

62-F-273m

LONG'S CREEK

BRIDGE

LAMBTON-KENT

TOWNLINE

ROAD

MEMORANDUM

TO: Mr. A. Stermac
Principal Foundation Eng.
Room 107, Lab. Bldg.

FROM: G.C.E. Burkhardt,

DATE: March 5, 1963.

OUR FILE REF.

IN REPLY TO

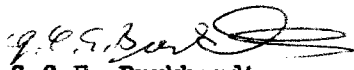
SUBJECT: County of Lambton,
Bridge over Long's Creek on the
Lambton-Kent Townline Rd.,
Structure Site No. 15-277
Our File No. BA 1568

Attached please find one (1) copy of the
Foundation Report, by E.M. Peto Associates Limited, for
your comments.

The proposed structure is a 50 foot clear span
simply supported bridge with a prestressed concrete super-
structure and concrete abutments as substructure. The
bridge is founded on spread footings at El. 86.00.

We like to approve the plans as soon as
possible and would appreciate it very much, if we could
have your comments at your earliest convenience.

GCEB/m


G.C.E. Burkhardt,
for K.L. Kleinsteinber,
Municipal Bridge Liaison Engineer

*Received
advised by phone*

5/3/63

BA 1568

E. M. PETO ASSOCIATES LIMITED

1287 Caledonia Road,
Toronto 19, Ontario.

Our Job Number 62152

RUSSELL 9 - 1126.

September 24th, 1962.

The County of Lambton,
c/o Todgham and Case,
Consulting Engineers,
P. O. Box 386,
Chatham, Ontario.

2734

Attention: Mr. H. H. Todgham.

Gentlemen,

Soil Site Investigation
Long's Creek Bridge
Township Bridge No. 25

We have pleasure in submitting three copies of our Report Number 62152 on the above site investigation. One additional copy has been forwarded directly to Mr. O. van Deurs, Lambton County Engineer.

The two test holes performed at this site have indicated that the subsoil consists of a very stiff, silty and clayey till, which provides a sound base for the support of spread footing foundations. The footings can be placed at any depth below a level of 7 ft below the existing grade at the positions of the test holes. A bearing pressure of 5 tons per sq. ft is considered safe, and will result in only negligible settlements.

STRUCTURE SITE No. 15-277

PAGE TWO

We consider the report to be comprehensive within your terms of reference; we would, however, gladly answer any questions that you may wish to raise in connection with this work.

Yours very truly,

E. M. PETO ASSOCIATES LTD.

A handwritten signature in dark ink, appearing to read 'E. M. Peto', written in a cursive style.

E. M. Peto, P. Eng.

EMP
RK/ap

THE COUNTY OF LAMBTON

C/O TODGHAM and CASE,
CONSULTING ENGINEERS

SOIL SITE INVESTIGATION

LONG'S CREEK BRIDGE
TOWNSHIP BRIDGE NO. 25

E. M. PETO ASSOCIATES LTD.

1287 Caledonia Road,
Toronto 19, Ontario.

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A. INTRODUCTION

The work described in this report was authorized verbally by Mr. H. H. Todgham, of Messrs. Todgham and Case, Consulting Engineers.

In connection with the proposed realignment of a minor road on the border of Lambton and Kent Counties, a new bridge is to be provided to replace an existing structure where the road crosses the Long's Creek. A site investigation was required to determine the subsoil conditions for the design of foundations.

The existing bridge, of steel truss design with stone abutments and wooden deck, has a span of 39.5 feet.

No data regarding the new bridge was available at this stage.

B. GENERAL INFORMATION

1. Two test holes were performed at the site, one on either side of Long's Creek and to the north of the existing bridge along the anticipated new alignment of the road. The positions of the test holes were chosen and set out in the field by Mr. H. H. Todgham.

In view of the very dense consistency of the subsoil, test hole 1 was terminated at a depth of 30 ft below the existing grade, while test hole 2 was taken down to a depth of 22.3 ft, where apparent refusal was encountered.

2. Locations of the test holes are shown on the enclosed site plan, prepared from Client's Drawing No. 62194, which also includes profiles along the centre line and fence lines of the existing road. The subsoil profile, included on the enclosed drawing was prepared on the basis of this data.

3. The field work was performed by our drilling unit No. 6, on September 7th and 8th, 1962. Our standard drilling and sampling procedures were followed, as outlined on the enclosed Appendix "A".

