

DOCUMENT MICROFILMING IDENTIFICATION

GEOCRES No. 30715-66

DIST. 6 REGION

W.P. No. 168-81-01

CONT. No. 82-114

W. O. No.

STR. SITE No.

HWY. No. 401

LOCATION Lynde Gear East, Noise
Barrier, N. side, 0.9 km

No of PAGES -

=====

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

*Silk Investigation Service
\$ 996.00
15.5 hrs*



**Ministry of
Transportation and
Communications**

FILE No. 168-81-01

DATE _____

REMARKS _____



Ministry of
Transportation and
Communications

foundation investigation and design report

ENGINEERING MATERIALS OFFICE
PAVEMENT & FOUNDATION DESIGN SECTION

WP 168-81-01

DIST 6

HWY 401

STR SITE N/A

Foundation Design Report, From Lynde Creek
Easterly 0.9 km Noise Barrier North Side

DISTRIBUTION

Memorandum



To: Mr. R.D. Gunter
Head, Geotechnical Section
Central (5000 Yonge St.) Region

Date: 82 11 26

Attn: G. Smolskis

From: Pavement & Foundation Design Section
Room 315, Central Bldg.
Downsview

Re: Foundation Design Report
W.P. 168-81-01, Highway 401
From Lynde Creek Easterly
0.9 km Noise Barrier North Side
District 6, Toronto

INTRODUCTION

As per your request of 82 10 19, a foundation investigation has been completed. In the initial planning stages, the major concern was poor soil conditions which your fieldcrew encountered towards the eastern portion of the proposed noise barrier alignment. In addition, you requested some additional boreholes in other areas along the noise barrier path. In order to determine lateral resistance of the subsoil for caissons supporting the noise barrier system, a field investigation was carried out between 82-11-02 and 82-11-03. Fieldwork consisted of a total of six sampled boreholes advanced to depths of up to 21 feet (6.4 m).

This memorandum presents the results of our subsurface data, together with our comments on the design of the noise barrier foundations.

SITE DESCRIPTION

The site is located within the right-of-way of Highway 401 from the Lynde Creek bridge, 0.6 miles (0.9 km) easterly to the Henry St. overpass in the Regional Municipality of Durham.

Topographically, this section of highway passes through rolling terrain, and is located in the physiographic region known as the Iroquois Plain. Subsoil in this region generally consists of lacustrine deposits overlying glacial till.

A handwritten signature, likely of the author, located at the bottom right of the page.

7/22

SUBSURFACE CONDITIONS

Subsoils along this portion of Highway 401 are fairly uniform. The summary of the foundation investigation data is attached for your information. It includes the 1) borehole number, 2) borehole elevation, 3) station and offset, and 4) a description of the subsoil based on field and laboratory classifications.

A general description of the subsurface conditions along the alignment are presented as follows:

- a) surficial conditions (along chainage)
- b) uniform subsoils

* The complete Record of Borehole Sheets are retained on file at the Pavement and Foundation Design Section, Downsview.

a) Surficial Conditions

Sta. 175 + 00 to Sta. 184 + 00

The surficial deposit is a cohesive fill material explored to a maximum depth of 8 ft. (2.4 m). The fill material is comprised of a heterogeneous mixture of silty clay, sand and gravel with some decayed organic material. Standard Penetration Test results gave 'N' values which generally increased with depth from 3 to 6 blows per foot, indicating the fill had undergone only a very moderate degree of compactive effort.

An approximate 2 ft (0.6m) silty sand layer, the top 10" (25 cm) being organic, was encountered at Borehole #2 (Sta. 180 + 00).

Sta. 172 + 00 + Sta. 173 + 50

Located between these locations is an approximate 7 foot (2.1m) high embankment consisting mainly of fine sand. The denseness of this material based on augering operations and SPT results can be assessed as being very loose throughout.

Sta. 157 + 50 to Sta. 163 + 75

In this section an approximate 2 ft. (0.6 m) thick layer of cohesive road way fill material was encountered, and resembled the roadway fill found between Sta. 184 + 00 to Sta. 175 + 00 in composition and degree of compaction.

