#66-F-39

W.P.#110-66-9

PROPOSED COMMUTER STN. PEDESTRIAN UNDERPASS SCARBOROUGH

cc 1 GEN. FILES

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

TO: Mr. W. D. Ratz,
Superintendent of Land Surveys,
Right-of-Way Division,
Admin. Bldg.

Attn: Mr. B. Wright,
Drafting Chief Inspector.

FROM: Foundation Section,
Materials and Testing Division,
Room 107, Lab. Bldg.

DATE: May 17, 1966

OUR FILE REF.

IN REPLY TO JUN 1 1966

SUBJECT:

FOUNDATION INVESTIGATION REPORT
For
Proposed Commuter Station
Pedestrian Underpass - Scarborough
District #6 (Toronto)
W.J. 66-F-39 -- W.P. 110-66-9

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

We believe that you will find the factual data and recommendations contained therein, adequate for your design requirements. Should additional information be required, please feel free to contact our Office.

A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

AGS/MdeF
Attach.

cc: Messrs. W. D. Ratz (4)
J. C. Thatcher
T. J. Kovich
Foundations Office
Gen. Files ✓

FOUNDATION INVESTIGATION REPORT
For
Proposed Commuter Station
Pedestrian Underpass - Scarborough
District #6 (Toronto)
W.J. 66-F-39 -- W.P. 110-66-9

A request to investigate the foundation conditions at the location of the above proposed underpass, was received by this Section, from Mr. B. Wright, Chief Inspector of Surveys. Subsequently an investigation consisting of two sampled boreholes, was carried out at this site. Presented in this report are the field data and laboratory results, together with our recommendations pertaining to the structure foundations.

A thin layer of topsoil is underlain by a stratum of clayey silt with sand extending to about 47 ft. in both boreholes. In borehole #2, a thin layer of dense (32 to 34 blows/ft.) silty sand was encountered between 12 and 18 ft. The 'N' values for the clayey silt with sand stratum ranged at random from 14 blows/ft. to 52 blows/ft. Wherever possible, an attempt was made to carry out in-situ vane shear strength measurements. In general, these vary from 1760 p.s.f. to more than 2000 p.s.f. The undrained shear strength of this deposit, as determined in the laboratory, ranged in general, from 1400 p.s.f. to 1800 p.s.f. However, below approximate elev. 505, and above the silty sand deposit, the strength of the stratum ranged from 600 p.s.f. to 1100 p.s.f.

The clayey silt with sand stratum is underlain by a deposit of silty sand. Penetration into the deposit was about 5 ft. in both boreholes. Standard Penetration test (N) values vary from 41 blows/ft. to 85 blows/6 in., from which a relative density of dense to very dense may be estimated.

Water level observations in the boreholes were carried out during the time of the investigation. These show the water table to be about 2 ft. below the ground level in both boreholes.

cont'd. /2 .....

At the time of writing this report, design details pertaining to the proposed pedestrian underpass are not available. However, it was assumed that the future structure may be located some 11 ft. below the bottom of the tracks at approximate elev. 529±. At this elevation the subsoil consists of stiff clayey silt with sand on the north side of the tracks, and of dense silty sand on the south side of the tracks. A safe design load of 1 t.s.f. may be used for design purposes for the proposed structure. Since the structure may be partially founded in the silty sand stratum, a dewatering scheme may be required. Consideration should also be given to locating the structure at or below elev. 525 in order to avoid any major dewatering problems.

It should be noted that the recommendations given in this report are conditional only, and are subject to revision at a later date when and if new design information becomes available.

The field investigation, performed in April 1966, together with the preparation of this report, was undertaken by Mr. R. Magi, Project Foundation Engineer. The investigation was carried out under the general supervision of Mr. M. Devata, Senior Foundation Engineer, who also reviewed this report.

Equipment was owned and operated by Dominion Soil Investigation Ltd. of Toronto.

May 1966

APPENDIX I.

