

#

58-F-256C

RANDALL-REBECCA

STREET

OAKVILLE T.

58-F-256C

Mr. A.M. Toye.
Bridge Engineer.
Materials & Research Section.

October 28th, 1958.
Re: Randall-Rebecca Street
Bridge, Town of Oakville.

Attention: Mr. K.L. Kleinstoiber.

We have reviewed the report and recommendations of the Consultants concerning this bridge, as requested by your memorandum of October 17th, 1958, and wish to make the following remarks:-

1. Using the data from the subsurface investigation by the Raymond Concrete Pile Company, we fully agree that a 40' high fill could not possibly be supported by the soft and deep beds of organic silts and clays, with shear values obtained from unconfined compression tests in the order of 550 lbs/sq.ft. Even for a 20' high fill, settlement and fill failure could be expected on this type of subsoil. Dry unit weights of soil between 50 and 70 lbs/cu.ft. with moisture contents between 50% and 60% in borehole #12, between 11' and 47' below the surface, indicate that the soil could be quite compressible. Therefore a pile supported structure on end bearing piles will be required.
2. It appears that the structure could be shortened at the east end by some 50' and replaced by an earth fill (max. 22' high). Borehole 8 indicates 7' of sand and clay overburden over shale bedrock. The abutment here should be founded on rock. No stability problem exists for the earth embankment. At the location of borehole 7 (80' west of borehole 8) the required depth of fill would be 36'. From the limited data available from boring 7, it can only be assumed that the soil between 11' and 32' depth is of similar type and strength as the soil in borehole number 4 for which test results from borehole number 12 can be used.

contd. p.2.

3. Corrosion of steel piles (soil pH = 7.4) is not expected. However, pitting of the inside of shelly tubes, as mentioned in the soils report, could be due to the activity of sulphate reducing bacteria working in an anaerobic environment. Information on the performance of existing steel foundations in the valley would be of great use.
4. Referring to remark 1, no special care in order to prevent slope or foundation failure during pile driving is required.
5. The paragraph in the Consultants report dealing with the present bridge is extremely short. Nothing has been mentioned of the type of bridge, age, foundation, performance of substructure or super-structure and no details of the careful investigation of the physical condition are given.
6. In our opinion the presentation of the boring results, plan location boreholes and subsurface section across the valley in the soils report could stand improvement.

A number of vane shear tests in the field (undisturbed and remolded,) could have given correlation with the unconfined compression tests, which were only done on samples of Hole #12.

An accident like freezing of samples does not fit in a careful soil sampling operation required for obtaining undisturbed samples.

It is not mentioned in the report if the 2" OD samples were taken with the standard split spoon and we get the impression that classification of these samples was only done by the drilling foreman in the field, except for Holes #12, #13 and #14, in the second investigation.

We hope the above information is satisfactory and we are returning herewith the plans as requested.

A. HUTKA.
Acting Mat'ls & Research Engr.

per:



P. Arkema.

c.c. Mr. H. McMillan.
Mr. T. Kovich.
Gen. File.
enc. pa/ar/zv.

Memorandum for Mr. A.M. Toye
Bridge Engineer
Department of Highways

Att Mr K.L. Kleinstieber

Re Randall-Rebecca Street Bridge
Town of Oakville.

~~have~~
We reviewed the report and recommendations of the Consultants concerning this bridge and wish to make the following remarks.

~~requested by your memorandum of Oct 17, 1958~~

1 Using the data from the subsurface investigation by the Raymond Concrete Pile Company, we fully agree that a 40' high fill could not possibly be supported by the soft and deep beds of organic silts and clays, with shear values obtained from unconfined compression tests in the order of 550 lbs/sq. ft. Even for a 20' high fill, settlement and fill failure could be expected on this type of subsoil.

Dry ~~unit~~ ^{unit} weights of soil between 50 and 75 lbs/cuft with moisture contents between 50% and 80% in borehole #12 between 11' and 47' below the surface indicate that the soil could be quite compressible.

Therefore a pile supported structure on end bearing piles will be required.

2 It appears that the structure could be shortened at the east end by some 50' and replaced by an earth fill (max. 22' high). Borehole B indicates 7' of sand and clay overburden over shale bedrock. The abutment here should be founded on rock.

No stability problem exists for the earth embankment.

At the location of borehole 7 (80' west of borehole 8) the required depth of fill would be 36'. From the limited data available from boring 7 it can only be assumed that the soil between 11' and 32' depth is of similar type and strength as the soil in borehole number 4, for which test results from borehole number 12 can be used.

(Soil pH = 7.4)
3 Corrosion of steel piles due to the ~~pH of 7.4~~ ^{pH of 7.4} of the soil is not expected. However pitting of the inside of Shelby tubes as mentioned in the soils report could be due to the activity of sulphate reducing bacteria working in ~~an~~ an anaerobic environment. Information on the performance of existing steel foundations in the valley would be of great use.

