

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 40P9-15

W.P. No. 109-68-10

CONT. No. BUILT BY C.N.R.

W. O. No. 72-11041

STR. SITE No. 35-408

HWY. No. H-E DIST. 3

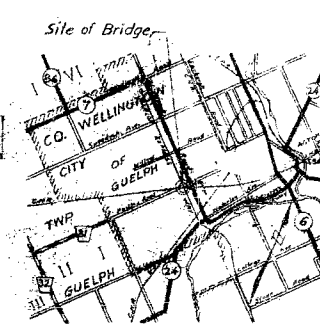
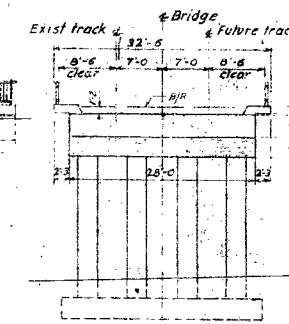
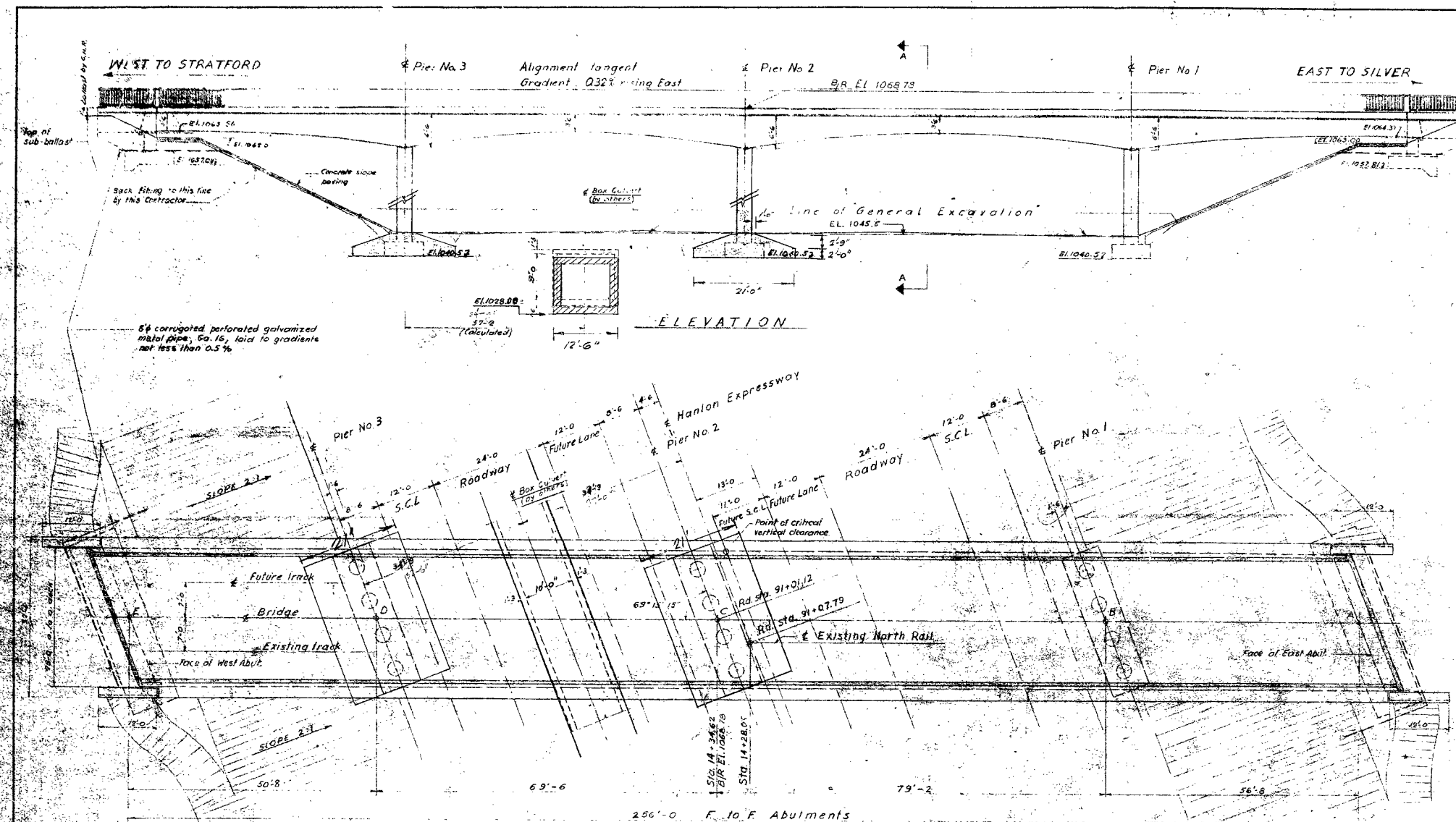
LOCATION GUELPH - C.N.R.

