

Ontario
Department of Transportation and Communications
~~XXXXXXXXXXXXXXXXXXXX~~

30M4-31
GEOCRE

MEMORANDUM

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 10 1971

SUBJECT:

30M4-31
GEOCRE No.

FOUNDATION INVESTIGATION REPORT

For

For the Proposed Bridge of Hwy. #75 Over
The Welland River, District #4 (Hamilton)
W.O. 71-11102 -- W.P. 454-64-02 — Cancelled

Str - Cite # 18-218

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. Faren
G. K. Hunter
C. R. Robertson
B. J. Giroux
T. J. Kovich
G. A. Wong
B. A. Singh

A. G. Sternac
A. G. Sternac,
PRINCIPAL FOUNDATION ENGINEER.

Foundations Office
Documents

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FOUNDATION INVESTIGATION REPORT

For

For the Proposed Bridge of Hwy. #75 Over
The Welland River, District #4 (Hamilton
W.O. 71-11102 -- W.P. 454-64-02

1. INTRODUCTION:

In a memo dated August 9, 1971, Mr. G. C. E. Burkhardt, Regional Bridge Planning Engineer, Central Region, requested a foundation investigation at the site of the proposed bridge of new Hwy. #75 over the Welland River. The subsequent field and laboratory investigations were undertaken by this Office, the results of which are compiled in this report, together with recommendations pertaining to structure foundations and approach fill stability.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The bridge site is situated some 250-300 ft. south of the existing Welland River Bridge of Regional Rd. #14. At the proposed crossing the river is about 70 ft. wide and 18 inches deep, following a meandering course. The water was almost stagnant during the time of the field work. The overall stability of the existing river banks seems acceptable; some earlier surface erosions and local lunar shape failures are, however, apparent mainly along the west bank. The vicinity of the bridge site is occupied by farmlands and it is flat to moderately undulating terrain.

The area in question belongs to the physiographic region known as the Haldimand Clay Plain. The depth of overburden in this region generally increases southward. Here the heavy tills were deposited as moraines and ground moraines, and as such they form shallow ridges of subdued relief.

3. FIELD AND LABORATORY INVESTIGATIONS:

A total of four sampled borsholes and adjacent to Boreholes #1 and 4, two dynamic cone penetration tests were carried out during the field work. A continuous flight auger, mounted on a Bombardier was used to advance the borings, taking split spoon samples at frequent intervals. Standard penetration tests were performed at each sample, according to conventional methods. Standard penetration "N" values (blows per ft.) are recorded on the attached borelogs, together with the results of laboratory tests. Identification and description of soil samples were done in the field and again in the laboratory. Representative samples were tested in order to determine Atterberg limits, grain size distributions and natural moisture contents of the soils. On Drawing #71-11102A at the end of this report the locations of the boreholes are marked. The soil profile presented on the drawing is based on the borelog sheets.

4. SUBSOIL CONDITIONS:

Beneath a 5-9 ft. deep desiccated silty clay stratum, a layer of sandy silts with clay and gravel was encountered. At the pier locations, near the edge of the river the silty clay zone was, however, almost entirely eroded. The surficial silty clay layer has very stiff to hard consistency and intermediate plasticity. The average plastic limit is around 22% and the liquid limit around 42%. The obvious overconsolidation of this material has been caused by desiccation.

The underlying sandy silts were found to extend to the end of the boreholes, some 25-28 ft. below ground levels. Samples taken within this layer contained some 4-13% of gravel and 7-24% of clay particles, indicating the glacial origin of the deposit. Penetration "N" values were found to be in excess of 50 blows per ft. - the majority, in fact, being over 100 blows per ft. The material has low to very low plasticity, with plastic limits averaging approx. 12% and liquid limits approx. 18%.

4. SUBSOIL CONDITIONS: (cont'd) ...

In Borehole #3, placed right at the river's edge, at elevation 551.2' a gravelly layer was found. Strong artesian water pressure was observed within this layer, the estimated head of water being several feet above ground surface. No ground water was noticed above elevation 551.2', and the rest of the boreholes remained dry and open during the entire field investigation.

