

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

HAS-22-23.60
VILLAGE OF HOPEDALE
GREEN TOWNSHIP
HARRISON COUNTY

PROJECT DESCRIPTION

IMPROVEMENT OF 0.06 MILE OF U.S. 22 IN THE VILLAGE OF HOPEDALE AND GREEN TOWNSHIP OF HARRISON COUNTY. THE IMPROVEMENT INCLUDES THE REHABILITATION OF THE EXISTING STRUCTURES HAS-22-2362 L&R OVER S.R. 151 BY REPLACEMENT OF THE BRIDGE DECK, BRIDGE RAILING, APPROACH SLABS, AND MINIMAL APPROACH PAVEMENT.

LIMITED ACCESS

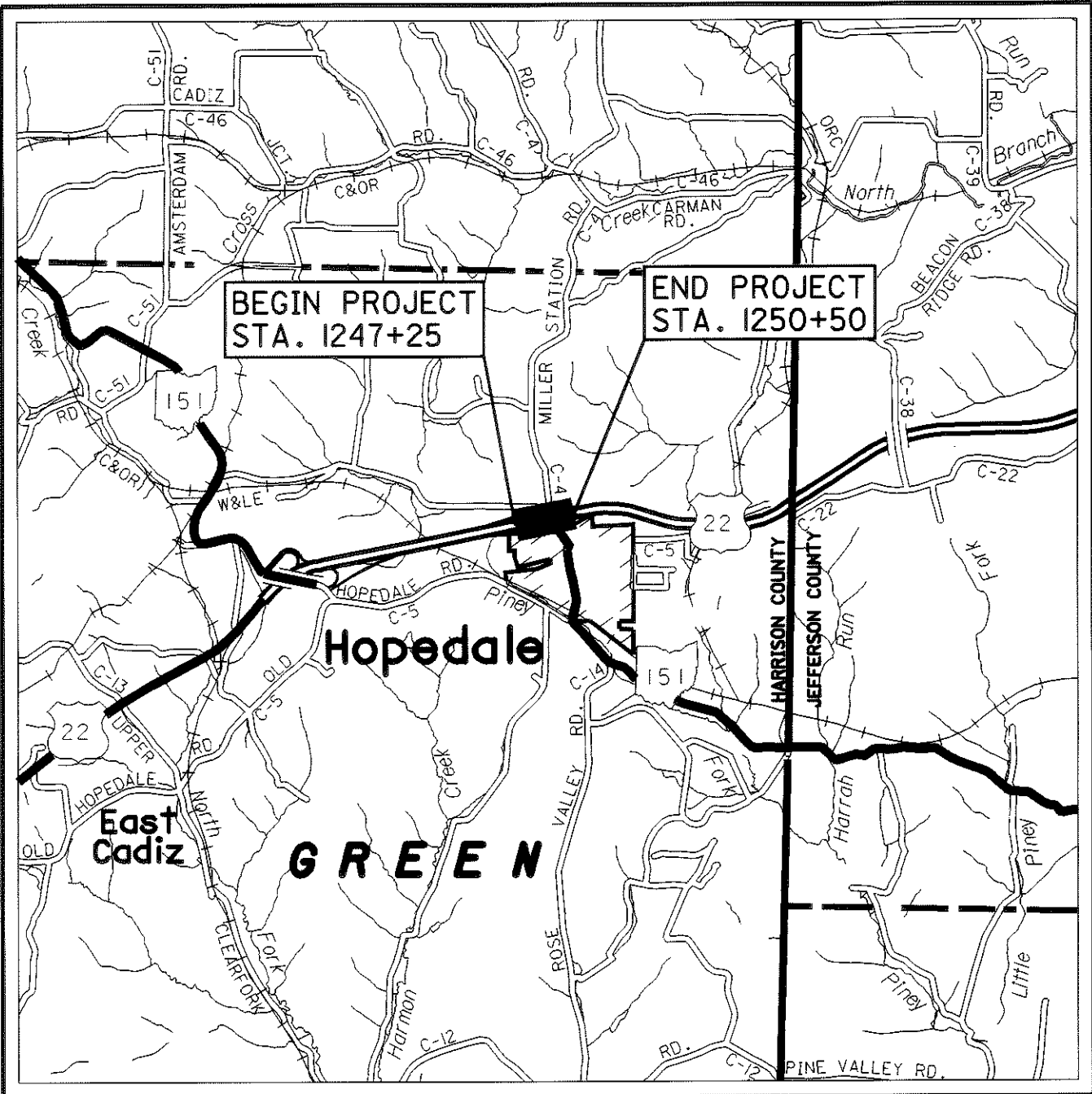
THIS IMPROVEMENT IS ESPECIALLY DESIGNED FOR THROUGH TRAFFIC AND HAS BEEN DECLARED A LIMITED ACCESS HIGHWAY OR FREEWAY BY ACTION OF THE DIRECTOR IN ACCORDANCE WITH THE PROVISIONS OF SECTION 5511.02 OF THE OHIO REVISED CODE.

2002 SPECIFICATIONS

THE STANDARD SPECIFICATIONS OF THE STATE OF OHIO, DEPARTMENT OF TRANSPORTATION, INCLUDING CHANGES AND SUPPLEMENTAL SPECIFICATIONS LISTED IN THE PROPOSAL SHALL GOVERN THIS IMPROVEMENT.

I HEREBY APPROVE THESE PLANS AND DECLARE THAT THE MAKING OF THIS IMPROVEMENT WILL NOT REQUIRE THE CLOSING TO TRAFFIC OF THE HIGHWAY AND THAT THE PROVISIONS FOR THE MAINTENANCE AND SAFETY OF TRAFFIC WILL BE AS SET FORTH ON THE PLANS AND ESTIMATES.

UNDER AUTHORITY OF SECTION 4511.21, DIVISION (I) OF THE REVISED CODE OF OHIO, THE REVISED PRIMA FACIE SPEED LIMITS AS INDICATED HEREIN ARE DETERMINED TO BE REASONABLE AND SAFE, AND ARE HEREBY ESTABLISHED FOR THE DURATION OF THIS PROJECT. THE PRIMA FACIE SPEED LIMIT OR LIMITS HEREBY ESTABLISHED SHALL BECOME EFFECTIVE WHEN APPROPRIATE SIGNS GIVING NOTICE THEREOF ARE ERECTED.



LOCATION MAP

LATITUDE: N40°19'40" LONGITUDE: W80°54'10"



PORTION TO BE IMPROVED _____
STATE & FEDERAL ROUTES _____
OTHER ROADS _____

DESIGN DESIGNATION

CURRENT ADT (2003) _____ 6700
DESIGN YEAR ADT (2023) _____ 7900
DESIGN HOURLY VOLUME (2023) _____ 790
DIRECTIONAL DISTRIBUTION _____ 55%
TRUCKS (24 HOUR B&C) _____ 16%
DESIGN SPEED _____ 60 MPH
LEGAL SPEED _____ 55 MPH

DESIGN FUNCTIONAL CLASSIFICATION - RURAL ARTERIAL
NHS PROJECT - YES

DESIGN EXCEPTION APPROVAL DATE SHEET NO.

STOPPING SIGHT DISTANCE 10-21-02 20

INDEX OF SHEETS

TITLE SHEET	1
TYPICAL SECTIONS	2
GENERAL NOTES	3-4
MAINTENANCE OF TRAFFIC	5-15
GENERAL SUMMARY	16-17
CALCULATIONS	18
PLAN SHEET	19
PROFILE SHEET	20
ESTIMATED QUANTITIES	21
CROSS SECTIONS	22-23
PRESSURE RELIEF JOINT DETAILS	24
STRUCTURES OVER 20' SPAN	25-43

ENGINEERS SEAL:

STATE OF OHIO
RICHARD H. WALTERS
E-46950
REGISTERED PROFESSIONAL ENGINEER

SIGNED: *[Signature]*
DATE: 12-18-02

ENGINEERS SEAL:

STATE OF OHIO
JOHN P. BARNHOUSE
E-62295
REGISTERED PROFESSIONAL ENGINEER

SIGNED: *[Signature]*
DATE: 12-18-02

UNDERGROUND UTILITIES
TWO WORKING DAYS
BEFORE YOU DIG
CALL 1-800-362-2764 (TOLL FREE)
OHIO UTILITIES PROTECTION SERVICE
NON-MEMBERS
MUST BE CALLED DIRECTLY

PLAN PREPARED BY:
O.D.O.T.
DISTRICT 11
NEW PHILADELPHIA, OHIO

STANDARD CONSTRUCTION DRAWINGS										SUPPLEMENTAL SPECIFICATIONS	
BP-1.1	7-28-00	RM-4.2	1-18-02	MT-35.10	4-20-01	TC-41.20	1-19-01	AS-1-81	7-19-02	864	7-11-00
BP-2.3	7-28-00			MT-95.30	4-19-02	TC-42.20	4-20-01	SBR-1-99	7-19-02		
BP-2.5	7-28-00			MT-95.40	4-19-02	TC-52.10	4-20-01	SICD-1-96	7-19-02		
BP-3.1	7-28-00			MT-96.20	4-19-02	TC-52.20	4-20-01				
BP-5.1	7-28-00	DM-1.1	7-19-02	MT-96.21	4-19-02	TC-82.10	4-19-02				
		DM-1.2	7-19-02	MT-96.26	4-20-01						
		DM-4.1	7-19-02	MT-97.10	4-19-02						
GR-1.1M	10-21-97	DM-4.2	7-19-02	MT-101.20	10-18-02						
GR-1.2M	1-3-96	DM-4.4	7-19-02	MT-101.60	10-18-02						
GR-2.1M	4-14-98			MT-101.70	10-18-02						
GR-3.1M	10-21-97			MT-105.10	10-18-02						
GR-3.2M	10-21-97			MT-105.11	10-18-02						
GR-5.1M	4-21-95			MT-120.00	3-01-00						
GR-6.1M	1-3-96										

APPROVED *[Signature]*
DATE: 12-29-02 DISTRICT DEPUTY DIRECTOR

APPROVED *[Signature]*
DATE: 3-14-03 DIRECTOR, DEPARTMENT OF TRANSPORTATION

HAS - USR 22 - 23.60 (Village of Hopedale)
030493 PID - 20466
Dist 11 10/8/2003

FEDERAL PROJECT NO. E031 (255)

PID NO. 20466

CONSTRUCTION PROJECT NO.

RAILROAD INVOLVEMENT NONE

HAS - 22 - 23.60

DESIGN SPECIFICATIONS: THIS STANDARD DRAWING CONFORMS TO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES" ADOPTED BY THE AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS, 1996, INCLUDING THE 1997, 1998 & 1999 INTERIM SPECIFICATIONS AND THE ODOT BRIDGE DESIGN MANUAL.

DESIGN DATA:
DESIGN LOADING: DEAD LOAD - 60 LB/FT² (F.W.S.)
LIVE LOAD - HS25 AND THE ALTERNATE MILITARY LOADING.

CONCRETE - COMPRESSIVE STRENGTH - 4500 PSI.

REINFORCING STEEL - MIN. YIELD STRENGTH - 60,000 PSI.

REINFORCING STEEL FOR SKEWED BRIDGES: THE A AND C BARS SHALL BE PLACED PARALLEL TO THE CENTER LINE OF ROADWAY AND THE B BARS SHALL BE PLACED PARALLEL TO THE ABUTMENTS.

LONGITUDINAL CONSTRUCTION JOINTS REQUIRED FOR STAGE CONSTRUCTION SHALL BE ACCORDING TO 511.12.

CURBS, BRIDGES WITH SIDEWALKS: FOR BRIDGES CONSTRUCTED WITH RAISED SIDEWALKS, DEFLECTOR PARAPETS OR OTHER TYPES OF CONSTRUCTION WHICH RETAIN ROADWAY SURFACE DRAINAGE, THE APPROACH SLABS SHALL EITHER INCLUDE INTEGRAL CURBS OR BE CONSTRUCTED IN CONJUNCTION WITH BRIDGE CURBS. CURB HEIGHT SHALL BE TRANSITIONED UNIFORMLY BETWEEN BRIDGE CURB HEIGHT AND ROADWAY CURB HEIGHT IN A LENGTH AS FOLLOWS: WHERE WINGWALL EXTENDS BEYOND END OF APPROACH SLAB, USE A MINIMUM LENGTH OF 10 FEET BEYOND END OF WINGWALL. WHERE THE APPROACH SLAB EXTENDS BEYOND THE END OF WINGWALL, TRANSITION IN THIS LENGTH. HOWEVER, THE TRANSITION LENGTH SHALL NOT BE LESS THAN 10 FEET AND THE TRANSITION SHALL EXTEND BEYOND THE END OF APPROACH SLAB IF NECESSARY.

APPROACH SLAB WIDTH (W): APPROACH SLABS SHALL BE THE SAME WIDTH AS THE BRIDGE ROADWAY.

APPROACH SLAB LENGTH (L): THE LENGTH SHOULD BE BASED ON FACTORS SUCH AS THE SIZE AND AMOUNT OF EXCAVATION BEHIND THE ABUTMENTS, NEW OR EXISTING EMBANKMENTS AND SKEW OF THE BRIDGE. THE LENGTH SHALL BE SHOWN ON THE PROJECT PLANS.

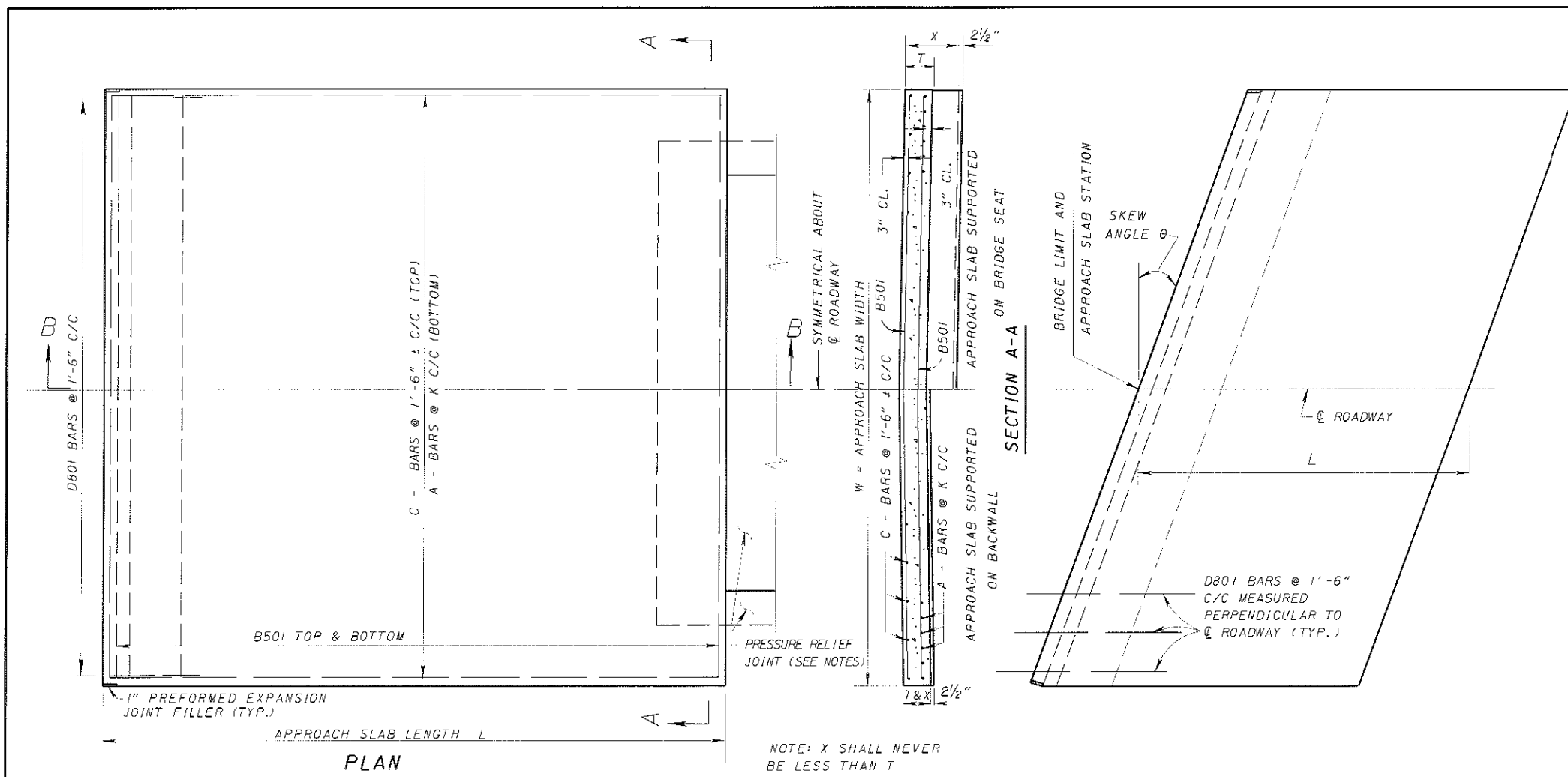
DECK CROWN AND SLOPE: THE LOCATION OF THE CROWN POINT AND THE RATE OF CROSS SLOPE ON THE APPROACH SLAB SHALL CONFORM TO THAT OF THE BRIDGE DECK AND APPROACH PAVEMENT. IF THE RATE OF CROSS SLOPE OF THE BRIDGE DECK DIFFERS FROM THAT OF THE APPROACH PAVEMENT, A SMOOTH TRANSITION SHALL BE PROVIDED WITHIN THE LIMITS OF THE APPROACH SLAB WHENEVER POSSIBLE.

WEARING SURFACE: GENERALLY APPROACH SLABS SHALL HAVE AN ASPHALT CONCRETE WEARING SURFACE ONLY WHEN BOTH THE APPROACH PAVEMENT SURFACE AND THE BRIDGE WEARING SURFACE ARE ASPHALT CONCRETE.

PRESSURE RELIEF JOINTS: RELIEF JOINTS, TYPE A, ARE TO BE PROVIDED REGARDLESS OF ABUTMENT DESIGN AT ALL BRIDGE APPROACHES WHERE APPROACH PAVEMENT IS RIGID, OR COMPOSITE CONSISTING OF A RIGID BASE. SEE STANDARD CONSTRUCTION DRAWING BP-2.3 FOR DETAILS

BASIS OF PAYMENT: IN ADDITION TO THE INCIDENTAL ITEMS LISTED IN 526.08, THE DEPARTMENT WILL INCLUDE THE FOLLOWING ITEMS FOR PAYMENT: THE PREFORMED EXPANSION JOINT FILLER AND JOINT SEALER AT THE CORNERS AND SIDES OF THE APPROACH SLAB; AND THE TYPE "A" WATER-PROOFING AND THE PREFORMED ELASTOMERIC COMPRESSION JOINT SEAL AT THE BRIDGE LIMIT END OF THE APPROACH SLAB.

THE DEPARTMENT WILL PAY FOR THE PRESSURE RELIEF JOINTS AND ANCHOR BARS (D801 OR D802) SEPARATELY.



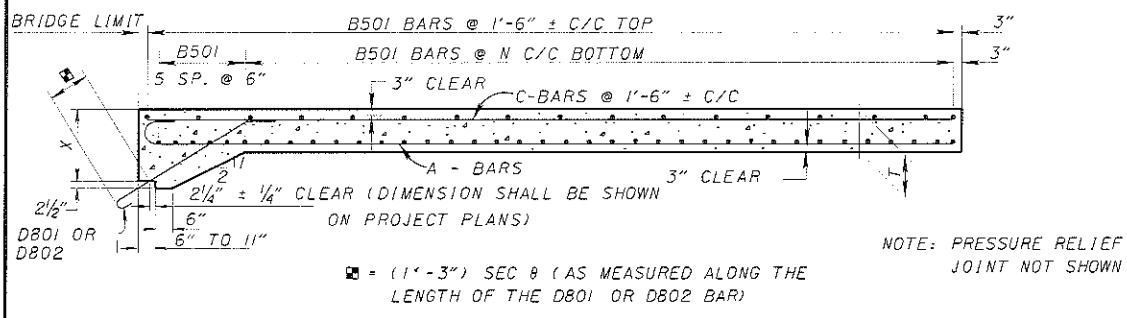
APPROACH SLAB FOR SKEWED STRUCTURE

GENERAL: THIS DRAWING PROVIDES DESIGN AND GENERAL CONSTRUCTION DETAILS. THE PROJECT PLANS WILL SHOW LENGTH, SKEW, CURBS (IF ANY), ESTIMATED QUANTITY (SQUARE YARDS), AND SPECIAL NOTES AND DETAILS WHERE NECESSARY. FOR CONDITIONS OTHER THAN THOSE INDICATED HEREON, THE APPROACH SLAB SHALL BE ADAPTED TO FIT THE ENDS OF THE BRIDGE AND THE APPROACH PAVEMENT.

THE D801 OR D802 ANCHOR BARS SHALL BE DIMENSIONED IN THE CONTRACT PLANS AND INCLUDED WITH ITEM 509 FOR PAYMENT FOR EACH SPECIFIC BRIDGE. D801 BARS CANNOT BE USED AS SHOWN IF APPROACH SLABS ARE SUPPORTED ON BACKWALLS LESS THAN 14 INCHES THICK. D802 BARS SHALL BE USED ON PRESTRESSED CONCRETE BOX BEAM BRIDGES WITH APPROACH SLABS SUPPORTED ON BACKWALLS 11 INCHES THICK.

D801 BARS CANNOT BE USED AS SHOWN WHERE APPROACH SLABS ARE SUPPORTED ON BACKWALLS LESS THAN 14 INCHES THICK. D802 BARS SHALL BE USED ON PRESTRESSED CONCRETE BOX BEAM BRIDGES WHERE THE APPROACH SLAB IS SUPPORTED ON AN 11 INCH THICK BACKWALL.

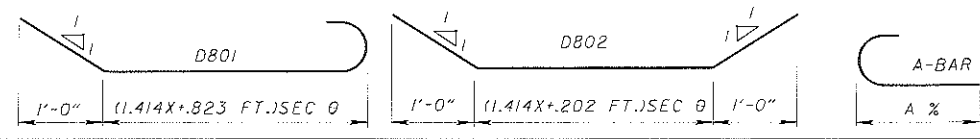
* AT THE OPTION OF THE CONTRACTOR AND AT NO ADDITIONAL COST TO THE STATE, B501 BARS MAY BE LAPPED 2'-6" MINIMUM AT THE CENTERLINE OF ROADWAY, OR WHERE REQUIRED FOR LONGITUDINAL CONSTRUCTION JOINTS, IN LIEU OF PROVIDING FULL LENGTH BARS AS SHOWN.

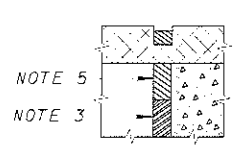


SECTION B-B

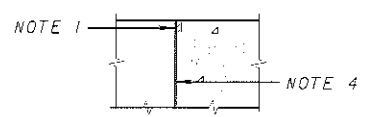
REINFORCING STEEL (FOR ONE APPROACH SLAB)														
LENGTH L	THICK- NESS T	A-BARS				B501 (BOTTOM)		B501 (TOP)		C-BARS			D801 OR D802	
		SP'C'G K	MARK	LENGTH	DIMENSION A	NO. REQ'D.	LENGTH	SP'C'G N	NO. REQ'D.	LENGTH	NO. REQ'D.	MARK	LENGTH	NO. REQ'D.
15'-0"	12"	10"	A1001	15'-11"	14'-6"	1	9"	22	11	C501	14'-6"	1	1	
20'-0"	13"	7 1/2"	A1002	20'-11"	19'-6"	1	8"	31	14	C502	19'-6"	1	1	
25'-0"	15"	7"	A1003	25'-11"	24'-6"	1	8"	39	18	C503	24'-6"	1	1	
30'-0"	17"	6 1/2"	A1004	30'-11"	29'-6"	1	8 1/2"	44	21	C504	29'-6"	1	1	

W = APPROACH SLAB WIDTH, OUT TO OUT, IN FEET
theta = ANGLE OF SKEW
K = A-BAR SPACING IN INCHES
N = B-BAR SPACING IN INCHES
X = APPROACH SLAB THICKNESS AT ABUTMENT END IN FEET
% = OUT TO OUT

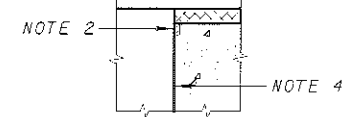




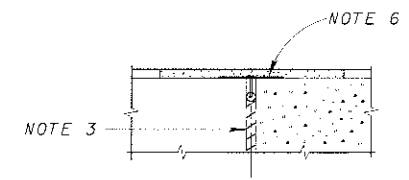
DETAIL A



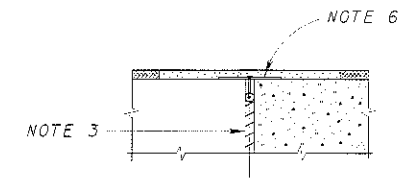
DETAIL B



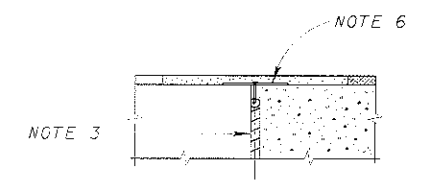
DETAIL C



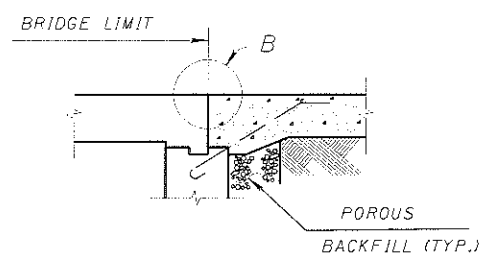
DETAIL D



DETAIL E

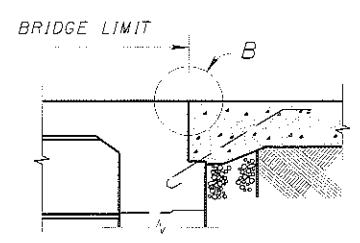


DETAIL F

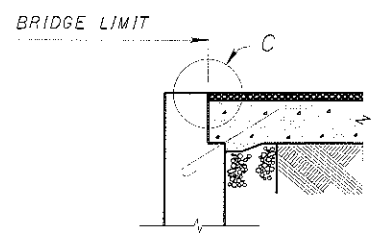


ON SLAB BRIDGES

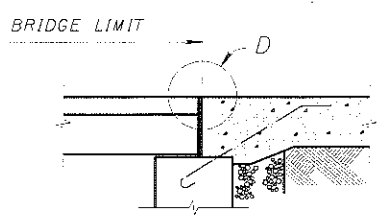
CONCRETE WEARING SURFACE ON BRIDGE DECK AND APPROACH SLAB



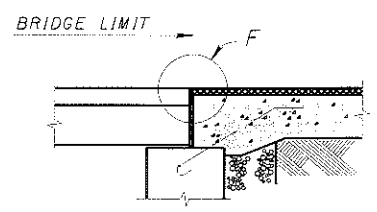
ON BRIDGES WITH INTEGRAL CONSTRUCTION (SEMI-INTEGRAL SIMILAR)



APPROACH SLAB SUPPORTED ON ABUTMENT BACKWALL

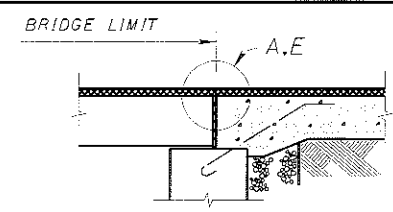


ON PRESTRESSED CONCRETE BOX BEAM BRIDGES

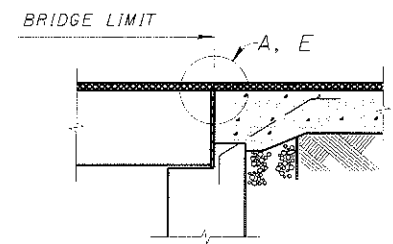


ON PRESTRESSED CONCRETE BOX BEAM BRIDGES

CONCRETE WEARING SURFACE ON BRIDGE DECK ONLY

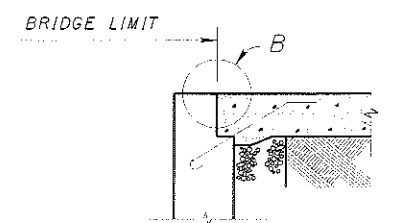


ON PRESTRESSED CONCRETE BOX BEAM BRIDGES



APPROACH SLAB SUPPORTED ON ABUTMENT BACKWALL

ASPHALT CONCRETE WEARING SURFACE ON BRIDGE DECK AND APPROACH SLAB



APPROACH SLAB SUPPORTED ON ABUTMENT BACKWALL

CONCRETE WEARING SURFACE ON BRIDGE DECK AND APPROACH SLAB

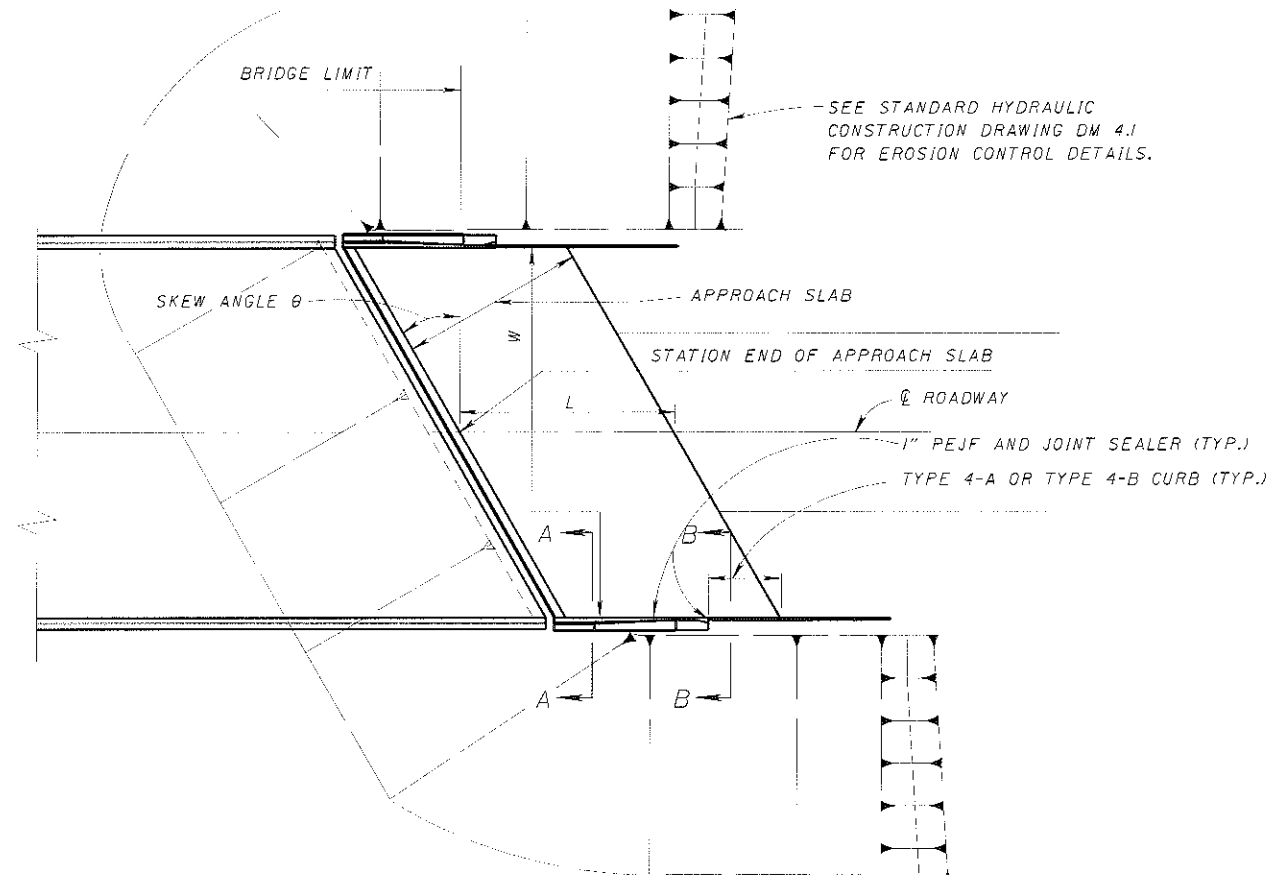
- NOTE 1: PREFORMED ELASTOMERIC COMPRESSION JOINT SEAL, 705.11 (1 1/4" WIDE FOR A 1/2" WIDE GROOVE) PLACED IN 1/2" x 2 1/4" GROOVE.
- NOTE 2: PREFORMED ELASTOMERIC COMPRESSION JOINT SEAL, 705.11 (1 1/4" WIDE FOR A 1/2" WIDE GROOVE) PLACED IN 1/2" x 2 1/8" GROOVE.
- NOTE 3: 1" PREFORMED EXPANSION JOINT FILLER, 705.03.
- NOTE 4: TYPE "A" WATERPROOFING.
- NOTE 5: SEE PLAN INSERT SHEET, "ABUTMENT JOINTS IN BITUMINOUS CONCRETE, BOX BEAM BRIDGES."
- NOTE 6: SEE PLAN INSERT SHEET, "POLYMER MODIFIED ASPHALT EXPANSION JOINT SYSTEM."

TYPE "A" WATERPROOFING SHALL NOT EXTEND ABOVE THE BOTTOM OF THE GROOVE INTO WHICH THE PREFORMED ELASTOMERIC COMPRESSION JOINT SEAL IS TO BE PLACED. IT SHALL BE APPLIED TO THE ENTIRE AREA OF THE ABUTMENT OR SUPERSTRUCTURE WHICH COMES INTO CONTACT WITH THE APPROACH SLAB.

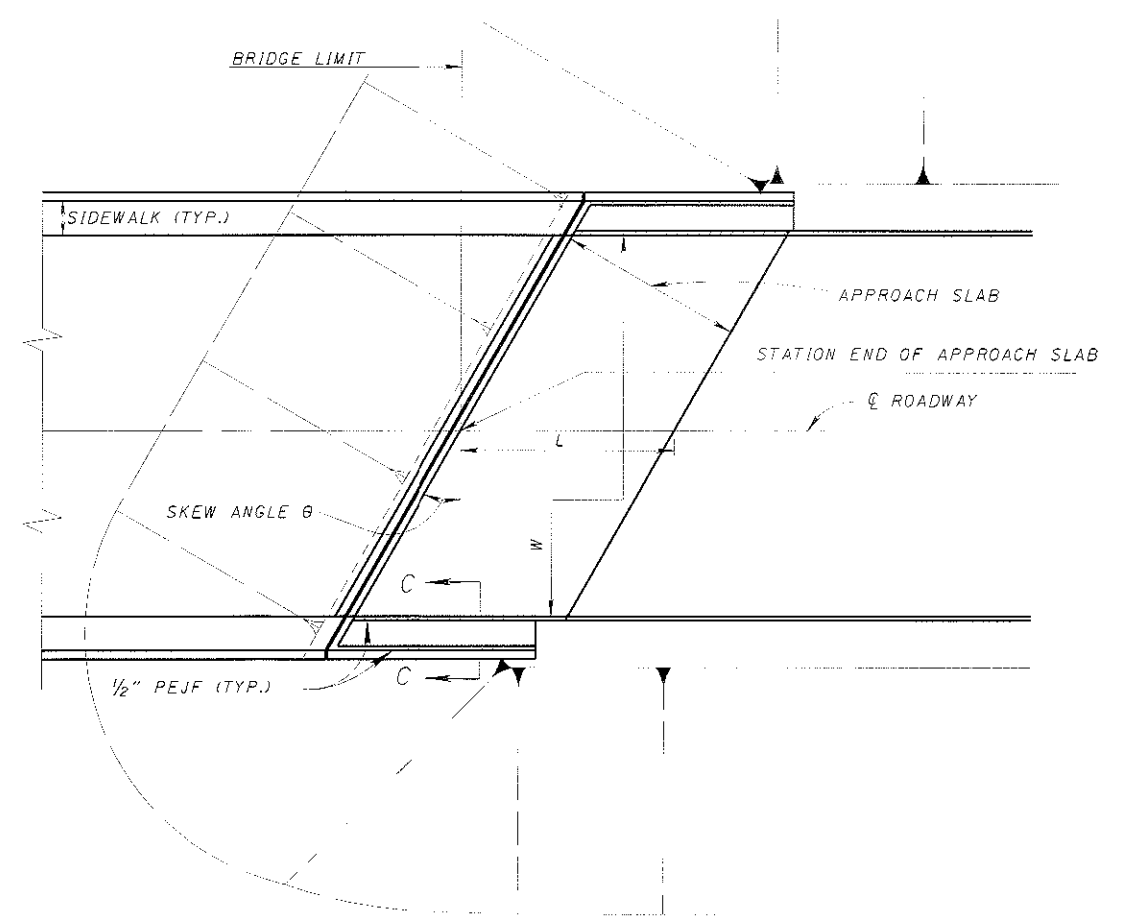
FOR PRESTRESSED CONCRETE BOX BEAM BRIDGES WITH ASPHALT CONCRETE ON BOTH BRIDGE DECK AND APPROACH SLAB, THE TOP OF APPROACH SLAB AT THE BRIDGE END SHALL BE CONSTRUCTED TO THE LEVEL OF THE TOP OF THE BEAMS TO FACILITATE WATERPROOFING OF THE JOINT. THE THICKNESS OF ASPHALT CONCRETE AT THE APPROACH END OF THE SLAB SHALL BE THE THICKNESS OF ASPHALT CONCRETE USED ON THE ROADWAY PAVEMENT. THE THICKNESS OF ASPHALT CONCRETE SHALL VARY UNIFORMLY, IF NECESSARY. IN THE LENGTH OF THE APPROACH SLAB. THE SUBGRADE (SUBBASE) SHALL BE GRADED TO PERMIT THE BOTTOM OF THE APPROACH SLAB TO BE PARALLEL TO THE TOP.

FOR STRUCTURES WITHOUT STRIP SEAL, COMPRESSION SEAL OR POLYMER MODIFIED ASPHALT EXPANSION JOINTS, THAT HAVE AN ASPHALT CONCRETE WEARING SURFACE ON BOTH THE BRIDGE DECK AND APPROACH SLAB, EXTEND THE DECK WATERPROOFING 2'-0" BEYOND THE BRIDGE LIMITS. FOR STRUCTURES WITH STRIP SEAL AND COMPRESSION SEAL EXPANSION JOINTS, END THE DECK WATERPROOFING AT THE PRESTRESSED BOX BEAM NOTCH. FOR STRUCTURES WITH POLYMER MODIFIED ASPHALT EXPANSION JOINTS, EXTEND THE DECK WATERPROOFING TO THE CENTERLINE OF THE JOINT.

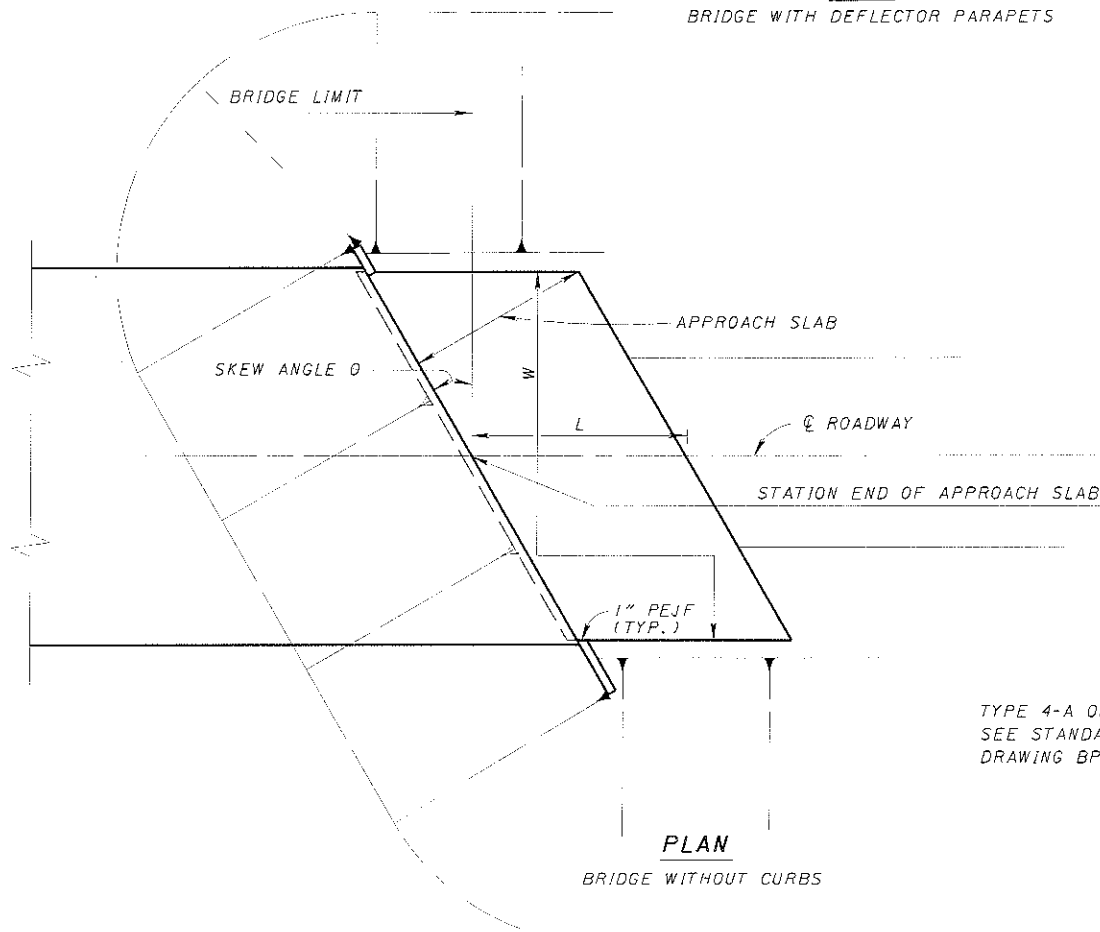
⊙ - THE APPROACH SLAB SEAT FOR THIS PRESTRESSED CONCRETE BOX BEAM BRIDGE IS SHOWN AT THE SAME ELEVATION AS THE BEAM SEAT. HOWEVER, IT MAY ACTUALLY BE HIGHER OR LOWER THAN THE BEAM SEAT DEPENDING ON THE BOX BEAM DEPTH.



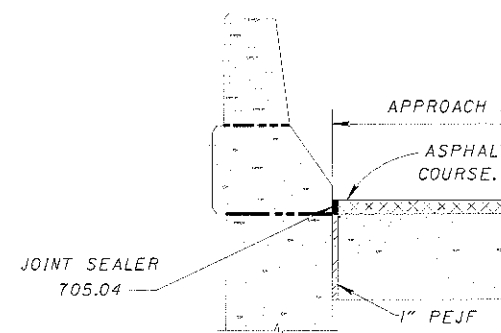
PLAN
BRIDGE WITH DEFLECTOR PARAPETS



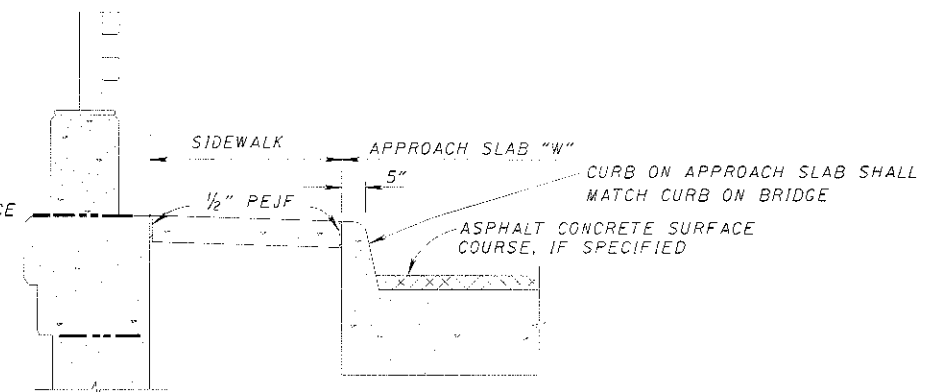
PLAN
BRIDGE WITH SIDEWALKS



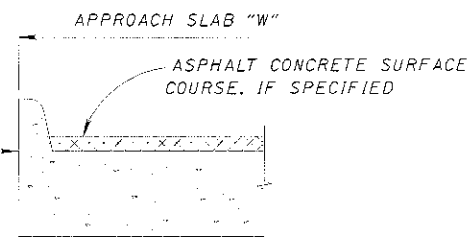
PLAN
BRIDGE WITHOUT CURBS



SECTION A-A



SECTION C-C



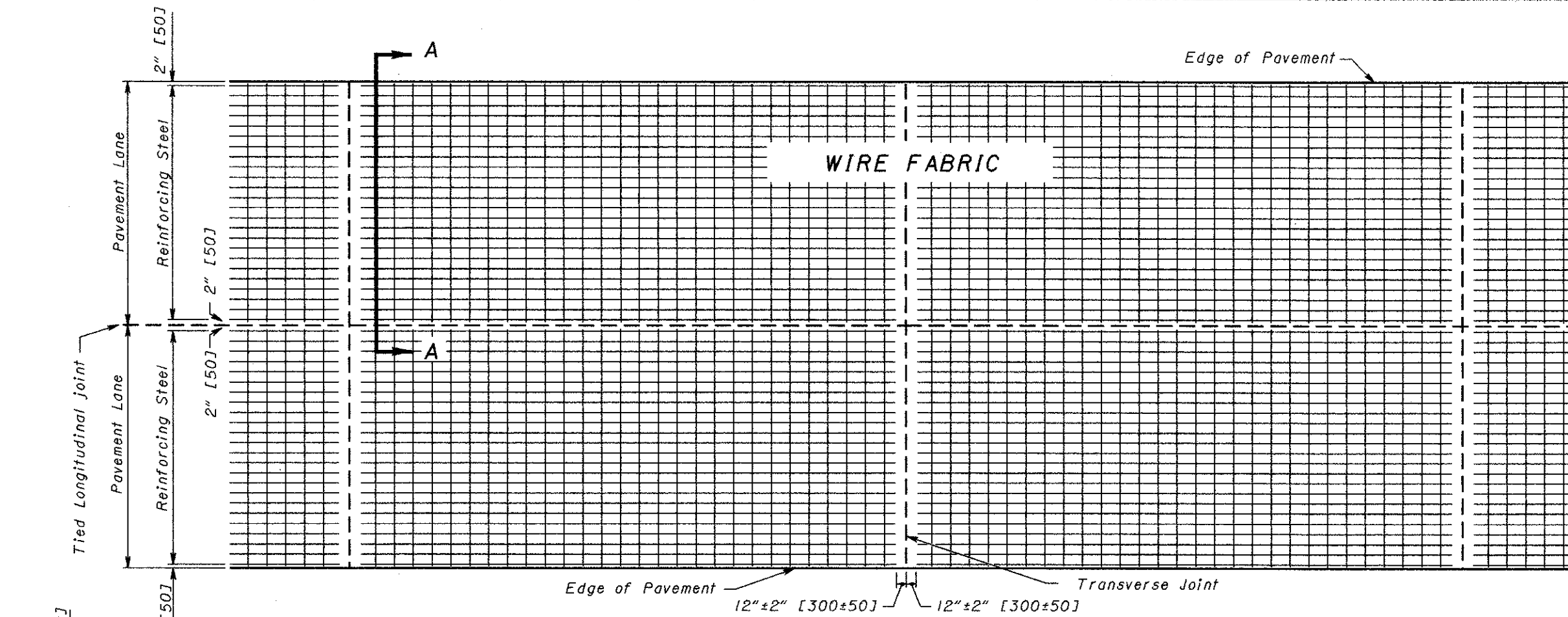
SECTION B-B

TYPE 4-A OR TYPE 4-B CURB
SEE STANDARD CONSTRUCTION
DRAWING BP-5.1

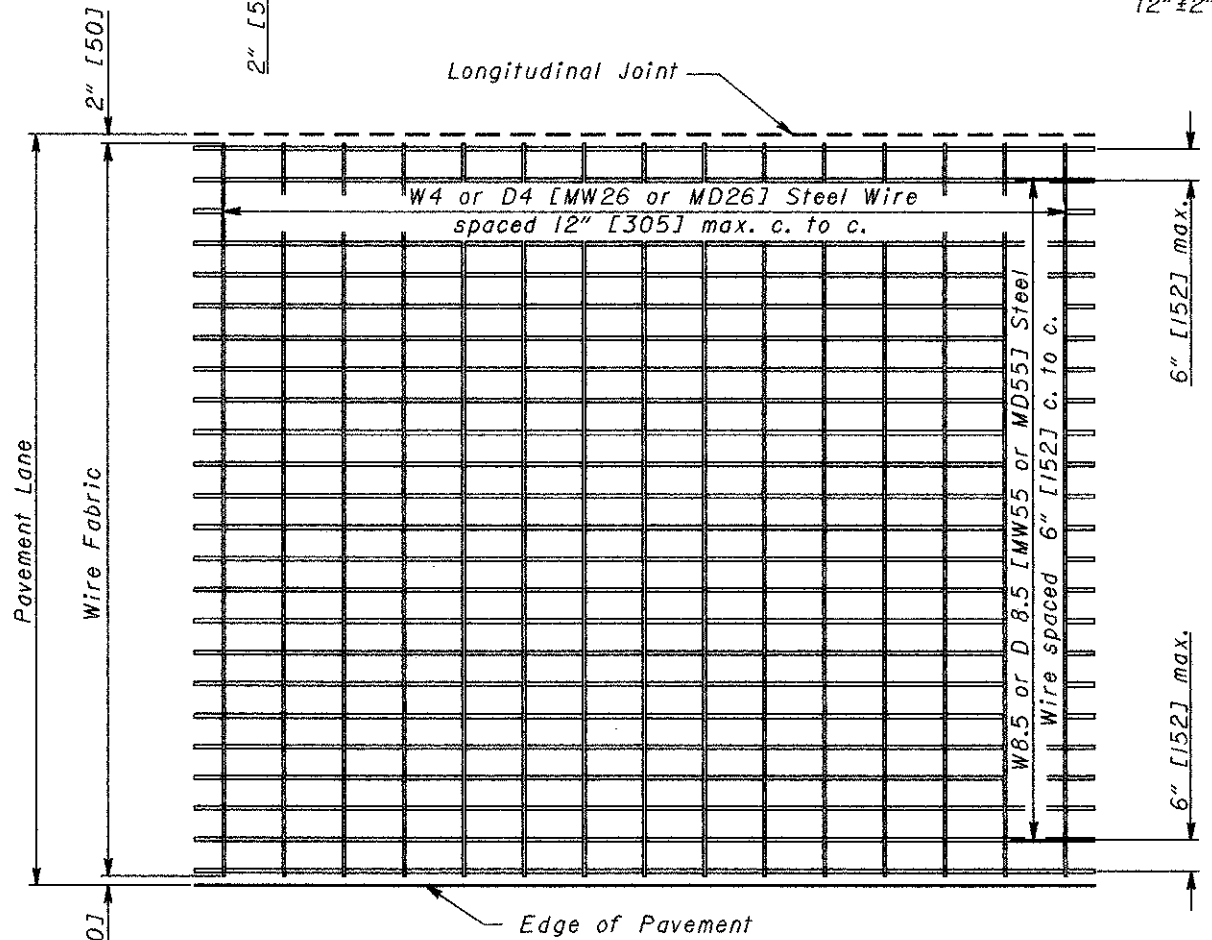
LEGEND

W = APPROACH SLAB WIDTH, OUT TO OUT, IN FEET.
L = APPROACH SLAB LENGTH.
PEJF = PREFORMED EXPANSION JOINT FILLER.

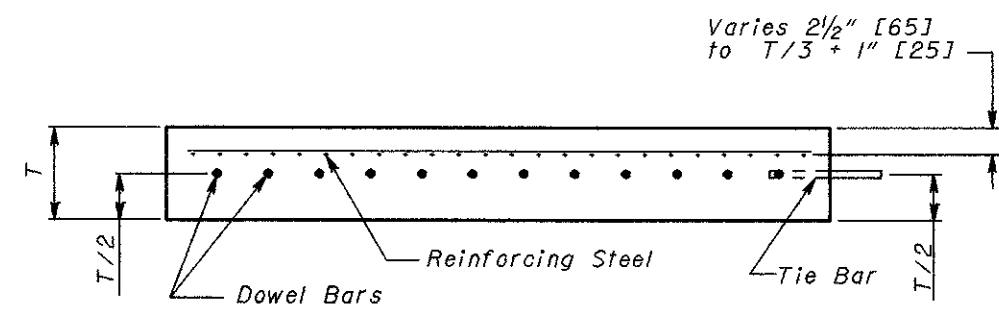
SEE STANDARD HYDRAULIC
CONSTRUCTION DRAWING DM 4.1
FOR EROSION CONTROL DETAILS.



PLAN



WIRE FABRIC DETAIL



SECTION A-A

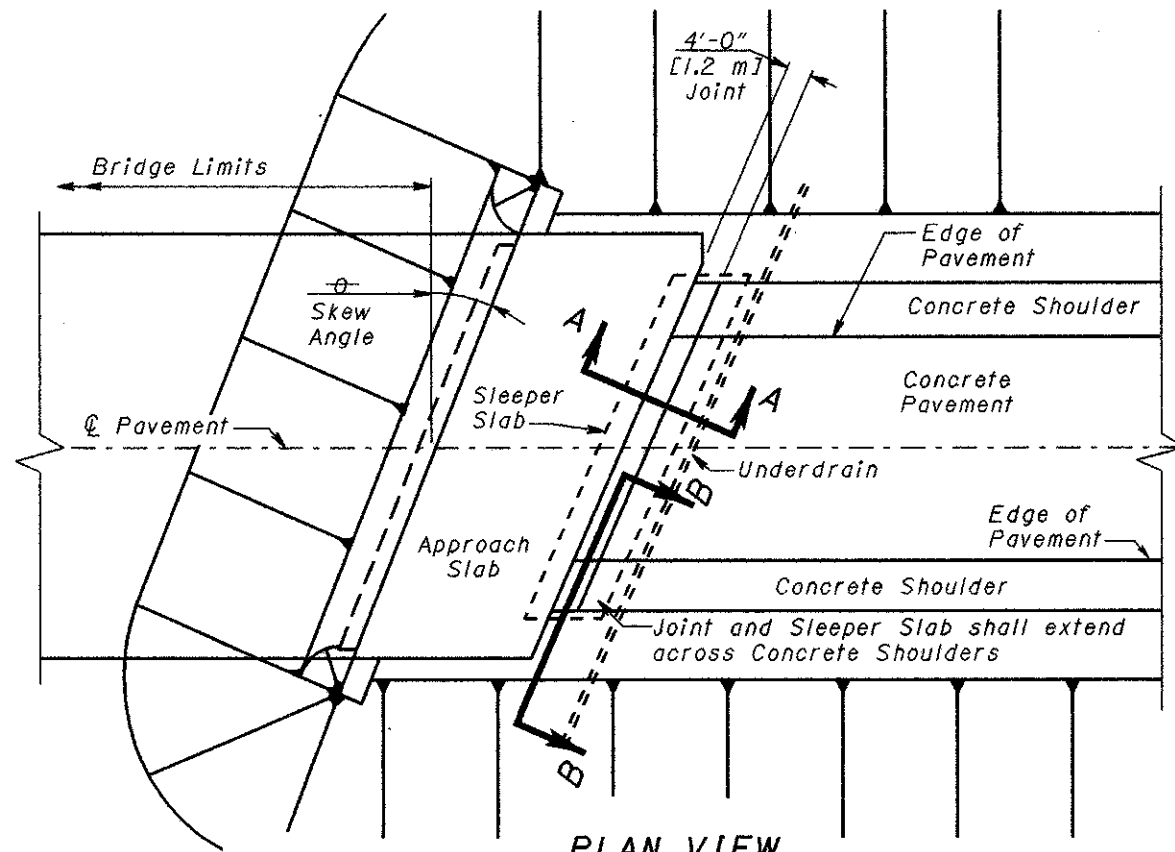
NOTES

STEEL REINFORCING: In normal or wider lane widths, reinforcing may consist of two units with an approved longitudinal hinge. The hinge shall consist of W4 or D4 [MW26 or MD26] steel wires connecting the two units such that the longitudinal members on either side of the hinge will be properly spaced when the reinforcing is in the final position.

Reinforcing steel in final position shall not touch either the dowels or tie bars.

THIS DRAWING REPLACES BP-1.1M DATED 10-28-94.

NUMBER BP-1.1	STANDARD ROADWAY CONSTRUCTION DRAWING	ROADWAY ENGINEERING SERVICES	STDS. ENGR. M. EVANS	REVISIONS	OHIO DEPARTMENT OF TRANSPORTATION
	CONCRETE PAVEMENT REINFORCING		DRAWN D. Focke		PROJECT NO. 0-28-00 DATE

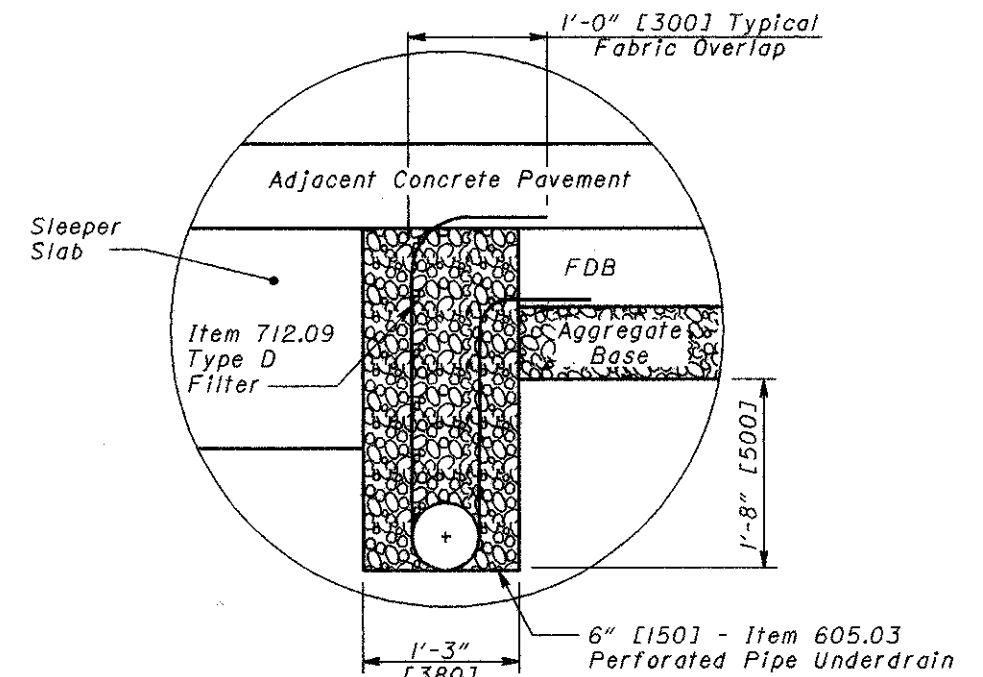


**PLAN VIEW
PRESSURE RELIEF JOINT - TYPE A
AT NEW APPROACH SLAB**
(Concrete Shoulders shown)

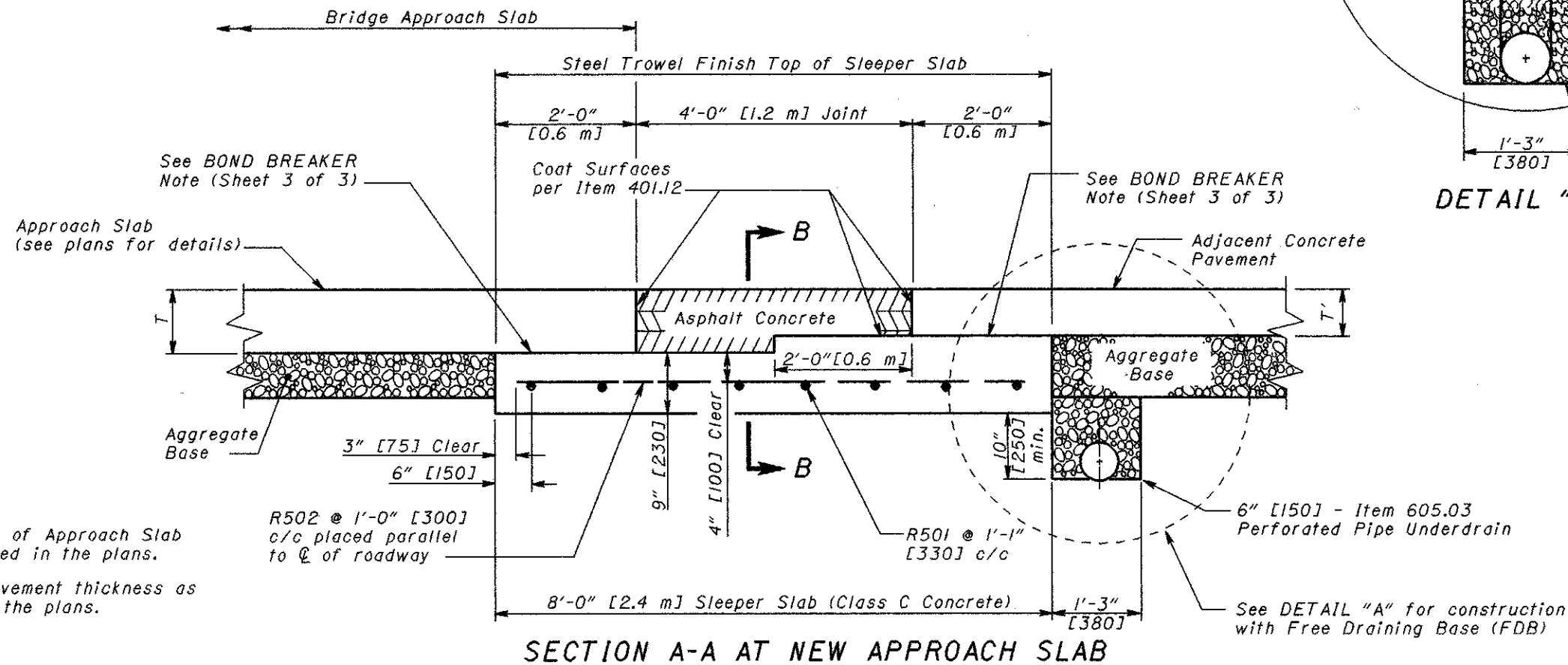
REINFORCING STEEL LIST					
Mark	Shape	Number		Length	
		English	Metric	English	Metric
R501 [#16M] [I]	Straight	8	8	S-0.5 ft.	S-0.15 m
R502 [#16M]	Straight	$N = \frac{S}{1 \text{ ft.}}$	$N = \frac{S}{0.3 \text{ m}}$	$\frac{8}{\cos \theta} \text{ ft.}$	$\frac{2.25}{\cos \theta} \text{ m}$

S = Length of sleeper slab in feet [meters]

[I] R501 bars may be furnished in segments with a 1'-7" [485] bar lap between segments.



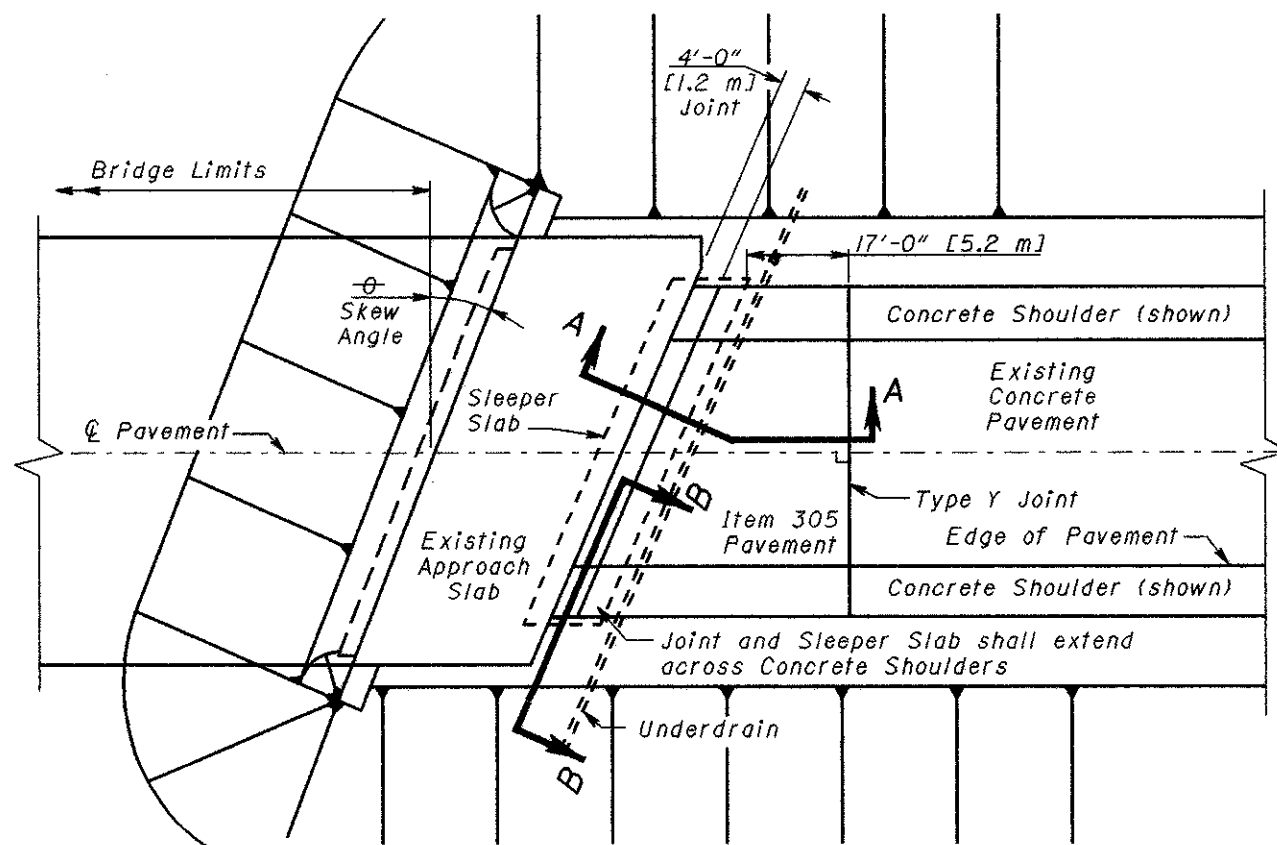
DETAIL "A"



T = Thickness of Approach Slab as required in the plans.
T' = Design Pavement thickness as shown in the plans.

SECTION A-A AT NEW APPROACH SLAB

STANDARD ROADWAY CONSTRUCTION DRAWING
 PRESSURE RELIEF JOINT TYPE A
 (at New Approach Slab)
 NUMBER BP-2.3
 1/3
 ROADWAY ENGINEERING SERVICES
 M. EVANS
 D. FOCKE
 REVISIONS 7-28-00
 QM0 DEPARTMENT OF TRANSPORTATION
 ROADWAY DESIGN ENGINEER
 DATE 29-99

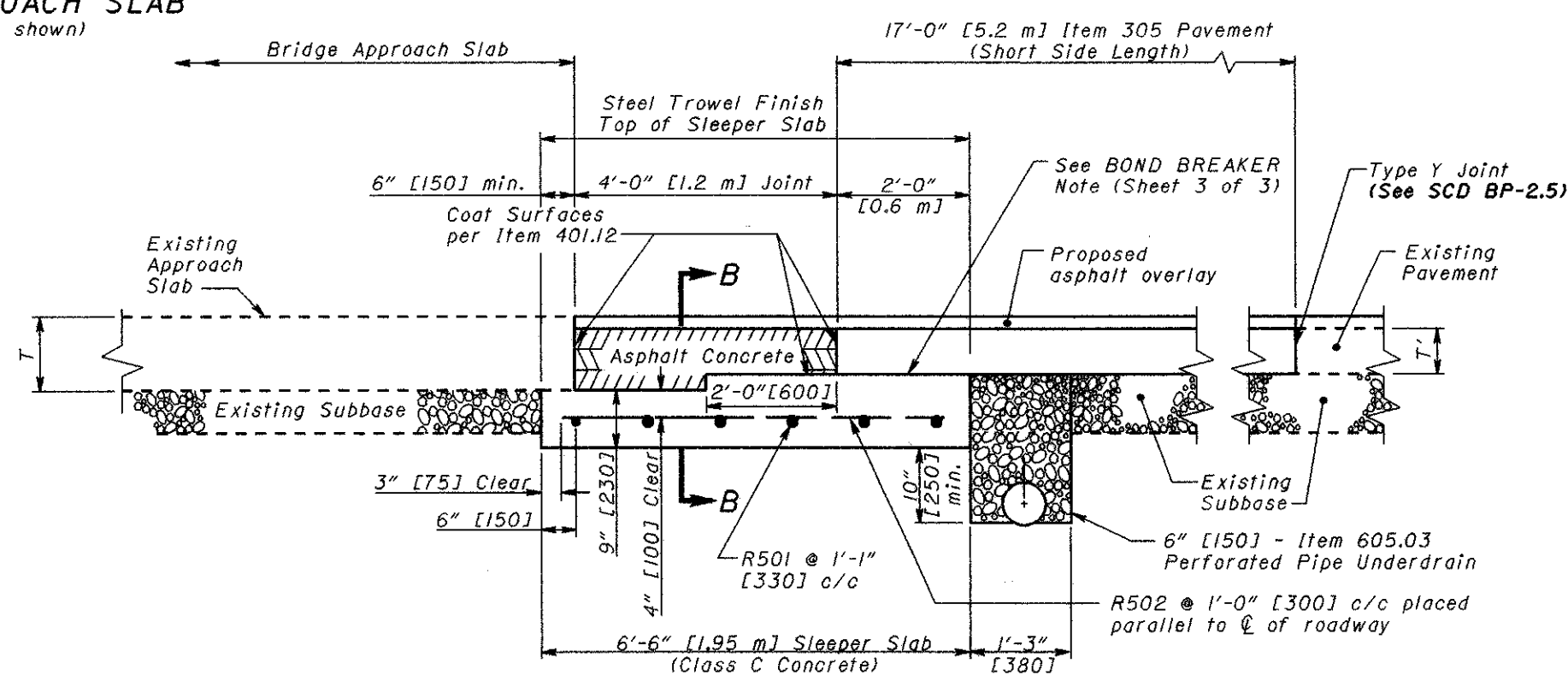


**PLAN VIEW
PRESSURE RELIEF JOINT - TYPE A
AT EXISTING APPROACH SLAB**
(Concrete Shoulders shown)

REINFORCING STEEL LIST					
Mark	Shape	Number		Length	
		English	Metric	English	Metric
R501 [#16M] [7]	Straight	6	6	S-0.5 ft.	S-0.15 m
R502 [#16M]	Straight	$N = \frac{S}{1 \text{ ft.}}$	$N = \frac{S}{0.3 \text{ m}}$	$\frac{6}{\cos \theta} \text{ ft.}$	$\frac{1.8}{\cos \theta} \text{ m}$

S = Length of sleeper slab in feet [meters]

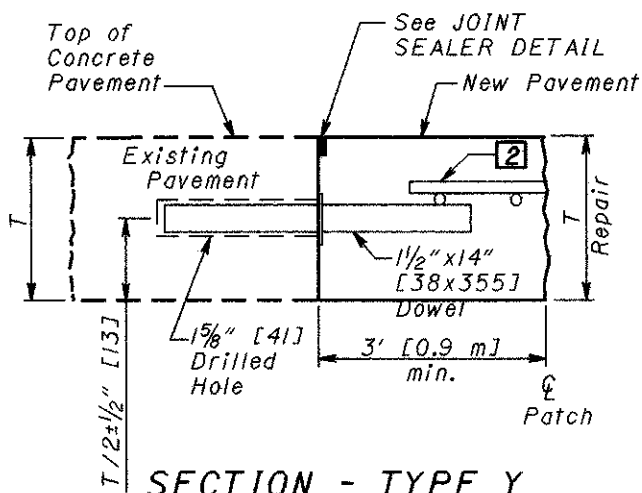
[7] R501 bars may be furnished in segments with a 1'-7" [485] bar lap between segments.