Subway adjacent to Paisley
Road.

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 2

REMARKS: _____

G.I.-30 SEPT. 1976



SECTION A-A

KEY PLAN
Scale 1" = 1 Mi

GENERAL NOTES
A new reinforced concrete bridge, consisting of 4 continuous spans supported on 3 piers and 2 abutments, is to be constructed to carry 2 C.N.R. tracks, of which one is future, over Hanlon Expressway.
Alignment remains unchanged. B/R elevations to be corrected as per drwg detail. Prop. profile of existing M.L. track, raised by 0.55 feet at Hanlon Expressway.
Live load: Cooper loading E70 + Diesel impact
Material specifications:
Concrete: C.S.A. A23.1 and A23.2
Reinforcing: C.S.A. G30 series.
Datum: D.H.O. B.M. No. 132-69 Elev. 1081.58
Two story stone house owned by Mr. L. Fisher, on S. side of Paisley Rd. being 0.6 mil. north of jct. of Hwy. No. 24 (Silvercreek Pkwy.) and Hwy. No. 24 (Waterloo Ave.), 668 ft. S. of corner and 0.2 mi. W. along Paisley Rd. and 225 ft. S. of Paisley Rd. Tablet is set horizontally in E. face of stone fdn. being 11.9 ft. S. of NE corner and 0.3 ft. above ground level.
Authorization: R.T.C. Order No. 15437 dated 4 December 1972.

Nearest station: Guelph Jct., Mi. 49.8
REFERENCE DRAWINGS:
Department of Highways of Ontario
Drg. No. G-4021 dated Sept. 1969 Revised Feb. 1972
Drg. No. E-4867 dated Sept. 1969 Revised Feb. 1972

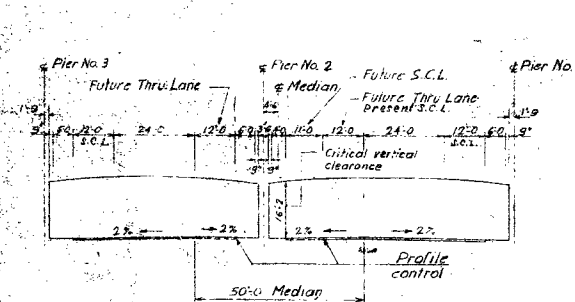
LIST OF DRAWINGS

General layout	AA 940-50.37-11	Spans Reinforcement	AA 940-50.37-12
Abutments - Concrete Details	13	Spans Reinforcement	17
Abutments - Reinforcement	13	Spans Reinforcement	18
Piers	14	Handrail	19
Spans - Concrete Details	15	Slope Paving	20

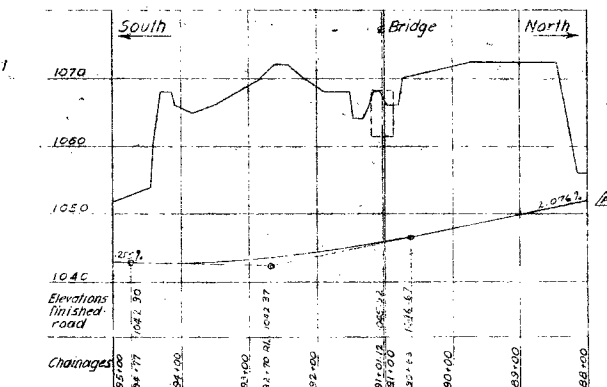
ESTIMATED QUANTITIES:

Concrete, 4000 p.s.i.	466 cu.yd.
Concrete, 4500 p.s.i.	1330 cu.yd.
Reinforcing steel	493,100 lb.

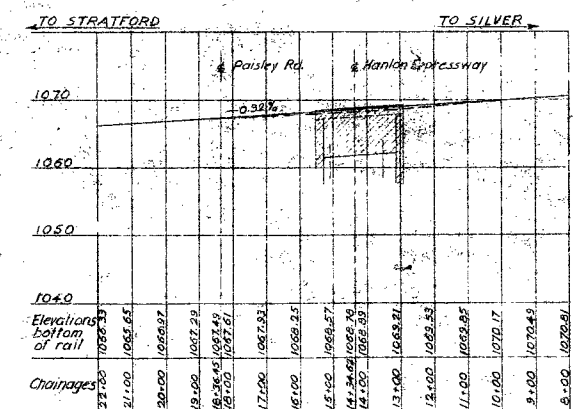
D	24 APR. 1973	SLOPE PAVING					
C	21 NOV. 1972	EXTERNAL SPANS LENGTHENED TO MEET NEGATIVE REACTION					
B	11 AUG. 1972	PARABOLIC SUPER					
A	21 JUNE 1972	PROFILE OF HANLON EXPRESSWAY REVISED					
Rev.	Date	Revised					
Region	GREAT LAKES	Area	SOUTHWESTERN	Sub-division	GUELPH	Mile	50.37
HANLON EXPRESSWAY SUBWAY							
GUELPH, ONTARIO							
GENERAL LAYOUT							
Drawn	G.E.K.	Checked	Verification	Approved	Signature	Scale	1" = 10' (DR) Date 10 APRIL 1973
Office of Chief Engineer Bureau de l'Ingénieur en chef							
File	50.37	GUELPH	Sheet	AA 940-50.37-11			



