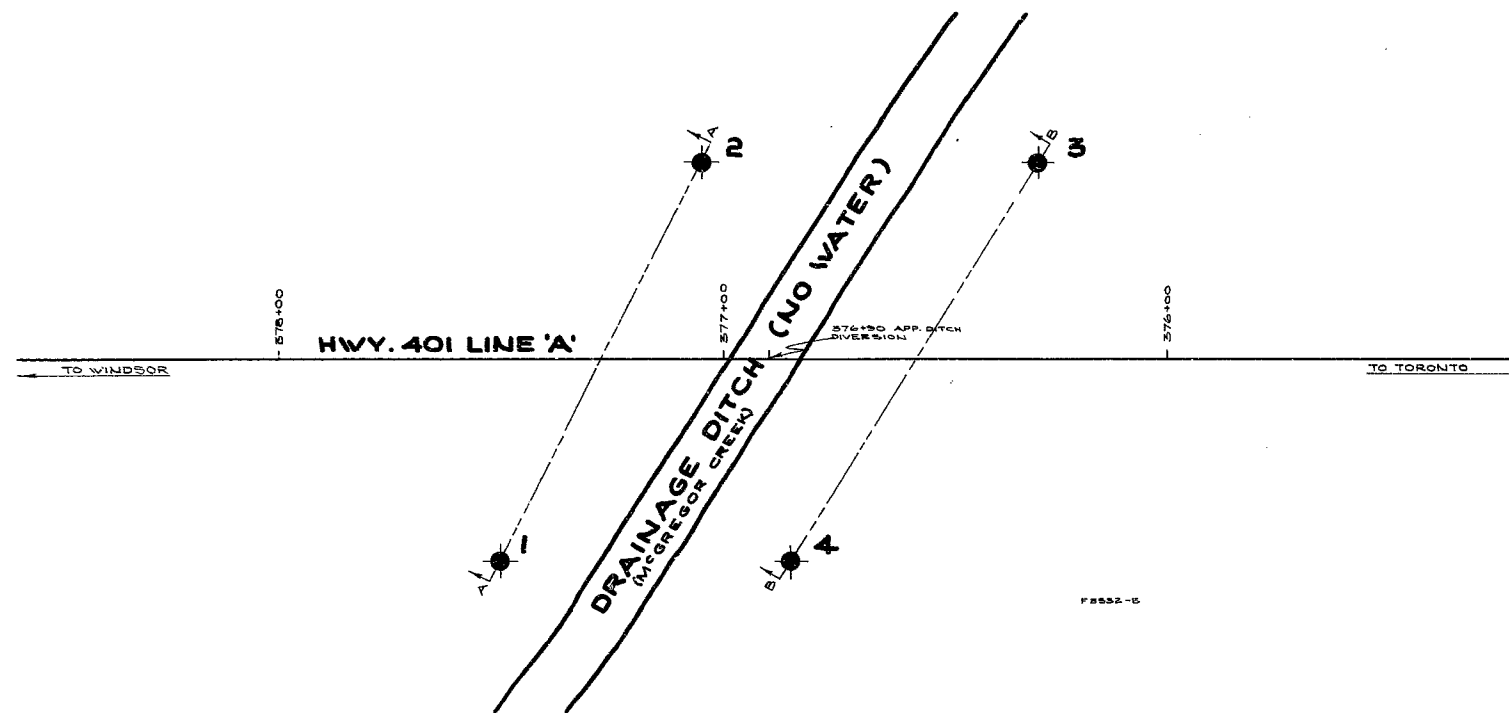
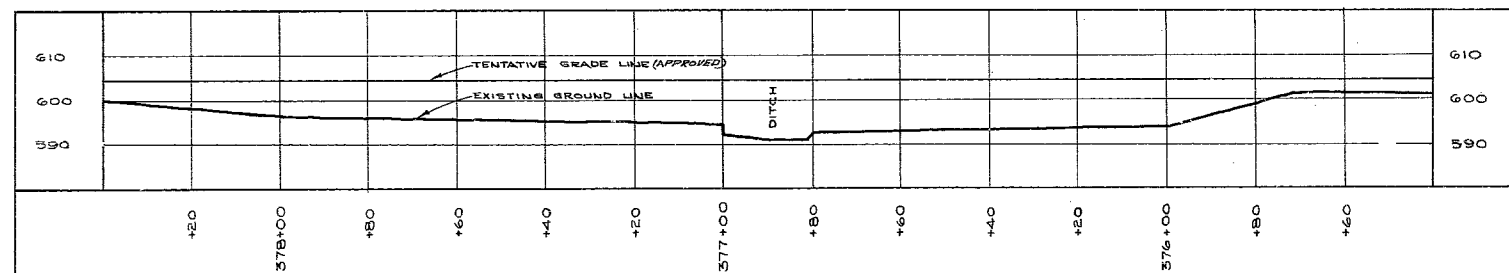


