

Ontario
Department of Transportation and Communications
~~DEPARTMENT OF HIGHWAYS~~

MEMORANDUM

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

ATTENTION:

DATE: November 8, 1971.

OUR FILE REF.

IN REPLY TO

NOV 17 1971

SUBJECT:

Geocres No
30M4-32

FOUNDATION INVESTIGATION REPORT
For

The Proposed Bridge of New Hwy. #75
Over Mill Creek

District #4 (Hamilton)

A.O. 71-11103 -- W.P. 454-64-03 - *Cancelled*

On Site # 18-219

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/so
Attach.

cc: Messrs. B. R. Davis

A. Rutke
D. W. Farren
G. K. Euster
C. R. Robertson
B. J. Giroux
T. J. Kovich
G. A. Wrong
B. A. Singh

A. G. Starnes
A. G. Starnes,
PRINCIPAL FOUNDATION ENGINEER.

Foundations Office
Documents

TABLE OF CONTENTS

1. INTRODUCTION.
 2. DESCRIPTION OF THE SITE AND GEOLOGY.
 3. FIELD AND LABORATORY INVESTIGATIONS.
 4. SOIL CONDITIONS.
 - 4.1) Overburden.
 - 4.2) Bedrock.
 - 4.3) Groundwater.
 5. DISCUSSION AND RECOMMENDATIONS.
 - 5.1) General.
 - 5.2) Foundations.
 6. MISCELLANEOUS.
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FOUNDATION INVESTIGATION REPORT
For
The Proposed Bridge of New Hwy. #75
Over Mill Creek
District #4 (Hamilton)
W.O. 71-11103 -- W.P. 454-64-03

1. INTRODUCTION:

The Foundation Office was requested by Mr. G. C. E. Burkhardt, Regional Bridge Planning Engineer, Central Region, to carry out a foundation investigation at the site of the proposed bridge of new Hwy. #75 over Mill Creek. The memo containing the request was dated August 9, 1971.

The field and laboratory investigations, implemented accordingly, have now been completed; the results of which are summarized in this report together with recommendations pertaining to structure foundations and approach fill stability.

2. DESCRIPTION OF THE SITE AND GEOLOGY:

The proposed crossing is situated at approx. 1000 ft. north-west of the existing bridge of Regional Rd. #14 over Mill Creek. At the time of the field investigation the creek bed was almost entirely dry, overgrown with grass and brush. In some meanders shallow stagnant pools of water were present. The 2-3 ft. high river banks are rather irregular, showing surface sloughings and erosions. The general area is flat to moderately rolling, the field being cultivated farmlands.

Geologically, the area 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:

Some three sampled boreholes and three dynamic cone penetration tests were carried out during the field work, test holes being placed at the locations of the proposed footings. Standard penetration tests were performed with every split spoon sample. Penetration "N" values (blows per ft.) as well as the results of laboratory tests are marked on the Records of boreholes appended to this report.

All the soil samples were subjected to visual examinations and classifications after recovery and again in the laboratory. Laboratory tests of moisture contents, atterberg limits and grain size analyses were carried out on representative soil specimens in order to determine physical properties of the material.

On Drawing #71-11103A in the Appendix, the locations and elevations of the boreholes are plotted, with the estimated stratigraphical profile projected to the centre line of proposed Hwy. #75.

4. SOIL CONDITIONS:

4.1) Overburden:

Subsoils at the investigated site were found to be glacial deposits, consisting of silty clays, clayey silts and silts with some sand and gravel throughout the overburden. In B.H. #1 at the location of the east abutment, the deposits were identified to be silty clays with intermediate plasticity. The average plastic limit moisture content is estimated to be 21% and liquid limit 40%. Standard Penetration "N" values generally range from 24 to 33 blows per ft. so that the overall consistency of the overburden is very stiff.

In the rest of the borings subsoils were classified to be silts to clayey silts having slight to very slight plasticity. Plastic limits obtained in these layers yielded values of 13-22% and liquid limits of 18-31%. The natural moisture contents average some 10-12%, well below the plastic limits.

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

4.1) Overburden: (cont'd) ...