CLEARANCE DIAGRAM
Normal to Hanlon Expressway
scale 1" = 20'



PROFILE HANLON EXPRESSWAY
scale Horiz. 1" = 100'
Vert. 1" = 10'



PROP B/R PROFILE OF EXIST. M.L. TRACK
scale Horiz. 1" = 200'
Vert. 1" = 10'

Feeding Dimensions added
15 June 1973, as quoted by
Systems Design.

409-15

72-11041
DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

TO: Mr. A. G. Stermac,
Principal Foundation Engineer,
Foundation Office,
Design Services Branch,
ATTENTION: West Bldg., DOWNSVIEW, Ont.

FROM: Bridge Planning,
Southwestern Region,
London, Ontario

DATE: February 24, 1972.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 109-68-10, Bridge Site 35-408
C. N. R. Subway # 1
City of Guelph
Hanlon Expressway
District 3, Stratford

40 P9 - 15
GEOCRES No.

Would you kindly arrange to have a Foundation Investigation conducted at the above location. I have enclosed two copies of bridge site plan E-4867-1 with the probable footing locations marked in red. I have also attached the Field Reconnaissance Report, a list of the utilities to be contacted, utilities plan #1 and a copy of C.N.R. Instructions for Foundation Consultants.

Please contact the C.N.R. Area Engineer, Mr. M.F.K. Leighton, in London, telephone 433-4511, local 235, for his assistance in locating the boreholes and the provision of flagmen, if required. One week advance notice would be appreciated.

We will require additional copies of the Foundation Investigation Report for the C.N.R.

SJ/fs
Encls.

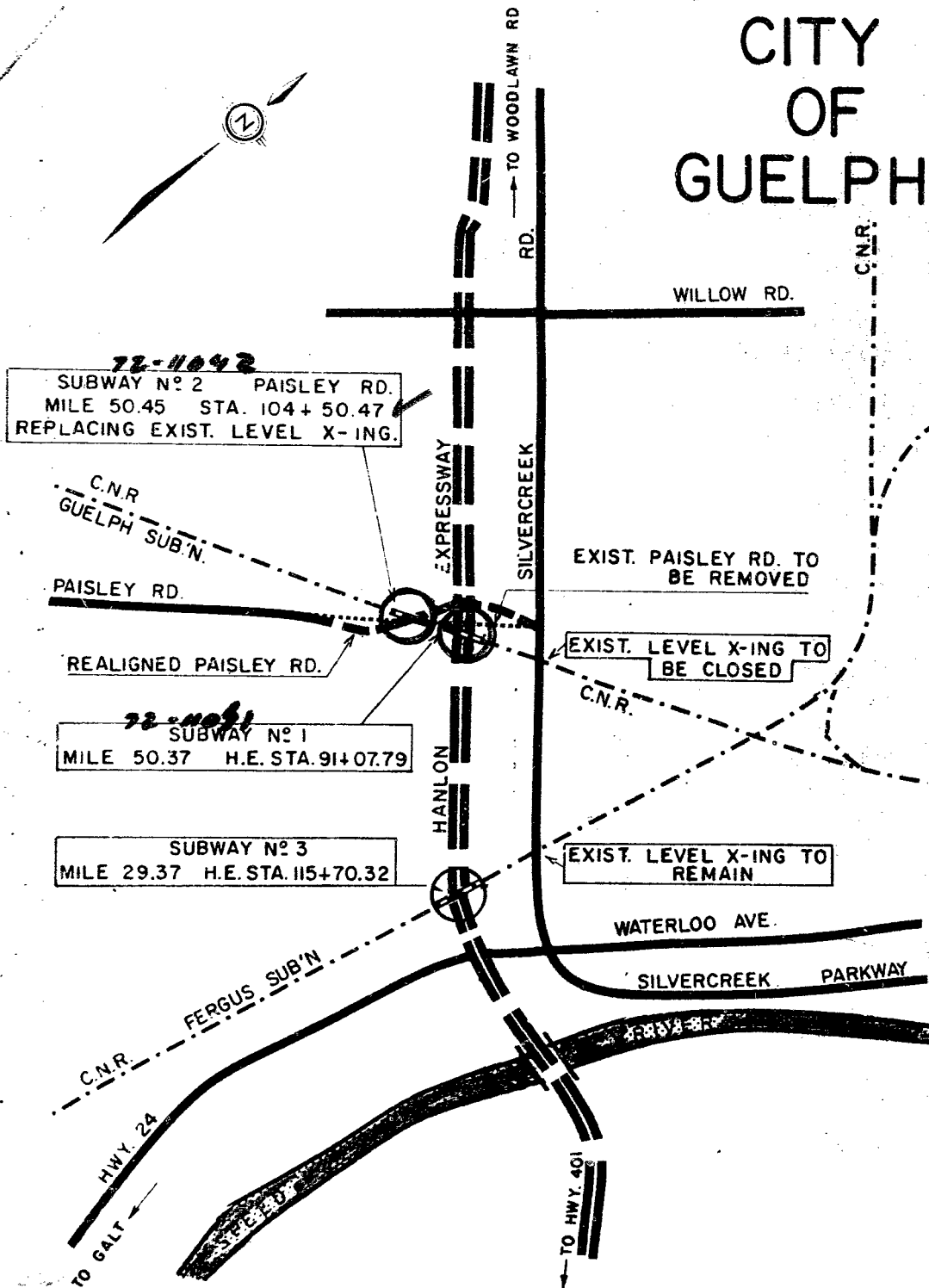
S. Jants
S. Jants,
Bridge Planning Technician,
Southwestern Region.

