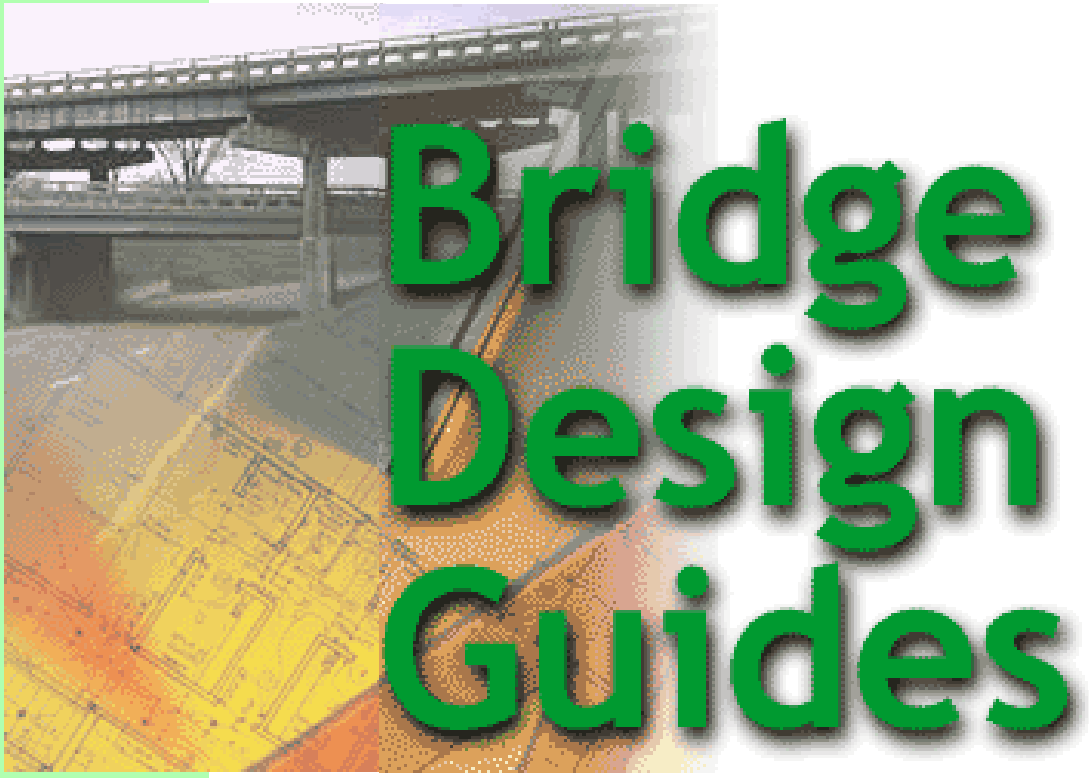
MDOT

Michigan Department of Transportation



MICHIGAN DEPARTMENT OF TRANSPORTATION

BRIDGE DESIGN GUIDES

Engineering Manual Preamble

This manual provides guidance to administrative, engineering, and technical staff. Engineering practice requires that professionals use a combination of technical skills and judgment in decision making. Engineering judgment is necessary to allow decisions to account for unique site-specific conditions and considerations to provide high quality products, within budget, and to protect the public health, safety, and welfare. This manual provides the general operational guidelines; however, it is understood that adaptation, adjustments, and deviations are sometimes necessary. Innovation is a key foundational element to advance the state of engineering practice and develop more effective and efficient engineering solutions and materials. As such, it is essential that our engineering manuals provide a vehicle to promote, pilot, or implement technologies or practices that provide efficiencies and quality products, while maintaining the safety, health, and welfare of the public. It is expected when making significant or impactful deviations from the technical information from these guidance materials, that reasonable consultations with experts, technical committees, and/or policy setting bodies occur prior to actions within the timeframes allowed. It is also expected that these consultations will eliminate any potential conflicts of interest, perceived or otherwise. MDOT Leadership is committed to a culture of innovation to optimize engineering solutions.

The National Society of Professional Engineers Code of Ethics for Engineering is founded on six fundamental canons. Those canons are provided below.

Engineers, in the fulfillment of their professional duties, shall:

1. Hold paramount the safety, health, and welfare of the public.
2. Perform Services only in areas of their competence.
3. Issue public statement only in an objective and truthful manner.
4. Act for each employer or client as faithful agents or trustees.
5. Avoid deceptive acts.
6. Conduct themselves honorably, reasonably, ethically and lawfully so as to enhance the honor, reputation, and usefulness of the profession.

1. MISCELLANEOUS STANDARDS

PREFACE TO
MICHIGAN DEPARTMENT OF TRANSPORTATION
BRIDGE DESIGN GUIDES

These Guides have been developed to serve as an aid for designing and detailing bridges in Michigan. The intent is to provide consistency in office practice and interpretation of current Specifications.

It is recognized that the details within these Guides are ever evolving, not applicable to all situations and that judgment must be used at times.

The Guides contained herein are to be used for reference only. When using details on plans, designers and detailers shall confirm that design calculations/assumptions, dimensions and notes are appropriate for job specific situations. It is the responsibility of the designer and/or detailer to ensure that all details and notes are the most current and comply with the appropriate specifications (AASHTO, AREMA, AWS, ASTM, MDOT, etc.).

MICHIGAN DEPARTMENT OF TRANSPORTATION
BRIDGE DESIGN GUIDES

TABLE OF CONTENTS

SECTION 1 - MISCELLANEOUS STANDARDS

1.00.01 - .05 Table of Contents

1.11.01 Decimal Parts of a Foot and Inch

1.21.01 Factors for Bridge Estimates

SECTION 3 - WATERWAY AND DRAINAGE

3.25.01 Drainage Details for Abutments in Cut

3.25.03 Drainage Details at Side Piers

SECTION 4 - APPROACHES

4.11.01 Vertical Curve Calculations

4.23.01 Median Treatment at Dual Structures with Separate Abutments

4.23.02 Median Treatment at Dual Structures with Continuous Abutments

SECTION 5 - SUBSTRUCTURE

5.16.01, .01A Cantilever Abutment Reinforcing

5.17.01 Slopewall Details

5.17.03 Retaining Wall Treatments

5.17.05 Return Wall Details - County Road over Trunklines

5.17.06 Wingwall Treatment - Trunkline over Trunkline, County Road or Railroad

5.17.07 Wingwall Treatment - Stream Crossing

5.18.01 Curtainwall Abutment

5.18.01A Curtainwall Abutment Reinforcing

5.20.01 Abutment Joints

5.20.02 Wall Expansion Joint Drain

5.21.01 Pier Nosing Detail

5.22.01 Base Wall Details for Pier Adjacent to Roadway

5.22.02 - .02B Pier Strut Retrofit

5.24.01 Base Wall Details for Pier Adjacent to Railroad

5.24.03 Railroad Side Clearances - Single Track Under

5.24.04 Railroad Side Clearances - Double Track Under

5.27.03 Pier Cap Details - Round Column Piers

5.27.04 Partial Metal Bulkhead for Pier Cap Construction Joint

5.27.05 Metal Bulkhead for Abutment Construction Joint

CONTENTS

SECTION 5 - SUBSTRUCTURE (cont)

5.45.01 Compacted Mound Under Footings

5.46.01 - .05A Structure Backfill and Embankment - Abutments

5.46.06 Structure Backfill and Foundation Excavation – Abutments

5.47.01 Protection of Spill-Through Abutment

SECTION 6 - SUPERSTRUCTURE

6.05.01A - .03 Bridge Deck Cross Sections

6.06.01 - .04 Substructure Clearances

6.11.01 Modified Parabolic Crown Offsets

6.11.02 Straight Line Superelevation

6.20.01 Typical Section thru Dependent Backwall

6.20.01A Replacement of Existing End Header

6.20.03 Typical Section thru Independent Backwall

6.20.03A Typical Section thru Independent Backwall with Sliding Slab

6.20.03B Independent Backwall Sliding Slab Details

6.20.04 Integral and Semi-Integral Abutment Backwall

6.20.04A Integral and Semi-Integral Abutment Partial Backwall Details

6.20.04B Integral and Semi-Integral Abutment Approach Slab Details

6.20.04D Integral Abutment - Single Row Of Piles (Section Thru Stub Abutment)

6.20.04E Integral Abutment - Single Row Of Piles (Pile Orientation)

6.20.04F Semi - Integral Abutment - Sliding Backwall (Section Thru Abutment)

6.20.05 – .05A Sleeper Slab Details

6.23.01 Construction, Expansion and False Joint Details

6.28.06 Expansion Joint Cover Retrofit

6.29.05 Joint Details for Solid Parapet, Sidewalk, or Brush Block with Expansion Joint Device EJ3

6.29.06 Bridge Railing, 2 Tube

6.29.08 Bridge Barrier Railing, Type 7

CONTENTS

SECTION 6 - SUPERSTRUCTURE (cont)

6.29.09	Bridge Barrier Railing, Type 6
6.29.09A, B, C	Bridge Barrier Railing, Type 4 (Mod.) for Railing Replacement
6.29.09D	Bridge Barrier Railing, Type 6 (Two-stage Deck)
6.29.10, .10A-C	Bridge Railing, Aesthetic Parapet Tube Sections and Details
6.29.10E	Bridge Railing, Aesthetic Parapet Tube Aesthetic Treatment
6.29.11	Joint Detail for Bridge Barrier Railing with Expansion Joint
6.29.13, .13A	Barrier Railing Details at Light Standard
6.29.15	Barrier Railing Details at Dependent Backwall
6.29.16, .16A	Barrier Railing Details at Independent Backwall
6.29.17, .17B-H	Bridge Railing, 4 Tube Sections and Details
6.41.01	Standard Bridge Slabs (Load Factor Design)
6.41.02	Standard Bridge Slabs (Empirical Design)
6.42.03	Slab Haunch & Reinforcement Cover
6.42.03A	Deep Haunch Details – Concrete Beams
6.44.01, .01A	Link Slab Details
6.60.01	Prestressed Concrete I Beam Details
6.60.02	Michigan 1800 Girder
6.60.03, .03A-D	Bulb Tee Beam Details
6.60.11, .11A-B	Pier Diaphragms for Prestressed Concrete Beams Continuous for Live Load
6.60.12	Concrete Diaphragms for Prestressed Concrete Beams/Girders
6.60.12A-B	Steel Diaphragms for 28" Through 54" Prestressed Girders
6.60.12C-D	Steel Diaphragms for 70" & MI 1800 Prestressed Girders
6.60.12E-F	Steel Diaphragms for 48” and 54” Bulb Tee Beams
6.60.12G-H	Steel Diaphragms for 60”, 66” and 72” Bulb Tee Beams
6.60.13	Details at Abutments for Prestressed Concrete I Beams
6.65.02, .02A-B	Prestressed Concrete Box Beam Properties
6.65.10, .10A-G	Prestressed Concrete Box Beam Reinforcement Details
6.65.10H-I	Prestressed Concrete Box Beam Reinforcement Alternative Details
6.65.11	Prestressed Concrete Box Beam Reinforcement Details (12 in. Deep)
6.65.12A	Prestressed Concrete Box Beam Details – Spread Box Beams
6.65.14, .14A-B	Prestressed Concrete Beam Lifting Device Details

CONTENTS

SECTION 7 - STEEL REINFORCEMENT

7.11.01 English Reinforcing Bars

7.14.02 Tension Development and Lap Splice Lengths Spacing Thresholds

7.14.02A Tension Development and Lap Splice Lengths Substructure

7.14.02B Tension Development and Lap Splice Lengths Superstructure

7.14.03 Minimum Dimensions for Standard Hooks in Tension

7.15.01, .02 Standard Reinforcing Bar Types

SECTION 8 - STRUCTURAL STEEL

8.06.02, .02A Welded Girder, Camber Diagram and Stiffener Details

8.06.03 Plate Girder Welding Details

8.07.01 Stud Shear Developer Details

8.11.03 Diaphragm and Connection Plate Details

8.11.04 End Diaphragm Connection Details 30º to 45º

8.11.05, .05A Lateral Bracing Details

8.11.06 End Cross Frames

8.11.07 Intermediate and Pier Cross Frames

8.11.08 Bolted Connections for Intermediate Diaphragms and Crossframes

8.14.02 Beam or Girder Suspender Design Table

8.15.01 Suspender Details for Cantilevered Plate Girders

8.15.01A Pin Detail

8.16.02 Suspender Details for Rolled Beams

8.21.01 CIP Pile Splices

8.21.02, .02A H Pile Splice Details

8.21.03 CIP Pile Point Details

8.26.01 Fastener Detailing Minimums

8.31.01 Guide for Selection of Bearing Types for Steel Structures

8.31.02 Offset Dimensions for Rocker Tilt

8.32.01, .02 Expansion Rockers - Steel Beams

8.32.03 - .06 Fixed Bearings - Steel Beams

8.32.07 Expansion Rocker with Provision for Uplift

8.42.01 Curved Steel Plate Bearing Details

8.43.01 Bearing Details for Prestressed Concrete I Beams

8.43.01A Bearing Details for Prestressed Concrete Box Beams

CONTENTS

SECTION 9 - UTILITY DATA

9.12.01	Weight of Utilities
9.21.01	Dimensions for 5" Steel Electrical Conduits
9.21.02	Structural Steel Diaphragm Details for 5" Steel Electrical Conduits
9.21.03	Dimensions for Telephone Company 4" Ducts
9.21.04	Structural Steel Diaphragm Details for Telephone Company Conduits
9.21.05	Backwall Details for Electrical and Telephone Conduits
9.22.01	Dimensions for 5" P.V.C. Electrical Conduits
9.22.02 - .07	Structural Steel Diaphragm Details for 5" P.V.C. Electrical Conduits
9.31.01	Nonmetallic Conduits in Sidewalk
9.33.01	Telephone Company Ducts in Sidewalks
9.40.01	Gas Main through Backwall
9.40.02	Structural Steel Diaphragm Details for Consumers Energy Company Gas Mains
9.40.03	Structural Steel Diaphragm for DTE Energy Gas Mains
9.50.01	Utility Charges

DRAWN BY: VZ CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT DECIMAL PARTS OF A FOOT AND INCH	ISSUED: 11/27/01 SUPERSEDES:

	DECIMAL PARTS OF A FOOT												Decimals of an inch	
Inches	0"	1"	2"	3"	4"	5"	6"	7"	8"	9"	10"	11"		
	0.0000	0.0833	0.1667	0.2500	0.3333	0.4167	0.5000	0.5833	0.6667	0.7500	0.8333	0.9167		
1/32	0.0026	0.0859	0.1693	0.2526	0.3359	0.4193	0.5026	0.5859	0.6693	0.7526	0.8359	0.9193	1/32	0.0313
1/16	0.0052	0.0885	0.1719	0.2552	0.3385	0.4219	0.5052	0.5885	0.6719	0.7552	0.8385	0.9219	1/16	0.0625
3/32	0.0078	0.0911	0.1745	0.2578	0.3411	0.4245	0.5078	0.5911	0.6745	0.7578	0.8411	0.9245	3/32	0.0938
1/8	0.0104	0.0938	0.1771	0.2604	0.3438	0.4271	0.5104	0.5937	0.6771	0.7604	0.8437	0.9271	1/8	0.1250
5/32	0.0130	0.0964	0.1797	0.2630	0.3464	0.4297	0.5130	0.5964	0.6797	0.7630	0.8464	0.9297	5/32	0.1563
3/16	0.0156	0.0990	0.1823	0.2656	0.3490	0.4323	0.5156	0.5990	0.6823	0.7656	0.8490	0.9323	3/16	0.1875
7/32	0.0182	0.1016	0.1849	0.2682	0.3516	0.4349	0.5182	0.6016	0.6849	0.7682	0.8516	0.9349	7/32	0.2188
1/4	0.0208	0.1042	0.1875	0.2708	0.3542	0.4375	0.5208	0.6042	0.6875	0.7708	0.8542	0.9375	1/4	0.2500
9/32	0.0234	0.1068	0.1901	0.2734	0.3568	0.4401	0.5234	0.6068	0.6901	0.7734	0.8568	0.9401	9/32	0.2813
5/16	0.0260	0.1094	0.1927	0.2760	0.3594	0.4427	0.5260	0.6094	0.6927	0.7760	0.8594	0.9427	5/16	0.3125
11/32	0.0286	0.1120	0.1953	0.2786	0.3620	0.4453	0.5286	0.6120	0.6953	0.7786	0.8620	0.9453	11/32	0.3438
3/8	0.0313	0.1146	0.1979	0.2813	0.3646	0.4479	0.5312	0.6146	0.6979	0.7812	0.8646	0.9479	3/8	0.3750
13/32	0.0339	0.1172	0.2005	0.2839	0.3672	0.4505	0.5339	0.6172	0.7005	0.7839	0.8672	0.9505	13/32	0.4063
7/16	0.0365	0.1198	0.2031	0.2865	0.3698	0.4531	0.5365	0.6198	0.7031	0.7865	0.8698	0.9531	7/16	0.4375
15/32	0.0391	0.1224	0.2057	0.2891	0.3724	0.4557	0.5391	0.6224	0.7057	0.7891	0.8724	0.9557	15/32	0.4688
1/2	0.0417	0.1250	0.2083	0.2917	0.3750	0.4583	0.5417	0.6250	0.7083	0.7917	0.8750	0.9583	1/2	0.5000
17/32	0.0443	0.1276	0.2109	0.2943	0.3776	0.4609	0.5443	0.6276	0.7109	0.7943	0.8776	0.9609	17/32	0.5313
9/16	0.0469	0.1302	0.2135	0.2969	0.3802	0.4635	0.5469	0.6302	0.7135	0.7969	0.8802	0.9635	9/16	0.5625
19/32	0.0495	0.1328	0.2161	0.2995	0.3828	0.4661	0.5495	0.6328	0.7161	0.7995	0.8828	0.9661	19/32	0.5938
5/8	0.0521	0.1354	0.2187	0.3021	0.3854	0.4688	0.5521	0.6354	0.7187	0.8021	0.8854	0.9687	5/8	0.6250
21/32	0.0547	0.1380	0.2214	0.3047	0.3880	0.4714	0.5547	0.6380	0.7214	0.8047	0.8880	0.9714	21/32	0.6563
11/16	0.0573	0.1406	0.2240	0.3073	0.3906	0.4740	0.5573	0.6406	0.7240	0.8073	0.8906	0.9740	11/16	0.6875
23/32	0.0599	0.1432	0.2266	0.3099	0.3932	0.4766	0.5599	0.6432	0.7266	0.8099	0.8932	0.9766	23/32	0.7188
3/4	0.0625	0.1458	0.2292	0.3125	0.3958	0.4792	0.5625	0.6458	0.7292	0.8125	0.8958	0.9792	3/4	0.7500
25/32	0.0651	0.1484	0.2318	0.3151	0.3984	0.4818	0.5651	0.6484	0.7318	0.8151	0.8984	0.9818	25/32	0.7813
13/16	0.0677	0.1510	0.2344	0.3177	0.4010	0.4844	0.5677	0.6510	0.7344	0.8177	0.9010	0.9844	13/16	0.8125
27/32	0.0703	0.1536	0.2370	0.3203	0.4036	0.4870	0.5703	0.6536	0.7370	0.8203	0.9036	0.9870	27/32	0.8438
7/8	0.0729	0.1562	0.2396	0.3229	0.4063	0.4896	0.5729	0.6562	0.7396	0.8229	0.9062	0.9896	7/8	0.8750
29/32	0.0755	0.1589	0.2422	0.3255	0.4089	0.4922	0.5755	0.6589	0.7422	0.8255	0.9089	0.9922	29/32	0.9063
15/16	0.0781	0.1615	0.2448	0.3281	0.4115	0.4948	0.5781	0.6615	0.7448	0.8281	0.9115	0.9948	15/16	0.9375
31/32	0.0807	0.1641	0.2474	0.3307	0.4141	0.4974	0.5807	0.6641	0.7474	0.8307	0.9141	0.9974	31/32	0.9688

PREPARED BY DESIGN DIVISION	1.11.01

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 06/22/26
CHECKED BY: CWC	FACTORS FOR BRIDGE ESTIMATES	SUPERSEDES: 01/26/26
APPROVED BY: BMW		

STEEL REINFORCEMENT WEIGHTS

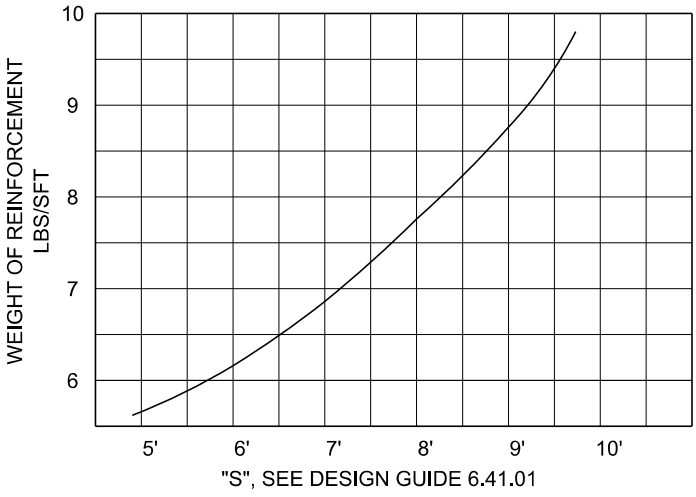
SUBSTRUCTURE UNIT	LBS/CYD OF CONC.
CANTILEVER ABUTMENT	50
COUNTERFORT ABUTMENT	100
GRAVITY ABUTMENT	15
CURTAIN WALL ABUTMENT	50
COLUMN & GIRDER PIER (HWY.)	120
COLUMN & GIRDER PIER (R.R.)	160
GRAVITY PIER	15
PILE CAP	70
SUPERSTRUCTURE UNIT	**LBS/CONC. UNIT**
STANDARD SLAB (ON STRINGERS)	SEE GRAPH BELOW
SIMPLE SPAN T-BEAM	250/CYD
CONTINUOUS SLAB	260/CYD
CONTINUOUS T-BEAM	350/CYD
SIMPLE SPAN SLAB	170/CYD
BURIED T-BEAM	200/CYD
RIGID FRAME	175/CYD
SOLID PARAPET RAILING	14/FT
BARRIER RAILING, TYPE 4	25/FT
BARRIER RAILING, TYPE 5	21/FT

RAILING WEIGHTS

RAILING TYPE	LBS/FT
SOLID PARAPET RAILING	⟨1⟩ 357
BRIDGE BARRIER RAILING, TYPE 4	475
BRIDGE BARRIER RAILING, TYPE 5	392
BRIDGE BARRIER RAILING, TYPE 6	601
BRIDGE BARRIER RAILING AESTHETIC TYPE 6, DET 2	615
BRIDGE BARRIER RAILING, TYPE 7	414
BRIDGE BARRIER RAILING AESTHETIC TYPE 7, DET 2	428
BRIDGE RAILING, 1 TUBE	10
BRIDGE RAILING, 2 TUBE (TUBE & POST ONLY)	⟨2⟩ 51
BRIDGE RAILING, 2 TUBE (WITH BRUSHBLOCK)	⟨2⟩ 185
BRIDGE RAILING, 3 TUBE WITH PICKETS (SIDEWALK)	⟨2⟩ 86
BRIDGE RAILING, 3 TUBE WITH PICKETS (BRUSHBLOCK)	⟨2⟩ 270
BRIDGE RAILING, 4 TUBE (BICYCLE)	⟨2⟩ 265
BRIDGE RAILING, 4 TUBE (PEDESTRIAN)	⟨2⟩ 80
BRIDGE RAILING, 5 TUBE	⟨2⟩ 70
BRIDGE RAILING, AESTHETIC PARAPET TUBE	⟨2⟩ 320

⟨1⟩ INCLUDES WEIGHT OF BRIDGE RAILING, 1-TUBE.

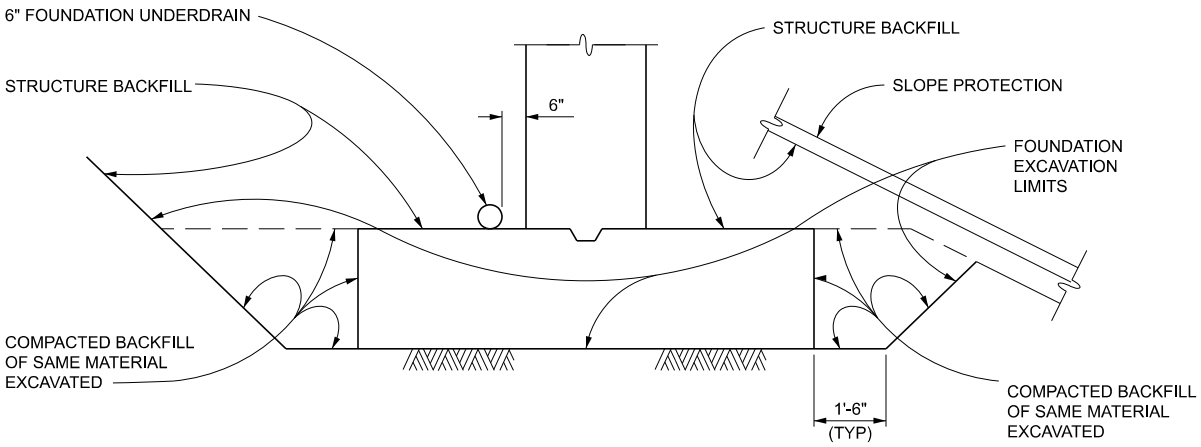
⟨2⟩ VARIES BASED UPON VERTICAL POST SPACING.



PREPARED BY DESIGN DIVISION	1.21.01

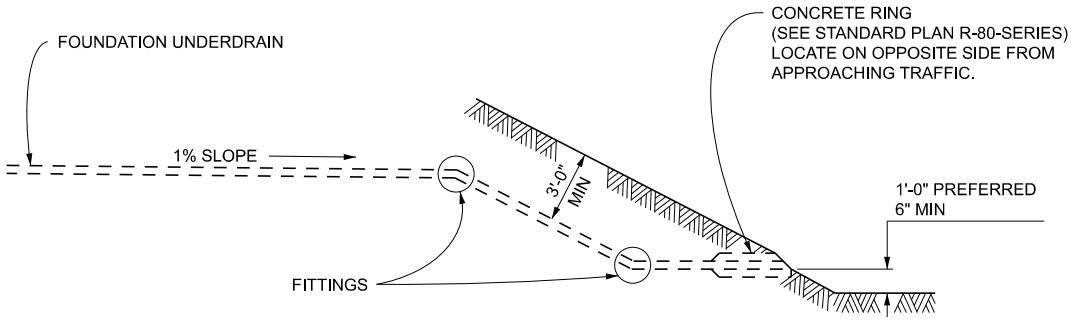
3. WATERWAY & DRAINAGE

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 08/25/25
CHECKED BY: CWC	DRAINAGE DETAILS FOR ABUTMENTS IN CUT	SUPERSEDES: 02/14/11
APPROVED BY: KCK		



DETAIL OF DRAINAGE AND BACKFILL AT ABUTMENTS FOR STRUCTURES CONSTRUCTED IN IMPERVIOUS SOIL

DRAIN FOUNDATION UNDERDRAIN INTO A DITCH, ROADWAY UNDERDRAIN, OR A SEWER



DETAIL FOR DRAINAGE INTO DITCH

BID ITEMS:

UNDERDRAIN, FDN, 6 INCH ..... FT
UNDERDRAIN OUTLET, 6 INCH ..... FT
* UNDERDRAIN, OUTLET ENDING, 6 INCH ..... EA
** DR MARKER POST ..... EA

* NOT REQUIRED WHEN CONNECTING TO A SEWER.
** USE WHEN FOUNDATION UNDERDRAIN DOES NOT OUTLET INTO A ROADWAY UNDERDRAIN OR A SEWER.

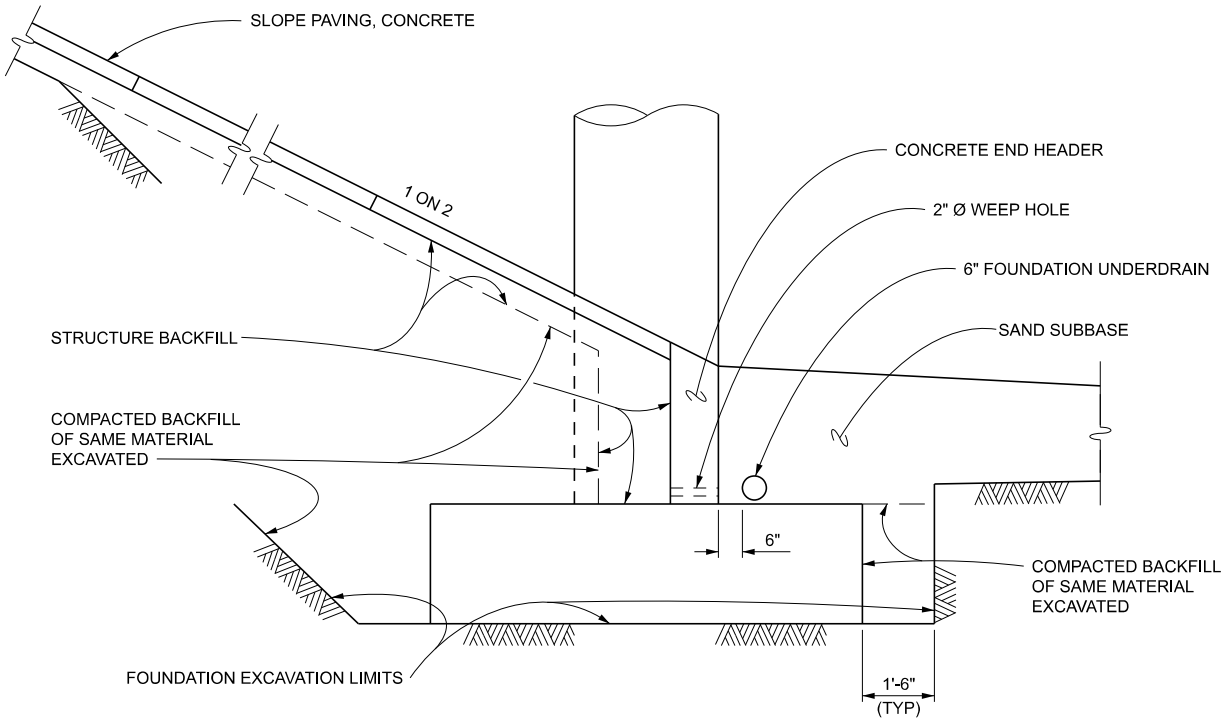
NOTES:

WHEN DRAINAGE WILL PERMIT, THE FOUNDATION UNDERDRAIN SHOULD BE PLACED AT THE BOTTOM OF FOOTING ELEVATION AND BACKFILLED WITH STRUCTURE BACKFILL (CIP).

FOUNDATION UNDERDRAINS SHOULD BE PROVIDED FOR PILE SUPPORTED ABUTMENTS ON FILLS (SEE GUIDE 5.46.01).

PREPARED BY DESIGN DIVISION	3.25.01

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 08/25/25
CHECKED BY: CWC	DRAINAGE DETAILS AT SIDE PIERS	SUPERSEDES: 02/14/11
APPROVED BY: KCK		



DETAIL OF DRAINAGE AND BACKFILL AT SIDE PIERS FOR STRUCTURES CONSTRUCTED IN IMPERVIOUS SOIL

BID ITEMS:

UNDERDRAIN, FDN, 6 INCH ..... FT
UNDERDRAIN OUTLET, 6 INCH ..... FT

NOTES:

WHEN DRAINAGE WILL PERMIT, THE FOUNDATION UNDERDRAIN SHOULD BE PLACED AT THE BOTTOM OF FOOTING ELEVATION AND BACKFILLED WITH STRUCTURE BACKFILL (CIP).

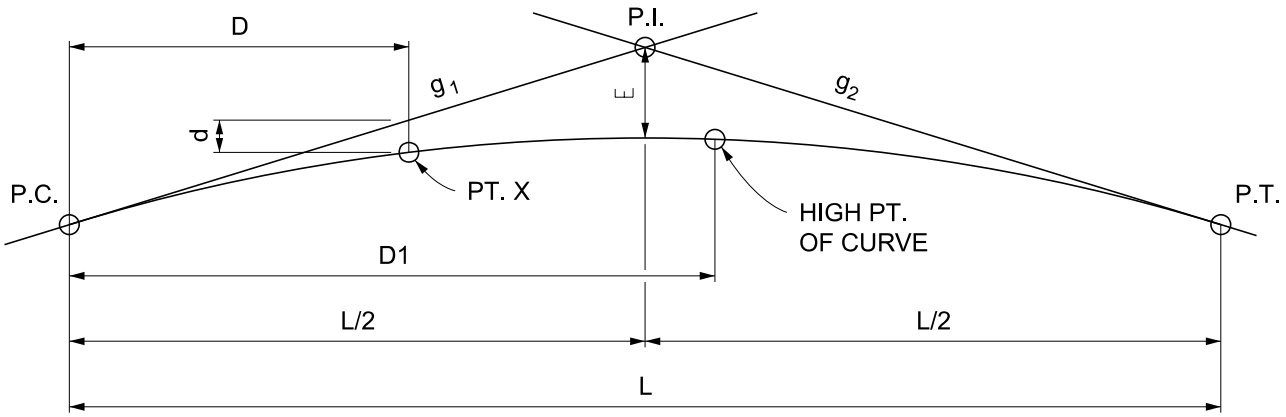
DRAINAGE DETAILS SHOWN ARE NOT APPLIABLE TO PIERS IN SIDE SLOPES.

DRAIN FOUNDATION UNDERDRAIN INTO A ROADWAY UNDERDRAIN OR A SEWER.

PREPARED BY DESIGN DIVISION	3.25.03

4. APPROACHES

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT VERTICAL CURVE CALCULATIONS	ISSUED: 11/27/01 SUPERSEDES: 04/15/95



L = LENGTH IN FEET

d = OFFSET = $\left[\frac{D}{L/2}\right]^2 E = \left[\frac{4E}{L^2}\right] D^2$

G = ALGEBRAIC DIFFERENCE = $g_1 - g_2$

D1 = SUBTANGENT TO HIGH POINT OF CURVE

E = EXTERNAL = $\frac{GL}{8}$

D = SUBTANGENT

EXAMPLE:

GIVEN: P.I. EL. = 100.000, L = 400 FT, g_1 = 0.03 & g_2 = -0.02

FIND G: $G = g_1 - g_2 = 0.03 - (-0.02) = 0.05$

FIND E: $E = \frac{GL}{8} = \frac{(0.05)(400\ FT)}{8} = 2.5\ FT$

FIND EL. @ X USING D = 100 FT

P.C. EL. = P.I. EL. - $(L/2)(g_1) = 100.000 - \left[\frac{400}{2}\right][0.03] = 94.000$

$d = \left[\frac{4E}{L^2}\right] D^2 = \left[\frac{(4)(2.5\ FT.)}{160{,}000}\right][10{,}000] = 0.625\ FT$

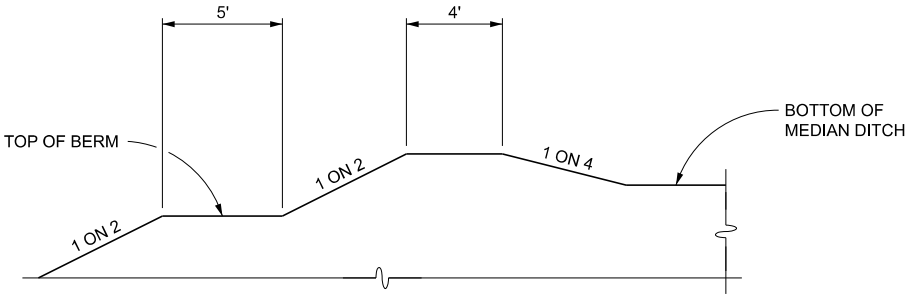
EL. @ X = P.C. EL. + $(D)(g_1)$ - d = 94.000 + (100)(0.03) - 0.625 = 96.375

FIND D1, $D1 = \frac{Lg_1}{G} = \frac{(400)(0.03)}{0.05} = 240\ FT$

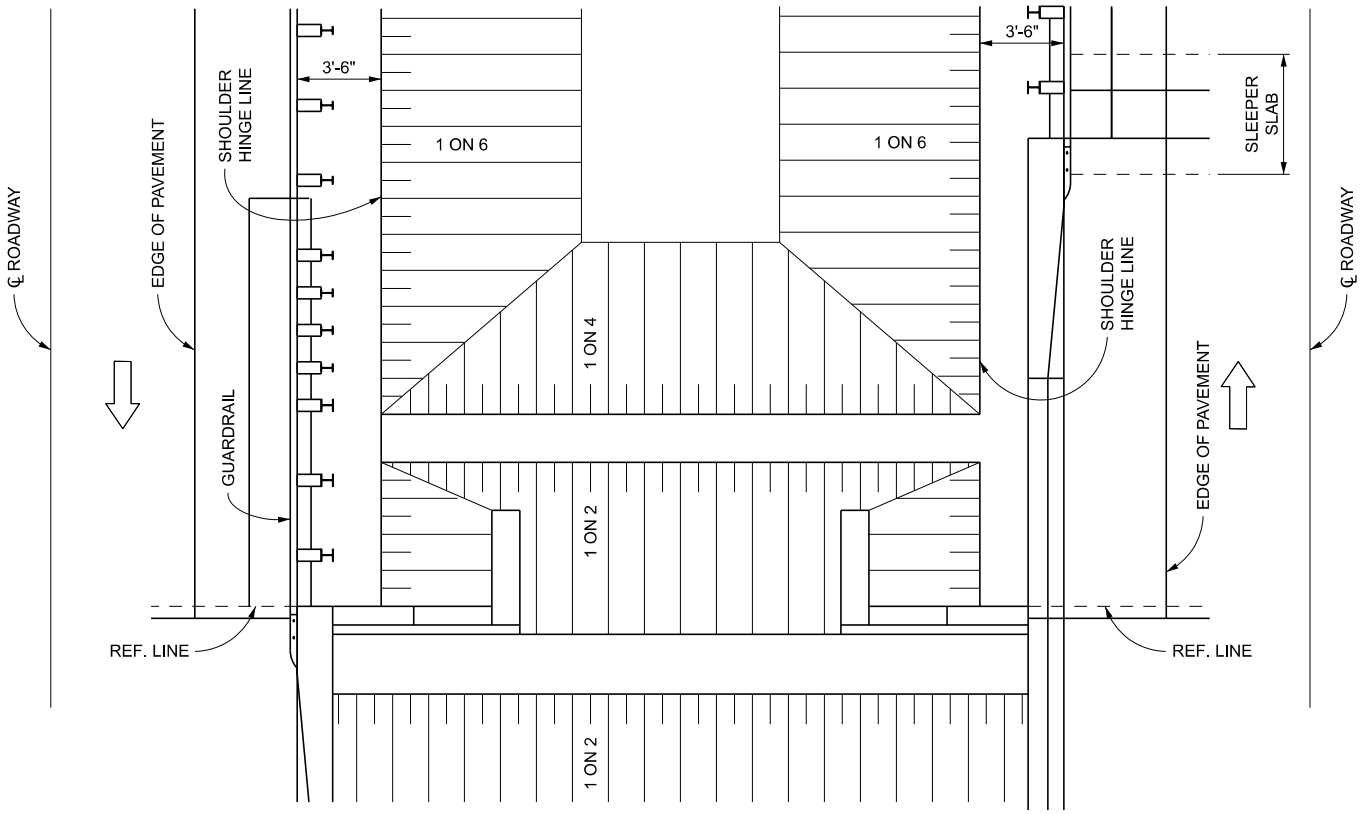
TO FIND EL. ON CURVE @ D1, UTILIZE METHOD USED TO FIND EL. @ X.

PREPARED BY DESIGN DIVISION	4.11.01

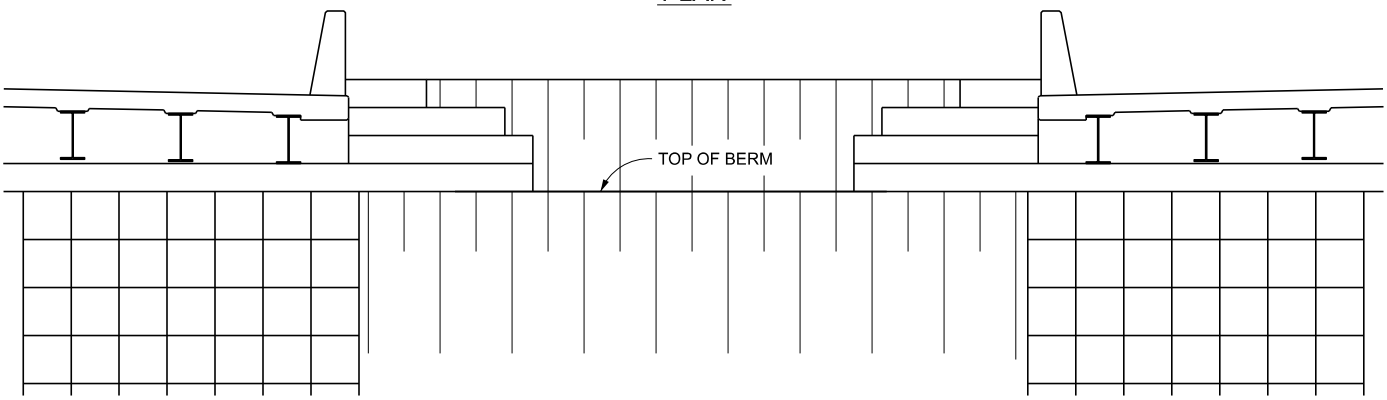
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 04/22/24
CHECKED BY: VZ	MEDIAN TREATMENT AT DUAL STRUCTURES WITH SEPARATE ABUTMENTS	SUPERSEDES: 12/16/19
APPROVED BY: KCK		



LONGITUDINAL APPROACH SECTION



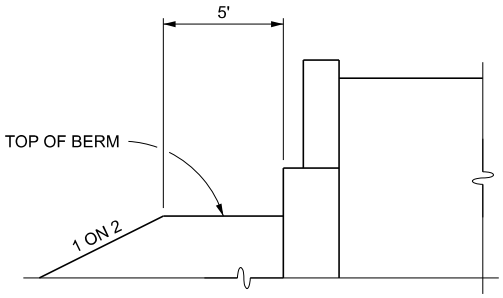
PLAN



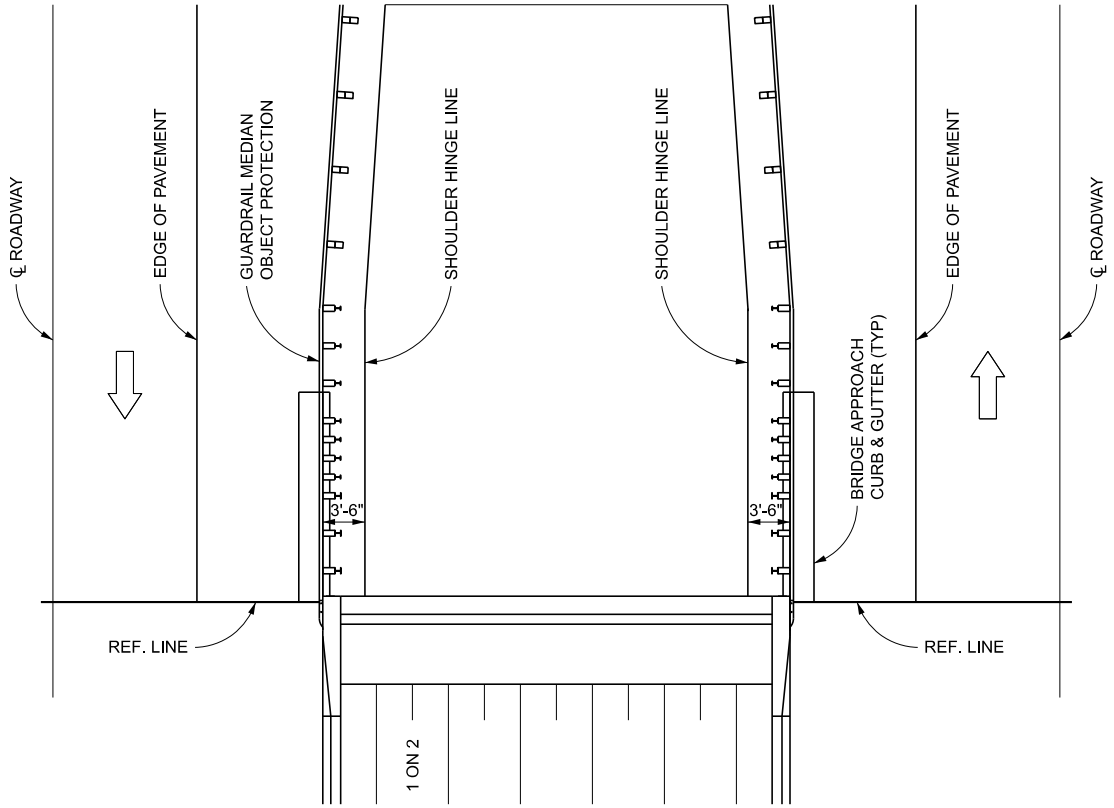
ELEVATION

PREPARED BY DESIGN DIVISION	4.23.01

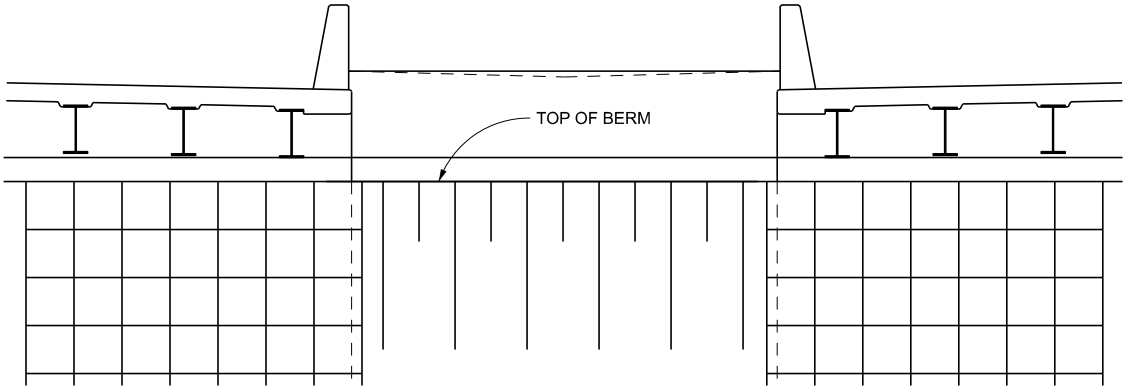
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 04/22/24
CHECKED BY: VZ	MEDIAN TREATMENT AT DUAL STRUCTURES WITH CONTINUOUS ABUTMENTS	SUPERSEDES: 01/27/20
APPROVED BY: KCK		



LONGITUDINAL APPROACH SECTION



PLAN

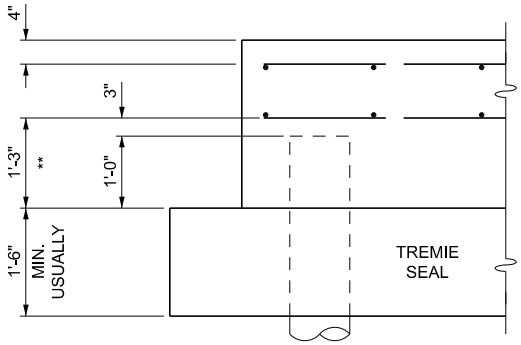


ELEVATION

PREPARED BY DESIGN DIVISION	4.23.02

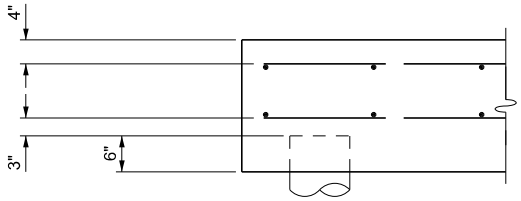
5. SUBSTRUCTURE

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/26/23
CHECKED BY: VZ	CANTILEVER ABUTMENT REINFORCING	SUPERSEDES: 05/04/06
APPROVED BY: KCK		



FOOTING WITH TREMIE SEAL

** 9" WHEN PILES NOT USED



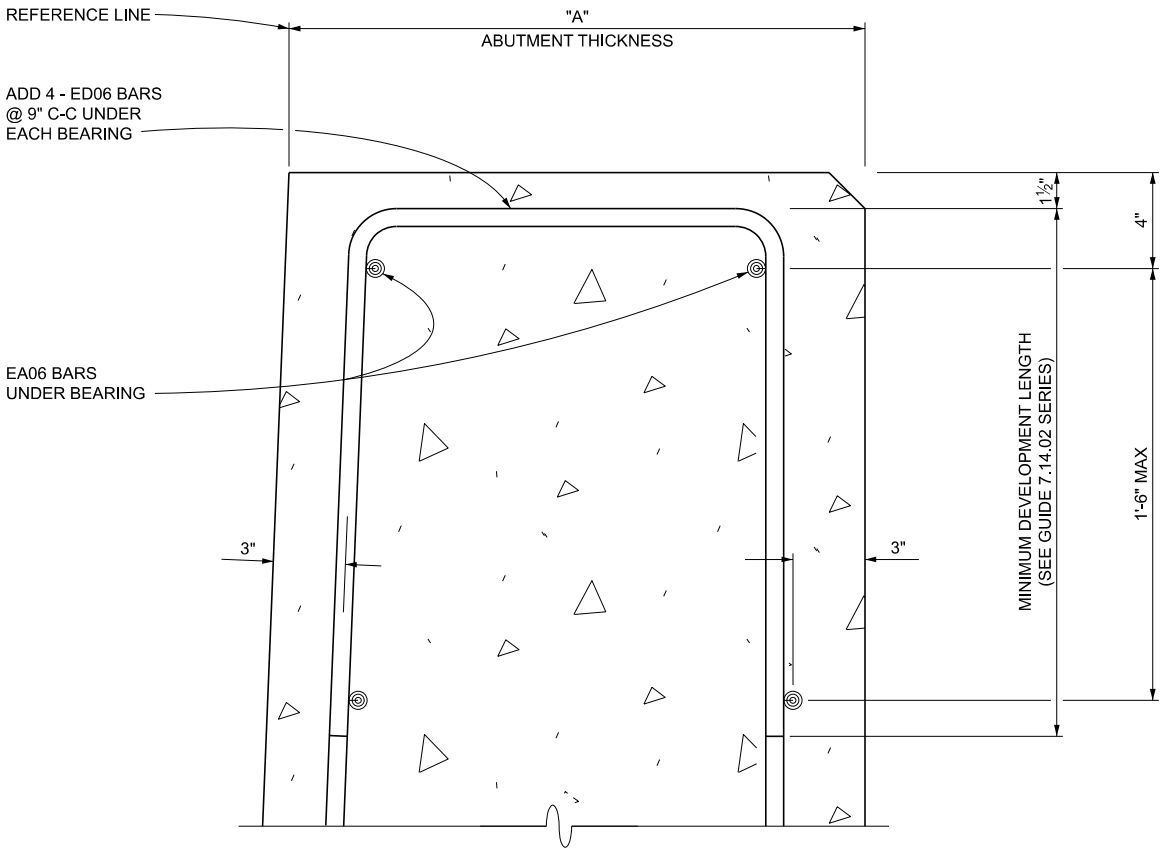
FOOTING ON PILES

(1) - SEE GUIDE 7.14.02 SERIES FOR MINIMUM DEVELOPMENT LENGTHS
(2) - SEE GUIDE 7.14.03 FOR MINIMUM DIMENSIONS FOR STANDARD HOOKS IN TENSION
(3) - IF LAPPING TENSION REINFORCEMENT EXTENDING OUT OF THE FOOTING WITH A SMALLER BAR IN THE ABUTMENT WALL, EXTEND THE TENSION REINFORCEMENT FROM THE FOOTING BEYOND THE POINT AT WHICH IT IS NO LONGER REQUIRED TO RESIST FLEXURE FOR A DISTANCE NOT LESS THAN WHAT IS REQUIRED IN AASHTO LRFD 5.10.8.1.2a.

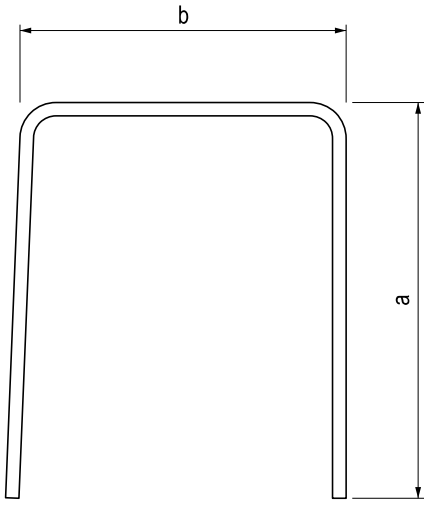
NOTES:
THE DETAILED REINFORCEMENT IN THE ABUTMENT IS THE MINIMUM. THE DESIGN OF THE ABUTMENT MAY REQUIRE ADDITIONAL REINFORCEMENT OR INCREASING THE REINFORCEMENT AREA (DIAMETER) SHOWN TO MEET THE REQUIREMENTS IN AASHTO LRFD FOR FLEXURAL REINFORCEMENT AND FOR RESISTING SHRINKAGE AND TEMPERATURE STRESSES.

PREPARED BY DESIGN DIVISION	5.16.01

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/26/23
CHECKED BY: VZ	CANTILEVER ABUTMENT REINFORCING	SUPERSEDES: 05/04/06
APPROVED BY: KCK		



DETAIL A



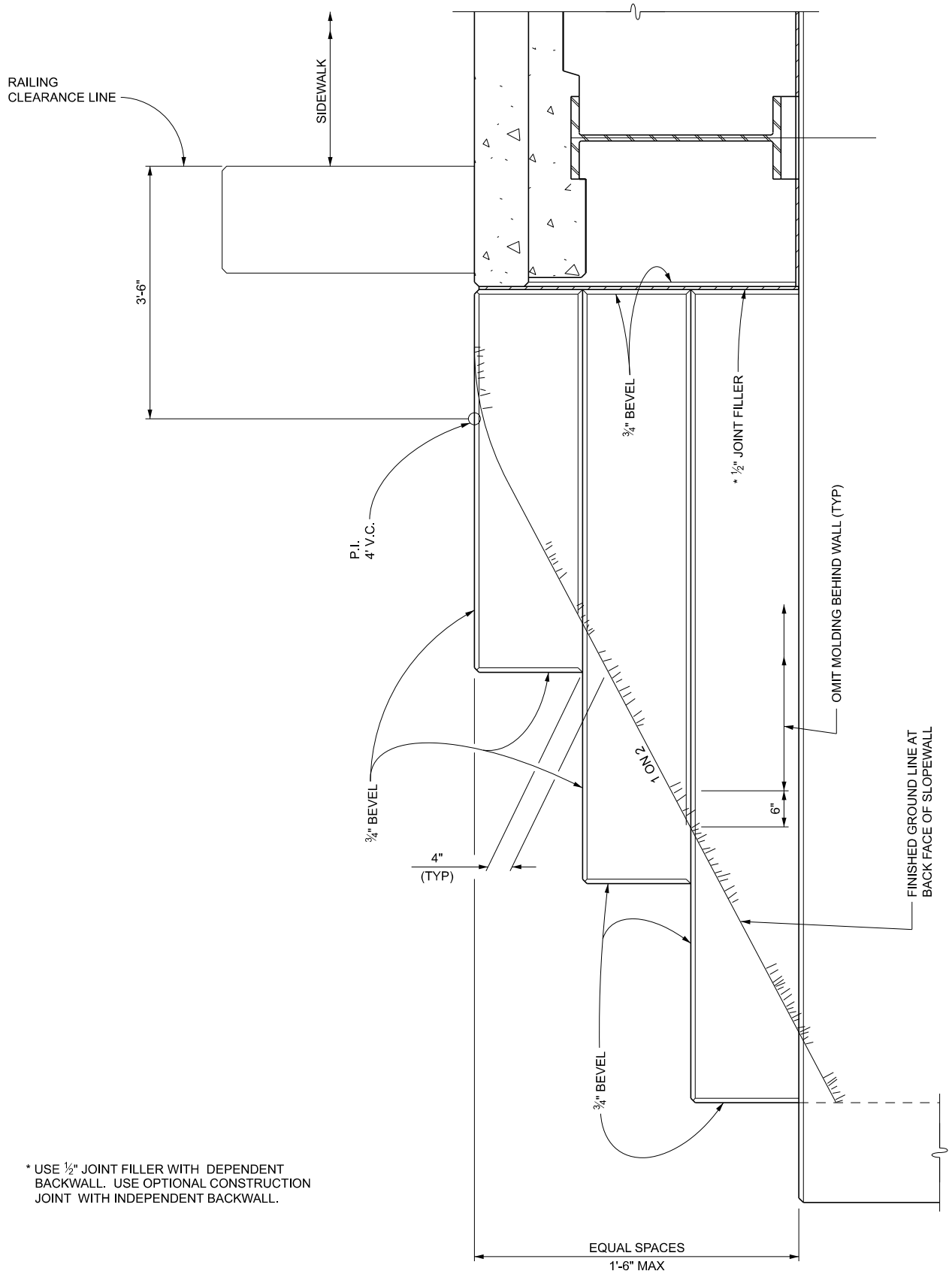
EA06 BAR

a = MINIMUM DEVELOPMENT LENGTH
(SEE GUIDE 7.14.02 SERIES)
b = A - 5⅞"

USE THESE DETAILS FOR STEEL BEAM BRIDGES ONLY WITH EITHER DEPENDENT OR INDEPENDENT BACKWALLS.

PREPARED BY DESIGN DIVISION	5.16.01A

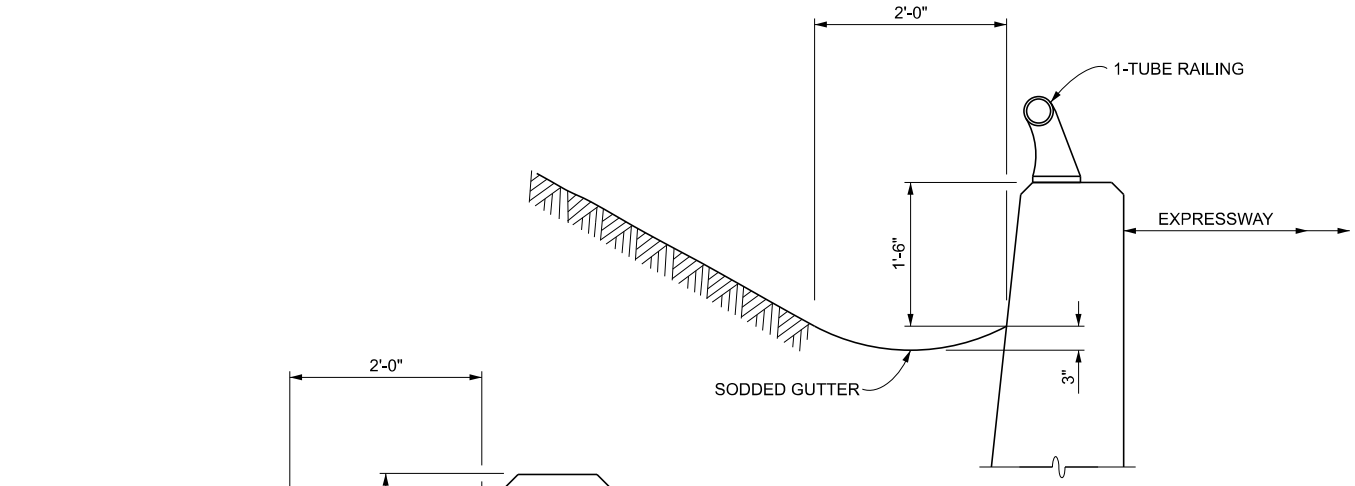
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 04/22/24
CHECKED BY: VZ	SLOPEWALL DETAILS	SUPERSEDES: 11/27/01
APPROVED BY: KCK		



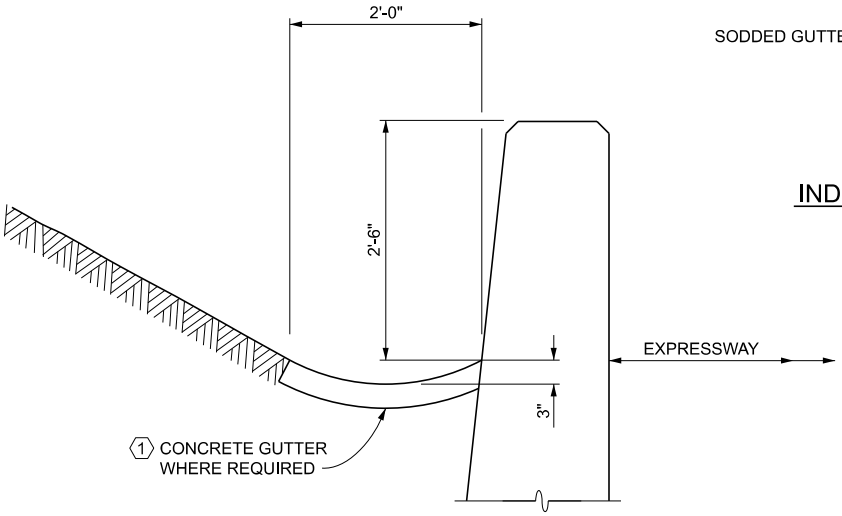
* USE ½" JOINT FILLER WITH DEPENDENT BACKWALL. USE OPTIONAL CONSTRUCTION JOINT WITH INDEPENDENT BACKWALL.

PREPARED BY DESIGN DIVISION	5.17.01

DRAWN BY: MJB	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 11/27/01
CHECKED BY: VZ	RETAINING WALL TREATMENTS	SUPERSEDES: 04/15/95
APPROVED BY: TGF		

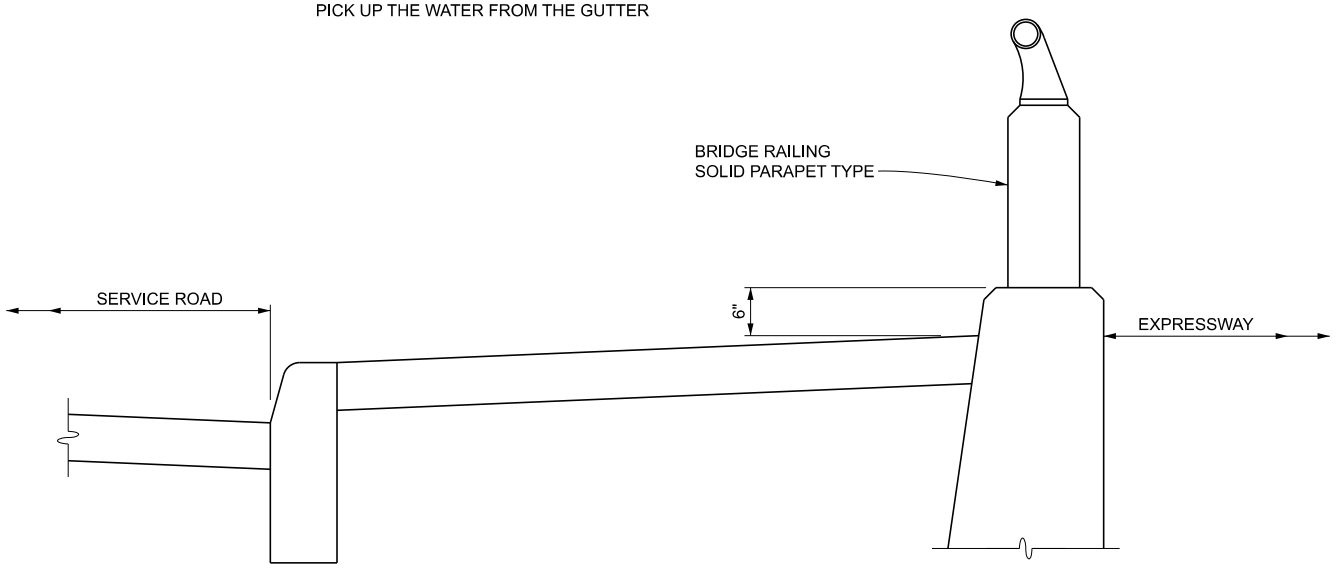


INDEPENDENT WALLS IN SLOPES



SLOPING WALLS ADJACENT TO BRIDGE

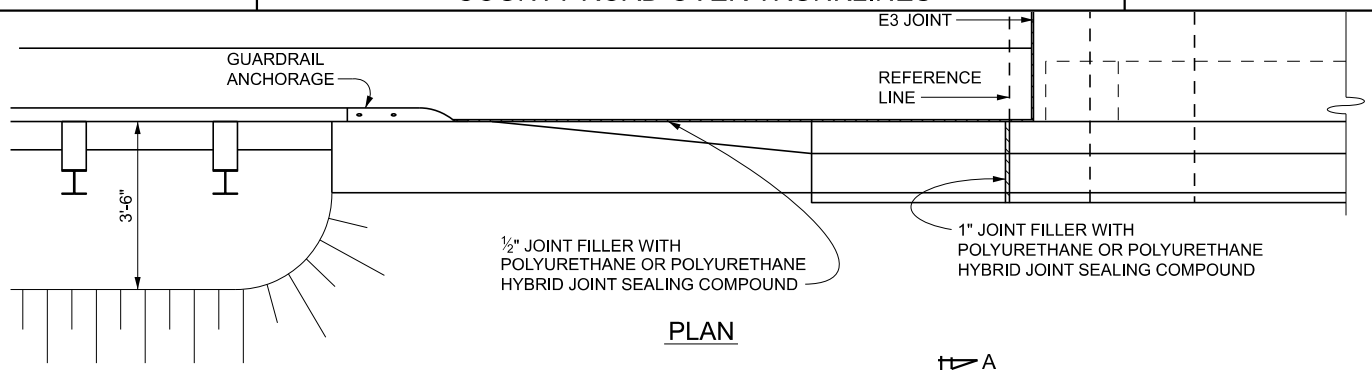
1 ON LONG WALL SECTIONS, CATCH BASINS SHALL BE PLACED AT ENDS OF WALL TO PICK UP THE WATER FROM THE GUTTER



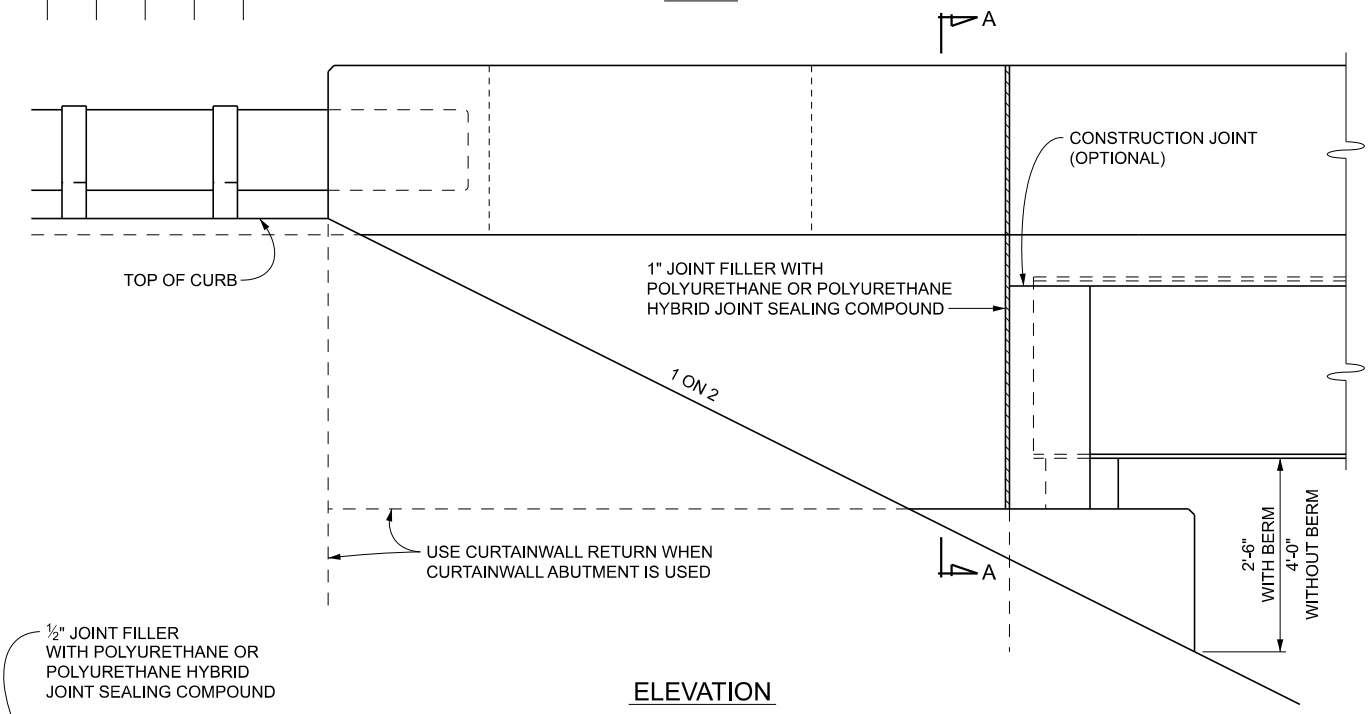
WALLS ADJACENT TO SERVICE ROADS

PREPARED BY DESIGN DIVISION	5.17.03

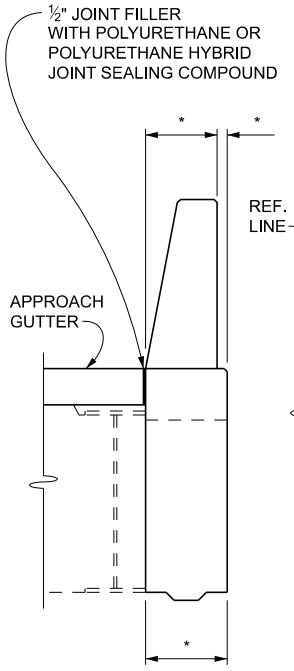
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 04/22/24
CHECKED BY: VZ	RETURN WALL DETAILS COUNTY ROAD OVER TRUNKLINES	SUPERSEDES: 01/27/20
APPROVED BY: KCK		



PLAN

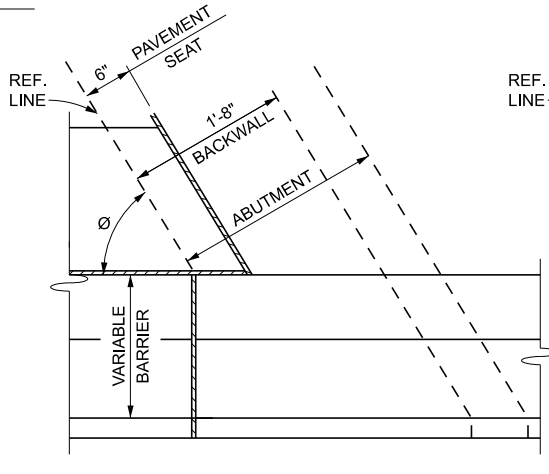


ELEVATION



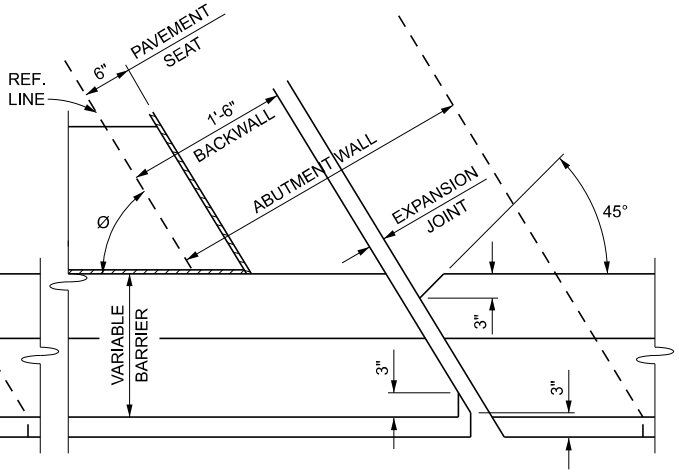
SECTION A-A

* DIMENSIONS VARIABLE, DEPENDENT UPON BARRIER TYPE AND AESTHETIC TREATMENT



DETAIL - SHOWING DEPENDENT BACKWALL

WHEN 70° < Ø < 110°, CARRY JOINT STRAIGHT THROUGH BARRIER

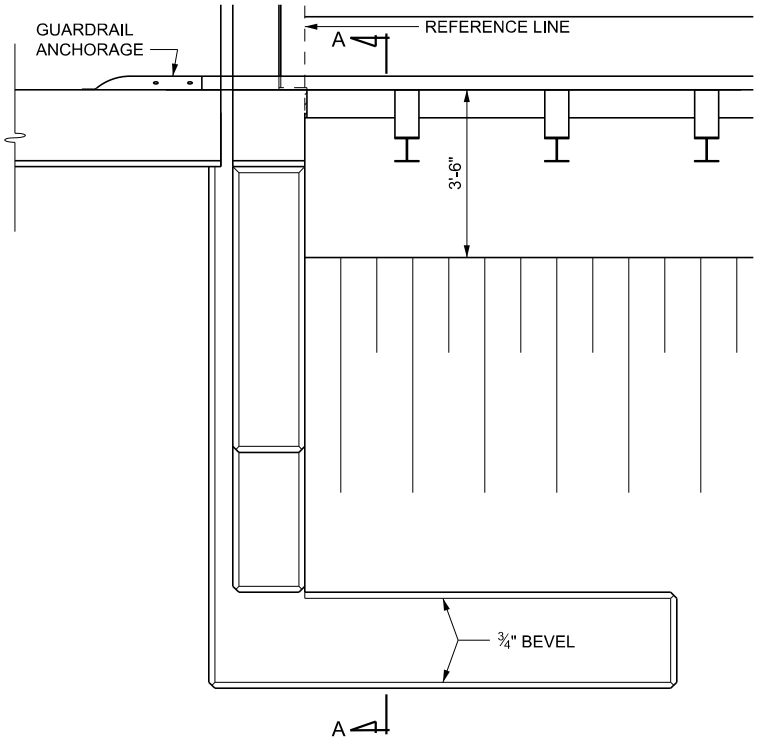


DETAIL - SHOWING INDEPENDENT BACKWALL

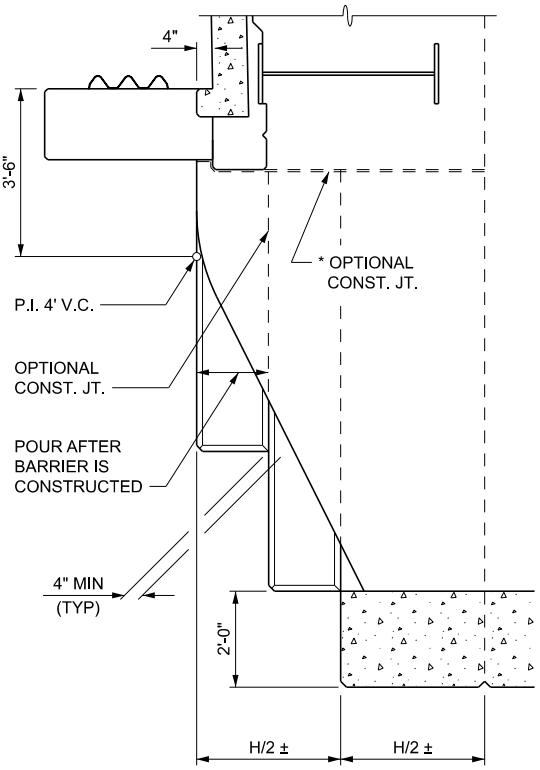
WHEN 70° < Ø < 110° OMIT 3" BEVELS

PREPARED BY DESIGN DIVISION	5.17.05

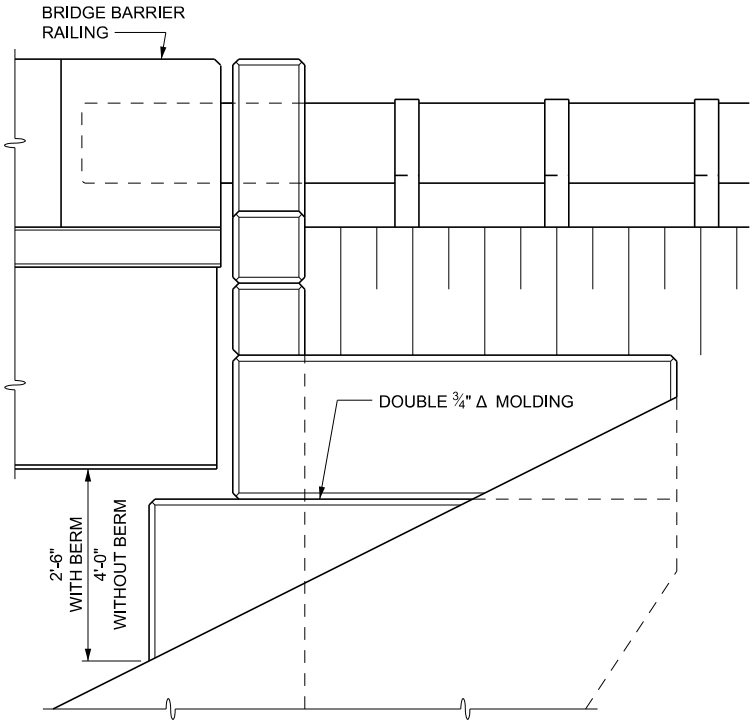
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 04/22/24
CHECKED BY: VZ	WINGWALL TREATMENT - TRUNKLINE OVER TRUNKLINE, COUNTY ROAD OR RAILROAD	SUPERSEDES: 12/16/19
APPROVED BY: KCK		



PLAN VIEW



SECTION A-A



ELEVATION

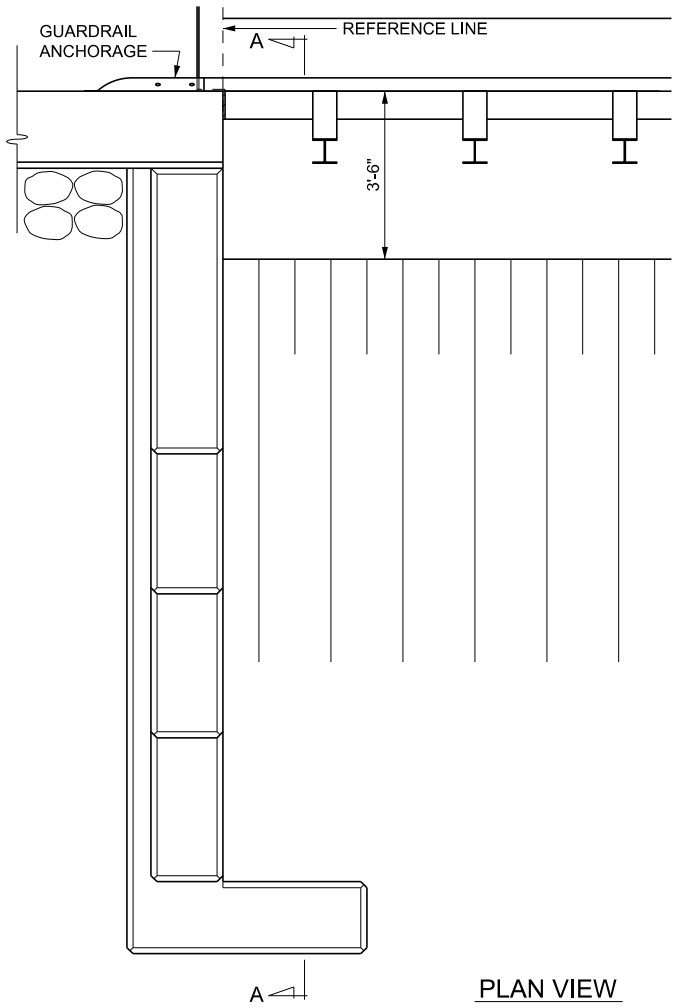
NOTES:

FOR ADDITIONAL SLOPE WALL DETAILS, SEE GUIDE 5.17.01.

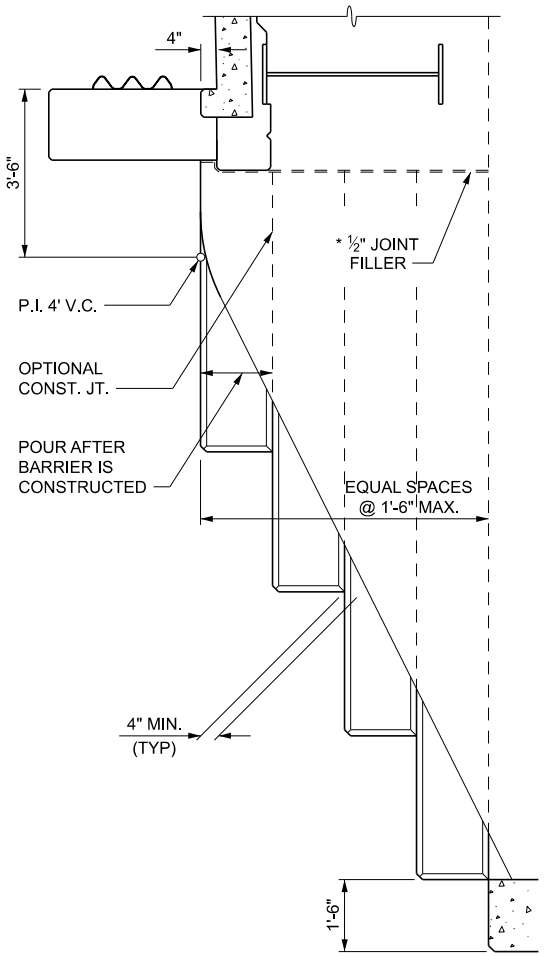
* USE WITH INDEPENDENT BACKWALL ONLY; USE ½" JOINT FILLER WITH DEPENDENT BACKWALL.

PREPARED BY DESIGN DIVISION	5.17.06

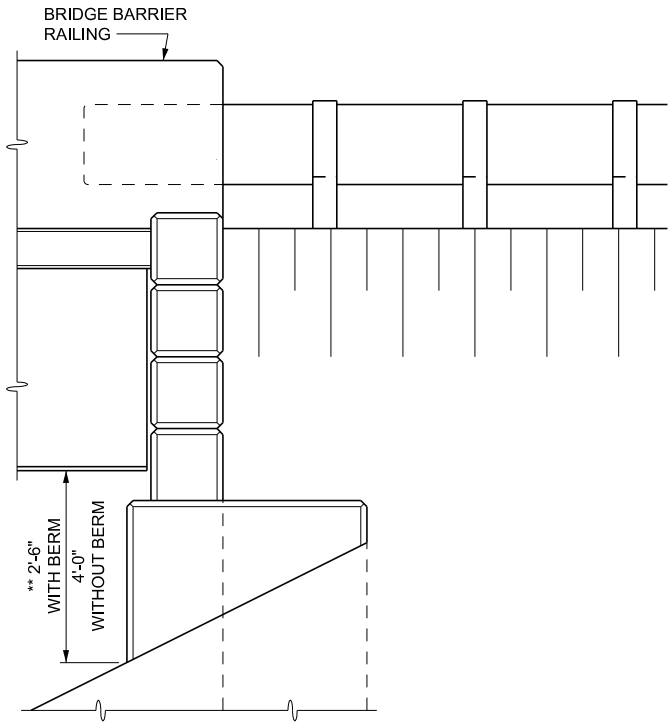
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 04/22/24
CHECKED BY: VZ	WINGWALL TREATMENT STREAM CROSSING	SUPERSEDES: 12/16/19
APPROVED BY: KCK		



PLAN VIEW



SECTION A-A



ELEVATION

NOTES:

DELETE RETURN WALL WHEN CURTAINWALL TYPE ABUTMENT IS USED.

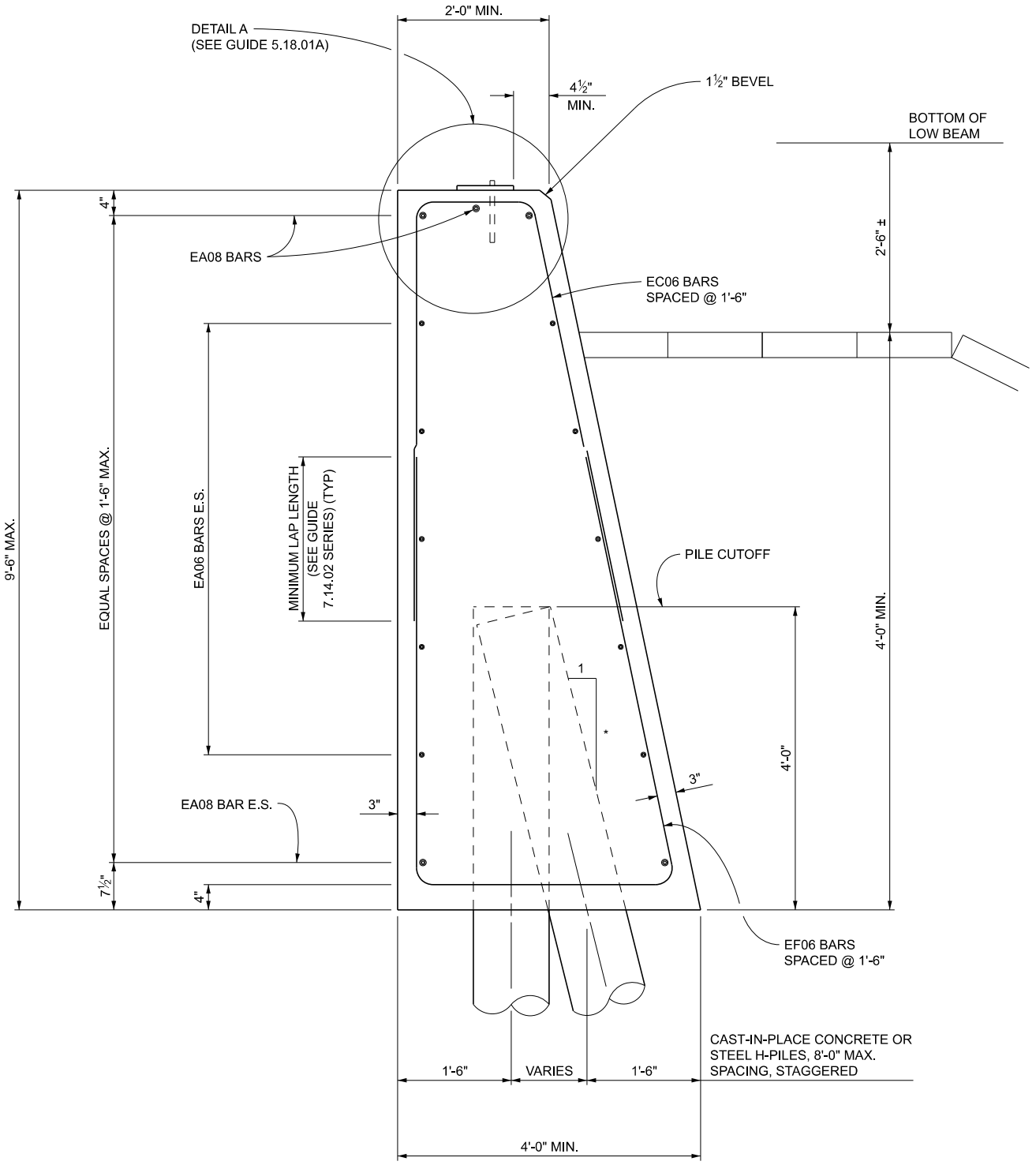
FOR ADDITIONAL SLOPEWALL DETAILS, SEE GUIDE 5.17.01.

* USE WITH DEPENDENT BACKWALL ONLY; USE OPTIONAL CONSTRUCTION JOINT WITH INDEPENDENT BACKWALL.

** USE A BERM ONLY WHEN LONGER TAIL SPANS ARE REQUIRED FOR STRUCTURAL OR AESTHETIC REASONS.

PREPARED BY DESIGN DIVISION	5.17.07

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/26/23
CHECKED BY: VZ	CURTAINWALL ABUTMENT	SUPERSEDES: 11/27/01
APPROVED BY: KCK		

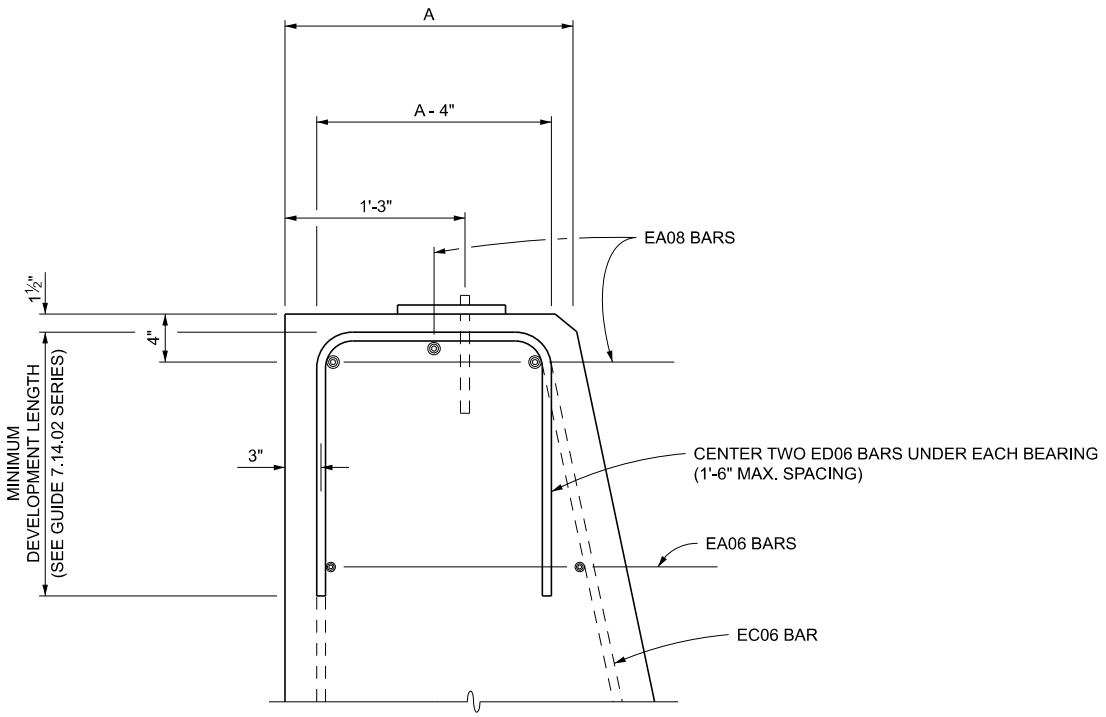


* FOR PILE BATTER, SEE BRIDGE DESIGN MANUAL 7.03.09

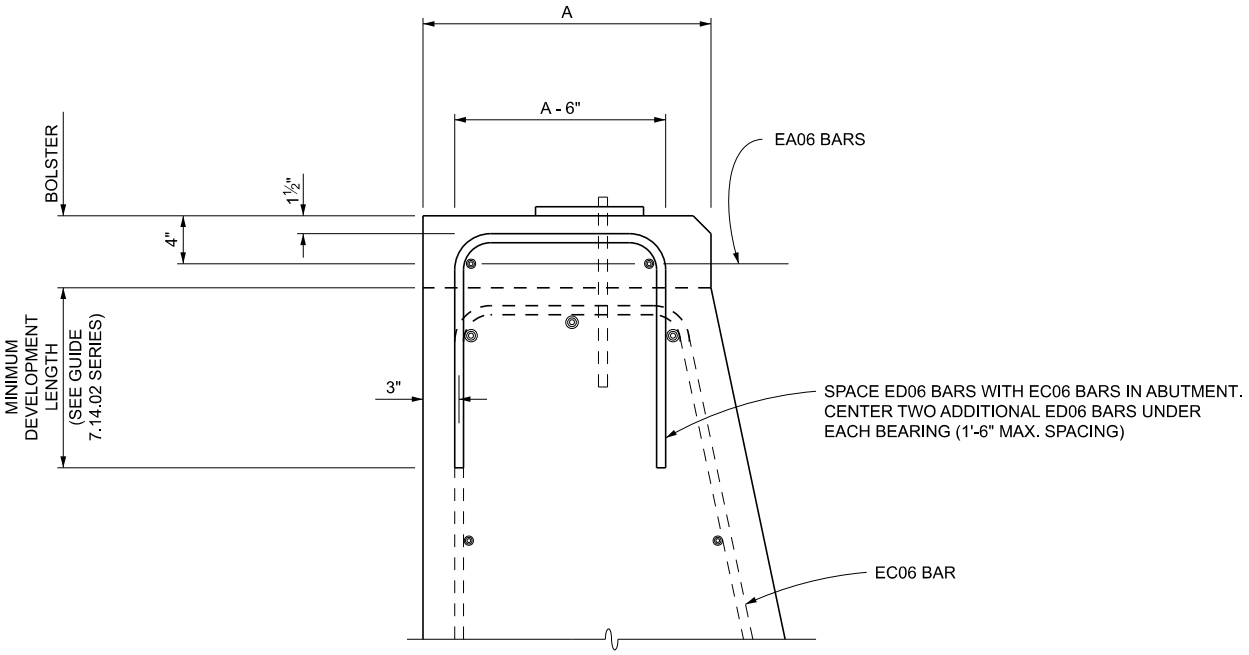
FOR ADDITIONAL REINFORCING DETAILS, SEE GUIDES 6.20.01 AND 6.20.03.

PREPARED BY DESIGN DIVISION	5.18.01

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/26/23
CHECKED BY: VZ	CURTAINWALL ABUTMENT REINFORCEMENT	SUPERSEDES: 11/27/01
APPROVED BY: KCK		



DETAIL A

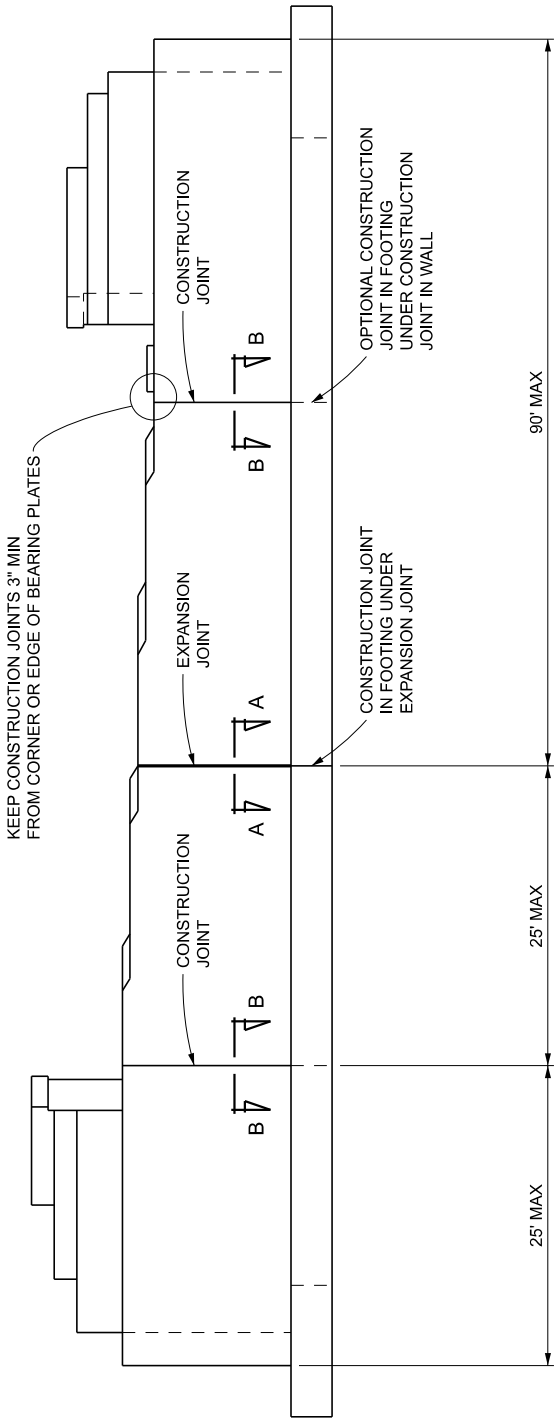


DETAIL A
(AT BOLSTER)

NOTE:
USE THESE DETAILS FOR STEEL BEAM BRIDGES WITH EITHER DEPENDENT OR INDEPENDENT BACKWALLS.

PREPARED BY DESIGN DIVISION	5.18.01A

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 05/04/06
CHECKED BY: VZ	ABUTMENT JOINTS	SUPERSEDES: 08/15/03
APPROVED BY: TGF		



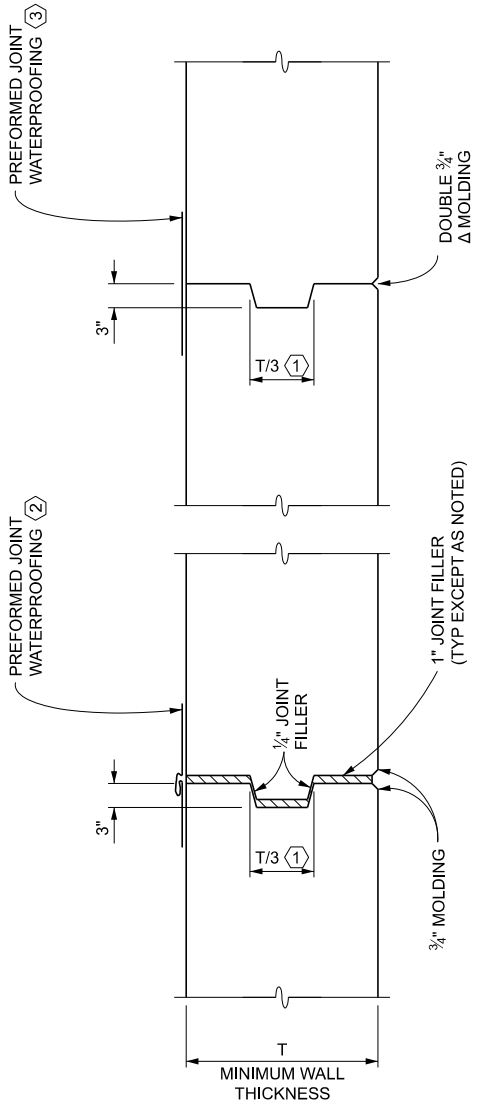
TYPICAL ABUTMENT ELEVATION

NOTES:

FOR WALLS OVER 30' IN HEIGHT, A CONSTRUCTION JOINT IS TO BE PLACED AT APPROXIMATELY MID-HEIGHT

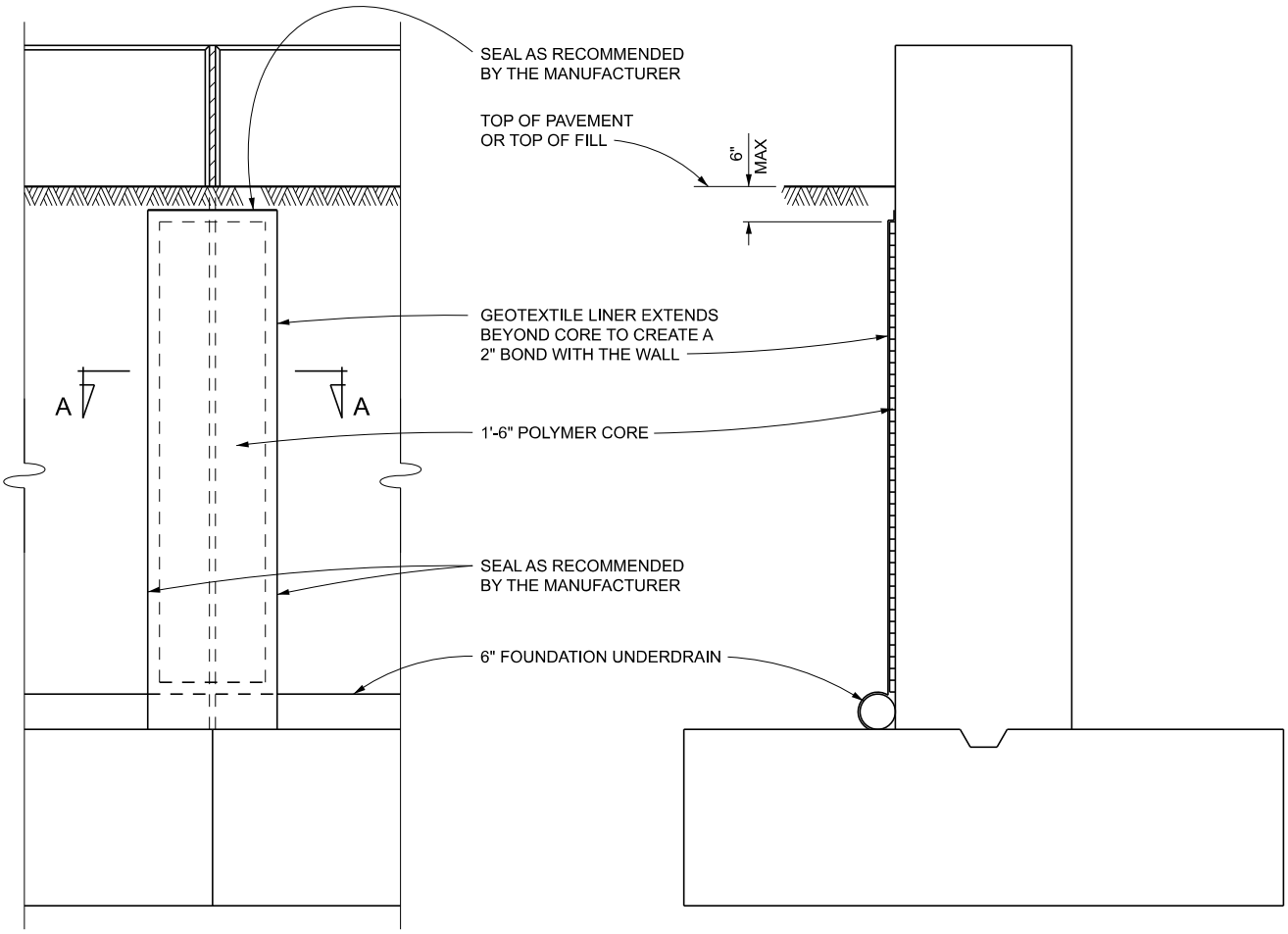
IF FOOTING POUR IS MORE THAN 90 CYD AN OPTIONAL CONSTRUCTION JOINT MAY BE PLACED IN THE FOOTING UNDER THE CONSTRUCTION JOINT IN THE WALL

1. ROUND T/3 TO EVEN 2" INCREMENT (NOMINAL DIMENSION, E.G., 3" x 8" KEY)
2. EXCEPT WHEN EXPANSION JOINT DRAIN IS USED.
3. JOINT WATERPROOFING MEMBRANE (J.W.P.) MAY BE USED AS AN ALTERNATE.



PREPARED BY DESIGN DIVISION	5.20.01

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT WALL EXPANSION JOINT DRAIN	ISSUED: 08/25/25 SUPERSEDES: 08/26/24



WALL ELEVATION

WALL SECTION

NOTE TO DETAILER:

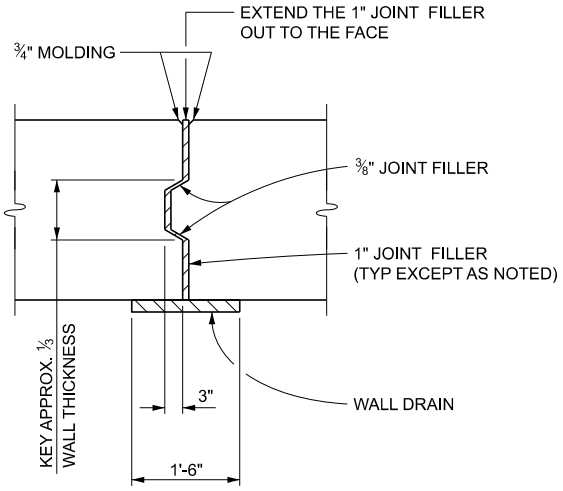
WALL DRAINS SHOULD BE USED AT EXPANSION JOINTS IN RETAINING WALLS AND FULL HEIGHT ABUTMENTS BUT SHOULD NOT BE PLACED ON STRUCTURES CROSSING WATERWAYS.

NOTES:

GEOCOMPOSITE DRAIN SHALL MEET THE REQUIREMENTS OF STANDARD SPECIFICATION 910.05.

THE ITEM "WALL DRAIN" INCLUDES FURNISHING AND ATTACHING THE POLYMER CORE AND GEOTEXTILE LINER AS DETAILED.

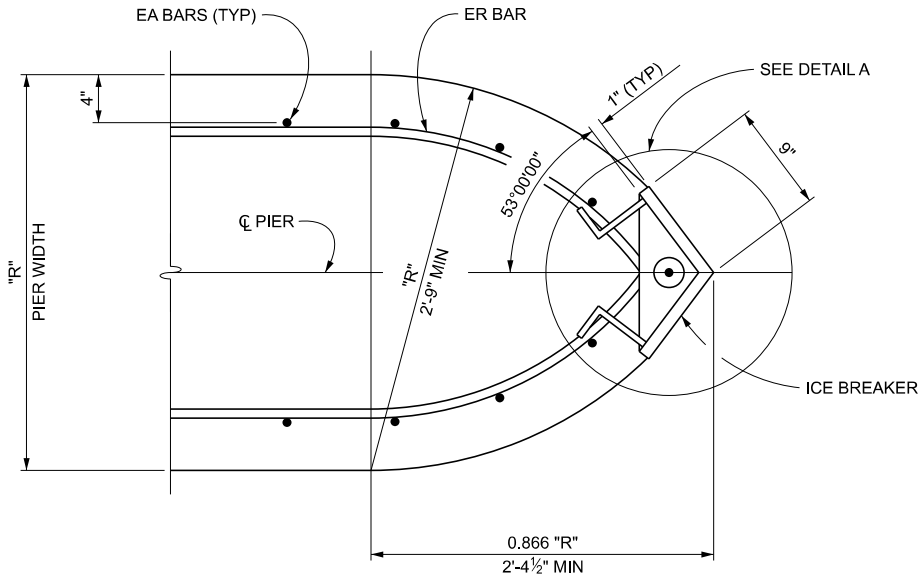
THE FOUNDATION UNDERDRAIN SHALL BE PAID FOR SEPARATELY AS "UNDERDRAIN, FDN, 6 INCH."



SECTION A-A

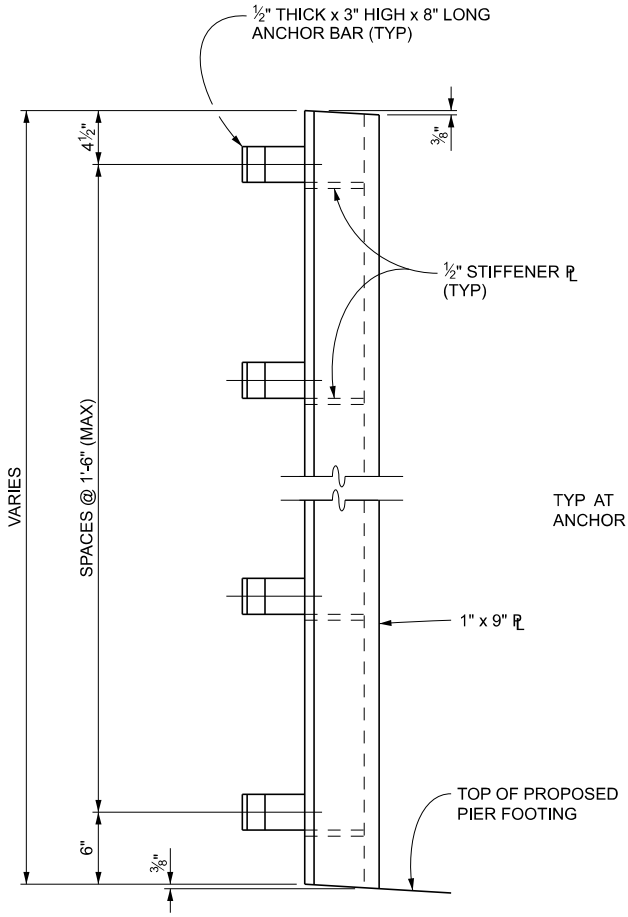
PREPARED BY DESIGN DIVISION	5.20.02

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT PIER NOSING DETAIL	ISSUED: 11/28/11 SUPERSEDES: 11/27/01

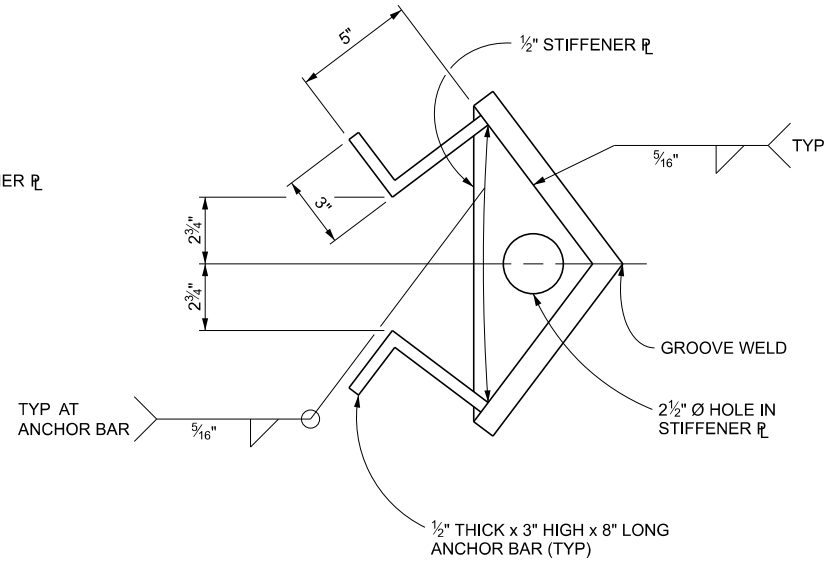


PIER NOSING DETAIL

PROPOSED ICE BREAKERS SHALL BE SET IN PLACE BEFORE POURING CONCRETE. MAKE A SMOOTH TRANSITION FROM FACE OF ICE BREAKER TO FACE OF WALL. ICE BREAKER SHALL BE MADE OF ASTM APPROVED STEEL AND HOT DIP GALVANIZED ACCORDING TO AASHTO M232.



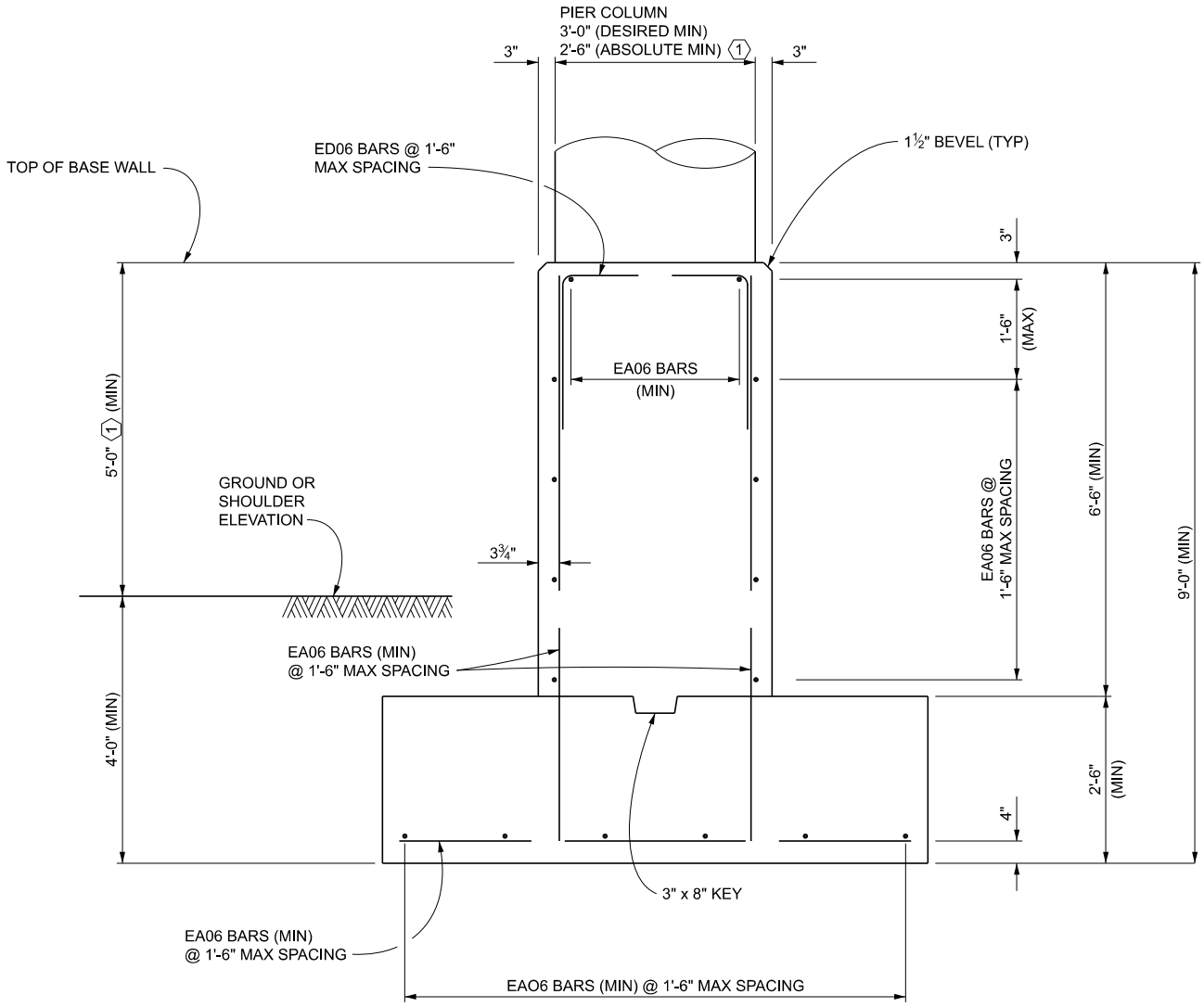
ELEVATION



DETAIL A

PREPARED BY DESIGN DIVISION	5.21.01

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 07/24/23
CHECKED BY: VZ	BASE WALL DETAILS FOR PIER ADJACENT TO ROADWAY	SUPERSEDES: 02/14/11
APPROVED BY: KCK		



1 THE WIDTH OF THE PIER COLUMN SHOULD BE 3'-0" MINIMUM WHENEVER PRACTICAL. INCREASE THE MINIMUM HEIGHT OF THE BASE WALL ABOVE THE ADJACENT GROUND OR SHOULDER TO 5'-3" IF THE WIDTH OF THE PIER COLUMN IS LESS THAN 3'-0". COLUMNS WITH A WIDTH LESS THAN 3'-0" ARE MORE SUSCEPTIBLE TO FAILURE WHEN STRUCK, AND THE ADDITIONAL HEIGHT OF THE BASE WALL ENSURES THE COLUMN IS PROTECTED AFTER FUTURE OVERLAYS OF THE ROADWAY ADJACENT TO THE PIER.

SECTION OF BASE WALL

NOTES:

EXTEND BASE WALL TO END OF FOOTING WHEN GUARDRAIL ATTACHMENT IS ANTICIPATED.

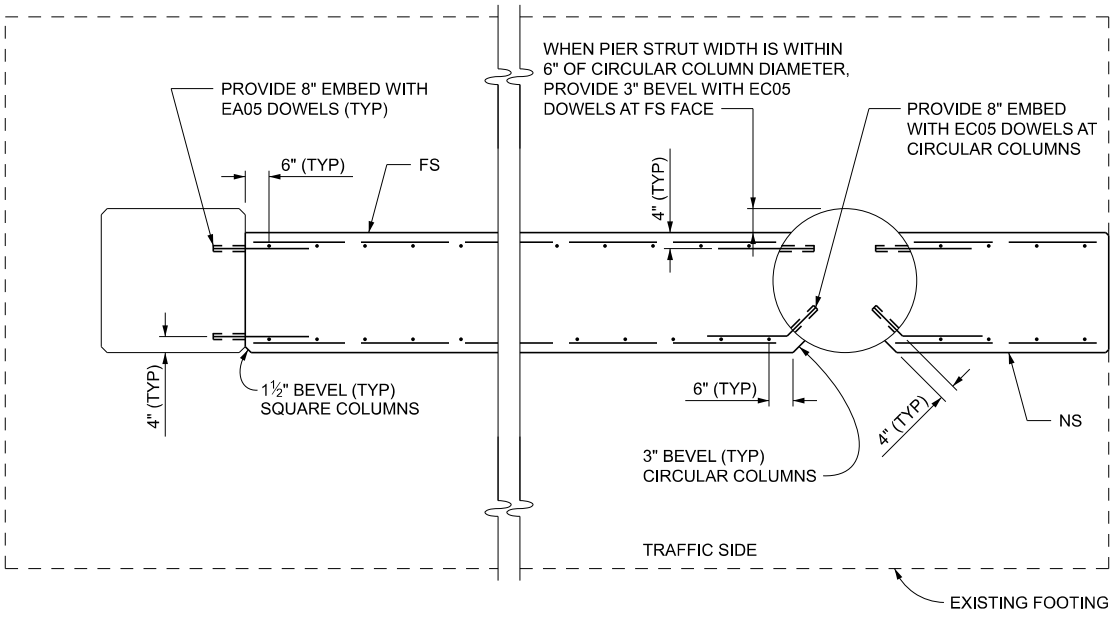
FOR ADDITIONAL REQUIREMENTS SEE BRIDGE MANUAL CHAPTER 7.

