

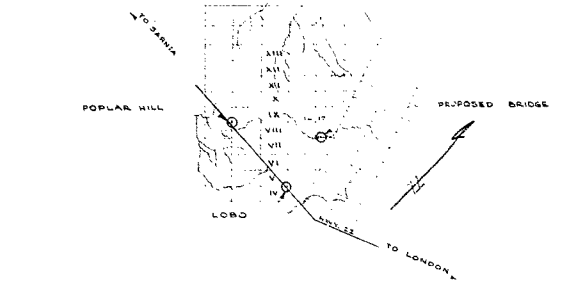
#63-F-254M

CAVERHILL

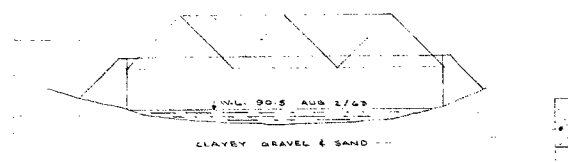
BRIDGE

SYDENHAM

RIVER

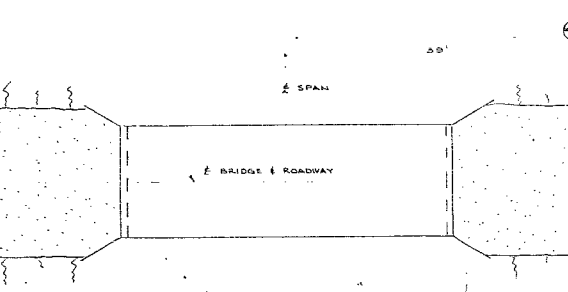


KEY PLAN
SCALE 1" = 1 MILE

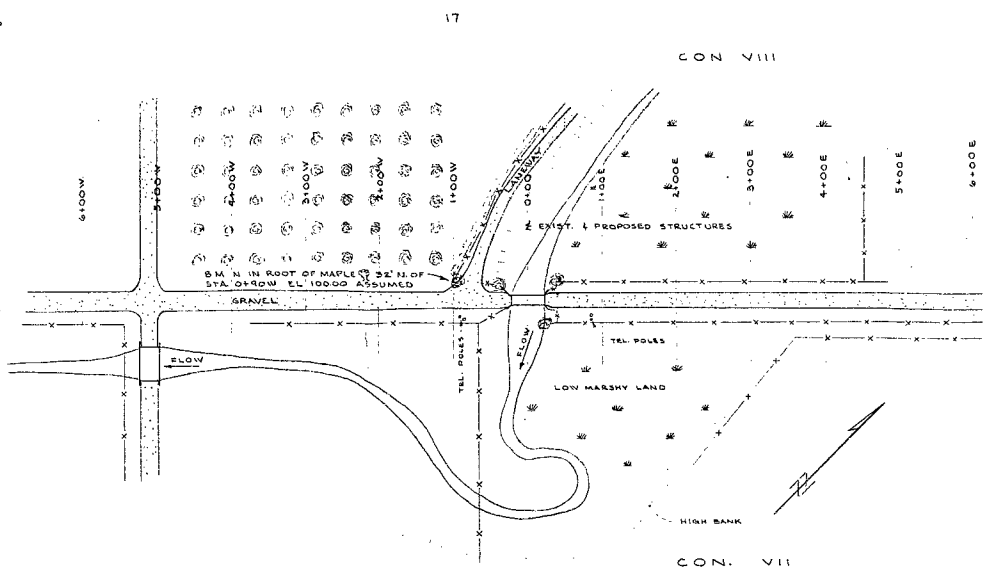


NOTE:
FOR B.M. SEE SITE PLAN

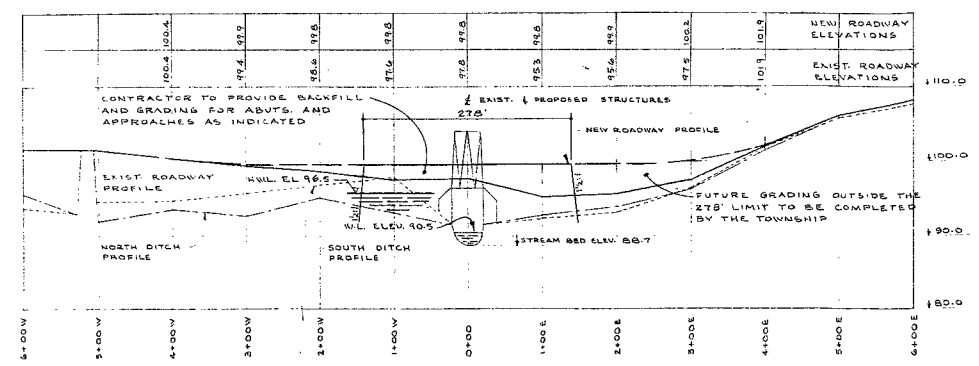
SUBSURFACE PROFILE
SCALE 1" = 10'



BOREHOLE LOCATION PLAN
SCALE 1" = 10'



SITE PLAN
SCALE 1" = 100'



ROADWAY PROFILE
SCALE HORIZ 1" = 100'
VERT 1" = 10'

