

# 69-F-115

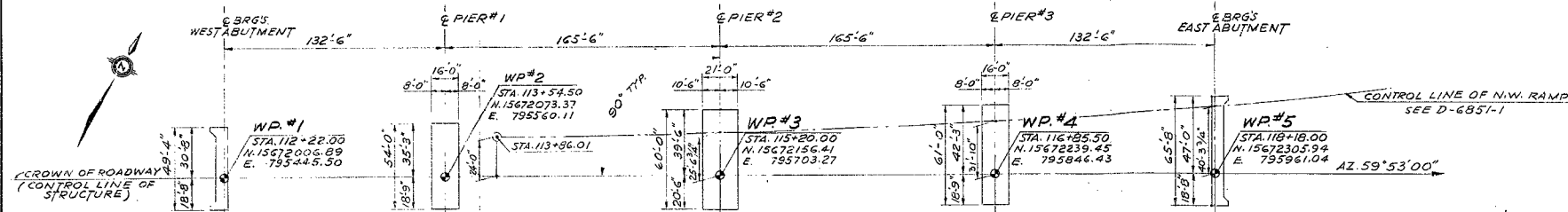
W.P. 70-68-02

BRANFORD EXPWY. #2

GRAND RIVER BRIDGE

WEST BOUND LANES.



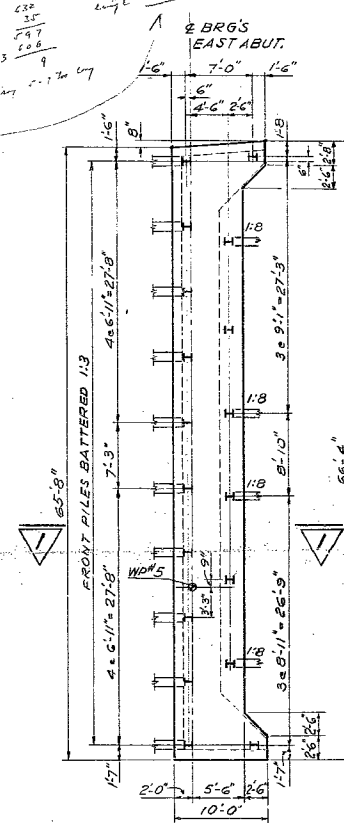
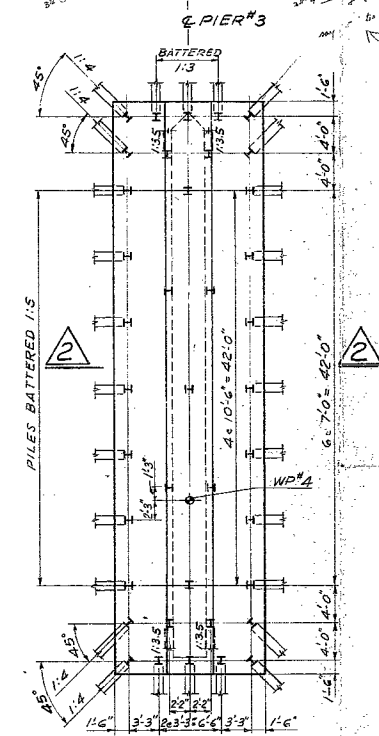
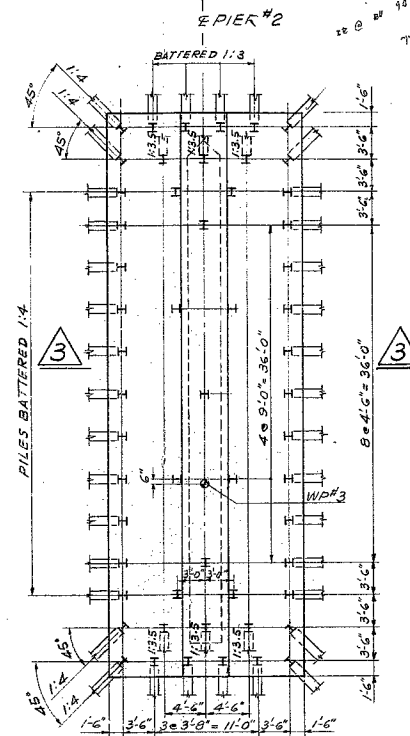
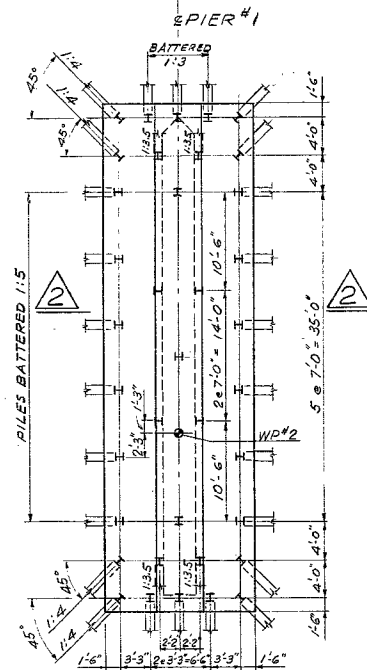
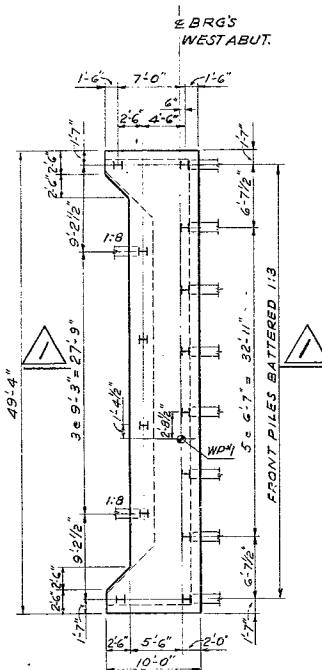


**PILE DATA**

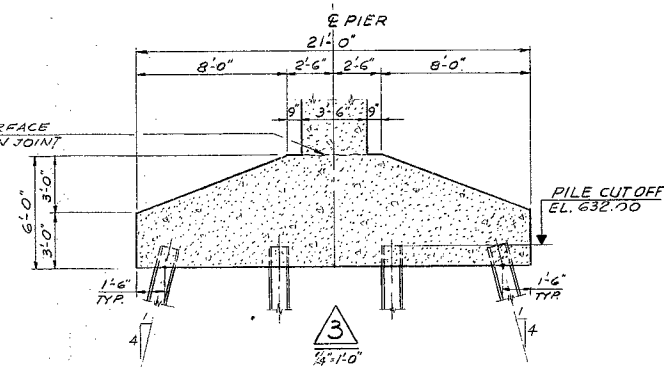
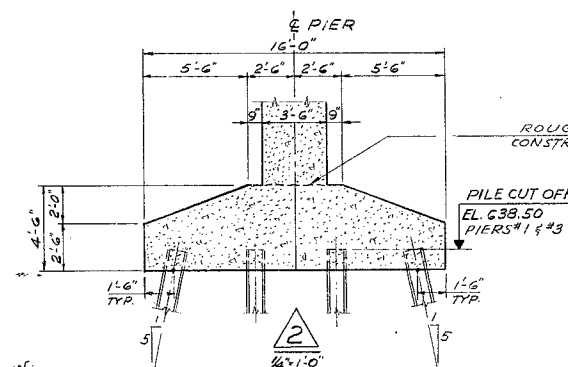
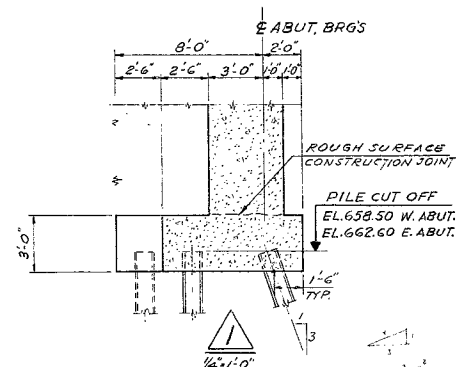
12 BPTA STEEL H-PILES  
 DESIGN LOAD = 95 TONS

