

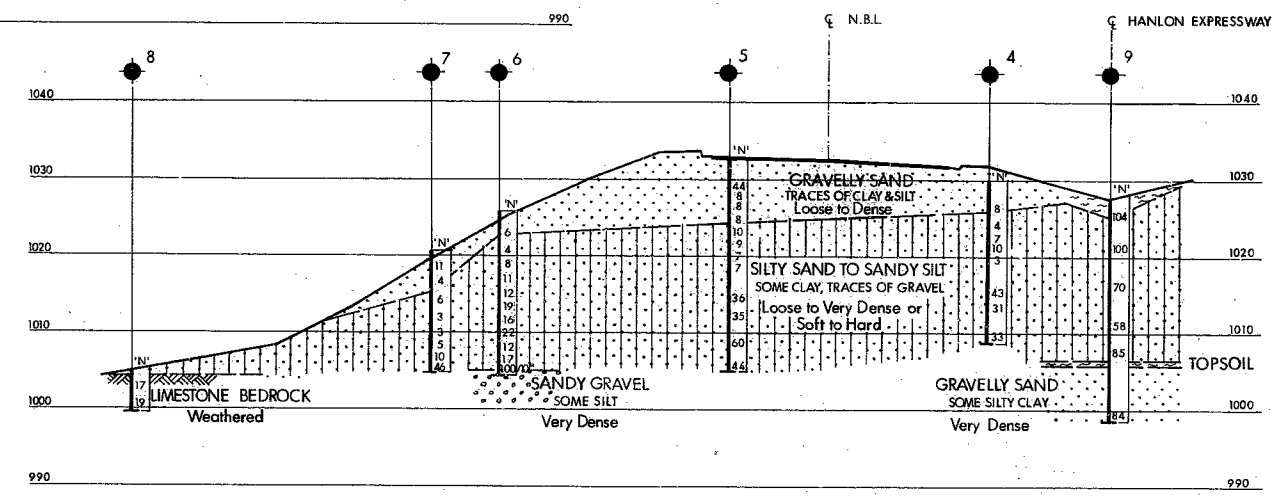
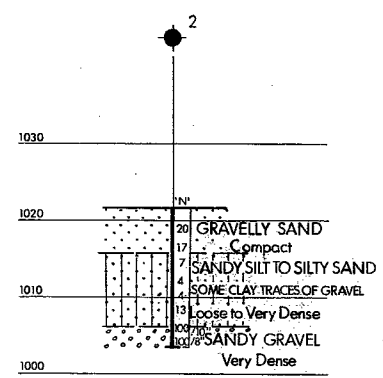
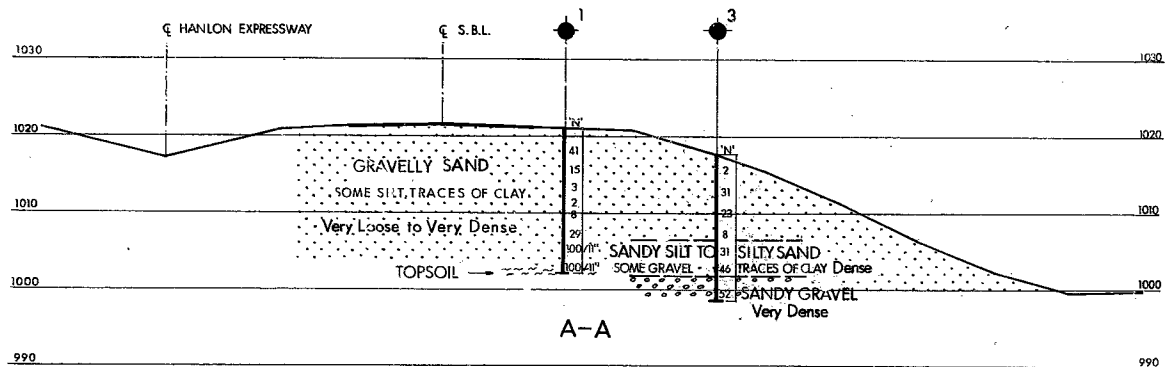
