

71-F-97	113-67-03	HWY. 20 & T.H.&B. SMITHVILLE	30M4-33
W.O.	W.P.	LOCATION	GEOCRES NO.

● DATA ON FILE IN SOIL MECHANICS SECTION

REFER TO: W.P. FILE

REMARKS Project Cancelled

**GEOCRES**

INDEXING CARD FOR REPORTS NOT MICROFILMED

GI-20 AUG. 74

OVERSIZED DRAWINGS

Program Status Report

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

TO: Mr. A. G. Stermac,  
Principal Foundation Engineer,  
Central Building.

FROM: G. C. E. Burkhardt,  
Structural Planning Office,  
90 Floral Parkway.

ATTENTION: Mr. K. Selby

DATE: April 20, 1972.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 113-67-03, Site 18-61,  
T. H. & B. Subway Replacement  
in the Village of Smithville,  
Highway 20, District 4.

Attached are 2 sets of plans of the existing subway for your information.

As you know, we have been asked to investigate the feasibility of retaining the existing subway by lowering the roadway grade approximately 2'-6". As this scheme depends on the conditions at the existing footings, please arrange for core drills at the abutments and pier footings so that an evaluation may be made.

In addition to this, please arrange for cores to be taken through the railway embankment, behind the abutments and at each side of the tracks. These are required for the possibility of providing pedestrians facilities through the railway embankment.

WMK:lc  
Attach.

*W. M. Killin*  
W. M. Killin,  
for:  
G. C. E. Burkhardt,  
REG. STRUCTURAL PLANNING ENG.

c.c. R. G. Burnfield  
C. S. Grebski

Department of Highways Ontario  
Copy for the Information of

Mr. A. Stermac

Structural Planning Office,  
Central Region,  
90 Floral Parkway,  
Toronto 15, Ontario,  
Telephone: 248-3097,  
April 14, 1972.

Mr. I. N. Wigle,  
Chief Engineer,  
The Toronto, Hamilton and  
Buffalo Railway Company,  
HAMILTON, Ontario.

RE: W.P. 113-67-03, Site 13-61,  
T. H. & B. Subway Replacement  
in the Village of Smithville,  
Dunnville Subdivision,  
Mileage 0.46,  
Highway 20, District 4.

Dear Sir:

We have received your letter of March 23rd and have passed it to our design section for their attention.

Our office has been asked to investigate the feasibility of retaining the existing subway by lowering the roadway grade approximately 2' - 6", allowing for a minimum vertical clearance of 15' - 3".

Since the scheme depends entirely upon whether the existing footings are supported on bedrock or are sufficiently deep enough to allow for frost protection after lowering the road grade we propose to have our Foundation Section investigate the footings. The results of their findings will determine whether or not we shall continue the study.

-- 2 --

RE: W. P. 113-67-03, Site 18-61,  
T. H. & B. Subway Replacement  
in the Village of Smithville.

We, therefore, request your permission to have core drills  
taken at the abutment and pier footings.

An early reply would be appreciated.

Yours truly,

GCEB:lc

G. C. E. Burkhardt,  
REG. STRUCTURAL PLANNING ENG.

c.c. R. Burnfield  
A. Stermac

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

TO: Mr. K. Selby,  
Sup. Foundation Engineer.

FROM: K. W. Ingham

ATTENTION:

DATE: April 21, 1972

OUR FILE REF.

IN REPLY TO

SUBJECT: Foundation Investigation 72-11050;  
Bridge Footing; Highway 20 at Smithville

A brief description is given below for each of three boreholes drilled to bedrock at this site, together with the appropriate bedrock elevation.

Hole No. 2 Bedrock at 596.9

3.1 to 5.7 Concrete, porous in the upper 0.5 ft.

5.7 to 6.5 Dolomite, medium brownish grey, fine grained, dense, moderately fractured.

6.5 to 11.8 Dolomite, medium brownish grey, fine grained, dense.

Hole No. 3A Bedrock at 596.0

2.8 to 6.6 Concrete.

6.6 to 12.3 Dolomite, medium brownish grey, fine grained, dense, moderately fractured in the upper 0.3 ft.

Hole No. 1 Bedrock at 595.2

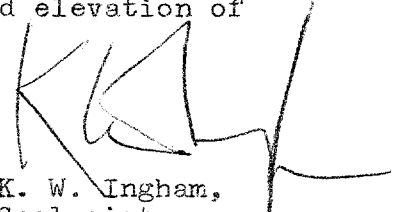
3.1 to 6.4 Concrete.

6.4 to 7.4 Brown stony till.

7.4 to 10.2 Dolomite, medium brownish grey, fine grained, dense, moderately fractured throughout.

