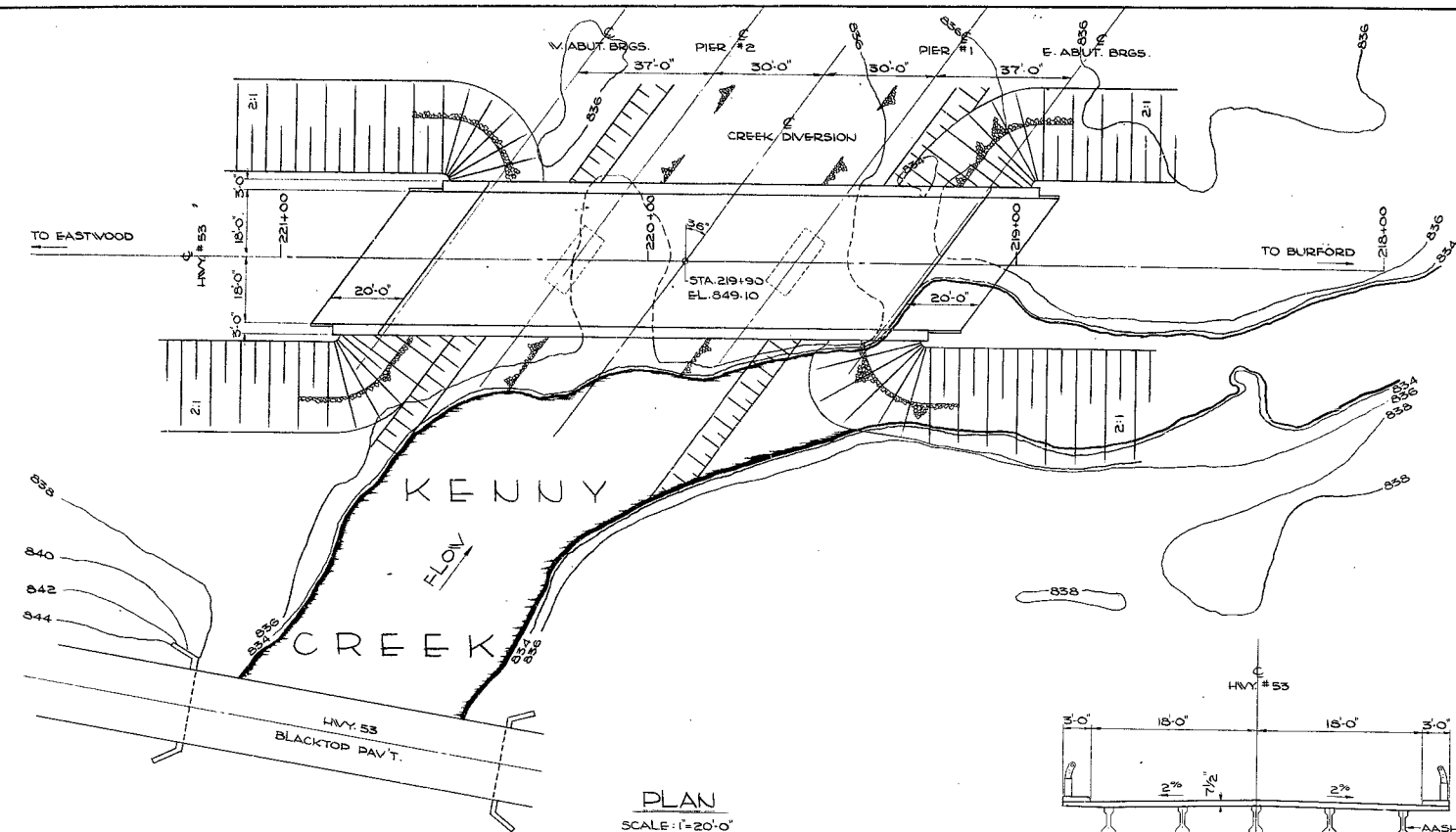
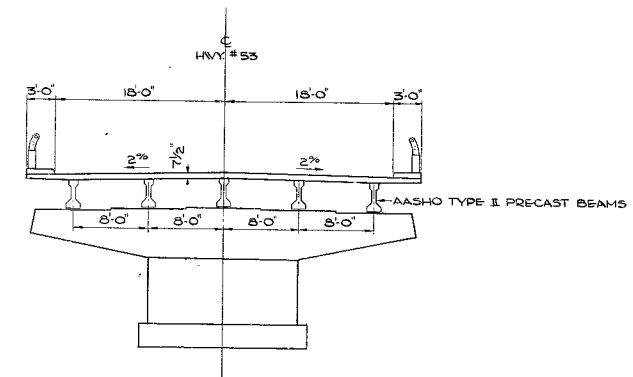


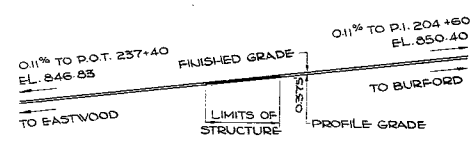
#66-F-234C
W.P. # 725-56
Hwy # 53
KENNY
CREEK
BRIDGE



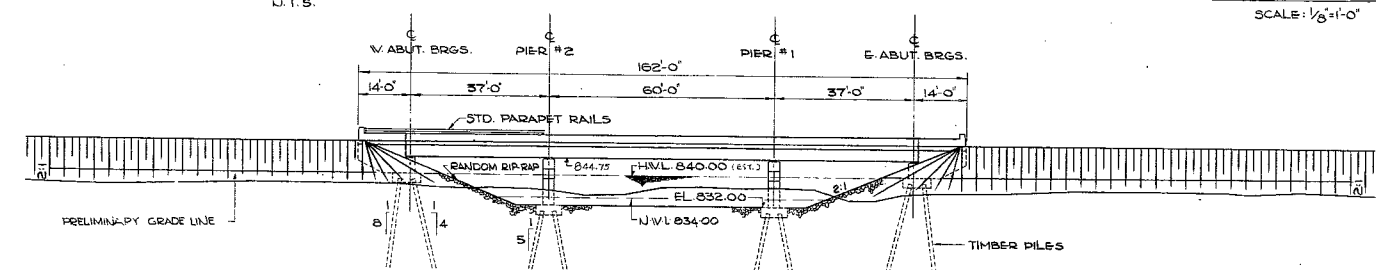
PLAN
SCALE: 1"=20'-0"



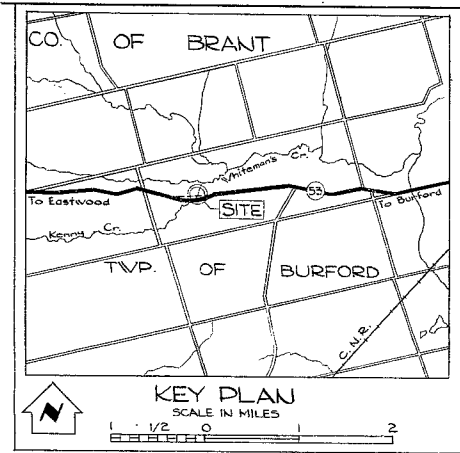
CROSS SECTION
SCALE: 1/8"=1'-0"



PROFILE OF HWY. 53 LINE 'A'
U.T.S.