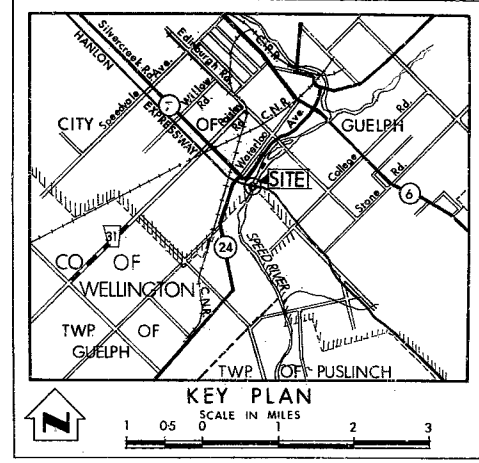
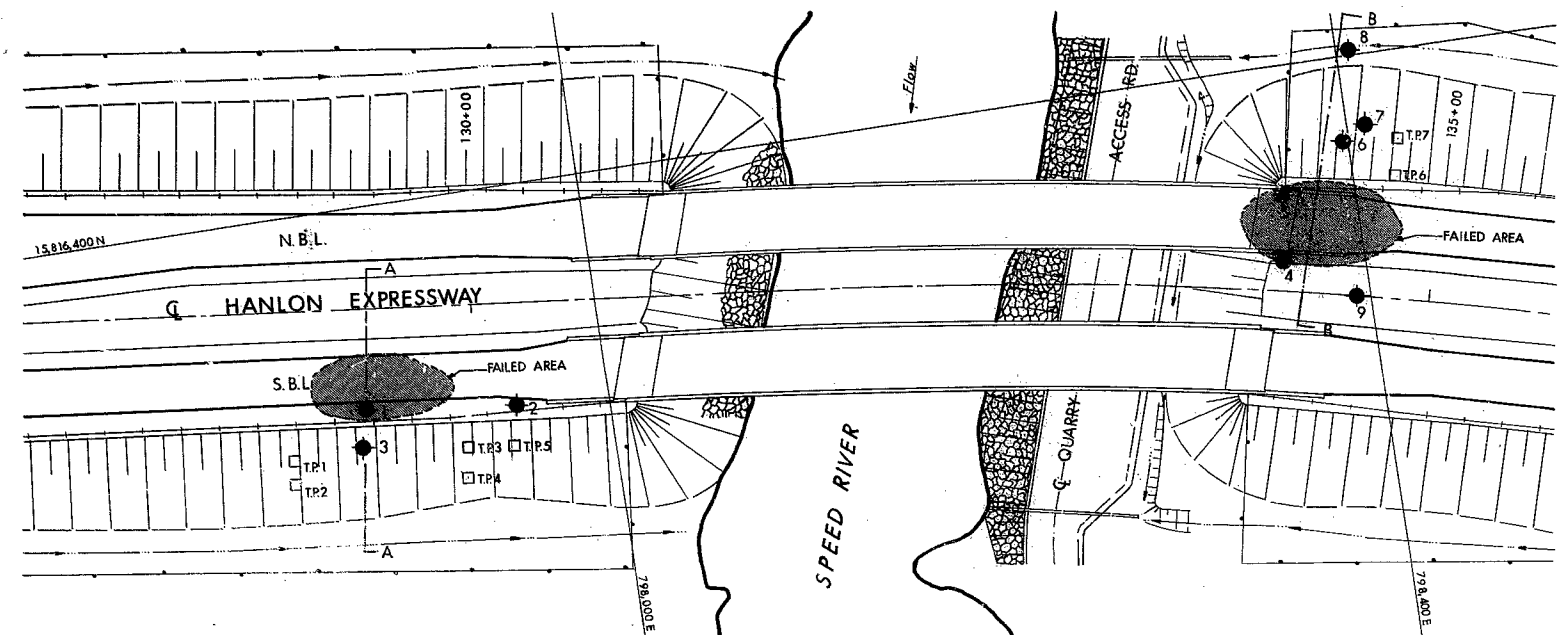
CONT. 71-1

HANLON EXP.

