	90% Rec									
11.5	End of Borehole					580								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2

JOB 73-11072

LOCATION Co-ords. 15,856,088 N; 958,567 E.

ORIGINATED BY VK

W.P. 127-66-60

BORING DATE Sept. 7, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and core with CME 750

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 P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT %				
							O UNCONFINED + FIELD VANE • QUICK TRIAXIAL x LAB VANE				w_p — w — w_L				
593.7	Ground Level											15 30 45			
0.0	Bot. mix. of clayey sl. to silty clay with some sand & gravel.		1	SS	37	590								590.2	
588.7	Glac. Till Hard		2	GS	75/10"									0 5 60 3	
5.0	Weathered sand		3	BXL	66%										
579.7	Shale with occasional interbedded limestone layers.		4	BXL	100%	580									
114.0	End of Borehole					570									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 3

JOB 7 3-11072 LOCATION Co-ords. 15,856,205 N; 958,565 E. ORIGINATED BY VK
W.P. 127-65-60 BORING DATE Sept. 7, 1973 COMPILED BY VK
DATUM Geodetic BOREHOLE TYPE Auger and core with CME 750 CHECKED BY VK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.			w_p w w_L				
							<input type="radio"/> UNCONFINED <input checked="" type="radio"/> QUICK TRIAXIAL	<input type="radio"/> FIELD VANE <input checked="" type="radio"/> LAB VANE						
594.9	Ground Level													
0.0	Net. mix. of clayey sl. to silty clay with some s. & grav. Glac. Till.		1	SS	68	590								590.1 0 5 64 3
589.1	Hard weathered		2	SS	125									
5.5	Shale Bedrock with occ. interbedded limestone layers.		3	BXL	90%									
579.4			4	BXL	100%									
15.5	End of Borehole					580								
						570								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 4

JOB 73-11072

LOCATION Co-ords. 15,856,335 N; 958,562 E.

ORIGINATED BY VK

W.P. 127-66-60

BORING DATE Sept. 7, 1973

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Auger and core with CME 750

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 P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.				w_p	w	w_L		
593.8	Ground Level						O UNCONFINED + FIELD VANE • QUICK TRIAXIAL X LAB VANE				WATER CONTENT % 15 30 45				
0.0	het. mix. of clayey sil. to silty clay with some sand & gravel		1	SS	1.6	590									
589.3	Glacial Till Hard		2	SS	113										
4.5	weathered		3	EXL	75										
	Shale Bedrock with occ. interbedded limestone layers.		4	BYL	100										
579.3			5	BXL	100	580									
14.5	End of Borehole														
						570									

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 5 (6, 73-11038)

JOB 73-11072 LOCATION Co-ords. 15,856,181 N; 958,571 E. ORIGINATED BY VK
 W.P. 127-61-60 BORING DATE June 18, 1973 COMPILED BY VK
 DATUM Geodetic BOREHOLE TYPE Drill with Tricone and BXL Bits CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT — w_L				BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT				PLASTIC LIMIT — w_p					
							SHEAR STRENGTH P.S.F.				WATER CONTENT — w					
592.9	Ground Level															
590.9	Glacial Till					590										
2.0																
584.1	Weathered															
8.5	Sound															
579.5	Shale Bedrock with occ. interbedded limestone layers.		1	BXL	100%	580										
13.5	End of Borehole															
	</															

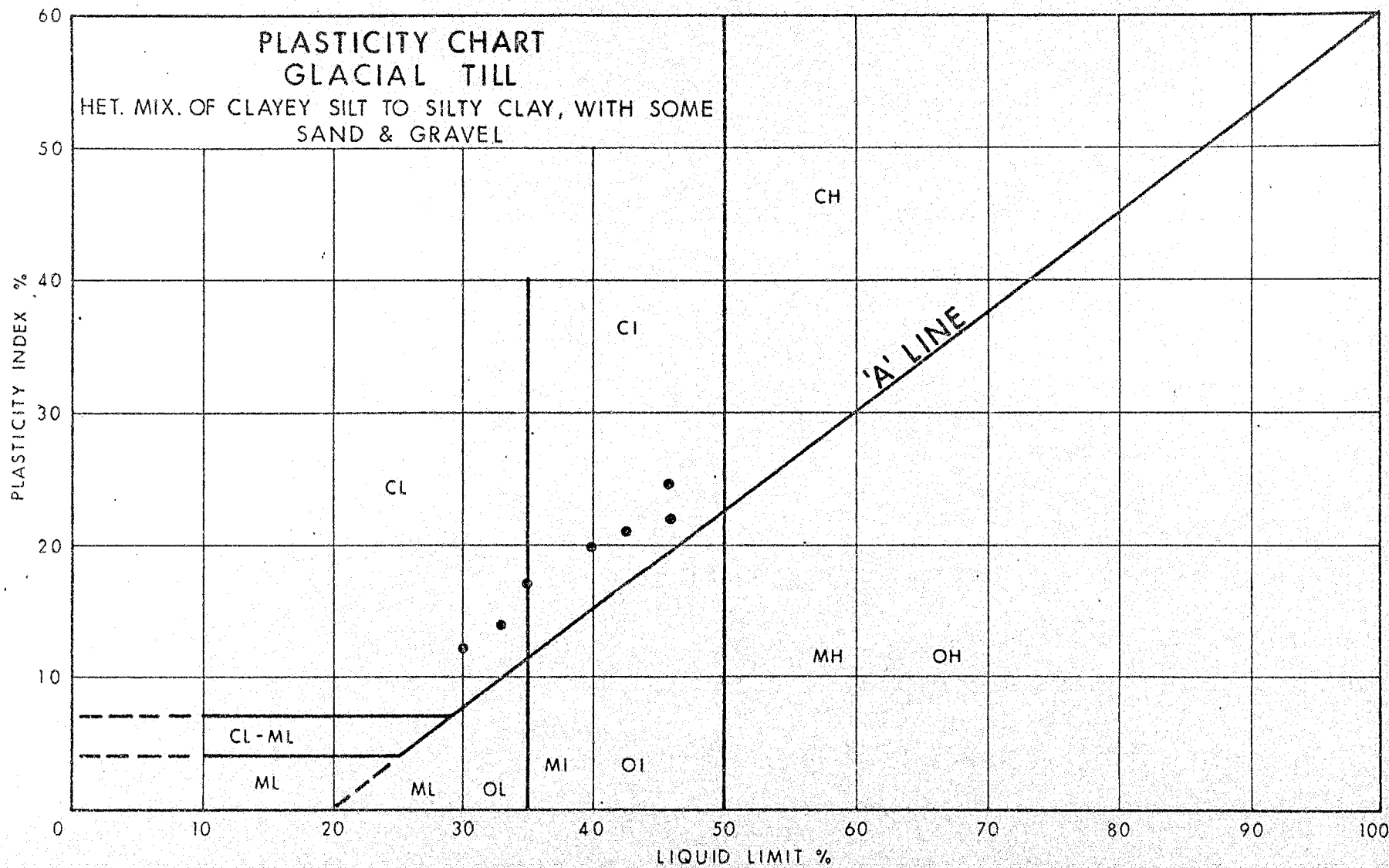
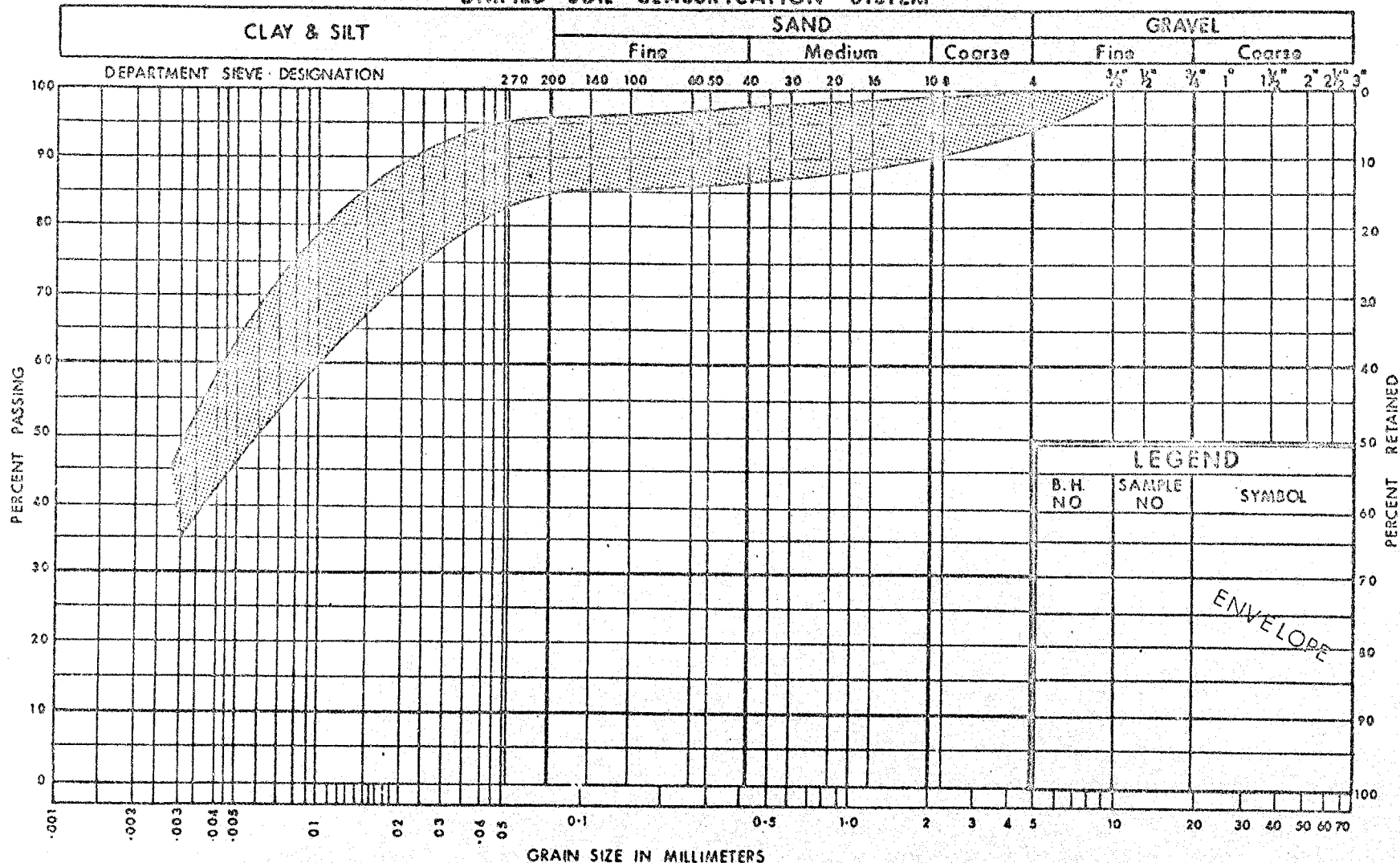


