

MEMORANDUM

To: Mr. A. Stermac
Principal Foundations Eng.,
Materials & Research Section,
Lab. Bldg.,

FROM: J.E. Garyfalakis
Bridge Division,
April 30, 1963.

DATE:

OUR FILE REF.

IN REPLY TO

SUBJECT: County of Norfolk,
Kelvin Bridge over Big Creek,
Windham/Burford, Lot II, Sub I/XIV,
Structure Site #21-4,
BA 1622

Under separate cover please find soil
report for this structure for your information
and files.

JEG/dm

J.E. Garyfalakis
J.E. Garyfalakis,
for K.L. Kleinsteinber,
Municipal Bridge Liaison Engineer.

Note:

Approval of bridge drawings was very urgent
and Bridge Division decided to approve without
Foundations Section's comments. This was done because
report was found to be straightforward and no
problems could be envisaged.

May 3, 1963

Afternoon

O.K. ass.

84 1622

WILLIAM A. TROW AND ASSOCIATES LTD.

SITE INVESTIGATIONS
LABORATORY TESTING
SOIL MECHANICS CONSULTATION

W. A. TROW, M.A.S.C., M.E.I.C., P.ENG.

1850 JANE ST.,
WESTON, ONT.
CH. 1-4644

Project: J799

February 2, 1962

McDowell and Jewitt,
Consulting Engineers,
92 Kent Street South,
Simcoe, Ontario

STRUCTURE SITE NO. 21-4

attention: Mr. McDowell

62-7-30 S M

Re: Foundation Conditions
Proposed County Road Bridge Replacement
Big Creek, Kelvin, Ontario

Dear Sirs:

This report describes the foundation conditions at this bridge site which lies near the east limits of Kelvin, Ontario, on the county road separating Windham and Hurford Townships.

Since very competent soil exists at shallow depth below the surface, at this location, no particular foundation problem is envisaged. Accordingly we shall be brief in our submission to you. Our observations and recommendations are presented under the headings that follow.

Site Description

The countryside adjacent to this bridge site consists of relatively flat farmland. The land bounding the creek is covered with trees and brush and it is somewhat swampy beyond the southwest bank of the stream.

The creek was about 2 feet deep at the time of the investigation, measured from the surface of the ice cover. Probing in the centre of the creek indicated a gravel bottom. It is reported that the velocity of flow is slow, even during flood periods. The estimated maximum flood level is about 5 feet above the ice surface. The existing banks of the river are about 1 to 3 feet high and there is no conspicuous evidences of erosion.

The existing bridge is a 75 foot long simple span steel truss structure, built about 50 years ago. The deck of the bridge was measured to be 8.4 feet above the ice surface at the time of the investigation. Photographs of the bridge and adjacent areas are included in the report.

Geology

As described in a recent report for the Vanessa Bridge Crossing, the major portion of Norfolk County comprises a delta formed by glacial stream deposits brought down from areas to the north of Brantford. These sand deposits cover glacial moraines and drumlins left during the Wisconsin glaciation of this part of Ontario. The results of this investigation indicate that these glacial till deposits rose close to the surface at this site.

Subsoil

Two borings were made at this site at the locations shown on Dwg. 1. One hole was taken to a depth of about 50 feet below the river surface in very dense soil. Because the soil was found to be dense, the other hole was terminated at a shallower depth.

The results of this field work are presented in the borehole logs, on Dwgs. 2 and 3, and summarized in the stratigraphical profile of drawing 1. In descending order of depth, the stratigraphy briefly is as follows:

Alluvial Sands: This material extends from the ground surface to about relative elevation 84 feet or about 2 feet below the present creek bed. This soil is loose and it contains fragments of wood and other organic alluvium.