THE MINIMUM LENGTH OF THE BASE WALL MUST BE 10'-0".

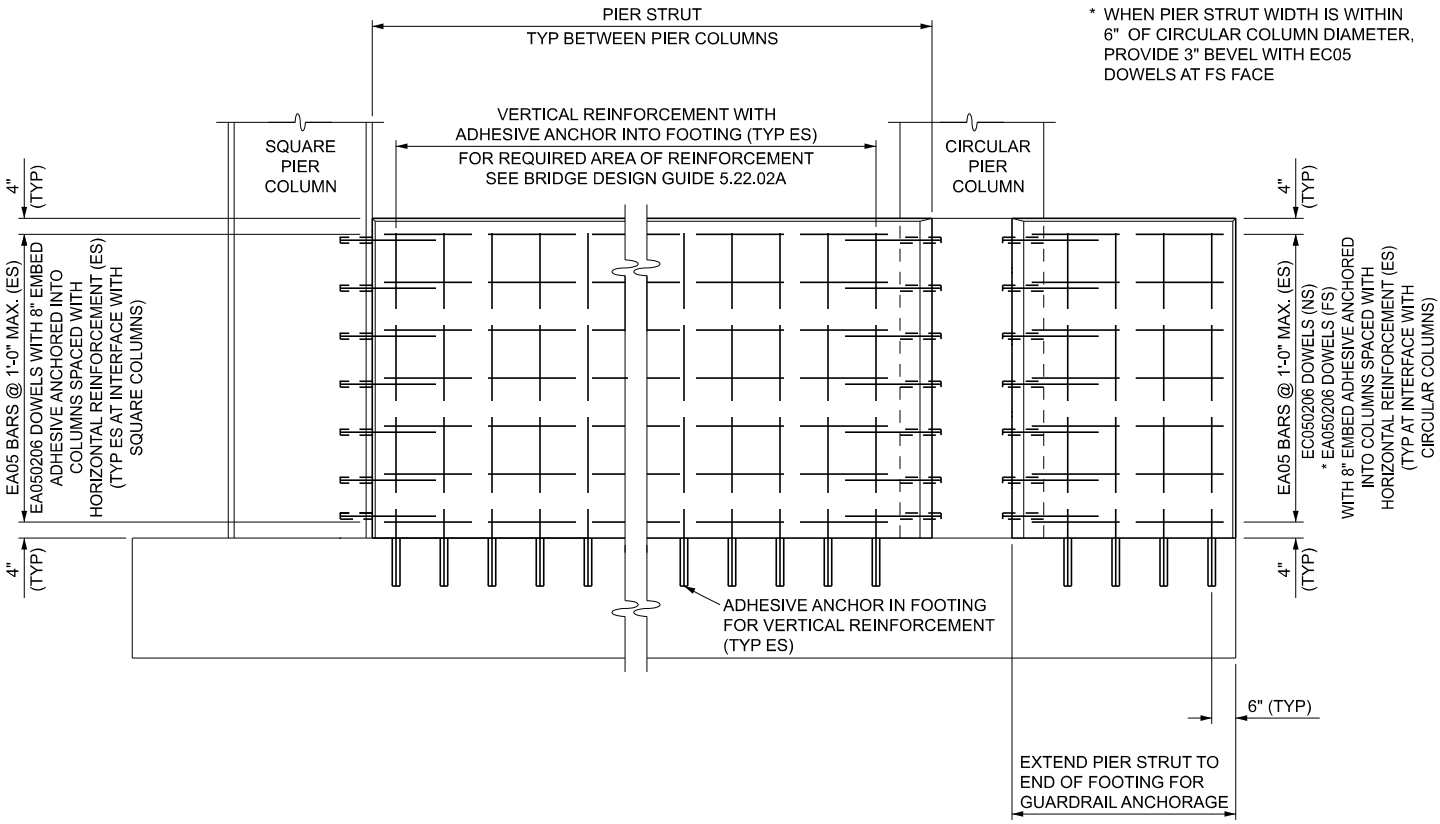
REINFORCEMENT SHOWN IS THE MINIMUM REINFORCEMENT. INCREASE THE SIZE AND/OR SPACING OF THE REINFORCEMENT WHEN THE DESIGN OF THE BASE WALL OR FOOTING REQUIRES IT.

PREPARED BY DESIGN DIVISION	5.22.01

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 02/26/24
CHECKED BY: VZ	PIER STRUT RETROFIT	SUPERSEDES:
APPROVED BY: KCK		



PIER STRUT PLAN

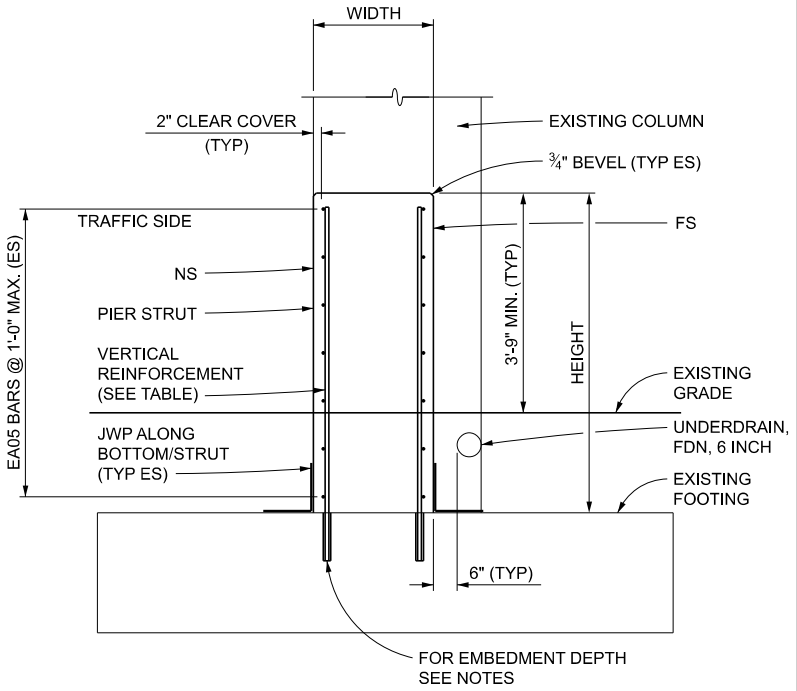


PIER STRUT ELEVATION

PREPARED BY DESIGN DIVISION	5.22.02

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 08/25/25
CHECKED BY: CWC	PIER STRUT RETROFIT	SUPERSEDES: 02/26/24
APPROVED BY: KCK		

PIER STRUT RETROFIT REINFORCED CONCRETE DESIGN			
HEIGHT (FT)	WIDTH (FT)	VERTICAL REINFORCEMENT (IN^2/FT)	APPLIED TENSION LOAD (KIP/FT)
5.0	1.5	1.11	60
6.0	2.0	0.90	52
7.0	2.0	1.11	61
8.0	2.5	0.94	54
9.0	2.5	1.11	61
10.0	3.0	0.95	56
11.0	3.0	1.05	61
12.0	3.0	1.18	67



PIER STRUT SECTION

NOTES:

NS DENOTES NEAR SIDE, FS DENOTES FAR SIDE, AND ES DENOTES EACH SIDE.

DETAILS INCLUDED IN THIS GUIDE MAY BE USED TO RETROFIT EXISTING BRIDGE PIERS THAT MEET ONE OF THE CONDITIONS OUTLINED IN BRIDGE DESIGN MANUAL SECTION 12.08.08.

INFORMATION PROVIDED IN THE TABLE APPLIES WHEN THE LENGTH OF THE PIER STRUT IS LESS THAN THE CRITICAL WALL LENGTH OVER WHICH THE YIELD LINE MECHANISM OCCURS (Lc). IF THE LENGTH OF THE PIER STRUT EXCEEDS Lc, DESIGN THE REINFORCEMENT IN ACCORDANCE WITH AASHTO LRFD SECTION A13.3.1. FOR DEFINITIONS OF YIELD LINE MECHANISM AND Lc SEE AASHTO LRFD A13.3.1.

AT MEDIAN PIERS, PLACE VERTICAL REINFORCEMENT, SPECIFIED IN THE TABLE, IN BOTH FACES OF THE PIER STRUT. THE WIDTH OF THE STRUT AT MEDIAN PIERS SHOULD MATCH THE WIDTH/DIAMETER OF THE EXISTING PIER COLUMNS.

VERTICAL ADHESIVE ANCHORS IN THE PIER FOOTING MUST BE DESIGNED FOR THE APPLIED TENSION (SEE TABLE) AND SHEAR LOADS USING THE DESIGN STRENGTH OF THE CONCRETE IN THE PIER FOOTING AND ASSUMING A CRACKED SECTION. THE ADHESIVE SYSTEM AND MINIMUM EMBEDMENT DEPTH OF THE VERTICAL REINFORCING ANCHORED INTO THE FOOTING IS REQUIRED TO MEET THE PROVISIONS OF BRIDGE DESIGN MANUAL SECTION 7.06.02.B.

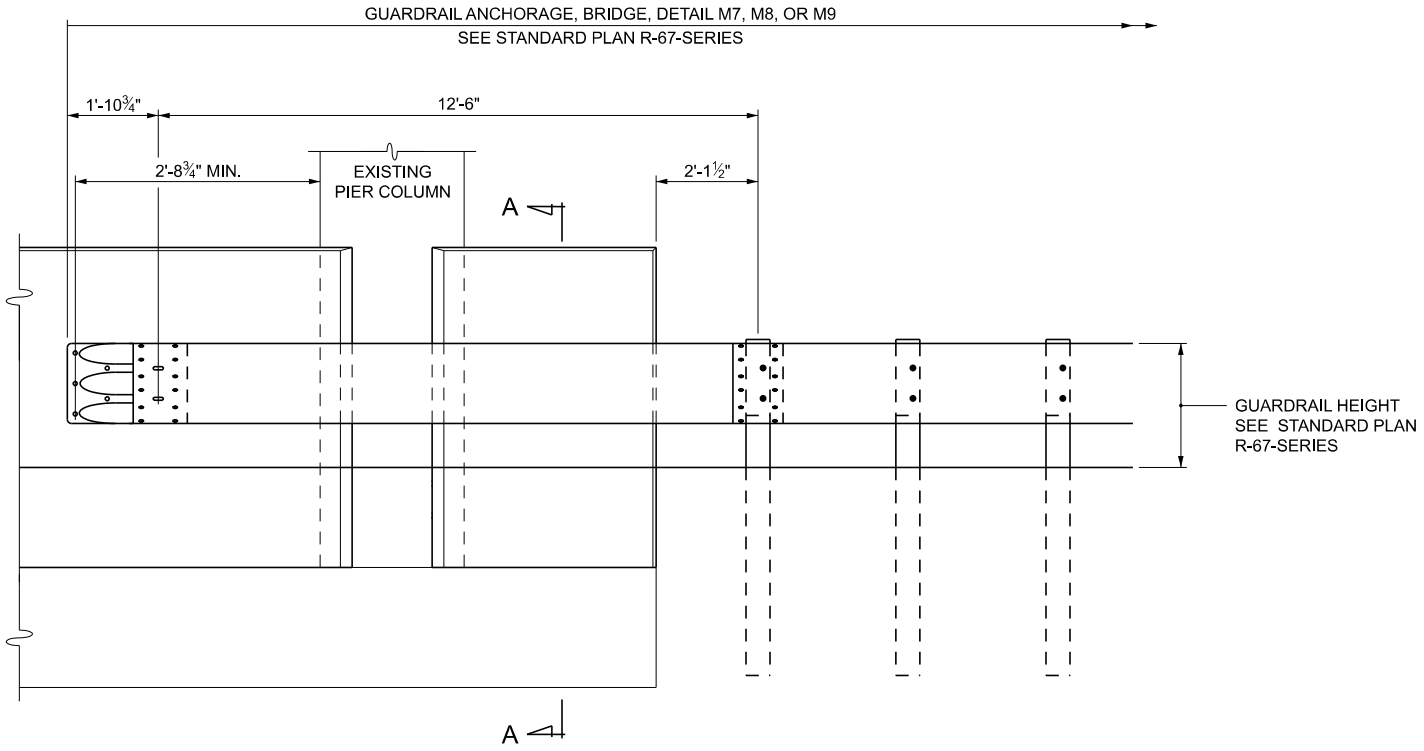
PIER STRUTS WITH HEIGHTS AND WIDTHS OTHER THAN THOSE LISTED IN THE PIER STRUT RETROFIT REINFORCED CONCRETE DESIGN TABLE SHALL BE DESIGNED IN ACCORDANCE WITH AASHTO LRFD SECTION 3.6.5.

PLACE ½" JOINT FILLER BETWEEN PIER COLUMNS OR STRUTS AND SLOPE PAVING OR HEADER. FOR SLOPE PAVING DETAILS AT THE INTERFACE WITH PIER COLUMNS OR STRUTS, SEE STANDARD PLAN B-102-SERIES.

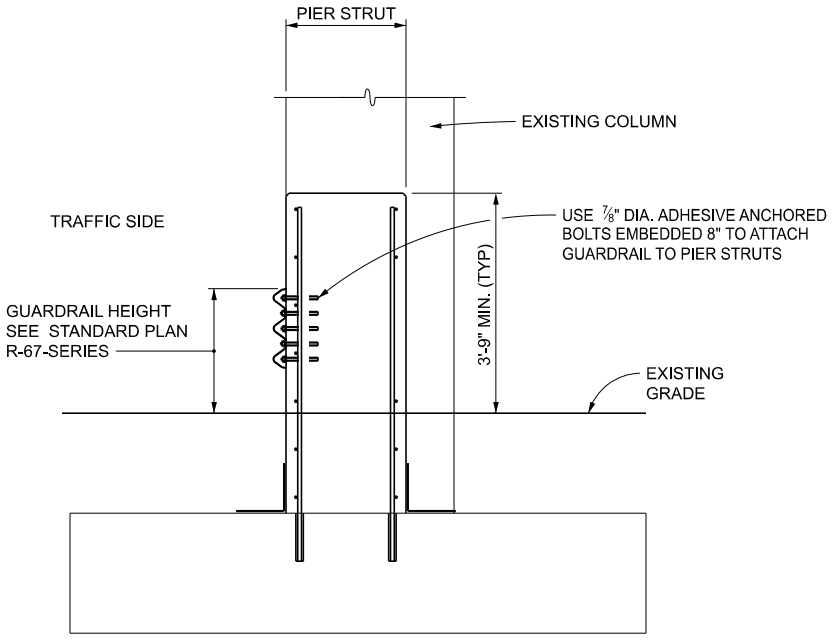
INCLUDE PAY ITEMS FOR UNDERDRAIN OUTLET AND UNDERDRAIN OUTLET ENDINGS. FOR UNDERDRAIN AND OUTLET ENDING DETAILS SEE STANDARD PLAN R-80-SERIES.

PREPARED BY DESIGN DIVISION	5.22.02A

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 02/26/24
CHECKED BY: VZ	PIER STRUT RETROFIT	SUPERSEDES:
APPROVED BY: KCK		



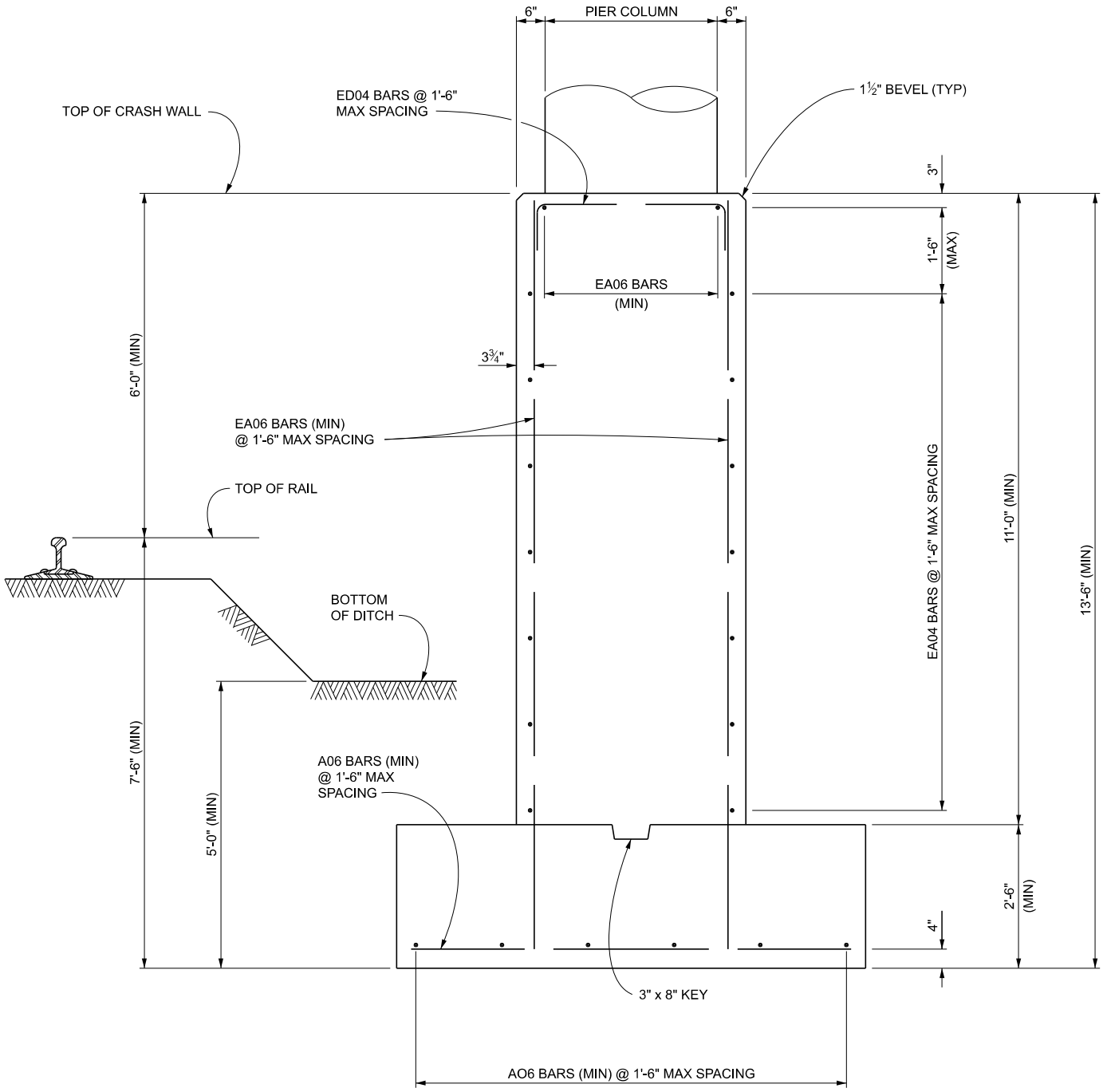
PIER STRUT ELEVATION
(SEE STANDARD PLAN R-67-SERIES FOR GUARDRAIL ATTACHMENT DETAILS)



SECTION A-A

PREPARED BY DESIGN DIVISION	5.22.02B

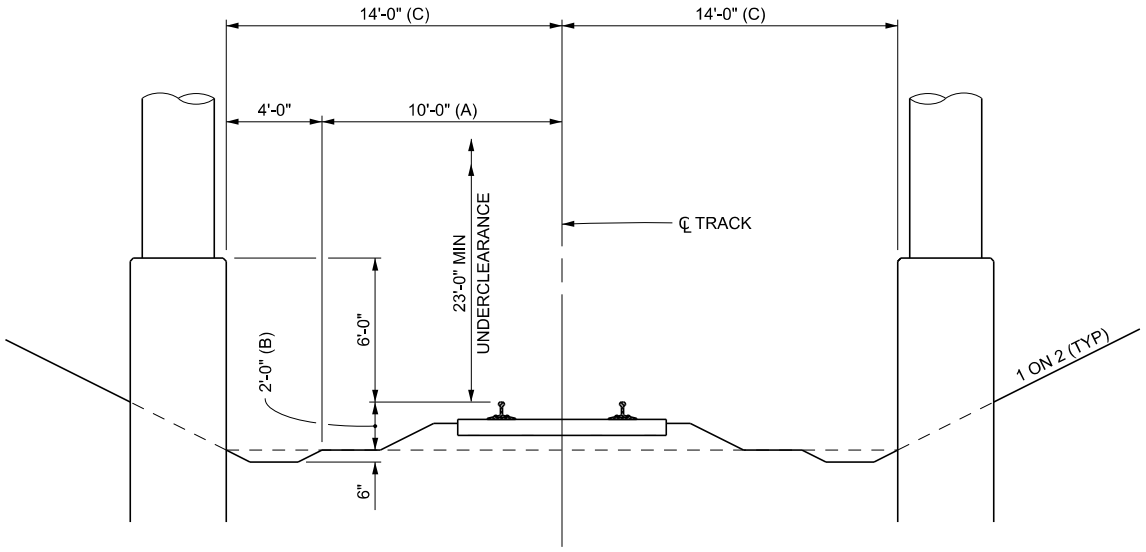
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BASE WALL DETAILS FOR PIER ADJACENT TO RAILROAD	ISSUED: 05/04/06 SUPERSEDES: 11/27/01



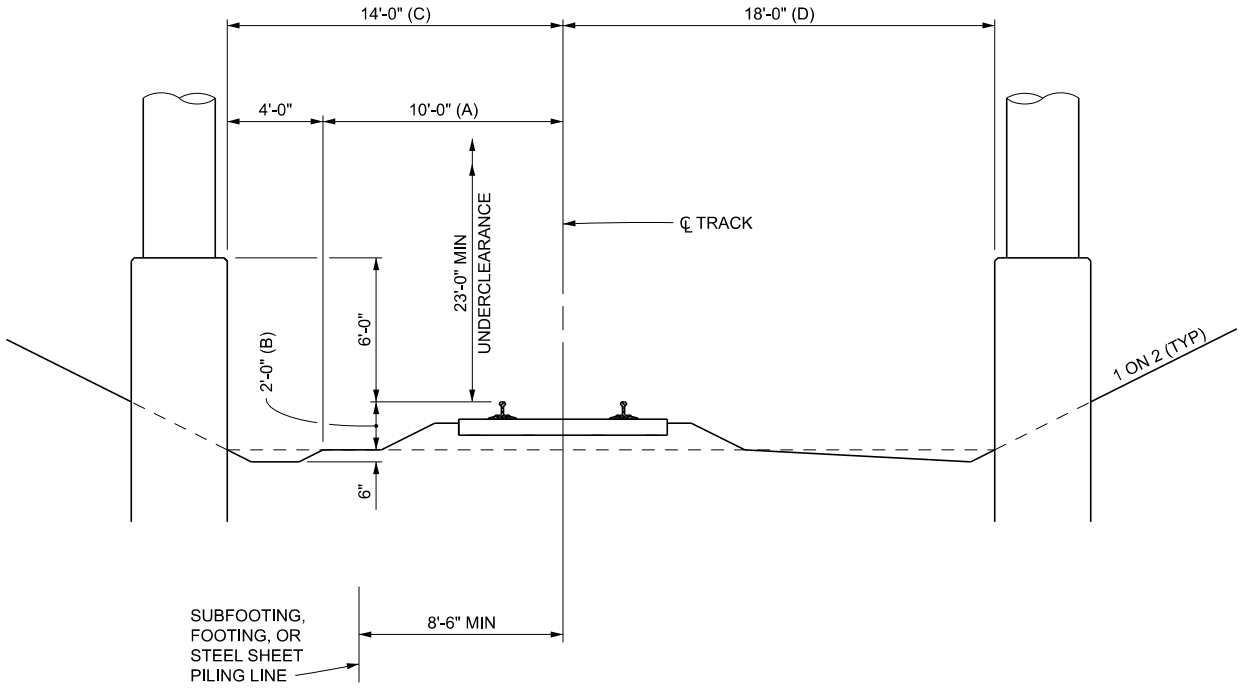
SECTION OF STANDARD CRASH WALL AT RIGHT ANGLES TO TRACK

PREPARED BY DESIGN DIVISION	5.24.01

DRAWN BY: MJB	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 11/27/01
CHECKED BY: VZ	RAILROAD SIDE CLEARANCES SINGLE TRACK UNDER	SUPERSEDES: 04/15/95
APPROVED BY: TGF		



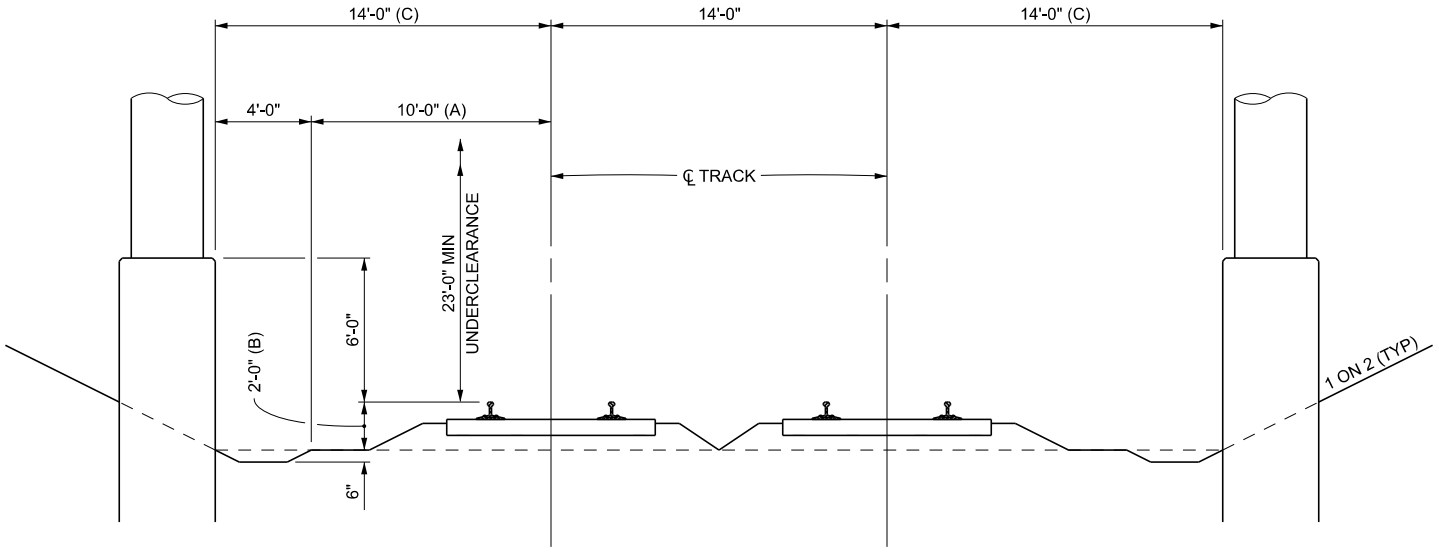
WITHOUT PROVISION FOR OFF-TRACK MAINTENANCE EQUIPMENT



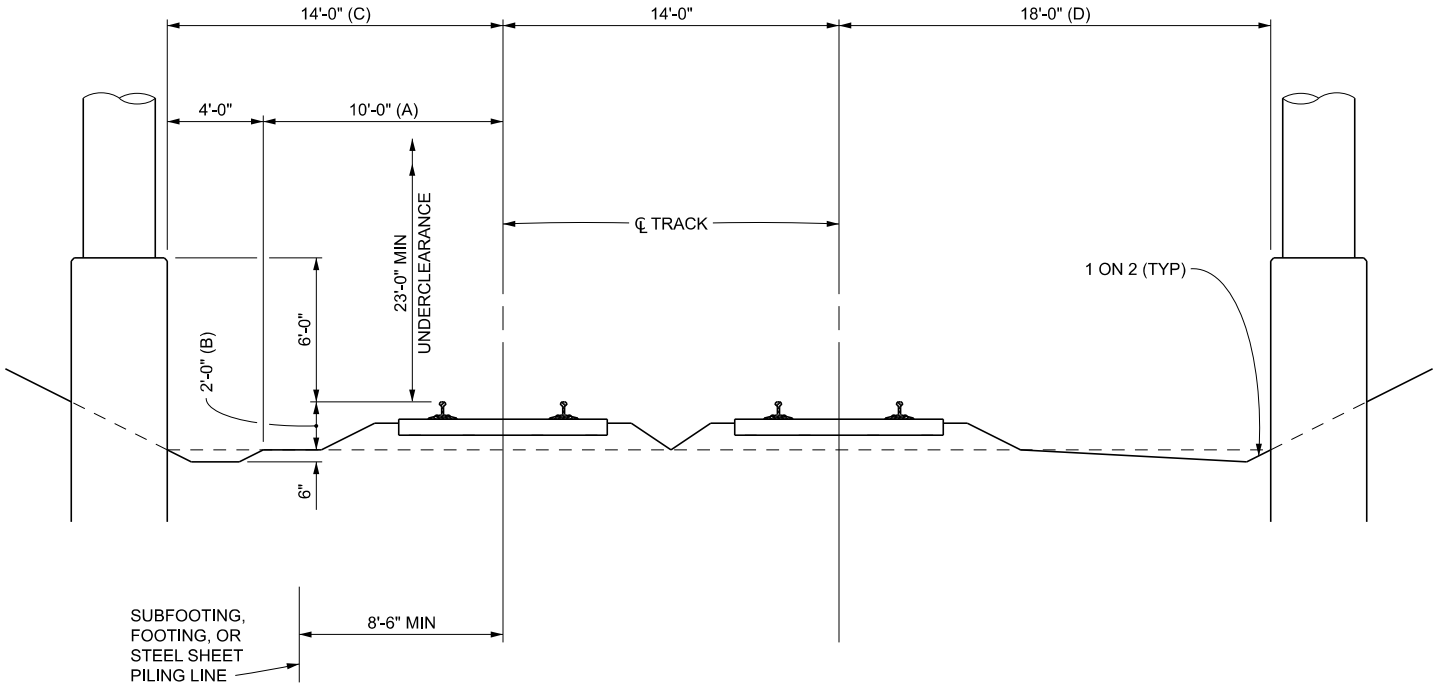
WITH PROVISION FOR OFF-TRACK MAINTENANCE EQUIPMENT

PREPARED BY DESIGN DIVISION	5.24.03

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 08/15/03
CHECKED BY: VZ	RAILROAD SIDE CLEARANCES DOUBLE TRACK UNDER	SUPERSEDES: 11/27/01
APPROVED BY: TGF		



WITHOUT PROVISION FOR OFF-TRACK MAINTENANCE EQUIPMENT



WITH PROVISION FOR OFF-TRACK MAINTENANCE EQUIPMENT

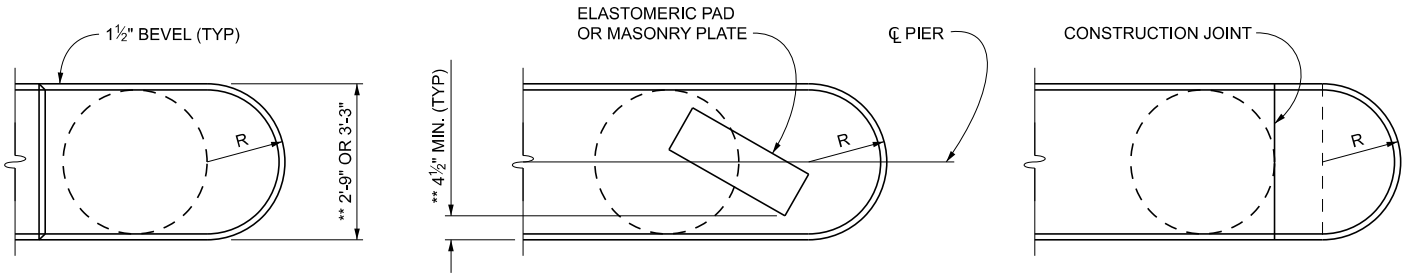
NOTES:
CRASHWALLS ARE NOT REQUIRED IF DISTANCE FROM ℄ OF TRACK TO FACE OF PIER EXCEEDS 25'-0".

ABOVE VIEWS ARE AT RIGHT ANGLES TO TRACK.

	A	B	C	D
NORFOLK SOUTHERN	12'-0"	2'-3"	16'-0"	18'-6"
CSX TRANSP.	11'-0"	---	15'-0"	---

PREPARED BY DESIGN DIVISION	5.24.04

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/26/23
CHECKED BY: VZ	PIER CAP DETAILS ROUND COLUMN PIERS	SUPERSEDES: 11/27/01
APPROVED BY: KCK		



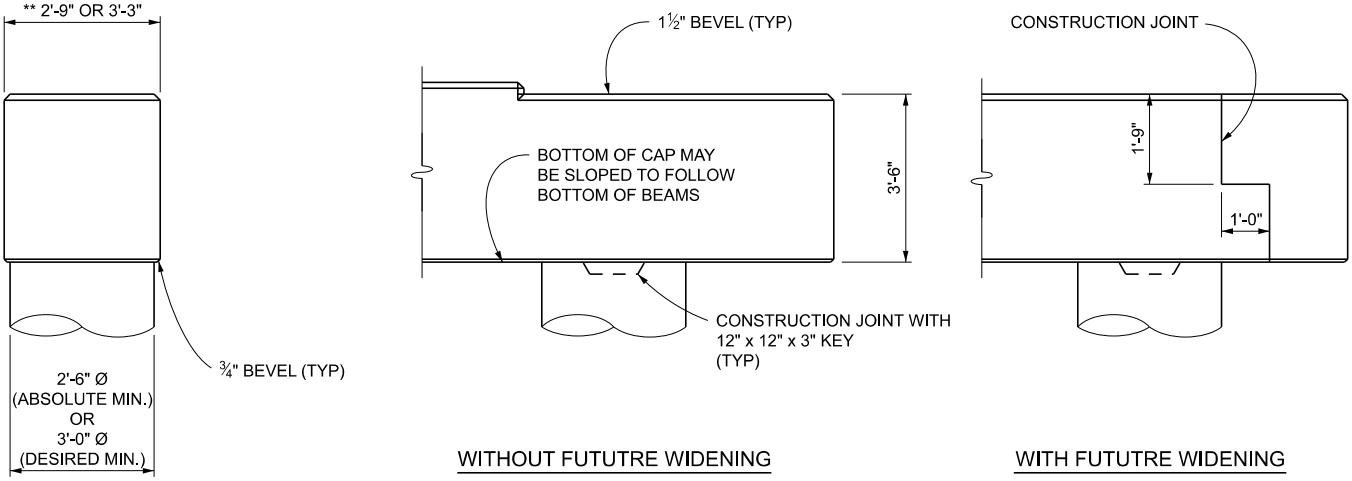
MIN. CANTILEVER WITHOUT FUTURE WIDENING

MIN. CANTILEVER WITH STRINGER ON CANTILEVER

MIN. CANTILEVER WITH FUTURE WIDENING

** INCREASE WIDTH AS REQUIRED TO PROVIDE 4½" CLEARANCE

PLAN OF CAP

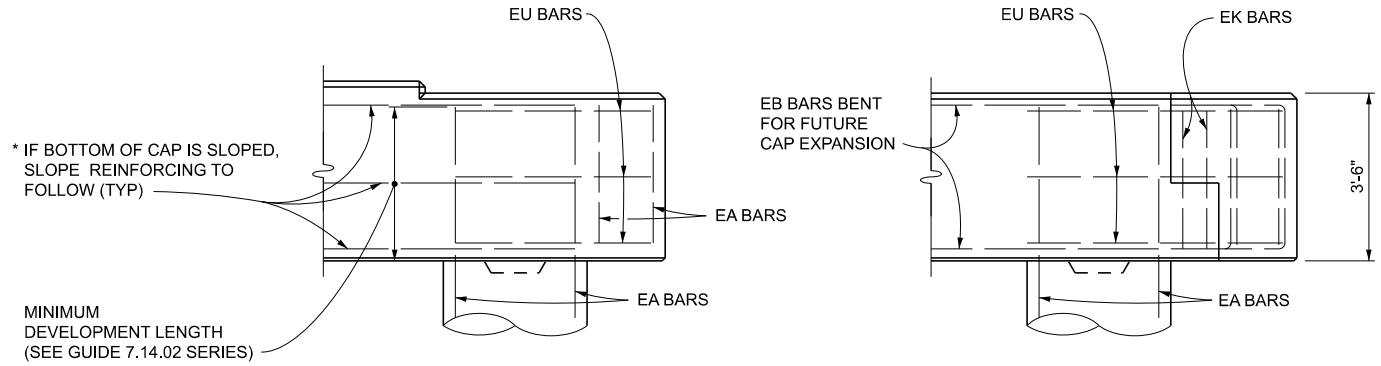


END VIEW

WITHOUT FUTUTRE WIDENING

WITH FUTUTRE WIDENING

SIDE VIEW AT END OF CAP



* 1'-0" MAXIMUM SPACING

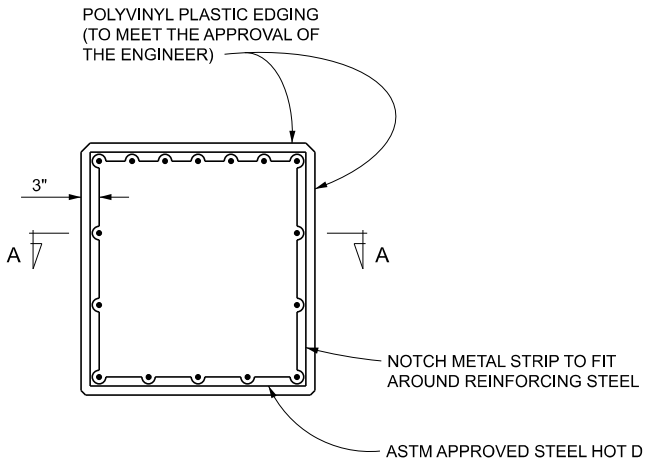
WITHOUT FUTURE WIDENING

WITH FUTURE WIDENING

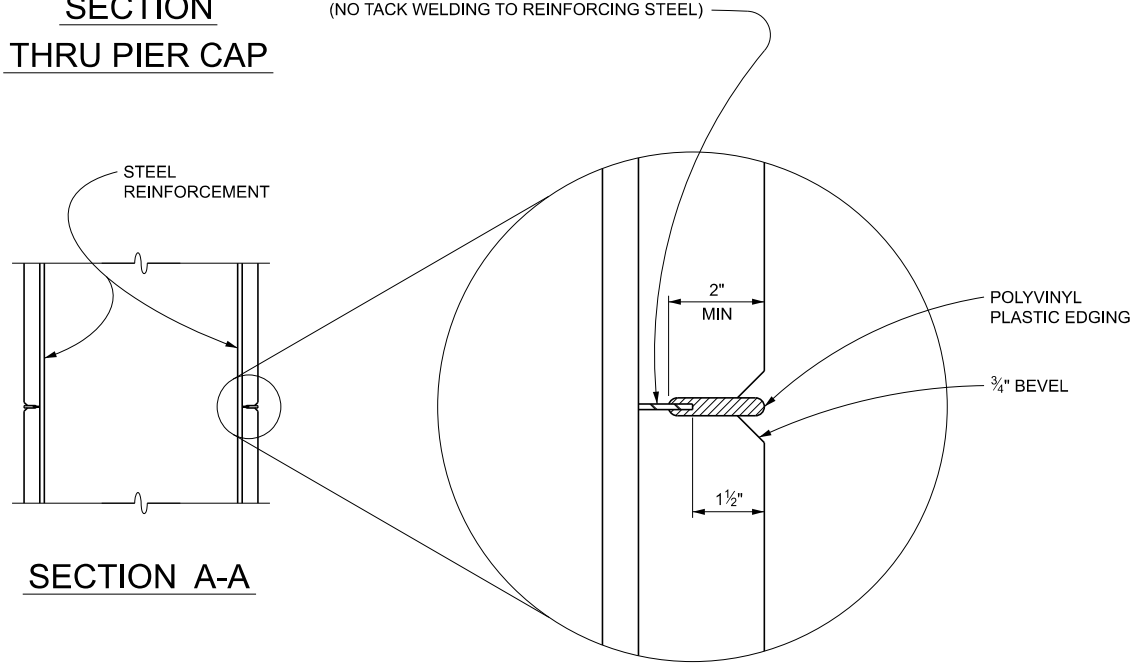
CAP REINFORCEMENT

PREPARED BY DESIGN DIVISION	5.27.03

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 06/23/25
CHECKED BY: CWC	PARTIAL METAL BULKHEAD FOR PIER CAP CONSTRUCTION JOINT	SUPERSEDES: 05/27/25
APPROVED BY: KCK		



SECTION
THRU PIER CAP



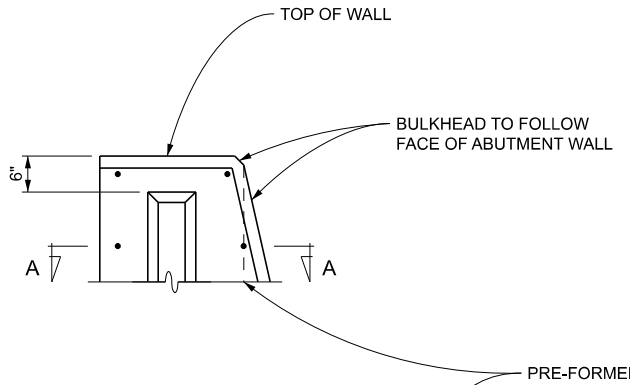
SECTION A-A

PLAN NOTES:

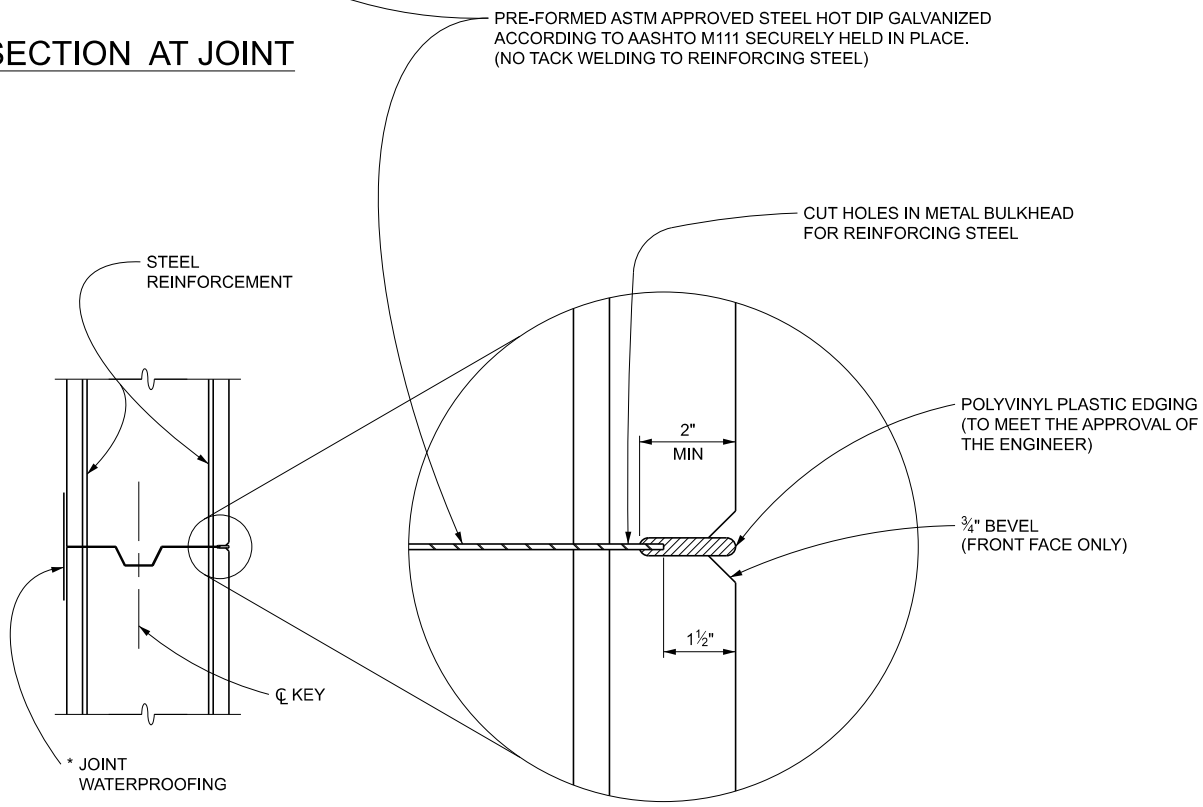
PARTIAL METAL BULKHEAD MAY BE USED AS ALTERNATE CONSTRUCTION JOINT AT CONTRACTOR'S EXPENSE. CARE IS TO BE USED IN CASTING CONCRETE TO PREVENT DISLOCATION OR MISALIGNMENT OF THE BULKHEAD.

PREPARED BY DESIGN DIVISION	5.27.04

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT METAL BULKHEAD FOR ABUTMENT CONSTRUCTION JOINT	ISSUED: 06/23/25 SUPERSEDES: 05/27/25



SECTION AT JOINT



SECTION A-A

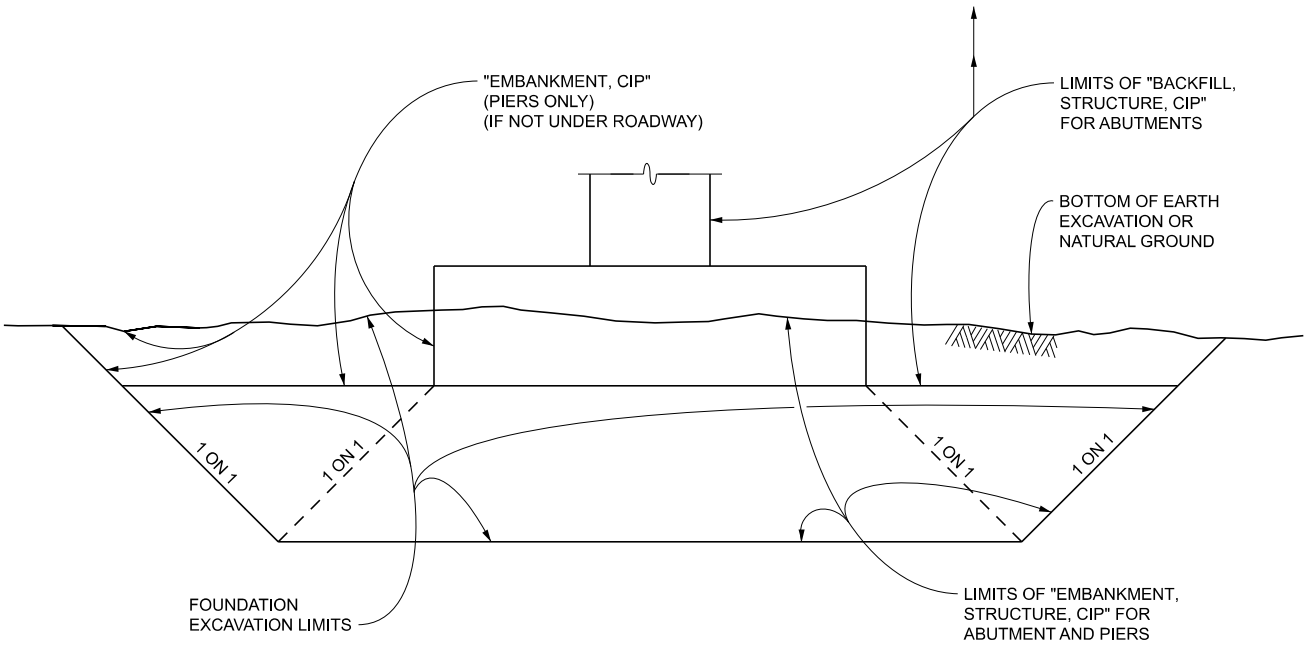
* PREFORMED WATERPROOFING MEMBRANE MAY BE USED AS AN ALTERNATE.

PLAN NOTES:

METAL BULKHEAD MAY BE USED AS ALTERNATE CONSTRUCTION JOINT AT CONTRACTOR'S EXPENSE. CARE IS TO BE USED IN CASTING CONCRETE TO PREVENT DISLOCATION OR MISALIGNMENT OF THE BULKHEAD.

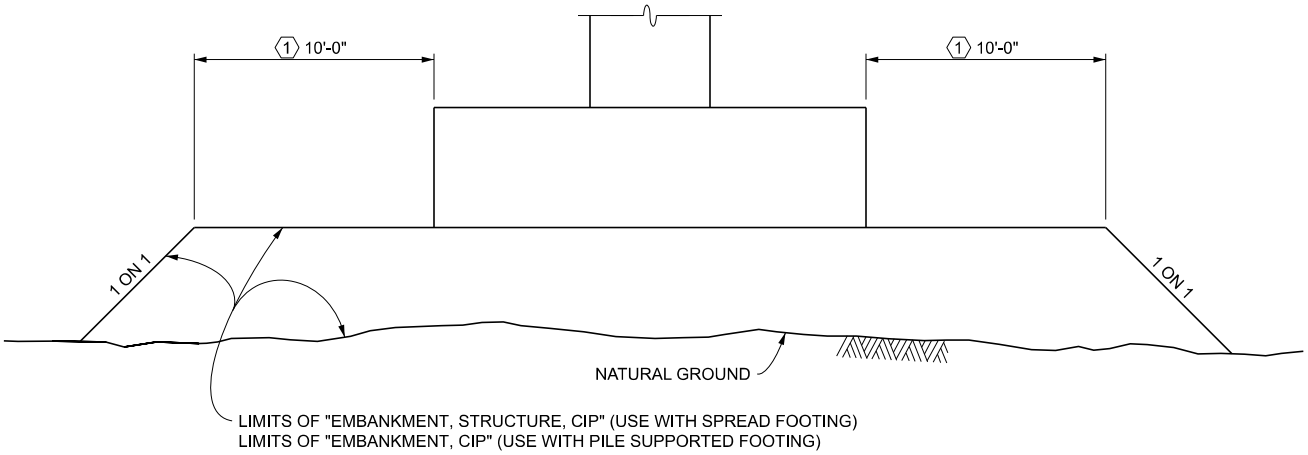
PREPARED BY DESIGN DIVISION	5.27.05

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT COMPACTED MOUND UNDER FOOTING	ISSUED: 11/27/01 SUPERSEDES: 05/24/99



SOIL CLASSIFIED AS ___ SHALL BE UNDERCUT AND REPLACED WITH "EMBANKMENT, STRUCTURE, CIP" COMPACTED TO 100% OF MAXIMUM UNIT WEIGHT. EXCAVATION & BACKFILL QUANTITIES ARE BASED ON ESTIMATED UNDERCUT TO ELEVATION ___. ACTUAL LIMITS OF EXCAVATION WILL BE DETERMINED BY THE ENGINEER AT THE TIME OF CONSTRUCTION.

FOUNDATION IN CUT



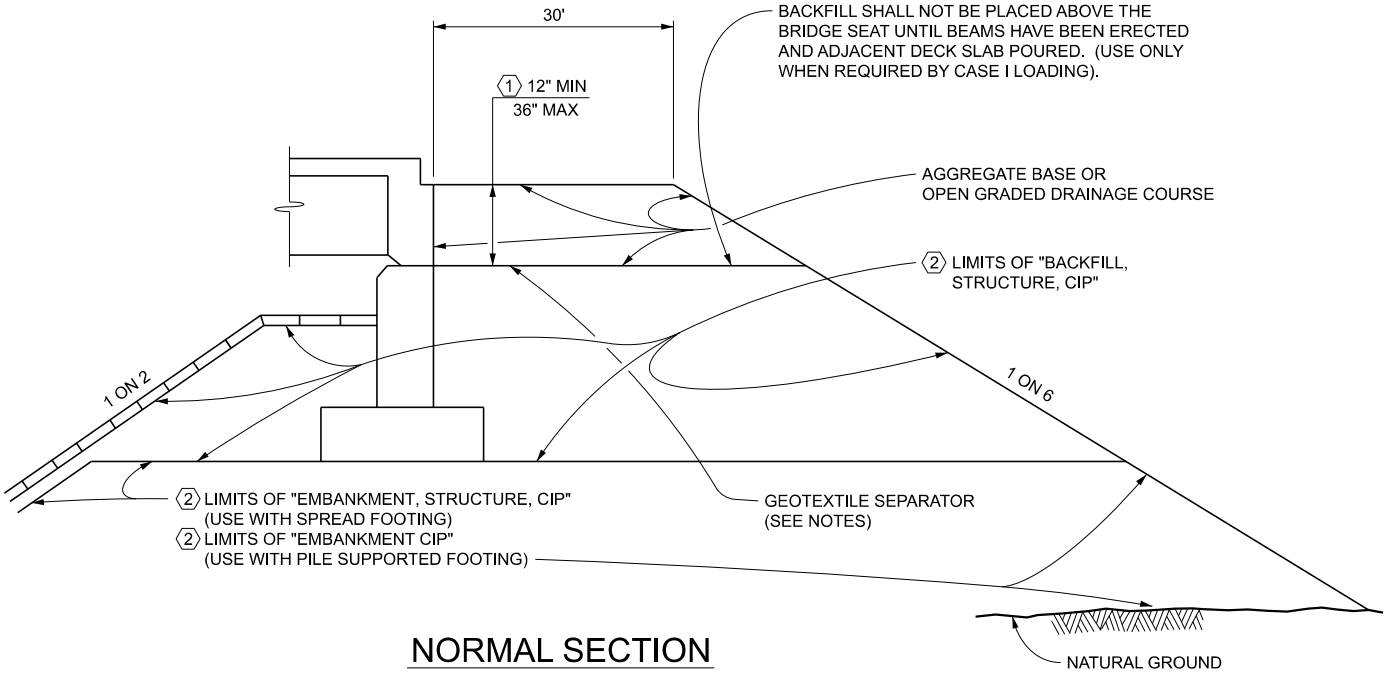
FOUNDATION ON FILL

(1) LIMITS FOR PIERS. FOR LIMITS FOR ABUTMENT, SEE BRIDGE DESIGN GUIDE 5.46.01.

THE MOUND IS INTENDED FOR USE WHERE THE FOOTING WOULD LIE ON FILL OR PARTIALLY IN CUT AND FILL. WHERE UNSUITABLE MATERIAL UNDERLYING THE FOOTING IS REMOVED, BACKFILL MATERIAL SHALL BE "EMBANKMENT, STRUCTURE, CIP".

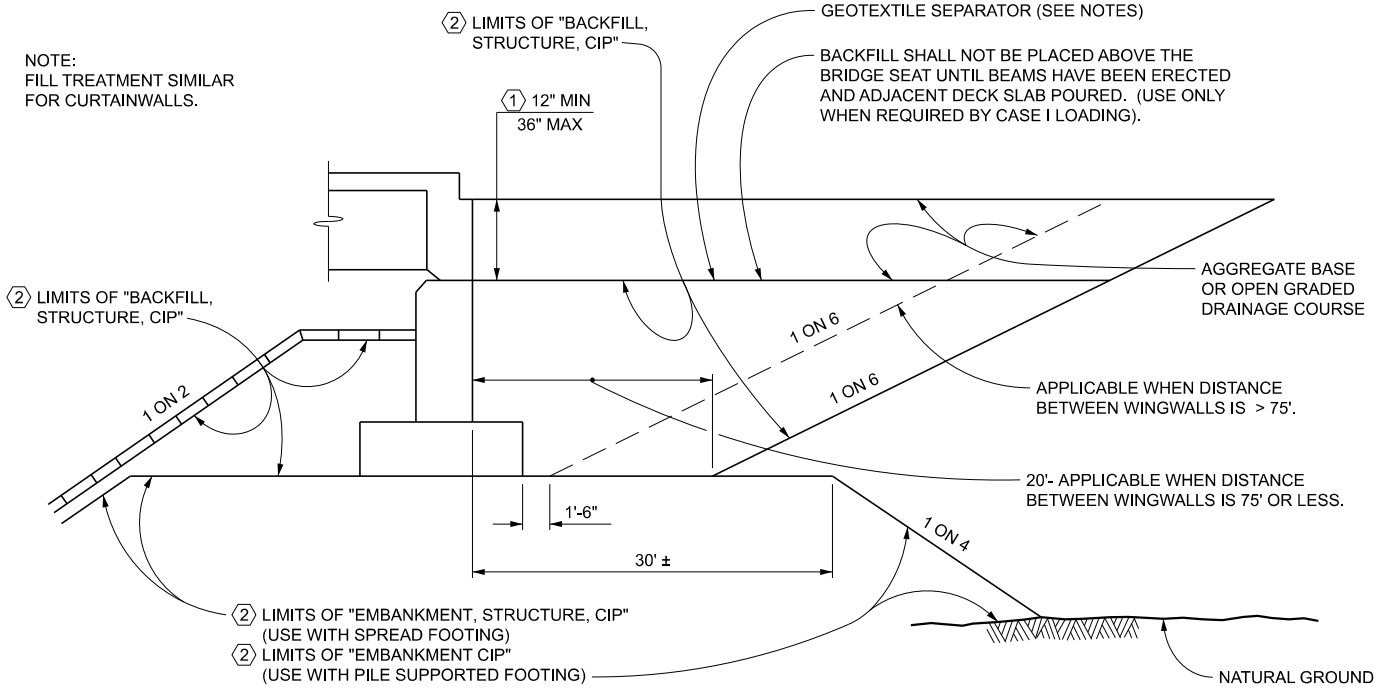
PREPARED BY DESIGN DIVISION	5.45.01

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 02/18/14
CHECKED BY: VZ	STRUCTURE BACKFILL AND EMBANKMENT ABUTMENTS ON FILL	SUPERSEDES: 11/27/01
APPROVED BY: DAJ		



NORMAL SECTION

USE WHEN THE BRIDGE IS BUILT PRIOR TO THE APPROACH EMBANKMENT BEING PLACED



SPECIAL SECTION IF REQUESTED BY CONSTRUCTION

USE WHEN THE BRIDGE IS BUILT AFTER THE EMBANKMENT IS PLACED

NOTES:
WHEN "EMBANKMENT CIP" IS USED, PLANS SHOULD SHOW DETAILS AND QUANTITIES FOR FOUNDATION DRAINS.

USE GEOTEXTILE SEPARATOR ONLY WITH OPEN GRADED DRAINAGE COURSE.

SEE GUIDE 3.25.01 FOR PLACEMENT DETAILS.

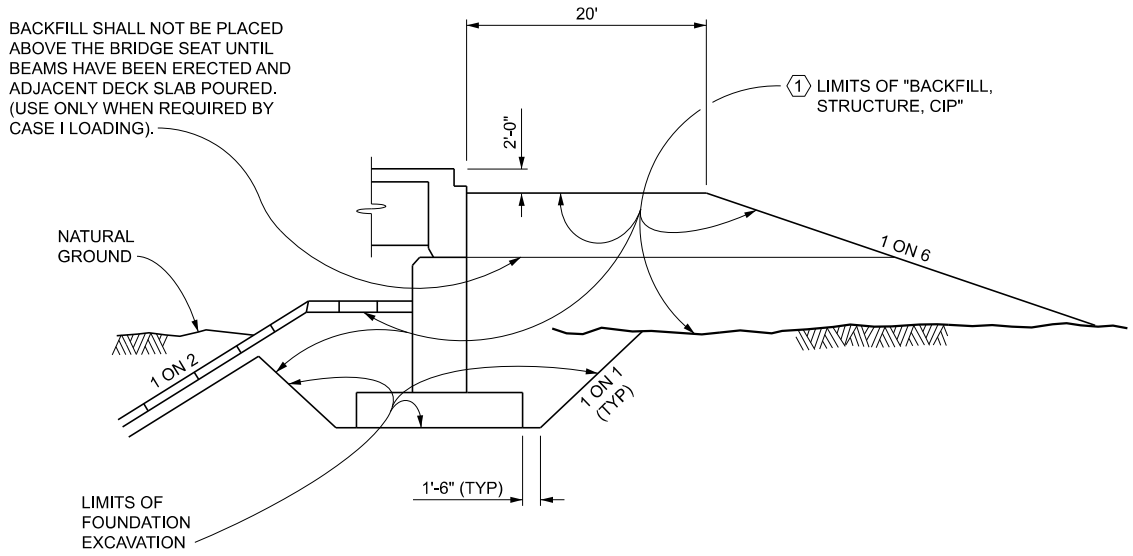
AGGREGATE BASE IS TO BE COMPACTED TO 98%.

1 OGDC OR AGGREGATE BASE SHALL EXTEND FROM BOTTOM OF SLEEPER SLAB FOR A DEPTH OF 36" MAX, NOT TO EXTEND BELOW THE TOP OF ABUTMENT WALL EXCEPT WHEN NECESSARY TO PROVIDE A MINIMUM OF 12" BELOW SLEEPER SLAB. PLACE BELOW APPROACH SLAB IF NO SLEEPER SLAB IS USED.

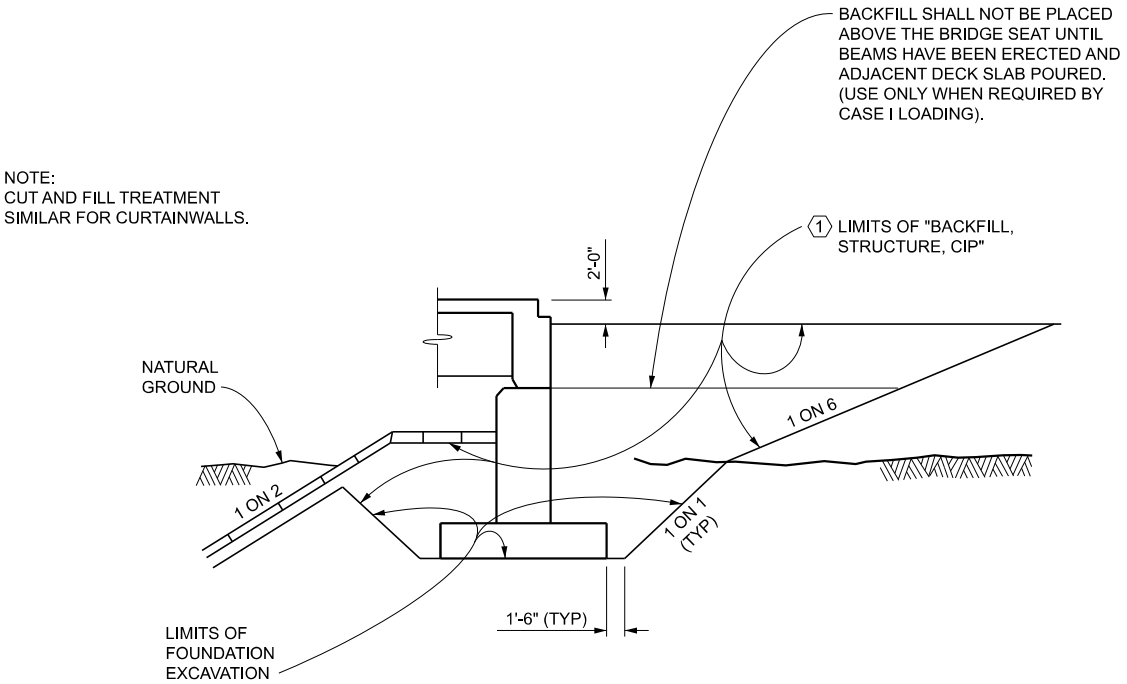
2 QUANTITIES ARE INCLUDED IN BRIDGE QUANTITIES.

PREPARED BY DESIGN DIVISION	5.46.01

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STRUCTURE BACKFILL AND EMBANKMENT ABUTMENTS IN CUT	ISSUED: 11/27/01 SUPERSEDES: 04/15/95



NORMAL SECTION



SPECIAL SECTION IF REQUESTED BY CONSTRUCTION

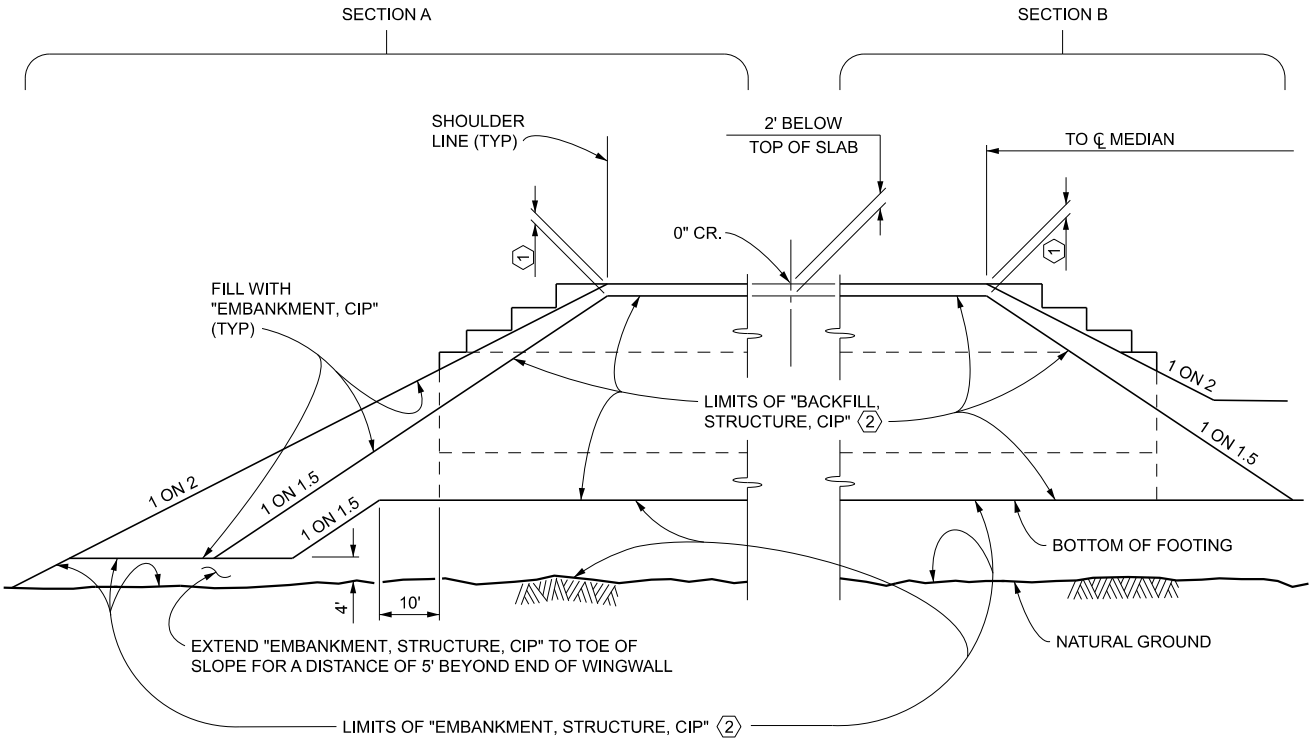
NOTES:

1 QUANTITIES ARE INCLUDED IN BRIDGE QUANTITIES.

FOR ADDITIONAL INFORMATION SEE GUIDE 3.25.01.

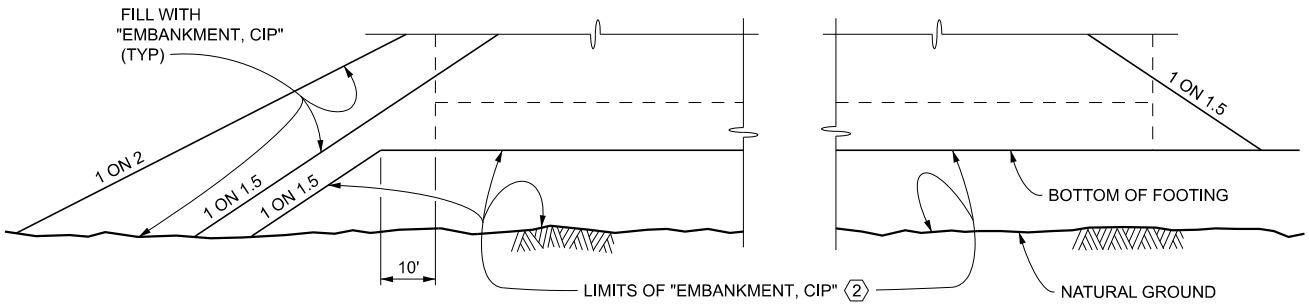
PREPARED BY DESIGN DIVISION	5.46.02

DRAWN BY: MJB	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 11/27/01
CHECKED BY: VZ	STRUCTURE BACKFILL AND EMBANKMENT FOR ABUTMENTS ON FILL (SLOPE WALLS)	SUPERSEDES: 05/24/99
APPROVED BY: TGF		



SECTION THRU BACKFILL NEAR ABUTMENTS

USE WITH SPREAD FOOTING



SECTION THRU BACKFILL NEAR ABUTMENTS

USE WITH PILE SUPPORTED FOOTING

NOTES:

WHEN "EMBANKMENT, CIP" IS USED, PLANS SHOULD SHOW DETAILS AND QUANTITIES FOR FOUNDATION DRAINS. SEE GUIDE 3.25.01 FOR PLACEMENT DETAILS.

FOR DIVIDED HIGHWAY - BOTH SECTION A AND SECTION B SHOULD APPEAR ON PLANS.

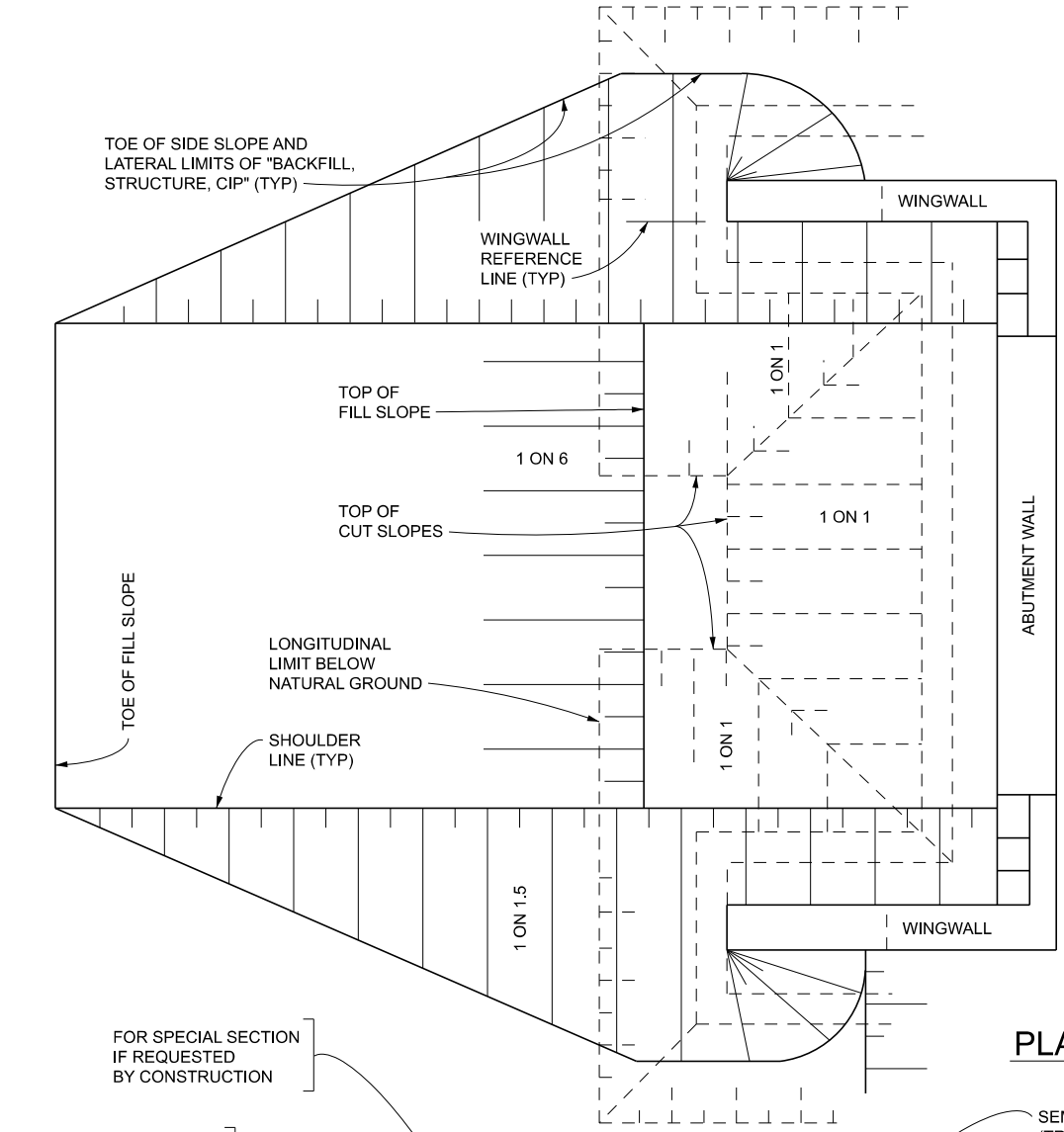
FOR SINGLE ROADWAY - SECTION A SHOULD APPEAR ON PLANS.

1 COMPUTE DIMENSION FROM TOP OF WALL TO TOP OF BACKFILL SO UPPER LIMIT OF FILL WILL APPROXIMATELY FOLLOW TOP OF PAVEMENT.

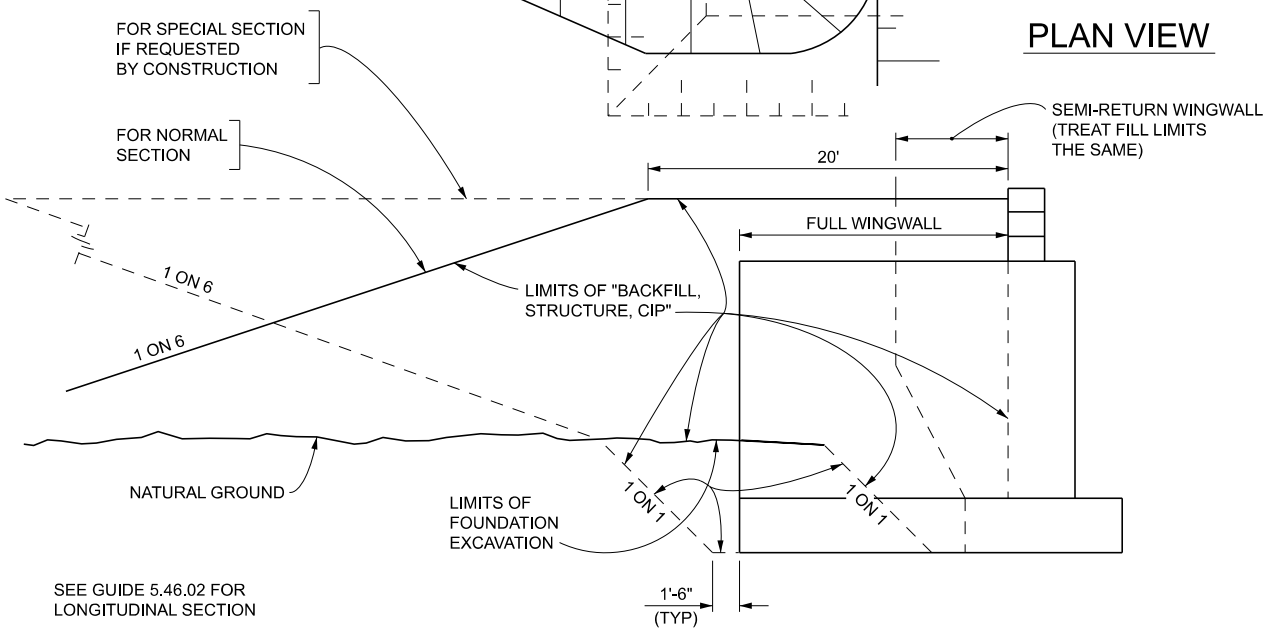
2 QUANTITIES ARE INCLUDED IN BRIDGE QUANTITIES.

PREPARED BY DESIGN DIVISION	5.46.03

DRAWN BY: MJB	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 11/27/01
CHECKED BY: VZ	STRUCTURE BACKFILL FOR ABUTMENTS IN CUT	SUPERSEDES: 04/15/95
APPROVED BY: TGF		



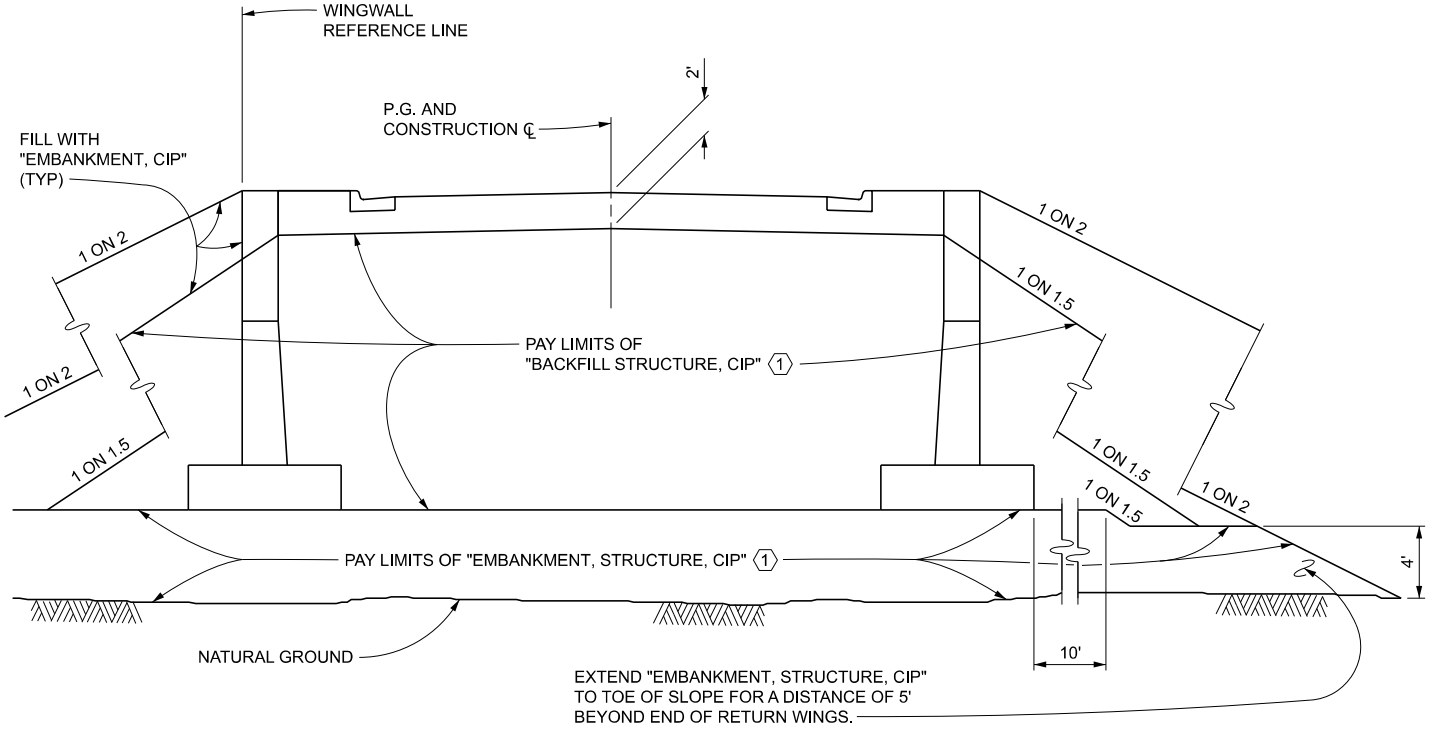
PLAN VIEW



ELEVATION VIEW

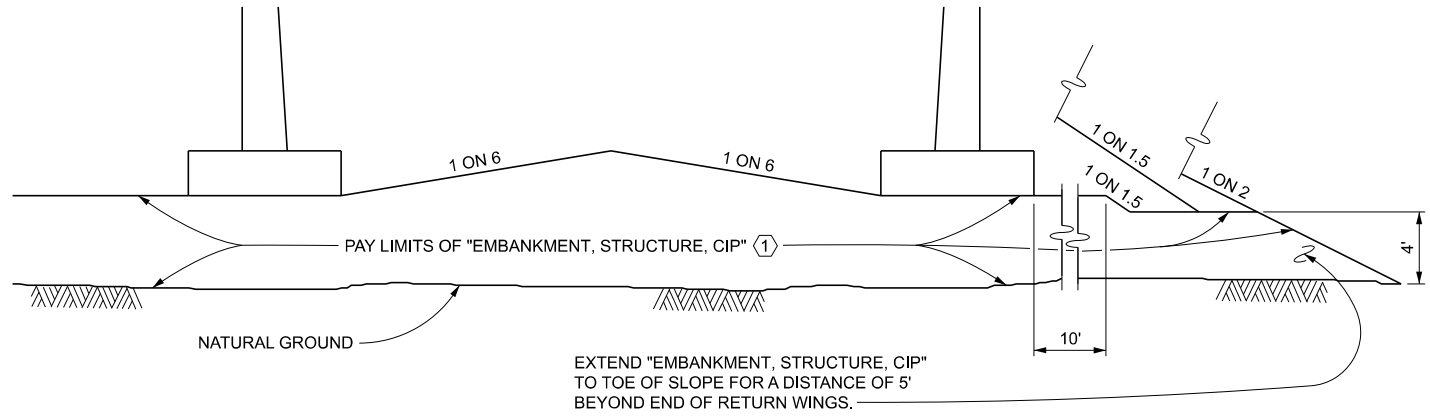
PREPARED BY DESIGN DIVISION	5.46.04

DRAWN BY: MJB	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 11/27/01
CHECKED BY: VZ	STRUCTURE BACKFILL AND EMBANKMENT FOR ABUTMENT WITH RETURN WINGS AND ON FILL	SUPERSEDES: 05/24/99
APPROVED BY: TGF		



SECTION THRU BACKFILL

USE WITH SPREAD FOOTING
APPLICABLE WHEN LENGTH OF WINGWALL IS 20' OR LESS,
AND/OR DISTANCE BETWEEN WINGWALLS IS 75' OR LESS.



SECTION THRU BACKFILL

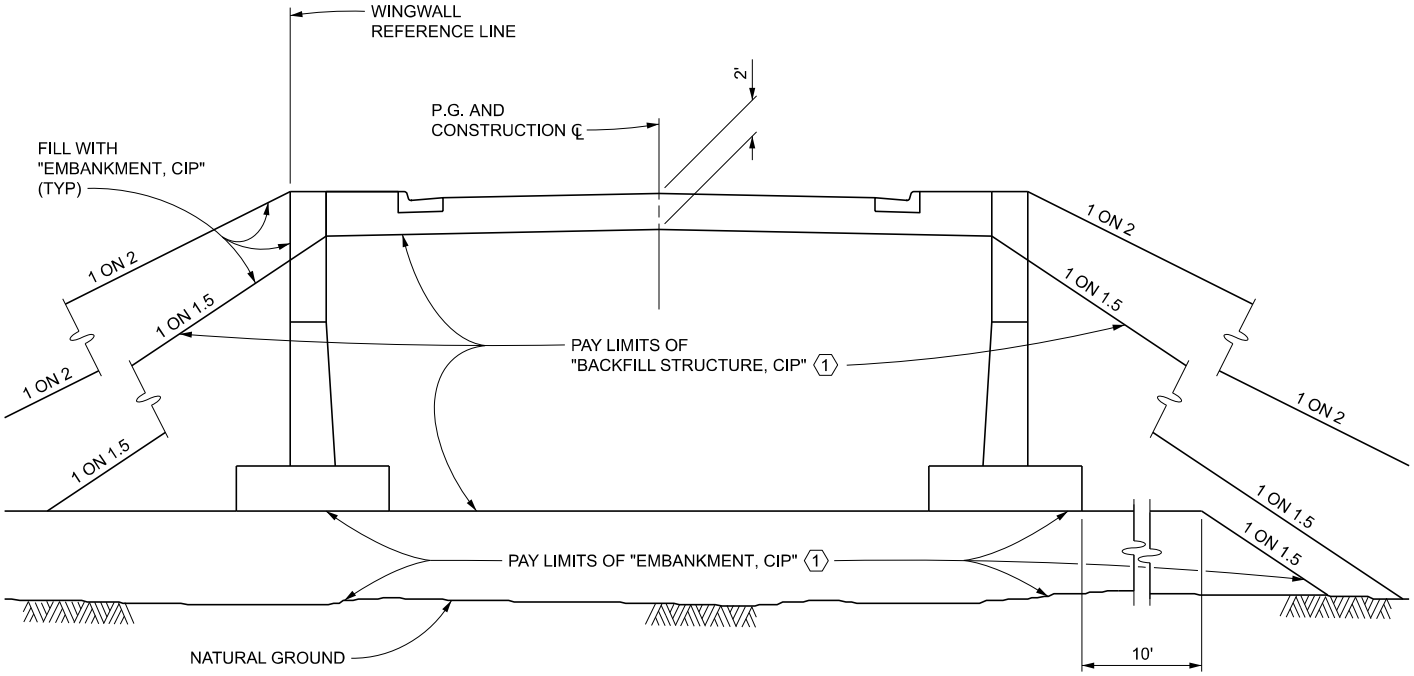
USE WITH SPREAD FOOTING
APPLICABLE WHEN LENGTH OF WINGWALL IS GREATER THAN 20',
AND/OR DISTANCE BETWEEN WINGWALLS IS GREATER THAN 75'.

NOTES:

1 QUANTITIES ARE INCLUDED IN BRIDGE QUANTITIES.

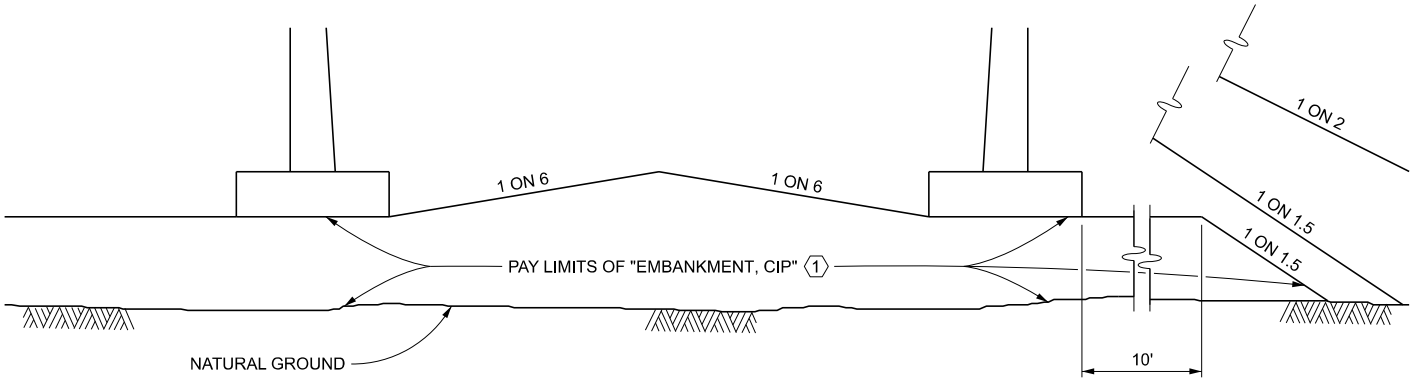
PREPARED BY DESIGN DIVISION	5.46.05

DRAWN BY: MJB	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 11/27/01
CHECKED BY: VZ	STRUCTURE BACKFILL AND EMBANKMENT FOR ABUTMENT WITH RETURN WINGS AND ON FILL	SUPERSEDES: 05/24/99
APPROVED BY: TGF		



SECTION THRU BACKFILL

USE WITH PILE SUPPORTED FOOTING
APPLICABLE WHEN LENGTH OF WINGWALL IS 20' OR LESS,
AND/OR DISTANCE BETWEEN WINGWALLS IS 75' OR LESS.



SECTION THRU BACKFILL

USE WITH PILE SUPPORTED FOOTING
APPLICABLE WHEN LENGTH OF WINGWALL IS GREATER THAN 20',
AND/OR DISTANCE BETWEEN WINGWALLS IS GREATER THAN 75'.

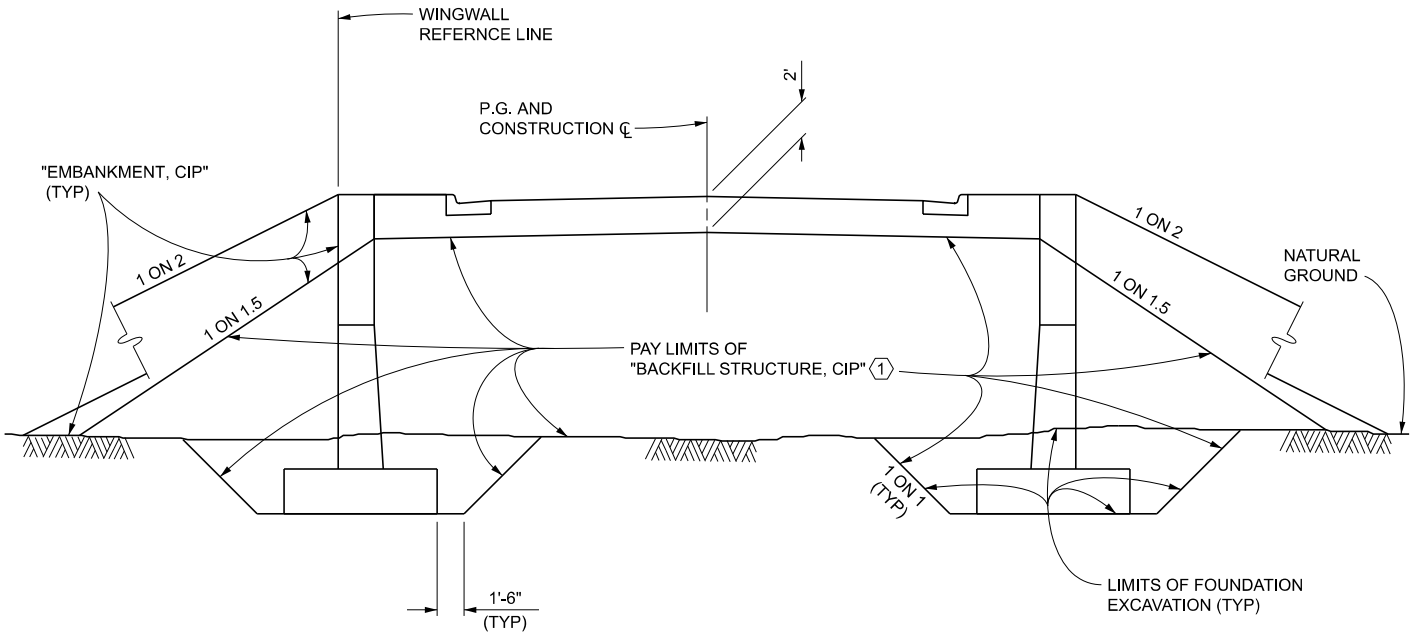
NOTES:

WHEN "EMBANKMENT, CIP" IS USED, PLANS SHOULD SHOW DETAILS AND QUANTITIES FOR FOUNDATION DRAINS. SEE GUIDE 3.25.01 FOR PLACEMENT DETAILS.

1 QUANTITIES ARE INCLUDED IN BRIDGE QUANTITIES.

PREPARED BY DESIGN DIVISION	5.46.05A

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STRUCTURE BACKFILL AND FOUNDATION EXCAVATION FOR ABUTMENT WITH RETURN WINGS AND IN CUT	ISSUED: 11/27/01 SUPERSEDES: 04/24/99



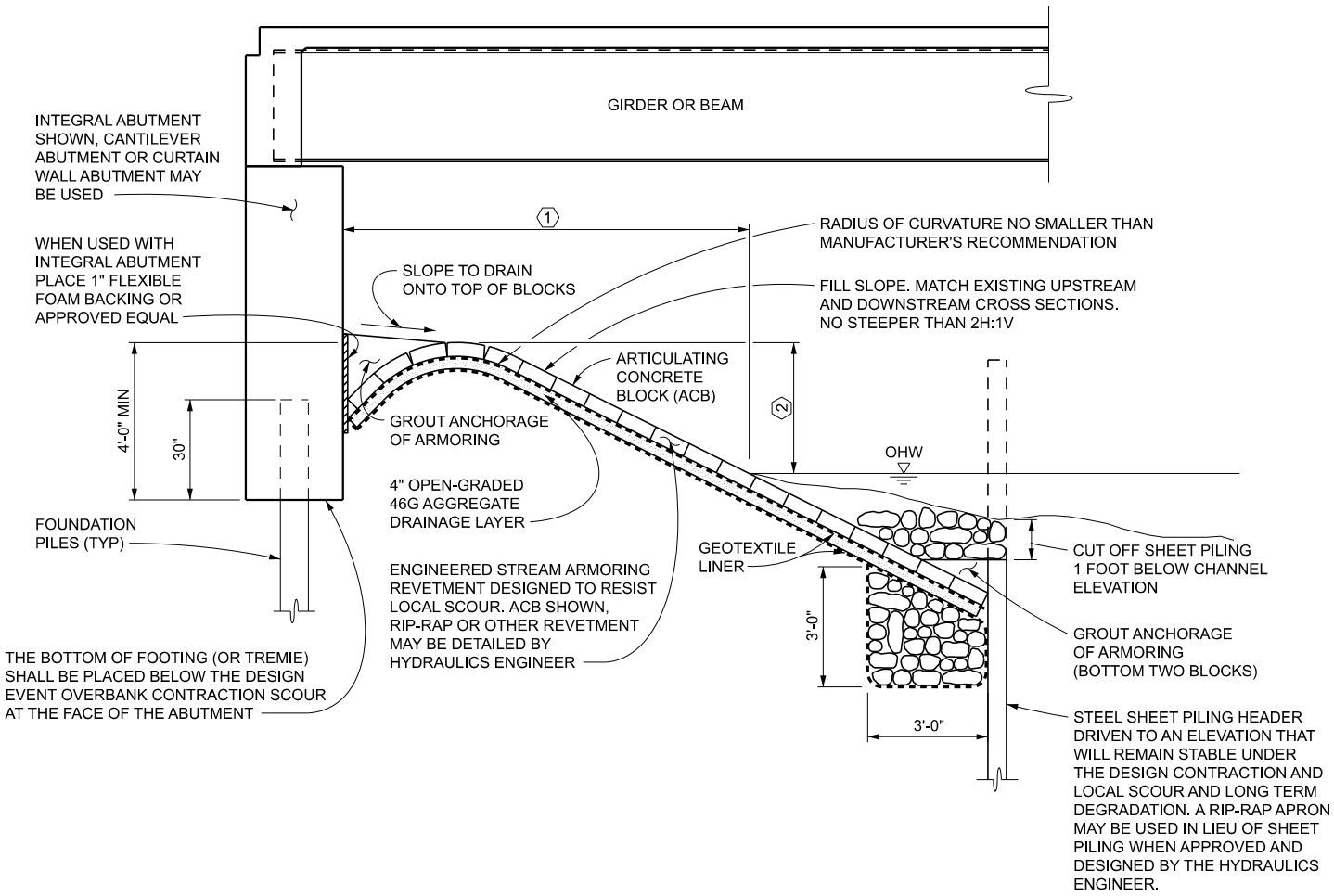
SECTION THRU BACKFILL

NOTES:

1. QUANTITIES ARE INCLUDED IN BRIDGE QUANTITIES.

PREPARED BY DESIGN DIVISION	5.46.06

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 05/22/23
CHECKED BY: VZ	PROTECTION OF SPILL-THROUGH ABUTMENT	SUPERSEDES: 09/24/18
APPROVED BY: KCK		



PROTECTION OF SPILL-THROUGH ABUTMENT

1. SET-BACK DISTANCE OF THE ABUTMENT FACE MEASURED FROM THE ORDINARY HIGH WATER. MINIMUM OF 25' OR 3H:1V SET-BACK RATIO OF THE DESIGN FLOOD HYDRAULIC DEPTH (WHICHEVER IS GREATER).

2. COUNTERMEASURES SHOULD BE EXTENDED 2' ABOVE THE DESIGN FLOOD ELEVATION, WHENEVER PRACTICAL.

NOTES:

FOR DEFINITIONS AND DESIGN CONSIDERATIONS SEE BRIDGE DESIGN MANUAL SECTION 7.03.01 B.5.

PREPARED BY DESIGN DIVISION	5.47.01

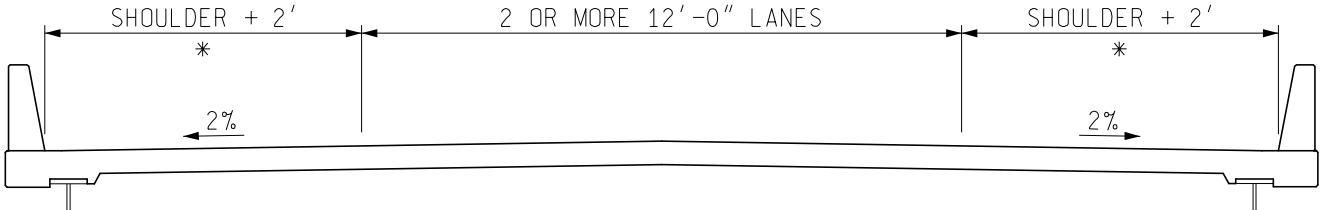
6. SUPERSTRUCTURE

DRAWN BY: CHECKED BY: APPROVED BY:	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: SUPERSEDES:

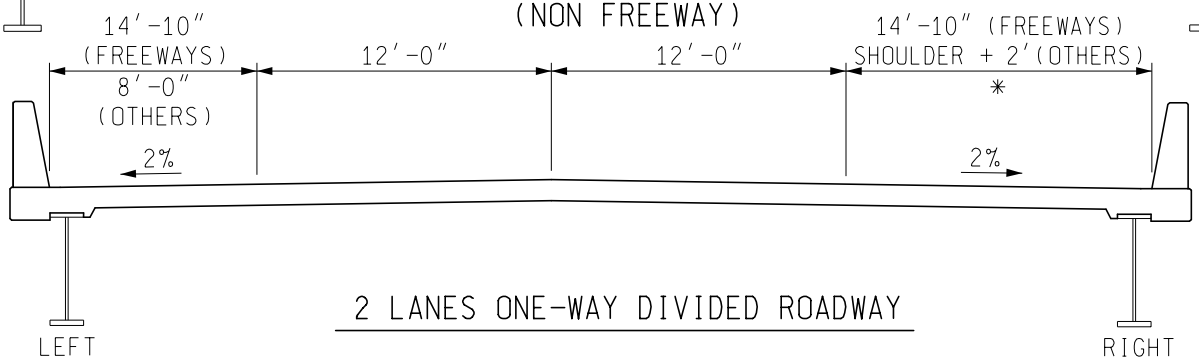
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PREPARED BY DESIGN DIVISION	

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BRIDGE CROSS SECTIONS NEW CONSTRUCTION/RECONSTRUCTION	ISSUED: 12/16/19 SUPERSEDES: 01/28/19

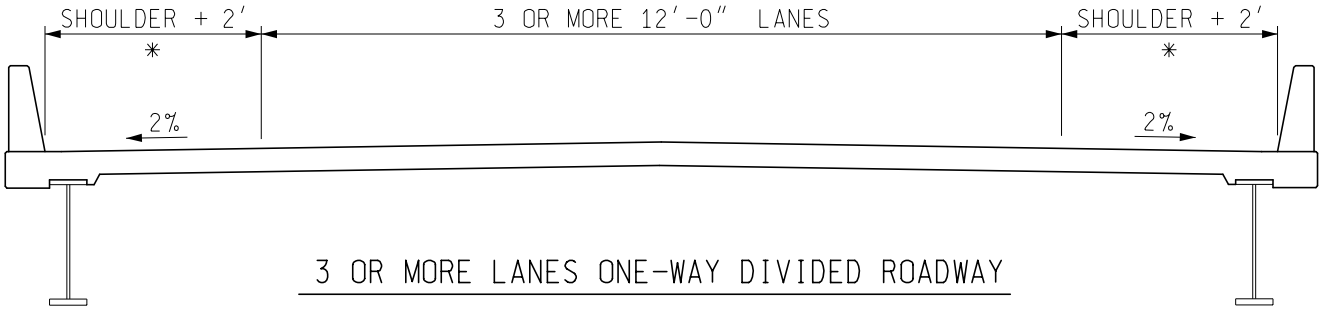


2 OR MORE LANES TWO-WAY
(NON FREEWAY)



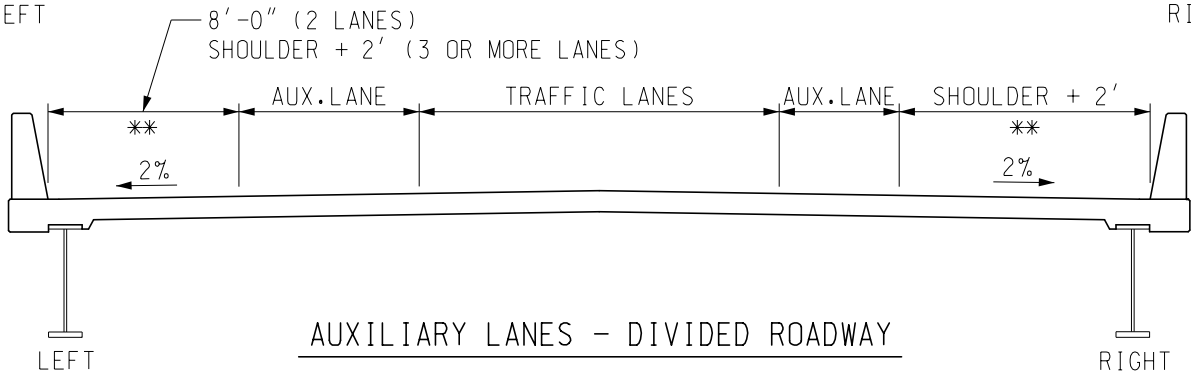
2 LANES ONE-WAY DIVIDED ROADWAY

LEFT RIGHT



3 OR MORE LANES ONE-WAY DIVIDED ROADWAY

LEFT RIGHT



AUXILIARY LANES - DIVIDED ROADWAY

LEFT RIGHT

NOTES:

IF A PEDESTRIAN FACILITY IS REQUIRED, SEE GUIDE 6.05.02.

* SEE ROAD DESIGN MANUAL APPENDIX 3A FOR FREEWAY AND RAMP APPROACH SHOULDER MINIMUMS. MAXIMUM SHOULDER WIDTH IS 12′ ON ALL STRUCTURES, EXCEPT 14′-10″ ON 2 LANE FREEWAYS. NON FREEWAY STRUCTURE SHOULDERS SHALL MATCH APPROACH SHOULDER WIDTHS BUT NOT BE LESS THAN VALUE FROM TABLE BELOW:

ADT VEH/DAY	<400	400-2000	>2000
MIN. APPROACH SHLDR.	4′	6′	8′

** EXTEND THIS SHOULDER WIDTH TO RAMP GORE, THEN TRANSITION TO RAMP SHOULDER WIDTH ALONG RAMP. WHEN RAMP SHOULDER OR TRANSITION TO RAMP SHOULDER IS ON STRUCTURE ADD 2′ TO SHOULDER OR TRANSITION.

INTERSTATE SHOULDER = PAVED PORTION OF SHOULDER.

NON INTERSTATE SHOULDER = FULL SHOULDER INCLUDING PAVED AND AGGREGATE SHOULDER BUT NOT INCLUDING THE LAST 1′ OF AGGREGATE TO THE HINGE POINT.

DECK REPLACEMENTS CARRY ONLY THE SHOULDERS ACROSS THE BRIDGE. THE ADDITIONAL 2′ IS NOT REQUIRED, BUT PREFERRED.

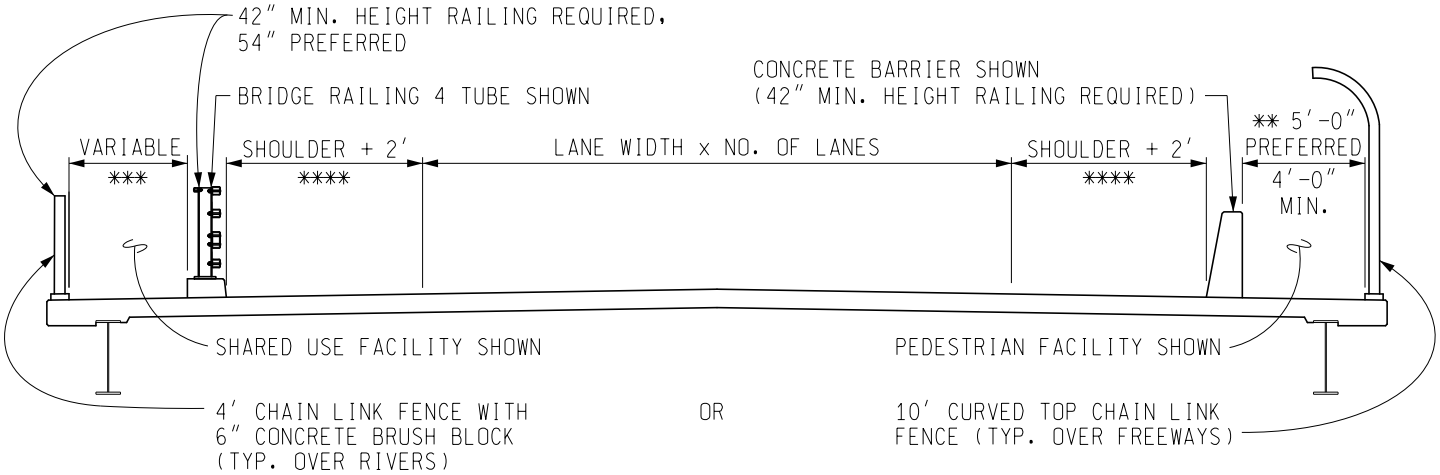
PREPARED BY DESIGN DIVISION	6.05.01A

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BRIDGE CROSS SECTIONS TRUNKLINE, COUNTY & CITY BRIDGES	ISSUED: 12/16/19 SUPERSEDES: 08/21/17

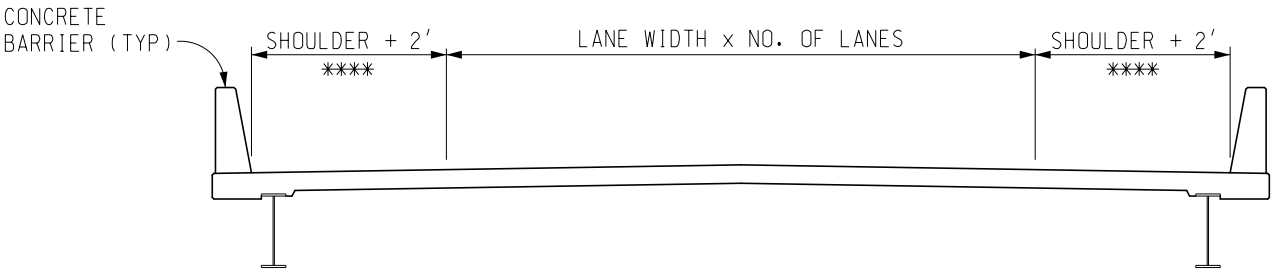


MAXIMUM POSTED SPEED 40 MPH
PEDESTRIAN FACILITY REQUIRED

FOR CURBED APPROACHES



POSTED SPEEDS GREATER THAN 40 MPH
PEDESTRIAN FACILITY REQUIRED



ANY POSTED SPEED
NO PEDESTRIAN FACILITY REQUIRED

FOR COUNTY & CITY BRIDGES ONLY
FOR TRUNKLINE BRIDGES WITHOUT PEDESTRIAN FACILITY
SEE BRIDGE DESIGN GUIDE 6.05.01

* 5'-2" TO TOE OF CURB, 5'-0" TO BEVEL POINT.

** WHEN A SIDEWALK WIDTH OF LESS THAN 5'-0" EXISTS FOR A LENGTH OF 200' OR MORE (INCLUDING APPROACHES) A PASSING SPACE, 5'-0" x 5'-0" (INCLUSIVE OF THE SIDEWALK), SHALL BE PRESENT EVERY 200' OR LESS OR A 5'-0" SIDEWALK SHALL BE USED TROUGHOUT.

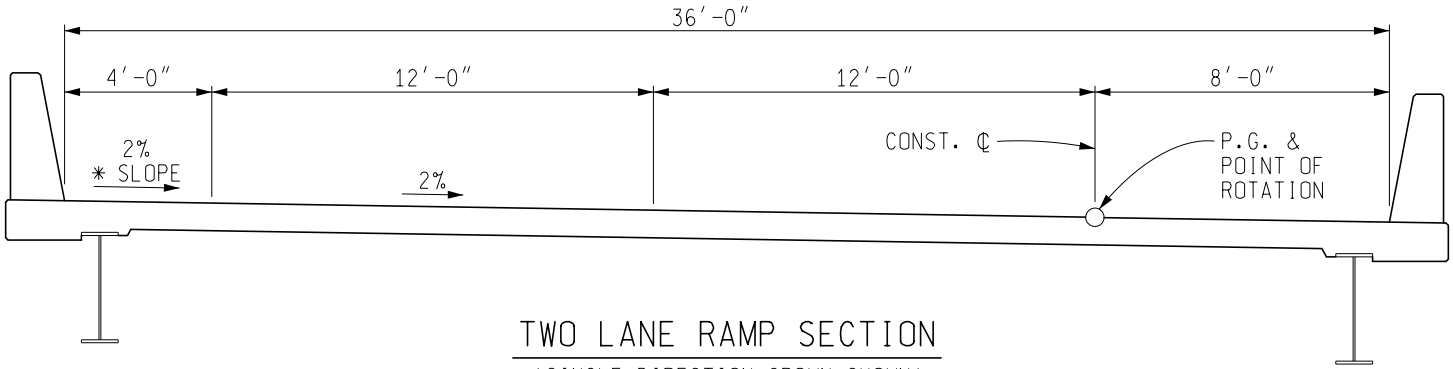
*** FOR WIDTH REFER TO AASHTO "GUIDE FOR THE DEVELOPMENT OF BICYCLE FACILITIES".

**** 2'-0" MIN. FOR CURB APPROACH. FOR MINIMUM APPROACH SHOULDER WIDTHS SEE BRIDGE DESIGN MANUAL CHAPTER 7 AND AASHTO "A POLICY ON GEOMETRIC DESIGN OF HIGHWAYS AND STREETS". 2' ADDITIONAL OFFSET APPLIES TO BRIDGES OVER MDOT JURISDICTIONAL FACILITY/ROADWAY.

WHERE AN AUXILIARY LANE ON THE STRUCTURE IS A CONTINUATION OF A RAMP, MATCH THE RAMP SHOULDER AS THE LATERAL CLEARANCE TO THE BRIDGE RAIL. USE 4' (TOTAL) MAX ON LEFT AND 8' (TOTAL) MAX. ON RIGHT.

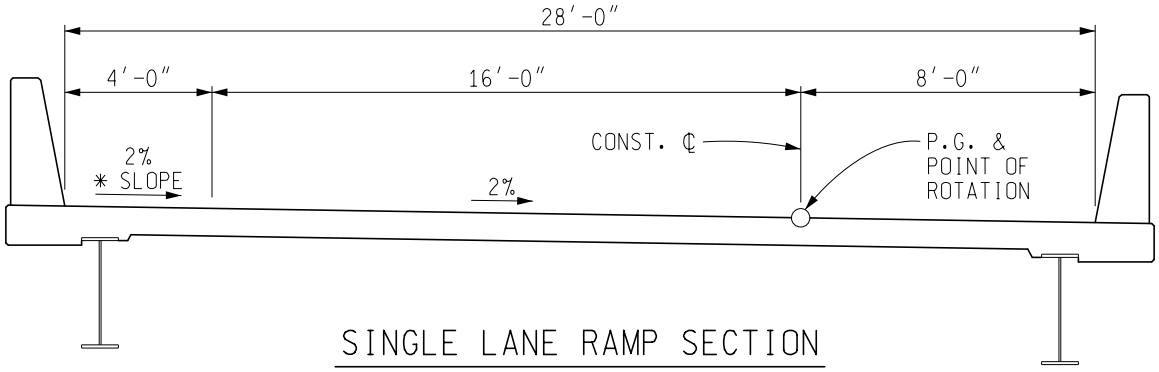
PREPARED BY DESIGN DIVISION	6.05.02

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BRIDGE RAMP AND U-TURN CROSS SECTIONS	ISSUED: 12/16/19 SUPERSEDES: 12/22/11

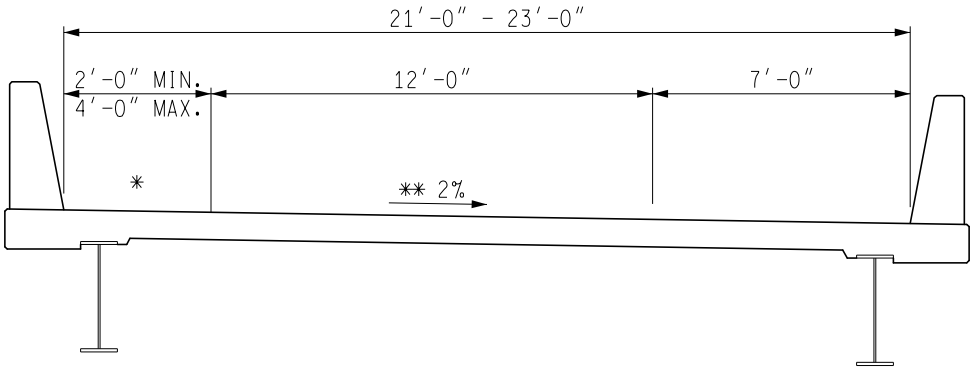


TWO LANE RAMP SECTION

(SINGLE DIRECTION CROWN SHOWN)

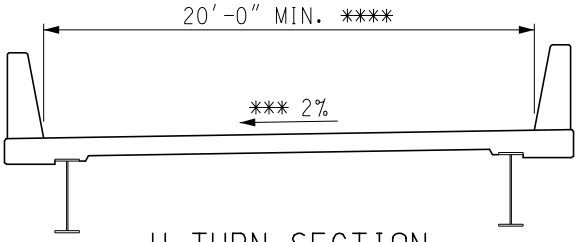


SINGLE LANE RAMP SECTION



SINGLE LANE SLIP RAMP SECTION

(A SLIP RAMP IS AN ANGULAR CONNECTION BETWEEN AN EXPRESSWAY AND A PARALLEL FRONTAGE ROAD)



U-TURN SECTION

NOTES:

* TRANSITION SHOULDER SLOPE ON APPROACH TO MATCH APPROACH ROAD SHOULDER SLOPE.

* MATCH BRIDGE SHOULDER SLOPE AND DIRECTION WITH ADJACENT THRU LANE.

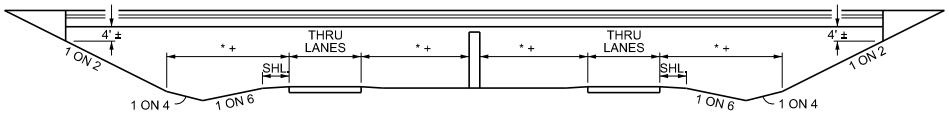
** USE 2% FOR 4R PROJECTS. MAINTAIN CURRENT SLOPE AND SECTION FOR 3R PROJECTS.