Note: Bedrock elevations based on a ground elevation of 602.6 ft.

KWI:mv

  
K. W. Ingham,  
Geologist.

## MEMORANDUM

71-11097

TO: Mr. F. C. Stormac,  
Principal Foundation Engineer,  
Room 107, Lab. building.

FROM: G. C. E. Burkhardt,  
Bridge Planning Section,  
80 Floral Parkway.

ATTENTION: Mr. E. Selby

DATE: August 17, 1971.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. ~~113-67-03~~, Site 18-142,  
T.B. & B. Subway at  
Smithville,  
Highway 80, District 4.

113-67-03  
IS CORRECT W.P.  
FOR STRUCTURE  
12/2/71 Nov. 15<sup>th</sup> 71

Attached are two prints of drawing E 5401-1 on which the probable location of footings have been marked in red. The location of both the replacement structure and the detour structure are shown in dark red while the retaining walls are shown in light red.

Please arrange for a foundation investigation of sufficient scope to enable us to proceed with the design.

Also attached is field reconnaissance report for your information.

WMK:lc  
Attach.

*W. M. Killin*  
W. M. Killin,  
for:  
G. C. E. Burkhardt,  
REG. BRIDGE PLANNING ENGINEER.

c.c. P. Fitzgibbon

((REPLIETIF)) DATE  
OCT 27/71

FIELD RECONNAISSANCE REPORT  
REQUIRED BY FOUNDATION SECTION  
FOR

FF-69  
SEPT. 1968

113-67-03

W.P. NO. 113-67-03 HIGHWAY NO. 70 DISTRICT 4 SITE PLAN NO. 5401-1 PROFILE NO. C1768-1  
RIVER CROSSING ☐ GRADE SEPARATION ☐ R.R. X. ☐ OTHER (SPECIFY) Subway  
ALTERNATE SCHEME (IF ANY) \_\_\_\_\_

EXISTING SITE CONDITIONS

DESCRIPTION:

TOPOGRAPHY: HILLY ☐ ROLLING ☐ VALLEY ☐ GULLIED ☐ FLAT ☒  
VEGETATION: TREES ☐ BRUSH ☐ GRASS ☐ SWAMP ☐ FARM CROPS ☐ CLEARED ☐  
SNOW COVER: 0"-6" ☐ 6"-12" ☐ >12" ☐  
ROCK OUTCROP (SPECIFY LOCATIONS) \_\_\_\_\_

UNDERGROUND UTILITIES: UTILITY COMPANY TELEPHONE NO. FOR DEFINITE LOCATION

Water Main/Sewers (1 Smithville  
2 Works Dept.  
3 \_\_\_\_\_  
Gas Mains 4 Grimsby Natural Gas Co.  
5 \_\_\_\_\_

EXISTING STRUCTURE(S):

FOUNDATIONS: SPREAD FOUNDATIONS ☒ SIZE \_\_\_\_\_ ELEVATION(S) \_\_\_\_\_  
PILES ☐ TYPE \_\_\_\_\_ LENGTH(S) \_\_\_\_\_  
DESIGN LOAD Railway T.S.F. \_\_\_\_\_ TONS/PILE \_\_\_\_\_  
CONDITION OF STRUCTURE Fair

APPROACHES: CUT ☐ FILL ☐ SIDE SLOPES Wwy. 20 in cut  
BERMS YES ☐ NO ☐ Railway on earth filled embankment.

OTHER OBSERVATIONS (USE BACK OF SHEET TO DESCRIBE ANY FAILURES IN AREA, PAST PERFORMANCE OF EXISTING APPROACHES & STRUCTURE, ETC.)

ACCESSIBILITY

IS STRUCTURE LOCATED ON D.H.O. RIGHT OF WAY? YES ☐ NO ☐ IF NO,  
HAS PERMISSION BEEN OBTAINED TO ENTER PROPERTY? YES ☐ NO ☐ IF NO,  
PROPERTY OWNER(S):

NAME	ADDRESS	TELEPHONE NO.
1 <u>Smithville Cemetery</u>		
2 <u>T.H. &amp; B. Railway</u>		
3 _____		
4 _____		

WHO WILL OBTAIN NECESSARY PERMISSION? \_\_\_\_\_

HAS SITE BEEN SURVEYED & STAKED? YES ☐ NO ☐ IF YES, DATE OF MOST RECENT SURVEY \_\_\_\_\_

WILL CLEARING BE NECESSARY TO ENTER SITE AREA? YES ☐ NO ☐

IS SITE ACCESSIBLE TO WHEELED VEHICLES? YES ☐ NO ☐

IF RIVER CROSSING:

