

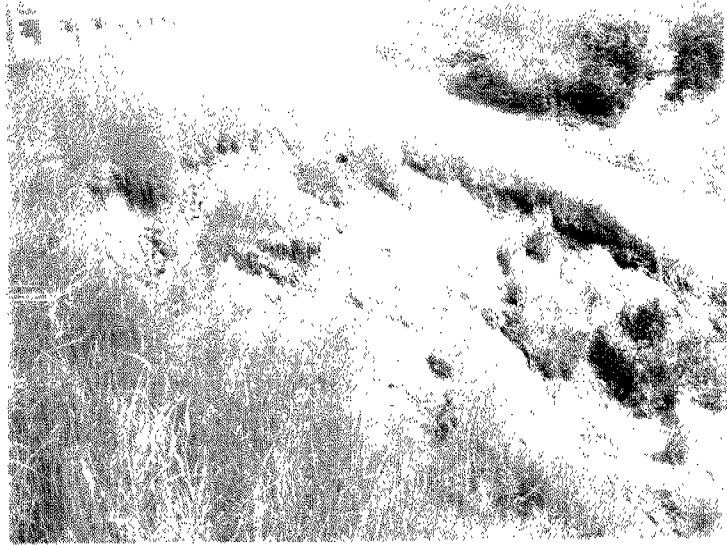
GEOCRES No. 30M5-97DIST. 4 REGION W.P. No. CONT. No. W. O. No. 74-11026STR. SITE No. HWY. No. 403LOCATION SLOPE FAILURE ATEAST SLOPE OF HWY 403 EBL~~NEAR HWY 6 JUNCTION~~ NEAR HWY 6 JUNCTION=====OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:



3652 (Aug 40346)

3673 (to site in Aug 99)

F 3 2 K 2 8 1



MINISTRY OF TRANSPORTATION AND COMMUNICATIONS, ONTARIO

MEMORANDUM

TO: Mr. C.R. Robertson, (2)
District Engineer,
District #4, Hamilton.

FROM: Soil Mechanics Section,
Geotechnical Office,
West Bldg., Downsview.

ATTENTION: Mr. J.L. Tansley.

DATE: July 24th, 1974.

OUR FILE REF.

IN REPLY TO

SUBJECT: RE: Slope Failure at East Slope
of Highway 403 E.B.L. near
Highway 6 Junction,
(Sta. 3+30 to 4+25).
W.O. 74-11026, W.P. Nil.

In response to a request from Mr. J.L. Tansley (memo dated May 22nd, 1974), who is Assistant Highway Maintenance Supervisor, District #4, Hamilton, a site inspection and subsequently a field investigation was carried out by the Soil Mechanics Section at the above-mentioned location.

The purpose of this investigation is to determine the causes of embankment failure and recommend remedial measures.

The failure occurred in the embankment on the east side of the Highway 403 E.B.L. (Station 3+30 to 4+25) near the junction of 403 and Hwy. 6. At this location Hwy. 403 has been constructed (1961) on a side hill using cut (W.B.L.) and fill (E.B.L.) operations. The side slope of the E.B.L. embankment at the present time is estimated to be approximately 1-3/4:1. The Highway 403 grade elevation at this site is about 75 ft. above the adjoining "Pond" waters.

The failure of the embankment at the abovementioned location resulted in the removal of sod and fill material. Based on visual observations, however, the failure is of a shallow type, which was probably caused by seepage forces through the slope.

An investigation consisting of five sampled boreholes was carried out at the site by means of a C.M.E. 55 auger machine, in order to determine the subsoil and groundwater conditions. The boring locations are shown on Drawing No. 74-11026A appended to this memo. The borings revealed that the overburden consists of 2.5 feet (B.H.#5) to 10.5 feet (B.H.#2) of fill material, which is a clayey silt, some sand and traces of gravel and organics. The fill material is underlain by shale bedrock. The upper 9.8 feet (B.H.#1) to 14.6 feet (B.H.#2) of the shale bedrock has been

July 24th, 1974.

