

DIST. 2 REGION                     

W.P. No. \_\_\_\_\_

CONT. No. \_\_\_\_\_

W. O. No. 91-11011

STR. SITE No. \_\_\_\_\_

HWY. No. 606

LOCATION County Rd. 43 at Otter  
Creek, County of Elgin

No of PAGES - 1

OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. \_\_\_\_\_

REMARKS: \_\_\_\_\_



**Golder Associates Ltd.**  
CONSULTING ENGINEERS

**FAXED**  
Dec 19/91

December 19, 1991

911-3401

The Corporation of the County of Elgin  
450 Sunset Drive  
St. Thomas, Ontario  
N5R 5V1

**COPY**

Attention: Mr. R.G. Moore, P. Eng.

RE: SUMMARY OF PILE INSTALLATIONS  
PHILLMORE BRIDGE REPLACEMENT  
COUNTY ROAD 43 AT OTTER CREEK  
COUNTY OF ELGIN, ONTARIO

Dear Sirs:

This letter summarizes the results of our inspection of the pile installation operation recently carried out in conjunction with the above project. The piling operation was carried out by Bermingham Construction Co. Ltd. between December 9 and 16, 1991 under the inspection of a member of our engineering staff between December 10 and 16, 1991.

#### BACKGROUND

The results of the geotechnical investigation carried out for the design of the bridge foundations were provided previously in Golder Associates Report No. 901-3465 entitled "Geotechnical Investigation, Proposed Phillmore Bridge Replacement, Lot 111, South Talbot Road, Township of Bayham, County of Elgin, Ontario" dated January 1991. Based on the results of the investigation, factored Ultimate Limit States and Serviceability Limit States, Type II pile capacities of 1,200 and 800 kilonewtons, respectively, were recommended for design purposes.

#### NORTH ABUTMENT

Nine piles, numbered 1 through 9, inclusive, were driven for the north abutment. The steel tube piles with an outside diameter of 324 millimetres, were driven closed ended to an approximate final tip elevation of 172.9 metres using a B300 diesel hammer with a direct drive cap system and a rated energy of 54,650 joules per blow. Dynamic monitoring and Hiley driving tests carried out during the pile driving operation indicated that the design pile capacity was achieved for all piles. Based on the driving resistance and the results of the boreholes drilled at the site, ultimate pile capacities were calculated using a coefficient of restitution of 0.32. The results of the pile monitoring are summarized in Table I and the pile locations are shown on the attached Plan, Figure 1. The total length of piling installed for the north abutment was 134.1 metres.

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SOUTH ABUTMENT

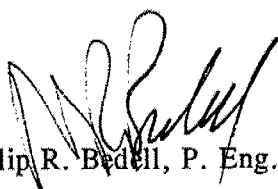
Five piles, number 10 through 14, inclusive, were driven to an approximate final tip elevation of 172.8 metres while piles 15 and 16 were driven to final tip elevations of 170.0 and 160.3 metres. Dynamic monitoring and driving tests during the pile driving operation indicated that the design pile capacity was achieved for all piles. The results of the pile monitoring are summarized in Table II and the pile locations are shown on the attached Plan, Figure 1. The total length of piling driven for the south abutment was 114.97 metres.

The results of the laboratory testing of concrete cylinders cast during concreting of the piles will be forwarded as they become available.

We trust that this letter and the attached are sufficient for your present requirements. Should you have any questions, please do not hesitate to contact this office.

Yours truly,

GOLDER ASSOCIATES LTD.



Philip R. Bedell, P. Eng.