WILL A RAFT BE NECESSARY? YES ☐ NO ☐ IF YES, GIVE MAX. DEPTH OF WATER \_\_\_\_\_ FT.  
CURRENT: SWIFT ☐ MODERATE ☐ SLOW ☐

DRILLING OPERATIONS

NEAREST SOURCE OF WATER (GIVE HAULING DISTANCE, IF KNOWN) Hydrants within 100 yds. either  
ADDITIONAL INVESTIGATION REQUIRED FOR THE FOLLOWING PURPOSES: \_\_\_\_\_ direction

ALTERNATE SCHEME: YES ☐ NO ☐ IF YES, SPECIFY \_\_\_\_\_

HYDROLOGIC REASONS: YES ☐ NO ☐ IF YES, SPECIFY (SCOUR, ETC.) \_\_\_\_\_

REMARKS

NEAREST AVAILABLE ACCOMODATION: Grimsby

OTHER COMMENTS: \_\_\_\_\_

DATE August 17, 1971.

REGIONAL BRIDGE LOCATION ENGINEER G. C. E. Burkhardt



## MEMORANDUM

30M4-33

To: Mr. G. C. E. Burkhardt, (2) FROM: Foundations Office,  
Regional Bridge Planning Engineer, Design Services Branch,  
Central Region, Central Bldg., Downsview.  
90 Floral Parkway.

ATTENTION: DATE: November 3, 1971.

OUR FILE REF.

IN REPLY TO

NOV 8 1971

SUBJECT:

FOUNDATION INVESTIGATION REPORT  
For

Proposed Subway at Hwy. #20  
And T.H.B. Railway  
Line 'C', Lot 6, Con. 9  
District #4 (Hamilton, Ont.)  
W.J. 71-11097 - W.P. 113-67-6103



*consulted per Reg. Station  
Report Jan 19/75*

Attached, we are forwarding to you our detailed foundation investigation report on the subsoil conditions existing at the above structure 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.

cc: Messrs. B. R. Davis  
A. Rutka  
D. W. Farren  
G. K. Hunter  
C. R. Robertson  
B. J. Giroux  
T. J. Kovich  
G. A. Wrong  
B. A. Singh

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

Foundations Office  
Documents

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FOUNDATION INVESTIGATION REPORT  
For

Proposed Subway at Hwy. #20  
And T.H.B. Railway  
Line 'C', Lot 6, Con. 9  
District #4 (Hamilton, Ont)  
W.J. 71-11097 - W.P. 113-67-01

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1. INTRODUCTION:

A request for a foundation investigation for a new subway structure at the crossing of Toronto-Hamilton-Buffalo Railway and Hwy. #20, was received from Mr. G. C. E. Burkhardt, Regional Bridge Planning Engineer, in a memorandum dated August 17, 1971.

A field investigation was subsequently carried out by the Foundation Section to determine the subsoil conditions existing at the site. This report contains the results of this investigation and our recommendations pertaining to the design of the proposed new structure and the temporary detour structure foundations.

2. DESCRIPTION OF THE SITE:

The site of the proposed new subway structure is situated in the Town of Smithville, at the crossing of T.H.B. Railway and Hwy. #20.

The surrounding area with the exception of the roadway cut and the railway approach embankments is flat residential area.

Physiographically, the site is located in the region referred to as the Haldimand Clay Plain.

### 3. FIELD AND LABORATORY INVESTIGATION PROCEDURES:

A total of six sampled boreholes was carried out during the course of the field work. Boring was achieved by means of a continuous flight auger machine adapted for soil sampling and rock coring purposes. During the field work, disturbed samples were obtained by means of a standard split-spoon sampler. The energy used in driving it conformed to the requirements of the standard penetration test.

The bedrock was proved at five borehole locations using AXI rock coring equipment.

The locations and elevations of the borings are shown on Drawing No. 71-11097A which accompanies this report.

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

Atterberg Limits

Moisture Content

Grain-Size Distribution

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

### 4. SOIL TYPES AND SOIL CONDITIONS:

#### 4.1) General:

Generally uniform subsoil conditions were found to prevail over the site area. The subsoil consists of a deposit of cohesive material (silty clay and clayey silt) followed by a shallow deposit of very dense glacial till, followed by dolomite bedrock). The boundaries between the different deposits are shown on the Record of Borehole sheets attached to the Appendix. The estimated stratigraphical profile of Drawing 71-11097A is based upon this information.

Boreholes No. 1-5 were put down in the roadway cut through the pavement and B.H. #6 on the original ground.

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

4. SOIL TYPES AND SOIL CONDITIONS: (cont'd) ...

4.2) Silty Clay and Clayey Silt with Trace of Sand:

This deposit was intersected in all borings and extends immediately below the topsoil (B.H. #6) or the pavement structure level. The lower boundary varies between elevation 594<sub>±</sub> and elevation 598<sub>±</sub>, but in general, it is higher at the west side of the railway.