4. Details of the soil conditions encountered in the test holes are described on the enclosed borehole logs, which contain also in situ moisture contents and results of standard penetration tests.

B. GENERAL INFORMATION - Cont'd

A simplified subsoil profile, in the form of a section through the test holes is included on the appended drawing.

5. Laboratory testing of soil samples was limited to Atterberg Limits and a grain size distribution of a typical sample of till, for soil classification purposes. Results of the tests are included in Appendix "B".

C. SITE and GEOLOGY

The site of the proposed new bridge is at Long's Creek, on a minor road forming the boundary between the Lambton County on the north side and Kent County of the south side. The Creek is crossed at a point situated along this road approximately 0.4 miles east of a gravel road, which runs north and south between Rutherford and Dawn Mills. The site is located some 1.8 miles south of Rutherford and approximately 4 miles north-east of Dresden.

The terrain in the area is relatively flat, covered mainly by pastures, and the creek is located in a small valley, the floor of which is roughly 15 feet below the level of the surrounding country. The stream, which flows in a southerly direction, is approximately 40 feet wide and, according to information on Consultant's Drawing No. 62194, the water

C. SITE A and GEOLOGY - Cont'd

level on August 7th, 1962, was 92.23, as compared to the existing bridge deck level of 101.8. The depth of the creek at normal flow is only two or three feet.

Geologically, the area is located in the St. Clair clay plain, where glacial processes have deposited a mantle of clayey till over a shale bedrock.

The depth to bedrock at the site was not determined, but in test hole 1 a very dense stratum of sandy silt, containing a large proportion of broken fragments of black shale was encountered at a depth of 22.8 ft and the test hole was terminated at a depth of 30 ft.

In test hole 2, similar material containing broken shale was encountered at a depth of 18.5 ft and refusal occurred at 22.3 ft.

The above information indicates that the black shale bedrock commences probably at a short distance below the bottom of the test holes.

D. SOIL CONDITIONS

Details of the soil conditions encountered in the test holes are described on the enclosed borehole logs, while a simplified subsoil profile, in the form of a section through the test holes, is included on the appended drawing.

The subsoil at the site can be subdivided into the following layers:

- a) Silty organic topsoil,
- b) Stiff fissured clayey silt,
- c) Stiff silty and sandy clay or clayey silt with pebbles (till),
- d) Extremely dense sandy silt with broken shale fragments.

Each of the above soil types will now be briefly described in turn.

a) Silty organic topsoil

A layer of topsoil consisting of sandy and clayey silt with organic matter, was found immediately below the existing grade in both test holes, and ranged in thickness from 4 to 5 inches.

b) Stiff fissured clayey silt

The topsoil covered a layer of clayey silt with some fine sand, which extended to an approximate depth of 7.5 feet in test hole 1, and 5.7 ft in test hole 2. This material forms the desiccated portion of the subsoil. It was of brown colour with some grey enclosures, and had

D. SOIL CONDITIONS - Cont'd

a stiff consistency, but was fissured and crumbly. Some plant roots were observed in samples of the material.

Standard penetration test results in this layer were 11 and 12 blows per foot and moisture contents of 15.7% and 20.8% were recorded.

It is considered that the new bridge foundations should be supported below this desiccated stratum.

c) Silty and sandy clay, or clayey silt with pebbles (till)

This layer commenced at a depth ranging from 5.7 ft in test hole 2 to 7.5 in test hole 1, and its upper boundary coincided approximately with the change from a brown to grey colour of the subsoil. It extended to a depth of 22.8 ft in test hole 1, and 18.5 ft in test hole 2, where it was followed by the extremely dense sandy silt with broken shale.

The till consisted of a well graded mixture of sand, silt and clay, together with pebbles. A typical grain size distribution curve of the material is included in Appendix "B". Some thin seams of fine sand were encountered at random in this stratum and the sand appeared to be almost dry.

D. SOIL CONDITIONS - Cont'd

Standard penetration test results ranged from 43 to 67 blows per foot in test hole 1 and from 55 to 166 blows per foot in test hole 2. The moisture contents were in the range of 6.0% to 11.3%.

Atterberg Limit tests were performed on three typical samples of the material and the following results were obtained:

Liquid Limit:	21.6 to 30.0%
Plastic Limit:	13.5 to 16.9%
Plasticity Index:	8.1 to 13.8

Compared to the Atterberg Limits, the natural moisture contents is found to be generally below the plastic limit of the material, confirming the very stiff consistency of the stratum.