cc: Mr. C. Gloski
Mr. A. Cowley
Mr. J. Anderson
C. N. R.

COMPLETION DATE
APR 30/72.

MICROFILM
THIS PAGE

CITY OF GUELPH



HANLON EXPRESSWAY

SKETCH SHOWING LOCATION OF THREE PROPOSED SUBWAYS UNDER RAILWAYS

Mr. F. E. Loscombe,
Reg. Super't of Eng. Surveys,
Southwestern Region,
LONDON, Ontario.

P. J. Rule

Mr. G. A. Baun,
Field Supervisor,
Engineering Surveys,
LONDON, Ontario.
March 24, 1972.

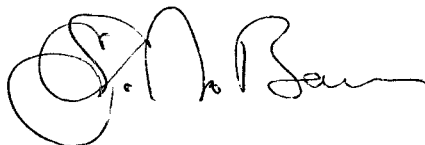
RE: W.P. 109-68-10 & 11, Hanlon Expressway, Job #150-71
City of Guelph, County of Wellington
District No. 3, Stratford
Party Chief - G. Telford

Please be advised that the request received from P. Payer, Foundations Office, Downsview on March 17, 1972 was completed March 21, 1972 and the information submitted to the engineer on the site.

A copy of the field notes comprised of borehole locations and elevations as well as top of rail elevation at the Hanlon Expressway crossing and the Paisley Road crossing are on file with P. J. Rule

Information being submitted is as follows:

- 1 Field book of borehole location at elevation at 2 sites as well as top of rail elevation at Hanlon Expressway and Paisley Road crossing
- 1 40' to 1" photo plan



G. A. Baun,
Field Supervisor.

GAB:ww

c.c. Mr. P. Payer, Foundations Office
Mr. A. Crowley.

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

TO: Mr. A. P. Watt, (4)
Regional Bridge Planning Eng.,
Southwestern Region,
London, Ontario.

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

ATTENTION: DATE: May 3, 1972.

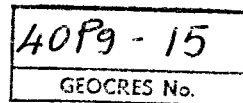
OUR FILE REF.

IN REPLY TO

MAY 5 1972

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
The Proposed C.N.R. Subway #1 Over
Hanlon Expressway, City of Guelph
District #3, Stratford.
W.O. 72-11041 -- W.P. 109-68-10



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/ao
Attach.

A. G. Stermac
A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER.

cc: Messrs. D. W. Farren
B. R. Davis
A. Rutka
W. A. Zonnenberg
W. D. Neillpovitz
B. J. Giroux
J. R. Roy
G. A. Wrong
B. A. Singh

Foundations Files
Documents ✓

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FOUNDATION INVESTIGATION REPORT
For
The Proposed C.N.R. Subway #1 Over
Hanlon Expressway, City of Guelph
District #3, Stratford.
W.O. 72-11041 -- W.P. 109-68-10

1. INTRODUCTION:

In a memo dated February 24, 1972, Mr. S. Jants, Bridge Planning Technician, Southwestern Region, requested a foundation investigation at the site of the proposed C.N.R. Subway #1 over the future Hanlon Expressway. The subsequent field and laboratory investigations were supervised by this Office; the boreholes were located in the field and surveyed by personnel of the Engineering Survey Office of the Southwestern Region.