#59-F-73  
W.P. 16-59  
HWY. 401 &  
MCGREGOR CR.  
DIV. DIST. # I

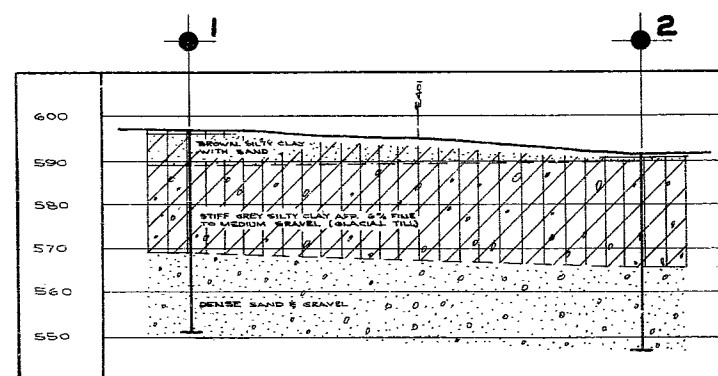




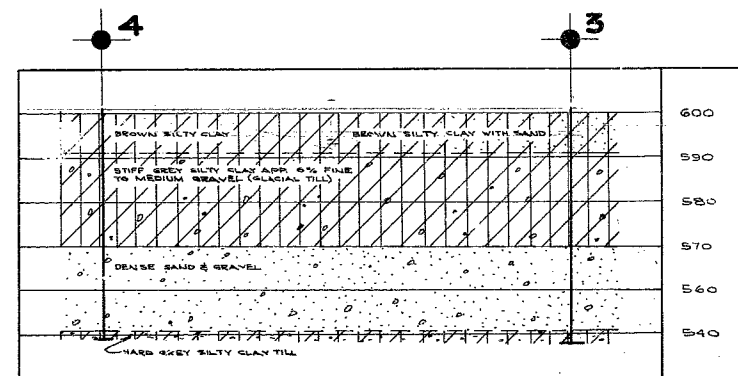
PLAN



PROFILE

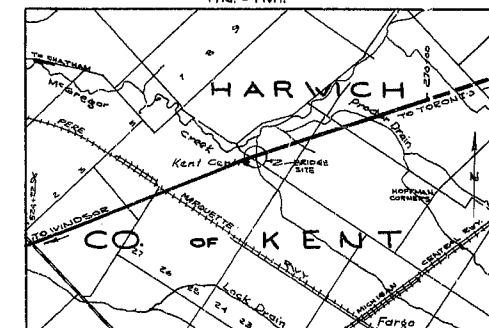


A-A



B-B

KEY PLAN



LEGEND

BORE HOLE  
PENETRATION HOLE  
BORE & PENETRATION HOLE

HOLE NO.	ELEVATION	STATION	DISTANCE FROM
1	597.0'	577+50	45' LT.
2	592.0'	577+05	45' RT.
3	601.0'	576+30	45' RT.
4	601.0'	576+25	45' LT.

- NOTE -

THE BOUNDARIES BETWEEN SOIL STRATA HAVE BEEN ESTABLISHED ONLY AT BORE HOLE LOCATIONS. BETWEEN BORE HOLES THE BOUNDARIES ARE ASSUMED FROM GEOLOGICAL EVIDENCE AND MAY BE SUBJECT TO CONSIDERABLE ERROR.

