

GEOCRES No. 41N-5

DIST. 18 REGION

W.P. No. 908-73-09

CONT. No.

W. O. No.

STR. SITE No. 38C-6

HWY. No. 17

LOCATION WIDENING OF ALGOMA

CENTRAL & HUDSON BAY RAILWAY OVERHEAD.

No of PAGES - —

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT.

REMARKS:

GENERAL PLAN

4. CONSTRUCT WIDENING. (N. SIDE)
5. MOVE TEMPORARY STEEL BEAM CURB RAIL TO SOUTH SIDE.
6. REMOVE EXISTING NORMAL ASPH. PAVEMENT AND CONCRETE.
7. CONSTRUCT NEW CARRIER WALL (S. SIDE)
8. REMOVE REMAINING PAVEMENT ON EXISTING DECK AND APPROACH SLABS AND WATERPROOF EXISTING AND NEW DECK.

TO BE USED

STAGE II

FOR ESTIMATING

PURPOSES ONLY

1. TO EXIST. SIDE
2. REMOVE EXISTING MORAL, AS
AND CONCRETE.
7. CONSTRUCT NEW BARRIER
8. REMOVE REMAINING PAVE
EXISTING DECK AND APPROX
WATERPROOF EXISTING AND

DATE... MAR 25 1976

CLASS OF CONCRETE

CLASS OF CONCRETE	
PRESSRESSED FLOW SLABS	5000 PSI
BARRIER WALLS, DECK TOPPING	4000 PSI
REMAINDER	5000 PSI

CLEAR COVER ON REINFORCING STEEL:

ABUTMENTS	3' (OR AS NOTED)
APPROACH SLABS, TOPPING	2' (" " ")
BARRIER WALLS	16'

CONSTRUCTION NOTES

THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS AS SPECIFIED ON THE DRAWINGS. NO CONCRETE SHALL BE PLACED ABOVE THE ADJUTANT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.

DIA. OF DRILLED HOLES FOR GROUTED COWLS:

* 8 BARS	—	1/2" MIN.	SEE DETAIL DWGS.
* 7 BARS	—	3/8" MIN.	FOR DEPTH OF
* 6 BARS	—	1/4" MIN.	HOLES.

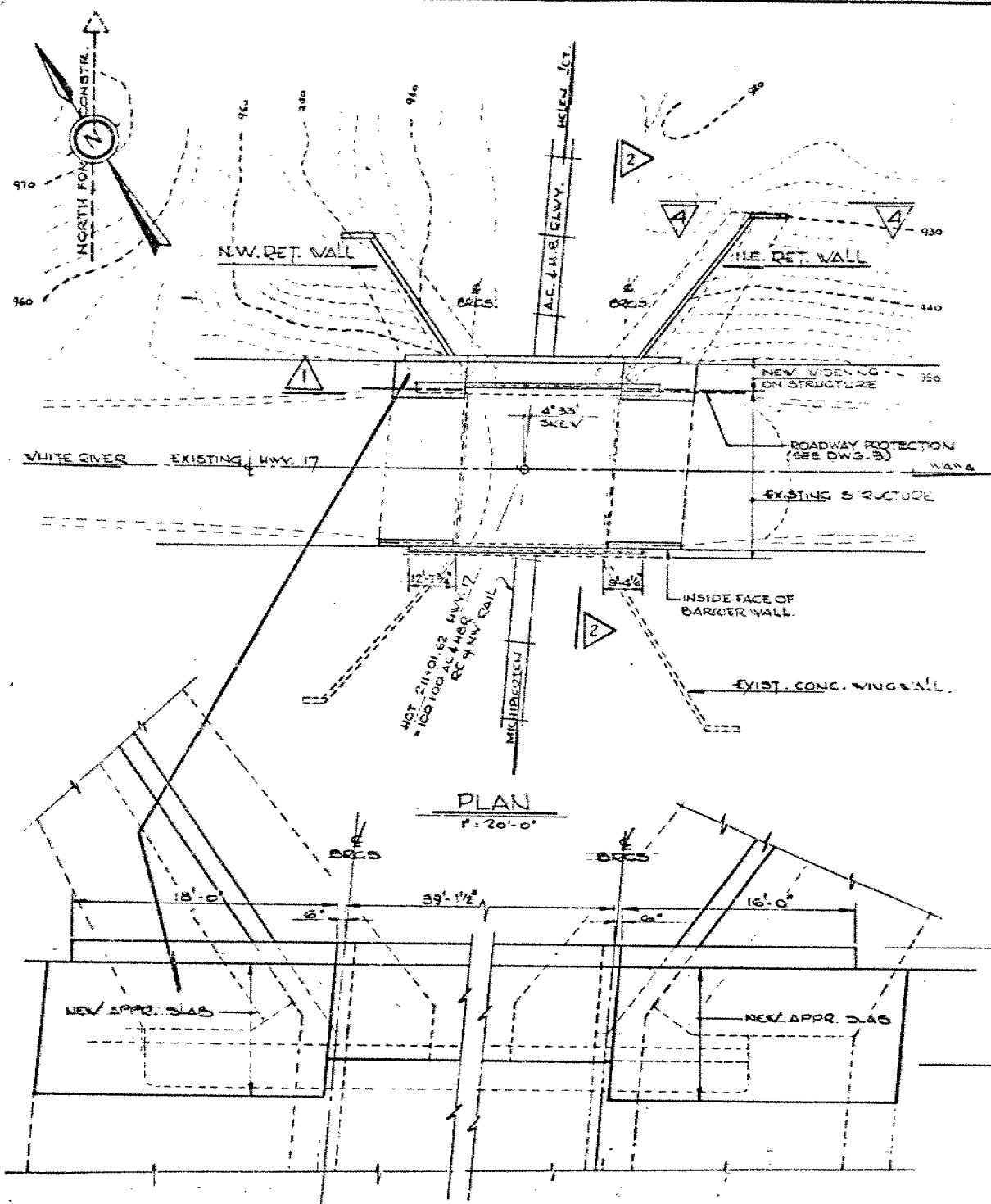
LIST OF DRAWINGS

1. GENERAL PLAN.
2. BOREHOLE LOCATIONS & SOIL STRATA.
3. ROADWAY PROTECTION, EXCAVATION & BACKFILL TO STRUCTURE.
4. REMOVAL OF CONCRETE IN WEST ABUTMENT.
5. REMOVAL OF CONCRETE IN EAST ABUTMENT.
6. WEST ABUTMENT WIDENING DETAILS.
7. EAST ABUTMENT WIDENING DETAILS.
8. WINGWALL DETAILS.
9. FOLLOW SLAB GIRDERS & BEARINGS.
10. DECK WIDENING DETAILS.
11. CONCRETE BARRIER WALLS (218 #2-11 HIGH).
12. STEEL BARRIER WALL RAILING (SINGLE TUBE).
13. APPROACH SLAB WIDENING DETAILS.
14. SHORING FOR TRACK PROTECTION.
15. STANDARD DETAILS.

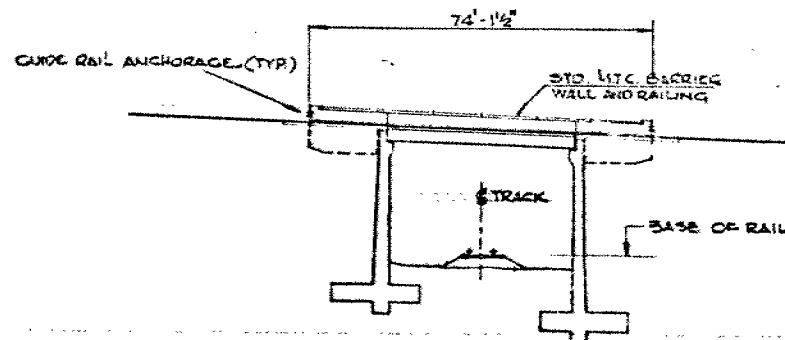
CONCRETE QUANTITIES:

ESTIMATED CONCRETE QUANTITIES ARE
LISTED BELOW FOR THE APPROPRIATE
LUMP SUM ITEMS.