ELEVATION
SCALE: 1"=20'-0"



KEY PLAN
SCALE IN MILES

NOTES:

- CLASS OF CONCRETE:
DECK, CURBS & PARAPET WALLS --- 4000 P.S.I.
REMAINDER --- 3000 P.S.I.
- CLEAR COVER ON REINFORCING STEEL:
FTGS., ABUTS. & PIERS | CURBS | PARAPET WALLS | DECK
3" | 2" | 1 1/2" | TOP 1 1/2"
| | | | BOTTOM 1"
- CONSTRUCTION NOTES:
THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF $\pm 1/8"$. NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.

PRINT RECORD		
No.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO BRIDGE DIVISION	
KENNY CREEK BRIDGE	
KING'S HIGHWAY No. 53	DIST. No. 4
CO. BRANT	APPROX. 3 MI. W. OF BURFORD
TWP. BURFORD	LOT 11 CON. 6
PRELIMINARY	
APPROVED	SITE No. 1-54 W.P. No. 725-56
DESIGN V.L.L. CHECK	CONTRACT No.
DRAWING R.M. CHECK	DRAWING No. D-6080-1
DATE JAN 67	LOADING 14520-44

DEPARTMENT OF HIGHWAYS OF ONTARIO
MATERIALS AND TESTING DIVISION
MACDONALD CARTIER FREEWAY AND KEELE STREET
DOWNSVIEW, ONTARIO

66 F 234 C

FOUNDATION CONDITIONS
PROPOSED BRIDGE REPLACEMENT
HWY. 53, KENNY CREEK
3 MILES WEST OF BURFORD
W.P. 725-56

Project: J3242

October, 1966

William Trow Associates Limited

90 Milvan Drive
Weston, Ontario
749-1290

William Trow

Project: J3242

Soil Mechanics
Consultants
W. A. Trow
MSc. MEIC. P. Eng.
K. Peaker
PhD. MEIC. P. Eng.
D. H. Shields
PhD. MEIC. P. Eng.



Associates Ltd.

Mr. A. Rutka, P.Eng.,
Department of Highways of Ontario,
Materials and Testing Division,
MacDonald Cartier Freeway and Keele Street,
Downsview, Ontario.

October 13, 1966

Attention: Mr. A.G. Stermac, P.Eng.

Foundation Conditions
Proposed Bridge Replacement
Hwy. 53, Kenny Creek
3 Miles West of Burford
W.P. 725-56

Dear Sirs:

This report contains the findings and recommendations resulting from our recent foundation study at the proposed bridge replacement, Hwy. 53 and the associated diversion of Kenny Creek. The field work was carried out during the period of September 27th. to October 4th, 1966.

A summary of our findings and recommendations are presented in the paragraphs that follow.

1) The subsoil at this site consists of alluvial sand deposits with organic staining for the first approximate 10 feet of depth or to present creek bed level. Natural dense medium to coarse sand with some gravel and silt underlies it to a depth of about 33 feet or El 802 feet where a stiff clay



stratum with silt layers is encountered. This deposit becomes siltier and dense with depth. The borings were terminated on it at a maximum depth of 82 feet.

2) It is recommended that the bridge be supported by simple spread footings founded in the dense medium sand at El 822 to 824 feet. The latter value applies if the river bed is well protected with rip rap and light sheeting is provided in front of the footings for scour protection. Footings at these levels may be designed for a safe net bearing pressure of 4 tsf, provided construction procedures do not disturb the founding soil.

Alternatively the bridge may be founded on short timber piles driven to El 815 feet or 19 feet below water level at which depth a working load of 20 tons may be applied, - assuming a pile tip 10 inches in diameter or greater.

3) Excavations for footings below the water table can be accomplished either by:-

- a) diverting the creek and working in oversized excavations as described later in the report,
- b) Diverting the creek and depressing the groundwater using vacuum wellpoints,
- c) ringing each excavation with interlocking sheet piling driven to a seal in the clay below El 802 feet.



4) Because the subsoil is essentially granular no stability or settlement problems are to be expected in the construction of the 15 foot high approach embankments.

5) The resistance to horizontal earth pressures and impact loads in the abutments is indicated in the report.

These points are expanded upon in the sections which follow.

PROJECT

The project comprises a realignment of Hwy. 53 and diversion of Kenny Creek. The abandonment of the existing bridge and its replacement by a new structure of either one or three spans is proposed.

FIELD WORK AND SUBSOIL STRATIGRAPHY

The field work consisted of 4 cased wet-sampled borings and 8 dynamic cone penetration tests. Two of the 4 borings were continued with great difficulty to depths of 71 and 82 feet without reaching positive refusal.

In general, the subsoil was found to be a fine to coarse sand with gravel to a depth of about 35 feet or El 802 feet



below which level stiff clay with silt seams was encountered. This deposit became siltier with depth. The upper approximate 10 feet of sand, or to river bed level was reworked by fluvial action of the creek.

More detailed descriptions of the subsoil can be found on Dwg. 2 to 4. The interpreted subsoil stratigraphy is shown on Dwg. 1.

Water levels in the boreholes were found to be at or near the creek water level.

FOUNDATIONS

As indicated in the opening paragraphs two founding alternatives appear to be available for the support of the bridge, i.e. either simple footings below present creek bed level or timber piles bearing in the sand at a greater depth.

a) Footings - Dense fine to coarse sand underlies the pit below the level of the present creek or below about El 826 feet. For scour protection footings should extend 4 feet below this level or about El 822 feet. However, if scour protection can be provided by adequate rip-rap in the river bed, and sheet piling around the exposed surfaces of the footings



a higher footing level up to El 824 feet is considered permissible. Rip-rap of the size presently under the existing bridge, laid on a bed of Class 'B' pit-run gravel 12 inches thick and continued a distance of about 20 feet upstream and downstream of the bridge and up to maximum flood level on the slopes should serve as scour protection. Alternatively the bed and slopes of the stream can be paved with reinforced concrete over the same distance. The sheet piling should extend about 8 feet below river level.