Mr. C.R. Robertson - RE: W.O. 74-11026.

badly weathered. During the field investigation, a front end loader was used to excavate test pits in the affected area. Several wet zones were exposed and their locations are shown on Drawing No. 74-11026A. At about Sta. 3+75, some 20 feet below the shoulder, a source of continuous seepage water was observed.

From the above observations it is concluded that the instability of the embankment was caused by the following reasons:

1. Action of seepage forces through the slope.
2. Side slope steeper than 2:1.
3. The fill material was not properly keyed to the hillside slope.

It should be noted that this type of failure is of recurring nature. It will happen during the spring thaw period or the period of heavy precipitation. At this time water will infiltrate into the fill material and soften the soil at the interface between the fill and the natural soil (or bedrock). The fill material would then slide along this softened zone which would have been the path of least resistance.

It is recommended that the following remedial measures be carried out to control seepage and to stabilize the embankment:

1. To remove all the failed and/or loosened material in the affected area,
2. The new fill material should be properly compacted in 6-inch layers at about optimum moisture content, and keyed to the existing slope in accordance with current M.T.C. standards. The side slope should not be steeper than 2 horizontal to 1 vertical.

July 24th, 1974.

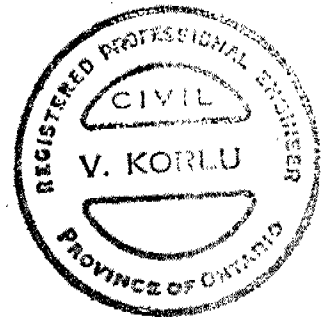
Mr. C.R. Robertson - RE: W.O. 74-11026.

3. Counterpart drains having a minimum base width of 2 feet and 4 feet deep should be constructed, extending transversely from the shoulder to the toe of the slope. The spacing of these drains should be 35 feet. The material to be used for the construction of counterpart drains should consist of a free draining granular material, such as Granular 'A'. In addition, an adequate drainage system should be provided at the toe of the slope to collect the water from the counterpart drains.

We believe that the above information is sufficient for your requirements. Should you have any further queries with regard to this project, please contact our Office.



V. Korlu
Project Engineer
For:
M. Devata
Supervising Engineer



VK/mj
c.c. D.A. Waller,
G.A. Wrong,
D. Gunther.

Documents
Files ✓

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1

JOB 74-11026

LOCATION Station 3+50 (Hwy. 403 EBL); 36' Rt.

ORIGINATED BY VK

W.P. --

BORING DATE June 19, 1974

COMPILED BY VK

DATUM Assumed

BOREHOLE TYPE Auger and sample with C.M.E. machine

CHECKED BY So

SOIL PROFILE			SAMPLES		ft/m ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m) 20 40 60 80 100	LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W W_P W W_L WATER CONTENT % 10 20 30	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE					
93.8	Ground Level								
0.0	Fill Material - clayey silt		1	SS	21	90			8 21 57 14
88.3	Reddish brown		2	SS	130/10"		120/6"		
5.5			3	SS	100/2"				
			4	SS	100/2"				
			5	SS	100/5"	80			
78.5	weathered		6	SS	100/3"				
15.3	sound		7	BXL	100% Rec.				
	Shale bedrock								
68.8					70				
25.0	End of Borehole								
					60				

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2

JOB 74-11026

LOCATION Station 3+73 (Hwy. 403 EBL); 33' Rt.

ORIGINATED BY VK

W.P. --

BORING DATE June 12, 1974

COMPILED BY VK

DATUM Assumed

BOREHOLE TYPE Auger and sample with C.M.E.- 55

CHECKED BY B

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m)		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 (0.3 m)		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT % 10 20 30				
94.7	Ground Level												
0.0	Fill Material clayey silt with some sand and trace of gravel Reddish brown		1	SS	46	90							
			2	SS	12								
84.2			3	SS	19								
10.5			4	SS	140	8"							
			5	SS	100	3"							
			6	SS	100	3"							
			7	SS	100	3"							
			8	SS	100	2"							
69.6	weathered		9	SS	100	3"							
25.1	sound Shale bedrock		10	SS	100	2"							
			11	BXL	100% Rec.								
			12	BXL	90% Rec.								
59.7						60							
35.0	End of Borehole												
						50							

