

MEMORANDUM

72-161

TO: Mr. W. D. Birch,  
Bridge Maintenance Engineer,  
Maintenance Office,  
Admin. Bldg.

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

ATTENTION:

DATE: April 30, 1971

OUR FILE REF.

IN REPLY TO **MAY 11 1971**

SUBJECT:

3:1-18
GEO. RES. No.

FOUNDATION INVESTIGATION REPORT

For

Existing Bridge on Wabi River

And Highway #65

Twp. of Kerns, Dist. of Timiskaming

District No. 14 (New Liskeard)

W.O. 71-11010 --

~~W.P. 629-56 (old)~~

CONT 72-161

site 47-45.

W.P. 120-71-01 (new)

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 feel free to contact our Office.

AGS/WJEF  
Attach.

*A. G. Stermac*  
A. G. Stermac  
PRINCIPAL FOUNDATION ENGINEER

cc: Messrs. W. D. Birch (2)  
B. R. Davis  
E. J. Orr  
P. G. Allen  
D. W. Farren  
E. McArthur  
T. A. Sharpe  
L. E. Authier  
J. C. McAllister (2)  
E. A. Saint  
E. J. Giroux  
B. A. Singh

Foundations Files ✓  
Gen. Files

## TABLE OF CONTENTS

1. INTRODUCTION.
  2. DESCRIPTION OF SITE.
  3. FIELD AND LABORATORY WORK.
  4. SUBSOIL CONDITIONS:
    - 4.1) General.
    - 4.2) Clayey Silt (Fill).
    - 4.3) Varved Clay.
    - 4.4) Sand.
    - 4.5) Bedrock.
  5. GROUNDWATER CONDITIONS.
  6. DISCUSSION AND RECOMMENDATIONS.
  7. MISCELLANEOUS.
-

FOUNDATION INVESTIGATION REPORT  
For  
Existing Bridge on Wabi River  
And Highway #65  
Twp. of Kerns, Dist. of Timiskaming  
District No. 14 (New Liskeard)  
W.O. 71-11010    --    W.P. 629-56

---

1. INTRODUCTION:

The Foundation Section was requested by Mr. W. D. Birch, Bridge Maintenance and Inspection Engineer, to carry out a foundation investigation at the location of the existing bridge carrying Hwy. #65 over the Wabi River. It has been reported by Mr. H. W. C. Rehn, Bridge Maintenance Section, that some signs of lateral movements under the bridge have been observed.

A field investigation was subsequently carried out by this Section to determine the subsoil conditions existing at the site. This report contains the results of this investigation and our recommendations pertaining to the remedial measures for stabilizing the forward slopes.

2. DESCRIPTION OF SITE:

The site of the crossing is situated about 19 miles northwest of New Liskeard. The river flows through a wide valley in a south to north direction. The slopes of the valley are about 50 ft. high, except immediately to southwest of the existing bridge. The natural slopes of the banks are about 3 horizontal to 1 vertical, or flatter. Signs of slope failures in the past can be seen all around. A large failure about 1,000 ft. south of the bridge is particularly noticeable.

### 3. FIELD AND LABORATORY WORK:

The field work at the proposed site consisted of a total of three sampled boreholes and four dynamic cone penetration tests. The boreholes were advanced using conventional diamond drilling equipment adapted for soil sampling purposes. Disturbed samples were obtained using a 2-inch O.D. split-spoon sampler driven according to the specifications for the Standard Penetration Test. Undisturbed samples were recovered using 2-inch I.D. Shelby tubes which were pushed into the soil by hand. Wherever possible, field vane tests were carried out at elevations 12 inches and 30 inches below sample depths.

Dynamic cone penetration tests were carried out adjacent to each borehole. In addition, one cone penetration (B.L. #4) was carried out behind the west abutment of the bridge. Driving energy to advance the cone was 350 ft.-lbs. per blow.

Samples were visually examined in the field and subsequently in the laboratory. Tests were carried out on selected samples to determine the following physical properties:

- Grain-size Distribution
- Atterberg Limits
- Natural Moisture Content
- Bulk Density
- Unconfined Shear Strength
- Effective Stress Parameters
- Consolidation Characteristics

The results of field and laboratory tests are summarized in the Record of Borehole sheets, which are contained in the Appendix to the report.

All boreholes were surveyed in the field by personnel from New Liskeard District. The locations and elevations of the borings are shown on Drawing No. 71-11010A, which accompanies this report.

#### 4. SUBSOIL CONDITIONS:

##### 4.1) General:

In general, the subsoil consists of local fill material, followed by a deposit of varved clay, underlain by a layer of sand, which in turn, overlies bedrock.

The boundaries between the different deposits are shown on the attached Record of Borehole sheets. The estimated stratigraphical profile shown on Drawing No. 71-11010A, is based upon this information.

From ground level downwards, the different soil deposits are described as follows:

##### 4.2) Clayey Silt (Fill):

This material was found from ground level down to depths of 11.5, 7.0 and 6.5 ft. in Boreholes 1, 2 and 3, respectively. The material can be described as clayey silt, and was probably obtained from cut areas behind the fills.

Physical properties of the material as determined from field and laboratory tests, are as follows:

Liquid Limit	:	22	-	40%
Plastic Limit	:	16	-	30%
Natural Moisture Content	:	22	-	32%

The unconfined shear strength varies from 860 to 2,290 p.s.f., indicating a firm to very stiff consistency.

##### 4.3) Varved Clay:

This was the predominant soil deposit at this location, and occurred in all boreholes down to the following elevations:

Borehole #1	:	679.5
#2	:	685.8
#3	:	680.1
#4	:	686.9

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

4.3) Varved Clay: (cont'd.) ...

On the east side - Boreholes 1 and 3 - the soil consists of alternate layers of silty clay to clayey silt (1/8" to 2" thick) and silt (1/2" to 6" thick). On the west side - Borehole 2 - the soil consists of alternate layers of silty clay (1/4" to 2" thick) and clayey silt to silt (1/4" to 5" thick). The stratification is horizontal. In general, the silt content increases from west to east and also with depth.

The range of Atterberg Limits for individual layers is as follows:

	<u>Liquid Limit</u>		<u>Plastic Limit</u>		<u>Natural Moisture Content</u>
Silty Clay (B.H. #2)	40	- 44%	21	- 23%	51 - 53%
Silty Clay to Clayey Silt (B.H.'s #1 & 3)	26	- 45%	17	- 24%	23 - 60%
Clayey Silt to Silt (B.H. #2)	24	- 28%	20	- 22%	26 - 31%
Silt (B.H.'s #1 & 3)	Non-plastic				25 - 34%

The natural moisture content of individual varves was found to be close to, or higher than, the liquid limit. This is reflected in the high sensitivity values as obtained from field vane tests.

The undrained shear strength was determined in the field by vane tests and in the laboratory by means of unconfined compression tests. The shear strength as determined from the field vane, ranged from 560 to more than 2,000 lbs. per sq. ft. but, in general, the average shear strength was about 800 lbs. However, it is borne out by experience, that the field vane test overestimates the shear strength and more so in the case of silty material. The vane shear strength was higher in the lower region where the silt content was higher. The values of the shear strength as obtained from laboratory unconfined compression tests,



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

4.3) Varved Clay: (cont'd.) ...

ranged from 430 to 1,080 lbs. per sq. ft. but, in general, varied from 430 to 600 lbs. per sq. ft. on the east side (B.H.'s #1 & 3) and 600 to 800 lbs. per sq. ft. on the west side (B.H. #2).

The shear strength values thus determined, have been plotted on the Record of Borehole sheets and are also shown in Fig. 1 as plotted against the elevation.