This report contains the results of the investigations, together with recommendations pertaining to foundations and approach cut stability.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The proposed bridge site is situated at the western portion of the City of Guelph, just east of the existing level crossing of the C.N.R. tracks and Paisley Rd. The immediate vicinity is partially built up, partially tree covered. Northwest of the proposed crossing there is a sand and gravel pit. Geologically the site belongs to the "Guelph Drumlin Field" physiographic region. The general land form pattern of this region consists of drumlins or groups of drumlins, fringed by gravel terraces and separated by swampy valleys, in which flow sluggish tributaries of the Grand River. The City of Guelph is located upon a gravel terrace at the confluence of the Speed and Eramoso Rivers.

3. FIELD AND LABORATORY INVESTIGATION PROCEDURES:

The field investigation consisted of five sampled boreholes and four dynamic cone penetration tests adjacent to the borings. A Bombardier mounted continuous hollow stem flight auger machine was used to advance the boreholes. Conventional sampling techniques were employed, taking split-spoon samples at regular intervals. Split-spoon samplers were driven 18 inches into the soil by the method known as the Standard Penetration Test. Penetration resistances (N = blows per ft.) are marked on the accompanying borelogs, together with the results of the laboratory tests. All the soil samples were visually examined and classified in the field and again upon arrival in the laboratory. A few additional laboratory tests were carried out to determine natural moisture contents, Atterberg limits and grain size distributions of the deposits.

The locations and elevations of the boreholes as well as the estimated stratigraphical profile are shown on Drawing #72-11041A in the Appendix.

4. SUBSOIL CONDITIONS:

4.1) Overburden:

Granular type subsoil was encountered in the boreholes, consisting of gravelly sands to sandy gravels, underlain by sandy silt with traces of clay and gravel. The depth of overburden was found to be some 40 ft. beneath which the bedrock was proved in one borehole location. Within the uppermost 22-32 ft. the material was classified to be gravelly sand to sandy gravel of brown colour. Penetration resistances were noted to be quite high, ranging from 22 blows per ft. to above 100 blows per ft. corresponding to generally dense to very dense relative density. The deposit is well graded, having approximately 50% gravel and 50% medium and fine sand size

particles. Underlying the gravelly sands sandy silts with some gravel and traces of clay were identified, extending to 38-42 ft. below ground level, to elevations 1023 ft. - 1027 ft. This soil exhibited very slight plasticity, with plastic limits of 13% - 14% and liquid limits of 18% - 21%. Dense to very dense relative densities were recorded within this layer as well, "N" values being above 30 blows per ft. and usually exceeding 100 blows per ft.

4.2) Bedrock:

In Borehole #3 bedrock was proved by diamond drilling for a depth of 5 ft., yielding 65% recovery. The top of the bedrock was established at elevation 1023.7 ft. at this location, and was identified to be a dolomitic limestone of the Lockport or Guelph formation.

4.3) Groundwater:

Groundwater observations were carried out at each borehole location. The equilibrium water levels are plotted on the borelog sheets. At the time of the field investigation the groundwater levels were found to lie around elevation 1043 ft. - 1046 ft. Seasonal fluctuations of the water levels are expected.

5. DISCUSSION AND RECOMMENDATIONS:

5.1) General:

Hanlon Expressway is proposed to cross the C.N.R. tracks with a subway at this location. The grade of the tracks will stay practically unchanged, while the grade of Hanlon Expressway at the crossing is designed to be at elevation 1046 ft. It is assumed that perched abutments will be constructed. The approximate 40 ft. deep overburden was found to consist of gravelly sands and sandy gravels, followed by sandy silts with traces of clay and gravel of dense to very dense relative

density. Around elevation 1023 ft. - 1027 ft. dolomitic limestone bedrock was observed.

5.2) Foundations:

Soil conditions appear to be favourable for spread footings under the abutments as well as under the piers. The base of the spread footings at the abutments should be placed at or below elevation 1061ft. with provision of a minimum cover of 4 ft. for frost protection.

Spread footings for the piers should be some 4 ft. below finished ground. Safe design loads of 3 t.s.f. may be applied on the footings of both the abutments and of the piers.

For the lack of cohesion, the subsoil is susceptible to conditions of unbalanced hydrostatic head; hence, quick conditions would occur at the bottom of excavations, extending below the groundwater level. In order to eliminate instability due to "boiling", a dewatering scheme will be necessary for the pier footing excavations.