The material in the deposit consists of silty clay in the upper portion and changes to clayey silt at lower elevations. The material also contains traces (approx. 3%) of sand.

Physical properties of the overall deposit, as determined from field and laboratory tests, are as follows:

Natural Moisture Content (%)	8 to 31
Liquid Limit (%)	19 to 52
Plastic Limit (%)	13 to 27
'N' Value (Blows/Ft.)	11 to 35

Grain-Size Distribution: Sand - 3%, Silt - 57%, Clay - 40%

The consistency of the deposit may be described as firm to hard.

4.3) Glacial Till:

The layer was found to underlie the cohesive type deposit at all borehole locations. The thickness varies from 0.5 to 4.0 ft.

The material in the deposit consists of a heterogeneous mixture of gravel (16%), sand (16%), Silt (37%), and clay (31%) with fragments of shale and dolomite. The average moisture content is in the order of 11%.

Standard penetration tests carried out within this zone indicate that the relative density is very dense, the obtained 'N' values being in excess of 100 blows per foot. In some instances, refusal to the standard penetration test was reached within this zone.

4. SOIL TYPES AND SOIL CONDITIONS: (cont'd) ...

4.4) Dolomite-Bedrock:

AXT rock drilling equipment were used to prove the bedrock at all but one (B.H. #6) borehole location. The bedrock was found to consist of dolomite type rock between elevation 592± and elevation 598±. The percentage of recovery and the visual inspection of the rock core samples indicate that extreme upper portion (0-2 ft.) is weathered and fractured to a great extent.

5. GROUNDWATER CONDITIONS:

The following groundwater levels were observed during the field work.

B.H. #1	El. 596.7
B.H. #2	El. 594.5
B.H. #3	El. 593.6
B.H. #4	El. Not Established
B.H. #5	El. Not Established
B.H. #6	El. Dry

It is pointed out that the foregoing quoted figures may not represent the true groundwater levels due to the short duration of the field work.

6. DISCUSSION AND RECOMMENDATIONS:

It is proposed to erect a new two-span (23'-23') bridge together with retaining walls to carry the T.H.B. Railway over Hwy. #20. This will also include the construction of a temporary four-span (30'-30'-30'-30') trussle bridge located some 50 ft. west of the existing structure.

At this location, Hwy. #20 runs in an approx. 8 ft. deep cut, the average original ground level is at elevation 610±, and the grade level of the existing railroad is at elevation 617±.

At this time, grade changes are not proposed.

The total length of the proposed retaining walls are in the order of 140 ft. on both sides of the roadway, compared to the existing ones, which are only 80 ft. long.

6. DISCUSSION AND RECOMMENDATIONS: (cont'd) ...

As described in the previous paragraphs, the subsoil at the site consists of firm to stiff silty clay and clayey silt with traces of sand, followed by a very dense heterogeneous mixture of gravel, sand, silt and clay with fragments of shale and dolomitic limestone, followed by dolomite type bedrock. The extreme upper portion (0 to 2 ft.) of the bedrock appears to be weathered.

In view of the foregoing, it is recommended that the proposed abutments, pier and retaining walls of the future structure be supported on footings, placed directly on the sound portion of the bedrock. The base of the footing excavation should be carefully inspected to ensure that all the weathered and fractured part of the bedrock is removed. If this procedure is followed safe loads of up to 15 t.s.f. may be used for design purposes.

Dewatering should not be a major problem since a relatively low head of water will prevail over the bases of excavations.

DETOUR STRUCTURE:

The piers of the proposed temporary detour structure should consist of pile bents driven to the bedrock. Due to the relatively shallow zone of overburden, transverse bracing of the pile bents is recommended.

The abutments may be constructed within the approach embankments and supported on piles driven to bedrock.

No stability problems are anticipated for the proposed approach embankments provided with 2:1 standard slopes.

7. MISCELLANEOUS:

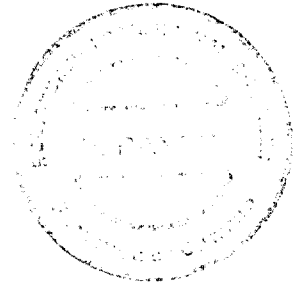
The field investigation was carried out during the period of September 27-29, 1971, under the supervision of Mr. P. Payer, Project Foundation Engineer, who also prepared this report.


7. MISCELLANEOUS:

Equipment was owned and operated by Canadian Longyear Ltd.

This report was reviewed by Mr. K. G. Selby,  
Supervising Foundation Engineer.

  
P. Payer, P. Eng.



  
K. G. Selby, P. Eng.

PP/ao  
November 3, 1971.



