

G.I.-30 SEPT. 1976

GEOCRES No. 40I13-43DIST. 2 REGION W.P. No. 40-66-12CONT. No. 80-77W. O. No. STR. SITE No. 19-528HWY. No. 402LOCATION Conc. Rd. 6 Underpass
5.3 mi W of Hwy 2No of PAGES -

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OVERSIZE DRAWINGS TO BE INCLUDED WITH THIS REPORT. REMARKS:

TO BE USED
FOR ESTIMATING
PURPOSES ONLY

DATE MAY 23, 1978

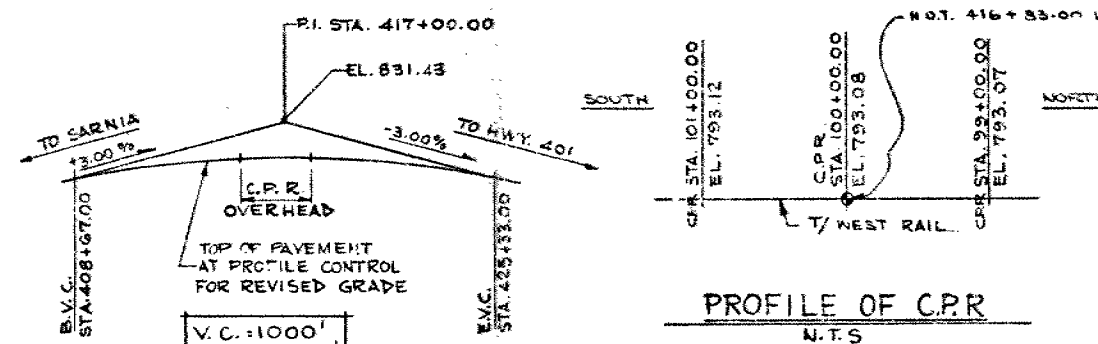
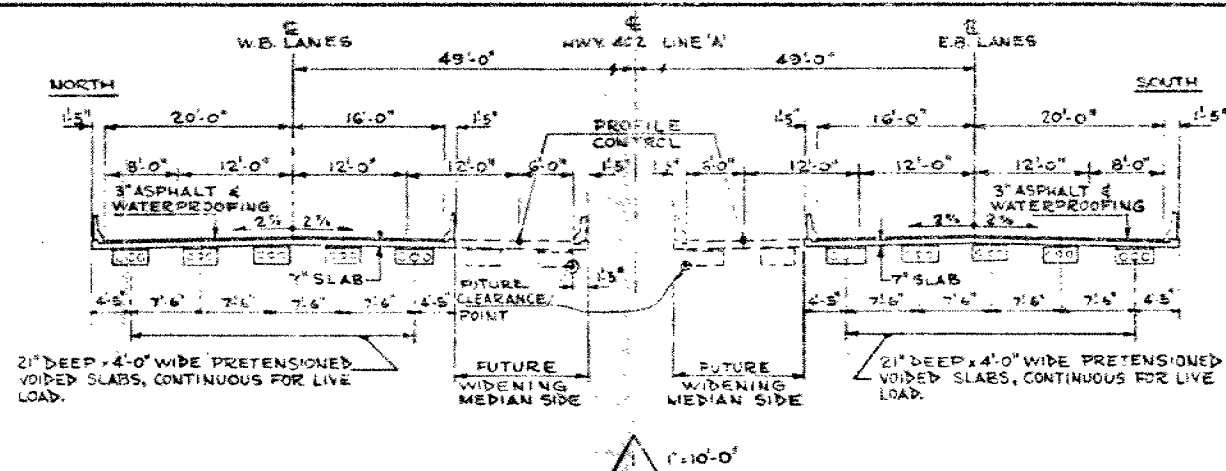
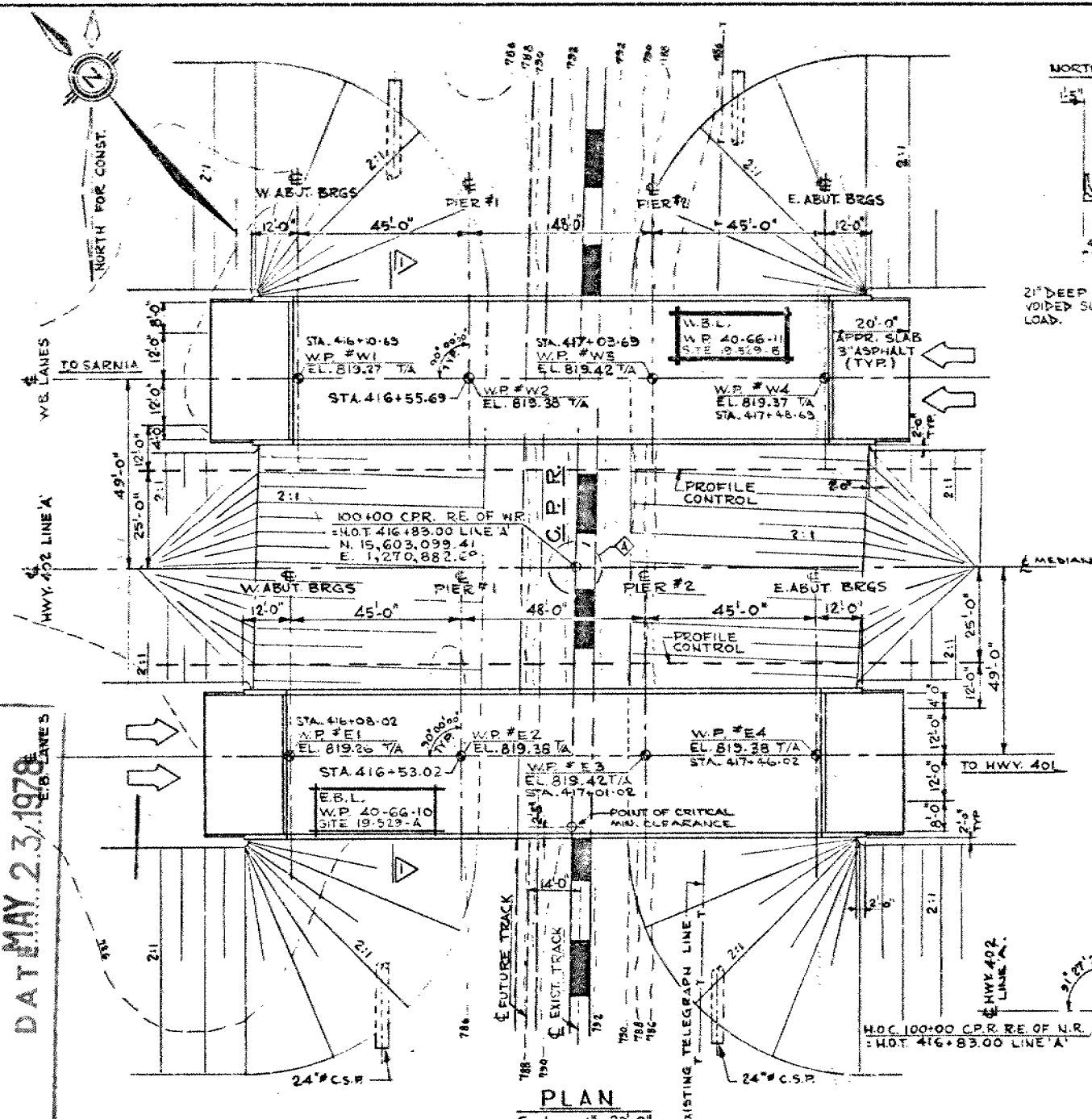
DIST. No 2
CONT No
WP No 40-66-11

SHEET

HWY 402, C.P.R. OVERHEAD
3.2 MILES WEST OF HWY 2
N.B. LANES BRIDGE
GENERAL LAYOUT

Mortenson, Harshfield,
Bryce & Hoggan, Limited
Consulting Engineers

MINIBU



PROFILE OF HWY. 402 ALONG
PROFILE CONTROL (LINE 'A')
(N.T.S.)

CONCRETE QUANTITIES

CONCRETE QUANTITIES ARE LISTED BELOW FOR THE
APPROXIMATE LUMP SUM TENDER ITEMS:

a) CONCRETE IN PIERS	26 CU. YDS.
b) CONCRETE IN ABUTMENTS & WINGWALLS	33 CU. YDS.
c) CONCRETE IN DECK & DIAPHRAGMS	145 CU. YDS.
d) CONCRETE IN BARRIER WALLS	27 CU. YDS.
e) CONCRETE IN APPROACH SLABS	47 CU. YDS.

LIST OF DRAWINGS

- 19-523-B - 1 GENERAL LAYOUT.
19-523-B - 2 BORING LOCATIONS & SOIL STRATA.
3 FOUNDATION LAYOUT & TRACK PROTECTION.
4 FOOTING REINFORCING & DETAILS.
5 WEST ABUTMENT & WINGWALLS.
6 EAST ABUTMENT & WINGWALLS.
7 PIER DETAILS.
8 SCREE ELEVATIONS & BEARING DETAILS.
9 BEAM LAYOUT & DETAILS.
10 DECK REINFORCEMENT DETAILS.
11 BARRIER WALL.
12 STEEL RAILING (SINGLE TUBE).
13 20 FT. APPROACH SLABS (BARRIER WALL).
14 STANDARD DETAILS I.
15 STANDARD DETAILS II.
16 STANDARD DETAILS III.
17 AS CONSTRUCTED ELEVATIONS & DIMENSIONS.

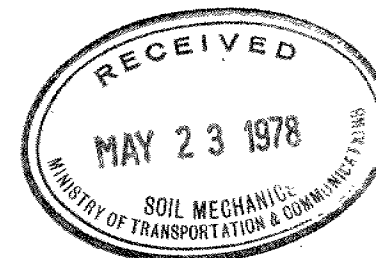
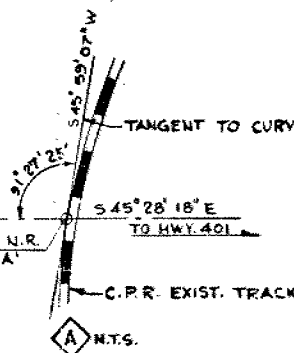
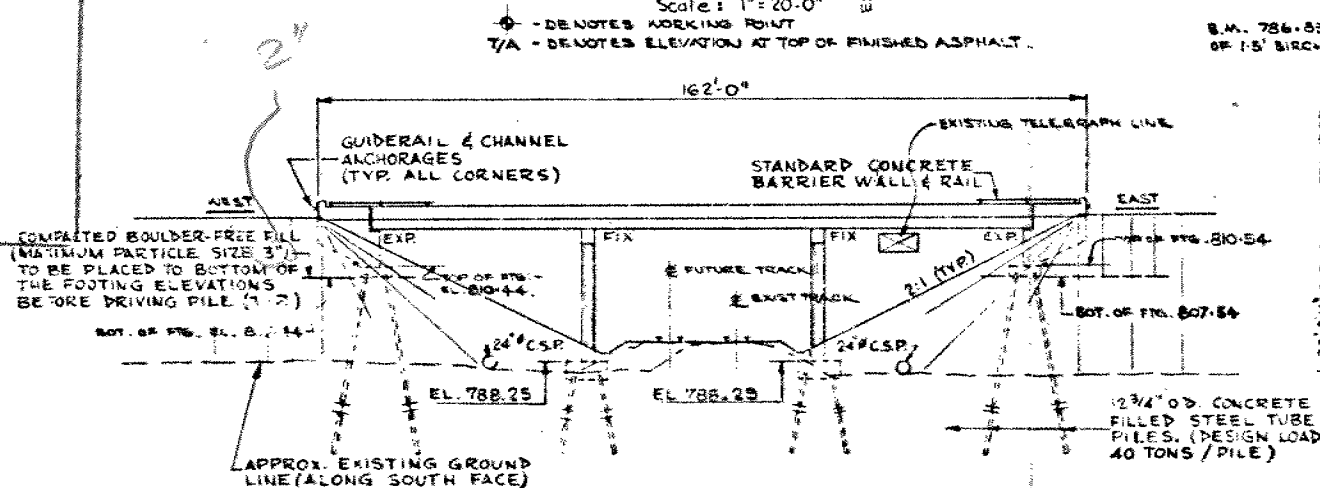
GENERAL NOTES

- CLASS OF CONCRETE:
a) PRESTRESSED PRECAST BEAMS 5000 PSI
b) DECK, BARRIER WALLS, ABUTMENTS, DIAPHRAGMS, PIERS & PIER CAPS 4000 PSI
c) FOOTINGS & APPROACH SLABS 3000 PSI
- CLEAR COVER TO REINR. STEEL UNLESS NOTED ON DRS:
a) DECK TOP 2", BOT. 1"
b) BARRIER WALLS & DIAPHRAGMS 1 1/2"
c) PIERS, PIER CAPS, ABUTMENTS & APPROACH SLABS 2"
d) FOOTINGS 3"

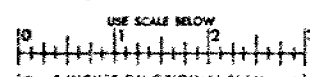
REINFORCING STEEL TO BE GRADE 60; REINFORCING STEEL
MARK IS GIVEN IN METRIC SIZES: e.g., A3018 3/8" INDICATES
A - BAR LIT, 20 - BAR SIZE, 30M, 18 - BAR NUMBER
B - BAR SPACING.

CONSTRUCTION NOTES

THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE
BEARING SEATS LEAD LEVEL TO THE SPECIFIED ELEVATIONS
WITHIN A TOLERANCE OF 1/8".
NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT
BEARING SEATS UNTIL THE CONCRETE IN THE DECK
FORMWORK BETWEEN END DIAPHRAGMS & BALLAST
WALLS, AND END DIAPHRAGMS & BEARING SEATS
(e.g., EXPANDED POLYSTYRENE) SHALL BE REMOVED.