- CONC. IN ABUTMENTS & WING WALLS 79.1 CUM
- CONC. IN DECK (TOPPING) 7.4 CUM
- CONC. IN BARRIER WALLS 13.0 CUM
- CONC. IN APPROACH SLABS 13.9 CUM

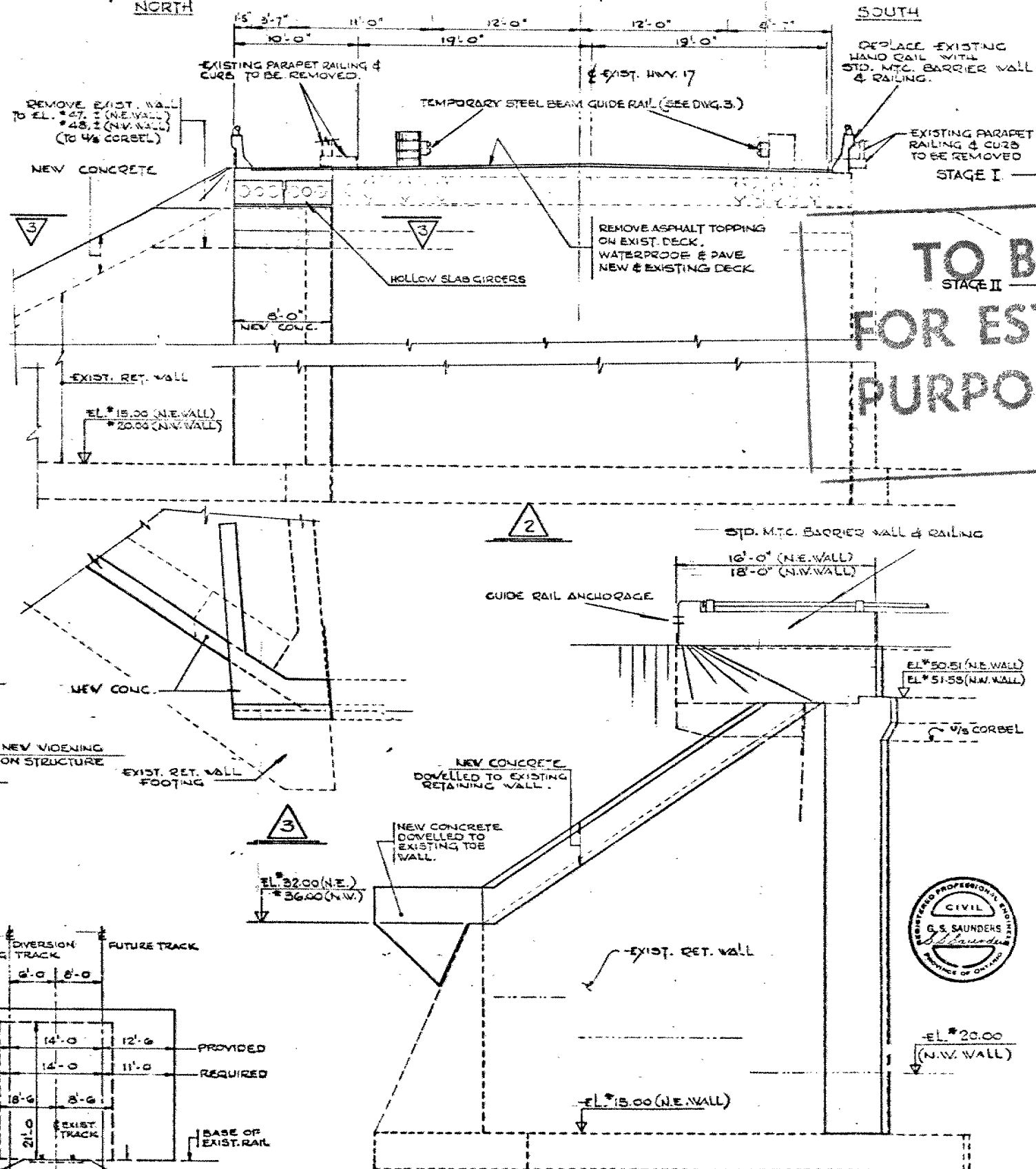
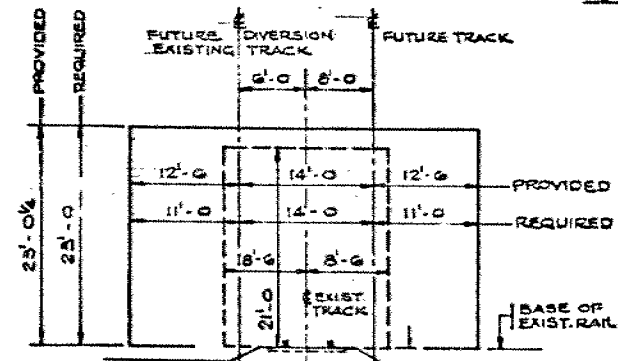


PART - PLAN
ON NEW WIDENING



RAILWAY CLEARANCE DIAGRAM

PERPENDICULAR TO & EXISTING TRACK
REQ'D CONSTRUCTION CLEARANCES
SHOWN DOTTED



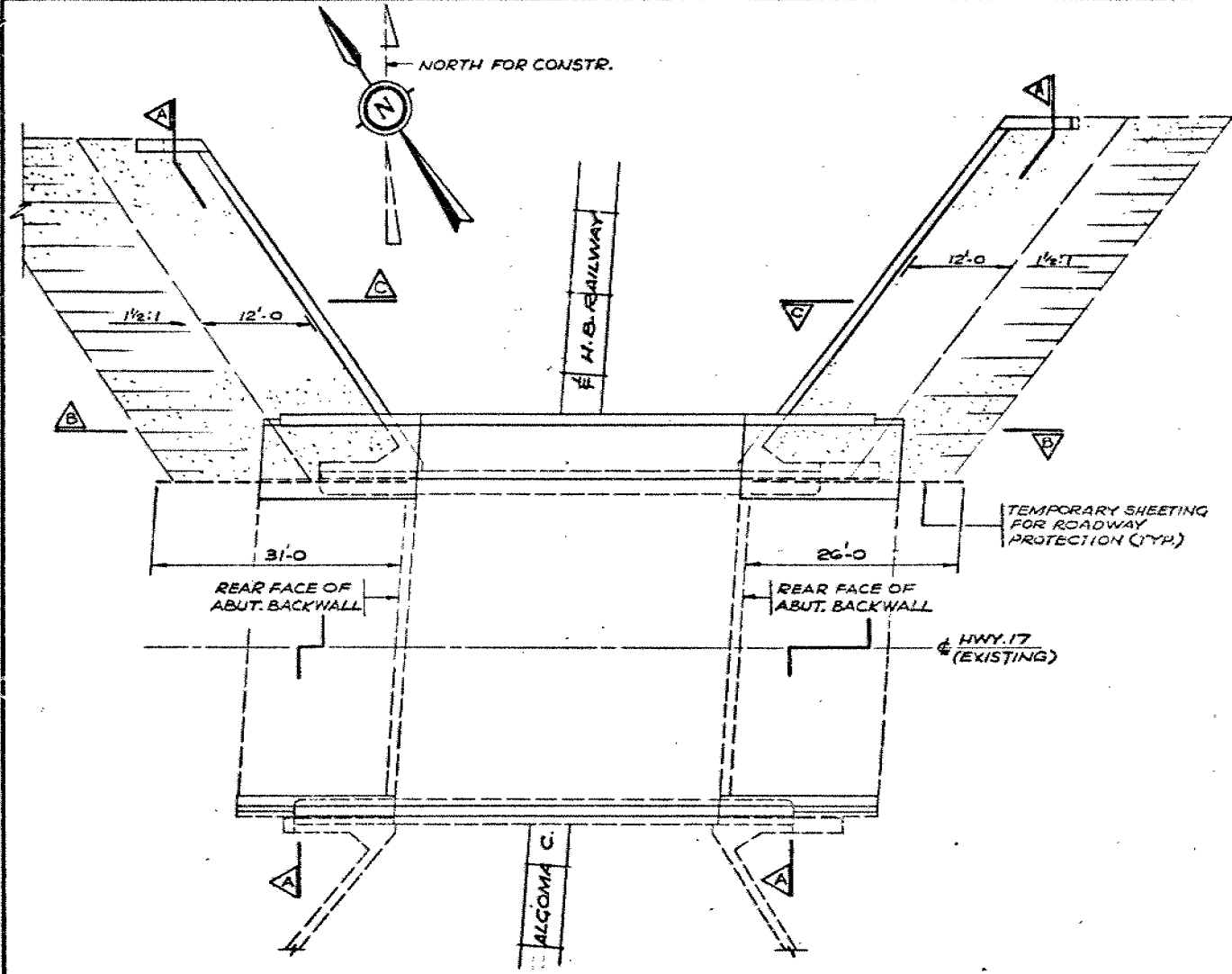
SCALE: $\frac{3}{16}'' = 1'-0$
UNLESS SHOWN OTHERWISE

