

72-F-89

181-67-02

HWY.29 & INDIAN RIVER

31F-56

W.O.

W.P.

LOCATION

GEOCRES NO.

● DATA ON FILE IN SOIL MECHANICS SECTION

REFER TO: ~~W.P. FILE~~ CONT 74-28

REMARKS

GEOCRES

INDEXING CARD FOR REPORTS NOT MICROFILMED

GI-20

AUG. 74

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

72-11089

TO: Mr. A. G. Stermac,
Principal Foundation Engineer,
Downsview, Ontario.

FROM: Structural Planning Office,
Kingston, Ontario.

ATTENTION: Mr. M. Devata

DATE: July 18, 1972.

OUR FILE REF.

IN REPLY TO

SUBJECT: W.P. 181-67-02, Site 15-41,
Indian River Bridge,
(3.1 Miles North of Highway 44),
Highway 29, District 9 - Ottawa

We are sending you herewith two prints of Bridge Site Plan E-5236-1 on which we have marked the proposed location of the above structure.

We would be pleased if you will make arrangements for the necessary foundation investigation and to have your report.

J. H. Tondeur
J. H. Tondeur

For: T. C. Kingsland
Regional Structural Planning Engineer

JHT/TCK/hl
encls.

c.c. R. Forrest
C. S. Grebski (encl.)

MEMORANDUM

TO: Mr. T. C. Kingsland, (2)
Regional Structural Planning Eng.,
Eastern Region,
Kingston, Ontario.

FROM: Foundations Office,
Design Services Branch,
West Bldg., Downsview.

ATTENTION:

DATE: October 17, 1972.

OUR FILE REF.

IN REPLY TO

OCT 18 1972

SUBJECT:

31F-56

FOUNDATION INVESTIGATION REPORT
For
New Structure at the Crossing of Hwy. #29
And the Indian River
Twp. of Ramsay, County of Lanark
District No. 9 (Ottawa)
W.O. 72-11089 -- W.P. 181-67-02

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 design requirements. Should additional information be required, please do not hesitate to contact our Office.

A. G. Stermac

A. G. Stermac,
PRINCIPAL FOUNDATIONS ENGINEER.

AGS/ao
Attach.

cc: E. J. Orr
B. R. Davis
A. Rutka
S. J. Markiewicz
J. E. Callaghan
B. J. Giroux
E. R. Saint
G. A. Wrong
B. A. Singh

Foundations Files ✓
Documents

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FOUNDATION INVESTIGATION REPORT
For
New Structure at the Crossing of Hwy. #29
And the Indian River
Twp. of Ramsay, County of Lanark
District No. 9 (Ottawa)
W.O. 72-11089 -- W.P. 181-67-02

1. INTRODUCTION:

The existing concrete arch bridge at the crossing of Hwy. #29 and Indian River, in the Township of Ramsay, County of Lanark, is to be replaced by a new wider single span structure. The Foundations Office was requested to carry out a subsurface investigation for the proposed new structure. The request was contained in a memo from the Bridge Office (Mr. T. C. Kingsland, Regional Structural Planning Engineer, Eastern Region), dated July 18, 1972. Subsequently, an investigation was carried out by this Office to determine the subsoil, bedrock and groundwater conditions at the site.

The factual data obtained from this investigation are presented in this report, together with our recommendations for the design of the structure foundations as well as the stability considerations associated with the approach fills.

2. SITE AND GEOLOGY:

The site is located at the crossing of Hwy. #29 and Indian River, which occurs about 3 miles north of the Village of Almonte, in the Township of Ramsay. The surrounding terrain, which is gently undulating in relief between elevations 346 and 354, is partially cultivated farmland with the remainder being used as pasture land.

The north flowing Indian River, which is a tributary of the Mississippi River, traverses this area. The Indian River valley has a crest width which varies from 80 to 120 feet and a depth of about 18 to 20 feet. At the time of the investigation (July, 1972) the river water level was at elevation 334, which represents about 3 to 4 foot depth of water.

The condition of the existing bridge at this crossing will be discussed in detail in Section 6.

The site is situated in the physiographic region known as "The Ottawa Valley Clay Plains;" in this region deposits of clay of marine origin are interrupted by ridges of sand and rock. In the vicinity of the site in question the clay is known to be quite shallow (5 to 15 feet in thickness). The overburden is underlain by metamorphic bedrock of Precambrian age.

3. FIELD AND LABORATORY WORK:

Four boreholes, each of which was accompanied by a dynamic cone penetration test, were put down at this site during the field investigation. The boreholes and the cone penetration tests were advanced by means of a diamond drill machine adapted for soil sampling purposes.

At required depths samples of the overburden were obtained by means of a 2" O.D. split spoon sampler. The method of driving the split-spoon conformed to the specifications for the Standard Penetration Test. The same method was used to advance the dynamic cone penetration tests. Bedrock was proven at all of the boring locations by obtaining AXT size rock core samples.

During sampling and drilling operations, detailed logs of the borings were made. These logs contain a record of the drilling and sampling techniques used, together with the soil types and bedrock encountered. The location and elevation of all the boreholes are shown on Drawing No. W.O. 72-11089A, together with estimated stratigraphical section across the site. Surveying at the site was carried out by the personnel from the Engineering Surveys Section, Eastern Region. The elevations given in this report are referenced to a Geodetic datum.

All samples were subjected to a careful visual examination in the field and subsequently in the laboratory. Following this examination laboratory testing was carried out on selected representative samples to determine the following physical properties of the overburden.

Natural Moisture Content

Atterberg Limits

Grain-Size Distribution

The results of these tests are plotted on the Record of Borelog sheets as well as on Figures No. 1 and 2, all of which are located in Appendix I of this report.

4. SUBSOIL AND BEDROCK CONDITIONS:

4.1) General:

The overburden, where present, is composed of a stiff to hard clayey silt to silty clay, whose thickness ranges from 6 to 11.5 feet. Sound metamorphic bedrock underlies the overburden; in some isolated areas it protrudes to within a few feet of original ground surface.

In some areas fill was placed along the approaches to the existing structure in order to realize the present profile grade of Hwy. #29. The fill is composed of a clayey silt to silty clay. Where encountered the thickness of the fill varied from 5.5 to 9 feet.

The boundaries of the various deposits, as determined in the boreholes, are shown on the accompanying Record of Borehole sheets. The stratigraphical sections, shown on Drawing No. W.O. 72-11089A, have been inferred from this data. From ground surface downward, the soil types and bedrock encountered are as follows.

4.2) Existing Fill:

In order to realize the present profile grade of Hwy. #29, fill had to be placed in certain areas. Where encountered, the thickness of the fill varied from 5.5 to 9 feet. The fill is

composed of a clayey silt to silty clay with gravel and some sand. Chunks of asphalt are present throughout the fill.

Standard penetration testing was carried out within the fill; the results are plotted on the Record of Borelog sheets. The testing gave 'N' values which ranged from 8 to 17 blows/ft., which would indicate that the material has been subjected to a moderate degree of compaction.

4.3) Clayey Silt to Silty Clay:

Beneath the fill, where it exists, or a thin topsoil cover elsewhere, is a stratum of stiff to hard ('N' values 14 to 117 blows/ft.) grey clayey silt to silty clay with sand and gravel. The thickness of the cohesive stratum, where encountered, ranges from 6 to 11.5 feet. It should be noted, however, that in some isolated areas the underlying bedrock protrudes to within a few feet of original ground surface; in these areas the cohesive stratum is often absent. At B.H. #1 the lower 4 feet of the stratum contains numerous boulders (up to 9 inches in size). Grain-size distribution tests were carried out on samples from the subsoil, the resulting curves are plotted on Figure #1.