FOR REDUCED PLAN
USE SCALE BELOW



REVISION	DATE	BY	DESCRIPTION
DESIGN	DATE	BY	DESCRIPTION
DRAWING	DATE	BY	DESCRIPTION

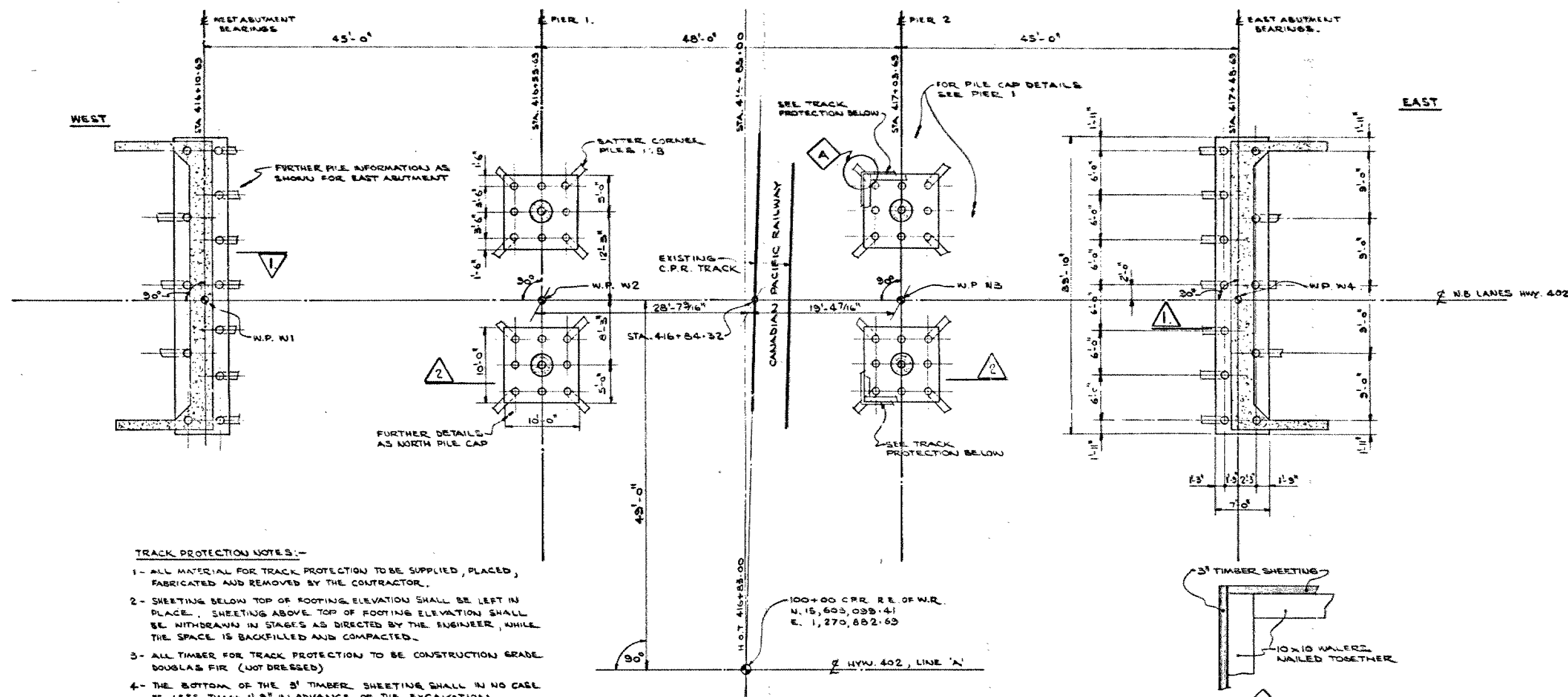


PILE NOTES:-

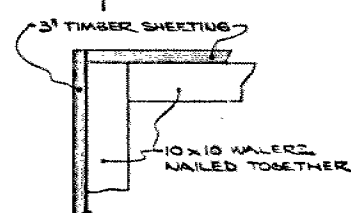
- 1- LAYOUT DIMENSIONS FOR PILES ARE GIVEN AT THE UNDERSIDE OF PIER AND ABUTMENT FOOTINGS.
- 2- PIER PILES AND ABUTMENT PILES SHALL BE 12 3/4" O.D. x 25' THICK WALL STEEL TUBE PILES AND SHALL BE DRIVEN IN ACCORDANCE WITH STD. 553-11 (DRG. 14) USING A SAFE DESIGN WORKING LOAD OF 40 TONS PER PILE, BUT MUST BE DRIVEN BELOW ELEVATION 750.00.
- 3- FOR PILE SPlicing AND DRIVING SHOE DETAILS SEE DRG. 14
- 4- ALL PILES SHALL BE FILLED WITH 3000 PSI CONCRETE AFTER INSTALLATION AND INSPECTION OF PILES.
- 5- PILES SHALL BE DRIVEN SO THAT THEIR FINAL LOCATION, MEASURED AT THE UNDERSIDE OF THE FOOTINGS, DOES NOT VARY BY MORE THAN 3" FROM THEIR PROPER LOCATION.
- 6- ALL PILE STEEL SHALL BE TO CSA. G40.21-GRADE 50 N.
- 7- APPROX. CONCRETE IN TUBE PILES = 100 CU. YDS. CEMENT FOR CONCRETE IN TUBE PILES TO BE SUPPLIED BY THE CONTRACTOR.

CO-ORDINATES OF WORKING POINTS:-

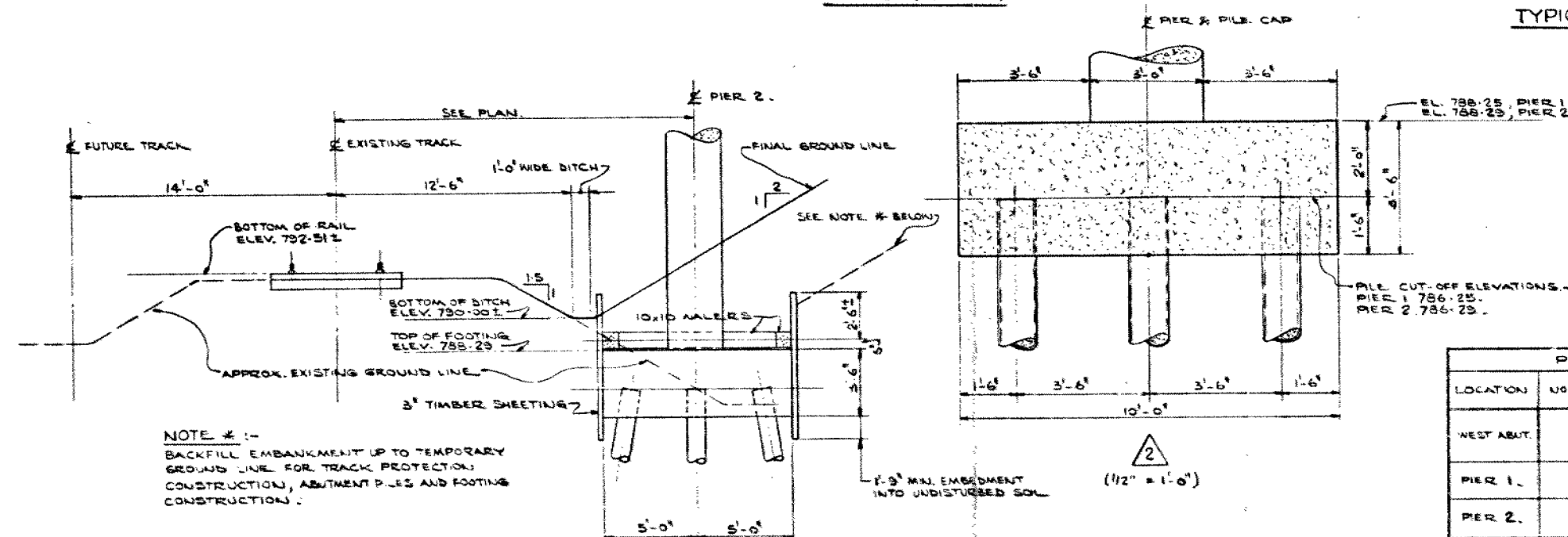
WORKING POINT	STATION	NORTH CO-ORDINATE	EAST CO-ORDINATE
W1	416+10.69	N 15,603,185.05	E 1,270,865.50
W2	416+55.63	N 15,603,153.43	E 1,270,837.58
W3	417+03.69	N 15,603,119.83	E 1,270,931.80
W4	417+48.63	N 15,603,088.27	E 1,270,963.88



PLAN (1/8" = 1'-0")



TYPICAL STRUT DETAIL.

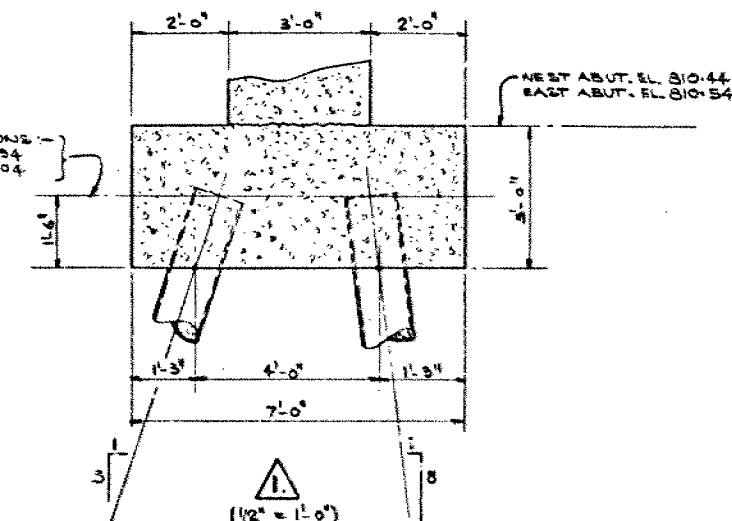


TYPICAL RAILWAY TRACK PROTECTION AT PIER 2.

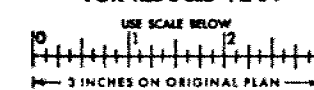
(1/4" = 1'-0")

PILE DATA			
LOCATION	NO. REQ'D	BASTER	LENGTH
WEST ABUT.	2	VERTICAL	66'-0"
	3	1:3	67'-0"
	7	1:3	70'-0"
PIER 1.	10	VERTICAL	44'-0"
	8	1:3	45'-0"
PIER 2.	10	VERTICAL	44'-0"
	8	1:3	45'-0"
EAST ABUT.	2	VERTICAL	66'-0"
	3	1:3	67'-0"
	7	1:3	70'-0"

PILE CUT-OFF ELEVATIONS:-
WEST ABUTMENT 808.54
EAST ABUTMENT 805.04



FOR REDUCED PLAN



REVISIONS	DATE	BY	DESCRIPTION

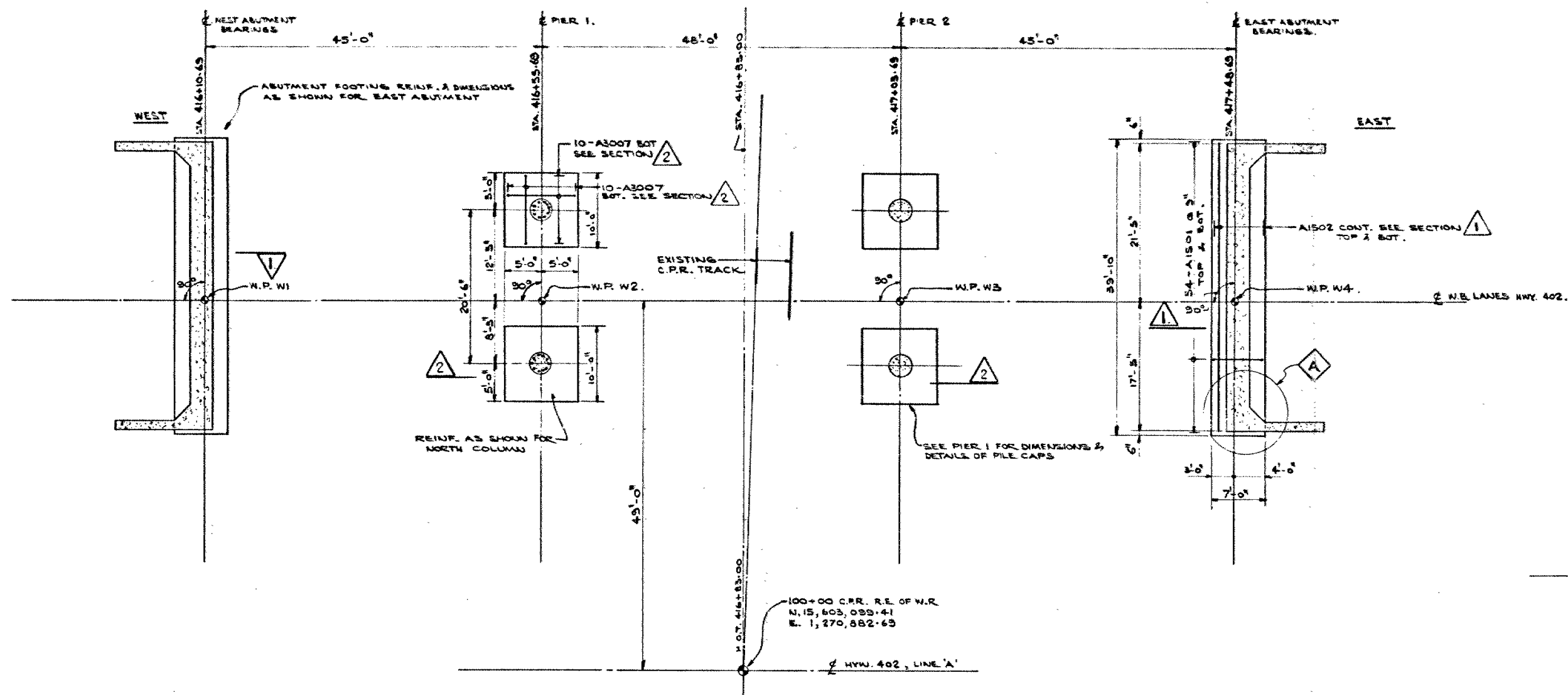
DIST. No 2
CONT No
WP No 40-66-II.