+ SPEED RIVER

APPROACHES

40P9-18



LEGEND				
●	Bore Hole			
⊕	Cone Penetration Test			
⊗	Bore Hole & Cone Test			
⬇	Water Levels established at time of field investigation.			
□	All Boreholes dry SEPT 1972			
□	Test Pit			
NO.	ELEVATION	CO-ORDINATES		
		NORTH	EAST	
1	1021-0	15,816,294	797,874	
2	1021-6	15,816,285	797,952	
3	1017-8	15,816,275	797,870	
4	1030-0	15,816,298	798,357	
5	1032-9	15,816,332	798,361	
6	1025-9	15,816,356	798,397	
7	1020-6	15,816,362	798,410	
8	1004-8	15,816,403	798,407	
9	1027-3	15,816,275	798,393	

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
DESIGN SERVICES BRANCH - FOUNDATIONS OFFICE

SPEED RIVER

HIGHWAY NO. HANLON EXPRESSWAY DIST. NO. 3
CO. WELLINGTON CITY OF GUELPH
TWP. GUELPH LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD. P.K.	CHECKED <u>/</u>	W.P. NO. 109-68-01	DRAWING NO.
DRAWN F.L.	CHECKED <u>/</u>	W.O. NO. 72-11108	72-11108A
DATE NOV. 15, 1972	SITE NO.	BRIDGE DRAWING NO.	
APPROVED <u>[Signature]</u>	CONT. NO.		

PRINCIPAL FOUNDATION ENGINEER

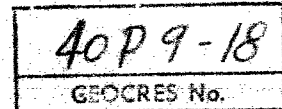


Mr. J. G. Forster,
Senior Soils Engineer,
Southwestern Region,
London, Ontario.

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

November 23, 1972.

*Soils Investigation to Determine Causes
of the Settlements and Slope Deteriorations
on the Approach Fills of the Speed River Bridge
Hanlon Expressway, W.O. 72-11108, Cont. #71-01*



Further to your request dated September 15, 1972, the results of our investigations are as follows:

Settlements and possibly small lateral movements have occurred at the Speed River approach fills of the Hanlon Expressway. The deteriorations were mainly confined within the south approach fill of the northbound and the north approach fill of the southbound structure. The recent soils investigation indicated a number of possible reasons for the deformations, it might also be postulated that they have been caused by a combination of these.

a) Inadequate Compaction

Standard penetration tests performed in the boreholes proved that under the actual road bed the soils have loose to compact relative density and soft to stiff consistency. Penetration N values were recorded to vary between 2 blows per foot and say 20 blows per foot. Higher N values within these strata were caused by larger size gravels rather than by better compaction. The vertical extent of this poorly compacted material was found to be approximately 10 ft. under the north approach fill and some 14-15 ft. under the south approach of the northbound structure.

b) High Moisture Contents of the Fills

Bulk samples taken from test pits appeared to have a great deal of excess water, rendering the soils soggy, soft and rubbery, although laboratory moisture contents of the samples indicated that they were not more than 3-4% higher than the optimum. It is to be pointed out, however, that only 1% higher than the optimum moisture content resulted in free water ponding in the Proctor mould. It can be concluded, therefore, that in this particular soil a very small increase in moisture will have a decidedly detrimental effect.

c) Surface Runoff and Drainage Conditions:

It is surmised that at least part of the soils used for the embankment construction was too wet. It is, therefore, essential that no further water could seep into the fills. During the field inspection it was noted that a considerable amount of surface water can indeed enter the body of the embankment, thus providing an almost continuous supply of water. A large area of the side slopes are not protected by sod, and on the sodded areas large cracks developed as mentioned earlier. It was observed that rainwater enters the embankment through the unpaved shoulders. Further, it was noted that the 12" CSP at the north approach fill, which discharges towards the median ditch has no effective drainage. Discharged water instead of running along the ditch, ponds around the pipe outlet and soaks the fill.

d) Conclusions

Any of the reasons discussed above may have contributed towards the recent deteriorations.