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 1

FOUNDATION SECTION

JOB 66-F-39 LOCATION See DWG 66-F-39A ORIGINATED BY RM
W.P. 110-66-9 BORING DATE April 28, 1966 COMPILED BY RM
DATUM Geodetic BOREHOLE TYPE Penn Auger CHECKED BY

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	TYPE	BLOWS / FOOT
544.6 / 0	Ground Level				
	Clayey Silt with Sand		1	SS	17
			2	SS	52
			3	SS	51
			4	SS	30
			5	SS	17
	Firm to Hard		6	TW	PH
			7	TW	PH
			8	TW	PH
			9	SS	43
			10	SS	31
			11	TW	PH
			12	SS	14
498.6 / 46			13	TW	PH
	Silty Sand		14	SS	41
493.1 / 51.5	Dense to V. Dense		15	SS	55/6"
	End of Borehole				

ELEV. SCALE: 540, 530, 520, 510, 500

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

SHEAR STRENGTH P.S.F.
+ Field Vane
• Quick Triaxial
500 1000 1500 2000 2500

LIQUID LIMIT — w_L
PLASTIC LIMIT — w_P
WATER CONTENT — w
w_P w w_L
WATER CONTENT %

BULK DENSITY
γ P.C.F.

REMARKS
▼W.L. Elev 542.7

20
15 5 Strain at Failure
10

DEPARTMENT OF HIGHWAYS - ONTARIO

MATERIALS & TESTING DIVISION

RECORD OF BOREHOLE NO. 2

FOUNDATION SECTION

JOB 66-F-39 LOCATION See DWG 66-F-39A ORIGINATED BY RM

W.P. 110-66-9 BORING DATE April 29, 1966 COMPILED BY RM

DATUM Geodetic BOREHOLE TYPE Penn Auger CHECKED BY MR

ELEV. / DEPTH	DESCRIPTION	STRAT. PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS / FOOT	ELEV. SCALE
543.9 / 0	Ground Level					
	Clayey Silt with Sand		1	SS	19	540
			2	SS	35	
			3	SS	47	
531.9 / 12						
	Silty Sand		4	SS	34	530
525.9 / 18	Dense		5	SS	32	
			6	SS	34	
						520
			7	SS	30	
	Stiff to Hard		8	SS	29	
						510
			9	SS	16	
			10	TW	PH	
			11	SS	20	
496.9 / 47						500
			12	SS	60/6"	
	Silty Sand Very Dense					
492.4 / 51.5			13	SS	85/6"	
	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT

SHEAR STRENGTH P.S.F.
+ Field Vane
• Quick Triaxial
500 1000 1500 2000 2500

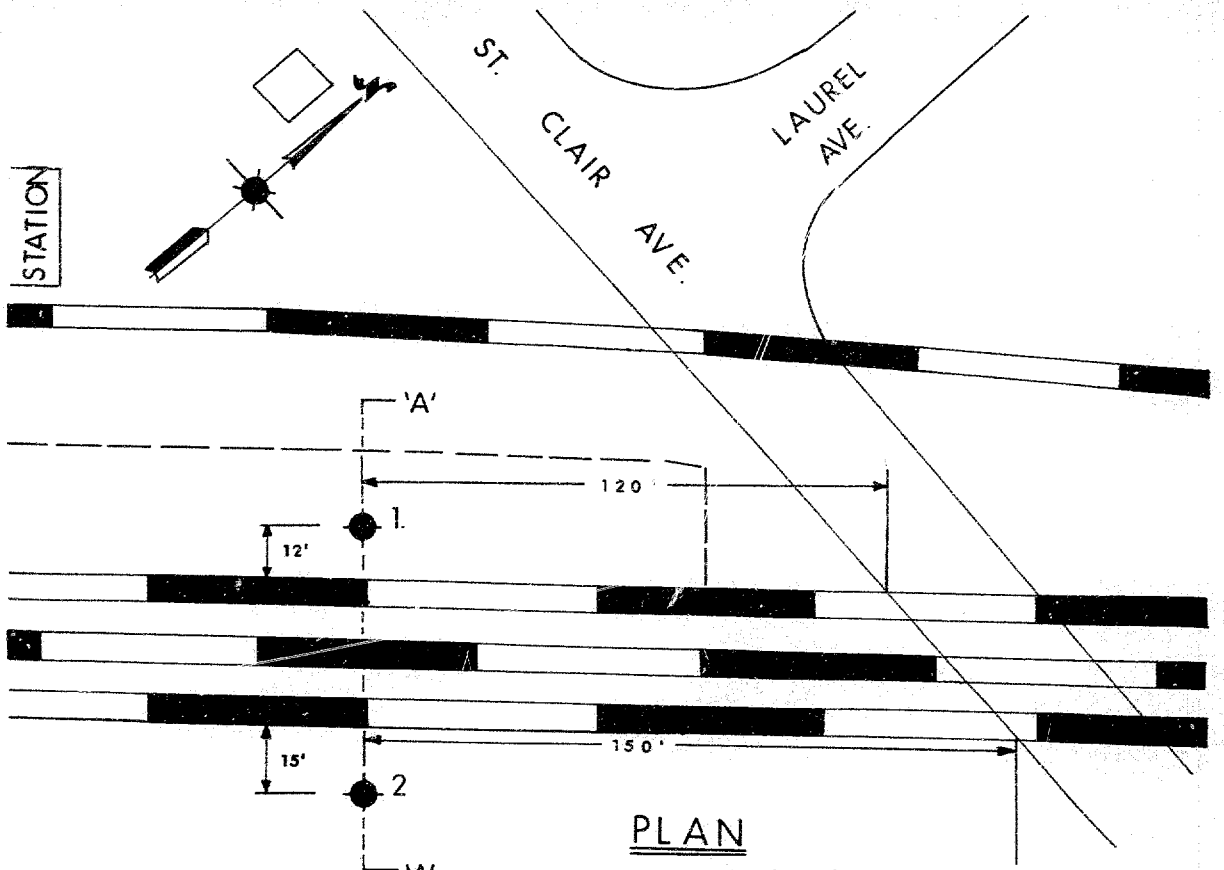
LIQUID LIMIT — w_L
PLASTIC LIMIT — w_P
WATER CONTENT — w
w_P w w_L
WATER CONTENT %

BULK DENSITY
P.C.F.

