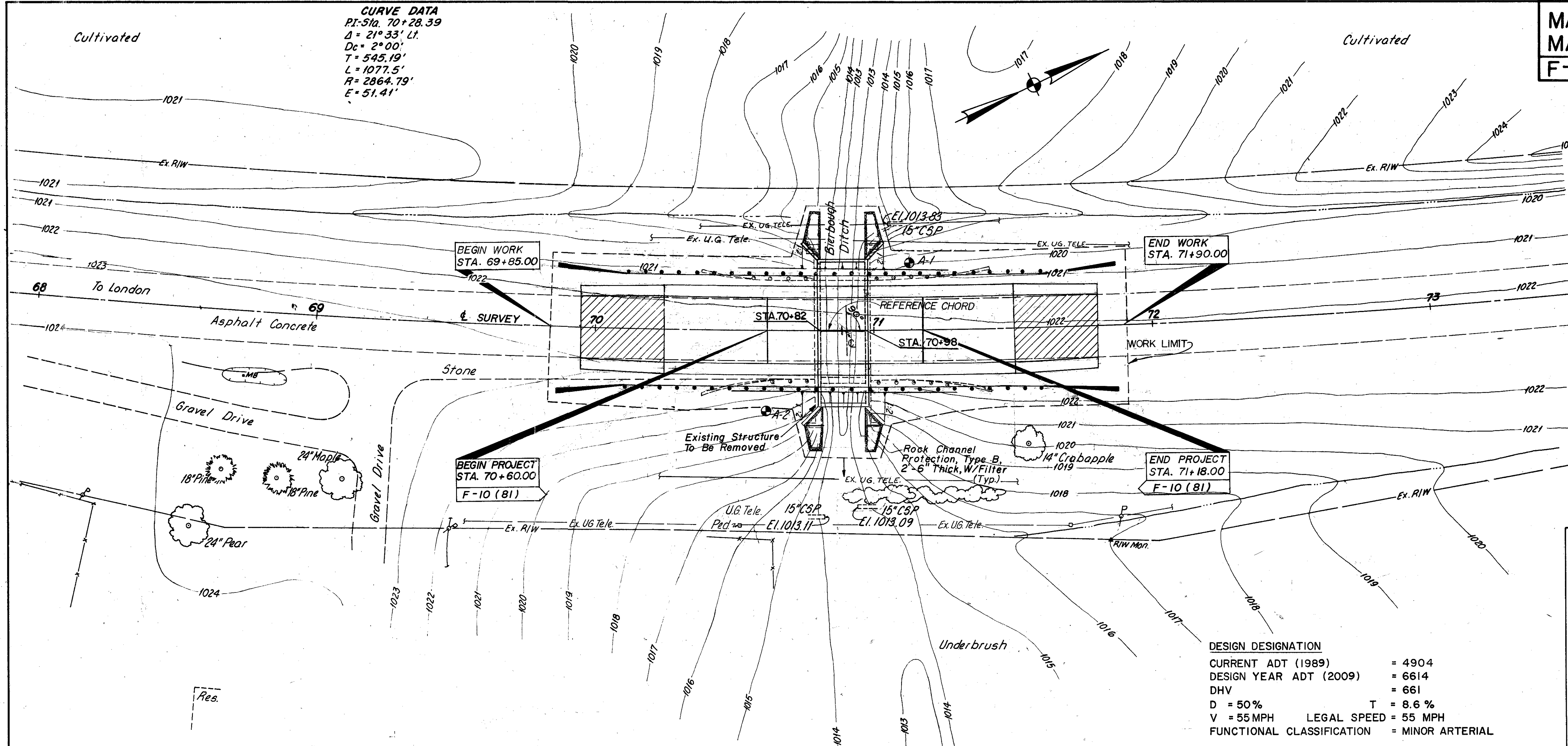


CURVE DATA  
PI: Sta. 70+28.39  
Δ = 21° 33' Lt.  
Dc = 2° 00'  
T = 545.19'  
L = 1077.5'  
R = 2864.79'  
E = 51.41'



BEGIN WORK  
STA. 69+85.00

END WORK  
STA. 71+90.00

BEGIN PROJECT  
STA. 70+60.00  
F-10 (81)

END PROJECT  
STA. 71+18.00  
F-10 (81)

B.M.  
R/W MONUMENT = 51 FEET LEFT  
STA. 80+00  
ELEVATION = 1024.16 FEET

T.B.M.  
S/E TOP OF WINGWALL  
ELEVATION = 1023.07 FEET

Earthwork Limits shown are  
approximate. Actual Slopes shall  
conform to Plan Cross Sections.

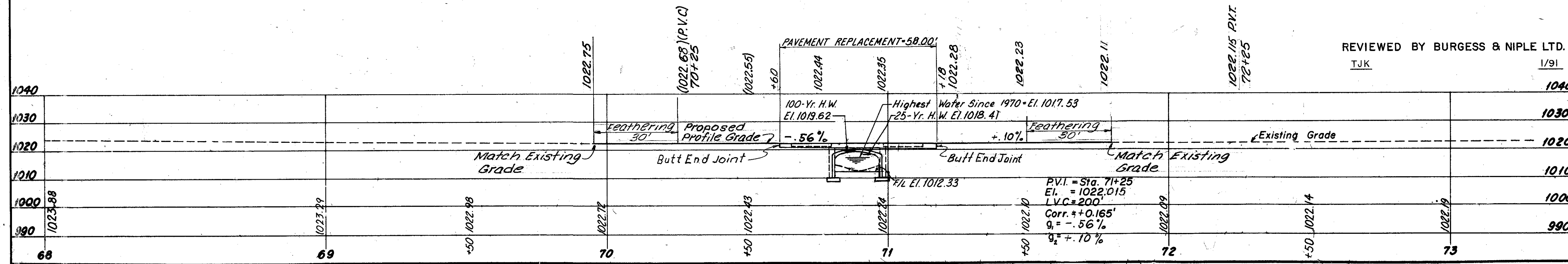
DESIGN DESIGNATION  
CURRENT ADT (1989) = 4904  
DESIGN YEAR ADT (2009) = 6614  
DHV = 661  
D = 50% T = 8.6 %  
V = 55 MPH LEGAL SPEED = 55 MPH  
FUNCTIONAL CLASSIFICATION = MINOR ARTERIAL

BRIDGE HYDRAULIC DATA  
DRAINAGE AREA = 1.69 SQ. MILES  
SLOPE (0.10L TO 0.85L) = 0.34% = 18.1 FT./MILE  
LOCAL SLOPE = 0.21% = 11.1 FT./MILE  
Q<sub>25</sub> = 470 C.F.S. Q<sub>100</sub> = 654 C.F.S.  
V<sub>25</sub> = 10.74 FT./SEC. V<sub>100</sub> = 12.85 FT./SEC.  
A<sub>25</sub> = 158.33 SQ. FT. A<sub>100</sub> = 211.20 SQ. FT.  
H.W. EL. = 1018.41 H.W. EL. = 1019.62

EXISTING STRUCTURE  
TYPE: REINFORCED CONCRETE SLAB (14 1/2" THICK)  
WITH REINFORCED GRAVITY CONCRETE  
SUBSTRUCTURE (FULL HEIGHT)  
SPAN: 16' CLEAR, 18'-6" O/D SLAB  
ROADWAY: 35' F/F RAILING/G.R., 37' O/D DECK  
LOADING: H 15-33  
SKEW: 0°  
WEARING SURFACE: CONCRETE + ASPHALT CON-  
CRETE  
APPROACH SLABS: AS-35 (10" THICK X 14'-0" LONG)  
ALIGNMENT: 2°-00' CURVE TO LEFT  
HEIGHT: GRADE TO STREAMBED = 9.2'; GRADE TO HIGH  
WATER = 4'  
CHANNEL: 15' BETWEEN BANKS; DEPTH = 6' (LT.), 3'  
(RT.); MUD BOTTOM, GRASSY BANKS  
CONDITION: POOR (BUILT IN 1939).  
S.F.N. 4901231

PROPOSED STRUCTURE  
TYPE: 3-SIDED PRECAST REINFORCED CONCRETE ARCH  
CULVERT WITH FOOTINGS  
LOADING: HS20-44 AND THE ALTERNATE MILITARY  
LOADING  
SKEW: 0°  
ALIGNMENT: 2°-00' TO LEFT  
SPAN: 16'-0"  
ROADWAY: 40'-0" F/F GUARDRAILS

REVIEWED BY BURGESS & NIPLE LTD.  
TJK 1/91



DESIGN 1					
RACKOFF ENGINEERS, INC. 1/9					
ENGINEERS - CONSULTANTS COLUMBUS, OHIO					
SITE PLAN					
STRUCTURE NO. MAD-42-0887					
OVER BIERBOUGH DITCH					
MADISON COUNTY STA. 70 + 82					
STA. 70 + 98					
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE
S.E.M.	E.A.	E.A.	M.R.	M.R.	11-5-90

**DESIGN DATA :** Design Loading HS20 - 44 and The Alternate Military Loading.  
 Concrete Class C - Compressive Strength 4000 psi  
 Reinforcing Steel - ASTM A615, A 616, A617 -  
 Grade 60, Min. Yield Strength = 60.000psi.

**REMOVAL OF EXISTING STRUCTURE:**

When no Longer Needed To Maintain Traffic The Existing Structure Shall Be Removed.  
 Masonry May Be Placed As Bank Protection As Directed By The Engineer.

**UTILITY LINES:** All Expenses Involved in Relocating The Affected Utility Lines Shall Be Borne By The Owners. The Contractor And Owners Are Requested To Cooperate By Arranging Their Work in Such A Manner That Inconvenience To Either Will Be Held To A Minimum.

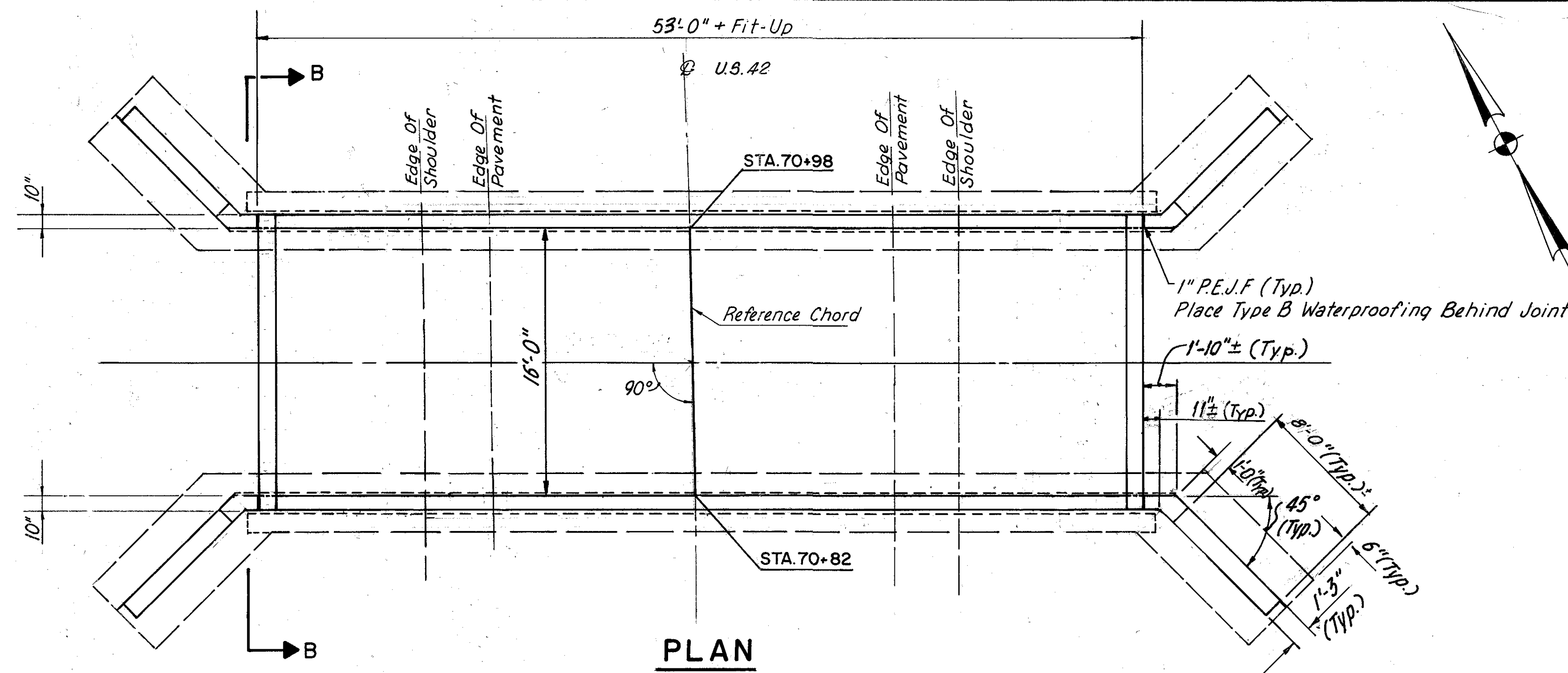
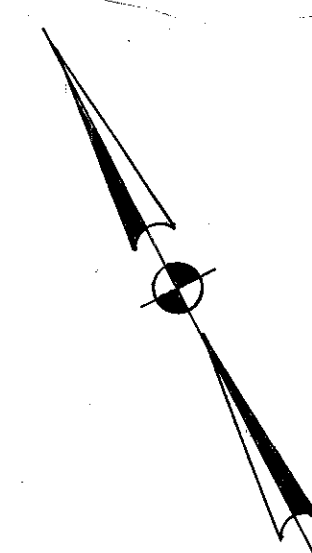
**DESIGN SPECIFICATIONS:** This Structure Conforms To "Standard Specifications For Highway Bridges" Adopted By The American Association Of State Highway And Transportation Officials, 1989 And The Ohio "Supplement" To These Specifications.

**FOUNDATION BEARING PRESSURE:** Footings, As Designed, Produce A Maximum Bearing Pressure Of 1.50 Tons Per Square Foot.

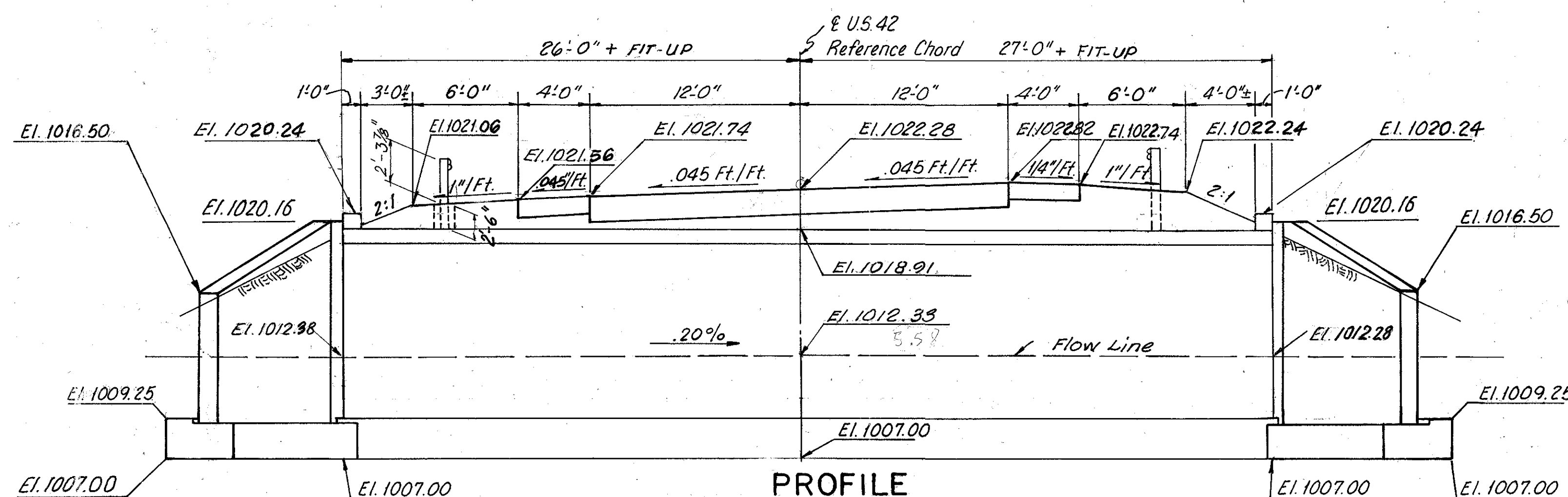
**GUARDRAIL POSTS:**

Guardrail Posts On The West Side Of The Structure Shall Be Installed Using A 4" Minimum Concrete Encasement, As Per Standard Drwg. GR-1. Posts On The East Side Require Standard Embedment.