FIG. 1

UNIFIED SOIL CLASSIFICATION SYSTEM



DEPARTMENT
OF
TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES
BRANCH

GRAIN SIZE DISTRIBUTION

GLACIAL TILL

HET. MIX. OF CLAYEY SILT TO SILTY CLAY, WITH SOME SAND
& GRAVEL

W.P. No. 127 - 66 - 60

JOB No. 73 - 11072

FIG. 2

ABBREVIATIONS & SYMBOLS USED IN THIS REPORTPENETRATION 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:-

<u>CONSISTENCY</u>	<u>c LB./SQ.FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
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
CU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAO	" " DRAINED "		

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
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_1	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 (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

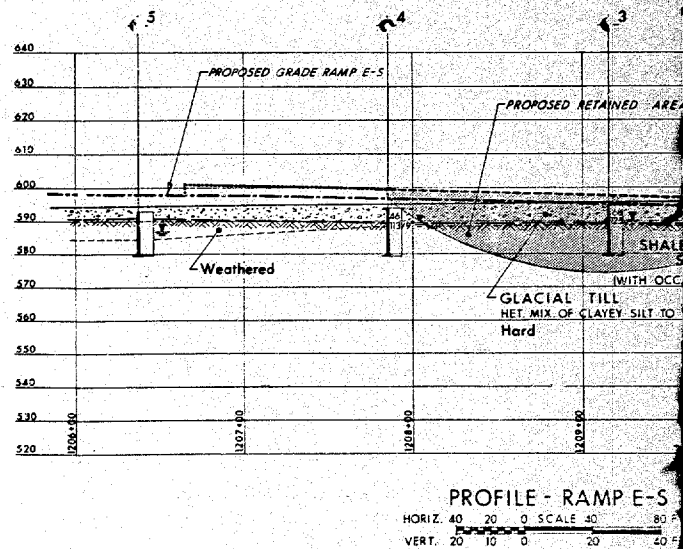
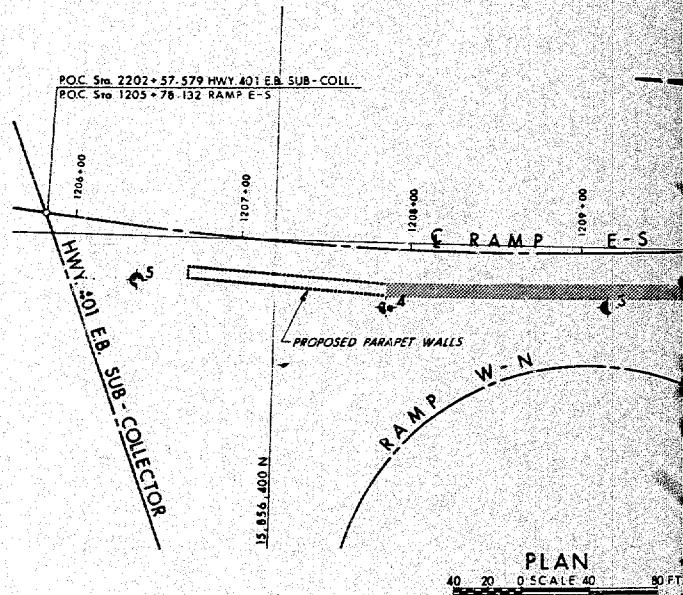
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

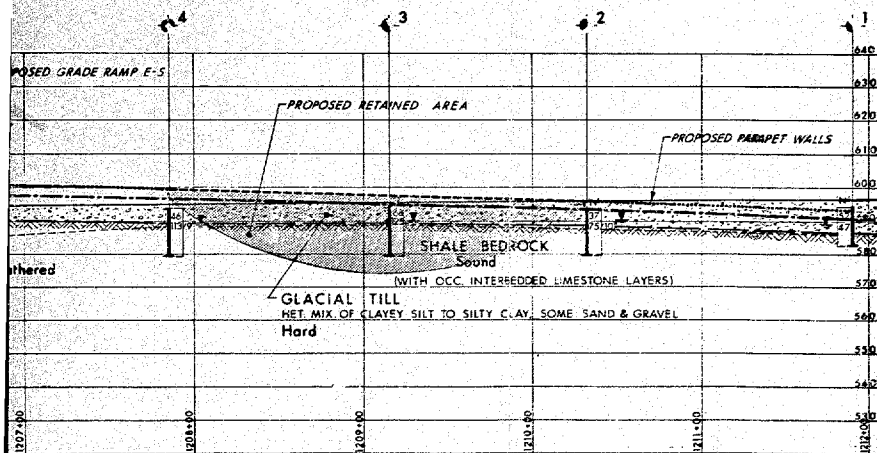
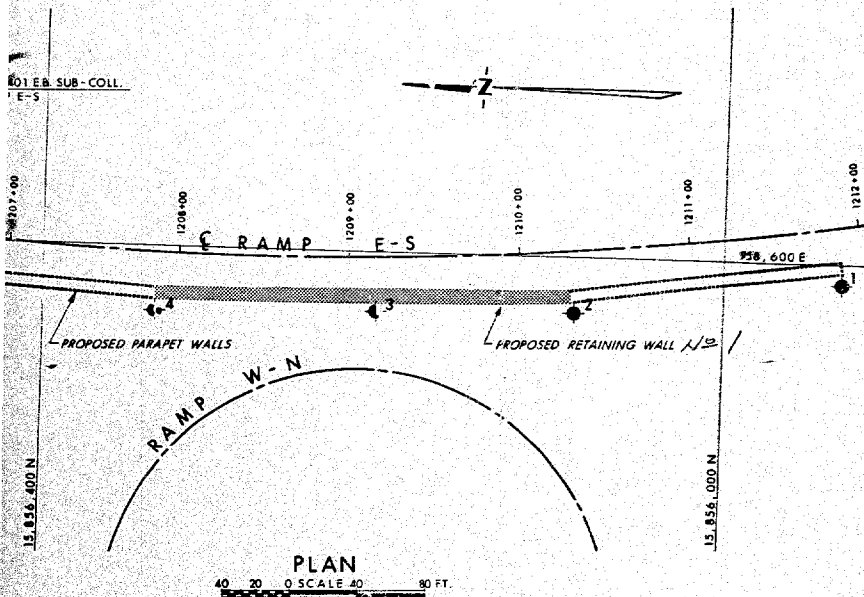
FOUNDATIONS

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

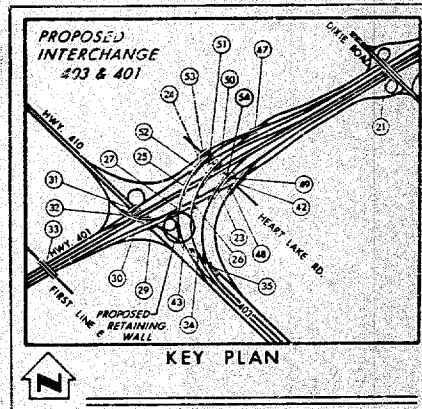




HORIZ. 40 20 0 SCALE 40 80 FT.
VERT. 20 10 0 20 40 FT.