Atterberg limit tests were performed on samples from the stratum, the results have been plotted on the Record of Borelog sheets as well as on the Plasticity Chart (Figure #2). This testing indicates that the cohesive material has a plasticity which is in the low to intermediate range. The natural moisture content is typically at or below the plastic limit.

4.4) Bedrock:

The overburden is underlain by bedrock which was proven in all of the borings by obtaining from 4.5 to 11.5 feet of AXT size rock core samples. The bedrock surface in the area was found to be very irregular, ranging from elevation 335 (B.H. #1) to elevation 348 (B.H. #4), corresponding to depths ranging from original ground surface to 11.5 feet below this level. This pattern could be expected since the area is known to have been subjected

,in the geologic past, to folding and faulting.

The bedrock is metamorphic in nature being primarily composed of gneiss with bands of granite. At B.H. #2, however, the bedrock is dolomitic to calcitic marble. The bedrock is sound as evidenced by the high percentage of rock core recovered.

5. GROUNDWATER CONDITIONS:

The groundwater conditions, across the site, were observed by taking elevation readings in the open boreholes during the field investigation (July 1972). The results of the readings are shown on the borelog sheets, as well as on Drawing No. 72-11089A.

The observations indicate that the groundwater level ranges between elevations 336 to 350.5, which corresponds to depths of from 3.5 to 15.5 feet below the existing ground surface. The water level of the Indian River was at elevation 334.3 at the time of the investigation.

6. EXISTING STRUCTURE:

The existing structure at this crossing is a single span (45'), 28 feet wide concrete arch bridge. The bridge abutments are founded on spread footings located within the bedrock at about elevation 334. This bridge is in a poor state of repair with several cracks noticeable in the arch and abutment walls.

7. DISCUSSION AND RECOMMENDATIONS:

7.1) General:

It is proposed to demolish the existing bridge at the crossing of Hwy. #29 and Indian River, in the Township of Ramsay, County of Lanark, and replace it with a new structure. The new 32 foot wide structure is to have a single 80 foot span; the scheme will incorporate closed type abutments.

The proposed profile grade of Hwy. #29, in the vicinity of the crossing, is to vary between elevations 363 and 364. At this grade the existing approaches will have to be heightened by

adding up to 9 feet of fill. Further, the approaches will have to be widened on either side of the centre-line.

The parent overburden, where present, is composed of a stiff to hard clayey silt to silty caly, whose thickness ranges from 6 to 11.5 feet. Sound metamorphic bedrock underlies the overburden. The surface of the bedrock, across the site, is irregular (varying between elevations 335 and 348); in some isolated areas it protrudes to within a few feet of the original ground surface.

In some areas cohesive fill was encountered along the approaches to the existing structure; where encountered the fill varied from 5.5 to 9 feet in thickness.

7.2) Abutment Foundations:

The closed type abutments can be supported on spread footings located on or within the sound metamorphic bedrock since the bedrock across the site is at a relatively shallow depth below the original ground surface; the footing levels are given in tabular form below.

<u>Abutment Location</u>	<u>Footings Founded at or Below (Elevation)</u>	<u>Refer To</u>
North	335 (West End) → → Stepping up to → → 342 (East End)	B.H.'s #1 & 2
South	345 (East End) → → Stepping up to → → 348 (West End)	B.H.'s #3 & 4

As discussed previously the bedrock topography in this area is irregular. This being the case it is recommended that the footing founding level should be approved on site by an engineer representing the M.T.C., in order to ensure that the foundations are located on or within sound bedrock. Footings, founded as recommended, could be designed using an allowable bearing value of up to 20.0 t.s.f.

At the aforementioned elevations the footings will be located above the invert level of Indian Creek. The forward slopes (in front of the abutment walls) will, however, be stable providing the rock face is cut to a slope of about 1/4:1.

The footing excavations will extend below the groundwater level recorded during the period. Since the excavations will extend through the relatively impervious subsoil no major dewatering

complications are anticipated. In some areas, such as the west end of the north abutment, the excavation may extend below the river water level. If this occurs measures will have to be taken to ensure that water from this source does not seep into the excavation. This could be accomplished by carrying out the excavation from within a dike composed of locally available relatively cohesive soil.

If the structure is designed as a rigid frame then a coefficient of earth pressure at rest (K_0) of 0.5 should be assumed for the granular fill placed behind the wall, when designing the abutments. However, if some movement of the top of the wall is permitted, then a coefficient of active earth pressure (K_a) of 0.33 can be used.

The granular backfill behind the wall should be allowed to drain in order to prevent the build up of excess hydrostatic groundwater pressure in this area. This can be accomplished by providing weep holes at the base of the walls. The location and spacing of these weep holes should be determined in accordance with current M.T.C. practices.

7.3) Hwy. #29 Approach Fills:

As discussed previously the existing approaches are to be i) heightened by adding up to 9 feet of fill (final height approximately 14 to 15 feet above original ground) and ii) widened on either side of the centre-line. No stability problems are anticipated provided standard slopes are employed (earth fill 2:1, rock fill 1-1/4:1).

In order to ensure the surficial stability of the revised embankment section, it is recommended that the topsoil be removed from the existing slopes and that the new fill be "keyed" into the existing section in accordance with current M.T.C. practices if earth fill is employed.

Settlement computations carried out for the heightened and widened embankment indicate that the maximum total settlement will not exceed 1 inch. This settlement will be of a recompression nature - i.e., take place during or immediately following fill placement. The differential settlement between the heightened

existing embankment and the widened portion will not exceed 1/2 inch.

8. MISCELLANEOUS:


The field work for this project was carried out between July 25 and 29, 1972, under the supervision of Mr. V. Korlu, Project Foundations Engineer.

This report was written by Mr. Korlu assisted by Mr. B. T. Darch, Senior Foundations Engineer. The report was reviewed by Mr. M. Devata, Supervising Foundations Engineer.

The equipment used was owned and operated by Dominion Soil Ltd. of Toronto.


V. Korlu, P. Eng.




M. Devata, P. Eng.

VK/ao

Oct. 16, 1972.

APPENDIX I

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 1

JOB 72-11089

LOCATION Sta. 600 + 38 22' Lt.

ORIGINATED BY VK

W.P. 181-67-02

BORING DATE July 25, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Washbore - Diamond Drill

CHECKED BY *AK*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT — WL PLASTIC LIMIT — WP WATER CONTENT — W Wp — W — WL WATER CONTENT % 15 30 45	BULK DENSITY Y P.C.F. GR. SA. SI. CL.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT					
352.0	Ground Level									
0.0	Clayey silt with grav some sand (fill) (chunks of asphalt) Stiff		1	SS	11	350				
346.5			2	SS	38					
5.5	Silty clay to clayey silt with sand and gravel. Hard		3	SS	36	340				
	Boulders up to 9" in size		4	SS	100	2"				
335.0			5	BXL	30%					
17.0	Bedrock Fine grain gneiss, bands of granite.		6	BXL	80%	330				
			7	BXL	100%					
325.0	Sound									
27.0	End of Borehole					320				

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 2

JOB 72-11089

LOCATION Sta. 600 + 47 22' Rt.