Particle size distributions within the samples tested indicated some 19-23% gravel, 19-58% sand, 39-42% silt, and 13-16% clay size grains. The silts and clayey silts were noted to have generally very dense relative densities and hard consistencies. The total depth of overburden is estimated to be around 44 ft. at the locations of the future abutments and some 36-37 ft. at the piers.

4.2) Bedrock:

At approx. elevation 540.0-541.0 ft. bedrock was encountered in B.H.'s #2 & 4. The rock was proved by diamond drilling, using AXT size core barrel in B.H. #4. Within the upper 2 ft. or so the rock was found to be weathered and severely fractured, beneath which fairly sound rock was established. The rock cores were identified to be dolomitic limestones. Diamond drilling resulted in some 40% recovery within the weathered and 85% within the underlying sound zone.

4.3) Groundwater:

Groundwater was observed only in B.H. #2, placed adjacent to the creek bed, while the rest of the borings remained dry during the time of field work. In B.H. #2, the equilibrium water level was observed to be at elevation 549 ft., well below the bottom of the creek bed.

5. DISCUSSION AND RECOMMENDATIONS:

5.1) General:

Proposed Hwy. #75 will cross Mill Creek with a three-span bridge. The total length of the structure is designed to be 100 ft., the width being 38 ft. The abutments are suggested to be spill through type, with approach fills of 25-26 ft. height.

Subsoils at the site were found to be silty clays, clayey silts and silts with sand and gravel having very stiff to hard consistency and very dense relative density. Bedrock underlies the subsoils at elevation 540.0 - 541.0 ft.

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

5.2) Foundations:

The glacial till deposits are regarded to have sufficient strength to support the structure on spread footings in shallow depths. Footings should be placed below the depth of scour; provision, of course, should be made for a minimum cover of 4 feet for frost protection. The depth of scour should be determined by the Hydrology Section. Design loads of 3 t.s.f. may be used on such spread footings. Immediately upon completion of the footing excavations lean concrete working slabs should be poured on the base of the excavations to prevent softening of the ground.

Perched abutments may also be supported on piles driven through the approach fills. Steel H piles appear to be the most economical, piles being driven to approx. 70 ton per pile capacity, as determined by the Hiley Formula (D.T.C. Standard #DD-1218 & DD-1219). It is estimated that above loads may be reached around elevation 545-550 ft. within the hard glacial till. By driving the piles to refusal on bedrock at elevation 540-541 ft. the applied design loads may be increased up to the full structural strength of the pile section used. In order to expediate pile driving, the fill should be devoid of bouldery material at the locations of the abutments.

No stability problems are anticipated for the approach fills, provided they are built with standard 2 horizontal to 1 vertical slopes. Forward slopes should be protected by rip-rap against erosion. The extent of such cover should be decided by the Hydrology Section.

6. MISCELLANEOUS:

The field work was carried out during October 12-14, 1971, and it was supervised by Mr. P. Korgemag!

6. MISCELLANEOUS: (cont'd) ...

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 Foundation Engineer, and reviled by Mr. K. G. Selby, Supervising Foundation Engineer.

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



AKB/so
November 5, 1971.

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

APPENDIX I

FOUNDATION SECTION

CHECKED BY

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | LIQUID LIMIT ——— w_L | PLASTIC LIMIT ——— w_p | WATER CONTENT ——— w | BULK DENSITY γ | REMARKS |
|--------------|---|-------------|---------|------|--------------|-------------|---|-------------------------|-------------------------|-----------------------|--------------------------|----------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | 20 40 60 80 100 | SHEAR STRENGTH P.S.F. | | | | |
| | | | | | | | ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE | w_p ——— w ——— w_L | | | | |
| 580.3 | Ground Level | | | | | | | | | | | |
| 0.0 | Silty clay with some sand and gravel. Very stiff to hard. Brown | | 1 | SS | 24 | 570 | | | | | | hole Dry |
| | | | 2 | SS | 33 | | | | | | | |
| | | | 3 | SS | 24 | | | | | | | |
| | | | 4 | SS | 25 | 560 | | | | | | |
| | | | 5 | SS | 29 | | | | | | | |
| | | | 6 | SS | 41 | | | | | | | |
| 555.2 | | | | 7 | SS | 100 | | 2" | | | | |
| 25.1 | End of Borehole | | | | | 550 | | | | | | |