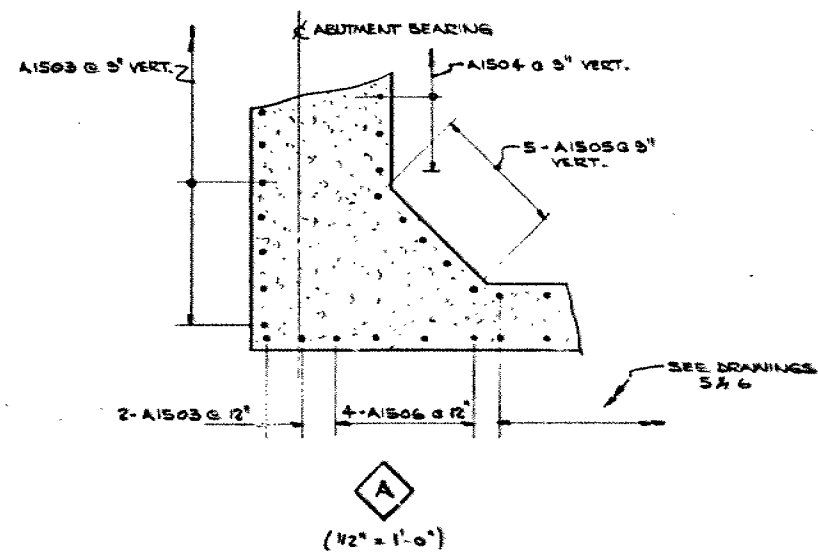
HWY. 402, C.P.R. OVERHEAD
3.8 MILES WEST OF HWY. 2
N.B. LANES BRIDGE.
FOOTING REINFORCING & DETAILS

MINBI

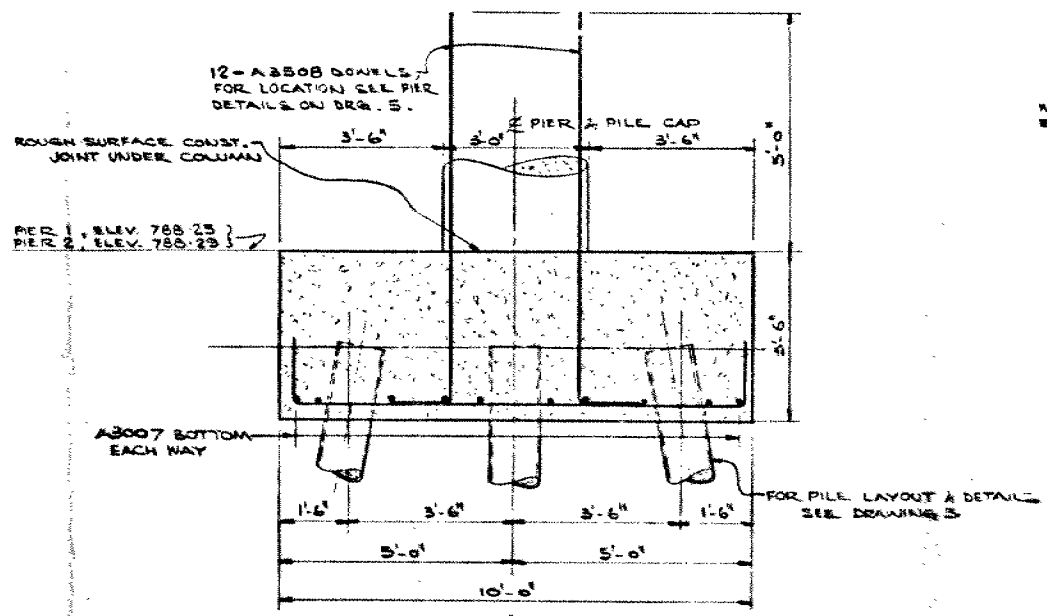
Norman, Hershfield
Burgess & Huggins, Limited
Consulting Engineers



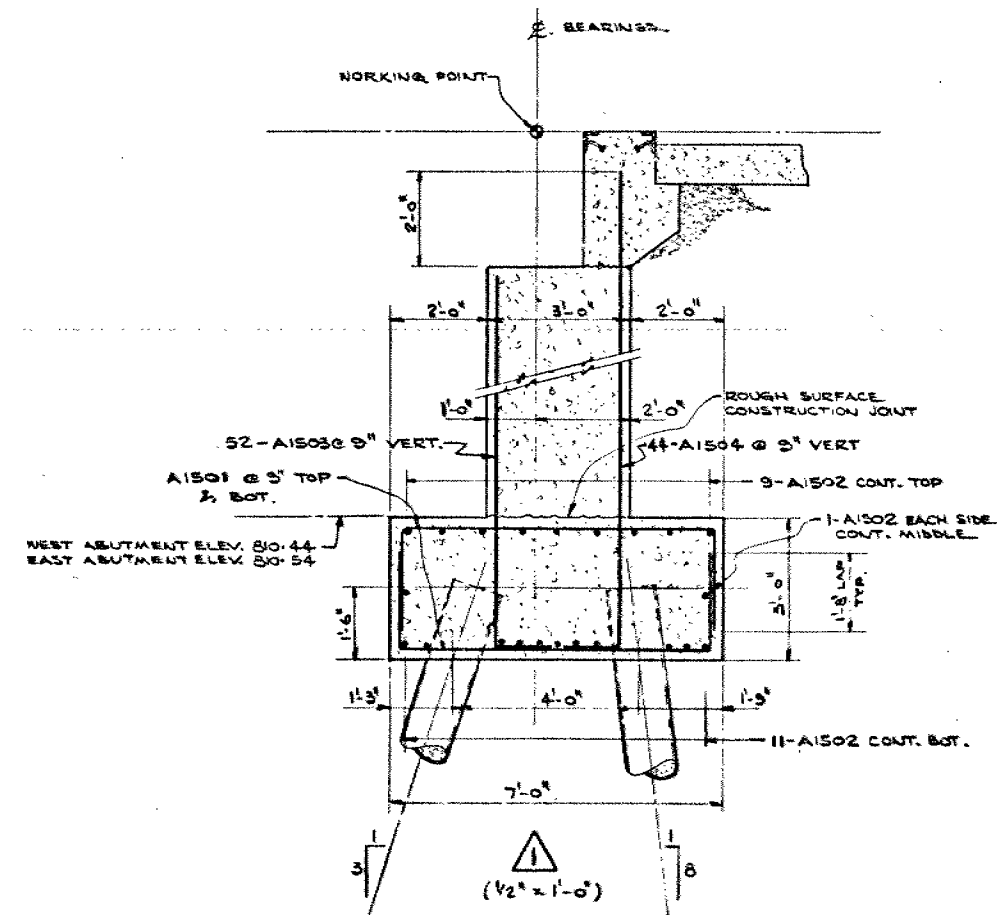
PLAN (1/8" = 1'-0")



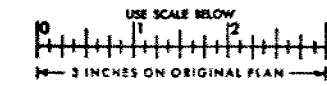
A
(1/2" = 1'-0")



2
(1/2" = 1'-0")

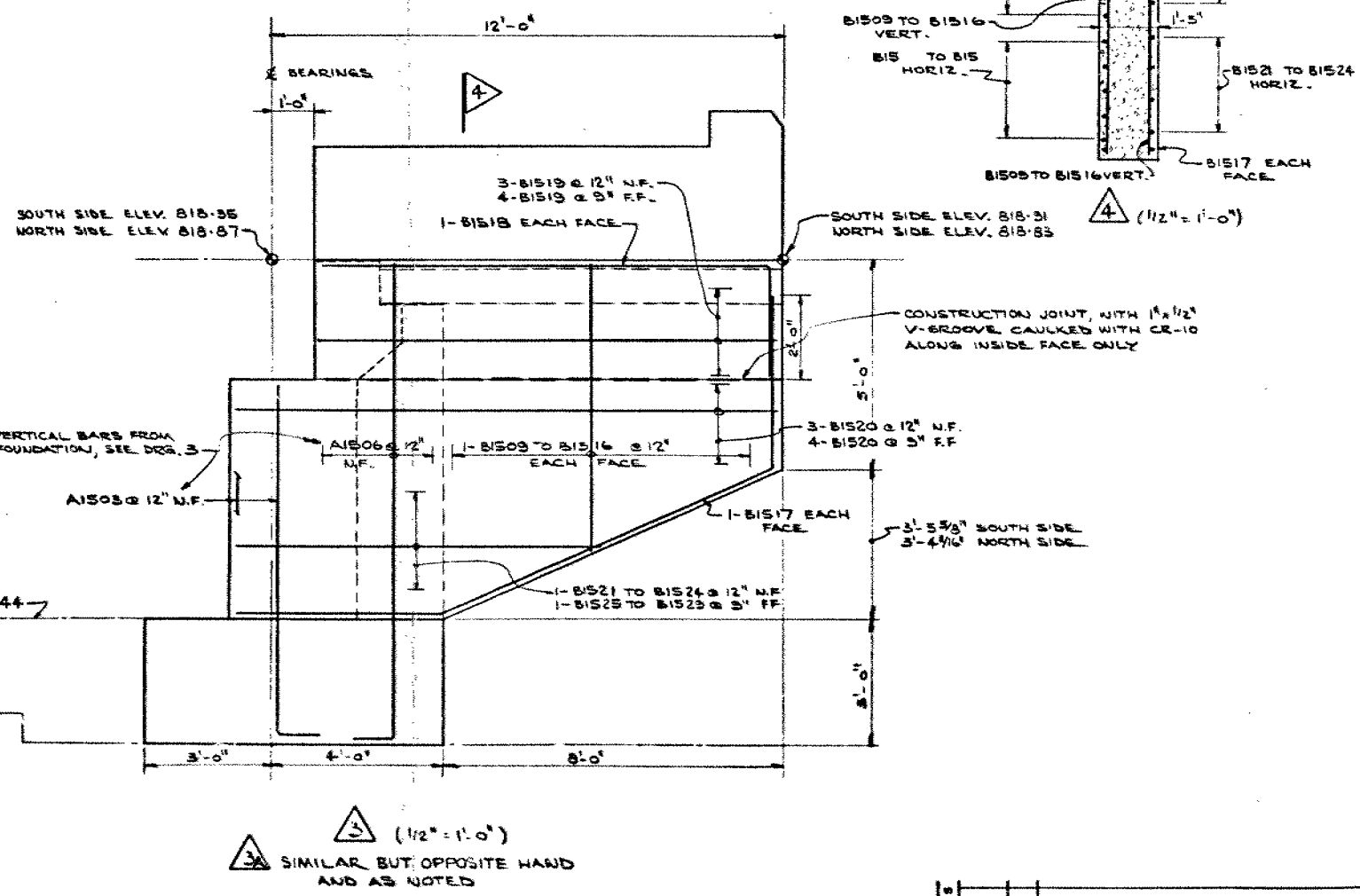
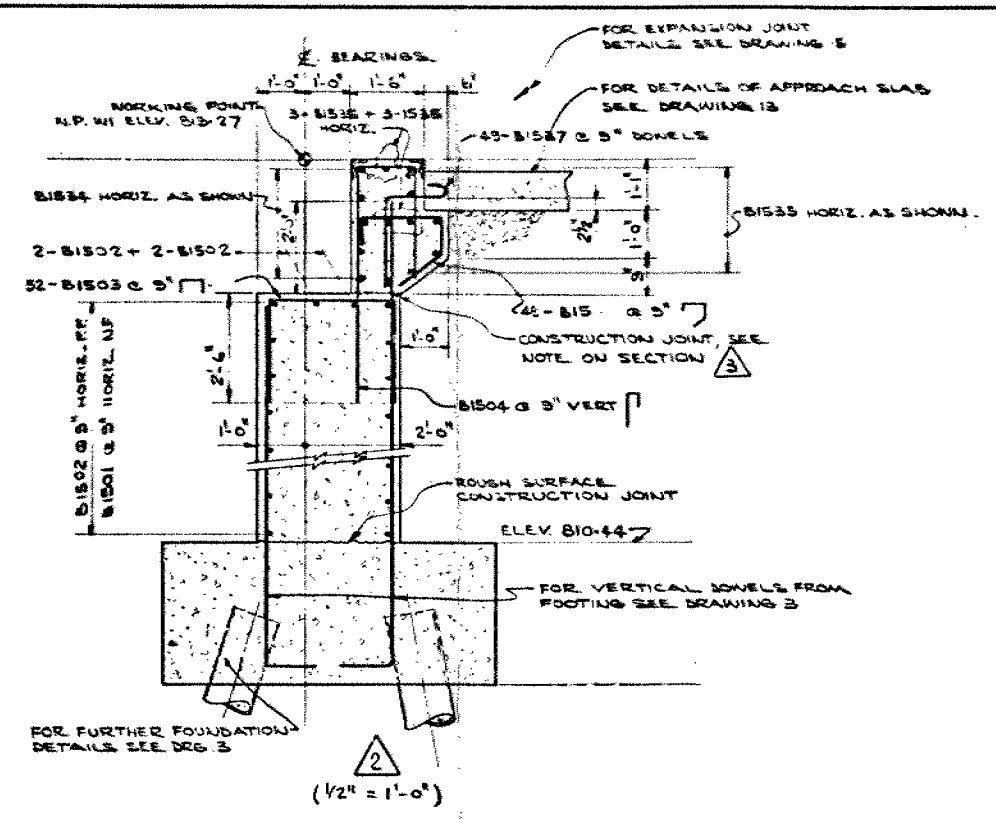
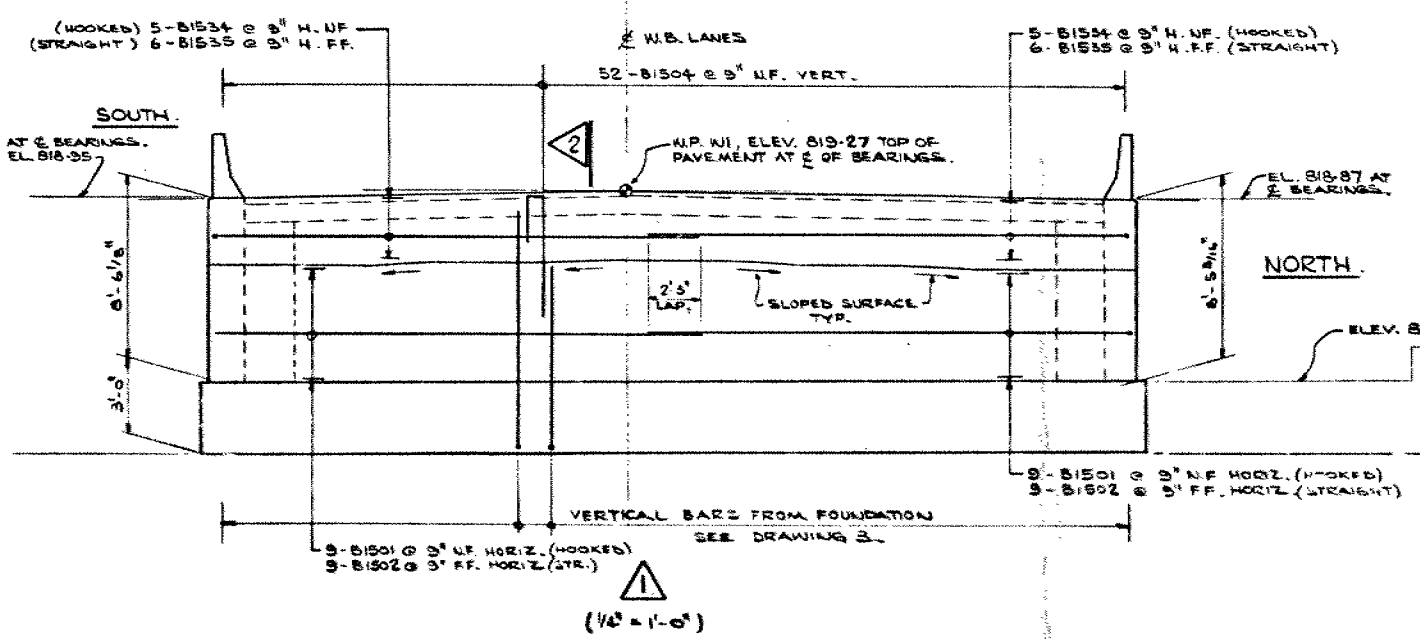
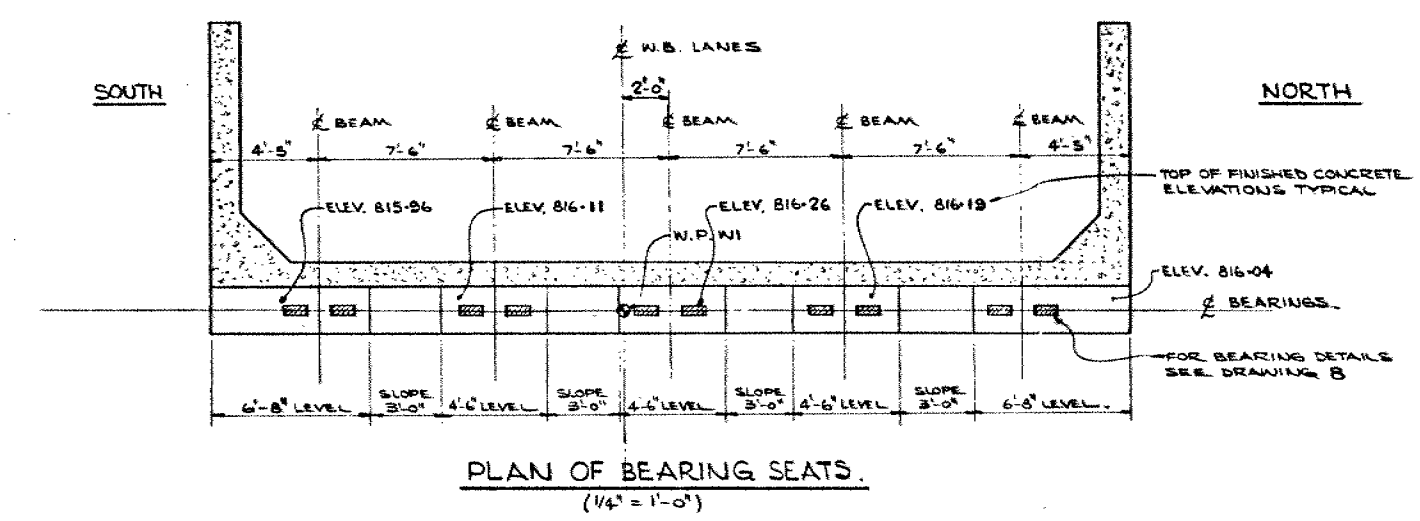
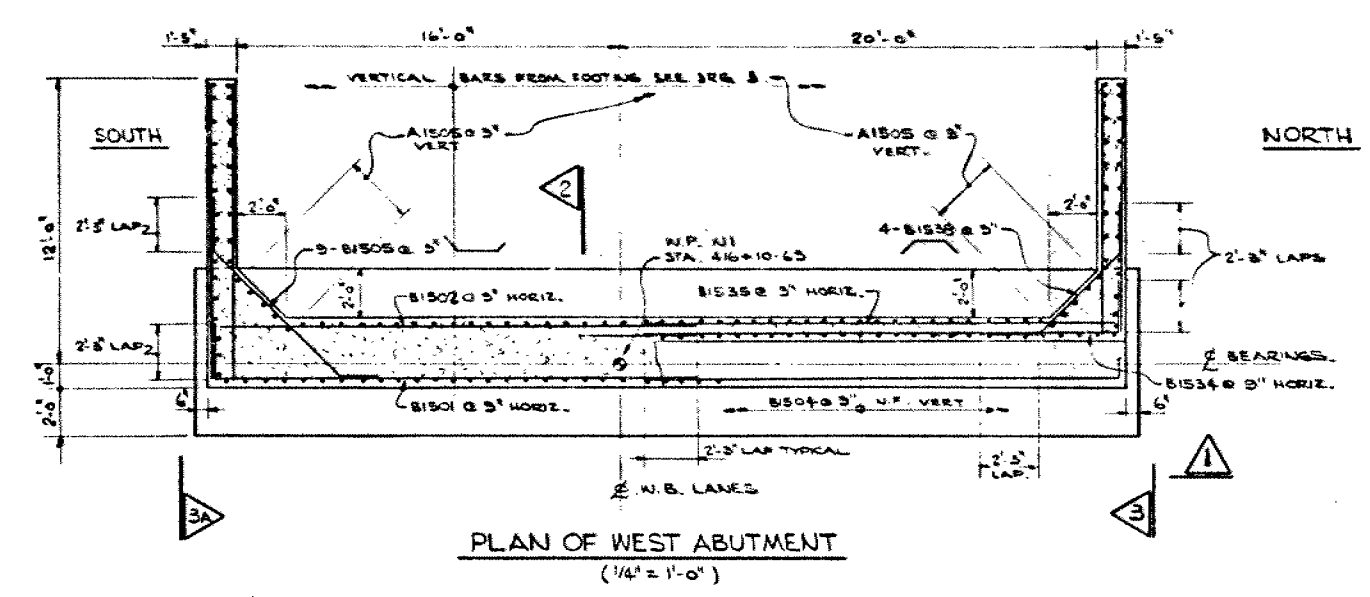