ORIGINATED BY VK

W.P. 181-67-02

BORING DATE July 27, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Washboring - Diamond Drill

 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT				LIQUID LIMIT — w_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	PLASTIC LIMIT — w_p	WATER CONTENT — w		
351.5	Ground Level											w_p — w — w_L	WATER CONTENT % 15 30 45	γ	GR. SA. SI. CL.
0.0	Clayey silt with some sand and gravel chunks of asphalt. (Fill)		1	SS	17	350									
342.3	Stiff to Very Stiff		2	SS	8										
9.2	Bedrock		3	SS	100	2"									
	Dolomitic Marble		4	BXL	85%	340									
	Calcitic Marble		5	BXL	80%										
331.0	Sound		6	BXL	90%										
20.5	End of Borehole					330									

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 3

JOB 72-11089

LOCATION Sta. 599 + 57 18' Rt.

ORIGINATED BY VK

W.P. 181-67-02

BORING DATE July 28, 1972

COMPILED BY VK

DATUM Geodetic

BOREHOLE TYPE Washbore - Diamond Drill

CHECKED BY *[Signature]*

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100	LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w w_p — w — w_L	BULK DENSITY γ P.C.F.	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE					
352.0	Ground Level								
0.0	Clayey silt to silty clay, some sand and gravel. Stiff		1	SS	14				0 7 46 47
345.5									345.5
6.5	Bedrock		2	BXL	80%				
	Fine grain gneiss		3	BXL	80%				
333.0	Sound		4	BXL	95%				
19.0	End of Borehole								

OFFICE REPORT ON SOIL EXPLORATION

DESIGN SERVICES BRANCH

FOUNDATIONS OFFICE

RECORD OF BOREHOLE NO 4

JOB 72-11089

LOCATION Sta. 599 + 43 15' Lt.

ORIGINATED BY VK

W.P. 181-67-02

BORING DATE July 29, 1972

COMPILED BY VK

DATUM Geodetic

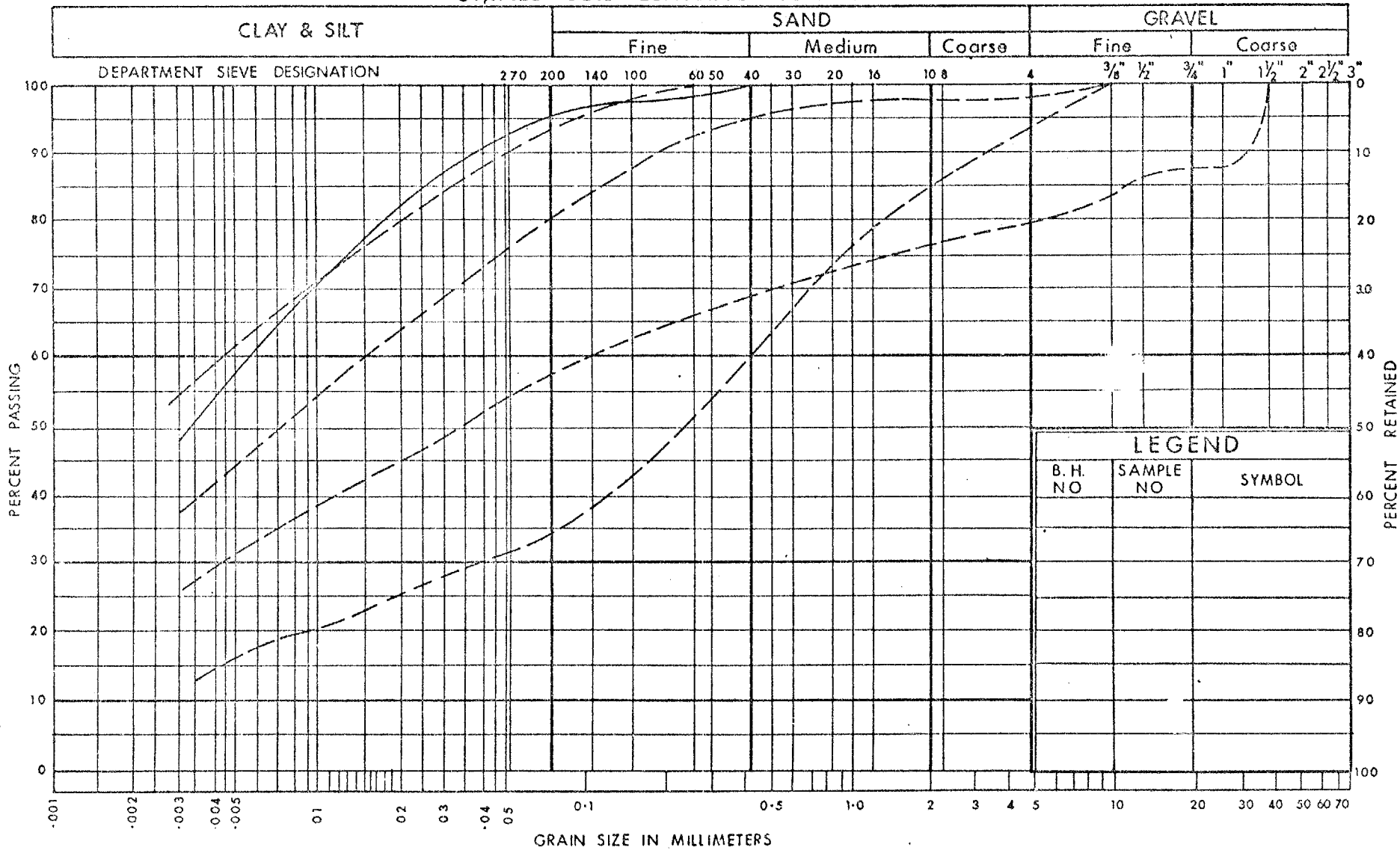
BOREHOLE TYPE Washboring-Diamond Drill

 CHECKED BY *[Signature]*

SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT w_L			BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	BLOWS/FOOT		BLOWS / FOOT	20	40	60	80	100	PLASTIC LIMIT w_p	WATER CONTENT w		
354.0	Ground Level															
0.0	Clayey silt with some sand and gravel. Hard		1	SS	117	350										350.5
348.0																2 18 49 31
6.0	Bedrock		2	BXL	70%											
343.5	Fine grain gneiss Sound		3	BXL	100%											
10.5	End of Borehole					340										

