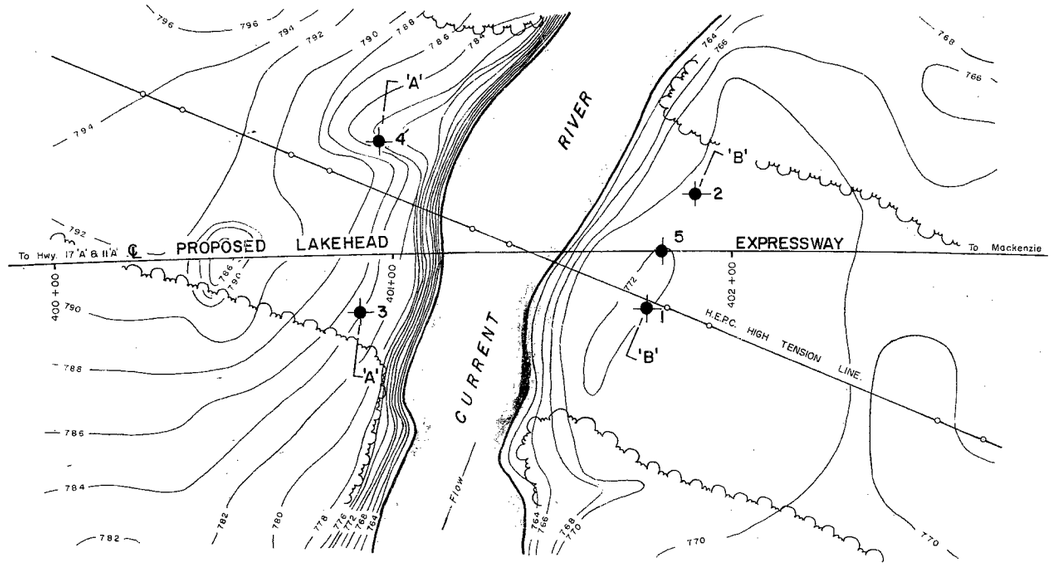
#64-F-66
W.P.#914-64
THUNDER BAY
EXPRESSWAY
(LAKEHEAD)
CURRENT RIVER

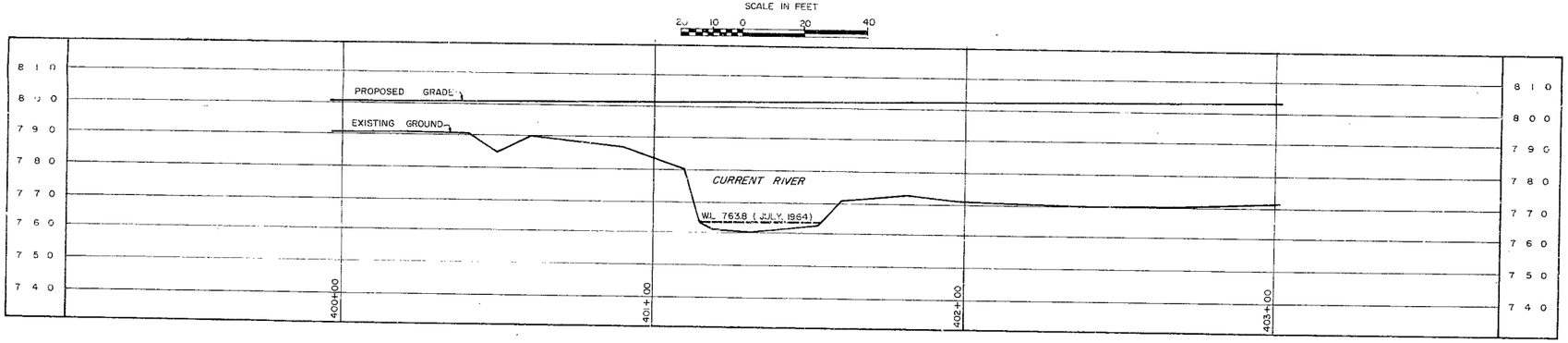
338 350 E
5372250 N 16 52 A 6 E



PLAN

SCALE IN FEET

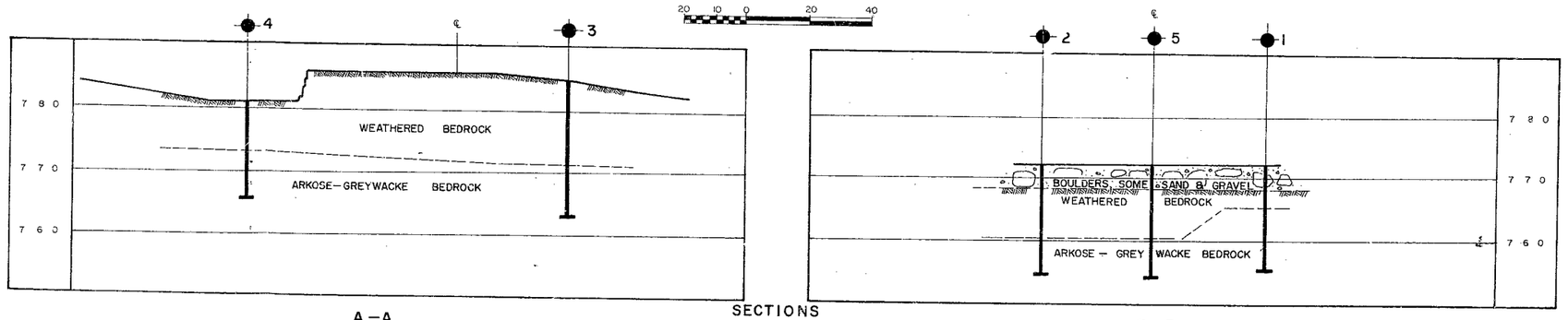
20 10 0 20 40



PROFILE

SCALE IN FEET

20 10 0 20 40

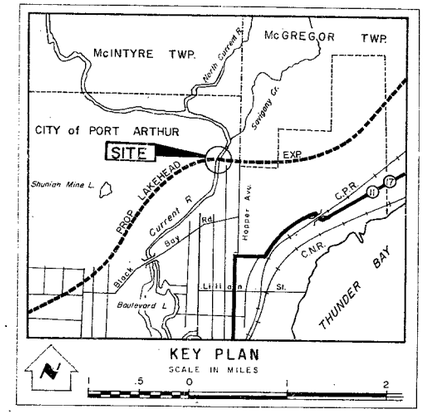


A – A

B – B

SECTIONS

SCALE 10 5 0 10 20 IN FEET



LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation.

NO.	ELEVATION	STATION	OFFSET
1	771.9	401+75	17' RT.
2	772.0	401+90	17' LT.
3	785.1	400+90	17' RT.
4	781.9	400+97	33' LT.
5	772.1	401+80	℄

– NOTE –

The boundaries between soil strata have been established only at Bore Hole locations. Between Bore Holes the boundaries are assumed from geological evidence and may be subject to considerable error.

PRINT RECORD		
NO.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS – ONTARIO

MATERIALS & RESEARCH DIVISION – FOUNDATION SECTION

CURRENT RIVER

TBE

KING'S HIGHWAY NO. PROP. ~~LAKEHEAD~~ EXP. DIST. NO. 19

CO. CITY of PORT ARTHUR

TWP. LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD. R.M.	CHECKED.	W.P. NO. 914 – 64	M.B.R. DRAWING NO.
DRAWN P.T.	CHECKED.	JOB NO. 64-F-66	64-F-66A
DATE SEPT 14 1964		SITE NO.	BRIDGE DRAWING NO.
APPROVED (PRINCIPAL FOUNDATION ENGINEER)		CONT. NO.	

REF. NO. E – 4505-1

23-67-56

~~W.P. 914-64~~

FOUNDATION INVESTIGATION REPORT

For

Current River Structure, Proposed
Lakehead Expressway, District No. 19
Fort William, Ontario

W.J. 64-F-66 -- W. P. 914-64

GEN. FILES

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. M. Toye,
Bridge Engineer,
Bridge Division.

Attention: Mr. S. McCombie

From: Foundation Section,
Materials and Testing Div.,
Room 107, Lab. Bldg.