Work to be undertaken in order to rectify the existing conditions would be quite expensive, and we feel that excessive remedial measures, based on somewhat hypothetical reasons, would not be economically justified at this time.

It is, however, recommended that the improvement of surface drainage be carried out as soon as possible, in order to eliminate rainwater seeping into the embankments. The improvement should consist of sodding the slopes, closing the open cracks of the already sodded areas, waterproofing the shoulders by asphalt, surface treatment or stabilization and providing proper runoff along the ditches.

By preventing the water from entering the fills, the loose soils may consolidate much faster, hence the settlements may stop.

Further settlement readings should be carried out by the construction personnel at least once each month and, the results should be submitted to this Office.

It is suggested that if the settlements do not stop or slow down considerably within six months after the completion of drainage improvement, further studies be implemented in order to confirm the necessity of carrying out more involved remedial measures.

AKB/ao

A. K. Barsvary,
SENIOR FOUNDATIONS ENGINEER.

cc: Foundations files
Documents

Mr. J. G. Forester,
Senior Soils Engineer,
Southwestern Region,
London, Ontario.

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

July 30, 1973.

Speed River Bridge Approaches, Hanlon
Expressway, District #3 (Stratford)
W.O. 72-11108 / -- Cont. 71-01

Further to our memo dated November 23, 1972, and to our recent meeting at the above-mentioned site, our conclusions as to the cause of the settlement problems on the approaches are as follows:

- 1) The most likely cause of settlements on the approaches in the presence of poorly compacted soil in the affected areas. Whether this soil was inadequately compacted during construction or whether it became softened afterwards by exposure to wet weather cannot be ascertained.
- 2) The situation is probably being aggravated by the seepage of water into the poorly compacted zone. Recommendations contained in our memo of November 23 to improve drainage should be implemented.
- 3) Settlements on the south approach appear to be occurring at a decreasing rate whilst settlements on the north approach seem to have been more or less at a uniform rate since October 1972. Patching will probably be required for some time to come on the north approach.
- 4) Some slips have occurred on the cut slopes south of the structure. We recommend that these be repaired by removing sufficient material to allow for the installation of an 18 inch thick filter blanket of Granular 'A' material over the affected areas. The blanket should extend to the toe of slope and suitable frost free drainage provided.

K. G. Selby

RGS/ao

c.c. Foundations Files
Documents

K. G. Selby,
SUPERVISING FOUNDATIONS ENGINEER.

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1

JOB 72-11108

LOCATION Co-ords. 816,294 N; 797,874 E.

ORIGINATED BY PK

W.P. 109-68-01

BORING DATE Sept. 25, 1972

COMPILED BY PK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY *[Signature]*

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				PLASTIC LIMIT ——— W_P				
							SHEAR STRENGTH P.S.F.				WATER CONTENT ——— W				
1021.0	Ground Level														
0.0	Gravelly sand, some silt, traces of clay.		1	SS	41	1020									40 49 (11)
			2	SS	15										34 48 14 4
			3	SS	3										
			4	SS	2										
			5	SS	8	1019									
			6	SS	29										
	Very Loose to Very Dense		7	SS	100/11"										39 37 18 6
1002.0	Black Topsoil		8	SS	100/11"										45 40 11 4
19.0	End of Borehole														

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2

JOB 72-11108

LOCATION Co-ords. 816,285 N; 797,952 E.