- DATA**
- Special Features: Waterfalls, Exceptional Floods, Ice, Driftwood, Sliding Banks, etc.
 - Watershed reasonably flat, stream has good fall, very little driftwood, low banks, and occasional ice jamming.
 - (a) Eastern and Western Bridges (Give Location, Length, Height above N.M.W.L., Net Cross-Sectional Area of N.M.W.L., Estimated Age)
 - 1 1/2 mi. upstream, 31' span, 16' roadway width, height above N.M.W.L. 210', net cross-sectional area at N.M.W.L. 210 sq. ft., Age 30-40 years. Also 1 mi. upstream on branch, conc. culvert 12' span, height above N.M.W.L. 40', net cross-sectional area 36 sq. ft., age 30 years.
 - 1/8 mi. downstream, 45' span rigid frame built in 1962.
 - 3/8 mi. downstream, 3 Armo pipe arches 6'-0" height 2'-6" span installed in 1959, net cross-sectional area 3 x 40 = 120 sq. ft.
 - 1 1/2 mi. downstream, 40' span, 30' roadway width, height above N.M.W.L. 34', net cross-sectional area at N.M.W.L. 390 sq. ft. built in 1959, rigid frame.
 - (b) Reasons why these bridges are, or are not, fair indications of the size of proposed bridge:

Most of the above bridges are a good indication of the size required except the 3 Armo pipe arches. The bottom chord of the older bridges are generally too low although the spans are adequate.
 - Reasons for Change in Height or Length from that of Old Bridge:

The span of the new bridge is the same as that of the old bridge-- 45'-0". The underside of the structure has been raised slightly to prevent ice jams and to improve the grade of the roadway.
 - Is ditch, stream, or river gradient liable to be lowered?

No appreciable lowering is expected.
 - Has Approval Been Obtained Under Navigable Water Protection Act?

YES
 - Is a Temporary Detour Required?

Who Will Build It? CONTRACTOR
Who Will Maintain It? CONTRACTOR
 - Information and Evidence of Extreme Flooding was Obtained from Local Residents, and reflects Highest Water Elevation in the area of this construction to be 92.5 and the Lowest Water Elevation to be 87.2.
 - Read Design Information: Estimated A.D.T. 100 Vehicles.
Design Speed: 50 m.p.h.
Stopping Sight Distance 800 ft.

STRUCTURE DATA

- Net span Length and Type of Bridge: 45' SPAN RIGID FRAME
- Roadway Width on Bridge: 30'-0"
- Number and Width of sidewalks: NONE
- Skew Angle: 0°
- Total Length and Type of Biling: 20'-12" DIA. 10' SQUARE
PRECAST CONC. PILES @ 15'-0" LONG x 360 LIN. FT.
- Approx. Volume of Concrete: 255.5 cu. yds.
- Approx. Weight of str. steel: Tons
- Approx. Volume of Approach Fill: 1400 cu. yds.
100' Each Side of Structure
- Drainage Area: 15.3 sq. ft.
- Approx. Weight of Reinforcement: 17.96 Tons.

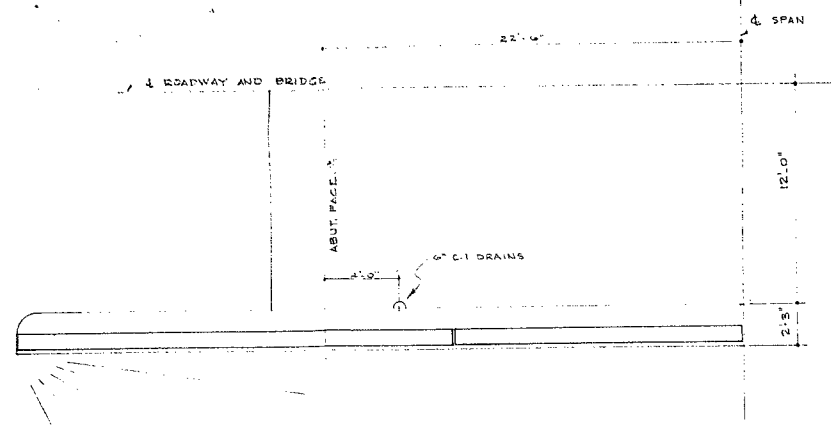
Field Investigation made Aug. 2, 1963 by: A.J. DEVOS
Survey Engineer

THE CAVERHILL BRIDGE
LOBO TOWNSHIP

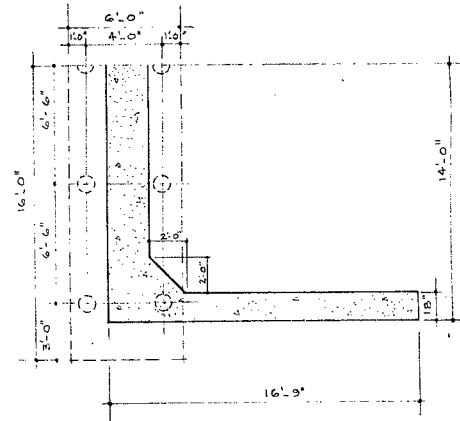
OWNER - TOWNSHIP MUNICIPAL DISTRICT NO. 2
COUNTY - MIDDLESEX ROAD NO. LOT-17
TOWNSHIP - LOBO CONCESSION - 7 & 8