4. Referring to remark 1, no special care in order to prevent slope or foundation failure during pile driving is required.

5

5 The paragraph in the Consultant's report dealing with the present bridge is extremely short. Nothing has been mentioned of the type of bridge, age, foundation, performance of substructure or superstructure and no details of the careful investigation of the physical condition are given.

6. In our opinion the presentation of the boring results plan location boreholes and subsurface section across the valley in the soils report could stand improvement.

A number of vane shear tests in the field (undisturbed and remolded) could have given correlation with the unconfined compression tests, which were only done on samples of Hole #12.

An accident like freezing of samples does not fit in a careful soil sampling operation required for obtaining undisturbed samples.

It is not mentioned in the report if the 2" OD samples were taken with the standard split spoon and we get the impression that ~~idea~~ classification of these samples was only done by the drilling foreman in the field, except for holes 12, 13 and 14. In the second investigation.

~~The organic matter content of 2.98% (boring 12 at 35') appears low considering the wet weight of the soil given in Fig 3 or 62.3 % wet wt~~

We hope the above information is satisfactory and we are returning herewith the plans

requested.

H. McMillan
T. Kavich
file





DEPARTMENT OF HIGHWAYS

Toronto 2, October 17th, 1958.

Memorandum for Mr. A. Rutka,
Acting Materials and Research Engineer,
Department of Highways,
Downsview, Ontario.

Re: Randall-Rebecca Street Bridge,
Town of Oakville.

Further to our memorandum of October 14th we are sending herewith one copy of the preliminary plans for this structure. We would appreciate the return of these plans along with your comments on the following:-

It is possible to shorten the structure by the addition of fill at the ends?

Are 'H' piles suitable for this site or should we recommend tube piles or precast concrete piles considering the pH of the soil?

Do we need to recommend care during pile driving in order to prevent slope or foundation failure?

K. L. KLEINSTEIBER
FOR A. M. TOYE
BRIDGE ENGINEER.

Encl
CLK*DW.



ONTARIO
DEPARTMENT OF HIGHWAYS

Toronto 2, October 14th, 1958.

Memorandum for Mr. A. Rutka,
Acting Materials and Research Engineer,
Department of Highways,
Downsview, Ontario.

Re: Randall-Rebecca Street Bridge,
Town of Oakville.

We are sending herewith one copy of the Preliminary Report by Philips and Roberts Limited along with a copy of the soils report that was compiled by Raymond Concrete Pile Company.

We would appreciate your comments and recommendations.

K. L. KLEINSTEIBER
FOR A. M. TOYE
BRIDGE ENGINEER.

Encls
KLK*DW.

RAYMOND CONCRETE PILE COMPANY, LIMITED

1900 Yonge Street
Toronto, Ontario

SOIL INVESTIGATION REPORT

for the

CORPORATION OF THE TOWN OF OAKVILLE

OAKVILLE, ONTARIO

PROJECT

BRIDGE SITE INVESTIGATION
REBECCA STREET BRIDGE
OAKVILLE, ONTARIO

Job No. B-705-T-L-38

June 12th, 1958.

I N T R O D U C T I O N

In April 1958, the Boring Division of the Raymond Concrete Pile Company, Limited was requested to investigate the site of the Rebecca Street Bridge in Oakville, Ontario, to obtain soils data for the design of a new structure or for enlarging the existing structure. Eleven boring locations were established by Philips and Roberts Limited, Consulting Engineers for the project. The results of these borings were reported in March under job No. B-705-T. During this investigation the Raymond Concrete Pile Company, Limited obtained several undisturbed soil samples. These were to be tested in the Laboratory for obtaining data for studying the stability of the bridge approaches if these were to be placed on about 40 ft. of fill. Due to unfortunate circumstances, the soil samples were frozen in transit to the Laboratory and had to be discarded.

In May 1958, two more borings were requested by the Consulting Engineers. The results of these two borings were submitted in June 1958, under job No. B-752-T. During the progress of this work, the Raymond Concrete Pile Company, Limited obtained several undisturbed Shelby tube samples from boring No. 13, and also made an additional boring (No. 12) adjacent to boring No. 4. This field work was done at no expense to the Corporation of the Town of Oakville. The samples obtained from these two borings were tested and the laboratory results are included in this report.

The site under investigation is the river bed of the 16 mile Creek at Rebecca Street. Figure 1 shows the location of the borings. Figure 2 shows the approximate profile of the river bed and approximate soil profile. Figures 3, 4, and 5 give a summary of the results of the Laboratory tests.

On the basis of field observations and laboratory tests, studies have been made of the probable behaviour of the soils under the proposed bridge loads. Suggestions are also included in this report regarding the foundations of the main bridge span and approaches.

SOIL CONDITIONS

The general soil profile is shown on Figure 2.