REF. NO. FENC03983-75K-115



LEGEND

- Bore Hole
- ⊕ Cone Penetration Test
- ⊕ Bore Hole & Cone Test
- ⊕ Water Levels established at time of field investigation, June & Sept. 1973

NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	594.2	15,855,930	958,588
2	593.7	15,856,088	958,567
3	594.9	15,856,205	958,565
4	593.8	15,856,335	958,562
5	592.9	15,856,481	958,574

NOTE FOR CONTRACT DOCUMENTS

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.

DATE	BY	DESCRIPTION

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

RETAINING WALL

(BETWEEN STRUCTURES No. 27 & No. 43)

HIGHWAY NO. 401 DIST. NO. 6

CO. PEEL

TOWN OF MISSISSAUGA LOT CON

BORE HOLE LOCATIONS & SOIL STRATA

SUBMIT V.K.	CHECKED	WP NO. 127-66-50	DRAWING NO.
DRAWN S.R.	CHECKED	WO NO. 73-11072	73-11072 A
DATE SEPT 21, 1973	SITE NO.		BRIDGE DRAWING NO.
APPROVED	CONT. NO.		



Memorandum

To: Mr. C. Mirza,
Head,
Soils Mechanics Section,
West Building, Downsview

From: G.C.E. Burkhardt,
Structural Section,
Central Region

Attention: Mr. M. Devata

Date: 1977-10-20

Our File Ref.

In Reply to

Subject:

RE: Retaining Wall No. 1,
Highway 401/403/410 Interchange,
Site 24, W.P. 127-66-60,
District 6

Please be advised that the W.P. number for the above mentioned structure has been changed from 127-66-50 to W.P. 127-66-60. All future reference to this retaining wall, will be associated with the new W.P. number. Retaining Wall No. 1 includes the perched barrier walls that connect the retaining wall to bridges No. 27 and 43.

This change in W.P. number has become necessary, as a result of the retaining wall's exclusion from contract number 76-120, and its subsequent inclusion into the group W.P. 127-66-37.

We are making the necessary changes in this retaining wall's Foundation Report that we have in our possession, but we would ask that you send us one additional copy of the report with the new W.P. number.

Michael N. Gergely

MG:gj

M.N. Gergely,
Assist. Structural
Project Engineer,
for:
G.C.E. Burkhardt,
Head, Structural Section