5.3) Approach cuts:

No stability problems are anticipated for the approach cuts, provided that they are built with 2 horizontal to 1 vertical slopes. Some seepage may occur along the slopes extending below the groundwater level. Since the seepage could erode the toe of the slopes, subdrains should be built to lower the groundwater level. Subdrains should consist of suitable size perforated pipes at the toe of the slopes, the invert of which should be at least 4 ft. below ground level. Granular type material is to be used for backfilling of the pipe trenches. As a further protective measure it is recommended to use a granular filter blanket along the portion of the cut below the groundwater level. The thickness of the blanket should be at least 12 inches. The actual necessity

of the filter blanket should be determined by the Engineer during construction.

6. MISCELLANEOUS:

The field work carried out during the period of March 24 - 28, 1972, was supervised by Mr. J. Bangs, Project Foundations Engineer.

The equipment used was owned and operated by P.V.K. Drilling Company, Burford, Ontario.

This report was written by Mr. A. K. Barsvary, Senior Foundations Engineer, and reviewed by Mr. K. G. Selby, Supervising Foundations Engineer.

A. K. Barsvary

A. K. Barsvary, P. Eng.

K. G. Selby

K. G. Selby, P. Eng.

AKB/ao
April 27, 1972.

APPENDIX I

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No./

FOUNDATION SECTION

JOB 72-11041

LOCATION Co-ords. 818,440 N; 794,716 E.

ORIGINATED BY JB

W.P. 109-68-10

BORING DATE March 24, 1972

COMPILED BY AKB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

SOIL PROFILE		STRAT. PLOT	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — W _L PLASTIC LIMIT — W _P WATER CONTENT — W		BULK DENSITY Y P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION		NUMBER	TYPE	BLOWS/FOOT		BLOWS/FOOT	RESISTANCE	WATER CONTENT %			
1065.7	Ground Level											
0.0												
	Medium sand, some gravel.		1	SS	33							
			2	SS	91	1060						
			3	SS	67							
			4	SS	111							
			5	SS	100							
	Dense to Very Dense		6	SS	110	1050						
			7	SS	75							
	Brown		8	SS	26	1040						
			9	SS	69							
1035.7												
30.0	Sandy silt, traces of gravel and clay.		10	SS	102	1030						
	Very Dense		11	SS	100/3"							
1024.2	Probable Bedrock											
41.5	End of Borehole					1020						

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 72-11041

LOCATION

Co-ords. 818.454 N; 794.747 E.

ORIGINATED BY J.B.

W.P. 109-68-10

BORING DATE

March 24, 1972

COMPILED BY AKB

DATUM Geodetic

BOREHOLE TYPE

Hollow Stem Auger

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT — w_L		BULK DENSITY γ P.C.F.	REMARKS				
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		BLOWS / FOOT	BLOWS / FOOT		PLASTIC LIMIT — w_P						
							20	40	60			80	100	WATER CONTENT — w	
							SHEAR STRENGTH P.S.F.					w_P — w — w_L			
						○ UNCONFINED + FIELD VANE		WATER CONTENT %							
						● QUICK TRIAXIAL x LAB. VANE		10 20 30							
1065.8	Ground Level										GR. SA. SI. CL.				
0.0															
	Gravelly sand to sandy gravel.		1	SS	23	1060					52 41 (7)				
			2	SS	56										
			3	SS	102	7"									
			4	SS	66										
			5	SS	46										
	Compact to Very Dense		6	SS	100	8"	1050								
			7	SS	69										
1043.8															
22.0	Fine sandy silt, traces of clay & gravel.		8	SS	29	1040					2 36 56 6				
	Compact to Very Dense		9	SS	38										
			10	SS	35	1030									
	Brown														
1025.8			11	SS	100	7"									
40.0	End of Borehole Probable Bedrock					1020									

End of Cone

52 41 (7)

2 36 56 6

FOUNDATION SECTION

JOB	<u>72-11041</u>	LOCATION	<u>Co-ords. 818,481 N; 794,811 E</u>	ORIGINATED BY	<u>JB</u>
W.P.	<u>109-68-10</u>	BORING DATE	<u>March 28, 1972</u>	COMPILED BY	<u>AKB</u>
DATUM	<u>Geodetic</u>	BOREHOLE TYPE	<u>Hollow Stem Auger</u>	CHECKED BY	<u>So</u>

[illegible]

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

DESIGN SERVICES BRANCH

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 72-11041

LOCATION Co-ords. 818,513 N; 794,884 E.