*** SLOPE STRUCTURE IN DIRECTION OF CURVE.

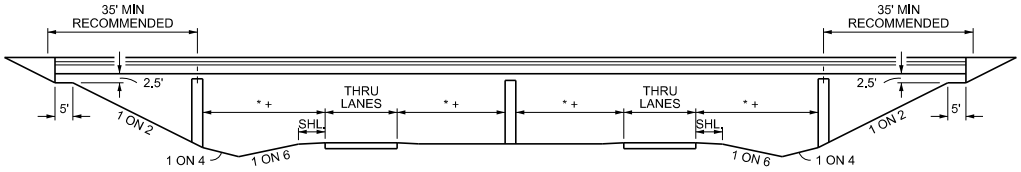
**** SEE GEOMETRIC DESIGN GUIDES GEO-400 SERIES

PREPARED BY DESIGN DIVISION	6.05.03

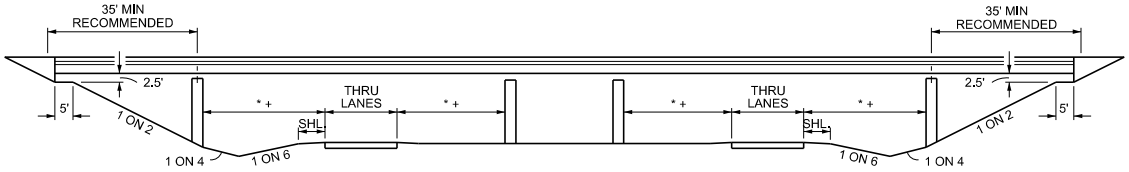
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 02/24/25
CHECKED BY: CWC	SUBSTRUCTURE CLEARANCES RURAL STATE TRUNKLINES	SUPERSEDES: 08/15/03
APPROVED BY: KCK		



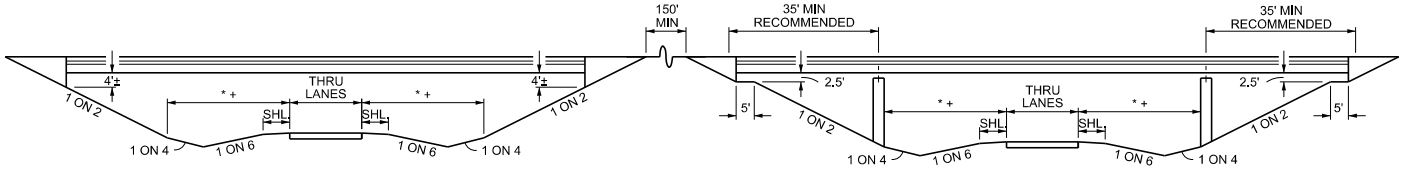
90° CROSSING OR MODERATELY SKEWED



SHARPLY SKEWED



SPREAD ROADWAYS - SINGLE STRUCTURES



90° CROSSING OR MODERATELY SKEWED

SHARPLY SKEWED

SPREAD ROADWAYS - SEPARATE STRUCTURES

(ALSO APPLICABLE FOR TURNING ROADWAYS)

WHERE CONDITIONS, SUCH AS TERRAIN AND COST DIFFERENTIAL, MAY BE SUCH THAT IT WOULD BE MORE DESIRABLE TO USE TWO STRUCTURES RATHER THAN ONE AND WHERE THE DISTANCE BETWEEN STRUCTURES WILL BE LESS THAN 150 FEET, CONSULT A DESIGN SUPERVISOR.

NOTES:

* MINIMUM DIMENSION IS THE CLEAR ZONE DISTANCE GIVEN IN ROAD DESIGN MANUAL 7.01.11C. USE THE MIDDLE OF RANGE AT THE APPROPRIATE DESIGN ADT. WHERE ROADWAY IS ON A CURVE WITH A RADIUS OF 2950' OR LESS, DISTANCE TO TOE OF 1-ON-2 SLOPE SHOULD BE INCREASED ON OUTSIDE OF CURVE PER ROAD DESIGN MANUAL 7.01.11D OR GUARDRAIL PROTECTION OF SLOPE OR PIER SHOULD BE PROVIDED.

\+ IF DISTANCE TO PIER OR TOE OF 1-ON-2 SLOPE IS LESS THAN THE CLEAR ZONE DISTANCE PROVIDE GUARDRAIL PROTECTION OF PIER OR SLOPE.

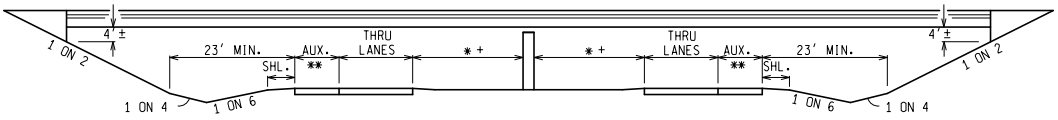
APPROACH SLOPE FACING TRAFFIC MUST BE GRADED TO 1-ON-6 WHEN THE TOE OF THE SLOPE IN FRONT OF THE ABUTMENT IS WITHIN THE CLEAR ZONE. SEE STANDARD PLAN R-105-SERIES.

SECTIONS ARE APPLICABLE GENERALLY FOR STRUCTURES WITH APPROACHES ON FILL OR WHEN DRAINAGE IS CARRIED THROUGH STRUCTURE AREA BY USE OF CULVERTS. FOR EXPRESSWAYS IN DEEP CUT, CARRY SAME DITCH SECTION THROUGH STRUCTURE AS CALLED FOR ON EXPRESSWAY SECTION.

ALL DIMENSIONS ARE AT RIGHT ANGLES TO ROADWAY.

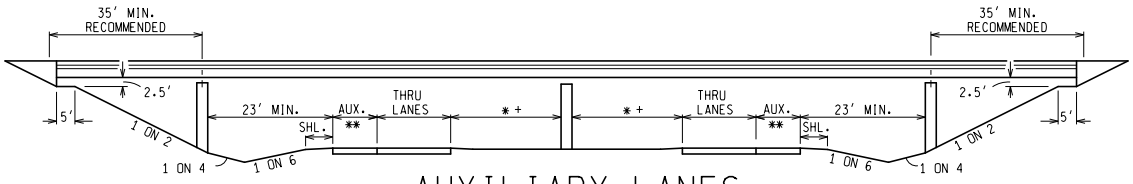
PREPARED BY DESIGN DIVISION	6.06.01

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT SUBSTRUCTURE CLEARANCES RURAL STATE TRUNKLINES	ISSUED: 02/14/11 SUPERSEDES: 08/15/03



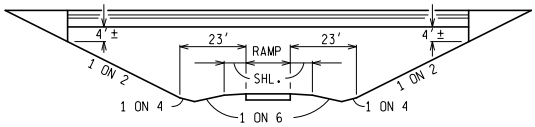
AUXILIARY LANES

90° CROSSING OR MODERATELY SKEWED



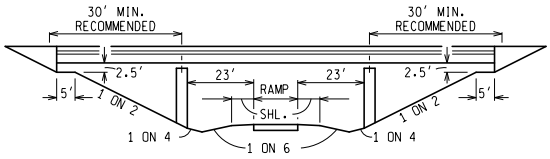
AUXILIARY LANES

SHARPLY SKEWED



RAMP

90° CROSSING OR MODERATELY SKEWED



RAMP

SHARPLY SKEWED

NOTES:

* MINIMUM DIMENSION IS THE CLEAR ZONE DISTANCE GIVEN IN BRIDGE DESIGN GUIDE 6.06.05. USE THE MIDDLE OF RANGE AT THE APPROPRIATE DESIGN ADT. WHERE ROADWAY IS ON A CURVE WITH A RADIUS OF 2860' OR LESS, DISTANCE TO TOE OF 1 ON 2 SLOPE SHOULD BE INCREASED ON OUTSIDE OF CURVE PER BRIDGE DESIGN GUIDE 6.06.05A OR GUARDRAIL PROTECTION OF SLOPE OR PIER SHOULD BE PROVIDED.

\+ IF DISTANCE TO PIER OR TOE OF 1 ON 2 SLOPE IS LESS THAN THE CLEAR ZONE DISTANCE PROVIDE GUARDRAIL PROTECTION OF PIER OR SLOPE.

APPROACH SLOPE FACING TRAFFIC MUST BE GRADED TO 1 ON 6 WHEN THE TOE OF THE SLOPE IN FRONT OF THE ABUTMENT IS WITHIN THE CLEAR ZONE. SEE STANDARD PLAN R-105-SERIES.

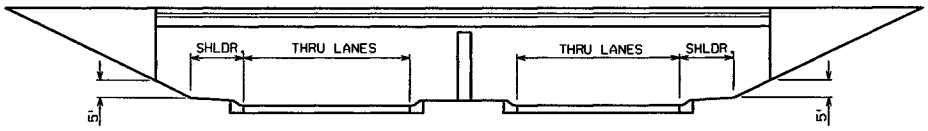
** AT AUXILIARY LANE TAPER SEE BRIDGE DESIGN GUIDE 6.06.01 AND CALCULATE CLEAR ZONE BASED ON THRU LANES. SEE SECTION 7.01 OF THE ROAD DESIGN MANUAL.

SECTIONS ARE APPLICABLE GENERALLY FOR STRUCTURES WITH APPROACHES ON FILL OR WHEN DRAINAGE IS CARRIED THROUGH STRUCTURE AREA BY USE OF CULVERTS. FOR EXPRESSWAYS IN DEEP CUT, CARRY SAME DITCH SECTION THROUGH STRUCTURE AS CALLED FOR ON EXPRESSWAY SECTION.

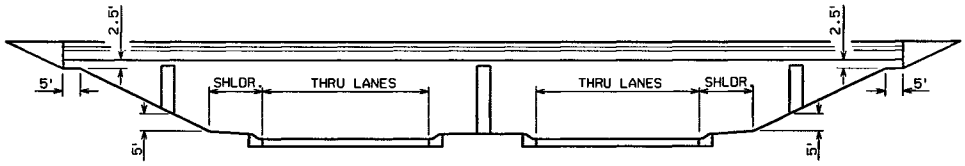
ALL DIMENSIONS ARE AT RIGHT ANGLES TO ROADWAY

PREPARED BY DESIGN DIVISION	6.06.02

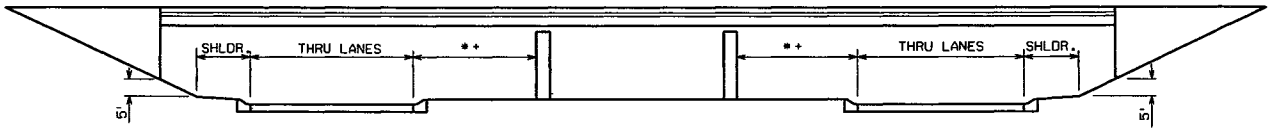
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT **SUBSTRUCTURE CLEARANCES URBAN STATE TRUNKLINES**	ISSUED: 08/15/03 SUPERSEDES: 11/27/01



90° CROSSING OR MODERATELY SKEWED



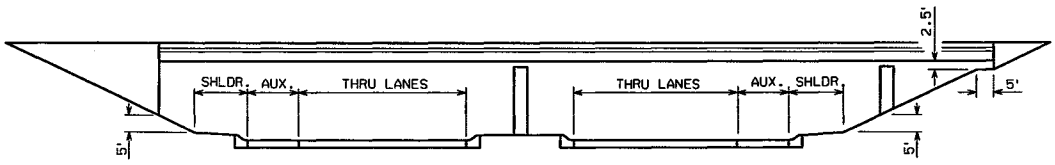
SHARPLY SKEWED



SPREAD ROADWAYS

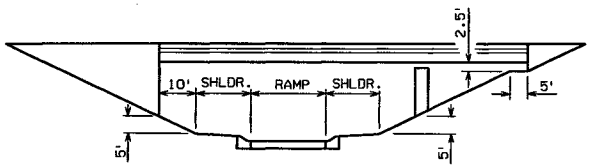
* MINIMUM DIMENSION IS THE CLEAR ZONE DISTANCE GIVEN IN BRIDGE DESIGN GUIDE 6.06.05. USE THE MIDDLE OF RANGE AT THE APPROPRIATE DESIGN ADT. WHERE ROADWAY IS ON A CURVE WITH A RADIUS OF 2860' OR LESS, DISTANCE TO TOE OF 1-ON-2 SLOPE SHOULD BE INCREASED ON OUTSIDE OF CURVE PER BRIDGE DESIGN GUIDE 6.06.05A OR GUARDRAIL PROTECTION OF SLOPE OR PIER SHOULD BE PROVIDED.

\+ IF DISTANCE TO PIER OR TOE OF 1-ON-2 SLOPE IS LESS THAN THE CLEAR ZONE DISTANCE PROVIDE GUARDRAIL PROTECTION OF PIER OR SLOPE.



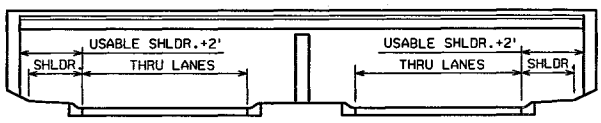
WITHOUT TAIL SPANS WITH TAIL SPANS

AUXILIARY LANES



WITHOUT TAIL SPANS WITH TAIL SPANS

RAMPS



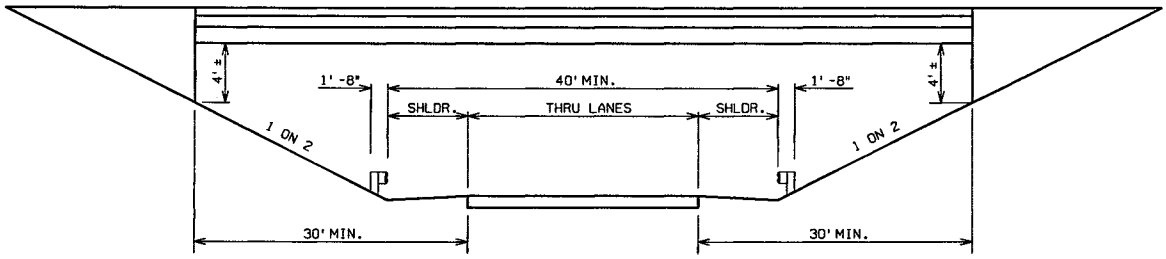
RETAINING WALL SECTIONS & RAILROAD OVER

GUARDRAIL PROTECTION OF RETAINING WALLS SHALL BE PROVIDED.

NOTE: ALL DIMENSIONS ARE AT RIGHT ANGLES TO EXPRESSWAY.

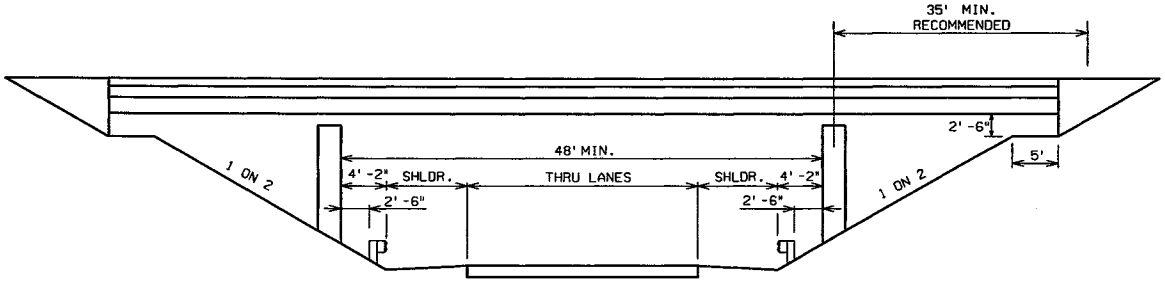
PREPARED BY DESIGN SUPPORT AREA	6.06.03

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT SUBSTRUCTURE CLEARANCES COUNTY ROAD AND CITY STREET UNDER	ISSUED: 08/15/03 SUPERSEDES: 11/27/01



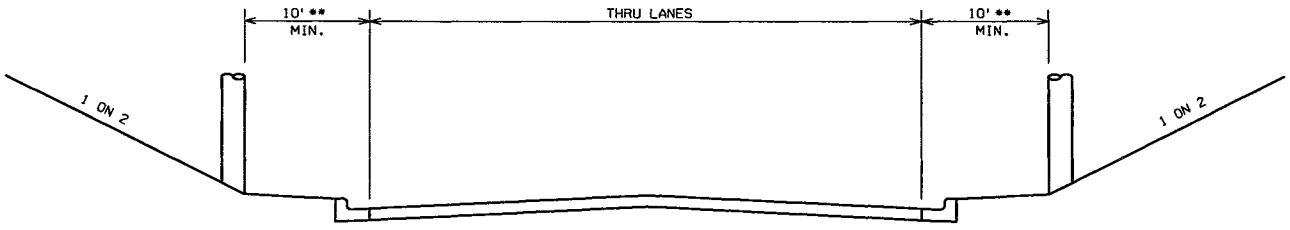
90° CROSSING OR MODERATELY SKEWED

COUNTY ROAD UNDER



SHARPLY SKEWED

COUNTY ROAD UNDER



CITY STREET UNDER

TRANSITION SLOPE AT FRONT OF ABUTMENT TO 1 ON 6 THROUGH CONE AREAS IN ALL QUADRANTS. WHERE THERE IS NOT SUFFICIENT ROOM FOR 1 ON 6 SLOPES FOR FULL HEIGHT OF EMBANKMENTS, BREAK SLOPES STARTING WITH 1 ON 6 AT GROUND LINE AND EXTENDING TO INTERSECT THE 1 ON 2 SLOPES.

ALL DIMENSIONS ARE AT RIGHT ANGLES TO COUNTY ROAD.

**MINIMUM DIMENSION, MAY BE MODIFIED BY AGREEMENT WITH CITY OR SPECIAL CONDITIONS.

PREPARED BY DESIGN SUPPORT AREA	6.06.04

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY TECHNICAL SERVICES MODIFIED PARABOLIC CROWN OFFSETS	ISSUED: 11/27/01 SUPERSEDES: 04/15/95

$$Y = 0.03354\ X^{1.5}$$

X(ft)	Y(in)	Y(ft)
1	0.0335	0.0028
2	0.0949	0.0079
3	0.1743	0.0145
4	0.2683	0.0224
5	0.3750	0.0312
6	0.4929	0.0411
7	0.6212	0.0518
8	0.7589	0.0632
9	0.9056	0.0755
10	1.0606	0.0884
11	1.2236	0.1020
12	1.3942	0.1162
13	1.5721	0.1310
14	1.7569	0.1464
15	1.9485	0.1624
16	2.1466	0.1789
17	2.3509	0.1959
18	2.5614	0.2134
19	2.7778	0.2315
20	2.9999	0.2500
21	3.2277	0.2690
22	3.4610	0.2884
23	3.6996	0.3083
24	3.9435	0.3286
25	4.1925	0.3494

X(ft)	Y(in)	Y(ft)
26	4.4465	0.3705
27	4.7055	0.3921
28	4.9694	0.4141
29	5.2379	0.4365
30	5.5112	0.4593
31	5.7890	0.4824
32	6.0714	0.5059
33	6.3582	0.5298
34	6.6494	0.5541
35	6.9449	0.5787
36	7.2446	0.6037
37	7.5486	0.6290
38	7.8567	0.6547
39	8.1688	0.6807
40	8.4850	0.7071
41	8.8052	0.7338
42	9.1293	0.7608
43	9.4573	0.7881
44	9.7891	0.8158
45	10.1247	0.8437
46	10.4640	0.8720
47	10.8071	0.9006
48	11.1539	0.9295
49	11.5042	0.9587
50	11.8582	0.9882

Y = CROWN OFFSET

X = DISTANCE FROM CROWN HIGH POINT

PREPARED BY DESIGN DIV.	6.11.01

STRAIGHT LINE SUPERELEVATION

RADIUS Feet	30 mph		35 mph		40 mph		45 mph		50 mph		55 mph		60 mph		65 mph		Freeways				Urban Freeways and Urban Ramps	
																	70 mph		75 mph		60 mph	
	e	Δ%	E	Δ%	e	Δ%	e	Δ%	e	Δ%	e	Δ%	e	Δ%	e	Δ%	e	Δ%	e	Δ%	e	Δ%
20000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--
17000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	2.0	0.30	N.C.	--
14000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	2.0	0.32	2.0	0.31	2.0	0.30	N.C.	--
12000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	2.0	0.36	2.0	0.32	2.0	0.31	2.0	0.30	2.0	0.36
10000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	2.0	0.38	2.0	0.36	2.0	0.32	2.0	0.31	2.0	0.30	2.0	0.36
8000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	2.0	0.40	2.0	0.38	2.0	0.36	2.0	0.32	2.0	0.31	2.0	0.30	2.0	0.36
6000	N.C.	--	N.C.	--	N.C.	--	2.0	0.40	2.0	0.40	2.0	0.38	2.0	0.36	2.0	0.32	2.0	0.31	2.5	0.31	2.0	0.36
5000	N.C.	--	N.C.	--	2.0	0.40	2.0	0.40	2.0	0.40	2.0	0.38	2.0	0.36	2.0	0.32	2.5	0.32	3.0	0.32	2.0	0.36
4000	N.C.	--	2.0	0.45	2.0	0.40	2.0	0.40	2.0	0.40	2.0	0.38	2.0	0.36	2.5	0.33	3.1	0.33	3.8	0.34	2.0	0.36
3500	N.C.	--	2.0	0.45	2.0	0.40	2.0	0.40	2.0	0.40	2.0	0.38	2.3	0.37	2.8	0.34	3.5	0.34	4.3	0.35	2.0	0.36
3000	2.0	0.50	2.0	0.45	2.0	0.40	2.0	0.40	2.0	0.40	2.1	0.38	2.7	0.38	3.3	0.36	4.1	0.36	5.0	0.36	2.4	0.37
2500	2.0	0.50	2.0	0.45	2.0	0.40	2.0	0.40	2.0	0.40	2.5	0.39	3.2	0.39	4.0	0.37	4.9	0.38	6.0	0.38	2.8	0.38
2050	2.0	0.50	2.0	0.45	2.0	0.40	2.0	0.40	2.4	0.41	3.1	0.40	3.9	0.40	4.8	0.40	6.0	0.40			3.4	0.39
1800	2.0	0.50	2.0	0.45	2.0	0.40	2.1	0.41	2.8	0.42	3.5	0.41	4.4	0.42	5.5	0.42					3.9	0.40
1675	2.0	0.50	2.0	0.45	2.0	0.40	2.3	0.41	3.0	0.42	3.8	0.42	4.8	0.42	5.9	0.43					4.2	0.41
1425	2.0	0.50	2.0	0.45	2.0	0.40	2.7	0.42	3.5	0.44	4.5	0.44	5.6	0.44							5.0	0.43
1350	2.0	0.50	2.0	0.45	2.2	0.41	2.9	0.43	3.7	0.44	4.7	0.44	5.9	0.45								
1150	2.0	0.50	2.0	0.45	2.5	0.42	3.4	0.45	4.3	0.46	5.5	0.46										
1075	2.0	0.50	2.0	0.45	2.7	0.43	3.6	0.46	4.7	0.47	5.9	0.47										
850	2.0	0.50	2.4	0.47	3.4	0.46	4.5	0.49	5.9	0.50												
820	2.0	0.50	2.5	0.47	3.5	0.47	4.7	0.49														
800	2.0	0.50	2.6	0.47	3.6	0.47	4.8	0.50														
720	2.0	0.50	2.8	0.49	4.0	0.49	5.4	0.52														
650	2.1	0.51	3.1	0.50	4.5	0.51	5.9	0.54														
600	2.3	0.51	3.4	0.51	4.8	0.53																
500	2.8	0.53	4.1	0.54	5.8	0.57																
450	3.1	0.54	4.5	0.56																		
400	3.5	0.56	5.1	0.58																		
345	4.0	0.58	5.9	0.62																		
300	4.6	0.61																				
232	6.0	0.66																				
$\Delta\%_{max}$		0.66		0.62		0.58		0.54		0.50		0.47		0.45		0.43		0.40		0.38		0.45
Rmin	232		340		485		643		833		1061		1333		1657		2042		2500		1412	

Use 7% superelevation for loop ramps (see Standard Plan R-107-Series). However, special consideration should be given to curves which approach a ramp terminal (stopping condition). If relative gradient (Δ%) values from the tables cannot be obtained for the design radius, use $\Delta\%_{max}$ for the corresponding design speed.
For radii less than those tabulated (but not less than Rmin) use e_{max} and $\Delta\%_{max}$.
Maximum superelevation for urban freeways and urban ramps (with 60 mph design speed) is 5%, otherwise e_{max} = 6%.

DRAWN BY: BLT
CHECKED BY: VZ
APPROVED BY:

MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DEVELOPMENT

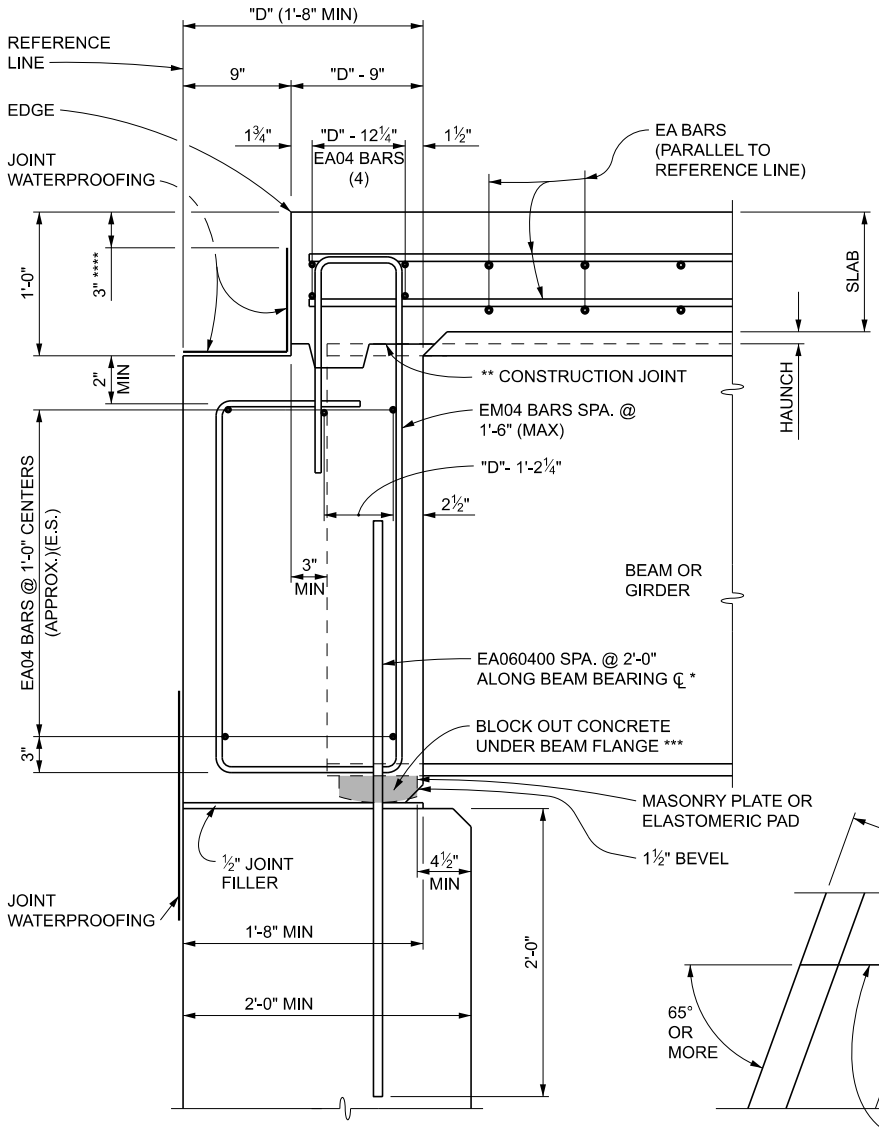
STRAIGHT LINE SUPERELEVATION

ISSUED: 02/14/11
SUPERSEDES: 05/04/06

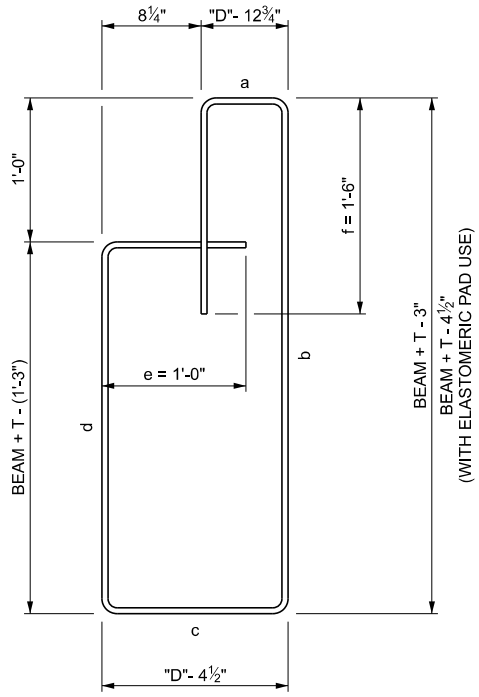
PREPARED BY
DESIGN DIVISION

6.11.02

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 06/24/24
CHECKED BY: VZ	TYPICAL SECTION THRU DEPENDENT BACKWALL	SUPERSEDES: 01/23/23
APPROVED BY: KCK		

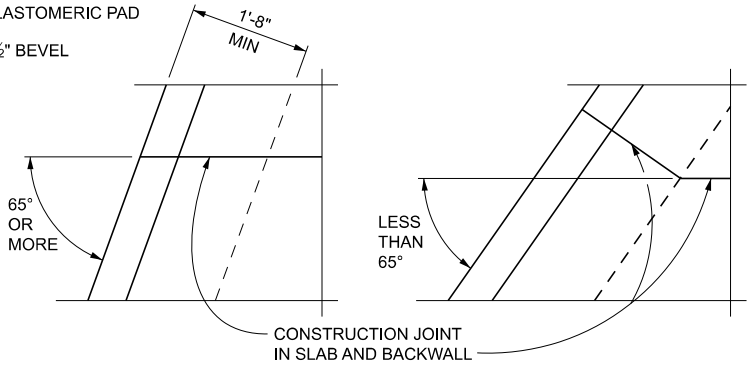


BACKWALL SECTION



EM04 BAR

NOTE: USE AN EK04 BAR WHERE THE BACKWALL DOES NOT INCLUDE A PAVEMENT SEAT.



BACKWALL JOINTS

PLAN NOTES:

CAST LOWER PORTION OF THE BACKWALL PRIOR TO PLACING DECK REINFORCEMENT. (USE WITH MANDATORY JOINT) (JOINT WATERPROOFING IS A PAY ITEM WHEN A CONSTRUCTION JOINT IS MANDATORY)

IF A CONSTRUCTION JOINT IS USED, CAST THE LOWER PORTION OF THE BACKWALL PRIOR TO PLACING DECK REINFORCEMENT. THERE WILL BE NO PAYMENT FOR THE REQUIRED JOINT WATERPROOFING. (USE WITH OPTIONAL JOINT).

**** ON THE VERTICAL FACE OF THE PAVEMENT SEAT, STOP THE JOINT WATERPROOFING 3" BELOW THE TOP OF DECK.

NOTE:

BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

THE BACKWALL THICKNESS "D" IS THE GREATER OF:

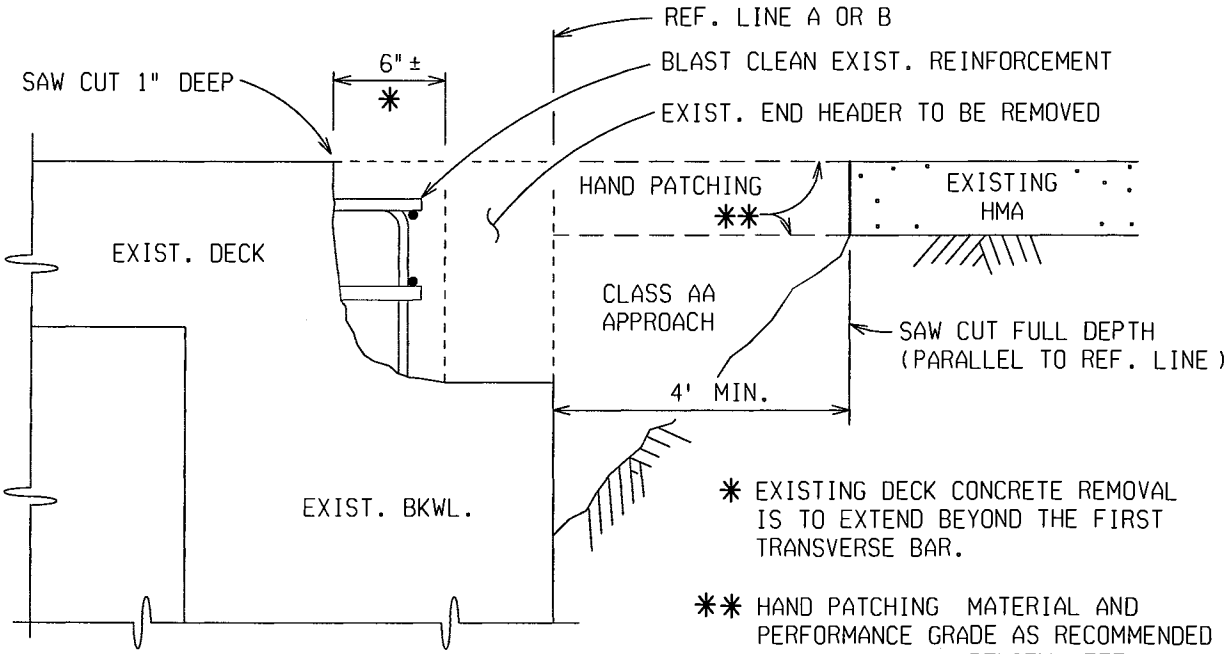
1) 1'-8" OR THE BEARING DIMENSION PLUS ½ THE BEARING WIDTH -- (FOR 90° CROSSINGS).
2) 1'-8" OR THE BEARING DIMENSION PLUS THE PRODUCT OF ½ FLANGE WIDTH AND COSINE ANGLE OF CROSSING –- (FOR SKEWED CROSSINGS)

HOLES IN WEB OF STRINGERS FOR BACKWALL REINFORCEMENT ON 90° JOBS SHOULD BE 1"Ø. INCREASE HOLE SIZE TO ACCOMMODATE REINFORCEMENT IN SKEWED BACKWALLS.

* USE FOR STEEL BEAM BRIDGES ONLY.
** THIS JOINT IS MANDATORY WHEN PLATE GIRDERS WITHOUT BEARING STIFFENERS ARE USED.OTHERWISE THE JOINT IS OPTIONAL.
*** USE FOR SKEWED BRIDGES.

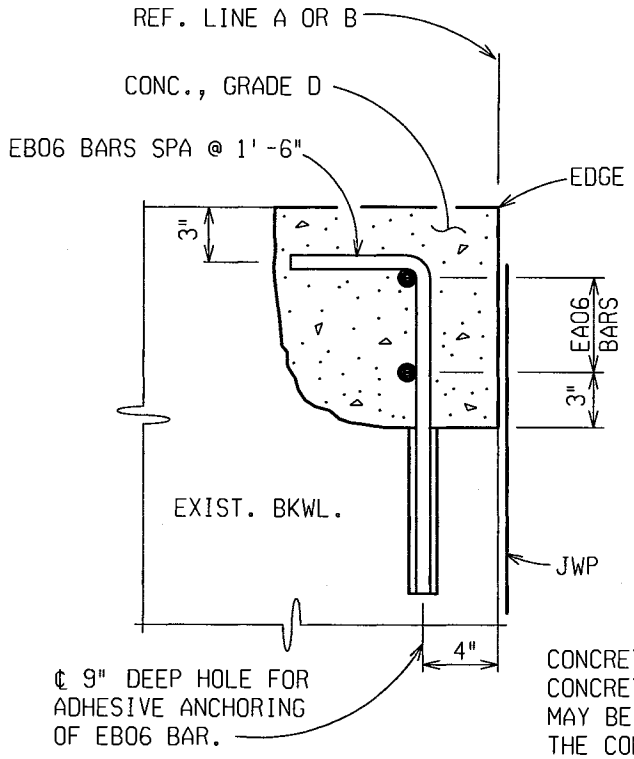
PREPARED BY DESIGN DIVISION	6.20.01

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT REPLACEMENT OF EXISTING END HEADER	ISSUED: 08/15/03 SUPERSEDES: 11/27/01

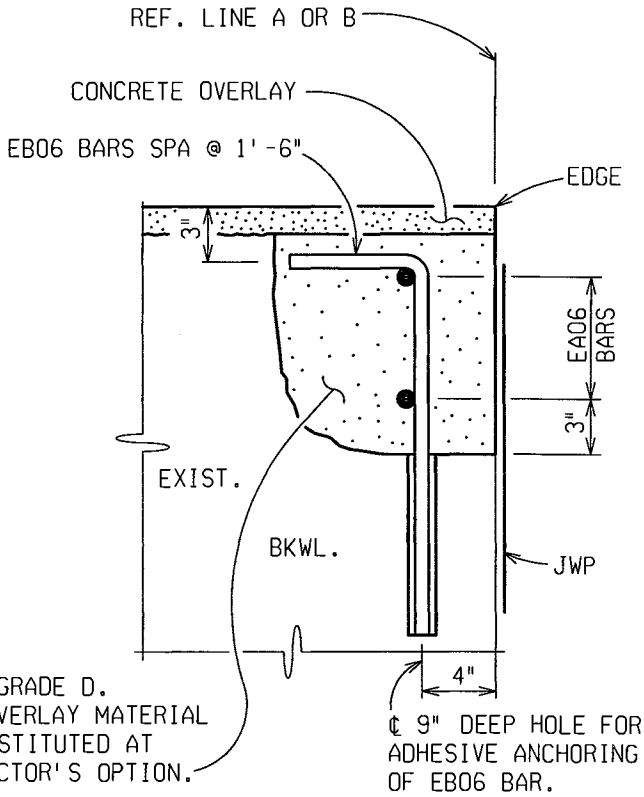


* EXISTING DECK CONCRETE REMOVAL IS TO EXTEND BEYOND THE FIRST TRANSVERSE BAR.

** HAND PATCHING MATERIAL AND PERFORMANCE GRADE AS RECOMMENDED ON AT THE PLAN REVIEW MEETING TO MATCH EXISTING APPROACH SECTION (440 LB./SYD. MIN.)



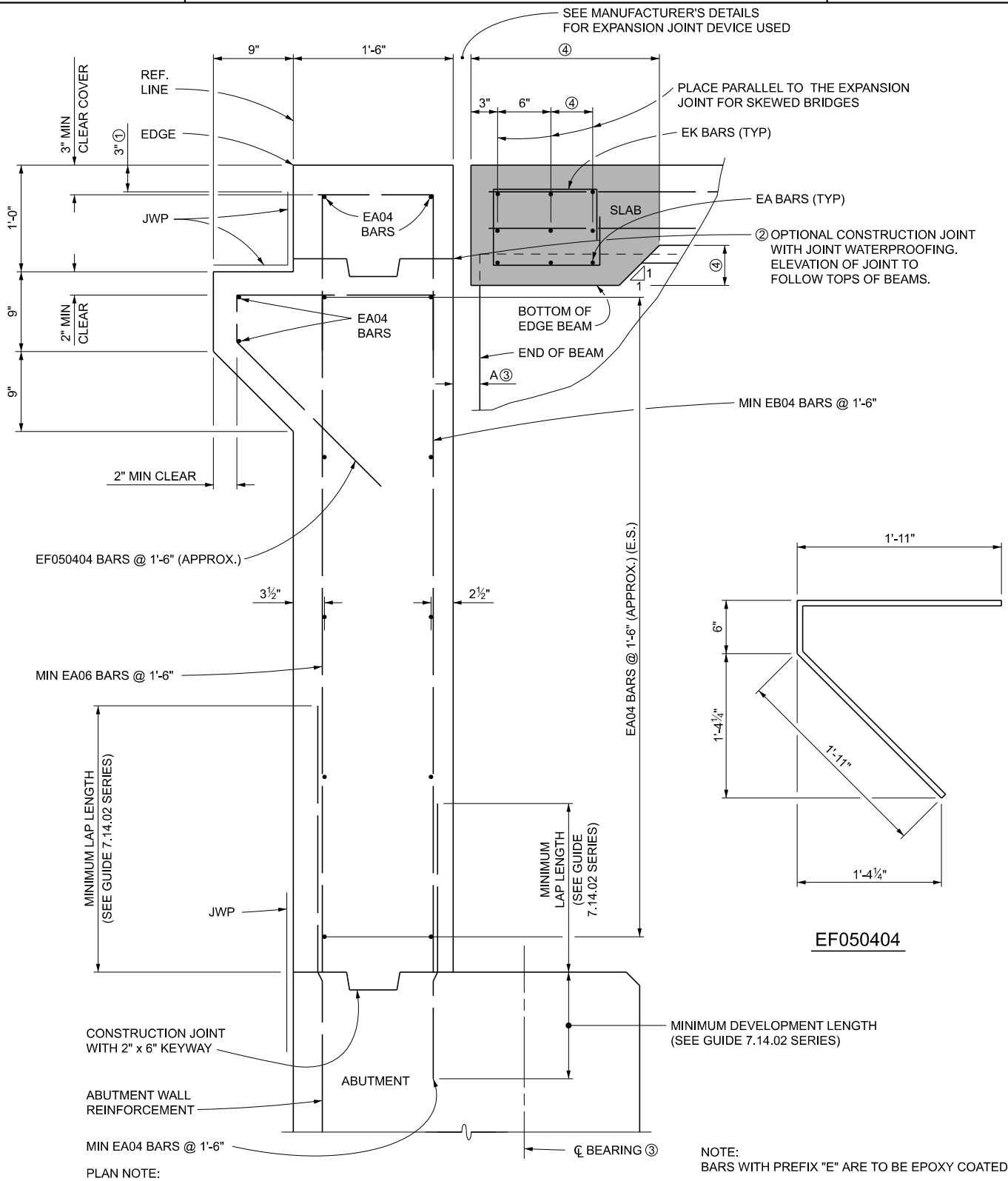
WITHOUT OVERLAY



WITH OVERLAY

PREPARED BY DESIGN SUPPORT AREA	6.20.01A

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 03/24/25
CHECKED BY: CWC	TYPICAL SECTION THRU INDEPENDENT BACKWALL	SUPERSEDES: 08/26/24
APPROVED BY: KCK		



PLAN NOTE:

① ON THE VERTICAL FACE OF THE PAVEMENT SEAT, STOP THE JOINT WATERPROOFING 3" BELOW THE TOP OF BACKWALL.

② WHERE CONSTRUCTION JOINT IS USED, THERE WILL BE NO PAYMENT FOR THE REQUIRED JOINT WATERPROOFING. THE CONCRETE USED TO CONSTRUCT THE BACKWALL IS PAID FOR AS "SUBSTRUCTURE CONC, HIGH PERFORMANCE".

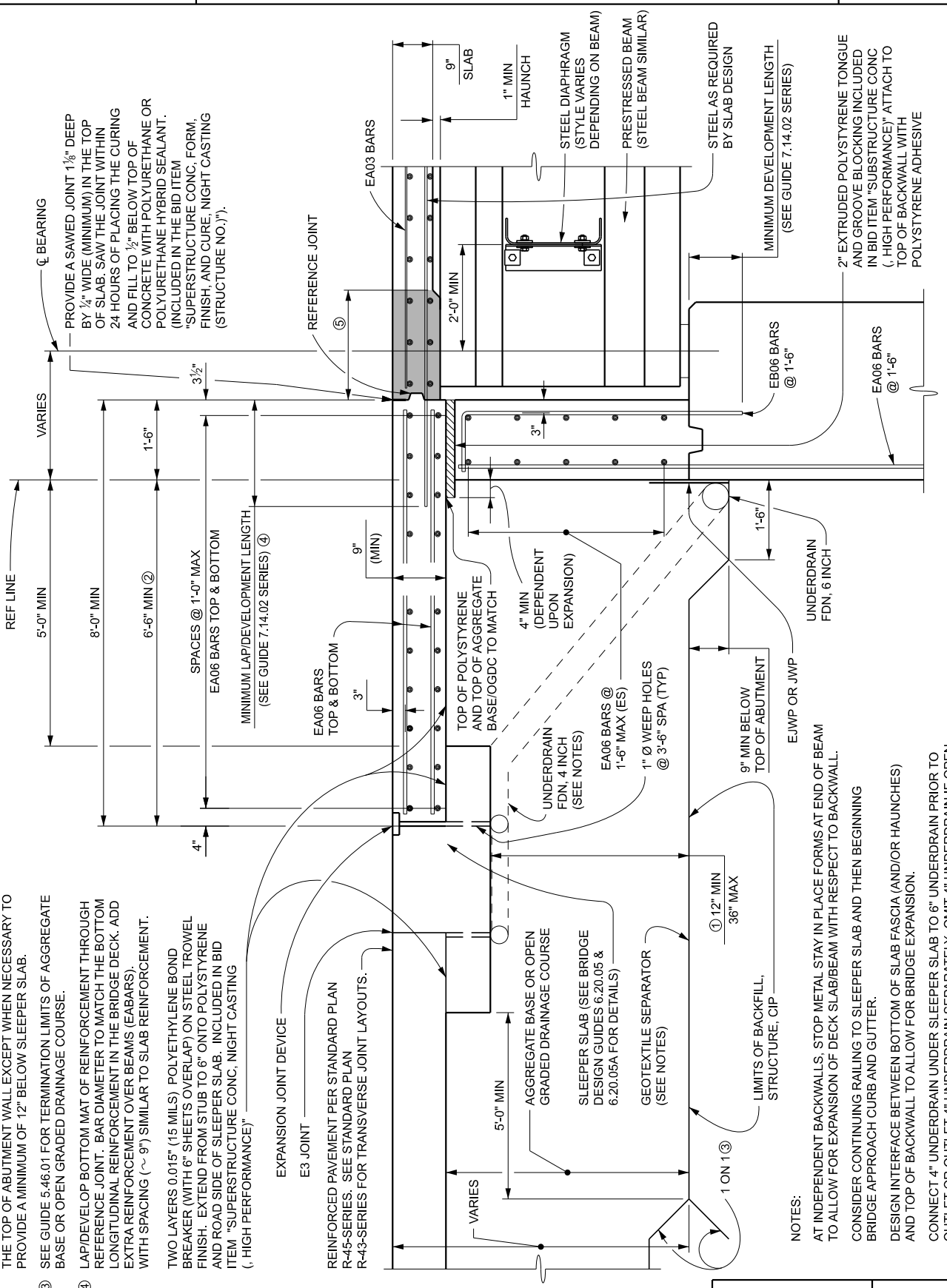
NOTE:
BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

③ TO ESTABLISH ℄ BEARING, USE "A" = ½ TOTAL MOVEMENT PARALLEL TO ℄ BEAM PLUS 1". FOR SKEWED BRIDGES, "A" IS MEASURED AT CORNER OF FLANGE.

④ ENSURE EDGE OF SLAB HAS CAPACITY. DESIGN AS EDGE BEAM IN ACCORDANCE WITH AASHTO LRFD. DIMENSION AND PROVIDE ADDITIONAL REINFORCEMENT AS NECESSARY.

PREPARED BY DESIGN DIVISION	6.20.03

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 08/25/25
CHECKED BY: CWC	TYPICAL SECTION THRU	SUPERSEDES: 03/24/25
APPROVED BY: KCK	INDEPENDENT BACKWALL WITH SLIDING SLAB	



① EXTEND OGDC OR AGGREGATE BASE FROM BOTTOM OF SLEEPER LAB FOR A DEPTH OF 36" MAX, NOT TO EXTEND BELOW THE TOP OF ABUTMENT WALL EXCEPT WHEN NECESSARY TO PROVIDE A MINIMUM OF 12" BELOW SLEEPER SLAB.

③ SEE GUIDE 5.46.01 FOR TERMINATION LIMITS OF AGGREGATE BASE OR OPEN GRADED DRAINAGE COURSE.

④ LAP/DEVELOP BOTTOM MAT OF REINFORCEMENT THROUGH REFERENCE JOINT. BAR DIAMETER TO MATCH THE BOTTOM LONGITUDINAL REINFORCEMENT IN THE BRIDGE DECK. ADD EXTRA REINFORCEMENT OVER BEAMS (EABARS). WITH SPACING (~ 9") SIMILAR TO SLAB REINFORCEMENT.

TWO LAYERS 0.015" (15 MILS) POLYETHYLENE BOND BREAKER (WITH 6" SHEETS OVERLAP) ON STEEL TROWEL FINISH. EXTEND FROM STUB TO 6" ONTO POLYSTYRENE AND ROAD SIDE OF SLEEPER SLAB. INCLUDED IN BID ITEM "SUPERSTRUCTURE CONC, NIGHT CASTING (, HIGH PERFORMANCE)"

NOTES:

AT INDEPENDENT BACKWALLS, STOP METAL STAY IN PLACE FORMS AT END OF BEAM TO ALLOW FOR EXPANSION OF DECK SLAB/BEAM WITH RESPECT TO BACKWALL.

CONSIDER CONTINUING RAILING TO SLEEPER SLAB AND THEN BEGINNING BRIDGE APPROACH CURB AND GUTTER.

DESIGN INTERFACE BETWEEN BOTTOM OF SLAB FASCIA (AND/OR HAUNCHES) AND TOP OF BACKWALL TO ALLOW FOR BRIDGE EXPANSION.

CONNECT 4" UNDERDRAIN UNDER SLEEPER SLAB TO 6" UNDERDRAIN PRIOR TO OUTLET OR OUTLET 4" UNDERDRAIN SEPARATELY. OMIT 4" UNDERDRAIN IF OPEN GRADED DRAINAGE COURSE IS USED INSTEAD OF AGGREGATE BASE. MAINTAIN 6" UNDERDRAIN AT ABUTMENT.

USE GEOTEXTILE SEPARATOR ONLY WITH OPEN GRADED DRAINAGE COURSE.

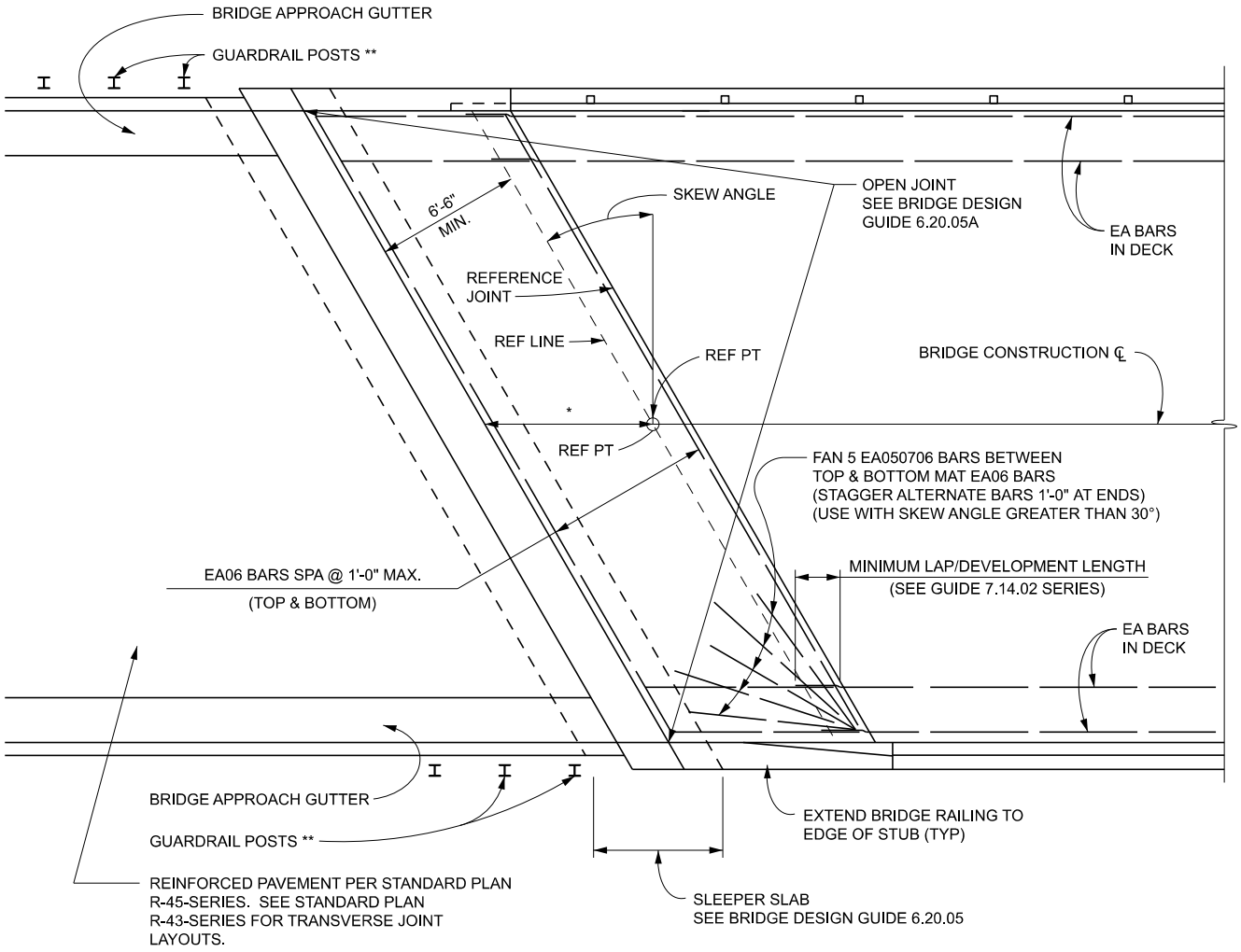
② SEE BRIDGE DESIGN GUIDE 6.20.03B FOR APPROACH SLAB ORIENTATION, REINFORCEMENT, AND DESIRED SLAB LENGTHS.

⑤ ENSURE EDGE OF SLAB HAS CAPACITY. IF NECESSARY, DESIGN AS EDGE BEAM IN ACCORDANCE WITH AASHTO LRFD.

PREPARED BY DESIGN DIVISION	6.20.03A

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/26/23
CHECKED BY: VZ	INDEPENDENT BACKWALL SLIDING SLAB DETAILS	SUPERSEDES: 07/25/22
APPROVED BY: KCK		

* FOR DESIGN SPEEDS GREATER THAN 45 MPH (POSTED > 40 MPH), THE DESIGNER MAY CONSIDER LENGTHS UP TO 20 FEET IN LENGTH (MEASURED ALONG ℄) AS PROJECT AND GEOMETRIC LIMITATIONS ALLOW.



PLAN OF APPROACH

NOTES:

POUR APPROACH SLABS FROM EXPANSION LOCATION TOWARD REFERENCE LINE (JOINT).

CAST APPROACH SLABS AT NIGHT WITH NIGHT TIME CASTING OF SUPERSTRUCTURE CONCRETE.

** USE GUARDRAIL ANCHORAGE, BRIDGE, DETAIL M4, M5 OR M6 PER STANDARD PLAN R-67-SERIES.

PLAN NOTE:
DO NOT USE WHEELED, ROLLER BASED OR MACHINE MOUNTED COMPACTION EQUIPMENT TO COMPACT THE SUBGRADE, SUBBASE, AND BASE WITHIN 10' OF THE SLEEPER SLAB AFTER IT IS BUILT. USE ONLY HAND/PLATE COMPACTORS. CONTACT PRESSURE OF COMPACTION EQUIPMENT SHALL NOT EXCEED 10 PSI.

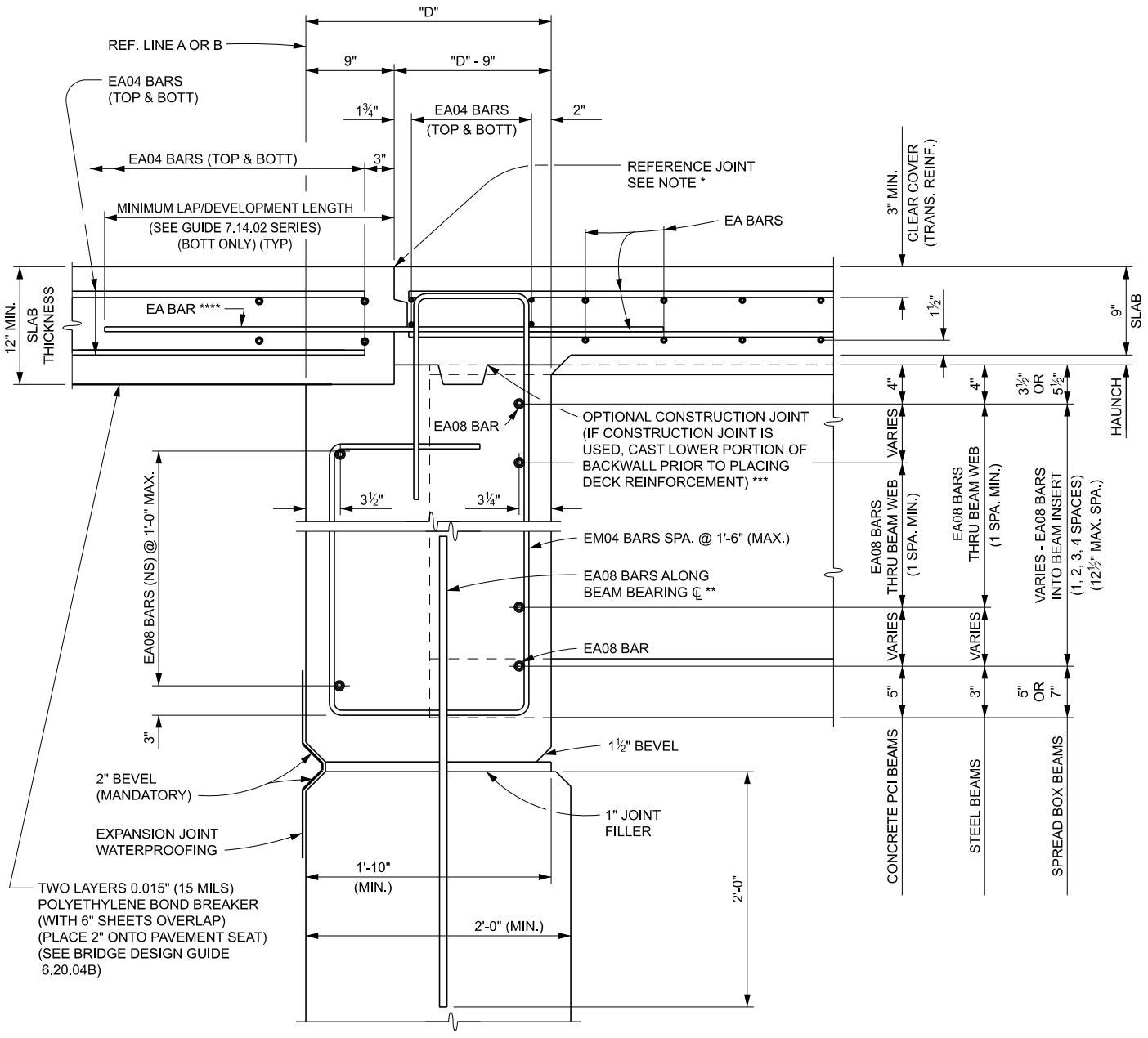
PREPARED BY DESIGN DIVISION	6.20.03B

DRAWN BY:	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED:
CHECKED BY:		SUPERSEDES:
APPROVED BY:		

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PREPARED BY DESIGN DIVISION	

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 08/26/24
CHECKED BY: VZ	INTEGRAL AND SEMI-INTEGRAL ABUTMENT BACKWALL	SUPERSEDES: 12/26/23
APPROVED BY: KCK		



PLAN NOTES:

*** THIS JOINT IS MANDATORY WHEN PLATE GIRDERS WITHOUT BEARING STIFFENERS ARE USED. OTHERWISE THE JOINT IS OPTIONAL. THE CONCRETE BELOW THE CONSTRUCTION JOINT IS PAID FOR AS "SUPERSTRUCTURE CONC, HIGH PERFORMANCE" AND THE CONCRETE ABOVE THE CONSTRUCTION JOINT IS PAID FOR AS "SUPERSTRUCTURE CONC, NIGHT CASTING, HIGH PERFORMANCE".

* PROVIDE A SAWED JOINT 1⅛" DEEP BY ¼" WIDE (MINIMUM) IN THE TOP OF SLAB. SAW THE JOINT WITHIN 24 HOURS OF PLACING THE CURING AND FILL TO ½" BELOW TOP OF CONCRETE WITH POLYURETHANE OR POLYURETHANE HYBRID SEALANT. (INCLUDED IN THE BID ITEM "SUPERSTRUCTURE CONC, FORM, FINISH, AND CURE, NIGHT CASTING (STRUCTURE NO.)").

NOTES:

USE INTEGRAL OR SEMI-INTERGRAL ABUTMENTS FOR STEEL BRIDGES LESS THAN 300' AND CONCRETE BRIDGES LESS THAN 400' IN LENGTH.

**** LAP/DEVELOP BOTTOM MAT OF REINFORCEMENT THROUGH REFERENCE JOINT. BAR DIAMETER TO MATCH THE BOTTOM LONGITUDINAL REINFORCEMENT IN THE BRIDGE DECK. ADD EXTRA REINFORCEMENT OVER BEAMS (EABARS).

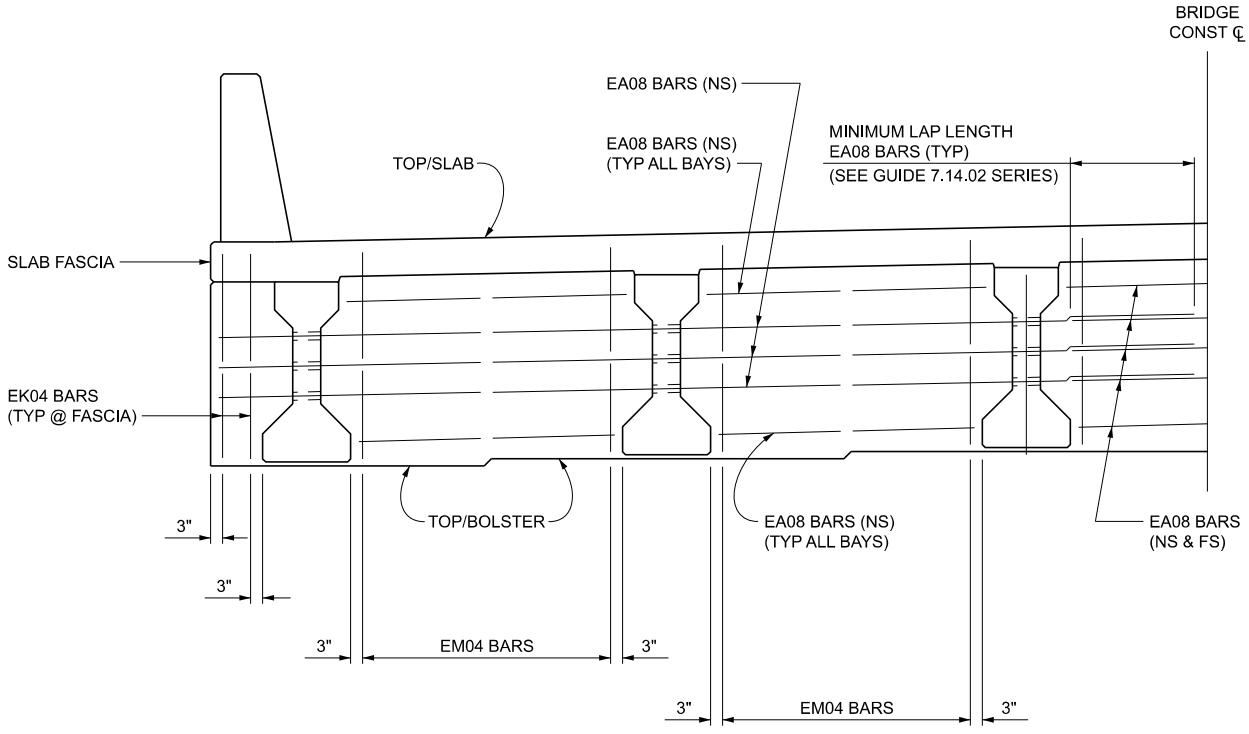
** USE FOR INTEGRAL ABUTMENT BRIDGES ONLY.

SEMI-INTEGRAL ABUTMENTS SHOULD BE USED AT STREAM CROSSINGS.

D = BACKWALL THICKNESS. SEE GUIDE 6.20.01 FOR DEFINITION.

PREPARED BY DESIGN DIVISION	6.20.04

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/26/23
CHECKED BY: VZ	INTEGRAL AND SEMI-INTEGRAL ABUTMENT PARTIAL BACKWALL DETAILS	SUPERSEDES: 01/27/20
APPROVED BY: KCK		



PARTIAL BACKWALL ELEVATION

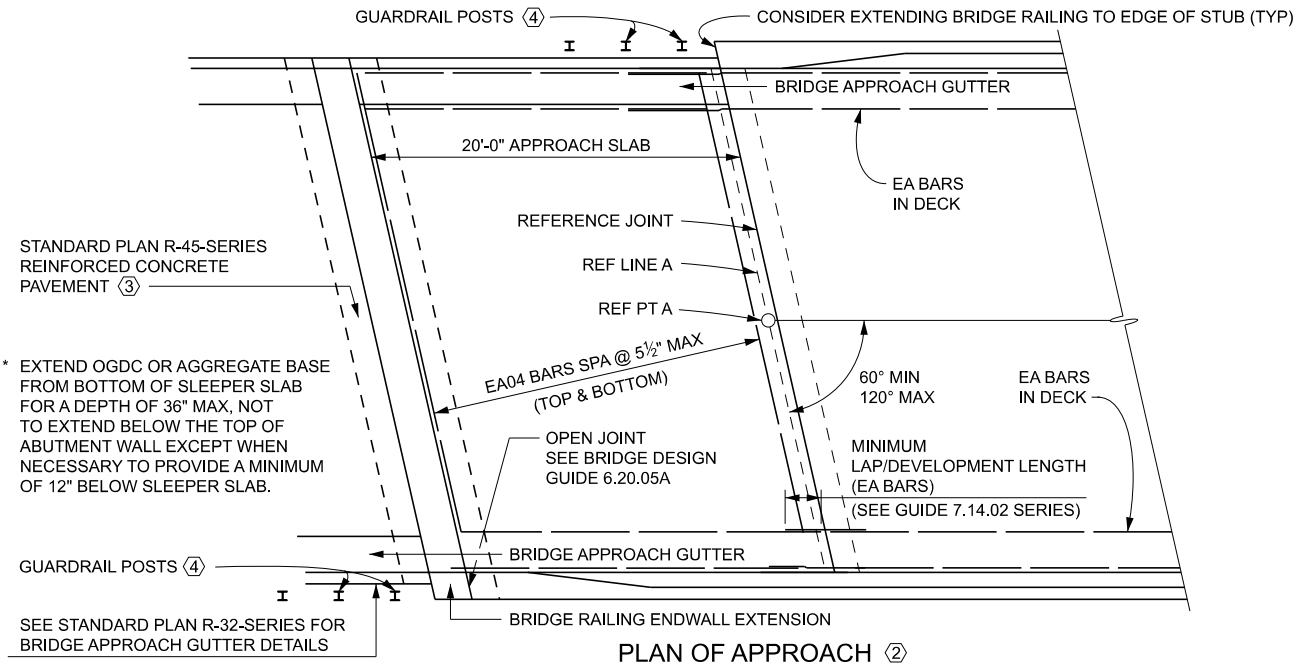
SIMILAR FOR STEEL BEAM BRIDGES

NOTE:

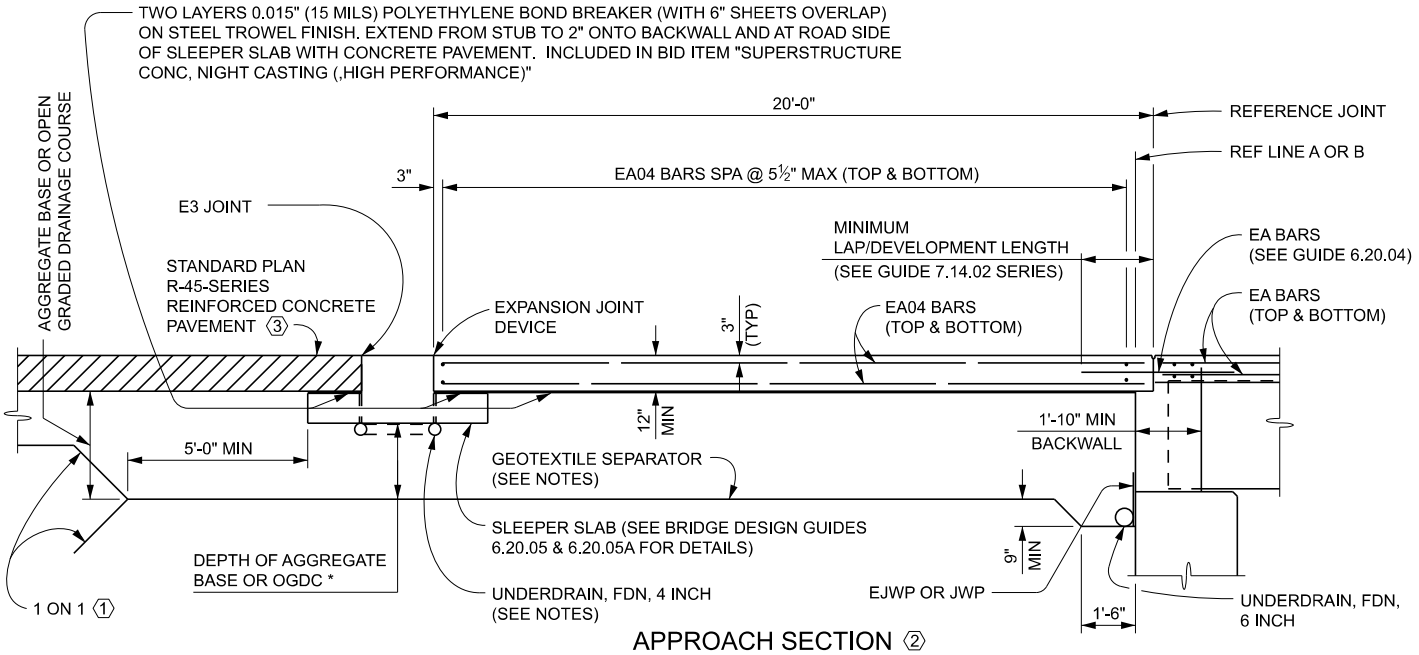
GROUT BARS IN BEAMS PRIOR TO CASTING BACKWALL, ALL GROUT AND MATERIALS, LABOR AND EQUIPMENT REQUIRED TO PLACE THE GROUT ARE INCLUDED IN THE BID ITEM "SUPERSTRUCTURE CONC, NIGHT CASTING".

PREPARED BY DESIGN DIVISION	6.20.04A

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 10/27/25
CHECKED BY: CWC	INTEGRAL AND SEMI-INTEGRAL ABUTMENT EMPIRICAL APPROACH SLAB DETAILS	SUPERSEDES: 08/25/25
APPROVED BY: KCK		



PLAN OF APPROACH ②



APPROACH SECTION ②

NOTES:

ATTACH APPROACH CURB AND GUTTER TO THE APPROACH SLAB WITH BOTTOM MAT TRANSVERSE REINFORCEMENT AND TO THE BRIDGE DECK WITH BOTTOM MAT LONGITUDINAL REINFORCEMENT.

POUR APPROACH SLABS FROM EXPANSION LOCATION TOWARD REFERENCE JOINT.

CAST APPROACH SLABS AT NIGHT WITH NIGHT TIME CASTING OF SUPERSTRUCTURE CONCRETE.

USE GEOTEXTILE SEPARATOR ONLY WITH OPEN GRADED DRAINAGE COURSE.

OMIT UNDERDRAIN UNDER SLEEPER SLAB IF OPEN GRADED DRAINAGE COURSE IS USED INSTEAD OF AGGREGATE BASE.

EMPIRICAL APPROACH SLABS (AS DETAILED ON THIS GUIDE) ARE NOT REQUIRED AT THE ENDS OF BRIDGES WITH A LENGTH CONTRIBUTING TO EXPANSION OF LESS THAN 50' FOR CONCRETE BEAM BRIDGES AND LESS THAN 25' FOR STEEL BEAM BRIDGES. INSTEAD, USE A PAVEMENT SEAT WITH STANDARD PLAN R-45-SERIES REINFORCED CONCRETE PAVEMENT.

① SEE GUIDE 5.46.01 FOR TERMINATION LIMITS OF AGGREGATE BASE OR OPEN GRADED DRAINAGE COURSE.

② DESIGN THE BRIDGE APPROACH SLAB BASED ON A LONGITUDINAL UNSUPPORTED LENGTH OF 10 FEET MEASURED ALONG THE CENTERLINE OF THE ROADWAY, A SLAB THICKNESS OF 12" AND A MAXIMUM CONCRETE COVER TO THE CENTERLINE OF THE BOTTOM LONGITUDINAL REINFORCEMENT OF 3". DEVIATION FROM THESE DESIGN PARAMETERS FOR SPECIFIC PROJECTS REQUIRES A COMPLETE REDESIGN OF THE BRIDGE APPROACH SLAB.

③ USE INVERTED "T" SLEEPER SLAB FOR CONCRETE AND HMA ROAD APPROACH PAVEMENT. PLACE STANDARD PLAN R-45-SERIES REINFORCED CONCRETE PAVEMENT THEN CONCRETE OR HMA ROAD APPROACH PAVEMENT.

④ USE GUARDRAIL ANCHORAGE, BRIDGE, DETAIL M4, M5 OR M6 PER STANDARD PLAN R-67-SERIES.

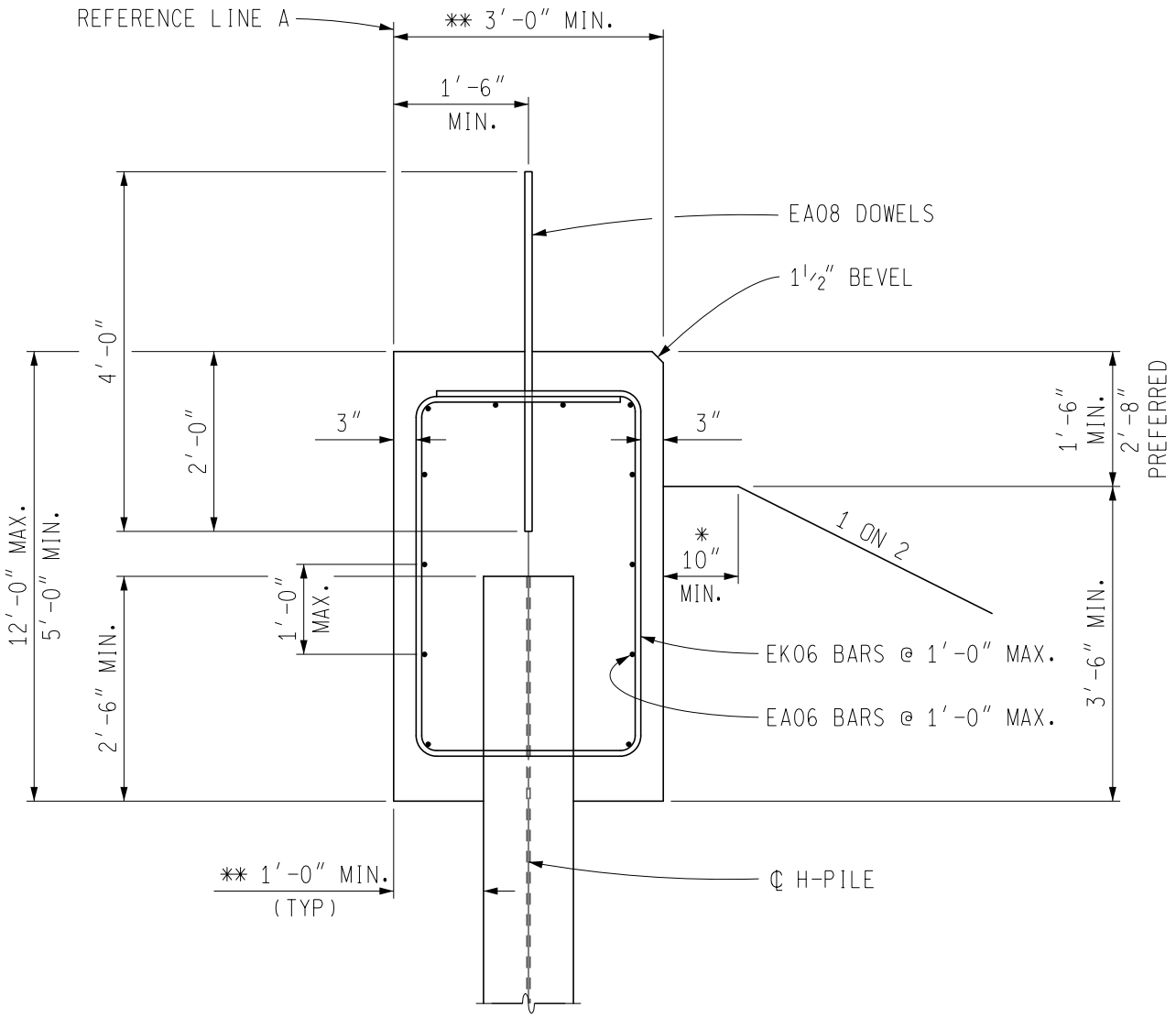
PREPARED BY DESIGN DIVISION	6.20.04B

DRAWN BY:	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED:
CHECKED BY:		SUPERSEDES:
APPROVED BY:		

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PREPARED BY DESIGN DIVISION	

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT INTEGRAL ABUTMENT - SINGLE ROW OF PILES (SECTION THRU STUB ABUTMENT)	ISSUED: 12/27/21 SUPERSEDES: 04/29/19



SECTION THRU STUB ABUTMENT

NOTES:

INTEGRAL STUB ABUTMENT BRIDGES WILL HAVE A SINGLE ROW OF PILES ORIENTED FOR WEAK AXIS BENDING.

THE WEBS OF THE H-PILES SHALL BE ORIENTED PARALLEL TO THE BRIDGE REFERENCE LINE.

PILES WILL BE EMDEDDED 2'-6" INTO THE ABUTMENT WALL.

UPON RECOMMEDATION FROM GEOTECHNICAL SERVICES SECTION, PREBORE PILE HOLE ACCORDING TO SECTION 705 OF STANDARD SPECIFICATIONS.

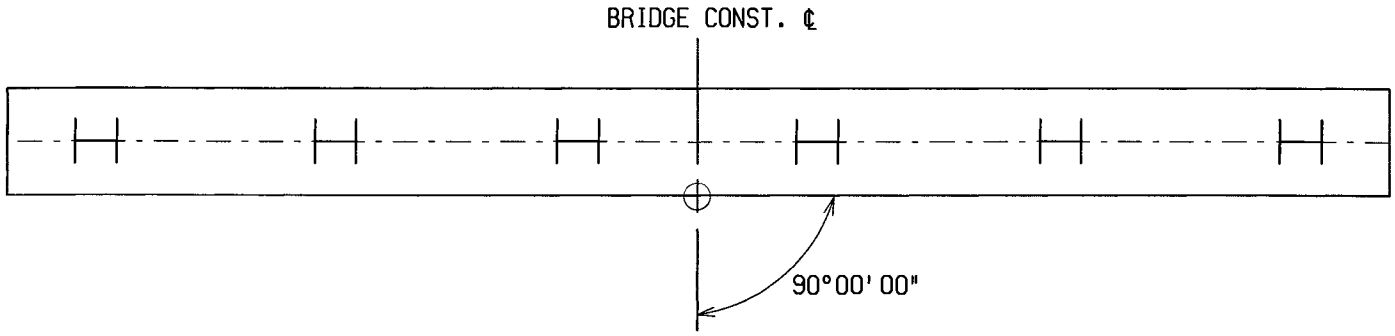
BACKFILL SHALL BE "BACKFILL, STRUCTURE, CIP" AS PER STANDARD SPECIFICATIONS.

* DELETE BERM WHEN STUB ABUTMENT HEIGHT IS GREATER THAN 5'-6".

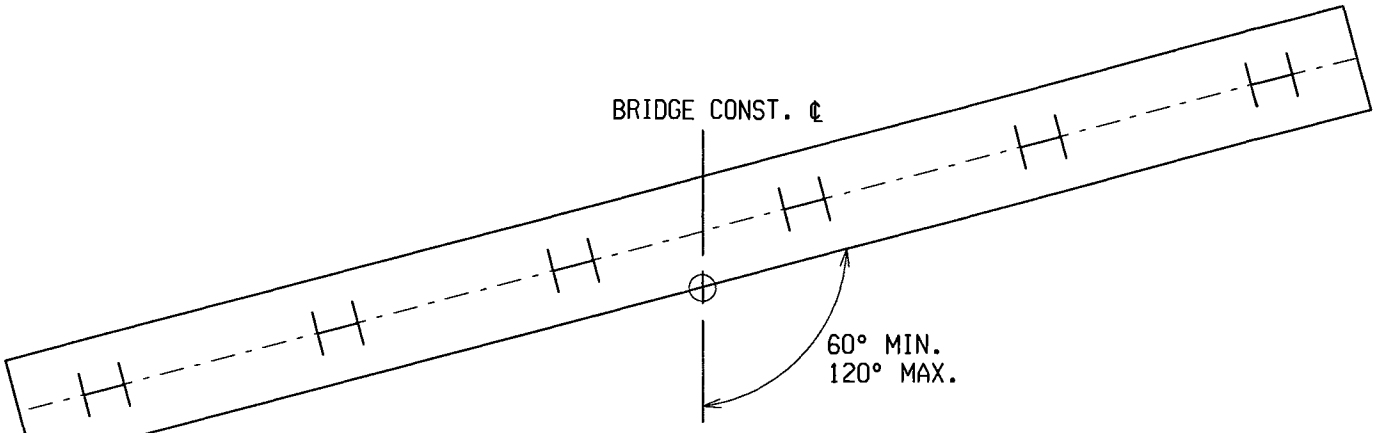
** INCREASE AS REQUIRED FOR PILE SIZE AND FORCES IN STUB ABUTMENT.

PREPARED BY DESIGN DIVISION	6.20.04D

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY TECHNICAL SERVICES INTERGRAL ABUTMENT - SINGLE ROW OF PILES (PILE ORIENTATION)	ISSUED: 11/27/01 SUPERSEDES: 08/21/97



90° ANGLE OF CROSSING



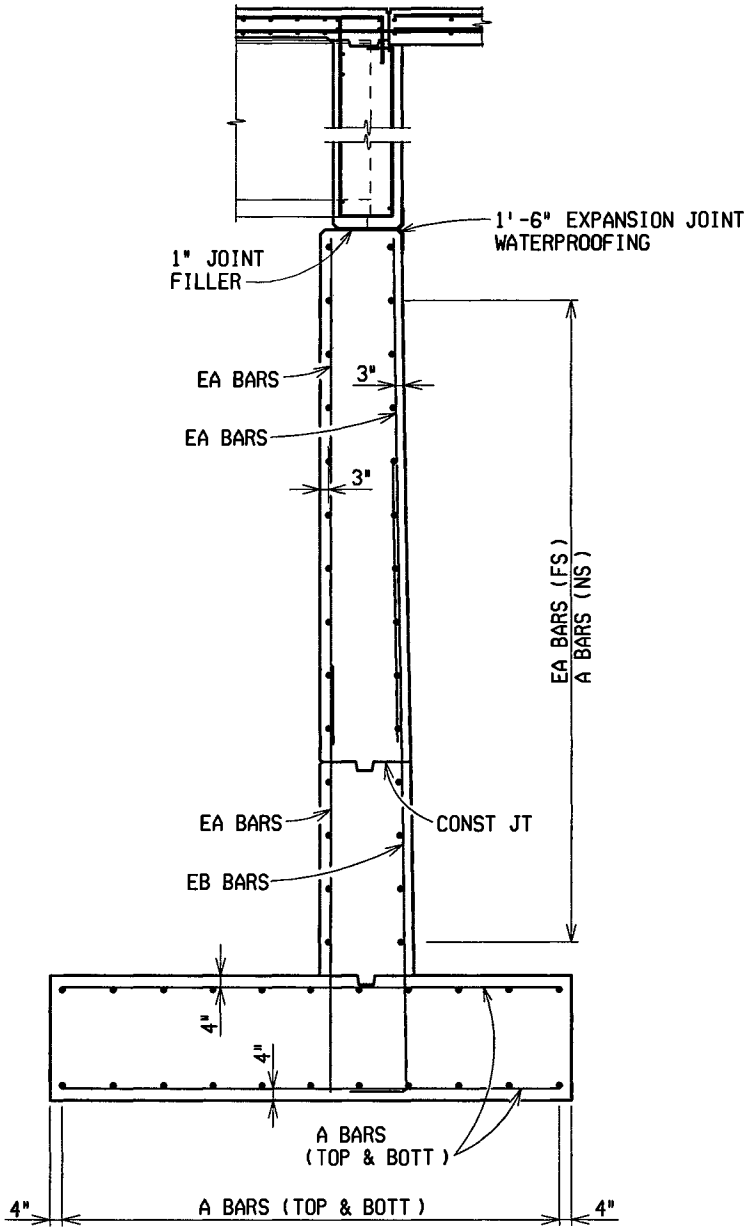
VARIABLE ANGLE OF CROSSING

NOTE:

INTEGRAL STUB ABUTMENT BRIDGES WILL HAVE A SINGLE ROW OF PILES ORIENTED FOR WEAK AXIS BENDING. THE WEBS OF THE H-PILES SHALL BE ORIENTED PARALLEL TO THE BRIDGE REFERENCE LINE.

PREPARED BY DESIGN DIV.	6.20.04E

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT SEMI-INTEGRAL ABUTMENT - SLIDING BACKWALL (SECTION THRU ABUTMENT)	ISSUED: 08/15/03 SUPERSEDES: 11/27/01



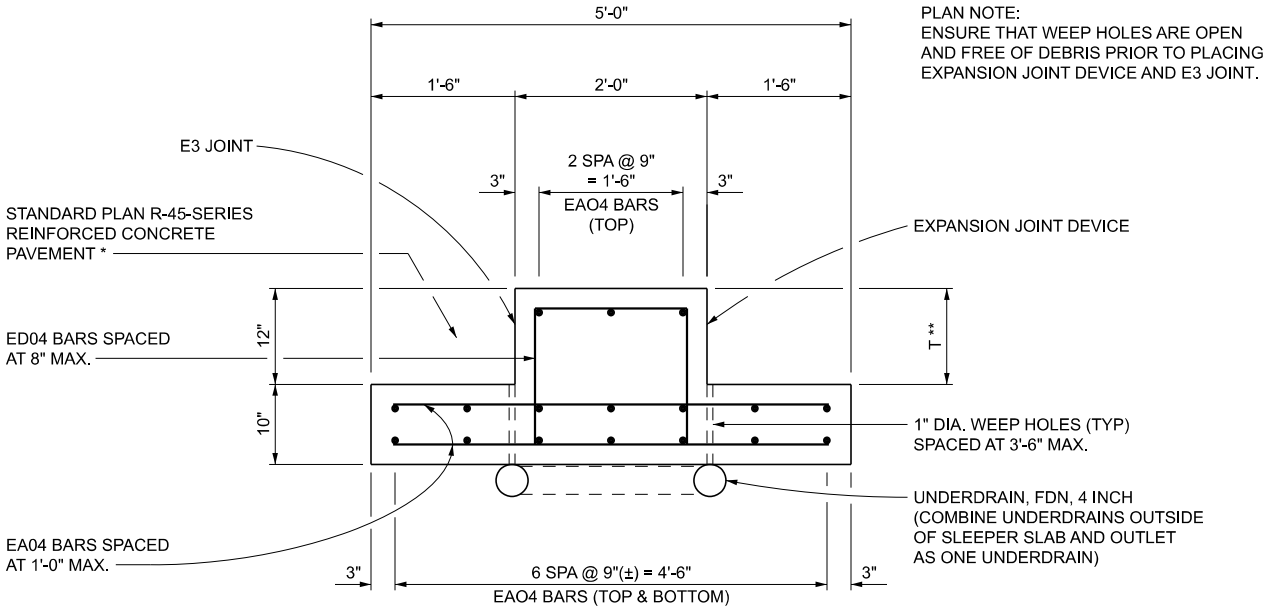
SEMI-INTEGRAL ABUTMENT (SLIDING BACKWALL)

NOTE:

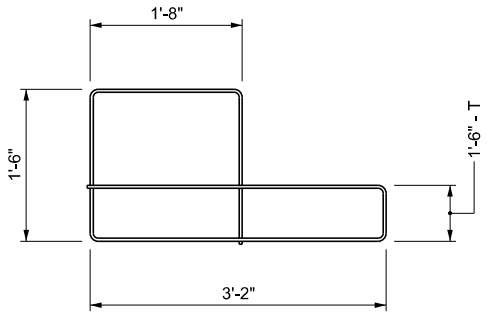
BACKFILL SHALL BE "BACKFILL, STRUCTURE, CIP" AS PER STANDARD SPECIFICATIONS.

PREPARED BY DESIGN SUPPORT AREA	6.20.04F

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/26/23
CHECKED BY: VZ	SLEEPER SLAB DETAILS	SUPERSEDES: 07/25/22
APPROVED BY: KCK		



TYPICAL SECTION THRU SLEEPER SLAB



EM04 BAR

L = 12'-6" - T

TYPICAL SECTION THRU END OF SLEEPER SLAB
BELOW BRIDGE RAILING ENDWALL EXTENSION

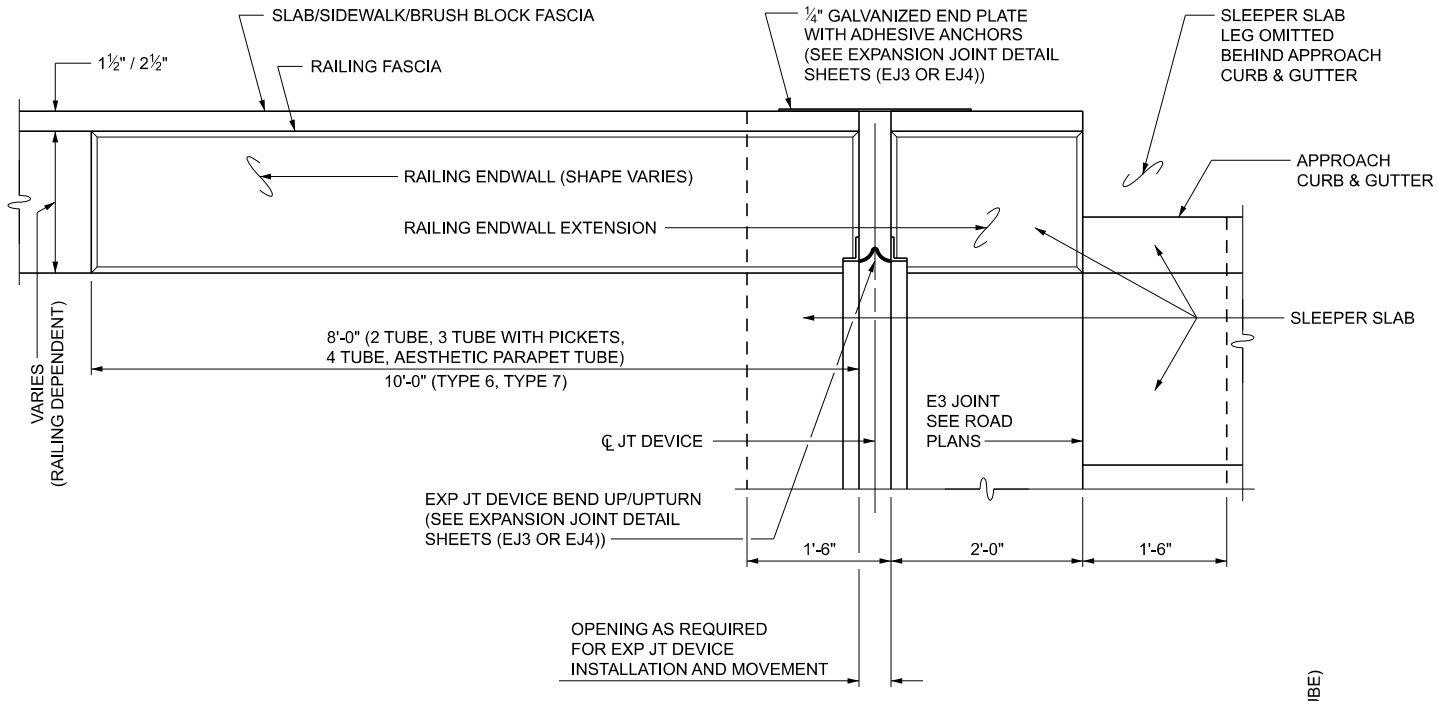
NOTES:
OMIT UNDERDRAIN UNDER SLEEPER SLAB IF OPEN GRADED DRAINAGE COURSE IS USED INSTEAD OF AGGREGATE BASE.

* USE STANDARD PLAN R-45-SERIES REINFORCED CONCRETE PAVEMENT WITH CONCRETE AND HMA ROAD APPROACHES. SEE STANDARD PLAN R-43-SERIES FOR TRANSVERSE JOINT LOCATIONS.

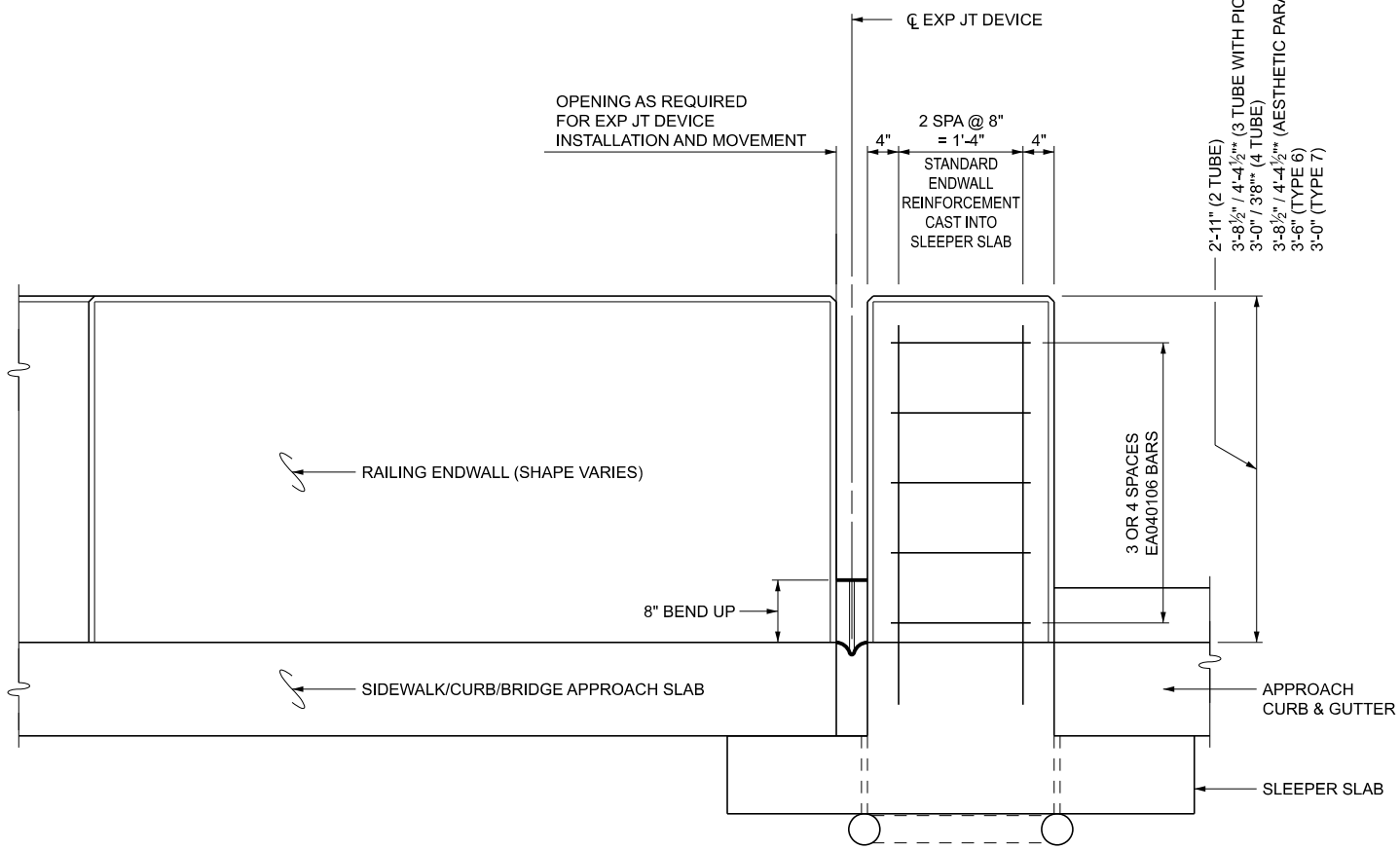
** T = APPROACH SLAB THICKNESS.
12" MINIMUM FOR DEPENDENT BACKWALL.
9" MINIMUM FOR INDEPENDENT BACKWALL.

PREPARED BY DESIGN DIVISION	6.20.05

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/26/23
CHECKED BY: VZ	SLEEPER SLAB DETAILS	SUPERSEDES: 07/25/22
APPROVED BY: KCK		



PLAN - ENDWALL EXTENSION DETAIL

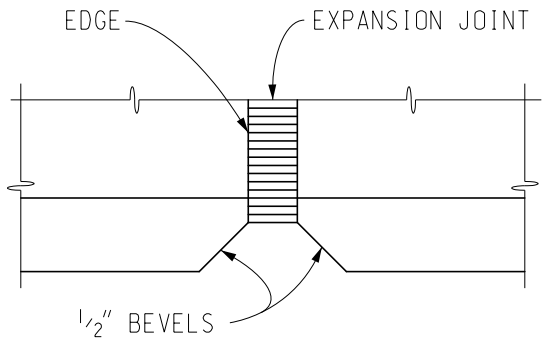


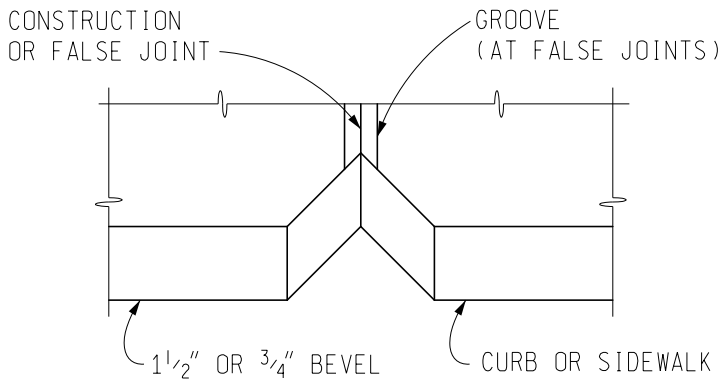
ENDWALL EXTENSION DETAIL

* HEIGHT WITH SIDEWALK

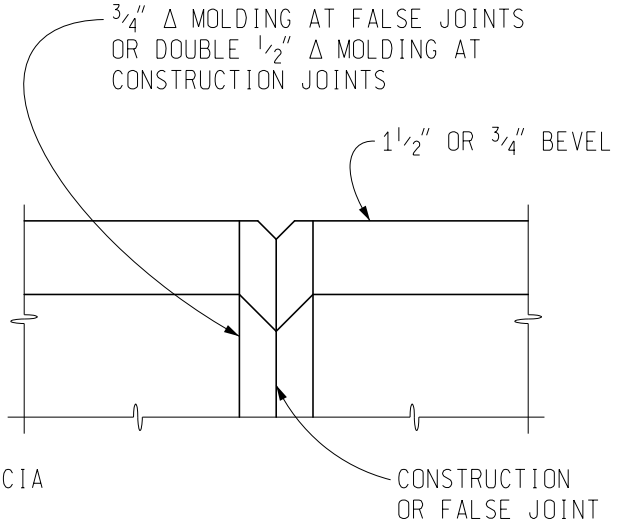
PREPARED BY DESIGN DIVISION	6.20.05A

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT CONSTRUCTION, EXPANSION AND FALSE JOINT DETAILS	ISSUED: 06/26/23 SUPERSEDES: 11/27/01





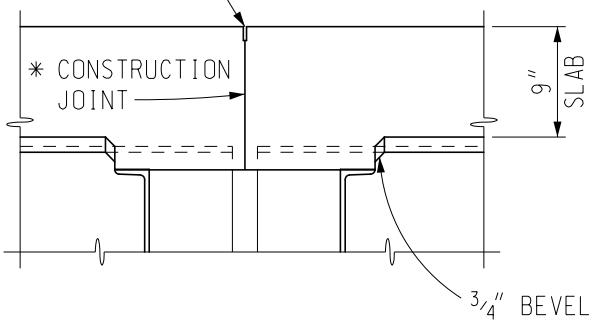
PLAN

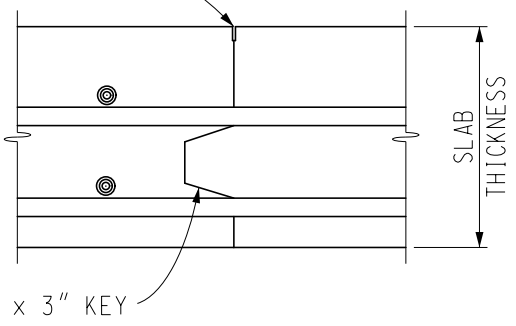


ELEVATION

MOLDING DETAILS

PROVIDE A SAWED JOINT 1 1/8" DEEP BY 1/4" WIDE (MINIMUM) IN THE TOP OF SLAB. SAW THE JOINT WITHIN 24 HOURS OF PLACING THE CURING AND FILL TO 1/2" BELOW TOP OF CONCRETE WITH POLYURETHANE OR POLYURETHANE HYBRID SEALANT. (INCLUDED IN THE BID ITEM "SUPERSTRUCTURE CONC, FORM, FINISH, AND CURE, NIGHT CASTING (STRUCTURE NO.)").





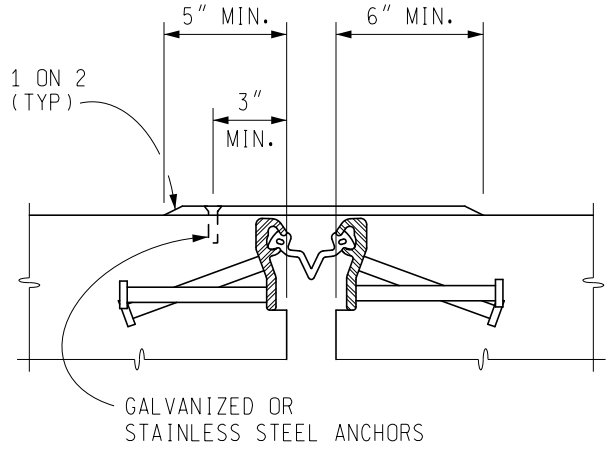
CONSTRUCTION JOINT IN SLAB OVER PIER OR AT FIXED HANGER

* DO NOT EXTEND SLAB REINFORCEMENT THROUGH CONSTRUCTION JOINT

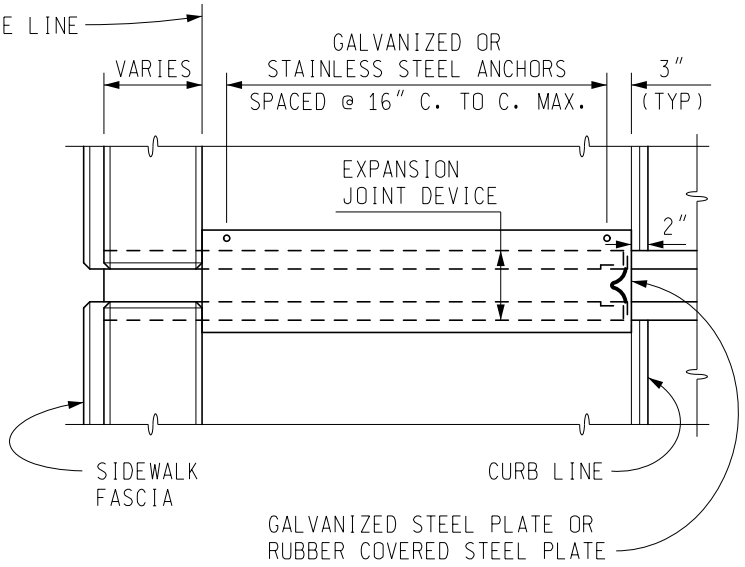
LONGITUDINAL CONSTRUCTION JOINT IN SLAB

PREPARED BY DESIGN DIVISION	6.23.01

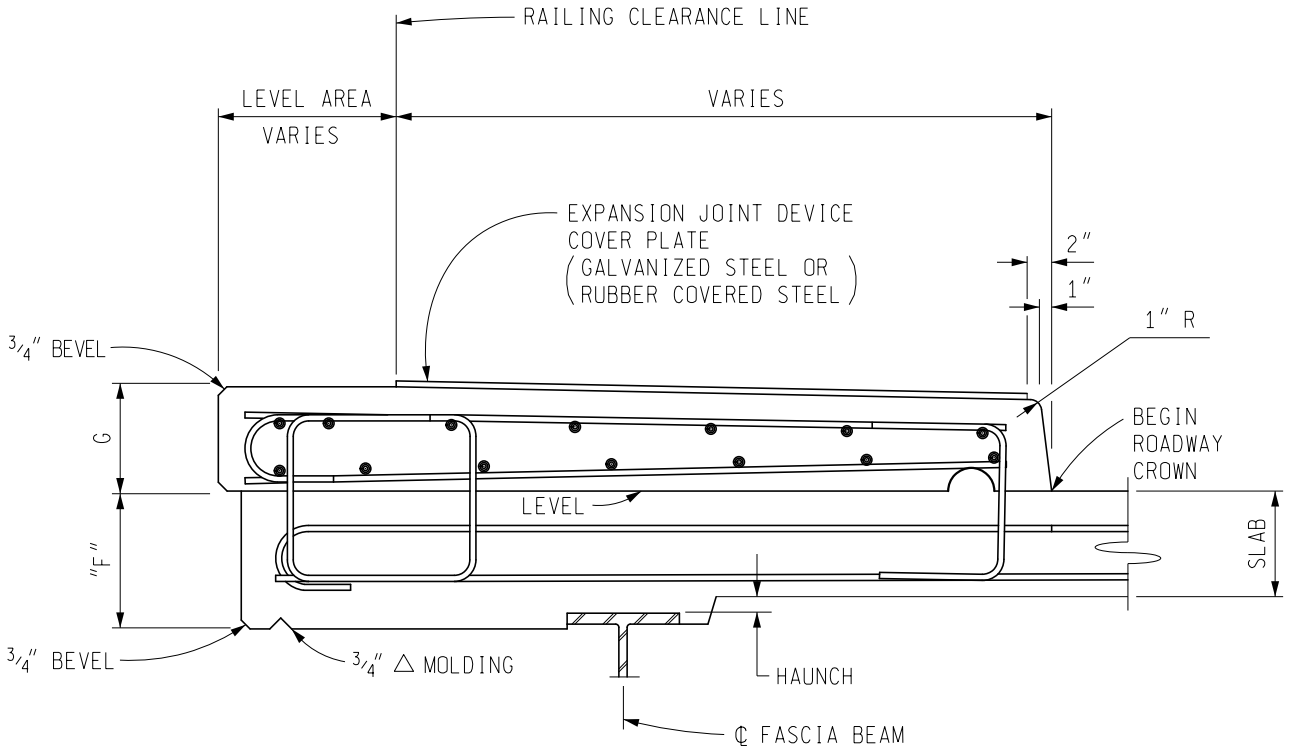
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT EXPANSION JOINT COVER RETROFIT	ISSUED: 01/23/23 SUPERSEDES: 12/24/11



SECTION THROUGH EXPANSION JOINT
(DEVICE TYPE VARIES)



PLAN VIEW



NOTES:

PROVIDE GALVANIZED STEEL PLATES (MINIMUM THICKNESS OF $^{3}/_{8}$") OR RUBBER COVERED STEEL PLATES (MINIMUM THICKNESS OF $^{3}/_{16}$" AND BLAST CLEANED).

PROVIDE STAINLESS STEEL OR GALVANIZED CONCRETE ANCHORS WITH A MINIMUM DIAMETER OF $^{3}/_{8}$".

DETAIL COVER PLATES THAT REQUIRE A LENGTH GREATER THAN 11' TO BE FABRICATED FROM TWO EQUAL LENGTH PIECES WITH A JOINT LOCATED AT THE CENTERLINE OF THE SIDEWALK OR PATH. PROVIDE A $^{1}/_{4}$" WIDE GAP AT THE JOINT THAT IS PARALLEL TO THE CENTERLINE OF THE SIDEWALK OR PATH.

PLAN NOTES:

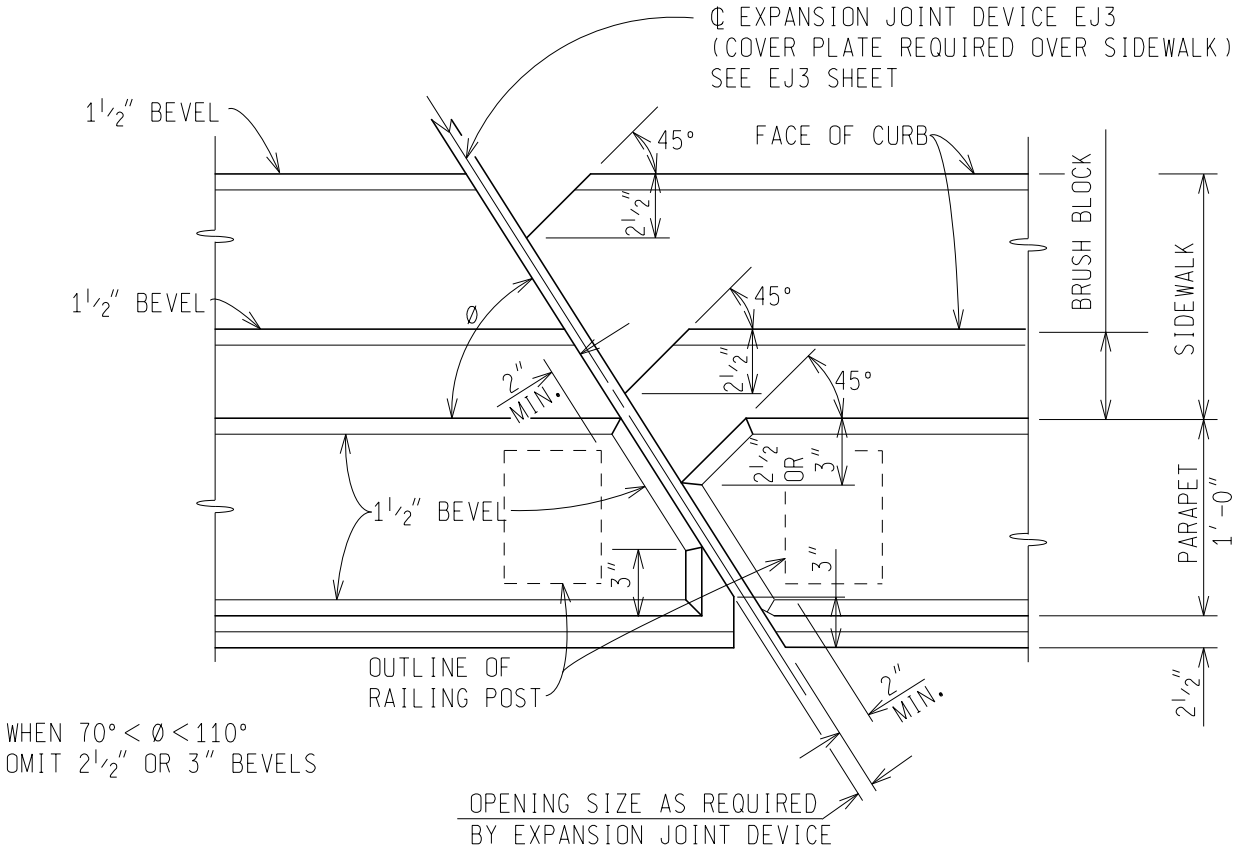
INSTALL PLATES SO THAT THE ANCHORS ARE SET ON THE HIGH SIDE OF LONGITUDINAL SIDEWALK GRADE,

CLEAN EXPOSED ELASTOMERIC COVER SYSTEM SURFACES WITH A CLEANER AS RECOMMENDED BY THE MANUFACTURE. REPAIR DAMAGE TO GALVANIZED SURFACES ACCORDING TO SECTION 7.16 OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.

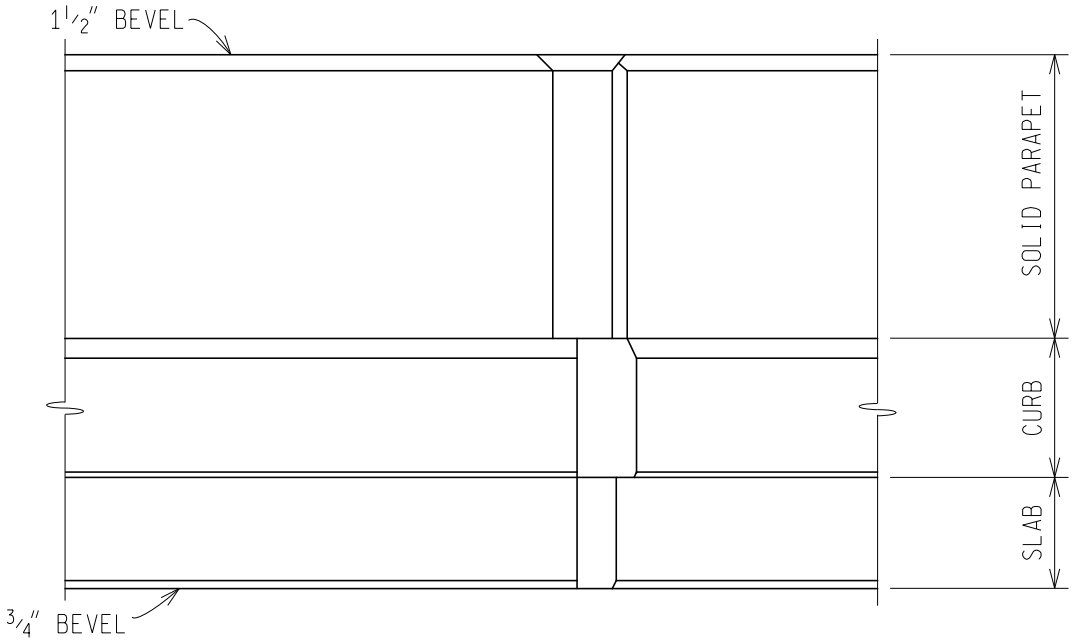
SPACE ANCHORS TO AVOID CONDUITS, CLAY TILE VOIDS OR OTHER OBJECTS IN SIDEWALKS.

PREPARED BY DESIGN DIVISION	6.28.06

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT JOINT DETAILS FOR SOLID PARAPET, SIDEWALK OR BRUSH BLOCK WITH EXP. JT. DEVICE EJ3	ISSUED: 02/14/11 SUPERSEDES: 05/04/06



PLAN

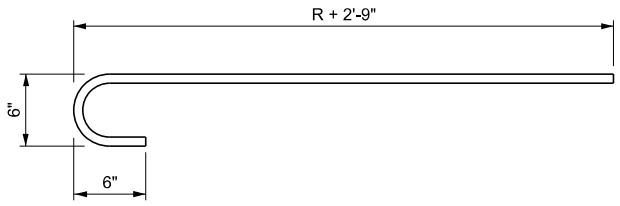


FASCIA ELEVATION

SEE EJ3 STANDARD SHEET FOR EXPANSION JOINT DEVICE DETAILS.