This deposit can be considered as capable of supporting very high foundation pressures without the risk of other than minor settlement.

d) Sandy silt with broken shale

Both test holes were terminated in a stratum consisting of a mixture of sand and silt with broken shale fragments, of dark grey to black colour, and of extremely dense packing. Standard penetration test results in this deposit were ⁱⁿ excess of 150 blows per foot. Natural moisture contents were in the range of 5.4% to 7.2%.

D. SOIL CONDITIONS - Cont'd

Test hole 1 was terminated at a depth of 30 ft below the existing grade, after penetrating 7.2 ft of this stratum. In test hole 2, where this material commenced at a depth of 18.5 ft, apparent refusal was encountered at a depth of 22.3 ft, where the test hole was terminated.

From the point of view of settlement of bridge foundations, this stratum can be considered as practically incompressible and capable of withstanding high foundation pressures.

It is highly probable that the black shale bedrock is present a short distance below the bottom of the test holes.

E. WATER CONDITIONS

No free water was encountered in either of the test holes, of which No. 1 was located within 10 ft of the creek. Some moist layers of till were encountered at a depth of 3 to 6 ft below the existing grade, corresponding roughly to the level of water in the creek.

The change from brown to grey colour of subsoil, which occurred at a depth of 6 to 7.5 ft, probably marks the upper boundary of the zone of permanent saturation, while the overlying, fissured brown crust has been desiccated by periodic drying cycles.

No free water was encountered in the sandy silt with broken shale stratum, which is more permeable than the overlying more clayey silt; also, sand seams within the clayey till were practically dry. These factors indicate that the water in the creek is perched on top of the till strata, and that, once the flow from the creek has been prevented from entering the excavations, the digging operations will be performed dry, or with only very minor seepage of ground water.

F. CONCLUSIONS and RECOMMENDATIONS

1. The two test holes have disclosed that the subsoil consists of a very stiff sandy and clayey silt till, which commences at a depth of 5.3 to 7.5 ft below the existing grade, and provides a very sound support for the new bridge foundations. The till stratum is overlain by the desiccated, fissured brown silt stratum and by a surficial layer of topsoil.

The till is followed at a depth of 18.5 to 22.8 ft by a deposit of extremely dense, dark grey to black sandy silt with broken shale fragments. Test hole 1 was terminated at a depth of 30 ft in this material, without reaching a shale bedrock, but from the composition of this stratum it would appear that the shale bedrock is present a short distance below the bottom of this test hole.

2. No details of the proposed new bridge were available at this stage.

However, on the basis of the soil conditions encountered in the test holes, the following conclusions can be submitted regarding the design of bridge foundations.

F. CONCLUSIONS and RECOMMENDATIONS - Cont'd

a) The new bridge foundations, in the form of spread footings, can be supported in the stratum of grey, very stiff sandy and silty clay till.

b) A suitable level for the footings is a depth of 7 to 8 ft below the existing grade, or any convenient depth below this level.

c) The allowable bearing pressure of footings placed not higher than 7 ft below the existing grade would be up to 5 tons per sq. ft.

d) Because of the very stiff consistency of the subsoil, small proportion of clay fraction, and limited depth to shale bedrock, any settlement under the footings designed to handle the above bearing pressure will be insignificant.

3. No free ground water was encountered in either of the test holes. Provided that water from the creek will not be allowed to penetrate into the excavation, it is expected that the work can be performed dry, or with only very minor water seepage. However, every precaution should be taken to protect the excavated grade below the footings against the ingress of water from the creek, from any pervious layers in the walls of excavations, or from the atmosphere, as contact with free water would lead to softening of the subsoil and result in additional subsequent settlements.

F. CONCLUSIONS and RECOMMENDATIONS - Cont'd

If the excavations have to stand open for any length of time, the excavated grade below the footings should be protected with an impervious seal, e.g. in the form of a thin layer of lean concrete. Alternatively the last four to six inches could be left unexcavated until the last possible moment before construction of the footings.

4. Because of the high silt content of the upper layers of the subsoil, on account of which the material must be classified as frost susceptible, a granular layer, at least 6 inches thick, should be provided below the pavements to protect them against possible damage caused by frost heave.