AMH/PRB/et

Attachments

cc. G. Aleong, P. Eng.  
Totten Sims Hubicki Associates Limited

SUMMARY OF PILE INSTALLATIONS  
NORTH ABUTMENT

Phillmore Bridge Replacement  
County Road 43 at Otter Creek  
County of Elgin, Ontario

<u>PILE</u>	<u>DATE OF DRIVING</u> (1991)	<u>BATTER</u> (V:H)	<u>PILE LENGTH</u> (m)	<u>FINAL TIP ELEVATION</u> (m)	<u>FACTORED PILE CAPACITY</u>	
					<u>ULS</u> (kN)	<u>SLS II</u> <u>(Estimated)</u> (kN)
1	Dec. 9 & 10	3:1	15.02	172.96	1310	875
2	Dec. 9 & 10	3:1	15.26	172.73	1340	890
3	Dec. 9 & 10	3:1	15.14	172.84	1250	840
4	Dec. 9 & 10	3:1	14.93	173.04	1410	940
5	Dec. 10	3:1	14.81	173.15	1340	930
6	Dec. 10	3:1	14.96	173.01	1260	840
7	Dec. 10	3:1	15.05	172.93	1330	880
8	Dec. 11	10:1	14.39	172.89	1350	900
9	Dec. 10 & 11	10:1	14.58	172.70	1550	1040

NOTES: -All piles are steel tube piles with outside diameter of 324 millimetres  
and wall thickness of 9.53 millimetres.  
-Pile cut off elevation is 187.20 metres.

SUMMARY OF PILE INSTALLATIONS  
SOUTH ABUTMENT

Phillmore Bridge Replacement  
County Road 43 at Otter Creek  
County of Elgin, Ontario

<u>PILE</u>	<u>DATE OF DRIVING</u> (1991)	<u>BATTER</u> (V:H)	<u>PILE LENGTH</u> (m)	<u>FINAL TIP ELEVATION</u> (m)	<u>FACTORED PILE CAPACITY</u>	
					<u>ULS</u> (kN)	<u>SLS II</u> (Estimated) (kN)
10	Dec. 13	3:1	15.64	172.76	860	1280
11	Dec. 13	3:1	15.77	172.64	810	1210
12	Dec. 13	3:1	15.51	172.89	830	1240
13	Dec. 13 & 16	3:1	15.52	172.88	970	1460
14	Dec. 16	3:1	15.62	172.78	860	1290
15	Dec. 16	10:1	17.70	169.99	1080	1620
16	Dec. 16	10:1	19.21	168.3^	820~	1230~

- NOTES:
- All piles are steel tube piles with outside diameter of 324 millimetres and wall thickness of 9.53 millimetres.
  - Pile cut off elevation is 187.60 metres.
  - ~Driving test not carried out on pile number 16.
  - ^Top of pile number 16 approximately 20 millimetres below cut off elevation.