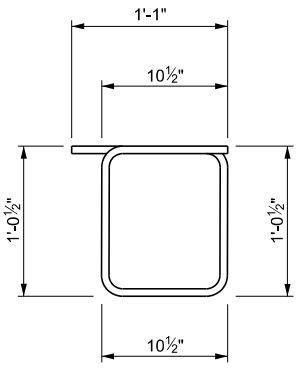
PREPARED BY DESIGN DIVISION	6.29.05

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BRIDGE RAILING, 2 TUBE	ISSUED: 08/24/26 SUPERSEDES: 07/27/26

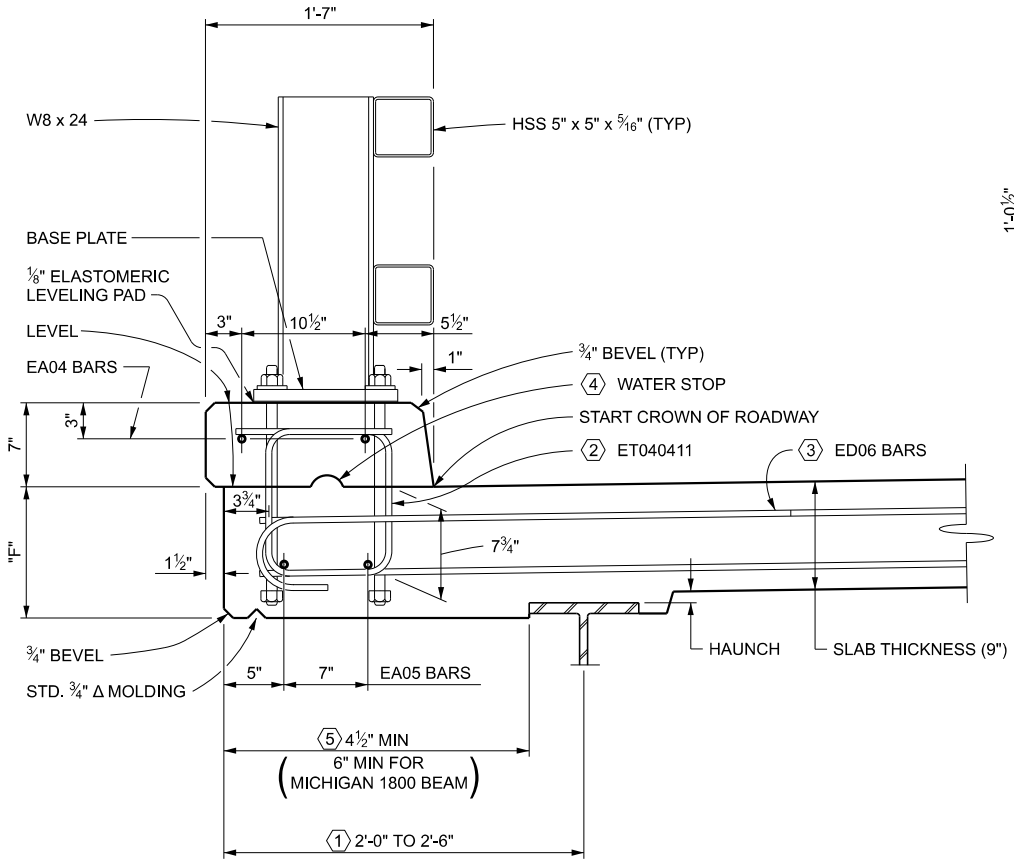


ED06 BAR

R = ℄ BEAM TO SLAB FASCIA DISTANCE



ET040411 BAR



NOTES:

"F" CONSTANT EQUALS SLAB THICKNESS PLUS THICKEST FASCIA BEAM FLANGE PLUS ½" PLUS AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN MINIMUM SLAB THICKNESS AT CURB PLUS HAUNCH (1").

IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

THE DETAILED REINFORCEMENT IN THE SLAB (EA05 & ED06 BARS) IS THE MINIMUM FOR THE RAILING. THE DESIGN OF THE SLAB OVERHANG MAY REQUIRE ADDITIONAL REINFORCEMENT (OR INCREASING THE REINFORCEMENT AREA (DIAMETER) SHOWN). BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

FOR ADDITIONAL DETAILS OF RAILING, SEE STANDARD PLAN B-21-SERIES.

1. IT IS PREFERRED TO PROVIDE A MINIMUM OF 1'-0" OF CLEARANCE FROM THE ET BARS TO THE FASCIA BEAM CENTERLINE TO PERMIT SUPPORT OF THE SCREED RAIL ALONG THE TOP OF THE FASCIA BEAM. IF SUPERSTRUCTURE GEOMETRY DOES NOT ALLOW FOR THIS 1'-0" MINIMUM DISTANCE, ALTERNATE SCREED RAIL SUPPORT METHODS MAY BE REQUIRED. IF THIS SCENARIO APPLIES, CONTACT BOBS BRIDGE CONSTRUCTION TO DISCUSS ALTERNATE SCREED RAIL OPTIONS, BRIDGE DECK FINISHING OPTIONS, AND PROPOSED SUPERSTRUCTURE CONSTRUCTABILITY.

2. SPACE AT ALTERNATE TRANSVERSE SLAB BARS (1'-6" MAX). PLACE ADDITIONAL ET040411 BARS 9" EACH SIDE OF ℄ RAILING POST.

3. AT EACH POST PLACE 7 - ED06 BARS SPACED AT 9".

4. 2" HIGH x 4" WIDE (±). FORMING NOT REQUIRED.

5. 4½" MINIMUM APPLIES TO CURVED GIRDERS ONLY.

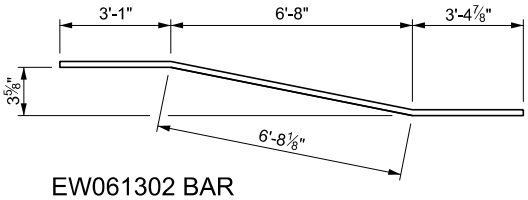
PREPARED BY DESIGN DIVISION	6.29.06

DRAWN BY:	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED:
CHECKED BY:		SUPERSEDES:
APPROVED BY:		

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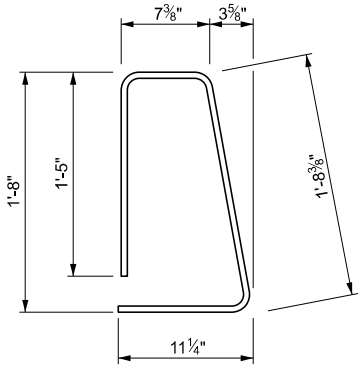
PREPARED BY DESIGN DIVISION	

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BRIDGE BARRIER RAILING TYPE 7	ISSUED: 04/27/26 SUPERSEDES: 01/26/26

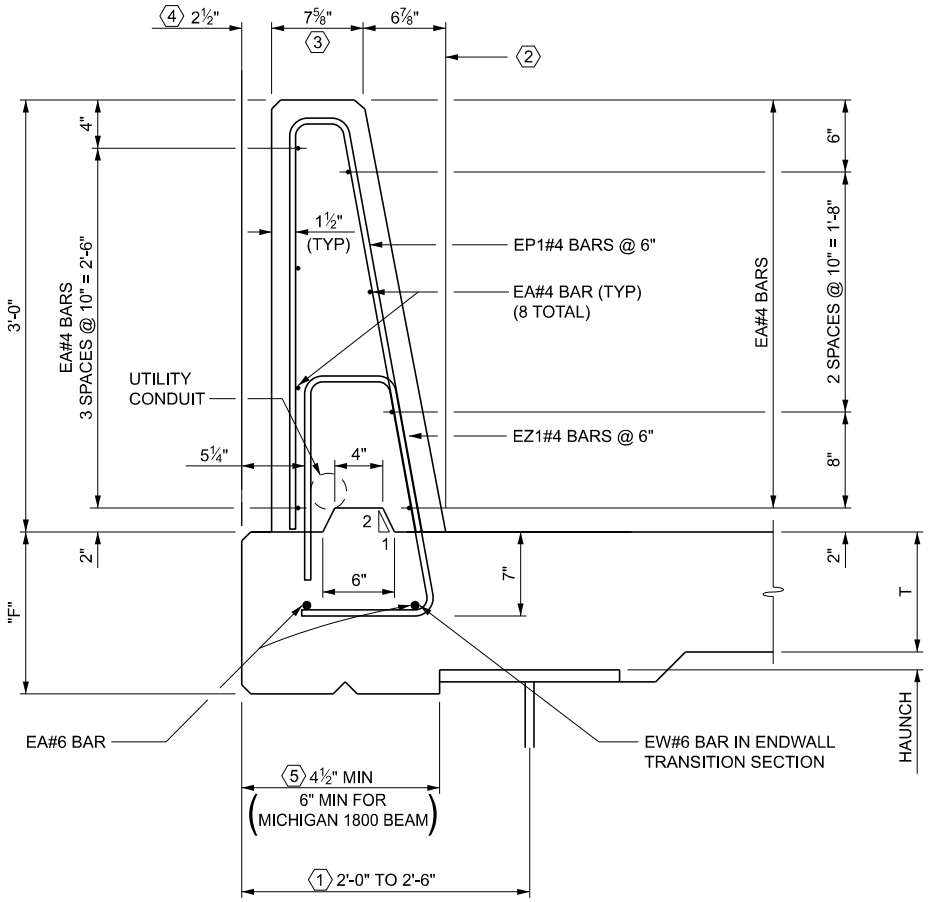


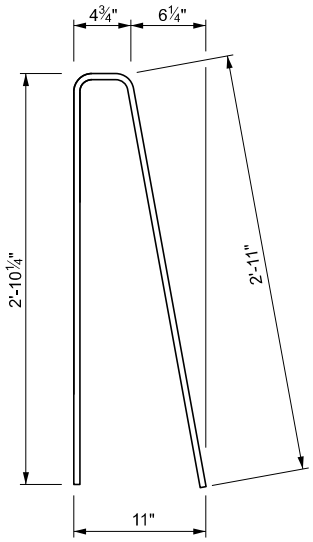
EW061302 BAR

WEIGHT =
414 LBS/LFT (BRIDGE BARRIER RAILING TYPE 7)
428 LBS/LFT (BRIDGE BARRIER RAILING AESTHETIC TYPE 7, DET 2)



EZ1#4 BAR





EP1#4 BAR

NOTE:

"F" EQUALS SLAB THICKNESS PLUS THICKEST FASCIA BEAM FLANGE PLUS ½" PLUS AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN MINIMUM SLAB THICKNESS AT CURB PLUS HAUNCH (1").

IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

FOR ADDITIONAL DETAILS OF RAILING, SEE STANDARD PLAN B-28-SERIES.

DO NOT PLACE MORE THAN ONE 3" Ø UTILITY CONDUIT IN THE BARRIER.

1. IT IS PREFERRED TO PROVIDE A MINIMUM OF 1'-0" OF CLEARANCE FROM THE EZ BARS TO THE FASCIA BEAM CENTERLINE TO PERMIT SUPPORT OF THE SCREED RAIL ALONG THE TOP OF THE FASCIA BEAM. IF SUPERSTRUCTURE GEOMETRY DOES NOT ALLOW FOR THIS 1'-0" MINIMUM DISTANCE, ALTERNATE SCREED RAIL SUPPORT METHODS MAY BE REQUIRED. IF THIS SCENARIO APPLIES, CONTACT BOBS BRIDGE CONSTRUCTION TO DISCUSS ALTERNATE SCREED RAIL OPTIONS, BRIDGE DECK FINISHING OPTIONS, AND PROPOSED SUPERSTRUCTURE CONSTRUCTABILITY.

2. PERPENDICULAR TO PLANE OF SLAB - NORMAL CROWN SECTION AND HIGH SIDE OF SUPERELEVATED SECTIONS. VERTICAL - LOW SIDE OF SUPERELEVATED SECTIONS.

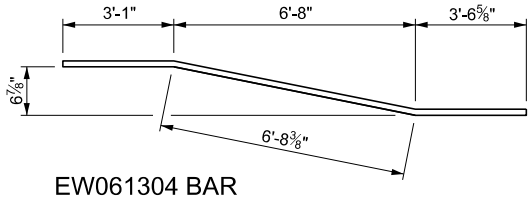
3. 8⅝" BRIDGE BARRIER RAILING AESTHETIC TYPE 7, DET 2.

4. BACK OF BARRIER TO SLAB FASCIA MAY BE DECREASED TO 1½" (FROM 2½") AND TOE OF BARRIER SHIFTED ACCORDINGLY TO ACCOMMODATE THE NEED FOR INCREASED OR MAINTAINING SHOULDER WIDTHS. DISTANCE TO BE DETAILED ON THE PLANS.

5. 4½" MINIMUM APPLIES TO CURVED GIRDERS ONLY.

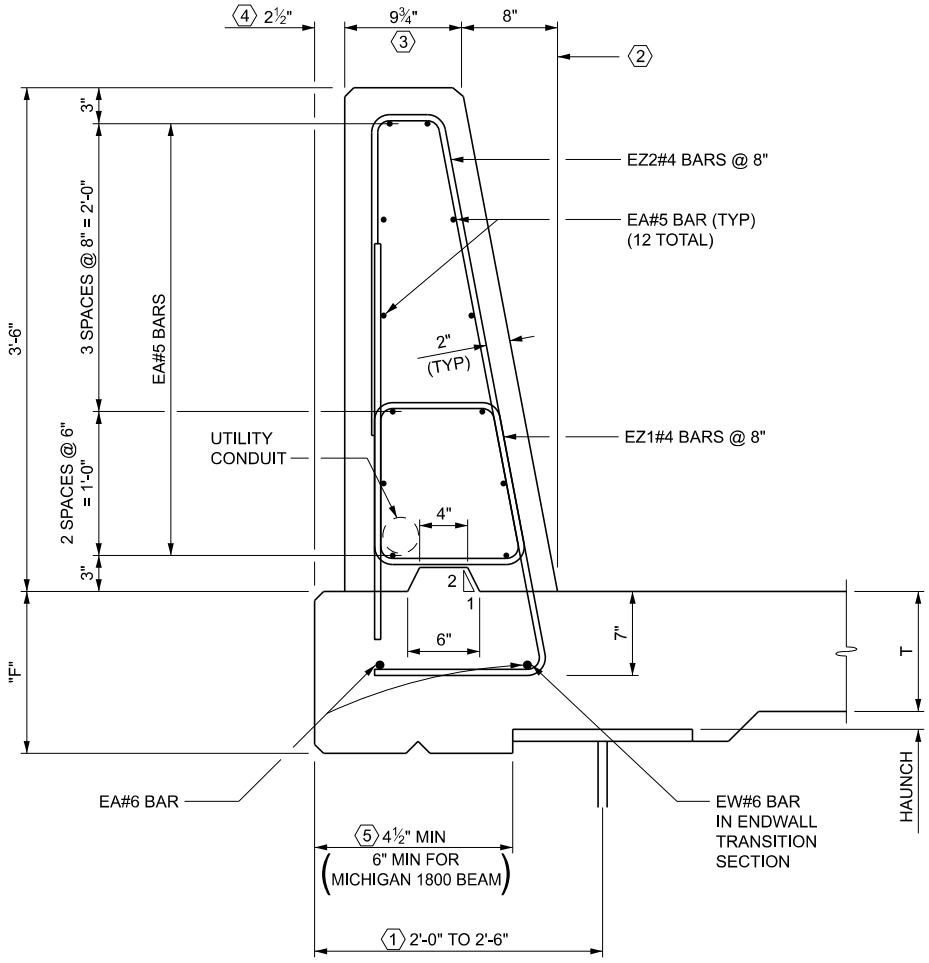
PREPARED BY DESIGN DIVISION	6.29.08

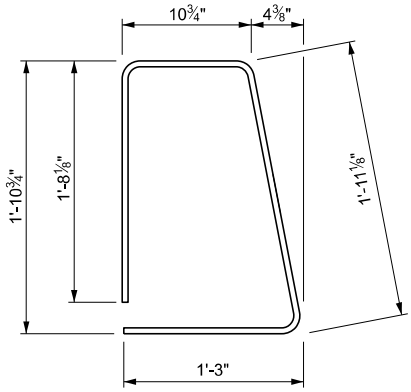
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 04/27/26
CHECKED BY: CWC	BRIDGE BARRIER RAILING TYPE 6	SUPERSEDES: 01/26/26
APPROVED BY: BMW		



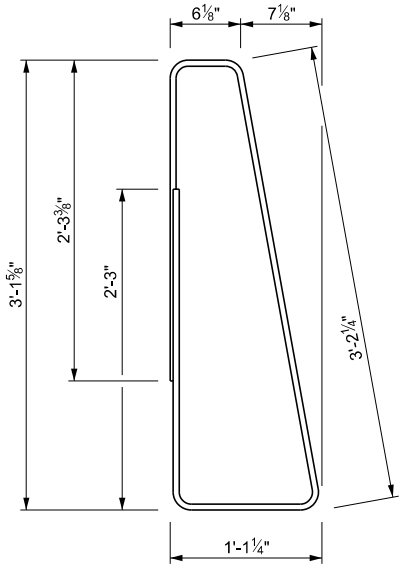
EW061304 BAR

WEIGHT =
601 LBS/LFT (BRIDGE BARRIER RAILING TYPE 6)
615 LBS/LFT (BRIDGE BARRIER RAILING AESTHETIC TYPE 6, DET 2)





EZ1#4 BAR



EZ2#4 BAR

NOTE:

"F" EQUALS SLAB THICKNESS PLUS THICKEST FASCIA BEAM FLANGE PLUS ½" PLUS AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN MINIMUM SLAB THICKNESS AT CURB PLUS HAUNCH (1").

IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

FOR ADDITIONAL DETAILS OF RAILING, SEE STANDARD PLAN B-29-SERIES.

DO NOT PLACE MORE THAN ONE 3" Ø UTILITY CONDUIT IN THE BARRIER.

1. IT IS PREFERRED TO PROVIDE A MINIMUM OF 1'-0" OF CLEARANCE FROM THE EZ BARS TO THE FASCIA BEAM CENTERLINE TO PERMIT SUPPORT OF THE SCREED RAIL ALONG THE TOP OF THE FASCIA BEAM. IF SUPERSTRUCTURE GEOMETRY DOES NOT ALLOW FOR THIS 1'-0" MINIMUM DISTANCE, ALTERNATE SCREED RAIL SUPPORT METHODS MAY BE REQUIRED. IF THIS SCENARIO APPLIES, CONTACT BOBS BRIDGE CONSTRUCTION TO DISCUSS ALTERNATE SCREED RAIL OPTIONS, BRIDGE DECK FINISHING OPTIONS, AND PROPOSED SUPERSTRUCTURE CONSTRUCTABILITY.

2. PERPENDICULAR TO PLANE OF SLAB - NORMAL CROWN SECTION AND HIGH SIDE OF SUPERELEVATED SECTIONS. VERTICAL - LOW SIDE OF SUPERELEVATED SECTIONS.

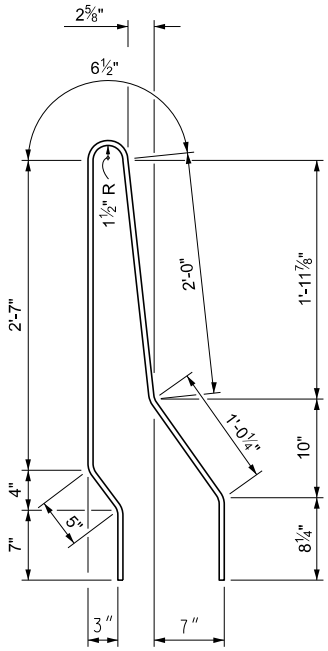
3. 10¾" BRIDGE BARRIER RAILING AESTHETIC TYPE 6, DET 2.

4. BACK OF BARRIER TO SLAB FASCIA MAY BE DECREASED TO 1½" (FROM 2½") AND TOE OF BARRIER SHIFTED ACCORDINGLY TO ACCOMMODATE THE NEED FOR INCREASED OR MAINTAINING SHOULDER WIDTHS. DISTANCE TO BE DETAILED ON THE PLANS.

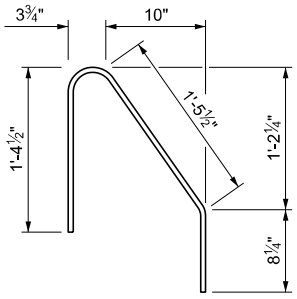
5. 4½" MINIMUM APPLIES TO CURVED GIRDERS ONLY.

PREPARED BY DESIGN DIVISION	6.29.09

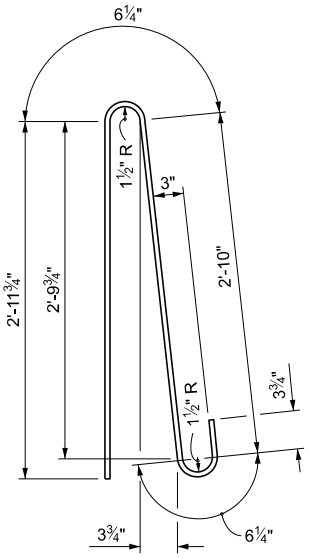
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 01/27/25
CHECKED BY: CWC	BRIDGE BARRIER RAILING, TYPE 4 FOR RAILING REPAIR	SUPERSEDES: 08/27/18
APPROVED BY: KCK		



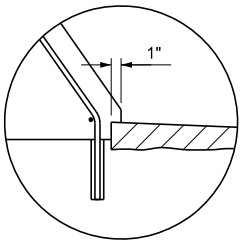
EG040710



EZ040310



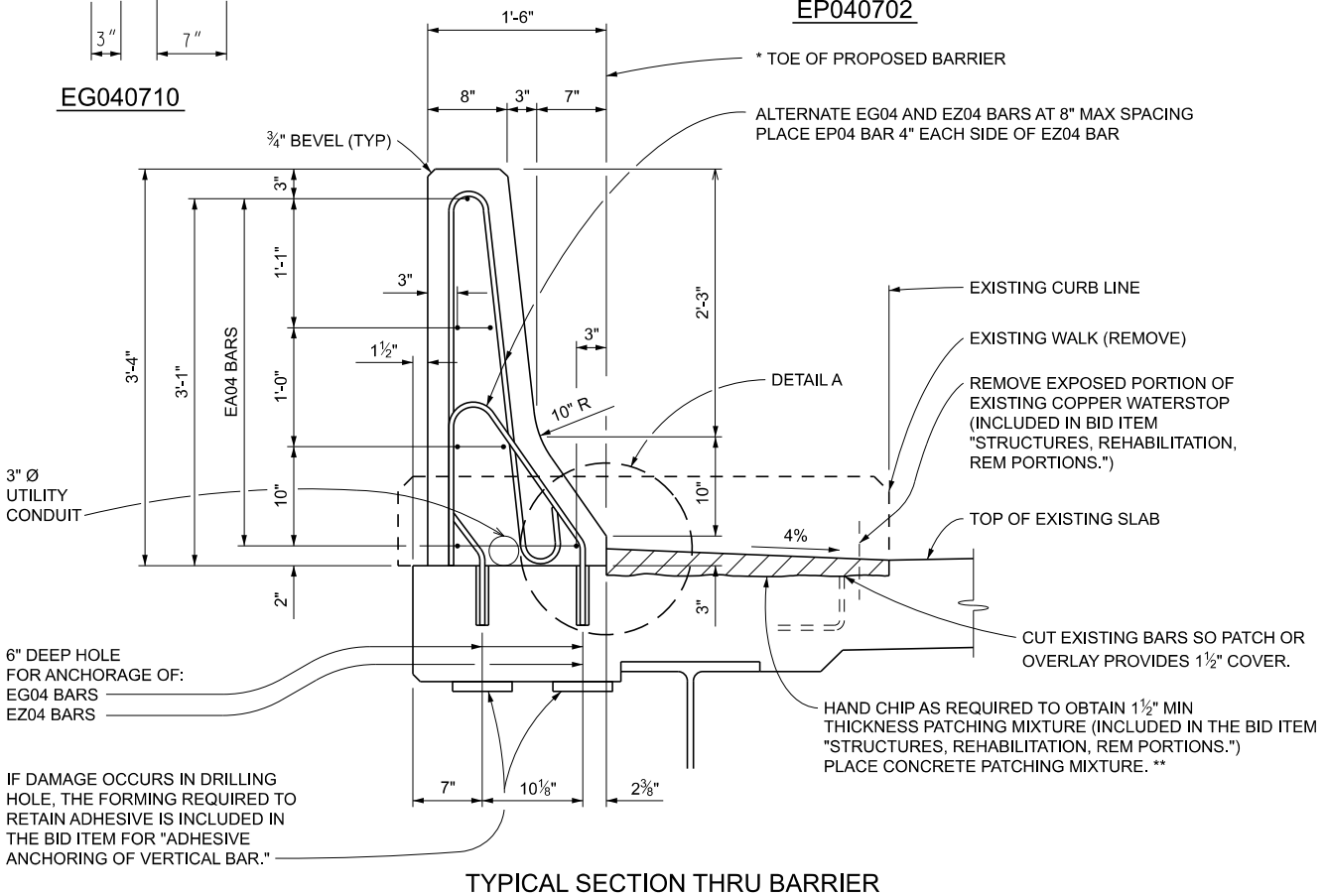
EP040702



DETAIL A

(OPTIONAL)

CONTRACTOR MAY PLACE OVERLAY PRIOR TO PLACEMENT OF BARRIER. ADDITIONAL OVERLAY MATERIAL NEEDED SHALL BE AT CONTRACTOR'S EXPENSE.



TYPICAL SECTION THRU BARRIER

* PERPENDICULAR TO PLANE OF SLAB - NORMAL CROWN SECTIONS AND HIGH SIDE OF SUPERELEVATED SECTIONS. VERTICAL - LOW SIDE OF SUPERELEVATED SECTIONS.

DO NOT PLACE MORE THAN ONE 3" Ø UTILITY CONDUIT IN THE BARRIER.

HAND CHIPPING IN FRONT OF BARRIER IS NOT REQUIRED WHEN PROJECT INCLUDES CONCRETE OVERLAY.

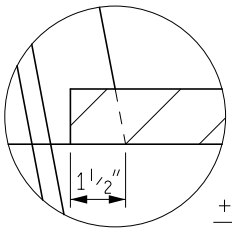
** PLAN QUANTITIES SHOULD SHOW PATCHING MIXTURE TO BE "PATCHING MORTAR OR CONCRETE."

NOTE:
DO NOT USE THIS GUIDE FOR FULL BRIDGE BARRIER REPLACEMENT.

FOR PERMISSIBLE USES OF BRIDGE BARRIER RAILING REPAIRS SEE BRIDGE DESIGN MANUAL SECTION 12.05.05.

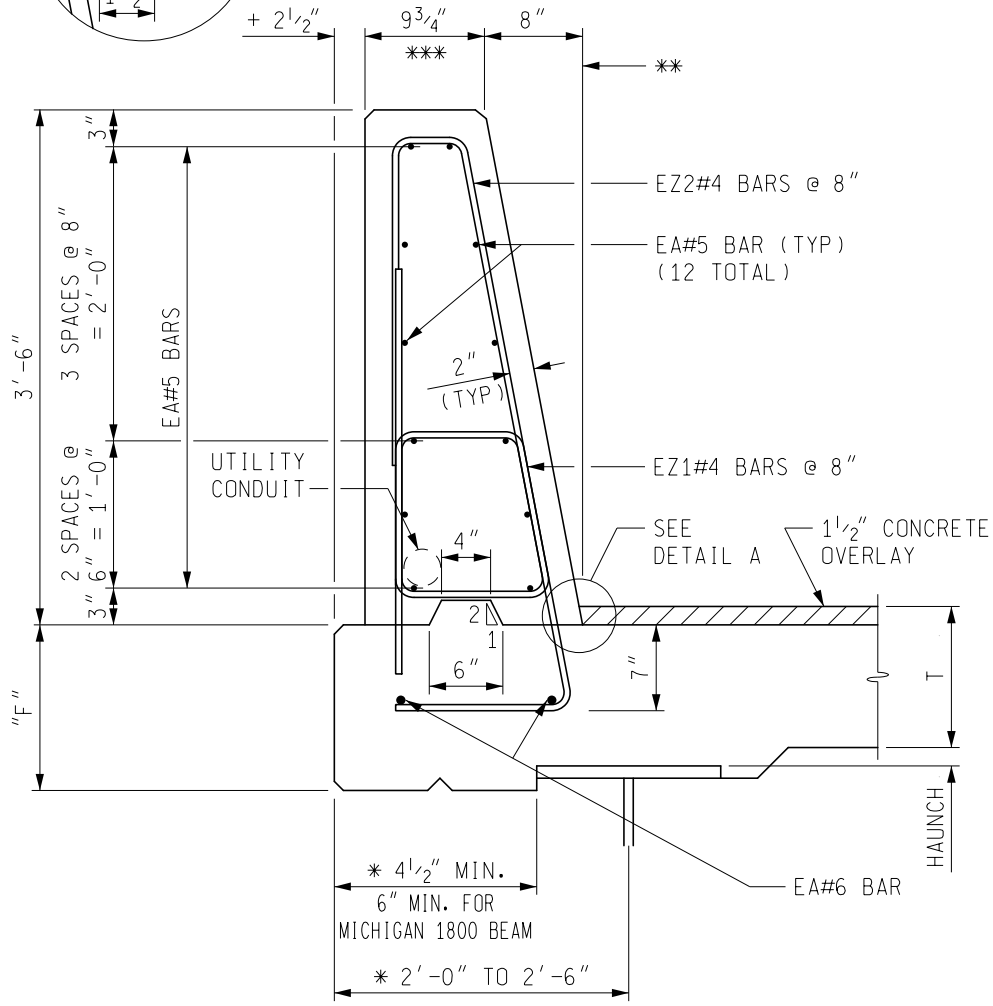
PREPARED BY DESIGN DIVISION	6.29.09A

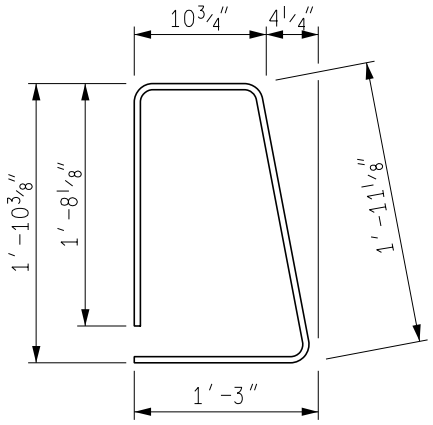
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BRIDGE BARRIER RAILING TYPE 6 TWO STAGE DECK	ISSUED: 12/16/19 SUPERSEDES: 02/14/11



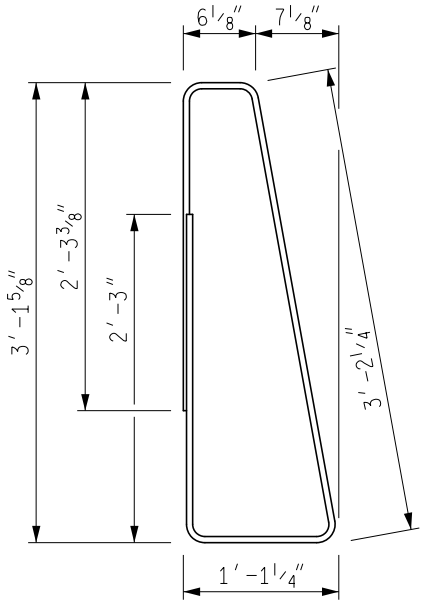
DETAIL A - OPTIONAL

CONTRACTOR MAY PLACE OVERLAY PRIOR TO PLACEMENT OF BARRIER. ADDITIONAL OVERLAY MATERIAL NEEDED SHALL BE AT CONTRACTOR'S EXPENSE.





EZ1#4 BAR



EZ2#4 BAR

NOTE:

"F" EQUALS SLAB THICKNESS, MINUS SECOND STAGE, PLUS THICKEST FASCIA BEAM FLANGE, PLUS 1/2", PLUS AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN MINIMUM THICKNESS AT CURB PLUS HAUNCH (1").

IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

FOR ADDITIONAL DETAILS OF RAILING, SEE STANDARD PLAN B-29-SERIES.

DO NOT PLACE MORE THAN ONE 3" Ø UTILITY CONDUIT IN THE BARRIER.

* IT IS PREFERRED TO POSITION THE FASCIA BEAM TO CARRY THE SCREED RAIL WHICH WILL BE 6" TO 8" FROM THE EZ BAR. HOWEVER, 4 1/2" MINIMUM WILL APPLY TO CURVED GIRDERS ONLY.

** PERPENDICULAR TO PLANE OF SLAB - NORMAL CROWN SECTION AND HIGH SIDE OF SUPERELEVATED SECTIONS. VERTICAL - LOW SIDE OF SUPERELEVATED SECTIONS.

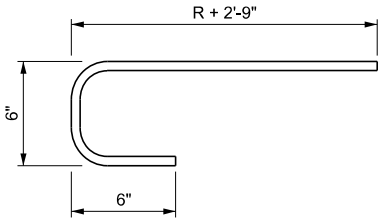
*** 10 3/4" BRIDGE BARRIER RAILING AESTHETIC TYPE 6, DET 2.

\+ BACK OF BARRIER TO SLAB FASCIA MAY BE DECREASED TO 1 1/2" (FROM 2 1/2") AND TOE OF BARRIER SHIFTED ACCORDINGLY TO ACCOMMODATE THE NEED FOR INCREASED OR MAINTAINING SHOULDER WIDTHS. DISTANCE TO BE DETAILED ON THE PLANS.

PREPARED BY DESIGN DIVISION	6.29.09D

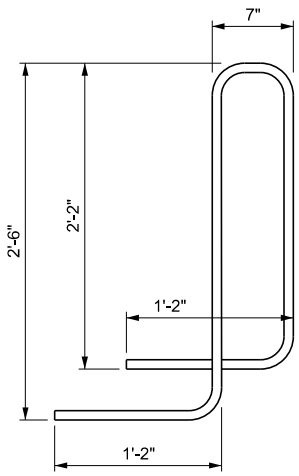
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 01/26/26
CHECKED BY: CWC	BRIDGE RAILING, AESTHETIC PARAPET TUBE	SUPERSEDES: 03/27/23
APPROVED BY: KCK		

WEIGHT = 320 LBS/FT

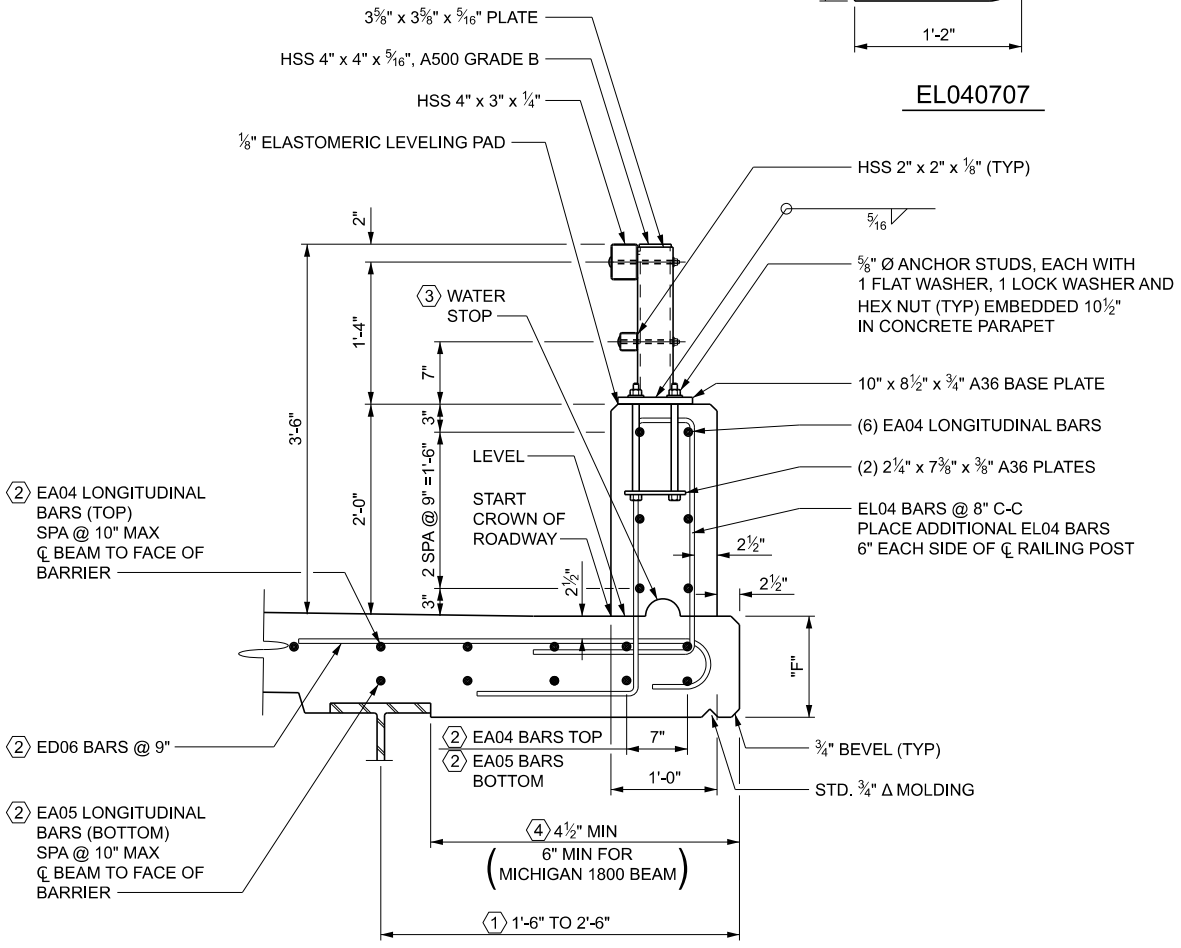


ED06 BAR

R = ℄ BEAM TO SLAB FASCIA DISTANCE



EL040707



FLUSH MOUNT BRIDGE RAILING

NOTES:

1. IT IS PREFERRED TO PROVIDE A MINIMUM OF 1'-0" OF CLEARANCE FROM THE EL BARS TO THE FASCIA BEAM CENTERLINE TO PERMIT SUPPORT OF THE SCREED RAIL ALONG THE TOP OF THE FASCIA BEAM. IF SUPERSTRUCTURE GEOMETRY DOES NOT ALLOW FOR THIS 1'-0" MINIMUM DISTANCE, ALTERNATE SCREED RAIL SUPPORT METHODS MAY BE REQUIRED. IF THIS SCENARIO APPLIES, CONTACT BOBS BRIDGE CONSTRUCTION TO DISCUSS ALTERNATE SCREED RAIL OPTIONS, BRIDGE DECK FINISHING OPTIONS, AND PROPOSED SUPERSTRUCTURE CONSTRUCTABILITY.

2. THE DETAILED REINFORCEMENT IN THE SLAB (EA04, EA05 & ED06 BARS) IS THE MINIMUM FOR THE RAILING IN ADDITION TO STANDARD BRIDGE SLAB REINFORCEMENT. THE DESIGN OF THE SLAB OVERHANG MAY REQUIRE ADDITIONAL REINFORCEMENT (OR INCREASING THE REINFORCEMENT AREA (DIAMETER) SHOWN). ALL TOP TRANSVERSE BRIDGE SLAB REINFORCEMENT IS HOOKED SIMILAR TO THE ED06 BAR DETAILED ON THIS SHEET. BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

3. 2" HIGH x 4" WIDE (±). FORMING NOT REQUIRED.

4. 4½" MINIMUM APPLIES TO CURVED GIRDERS ONLY.

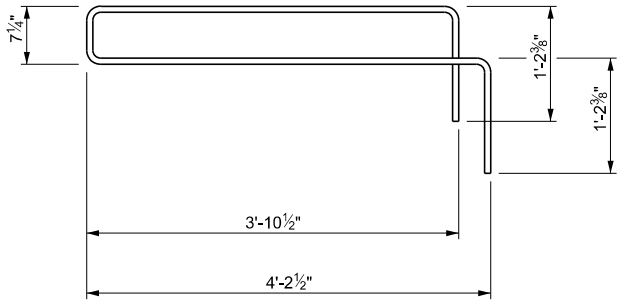
FOR ADDITIONAL DETAILS ON RAILING, SEE STANDARD PLAN B-25-SERIES AND GUIDES 6.29.10A & 6.29.10B.

DO NOT PLACE UTILITY CONDUITS IN THE BARRIER.

IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

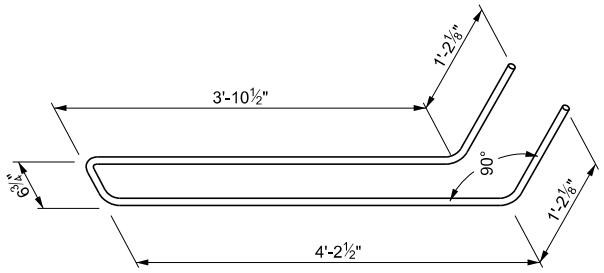
PREPARED BY DESIGN DIVISION	6.29.10

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BRIDGE RAILING, AESTHETIC PARAPET TUBE END WALL DETAIL	ISSUED: 07/27/26 SUPERSEDES: 06/22/26



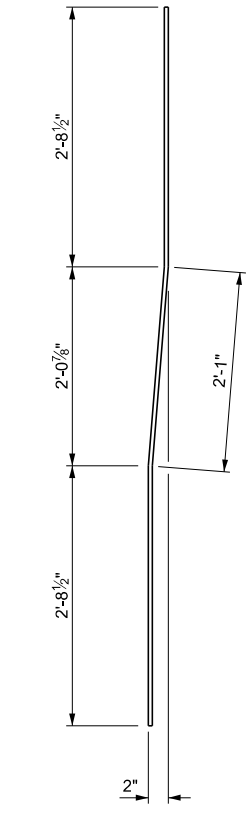
EL061101

L = a + b + c + d + e = 11'-1"
a = 4'-2½" b = 7¼" c = 3'-10½"
d = 1'-2⅜" e = 1'-2⅜" f = 7¼"
g = 0

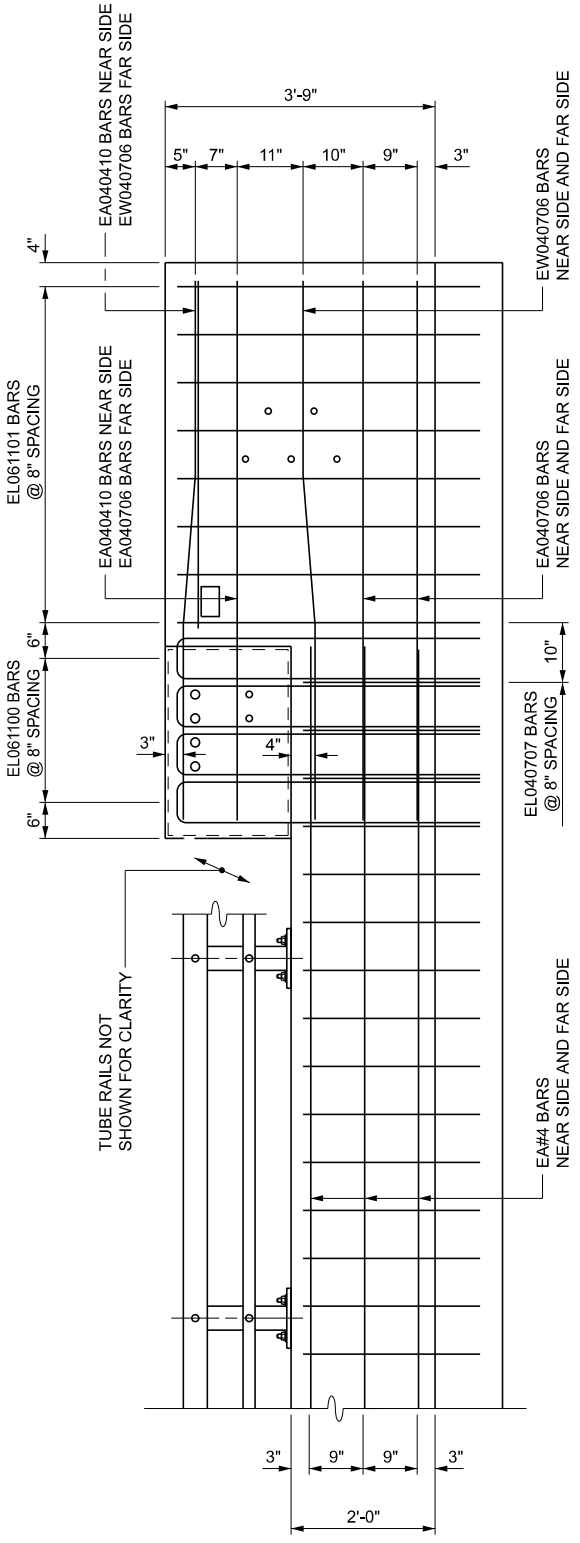


EL061100

L = a + b + c + d + e = 11'-0"
a = 3'-10½" b = 6¾" c = 4'-2½"
d = 1'-2⅛" e = 1'-2⅛" f = 0
g = 6¾"



EW040706

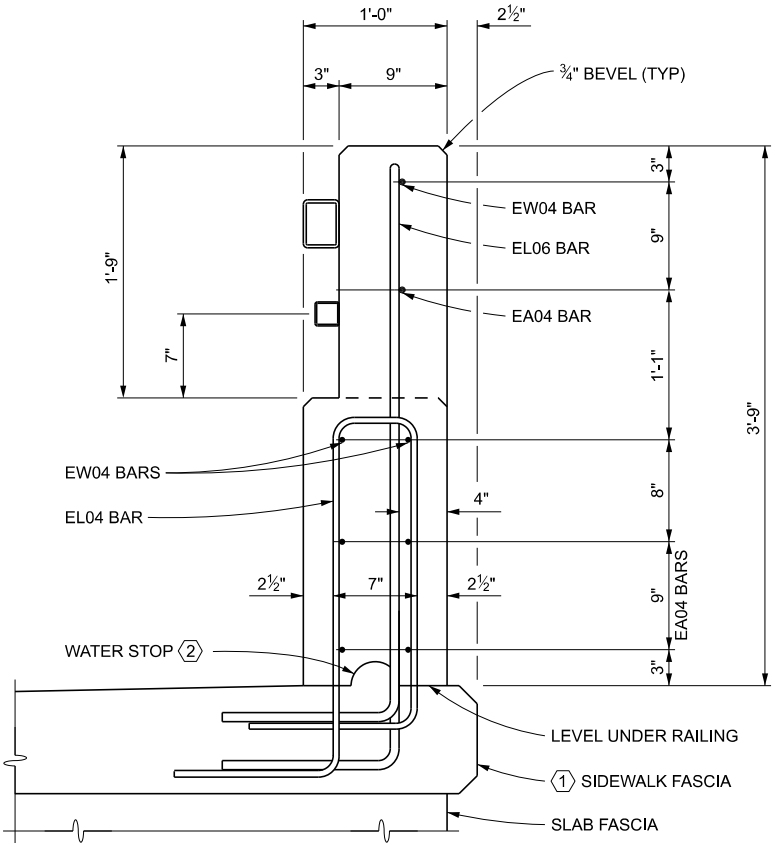


END WALL DETAIL

NOTE:
FOR ADDITIONAL DETAILS OF RAILING, SEE STANDARD PLAN
B-25-SERIES AND GUIDES 6.29.10 & 6.29.10B.

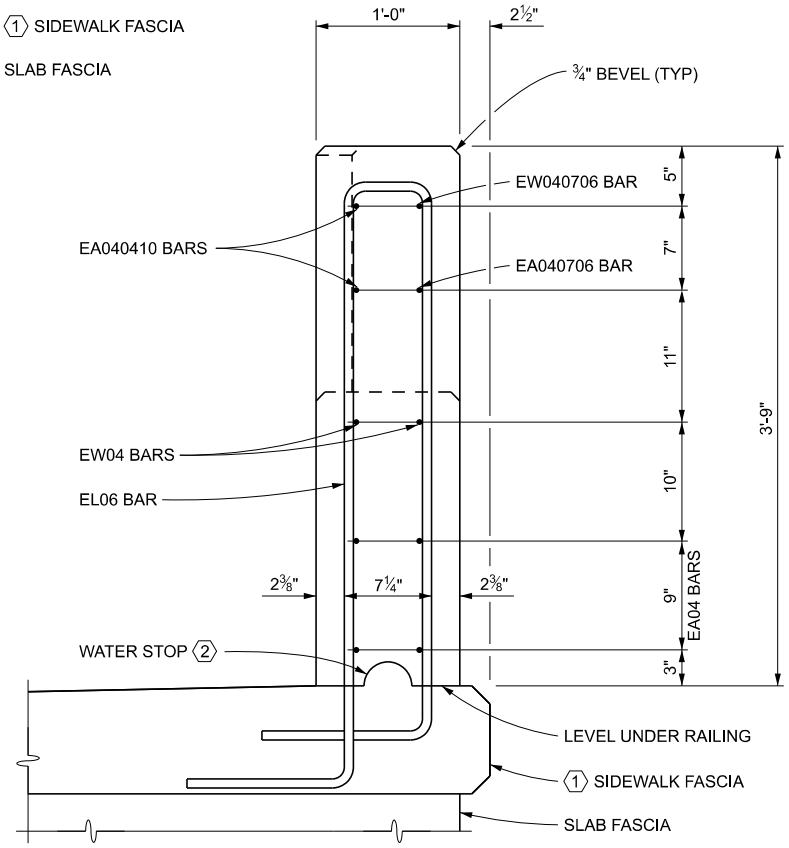
PREPARED BY DESIGN DIVISION	6.29.10A

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 07/27/26
CHECKED BY: CWC	BRIDGE RAILING, AESTHETIC PARAPET TUBE END WALL SECTIONS	SUPERSEDES: 06/22/26
APPROVED BY: BMW		



SECTION AT END WALL

(TUBE CONNECTION AREA)



SECTION AT END WALL

(FULL CONCRETE AREA)

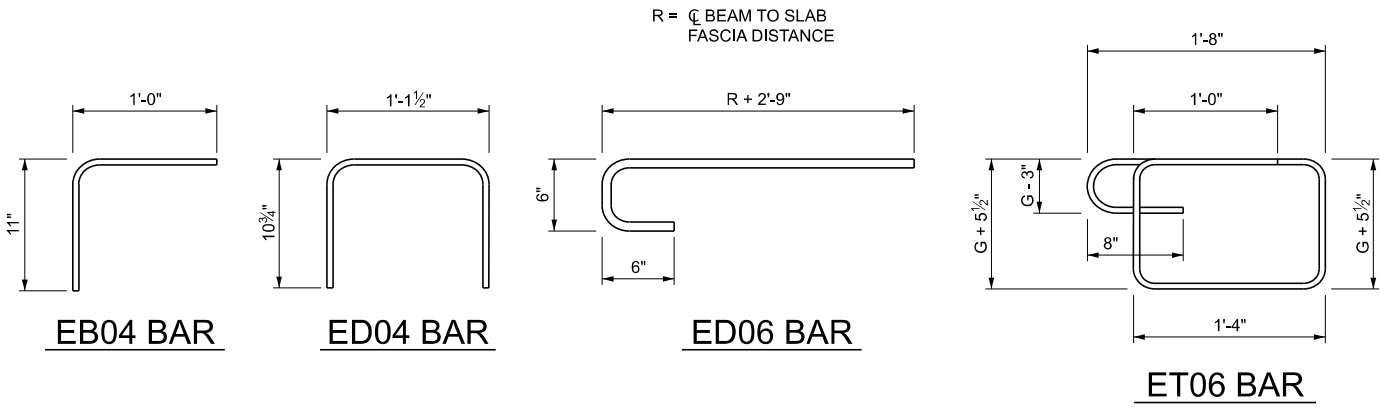
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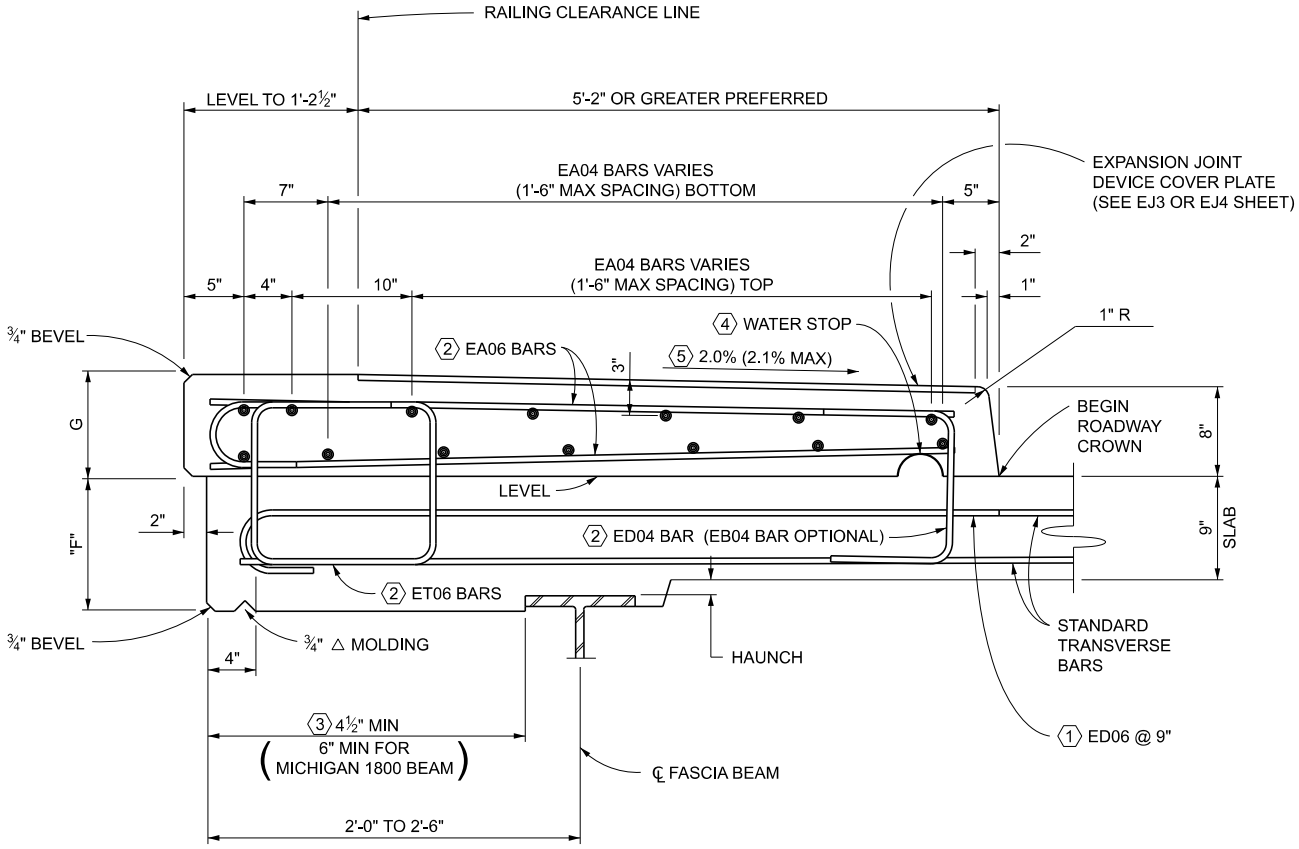
1 IF BRIDGE RAILING IS MOUNTED FLUSH TO THE SLAB, THE "EL" BARS SHALL BE CAST IN THE SLAB.

2 2" HIGH x 4" WIDE (±). FORMING NOT REQUIRED. USE WHEN RAILING IS MOUNTED FLUSH TO THE SLAB.

PREPARED BY DESIGN DIVISION	6.29.10B

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BRIDGE RAILING, AESTHETIC PARAPET TUBE SIDEWALK SECTION	ISSUED: 07/27/26 SUPERSEDES: 02/26/24





NOTES:

"F" CONSTANT EQUALS SLAB THICKNESS PLUS HAUNCH PLUS THICKEST FASCIA BEAM FLANGE PLUS ½" PLUS AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN SLAB THICKNESS AT CURB LINE.

IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

1. THE DETAILED REINFORCEMENT IN THE SLAB (ED06 BARS) IS THE MINIMUM FOR THE RAILING. THE DESIGN OF THE SLAB OVERHANG MAY REQUIRE ADDITIONAL REINFORCEMENT (OR INCREASING THE REINFORCEMENT AREA (DIAMETER) SHOWN). ALL TOP TRANSVERSE BRIDGE SLAB REINFORCEMENT IS HOOKED SIMILAR TO THE ED06 BAR DETAILED ON THIS SHEET. BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

2. SPACE WITH ALTERNATE TRANSVERSE SLAB BARS (1'-6" MAX.). EB04 BAR MAY BE ADHESIVE ANCHORED INTO 6" DEEP HOLE INSTEAD OF ED04 BAR. PLACE ADDITIONAL ET06 BAR 6" EACH SIDE OF ℄ RAILING POST.

3. APPLIES TO CURVED BRIDGES ONLY.

4. 2" HIGH x 4" WIDE (±). FORMING NOT REQUIRED.

5. USE A TARGET CROSS SLOPE (2.0%) LESS THAN THE MAXIMUM TO ACCOUNT FOR INCONSISTENCIES IN CONCRETE FINISHING.

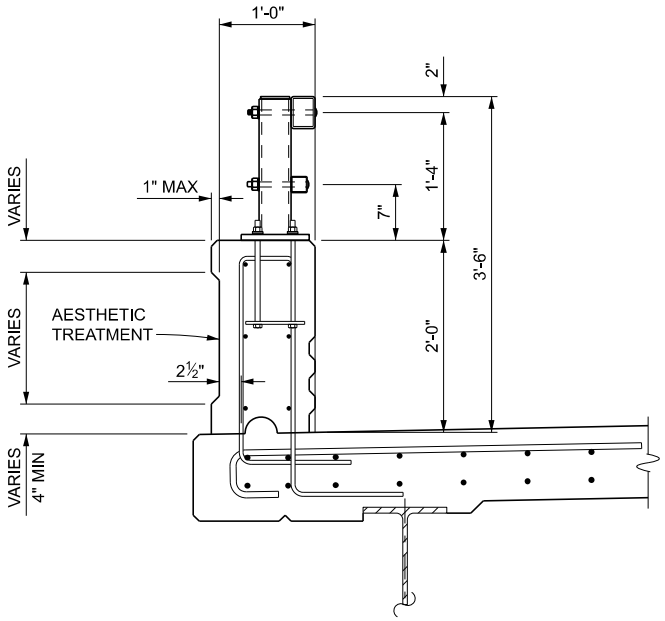
PREPARED BY DESIGN DIVISION	6.29.10C

DRAWN BY:	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED:
CHECKED BY:		SUPERSEDES:
APPROVED BY:		

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PREPARED BY DESIGN DIVISION	

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 09/22/25
CHECKED BY: CWC	BRIDGE RAILING, AESTHETIC PARAPET TUBE AESTHETIC TREATMENT	SUPERSEDES: 02/14/11
APPROVED BY: KCK		



PAY ITEM

BRIDGE RAILING, AESTHETIC PARAPET TUBE, DET 2

NOTES:

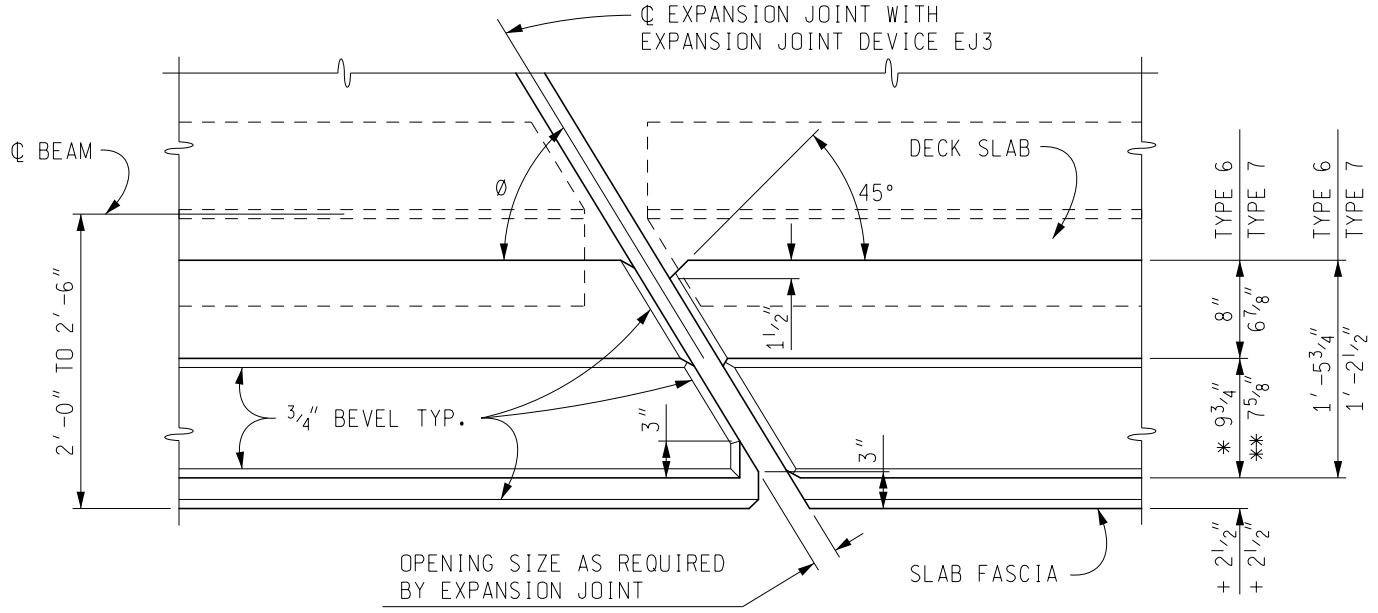
CONSTRUCT RAILING IN THE SAME MANNER AS STANDARD BRIDGE RAILING, AESTHETIC PARAPET TUBE, EXCEPT ADJUST THE WIDTH ACCORDING TO THE DETAILS ON THE PLAN TO ACCOMODATE FORM LINERS TO ACCOMPLISH CONCRETE TEXTURING ON THE BACK OF THE BRIDGE RAILING.

USE LONG ANCHOR BOLTS AN A 14" x 26" x ⅜" PLATE TO ATTACH THE GUARDRAIL TO THE BARRIER.

REFER TO THE CONTRACT DOCUMENTS FOR REQUIREMENTS FOR TEXTURING CONCRETE.

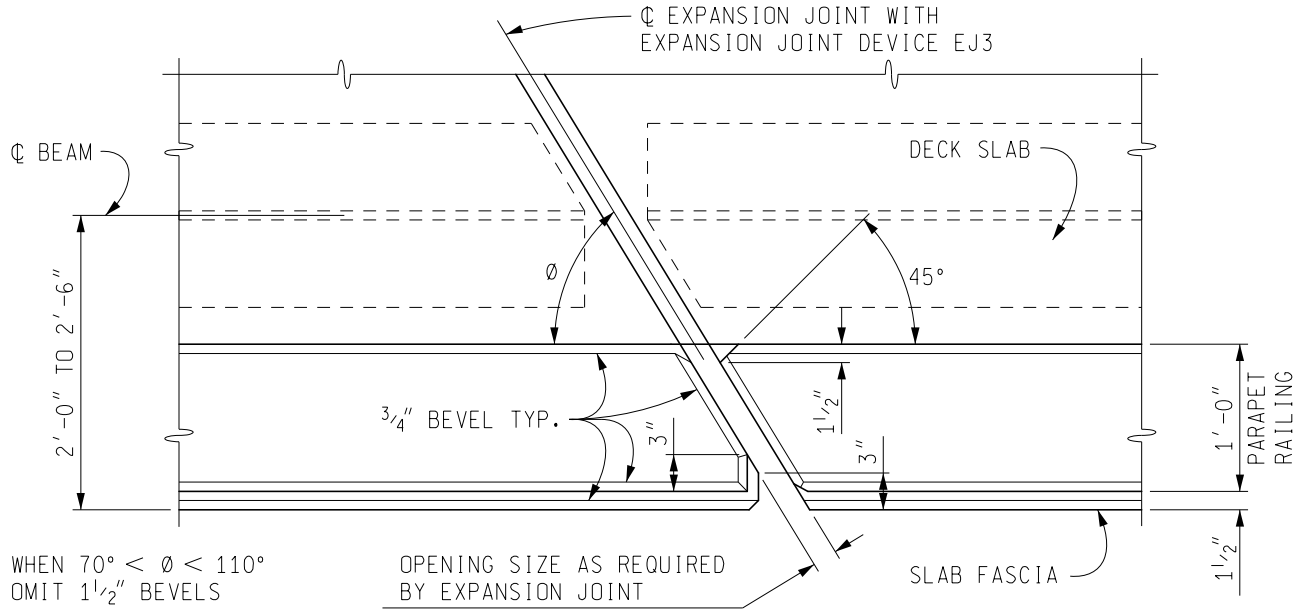
PREPARED BY DESIGN DIVISION	6.29.10E

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT JOINT DETAIL FOR BRIDGE BARRIER RAILING WITH EXPANSION JOINT	ISSUED: 01/27/20 SUPERSEDES: 12/16/19



PLAN VIEW
JOINT WITH EJ3 EXPANSION JOINT

SEE EJ3 STANDARD SHEET FOR EXPANSION JOINT DEVICE DETAILS



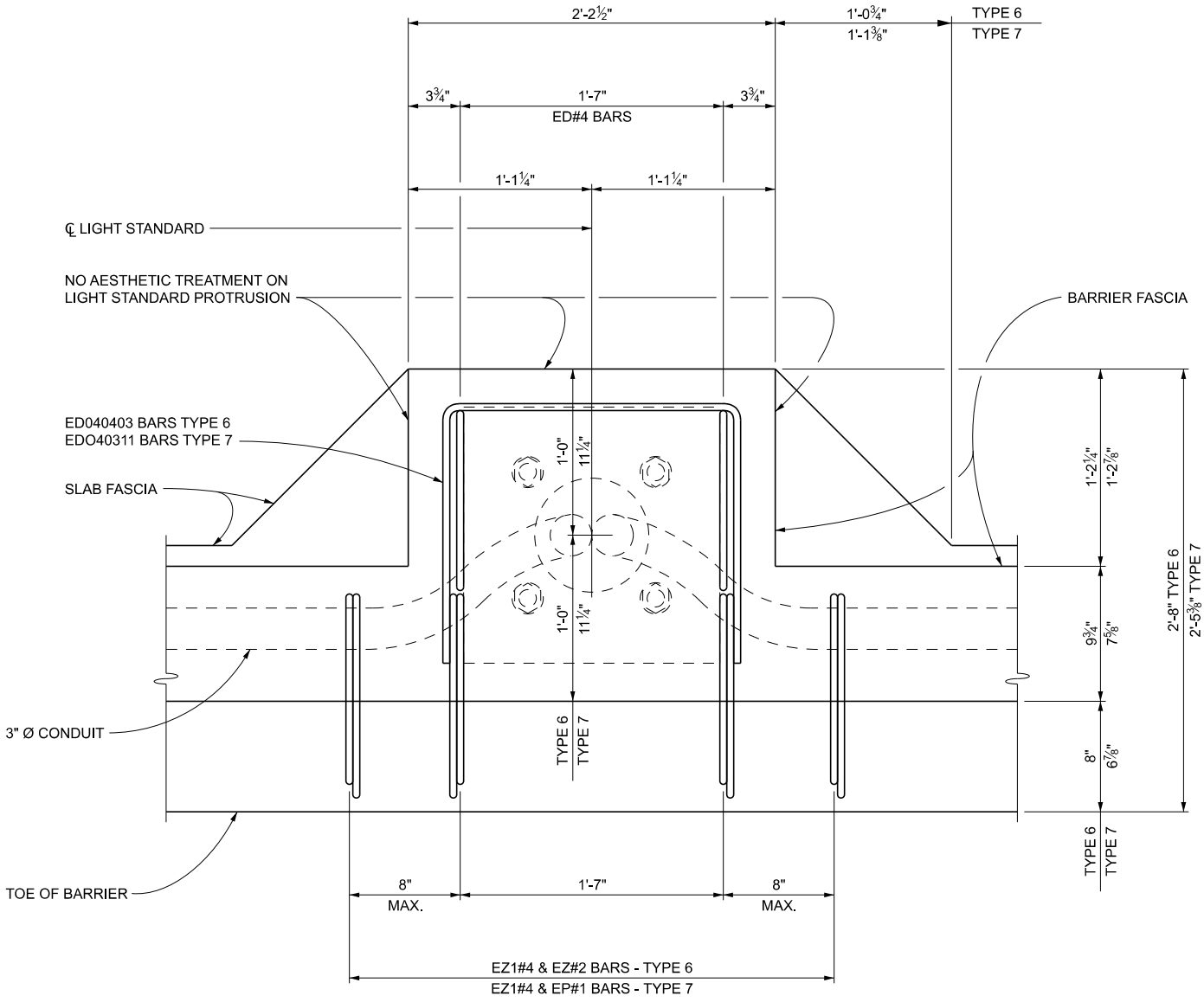
PLAN VIEW
JOINT WITH EJ3 EXPANSION JOINT

SEE EJ3 STANDARD SHEET FOR EXPANSION JOINT DEVICE DETAILS

* 10¾″ BRIDGE BARRIER RAILING AESTHETIC TYPE 6, DET 2
** 8⅝″ BRIDGE BARRIER RAILING AESTHETIC TYPE 7, DET 2
\+ BACK OF BARRIER TO SLAB FASCIA MAY BE DECREASED TO 1½″ (FROM 2½″) AND TOE OF BARRIER SHIFTED ACCORDINGLY TO ACCOMMODATE THE NEED FOR INCREASED OR MAINTAINING SHOULDER WIDTHS. DISTANCE TO BE DETAILED ON THE PLANS.

PREPARED BY DESIGN DIVISION	6.29.11

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 01/29/24
CHECKED BY: VZ	BARRIER RAILING DETAILS AT LIGHT STANDARD	SUPERSEDES: 12/16/19
APPROVED BY: KCK		



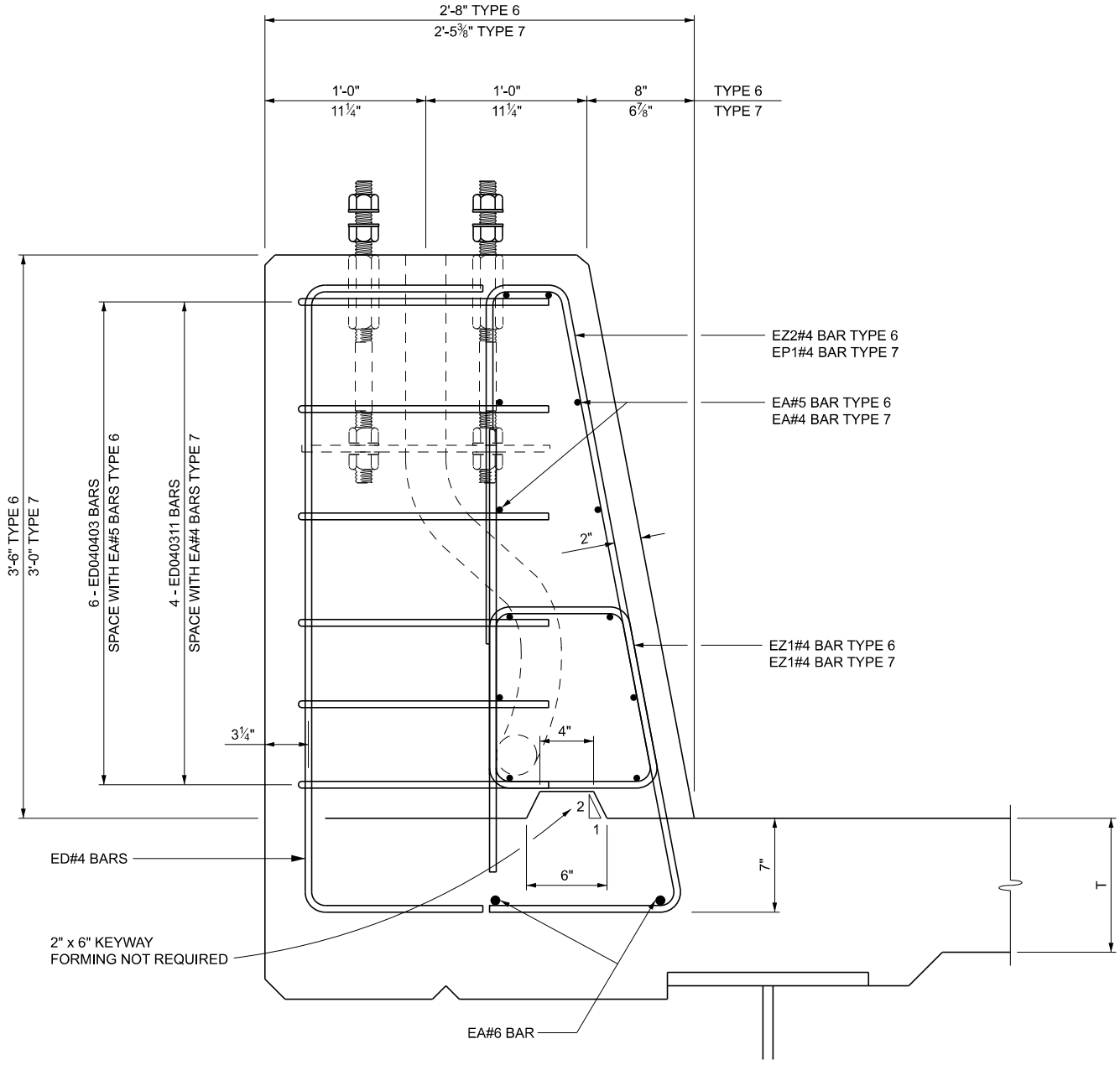
PLAN VIEW

TYPE 6 SHOWN

SEE STANDARD PLAN B-103-SERIES FOR ANCHOR BOLT ASSEMBLY DETAILS.

PREPARED BY DESIGN DIVISION	6.29.13

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 01/29/24
CHECKED BY: VZ	BARRIER RAILING DETAILS AT LIGHT STANDARD	SUPERSEDES: 12/16/19
APPROVED BY: KCK		



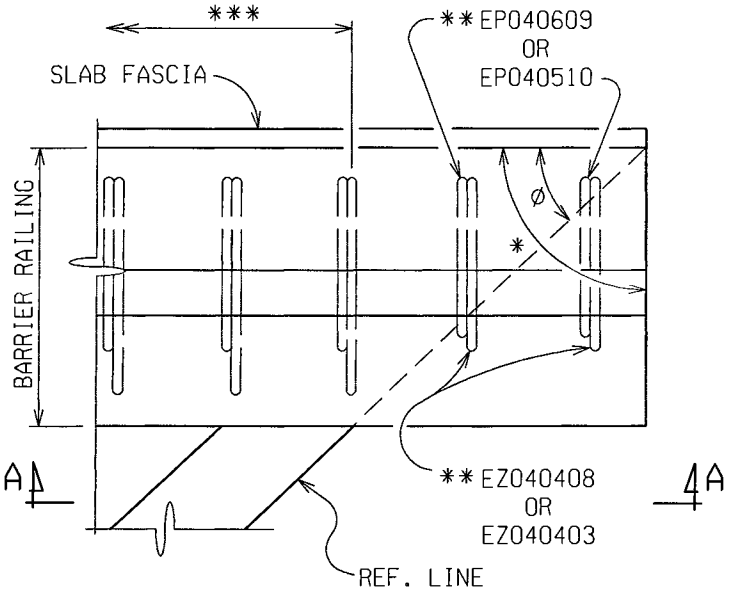
SECTION

TYPE 6 SHOWN

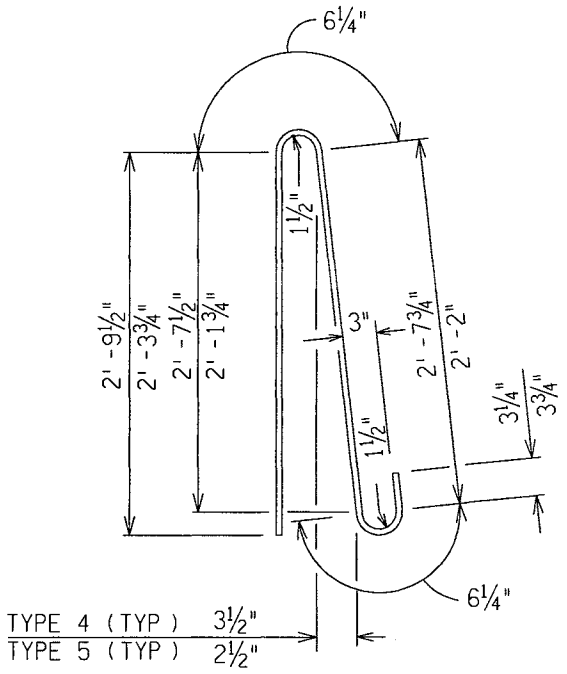
SEE STANDARD PLAN B-103-SERIES FOR ANCHOR BOLT ASSEMBLY DETAILS.

PREPARED BY DESIGN DIVISION	6.29.13A

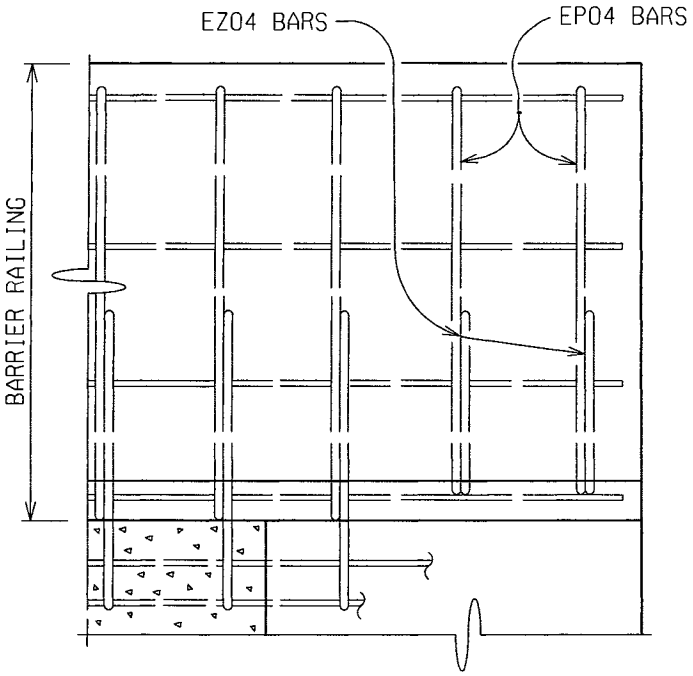
DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY TECHNICAL SERVICES **BARRIER RAILING DETAILS AT DEPENDENT BACKWALL**	ISSUED: 11/27/01 SUPERSEDES: 08/08/96



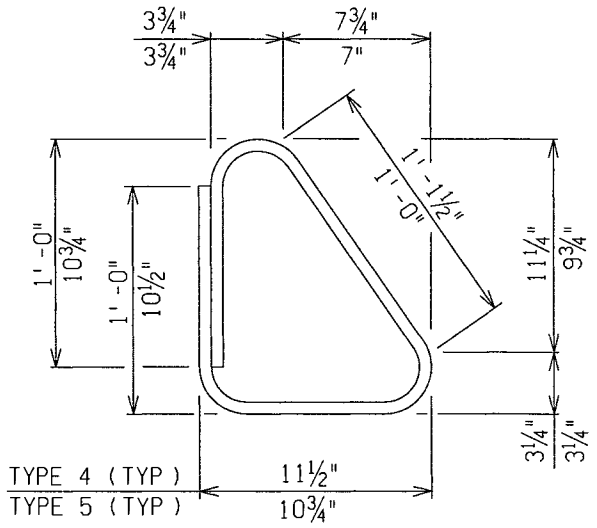
PLAN



EP040609 (TYPE 4)
EP040510 (TYPE 5)



SECTION A-A



EZ040408 (TYPE 4)
EZ040403 (TYPE 5)

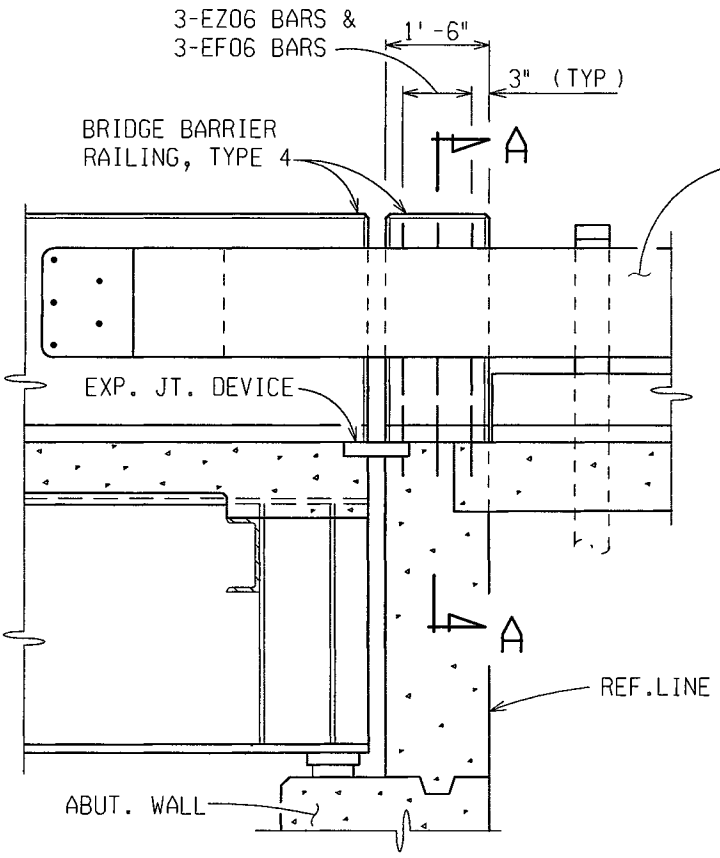
* CAST SQUARE WHEN $\emptyset < 70°$ OR $\emptyset > 110°$; CAST PARALLEL TO REF. LINE WHEN $70° \leq \emptyset \leq 110°$.

** PROVIDE 2 OR 3 EP BARS PAIRED WITH EZ BARS AS SHOWN WHEN END OF BARRIER IS CAST SQUARE ON A SKEWED STRUCTURE.

*** SEE APPROPRIATE 6.29 SERIES GUIDES FOR STANDARD BARRIER REINFORCEMENT.

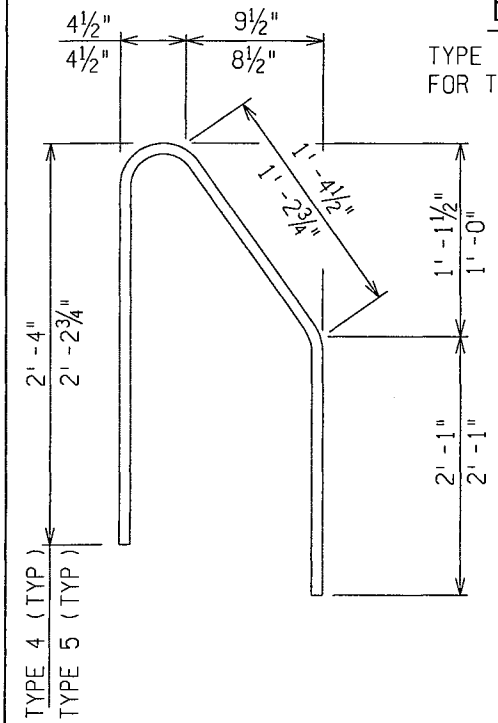
PREPARED BY DESIGN DIV.	6.29.15

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY TECHNICAL SERVICES **BARRIER RAILING DETAILS AT INDEPENDENT BACKWALL**	ISSUED: 11/27/01 SUPERSEDES: 08/08/96

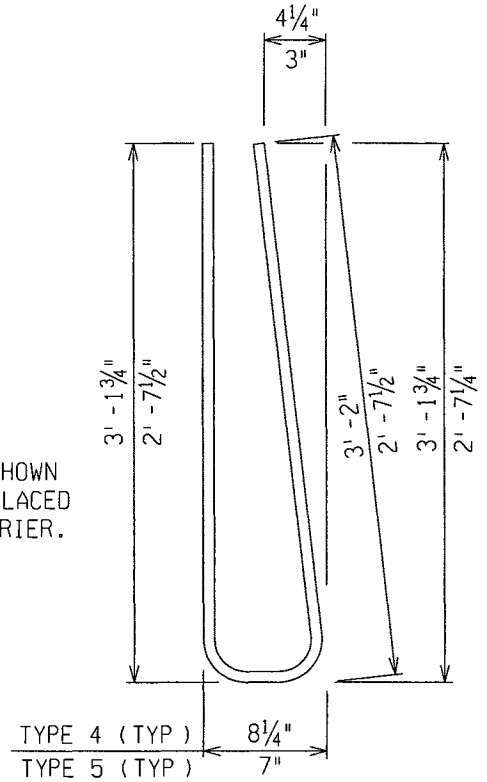


ELEVATION

TYPE 4 BARRIER SHOWN, DETAILS FOR TYPE 5 BARRIER SIMILAR.



NOTE:
USE BAR DIMENSIONS SHOWN ONLY WHEN BARS ARE PLACED PERPENDICULAR TO BARRIER.

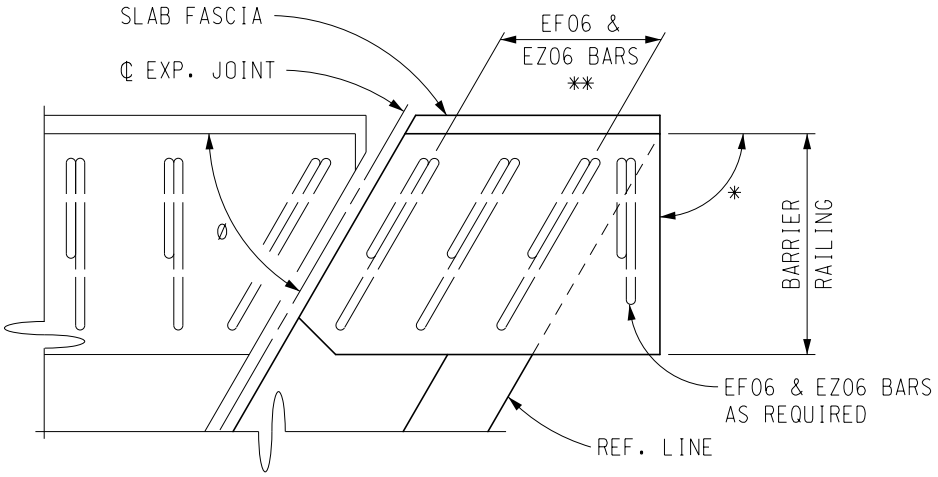


EZ060602 (TYPE 4)
EZ060511 (TYPE 5)

EF060700 (TYPE 4)
EF060510 (TYPE 5)

PREPARED BY DESIGN DIV.	6.29.16

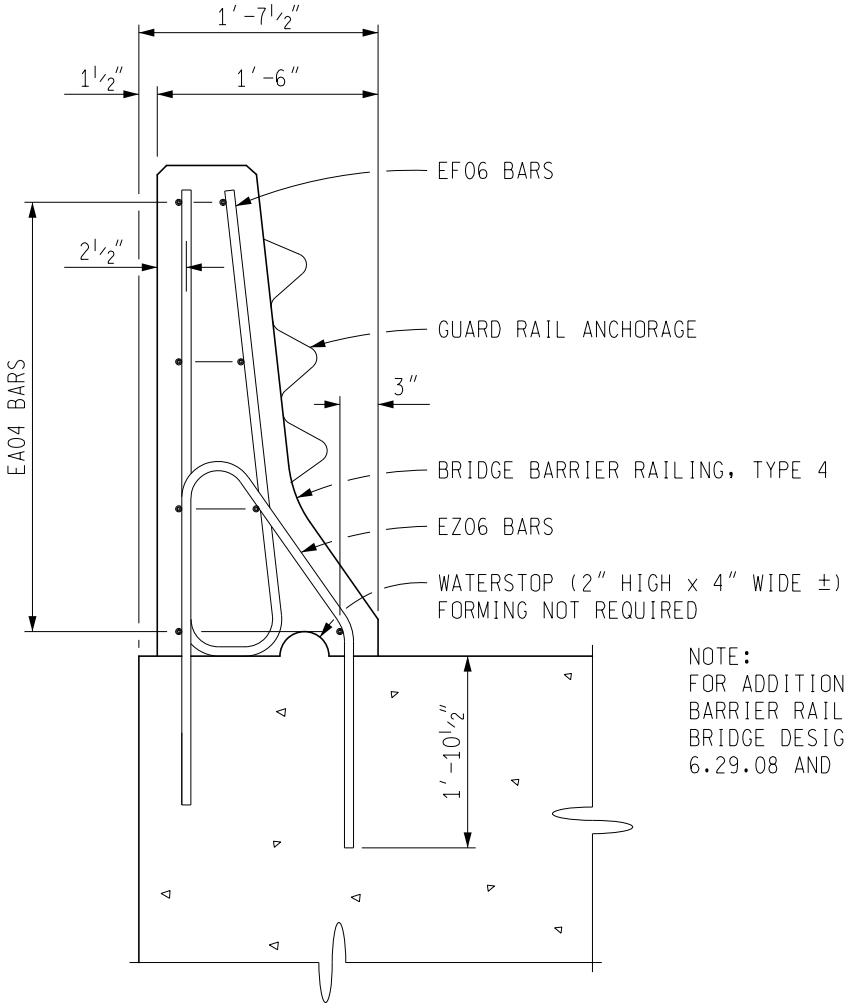
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: DAJ	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT BARRIER RAILING DETAILS AT INDEPENDENT BACKWALL	ISSUED: 05/23/16 SUPERSEDES: 05/04/06



PLAN

* WHEN Ø ≤ 70° OR Ø ≥ 110°, CAST BARRIER END SQUARE; OTHERWISE CAST PARALLEL TO REFERENCE LINE.

** WHEN Ø ≤ 80° OR Ø ≥ 100°, PLACE BARS PARALLEL TO REFERENCE LINE, OTHERWISE PLACE PERPENDICULAR TO BARRIER.



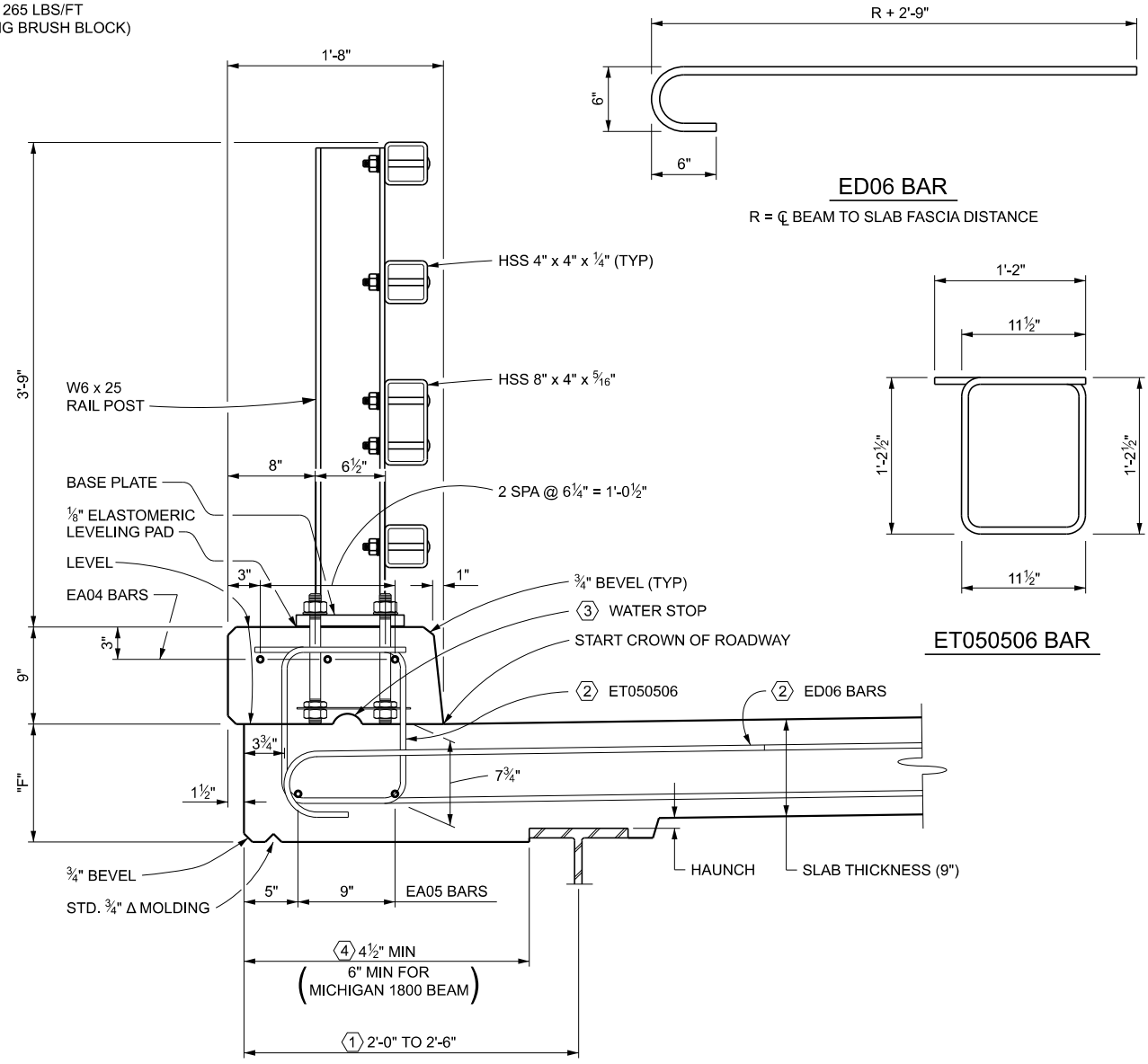
NOTE:
FOR ADDITIONAL DETAILS OF BARRIER RAILINGS, SEE BRIDGE DESIGN GUIDES 6.29.08 AND 6.29.09.

SECTION A-A

PREPARED BY DESIGN DIVISION	6.29.16A

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BRIDGE RAILING, 4 TUBE BICYCLE RAILING OPTION	ISSUED: 07/27/26 SUPERSEDES: 01/26/26

WEIGHT = 265 LBS/FT
(INCLUDING BRUSH BLOCK)



NOTES:

"F" CONSTANT EQUALS SLAB THICKNESS PLUS THICKEST FASCIA BEAM FLANGE PLUS ½" PLUS AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN MINIMUM SLAB THICKNESS AT CURB PLUS HAUNCH (1").

IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

THE DETAILED REINFORCEMENT IN THE SLAB (EA05 & ED06 BARS) IS THE MINIMUM FOR THE RAILING. THE DESIGN OF THE SLAB OVERHANG MAY REQUIRE ADDITIONAL REINFORCEMENT (OR INCREASING THE REINFORCEMENT AREA (DIAMETER) SHOWN). BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

FOR ADDITIONAL DETAILS OF RAILING, SEE STANDARD PLAN B-26-SERIES.

1 IT IS PREFERRED TO PROVIDE A MINIMUM OF 1'-0" OF CLEARANCE FROM THE ET BARS TO THE FASCIA BEAM CENTERLINE TO PERMIT SUPPORT OF THE SCREED RAIL ALONG THE TOP OF THE FASCIA BEAM. IF SUPERSTRUCTURE GEOMETRY DOES NOT ALLOW FOR THIS 1'-0" MINIMUM DISTANCE, ALTERNATE SCREED RAIL SUPPORT METHODS MAY BE REQUIRED. IF THIS SCENARIO APPLIES, CONTACT BOBS BRIDGE CONSTRUCTION TO DISCUSS ALTERNATE SCREED RAIL OPTIONS, BRIDGE DECK FINISHING OPTIONS, AND PROPOSED SUPERSTRUCTURE CONSTRUCTABILITY.

2 AT EACH POST PLACE 7 - ET050506 BARS SPACED AT 6" AND ED06 BARS WITH ALTERNATE ET05 BARS. PLACE ET05 AND ED06 BARS AT 12" MAX IN REMAINING AREAS.

3 2" HIGH x 4" WIDE (±). FORMING NOT REQUIRED.

4 4½" MINIMUM APPLIES TO CURVED GIRDERS ONLY.

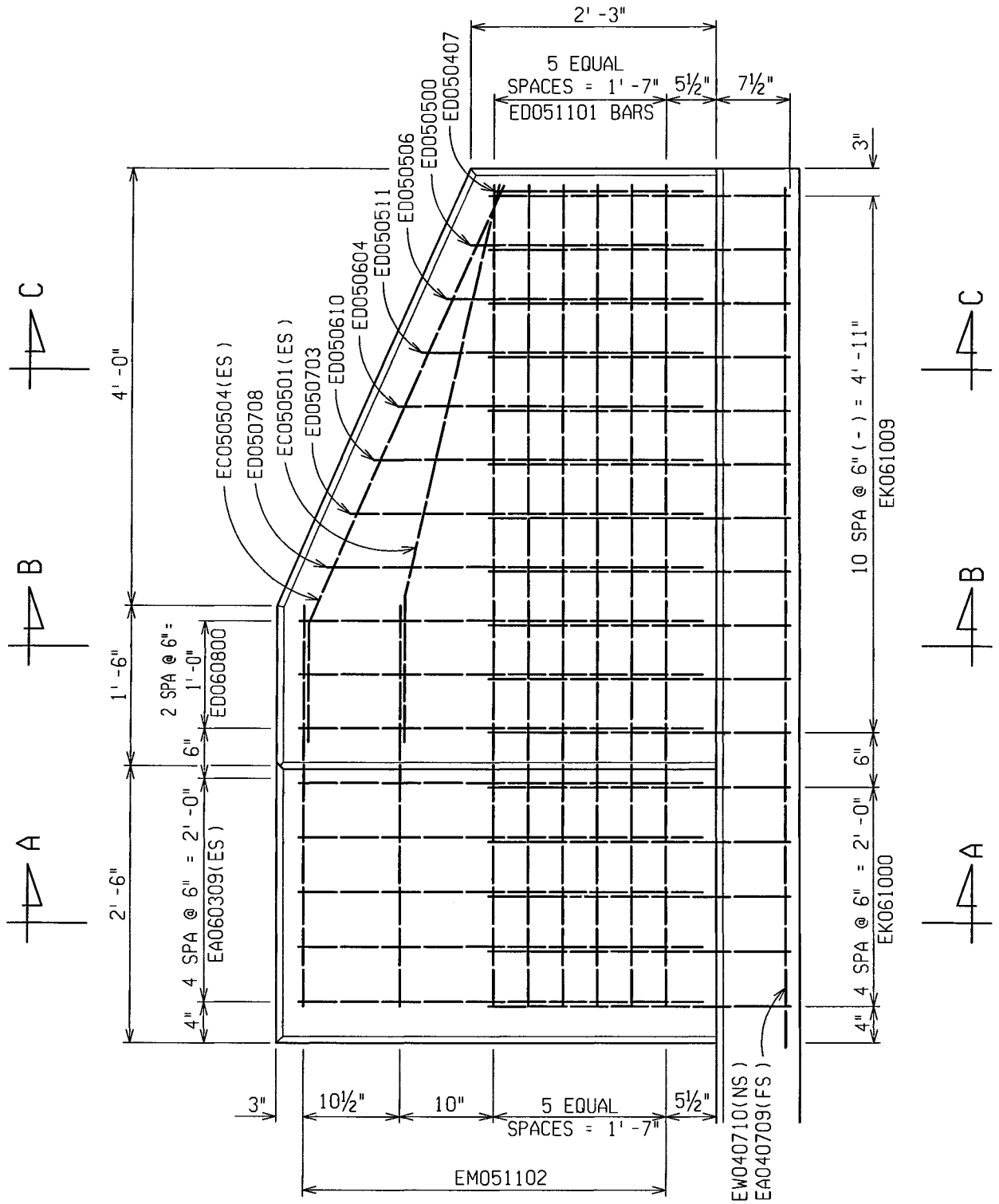
PREPARED BY DESIGN DIVISION	6.29.17

DRAWN BY:	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED:
CHECKED BY:		SUPERSEDES:
APPROVED BY:		

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PREPARED BY DESIGN DIVISION	

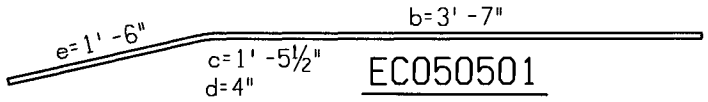
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT **BRIDGE RAILING, 4 TUBE** **BICYCLE RAILING OPTION END WALL**	ISSUED: 08/15/03 SUPERSEDES: / /



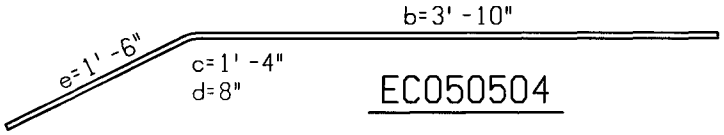
FOR REINFORCEMENT DETAILS SEE BRIDGE GUIDE 6.29.17C
FOR END WALL SECTIONS SEE BRIDGE GUIDE 6.29.17D

PREPARED BY DESIGN SUPPORT AREA	6.29.17B

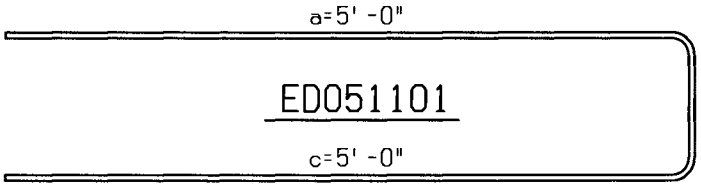
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: T&F	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT BRIDGE RAILING, 4 TUBE BICYCLE RAILING OPTION END WALL	ISSUED: 08/15/03 SUPERSEDES: / /



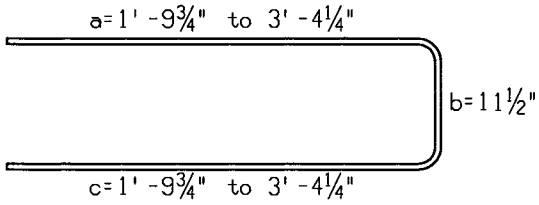
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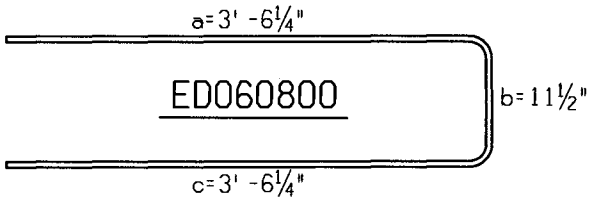


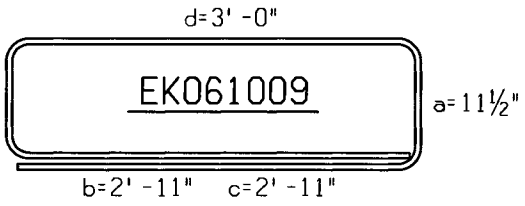
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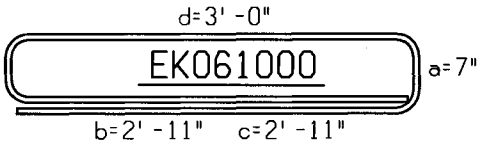


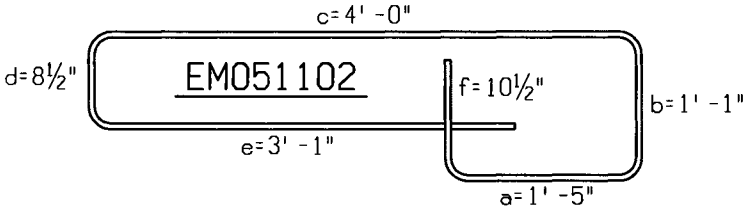
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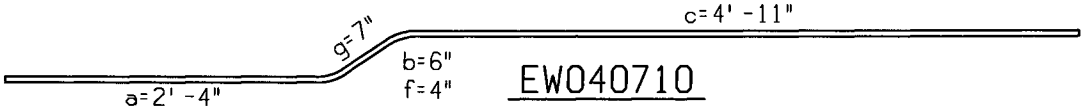








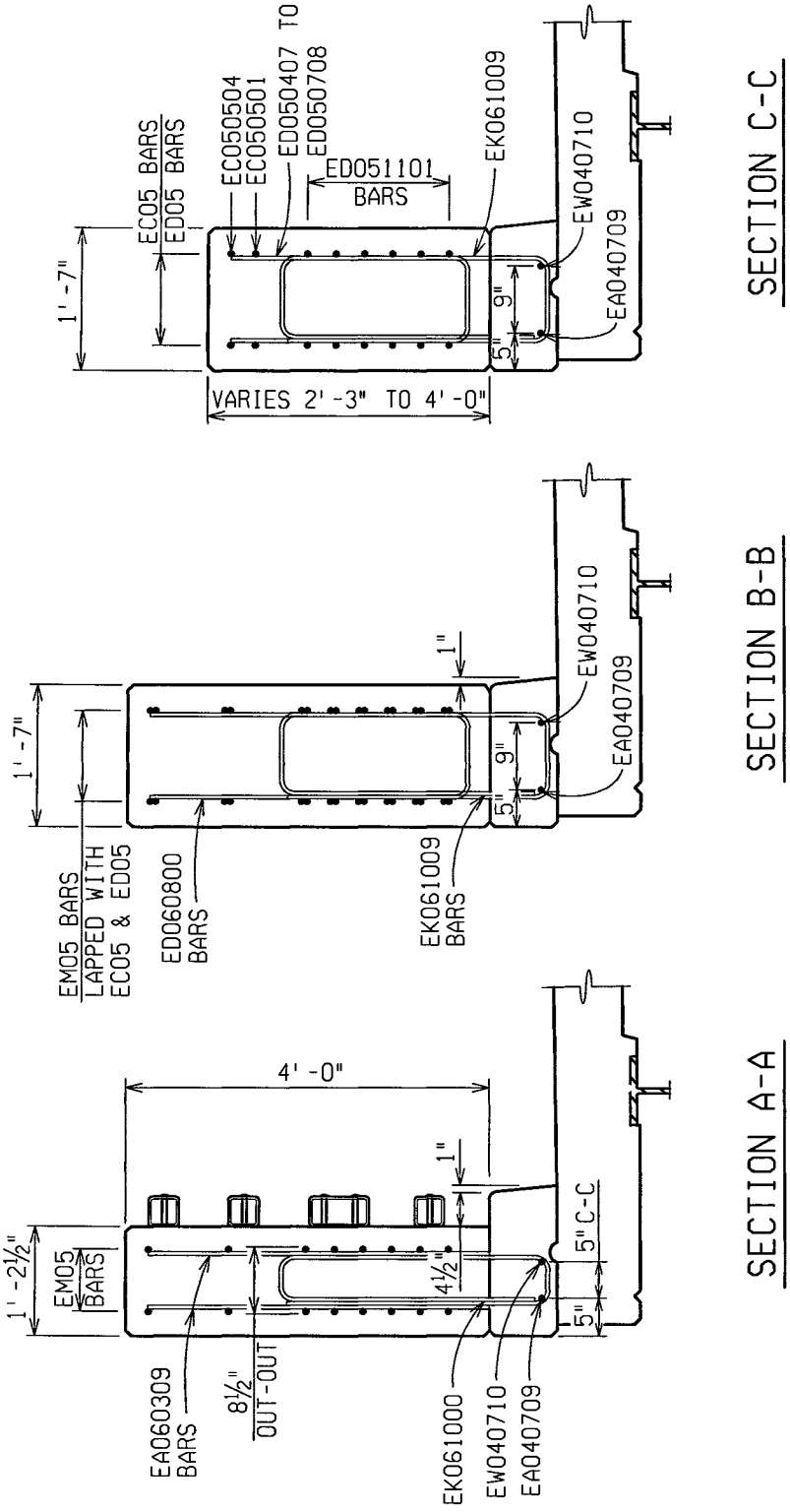




EW040710

PREPARED BY DESIGN SUPPORT AREA	6.29.17C

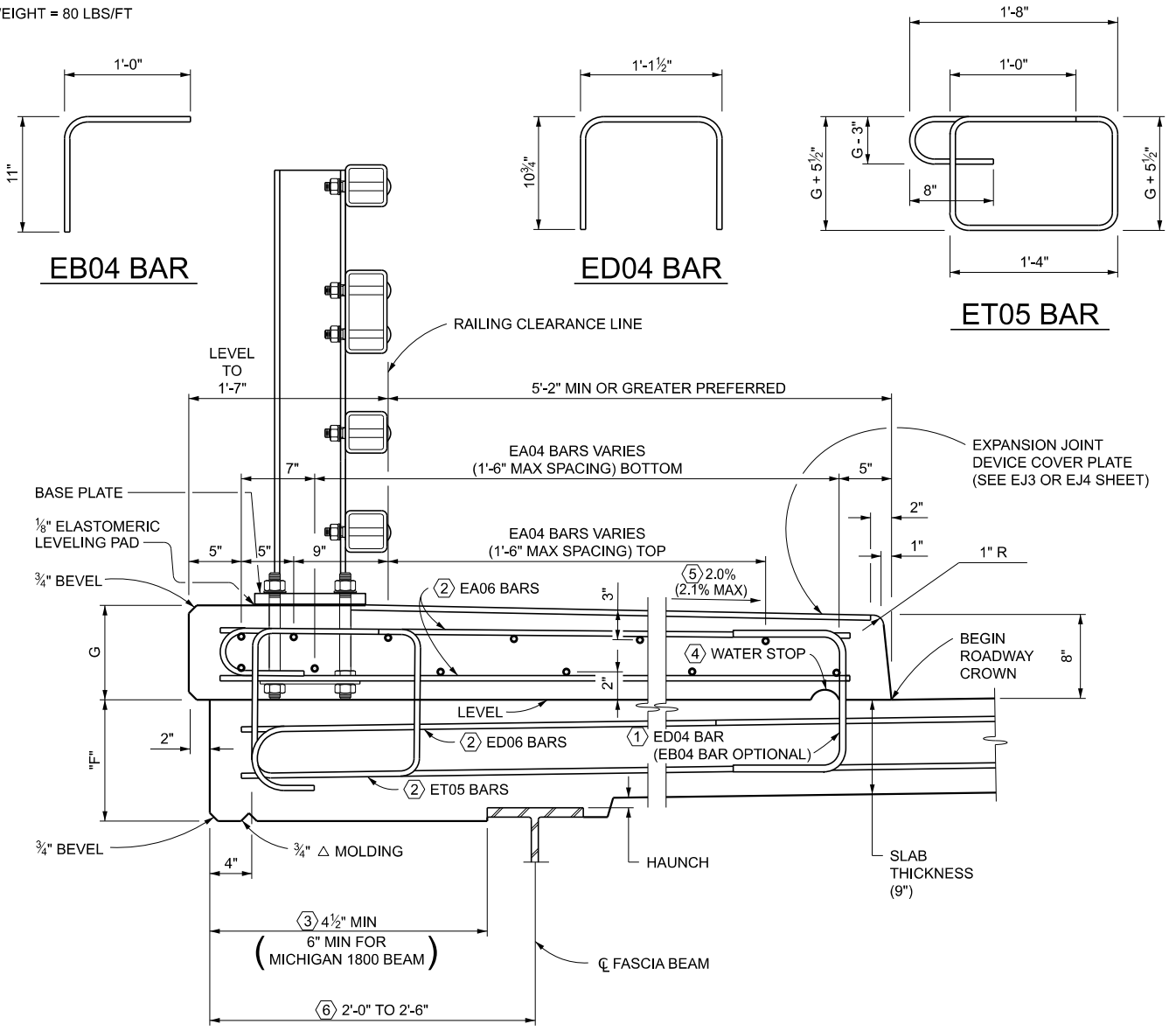
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT BRIDGE RAILING, 4 TUBE BICYCLE RAILING SECTIONS	ISSUED: 08/15/03 SUPERSEDES: / /



PREPARED BY DESIGN SUPPORT AREA	6.29.17D

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 07/27/26
CHECKED BY: CWC	BRIDGE RAILING, 4 TUBE - SIDEWALK SECTION PEDESTRIAN RAILING OPTION	SUPERSEDES: 01/26/26
APPROVED BY: BMW		

WEIGHT = 80 LBS/FT



NOTES:

"F" CONSTANT EQUALS SLAB THICKNESS PLUS HAUNCH PLUS THICKEST FASCIA BEAM FLANGE PLUS ½" PLUS AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN SLAB THICKNESS AT CURB LINE.

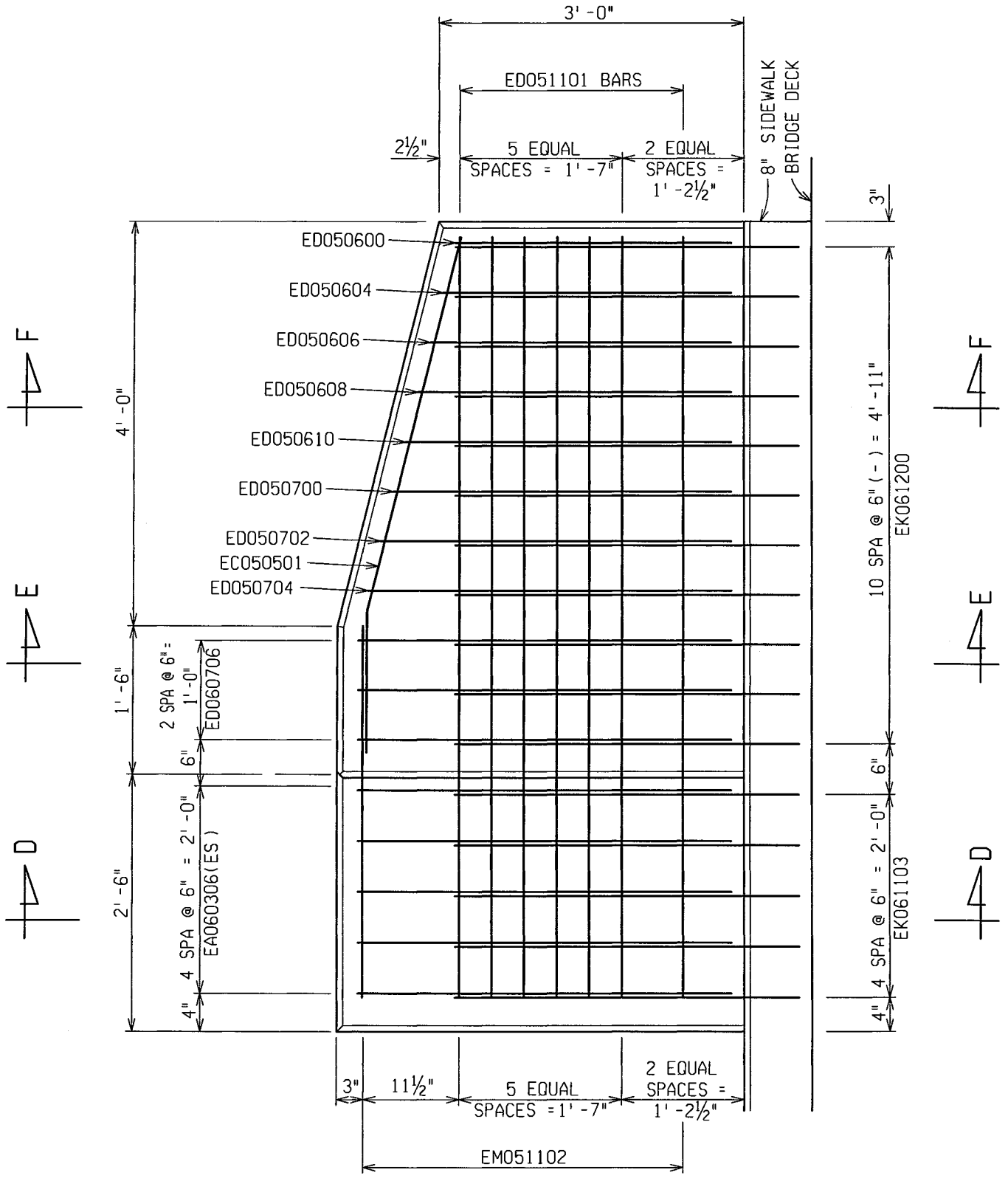
IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

THE DETAILED REINFORCEMENT IN THE SLAB (ED06 BARS) IS THE MINIMUM FOR THE RAILING. THE DESIGN OF THE SLAB OVERHANG MAY REQUIRE ADDITIONAL REINFORCEMENT (OR INCREASING THE REINFORCEMENT AREA (DIAMETER) SHOWN). BARS WITH PREFIX "E" ARE TO BE EPOXY COATED.