APPENDIX I

## FOUNDATION SECTION

ORIGINATED BY PP

COMPILED BY PP

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LIQUID LIMIT ——— W <sub>L</sub> PLASTIC LIMIT —— W <sub>P</sub> WATER CONTENT ——— W			REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.	 W <sub>p</sub> W      W <sub>L</sub>			
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE				
602.7	Parent Level										
0.4	Asphalt and sand										
1.0	Silty clay and clayey silt		1	SS	19	600					
593.8	Very stiff to hard		2	SS	35						
592.6	Glacial Till		3	SC	16 1/2"						
10.1	Weathered Dolomite		4	AXT	37%	590					
585.6	Sound		5	AXT	100%						
17.1	End of Borehole					580					

## FOUNDATION SECTION

ORIGINATED BY PP

COMPILED BY PP

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 $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ⊗ QUICK TRIAXIAL x LAB. VANE			$w_p$ ——— $w$ ——— $w_L$ WATER CONTENT % 15 30 45				
602.4	Pavement Level					600								0 3 44 53 6 12 47 35 595.1
1.0	Pavement		1	SS	17									
595.4	Silty clay, trace of sand.		2	SS	27									
593.2	Stiff to Very Stiff													
593.2	Glacial Till with limestone fragments													
9.2	Dolomite		3	AXT	88%	590								
589.7	Sound													
12.7	End of Borehole					580								

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 71-11097 LOCATION Sta. 611 + 73 26' Lt. ORIGINATED BY PP  
 W.P. 110-67-03 BORING DATE Sept. 27 & 28, 1971 COMPILED BY PP  
 DATUM Geodetic BOREHOLE TYPE Cent. Flight Auger & AXT Rock Core CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE				LIQUID LIMIT — $w_L$			BULK DENSITY $\gamma$ P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS / FOOT		BLOWS / FOOT				PLASTIC LIMIT — $w_p$					WATER CONTENT — $w$
							SHEAR STRENGTH P.S.F.				WATER CONTENT %					
602.6	Pavement Level															
598.6	Clayey silt. Firm		1	SS	19/30	600									598.6	
594.3	Glacial Till Very Dense		2	AXT	35%											
588.4	Weathered Dolomite Sound		3	AXT	85%	590										
14.2	End of Borehole					580										

DEPARTMENT OF HIGHWAYS- ONTARIO

MATERIALS &amp; TESTING OFFICE

## RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 71-11097

LOCATION Sta. 612 + 05 16' Rt.

ORIGINATED BY FP

W.P. 113-67-03

BORING DATE Sent. 27 &amp; 28, 1971

COMPILED BY PP

DATUM Geodetic

BOREHOLE TYPE Cont. Flight Auger, AXT Rock Core

CHECKED BY *SK*

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	RESISTANCE	PLASTIC LIMIT — $w_p$	WATER CONTENT — $w$		
602.7	Pavement Level											
0.0	Pavement											
508.1	Silty Clay. Stiff		1	SS	18/10"	600						
4.6	Weathered											
594.1	Dolomite Sound		2	AXT	49%							
8.6	End of Borehole					590						

MATERIALS &amp; TESTING OFFICE

## RECORD OF BOREHOLE No. 5

FOUNDATION SECTION

LOCATION Sta. 612 + 18 5' Lt.

ORIGINATED BY PP

BORING DATE Sept. 28, 1971


COMPILED BY PP

BOREHOLE TYPE Con., Flight Auger, AXT Rock Core

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 $\gamma$ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.		WATER CONTENT % $w_p$ — $w$ — $w_L$				
602.6	Payement Level												
596.1	Clayey silt Stiff		1	SS	11	600							
593.1	Glacial Till Very Dense		2	SS	10								
9.5	Weathered Dolomite		3	AXT	105								
586.1	Sound		4	AXT	100	590							
16.5	End of Borehole					580							

FOUNDATION SECTION

CHECKED BY 

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION BLOWS / FOOT	RESISTANCE	LIQUID LIMIT ——— W <sub>L</sub>	PLASTIC LIMIT ——— W <sub>P</sub>	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 <sub>P</sub> W      W <sub>L</sub>  -----  15     30    45 %				
610.8	Ground Level												
0.0	Silty clay and clayey silt.		1	SS	33	610							
	Very stiff to hard.		2	SS	28								
			3	AA	16	600							
597.4			Glacial Till	4	SS	10/8"							
13.4	End of Borehole					590							

## 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 300 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

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	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
$\tau_f$	SHEAR STRENGTH
$c'$	EFFECTIVE COHESION
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_r$	SENSITIVITY