The silty organic topsoil and any material which, by visual examination, may appear to contain large quantities of organic matter, should preferably be rejected and not reused below embankment footings or as a backfill to the bridge abutments.

5. We would recommend that the backfill behind the footings consist of well compacted, impervious material below the creek level and well-compacted free draining granular fill behind the abutments above the Creek level.

Report prepared by:

E. M. PETO ASSOCIATES LTD.

R. Kulesza, P. Eng.

C. F. Freeman
C. F. Freeman, P. Eng.,
Chief Engineer.

RK/ap

APPENDIX "A"
STANDARD PROCEDURE

The field investigation work is carried out by means of a skid mounted diamond drill rig.

Standard sampling procedures are followed. Casing is driven and cleaned, either by augers, tubes or by wash water.

Samples are recovered ahead of the casing at frequent intervals, with either a 2 inch or 3 inch O. D. split barrel sampling tube, Shelby tube, or split barrel sampling tube fitted with brass liners and special sharp cutting nose.

The standard penetration test results are recorded when sampling with the regular 2 inch O. D. split barrel sampler, these being the number of blows of a 140 pound hammer falling 30 inches, required to drive the sampling tube a distance of one foot into undisturbed soil.

The Dutch Cone probe test is made by driving the drill rods into the ground with a 2 inch dia. x 60° cone tip. The number of 4200 inch pound blows per foot of penetration are recorded, as in the standard penetration test.

Where required, "in situ" shear strength tests are made ahead of the casing, using Modified Acker vane test equipment.

Disturbed samples are visually classified in the field, sealed in sample jars, and are re-examined, and tested as necessary, in the soils laboratory. Undisturbed samples are returned to the laboratory for later examination and testing as required.

The test holes are bailed (or pumped out) during the work as necessary, at the end of the day, and on completion. Subsequent water level readings are taken for the duration of the field work. Water pressure readings are recorded when Artesian water conditions are encountered. Moisture content samples are recovered at frequent intervals to assist in the soil classification and the interpretation of water table results.

Borehole logs are prepared giving details of the soil description and condition as recorded in the field. These logs form the basis of the soil profile, which indicates the general stratigraphy assumed to exist between the boreholes as represented by the borehole logs.

The boreholes are normally set out by the Field Engineer, who also records the ground elevations referred to a temporary bench mark or known reference point. If the client has been responsible for setting out the boreholes and recording their ground elevations this is stated in the preamble to the report.

A plan is drawn up from drawings supplied by the Client or his representatives, showing the locations of the boreholes and the T.B.M. where applicable.

Normally, the standard penetration blows and the natural moisture contents are plotted against elevation as a graph, and these graphs form part of the appendices, together with laboratory test result details, ground water readings and other soil characteristics which can be best illustrated in graphical form.

APPENDIX "B"