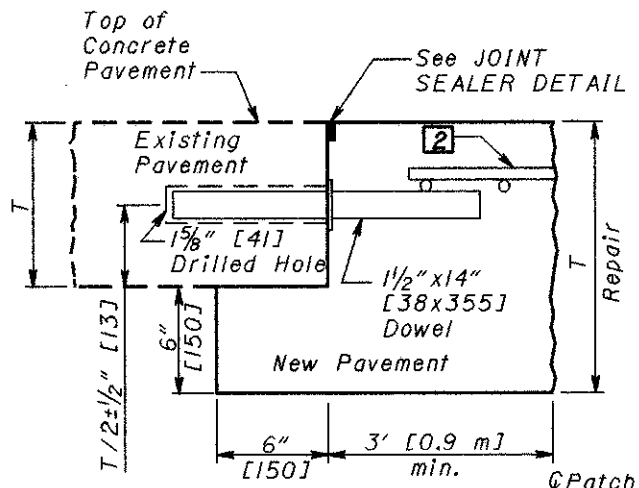
T = Thickness of Approach Slab as shown in the plans.
T' = Design Pavement thickness as shown in the plans.

SECTION A-A AT EXISTING APPROACH SLAB

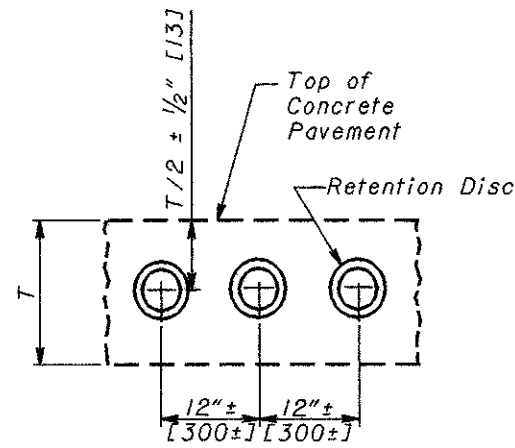
OHIO DEPARTMENT OF TRANSPORTATION
 REVISIONS 7-28-00
 STD. ENGR. M. EVANS
 DRAWN D. FOCKE
 ROADWAY DESIGN ENGINEER
 ROADWAY ENGINEERING SERVICES
 STANDARD ROADWAY CONSTRUCTION DRAWING
 PRESSURE RELIEF JOINT TYPE A
 (at Existing Approach Slab)
 NUMBER BP-2.3
 2/3



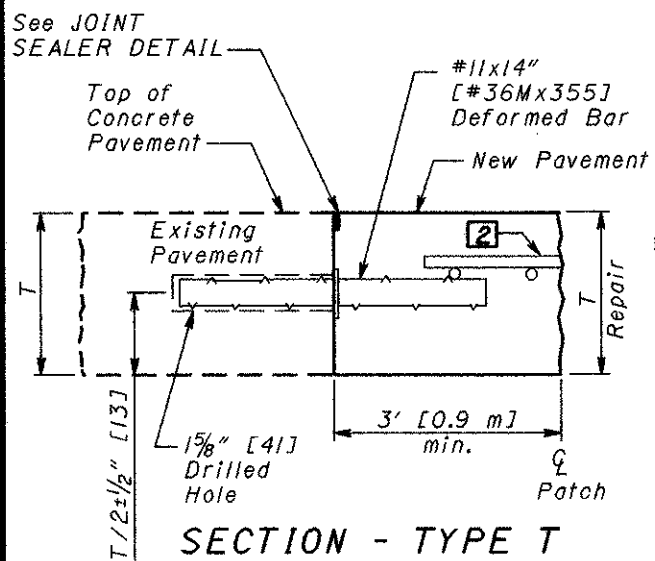
SECTION - TYPE Y
(Contraction)



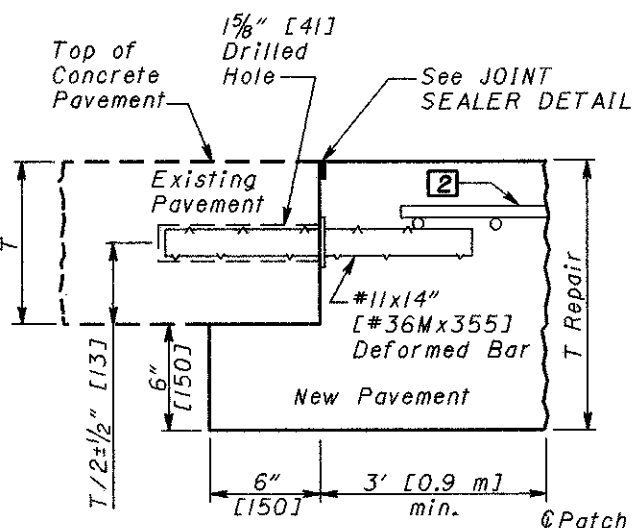
SECTION - TYPE YU
(Undercut - Contraction)



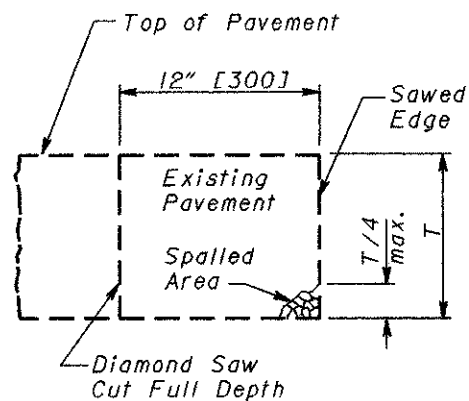
HOLE DRILLING DETAIL



SECTION - TYPE T
(Tied)



SECTION - TYPE TU
(Undercut - Tied)



ADDITIONAL PAVEMENT REMOVALS

NOTES

GENERAL: All joints shall be constructed normal to the centerline of the pavement lane unless otherwise specified in the plans.
All dowel holes shall be drilled by a mechanical device that will allow independent adjustment of all drill shafts in the horizontal and vertical direction. The device shall be capable of drilling a minimum of three holes at a time.
All smooth dowels shall be coated with a thin layer of oil or other "bond-breaking" material after they have been installed in the existing pavement and just prior to placing the patch. All dowels shall be placed parallel to the pavement surface and the centerline of the pavement lane.
This standard drawing is intended for use in repairing both concrete and composite pavements. For clarity, asphalt overlays are not shown.
When Prefabricated Edge Drains are used, they shall be placed after joint repairs are completed.

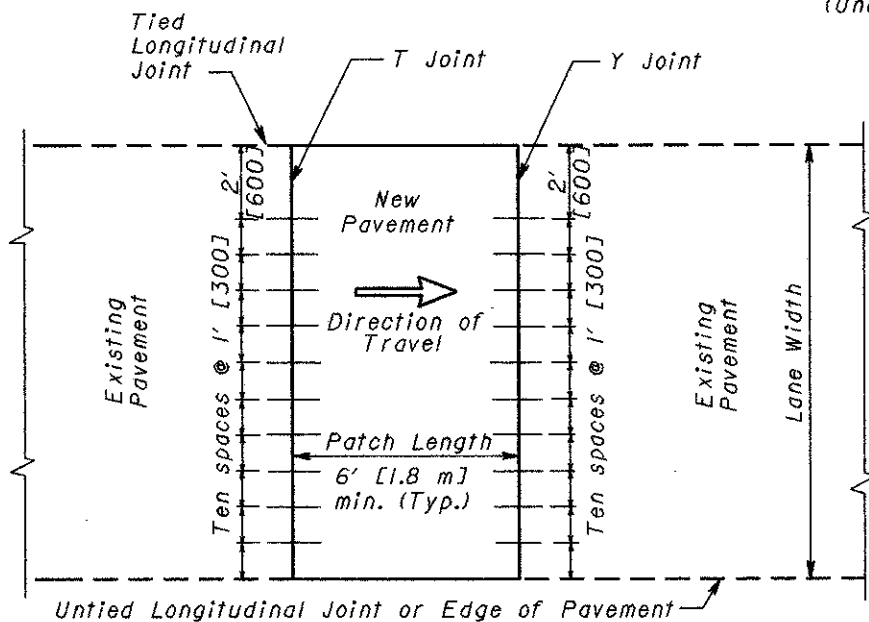
TYPE N JOINT: Joints referred to as Type N joints on the plan shall be constructed as contraction joints per **SCD BP-2.2**.

ADDITIONAL PAVEMENT REMOVAL: If, after the sawing and removal of the pavement from the area to be repaired, the face of the remaining pavement is spalled or deteriorated for a height greater than one-fourth (1/4) the thickness of the rigid pavement, an additional saw cut shall be made as shown and as directed by the Engineer. This additional work shall be measured for additional payment for full depth pavement sawing, rigid pavement removal and replacement.

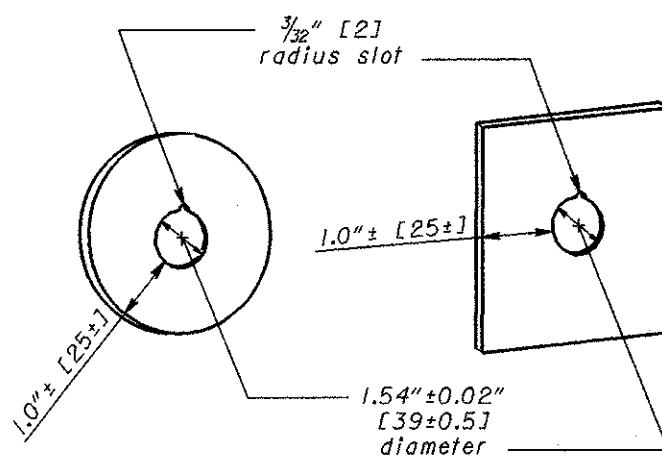
LONGITUDINAL JOINT: For patches 10' [3.0 m] or greater in length, the longitudinal joint shall be constructed per **SCD BP-2.1**.
The tie bars or hook bolts shall be spaced at no more than 30" [760] nor less than 24" [610] on center.

LEGEND

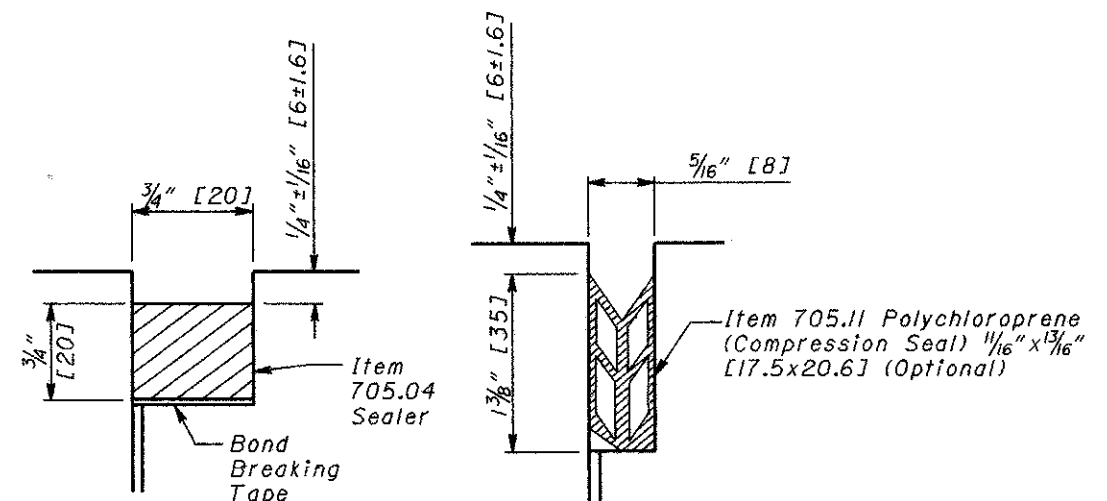
- 1 Bars shall be placed 2' [600] from the tied longitudinal joint and continue across with a 1' [300] spacing to the edge of pavement or an untied longitudinal joint. Where lane widths are between two tied longitudinal joints, begin bars 2' [600] from each tied longitudinal joint and continue across with a 1' [300] spacing.
- 2 Reinforcement will be required for all repairs greater than 10' [3.0 m] in length or for repairs that will be opened to traffic within 24 hours of placement. The fabric shall consist of W8.5 or D8.5 [MW55 or MD55] longitudinal wires spaced 6" [150] c/c and W4 or D4 [MW26 or MD26] transverse wires spaced 12" [300] c/c. The clearance from the end of the wire fabric to the edge of pavement or new transverse joint shall be 4" +/- 2" [100 +/- 50].
- 3 Nylon or plastic grout retention discs shall be clear or opaque white in color.



TIE / DOWEL BAR PLACEMENT DETAIL
(See 1 for Bar Placement)

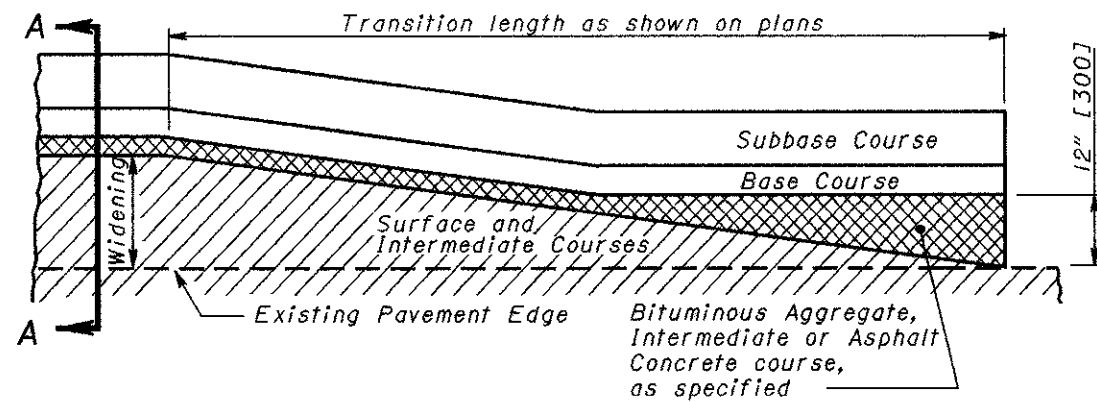


NYLON OR PLASTIC GROUT RETENTION DISCS FOR DOWEL/TIE BARS 3
(1/16" [1.6] min. thickness)



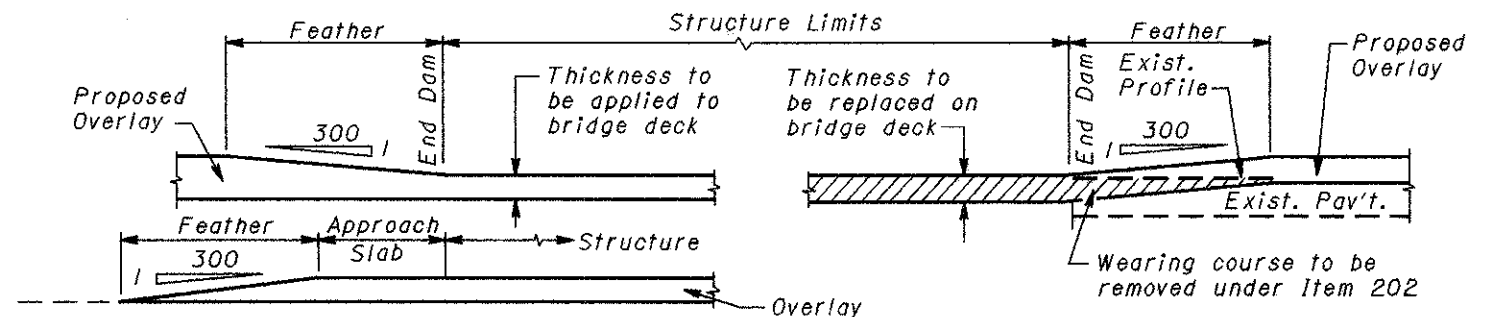
JOINT SEALER DETAIL

THIS DRAWING REPLACES BP-2.5M DATED 4-8-97.
 STANDARD ROADWAY CONSTRUCTION DRAWING
 ROADWAY ENGINEERING SERVICES
 RIGID REPLACEMENT
 NUMBER BP-2.5
 DATE 1/1
 STDS. ENGR. M. EVANS
 DRAWN D. FOCKE
 REVISIONS
 DATE DEPARTMENT TRANSPORTATION
 ROUTE 7-28-00
 ROADWAY DESIGN ENGINEER



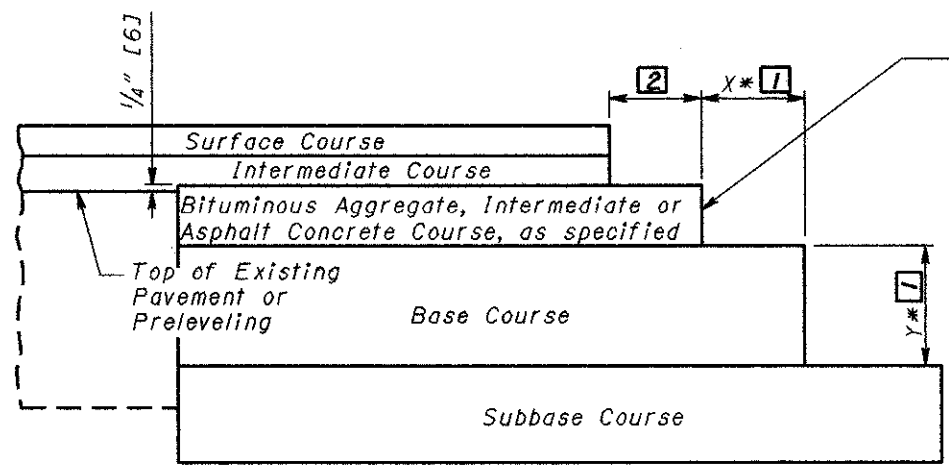
PLAN

MERGING EDGE OF PAVEMENT WIDENING WITH EDGE OF EXISTING PAVEMENT



Details assume non-settled approach slabs. Smoothing of the profile for settlement is required per plan grades or as directed by the Engineer.

FEATHERING AT STRUCTURES

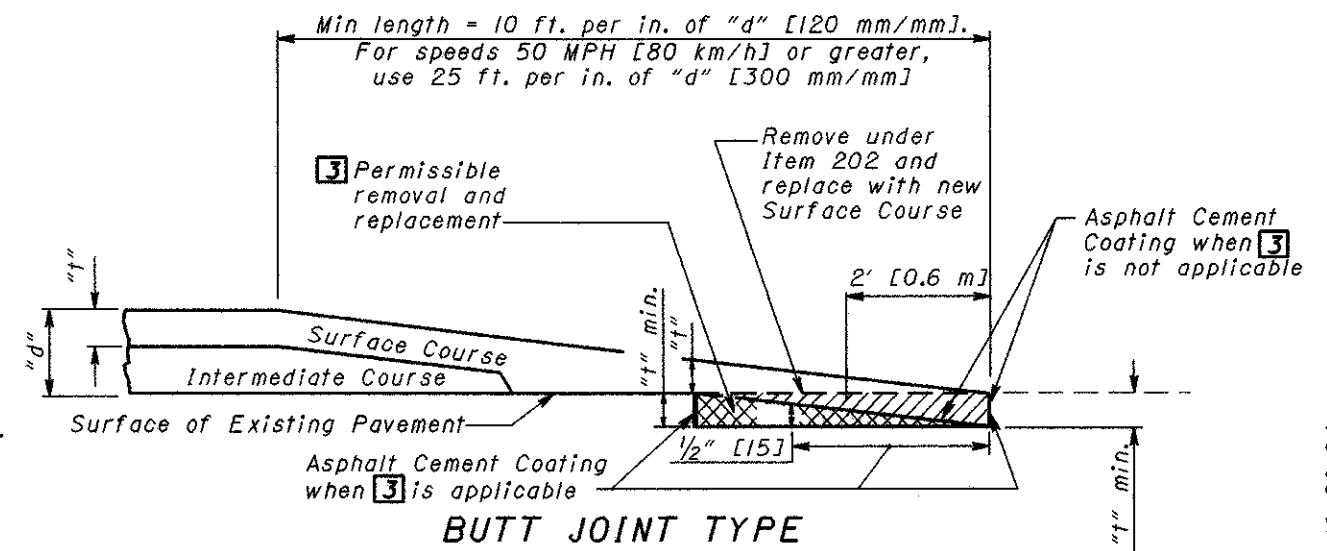


SECTION A-A
COURSE DETAIL FOR WIDENING

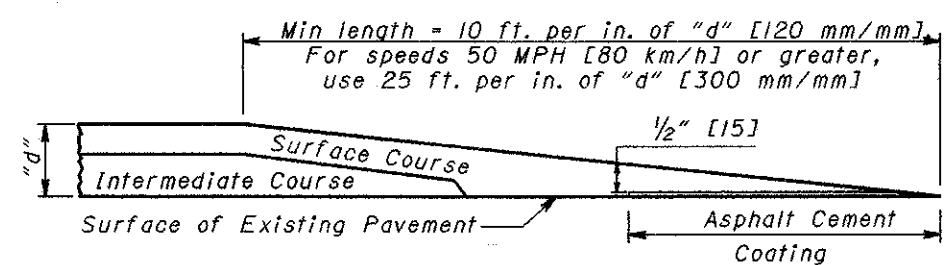
The Bituminous Aggregate in the upper part of the base widening shall finish approximately 1/4" [6] above the edge of the existing pavement where no preleveling is used. Where a preleveling (using intermediate course material) is specified it shall be placed prior to excavation of the widening trench and the upper course of the base widening shall finish approximately 1/4" [6] above the preleveling.

LEGEND

- 1 The extended width (X) of a base or subbase course shall be equal to the depth (Y) of that particular course, unless otherwise specified in the plans.
- 2 The extended width shall be equal to the thickness of the surface course plus the intermediate course, or 4 inches [100], whichever is greater.



BUTT JOINT TYPE

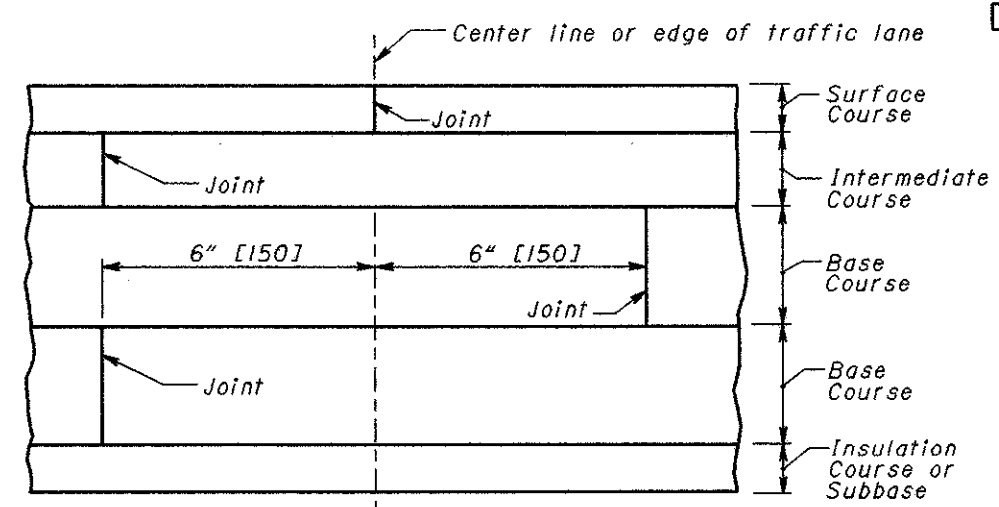


TAPER EDGE TYPE

NOTE: Either butt or taper type may be used unless type is specified by the plan.

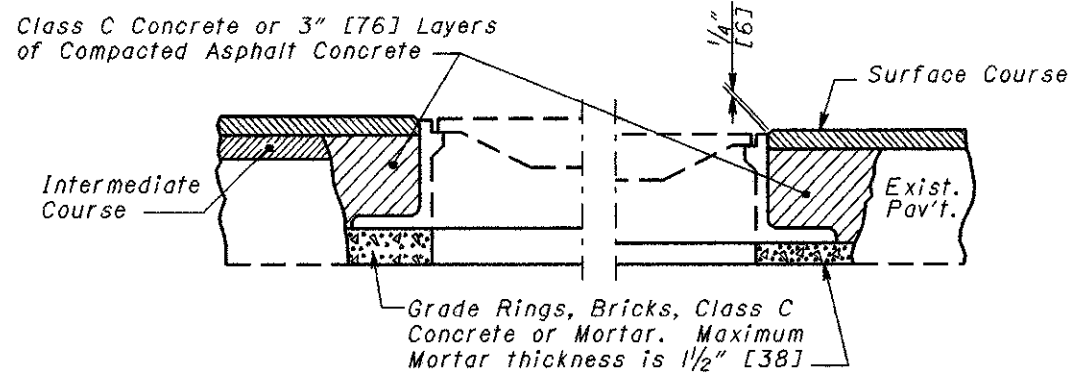
PLACING FEATHERED AREAS

Values for "t" and "d" are obtained from the plan.

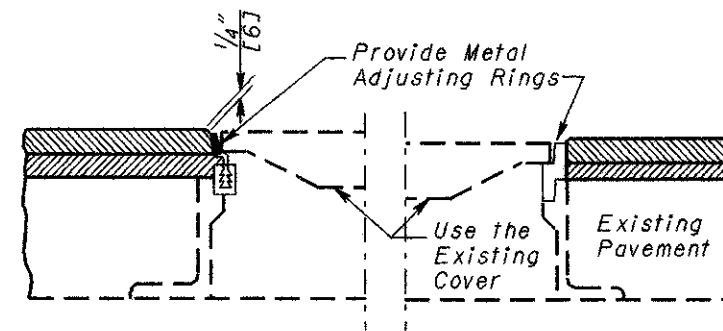


LAPPING LONGITUDINAL JOINTS

OHIO DEPARTMENT OF TRANSPORTATION
 ROADWAY DESIGN ENGINEER
 DATE
 REVISIONS
 STDS. ENGR. M. EVANS
 DRAWN D. FOCKE
 ALL metric dimensions (in brackets []) are in millimeters unless otherwise noted.
 ROADWAY ENGINEERING SERVICES
 STANDARD ROADWAY CONSTRUCTION DRAWING
 RESURFACING
 NUMBER BP-3.1
 THIS DRAWING REPLACES BP-3.1M DATED 10-28-94.
 1/2



USING CONCRETE OR MORTAR



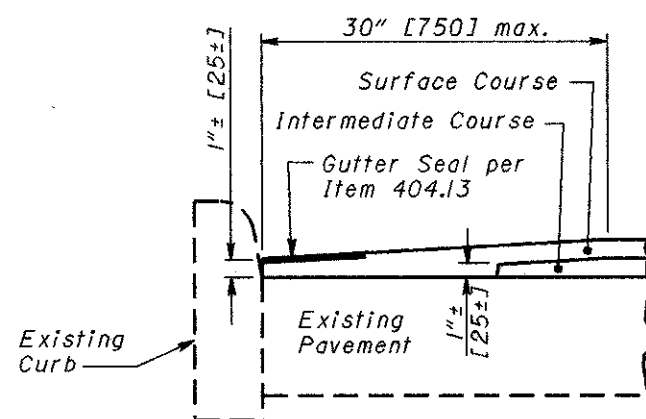
USING METAL ADJUSTING RINGS

Metal adjusting rings shall:

- (a) attach securely to the existing frame by welding or mechanical devices;
- (b) consist either of cast metal having an integral rim and seat, or be fabricated metal with a sturdy connection between the seat and rim; and
- (c) provide an even seat for the manhole cover.

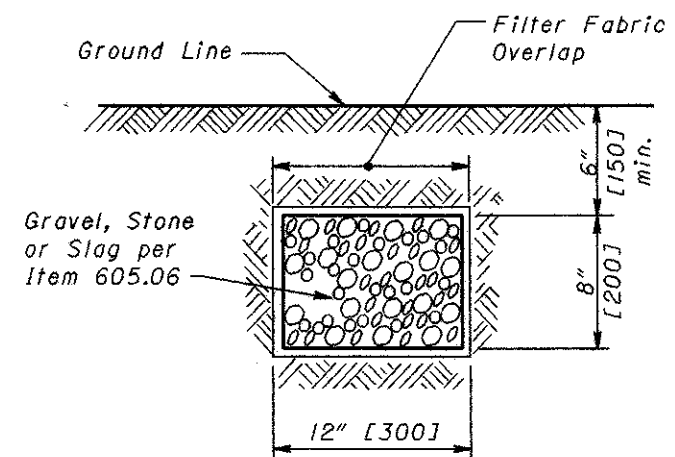
In addition, the adjusting ring type shall be a design acceptable to the local governmental agency responsible for street and sewer maintenance. Any installation unacceptable to the Engineer shall be replaced by the Contractor at his expense.

MANHOLES ADJUSTED TO GRADE



Special care shall be taken during construction to obtain maximum compaction of bituminous concrete in gutters.

GUTTER FINISH



Aggregate drains to be placed where and as directed by Engineer. Provide Filter Fabric when specified as a separate pay item.

AGGREGATE DRAIN

THIS DRAWING REPLACES BP-3.1M DATED 10-28-94.

STANDARD ROADWAY CONSTRUCTION DRAWING

RESURFACING

NUMBER
BP-3.1

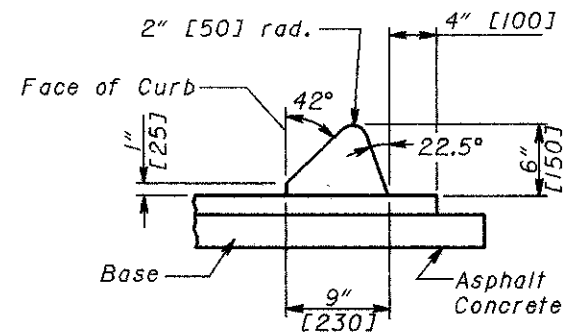
2/2

All metric dimensions (in brackets []) are in millimeters unless otherwise noted.

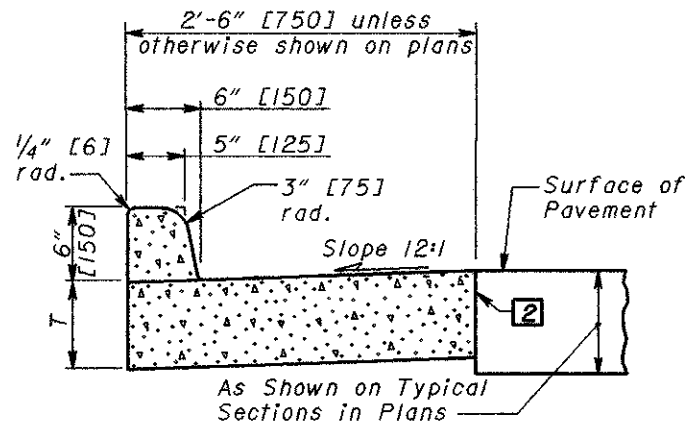
STDS. ENGR.
M. EVANS
DRAWN
D. Focke

REVISIONS

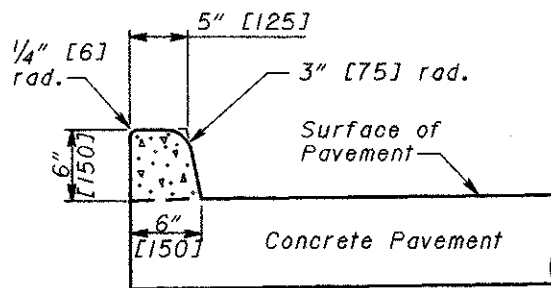
DATE
ROADWAY DESIGN ENGINEER
-28-00
DEPARTMENT OF TRANSPORTATION
Ken T. Siskind



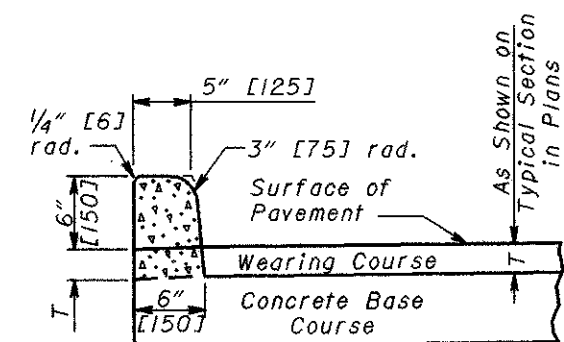
TYPE 1



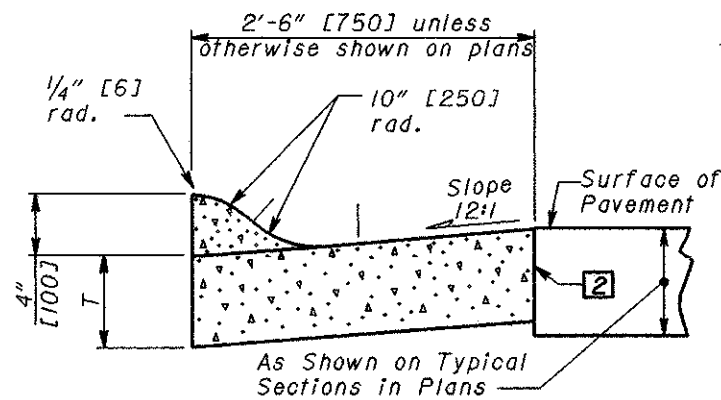
TYPE 2



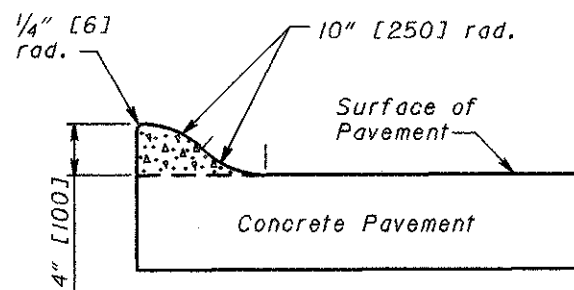
TYPE 2-A



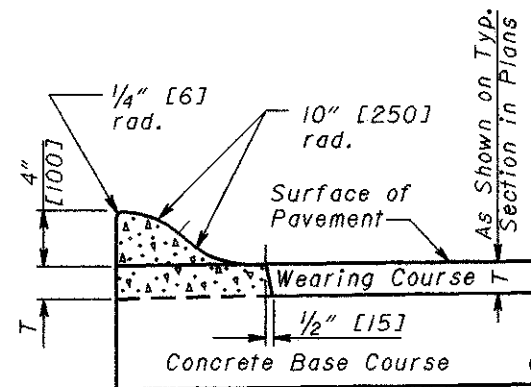
TYPE 2-B



TYPE 3



TYPE 3-A



TYPE 3-B

NOTES

GENERAL: This drawing shows alternate types of curb that may be used on various types of pavement. The typical section of the project shows the type to be used, also the thickness of the edge of the pavement or the edge of the curb and gutter section.

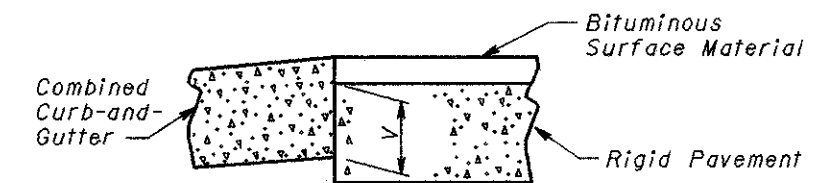
JOINTS: 1" [25] expansion joints shall extend up to the top of the curb and shall be constructed in the curb and gutter section in such a manner that the joint seal will extend the full width of the gutter and into the curb face a sufficient distance to seal the joint to an elevation of at least 2" [50] above the flow line of the gutter. Dowel bars shall be used in the curb and gutter section at expansion joints and to the surface of the pavement. Transverse expansion joint material shall meet the requirements of Item 705.03.

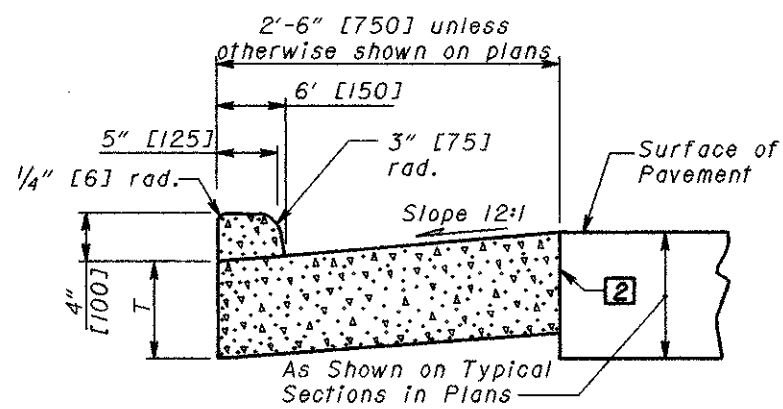
GUTTER PLATE THICKNESS: Thickness of gutter plate "T" shall be 9" [230] unless otherwise shown on the plans.

TOLERANCES: Dimensional tolerances are as follows:
 Curbs: $-\frac{1}{32}$ " to $+\frac{1}{4}$ " [-1 to +5],
 Gutters: 0 to $+\frac{1}{2}$ " [0 to +12].

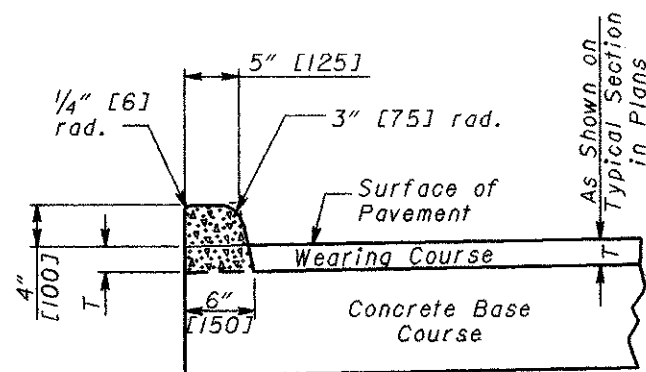
LEGEND

- 1 Expansion joint material and joint sealer are not required for the portion of the curb that is adjacent to a flexible pavement type. Both materials are required, as detailed, for the full height of rigid pavement and concrete bases.
- 2 Butt joints shall be provided between combined curb-and-gutter and new or existing rigid pavements, with tie bars or hook bolts provided at intervals of 5' [1.5 m]. See **SCD BP-2.1** for details of tie bars and hook bolts. If the combined curb-and-gutter adjoins a new rigid base or an existing rigid base or pavement that is to be surfaced with bituminous material, a butt joint shall also be provided. However, tie bars or hook bolts shall be omitted when the vertical overlap ("V" in detail below) between the curb-and-gutter and rigid pavement is less than 7" [175].

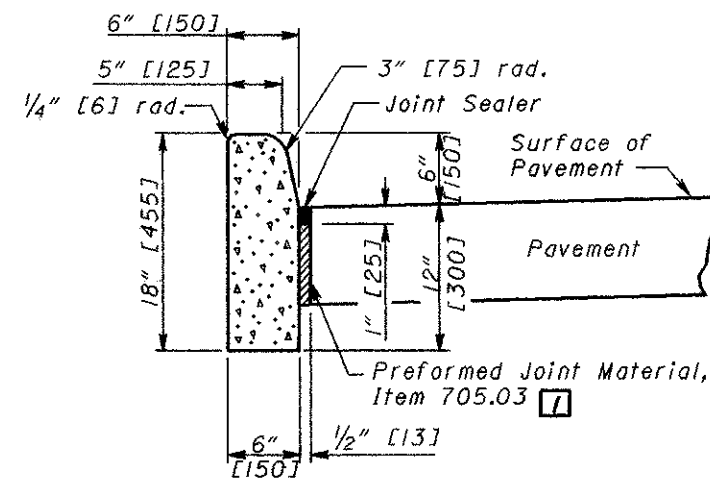




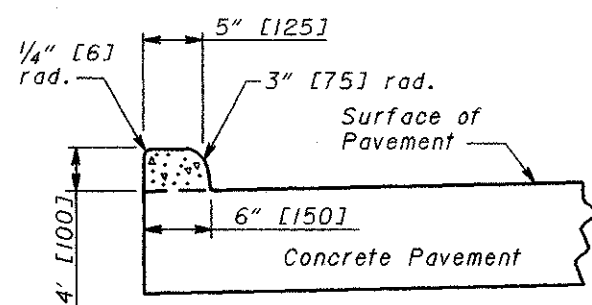
TYPE 4



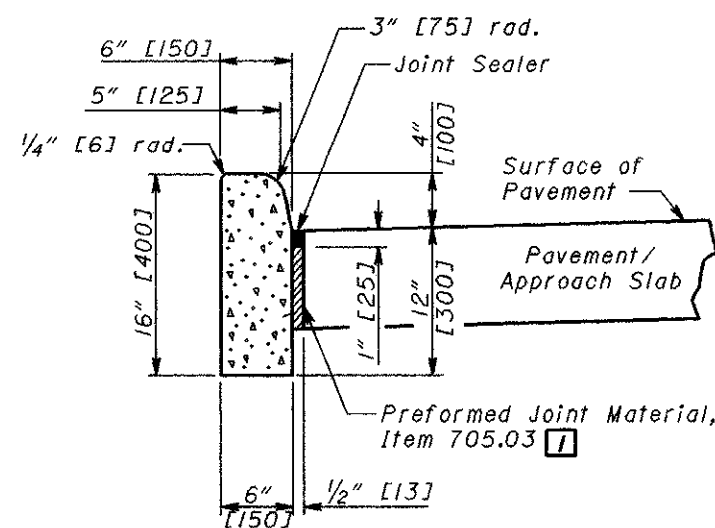
TYPE 4-B



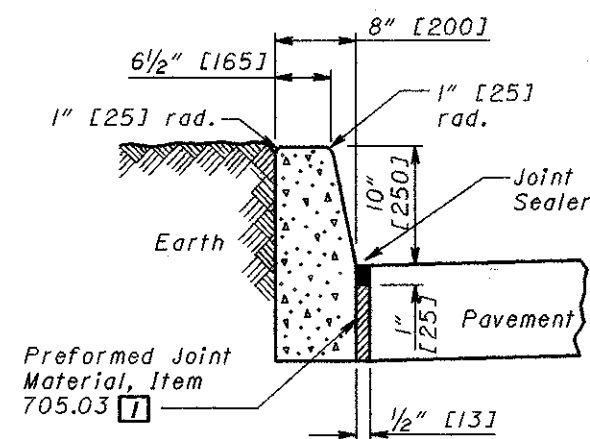
TYPE 6



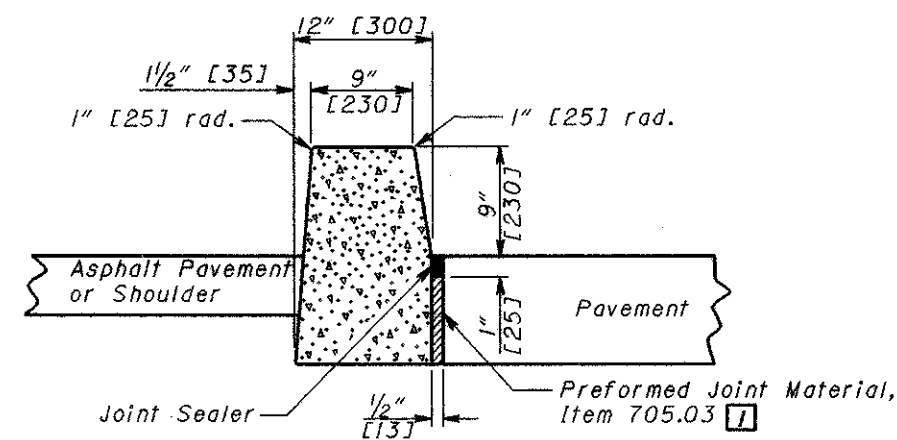
TYPE 4-A



TYPE 4-C



TYPE 7



TYPE 8

See Sheet 1 of 2 for Notes and Legend.

THIS DRAWING REPLACES BP-5.1M DATED 10-28-94.

STDS. ENGR. M. EVANS	REVISIONS	OHIO DEPARTMENT OF TRANSPORTATION
DRAWN D. Focke		RDWY DESIGN ENGINEER
ROADWAY ENGINEERING SERVICES		DATE
CONCRETE CURBS AND GUTTERS COMBINED CURB AND GUTTERS		
NUMBER BP-5.1		
2	2	

CONSTRUCTION METHODS

NOTES

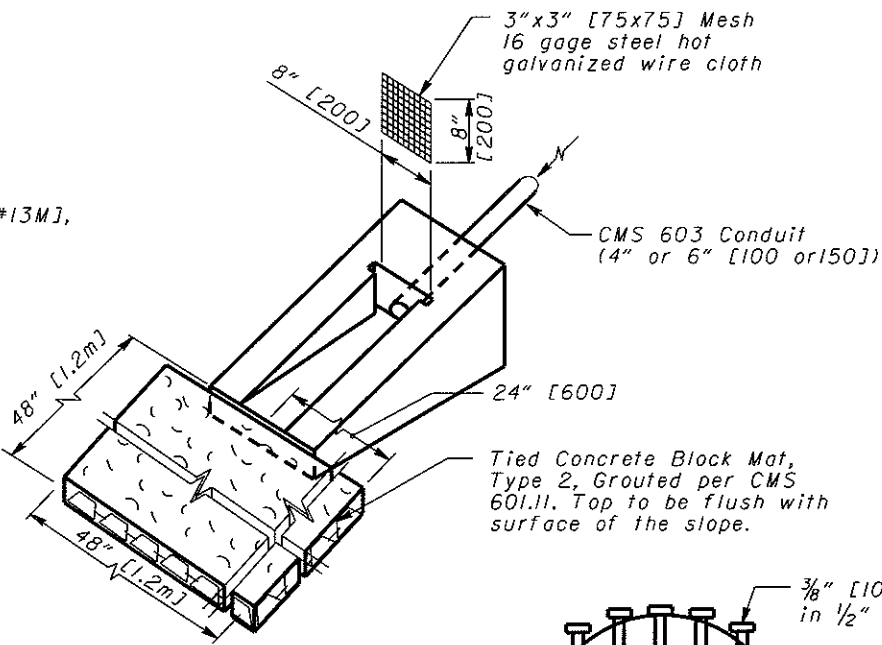
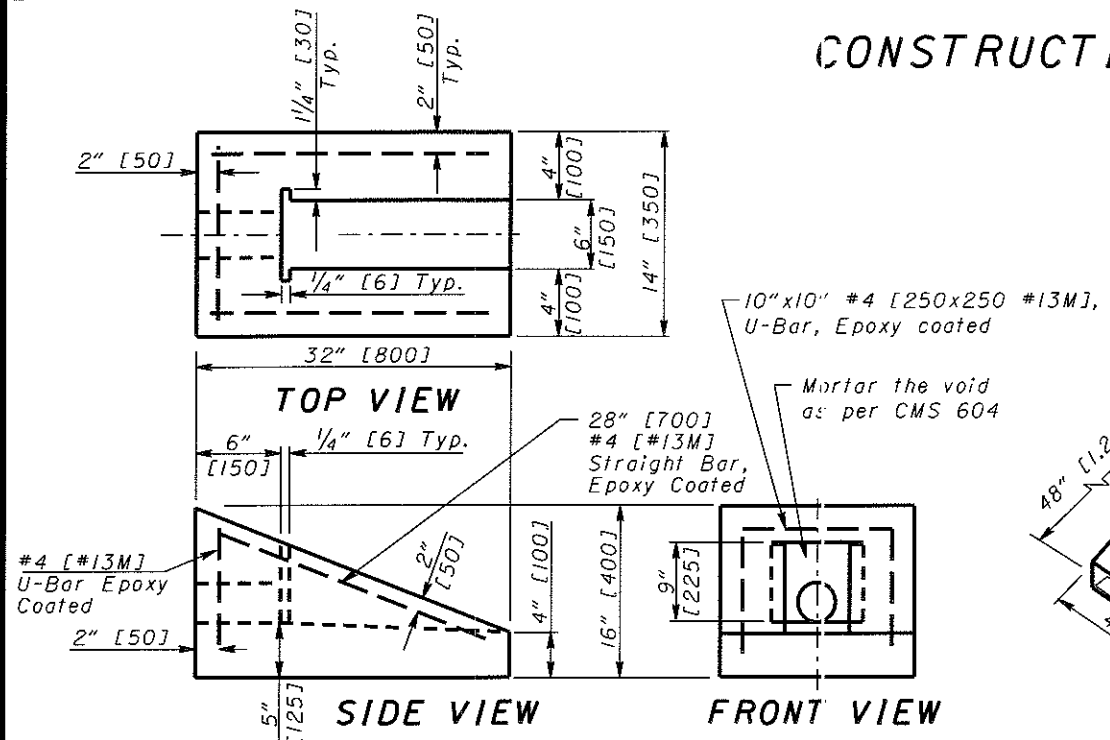
MASONRY COLLARS: A masonry collar shall be provided where plans require that a pipe extension be joined to the end of an existing pipe with a butt joint. The cost shall be included in the unit price bid for the new conduit.

EROSION CONTROL PAD AND ANIMAL GUARDS: These items shall be provided at the outlet end of all farm drains except where they outlet into a drainage structure. The steel bolts or rods for the animal guard shall be galvanized per CMS 710.06. In lieu of drilling or punching the 1/2" [13] diameter holes into the pipe, a metal collar meeting all of the above requirements may be clamped onto the pipe if approved by the Engineer.

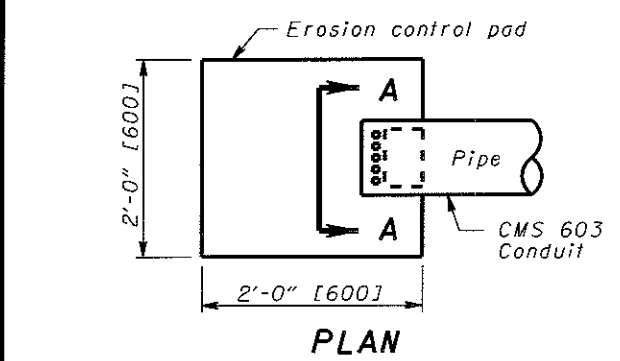
PAYMENT: Erosion control pads, masonry collars, and animal guards shall be included in the unit price bid for **Item 603 - ___ inch [mm] Conduit, Type ___**.

PRECAST REINFORCED CONCRETE OUTLET: The concrete outlet shall meet the requirements of CMS 604.

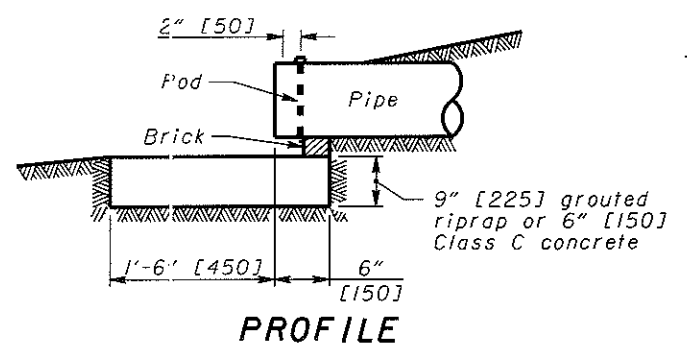
PAYMENT: The Mortar; Tied Concrete Block Mat, Type 2, Grouted; and Wire Mesh shall be included in the unit price bid for **Item 604 - Precast Reinforced Concrete Outlet**.



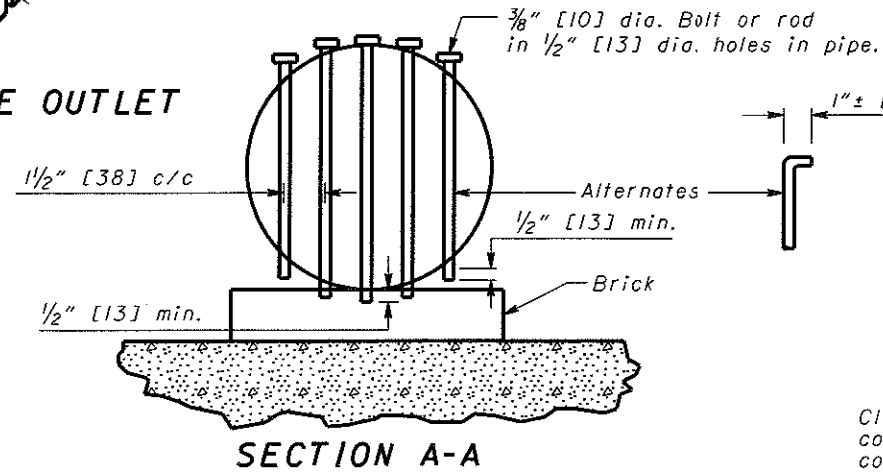
PRECAST REINFORCED CONCRETE OUTLET



EROSION CONTROL PAD AND ANIMAL GUARD FOR OUTLET PIPE

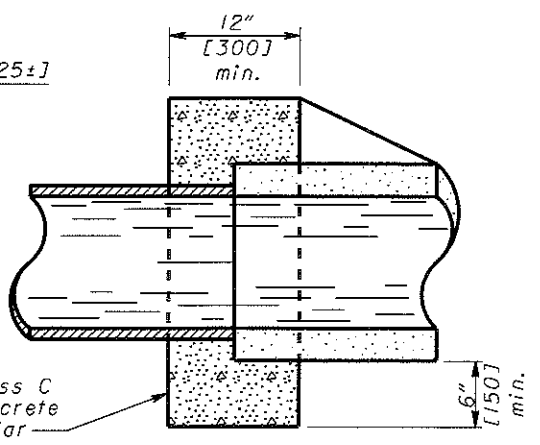


PROFILE

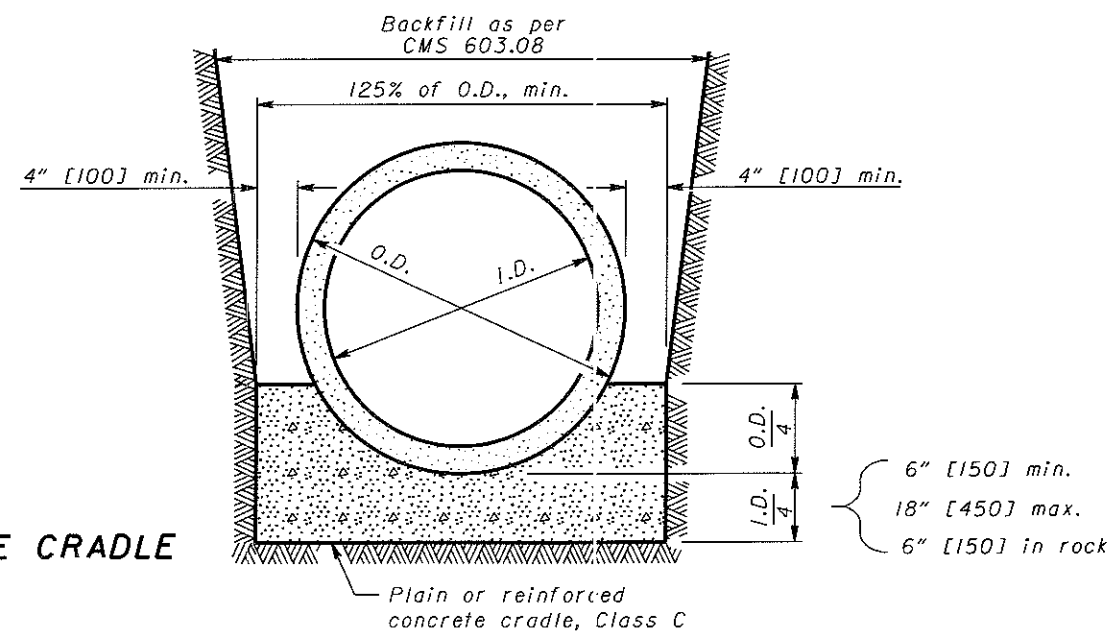


SECTION A-A

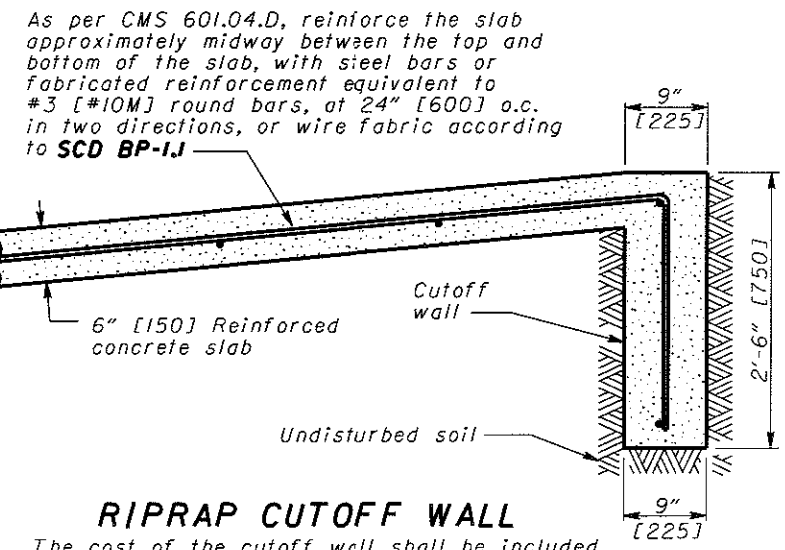
CONDUIT SIZE	4" [100]	6" [150]	8" [200]	10" [250]	12" [300]	15" [375]	18" [450]
No. of Bolts	2	3	5	6	7	9	11



MASONRY COLLAR



CONCRETE CRADLE



RIPRAP CUTOFF WALL

The cost of the cutoff wall shall be included in the unit price bid for Item 601 Riprap using 6" [150] reinforced concrete slab.

OHIO DEPARTMENT OF TRANSPORTATION
 ENGINEER OF BRIDGES
 DATE
 7-20-01
 7-19-02
 HYDRAULIC ENGINEER
 D. GRUYER
 All metric dimensions (in brackets []) are in millimeters unless otherwise noted.
 OFFICE OF STRUCTURAL ENGINEERING
 STANDARD HYDRAULIC CONSTRUCTION DRAWING
 OUTLETS, DRAINS AND SEWERS
 NUMBER
 DM-1.1
 1 / 2

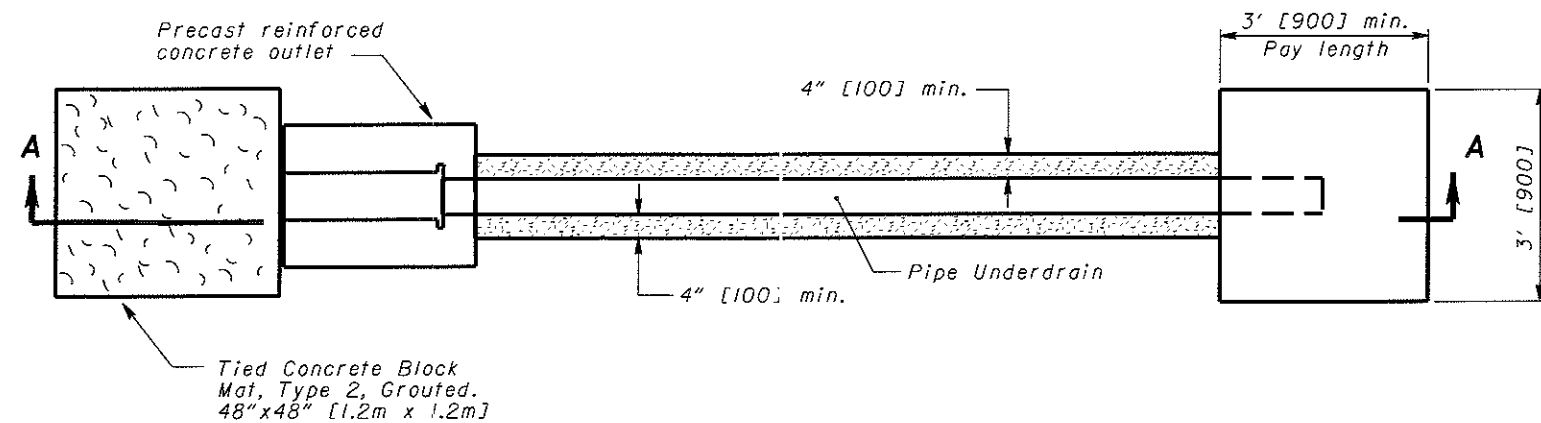
NOTES

SPRING DRAIN: Aggregates, tarred paper, tarred burlap, or geotextile fabric backfill and necessary excavation for spring drains shall be included for payment in the unit price bid per Foot [Meter] for **Item 605 - Aggregate Drains for Springs.**

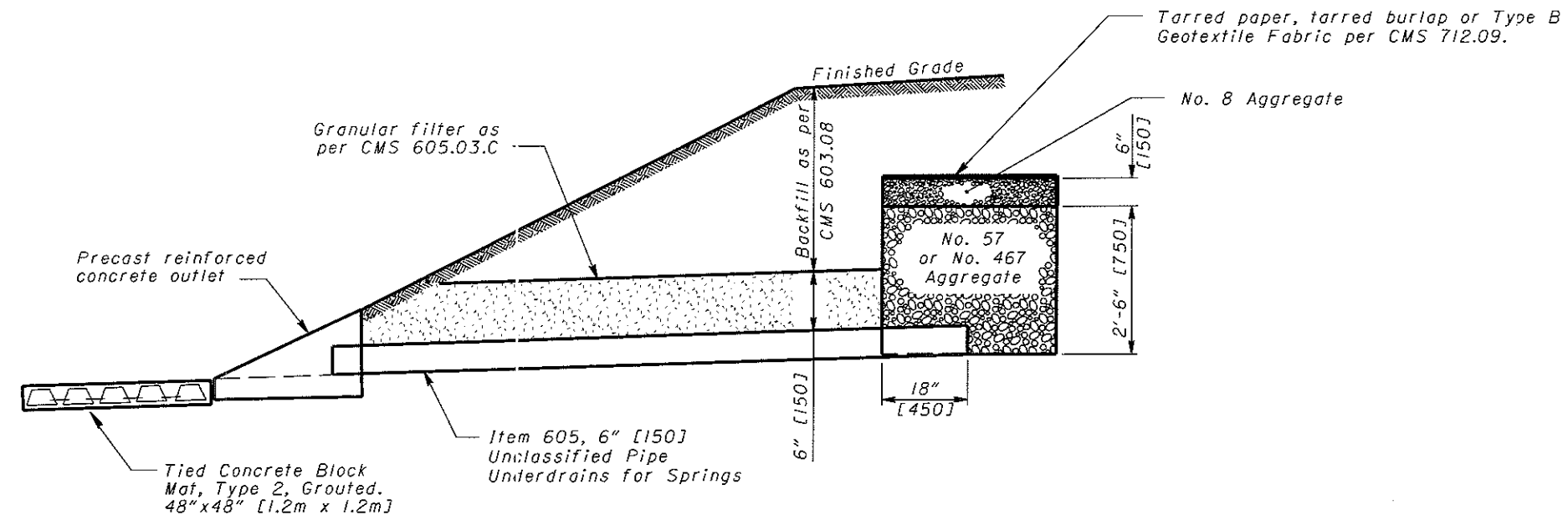
PAYMENT: The pipe shall be included in the unit price bid per Foot [Meter] for **Item 605 - 6" [150] Unclassified Pipe Underdrains for Springs.**

PRECAST REINFORCED CONCRETE OUTLET: The concrete outlet shall meet the requirements of CMS 604.

PAYMENT: The Mortar; Tied Concrete Block Mat, Type 2, Grouted; and Wire Mesh shall be included in the unit price bid for **Item 604 - Precast Reinforced Concrete Outlet.**



PLAN



SECTION A-A

SPRING DRAIN DETAIL

NOTES

DESCRIPTION: This item shall consist of furnishing and installing either a pipe underdrain system or a prefabricated edge underdrain system in accordance with the specifications and with the details on the plans or as directed by the Engineer.

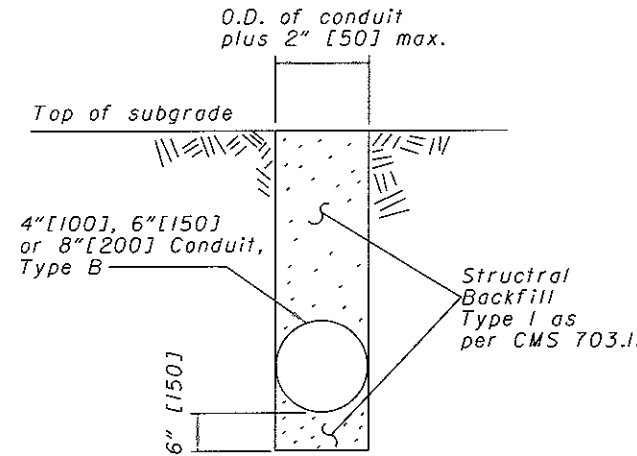
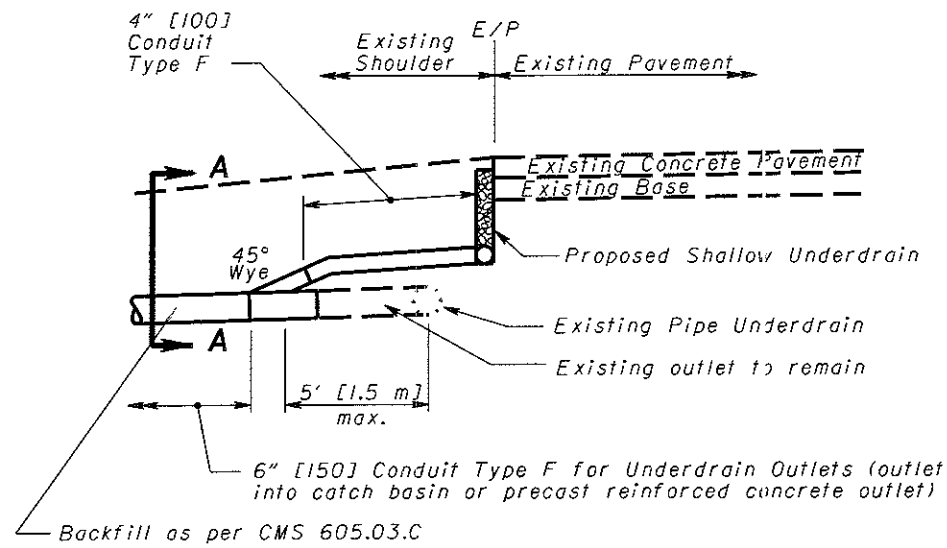
MATERIALS: The underdrain shall either be a pipe underdrain system or a prefabricated edge underdrain system meeting the requirements of CMS 605.

BASIS OF PAYMENT FOR PIPE UNDERDRAIN SYSTEM ONLY: Work completed, accepted and measured under this item shall be paid for at the contract unit price bid for **Item 605 - 4" [100] Shallow Pipe Underdrains**. The price shall be full compensation for excavation and backfill; for furnishing materials, including materials for outlet fittings and Item 301; and for all labor, tools, equipment and incidentals necessary to complete the work.

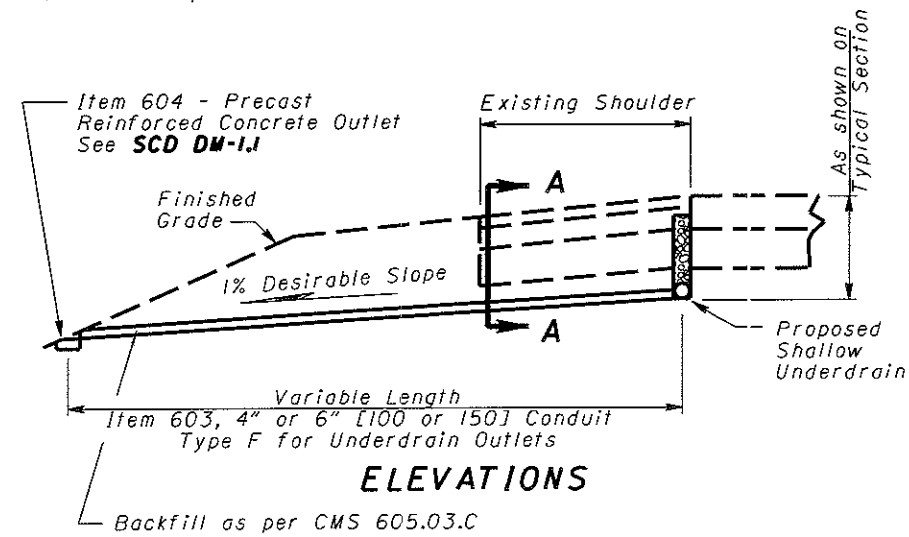
BASIS OF PAYMENT FOR SHALLOW UNDERDRAIN SYSTEM: Work completed, accepted and measured under this item shall be paid for at the contract unit price bid for **Item 605 - Shallow Underdrains**. The price shall be full compensation for excavation and backfill; for removing and disposing of all surplus excavation in accordance with CMS 105.16 and 105.17; for furnishing materials, including materials for splices, outlet fittings, and Item 301; and for all labor, tools, equipment and incidentals necessary to complete the work associated with the installation of pipe underdrains.

BASIS OF PAYMENT FOR PREFABRICATED EDGE DRAIN SYSTEM: Work completed, accepted and measured under this item shall be paid for at the contract unit price bid for **Item 605 - Prefabricated Edge Underdrains**. The price shall be full compensation for excavation and backfill; for removing and disposing of all surplus excavation in accordance with CMS 105.16 and 105.17; for furnishing materials, including materials for splices, outlet fittings, and Item 301; and for all labor, tools, equipment and incidentals necessary to complete the work associated with the installation of prefabricated edge underdrains.

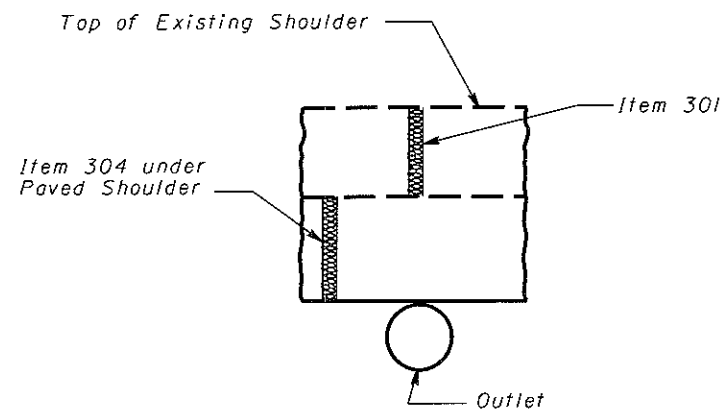
The cost of the 4" [100] Conduit Type F and necessary pipe bends and branches needed to connect the existing and proposed underdrains shall be included with the cost of the 6" [150] Conduit Type F for Underdrain Outlets.