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 3

JOB 74-11026 LOCATION Station 4+05 (Hwy. 403 EBL); 34' Rt. ORIGINATED BY _____
 W.P. -- BORING DATE June 14, 1974 COMPILED BY _____
 DATUM Assumed BOREHOLE TYPE Auger and sample with G.M.E.- 55 CHECKED BY 8

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m)		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 (0.3 m)		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE		WATER CONTENT % W_P W W_L				
94.0	Ground Level												
0.0	Fill Material clayey silt, some sand and traces of gravel		1	SS	14	90							0 44 45 11
85.0	Reddish brown		2	SS	17								
9.0			3	SS	175								
			4	SS	100/6"								
			5	SS	100/4"80								
			6	SS	100/6"								
			7	SS	100/1"								
74.0 20.0	weathered sound Shale bedrock		8	BXL	100% Rec.	70							
64.0													
30.0	End of Borehole					60							

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 4

JOB 74-11026

LOCATION Station 4+34 (Hwy. 403 EBL); 34' Rt.

ORIGINATED BY VK

W.P. --

BORING DATE June 17, 1974

COMPILED BY VK

DATUM Assumed

BOREHOLE TYPE Auger and sample with C.M.E. - 55

CHECKED BY Jo

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT (0.3 m)					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 (0.3 m)		SHEAR STRENGTH P.S.F. O UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE					W_P	W	W_L		
95.2	Ground Level											10	20	30		
0.0	Fill Material - clayey silt with some sand, traces of organics	X	1	SS	8	90										0 15 57 28
87.2	Reddish brown		2	SS	7											
8.0		X	3	SS	160/9"											
			4	SS	100/5"											
			5	SS	100/5"	80										
			6	SS	118											
75.1	weathered	X	7	SS	100/2"											
20.1	sound		8	SS	100/1"											
	Shale bedrock		9	BXL	93% Rec.	70										
65.2																
30.0	End of Borehole					60										