REMARKS

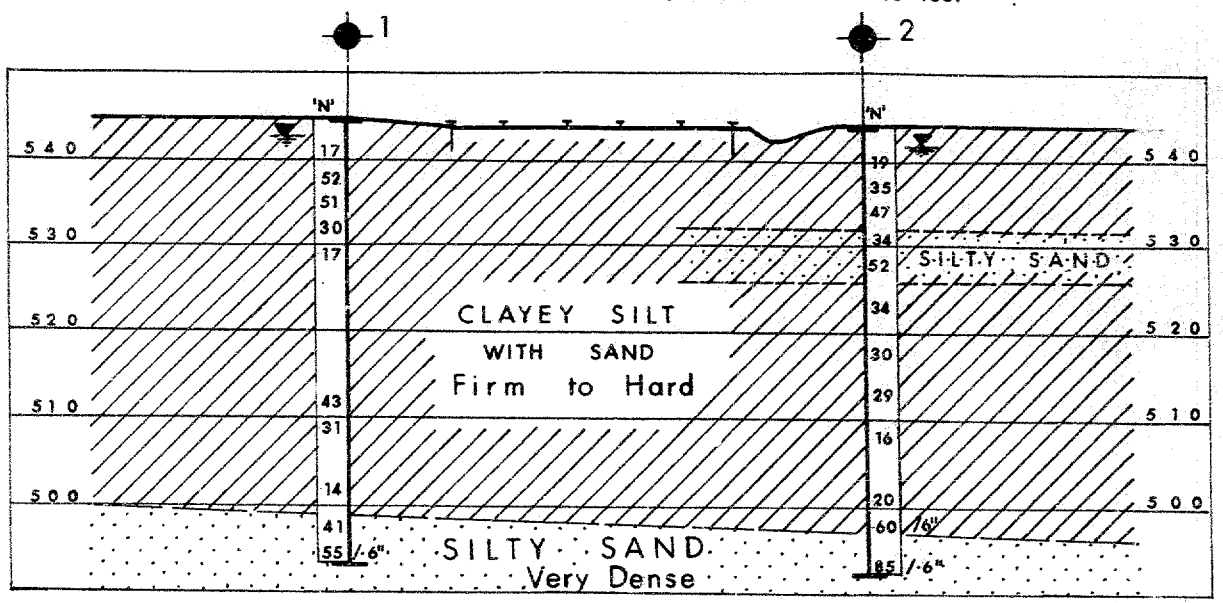
W.L. Elev 541.9

20
15 — 5 Percent Strain at Failure
10



PLAN

SCALE: 1 inch = 40 feet



A — A

SCALE : 1 inch = 20 feet

REF NO: M-4115

DEPARTMENT OF HIGHWAYS
MATERIALS and TESTING DIVISION
ONTARIO

PROPOSED PEDESTRIAN UNDERPASS
SCARBOROUGH COMMUTER STATION
CANADIAN NATIONAL RAILWAYS

W.P.:110-66-9 DIST: 6 JOB: 66-F-39

DATE 26 MAY, 1966 APPROVED [signature] DRAWING NO. 66-F-39 A

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 350 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 :-

CONSISTENCY	'N' BLOWS / FT.	c LB. / SQ. FT.	DENSENESS	'N' BLOWS / FT.
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

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	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 $= \frac{-\Delta e}{(1+e)\Delta \bar{\sigma}'}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX $= \frac{\Delta e}{\Delta \log_{10} \bar{\sigma}'}$
T_v	TIME FACTOR $= \frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT — IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \bar{\sigma}' \tan \phi'$
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION — IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \bar{\sigma}' \tan \phi'$
c_u	APPARENT COHESION — IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION — IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3·1416
e	BASE OF NATURAL LOGARITHMS 2·7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a 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
σ	NORMAL STRESS
$\bar{\sigma}'$	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ε	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNGS MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

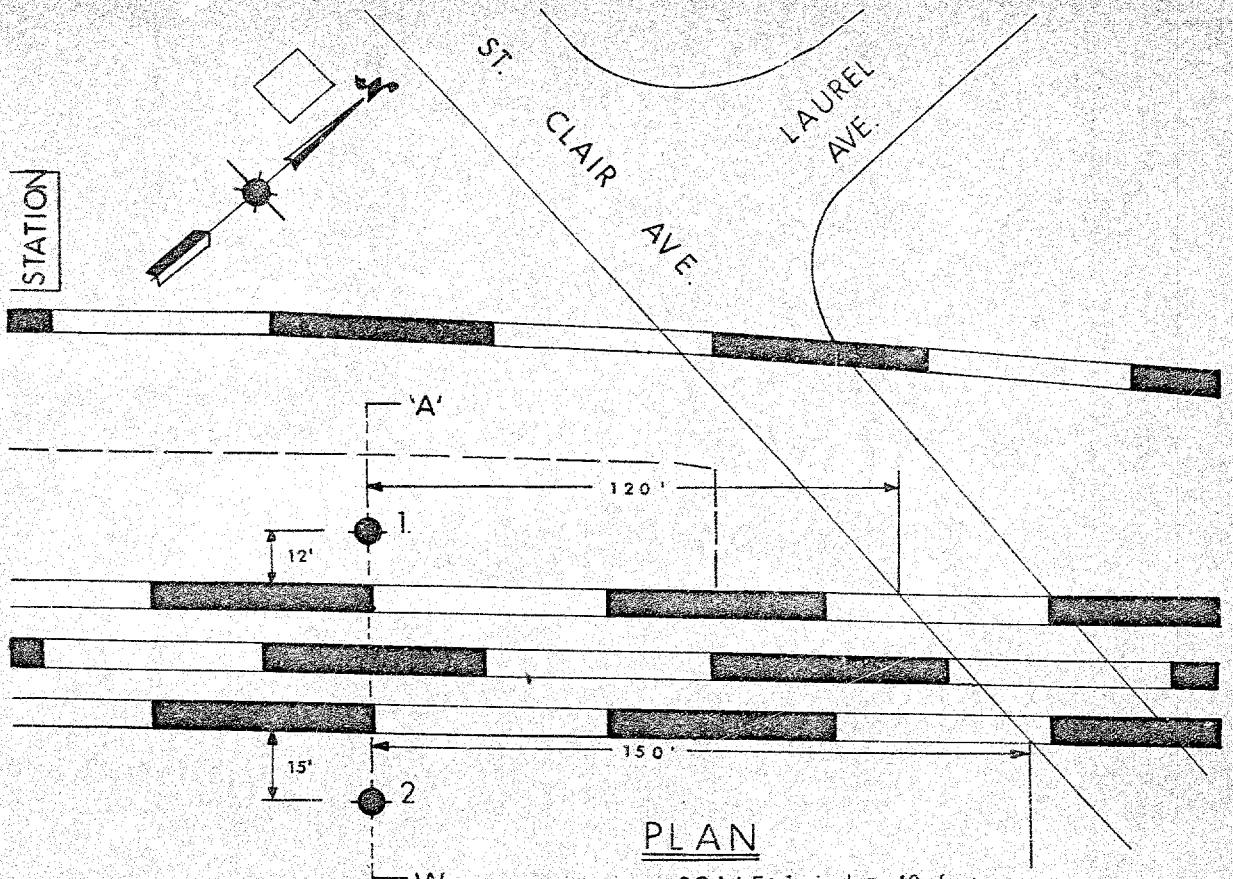
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

