DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. B. R. Davis,
Bridge Engineer,
Bridge Division,
Admin. Bldg.

From: Foundation Section,
Materials & Testing Office,
Room 107, Lab. Bldg.

Attention: Mr. S. McCombie

Date: September 2, 1969.

Our File Ref.

In reply to SEP - 8 1969

Subject:

FOUNDATION INVESTIGATION REPORT
For
The proposed Boyne River Bridge
On Hwy. 25. Town of Oakville
District No. 4
W.J. 69-F-54 W.P. 132-65

Attached, we are forwarding to you, our detailed foundation investigation report on the subsoil conditions existing at the above structure 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
PRINCIPAL FOUNDATION ENGINEER

AGS/ia
Attach.

cc: Messrs. B.R. Davis (2)
H.A. Tregaskes
D.W. Farren
C.K. Hunter (2)
H. Greenland
W.S. Melinyshyn
T.J. Kovich
B.A. Singh

Foundations Files
Gen. Files

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FOUNDATION INVESTIGATION REPORT
For
The proposed Boyne River Bridge
On Hwy. 25. Town of Oakville
District No. 4
W.J. 69-F-54   W.P. 132-65

1. INTRODUCTION:

A foundation investigation was carried out at the site of a proposed new bridge over the Boyne River (Oakville Creek) along Hwy. #25. The investigation was requested by Mr. W.S. Melinyshyn, Regional Bridge Location Engineer, in a memo dated June 18th, 1969. The subsequent field and laboratory investigations were supervised by this section the results of which were compiled in the present report.

2. DESCRIPTION OF THE SITE:

The site is situated about 3 miles south of the town of Milton at the crossing of Hwy. #25 and the Boyne River. The existing structure over the river is a reinforced concrete arch of some 26 ft. wide. At the north side of the river the Hwy. is on an embankment of approximately 15 ft. height, at the south it is in a cut. The river is about 1.5 - 2.0 ft. deep, following a meandering course with a somewhat sluggish flow. The adjacent area has an undulating terrain, mainly occupied by farmlands.

Geologically the site belongs to the west end of the physiographic region known as the Peel Plain. The predominant subsoil of this plain is a till or boulder clay containing large amounts of Palaeozoic shale and limestone. The overburden is not deep, the till is dense and there are a few thick beds of sand to serve as aquifers.

cont'd. /2

3. FIELD AND LABORATORY INVESTIGATIONS:

Some four sampled boreholes and adjacent to the borings four dynamic cone penetration tests were carried out during the course of field work. The locations and elevations of the boreholes together with the stratigraphical sections are shown on Drawing #69-F-54 A. B.H.-s # 1 and 2 were placed near the abutments of the existing bridge at the upstream side. B.H.-s #3 and 4 were located downstream and were intended to reveal soil conditions at the site of the proposed Bailey structure for the temporary detour as well as for the new permanent structure.

The fieldwork was undertaken by means of a conventional diamond rig, adapted for soil sampling purposes. On account of the heterogeneous nature and the very dense relative density of the soils only 2" O.D. split spoon samplings were carried out. Standard penetration tests were performed according to conventional techniques and the penetration "N" values were recorded. The bedrock was penetrated by means of diamond drilling, core samples being taken by BX size core barrels. Upon arrival in the laboratory soil samples were recorded and identified using some simple tests. Further laboratory tests of Atterberg limits, natural moisture content and grain size analysis were implemented on representative samples. Field and laboratory test results are plotted on the borelog sheets accompanying this report.

4. SOIL CONDITIONS:

4.1) General :

Below an approximate 2 foot thick organic topsoil a mixture of clayey silt with sand and gravel (glacial till) deposit was found, which in turn was underlain by shale bedrock. Since the topsoil has no engineering significance and will be excavated at the footings anyway no further comments are given.

A brief description of the glacial till and the bedrock follows:-

cont'd./3

4. SOIL CONDITIONS: (cont'd.) ...

4.2) Heterogeneous mixture of clayey silt with sand and gravel.

Underlying the topsoil a heterogeneous mixture of clayey silt with sand and gravel was encountered in every borehole. The unsorted nature of the soil and the very high degree of overconsolidation are indicative of the glacial origin of the deposit. Grain size analysis showed a great scatter of the various grain sizes within each sample tested. The constituent clay size particles were found to range between 3% and 20%, while the gravel sizes ranged between 6% and 47%. On account of the particle sizes the deposit exhibits partially fine grained and partially coarse grained soil properties.

Penetration "N" values usually increase with depth, varying from 8 blows per foot to much in excess of 100 blows per foot. Based on the penetration resistances, the consistency of the cohesive portion of the stratum may be specified as hard whereas the relative density of the granular portion is very dense. The fine grained zones of the till were observed to have slight plasticity with an average plastic limit of 16% and liquid limit of 17-18%. The natural moisture content of the samples were all much lower than the plastic limits, further confirming the over-consolidated state of the material.

4.3) Bedrock:

The 25-28 foot thick overburden is underlain by shale bedrock, the surface of which was observed to be at elevation 571-572 feet in B.H.-s # 2, 3 and 4. In B.H. #1 the rock surface was found somewhat deeper, however no diamond drilling was carried out at this location.

Some five feet thickness of the rock was proved by diamond drilling and the cores were examined by a D.H.O. Geologist. The bedrock was classified to be red shale with layers (up to 3") of greenish grey medium hard limestone. Geologically the rock belongs to the Upper Ordovician epoch and to the Queenston Formation. It was found to be very slightly fissured, but no signs of weathering were visible.

cont'd. /4

5. GROUNDWATER CONDITIONS:

In B.H.-s #2, 3 and 4 the groundwater level was found to be at the groundsurface around elevation 597 feet. In B.H. #1 the water level was somewhat higher at elevation 601 feet. The river water level surveyed in March 1969, was established at elevation 594.5 feet. Observations indicate that the prevailing groundwater is higher than the river water level and there is a seepage flow towards the river.

A second waterlevel was encountered in B.H. #2 at elevation 574 feet, some 23 feet below groundlevel. This water was found to be under artesian pressure, raising the water in the casing up to 5 feet above ground surface.

6. DISCUSSION & RECOMMENDATIONS:

6.1) General:

It is proposed to replace the existing and functionally inadequate archbridge by a three span structure at the Boyne River crossing of Hwy. #25. The grade of the new structure is proposed to be 2 feet higher than the existing one. The width of the bridge will be 44 feet, the full length 100 feet with spill through type abutments.

During construction the traffic will be diverted to a detour, crossing the river by a temporary Bailey Bridge, immediately east of the existing road.

Subsoils at the site consist of a 25-26 feet thick layer of very dense and hard heterogeneous mixture of clayey silt with sand and gravel (glacial till), underlain by shale bedrock at elevation 571-572 feet. The glacial till appears to have sufficient strength to support the structure on spread footings. Recommendations are presented below separately for the abutment and pier footings. All suggested footing elevations are given with the understanding that a minimum of four foot cover is provided above the footing bases for frost protection.

cont'd./5

6. DISCUSSION & RECOMMENDATIONS: (cont'd.)...

6.2) Abutment Footings:

The north approach may be designed either with closed or spill through type abutment. The closed abutment can be supported on spread footings, the base of footing being at or below elevation 593 feet. Up to 4 TSF safe loads may be used on footings at above elevations. In the case of designing perched abutments, piled foundation may be considered, the pile caps being formed within the approach fill. Steel H piles will be the most economical at this location. It is believed that 12 BP @ 53 steel H piles driven to approximate elevation 585 feet will support safe loads up to 70 tons per pile.