401B-13  
GEOCRES No.

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & RESEARCH SECTION

## DRAINAGE DITCH PROPOSED CROSSING

SHOWING POSITIONS & ELEVATIONS OF HOLES

HWY. 401 DISTRICT 1 COUNTY KENT  
TOWNSHIP HARWICH LOT 26 CON. 11/12  
LOCATION APP. 3/4 MILE SE CHADHAM

DRAWN BY: T. MELLORS  
DATE: 25 MAY 1959  
SCALE: 1 IN. = 20 M.

CHECKED BY:  
APPROVED BY:

W.P. 10-59  
DRAWING NO.  
**F59-33A**

Mr. A. M. Toye,

August 17, 1959.

Bridge Engineer.

Re: FOUNDATION REPORT -

Materials & Research Section.

W.J. F-59-73 -- W.P. 16-59.

Attention: Mr. S. McCombie.

Hwy. 401 Line 'A' & McGregor Creek Diversion Crossing,  
Approx. 8 miles S.E. of Chatham (at Kent Centre)  
Lots 25 & 26, Con. I E.C.R., Twp. of Harwich.

Enclosed herewith is our detailed report on the foundation investigation at the above noted structure site. A realignment of the creek resulted in a change in structure location and necessitated additional borings. The attached report presents the results of the three additional borings carried out at the final proposed creek diversion crossing site.

For your convenience, principal comments contained in this report are summarized as follows:-

1. Subsoil consists of a dense clay till stratum intercepted by a layer of water-bearing sand and gravel.
2. Strength and compressibility characteristics are such that spread footing support can be obtained in the upper dense clay till. A safe allowable footing pressure of 2 1/2 t.s.f. is recommended. Final depth of footings to be founded will depend on the realigned channel of the creek. To avoid undermining of the footings due to stream erosion and scour, and to allow for future deepening of the creek channel, it is recommended that footings be founded at Elev. 585' (approx. 6 ft. below stream-bed, assuming stream-bed elevation of creek diversion at approx. Elev. 591') or below.

cont'd. /2 ...

Principal Comments: (cont'd.) ...

3. An artesian water condition was noted in the underlying sand and gravel layer during the boring programme. To guard against "piping" during footing excavations, it is recommended that footings should not be founded below Elev. 580'. No excessive seepage problems during footing excavations are anticipated, if footings are founded above Elev. 580'.
4. No approach fill stability problems are anticipated.

L. G. Soderman,  
PRINCIPAL SOILS & FOUNDATIONS ENGR.  
per:

*AKL*

AKL/Mdef  
Encl.

(A. K. Loh,  
Project Foundation Engineer)

cc: Messrs. A. M. Taya  
H. A. Tregaskes  
D. G. Ramsay  
A. Gater  
G. U. Howell  
J. Roy  
A. Watt  
Foundation Office  
Gen. Files

# FOUNDATION REPORT

on

Hwy. 401 Line 'A' & McGregor Creek Diversion Crossing  
Approx. 8 miles S.E. of Chatham (at Kent Centre)  
Lots 25 & 26, Cen. I E.C.R., Twp. of Harwich.

---

Bridge Office Dwg. No: BW-285.  
Plan No: F-3532-1.  
Profile No: F-3532-3.  
Chainage: Sta. 372+80.

## Distribution:

Mr. A. M. Towe,  
Bridge Engineer. (2)

Mr. H. A. Tregaskes,  
Construction Engineer. (1)

Mr. D. G. Ramsay,  
Rd. Design Engineer. (1)

Mr. A. Gater,  
Sr. Proj. Design Engineer. (1)

Mr. G. U. Howell,  
District Engr., Chatham. (1)

Mr. J. Roy,  
Regional Soils Engr. (1)

Mr. A. Watt,  
Ont. Water Resources Commission. (1)

Foundation Section. (1)

Gen. Files. (1)

W.J. F-59-73.

W.P. 16-59.