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 71A-11103 LOCATION Sta. 172 + 27 17' Rt. ORIGINATED BY PK
 W.P. 450-61-03 BORING DATE Oct. 12, 1971, Oct. 13, 1971 COMPILED BY JK
 DATUM Geodetic BOREHOLE TYPE Auger CHECKED BY JK

| SOIL PROFILE | | STRAT. PLOT | 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 | | NUMBER | TYPE | BLOWS / FOOT | | SHEAR STRENGTH P.S.F. | | | | WATER CONTENT % | | | | |
| | | | | | | | | \circ UNCONFINED \bullet QUICK TRIAXIAL | + FIELD VANE x LAB. VANE | | | w_p | w | | |
| 577.2 | Ground Level | | | | | | | | | | | | | | |
| 0.0 | | | | | | | | | | | | | | | |
| | Silt to clayey silt | | 1 | SS | 33 | | | | | | | | | | |
| | with some sand and | | 2 | SS | 45 | 570 | | | | | | | | | |
| | gravel. | | 3 | SS | 107 1/4" | | | | | | | | | | |
| | | | 4 | SS | 110 | | | | | | | | | | |
| | | | 5 | SS | 113 | 560 | | | | | | | | | |
| | Very Dense to Hard | | 6 | SS | 118 | | | | | | | | | | |
| | Brown | | 7 | SS | 101 1/2" | 550 | | | | | | | | | |
| | | | 8 | SS | 100 3/4" | | | | | | | | | | |
| 540.6 | Probable Bedrock | | 9 | SS | 100 1/2" | | | | | | | | | | |
| 36.6 | End of Borehole | | 10 | SS | 100 1/4" | 540 | | | | | | | | | |

23 19 42 16

29 58 (13)

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 71-11103

LOCATION Sta. 171 + 86 17' Lt.

ORIGINATED BY FK


W.P. 451-61-03

BORING DATE Oct. 14, 1971

COMPILED BY BK

DATUM Geodetic

BOREHOLE TYPE Auger

CHECKED BY 

| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT ——— w_L | | BULK DENSITY γ | REMARKS |
|--------------|------------------|-------------|---------|------|--------------|-------------|--------------------------------|------------|-------------------------|-----------------------|--------------------------|-----------------|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS / FOOT | | BLOWS / FOOT | RESISTANCE | PLASTIC LIMIT ——— w_p | WATER CONTENT ——— w | | |
| 580.2 | Ground Level | | | | | 580 | | | | | P.C.F. | GR. SA. SI. CL. |
| 567.0 | | | | | | 570 | | | | | | |
| 13.2 | End of Cone Test | | | | | 560 | | | | | | |

DEPARTMENT OF HIGHWAYS- ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 73-11103

LOCATION Sta. 171 + 5L 17' Rt.