FOR REDUCED PLAN

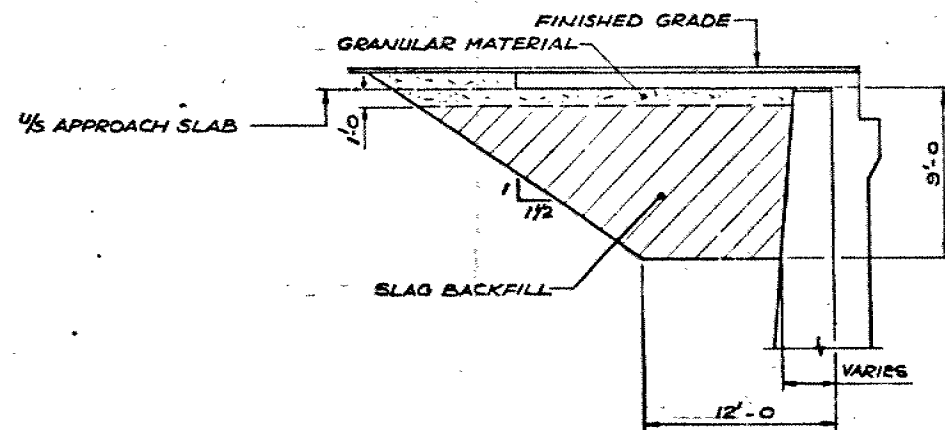
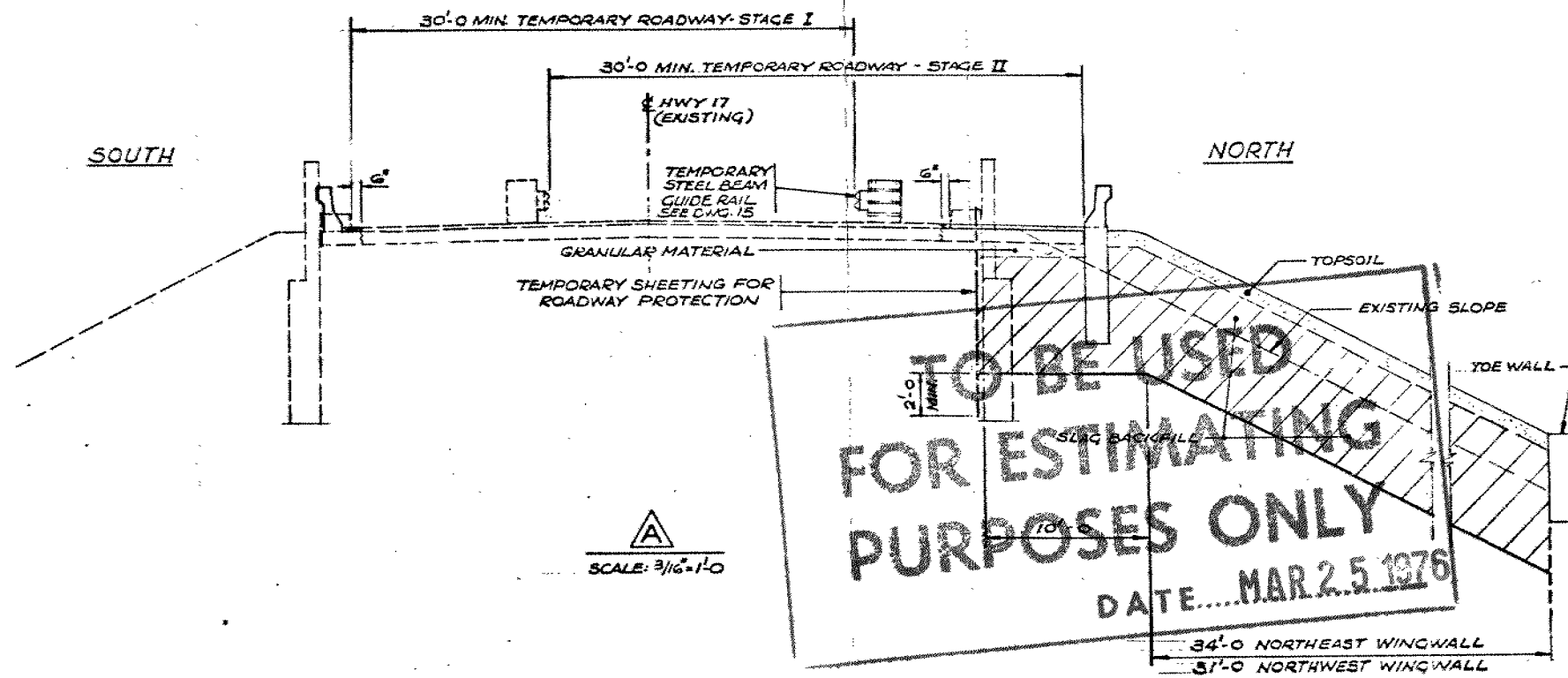
USE SCALE BELOW

1 - 1 INCHES IN ORIGINAL PLAN

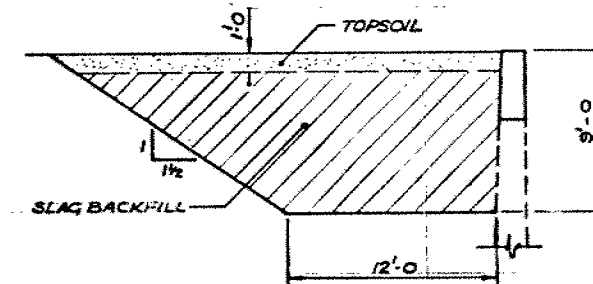
REVISIONS	DATE	BY	DESCRIPTION
DESIGN A	Q	CHECK AS LOADING	25-23 DATE/MAR 7
DRAWING	Q	CHECK AS SITE	25-23 DATE/MAR 7



PLAN
SCALE: 3/32" = 1'-0"

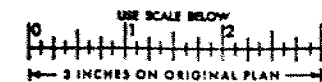


N.T.S.



N.T.S.

FOR REDUCED PLAN

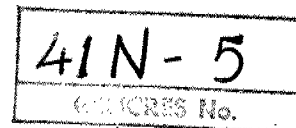


REVISIONS	DATE	BY	DESCRIPTION
1			
2			
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7			
8			
9			
10			





Ministry of
Transportation and
Communications



Memorandum

To: B.J. McKenna (2)
Reg. Structural Planning Engineer
Northwestern Region
Thunder Bay

From: Soil Mechanics Section
Geotechnical Office
West Building, Downsview

Attention:

Date: August 22, 1975

Our File Ref.

In Reply to

AUG 25 1975

Subject:

FOUNDATION INVESTIGATION REPORT

For

Widening of A.C. & H.B. Overhead
Highway 17
Twp. of Lendrum, Dist. of Algoma
District 18, Sault Ste. Marie
W.P. 908-73-09 Site No. 38C-6

Attached we are forwarding to you our detailed Foundation Investigation Report on the subsoil conditions existing at the above mentioned site.

We believe that the factual data and recommendations contained therein will prove adequate for your requirements. Should additional information be required, please do not hesitate to contact our Office.

M. Devata
M. DEVATA
Supervising Engineer

c.c. E.J. Orr
B.R. Davis
B.J. Giroux
G.A. Wrong
W.L. Lees
R. Morgenroth
G.E. French
R. Hore
J. Anderson)
N.G. Maluzinsky) memo only
G. Sloan
Files
Record Services

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1. INTRODUCTION
2. SUBSOIL CONDITIONS
3. DISCUSSION AND RECOMMENDATIONS
4. MISCELLANEOUS

FOUNDATION INVESTIGATION REPORT

For

Widening of A.C. & H.B. Overhead
Highway 17
Twp. of Lendrum, Dist. of Algoma
District 18, Sault Ste. Marie
W.P. 908-73-09 Site No. 38C-6

1. INTRODUCTION

The Soil Mechanics Section was requested by Mr. B.J. McKenna, Structural Planning Engineer, Northwestern Region, to carry out a foundation investigation at the above site. The site is located about 2 miles northwest of Wawa.

The existing structure is a single span (39 ft.) two lane concrete bridge with concrete wing walls. The bridge is supported on spread footings and is in fair condition. The construction was carried out in 1957 (Contract #57-219). It is proposed to widen the bridge by 9 ft. on the north side to accommodate a truck climbing lane in the west-bound direction.

The foundation investigation for the existing bridge was carried out by Racey MacCallum & Associates Ltd. in 1956 (W.P. 649-56, BA580).

2. SUBSOIL CONDITIONS

Field work for the proposed widening consisted of two boreholes accompanied by a dynamic cone penetration test adjacent to each borehole. Two open test pits, one at each footing location were also dug by means of a back-hoe. Undisturbed samples were recovered by driving a split-spoon in accordance with the Standard Penetration Test requirements. Grain size analyses were carried out on selected samples to determine the distribution of particle sizes.