Date: August 31, 1964

Our File Ref.

In reply to

Subject:

FOUNDATION INVESTIGATION REPORT
For
Current River Structure, Proposed
Lakehead Expressway, District No.19
Fort William, Ontario
W. J. 64-F-66 -- W. P. 914-64

It is proposed to construct a rigid frame structure at the above location. A total of 5 boreholes was carried out in order to determine the bedrock contact and the extent of weathering.

Boreholes #1, #2 and #5 were drilled on the east bank of the river and revealed the area to be underlain by 4 ft. of boulders, followed by 3 ft. to 8 ft. of weathered bedrock. Immediately below this, sound arkose-greywacke bedrock was established.

On the west bank of the river (boreholes #3 and #4), weathered bedrock was encountered immediately below the ground surface to a depth of 6 ft. to 13 ft. Underlying this, the sound bedrock was observed.

cont'd. /2 ...

The field work, performed during July 1964, together with the preparation of this report, was undertaken by Mr. R. Magi, Project Foundation Engineer. The investigation was carried out under the general supervision of Mr. M. Devata, Senior Foundation Engineer, who reviewed this report.

If you have further queries regarding this project, please contact this Office.

M. Devata
for A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

RM/MdeF

cc: Messrs. A. M. Toye (_)
H. A. Tregaskes
H. D. McMillan
H. W. Hurrell
V. A. Snell
F. Norman
A. Watt

Foundations Office
Gen. Files ✓

APPENDIX I.

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' :- 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 :-

CONSISTENCY	'N' BLOWS / FT.	c LB. / SQ. FT.	DENSENESS	'N' BLOWS / FT.
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

S.S	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C	ROCK CORE
S.T	SLOTTED TUBE SAMPLE		
	P.H SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS 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
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
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

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 (YOUNGS 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_o	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

cc: Foundations Office (Rm. 110)

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

Attention: Mr. C. Grebski

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

April 9, 1965

Current River Structure at Proposed
Lakehead Expressway, District #19,
Fort William, Ontario.
W.J. 64-F-66 -- W.P. 914-64

Following our conversation regarding the above-mentioned project, we are confirming the recommendations discussed at that time with you.

The proposed structure may be founded on spread footings placed some 3 ft. below the surface of the bedrock. A design load of 5 t.s.f. may be assumed. All footings should be inspected carefully prior to placing concrete, to ensure that all badly weathered material has been removed. In the case of piles driven through the fill, it should be assumed that the refusal will occur at the existing bedrock surface.

M. Devata

MD/MdeF

A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

cc: Foundations Office ✓
Gen. Files

MURTY

OCT 22 AM 10:03

LUC64

DOWN FTWP 4 OCT 22/64 855A

A G STERMAC PRIN FOUNDATION ENGR MAT AND TESTING

RE: WP 914-64 CURRENT RIVER STRUCTURE 64-F-66

HAVE DISCUSSED THIS WITH R MAGI. I WAS NOT AWARE THAT BRIDGE OFFICE REQUESTED BORINGS BE DONE ONLY TO DETERMINE SOUND BEDROCK. I ORIGINALLY THOUGHT THERE SHOULD HAVE BEEN SOME RECOMMENDATIONS IN YOUR REPORT RE FOOTING ELEVATIONS ETC. NO FURTHER PROBLEMS NOW

R MORGANROTH PROJ SOILS ENGR MAT AND TESTING

JC

TELETYPE

FORM SB-OS-62 63-3708

DEPARTMENT OF HIGHWAYS ONTARIO

ACTION SLIP

DATE Oct 22. 1964

TO M Dwitor

FROM A. G. STERMAC

- ☐ NOTE AND FILE
- ☐ NOTE AND RETURN TO ME
- ☐ RETURN WITH MORE DETAILS
- ☐ NOTE AND SEE ME
- ☐ PLEASE ANSWER
- ☐ FOR YOUR APPROVAL
- ☐ RETURN WITH YOUR COMMENTS
- ☐ PREPARE REPLY FOR MY SIGNATURE
- ☐ TAKE APPROPRIATE ACTION
- ☐ PER YOUR REQUEST
- ☐ FOR YOUR SIGNATURE
- ☐ FOR YOUR INFORMATION
- ☐ INVESTIGATE AND REPORT
- ☐ _____

COMMENTS

Spoke to Ken - He's to see R. Morgenroth and ask about details. Will send teletype. See in the meantime what can be done.