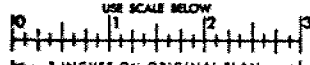
FOR REDUCED PLAN



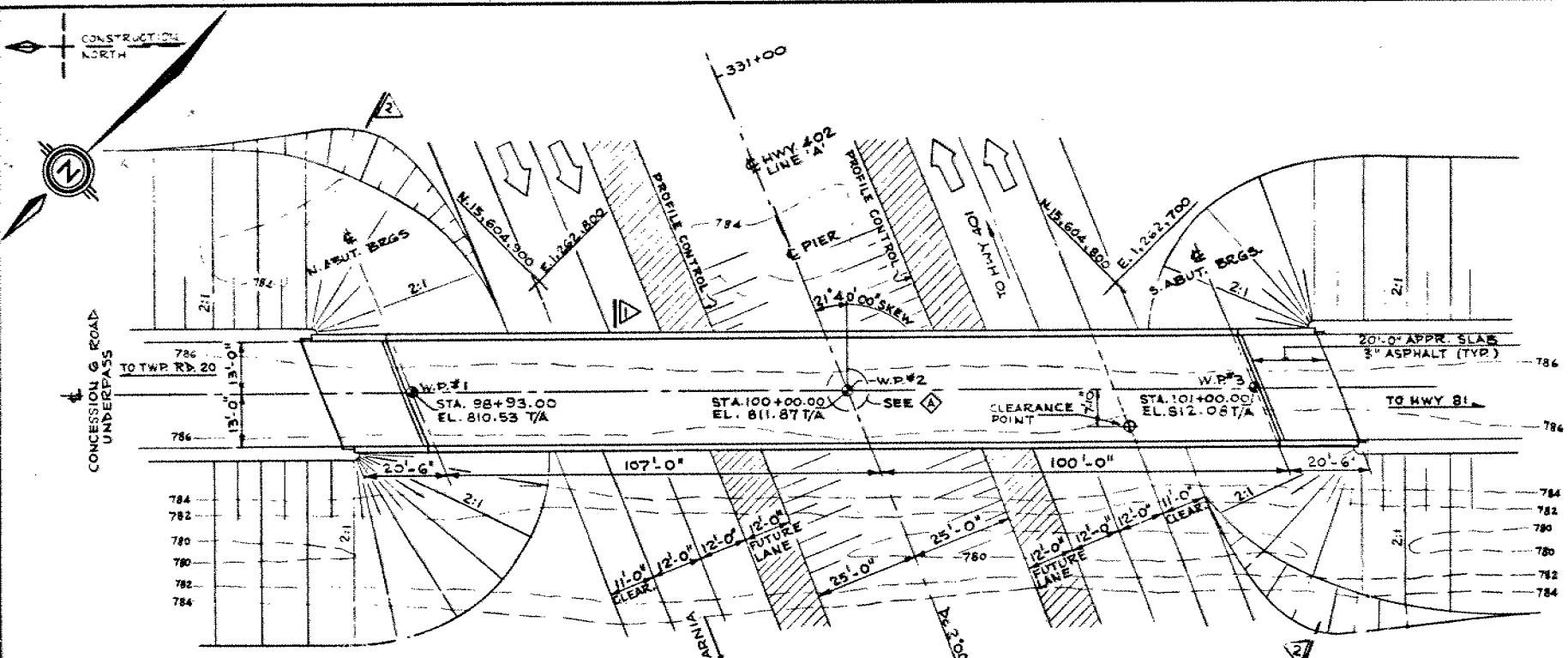
REVISIONS	DATE	BY	DESCRIPTION

DESIGN A.C. CHECK A.T. LOADING WS 20-44 DATE APR. 78
DRAWING ENR. CHECK A.C. SITE No 13-523.6 DWG 4.



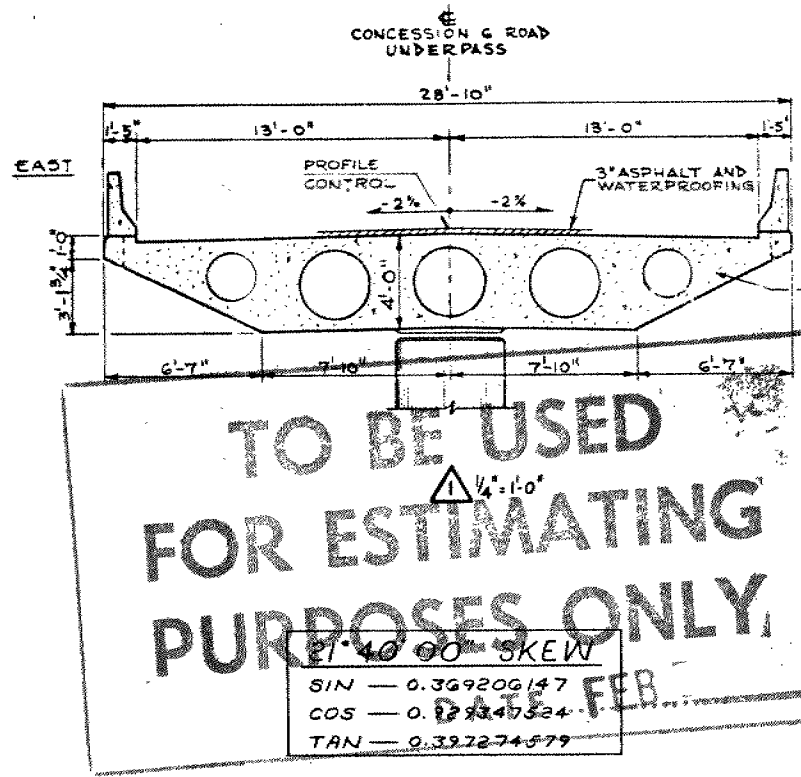
FOR REDUCED PLAN
USE SCALE BELOW


REVISIONS	DATE	BY	DESCRIPTION
1			
2			
3			
4			
5			



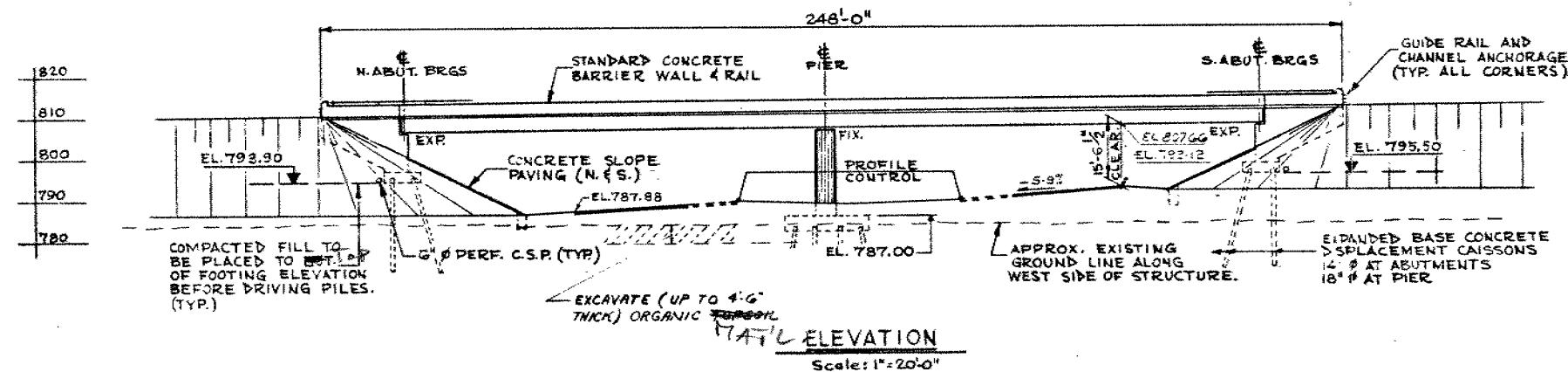
NOTE:
 W.P. DENOTES WORKING POINT.
 T/A DENOTES TOP OF ASPHALT.

PLAN
 Scale: 1"=20'-0"



ROUND VOIDED
 POST TENSIONED
 CONCRETE DECK

- NOTES:**
- CLASS OF CONCRETE**
- DECK & BARRIER WALLS — 5000 p.s.i.
 - PIER COLUMN — 5000 p.s.i.
 - REMAINDER — 3000 p.s.i.
 - OR AS NOTED ON THE DRAWINGS
- CLEAR COVER ON REINFORCING STEEL**
- FOOTINGS, ABUTMENTS, PIER COLUMN, — 3"
 - DECK-TOP BOT. BARRIER WALL, APPROACH SLABS — 2" 1 1/2" 1 1/2" 2"
 - OR AS NOTED ON THE DRAWINGS
- REINFORCING STEEL GRADE**
 ALL STEEL = 50
- CONSTRUCTION NOTES**
 THE CONTRACTOR IS RESPONSIBLE FOR FINISHING THE BEARING SEATS DEAD LEVEL TO THE SPECIFIED ELEVATIONS WITH A TOLERANCE OF ± 1/8"
- NO CONCRETE SHALL BE PLACED ABOVE THE ABUTMENT BEARING SEATS UNTIL THE CONCRETE IN THE DECK HAS BEEN PLACED, STRESSED AND GROUTED.