## GENERAL

$\pi$	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e \sigma$ OR $\ln \sigma$	NATURAL LOGARITHM OF $\sigma$
$\log_{10} \sigma$ OR $\log \sigma$	LOGARITHM OF $\sigma$ 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
$\sigma$	NORMAL STRESS
$\bar{\sigma}$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

## EARTH PRESSURE

d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	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
$\beta$	ANGLE OF SLOPE TO HORIZONTAL

## DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

## MEMORANDUM

TO: Mr. G.C.E. Burkhardt, FROM: Foundations Files,  
Regional Structural Planning Eng., Design Services Branch,  
Central Region, Central Bldg., Downsview.  
90 Floral Parkway,  
ATTENTION: Downsview, Ontario. DATE: June 20, 1972  
OUR FILE REF. IN REPLY TO JUN 27 1972

SUBJECT: Hwy. #20 & T.H. & E. Railway, Line 'C',  
at Smithville, Ontario, District #4  
(Hamilton), W.O. 71-11097 N.P. 112-67-03

As requested by Mr. W.M. Killin in a memo, dated April 20, 1972, we have carried out three additional borings at the abovementioned site. The borings were located so as to intersect the abutment and pier footings of the existing structure, and were carried out to determine the nature of the foundation material immediately under the footings. B.H. #7, which was drilled at the west abutment indicated 1 foot of hard glacial till between bottom of footing and bedrock. B.H.'s 8 and 9, which were drilled at the centre pier and south abutment respectively, showed that these footings were founded directly on the bedrock.

As an alternative to constructing a new bridge at this location, it has been proposed that required heightening be achieved by lowering the grade of Hwy. #20 by 2'-6", and that required widening be achieved by removing the sidewalks and providing pedestrian access by constructing a tunnel behind each abutment. In view of the results of our recent borings, we see no problems in connection with these proposals.

Attached to this memo are copies of Record of Borehole sheets #7, 8 and 9, together with revised Drawing #71-11097A. Please attach these to your copy of Foundation Report #71-11097.

June 20, 1972

If we can be of any further assistance in this matter, please contact this Office.

*K. G. Selby*

KGS/ht  
Attach.

K.G. Selby,  
SUPERVISING FOUNDATIONS ENGINEER

c.c. Messrs. D.W. Farren  
B.R. Davis  
A. Rutke  
P.J. Harvey  
C.R. Robertson  
B.J. Giroux  
T.J. Kovich  
G.A. Wrong  
B.A. Singh

Foundations Files ✓  
Documents

CHECKED BY *S.R.*

[illegible]