LOCATION	NO. OF PILES	PILE LENGTH
WEST ABUT.	14	62'-0"
PIER #1	37	40'-0"
PIER #2	55	35'-0"
PIER #3	39	40'-0"
EAST ABUT.	18	66'-0"

- ALL PILES TO BE DRIVEN TO REFUSAL AT SOUND BEDROCK.
- FOR PILE SPLICING AND SHOE PLATE DETAILS SEE D-6851-20



**PLAN OF FOOTINGS**  
 1/8" = 1'-0"



FOR FOOTING ELEVATIONS SEE D-6851-1

**REVISIONS**

DATE	BY	DESCRIPTION

DEPARTMENT OF HIGHWAYS ONTARIO  
 BRIDGE OFFICE

68-F-115

**GRAND RIVER BRIDGE**  
 WEST BOUND LANES

KING'S HIGHWAY No. BRANTFORD EXPWY #2 DIST. No. 4  
 CO. OF BRANT  
 TWP. CITY OF BRANTFORD JT. CON.

**FOOTING LAYOUT**

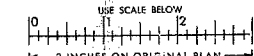
APPROVED: 1/69 W.P. No. 70-68-02

DESIGN: HG CHECK: HG  
 DRAWING: A.S. CHECK: HG  
 DATE: FEB 1971 LOADING: AS-20-44

CONTRACT No. D-6851-3



FOR REDUCED PLAN



DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

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

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

ATTENTION:

DATE: February 12, 1970

ORIGIN FILE REF.

IN REPLY TO

FEB 27 1970

SUBJECT:

FOUNDATION INVESTIGATION REPORT  
For  
The Proposed Grand River Crossing of  
The Brantford Expressway No. 2  
City of Brantford  
District No. 4 (Hamilton)  
W.J. 69-P-115 -- W.P. 70-63-02

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.

AGS/MieF  
Attach.

cc: Messrs. B. R. Davis  
H. A. Fregaskes  
D. W. Farren  
W. Zonnenberg  
E. Greenland  
A. P. Watt (2)  
J. Roy  
B. A. Singh

Foundations Files  
Gen. Files

*A. G. Sternac*  
A. G. Sternac  
PRINCIPAL FOUNDATION ENGINEER

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FOUNDATION INVESTIGATION REPORT  
For  
The Proposed Grand River Crossing of  
The Brantford Expressway No. 2  
City of Brantford  
District No. 4 (Hamilton)  
W.J. 69-P-115      --      W.P. 70-68-02

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1. INTRODUCTION:

A foundation investigation was requested by Mr. A. P. Watt, Regional Bridge Planning Engineer, Southwestern Region, at the site of a proposed bridge of the Brantford Expressway over the Grand River. The memo containing the request was dated December 3, 1969.

A preliminary foundation investigation was already carried out along the alignment of the proposed Expressway during the functional planning stage in 1968. The results of that investigation were reported under Job Number W.J. 68-P-64. Boreholes (Nos. 9A and 10A) placed near the Grand River crossing during the preliminary field work, are incorporated in the present report.

Following is a description of the site and subsoil stratigraphy, together with some discussion and recommendations as to the structure foundation and approach embankment stability.

2. DESCRIPTION OF THE SITE:

The width of the Grand River at the proposed crossing is approx. 270 ft. The water level at the time of the field work (December, 1969) was measured to be at el. 542.24 ft., the depth of the river at the middle being about 3.5 ft. The current is rather swift, creating visible rapids. Along the east bank there is a dyke, protected by a concrete retaining wall against scour. The west bank at the proposed crossing serves as a dumping area for the City of Brantford. Both banks are covered by shrubs and brush.

2. DESCRIPTION OF THE SITE: (cont'd.) ...

Geologically the area lies at the border of the physiographic regions known as the "Norfolk Sand Plain" and the "Horseshoe Moraines". The beds of silts and sands are considered to be deltaic in glacial lakes Whittlesey and Warren. The deep varved silts and clayey silts were also deposited by Lake Warren during the recession of the Wisconsin glacier.

3. FIELD AND LABORATORY INVESTIGATIONS:

Four boreholes were carried out at the approx. locations of the proposed footings during the course of the recent field investigation. The boreholes were numbered 1 - 4 inclusive, the locations of which are shown on the attached Drawing #69-P-115A, together with the soil stratigraphy, established in the borings. A hollow stem continuous auger was used for penetrating within the overburden, while the bedrock was proved by means of a diamond drill rig.

Conventional sampling techniques were followed, taking split-spoon and, where possible, Shelby tube samples at regular intervals. Standard penetration resistances (blows per ft.) are recorded on the accompanying borelog sheets, together with the laboratory test results.

In the laboratory, after visual examination and identification of the samples, some further laboratory tests were performed in order to determine Atterberg limits, natural moisture contents, undrained shear strengths, and consolidation characteristics of the various layers.

4. SOIL CONDITIONS:

4.1) General:

The overburden within the investigated area was found to consist of a surficial mixed fill, followed by sandy gravels to gravelly sands, stratified clayey silts and glacial tills of silts

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

##### 4.1) General:

and clayey silts. The fill was missing within the floodplain at both banks of the river and within the riverbed. The overburden is underlain by dolomite bedrock.

The various layers are briefly described below:

##### 4.2) Mixed Fill:

The depth of the mixed fill varies between 5 ft. and 12 ft. and, since the site had been used as a dump area, the fill had a very heterogeneous nature. It consisted mainly of cinders but, besides, all kinds of waste and organic materials were found. The relative density of this uppermost layer is very loose, indicating a lack of compaction. Although the fill exhibited some plasticity at certain locations due to organic contamination, it may be regarded as a granular material.

##### 4.3) Granular Deposit:

The granular deposit overlying the clayey silts was identified to consist of silty sands, gravelly sands and sandy gravels. The dyke was also found to be built of silty sand materials. The thickness of this layer ranges from 10 to 20 ft., the relative density from very loose to compact, corresponding to penetration 'N' values between 2 and 28 blows per ft. Laboratory grain-size analyses resulted in some 3 - 50% gravel, 42 - 61% sands, and 7 - 42% silts and clays. The deposit is rather poorly graded and acts as an aquifer.

##### 4.4) Stratified Clayey Silts:

At around elevation 636 ft. - 640 ft., a stratified clayey silt deposit was observed at each borehole location. The seams and layers are generally near horizontal but, occasionally, contorted and sloping seams were also observed. The colour of the various seams are red-brown, grey and greyish-brown, the thickness



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

4.4) Stratified Clayey Silts: (cont'd.) ...

of which varies between 1/8 inch to 3 - 4 inches. Among the seams some sand, silt and silty clay were recorded; predominantly, however, it is clayey silt. The total thickness of this cohesive layer is around 14 ft. to 21 ft. The plastic limit of the samples averaged around 18 - 21%, the liquid limits ranged from 25% to 40%, depending upon the clay percentage of the particular seam. In view of the various seams, the laboratory shear test values scattered a great deal, as shown on the borelog sheets. For estimating purposes, the average undrained shear strength of the material may be taken to be 1200 - 1500 PSF, with bulk densities of 120 - 130 PCF.