The soils encountered in practically all of the borings are typical of slow-moving water deposits. The original river bed was found to lie at a depth of about 60 ft. below present ground surface. It is composed of shale beds. Overlying the shale and extending almost to the surface are found strata of soft organic clays, silts and occasional thin layers of sand. As may be expected, the sandier soils are found closer to the shale banks where the river current would normally be slower. The five to ten ft. of soil at the surface are composed of miscellaneous fill.

The soil strata that are of concern to the foundation engineer are the thick beds of organic silts and clays which form the major portion of the soil deposits at the site.

This soil is extremely soft. It's high organic content may be judged by the change in the plasticity Index after oven-drying. A further indication of the organic content is the extremely low unit weight of the soil.

Not only is this soil extremely soft but it is also highly compressible. This may be judged by the high Liquid Limits and high water contents as shown on Figures 3 and 4. The lower limit of the Compression Index of such a soil may range from 0.5 to 0.8.

During examination of several of the undisturbed Shelby tube samples it was found that the containing tube was pitted or corroded on the inside. This led to the decision to test the soil for pH, sulphates and chlorides. The results of such tests may be useful in design considerations regarding steel or concrete that would come in contact with the soil. The soil was found to be quite alkaline; the quantities of sulphates and chlorides are given on Figure 5.

DESIGN CONSIDERATIONS & RECOMMENDATIONS

Consideration has been given to form the approaches of the bridge by placing some 40 ft. of fill over the existing Valley floor; however, this is not believed to be a satisfactory solution for the following reasons:

The highly organic soil on which this fill would be resting is extremely compressible. Being about 40 to 50 ft. thick this clay stratum would consolidate and cause the roadway to continue to settle over a long period of time - certainly over a period of several years. Due to subsoil consolidation alone, the settlement would be in the range of over 4 ft. In addition to direct consolidation, settlements may also result from gradual plastic yielding as well as from the decay of organic matter. Thus the overall settlement may be very high. A further inconvenience in using fill for the approaches is that such fill would have to be placed in controlled quantities in order not to overload the subsoil. Such placing would have to be carried out over a period of many months. This procedure would permit some consolidation and thus strengthening of the subsoil during construction.

Rapid loading may cause outright shear failure through the embankment and the underlying soil. Side slopes would also have to be rather flat because of the low shear values of the subsoil.

The exact procedure to be followed for the above construction if the approaches are to be made of fill may be determined from the information contained in this and the previous reports, however, no such calculations have been made. Such calculations are lengthy and will be made on request if the above-mentioned settlements are admissible.


It is understood that the Consulting Engineer is advising to place the main bridge span on piled foundations. This is believed to be the most reasonable and economical approach.

If any fill, or approach ramps are constructed adjacent to the piled foundation, some negative friction will result due to consolidation of the soft organic soils due to the fill load. It is suggested that such piles be designed to take an additional load of 200 to 300 lbs. per sq. ft. of surface which will be transmitted from the soil to the piles.

It is strongly recommended to carry both the approach road and main bridge span on piled foundations.

Piles should be driven to bedrock or into the dense till overlying the bedrock. It is suggested that the loading on the usual concrete cast-in-place or structural steel piles be limited to 60 tons. Higher loading, however, may be used if a pile load-testing program is specified.

RAYMOND CONCRETE PILE COMPANY, LIMITED



E. Rubinsky, P. Eng.
Soils Engineer

ER/h

SUMMARY OF SOIL LABORATORY TEST RESULTS

Job No. B-705-T-L-38

Boring No. 12 (Adjacent to No. 4)

Laboratory Test Results - See Note 1

<u>Depth</u>	<u>Description</u>	<u>U.C.</u>	<u>STRN.</u>	<u>Weight</u>	<u>W</u>	<u>LL</u>	<u>PL</u>	<u>PI</u>
10'9"	See Note 2	0.52	9	104.0	23.4	22	17.4	4.6
11'3"	See Note 2	0.56	11	109.5	20.8			
11'8"	See Note 3							
16'2"	See Note 4	0.62	7	54.0	75.3	97.0	59.4	37.6
"	"			Oven dried		57.0	47.4	9.6
16'8"	"	0.60	7.5	51.1	82.5			
26'8"	"	0.49	6	71.0	47.5			
37'0"	"	0.65	5	62.3	55.4			
45'8"	"	Too soft for testing			58.3			
46'8"	"	0.47	9.5	73.6	45.2	56.3	32.2	24.1

Note 1: Lab Tests UC Unconfined Compressive Strength - Tons/sq. ft.
 STRN Corresponding Strain - percent
 Weight Dry Unit Weight - lbs. per cu. ft.
 W Natural Water Content - Percent
 LL Liquid Limit - percent
 PL Plastic Limit - percent
 PI Plasticity Index

Note 2: Medium soft reddish grey slightly sandy slightly clayey silt of low compressibility with trace of organic matter and white shells.