5. DISCUSSION AND RECOMMENDATIONS:

5.1) General:

In conjunction with the new Hwy. #75 line 'A', the construction of a three span bridge is proposed over the Welland River. The length of the bridge will be 168 ft., the width being 38 ft. The grades of the highway at the crossing will vary between elevation 600 ft. and 604 ft., necessitating approach fills in the order of 20-25 ft. height. It is assumed that spill through type abutments will be built.

Subsoils at the site were found to consist of silty clays and sandy silt glacial tills with hard consistency, within a depth of 25-28 ft.

5.2) Foundations:

The silty clay and hard glacial tills are considered to be very competent load bearing strata. Consequently, it is suggested that the bridge be supported on spread footings. Four foot cover should be provided above the underside of the footings for frost protection. Pier footings should also be below the depth of scour. No loose surficial soils were found in the holes placed at the pier locations, indicating very little or no scour, nevertheless, the Hydrology Section should be consulted concerning the depth of scour. Design loads up to 5 t.s.f. may be employed on spread footings constructed according to above requirements. Lean concrete working slabs should be poured on the footing excavations, immediately upon completion, in order to prevent softening of the bases of the excavations.

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

5.2) Foundations:

If it is desired to place the abutment footings within the approach fills, they may be supported on short piles, driven through the fills. Steel H or tubular piles may be used, piles being driven to approx. 70 ton per pile capacity as determined by the Hiley Formula (D.T.C. standards DD-1213-DD-1219). It is surmised that above loads might be reached around elevation 580-583 ft. below the west abutment and around elevation 570-575 ft. beneath the east. If for hydrology or other reasons the piles have to be driven deeper than the given elevation, it might be necessary to pre-auger the holes, on account of the very hard consistency of the glacial tills. No bouldery material should be used for the embankments in the locations of the piles.

No stability problems are foreseen for the approach fills, provided they are built with two horizontal to one vertical slopes.

Erosion control should be provided by rip-rap or by similar means, covering the forward slopes up to above the high water level.

6. MISCELLANEOUS:

The field work carried out during October 4-6, 1971, was supervised by Mr. P. Korgemagi, Project Foundation Engineer.

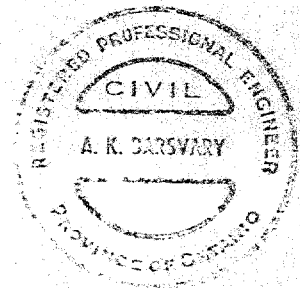
Equipment used was owned and operated by P.V.K. Drilling Company, Burford, Ontario.

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

A. K. Barsvary
A. K. Barsvary, P. Eng.

K. G. Selby
K. G. Selby, P. Eng.

AKB/ao
November 1, 1971.



APPENDIX I

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

FOUNDATION SECTION

JOB 71-11102

LOCATION Sta. 148 + 11 19' Rt.

ORIGINATED BY W

W.P. 154-01-02

BORING DATE Oct. 6, 1971

COMPILED BY J

DATUM Geodetic

BOREHOLE TYPE Auger

CHECKED BY SK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE			LIQUID LIMIT — w_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT.	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT	RESISTANCE	RESISTANCE	PLASTIC LIMIT — w_p	WATER CONTENT — w	WATER CONTENT %		
581.0	Ground Level						20 40 60 80 100							
0.0	Silty clay, desiccated					580	SHEAR STRENGTH P.S.F.			w_p — w — w_L WATER CONTENT % 20 40 60				
576.0	Hard		1	SS	30		○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE							
5.0	Sandy silt with clay and gravel (Glacial Till) Hard Very Dense		2	SS	100	3"								4 33 47 1
			3	SS	100	2"								
			4	SS	100	5"								
			5	SS	110	7"								
			6	SS	100	8"								
			7	SS	100	9"								
556.6						560								
25.2	End of Borehole													