4.5) Glacial Till:

The stratified clayey silts are underlain by an approx. 15-ft. thick glacial till deposit, the physical properties of both strata being quite similar. A marked difference between the two contiguous layers is the shear strength, the glacial deposit having a hard consistency with penetration 'N' values between 57 blows per ft. to much above 100 blows per ft., indicating undrained shear strengths of 5000 PSF and over. At certain locations (B.H. #2) large size boulders were found and drilled by means of a bicone bit within the till; at other locations no such boulders were noticed.

4.6) Bedrock:

Bedrock was proved in two locations in B.H.'s #2 and #3. The rock was also drilled during the preliminary investigation under the future approach fills. The bedrock was identified to be sound dolomite of the Lockport formation; cores resulted in 95 - 100% recovery.

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

4.7) Groundwater Conditions:

Groundwater level observations were carried out in the boreholes during the field work. Water levels were established within the granular stratum coincidental to the river level, around el. 643 ft.

5. DISCUSSION AND RECOMMENDATIONS:

5.1) General:

Two alternative proposals are put forth for the crossing of the Grand River at the investigated location: one calls for a three-span, and one for a six-span structure. It is understood that only the Westbound lanes will be constructed under the first stage; recommendations discussed below, however, are valid for the second stage (Eastbound lanes) as well.

As described earlier, subsoils at the site consist of an approx. 40 - 50 ft. thick overburden of granular and cohesive strata, underlain by dolomite bedrock.

5.2) Structure Foundations:

Shallow foundations for the bridge within the overburden appear to be impractical on account of the rather low relative density and consistency of the layers. It is suggested, therefore, that the whole structure - whether the three- or six-span alternative is adopted - be supported on piled foundations. The use of steel H-piles will probably be the most economical, piles being driven to refusal on bedrock. The elevation of the bedrock varies between 605 ft. and 607 ft., being higher under the west bank and lower under the proposed east approach.

Due to the presence of boulders within the glacial till, refusal may be reached at higher elevations in a few locations. Because of the possibility of damage to piles on the boulders, it is recommended that standard flange plates be welded to the pile tips. The full structural strength may be utilized on piles provided they are driven to sound bedrock. Four ft. of cover

5. DISCUSSION AND RECOMMENDATIONS: (cont'd.) ...

5.2) Structure Foundations: (cont'd.) ...

should be maintained for the pile caps for frost protection. It is believed that excavations for the cut-offs and pile caps will stay above the normal groundwater level, thus no excavation problems are anticipated. Should the excavations, however, be lowered below the groundwater table, dewatering problems will be encountered, in view of the granular deposit. In order to eliminate 'quick' conditions at the excavation bottoms, some dewatering scheme will be necessary, in which case, the excavations may be protected by interlocking sheet piles, or by a cofferdam. A well-point system may also be employed, to lower the water table below the excavation bottom. In designing perched abutments the pile caps may be formed within the approach fills. No bouldery material should be used at the abutment locations if the latter method is adopted.

5.3) Approach Fill Stability:

The height of the approach fill at the east side of the river will be roughly 35 ft., at the west side some 16 ft. Embankments of such heights will be stable, provided they are built with side slopes of 2 horizontal to 1 vertical.

Some settlements will take place, especially below the east approach fill, on account of the compressible nature of the clayey silt deposits. It would be advantageous to construct this fill section well ahead of the construction of the structure, so that a large part of the settlements could be completed before and during the construction of the bridge.

As was mentioned earlier, some organic fill was found right below the ground level at certain locations. The organic material should be removed and replaced by acceptable soils below the proposed embankments. The exact depth and extent of the organic deposit should be determined by the Soil Section, during the course of the regular soils investigation.

6. MISCELLANEOUS:

The field work, carried out during the period December 15 - 18, 1969, was supervised by Mr. A. K. Barsvary, Senior Foundation Engineer.

Equipment used was owned and operated by P.V.K. Soil Investigation Ltd.

This report was prepared by Mr. A. K. Barsvary and reviewed by Mr. K. G. Selby, Supervising Foundation Engineer.

February, 1970

APPENDIX I

# PILE DATA

12 BP 74 STEEL H PILES  
DESIGN LOAD - 95 TONS

LOCATION	NO. OF PILES	PILE LENGTH
W. ABUTMENT	VERTICAL 4	55'-0"
	BATTERED 10	58'-0"
PIER NO. 1	VERTICAL 7	35'-0"
	BATTERED 30	37'-0"
PIER NO. 2	VERTICAL 11	28'-0"
	BATTERED 44	30'-0"
PIER NO. 3	VERTICAL 7	36'-0"
	BATTERED 32	38'-0"
E. ABUTMENT	VERTICAL 4	60'-0"
	BATTERED 14	63'-0"

FOUNDATION SECTION

CHECKED BY

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT	LQUID LIMIT ——— W <sub>L</sub> PLASTIC LIMIT ——— W <sub>P</sub> WATER CONTENT ——— W	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. NO.	NUMBER TYPE	BLOWS / FOOT	SHEAR STRENGTH P.S.F. ○ UNCONFINED      + FIELD VANE ● QUICK TRIAXIAL    x LAB. VANE	WATER CONTENT % No.      W      N:	
				ELEV. SCALE	1000      2000	10      20      30	P.C.F. GR. SA. SI. CL.
663.9	Ground Level						
0.0	Silty sand, traces of gravel with some organic & vegetable matter. Fill.		1 SS 7	660			
			2 SS 12				4 61 31 h
			3 SS 15	650			
	Compact		4 SS 5				
643.9			5 SS 60	640			61 33 ( 6 )
20.0	Sandy gravel						
636.9			6 SS 24				
27.0	Very dense Clayey silt, occasional seams of red silty clay.		7 TW PH	630			124
	Stiff. Grey		8 TW PH				126
622.9			9 SS 75	620			123
41.0	Clayey silt to silt traces of gravel (Fill)						
614.4	Hard		10 SS 66				
49.5	End of Borehole						

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 69-F-115

LOCATION

Co-ords. 672,265 N; 795,865 E.

ORIGINATED BY

AKB

W.P. 70-68-02

BORING DATE

Dec. 17 - 18, 1969

COMPILED BY

AKB

METHOD Geodetic

BOREHOLE TYPE

Washboring, HX Casing

CHECKED BY

AKB

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION	RESISTANCE	LIQUID LIMIT — W <sub>L</sub> PLASTIC LIMIT — W <sub>P</sub> WATER CONTENT — W			BULK DENSITY Y P.C.F.	REMARKS
ELEV. DEPT.	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.		WATER CONTENT %				
						○ UNCONFINED ● QUICK TRIAXIAL	+ FIELD VANE x LAB. VANE					
						1000	2000					
647.7	Ground Level											
0.0	Gravelly sand											
640.0	Very dense	1	SS	81	640							
7.0												
	Clayey silt to silt, occasional red seams of silty clay & silt.	2	SS	8								
		3	FW	FM	630						128	
		4	SS	8							131	
	Stiff to very stiff	5	FW	FM							126	
619.7					620						125	
28.0	Clayey silt with gravel & boulders (Glacial Till)	Drilled with Blcone Bit										
	Hard				610							
605.2												
42.5	Dolomite											
599.2	Bedrock	6	RC	100%	600							



DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 3

FOUNDATION SECTION

JOB 69-F-115

LOCATION

Co-ords. 672,164 N; 795,692 E.