64 OCT 21 AM 10:43

ONTAR

TELETYPE

DOWN FTWP 2 OCT 21/64 9354

A G STERMAC PRINC FOUNDATION ENGR MAT AND TESTING

ATT: MR M DEVATA

64-T 66

RE: WP 914-64 - CURRENT RIVER STRUCTURE - LAKEHEAD EXPRESSWAY

WE ARE PREPARING OUR REPORT FOR THIS PROJECT AND WOULD APPRECIATE YOUR RECOMMENDATIONS FOR THIS PROJECT SUCH AS:

1. FOOTING ELEVATIONS FOR THE ABUTMENTS

2. RIP-RAP

3. ANY OTHER REMARKS ON FOUNDATION CONDITIONS

R MORGANROTH PROJ SOILS ENGR

JC

WP. 914-64.

Job No. 64-F-66

Project Engineer: R. Magi

Supervisor: M Devata.

Ok.
JP
July 26/65.

Ok
M. Devata
July 26/65.

FILE WITH REPORT
July 29/65

FORM SB-OS-62 64-1239

DEPARTMENT OF HIGHWAYS ONTARIO

ACTION SLIP

DATE July 21/65

TO K. Selby

FROM Agterman

- [ ] NOTE AND FILE
- [ ] NOTE AND RETURN TO ME
- [ ] RETURN WITH MORE DETAILS
- [ ] NOTE AND SEE ME
- [ ] PLEASE ANSWER
- [ ] FOR YOUR APPROVAL
- [x] RETURN WITH YOUR COMMENTS
- [ ] PREPARE REPLY FOR MY SIGNATURE
- [ ] TAKE APPROPRIATE ACTION
- [ ] PER YOUR REQUEST
- [ ] FOR YOUR SIGNATURE
- [ ] FOR YOUR INFORMATION
- [ ] INVESTIGATE AND REPORT
- [ ] _____

COMMENTS

If it is Rusty's
does on please

No Comments

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. K. Y. Lo,
Supervising Functional Engineer,
Administration Bldg.,
Downsview, Ontario.

From: F. DeVisser,
Regional Bridge Location Engineer,
208 Simpson Street,
FORT WILLIAM, Ontario.

Date: July 16, 1965.

Our File Ref.

In reply to

Subject:

Re: Current River Bridge
W. P. 914-64, Site 48C-110,
L. E. W. Hwy. 17, District 19.

Enclosed is one print of our Preliminary Bridge Plan D-5573-P.

If you have any comments, please let us know.

F. DeVISSER,
Regional Bridge Location Engineer.

FDV/mcr
Enc.

c. c. Mr. S. McCombie.

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

BA 1908

To: Mr. A. M. Toye,
Bridge Engineer,
Bridge Division.

Attention: Mr. S. McCombie

From: Foundation Section,
Materials and Testing Div.,
Room 107, Lab. Bldg.

Date: August 31, 1964

Our File Ref.

In reply to

Subject:

FOUNDATION INVESTIGATION REPORT
For
Current River Structure, Proposed
Lakehead Expressway, District No.19
Fort William, Ontario
W. J. 64-F-66 -- W. P. 914-64

It is proposed to construct a rigid frame structure at the above location. A total of 5 boreholes was carried out in order to determine the bedrock contact and the extent of weathering.

Boreholes #1, #2 and #5 were drilled on the east bank of the river and revealed the area to be underlain by 4 ft. of boulders, followed by 3 ft. to 8 ft. of weathered bedrock. Immediately below this, sound arkose-greywacke bedrock was established.

On the west bank of the river (boreholes #3 and #4), weathered bedrock was encountered immediately below the ground surface to a depth of 6 ft. to 13 ft. Underlying this, the sound bedrock was observed.

cont'd. /2 ...