ORIGINATED BY PK

W.P. 109-68-01

BORING DATE Sept. 25, 1972

COMPILED BY PK

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		SHEAR STRENGTH P.S.F.				w_p w w_L				
							O UNCONFINED		+ FIELD VANE						
						● QUICK TRIAXIAL		x LAB VANE		WATER CONTENT %					
						1000		2000		10 20 30					
1021.6	Ground Level														
0.0	Compact					1020									21 69 (10)
1015.6	Gravelly sand, some silt, traces of clay.		1	SS	20										
			2	SS	17										8 48 33 11
6.0	Sandy silt to silty sand, some clay, traces of gravel.		3	SS	7										
			4	SS	4										
			5	SS	4	1010									
			6	SS	13										
1005.8	Loose to Very Dense		7	SS	100/10"										
1003.4	Sandy gravel														
	Very Dense		8	SS	100/8"										53 35 (12)
18.2	End of Borehole														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 3

JOB 72-11108

LOCATION Co-ords. 816,275 N; 797,870 E.

ORIGINATED BY PK

W.P. 109-68-01

BORING DATE Sept. 26, 1972

COMPILED BY PK

DATUM Geodetic

BOREHOLE TYPE Hollow Stem Auger

CHECKED BY

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT —WL PLASTIC LIMIT —WP WATER CONTENT —W			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB VANE				WP	W	WL		
1017.8	Ground Level														
0.0	Gravelly sand, some silt, traces of clay	...	1	SS	2	1010									
		...	2	SS	31										40 33 21 6
		...	3	SS	23										30 40 23 7
1006.3	Very Loose to Dense	...	4	SS	8										
11.5	Sandy silt to silty sand, some gravel, trace of clay. Dense	...	5	SS	31	1000									16 40 32 12
1001.8		...	6	SS	46										
16.0	Sandy gravel. Very Dense	...	7	SS	52										15 32 17 6
19.3	End of Borehole														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 4

JOB 72-11108

LOCATION Co-ords. 816,298 N; 798,357 E.

ORIGINATED BY PK


W.P. 109-68-01

BORING DATE Oct. 3, 1972

COMPILED BY PK

DATUM Geodetic

BOREHOLE TYPE Washboring

CHECKED BY 

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT _____w _L PLASTIC LIMIT _____w _p WATER CONTENT _____w _v			BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	BLOWS/FOOT		SHEAR STRENGTH P.S.F.				WATER CONTENT %				
							○ UNCONFINED		+ FIELD VANE		w _p — w — w _L				
						● QUICK TRIAXIAL		x LAB VANE							
1030.0	Ground Level						1000	2000			10	20	30		GR.SA.SI.CL.
0.0	Topsoil														
0.6	Gravelly Sand														
1026.0	Loose		1	SS	8										
4.0	Sandy silt to silty sand, some gravel, traces of clay.		2	SS	4										19 42 37 2
			3	SS	7										
			4	SS	10										
			5	SS	3	1020									
			6	TW	PM										
			7	SS	43										
			8	SS	31										
1008.5	Loose to Dense		9	SS	33	1010								17 34 38 11	
21.5	End of Borehole														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N^o5

JOB 72-11108

LOCATION Co-ords. 816,332 N; 798,361 E.

ORIGINATED BY PK

W.P. 109-68-01

BORING DATE Sept. 27, 1972

COMPILED BY PK

DATUM Geodetic

BOREHOLE TYPE Washboring

CHECKED BY *SP*

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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE				W_p W W_L WATER CONTENT % 10 20 30				
1032.9	Ground Level														GR. SA. SI. CL.
0.0	Gravelly sand, traces of clay and silt.		1	SS	44	1030									29 64 (7)
			2	SS	8										50 47 (3)
1024.4	Loose to Dense		3	SS	8										
			4	SS	8										
8.5	Sandy silt to silty		5	SS	10										
			6	SS	9										
	Sand with some clay,		7	SS	7	1020									8 48 34 10
	traces of gravel.		8	SS	7										
			9	SS	7										
	Moderately plastic		10	CS	-										8 35 41 16
			11	SS	36										
			12	SS	35										
1004.9	Loose to Very Dense		13	CS	-	1010									9 41 36 14
			14	SS	60										
28.0	End of Borehole		15	SS	44										

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

 RECORD OF BOREHOLE N^o6

JOB 72-11108

LOCATION Co-ords. 816,356 N; 798,397 E.