ORIGINATED BY JB

W.P. 109-68-10

BORING DATE March 27, 1972

COMPILED BY AKB

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger


CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE		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		BLOWS / FOOT	20 40 60 80 100	W _P — W — W _L	10 20 30			
065.3	Ground Level												
0.0	Gravelly sand to sandy gravel.		1	SS	47	1060			○				43 50 (7)
			2	SS	37				○				
			3	SS	34				○				
			4	SS	100/7"				○				
			5	SS	75				○				
	Dense to Very Dense		6	SS	100/8"	1050			○				
			7	SS	100/6"				○				
	Brown		8	SS	100				○				
1038.3						1040							
27.0	Sandy silt with some gravel, traces of clay.		9	SS	16								
			10	SS	35	1030			○				
	Compact to Very Dense												
1025.8			11	SS	100/8"				○				
39.5	End of Borehole Probable Bedrock					1020							

100/11"
End of cone test

36 24 39 1

FOUNDATION SECTION

JOB	72-11041	LOCATION	Co-ords. 818,529 N; 794,920 E.	ORIGINATED BY	JB
W.P.	109-68-10	BORING DATE	March 27, 1972	COMPILED BY	AKB
DATUM	Geodetic	BOREHOLE TYPE	Hollow Stem Auger	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. PLOT	NUMBER	TYPE	BLOWS / FOOT		20 40 60 80 100						w_p w w_L		
							SHEAR STRENGTH P.S.F.						WATER CONTENT %		
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE						10 20 30		
1065.6	Ground Level														
0.0	Gravelly sand to sandy gravel. Compact to Very Dense Brown		1	SS	22	1060		100/9"	End of cone test	○			3 16 77 4		
2			SS	50	○										
3			SS	79	○										
4			SS	85	○										
5			SS	100	○										
6			SS	100	○										
7			SS	63	○										
8			SS	24	○										
9			SS	70	○										
1033.6					10					SS	54	1040			
32.0	Sandy silt, traces of clay & gravel.					1030									
1027.1															
38.5	End of Borehole Probable Bedrock					1020									

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' - 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>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T.	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS 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
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
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
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 (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

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. A. G. Stermac
Principal Foundation Engineer
Foundation Office
West Bldg., Downsview
ATTENTION: Mr. K. G. Selby
Assistant Foundation Engineer
OUR FILE REF.

FROM: Structural Planning
Southwestern Region

DATE: February 26, 1973

IN REPLY TO

SUBJECT: W.P. 109-68-10, Bridge Site 35-408
C.N.R. Subway #1
Hanlon Expressway Sta. 91 + 07.79
District 3, Stratford

72-11-041

Enclosed please find one print of a General Layout Drawing
AA 940-50.37-1.1, revision C, prepared by the C.N.R. for
the above noted structure.

May we please have your comments as soon as possible.



S. Jants
Structural Planning Technician

SJ:sz
Enc.

cc F. K. Leighton

No comments

APR

Mar 2, 73

Mr. B. J. McKenna,
Structural Location Engineer,
Structural Planning Office,
Southwestern Region,
London, Ontario.

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

March 23, 1973.

W.P. 109-68-10 W.O. 72-11041
C.N.R. Subway #1, Hanlon Expressway
City of Guelph, District #3 (Stratford)

We have reviewed the general layout drawing for the above project and find it to be in accordance with the recommendations contained in our foundation investigation report.

We have no comments to make.

K. G. Selby

KGS/ao

K. G. Selby,
SUPERVISING FOUNDATIONS ENGINEER.

FOUNDATIONS OFFICE

REVIEW OF DESIGN DRAWINGS:

W.P. 109-68-10
W.O. 72-11041

Foundations Report by:

Review of Design Drawings by:

Design Drawing No.'s:

G. ALLEN
A. PRAKASH
A A 940-50.37-1.1 C

1. Does footing design comply with our report or subsequent memos? yes
2. If answer to 1. is 'No'; is present design acceptable? -
3. Has sufficient field work been done? yes
4. Are estimated pile lengths shown on Drawings correct? If not, make a new list. -
5. If excavation of unstuitable soil is recommended, is this shown on drawings? -
6. Are approaches designed in accordance with our report? Check slopes and berm lengths. yes
7. Do you anticipate any construction problems? i.e. dewatering, stability of temporary slopes or excavations. No
8. Summarize your comments; on separate sheet is necessary.

Drawings Received Feb. 28.....1973...
Reviewed Mar. 2.....1973...

SignedA. Prakash.....

MEMORANDUM

TO: Mr. J. G. Forster,
Regional Materials Eng.,
London.

FROM: E. A. Wood,
Project Foundations Eng.

ATTENTION: R. Mephram

DATE: June 25, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 109-68-08

Having received your memo dated June 15, 1973 concerning the relationship of the 10' x 9' concrete culvert to the pier footings of the structure at Paisley Road and Hanlon Expressway, we have reviewed the situation to determine whether any problems are anticipated.