The site of the overhead lies near the southeast base of a sand bank. The sand bank is about 50 ft. high and has 2 horizontal to 1 vertical slopes. The railway appears to have been cut into this bank

slightly. The ground to the east is generally flat for a distance of 1/2 mile, where it drops off sixty ft. into the Magpie River Valley. These terraces are lake deposits formed, when after the retreat of the pleistocene glaciers, the waters in the Superior basin stood higher. They occur at different elevations and represent successive drops in the water level. The entire ground surface in the area is granular in nature.

The stratigraphy at the borehole locations and the results of field and laboratory tests are shown on the respective Record of Borehole Sheets attached in the Appendix, and is briefly as follows:

B.H. #1 (G.L. 924)	B.H. #2 (G.L. 926)	
0 - 12		Sand & gravel, numerous cobbles
12 - 17	0 - 9	Silty sand to sandy silt
17 - 19	9 - 13	Silt
19 - 27		Fine sand
	13 - 27	Silty sand to sandy silt

The relative density in the upper portion varies from loose to compact and in the lower portion varies from compact to very dense. However, material in the upper portion may consist of native backfill which was placed after footings for the existing structure were poured. The open test pit showed that on the east side (B.H. #1) numerous cobbles were present to a depth of 12 ft. These cobbles could not be recovered in the split spoon sampler and the grain size analysis carried out on the sample from this layer does not include cobbles. The N-values as determined from the Standard Penetration Test may also be on the higher side because of the presence of cobbles. On the west side (B.H. #2) the material is slightly finer in composition and is devoid of cobbles.

An attempt was made to excavate down to the base of the existing footings. On the east side the top of footing was encountered at a depth of about 10 ft. Excavation deeper than 12 ft. was not possible because of the instability of the sides and the confinement of the area between the structure and the railway tracks. On the west side, the top of footing was encountered at a depth of about 7 ft. and the thickness of the footing was 3 ft. Near the bottom of the excavation the material

was silt. All boreholes and excavations were dry. Drawing No. D3841-2 shows the top of east and west footings at approx. elev. 915 and 920 ft. respectively (at depths of 9 and 6 ft.) and the footings are shown to be about 4 ft. thick.

The dynamic cone penetration tests were terminated at depths of 66-67 ft. (elev. 857-860) where refusal was achieved and the hammer was bouncing. During the original investigation done in 1956, refusal was met at similar elevations.

The location of boreholes and subsoil stratigraphy is shown on Drawing 9087309A included in the Appendix.

3. DISCUSSION AND RECOMMENDATIONS

It is proposed to widen the existing bridge on the north side by 9 ft. in order to accommodate a thick climbing lane in the west-bound direction.

The extension for the widening may be supported on spread footing type foundations placed in the original ground. It is recommended that the footings be placed at the same elevations as the existing footings. A safe bearing capacity of 2 tons/sq. ft. may be used. However, if the footings are placed at or below the following elevations, a safe bearing capacity of 3 tons/sq. ft. may be used:

East abutment	908 ft.
West abutment	912 ft.

As an alternative, the extension may be supported on end-bearing piles. Pile driving should be controlled in accordance with MTC Standard SS-3-10 & 11. From the dynamic penetration test it is estimated that the required capacity will be achieved at approximate elevation 855 ft. The piles should preferably be of non-displacement type, e.g. steel H-piles or steel tube piles driven open-ended. The maximum allowable load for the particular pile section chosen may be used for design purposes.

The settlements under the footings will be of elastic nature and will occur instantaneously. It is estimated that the magnitude of differential movement between the existing footing and the footing for the extension will be 1-2 inches. In this case the footing of the extension is supported on end-bearing piles, the existing footing will settle with respect to the extension, and its magnitude will be 1/2-1 inch. It is recommended that a joint be provided between the present footings and the extension in order to accommodate differential movements.

A minimum of 8 ft. earth cover should be provided to the underside of the footings or pile caps for frost protection purposes. No dewatering for excavations for the footings or pile caps will be necessary because the groundwater level is at least 27 ft. below the surrounding ground. The boreholes which were terminated at 27 ft. were dry.

One and one-half horizontal to one vertical slopes for the cuts will be stable during construction. Due to the proximity of railway tracks it may be necessary to sheet the excavation.

The extension of the footings may require removal of part of the wing walls. Therefore, a roadway protection scheme may be necessary to prevent any movement of the existing structure and associated approaches during construction.

4. MISCELLANEOUS

Field work for this project was carried out during the period July 15-18, 1975, under the supervision of Mr. T. Kazmierowski, Student Technician.

The diamond drilling equipment adapted for soil sampling purposes was owned and operated by Dominion Soil Investigation Ltd., Toronto.

This report was prepared by Mr. A. Prakash, Senior Engineer and reviewed by Mr. M. Devata, Supervising Engineer.

A. Prakash

A. PRAKASH



M. Devata

M. DEVATA

August 1975

APPENDIX

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 1

W.P. 908-73-09

LOCATION Sta. 211 + 25 36' Lt.

ORIGINATED BY TK

DIST. 18 HWY. 17

BORING DATE July 15-16, 1975

COMPILED BY AP

DATUM Geodetic

BOREHOLE TYPE Washboring, NX Casing & Cone

CHECKED BY

SOIL PROFILE			SAMPLES			GROUND WATER ELEV.	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
924.±	Ground Level															GR SA. SI. CL
0.0	Sand and gravel, numerous cobbles, trace of silt, Fill		1	SS	24	920										67 28 5 0
			2	SS	11											
			3	SS	19											
912.0	Compact															
12.0	Silty sand to sandy silt, varying amount of gravel. Compact to Dense		5	SS	15	910										6 47 47 0
907.0			6	SS	42											35 32 33 0
17.0	Silt, trace of sand. Compact		7	SS	29											0 9 91 0
19.3	Fine sand, trace of silt.		8	SS	28											0 90 10
897.5	Compact to Very Dense		9	SS	55	900										
26.5	End of Borehole															Borehole Dry
						890										
						880										
						870										
						860										Hammer bouncing.
857.1																
66.9	End of Cone Test					850										

W.P. 908-73-09 LOCATION Sta. 210 + 90 36' Lt. ORIGINATED BY TK
DIST. 18 HWY. 17 BORING DATE July 17, 18, 1975 COMPILED BY OY
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing & Cone CHECKED BY _____

20
15 ϕ 5 % STRAIN AT FAILURE
10

ABBREVIATIONS & SYMBOLS USED IN THIS REPORTPENETRATION RESISTANCE

'N'-STANDARD PENETRATION RESISTANCE : - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A STANDARD SPLIT SPOON SAMPLER 12 INCHES INTO THE SUBSOIL, DRIVEN BY MEANS OF A 140 POUND HAMMER FALLING FREELY A DISTANCE OF 30 INCHES.

DYNAMIC PENETRATION RESISTANCE : - THE NUMBER OF BLOWS REQUIRED TO ADVANCE A 2 INCH, 60 DEGREE CONE, FITTED TO THE END OF DRILL RODS, 12 INCHES INTO THE SUBSOIL, THE DRIVING ENERGY BEING 350 FOOT POUNDS PER BLOW.

DESCRIPTION OF SOIL

THE CONSISTENCY OF COHESIVE SOILS AND THE RELATIVE DENSITY OR DENSENESS OF COHESIONLESS SOILS ARE DESCRIBED IN THE FOLLOWING TERMS :-

<u>CONSISTENCY</u>	<u>c LB./SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 250	VERY LOOSE	0 - 4
SOFT	250 - 500	LOOSE	4 - 10
FIRM	500 - 1000	COMPACT	10 - 30
STIFF	1000 - 2000	DENSE	30 - 50
VERY STIFF	2000 - 4000	VERY DENSE	> 50
HARD	> 4000		

TERMS TO BE USED IN DESCRIBING SOILS:-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC.