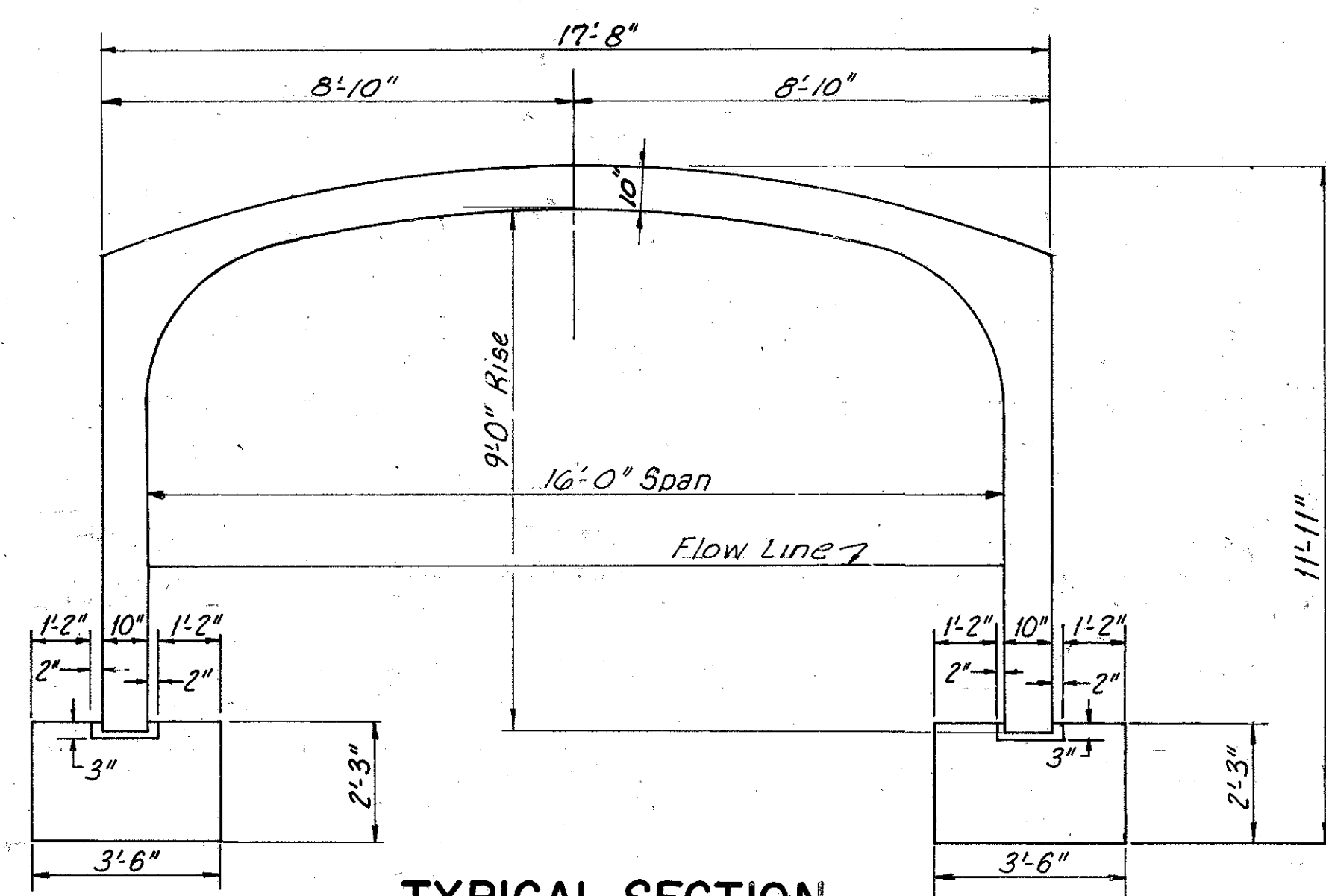
Tubular Back-up Is Not Required.



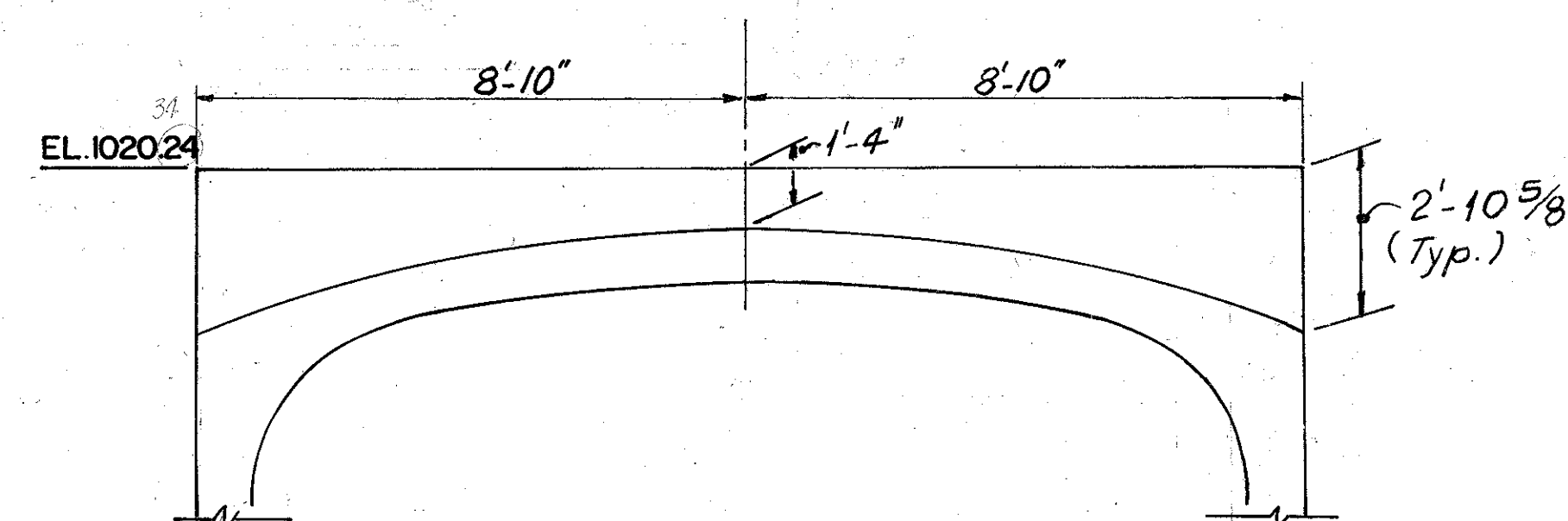
**PLAN**



**PROFILE**



**TYPICAL SECTION**



**VIEW B-B**

DESIGN 1 "ARCH"					
RACKOFF ENGINEERS, INC. 2/9					
ENGINEERS - CONSULTANTS COLUMBUS, OHIO					
<b>CULVERT DETAILS</b>					
STRUCTURE NO. MAD - 42 - 0887					
OVER BIERBOUGH DITCH					
MADISON COUNTY STA. 70 + 82					
STA. 70 + 98					
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE
SEM.	SEM.	E.A.	M.R.	M.R.	7-26-90
REVISED					



DESIGN 1

ESTIMATED QUANTITIES				CALC'D S.E.M.	CHECKED BY: LMG
ITEM	ITEM EXT.	TOTAL	UNIT	DESCRIPTION	DATE: 10-08-90
202	11000	LUMP		STRUCTURE REMOVED	
503	11100	LUMP		COFFERDAMS, CRIBS AND SHEETING	
503	21300	LUMP		UNCLASSIFIED EXCAVATION	
509	11400	3608	LB.	REINFORCING STEEL, GRADE 60	
511	46000	18	CUYD.	CLASS C CONCRETE, RETAINING WALL OR WINGWALL	
511	46500	49	CUYD.	CLASS C CONCRETE, FOOTINGS	
512	44400	7	SQ. YD.	TYPE B WATERPROOFING	
516	13600	36	SQ. FT.	1" PREFORMED EXPANSION JOINT FILLER	
518	21200	10	CUYD.	POROUS BACKFILL WITH FILTER FABRIC	
603	71001	53	LIN. FT.	CONDUIT, TYPE A, PRECAST REINFORCED CONCRETE ARCH SECTIONS, AS PER PLAN	
				16'-0" SPAN x 9'-0" RISE	

DESIGN 1

REINFORCING STEEL - GRADE 60 - WALLS						BENDING DIAGRAMS	
MARK	NO.	LENGTH	WEIGHT	SHAPE	COMMENTS		
W507	20	10'-5"	217	STR.			
W510	40	A	355	STR.	* 8 SERIES OF 5 BARS		
W511	40	8'-6"	355	STR.			
W515	16	B	94	STR.	Y 8 SERIES OF 2 BARS		
W516	8	9'-4"	78	BT.			
W518	32	2'-5"	81	BT.			
W519	32	1'-7"	53	STR.			
REINFORCING STEEL - GRADE 60 - FOUNDATIONS							
F405	140	3'-0"	280	STR.			
F505	8	3'-4"	28	STR.			
F510	32	C	392	BT.	* 8 SERIES OF 4 BARS		
F511	56	5'-0"	292	STR.			
F512	32	4'-3"	142	STR.			
F605	32	5'-8"	273	BT.			
F606	24	26'-10"	968	STR.			
TOTAL				3608			

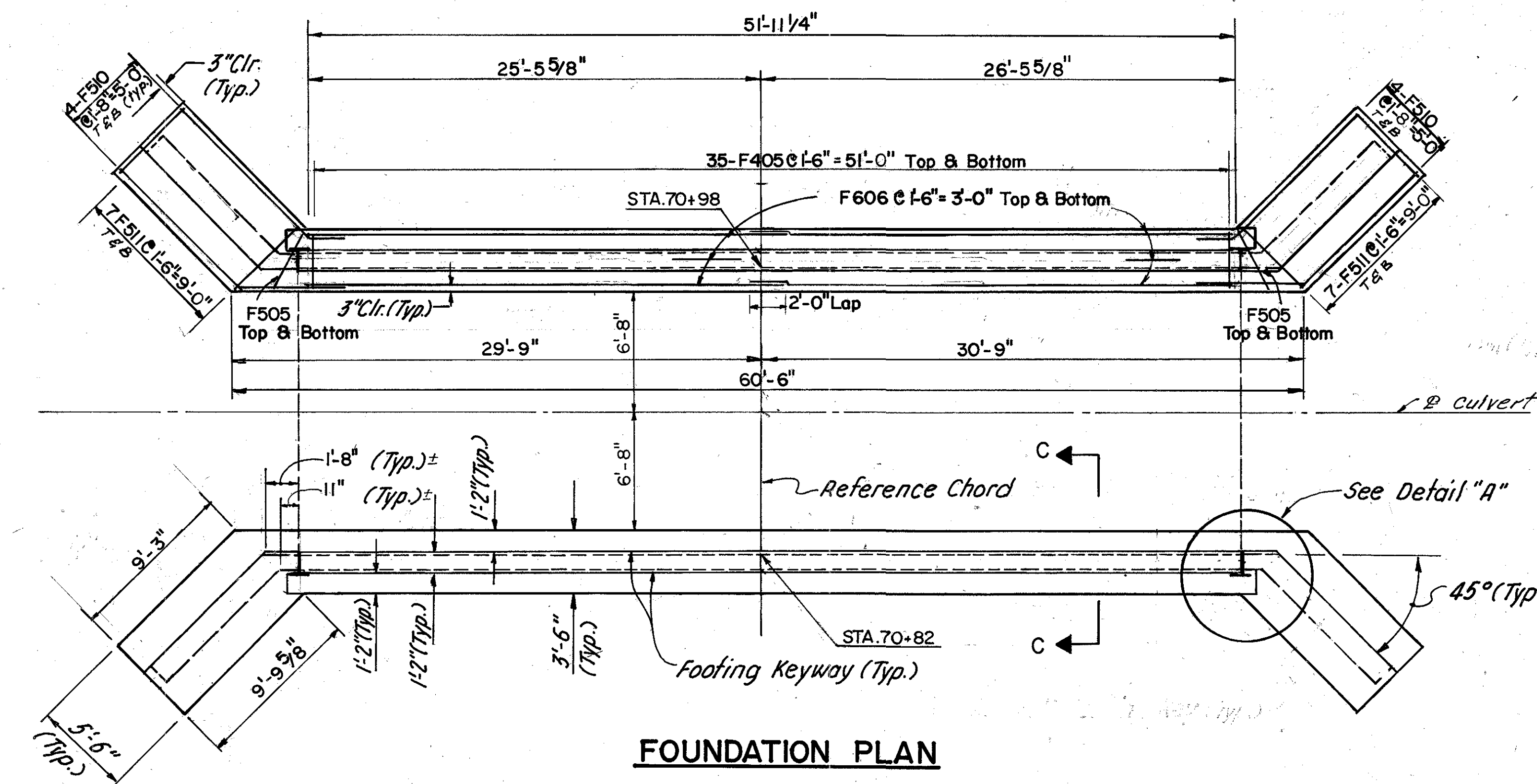
A - VARIES 7'-0" TO 10'-0" INC. 9"  
B - VARIES 4'-0" TO 7'-3" INC. 3'-3"  
C - VARIES 11'-0" TO 12'-6" INC. 6"