Because of the non-cohesive nature of the subsoil and the position of the groundwater level relative to the bottom of the culvert, it is expected that dewatering of the excavation for the culvert will be necessary whether the culvert is placed before or after the adjacent footings are constructed. Because of the limited head room it will not be possible to drive sheet piling under the structure after it has been completed. If the culvert is placed after the adjacent piers have been constructed, the dewatering of the excavation may depress the groundwater level under the piers causing settlement of the piers. For these reasons it is recommended that the portion of the culvert located under the structure be placed before the adjacent piers are constructed. In order to ensure that no settlement of the piers occurs when the remainder of the culvert is placed, the ends of the portion of the culvert under the structure should be a minimum distance of 15' away from the adjacent pier footings.

EAW Wood

EAW/js

c.c. A. P. Watt

E. J. Orr

B. R. Davis

A. Rutka

A. Wittenberg

W. D. Neilipovitz

B. J. Giroux

J. R. Roy

G. A. Wrong

Foundations File ✓
Documents

for

E. A. Wood,

Project Foundations Eng.

K. G. Selby,

Supervising Foundations Eng.

72-11041

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. A. Stermac,
Principal Foundations Engineer,
Downsview.

FROM: Materials and Testing Office,
London.

ATTENTION: Mr. K. Selby.

DATE: June 15, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 109-68-08, Hanlon Expressway,
Stage 111, Stratford District.

Referring to our conversation by telephone on June 13th, I am enclosing a print of the structure at Paisley Road and Hanlon Expressway on which I have shown the relationship of the 10' x 9' concrete culvert to the pier footings. You have your foundation report for this bridge, W.P. 109-68-10 and W.O. 72-11041.

Will you examine the situation? The C.N.R. structure is going to tender on June 16 and the culvert will be constructed later under the Ministry contract for the Expressway and will be beneath the south bound lane to pass under the railway and then move to the west side to the north and south of the cut.

The water table may well be quite different from that determined at the time of your borehole investigation due to the draining of the old gravel pit to the south, the installation of the open municipal ditch up to just south of the railway, and the excavation for and beneath the bridge.

If you can reply soon with your comments on the possible problems and precautions necessary to install the culvert there may still be an opportunity to add a portion of it, as an addendum, into the contract for the construction of the bridge. In any case we feel some special precautions should be specified in our contract.

Please call us if you have any questions and thank you.

RM:hp.
c.c. - G. A. Wrong,
A. Wittenberg,
File.


R. MEPHAM,
FOR: J. G. FORSTER,
SENIOR SOILS ENGINEER.



Inter-departmental Correspondence

department, place and date Engineering, Montreal, Que.,

September 25, 1973

your file

and letter dated

our file 50.37 Guelph

subject Hanlon Expressway Subway, Mile 50.37 Guelph Subdivision.

CN-11 (2-68)
AS-60-077

Mr. Z. L. Szeliski,
Engineer of Structures Design,
Montreal.

Attention: Mr. J. W. Strzelecki

Confirming our discussion and recommendation made to you regarding construction of MTC's 10' x 9' concrete box culverts to be located between Piers #2 and #3.

Bottom of culvert shall be at El. 1028. This elevation is very close to bedrock, as bedrock surface is approximately at about El. 1025. Excavation to El. 1028 will encounter gravelly sand to sandy silt material. Ground water table was found at about El. 1045 during test boring in March 1972.

In view of the very close proximity of the pier footings to the culvert, it appears necessary that we should retain or shore the excavation for the culvert to ensure that foundation soil under the footings would not be disturbed. For this purpose, a designed system of soldier piles with horizontal struts and laggings can be provided.

Soldier piles should be driven into rock which may or may not be weathered at the surface. The piles could be designed with supports on two levels of struts. One strut above top of culvert and the other at bottom of excavation so that construction of the box culvert will be clear of obstructions. Working slab which may be poured lean concrete up to 9" thick could be used as bottom struts. At the end section of the excavation where the railway diversion fill must be safely retained, the soldier piles there could be supported on top by cross struts onto the adjacent soldier piles.

SEP 27 1973

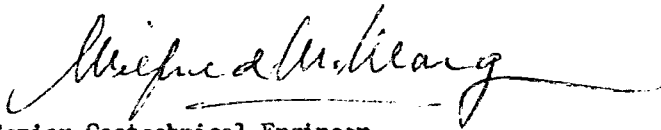
SOUTH WEST REGION

... / 2

15/74

Since the above shoring method cannot be a water-tight system, there is strong possibility that some loss and undermining of ground surrounding the excavation would take place due to seepage water through base of excavation and between laggings. Since the soil to be excavated is non-cohesive and water table is high, the fines in the material are bound to filter through under seepage pressure. I therefore suggest that we call for a well-point dewatering system as an optional item which could be installed without delay should field condition indicate that it is necessary.

It is understood that the box culvert will be installed prior to construction of the pier footings.



Senior Geotechnical Engineer.

cc: Mr. C. S. Dunn,
Construction Engineer,
Toronto, Ont.

4/2 E. J. Stetson 28/9/77,
T. Stermac 3/10/77