ORIGINATED BY IK

W.P. 45L-64-03

BORING DATE October 11, 1971

COMPILED BY IK

DATUM Geodetic

BOREHOLE TYPE Auger

CHECKED BY *[Signature]*

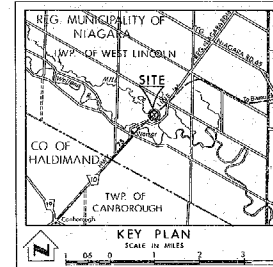
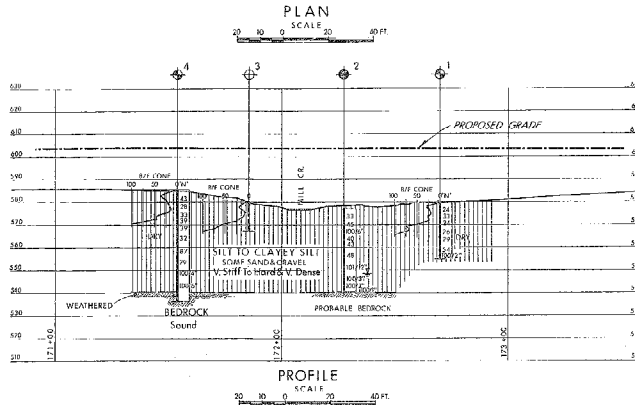
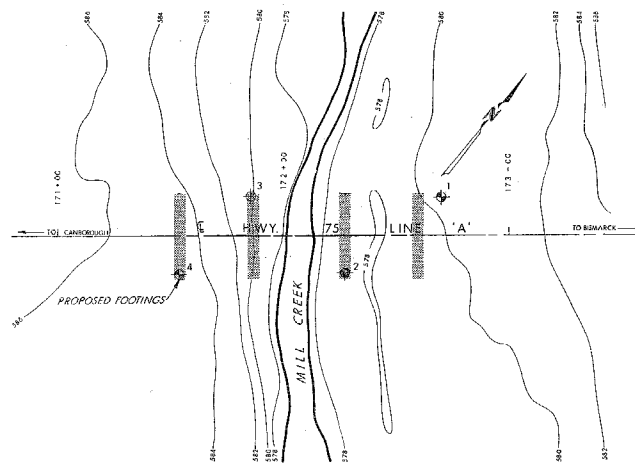
| SOIL PROFILE | | | SAMPLES | | | ELEV. SCALE | DYNAMIC PENETRATION RESISTANCE | | LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w | | BULK DENSITY γ P.C.F. | REMARKS |
|--------------|---|-------------|---------|------|------------|-------------|---|--|--|--|------------------------------------|---|
| ELEV. DEPTH | DESCRIPTION | STRAT. PLOT | NUMBER | TYPE | BLOWS/FOOT | | SHEAR STRENGTH P.S.F. | | WATER CONTENT % | | | |
| 585.0 | Ground Level | | | | | | ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE | | w_p — w — w_L | | | |
| 0.0 | Silt to clayey silt with some sand and gravel. Very Stiff to Hard and very dense Brown | | 1 | SS | 13 | 580 | | | | | | Hole Dry 19 26 39 16 |
| | | | 2 | SS | 21 | | | | | | | |
| | | | 3 | SS | 23 | | | | | | | |
| | | | 4 | SS | 32 | | | | | | | |
| | | | 5 | SS | 34 | 570 | | | | | | |
| | | | 6 | SS | 32 | | | | | | | |
| | | | 7 | SS | 87 | 560 | | | | | | |
| | | | 8 | SS | 79 | | | | | | | |
| | | | 9 | SS | 102 | 550 | | | | | | |
| | | | 10 | SS | 102 | 540 | | | | | | |
| 540.7 | weathered Sound Bedrock | | 11 | RC | | 540 | | | | | | |
| 44.3 | | | 12 | RC | | | | | | | | |
| 48.7 | End of Borehole | | | | | | | | | | | |

W.P. 454-64-3

HWY. 75 OVER

MILL CREEK

30M4-32



| LEGEND | | | |
|--------|---|---------|--------|
| | Bore Hole | | |
| | Cone Penetration Test | | |
| | Bore Hole & Cone Test | | |
| | Water Levels established at time of field investigation OCT, 1971 | | |
| NO. | ELEVATION | STATION | OFFSET |
| 1 | 580.3 | 172+70 | 12' LL |
| 2 | 577.2 | 172+27 | 12' RL |
| 3 | 580.2 | 171+56 | 12' LL |
| 4 | 585.0 | 171+54 | 12' RL |

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

| ELEVATION | DATE | BY | DESCRIPTION |
|-----------|------|----|-------------|
| | | | |

DEPARTMENT OF TRANSPORTATION & COMMUNICATIONS
DESIGN SERVICES BRANCH — FOUNDATION OFFICE

MILL CREEK

HIGHWAY NO. 75, LINE 'A' DIST. NO. 4
REG. MUNICIPALITY OF NIAGARA
TWP. W. LINCOLN LOT 8 CON. 2

BORE HOLE LOCATIONS & SOIL STRATA

SURV. S. K. [checked] WP. NO. 251-AM-03 DRAWING NO. 71-11103A
DESIGN. E. D. [checked] JOB NO. 71-11103
DATE NOV. 5, 1971 SHEET NO. BRIDGE DRAWING NO.
APPROVED [signature] CONT. NO.

SEE NO. E-4991-1

| PILOT RECORD | NO. | FOR | DATE |
|--------------|-----|-----|------|
| | | | |
| | | | |
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