The safe bearing value to apply at El 822 - 824 feet is 4 tsf which value is based on the penetration resistance records of the investigation program.

b) Piles - Timber piles of 10 inch tip or greater, driven to a depth of 19 feet below water level or to El 815 feet should have a working capacity of 20 tons. This estimate is based on the following computation:

$$Q = \frac{1}{F} A \gamma DN$$

where:

Q is the working load in tons

A is the pile tip area in square feet

D is the bearing depth below river bed in feet

$\gamma = 70$ pcf, the submerged weight below river bed

N is the bearing capacity factor estimated to be at least 300 for this dense sand

F = 3 is the required safety factor

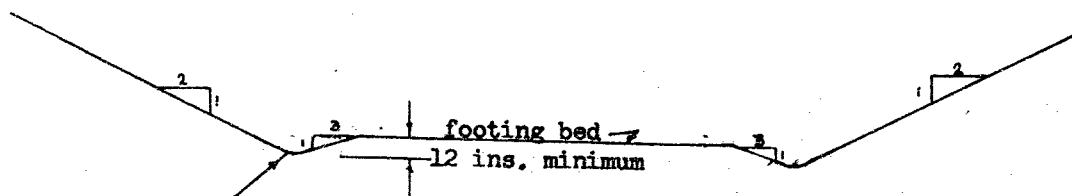
Settlement of the structure associated with the recommended loadings will be negligible and will take place during the construction stage.

EXCAVATIONS

If the footing scheme is adopted, two methods are suggested for reaching footing level without groundwater difficulty. Both methods require that the river be diverted well clear of the construction work.

a) Dewatering using Vacuum Wellpoints - Since the sand is sufficiently free-draining wellpoints may be jetted into place around any given footing location. The tips should penetrate 4 feet below desired footing level. The system must be kept in operation until all footings are installed and backfilled.

b) Oversize Excavation - By excavating to footing level below the water table at each footing site, digging to the approximate shape indicated below and by gradually pumping out, with final pumping confined to the shallow perimeter ditches around the footing area, an undisturbed dense footing base can be exposed. The rate of pumping should be such that the sides of the excavation do not slough in.



perimeter ditches
must be pumped out at
all times until footing
placed.

Sketch of Required Underwater Excavation

APPROACH EMBANKMENTS

No problems are anticipated in connection with the construction of the approach embankments. The approaches will be founded on the alluvial deposits and stability will not be a problem.

EARTH PRESSURES

Closed abutments and wing walls should be designed to withstand the lateral earth pressure exerted by the retained soils. The lateral earth pressure, p , at any depth, h , below the surface can be estimated using the expression:



$$p = 0.25(\gamma h + q)$$

where: 0.25 is the earth pressure considered appropriate

γ is the unit weight of the backfill = 120 pcf above the water table and about 65 pcf below

q is an allowance for surcharge from traffic

Resistance to horizontal sliding of the abutments will be developed by the friction generated along the base of the footings. The coefficient of sliding along the base under the weight of the abutment is estimated to be $\tan \phi = 0.7$. The horizontal force on piled foundations can be taken by batter piles set at El 815 feet.

Should you have any queries after examining the contents of this report, please do not hesitate to call this office.

Yours very truly,

OAJ/ss
Encls.

Dist:- (12)

O.A. Johnston, B.Sc.

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

LEGEND

BOREHOLE NO. 1
 PROJECT Proposed Bridge Replacement,
 LOCATION Kenny Creek, near Burford, Ontario.
 HOLE LOCATION See Dwg. 1
 HOLE ELEVATION 837.3 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) ⊕^s