Note 3: Extremely soft, highly compressible dark brown and black peat. Slight organic odour.

Note 4: Reddish-brown organic clay of very high compressibility containing pieces of wood, trace of shells and faint organic odour.

FIGURE 3

SUMMARY OF SOIL LABORATORY TEST RESULTS

Job No. B-705-T-L-38

Boring No. 13

Laboratory Test Results - See Note 1

<u>Depth</u>	<u>Description</u>	<u>U.C</u>	<u>STRN.</u>	<u>Weight</u>	<u>W</u>	<u>LL</u>	<u>PL</u>	<u>PI</u>
15'6"	See Note 2	0.85	9	73.0	47.0	-	-	-
35' to 40'	See Note 3	Strength test not possible due to sample composition.						

Note 1: Lab Tests:

UC	Unconfined Compressive Strength - Tons/sq/ft.
STRN	Corresponding Strain - percent.
Weight	Dry Unit Weight - lbs/per cu. ft.
W	Natural Water Content - Percent
LL	Liquid Limit - percent
PL	Plastic Limit - Percent
PI	Plasticity Index

Note 2: Medium soft reddish brown organic silty clay with occasional fine seams of fine silty sand and/or grey coarse sand. Trace of pieces of wood and shells.

Note 3: Layers of coarse brown and grey sand, pieces of wood and chunks and layers of grey clay and silty grey clay.

SUMMARY OF CHEMICAL LABORATORY TEST RESULTS

Job No. E-705-T-L-38

Soil Sample	pH	Soluble Sulphate SO ₄ mmg./100 gms. soil	Soluble Chloride Cl mmg./100 gms. soil	Organic Matter
Boring 12 depth 15'0"	7.6	46.4	6.4	not run
Boring 12 depth 35'0"	7.6	9.6	2.5	2.98
Boring 12 depth 45'8"	7.4	12.0	11.8	not run
Boring 12 depth 46'8"	7.3	24.6	10.1	not run
Boring 13 depth 41'0"	7.5	52.8	14.4	not run

This soil will cause slight corrosion of unprotected steel work.

FIGURE 5.

RAYMOND

CONCRETE PILE COMPANY LTD.