DESIGN 1 PRECAST REINFORCED CONCRETE ARCH CULVERT

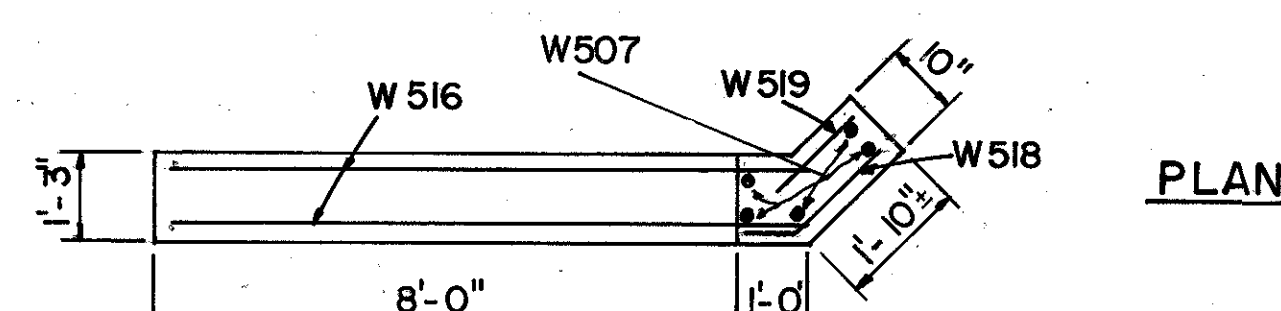
RACKOFF ENGINEERS, INC.  
ENGINEERS CONSULTANTS  
COLUMBUS, OHIO

CULVERT DETAILS  
STRUCTURE NO. MAD - 42 - 0887  
OVER BIERBOUGH DITCH  
MADISON COUNTY STA. 70+82  
STA. 70+98

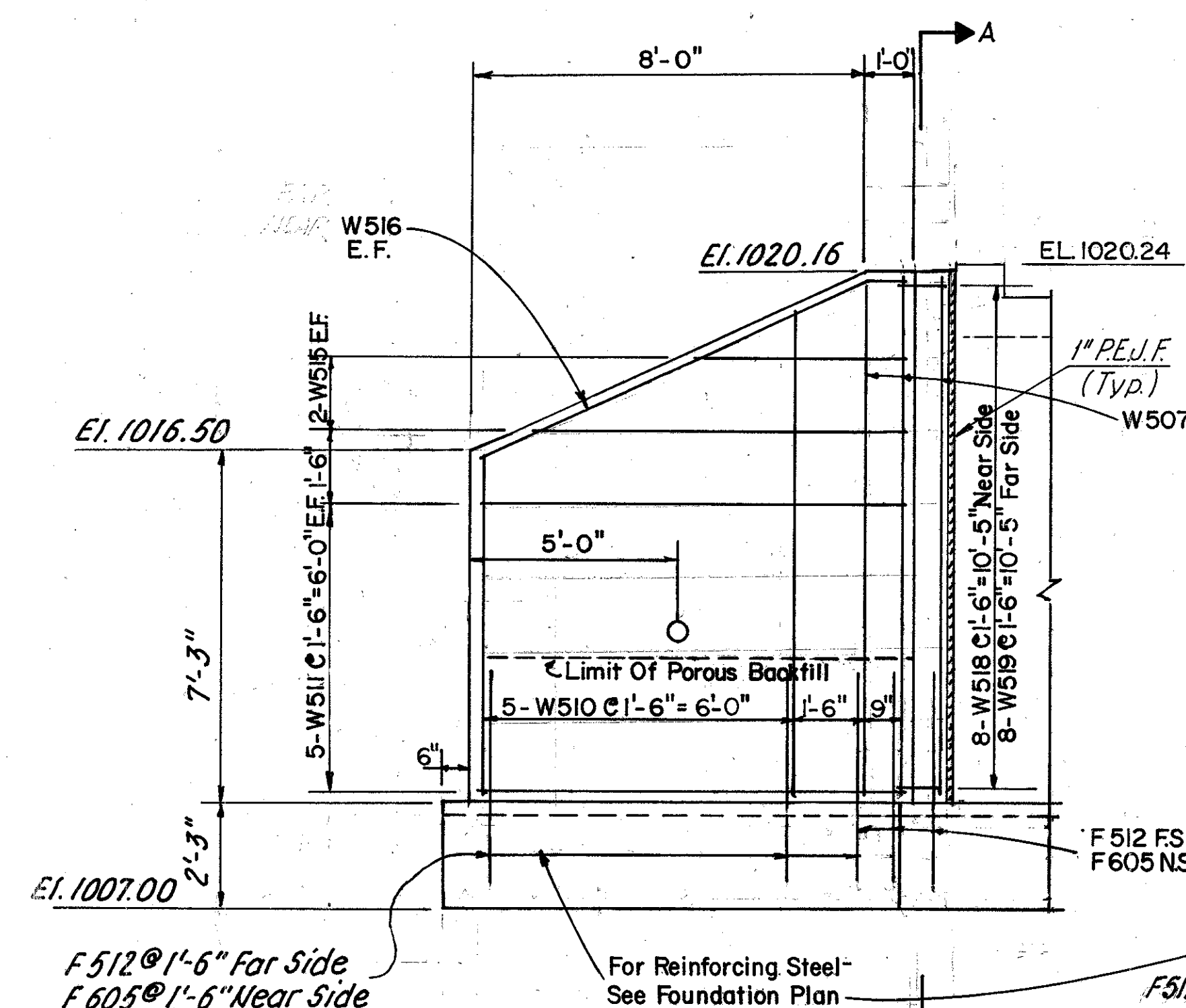
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
S.E.M.	E.A.	E.A.	M.R.	M.R.	11-5-90	



FOUNDATION PLAN

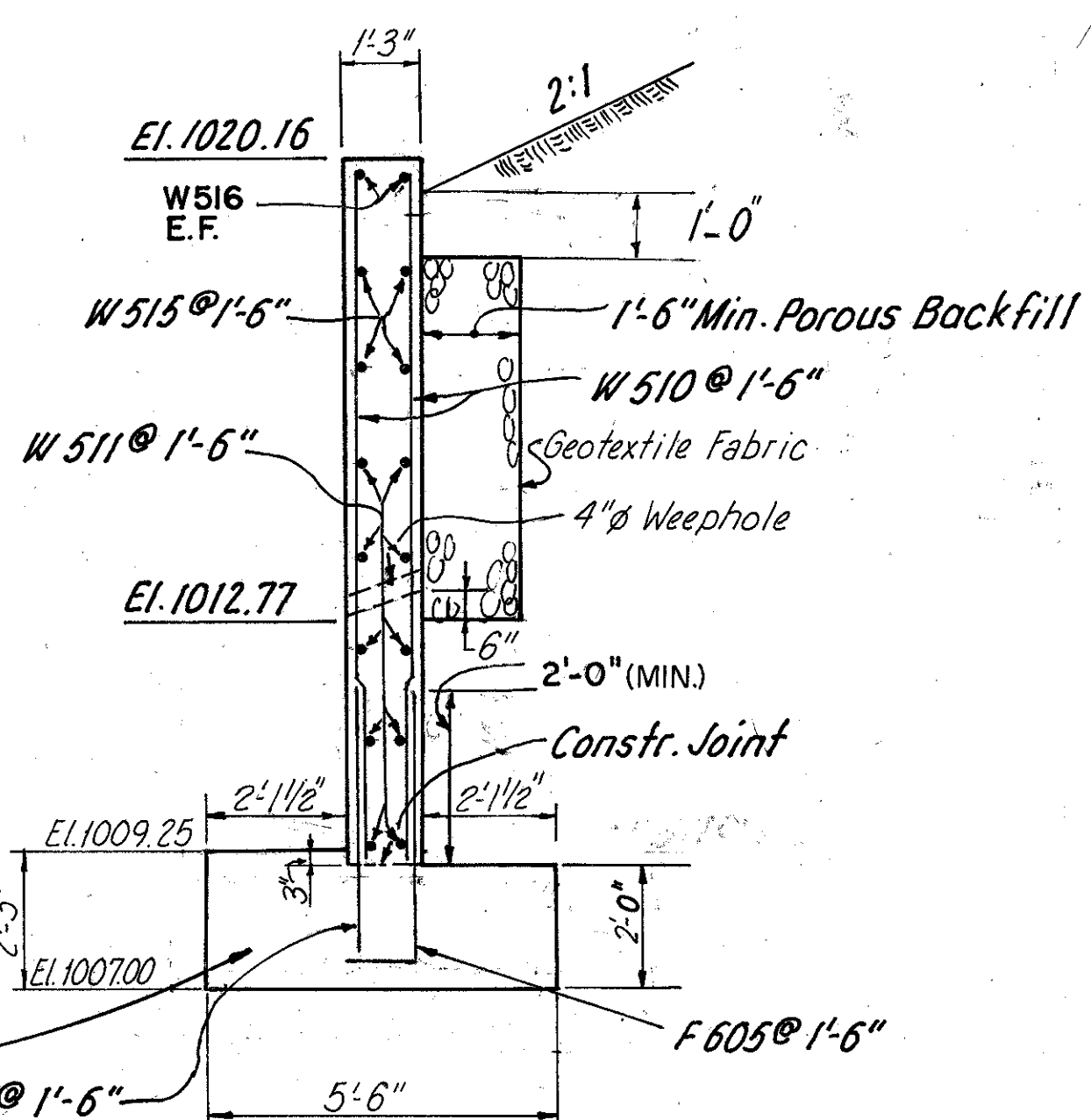


PLAN

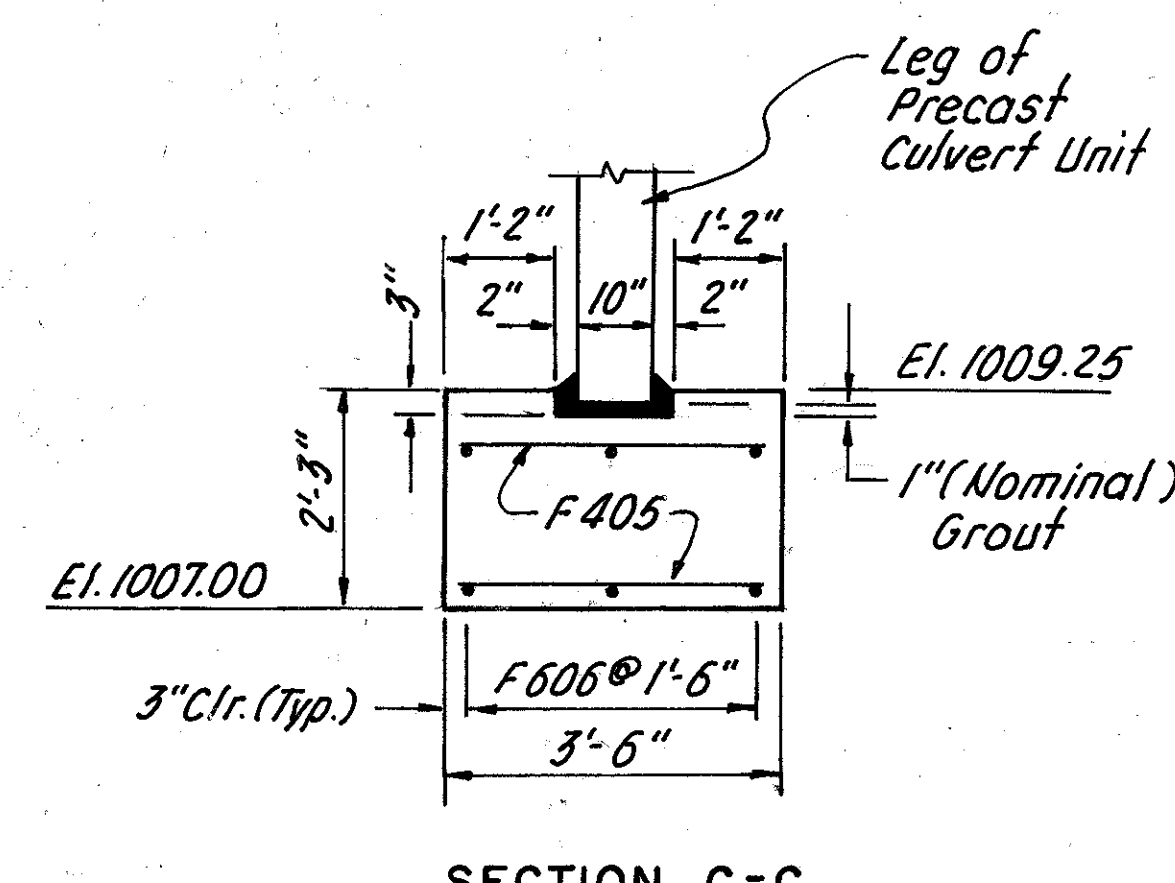


ELEVATION  
(Typical All Wingwalls)

WINGWALLS



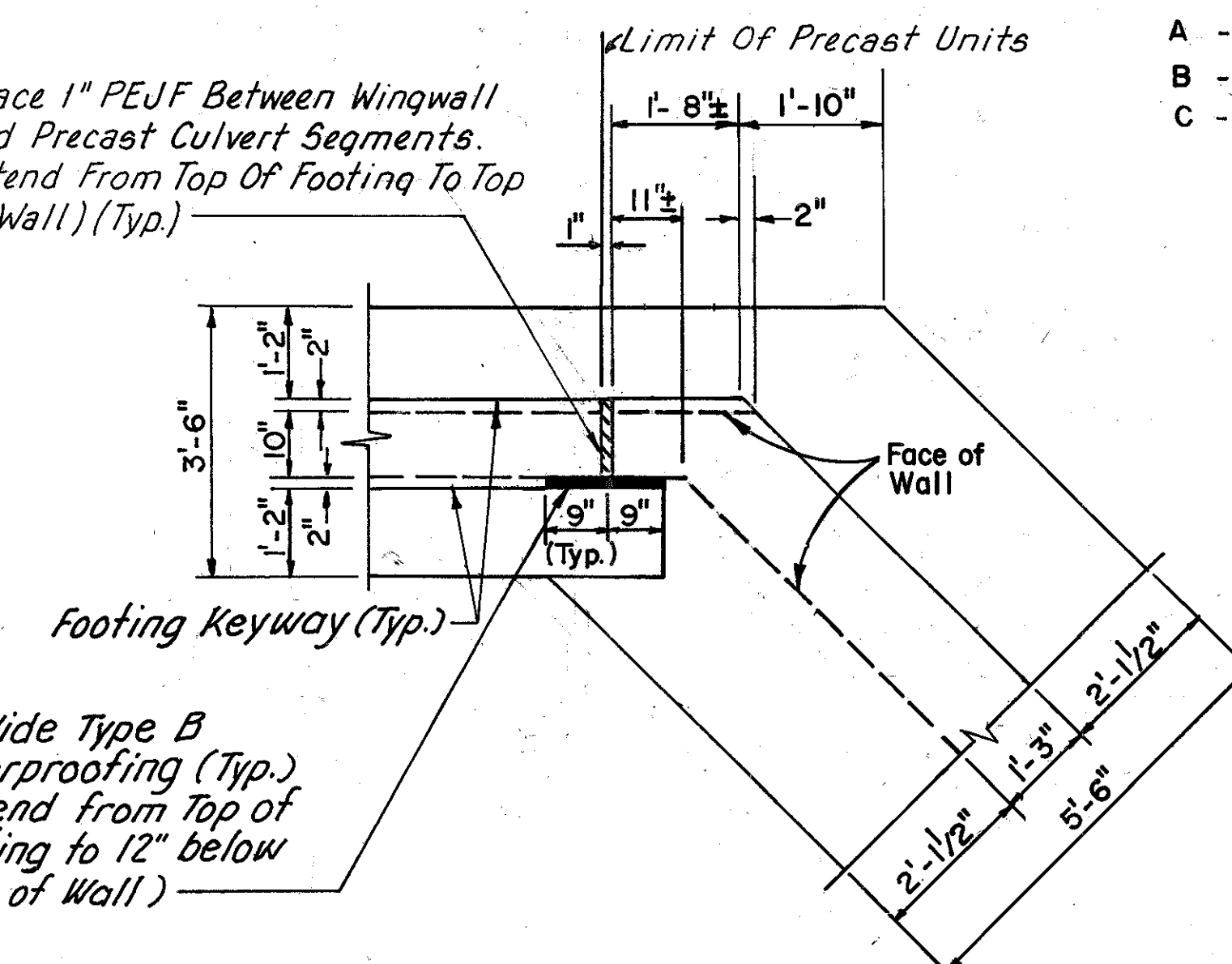
SECTION A-A  
(Typical All Wingwalls)



SECTION C-C

Place 1" PEJF Between Wingwall And Precast Culvert Segments. (Extend From Top Of Footing To Top Of Wall) (Typ.)