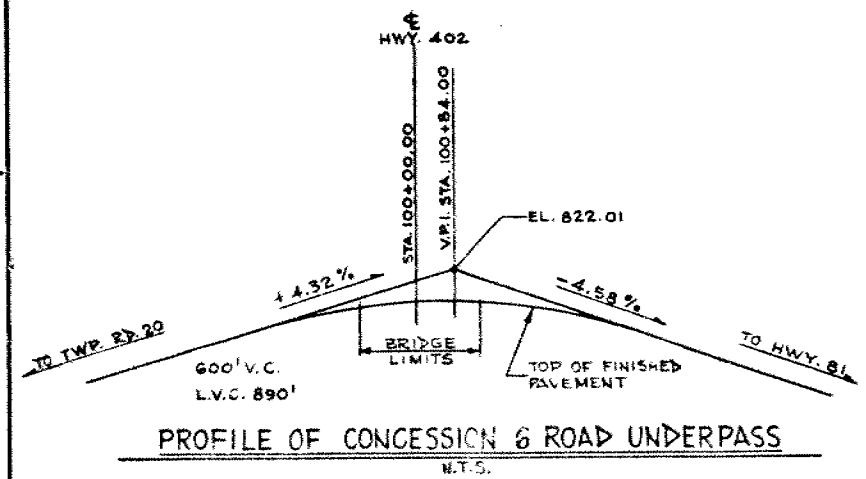


ELEVATION
 Scale: 1"=20'-0"

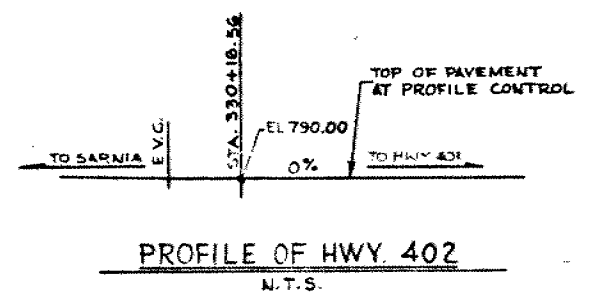
LIST OF DRAWINGS:

- 19-528-1 GENERAL LAYOUT
- 2 BOREHOLE LOCATIONS & SOIL STRATA
- 3 FOOTING LAYOUT
- 4 ABUTMENTS
- 5 PIER REINFORCING & PIER BEARING
- 6 DECK DETAILS, SCREED ELEV. & ABUT. BRGS.
- 7 DECK REINFORCING I
- 8 DECK REINFORCING II
- 9 CABLE DETAILS
- 10 TRANSVERSE CABLE DETAILS
- 11 BARRIER WALL
- 12 STEEL RAILING (SINGLE TUBE)
- 13 20 FT. APPROACH SLAB (BARRIER WALL)
- 14 DETAILS OF CONC. SLOPE PAVING
- 15 STANDARD DETAILS I
- 16 STANDARD DETAILS II
- 17 STANDARD DETAILS III
- 18 AS CONSTRUCTED ELEV. & DIM.

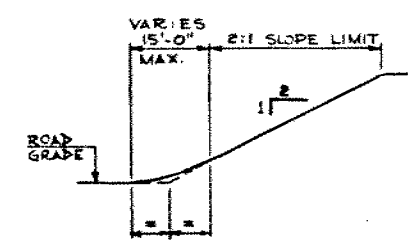
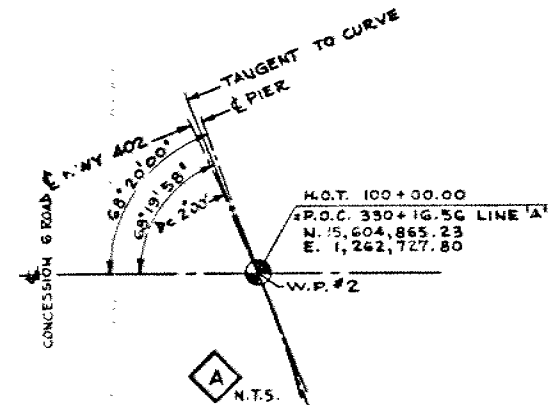
- CONCRETE QUANTITIES:**
- CONCRETE QUANTITIES ARE LISTED BELOW FOR THE APPROPRIATE CONCRETE LUMP SUM TENDER ITEMS:
- 1. CONCRETE IN PIER, ABUTMENTS AND WINGWALLS — 5000 P.S.I. - 13 CU. YD.
 - 2. CONCRETE IN DECK — 5000 P.S.I. - 179 CU. YD.
 - 3. CONCRETE IN BARRIER WALLS — 3000 P.S.I. - 38 CU. YD.
 - 4. CONCRETE IN APPROACH SLABS — 3000 P.S.I. - 33 CU. YD.
 - 5. CONCRETE IN SLOPE PAVING — 29 CU. YD.



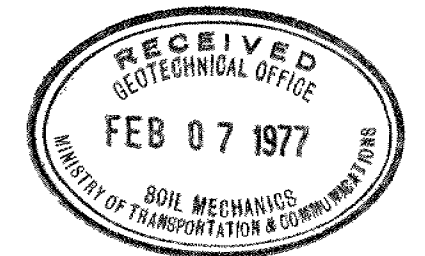
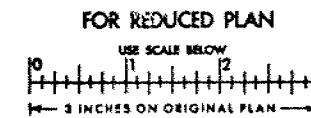
PROFILE OF CONCESSION & ROAD UNDERPASS
 N.T.S.



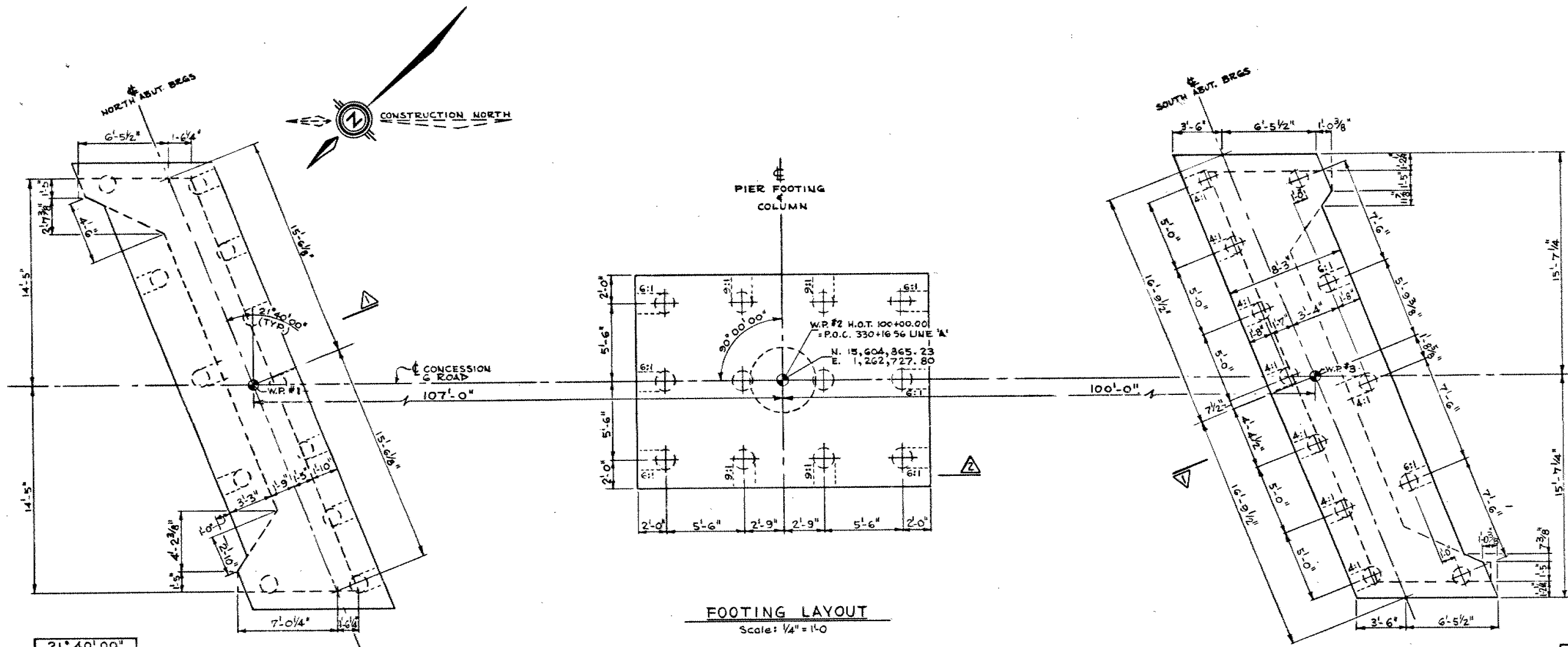
PROFILE OF HWY. 402
 N.T.S.



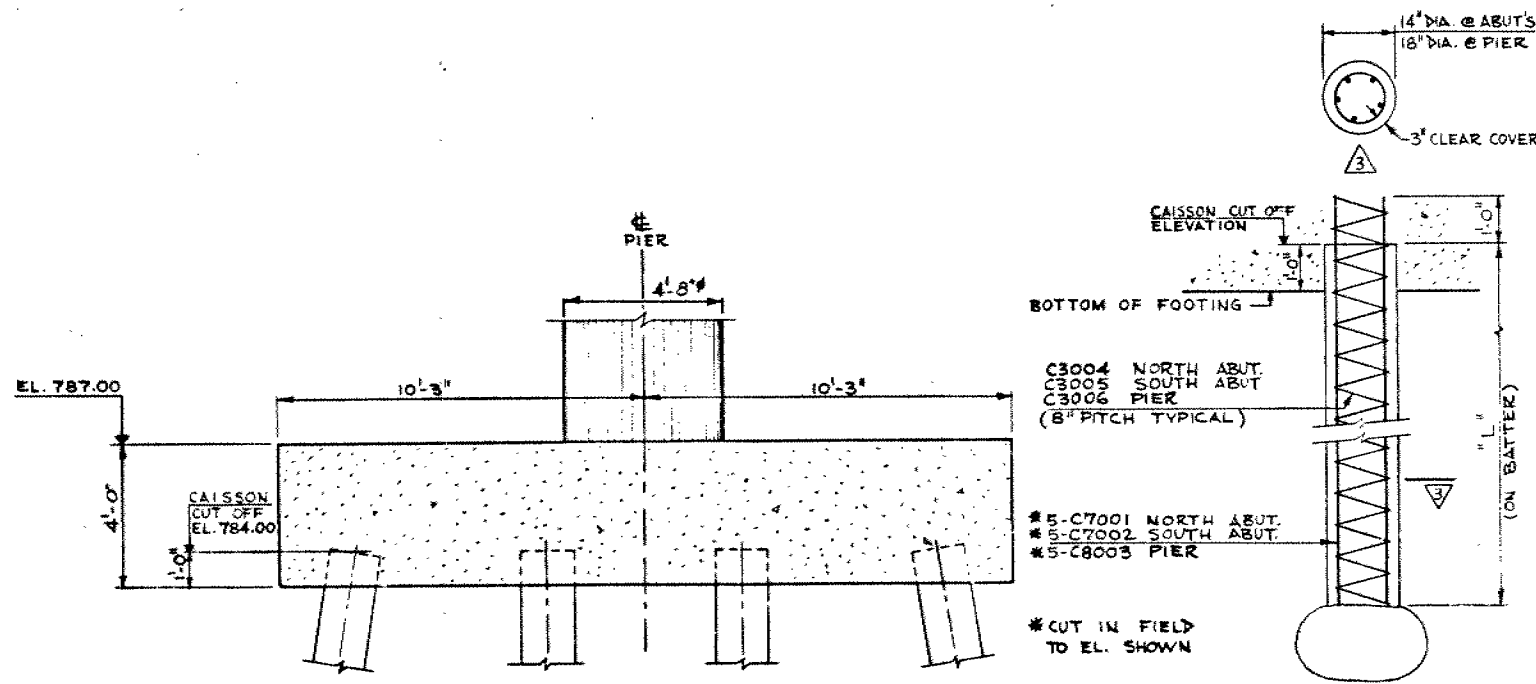
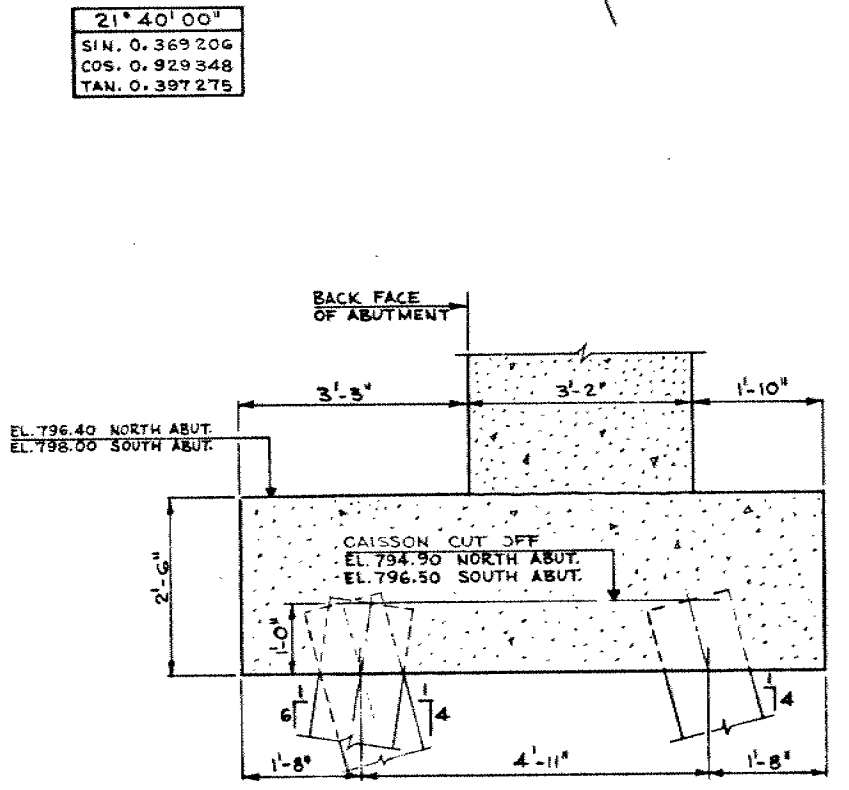
2 N.T.S.



REVISIONS	DATE	BY	DESCRIPTION
DESIGN		CHECKED	LOADING
DRAWING		CHECKED	SITE



- NOTES:
- THIS DRAWING TO BE READ IN CONJUNCTION WITH DRAWINGS 4 & 5.
 - DIMENSIONS, REINFORCING AND CAISSON LAYOUT SIMILAR AT NORTH AND SOUTH ABUTMENT FOOTINGS.
 - SPACING OF CAISSONS TO BE MEASURED AT UNDERSIDE OF FOOTINGS.
 - CONCRETE STRENGTH IN CAISSONS AT 28 DAYS - 4000 p.s.i.
 - CONCRETE SLUMP = 0



CAISSON DATA						
LOCATION	NO	LENGTH	BATTER	TYPE	DESIGN LOAD	
ABUTMENTS	NORTH	FRONT	7 22'-5"	4:1	EXPANDED BASE CONCRETE DISPLACEMENT CAISSONS	70 TONS PER CAISSON
		REAR	1 22'-5"	4:1		
	SOUTH	FRONT	2 22'-1"	6:1		
		REAR	2 21'-9"	VERT.		
	PIER	WEST PILE LINE	2 24'-3"	4:1	EXPANDED BASE CONCRETE DISPLACEMENT CAISSONS	125 TONS PER CAISSON
		CENTRE PILE LINE	2 24'-3"	4:1		
		EAST PILE LINE	2 24'-3"	6:1		
			2 24'-1"	9:1		

CONCRETE QUANTITIES

ABUTMENT CAISSONS 27 cu. yds.

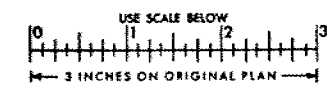
PIER CAISSONS 23 cu. yds.