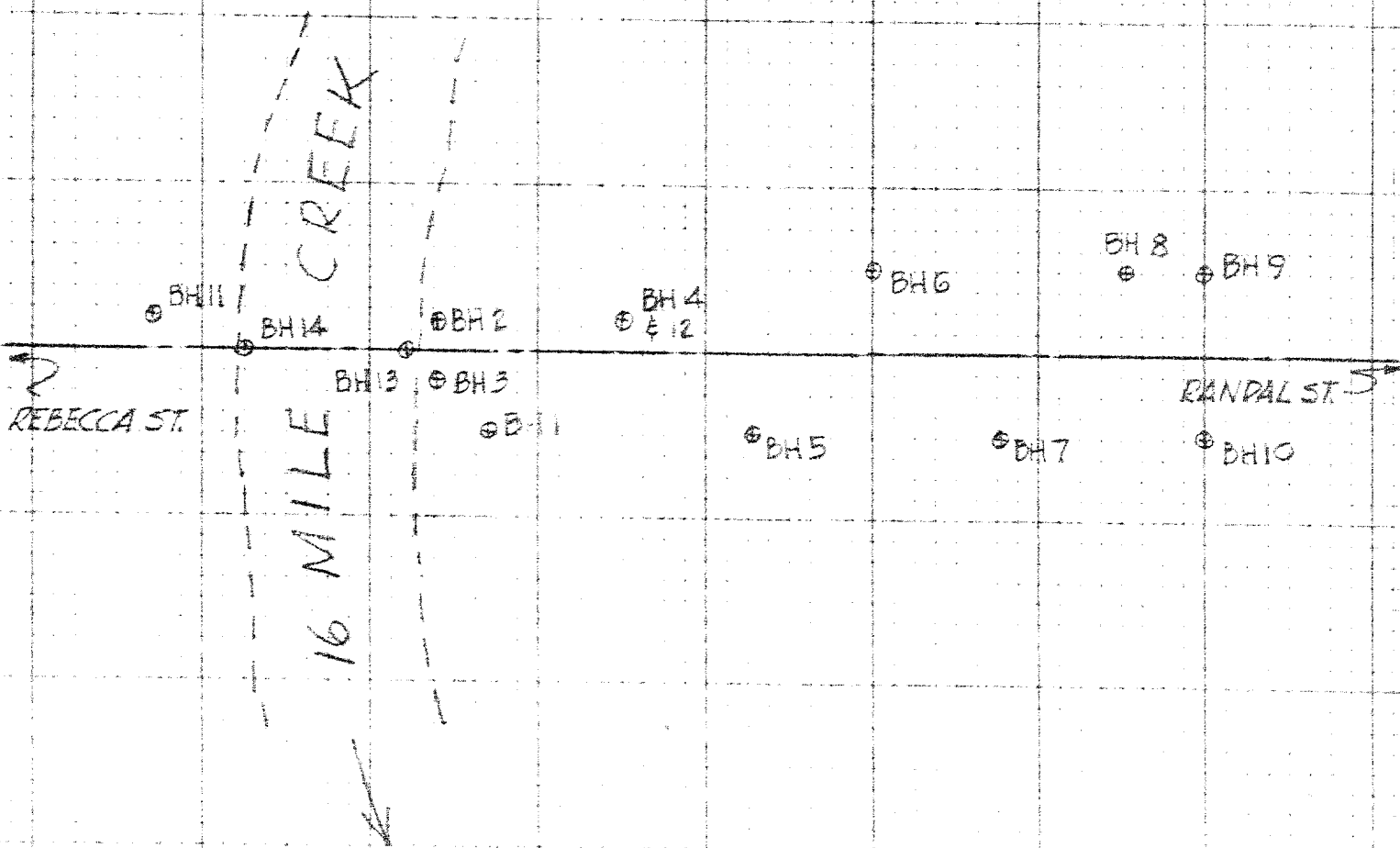
LOCATION PLAN

To CORPORATION OF OAKVILLE
 Address OAKVILLE, ONTARIO
 Project BRIDGE AT 16 MILE CREEK

Date

JUNE 12, 1958

SCALE 1" = 100'



Compass Points



This boring report prepared in the
 TORONTO OFFICE of the
 Raymond Concrete Pile Company Ltd.

By AE

Job No. B 705-71-38

FIG 1

RAYMOND

CONCRETE PILE COMPANY LTD.

LOCATION PLAN

To CORPORATION OF OAKVILLE

Date

JUNE 12, 1958

Address OAKVILLE, ONTARIO

Project BRIDGE AT 16 MILE CREEK

SCALE 1" = 100' VERT. & HORIZ.

REBECCA ST.

DUNDAS ST.

ELEV. 148.0

BRIDGE DECK ELEV. 150.0

ELEV. 142.0

ELEV. 106.0

ELEV. 110.0

ELEV. 110.0

ELEV. 115.0

BROWN ORGANIC CLAY & SILT WITH OCCASIONAL
POCKETS & LAYERS OF SAND & SILTY SAND
SHALE

VERTICAL SECTION THROUGH & OF
PROPOSED BRIDGE SITE

Compass Points



This boring report prepared in the
TORONTO OFFICE of the
Raymond Concrete Pile Company Ltd.

By AE

100-50-795-TL-38

FIG. 2

Mr. A. H. Toye,

July 17, 1961.

Bridge Engineer.

B.H.C. PILE LOADING TEST -

Materials & Research Section,
(Foundations Office).

W.J. 61-P-47 (Municipal Job).

Attention: Mr. L. L. Kleinaleiber.

Re: Rebecca St. Bridge - Oakville Creek,
Oakville, Ont., Dist. #6.

A pile loading test has recently been completed at the above site. The pile tested (Pile #5), was a 12 BP 53 located in the West abutment at Sta. 24+62; 3'-1" St. It had been driven 15' through mixed sand, gravel and clay into sound shale with a resultant pile tip elevation of 265.26'. For subsoil profile, see Appendix (B.H. #11 on Pwg. 1065-3, Philips & Roberts, Ltd.)

The pile was loaded for 26 hours and had a maximum applied load of 100 tons. Gross settlement for 100 tons was .17" of which .1125" was elastic compression of the pile, itself.

Upon removal of the load, the net settlement was 0.0575".
(See pile dwg. in App. I.)

If you desire any additional information concerning this investigation, please feel free to contact the Foundations Office.

CCC/wdeF
Attach.

cc: Messrs. A. H. Toye (2)
H. A. Fregaskes
H. D. McMillan
I. C. Campbell
L. O. Flander
F.J. Kovich

A. Watt
Philips & Roberts, Ltd.
Foundations Office
Gen. Files. ✓

L. G. Stierman,
PRINCIPAL FOUNDATION ENGR.
Per:

G. C. Cherrington
(G.C. Cherrington,
PROJECT FOUNDATION ENGR.)

Approved by:

L. G. Stierman
(L. G. Stierman,
SUPERVISING FOUNDATION ENGR.)

APPENDIX I.