The consolidated undrained triaxial compression stage tests were performed in the laboratory to determine the effective stress parameters. The results obtained from these tests are:

Effective Cohesion Intercept  $C' = 90 - 250$  p.s.f.

Effective Angle of Internal Friction  $\phi' = 23 - 32$  degrees

However, from the experience acquired at similar sites in the New Liskeard area, the values of  $\phi'$  as obtained in the laboratory appear to be higher than the actual value. It is felt that a value of  $\phi' = 24^\circ$  is more representative of this material.

4.4) Sand:

This deposit was encountered immediately below the varved clay layer and is underlain by the bedrock. The thickness of the stratum varied from 5.8 ft. in Borehole #1 to 8.1 ft. in Borehole #2. Boreholes #3 and 4 were terminated in this stratum. The material consists of sand with varying amounts of gravel, silt and clay. The grain-size analyses showed the following ranges:

Gravel	:	20 - 44%
Sand	:	29 - 72%
Silt	:	1 - 27%
Clay	:	0 - 23%

Standard Penetration tests gave 'N' values indicating a loose to very dense denseness.

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

4.5) Bedrock:

Bedrock in Boreholes #1 and 2 was assumed to be at elevations when refusal to further penetration by washboring, to driving the split-spoon and to driving the casing was met. The bedrock was at Elevations 673.7 and 678.6 in Boreholes #1 and 2, respectively.

5. GROUNDWATER CONDITIONS:

The water level in the river and in various boreholes at the time of investigation was as follows:

Borehole #1	:	Elev. 722.5
#2	:	729.8
#3	:	718.8
Wabi River (Ice level)	:	718.6

6. DISCUSSION AND RECOMMENDATIONS:

The existing bridge was constructed in 1958 and consists of 7 spans (18' - 20' - 19.5' - 41' - 19.5' - 20' - 18'), the total length being 156 ft. The main span has steel beams with a concrete deck, while the approach spans have a timber and concrete (composite) deck. The entire structure is supported on creosoted timber piles reported to have been driven to the bedrock. The total height of the east approach is about 32 ft., and of the west approach, is about 35 ft. above the river bed.

As described earlier, the subsoil consists of local clayey silt fill material, followed by a deep deposit of varved clay, followed by a sand stratum which overlies bedrock.

In 1969, some movements of piles towards the river were observed, indicating probable earth movements.



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

From the results of field and laboratory determinations of undrained shear strength, it is concluded that the average undrained shear strength of the material is about 650 lbs./sq. ft. However, as already discussed, the effective stress parameters as obtained from the laboratory tests, appear to be on the higher side.

In order to find the average shear strength of the material as exhibited in the field, the forward slopes of the existing bridge were analyzed in terms of total stress and also in terms of effective stress. Since some movements of the slopes have been noticed, it was assumed that the present factor of safety of the existing slopes is close to 1.0 in both the total and the effective stress analyses. The analysis was carried out by using the IBM 360 computer, and it was found that for the slopes to have a factor of safety of 1.0, the subsoil would have the following shear strength parameters:

Undrained Shear Strength	:	$C_u$ = 650 p.s.f.
Apparent Cohesion - (in terms of effective stress)	:	$C'$ = 50 p.s.f.
Apparent Angle of Friction - (in terms of effective stress)	:	$\phi'$ = $24^\circ$

The value of undrained shear strength  $C_u$ , so deduced, is in close agreement with the values obtained from the field and laboratory tests. The values of  $C'$  and  $\phi'$  are supported by past experience with sites in this area. These values are lower than those determined from the laboratory tests because of the following reasons:

- 1) The mode of failure, including the set of stresses and the plane of failure cannot be duplicated in the laboratory.

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

ii) Because of the layered nature of the subsoil, the failure in the field will take place in a fashion which would mobilize the worst combination of the effective stress parameters of the cohesive and non-cohesive layers, and the failure surface so generated cannot be simulated in the laboratory.

The natural slopes in the vicinity of the bridge are about 3 horizontal to 1 vertical, while the average forward slopes of the existing bridge are about 2.3 horizontal to 1 vertical, indicating a probable low factor of safety. New forward slopes with acceptable factors of safety - in terms of both the total, and the effective stress analyses - were designed using the following values of the parameters:

$$C_u = 650 \text{ p.s.f.}$$

$$C' = 50 \text{ p.s.f.} \quad \phi' = 24^\circ$$

The forward slopes can be stabilized by flattening the overall slopes. This can be achieved by removing material from the upper half of the existing slopes and adding an additional approach span at each end. The extent of excavation and the resulting slopes are shown on Drawing 71-11010B. The additional approach spans at each end are 30 ft. in length.

The proposed abutments should be supported on creosoted timber piles or steel H-piles driven to bedrock. Design loads to be used should be the maximum allowable for the particular pile section adopted.

It is reported that the existing structure is supported on end-bearing timber piles. From the information available, it appears that 74 piles, each 70 ft. long (= 5,180 linear ft.) were ordered, of which the total length driven was 4,632 ft. The total length of piles required to reach bedrock, was estimated

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

using the drawing used for the construction and the bedrock elevations from the foundation investigation. It was found that the total length needed would be 4,845 ft., which is 213 ft. more than actually driven.

It should be borne in mind that the construction of additional spans will increase the load carried by the piles supporting the existing abutments. The recommendation of providing end-bearing piles for the proposed abutments is based on the assumption that the piles of the existing abutments and the adjacent bents have been driven to bedrock. Therefore, it is important that it should be checked and ensured by the District, that the piles carrying the existing abutments and adjacent bents have actually been driven to the bedrock. If they are not driven to the bedrock, removal of earth around them (for the benches) will cause a reduction in their supporting capacity.

No dewatering problems are anticipated because ground-water level is below the level of proposed cuts.

Scour protection should be provided up to H.W.L. if required by the Bridge Hydrology Section.

7. MISCELLANEOUS:

The field work for this project was carried out during the period February 23 to 27, 1971, under the supervision of Mr. A. Prakash, Project Foundation Engineer, who also prepared this report.

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

This report was reviewed by Mr. K. G. Selby, Supervising Foundation Engineer.

May, 1971.

APPENDIX I

---

JOB 71-11010 LOCATION Hwy. 65, Sta. 260+46 o/s 32' Lt. ORIGINATED BY AP  
W.P. 629-76 BORING DATE Feb. 26-27, 1971 COMPILED BY AP  
DATUM Geodetic BOREHOLE TYPE Washboring, NX Castlg & Cone CHECKED BY

SOIL PROFILE		SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT — $w_L$ PLASTIC LIMIT — $w_p$ WATER CONTENT — $w$			BULK DENSITY Y P.C.F. GR. SA. SI. G.	REMARKS							
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE		20	40	60	80	100	SHEAR STRENGTH P.S.F. ○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE					WATER CONTENT % $w_p$ — $w$ — $w_L$						
739.5	Ground Level										400	800	1200	1600	2000	20	40	60				
0.0	Fill		1	SS	4																	
	Clayey Silt		2	TW	PM																118	
	Firm																					
728.0			3	TW	PM	730															125	
11.5			4	TW	PM																126	
			5	TW	PM	720															95	
	Varved Clay		6	SS	10																	117
			7	TW	PM																	
	Layers of clayey silt (1/8" to 2") and silt (1/2" to 6").		8	TW	PM	710																109
			9	TW	PM																	
	Firm		10	TW	PM	700																120
			11	TW	PM																	
			12	TW	PM	690																
			13	TW	PM																	
679.5				14	SS	58	680															21 29 27 2
60.0	Sand with gravel and varying amounts of silt & clay. Very Dense	15		SS	-																	44 55 1 0
673.7																						
65.8	End of Borehole Probable Bedrock					670																