CAISSON DETAILS

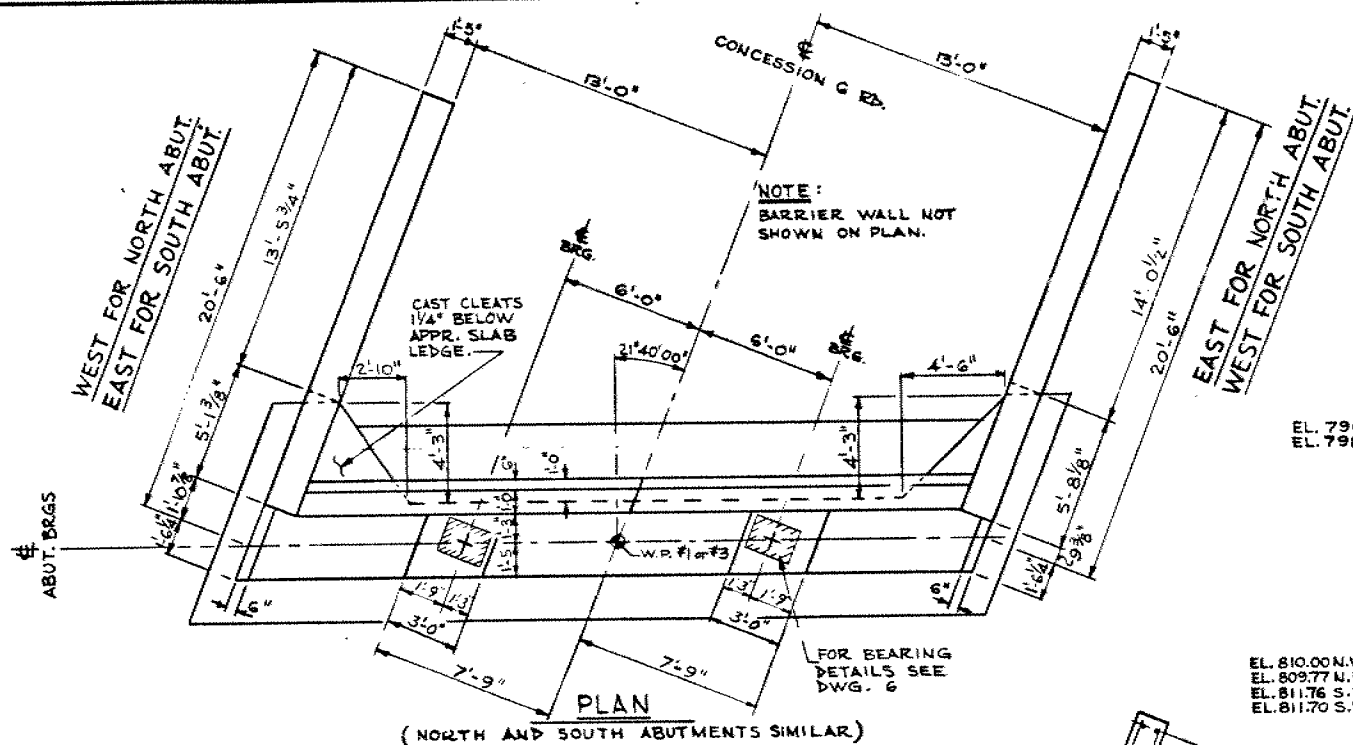
Not To Scale

FOR REDUCED PLAN

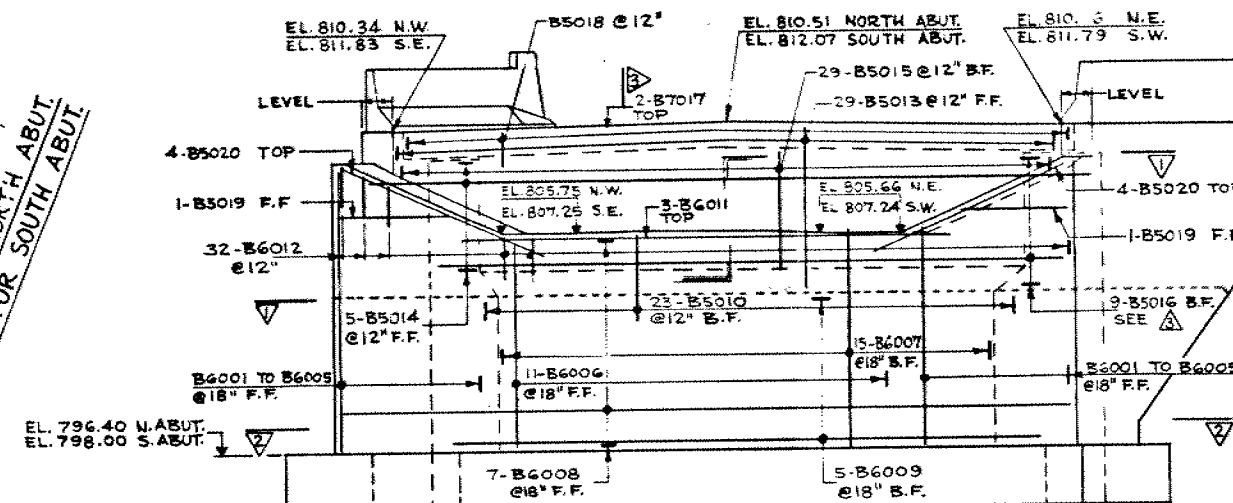


REVISIONS	DATE	BY	DESCRIPTION
DESIGN	4-20-44	K. Z. STOLARSKI	LOADING
DRAWING	4-20-44	K. Z. STOLARSKI	SITE No. 40-66-12

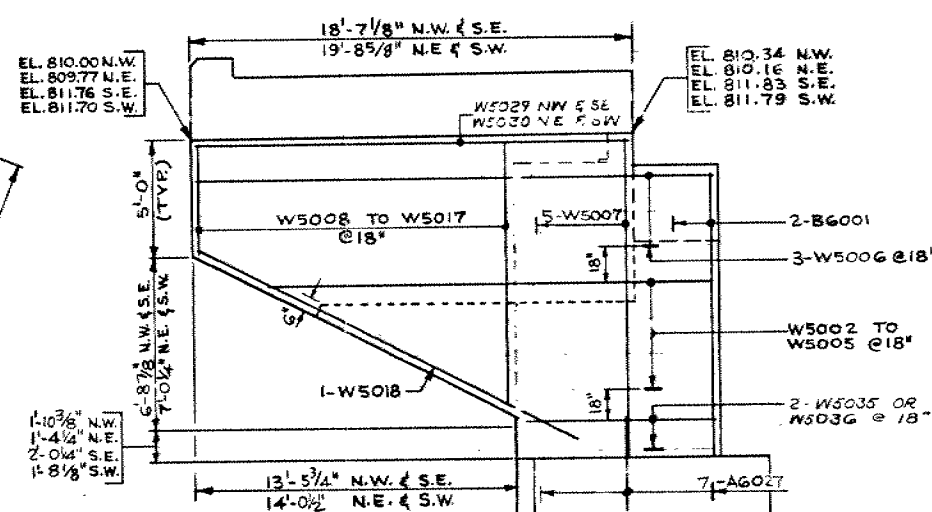
ABUTMENTS



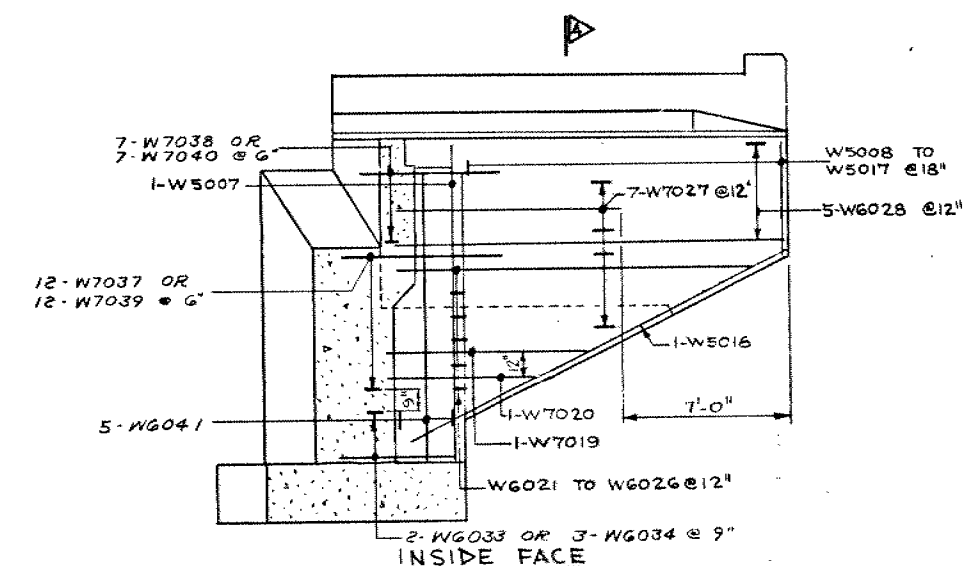
(NORTH AND SOUTH ABUTMENTS SIMILAR)



ELEVATION
(NORTH & SOUTH ABUT. REINF. SIMILAR EXCEPT AS NOTED)

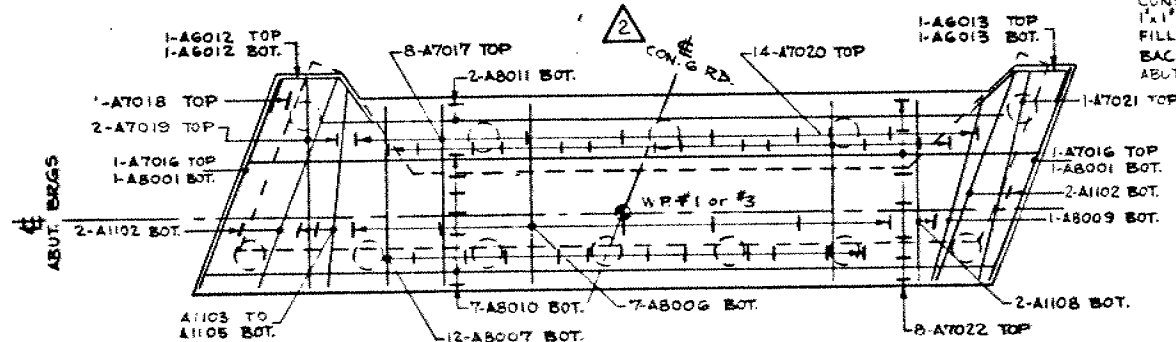
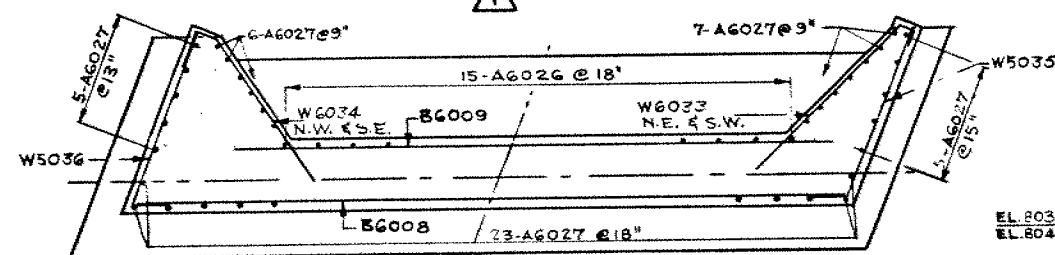
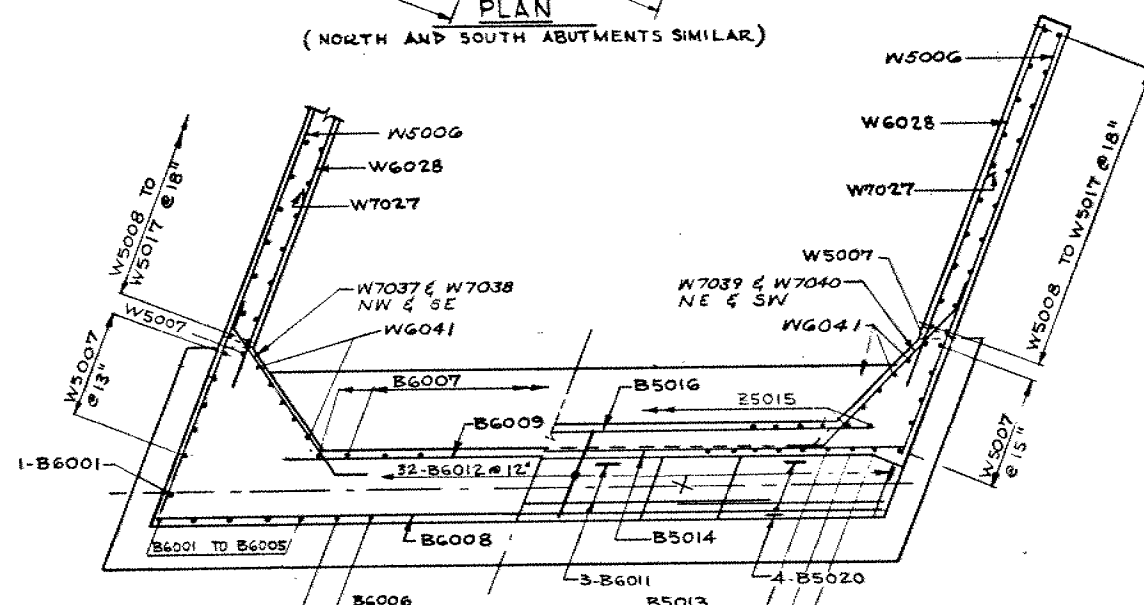


OUTSIDE FACE

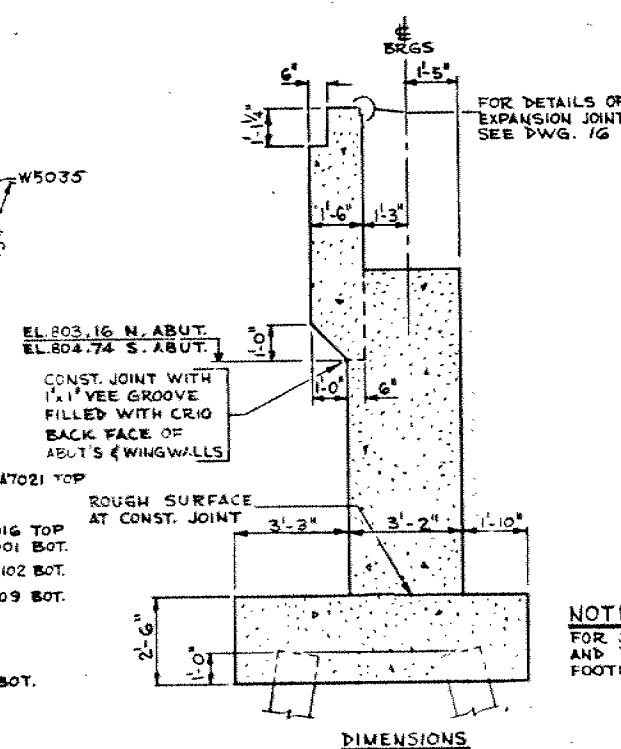


WING WALLS

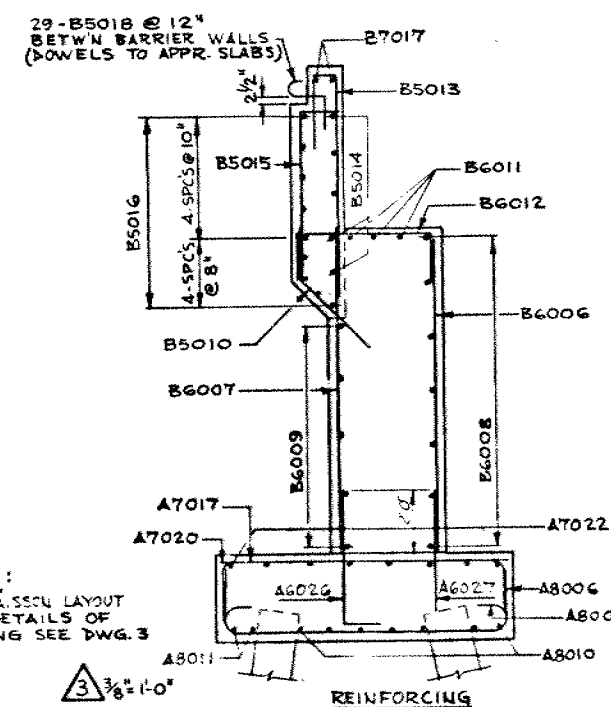
ALL SCALES ARE $\frac{1}{4}" = 1'-0"$
UNLESS SHOWN OTHERWISE