PILE DRIVING LOG

Contractor/Sub Contractor
Job/Job No.
Pile Type & Section
Method
Hammer

BIRMINGHAM
1065/OAKVILLE ARBREA ST BRIDGE
12 BP 53
1 1/2 YD CRAWLER CRANE - HANGING LEADS
DELMAR 612 D1212

WEST MAIN CAVEMENT Description	P	L	L	E	N	II	M	B	E	R	
	5	16	3	17	18	19	20	1	4	2	6
Vertical	✓		✓					✓			✓
Batter		1:2 1/2		1:2 1/2	1 1/2	1:2 1/2	1:2 1/2		1:2 1/2	1:2 1/2	
Chainage	24+	62	66.5	62	66.5	66.5	66.5	62	62	62	62
Offset L.R.	3'-1 1/2"	3'-4 1/2"	15'-5 1/2"	9'-3 1/2"	15'-5 1/2"	21'-7 1/2"	22'-4 1/2"	22'-4 1/2"	9'-3 1/2"	21'-7 1/2"	3'-1 1/2"
Length Driven	25'	25'	16'	17'	17'	25'	25'	18'-5 1/2"	25'-00"	25'-00"	16'-6 1/2"
Splice Locations 1	-	-	-	-	-	-	-	-	-	-	-
From Point	2	-	-	-	-	-	-	-	-	-	-
Length Cut Off	4'70	8'66	0'00	2'08	0'00	7'00	10'26	2'00	8'25	7'00	1'33
Cut-Off Elevation	280.50	2°	0°	0°	0°	0°	0°	0°	0°	0°	0°
Length below Cutoff	15'30	16'34	16'00	14'02	17'00	18'00	14'25	16'58	16'75	18'00	15'33
Penetration/Blows	4"/15	4"/12	4"/15	4"/20	4"/15	4"/15	4"/18	4"/20	4"/20	4"/19	4"/17
	4"/15	4"/15	4"/15	4"/35	4"/25	4"/20	4"/20	4"/20	4"/25	4"/36	4"/18
	4"/50	4"/10	1"/10	4"/28	3"/100	1"/20	1"/20	4"/34	4"/60	1"/10	4"/50
								</			

NOTE: Enter in order of Driving.

Note any rejections or repairs on reverse. INSPECTOR R. E. MATTHEW

PHILIPS & ROBERTS LTD

PILE LOADING TEST #5
OAKVILLE-REBECCA ST BRIDGE
STA. 24+62 3'1" RT
61-F-47
DRIVEN - 5 MARCH, 1961
TESTED - 4 MAY, 1961
PILE TYPE - 12 SP 53
LENGTH DRIVEN - 25'
TIP ELEV. 245.25