DESIGN SERVICES BRANCH

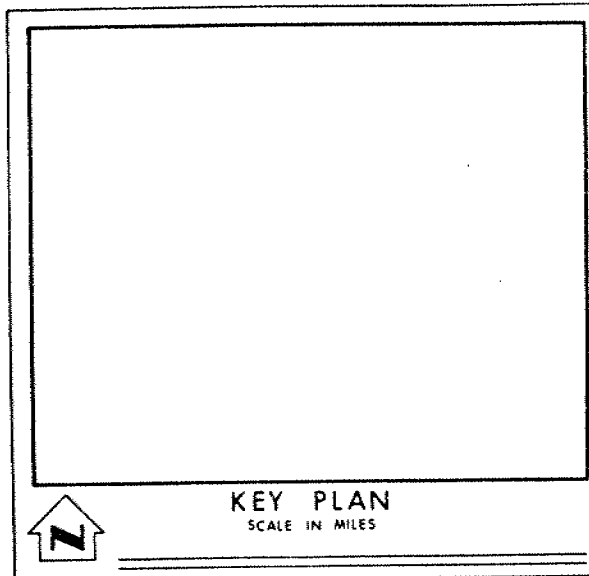
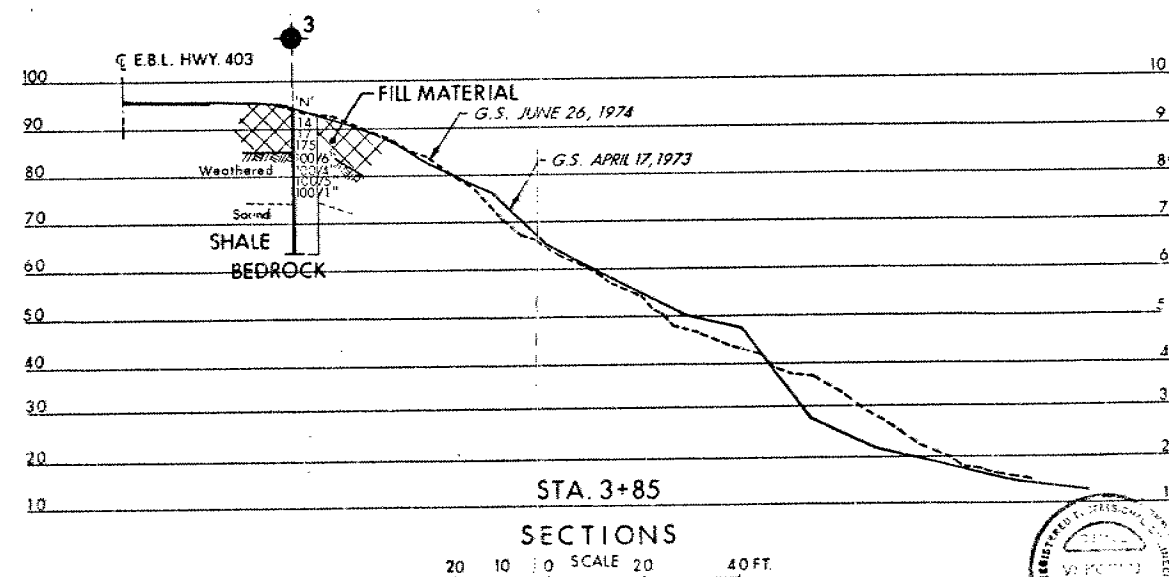