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

# RECORD OF BOREHOLE No. 2

FOUNDATION SECTION

JOB 71-11010 LOCATION Hwy. 65, Sta. 262 + 14 o/s 29' Rt.  
W.P. 629-56 BORING DATE Feb. 25 - 26, 1971  
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing and Cone

ORIGINATED BY AP  
COMPILED BY AP  
CHECKED BY *AK*

ELEV. DEPTH	SOIL PROFILE DESCRIPTION	STRAT. PLT.	SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS/FOOT					LIQUID LIMIT PLASTIC LIMIT WATER CONTENT			BULK DENSITY $\gamma$	REMARKS
			NUMBER	TYPE	BLOWS/FOOT		20	40	60	80	100	W <sub>p</sub>	W <sub>L</sub>	W		
745.8	Ground Level															
0.0	Fill		1	SS	19											
	Clayey silt															
738.8	Very Stiff		2	TW	PM	740									119	
7.0			3	TW	PM											
			4	TW	PM	730										
			5	TW	PM											
	Varved Clay		6	TW	PM	720										
	Layers of silty clay (1/4" to 2") and clayey silt to silt (1/2" to 5")		7	TW	PM											
			8	TW	PM	710										
			9	TW	PM											
	Firm		10	TW	PM	700										
	Stiff		11	TW	PM											
			12	TW	PM	690										
685.8			13	SS	8											
60.0	Sand with some gravel, traces of silt & clay		14	SS	100/4"	680										
677.7	Loose to Very Dense															
68.1	End of Borehole Probable Bedrock															

20  
10-5 % STRAIN AT FAILURE  
10



JOB 79-11010 LOCATION Hwy. 65, Sta. 260 + 94 o/s 26' Lt. ORIGINATED BY AP  
W.P. 629-56 BORING DATE Feb. 25 - 26, 1971 COMPILED BY AP  
DATUM Geodetic BOREHOLE TYPE Washboring, NX Casing & Cone CHECKED BY H.L.

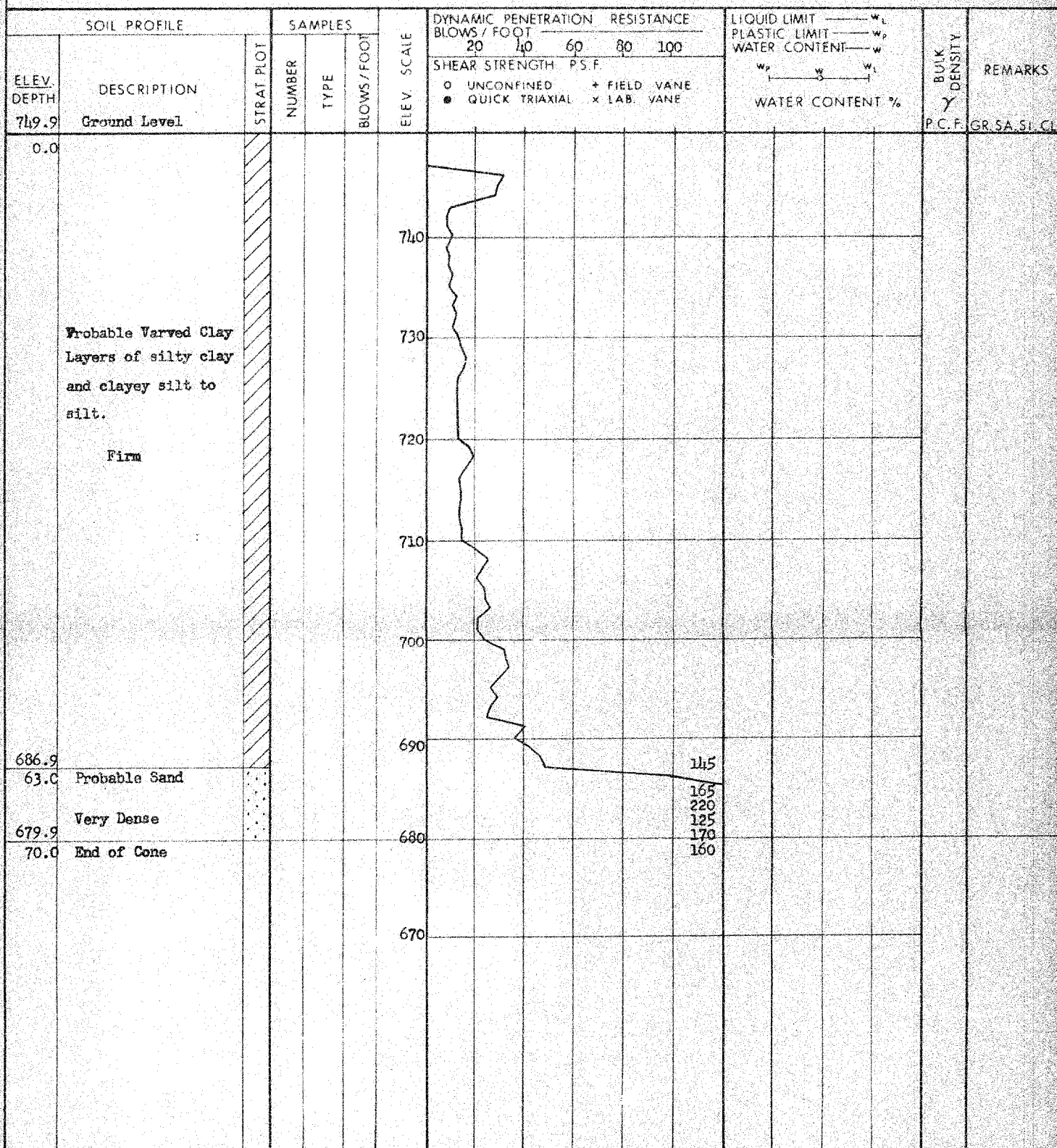
SOIL PROFILE			SAMPLES			ELEV. SCALE	DYNAMIC PENETRATION RESISTANCE BLOWS / FOOT					LIQUID LIMIT ——— $w_L$ PLASTIC LIMIT ——— $w_p$ WATER CONTENT ——— $w$			BULK DENSITY Y	REMARKS
ELEV. DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	BLOWS / FOOT		SHEAR STRENGTH P.S.F.					WATER CONTENT %				
							○ UNCONFINED + FIELD VANE ● QUICK TRIAXIAL x LAB. VANE					$w_p$ ——— $w$ ——— $w_L$				
						400	800	1200	1600	2000	20	40	60			
730.1	Ground Level															
0.0	Fill		1	SS	2											
723.6	Clayey Silt		2	TW	PM											
6.5	Soft to Firm															
			3	TW	PM	720								119	718.8	
			4	TW	PM									118	Feb. 26 / 71	
	Varved Clay		5	TW	PM	710										
	Layers of silty clay to clayey silt (1/8" to 2") and silt (1/2" to 6")		6	TW	PM									112		
	Firm		7	TW	PM	700								118		
			8	TW	PM									119		
			9	TW	PM	690										
680.1						680										
678.6	Sand, Very Dense		10	SS	125											
51.5	End of Borehole															
	End of Cone Test															