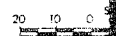
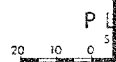
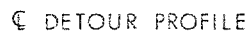
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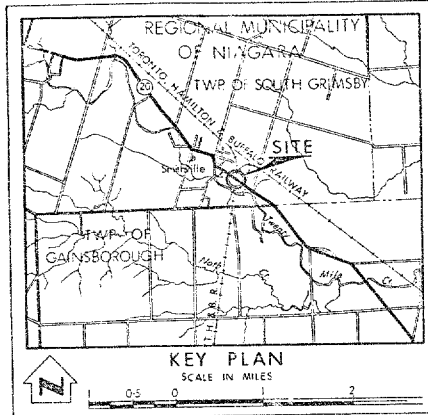
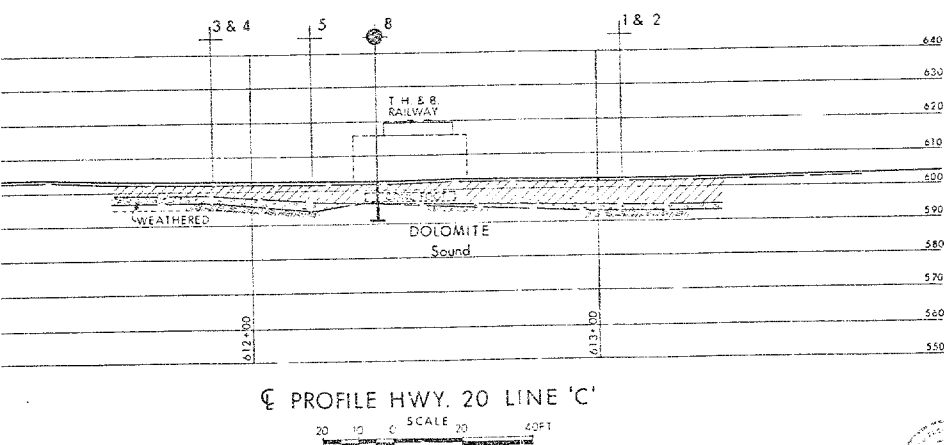
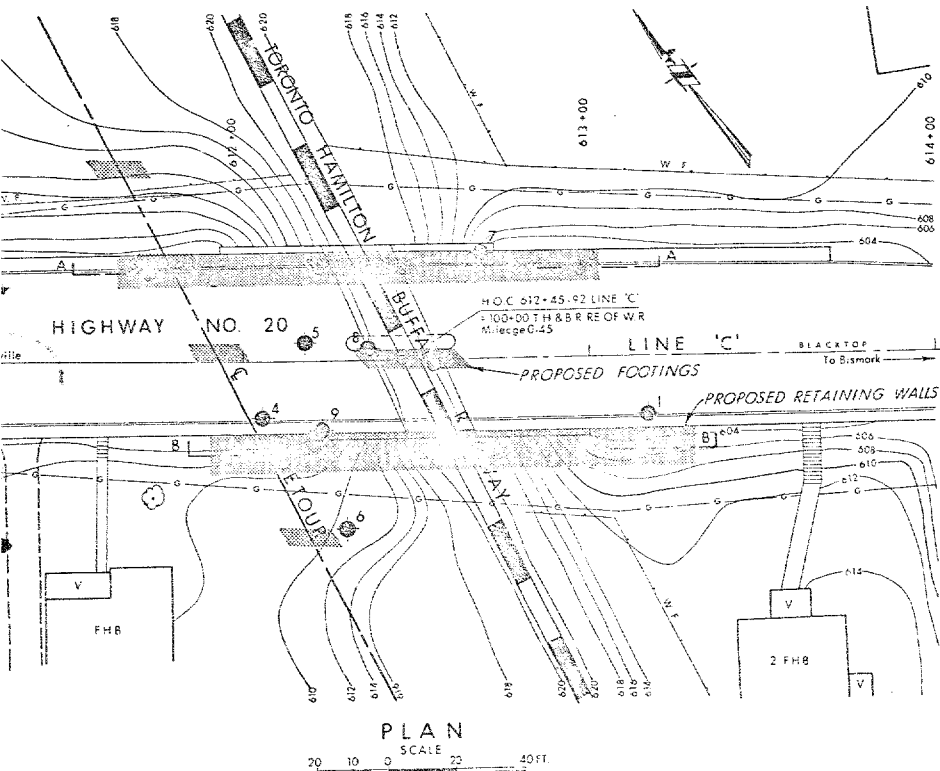
CHECKED BY S.S.

[illegible]

JOB <u>71-11097</u>	LOCATION <u>Sta. 612 + 23 20' Rt.</u>	ORIGINATED BY <u>W. TRCW</u>
W.P. <u>113-67-03</u>	BORING DATE <u>April 5, 1972</u>	COMPILED BY <u>O.E.</u>
DATUM <u>Geodetic</u>	BOREHOLE TYPE <u>Cased BX</u>	CHECKED BY <u>S.O.</u>

[illegible]





LEGEND				
	Bore Hole			
	Cone Penetration Test			
	Bore Hole & Cone Test			
	Water Levels established at time of field investigation.			
W.L. Not established in Boreholes 4, 5 & 6				
NO.	ELEVATION	STATION	OFFSET	
1	602.7	613+17	17' RT.	
2	602.4	612+98	26' LT.	
3	602.6	611+73	26' LT.	
4	602.7	612+00	16' RT.	
5	602.6	612+18	5' LT.	
6	610.8	612+29	49' RT.	
7	602.6	612+69	31' LT.	
8	602.6	612+36	4' LT.	
9	602.6	612+23	20' RT.	

— NOTE —  
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

REVISIONS	DATE	BY	DESCRIPTION
1			REMARKS: C.E. BORE HOLES 7, 8, & 9 ADDED, SECTIONS ALTERED

DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS  
DESIGN SERVICES BRANCH—FOUNDATION OFFICE

T. H. & B. RAILWAY & DETOUR

HIGHWAY NO. 20 LINE 'C' DIST. NO. 4  
CO. REGIONAL MUNICIPALITY OF NIAGARA  
TWP. SOUTH GRIMSBY LOT 6 CON. 9

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD P.P. CHECKED: W.P. NO. 113-67-03 DRAWING NO. 71-11097A  
DRAWN: M. CHECKED: J. NO. 71-11097  
DATE OCT 28 1971 SITE NO. BRIDGE DRAWING NO.  
APPROVED: [Signature] CONT NO.  
PRINCIPAL, FOUNDATION ENGINEER



Mr. K. Selby,  
Sup. Foundation Engineer.

K. W. Ingham

April 21, 1972

Foundation Investigation 72-11050;  
Bridge Footing; Highway 20 at Smithville

A brief description is given below for each of three boreholes drilled to bedrock at this site, together with the appropriate bedrock elevation.