18" Wide Type B Waterproofing (Typ.) (Extend from Top of Footing to 12" below Top of Wall)



DETAIL "A"



ITEM 603 - PRECAST REINFORCED CONCRETE ARCH SECTIONS

MADISON COUNTY  
MAD-42-8.87  
F-10 (81)

F.H.W.A. REGION	STATE	PROJECT	
5	OHIO		

11
16

DESCRIPTION

This item shall consist of manufacturing precast reinforced concrete arch sections for culverts. Precast arch sections shall be manufactured in accordance with these notes and shall be designated by span, rise and cover (1.0 feet minimum) above the exterior crown section. The arch sections are designed in accordance with the "Standard Specifications for Highway Bridges" adopted by the American Association of State Highway and Transportation Officials, 1983, including all issued Interim Specifications and the Ohio "Supplement" to these specifications.

DESIGN LOADING

HS20 - 44 and the Alternate Military Loading.

DESIGN STRESSES

Concrete Class C - compressive strength 4000 p.s.i.

Reinforcing Steel - ASTM A 615, A 616 minimum yield strength 60,000 p.s.i.

Welded Wire Fabric - ASTM A 185, A 497 minimum yield strength 65,000 p.s.i.

Dimensions shall be as prescribed in the plans.

Manufacturer - Standard drawings on record in the Bridge Bureau Structures Rating Inventory Sections and the District offices

MATERIALS - CONCRETE

The concrete for the arch sections shall be air entrained, composed of portland cement, fine and coarse aggregates, admixtures and water. Portland cement shall conform to the requirements of 701.04 or 701.05. Aggregates shall meet the quality requirements of 703.02. The manufacturer may submit for approval by the Engineer, water-reducing admixture for the purpose of increasing workability and reducing water requirements. The air entraining admixture shall conform to 705.10. Concrete shall contain 6 (plus or minus) 2 percent air. The addition to the mix of calcium chloride will not be permitted.

MATERIALS - REINFORCEMENT AND HARDWARE

All reinforcing steel for the sections shall be fabricated and placed in accordance with the plans and these notes. Reinforcement shall consist of welded wire fabric or deformed billet - steel bars.

MATERIALS - CONCRETE SEALERS

A sealer shall be applied on the top of the arch and the arch joint mating surfaces, for the full length of the structure or the limits which are in contact with the backfill. One of the following sealers shall be used: An epoxy sealer meeting the requirements of Proposal Note 110-84 or Hydrozo Clear 56 as manufactured by Hydrozo Coating Co., 855 W. Street, Lincoln, Nebraska 68501. See the proposal note for preparation requirements, application rates, material requirements and application procedures for the epoxy sealers. The Hydrozo Clear 56 shall be applied in one coat at a rate of 100 square feet per gallon. Surface preparation and application procedures shall be as recommended by Hydrozo for Hydrozo 56.

MANUFACTURE

The aggregates, cement and water shall be proportioned and mixed in a batch mixer to produce a homogeneous concrete meeting the strength requirements of these notes. The proportion of portland cement in the mixture shall not be less than 564 pounds per cubic yard of concrete.

The arch sections shall be cured for a sufficient length of time so that the concrete will develop the specified compressive strength in 28 days or less. Any one of the methods of curing or combination thereof shall be used:

Steam Curing - The sections may be low pressure, steam cured by a system that will maintain a moist atmosphere.

Water Curing - The sections may be water cured by any method that will keep the sections moist.

The forms used in manufacture shall be sufficiently rigid and accurate to maintain the sections dimensions within the permissible variations given in these notes. All casting surfaces shall be of smooth material.

Not more than four holes may be cast or drilled in the shell of each section for the purpose of handling or setting. Before backfilling, the holes shall be filled with portland cement mortar, or with precast concrete plugs which shall be secured with portland cement mortar, or other approved adhesive.

The sections shall be stored in such a manner to prevent cracking or damage. The units shall not be stored in an upright position until the compressive strength is a minimum of 4,000 p.s.i.

The cover of concrete over the outside circumferential reinforcement shall be 2 inches minimum. The cover of concrete over the inside circumferential reinforcement shall be 1 1/2 inches minimum. The clear distance of the end circumferential wires shall not be less than one inch nor more than two inches from the ends of the sections. Reinforcement shall be assembled utilizing single or multiple layers of welded wire fabric, or utilizing a single layer of deformed billet-steel bars. The welded wire fabric shall be composed of circumferential and longitudinal wires meeting the spacing requirements of these notes and shall contain sufficient longitudinal wires extending through the section to maintain the shape and position of reinforcement. Longitudinal distribution reinforcement may be welded wire fabric or deformed billet-steel bars and shall meet the spacing requirements of these notes. The ends of the longitudinal distribution reinforcement shall be not more than 3 inches from the ends of the sections.

The outside and inside circumferential reinforcing steel for the corners of the culvert shall be bent to such an angle that it is approximately equal to the configuration of the culverts outside corner.

Tension splices in the circumferential reinforcement shall not be made. For splices other than tension splices, the overlap shall be a minimum of 12 inches for welded wire fabric or deformed billet-steel bars. The spacing center to center of the circumferential wires in a wire fabric sheet shall be not less than 2 inches nor more than 4 inches. For the wire fabric, the spacing center to center of the longitudinal wires shall not be more than 8 inches. The spacing center to center of the longitudinal distribution steel for either line of reinforcing in the top slab shall be not more than 16 inches.

The sections shall be produced with butt ends. The ends of the sections shall be such that when the sections are laid together they will make a continuous line of sections with a smooth interior free of appreciable irregularities, all compatible with the permissible variations in these notes. Provide a tapered notch more narrow on the top surface at the sections joint to form a void for non-shrinking mortar. After the sections are set in place the largest gap at each joint shall be 3/4 inch.

The sections shall be substantially free of fractures. The ends of the sections shall be normal to the walls and center line of the section, within the limits of variations given in these notes except where beveled ends are specified. The surface of the section shall be a smooth steel form or troweled surface. Trapped air pockets causing surface defects shall be considered as part of a smooth steel form finish.

Sections may be repaired, if necessary, because of imperfections in manufacture or handling damage and will be acceptable if in the opinion of the purchaser, the repairs are sound, properly finished and cured, and the repaired section conforms to the requirements of these notes.

The quality of materials, the process of manufacture, and the finished sections shall be subject to inspection by the purchaser.

Sections shall be subject to rejection on account of any of the requirements in these notes. Individual sections may be rejected because of any of the following:

Fractures or cracks passing through the wall, except for a single end crack that does not exceed one half the thickness of the wall.

Defects that indicate proportioning, mixing, and molding not in compliance with these notes.

Honeycombed or open texture.

Damaged ends where such damage would prevent making a satisfactory joint.

Each section shall be clearly marked by waterproof paint. The following information shall be shown on the inside surface of the vertical leg of the section:

Section Span x Rise  
Earth Cover  
Date of Manufacturer  
Name or Trademark of the Manufacturer

PERMISSIBLE VARIATIONS

The internal dimension shall vary not more than 1 percent from the design dimensions nor more than 1 1/2 inches whichever is less. The haunch dimensions shall vary not more than 3/4 inch from the design dimension.

The slab and wall thickness shall not be less than that shown in the design by more than 1/4 inch. A thickness more than that required in the design shall not be cause for rejection.

Variations in laying lengths of two opposite surfaces shall not be more than 5/8 inch in any section, except where beveled ends for laying of curves are specified by the purchaser.

The under-run in length of a section shall not be more than 1/2 inch.

The maximum variation in position of the reinforcement shall be plus or minus 1/2 inch. In no case shall the cover over the reinforcement be less than 1 1/2 inches for the outside circumferential steel or be less than one inch for the inside circumferential steel as measured to the external or internal concrete surface. These tolerances or cover requirements do not apply to mating surfaces of the joints.

The areas of steel reinforcement shall be the design steel areas as described in Standard drawings on record in the Bridge Bureau Structures Rating Inventory Sections and the District offices. Steel areas greater than those shown shall not be cause for rejection.

TESTING AND INSPECTION

Concrete compressive strength shall be determined from compression tests made on cores. For core testing, one core shall be cut from a section selected at random from each group of 15 sections or less of a particular size and production run. For each continuous production run, each group of 15 sections of a single size or fraction thereof shall be considered separately for the purpose of testing and acceptance. A production run shall be considered continuous if not interrupted for more than 3 consecutive days.

Cores shall be obtained and tested for compressive strength in accordance with methods described in AASHTO T-33.

The compressive strength of the concrete in each group of sections is acceptable when the core test strengths are equal to or greater than the design concrete strength. When the compressive strength of the core tested is less than the design concrete strength, the section from which that core was taken may be rejected. When the compressive strength of the re-core is equal to or greater than the design concrete strength, the compressive strength of the concrete in that group of sections is acceptable. When the compressive strength of any re-core is less than the design concrete strength, the section from which that core was taken shall be rejected. Two sections from the remainder of the group shall be selected at random and one core shall be taken from each. If the compressive strength of both cores is equal to or greater than the design concrete strength, the compressive strength of the remainder of that group of sections is acceptable. If the compressive strength of either of the two cores tested is less than the design concrete strength, the remainder of the group of sections shall be rejected or, at the option of the manufacturer, each section of the remainder of the group shall be cored and accepted individually, and any of these sections that have cores with less than the design strength shall be rejected.

The core holes shall be plugged and sealed by the manufacturer in a manner that the section will meet all of the requirements of these notes.

Every manufacturer furnishing arch sections shall furnish all facilities and personnel necessary to carry out the tests required.

INSTALLATION

The structure shall be installed in accordance with specifications for Type A Conduit, Section 603 of the Construction and Material Specifications, State of Ohio, Department of Transportation, except as modified herein.

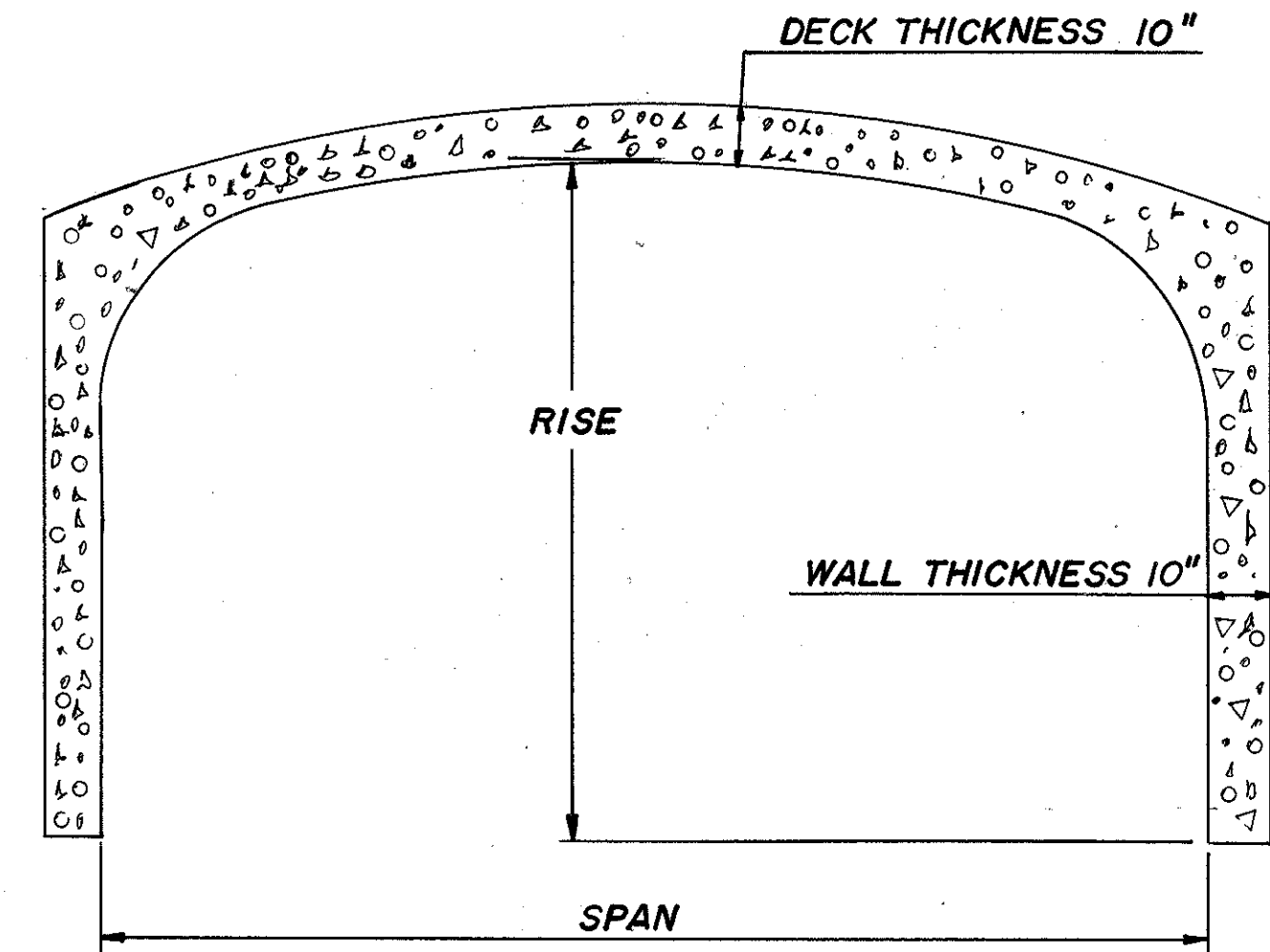
603.03: Where the arch section is to be placed in a trench, a minimum trench width of 2 feet on each side of the section shall be required. Where the section is to be placed within an embankment or the section is above the existing ground, the requirement that the embankment shall be constructed at least to the spring-line before trenching is waived.

603.08: When the top of the trench is above the top of the arch section, backfill material shall be granular and shall be compacted with mechanical tampers or approved compacting equipment in layers not to exceed 6" (loose depth). Granular material may be compacted with water in accordance with Type A conduit. When the top of the section is above the top of the trench, granular material shall be placed and compacted to a minimum depth of 2 feet over the top of the sections (where applicable) and for a width of 4 feet on each side of the section or as directed by the engineer. The remainder of the adjacent embankment material shall be furnished, placed, and paid for in accordance with 203. Backfill and fill materials shall be placed uniformly on both sides of the section.

Fill material beyond 4 feet of the sides of the sections may be compacted by heavy compaction equipment.

The sections shall be installed on concrete footings. The design, size and elevation of the footers shall be as shown in the plans. A 2-3 inch deep by 14 inch wide key-way shall be formed in the center of the footing.

The footings shall be given a smooth float finish and shall reach a compressive strength of 2,000 p.s.i. before placement of the sections. The completed footing surface shall be constructed in accordance with grades shown on the plans.



STATE OF OHIO DEPARTMENT OF TRANSPORTATION BUREAU OF LOCATION AND DESIGN				
4 / 9				
PRECAST REINFORCED CONCRETE ARCH SECTIONS GENERAL NOTES				
STRUCTURE NO. MAD-42-0887 OVER BIERBOUGH DITCH MADISON COUNTY STA. 70+82 TO 70+98				
DESIGNED WJK	DESIGNED JDH	DRAWN	DATE 6/11/87	REVISED





**DESIGN DATA:** Design Loading H520-44 and The Alternate Military Loading:  
 Concrete Class C-Compressive Strength 4000psi  
 Reinforcing Steel-A57M A615, A616, A617-Grade 60

**REMOVAL OF EXISTING STRUCTURE:** When No Longer Needed To Maintain Traffic The Existing Structure Shall Be Removed. Suitable Waste Masonry May Be Placed As Bank Protection As Directed By The Engineer.