Clayey Silt Till: This glacial deposit extends to approximate El 66 feet, or 20 feet below the creek bed. At depths greater than about 6 feet below the creek bed, or El 80 feet, it exists in a very stiff to hard condition, with a moisture content close to the plastic limit. Measured properties for this hard soil are as follows:

Undrained shear strength	= 6300 to 8600 psf
Liquid limit	= 24.5 %
Plastic limit	= 15.0 %
Natural moisture content	= below plastic limit
Natural unit weight	= 144 to 146 pcf

Above relative El 80 it is somewhat less stiff, as evidenced by lower penetration resistances in both holes and a higher moisture content in hole 1. This probably results from the close proximity of this soil to the overlying wet alluvium. An increase in the percentage of clay was noted at various levels in this till.

Fine Sand: This material extends to El 46 feet. It is silty and dense. Thin layers of clay are present in it and these layers become more frequent with depth.

The penetration resistance of the sand was found to be in the order of 40 blows per foot. This sand, with its thin clay layers, is similar in character to the soil encountered at the Vanessa bridge site 4 miles downstream to the south. The presence of the glacial material overlying it is indicative of some temporary readvances of ice at an intermediate stage of the delta sand formation.

Clay Till: Borehole 1 was terminated in this stratum. According to a field vane measurement, it has a strength in the order of 1350 psf and its moisture content is midway within the plastic range. This low plasticity clay will be unaffected by bridge loads.

Foundations

In view of the close proximity of the hard clayey silt till below the bed of Big Creek, there is no problem involved in the selection of the type of foundation support. This stratum has more than sufficient capacity to support the abutment loads of the proposed bridge replacement both safely and economically.

According to two laboratory compression measurements taken on specimens from depths of 15 and 20 feet in hole 1, the undrained shear strength of the till ranges from 6300 to 8600 psf. The moisture contents of these samples are below the plastic limit, and, - as additional evidence of the dense, incompressible state of the soil, - its unit weight is in the order of 145 pcf.

For these magnitudes of shear strength, the safe net bearing value at these levels is at least equal to 6 tsf. However, since the clayey silt till is somewhat softer near its upper boundary, a reduction in this net bearing pressure must be applied. The footings should be taken at least 4 feet below the creek bed, in order to provide protection against scouring. At this depth, the footings will still be in the relatively less stiff upper till. On the basis of the field vane test attempted in hole 1, the recommended safe net bearing value to apply at this level is 3 tsf. By digging about 2 to 3 feet deeper, down to the hard till, a safe net bearing value of 6 tsf can be utilized.

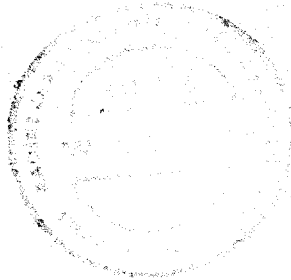
This pressure represents the net permissible increase of stress that may be applied in excess of the minimum surcharge weight acting adjacent to the footings. The settlement associated with the application of these stresses should be considerably less than 1 inch.

Although river bed scouring does not appear to be a problem, at this location, some rip rap protection should be provided around the sides of each abutment. No serious difficulties will be experienced when digging to this specified footing depth. The seepage into the excavation from the overlying sand alluvium can be pumped directly from sumps placed adjacent to the footing bed.

We hope that the information contained in this report assists you in the design of foundations for this structure. Please contact us if you have any queries on the subject.