The location of the south abutment is proposed to be in a cut. Subsoil at or below elevation 603 feet exhibits adequate strength for spread footing type foundations, thus it is recommended that footings be placed at or below elevation 603 feet with design loads up to 4 TSF on the footing bases.

6.3) Piers:

Spread footings are suggested for both proposed piers, the depth of footings being governed by the depth of scour. Information as to the depth of scour should be obtained from the Hydrology section. It is recommended that a minimum distance of four feet be provided between the bottom of scour and the base of footings. Up to 4 TSF safe loads may be employed on spread footings.

Excavations for the pier footings will extend below the groundwater levels. It is however believed that on account of the very high densities and the sufficient amount of clay binders within the till, no instability will occur under the excess hydrostatic head. Water might be expelled by pumping from open sumps, placed around the perimeter of the excavations.

cont'd./6

6. DISCUSSION & RECOMMENDATIONS: (cont'd.)...

6.4) Embankment Stability:

The proposed embankment at the north approach will be only 2 - 3 feet higher than the existing one. No stability problems are foreseen for fills of such height provided they are built with 2 horizontal to 1 vertical slopes.

6.5) Footings at the temporary Bailey Bridge:

The temporary Bailey Bridge at the proposed detour may be supported on spread footings at some 4 feet below finished grade. It is to be pointed out that the footings should entirely be supported on the hard glacial till, and all organic topsoil should be removed at the footing locations.

7. SUMMARY:

A foundation investigation at the site of the proposed new bridge above the Boyne River at Hwy. #25 is reported.

Subsoils of very dense and hard glacial tills were found to have adequate strength to support the structure on spread footings. Detailed foundation recommendations are given for the piers as well as for the abutments under paragraph (6).

4 TSF safe loads may be employed on spread footings placed at the specified elevations.

Alternative proposals for piled foundations are given for spill through type abutments at the north approach. 70 Ton/pile design loads may be used on 12 BP @ 53 steel H piles driven to approximately elevation 585 feet.

No major dewatering scheme will be necessary for the pier footing excavations on account of the very dense nature and the sufficient clay binder of the subsoil.

cont'd./7

8. MISCELLANEOUS:

The field work and preparation of the report was carried out by Mr. T. Vanvari, engineering student during the period from the 8th to 18th of July 1969.

The drilling equipment used was owned and operated by Canadian Longyear Ltd.

The entire project was under the supervision of Mr. K.G. Selby, Supervising Foundation Engineer.

September 2, 1969.

APPENDIX I

FORM OB-MT-126 (REV 1969) OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 1

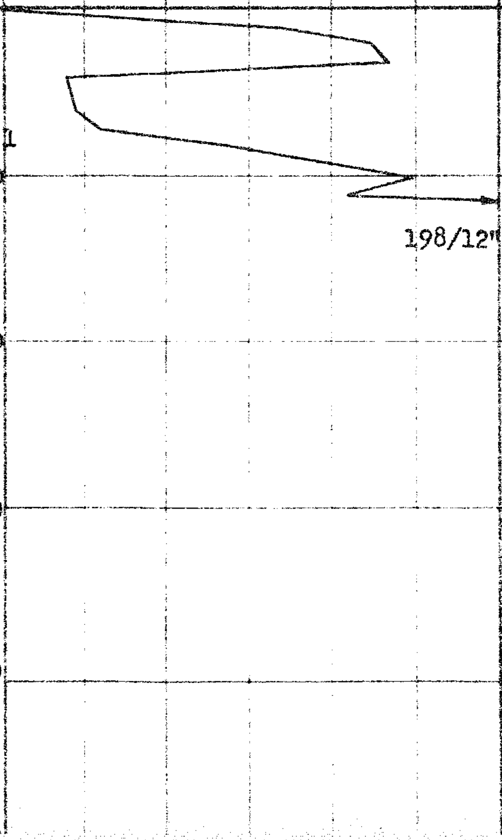
FOUNDATION SECTION

JOB	69-F-54	LOCATION	Sta. 306 + 03 23.5' Lt.	ORIGINATED BY	MV
W.P.	132-65	BORING DATE	July 16, 17, 18, 21, 1969	COMPILED BY	MV
DATUM	Geodetic	BOREHOLE TYPE	Washboring - Diamond Drill	CHECKED BY	[illegible]

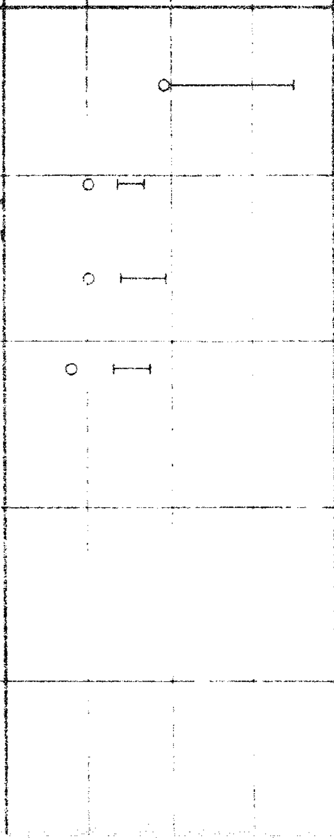
SOIL PROFILE / SAMPLES

ELEV DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT	ELEV SCALE	REMARKS GR. SA. SI. CL.
609.9	Ground Level					
607.0	Topsoil	1	SS	19		
2.0	Het. mix. of clayey silt, sand & gravel - Till Hard & V. Dense	2	SS	8		6 15 59 20
		3	SS	57	601.1	
		4	SS	148	600	
		5	SS	165/6"		
		6	SS	125		12 32 45 11
					590	
		7	SS	104		
		8	SS	165/6"		
		9	SS	85/3"	580	47 36 (17)
		10	SS	285		
569.9					570	
40.0	End of Borehole					

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100
SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB. VANE



LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w
WATER CONTENT % 10 20 30



BULK DENSITY γ P.C.F.

FORM OB-MT-126 (REV. 1969)

OFFICE REPORT ON SOIL EXPLORATION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 2