*DWG REVISED &
REVISED REPORT
SENT TO*

*WO
73-11072*

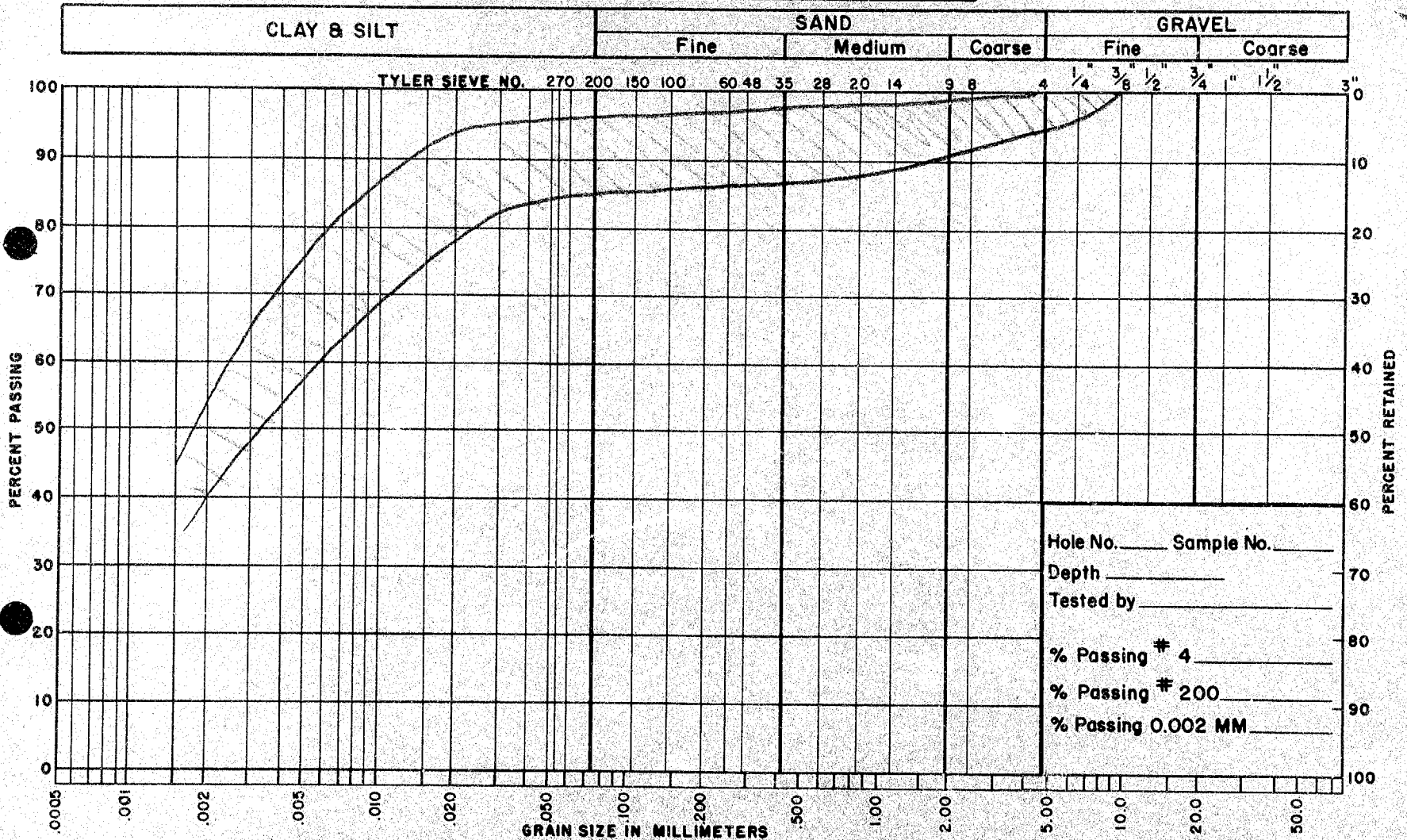
2/77



73-11072

Fig. 2

UNIFIED SOIL CLASSIFICATION SYSTEM



NOTES _____

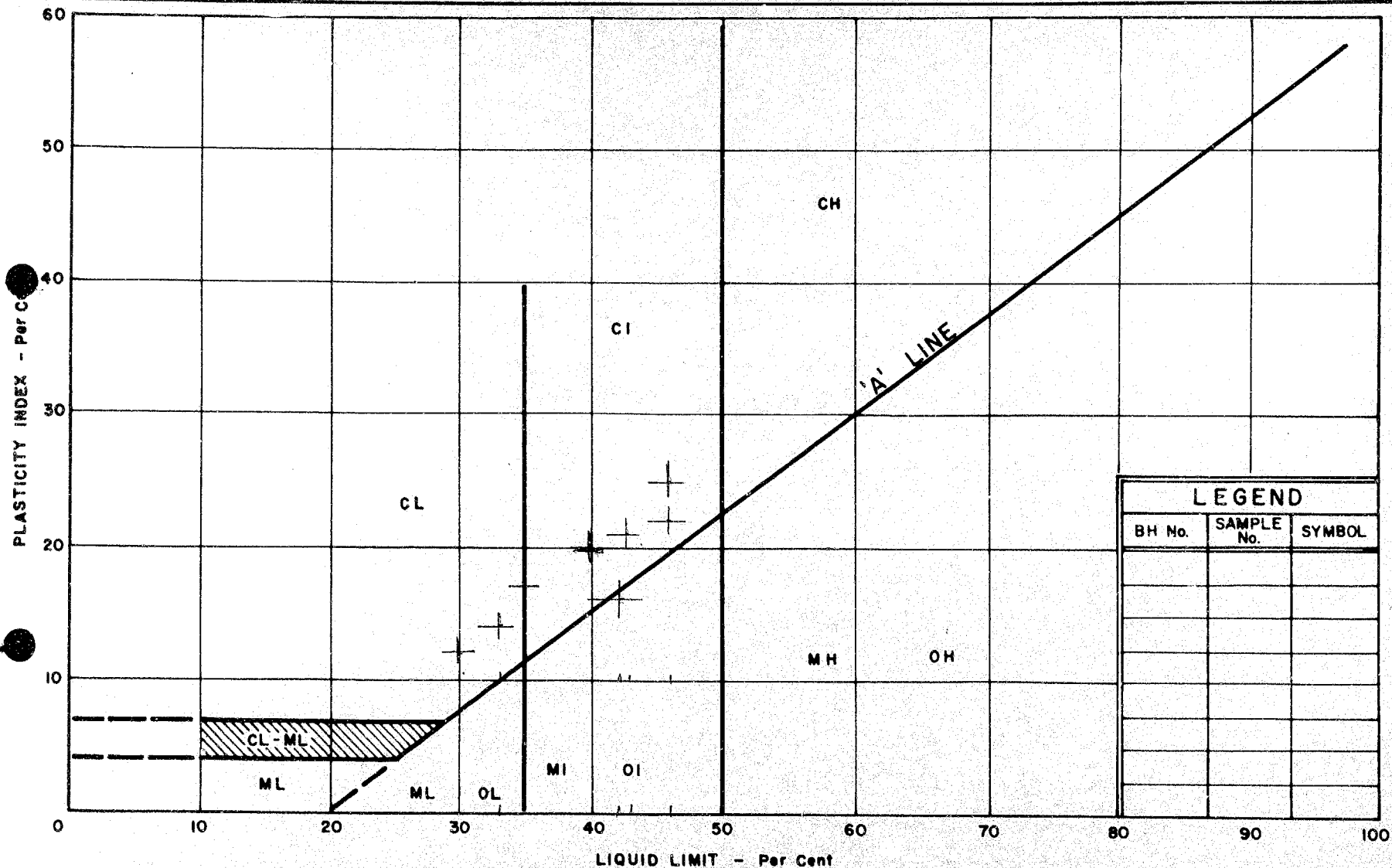
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & RESEARCH SECTION
GRAIN SIZE DISTRIBUTION

Job No. _____ W.P. No. _____

Location _____

73-11072

Fig. 1



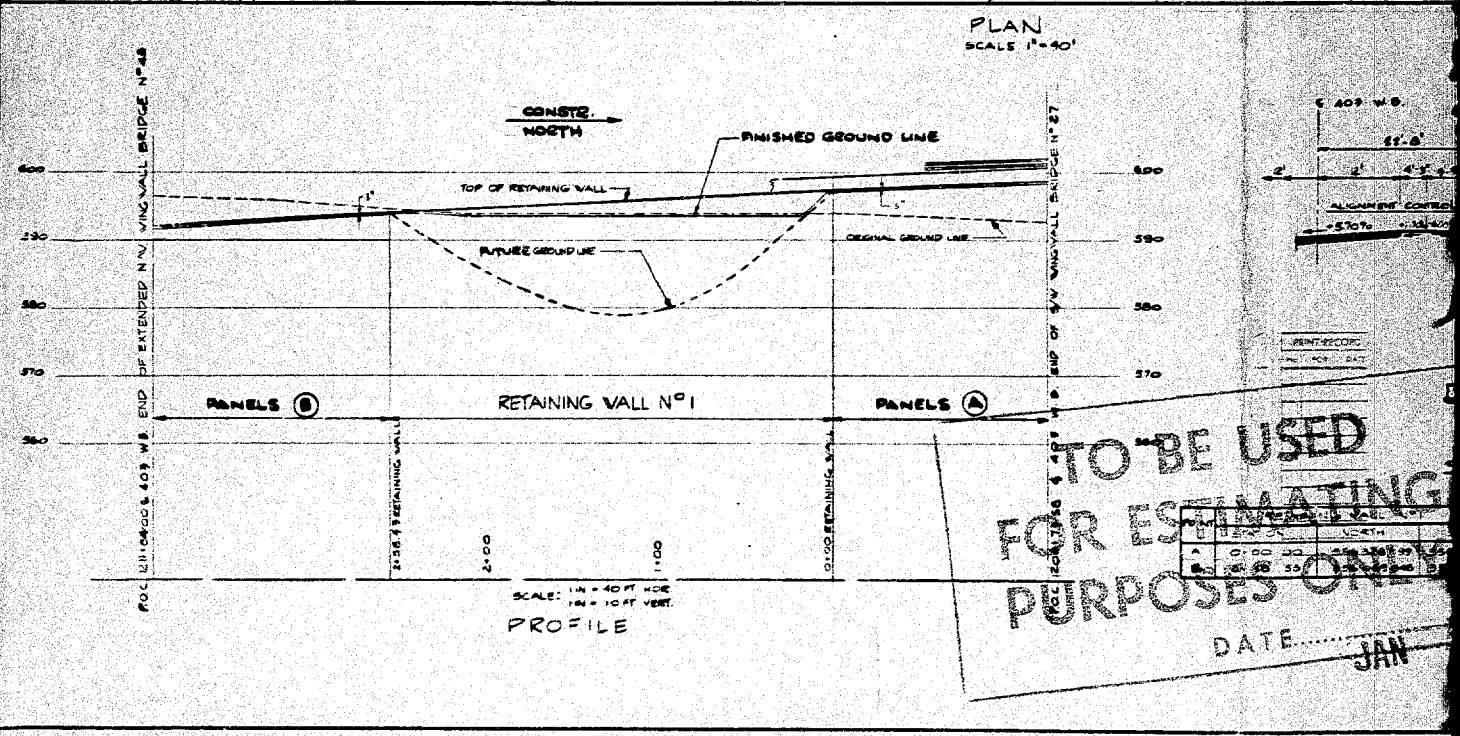
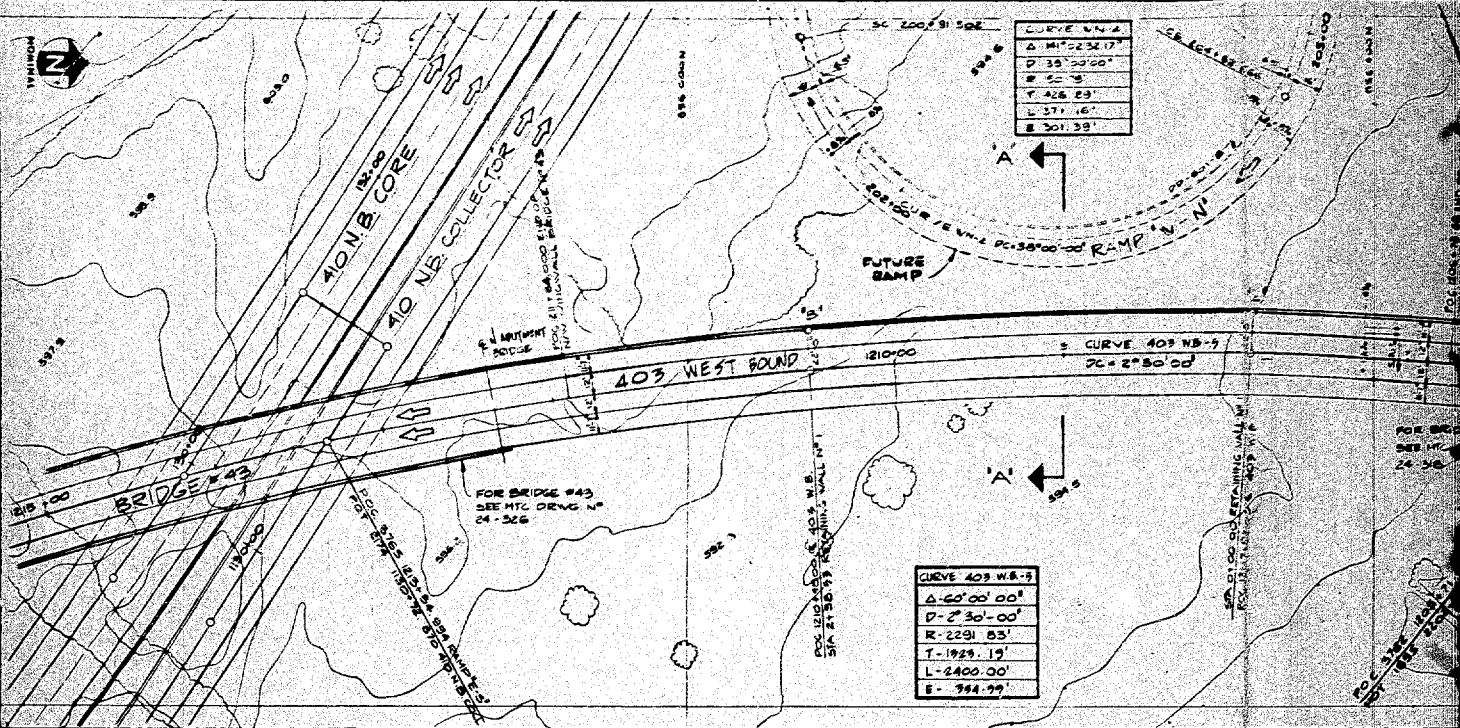
DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