LOAD IN TONS

MOVEMENT IN INCHES

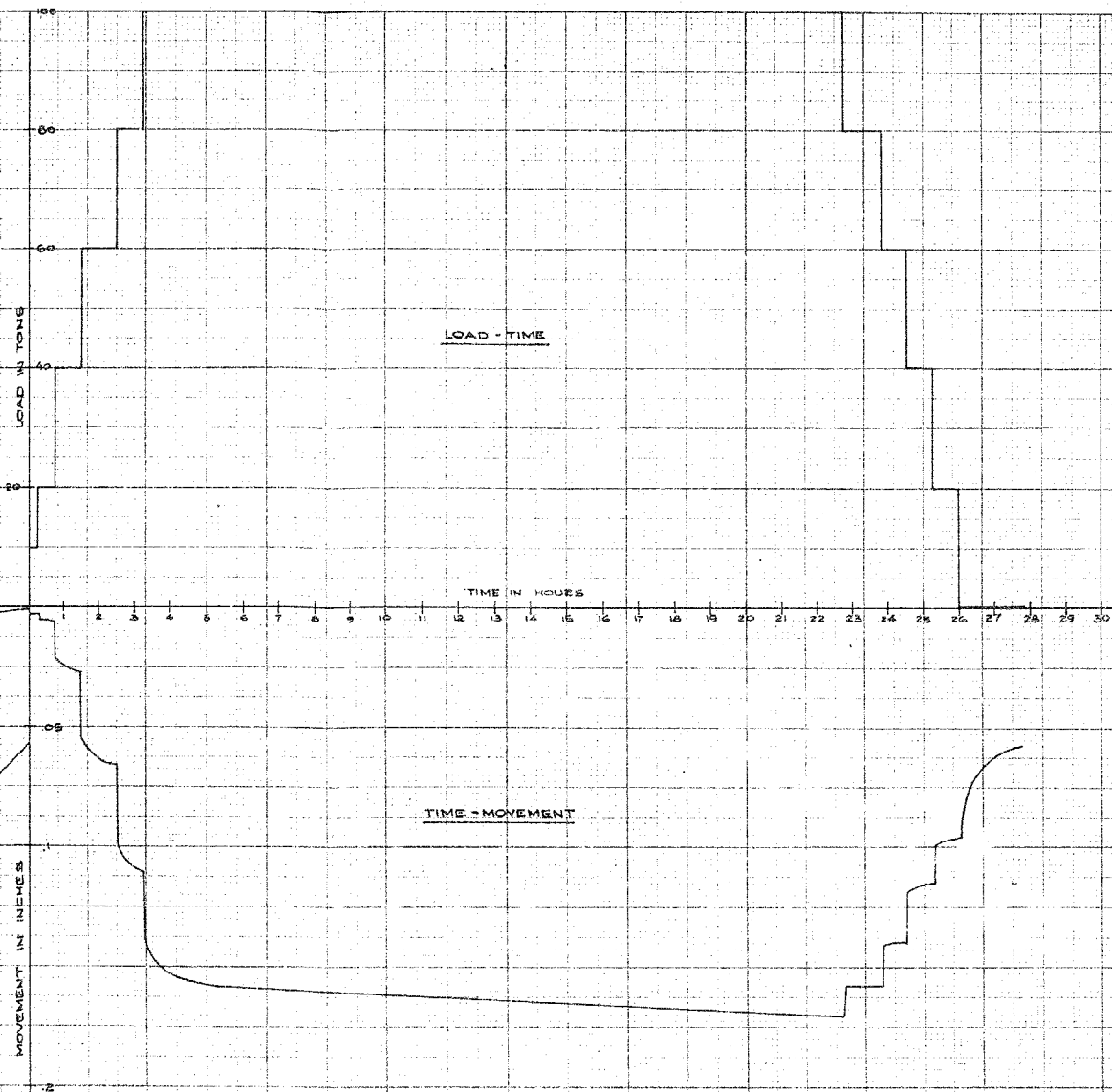
LOAD - TIME

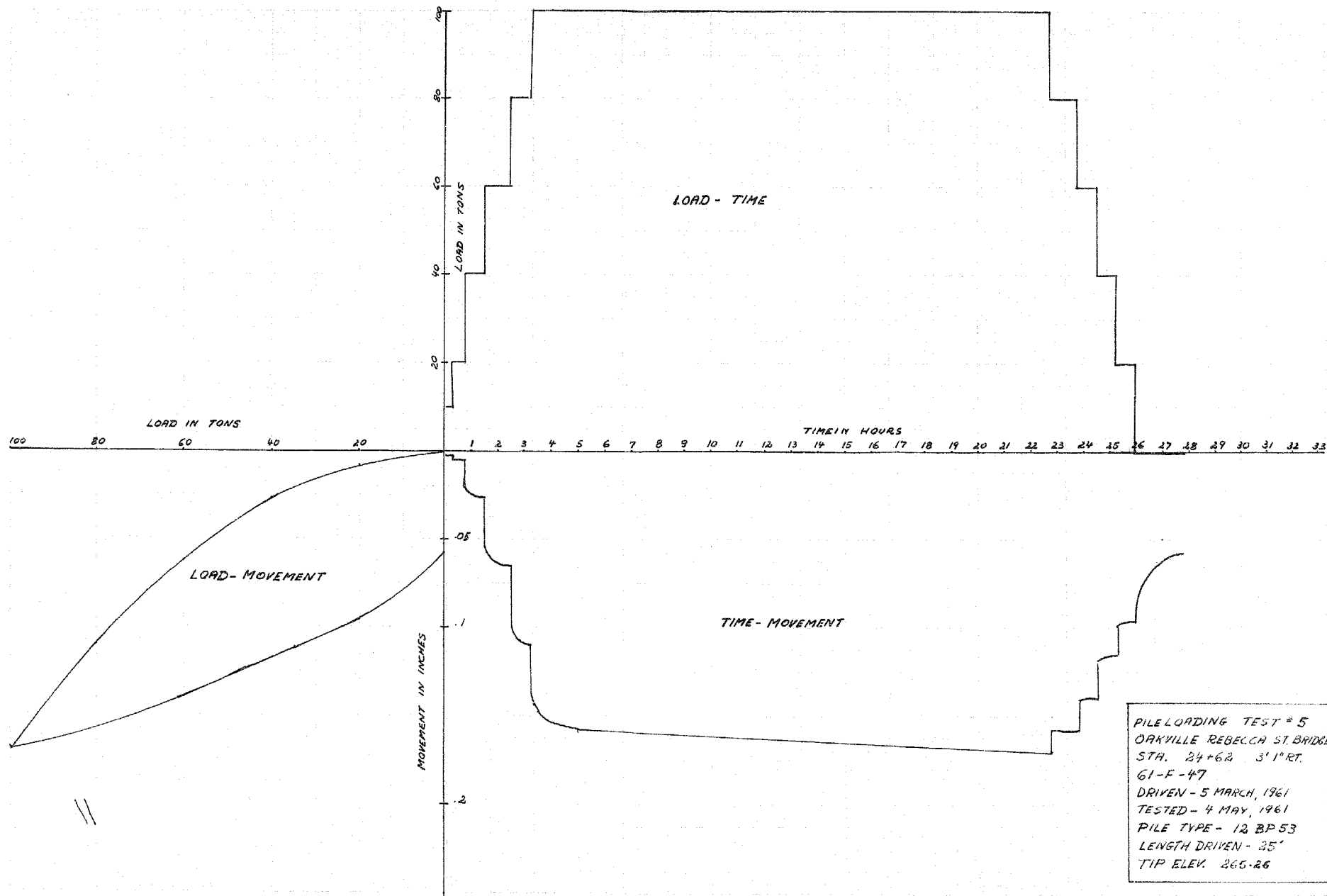
TIME - MOVEMENT

LOAD IN TONS

TIME IN HOURS