OFFICE REPORT ON SOIL EXPLORATION

UNIFIED SOIL CLASSIFICATION SYSTEM



ONTARIO

DESIGN SERVICES
BRANCH

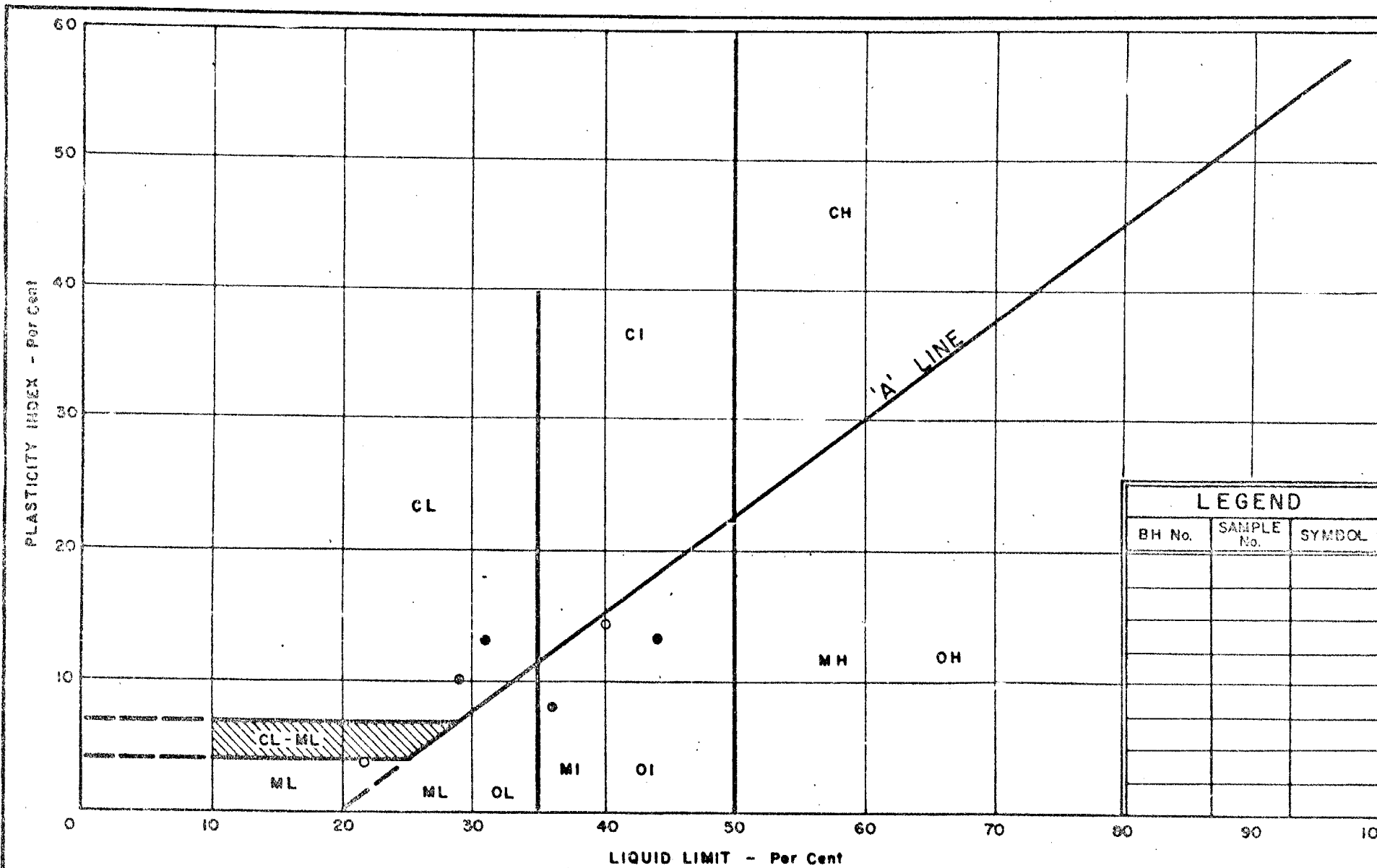
GRAIN SIZE DISTRIBUTION

-----CLAYEY SILT TO SILTY CLAY
 -----CLAYEY SILT TO SILTY CLAY (FILL)

W.P. No. 181-67-02

JOB No. 72 - 11089

FIG. 1



DEPARTMENT OF HIGHWAYS
MATERIALS and
TESTING
DIVISION

PLASTICITY CHART

- CLAYEY SILT TO SILTY CLAY
- CLAYEY SILT TO SILTY CLAY (FILL)

W.P. No. 181-67-02

JOB No. 72-11089

FIG. 2

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 :-

<u>CONSISTENCY</u>	<u>'N' BLOWS / FT.</u>	<u>c LB. / SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
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
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
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
$\bar{\sigma}$	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

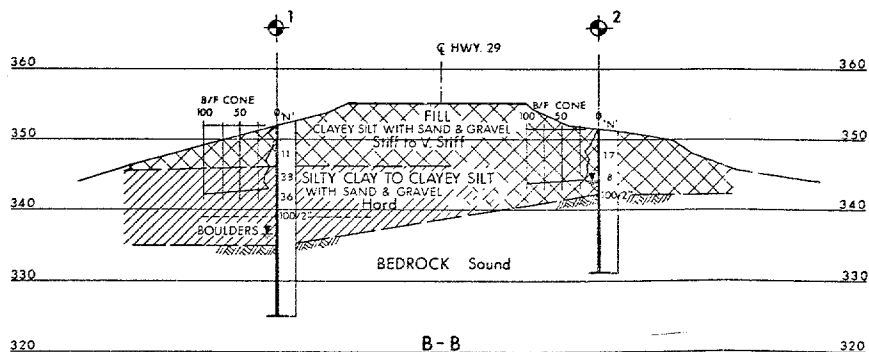
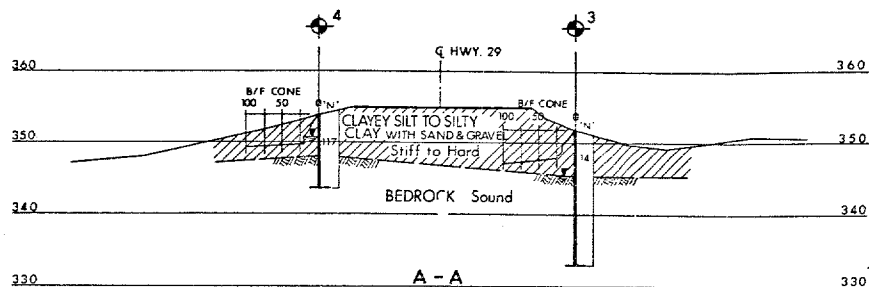
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_0	COEFFICIENT OF EARTH PRESSURE AT REST

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

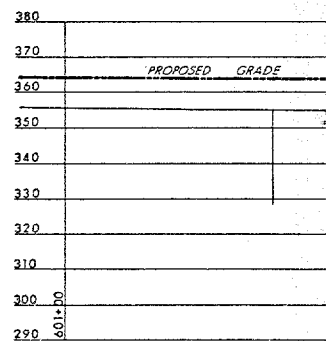
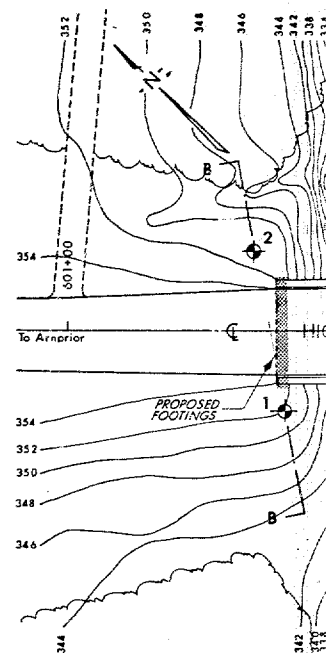
SLOPES