*Net. Mix of
Silty clay to clayey silt with some sand
and trace of gravel - Glacial till*

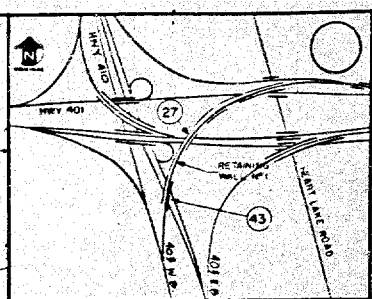
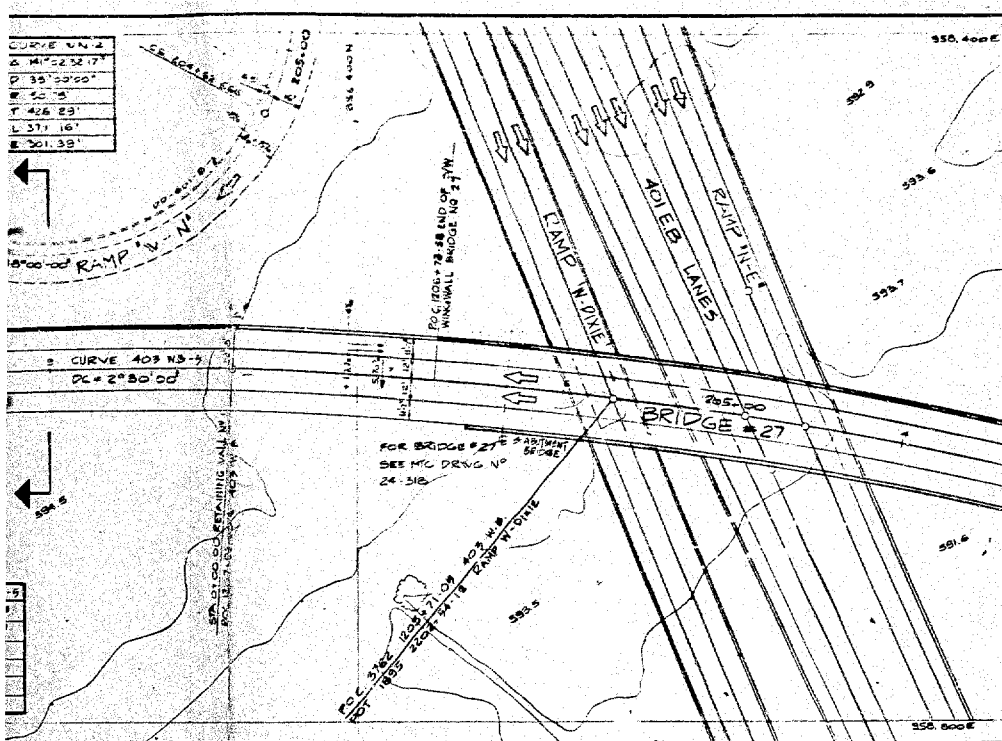
PLASTICITY CHART

WP No.

JOB No.



CURVE UN-1
 Δ 11°22'52"17"
 P 39°59'50"
 E 50°15"
 T 426.23
 L 371.16'
 E 3011.39'



KEY PLAN

TABLE FOR RETAINING WALL ELEVATIONS

STATION	ELEVATION	FUTURE GROUNDLINE
0+00	596.974	596.72
0+10	596.866	
0+20	596.757	
0+30	596.650	590.50
0+40	596.539	
0+50	596.426	
0+60	596.313	584.30
0+70	596.198	
0+80	596.079	
0+90	595.963	580.60
1+00	595.838	
1+10	595.717	
1+20	595.596	579.00
1+30	595.470	
1+40	595.345	
1+50	595.216	580.12
1+60	595.086	
1+70	594.953	
1+80	594.822	582.80
1+90	594.688	
2+00	594.551	
2+10	594.413	586.40
2+20	594.275	
2+30	594.134	
2+40	593.994	591.30
2+50	593.848	
2+60	593.723	595.47

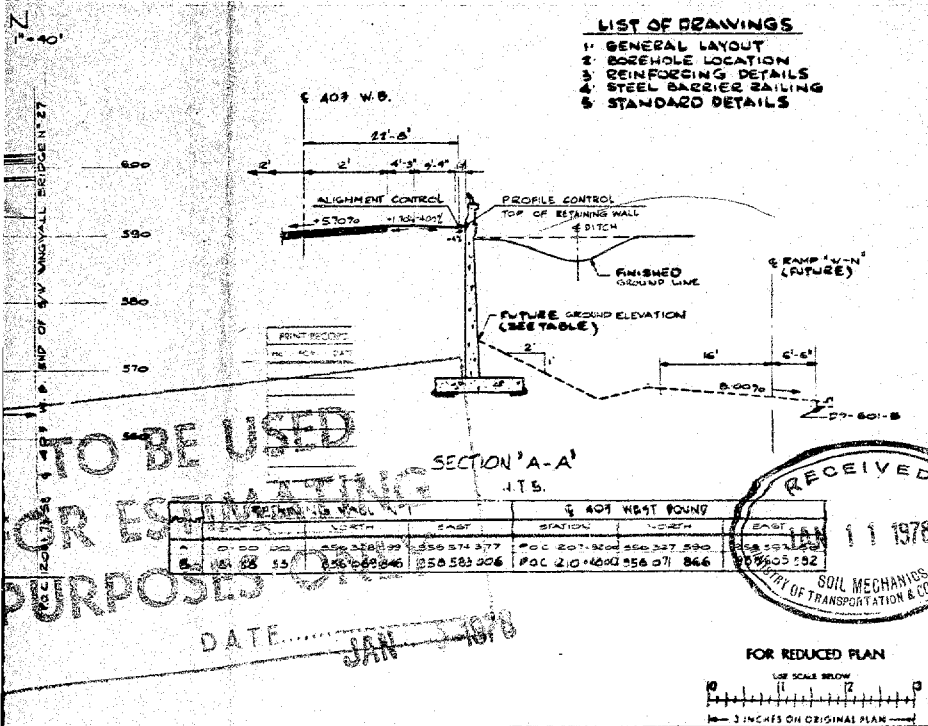


TABLE FOR BARRIER WALL ELEVATIONS FROM RET. WALL N° 1 TO BRIDGE N° 43

STATION*	ELEVATION**	STATION*	ELEVATION**
1210+50.000	593.70	1206+60.000	598.12
1210+60.000	592.96	1206+70.000	598.04
1210+70.000	593.41	1206+80.000	597.99
1210+80.000	592.52	1206+90.000	597.95
1210+90.000	593.10	1207+00.000	597.89
1211+00.000	592.92	1207+10.000	597.80
1211+10.000	592.79	1207+20.000	597.71
1211+20.000	592.63	1207+30.000	597.61
1211+30.000	592.47	1207+40.000	597.51
1211+40.000	592.32	1207+50.000	597.42
1211+50.000	592.18	1207+60.000	597.32
1211+60.000	592.00	1207+70.000	597.21
1211+70.000	591.82	1207+80.000	597.11
1211+80.000	591.69	1207+90.000	597.00
1211+90.000	591.61		

* STATION ON Q. OF 403 WEST BOUND
 ** OFFSET 23'-7" RIGHT OF Q. OF 403 N.B. COINCIDES WITH PROFILE CONTROL OF R/W.