# PILE LOCATION PLAN

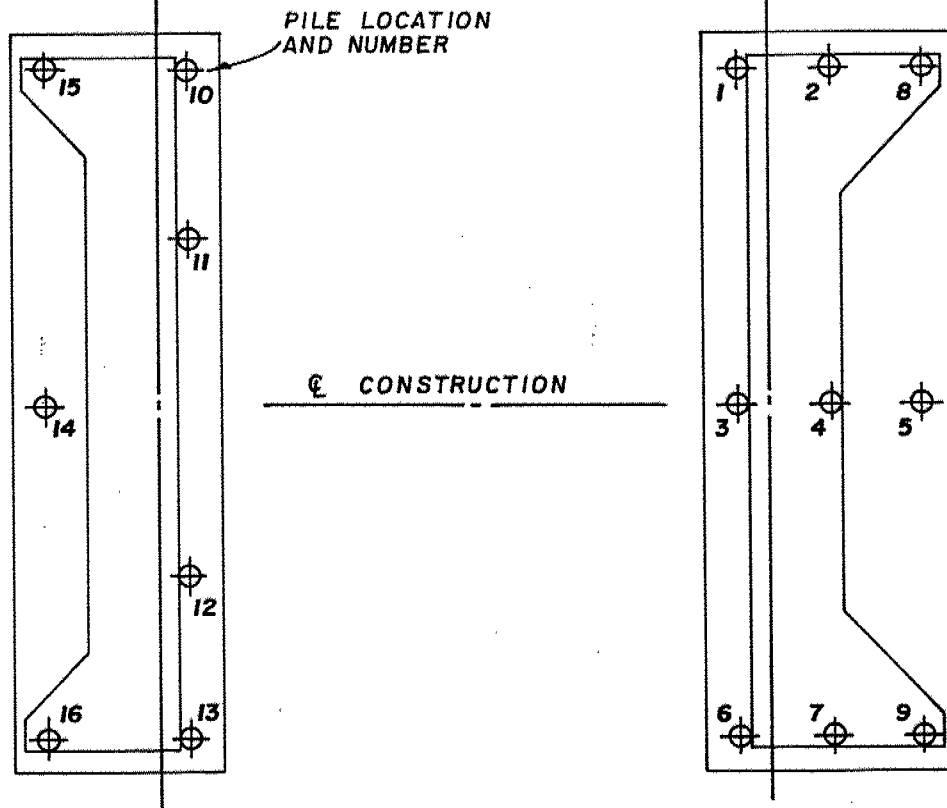
FIGURE 1

PHILLMORE BRIDGE REPLACEMENT, ELGIN COUNTY RD. 43 AT OTTER CR.



☒ SOUTH ABUTMENT BRG'S

☒ NORTH ABUTMENT BRG'S.



THIS DRAWING IS SCHEMATIC ONLY  
AND IS TO BE READ IN CONJUNCTION  
WITH ACCOMPANYING LETTER.

Date DEC. 18, 1991  
Project 911-3401

**Golder Associates**

Drawn WDF  
Chkd -

# OVERSIZE DRAWING(S)

PROJECT: 901-3465

LOCATION: STA. 7+23.

SAMPLER HAMMER, 140 lbs.; DROP, 30 in.

## RECORD OF BOREHOLE 1

BORING DATE: DEC. 20, 1990

SHEET 1 OF 2

DATUM: GEODETIC

PENETRATION TEST HAMMER, 140 lbs.; DROP, 30 in.



DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE		SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/FT		HYDRAULIC CONDUCTIVITY, k, cm/s		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT ELEV. DEPTH (ft)	NUMBER	TYPE	BLOWS/FT	SHEAR STRENGTH Cu, psf	WATER CONTENT, PERCENT Wp   W   Wi				
-5												
0		GROUND SURFACE	618.4 0.0									
		Loose brown fine to medium SAND, trace silt, occ. rootlets, shell, and wood fragment, occ. silt layer		1	N DO	5						
5		Loose brown SILT, occ. silty sand layer	614.6 4.8	2	N DO	7						
		Compact to loose brown SILTY FINE SAND, occ. silt layer	612.2 7.2	3	N DO	10						
10				4	N DO	8						
		Compact to loose grey fine to medium SAND, trace silt, numerous shells and wood fragments	607.2 12.2	5	N DO	10						
15				6	N DO	6						
		Very stiff grey SILTY CLAY, occ. gravel	602.1 17.3	7	N DO	20						
20				8	N DO	18						
				9	N DO	18						
25				10	N DO	37						
		Hard grey CLAYEY SILT, trace sand, occ. gravel and silty clay layer (TILL)	594.8 24.5	11	N DO	37						
30				12	N DO	47						
				13	N DO	39						
35		CONTINUED ON NEXT PAGE										

DATA INPUT: W.D.F.

DEPTH SCALE

1 inch to 5 feet

0 15 10 5 PERCENT AXIAL STRAIN AT FAILURE

Golder Associates

LOGGED: F.F.

CHECKED:

Augered Material

MH

Piezometer No. 2

H

Caved Material  
Bentonite Seal



PROJECT: 901-3465

LOCATION: STA. 7+23

SAMPLER HAMMER, 140 lbs; DROP, 30 in.

## RECORD OF BOREHOLE 1

BORING DATE: DEC. 20, 1990

SHEET 2 OF 2

DATUM: GEODETIC

PENETRATION TEST HAMMER, 140 lbs.; DROP, 30 in.



DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/FT	HYDRAULIC CONDUCTIVITY, k, cm/s		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT ELEV. DEPTH (ft)	NUMBER TYPE BLOWS/FT	WATER CONTENT, PERCENT Wp — W — Wl 10 20 30 40					
35	POWER AUGER (HOLLOW STEM)	CONTINUED FROM PREVIOUS PAGE								
		Hard grey CLAYEY SILT (TILL)	582.4 37.0	14 N DO	42					
		Very dense grey SILT, trace clay, occ. sandy silt layer		15 N DO	78					
40				16 N DO	100					
		Hard grey CLAYEY SILT, trace sand, occ. gravel (TILL)	577.4 42.0	17 N DO	30					
45				18 N DO	38					
		Very dense grey SANDY SILT, some clay, occ. gravel (TILL)	572.4 47.0	19 N DO	85					
50				20 N DO	105					
		Very dense grey SANDY SILT, occ. clayey silt layer	567.4 52.0	21 N DO	100 / 5in.					
55				22 N DO	100 / 4in.					
	Hard grey CLAYEY SILT, trace sand, occ. gravel (TILL)	562.4 57.0	23 N DO	106						
60		END OF BOREHOLE	560.4 59.0							

WL ENCOUNTERED  
AT ELEV. 611.8  
AND 581.8  
DURING DRILLING  
DEC. 20, 1990

SEE TABLE 1  
FOR ADDITIONAL  
WATER LEVELS

15 5 PERCENT AXIAL STRAIN AT FAILURE  
10

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED: F.F.

CHECKED:

DATA INPUT: W.D.F.

PROJECT: 901-3465

LOCATION: STA. 8+45.5

SAMPLER HAMMER, 140 lbs.; DROP, 30 in.

## RECORD OF BOREHOLE 2

BORING DATE: DEC. 20 &amp; 21, 1990

SHEET 1 OF 2

DATUM: GEODETIC

PENETRATION TEST HAMMER, 140 lbs.; DROP, 30 in.



DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/FT		HYDRAULIC CONDUCTIVITY, K, cm/s		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT ELEV. DEPTH (ft)	NUMBER TYPE	BLOWS/FT	SHEAR STRENGTH Cu, psf	WATER CONTENT, PERCENT Wp   W   Wl				
0		GROUND SURFACE	618.0								
0.1		Brown sandy TOPOSIL, occ. rootlet	0.1	1	DO	4					
5		Loose brown fine SAND, occ. rootlet and shell fragment, occ. silt layer	811.3	2	DO	4					
5		Loose brown SANDY SILT	811.3	3	DO	5					
10		Loose to very loose brown becoming grey at elev. 604.0 ft. SILTY FINE SAND, occ. sandy silt layers, numerous shell and wood fragments	606.2	4	DO	5					
15			606.2	5	DO	3					
20		Stiff to very stiff grey SILTY CLAY	598.7	6	DO	2					
20			598.7	7	DO	12					
25			598.7	8	DO	17					
25			598.7	9	DO	17					
25		Very stiff to hard grey CLAYEY SILT, trace sand, occ. gravel, silt and silty clay layers (TILL)	591.5	10	DO	24					
30			591.5	11	DO	23					
30			591.5	12	DO	65					
35			591.5	13	DO	45					

POWER AUGER  
(HOLLOW STEM)

Augered Material

MH

CONTINUED ON NEXT PAGE

15 5 PERCENT AXIAL STRAIN AT FAILURE

DEPTH SCALE  
1 inch to 5 feet

Golder Associates

LOGGED: F.F.  
CHECKED:

PROJECT: 901-3465

## RECORD OF BOREHOLE 2

SHEET 2 OF 2

LOCATION: STA. B+45.5

BORING DATE: DEC. 20 &amp; 21, 1990

DATUM: GEODETIC

SAMPLER HAMMER, 140 lbs; DROP, 30 in.

PENETRATION TEST HAMMER, 140 lbs.; DROP, 30 in.



DEPTH SCALE FEET	BORING METHOD	SOIL PROFILE			SAMPLES			DYNAMIC PENETRATION RESISTANCE, BLOWS/FT			HYDRAULIC CONDUCTIVITY, k, cm/s			ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (ft)	NUMBER	TYPE	BLOWS/FT	SHEAR STRENGTH			WATER CONTENT, PERCENT				
								Cu, psf	nat.V - + rem.V - @	Q - ● U - ○	Wp	W	Wl		