Yours very truly,

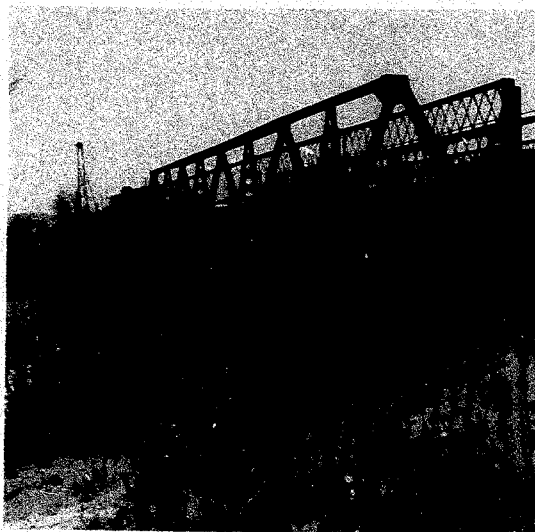
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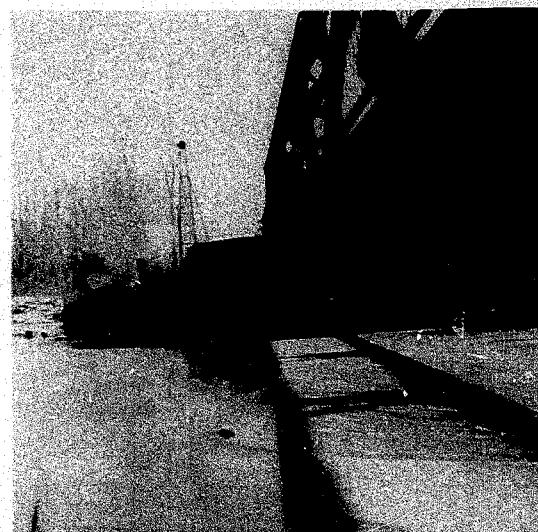
W. A. Trow
William A. Trow, P. Eng.



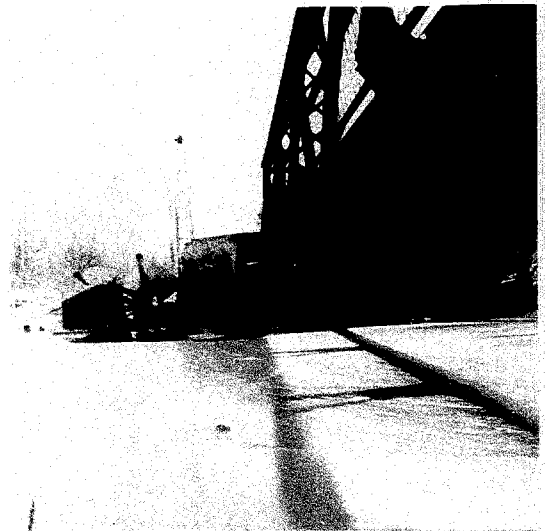
Kelvin Bridge Looking North



Kelvin Bridge From the West
(Drill on BH 2 Beside East Abutment)



Kelvin Bridge From the West
Looking at East Abutment
(Drill on BH 2)





Kelvin Bridge From the Northeast
(Truck on Road Near Bl 1)



Kelvin Bridge From the East



Kelvin Bridge From the West



View of the snow-covered field from the road.





View of the snow-covered road from the car.




View of the snow-covered road from the car.


PENETRATION RESISTANCE


2" O.D. SPLIT TUBE 


2" I.D. SHELBY TUBE 

2" DIA. CONE 

SHEAR STRENGTH

UNDRAINED TRIAXIAL AT OVERBURDEN PRESSURE 

UNCONFINED COMPRESSION 

VANE TEST AND SENSITIVITY  (S_t)