REMARKS

DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS
 ONTARIO

FENCO CONSULTANTS LIMITED

RETAINING WALL N° 1

BRIDGE HIGHWAY No. 401

DIST. No. 6

GENERAL LAYOUT

APPROVED	CONTRACT No.
DESIGN	W.P. No.
CHECK	27-66-60
DATE	SITE No. 24-RV1 SHEET 1

DOCUMENT WORKING IDENTIFICATION

GEOCRES No. 30 H 12-66

DIST. 6 REGION CENTRAL

W.P. No. 127-16-60

CONT. No. 78-60

W. O. No. 73-11072

STR. SITE No. 24- RW1

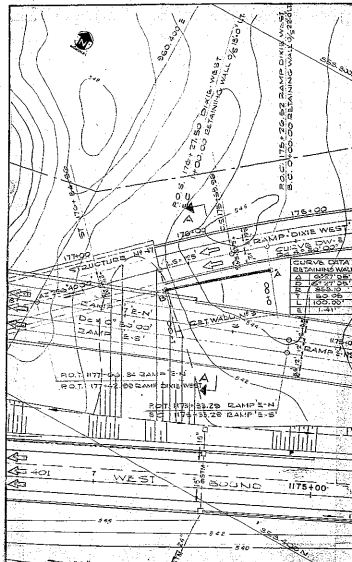
HWY. No. 401 / 410 / 403

LOCATION BETWEEN WALL # 1

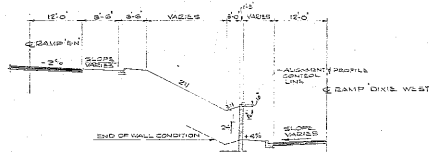
BETWEEN STRUCTURE # 27 AND # 43

OVER-SAT DRILLINGS TO BE INCLUDED WITH THIS REPORT 5

REMARKS:

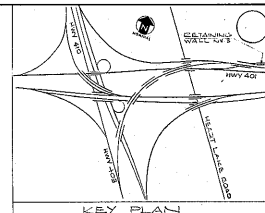


PLAN
SCALE 1" = 40'



SECTION A-A
SCALE 1" = 10'

POINT	STATION	NORTH	EAST	STATION	WEST	EAST
A	0+00	552.514-542	550.576-554	10+75-1052	555.551-541	550.543-530
B	1+00	558.551-510	553.455-160	10+75-1052	555.551-261	550.455-554

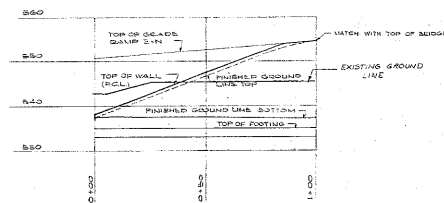


GENERAL NOTES
CLASS OF CONCRETE
RET. WALL 3000 P.S.I.
FOOTINGS 3000 P.S.I.
CLEAR COVER TO REINFORCING STEEL
RET. WALL 3"
REINFORCING STEEL SHALL BE HARD GRADE (G60)

CONCRETE QUANTITIES

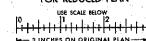
CONCRETE FOR RET. WALL 71.0 CU. YDS.

STATION	ELEVATIONS	FINISHED GROUND LINE TOP	FINISHED GROUND LINE BOT
0+00	553.15	557.05	557.05
0+10	553.00	557.05	557.05
0+20	551.50	557.05	557.05
0+30	551.50	557.05	557.05
0+40	551.50	557.05	557.05
0+50	551.50	557.05	557.05
0+60	551.50	557.05	557.05
0+70	551.50	557.05	557.05
0+80	551.50	557.05	557.05
0+90	551.50	557.05	557.05
1+00	551.50	557.05	557.05



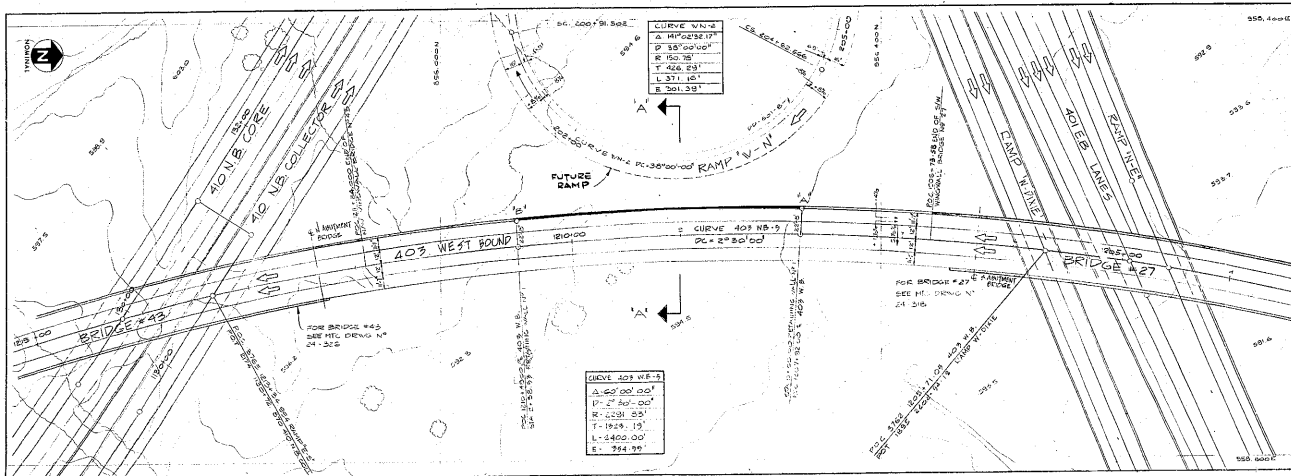
RETAINING WALL NO. 3
SCALE VERT. 1" = 10'
HORIZ. 1" = 20'

FOR REDUCED PLAN



DATE		BY		DESCRIPTION	
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO					
FOUNDATION OF CANADA ENGINEERING CORPORATION LIMITED					
RETAINING WALL NO. 3					
KINDS HIGHWAY No. 401		DIST. No. 5			
CITY OF MISSISSAUGA		CITY OF MISSISSAUGA		CON. No. 5	
GENERAL DRAWING					
APPROVED		CONTRACT No.			
DESIGN		CHECK		W.F. No. 107-55-50	
DRAWN		CHECK		SITE No. 34/9/3	
DATE		DRAWN		SHEET 1	

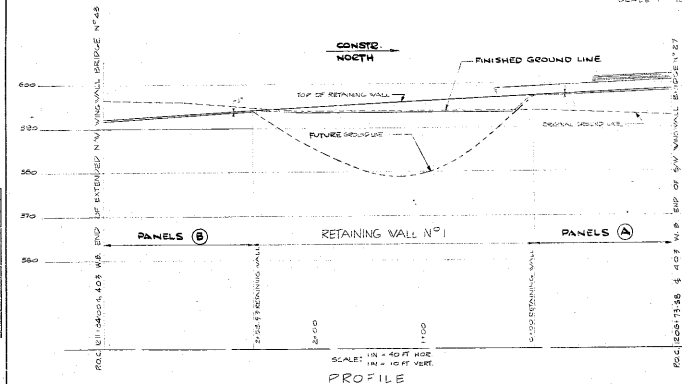
30412-65



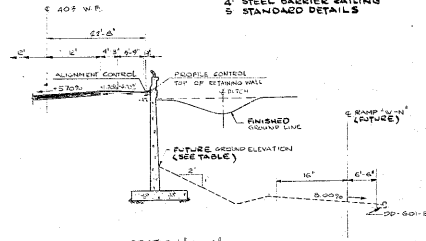
PLAN
SCALE 1"=40'

LIST OF DRAWINGS

1. GENERAL LAYOUT
2. BORING LOCATION
3. REINFORCING DETAILS
4. STEEL BARREL RAILING
5. STANDARD DETAILS

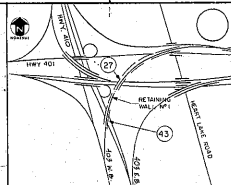


PROFILE
SCALE: 1"=40 FT HORIZ
1"=10 FT VERT



SECTION 'A-A'
N.T.S.