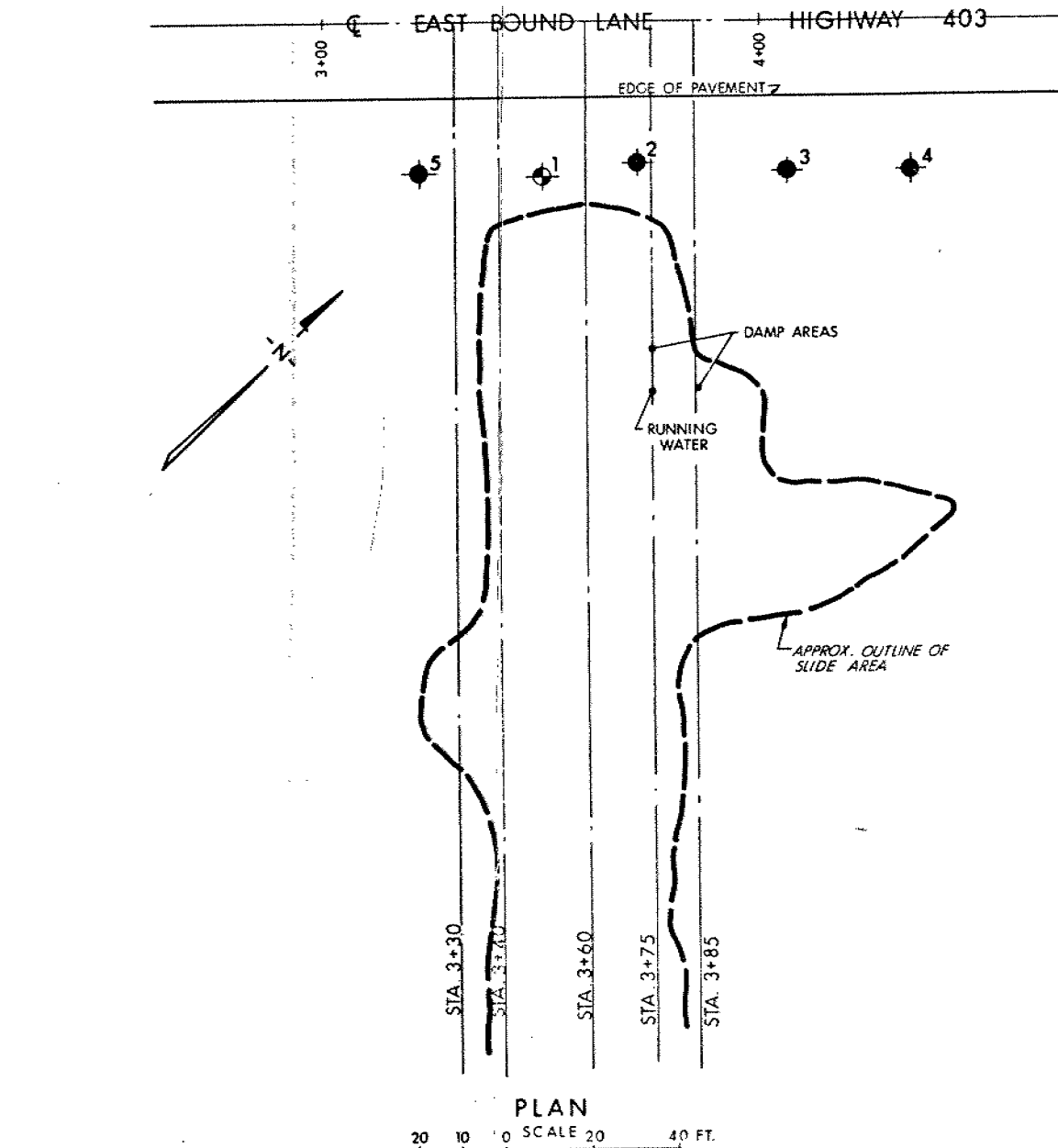
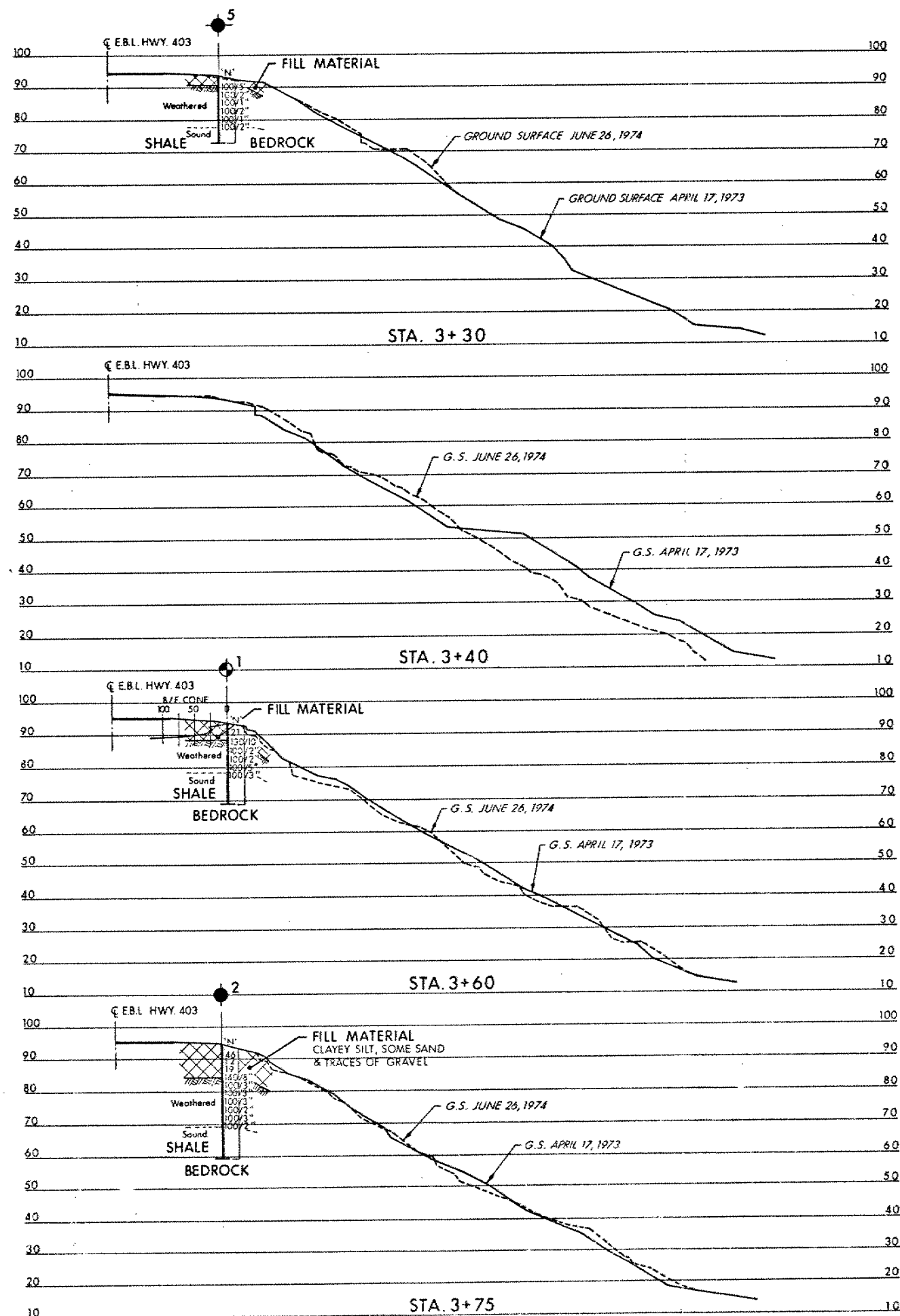
FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 5