7/23

MBF

b) Uniform Subsoils

Silty Clay (Trace to with Sand, Trace Gravel)

Encountered along the entire length of the proposed noise barrier alignment studied (exception of B.H. #3) is a lacustrine deposit of silty clay of low plasticity lying directly below the fill material and fine sand deposits. The silty clay stratum was explored to a maximum depth of 10 feet, and within the deposit, increased amounts of sand and gravel occurred.

Results of Atterberg Limits Testing on selected representative samples are summarized below:

	<u>Range</u>	<u>Average</u>
Natural Moisture Content (W)%	20-32	23
Liquid Limit (W_L)%	21-49	34
Plastic Limit (W_p)%	11-21	15
Plasticity Index (I_p)%	10-28	19

Undrained Shear Strength as determined by

In-Situ Field Vane	400- > 2000	1600
Unconfined Compression Test	1000	

These results indicate the material is an inorganic clay of low to medium plasticity (CL to CI). The consistency of the silty clay stratum ranged from stiff to firm with increasing depth.

Layers of Silty Clay and Silty Sand, some Gravel

Below the silty clay stratum were layers of silty clay of slight plasticity and layers of silty sand, some gravel. This layered deposit was penetrated to a maximum thickness of 7 ft. (2.4 m) before borings were terminated.

Based on augering operations and 'N' values, the consistency of the cohesive layers can be assessed as being generally stiff to hard, and the granular portion as very dense.

MBF

12/11

Groundwater

Due to the marshy nature of areas in the vicinity of the noise barrier path, as well as visible free water at various locations, groundwater levels can be assumed to be at or immediately below natural ground surface.

DISCUSSIONS AND RECOMMENDATIONS

It is proposed to erect approximately 0.6 miles (0.9 km) of noise barriers within the Highway 401 right-of-way between Lynde Creek and Henry St., west of the City of Oshawa.

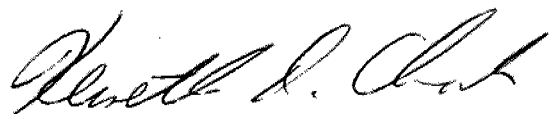
Borings carried out at selected locations along the path of the proposed noise barriers indicate the subsoils are fairly uniform in composition within the project area. Reference should be made to the attached Summary of Borehole Sheets for subsoil data.

Due to the effects of wind loading on the noise barrier wall system, the caisson foundations will be required to resist horizontal loads while minimizing the deflection required to mobilize subgrade reaction of the surrounding subsoils.

Analysis was carried out based on strength characteristics of the fill material and subsoil data, and using a standard 18 in. (0.5m) Ø concrete caisson.

Results indicate that to insure stability of the noise barrier system, the 18" Ø concrete caisson should be embedded a minimum of 12 feet below ground surface along the entire length of the noise barrier alignment.

Due to the high water table along the noise barrier alignment, and the relatively loose nature of surficial soils, holes should be cased prior to placement of the concrete caissons. It is also recommended that caissons be placed to the required depth prior to the removal of the casing.



K.D. Chak
Trainee Engineer

For: M. Devata, P. Eng.
Senior Foundations Engineer

KDC:syc

Att.

SUMMARY OF FOUNDATION INVESTIGATION FIELDWORK

<u>B.H.#</u>	<u>Elevation</u>	<u>Station and Offset*</u>	<u>Subsurface Conditions</u>	<u>'N' Values (Blows/ft.)</u>
1	265+	184+00, Lt. 280'	0 - 7' Cohesive Fill Matl. Firm to Stiff 7 - 14.5' Silty Clay, trace Sand Hard to Firm 14.5 - 21.5'+ Silty Clay and Silty Sand (Layers) Hard or Very Dense	5 to 6 27 to 5 55
2	265+	180+00, Lt. 280'	0 - 8' Cohesive Fill Matl. Firm to Soft (Silty Sand with Organics 5' - 6.5') 8 - 14.5' Silty Clay, trace Sand Stiff 14.5 - 21.5'+ Silty Clay and Silty Sand (Layers) Hard or Very Dense	4 to 3 10 to 15 18 to 52
3	266+	175+00, Lt. 390'	0 - 7' Cohesive Fill Matl. Very Soft to Hard 7 - 12.5'+ Silty Sand with Gravel Very Dense	2 to 51 49 to 88
4	270+	172+75, Lt. 390'	0 - 6.5' Fine Sand, some Silt Very Loose to Compact 6.5 - 18.5' Silty Clay, trace Sand Stiff to Firm 18.5 - 21.5'+ Silty Clay and Silty Sand (Layers) Hard or Very Dense	1 to 11 10 to 6 35

* Station and Offset taken from Highway 401 Centreline Chainage.

cont'd.