P.N.	RETAINING WALL NO. 1				E. 403 WEST BOUND			
	STATION	ELEVATION	DEPTH	REMARKS	STATION	ELEVATION	DEPTH	REMARKS
A	0+00.00	556.374	3.77	P.C. 10+100.00	0+00.00	556.374	3.77	P.C. 10+100.00
B	1+50.50	556.602	2.66	P.C. 10+100.00	1+50.50	556.602	2.66	P.C. 10+100.00



KEY PLAN

TABLE FOR RETAINING WALL ELEVATIONS			
STATION	ELEVATION	STATION	ELEVATION
0+00	556.374	1+50.50	556.602
0+10	556.377	1+60.50	556.605
0+20	556.380	1+70.50	556.608
0+30	556.383	1+80.50	556.611
0+40	556.386	1+90.50	556.614
0+50	556.389	2+00.50	556.617
0+60	556.392	2+10.50	556.620
0+70	556.395	2+20.50	556.623
0+80	556.398	2+30.50	556.626
0+90	556.401	2+40.50	556.629
1+00	556.404	2+50.50	556.632
1+10	556.407		
1+20	556.410		
1+30	556.413		
1+40	556.416		
1+50	556.419		
1+60	556.422		
1+70	556.425		
1+80	556.428		
1+90	556.431		
2+00	556.434		
2+10	556.437		
2+20	556.440		
2+30	556.443		
2+40	556.446		
2+50	556.449		

TABLE FOR BARRIER WALL ELEVATIONS FROM RET. WALL			
STATION	ELEVATION	STATION	ELEVATION
0+00	556.374	1+50.50	556.602
0+10	556.377	1+60.50	556.605
0+20	556.380	1+70.50	556.608
0+30	556.383	1+80.50	556.611
0+40	556.386	1+90.50	556.614
0+50	556.389	2+00.50	556.617
0+60	556.392	2+10.50	556.620
0+70	556.395	2+20.50	556.623
0+80	556.398	2+30.50	556.626
0+90	556.401	2+40.50	556.629
1+00	556.404	2+50.50	556.632
1+10	556.407		
1+20	556.410		
1+30	556.413		
1+40	556.416		
1+50	556.419		
1+60	556.422		
1+70	556.425		
1+80	556.428		
1+90	556.431		
2+00	556.434		
2+10	556.437		
2+20	556.440		
2+30	556.443		
2+40	556.446		
2+50	556.449		

* STATION ON R. OF 403 WEST BOUND
* OFFSET 1' FROM R. OF 403 W.B. COINCIDES WITH
PROFILE CONTROL OF R.W.

REVISION	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS
ONTARIO

RETAINING WALL NO. 1

ENGINEER: **30412-65**

DESIGN: **30412-65**

CITY OF MISSISSAUGA

GENERAL LAYOUT

APPROVED: **30412-65**

DESIGN: **30412-65**

DRAWING: **30412-65**

DATE: **30412-65**

CONTRACT NO. **30412-65**

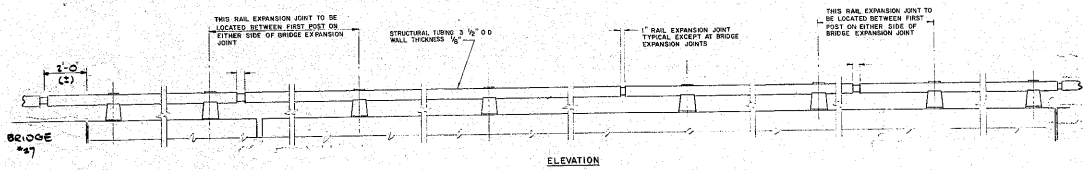
W.P. NO. **30412-65**

SITE NO. **30412-65**

SHEET 1

30412-65

CONT No	WP No	127-66-60
RETAINING WALL No 1		SHEET
STEEL RAILING (SINGLE TUBE)		



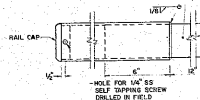
BRIDGE # 43

DISTANCE END TO END OF RAIL	POST SPACING	
	MINIMUM	MAXIMUM
UNDER 40'	9'-0"	12'-0"
OVER 40'	10'-0"	12'-0"

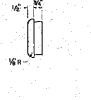
GALVANIZING ON MATTING SURFACES
OF TUBES TO HAVE MINIMUM
THICKNESS NOT EXCEEDING .005"
TO ENSURE SLIDING FIT

OUTSIDE DIAMETER OF
UNGALVANIZED SPlice TUBE
TO BE 5/16" (1/16" TOL.)
LESS THAN MEASURED I.D.
OF GALVANIZED OUTER TUBE

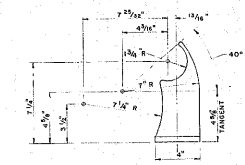
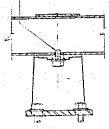
PIPE TO BE DRILLED AND
TAPPED IN FIELD FOR GALV.
HEX CAP SCREW 1/2" x 1 1/2"



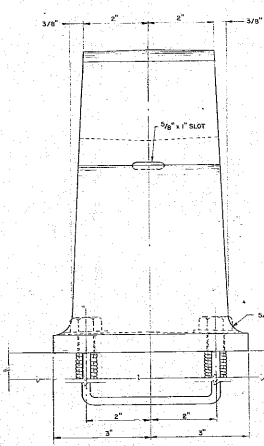
RAIL ASSEMBLY



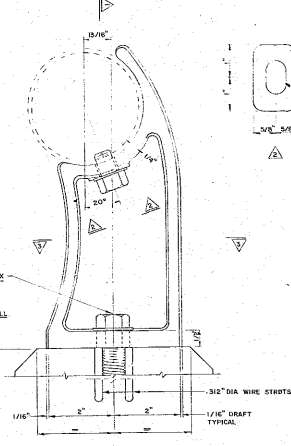
RAIL CAP



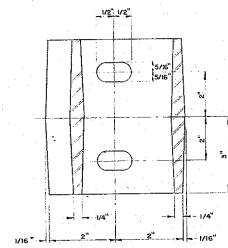
RADIAL DIMENSIONS



FRONT ELEVATION



SIDE ELEVATION



- NOTES**
- RAIL ELEMENTS SHALL BE STRUCTURAL TUBING SUPPLIED IN ACCORDANCE WITH ASTM A36
 - STEEL IN POSTS SHALL BE CAST STEEL, SUPPLIED IN ACCORDANCE WITH ASTM A27-60 GRADE 65-35
 - RAIL TUBING SHALL BE SPICED WITH SPIES IN LENGTHS OF 20'-0" (EXCLUDING SPICES) EXCEPT AS NOTED
 - POSTS AND ANCHORS SHALL BE GALVANIZED IN ACCORDANCE WITH A-58 ALL SURFACES SHALL BE GALVANIZED SHALL BE DONE AFTER FABRICATION
 - ELECTRODES SHALL BE A LOW HYDROGEN SPECIFICATION & WELD FOR OR 7018
 - ANCHORAGE FOR POSTS TO CONCRETE SHALL BE REINFORCED TYPE A-7 SET OF 400# LANCHOR WARRERS AND ANCHOR BOLTS SHALL BE GALVANIZED IN ACCORDANCE WITH A-58 FOR BOLTS SHALL BE GIVEN A LUBRICATING COATING OF WHITE NON-STAINING GREASE & 1/2" THICK TEMPLATES 6"x6" SHALL BE PROVIDED FOR EACH ANCHORAGE
 - HEX CAP SCREWS AND WASHERS FOR FASTENING STEEL TUBING TO POSTS SHALL BE GALVANIZED (SEA G-54) CAP SCREWS SHALL NOT BE TIGHTENED ON POSTS ADJACENT TO BRIDGE EXPANSION JOINTS
 - RAIL TUBING SHALL BE PRESENT TO FOLLOW ROAD CURVATURE WHERE ROAD IS LESS THAN 500 FEET
 - RAIL POSTS SHALL BE SET PERPENDICULAR TO GRADE
 - WHERE LAYOUT OF POSTS IS NOT SHOWN, POST LOCATION SHALL BE DETERMINED BY THE CONTRACTOR
 - RAIL MAY BE CUT AS REQUIRED IN FIELD WITH PIPE NOT FASTENED TO BE SURFACE TREATED WITH ZINC
 - WHEN CONNECTING TO EXISTING RAILING, RAIL MUST BE MADE CONTINUOUS AND POST SPACING DETERMINED WITH REFERENCE TO EXISTING POSTS
 - ALTERNATIVE ALUMINUM RAIL AND POST DESIGNS WILL BE PERMITTED SUBJECT TO PRIOR APPROVAL BY A.E.C. ALUMINUM DESIGN SHALL BE SUBMITTED TO THE DESIGN SHOWN ON THIS DRAWING, WITH A CONFIGURATION TO PERMIT COMPLETE INTERCHANGEABILITY WITH GALVANIZED STEEL POSTS AND RAILS