**UTILITY LINES:** All Expenses Involved In Relocating The Affected Utility Lines Shall Be Borne By The Owners. The Contractor And Owners Are Requested To Cooperate By Arranging Their Work In Such A Manner That Inconvenience To Either Will Be Held To A Minimum.

**DESIGN SPECIFICATIONS:** This Structure Conforms To "Standard Specifications For Highway Bridges" Adopted By The American Association Of State Highway And Transportation Officials, 1989,

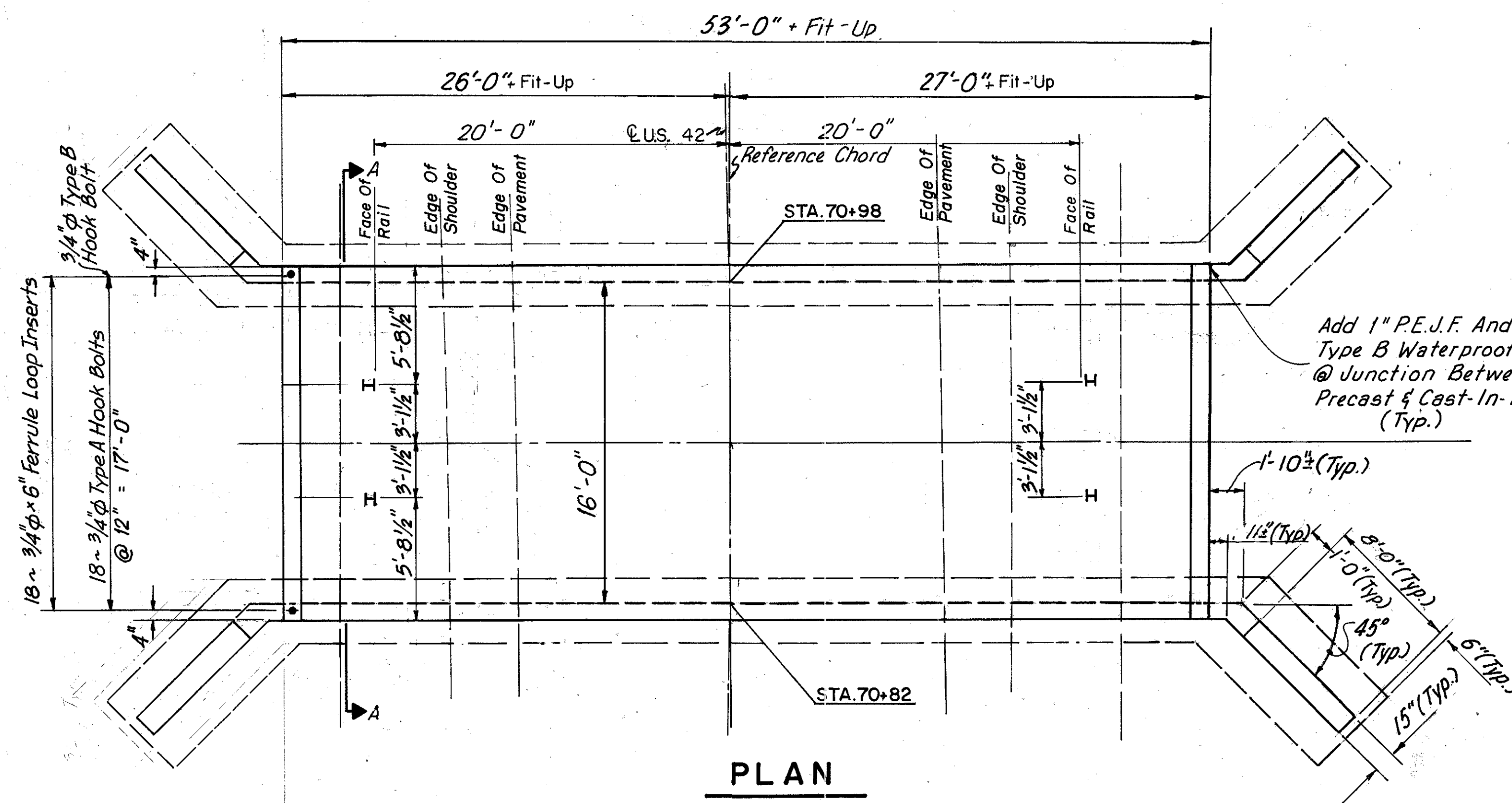
And The Ohio "Supplement" To These Specifications.

**FOUNDATION BEARING PRESSURE:** Footings As Designed, Produce A Maximum Bearing Pressure Of 1.50 Tons Per Square Foot.

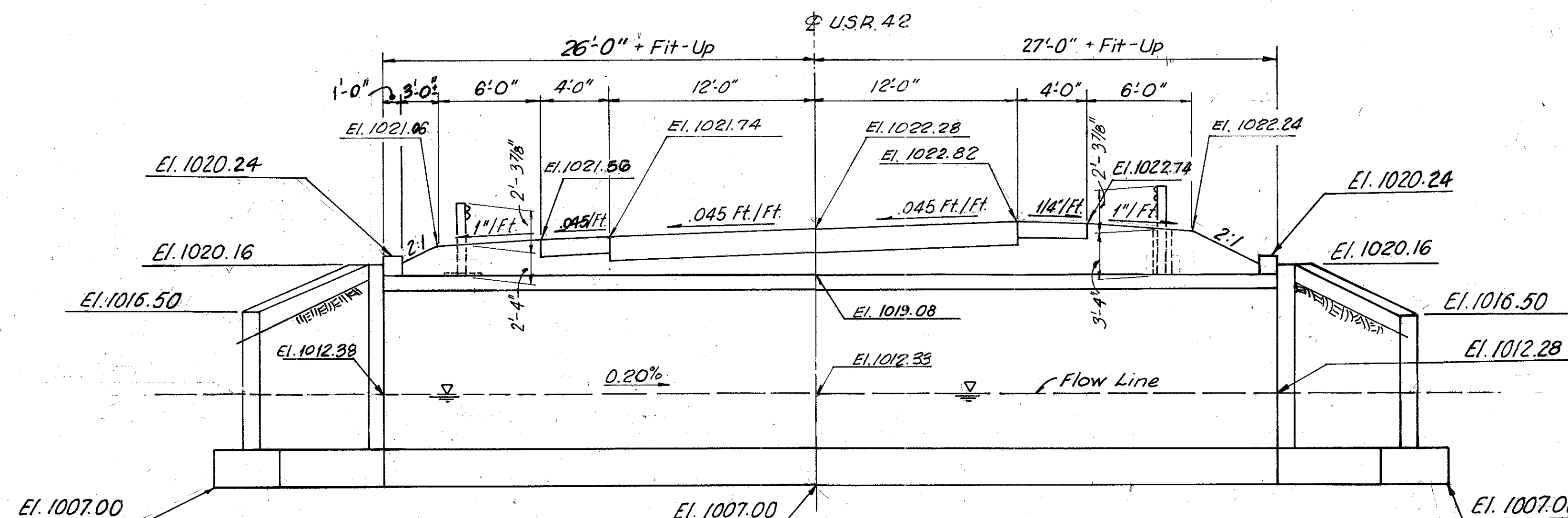
**GUARDRAIL POSTS:** Guardrail Posts On The West Side Of The Structure Shall Be Through Bolted To The Structure As Per Std. Drwg. GR-1. Posts On The East Side Require 4" Min. Concrete Encasement.

**DRILLING METHODS:** Drilling Methods That Cause Spalling Of The Concrete When The Bit Passes Out Through The Under Side Of The Structure Deck Shall Not Be Permitted. As An Alternate To The Through Bolting Per GR-1, Partial Depth Resin Bonded Anchoring Systems May Be Used. The Anchor Shall Be Galvanized And Be The Same Diameter And Strength As The Bolts Specified. 7/8" Diameter Anchor Systems Should Resist An Average Ultimate Tensile Load Of 24,000 Pounds And The 1 1/4" Diameter, 43,700 Pounds. Kelken Gold, Inc. Or Hilti Systems Installed Per The Manufacturer's Recommendations Are Acceptable. Test Load Data Shall Be Submitted To Verify Manufacturers' Recommended Anchor, Hole Size, Embedment Depth, Bonding Medium, Etc., to Satisfy The Load Requirements.

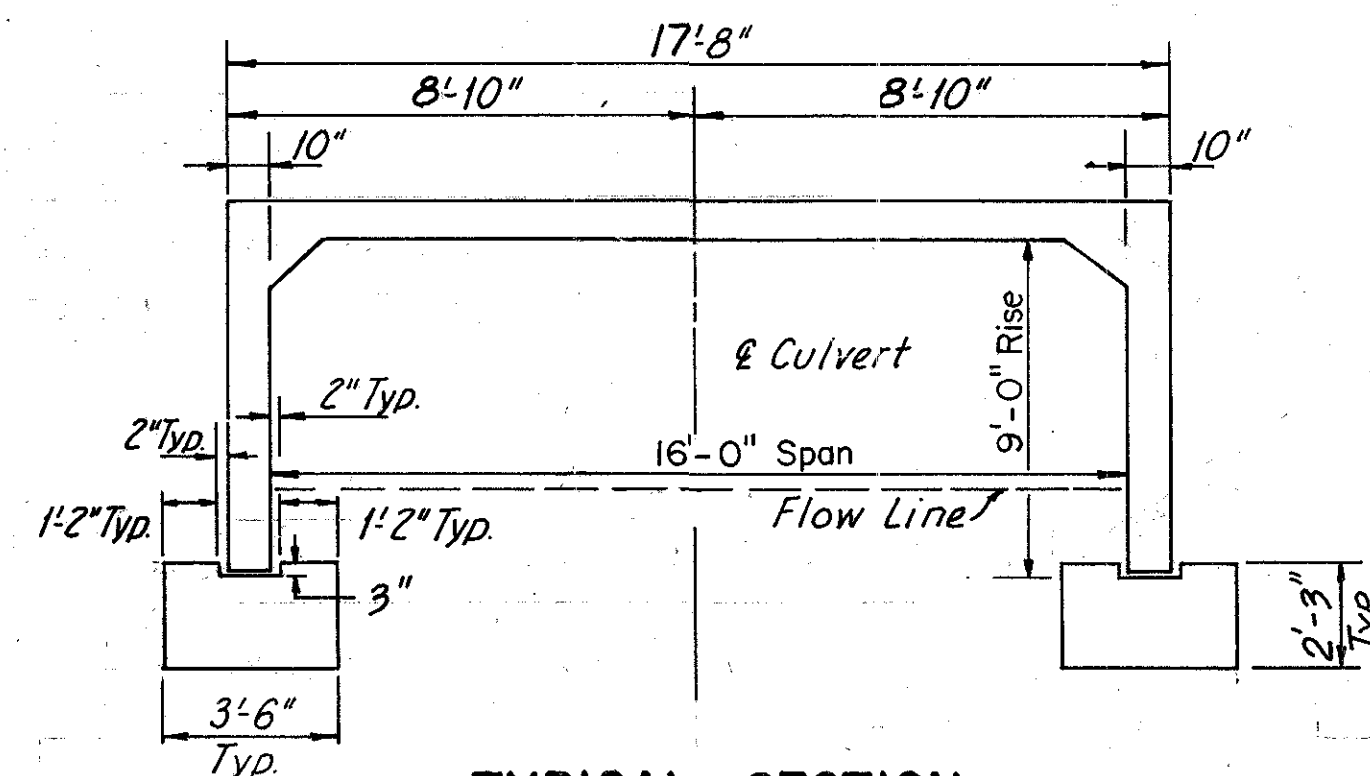
Tubular Back-up Is Not Required.