DEPARTMENT OF HIGHWAYS- ONTARIO  
MATERIALS & TESTING OFFICE

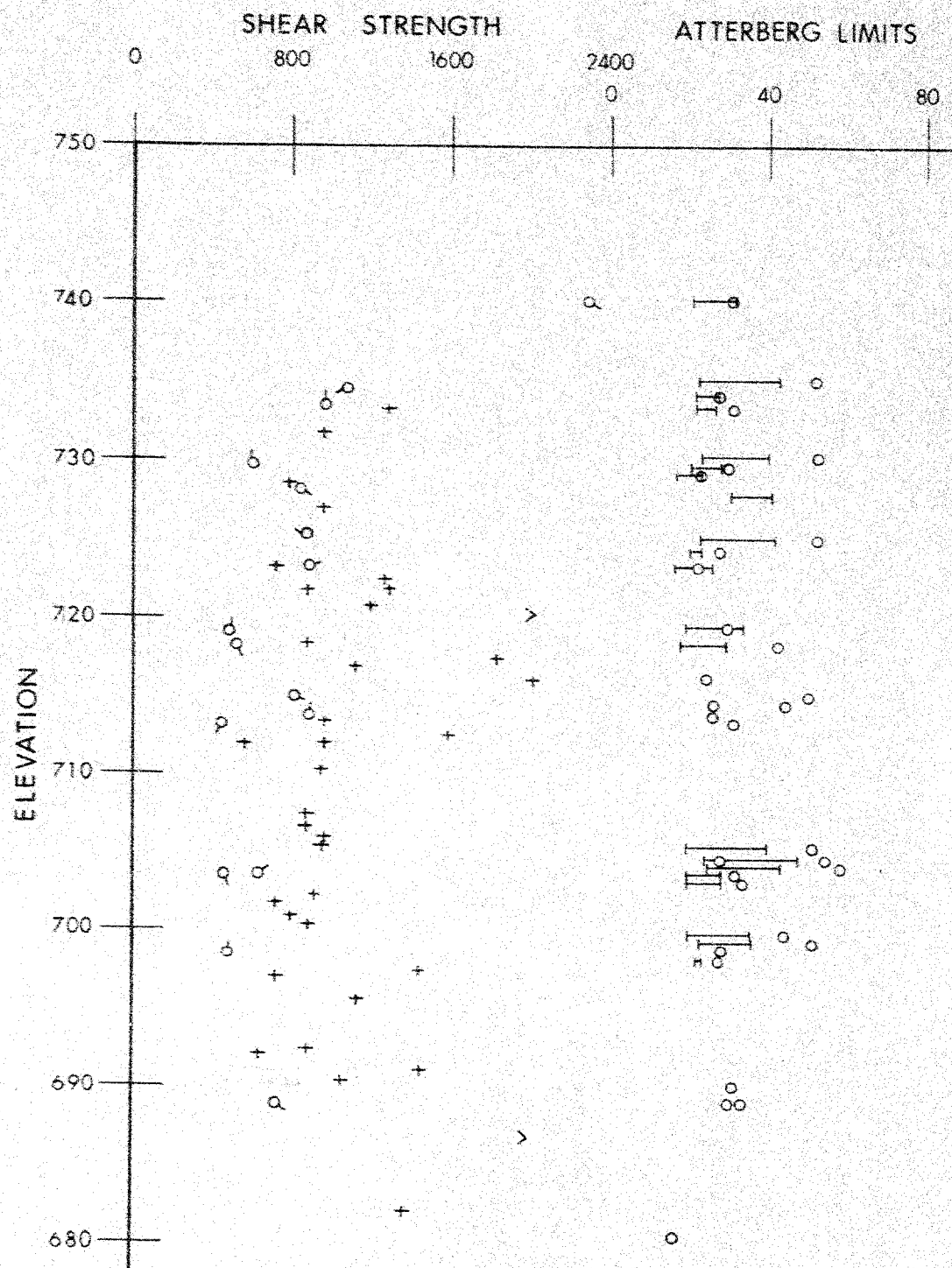
## RECORD OF BOREHOLE No. 4

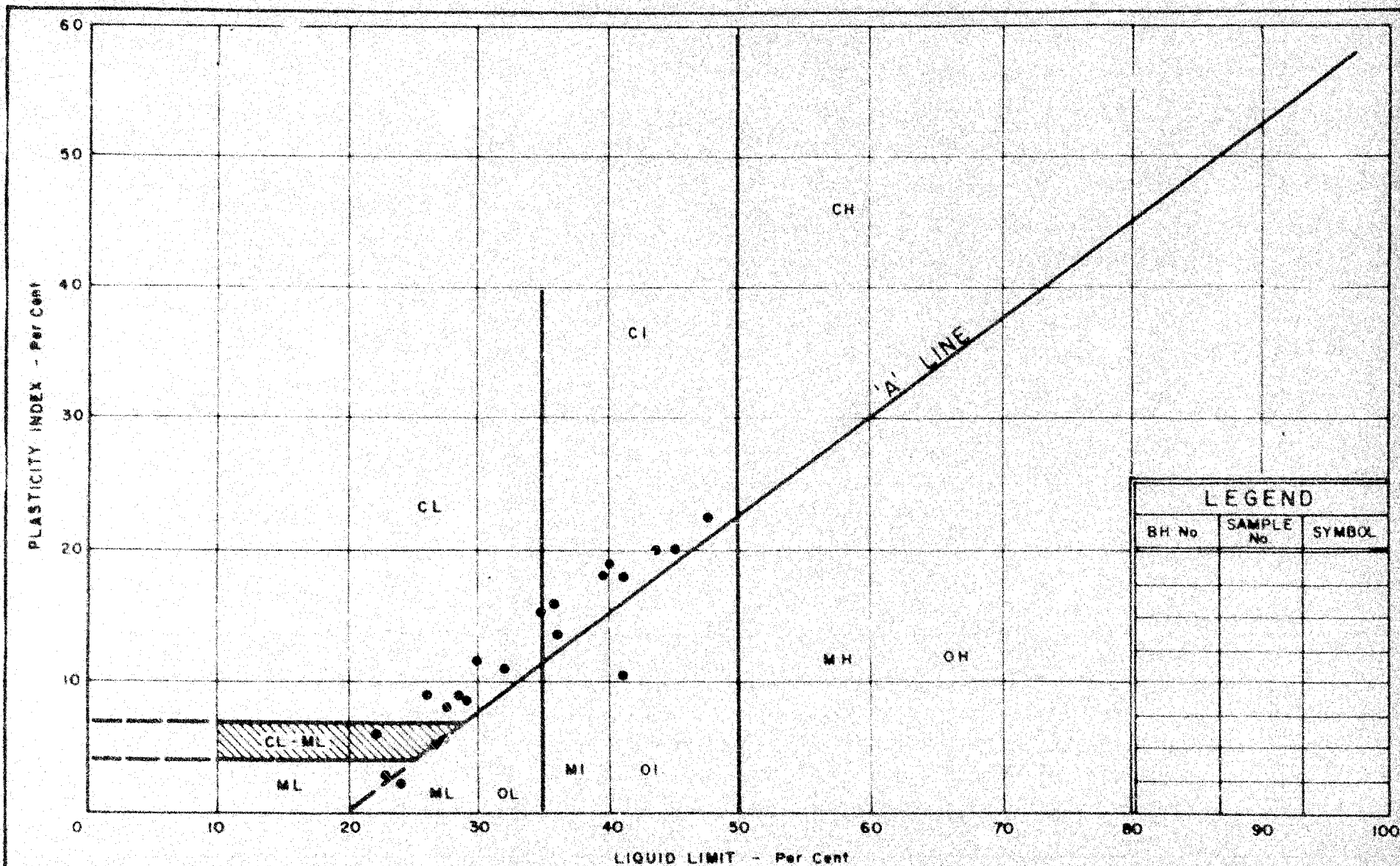
FOUNDATION SECTION

JOB 71-11010 LOCATION Hwy. 65 Sta 262 + 89 o/s 15' Lt. ORIGINATED BY AP  
 W.P. 629-56 BORING DATE Feb. 23, 1971 COMPILED BY AP  
 DATUM Geodetic BOREHOLE TYPE Dynamic Cone Test CHECKED BY AK