1. EB04 BAR MAY BE ADHESIVE ANCHORED INTO 6" DEEP HOLE INSTEAD OF ED04 BAR. SPACE WITH ALTERNATE TRANSVERSE SLAB BARS (1'-6" MAX).
2. AT EACH POST PLACE 7 - ET05 BARS SPACED AT 6", ED06 BARS (SEE GUIDE 6.29.17) AND EAO6 BARS WITH ALTERNATE ET05 BARS. PLACE ET05 BARS, ED06 BARS AND EA06 BARS AT 12" MAXIMUM IN REMAINING AREAS.
3. APPLIES TO CURVED BRIDGES ONLY.
4. 2" HIGH x 4" WIDE (±). FORMING NOT REQUIRED.
5. USE A TARGET CROSS SLOPE (2.0%) LESS THAN THE MAXIMUM TO ACCOUNT FOR INCONSISTENCIES IN CONCRETE FINISHING.
6. IT IS PREFERRED TO PROVIDE A MINIMUM OF 1'-0" OF CLEARANCE FROM THE ET BARS TO THE FASCIA BEAM CENTERLINE TO PERMIT SUPPORT OF THE SCREED RAIL ALONG THE TOP OF THE FASCIA BEAM. IF SUPERSTRUCTURE GEOMETRY DOES NOT ALLOW FOR THIS 1'-0" MINIMUM DISTANCE, ALTERNATE SCREED RAIL SUPPORT METHODS MAY BE REQUIRED. IF THIS SCENARIO APPLIES, CONTACT BOBS BRIDGE CONSTRUCTION TO DISCUSS ALTERNATE SCREED RAIL OPTIONS, BRIDGE DECK FINISHING OPTIONS, AND PROPOSED SUPERSTRUCTURE CONSTRUCTABILITY.

PREPARED BY DESIGN DIVISION	6.29.17E

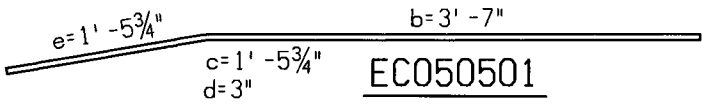
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT BRIDGE RAILING, 4 TUBE PEDESTRIAN RAILING OPTION END WALL	ISSUED: 08/15/03 SUPERSEDES: / /



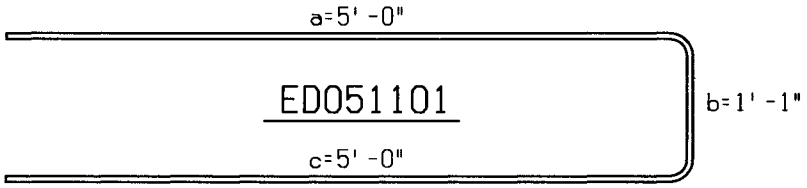
FOR REINFORCEMENT DETAILS SEE BRIDGE GUIDE 6.29.17G.
FOR END WALL SECTIONS SEE BRIDGE GUIDE 6.29.17H

PREPARED BY DESIGN SUPPORT AREA	6.29.17F

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT BRIDGE RAILING, 4 TUBE PEDESTRIAN RAILING OPTION END WALL	ISSUED: 08/15/03 SUPERSEDES: / /

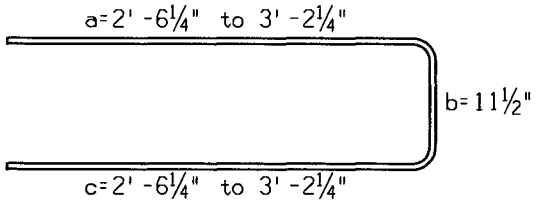


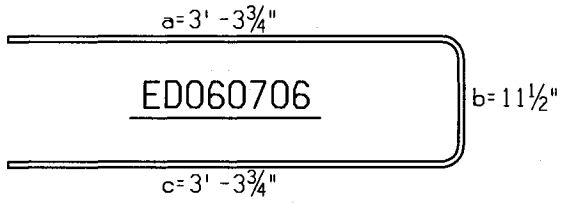
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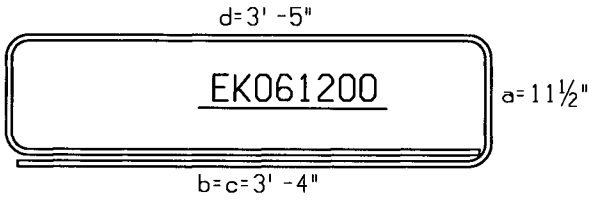


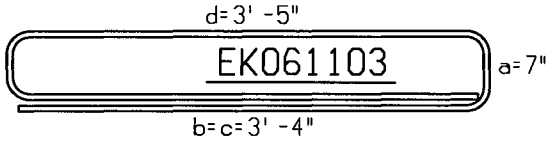
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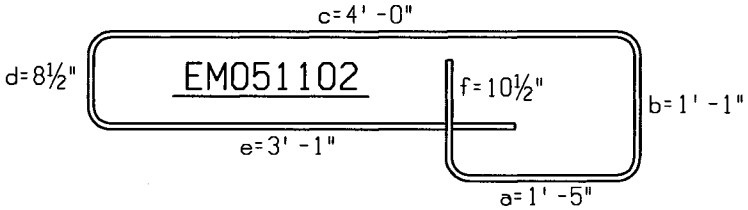
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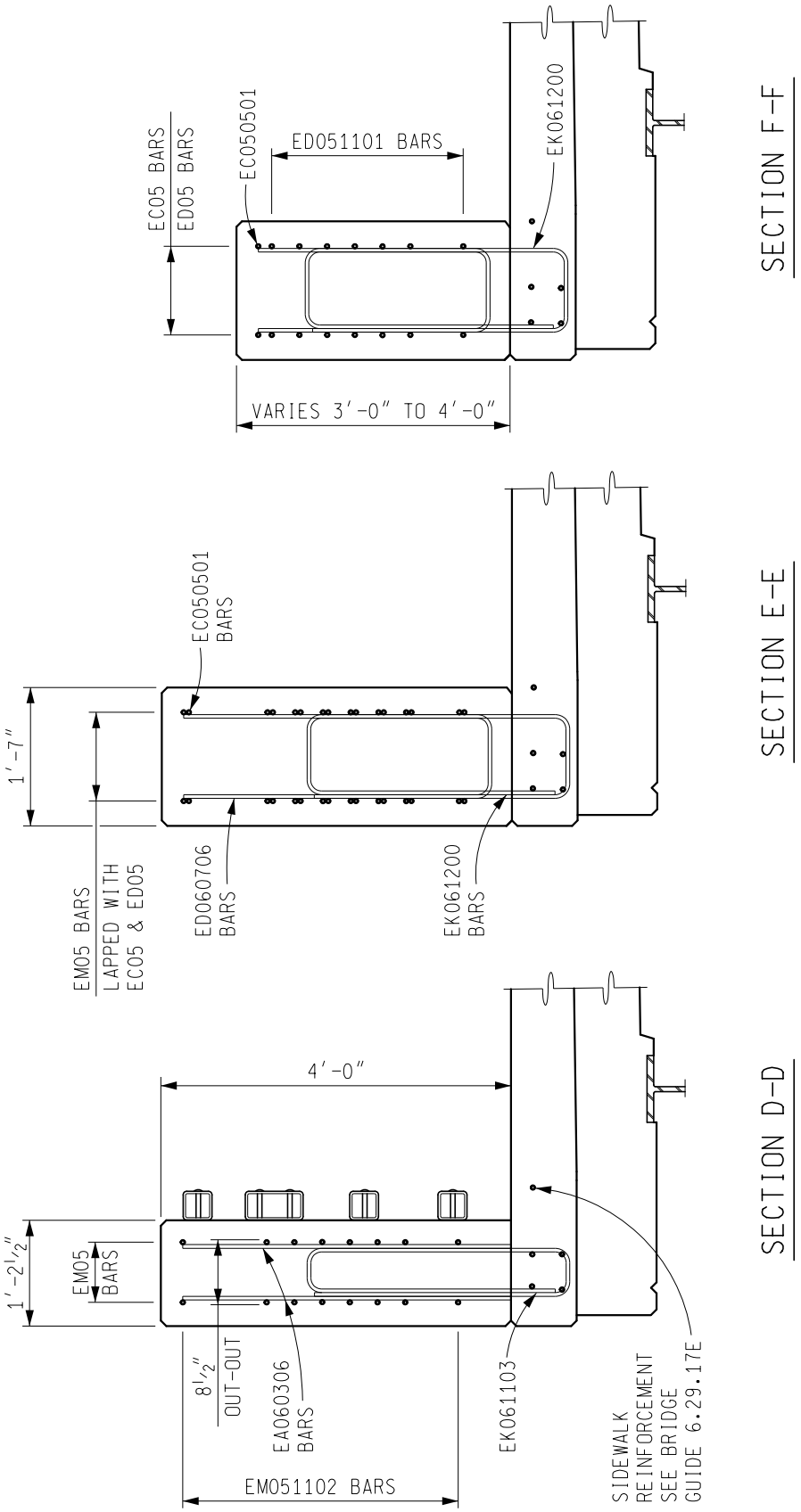






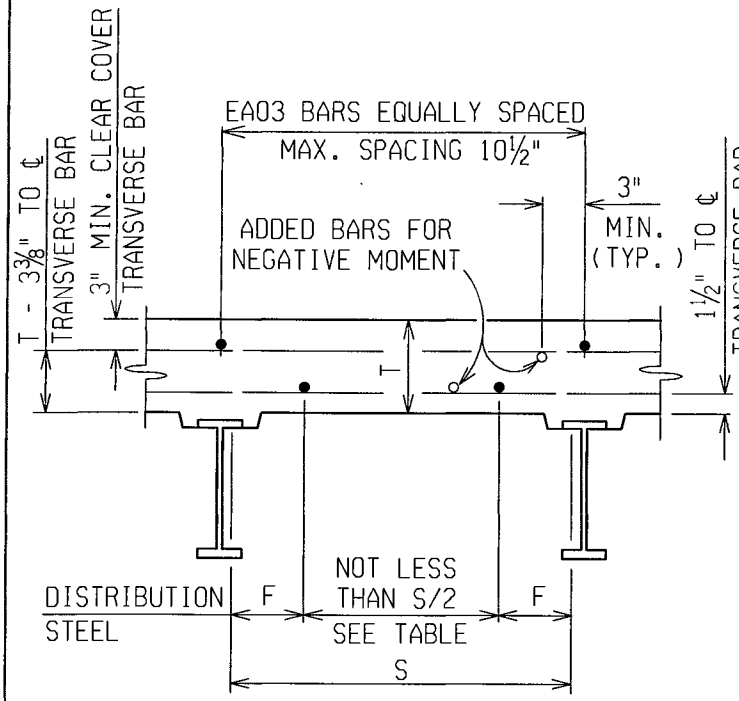
PREPARED BY DESIGN SUPPORT AREA	6.29.17G

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: DAJ	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT BRIDGE RAILING, 4 TUBE PEDESTRIAN RAILING SECTION	ISSUED: 05/23/16 SUPERSEDES: 08/15/03



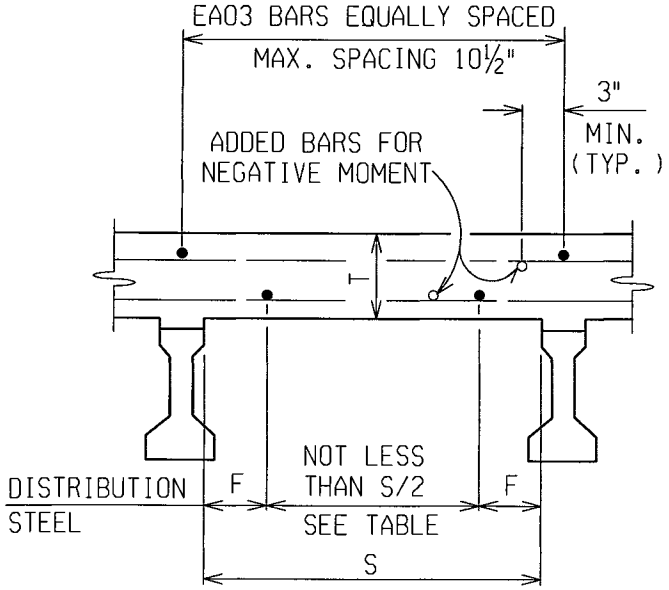
PREPARED BY DESIGN DIVISION	6.29.17H

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT **STANDARD BRIDGE SLABS** **(LOAD FACTOR DESIGN)**	ISSUED: 05/04/06 SUPERSEDES: 11/27/01



S = BEAM SPACING MINUS 1/2 FLANGE WIDTH

SLAB ON STEEL BEAMS



S = BEAM SPACING MINUS TOP FLANGE WIDTH

SLAB ON PRESTRESSED I-BEAMS

FOR 70" PRESTRESSED I-BEAMS AND MICHIGAN 1800 GIRDER, S = BEAM SPACING MINUS ½ TOP FLANGE WIDTH.

FOR SPREAD BOX BEAMS, S= BEAM SPACING MINUS TOP FLANGE WIDTH.

NOTES:

ADDITIONAL BARS ARE REQUIRED IN REGIONS OF NEGATIVE MOMENT (SEE AASHTO SPECIFICATION 10.38.4.3).

DISTRIBUTION STEEL BASED ON $220/\sqrt{S}$ OF TRANSVERSE STEEL (67% MAX.)

DESIGN INCLUDES ALLOWANCE OF 25 psf DEAD LOAD FOR FUTURE WEARING SURFACE.

CONCRETE f'c = 4,000 psi; STEEL REINFORCEMENT CONFORMS TO ASTM A615 GRADE 60 (fs = 24,000 psi).

"F" SHOULD NOT EXCEED THE SPACING OF THE DISTRIBUTION STEEL.

DISTRIBUTION STEEL FOR SPREAD BOX BEAMS AND MICHIGAN 1800 GIRDER SHALL BE EQUALLY SPACED SUCH THAT THE DISTANCE BETWEEN THE END BARS AND THE BEAM ℄ DOES NOT EXCEED 1'-0".

DESIGN IS FOR SLABS CONTINUOUS OVER 3 OR MORE SUPPORTS OF SIMILAR STRUCTURAL CAPACITY.

WHERE THE ANGLE OF CROSSING IS 70° OR GREATER, TRANSVERSE BARS MAY BE PLACED PARALLEL TO THE REFERENCE LINES IF "S ALONG THE SKEW" FALLS IN THE SAME BEAM SPACING RANGE AS "S NORMAL TO THE BEAMS" OR THE NEXT LARGER RANGE. "S ALONG THE SKEW" SHOULD BE USED TO DETERMINE THE SLAB REINFORCEMENT.

FOR UNIFORM SPACING OF TOP AND BOTTOM TRANSVERSE STEEL, USE THE TOP TRANSVERSE STEEL SPACING FOR BOTH THE TOP AND BOTTOM STEEL.

INFORMATION IN CHART IS BASED ON A SLAB THICKNESS (T) OF 9".

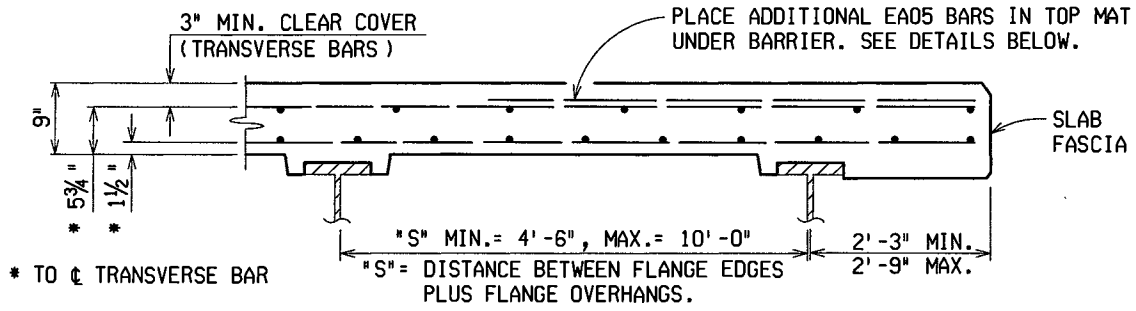
32 kip SINGLE AXLE AND ALL LEGAL LOADS

"S"	TRANSVERSE STEEL (TOP)		TRANVERSE STEEL (BOTTOM)		DISTRIBUTION STEEL	
	BAR SIZE	SPACE in	BAR SIZE	SPACE in	BAR SIZE	SPACE in
9'-10" to 10'-2"	06	7½"	06	7½"	05	8½"
9'-6" to 9'-10"	06	7½"	06	7½"	05	8½"
9'-2" to 9'-6"	06	8"	06	8"	05	8½"
8'-10" to 9'-2"	06	8"	06	8"	05	9"
8'-6" to 8'-10"	06	8½"	06	8½"	05	9"
8'-2" to 8'-6"	06	8½"	06	8½"	05	9½"
7'-10" to 8'-2"	06	9"	06	9"	05	10"
7'-6" to 7'-10"	05	7"	05	7"	04	7"
7'-2" to 7'-6"	05	7"	05	7"	04	7½"
6'-10" to 7'-2"	05	7½"	05	7½"	04	7½"
6'-6" to 6'-10"	05	8"	05	8"	04	8"
6'-2" to 6'-6"	05	8"	05	8"	04	8½"
5'-10" to 6'-2"	05	8½"	05	8½"	04	8½"
5'-6" to 5'-10"	05	9"	05	9"	04	9"
5'-3" to 5'6"	05*	9½"	05	9½"	04	9½"
4'-11" to 5'-3"	05*	9½"	05	9½"	04	10"
4'-7" to 4'-11"	05*	10½"	05	10"	04	10"

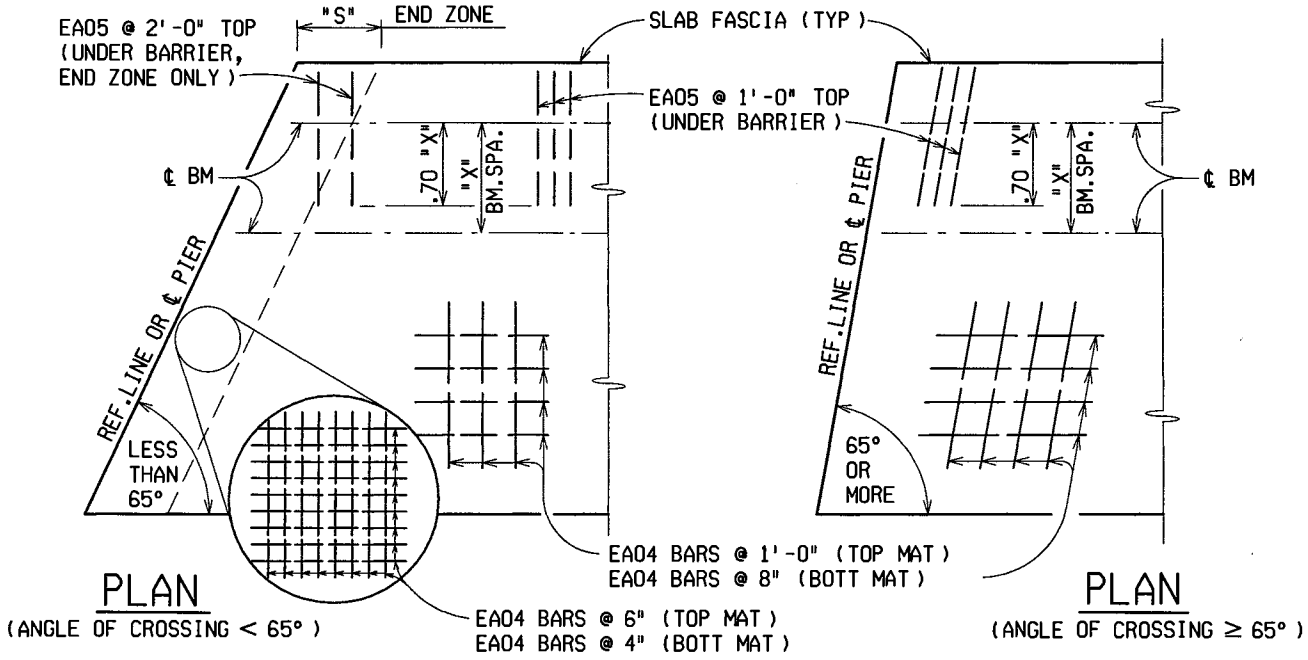
* AT OVERHANG, SPACE ADDITIONAL #03 BARS BETWEEN #05 TRANSVERSE BARS. BAR LENGTH (#03 BAR) SHALL BE THE DISTANCE FROM ℄ FASCIA BEAM TO SLAB FASCIA PLUS 8".

PREPARED BY DESIGN SUPPORT AREA	6.41.01

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAYS TECHNICAL SERVICES STANDARD BRIDGE SLAB (EMPIRICAL DESIGN)	ISSUED: 11/27/01 SUPERSEDES: 05/28/99



SECTION THRU DECK



PLAN
(ANGLE OF CROSSING < 65°)

PLAN
(ANGLE OF CROSSING ≥ 65°)

NOTES:

USE THESE DETAILS ONLY WHERE BARRIER TYPE BRIDGE RAILING IS USED AND SLAB IS MADE COMPOSITE WITH BEAMS OR GIRDERS. SHEAR CONNECTORS SHALL BE PLACED IN NEGATIVE MOMENT REGIONS OF CONTINUOUS BEAMS. (USE UNIFORM SHEAR STUD SPACING OVER ENTIRE LENGTH OF STEEL BEAMS.)

WHERE THE ANGLE OF CROSSING IS 65° OR GREATER, TRANSVERSE BARS MAY BE PLACED PARALLEL TO THE REFERENCE LINES; OTHERWISE, TRANSVERSE REINFORCEMENT SHOULD BE PLACED PERPENDICULAR TO THE BRIDGE ℄ AND SPACED IN EACH "END ZONE" AS SHOWN ABOVE. THE END ZONE REINFORCEMENT IS REQUIRED FOR BOTH CONTINUOUS AND SIMPLY SUPPORTED SPANS.

INTERMEDIATE DIAPHRAGMS SHALL BE USED BETWEEN BOXES AT A SPACING NOT EXCEEDING 25'-0" FOR SPREAD BOX BEAMS.

ADDITIONAL BARS ARE REQUIRED IN NEGATIVE MOMENT REGIONS OF CONTINUOUS SPANS. (SEE AASHTO SPECIFICATION 10.38.4.3).

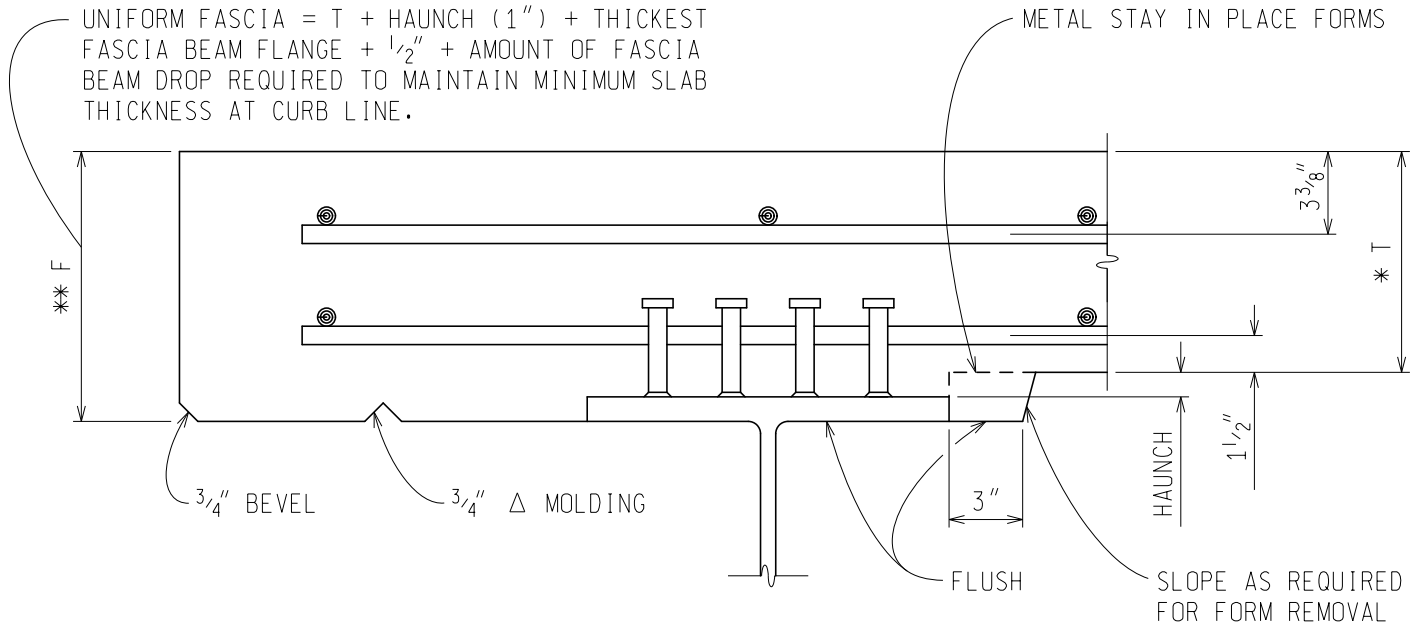
FLANGED REINFORCEMENT SPLICES CHOSEN FROM THE QUALIFIED PRODUCTS LIST MAY BE USED WITH STRUCTURE WIDENING OR PART WIDTH CONSTRUCTION.

FOR PART WIOTH CONSTRUCTION, THE OVERHANG AND ADJACENT BAY SHALL BE REINFORCED WITH THE EQUIVALENT REINFORCEMENT OF A CONVENTIONAL BRIDGE DECK.

CONCRETE f'_c = 4,000 psi; STEEL REINFORCEMENT CONFORMS TO ASTM A615 GRADE 60 (f_s = 24,000 psi).

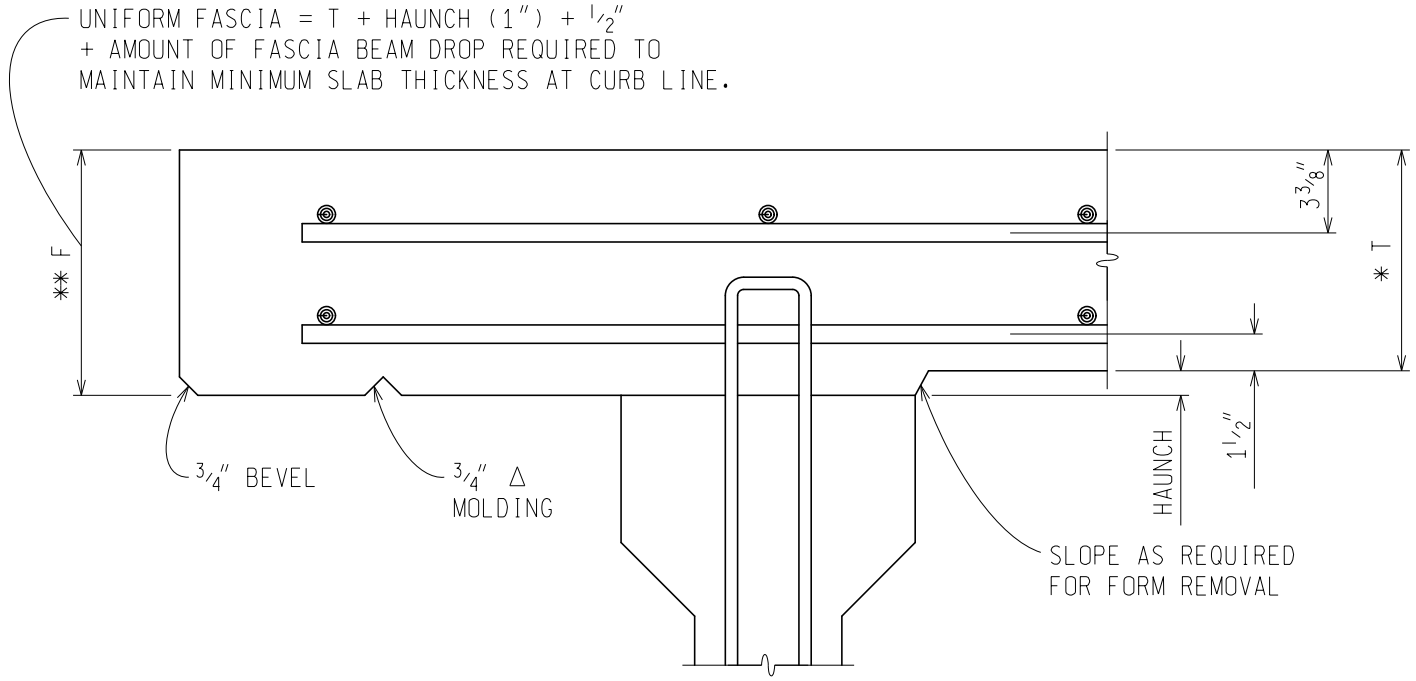
PREPARED BY DESIGN DIV.	6.41.02

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: DAJ	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT SLAB HAUNCH AND REINFORCEMENT COVER	ISSUED: 12/22/11 SUPERSEDES: 11/27/01



FASCIA INTERIOR

STEEL BEAM AND GIRDERS



FASCIA INTERIOR

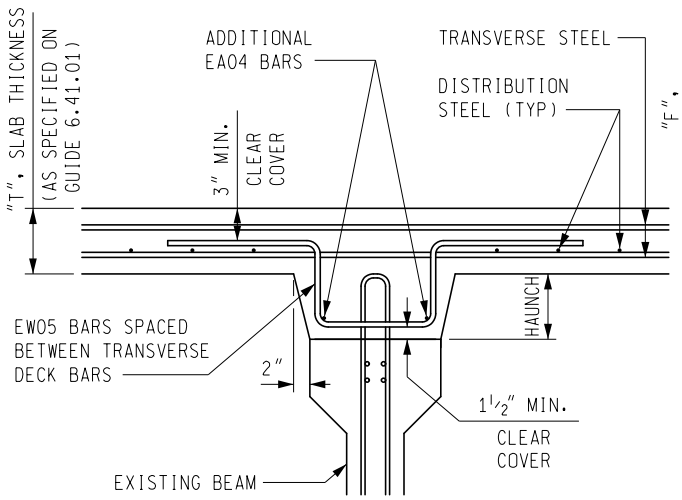
PRESTRESSED CONCRETE I BEAMS

* SLAB THICKNESS "T" AS GIVEN ON GUIDE 6.41.01

** IF "F" BECOMES GREATER THAN 12" USE A HAUNCH DETAIL ON THE FASCIA SIDE OF THE BEAM SIMILAR TO THE HAUNCH DETAIL ON THE INTERIOR SIDE. ADDITIONAL REINFORCEMENT MAY BE REQUIRED IN THE AREA OVER THE BEAM FLANGE IF THE HAUNCH BECOMES EXCESSIVE.

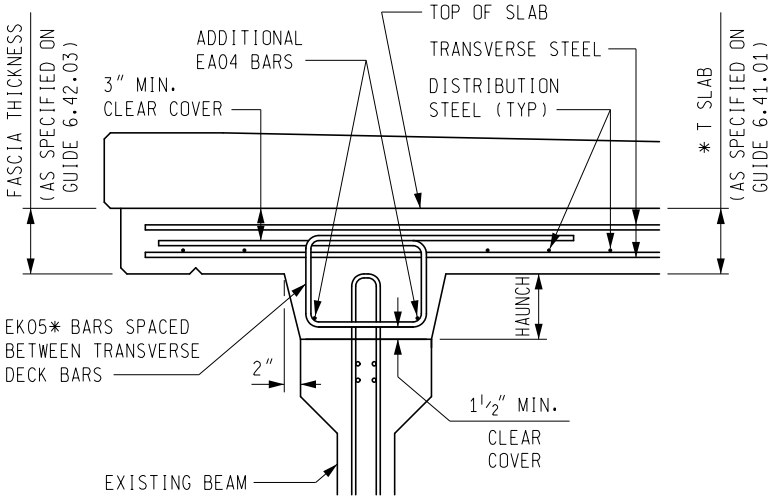
PREPARED BY DESIGN DIVISION	6.42.03

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: DAJ	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT DEEP HAUNCH DETAILS - CONCRETE BEAMS	ISSUED: 09/25/17 SUPERSEDES: 12/19/16



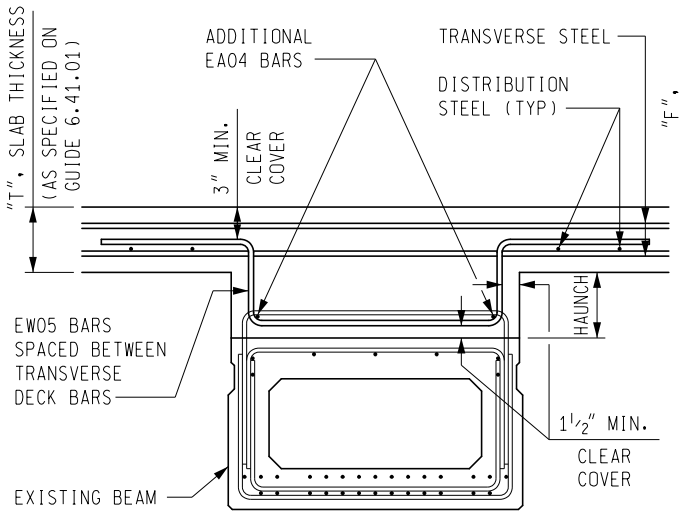
INTERIOR BEAM HAUNCH > 4" DETAIL **

CONVENTIONAL FORMS



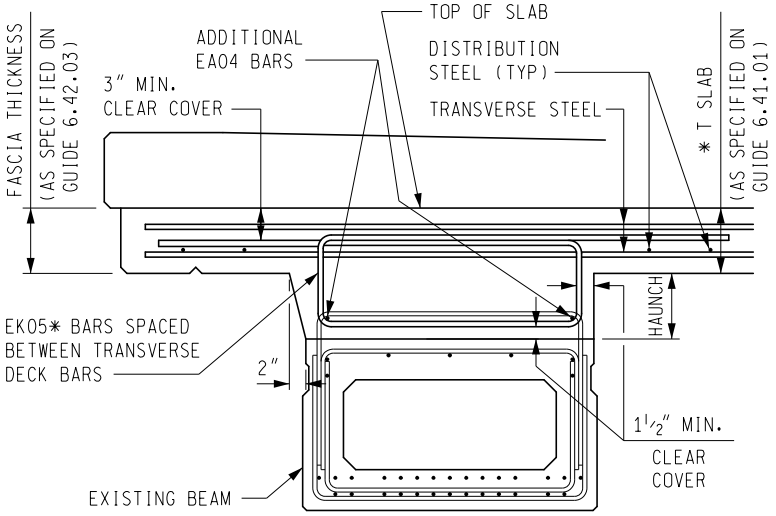
FASCIA BEAM HAUNCH > 4" DETAIL **

CONVENTIONAL FORMS



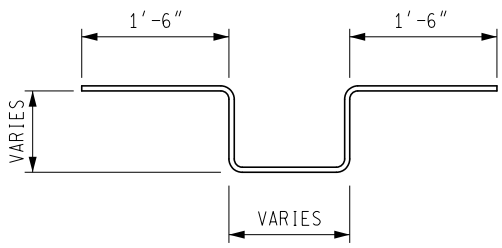
INTERIOR BEAM HAUNCH > 4" DETAIL **

METAL STAY IN PLACE FORMS

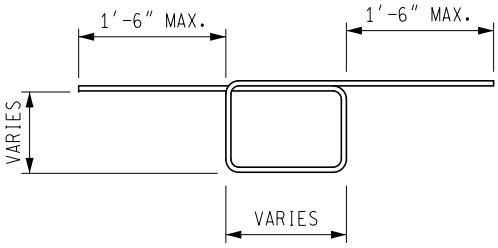


FASCIA BEAM HAUNCH > 4" DETAIL **

METAL STAY IN PLACE FORMS



EW05 BAR



EK05* BAR

NOTES:

* USE EW05 BAR WHEN OVERHANG IS GREATER THAN 1'-6"

DETAIL HAUNCH REINFORCEMENT ON PLAN SHEETS AND STEEL REINFORCEMENT DETAILS SHEET.

SHOW LIMITS OF HAUNCH REINFORCEMENT ALONG THE LENGTH OF EACH BEAM. WHERE LIMITS ARE UNKNOWN PROVIDE EXTRA HAUNCH REINFORCEMENT IN QUANTITY TOTALS.

** FOR BULB-T BEAMS USE WHEN HAUNCH > 3".

PLAN NOTES:
THE HAUNCH REINFORCEMENT QUANTITY SHOWN PROVIDES THE AMOUNT NECESSARY TO COVER THE LIMITS SHOWN ON THE PLANS. ADDITIONAL REINFORCEMENT SHALL BE PROVIDED IN AREAS WHERE THE HAUNCH EXCEEDS 4" IN DEPTH.

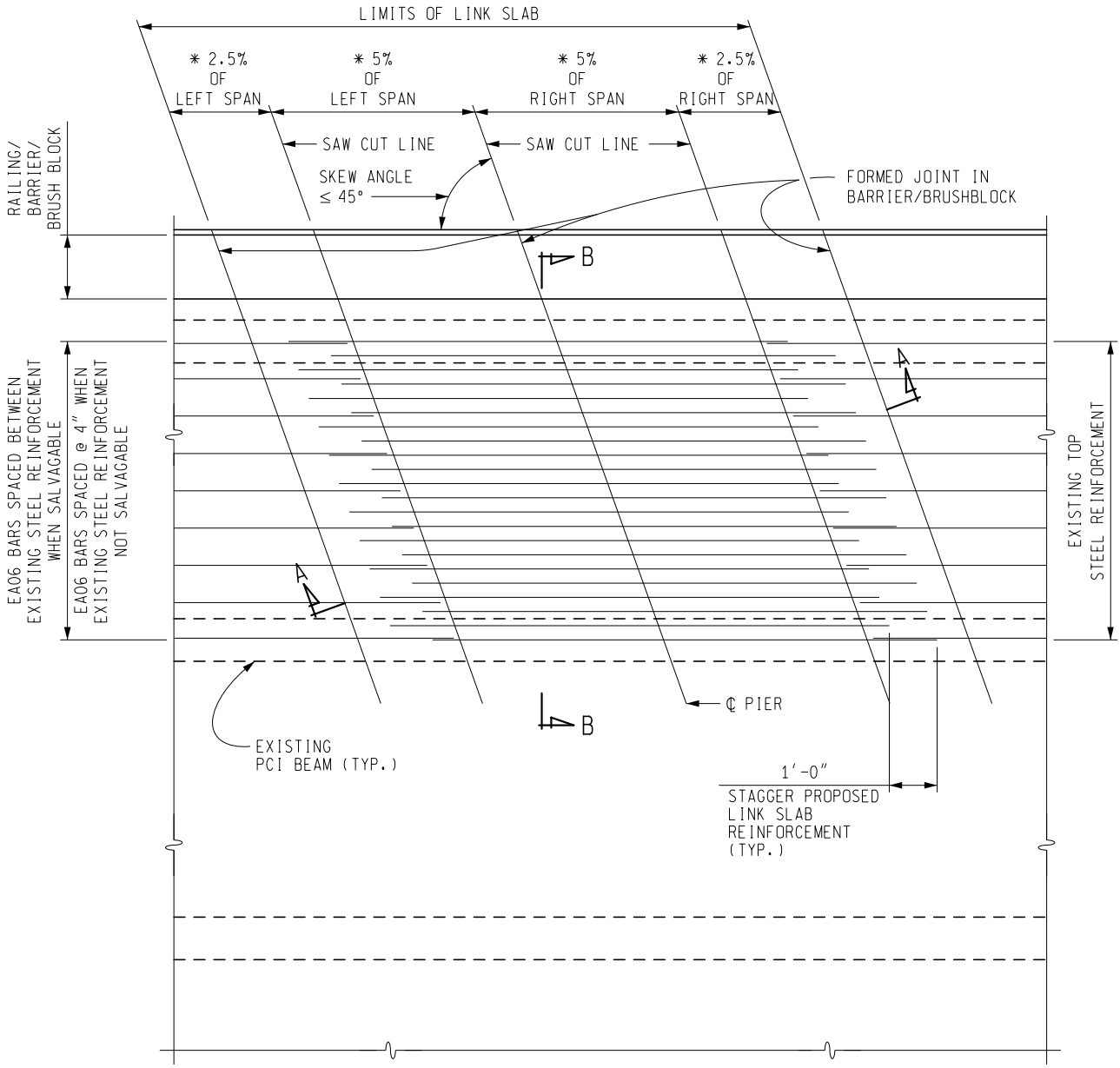
PREPARED BY DESIGN DIVISION	6.42.03A

DRAWN BY: CHECKED BY: APPROVED BY:	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: SUPERSEDES:

BLANK PAGE

PREPARED BY DESIGN DIVISION	

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT LINK SLAB DETAILS	ISSUED: 01/25/21 SUPERSEDES: / /



PARTIAL DECK PLAN AT PIER

(TRANSVERSE STEEL REINFORCEMENT IS NOT SHOWN)
(CONCRETE BEAM SHOWN STEEL BEAM SIMILAR)

NOTES:

USE LINK SLAB DETAILS WHEN SKEW ANGLE IS LESS THAN OR EQUAL TO 45°.

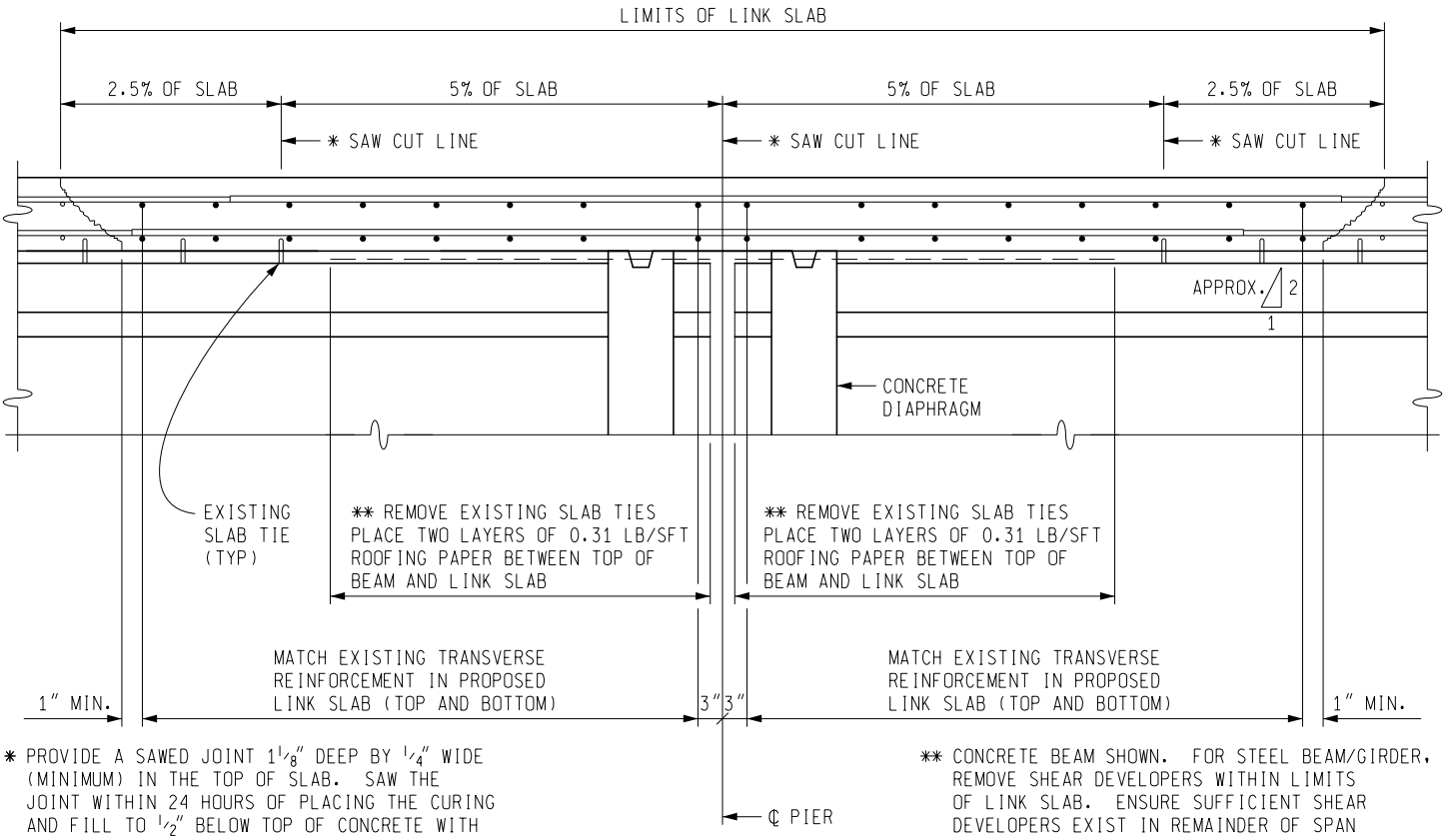
STEEL REINFORCEMENT FOR THE RAILING AND BRUSH BLOCK SHALL BE REPLACED IN KIND AS DIRECTED BY THE ENGINEER AND AS DETAILED ON THE PLANS.

ALL SAW CUTS FOR DECK, BRIDGE RAILING AND BRUSH BLOCK REMOVAL SHALL BE INCLUDED IN THE PAY ITEM "STRUCTURES, REHABILITATION, REM PORTIONS (STRUCTURE NO.)".

* 2.5% AND 5% OF PARTICULAR SPAN. SPAN LENGTHS CAN VARY AND RESULT IN DIFFERING LINK SLAB LENGTHS IN ADJOINING SPANS.

PREPARED BY DESIGN DIVISION	6.44.01

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT LINK SLAB DETAILS	ISSUED: 06/26/23 SUPERSEDES: 01/25/21

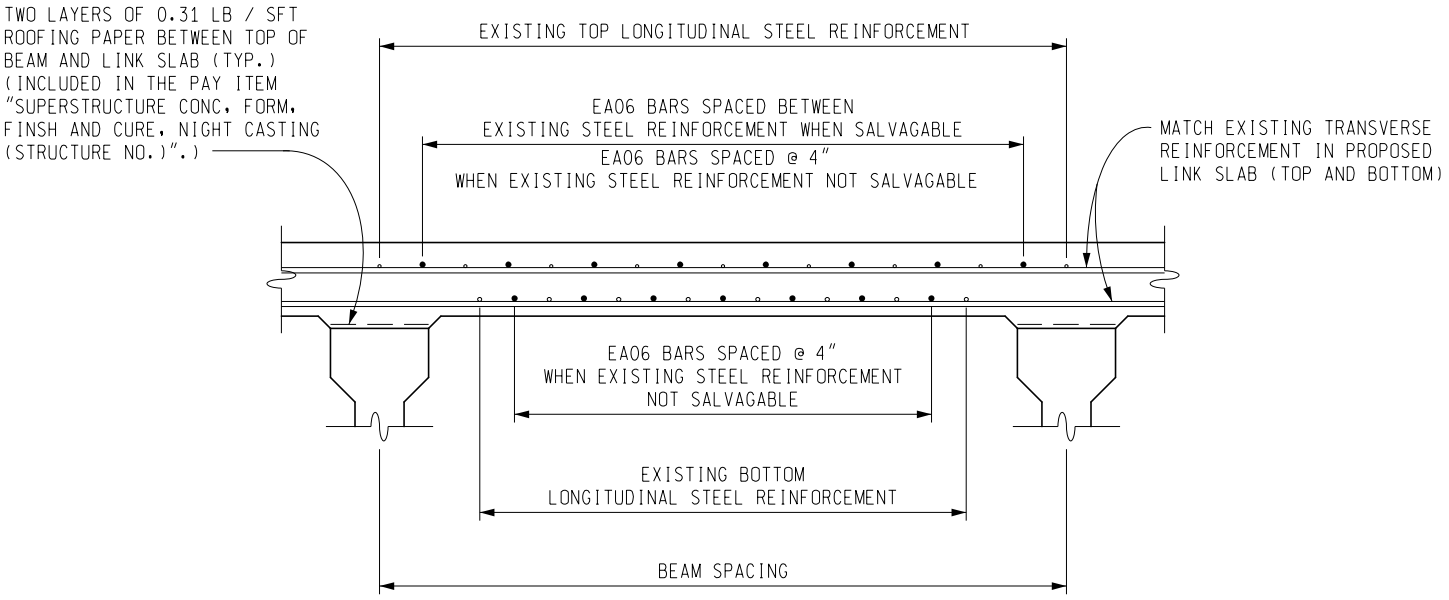


* PROVIDE A SAWED JOINT $1\frac{1}{8}$" DEEP BY $\frac{1}{4}$" WIDE (MINIMUM) IN THE TOP OF SLAB. SAW THE JOINT WITHIN 24 HOURS OF PLACING THE CURING AND FILL TO $\frac{1}{2}$" BELOW TOP OF CONCRETE WITH POLYURETHANE OR POLYURETHANE HYBRID SEALANT. (INCLUDED IN THE BID ITEM "SUPERSTRUCTURE CONC, FORM, FINISH, AND CURE, NIGHT CASTING (STRUCTURE NO.)").

** CONCRETE BEAM SHOWN. FOR STEEL BEAM/GIRDER, REMOVE SHEAR DEVELOPERS WITHIN LIMITS OF LINK SLAB. ENSURE SUFFICIENT SHEAR DEVELOPERS EXIST IN REMAINDER OF SPAN TO PROVIDE FOR HORIZONTAL SHEAR TRANSFER. IF REQUIRED, INCREASE DECK REMOVAL LIMITS TO PERMIT PLACEMENT OF ADDITIONAL SHEAR DEVELOPERS BEYOND THE LINK SLAB.

SECTION A-A

(CONCRETE BEAM SHOWN STEEL BEAM SIMILAR)

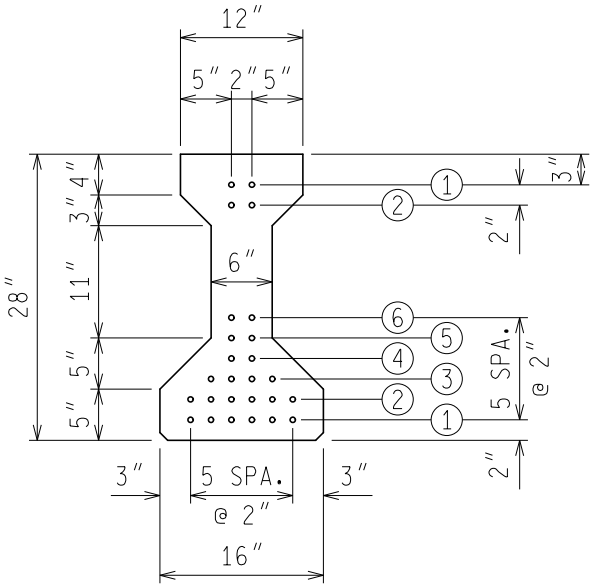


SECTION B-B

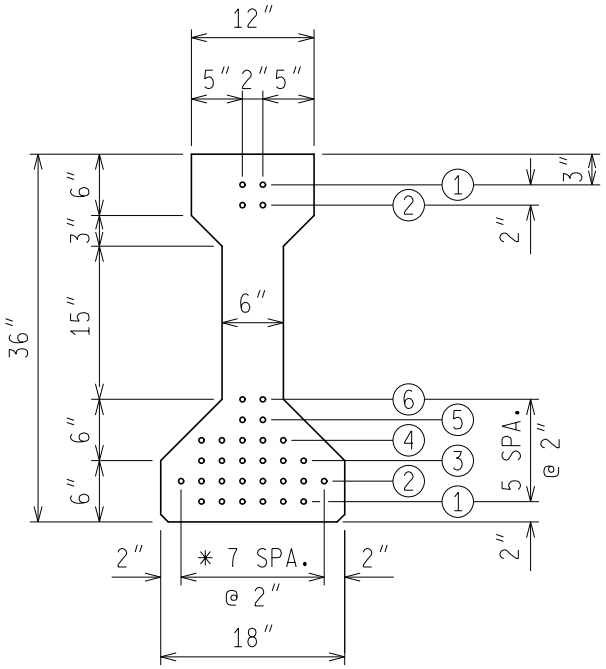
(CONCRETE BEAM SHOWN STEEL BEAM SIMILAR)

PREPARED BY DESIGN DIVISION	6.44.01A

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT PRESTRESSED CONCRETE I-BEAM DETAILS	ISSUED: 02/14/11 SUPERSEDES: 05/04/06

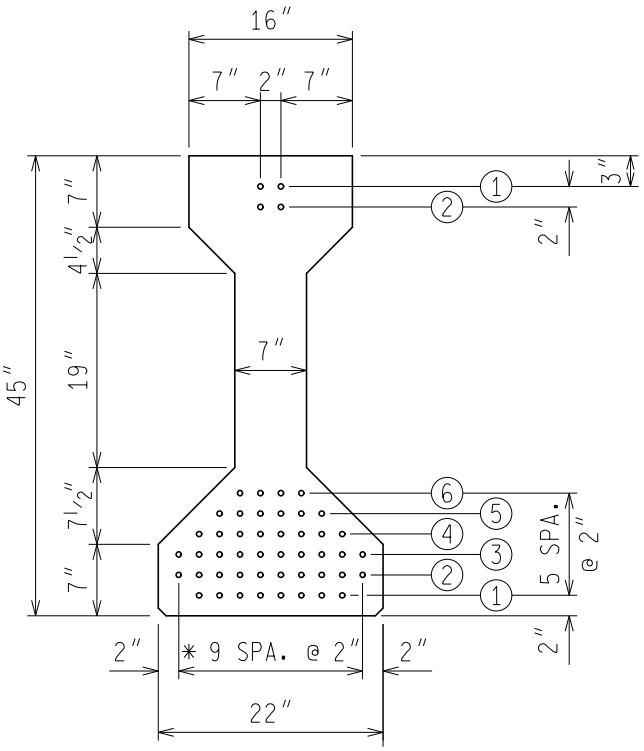


TYPE I



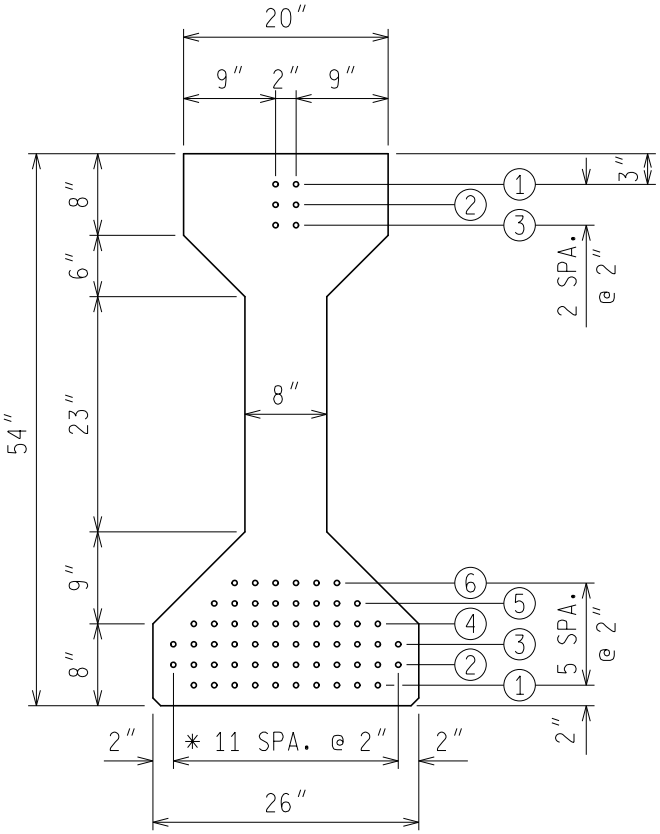
TYPE II

* 5 SPA. @ 2" FOR ROW (1) ONLY



TYPE III

* 7 SPA. @ 2" FOR ROW (1) ONLY



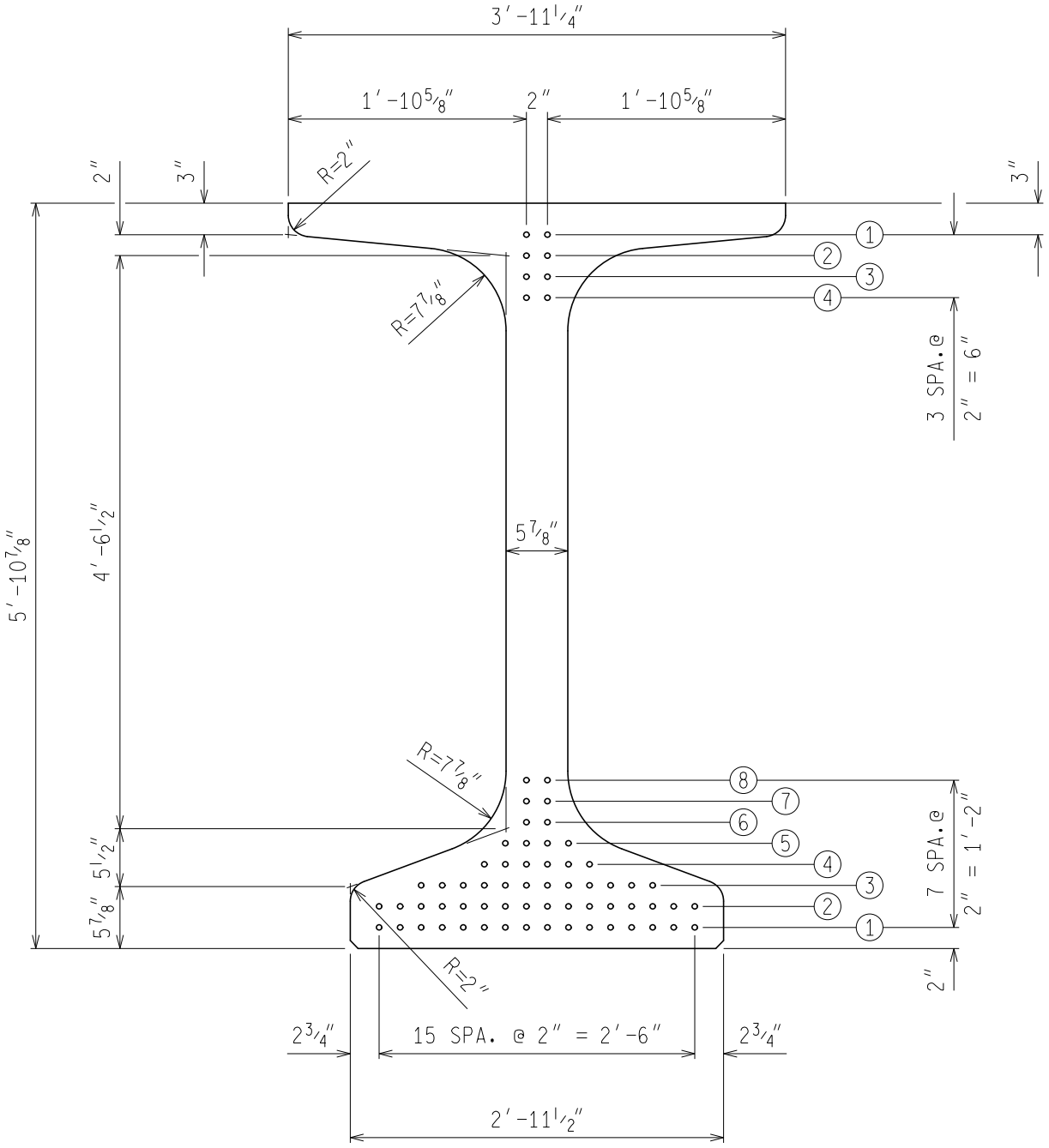
TYPE IV

* 9 SPA. @ 2" FOR ROW (1) ONLY

BEAM PROPERTIES					
TYPE	WEIGHT lbs/ft	AREA in^2	S_T in^3	S_B in^3	I in^4
I	288	276	1475	1805	22,800
II	384	369	2530	3220	51,000
III	583	560	5070	6190	125,000
IV	822	789	8910	10,550	261,000

PREPARED BY DESIGN DIVISION	6.60.01

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT MICHIGAN 1800 GIRDER	ISSUED: 02/14/11 SUPERSEDES: 05/04/06

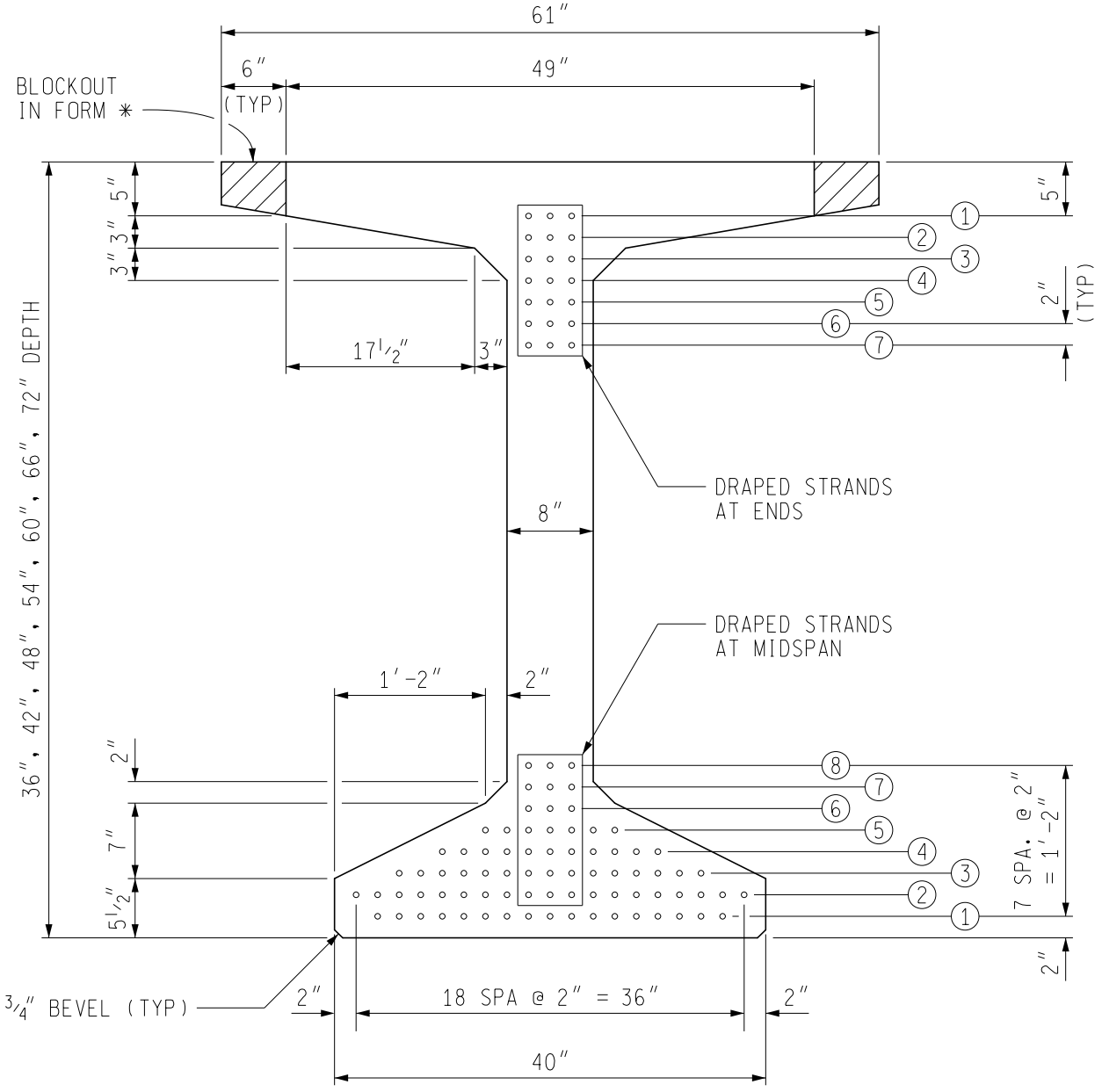


SECTION

BEAM PROPERTIES				
WEIGHT lbs/ft	AREA in^2	S_T in^3	S_B in^3	I in^4
910	875	16,600	18,800	624,700

PREPARED BY DESIGN DIVISION	6.60.02

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BULB TEE BEAM PROPERTIES	ISSUED: 05/22/23 SUPERSEDES: 04/17/17



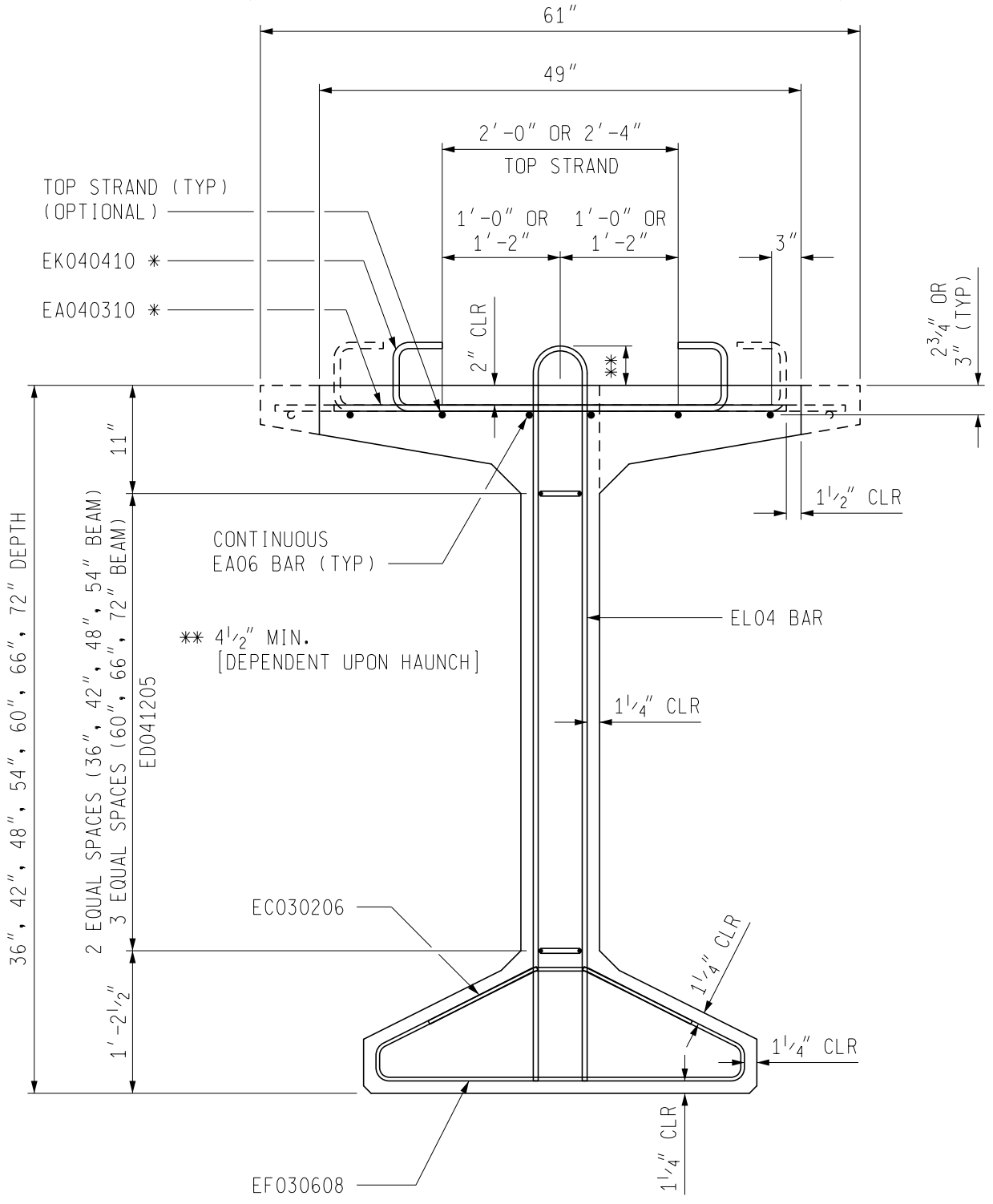
BEAM PROPERTIES

	49″ TOP FLANGE WIDTH				61″ TOP FLANGE WIDTH			
DEPTH	WEIGHT	AREA	Y_{BOT}	I_{xx}	WEIGHT	AREA	Y_{BOT}	I_{xx}
in	lbs/ft	in^2	in	in^4	lbs/ft	in^2	in	in^4
36	915	878.3	18.2	145,592	972	932.4	19.1	158,022
42	965	926.3	21.1	217,461	1022	980.4	22.1	235,306
48	1015	974.3	24.0	305,994	1072	1028.4	25.2	330,233
54	1065	1022.3	27.0	412,056	1112	1076.4	28.2	443,668
60	1115	1070.3	29.9	536,513	1172	1124.4	31.3	576,476
66	1165	1118.3	32.9	680,229	1222	1172.4	34.3	729,521
72	1215	1166.3	35.8	844,069	1272	1220.4	37.3	903,667

* REMOVE BLOCKOUT IN FORM IF REQUIRED FOR COMPRESSION FORCES OR BEAM STABILITY.

PREPARED BY DESIGN DIVISION	6.60.03

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BULB TEE BEAM REINFORCEMENT	ISSUED: 01/23/23 SUPERSEDES: 09/26/22

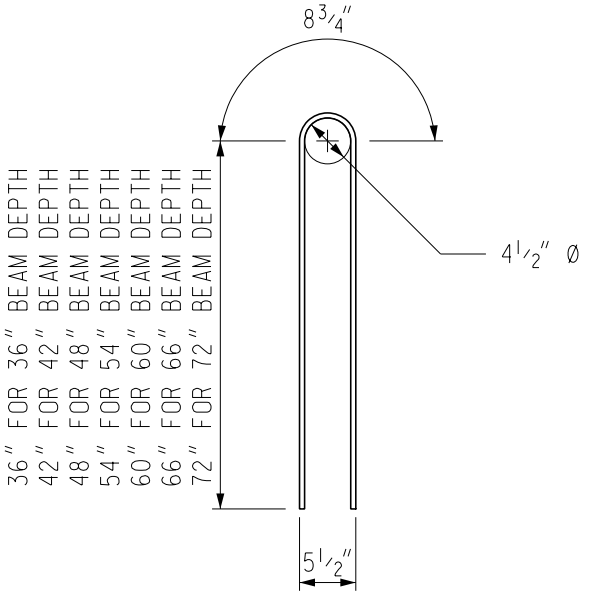


NOTE:
EC030206 AND EF030608 BARS COMBINE TO FORM STIRRUP.

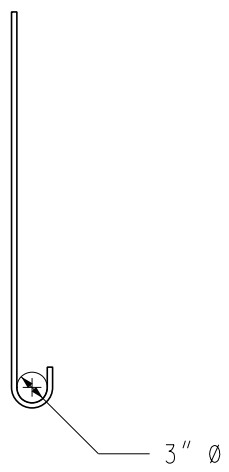
* ALTERNATE EK04 WITH EA04 BARS IF REQUIRED FOR SHEAR/COMPOSITE ACTION. USE EA040410 AND EK040510 WITH BLOCKOUT REMOVAL / 61″ TOP FLANGE, SEE GUIDE 6.60.03B. DECREASE EA04 BAR LENGTHS AT SHORTENED AND/OR CLIPPED TOP FLANGE AND START ALTERNATING EA04 AND EK04 PAST SHORTENING/CLIP. SEE GUIDE 6.60.03C FOR BEAM FLANGE SHORTENING/CLIP DETAILS.

PREPARED BY DESIGN DIVISION	6.60.03A

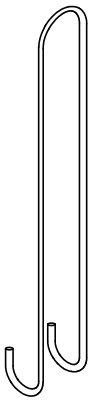
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BULB TEE BEAM REINFORCEMENT	ISSUED: 01/27/20 SUPERSEDES: 04/17/17



END VIEW

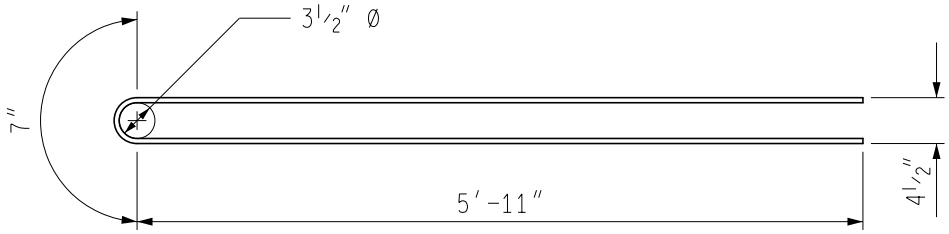


SIDE VIEW

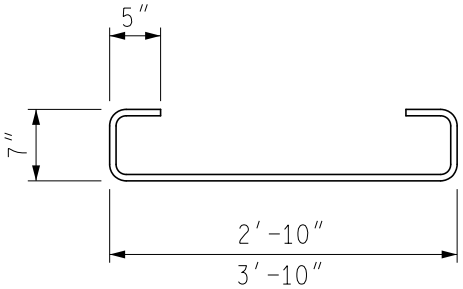


ISOMETRIC VIEW

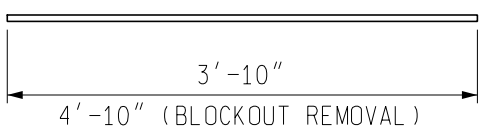
EL04 BAR



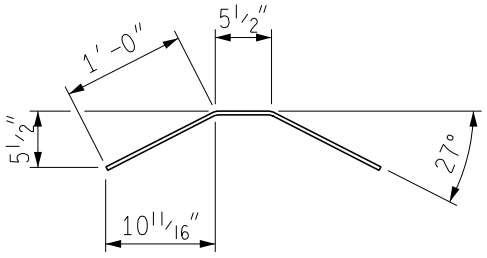
ED041205



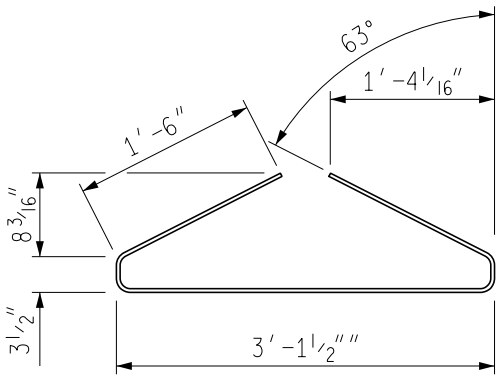
EK040410
(EK040510)
USE FOR SHEAR/COMPOSITE ACTION
OR BLOCKOUT REMOVAL



EA040310
(EA040410)



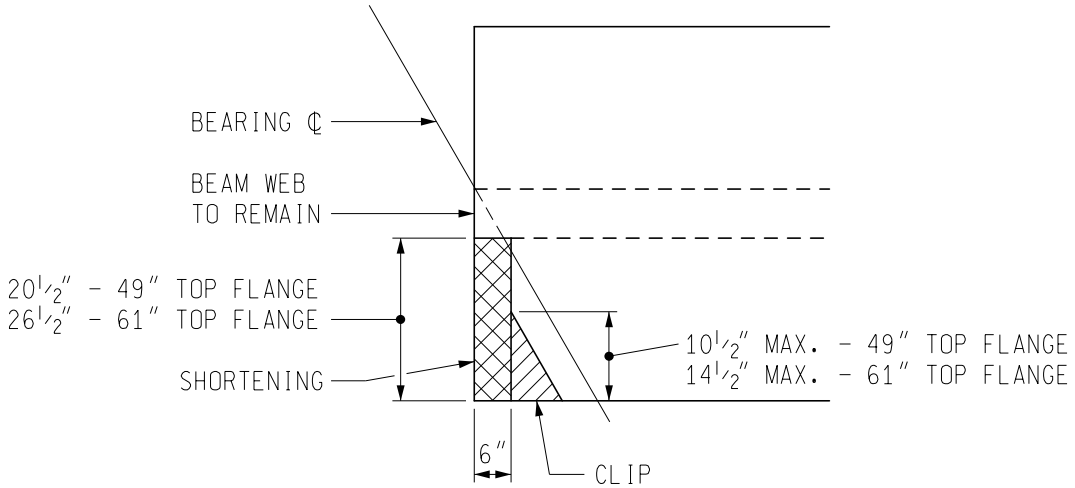
EC030206



EF030608

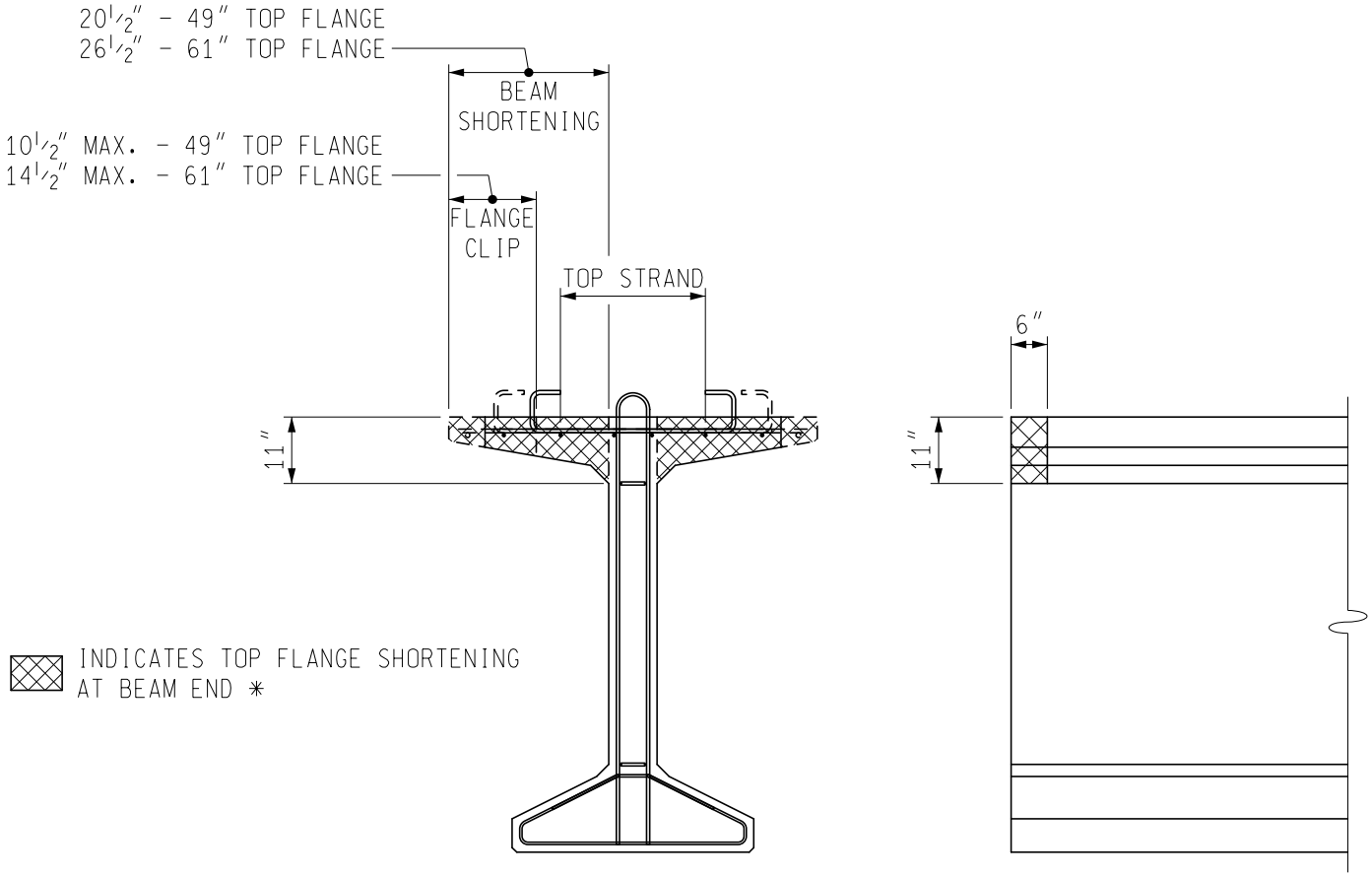
PREPARED BY DESIGN DIVISION	6.60.03B

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BULB TEE BEAM FLANGE SHORTENING & CLIP DETAILS	ISSUED: 01/23/23 SUPERSEDES: 04/17/17



SHORTEN APPROPRIATE FLANGE WITH RESPECT TO CENTERLINE BEARING. CLIP SHORTENED FLANGE AS REQUIRED TO PROVIDE ADDITIONAL CLEARANCE FOR PAVEMENT SEAT.

TOP FLANGE



BEAM ELEVATION WITH SHORTENING/CLIP

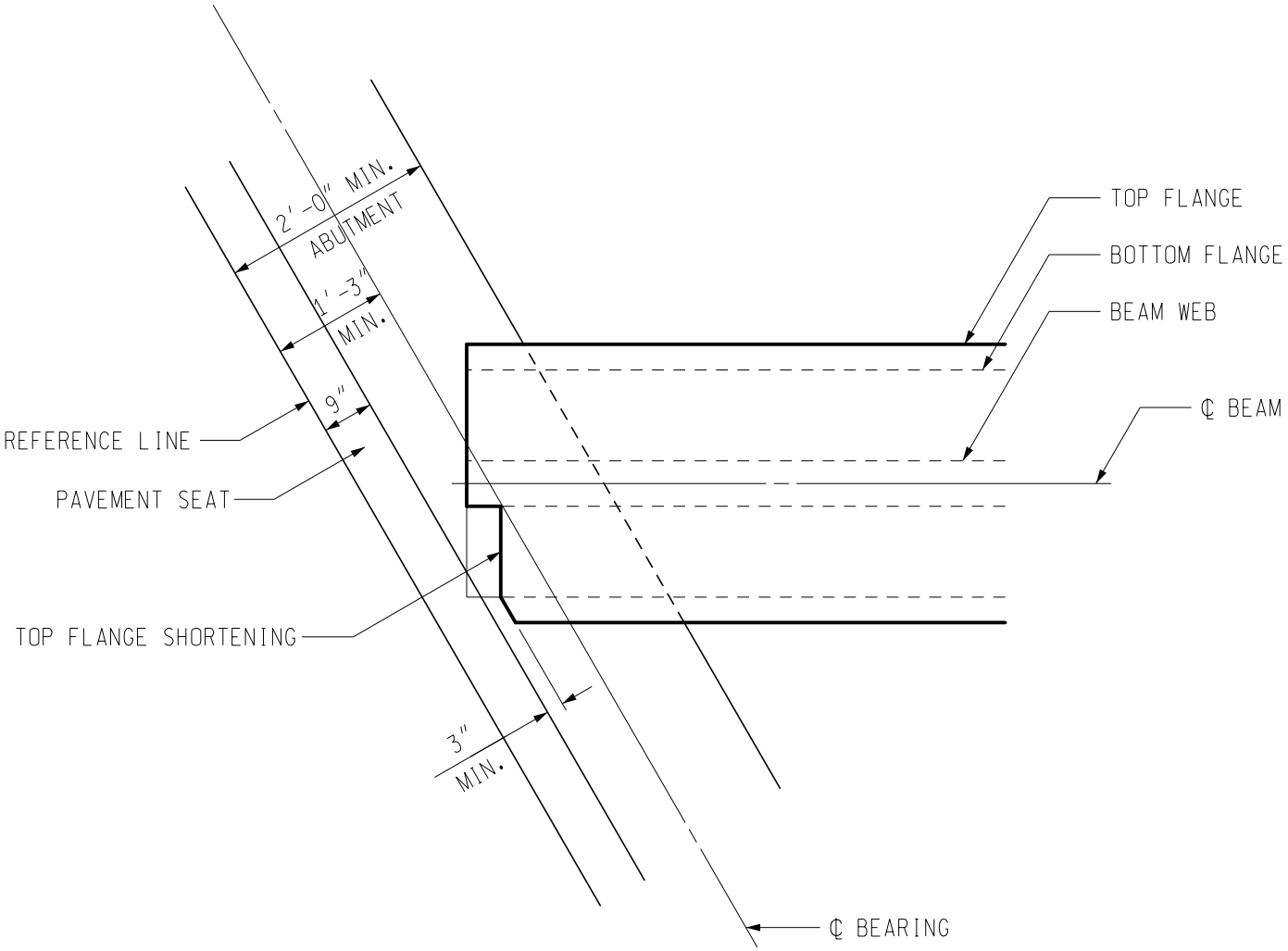
NOTES:

* WHEN NEEDED SHORTEN THE BEAM FLANGE FROM THE EDGE OF THE FLANGE TO THE WEB OF THE BEAM. SHORTENING OR NOTCHING THE BEAM WEB IS NOT ALLOWED. SHORTEN AND OR CLIP TO PROVIDE CLEARANCE FROM PAVEMENT SEAT AND TO DECREASE SUBSTRUCTURE UNIT WIDTH.

FOR BEAM AND BEARING CLEARANCE SEE BGRIDGE DESIGN GUIDES 6.60.03D & 6.60.13.

PREPARED BY DESIGN DIVISION	6.60.03C

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BULB TEE BEAM END SHORTENING & CLIP AT ABUTMENT DETAILS	ISSUED: 01/23/23 SUPERSEDES: / /



ABUTMENT WIDTH AND BEAM SHORTENING/CLIP LAYOUT DETAIL

(49" TOP FLANGE SHOWN, 61" SIMILAR)

FOR SHORTENING AND CLIP DETAILS SEE BRIDGE DESIGN GUIDE 6.30.03C.

FOR BEARING CLEARANCES SEE BRIDGE DESIGN GUIDE 6.60.13.

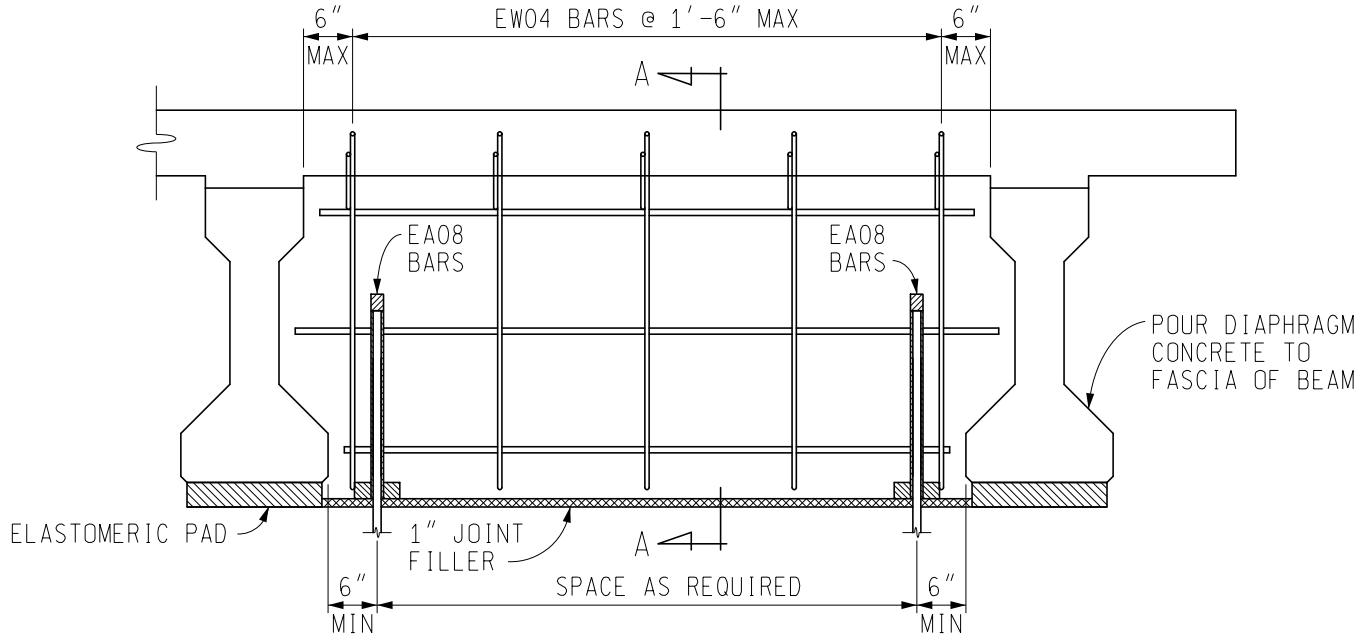
PREPARED BY DESIGN DIVISION	6.60.03D

DRAWN BY: CHECKED BY: APPROVED BY:	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: SUPERSEDES:

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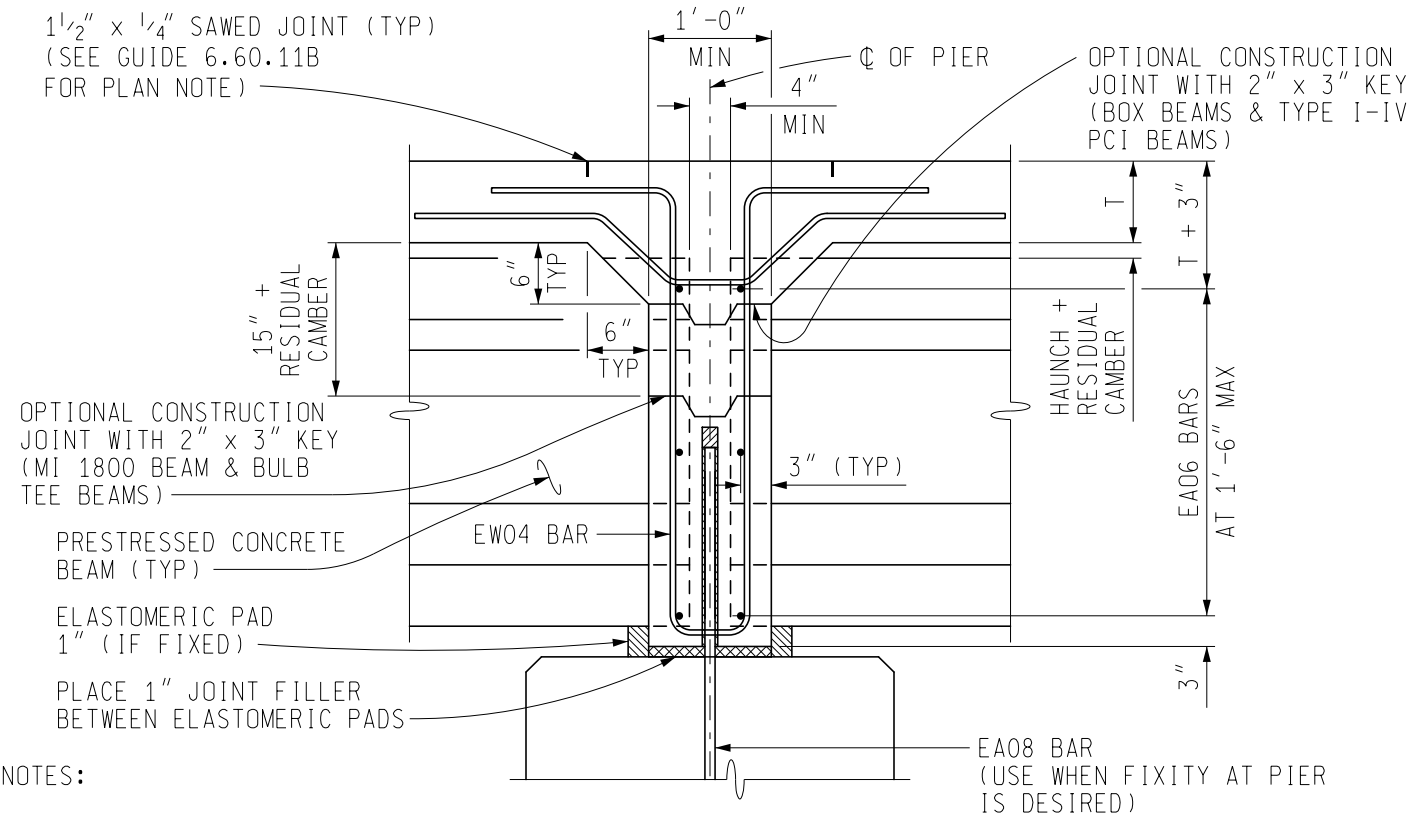
PREPARED BY DESIGN DIVISION	

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT PIER DIAPHRAGMS FOR PRESTRESSED CONCRETE BEAMS CONTINUOUS FOR LIVE LOAD	ISSUED: 07/24/23 SUPERSEDES: 06/26/23



PIER DIAPHRAGM ELEVATION

PCI BEAMS SHOWN. SPREAD BOX BEAMS, MICHIGAN 1800 BEAMS, AND BULB TEE BEAMS ARE SIMILAR.



SECTION A-A

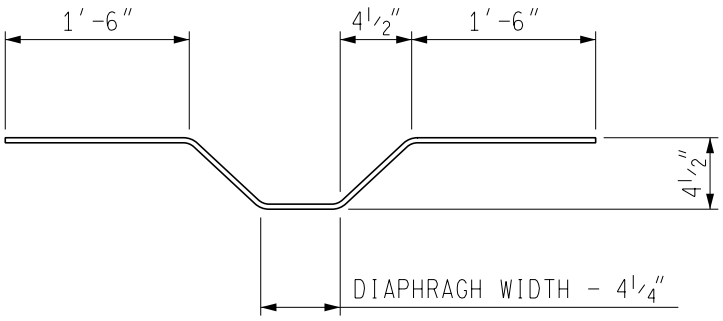
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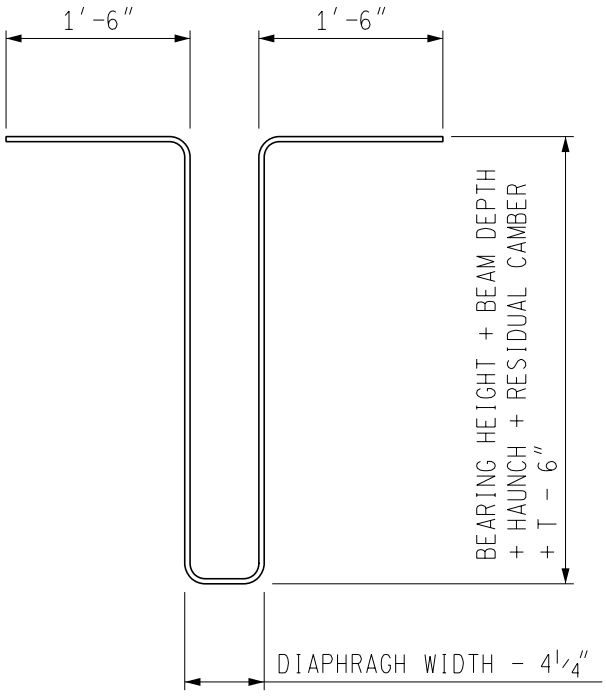
RESIDUAL CAMBER IS DEFINED AS THE ESTIMATED REMAINING CAMBER IN PRESTRESSED CONCRETE BEAMS AFTER ANY DEFLECTION FROM THE DEAD LOAD OF STRUCTURAL COMPONENTS, NON-STRUCTURAL ATTACHMENTS, WEARING SURFACES AND UTILITIES HAVE BEEN ACCOUNTED FOR.

PRESTRESSED CONCRETE BEAMS SHALL BE DESIGNED AS SIMPLE SPAN BEAMS FOR DEAD LOAD AND LIVE LOAD. THE BRIDGE SLAB SHALL BE DESIGNED CONTINUOUS FOR LIVE LOAD OVER PIERS.

PREPARED BY DESIGN DIVISION	6.60.11

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT PIER DIAPHRAGMS FOR PRESTRESSED CONCRETE BEAMS CONTINUOUS FOR LIVE LOAD	ISSUED: 07/24/23 SUPERSEDES: 06/26/23

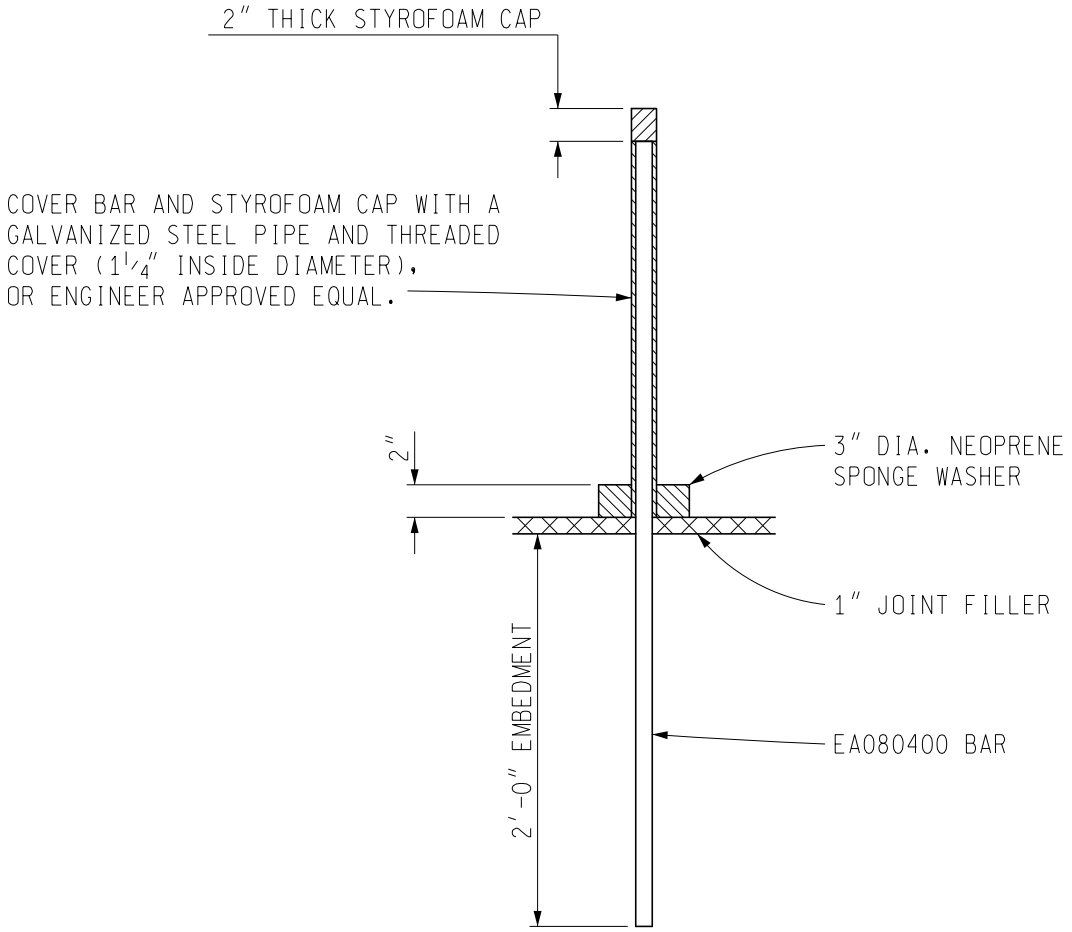




EW04 BARS

PREPARED BY DESIGN DIVISION	6.60.11A

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT PIER DIAPHRAGMS FOR PRESTRESSED CONCRETE BEAMS CONTINUOUS FOR LIVE LOAD	ISSUED: 06/26/23 SUPERSEDES: 01/25/21



DETAIL B

ALL WORK AND MATERIAL FOR THE STYROFOAM CAP, METAL SLEEVE AND NEOPRENE SPONGE WASHER SHALL BE INCLUDED IN THE BID ITEM "SUPERSTRUCTURE CONC, NIGHT CASTING."

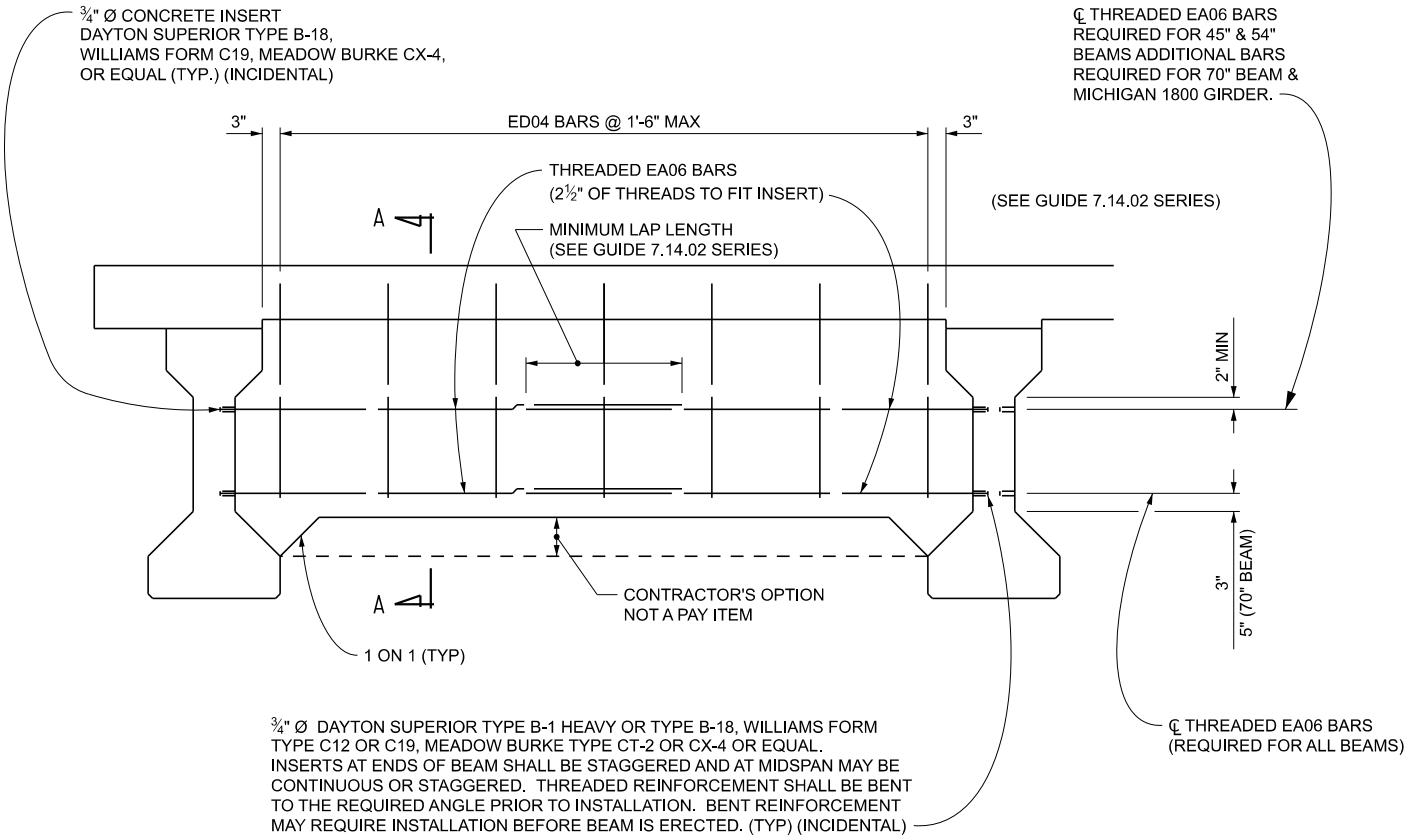
PLAN NOTES:

BLOCK OUT CONCRETE AT ELASTOMERIC BEARINGS. ATTACH NO. 30 ASPHALT FELT WITH ROOFING TAR/ASPHALT TO SIDES OF BEAMS FROM BEAM END TO 1" PAST EDGE OF PIER DIAPHRAGM. REMOVE 1" EXCESS ON OUTSIDE OF FASCIA BEAMS AFTER DIAPHRAGM FORM REMOVAL. ALL LABOR, MATERIALS AND CLEANUP/REMOVAL ARE INCLUDED IN THE BID ITEM "SUPERSTRUCTURE CONC, NIGHT CASTING."

JOINT BETWEEN BEAM ENDS SHALL BE FILLED WITH CONCRETE.

PROVIDE A SAWED JOINT 1½" DEEP BY ¼" WIDE (MINIMUM) IN THE TOP OF SLAB AT THE LOCATIONS SHOWN IN SECTION(S) ____. SAW THE JOINT WITHIN 24 HOURS OF PLACING THE CURING AND FILL TO ½" BELOW TOP OF CONCRETE WITH POLYURETHANE OR POLYURETHANE HYBRID SEALANT. (INCLUDED IN THE BID ITEM "SUPERSTRUCTURE CONC, FORM, FINISH, AND CURE, NIGHT CASTING (STRUCTURE NO.)").

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 11/25/24
CHECKED BY: CWC	CONCRETE DIAPHRAGMS FOR PRESTRESSED CONCRETE BEAMS/GIRDERS	SUPERSEDES: 12/26/23
APPROVED BY: KCK		



CONCRETE DIAPHRAGM ELEVATION

NOTES:

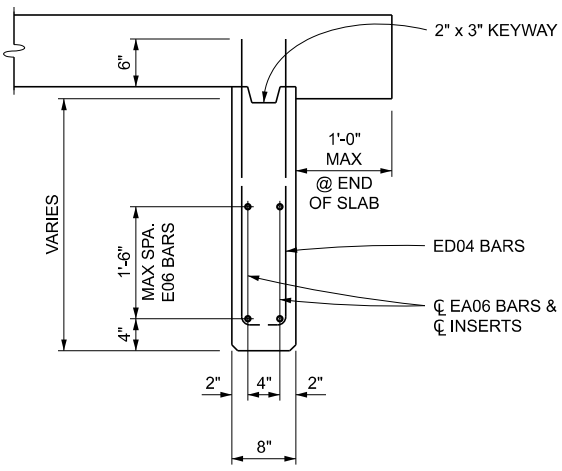
USE ONLY WHEN REPLACING EXISTING CONCRETE DIAPHRAGMS.
PLACE DIAPHRAGMS PARALLEL TO REF. LINE.

USE ONE INTERMEDIATE DIAPHRAGM AT MID-POINT.

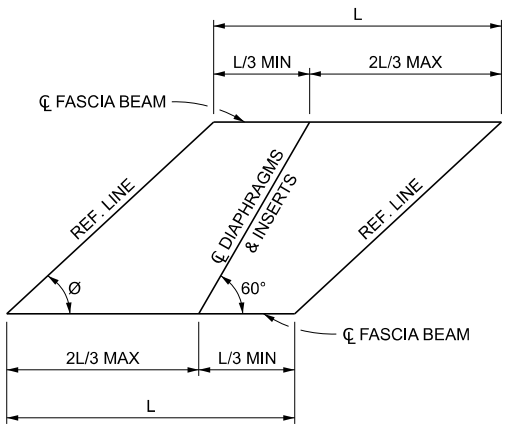
FOR 60° ≤ Ø ≤ 90°, PLACE INTERMEDIATE DIAPHRAGMS PARALLEL TO REF. LINE.

FOR ANGLE OF CROSSING < 60°, SEE PLAN.

DO NOT POUR DECK UNTIL DIAPHRAGM CONCRETE ATTAINS A COMPRESSIVE STRENGTH OF 3000 PSI.



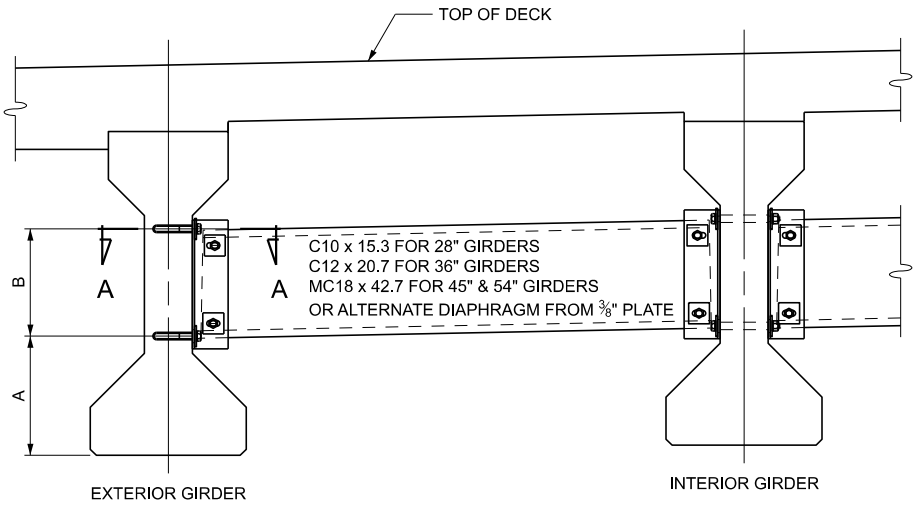
SECTION A-A



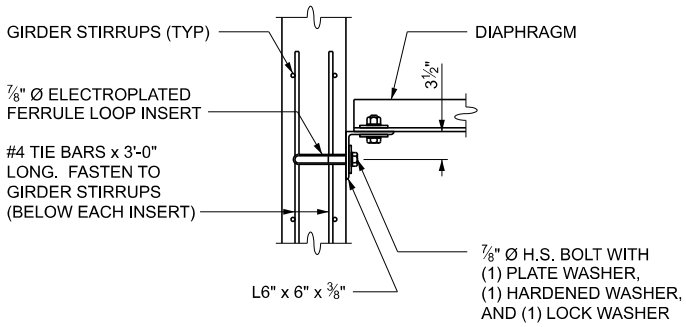
PLAN

PREPARED BY DESIGN DIVISION	6.60.12

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 11/25/24
CHECKED BY: CWC	STEEL DIAPHRAGMS FOR 28" THROUGH 54" PRESTRESSED GIRDERS	SUPERSEDES: 08/27/18
APPROVED BY: KCK		

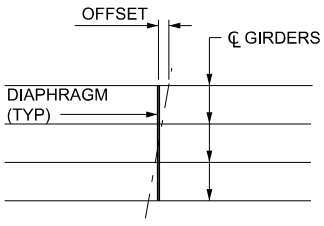


PARTIAL TRANSVERSE SECTION AT DIAPHRAGM

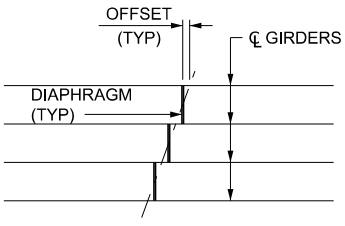


SECTION A-A

DIMENSION TABLE		
GIRDER HEIGHT	A	B
28"	1'-0 7/8"	5 7/8"
36"	1'-2 7/8"	9 7/8"
45"	1'-5 3/8"	1'-1 7/8"
54"	1'-7 7/8"	1'-5 7/8"



PLAN FOR SKEW ANGLE ≤ 10°



PLAN FOR SKEW ANGLE > 10°

NOTES:

WORK THIS GUIDE WITH 6.60.12B.

BOLTS CONNECTING THE CLIP ANGLES TO GIRDERS MUST BE TIGHTENED TO A SNUG TIGHT CONDITION ENSURING THE LOCK WASHER IS COMPLETELY COMPRESSED, WITH A MINIMUM 80 FT. LBS. OF TORQUE.

BOLTS CONNECTING THE CLIP ANGLES TO DIAPHRAGMS MUST BE TIGHTENED BY THE TURN OF NUT METHOD PER SUBSECTION 707.03.D OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.

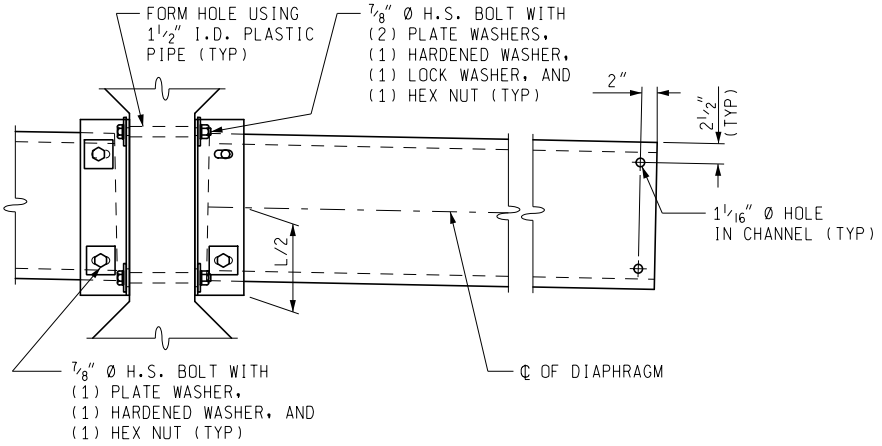
H.S. DENOTES HIGH STRENGTH BOLTS.

USE STEEL DIAPHRAGMS AT MIDPOINT AND AT INDEPENDENT BACKWALLS. SEE GUIDES 6.20.03A AND 6.60.13.

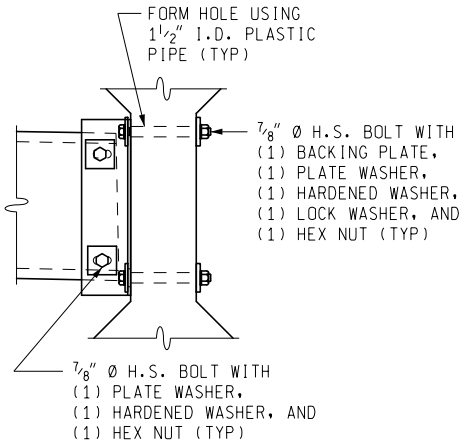
APPLY AASHTO REQUIREMENTS WHEN DETERMINING NEED FOR DIAPHRAGMS.

PREPARED BY DESIGN DIVISION	6.60.12A

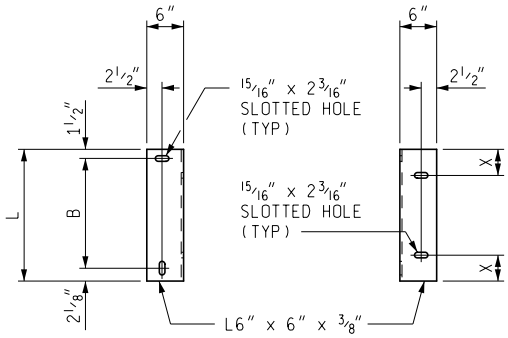
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STEEL DIAPHRAGMS FOR 28″ THROUGH 54″ PRESTRESSED GIRDERS	ISSUED: 11/28/22 SUPERSEDES: 08/27/18



CONNECTION DETAIL
(SKEW ANGLES ≤ 10°)



CONNECTION DETAIL
(SKEW ANGLES > 10°)



CLIP ANGLE

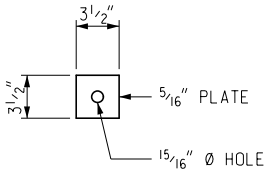
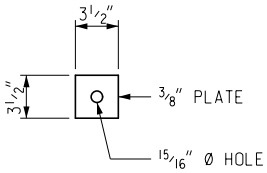
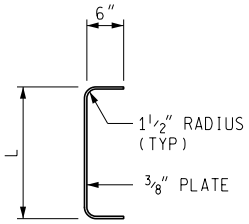


PLATE WASHER



BACKING PLATE

DIMENSION TABLE			
GIRDER HEIGHT	B	L	*X
28″	5⅞″	9½″	2¼″
36″	9⅞″	1′-1½″	3¼″
45″	1′-1⅞″	1′-5½″	2¼″
54″	1′-5⅞″	1′-9½″	4¼″
* X = 2½″ FOR ALTERNATE PLATE DIAPHRAGM			



ALTERNATE DIAPHRAGM

NOTES:

WORK THIS GUIDE WITH 6.60.12A.

BOLTS CONNECTING THE CLIP ANGLES TO GIRDERS MUST BE TIGHTENED TO A SNUG TIGHT CONDITION ENSURING THE LOCK WASHER IS COMPLETELY COMPRESSED, WITH A MINIMUM 80 FT. LBS. OF TORQUE.

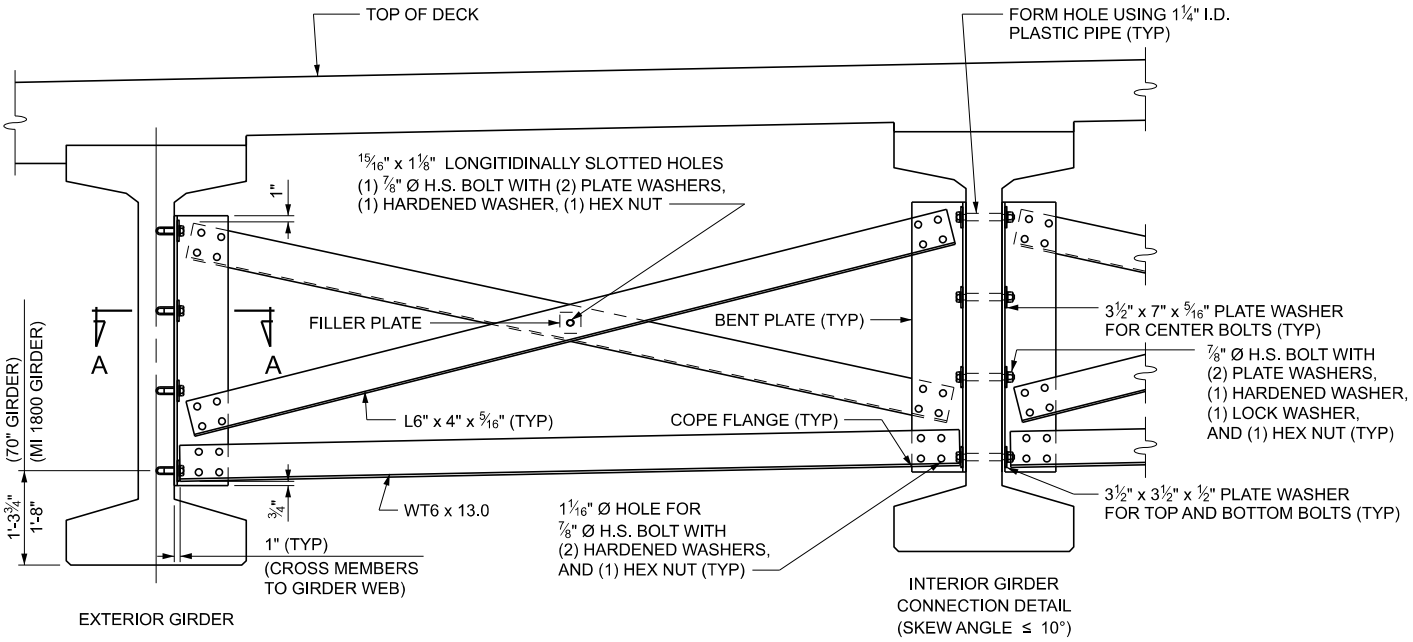
BOLTS CONNECTING THE CLIP ANGLES TO DIAPHRAGMS MUST BE TIGHTENED BY THE TURN OF NUT METHOD PER SUBSECTION 707.03.D OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.