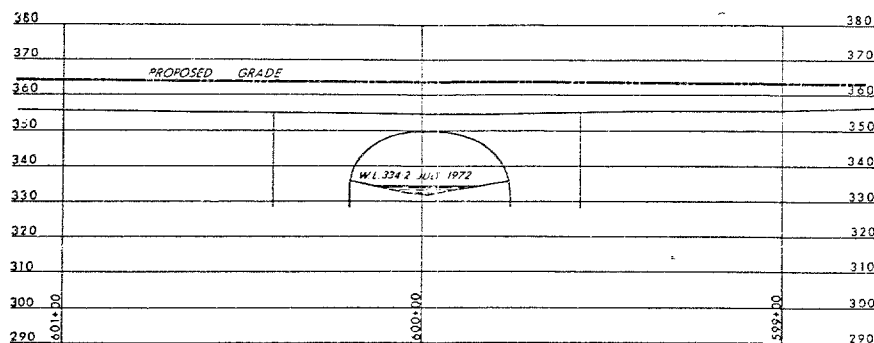
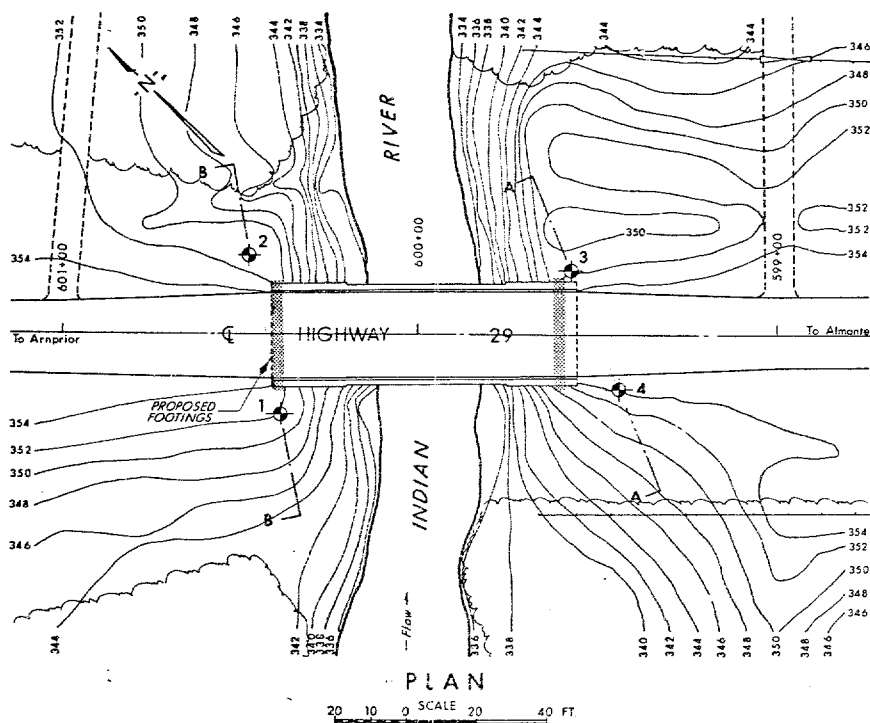
H	VERTICAL HEIGHT OF SLOPE
D	DEPTH BELOW TOE OF SLOPE TO HARD STRATUM
β	ANGLE OF SLOPE TO HORIZONTAL



SECTIONS

10 5 0 SCALE 10 20 FT



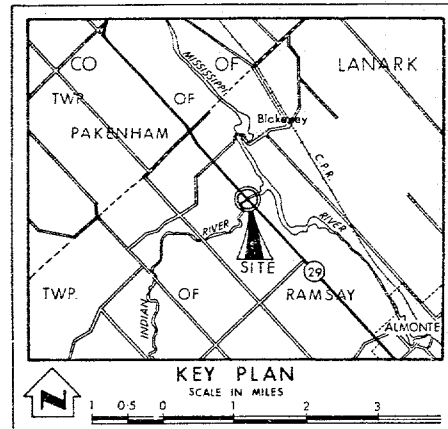


PROFILE

20 10 0 SCALE 20 40 FT.



REF NO. E-5236-1



LEGEND

- Bore Hole
- ⊕ Cone Penetration Test
- ⊕ Bore Hole & Cone Test
- ⊕ Water Levels established at time of field investigation, JULY 1972

NO.	ELEVATION	STATION	OFFSET
1	352.0	600+38	22' LT.
2	351.5	600+47	22' RT.
3	352.0	599+57	18' RT.
4	354.0	599+43	15' 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.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS—ONTARIO
DESIGN SERVICES BRANCH—FOUNDATIONS OFFICE

INDIAN RIVER

HIGHWAY NO. 29 DIST. NO. 9
CO. LANARK
TWP. RAMSAY LOT 24 CON. 8 & 9

BORE HOLE LOCATIONS & SOIL STRATA

SUBMD V K	CHECKED	W.P. NO. 181-67-02	DRAWING NO.
DRAWN S O	CHECKED	W.D. NO. 72-11089	72-11089A
DATE 4 OCT. 1972	SITE NO.	BRIDGE DRAWING NO.	
APPROVED	PRINCIPAL	DESIGNER	CONT. NO.

SCALE: 1" = 100'

MEMORANDUM

TO: T. C. Kingsland,
Reg. Structural Planning Engineer,
EASTERN REGION, Kingston.

FROM: Structural Office,
West Building,
Downsview.

ATTENTION:

DATE: April 16th, 1973.

OUR FILE REF.

IN REPLY TO

SUBJECT:

Indian River Bridge,
3.1 Miles N. of Hwy. 44,
W.P.#181-67-02, Site #15-41,
Hwy. #29, District #9.

72-11-089

Attached herewith are prints of the Preliminary Bridge Plan Drawing D-15-41-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$88,000 which includes tender, materials, engineering, and sundry construction.

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

C.S. Grebski

C.S. Grebski,
Structural Design Engineer.

CSG:dp
Attach.

cc. B.R. Davis,
W.D. Birch,
A. E. McKim,
A.G. Stermac (2), ✓
J. Harris,
J. Anderson,
R. Forrest,
M. Stoyanoff,
W. McFarlane.

Excavation for the north abutment will be below the water level. Some dewatering measures may be required.
M. Devata
May 14/73

FOUNDATIONS OFFICEREVIEW OF DESIGN DRAWINGS:

W.P. ...181-67-02....

W.O. ...72-11089.....

Foundation Report By:

.....U. K.

Review of Design Drawings By:

.....P. P.

Design Drawing No.'s:

.....15-41-31.....

1. Does footing design comply with our report or subsequent memos? *YES*

2. If answer to 1. is No, is present design acceptable?

3. Has sufficient field work been done? *YES*

4. Are estimated pile lengths shown on Drawings correct?
If not, make a new list. *N.A.*

5. If excavation of unsuitable soil is recommended,
is this shown on Drawings? _____

6. Are approaches designed in accordance with our
report? Check slopes and berm lengths. *YES*

7. Do you anticipate any construction problems?
i.e., dewatering, stability of temporary slopes
or excavations.

8. Summarize your comments; on separate sheet if necessary. *DEWATERING - NORTH ABUTMENT in flood season.*

*Actual Bedrock elevations for footings have to be confirmed
by an Engineer at the site during the excavations.*

Drawings Received*APRIL 18*.....19*73*..

Reviewed*APRIL 19*.....19*73*..

Signed*P. Payer*.....

FOUNDATIONS OFFICE

REVIEW OF DESIGN DRAWINGS:

W.P. ...181-67-02....
W.O. ...72-11089#....

Foundation Report By:

.....U.K.

Review of Design Drawings By:

.....PP

Design Drawing No.'s

.....15-41-1.#3.....

1. Does footing design comply with our report or subsequent memos? YES

2. If answer to 1. is No, is present design acceptable?

3. Has sufficient field work been done? YES

4. Are estimated pile lengths shown on Drawings correct?
If not, make a new list. N-A.

5. If excavation of unsuitable soil is recommended,
is this shown on Drawings? N-A.

6. Are approaches designed in accordance with our report? Check slopes and berm lengths. YES

7. Do you anticipate any construction problems?
i.e., dewatering, stability of temporary slopes
or excavations.

DEWATERING ~~SCHEME~~ MAY BE REQUIRED FOR THE NORTH ABUTMENT.
8. Summarize your comments; on separate sheet if necessary.

FINALIZED &
SENT TO BRIDGE OFFICE
27 JULY 1973

No comments.
July 23/73
M.W.

Drawings Received19.....

Reviewed ...JULY 23/73.....19.....

SignedP. Taylor.....

OVERSIZED DRAWINGS

General Layout
Foundation & Rein.