LOAD - MOVEMENT



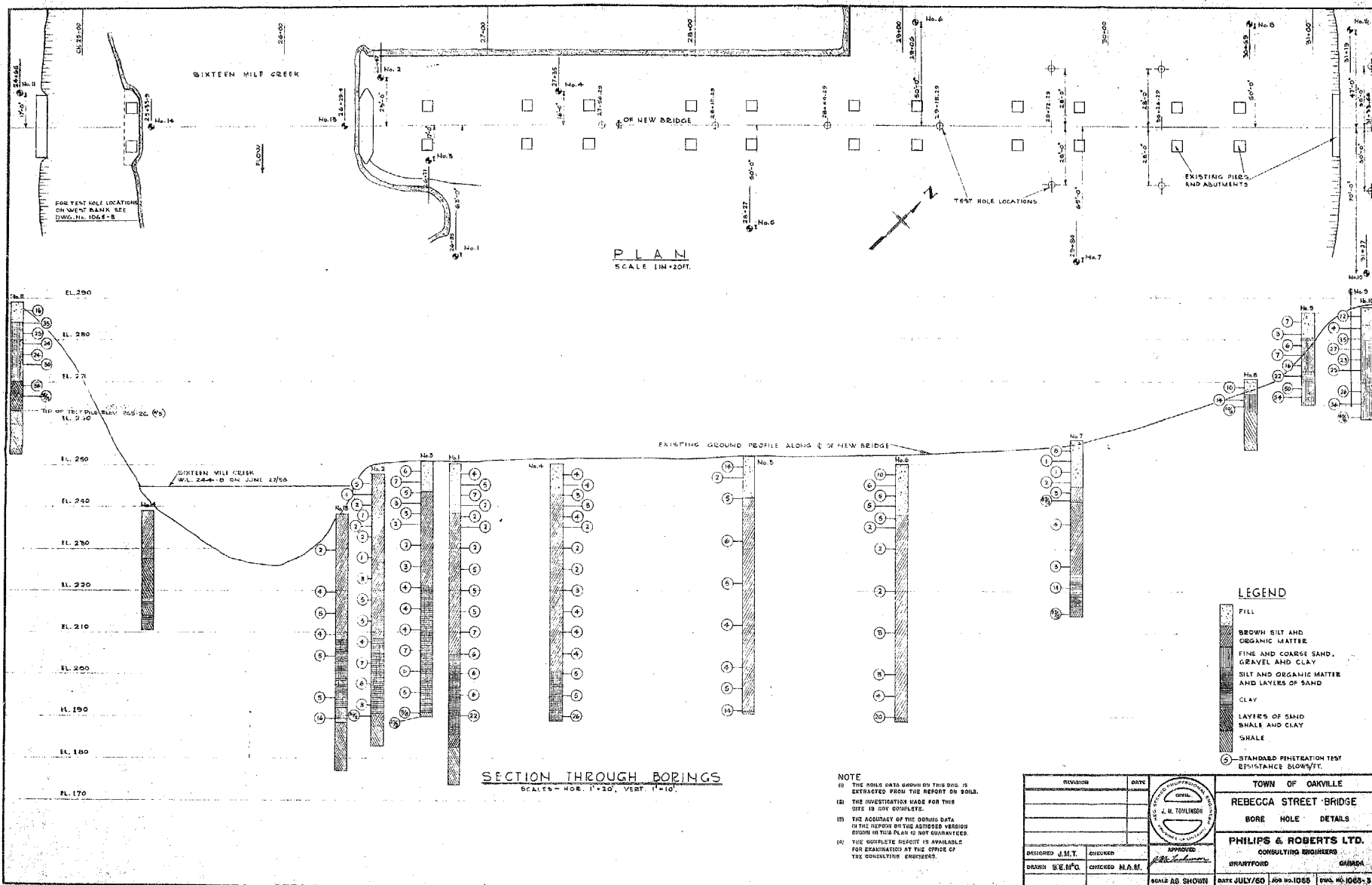


61-F-47

REBECCA ST.

BRIDGE AT

OAKVILLE CR.



SOME DEFECTS IN NEGATIVE DUE

TO CONDITION OF ORIGINAL DOCUMENTS