H.S. DENOTES HIGH STRENGTH BOLTS.

I.D. DENOTES INSIDE DIAMETER.

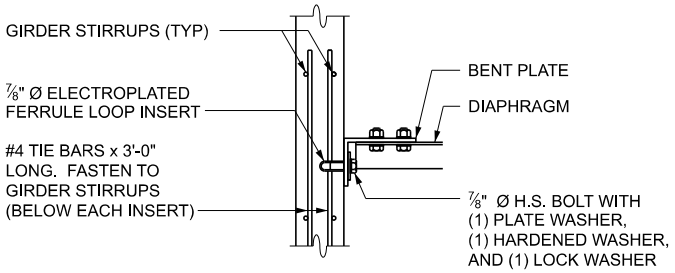
PREPARED BY DESIGN DIVISION	6.60.12B

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STEEL DIAPHRAGMS FOR 70" & MI 1800 PRESTRESSED GIRDERS	ISSUED: 11/25/24 SUPERSEDES: 11/28/22

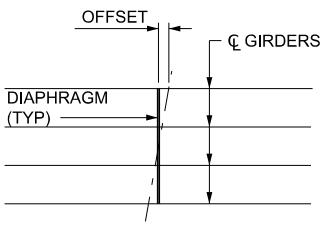


PARTIAL TRANSVERSE SECTION AT DIAPHRAGM

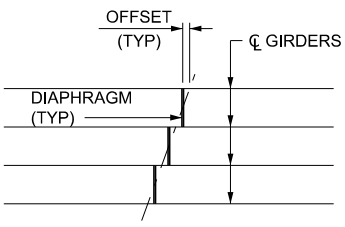
70" GIRDER SHOWN, MI 1800 GIRDER SIMILAR



SECTION A-A



PLAN FOR SKEW ANGLE ≤ 10°



PLAN FOR SKEW ANGLE > 10°

NOTES:

WORK THIS GUIDE WITH 6.60.12D.

BOLTS CONNECTING THE CLIP ANGLES TO GIRDERS MUST BE TIGHTENED TO A SNUG TIGHT CONDITION ENSURING THE LOCK WASHER IS COMPLETELY COMPRESSED, WITH A MINIMUM 80 FT. LBS. OF TORQUE.

BOLTS CONNECTING THE CLIP ANGLES TO DIAPHRAGMS MUST BE TIGHTENED BY THE TURN OF NUT METHOD PER SUBSECTION 707.03.D OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.

H.S. DENOTES HIGH STRENGTH BOLTS.

I.D. DENOTES INSIDE DIAMETER.

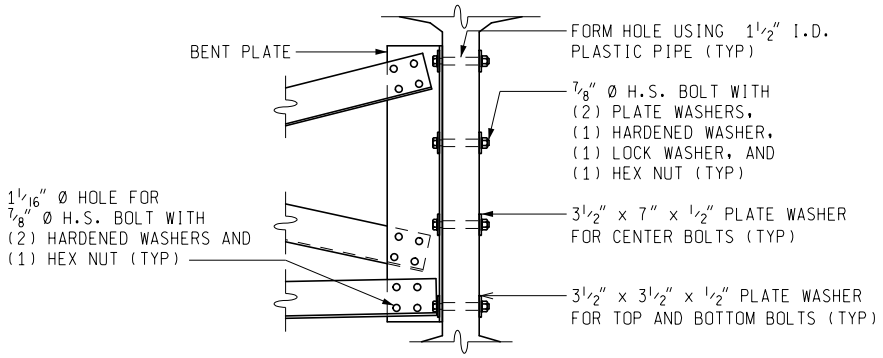
MINIMUM DISTANCE BETWEEN CENTERS OF FASTENERS FOR BENT PLATE AND ANGLE CONNECTIONS SHALL BE 3⅛" AND THE MINIMUM EDGE DISTANCE SHALL BE 1½".

USE STEEL DIAPHRAGMS AT MIDPOINT AND AT INDEPENDENT BACKWALLS. SEE GUIDES 6.20.03A AND 6.60.13.

APPLY AASHTO REQUIREMENTS WHEN DETERMINING NEED FOR DIAPHRAGMS.

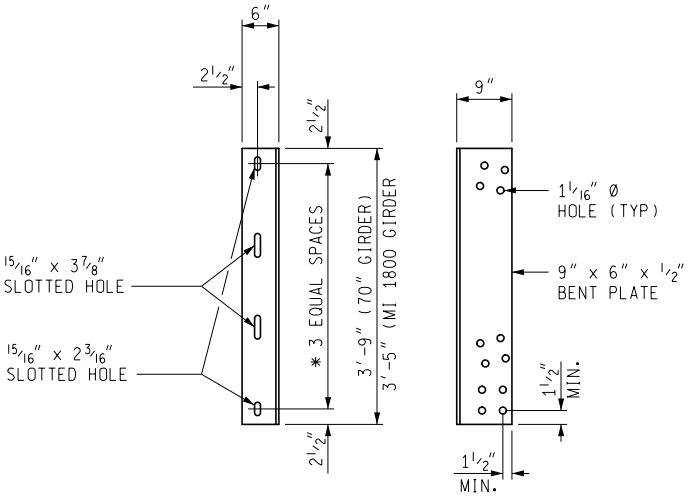
PREPARED BY DESIGN DIVISION	6.60.12C

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STEEL DIAPHRAGMS FOR 70″ & MI 1800 PRESTRESSED GIRDERS	ISSUED: 11/28/22 SUPERSEDES: 08/27/18

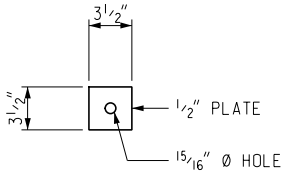


CONNECTION DETAIL

(SKEW ANGLE > 10°)



BENT PLATE



FILLER PLATE

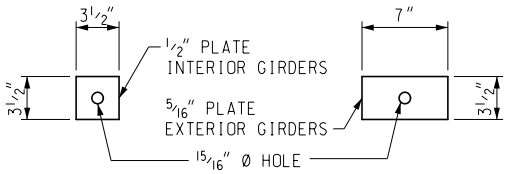


PLATE WASHERS

* BOLT HOLES SHALL BE SPACED TO MISS PRESTRESSING STRANDS IN CONCRETE GIRDERS

NOTES:

WORK THIS GUIDE WITH 6.60.12C.

BOLTS CONNECTING THE CLIP ANGLES TO GIRDERS MUST BE TIGHTENED TO A SNUG TIGHT CONDITION ENSURING THE LOCK WASHER IS COMPLETELY COMPRESSED, WITH A MINIMUM 80 FT. LBS. OF TORQUE.

BOLTS CONNECTING THE CLIP ANGLES TO DIAPHRAGMS MUST BE TIGHTENED BY THE TURN OF NUT METHOD PER SUBSECTION 707.03.D OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.

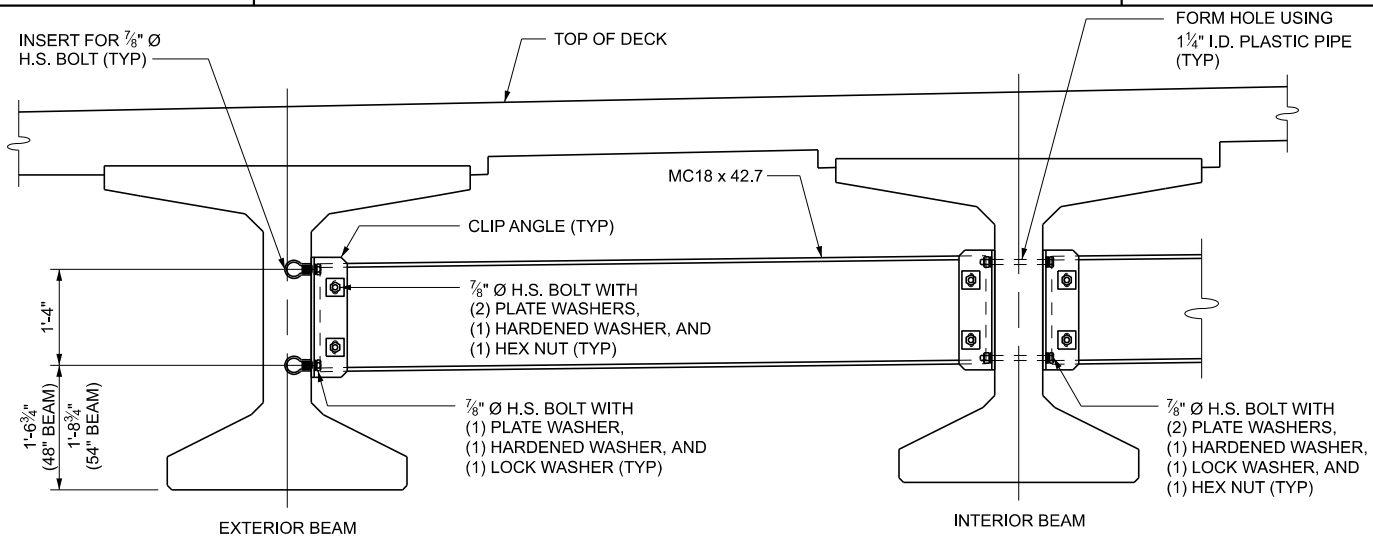
H.S. DENOTES HIGH STRENGTH BOLTS.

I.D. DENOTES INSIDE DIAMETER.

MINIMUM DISTANCE BETWEEN CENTERS OF FASTENERS FOR BENT PLATE AND ANGLE CONNECTIONS SHALL BE 3 1/8″ AND THE MINIMUM EDGE DISTANCE SHALL BE 1 1/2″.

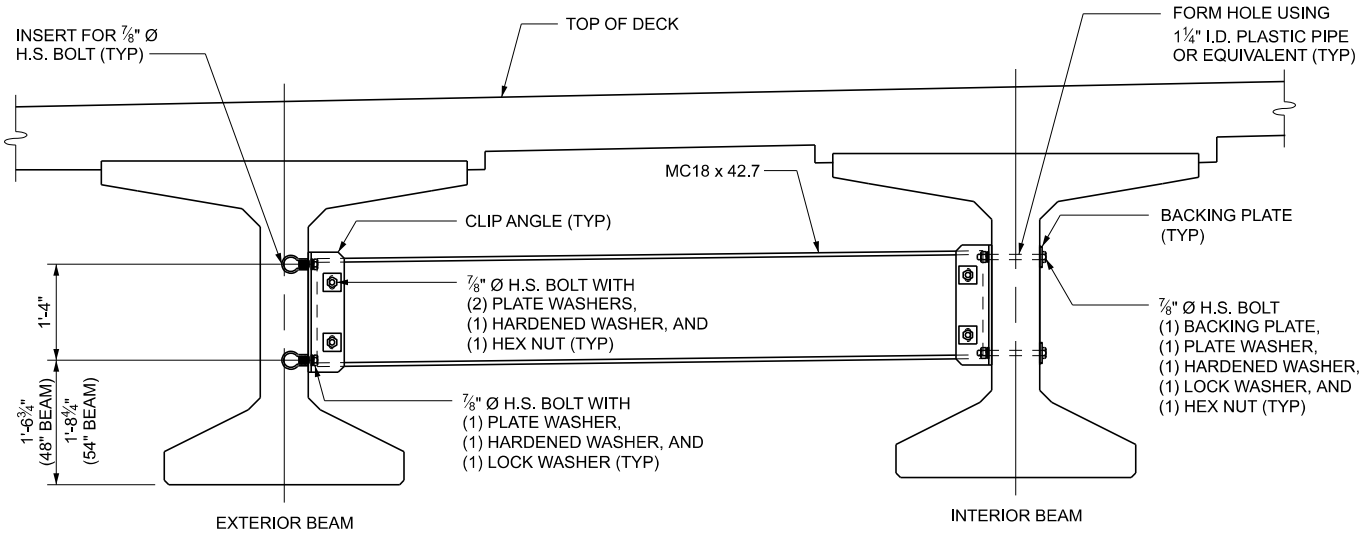
PREPARED BY DESIGN DIVISION	6.60.12D

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 11/25/24
CHECKED BY: CWC	STEEL DIAPHRAGMS FOR 48" AND 54" BULB TEE BEAMS	SUPERSEDES: 11/28/22
APPROVED BY: KCK		



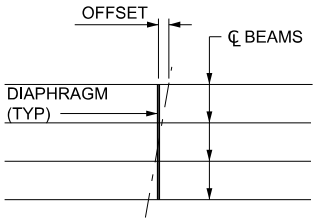
PARTIAL TRANSVERSE SECTION AT DIAPHRAGM

SKEW ANGLE ≤ 10°

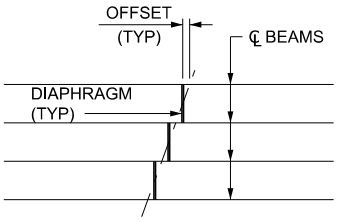


PARTIAL TRANSVERSE SECTION AT DIAPHRAGM

SKEW ANGLE > 10°



PLAN FOR SKEW ANGLE ≤ 10°



PLAN FOR SKEW ANGLE > 10°

NOTES:

WORK THIS GUIDE WITH 6.60.12F.

BOLTS CONNECTING THE CLIP ANGLES TO GIRDERS MUST BE TIGHTENED TO A SNUG TIGHT CONDITION ENSURING THE LOCK WASHER IS COMPLETELY COMPRESSED, WITH A MINIMUM 80 FT. LBS. OF TORQUE.

BOLTS CONNECTING THE CLIP ANGLES TO DIAPHRAGMS MUST BE TIGHTENED BY THE TURN OF NUT METHOD PER SUBSECTION 707.03.D OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.

H.S. DENOTES HIGH STRENGTH BOLTS.

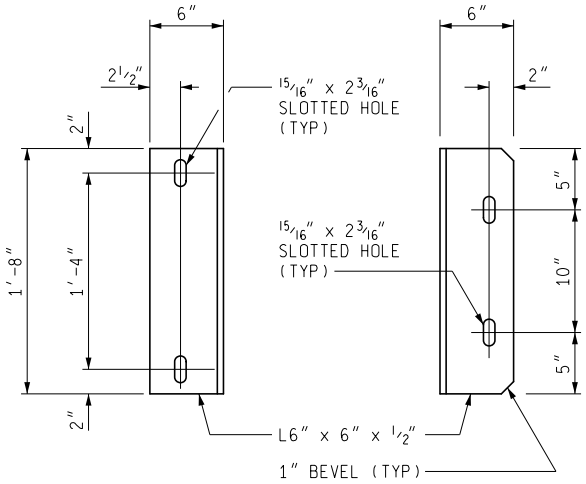
I.D. DENOTES INSIDE DIAMETER.

USE STEEL DIAPHRAGMS AT MIDPOINT AND AT INDEPENDENT BACKWALLS. SEE GUIDES 6.20.03A AND 6.60.13.

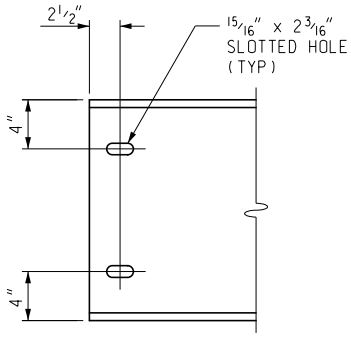
APPLY AASHTO REQUIREMENTS WHEN DETERMINING NEED FOR DIAPHRAGMS.

PREPARED BY DESIGN DIVISION	6.60.12E

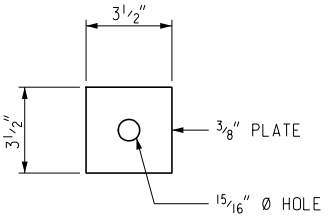
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STEEL DIAPHRAGMS FOR 48″ AND 54″ BULB TEE BEAMS	ISSUED: 08/27/18 SUPERSEDES: / /



CLIP ANGLE



CHANNEL END



BACKING PLATE
SKEW ANGLE > 10° ONLY

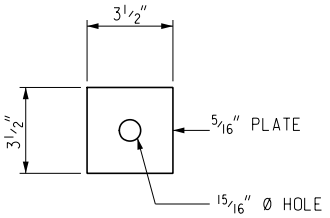
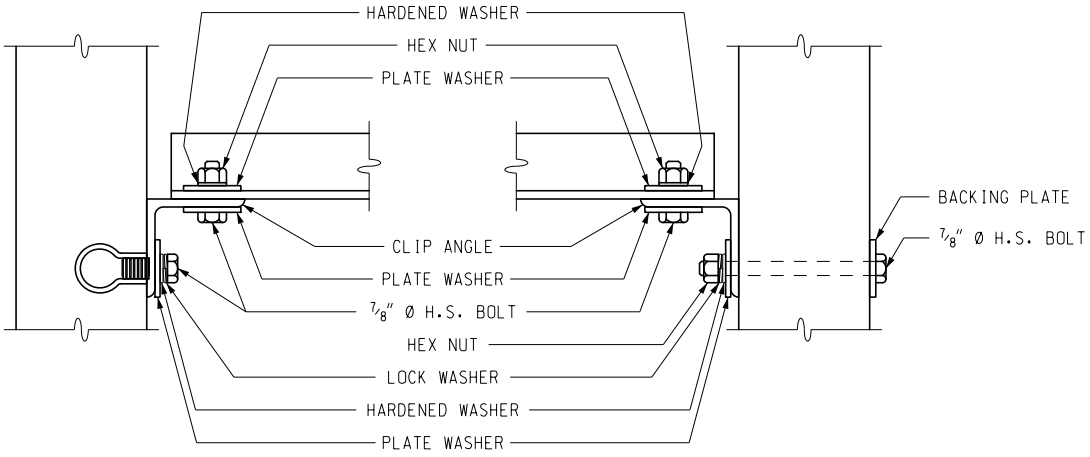
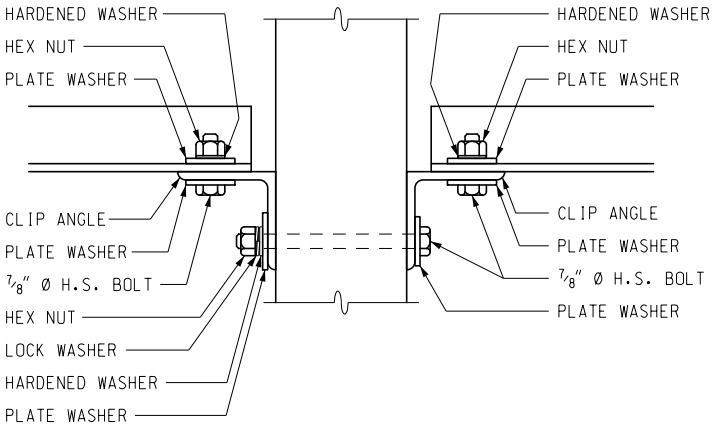


PLATE WASHER



EXTERIOR BEAM

INTERIOR BEAM
SKEW ANGLE > 10°



INTERIOR BEAM
SKEW ANGLE ≤ 10°

NOTES:

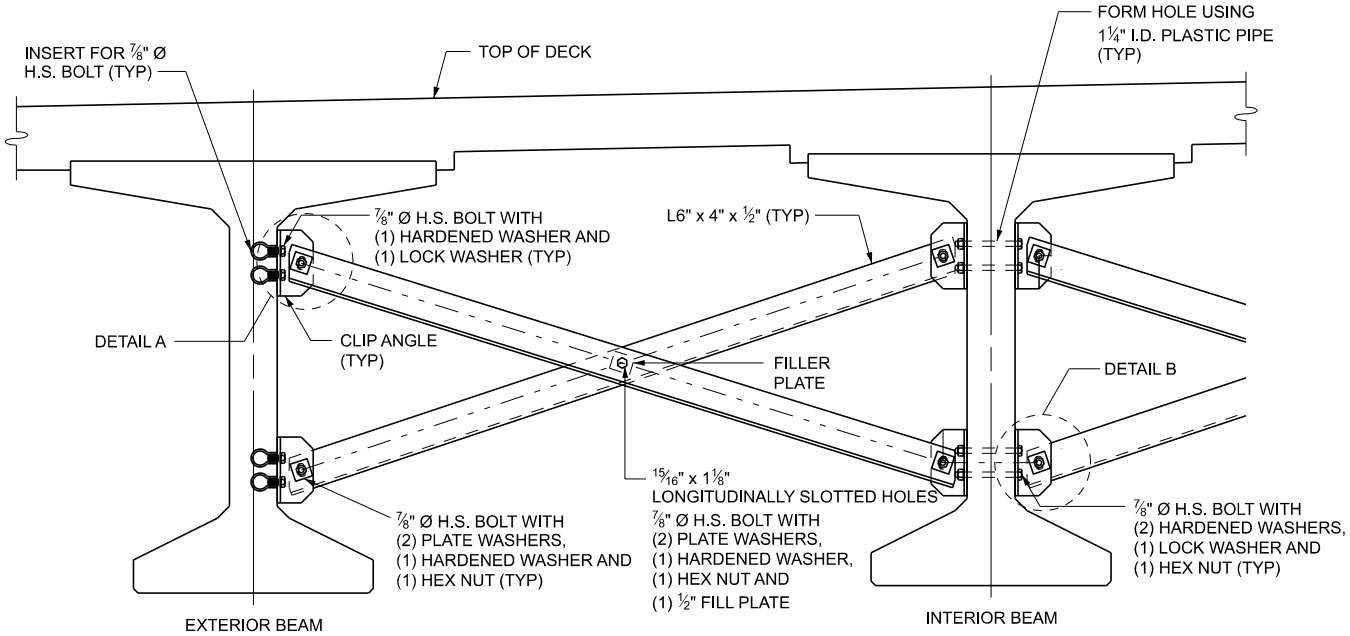
WORK THIS GUIDE WITH 6.60.12E.

H.S. DENOTES HIGH STRENGTH BOLTS.

CONNECTION DETAILS

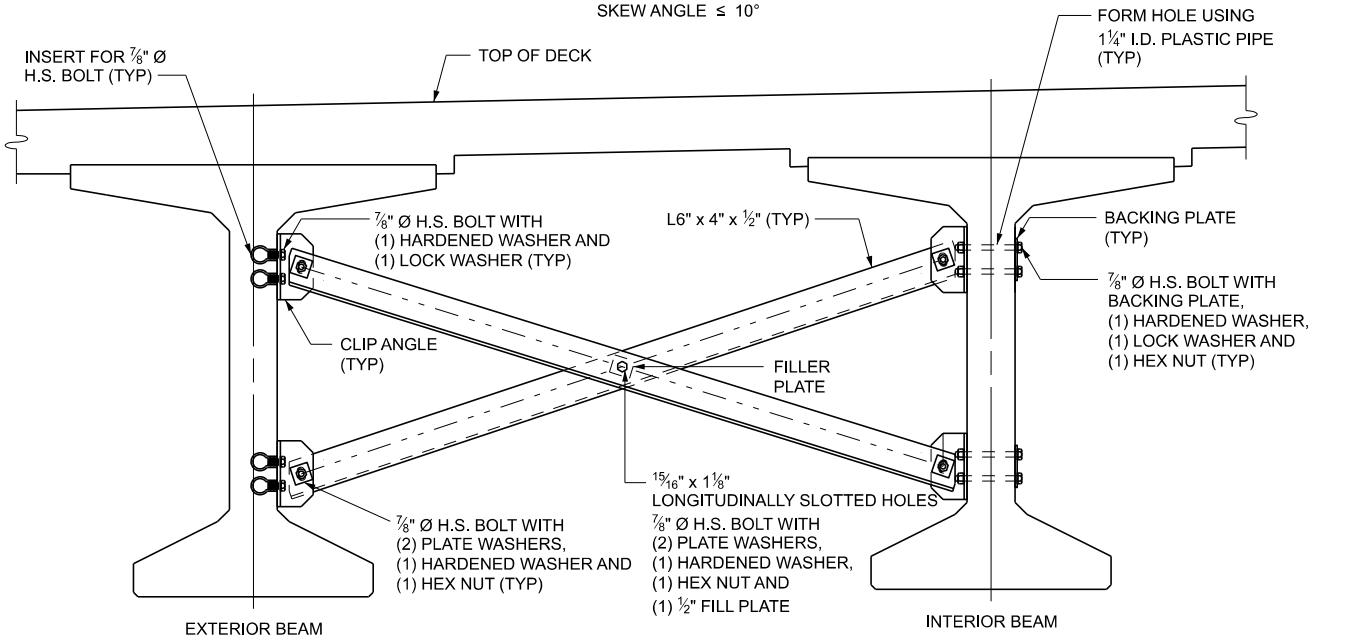
PREPARED BY DESIGN DIVISION	6.60.12F

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 11/25/24
CHECKED BY: CWC	STEEL DIAPHRAGMS FOR 60", 66" AND 72" BULB TEE BEAMS	SUPERSEDES: 11/28/22
APPROVED BY: KCK		



PARTIAL TRANSVERSE SECTION AT DIAPHRAGM

SKEW ANGLE ≤ 10°



PARTIAL TRANSVERSE SECTION AT DIAPHRAGM

SKEW ANGLE > 10°

NOTES:

WORK THIS GUIDE WITH 6.60.12H.

BOLTS CONNECTING THE CLIP ANGLES TO GIRDERS MUST BE TIGHTENED TO A SNUG TIGHT CONDITION ENSURING THE LOCK WASHER IS COMPLETELY COMPRESSED, WITH A MINIMUM 80 FT. LBS. OF TORQUE.

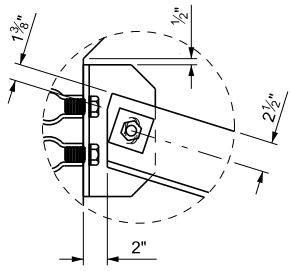
BOLTS CONNECTING THE CLIP ANGLES TO DIAPHRAGMS MUST BE TIGHTENED BY THE TURN OF NUT METHOD PER SUBSECTION 707.03.D OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.

H.S. DENOTES HIGH STRENGTH BOLTS.

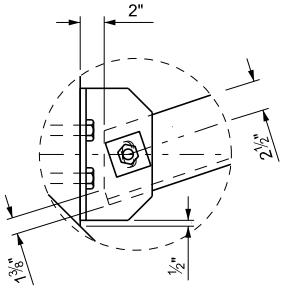
I.D. DENOTES INSIDE DIAMETER.

USE STEEL DIAPHRAGMS AT MIDPOINT AND AT INDEPENDENT BACKWALLS. SEE GUIDES 6.20.03A AND 6.60.13.

APPLY AASHTO REQUIREMENTS WHEN DETERMINING NEED FOR DIAPHRAGMS.



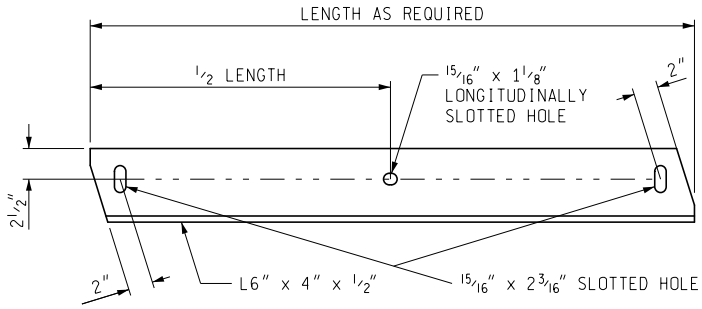
DETAIL A



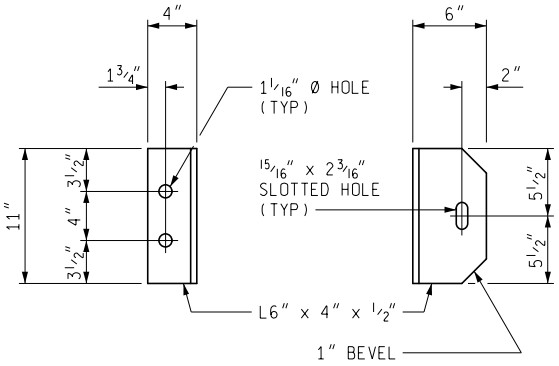
DETAIL B

PREPARED BY DESIGN DIVISION	6.60.12G

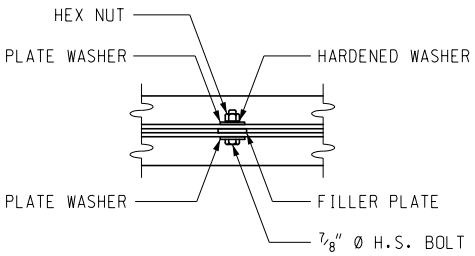
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STEEL DIAPHRAGMS FOR 60", 66" AND 72" BULB TEE BEAMS	ISSUED: 08/27/18 SUPERSEDES: / /



CROSS ANGLE



CLIP ANGLE



CROSS ANGLES

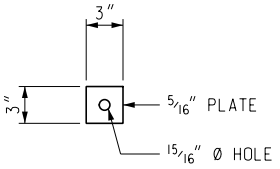
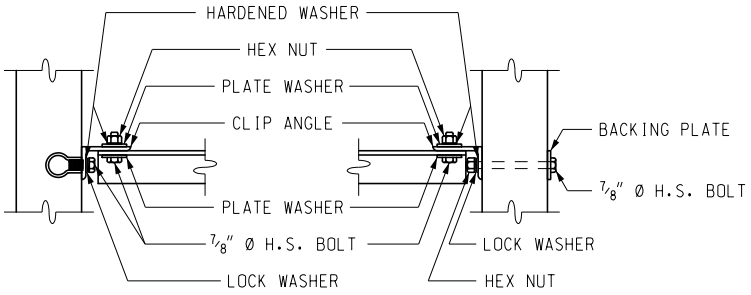
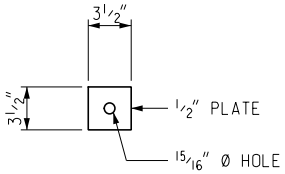


PLATE WASHER

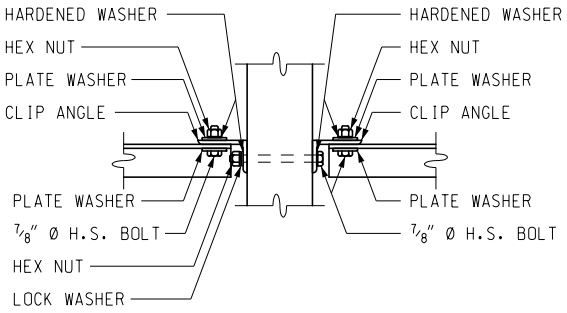


EXTERIOR BEAM

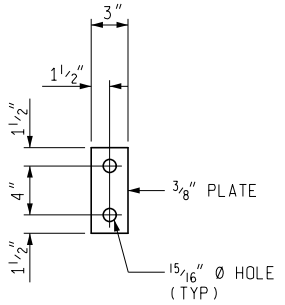
INTERIOR BEAM
SKEW ANGLE > 10°



FILLER PLATE

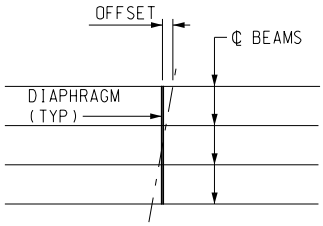


INTERIOR BEAM
SKEW ANGLE ≤ 10°

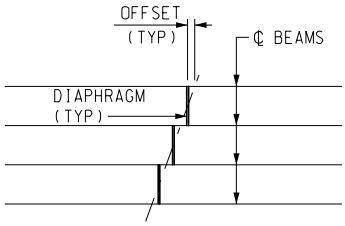


BACKING PLATE
SKEW ANGLE > 10° ONLY

CONNECTION DETAILS



PLAN FOR
SKEW ANGLE ≤ 10°



PLAN FOR
SKEW ANGLE > 10°

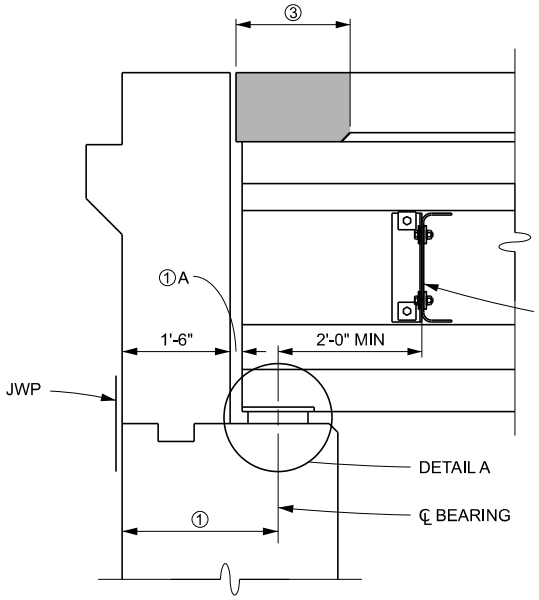
NOTES:

WORK THIS GUIDE WITH 6.60.12G.

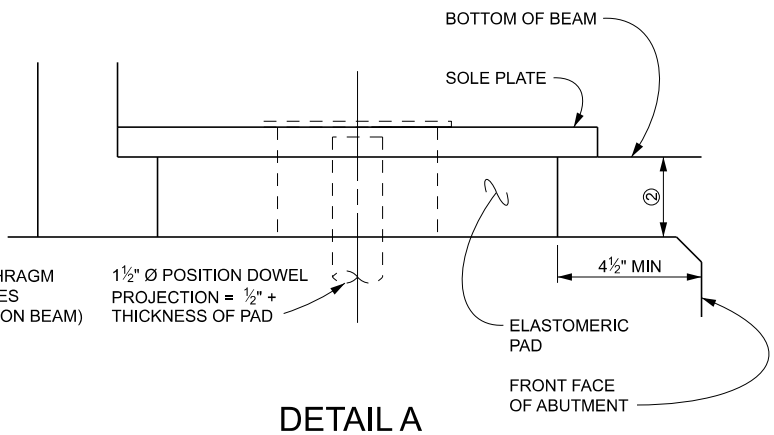
H.S. DENOTES HIGH STRENGTH BOLTS.

PREPARED BY DESIGN DIVISION	6.60.12H

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT DETAILS AT ABUTMENTS FOR PRESTRESSED CONCRETE I-BEAMS	ISSUED: 03/24/25 SUPERSEDES: 11/25/24



INDEPENDENT BACKWALL



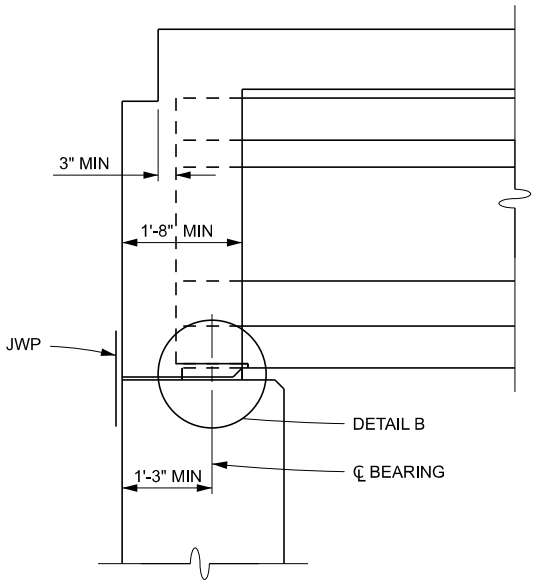
DETAIL A

ALSO APPLIES AT PIERS

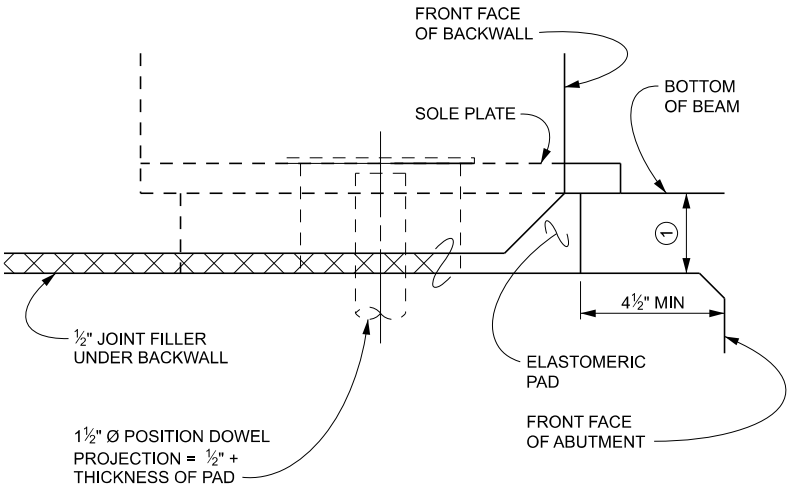
① TO ESTABLISH ℄ BEARING USE "A"= ½ TOTAL MOVEMENT (PARALLEL TO ℄ BEAM) PLUS 1".
FOR SKEWED BRIDGES "A" IS MEASURED AT CORNER OF BOTTOM FLANGE.

② INCREASE ELASTOMERIC PAD THICKNESS AS REQUIRED TO PROVIDE CLEARANCE FOR STRUCTURES ON GRADE AND/OR SKEW.

③ ENSURE EDGE OF SLAB HAS CAPACITY. IF NECESSARY, DESIGN AS EDGE BEAM IN ACCORDANCE WITH AASHTO LRFD.



DEPENDENT BACKWALL



DETAIL B

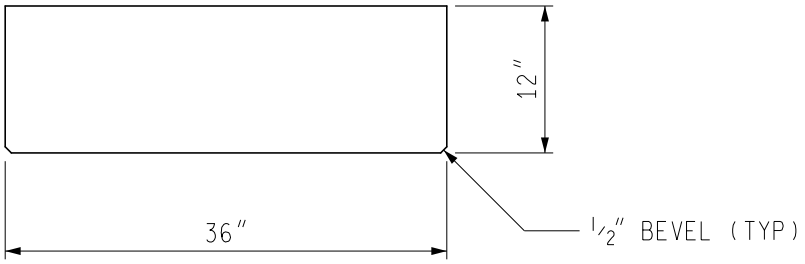
NOTES:

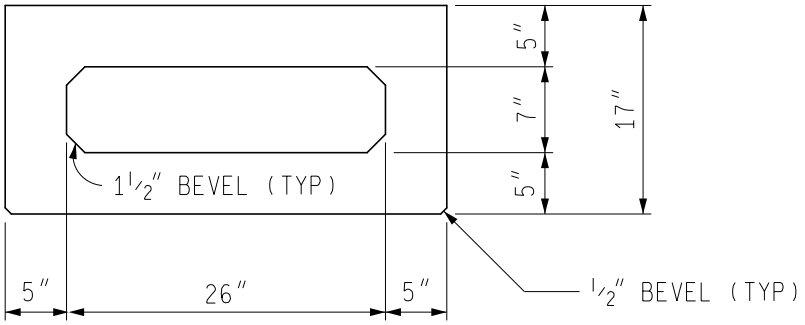
FOR ADDITIONAL BACKWALL DETAILS AND NOTES, SEE DESIGN GUIDES 6.20.01, 6.20.03 SERIES AND 6.20.04 SERIES.

FOR BEARING DETAILS SEE DESIGN GUIDE 8.43.01.

PREPARED BY DESIGN DIVISION	6.60.13

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT PRESTRESSED CONCRETE 12″ & 17″ BOX BEAM PROPERTIES	ISSUED: 05/22/23 SUPERSEDES: 12/27/18

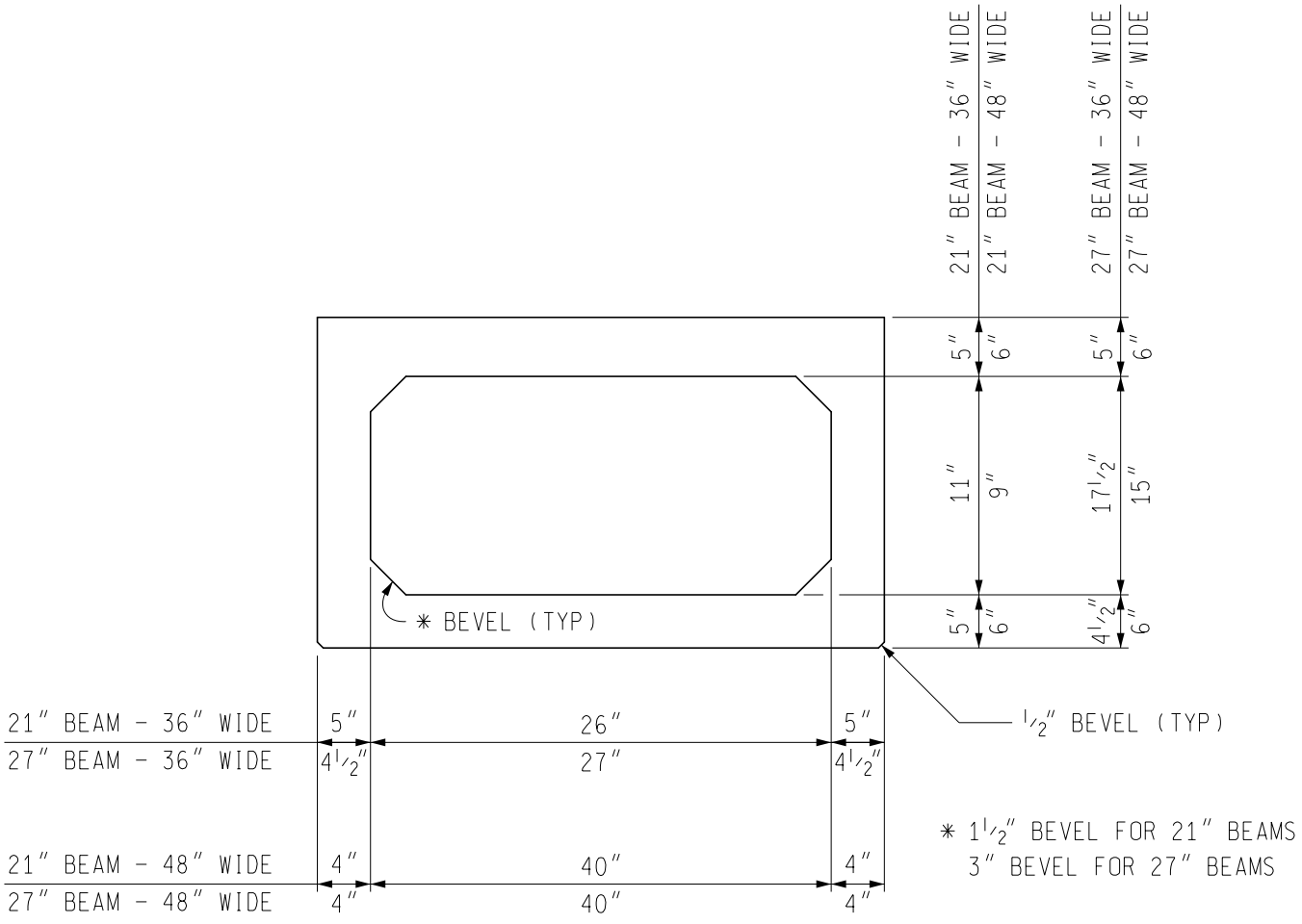




BEAM PROPERTIES								
DEPTH in	WIDTH in	WEIGHT lbs/ft	AREA in^2	Y_T in	Y_B in	S_T in^3	S_B in^3	I in^4
12	36	442	424	6.04	5.96	848	860	5,120
17	36	445	427	8.58	8.42	1610	1640	13,800

PREPARED BY DESIGN DIVISION	6.65.02

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT PRESTRESSED CONCRETE 21″ & 27″ BOX BEAM PROPERTIES	ISSUED: 05/22/23 SUPERSEDES: 12/17/18

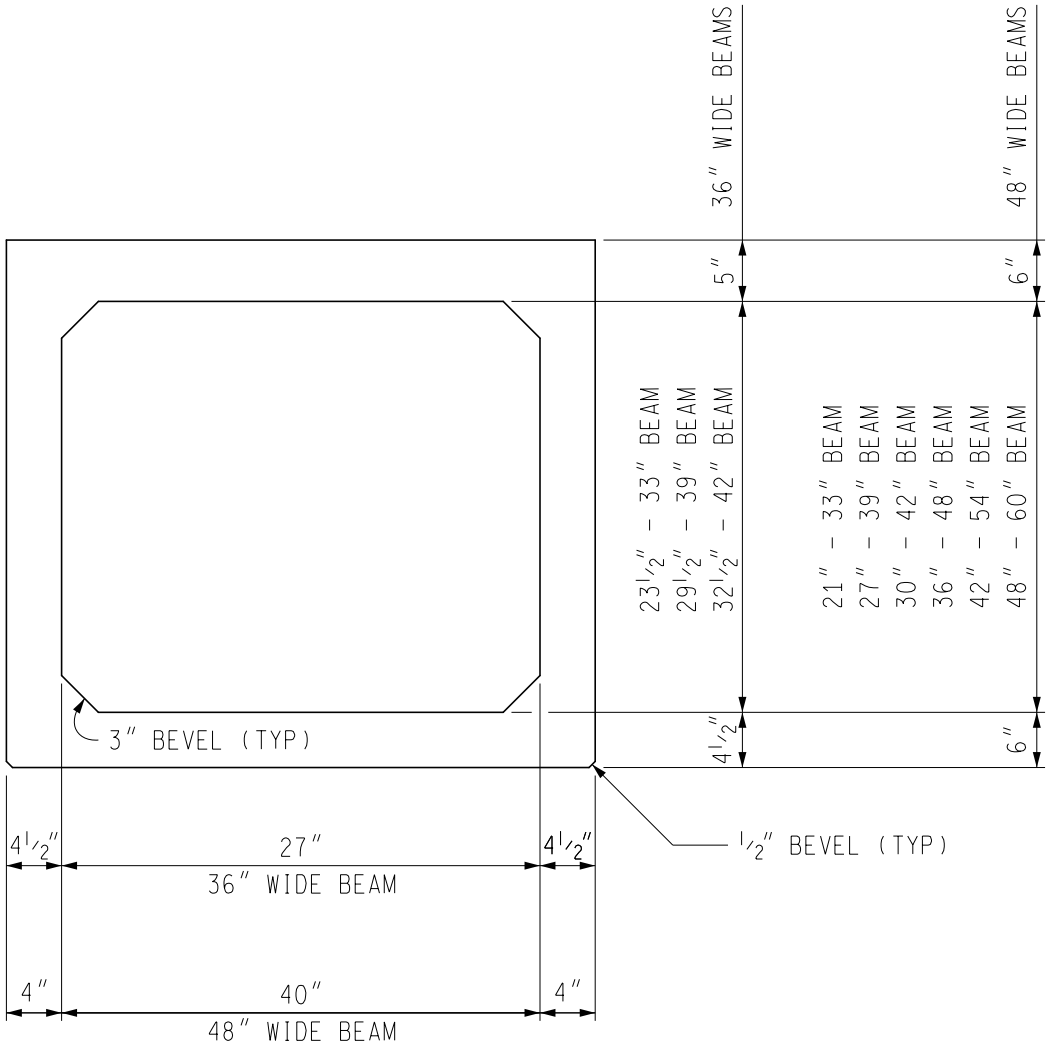


BEAM PROPERTIES

DEPTH in	WIDTH in	WEIGHT lbs/ft	AREA in^2	Y_T in	Y_B in	S_T in^3	S_B in^3	I in^4
21	36	486	467	10.60	10.40	2320	2360	24,600
21	48	686	659	10.58	10.42	3260	3310	34,500
27	36	530	509	13.43	13.57	3520	3480	47,300
27	48	736	707	13.59	13.41	4970	5030	67,500

PREPARED BY DESIGN DIVISION	6.65.02A

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT PRESTRESSED CONCRETE 33″ THROUGH 60″ BOX BEAM PROPERTIES	ISSUED: 05/22/23 SUPERSEDES: 12/17/18



BEAM PROPERTIES

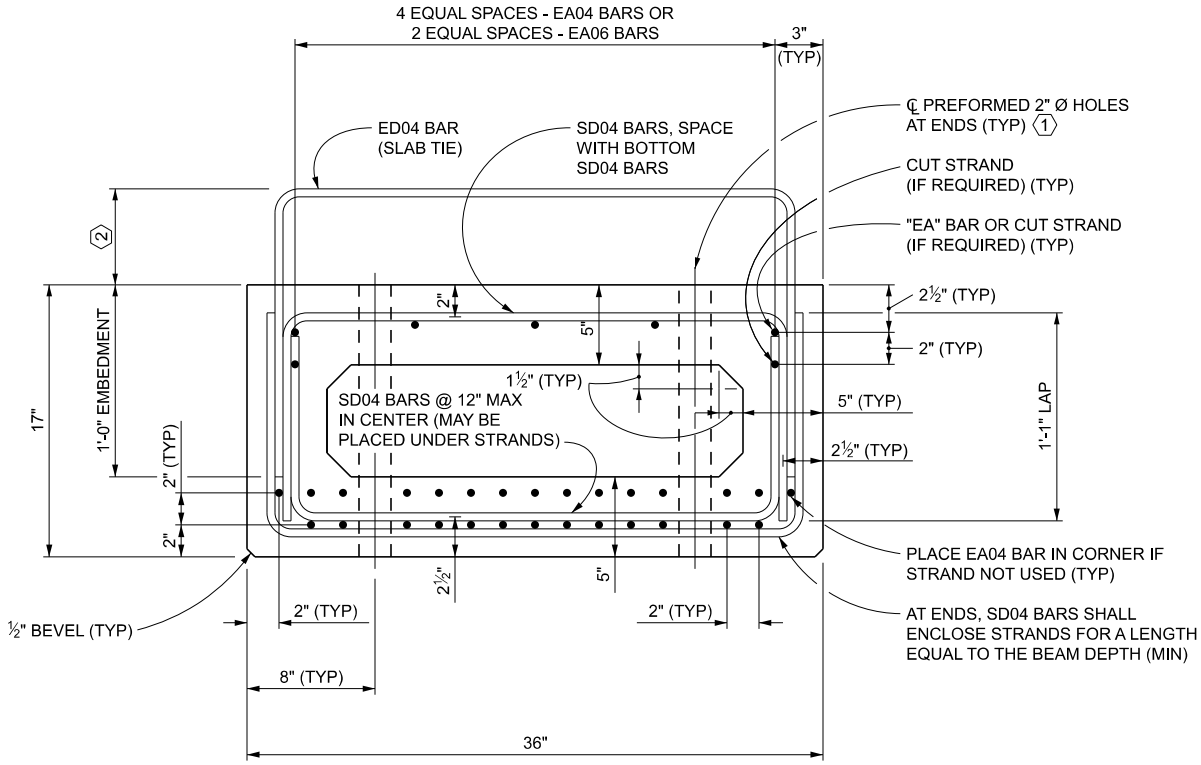
DEPTH in	WIDTH in	WEIGHT lbs/ft	AREA in^2	Y_T in	Y_B in	S_T in^3	S_B in^3	I in^4
33	36	581	558	16.45	16.55	4820	4790	79,300
33	48	786	755	16.66	16.34	6790	6930	113,200
39	36	638	613	19.45	19.55	6240	6210	121,400
39	48	836	803	19.64	19.36	8780	8910	172,500
42	36	666	640	20.95	21.05	6990	6960	146,500
42	48	861	827	21.15	20.85	9830	9970	208,000
48	48	906	870	24.25	23.75	11,830	12,080	287,000
54	48	956	918	27.30	26.70	14,060	14,380	384,000
60	48	1005	965	30.30	29.70	16,430	16,770	498,000

DRAWN BY:	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED:
CHECKED BY:		SUPERSEDES:
APPROVED BY:		

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PREPARED BY DESIGN DIVISION	

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 06/22/26
CHECKED BY: CWC	PRESTRESSED CONCRETE 3 FT. WIDE BOX BEAM REINFORCEMENT DETAILS	SUPERSEDES: 09/26/22
APPROVED BY: BMW		



TYPICAL SECTION - 17" BEAMS

PLAN NOTES:
WHERE REQUIRED, DECREASE VOID BOXES HEIGHT TO PROVIDE 1½" CLEAR COVER FOR PRESTRESSING STRANDS IN UPPER ROW.

NOTES:
1 IF REQUIRED FOR STRENGTH, USE 3" Ø HOLES FOR BUNDLED REINFORCEMENT FOR CONTINUOUS FOR LIVE LOAD INTEGRAL STUB ABUTMENTS.

2 6" MIN [DEPENDENT UPON HAUNCH]

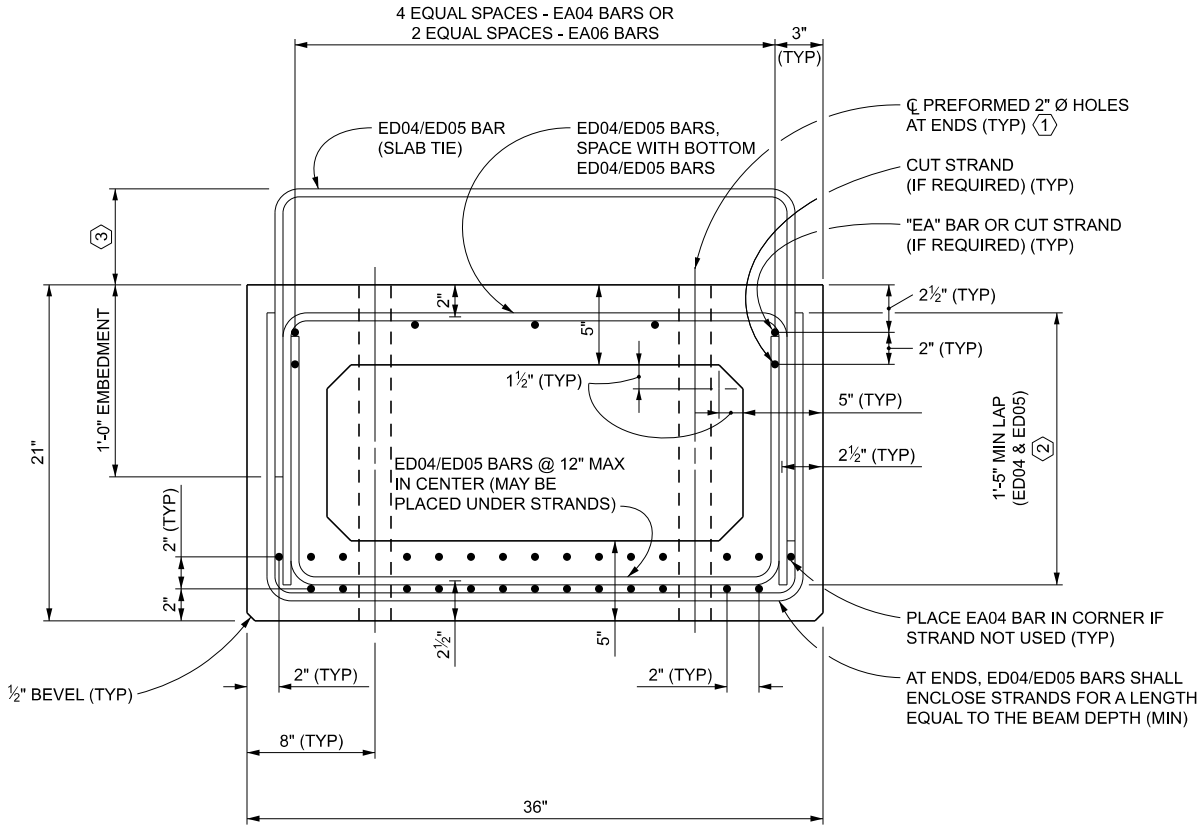
MINIMUM REINFORCEMENT SHOWN.

PLACE SPREAD BOX BEAM DIAPHRAGM/BACKWALL INSERTS AT 5" OR 7" UP FROM BOTTOM OF BEAM AND 3½" OR 5½" DOWN FROM TOP OF BEAM.

EA AND ED BARS ARE GRADE 60 (ksi) STEEL.
SD BARS ARE GRADE 60 (ksi) STAINLESS STEEL.
DESIGN AND SPACING OF ED AND SD BARS IS BASED ON GRADE 40 (ksi).
ADD BRIDGE DESIGN MANUAL NOTE 8.07.03P TO THE PLANS.

FOR ALTERNATIVE REINFORCEMENT CONFIGURATION SEE 6.65.10H.

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT PRESTRESSED CONCRETE 3 FT. WIDE BOX BEAM REINFORCEMENT DETAILS	ISSUED: 06/22/26 SUPERSEDES: 09/26/22



TYPICAL SECTION - 21" BEAMS

PLAN NOTES:
WHERE REQUIRED, DECREASE VOID BOXES HEIGHT TO PROVIDE 1½" CLEAR COVER FOR PRESTRESSING STRANDS IN UPPER ROW.

NOTES:
1. IF REQUIRED FOR STRENGTH, USE 3" Ø HOLES FOR BUNDLED REINFORCEMENT FOR CONTINUOUS FOR LIVE LOAD INTEGRAL STUB ABUTMENTS.

2. IF REQUIRED FOR SHEAR, USE ED05 BARS AND MINIMUM CONCRETE COMPRESSIVE STRENGTH OF 7600 PSI FOR BEAM DESIGN.

3. 6" MIN [DEPENDENT UPON HAUNCH]

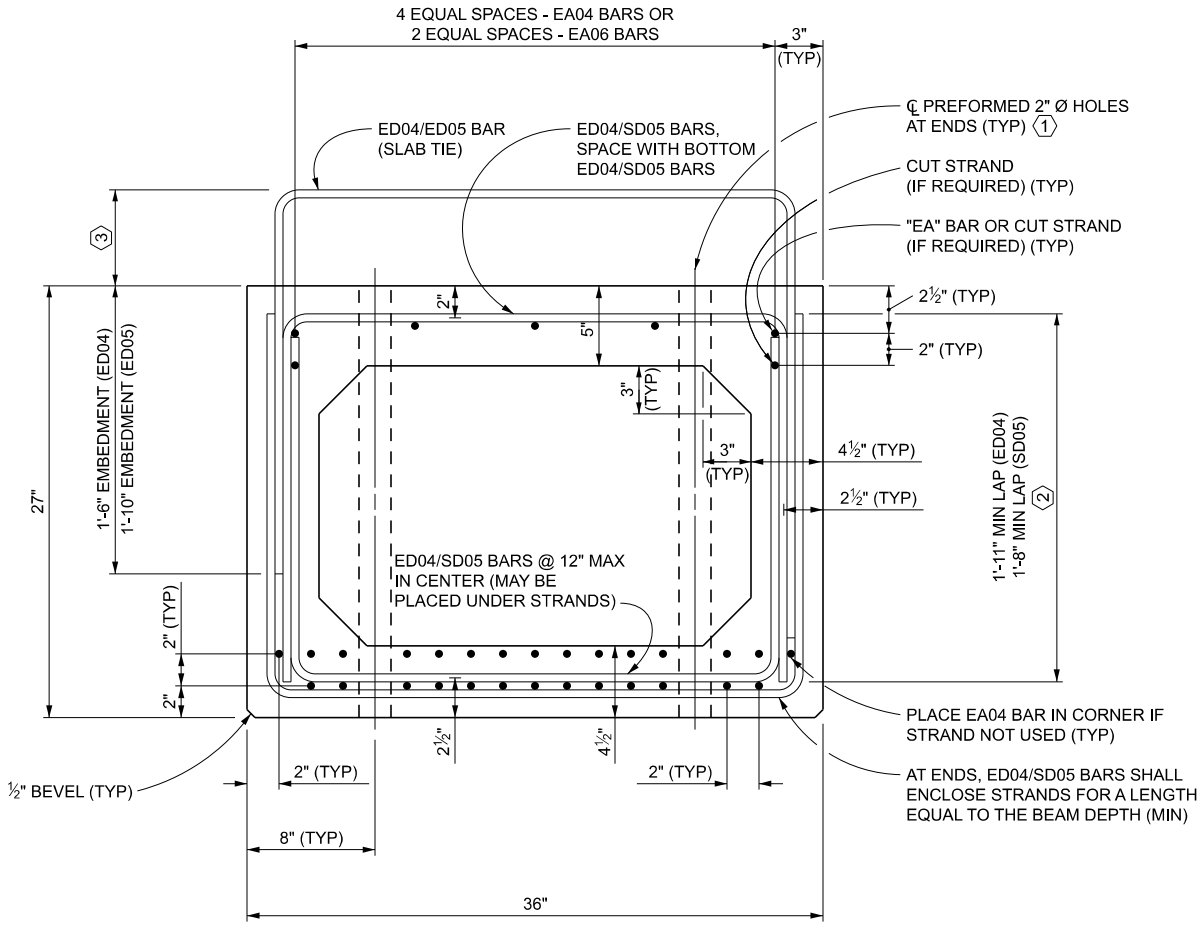
MINIMUM REINFORCEMENT SHOWN.

PLACE SPREAD BOX BEAM DIAPHRAGM/BACKWALL INSERTS AT 5" OR 7" UP FROM BOTTOM OF BEAM AND 3½" OR 5½" DOWN FROM TOP OF BEAM.

EA AND ED BARS ARE GRADE 60 (ksi) STEEL.
SD BARS ARE GRADE 60 (ksi) STAINLESS STEEL.
DESIGN AND SPACING OF ED AND SD BARS IS BASED ON GRADE 40 (ksi).
ADD BRIDGE DESIGN MANUAL NOTE 8.07.03P TO THE PLANS.

FOR ALTERNATIVE REINFORCEMENT CONFIGURATION SEE 6.65.10H.

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT PRESTRESSED CONCRETE 3 FT. WIDE BOX BEAM REINFORCEMENT DETAILS	ISSUED: 06/22/26 SUPERSEDES: 09/26/22



TYPICAL SECTION - 27" BEAMS

PLAN NOTES:
WHERE REQUIRED, DECREASE VOID BOXES HEIGHT TO PROVIDE 1½" CLEAR COVER FOR PRESTRESSING STRANDS IN UPPER ROW.

NOTES:
1. IF REQUIRED FOR STRENGTH, USE 3" Ø HOLES FOR BUNDLED REINFORCEMENT FOR CONTINUOUS FOR LIVE LOAD INTEGRAL STUB ABUTMENTS.

2. IF REQUIRED FOR SHEAR, USE SD05 BARS (STAINLESS STEEL) FOR BEAM DESIGN.

3. 6" MIN [DEPENDENT UPON HAUNCH]

MINIMUM REINFORCEMENT SHOWN.

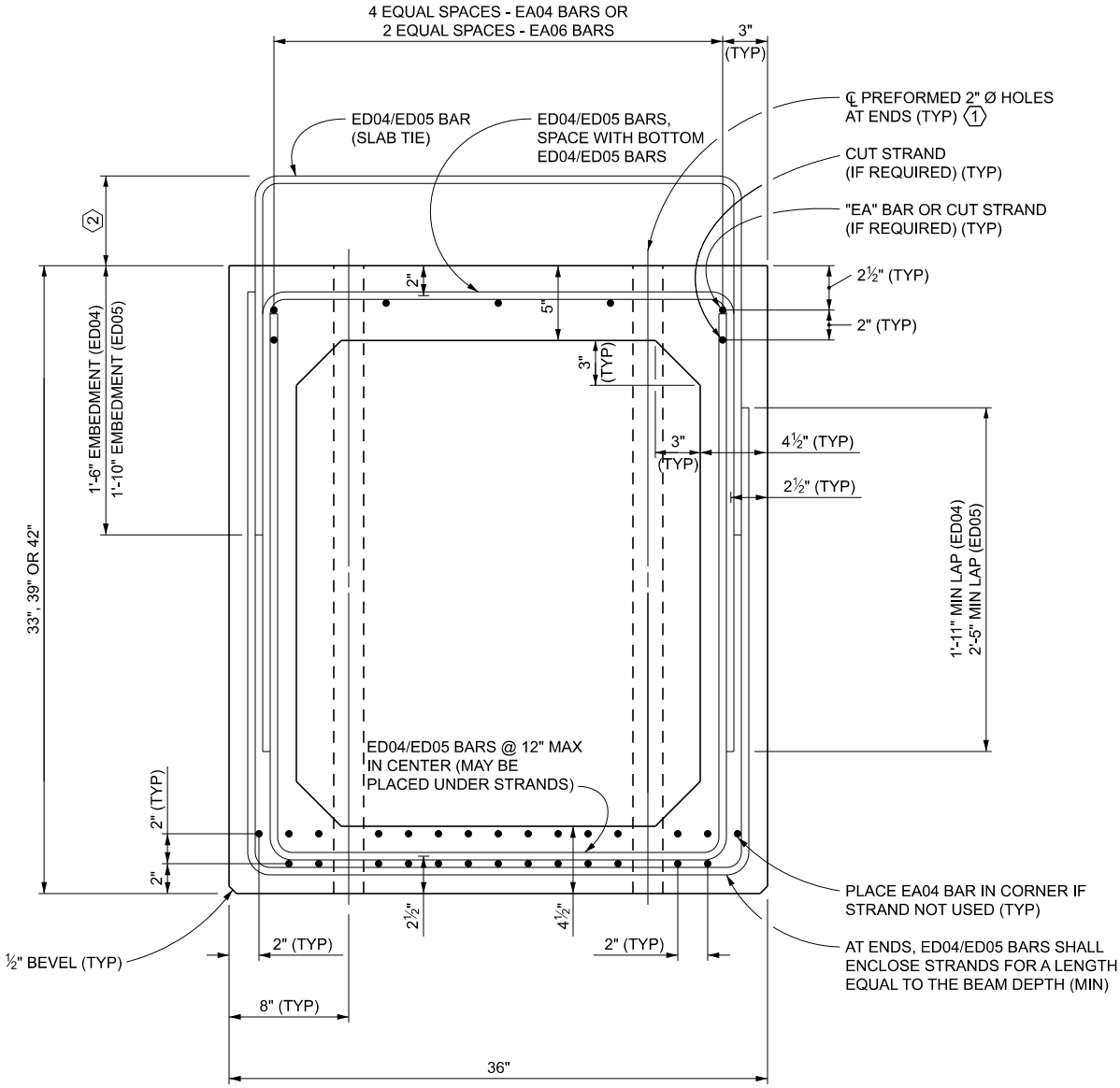
PLACE SPREAD BOX BEAM DIAPHRAGM/BACKWALL INSERTS AT 5" OR 7" UP FROM BOTTOM OF BEAM AND 3½" OR 5½" DOWN FROM TOP OF BEAM.

EA AND ED BARS ARE GRADE 60 (ksi) STEEL.
SD BARS ARE GRADE 60 (ksi) STAINLESS STEEL.

FOR ALTERNATIVE REINFORCEMENT CONFIGURATION SEE 6.65.10H.

PREPARED BY DESIGN DIVISION	6.65.10B

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 06/22/26
CHECKED BY: CWC	PRESTRESSED CONCRETE 3 FT. WIDE BOX BEAM REINFORCEMENT DETAILS	SUPERSEDES: 09/26/22
APPROVED BY: BMW		



TYPICAL SECTION - 33", 39" & 42" BEAMS

PLAN NOTES:
WHERE REQUIRED, DECREASE VOID BOXES HEIGHT TO PROVIDE 1½" CLEAR COVER FOR PRESTRESSING STRANDS IN UPPER ROW.

NOTES:
1 IF REQUIRED FOR STRENGTH, USE 3" Ø HOLES FOR BUNDLED REINFORCEMENT FOR CONTINUOUS FOR LIVE LOAD INTEGRAL STUB ABUTMENTS.

2 6" MIN [DEPENDENT UPON HAUNCH]

MINIMUM REINFORCEMENT SHOWN.

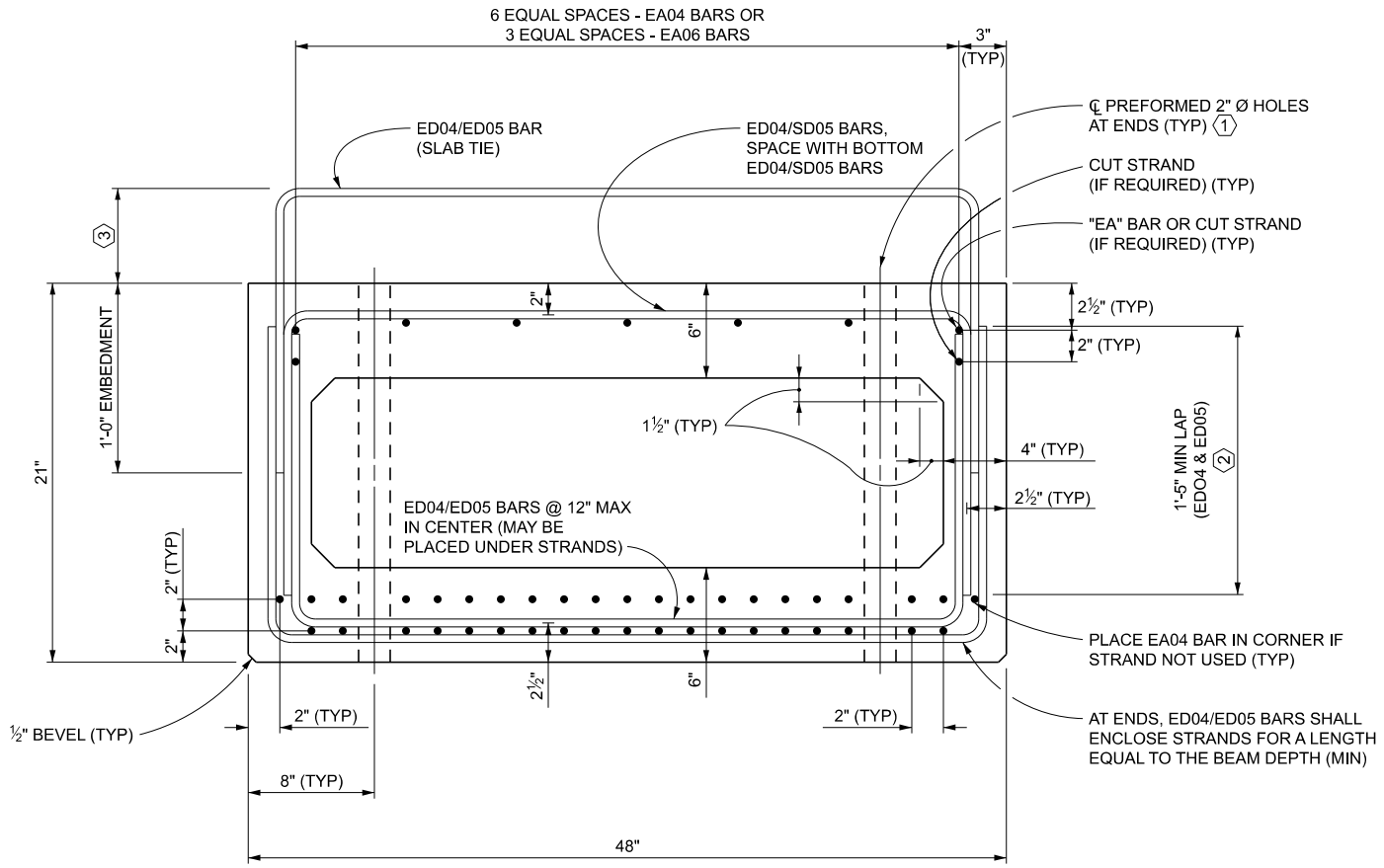
PLACE SPREAD BOX BEAM DIAPHRAGM/BACKWALL INSERTS AT 5" OR 7" UP FROM BOTTOM OF BEAM AND 3½" OR 5½" DOWN FROM TOP OF BEAM.

EA AND ED ARE GRADE 60 (ksi) STEEL.

FOR ALTERNATIVE REINFORCEMENT CONFIGURATION SEE 6.65.10I.

PREPARED BY DESIGN DIVISION	6.65.10C

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 06/22/26
CHECKED BY: CWC	PRESTRESSED CONCRETE 4 FT. WIDE BOX BEAM REINFORCEMENT DETAILS	SUPERSEDES: 09/26/22
APPROVED BY: BMW		



TYPICAL SECTION - 21" BEAMS

PLAN NOTES:
WHERE REQUIRED, DECREASE VOID BOXES HEIGHT TO PROVIDE 1½" CLEAR COVER FOR PRESTRESSING STRANDS IN UPPER ROW.

NOTES:
1. IF REQUIRED FOR STRENGTH, USE 3" Ø HOLES FOR BUNDLED REINFORCEMENT FOR CONTINUOUS FOR LIVE LOAD INTEGRAL STUB ABUTMENTS.

2. IF REQUIRED FOR SHEAR, USE ED05 BARS AND MINIMUM CONCRETE COMPRESSIVE STRENGTH OF 7600 PSI FOR BEAM DESIGN.

3. 6" MIN [DEPENDENT UPON HAUNCH]

MINIMUM REINFORCEMENT SHOWN.

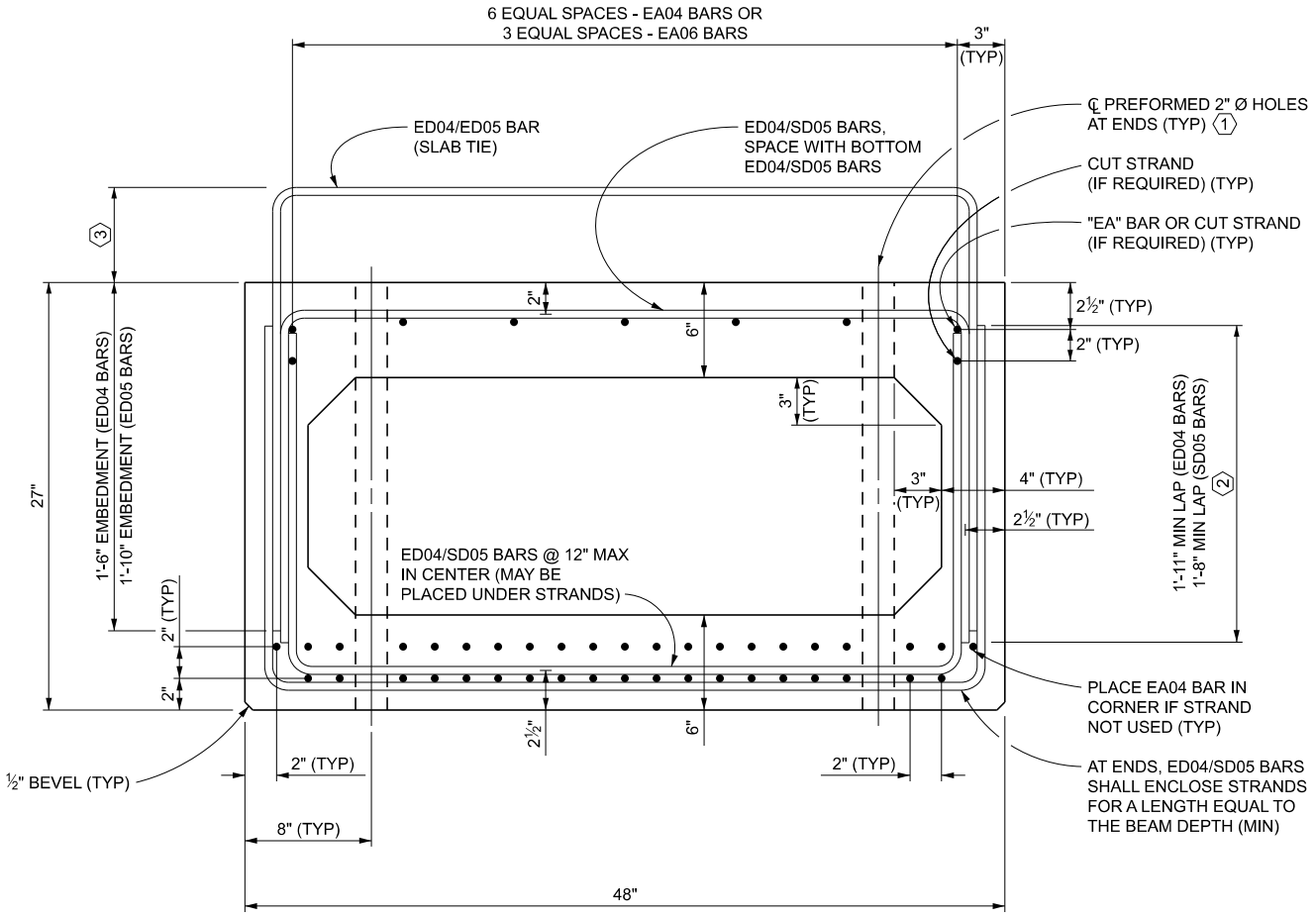
PLACE SPREAD BOX BEAM DIAPHRAGM/BACKWALL INSERTS AT 5" OR 7" UP FROM BOTTOM OF BEAM AND 3½" OR 5½" DOWN FROM TOP OF BEAM.

EA AND ED BARS ARE GRADE 60 (ksi) STEEL.
DESIGN AND SPACING OF ED BARS IS BASED ON GRADE 40 (ksi).
ADD BRIDGE DESIGN MANUAL NOTE 8.07.03P TO THE PLANS.

FOR ALTERNATIVE REINFORCEMENT CONFIGURATION SEE 6.65.10H.

PREPARED BY DESIGN DIVISION	6.65.10D

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT PRESTRESSED CONCRETE 4 FT. WIDE BOX BEAM REINFORCEMENT DETAILS	ISSUED: 06/22/26 SUPERSEDES: 04/28/25



TYPICAL SECTION - 27" BEAMS

PLAN NOTES:
WHERE REQUIRED, DECREASE VOID BOXES HEIGHT TO PROVIDE 1½" CLEAR COVER FOR PRESTRESSING STRANDS IN UPPER ROW.

NOTES:
1. IF REQUIRED FOR STRENGTH, USE 3" Ø HOLES FOR BUNDLED REINFORCEMENT FOR CONTINUOUS FOR LIVE LOAD INTEGRAL STUB ABUTMENTS.
2. IF REQUIRED FOR SHEAR, USE SD05 BARS (STAINLESS STEEL) FOR BEAM DESIGN.
3. 6" MIN [DEPENDENT UPON HAUNCH]

MINIMUM REINFORCEMENT SHOWN.

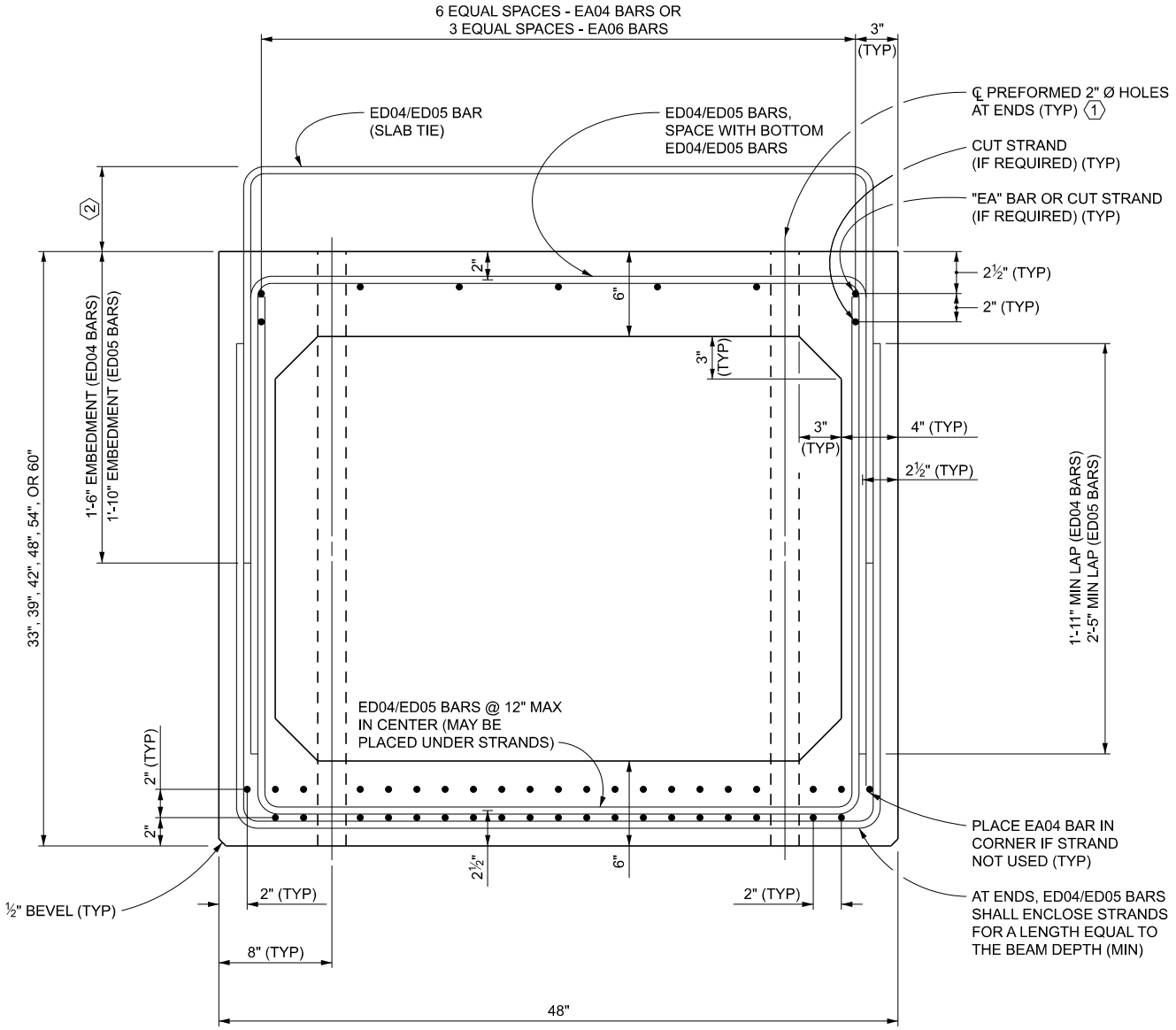
PLACE SPREAD BOX BEAM DIAPHRAGM/BACKWALL INSERTS AT 5" OR 7" UP FROM BOTTOM OF BEAM AND 3½" OR 5½" DOWN FROM TOP OF BEAM.

EA AND ED BARS ARE GRADE 60 (ksi) STEEL.
SD BARS ARE GRADE 60 (ksi) STAINLESS STEEL.

FOR ALTERNATIVE REINFORCEMENT CONFIGURATION SEE 6.65.10H.

PREPARED BY DESIGN DIVISION	6.65.10E

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT PRESTRESSED CONCRETE 4 FT. WIDE BOX BEAM REINFORCEMENT DETAILS	ISSUED: 06/22/26 SUPERSEDES: 09/26/22



TYPICAL SECTION - 33", 39", 42", 48", 54", & 60" BEAMS

PLAN NOTES:
WHERE REQUIRED, DECREASE VOID BOXES HEIGHT TO PROVIDE 1½" CLEAR COVER FOR PRESTRESSING STRANDS IN UPPER ROW.

NOTES:
1 IF REQUIRED FOR STRENGTH, USE 3" Ø HOLES FOR BUNDLED REINFORCEMENT FOR CONTINUOUS FOR LIVE LOAD INTEGRAL STUB ABUTMENTS.

2 6" MIN [DEPENDENT UPON HAUNCH]

MINIMUM REINFORCEMENT SHOWN.

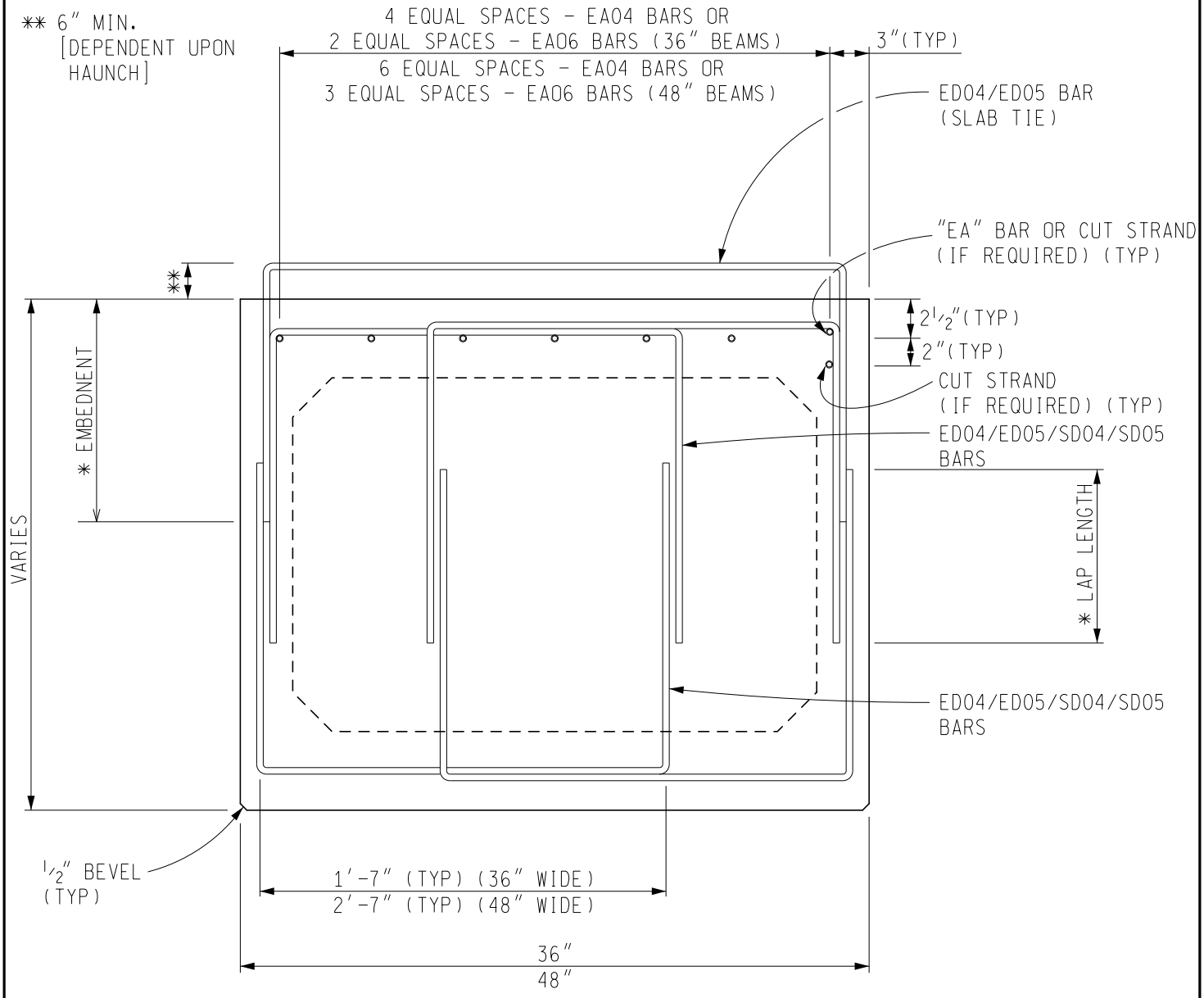
PLACE SPREAD BOX BEAM DIAPHRAGM/BACKWALL INSERTS AT 5" OR 7" UP FROM BOTTOM OF BEAM AND 3½" OR 5½" DOWN FROM TOP OF BEAM.

EA AND ED BARS ARE GRADE 60 (ksi) STEEL.

FOR ALTERNATIVE REINFORCEMENT CONFIGURATION SEE 6.65.10I.

PREPARED BY DESIGN DIVISION	6.65.10F

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT PRESTRESSED CONCRETE BOX BEAM DOUBLE STIRRUP DETAILS	ISSUED: 09/26/22 SUPERSEDES: 12/27/21



TYPICAL SECTION - DOUBLE STIRRUP DETAIL, ALL BEAMS

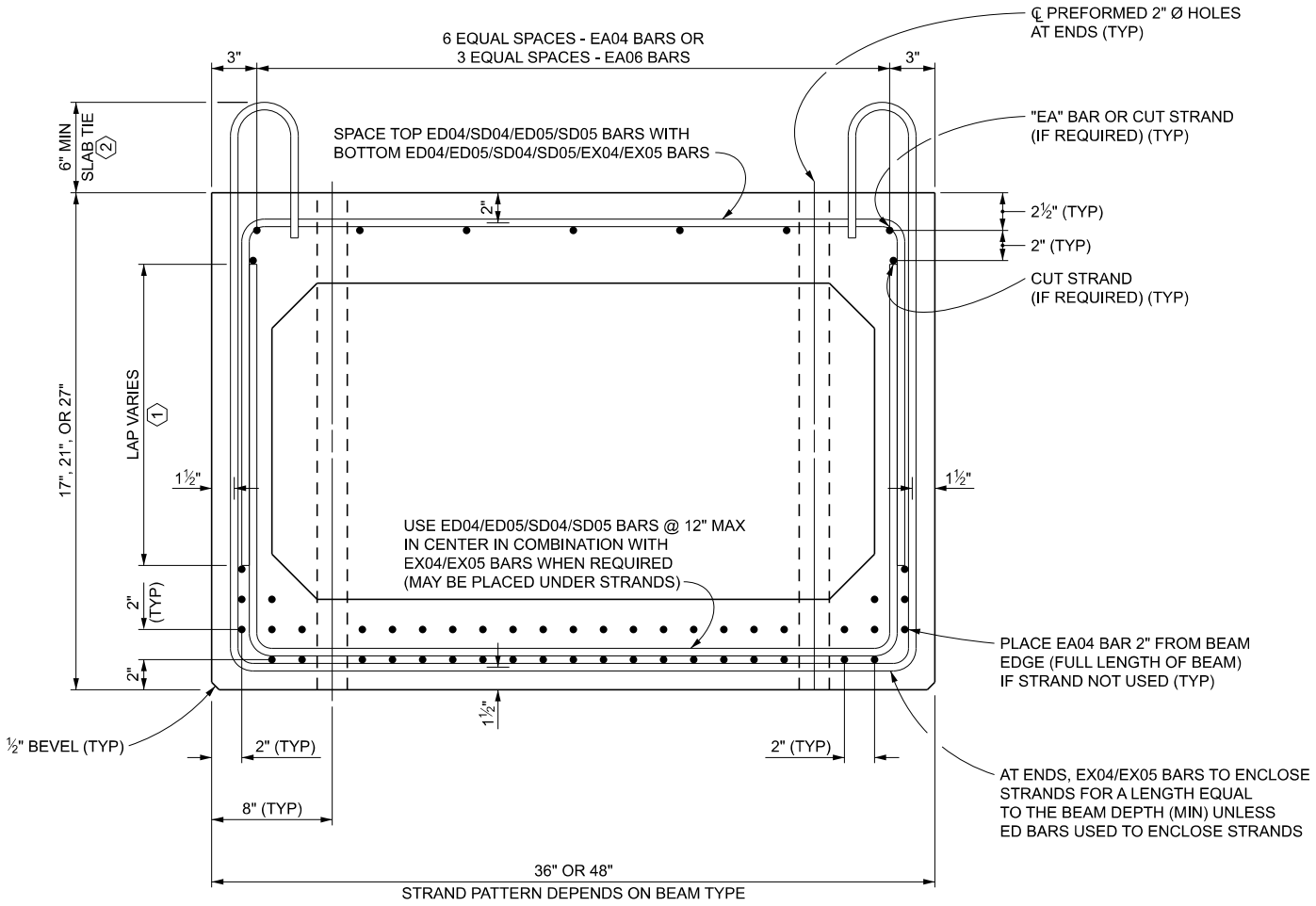
NOTES:

* SEE GUIDES 6.65.10 - 6.65.10F FOR APPLICABLE EMBEDMENTS, LAP LENGTHS AND APPLICABLE STEEL GRADES.

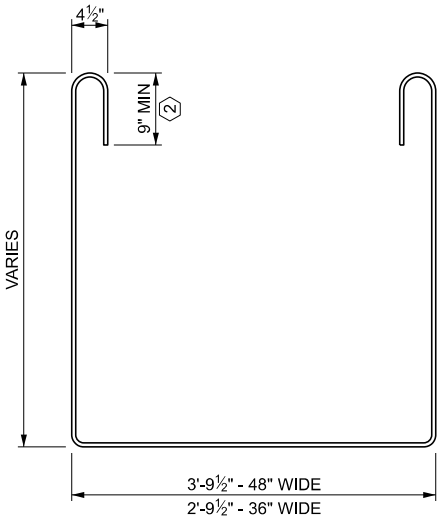
EXTEND BOX BEAM END BLOCK TO A MINIMUM OF 3" BEYOND LAST DOUBLE STIRUP.

PREPARED BY DESIGN DIVISION	6.65.10G

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 06/22/26
CHECKED BY: CWC	PRESTRESSED CONCRETE 17 IN., 21 IN., AND 27 IN. BOX BEAM REINFORCEMENT ALTERNATIVE DETAILS	SUPERSEDES:
APPROVED BY: BMW		

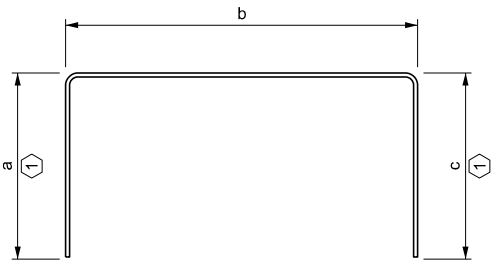


BOX BEAM



EX04/EX05 BAR (BOTTOM)

ED04/SD04/ED05/SD05 DIMENSIONS				
PRESTRESSED BOX BEAM TYPE	#4 BAR LENGTH		#5 BAR LENGTH	
	a & c	b	a & c	b
17" BEAM - 36" WIDE	1'-1"	2'-8"	1'-1"	2'-8"
21" BEAM - 36" WIDE	1'-5"	2'-8"	1'-5"	2'-8"
21" BEAM - 48" WIDE	1'-5"	3'-8"	1'-5"	3'-8"
27" BEAM - 36" WIDE	1'-11"	2'-8"	1'-11"	2'-8"
27" BEAM - 48" WIDE	1'-11"	3'-8"	1'-8"	3'-8"



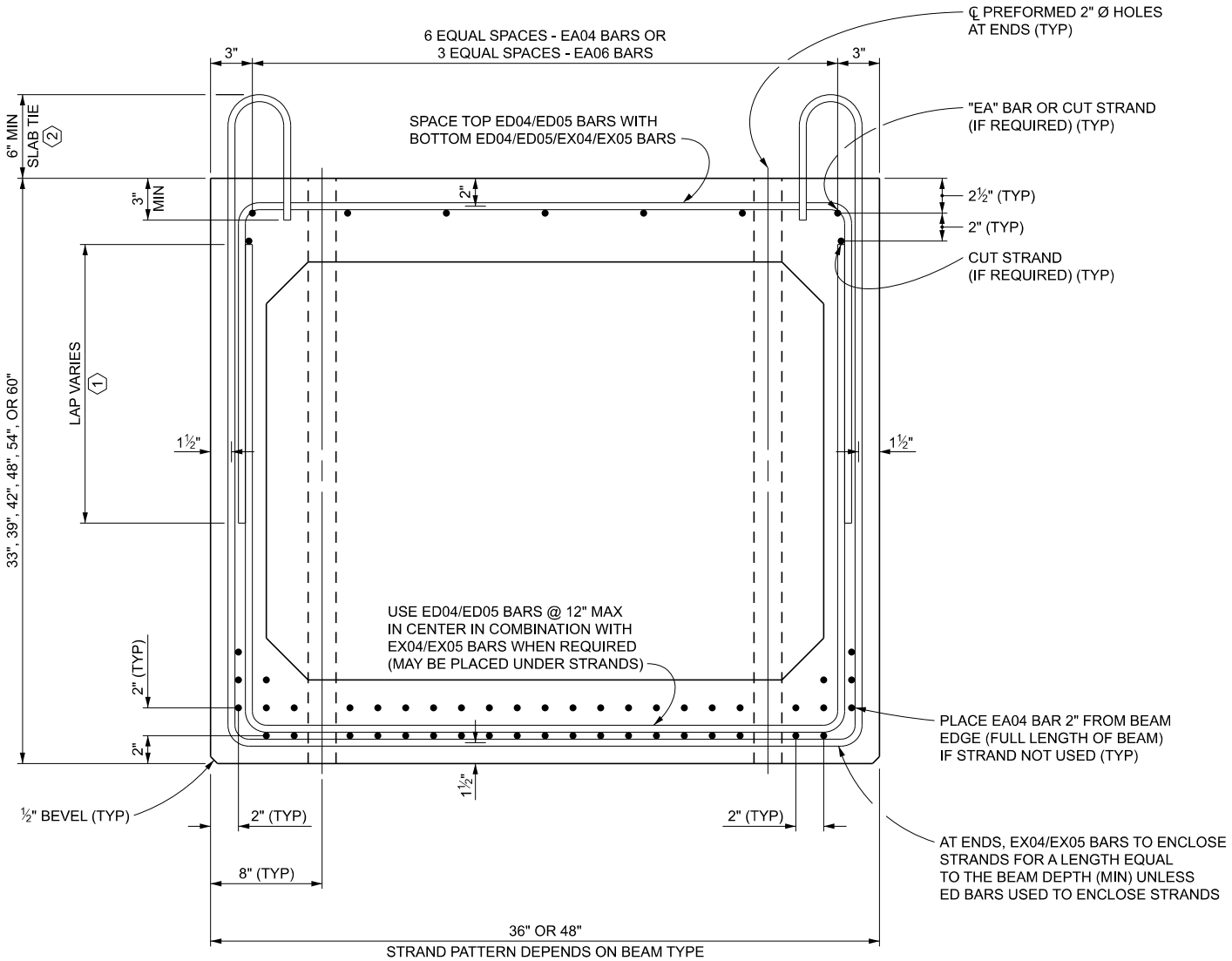
ED04/ES04/ED05/SD05 BAR

NOTES:
1. DEPTH DEPENDS ON BEAM TYPE. SEE TABLE.
2. DEPENDENT ON HAUNCH.

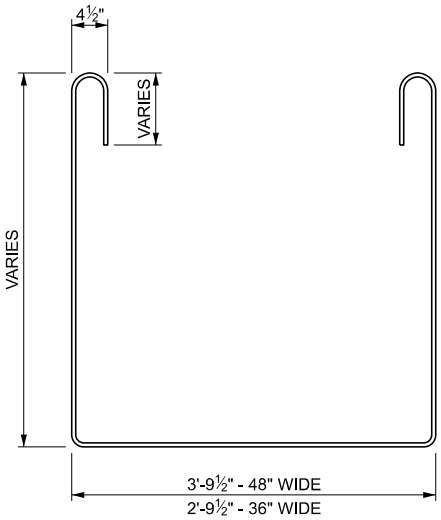
USE WITH BRIDGE DESIGN GUIDE 6.65.10 SERIES.

PREPARED BY DESIGN DIVISION	6.65.10H

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 06/22/26
CHECKED BY: CWC	PRESTRESSED CONCRETE 33 IN. THROUGH 60 IN. BOX BEAM REINFORCEMENT ALTERNATIVE DETAILS	SUPERSEDES:
APPROVED BY: BMW		

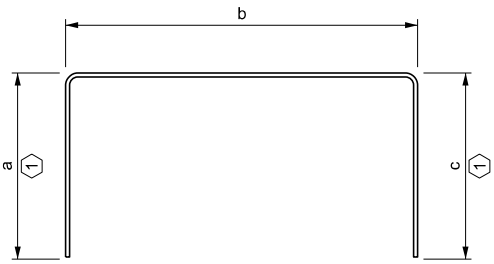


BOX BEAM



EX04/EX05 BAR (BOTTOM)

ED04/ED05 DIMENSIONS				
PRESTRESSED BOX BEAM TYPE	#4 BAR LENGTH		#5 BAR LENGTH	
	a & c MIN	b	a & c MIN	b
33" BEAM - 36" WIDE	1'-11"	2'-8"	1'-11"	2'-8"
33" BEAM - 48" WIDE	1'-11"	3'-8"	2'-5"	3'-8"
39" BEAM - 36" WIDE	1'-11"	2'-8"	2'-5"	2'-8"
39" BEAM - 48" WIDE	1'-11"	3'-8"	2'-5"	3'-8"
42" BEAM - 36" WIDE	1'-11"	2'-8"	2'-5"	2'-8"
42" BEAM - 48" WIDE	1'-11"	3'-8"	2'-5"	3'-8"
48" BEAM - 48" WIDE	1'-11"	3'-8"	2'-5"	3'-8"
54" BEAM - 48" WIDE	1'-11"	3'-8"	2'-5"	3'-8"
60" BEAM - 48" WIDE	1'-11"	3'-8"	2'-5"	3'-8"

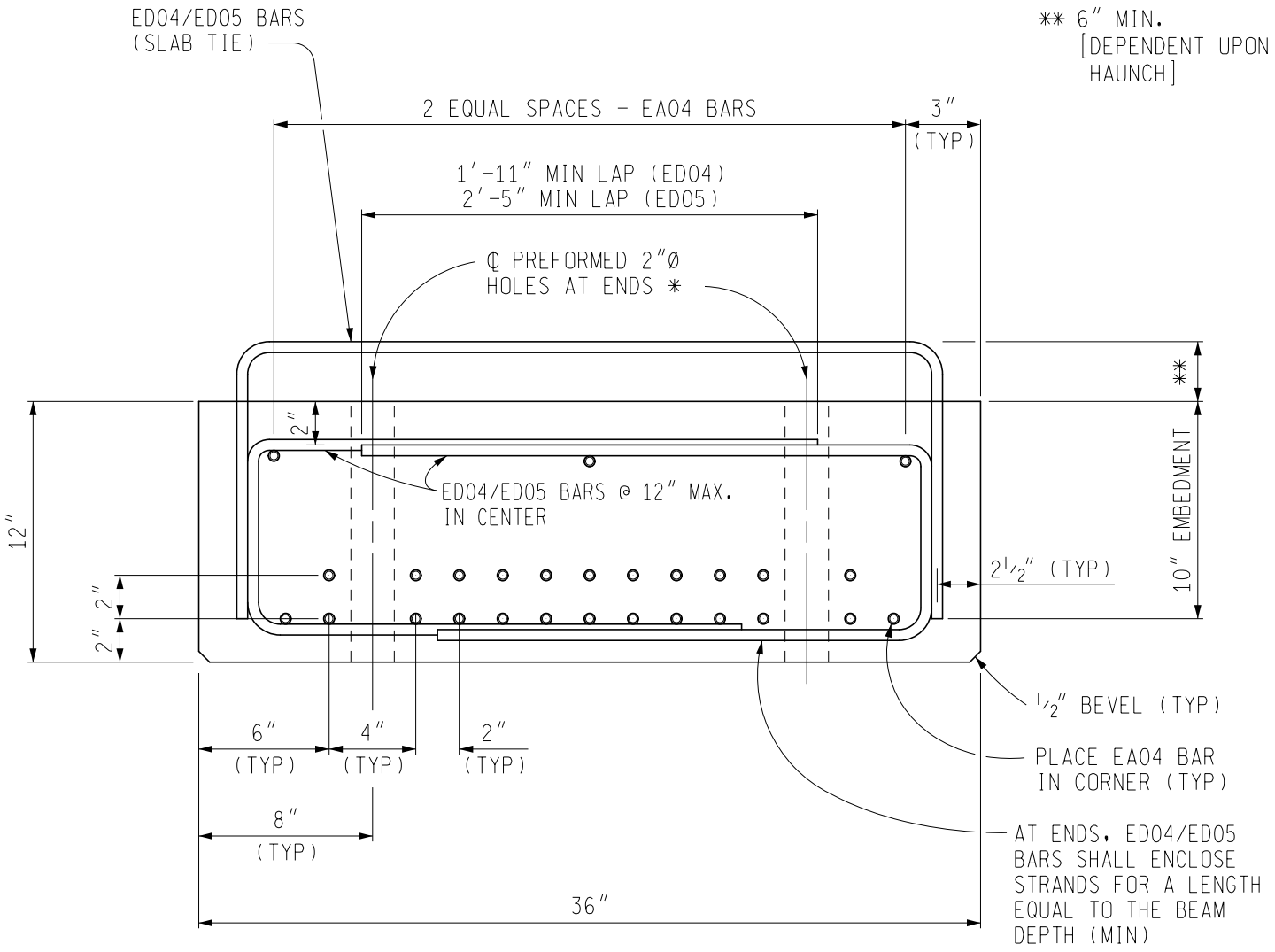


ED04/ED05 BAR

NOTES:
(1) DEPTH DEPENDS ON BEAM TYPE. SEE TABLE.
(2) DEPENDENT ON HAUNCH.
USE WITH BRIDGE DESIGN GUIDE 6.65.10 SERIES.

PREPARED BY DESIGN DIVISION	6.65.10I

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT PRESTRESSED CONCRETE 3′ WIDE BOX BEAM REINFORCEMENT DETAILS	ISSUED: 09/26/22 SUPERSEDES: 12/27/21



TYPICAL SECTION - 12″ BEAM

NOTES:

* IF REQUIRED FOR STRENGTH, USE 3″Ø HOLES FOR BUNDLED REINFORCEMENT FOR CONTINUOUS FOR LIVE LOAD INTEGRAL STUB ABUTMENTS.

EA AND ED BARS ARE GRADE 60 (ksi) STEEL.

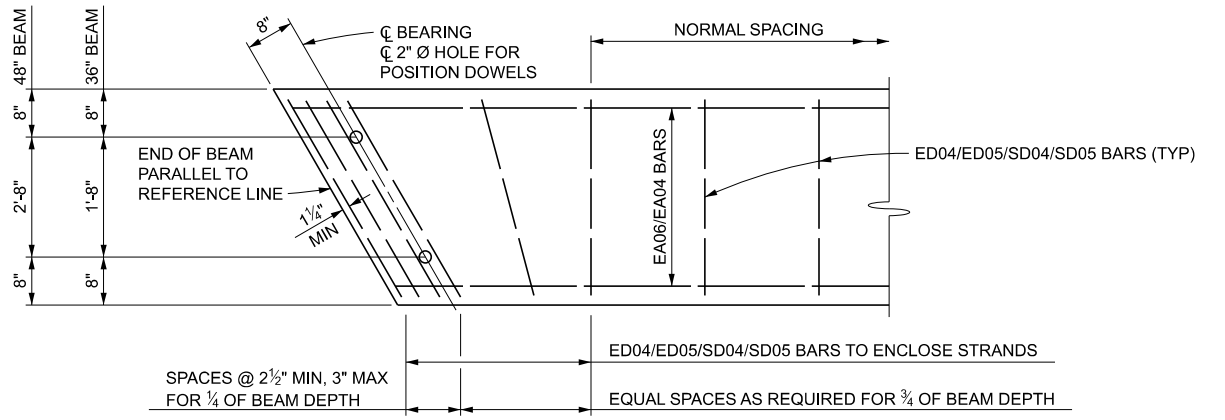
PREPARED BY DESIGN DIVISION	6.65.11

DRAWN BY:	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED:
CHECKED BY:		SUPERSEDES:
APPROVED BY:		

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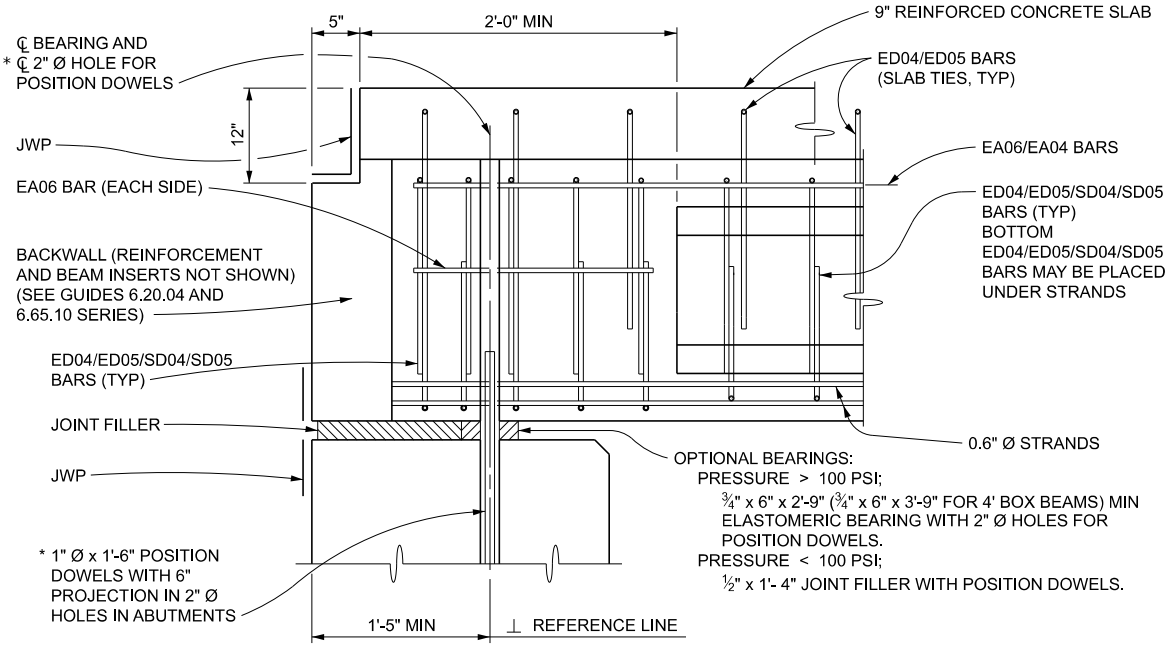
PREPARED BY DESIGN DIVISION	

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT PRESTRESSED CONCRETE BOX BEAM DETAILS - SPREAD BOX BEAMS	ISSUED: 06/23/25 SUPERSEDES: 12/27/21



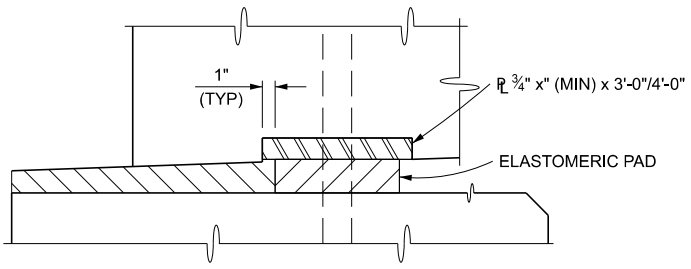
PLAN AT END

SPACE ED04/ED05/SD04/SD05 BARS TO CLEAR HOLES FOR POSITION DOWELS



SECTION THROUGH END BLOCK AT ABUTMENT

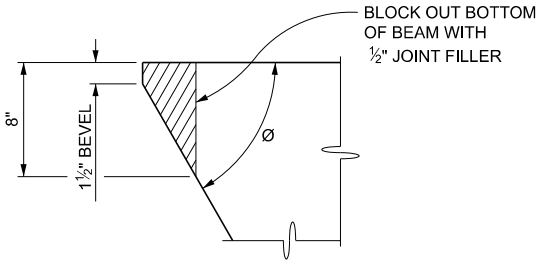
* IF NEEDED FOR STRENGTH, FOR CONTINUOUS FOR LIVE LOAD INTEGRAL STUB ABUTMENTS, REINFORCING STEEL MAY BE USED IN 2" OR 3" Ø HOLES.



ALTERNATE BEARING DETAILS

USE ¾" STEEL PLATE CAST IN BEAM AND TILTED AS REQUIRED WHEN CALCULATED BEVEL EXCEEDS 1%.

PROVIDE ¼" x 2" x 4" ANCHORS OR ½" Ø SHEAR STUD FOR ¾" PLATE. (SEE GUIDE 8.43.01A FOR DETAILS)

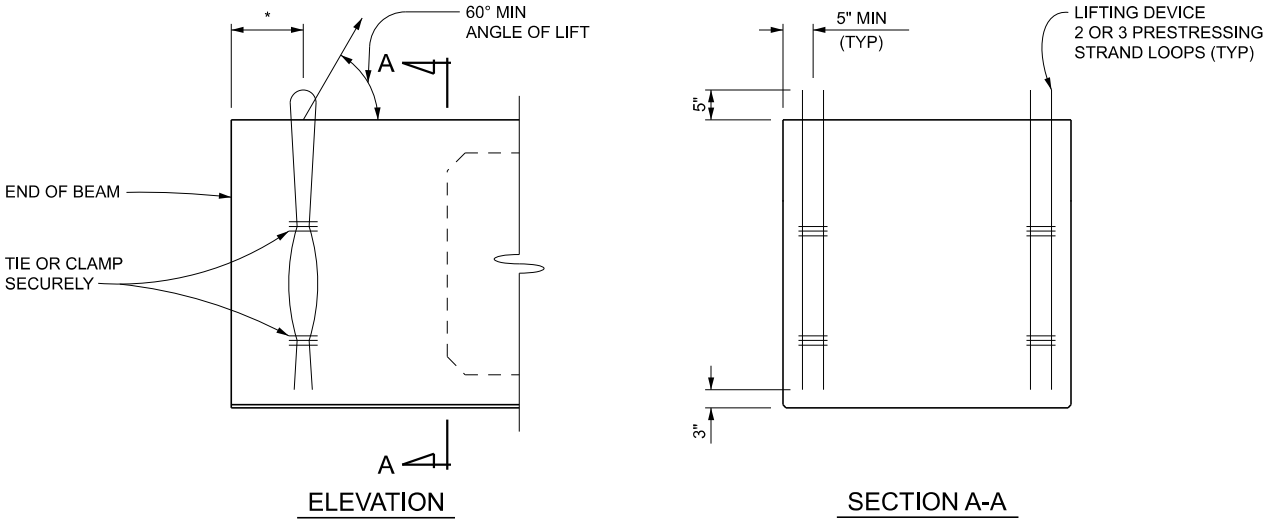


CORNER BLOCKING DETAIL

USE WHEN Ø < 70°

PREPARED BY DESIGN DIVISION	6.65.12A

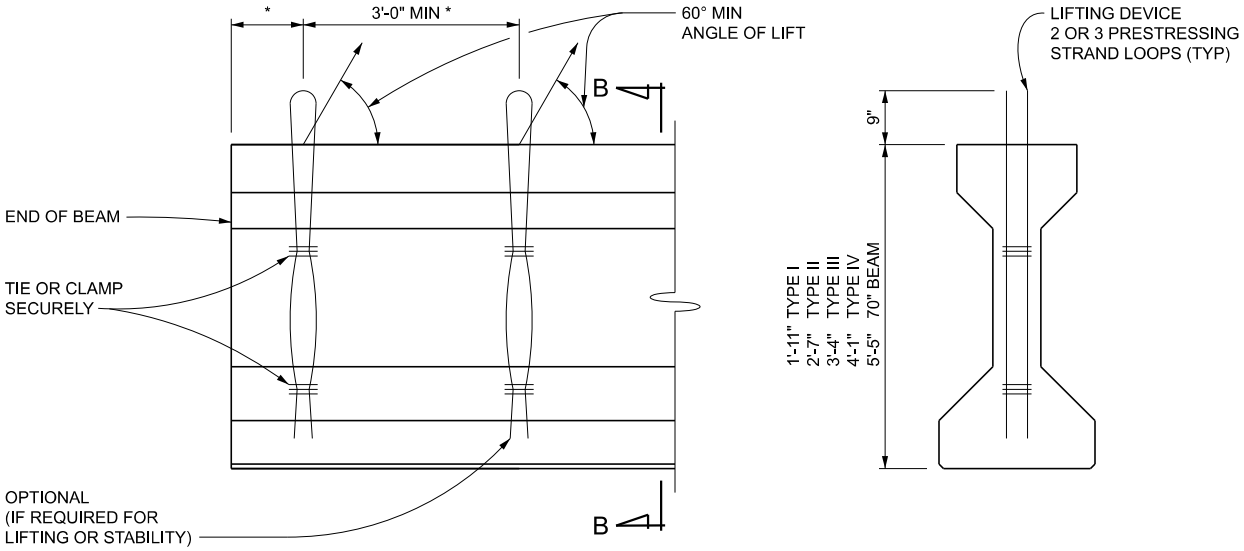
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/22/25
CHECKED BY: CWC	PRESTRESSED CONCRETE BEAM LIFTING DEVICE DETAILS	SUPERSEDES: 11/28/22
APPROVED BY: KCK		



ELEVATION

SECTION A-A

DETAILS FOR BOX BEAMS



ELEVATION

SECTION B-B

DETAILS FOR I-BEAMS

* CHECK THE STABILITY OF PRESTRESSED CONCRETE GIRDERS DURING LIFTING AND TRANSPORT. LOCATE LIFTING LOOPS TO ENSURE STABILITY AND TO KEEP THE APPLIED STRESS BELOW THE ALLOWABLE LIMITS IN AASHTO LRFD. DIMENSION TO THE SPECIFIC LOCATIONS OF THE LIFTING LOOPS USED IN THE STABILITY ANALYSIS ON THE CONTRACT PLANS; DO NOT PROVIDE A DISTANCE RANGE. SEE SECTION 7.02.18.A.9 OF THE BRIDGE DESIGN MANUAL FOR MORE INFORMATION.