SITE PLAN

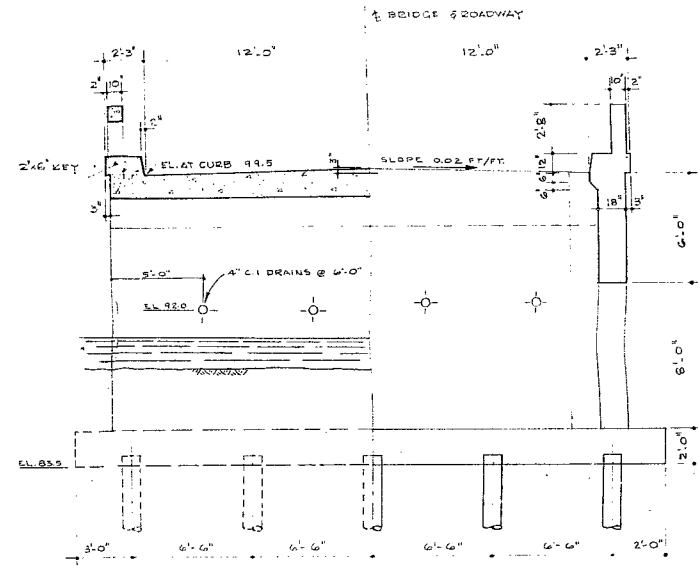
SCALE AS SHOWN	APPROVED BY:	JOB NO.	DRAWN BY: G.D.V.
DATE: 29-12-63		6340	REVISED
ELI CURRIE ROAD SUPERINTENDENT			
DRAWING NUMBER			



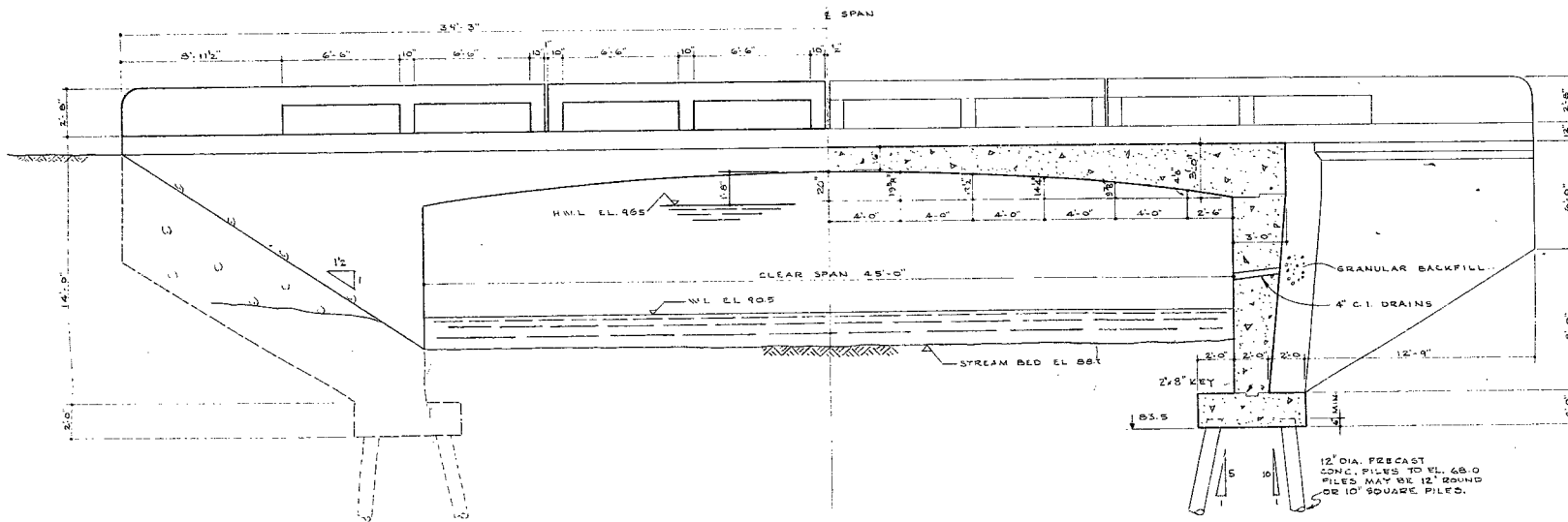
QUARTER PLAN
SCALE: 1/4" = 1'-0"



QUARTER SECTION
SCALE: 1/4" = 1'-0"



HALF CROSS SECTION HALF END VIEW
SCALE: 1/4" = 1'-0"

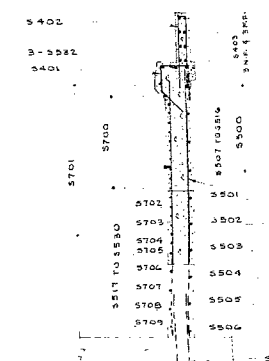
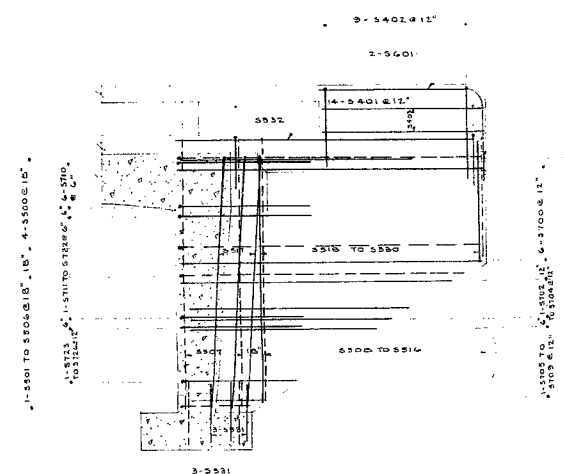
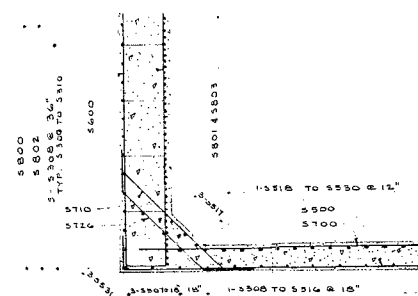
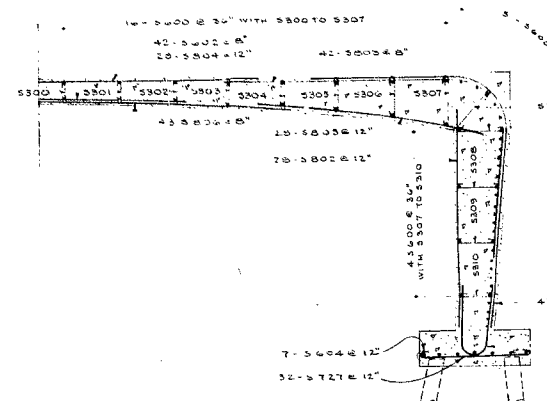