DOCUMENT MICROFILMING IDENTIFICATION

GEOCREs No. 31F-56

DIST. 9 REGION EASTERN

W.P. No. 181-67-02

CONT. No. 74-28

W. O. No. 72-F-89

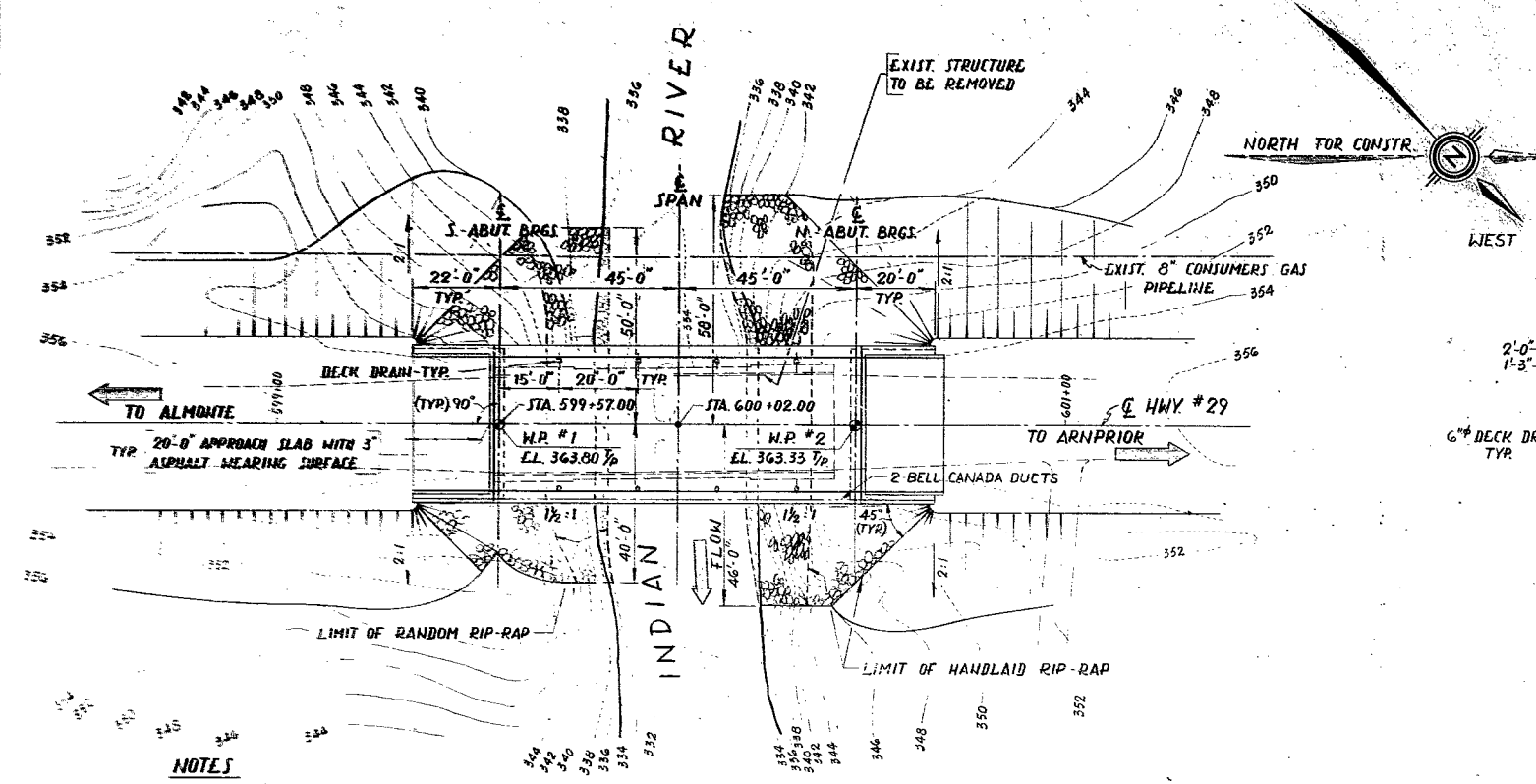
STR. SITE No. 15-41

HWY. No. 3.1 MILES N. OF HWY. 44

LOCATION HWY 29 & INDIAN RIVER

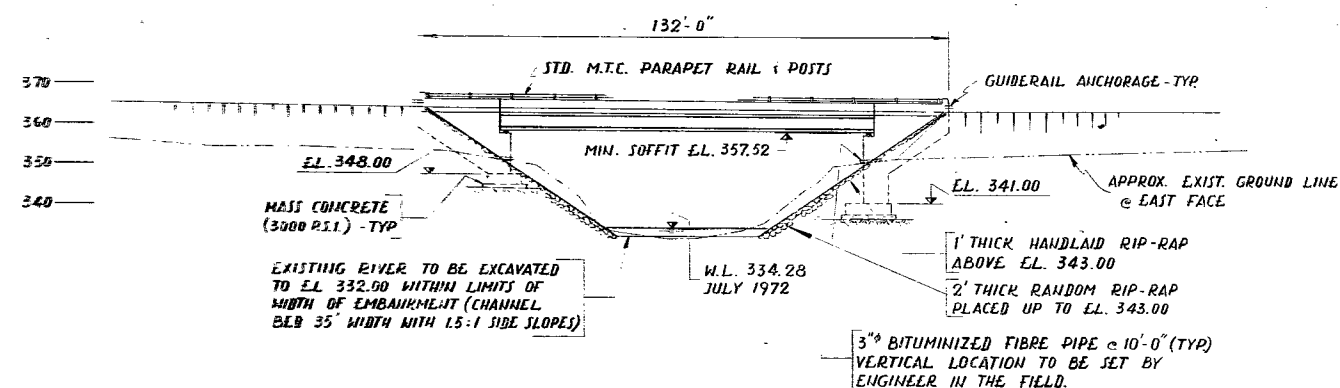
OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. 2.

REMARKS: DOCUMENTS TO BE UNFOLDED
BEFORE MICROFILMED

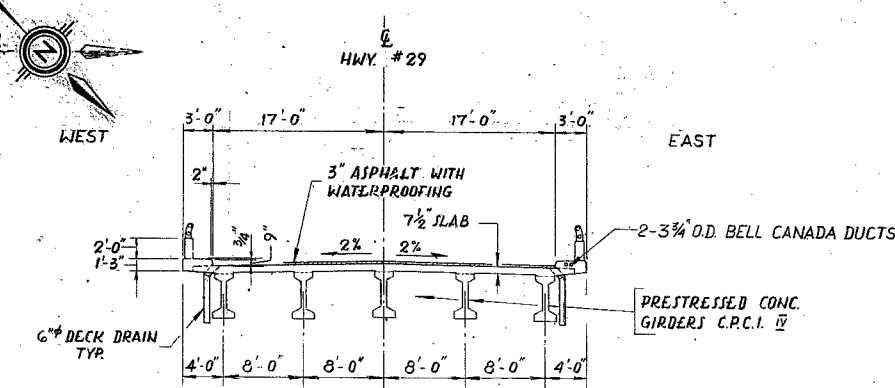


- NOTES**
- W.P. BEARINGS WORKING POINT
 - TYP. BEARINGS TOP OF FINISHED PAVEMENT

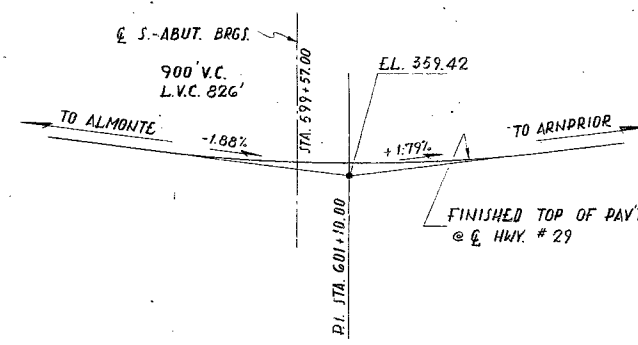
PLAN
SCALE: 1" = 20'-0"