PRESTRESSING STRAND LIFTING DEVICES

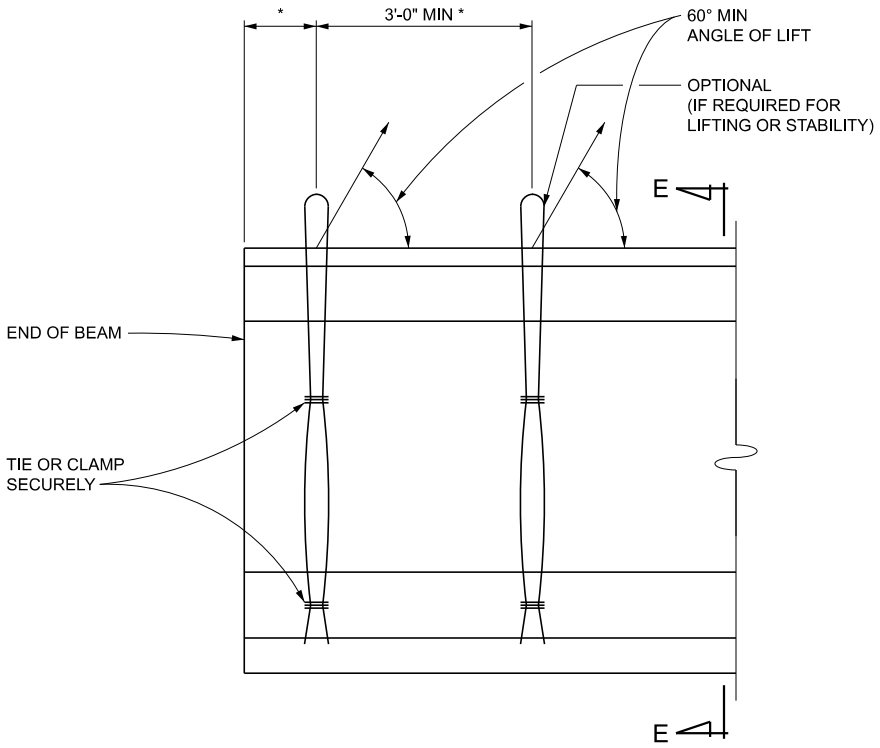
BEAM WEIGHT (TONS)	STRAND SIZE	NUMBER OF STRANDS
20	3/8"	2
27	7/16"	2
36	1/2"	2
30	3/8"	3
40.5	7/16"	3
54	1/2"	3

PLAN NOTE:

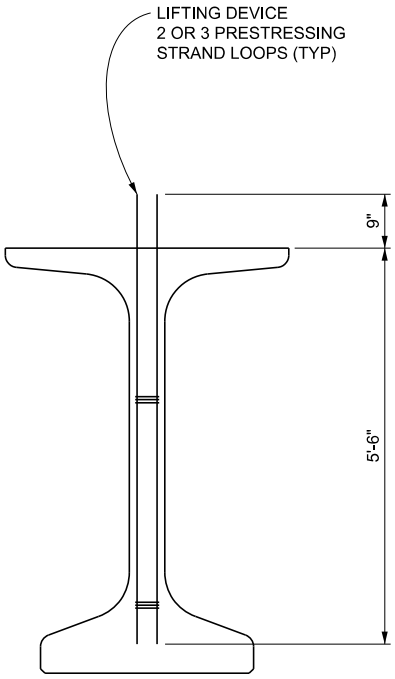
REMOVE LIFTING DEVICES AFTER BEAMS ARE ERECTED. CUT LIFTING DEVICE 1" ABOVE STEEL REINFORCEMENT AND PROTECT REINFORCEMENT FROM DAMAGE. REMOVAL IS INCLUDED IN THE BID ITEM "PREST CONC BOX BEAM, ERECT, __ INCH" OR "PREST CONC I BEAM, ERECT, __ INCH".

PREPARED BY DESIGN DIVISION	6.65.14

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/22/25
CHECKED BY: CWC	PRESTRESSED CONCRETE BEAM LIFTING DEVICE DETAILS	SUPERSEDES: 11/28/22
APPROVED BY: KCK		



ELEVATION



SECTION E-E

DETAILS FOR MICHIGAN 1800 CONCRETE BEAMS

PRESTRESSING STRAND LIFTING DEVICES		
BEAM WEIGHT (TONS)	STRAND SIZE	NUMBER OF STRANDS
34	3/8"	2
43	7/16"	2
53	1/2"	2
53	3/8"	3
62	7/16"	3
70	1/2"	3

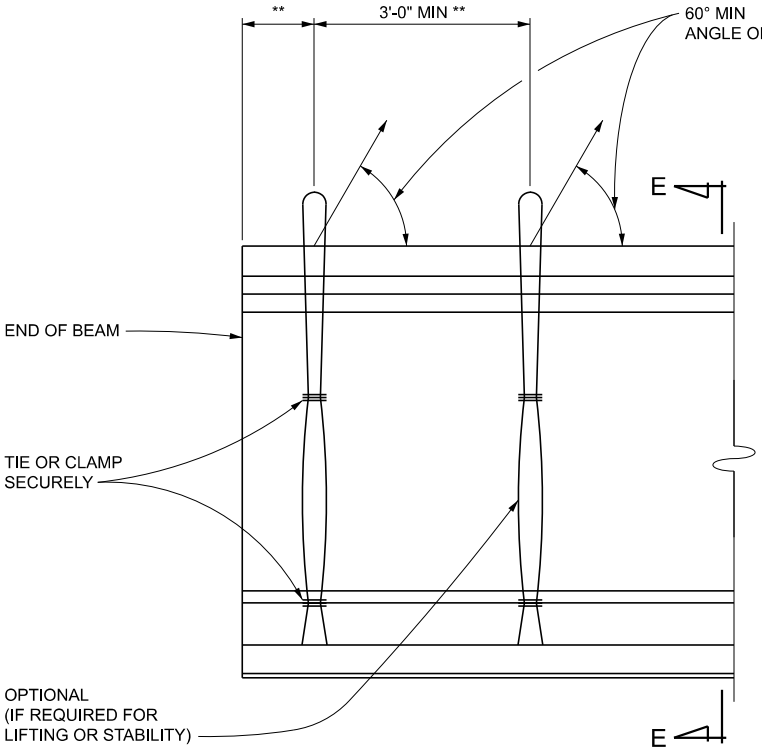
* CHECK THE STABILITY OF PRESTRESSED CONCRETE GIRDERS DURING LIFTING AND TRANSPORT. LOCATE LIFTING LOOPS TO ENSURE STABILITY AND TO KEEP THE APPLIED STRESS BELOW THE ALLOWABLE LIMITS IN AASHTO LRFD. DIMENSION TO THE SPECIFIC LOCATIONS OF THE LIFTING LOOPS USED IN THE STABILITY ANALYSIS ON THE CONTRACT PLANS; DO NOT PROVIDE A DISTANCE RANGE. SEE SECTION 7.02.18.A.9 OF THE BRIDGE DESIGN MANUAL FOR MORE INFORMATION.

PLAN NOTE:

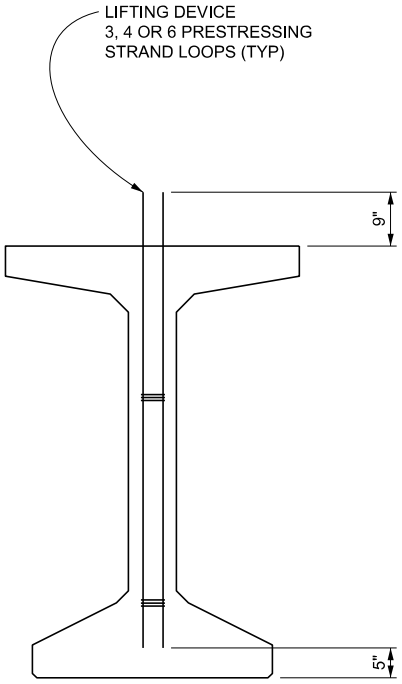
REMOVE LIFTING DEVICES AFTER BEAMS ARE ERECTED. CUT LIFTING DEVICE 1" ABOVE STEEL REINFORCEMENT AND PROTECT REINFORCEMENT FROM DAMAGE. REMOVAL IS INCLUDED IN THE BID ITEM "PREST CONC 1800 BEAM, ERECT."

PREPARED BY DESIGN DIVISION	6.65.14A

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/22/25
CHECKED BY: CWC	PRESTRESSED CONCRETE BEAM LIFTING DEVICE DETAILS	SUPERSEDES: 11/28/22
APPROVED BY: KCK		



ELEVATION



SECTION E-E

DETAILS FOR BULB TEE BEAMS

BEAM DEPTH (INCHES)	NUMBER OF STRANDS AND SIZE					
	3 - ½"	3 - 0.6"	4 - ½"	4 - 0.6"	6 - ½" *	6 - 0.6" *
	BEAM WEIGHT (TONS)					
36	32	39	41	49	64	78
42	39	47	49	60	78	94
48	45	54	57	68	90	108
54	52	62	65	78	104	124
60	58	70	73	87	116	140
66	64	77	81	92	128	154
72	71	85	89	106	142	170

* DOUBLE LOOPS WITH 3 STRANDS EACH.

** CHECK THE STABILITY OF PRESTRESSED CONCRETE GIRDERS DURING LIFTING AND TRANSPORT. LOCATE LIFTING LOOPS TO ENSURE STABILITY AND TO KEEP THE APPLIED STRESS BELOW THE ALLOWABLE LIMITS IN AASHTO LRFD. DIMENSION TO THE SPECIFIC LOCATIONS OF THE LIFTING LOOPS USED IN THE STABILITY ANALYSIS ON THE CONTRACT PLANS; DO NOT PROVIDE A DISTANCE RANGE. SEE SECTION 7.02.18.A.9 OF THE BRIDGE DESIGN MANUAL FOR MORE INFORMATION.

PLAN NOTE:

REMOVE LIFTING DEVICES AFTER BEAMS ARE ERECTED. CUT LIFTING DEVICE 1" ABOVE STEEL REINFORCEMENT AND PROTECT REINFORCEMENT FROM DAMAGE. REMOVAL IS INCLUDED IN THE BID ITEM "PREST CONC BULB-TEE BEAM, ERECT, __ INCH BY __ INCH".

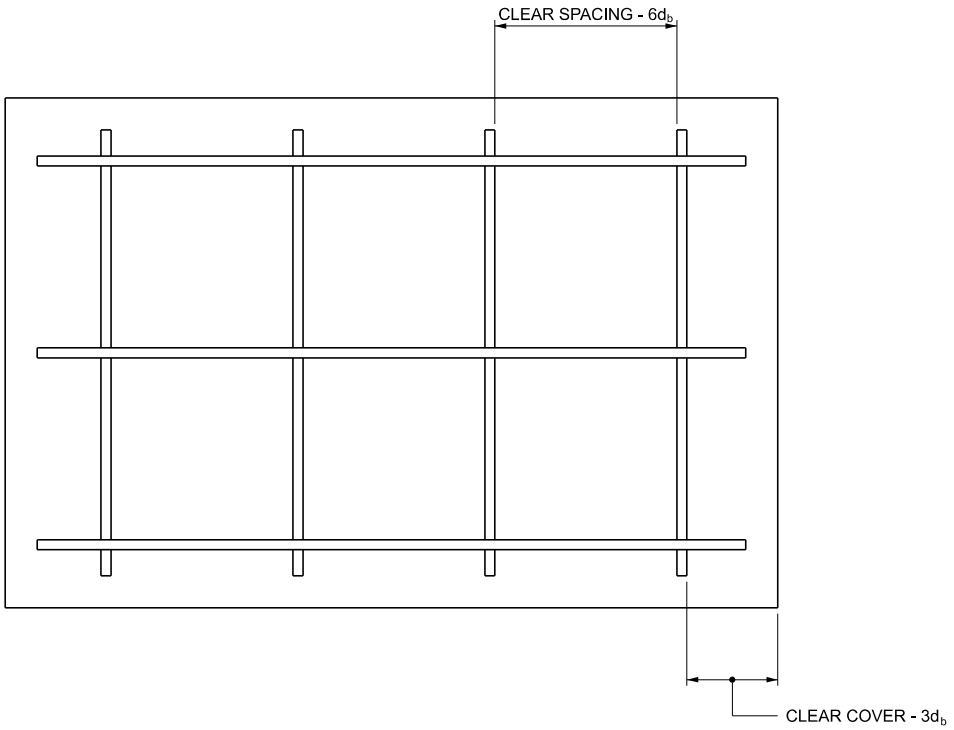
PREPARED BY DESIGN DIVISION	6.65.14B

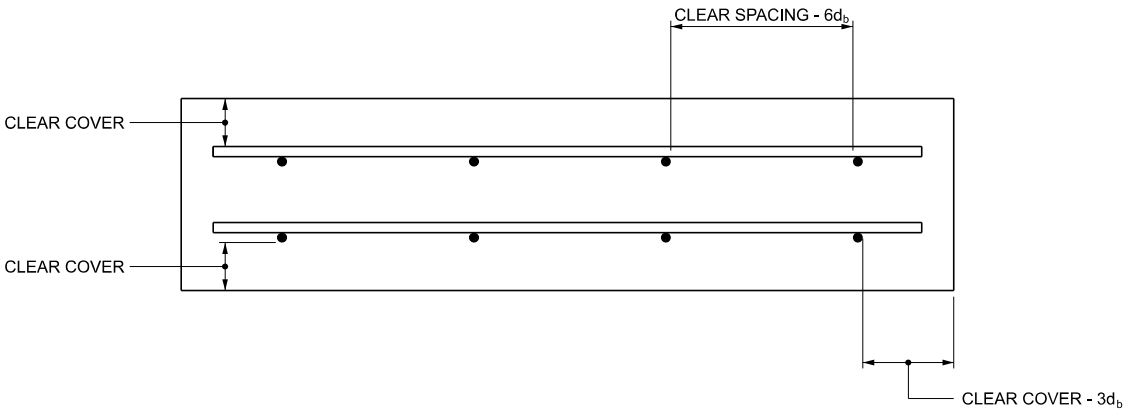
7. STEEL REINFORCEMENT

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT ENGLISH REINFORCING BARS	ISSUED: 11/27/01 SUPERSEDES: 08/08/96

BAR SIZE DESIGNATION		NOMINAL DIMENSIONS		
ENGLISH	METRIC	WEIGHT (lbs/ft)	DIAMETER (in)	AREA (in^2)
03	10	0.376	0.375	0.11
04	13	0.668	0.500	0.20
05	16	1.043	0.625	0.31
06	19	1.502	0.750	0.44
07	22	2.044	0.875	0.60
08	25	2.670	1.000	0.79
09	29	3.400	1.128	1.00
10	32	4.303	1.270	1.27
11	36	5.313	1.410	1.56
14	43	7.650	1.693	2.25
18	57	13.600	2.257	4.00

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/26/23
CHECKED BY: VZ	TENSION DEVELOPMENT AND LAP SPLICE LENGTHS SPACING THRESHOLDS	SUPERSEDES:
APPROVED BY: KCK		





d_b = DIAMETER OF REINFORCING BAR

CLEAR SPACING = CENTER TO CENTER SPACING - DIAMETER OF REINFORCING BAR

PREPARED BY DESIGN DIVISION	7.14.02

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/26/23
CHECKED BY: VZ	TENSION DEVELOPMENT AND LAP SPLICE LENGTHS FOR SUBSTRUCTURE	SUPERSEDES: 11/27/01
APPROVED BY: KCK		

EPOXY COATED REINFORCEMENT
F'_c = 3.0 ksi
F_y = 60.0 ksi

BAR SIZE	SPACING THRESHOLD *		TENSION DEVELOPMENT LENGTH				
				≤ 12" OF CONCRETE BELOW		> 12" OF CONCRETE BELOW	
	$3d_b$ (in)	$6d_b$ (in)	BASIC DEVELOPMENT LENGTH (in) **	CLEAR COVER ≥ $3d_b$ & CLEAR SPACING ≥ $6b_d$ (in)	ALL OTHER CASES (in)	CLEAR COVER ≥ $3d_b$ & CLEAR SPACING ≥ $6b_d$ (in)	ALL OTHER CASES (in)
3	1⅛	2¼	32	16	20	20	22
4	1½	3	42	21	26	27	29
5	1⅞	3¾	52	25	32	33	36
6	2¼	4½	63	31	38	40	43
7	2⅝	5¼	73	36	44	46	50
8	3	6	84	41	51	53	58
9	3⅜	6¾	94	46	57	59	64
10	3¾	7½	104	50	63	65	71
11	4⅛	8¼	115	56	69	72	79

BAR SIZE	SPACING THRESHOLD *		TENSION LAP LENGTH			
			≤ 12" OF CONCRETE BELOW		> 12" OF CONCRETE BELOW	
	$3d_b$ (in)	$6d_b$ (in)	CLEAR COVER ≥ $3d_b$ & CLEAR SPACING ≥ $6b_d$ (in)	ALL OTHER CASES (in)	CLEAR COVER ≥ $3d_b$ & CLEAR SPACING ≥ $6b_d$ (in)	ALL OTHER CASES (in)
3	1⅛	2¼	20	26	26	29
4	1½	3	27	33	35	38
5	1⅞	3¾	33	41	43	46
6	2¼	4½	40	50	52	56
7	2⅝	5¼	46	57	60	65
8	3	6	53	66	69	75
9	3⅜	6¾	59	74	77	84
10	3¾	7½	65	82	85	92
11	4⅛	8¼	72	90	94	102

* USE SPACING THRESHOLD VALUES IN DETERMINING THE APPROPRIATE COLUMN FROM WHICH TO SELECT THE DEVELOPMENT AND LAP LENGTH.

** IF THE PROJECT SPECIFIC CONDITIONS DO NOT FALL INTO ONE OF THE COLUMNS INCLUDED IN THE TABLE ABOVE OR ARE NOT IN ALIGNMENT WITH THE NOTES ON THIS BRIDGE DESIGN GUIDE CALCULATE THE TENSION DEVELOPMENT AND LAP LENGTHS USING THE BASIC DEVELOPMENT LENGTH FROM THE TABLE ABOVE AND THE APPROPRIATE MODIFICATION FACTORS OUTLINED IN AASHTO LRFD 5.10.8.

NOTES:

THE VALUES IN THE TABLE ABOVE ARE BASED ON THE REQUIREMENTS OUTLINED IN AASHTO LRFD 5.10.8.

THE VALUES IN THE TABLE ABOVE ASSUME THE AREA OF REINFORCEMENT PROVIDED IS EQUAL TO THE AREA OF REINFORCEMENT REQUIRED BY THE DESIGN (λ_{er} = 1.0).

THE VALUES IN THE TABLE ABOVE ACCOUNT FOR THE TYPICAL CONFINEMENT REINFORCEMENT DETAILED IN THE MDOT BRIDGE DESIGN GUIDES (λ_{rc} = 0.4).

LAP LENGTHS ARE BASED ON CLASS B LAP SPLICES IN ACCORDANCE WITH AASHTO LRFD 5.10.8.4.3a.

DEVELOPMENT AND LAP LENGTHS IN THE TABLES ABOVE WILL BE CONSERVATIVE FOR UNCOATED REINFORCEMENT.

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT TENSION DEVELOPMENT AND LAP SPLICE LENGTHS FOR SUPERSTRUCTURE	ISSUED: 12/26/23 SUPERSEDES: 11/27/01

EPOXY COATED REINFORCEMENT
F'_c = 4.0 ksi
F_y = 60.0 ksi

BAR SIZE	SPACING THRESHOLD *		TENSION DEVELOPMENT LENGTH				
				≤ 12" OF CONCRETE BELOW		> 12" OF CONCRETE BELOW	
	$3d_b$ (in)	$6d_b$ (in)	BASIC DEVELOPMENT LENGTH (in) **	CLEAR COVER ≥ $3d_b$ & CLEAR SPACING ≥ $6b_d$ (in)	ALL OTHER CASES (in)	CLEAR COVER ≥ $3d_b$ & CLEAR SPACING ≥ $6b_d$ (in)	ALL OTHER CASES (in)
3	1⅛	2¼	27	13	17	17	19
4	1½	3	36	18	22	23	25
5	1⅞	3¾	45	22	27	29	31
6	2¼	4½	54	26	33	34	37
7	2⅝	5¼	63	31	38	40	43
8	3	6	72	35	44	45	49
9	3⅜	6¾	81	39	49	51	56
10	3¾	7½	90	46	57	59	65
11	4⅛	8¼	99	55	69	72	78

BAR SIZE	SPACING THRESHOLD *		TENSION LAP LENGTH			
			≤ 12" OF CONCRETE BELOW		> 12" OF CONCRETE BELOW	
	$3d_b$ (in)	$6d_b$ (in)	CLEAR COVER ≥ $3d_b$ & CLEAR SPACING ≥ $6b_d$ (in)	ALL OTHER CASES (in)	CLEAR COVER ≥ $3d_b$ & CLEAR SPACING ≥ $6b_d$ (in)	ALL OTHER CASES (in)
3	1⅛	2¼	17	22	22	24
4	1½	3	23	29	30	32
5	1⅞	3¾	29	36	37	40
6	2¼	4½	34	43	44	48
7	2⅝	5¼	40	50	52	56
8	3	6	45	57	59	64
9	3⅜	6¾	51	64	66	72
10	3¾	7½	59	74	77	84
11	4⅛	8¼	72	89	93	101

* USE SPACING THRESHOLD VALUES IN DETERMINING THE APPROPRIATE COLUMN FROM WHICH TO SELECT THE DEVELOPMENT AND LAP LENGTH.

** IF THE PROJECT SPECIFIC CONDITIONS DO NOT FALL INTO ONE OF THE COLUMNS INCLUDED IN THE TABLE ABOVE OR ARE NOT IN ALIGNMENT WITH THE NOTES ON THIS BRIDGE DESIGN GUIDE CALCULATE THE TENSION DEVELOPMENT AND LAP LENGTHS USING THE BASIC DEVELOPMENT LENGTH FROM THE TABLE ABOVE AND THE APPROPRIATE MODIFICATION FACTORS OUTLINED IN AASHTO LRFD 5.10.8.

NOTES:

THE VALUES IN THE TABLE ABOVE ARE BASED ON THE REQUIREMENTS OUTLINED IN AASHTO LRFD 5.10.8.

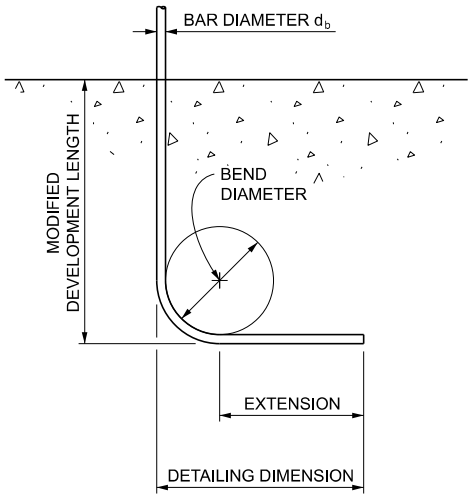
THE VALUES IN THE TABLE ABOVE ASSUME THE AREA OF REINFORCEMENT PROVIDED IS EQUAL TO THE AREA OF REINFORCEMENT REQUIRED BY THE DESIGN (λ_{er} = 1.0).

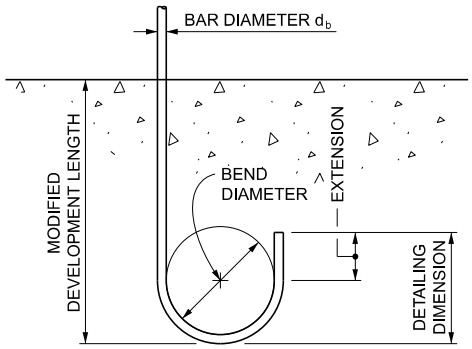
THE VALUES IN THE TABLE ABOVE ACCOUNT FOR THE TYPICAL CONFINEMENT REINFORCEMENT DETAILED IN THE MDOT BRIDGE DESIGN GUIDES (λ_{rc} = 0.4).

LAP LENGTHS ARE BASED ON CLASS B LAP SPLICES IN ACCORDANCE WITH AASHTO LRFD 5.10.8.4.3a.

DEVELOPMENT AND LAP LENGTHS IN THE TABLES ABOVE WILL BE CONSERVATIVE FOR UNCOATED REINFORCEMENT.

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/26/23
CHECKED BY: VZ	MINIMUM DIMENSIONS FOR STANDARD HOOKS IN TENSION	SUPERSEDES: 11/27/01
APPROVED BY: KCK		





90 DEGREE HOOK END LENGTHS		
BAR NO.	EXTENSION LENGTH	DETAILING DIMENSION
3	5"	7"
4	6"	8"
5	8"	11"
6	9"	12"
7	11"	15"
8	12"	16"
9	14"	20"
10	16"	23"
11	17"	25"
14	21"	32"
18	28"	42"

180 DEGREE HOOK END LENGTHS		
BAR NO.	EXTENSION LENGTH	DETAILING DIMENSION
3	3"	5"
4	3"	5"
5	3"	6"
6	3"	6"
7	4"	8"
8	4"	8"
9	5"	11"
10	6"	13"
11	6"	14"
14	7"	18"
18	10"	24"

MINIMUM DIMENSIONS FOR STANDARD HOOKS IN TENSION						
BAR NO.	CLEAR SIDE COVER ≥ 2½"			CLEAR SIDE COVER ≤ 2½"		
	3 KSI CONCRETE	4 KSI CONCRETE	5 KSI CONCRETE	3 KSI CONCRETE	4 KSI CONCRETE	5 KSI CONCRETE
3	8"	7"	7"	10"	9"	8"
4	11"	10"	9"	14"	12"	11"
5	14"	12"	11"	17"	15"	13"
6	16"	14"	13"	20"	18"	16"
7	19"	16"	15"	24"	20"	18"
8	22"	19"	17"	27"	23"	21"
9	24"	21"	19"	30"	26"	24"
10	27"	24"	21"	34"	29"	26"
11	30"	26"	24"	38"	33"	29"
14	45"	39"	35"	45"	39"	35"
18	60"	52"	47"	60"	52"	47"

NOTES:

MODIFIED DEVELOPMENT LENGTHS ARE BASED ON THE REQUIREMENTS OUTLINED IN AASHTO LRFD 5.10.8.2.4 FOR STANDARD HOOKS IN TENSION WITHOUT CONFINEMENT OF STIRRUPS OR TIES.

THE DETAILING DIMENSION IS CALCULATED USING THE MINIMUM INSIDE BEND DIAMETERS OUTLINED IN AASHTO LRFD 5.10.2.1

THE MODIFIED DEVELOPMENT LENGTHS UTILIZE THE SPECIFIED CONCRETE COMPRESSIVE STRENGTHS AND A YIELD STRENGTH OF 60.0 KSI FOR THE STEEL REINFORCEMENT.

FOR ALL BAR SIZES WITH 90 DEGREE HOOKS, THE REQUIRED CLEAR COVER AT THE END OF THE EXTENSION BEYOND THE HOOK IS NOT LESS THAN 2 INCHES.

MODIFIED DEVELOPMENT LENGTHS WILL BE CONSERVATIVE FOR UNCOATED STEEL REINFORCEMENT.

THE MODIFIED DEVELOPMENT LENGTHS ASSUME THE AREA OF REINFORCEMENT PROVIDED IS EQUAL TO THE AREA OF REINFORCEMENT REQUIRED BY THE DESIGN (λ_{er} = 1.0).

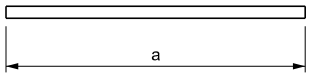
PREPARED BY DESIGN DIVISION	7.14.03

DRAWN BY:	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED:
CHECKED BY:		SUPERSEDES:
APPROVED BY:		

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PREPARED BY DESIGN DIVISION	

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD REINFORCING BAR TYPES	ISSUED: 09/28/20 SUPERSEDES: 09/22/14



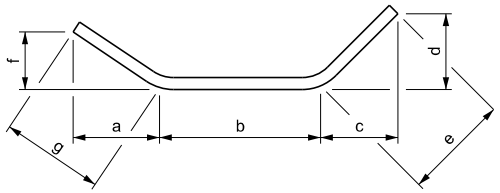
L = a

A



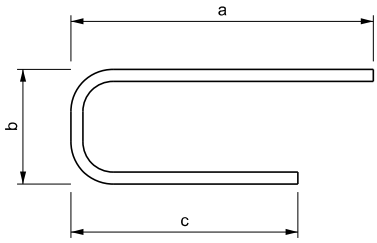
L = a + b

B



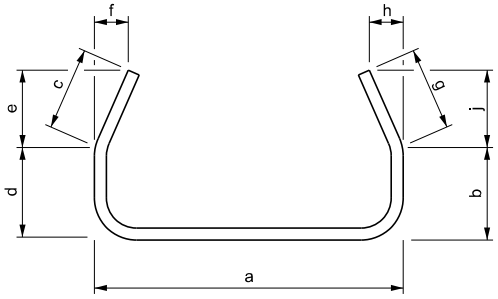
L = b + e + g

C



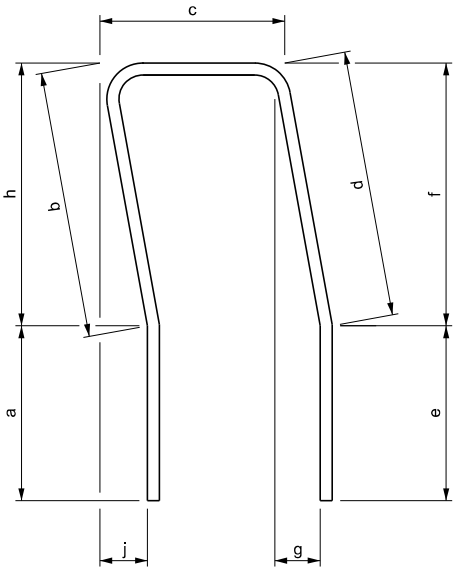
L = a + b + c

D



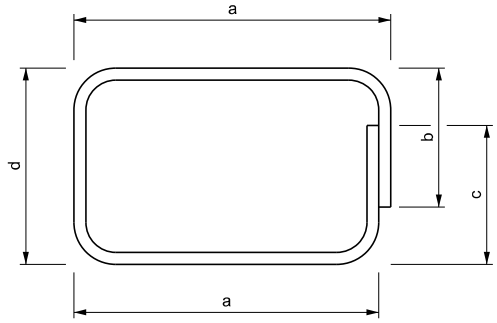
L = a + b + c + d + g

F



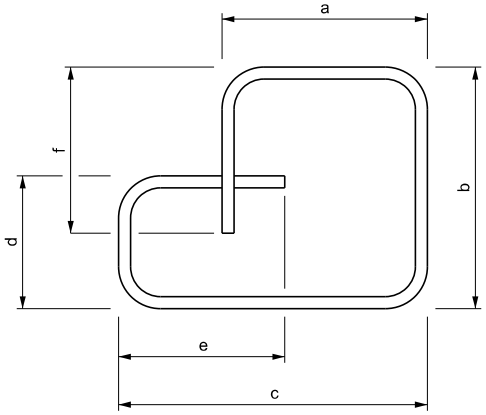
L = a + b + c + d + e

G



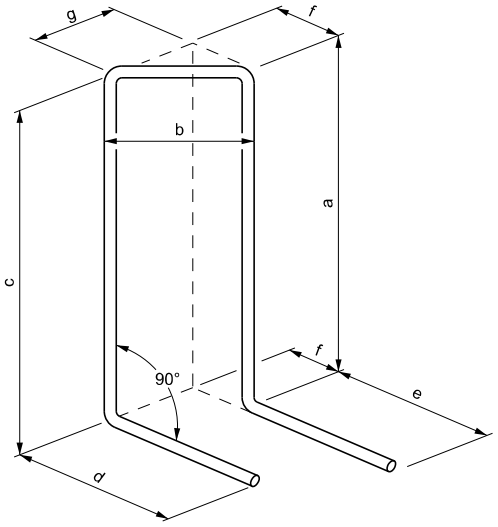
L = 2a + b + c + d

K



L = a + b + c + d + e + f

M

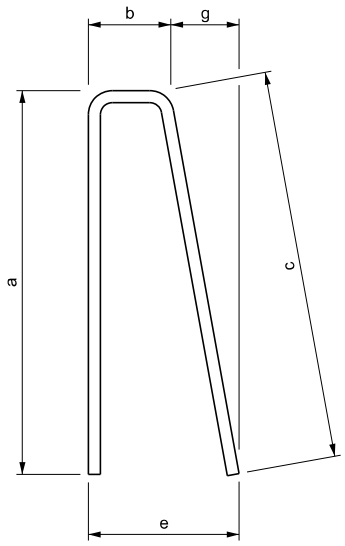


L = a + b + c + d + e

L

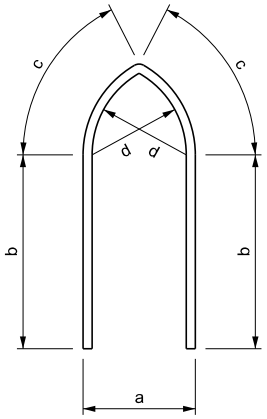
PREPARED BY DESIGN DIVISION	7.15.01

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STANDARD REINFORCING BAR TYPES	ISSUED: 09/28/20 SUPERSEDES: 11/26/18



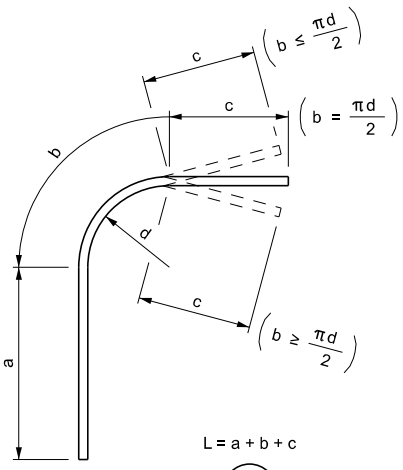
L = a + b + c

P



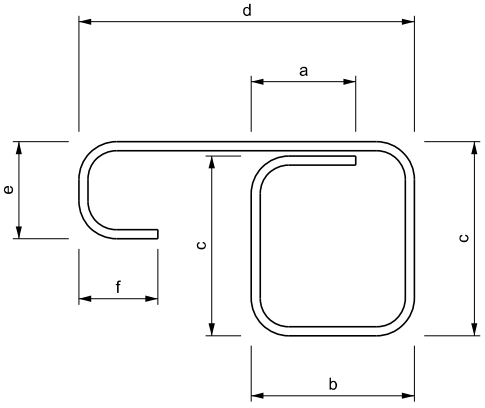
L = 2b + 2c

R



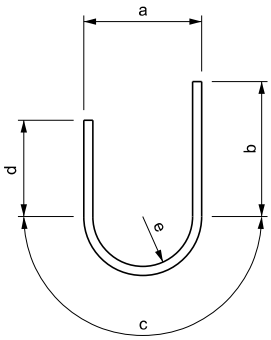
L = a + b + c

S



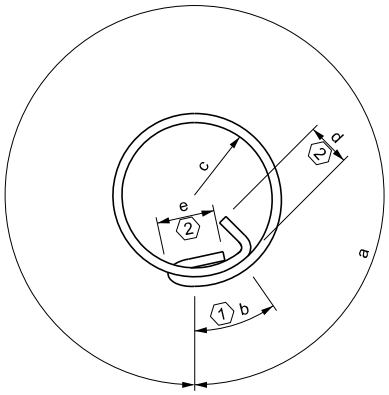
L = a + b + 2c + d + e + f

T



L = b + c + d

U

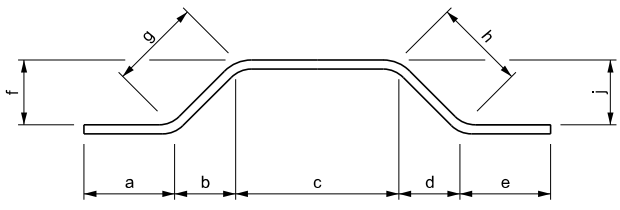


L = a + b + d + e

(1) b = 6" MIN OR REQUIRED LAP LENGTH

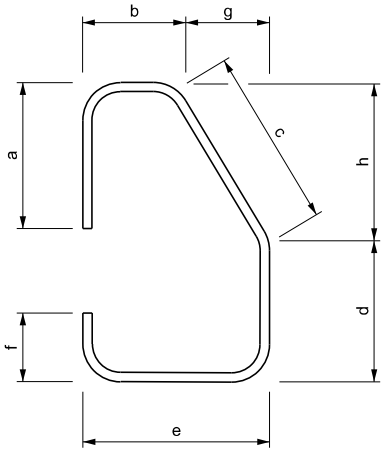
(2) USE EITHER 180° OR 135° HOOKS AS REQUIRED

V



L = a + c + e + g + h

W



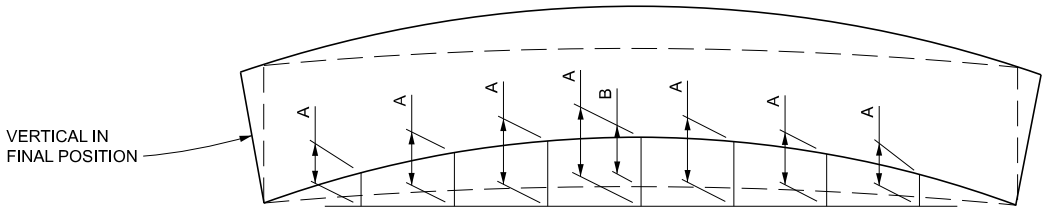
L = a + b + c + d + e + f

Z

PREPARED BY DESIGN DIVISION	7.15.02

8. STRUCTURAL STEEL

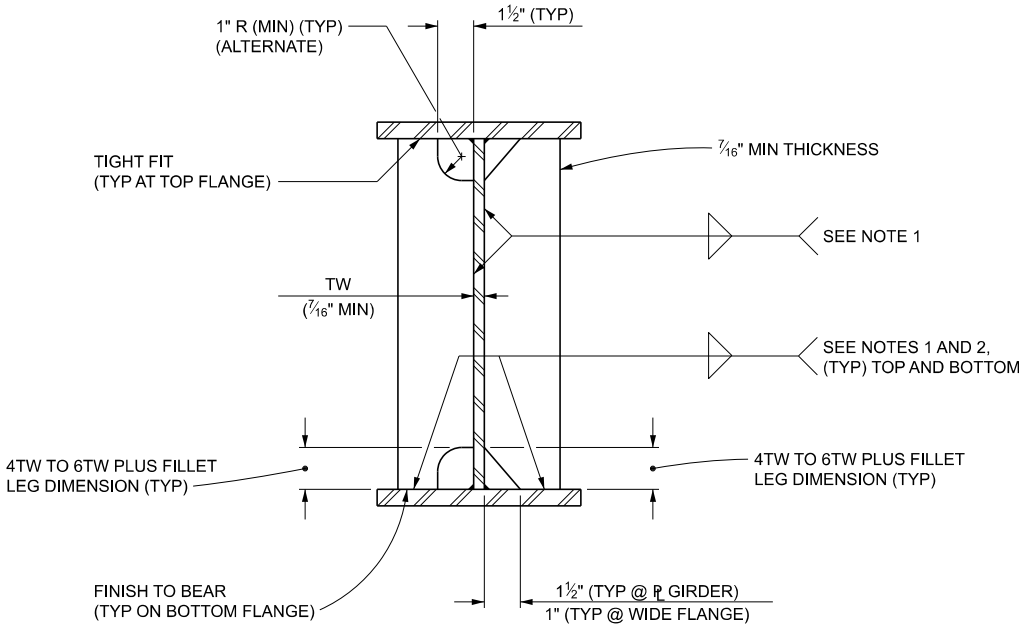
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 04/28/25
CHECKED BY: CWC	WELDED GIRDER, CAMBER DIAGRAM AND STIFFENER DETAILS	SUPERSEDES: 02/16/16
APPROVED BY: KCK		



WEBS - CAMBER DIAGRAM

A = TOTAL CAMBER REQUIRED WITH GIRDER LYING ON ITS SIDE. (PROVIDE CAMBER ORDINATES AT A SPACING OF APPROXIMATELY 10'.)

B = DEFLECTION OF ℄ GIRDER DUE TO ITS OWN WEIGHT, CENTER ONLY.



BEARING STIFFENERS

NOTE 1: STOP WELD ¼" SHORT OF CORNER CLIPS
NOTE 2: WRAP WELD AROUND OUTSIDE EDGE

NOTES TO DESIGNER:

ALL BEARING STIFFENERS, WHETHER FOR PLATE GIRDERS OR ROLLED BEAMS, SIMPLE OR CONTINUOUS, SHALL BE GIVEN THE TREATMENT SHOWN ABOVE.

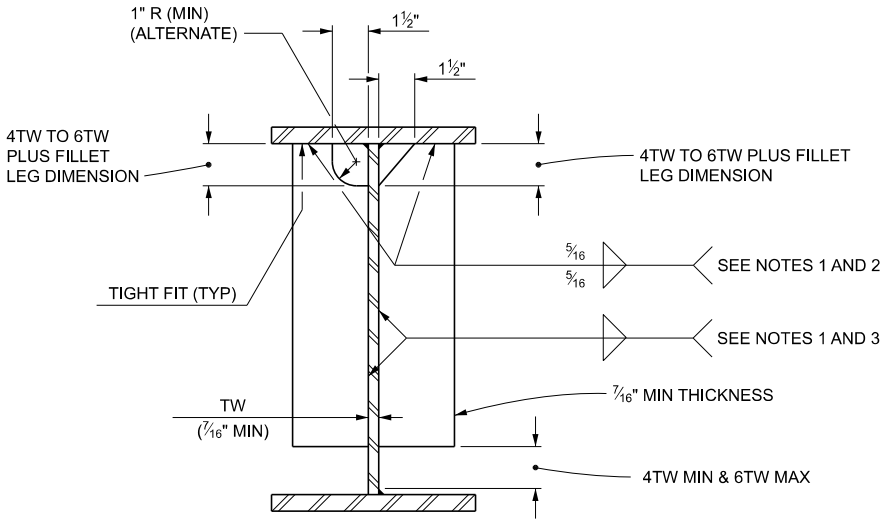
DESIGNER MUST INSURE THAT THE FATIGUE REQUIREMENTS OF AASHTO ARE MET.

STIFFENER TO WEB WELD MUST TRANSMIT END REACTION TO WEB.

FIT AND FINISH OF STIFFENER MUST MEET REQUIREMENTS OF AWS D1.5

PREPARED BY DESIGN DIVISION	8.06.02

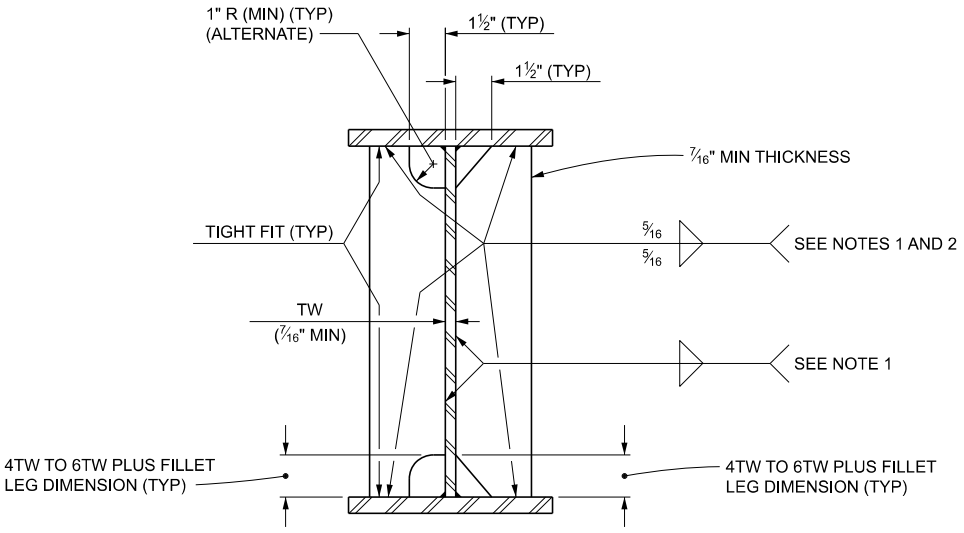
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 02/16/16
CHECKED BY: VZ	WELDED GIRDER AND STIFFENER DETAILS	SUPERSEDES: 05/04/06
APPROVED BY: DAJ		

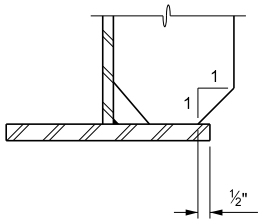


INTERMEDIATE TRANSVERSE STIFFENERS

NOTE 1: STOP WELD ¼" SHORT OF CORNER CLIP
NOTE 2: WRAP WELD AROUND OUTSIDE EDGE
NOTE 3: WRAP WELD AROUND STIFFENER END NOT WELDED TO FLANGE

NOTES:
WELD TO COMPRESSION FLANGE.
DESIGNER MUST INSURE THAT THE FATIGUE REQUIREMENTS OF AASHTO ARE MET.
EITHER BEVEL OR J COPE HOLES MUST BE USED ON A PARTICULAR PROJECT.





DETAIL A

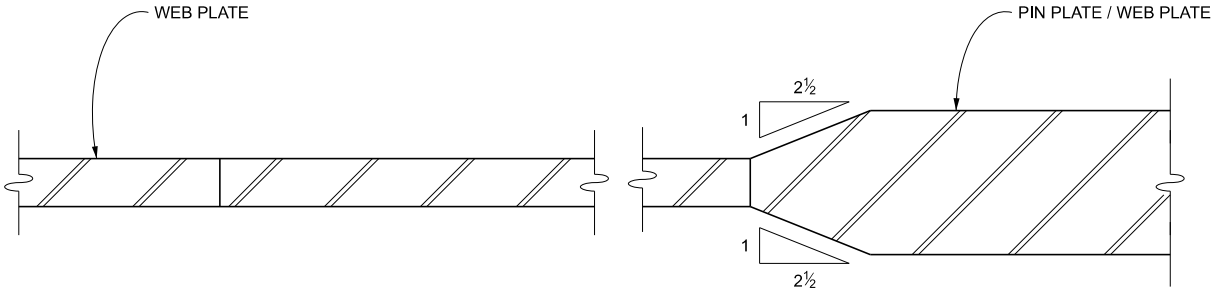
INTERMEDIATE TRANSVERSE STIFFENERS @ CROSSFRAME LOCATIONS

NOTE 1: STOP WELD ¼" SHORT OF CORNER CLIPS
NOTE 2: WRAP WELD AROUND OUTSIDE EDGE

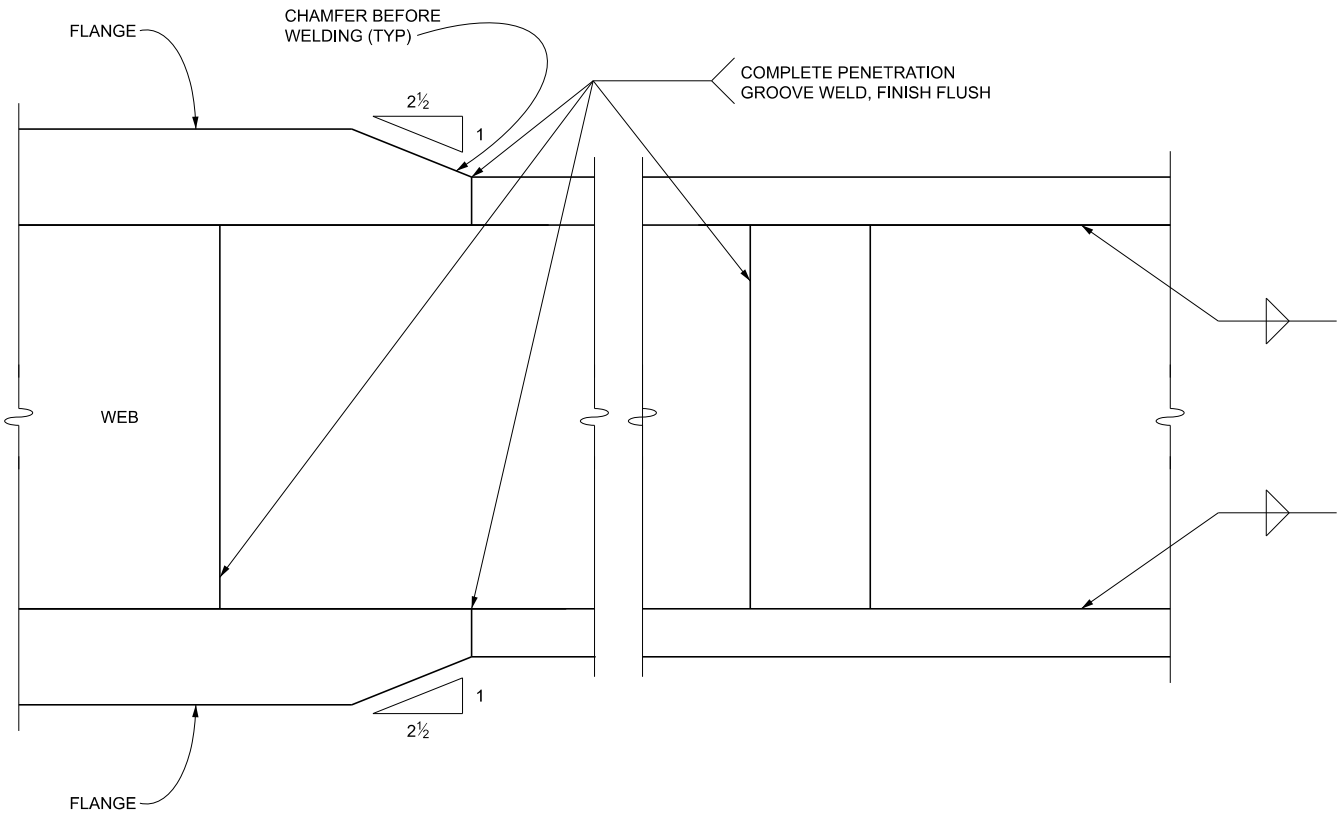
NOTES:
DESIGNER MUST INSURE THAT THE FATIGUE REQUIREMENTS OF AASHTO ARE MET.
USE DETAIL A IF CONNECTION PLATE STIFFENER EXTENDS BEYOND FLANGE.
EITHER BEVEL OR J COPE HOLES MUST BE USED ON A PARTICULAR PROJECT.

PREPARED BY DESIGN DIVISION	8.06.02A

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: DAJ	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT PLATE GIRDER WELDING DETAILS	ISSUED: 02/16/16 SUPERSEDES: 11/27/01



WEB TRANSITION



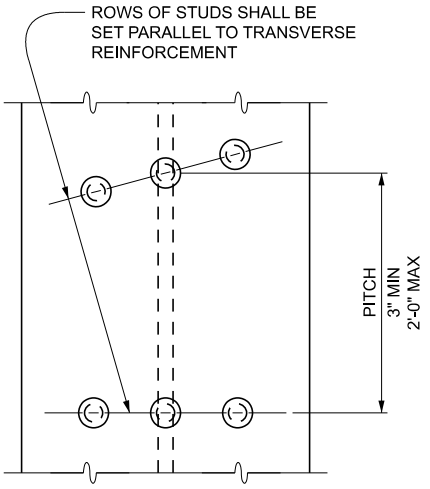
WELDED JOINT INFORMATION FOR DESIGN PLANS

CHECKER PLEASE NOTE:

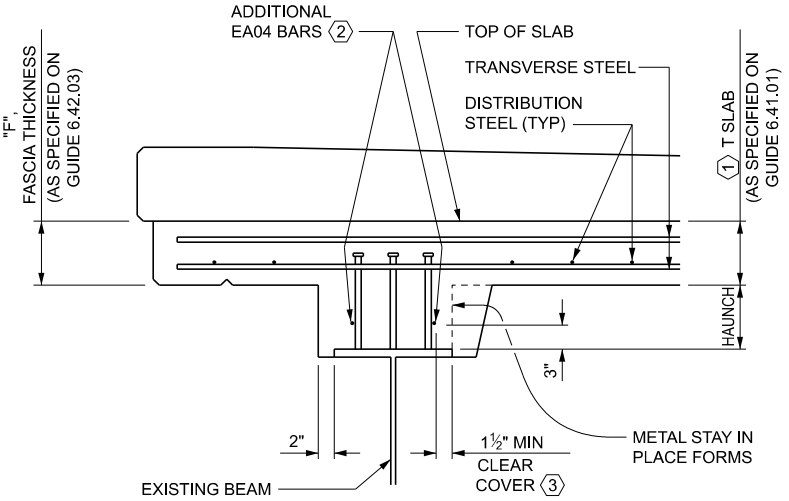
SHOP DRAWINGS MUST SHOW WELD CALLOUTS AND WELD PROCEDURE SPECIFICATION NUMBER IN TAIL.

PREPARED BY DESIGN DIVISION	8.06.03

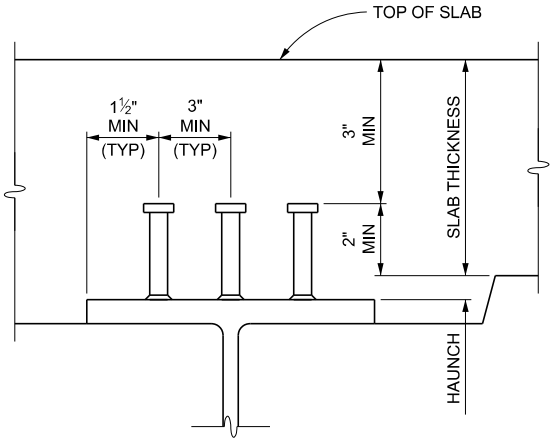
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: DAJ	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STUD SHEAR DEVELOPER DETAILS	ISSUED: 09/25/17 SUPERSEDES: 12/19/16



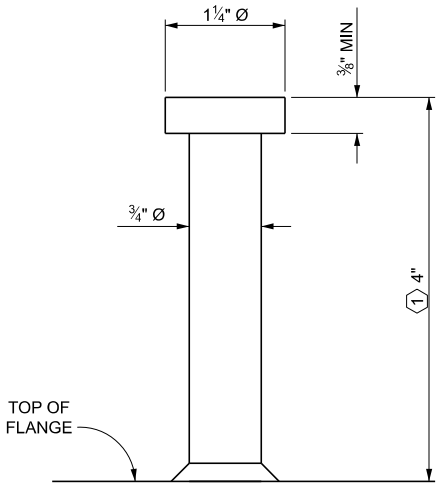
PLAN



BEAM HAUNCH > 6" DETAIL



SECTION



DETAIL OF STUD

PLAN NOTES:
THE HAUNCH REINFORCEMENT QUANTITY SHOWN PROVIDES THE AMOUNT NECESSARY TO COVER THE LIMITS SHOWN ON THE PLANS.

NOTES:

1 INCREASE LENGTH OF STUD WHEN NECESSARY TO MAINTAIN 2" MINIMUM PENETRATION OF STUD INTO DECK SLAB. (1" INCREMENTS)

MAXIMUM STUD LENGTH IS LIMITED TO 16".

2 EXTEND EA04 BARS A MINIMUM OF 2'-0" BEYOND THE POINT WHERE THE HAUNCH DROPS BELOW 6". DETAIL REINFORCEMENT ON PLAN SHEETS AND STEEL REINFORCEMENT DETAILS SHEET.

3 PLACE EA04 BAR INSIDE OF STUD IF NECESSARY TO MEET CLEAR COVER REQUIREMENTS.

IF FEASIBLE/EFFECTIVE, USE "W" BAR INSTEAD OF LONGER STUDS SIMILAR TO DETAILS ON GUIDE 6.42.03A.

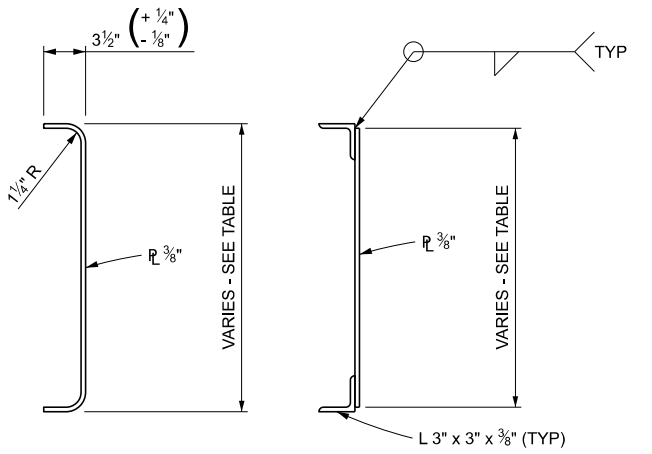
DETAILS AND SPACING FOR STUDS SHOULD BE SHOWN ON THE PLANS.

FOUR STUDS PER ROW MAY BE USED WHEN REQUIRED.

USE OF HAUNCH GREATER THAN 12" MUST BE APPROVED BY THE BRIDGE DESIGN SUPERVISING ENGINEER.

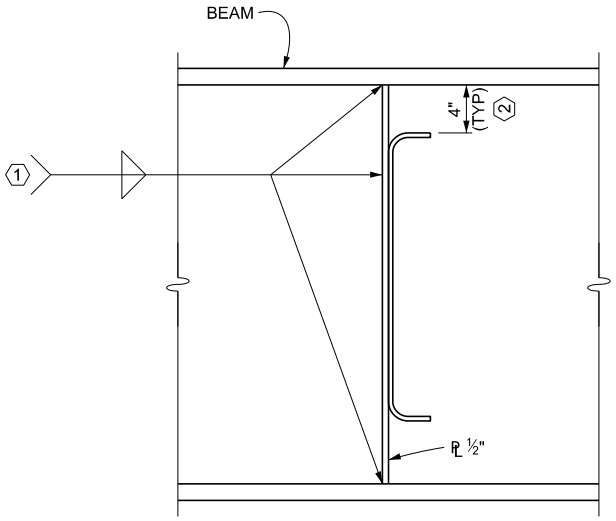
PREPARED BY DESIGN DIVISION	8.07.01

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: BMW	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT DIAPHRAGM AND CONNECTION PLATE DETAILS	ISSUED: 10/26/26 SUPERSEDES: 11/27/01



ALTERNATE

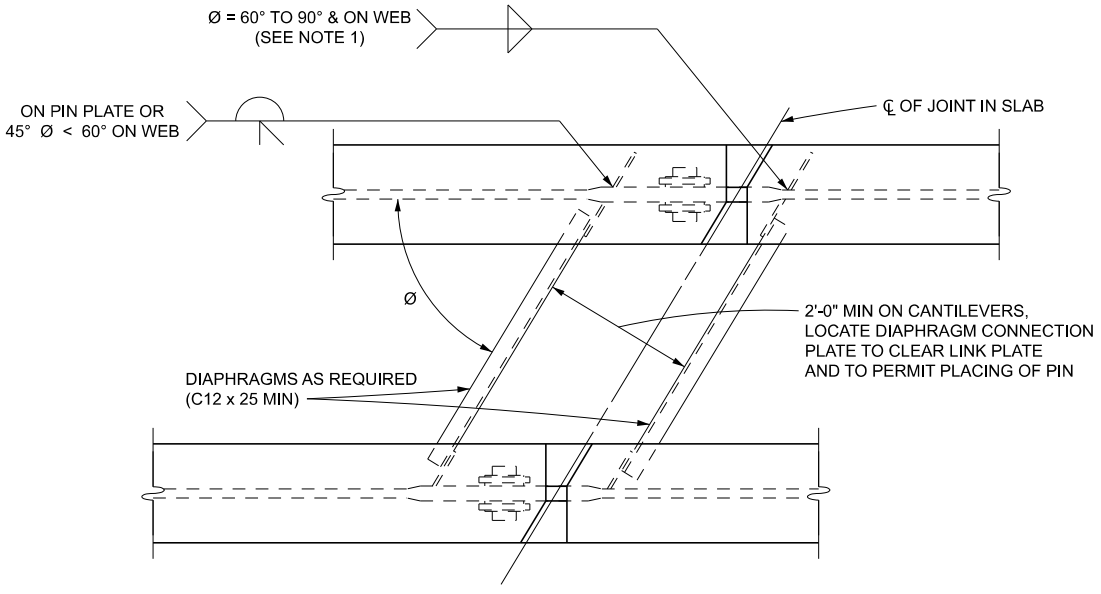
INTERMEDIATE DIAPHRAGM



WELDED DIAPHRAGM CONNECTION PLATE DETAIL

1. WRAP WELD AROUND OUTSIDE EDGE. STOP ALL WELDS ¼" SHORT OF CORNER CLIPS.
2. 3" FOR PLATE GIRDERS WITH WEB DEPTHS OF 24" AND 27".

INTERMEDIATE DIAPHRAGMS							
BEAM DEPTH/PLATE GIRDER WEB DEPTH	21"	24"	27"	30"	33"	36"	42"
DIAPHRAGM DEPTH WITH ROLLED BEAMS	11"	12"	16"	18"	22"	24"	30"
DIAPHRAGM DEPTH WITH PLATE GIRDERS	N/A	18"	21"	23"	25"	27"	32"



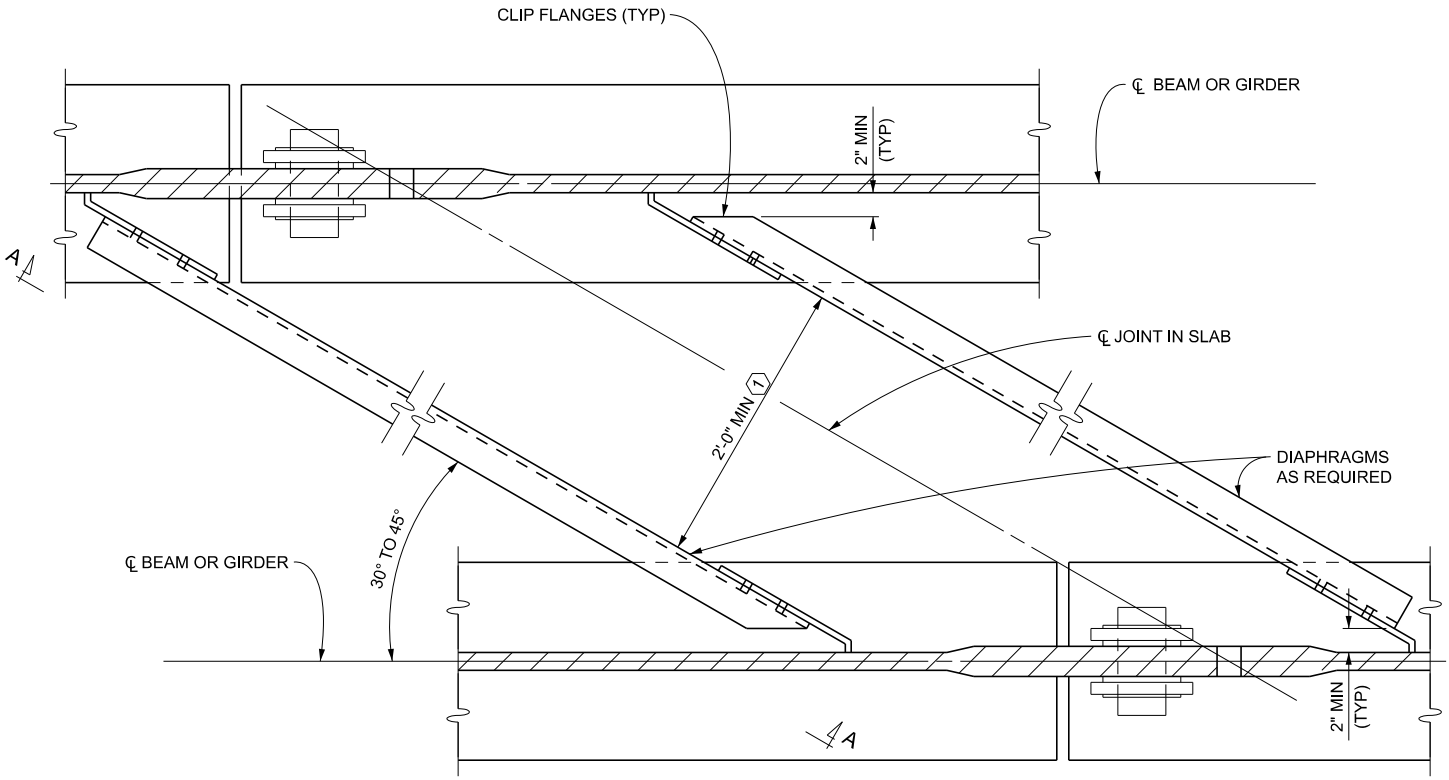
END DIAPHRAGM

NOTES:

1. IF WELDS ARE DISALLOWED BY FATIGUE, USE GUIDE 8.11.08.
2. FOR ADDITIONAL END DIAPHRAGM DETAILS SEE GUIDE 8.11.04.
3. FOR CROSS FRAME DETAILS SEE GUIDE 8.11.07.

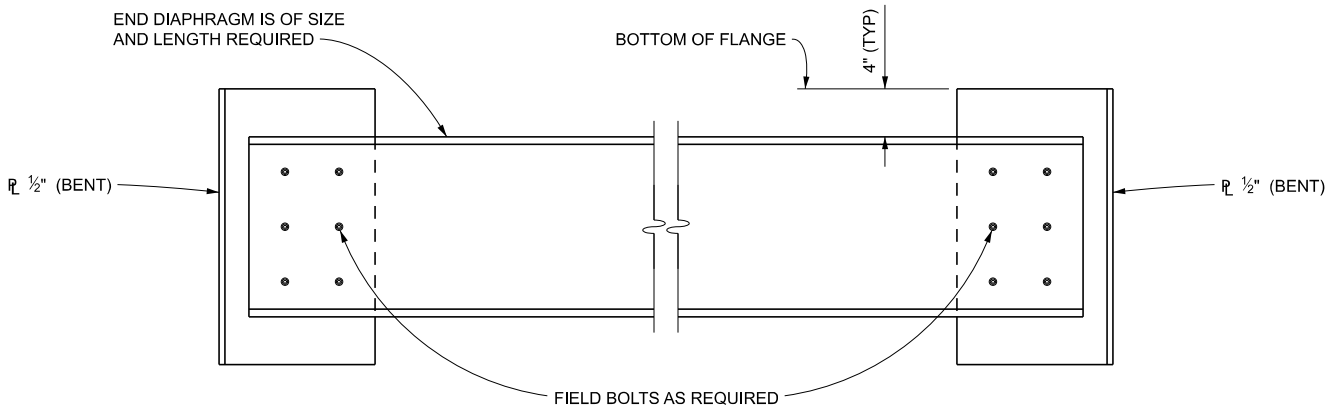
PREPARED BY DESIGN DIVISION	8.11.03

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT END DIAPHRAGM CONNECTION DETAILS 30° TO 45°	ISSUED: 11/27/01 SUPERSEDES: 04/15/95



(1) ON CANTILEVERS, LOCATE DIAPHRAGM CONNECTION PLATE TO CLEAR LINK PLATE AND TO PERMIT PLACING OF PIN

PLAN



VIEW A-A

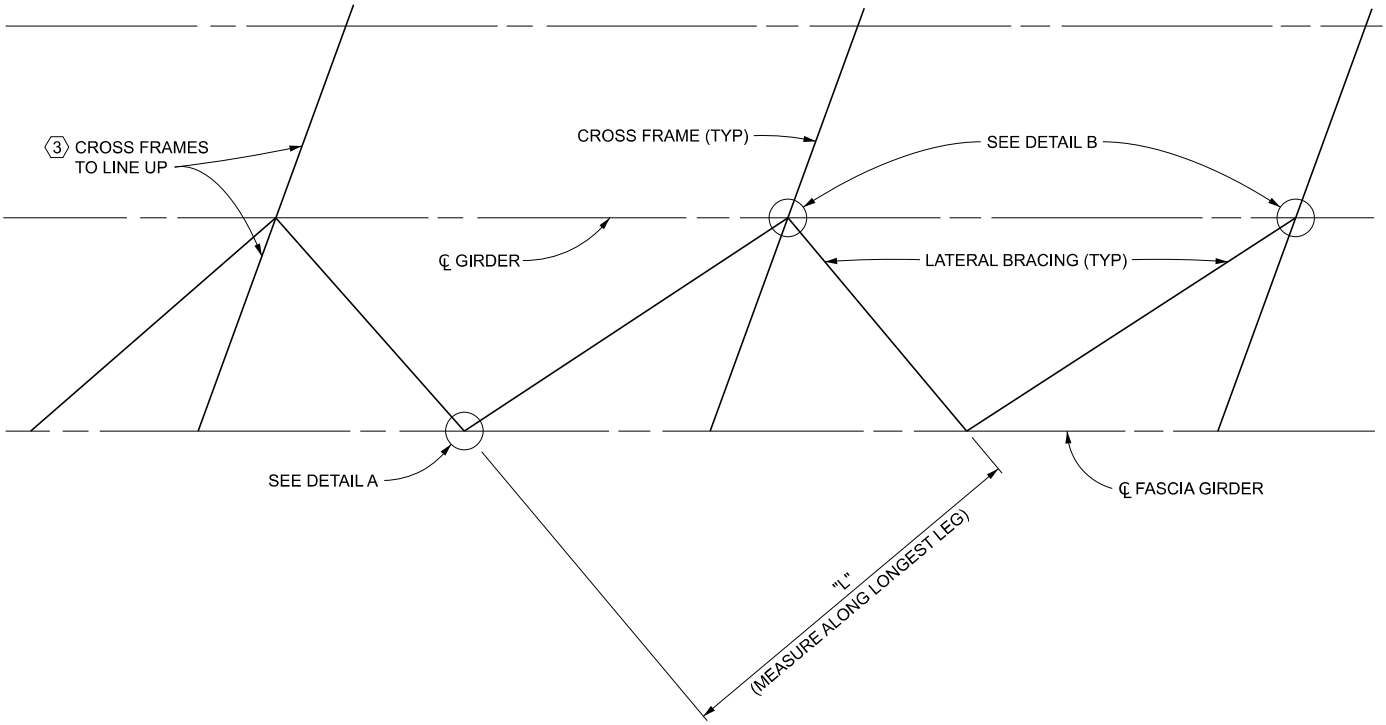
NOTES:

SEE GUIDE 8.11.03 FOR CONNECTION PLATE WELDING.

IF WELDS ARE DISALLOWED BY FATIGUE, USE GUIDE 8.11.08.

PREPARED BY DESIGN DIVISION	8.11.04

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 06/19/17
CHECKED BY: VZ	LATERAL BRACING DETAILS	SUPERSEDES: 11/27/01
APPROVED BY: DAJ		



LATERAL BRACING TABLE

LATERAL BRACING LENGTH "L"	STRUCTURAL TEE SIZE	① BOLTS REQUIRED WEB CONNECTION	② BOLTS REQUIRED TEE CONNECTION
UP TO 14'-6"	WT 5 x 11.0	5	4
OVER 14'-6" TO 15'-9"	WT 5 x 13.0	5	4
OVER 15'-9" TO 17'-9"	WT 6 x 17.5	6	4
OVER 17'-9" TO 18'-6"	WT 6 x 22.5	7	6

NOTES:

① NUMBER OF ¾" Ø ASTM F3125/F3125M, GRADE A325 BOLTS REQUIRED TO BOLT ANGLE OR BENT PLATE TO GIRDER WEB.

② NUMBER OF ¾" Ø ASTM F3125/F3125M, GRADE A325 BOLTS REQUIRED TO BOLT TEE TO ANGLE OR BENT PLATE.

③ CROSS FRAMES PARALLEL TO REFERENCE LINE FOR ANGLE OF CROSSING 70° TO 90°.
CROSS FRAMES PERPENDICULAR TO BEAM FOR ANGLE OF CROSSING < 70°.

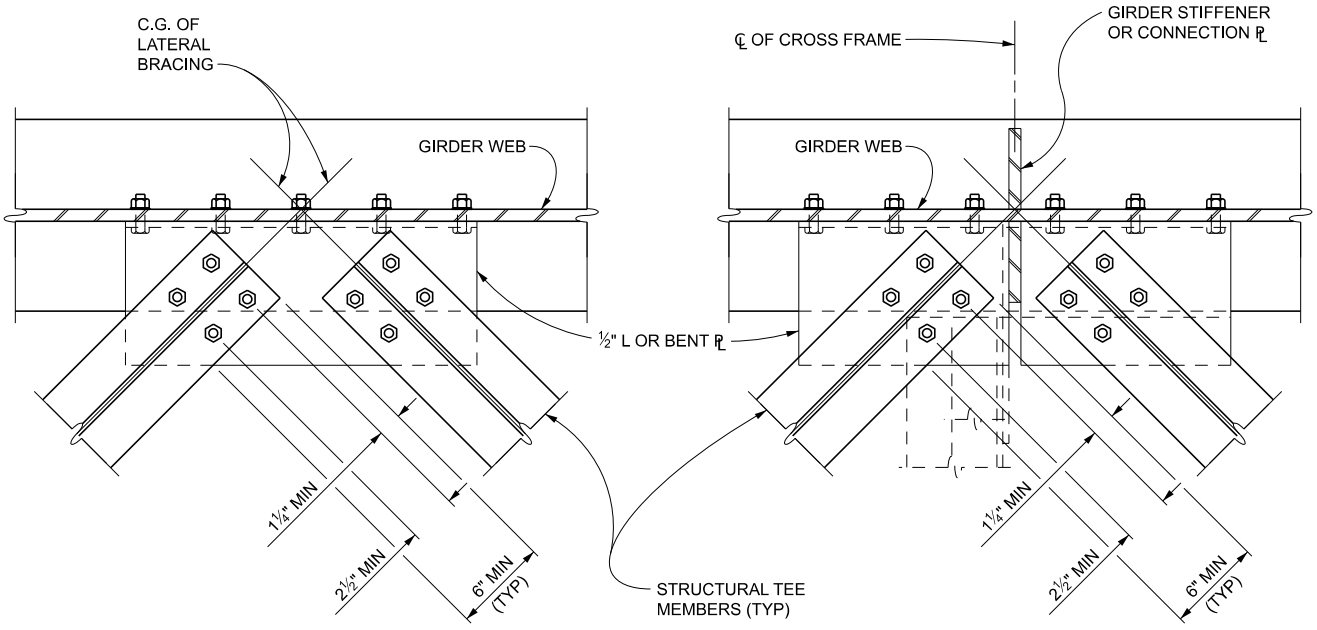
LATERAL BRACING IS DETERMINED BY CURRENT AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES.
PLACE LATERAL BRACING IN THE FASCIA BAYS.

PROVIDE LATERAL BRACING IN THE CANTILEVER WHEN DISTANCE FROM CENTERLINE BEARING TO PIN EXCEEDS BEAM SPACING.

WORK THIS GUIDE WITH GUIDE 8.11.05A.

PREPARED BY DESIGN DIVISION	8.11.05

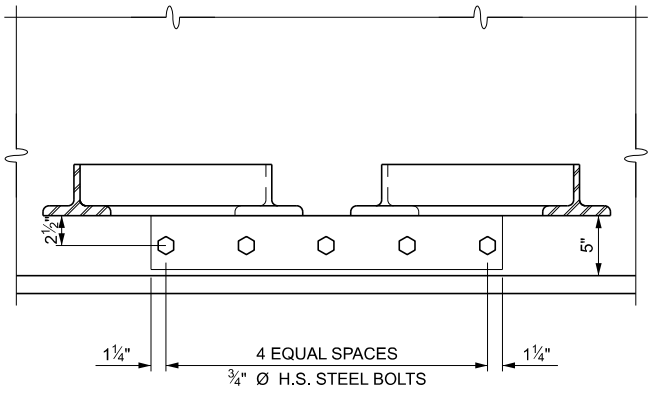
DRAWN BY: MJB	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 11/27/01
CHECKED BY: VZ	LATERAL BRACING DETAILS	SUPERSEDES: 04/15/95
APPROVED BY: TGF		



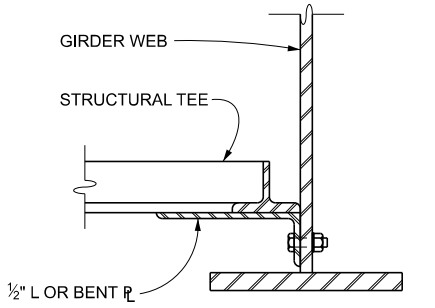
DETAIL A
(ROTATED 180°)
(FASCIA GIRDERS)

DETAIL B
(INTERIOR GIRDERS)

BOLTS FOR WEB CONNECTION SHOULD BE INSTALLED IN THE SHOP AND TORQUE CHECKED IN THE FIELD



ELEVATION

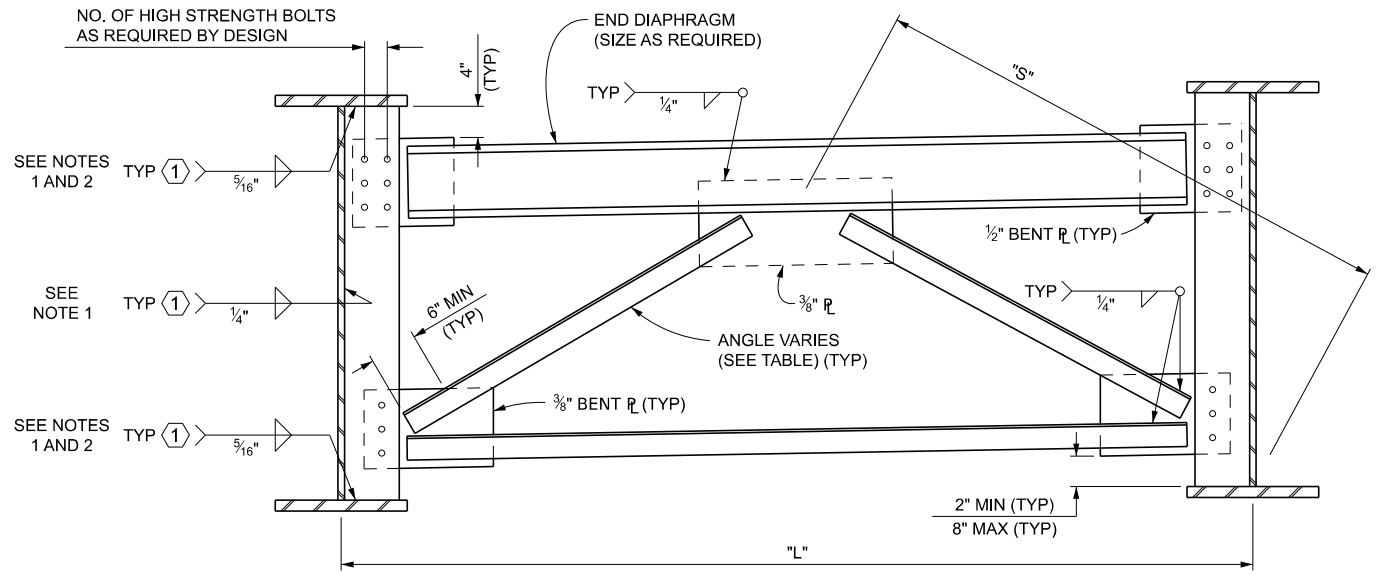


HALF SECTION

WORK THIS GUIDE WITH GUIDE 8.11.05

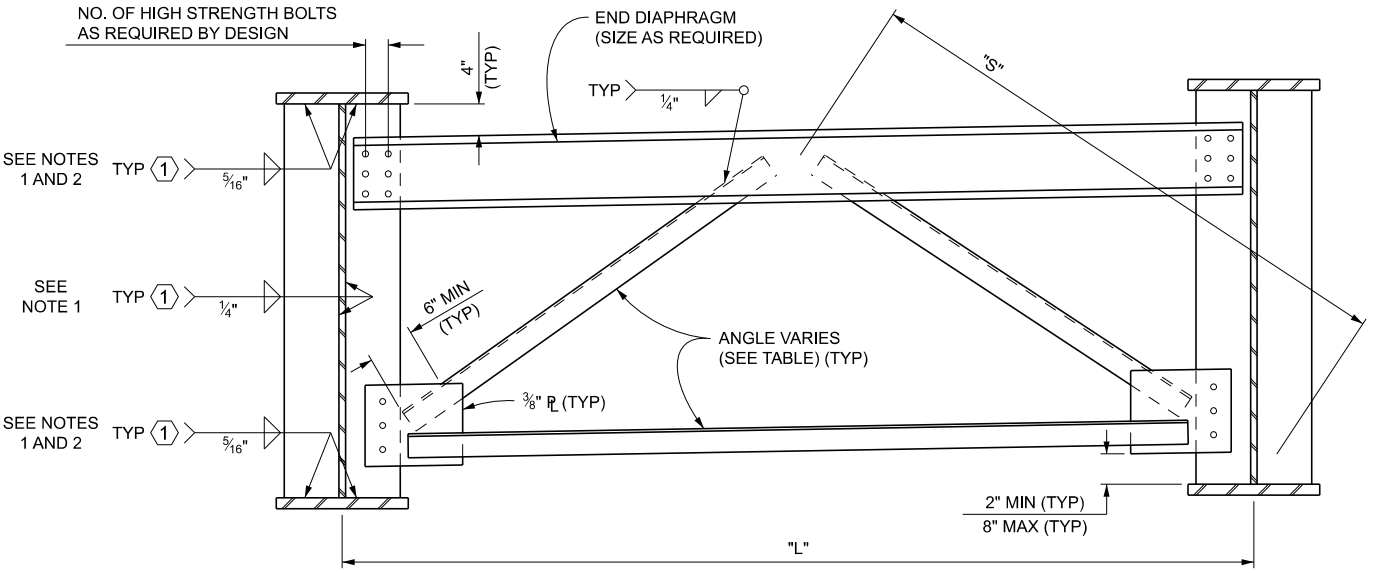
PREPARED BY DESIGN DIVISION	8.11.05A

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 11/27/17
CHECKED BY: VZ	END CROSS FRAMES	SUPERSEDES: 06/25/12
APPROVED BY: DAJ		



ANGLE OF CROSSING < 45° AT HANGERS OR
< 70° AT PIERS & ABUTMENTS WITH INDEPENDENT BACKWALLS

BEARING STIFFENERS OR CONNECTION PLATES SHALL BE SET PERPENDICULAR TO GIRDER



ANGLE OF CROSSING = 45° - 90° AT HANGERS OR
= 70° - 90° AT PIERS & ABUTMENTS WITH INDEPENDENT BACKWALLS

BEARING STIFFENERS OR CONNECTION PLATES SHALL BE SET AT ANGLE OF CROSSING

STRAIGHT GIRDERS	
"L" OR "S"	MINIMUM ANGLE SIZE
LESS THAN 6'-9"	3" x 3" x 5/16"
6'-9" TO 9'-3"	4" x 4" x 5/16"
9'-3" TO 11'-6"	5" x 5" x 3/8"
11'-6" TO 13'-9"	6" x 6" x 3/8"
13'-9" TO 18'-6"	8" x 8" x 1/2"
CURVED GIRDERS	
LESS THAN 5'-9"	3" x 3" x 5/16"
5'-9" TO 7'-9"	4" x 4" x 5/16"
7'-9" TO 9'-9"	5" x 5" x 3/8"
9'-9" TO 11'-9"	6" x 6" x 1/2"
11'-9" TO 15'-9"	8" x 8" x 5/8"

NOTES:

USE FULL DEPTH STIFFENERS OR 1/2" CONNECTION PLATES.

ANGLE SIZE BASED ON L/R RATIO. STRESSES MAY REQUIRE USE OF LARGER ANGLES.

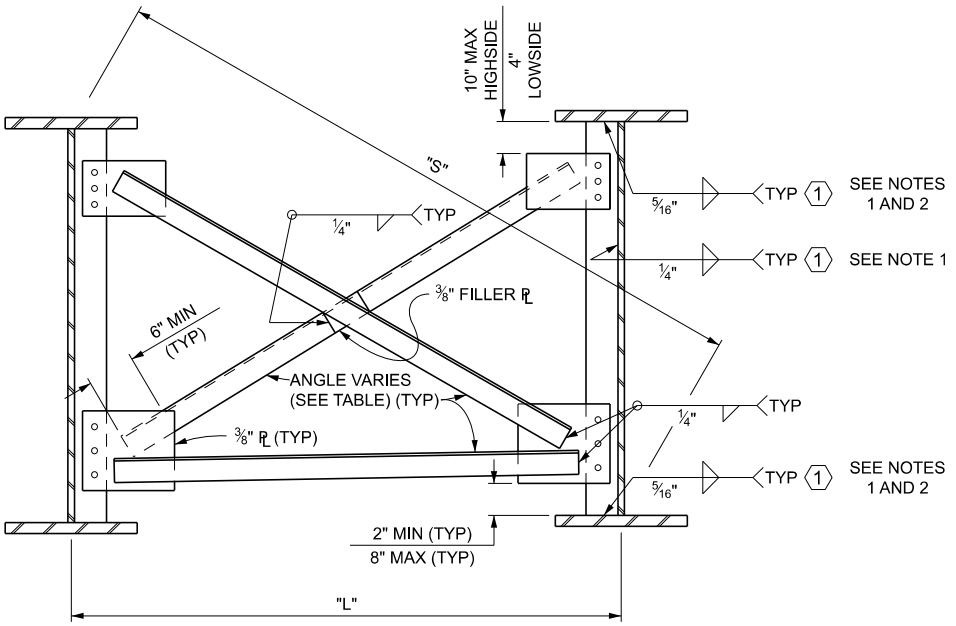
USE DETAIL A, GUIDE 8.06.02 IF CONNECTION PLATE EXTENDS BEYOND FLANGE.

(1) WELD TOP AND BOTTOM UNLESS FATIGUE LIMITATIONS CONTROL. CONNECTION PLATE WELDS SHOWN HERE. SEE GUIDE 8.06.02 FOR STIFFENER WELDING DETAILS. SEE GUIDE 8.11.08 FOR CONNECTION PL DETAILS IF FATIGUE LIMITATIONS CONTROL.

NOTE 1: STOP WELD 1/4" SHORT OF CORNER CLIPS
NOTE 2: WRAP WELD AROUND OUTSIDE EDGE

PREPARED BY DESIGN DIVISION	8.11.06

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 10/26/26
CHECKED BY: CWC	INTERMEDIATE AND PIER CROSS FRAMES	SUPERSEDES: 11/27/17
APPROVED BY: BMW		



PIER AND INTERMEDIATE CROSS FRAMES

NOTES:

USE FULL DEPTH STIFFENERS OR ½" CONNECTION PLATES.

FOR ANGLES OF CROSSING > 70°, SET CONNECTION PLATE AND BEARING STIFFENER TO ANGLE OF CROSSING. FOR ANGLE OF CROSSING < 70°, SET CONNECTION PLATE AND BEARING STIFFENER NORMAL TO WEB. USE BENT GUSSET PLATES ON PIER CROSSFRAMES.

USE DETAIL A, GUIDE 8.06.02A IF CONNECTION PLATE EXTENDS BEYOND FLANGE.

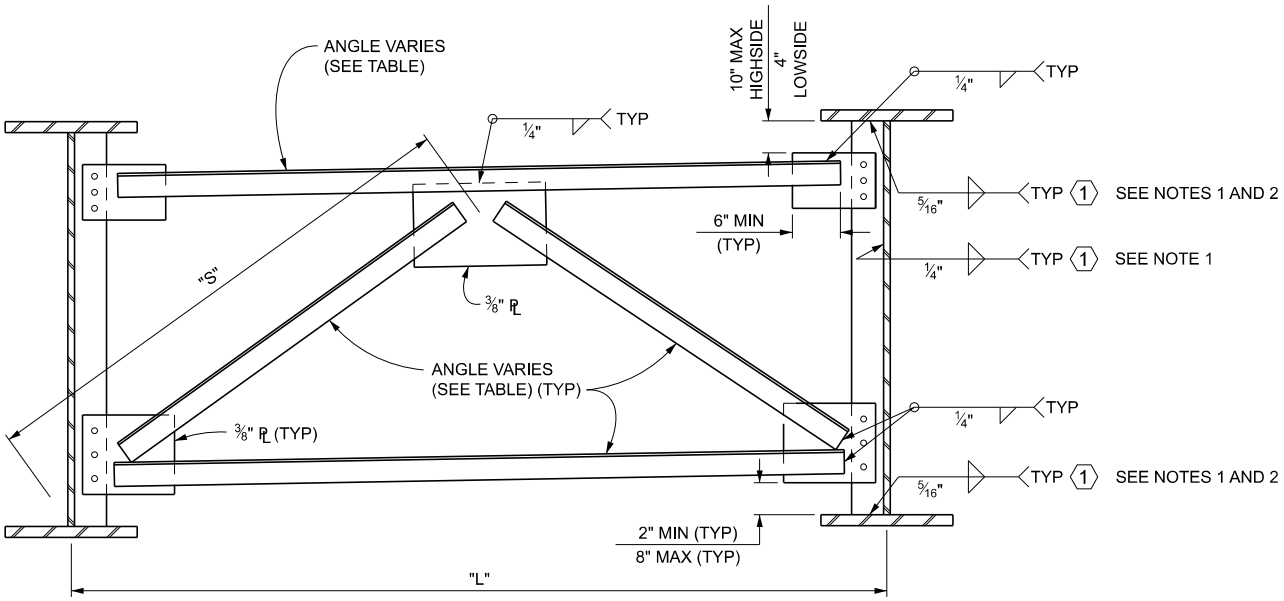
INTERMEDIATE CROSS FRAMES TO BE IN LINE.

ANGLE SIZE BASED ON L/R RATIO. STRESSES MAY REQUIRE USE OF LARGER ANGLES.

USE DIAPHRAGMS FOR WEB DEPTHS < 48". SEE GUIDE 8.11.03 FOR DETAILS.

(1) WELD TOP AND BOTTOM UNLESS FATIGUE LIMITATIONS CONTROL. CONNECTION PLATE WELDING SHOWN HERE. SEE GUIDE 8.06.02 FOR STIFFENER WELDING DETAILS. SEE GUIDE 8.11.08 FOR CONNECTION PLATE DETAILS IF FATIGUE LIMITATIONS CONTROL.

NOTE 1: STOP WELD ¼" SHORT OF CORNER CLIPS
NOTE 2: WRAP WELD AROUND OUTSIDE EDGE



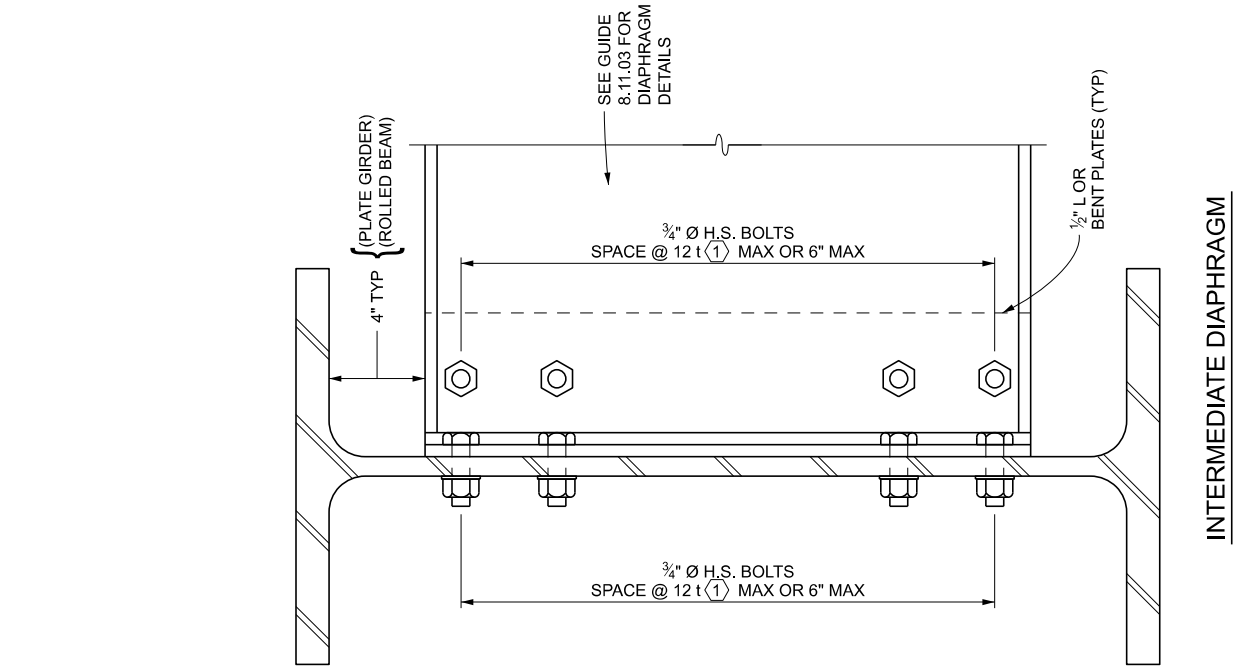
PIER CROSS FRAMES

BEAM SPACING > 12'-6"

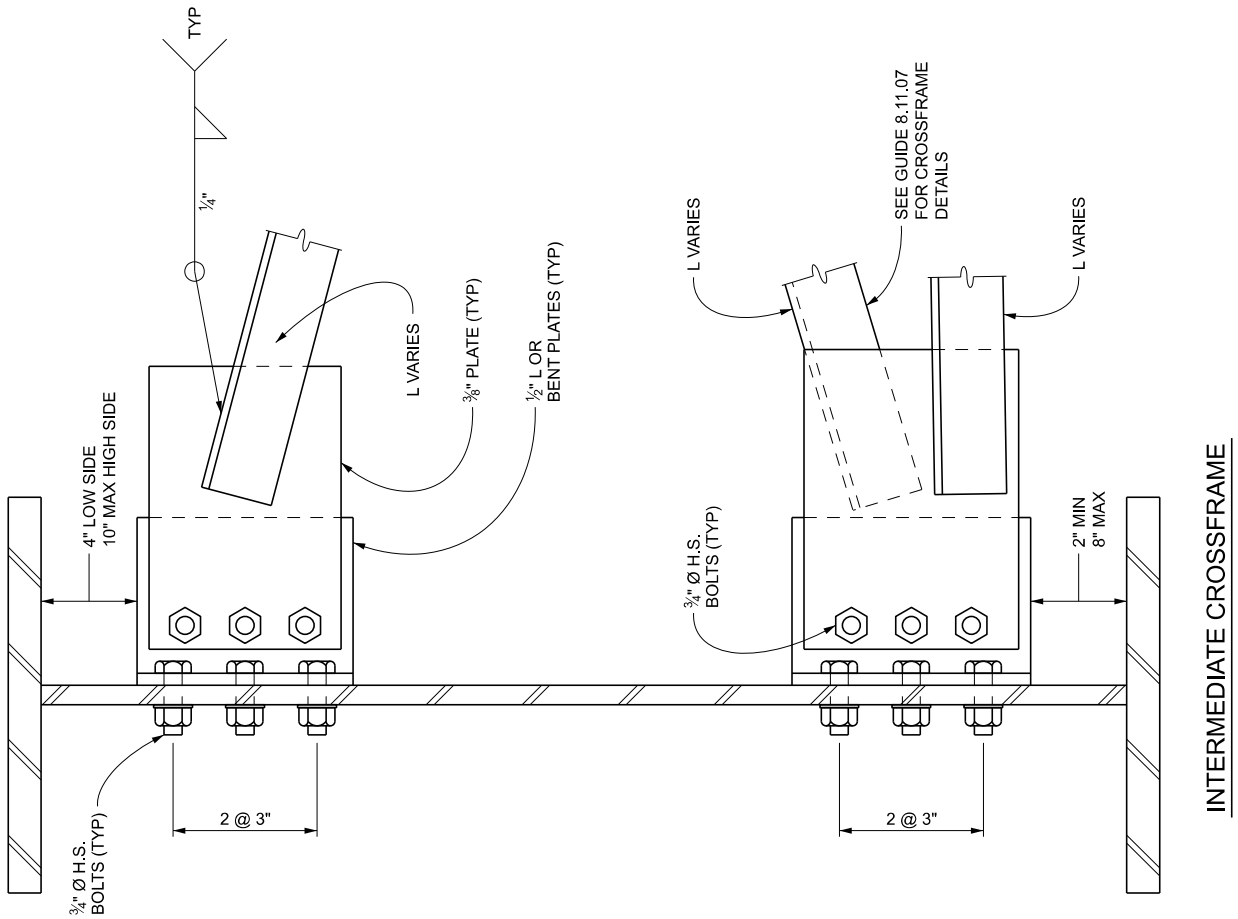
STRAIGHT GIRDERS	
"L" OR "S"	MINIMUM ANGLE SIZE
LESS THAN 6'-9"	3" x 3" x 5/16"
6'-9" TO 9'-3"	4" x 4" x 5/16"
9'-3" TO 11'-6"	5" x 5" x 3/8"
11'-6" TO 13'-9"	6" x 6" x 3/8"
13'-9" TO 18'-6"	8" x 8" x 1/2"
CURVED GIRDERS	
LESS THAN 5'-9"	3" x 3" x 5/16"
5'-9" TO 7'-9"	4" x 4" x 5/16"
7'-9" TO 9'-9"	5" x 5" x 3/8"
9'-9" TO 11'-9"	6" x 6" x 1/2"
11'-9" TO 15'-9"	8" x 8" x 5/8"

PREPARED BY DESIGN DIVISION	8.11.07

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 05/04/06
CHECKED BY: VZ	BOLTED CONNECTIONS FOR INTERMEDIATE DIAPHRAGMS AND CROSSFRAMES	SUPERSEDES: 11/27/01
APPROVED BY: TGF		



INTERMEDIATE DIAPHRAGM



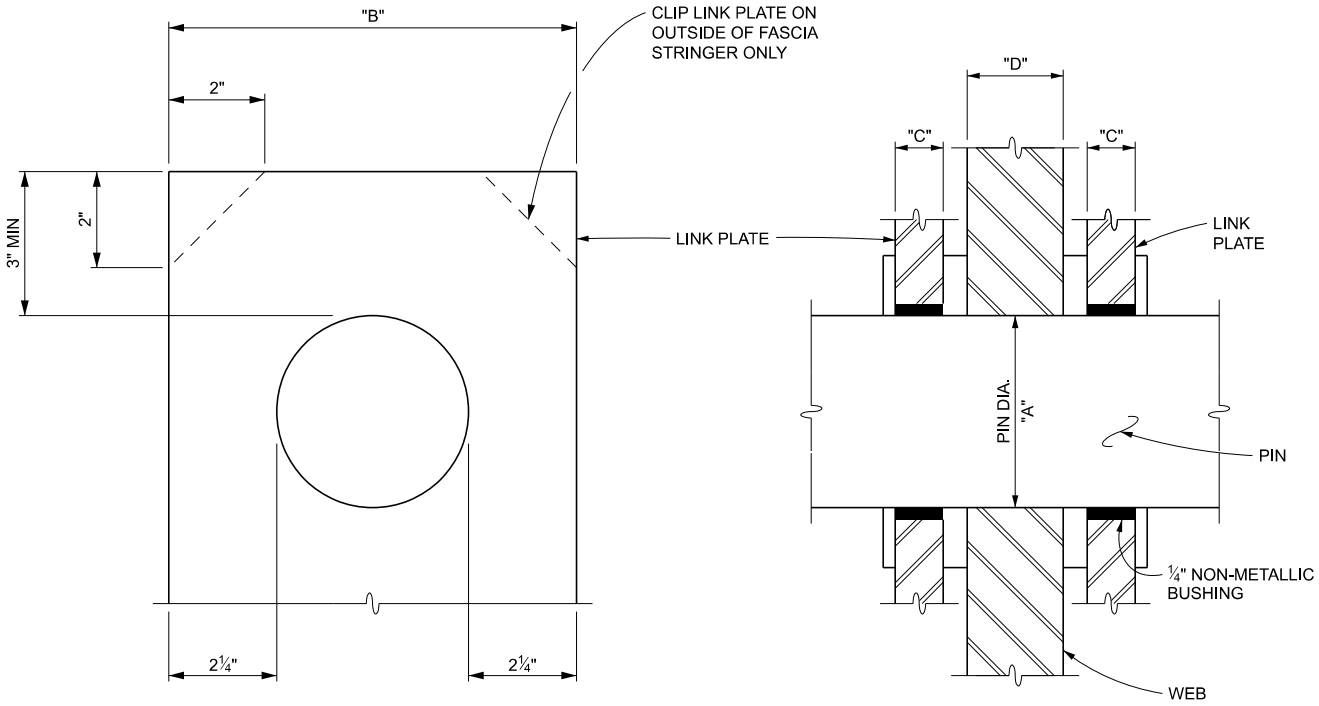
INTERMEDIATE CROSSFRAME

⟨1⟩ t = THICKNESS OF THINNER PART JOINED.

TO BE USED ON SHORT ANCHOR SPANS OR TRANSVERSELY UNSTIFFENED CONTINUOUS SPANS WHERE FATIGUE LIMITATIONS DO NOT PERMIT A WELDED CONNECTION.

PREPARED BY DESIGN DIVISION	8.11.08

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 05/04/06
CHECKED BY: VZ	BEAM OR GIRDER	SUPERSEDES: 11/27/01
APPROVED BY: TGF	SUSPENDER DESIGN TABLE	



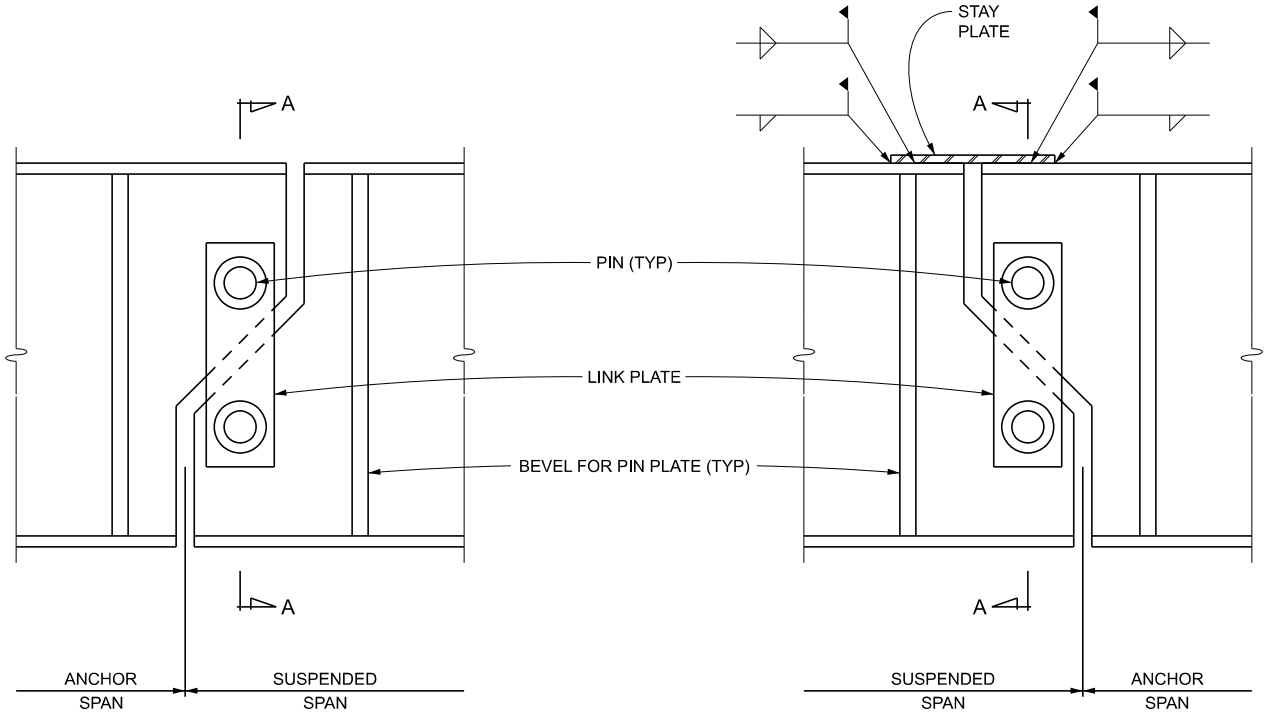
REACTION "KIPS"	PIN DIA. "A"	LINK PLATE "B"	LINK PLATE "C"	WEB "D"
80	4"	⟨1⟩	⟨1⟩	1"
100	4"	⟨1⟩	⟨1⟩	1¼"
120	4"	⟨1⟩	⟨1⟩	1½"
140	4"	⟨1⟩	⟨1⟩	1¾"
157	5"	⟨1⟩	⟨1⟩	1¾"
180	5"	⟨1⟩	⟨1⟩	2"
202	5"	⟨1⟩	⟨1⟩	2¼"

ALLOWABLE STRESSES (P.S.I.)		A276 STAINLESS STEEL PIN	AASHTO M223 OR M222 (ASTM A572 OR A588) LINK PLATE OR WEB
BENDING	=	40,000	
SHEAR	=	20,000	
BEARING	=	20,000	20,000
TENSION	=		27,000

⟨1⟩ LINKS PLATES SHALL BE DESIGNED ACCORDING TO THE AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 10.

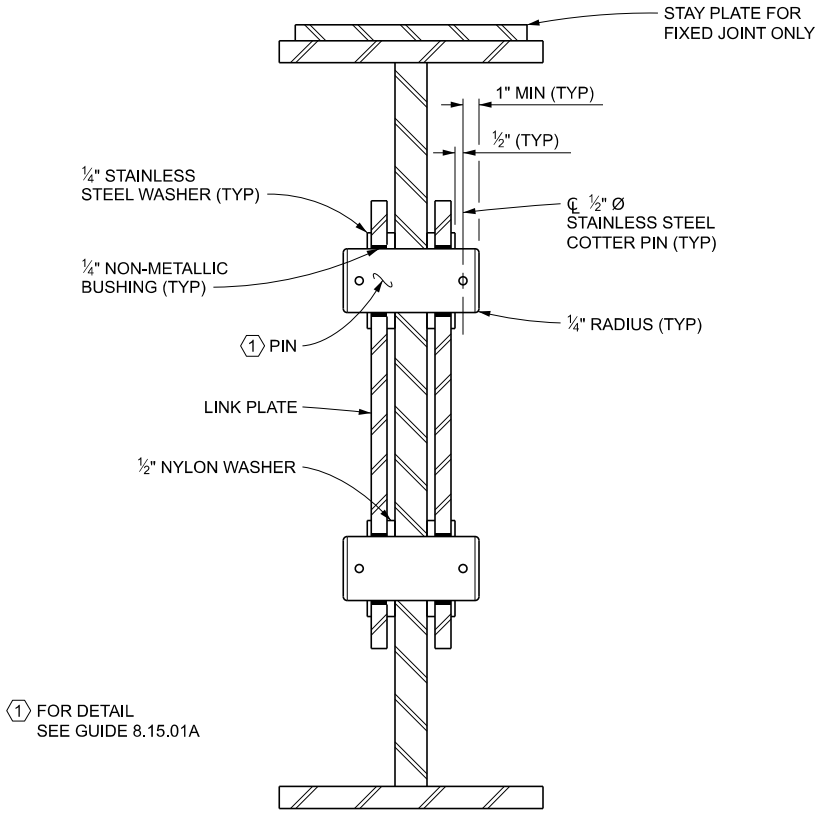
PREPARED BY DESIGN DIVISION	8.14.02

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 06/25/12
CHECKED BY: VZ	SUSPENDER DETAILS FOR CANTILEVERED PLATE GIRDERS	SUPERSEDES: 05/04/06
APPROVED BY: DAJ		



ELEVATION
EXPANSION JOINT

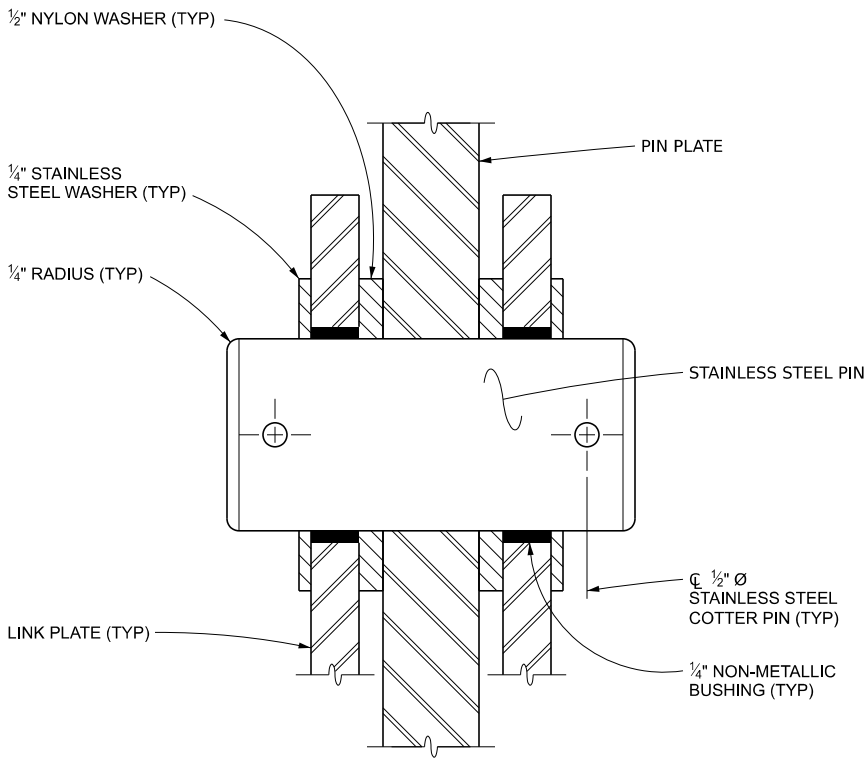
ELEVATION
FIXED JOINT



SECTION A-A

PREPARED BY DESIGN DIVISION	8.15.01

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 05/04/06
CHECKED BY: VZ	PIN DETAIL	SUPERSEDES: 11/27/01
APPROVED BY: TGF		

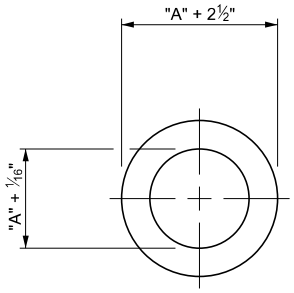


PIN DETAIL

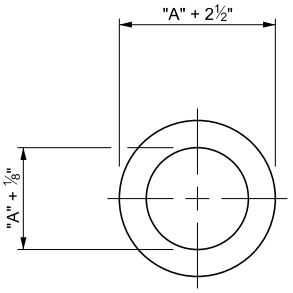
NOTE:
SEE GUIDE 8.16.02 FOR WASHER DETAILS.

PREPARED BY DESIGN DIVISION	8.15.01A

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT SUSPENDER DETAILS FOR ROLLED BEAMS	ISSUED: 05/04/06 SUPERSEDES: 11/27/01

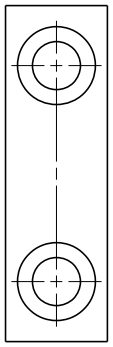


¼" STAINLESS STEEL WASHER

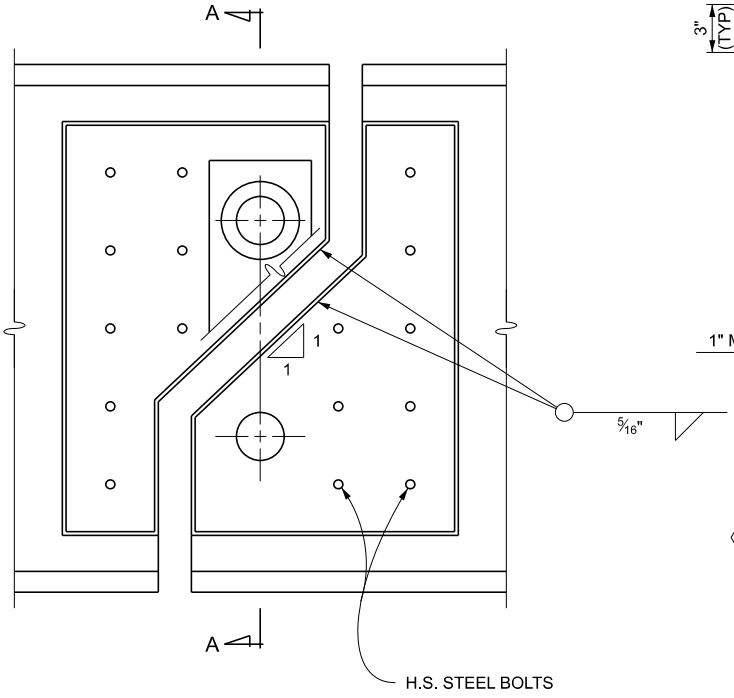


½" NYLON WASHER

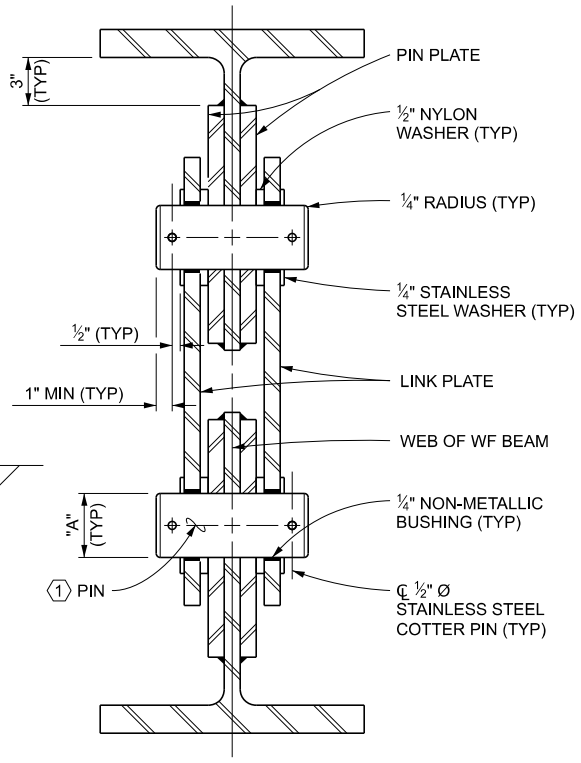
INCLUDED IN THE BID ITEM
"STRUCTURAL STEEL, [TYPE], FURN AND FAB"



LINK PLATE



WELDED PIN PLATES



SECTION A-A

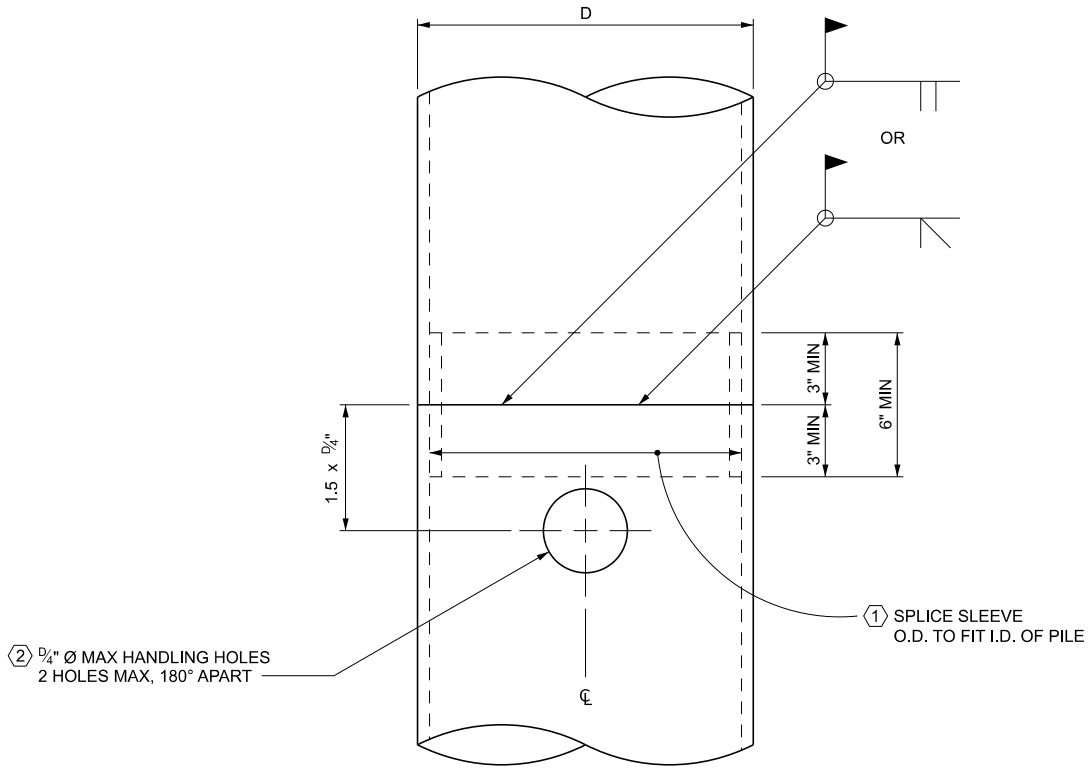
1 FOR DETAIL SEE 8.15.01A

NOTE:

SPACING OF THE H.S. STEEL BOLTS SHALL BE ACCORDING TO THE CURRENT AASHTO SPECIFICATIONS.