HALF ELEVATION
SCALE: 1/4" = 1'-0"

HALF SECTION
SCALE: 1/4" = 1'-0"

- GENERAL NOTES**
- Structure designed for H20-S16 loading.
 - Work on the structure must not be commenced until monuments to fix control points have been erected and checked by the Engineer.
 - Structure to be built in accordance with D.H.C. Form 9 Revised and the Engineers specifications for the Caverhill Bridge, Concession VII & VIII, Lot 17.
 - The complete soil investigation report by Dominion Soil Investigation Limited may be examined at the Consulting Engineer's office. The Consulting Engineer does not guarantee the accuracy of this report.
 - Footings depths subject to revision by Engineer.
 - Footings to be finished to the neat dimensions and the concrete shall be poured against undisturbed material where applicable.
 - No concrete shall be placed in the footings before the character of the soil and excavation for footings has been approved by the Engineer.
 - Concrete Mix**
(a) Minimum strength at 28 days 3000 psi.
(b) All concrete except in footings shall include an approved air entraining agent.
(c) Maximum size of aggregate shall be 5/8 in. in deck slab, curb and guardrail; 1 1/2 in. footings and 1 in. elsewhere or as specified.
(d) Concrete Min 1-71-14.
 - All exposed edges to be chamfered 1" unless otherwise noted. All acute angles shall be filleted as indicated.
 - No concrete to be poured before materials, men, formwork, falsework and reinforcing have been checked by the Engineer.
 - Deck falsework shall not be struck until all backfill has been placed and compacted behind the abutments, to the satisfaction of the Engineer. In case of piers and beams, no backfill to be placed before piers are erected and secured.
 - Backfill behind abutments to be brought up simultaneously at both ends.
 - Construction joints not shown on plans must be approved by the Engineer.
 - Reinforcing steel to be #10-rod. Other sizes unless otherwise noted; 3" in footings and 1 1/2 in surfaces in contact with earth or water; 1 1/2 in bottom of decks; 2" elsewhere.
 - PILE FOUNDATION**
TYPE: 12" DIA. OR 10" SQUARE PRECAST CONC. PILES
DESIGN LOAD - 40 TONS PER PILE
LENGTH OF PILE - 15'
(a) Grading of approaches shall be by the Township OUTSIDE OF LIMITS SHOWN
 - Estimated Quantities**
(a) Reinforcing steel 17.96 TONS
(b) Concrete 254.5

THE CAVERHILL BRIDGE			
TOWNSHIP OF LOBO			
	SCALE: 1/4" = 1'-0"	APPROVED BY:	JOB NO. 6349
	DATE: 27-12-63	DESIGNED BY: S.D. VALLES	REVISED BY:
PLANS, SECTIONS AND ELEVATIONS			DRAWING NUMBER
S. D. VALLES & ASSOCIATES CONSULTING ENGINEERS LONDON & TORONTO			2



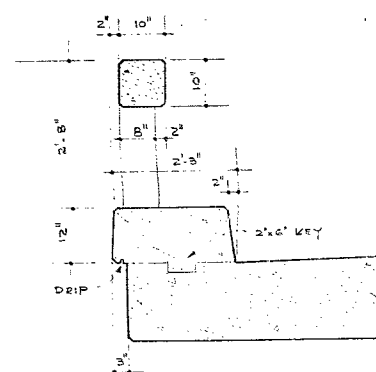
HALF FRAME SECTION

H A L F A B U T . S E C T I O N

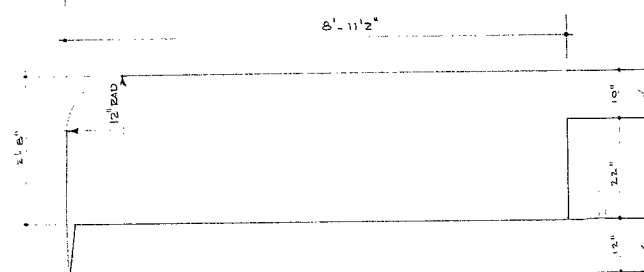
W I N G W A L L E L E V A T I O N

W I N G W A L L S E C T I O N

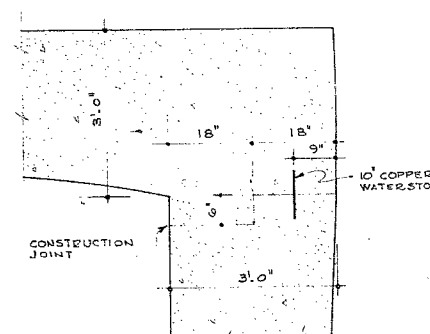
SCALE : $\frac{1}{4}'' = 1'-0''$



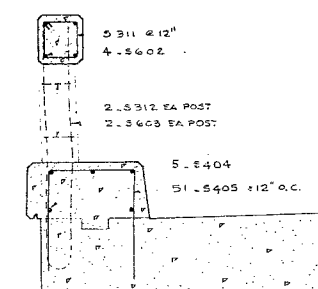
C U R B D E T A I L
S C A L E : $\frac{3}{4}" = 1' - 0"$