## INTRODUCTION:

Presented in this report are the results of a subsoil investigation carried out at a structure location approximately 8 miles southeast of Chatham (at Kent Centre) where proposed Highway 401 line 'A' crosses the McGreger Creek diversion in Lot 25 & 26, Con. I, township of Harwich (Sta. 372+80, Profile No. F-3532-3). This report contains field and laboratory findings and recommendations for the foundation of the structure.

The field work commenced on July 20, 1959 and was completed on July 21, 1959.

An initial subsoil investigation was carried out between April 24 and April 25, 1959, approximately 400 feet west of the proposed site at the existing Creek Crossing (Sta. 376+90, Profile No. F-3532-3). After the completion of this investigation a creek diversion was proposed at Sta. 372+80. This initial investigation consisting of 4 sampled boreholes was carried out by a continuous flight auger, adapted for soil sampling. Results of this initial investigation are not presented in this report but are kept for references.

## DESCRIPTION OF THE SITE AND GEOLOGY

The site and its surrounding areas are generally flat farmlands. The crossing site is located on a cornfield presently under cultivation. Approximately 400 feet west of the site, McGreger Creek meanders on a rather sharp-bottom valley, flowing at a moderate velocity. During spring run-off it has

been reported that half of the valley was flooded. At the time of the investigation, the stream bed of the creek was covered with approximately 2 feet of water. Some minor erosion due to scour are exhibited along the banks of the creek.

Physiographically, the site under consideration is located on a bevelled till plain between the Bothwell sand plain and St. Clair Clay Plains. At this site the dense clay till was found to be overlain by the topsoil only.

#### FIELDWORK

The fieldwork associated with this investigation was carried out on 2 separate occasions. An initial boring programme consisting of 4 sampled boreholes was carried out at the existing McGregor Creek Crossing between April 24 and April 25, 1959 at Sta. 376+90. After the completion of this investigation a creek diversion was proposed at Sta. 372+80. As a result of this change in structure location, a second investigation consisting of 3 sampled boreholes, was carried out by a continuous flight auger adapted for soil sampling between July 20 and July 21, 1959. This investigation confirmed similar subsoil findings at both investigated sites.

Boreholes were advanced by conventional auger boring procedures. Samples were recovered at depth required by means of a 2" O.D. split barrelled spoon sampler. The dimensions of this spoon sampler and the energy used to drive it conform to the requirements of the Standard Penetration Test. Immediately upon recovery, samples were visually examined and identified



and placed in moisture proof containers for transport to our laboratory. Upon receipt in the laboratory samples were visually examined and identified. Routine index tests were carried out on selected representative samples. Laboratory test results have been presented in the borehole logs and detailed in Table No. 1 under Appendix I.

The location plan and subsoil profile are presented in Drawing No. F-59-73A.

#### SUBSOIL CONDITIONS

The site is underlain by a dense clay till stratum intercepted by a layer of water-bearing sand and gravel.

In each of the sampled boreholes, the topsoil was found to be underlain by the dense fissured silty clay till, the upper 6 feet of which contains organic matter and has been oxidized to its present brownish colour. Underneath the upper dense clay till stratum, a layer of water-bearing sand and gravel was intercepted at Elev. 569.5' in Boring 1 (approximately 32 ft. in depth), Elev. 561.5' in Boring 2 (approximately 40 ft. depth), and Elev. 573.5' in Boring 3 (approximately 28 ft. depth). This layer of sand and gravel was not fully explored due to "cave in" of the auger holes when this layer was encountered during the boring programme. Reference to our initial boring data at the existing McGregor Creek Crossing shows that this layer of sand and gravel is approximately 19 ft. in thickness and exists in a dense condition. It is underlain by dense clay till of similar deposits as the upper dense clay till. This lower clay till stratum was explored for a distance of 3 ft. in our initial investigation at the existing McGregor Creek Crossing.