# VARIATION OF SHEAR STRENGTH & ATTERBERG LIMITS WITH DEPTH





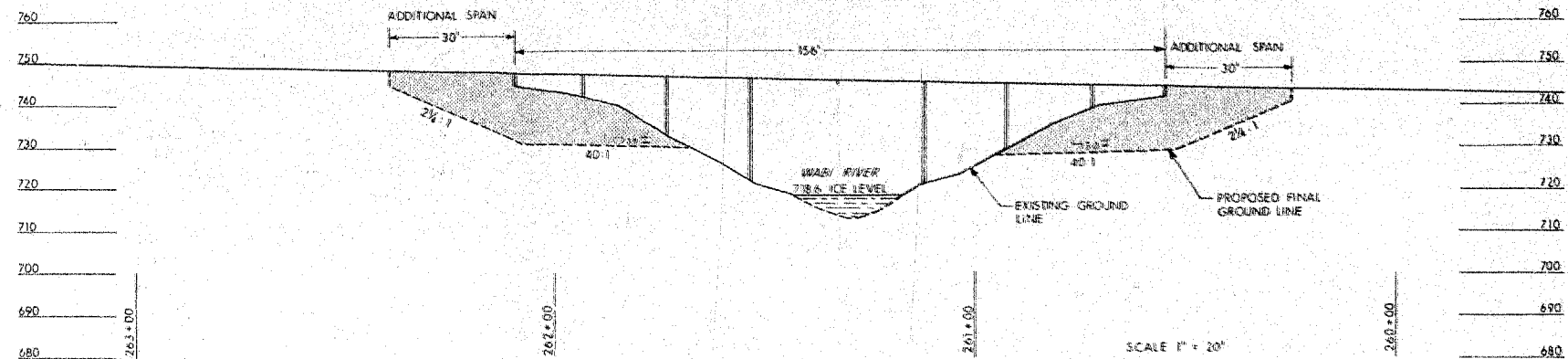
DEPARTMENT OF HIGHWAYS  
MATERIALS and  
TESTING  
DIVISION

## PLASTICITY CHART

WP No. 629 - 56

JOB No. 71 - 11010

FIG. 2



- CONSTRUCTION SEQUENCE :
- ① EXCAVATE SHADED AREAS PROCEEDING FROM HIGHER LEVEL TO LOWER LEVEL. SIDE SLOPES SHOULD BE 2 1/4 HORIZ. TO 1 VERT. OR FLATTER.
  - ② DRIVE PILES TO BEDROCK FOR THE PROPOSED ABUTMENTS.
  - ③ POUR BRIDGE DECK.



# WABI RIVER BRIDGE

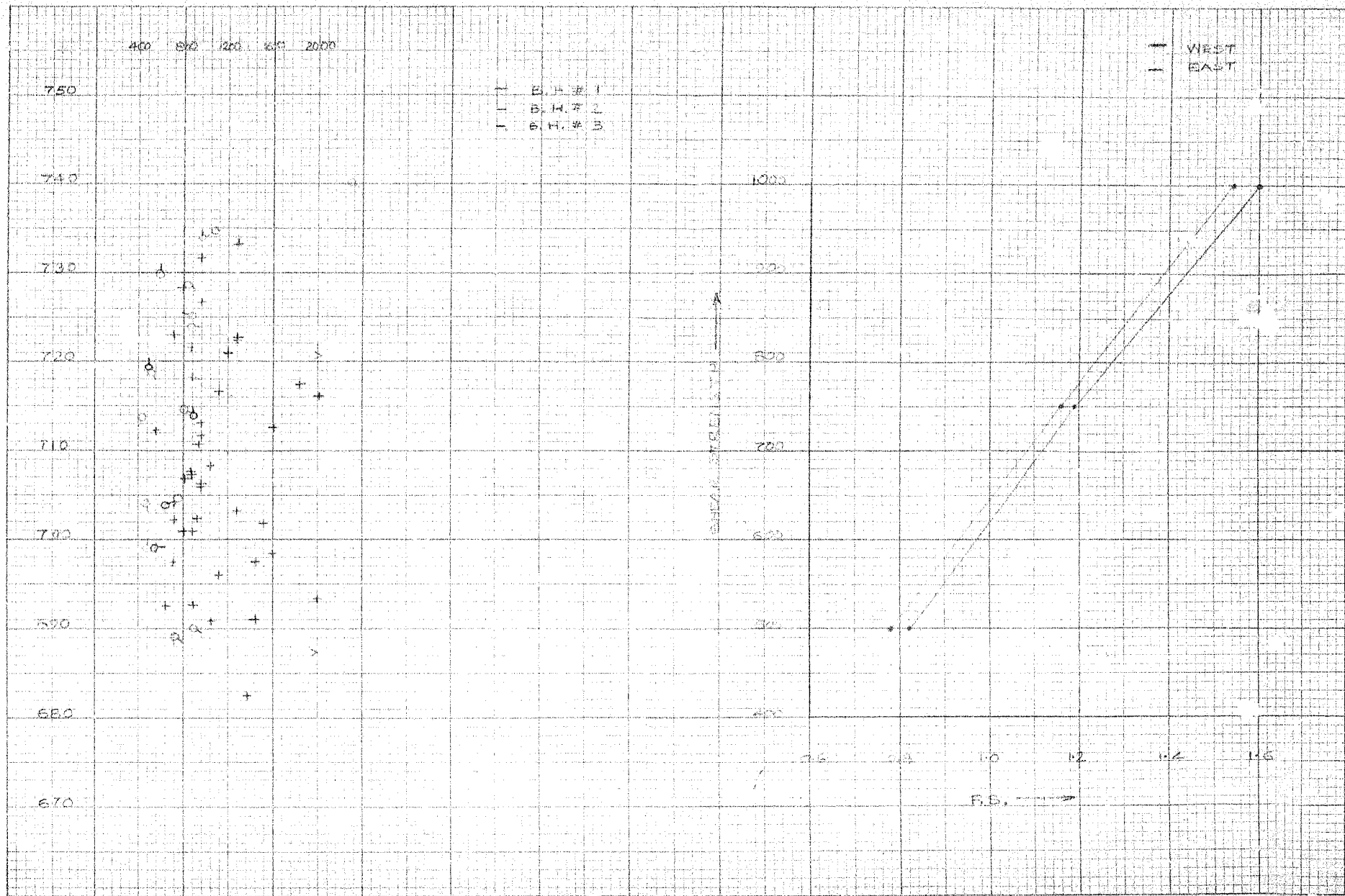
PROPOSED REMEDIAL MEASURES TO STABILIZE  
THE FORWARD SLOPES

DATE APRIL 28, 1971

W.P. NO. 629 - 56

DRAWING NO. 71.11010 B







## SUMMARY OF PILE DRIVING RECORDS

W.O. 71-11010 W.P. 629-56 CONT. 72-161 DIST. 15  
SITE 407 65-5 120-71-01 N481 210

DATE DRIVEN Oct. 72 WEIGHT OF ANVIL 500 LBS

HAMMER TYPE GRAVITY WEIGHT 3500 <sup>FALL</sup> 1 CAS 125 ENERGY 1-12

[illegible]

## BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 14 CONTRACT NO. 72-161 STRUCTURE WAG. CREEK N BRIDGE  
1.0 MI. EAST Hwy 512 at Hwy 615  
 CONTRACTOR JOHN CHISHOLM LTD DESIGN LOAD OF PILE REUSE  
 HAMMER DETAILS: TYPE Heavy Hammer WEIGHT 3500 lb HEIGHT OF FALL OR ENERGY 2'-12"  
Outside String Timber  
 TYPE OF ANVIL OR CAP Steel Cap Wooded Pile WEIGHT OF ANVIL OR CAP 500 lb  
 PILE DETAILS 12 Cords Fir Timber with a 3" wide band 12" from top of pile  
 PILE NO. 36 LOCATION Const Sta 282+28.15 LINE 8 BENT of BATTERED DATE DRIVEN Oct 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.
	1		72	26	3	72	51	3		76	
	2		72	27	3	72	52	3		77	
	3		72	28	3	72	53	3		78	
	4		72	29	3	72	54	3		79	
	5		72	30	3	72	55	3		80	
	6		72	31	3	72	56	3		81	
	7		72	32	3	72	57	4		82	
	8		72	33	3	72	58	4		83	
72	9	2	72	34	4	72	59	4		84	
72	10	2	72	35	4	72	60	12		85	
72	11	2	72	36	4	72	61	REUSE		86	
72	12	2	72	37	3		62			87	
72	13	2	72	38	3		63			88	
72	14	2	72	39	3		64			89	
72	15	3	72	40	3		65			90	
72	16	3	72	41	3		66			91	
72	17	3	72	42	3		67			92	
72	18	3	72	43	3		68			93	
72	19	3	72	44	3		69			94	
72	20	3	72	45	3		70			95	
72	21	3	72	46	3		71			96	
72	22	3	72	47	3		72			97	
72	23	3	72	48	3		73			98	
72	24	3	72	49	3		74			99	
72	25	3	72	50	3		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	63.6'			FINAL CUT OFF ELEVATION 745.08		

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

SIGNED [Signature]  
 NAME (PRINT) R. M. McLean  
 DATE Oct 17/72

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 $\frac{1}{2}$ " 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.

## BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 14 CONTRACT NO. 72-161 STRUCTURE WAB/ CREEK No. 1 BRIDGE  
 CONTRACTOR JOHN CHRISTENSEN LTD. DESIGN LOAD OF PILE REFUSAL  
 HAMMER DETAILS: TYPE GRAVITY HAMMER WEIGHT 2500 LB HEIGHT OF FALL OR ENERGY 2'-12"  
 TYPE OF ANVIL OR CAP OUTSIDE FITTING TIMBER WEIGHT OF ANVIL OR CAP 300 LB  
 PILE DETAILS #12 T&G TIMBER (FIR) WITH A 3" WIRE BAND 12" FROM PILE TOP  
 PILE NO. 30 LOCATION 75' R/S 5026211-5 BENT D LINE 11 DATE DRIVEN OCT 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.
	1		72	26	3		51			76	
	2		72	27	3		52			77	
	3		72	28	3		53			78	
	4		72	29	3		54			79	
	5		72	30	3		55			80	
	6		72	31	3		56			81	
	7		72	32	3		57			82	
	8		72	33	3		58			83	
	9		72	34	3		59			84	
72	10	2	72	35	3		60			85	
72	11	2	72	36	3		61			86	
72	12	2	72	37	3		62			87	
72	13	2	72	38	3		63			88	
72	14	2	72	39	3		64			89	
72	15	2	72	40	3		65			90	
72	16	2	72	41	3		66			91	
72	17	2	72	42	3		67			92	
72	18	2	72	43	3		68			93	
72	19	2	72	44	3		69			94	
72	20	2	72	45	3		70			95	
72	21	2	72	46	3		71			96	
72	22	2	72	47	4		72			97	
72	23	2	72	48	12		73			98	
72	24	2	72	49	Refusal		74			99	
72	25	2		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	63.7'			FINAL CUT OFF ELEVATION 745.43		

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

745.43  
 63.70  
 681.73

SIGNED R. McLean  
 NAME (PRINT) R. McLEAN  
 DATE OCT 5/72  
 ATTACH SKETCH OF PILE NUMBERING SYSTEM  
OCT 17/72





## BRIDGE CONSTRUCTION — PILE DRIVING RECORD

DISTRICT NO. 14 CONTRACT NO. 72-161 STRUCTURE Wash Creek Bridge No. 10191  
East of Hwy 562 on Hwy 65  
 CONTRACTOR John C. Sholman Ltd. DESIGN LOAD OF PILE Refusal  
 HAMMER DETAILS: TYPE Gravity Hammer WEIGHT 3500 lb HEIGHT OF FALL OR ENERGY 1-12  
Inside Fitting Hammer  
 TYPE OF ANVIL OR CAP Pne Cap with Wood Cushion WEIGHT OF ANVIL OR CAP 500 lb  
 PILE DETAILS #12 Timber Pile Cased for 72' Long 3" Wire Band 12" from Pile Top  
 PILE NO. 46 LOCATION 10 R/S A 262146.0 Bent F Line 12 DATE DRIVEN Oct 10/92

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		72	26	3	72	51	3		76	
	2			27	3		52	3		77	
	3			28	3		53	3		78	
	4			29	3		54	3		79	
	5			30	3		55	3		80	
	6			31	3		56	3		81	
	7			32	3		57	3		82	
	8			33	3		58	3		83	
	9			34	3		59	6		84	
72	10	2		35	3		60	6		85	
	11	2		36	3		61	7		86	
	12	2		37	3		62	7		87	
	13	2		38	4		63	8		88	
	14	2		39	4		64	8		89	
	15	2		40	4		65	11		90	
	16	2		41	4		66	Refusal		91	
	17	2		42	4		67			92	
	18	3		43	4		68			93	
	19	3		44	4		69			94	
	20	3		45	4		70			95	
	21	3		46	4		71			96	
	22	3		47	4		72			97	
	23	3		48	4		73			98	
	24	3		49	4		74			99	
	25	3		50	4		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	65.0'			FINAL CUT OFF ELEVATION 746.21		

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

SIGNED [Signature]  
 NAME (PRINT) R. J. McLean  
 DATE Oct 10/92

ATTACH SKETCH OF PILE NUMBERING SYSTEM

746.21  
 65'-0"  
 746.21



**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 $\frac{1}{2}$ " 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.

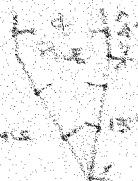
Measured rebounds recorded on this form must be the average for each individual inch for the final six inches of penetration.