ORIGINATED BY PK

W.P. 109-68-01

BORING DATE Sept. 28, 1972

COMPILED BY PK

DATUM Geodetic

BOREHOLE TYPE Washboring

 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		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE			WATER CONTENT % 10 20 30				
1025.9	Ground Level													GR.SA.SI.CL
0.0	Gravelly sand													
1022.9	Loose		1	SS	6									
3.0	Silty sand to sandy		2	SS	4	1020								
	silt, some clay and		3	SS	8									
	gravel		4	SS	11									
	Moderately plastic		5	SS	12									
	Soft to Hard		6	SS	12									
	Brown		7	SS	19									17 29 39 15
	Sandy grav. some silt,		8	SS	16									
20.0	Very Dense		9	SS	22	1010								
1001.1			10	SS	12									8 37 41 14
21.8	End of Borehole		11	SS	17									42 33 20 5
			12	SS	10									
			13	SS	100	10"								

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE N^o7

JOB 72-11108

LOCATION Co-ords. 816,362 N; 798,410 E.

ORIGINATED BY PK

W.P. 109-68-01

BORING DATE Oct. 2, 1972

COMPILED BY PK

DATUM Geodetic

BOREHOLE TYPE Washboring

CHECKED BY PK

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			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	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							
1020.6	Ground Level													
0.0	Topsoil					1020								
1.0	Gravelly sand		1	SS	11	1010								
1015.0	Compact		2	SS	1									
5.6	Silty sand to sandy silt, some clay, traces of gravel Moderately plastic Brown Soft to Hard		3	SS	6									
			4	SS	3									
			5	SS	3									
			6	SS	5									
			7	SS	10									
			8	SS	16									
1004.6														
16.0	End of Borehole													

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 8

JOB 72-11108

LOCATION Co-ords. 816,403 N; 798,407 E.

ORIGINATED BY PK


W.P. 109-68-01




BORING DATE Oct. 2, 1972

COMPILED BY PK

DATUM Geodetic

BOREHOLE TYPE Washboring

CHECKED BY 

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				PLASTIC LIMIT — w_p				
							SHEAR STRENGTH P.S.F.				w_p — w — w_L				
							○ UNCONFINED + FIELD VANE				WATER CONTENT %				
							● QUICK TRIAXIAL x LAB VANE				10 20 30				
1004.8	Ground Level														
0.0	Silty sand Brown														
0.7	Limestone Bedrock		1	SS	17										
999.3	Weathered Grey		2	SS	19	1000									34 49 (17)
5.5	End of Borehole														

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 9

JOB 72-11108

LOCATION Co-ords. 816,275 N; 798,393 E

ORIGINATED BY PK


W.P. 109-68-01

BORING DATE Sept. 26, 1972

COMPILED BY PK

DATUM Geodetic

BOREHOLE TYPE Washboring

CHECKED BY 

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT			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	BLOWS/FOOT		SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE							
1027.3	Ground Level													
1025.0	Topsoil Black		1	SS	104	1020								22 30 38 10
2.3	Silty sand to sandy silt with some gravel and traces of clay.		2	SS	100									
		3	CS	-										
		4	SS	70										
	Very Dense Moderately plastic		5	SS	58	1010								23 32 38
21.4	Clayey silt topsoil Black		6	SS	85									
22.0	Gravelly sand, some silt & clay.					1000								35 47 (18)
998.3	Very Dense		7	SS	84									
29.0	End of Borehole													

OFFICE REPORT ON SOIL EXPLORATION