35	POWER AUGER (HOLLOW STEM)	CONTINUED FROM PREVIOUS PAGE													<div>Caved Material</div> <div>Bentonite Seal</div> <div>Gravel Backfill</div> <div>Caved Material</div> <div>Piezometer No. 1</div> <div>WL ENCOUNTERED AT ELEV. 608.5, 570.0 AND 580.0 DURING DRILLING DEC. 20&amp;21, 1990</div> <div>SEE TABLE I FOR ADDITIONAL WATER LEVELS</div>
		Very stiff to hard grey CLAYEY SILT (TILL)		14	N DO	37							○		
				15	N DO	31							○		
40				18	N DO	35							○		
			574.0 42.0	17	N DO	54					○				
		Very dense grey SANDY SILT, trace to some clay, occ. gravel (TILL)		18	N DO	80					○				
45				19	N DO	90					○				
			566.5 49.5	20	N DO	125 / 6in.					○				
		Very dense grey SILT		21	N DO	101					○				
50			564.0 52.0	22	N DO	86					○				
		Hard grey CLAYEY SILT, trace sand, occ. gravel (TILL)		23	N DO	45 / 6in.					○				
55			559.0 57.0	24	N DO	WH					○				
		Very loose to very dense grey SILT, trace sand, occ. wood fragment		25	N DO	51						○			
60			552.0 64.0												
		END OF BOREHOLE													
65															
70															
75															

DATA INPUT: W.D.F.

15 0 5 PERCENT AXIAL STRAIN AT FAILURE  
10

WL ENCOUNTERED  
AT ELEV. 608.5,  
570.0 AND 560.0  
DURING DRILLING  
DEC. 20&21, 1990

SEE TABLE I  
FOR ADDITIONAL  
WATER LEVELS

DEPTH SCALE

1 inch to 5 feet

Golder Associates

LOGGED: F.F.

CHECKED:

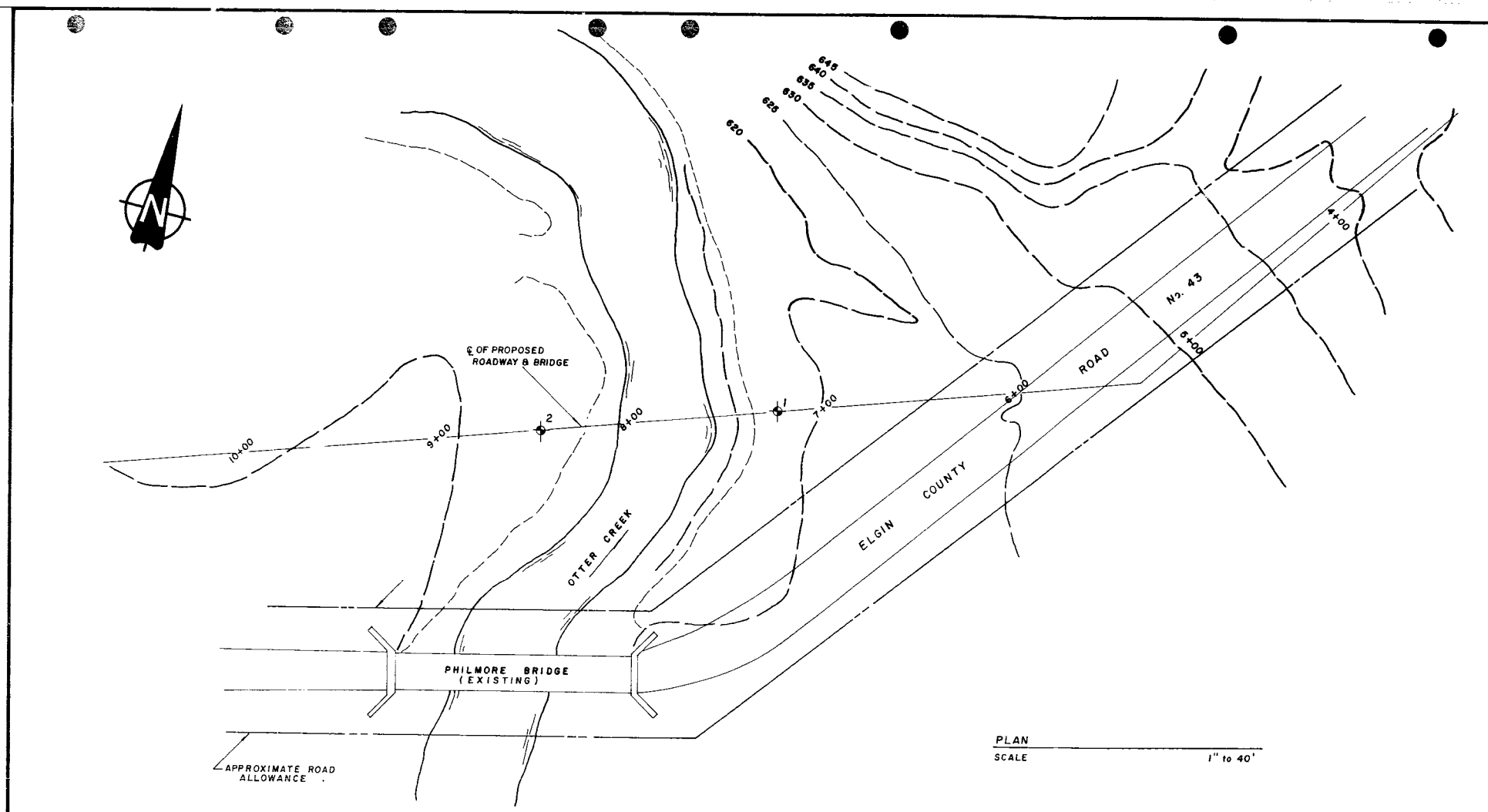
SUMMARY OF PILE INSTALLATIONS  
SOUTH ABUTMENT

Phillmore Bridge Replacement  
County Road 43 at Otter Creek  
County of Elgin, Ontario

<u>PILE</u>	<u>DATE OF DRIVING</u> (1991)	<u>BATTER</u> (V:H)	<u>PILE LENGTH</u> (m)	<u>FINAL TIP ELEVATION</u> (m)	<u>FACTORED PILE CAPACITY</u>	
					<u>ULS</u> (kN)	<u>SLS II</u> (Estimated) (kN)
10	Dec. 13	3:1	15.64	172.76	1280	860
11	Dec. 13	3:1	15.77	172.64	1210	810
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13	Dec. 13 & 16	3:1	15.52	172.88	1460	970
14	Dec. 16	3:1	15.62	172.78	1290	860
15	Dec. 16	10:1	17.70	169.99	1620	1080
16	Dec. 16	10:1	19.21	168.3^	1230~	820~

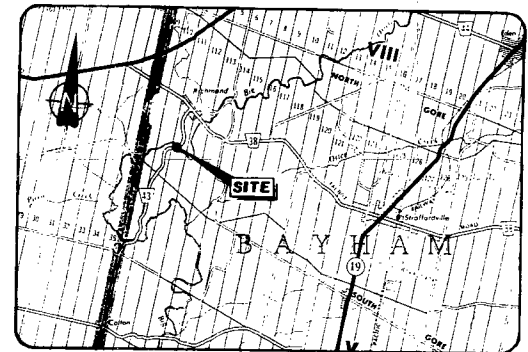
NOTES:

- All piles are steel tube piles with outside diameter of 324 millimetres and wall thickness of 9.53 millimetres.
- Pile cut off elevation is 187.60 metres.
- ~Driving test not carried out on pile number 16.
- ^Top of pile number 16 approximately 20 millimetres below cut off elevation.



**LOCATION PLAN**

FIGURE 1



**LEGEND**

BOREHOLE LOCATION IN PLAN

**REFERENCE**

PLAN SUPPLIED BY CORPORATION OF COUNTY OF ELGIN  
ENTITLED PLAN OF PHILMORE BRIDGE AREA  
LOT III, SOUTH TALBOT ROAD  
TOWNSHIP OF BAYHAM  
COUNTY OF ELGIN  
SCALE 1" to 40' DATED DEC. 4, 1990

PLAN  
SCALE 1" to 40'

40115-30  
GEOCRE No.

JAN. 10, 1991  
Date  
901-3485  
Project

**Golder Associates**

DCJ  
Drawn  
CHKD