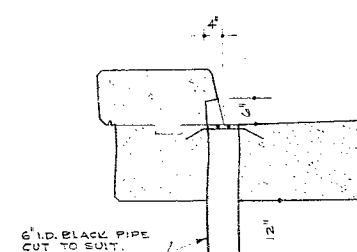
E N D P O S T D E T A I L
S C A L E : $\frac{3}{4}" = 1'-0"$



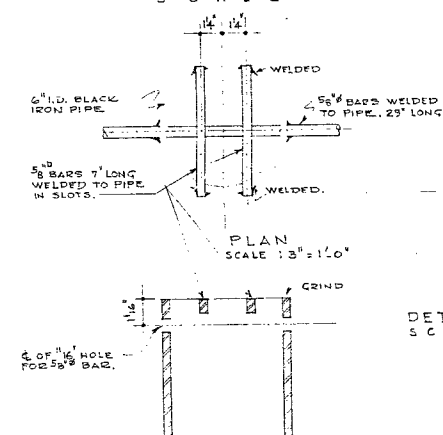
K N E E D E T A I L
S C A L E : 3' = 1'-0'



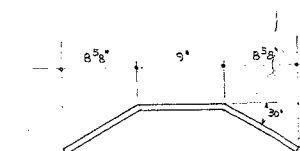
C U R B R E I N F.
S C A L E : $\frac{3}{4}" = 1'-0"$



DRAIN DETAIL
SCALE: 3/4" = 1'-0"



SECTION
SCALE: 3"=1'-0"

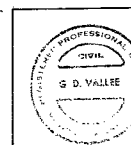


DETAIL OF 58[#] BAZ
SCALE 1/2" = 1'-0"

ONE REQ'D FOR EACH DRAIN.
BAZ TO BE BENT AFTER
INSERTED IN PIPE.

D R A I N A G E D E T A I L S

PRECAST CONG. PILE DETAILS



<h1 style="text-align: center;">THE CAVERHILL BRIDGE</h1> <h2 style="text-align: center;">TOWNSHIP OF LOBO</h2>			
SCALE AS SHOWN DATE: 2-9-12-G3	APPROVED BY:	JOB NO. 6340	DRAWN BY: G.D. REVISOR:
<h3>MISC. DETAILS AND REINFORCING</h3>			DRAWING NUMBER 3

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. Stermac,
Principal Foundation Engineer,
Room 107, Lab. Bldg.,

FROM: G. C. E. Burkhardt

DATE: February 20, 1964.

OUR FILE REF.

IN REPLY TO

SUBJECT:

Township of Lobo - Bridge over the Sydenham River
Lot 17, Con. VII/VIII - County of Middlesex
Structure Site No. 20-135 - Our File No. BA 1748

Attached please find one copy of the Foundation Report, by Dominion Soil Investigation Limited, and one copy of the Preliminary Plans for your comments.

We would appreciate it very much, if we could have your comments on/or before the February 28th, 1964.

GCEB/bm

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

*No B/H on west side of bridge!
otherwise no comment*

25/2/64

Because of inadequate information report not considered.

Feb. 26. 1964

aps Byrnhme

MESSRS. A. M. SPRIET & ASSOCIATES
CONSULTING ENGINEERS
264 WELLINGTON STREET
LONDON - ONTARIO

3-8-63 254 M

Report on
SOIL INVESTIGATION
for
ROAD BRIDGE CAVE MILL BR.
CONCESSIONS VII & VIII, LOT 17
TOWNSHIP OF LOBO

Middlesex

by
DOMINION SOIL INVESTIGATION LIMITED
363 Queens Avenue
LONDON - ONTARIO
Reference No. 3-8-L4
August 1963

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GEOTECHNICAL DATA SHEET	3

SUMMARY

The principal stratum is a dense to very dense sandy silt. The level of the water table at the time of this investigation was El.90 feet.

A spread footing design is feasible using a soil pressure of 6000 p.s.f. at El.83 feet. Special dewatering procedures using a deep sheet-pile enclosure will be necessary to maintain the stability of the bottom and sides of the excavation.

As an alternative, the use of driven displacement piles of Steel or precast concrete is recommended. Piles with a safe working load of 40 tons are expected to reach a satisfactory set at El.68 feet.

I INTRODUCTION

In accordance with verbal authorization from Mr. A. M. Spriet a soil investigation has been carried out at a site in the Township of Lobo, where it is proposed to replace an existing road bridge with a new structure. The present bridge carries a gravel road across the Bear Creek which is a headwater of the Sydenham River.

It is understood that the new bridge will have a span of 40 to 50 feet, and will be located in the same position as the existing structure.

A soil investigation for a nearby bridge a few hundred feet to the west was made in October 1961*. In view of the similarity of soil conditions at the two sites, the present field programme was limited to one borehole after consultation with Mr. Spriet.

The purpose of this investigation has been to reveal the subsurface conditions and to determine the **necessary soil** properties for the design and construction of foundations.

II FIELD WORK

Field work was carried out on the 10th and 12th of August, 1963 and consisted of one borehole at the location shown on enclosure 2. The hole was advanced by washboring and lined with Bx (3-inch) casing.

Standard Penetration tests were made at frequent intervals of depth to obtain a measure of the relative density or consistency of the soil and to recover disturbed samples. A dynamic cone penetration test was performed adjacent to the borehole.

The results of the field tests are recorded on enclosure 3. Elevations have been referred to the client's local reference datum, viz., a spike on a tree root to the north-west of the site (El.100.0 feet).