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX

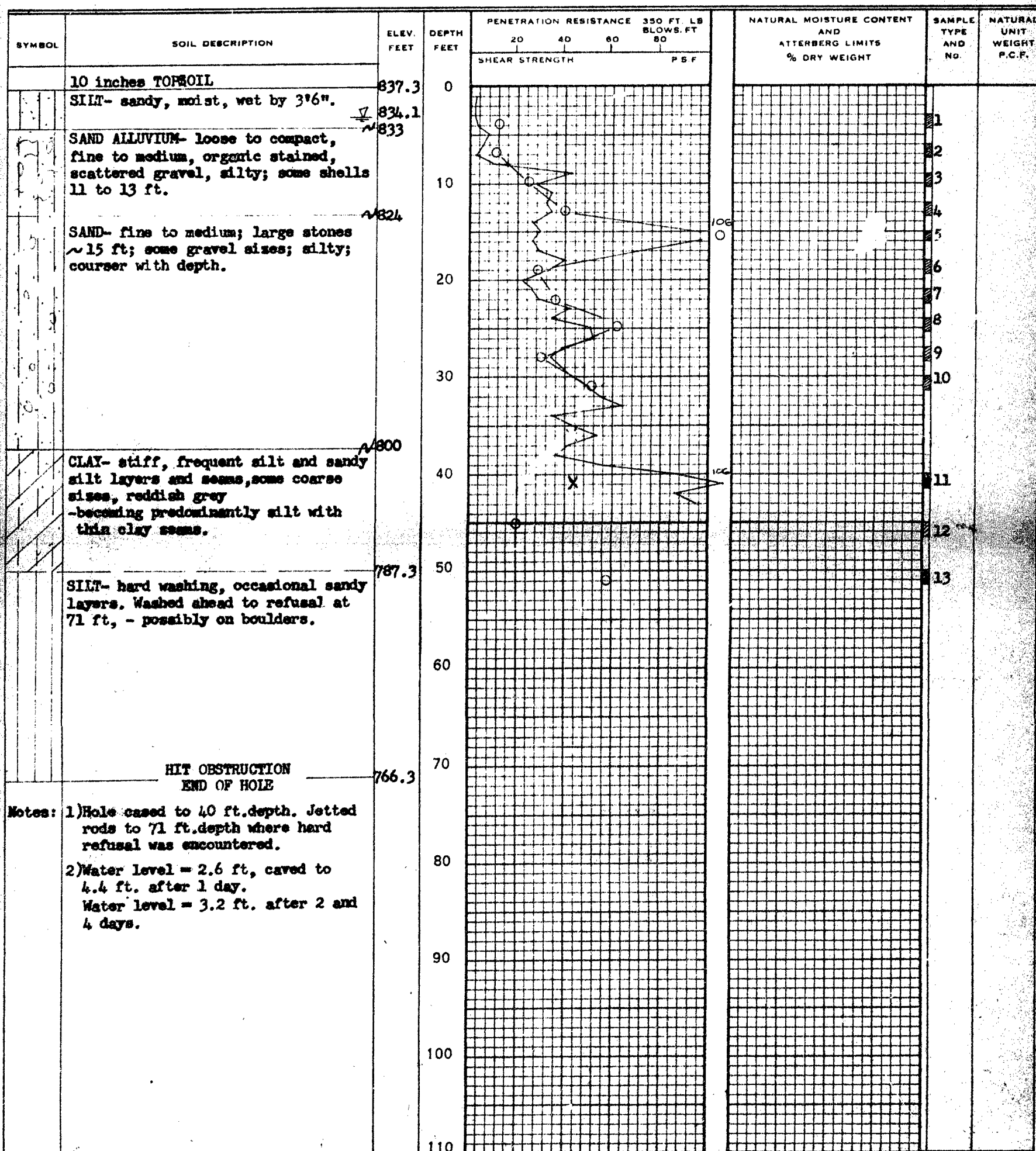
ATTERBERG LIMITS

LIQUID LIMIT —○—

PLASTIC LIMIT ———



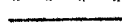
SAMPLE TYPE

2" O.D. SPLIT TUBE —■—
 2" I.D. SHELBY TUBE —■—
 3" O.D. SHELBY TUBE —■—






LEGEND

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
AND LIQUIDITY INDEX

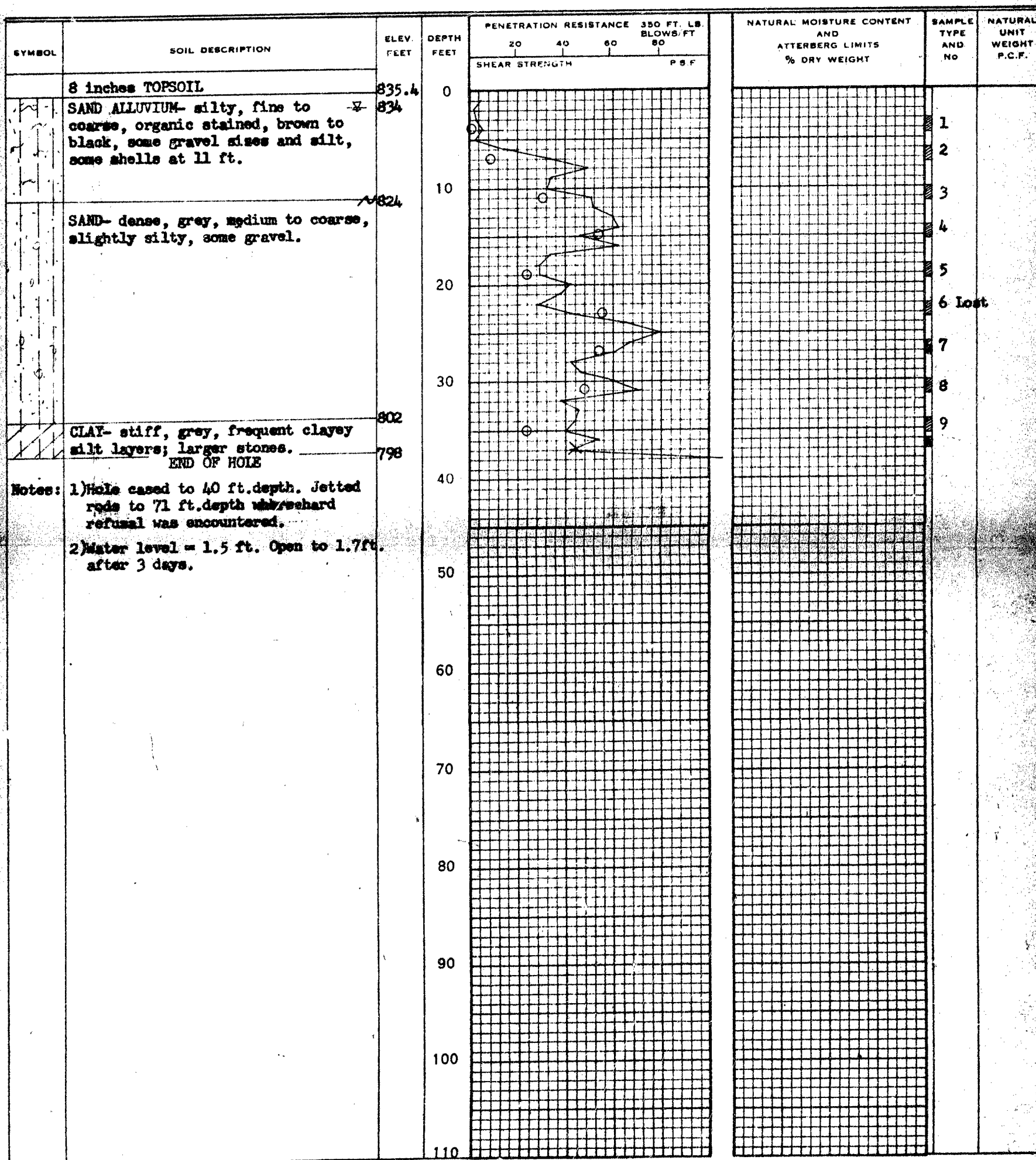
ATTERBERG LIMITS

LIQUID LIMIT PLASTIC LIMIT 

SAMPLE TYPE

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

BOREHOLE NO. 2
 PROJECT Proposed Bridge Replacement,
 LOCATION Kenny Creek, near Burford, Ontario.
 HOLE LOCATION See Dwg. 1
 HOLE ELEVATION 835.4 ft.
 DATUM Ground level



BOREHOLE NO. 3
PROJECT Proposed Bridge Replacement,
LOCATION Kenny Creek, near Burford, Ontario.
HOLE LOCATION See Dwg. 1
HOLE ELEVATION 837.1 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) ⊕^s