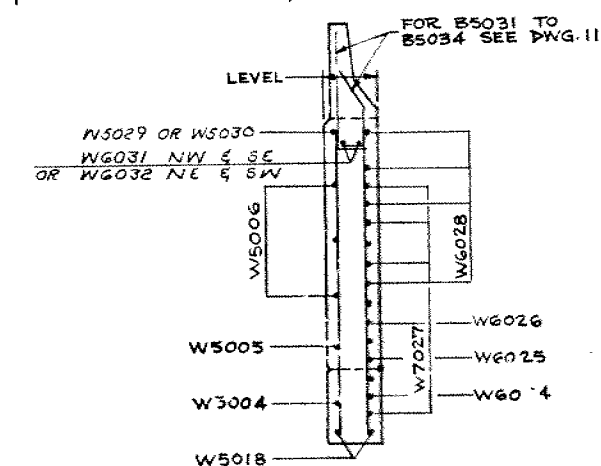
PLAN OF FOOTING



DIMENSIONS

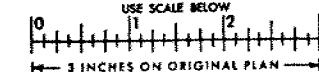


REINFORCING

 $\Delta 3/8" = 1'-0"$

FOR REDUCED PLAN

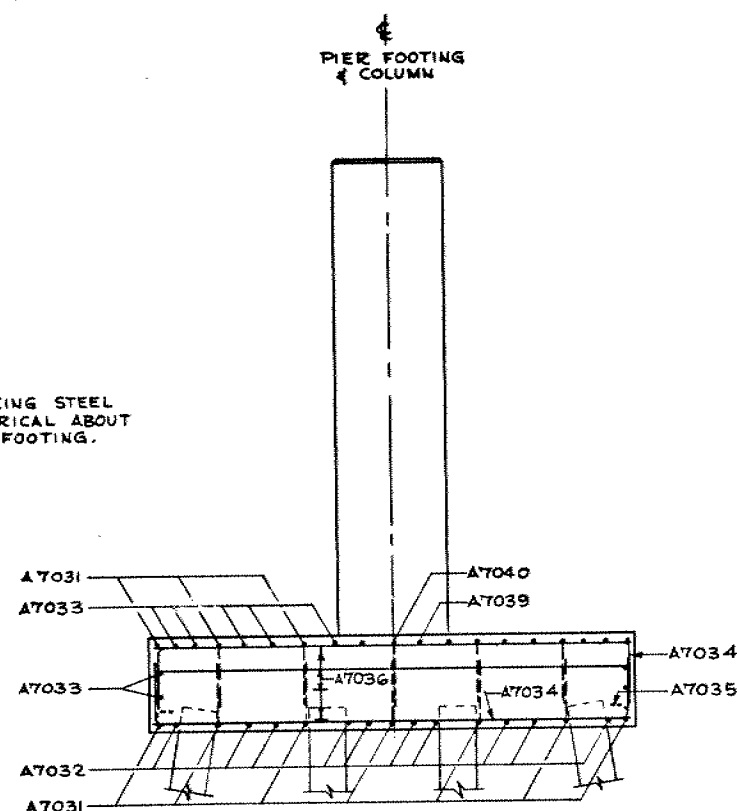
USE SCALE BELOW



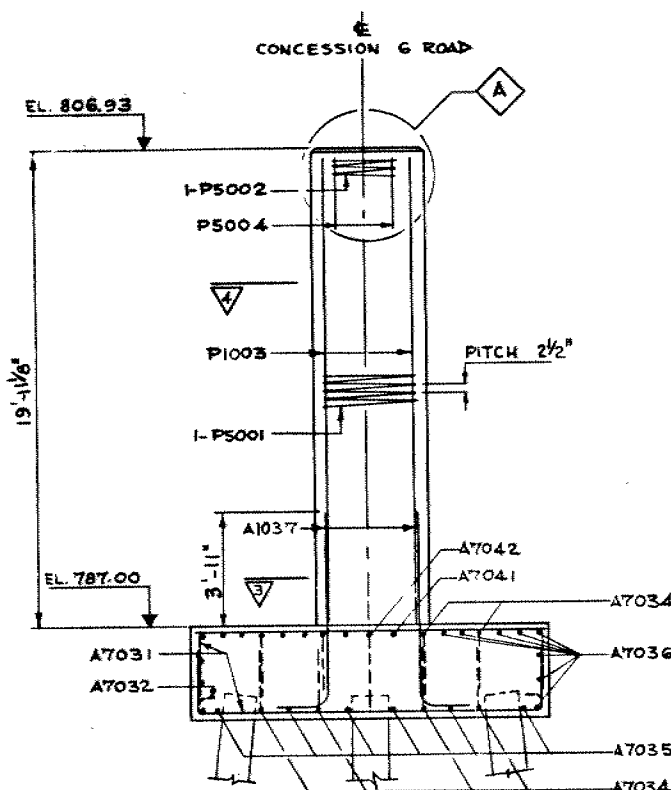
3	REVISIONS				
	DATE	BY	DESCRIPTION		
	DESIGN	CHECK	A K	LOADING	DATE
	DRAWING	CHECK	P	SITE No	DWG



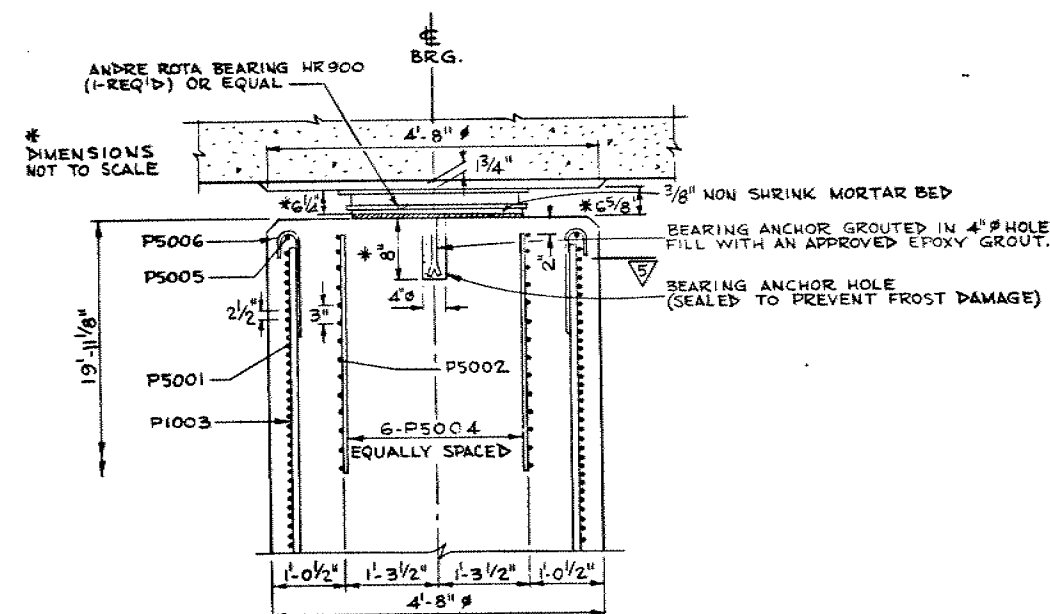
NOTE:
 REINFORCING STEEL
 SYMMETRICAL ABOUT
 & PIER FOOTING.



1 1/4" = 1'-0"

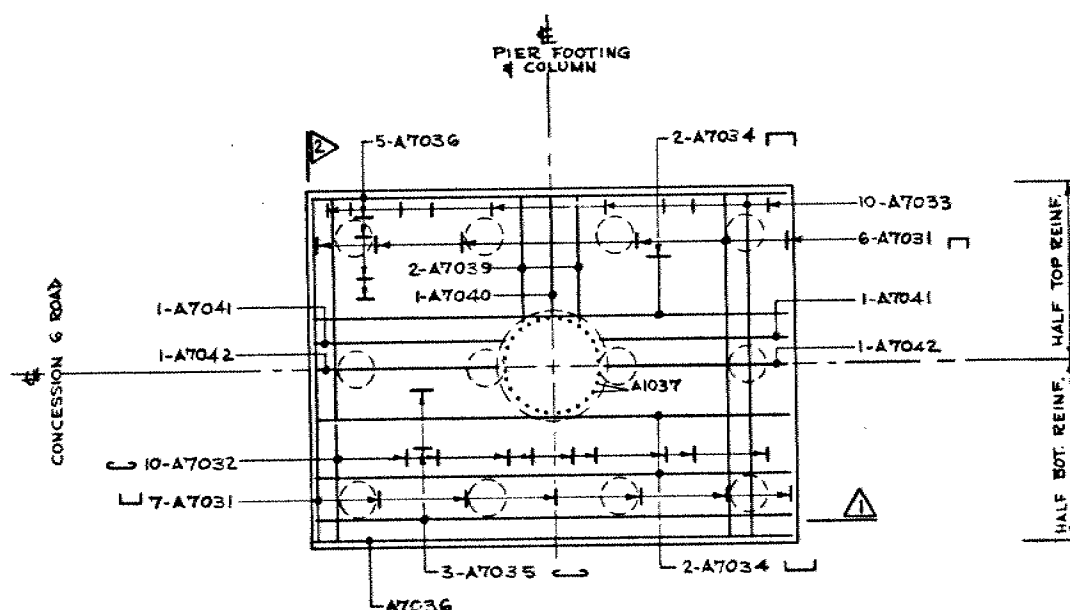


2 1/4" = 1'-0"

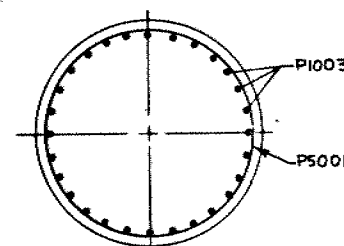


3 3/4" = 1'-0"
 FIXED BEARING AT PIER

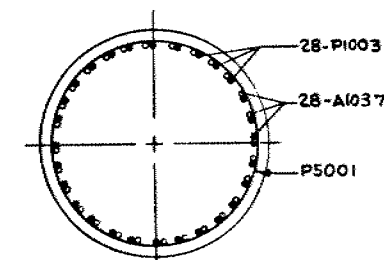
DESIGN DATA - PIER BEARING
 D.L. = 1540 K
 D.L. + L.L. = 1715 K



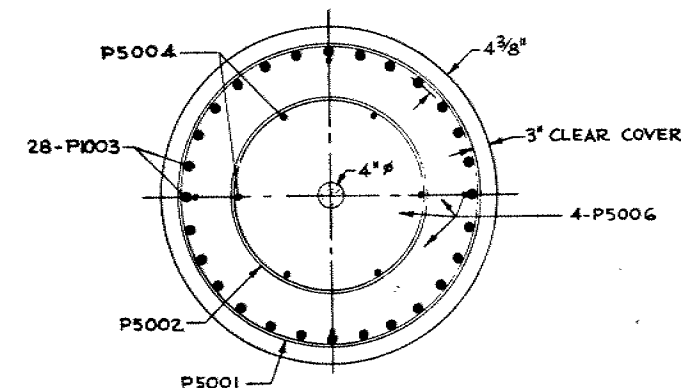
PLAN OF FOOTING
 Scale: 1/4" = 1'-0"



4 1/2" = 1'-0"



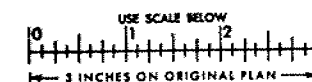
3 1/2" = 1'-0"



5 3/4" = 1'-0"

NOTE:
 FOR DETAILS OF FOOTING AND
 PILE LAYOUT SEE DRAWING 3

FOR REDUCED PLAN



REVISIONS	DATE	BY	DESCRIPTION
1			
2			
3			





Ministry of
Transportation and
Communications

Memorandum

40113-43
GEOCRES No.

To: Mr. A.P. Watt (2)
Regional Structural Planning Engineer,
Southwestern Region, London.

From: Soil Mechanics Section,
Geotechnical Office,
West Building, Downsview.

Attention:

Date: November 27, 1975.

Our File Ref.

In Reply to

DEC 08 1975

Subject:

FOUNDATION INVESTIGATION REPORT

W.P. 40-66-12
Site No. 19-528
Hwy. 402 District 2
Concession 6 Road Underpass
5.3 Miles West of Hwy. 2

Attached we are forwarding to you our detailed Foundation Investigation Report on the subsoil conditions existing at the above mentioned site.

We believe that the factual data and recommendations contained therein will prove adequate for your requirements. Should additional information be required, please do not hesitate to contact our Office.

K.G. Selby

K.G. SELBY,
Supervising Engineer.

cc: E.J. Orr
B.R. Davis
B.J. Giroux
G.A. Wrong
A. Wittenberg
J.R. Roy
D.P. Collins
R. Hore

J. Anderson)
A. Crowley } memo only
G. Sloan)

Files
Record Services

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FOUNDATION INVESTIGATION REPORT

W.P. 40-66-12
Site No. 19-528
Hwy. 402 District 2
Concession 6 Road Underpass
5.3 Miles West of Hwy. 2

1. INTRODUCTION

This report is to provide information for the design and construction of the proposed structure and its approaches at the above mentioned site. The subsoil information is based on four sampled boreholes and three dynamic cone penetration tests.

2. SITE DESCRIPTION

The proposed site is located in the Township of Caradoc some 6 miles southeast of the Town of Strathroy. It is located approximately $\frac{1}{4}$ mile west of the junction of Concession Road 6 and the 20th Sideroad.

This general area is a flat sand plain with only occasional low ridges. Land use varies from wood lots to specialty crops such as orchards and tobacco farms. The predominant use however, remains mixed farming. The area in the immediate vicinity of the site is swampy bushland with an agricultural drainage ditch running immediately to the north of the Concession Road. Spoil from this ditch has been placed next to the Concession Road giving a greater than normal depth of topsoil.