ORIGINATED BY **AKB**

N P 70-68-02

**BORING DATE**

Dec. 15-16, 1969

COMPILED BY AK3

DATUM Geodetic

BOREHOLE TYPE

Washboring, BK Casing

CHECKED BY *[Signature]*

SOIL PROFILE		SAMPLES		ELEV. SCALE	DYNAMIC PENETRATION	RESISTANCE	LIQUID LIMIT — $w_L$	PLASTIC LIMIT — $w_p$	WATER CONTENT — $w$	BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE		BLOWS / FOOT	SHEAR STRENGTH P.S.F.					
642.2	Water Level										
0.0	River										
638.7				640							
3.5	Clayey silt with streaks of red silty clay & silt	1	SS	11							
		2	TW	PM							
		3	SS	21							
	Stiff to very stiff	4	TW	PM/12"							
621.2		5	SS	32							
21.0	Silt to clayey silt, traces of gravel. (Glacial Till)	6	SS	116							
		7	SS	96							
	Hard			610							
606.7		8	SS	100/3"							
35.5	Dolomite										
600.7	Bedrock	9	RC	99%							
41.5	End of Borehole			600							

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING OFFICE

# RECORD OF BOREHOLE No. 4

FOUNDATION SECTION

JOB 69-F-115

LOCATION

Co-ords. 672,084 N; 795,508 E.

ORIGINATED BY AKB

W.P. 70-68-02

BORING DATE

Dec. 15 - 16, 1969

COMPILED BY AKB

DATUM Geodetic

BOREHOLE TYPE

Auger

CHECKED BY

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE		LIQUID LIMIT PLASTIC LIMIT WATER CONTENT		BULK DENSITY	REMARKS
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLows / FOOT	RESISTANCE	W <sub>L</sub>	W <sub>P</sub>		
655.7	Ground Level								
0.0	Black cinder & mixed fill.	1	SS	1					
650.7	Very loose.								
5.0	Sandy gravel with traces of silt.	2	SS	22					50 42 ( 8 )
	Very loose to Compact	3	SS	2					
		4	SS	11					
635.7		5	SS	28					36 56 ( 9 )
20.0	Clayey silt with red seams of silty clay.	6	SS	17					
	Stiff to very stiff	6A	TW	PH				129	
		7	TW	PH				131	
		7A	TW	PH				119	
620.7		8	TW	PM				124	
35.0	Silt to clayey silt, traces of gravel (Glacial Till)	9	SS	10				121	
	Hard	10	SS	67				126	
		11	SS	57					
606.7	Hammer bouncing	12	SS	26					
49.0	End of Borehole								

## FOUNDATION SECTION

ORIGINATED BY AMS

COMPILED BY AKB

CHECKED BY

SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT		BULK DENSITY	REMARKS	
DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS/30 CM	ELEV	SLIDE	20	40	60	80			100
					SHEAR STRENGTH PCF					WATER CONTENT %			
					○ UNCONFINED FIELD VANE ● CONFINED TRIAXIAL LAB VANE								
										20 40 60			
652.5	Ground Level												
0.0	Cinder and mixed fill.												
647.5		1	SS	3									
5.0	Sandy gravel with some silt.	2	SS	9									
		3	SS	28									
	Loose to compact.	4	SS	27									
637.5		5	SS	6									
15.0	Layers of silt & clayey silt, seams of sand and clay	6	SS	17									
	Firm to hard.	7	SS	50									
620.5		8	SS	31									
32.0	Clayey silt with gravel & boulders (Glacial Fill)	9	RC	8 <sup>u</sup>									
				Rec									
		10	SS	125									
	Hard												
605.5													
47.0	Dolomite	11	RC	100%									
600.5	Bedrock												
52.0	End of Borehole												

DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING OFFICE

## RECORD OF BOREHOLE No. 10A (68-F-64)

FOUNDATION SECTION

JOB 69-F-115

LOCATION

Co-ords 671,983 N; 795,451 E.

ORIGINATED BY AMS

W.P. 79-68-02

BORING DATE

Aug. 6, 1968

COMPILED BY AKB

DATUM Geodetic

BOREHOLE TYPE

Washboring, NX Casing

CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE					LIQUID LIMIT ——— w <sub>L</sub> PLASTIC LIMIT ——— w <sub>P</sub> WATER CONTENT ——— w			BULK DENSITY Y P.C.F.	REMARKS	
ELEV. DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS / FOOT		20	40	60	80	100	SHEAR STRENGTH P.S.F.					WATER CONTENT % 20 40 60
											○ UNCONFINED    ▲ FIELD VANE ● QUICK TRIAXIAL    x LAB. VANE					
658.6	Ground Level															
0.0	Silty sand becoming gravelly sand.	1	SS	6												
		2	SS	2												
	Very loose to compact.	3	SS	6	650											
		4	SS	15												
		5	SS	2												
		6	SS	8	640											
635.6	Irregular layers of clayey silt & silt.	7	SS	16	630											
23.0		8	SS	11												
	Stiff to hard.	9	SS													
620.0		10	SS	148	620											
38.6	Clayey silt, traces of sand & gravel (Glacial Till)	11	SS	76												
607.6		12	SS	50/6"	610											
51.0	Dolomite	13	RC	100%												
602.1	Bedrock															
56.5	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:--

<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

$\gamma$	UNIT WEIGHT OF SOIL (BULK DENSITY)
$\gamma_s$	UNIT WEIGHT OF SOLID PARTICLES
$\gamma_w$	UNIT WEIGHT OF WATER
$\gamma_d$	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
$\gamma'$	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
$\tau_f$	SHEAR STRENGTH
c'	EFFECTIVE COHESION
$\phi'$	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
$c_u$	APPARENT COHESION
$\phi_u$	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
$\mu$	COEFFICIENT OF FRICTION
$S_i$	SENSITIVITY

## GENERAL

$\pi$	= 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
$\sigma$	NORMAL STRESS
$\bar{\sigma}$	NORMAL EFFECTIVE STRESS ( $\bar{\sigma}$ IS ALSO USED)
$\tau$	SHEAR STRESS
$\epsilon$	LINEAR STRAIN
$\gamma$	SHEAR STRAIN
$\nu$	POISSON'S RATIO ( $\mu$ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
$\eta$	COEFFICIENT OF VISCOSITY