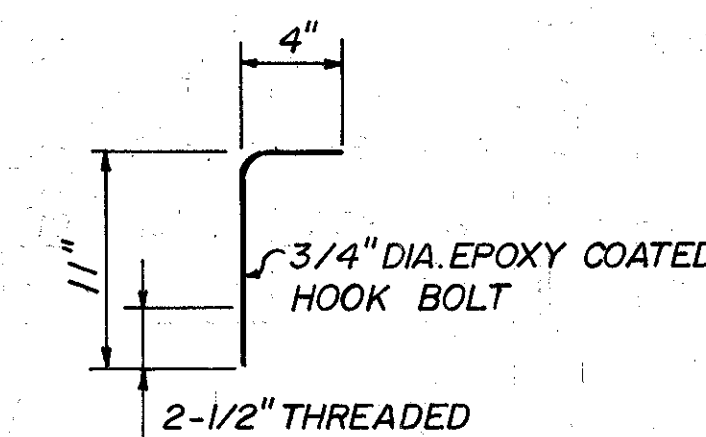
**PLAN**



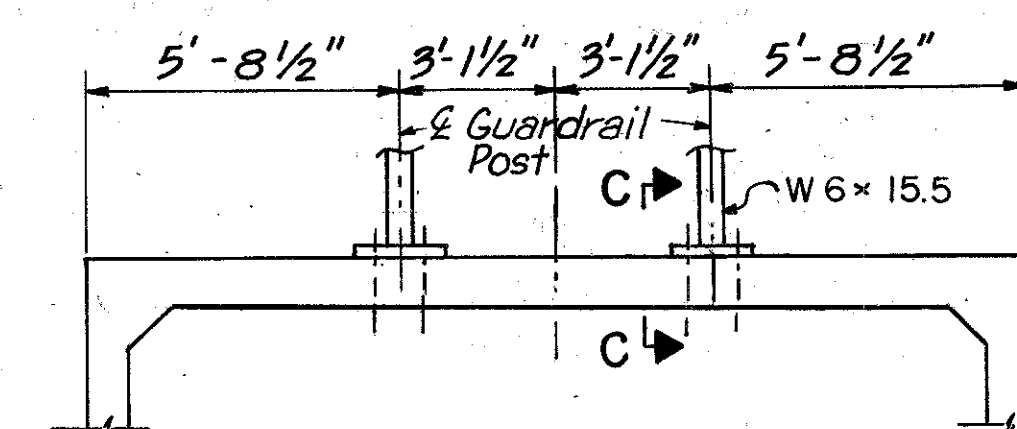
**ELEVATION**



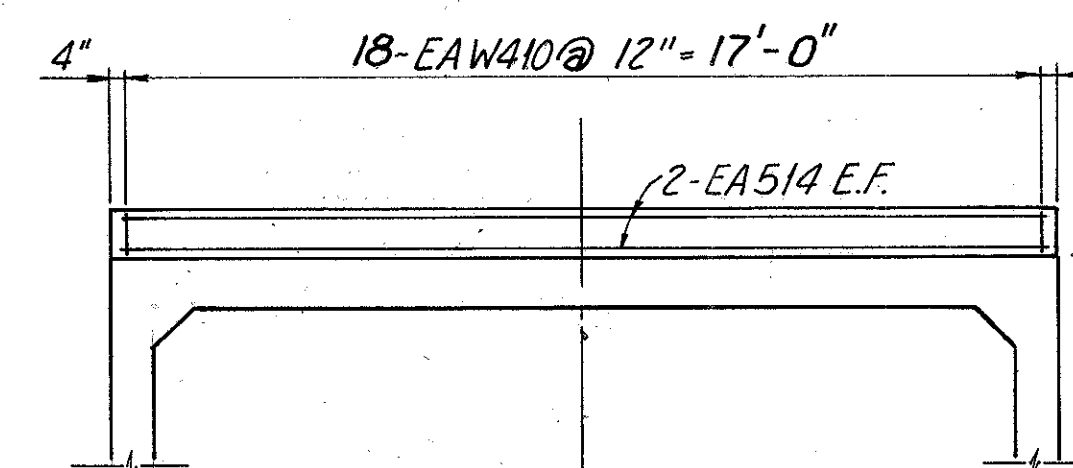
**TYPICAL SECTION**



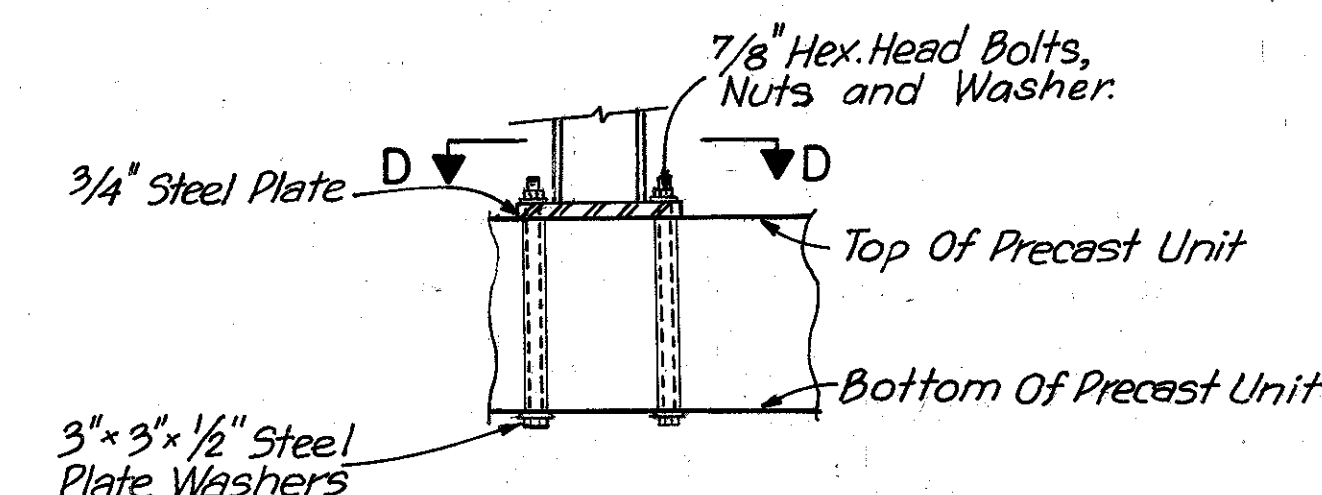
**TYPE A  
HOOK BOLT DETAIL**



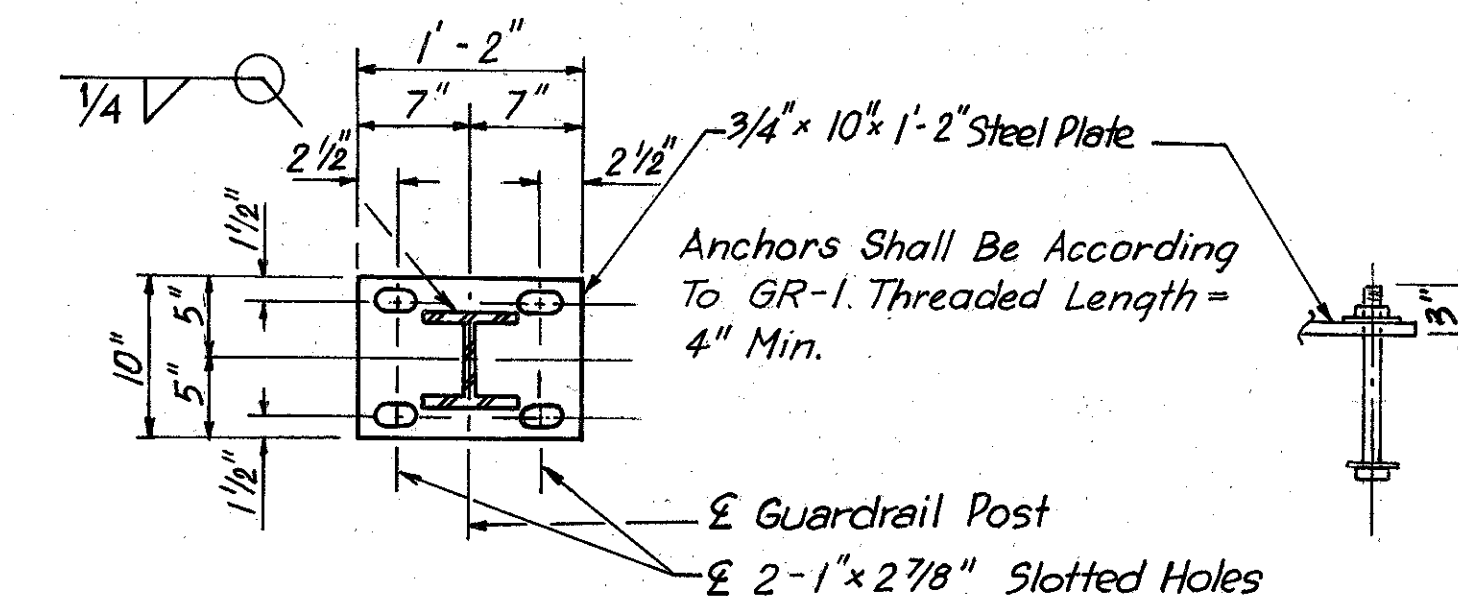
**SECTION A-A**



**VIEW B-B**



**SECTION C - C**



**SECTION D - D  
GUARDRAIL POST DETAIL**

GALVANIZING AS PER STD. DWG. DBR-2-73 SHALL APPLY. INCLUDE WITH ITEM 606 FOR PAYMENT.

**DESIGN 2**

RACKOFF ENGINEERS, INC. 6/9						
ENGINEERS - CONSULTANTS COLUMBUS, OHIO						
CULVERT DETAILS						
STRUCTURE NO. MAD - 42 - 0887						
OVER BIERBOUGH DITCH						
MADISON COUNTY STA. 70 + 82						
STA. 70 + 98						
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
S.E.M.	E.A.	E.A.	MR	M.R.	11-5-90	

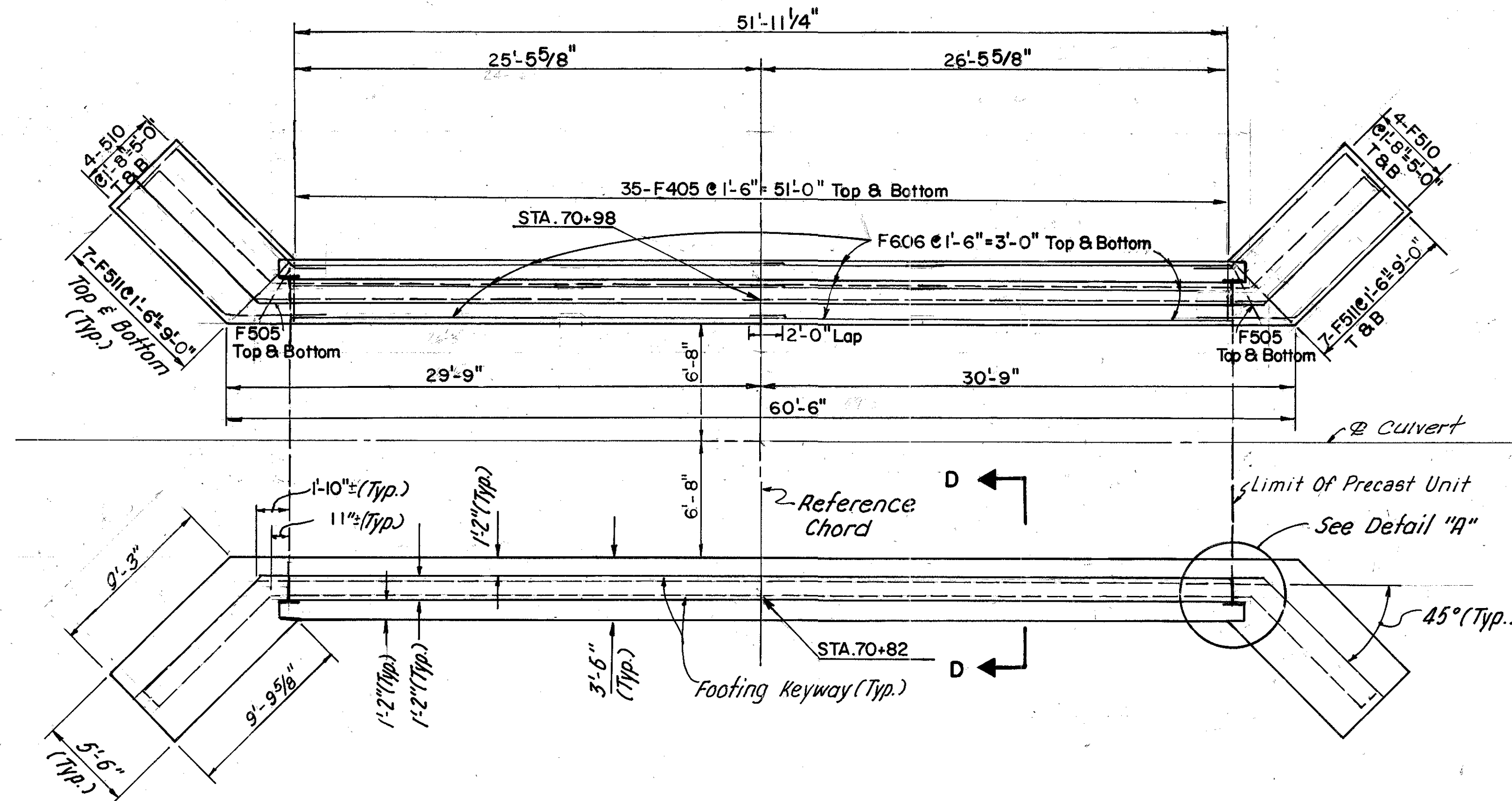


DESIGN 2

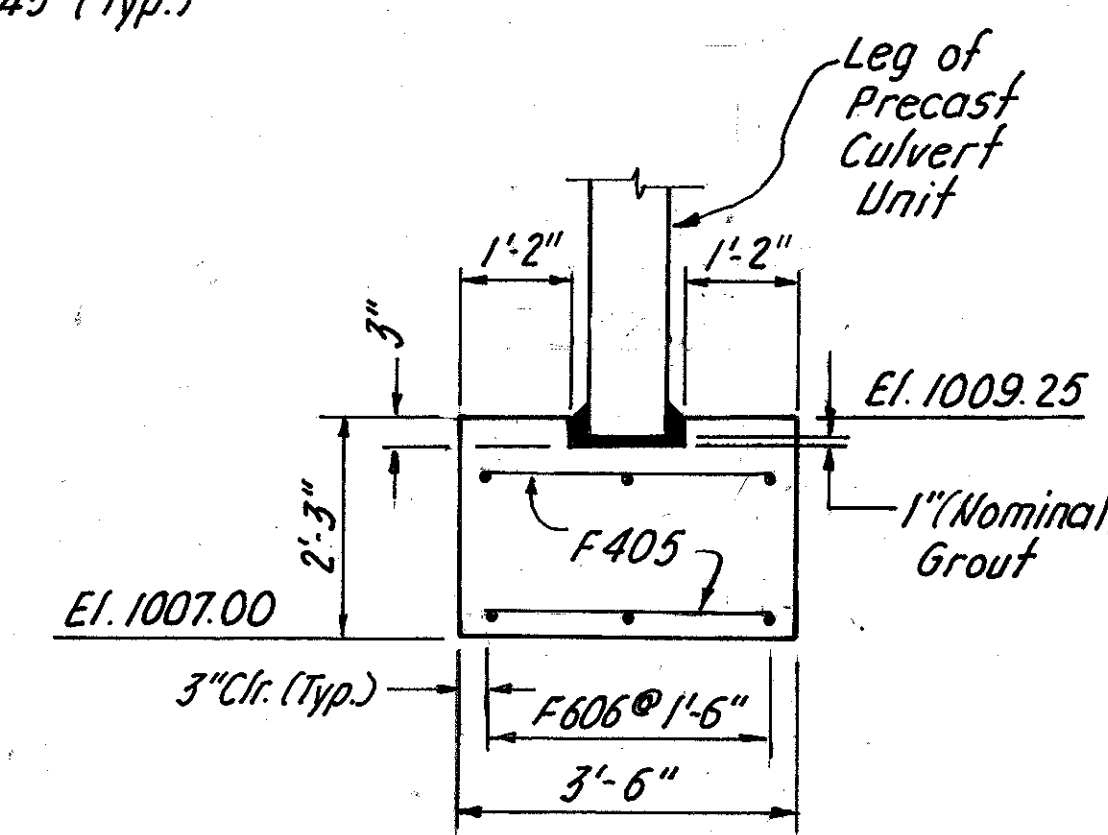
ESTIMATED QUANTITIES				CALC'D S.E.M.	CHECKED BY: LMG
ITEM	ITEM EXT.	TOTAL	UNIT	DESCRIPTION	DATE: 10-08-90
202	11000	LUMP		STRUCTURE REMOVED	DATE: 10-08-90
503	11100	LUMP		COFFERDAMS, CRIBS AND SHEETING	
503	21300	LUMP		UNCLASSIFIED EXCAVATION	
509	11400	3802	LB.	REINFORCING STEEL, GRADE 60	
511	46000	20	CU.YD.	CLASS C CONCRETE, RETAINING WALL OR WINGWALL	
511	46500	49	CU.YD.	CLASS C CONCRETE, FOOTINGS	
512	44400	7	SQ.YD.	TYPE B WATERPROOFING	
516	13600	36	SQ.FT.	1" PREFORMED EXPANSION JOINT FILLER	
518	21200	10	CU.YD.	POROUS BACKFILL WITH FILTER FABRIC	
603	70001	53	LIN.FT.	CONDUIT TYPE A PRECAST REINFORCED CONCRETE FLAT TOPPED THREE-SIDED CULVERT, AS PER PLAN, 16'-0" SPAN 9'-0" RISE	