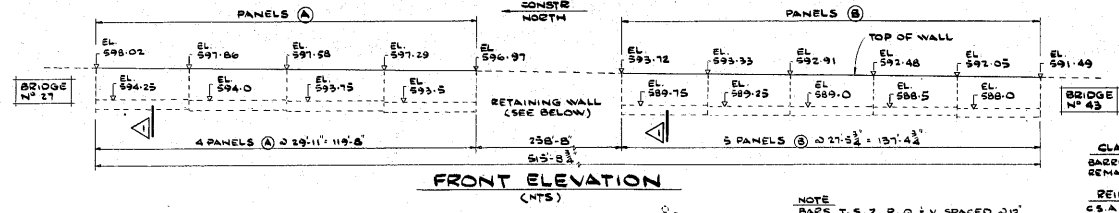
ITEM	MT	LINEAR	BENDING	LOCATION
REQD	FEET		RADIUS	
POST AND ANCHORAGE	22			
END CAP				
3 1/2" TUBE WITH SPICE (20'-0" LONG)	23	504'-1"		
3 1/2" TUBE WITHOUT SPICE (1 LONG)	1	12'-0"		

- POST AND ANCHORAGE TO INCLUDE ALL BOLTS, WASHERS AND NUTS AND TEMPLATES AS SHOWN OR INDICATED IN NOTES
- END CAP TO INCLUDE 25 SELF TAPPING FASTENERS
- LENGTH FOR 3 1/2" TUBE WITH SPICE GIVEN IN TABLE DOES NOT INCLUDE 12" PROTRUSION OF SPICE TUBE

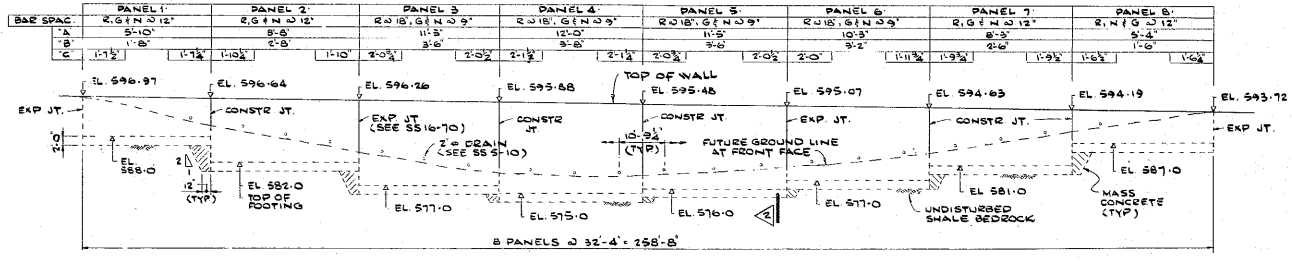
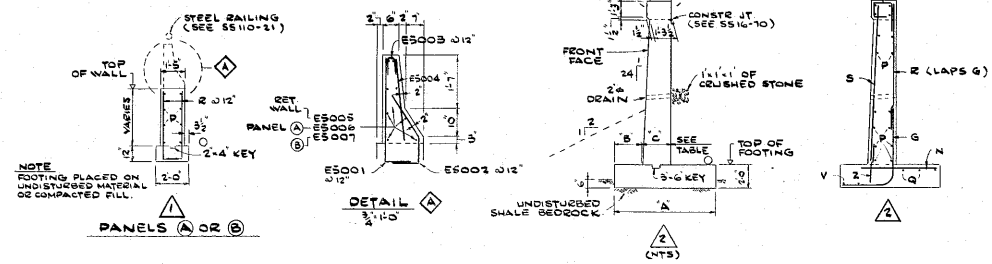
STANDARD DRAWING		SS 110-21
APPROV. BY		
DATE		JAN 14 1968
DESIGNED BY	CHECKED	DATE 10-11-67
DRAWING NO	CHECKED	DATE 10-11-67

30112-65

DIST No		SHEET
CONT No		
WP No	127-65-60	
RETAINING WALL No		
REINFORCING DETAILS		



- CLASS OF CONCRETE**
 BARRIER WALL 4000 PS I
 REMAINDER 3000 PS I
- REINFORCING STEEL**
 BARS T, S, Z, P, Q & V SPACED @ 12"
 FOR SPACING OF BARS R, G & N SEE TABLE BELOW.
- CLEAR COVER TO REINFORCING**
 BARRIER WALL 1 1/2" AS NOTED
 REMAINDER 3"
- CONCRETE QUANTITY**
 1 CONCRETE IN BARRIER WALL 39 CU. YD.
 2 CONCRETE IN RETAINING WALL 182 CU. YD.



ELEVATION OF RETAINING WALL
 1"=10'-0"
 CONSTR NORTH

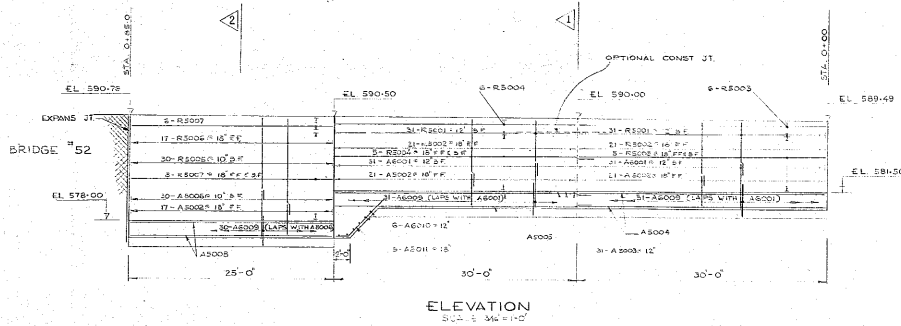
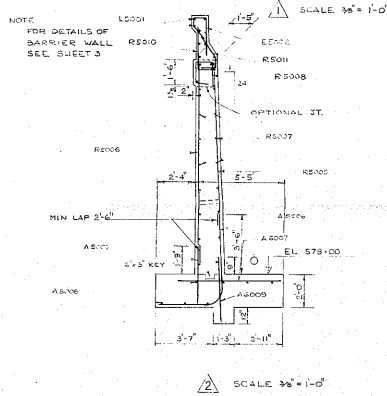
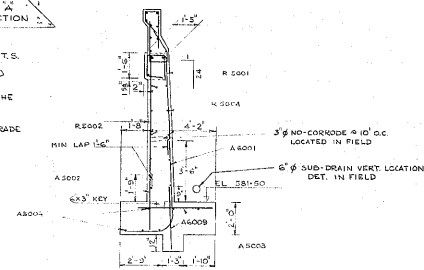
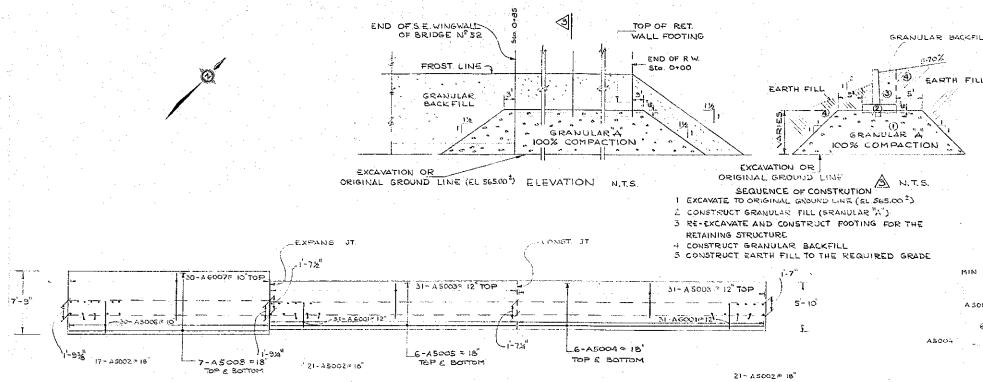
FOR REDUCED PLAN
 USE SCALE BELOW
 1"=3' INCHES ON ORIGINAL PLAN

DATE BY	DESCRIPTION
DESIGN	CHECK (GARDING HEAD) (DATE MONTH)
DRAWING	CHECK (DATE MONTH)



UNITS OF MEASUREMENT AND CONVERSIONS: 1 INCH = 1 FOOT

DIST. No 6	○
CONT No WP No 127-66-50	
HWY'S 401 & 403	SHEET
RETAINING WALL No 2 (DETAILS)	



DATE BY	DESCRIPTION	DATE
DESIGN STD. CHECK	LOADING	11/1/75
DRAWING J.E. CHECKED	DATE 12-7-75	DWG 7

30M12-65