## EARTH PRESSURE

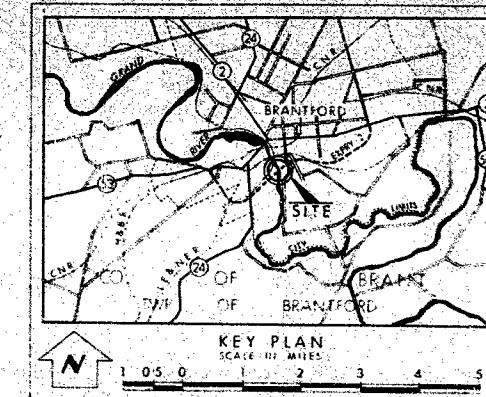
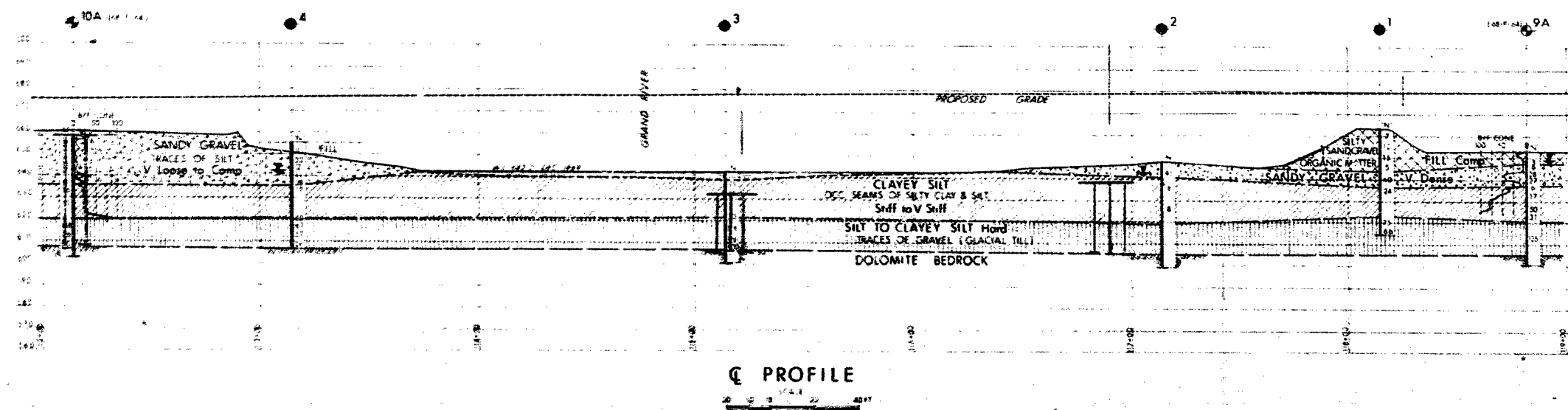
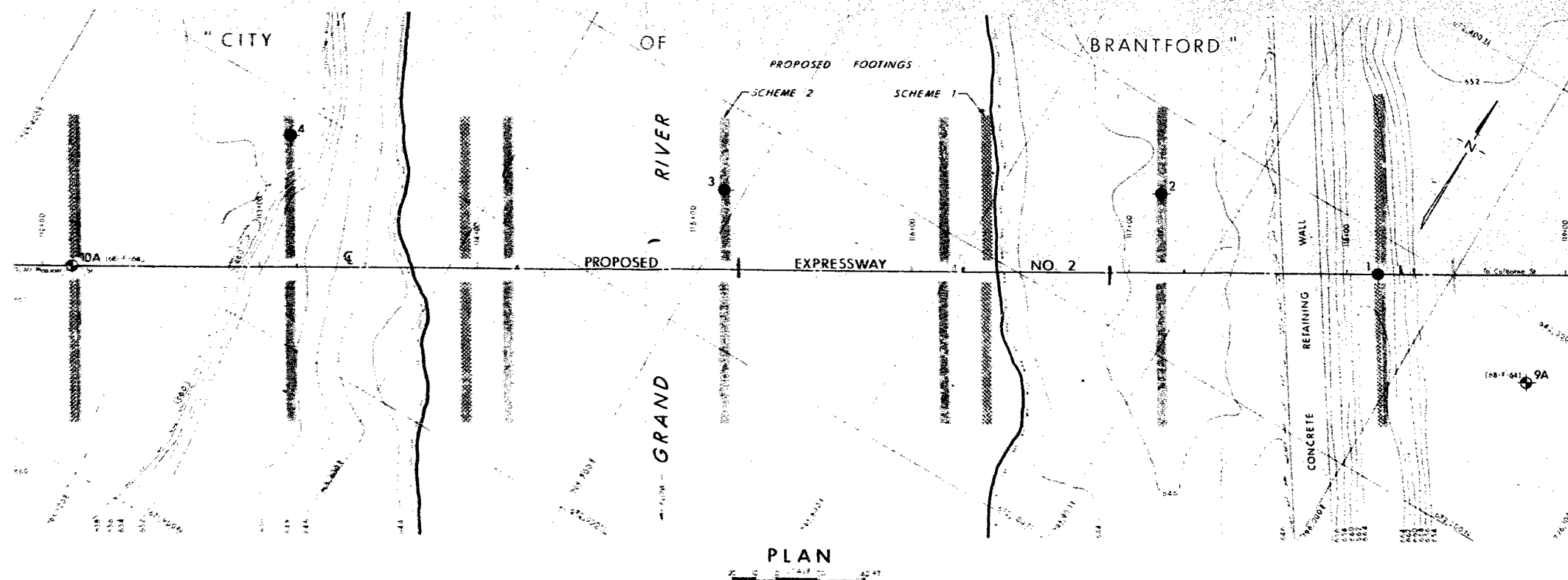
d	DISTANCE FROM TOP OF WALL TO POINT OF APPLICATION OF PRESSURE
$\delta$	ANGLE OF WALL FRICTION
K	DIMENSIONLESS COEFFICIENT TO BE USED WITH VARIOUS SUFFIXES IN EXPRESSIONS REFERRING TO NORMAL STRESS ON WALLS
$K_0$	COEFFICIENT OF EARTH PRESSURE AT REST

## 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
$\beta$	ANGLE OF SLOPE TO HORIZONTAL



LEGEND			
●	Bore Hole		
⊕	Cone Penetration Hole		
⊕	Bore & Cone Penetration Hole		
+	Water Levels established at time of field investigation DEC 1969		
NOTE - Water Levels in Bore Holes 1, & 10 A not established at time of field investigation			
NO.	ELEVATION	CO-ORDINATES	
		NORTH	EAST
1	663.9	672,284	795,970
2	647.7	672,265	795,865
3	642.2	672,164	795,692
4	655.7	672,084	795,503
9A	652.5	672,275	796,054
10A	658.6	671,983	795,451

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

REVISIONS	DATE	BY	DESCRIPTION

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

**GRAND RIVER**

KING'S HIGHWAY NO. EXPRESSWAY NO. 2 DIST. NO. 4  
CO. BRANT CITY OF BRANTFORD  
TWP. BRANTFORD LOT   CON.  

**BORE HOLE LOCATIONS & SOIL STRATA**

SUBMITTAL	CHECKED	W.P. NO.	70-68-02	M & T. DRAWING NO.
DRAWN	5.0	CHECKED	JOB NO.	69-F-115
DATE	10 FEB 1970	SITE NO.		69-F-115A
APPROVED		BRIDGE DRAWING NO.		