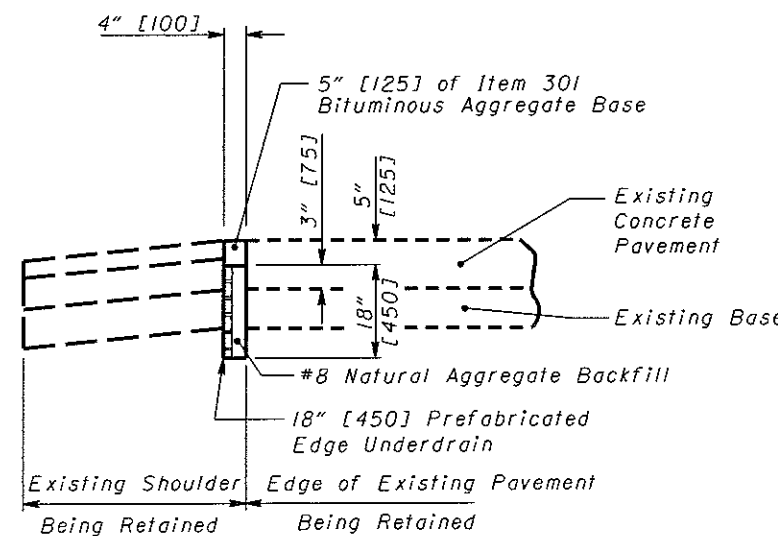
603 4", 6", or 8" [100, 150, or 200] CONDUIT, TYPE B



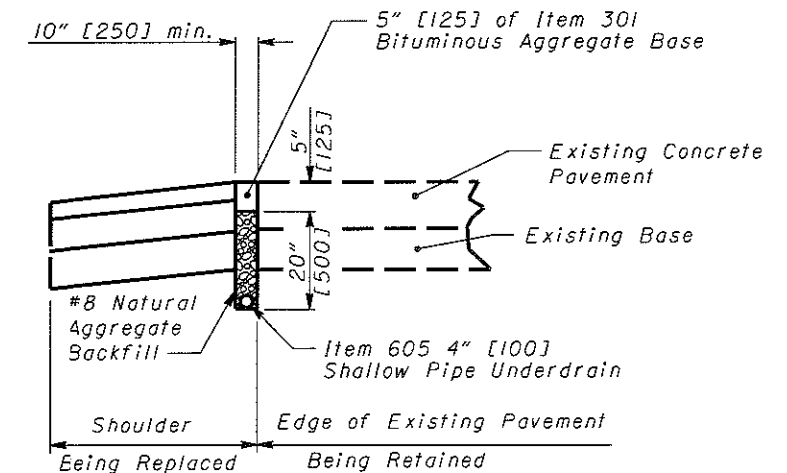
ELEVATIONS



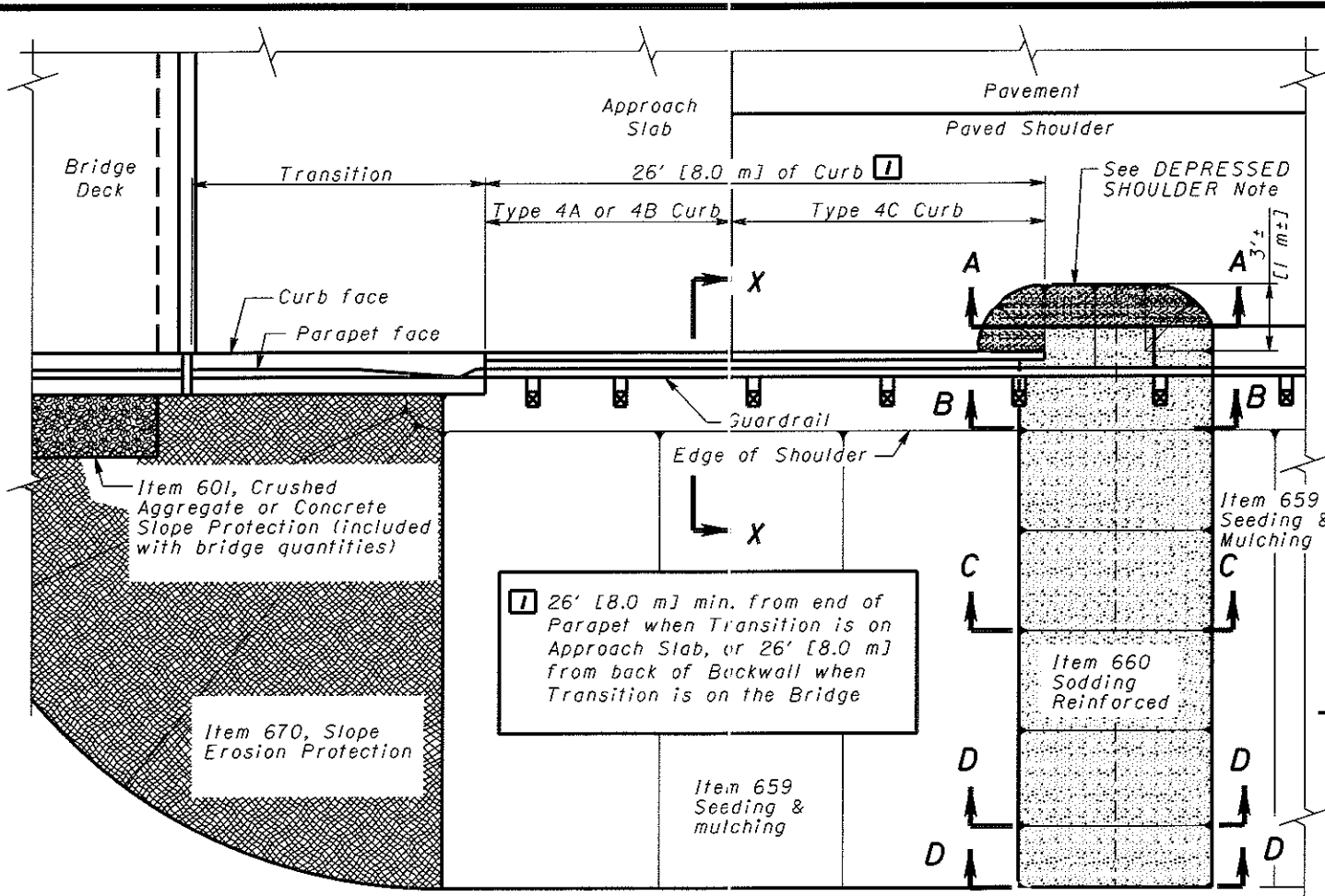
**SECTION A-A
SHALLOW UNDERDRAIN SYSTEM**



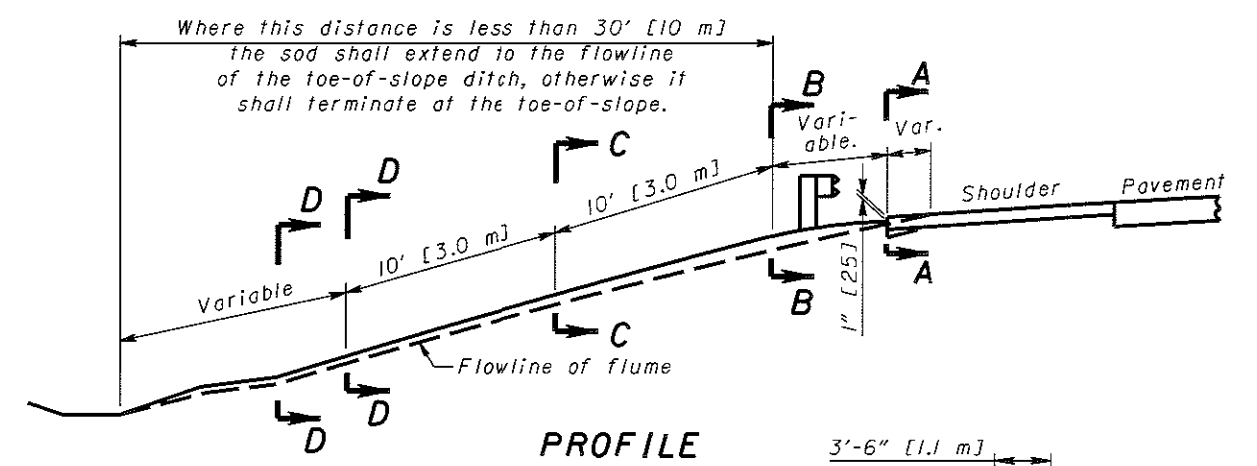
PREFABRICATED EDGE DRAIN SYSTEM



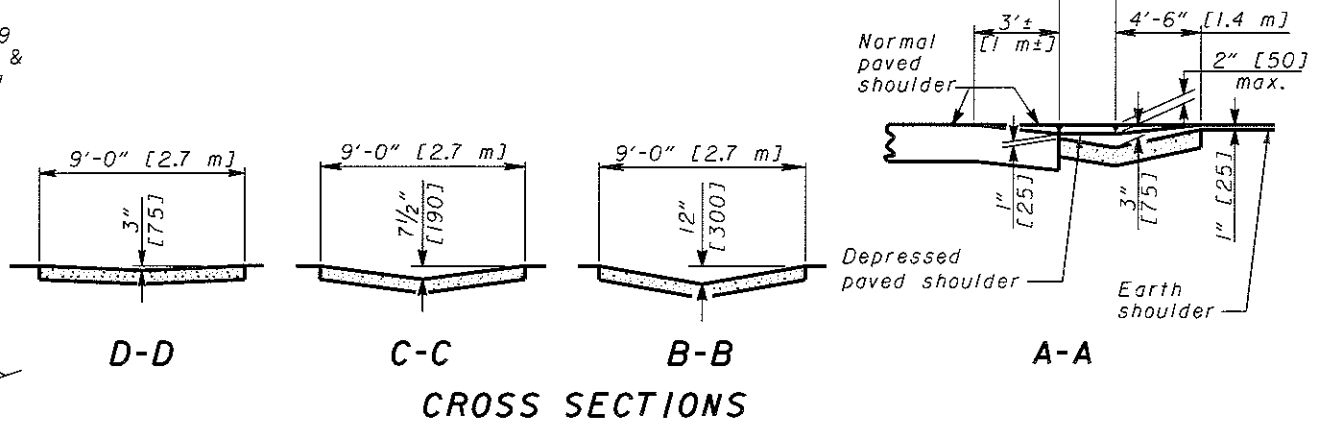
PIPE UNDERDRAIN SYSTEM



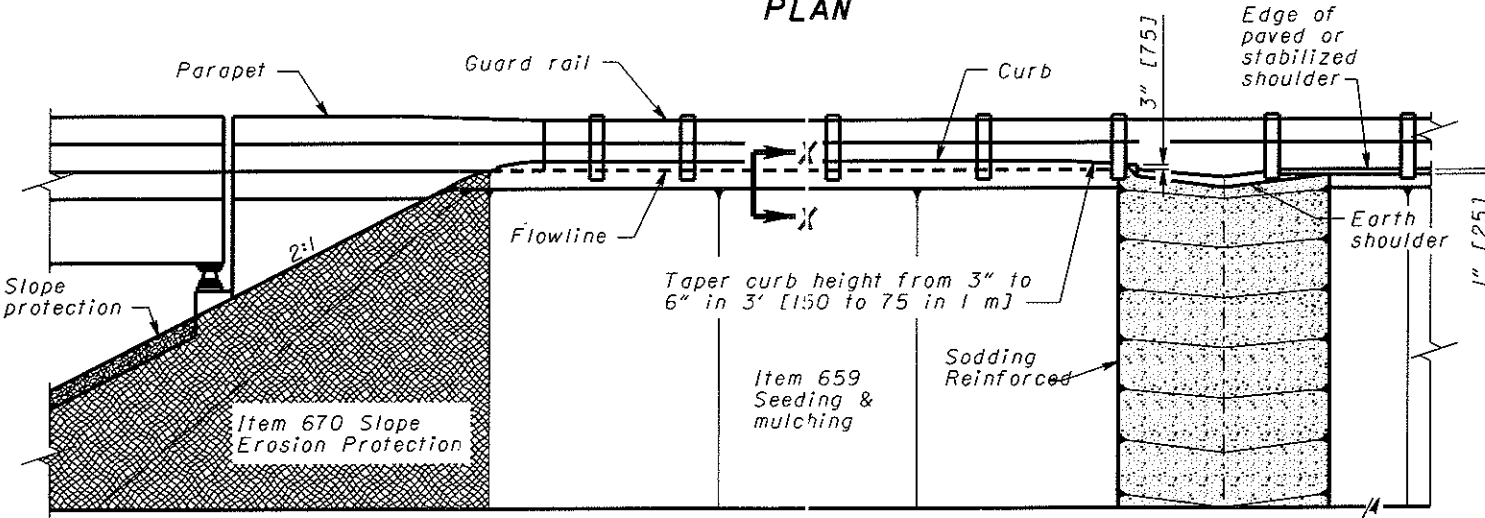
PLAN



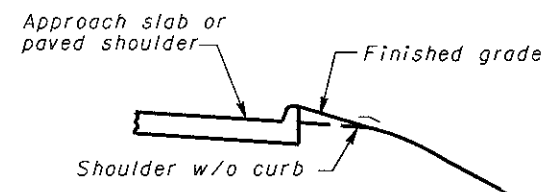
PROFILE



CROSS SECTIONS



ELEVATION



SECTION X-X

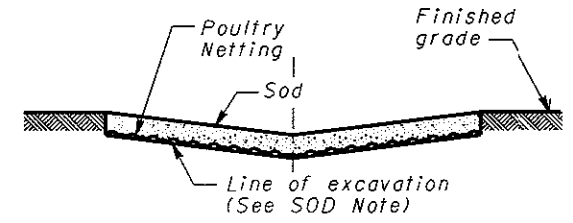
NOTES

DEPRESSED SHOULDER: This portion of the shoulder shall be depressed to ensure positive drainage into the sodded flume. It is especially important in the shoulder area to excavate and shape the subgrade according to the cross-sections.

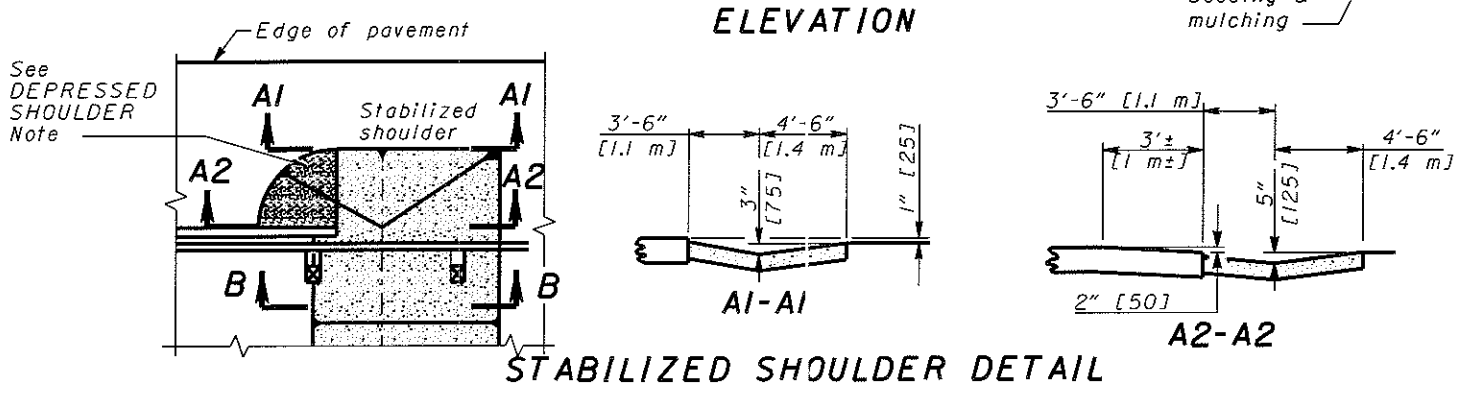
PLACING REINFORCED SODDING: Prior to placing the sod, galvanized poultry netting shall be placed on the finished subgrade. The netting shall be 4' [1.2 m] wide, poultry netting or equivalent, with 2" [50] mesh and No. 20 gage minimum wire. Each strand shall be staked securely to the subgrade by using T-shaped pins or 1"x1"x8" [25x25x200] wood stakes. The stakes or pins shall be placed at 4' [1.2 m] intervals on the top and bottom and in rows 4' [1.2 m] apart. Fasten the poultry netting to the wood stakes with staples. Where the sodding is from 8' to 9' [2.5 to 3.0 m] wide, two strands of netting for a total width of 8' [2.5 m] is permitted.

SOD: Sod shall be laid in accordance with CMS 660. Special care shall be taken to excavate the sod bed to a proper depth so that the sod is flush with the surrounding grade.

PAYMENT: Payment for all the above shall be included in the unit price bid for **Item 660, Sodding Reinforced, Square Yard [Square Meter].**

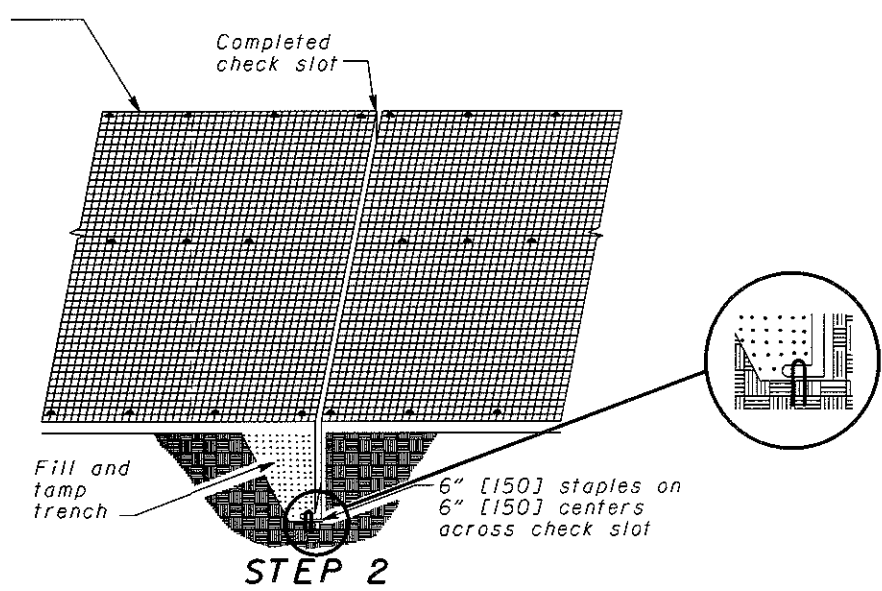
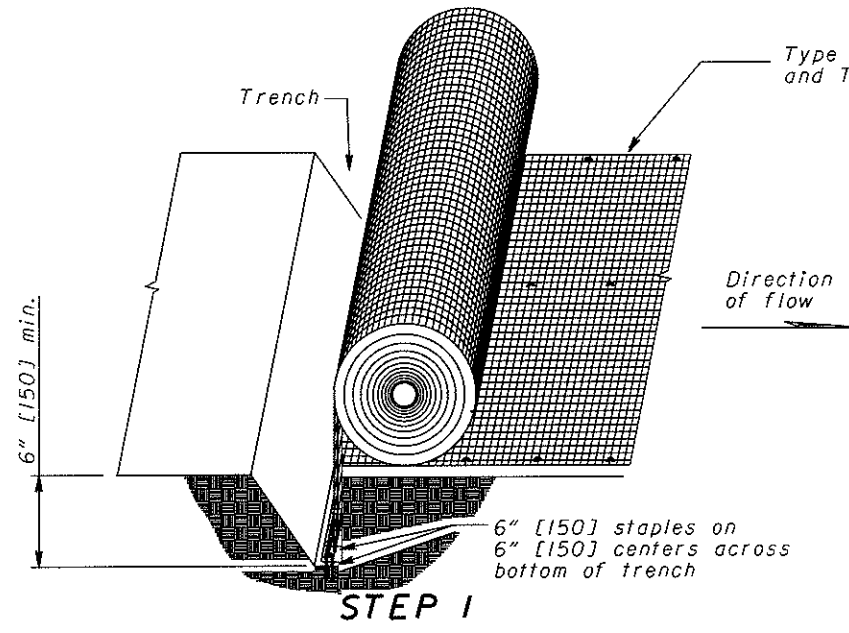
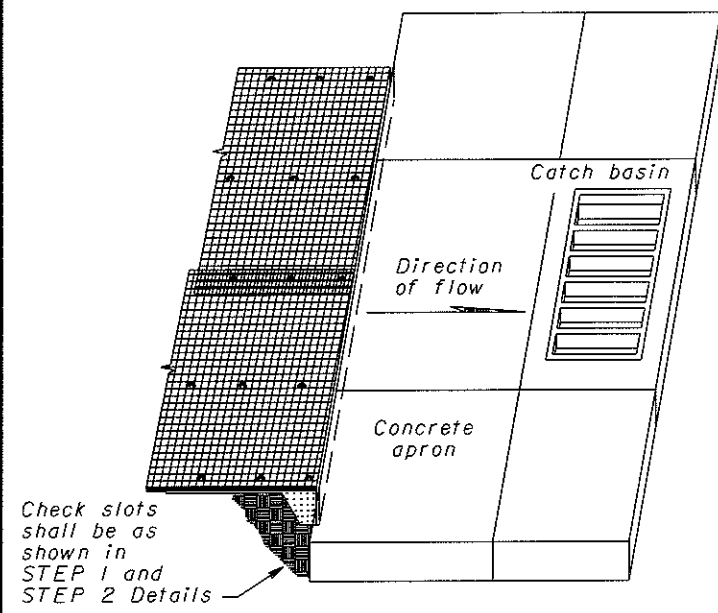


SOD INSTALLATION DETAIL

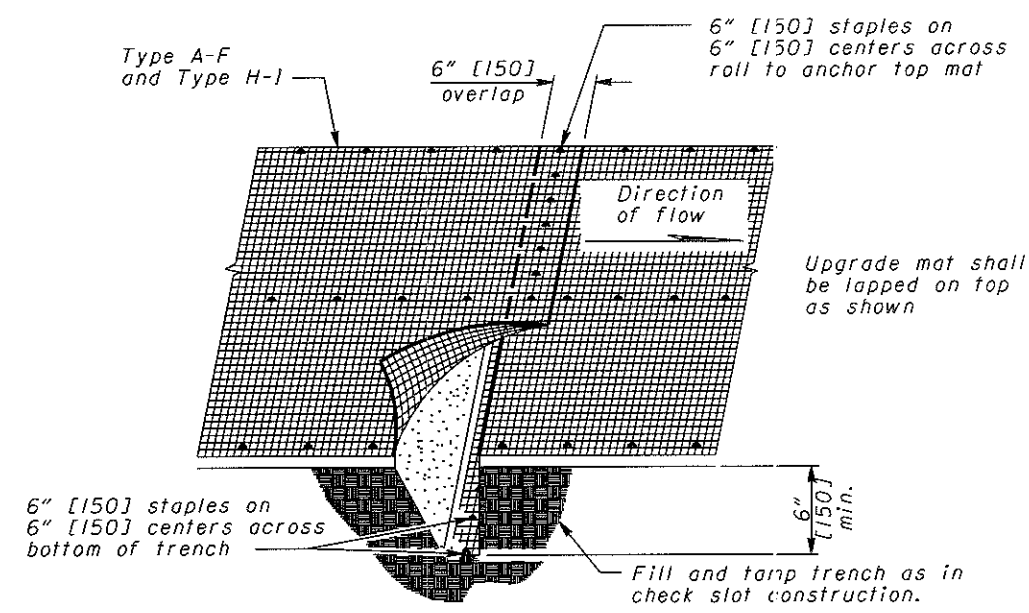


STABILIZED SHOULDER DETAIL

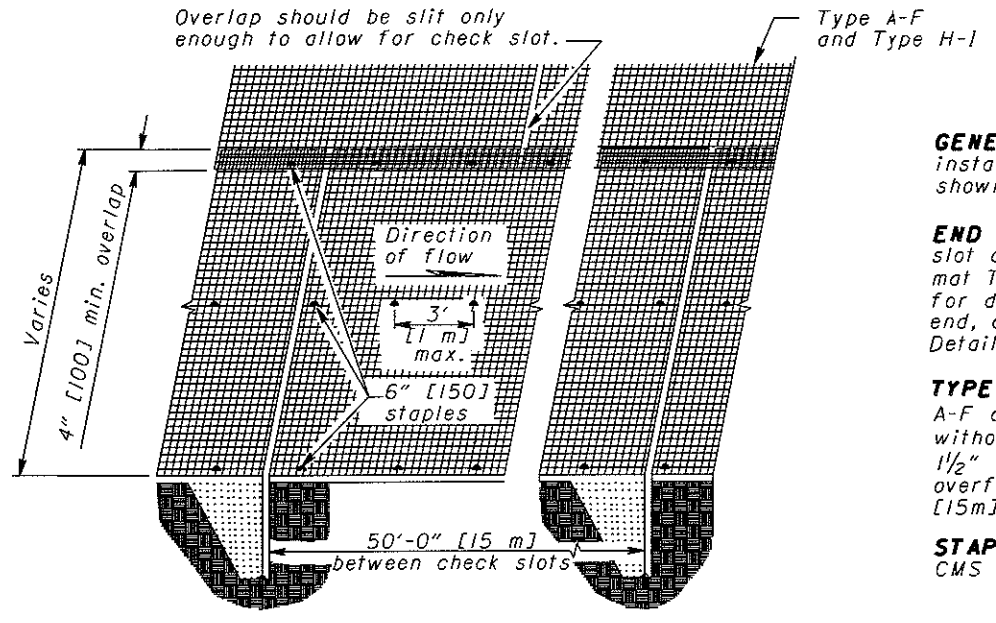
EROSION CONTROL MAT TYPE A-F AND TYPE H-I INSTALLATION



CHECK SLOT AT STRUCTURES



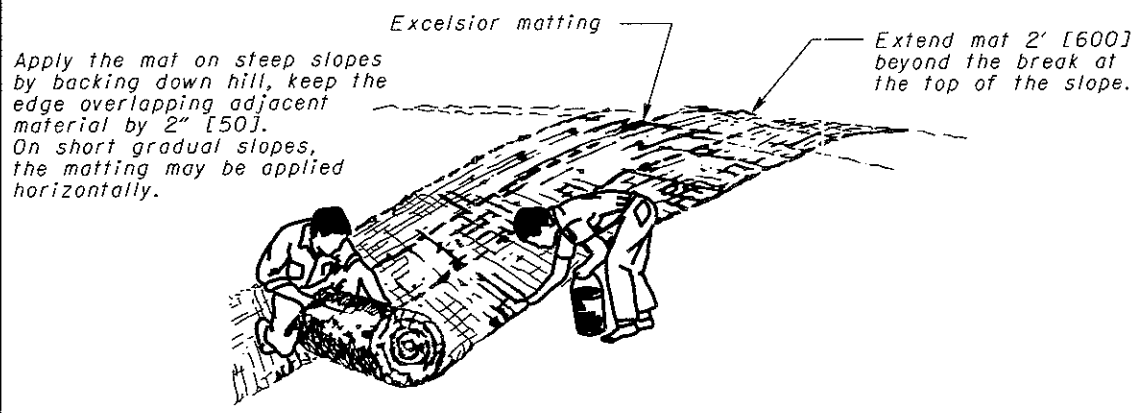
CHECK SLOT CONSTRUCTION DETAILS



NOTES

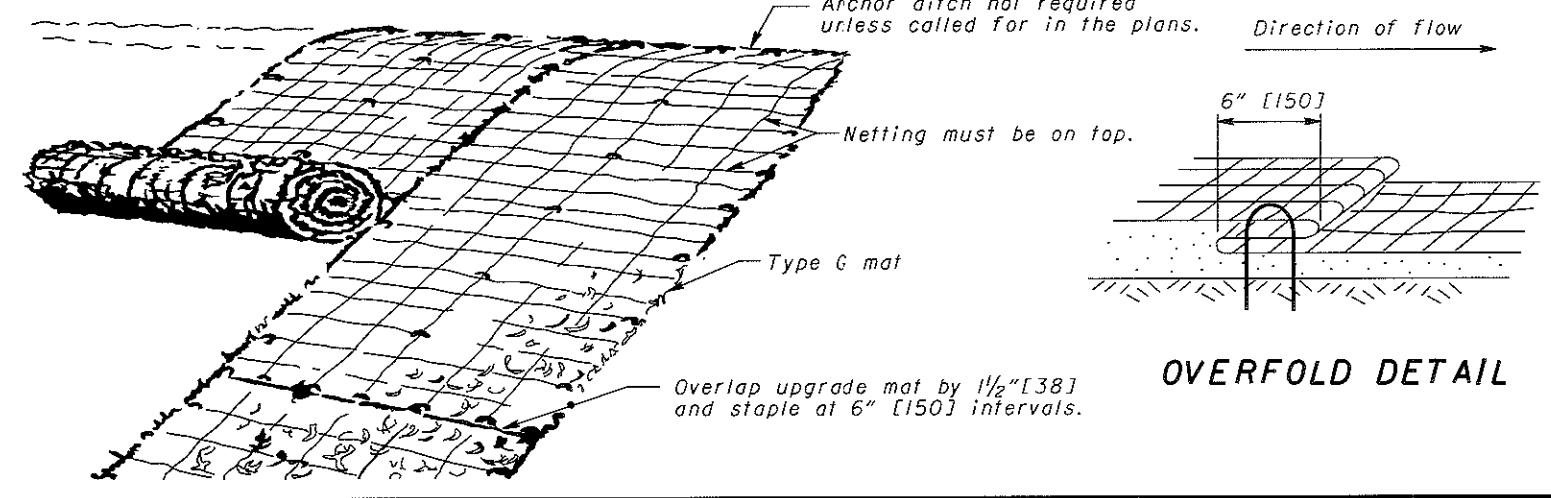
- GENERAL:** The details shown govern the installation of mat Types A-I unless otherwise shown in the plan.
- END OF RUN:** Use a check slot and staple in the slot as shown in END OF ROLL OVERLAP Detail for mat Type A - F and H-I. When placing matting for ditch protection, start at the downstream end, as shown in the CHECK SLOT AT STRUCTURES Detail.
- TYPE G MAT:** Staple mat as detailed for mat Type A-F and H-I except use staples on 6" [150] centers without a buried end at the roll ends and at 1/2" [38] end overlaps. Place a 6" [150] overfold across long rolls at intervals of 50' [15m] or less and staple on 6" [150] centers.
- STAPLES:** Staples shall be in accordance with CMS 671.02.

END OF ROLL OVERLAP



EROSION CONTROL MAT TYPE G INSTALLATION

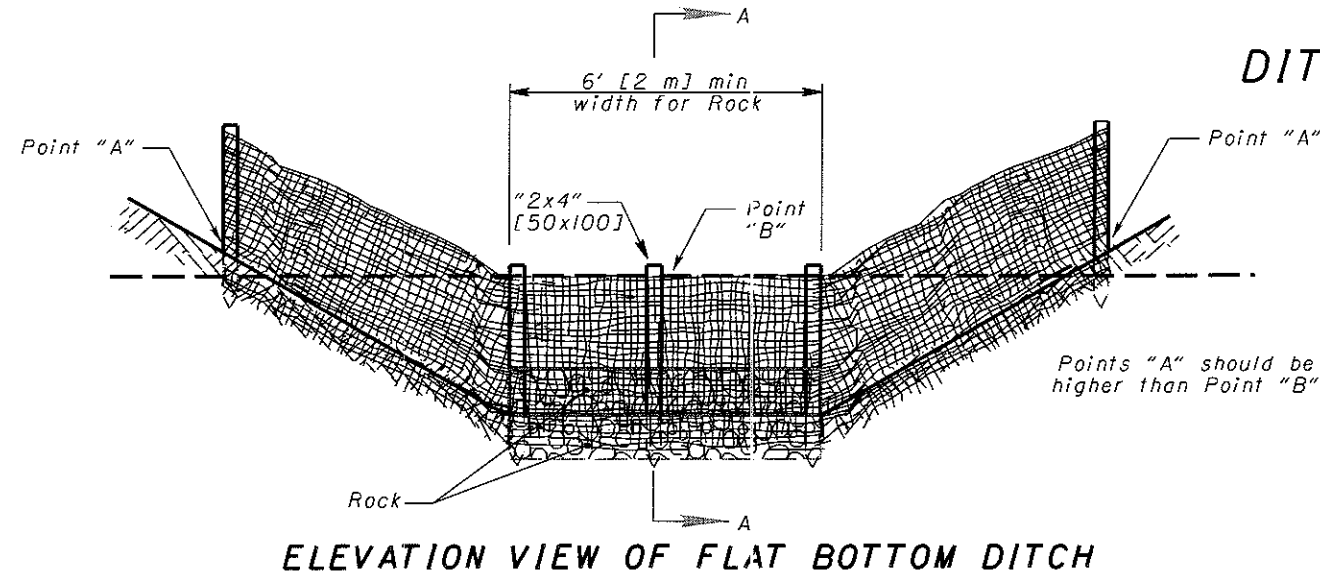
TYPICAL INSTALLATION



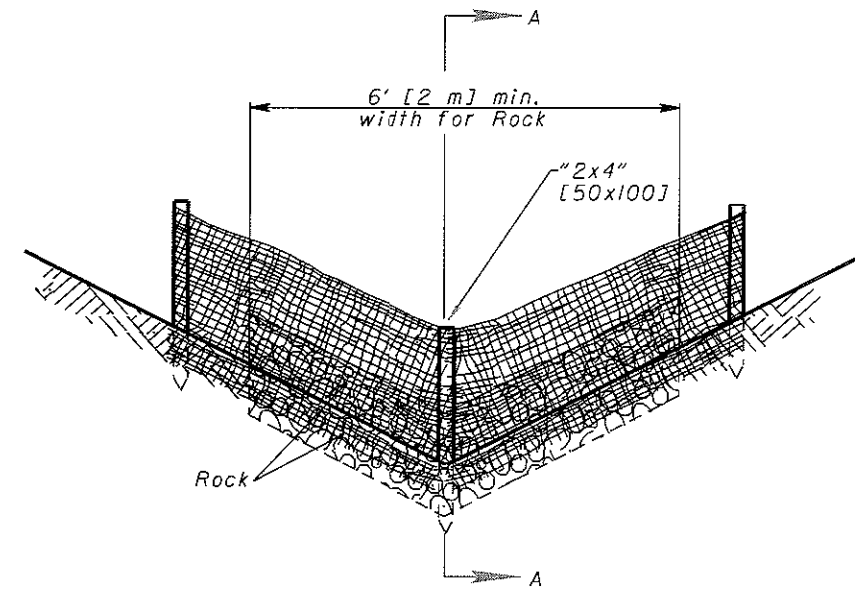
OVERFOLD DETAIL

OHIO DEPARTMENT OF TRANSPORTATION
DATE 7-20-01
7-19-02
HYDRAULIC ENGINEER
D. Gruver
All metric dimensions (in brackets []) are in millimeters unless otherwise noted.
OFFICE OF STRUCTURAL ENGINEERING
STANDARD HYDRAULIC CONSTRUCTION DRAWING
EROSION CONTROL MAT TYPE A-I
NUMBER DM-4.2

DITCH CHECKS



ELEVATION VIEW OF FLAT BOTTOM DITCH



ELEVATION VIEW OF "V" DITCH

NOTES

FILTER FABRIC DITCH CHECKS:

MATERIALS: Furnish filter fabric ditch checks consisting of the following materials:

1. 30" [0.8 m] wide filter fabric with sound wood supports with maximum on-center spacing of 10' [3.0 m]. Use filter fabric conforming to 712.09 Type C.
2. A vertically driven "2x4" [50x100] stake in the center of the ditch
3. Gravel or limestone material conforming to one of the following gradations No. 1 through No. 4 on Table 703.01-1.

CONSTRUCTION: Trench the filter fabric fence as detailed for PERIMETER FILTER FABRIC FENCE. (see Sheet 2/2) Place a vertical "2x4" [50x100] stake in the center of the ditch with the top level to the top of the fence and at least 6" [150] below the bottom of the ditch. Excavate for and place the gravel or limestone on the upstream side of the ditch check.

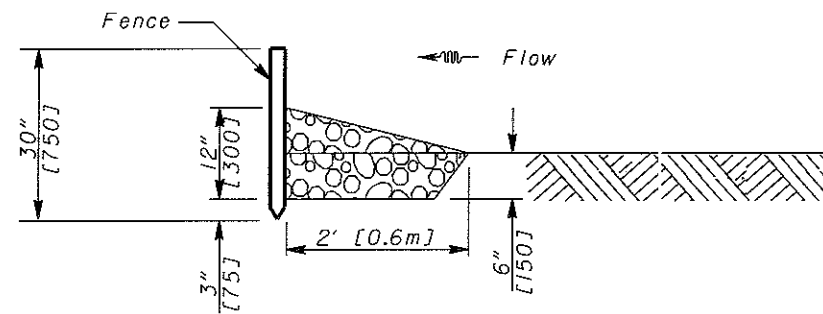
PAYMENT: The Department will pay for the accepted quantities at the contract prices in feet [meters] as follows: **Item 207 - Filter Fabric Ditch Check.**

ROCK CHECKS:

MATERIALS: Furnish material conforming to Item 601 Rock Channel Protection Type C or D without filter.

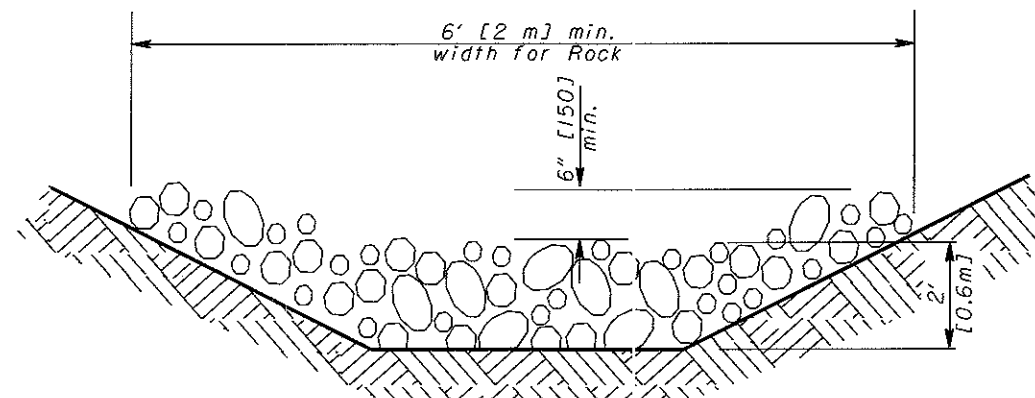
CONSTRUCTION: Place the rock outside the traffic clear zone in the ditch.

PAYMENT: The Department will pay for the accepted quantities at the contract prices in cubic yards [cubic meters] as follows: **Item 207 - Rock Channel Protection Type C or D without filter.**



SIDE VIEW OF FLAT BOTTOM AND V DITCH

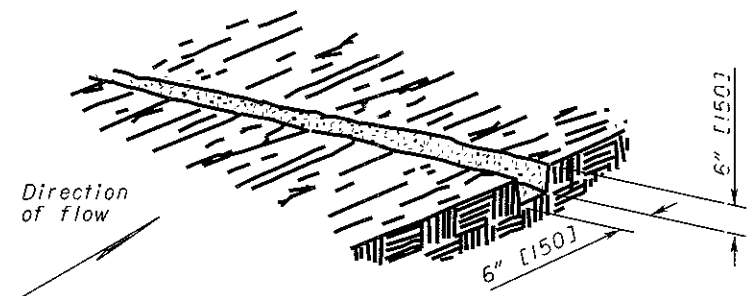
SECTION A-A



Minimum dimensions: 2' [0.6 m] high x 6' [2 m] wide x 3' [0.9 m] long

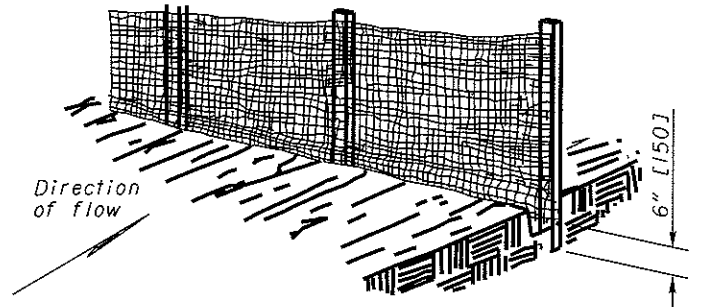
ELEVATION VIEW
ROCK CHECK

PERIMETER FILTER FABRIC FENCE



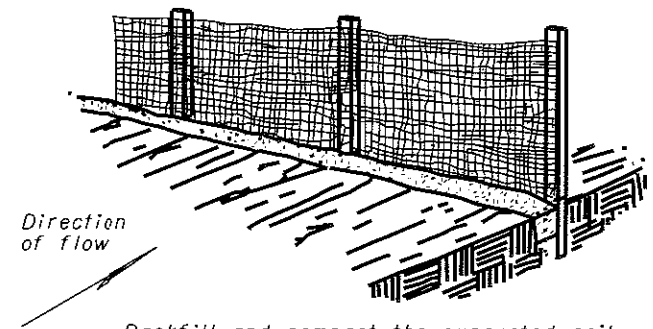
Excavate a 6"x6" [150x150] trench along the proposed fence line.

STEP 1



Place fabric and support stakes and extend fabric into the trench.

STEP 2



Backfill and compact the excavated soil.

STEP 3

NOTES

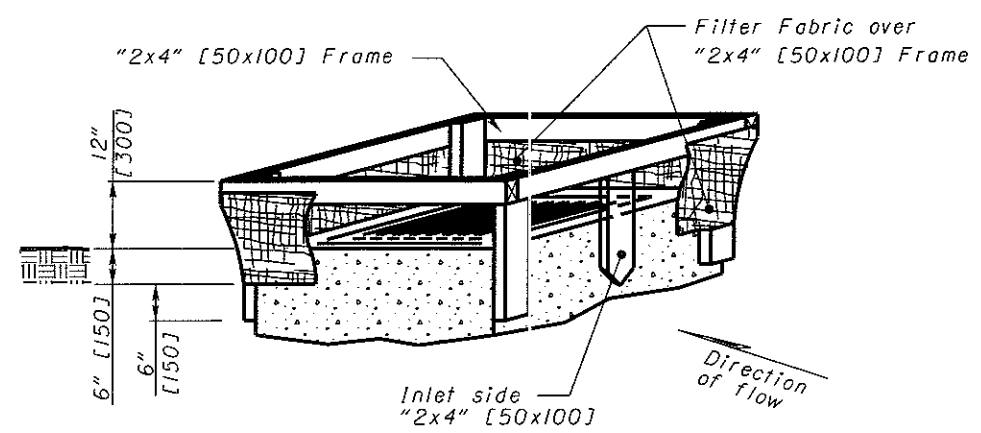
MATERIALS: Furnish 30" [0.8 m] wide filter fabric with sound wood supports with maximum on-center spacing of 10' [3.0 m]. Use filter fabric conforming to 712.09 Type C. The Contractor may elect to use straw or hay bales. Use 30" [750] long 2"x2" [50x50] wooden stakes, reinforcing bars or fence posts for the straw or hay bales.

CONSTRUCTION: Trench the filter fabric fence as detailed. The Contractor may elect to trench the fence detailed on steps 1 through 3 in one plowing operation.

When straw or hay bales are used conform to the following: Tightly place each bale adjacent to one another. Entrench 2" [50] to 3" [75] into the ground prior to staking. Firmly stake each bale with at least two stakes. Use loose hay or straw to fill the voids under or between the bales.

PAYMENT: The Department will pay for the accepted quantities at the contract prices in feet [meters] as follows: **Item 207 - Perimeter Filter Fabric Fence.**

INLET PROTECTION



INLET PROTECTION

NOTES

MATERIALS: Furnish inlet protection consisting of 18" [0.5 m] wide filter fabric fence with a securely nailed "2x4" [50x100] wood frame with a vertically driven "2x4" [50x100] on the inlet or flow side of the structure. Use filter fabric conforming to 712.09 Type C.

CONSTRUCTION: Construct an 18" [0.5 m] wide filter fabric fence supported around a storm drain inlet or catch basin with a securely nailed "2x4" [50x100] wood frame. Excavate a 6" [150] trench around the inlet, and drive support posts 6" [150] below the excavated trench bottom. Stretch the fabric around the frame. Secure it tightly ensuring that 6" [150] of fabric is in the trench. Overlap the fabric on one side of the inlet so that the fabric ends are not attached to the same post. Backfill and compact the excavated soil tightly onto the fabric. Place a vertical "2x4" [50x100] in the center of the inlet so that the top is at the top of the fence and the bottom is at least 6" [150] below the bottom of the ditch.

PAYMENT: The Department will pay for the accepted quantities at the contract prices in feet [meters] as follows: **Item 207 - Inlet Protection.**

OHIO DEPARTMENT OF TRANSPORTATION
DATE 4-29-02
7-19-02
HYDRAULIC ENGINEER
D. Gruver
All metric dimensions (in brackets []) are in millimeters unless otherwise noted.
OFFICE OF STRUCTURAL ENGINEERING
STANDARD HYDRAULIC CONSTRUCTION DRAWING
CONSTRUCTION EROSION CONTROL
NUMBER DM-4.4
2/2

NOTES

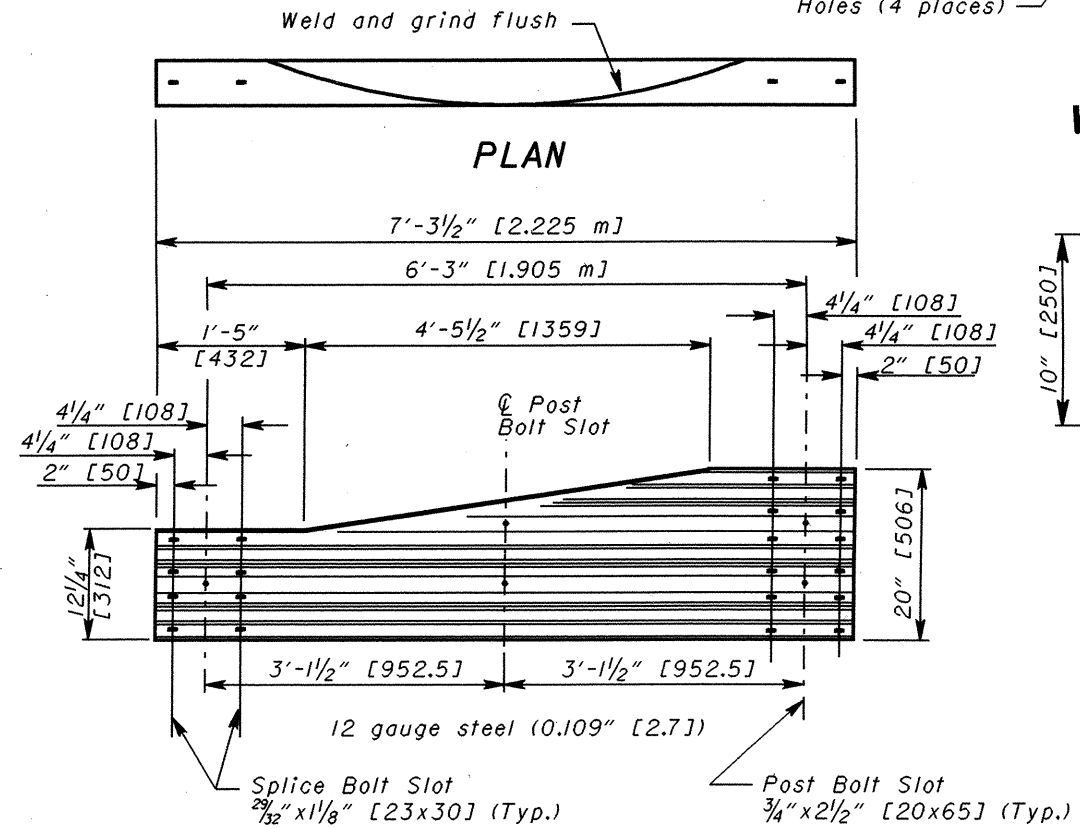
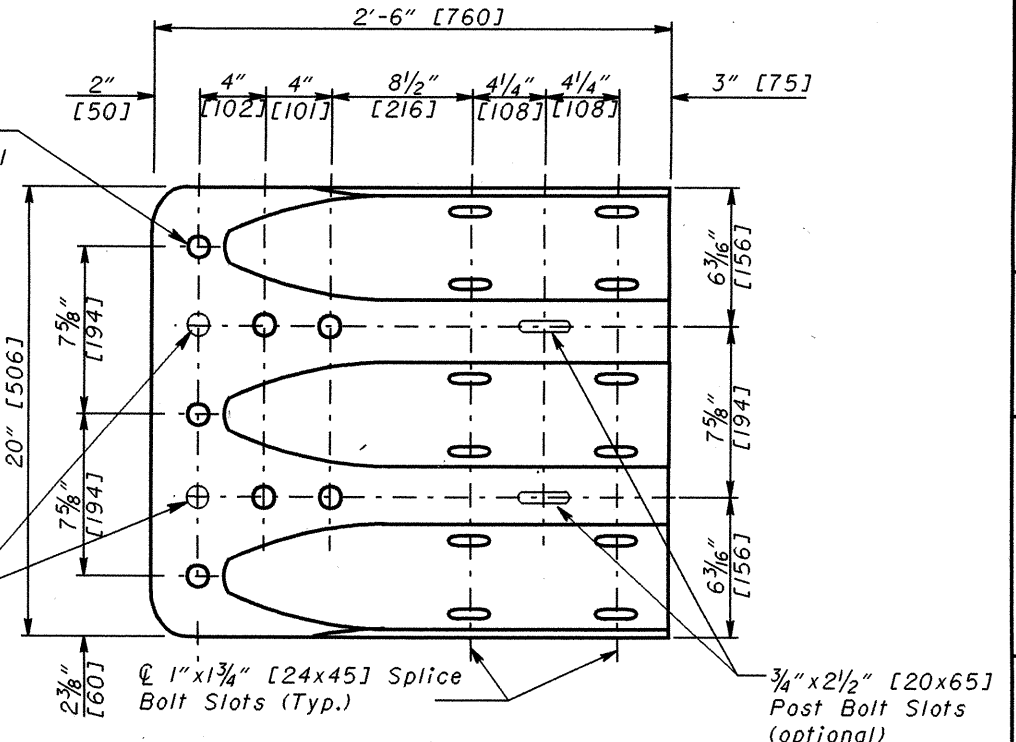
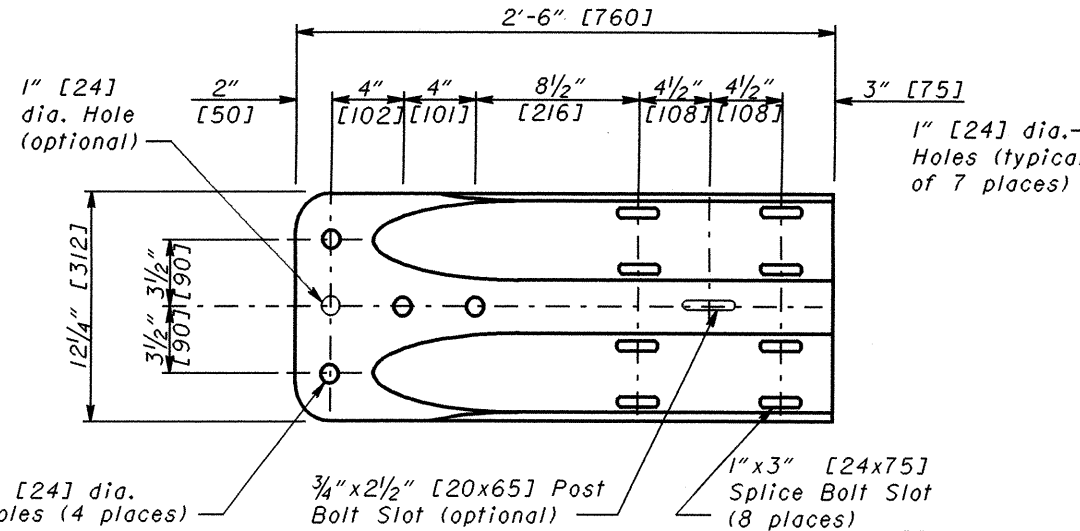
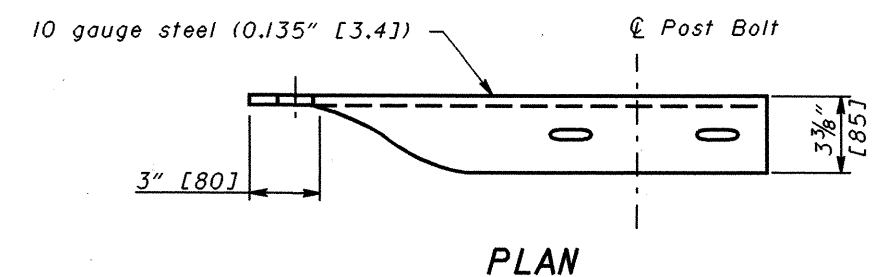
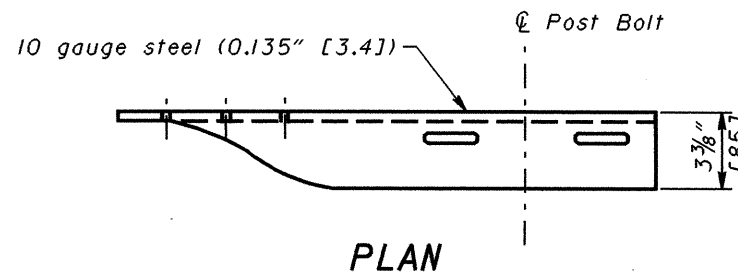
GENERAL: Components shown on this drawing are used in a variety of guardrail systems. See individual guardrail drawing for specific applications.

See CMS 606 for guardrail specifications not covered on these drawings.

Refer to AASHTO M 180 for dimensional details of W-Beam and Thrie-Beam rail elements, related buffer and end sections, beam splices, post and splice bolts, nuts, and Type I W-Beam to Thrie-Beam Transition sections.

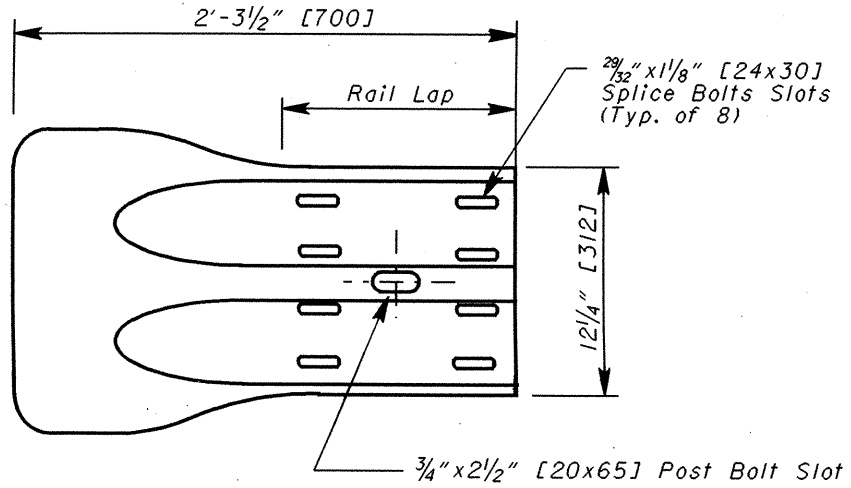
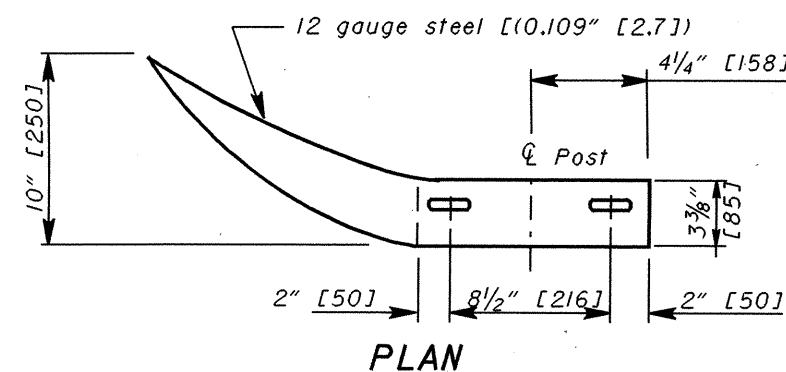
RAIL ELEMENTS: W-Beam Rail has an effective length of 12'-6" [3.81 m], unless otherwise specified, with 3/4"x2 1/2" [19x64] post bolt slots on 6'-3" [1.905 m] centers regardless of post spacing. Field punch or drill bolt holes or slots for irregularly spaced posts as specified in CMS 606.04.

RAIL SPLICE: Lap splices between two rail elements or between a rail and terminal connector in the direction of traffic. Lap the buffer or flared end sections in the direction of traffic.



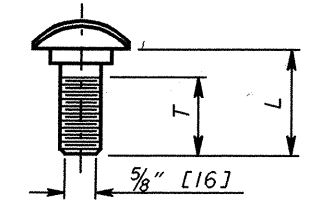
**ELEVATION
TYPE 2 TRANSITION SECTION
(Asymmetric W to Thrie-Beam)**

For details of Type I Transition Section (Symmetric), refer to AASHTO M 180, Figure 4.



**ELEVATION
W-BEAM FLARED END SECTION**

**ELEVATION
THRIE-BEAM TERMINAL CONNECTOR**



GUARDRAIL BOLT (For Post and Splice Bolts)		
L	T min.	Bolt Use
18" [460] (Standard Rail)	4" [100]	Type 5: WP/WB, PB
26" [640] (Barrier Rail)	4" [100]	Type 5: SP/WB, PB
10" [255]	4" [100]	Type 5: SP/WB, PB
1 3/8" [35]	1 1/8" [30]	Splice Bolt

WP= Wood Post WB= Wood Blockout
SP= Steel Post PB= Plastic Blockout
Longer Bolt may be needed for round Wood Post larger than 8" [200] dia.

THIS DRAWING REPLACES GR-1M DATED 10-21-97.

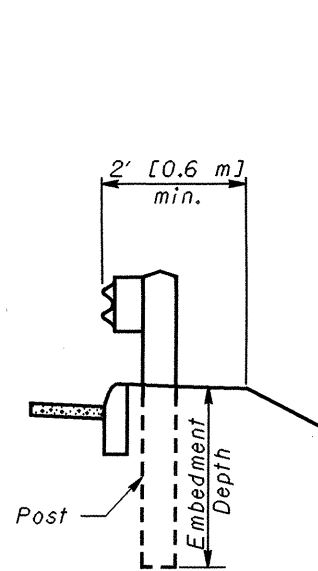
STANDARD ROADWAY CONSTRUCTION DRAWING
GUARDRAIL DETAILS
 (Rail Components)

ROADWAY ENGINEERING SERVICES

STDS. ENGR. D. Focke

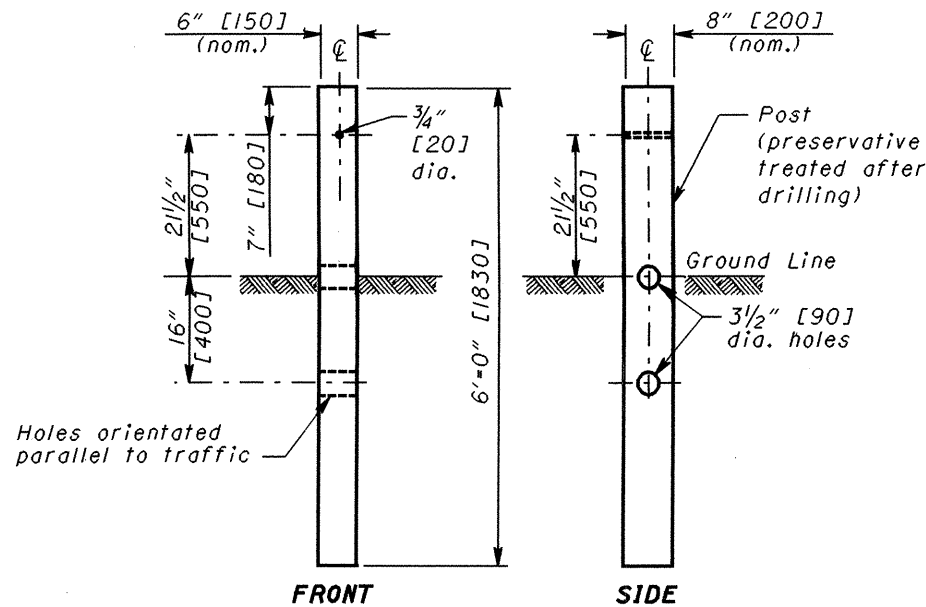
PHILIP DEPARTMENT OF TRANSPORTATION
 ROADWAY DESIGN ENGINEER
 4-18-03
 DATE

NUMBER GR-1J
 1/3

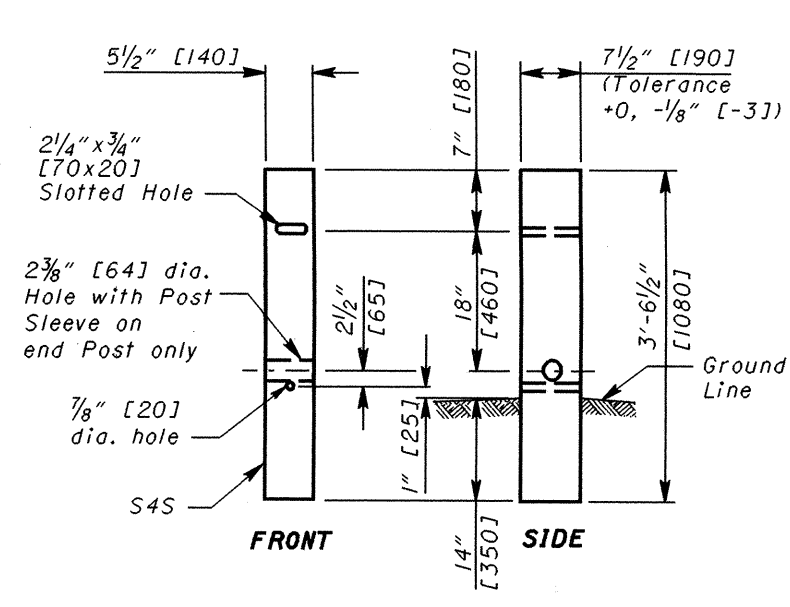


DETAIL A

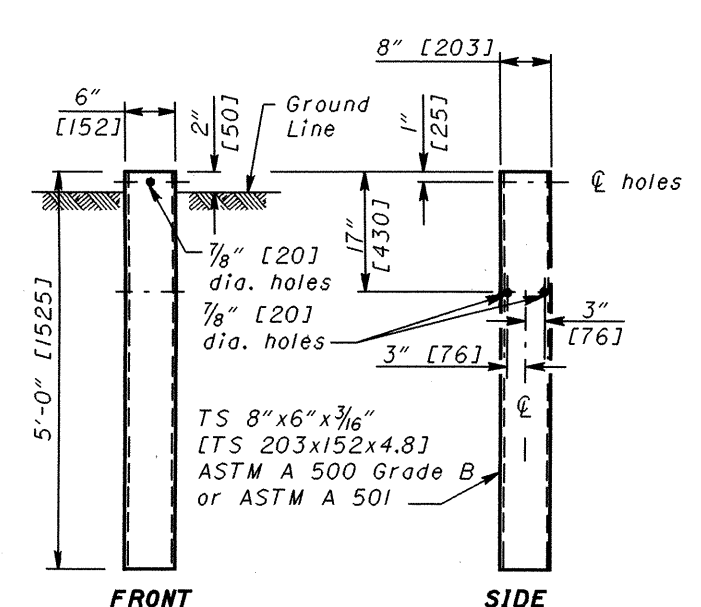
See POST EMBEDMENT DEPTH Note



TYPE 1 BREAKAWAY CRT POST



TYPE 2 BREAKAWAY CRT POST



STEEL GROUND TUBE

TS 8"x6"x3/16"
[TS 203x152x4.8]
ASTM A 500 Grade B
or ASTM A 501

NOTES

GUARDRAIL HEIGHT: For initial installation, construct the guardrail within $\pm 1"$ [25] of the standard height, h , or $27\frac{3}{4}"$ [706] to the top of W-Beam rail. (See MEASURING GUARDRAIL HEIGHT Detail.) When subsequent projects, such as resurfacings, affect the height of existing guardrail, the finished height is to be within $\pm 3"$ [75] of the standard height.

POST EMBEDMENT DEPTH: Where less than 2' [0.6 m] of graded shoulder shoulder width (10:1 or flatter) exists, measured from from the face of the guardrail (see DETAIL "A"), use longer posts so that a minimum of 5'-5" [1.65 m] embedment depth is provided. Payment for the longer posts will be made at the unit price bid for **Item 606 - Guardrail Post, 9' [2.75 m], Each.**

SPECIAL POST MOUNTINGS: Install posts located over a drainage inlet or structure as shown in the FOOTING ANCHOR Detail, or anchor per the details shown on **SCD 6R-2.2.**

Install posts located over a footing with a cover of less than 2'-6" [0.75 m] with a footing anchor as detailed here. (A plate, as detailed on SECTION B-B of **SCD 6R-2.2**, may be used as an alternative attachment method.) Where the cover is between 2'-6" [0.75 m] and 3'-5" [1.04 m], the footing anchor may be omitted and the post encased instead with 4" [100] (min.) of concrete.

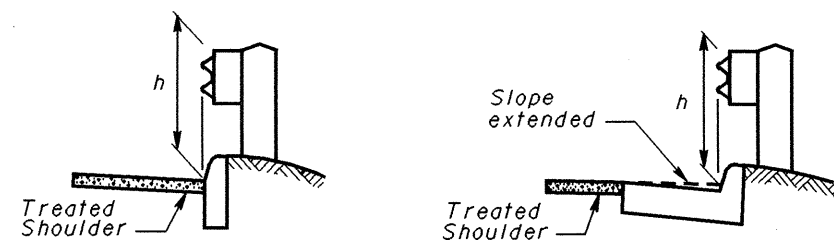
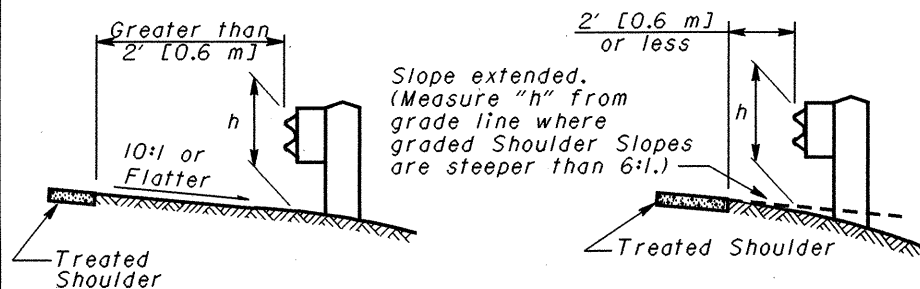
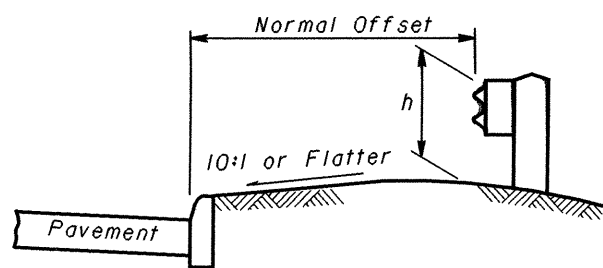
Do not drive posts located over a culvert with less than 4'-3" [1.3 m] of cover; instead set in drilled or dug holes. Where the available post embedment depth is less than 3'-5" [1.04 m], encase the post with a minimum of 4" [100] concrete.

All costs associated with special post mountings are included in the unit price bid for Item 606 Guardrail of the type specified in the plans.

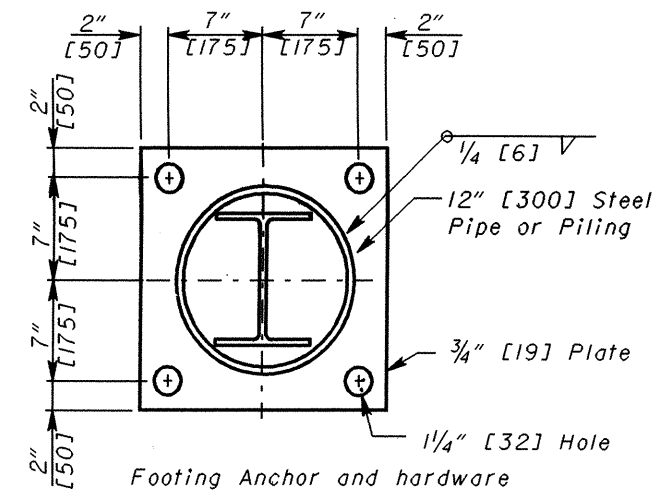
ANCHORS: Holes and grouting shall comply with CMS 510. Use either cement or nonshrink, nonmetallic grout.

Expansion shield anchors as specified in CMS 712.01 may be substituted except where concrete deterioration has occurred, as determined by the Engineer. Where self-drilling anchors are used, drill the holes with the expansion shield (not by a drill bit) and install the shield flush with the concrete surface.

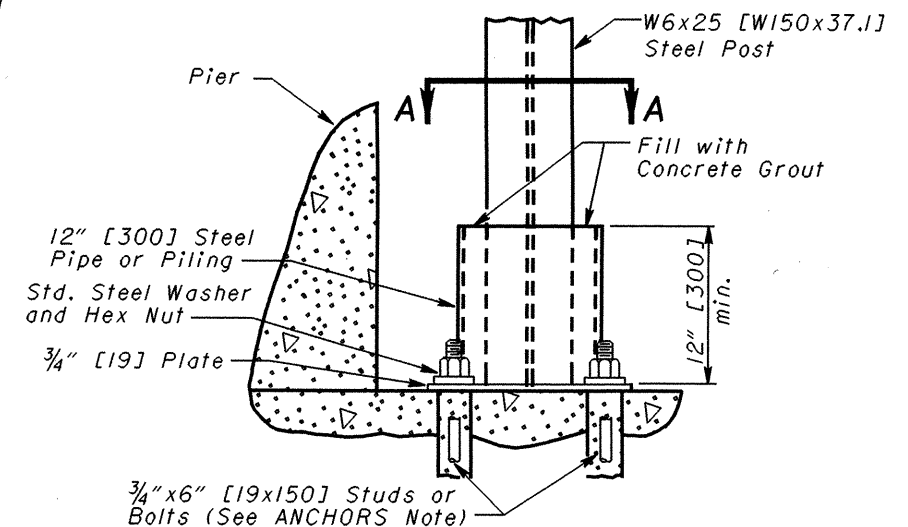
PROTECTIVE COATING: In lieu of the complying with CMS 710.06, coat expansion shields, anchors and concrete insert anchor assemblies embedded in concrete in accordance with ASTM A 153 or be of stainless steel. Any bolts screwed into these devices shall meet CMS 710.06. (See sheet 3 for Concrete Insert Anchor Assembly Detail.)



h = Standard Height (See GUARDRAIL HEIGHT Note)
MEASURING GUARDRAIL HEIGHT

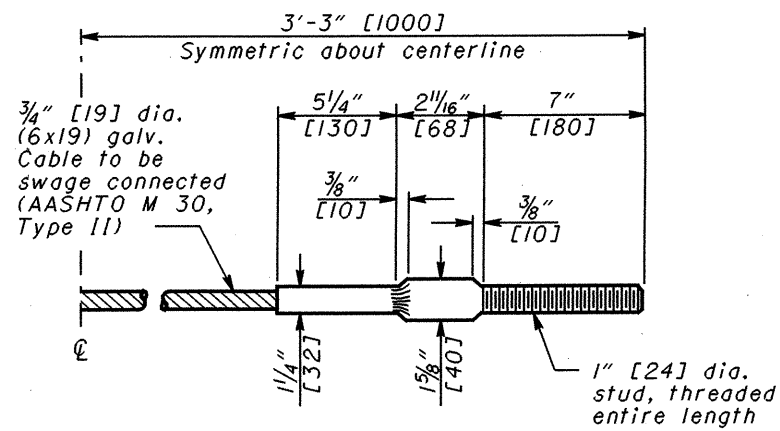


SECTION A-A

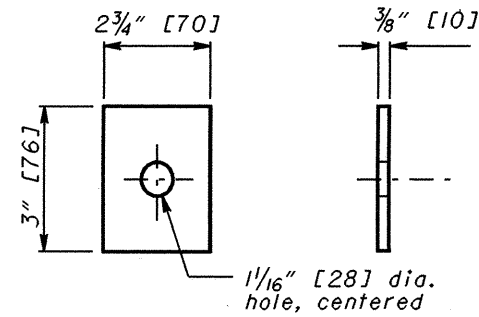


ELEVATION FOOTING ANCHOR
See SPECIAL POST MOUNTINGS Note.