Pile Layout West Side White Creek N. of Base 1.0 Mi. East Hwy 36200  
 Hwy 65

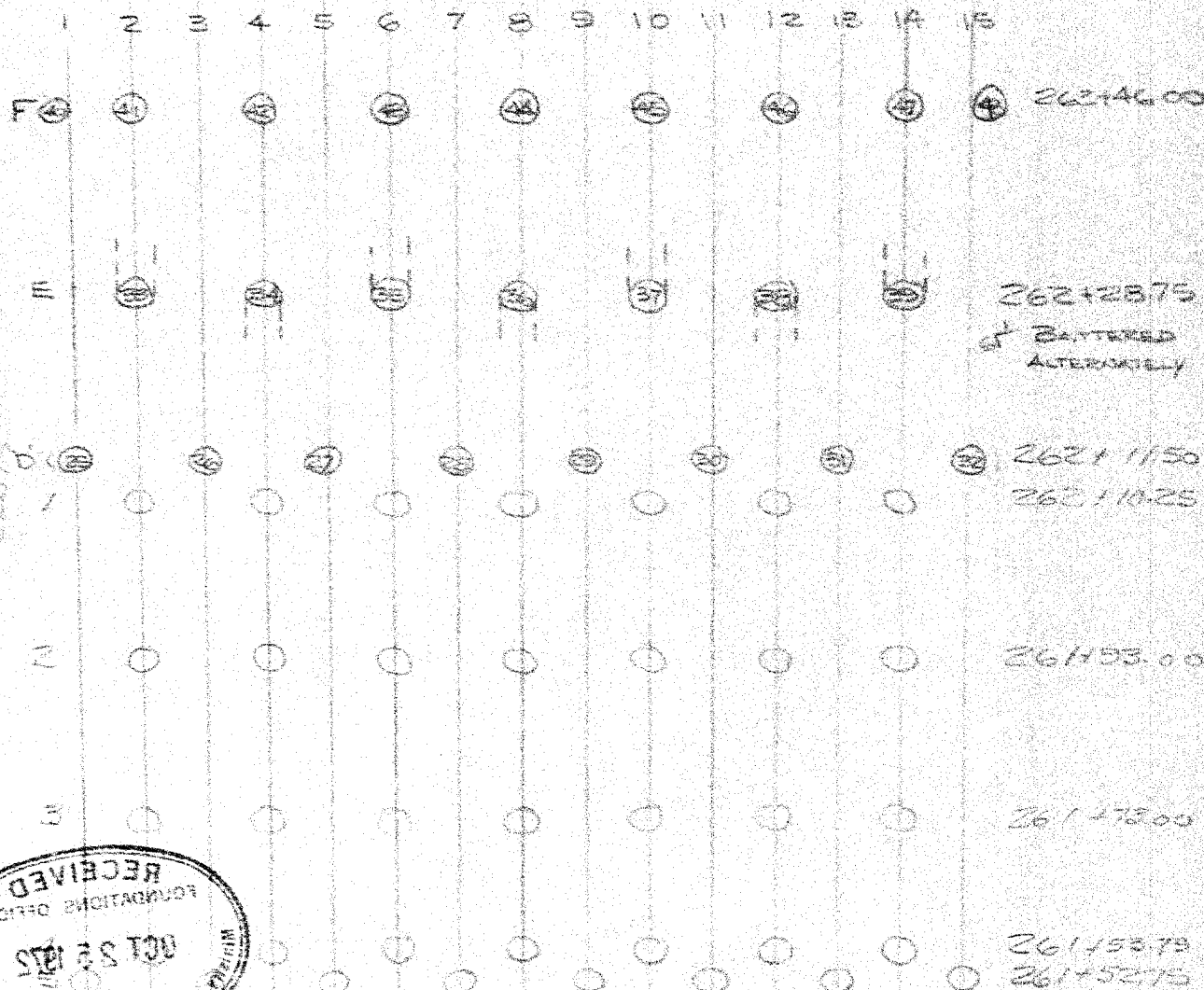
SHOE DETAILS

1/4" x 4" x 34" STEEL

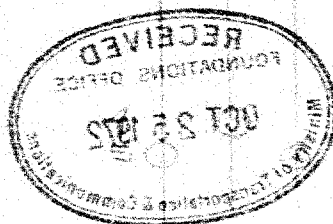
ATTACHED WITH 10-4" NAILS



CONC.  
 LINES (2.5' APART)



BATTERED  
 ALTERNATELY



White Creek flow →



NTS

OVER

624-36  
120-71-01 NEW  
71-11810

## BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 14 CONTRACT NO. 72-161 STRUCTURE WATER CREEK N. BRIDGE 1st E. on Hwy 500 on Hwy 65  
 CONTRACTOR JOHN CRISHAM LTD DESIGN LOAD OF PILE REFUSAL  
 HAMMER DETAILS: TYPE GRAVITY HAMMER WEIGHT 2500 HEIGHT OF FALL OR ENERGY 2-12'  
 TYPE OF ANVIL OR CAP OUTSIDE PILING ANVIL WEIGHT OF ANVIL OR CAP 500 LB  
 PILE DETAILS: 12" 72' TIMBER PILE 3" WIRE BUNDLES 12" FROM TOP OF PILE  
 PILE NO. 1 LOCATION 17.5' STA 260134.5 BENT 'C' LINE 1 DATE DRIVEN SEP 27/72

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.
	1	5	72	26	5	72	51	6		76	
	2	5	72	27	5	72	52	6		77	
	3	5	72	28	5	72	53	6		78	
72	4	3	72	29	5	72	54	6		79	
72	5	4	72	30	5	72	55	6		80	
72	6	4	72	31	4	72	56	6		81	
72	7	5	72	32	4	72	57	7		82	
72	8	5	72	33	4	72	58	11		83	
72	9	5	72	34	4	72	59	11		84	
72	10	5	72	35	4		60			85	
72	11	5	72	36	4		61			86	
72	12	5	72	37	4		62			87	
72	13	6	72	38	4		63			88	
72	14	5	72	39	4		64			89	
72	15	5	72	40	4		65			90	
72	16	5	72	41	4		66			91	
72	17	5	72	42	5		67			92	
72	18	5	72	43	5		68			93	
72	19	5	72	44	5		69			94	
72	20	5	72	45	5		70			95	
72	21	5	72	46	5		71			96	
72	22	5	72	47	5		72			97	
72	23	5	72	48	5		73			98	
72	24	5	72	49	5		74			99	
72	25	5	72	50	6		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	63.5'					FINAL CUT OFF ELEVATION 741.93

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

SIGNED R. J. McLean  
 NAME (PRINT) R. J. McLean  
 DATE SEP 27/72

ATTACH SKETCH OF PILE NUMBERING SYSTEM

741.99  
 89.50

672.49

**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.



## BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 2 CONTRACT NO. 72-161 STRUCTURE WATER CREEK N. BRIDGE 1/4 MI. EAST OF HWY 563 ON HWY 63  
 CONTRACTOR JOHN CHRISTENSEN LTD DESIGN LOAD OF PILE REFUSAL  
 HAMMER DETAILS: TYPE CRANEY HAMMER WEIGHT 2500 LB HEIGHT OF FALL OR ENERGY 2-13'  
 TYPE OF ANVIL OR CAP ANVIL FORMING TAPER THE CAP WITH LEADS CUSHION WEIGHT OF ANVIL OR CAP 500 LB  
 PILE DETAILS #12 TIMBER PILE (HCL) 72' LONG CROOKED 3" WIDE BAND 12' FROM PILE TOP  
 PILE NO. 12 LOCATION 4 CONST 26013725 LINE 8 RENT 6' ENTERED 6' DATE DRIVEN SEPT 30/72

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.
	1		72	23	5	72	51	8		76	
	2		72	27	5	72	52	9		77	
	3		72	28	5	72	53	9		78	
	4		72	29	5	72	54	9		79	
	5		72	30	6	72	55	9		80	
	6		72	31	6	72	56	9		81	
	7		72	32	6	72	57	9		82	
72	8	5	72	33	6	72	58	9		83	
72	9	2	72	34	6	72	59	9		84	
72	10	3	72	35	6	72	60	9		85	
72	11	3	72	36	6	72	61	9		86	
72	12	4		37	6	72	62	REFUSAL		87	
72	13	5		38	6		63			88	
72	14	5		39	6		64			89	
72	15	5	72	40	6		65			90	
72	16	5	72	41	7		66			91	
72	17	5	72	42	8		67			92	
72	18	5	72	43	8		68			93	
72	19	5	72	44	8		69			94	
72	20	4	72	45	8		70			95	
72	21	5	72	46	9		71			96	
72	22	5	72	47	8		72			97	
72	23	5	72	48	8		73			98	
72	24	5	72	49	8		74			99	
72	25	5	72	50	8		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	67.7'			FINAL CUT OFF ELEVATION 740.98		