In general the soil types encountered are as follows:-

1. Upper Dense Clay Till

This upper stratum of dense clay till, believed to be the result of glaciations was encountered immediately below the topsoil. The upper 6 feet contains decayed and organic matter and has been subjected to oxidation resulting in its present brownish colour. Below the oxidized zone the colour is predominantly grey. The silty clay till is fissured and contains predominantly clay and silt with various percentages of sand and gravel. The average unit weight and moisture content were found to be 138 p.c.f. and 16%. It is of very low plasticity. Due to the gravelly and fissured nature of the dense silty clay till, laboratory strength tests cannot be carried out on the samples. Field tests show an "N" value (standard penetration resistance expressed in blows per foot) of 23 to be representative for the stratum.

2. Sand and Gravel

This formation believed to be of post-glacial origin was encountered immediately below the upper dense clay till stratum. It was intercepted at Elev. 569.5' (approximately 32 ft. depths) in Boring 1, Elev. 561.5' (approximately 40 ft. depth) in Boring 2 and Elev. 573.5' (approximately 28 ft. depth) in Boring 3. According to our boring data at the existing McGregor Creek Crossing, this layer is of the order of 19 ft. in thickness. The material contains predominately fine sand and medium gravel and is water bearing. It exists in a dense condition. An artesian water condition was noted in this layer of sand and gravel and will be discussed under "Water Conditions".

### 3. Lower Dense Clay Till

This stratum was not explored at this site, but in view of the similarity in geological formation as well as subsoil conditions between this site and the existing McGregor Creek Crossing site previously investigated, it is believed that similar stratifications are likely to be encountered here at this creek diversion site. Reference to this previous investigation shows that this lower stratum was encountered immediately below the layer of sand and gravel. The materials are of similar deposits as the upper clay till stratum. The clay till here exists in a very dense condition with "N" values in excess of 50 registered during the field sampling operations. According to available geological information this clay till extends to a considerable depth over limestone bedrock.

The field and laboratory test results have been summarized in Table No. 1 and are included in this report under Appendix I.

### WATER CONDITIONS

Due to the impermeable nature of the clay till it was not possible to accurately establish the ground water table at the site during the boring programme. All the samples obtained below the normal McGregor Creek water level were saturated and it has been assumed that the ground water table is at or close to the creek water level at approximately Elev. 593'.

Artesian water conditions were noted in each of the sampled boreholes when the layer of sand and gravel was en-

countered. The condition was encountered at Elev. 569.5' in Boring 1, Elev. 561.5' in Boring 2 and Elev. 573.5' in Boring 3. The excess hydrostatic head reached Elev. 585.5' in Boring 1, Elev. 581.5' in Boring 2 and Elev. 588' in Boring 3. The critical elevation below which "piping" occurs during footing excavations has been estimated to be at 576' in Boring 1, 570 in Boring 2, and 580 in Boring 3.

#### FOUNDATION CONSIDERATIONS

The upper dense clay till is competent to provide adequate foundation support for the structure. Subsoil conditions are such that at Elev. 590' or below spread footing support can be obtained in the dense clay till. At this elevation or below, for footings of 7' to 10' wide, a bearing pressure of 2½ t.s.f. incorporating a safety factor of 3 can be used for spread footing design. Settlement consequent upon application of this bearing pressure will be within tolerable limits. To avoid undermining of the footings due to stream erosion and scour and to allow for future deepening of the creek channel, considerations should be given to founding the footings at an elevation below the stream-bed. In view of the fact that Mcgreger Creek is relatively active, it is recommended that footings should be founded at Elev. 585' (approximately 6 ft. below stream-bed assuming stream-bed elevation of creek diversion at 591'.) or below. In order to guard against "piping" during footing excavations due to the artesian water conditions encountered in the underlying sand and gravel layer, they

should not be placed below Elev. 580'. No excessive seepage problems are anticipated if footings are founded above Elev. 580'.

Under the proposed grade line, the maximum height of fill is approximately 3 ft. The subsoil can safely support this embankment loading.