III SUBSURFACE CONDITIONS

Details of the subsoil stratification are shown on enclosures 2 and 3.

The upper layer of compact gravel and sand contains all sizes of rounded and subangular particles up to about 2-inches in diameter. A small percentage of clay is present but the material is still highly pervious.

A dense grey-brown sandy silt extends from 7'-0" to 23'-6". It is generally a cohesionless material except for a few seams of brown clay of 1/4-inch to 1/2-inch in thickness.

* See reference 1

Below 23'-6" the sandy silt becomes very dense and cohesive, and contains clay seams up to 1-1/2 inches in thickness.

The level of water in the creek at the time of the investigation was El.90.1 feet.

IV FOUNDATIONS

The elevation of the bed of the creek is 88.2 feet, so that allowing for erosion the level of footings or pile caps should be about El.83 feet. Both footing foundations and piled foundations are considered in the following analysis.

(a) Spread footings

At or below El.83.0 the soil has a relative density in excess of 75%, indicating a safe soil pressure of at least 6000 p.s.f. *provided that the footings can be poured on an undisturbed grade.* To achieve this condition will require special dewatering procedures.

Well-points would be difficult to install through the coarse gravel layer and they might be unable to effectively drain that layer. The yield of pumping would be high. The use of a watertight sheet pile enclosure appears to be the best solution. For the prevailing water level of El.90 feet, the sheet piles should be driven to El.74 feet. The excavation can then be pumped out without heaving the bottom. (Whatever the prevailing water level, the piles should be driven to such a level that the distance from the footing grade to the pile tip is about 2 feet more than the distance from the grade to the natural water table).

(b) Piles

As an alternative to spread footings and the accompanying dewatering costs, the use of precast concrete or steel pipe piles should be considered.

It is recommended that the piles should be driven at least 15 feet below the pile cap, i.e. to El.68 feet. At this level the calculated ultimate end-bearing resistance of a pile with a cross-sectional area of 0.75 square feet is 120 tons. Applying a factor of safety of 3 the safe working load is 40 tons per pile. The piles should be driven to a satisfactory set in accordance with the Hiley formula, irrespective of the level at which this set is achieved. Provided that the pile spacing is not closer than 2.5 diameters, it may be assumed that the safe working load for the pile group is the sum of that for the individual piles.

The settlement of the structure will be negligible.

In the foregoing calculation the effect of skin friction has been ignored to compensate for possible variations in the subsoil conditions. The effect of skin friction for the conditions encountered at the borehole would be to add about 20% to the calculated bearing capacity.

When forming the pile cap it may be necessary to drive timber or steel sheeting to a depth of several feet below the bottom of the excavation to prevent "boiling" in the subsoil. This will depend to a large extent on the prevailing groundwater level. Any deep seated disturbance of the soil must be avoided.

Of the two foregoing methods of construction the use of piles is preferred. It avoids the uncertainty which can be associated with a footing design in these conditions unless the dewatering is carried out in a very conscientious manner by the contractor.

REFERENCES

1. Dominion Soil Investigation report No. 1-8-L6, October 1961.
2. Procedures for Testing Soils, ASTM, April 1958. pp. 186 to 198. (Unified Soil Classification System - by A. A. Wagner).
3. Proceedings of the 4th International Conference on Soil Mechanics and Foundation Engineering (Research on Determining the Density of Sands by Spoon Penetration Testing - by H. J. Gibbs and W. G. Holtz of the United States Bureau of Reclamation.) London, 1957.
4. Terzaghi and Peck: Soil Mechanics in Engineering Practice. John Wiley and Sons, New York 1948.
5. Standard Penetration Tests and Bearing Capacity of Cohesionless Soils, by G. G. Meyerhof, ASCE Paper 866, January 1956.



DOMINION SOIL INVESTIGATION LIMITED

James Park
James Park, M.Sc., P.Eng.

LIST OF SYMBOLS, ABBREVIATIONS AND NOMENCLATURE.

SOIL COMPONENTS AND GROUND WATER CONDITIONS.

BOULDER	COBBLE	GRAVEL		SAND			SILT	CLAY	ORGANICS	BEDROCK	GROUND WATER LEVEL	DEPTH OF CAVE-IN
		COARSE	FINE	COARSE	MEDIUM	FINE						
Ø	> 8"	3"	3/4"	4.76mm	2.0	0.42	0.074	0.002	>	NO SIZE LIMIT		
U.S. Standard Sieve Size :				No. 4	No. 10	No. 40	No. 200					

SAMPLE TYPES.

AS Auger sample	RC Rock core	TP Piston, thin walled tube sample
CS Sample from casing	% Recovery	TW Open, thin walled tube sample
ChS Chunk sample	SS Split spoon sample	WS Wash sample

SAMPLER ADVANCED BY static weight : w
 " pressure : p
 " tapping : t

OBSERVATIONS MADE WHILE CORING
 Steady pressure
 No pressure
 Intermittent pressure

Washwater returns
 Washwater lost

PENETRATION RESISTANCES.

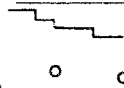
DYNAMIC PENETRATION RESISTANCE : to drive a 2" \emptyset , 60° cone attached to the end of the drilling rods into the ground, expressed in blows per foot

STANDARD PENETRATION RESISTANCE, -N- : to drive a 2" outside dia, split spoon sampler 1 foot into the ground, expressed in blows per foot.