<u>B.H.#</u>	<u>Elevation</u>	<u>Station and Offset*</u>	<u>Subsurface Conditions</u>	<u>'N' Values (Blows/ft.)</u>
5	257.5'	163+75, Lt. 380'	0 - 2' Cohesive Fill Matl. Firm	3
			2 - 7' Silty Clay, trace Sand Very Stiff to Firm	24 to 8
			7 - 14.0'+ Silty Clay and Silty Sand (Layers) Hard or Very Dense	10 to 43
6	262+	157+50, Lt. 350'	0 - 2' Cohesive Fill Matl. Firm	4
			2 - 13.3' Silty Clay, trace Sand Very Stiff to Firm	16 to 4
			13.3 - 21.5'+ Silty Clay and Silty Sand (Layers) Hard or Very Dense	44 to 60

RECORD OF BOREHOLE No /

W P 168-81-01 LOCATION Sta. 184+00 21' Lt. of trav. edge of pavement ORIGINATED BY KC
DIST 6 HWY 401 BOREHOLE TYPE Hollow Stem COMPILED BY KC
DATUM Geodetic DATE 82 11 2 CHECKED BY

[illegible]

+3, x5: Numbers refer to Sensitivity

W P 168-81-01 LOCATION Sta. 180+00 21' Lt. of trav. edge of pavement ORIGINATED BY KC
DIST 6 HWY 401 BOREHOLE TYPE Hollow Stem COMPILED BY KC
DATUM Geodetic DATE 82 11 2 CHECKED BY _____

+3, x5: Numbers refer to Sensitivity



RECORD OF BOREHOLE No 3

W P 168-81-01 LOCATION Sta 175+00 30' Lt of Trav. edge of pavement ORIGINATED BY KC
DIST 6 HWY 401 BOREHOLE TYPE Hollow Stem COMPILED BY KC
DATUM Geodetic DATE 82 11 3 CHECKED BY _____