#### CONCLUSIONS & RECOMMENDATIONS

1. The site is underlain by a dense clay till stratum intercepted by a layer of water-bearing sand and gravel.
2. Subsoil conditions are such that at Elev. 590' or below spread footing support can be obtained in the dense clay till. At this elevation or below for footings of 7' to 10' wide a bearing pressure of  $2\frac{1}{2}$  t.s.f. can be used in spread footing design. Settlement consequent upon application of this bearing pressure will be within tolerable limits. In order to avoid undermining of the footings due to stream erosion and scour and to allow for future deepening of the Creek channel, it is recommended that footings should be founded at Elev. 585' (approximately 6 ft. below stream-bed assuming stream-bed elevation of creek diversion at approximately Elev. 591') or below.
3. To guard against "piping" during footing excavations due to the artesian water conditions encountered in the underlying sand and gravel layer, footings should not be founded below Elev. 580'. No excessive seepage problems during footing excavations are anticipated if footings are founded above Elev. 580'.
4. No approach fill stability problems are anticipated.

*AKGL*  
A. K. Loh  
Foundation Project Engineer

APPENDIX I.

W.P. 16 - 59

W.P. - 16 - 59 ----- BORE HOLE NO. - 1 -  
JOB E 59 - 73 ----- STATION 373+00 (50' RT)  
ELEVATION 601.5' ----- COMPILED BY - B.K. -  
BORING DATE July 21/59 ----- CHECKED BY - A.L. -

2" DIA. SPLIT TUBE \_\_\_\_\_  
2" SHELBY TUBE \_\_\_\_\_  
2" SPLIT TUBE \_\_\_\_\_  
2" DIA. CONE \_\_\_\_\_  
2" SHELBY \_\_\_\_\_  
CASING \_\_\_\_\_

1/2 UNCONFINED COMPRESSION (Qu) --- O  
VANE TEST (C) AND SENSITIVITY (S) --- +  
NATURAL MOISTURE AND --- L  
LIQUIDITY INDEX --- X  
LIQUID LIMIT ---  
PLASTIC LIMIT ---

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE		CONSISTENCY		SAMPLE	NATURAL UNIT WT. P.C.F.
				P.S.F.	BLOWS/FT.	MOIST. CONTENT- % DRY WT.			
	↓ Ground level		0						
	topsoil	601.5							
	Brown fine sand with organic matter	598.5							
	Stiff grey-brown fissured sandy clay with organic matter	595.5							
	Dense grey fissured silty clay till, gravelly								
		569.5							
	Sand & gravel (water-bearing)	566.0							
	End of borehole								
	Artesian water conditions @ Elevation 569.5' - excess hydrostatic head reached Elevation 585.5'								

B.H. 1



B.H. 2

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS AND RESEARCH SECTION

W.P. 16 - 59 BORE HOLE NO. 3  
JOB F 59 - 73 STATION 372+59 (E)  
DATUM 601.5' COMPILED BY B.K.  
BORING DATE July 20/59 CHECKED BY A.L.

2" DIA. SPLIT TUBE  
2" SHELBY TUBE  
2" SPLIT TUBE  
2" DIA. CONE  
2" SHELBY  
CASING

LEGEND

1/2 UNCONFINED COMPRESSION (Qu) O  
VANE TEST (C) AND SENSITIVITY (S) +  
NATURAL MOISTURE AND LIQUIDITY INDEX LI  
LIQUID LIMIT X  
PLASTIC LIMIT

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET	STRENGTH AND PENETRATION RESISTANCE		CONSISTENCY			SAMPLE	NATURAL UNIT WT. P.C.F.
				P.S.F.		MOIST. CONTENT - % DRY WT.				
	↓ Ground level	601.5	0	25 50		10 20 30				
	topsoil	601.0								
	Stiff brown fissured silty clay with organic matter									
	Dense grey-brown fissured silty clay till, gravelly	595.5							S1	132.0
		592.5	10						S2	138.2
	Dense grey fissured silty clay till, gravelly								S3	135.8
			20						S4	131.8
									S5	136.1
	Fine silty sand (water-bearing)	573.5	30						S6	--
		570.0								
	End of borehole		40							
	Artesian water condition @ Elev. 573.5' - excess hydrostatic head reached Elev. 588'									

Cone Penetration  
Ref. to Elev. 568.5'

B.H. 3