REPORT TO BE SENT TO: - PRINCIPAL FOUNDATION ENGINEER  
 740.98  
 67.70  
 673.28  
 MATERIALS & TESTING DIVISION  
 DEPARTMENT OF HIGHWAYS  
 DOWNSVIEW, ONTARIO

SIGNED R. J. McLean  
 NAME (PRINT) R. J. McLean  
 DATE Sept 30/72

ATTACH SKETCH OF PILE NUMBERING SYSTEM

NOTE: STARTED DRIVING 8" IN GROUND  
 PILE DRIVEN TO REFUSAL

**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.



## BRIDGE CONSTRUCTION - PILE DRIVING RECORD

DISTRICT NO. 14 CONTRACT NO. 72-161 STRUCTURE WABE CREEK N BRIDGE 1.041  
EAST OF HWY 552 ON HWY 605  
 CONTRACTOR JOHN CHISHOLM LTD DESIGN LOAD OF PILE REFUSAL  
 HAMMER DETAILS: TYPE GRAVITY HAMMER WEIGHT 3500 lb HEIGHT OF FALL OR ENERGY 2'-12"  
CUTS OFF FIRING TINDER  
 TYPE OF ANVIL OR CAP REC' CAP ALUMINUM CUSHION WEIGHT OF ANVIL OR CAP 500 lb  
 PILE DETAILS 12" TINDER PILE (FIR) 72' LONG (CREOSOTED) 3 WIRE BOND 12" FROM PILE TOP  
 PILE NO. 21 LOCATION 5' R. STA 260+20 BENT A LINE 10 DATE DRIVEN Oct 2/72

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.
	1		72	26	5	72	51	5		76	
	2			27	6		52	8		77	
	3			28	6		53	8		78	
	4			29	6		54	8		79	
	5			30	6		55	9		80	
	6			31	6		56	9		81	
	7			32	6		57	8		82	
	8			33	6		58	8		83	
	9			34	6		59	8		84	
	10			35	6		60	8		85	
72	11	3		36	6		61	8		86	
	12	3		37	7		62	9		87	
	13	4		38	7		63	10		88	
	14	4		39	7		64	10		89	
	15	4		40	7		65	12		90	
	16	4		41	7		66	12		91	
	17	4		42	7		67	Refusal		92	
	18	4		43	7		68			93	
	19	4		44	8		69			94	
	20	5		45	8		70			95	
	21	5		46	8		71			96	
	22	5		47	8		72			97	
	23	5		48	8		73			98	
	24	5		49	8		74			99	
	25	5		50	8		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	66.0'					
FINAL CUT OFF ELEVATION	741.46					

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

SIGNED R. J. McLean  
 NAME (PRINT) R. J. McLean  
 DATE Oct 2/72

ATTACH SKETCH OF PILE NUMBERING SYSTEM

741.46  
 66.00  
 675.46

**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.

Wash Creek Flow →



DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

MEMORANDUM

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

FROM: Structural Office,  
West Bldg., Downsview.

ATTENTION:

DATE: March 30, 1972.

OUR FILE REF.

IN REPLY TO

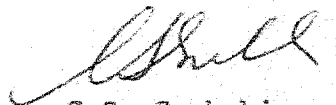
SUBJECT:

Re: Wabi River Bridge Extensions,  
1.0 Miles East of Hwy. #562,  
W.P. #120-71-01, Site 47-45,  
Hwy. No. 65, District #14.

71-11-010

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,  
Structural Design Engineer.

CSG:sr  
Attach.

c.c. Foundation Office.

No comments

K. L. Sully

to B.O.  
2 Feb. 72  
JR

DEPARTMENT OF TRANSPORTATION AND COMMUNICATIONS

Copy for the information of

A. Stermac

J.W. McMillister,  
Asst. Bridge Planning Supvr.,  
North Bay Regional Office.

Structural Office,  
West Bldg., Downsview.

February 28, 1972.

Re: Wabigoon River Br. Extensions,  
1.0 mile E. of Hwy. #552,  
W.P. 120-71-01, Site 47-45,  
Hwy. No. 65, District #14.

71-11-010  
67-F-57

Attached herewith are prints of the Preliminary Bridge  
Plan Drawing D-47-45-P1 for the above-mentioned structure.

The estimated cost of the proposed structure is  
\$47,000.00, which includes tender, materials, engineering and  
sundry construction.

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

C.S. Grebski,  
Structural Design Engineer.

CEG:sr  
Attach.

c.c. A. McKin  
B. Davis  
A. Stermac (2)  
J. Anderson  
R. Murphy

No comments

K. L. Sully  
March 23<sup>rd</sup> 1972

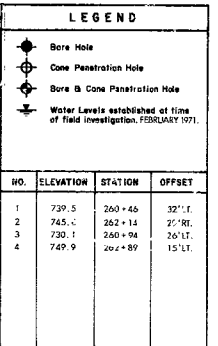
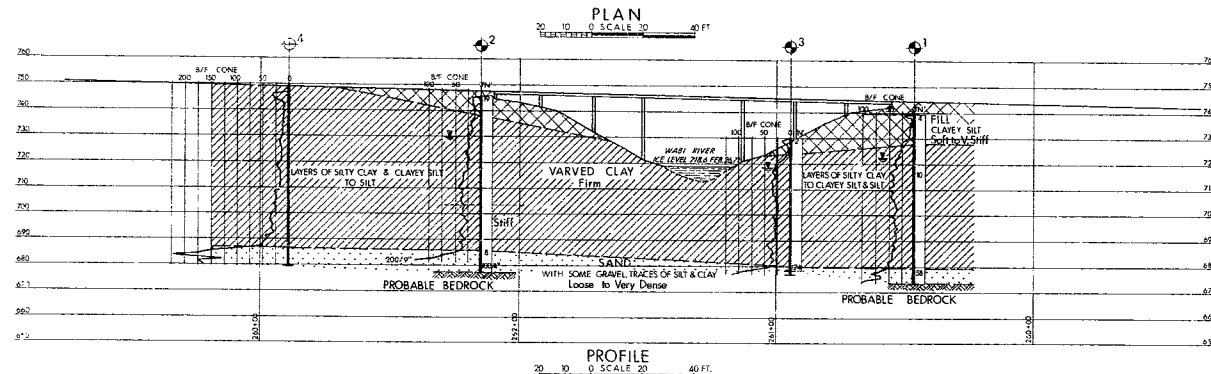
CONT. 72-161

HWY. 65

TWP. OF KERNS

31M-18





- 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.

[illegible]

DEPARTMENT OF HIGHWAYS - ONTARIO			
MATERIALS & TESTING OFFICE - FOUNDATION SECTION			
WABI RIVER			
KING'S HIGHWAY NO.	65	DIST. NO.	14
DIST. <u>TIMISKAMING</u>			
TWP.	KERNS	LOT	11
		CON.	V
BORE HOLE LOCATIONS & SOIL STRAT.			
BURN'S A.P.	CHECKED <u>HC</u>	REF. NO.	629 - 56
GRANER S.P.	CHECKED <u>HC</u>	JOB NO.	71 - 11010
DATE: APRIL 19, 1971		SITE NO.	
APPROVED <u>W. J. G. [Signature]</u>		PROJECT DRAWING NO.	
REGIONAL ENGINEER			

GEOCREG NO. 31M-18