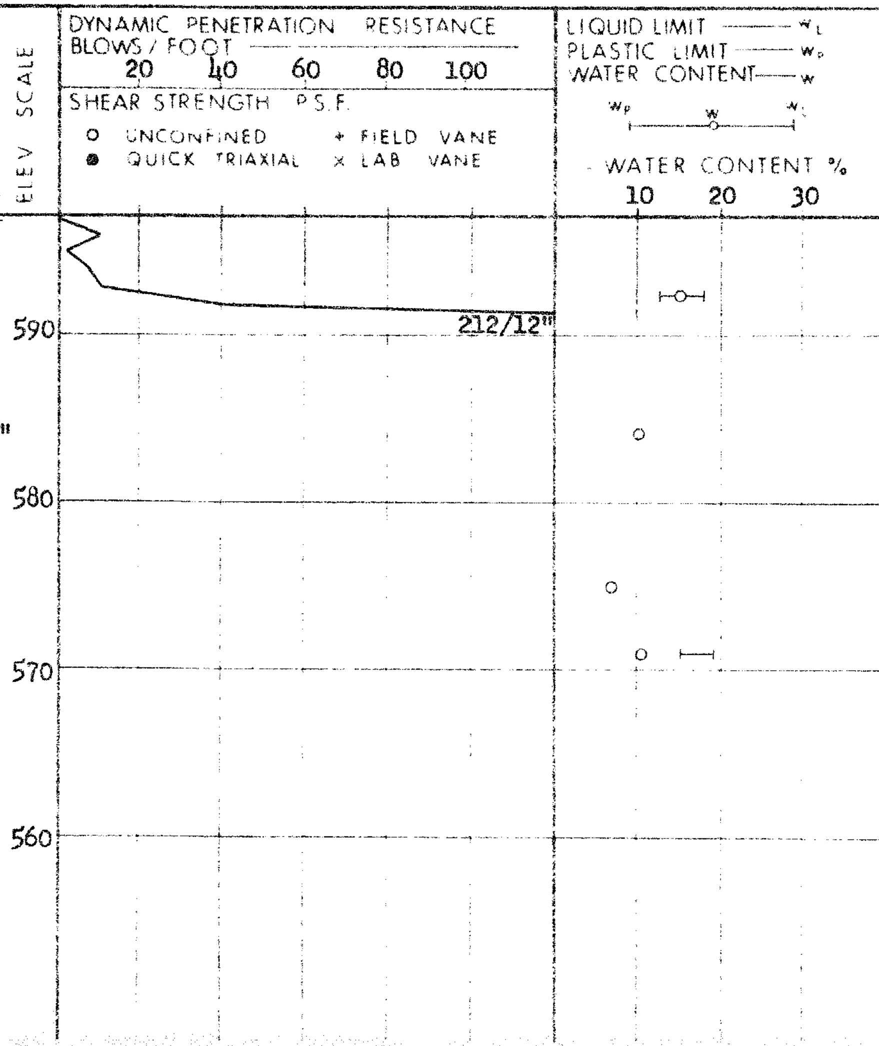
FOUNDATION SECTION

JOB 69-F-54 | LOCATION Sta. 306 + 83 30.7' Lt. | ORIGINATED BY MV

W.P. 132-65 | BORING DATE July 10, 11, 1969 | COMPILED BY MV

DATUM Geodetic | BOREHOLE TYPE Washboring - Diamond Drill | CHECKED BY [illegible]

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT	REMARKS (GR. SA. SI. CL.)
596.9	Ground Level				
594.9	Topsoil				
2.0	Het. mix. of clayey silt, sand & gravel - till. Very dense	1	SS	131/9"	
		2	SS	120	
		3	SS	98/4"	
		4	SS	141/7"	
		5	SS	99/6"	19 36 40 5
		6	SS	67/6"	
571.4 / 25.5	Bedrock. Calcareous Shale	7	SS	98/6"	▽ Encountered
		8	BX		
565.8 / 31.1	End of Borehole				



BULK DENSITY γ P.C.F.

REMARKS ▽ HEAD

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 69-F-54	LOCATION Sta. 306 + 73 26.6' Rt.	ORIGINATED BY MV
W.P. 132-65	BORING DATE July 8, 9, 1969	COMPILED BY MY
DATUM Geodetic	BOREHOLE TYPE Washboring - Diamond Drill	CHECKED BY [illegible]

ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT	REMARKS GR. SA. SI. CL.
597.6	Ground Level				
595.6	Topsoil				
2.0	Het mix. of clayey silt, sand & gravel - Till Very dense	1	SS	22	
		[illegible]	SS	101	28 39 30 3
		3	SS	100/6"	
		4	SS	89/6"	
		5	SS	168/6"	
		6	SS	107/6"	30 36 27 7
572.1		7	SS	133/6"	
25.5	Bedrock - Calcareous Shale	8	AX		
570.1		9	AX		
27.5	End of Borehole				

DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT 20 40 60 80 100

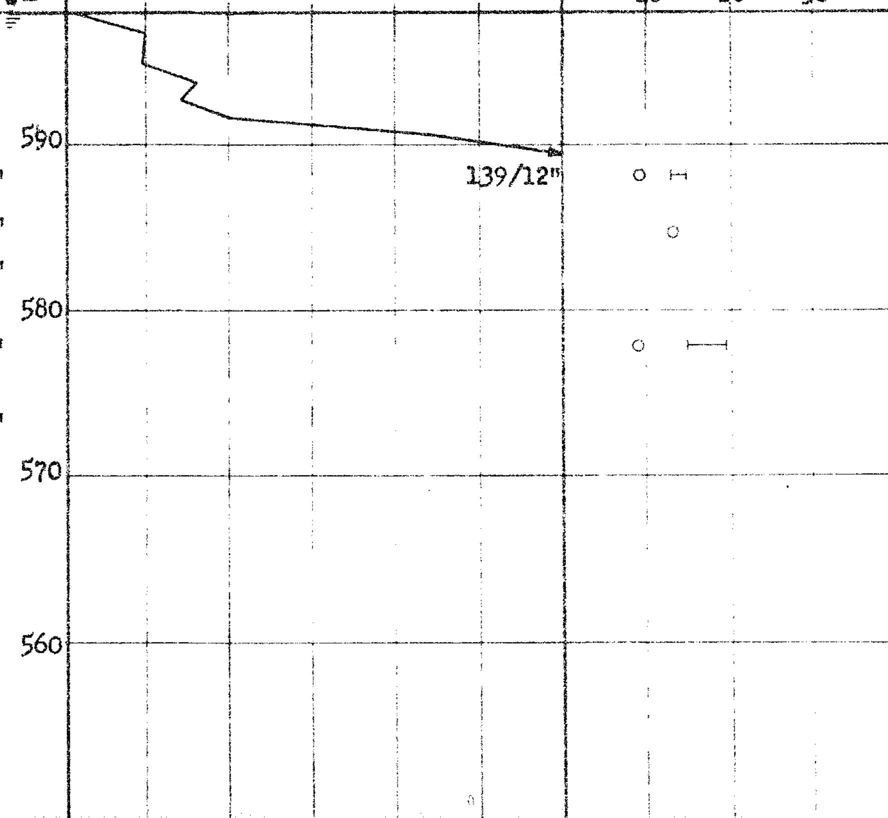
SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL × LAB. VANE

LIQUID LIMIT w_L PLASTIC LIMIT w_P WATER CONTENT w

WATER CONTENT % 10 20 30

BULK DENSITY γ P.C.F.