EXTRAPOLATED -N- VALUE

The energy for the penetration resistances is supplied by a 140 lb. hammer falling 30 inches

SYMBOL :



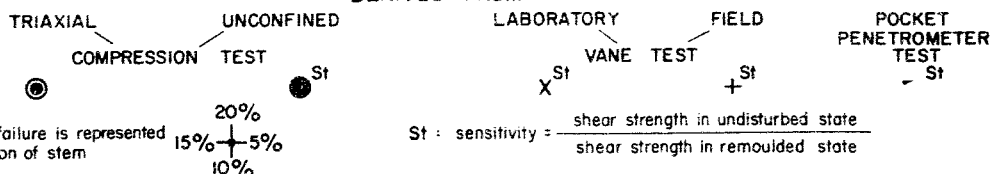
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SOIL PROPERTIES.

W % Water content	γ_s Natural bulk density (unit weight)	k Coeff of permeability
LL % Liquid limit	e Void ratio	C Shear strength in terms of total stress
PL % Plastic limit	RD Relative density	ϕ Angle of int. friction in terms of effective stress
PI % Plasticity index	C _v Coeff. of consolidation	C' Cohesion
LI Liquidity index	m _v Coeff. of volume compressibility	ϕ' Angle of int. friction

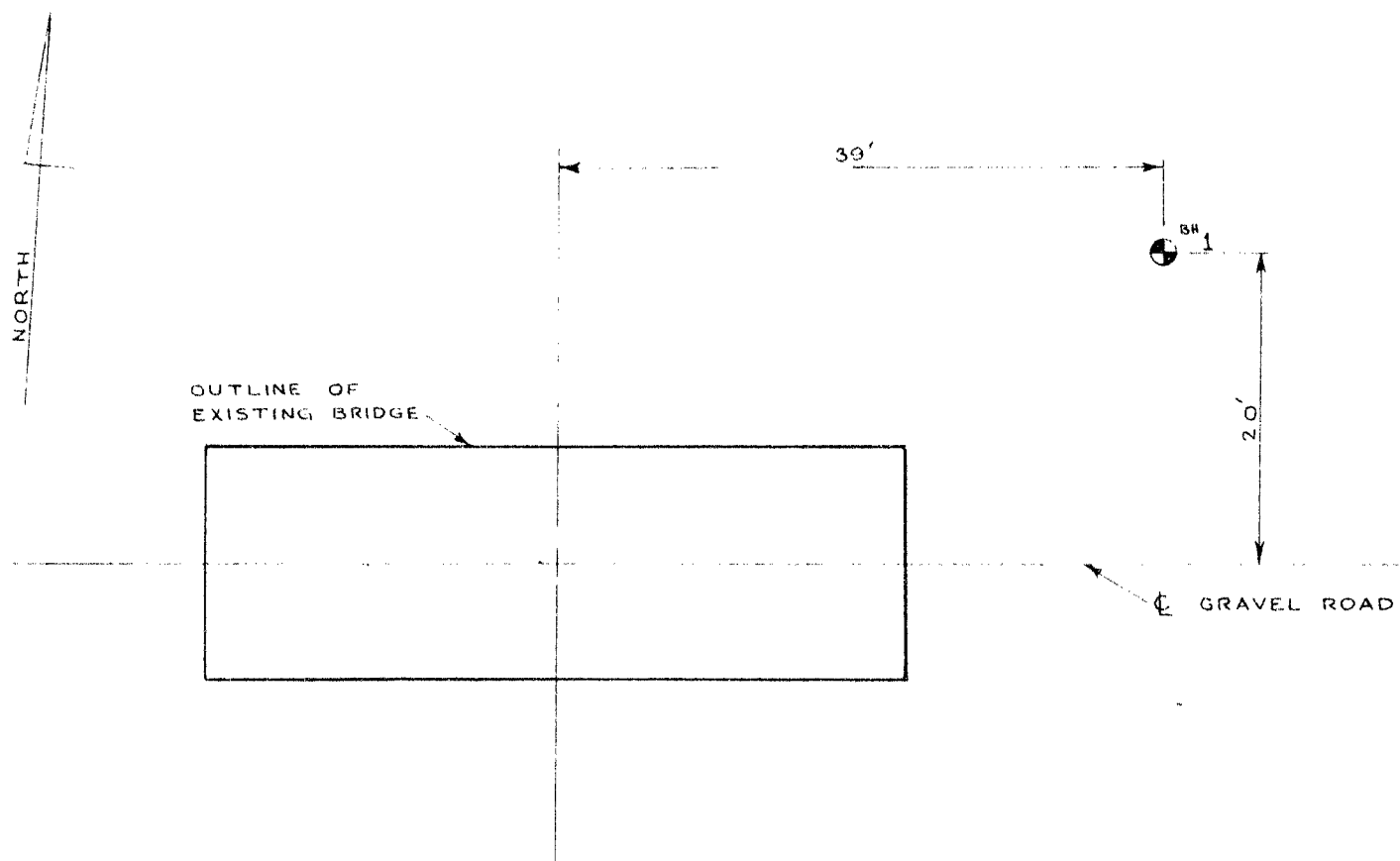
UNDRAINED SHEAR STRENGTH.