JOB 74-11026 LOCATION Station 3+22 (Hwy. 403 EBL); 3 1/4' Rt. ORIGINATED BY VK
 W.P. -- BORING DATE June 17, 1974 COMPILED BY VK
 DATUM Assumed BOREHOLE TYPE Auger and sample with C.M.E.- 55 CHECKED BY [Signature]

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 (0.3 m)		BLOWS / FOOT (0.3 m)				PLASTIC LIMIT w_p				
							SHEAR STRENGTH P.S.F.				WATER CONTENT w				
93.0	Ground Level														
0.0	Fill material - clayey														
90.5	silt, some sand Brown														
2.5			1	SS	100	5"									
			2	SS	100	2"									
			3	SS	100	1"									
			4	SS	100	2"									
			5	SS	100	1"									
77.8	weathered		6	SS	100	2"									
15.2	sound														
73.0	Shale bedrock		7	BXL	95% Rec.										
20.0	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION



LEGEND			
	Bore Hole		
	Cone Penetration Test		
	Bore Hole & Cone Test		
	Water Levels established at time of field investigation.		

NO.	ELEVATION	STATION	OFFSET
1	93.8	3+50	36' RT.
2	94.7	3+73	33' RT.
3	94.0	4+05	34' RT.
4	95.2	4+34	34' RT.
5	93.0	3+22	34' 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.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO
ENGINEERING SERVICES BRANCH—GEOTECHNICAL OFFICE

SLOPE FAILURE
STA. 3+30 TO STA. 4+25

HIGHWAY NO. 403 E.B.L. DIST. NO. 4
CO. WENTWORTH
TWP. W. FLAMBOROUGH LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBNO. V.K. <u> </u>	CHECKED <u> </u>	W.P. NO. <u> </u>	DRAWING NO. <u>74-11026A</u>
DRAWN S.O. <u> </u>	CHECKED <u> </u>	W.O. NO. <u>74-11026</u>	BRIDGE DRAWING NO. <u> </u>
DATE <u>23 JULY 1971</u>	SITE NO. <u> </u>	CONT. NO. <u> </u>	
APPROVED <u> </u>			



MAY 30 12 32 PM '74

DOWN HAMN 3 MAY 30/74 12 35 P

M DECARA SUPVR FOUNDATION ENGR

FOUNDATION OFFICE WEST BLDG

SUBJECT BANK SLIPPAGE HWY 403 SOUTH SIDE AT HWY 6
EASTBOUND

FURTHER TO YOUR TELEPHONE CONVERSATION WITH MR J TANSLEYRE- BANK
SLIPPAGE AT THE ABOVE NOTED LOCATION.

ADDITIONAL SLIPPAGE HAS TAKEN PLACE SINCE. WOULD YOU PLEASE
ADVISE WHEN YOU MAY ATTEND A FIELD MEETING AT THE SITE ON THIS MATTER

M T SCRIMSHAW DIST 4 HAMILTON

RH

A site visit was made to review the problem on June 4/74
M. 22

T
E
L
E
T
Y
P
E

T
E
L
E
T
Y
P
E