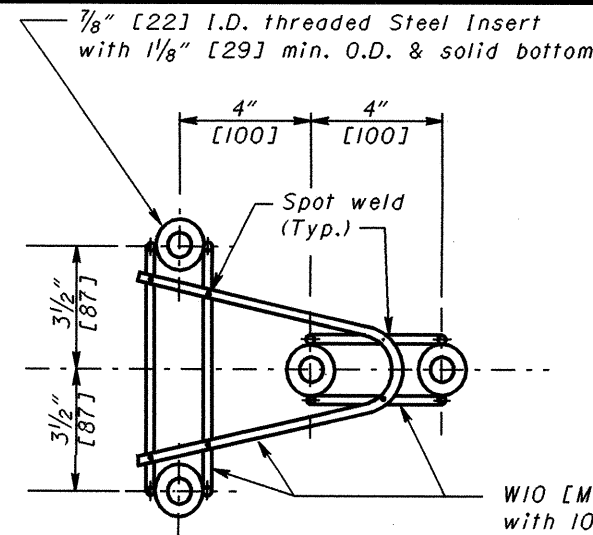
THIS DRAWING REPLACES GR-1.2M DATED 1-3-96.
 STANDARD ROADWAY CONSTRUCTION DRAWING
GUARDRAIL DETAILS (Posts)
 NUMBER **GR-1.1**
 2 / 3
 OHIO DEPARTMENT OF TRANSPORTATION
 ROADWAY DESIGN ENGINEER
 D. Focke
 STOS. ENGR.
 All metric dimensions (in brackets []) are in millimeters unless otherwise noted.
 4-18-03 DATE



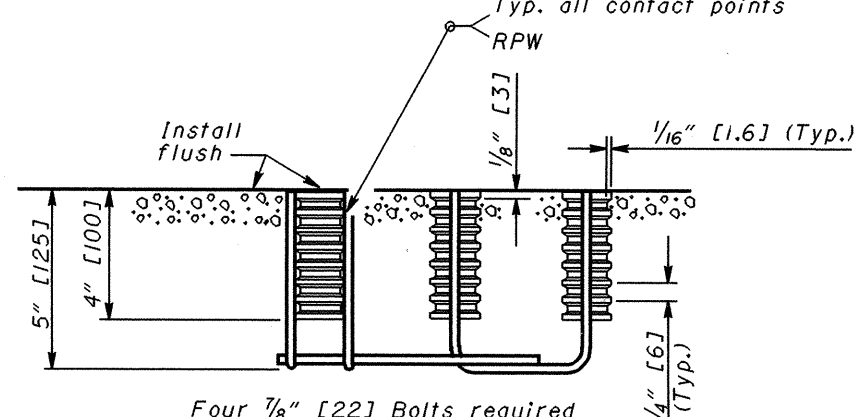
STANDARD SWAGED FITTING AND STUD
CABLE ANCHOR



END PLATE



PLAN

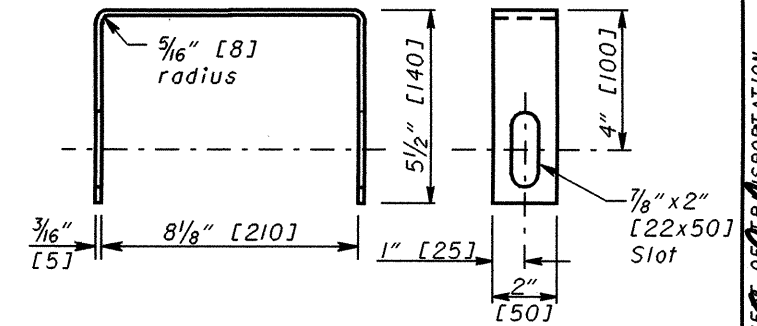


Four 7/8" [22] Bolts required

ELEVATION

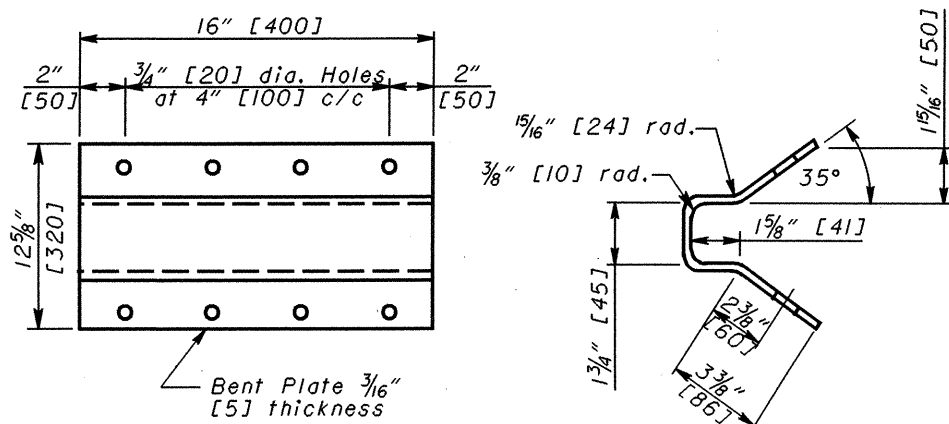
CONCRETE INSERT ANCHOR ASSEMBLY
(W-BEAM ONLY)

See ANCHORS and PROTECTIVE
COATINGS Notes on Sheet 2

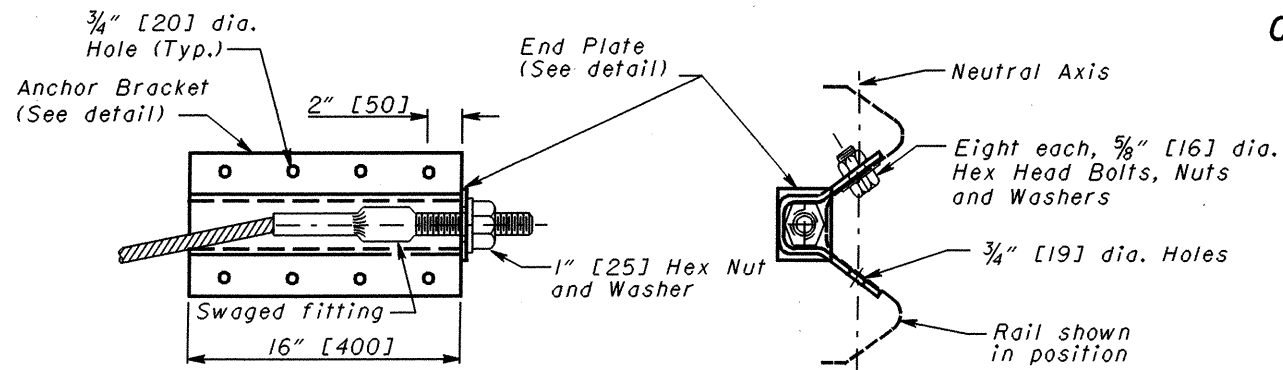


YOKE

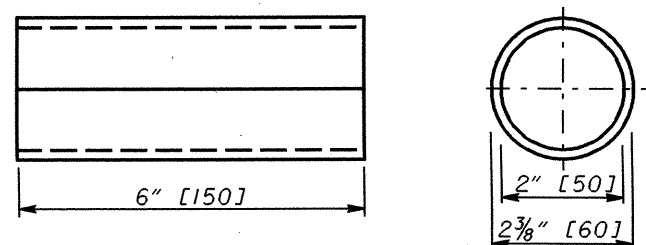
Two required in Assembly



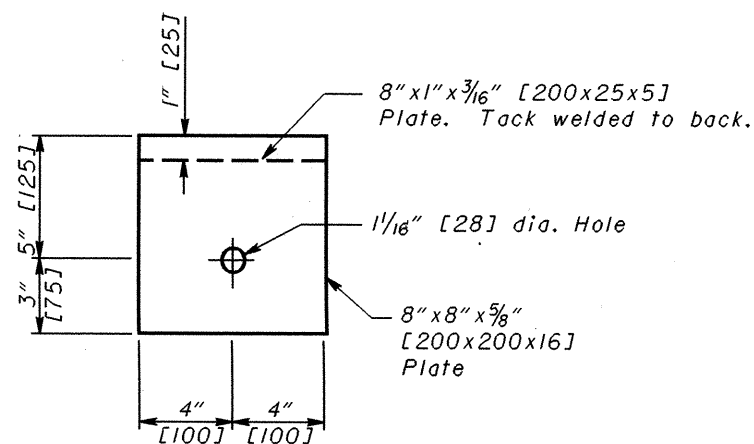
ANCHOR BRACKET



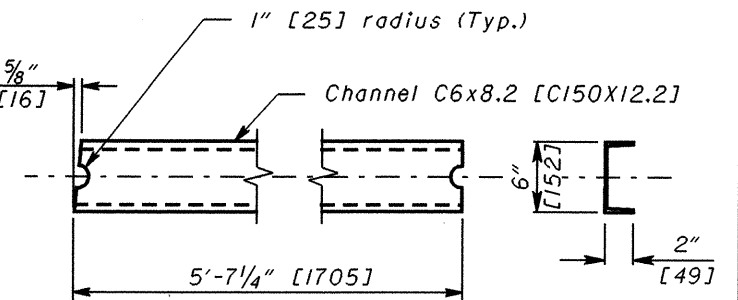
ANCHOR BRACKET ASSEMBLY DETAILS



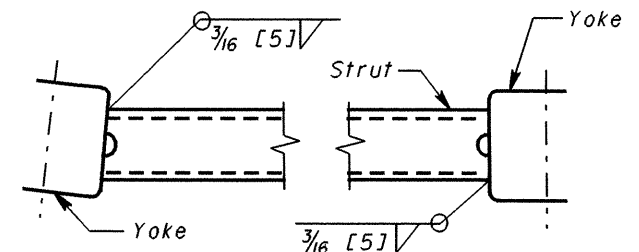
POST SLEEVE



BEARING PLATE

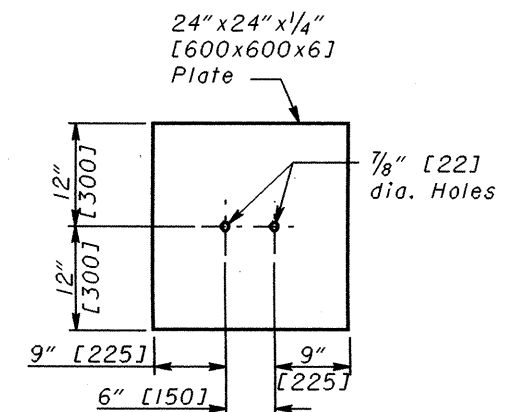


STRUT



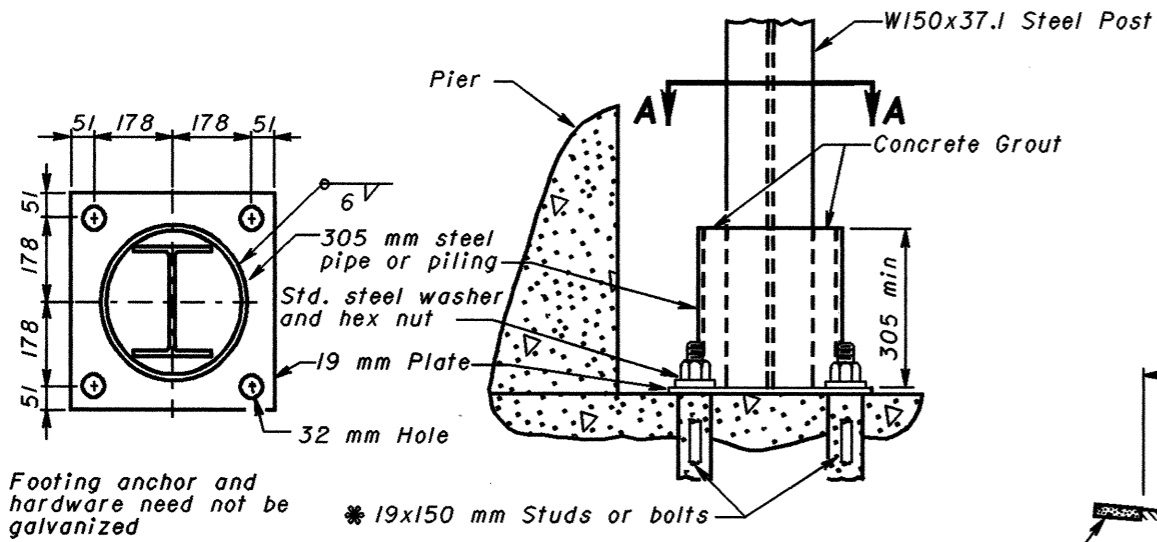
Channel legs shown down. For opposite
hand, install Channel legs up.

STRUT AND YOKE ASSEMBLY

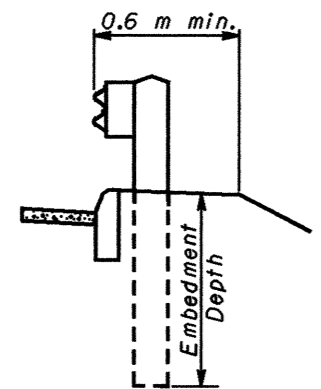


SOIL PLATE

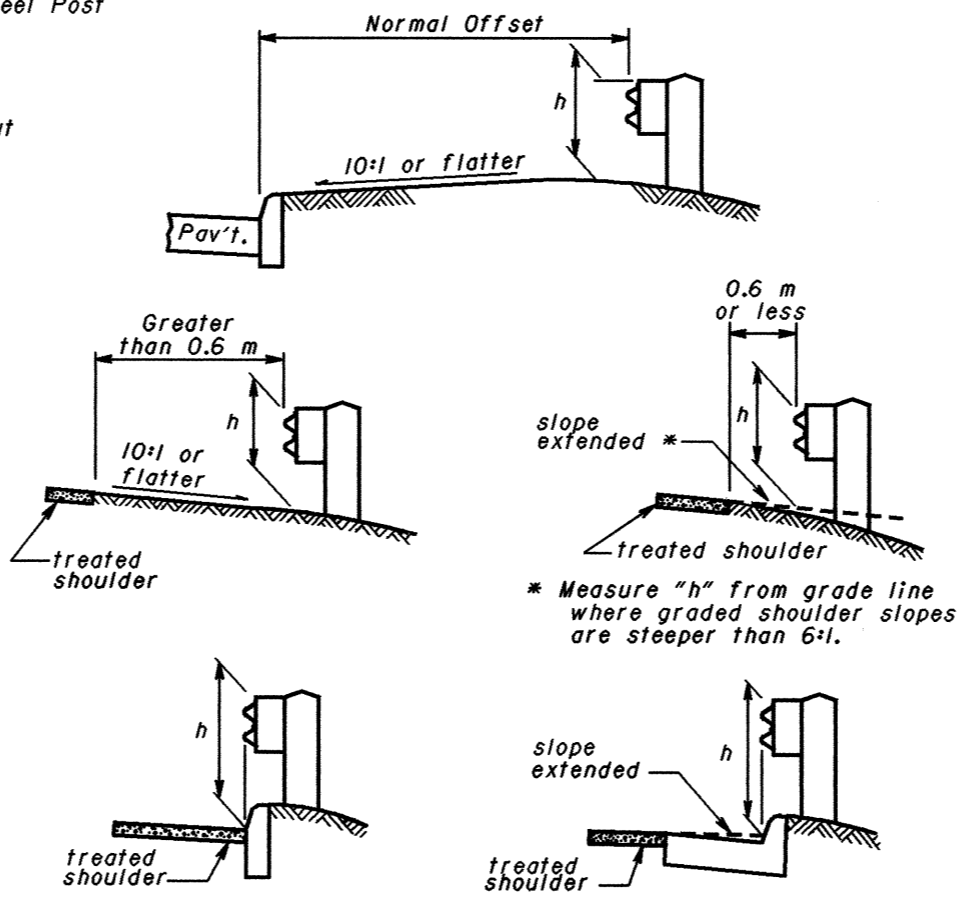
THIS DRAWING REPLACES GR-1.3M DATED 11-30-94.
 STANDARD ROADWAY CONSTRUCTION DRAWING
 GUARDRAIL DETAILS
 (Misc. Components)
 NUMBER GR-1/J
 3/3
 ROADWAY ENGINEERING SERVICES
 D. Focke
 STDS. ENGR.
 ALL metric dimensions (in brackets []) are in millimeters unless otherwise noted.
 ROADWAY DESIGN ENGINEER
 Paul H. Stuebeland
 OHIO DEPARTMENT OF TRANSPORTATION
 4-18-03
 DATE



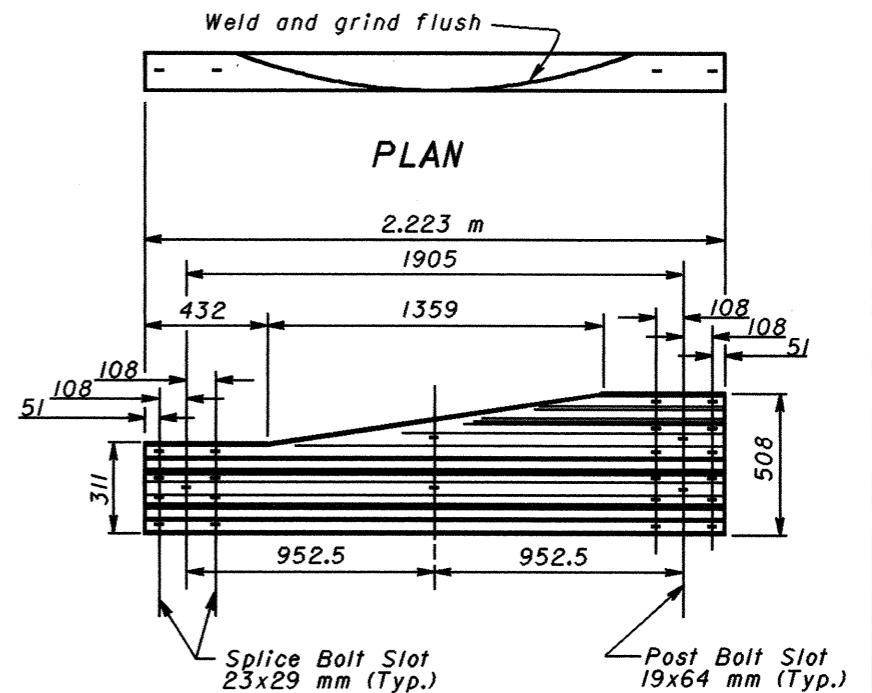
SECTION A-A
FOOTING ANCHOR



DETAIL A



MEASURING GUARDRAIL HEIGHT
 h = Standard height (Tolerance ± 25 mm)



TYPE 2
TRANSITION SECTION *
(W-Beam to Thrie-Beam)

* For details of Type 1 Transition Section, refer to AASHTO M 180, Figure 4.

NOTES

BEAM RAIL ELEMENTS: Elements shall be 3.81 m effective length, unless otherwise specified, with 19x64 mm post bolt slots on 1.905 m centers regardless of post spacing. Field punching or drilling of bolt holes or slots for irregularly spaced posts shall be according to CMS 606.05.

BEAM RAIL SPLICE between two rail elements or between a rail and terminal connector shall be lapped in the direction of traffic. The buffer or flared end sections shall lap on the traffic face. A 305 mm length of beam rail (Back-up Plate), with a 19 mm diameter bolt hole or a 19x64 mm slot, shall be provided at steel posts not having a rail splice.

EMBEDMENT DEPTH: Where less than 0.6 m of graded shoulder width (10:1 or flatter) exists, measured from the face of the guardrail (see Detail "A"), longer posts shall be used so that a minimum of 1.65 m embedment depth is provided. Payment for the longer posts will be made at the unit price bid per Each, Item 606 - Guardrail Post, 2.75 m.

PROTECTIVE COATING: In lieu of the requirements of CMS 710.06, expansion shields, anchors and insert anchor assemblies installed (embedded) in concrete shall be coated in accordance with ASTM A 153 or be of stainless steel. Any bolts screwed into these embedded devices shall meet CMS 710.06.

SPECIAL POST MOUNTINGS: Posts located over a drainage inlet or structure shall be encased or anchored per the details shown on Standard Construction Drawing GR-2.2M.

Posts located over a footing with a cover of less than 0.75 m shall be installed with a footing anchor as detailed hereon. (A plate, as detailed on Section B-B of Standard Construction Drawing GR-2.2M, may be used as an alternate attachment method.) Where the cover is between 0.75 m and 1.04 m, the footing anchor may be omitted and the post encased instead with 100 mm (min.) of concrete.

Posts located over a culvert with less than 1.3 m of cover shall not be driven, but shall be set in drilled or dug holes. Where the available post embedment depth is less than 1.04 m, the post shall be encased with 100 mm (min.) of concrete.

All costs associated with special post mountings shall be included in the unit price bid for 606 Guardrail of the type specified in the plans.

* **ANCHORS:** Holes and grouting shall comply with CMS 510. Either cement or nonshrink, nonmetallic grout may be used.

Expansion shield anchors conforming to CMS 712.01 may be substituted except where concrete deterioration has occurred, as determined by the Engineer. The same bolt diameter specified shall be required. Where self-drilling anchors are used, the holes shall be drilled with the expansion shield (not by a drill bit) and the shield installed flush with the concrete surface.

All dimensions are in millimeters unless otherwise noted.



This Drawing Replaces GR-1.2.

OFFICE OF ROADWAY ENGINEERING OHIO DEPARTMENT OF TRANSPORTATION	
GUARDRAIL DETAILS	DATE 1-3-96
STANDARD CONSTRUCTION DRAWING GR-1.2M	
APPROVED <u>D.K. Hellman, P.E.</u> ADMINISTRATOR	

NOTES

RAIL: Use W-Beam rail meeting AASHTO M 180 Type II Class A, as specified in CMS 606.

POSTS: Posts may be constructed of wood or steel. Wood posts may be round or 6"x8" [150x200] square-sawed.

Use round wood posts on runs of single-sided rail. The round posts shall be 8"±1 [200±25] in diameter at the top and not more than 3" [75] larger at the butt with a uniform taper.

Fabricate wood posts with square ends. Posts shall be pressure-treated as per CMS 710.14. Bore bolt holes and, if required, trim the tops of posts after the posts are set.

Steel posts are to be W6x9 [W150x13.5] or W6x8.5 [W150x12.8] galvanized steel. Use the same type of post throughout the length of the project unless otherwise specified in the plans or permitted by the Engineer.

All posts are 6'-0" [1830] long unless specified otherwise in the Contract Document. Posts may be set in drilled holes or may be driven to grade.

WELDED BEAM POSTS: Welded beam guardrail posts may be used for Item 606, Guardrail, provided the web and flange sizes are as shown here. Welding of the web to the flanges must comply with ASTM A 769, Class 1, using Grade 36 steel [250 MPa yield point] with the following exceptions:

- Sec. 7.2 Test reports of tensile properties for each lot shall accompany each shipment.
- Sec. 12 Beams that have imperfections repaired by welding shall not be accepted for use in Item 606.
- Sec. 13 Random samples shall be tested by the Department from materials delivered to the project site or other locations designated by the Laboratory.

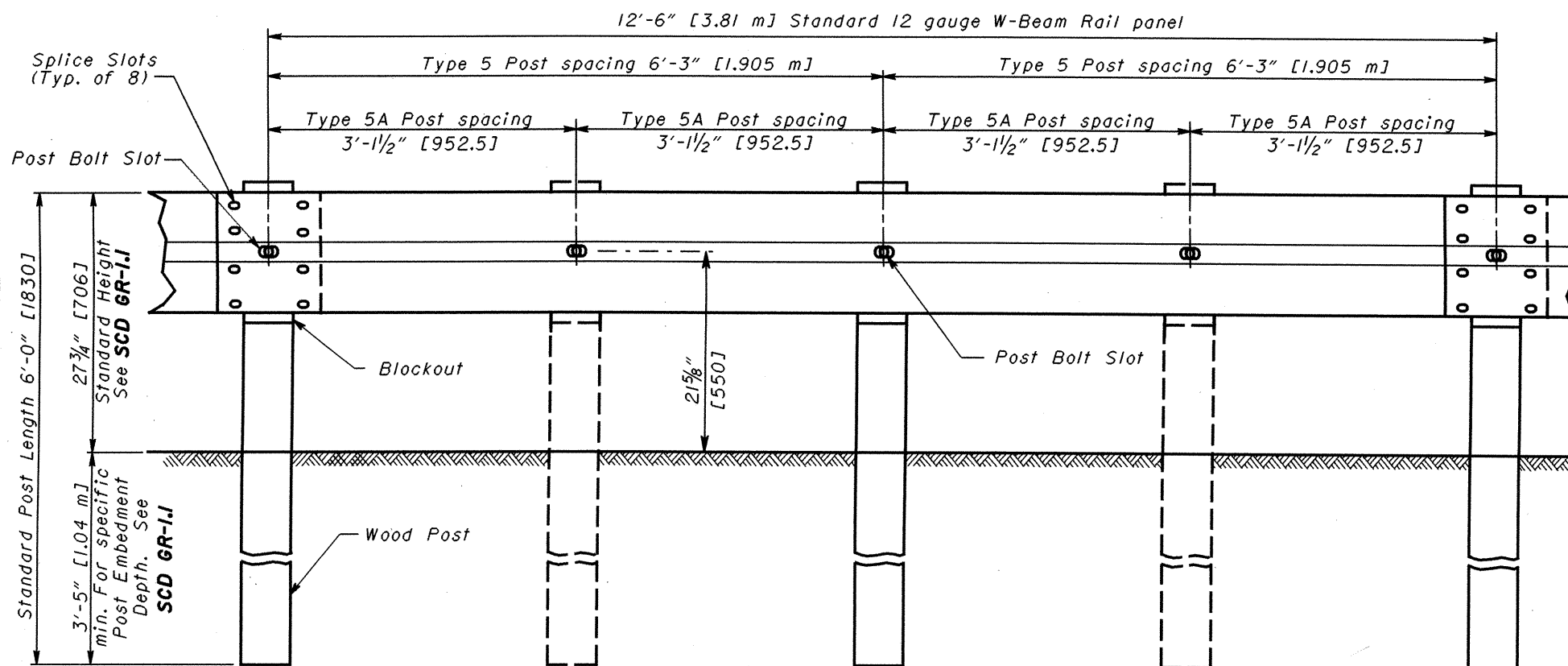
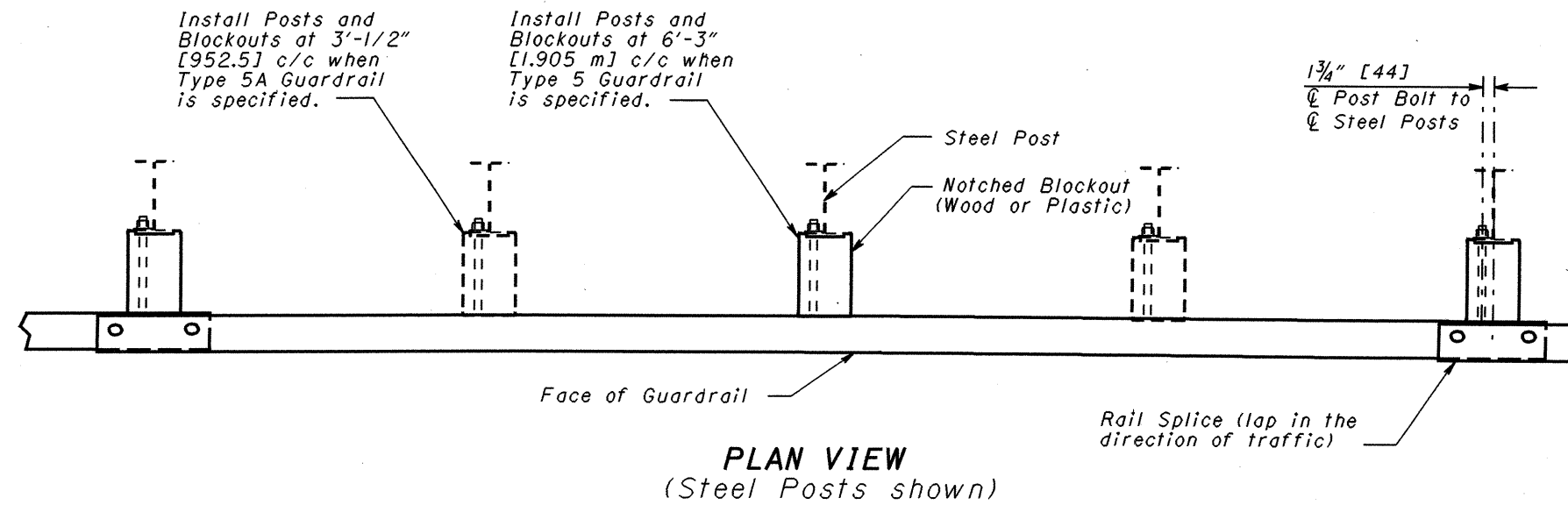
ALTERNATE POSTS: Engineered guardrail posts having met NCHRP 350 criteria, and listed on the **Office of Materials Management's** Approved List are permitted as an equal alternate when installed according to the Manufacturer's instructions and within the limitations shown on the Approved List.

BLOCKOUTS: Blockout dimensions are dependent on post used. Wood Blockouts are to be pressure treated as specified in CMS 710.14. Bore bolt holes. Approved plastic blockouts may be used in lieu of the wood blockouts shown. The approved list is maintained by the **Office of Materials Management**.

WASHERS: Install appropriate sized standard galvanized steel washers on the nut side of bolts installed on wood posts.

DELINEATION: For barrier reflectors, see CMS 626.

MISCELLANEOUS: For other guardrail details, see **SCD GR-1.1**.



ELEVATION
(Wood Posts shown)

STEEL BEAM POSTS (English)				
Size	Beam depth	Flange width	Flange thickness	Web thickness
Rolled W6x8.5	5.8"	3.94"	0.193"	0.170"
Rolled W6x9	5.9"	3.94"	0.215"	0.170"
Welded 6x8.5	6.0"	3.94"	0.193"	0.170"
Welded 6x9	6.0"	3.94"	0.215"	0.170"

STEEL BEAM POSTS (Metric)				
Size	Beam depth	Flange width	Flange thickness	Web thickness
Rolled W150x12.6	148 mm	100 mm	4.9 mm	4.3 mm
Rolled W150x13.5	150 mm	100 mm	5.5 mm	4.3 mm
Welded 150x12.6	152 mm	100 mm	4.9 mm	4.3 mm
Welded 150x13.5	152 mm	100 mm	5.5 mm	4.3 mm

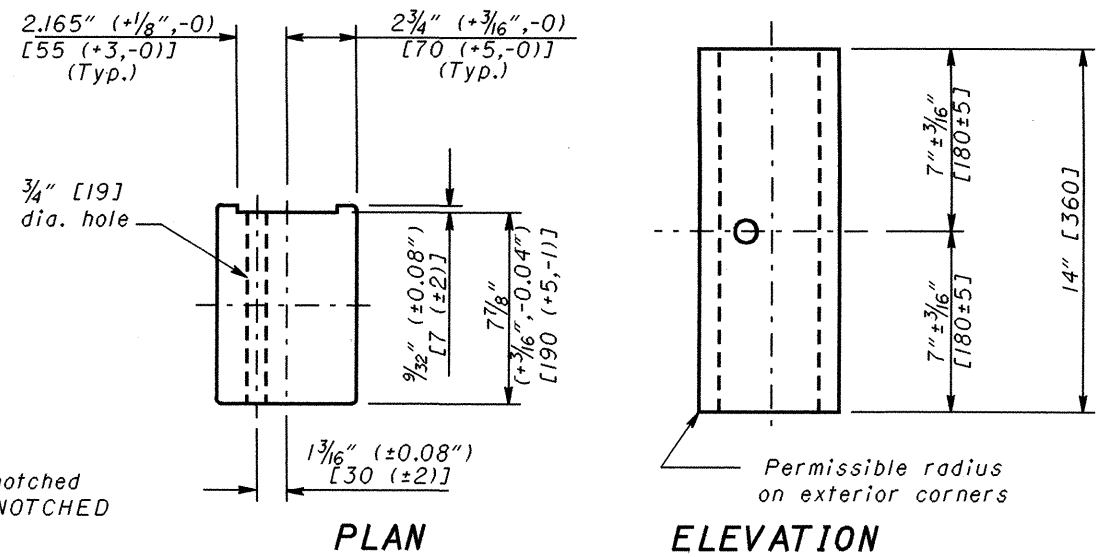
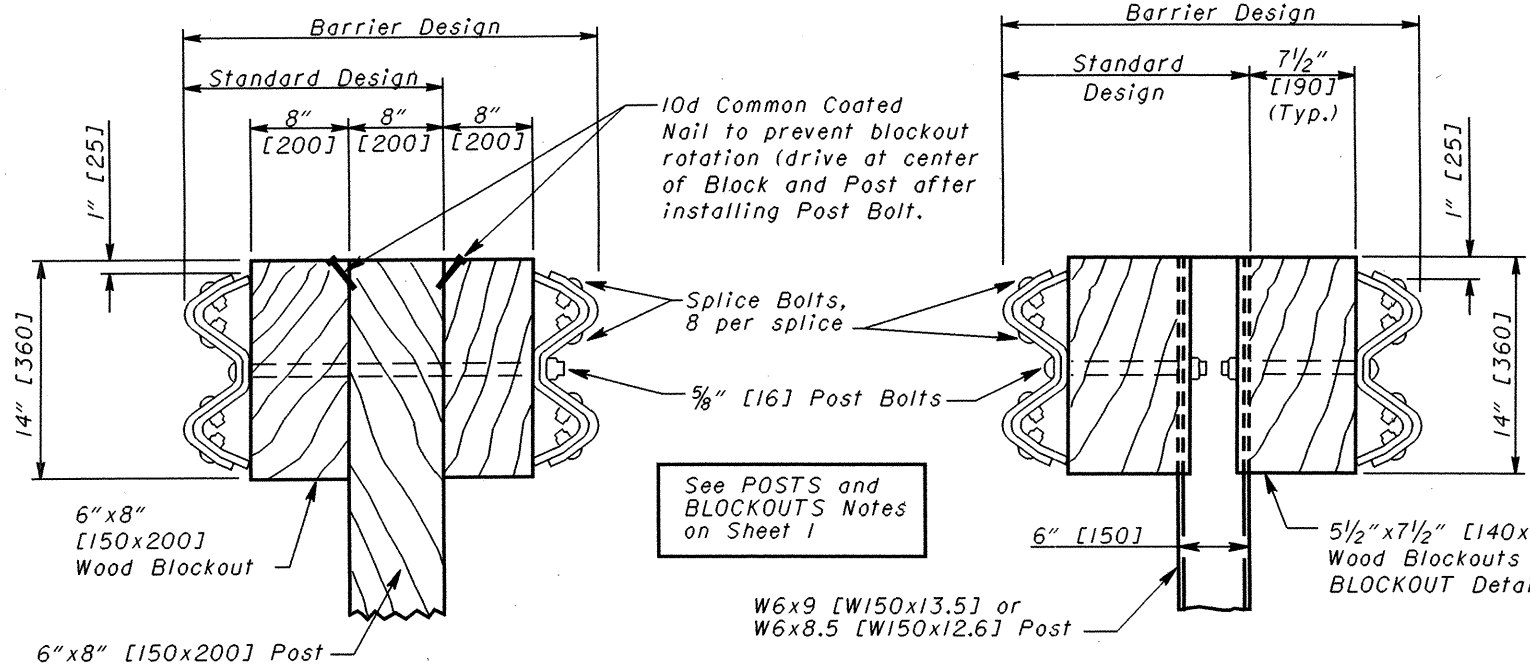
THIS DRAWING REPLACES GR-2.1M DATED 4-18-98.

STANDARD ROADWAY CONSTRUCTION DRAWING
GUARDRAIL TYPE 5 & 5A
NUMBER GR-2.1

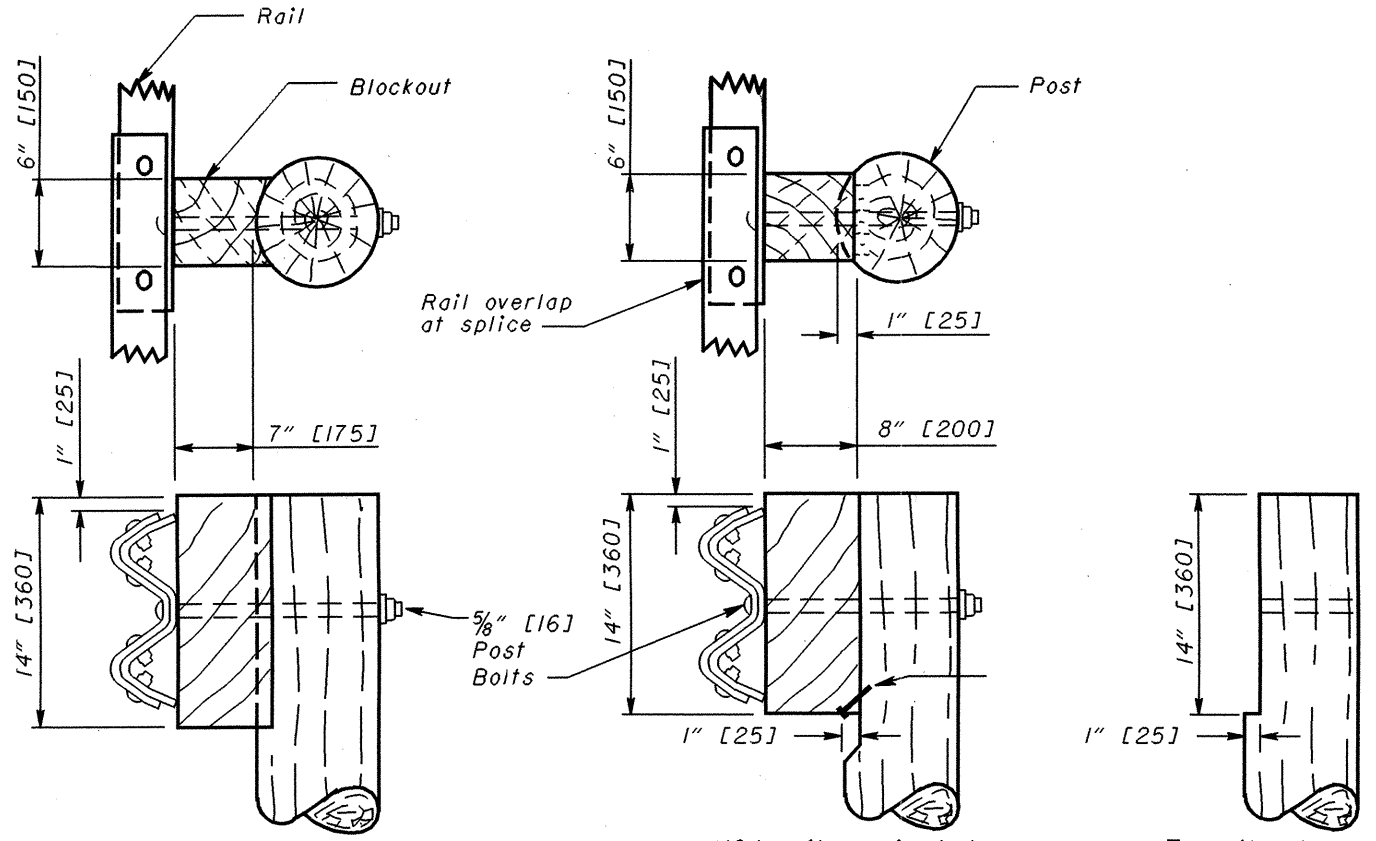
STDS. ENGR.
D. Focke

OHIO DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN ENGINEER
Raymond T. Siskind

DATE
4-18-03

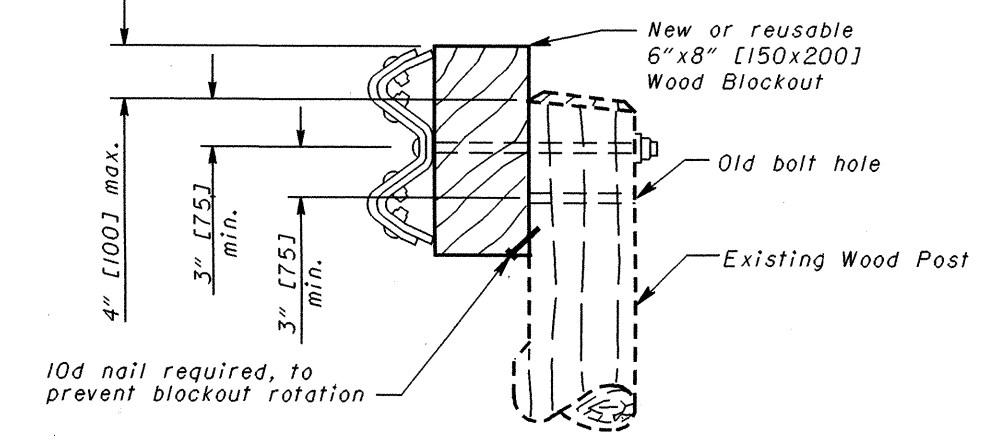


NOTCHED BLOCKOUTS FOR STEEL POSTS
See BLOCKOUTS Note on Sheet 1



METHOD 1 Routed Blockout

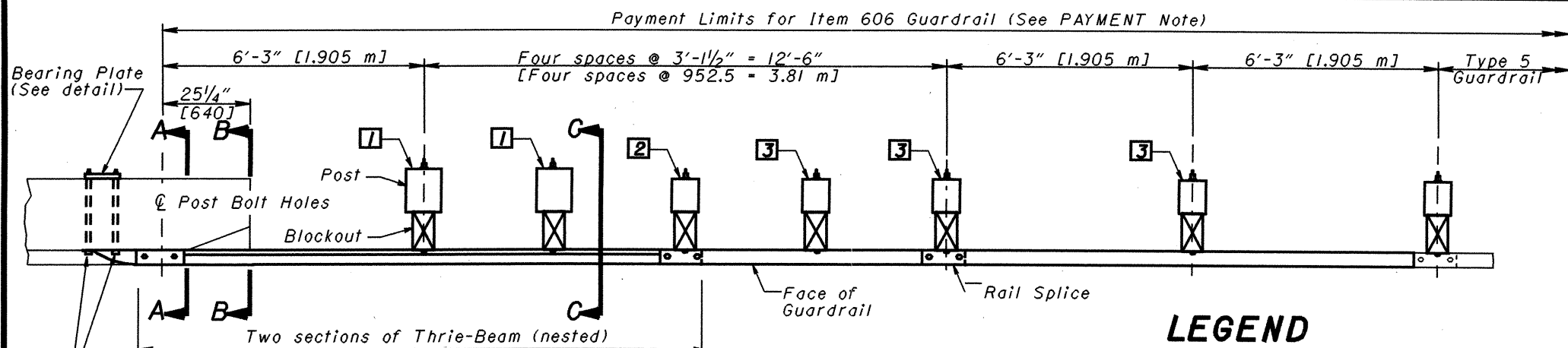
METHOD 2 Notched Post



Alternate methods of placing the Blockouts on round Posts may be submitted for consideration and approved by the Engineer.

ROUND WOOD POSTS
Single Sided runs only (Standard Design)

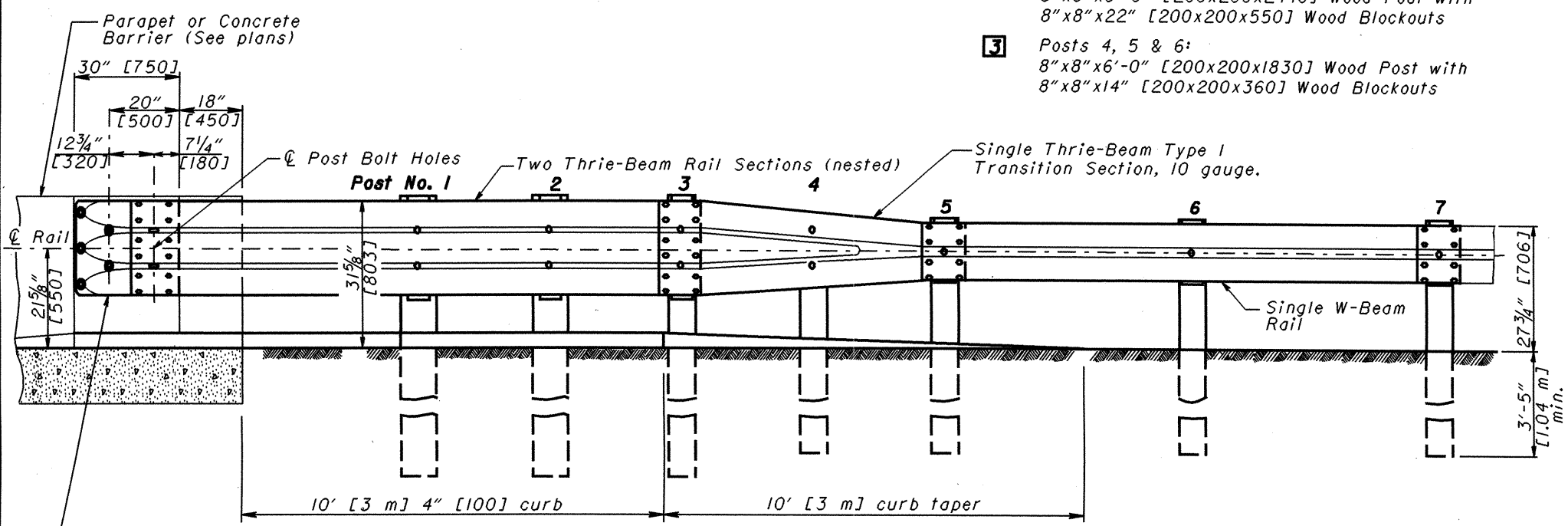
THIS DRAWING REPLACES GR-2.1M DATED 4-18-98.



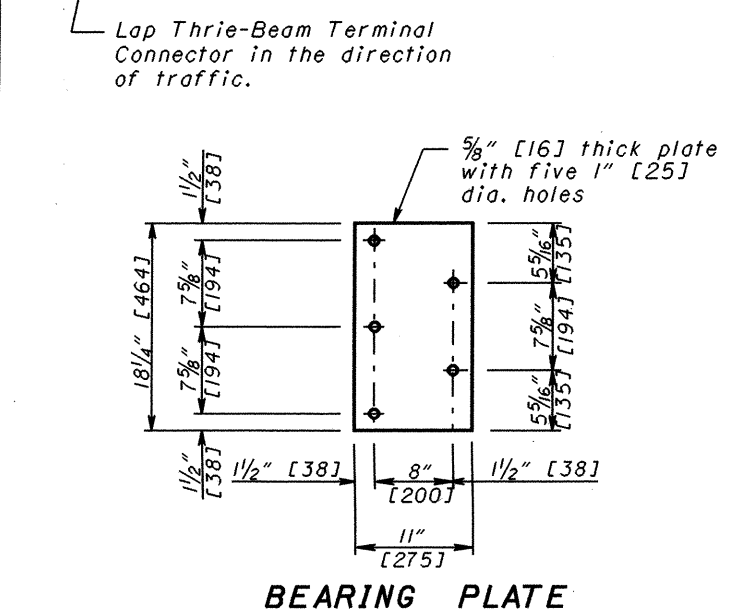
PLAN

LEGEND

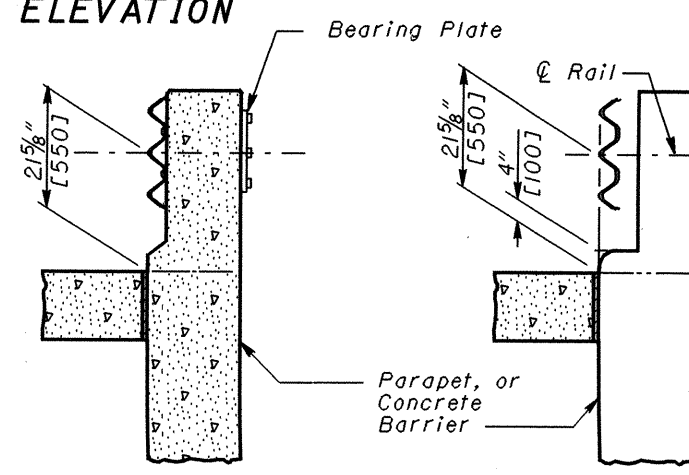
- 1 Posts 1 & 2:
10" x 10" x 8'-0" [250 x 250 x 2440] Wood Post with
8" x 8" x 22" [200 x 200 x 550] Wood Blockouts
- 2 Post 3:
8" x 8" x 8'-0" [200 x 200 x 2440] Wood Post with
8" x 8" x 22" [200 x 200 x 550] Wood Blockouts
- 3 Posts 4, 5 & 6:
8" x 8" x 6'-0" [200 x 200 x 1830] Wood Post with
8" x 8" x 14" [200 x 200 x 360] Wood Blockouts



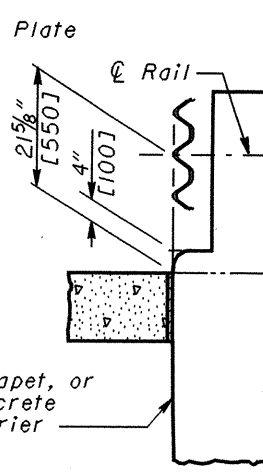
ELEVATION



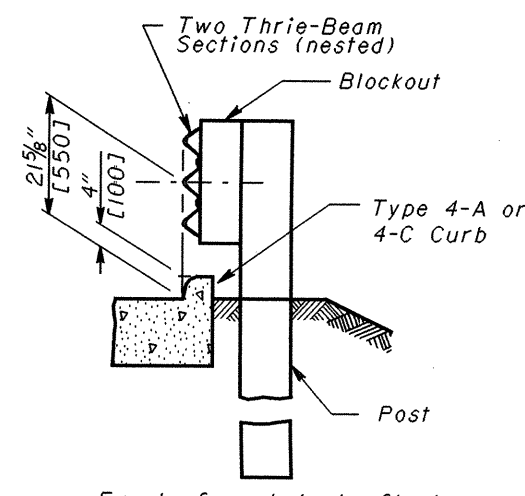
BEARING PLATE



SECTION A-A



SECTION B-B



SECTION C-C

NOTES

GENERAL: For additional details, see **SCD GR-1.1**.

APPLICATION: Use Type 1 Bridge Terminal Assembly to connect guardrail runs to bridges having Deflector Parapet type Bridge Railing (see **Structural Engineering's SCD BR-1**). It may also be used to connect guardrail runs to the approach ends of Concrete Barrier (see **SCD RM-4.6**).
On undivided, bi-directional roadways, Type 1's may be used to anchor guardrail runs to the trailing end of Deflector Parapets or Concrete Barrier installations.

THRIE BEAM TRANSITION: Symmetrical W-Beam to Thrie Beam transition panel shall be 10 gauge.

POSTS: Posts may be set in drilled holes or driven to grade. See **SCD GR-1.1** for additional Post embedment details.

WOOD POSTS - Use square sawed pressure treated wood as per CMS 710.14 and fabricate with square ends. Bore bolt holes and trim the tops of posts, if required, after the posts are set.

STEEL POSTS - are allowed as an alternate. Use W8x24 [W200x35.9] for 10" x 10" [250 x 250] wood posts and use W6x25 [W150x37.1] for 8" x 8" [200 x 200] posts. Use same post material throughout assembly.

BLOCKOUTS: Use wood blockouts only, steel or plastic blockouts are not permitted. Use routed blockouts with steel posts.

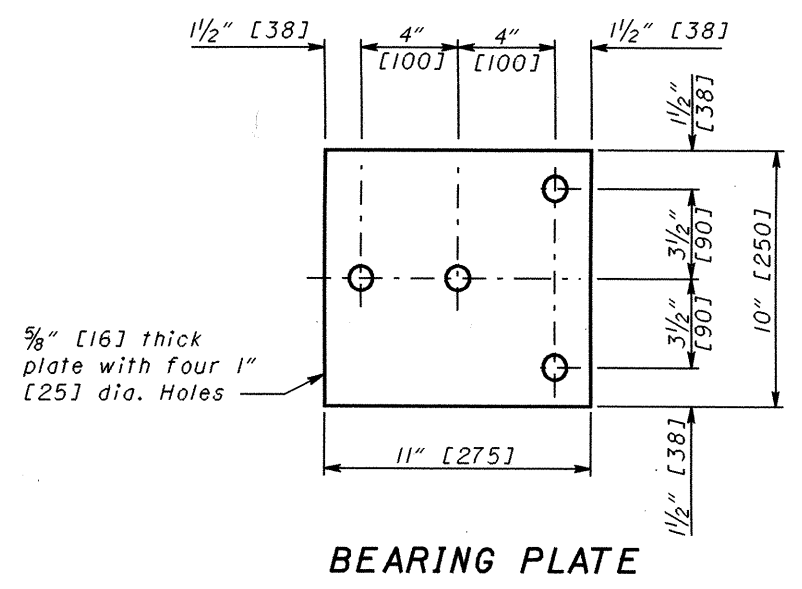
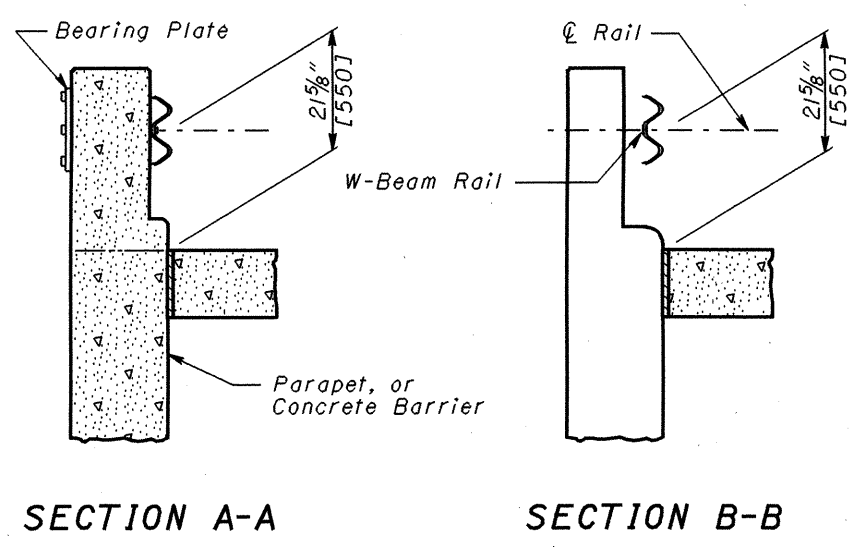
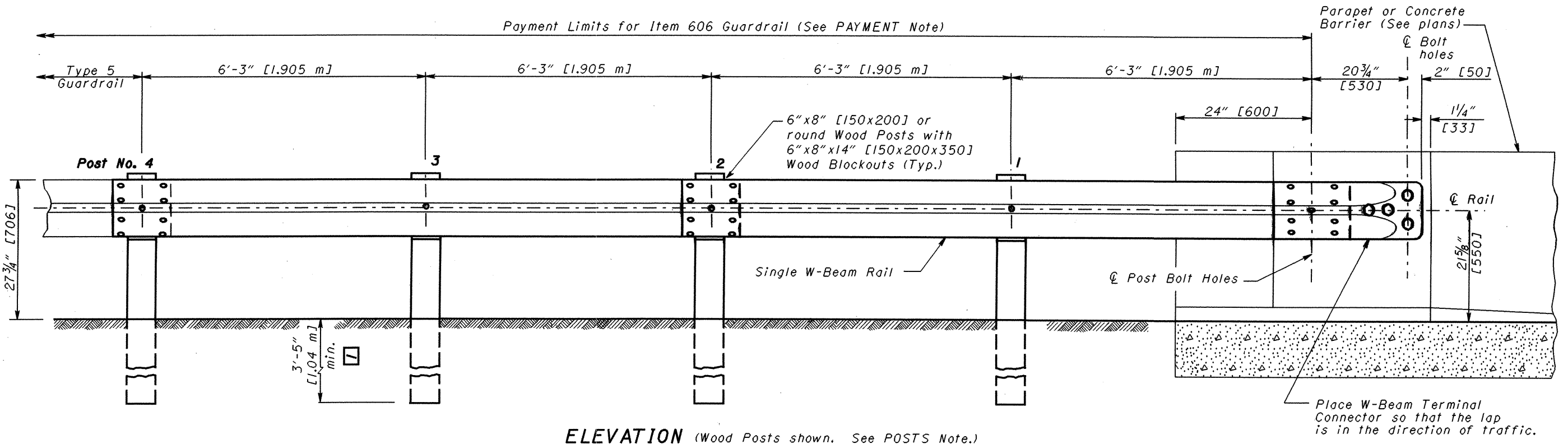
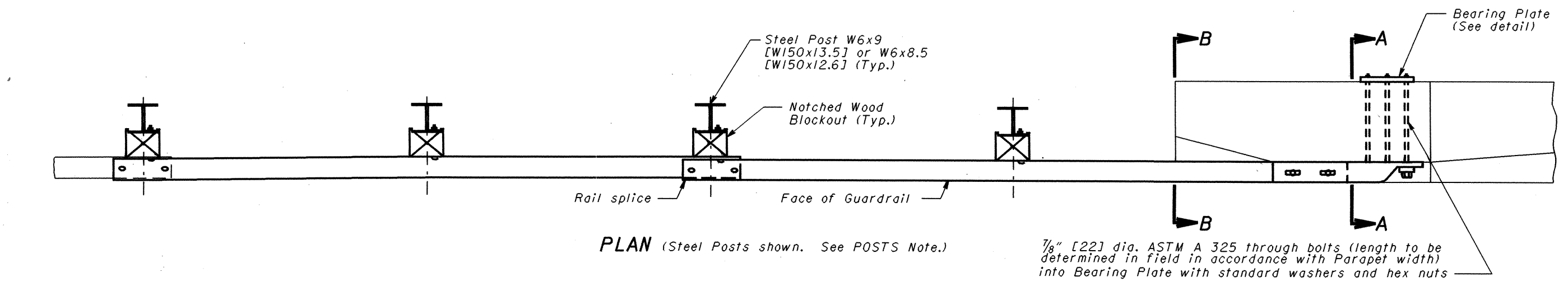
CURB: Provide a Type 4-A or 4-C concrete curb minimum of 20' [6 m], or longer as shown on plans, including a 10' [3 m] taper (from curb height to flush). Front of curb to be flush with face of guardrail.

FLARED GUARDRAIL: Begin Standard Guardrail Flares as shown on **SCD GR-5.1** preferably at or beyond Post No. 7; however, the flare may begin at Post No. 5.

PAYMENT: Item 606 - Bridge Terminal Assembly, Type 1, Each, includes the cost of extra components, in excess of normal guardrail, for additional and different size of posts and blockouts, nested Thrie-Beam, transition and connector sections, Bearing Plate, bolts, washers, nuts, other hardware, and curbs.

THIS DRAWING REPLACES GR-3.1M DATED 10-21-97.

ROADWAY ENGINEERING SERVICES
 STANDARD ROADWAY CONSTRUCTION DRAWING
 BRIDGE TERMINAL ASSEMBLY, TYPE 1
 NUMBER GR-3J
 STATUS: ENGR. D. Focke
 ALL metric dimensions (in brackets []) are in millimeters unless otherwise noted.
 CIVIL DEPARTMENT OF TRANSPORTATION
 ROADWAY DESIGN ENGINEER
 4-18-03 DATE



NOTES

- GENERAL:** For additional rail and post details, see **SCD GR-1.1**.
- APPLICATION:** Use Type 2 Bridge Terminal Assembly to connect guardrail runs to the trailing end of Parapets or Concrete Barriers (see **SCD RM-4.6** for barrier) on one-directional roadways. Do not use if located within clear zone of opposing traffic.
- POSTS:** Posts shall be of standard size and material specified for the appropriate type of guardrail to be installed leaving the bridge or barrier. For Type 5 guardrail, see **SCD GR-2.1**.
- BLOCKOUTS:** Use Wood Blockouts only. Steel or plastic blockouts are not permitted.
- FLARED GUARDRAIL:** Begin Standard Guardrail Flares as shown on **SCD GR-5.1**, preferably at or beyond Post No. 4; however, the flare may begin at Post No. 2.
- PAYMENT:** Item 606 - Bridge Terminal Assembly, Type 2, Each, includes the cost of extra components, in excess of normal guardrail, for the Terminal connector, Bearing Plates, bolts, washers, nuts, and other hardware.

THIS DRAWING REPLACES GR-3.2M DATED 10-21-97.

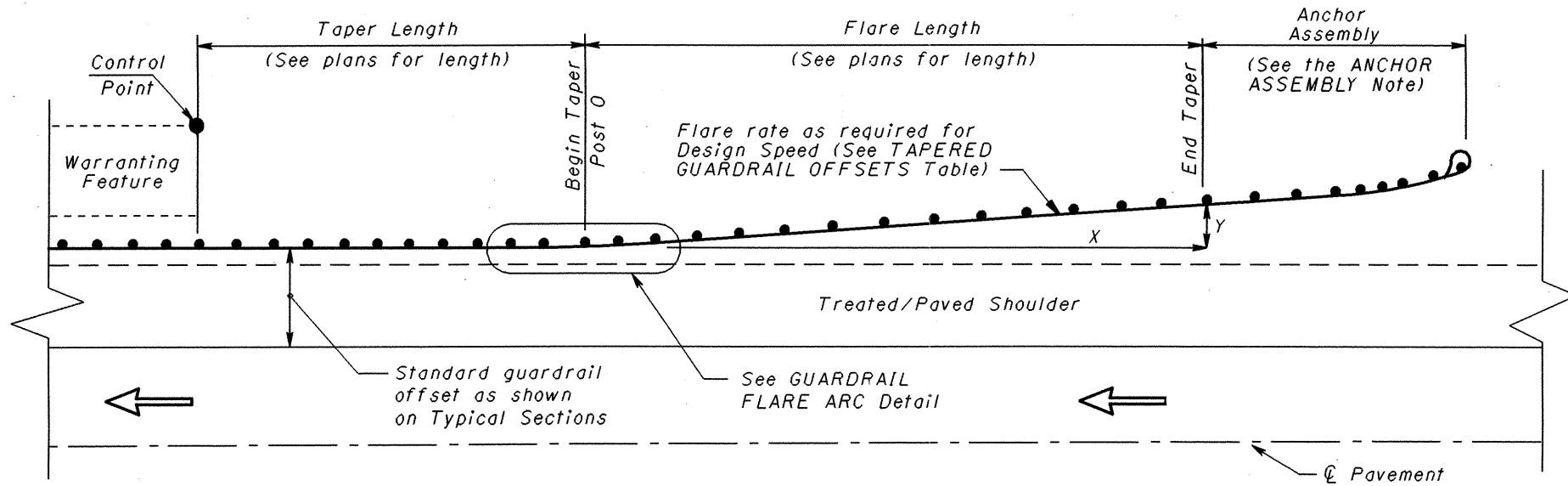
NOTES

STANDARD GUARDRAIL FLARE: Construct the flare shown here when indicated in the construction plans and in conjunction with **SCD 6R-5.2**.

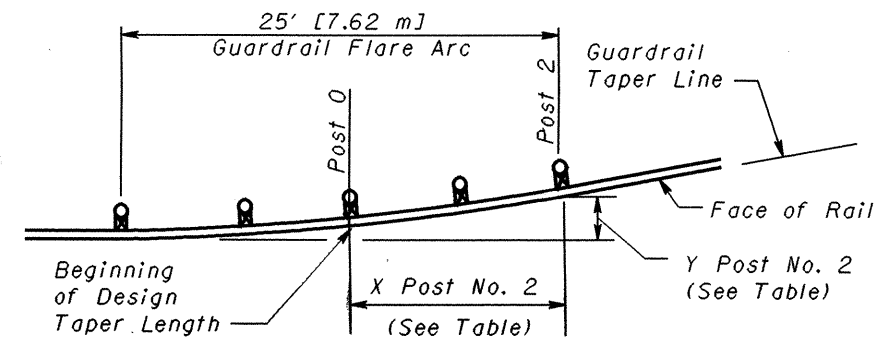
FLARE RATES AND OFFSET SPEEDS: Use the Design Speed shown on the plans to determine flare rates and offsets. Where a Design Speed is not shown or available, use the legal posted speed limit.

ANCHOR ASSEMBLY: Use a Type B-98 Anchor Assembly with standard guardrail flares unless otherwise specified. The Type A can be used, with restrictions. See **Location & Design Manual, Volume 1**, Section 603.

CONTROL POINT: The point shown designates the extent of the hazard being protected and is shown for design use only.



STANDARD GUARDRAIL FLARE
(Plan View)



GUARDRAIL FLARE ARC DETAIL

TAPERED GUARDRAIL OFFSETS (Feet)

Post No.	Flare Length	45 MPH or less 10:1 Taper		50 MPH 11:1 Taper		55 MPH 12:1 Taper		60 MPH 13:1 Taper		65 MPH 14:1 Taper		70 MPH 15:1 Taper	
		X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
		0		0	0.3	0	0.3	0	0.3	0	0.2	0	0.2
2		12.4	1.3	12.5	1.1	12.5	1.0	12.5	1.0	12.5	0.9	12.5	0.8
4	25	24.9	2.5	24.9	2.3	24.9	2.1	24.9	1.9	24.9	1.8	24.9	1.7
6		37.3	3.7	37.3	3.4	37.4	3.1	37.4	2.9	37.4	2.7	37.4	2.5
8	50	49.8	5.0	49.8	4.5	49.8	4.1	49.9	3.8	49.9	3.6	49.9	3.3
10		62.2	6.2	62.2	5.7	62.3	5.2	62.3	4.8	62.3	4.5	62.4	4.2
12	75	74.6	7.5	74.7	6.8	74.7	6.2	74.8	5.7	74.8	5.3	74.8	5.0
14		87.1	8.7	87.1	7.9	87.2	7.3	87.2	6.7	87.3	6.2	87.3	5.8
16	100	99.5	9.9	99.6	9.1	99.7	8.3	99.7	7.7	99.7	7.1	99.8	6.7
18		111.9	11.2	112.0	10.2	112.1	9.3	112.2	8.6	112.2	8.0	112.3	7.5
20	125	124.4	12.4	124.5	11.3	124.6	10.4	124.7	9.5	124.7	8.9	124.7	8.3
22		136.8	13.7	136.9	12.5	137.0	11.4	137.1	10.5	137.1	9.8	137.2	9.1
24	150	149.3	14.9	149.4	13.6	149.5	12.5	149.6	11.5	149.6	10.7	149.7	10.0
26		161.7	16.2	161.8	14.7	161.9	13.5	162.0	12.5	162.1	11.6	162.1	10.8
28	175	174.1	17.4	174.3	15.8	174.4	14.5	174.5	13.4	174.6	12.5	174.6	11.6
30		186.6	18.7	186.7	17.0	186.9	15.6	186.9	14.4	187.0	13.4	187.1	12.5
32	200	199.0	19.9	199.2	18.1	199.3	16.6	199.4	15.3	199.5	14.3	199.6	13.3

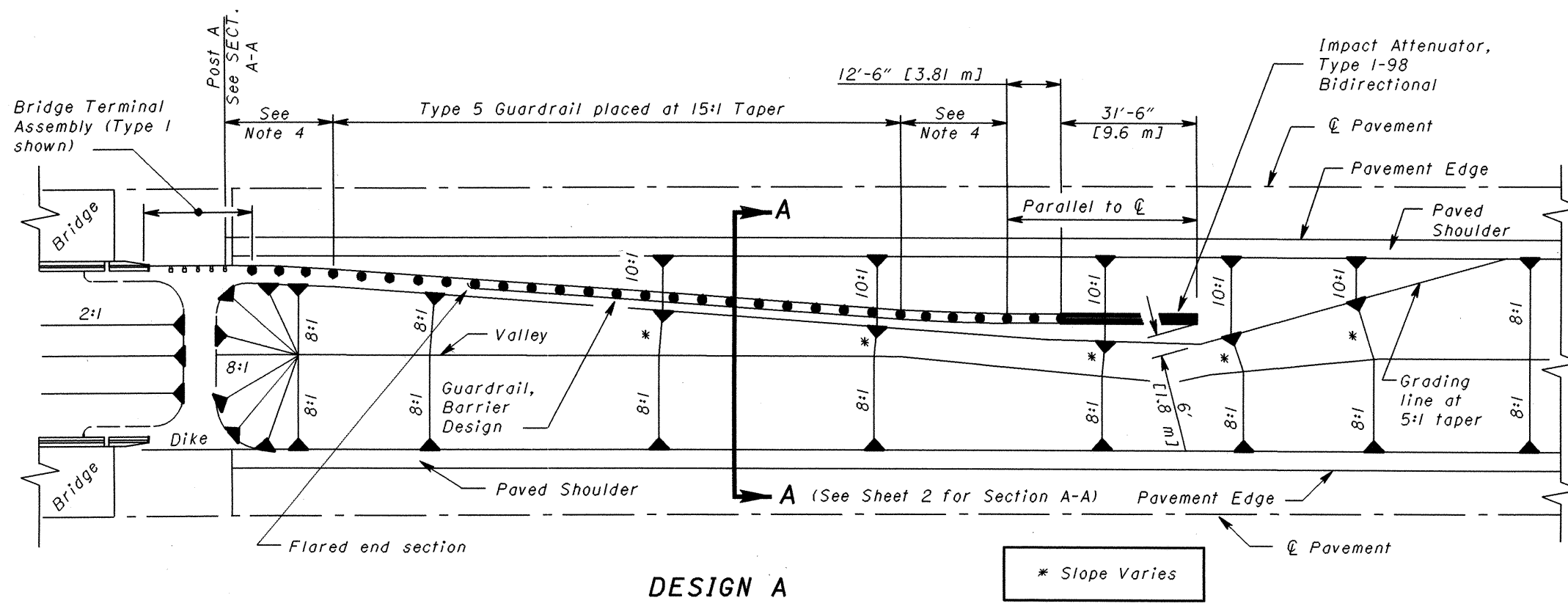
All "X" dimensions shown are from the centerline of Post 0 to the centerline of the indicated post along the standard guardrail offset line extended.
All "Y" dimensions shown are from the standard guardrail offset line extended to the face of rail at the post indicated.