— DERIVED FROM —

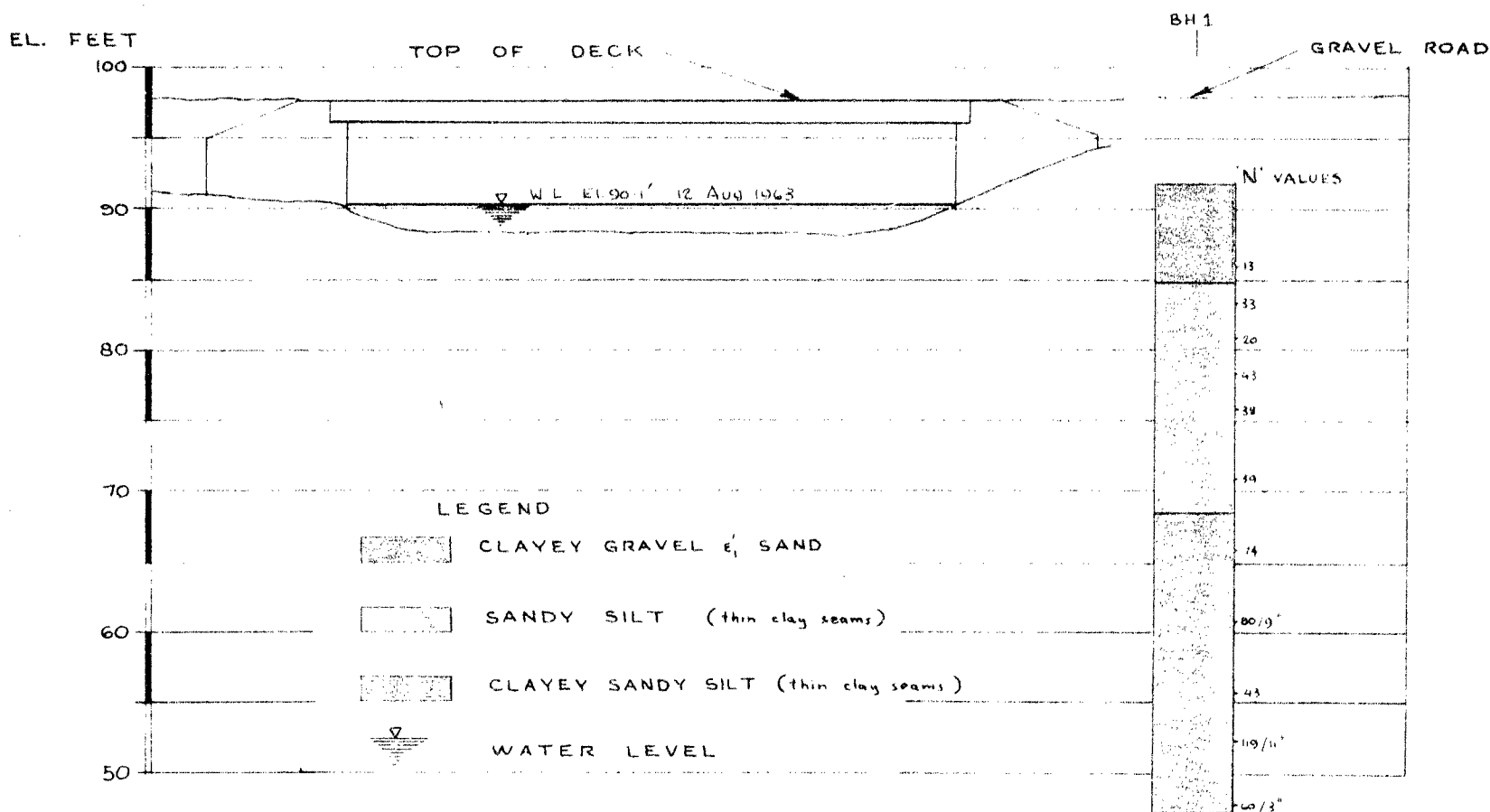


SOIL DESCRIPTION.

COHESIONLESS SOILS :	RD :	COHESIVE SOILS :	C lbs/sq ft.
Very loose	0 - 15 %	Very soft	less than 250
Loose	15 - 35 %	Soft	250 - 500
Compact	35 - 65 %	Firm	500 - 1000
Dense	65 - 85 %	Stiff	1000 - 2000
Very dense	85 - 100 %	Very stiff	2000 - 4000
		Hard	over 4000



LOCATION OF BOREHOLE
SCALE : 1" TO 10'



SUBSURFACE PROFILE LOOKING NORTH
VERT. SCALE : 1" TO 10'

GEOTECHNICAL DATA SHEET FOR BOREHOLE 1

OUR REFERENCE NO 3-8-L4

CLIENT MESSRS. A. M. SPRIET & ASSOCIATES
PROJECT ROAD BRIDGE
LOCATION TOWNSHIP OF LOBO
DATUM ELEVATION 91.8

METHOD OF BORING WASHBORING
DIAMETER OF BOREHOLE 2 1/8"
DATE AUG. 2-12, 1963

ENCLOSURE NO 3

ELEVATION ft	DEPTH ft	STRATIFICATION DESCRIPTION	STRATIFICATION SYMBOL	SAMPLES			PENETRATION RESISTANCE		CONSISTENCY		REMARKS
				NUMBER	TYPE	N or Advancement of Sampler	blows per foot	SHEAR STRENGTH lbs/sq ft	water content % PL W LI		
91.8	0										
90	5	FINE TO COARSE CLAYEY GRAVEL AND SAND (compact)		1	SS	13					
85	10	GREY - BROWN SANDY SILT few thin clay seams (dense)		2	SS	33					
	3			SS	20						
80	15			4	SS	43					
75	20			5	SS	38					
70	25			6	SS	39					
65	30	GREY CLAYEY SANDY SILT with clay seams (dense to very dense)		7	SS	74					
60	35			8	SS	80 9'					
55	40			9	SS	43					
50	45			10	SS	119 11"					
45	45	END OF BOREHOLE		11	SS	60 3"					

Diagram showing cone test results (blows per foot) plotted against depth (ft). The cone test results are indicated by circles on the right side of the chart, with a line labeled 'CONE' pointing to the data points.