ELEV. SCALE



FORM OB-MT-126 (REV. 1969) OFFICE REPORT ON SOIL EXPLORATION

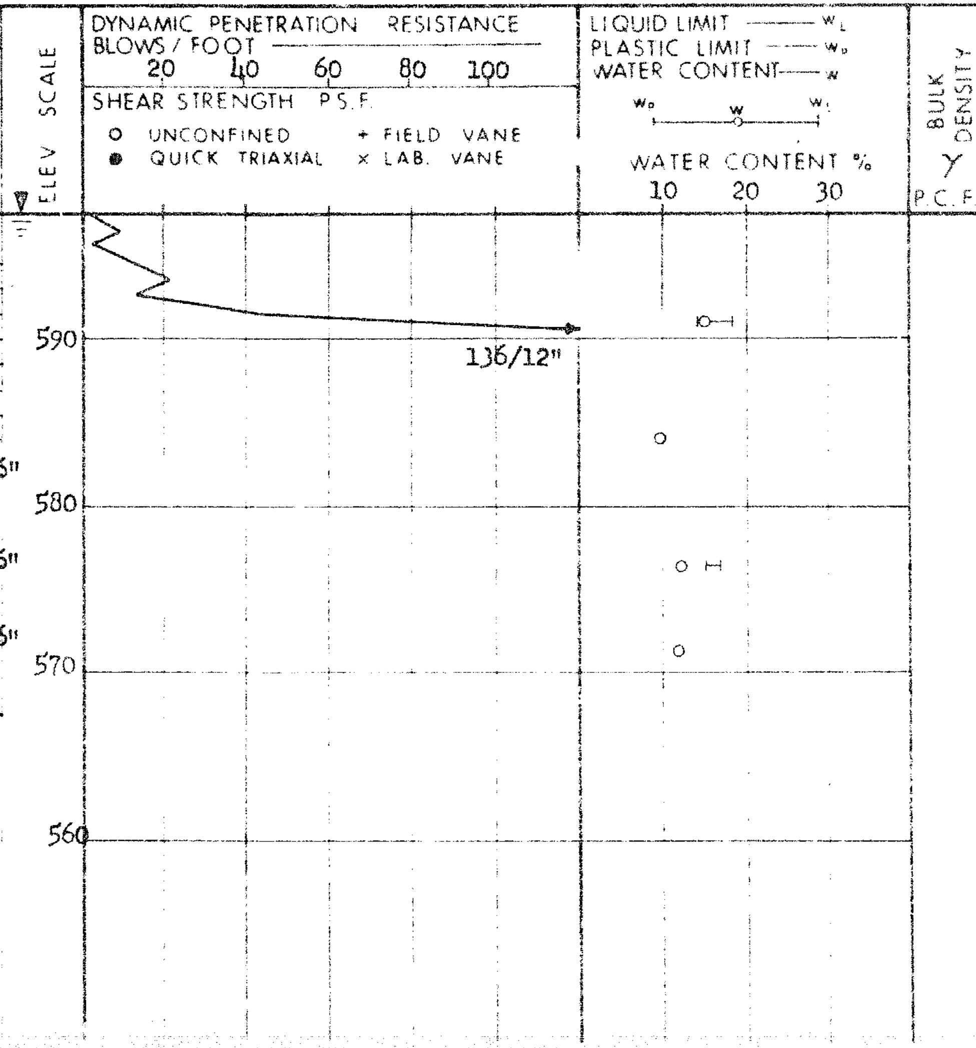
DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE

RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 69-F-54	LOCATION Sta. 306 + 18 27.8' Rt.	ORIGINATED BY MV
W.P. 132-65	BORING DATE July 14, 15, 1969	COMPILED BY MV
DATUM Geodetic	BOREHOLE TYPE Washboring - Diamond Drill	CHECKED BY [illegible]

ELEV DEPTH	SOIL PROFILE DESCRIPTION	SAMPLES NUMBER	TYPE	BLOWS / FOOT	REMARKS GR. SA. SI. CL.
597.5	Ground Level				
595.5	Topsoil				
2.0	Het. mix. of clayey silt, sand & gravel - Till Hard & V. Dense	1	SS	17	
		2	SS	142	8 17 67 8
		3	SS	158	
		4	SS	141	
		5	SS	134/6"	
		6	SS	169/6"	13 37 41 9
572.0		7	SS	150/6"	
25.5	Bedrock Calcareous Shale	8	BX		
567.0 / 30.5	End of Borehole				



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 — IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION — IN TERMS OF EFFECTIVE STRESS $\tau_f = c' + \sigma' \tan \phi'$
c_u	APPARENT COHESION — IN TERMS OF TOTAL STRESS $\tau_f = c_u + \sigma \tan \phi$
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

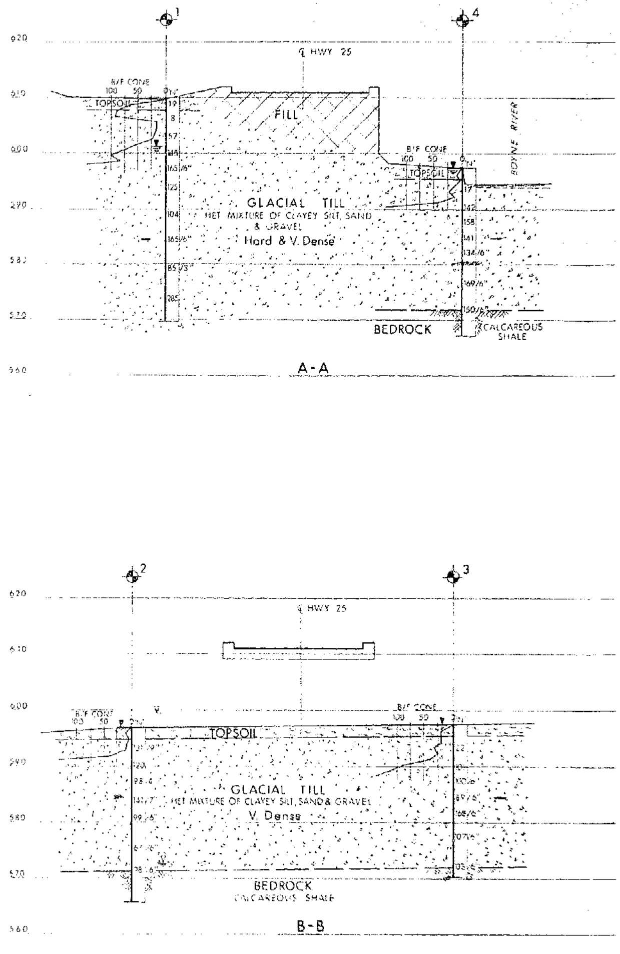
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
δ	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
K_o	COEFFICIENT OF EARTH PRESSURE AT REST

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

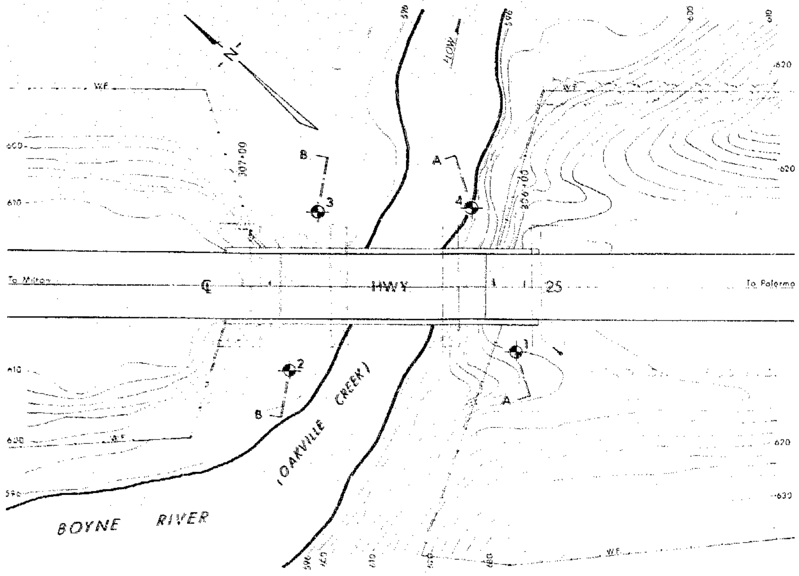
SLOPES

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



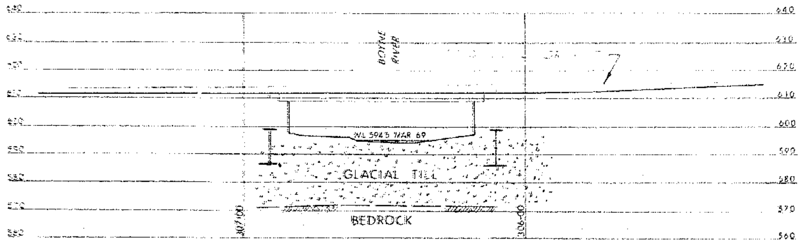
SECTIONS

SCALE



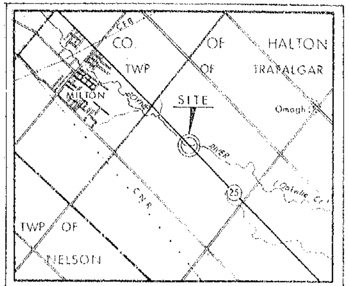
PLAN

SCALE



℄ PROFILE

SCALE



KEY PLAN

SCALE IN MILES

LEGEND

- Bore Hole
- Cone Penetration Hole
- Bore & Cone Penetration Hole
- Water Levels established at time of field investigation. JULY 1969
- Head / Encountered — ARTESIAN CONDITION