SOIL TEST RESULTS

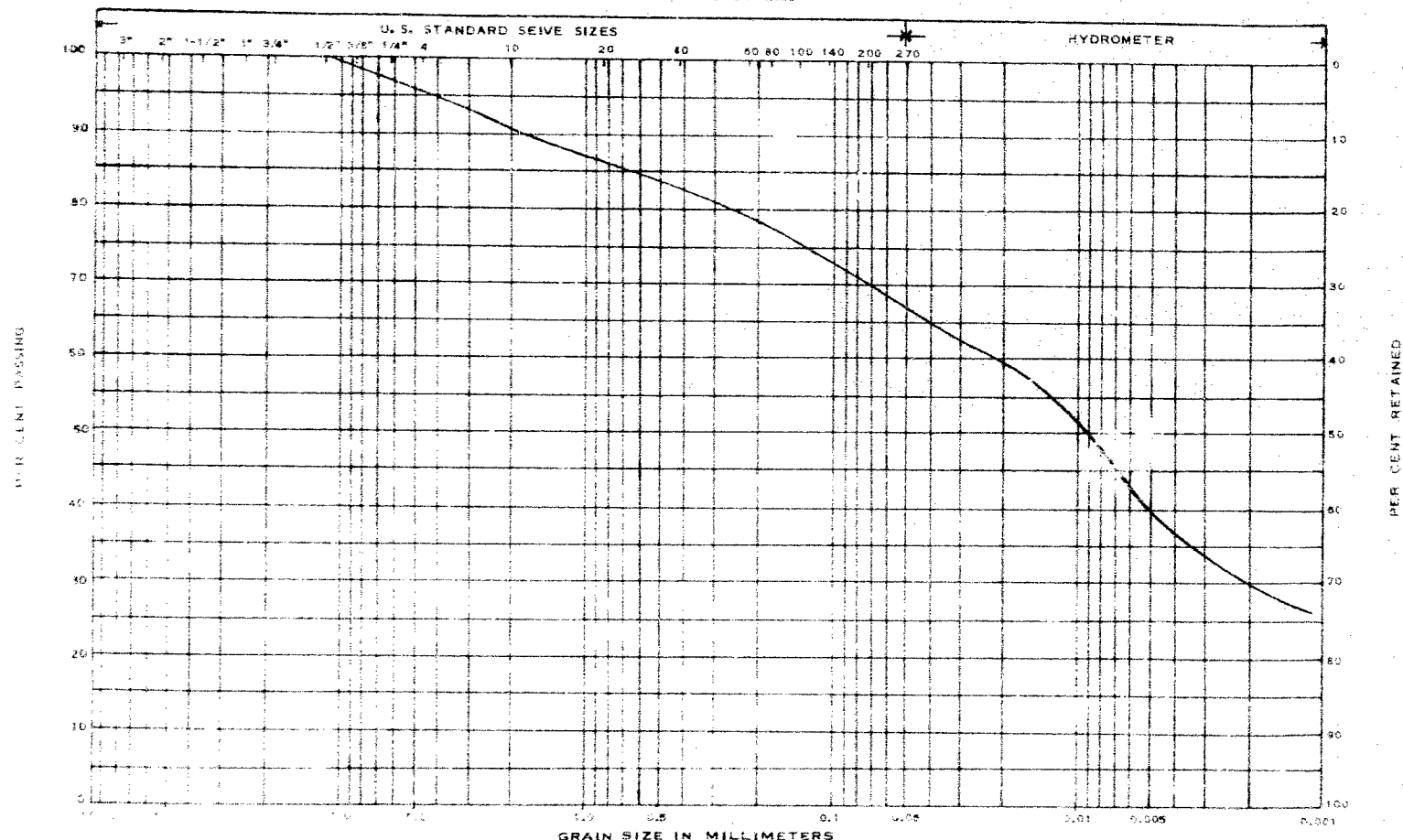
Job No. 62152

ATTERBERG LIMIT TEST RESULTS

B.H./S.A.-No	DEPTH	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	NATURAL WATER CONTENT
	ft	%	%		%
1/2	13	30.0	16.2	13.8	11.3
1/7	21	28.9	16.9	12.0	11.1
2/3	8	21.6	13.5	8.1	8.6

e. m. peto associates ltd.

Toronto 19, Ontario



GRAVEL	COARSE SAND	MED. SAND	FINE SAND	COARSE SILT	MED. SILT	FINE SILT	CLAY
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MASS. INST. OF TECH. CLASSIFICATION

JOB NAME Township Bridge #25 Long's Creek JOB NO. 02152 HOLE NO. 1 SAMPLE NO. 4
 DEPTH 10-11 ft ELEVATION REMARKS Sandy and clayey till