NATURAL MOISTURE CONTENT AND LIQUIDITY INDEX

ATTERBERG LIMITS

LIQUID LIMIT —○—

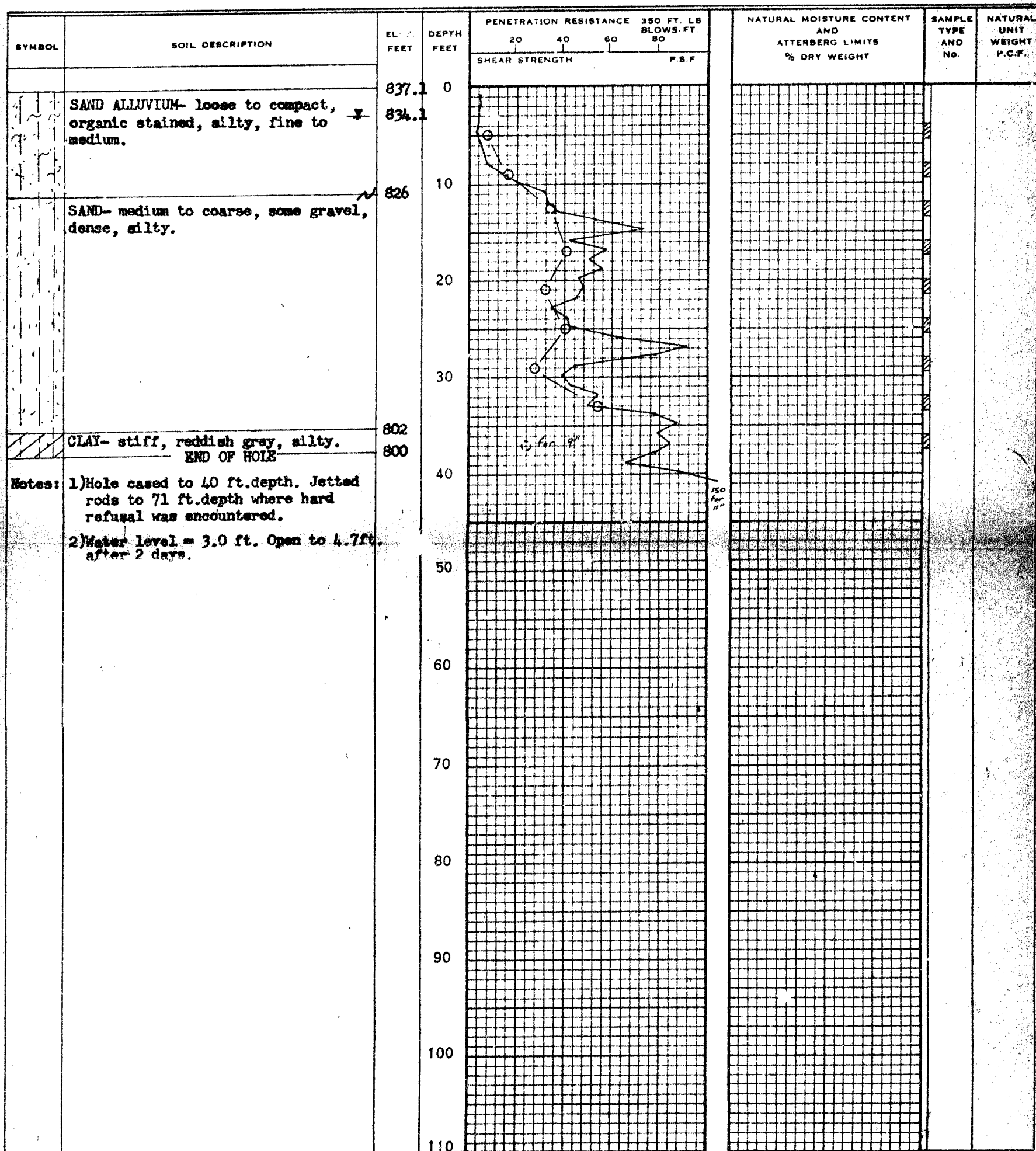
PLASTIC LIMIT ———

SAMPLE TYPE

2" O.D. SPLIT TUBE —■—


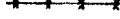

2" I.D. SHELBY TUBE —■—

3" O.D. SHELBY TUBE —■—






BOREHOLE NO. 4
 PROJECT Proposed Bridge Replacement,
 LOCATION Kenny Creek, near Burford, Ontario.
 HOLE LOCATION See Dwg. 1
 HOLE ELEVATION 836.8 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

AND LIQUIDITY INDEX

ATTERBERG LIMITS

LIQUID LIMIT

PLASTIC LIMIT

SAMPLE TYPE

2" O.D. SPLIT TUBE

2" I.D. SHELBY TUBE

3" O.D. SHELBY TUBE

X LI

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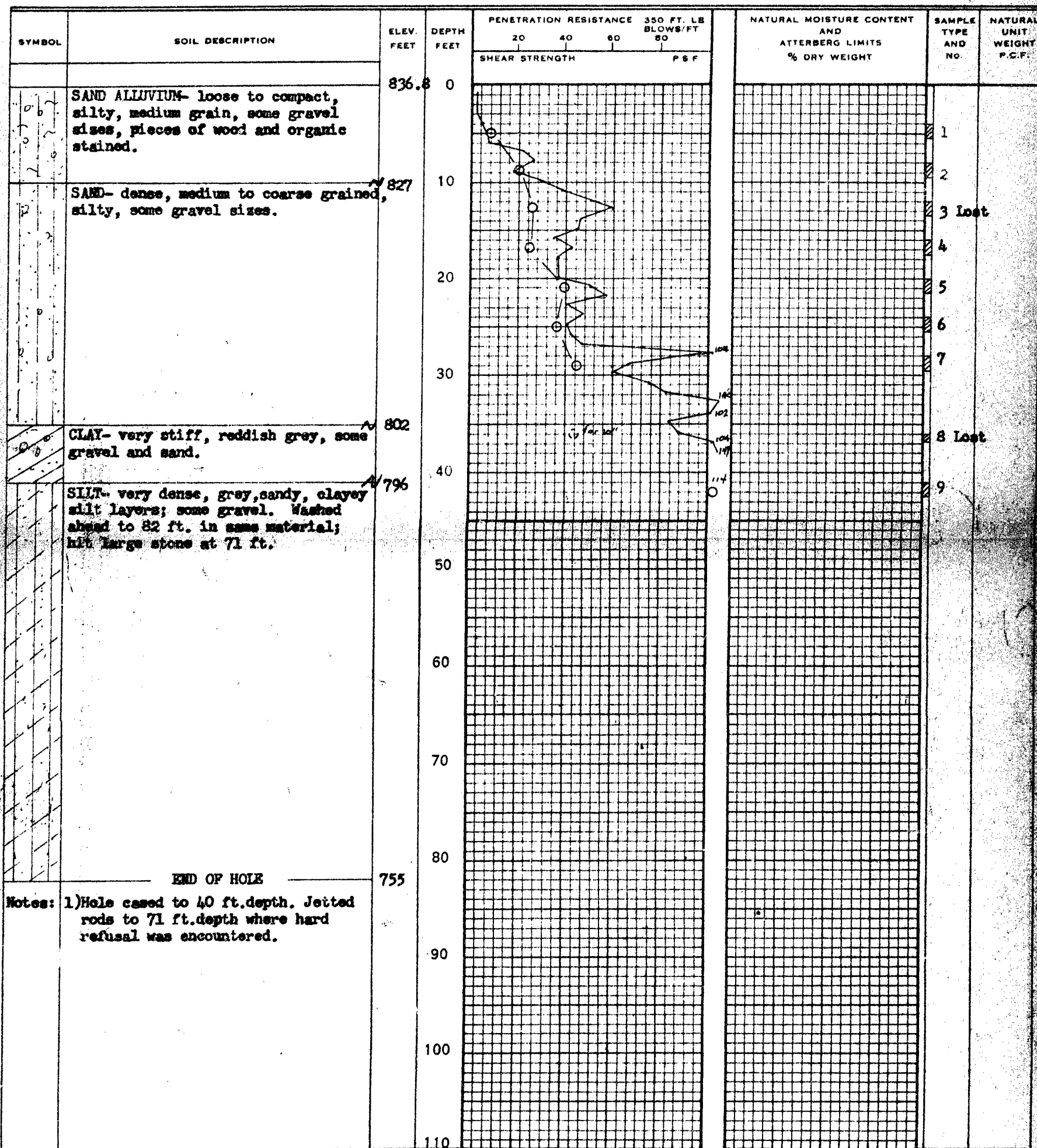
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LEGEND