TAPERED GUARDRAIL OFFSETS (Meters)

Post No.	Flare Length	70 km/h or less 10:1 Taper		80 km/h 11:1 Taper		90 km/h 12:1 Taper		100 km/h 13:1 Taper		110 km/h 14:1 Taper		120 km/h 15:1 Taper	
		X	Y	X	Y	X	Y	X	Y	X	Y	X	Y
		0		0	0.09	0	0.09	0	0.08	0	0.07	0	0.07
2		3.79	0.38	3.80	0.35	3.80	0.32	3.80	0.29	3.80	0.27	3.80	0.25
4	7.62	7.58	0.76	7.59	0.69	7.59	0.64	7.60	0.59	7.60	0.54	7.60	0.51
6		11.37	1.14	11.38	1.04	11.39	0.95	11.40	0.88	11.40	0.82	11.40	0.76
8	15.24	15.16	1.52	15.18	1.39	15.19	1.27	15.19	1.17	15.20	1.09	15.21	1.02
10		18.95	1.91	18.97	1.73	18.98	1.59	18.99	1.47	19.00	1.36	19.01	1.27
12	22.86	22.75	2.29	22.77	2.08	22.78	1.91	22.79	1.76	22.80	1.63	22.81	1.52
14		26.54	2.67	26.56	2.42	26.58	2.22	26.59	2.05	26.60	1.91	26.61	1.78
16	30.48	30.33	3.05	30.35	2.77	30.37	2.54	30.39	2.34	30.40	2.18	30.41	2.03
18		34.12	3.43	34.15	3.12	34.17	2.86	34.19	2.64	34.20	2.45	34.21	2.29
20	38.10	37.91	3.81	37.94	3.46	37.97	3.18	37.99	2.93	38.00	2.72	38.02	2.54
22		41.70	4.19	41.74	3.81	41.76	3.49	41.79	3.22	41.80	2.99	41.82	2.79
24	45.72	45.49	4.57	45.53	4.16	45.56	3.81	45.58	3.52	45.60	3.27	45.62	3.05
26		49.28	4.95	49.32	4.50	49.36	4.13	49.38	3.81	49.40	3.54	49.42	3.30
28	53.34	53.07	5.33	53.12	4.85	53.15	4.45	53.18	4.10	53.20	3.81	53.22	3.56
30		56.86	5.72	56.91	5.20	56.95	4.76	56.98	4.40	57.00	4.08	57.02	3.81
32	60.96	60.65	6.10	60.71	5.54	60.75	5.08	60.78	4.69	60.80	4.35	60.82	4.06

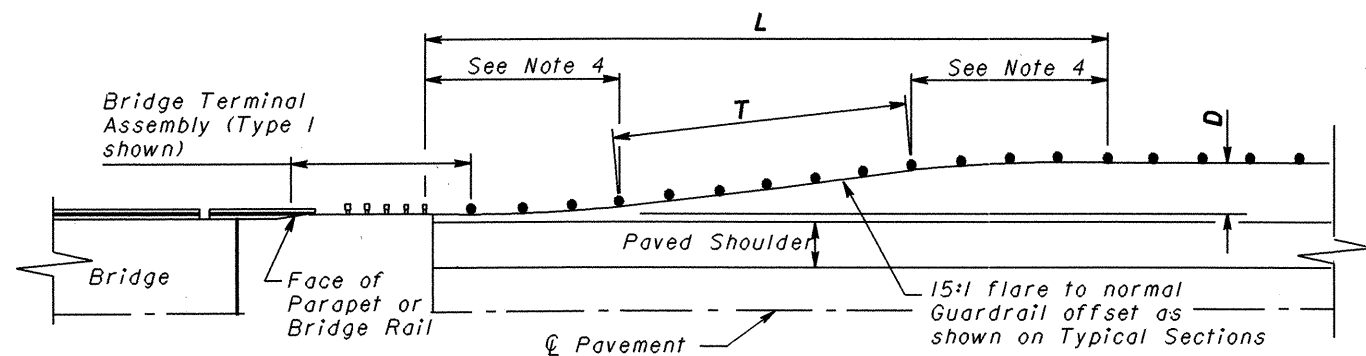
All "X" dimensions shown are from the centerline of Post 0 to the centerline of the indicated post along the standard guardrail offset line extended.
All "Y" dimensions shown are from the standard guardrail offset line extended to the face of rail at the post indicated.

TRANSPORTATION 4-18-03 DATE
 ROADWAY DESIGN ENGINEER
 ROADWAY ENGINEERING SERVICES
 STANDARD ROADWAY CONSTRUCTION DRAWING
 GUARDRAIL FLARE DETAILS
 THIS DRAWING REPLACES GR-5.1M DATED 4-21-95.
 NUMBER GR-5.1
 1/1



DESIGN A
Narrow Median (See NOTE 2)

INTRODUCED GUARDRAIL APPROACH INSTALLATIONS



RECOMMENDED LENGTHS FOR GUARDRAIL OFFSET TRANSITIONS					
English (ft)			Metric (m)		
D Difference in Offset	L Total Length	T Tangent Length on Flares	D Difference in Offset	L Total Length	T Tangent Length on Flares
2	62.5	12.5	0.6	19.05	3.81
4	87.5	37.5	1.2	26.67	11.43
6	125.0	75.0	1.8	38.10	22.86
8	150.0	100.0	2.4	45.72	30.48
10	175.0	125.0	3.0	53.34	38.10

GUARDRAIL OFFSET TRANSITION

NOTES

- 1) The length of guardrail needed shall be determined according to methods contained in the **Location and Design Manual, Volume 1, Section 602**. Quantities shown on this sheet are based on these methods, using a lateral offset of 30' [9 m] for the area of concern, a runout length of 472' [144 m], and a guardrail flare rate of 15:1.
- 2) Use **DESIGN "A"** in narrow medians where the end of the guardrail run extends into the clear zone of the opposite side traffic. In medians where the guardrail run would otherwise extend beyond the centerline of the median, turn the guardrail run to follow the centerline using a standard flare arc. The plans shall clearly indicate what portion of the flared guardrail run is to be constructed using barrier guardrail.
- 3) Use **DESIGN "B"** (see Sheet 2 of 2) where the guardrail run lies outside of the Clear Zone of the opposite side traffic. In this case, the design of the guardrail flare in the median would be similar to that of the guardrail approach on the outside shoulder. Estimated quantities are provided in the box below.
- 4) Use a 25'-0" [7.62 m] Standard Flare Arc per **SCD GR-5.1**.
- 5) Provide 10:1 or flatter cross-slopes in front of guardrail. The 8:1 slopes shown in the median at other locations are the recommended practice, although other slopes may be designated in the plans.

THIS DRAWING REPLACES GR-6.1M DATED 1-3-96.

STANDARD ROADWAY CONSTRUCTION DRAWING

ROADWAY ENGINEERING SERVICES

OHIO DEPARTMENT OF TRANSPORTATION

STDS. ENGR. D. Focke

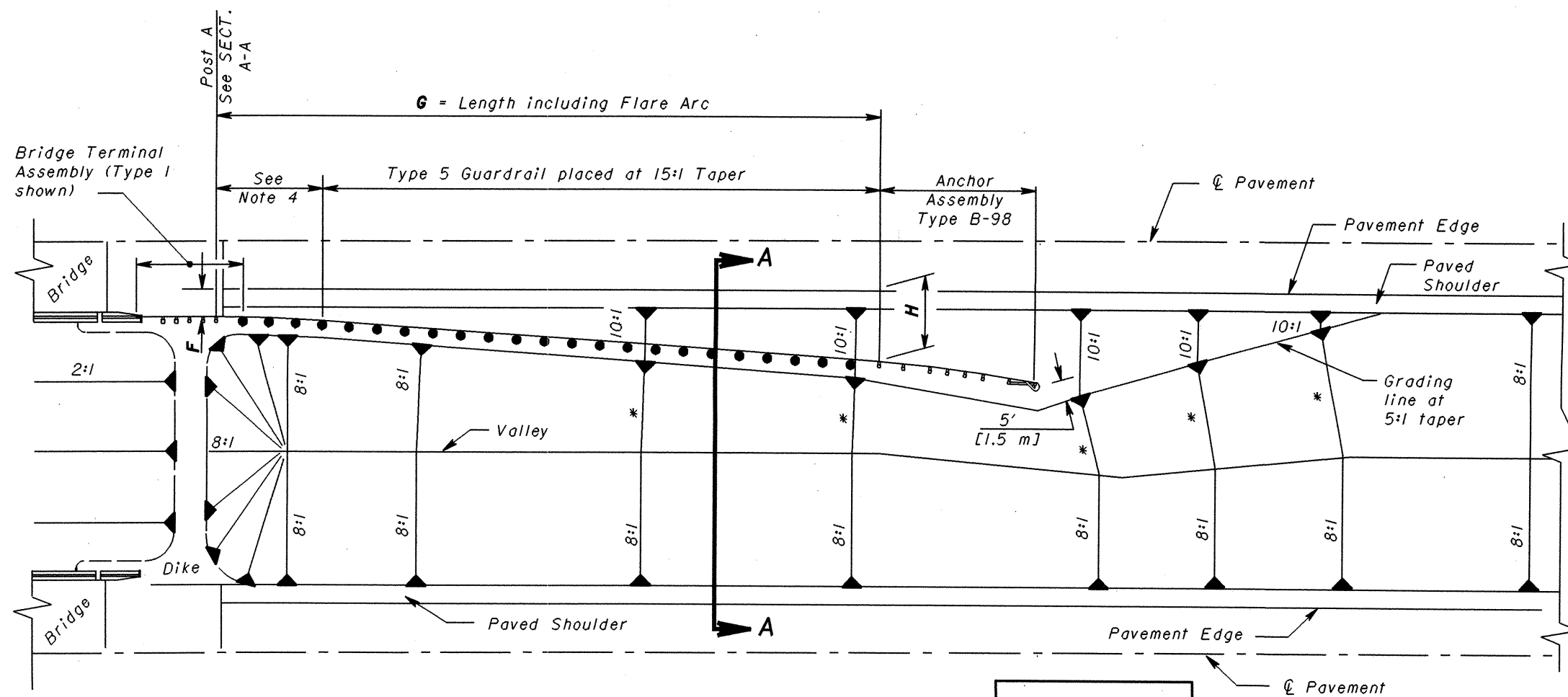
ROADWAY DESIGN ENGINEER

4-18-03

DATE

NUMBER GR-6.1

1/2

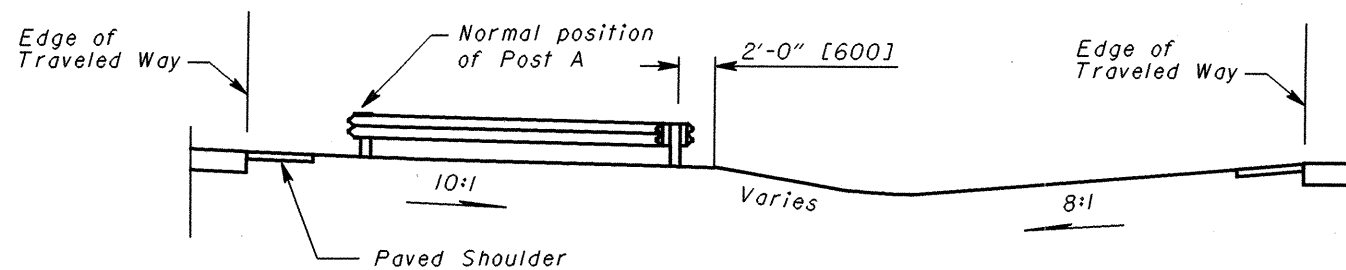


DESIGN B

Wide Median (See NOTE 3 on Sheet 1)

* Slope Varies

INTRODUCED GUARDRAIL APPROACH INSTALLATIONS



SECTION A-A

RECOMMENDED LENGTHS⁽¹⁾ FOR GUARDRAIL FLARES AT BRIDGE APPROACHES⁽²⁾

English (ft)			Metric (m)		
F Guardrail Offset at Bridge	G Length of Need (3)	H Offset at End of Run	F Guardrail Offset at Bridge	G Length of Need (3)	H Offset at End of Run
4	212.5	17.3	1.2	64.77	5.26
6	200.0	18.4	1.8	60.96	5.61
8	175.0	18.7	2.4	53.34	5.70
10	162.5	19.8	3.0	49.53	6.05
12	150.0	21.0	3.6	45.72	6.39
14	137.5	22.1	4.2	41.91	6.74
16	125.0	23.3	4.8	38.10	7.09

- 1 Including the 25'-0" [7.62 m] Standard Flare Arc coming off the Bridge, but excluding the Anchor Assembly/Attenuator device.
- 2 For use with a DESIGN "B" Median (see this sheet) or on the outside Shoulder approach to the Bridge.
- 3 Lengths are based on using whole numbers of Guardrail panels (12'-6" [3.81 m] long).

THIS DRAWING REPLACES GR-6.1M DATED 1-3-96.

STANDARD ROADWAY CONSTRUCTION DRAWING
GUARDRAIL AT BRIDGES

NUMBER
GR-6.1

2 / 2

STDS. ENGR.
D. Focke

All metric dimensions (in brackets []) are in millimeters unless otherwise noted.

ROADWAY ENGINEERING SERVICES

OHIO DEPARTMENT OF TRANSPORTATION
Raymond J. Siskind
ROADWAY DESIGN ENGINEER

4-18-03
DATE

614 WORK ZONE RAISED PAVEMENT MARKERS

GENERAL

This item of work shall consist of furnishing, installing, maintaining and subsequently removing work zone raised pavement markers (TRPMs). The markers shall be yellow or white, as described in the plan.

MATERIAL

All markers and retroreflectors shall be of sufficient strength and properly shaped so as not to be dislodged or broken by impacts from vehicles tires, including those of high pressure truck tires loaded to 4500 pounds (2040 kilograms).

Retroreflectors shall be provided in one or two directions on each marker as required by the usage and shall return white or yellow light as is appropriate for the application.

The reflector shall have an effective area of 0.35 sq. inches (225 sq. mm) for Type A or 3.0 sq. inches (1935 sq. mm) for Type B. Its brightness or specific intensity (when tested at 0.2 degree angle of observation and the following angles of incidence) shall meet or exceed the following:

SPECIFIC INTENSITY		
TYPE A		
INCIDENCE ANGLE (DEGREES)	WHITE	YELLOW
0	1.0	0.6
20	0.4	0.24
45	—	—
TYPE B		
INCIDENCE ANGLE (DEGREES)	WHITE	YELLOW
0	3.0	1.8
20	1.2	0.72
45	0.3	0.2

Angle of incidence formed by a ray from light source to the marker and the normal to the leading edge of the marker face (also horizontal entrance angle).

Angle of observation formed by a ray from light source to the marker and the returned ray from the marker to the measuring receptor.

Specific intensity is the mean candlepower of the reflected light (at given incidence and divergence angles) for each foot candle (10.7 lux) at the reflector (on a plane perpendicular to the incident light).

Type A markers are intended to provide high visibility both day and night. Their daytime visibility shall be assured by size, shape and color as follows:

- 1) The markers shall be a high visibility yellow or white color which will not degrade substantially due to traffic wear and which will match the color of the reflector.
- 2) When viewed from above, the markers shall have a visible area of not less than 14 sq. inches (9030 sq. mm).
- 3) When viewed from the front, parallel to the pavement, as from approaching traffic, the marker shall have a width of approximately 4 inches (100 mm) and a visible area of not less than 1.5 sq. inches (970 sq. mm).

Type B markers are intended to provide high visibility at night by retroreflecting light from automotive headlights back to the driver.

INSTALLATION

WZRPMS shall be attached to clean, dry pavement by a butyl adhesive pad, a bituminous adhesive or other construction grade adhesives (such as Franklin Panel and Metal Adhesive) suitable to anchor the marker under the above conditions. When it is necessary to attach markers to new concrete pavement with curing compound remaining, the curing compound membrane shall be removed by sandblasting or other mechanical cleaning method. Markers shall be installed in accordance with the manufacturer's recommendations.

The Contractor shall immediately replace, at his expense, any markers which fail (broken housing, housing worn to the extent that daytime visibility is significantly diminished or of an unacceptable color, detached or broken reflector, housing detached from adhesive).

Markers are likely to be removed by snow plowing operations, thus they are not considered suitable for use during the period from October 15 until April 30. The Contractor is advised to schedule his work and/or the use of these devices to avoid this period. Should the Contractor choose to use WZRPMS during this period and they are subsequently removed or destroyed by snow and ice control activities, the Contractor shall immediately, at his expense, provide a substitute traffic guidance system effective during day and night and which is acceptable to the Engineer.

The markers shall be placed accurately to depict straight or uniformly curving lines. When used to supplement work zone pavement markings, they shall be placed on or immediately adjacent to the pavement marking. Locations shall be adjusted up to 12 inches (300 mm) longitudinally or 6 inches (150 mm) laterally to avoid placement on joints, or on cracked or deteriorated pavement. Markers shall not be placed directly on pavement markings if this detracts from their ability to remain attached to the pavement.

APPLICATION

1) When required to supplement pavement marking, work zone raised pavement markers shall be placed as follows:

LINE	TYPE	SPACING
EDGE LINE	A OR B	20' (6 m) C/C
LANE LINE	A OR B	40' (12 m) C/C*
CENTER LINE (SINGLE BROKEN)	A OR B	40' (12 m) C/C*
CENTER LINE (DOUBLE/SOLID)	A OR B	2 UNITS SIDE BY SIDE 4" (100 mm) APART 20' (6 m) C/C
CHANNELIZING LINE (INCLUDES EXIT GORE NOSE)	A OR B	10' (3 m) C/C

* CENTERED IN GAP

2) When used to substitute for (replace) pavement marking, work zone raised pavement markers shall be placed as follows:

LINE	TYPE	SPACING
EDGE LINE	A	5' (1.5 m) C/C
LANE LINE	A	5 @ 2.5' (0.75 m) C/C 30' (9 m) GAP [40' (12 m) CYCLE]
CHANNELIZING LINE (INCLUDES EXIT GORE NOSE)	A	5' (1.5 m) C/C
EDGE LINE (TWO COLOR) (WHITE/YELLOW)	A	BACK TO BACK 5' (1.5 m) C/C

Yellow markers used to separate opposite flows of traffic (center lines) shall include retroreflectors for both directions. All other yellow and white markers shall provide retroreflectivity for one direction only.

REMOVAL

Removal shall be accomplished in a manner such that little or none of the adhesive remains on the pavement. Permanent pavement surfaces shall not be scarred, broken or roughened significantly.

PAYMENT

Basis of payment shall be at the contract unit price per each marker and shall include all labor, equipment, hardware and incidentals required to perform the work. It shall also include replacement at no additional cost of all work zone raised pavement markers which, in the judgement of the Engineer, fail for any reason, except due to failure of the pavement to which they are attached.

ITEM	UNIT	DESCRIPTION
614	EACH	WORK ZONE RAISED PAVEMENT MARKER

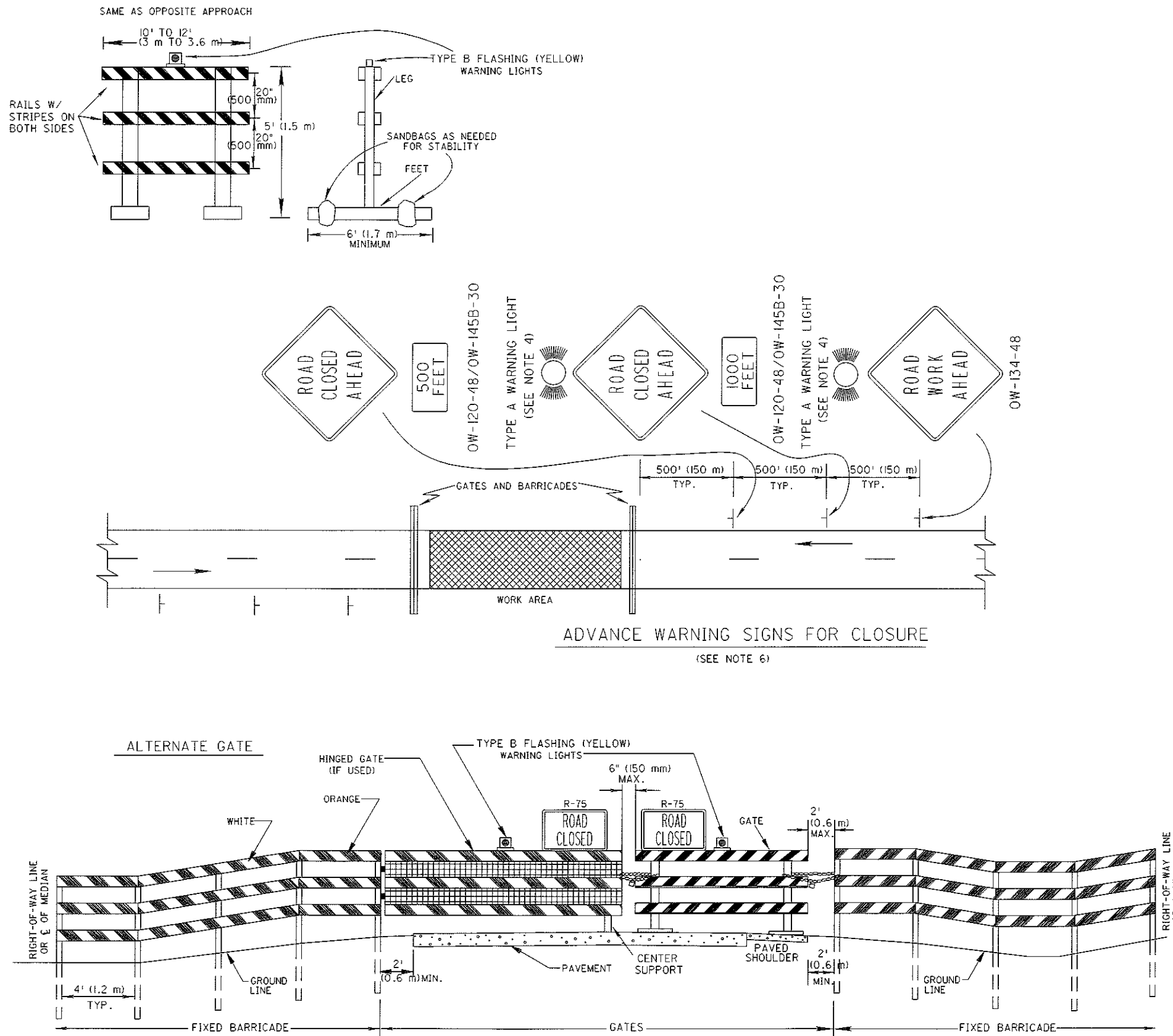
10-18-02

WORK ZONE RAISED PAVEMENT MARKERS

OFFICE OF TRAFFIC ENGINEERING

MT-101.20

JAM



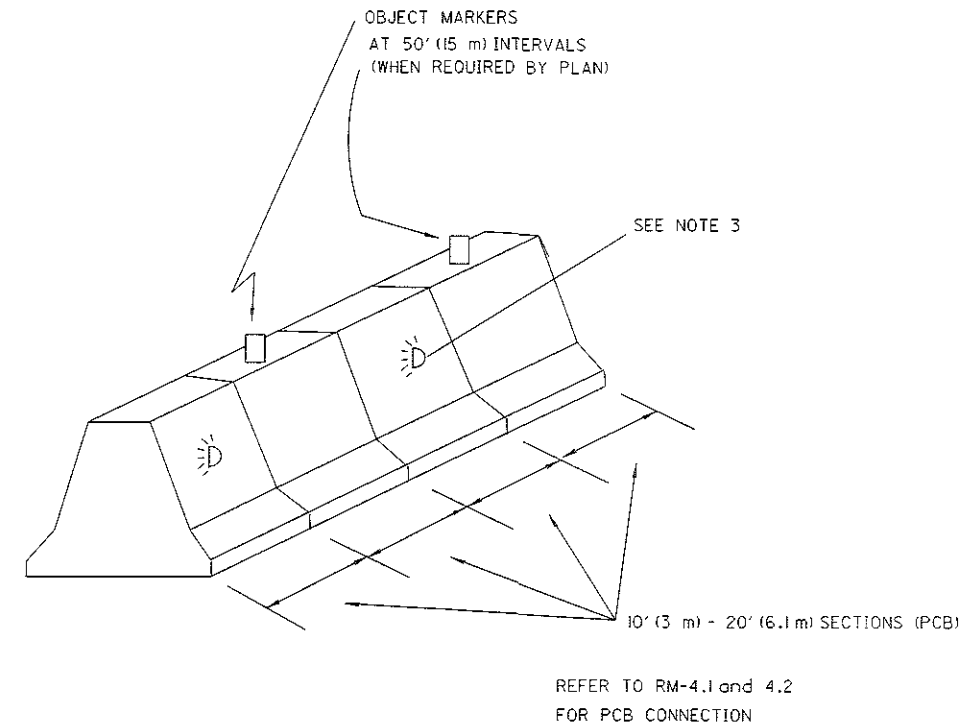
GENERAL NOTES

- Barricades:** Barricades shall be constructed according to details shown. When the road is closed to traffic, barricades and gates shall be used to effectively close the entire roadway including the median of divided highways. In urban areas and at locations where it is impractical to extend the barricade to the Right-Of-Way line because of a sidewalk which is to remain open or other obstruction, the ends of the barricade shall be located as directed by the Engineer to effect the desired closing of the highway.
- Painting and Reflectorization:** In construction or maintenance areas all rails of the barricades and gates shall be reflectorized with orange and white reflectorized Type G sheeting in 6" (150 mm) wide alternate stripes which slope downward toward the center line of the road at an angle of 45°. Any barricade placed on the pavement must be considered as a gate. The top rail of the A-frame and all three rails of the hinged gate shall be striped on both sides. All posts, braces, gate legs, and any unstriped rails shall be painted white. (Gates and barricades used in permanent or semipermanent application shall differ only in that they shall use red and white stripes).
- Gates:** One gate shall be erected for each traffic lane. Gates shall be chained and padlocked to one another and to adjacent post of the barricades. Chains shall be 1/4" (6.4 mm) stock or larger with welded links. A hinged gate may be used and shall be supported at the center in an approved manner.
- Type A Flashing Warning Lights:**
Type A Flashing Warning Lights are required on the OW-134 and the first OW-120 signs.
- Type B Flashing Warning Lights:**
Each gate shall be equipped with a Type B Flashing Warning Light, conspicuously visible at all distances up to 1000' (300 m) under normal atmospheric conditions. The light shall be in operation at all times during the period the highway is closed.
- Signs:** Where the road is closed to traffic by the erection of gates and barricades, R-75 signs shall be mounted on the gates as shown. The Advance Warning Signs shown on this drawing will not be required when all traffic has been directed from the roadway at or just in advance of the gates and barricades such as on a Limited Access Highway or when a temporary run around similar to Figure C-24 of The Ohio Manual of Uniform Traffic Control Devices (OMUTCD) is used. Advance Warning Signs shall be required in all other situations and when required in the plans. Advance Warning Signs on an approach shall consist of two OW-120 signs with distance plaques placed about 500' (150 m) and 1000' (300 m) from the closure and a OW-134 placed about 1500' (450 m) from closure, the signs shall be placed on both sides of the road (dualled for 4-lane divided highways or when required by the plans).
- Operation:** On a 2-Lane 2-Way roadway the Contractor will normally open only the left hand gate as necessary to allow vehicles to enter and immediately close it. Both gates will not normally be opened at the same time. The Contractor shall assign an employee to assure that gates are closed and chained shut at the end of each workday.

I. PCB SHALL BE DELINEATED AS FOLLOWS:

<u>PCB TYPE</u>	<u>DELINEATION</u>
32" (813 mm) HIGH WITHOUT GLARE SCREEN	BARRIER REFLECTORS @ 50' (15 m) C-C (MAX.) TOP MOUNTED OBJECT MARKERS 6"X12" (150 X 300 mm) @ 50' (15 m) C-C (MAX.)
32" (813 mm) HIGH WITH GLARE SCREEN	BARRIER REFLECTORS @ 50' (15 m) C-C VERTICAL STRIPES ON PADDLES 2"X12" (50 X 300 mm) @ 50' (7.6 m) C-C (MAX.)
50" (1270 mm) HIGH	BARRIER REFLECTORS @ 25' (7.6 m) C- C (MAX.)
TAPERED END SECTION AND EXPOSED END	OBJECT MARKERS 6"X12" (150 X 300 mm) TOP MOUNTED @ EACH END

2. DRAWING SHALL BE USED WHEN PCB IS SPECIFIED IN THE PLANS.
3. THE TOP OF THE BARRIER REFLECTOR SHALL BE MOUNTED AT 26 INCHES (660 mm) FROM THE BASE.



PORTABLE CONCRETE BARRIER (PCB)

TEMPORARY SIGN SUPPORT REQUIREMENTS

A. PLACEMENT OF SIGNS WHICH WILL REMAIN MORE THAN ONE DAY:

- 1) Lateral placement to nearest edge of signs shall be as follows:
 - A) On the right side of the road for approaching traffic (except for dual mounted signs and signs designated in the plans for left side mounting).
 - B) Curbed roadway - minimum 2' (0.6 m) behind face of curb.
 - C) Uncurbed roadway - 12' (3.6 m) from edge of traffic lane or 6' (1.8 m) from edge of paved or useable shoulder, whichever is greater.
 - D) Behind guardrail or barrier - preferably 2' (0.6 m) behind face of guardrail (minimum 1' (0.3 m)) for signs on class a supports; 4' (1.2 m) for Class B or C supports; 1' (0.3 m) behind face of Concrete Barrier unless barrier top mounting is required by the plan.
- 2) Vertical clearance of signs, measured above roadway elevation, shall be as follows:
 - A) Rural - 5' (1.5 m) when parked cars, construction equipment, etc will not obscure sign visibility.
 - B) Rural areas with parked cars or construction equipment - 7' (2.1 m)
 - C) Urban - 7' (2.1 m)
 - D) Care shall be taken to assure that signs will not be obscured by construction equipment, trees, weeds or other obstacles. Brush, weeds or grass within the right of way shall be trimmed as necessary. Signs shall normally be visible to traffic 400' (120 m) to 600' (180 m) in advance of the sign.
- 3) Supports for signs which will remain in place more than one day shall be fixed rather than portable except in situations where the sign must rest on permanent pavement or other surface which would be damaged by insertion of post type supports.

B. PLACEMENT OF SIGNS WHICH WILL REMAIN FOR ONE DAY OR LESS:

- 1) Same as A-1 above except that signs may be placed on the roadway only if they do not intrude into a traffic lane in use.
- 2) Minimum of 1' (0.3 m) above roadway

C. CLASSES OF SUPPORTS:

All temporary sign supports shall be of the following types:

1) CLASS A:

Supports shall be used for exposed locations on highways where traffic approach speeds of 40 MPH and higher are encountered. They are also suitable for use in all other locations.

2) CLASS B:

Supports may only be used where fully protected by guardrail, concrete barrier and in locations positively protected from traffic such as on retaining walls.

D. TRAFFIC APPROACH SPEEDS:

Traffic approach speeds shall be the locally posted speed (not advisory speed signs) or the measured actual (85th percentile) speed (if available) of approaching traffic, whichever is higher, adjacent to the sign location.

TABLE

APPROACH SPEED (MPH)	COMPLETELY PROTECTED BY GUARDRAIL OR BARRIER	PARTLY PROTECTED BY GUARDRAIL OR BARRIER *	GREATER THAN 30' (9 m) FROM EDGE OF PAVEMENT	WITHIN 30' (9 m) FROM EDGE OF PAVEMENT
40 AND HIGHER	A OR B	A OR B	A OR B **	A ONLY
26 TO 39	A OR B	A OR B	A OR B	A OR B
0 TO 25	A OR B	A OR B	A OR B	A OR B

* If supports are behind guardrail but not fully 5'6" (1.7 m) behind face of rail or if sign is not 1' (0.3 m) behind face of concrete barrier.

** 30' (9 m) criterion is based upon straight roadway and a slope of 6 to 1 or flatter. Supports on the outside of curves or located down a slope (steeper than 6 : 1) will require use of class a supports.

E. BALLASTING

Ballasting of portable supports shall be with sandbags placed within 1' (0.3 m) of the ground. In no case shall hard objects be used for ballast.

F. STRENGTH OF SIGN SUPPORTS

The Contractor shall choose sign supports of adequate strength and with adequate foundations and anchorage to support the sign sizes erected. Proprietary devices shall not be loaded beyond the limits recommended by the manufacturer. Slip base type breakaway beam connections shall be at least partially embedded in concrete consisting of a 1' (0.3 m) deep by 1' (0.3 m) diameter collar. Sign supports which fail under typical wind load conditions shall be immediately modified or replaced with a support of adequate strength.

G. PROHIBITED SUPPORTS

The following support types shall not be permitted on projects:

- 1) Supports fabricated from automotive axle differential assemblies and similarly heavy assemblies which cannot be considered breakaway type.
- 2) Supports consisting of vertical posts with angled braces made from drivepost or other rigid elements.
- 3) Supports that are not NCHRP 350 compliant.

CLASS A SUPPORTS FIXED SUPPORTS

- 1) All #2 and #3 posts when installed singly or in pairs (side by side) according to the details of TC-41.20. The number of supports shall be as shown on TC-52.10 and TC-52.20.
- 2) The following post types, when installed singly, by imbedment or driving into earth to a depth of about 42 inches (1.1 m).
 - A) - up to 4"x4" (102x102 mm) wood.
 - B) - up to 2" (51 mm) diameter schedule 40 steel pipe.
 - C) - up to 3" (76 mm) diameter schedule 40 aluminum pipe.
 - D) - up to 2 1/4" (56.4 mm) square, 12 gauge wall, punched steel post.
 - E) - up to 6"x8" (152x203 mm) wood with breakaway holes shown on MT-105.11.
- 3) The following post types when installed in pairs (side by side) with less than 6'-5/8" (2 m) between posts, by imbedment or driving into earth to a depth of about 42 inches (1.1 m):
 - A) - up to 4"x4" (102x102 mm) wood.
 - B) - up to 2" (51 mm) diameter schedule 40 steel pipe.
 - C) - up to 3" (76 mm) diameter schedule 40 aluminum pipe.
 - D) - up to 2" (51 mm) square, 14 gauge wall, punched steel post.
- 4) Fixed Type III Barricades:
- 5) All breakaway connection beam supports, when installed according to the proper details shown on TC-41.10 with a minimum clear distance between supports of 7' (2.1 m) for supports larger than w6 x 9.
- 6) Any breakaway post or post and connection which has been crash tested and approved by the FHWA as satisfying the breakaway criteria described in 630.06.

(CONTINUED ON MT-105.11)

10-18-02

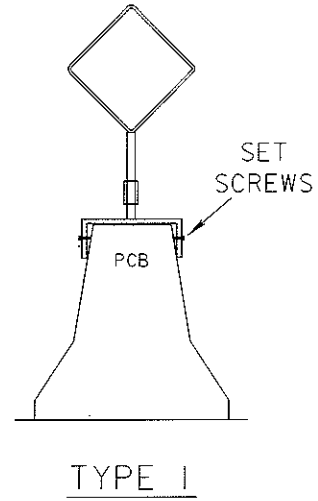
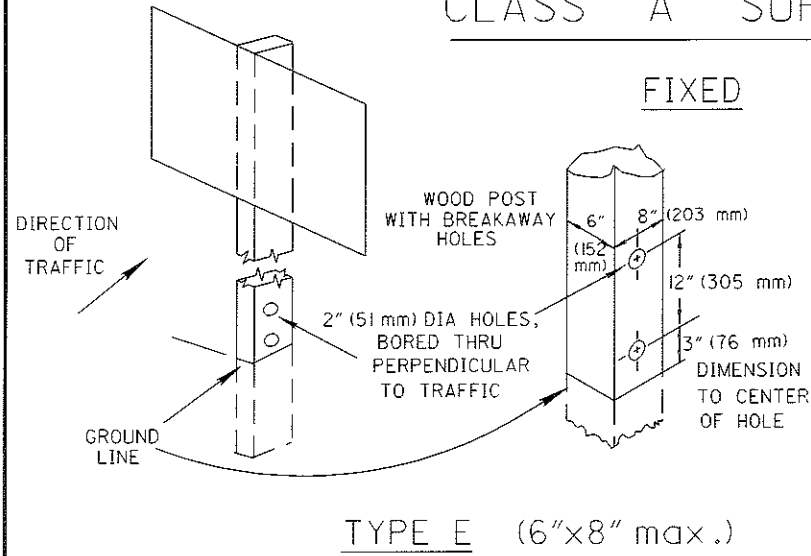
TEMPORARY SIGN SUPPORT I

OFFICE OF TRAFFIC
ENGINEERING

MT-105.10

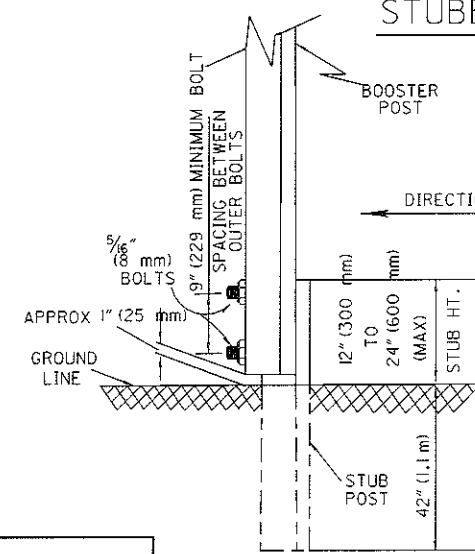
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CLASS A SUPPORTS



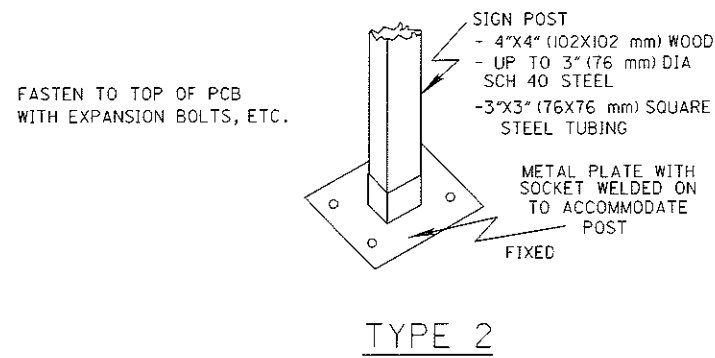
CLASS A SUPPORTS

STUBBING STANDARD



NOTES

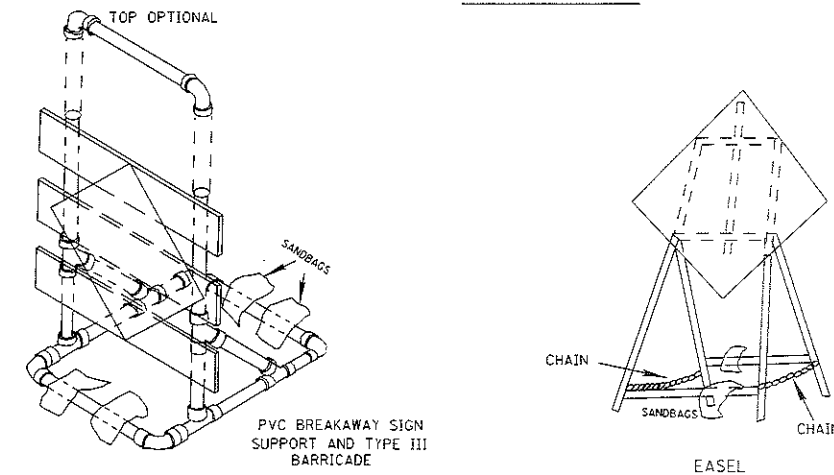
1. FOR USE WITH #3 POST OR SMALLER ONLY
2. BOLTS SHALL BE STEEL OR ALUMINUM
3. A MINIMUM OF TWO FASTENERS SHALL BE USED PER ASSEMBLY
4. BOOSTER POST SHALL BE MOUNTED BEHIND STUB POST
5. BOOSTER POST SHALL BE THE SAME OR 1LB/FT (1.5 kg/m) LESS THAN STUB POST



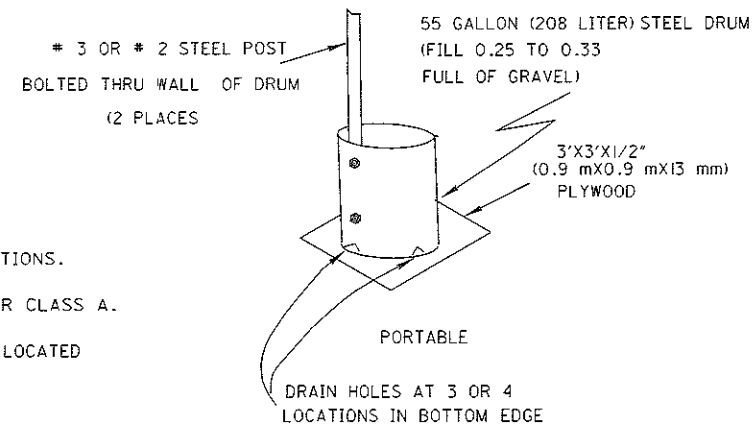
NOTE: SPECIFIC INFORMATION SEE MT-105.10

CLASS A SUPPORTS

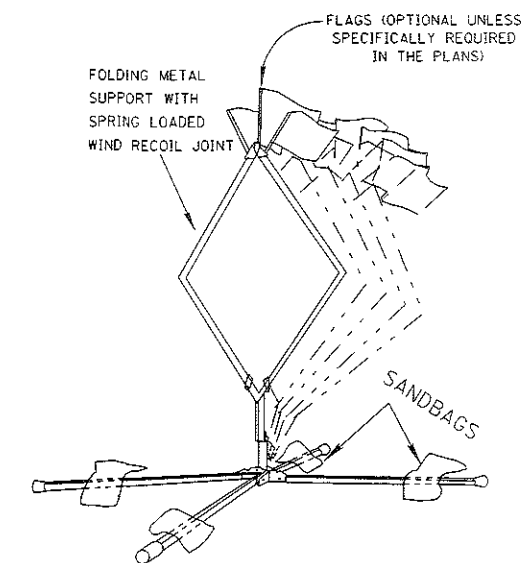
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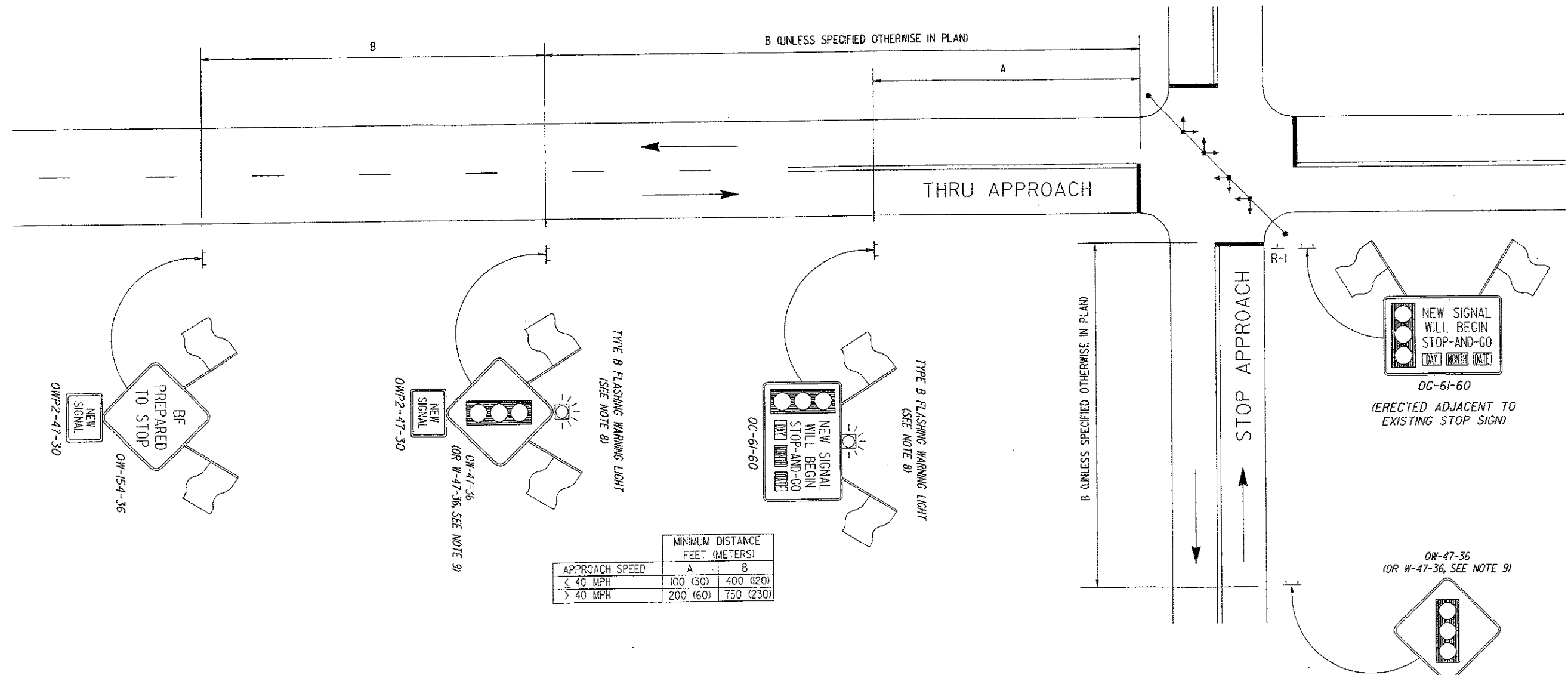


CLASS B SUPPORTS



1. ALL BEAM TYPE SUPPORTS WITHOUT BREAKAWAY CONNECTIONS.
2. SUPPORTS SIMILAR TO BUT LARGER THAN PERMITTED FOR CLASS A.
3. THE STEEL DRUM(S) SHOWN BELOW MAY BE USED ONLY WHEN LOCATED BEHIND GUARDRAIL OR BARRIER.

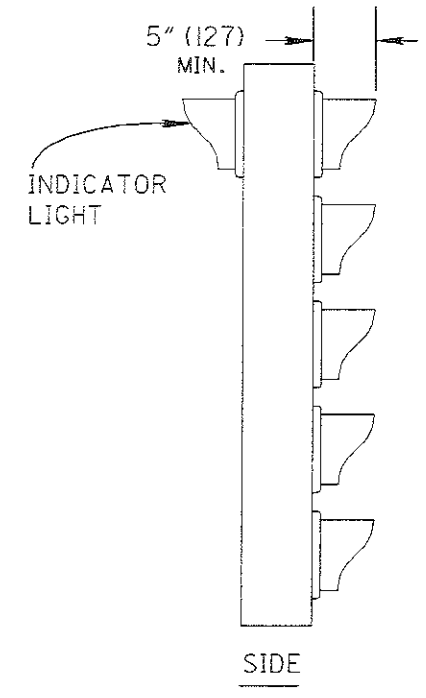
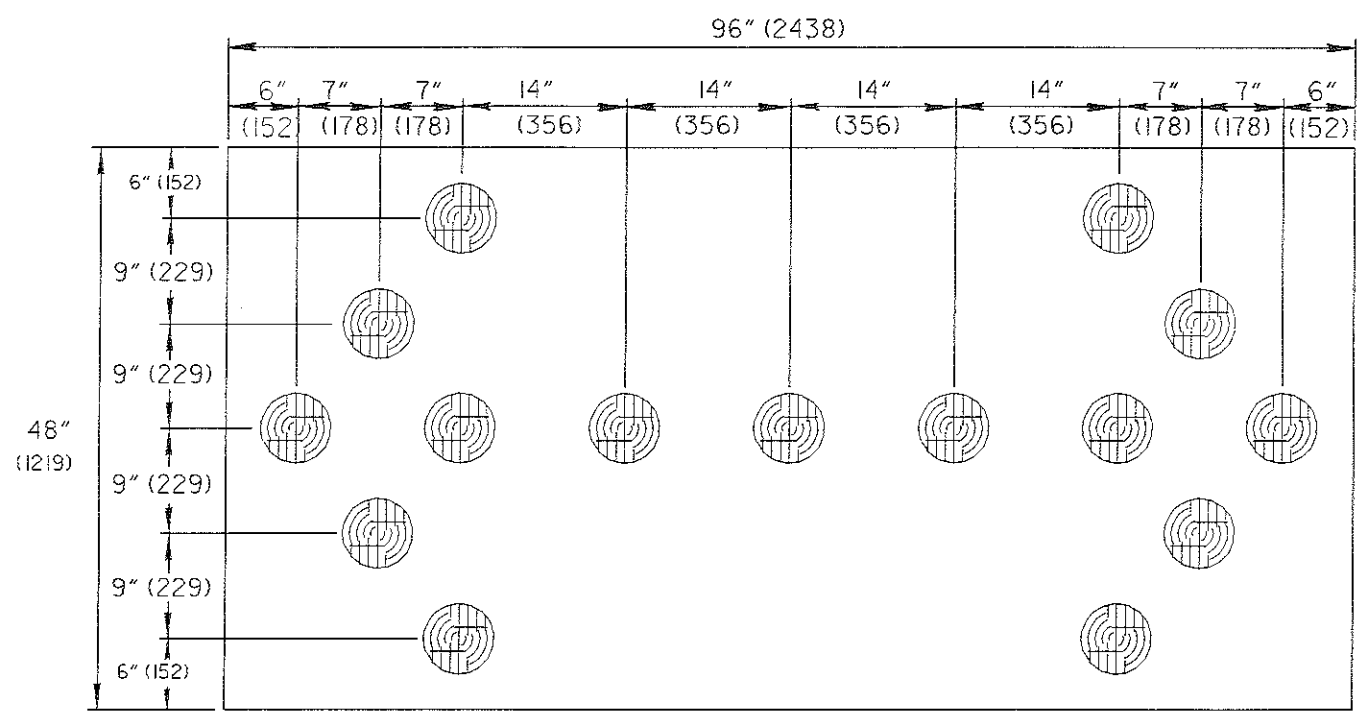
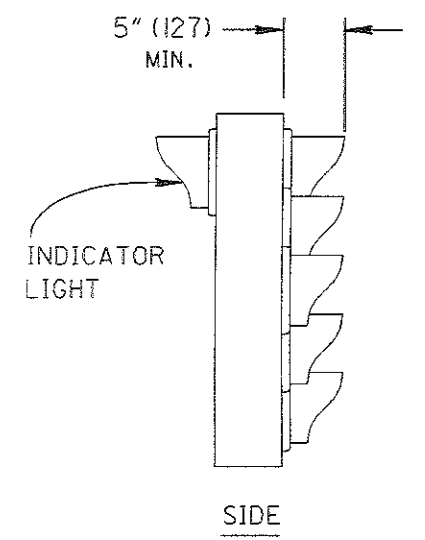
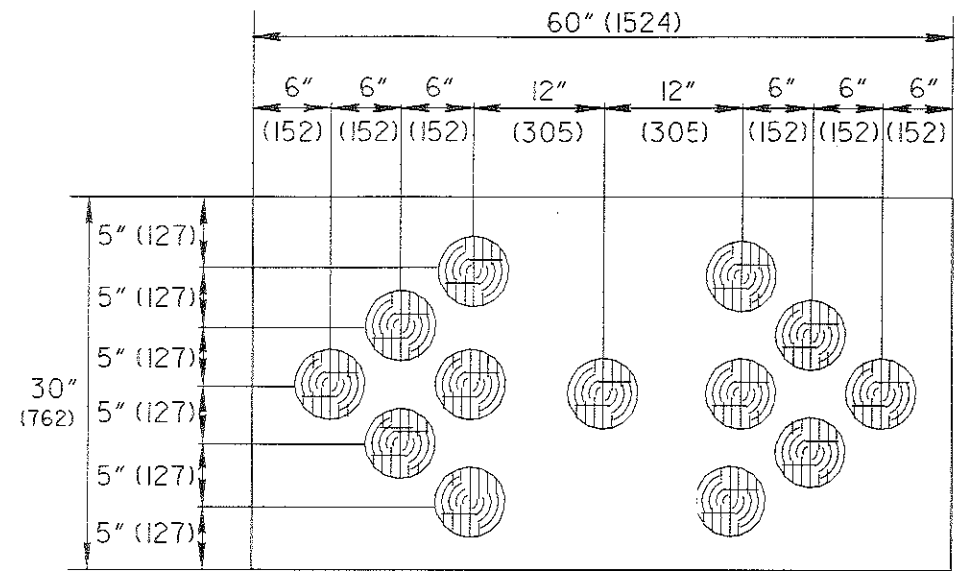
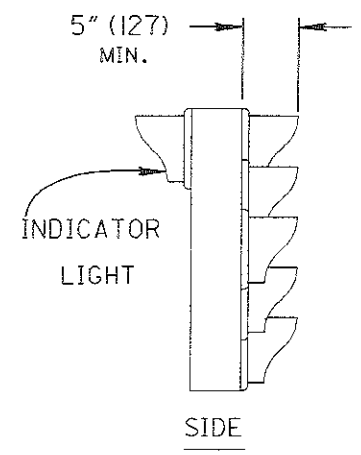
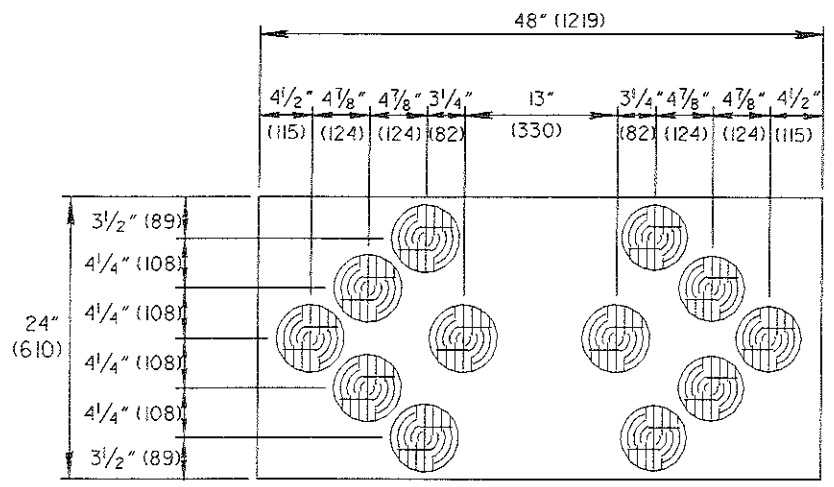




APPROACH SPEED	MINIMUM DISTANCE FEET (METERS)	
	A	B
< 40 MPH	100 (30)	400 (120)
> 40 MPH	200 (60)	750 (230)

NOTES:

- The Contractor shall furnish, install, maintain and remove all signs, flashing warning lights (when required) and flags as shown above, including supports and all necessary mounting hardware.
- After receiving approval from the Engineer to activate the signal, the Contractor shall notify the Engineer at least ten (10) days prior to placing the signal in stop-and-go mode to allow the Engineer time to notify local media and law enforcement of the schedule signal activation.
- A permanent new signal or signal upgrade from a flasher, shall operate in flash mode for three (3) to ten (10) consecutive days before being placed in a stop-and-go mode for the ten (10) day burn test, as directed by the Engineer.
- The Contractor shall erect the OC-61-60 (with activation day, month, and date; e.g. MON AUG 12) signs equipped with orange flags and flashing warning lights (when required) as shown above on each approach of the intersection at the time the signal is placed in flash mode.
- Immediately before placing the new signal installation in stop-and-go mode, the Contractor shall remove the OC-61-60 signs and install or uncover the OW-47 and OW-154 sign assemblies as shown above.
- Immediately after changing the signal to stop-and-go operation the Contractor shall remove the existing stop signs and post supports.
- The Contractor shall remove the flashing warning lights, flags, brackets, OWP2-30, OW-47, and OW-152 signs 21-30 days after the signal is placed in stop-and-go mode.
- Flags shall be erected as shown above. The flags shall be 18" X 18" (450 mm X 450 mm) in size, made of orange vinyl material, and securely fastened to the sign or sign support, when required by plan note, type B flashing warning lights shall be installed as shown above.
- The OW-154 sign installation (including the OWP2-47 sign and flags) on the thru approach shall be omitted when a permanent 'PREPARE TO STOP WHEN FLASHING' (W-44) sign is erected. When specified in the plan, a W-47 sign shall be used in place of the OW-47 sign on the thru approach. The 'NEW SIGNAL' (OWP2-47) sign, flags, and flashing warning light, when required, shall be installed with the W-47 sign as shown. When specified in the plan, a W-47 sign shall be used in place of the OW-47 sign on the stop approach. The 'NEW SIGNAL' (OWP2-47) shall be installed with the (OW-47) sign as shown.
- On multilane thru approaches, replace the OW-154-36 sign with an OW-154-48 sign, and replace the OW-47-36 sign with an OW-47-48 sign. On multilane divided thru approaches, erect signs in median identical to those on right to create dual installations, including supplemental signs and flags, and, when required by plan note, flashing warning lights.
- For multi-way stop approaches, each approach controlled by a stop sign shall be treated as shown above for the stop approach.
- The signal shall not be activated to stop-and-go operation on a Friday, Saturday or Sunday, or the day preceding or during a national holiday, (New Years, Memorial Day, Independence Day, Labor Day, Thanksgiving, or Christmas).
- Permanent supports, permanent signs (W-44 and W-47), and Type B flashing warning lights shall be paid for under separate pay items in the plan. Payment for all other labor, equipment and materials necessary to complete this work shall be included in the lump sum price bid for 614 Maintaining Traffic.



ALL DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS, UNLESS NOTED OTHERWISE.

FLASHING ARROW PANEL

The flashing arrow panel shall consist of the following components:

- A. flasher panel
- B. lamps
- C. controls
- D. power supply
- E. mounting

A. Flasher panel

The flasher panel shall be of exterior type plywood or corrosion resistant metal construction of adequate design and strength. The panel finish shall be flat black.

A flasher panel shall be one of three sizes. The type A panel shall be a nominal 24" (610 mm) high by 48" (1219 mm) wide. Type B shall be a nominal 30" (762 mm) high by 60" (1524 mm) wide. Type C shall be a nominal 48" (1219 mm) high by 96" (2438 mm) wide.

Flashing arrow panels shall normally utilize high output (4412A and 4415A) lamps powered by an engine driven generator when permitted by the plans. The contractor may also furnish units powered by a solar array and batteries or only batteries. However, these units shall not be used where the approaching traffic would be on a horizontal curve in excess of 3 degrees. These units shall not be used if the approaching traffic, closer than 1 mile (1.6 km) [1/2 mile (.8 km) where speed limits are less than 40 MPH], is more than 5 1/2 degrees horizontally or 2 degrees vertically from the central axis of the lens units.

B. Lamps

For engine powered generator units, lamps shall be ANSI Number 4412a (PAR 46) for type B and C and 4415a (PAR 36) for type A. The lamp shall be fitted with an upper hood of not less than 180° at least 5" (127 mm) long. Arrow panels may use a lower power (wattage) lamp than the standard arrow panels. The lamps shall be approximately 5" (127 mm) diameter with a parabolic reflector. The lamp shall provide improved light distribution control by means of high quality reflectors and refractors. The light output from each lamp of the arrow shall not be less than shown in figure 1 when operating at full daytime brightness.

The lamps shall be securely mounted and positioned in the panel perpendicular to the panel face and oriented so that the lamp location lug (on back of the lamp) is on the horizontal center line through the lens. The lug will be on the right side of the lamp as viewed from the front.

The lamps shall be wired in circuits that can be switched to display any one of the following messages: left arrow, right arrow, left and right, and caution bar. A minimum of three indicator lights shall be placed on the back of the panel to indicate which message mode is in operation.

Each panel shall contain the following number of lamps as a minimum: type A-12 lamps, type B-13 lamps, type C-15 lamps.

CANDLE POWER CHART

				100					4°
		100	150	200	150	100			2°
100	150	200	250	350	250	200	150	100	0° HORIZONTAL
		100	150	200	150	100			- 2°
				100					- 4°
10°	7.5°	5°	2.5°	0°	2.5°	5°	7.5°	10°	

- (1) Measurements expressed in candela.
- (2) Color of output light shall be yellow to light yellow.

Figure 1

C. Controls

Each flashing arrow panel shall contain a flasher control and a dimmer control unit housed in a cabinet which can be locked.

1. Flasher control

The flash rate for the sign panel shall be 25 to 40 flashes per minute. The flasher shall not cause electromagnetic interference. The lamps shall have a minimum "on time" of 50% and a maximum of 66%.

2. Dimmer control

Lamp intensity shall be variable by means of a photoelectrically controlled circuit which shall reduce lamp output during low ambient light conditions. Lamp intensity shall be at the nighttime level whenever the ambient illumination is in or below the range 2 foot-candle (21 lux) to 5 foot-candle (54 lux) and shall be at daytime level when ambient illumination is in or above the range 5 foot-candle (54 lux) to 10 foot-candle (108 lux). If controls provide for continuous adjustment of lamp intensity with respect to ambient illumination, then lamp intensity shall increase linearly from nighttime intensity at 5 foot-candle (54 lux) to daytime intensity at 3250 foot-candle (35,000 lux). A time delay shall be built into the control to prevent false operation due to light flashes. The photoelectric control shall contain a switch which shall override the photoelectric control.

D. Power supply

The flashing arrow panel shall operate from power sources capable of continuously furnishing the proper voltage to the lamps a minimum of 24 hours without attendance.

D. Cont.

Motor generators, if used shall be of modern design to provide low emission of pollutants and shall be properly muffled. The motor generator shall be enclosed in a mesh enclosure which can be locked. The fuel tank shall have a cap which can be locked. Motor generators supplying power to a flashing arrow sign shall not be used to supply power to other equipment. Gasoline fueled engines shall not be used.

Battery and solar/battery units shall have a no-charge-life of not less than 15 days. No-charge-life is the number of consecutive days that the system can continue to function (double arrow mode, normal dimming during 12 hour night, full output during 12 hour day) starting with a full battery charge and with no additional charge being provided by the solar cells. The no-charge-life may be based upon calculations providing that manufacturer's ratings and efficiency calculations are furnished for each major component.

E. Mounting

The flashing arrow panel may be trailer or vehicle mounted or mounted on a rigid supporting device suitable for maintaining it in the designated position. Each of the mounting methods shall be suitably stable such as to prevent movement due to high winds or passage of large vehicles.

When a trailer is used, construction shall be such as to transport the flashing arrow panel and appurtenances adequately and legally as well as support them properly during operation. The trailer shall be equipped with devices which shall provide leveling and stability during operation.

Minimum arrow panel mounting height shall be 7 feet (2.1m) above the pavement surface (measured to the bottom of the panel).

Use and operation

The flashing arrow panel shall be located as shown in the maintenance of traffic drawings or as directed by the Engineer and operated continuously during traffic maintained periods. The Contractor shall supply all fuel, lubricants and parts necessary to obtain continuous operation and shall provide all service. The Contractor shall inspect the operation of the unit daily, including weekends and holidays. The Contractor shall arrange with the Engineer, an acceptable method of obtaining service for a malfunctioning panel within 30 minutes of a reported malfunction. Lamp intensity shall be adjusted to provide minimum legibility distances of 1/2 mile (.8 km) type A, 3/4 mile (1.21 km) type B and 1 mile (1.6 km) type C.

Type C panels shall be used for stationary operations on high speed 55 MPH or greater, high volume roadways. Type B shall be used for stationary operations on intermediate speed 40-50 MPH facilities, and type A on low speed 20-35 MPH facilities.

In addition, type B panels shall be used for moving operations on freeways and expressways and type A for moving operations on other facilities.

Battery and solar/battery units shall be fully charged when first set up. They shall have gauges to indicate approximate battery charge remaining. The Contractor shall verify daily that the unit is operating satisfactorily and the remaining battery charge is sufficient for at least 2 more days.

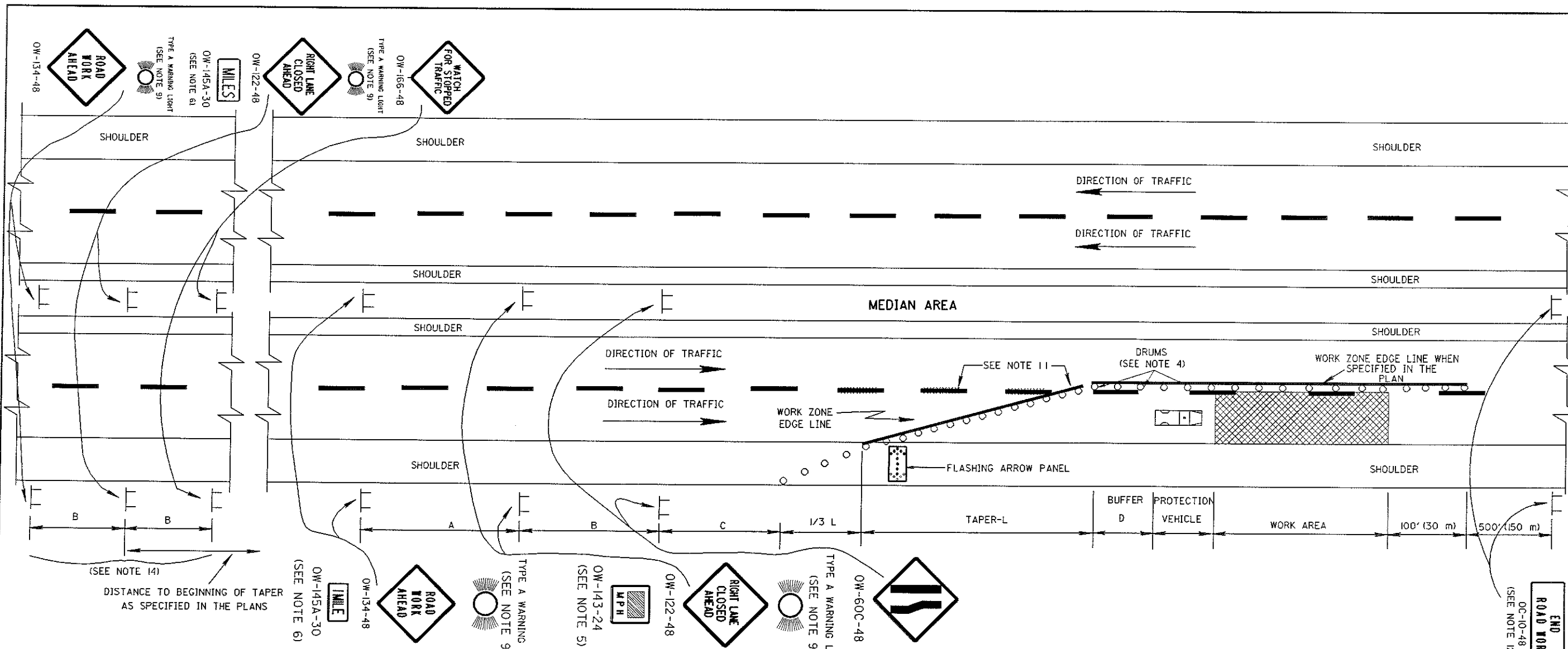
Flashing arrow panels are not to be used on two lane-two way roadways.

When left unattended the control cabinet, motor generator enclosure and fuel tank shall be locked.

Type A and type B panels used in moving operations may be powered by the vehicle's electrical system but shall not be left unattended when so powered.

When not in use, the flashing arrow panel shall be stored at a location which will not be hazardous to traffic or pedestrians.

The panels shall be designed for operation in 100% humidity and temperatures from -20 to + 130 degrees Fahrenheit (-29 to + 54 degrees Celsius).



GENERAL NOTES:

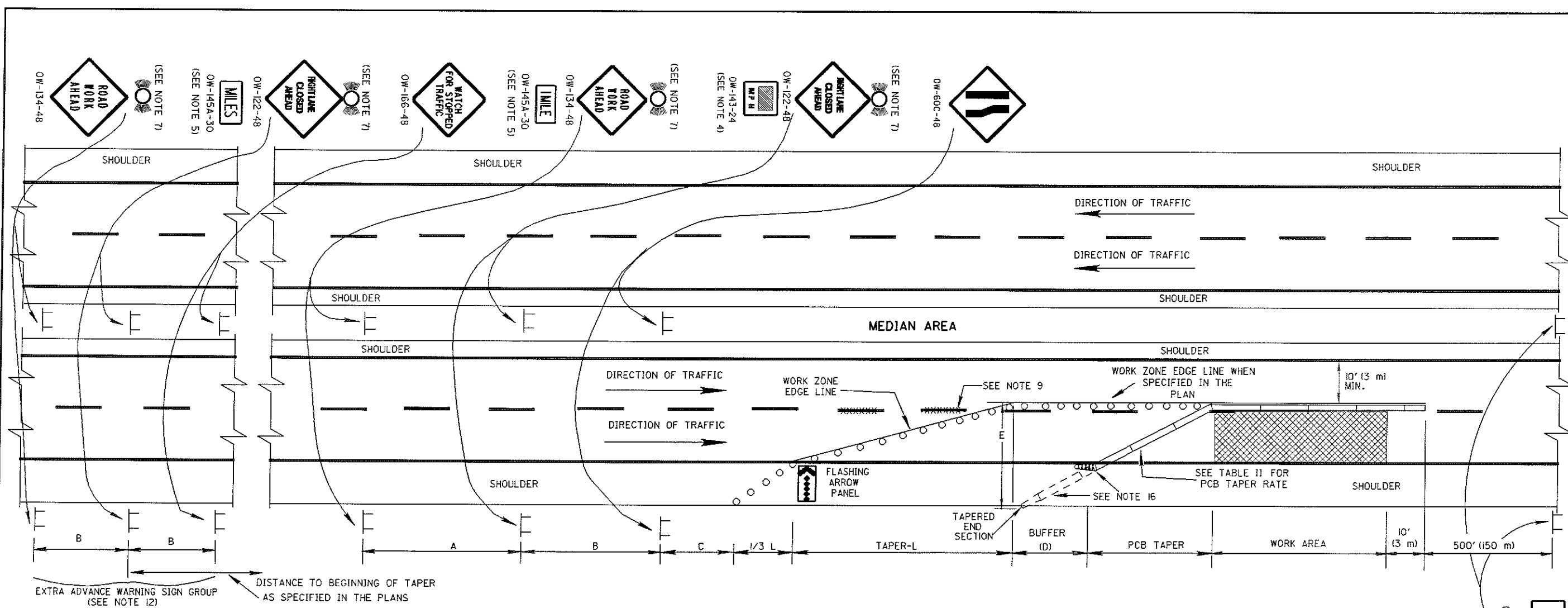
- The location of the merging taper and the advance warning signs should be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.
- The spacing between proposed signs should be adjusted to not conflict with and to provide a minimum of 200 ft (60 m) clearance to existing signs.
- The taper length (L) and spacing (s) of drums shall conform to table II. Drum spacing (s) shall be used for the merging taper, the buffer area and for the first 1000 ft (300 m) of the work area and at other hazardous locations as directed by the engineer. The maximum drum spacing for the balance of the work area is to be two times the spacing (s) in table II. A minimum of 5 drums shall be used to close the shoulder.
- Cones having a minimum height of 28 inches (0.7 m) may be substituted for drums for daytime lane closures. Provisions shall be made to safely stabilize the cones to prevent them from blowing over. If this cannot be achieved, drums shall be used.
- The advisory speed sign OW-143 shall be used when specified in the plan.
- The distance plate OW-145A shall indicate the distance to the beginning of the merging taper (L). Distances less than one mile may be expressed in feet. The plaque may be omitted if extra advance sign groups are not used.
- The protection vehicle, located close to the work, shall be in place and unoccupied whenever workers are in the work area. This vehicle shall be removed from the pavement whenever workers are not in the work area. The vehicle shall be equipped with a 360 degree rotating or flashing amber beacon clearly visible a minimum of 1/4 mile (400 m). Other protective devices may be used in lieu of the protection vehicle shown when approved by the Engineer.
- The flashing arrow panel shall meet the requirements of Standard Construction Drawing MT-35.10.
- Type A flashing warning lights shown on the OW-134 and OW-122 (I23) signs are required whenever a night lane closure is necessary
- When work is being performed in the lane adjacent to the median on a divided highway, OW-123 signs shall be substituted for the OW-122 signs and OW-60D signs shall be substituted for the OW-60C signs.
- If the construction operation requires the lane closure for more than one day then the existing conflicting pavement markings and reflectors from the raised pavement markers (RPMs) shall be removed and the appropriate color work zone edge line shall be applied along the taper. Work zone edge lines which would conflict with final traffic lanes shall be removable (740.06 type I) tape unless the area will be resurfaced in the next work phase. After completion of the work, pavement markings other than 740.06 type I shall be removed in accordance with 641.10. The original markings and raised pavement marker reflectors shall be restored at no additional cost.
- The DC-10 signs are only required for lane closures of more than one day and may be omitted if they fall within the limits of a construction project.
- OW-134 signs shall be provided on entrance ramps and/or side roads located within the work limits or the advance warning sign group. Within the length of closure, provision shall be made to control traffic entering from intersecting streets and driveways. Three drums shall be placed on each side across the closed lane at each intersection and driveway.
- Extra advance warning sign groups consisting of OW-134, OW-122 and OW-166 signs plus distance plates may be specified in the plans or required to be erected at the direction of the Engineer.
- All material and equipment shall be removed from the closure and the work area when no work is being done.
- The speed limit chosen for design of tapers shall be the normal legal speed except where the legal speed limit is reduced due to the construction and the subject lane closure is not the first active construction area encountered by traffic within the project.
- This drawing should be used on projects with dropoffs less than 5' in the work area. Projects with dropoffs greater than 5' in the work area should refer to MT-95.40 or MT-95.41.