NO.	ELEVATION	STATION	OFFSET
1	609.9	306+03	23.5'LT
2	596.9	306+83	30.7'LT
3	597.6	306+73	26.6'R
4	597.5	306+18	27.8'RT

– 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.

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS - ONTARIO
MATERIALS & TESTING OFFICE - FOUNDATION SECTION

BOYNE RIVER
(OAKVILLE CREEK)

KING'S HIGHWAY NO. 25 DIST. NO. 4
CO. HALTON
TWP. TRAFALGAR LOT CON.

BORE HOLE LOCATIONS & SOIL STRATA

SUBM'D. M.R.V.	CHECKED	W.P. NO. 132-65	M.O.T. DRAWING NO. 69-F-54A
DRAWN S.O.	CHECKED	JOB NO. 69-F-54	
DATE 18 AUG. 1969		SITE NO.	BRIDGE DRAWING NO.
APPROVED		CONT. NO.	

PRINCIPAL FOUNDATION ENGINEER

REF. NO. E-4968-1

PRINT RECORD

NO.	FOR	DATE

SUMMARY OF PILE DRIVING RECORDS

W.O. 69-F-54 W.P. 132-65 CONT. 72-26 DIST. 4

SITE Boyne River & Hwy 25

DATE DRIVEN July 5-6/73 WEIGHT OF ANVIL 1100 lb

HAMMER TYPE Bermingham 225 WEIGHT ? ENERGY ?

LOCATION OF PILES	PILE				ESTIMATED TIP EL. (ft.)	DIFFERENCE Longer(+) Shorter(–) Than Estimated (ft.)	REMARKS
	TYPE	NO.	LENGTH (ft.)	TIP EL. (ft.)			
North Abut.	12 BP 53	6	13.2	586.5	585.0	– 1.5	Driven to
South -"-	-"-	7	13.7	585.3	-"-	– 0.3	Glacial Till

FF 91

OVER

Form OB-MT-285 (Formerly OB-ML-285)
200 Pads -65-278

DEPARTMENT OF HIGHWAYS — ONTARIO
MATERIALS & TESTING DIVISION
FOUNDATION SECTION

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 4 CONTRACT NO. 72-26 STRUCTURE Boyne River Bridge

CONTRACTOR Bermingham Const. DESIGN LOAD OF PILE 70 Ton

HAMMER DETAILS: TYPE Bermingham 22.5 WEIGHT 5800# HEIGHT OF FALL OR ENERGY

TYPE OF ANVIL OR CAP Bermingham WEIGHT OF ANVIL OR CAP 1100#

PILE DETAILS H Piles 1:3 Batter (12 BP 53)

PILE NO. 6 LOCATION North Abutment DATE DRIVEN July 5/72

TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS / FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS / FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS / FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS / FT.
16.0	1	1		26			51			76	
16.0	2	1		27			52			77	
16.0	3	1		28			53			78	
16.0	4	1		29			54			79	
16.0	5	1		30			55			80	
16.0	6	1		31			56			81	
16.0	7	2		32			57			82	
16.0	8	10		33			58			83	
16.0	9	14		34			59			84	
16.0	10	22		35			60			85	
16.0	11	36		36			61			86	
16.0	12	45		37			62			87	
16.0	13			38			63			88	
16.0	14			39			64			89	
	15			40			65			90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			96	
	22			47			72			97	
	23			48			73			98	
	24			49			74			99	
	25			50			75			100	

DETAILS FOR FINAL SIX INCHES OF PENETRATION	1	2	3	4	5	6
BLOWS PER INCH	5	5	6	6	7	7
MEASURED REBOUND IN INCHES	3/8	3/8	3/8	3/8	3/8	3/8
FINAL LENGTH OF PILE 13'2"		FINAL CUT OFF ELEVATION 599.00				

REPORT TO BE SENT TO: - PRINCIPAL FOUNDATION ENGINEER
MATERIALS & TESTING DIVISION
DEPARTMENT OF HIGHWAYS
DOWNSVIEW, ONTARIO

599.0
12.5
586.5 TO

SIGNED [illegible signature]

NAME (PRINT) R. Armstrong

DATE July 7/72

ATTACH SKETCH OF PILE NUMBERING SYSTEM

Notes:-

In general this form should be completed for every tenth pile in a group, but at least one is required for every pier and abutment.

Piles driven vertically should be selected where possible.

Pile Details must include type, dimensions and weight per foot, details of shoe, and slope of batter: e.g. 12¾" O.D. steel tube x 0.251" @ 33 lbs. per ft. Vertical. 12¾" x ½" steel plate shoe.

Details for the final six inches of penetration must be completed for all piles except in the case of an end bearing pile driven to bedrock. Final length of pile, and final cut off elevation must always be given.

The total length being driven is the full length of the pile and remains unchanged until a length is cut off or spliced on.

The penetration in blows per foot must be recorded for every foot of penetration of the pile.

Measured rebounds recorded on this form must be the average for each individual inch for the final six inches of penetration.

OVER

Form OB-MT-285 (Formerly OB-ML-285)
200 Pads -65-278

DEPARTMENT OF HIGHWAYS — ONTARIO
MATERIALS & TESTING DIVISION
FOUNDATION SECTION

BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 4 CONTRACT NO. 72-26 STRUCTURE Boyle River Bridge

CONTRACTOR Beamish... Const. DESIGN LOAD OF PILE 70 Ton

HAMMER DETAILS: TYPE ... 225 WEIGHT 5800# HEIGHT OF FALL OR ENERGY

TYPE OF ANVIL OR CAP ... WEIGHT OF ANVIL OR CAP 1100#

PILE DETAILS ... Piles, Vertical

PILE NO. 7 LOCATION South Abutment DATE DRIVEN July 6/72

TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS / FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS / FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS / FT.	TOTAL LENGTH BEING DRIVEN	LENGTH IN GROUND	PENETRATION BLOWS / FT.
16.0	1	8		26			51			76	
16.0	2	13		27			52			77	
16.0	3	15		28			53			78	
16.0	4	15		29			54			79	
16.0	5	22		30			55			80	
16.0	6	19		31			56			81	
16.0	7	24		32			57			82	
16.0	8	27		33			58			83	
16.0	9	31		34			59			84	
16.0	10	33		35			60			85	
16.0	11	37		36			61			86	
16.0	12	40		37			62			87	
16.0	13	54		38			63			88	
16.0	14			39			64			89	
	15			40			65			90	
	16			41			66			91	
	17			42			67			92	
	18			43			68			93	
	19			44			69			94	
	20			45			70			95	
	21			46			71			96	
	22			47			72			97	
	23			48			73			98	
	24			49			74			99	
	25			50			75			100	

DETAILS FOR FINAL SIX INCHES OF PENETRATION	1	2	3	4	5	6
BLOWS PER INCH	8	8	8	8	8	8
MEASURED REBOUND IN INCHES	1/4"	1/4"	1/4"	1/4"	1/4"	1/4"

FINAL LENGTH OF PILE 13' 7" FINAL CUT OFF ELEVATION 599.00

REPORT TO BE SENT TO: - PRINCIPAL FOUNDATION ENGINEER
MATERIALS & TESTING DIVISION
DEPARTMENT OF HIGHWAYS
DOWNSVIEW, ONTARIO

599.0
13.7
585.3

TIP

SIGNED [signature]

NAME (PRINT) ...