ELEVATION
SCALE: 1" = 20'-0"

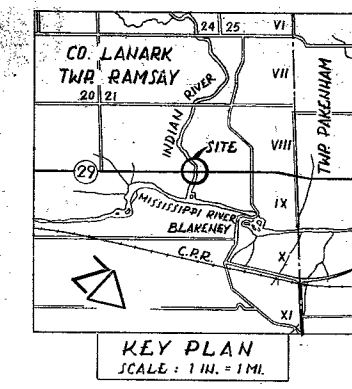
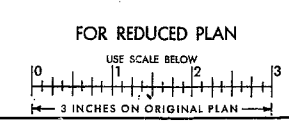


TYP. DECK SECTION
SCALE: 1/8" = 1'-0"



PROFILE OF HWY. #29
N.T.S.

- LIST OF DRAWINGS**
- SHEET 1 GENERAL LAYOUT
 2 BORE HOLE LOCATIONS & SOIL STRATA
 3 FOUNDATION LAYOUT & REINF.
 4 SOUTH ABUTMENT
 5 NORTH ABUTMENT
 6 PRESTRESSED GIRDERS & BEARINGS
 7 DECK
 8 PARAPET WALL DETAILS
 9 STANDARD STEEL PARAPET RAIL
 10 20 FOOT APPROACH SLAB
 11 STANDARD DETAILS I
 12 STANDARD DETAILS II
 13 BAILEY BRIDGE
 SHEET 14 BAILEY BRIDGE

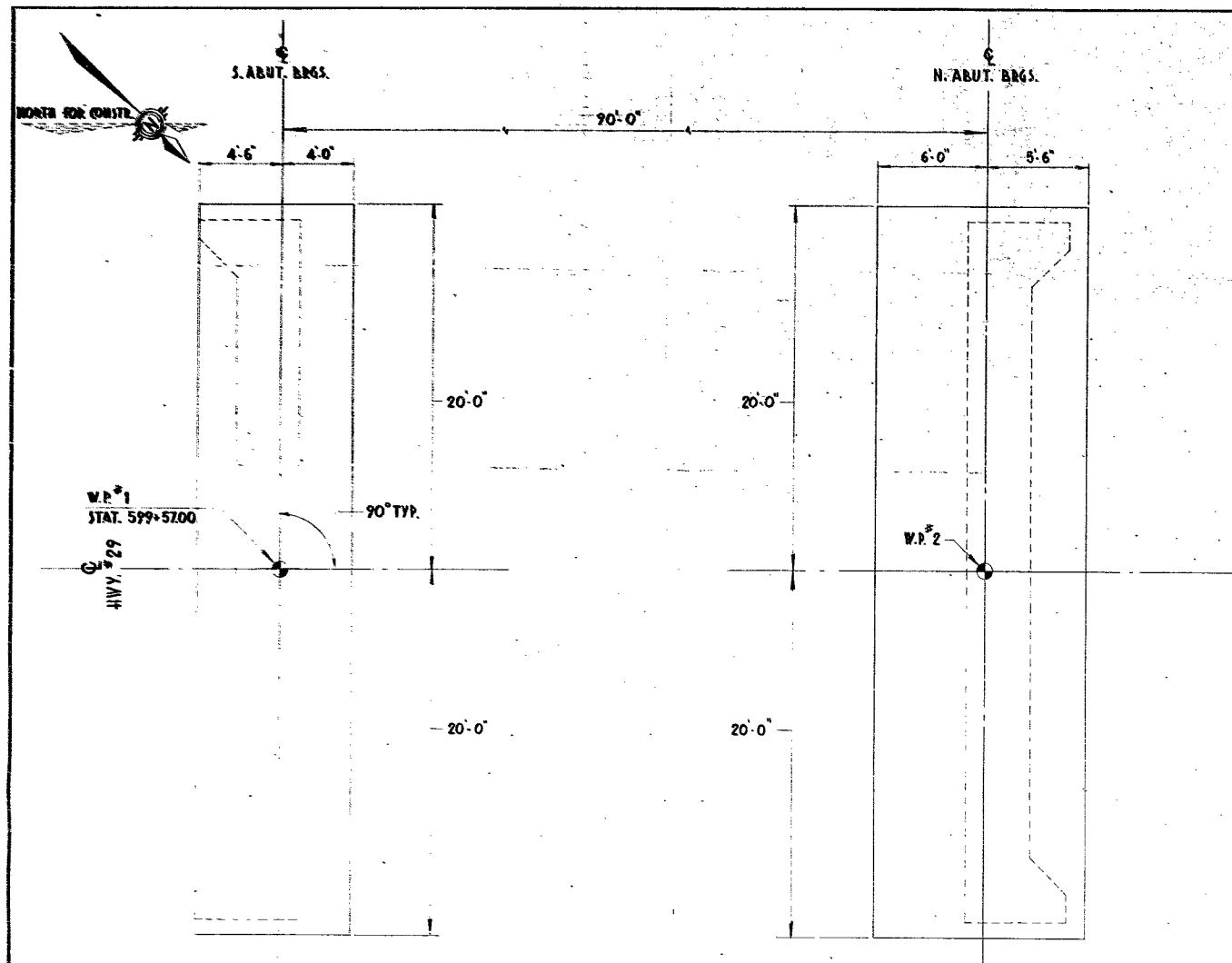


REFERENCE BENCH MARK
 B.M. 376.64
 GEODETIC DATUM
 N 4° W IN NW CORNER OF 1/4 SPRUCE
 81' RT. 608+58

- NOTES**
- CLASS OF CONCRETE**
 PRESTRESSED GIRDERS — 5000 P.S.I.
 DECK & CURBS — 4000 P.S.I.
 REMAINDER — 3000 P.S.I.
- CLEAR COVER ON REIN. STEEL**
 FOOTINGS & ABUTMENTS 3"
 CURBS & APPROACH SLABS 2"
 TOP OF DECK 1 1/2", BOT. 1"
 PARAPET WALLS 1 1/2"
- CONSTRUCTION NOTES**
 THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ± 1/8".
 NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.