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
 AND LIQUIDITY INDEX

ATTERBERG LIMITS

LIQUID LIMIT —○—

PLASTIC LIMIT —|—

SAMPLE TYPE

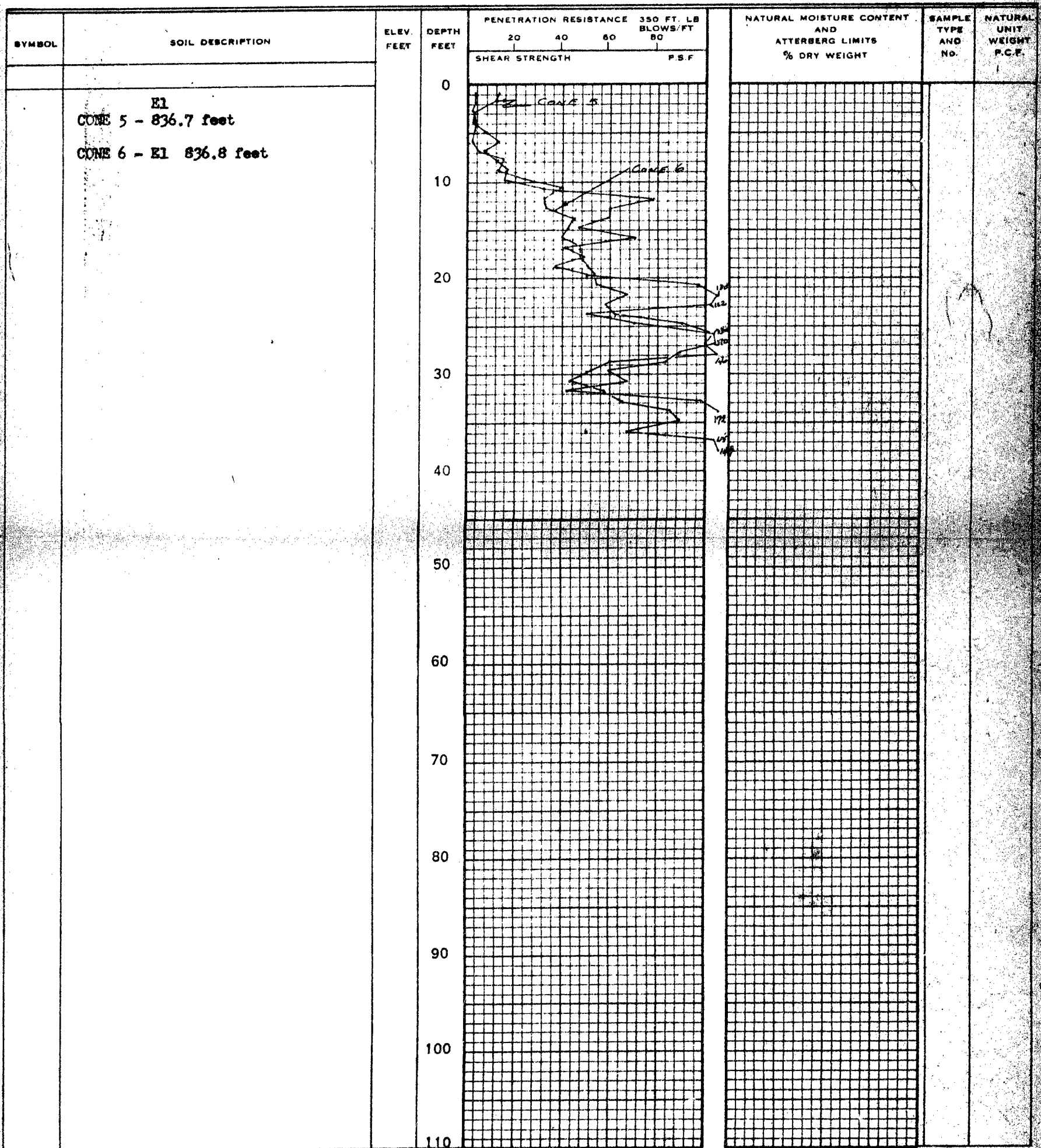
2" O.D. SPLIT TUBE —■—
 2" I.D. SHELBY TUBE —■—
 3" O.D. SHELBY TUBE —■—

BORING No. CONES 5 and 6PROJECT Proposed Bridge ReplacementLOCATION Kenny Creek, near Burford, Ontario.

HOLE LOCATION _____

HOLE ELEVATION _____




DATUM _____






LEGEND

BOREHOLE NO. CONES 7 and 8
 PROJECT Proposed Bridge Replacement,
 LOCATION Kenny Creek, near Burford, Ontario.
 HOLE LOCATION _____
 HOLE ELEVATION _____
 DATUM _____

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) 