DATE July 7/72

ATTACH SKETCH OF PILE NUMBERING SYSTEM

Notes:-

In general this form should be completed for every tenth pile in a group, but at least one is required for every pier and abutment.

Piles driven vertically should be selected where possible.

Pile Details must include type, dimensions and weight per foot, details of shoe, and slope of batter: e.g. 12$\frac{3}{4}$" O.D. steel tube x 0.251" @ 33 lbs. per ft. Vertical. 12$\frac{3}{4}$" x $\frac{1}{2}$" steel plate shoe.

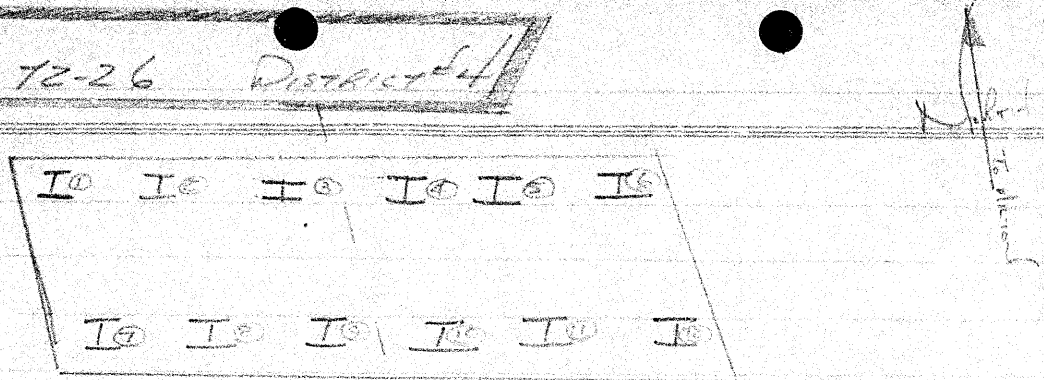
Details for the final six inches of penetration must be completed for all piles except in the case of an end bearing pile driven to bedrock. Final length of pile, and final cut off elevation must always be given.

The total length being driven is the full length of the pile and remains unchanged until a length is cut off or spliced on.

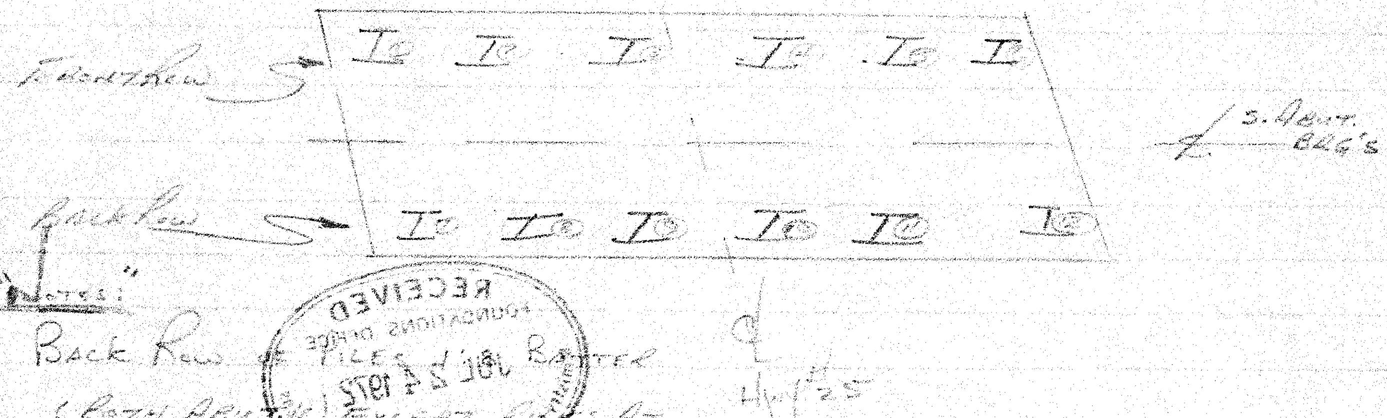
The penetration in blows per foot must be recorded for every foot of penetration of the pile.

Measured rebounds recorded on this form must be the average for each individual inch for the final six inches of penetration.

CONTRACT 72-26 DISTRICT #4



BOYNE RIVER (CORKVILLE CREEK)



"NOTES:"

Back Row of Piles [illegible] Batter (Both Abut's) Except Piles At End.

Front Row of Piles 1:3 Batter (Both Abut's)

9970

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

From: Bridge Office

Attention: Mr. K.G. Selby

Date: February 24, 1970

Our File Ref.

In reply to

Subject: Boyne River (Oakville Creek) Bridge
W.P. 132-65, Site 10-65
Highway 25, District 4 - Hamilton

69-F-54

Regarding your memo of February 20, 1970, recommending that the pile lengths at both the abutments be increased to 20 ft.; this means that you expect the piles will meet refusal at approximately El. 580.00.

The borehole data indicates that the 'N' values below El. 590.00 are over 100 blows/ft. We do not think that the piles can be driven below this elevation following normal pile driving procedures. Our drawings call for the piles to be driven to refusal in accordance with Std. DD1219, except that the South Abutment piles have to be driven to El. 586.00 or lower. The reason for the exception at the South Abutment is that it is located on the outside of the river bend which is susceptible to scour, but if the piles are driven to El. 586 or lower, this scour would not endanger the structure.

We feel that the pile lengths shown on our drawings are more than adequate, but we will be pleased to discuss this matter further with you at your convenience.

K.G. Bassi,
Reg. Bridge Design Engineer

for C.S. Grebski,
Bridge Design Engineer

KGB:rd

c.c. A.E. McKim

CAF FOUNDATIONS & RM 110

QJ

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. C. S. Grebski,
Bridge Design Engineer,
Bridge Office,
Admin. Bldg.

From: Foundation Section,
Materials & Testing Office,
Room 107, Lab. Bldg.

Attention:

Date: February 20, 1970

Our File Ref.

In reply to

Subject:

Boyne River (Oakville Creek) Bridge
4.5 Miles North of Hwy. #5
W.P. 132-65, Site #10-65,
Hwy. #25, District #4 (Hamilton)
W.J. 69-F-54 --

We have reviewed the final bridge drawings for the above mentioned structure. We have further reviewed our foundation report with regard to estimated pile tip elevations for design loads of 70 tons per pile.

We recommend that pile lengths supplied should be according to the following table:

P I L I N G D A T A		
TYPE: 12 BP 53		
Location	Number	Length
North Abutment	12	20'-0"
South Abutment	12	20'-0"
DESIGN LOAD: 70 TON/PILE		

K. G. Selby

KGS/McF

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

cc: Mr. A. McKim
Foundations Files
Gen. Files

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

From: C.S. Grebski,
Bridge Office

Attention:

Date: February 5, 1970

Our File Ref.