NATURAL MOISTURE CONTENT
AND LIQUIDITY INDEX

ATTERBERG LIMITS

LIQUID LIMIT

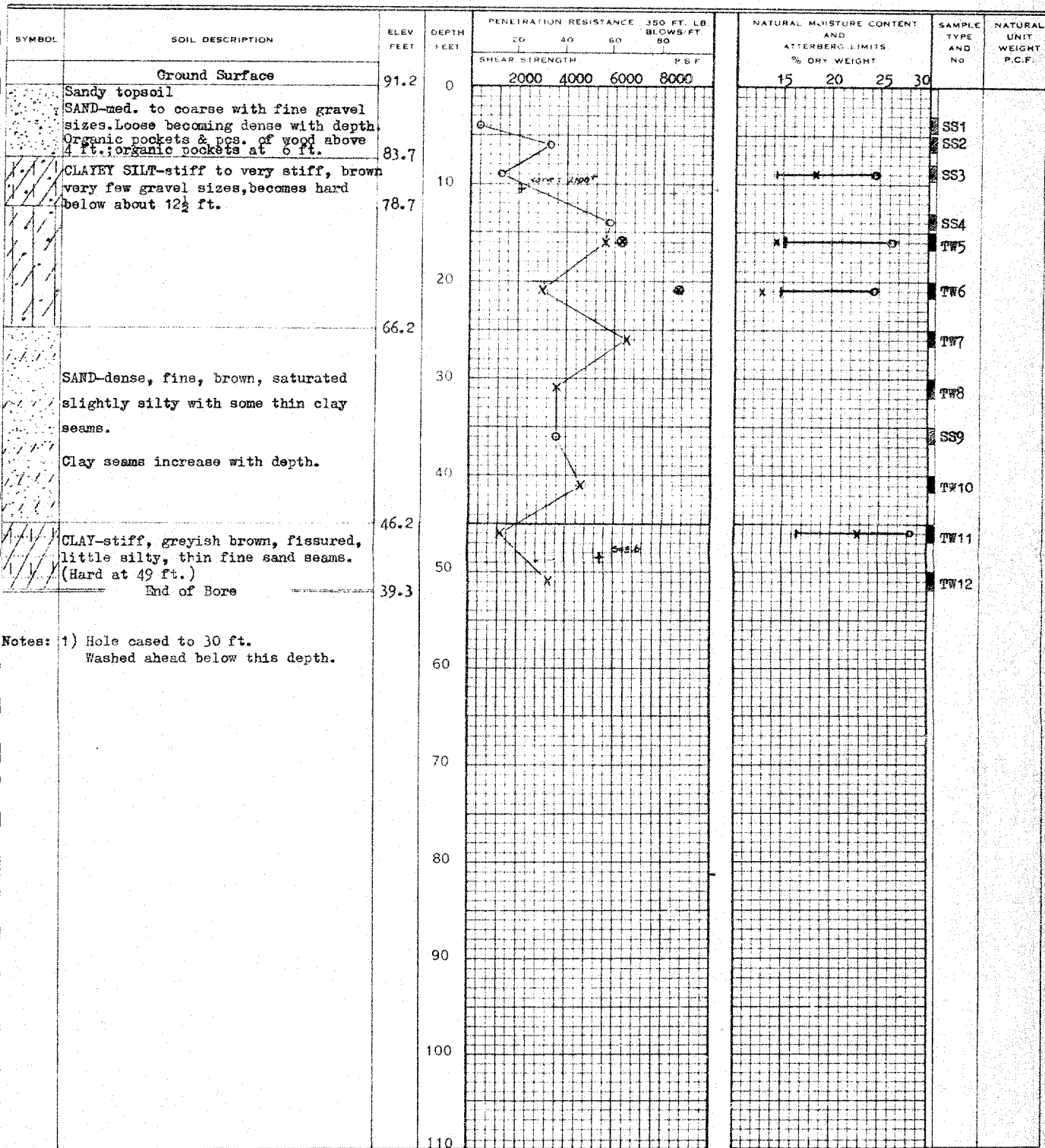
PLASTIC LIMIT

SAMPLE TYPE

2" O.D. SPLT TUBE

1" O.D. SHELBY TUBE

3" O.D. SHELBY TUBE



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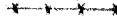

SITE INVESTIGATIONS SOIL MECHANICS CONSULTATION

LEGEND





DRAWING NO. 3
PROJECT NO. J799

BORSHOLE NO. 2
PROJECT County Road Bridge
LOCATION Kelvin, Ontario
HOLE LOCATION See Dwg. 1.
HOLE ELEVATION 88.2 ft.
DATUM See Dwg. 1.

PENETRATION RESISTANCE

2" O.D. SPLIT TUBE 
2" I.D. SHELBY TUBE 
2" DIA. CONE 

SHEAR STRENGTH




UNDRAINED TRIAXIAL 
AT OVERBURDEN PRESSURE 
UNCONFINED COMPRESSION 
VANE TEST AND SENSITIVITY (S) 