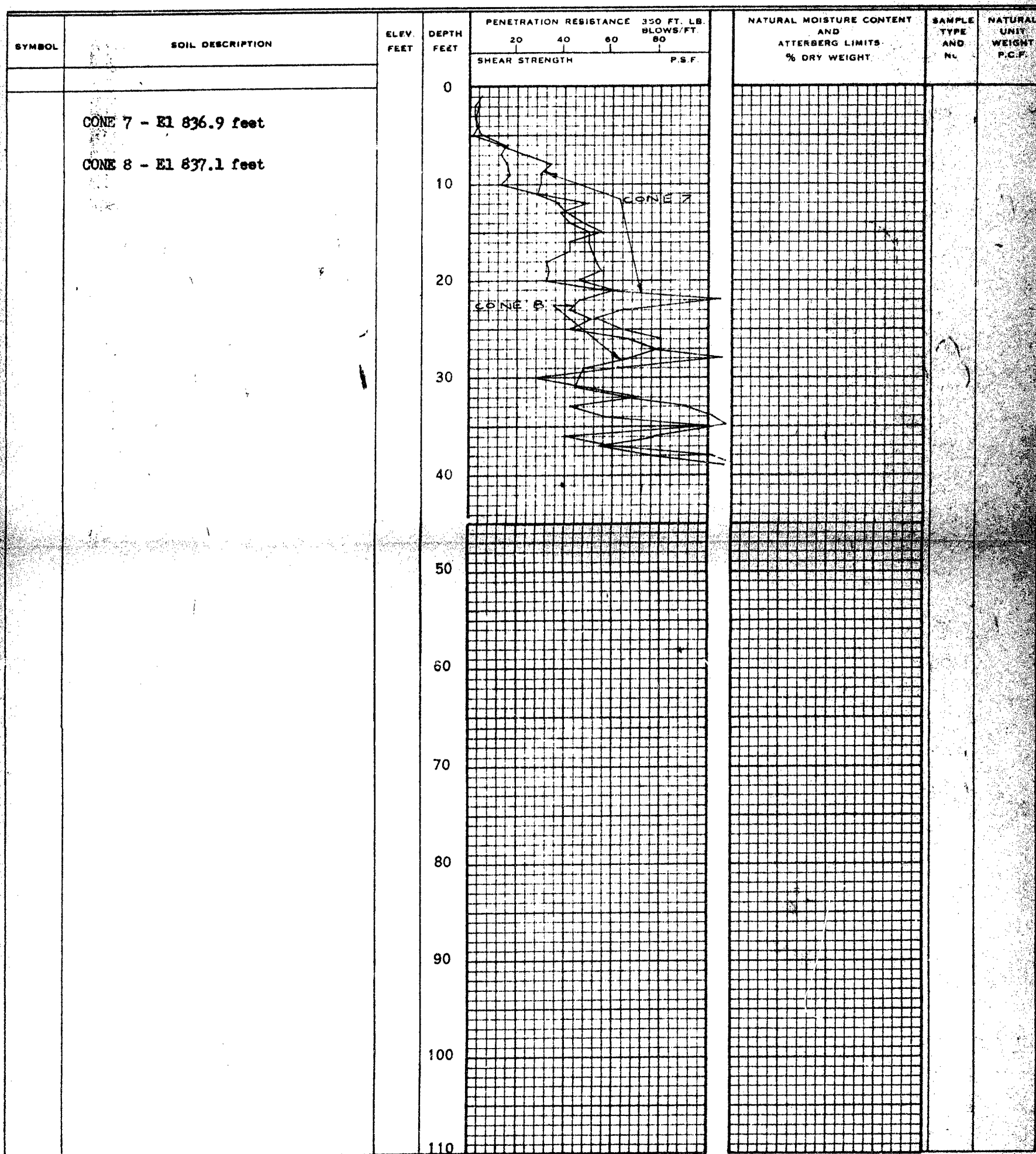
NATURAL MOISTURE CONTENT
 AND LIQUIDITY INDEX 

ATTERBERG LIMITS

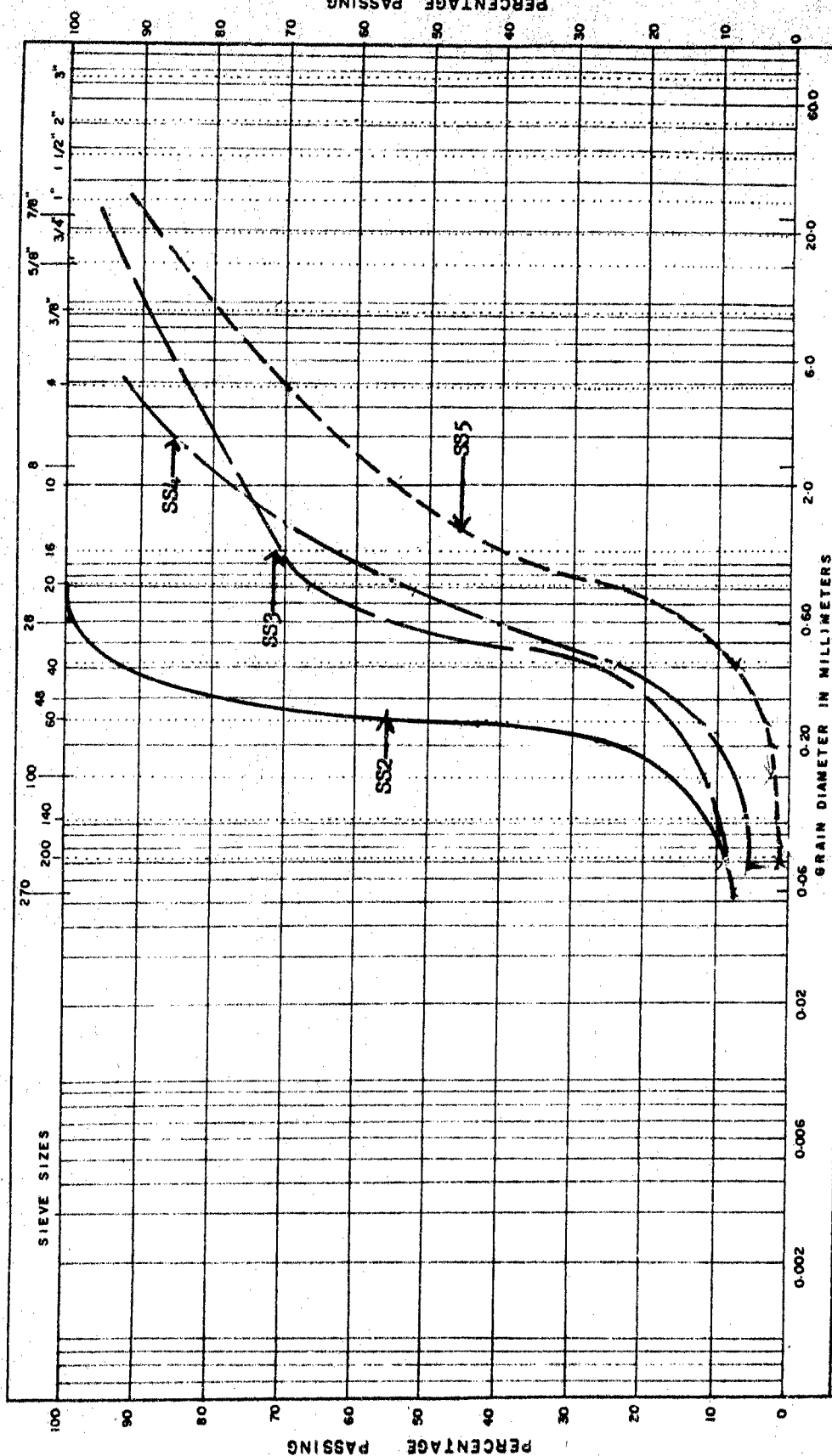
LIQUID LIMIT 
 PLASTIC LIMIT 


SAMPLE TYPE

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



MECHANICAL ANALYSIS



CLAY		FINE		MEDIUM		COARSE		FINE		MEDIUM		COARSE	
		SILT						GRAVEL					
MODIFIED M.I.T. CLASSIFICATION													
GRADINGS OF SAND, HOLE 2, KENNY CREEK													
WILLIAM TROW  ASSOCIATES LTD.													

ays

Mr. E. Greenland,
District Engineer,
District #4 (Hamilton).

Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

Attn: Mr. E. Britton,
Construction Engineer

July 24, 1968

Kenny Creek Bridge, Hwy. 53
Contract 68-77, W.P. 725-56
District #4 (Hamilton)

At the request of Mr. J. Reagan of your Office, the above mentioned site was visited by the writer on July 23, 1968. 'Boiling' conditions had arisen when the Contractor carried out excavations for the East and West pier footings. The following observations were made:

- (1) Excavations had been carried out below the ground-water level without prior precautions being taken to prevent 'boiling' - i.e., the installation of sheeting or well points.
- (2) Excavations had reached to within 1 or 2 feet of footing level and 'boiling' was taking place at several locations within the excavations. Water was being pumped out from sumps, the net result of which was to aggravate and maintain the 'boiling' conditions.
- (3) Subsoil, visible within the excavations, consisted of very loose grey sandy silt, containing organics. At some locations the 'boiling' has resulted in loosening of the soil to depths of about 2 feet below footing level.

The above points were discussed with Project Supervisor, Mr. J. Cleaver and the Contractor's Superintendent, who were advised that the footings could be successfully excavated and dewatered by:

- (a) Driving interlocking steel sheeting to a depth below the excavation bottom equal to the height of the prevailing groundwater level above it, then proceeding with excavation and pumping in the normal way.

cont'd. /2 ...