In reply to

Subject: Boyne River (Oakville Creek) Bridge
4.5 Mi. N. of Hwy. #5
W.P. 132-65, Site No. 10-65
Highway 25, District No. 4

69-F-54

Attached herewith we are submitting the final bridge drawings which show the foundation design for this structure.

Kindly give us your comments at your earliest convenience.

C.S. Grebski,
Bridge Design Engineer

CSG:rd

Attach.

c.c. Foundation Office

~~No comments~~

PP.

FEB. 16/70

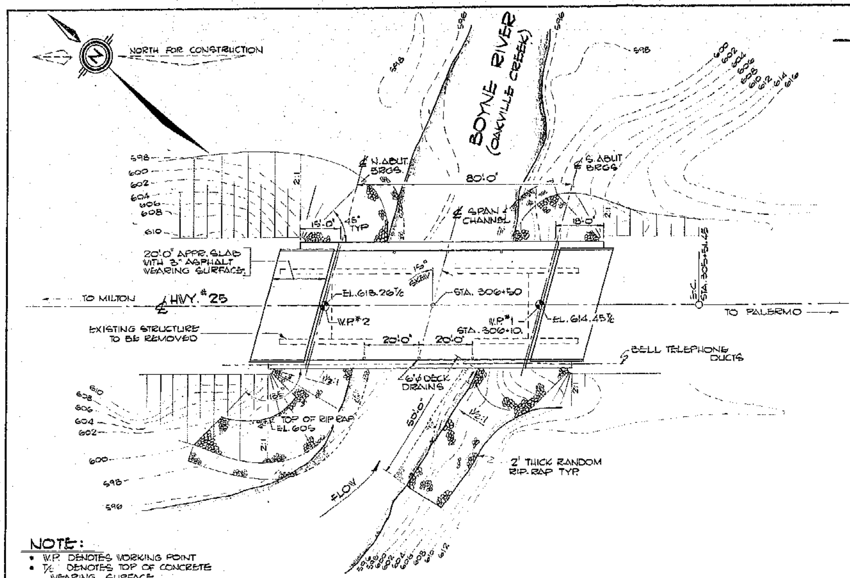
Letter sent Feb. 19th 1970

#69-F-54

W.P. 132-65

H.W.Y. #25

BOYNE RIVER BRIDGE



NOTE:
- W.P. DENOTES WORKING POINT
- T/C DENOTES TOP OF CONCRETE WEARING SURFACE

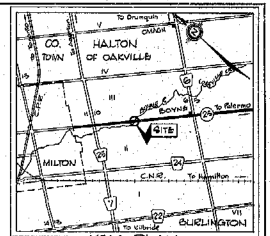
PLAN
1" = 20'-0"

SKEW DATA - 15°

SIN. - 0.25882
COS. - 0.96593
TAN. - 0.26795
SEC. - 1.03528

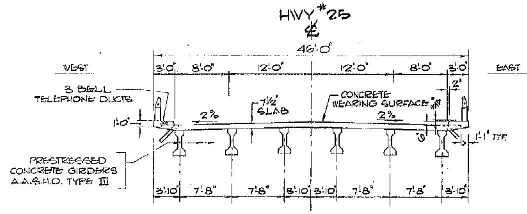
LIST OF DRAWINGS.

D-6732-1 GENERAL LAYOUT
2 BORE HOLE LOCATION & SOIL STRATA
3 ABUTMENTS & FOOTING LAYOUT
4 PRESTRESSED GIRDERS & BEARINGS
5 DECK
6 PARAPET WALL DETAILS
7 STANDARD STEEL PARAPET RAIL
8 APPROACH SLABS
9 STANDARD DETAILS - I
D-6732-10 STANDARD DETAILS - II



KEY PLAN
SCALE: 1 IN. = 1 MI.

B.M. 611.22
GEODETIC DATUM
CUT CROSS ON CONC. CURB 12.0' LT. 306+13



TYP. DECK SECT.
1/8" = 1'-0"

NOTES:

CLASS OF CONCRETE

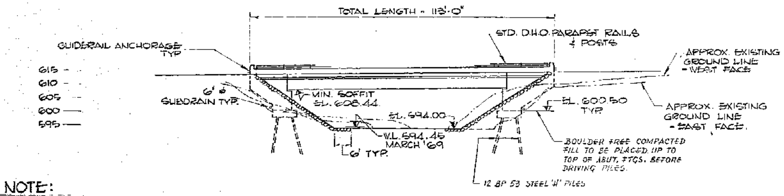
DECK & PARAPET WALLS —— 4000 P.S.I.
PRESTRESSED GIRDERS —— 5000 P.S.I.
REMAINDER —— 3000 P.S.I.

CLEAR COVER ON REINF. STEEL

FOOTINGS & ABUTMENTS —— 3"
DECK TOP —— 1 1/2"
" BOTTOM —— 1"
CURBS —— 2"
PARAPET WALL —— 1 1/2"

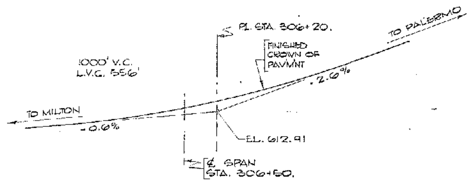
CONSTRUCTION NOTES.

THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE ± 1/8".
NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED.



NOTE:
EXISTING RIVER TO BE EXCAVATED TO EL. 594.00 WITHIN LIMITS OF WIDTH OF EMBANKMENTS (CHANNEL BED WIDTH 45' WITH 1 1/2:1 SIDE SLOPES)

ELEVATION
1" = 20'-0"



PROFILE OF HWY. #25
N.T.S.

PRINT RECORD		
No.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO
BRIDGE DIVISION

69-F-54

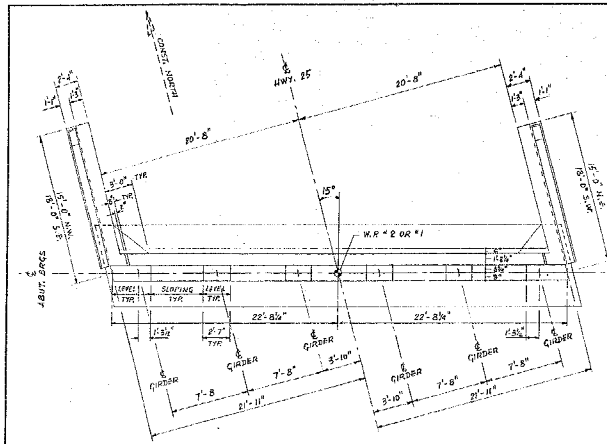
BOYNE RIVER (OAKVILLE CREEK) BRIDGE
4.5 MI. N. OF HWY #5

KING'S HIGHWAY No. 25 DIST. No. 4
CO. HALTON
TWP. TOWN OF OAKVILLE LOT 8 & 9 CON. II & III

GENERAL LAYOUT

APPROVED				SITE No. 10-65	W.P. No. 132-65
		BRIDGE ENGINEER		CONTRACT No.	
DESIGN	R.S.R.	CHECK			
DRAWING	G.D.T.	CHECK		DRAWING No.	D-6732-1
DATE	FEB.'70	LOADING	HS20-44		