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

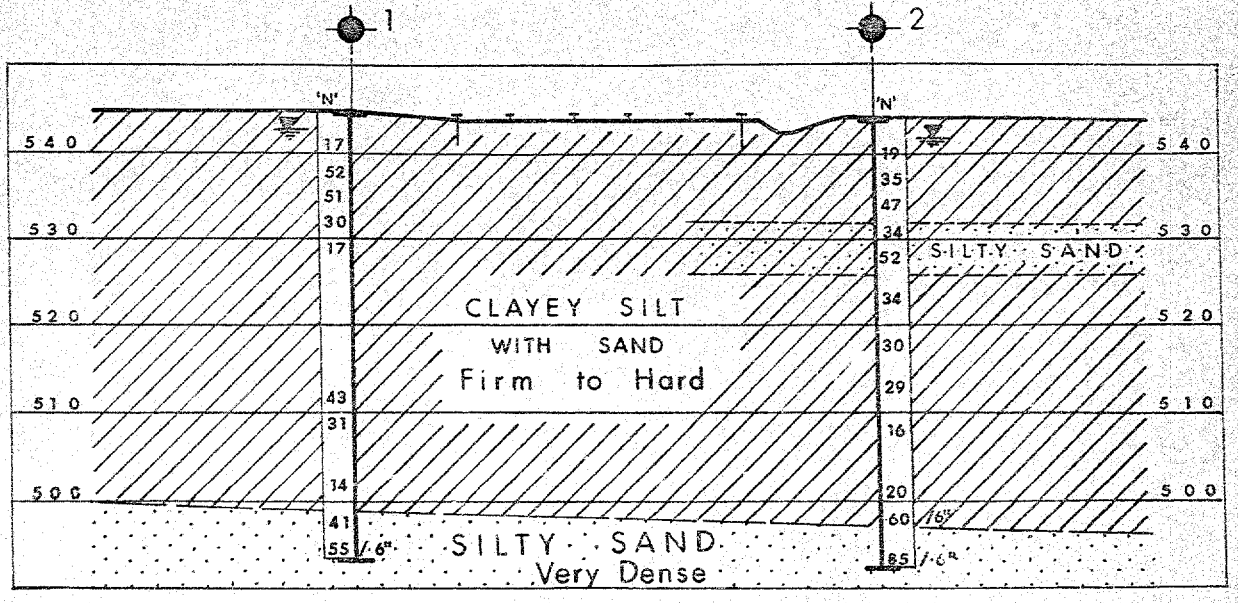
SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



PLAN

SCALE: 1 inch = 40 feet



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