TABLE I

MINIMUM DISTANCE FT (METERS)	A	B	C
MAJOR STANDARD	500 (150)	500 (150)	500 (150)
FREEWAY & EXPRESSWAY	2600 (780)	1600 (480)	1000 (300)

TABLE II

NORMAL SPEED LIMIT (MPH)	MINIMUM TAPER (L) FT (m)	MAXIMUM SPACING (S) OF DRUMS FT (m)	BUFFER (D) FT (m)
30-40	320 (98)	30 (9)	170 (52)
45-55	660 (201)	40 (12)	335 (102)
60-65	780 (238)	60 (18)	485 (148)



GENERAL NOTES:

- The location of the merging taper and the Advance Warning signs should be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment.
- The spacing between proposed signs should be adjusted to not conflict with and to provide a minimum of 200 ft (60 m) clearance to existing signs.
- The Taper length (L) and spacing (S) of drums shall conform to table II. Drum spacing (s) shall be used for the merging taper and the buffer area. A minimum of 5 drums shall be used to close the shoulder.
- The advisory speed sign OW-143 shall be used when specified in the plan.
- The distance plate OW-145A shall indicate the distance to the beginning of the merging taper (L). Distances less than one mile may be expressed in feet. The plaque may be omitted if extra advance sign groups are not used.
- The flashing arrow panel shall meet the requirements of Standard Construction Drawing MT-35.10.
- Type A flashing warning lights shown on the OW-134 and OW-122 (123) signs are required.
- When work is being performed in the lane adjacent to the median on a divided highway, OW-123 signs shall be substituted for the OW-122 signs and OW-600 signs shall be substituted for the OW-600 signs.

- The existing conflicting pavement markings and reflectors from the raised pavement markers (RPMs) shall be removed and the appropriate color work zone edge line shall be applied along the taper. Work zone edge lines which would conflict with final traffic lanes shall be removable (740.06 Type-II) tape unless the area will be resurfaced in the next work phase. After completion of the work, pavement markings other than 740.06, Type I shall be removed in accordance with 641.10. The original markings and raised pavement marker reflectors shall be restored at no additional cost.
- The OC-10 signs may be omitted if they fall within the limits of a construction project.
- OW-134 signs shall be provided on entrance ramps and/or side roads located within the work limits or the advance warning sign group. Within the length of closure, provision shall be made to control traffic entering from intersecting streets and driveways. Three drums shall be placed across the closed lane at each intersection and driveway.
- Extra advance warning sign groups consisting of OW-134, OW-122 and OW-166 signs plus distance plates may be specified in the plans or required to be erected at the direction of the Engineer.
- The speed limit chosen for design of tapers shall be the normal legal speed except where the legal speed limit is reduced due to the construction and the subject lane closure is not the first active construction area encountered by traffic within the project.
- No equipment or material shall be located other than behind the PCB.
- This standard drawing shall be used with standard drawing MT-101.70.

- A taper end section may be used in place of the impact attenuator at locations where the last full section of PCB can be extended outside of the clear zone for approaching traffic. See TABLE II for clear zone widths.
- This standard drawing should be used in projects with Drop-Offs in the work area that are 5' or greater.

TABLE I

MINIMUM DISTANCE FT (m)	A	B	C
MAJOR STANDARD	500 (150)	500 (150)	500 (150)
FREEWAY & EXPRESSWAY	2600 (780)	1600 (480)	1000 (300)

TABLE II

SPEED LIMIT (MPH)	MINIMUM DRUM TAPER (L) FT (m)	MAXIMUM SPACING (S) OF DRUMS FT (m)	PCB TAPER RATE	BUFFER (D) FT (m)	CLEAR ZONE WIDTH (E) FT (m)
30-40	320 (98)	30 (10)	11 : 1	170 (52)	15 (5)
45-55	660 (201)	40 (12)	16 : 1	335 (102)	23 (7)
60-65	780 (238)	60 (18)	19 : 1	485 (148)	30 (9)

LEGEND

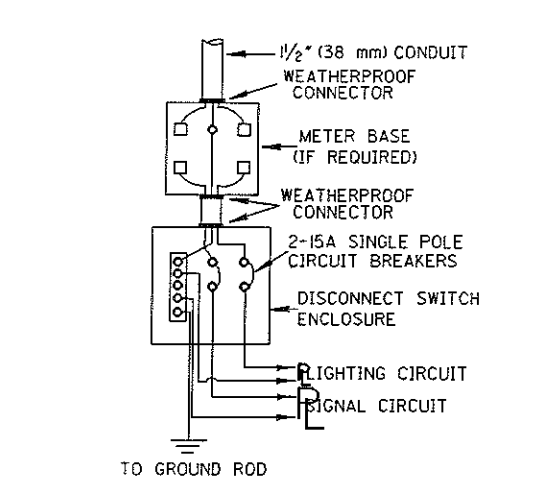
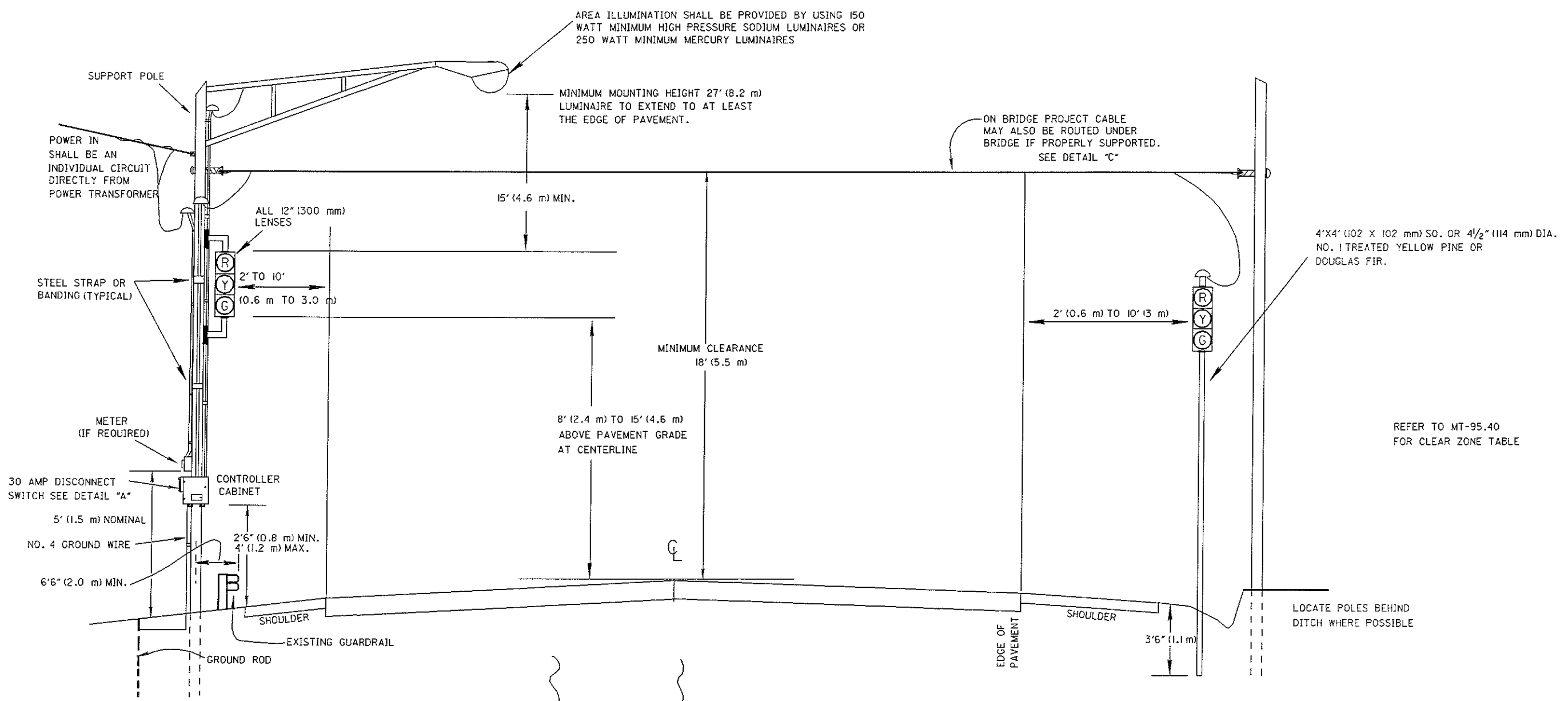
DRUMS ○ ○ ○ ○ ○ ○ ○ ○

PORTABLE CONCRETE BARRIER (PCB) [Symbol]

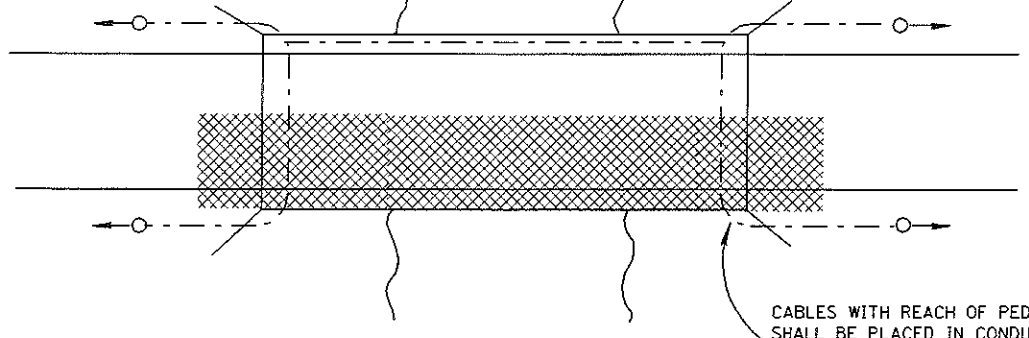
REMOVE EXISTING MARKINGS XXXXXXXXXX

ATTENUATOR [Symbol]

OPTIONAL TREATMENT [Symbol]

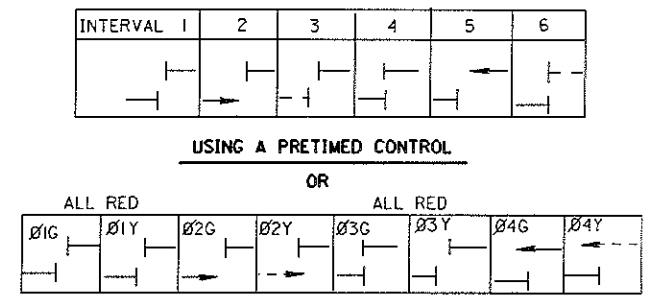


DETAIL "A"



ALTERNATE CABLE ROUTING

DETAIL "C"

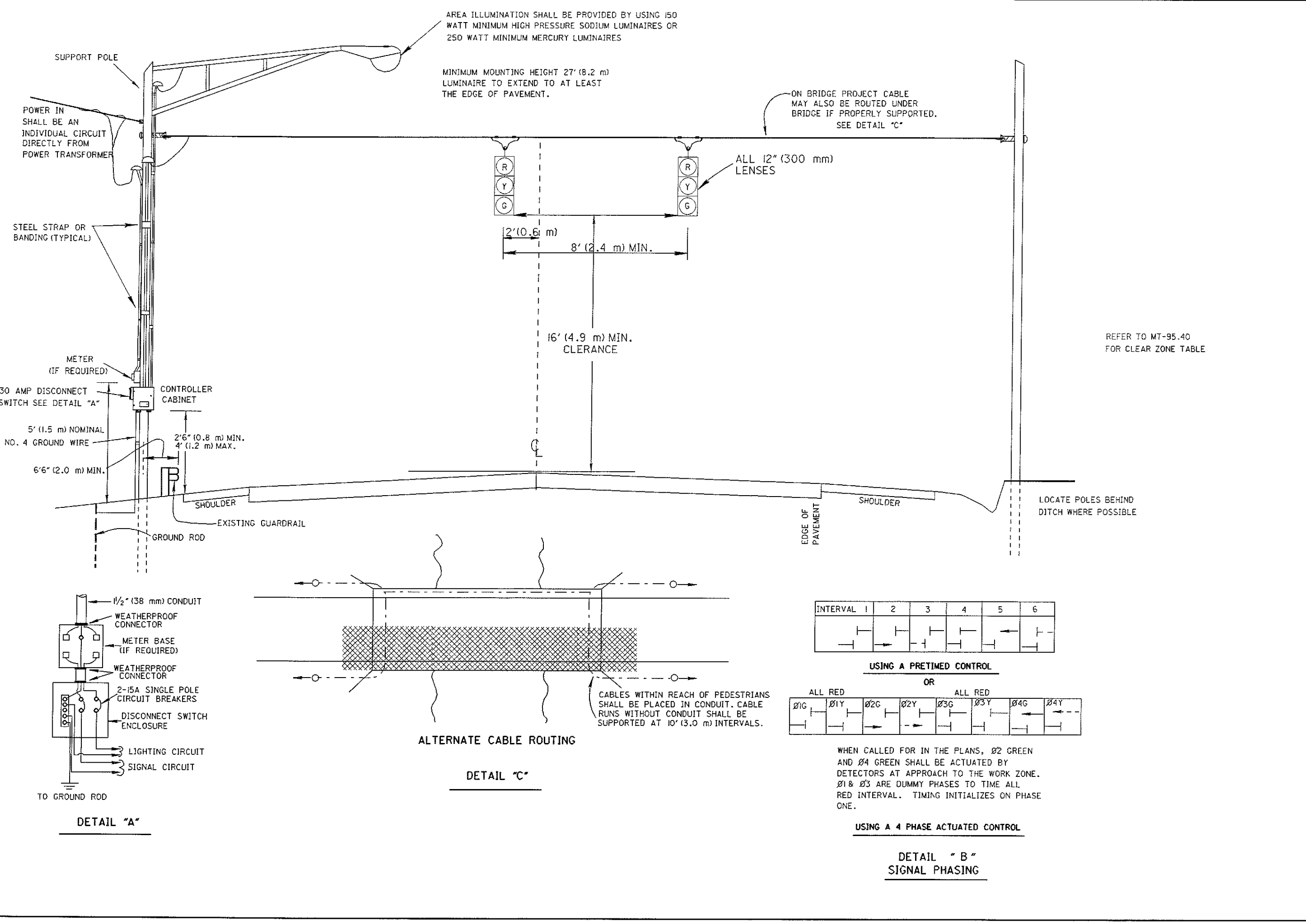


WHEN CALLED FOR IN THE PLANS, Ø2 GREEN AND Ø4 GREEN SHALL BE ACTUATED BY DETECTORS AT APPROACH TO THE WORK ZONE. Ø1 & Ø3 ARE DUMMY PHASES TO TIME ALL RED INTERVAL. TIMING INITIALIZES ON PHASE ONE.

USING A 4 PHASE ACTUATED CONTROL

DETAIL "B" SIGNAL PHASING

lmccome@TRCCD109 - m19621.m - Wednesday April 10 2002 07:12:52 AM EDT



AREA ILLUMINATION SHALL BE PROVIDED BY USING 150 WATT MINIMUM HIGH PRESSURE SODIUM LUMINAIRES OR 250 WATT MINIMUM MERCURY LUMINAIRES

MINIMUM MOUNTING HEIGHT 27' (8.2 m) LUMINAIRE TO EXTEND TO AT LEAST THE EDGE OF PAVEMENT.

ON BRIDGE PROJECT CABLE MAY ALSO BE ROUTED UNDER BRIDGE IF PROPERLY SUPPORTED. SEE DETAIL "C"

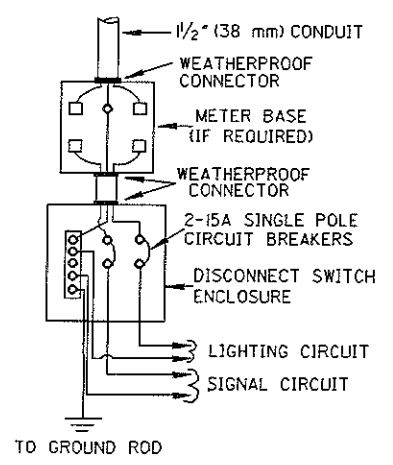
ALL 12" (300 mm) LENSES

2' (0.6 m) 8' (2.4 m) MIN.

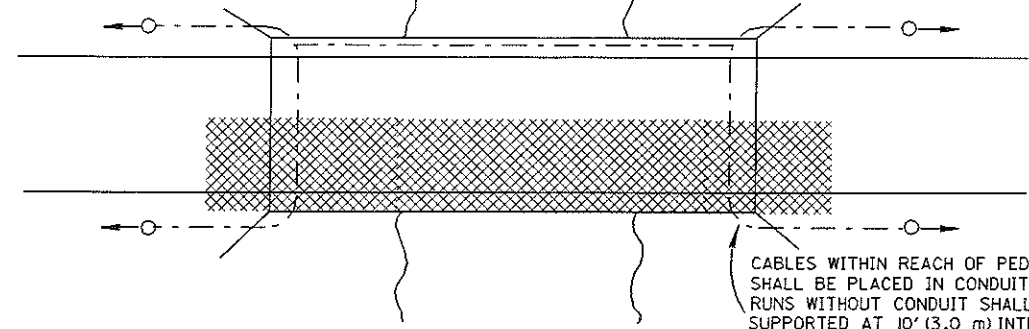
16' (4.9 m) MIN. CLEARANCE

REFER TO MT-95.40 FOR CLEAR ZONE TABLE

LOCATE POLES BEHIND DITCH WHERE POSSIBLE

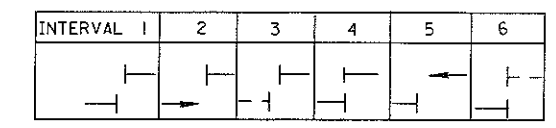


DETAIL "A"



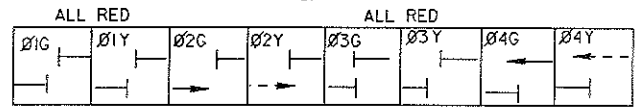
ALTERNATE CABLE ROUTING

DETAIL "C"



USING A PRETIMED CONTROL

OR



WHEN CALLED FOR IN THE PLANS, Ø2 GREEN AND Ø4 GREEN SHALL BE ACTUATED BY DETECTORS AT APPROACH TO THE WORK ZONE. Ø1 & Ø3 ARE DUMMY PHASES TO TIME ALL RED INTERVAL. TIMING INITIALIZES ON PHASE ONE.

USING A 4 PHASE ACTUATED CONTROL

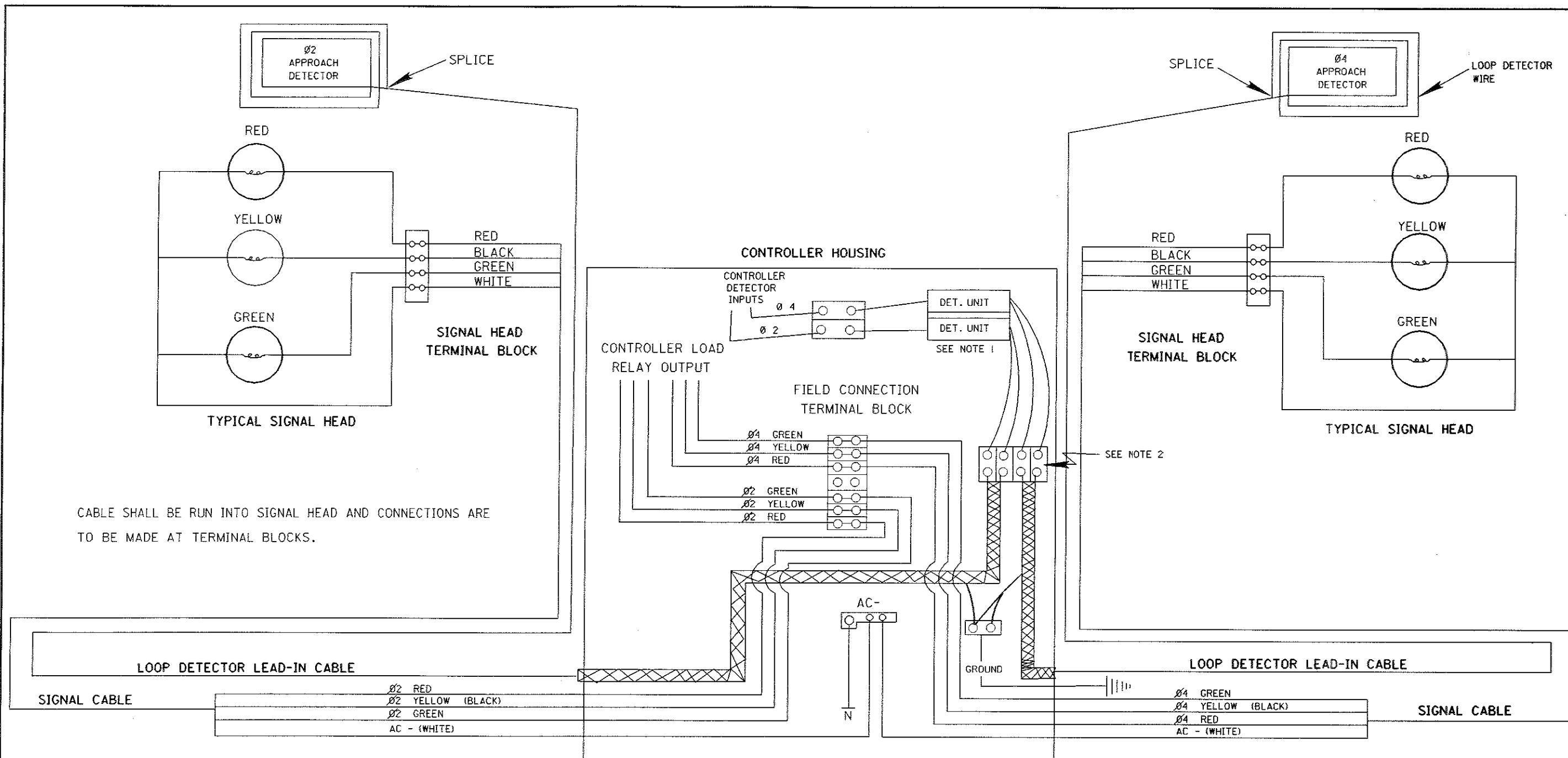
DETAIL "B" SIGNAL PHASING

04-19-02

DETAILS FOR SIGNALIZED CLOSING 1 LANE OF A 2 LANE HIGHWAY-OVERHEAD MOUNTED

OFFICE OF TRAFFIC ENGINEERING

MT-96.21



CABLE SHALL BE RUN INTO SIGNAL HEAD AND CONNECTIONS ARE TO BE MADE AT TERMINAL BLOCKS.

TYPICAL SIGNAL HEAD HOOK-UP

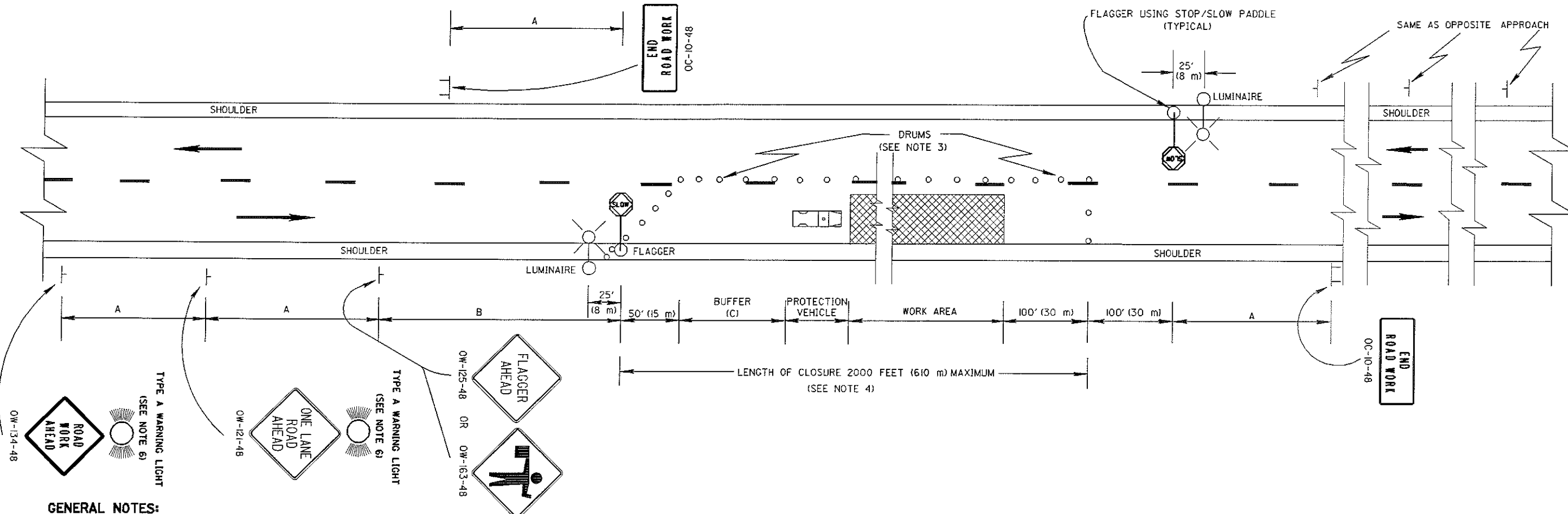
GENERAL NOTES:

1. Detection may be loop, magnetometer, sonic or infra-red but shall be chosen, installed and operated to provide dependable accurate detection on each approach without false calls resulting from other traffic. Cabling shown is for loop detectors. However, suitable cable types, as recommended by the manufacturers shall be used for other detectors.
2. Lightning protection, as required in 733.04 shall be provided for solid state electronic controllers and detectors.
3. Signal cable shall be 5/c No. 14 AWG as specified in 732.19. All electrical connections to be made at terminal blocks using lock fork terminals. Splices in signal cable should be avoided but if necessary splice kits shall be used. All connections at splice points shall be soldered.
4. Signal timing settings shall be as shown in the plans or provided to the Contractor by the Engineer prior to implementation of signal control. The Contractor shall periodically monitor the signal operation to determine failure or inefficient operation.

All equipment failures including timing mechanisms and detectors shall be reported to the Engineer and fully repaired by the Contractor as soon as possible, but in no case longer than 8 hours following notification of the

Contractor by the Engineer. All failures resulting in unsafe operations of the signal (i.e., signal or lamp failure, short-timing of yellow or all red intervals, mis-aimed signals, conflicting displays) shall result in the Contractor using 2-way radios to control traffic through the work area until the signal is fully repaired. Failures shall include situations caused by traffic accidents, acts of God or any other cause whether under the control of the Contractor or not.

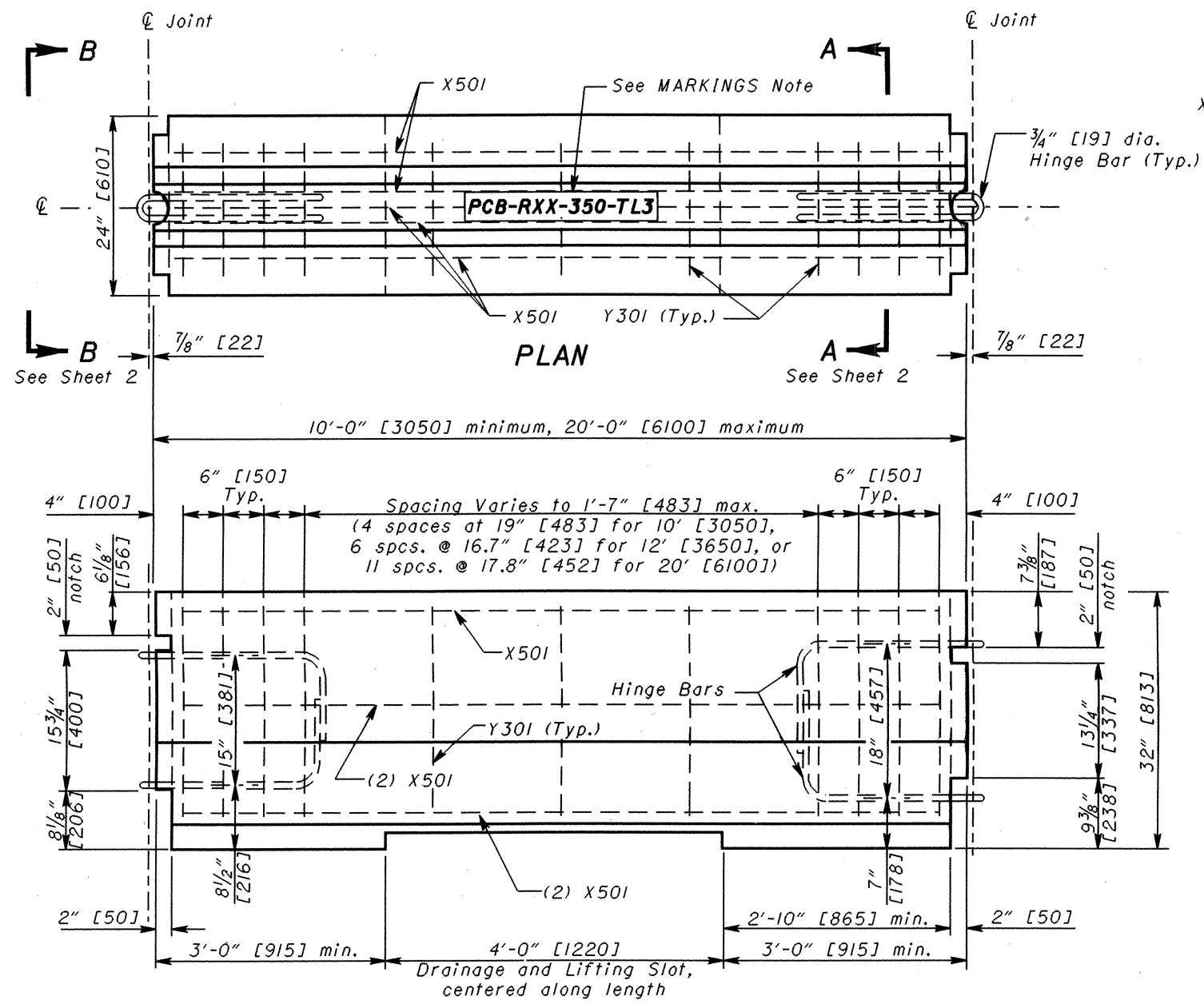
If the Engineer determines that the signal operation, although in accordance with the plans and previous orders, is not providing acceptable safe and efficient movement of traffic, the Engineer shall order that appropriate changes such as timing alterations, signal or detector relocations, etc. be made to remedy the situation, at no additional cost to the State. Timing changes and signal relocations shall be implemented within four hours, detector relocations and changes within 24 hours. Failure to make required changes within these time limits shall result in the assessment of liquidated damages of \$100.00 per calendar day until the changes are completed.



GENERAL NOTES:

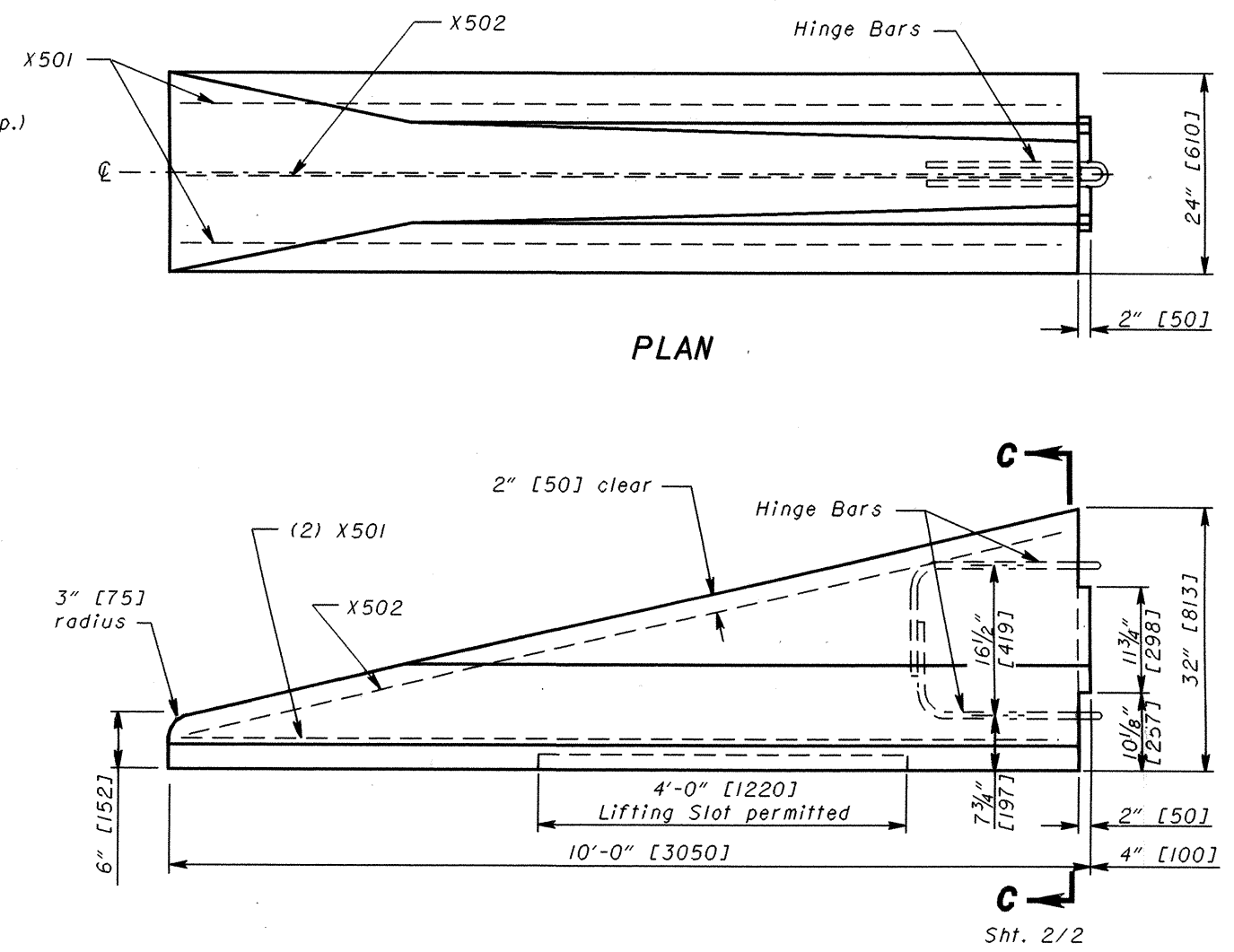
1. The location of the Advance Warning signs should be adjusted to provide for adequate sight distance for the existing vertical and horizontal roadway alignment. The distances shown are minimums.
2. Flaggers, one for each direction shall be used to control traffic continuously for as long as a one lane operation is in effect. The flaggers shall be able to communicate with each other at all times.
3. Drums shall be spaced at 50' (15 m) center to center along the closure. Drums on the advance taper shall be spaced at 10' (3 m) center to center. Cones having a minimum height of 28" (0.7 m) may be substituted for drums for daytime lane closures. Provisions shall be made to stabilize the cones to prevent them from blowing over.
4. Several small work areas close together shall be combined into one work zone. However, the closure shall not be more than 2000' (610 m) long unless approved by the Engineer. The minimum length between closures shall be 2000' (610 m). Only one side of the road shall be closed in any one work zone.
5. The protection vehicle shown at the beginning of the work area shall be in place and unoccupied whenever workers are in the work area. This protection vehicle shall be removed from the pavement when workers are not in the work area. Other protective devices such as truck mounted attenuator may be used. The vehicle shall be equipped with a 360° rotation or flashing amber beacon clearly visible a minimum of one quarter mile (400 m).
6. The Type A flashing warning lights shown on the OW-134 and the OW-121 signs are required whenever a night lane closure is necessary.
7. Adequate area illumination of each flagger station shall be provided at night by using 150 watt minimum high pressure sodium luminaires or 250 watt minimum mercury luminaires. Luminaires shall be located adjacent to one flagger station for each direction of traffic as shown above. The mounting height for luminaires shall be a minimum of 27' (8.2 m) above the pavement and mounted on a support of adequate strength to provide a satisfactory installation. The overhead conductor clearance shall be a minimum of 18' (5.5 m) above the pavement. The luminaire arm shall be of sufficient length to extend to the edge of the pavement. Poles shall be erected a minimum of 6'6" (2.1 m) behind face of guardrail where existing, or 12' (3.6 m) from the edge of pavement, where possible locate the luminaires behind ditch. Lighting material shall comply with specification 713.
8. Within the length of closure, provision shall be made to control traffic entering from intersecting streets and major drives as necessary to prevent wrong way movements and to keep vehicles off of new pavement not ready for traffic. The method of control shall be subject to the approval of the Engineer.
9. 36 inch (900 mm) warning sign sizes may be used when the legal speed limit is 40 mph or less.

MINIMUM DISTANCE FT (m)	A	B	C
URBAN (≤ 40 MPH)	200 (60)	200 (60)	170 (50)
URBAN (≥ 45 MPH)	350 (105)	350 (105)	335 (100)
RURAL	500 (150)	500 (150)	335 (100)



ELEVATION

32" [813-mm] BARRIER SECTION



ELEVATION

32" [813] TAPERED END

NOTES

GENERAL: See CMS 622 for additional information.

PORTABLE CONCRETE BARRIER (PCB): PCB, as shown, shall not be used on bridge deck edges. PCB, Bridge Mounted, shall be used at such locations in accordance with **Structural Engineering's Standard Drawing PCB-91 [PCB-91M]**.

CONNECTING HARDWARE: Bolts, washers and hex nuts shall be galvanized after fabrication per CMS 711.02 and shall meet the requirements of CMS 711.09 except that the Rotational Capacity test specified in ASTM A 325 shall be waived.

In lieu of the pin and loop connections detailed on this Standard Construction Drawing, barrier sections with "J-J Hooks" end connections may be utilized.

Transition barrier sections with pin and loop connections on one end and "J-J Hooks" on the other shall be used to connect runs of "J-J Hooks" barrier to other permitted barrier types. The heights of the transition sections shall be the same as the barrier runs being connected.

"J-J Hooks" is a trademark of Easi-Set Industries, P.O. Box 300, Midland, VA 22728, (540) 439-8911 or (800) 547-4045.

HINGE AND REINFORCING BARS: The 3/4" [19] hinge may be ASTM A-36. Rebars shall meet the requirements of CMS 509. Black steel is permitted.

HANDLING DEVICES: Such devices may be used in lieu of the lifting slot for moving the barrier. They may be of any design sufficient to safely handle the weight of the section being lifted. No handling devices shall protrude from the surface of the barrier when in place.

MARKINGS: All barrier segments shall be marked on the top, as shown, where XX indicates the year cast. These markings shall be permanently impressed in the barrier using a minimum of 2" [50] high lettering. The tapered end section is not required to be marked.

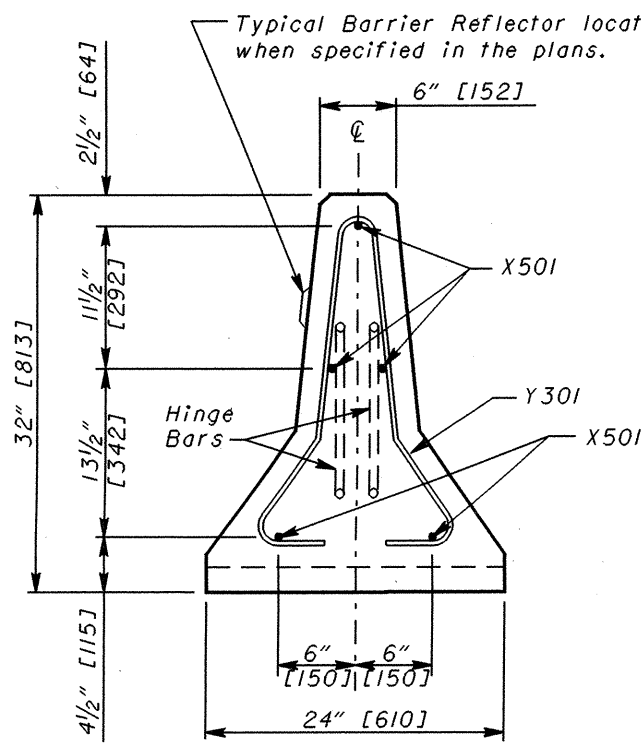
Each segment, including the tapered end section, shall have on its top, a unique identification as to its manufacturer. And somewhere on the barrier, the day and the month that the barrier was manufactured.

REFLECTORIZATION: Barrier reflectors shall be installed in accordance with **Traffic Engineering Standard Drawing MT-95.82**, when specified in the plans.

The Tapered End section is not a crashworthy terminal and should not be used on the approach end of temporary barrier unless it is fully located beyond the clear zone.

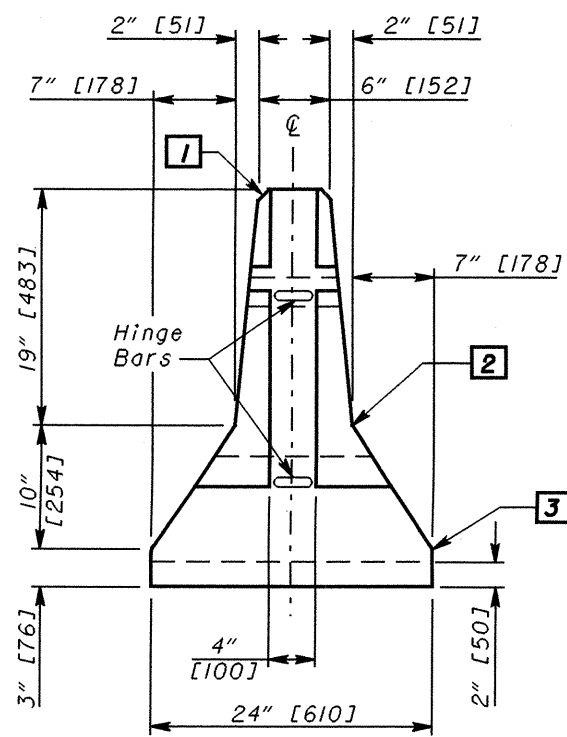
THIS DRAWING REPLACES RM-4.2 DATED 1-18-02.

NUMBER RM-4.2	STANDARD ROADWAY CONSTRUCTION DRAWING 32" PORTABLE CONCRETE BARRIER	ROADWAY ENGINEERING SERVICES	OHIO DEPARTMENT OF TRANSPORTATION D. Focke ROADWAY DESIGN ENGINEER	4-18-03
				DATE

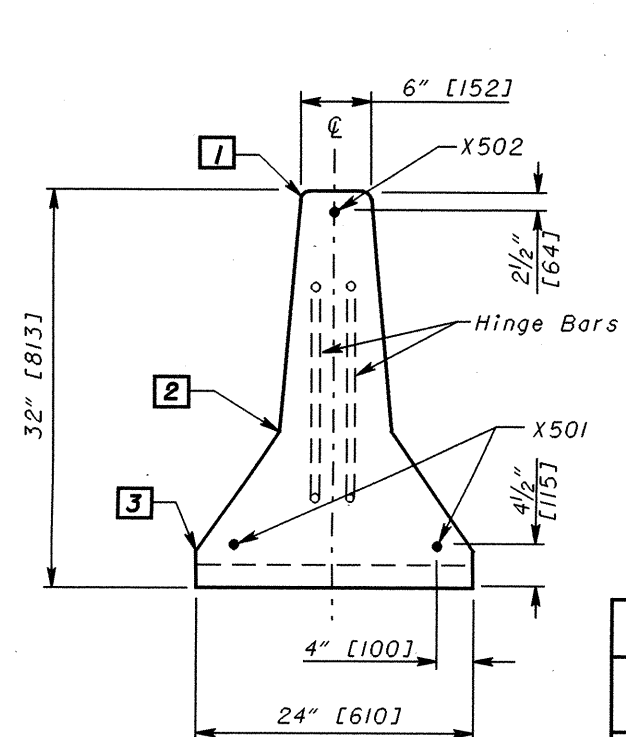


Vertical edges on Lifting Slot may be battered. Depth 2" ± 1/4" [50 ± 6].

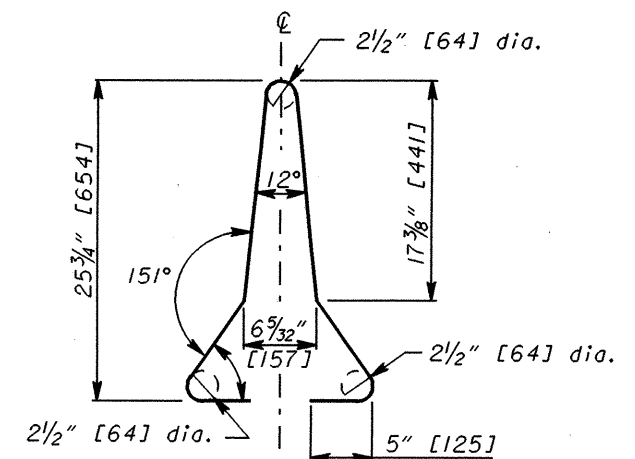
SECTION A-A
See Sheet 1.



VIEW B-B
See Sheet 1.

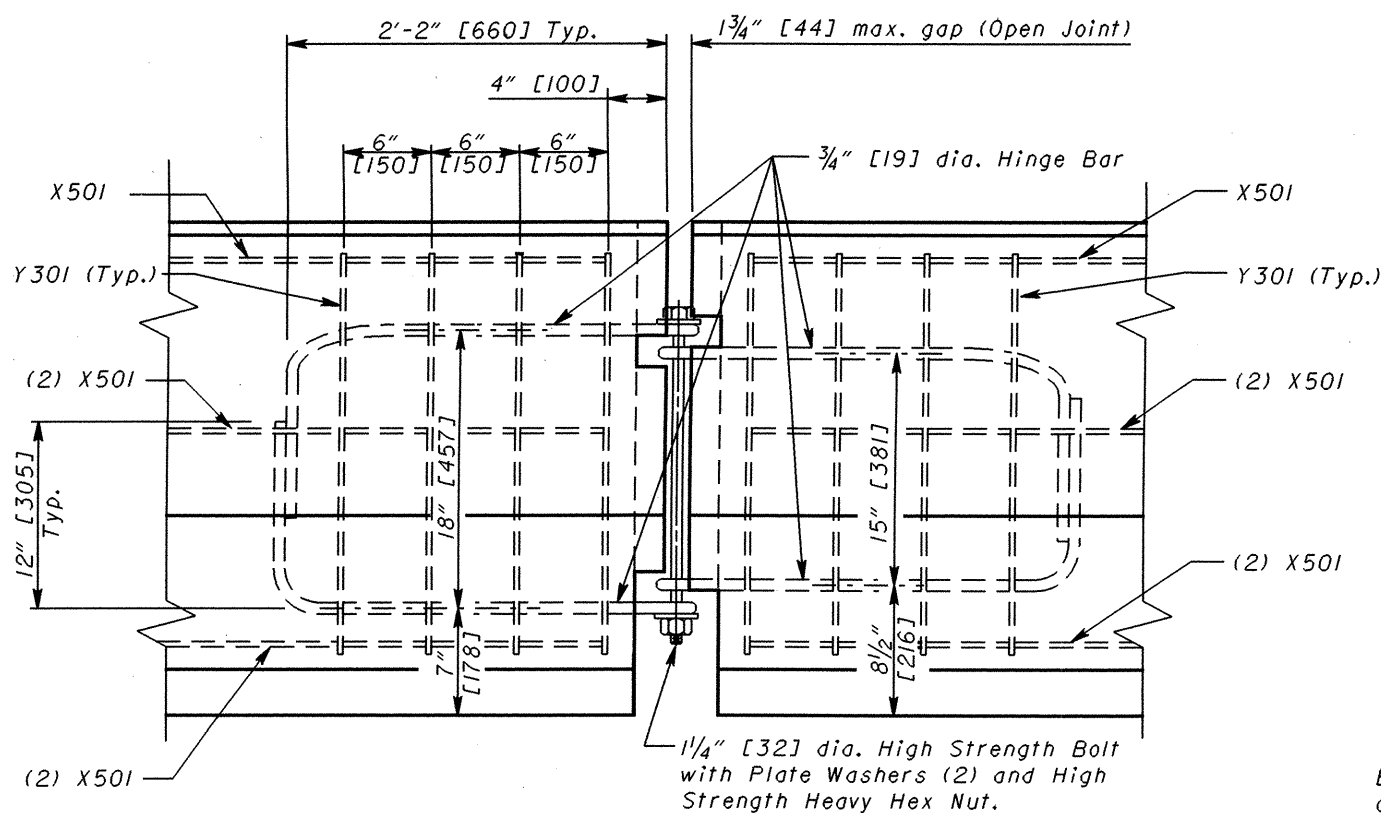


SECTION C-C
Tapered End Section
See Sheet 1.

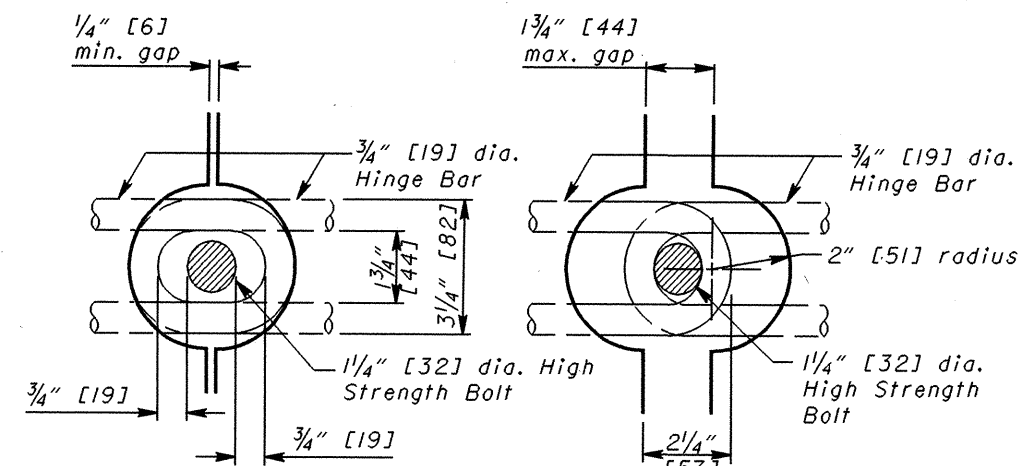


Y301
BENDING DIAGRAM

REINFORCING BAR LIST							
	Mark	Bar	Bar Length	Shape	Quantity per typ. length		
					10'	12'	20'
BARRIER SECTION	X501	#5 [#16M]	9'-4" [2850]	Str.	5	---	---
			11'-4" [3450]	Str.	---	5	---
			19'-4" [5890]	Str.	---	---	5
	Y301	#3 [#10M]	5'-5" [1650]	Bent	11	13	18
TAPERED END	X501	#5 [#16M]	9'-6" [2900]	Str.	2	---	---
	X502	#5 [#16M]	9'-8" [2950]	Str.	1	---	---



DETAIL AT HINGED CONNECTION



CLOSED JOINT

Barriers shall initially be placed close together so that Bolts can be easily inserted through Hinge Bar loop.

OPEN JOINT

Barrier joints shall be fully open before the Nut is tightened onto Bolt.

LEGEND

- 1 1" [25] radius or 3/4" [19] chamfer, all top and end corners.
- 2 Permissible 10" [250] radius.
- 3 Permissible 1" [25] radius.

THIS DRAWING REPLACES RM-4.2 DATED 1-18-02.

LEGEND: N.S. - NEAR SIDE
F.S. - FAR SIDE

DESIGN SPECIFICATIONS: "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES" ADOPTED BY AASHTO, 1996, AND THE ODOT BRIDGE DESIGN MANUAL.

DESIGN DATA:
CONCRETE - COMPRESSIVE STRENGTH 4500 PSI.
REINFORCING STEEL - MINIMUM YIELD STRENGTH = 60,000 PSI.

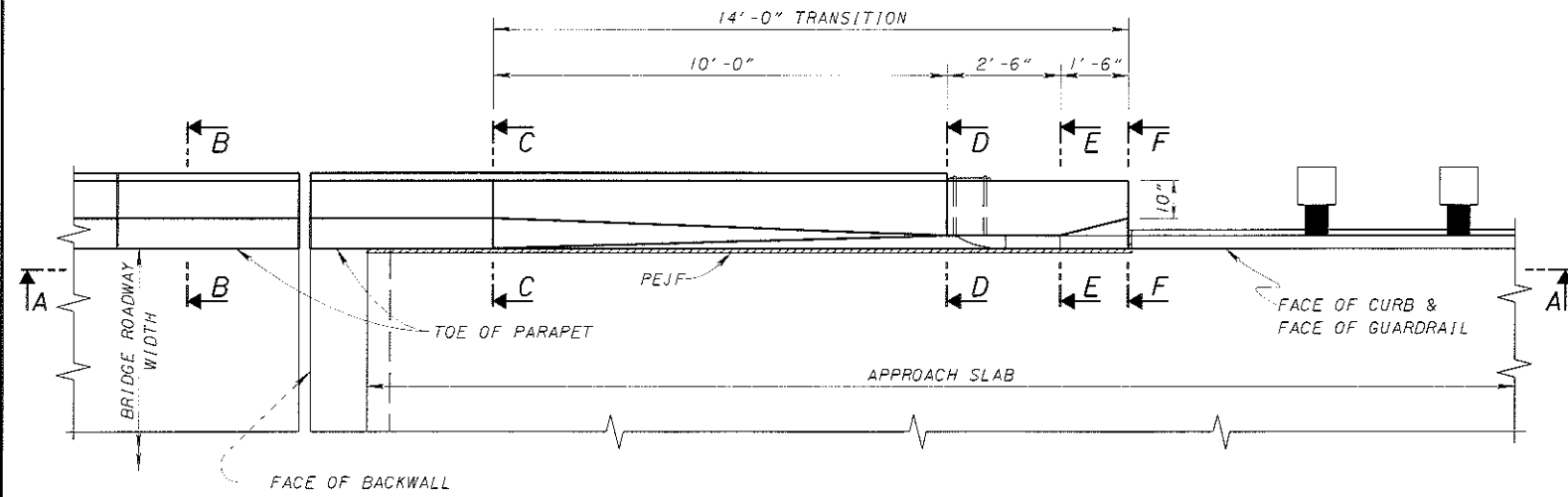
CONTROL JOINTS FOR CONCRETE PARAPETS: SAWCUT 1/4" DEEP CONTROL JOINTS ALONG THE PERIMETER OF THE PARAPET AS SOON AS THE SAW CAN BE OPERATED WITHOUT DAMAGING THE CONCRETE.

USE AN EDGE GUIDE, FENCE OR JIG TO ENSURE THAT THE CUT JOINT IS STRAIGHT, TRUE AND ALIGNED ON ALL FACES OF THE PARAPET. THE JOINT WIDTH SHALL BE THE WIDTH OF THE SAW BLADE, A NOMINAL WIDTH OF 1/4 INCH.

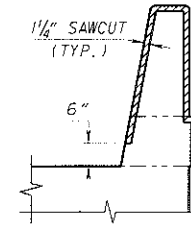
PLACE CONTROL JOINTS AT A MINIMUM OF 6'-0" AND A MAXIMUM OF 10'-0" CENTERS.

SEAL THE PERIMETER OF THE CONTROL JOINT TO A MINIMUM DEPTH OF ONE INCH WITH A POLYURETHANE OR POLYMERIC MATERIAL CONFORMING TO ASTM C920, TYPE S. LEAVE THE BOTTOM ONE-HALF INCH OF BOTH THE INSIDE AND OUTSIDE FACES OF THE PARAPET UNSEALED TO ALLOW ANY WATER WHICH MAY ENTER THE JOINT TO ESCAPE.

FOR BRIDGE TERMINAL ASSEMBLY SEE STANDARD CONSTRUCTION DRAWING GR-3.1 AND GR-3.2.

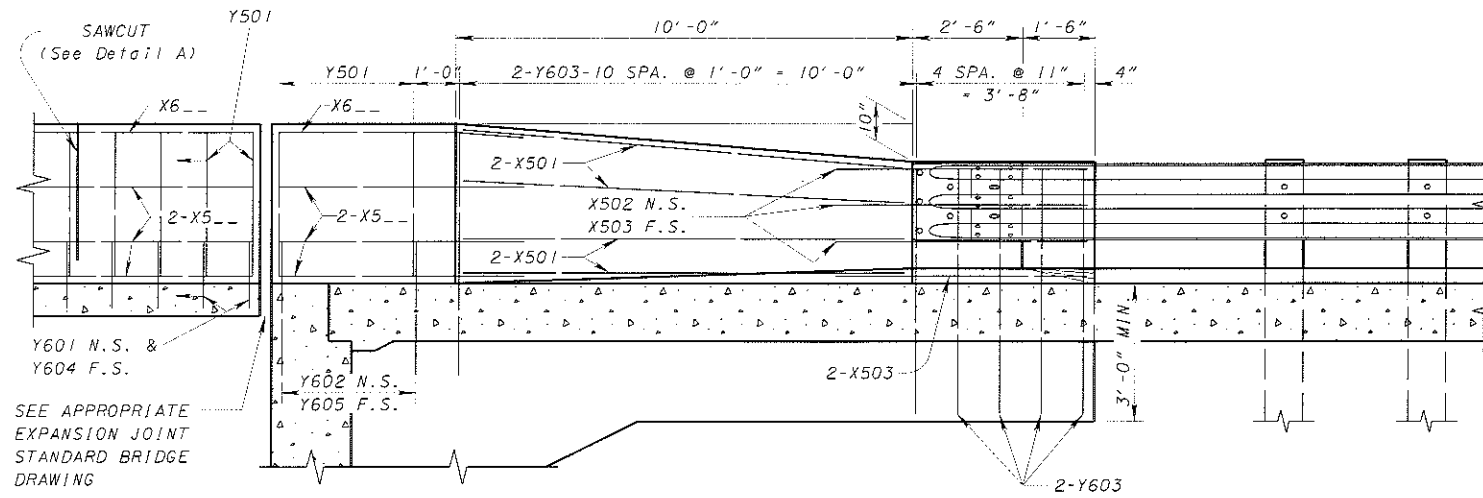


PART PLAN AT ABUTMENT



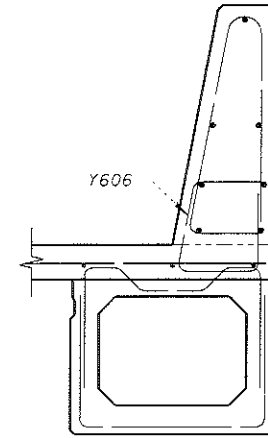
DETAIL A

(Section through sawcut)
Sawcut Perimeter = 7'-6"



SECTION A-A

VERTICAL BARS SHALL BE SPACED AT 1'-0" MAXIMUM.
(See Project Plans)



BOX BEAM REINFORCING DETAIL

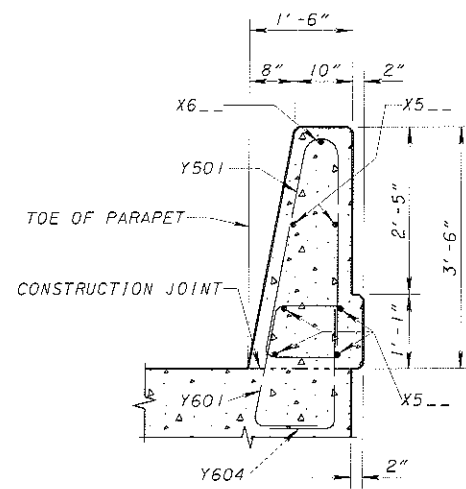
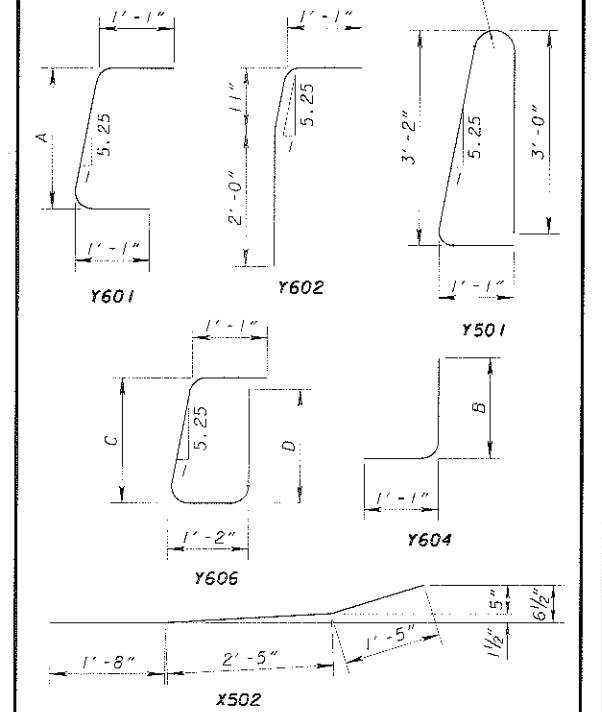
(Composite Deck)

Volume of 14'-0" transition section is 1.89 yd³

REINFORCING BAR LIST					
MARK	LENGTH	SHP.	MARK	LENGTH	SHP.
X501	10'-0"	STR.	Y501	7'-5"	BT.
X502	5'-6"	BT.	Y601	A+2'-0"	BT.
X503	5'-6"	STR.	Y602	3'-11"	BT.
X5--	⊗	STR.	Y603	5'-4"	STR.
X6--	⊗	STR.	Y604	B+11"	BT.
			Y605	2'-11"	STR.
			Y606	C+D+2'-0"	BT.

⊗ - SEE PROJECT PLANS

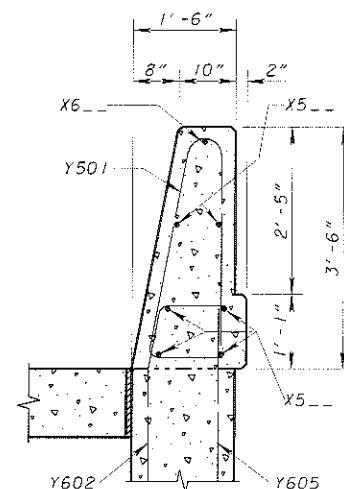
I.R. = 2 3/4"



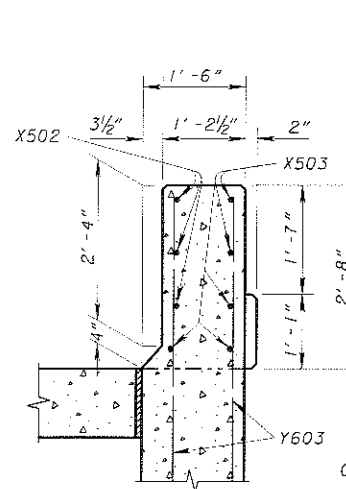
SECTION B-B

(except box beam)

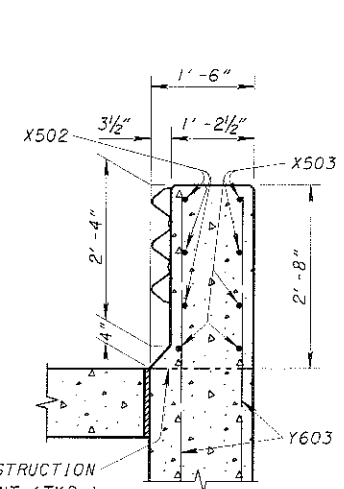
Area = 4.26 ft²



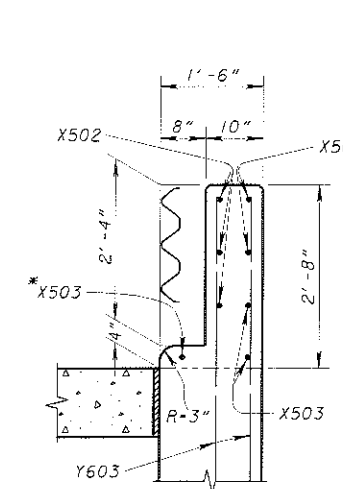
SECTION C-C



SECTION D-D



SECTION E-E



SECTION F-F

* FIELD BEND IF NECESSARY

DESIGN AGENCY
OFFICE OF
STRUCTURAL ENGINEERING

STATE OF OHIO DEPARTMENT OF TRANSPORTATION
01-12-99
DATE

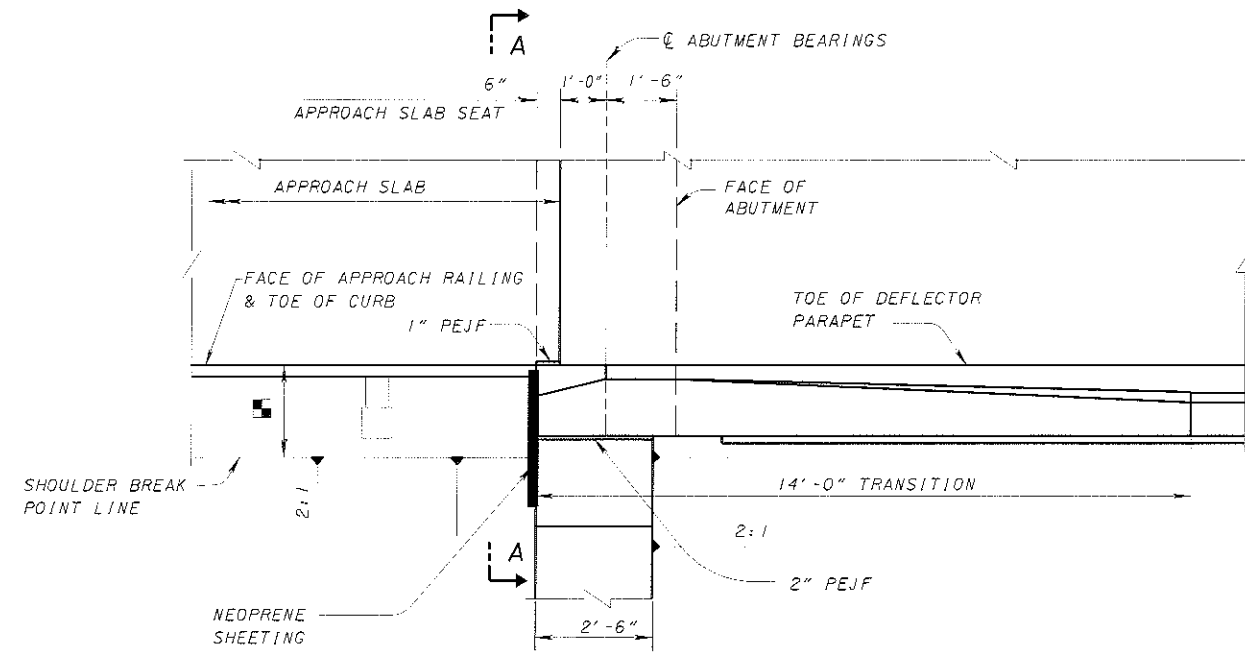
ADMINISTRATOR
Brad Fogwell

REVIEWED
WTL
SBR-1-99

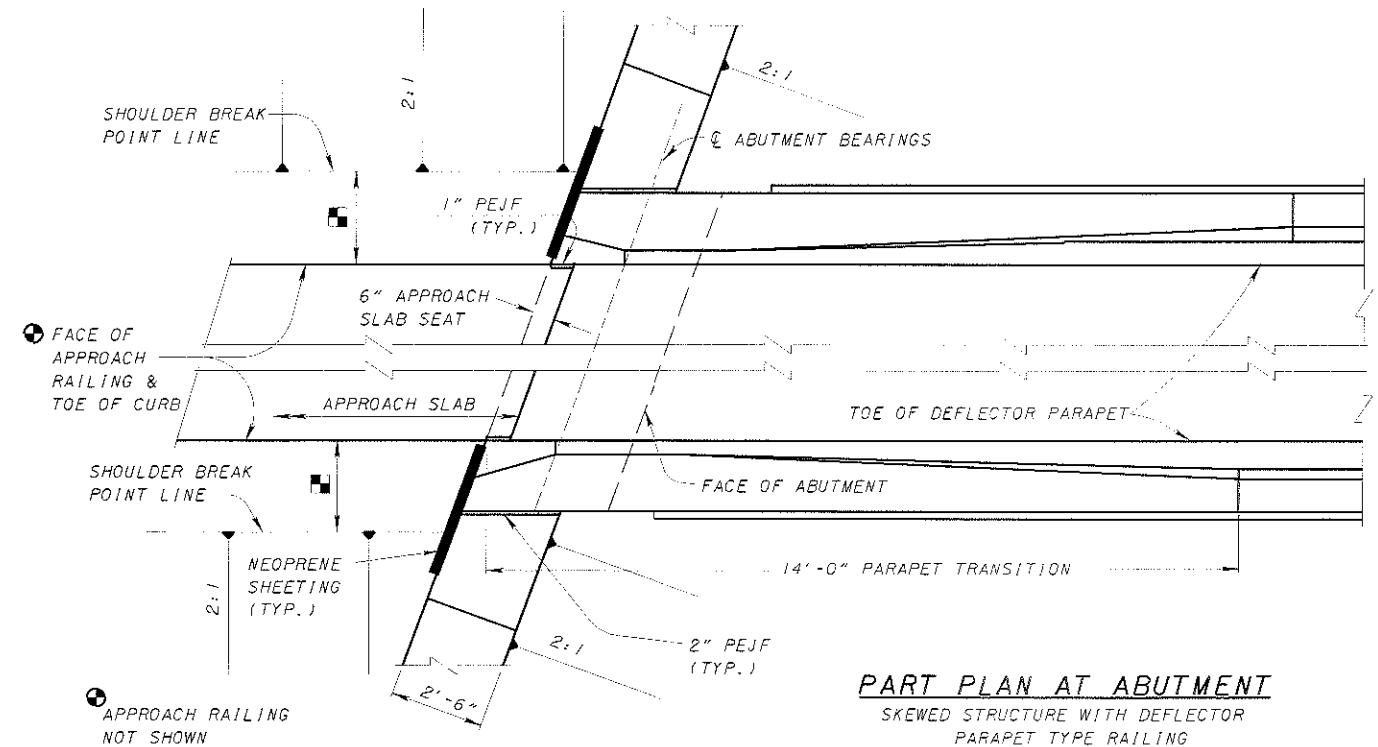
CHECKED
JS

DESIGNED
RZ/SAM
DRAWN
RZ/SAM

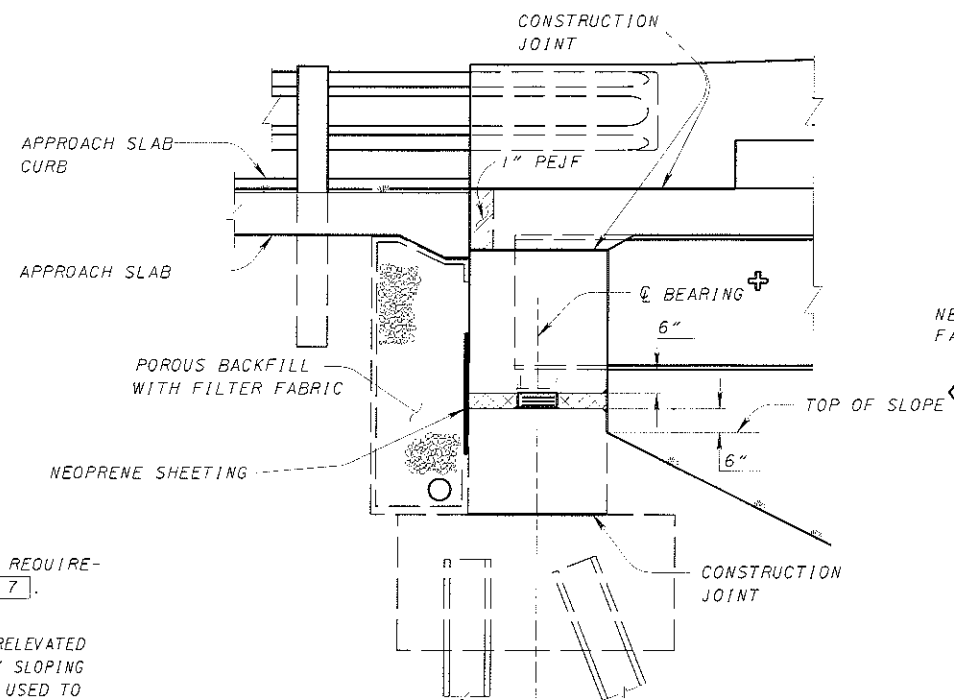
STANDARD
BRIDGE RAILING
SINGLE SLOPE DEFLECTOR PARAPET TYPE
42"



PART PLAN AT ABUTMENT
 SQUARE STRUCTURE WITH DEFLECTOR
 PARAPET TYPE RAILING
 (BR-1 SHOWN, SBR-1-99 SHALL BE SIMILAR)



PART PLAN AT ABUTMENT
 SKEWED STRUCTURE WITH DEFLECTOR
 PARAPET TYPE RAILING
 (BR-1 SHOWN, SBR-1-99 SHALL BE SIMILAR)

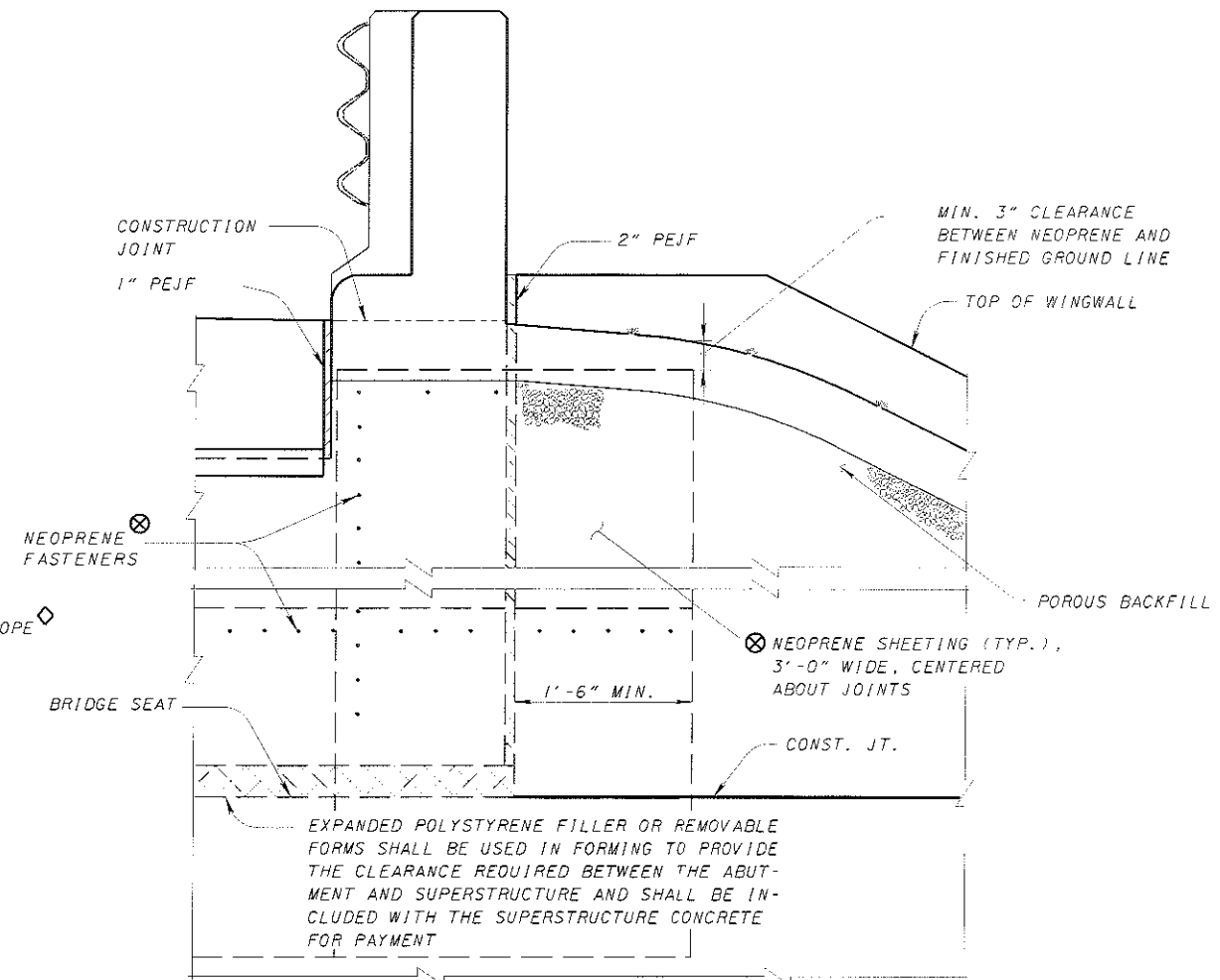


ELEVATION

⊕ FOR BEARING RETAINER REQUIREMENTS SEE SHEET 6 / 7.