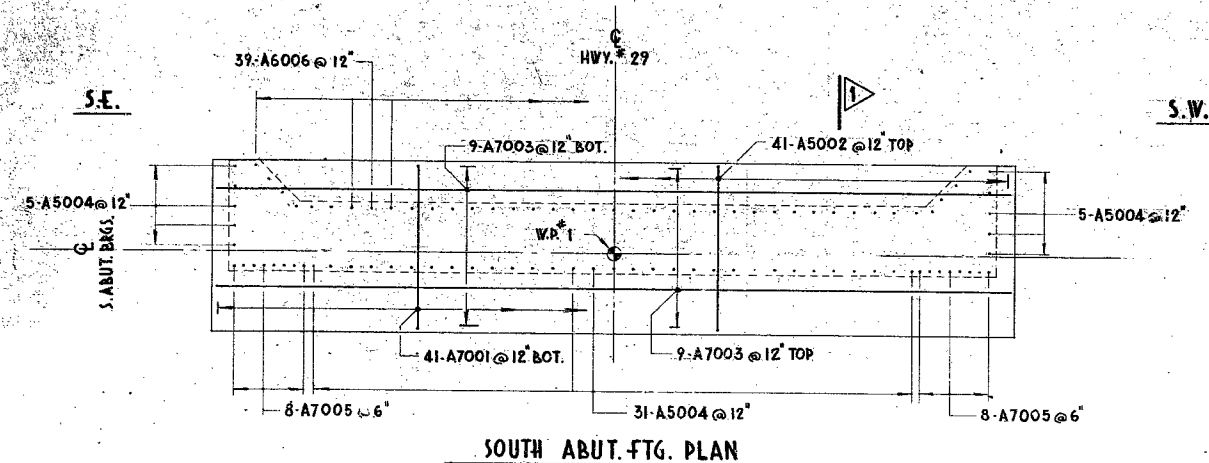
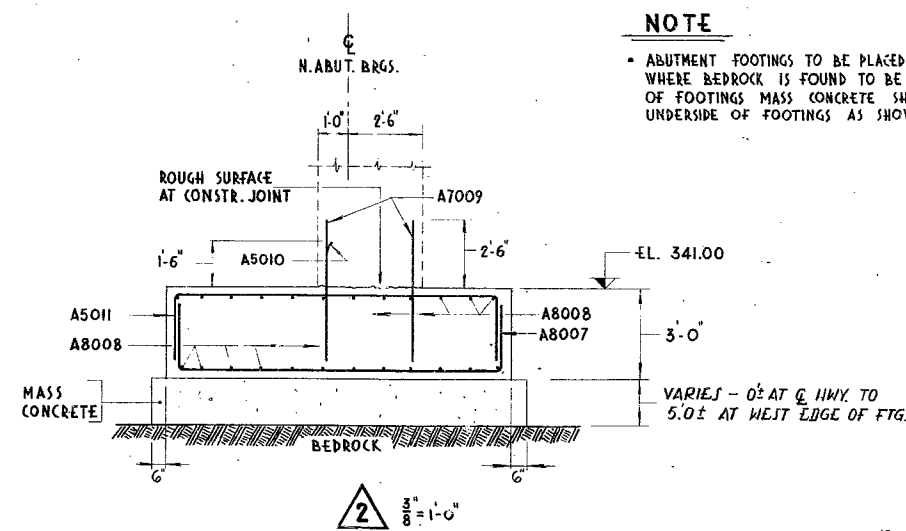
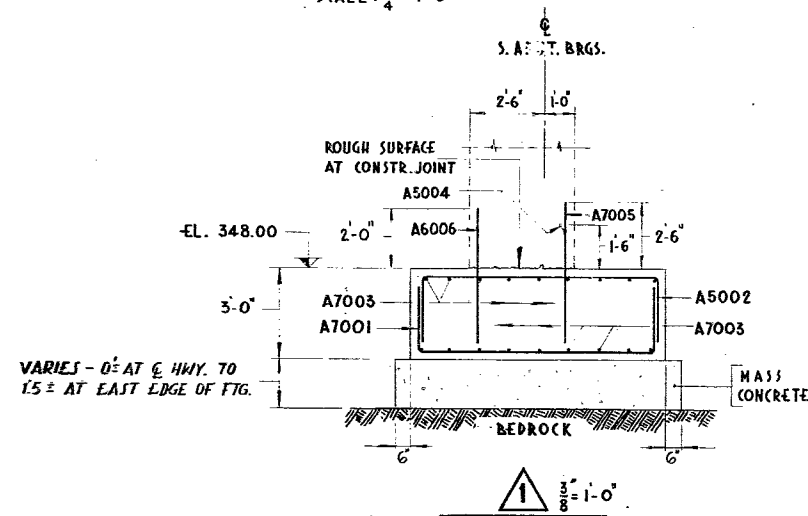
31F-56
 GEORES No.

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS ONTARIO			
INDIAN RIVER BRIDGE 3.1 MILES NORTH OF HWY. 44			
KING'S HIGHWAY No. 29		DIST. No. 9	
CO. LANARK		TWP. RAMSAY	
LOT 24		CON. IX	
— GENERAL LAYOUT —			
APPROVED <i>[Signature]</i>		CONTRACT No.	
DESIGN A.A.	CHECK P.C.R.	W.P. No.	181-67-62
DRAWING A.A.	CHECK A.A.	SITE No.	15-41
DATE JUNE '73	LOADING 4520-44	SHEET 1	

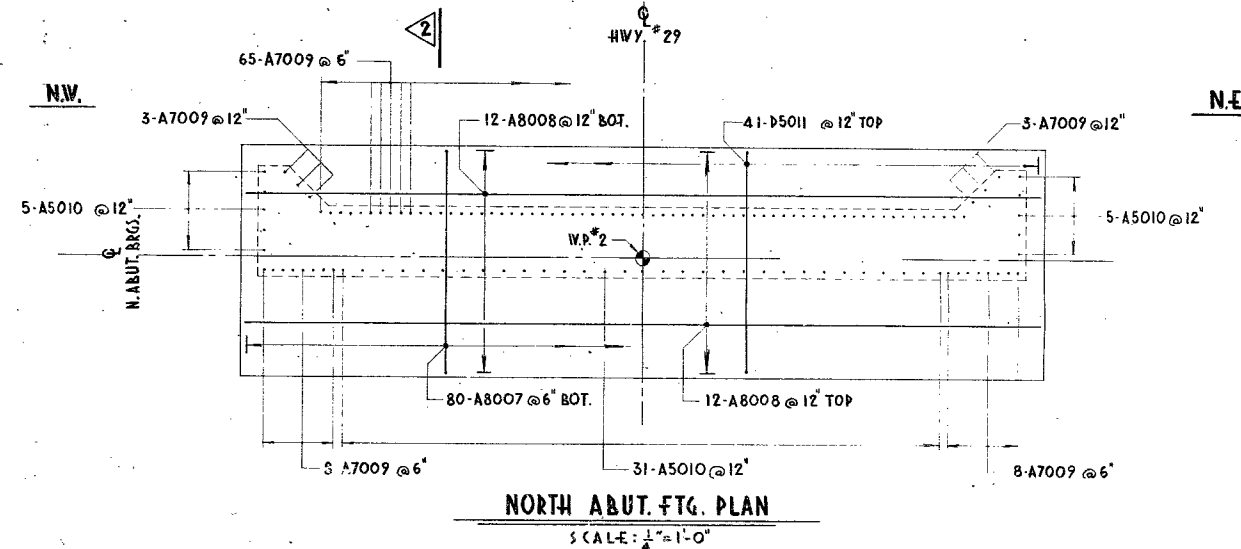


FOUNDATION LAYOUT

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



SOUTH ABUT. FTG. PLAN



NORTH ABUT. FTG. PLAN

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

NOTE

- ABUTMENT FOOTINGS TO BE PLACED ON SOUND BEDROCK. WHERE BEDROCK IS FOUND TO BE BELOW THE UNDERSIDE OF FOOTINGS MASS CONCRETE SHALL BE PLACED UP TO UNDERSIDE OF FOOTINGS AS SHOWN.

REVISIONS	DATE	BY	DESCRIPTION

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS
ONTARIO

INDIAN RIVER BRIDGE

3.1 MILES NORTH OF HWY. #44

KING'S HIGHWAY No. 29 DIST. No. 9
CO. LANARK
TWP. RAMSAY LOT 24 CON. 1X

FOUNDATION LAYOUT & REINF.

DESIGN	A. W.	CHECK	R. S. C.	W.P. No.	181-67-02
DRAWING	G. C.	CHECK	A. S.	SITE No.	15-41
DATE	JUNE/73	LOADING	11320-44	SHEET	3



FOR REDUCED PLAN