REINFORCING STEEL - GRADE 60 - WALLS, FOUNDATIONS SEE DESIGN 1. SHEET 3/9

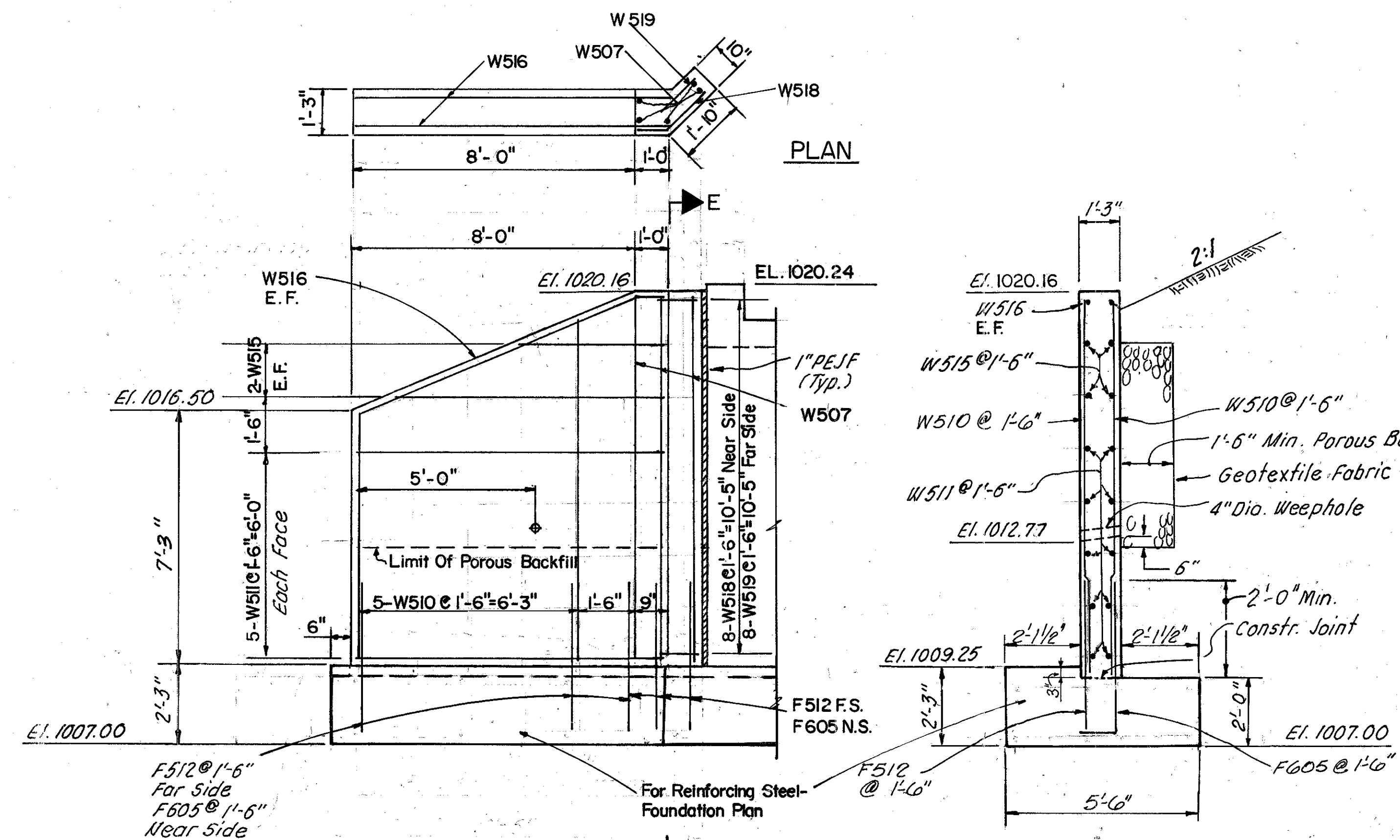
REINFORCING STEEL - GRADE 60 - HEADWALLS					
MARK	NO.	LENGTH	WEIGHT	SHAPE	BENDING DIAGRAM
EAW410	36	2'-2"	52	BT	
EA514	8	17'-0"	142	STR	
	TOTAL		194		



FOUNDATION PLAN



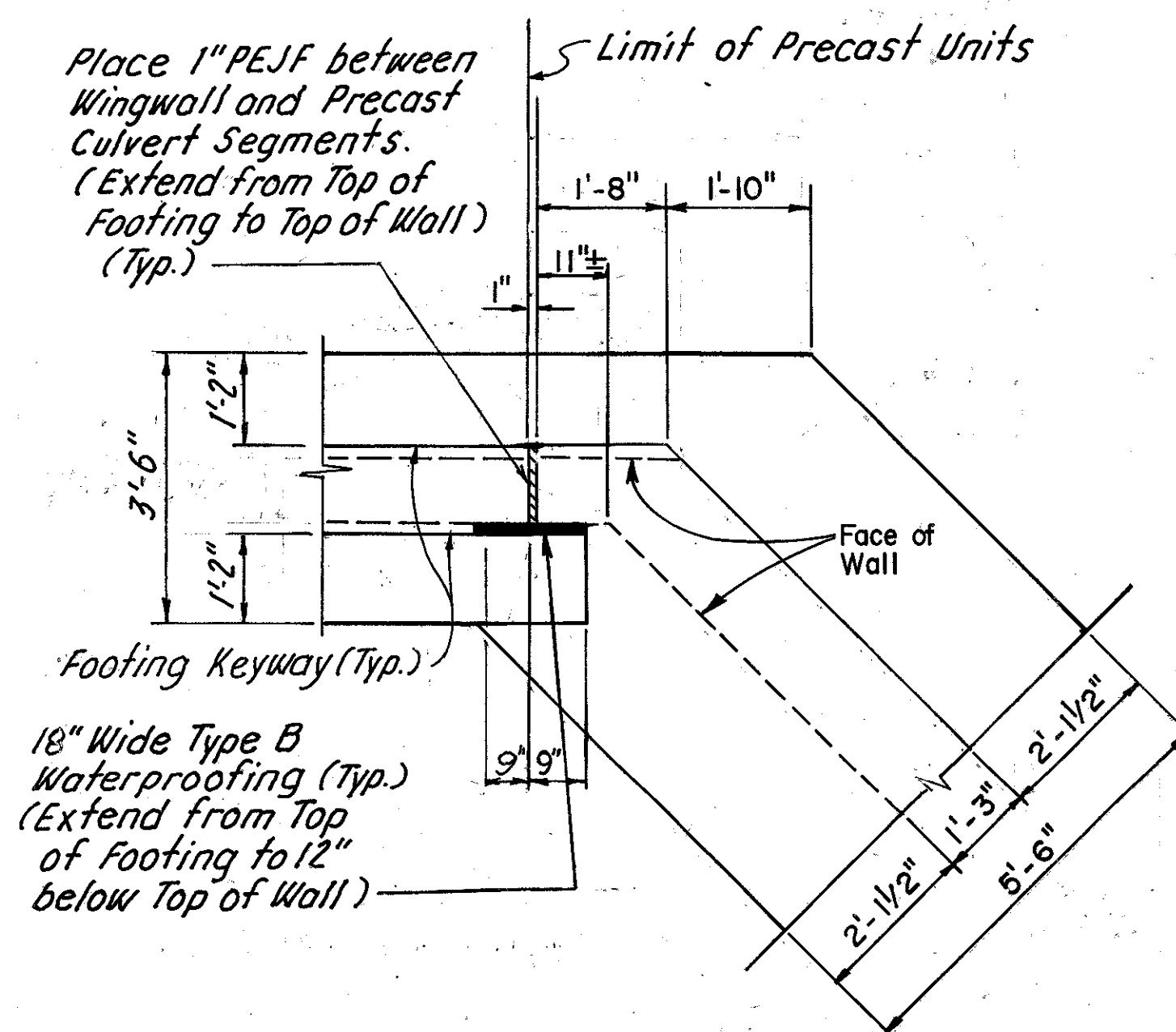
SECTION D-D



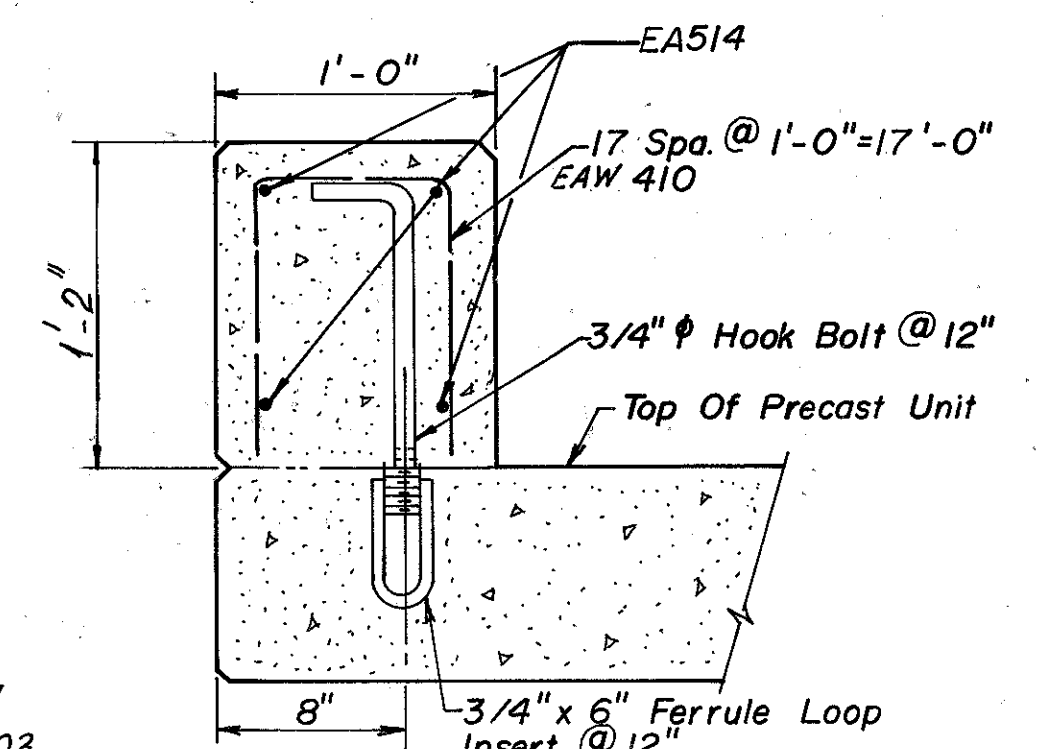
ELEVATION  
(Typical All Wingwalls)

WINGWALLS

SECTION E-E  
(Typical All Wingwalls)



DETAIL "A"



HEADWALL DETAIL

INCLUDE HEADWALL CONCRETE WITH WING-WALLS FOR PAYMENT.

DESIGN 2 PRECAST REINFORCED CONCRETE CULVERT

RACKOFF ENGINEERS, INC. 7/9

CULVERT DETAILS  
STRUCTURE NO. MAD - 42-0887  
OVER BIERBOUGH DITCH  
MADISON COUNTY STA. 70+82  
STA. 70+98

DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
S.E.M.	E.A.	E.A.	MR	M.R.	11-5-90	

GENERAL NOTES

F-10 (81)

FHWA REGION	STATE	PROJECT	
5	OHIO		

15

16

MADISON COUNTY  
MAD-42-8.87

ITEM 603-Precast Reinforced Concrete Flat  
Topped Three-sided Culverts

11/3/88

General

Where the plans call for "Item 603 Precast Reinforced Concrete Flat Topped Three-sided Culverts " the culverts shall be manufactured to comply with the following.

These Culverts shall be flat deck structures with a minimum span of 14 feet and a minimum rise of 4 feet; and a maximum span of 34 feet and maximum rise of 10 feet. Minimum wall and deck thicknesses shall be 10 inches and 12 inches respectively, measured under the haunch and at the centerline of the span.

These culverts are intended to be used for the conveyance of storm water, and will be subjected to earth and highway loadings. The culverts are designated by clear span, measured perpendicular to the structure walls, and opening rise. The requirements of the Construction and Material Specifications (CMS) Item 603 Type A conduit shall apply except as modified hereinafter.

Basis of Acceptance

Acceptability of the three-sided culvert produced in accordance with this note shall be determined by the results of the concrete compressive strength tests, by the material requirements described hereinafter and by inspection of the finished product. The manufacturer shall submit shop drawings for review and approval. Manufacture shall not begin until written approval of the submitted drawings has been received from the Bureau of Location and Design.

Materials

Cement - Portland cement shall conform to the requirements of AASHTO M 85.

Aggregates - Fine aggregates shall be a natural sand conforming to the CMS 703.02. Course aggregate shall have a standard size designation from a number 5 to a number 8 inclusive as specified in CMS 703.01. The quality requirements of CMS 703.02 shall apply.

Admixtures - Air entraining admixtures conforming to CMS 705.10 and Chemical admixtures conforming to CMS 705.12 Types A, B, D, or F may be used.

Steel Reinforcement - Reinforcement shall consist of welded wire fabric conforming to CMS 709.10 or 709.12, or deformed billet steel bars conforming to CMS 709.01, Grade 60. Both mats of top slab reinforcing and exterior wall mat reinforcing shall be epoxy coated as per CMS 709.00 unless the depth of fill on the culvert measured at the edge of roadway pavement exceeds 3 ft. In lieu of epoxy coated reinforcing, a calcium nitrite-based corrosion inhibiting concrete admixture may be used. The admixture shall conform to ASTM C 494 type C. The calcium nitrite shall be a minimum of 2% calcium nitrite solids by weight of cement. Payment will be included in the bid price for the three-sided culvert.

Design

The culvert design shall be in accordance with the AASHTO standard specifications for highway bridges. The culvert dimensions shall be as shown, subject to the permissible variations contained hereinafter. The minimum concrete compressive strength shall be 5000 p.s.i. Approved reinforcement designs for the structure sections shown are on record in the Bureau of Bridges and Structures, rating and inventory section and in the District Bridge office.

Modified and Special Designs - The manufacturer may request approval by the purchaser of modified designs which differ from the approved designs.

Placement of Reinforcement - The concrete cover dimension over reinforcement shall be a minimum of 1". When the earth cover over the culvert deck is less than 3 ft. measured at the edge of roadway pavement the minimum concrete cover dimension over the top line of reinforcement in the deck shall be 2". When calcium nitrite-based corrosion inhibiting admixture is used the minimum concrete cover over all exterior reinforcement shall be 2". The clear distance of the end circumferential wires shall not be less than 5/8 in. nor more than 2 in. from the ends of the culvert. Reinforcement shall be assembled utilizing any combination of single or multiple layers (3 maximum) of welded wire fabric or steel bars. The welded wire fabric shall be composed of circumferential and longitudinal wires meeting the spacing requirements hereinafter. The ends of the longitudinal reinforcement shall not be more than 2 in. from the ends of the culvert. The exposure of the ends of longitudinal reinforcement, and spacers used to position the reinforcement shall not be cause for rejection.

Reinforcing development, splices, and spacings

Exterior corner reinforcement shall be fully developed or extend 12 in. past the point of peak stress. For deformed steel bars (CMS 709.01) equal leg 90 degree bends with leg lengths as follows: \*3-13", \*4-17", \*5-21", \*6-34", \*7-40", and \*8-40" will satisfy this development criteria. The development length for welded wire fabric (CMS 709.10 or 709.12) shall conform to AASHTO standard specifications for highway bridges.

Splices in circumferential reinforcement shall be made by lapping and not by welding. Lap lengths shall be as per AASHTO standard specifications for highway bridges.

Spacing center to center of the circumferential wires in a fabric sheet shall not be less than 2 in. nor more than 4 in. The spacing center to center of the longitudinal wires or bars shall not be more than 8 in. Where circumferential reinforcement is composed of bars, crack control criteria shall be checked. Calculations performed by a registered professional engineer verifying that the proposed bar spacings meet the crack control criteria shall be submitted to the purchaser.

Joints

The precast reinforced concrete flat topped three-sided culvert sections shall be produced with a grout filled keyway. The keyway shall provide a void volume equivalent to that of 12" prestressed beam as per Std. Dwg. PSBD-1-81. The keyway surfaces shall be given a medium sandblast, 2000 p.s.i. water blast, or a thorough wire brushing at the plant within four days prior to leaving the plant. The ends shall be of such design and the ends of the culvert sections so formed that when they are laid together they will make a continuous line of culverts with a smooth interior free of appreciable irregularities, all compatible with the permissible variations hereinafter.

Mortar for the keyway shall be a non-shrinking non-metallic mortar having a minimum compressive strength at 28 days of 5000 p.s.i. according to the Corps of Engineers Specification CRD-C621 when prepared to a moderate fluidity (124-145% @ 5 drops). The mortar or grout shall also meet all other requirements of Specification CRD-C621. A list of approved mortars will be maintained by the ODOT Testing Laboratory located at 1600 West Broad Street in Columbus, Ohio 43223. The mortar shall be prepared, placed and cured in accordance with the manufacturer's recommendations. Before mortaring the keyway shall be thoroughly clean of all dirt, dust and other foreign matter. The keyway surfaces shall be wetted, but no free water shall be allowed to remain in the keyway.

The joint exterior shall be covered with a minimum of a 9 inch wide wrap centered on the joint. The external wrap shall be as per ASTM C-877, or Petrofac as manufactured by Phillips Fiber Corp. Care shall be exercised to keep the joint wrap in its proper location during backfilling.