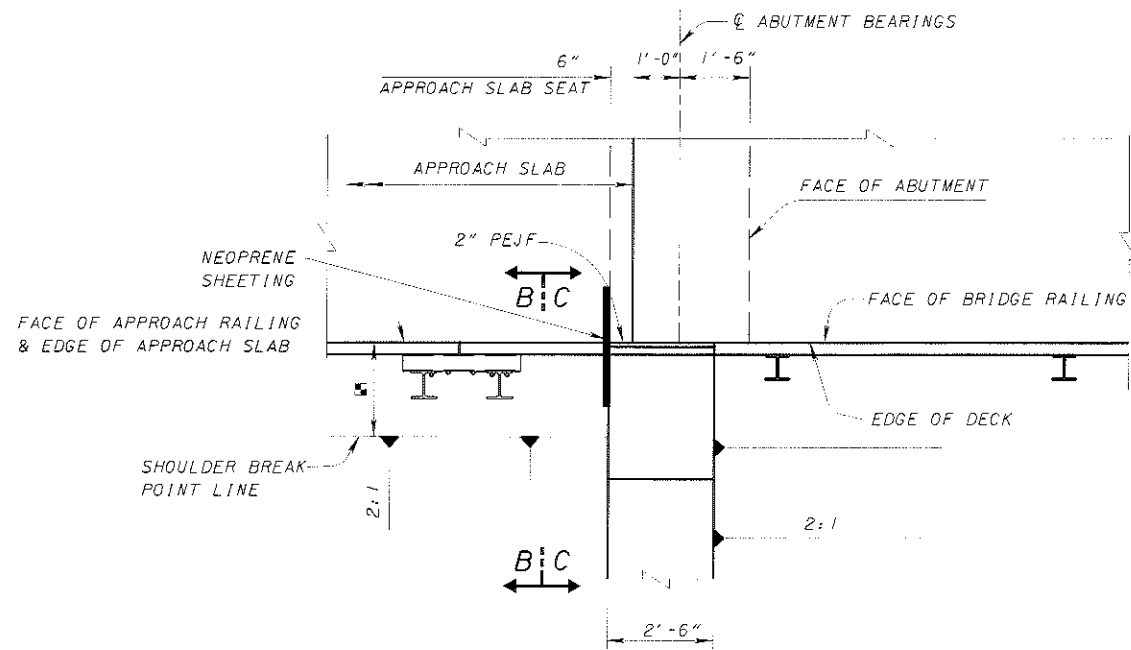
◇ TOP OF SLOPE: ON SUPERELEVATED STRUCTURES, A LATERALLY SLOPING "TOP OF SLOPE" MAY BE USED TO AVOID EXCESSIVELY LONG WING WALL LENGTHS.

■ SEE ROADWAY TYPICAL SECTION.



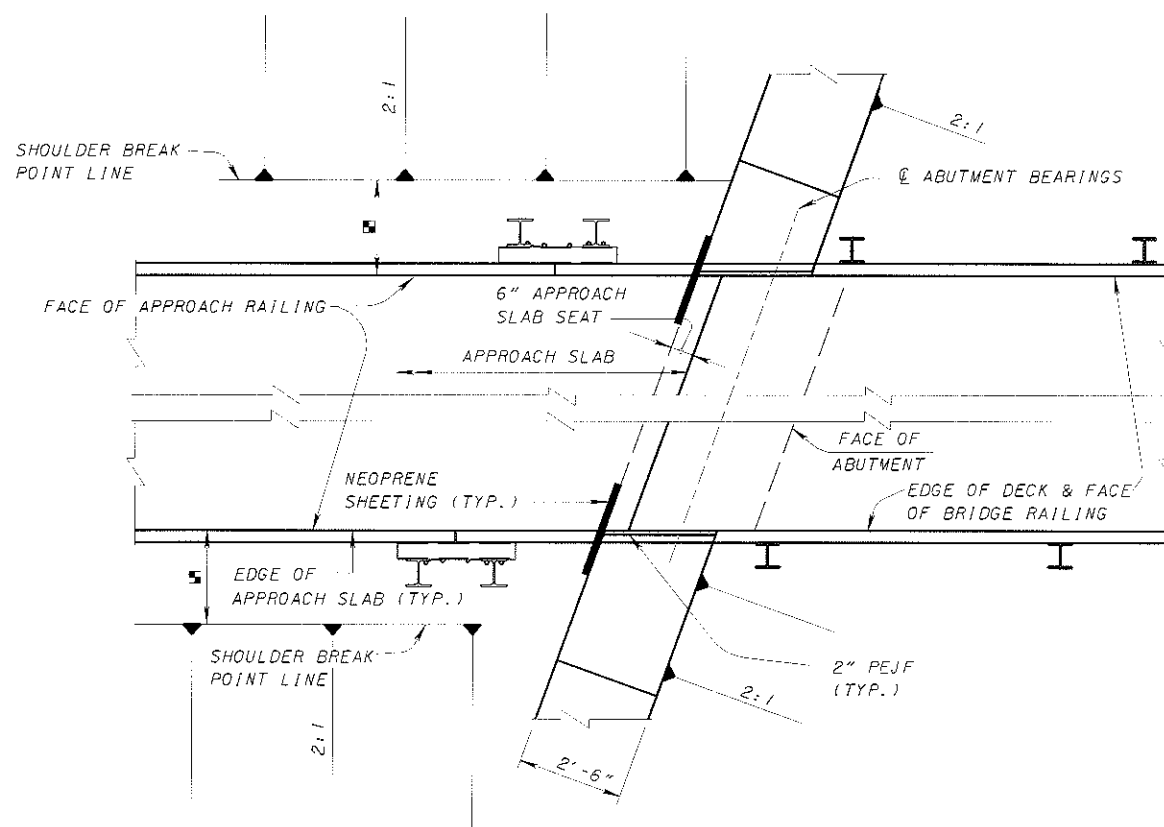
SECTION A-A

⊗ SEE PROJECT PLANS FOR ADDITIONAL NEOPRENE SHEETING PLACEMENT REQUIREMENTS.



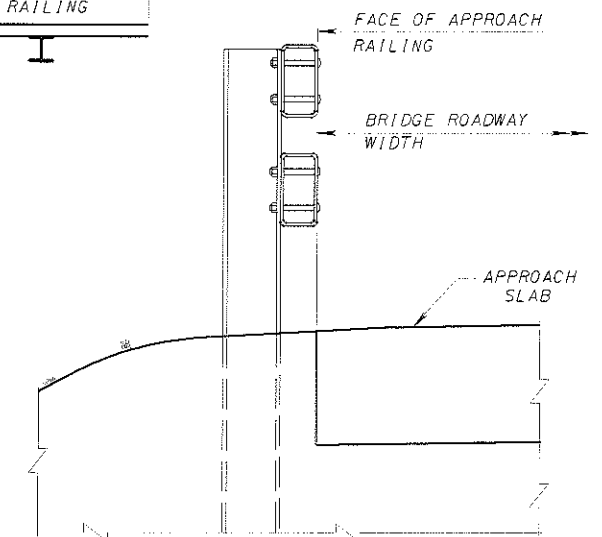
PART PLAN AT ABUTMENT

SQUARE STRUCTURE WITH TWIN STEEL TUBE BRIDGE RAILING

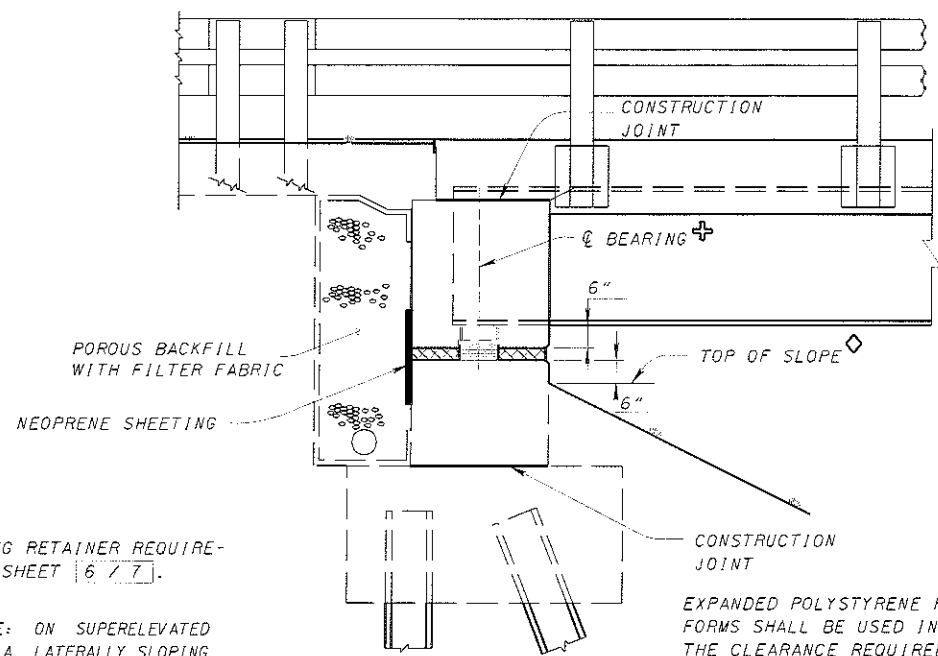


PART PLAN AT ABUTMENT

SKEWED STRUCTURE WITH TWIN STEEL TUBE BRIDGE RAILING



SECTION B-B



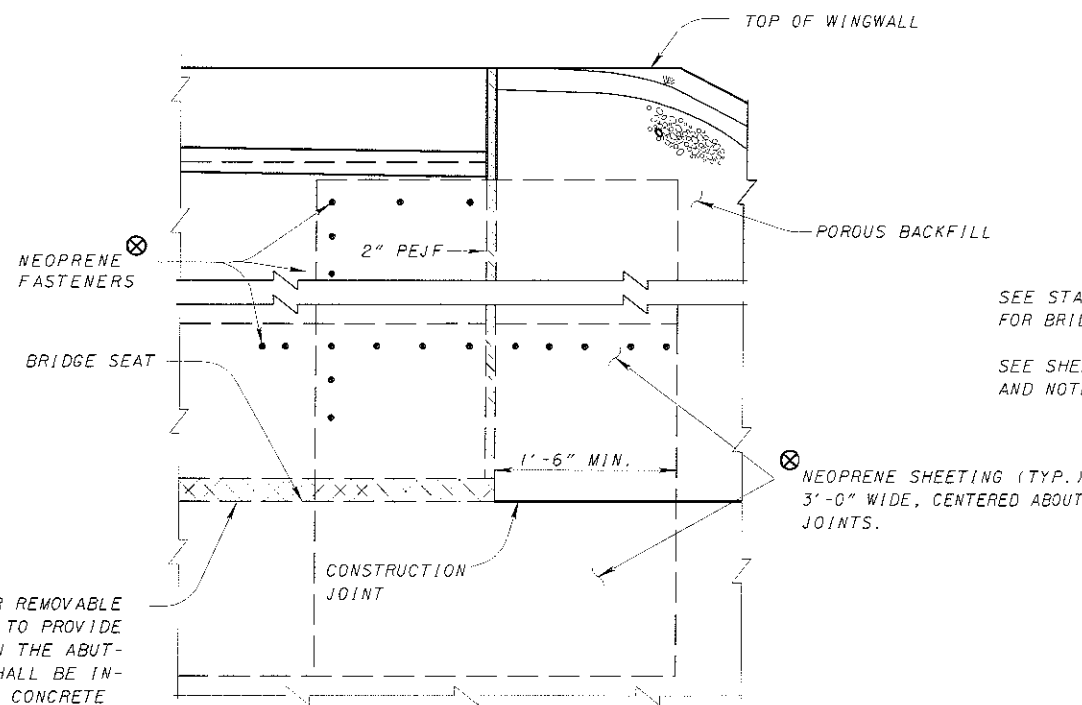
ELEVATION

⊕ FOR BEARING RETAINER REQUIREMENTS SEE SHEET 6/7.

◇ TOP OF SLOPE: ON SUPERELEVATED STRUCTURES, A LATERALLY SLOPING "TOP OF SLOPE" MAY BE USED TO AVOID EXCESSIVELY LONG WING WALL LENGTHS.

■ SEE ROADWAY TYPICAL SECTION.

EXPANDED POLYSTYRENE FILLER OR REMOVABLE FORMS SHALL BE USED IN FORMING TO PROVIDE THE CLEARANCE REQUIRED BETWEEN THE ABUTMENT AND SUPERSTRUCTURE AND SHALL BE INCLUDED WITH THE SUPERSTRUCTURE CONCRETE FOR PAYMENT

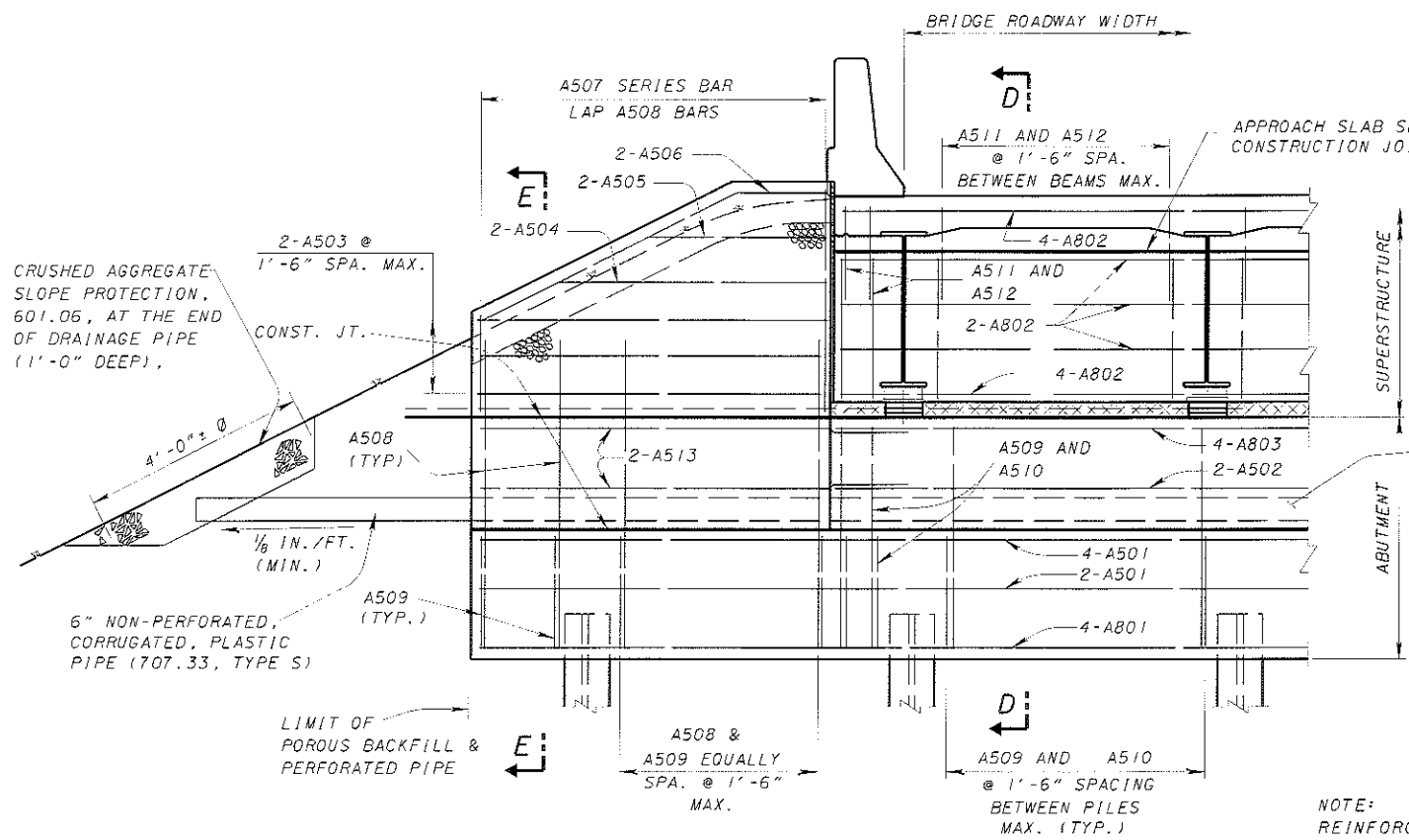


SECTION C-C

SEE STANDARD BRIDGE DRAWING TST-1-99 FOR BRIDGE TERMINAL ASSEMBLIES.

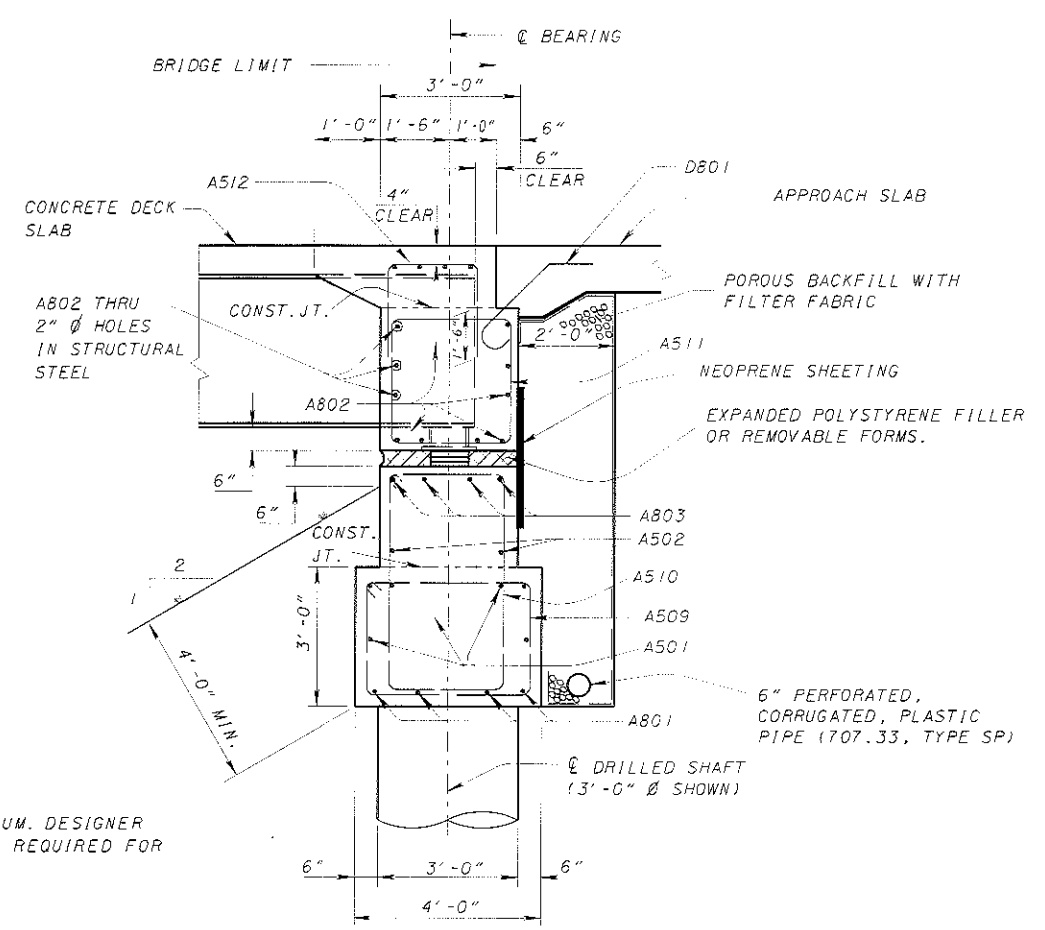
SEE SHEET 1/7 FOR ADDITIONAL DETAILS AND NOTES.

⊗ SEE PROJECT PLANS FOR ADDITIONAL NEOPRENE SHEETING PLACEMENT REQUIREMENTS.

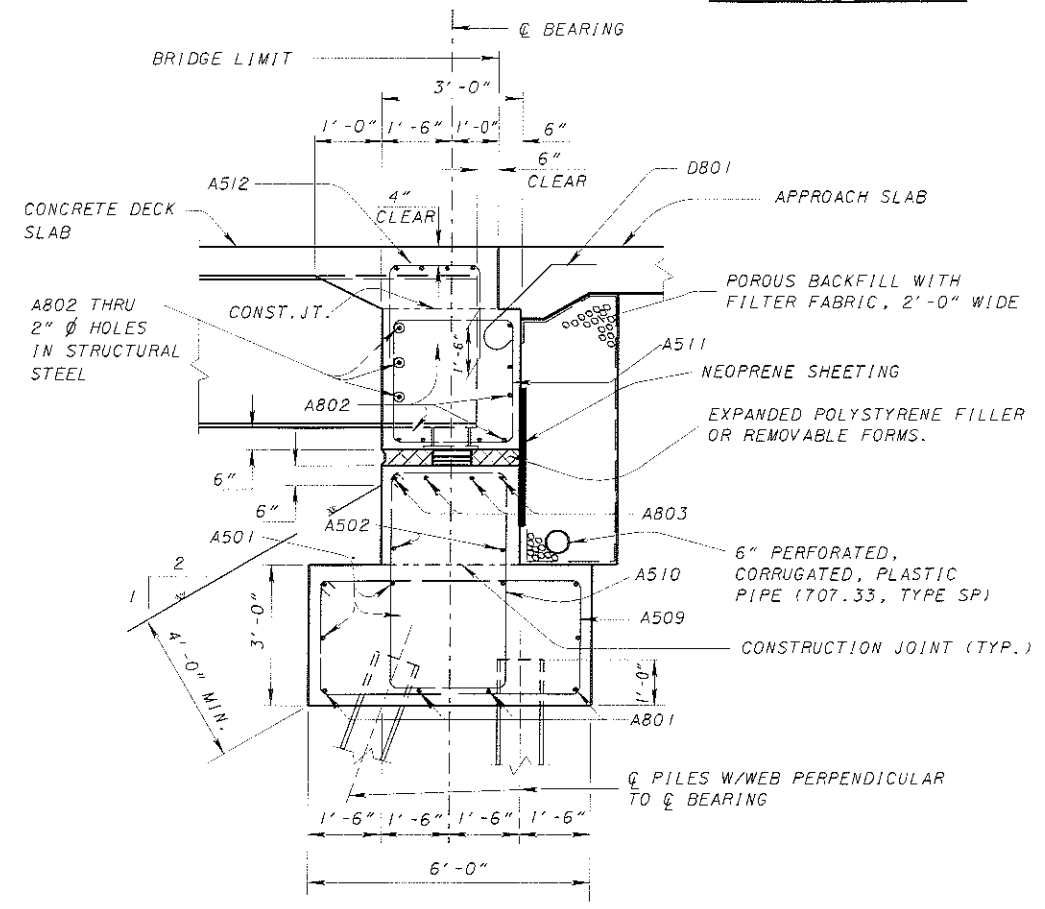


PART ELEVATION

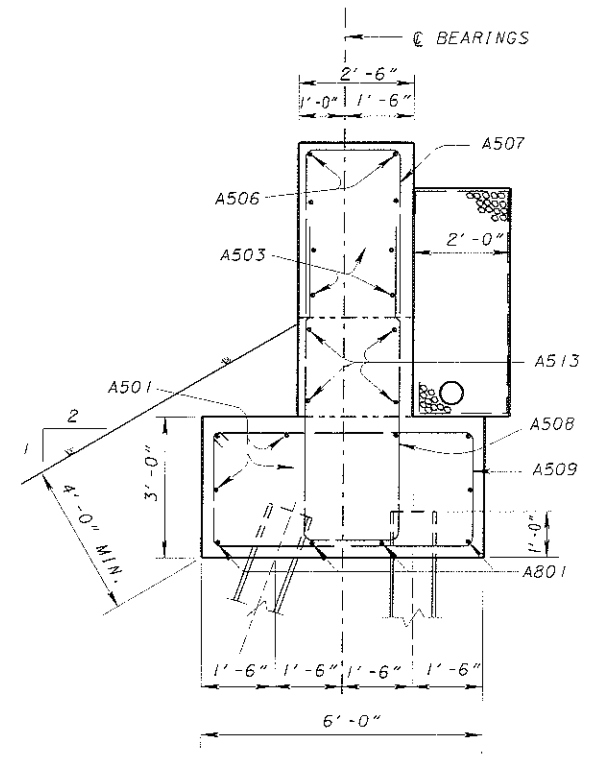
NOTE:
REINFORCING STEEL SHOWN IS MINIMUM. DESIGNER
SHALL PROVIDE THE REINFORCEMENT REQUIRED FOR
THE INDIVIDUAL STRUCTURE.



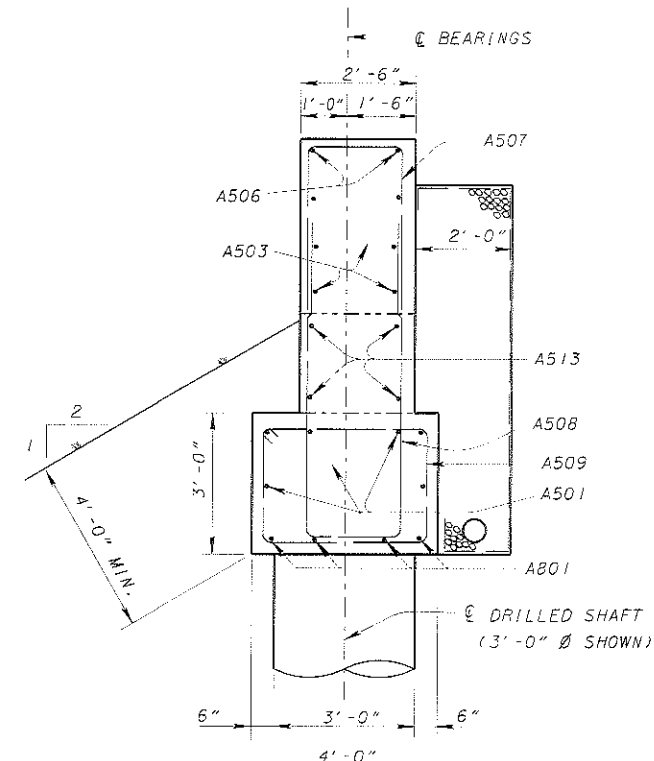
**SECTION D-D
(ON DRILLED SHAFT)**



**SECTION D-D
(ON PILES)**

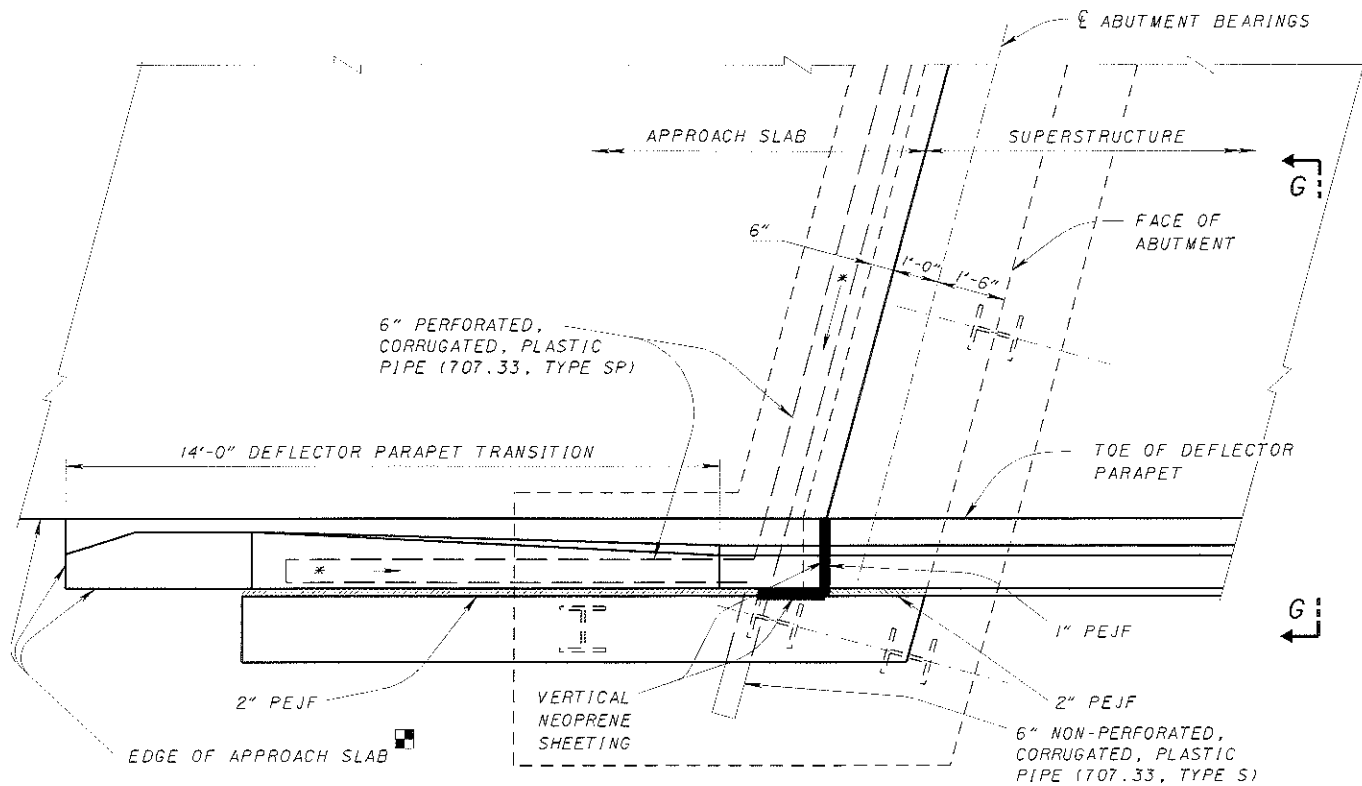


**SECTION E-E
(ON PILES)**



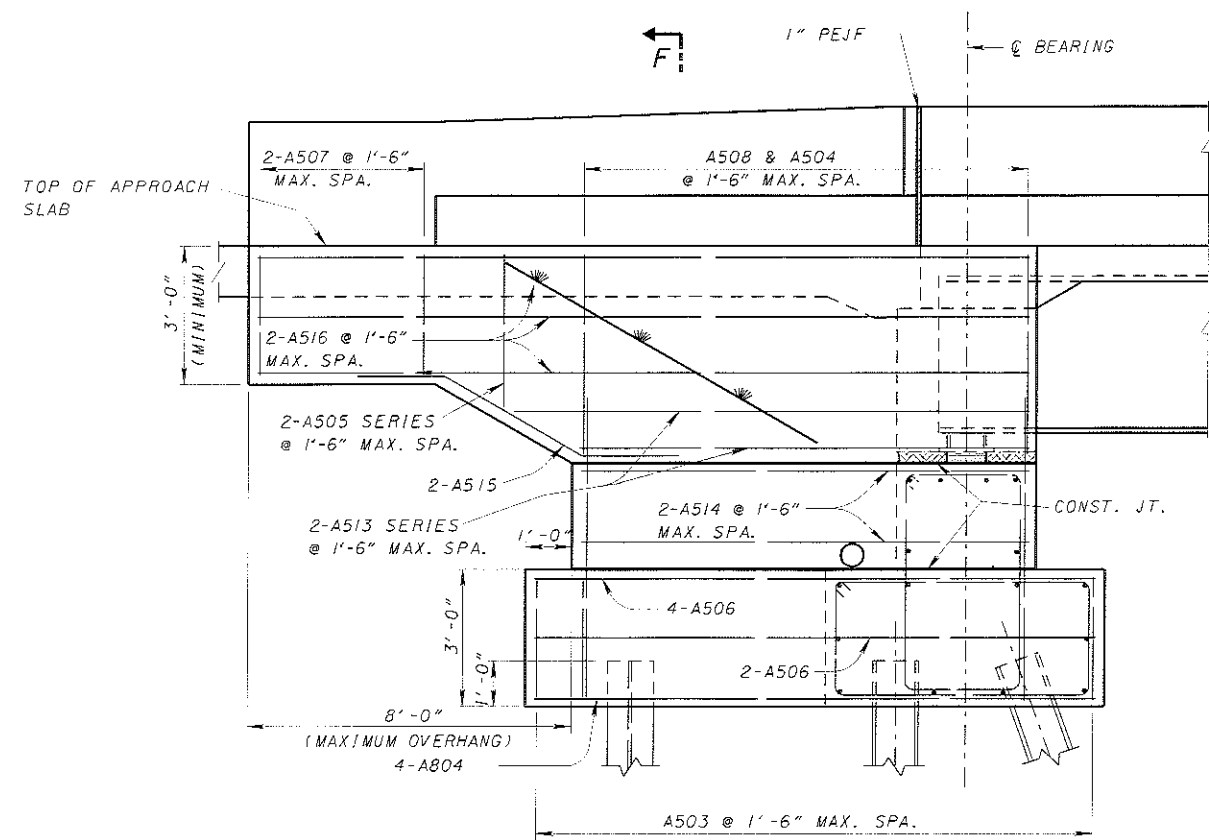
**SECTION E-E
(ON DRILLED SHAFT)**

DESIGN AGENCY	OFFICE OF	STRUCTURAL ENGINEERING
STATE OF OHIO DEPARTMENT OF TRANSPORTATION	DATE	2-12-97
ADMINISTRATOR	ADMINISTRATOR	Brad Taggell
REVIEWED	LMW	
CHECKED	MFG/JJS	
DESIGNED	WLF	
REVISIONS	04-20-01	07-19-02
STANDARD	SEMI-INTEGRAL CONSTRUCTION DETAILS FOR STEEL BEAM AND GIRDER BRIDGES ON RIGID ABUTMENTS	
SICD-1-96		
3		7



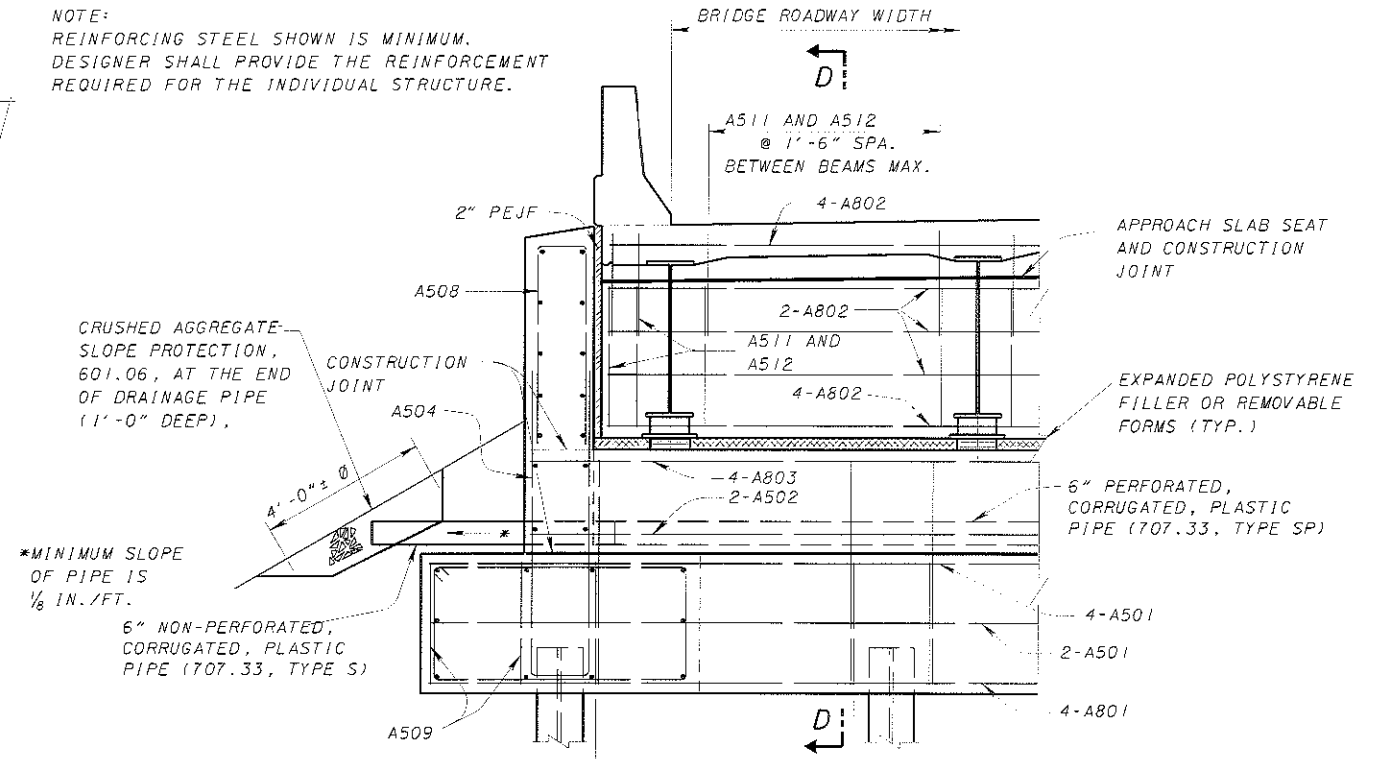
PART PLAN

■ SPECIAL DESIGN OF APPROACH SLAB MAY BE REQUIRED



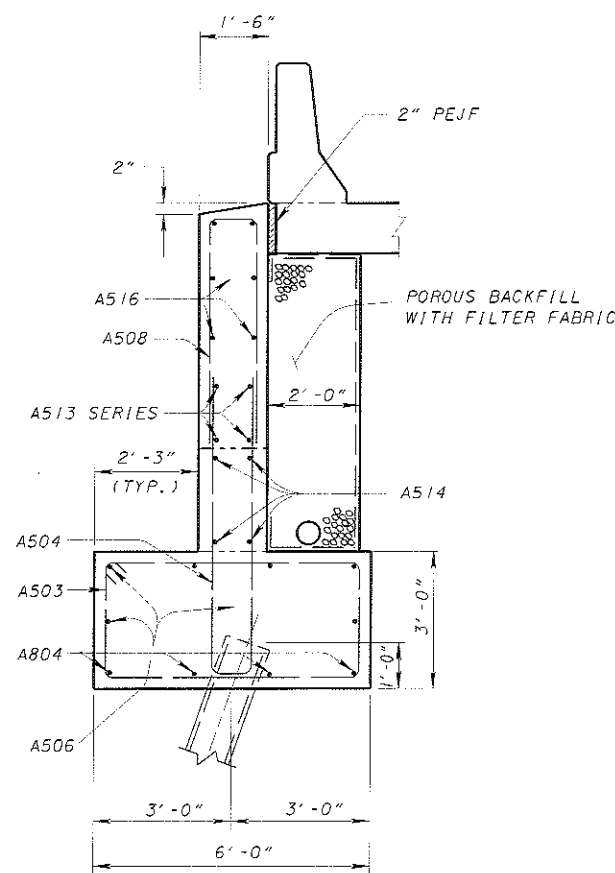
ELEVATION

NOTE:
REINFORCING STEEL SHOWN IS MINIMUM.
DESIGNER SHALL PROVIDE THE REINFORCEMENT
REQUIRED FOR THE INDIVIDUAL STRUCTURE.

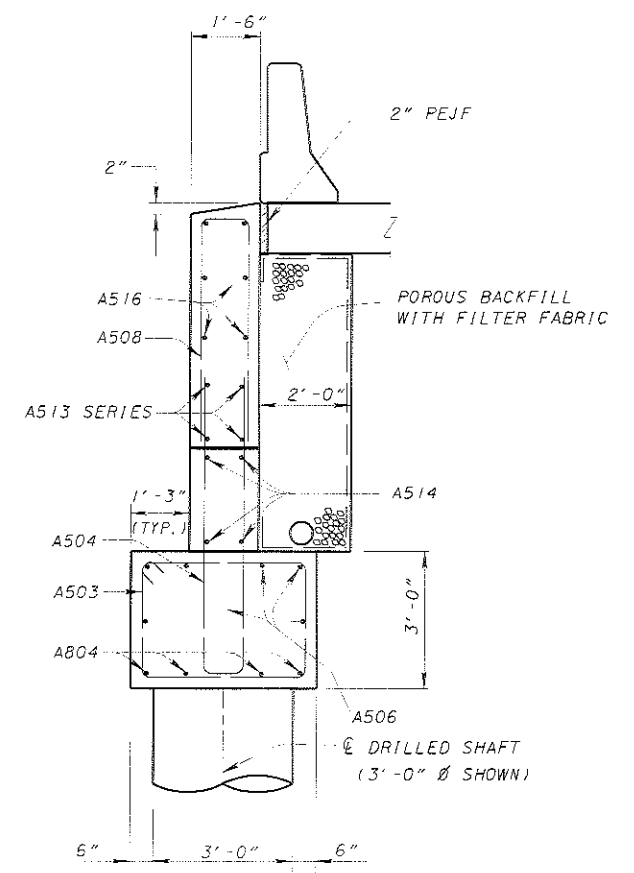


VIEW G-G

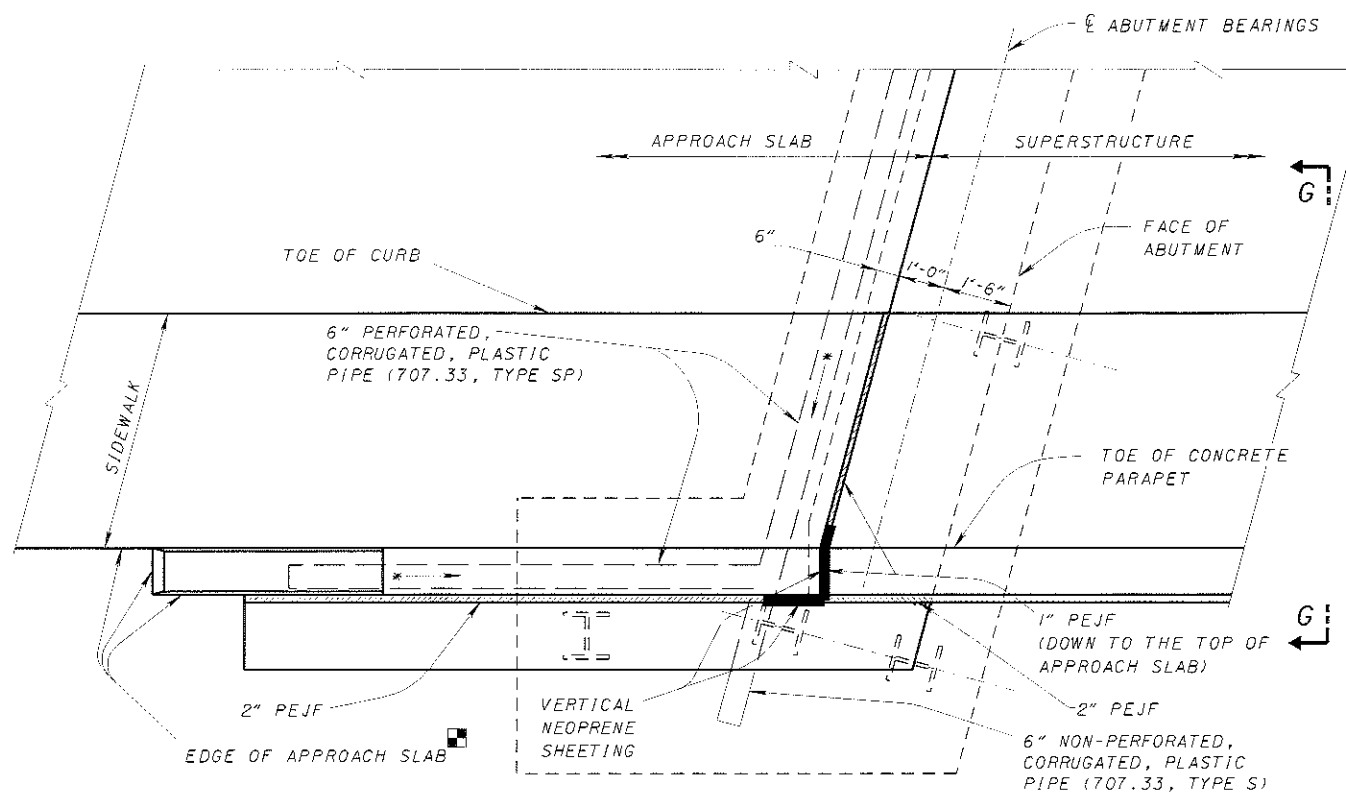
NOTE:
FOR SECTION D-D
SEE SHEET 3/7



**SECTION F-F
(ON PILES)**

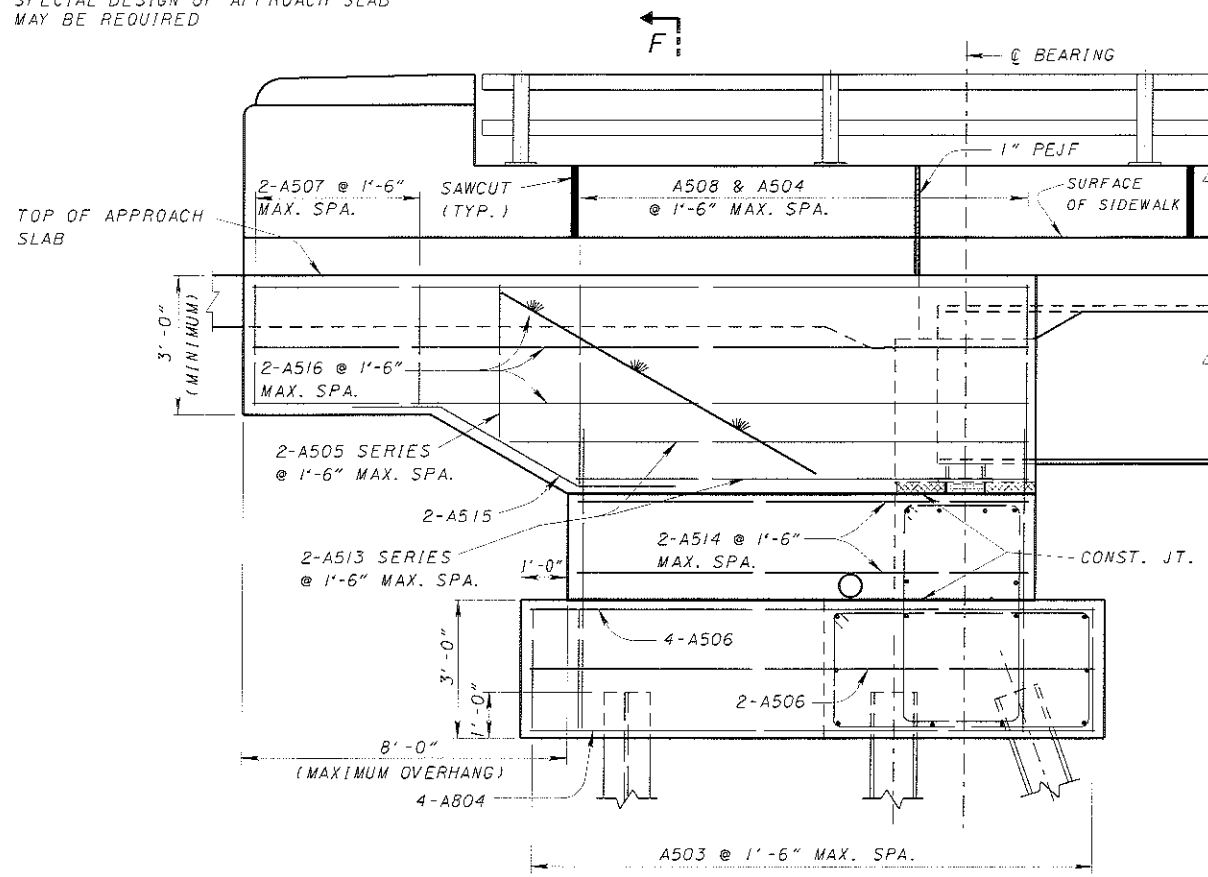


**SECTION F-F
(ON DRILLED SHAFTS)**



PART PLAN
STEEL TUBE & POSTS NOT SHOWN

■ SPECIAL DESIGN OF APPROACH SLAB
MAY BE REQUIRED



ELEVATION

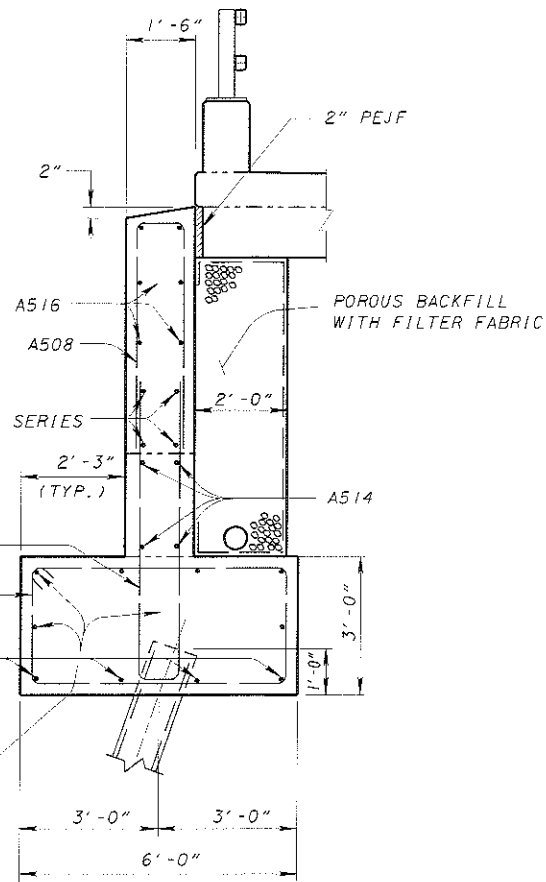
NOTE:
REINFORCING STEEL SHOWN IS MINIMUM.
DESIGNER SHALL PROVIDE THE REINFORCEMENT
REQUIRED FOR THE INDIVIDUAL STRUCTURE.

*MINIMUM SLOPE
OF PIPE IS
1/8 IN./FT.

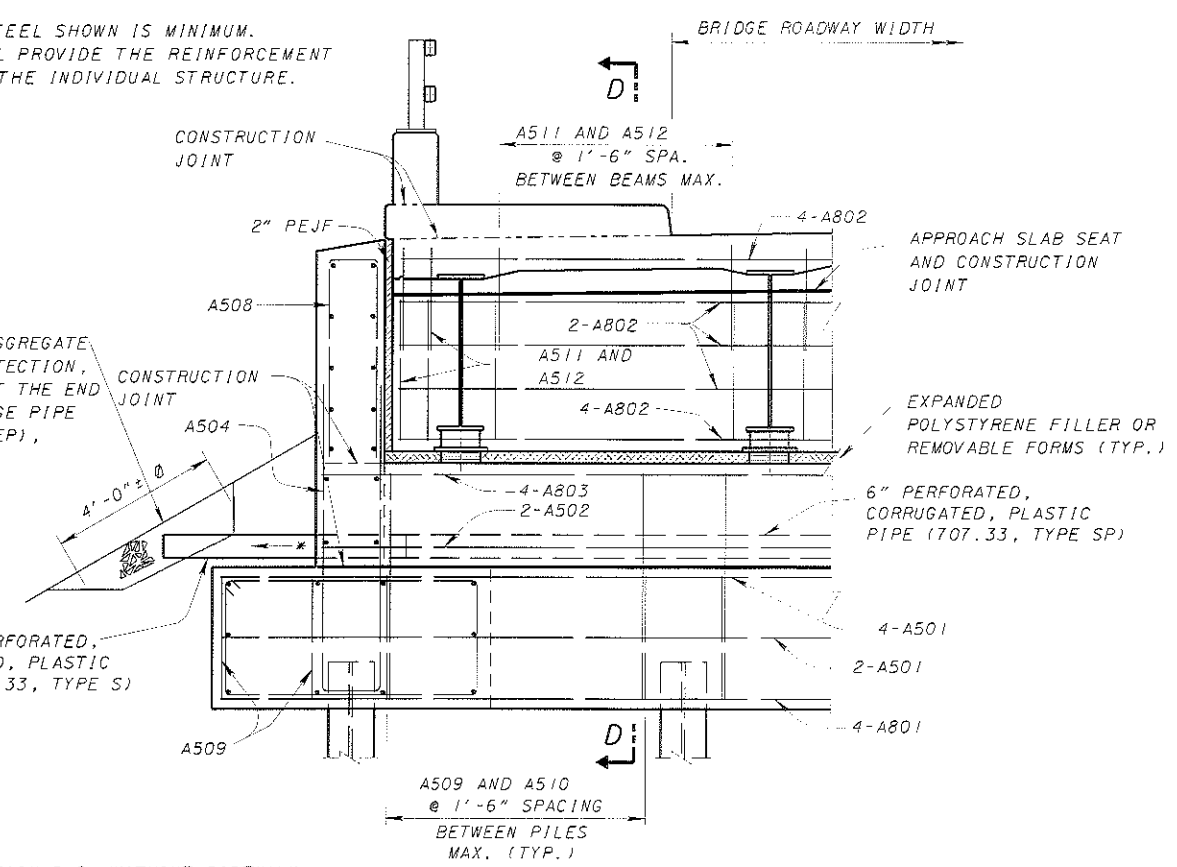
CRUSHED AGGREGATE
SLOPE PROTECTION,
601.06, AT THE END
OF DRAINAGE PIPE
(1'-0" DEEP),

6" NON-PERFORATED,
CORRUGATED, PLASTIC
PIPE (707.33, TYPE S)

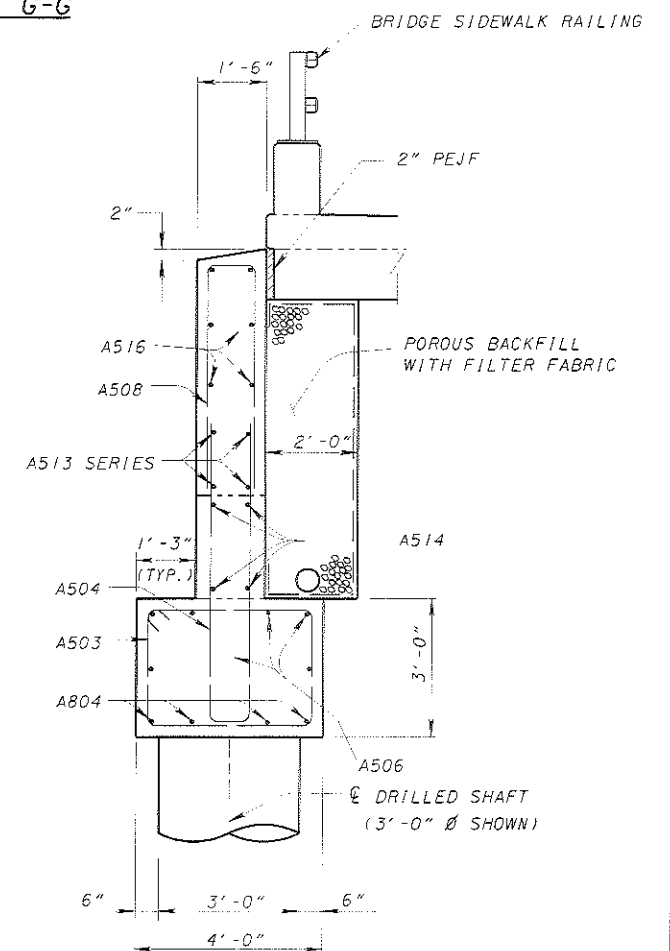
NOTE:
FOR SECTION D-D, WITHOUT SIDEWALK,
SEE SHEET 3/7



SECTION F-F
(ON PILES)

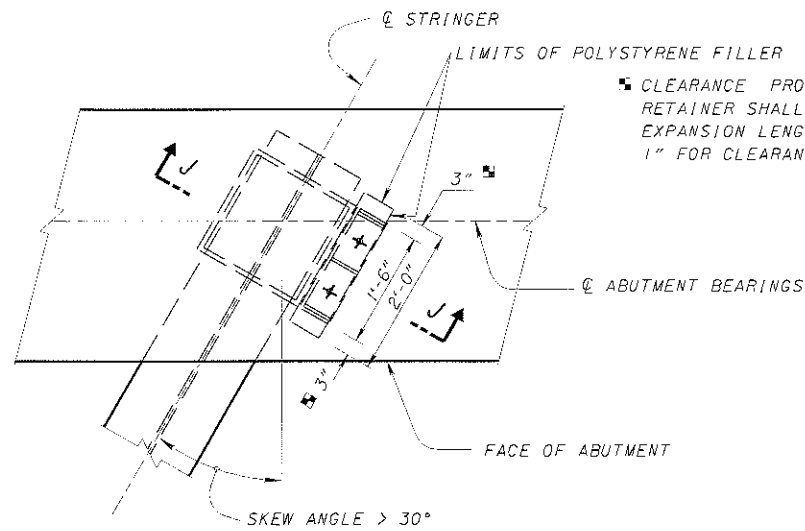


VIEW G-G



SECTION F-F
(ON DRILLED SHAFTS)

DESIGN AGENCY	OFFICE OF	STRUCTURAL ENGINEERING
STATE OF OHIO DEPARTMENT OF TRANSPORTATION	DATE	2-12-97
ADMINISTRATOR	ADMINISTRATOR	Barclay Fagell
REVISIONS	DESIGNED	CHECKED
04-20-01	WLF	MRC/JJS
07-19-02	WLF	LMW
STANDARD	DESIGNED	CHECKED
SEMI-INTEGRAL CONSTRUCTION DETAILS	WLF	MRC/JJS
FOR STEEL BEAM AND GIRDER BRIDGES	WLF	LMW
ON RIGID ABUTMENTS	WLF	LMW
SICD-1-96	DATE	2-12-97
5	7	



CLEARANCE PROVIDED FROM EACH END OF BEARING RETAINER SHALL BE 3" WHICH ALLOWS FOR MAXIMUM EXPANSION LENGTH OF 250'-0" PLUS AN ADDITIONAL 1" FOR CLEARANCE.

**BEARING RETAINER FOR
30° < SKEW ANGLE ≤ 45°**

PLACE RETAINER ASSEMBLY ON ACUTE ANGLE SIDE OF BEARINGS.

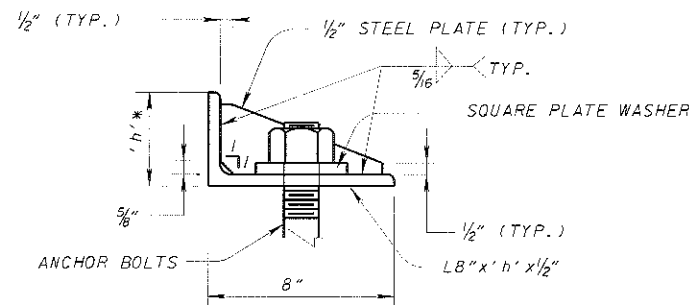
NOTE:

HP STEEL SHAPE INCLUDED WITH ELASTOMERIC BEARING FOR PAYMENT.

1 1/2" DIAMETER X 12" LONG ANCHOR BOLTS WITH NUT AND 4" X 4" X 1/2" SQUARE PLATE WASHER WITH 1 3/8" DIAMETER HOLES, TO BE FIELD DRILLED AND GROUTED WITH AN EPOXY NON-SHRINKING GROUT, 705.20, IN 1 3/4" X 10" DEEP HOLES.

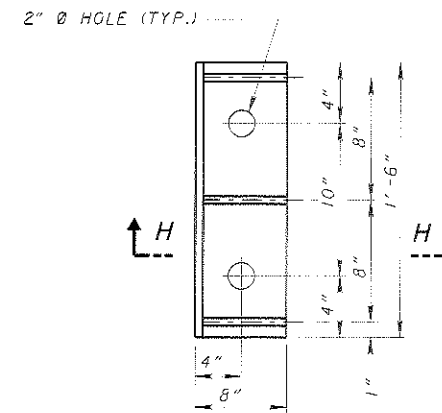
REINFORCING STEEL IN THE VICINITY OF THE BEARING RETAINER SHALL BE ACCURATELY PLACED TO AVOID INTERFERENCE WITH THE DRILLING OF BEARING RETAINER ANCHOR HOLES.

SEE NOTES ON SHEET 7/7 FOR ADDITIONAL REQUIREMENTS.



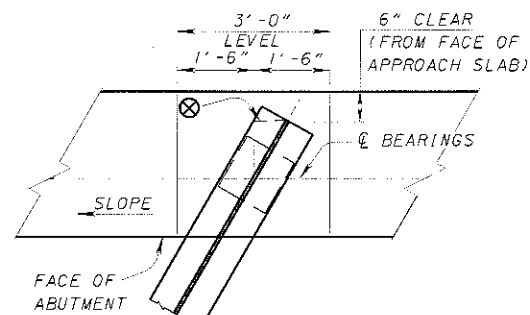
* DIMENSION 'h' VARIES AND SHALL BE EQUAL TO ELASTOMERIC BEARING HEIGHT + LOAD PLATE THICKNESS BUT SHALL NOT BE LESS THAN 4".

SECTION H-H



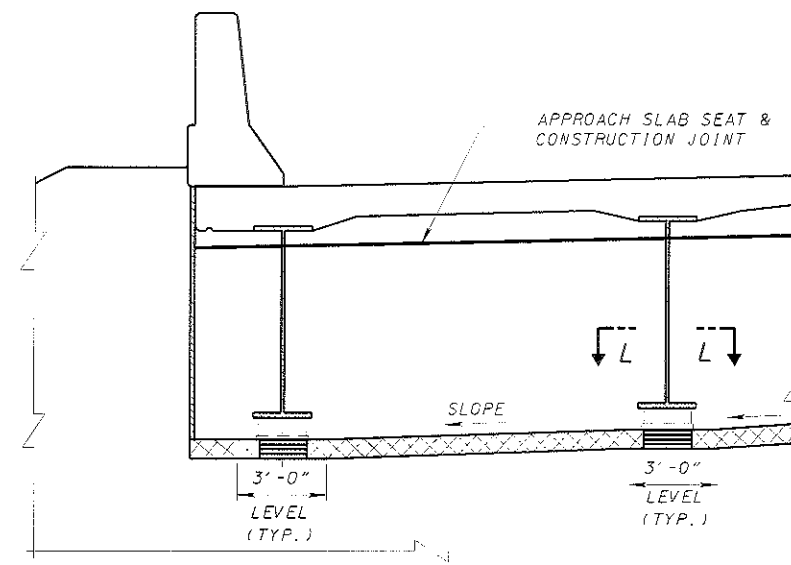
BEARING RETAINER ASSEMBLY

SEE SHEET [77] FOR PLACEMENT INSTRUCTIONS

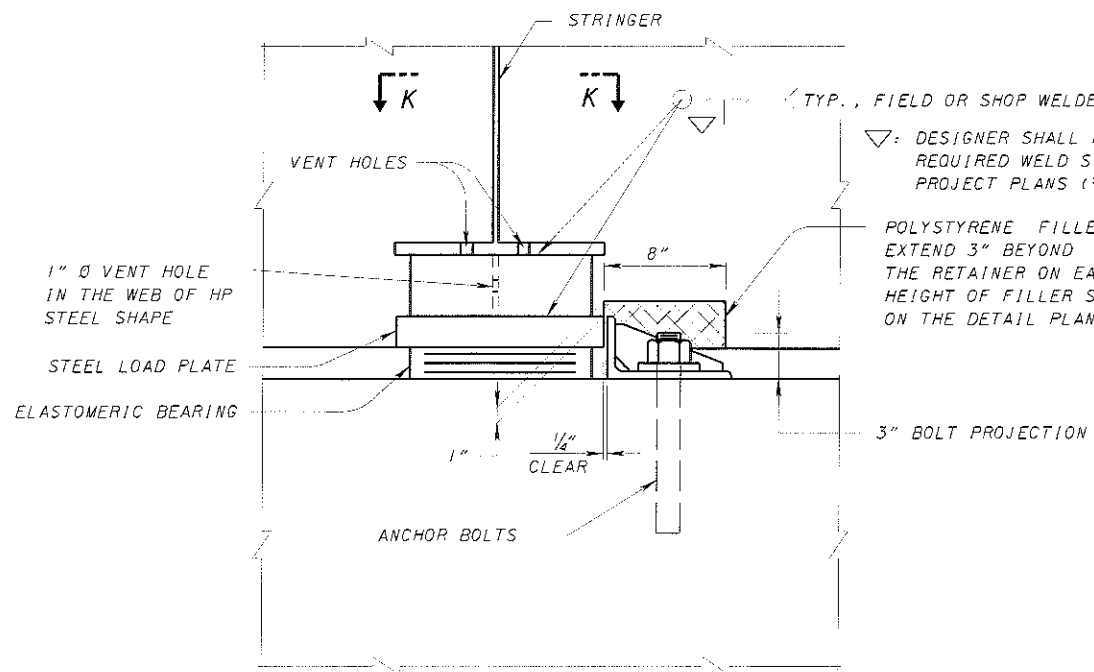


SECTION L-L

⊗ CLIP ONLY THE TOP FLANGE TO MAINTAIN THE CLEARANCE



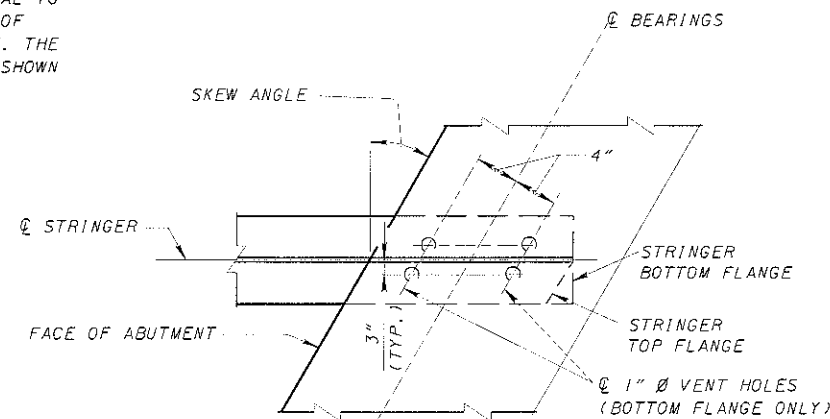
PART ELEVATION OF BEAM SEAT



SECTION J-J

▽: DESIGNER SHALL PROVIDE THE REQUIRED WELD SIZE IN THE PROJECT PLANS (3/16" MIN.).

POLYSTYRENE FILLER MATERIAL TO EXTEND 3" BEYOND THE END OF THE RETAINER ON EACH SIDE. THE HEIGHT OF FILLER SHALL BE SHOWN ON THE DETAIL PLANS.