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

U	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
UU	UNCONSOLIDATED UNDRAINED TRIAXIAL	F.V.	FIELD VANE
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
I_p	PLASTICITY INDEX
w_s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_c	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
T_v	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

IN TERMS OF
EFFECTIVE STRESS
 $\tau_f = c' + \sigma' \tan \phi'$

IN TERMS OF
TOTAL STRESS
 $\tau_f = c_u + \sigma \tan \phi$

GENERAL

π	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e a$ OR $\ln a$	NATURAL LOGARITHM OF a
$\log_{10} a$ OR $\log a$	LOGARITHM OF a TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
σ'	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

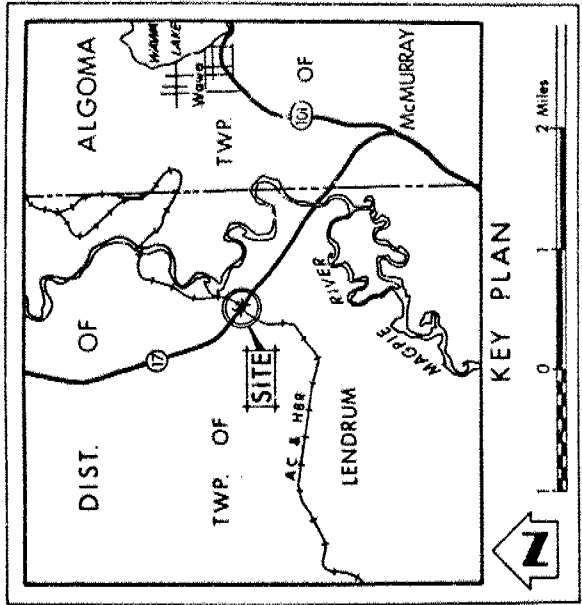
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



LEGEND			
●	Bore Hole		
⊕	Dynamic Cone Penetration Resistance Test		
⊕	6" CONE - Blow/Ft. Cone Test (350 lbs. energy/blow)		
⊕	Bore Hole & Cone Test		
⊕	Water Levels established at time of field investigation.		
NO.	ELEVATION	STATION	OFFSET
1	924.0	211+25	36' LT.
2	926.0	210+90	36' LT.

— NOTE —
The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence.

NOTE FOR CONTRACT DOCUMENT
The complete foundation investigation report for this structure may be examined at the Structural Office and Foundations Office, Downsview, and at the South St. Marie District Office.

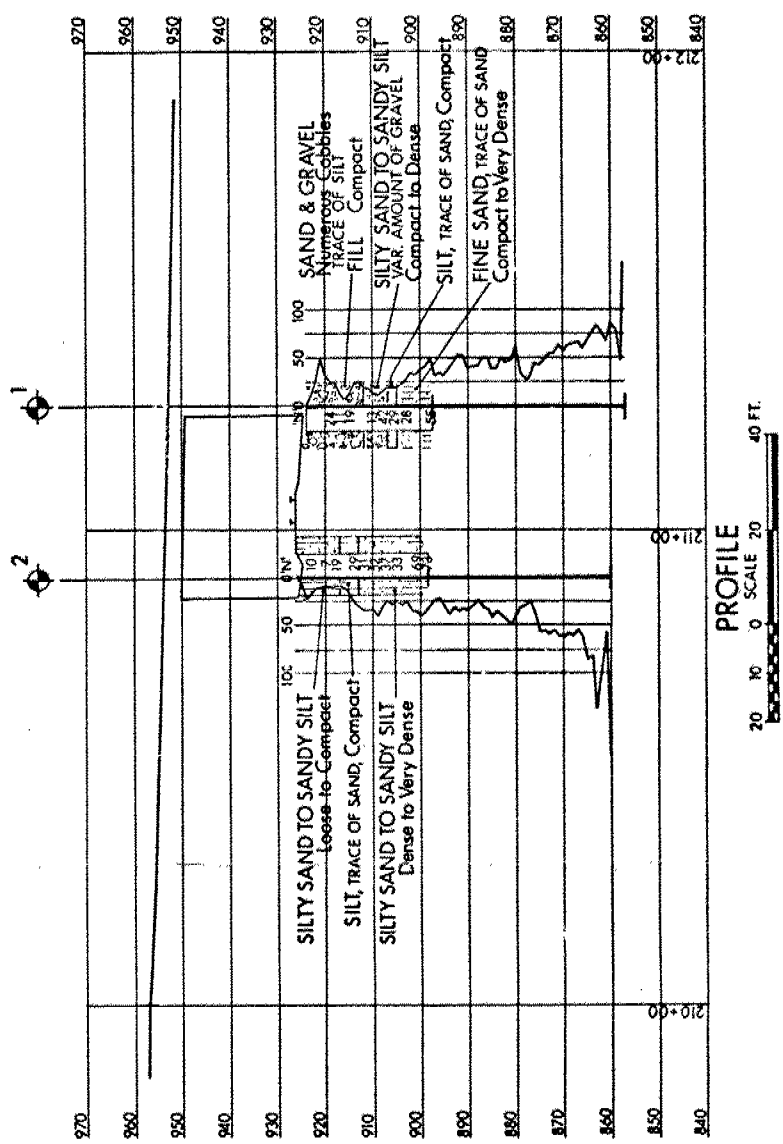
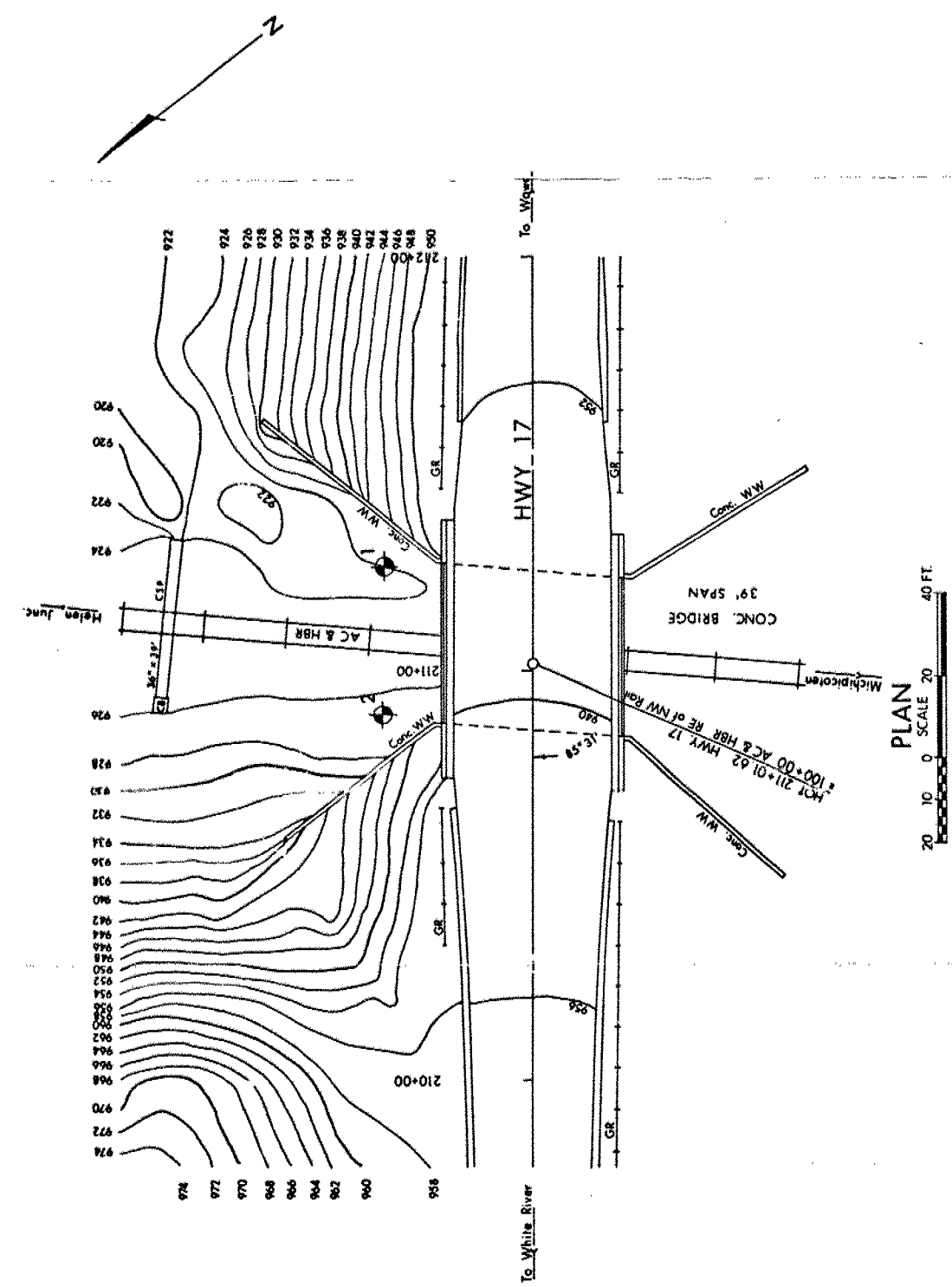
MINISTRY OF TRANSPORTATION AND COMMUNICATIONS - ONTARIO
ENGINEERING SERVICES BRANCH - GEOTECHNICAL OFFICE - SOIL MECHANICS SECTION