The field work, performed during July 1964, together with the preparation of this report, was undertaken by Mr. R. Magi, Project Foundation Engineer. The investigation was carried out under the general supervision of Mr. M. Devata, Senior Foundation Engineer, who reviewed this report.

If you have further queries regarding this project, please contact this Office.

M. Devata
for A. G. Stermac,
PRINCIPAL FOUNDATION ENGINEER

cc. A. M. Toye (2)
H. A. Tregaskes
F. D. McMillan
F. W. Hurrell
. . Snell
. . rman
. Watt

Foundations Office
Gen. Files

APPENDIX I.

ABBREVIATIONS USED IN THIS REPORT

PENETRATION RESISTANCE

STANDARD PENETRATION RESISTANCE 'N' :- 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 -

CONSISTENCY	'N' BLOWS/FT.	c LB./SQ.FT.	DENSENESS	'N' BLOWS/FT.
VERY SOFT	0 - 2	0 - 250	VERY LOOSE	0 - 4
SOFT	2 - 4	250 - 500	LOOSE	4 - 10
FIRM	4 - 8	500 - 1000	COMPACT	10 - 30
STIFF	8 - 15	1000 - 2000	DENSE	30 - 50
VERY STIFF	15 - 30	2000 - 4000	VERY DENSE	> 50
HARD	> 30	> 4000		

TYPE OF SAMPLE

S.S	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.B.	SCRAPER BUCKET SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE
S.T	SLOTTED TUBE SAMPLE		
	P.H. SAMPLE ADVANCED HYDRAULICALLY		
	P.M. SAMPLE ADVANCED MANUALLY		

SOIL TESTS

Qu	UNCONFINED COMPRESSION	L.V	LABORATORY VANE
Q	UNDRAINED TRIAXIAL	F.V.	FIELD VANE
Qcu	CONSOLIDATED UNDRAINED TRIAXIAL	C	CONSOLIDATION
Qd	DRAINED TRIAXIAL	S	SENSITIVITY

ABBREVIATIONS 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
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
	IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
	IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

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 (YOUNGS 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_o	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

64-F-66.

Mr. W.L. Lees,
Manager,
Systems Design Office,
Northwestern Region, Thunder Bay.

Soil Mechanics Section,
Geotechnical Office,
West Building, Downsview.

August 1st, 1974.

RE: Revisions to 18' x 8' Concrete Culvert
at McVicar Creek, Sta. 248+58, Hwy. 17,
Contract 67-56, District 19, Thunder Bay.

This is in reply to your verbal request for our comments regarding proposed revisions to the abovementioned culvert. As we understand the problem, a proposed new development adjacent to this section of road has imposed upon the Ministry the need to increase the culvert capacity. This can be done by widening the existing culvert or adding an additional culvert, or culverts, to the site.

We have reviewed the problem and it would appear that the most feasible solution is to add an additional culvert, or culverts, by tunnelling through the existing fill as opposed to open cut methods. The number and size of culverts is dependent upon the additional capacity needed, as determined by the Hydrology Office. If the additional capacity required is large we would suggest that a cost comparison be made between tunnelling for one large culvert or a number of smaller culverts.

At the location of the existing culvert, subsoil consisted originally, of muck overlying bedrock or boulders, sand and gravel. This muck deposit extended out about 50 ft. south side and 200 ft. north of the $\mathcal{L}$ of culvert. Presumably the muck was removed during construction of the embankment and replaced with granular type backfill. We are informed that the rest of the embankment was built of 'sandy type' material.

It would appear to us that tunnelling through the embankment would be a feasible proposition provided that the work can be done above groundwater level. Therefore, we would recommend that this construction procedure be adopted and that the invert level of the new culvert or culverts be kept as high as possible.

..... /2

Mr. W.L. Lees - RE: Contract 67-56.

We also note that bedrock was encountered during construction of the footings for the existing culvert. A soil investigation should be done to ensure that bedrock will not be encountered during tunnelling.

We trust that the above will be of some assistance. Please contact this Office if we can be of any further help.

W. Greskow,
For:
K.G. Selby,
Supervising Engineer.

WG/mj
c.c. R.W. Franks
B. McKenna
Files
Documents