Hole No. 28

Bedrock at 598.7

- 3.1 to 5.7 Concrete, porous in the upper 0.5 ft.  
5.7 to 6.5 Dolomite, medium brownish grey, fine grained, dense, moderately fractured.  
6.5 to 11.8 Dolomite, medium brownish grey, fine grained, dense.

Hole No. 29

Bedrock at 596.0

- 4.8 to 6.6 Concrete.  
6.6 to 12.3 Dolomite, medium brownish grey, fine grained, dense, moderately fractured in the upper 0.3 ft.

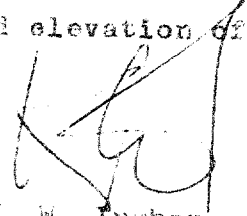
Hole No. 17

Bedrock at 595.2

- 3.1 to 6.4 Concrete.  
6.4 to 7.4 Brown stony till.  
7.4 to 10.2 Dolomite, medium brownish grey, fine grained, dense, moderately fractured throughout.

Note: Bedrock elevations based on a ground elevation of 602.6 ft.

K&I:mv

  
K. W. Ingham,  
Geologist.

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30M4-33

DIST. 4 REGION CENTRAL

W.P. No. 1B-64-03

CONT. No. N.A. PROJECT CANCELLED

W. O. No. 71-F-97

STR. SITE No. 18-61

HWY. No. 20

LOCATION: HWY. 20 & T.H. & B.

SMITHVILLE

OVERLAY DRAWINGS TO BE HARDED WITH THIS REPORT, 1

REMARKS:



## PROGRAM STATUS REPORT

W.P. 113-67-030 DIST. 4 HWY. 20 TYPE OF WORK Signature  
DESCRIPTION T. H. & B. Subway in the Village of Smithville

PRESENT PROGRAM YEAR 19EX DATE INITIATED Jan. 14/71

As the life expectancy of the existing T. H. & B. Structure, in the Village of Smithville, is a minimum of 30 years as stated in the T. H. & B. May/73 letter and since it is now proposed to construct two pedestrian underpasses on each side of the existing subway, as well as re-constructing the roadway to lower grade under the existing structure. The need for a new structure at this location no longer exists and the following project is cancelled.

W.P. No.	Group No.	Hwy.	Type of Work	Description	Est. Val.
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113-67-034	113-67-03	20	Str.	T. H. & B. Subway in the Village of Smithville	\$75,000
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JG/DBW/ws

## REMARKS

Please note the above comments and adjust your records accordingly

## PRE-CONTRACT ENGINEERING SCHEDULE

STATUS REPORT	Jan 1972	STATION, PLANT'S COMPLETE
1. FEASIBILITY STUDY REPORT		2. SITE PLAN, PLANT TO S.O.A.
3. TRAFFIC STUDY		3. S.O.A. APPROVAL REC'D.
4. PRE-DESIGN PHOTOGRAMMETRY		4. N.E.P.A. APPROVAL REC'D.
5. GRADIENT STUDY REPORT		5. BOLL DESIGN REPORT
6. DESIGN STUDY REPORT		6. "W" PLANS ISSUED
7. TITLE SEARCH REQUEST		7. CO-ORDINATED ALIGNMENT
8. PRE-DESIGN REQUEST		8. LINDSEY SITE SHOWING
9. PHASE ALIGNMENT REQUEST		9. INTERSECTION DESIGN COMP.
10. PRELIMINARY DESIGN REQUEST		10. PHASE PROGRESS REQUEST
11. DESIGN A-BUTTON ISSUED		11. N.T.C. APPL. REC'D.
12. PLANS A-BUTTON TO S.O.A.		12. S.O.A. APPROVAL REC'D.
13. PLANS A-BUTTON REQUEST		13. ACTUAL DESIGN REPORT
14. B & B PLANS ISSUED		14. LUMINATION DESIGN COMP.
15. PRELIMINARY DESIGN REQUEST		15. FUTURE DESIGN REQUEST
16. FORMALIZATION REPORT REC'D.		16. PERCENT COMPLETE S.O.A.
17. FORMALIZATION REQUEST		17. STREET DESIGN REQUEST
18. STATION, PLANS REQUEST		18. PERCENT COMP. STA. DESIGN
19. PRELIM. STRUCTURE PLANS		19. JOGGWATER IN COURTYARD
20. STRUCTURE DESIGN REQUEST		20. PROPERTY CLEARANCE

\_\_\_\_\_  
 PROJECT MANAGER/ENGINEER  
 DATE Jan 14/75  
 \_\_\_\_\_  
 PROJECT SUPERVISOR  
 DATE Jan 15/75  
 \_\_\_\_\_  
 REGIONAL DIRECTOR  
 DATE Feb 4/75

3874-23  
 PROCESS NO.