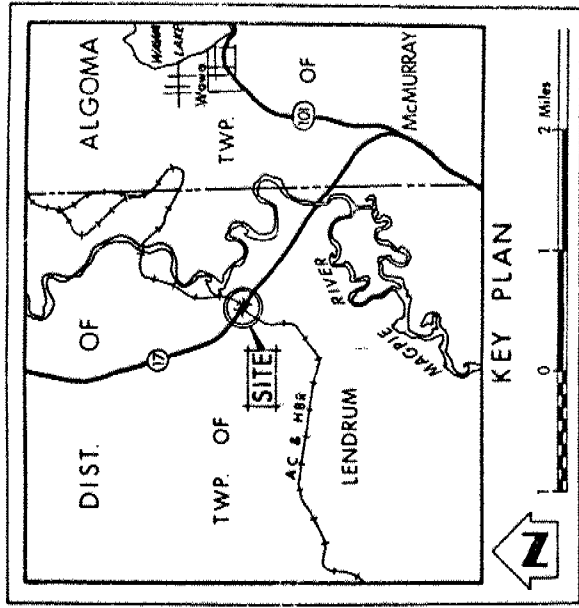
ALGOMA CENTRAL
& HUDSON BAY RAILWAY

HIGHWAY NO. 17 DIST. NO. 18
TWP. LENDRUM LOT CON

BORE HOLE LOCATIONS & SOIL STRATA

SUBMITTAL T.K.	CHECKED	W.P. NO.	908-73-09	DRAWING NO.	9087309-A
DRAWN BY	W.D. NO.				
DATE	18 AUGUST 1975	SITE NO.		BRIDGE DRAWING NO.	
APPROVED		CONF. NO.			





LEGEND			
●	Bore Hole		
⊕	Dynamic Cone Penetration Resistance Test		
⊕	Blow/Ft. Cone Test (3500 ft. lbs. energy/blow)		
⊕	Bore Hole & Cone Test		
⊕	Water Levels established at time of field investigation.		

NO.	ELEVATION	STATION	OFFSET
1	924.0	211+25	36' LT.
2	926.0	210+90	36' LT.

— NOTE —
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REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO
ENGINEERING SERVICES BRANCH—GEOTECHNICAL OFFICE—SOIL MECHANICS SECTION

ALGOMA CENTRAL

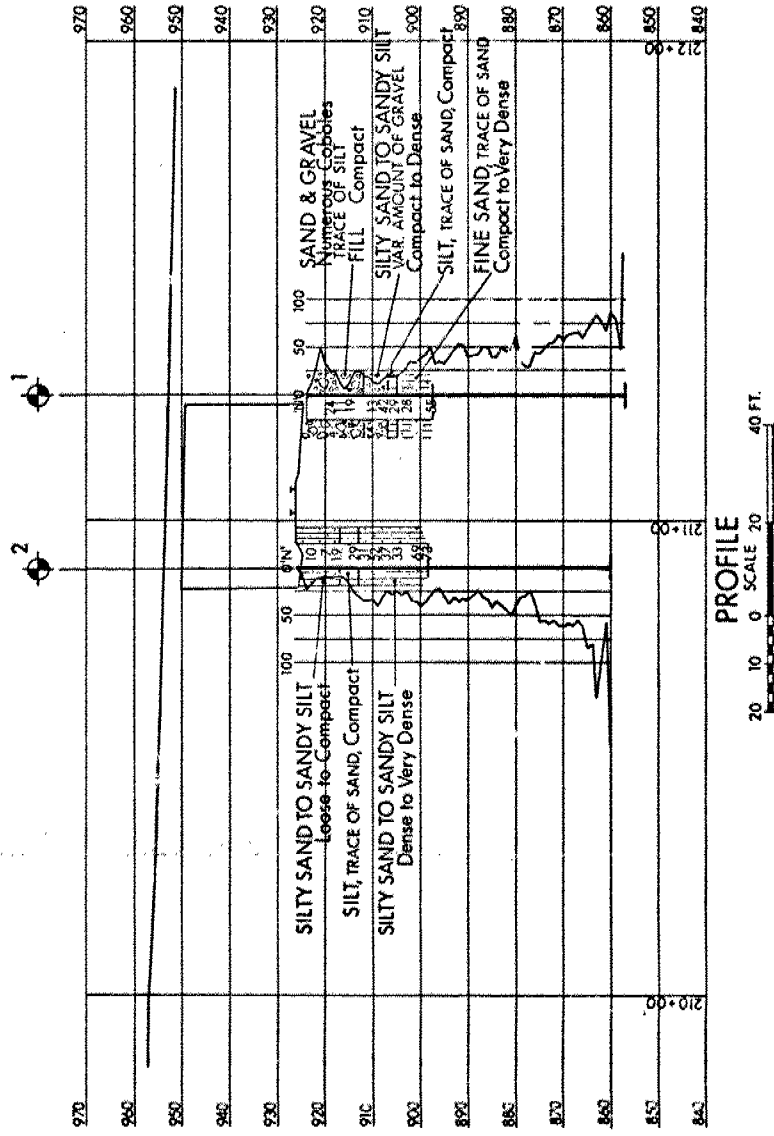
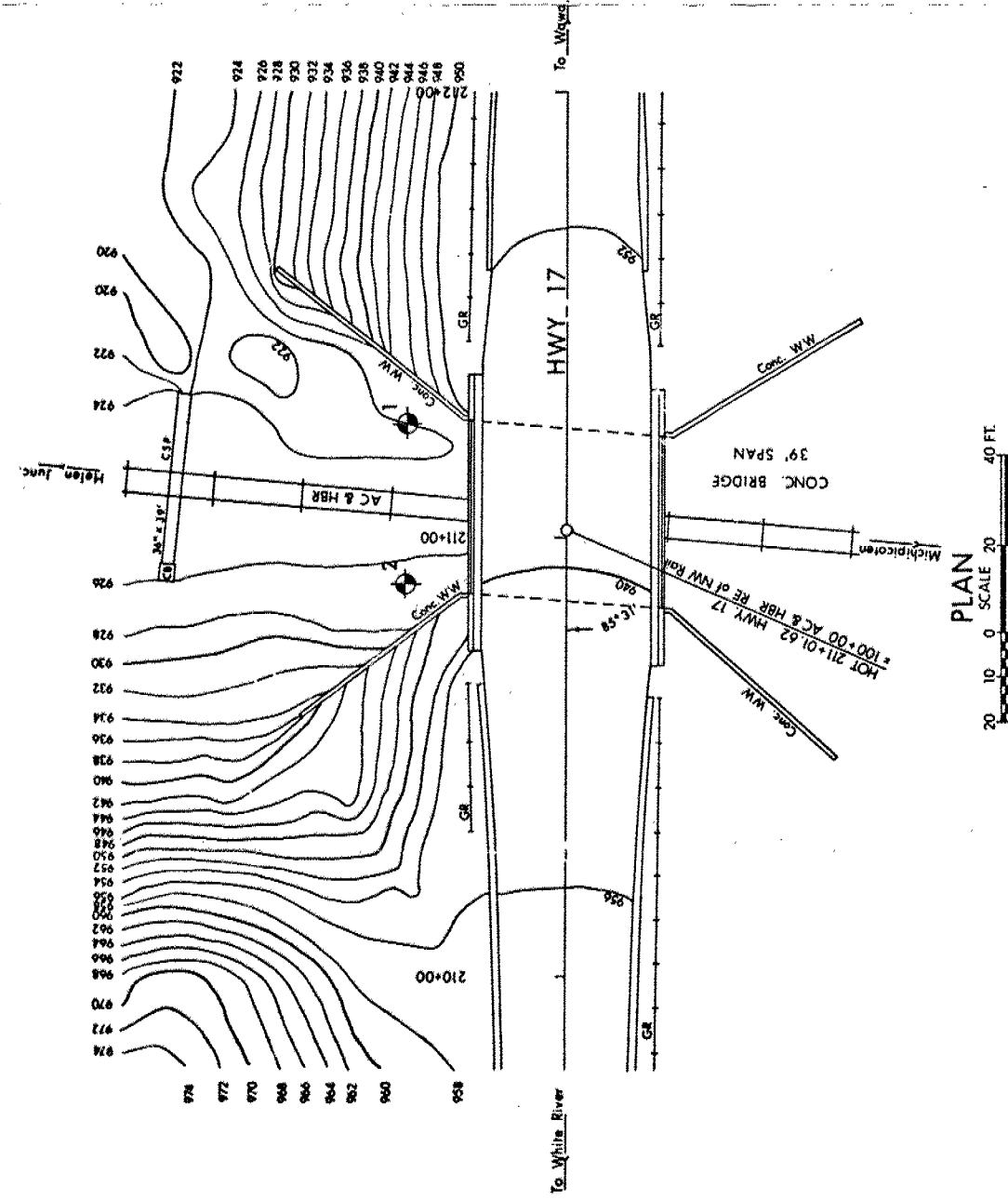
& HUDSON BAY RAILWAY

HIGHWAY NO. 17 DIST. NO. 18
TWP. OF LENDRUM LOT CON

BORE HOLE LOCATIONS & SOIL STRATA

SUBMITTAL	T.K.	CHECKED	W.P. NO.	908-73-09	DRAWING NO.	9087309-A
DRAWN BY	W.P.	CHECKED	W.C. NO.			
DATE	18 AUGUST 1975	SITE NO.			BRIDGE DRAWING NO.	
APPROVED		CONT. NO.				