FOR REDUCED PLAN
USE SCALE BELOW
0 1 2 3
3 INCHES ON ORIGINAL PLAN

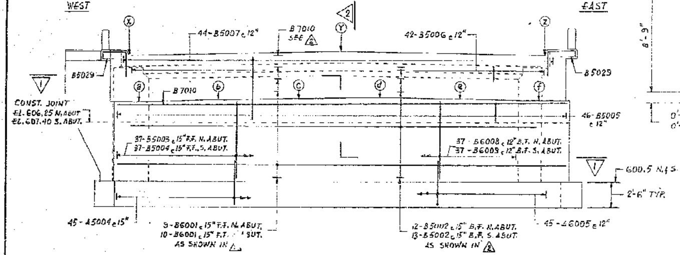


PLAN OF NORTH ABUTMENT

SCALE: 3/16" = 1'-0"

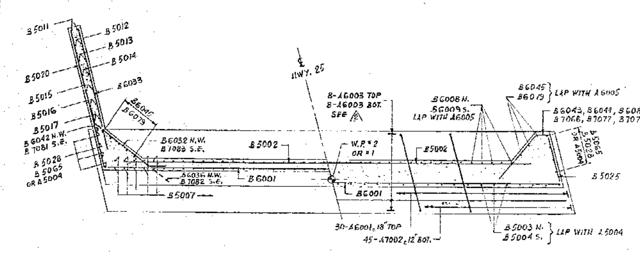
ABUT. ELEVATIONS

LOCATION	AT BEARING SEATS						AT FRONT FACE OF BALL. WALL		
	a	b	c	d	e	f	X	Y	Z
SOUTH ABUT.	609.53	609.72	609.91	609.94	609.82	609.70	613.98	614.46	614.15
NORTH ABUT.	608.36	608.54	608.72	608.76	608.62	608.49	612.78	613.25	612.92

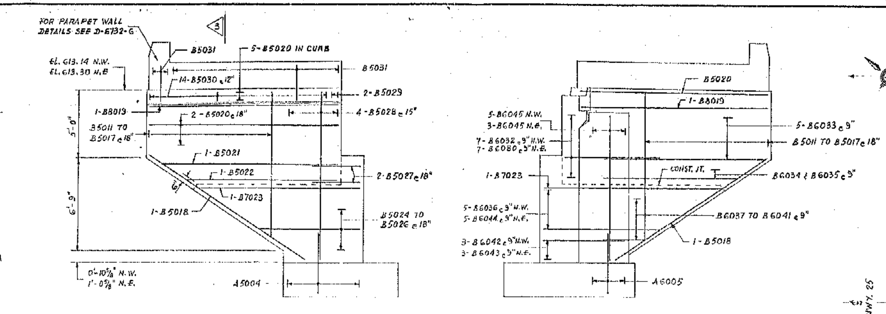


ELEVATION OF NORTH ABUTMENT

SCALE: 3/16" = 1'-0"



1 3/16" = 1'-0"



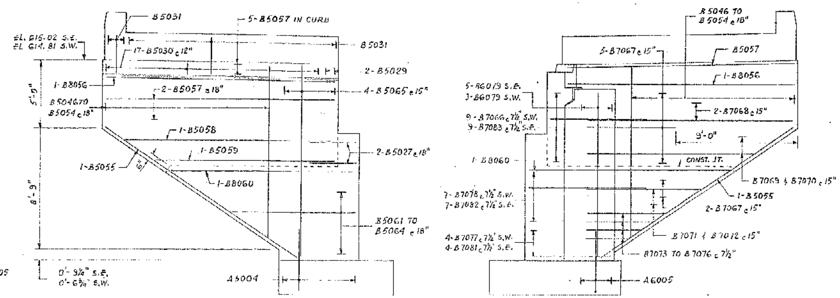
OUTSIDE FACE

INSIDE FACE

N.W. WING WALL ELEVATION

N.E. WING WALL SIMILAR EXCEPT WHERE NOTED

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



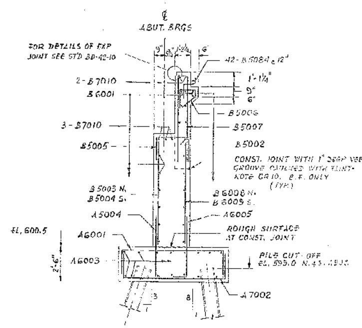
OUTSIDE FACE

INSIDE FACE

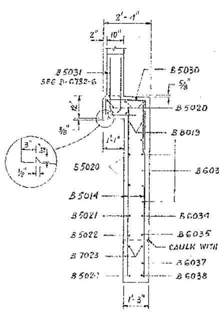
S.E. WING WALL ELEVATION

S.W. WING WALL SIMILAR EXCEPT WHERE NOTED

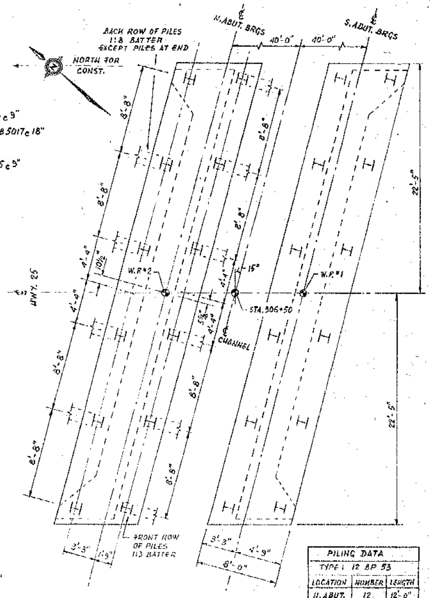
SCALE: 1/4" = 1'-0"



2 1/4" = 1'-0"



3 3/4" = 1'-0"



FOOTINGS & PILES LAYOUT

SCALE: 3/16" = 1'-0"

PILING DATA		
TYPE: 12 BP 53		
LOCATION	NUMBER	LENGTH
N. ABUT.	12	12'-0"
S. ABUT.	12	16'-0"
DESIGN LOAD 70 TON/PILE		

NOTES:

- SPACING OF PILES SHALL BE MEASURED AT UNDERSIDE OF FOOTINGS.
- PILES SHALL BE DRIVEN TO REFUSAL IN ACCORDANCE WITH ST'D DD-1219, BUT THE SOUTH ABUT. PILES MUST BE DRIVEN TO EL. 586.00 OR LOWER.
- NORTH AND SOUTH ABUTMENTS SIMILAR EXCEPT AS NOTED.
- F.F. DENOTES FRONT FACE.
- B.F. DENOTES BACK FACE.

PRINT RECORD		
No.	FOR	DATE

REVISIONS		
DATE	BY	DESCRIPTION

FOR REDUCED PLAN

USE SCALE BELOW

0 1 2 3

3 INCHES ON ORIGINAL PLAN

DEPARTMENT OF HIGHWAYS ONTARIO

BRIDGE DIVISION

64-F-54

BOYNE RIVER (OAKVILLE CREEK) BRIDGE

KING'S HIGHWAY No. 25 DIST. No. 4

CO. HALTON

TWP. TOWN OF OAKVILLE LOT 8 & 9 CON. II & III

ABUTMENTS & FOOTING LAYOUT

APPROVED	BRIDGE ENGINEER			SITE No. 10-65	W.P. No. 132-65
DESIGN	R.S.R.	CHECK	M.V.S.	CONTRACT No.	
DRAWING	R.K.	CHECK	R.S.R.	DRAWING No.	D-6732-3
DATE	FEB 1970	LOADING	HS 20-44		