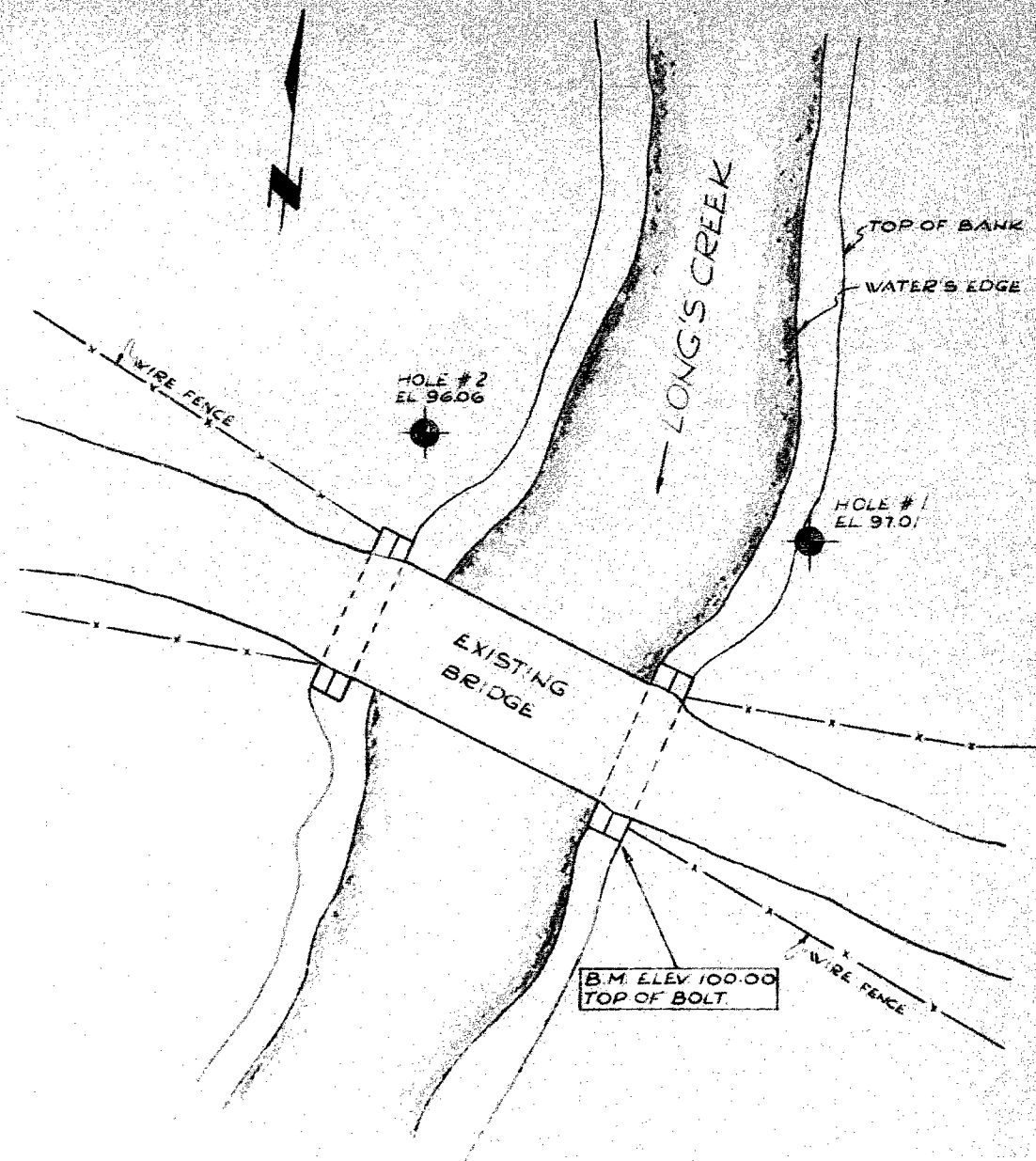
GRAIN SIZE DISTRIBUTION

DEFECTS IN NEGATIVE DUE TO
 CONDITION OF ORIGINAL DOCUMENT

Test Hole Terminated at 30 ft

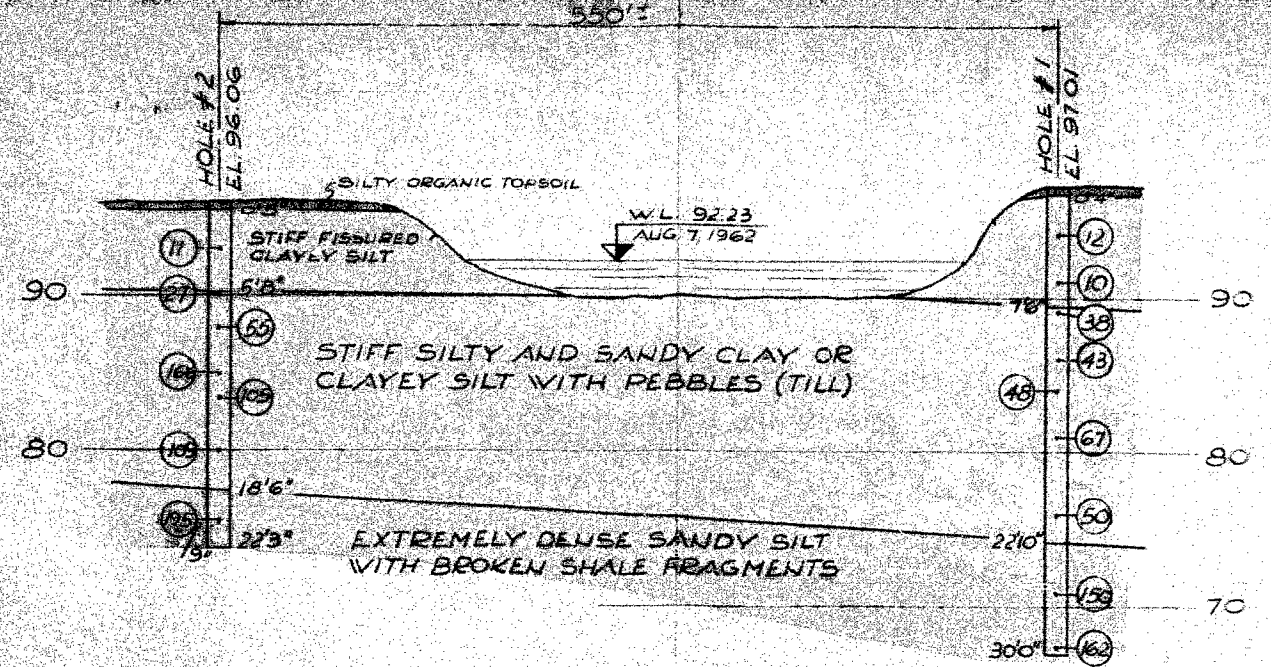
SAMPLE CONDITION		SAMPLE TYPE		ABBREVIATIONS	
	UNDISTURBED	A.S. AUGER SAMPLE	V.T. IN SITU VANE SHEAR TEST		
	FAIR	C.S. CASING SAMPLE	M. MOIST		
	DISTURBED	S.S. 2" STANDARD SPLIT TUBE SAMPLE	W.L. WATER LEVEL IN CASING		
	LOST	S.L. SPLIT BARREL WITH LINERS	W.T. GROUND WATER TABLE IN SOIL		
		S.T. THIN-WALLED SHELBY TUBE SAMPLE	W.T.P.L. WETTER THAN PLASTIC LIMIT		
		W.S. WASH SAMPLE	D.T.P.L. DRIER THAN PLASTIC LIMIT		
		R.C. ROCK CORE	A.P.L. ABOUT PLASTIC LIMIT		

SOIL DESCRIPTION	COLOUR	Density or Consistency	Depth Elevation	Legend	Sample No. and Condition	Sample Type	No. of Blows per Ft.	Moisture Content	WATER LEVELS & REMARKS
Clayey silt with organic matter (topsoil)	Brown		0.5'						Dry
Desiccated silt with some fine sand	Light brown	Stiff but crumbly	5'0"		1	S.S.	11	15.7	
Silty clay, changing to as below	Grey with brown pockets	Stiff	5'8"		2	S.S.	27	10.1	Moist at 5'8"