REF. NO. E-5161-1, October 1974



#56-F-224C

Hwy #17

ALGOMA

CENTRAL RAILWAY

BA 580

RACEY, MACCALLUM AND ASSOCIATES
LIMITED

A COMPANY OWNED, DIRECTED AND OPERATED BY

Consulting Engineers
AND ASSOCIATED STAFF

MONTREAL  VANCOUVER

DONALD C. MACCALLUM, B.ENG., M.E.I.C., P.ENG.

H. JOHN RACEY, B.SC., M.E.I.C., P.ENG.

TORONTO

A. ERIC RANKINE, B.SC., M.E.I.C., A.M.I.ELEC.E., P.ENG.

TORONTO DIVISION
20 CARLTON STREET

REFERENCE: S-500-632/T-492

12 November 1956.

The Department of Highways of Ontario,
c/o De Leuw, Cather and Company of Canada Limited,
52 St. Clair Avenue East,
TORONTO, Ontario.

56-F-224 C

Attention: Mr. H. Juhl

RE: FOUNDATION INVESTIGATION FOR A
RAILWAY OVERPASS AT THE INTERSECTION
OF PROPOSED HIGHWAY 17 AND ALGOMA
CENTRAL RAILWAY, APPROXIMATELY ONE
HALF A MILE SOUTH OF JAMESTOWN, ONTARIO.

Dear Sirs:

We have completed our investigation of the subsoil underlying the proposed railway overpass at the above-noted site, and our report on the subject is attached hereto. A review of its contents indicates that the soil at the site is entirely granular in nature, and that its safe bearing value for abutment footing support, at a limiting settlement of one inch, is 3000 p.s.f. This pressure recommendation is based upon the results of the standard penetration test, which is believed to be somewhat conservative.

We shall be pleased to discuss any matters that may come to mind, after this report has been reviewed. We thank you for this opportunity to be of service to you.

Yours very truly,
RACEY, MACCALLUM AND ASSOCIATES LIMITED

W.A. Trow

W.A. Trow, P. Eng.,
Divisional Soils Engineer.

WAT/MD

FOUNDATION INVESTIGATION FOR A RAILWAY
OVERPASS AT THE INTERSECTION OF THE
PROPOSED HIGHWAY 17 AND ALGOMA CENTRAL
RAILWAY, APPROXIMATELY ONE HALF A MILE
SOUTH OF JAMESTOWN, ONTARIO.

Reference: S-500-632/T-492

Racey, MacCallum and Associates Limited

12 November 1956

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12 November 1956.

FOUNDATION INVESTIGATION FOR A
RAILWAY OVERPASS AT THE INTERSECTION
OF PROPOSED HIGHWAY 17 AND ALCONA
CENTRAL RAILWAY, APPROXIMATELY ONE
HALF A MILE SOUTH OF JAMESTOWN, ONTARIO.

This report describes the results of a foundation investigation performed at the above noted site, in order to determine the competence of the subsoil for supporting a proposed overpass structure. This work was carried out during the period from 21 October to 27 October 1956, and consisted of two borings and four cone penetration tests at the locations noted in enclosure no.1.

DESCRIPTION OF THE SITE AND OF THE UNDERLYING SOIL

The site of the proposed railway overpass lies near the southern base of a sand bank, which is inclined to the north on a slope of approximately two to one for a vertical height of fifty feet. The present railway appears to have been cut into this bank slightly. The ground to the south is generally flat for a distance of approximately 2600 feet, where it drops off sixty feet into the Magpie River valley. The entire ground surface in the area is granular in nature.

The results of the two soil borings and of the penetration tests taken adjacent to them, are shown in enclosures 2 and 3. It will be seen that the subsoil at both locations is predominantly fine to medium sand, although somewhat coarser conditions exist near the surface. Both borings were found to be dry during the investigation and, hence, the ground water table must be quite low. The sixty foot drop in elevation, one half a mile to the south, probably creates this condition.

The relative density of the subsoil was appraised on the basis of penetration tests, using the standard two inch split spoon and a two inch diameter cone. Dynamic cone tests are extremely valuable in soils of this nature, since they serve to indicate any changes in the relative density of the soil, as well as to provide a rapid check on the uniformity of conditions across the site. Cone tests were made twenty feet to the left and right of each boring. Refusal to the cone was encountered at elevations ranging from 860.5 feet to 869 feet.

On the basis of the standard penetration test, the subsoil would be classed as being in a loose to medium dense state. Comments on the limitations of the standard penetration test are presented in the following discussion.

DISCUSSION OF SUBSOIL COMPETENCE

Reference to the penetration measurements in enclosures 2 and 3, indicates that the subsoil conditions are relatively uniform at all locations, and that the increase in relative density with depth is very slight.

12 November 1956.

On the basis of published information empirically relating the standard penetration measurements to safe bearing values, the permissible bearing value for abutment footings at this site, for a limiting settlement of one inch, is of the order of 3000 p.s.f. The factor of safety against ultimate failure under this pressure is greater than three and Terzaghi, who originated this empirical standard, admits to its conservativeness. Personal experience and correspondence with soil mechanics personnel at Imperial College, England, tends to confirm this view and also suggest that the settlement under any given pressure, will be less than indicated by this empirical standard.

Considered from the geological point of view, it is highly probable that the sand banks bounding the north side of the railway, formed the shores of a post glacial lake and, hence, it is not unlikely that these banks extended farther to the south before erosion carried them to their present position. The present difference in elevation of fifty feet below the top of the natural sand bank, represents a unit pressure of the order of 5000 p.s.f. It should therefore be possible to re-apply a pressure equivalent to this prestress, without experiencing any significant settlement other than would be produced by elastic compression. This movement will take place as the bridge load is being applied, and should be relatively unimportant in its effect on the structure.

It is noted that the embankment approaches to the bridge reach a height of approximately 32 feet, adjacent to the abutments. Because of the rigidity of the structure, the embankment materials will develop an earth pressure at rest condition with an earth pressure coefficient of approximately 0.4; hence the unit horizontal pressures exerted by the fill will be equal to 0.4 times the surcharge weight at any depth. Since the embankment will probably be constructed of adjacent granular materials, no stability problem should exist.