Mr. H. Greenland,
District Engineer,
District #4 (Hamilton)

2.

Attn: Mr. R. Britten, Const. Engr.

July 24, 1968

(b) Lowering the groundwater level over the entire footing area by means of well points, to a level at least 2 feet below the future excavation base. The number of well points required cannot be predetermined, since this depends on a number of variables. It will be necessary to keep the groundwater level lowered until the concrete pile caps are poured and backfilled.

For Method (a) the groundwater level may be taken to be equal to the creek water level. The Contractor expressed some concern that the 'springs' in the excavations were caused by pre-existing artesian pressures; there is no evidence of this in the Foundation Report.

Following the successful excavations for the pier footings, it is recommended that all loose soil and soil containing organics be removed from below the footing level and replaced with suitable granular material.

KGS/MieF

H. G. Selby
K. G. Selby,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Sterzno,
PRINCIPAL FOUNDATION ENGR.

cc: Messrs. B. H. Davis
A. McKim
H. A. Tregaskes
D. M. Hopper

Foundations Files ✓
Gen. Files

Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Division,
Admin. Bldg.

Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

February 10, 1967

Preliminary Plan No. D-6080-1,
Kenney Creek Bridge, Hwy. #53,
District #4 (Hamilton),
W.P. 725-56

We have reviewed the above mentioned preliminary plan with regard to the foundation design. Since no details are given concerning the length and design capacity of the timber piles, we assume that the recommendations given in the foundation report by William Trow Associates Ltd., are being followed.

We note also, that the piles for the abutments will not be permanently below the groundwater level and recommend, therefore, that they be 'treated' to ensure preservation.

KGS/kdeP

cc: Messrs. S. McCombie
W. S. Melinyshyn
Foundations Files ✓
Gen. Files

K. G. Selby
K. G. Selby,
SUPERVISING FOUNDATION ENGR.
For:
A. G. Stermac,
PRINCIPAL FOUNDATION ENGR.

Department of Highways Ontario

Copy for the information of

Mr. A. Stermac, Principal Foundation Engineer,
Room 107, Lab. Building

Mr. W. Melnyshyn,
Regional Bridge Location Engineer,
Central Region,
Administration Building

Bridge Division,
Downsview, Ontario

February 3, 1967

Kenny Creek Bridge
W.P. 725-56, Site 1-54
Highway 53, District No. 4

Attached herewith are prints of the Preliminary Bridge
Plan Drawing B-6080-1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$73,000.
This cost includes tender, materials, engineering and sundry
construction.

Any comments or revisions you may have should be submitted
within three weeks.

CSG:rd

C.S. Grebaki,
Bridge Design Engineer

Attach.

C.C. R. Forrest
E. Cross
A. Stermac
S. McCombie

Mr. B. B. Davis,
Bridge Engineer,
Bridge Division.

Attention: Mr. B. MacCormick

Foundation Section,
Materials & Testing Div.,
Room 107, Lab. Bldg.

October 14, 1966

OCT 14 1966

FOUNDATION INVESTIGATION REPORT FOR D.B.C.
BY: William Frow Associates Limited --
Proposed Bridge Replacement, Hwy. 53, Kenny Creek,
3 Miles West of Burford, Ont. - Dist. 4 (Hamilton)
-- U.F. 725-56 --

Attached, please find the above mentioned report prepared and submitted by the consultant, William Frow Associates Ltd.

In the report the consultant discusses various foundation and construction alternatives. We have certain comments regarding the recommendations, but would prefer to make them after you have the chance to familiarize yourself with the subsoll conditions. It would also be quite essential that the recommendations of the Hydrology Section be known.

We would suggest that a meeting be called at which the designer and a representative of this Section should be present. At this meeting a number of problems pertaining to the design and construction of the foundations should be analyzed and final recommendations made.

ACK/die?

Attn:

cc: Messrs. B. B. Davis (2)
E. A. Tregaskes
D. W. Farren
C. A. Hunter (2)
W. S. Melnyshyn
H. Greenland
T. J. Kovick
A. Watt

Foundations Office
Gen. Files

A. G. Stern
A. G. Stern,
PRINCIPAL FOUNDATION ENGINEER

Bay. 401 & Keele St.,
Downsview, Ontario.

September 7, 1966

Materials and Testing Division

William A. Iron Associates Ltd.,
90 Silver Drive,
Aurora, Ontario.

Attention: Mr. W. A. Iron -- Letter of Authority --

- Re: 1) W.P. 942-64, Site No. 22-189,
Beaverton Road, 1.4 Mi. East of the
North Jct. Highway 12,
Highway 7 (T.C.S.) District 6 (Toronto).
- 2) W.P. 725-56,
Kenny Creek Bridge,
Highway 33, District 4 (Hamilton).

Dear Sir:

Please consider this your authority to carry out the foundation investigations for the two above mentioned structures. You are kindly requested to submit the final reports on or before the following dates:

- W.P. 942-64 -- October 7, 1966 (12 copies)
W.P. 725-56 -- October 14, 1966 (12 copies)

The field investigation should, at all times, be supervised by a qualified Geils Engineer. Any other arrangement has to meet our prior approval.

Any additional information regarding the location of the sites or surveying data, can be obtained from the Regional Bridge Location Engineer, Toronto, Mr. W. D. Melnychyn - Phone No. 246-3500, or through the Foundation Section.

The necessary plans were given to your Mr. W. A. Iron on September 7, 1966.

Since the drawings accompanying the foundation reports, showing the location of borings, the inferred subsail conditions, etc., are to become contract drawings, you are required to prepare

cont'd. /2 ...

Mr. A. Trow -
William A. Trow Assoc.

- 2 -

September 7, 1966

them in accordance with the D.H.O. Standards. To enable you to do this, we are supplying you with a sample drawing with all the necessary explanations, together with linen sheets for your drawings. You are also requested to provide us with Cronaflex copies of the drawings.

Previous requirements as to preliminary borehole information and laboratory testing program should be followed.

Charges for the work performed will be in accordance with your schedule of rates, dated January 1, 1966, and invoices to be addressed to the attention of the undersigned.

We are attaching the following Purchase Orders:

A-038-4 -- A.P. 942-64, Site No. 22-189;

A-03805 -- A.P. 725-55, Kenny Green Bridge,

covering the purchase of any new material required for this work, in order that you may use them as a basis for exemption from the Federal Tax for such purchases. The Exemption Certificate is printed thereon.

Yours very truly,

SGS/ndc?
attach.

Altermann
H. A. Rutka,
MATERIALS & TESTING ENGINEER

cc: Messrs. S. McCombie
G. S. Hunter
T. Allen
H. Greenland
W. B. Melinyshyn
T. J. Kovich
R. Konings
Mrs. I. Steinberg
H. Szymanski (2)
A. Crowley
Foundations Office
Gen. Files (2)