Physiographically, the site lies in an area referred to as the 'Caradoc Sand Plain'.

3. SUBSOIL

(3.1) General

Subsoil consists of up to $4\frac{1}{2}$ feet of black topsoil overlying a layer of $1\frac{1}{2}$ feet of light grey marl extending over most of the site. The uniformity of these upper layers has been destroyed through the construction of an agricultural drainage ditch to the north of the Concession Road. This has resulted in removal of the

marl from a limited area and a deepening of the topsoil where spoil from this ditch was placed. Underlying this surficial deposit is approximately 50 feet of fine sand trace of silt laid down as a delta at the mouth of an ancestor of the Thames River. Beneath this is a layer of clayey silt in excess of 55 feet in thickness in which the deepest borehole was terminated.

(3.2) Fine Sand Trace of Silt

The fine sand trace of silt (grain size distribution shown as an envelope in Figure 1) has a thickness of approximately 50 feet. Its relative density ranges from compact to very dense with Standard Penetration 'N' values ranging from 11 to in excess of 100 blows per foot. Except for occasional silt pockets in the upper portion of the deposit, the silt content is low, generally being less than 10%. Laboratory tests indicate a moisture content of approximately 20%.

(3.3) Clayey Silt

The clayey silt deposit extends from a depth of 55 feet to in excess of 110 feet. It has a very stiff to hard consistency with Standard Penetration 'N' values ranging from 27 to over 100 blows per foot. The deposit has a low degree of plasticity with a moisture content of approximately 15%.

(3.4) Groundwater

Groundwater was encountered in the fine sand at elevation 780. This water level corresponds with the water level in the agricultural drainage ditch to the north of the Concession Road.

4. DISCUSSION AND RECOMMENDATIONS

(4.1) General

The underpass as proposed will consist of a two span structure with each span being 105 feet in length. The approach embankments will be approximately 29 feet in height.

(4.2) Franki Piles

Any or all of the structure footings may be supported on Franki type displacement caissons. To form these piles the drive

tube should be advanced to elevation 773 with the bulb of the pile formed below this elevation. Piles with following shaft diameters (inside diameter of the drive tube) will develop the following design bearing capacities.

14 in. - 70 tons
18 in. - 125 tons
22 in. - 150 tons

The cost of installing these piles complete with all material other than reinforcing steel may be estimated assuming \$25.00, \$28.00 and \$32.00 per linear foot for the 14 inch, 18 inch and 22 inch types, respectively.

(4.3) Steel Tube Piles

Alternatively, the structure footings may be supported on steel tube piles (12 3/4" x 1/4") driven to elevation 760 under the centre pier and elevation 773 under the abutments. A safe design load of 35 tons per pile should be assumed for design purposes. Any horizontal loading should be resisted by battered piles.

(4.4) Dewatering

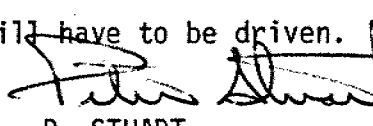
No dewatering problems are anticipated as the pile caps will be founded above the ground water level.

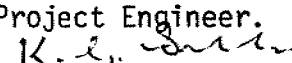
(4.5) Settlements

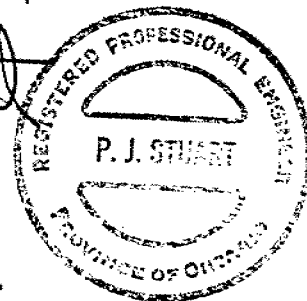
Settlement of the pile caps which will occur as the load is applied will be less than 1 inch.

(4.6) Approach Embankments

No stability problems are anticipated with embankment fills (29 feet) if 2:1 slopes are employed providing all organic material is removed for the full width of the embankment. Cobbles exceeding a 3 inch diameter should be removed from fill placed at locations through which piles will have to be driven.


P. STUART,
Project Engineer.


K.G. SELBY,
Supervising Engineer.



APPENDIX

RECORD OF BOREHOLE NO 1

WP 40-66-12 LOCATION Co-ords. 15,604,796 N; 1,262,639 E. ORIGINATED BY PJS
 DIST 2 HWY 402 BORING DATE Sept. 30, 1975 COMPILED BY GP
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY GP

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT W_L PLASTIC LIMIT W_P WATER CONTENT W			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	W_P	W	W_L		
785.0	Ground Level															
0.0	Organic Topsoil															
780.5	Black															
4.5	Fine sand, trace of silt.		1	SS	11	780										0 88 (12)
			2	SS	17											0 92 (8)
			3	SS	32											
			4	SS	87											
			5	SS	14	770										0 90 (10)
	Compact to Very Dense		6	SS	61											
			7	SS	76											
			8	SS	15	760										
753.5			9	SS	50											
31.5	End of Borehole															

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 2

WP 40-66-12 LOCATION Co-ords. 15,604,876 N; 1,262,717 E. ORIGINATED BY PJS
DIST 2 HWY 402 BORING DATE Sept. 29 and 30, 1975 COMPILED BY GP
DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY *GP*

SOIL PROFILE			SAMPLES			GROUND WATER	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
785.3	Ground Level															
0.0	Organic Topsoil															
782.8	Black															
781.3	Marl light grey		1	AS	-							$w_p=55$	$w=106$	$w_L=81$	OC=7.1%	
4.0			2	SS	14	↓ 780										
			3	SS	23											0 92 (8)
	Silt		4	SS	29											0 6 91 3
			5	SS	81											0 86 (14)
	Fine sand, trace of		6	SS	38	770										
	silt.		7	SS	124											
			8	SS	11											
			9	SS	65	760										
	Compact to Very Dense		10	SS	52											0 95 (5)
			11	SS	12	750										
			12	SS	36											4 89 (7)
			13	SS	48	740										
730.3						730										
55.0	Clayey Silt		14	SS	30											
						720										
	Very Stiff to Hard		15	SS	27											
						710										
						700										
			16	SS	125	690										
681.3																
104.0			17	SS	83											

MINISTRY OF TRANSPORTATION AND COMMUNICATIONS-ONTARIO
ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE No 2 Continued

WP 40-66-12 LOCATION Co-ords. 15,604,876 N; 1,262,717 E. ORIGINATED BY PJS
DIST 2 HWY 402 BORING DATE Sept. 29 and 30, 1975 COMPILED BY GP
DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY [Signature]

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT w_L PLASTIC LIMIT w_p WATER CONTENT w			UNIT WEIGHT γ	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
681.3	continued															
104.0	Clayey Silt Very Stiff to Hard					680										
673.8			18	SS	71											
111.5	End of Borehole															

RECORD OF BOREHOLE NO 3

W/P 40-66-12 LOCATION Co-ords. 15,604,950 N; 1,262,790 E. ORIGINATED BY PJS
 DIST 2 HWY 402 BORING DATE Oct. 1, 1975 COMPILED BY GP
 DATUM Geodetic BOREHOLE TYPE Hollow Stem Auger CHECKED BY *GP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT				LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS
ELEV DEPTH	DESCRIPTION	STRAT. PLT	NUMBER	TYPE	N' VALUES		20	40	60	80	100	w_p	w	w_L	
785.5	Ground Level														
0.0	Organic Topsoil														
782.5	Black														
781.5	Marl light grey		1	AS	-										
4.0			2	SS	12										
	Fine sand, trace		3	SS	41										0 92 (8)
	of silt.		4	SS	46										
			5	SS	124										
	Compact to Very		6	SS	100	8"									0 94 (6)
	Dense		7	SS	100	8"									
			8	SS	23										
754.0			9	SS	35										
31.5	End of Borehole														
	Note: WL not established														

ENGINEERING SERVICES BRANCH-GEOTECHNICAL OFFICE-SOIL MECHANICS SECTION

RECORD OF BOREHOLE NO 4

WP 40-66-12 LOCATION Co-ords. 15,604,869 N; 1,262,710 E. ORIGINATED BY PJS
 DIST 2 HWY 402 BORING DATE October 2, 1975 COMPILED BY GP
 DATUM Geodetic BOREHOLE TYPE B Casing CHECKED BY *GP*

SOIL PROFILE			SAMPLES			GROUND WATER ELEV	DYNAMIC CONE PENETRATION RESISTANCE PLOT					LIQUID LIMIT — w_L PLASTIC LIMIT — w_p WATER CONTENT — w			UNIT WEIGHT γ	REMARKS % GR SA SI CL
ELEV DEPTH	DESCRIPTION	STRAT. PLOT	NUMBER	TYPE	'N' VALUES		20	40	60	80	100	w_p	w	w_L		
785.3	Ground Level															
0.0	Organic topsoil															
782.8	Black															
781.3	Marl light grey															
4.0						780										
	Silt		1	SS	27											0 4 93 3
	Fine sand, trace		2	SS	100											0 86 (14)
	of silt.		3	SS	42	770										
			4	SS	100	7"										0 92 (8)
	Compact to Very Dense		5	SS	51											
			6	SS	100	8"										
758.8			7	SS	79	760										
26.5	End of Borehole															
	WL not established															

W P 40-66-12

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

PENETRATION RESISTANCE

'N'=STANDARD PENETRATION RESISTANCE : - 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>c LB./SQ. FT.</u>	<u>DENSENESS</u>	<u>'N' BLOWS / FT.</u>
VERY SOFT	0 - 250	VERY LOOSE	0 - 4
SOFT	250 - 500	LOOSE	4 - 10
FIRM	500 - 1000	COMPACT	10 - 30
STIFF	1000 - 2000	DENSE	30 - 50
VERY STIFF	2000 - 4000	VERY DENSE	> 50
HARD	> 4000		

TERMS TO BE USED IN DESCRIBING SOILS :-

TRACE < 10% , SOME 10-25% , WITH 25-40% , > 40% SILTY, SANDY, GRAVELLY, CLAYEY ETC.

TYPE OF SAMPLE

S.S.	SPLIT SPOON	T.W.	THINWALL OPEN
W.S.	WASHED SAMPLE	T.P.	THINWALL PISTON
S.T.	SLOTTED TUBE SAMPLE	O.S.	OESTERBERG SAMPLE
A.S.	AUGER SAMPLE	F.S.	FOIL SAMPLE
C.S.	CHUNK SAMPLE	R.C.	ROCK CORE

P.H. SAMPLE ADVANCED HYDRAULICALLY

P.M. SAMPLE ADVANCED MANUALLY

SOIL TESTS

U	UNCONFINED COMPRESSION	L.V.	LABORATORY VANE
UU	UNCONSOLIDATED UNOAINED TRIAXIAL	F.V.	FIELD VANE
CIU	CONSOLIDATED ISOTROPIC UNDRAINED TRIAXIAL	C	CONSOLIDATION
CID	" " DRAINED "	S	SENSITIVITY
CAU	" ANISOTROPIC UNDRAINED "		
CAD	" " DRAINED "		

ABBREVIATIONS & SYMBOLS USED IN THIS REPORT

SOIL PROPERTIES

γ	UNIT WEIGHT OF SOIL (BULK DENSITY)
γ_s	UNIT WEIGHT OF SOLID PARTICLES
γ_w	UNIT WEIGHT OF WATER
γ_d	UNIT DRY WEIGHT OF SOIL (DRY DENSITY)
γ'	UNIT WEIGHT OF SUBMERGED SOIL
G	SPECIFIC GRAVITY OF SOLID PARTICLES $G = \frac{\gamma_s}{\gamma_w}$
e	VOID RATIO
n	POROSITY
w	WATER CONTENT
S_r	DEGREE OF SATURATION
w_L	LIQUID LIMIT
w_p	PLASTIC LIMIT
I_p	PLASTICITY INDEX
w_s	SHRINKAGE LIMIT
I_L	LIQUIDITY INDEX = $\frac{w - w_p}{I_p}$
I_C	CONSISTENCY INDEX = $\frac{w_L - w}{I_p}$
e_{max}	VOID RATIO IN LOOSEST STATE
e_{min}	VOID RATIO IN DENSEST STATE
I_D	DENSITY INDEX = $\frac{e_{max} - e}{e_{max} - e_{min}}$
	RELATIVE DENSITY D_r IS ALSO USED
h	HYDRAULIC HEAD OR POTENTIAL
q	RATE OF DISCHARGE
v	VELOCITY OF FLOW
i	HYDRAULIC GRADIENT
k	COEFFICIENT OF PERMEABILITY
j	SEEPAGE FORCE PER UNIT VOLUME
m_v	COEFFICIENT OF VOLUME CHANGE = $\frac{-\Delta e}{(1+e)\Delta\sigma}$
c_v	COEFFICIENT OF CONSOLIDATION
C_c	COMPRESSION INDEX = $\frac{\Delta e}{\Delta \log_{10} \sigma}$
T_v	TIME FACTOR = $\frac{c_v t}{d^2}$ (d, DRAINAGE PATH)
U	DEGREE OF CONSOLIDATION
τ_f	SHEAR STRENGTH
c'	EFFECTIVE COHESION INTERCEPT
ϕ'	EFFECTIVE ANGLE OF SHEARING RESISTANCE, OR FRICTION
c_u	APPARENT COHESION
ϕ_u	APPARENT ANGLE OF SHEARING RESISTANCE, OR FRICTION
μ	COEFFICIENT OF FRICTION
S_t	SENSITIVITY

GENERAL

π	= 3.1416
e	BASE OF NATURAL LOGARITHMS 2.7183
$\log_e \sigma$ OR $\ln \sigma$	NATURAL LOGARITHM OF σ
$\log_{10} \sigma$ OR $\log \sigma$	LOGARITHM OF σ TO BASE 10
t	TIME
g	ACCELERATION DUE TO GRAVITY
V	VOLUME
W	WEIGHT
M	MOMENT
F	FACTOR OF SAFETY

STRESS AND STRAIN

u	PORE PRESSURE
σ	NORMAL STRESS
$\bar{\sigma}$	NORMAL EFFECTIVE STRESS ($\bar{\sigma}$ IS ALSO USED)
τ	SHEAR STRESS
ϵ	LINEAR STRAIN
γ	SHEAR STRAIN
ν	POISSON'S RATIO (μ IS ALSO USED)
E	MODULUS OF LINEAR DEFORMATION (YOUNG'S MODULUS)
G	MODULUS OF SHEAR DEFORMATION
K	MODULUS OF COMPRESSIBILITY
η	COEFFICIENT OF VISCOSITY

EARTH PRESSURE

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

FOUNDATIONS

B	BREADTH OF FOUNDATION
L	LENGTH OF FOUNDATION
D	DEPTH OF FOUNDATION BENEATH GROUND
N	DIMENSIONLESS COEFFICIENT USED WITH A SUFFIX APPLYING TO SPECIFIC GRAVITY, DEPTH AND COHESION ETC. IN THE FORMULA FOR BEARING CAPACITY
k_s	MODULUS OF SUBGRADE REACTION

SLOPES

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