## SUMMARY OF PILE DRIVING RECORDS

W.O. 69-1115 W.P. 70-68-02 CONT. 71-77 DIST. 4  
SITE GRAND RIVER CROSSING OF THE BRANTFORD EXPI. #2  
DATE DRIVEN SEPT 24 - OCT. 7/71 WEIGHT OF ANVIL 1100 lb  
HAMMER TYPE DELMAR D-22 WEIGHT 10 755 lb ENERGY 39000 Ft/Lb

[illegible]



WP 70-68-02  
WO 69-F-115

# BRIDGE CONSTRUCTION — PILE DRIVING RECORD

DISTRICT NO. 4 CONTRACT NO. 71-77 STRUCTURE GRAND RIVER BRIDGE  
CONTRACTOR BERMINGHAM DESIGN LOAD OF PILE 95 TON  
HAMMER DETAILS: TYPE DELMAG D22 WEIGHT 10785 HEIGHT OF FALL OR ENERGY 39000  
TYPE OF ANVIL OR CAP H PILE CAP WEIGHT OF ANVIL OR CAP 1100 LBS.  
PILE DETAILS 12 B.P. 74 STEEL H. PILES  
PILE NO. 8 LOCATION WEST ABUTMENT 572 112720 DATE DRIVEN OCT 5/71

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.
26	1	1	26	26	2	51	51	54		76	
	2	1		27	2		52	25	525	77	
	3	1		28	4		53			78	
	4	1		29	2		54			79	
	5	2		30	9		55	9250W		80	
	6	2		31	9		56			81	
	7	2		32	9		57			82	
	8	2		33	9		58			83	
	9	2		34	8		59	720		84	
	10	5		35	2		60	81520		85	
	11	5		36	15		61			86	
	12	4		37	16		62			87	
	13	2		38	22		63			88	
	14	2		39	23		64	70019		89	
	15	2		40	3000		65	7200		90	
	16	5		41	19		66			91	
	17	3		42	28		67			92	
	18	10		43	20		68	70001		93	
	19	9		44	42		69	70000		94	
	20	9		45	50		70	70000		95	
	21	5		46	50		71	70000		96	
	22	9		47	52		72			97	
	23	9		48	52		73	70000		98	
50	24	10		49	54		74	70000		99	
	25	9		50	50		75			100	

DETAILS FOR FINAL SIX INCHES OF PENETRATION	1	2	3	4	5	6
BLOWS PER INCH						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	52' 9"			FINAL CUT OFF ELEVATION		

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

SIGNED [Signature]  
NAME (PRINT) J. FRALICK  
DATE OCT 5/71

ATTACH SKETCH OF PILE NUMBERING SYSTEM

658.5  
53.8  
605.7

**SECRET**

## CONSTITUTION OF THE PARTY

14-00000

ROTARY

[illegible]

# WATER GATE

92 次 114 次 116 次

100 20 10000 20 10000

21 8733 3 19

76.7501 28 415

22 May 2009

**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 $\frac{1}{2}$ " O.D. steel tube x 0.251" @ 33 lbs. per ft. Vertical. 12 $\frac{1}{2}$ " 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.

REPORT OF THE BOARD OF DIRECTORS

2024 SEP 28 20:18

77525 2 044000 03012400

2013-2014

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035 2036 2037 2038 2039 2040 2041 2042 2043 2044 2045 2046 2047 2048 2049 2050 2051 2052 2053 2054 2055 2056 2057 2058 2059 2060 2061 2062 2063 2064 2065 2066 2067 2068 2069 2070 2071 2072 2073 2074 2075 2076 2077 2078 2079 2080 2081 2082 2083 2084 2085 2086 2087 2088 2089 2090 2091 2092 2093 2094 2095 2096 2097 2098 2099 2100 2101 2102 2103 2104 2105 2106 2107 2108 2109 2110 2111 2112 2113 2114 2115 2116 2117 2118 2119 2120 2121 2122 2123 2124 2125 2126 2127 2128 2129 2130 2131 2132 2133 2134 2135 2136 2137 2138 2139 2140 2141 2142 2143 2144 2145 2146 2147 2148 2149 2150 2151 2152 2153 2154 2155 2156 2157 2158 2159 2160 2161 2162 2163 2164 2165 2166 2167 2168 2169 2170 2171 2172 2173 2174 2175 2176 2177 2178 2179 2180 2181 2182 2183 2184 2185 2186 2187 2188 2189 2190 2191 2192 2193 2194 2195 2196 2197 2198 2199 2200 2201 2202 2203 2204 2205 2206 2207 2208 2209 2210 2211 2212 2213 2214 2215 2216 2217 2218 2219 2220 2221 2222 2223 2224 2225 2226 2227 2228 2229 2230 2231 2232 2233 2234 2235 2236 2237 2238 2239 2240 2241 2242 2243 2244 2245 2246 2247 2248 2249 2250 2251 2252 2253 2254 2255 2256 2257 2258 2259 2260 2261 2262 2263 2264 2265 2266 2267 2268 2269 2270 2271 2272 2273 2274 2275 2276 2277 2278 2279 2280 2281 2282 2283 2284 2285 2286 2287 2288 2289 2290 2291 2292 2293 2294 2295 2296 2297 2298 2299 2300 2301 2302 2303 2304 2305 2306 2307 2308 2309 2310 2311 2312 2313 2314 2315 2316 2317 2318 2319 2320 2321 2322 2323 2324 2325 2326 2327 2328 2329 2330 2331 2332 2333 2334 2335 2336 2337 2338 2339 2340 2341 2342 2343 2344 2345 2346 2347 2348 2349 2350 2351 2352 2353 2354 2355 2356 2357 2358 2359 2360 2361 2362 2363 2364 2365 2366 2367 2368 2369 2370 2371 2372 2373 2374 2375 2376 2377 2378 2379 2380 2381 2382 2383 2384 2385 2386 2387 2388 2389 2390 2391 2392 2393 2394 2395 2396 2397 2398 2399 2400 2401 2402 2403 2404 2405 2406 2407 2408 2409 2410 2411 2412 2413 2414 2415 2416 2417 2418 2419 2420 2421 2422 2423 2424 2425 2426 2427 2428 2429 2430 2431 2432 2433 2434 2435 2436 2437 2438 2439 2440 2441 2442 2443 2444 2445 2446 2447 2448 2449 2450 2451 2452 2453 2454 2455 2456 2457 2458 2459 2460 2461 2462 2463 2464 2465 2466 2467 2468 2469 2470 2471 2472 2473 2474 2475 2476 2477 2478 2479 2480 2481 2482 2483 2484 2485 2486 2487 2488 2489 2490 2491 2492 2493 2494 2495 2496 2497 2498 2499 2500 2501 2502 2503 2504 2505 2506 2507 2508 2509 2510 2511 2512 2513 2514 2515 2516 2517 2518 2519 2520 2521 2522 2523 2524 2525 2526 2527 2528 2529 2530 2531 2532 2533 2534 2535 2536 2537 2538 2539 2540 2541 2542 2543 2544 2545 2546 2547 2548 2549 2550 2551 2552 2553 2554 2555 2556 2557 2558 2559 2560 2561 2562 2563 2564 2565 2566 2567 2568 2569 2570 2571 2572 2573 2574 2575 2576 2577 2578 2579 2580 2581 2582 2583 2584 2585 2586 2587 2588 2589 2590 2591 2592 2593 2594 2595 2596 2597 2598 2599 2600 2601 2602 2603 2604 2605 2606 2607 2608 2609 2610 2611 2612 2613 2614 2615 2616 2617 2618 2619 2620 2621 2622 2623 2624 2625 2626 2627 2628 2629 2630 2631 2632 2633 2634 2635 2636 2637 2638 2639 2640 2641 2642 2643 2644 2645 2646 2647 2648 2649 2650 2651 2652 2653 2654 2655 2656 2657 2658 2659 2660 2661 2662 2663 2664 2665 2666 2667 2668 2669 2670 2671 2672 2673 2674 2675 2676 2677 2678 2679 2680 2681 2682 2683 2684 2685 2686 2687 2688 2689 2690 2691 2692 2693 2694 2695 2696 2697 2698 2699 2700 2701 2702 2703 2704 2705 2706 2707 2708 2709 2710 2711 2712 2713 2714 2715 2716 2717 2718 2719 2720 2721 2722 2723 2724 2725 2726 2727 2728 2729 2730 2731 2732 2733 2734 2735 2736 2737 2738 2739 2740 2741 2742 2743 2744 2745 2746 2747 2748 2749 2750 2751 2752 2753 2754 2755 2756 2757 2758 2759 2760 2761 2762 2763 2764 2765 2766 2767 2768 2769 2770 2771 2772 2773 2774 2775 2776 2777 2778 2779 2780 2781 2782 2783 2784 2785 2786 2787 2788 2789 2790 2791 2792 2793 2794 2795 2796 2797 2798 2799 2800 2801 2802 2803 2804 2805 2806 2807 2808 2809 2810 2811 2812 2813 2814 2815 2816 2817 2818