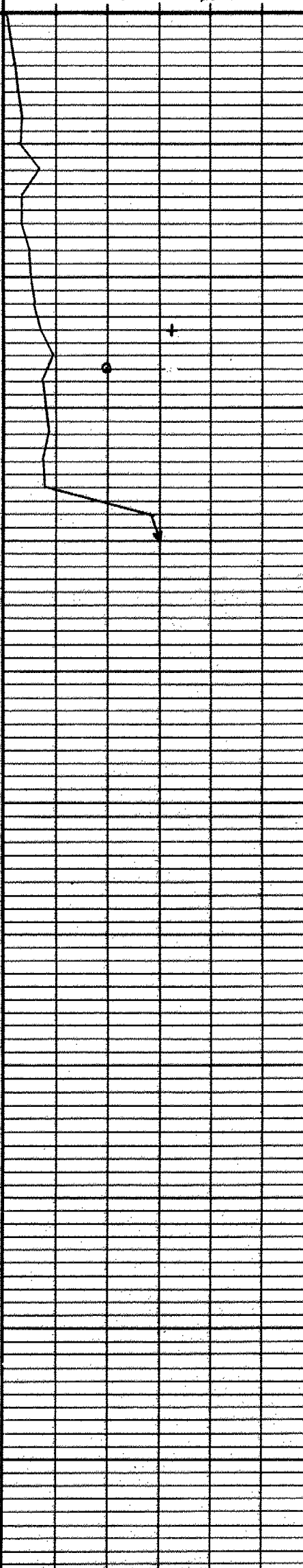
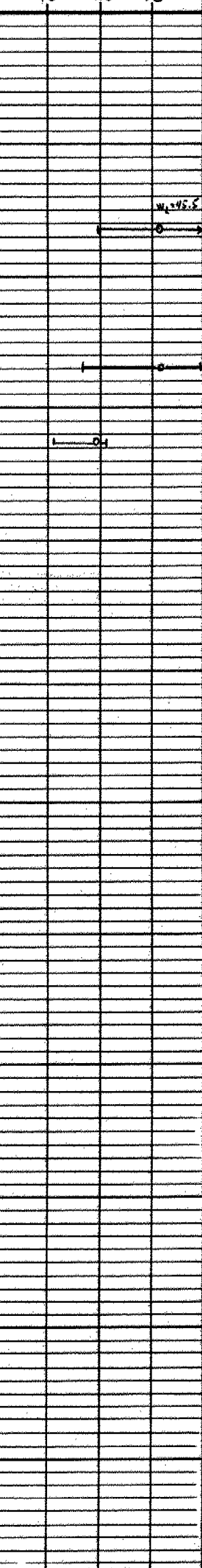
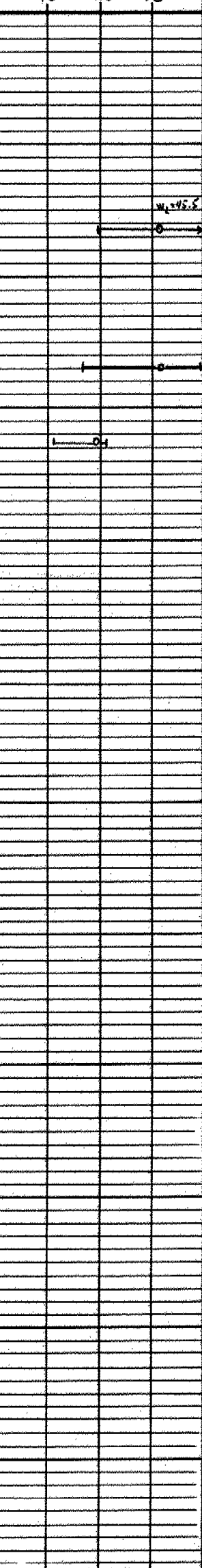
[illegible]

+3, x⁵ : Numbers refer to Sensitivity

20
15 ϕ 5 (%) STRAIN AT FAILURE
10

RECORD OF BOREHOLE No 4

W P 168-81-01 LOCATION Sta 172+75 ORIGINATED BY KC
DIST 6 HWY 401 BOREHOLE TYPE Hollow Stem COMPILED BY KC
DATUM Geodetic DATE 82 11 3 CHECKED BY _____

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION SCALE	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 SHEAR STRENGTH ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB VANE 1000 2000	PLASTIC LIMIT W _p NATURAL MOISTURE CONTENT W LIQUID LIMIT W _L WATER CONTENT (%) 10 20 30	UNIT WEIGHT γ pcf	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL					
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	'N' VALUES											
270 0.0	Fine Sand Some silt, trace of clay Brown Very loose to Compact		1	SS	1	11 11	265				0-77-17-6					
			2	SS	1											
			3	SS	11											
263.5 6.5	Silty Clay of low to Medium PLASTICITY trace of sand Brown to Grey Stiff to Firm		4	SS	10							260			0-4-56-40	
			5	SS	8											
			5A	TN	PH											
	6	SS	6	255												
254 16.0	Layers of Silty Clay of Slight Plasticity and Silty Sand, some gravel Grey Hard to Very Dense		7			SS	35									
248.5 21.5								End of Borehole								
25 25																
30 30																
35 35																

+3, x5: Numbers refer to
Sensitivity

20
15 5 (%) STRAIN AT FAILURE
10

W P 168-81-01 LOCATION Sta 163+75 30' Lt of trav. edge of pavement ORIGINATED BY KC
DIST 6 HWY 401 BOREHOLE TYPE Hollow Stem COMPILED BY KC
DATUM Geodetic DATE 82 11 3 CHECKED BY _____

+3, x5: Numbers refer to Sensitivity

W P 168-81-01 LOCATION Sta 157+50 35' Lt. of trav. edge of pavement ORIGINATED BY KC
DIST 6 HWY 401 BOREHOLE TYPE Hollow Stem COMPILED BY KC
DATUM Geodetic DATE 82 11 3 CHECKED BY _____

+3, x5: Numbers refer to Sensitivity