Silt, sand and clay with pebbles (till)	Grey	Very stiff	10'0"		3	S.S.	55	8.6	
As above, with pockets of very fine sand, and partly fissures	Grey	Very hard	15'0"		4	S.S.	166	9.6	
Ditto	Ditto	Ditto	18'6"		5	S.S.	105	9.4	Pockets of sand and almost dry
Ditto	"	"	20'0"		6	S.S.	109	11.1	
Broken shale, with silt	Dark grey to black	Extremely Dense	22'3"		7	S.S.	75/6" 120/3"	5.4	Refusal at 22'3"
Test Hole Terminated at 22'3"									



SITE PLAN

SCALE: 20' TO 1"



SECTION THROUGH HOLES 2 & 1

SCALE: 10' TO 1" (NATURAL)

LEGEND

- BOREHOLE
- ⊖ BLOWS/FOOT S.P.T.

NOTES:

- a) POSITIONS OF BOREHOLES WERE
SCALED OFF CLIENT'S DRAWING
(NO. 62194) AND ARE ONLY APPROXIMATE.
- b) SEE BOREHOLE LOGS FOR
COMPLETE SOIL DATA.

NOTE: The actual soil stratification has been verified from data obtained at the borehole locations only. The inferred contacts shown are based on geological evidence and these may vary from those shown between borings.



THE COUNTY OF LAMBTON
% TODGHAM & CASE, CONSULTING ENGINEERS

LONG'S CREEK BRIDGE

PREPARED BY
e m. peto associates ltd

JOB No 62152 SEPT 1962 DVN BY K.K.