Manufacture and Construction

Mixture - Aggregates, cement, and water shall be proportioned and mixed in a batch mixer to produce a homogeneous concrete, meeting the strength requirements as stated. In no case however, shall the proportion of portland cement be less than 564 lb./C.Y. of concrete. The concrete shall contain 4 percent entrained air.

Forms - The forms used shall be sufficiently rigid and accurate to maintain the culvert dimensions within the permissible variations given hereinafter. All the casting surfaces shall be of a smooth material.

Curing - The culvert shall be cured for a sufficient length of time so that the concrete will develop the specified compressive strength in 28 days or less. Any one of the following methods of curing or combinations thereof shall be used for culvert sections.

Steam Curing - The culvert sections may be low pressure, steam-cured by a system that will maintain a moist atmosphere.

Water Curing - The culvert sections may be water cured by any method that will keep the sections moist.

Forms Left in Place - An accelerated overnight cure accomplished through the use of an external heat source may be used provided moisture loss from exposed surfaces is minimized. The maximum temperature increase or decrease shall be 40 degrees Fahrenheit per hour. The initial application of the heat shall be two hours after the final placement of concrete to allow the initial set to take place.

Handling - Devices or holes shall be permitted in each culvert section for the purpose of handling. However, not more than four holes may be cast or drilled in each section. The holes shall be tapered unless drilled, and before backfilling the tapered holes shall be filled with portland cement mortar, or with precast concrete plugs which shall be secured with portland cement mortar or other approved adhesive. Drilled holes shall be filled with portland cement mortar. Holes shall be covered on the exterior with the joint wrap material. This wrap shall have a minimum length and width of 9".

Where the culvert is to be placed in a trench, a minimum trench width of 2 ft. on each side of the conduit shall be required. Where the culvert is above the existing ground, the CMS 603.03 requirement that the embankment be constructed to at least the spring-line before trenching is waived.

Physical Requirements

Test Specimen - Concrete compressive strength shall be determined from compression tests made on cores. For each continuous production run, each group of 15 culvert sections of a single size or fraction thereof shall be considered separately for the purpose of testing and acceptance. A production run shall be considered continuous if not interrupted for more than 3 consecutive days.

Compression Testing of Cores: Cores shall be obtained and tested for compressive strength in accordance with the provisions of ASTM C 497. One core shall be cut from a section selected at random from each group of 15 culvert sections or fraction thereof of a single size from each continuous production run.

Acceptability by core tests: The compressive strength of the concrete in each group of culvert sections defined above is acceptable when the core test strengths are equal to or greater than the design concrete strength.

When the compressive strength of the core tested is less than the design concrete strength, the culvert section from which that core was taken may be cored again. When the compressive strength of the new core is equal to or greater than the design concrete strength, the compressive strength of the concrete in that group of culvert sections is acceptable.

When the compressive strength of any new core is less than the design concrete strength, the culvert section from which that core was taken shall be rejected. Two culvert sections from the remainder of the group shall be selected at random and one core shall be taken from each. If the compressive strength of both cores is equal to or greater than the design concrete strength, the compressive strength of the remainder of that group of culvert sections is acceptable. If the compressive strength of either of the two cores tested is less than the design concrete strength, each culvert of the remainder of the group shall be cored and accepted individually, and any of these culvert sections that have cores with less than the design concrete strength shall be rejected.

Plugging Core Holes - The core holes shall be plugged and sealed by the manufacturer in a manner such that the culvert section will meet all of the test requirements of this proposal. Culvert sections so sealed shall be considered satisfactory for use.

Coring equipment - Every manufacturer furnishing culvert sections under this proposal shall furnish equipment and personnel necessary to obtain the cores.

Permissible Variations

Internal Dimensions - The internal dimension shall vary not more than 2 in. from the design dimensions. The haunch dimensions shall vary not more than 3/4 in. from the dimensions shown.

Deck and Wall Thickness - The deck and wall thickness shall not be less than that shown by more than 3/4 in. A thickness more than that required shall not be cause for rejection.

Length of Opposite Surfaces - Variations in laying lengths of two opposite surfaces of the culvert sections shall not be more than 1 in., except where beveled ends for laying of curves are specified.

STATE OF OHIO DEPARTMENT OF TRANSPORTATION BUREAU OF LOCATION AND DESIGN					8 / 9	
PRECAST REINFORCED CONCRETE FLAT TOPPED THREE-SIDED CULVERTS GENERAL NOTES STRUCTURE NO. MAD-42-0887 OVER BIERBOUGH DITCH MADISON COUNTY STA. 70+82 TO STA. 70+98						
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED
					11-5-90	



GENERAL NOTES

FHWA REGION	STATE	PROJECT	
5	OHIO		

16  
16

MADISON COUNTY  
MAD-42-8.87  
F-10 (81)

Length of Section - The under run in length shall not be more than 1/2 in. in any culvert section.

Position of Reinforcement - The maximum variation in the position of the reinforcement shall be  $\pm \frac{3}{8}$  inch, except the cover over the reinforcement for the external surface of the top slab shall not be less than 2 inches for earth covers less than 3 ft. The above tolerances or cover requirements do not apply to mating surfaces of the joint.

Area of Reinforcement - The areas of steel reinforcement shall be the design steel areas per linear ft. Steel areas greater than those required shall not be cause for rejection. The permissible variation in diameter of any reinforcement shall conform to the tolerances prescribed in the ASTM specification for that type of reinforcement.

Workmanship and Finish

The culverts shall be substantially free of fractures. All surfaces shall have a smooth finish. The ends shall be normal to the walls and center line within the limits of variations given above, except where beveled ends are specified.

Culverts may be repaired, if necessary, because of occasional imperfections in manufacture, handling damage, or construction. Repairs shall be made in accordance with CMS 519. No additional payment will be made for culvert repairs. Repairs will be acceptable if in the opinion of the purchaser the repairs are sound, properly finished and cured, and the repaired culvert conforms to the requirements contained hereinabove.

Culverts shall be subject to rejection for failure to conform to any of the requirements contained hereinabove or any of the following:

Fractures or cracks passing through the slab or wall.  
Defects that indicate imperfect proportioning, mixing, and forming.

Honeycombed or open texture.

Precast Damaged ends, where such damage would prevent making a satisfactory joint.

Inspection

The quality of materials, the process of manufacture, and the finished culvert shall be subject to inspection by the purchaser.

Marking

The following information shall be clearly marked on the interior of the culvert by indentation, waterproof paint, or other approved means:

Culvert span and rise  
Design earth cover  
Date of manufacture  
Name or trademark of the manufacturer

Sealing

One sealer shall be applied on the top surface of the culvert and shall extend 5' vertically down the sides, except in the keyway. The sealer shall be provided for the full length of the structure. Surface preparation and application procedures shall be as recommended by the sealer manufacturer.

Sealer Alternates:

Penseal 50 as manufactured by: American Metaseal Co.  
509 Washington Avenue Carlstadt, New Jersey 07072

Two coats shall be applied at a rate of one gallon per 120 square feet for each coat. Prior to drying, the second coat shall be seeded with silica sand at 1 1/2 lb. per square yard.

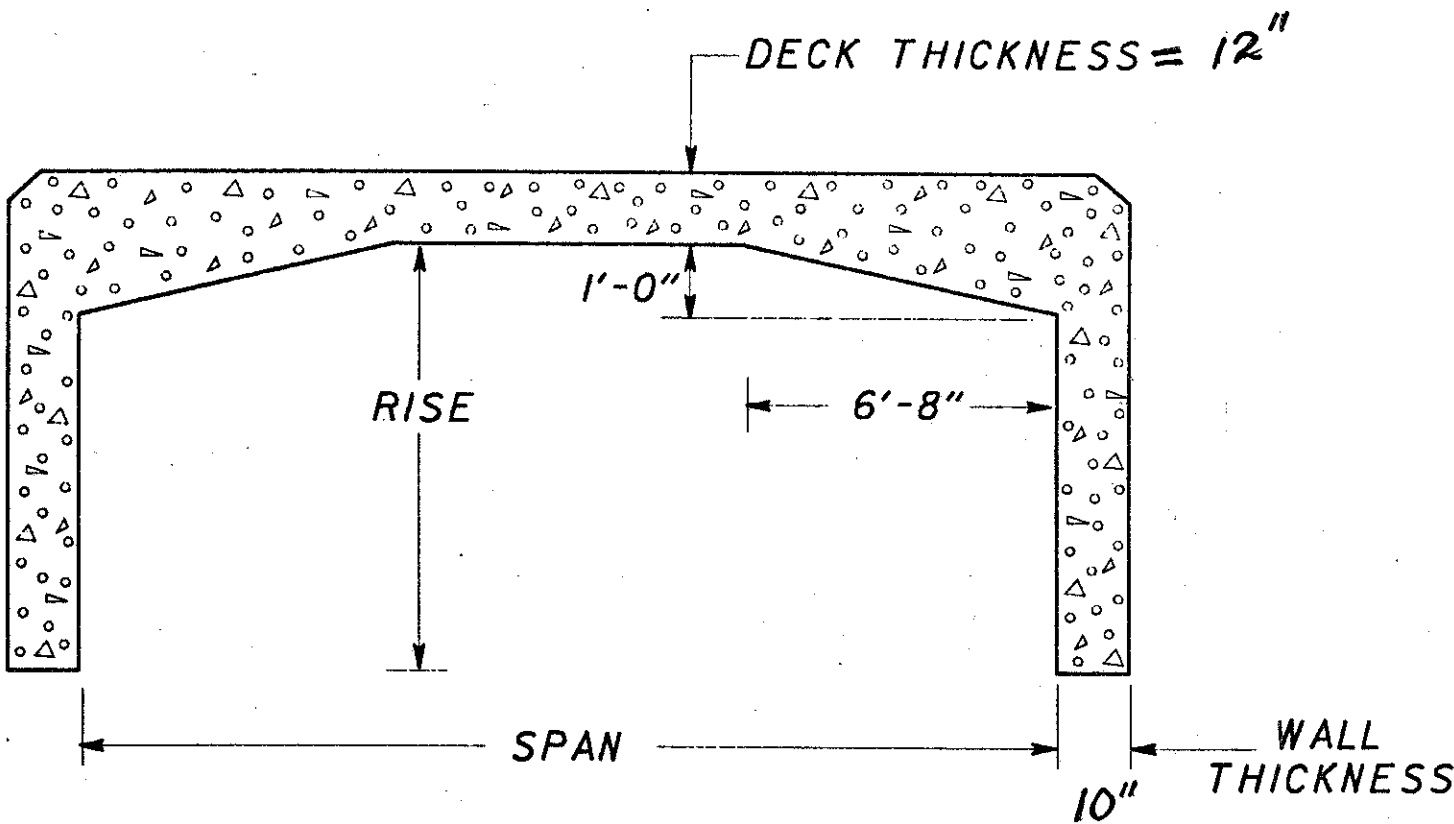
Hydrozo Clear 56 as manufactured by: Hydrozo Coatings Co.  
1001 Y Street P.O. Box 80879 Lincoln, Neb. 68501

One coat shall be applied at a rate of one gallon per 100 square feet.

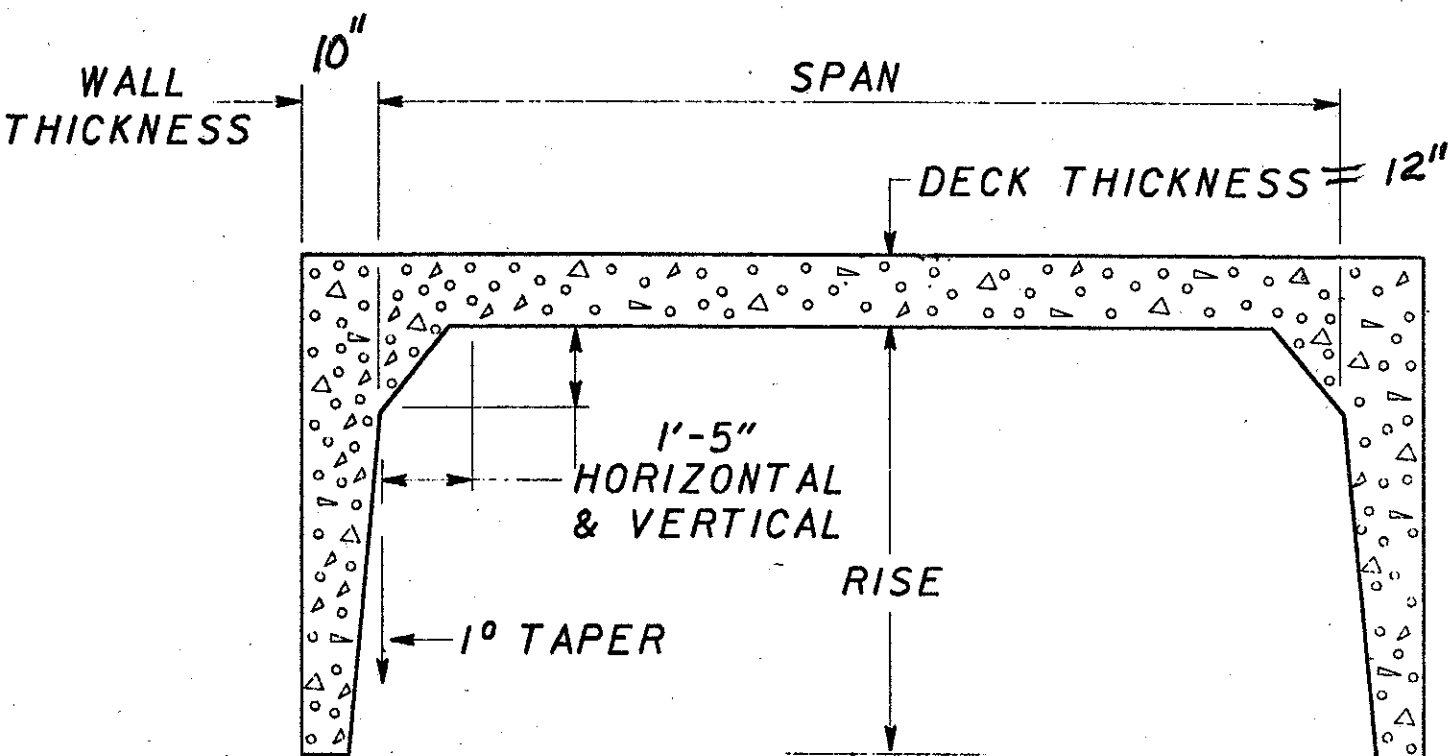
Basis of Payment

The accepted quantity of conduit of the size specified will be paid for at the contract unit price per linear foot, complete in place. Payment will be made under:

Item	Unit	Description
603	Linear Foot	16'-0" span x 9'-0" rise Conduit, Type A Precast Reinforced Concrete Flat Topped Three-sided Culvert As Per Plan.



HY-SPAN  
As manufactured by  
HYWAY CONCRETE PIPE COMPANY  
FINDLAY, OHIO



3/S BRIDGE  
As manufactured by  
PRICE BROTHERS COMPANY  
DAYTON, OHIO

STATE OF OHIO DEPARTMENT OF TRANSPORTATION BUREAU OF LOCATION AND DESIGN					9 / 9
PRECAST REINFORCED CONCRETE FLAT TOPPED THREE-SIDED CULVERTS GENERAL NOTES STRUCTURE NO. MAD-42-0887 OVER BIERBOUGH DITCH MADISON COUNTY STA. 70+82 TO 70+98					
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE 11-5-90
					REVISED