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 71-11102

LOCATION Sta. 116 + 83

ORIGINATED BY IT

W.P. 151-61-02

BORING DATE Oct. 5, 1971

COMPILED BY ITDATUM GeodeticBOREHOLE TYPE AugerCHECKED BY IT

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		SHEAR STRENGTH P.S.F.		WATER CONTENT % 20 40 60				
573.2	Water Level												
	Sandy silt with clay and gravel (Glacial Till) Hard		1	SS	50	570							
			2	SS	100	9"							
			3	SS	100	10"							
			4	SS	100	7"	560						
			5	SS	100	5"							
551.2			6	SS	100	7"							
22.0	End of Borehole					550							

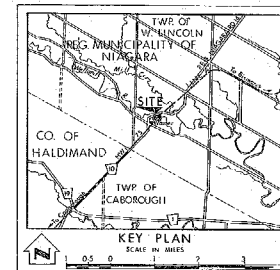
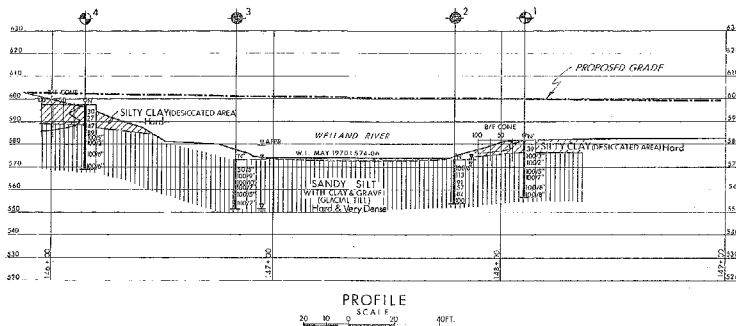
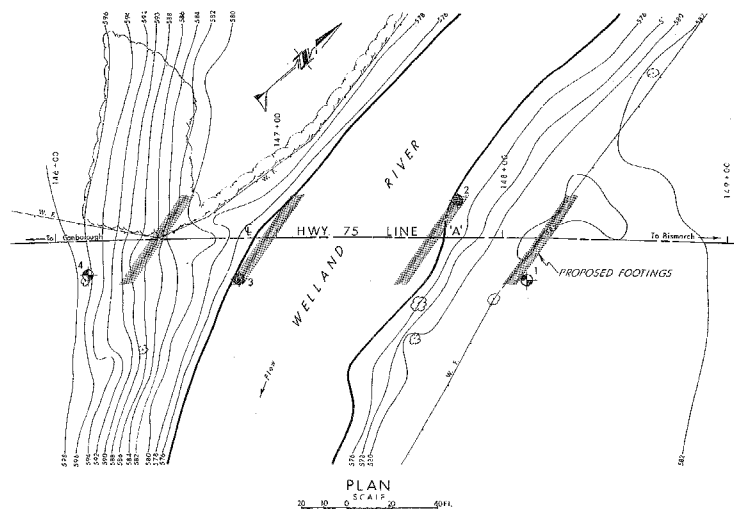
W.P. 454-64-2

HWY. 75 OVER

THE WELLAND

RIVER

30M 4-31



LEGEND				
	Bore Hole			
	Cone Penetration Test			
	Bore Hole & Cone Test			
	Water Levels established at time of field investigation, OCT. 1, 1971			
	Head of Water			
	Encountered			
NO.	ELEVATION	STATION	OFF-SET	
1	581.5	145+11	19'RT	
2	573.4	147+40	17'LT	
3	573.2	146+40	18'RT	
4	597.9	145+14	15'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.

DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS	
DESIGN SERVICES BRANCH — FOUNDATION OFFICE	
WELLAND RIVER	
Highway No. 75 Line 'A'	Dist. No. 4
Co. — REGIONAL MUNICIPALITY OF NIAGARA	
Twp. W. LINCOLN	Lot 9
Con. 18.2	
BORE HOLE LOCATIONS & SOIL STRATA	
Drawn P. H. [initials]	Checked [initials]
Drawn [initials]	Checked [initials]
Date OCT. 31 1971	Site No.
Project No. 71-11102	Bridge Drawing No.
71-11102A	



SEE NO. E-4990-1