SECTION K-K

DESIGN AGENCY	OFFICE OF	STRUCTURAL ENGINEERING
STATE OF OHIO DEPARTMENT OF TRANSPORTATION	2-12-97	DATE
ADMINISTRATOR	Brad Fogell	
CHECKED	REVIEWED	SICD-1-96
MFG/JJS	L/MW	
DESIGNED	DRAWN	
WLF	WLF	
REVISIONS	04-20-01	
	07-19-02	
STANDARD	SEMI-INTEGRAL CONSTRUCTION DETAILS FOR STEEL BEAM AND GIRDER BRIDGES ON RIGID ABUTMENTS	
6	7	

REINFORCING STEEL FOR STRAIGHT WINGWALL ABUTMENTS

MARK	LENGTH	TYPE	A	B	C	BENDING DIAGRAMS
A801	*	STR				<p>TYPE 1</p> <p>TYPE 2</p> <p>TYPE 3 SEE STANDARD BRIDGE DWG. AS-1-81.</p> <p>TYPE 4</p>
A802	*	STR				
A803	*	STR				
A501	*	STR				
A502	*	STR				
A503	*	STR				
A504	*	STR				
A505	*	STR				
A506	*	4	*	*	*	
A507	SERIES BAR	1	2'-2"	*		
A508	*	1	2'-2"	*		
A509	*	2	*	2'-7"		
A510	*	2	2'-8"	*		
A511	*	2	2'-8"	*		
A512	*	1	1'-10"	*		
A513	*	STR				
D801	*	3				

* DIMENSIONS VARY

REINFORCING STEEL FOR U-TYPE ABUTMENT

MARK	LENGTH	TYPE	A	B	C	BENDING DIAGRAMS
A801	*	STR				<p>TYPE 1</p> <p>TYPE 2</p> <p>TYPE 3 SEE STANDARD BRIDGE DWG. AS-1-81.</p> <p>TYPE 4</p>
A802	*	STR				
A803	*	STR				
A804	*	STR				
A501	*	STR				
A502	*	STR				
A503	*	2	*	2'-7"		
A504	*	1	1'-2"	*		
A505	SERIES BAR	1	1'-2"	*		
A506	*	STR				
A507	*	1	1'-2"	*		
A508	*	1	1'-2"	*		
A509	*	2	*	2'-7"		
A510	*	2	2'-8"	*		
A511	*	2	2'-8"	*		
A512	*	1	1'-10"	*		
A513	SERIES BAR	STR				
A514	*	STR				
A515	*	4	*	*	*	
A516	*	STR				
D801	*	3				

* DIMENSIONS VARY

GENERAL:

DETAILS SHOWN ARE TYPICAL FOR A STEEL BEAM OR GIRDER BRIDGE WITH ELASTOMERIC BEARINGS.

LIMITATIONS: THESE ABUTMENT DETAILS ARE INTENDED FOR USE ON STRAIGHT ALIGNMENT STRUCTURES WITH SKEWS NOT GREATER THAN 45 DEGREES, A BRIDGE EXPANSION LENGTH UP TO 250'-0" AND/OR A TOTAL LENGTH OF 400'-0" FOR SKEWS GREATER THAN 45 DEGREES, A SPECIAL DESIGN SHALL BE PERFORMED AS THE ABUTMENT BEAM SEATS SHOWN ON THESE PLANS, WOULD NEED TO BE SPECIFICALLY DESIGNED FOR THAT SKEW TO ACCOMMODATE THE BEARING RETAINER ASSEMBLIES.

SEMI-INTEGRAL ABUTMENT DETAILS CAN BE USED ON WALL TYPE ABUTMENTS, SPILL THRU TYPE ABUTMENTS ON TWO OR MORE ROWS OF PILES, SPREAD FOOTING TYPE ABUTMENTS FOUNDED ON ROCK, OR ABUTMENTS ON DRILLED SHAFTS. THIS ABUTMENT DESIGN SHOULD NOT BE USED ON NEW STRUCTURES WITH SPREAD FOOTINGS FOUNDED ON SOIL OR EXISTING STRUCTURES WHERE SPREAD FOOTINGS ON SOIL ARE EXPECTED TO CONTINUE TO HAVE SETTLEMENT.

HOLE LOCATIONS: THE DESIGNER SHALL DETAIL THE HOLE LOCATIONS IN THE PROJECT PLANS. FIELD CUTTING OF THE HOLES IN THE FIELD WILL NOT BE PERMITTED.

BEARING RETAINERS:

GENERAL: RETAINERS ARE REQUIRED FOR ANY BRIDGE STRUCTURE WITH A SKEW GREATER THAN 30 DEGREES. NEW AND REHABILITATED BRIDGE STRUCTURES WITHOUT PHASED CONSTRUCTION REQUIRE TWO RETAINER ASSEMBLIES AT EACH ABUTMENT, ONE LOCATED AT EACH OF THE OUTSIDE (FASCIA) BEAM LINES. STRUCTURES THAT REQUIRE PHASED CONSTRUCTION SHALL HAVE RETAINER ASSEMBLIES LOCATED AT EACH OF THE OUTSIDE BEAM LINES FOR THE FIRST PHASE OF CONSTRUCTION AND ADDITIONAL RETAINER ASSEMBLIES LOCATED AT THE NEW OUTSIDE BEAM OF EACH ADDITIONAL PHASE OF CONSTRUCTION.

CONSTRUCTION PROCEDURE: FIELD DRILL ANCHOR BOLT HOLES, INSTALL ANCHOR BOLTS AND PLACE EPOXY GROUT AFTER THE ERECTION OF STRUCTURAL STEEL BEAMS. WHEN DRILLING HOLES, TAKE PRECAUTIONS TO AVOID INTERFERING WITH REINFORCING STEEL. POSITION AND TIGHTEN THE RETAINER AND INSTALL A BLOCK OF POLYSTYRENE FILLER MATERIAL, DIMENSIONED AS SHOWN ON SHEET 6 OF 7, OVER THE TOP OF THE RETAINER ASSEMBLY BEFORE THE CONCRETE PLACEMENT FOR THE BEAM END ENCASMENT.

MATERIALS: THE STEEL RETAINER ASSEMBLY AND THE SQUARE PLATE WASHER SHALL BE THE SAME GRADE OF STEEL AS THE MAIN STRUCTURAL MEMBERS. ANCHOR BOLTS AND NUTS SHALL BE ASTM A325. STEEL RETAINER ASSEMBLIES SHALL HAVE THE SAME PROTECTIVE COATING AS THE MAIN STRUCTURAL STEEL ANCHOR BOLTS, NUTS AND SQUARE PLATE WASHERS SHALL BE GALVANIZED ACCORDING TO 711.02. THE THREAD LENGTH REQUIREMENTS OF ASTM A325 MAY BE WAIVED. THE GROUT SHALL BE A NON-SHRINK, EPOXY GROUT MEETING THE REQUIREMENTS OF 705.20.

THE COSTS FOR FURNISHING AND INSTALLING THE STEEL RETAINER ASSEMBLIES, INCLUDING THE POLYSTYRENE, WILL BE INCLUDED FOR PAYMENT IN THE UNIT PRICE BID FOR THE ELASTOMERIC BEARINGS.

STEEL LOAD PLATE AND THE HP SHAPE (SUPPORT MEMBER): THE DESIGNER SHALL SPECIFY THE STEEL MATERIAL FOR THE LOAD PLATE AND THE HP SHAPE SUPPORT MEMBER TO BE THE SAME GRADE OF STEEL AS THE MAIN STRUCTURAL MEMBERS. THE BEARINGS SHALL BE FURNISHED AND INSTALLED ACCORDING TO 516. THE DESIGNER SHALL SHOW ALL BEARING DETAILS, INCLUDING NOTES, IN THE PROJECT PLANS. THE HP SHAPE IS CONSIDERED A COMPONENT OF THE BEARING.

DESIGN AGENCY
OFFICE
OF
STRUCTURAL ENGINEERING

STATE OF OHIO DEPARTMENT OF TRANSPORTATION
Brad Fingell
ADMINISTRATOR
2-12-97
DATE

REVIEWED
LWJ
CHECKED
MRG/JJS
DESIGNED
WLF
DRAWN
WLF

REVISIONS
04-20-01
07-19-02

STANDARD
SEMI-INTEGRAL CONSTRUCTION DETAILS
FOR STEEL BEAM AND GIRDER BRIDGES
ON RIGID ABUTMENTS

STATE OF OHIO
DEPARTMENT OF TRANSPORTATION

SUPPLEMENTAL SPECIFICATION 864
SEALING OF CONCRETE SURFACES

July 11, 2000

864.01	Description
864.02	Materials
864.03	Equipment
864.04	Mixing
864.05	Storage
864.06	Surface Condition
864.07	Surface Preparation
864.08	Application and Coverage
864.09	Test Site/Application
864.10	Appearance
864.11	Traffic
864.12	Safety Precautions
864.13	Protection of Adjoining Surfaces and the Public
864.14	Environmental Requirements
864.15	Method of Measurement
864.16	Basis of Payment

864.01 Description. This work consists of applying an approved sealer on existing and new concrete surface areas after the concrete is cured and repairs completed and cured. Apply the sealer to locations described in the plans. Use sealers on the Office of Materials Management's approved list. Apply the sealer listed in the pay item description. Choose a type of sealer if no sealer is listed in the pay item description.

864.02 Materials. Approved sealer systems meet the following performance requirements:

1. Absorption - ASTM C642 (non-air entrained concrete). Concrete should be proportioned and mixed in accordance with ASTM C672. Sealed concrete, under total immersion, will not exceed 1.0% after 48 hours or 2.0% after 50 days
2. Scaling Resistance - ASTM C672 A rating of "No Scaling" after 100 cycles on the sealed concrete (non-air entrained concrete) as compared to "Severe Scaling" on untreated concrete.
3. NCHRP 244, Series 11 - Cube Test
 - 3.1 Weight gain - not to exceed 25% of untreated cube
 - 3.2 Absorbed chloride - not to exceed 25% of untreated cube
4. NCHRP 244, Series IV - Southern Exposure
 - 4.1 Absorbed chloride - not to exceed 10% of untreated concrete

5. Record and report the application rate (square footage/gallon) of sealer during the tests.

Provide test data from an approved independent testing facility. The sealer manufacturer funds the testing costs. Furnish the test data, a one quart (one liter) sample, and the MSDS to the Office of Materials Management. Pre-qualified sealers will be on the Department's approved list

864.03 Equipment. Use application equipment recommended by the sealer manufacturer. Use spray equipment, tanks, hoses, brooms, rollers, coaters, squeegees, etc., that is clean, free of foreign matter, oil residue and water.

864.04 Mixing. Mix the sealer according to the manufacturer's recommended procedures. Furnish the Engineer with the manufacturer's application instructions. Don't mix or apply the sealer until the manufacturer's written recommendations are supplied to the Engineer. Mixed materials to a uniform consistency and maintain during application.

864.05 Storage. Store all sealer components in tightly sealed containers, in a dry location, and as recommended by the manufacturer. Deliver unopened drums or containers of the sealer or sealer components to the job site with the manufacturer's numbered seal intact.

864.06 Surface Condition. Apply sealers to surfaces which are dry, free from dust, dirt, oil, wax, curing compounds, efflorescence, laitance, coatings and other foreign materials. Repair any structurally unsound surfaces, weak sections or spalled areas before applying any sealer.

Air dry concrete surfaces for at least five (5) days after completion of required curing. Air dry any cavities which require grout filling and curing for five days. Do not apply sealer until the air drying is complete.

Seal accelerated cured precast concrete after it has attained the required 28 day strength and after any cavities which require grout filling have been filled, cured and air-dried for five days.

864.07 Surface Preparation. Remove dust, dirt, oil, wax, curing compounds, efflorescence, laitance, coatings and other foreign materials from surfaces to be sealed. Use chemicals or other cleaning compounds if removal requires their use but only use products approved by the sealer manufacturer. Furnish the Engineer documentation of the sealer manufacturer's approval. Apply the sealer within 48 hours of surface preparation.

Install suitable traps, filters, drip pans and other separation devices in the cleaning equipment so oil and other foreign material isn't deposited on the surface.

Use the following cleaning methods depending on the surface type:

- A. New water cured exposed concrete surfaces.
 1. Water blast at 7,000 psi (48 MPa) minimum
- B. New, liquid membrane cured, exposed concrete surfaces.

1. Water blast at 7,000 psi (48 MPa) minimum, or
 2. Sandblast, followed by air brooming or power sweeping, to remove dust and sand from the surfaces and opened pores. Remove all membrane curing compound.
- C. Exposed surfaces of new prestressed concrete box beams
1. Clean with high pressure hot water or steam jenny, or
 2. Water blast at 7,000 psi (48 MPa) minimum, or
 3. Sandblast, followed by air brooming or power sweeping, to remove dust and sand from the surfaces and opened pores
- D. Existing concrete surfaces.
1. Water blast at 7,000 psi (48 MPa) minimum, or
 2. Sandblast, followed by air brooming or power sweeping, to remove dust and sand from the surface and opened pores.

864.08 Application and Coverage.

A. Epoxy - Urethane sealers.

1. Apply each coat of the Epoxy-urethane sealer at the coverage rate specified on the Office of Materials Management's approved list.
(Web site is: <http://www.dot.state.oh.us/testlab/applists/cement/Epoxies.htm>)
If no application rate is listed, apply each coat at 120 square feet per gallon (2.9 square meter/liter).
2. Only apply sealer when the surface temperature is 50F (10 C) or above
3. Apply with a brush, squeegee, roller or spraying equipment and as recommended by the manufacturer.
4. Apply one coat of epoxy and one coat of the urethane top coat. Time between coats shall meet the manufacturer's recommendation. Use epoxy and urethane from the same manufacturer. Achieve specified coverage regardless of the number of passes per coat.
5. Tint so the final color is Federal Color Standard No. 17778 - Light Neutral. Pigment content shall be limited so as not to reduce sealing effectiveness of the second coat. Refer to the plans for colors for specific projects.
6. Sags and runs are not acceptable in the sealer.
7. For sealed sidewalks or other horizontal surfaces with repetitive foot traffic or vehicular traffic, integrate 1-1/2 lbs. per square yard(0.8 kg/square meter) of silica sand into the surface of the second coat to produce a non-skid surface satisfactory to the Engineer.

B. Non-epoxy sealer.

1. Apply the sealer according to the manufacturer's recommended mode of application and under the observation of the Engineer.
2. Coverage.
Surfaces subject to abrasive wear (bridge decks, bridge deck shoulders and sidewalks)
 1. Minimum, one gallon (3.875 liter) of sealer for each 100 square feet (9.0 square meter);

Curbs, vertical surfaces of beams and deck slabs subject to direct roadway drainage

2. Minimum, one gallon (3.875 liter) for each 125 square feet (11.5 square meter)

Other surfaces (for example, parapets, abutments, pier caps and median dividers)

3. Minimum, one gallon (3.875 liter) for each 150 square feet (14.0 square meter)

3. Apply sealer on surfaces in a one-pass operation at the required coverage. Acceptable applications saturate a horizontal surface and take a few seconds before completely penetrating. Broom in the sealer if recommended by the manufacturer.
4. Vertical surface sealer spraying will create runs. Acceptable applications of penetrating sealer developing 6 to 12 inch (150 to 300 mm) runs below the spray pattern. Apply additional passes in 10 to 15 minutes if coverage rate is not achieved with first pass. Apply sealers with brush or roller if recommended by the manufacturer.
5. After 10 to 15 minutes, squeegee off excess material on smooth finished or dense concretes where the required coverage is not absorbed.
6. For sealed sidewalks or other horizontal surfaces with repetitive foot traffic or vehicular traffic, integrate 1-1/2 lbs. per square yard(0.8 kg/square meter) of silica sand into the sealer application to produce a non-skid surface satisfactory to the Engineer.
7. Tint clear non-epoxy sealers with a vanishing dye that will not damage the concrete.
8. Don't apply sealer if the ambient temperature is below 40F (5 C) or will fall below 32 F (0 C) within 12 hours after application.

General. Do not apply sealer if rain is anticipated within 2 hours after application. Clearly mark where the sealer application stops if not continuous.

864.09 Test Site/Application Apply sealer to measured coverage areas, both on a horizontal and vertical surfaces, and on different concrete types, demonstrating:

1. The project's visual effects for the epoxy/urethane sealer application at the required coverage rate.
2. Visually, the absorption necessary to achieve the specified coverage rate for the non-epoxy sealer. Use at least 1/2 gallon (2 liter) of sealer, following the manufacturer's recommended method of application, for the total of the test surfaces.
3. Apply to the deck, safety curb or sidewalk for the horizontal test surfaces Use an abutment parapet or pier face for the vertical test surface and so different textures are tested.

864.10 Appearance.

Epoxy/Urethane sealers. Uniform appearance and the final color shall visually match the test section. Re-coating, removal and re-application or other methods recommended by the manufacturer will be required to final appearance.

Non Epoxy Sealers. The sealer shall result in a uniform appearance.

864.11 Traffic. Allow traffic on deck shoulder areas after 12 hours of drying time for an epoxy/urethane sealer. Keep traffic off a non-epoxy sealer until the sealer appears totally dry.

864.12 Safety Precautions. Follow precautions defined on the manufacturer's MSDS. Provide the Engineer a copy of the MSDS sheet for information before any work commences.

864.13 Protection of Adjoining Surfaces and the Public. Protect the public during all operations, specially when applying sealer to the fascia or the underside portions a bridge that span an area used by the public.

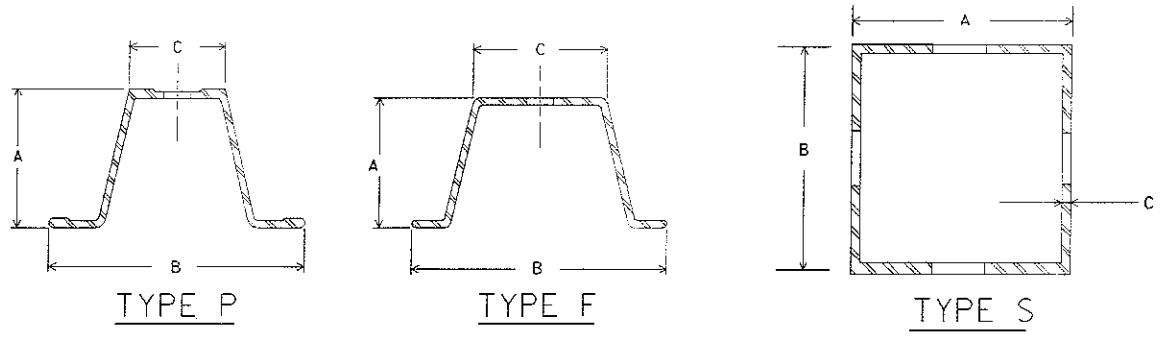
During sealing, mask off, or use other means of protection, for surfaces not being sealed . Protect asphalt and mastic type surfaces from spillage and heavy overspray. Do not apply sealers to joint sealants which have not cured according to the manufacturer's instructions. Joint sealants, traffic paints and asphalt overlays may be applied to the treated surfaces 48 hours after the sealer has been applied. Protect nearby steel, aluminum or glass surfaces when non-epoxy overspray could be deposited on those surfaces.

864.14 Environmental Requirements. Protect plants and vegetation from overspray by covering with drop cloths.

864.15 Method of Measurement. The quantity will be the actual area in square yards (square meters) of surfaces sealed.

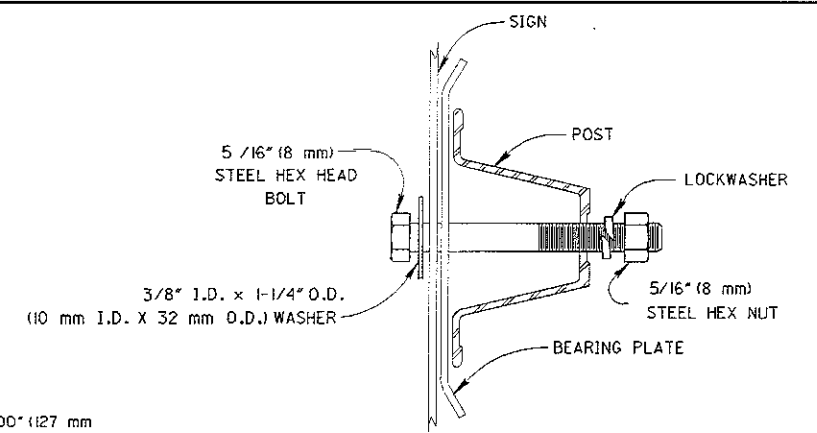
864.16 Basis of Payment. Payment will be made for completed and accepted work, including surface preparation, material, application, and pre-qualification testing costs, under the following:

ITEM	UNIT	DESCRIPTION
864	Square yard (square meter)	Sealing of concrete surfaces
864	Square yard (square meter)	Sealing of concrete surfaces (non-epoxy)
864	Square yard (square meter)	Sealing of concrete surfaces (epoxy-urethane)

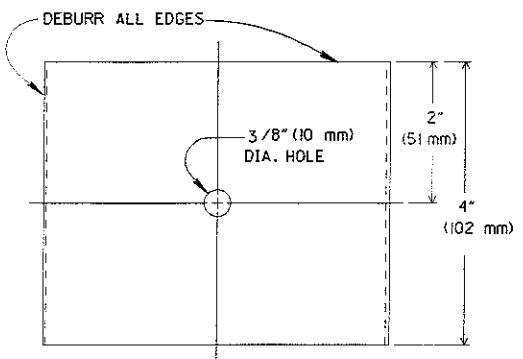
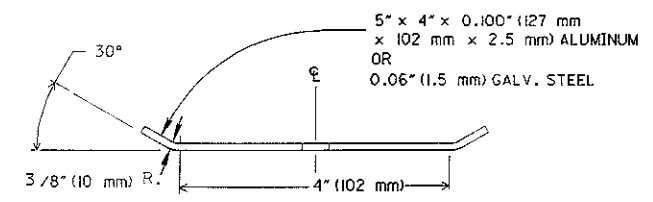


POST NO.	TYPE	LB/FT	POST DIMENSIONS (INCHES)			ANCHOR DIMENSIONS			NUMBER OF POSTS PERMITTED IN SEVEN FOOT PATH IN EXPOSED LOCATIONS
			A	B	C	A	B	C	
1	F	1.12	0.875	2.063	0.813				
	P	2.00	1.469	3.063	1.281				2
2	F	2.00	1.516	3.125	1.250				2
	S		1.750	1.750	0.083	2.000	2.000	0.105	2
3	P	3.00	1.875	3.500	1.313				2
	F	3.00	1.750	3.500	1.625				2
4	S		2.00	2.00	0.083	2.250	2.250	0.105	2
	P	4.00	TWO NO.2 POST						0
6	F	6.00	TWO NO.2 POST						0
	S		2.500	2.500	0.105	3.000	3.000	0.188	1

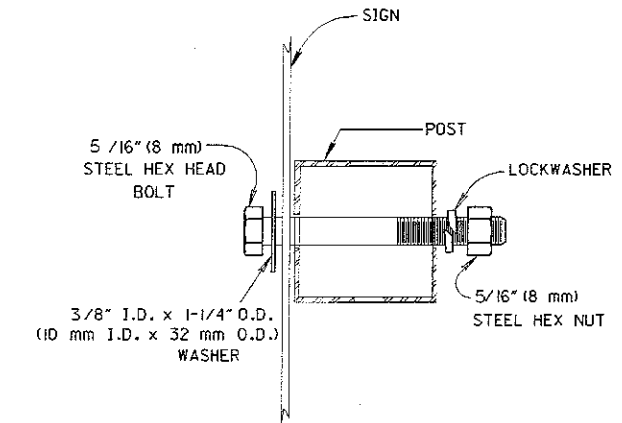
POST NO.	TYPE	Kg/m	POST DIMENSIONS (mm)			ANCHOR DIMENSIONS			NUMBER OF POSTS PERMITTED IN 2.1m PATH IN EXPOSED LOCATIONS
			A	B	C	A	B	C	
1	F	1.7	22	52	21				
	P	3.0	37	78	33				2
2	F	3.0	39	79	32				2
	S		44	44	2.1	51	51	2.7	2
3	P	4.5	48	89	33				2
	F	4.5	44	89	41				2
4	S		51	51	2.1	57	57	2.7	2
	P	6.0	TWO NO.2 POST						0
6	F	9.0	TWO NO.2 POST						0
	S		63	63	2.7	76	76	4.8	1



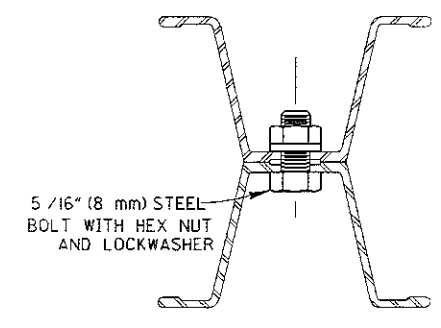
U - CHANNEL SIGN ATTACHMENT DETAIL



BEARING PLATE



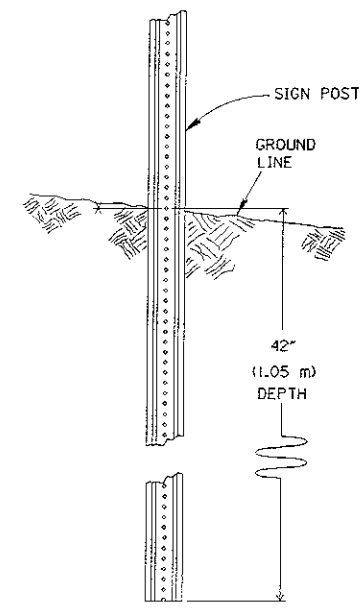
SQUARE POST SIGN ATTACHMENT DETAIL



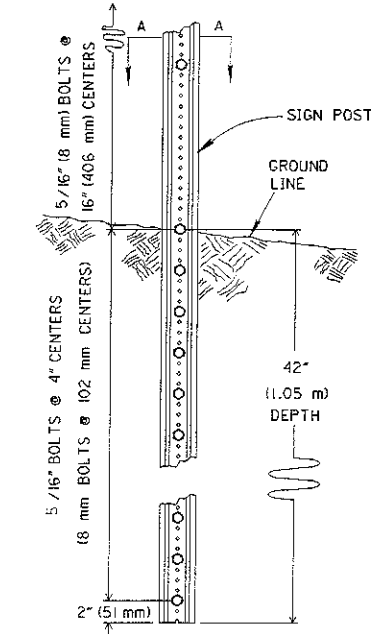
SECTION A - A

NOTES

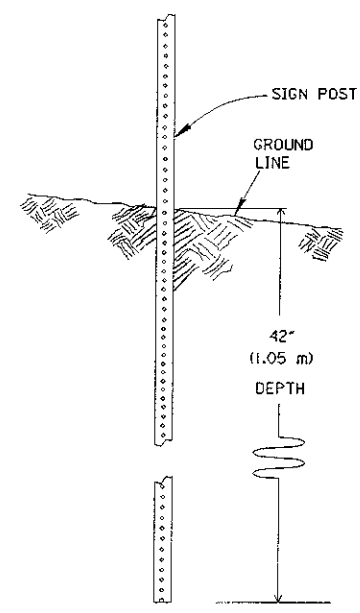
1. Install number 4 type P and F posts, and number 6 type P and F posts, only in protected locations (e.g. behind guardrail). Install two post installations of number 4 type S posts within 7 foot (2.1m) path only in protected locations.
2. Use of anchor base with No. 2 and No. 3 square post is optional. Use of anchor base with No. 4 square post is required.
3. Square post may have die-cut knockouts or open holes.



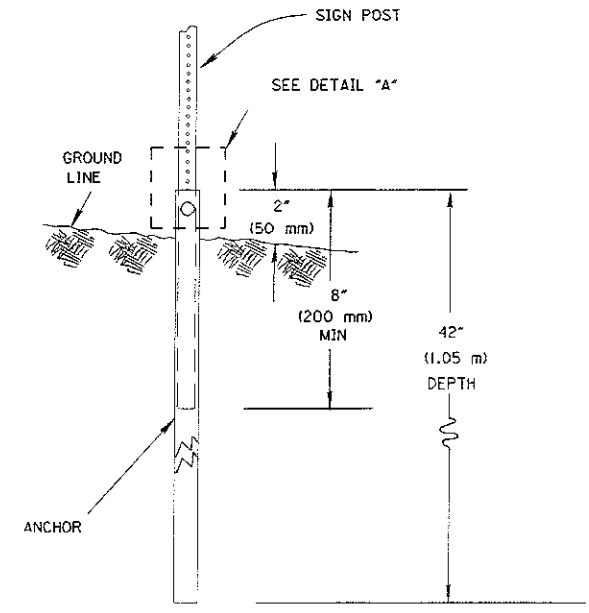
TYPICAL NO. 1, NO. 2 AND NO. 3 U - CHANNEL DRIVEN INSTALLATION



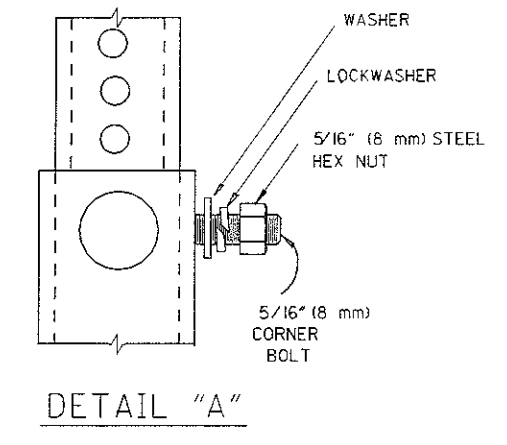
TYPICAL NO. 4 AND NO. 6 U - CHANNEL DRIVEN INSTALLATION



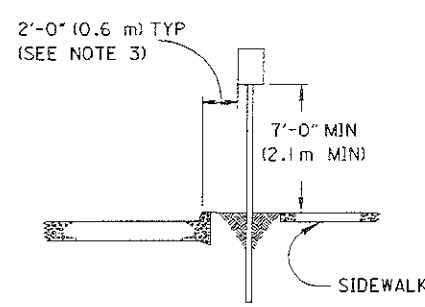
TYPICAL SQUARE POST DRIVEN INSTALLATION



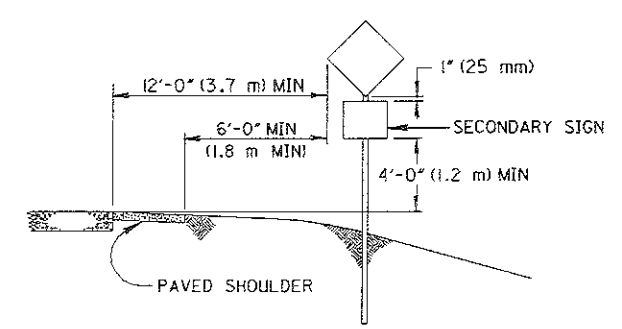
TYPICAL SQUARE POST ANCHOR BASE INSTALLATION



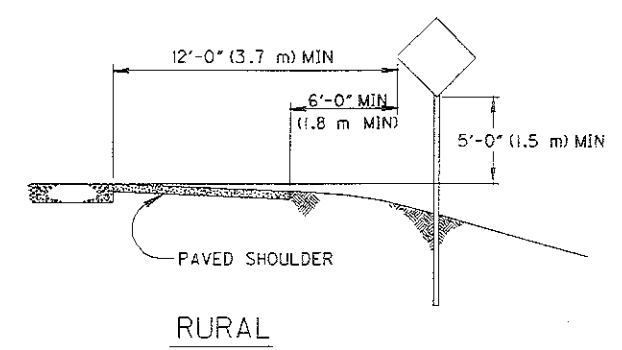
DETAIL "A"



URBAN-RESIDENTIAL AND BUSINESS



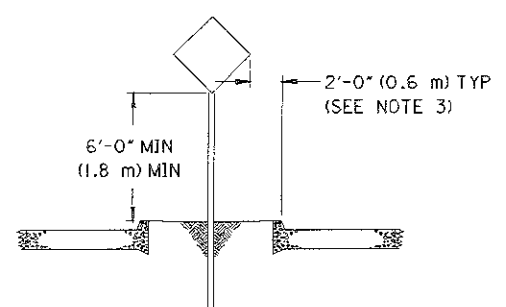
RURAL
W/SECONDARY SIGN



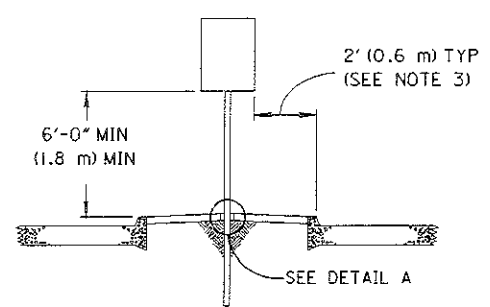
RURAL

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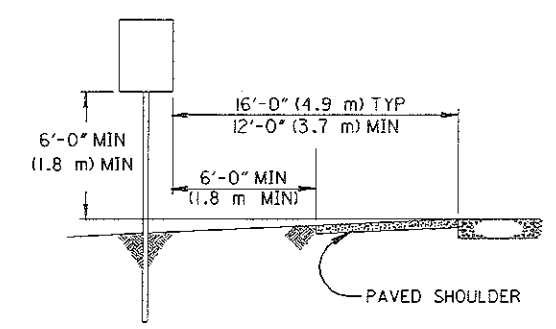
1. See drawing TC-41.20 for details on yielding supports.
2. All signs shall be placed 90° to the roadway, except parking signs with arrow shall be set at an angle of not less than 30° nor more than 45° with a line parallel to the flow of traffic.
3. A clearance of 1 foot (0.3 m) is permissible where sidewalk width is limited or where existing poles are close to the curb.
4. See drawings TC-52.10 and TC-52.20 for dimensions between supports.



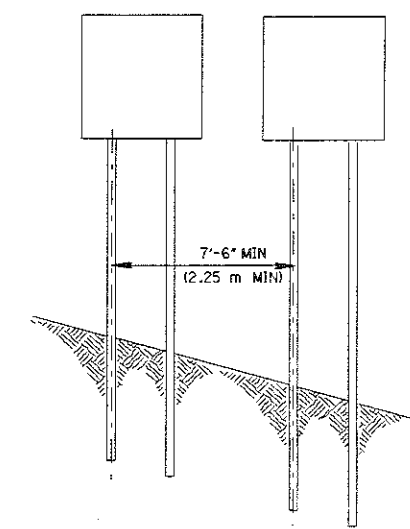
MEDIAN



PAVED MEDIAN

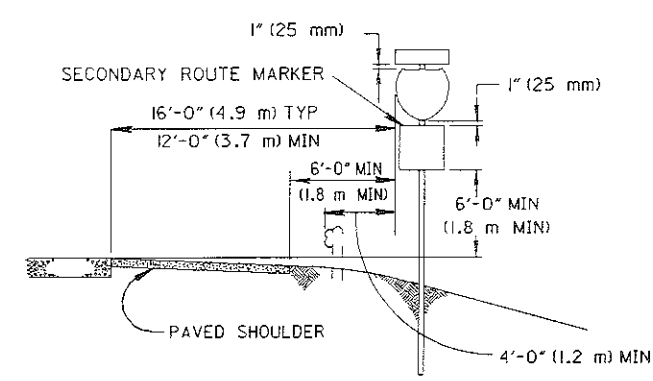


MEDIAN-EXPRESSWAY OR FREEWAY

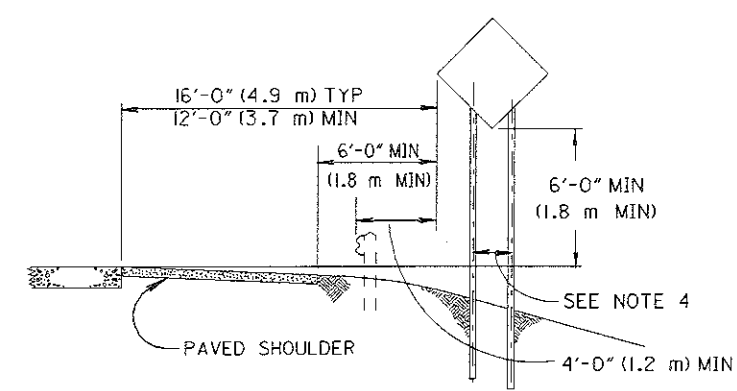


ADJACENT SIGN INSTALLATION

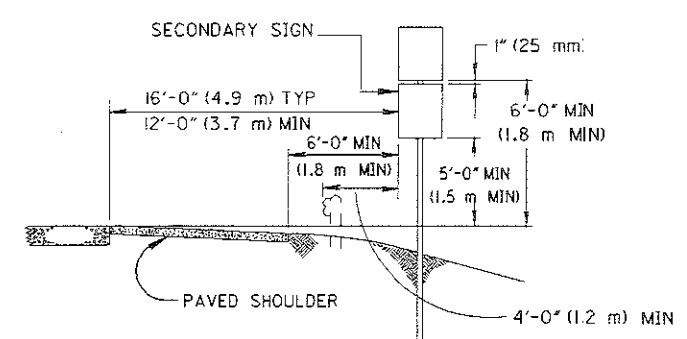
FOR NO. 2 AND NO. 3 YIELDING POST SUPPORTS IN EXPOSED LOCATIONS



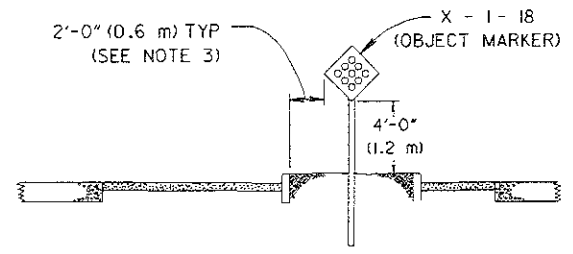
EXPRESSWAY OR FREEWAY
W/SECONDARY SIGN



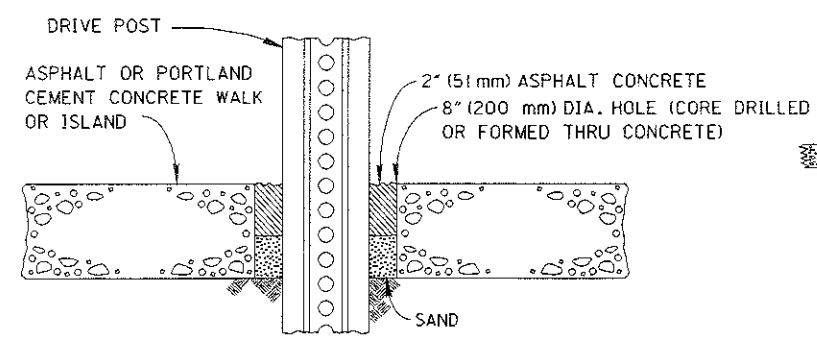
EXPRESSWAY OR FREEWAY



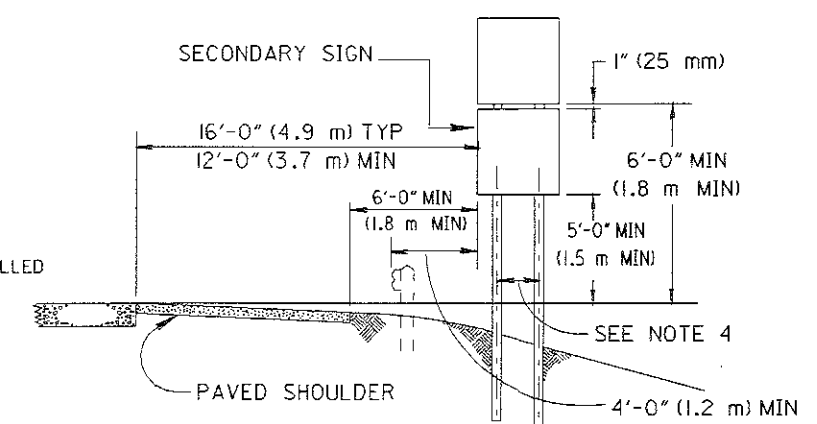
EXPRESSWAY OR FREEWAY
W/SECONDARY SIGN



EXPRESSWAY OR FREEWAY



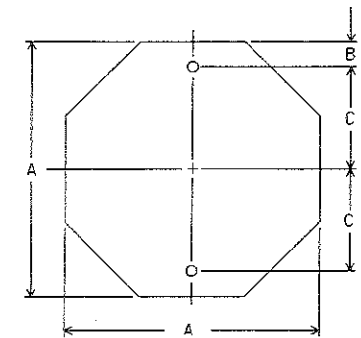
DETAIL A



EXPRESSWAY OR FREEWAY
W/SECONDARY SIGN

NOTES

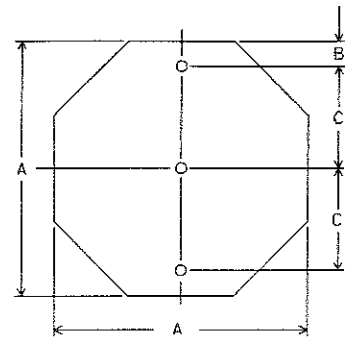
1. For each detail shown, the top table is in inches and the lower table is in millimeters unless otherwise noted.
2. All bolt holes shall be 3/8" (10 mm) in diameter, and may be drilled or punched to finished size.
3. Dimensions between bolt holes shall be to tolerance of $\pm 1/32"$ (± 0.8 mm).
4. All route shields shall be 0.063" (1.6 mm) thick and attached to extrusheet signs with aluminum blind rivets.



OCTA-1-2

A	B	C	GAUGE	SQ. FT.
18	3	6	0.063	2.25
24	3	9	0.063	4.00

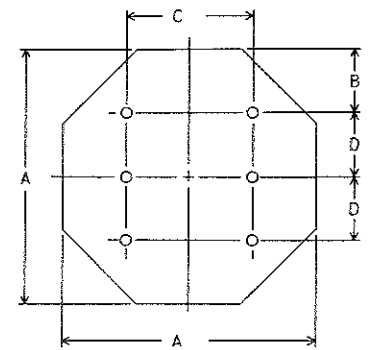
A	B	C	THICKNESS	m ²
450	75	150	1.6	0.20
600	75	225	1.6	0.36



OCTA-1-3

A	B	C	GAUGE	SQ. FT.
30	3	12	0.080	6.25
36	6	12	0.080	9.00

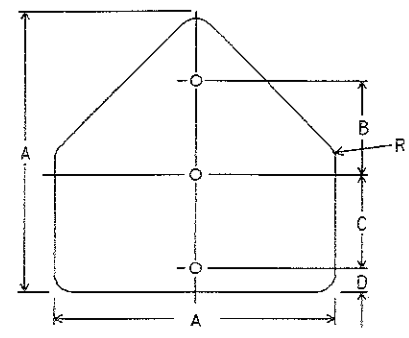
A	B	C	THICKNESS	m ²
750	75	300	2.0	0.56
900	150	300	2.0	0.81



OCTA-2-6

A	B	C	D	GAUGE	SQ. FT.
48	12	24	12	0.100	16.00

A	B	C	D	THICKNESS	m ²
1200	300	600	300	2.5	1.44



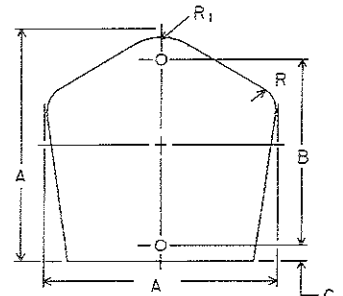
PENT-1-3

A	B	C	D	R	GAUGE	SQ. FT.
30	10	11	3	1.88	0.080	6.25
36	12	12	3	2.25	0.080	9.00
42	14	13	4	2.50	0.100	12.25

A	B	C	D	R	THICKNESS	m ²
750	250	275	75	48	2.0	0.56
900	300	300	75	57	2.0	0.81
1050	350	325	100	64	2.5	1.10

SHAPE NO. BOLTS REQUIRED
 NO. SUPPORTS REQUIRED

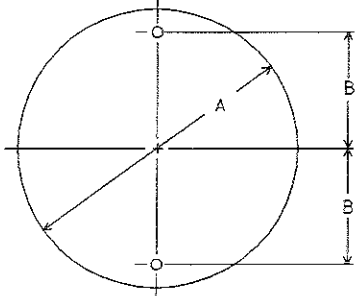
OCTA-2-6



CO-1-2

A	B	C	R ₁	R	GAUGE	SQ. FT.
18	15	1	5	2	0.063	2.25
24	18	2	5.31	2.69	0.063	4.00
30	24	2	6.63	3.38	0.080	6.25

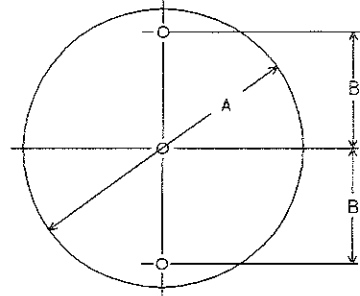
A	B	C	R ₁	R	THICKNESS	m ²
450	375	25	125	50	1.6	0.20
600	450	50	135	68	1.6	0.36
750	600	50	168	86	2.0	0.56



CIR-1-2

A	B	GAUGE	SQ. FT.
18	6	0.063	2.25
24	9	0.063	4.00

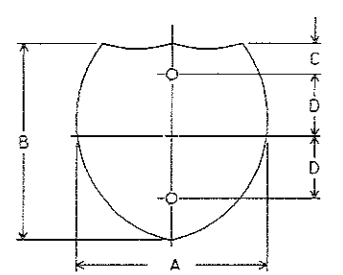
A	B	THICKNESS	m ²
450	150	1.6	0.20
600	225	2.0	0.36



CIR-1-3

A	B	GAUGE	SQ. FT.
30	12	0.080	6.25
36	15	0.080	9.00

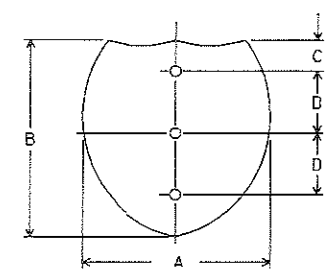
A	B	THICKNESS	m ²
750	300	2.0	0.56
900	375	2.0	0.81



I.S.-1-2

A	B	C	D	GAUGE	SQ. FT.
24	24	3	9	0.063	4.00
30	24	3	9	0.080	5.00
30	30	3	12	0.080	6.25
40	30	3	12	0.080	8.33

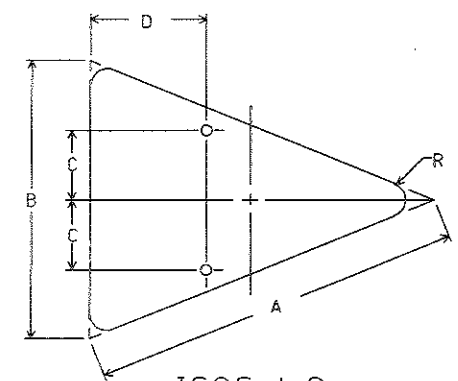
A	B	C	D	THICKNESS	m ²
600	600	75	225	1.6	0.36
750	600	75	225	2.0	0.45
750	750	75	300	2.0	0.56
1000	750	75	300	2.0	0.75



I.S.-1-3

A	B	C	D	GAUGE	SQ. FT.
36	36	6	12	0.080	9.00
48	36	6	12	0.100	12.00

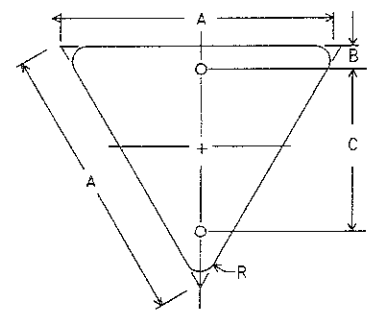
A	B	C	D	THICKNESS	m ²
900	900	150	300	2.0	0.81
1200	900	150	300	2.5	1.08



ISOS-1-2

A	B	C	D	R	GAUGE	SQ. FT.
40	30	17.50	12	1.88	0.080	3.86
48	36	9	15	2.25	0.100	5.56

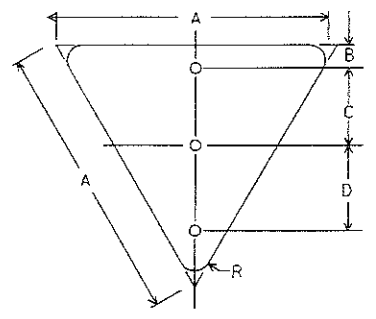
A	B	C	D	R	THICKNESS	m ²
1000	750	187	300	48	2.0	0.35
1200	900	225	375	57	2.5	0.50



TRI-1-2

A	B	C	R	GAUGE	SQ. FT.
24	2	14	1.50	0.080	1.73

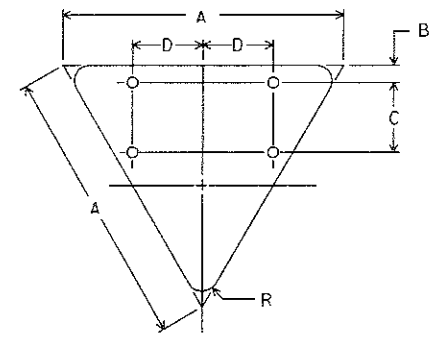
A	B	C	R	THICKNESS	m ²
600	50	350	38	2.0	0.16



TRI-1-3

A	B	C	D	R	GAUGE	SQ. FT.
36	3	10	11	2.00	0.100	3.90

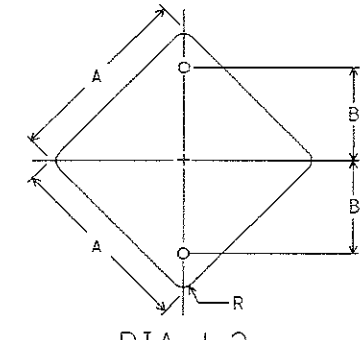
A	B	C	D	R	THICKNESS	m ²
900	75	1250	275	50	2.5	0.35



TRI-2-4

A	B	C	D	R	GAUGE	SQ. FT.
48	3	12	12	3	0.100	6.93
60	3	18	15	4	0.100	10.83

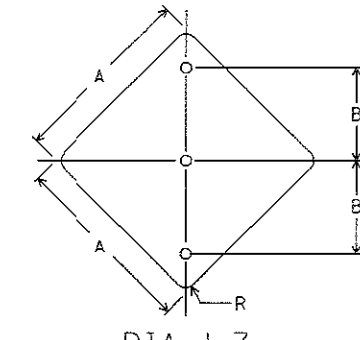
A	B	C	D	R	THICKNESS	m ²
1200	75	300	300	75	2.5	0.62
1500	75	450	375	100	2.5	0.97



DIA-1-2

A	B	R	GAUGE	SQ. FT.
18	9	11.50	0.063	2.25

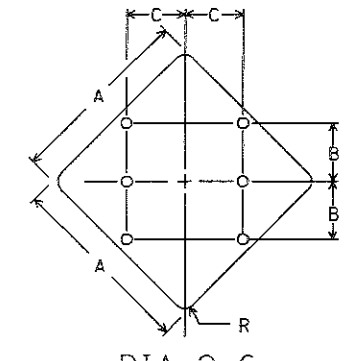
A	B	R	THICKNESS	m ²
450	225	38	1.6	0.20



DIA-1-3

A	B	R	GAUGE	SQ. FT.
24	12	15.00	0.063	4.00
30	15	18.88	0.080	6.25
36	18	22.50	0.080	9.00

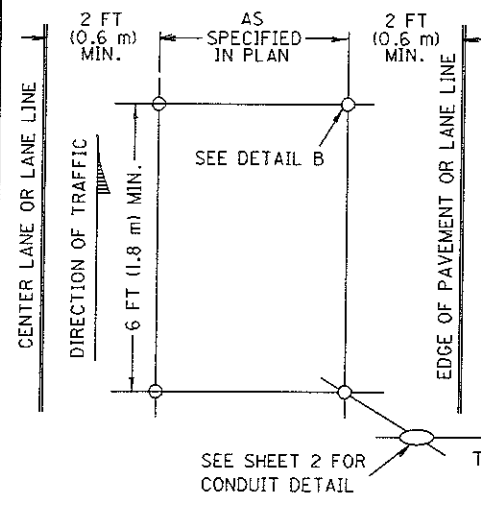
A	B	R	THICKNESS	m ²
600	300	38	1.6	0.36
750	375	48	2.0	0.56
900	450	57	2.0	0.81



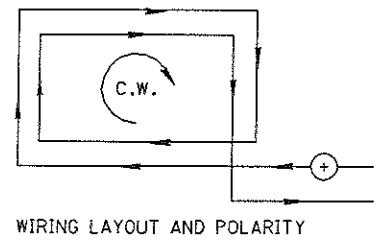
DIA-2-6

A	B	C	R	GAUGE	SQ. FT.
48	15	15	3	0.100	16.00
60	18	18	3.75	0.100	25.00

A	B	C	R	THICKNESS	m ²
1200	375	375	75	2.5	1.44
1500	450	450	95	2.5	2.25



LOOP CONSTRUCTION	
LOOP PERIMETER	NUMBER OF TURNS
LESS THAN 40 FT (12 m)	4
40 FT (12 m) TO 160 FT (49 m)	3
OVER 160 FT (49 m)	2



TYPICAL DETECTOR LOOP DETAILS

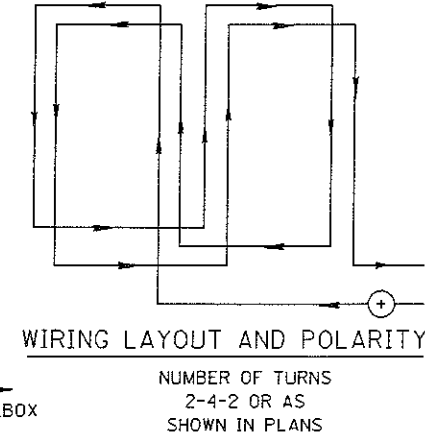
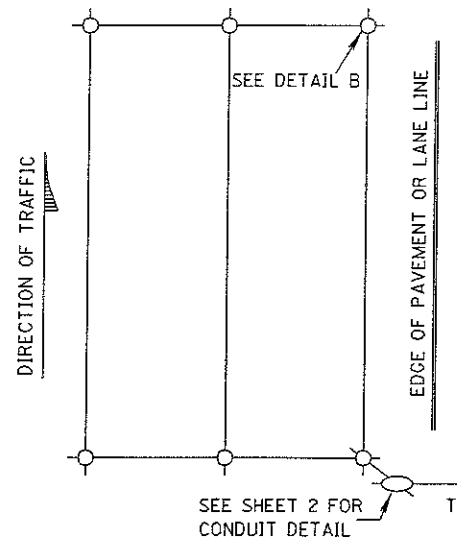
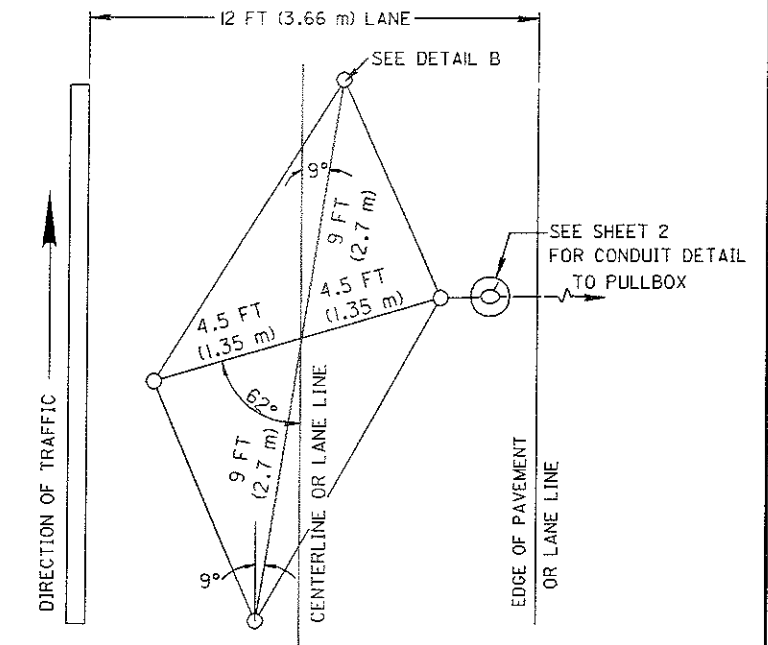
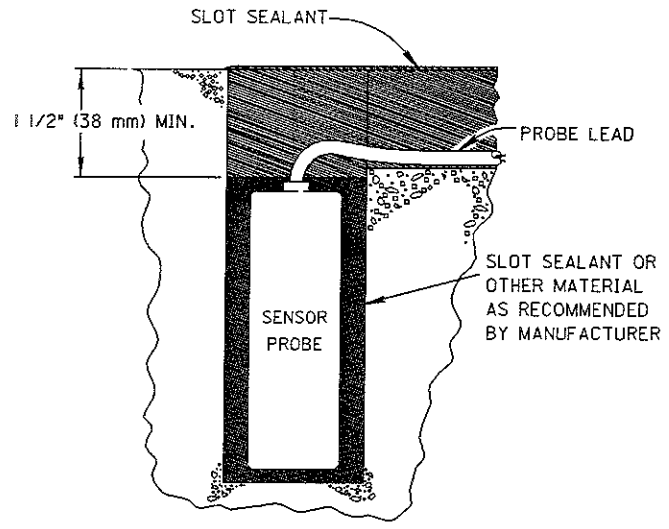


FIGURE 8 (QUADRUPOLE) LOOP DETAILS



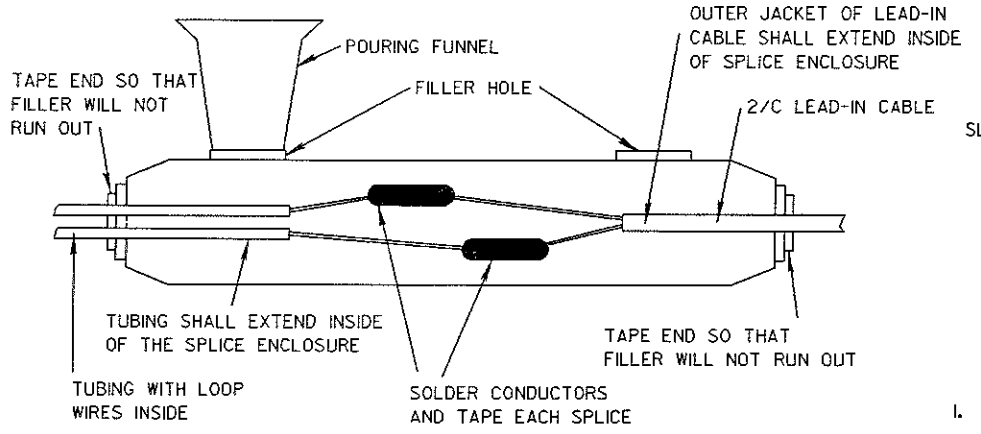
OTHER SIZES CAN BE DESIGNATED AS LONG AS THE ANGLES REMAIN THE SAME AS SHOWN AND THE DIMENSION RATIO REMAINS 2:1.

ANGULAR DESIGN DETECTION LOOP DETAIL



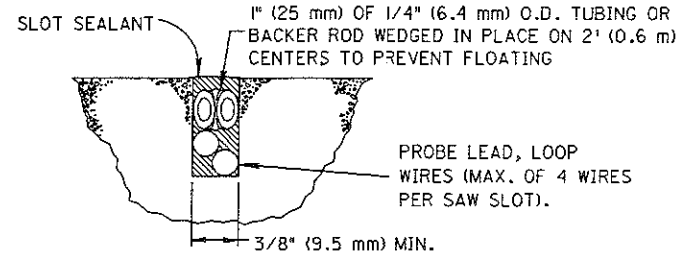
THE MAGNETOMETER HOLE SIZE SHALL BE APPROXIMATELY 3/4" (19 mm) LARGER THAN THE DETECTOR PROBE DIAMETER AND A DEPTH AS RECOMMENDED BY THE MANUFACTURER OR AS DIRECTED BY THE ENGINEER.

MAGNETOMETER SENSOR PROBE DETAIL



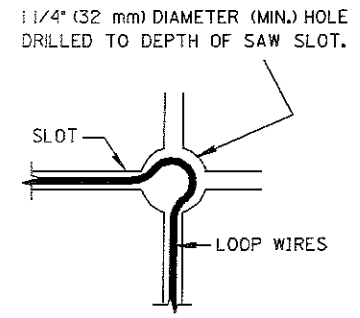
1. LOOP DETECTOR WIRE TO LEAD-IN CABLE SPLICES WITHIN THE ENCAPSULATED SPLICE ENCLOSURE SHALL BE SOLDERED.
2. IF A PULLBOX IS NOT SPECIFIED IN THE PLANS, THE WATERPROOF SPLICE ENCLOSURE SHALL BE LOCATED IN THE FIRST ENTERED POLE OR PEDESTAL, EXCEPT IF THE CONTROLLER CABINET IS MOUNTED ON THAT POLE OR PEDESTAL, IN WHICH CASE THE LOOP WIRES SHALL BE ROUTED DIRECTLY INTO THE CABINET.
3. VISIBLE AIR BUBBLES (VOIDS) OF 1/4" (6 mm) OR GREATER MAY BE CAUSE FOR REJECTION OF THE SPLICE.

SPLICE ENCLOSURE DETAIL

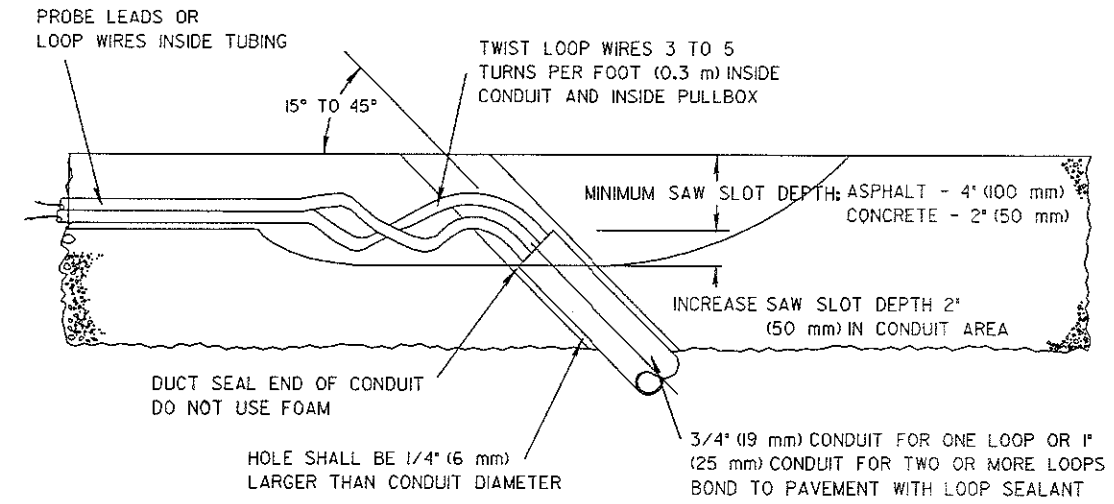
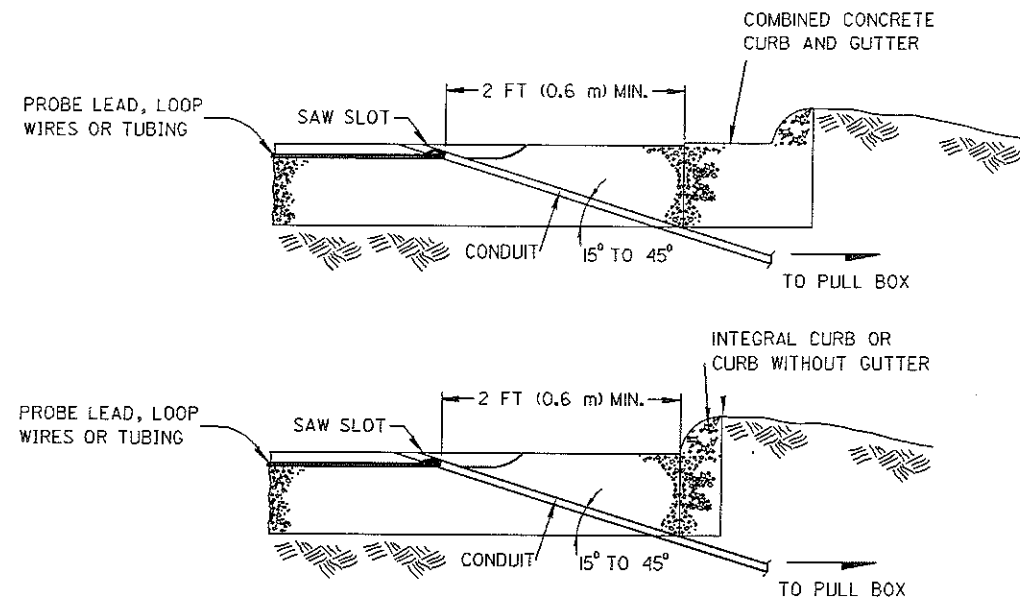


1. MINIMUM SAW SLOT DEPTH: ASPHALT 4" (100 mm), CONCRETE 2" (50 mm)
2. LOOP DETECTOR WIRE IN TUBING SHALL BE AS SPECIFIED IN CMS TABLE 732J9-1.
3. LOOP DETECTOR SEALANT SHALL BE A PREQUALIFIED PRODUCT IN ACCORDANCE WITH SUPPLEMENT 104B.
4. SAW SLOTS AND PROBE HOLES SHALL BE THOROUGHLY CLEANED AND DRIED PRIOR TO INSTALLATION OF SEALANT.
5. WIRE INSTALLATIONS IN NEW ASPHALT MAY BE SAWED AND EMBEDDED WITH SEALANT IN A SUB-SURFACE COURSE WITH SUBSEQUENT COVERING BY THE SURFACE COURSE, SUBJECT TO APPROVAL OF THE ENGINEER.

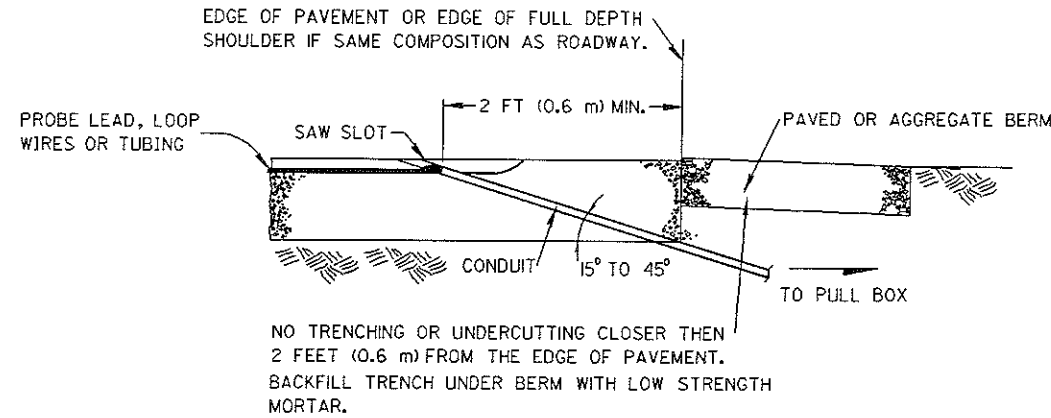
SLOT DETAIL



DETAIL B

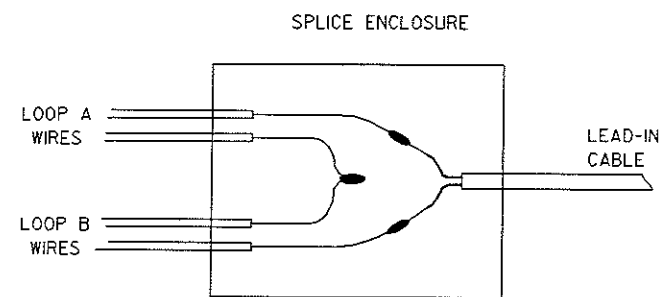


CONDUIT DRILLED HOLE DETAIL



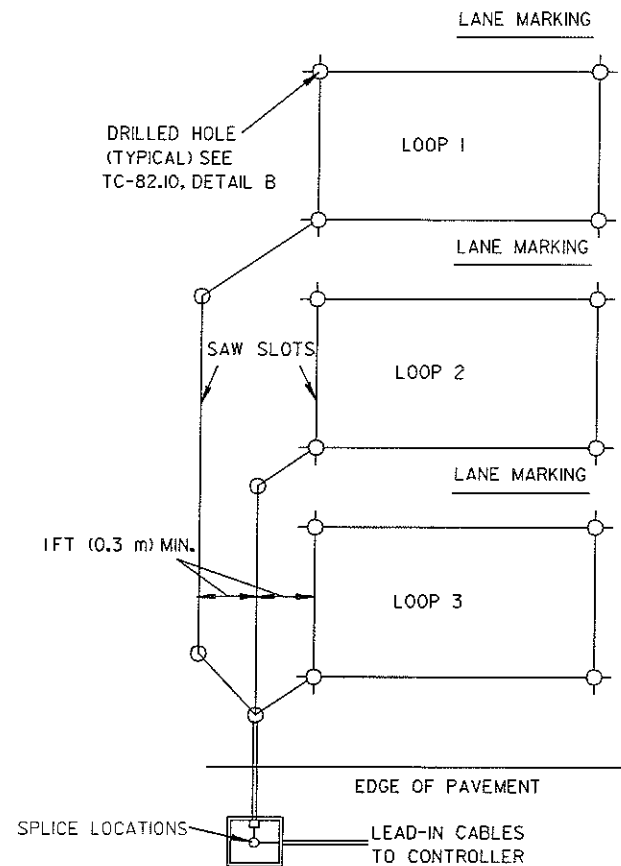
1. THE DRILLED HOLE SHALL BE LOCATED AS SHOWN ABOVE AND WITHIN THE FULL DEPTH PAVEMENT. IT SHALL NOT BE DRILLED OR CUT THROUGH THE PAVED BERM, CURB OR CURB AND GUTTER SECTION.
2. IN AREAS OF POOR PAVEMENT CONDITION, THE SAW SLOT DEPTH SHALL BE INCREASED TO INSURE ADEQUATE WIRE EMBEDMENT. ALL FIELD ADJUSTMENTS SHALL BE SUBJECT TO THE APPROVAL OF THE ENGINEER.

TYPICAL DRILLED HOLE LOCATIONS



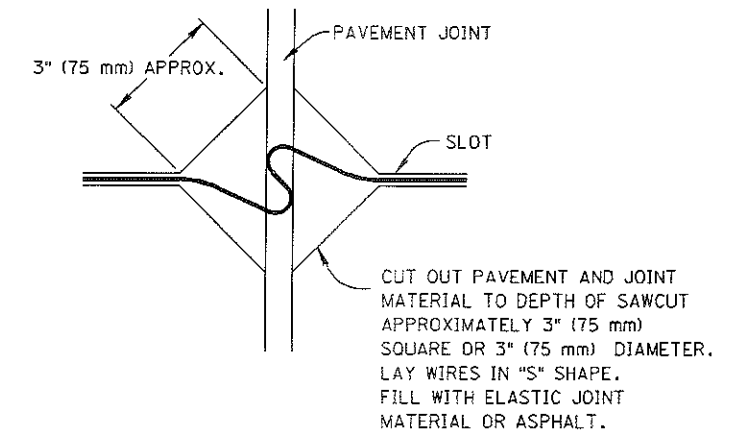
SERIES CONNECTIONS

1. WHERE MULTIPLE LOOPS USE A SINGLE LEAD-IN CABLE, SERIES CONNECTIONS SHALL BE USED.
2. A MAXIMUM OF 2 LOOPS (3 WIRE SPLICES) SHALL BE USED IN ANY ENCAPSULATED SPLICE KIT.



MULTIPLE LOOP LAYOUT

1. ONLY ONE SET OF LOOP WIRES SHALL BE RUN IN A SAW SLOT OVER TO THE CONDUIT HOLE LOCATION.
2. ALL ADJACENT SAW SLOTS SHALL HAVE A MINIMUM DISTANCE OF 1 FOOT (0.3 m) BETWEEN THEM. NO SAW SLOT SHALL BE LOCATED WITHIN 1 FOOT (0.3 m) OF A LONGITUDINAL OR TRANSVERSE JOINT IN P.C.C. PAVEMENTS IF THE SLOT IS PARALLEL TO THE JOINT.



JOINT CROSSING DETAIL IN P.C.C. PAVEMENTS