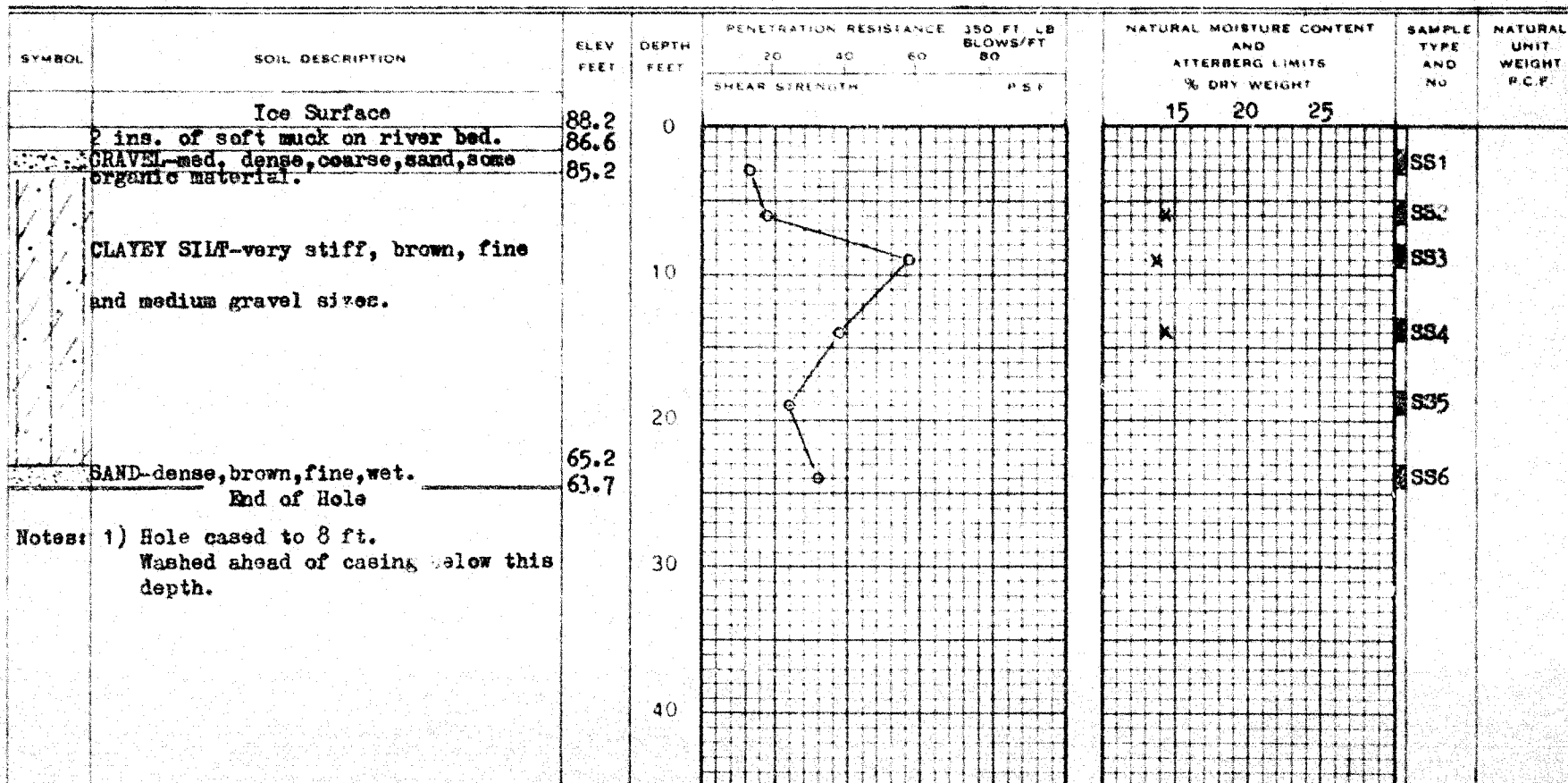
NATURAL MOISTURE CONTENT
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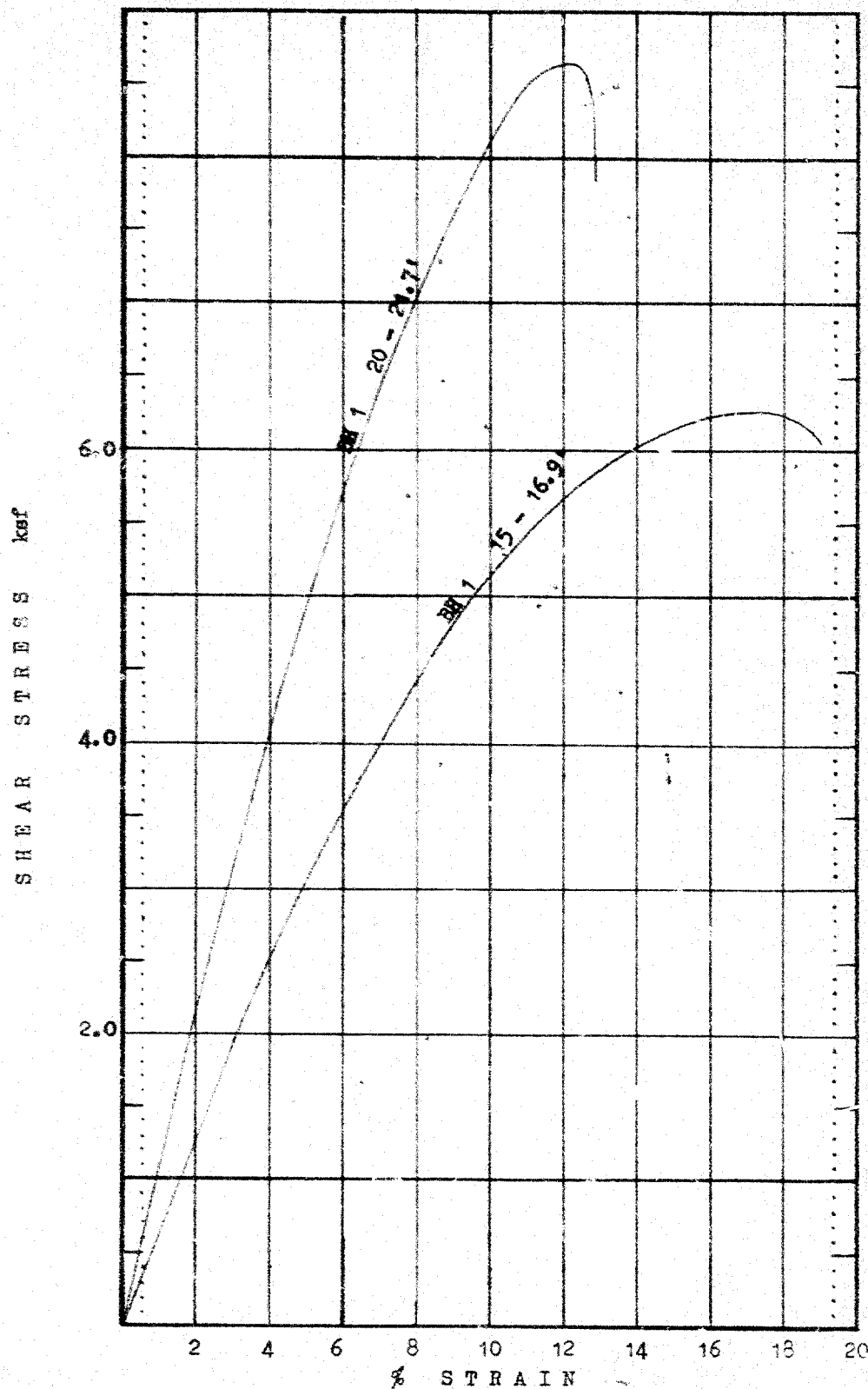
ATTERBERG LIMITS

LIQUID LIMIT 
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SAMPLE TYPE

2" O.D. SPLIT TUBE 
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3" O.D. SHELBY TUBE 





STRESS-STRAIN CURVES - UNCONFINED COMPRESSION TESTS

WILLIAM A. TROW AND ASSOCIATES

#62-F-305 M

KELVIN BRIDGE

LOT 11, CON. 1/XIV

WINDHAM/BURFORD