CONCLUSIONS

The foregoing comments can be summarised as follows:-

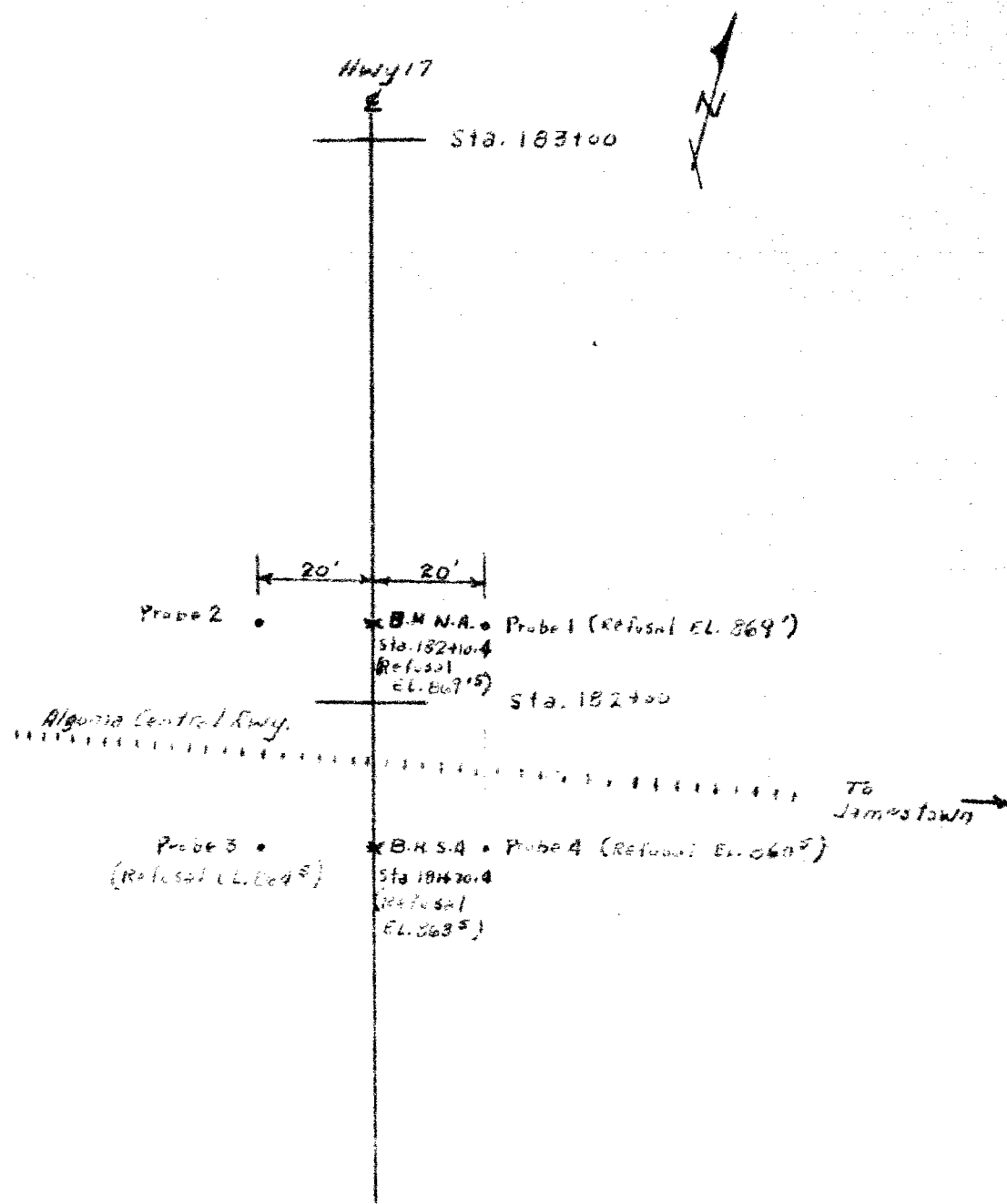
1. The subsoil at the site is essentially granular in nature consisting, for the most part, of fine to medium sand.
2. On the basis of the standard penetration test, the safe bearing value for this material is of the order of 3000 p.s.f. This value is believed to be somewhat conservative and the reasons for this view are presented in the above discussion. Present soil mechanics techniques do not provide economic means for undisturbed sampling of coarse granular soils and, therefore, actual measurements of the relative density of sands are not possible.

WAT/MD
In quadruplicate

W.A. Trow, P. Eng.



Prep. By W.T.



Sketch Indicating Borehole and Cone Test Locations
Scale 1"=30'

Order No. 5500-632/7092 RACEY, MACCALLUM AND ASSOCIATES

LIMITED

Hole Begun _____

Foundation Engineering Division

Driller _____

Hole Ended _____

Engineering Data Sheet for Borehole: N.A.

Helper _____

Job Name: HWY. 17 Railway Overpass

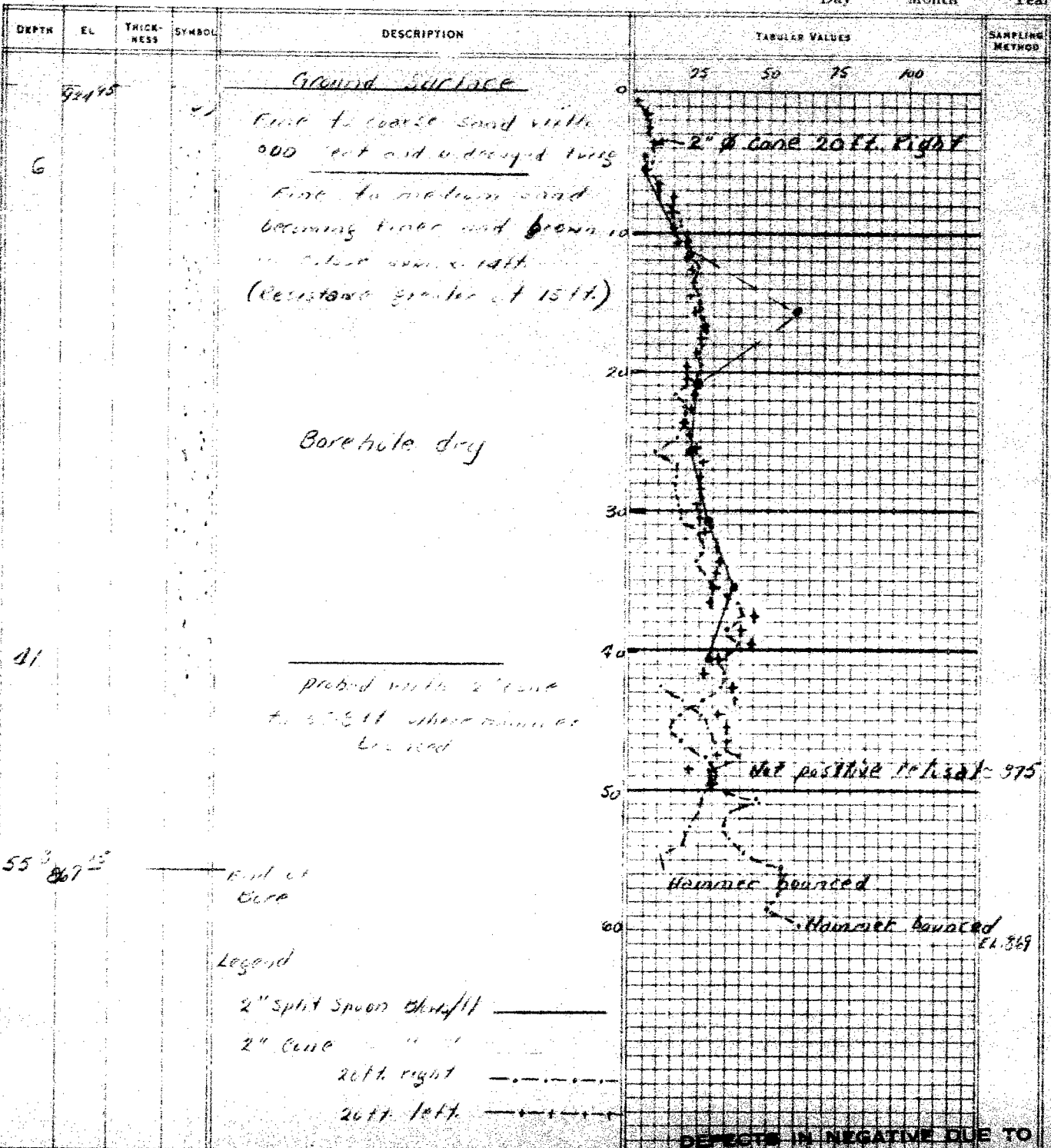
Job Located: Approx 1/2 mi. South Tuxeter, Ont

Checked by _____

Hole Located: See each sheet

Hole Elevation: 924.95 Datum: As per De Leuw, Cather & Co

Day _____ Month _____ Year _____



DEFECTS IN NEGATIVE DUE TO
CONDITION OF ORIGINAL DOCUMENT

Order No. 5500-632/7492 RACEY, MacCALLUM AND ASSOCIATES

L I M I T E D

Driver

Hole Begun

Foundation Engineering Division

Hole Ended

Engineering Data Sheet for Borehole: JA

Helper

Job Name: Hwy 17 Railway Overpass

Job Located: Approx. 1/2 mi. South. Jamestown Ont.

Checked by

Hole Located: *See encl. No 1*

Hole Elevation: 919.50 Datum:

Day Month Year

DEPTH	EL.	THICK- NESS	SYMBOL	DESCRIPTION	TABULAR VALUES	SAMPLING METHOD
				<u>Ground Surface</u>	25 50 75 100	
26'	919.50			Fine to medium brown sand and fine gravel very fine to medium brown sand becoming grey at 13 1/2 ft.		
				Probed with 2" cone to 56 ft		
56	863.50			End of Bore		
				<u>Legend</u> See encl. No. 2		
				EL. Hammer bounced		
				20 ft. left. $\approx 860 \pm$		
				20 ft. right $\approx 860 \pm$		