5399-2

REPORT TO BE SENT TO - PRINCIPAL FOUNDATION & HIGHWAY  
MATERIALS & TESTING DIVISION  
DEPARTMENT OF HIGHWAYS  
DOWNVIEW, ONTARIO

2350

ATTACHMENT 2: 2013-2014 BUDGET

OVER

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS & TESTING DIVISION  
FOUNDATION SECTION

WP 70-68-02  
WO 69-F-115

# BRIDGE CONSTRUCTION — PILE DRIVING RECORD

DISTRICT NO. 4 CONTRACT NO. 71-77 STRUCTURE GRAND RIVER BRIDGE  
CONTRACTOR BERMINE HAN DESIGN LOAD OF PILE 75 TON  
HAMMER DETAILS: TYPE DELTA 1122 WEIGHT 10755 HEIGHT OF FALL OR ENERGY 39000  
TYPE OF ANVIL OR CAP H PILE CAP WEIGHT OF ANVIL OR CAP 1100 LBS  
PILE DETAILS 12 RP-74 STEEL H PILES  
PILE NO. 3 LOCATION WEST ABUTMENT FOOTING DATE DRIVEN OCT 7/71

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

DETAILS FOR FINAL SIX INCHES OF PENETRATION	1	2	3	4	5	6
BLOWS PER INCH						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	50' 6"			FINAL CUT OFF ELEVATION 658.50		

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

SIGNED J. Fralick  
NAME (PRINT) J. FRALICK  
DATE OCT 7/71

ATTACH SKETCH OF PILE NUMBERING SYSTEM

658.5  
50.5  
608.0

# BRIDGE CONSTRUCTION - PILE DRIVING RECORD

STRUCTURE \_\_\_\_\_ CONTRACT NO. \_\_\_\_\_ DISTRICT NO. \_\_\_\_\_  
DESIGN LOAD OF PILE \_\_\_\_\_ CONTRACTOR \_\_\_\_\_  
WEIGHT OF PILE \_\_\_\_\_ HAMMER DETAILS TYPE \_\_\_\_\_  
WEIGHT OF ANVIL OR CAP \_\_\_\_\_ TYPE OF ANVIL OR CAP \_\_\_\_\_  
PILE DETAILS \_\_\_\_\_ LOCATION \_\_\_\_\_

## 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.

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

OVER

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS & TESTING DIVISION  
FOUNDATION SECTION

WP 70-68-02  
100 69-F-115

# BRIDGE CONSTRUCTION — PILE DRIVING RECORD

DISTRICT NO. 4 CONTRACT NO. 71-77 STRUCTURE GRAND RIVER BRIDGE  
CONTRACTOR BERMINGHAM CONST. DESIGN LOAD OF PILE 95 TON  
HAMMER DETAILS: TYPE DELMAG WEIGHT 10755 HEIGHT OF FALL OR ENERGY 39000  
TYPE OF ANVIL OR CAP H. PILE CAP WEIGHT OF ANVIL OR CAP 1100 LBS  
PILE DETAILS 12 BP 74 STEEL H. PILES  
PILE NO. 3 LOCATION PIER FOOTING " 2 DATE DRIVEN SEPT 28/71

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

DETAILS FOR FINAL SIX INCHES OF PENETRATION	1	2	3	4	5	6
BLOWS PER INCH						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE <u>25' 11"</u>	FINAL CUT OFF ELEVATION <u>632.00</u>					

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

SIGNED T. Fralick  
NAME (PRINT) T. FRALICK

DATE SEPT 28/71

ATTACH SKETCH OF PILE NUMBERING SYSTEM

OK  
632.0  
25.9  
606.1

OVER

Form OF M-123 (formerly OF M-122)  
500 Pcs. 125 378DEPARTMENT OF HIGHWAYS - ONTARIO  
MATERIALS & TESTING DIVISION  
FOUNDATION SECTION

## BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. \_\_\_\_\_ CONTRACT NO. \_\_\_\_\_  
 STRUCTURE NO. \_\_\_\_\_  
 DESIGN LOAD OF PILE \_\_\_\_\_  
 CONTRACTOR \_\_\_\_\_  
 WEIGHT OF PILE \_\_\_\_\_  
 HEIGHT OF FALL OR ENERGY \_\_\_\_\_  
 TYPE OF ANVIL OR CAP \_\_\_\_\_  
 PILE DETAILS \_\_\_\_\_  
 DATE GIVEN \_\_\_\_\_

## 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.

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

OVER

DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS & TESTING DIVISION  
FOUNDATION SECTION

WP 70-68-02  
WC 69-F-115

BRIDGE CONSTRUCTION — PILE DRIVING RECORD

DISTRICT NO. 4 CONTRACT NO. 71-77 STRUCTURE GRAND RIVER STRUCTURE  
CONTRACTOR BURNINGHAM DESIGN LOAD OF PILE 95 TON  
HAMMER DETAILS: TYPE DELMAC D 00 WEIGHT 10755 HEIGHT OF FALL OR ENERGY 3900  
TYPE OF ANVIL OR CAP H. BLUE CAP WEIGHT OF ANVIL OR CAP 1100 LBS  
PILE DETAILS 12 PILES 74 STICK 11 PILES  
PILE NO. 40 LOCATION PUR FOOTING # 2 DATE DRIVEN SEPT 30/71

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.
30	1		30	26	47	30	51			76	
	2			27			52			77	
	3			28			53			78	
	4			29			54			79	
	5			30			55			80	
	6			31			56			81	
	7			32			57			82	
	8			33			58			83	
	9			34			59			84	
	10			35			60			85	
	11			36			61			86	
	12			37			62			87	
	13			38			63			88	
	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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE	FINAL CUT OFF ELEVATION <u>632.00</u>					

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

SIGNED T. Fralick  
NAME (PRINT) T. FRALICK  
DATE SEPT 30/71

ATTACH SKETCH OF PILE NUMBERING SYSTEM

632.0  
26.2  
605.2

OK Div 210

907095700

DATE: \_\_\_\_\_

242 70 11484 70 75511

24 3/4

\*\*\*\*\*



OVER

Form OB-MT-285 (Formerly OB-ML-285)  
286 Peds. 65-278DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS & TESTING DIVISION  
FOUNDATION SECTIONWP 70-68-02  
NO 69-F-115

## BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 4 CONTRACT NO. 71-77 STRUCTURE GRAND RIVER BRIDGE  
 CONTRACTOR BERMINGHAM DESIGN LOAD OF PILE 95 TON  
 HAMMER DETAILS: TYPE DELMAR D 22 WEIGHT 10755 HEIGHT OF FALL OR ENERGY 39000  
 TYPE OF ANVIL OR CAP H PILE CAP WEIGHT OF ANVIL OR CAP 1100 LBS  
 PILE DETAILS 12 BP 74 STEEL H PILES  
 PILE NO. 1 LOCATION PIER FOOTING # 3 DATE DRIVEN SEPT 27/71

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

DETAILS FOR FINAL SIX INCHES OF PENETRATION	1	2	3	4	5	6
BLOWS PER INCH						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE <u>33' 7"</u>	FINAL CUT OFF ELEVATION <u>638.50</u>					

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

SIGNED T. Fralick  
 NAME (PRINT) T. FRALICK  
 DATE Sept 27/71

ATTACH SKETCH OF PILE NUMBERING SYSTEM

638.5  
 33.6  
 604.9

# BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. \_\_\_\_\_ CONTRACT NO. \_\_\_\_\_  
 STRUCTURE \_\_\_\_\_  
 DESIGN LOAD OF PILE \_\_\_\_\_  
 CONTRACTOR \_\_\_\_\_  
 HAMMER DETAILS TYPE \_\_\_\_\_  
 WEIGHT OF FALL OR ENERGY \_\_\_\_\_  
 TYPE OF ANVIL OR CAP \_\_\_\_\_  
 PILE DETAILS \_\_\_\_\_  
 LOCATION \_\_\_\_\_  
 DATE \_\_\_\_\_

## 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 $\frac{1}{2}$ " O.D. steel tube x 0.251" @ 33 lbs. per ft. Vertical. 12 $\frac{1}{2}$ " 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.

OVER

Form OB-MT-285 (Formerly OB-MT-285)  
200 Pads - 65-278DEPARTMENT OF HIGHWAYS — ONTARIO  
MATERIALS & TESTING DIVISION  
FOUNDATION SECTIONWP 70-68-02  
V00 69-E-115

## BRIDGE CONSTRUCTION — PILE DRIVING RECORD

DISTRICT NO. 4 CONTRACT NO. 71-77 STRUCTURE GRAND RIVER BRIDGE  
 CONTRACTOR BERMINGHAM CONST. DESIGN LOAD OF PILE 95 TON  
 HAMMER DETAILS: TYPE DELMA D 22 WEIGHT 10755 HEIGHT OF FALL OR ENERGY 39000  
 TYPE OF ANVIL OR CAP H PILE CAP WEIGHT OF ANVIL OR CAP 1100 LBS  
 PILE DETAILS 12 RP 74 - STEEL H PILLS  
 PILE NO. 27 LOCATION PIER FOOTING #3 DATE DRIVEN SEPT 24/71

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.
28	1	↑	26	31		51				76	
	2		27	34		52				77	
	3		28	40		53				78	
	4		29	41		54				79	
	5		30	32		55				80	
	6		31	38		56				81	
	7		32	37	31' 9"	57				82	
	8		33			58				83	
	9		34			59				84	
	10		35			60				85	
	11		36			61				86	
	12		37			62				87	
	13		38			63				88	
	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						
MEASURED REBOUND IN INCHES						
FINAL LENGTH OF PILE <u>32' 8"</u>	FINAL CUT OFF ELEVATION <u>638.50</u>					

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

SIGNED T. Frank  
 NAME (PRINT) T. FRANK  
 DATE Sept 24/71

ATTACH SKETCH OF PILE NUMBERING SYSTEM

638.5  
 32.7  
 605.8

# BRIDGE CONSTRUCTION — PILE DRIVING RECORD

DISTRICT NO. \_\_\_\_\_ CONTRACT NO. \_\_\_\_\_  
STRUCTURE NO. \_\_\_\_\_  
DESIGN LOAD OF PILE \_\_\_\_\_  
CONTRACTOR \_\_\_\_\_  
WEIGHT \_\_\_\_\_  
TYPE OF HAMMER \_\_\_\_\_  
TYPE OF PILE OR CAP \_\_\_\_\_  
WEIGHT OF ANCHOR OR CAP \_\_\_\_\_  
PILE DETAILS \_\_\_\_\_

## 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 $\frac{1}{2}$ " O.D. steel tube x 0.251" @ 33 lbs. per ft. Vertical. 12 $\frac{1}{2}$ " 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 splited 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.

NAME \_\_\_\_\_  
DATE \_\_\_\_\_

REPORT TO BE MADE BY: \_\_\_\_\_  
MATERIALS & TESTING DIVISION  
DEPARTMENT OF HIGHWAYS  
ONTARIO

DATE \_\_\_\_\_

MEMORANDUM

AGS  
✓

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

FROM: C.S. Grebski,  
Bridge Office

ATTENTION:

DATE: February 26, 1971

OUR FILE REF.

IN REPLY TO

SUBJECT: Grand River Bridge - Westbound Lanes  
City of Brantford  
W.P. 70-68-02, Site No. 1-169  
Brantford Expressway, District No. 4

69-F-115

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

Pile Data should be comments  
as per attached table

12 L. Grebski  
March 5<sup>th</sup> 1971

dl  
21 Mar 71

Department of Highways Ontario  
Copy for the information of

A. P. Watt,  
Reg. Bridge Planning Engineer,  
London Regional Office.

Bridge Office,  
Downsview.

August 5, 1970

Grand River Bridge  
Westbound Lanes - City of Brantford  
W. R. 70-68-02, Site #1-169  
Brantford Expressway #2

69-F-115

Attached herewith are prints of the preliminary Bridge  
Plan Drawing D-6351-F1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$864,000.  
This cost includes tender, materials, engineering and sundry  
construction.

Any comments or revisions you may have should be sub-  
mitted within three weeks.

C. S. Grebski,  
Bridge Design Engineer.

CSG:DL

Attach.

c.c. S. McCombie  
A. Sterrac (2) ✓  
J. Anderson

206.7 1970

NO COMMENTS

A. K. B.

(initials)

Copy for the information of

445

40 P01 - 43
GEOCRES No.

A. F. Watt,  
Reg. Bridge Planning Engineer,  
London Regional Office.

Bridge Office,  
Downsview.

August 5, 1970

Grand River Bridge  
Westbound Lanes - City of Brantford  
W. L. 70-68-02, Site #1-159  
Brantford Expressway #2

69-F-115

Attached herewith are prints of the preliminary Bridge  
Plan Drawing D-6391-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is \$864,000.  
This cost includes tender, materials, engineering and sundry  
construction.

Any comments or revisions you may have should be sub-  
mitted within three weeks.

C. S. Grebski,  
Bridge Design Engineer.

CFG:122

Attach.

c.c. E. McCombie  
A. Stermac (2) ✓  
J. Anderson

AUG 7 1970

NO COMMENTS

A 43.

(212)

40 P1-43  
650023 (1)

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

AGS  
✓

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

FROM: C.S. Grebski,  
Bridge Office

ATTENTION:

DATE: February 26, 1971

OUR FILE REF.

IN REPLY TO

SUBJECT: Grand River Bridge - Westbound Lanes  
City of Brantford  
W.P. 70-68-02, Site No. 1-169  
Brantford Expressway, District No. 4

69-F-115

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

Pile Data should be comments  
as per contract table

K.L. Grebski  
March 5<sup>th</sup> 1971

all  
29 Mar 71