PREPARED BY DESIGN DIVISION	8.16.02

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 03/16/15
CHECKED BY: VZ	CIP PILE SPLICES	SUPERSEDES: 02/14/11
APPROVED BY: DAJ		

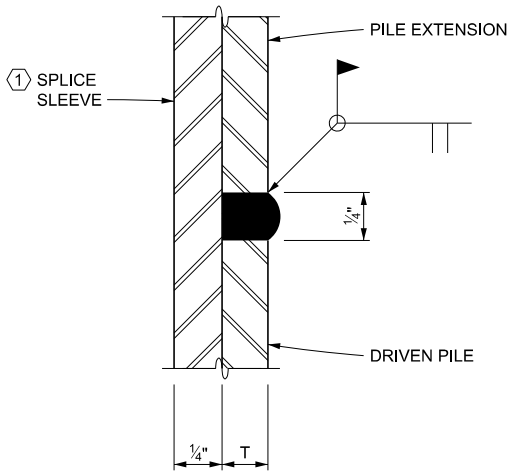


SPLICE DETAILS

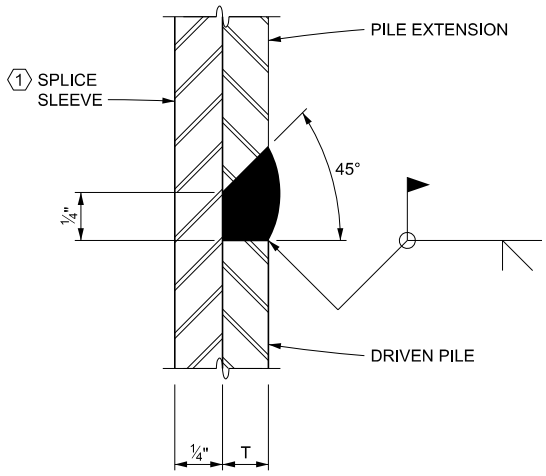
FOR SPIRAL WELDED AND SEAMLESS PIPE SHELLS

1. SPLIT CHILL RINGS AS RECOMMENDED BY THE MANUFACTURER MAY BE SUBSTITUTED FOR SPLICE SLEEVES IF APPROVED BY THE ENGINEER.

2. DRILL OR FLAME CUT CIRCULAR HANDLING HOLES. GRIND FLAME CUT HOLES TO MAKE CIRCULAR AND REMOVE HARDENED EDGE OR CUT OFF SECTION OF PILE WITH FLAME CUT HOLES PRIOR TO SPLICING OR CONCRETE PLACEMENT.



$T \leq \frac{1}{4}"$



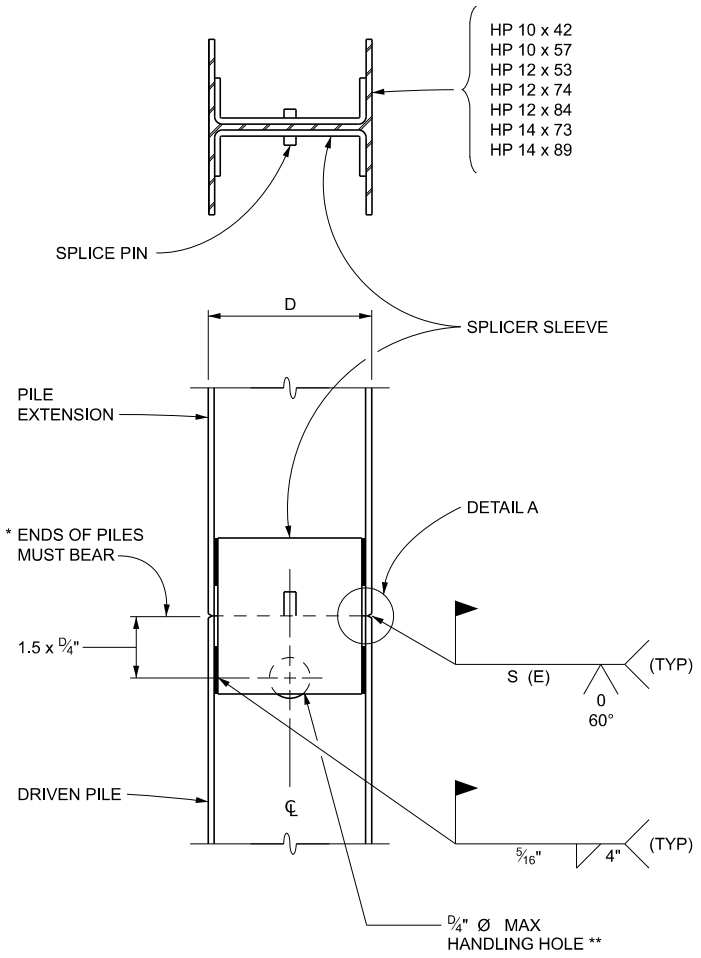
$T > \frac{1}{4}"$

NOTE:

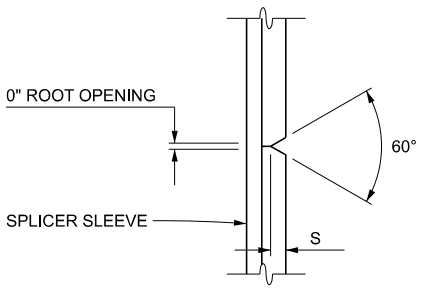
THESE DETAILS SHOULD BE SHOWN ON PLANS WHERE CAST-IN-PLACE PILES ARE USED.

PREPARED BY DESIGN DIVISION	8.21.01

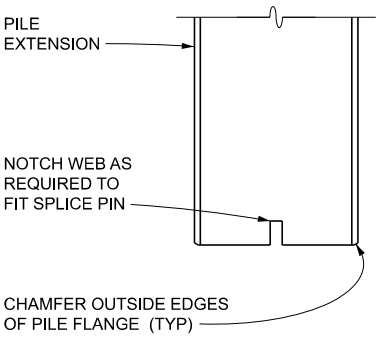
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 06/23/25
CHECKED BY: CWC	H PILE	SUPERSEDES: 08/22/16
APPROVED BY: KCK	ABUTMENT CONSTRUCTION JOINT	



ALTERNATE SPLICE DETAILS



DETAIL A



NOTCH DETAIL

* SET PILE EXTENSION IN PLACE WITH SPLICER SLEEVE ATTACHED, TAP STEEL PILE AND SPLICER SLEEVE ASSEMBLY FROM THE SIDES WITH A SUFFICIENT HAMMER TO IMPROVE BEARING CONTACT AND ENSURE FULL BEARING BETWEEN PILE EXTENSION AND DRIVEN PILE, THEN COMPLETE THE WELDING OF SLEEVES TO LOWER SECTION.

** DRILL OR FLAME CUT CIRCULAR HANDLING HOLE. GRIND FLAME CUT HOLE TO MAKE CIRCULAR AND REMOVE HARDENED EDGE OR CUT OFF SECTION OF PILE WITH FLAME CUT HOLE PRIOR TO SPLICING OR CONCRETE PLACEMENT. HOLES IN FLANGES ARE PERMITTED FOR HANDLING ONLY IF THAT PORTION OF THE PILE IS CUT OFF PRIOR TO SPLICING OR EMBEDMENT INTO CONCRETE.

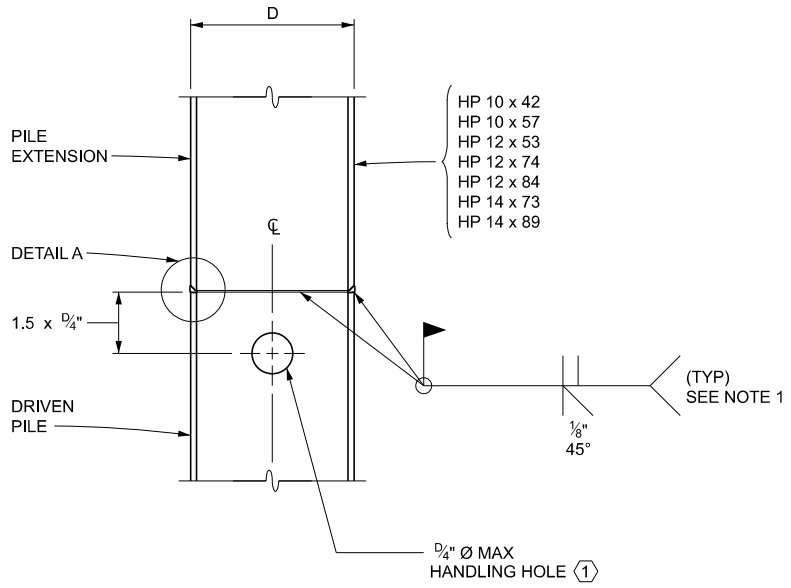
PILE	WELD SIZE (E)	BEVEL DEPTH (S)
HP 10 x 42 HP 10 x 57 HP 12 x 53	5/16" 5/16" 5/16"	5/16" 5/16" 5/16"
HP 12 x 74 HP 14 x 73 HP 14 x 89	3/8" 3/8" 3/8"	3/8" 3/8" 3/8"
HP 12 x 84	7/16"	7/16"
ALL OTHERS	CHECK WITH MDOT CONSTRUCTION FIELD SERVICES GEOTECHNICAL SECTION AND THE BRIDGE FIELD SERVICES SECTION.	

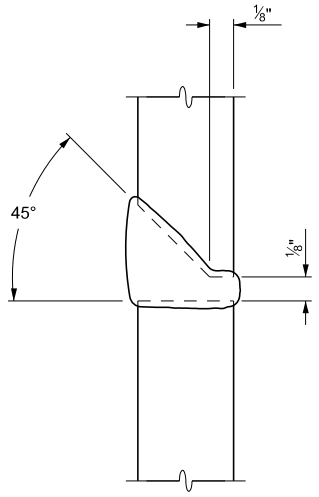
NOTES:

DO NOT USE THE ALTERNATE SPLICE SLEEVE DETAIL WITH INTEGRAL ABUTMENTS, PILE BENTS, OR ANY OTHER PILES THAT MUST RESIST BENDING STRESSES. ONLY USE FULL PENETRATION BUTT WELD SPLICE DETAIL WITH INTEGRAL ABUTMENTS.

PREPARED BY DESIGN DIVISION	8.21.02

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: DAJ	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT H PILE SPLICE (FULL PENETRATION BUTT WELD)	ISSUED: 03/16/15 SUPERSEDES: 01/23/12

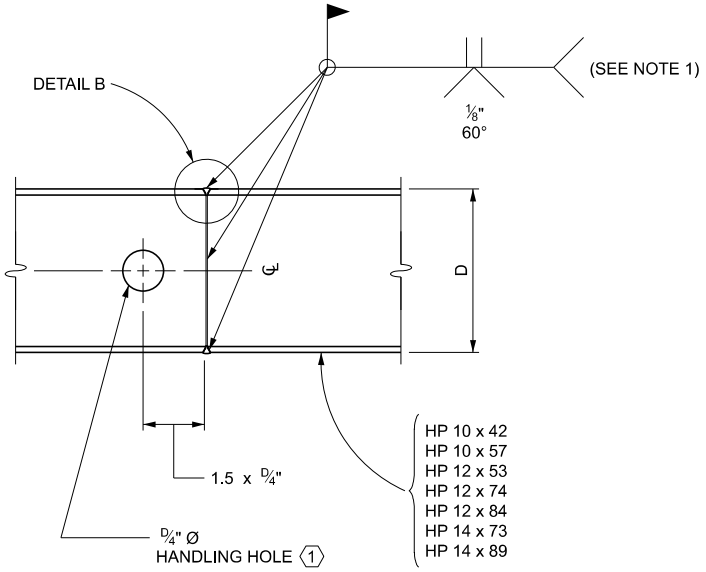


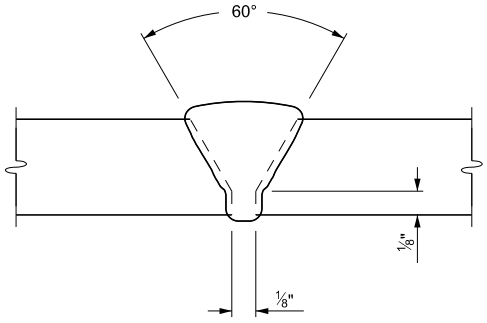


DETAIL A

SPLICE DETAILS

FOR PILES IN PLACE (HORIZONTAL JOINT)





DETAIL B

SPLICE DETAILS

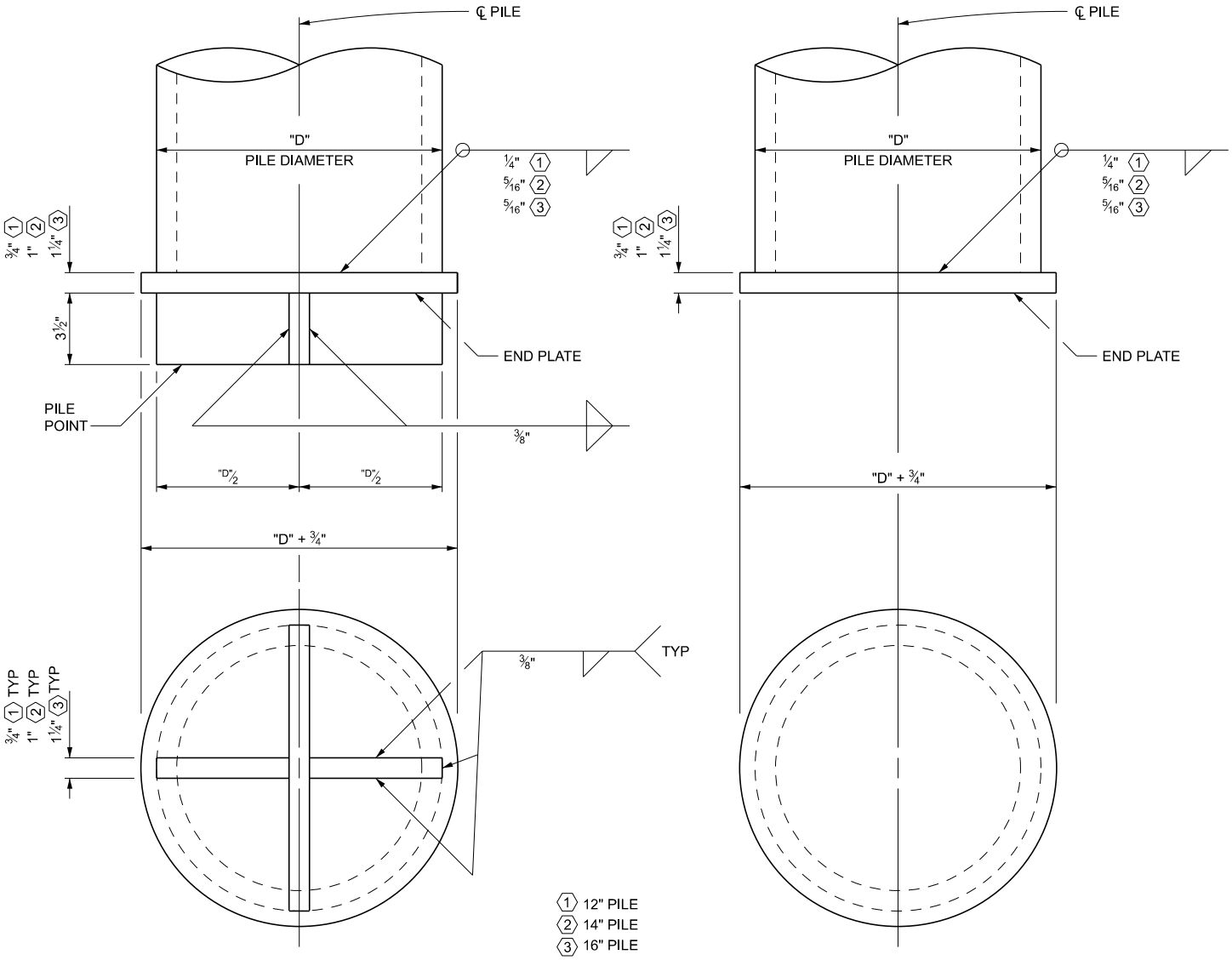
FOR PILES IN HORIZONTAL POSITION

NOTE 1: BACK GOUGE AND GRIND EDGE PREPARATION SMOOTH.

1 DRILL OR FLAME CUT CIRCULAR HANDLING HOLE. GRIND FLAME CUT HOLE TO MAKE CIRCULAR AND REMOVE HARDENED EDGE OR CUT OFF SECTION OF PILE WITH FLAME CUT HOLE PRIOR TO SPLICING OR CONCRETE PLACEMENT. HOLES IN FLANGES ARE PERMITTED FOR HANDLING ONLY IF THAT PORTION OF THE PILE IS CUT OFF PRIOR TO SPLICING OR EMBEDMENT INTO CONCRETE.

PREPARED BY DESIGN DIVISION	8.21.02A

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 12/26/17
CHECKED BY: VZ	CIP PILE POINT/END PLATE DETAILS	SUPERSEDES: 10/17/16
APPROVED BY: DAJ		



CIP PILE POINT DETAILS

FOR POINT BEARING PILES ONLY. USE WHEN RECOMMENDED BY GEOTECHNICAL SERVICES SECTION.

CIP PILE END PLATE DETAILS

NOTE TO DESIGNER:

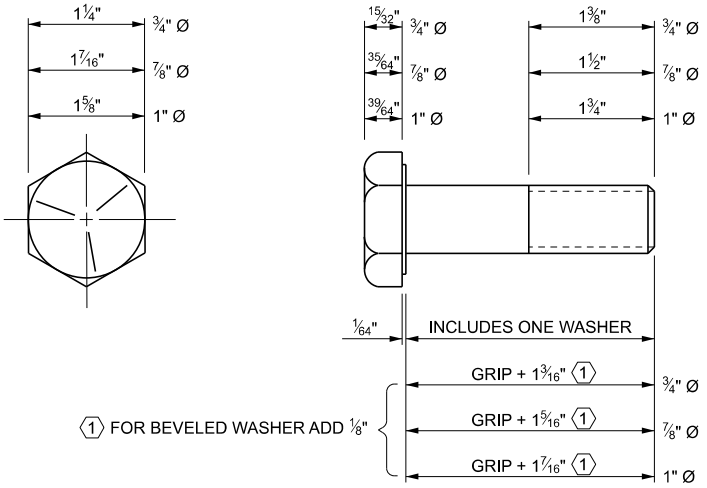
THE END PLATES DETAILED ON THIS SHEET SHOULD NOT BE PAID FOR SEPARATELY.

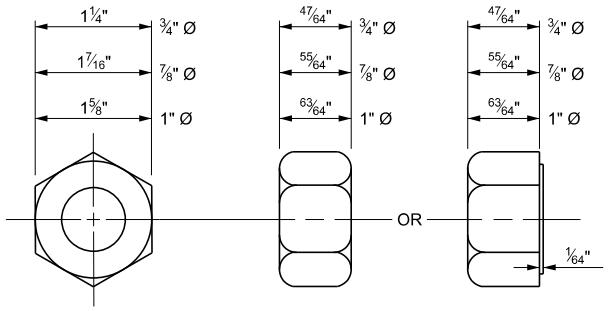
PREPARED BY DESIGN DIVISION	8.21.03

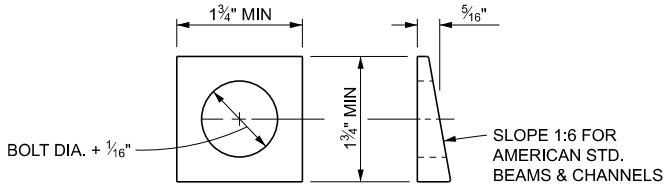
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: DAJ	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT FASTENER DETAILING MINIMUMS FOR ASTM F 3125 GRADE A 325 BOLTS AND NUTS	ISSUED: 06/09/17 SUPERSEDES: 11/27/01

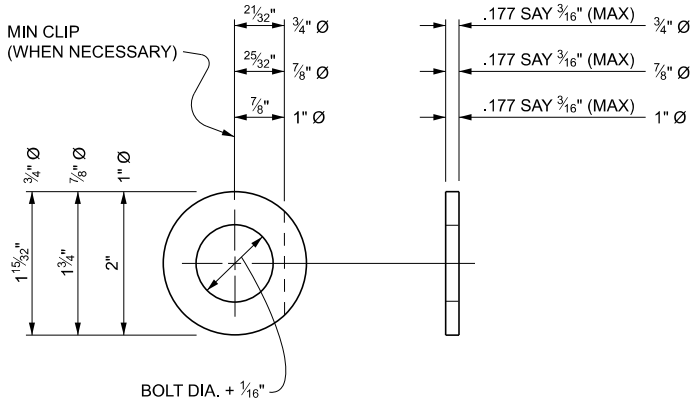
ASTM F 3125 GRADE A 325 STRUCTURAL BOLTS & NUTS

DIMENSIONS SHOWN ARE NOMINAL EXCEPT AS NOTED





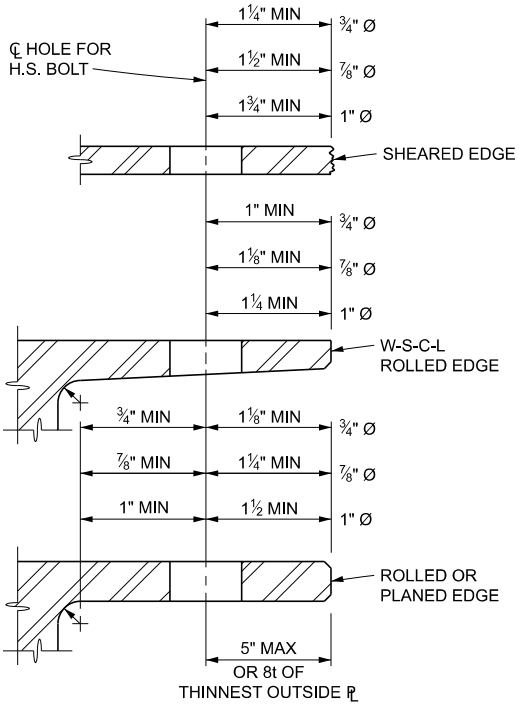




BEVELED WASHER FOR

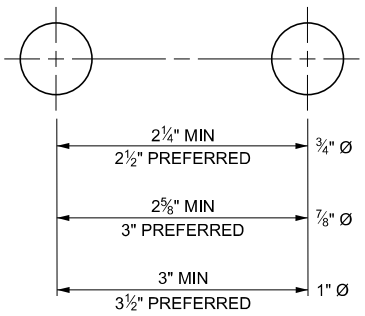
¾" Ø, ⅞" Ø, & 1" Ø BOLTS

NOTE: USE BEVELED WASHER WHEN SLOPE IS MORE THAN 1:20



CIRCULAR FLAT WASHER

FOR ¾" Ø WASHERS, USE 4.8# PER 100
FOR ⅞" Ø WASHERS, USE 7.0# PER 100
FOR 1" Ø WASHERS, USE 9.4# PER 100



MIN SPACING FOR BOLTS

SEE ART. 10.24.5 OF AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES 17th EDITION
SEE ART. 6.13.2.6 OF AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

MIN EDGE DISTANCES FOR BOLTS

SEE ART. 10.24.7 OF AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES 17th EDITION
SEE ART. 6.13.2.6 OF AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

PREPARED BY DESIGN DIVISION	8.26.01

CONTINUOUS AND SIMPLE SPANS

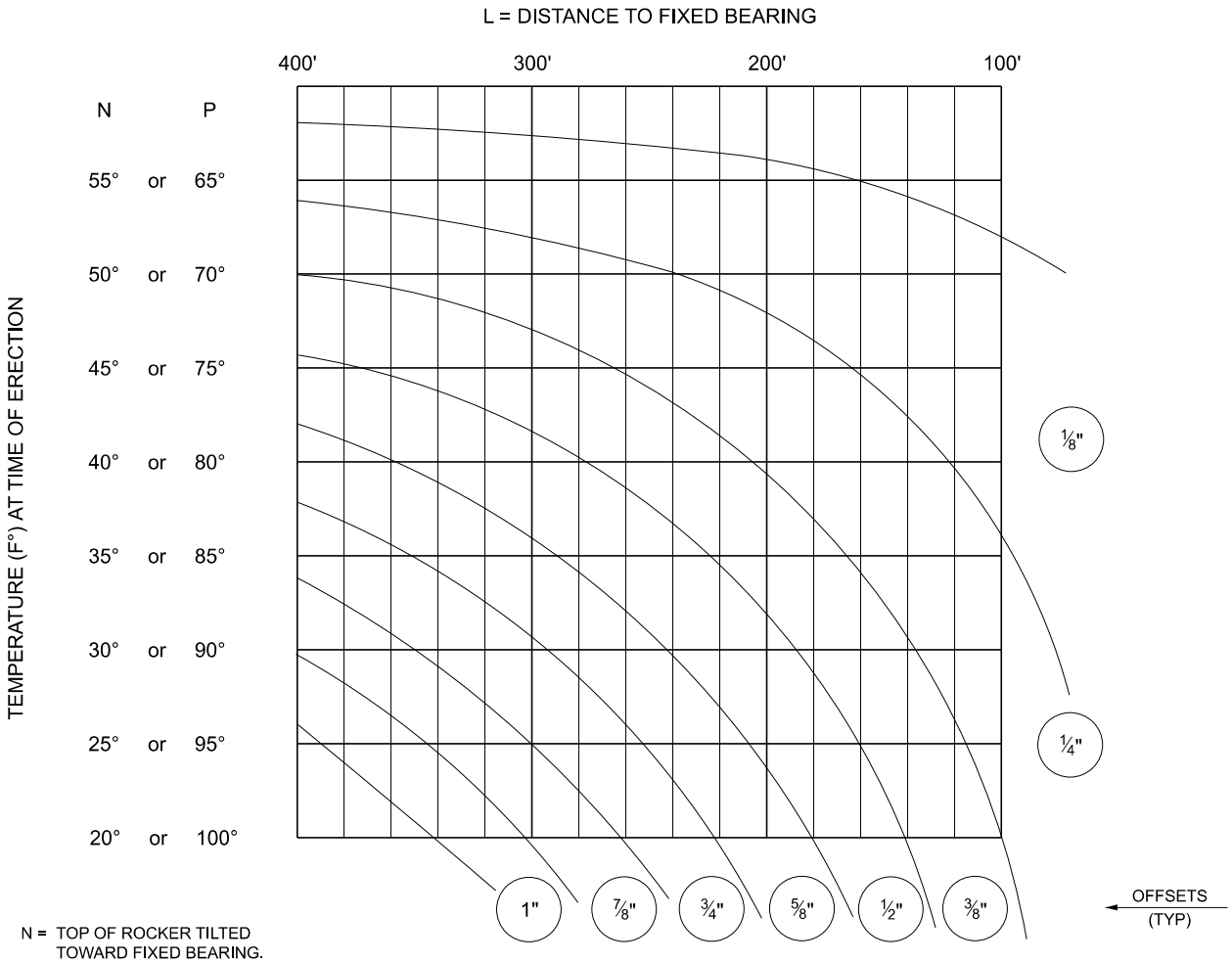
LENGTH OF EXPANSION	TYPE OF MOVEMENT	TYPE OF BEARING	BEVEL SOLE PLATE
THRU 120'	FIXED	CURVED STEEL PLATES (SEE BRIDGE DESIGN GUIDE 8.42.01)	YES
	EXPANSION	ELASTOMERIC BEARINGS SEE SECTION 14 OF EITHER (AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES OR LRFD BRIDGE DESIGN SPECIFICATIONS)	YES
OVER 120'	FIXED	BUILT UP PEDESTALS (SEE BRIDGE DESIGN GUIDES 8.32.03 & 8.32.05)	NO
	EXPANSION	BUILT UP ROCKERS (SEE BRIDGE DESIGN GUIDES 8.32.01)	NO

IF ROCKERS ARE REQUIRED AT ANY BEARINGS, USE ROCKERS AND PEDESTALS THROUGHOUT.

PROVIDE ANCHORAGE FOR UPLIFT OF ANCHOR SPANS OF CONTINUOUS BRIDGES. SEE BRIDGE DESIGN GUIDE 8.32.07 FOR EXPANSION ROCKER WITH PROVISION FOR UPLIFT.

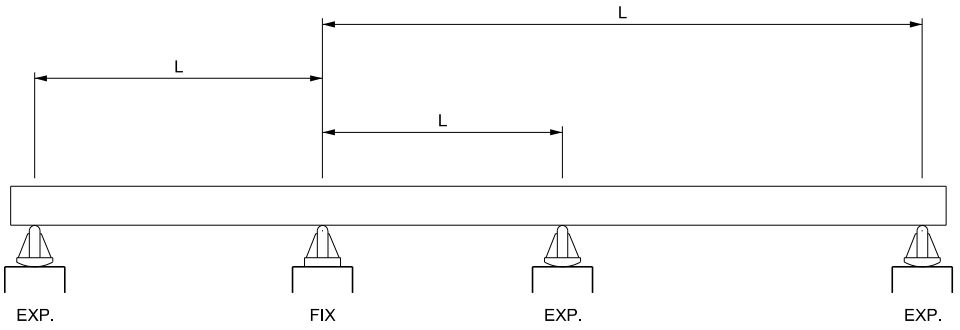
CURVED GIRDERS TO HAVE ALL ELASTOMERIC BEARINGS.

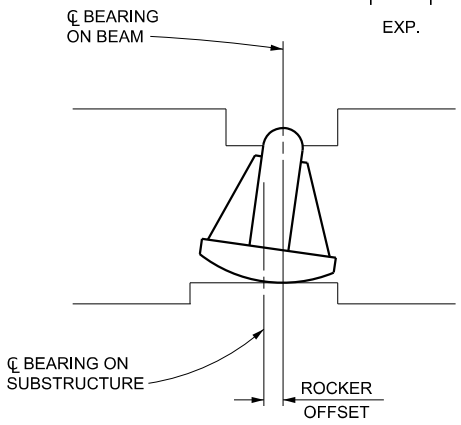
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 02/14/11
CHECKED BY: VZ	OFFSET DIMENSIONS FOR ROCKER TILT	SUPERSEDES: 11/27/01
APPROVED BY: TGF		



N = TOP OF ROCKER TILTED TOWARD FIXED BEARING.

P = TOP OF ROCKER TILTED AWAY FIXED BEARING.

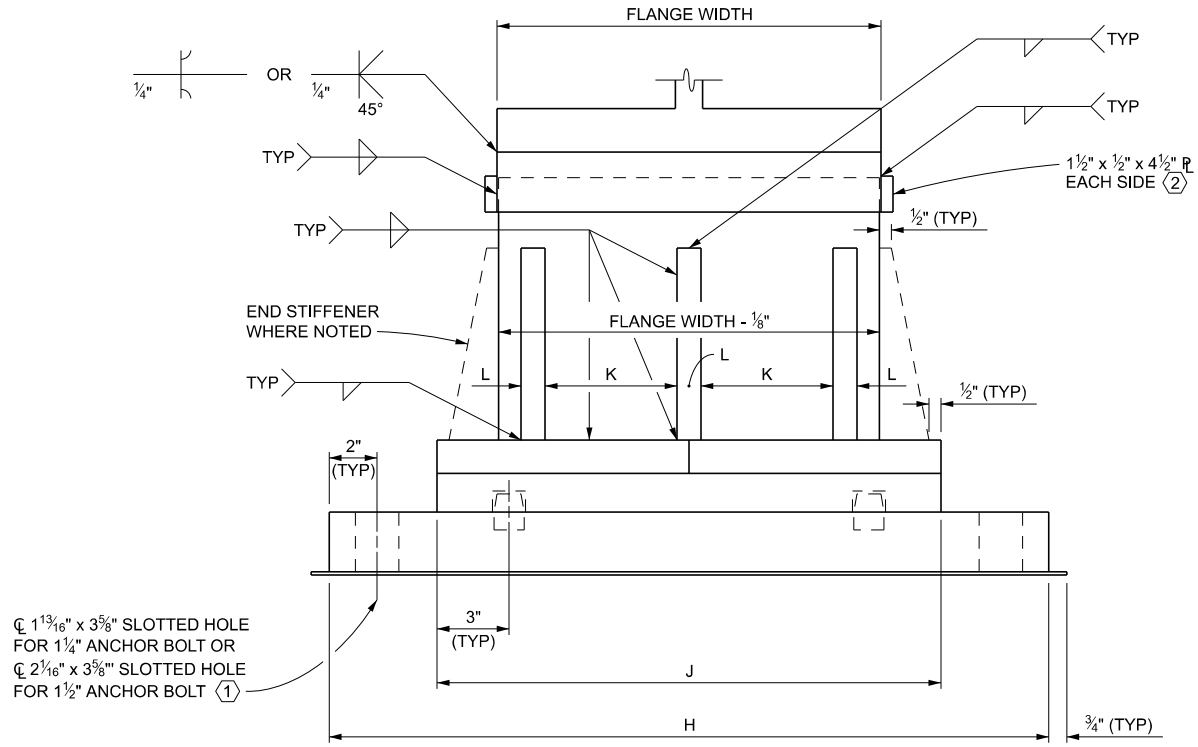




THE SPAN LENGTH DIMENSIONS SHOWN ON THE PLANS ASSUME A TEMPERATURE OF 60°F WHEN BEAMS ARE ERECTED. THE BEAMS WILL BE LONGER IF THE TEMPERATURE IS HIGHER, AND SHORTER IF COLDER, WITH THE ROCKERS TILTED AT TIME OF ERECTION. IT MAY BE NECESSARY TO ADJUST THE MASONRY PLATE TO ACHIEVE THE PROPER OFFSETS.

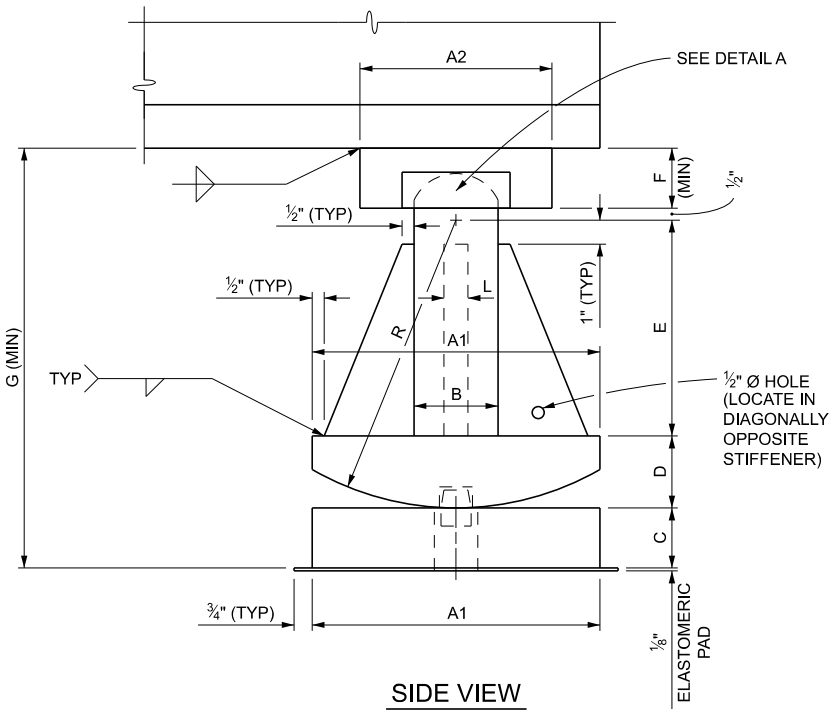
PREPARED BY DESIGN DIVISION	8.31.02

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 02/14/11
CHECKED BY: VZ	EXPANSION ROCKER	SUPERSEDES: 11/27/01
APPROVED BY: TGF		

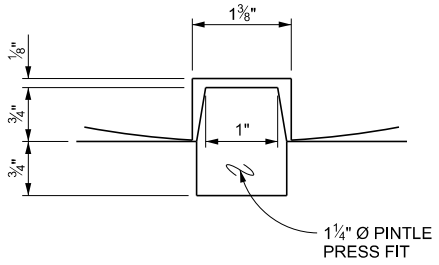


END VIEW

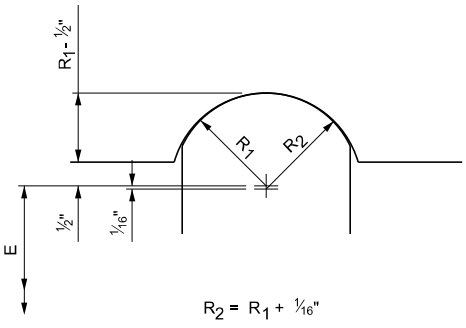
NOTE: ANCHOR BOLTS SHALL BE FURNISHED WITH ¼" x 3" x 6½" PL WASHERS.



SIDE VIEW



PINTLE DETAIL



DETAIL A

NOTES:

SEE GUIDE 8.32.02 FOR TABULATION OF BEARING DIMENSIONS

1 USE 1½" ANCHOR BOLT FOR SPANS OVER 100'

2 USE 2" x ½" x 5½" PL WHEN $R_1 = 1\frac{15}{16}$"

PREPARED BY DESIGN DIVISION	8.32.01

MAX LOAD (kip)	FLANGE WIDTH (in)	A1 (in)	A2 (in)	B (in)	C (in)	D (in)	E (in)	F (MIN) (in)	G (MIN) (in)	H (in)	J (in)	K (in)	L (in)	END STIFF REQ.	R1 (in)	R (MIN) (in)	WEIGHT OF STEEL (lbs)
100	12	6	6	2½	1¾	1½	6½	2	12¼	22	13	4	⅝		1 7/16	8	200
100	14	6	6	2½	1¾	1¼	6¾	2	12¼	24	15	5	⅝		1 7/16	8	225
100	16	6	6	2½	1¾	1¼	6¾	2	12¼	26	17	6	⅝		1 7/16	8	250
125	12	7	6	2½	2	1¾	6¼	2	12½	22	13	4	¾		1 7/16	8	230
125	14	7	6	2½	2	1¾	6¼	2	12½	24	15	5	¾		1 7/16	8	260
125	16	7	6	2½	1¾	1¾	6¼	2	12¼	26	17	6	¾		1 7/16	8	280
150	12	8	6	2½	2	2	6	2	12½	23	14	4	¾		1 7/16	8	260
150	14	8	6	2½	2	2	6	2	12½	24	15	5	¾		1 7/16	8	285
150	16	8	6	2½	2	2	6	2	12½	26	17	6	¾		1 7/16	8	320
175	12	9	6	2½	2¼	2¼	9¾	2	16¾	22	13	4	¾		1 7/16	12	340
175	14	9	6	2½	2¼	2¼	9¾	2	16¾	24	15	5	¾		1 7/16	12	380
175	16	9	6	2½	2	2¼	9¾	2	16½	26	17	6	¾		1 7/16	12	410
200	12	10	6	2½	2½	2½	9½	2	17	22	13	4	¾		1 7/16	12	380
200	14	10	6	2½	2¼	2½	9½	2	16¾	24	15	5	¾		1 7/16	12	410
200	16	10	6	2½	2¼	2½	9½	2	16¾	26	17	6	¾		1 7/16	12	460
250	14	11	8	3½	2½	3	9	2½	17½	24	15	5	¾		1 15/16	12	540
250	16	11	8	3½	2½	3	9	2½	17½	26	17	6	¾		1 15/16	12	600
300	16	12	8	3½	2½	3	9	2½	17½	30	21	5½	1		1 15/16	12	700
300	18	12	8	3½	2½	3	9	2½	17½	28	19	6½	1		1 15/16	12	695
350	16	13	8	3½	2¾	3	9	2½	17¾	33	24	5½	1	⟨1⟩	1 15/16	12	825
350	18	13	8	3½	2¾	3	9	2½	17¾	33	24	6½	1		1 15/16	12	845
400	16	14	8	3½	2¾	3½	8½	2½	17¾	35	26	5½	1	⟨1⟩	1 15/16	12	950
400	18	14	8	3½	2¾	3½	8½	2½	17¾	35	26	6½	1	⟨1⟩	1 15/16	12	975
400	20	14	8	3½	2¾	3½	8½	2½	17¾	35	26	7½	1		1 15/16	12	995
450	18	15	8	3½	3	3½	8½	2½	18	37	28	6	1¼	⟨1⟩	1 15/16	12	1110
450	20	15	8	3½	3	3½	8½	2½	18	37	28	7	1¼	⟨1⟩	1 15/16	12	1140
450	22	15	8	3½	3	3½	8½	2½	18	37	28	8	1¼		1 15/16	12	1155

⟨1⟩ DENOTES END STIFFNERS ARE REQUIRED

DRAWN BY: BLT
CHECKED BY: VZ
APPROVED BY: TGF

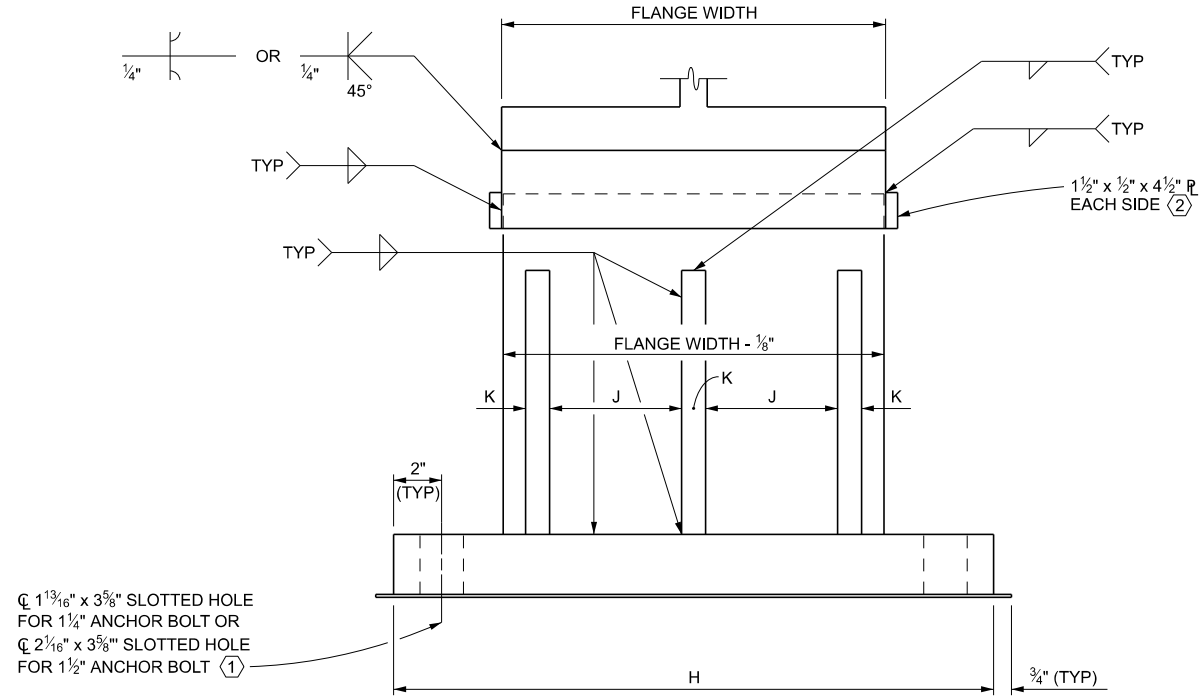
MICHIGAN DEPARTMENT OF TRANSPORTATION
BUREAU OF DEVELOPMENT
ROCKER BEARING DIMENSIONS

ISSUED: 05/04/06
SUPERSEDES: 11/27/01

PREPARED BY DESIGN DIVISION

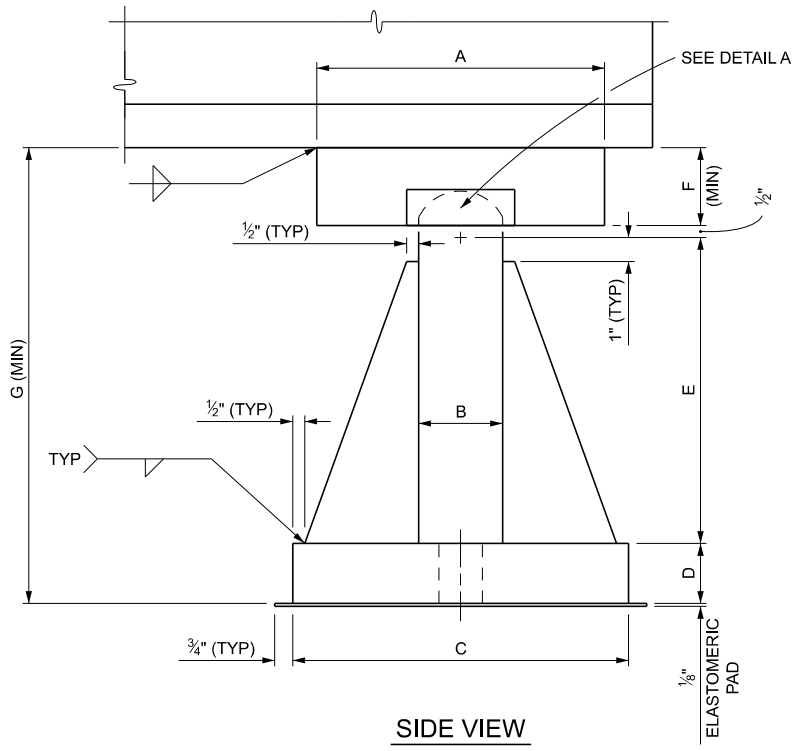
8.32.02

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 02/14/11
CHECKED BY: VZ	FIXED BEARING	SUPERSEDES: 11/27/01
APPROVED BY: TGF		

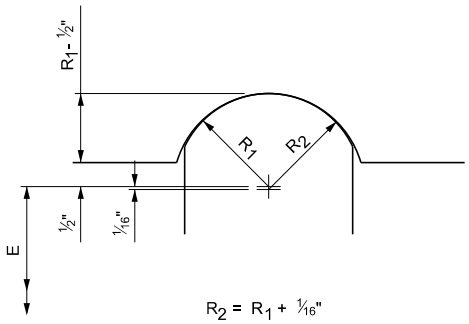


END VIEW

NOTE: ANCHOR BOLTS SHALL BE FURNISHED WITH ¼" x 3" x 6½" ℙ WASHERS.



SIDE VIEW



$R_2 = R_1 + \frac{1}{16}"$

DETAIL A

NOTES:

SEE GUIDE 8.32.04 FOR TABULATION OF BEARING DIMENSIONS

1 USE 1½" ANCHOR BOLT FOR SPANS OVER 100'

2 USE 2" x ½" x 5½" ℙ WHEN $R_1 = 1\frac{15}{16}"$

USE THIS BEARING WHEN A BUILT UP PEDESTAL AND EXPANSION ROCKER ARE REQUIRED ON THE SAME PIER.

EQUIV. d FOR BEARING CHECK:

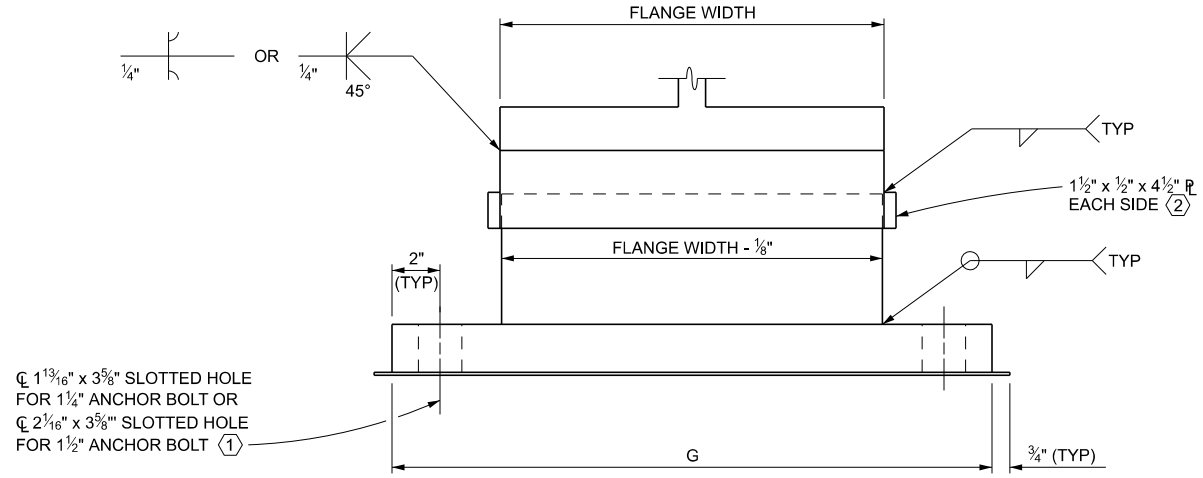
$$d = \frac{2R_1\ R_2}{R_2 - R_1}$$

PREPARED BY DESIGN DIVISION	8.32.03

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT FIXED BEARING DIMENSIONS	ISSUED: 05/04/06 SUPERSEDES: 11/27/01

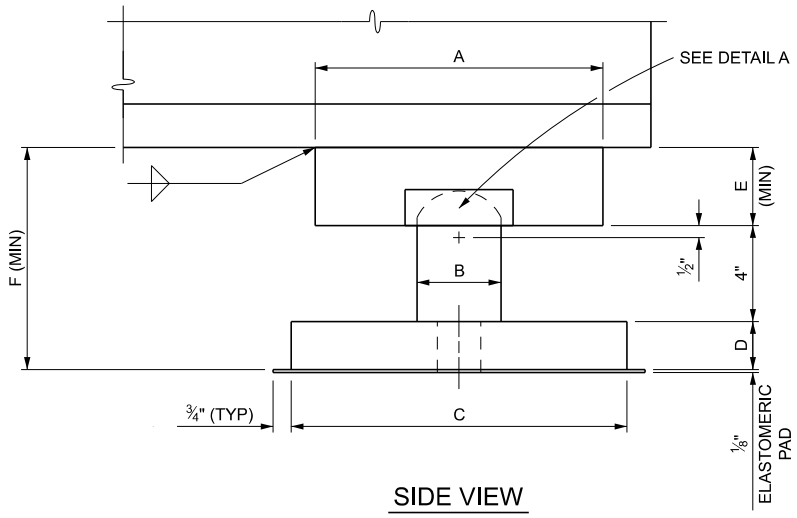
MAX LOAD (kip)	FLANGE WIDTH (in)	A (in)	B (in)	C (in)	D (in)	E (in)	F (MIN) (in)	G (MIN) (in)	H (in)	J (in)	K (in)	R1 (in)	WEIGHT OF STEEL (lbs)
100	12	6	2½	7	1½	8¼	2	12¼	21	4	¾	1 7/16	185
100	14	6	2½	6	1½	8¼	2	12¼	23	5	¾	1 7/16	200
100	16	6	2½	6	1½	8¼	2	12¼	25	6	¾	1 7/16	225
125	12	7	2½	8	1⅝	8⅜	2	12½	21	4	¾	1 7/16	215
125	14	7	2½	7	1⅝	8⅜	2	12½	23	5	¾	1 7/16	230
125	16	7	2½	7	1⅝	8⅛	2	12¼	25	6	¾	1 7/16	250
150	12	8	2½	9	1¾	8¼	2½	13	21	4	¾	1 7/16	250
150	14	8	2½	8	1¾	8¼	2	12½	23	5	¾	1 7/16	255
150	16	8	2½	8	1¾	8¼	2	12½	25	6	¾	1 7/16	285
175	12	9	2½	11	1¾	12½	2½	17¼	21	4	¾	1 7/16	330
175	14	9	2½	10	1¾	12½	2½	17¼	23	5	¾	1 7/16	360
175	16	9	2½	9	1¾	12¼	2½	17	25	6	¾	1 7/16	380
200	12	10	2½	12	1¾	12¾	3	18	21	4	¾	1 7/16	375
200	14	10	2½	11	1¾	12½	2½	17¼	23	5	¾	1 7/16	355
200	16	10	2½	10	1¾	12½	2½	17¼	25	6	¾	1 7/16	410
250	14	11	3½	13	1¾	12¾	3¼	18¼	23	5	¾	1 15/16	505
250	16	11	3½	12	1¾	12¾	3	18	25	6	¾	1 15/16	540
300	16	12	3½	14	1¾	12¾	3¼	18¼	25	5½	1	1 15/16	610
300	18	12	3½	13	1¾	12¾	3¼	18¼	27	6½	1	1 15/16	655
350	16	13	3½	16	1¾	13	3⅜	18⅝	25	5½	1	1 15/16	675
350	18	13	3½	15	1¾	13	3¼	18½	27	6½	1	1 15/16	715
400	16	14	3½	19	1¾	13	3½	18¾	25	5½	1	1 15/16	750
400	18	14	3½	18	1¾	13	3⅜	18⅝	27	6½	1	1 15/16	795
400	20	14	3½	16	1¾	13	3¼	18½	29	7½	1	1 15/16	820
450	18	15	3½	20	1¾	13¼	3¾	19¼	27	6	1¼	1 15/16	905
450	20	15	3½	19	1¾	13¼	3½	19	29	7	1¼	1 15/16	940
450	22	15	3½	17	1¾	13¼	3¼	18¾	31	8	1¼	1 15/16	955

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 03/26/12
CHECKED BY: VZ	FIXED SHOE	SUPERSEDES: 02/14/11
APPROVED BY: DAJ		

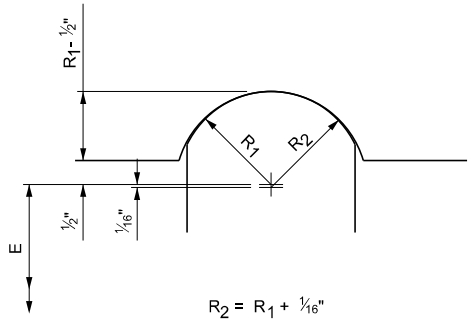


NOTE: ANCHOR BOLTS SHALL BE FURNISHED WITH ¼" x 3" x 6½" PL WASHERS.

END VIEW



SIDE VIEW



DETAIL A

EQUIV. d FOR BEARING CHECK:

$$d = \frac{2R_1\ R_2}{R_2 - R_1}$$

NOTES:

SEE GUIDE 8.32.06 FOR TABULATION OF BEARING DIMENSIONS

USE FIXED SHOE WHEN A BUILT UP PEDESTAL IS REQUIRED. AN EXCEPTION IS WHEN A PEDESTAL IS USED ON THE SAME PIER AS A ROCKER, THEN USE GUIDE 8.32.03.

(1) USE 1½" ANCHOR BOLT FOR SPANS OVER 100'

(2) USE 2" x ½" x 5½" PL WHEN $R_1 = 1\ 15/16$"

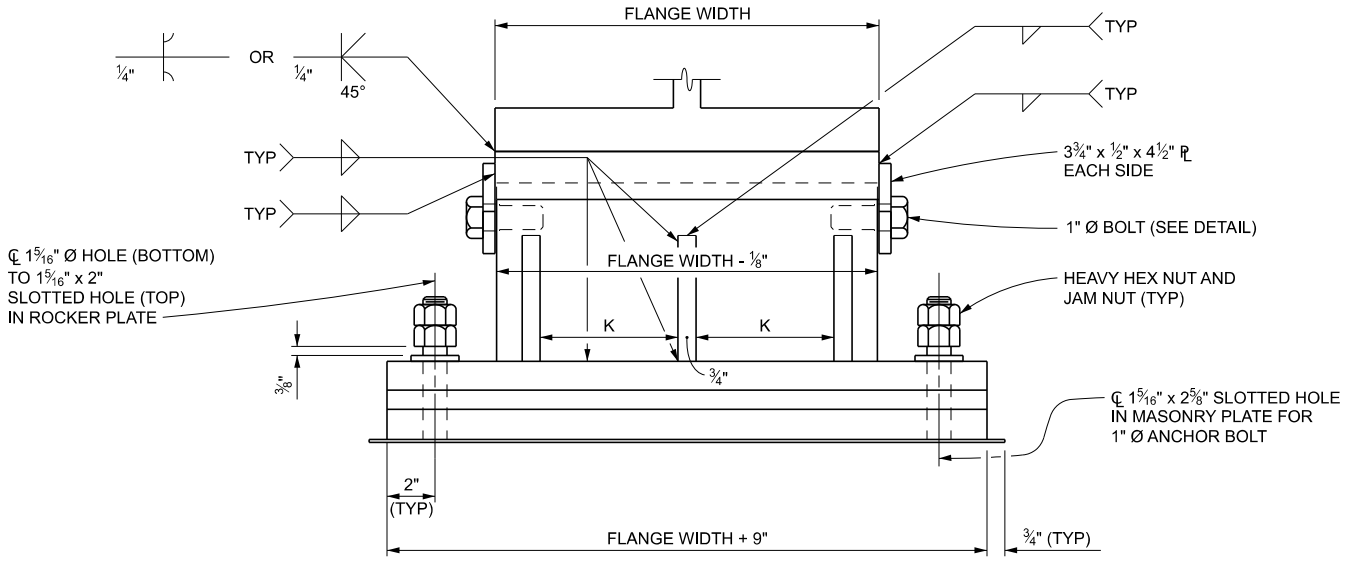
PREPARED BY DESIGN DIVISION	8.32.05

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT FIXED SHOE DIMENSIONS	ISSUED: 05/04/06 SUPERSEDES: 11/27/01

MAX LOAD (kip)	FLANGE WIDTH (in)	A (in)	B (in)	C (in)	D (in)	E (in)	F (MIN) (in)	G (in)	R1 (in)	WEIGHT OF STEEL (lbs)
100	12	6	2½	6	2	2	8	21	1 7/16	150
100	14	6	2½	6	2	2	8	23	1 7/16	170
100	16	6	2½	6	2	2	8	25	1 7/16	185
125	12	7	2½	7	2	2	8	21	1 7/16	165
125	14	7	2½	7	2	2	8	23	1 7/16	190
125	16	7	2½	7	2	2	8	25	1 7/16	210
150	12	8	2½	8	2	2½	8½	21	1 7/16	200
150	14	8	2½	8	2	2	8	23	1 7/16	210
150	16	8	2½	8	2	2	8	25	1 7/16	235
175	12	9	2½	10	2¼	2½	8¾	21	1 7/16	245
175	14	9	2½	9	2¼	2½	8¾	23	1 7/16	265
175	16	9	2½	9	2¼	2½	8¾	25	1 7/16	295
200	12	10	2½	11	2½	3	9½	21	1 7/16	300
200	14	10	2½	10	2¼	2½	8¾	23	1 7/16	290
200	16	10	2½	10	2¼	2½	8¾	25	1 7/16	320
250	14	11	3½	12	2½	3¼	9¾	23	1 15/16	395
250	16	11	3½	12	2½	3	9½	25	1 15/16	425
300	16	12	3½	13	2½	3¼	9¾	25	1 15/16	470
300	18	12	3½	13	2½	3¼	9¾	27	1 15/16	520
350	16	13	3½	15	3	3⅜	10⅜	25	1 15/16	580
350	18	13	3½	14	2¾	3¼	10	27	1 15/16	585
400	16	14	3½	17	3¼	3½	10¾	25	1 15/16	680
400	18	14	3½	16	3¼	3⅜	10⅝	27	1 15/16	715
400	20	14	3½	15	3	3¼	10¼	29	1 15/16	710
450	18	15	3½	18	3½	3¾	11¼	27	1 15/16	850
450	20	15	3½	17	3½	3½	11	29	1 15/16	870
450	22	15	3½	16	3½	3½	11	31	1 15/16	915

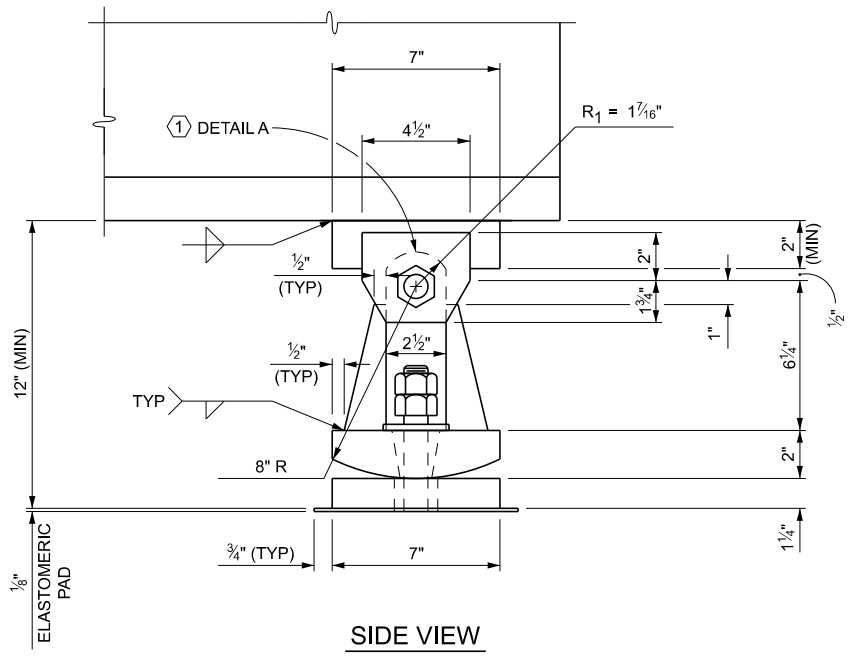
PREPARED BY DESIGN DIVISION	8.32.06

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 02/14/11
CHECKED BY: VZ	EXPANSION ROCKER WITH PROVISION FOR UPLIFT	SUPERSEDES: 11/27/01
APPROVED BY: TGF		

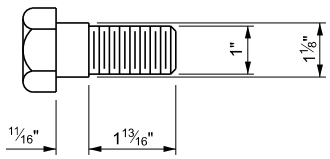


END VIEW

NOTE: ANCHOR BOLTS SHALL BE FURNISHED WITH
¼" x 2" x 3½" PL WASHERS WITH 1 3/16" Ø HOLES.



SIDE VIEW



BOLT DETAIL

MAX LOAD	FLANGE	K	WEIGHT
125 K	12"	4"	240 LBS
	14"	5"	270 LBS
	16"	6"	300 LBS

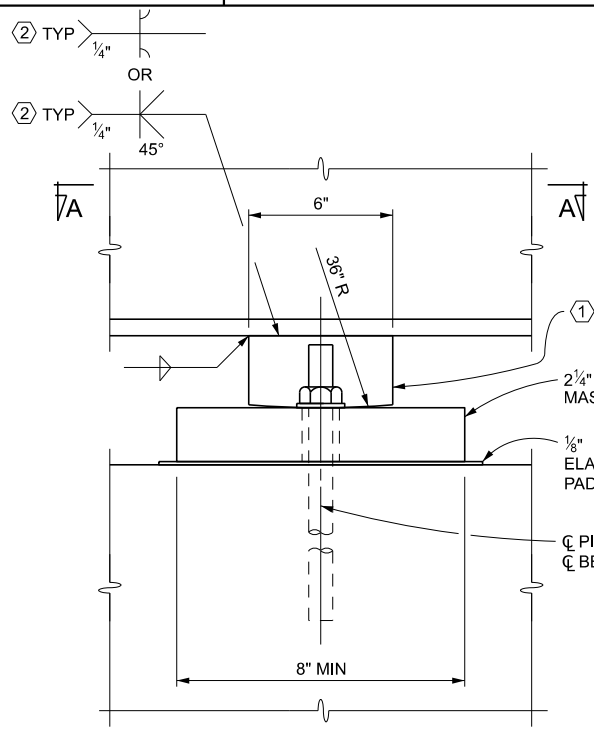
NOTES:

ANCHOR BOLTS AND KEEPER BOLTS SHOWN ARE MINIMUM.
INCREASE IF NECESSARY BASED ON AMOUNT OF UPLIFT.

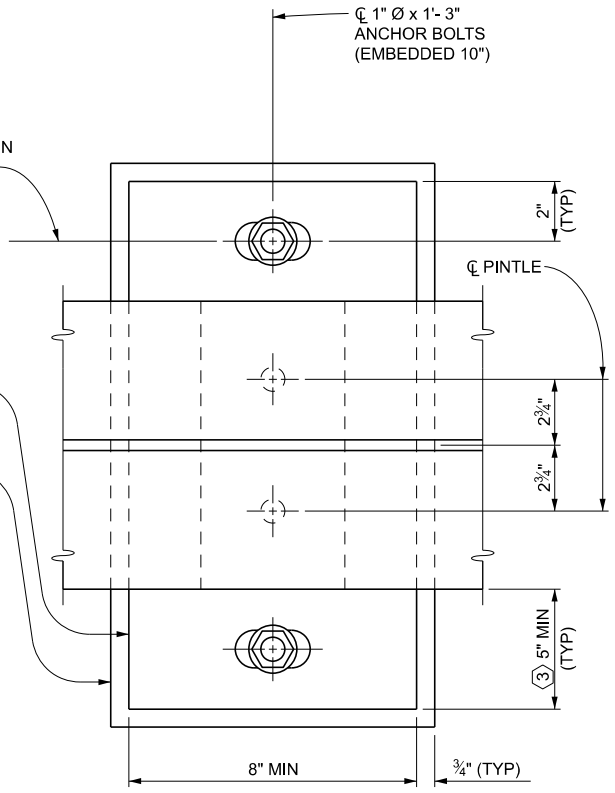
1 SEE GUIDE 8.32.01 FOR DETAIL A.

PREPARED BY DESIGN DIVISION	8.32.07

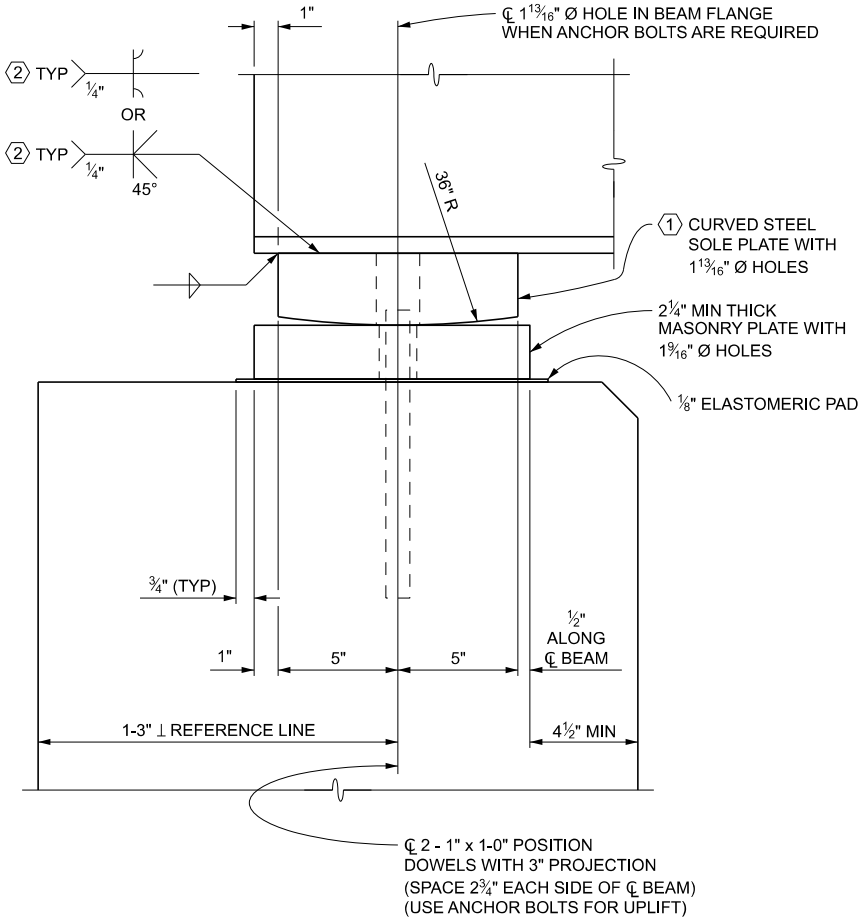
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 02/14/11
CHECKED BY: VZ	CURVED STEEL PLATE BEARING DETAILS	SUPERSEDES: 11/27/01
APPROVED BY: TGF		



ELEVATION AT PIER



SECTION A-A



ELEVATION AT ABUTMENT

NOTES:

FOR PINTLE DETAILS, SEE GUIDE 8.32.01.

MAKE SOLE PLATE SAME WIDTH AS FLANGE (MIN).

BEVEL SOLE PLATE WHEN REQUIRED BEVEL EXCEEDS ⅛" PER FOOT.

AT ABUTMENTS, USE MASONRY PLATE 1" WIDER THAN SOLE PLATE (MIN).

PLATE THICKNESSES SHOWN ON THIS SHEET ARE FOR EITHER A572 OR A36 STEEL.

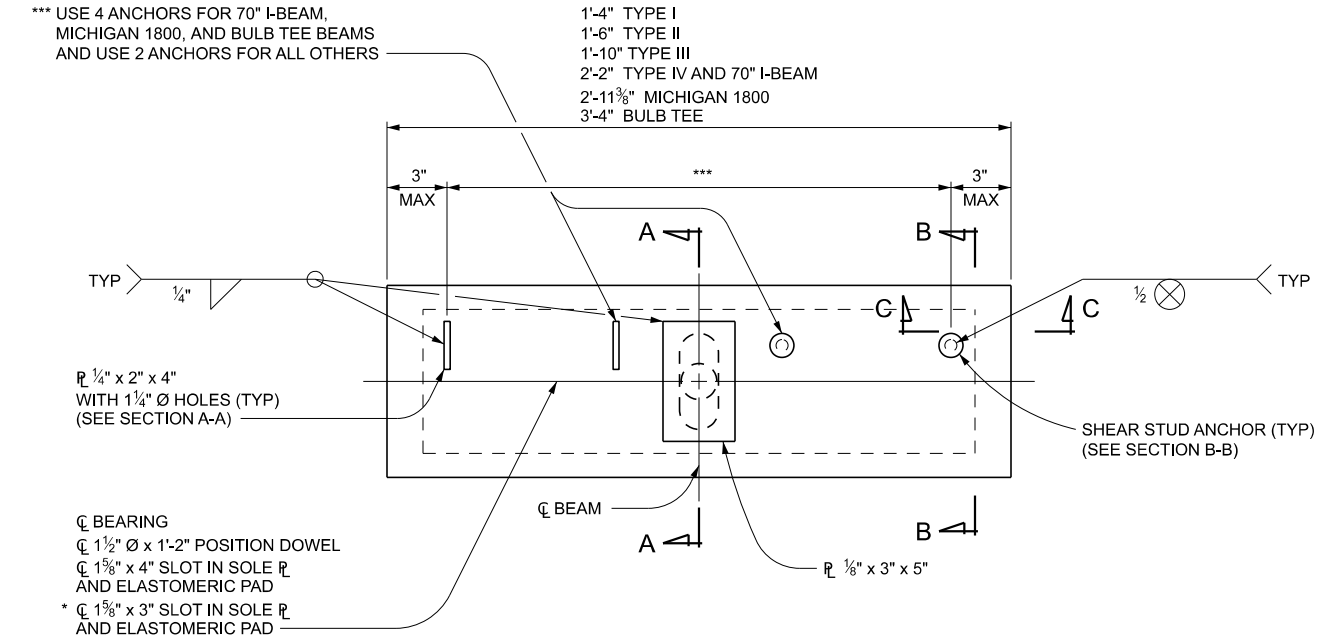
1 MINIMUM SOLE PLATE THICKNESS IS 1½", MAXIMUM THICKNESS IS 6".

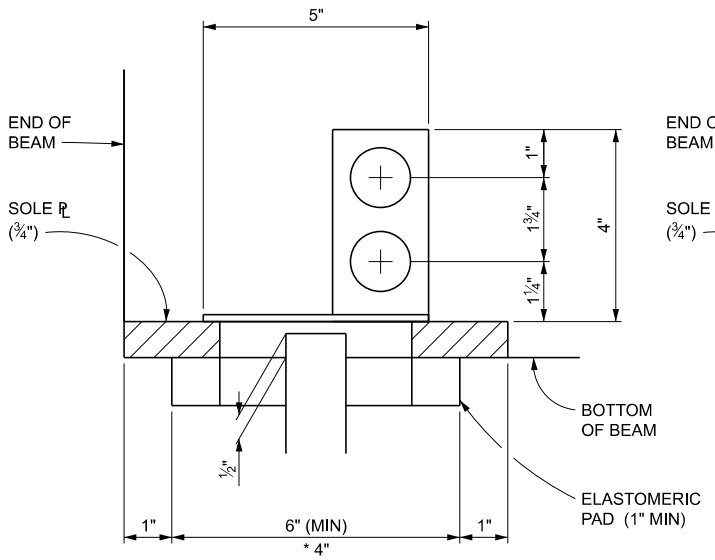
2 USE FILLET WELD WHEN SOLE PLATE IS WIDER THAN FLANGE.

3 WHEN MORE THAN 6" IS REQUIRED TO OBTAIN THE ALLOWABLE MASONRY PRESSURE, USE A FIXED SHOE (SEE GUIDE 8.32.05).

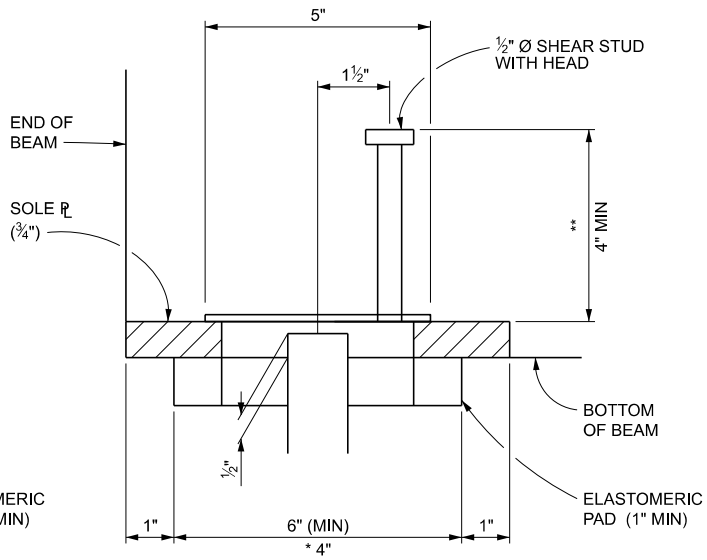
PREPARED BY DESIGN DIVISION	8.42.01

DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BEARING DETAILS FOR PRESTRESSED CONCRETE BEAMS	ISSUED: 02/24/25 SUPERSEDES: 12/23/24



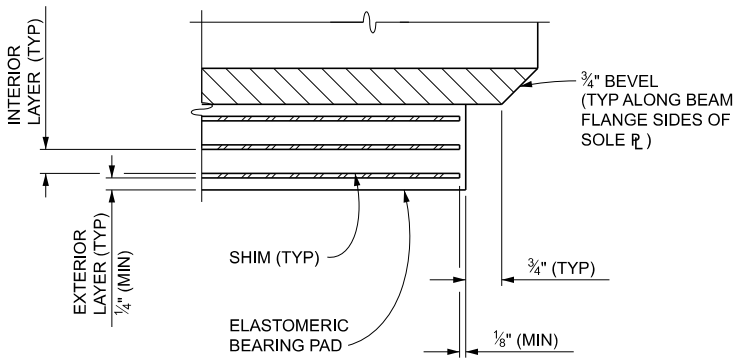


SECTION A-A



SECTION B-B

** EXTEND SHEAR STUDS ABOVE HIGHEST ROW WITH STRANDS WITHOUT INTERFERENCE TO REINFORCEMENT



SECTION C-C

NOTES:

THIS BEARING IS TO BE USED AT PIERS AND AT ABUTMENTS.

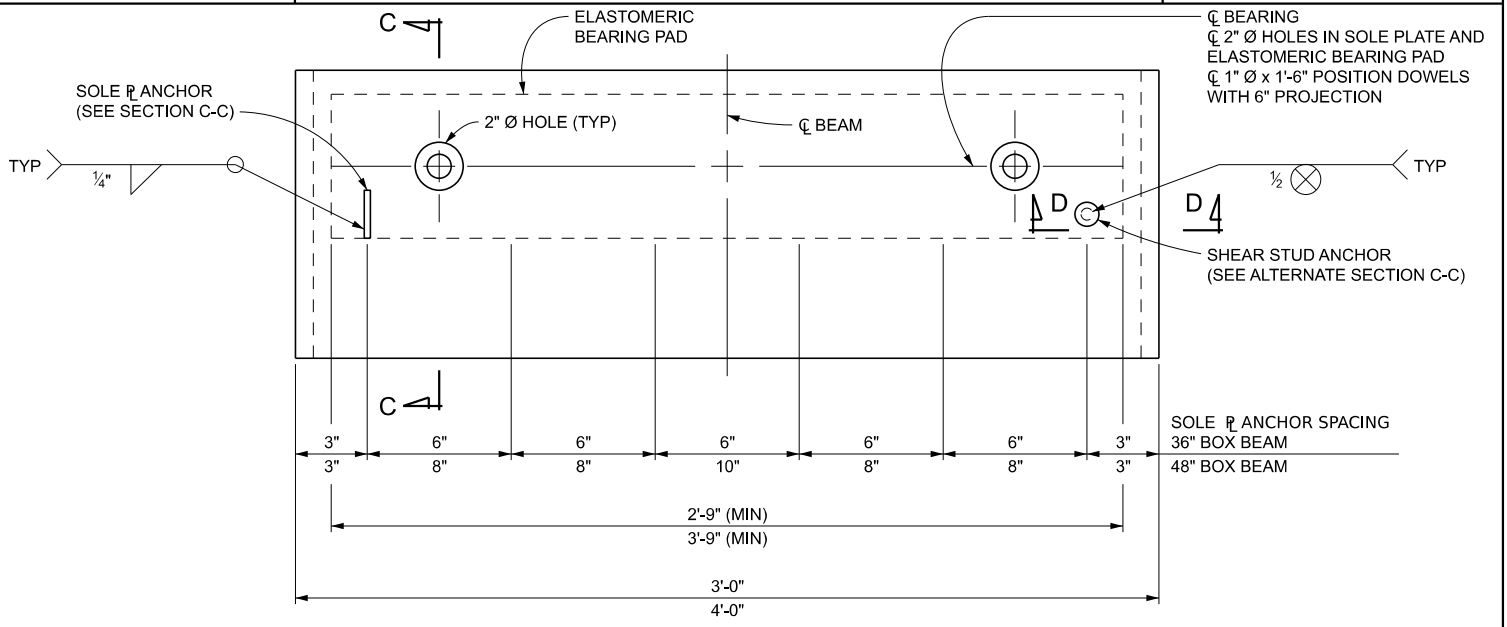
SOLE PLATES SHOULD BE TILTED TO PROVIDE REQUIRED BEVELS WHICH EXCEED ⅛"/FT.

* 4" MINIMUM PAD LENGTH WITH 3" SLOT MAY BE USED WHEN BEAM ROTATION AND PAD PRESSURE REQUIREMENTS DICTATE.

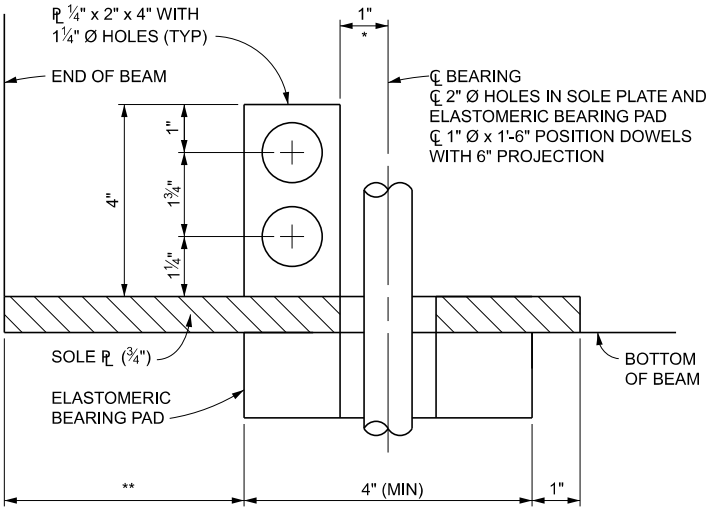
DETAIL SECTION B-B ON PLANS AS AN ALTERNATE OPTION TO SECTION A-A.

PREPARED BY DESIGN DIVISION	8.43.01

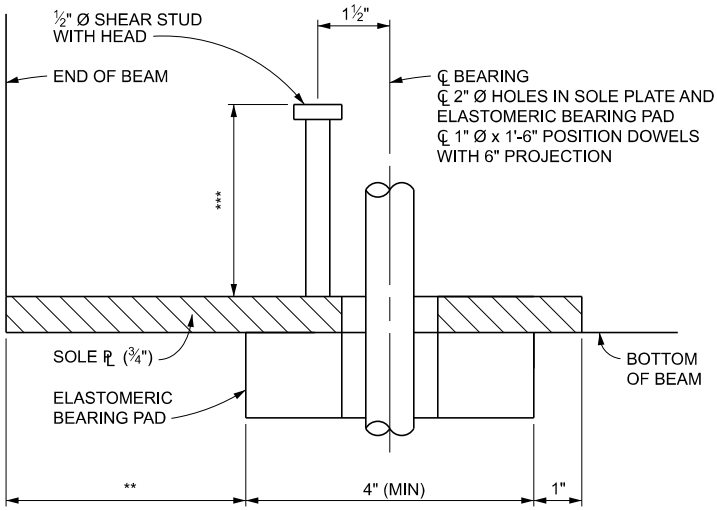
DRAWN BY: BLT CHECKED BY: CWC APPROVED BY: KCK	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT BEARING DETAILS FOR PRESTRESSED CONCRETE BOX BEAMS	ISSUED: 04/28/25 SUPERSEDES: 02/24/25



PLAN



SECTION C-C

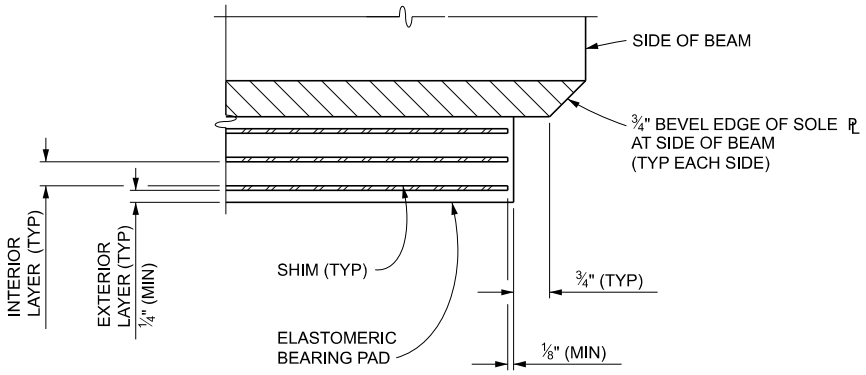


ALTERNATE SECTION C-C

* DECREASE TO 0" WHEN PAD LENGTH IS LESS THAN 6"

** END OF BEAM TO CENTERLINE OF BEARING - ½ OF ELASTOMERIC BEARING PAD WIDTH

*** EXTEND SHEAR STUDS ABOVE HIGHEST ROW WITH STRANDS WITHOUT INTERFERENCE TO REINFORCEMENT



SECTION D-D

NOTES:

SOLE PLATE MAY BE SHORTENED WHEN BEAM ROTATION AND PAD PRESSURE REQUIREMENTS DICTATE.

PREPARED BY DESIGN DIVISION	8.43.01A

9. UTILITY DATA

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT WEIGHT OF UTILITIES	ISSUED: 11/27/01 SUPERSEDES: 04/15/95

POUNDS PER LINEAL FOOT

STEEL GAS MAINS

ITEM \ SIZE	2"	4"	6"	8"	10"	12"
STANDARD PRESSURE	3.75	8.64	12.89	16.90	24.60	33.38
MEDIUM PRESSURE	3.75	8.64	12.89	16.90	24.60	33.38
HIGH PRESSURE	3.75	8.64	14.97	19.64	24.60	33.38

TELEPHONE DUCTS

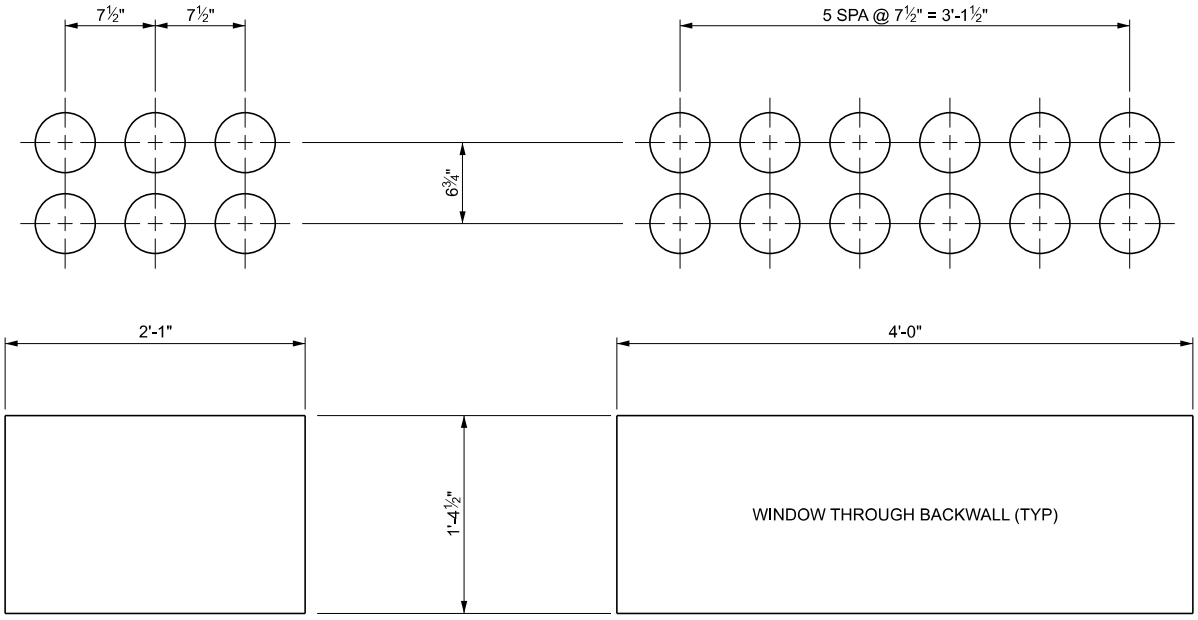
ITEM \ SIZE	3"		3½"		4"		
	TYPE B	TYPE C	TYPE B	TYPE C	TYPE B	TYPE C	PVC
DUCT	2.5	3.2	2.9	3.6	3.2	4.2	0.5
CABLE	5.0	5.0	5.0	5.0	5.0	5.0	5.8
TOTAL	7.5	8.2	7.9	8.6	8.2	9.2	6.3

STEEL ELECTRICAL CONDUITS & STEAM PIPES

ITEM \ SIZE	5" CONDUIT	16" STEAM	8" STEAM	8" 120 kv	10" STEAM	12" STEAM	20" STEAM
PIPE	15.0	63.0	28.55	22.4	40.48	49.6	79.0
INSULATION OR COATING		12.0	5.0	14.0	7.0	9.0	15.0
CABLE	7.0			22.0			
TOTAL	22.0	75.0	33.55	58.4	47.48	58.6	94.0

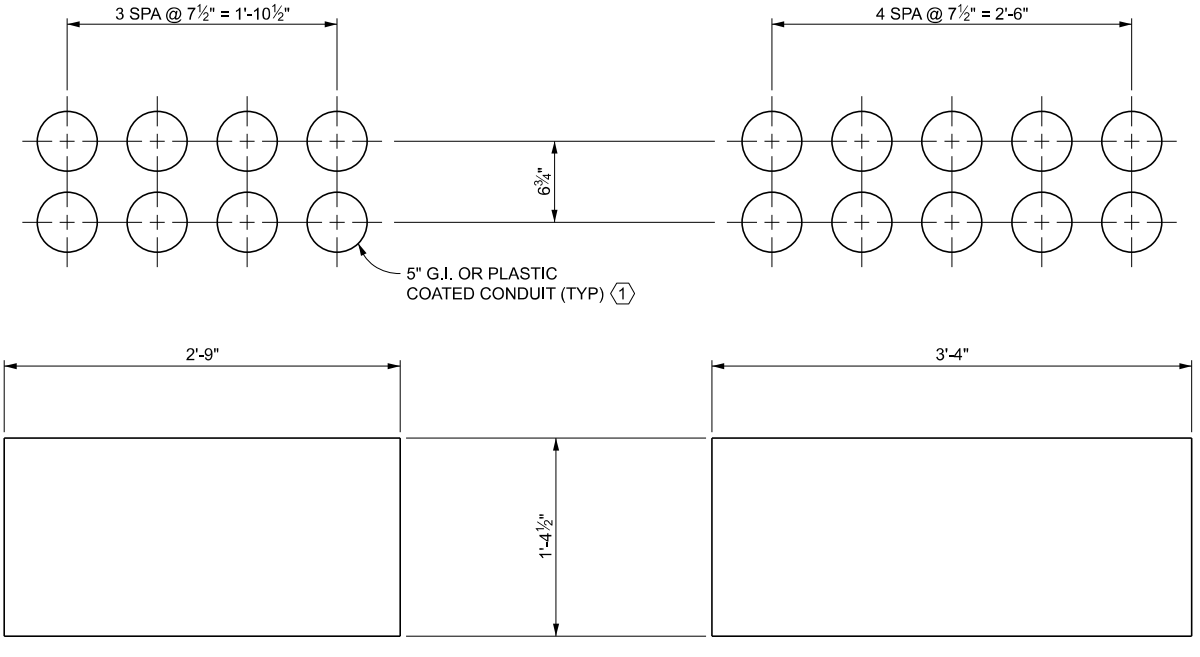
PREPARED BY DESIGN DIVISION	9.12.01

DRAWN BY: MJB	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 11/27/01
CHECKED BY: VZ	DIMENSIONS FOR 5 IN. STEEL ELECTRICAL CONDUITS	SUPERSEDES: 04/15/95
APPROVED BY: TGF		



6 DUCT SECTION

12 DUCT SECTION



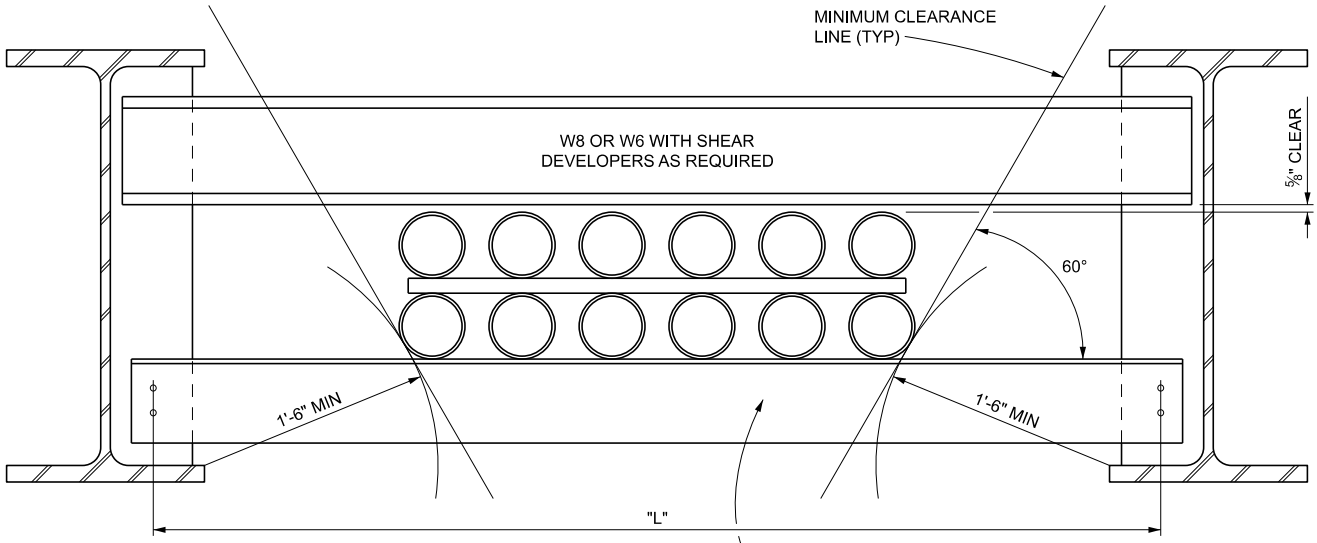
8 DUCT SECTION

10 DUCT SECTION

1 G.I. TO BE USED WITH PAINTED BRIDGES
PLASTIC COATED CONDUIT TO BE USED WITH
UNPAINTED BRIDGES.

PREPARED BY DESIGN DIVISION	9.21.01

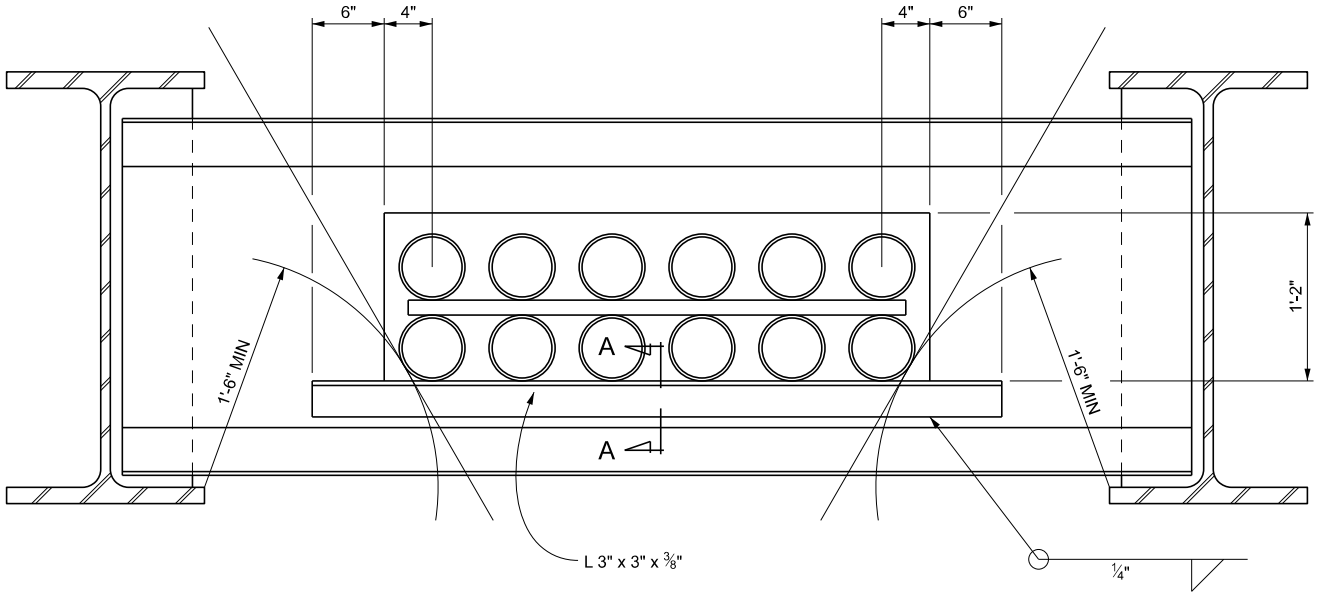
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STRUCTURAL STEEL DIAPHRAGM DETAILS FOR 5 IN. STEEL ELECTRICAL CONDUITS	ISSUED: 05/04/06 SUPERSEDES: 11/27/01



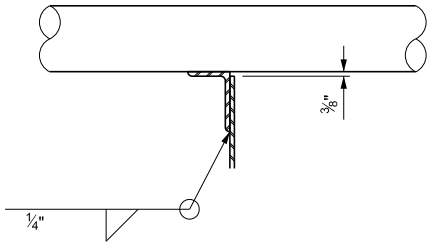
NOTE TO DESIGNER:
LOCATE THE ELECTRICAL CONDUITS
AS LOW IN THE BAY AS FEASIBLE

FOR SIZE OF ANGLE, SEE TABLE BELOW.
THIS TABLE IS ADEQUATE FOR DIAPHRAGM
SPACING UP TO 30'

END DIAPHRAGM



INTERMEDIATE DIAPHRAGM



N0. OF CONDUITS	"L"					
	6'	7'	8'	9'	10'	11'
6	A	B	D	E	F	
8	B	C	F	F	G	
10	C	F	F	G	H	
12	C	F	G	H	H	J

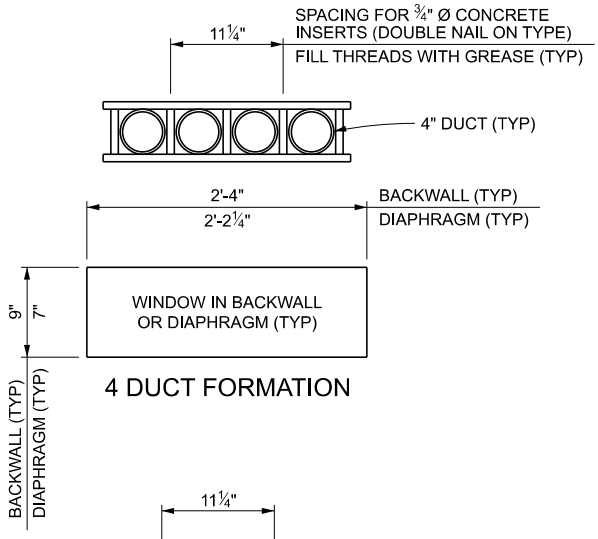
A - 5" x 3½" x 5/16"
B - 6" x 3½" x 5/16"
C - 6" x 3½" x 3/8"
D - 6" x 4" x 5/16"
E - 6" x 4" x 3/8"
F - 7" x 4" x 3/8"
G - 7" x 4" x ½"
H - 8" x 4" x ½"
J - 8" x 6" x 7/16"

SECTION A-A

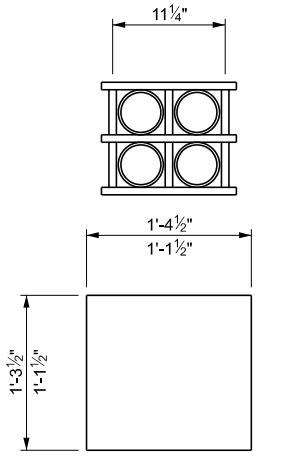
NOTE: USE 22 LBS./FT. FOR WEIGHT OF 5" CONDUIT

PREPARED BY DESIGN DIVISION	9.21.02

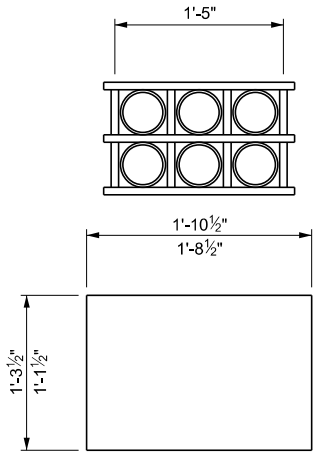
DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT DIMENSIONS FOR TELEPHONE COMPANY 4 IN. DUCTS	ISSUED: 05/04/06 SUPERSEDES: 11/27/01



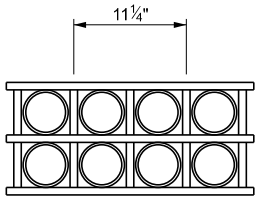
4 DUCT FORMATION

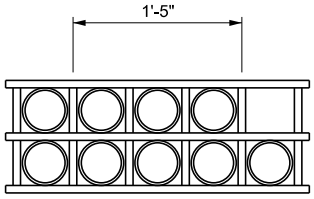


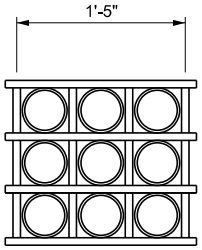
4 DUCT FORMATION

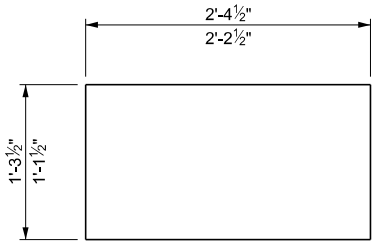


6 DUCT FORMATION

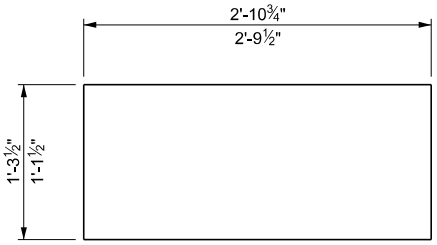




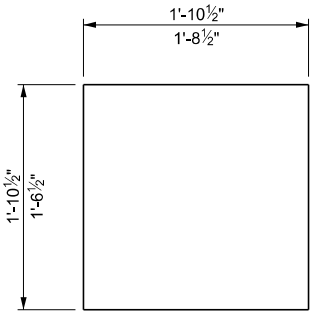




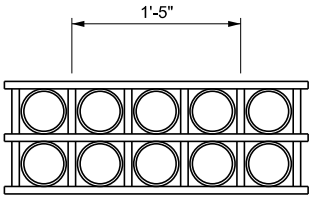
8 DUCT FORMATION

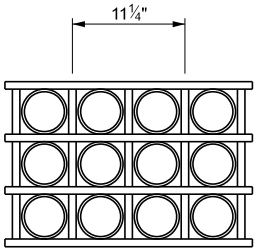


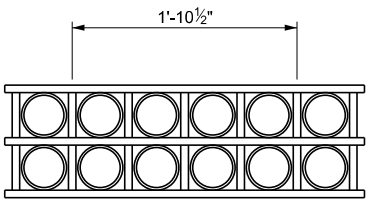
9 DUCT FORMATION

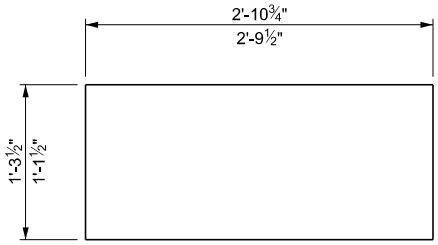


9 DUCT FORMATION

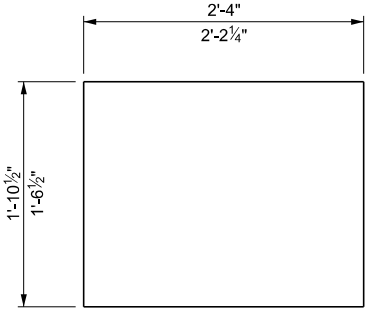




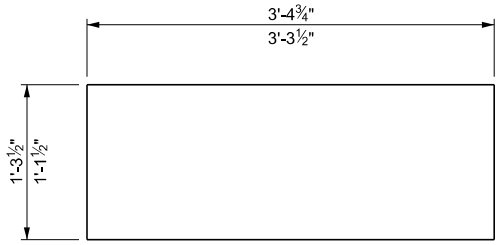




10 DUCT FORMATION



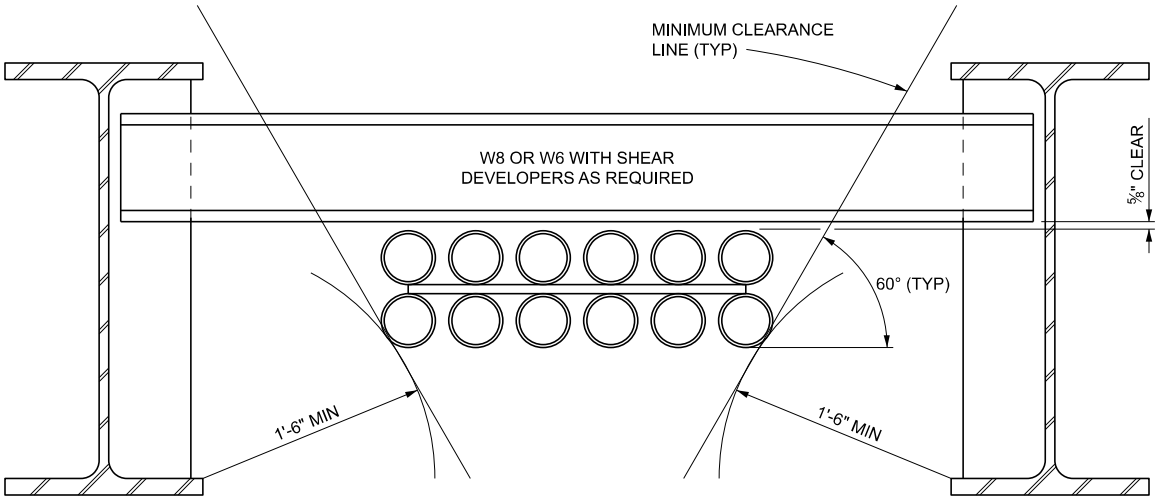
12 DUCT FORMATION



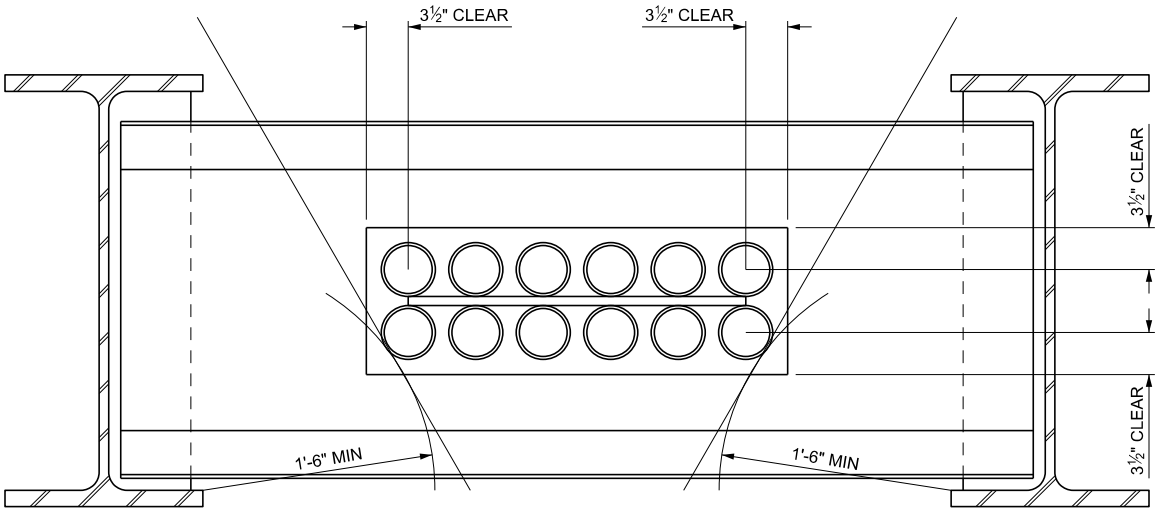
12 DUCT FORMATION

PREPARED BY DESIGN DIVISION	9.21.03

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STRUCTURAL STEEL DIAPHRAGM DETAILS FOR TELEPHONE COMPANY CONDUITS	ISSUED: 05/04/06 SUPERSEDES: 11/27/01



END DIAPHRAGM

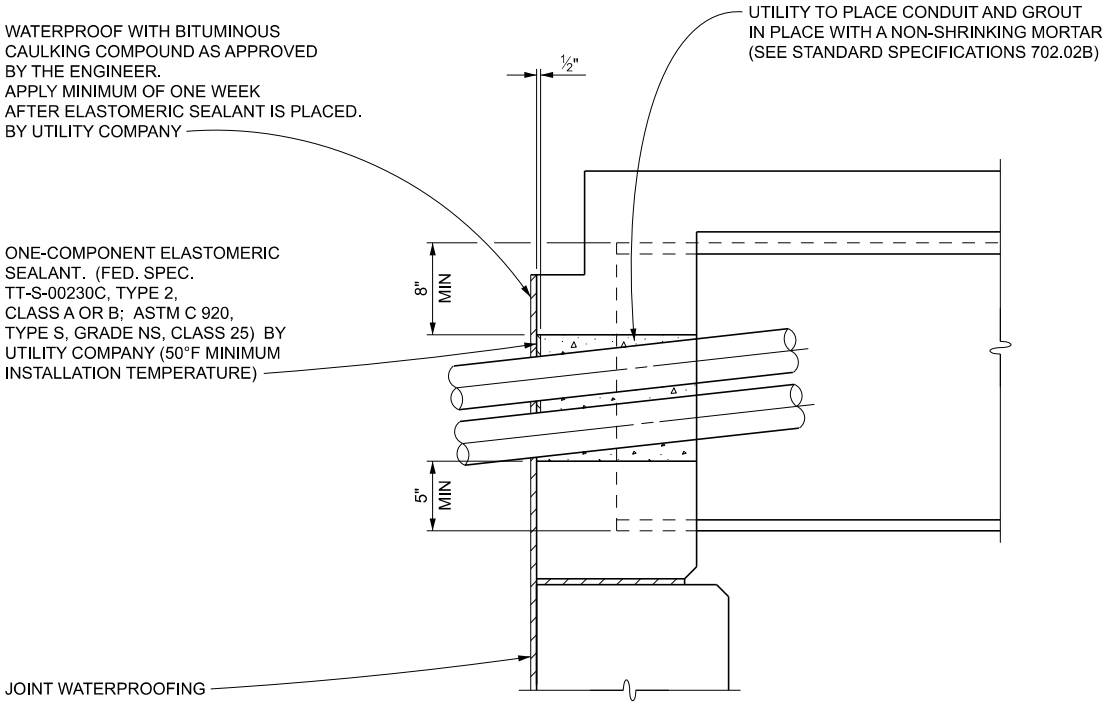


INTERMEDIATE DIAPHRAGM

TELEPHONE CONDUITS ARE SUPPORTED BY HANGERS SCREWED INTO INSERTS IN SLAB. INSERTS FURNISHED AND PLACED BY BRIDGE CONTRACTOR. TELEPHONE CONDUITS AND ALL ADDITIONAL MATERIAL FOR SUPPORTS ARE FURNISHED AND PLACED BY THE TELEPHONE COMPANY.

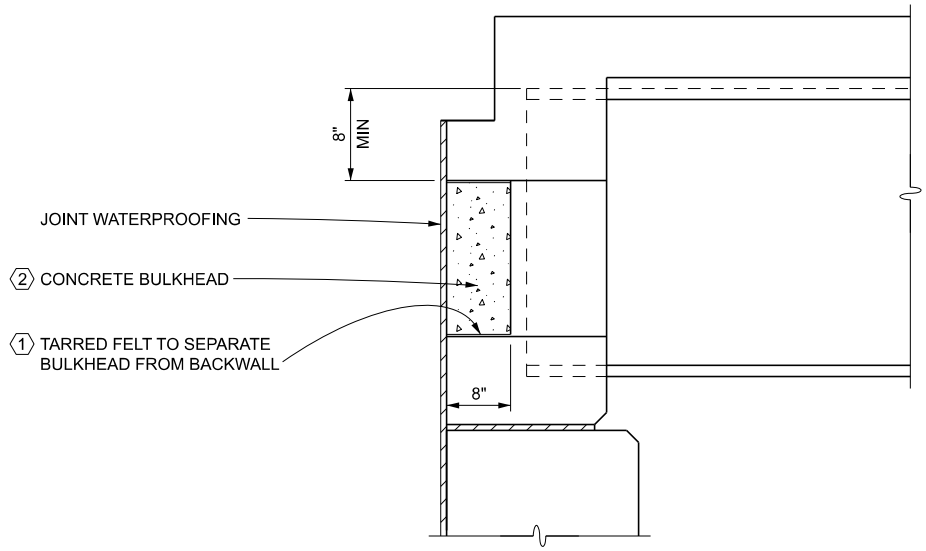
PREPARED BY DESIGN DIVISION	9.21.04

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 05/04/06
CHECKED BY: VZ	BACKWALL DETAILS FOR ELECTRICAL AND TELEPHONE CONDUITS	SUPERSEDES: 08/15/03
APPROVED BY: TGF		



INITIAL INSTALLATION

NOTE TO DESIGNER:
LOCATE THE ELECTRIC COMPANY CONDUITS AS LOW IN THE BAY AS FEASIBLE.



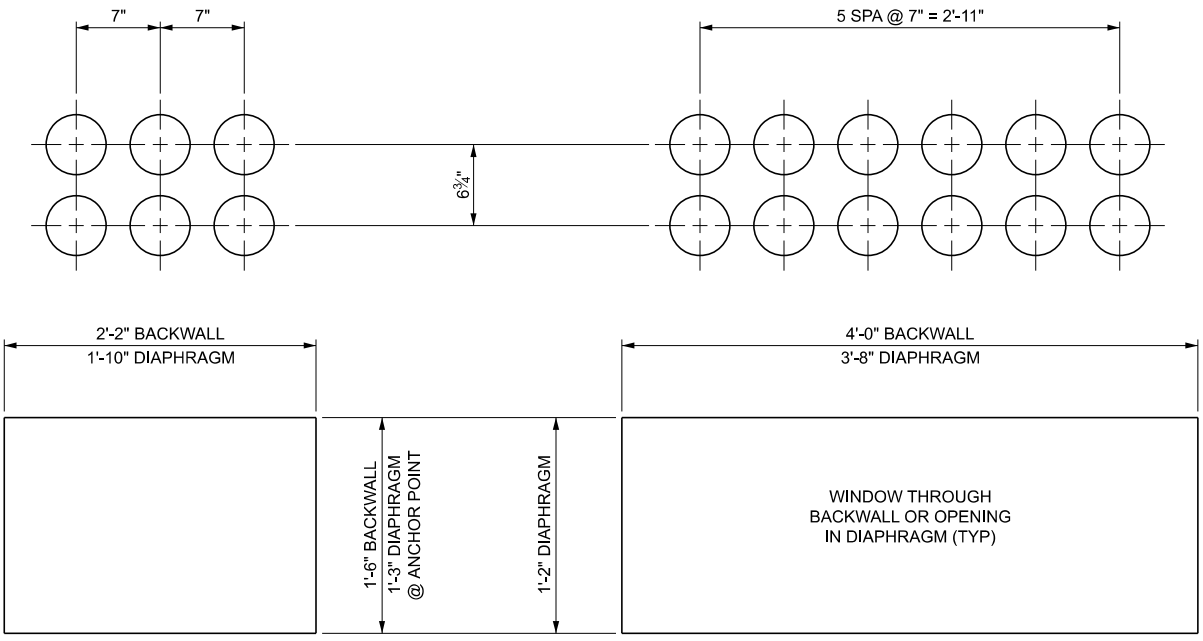
FUTURE INSTALLATION

1 INCIDENTAL TO SUPERSTRUCTURE CONCRETE.

2 INCLUDED WITH SUPERSTRUCTURE CONCRETE QUANTITY.

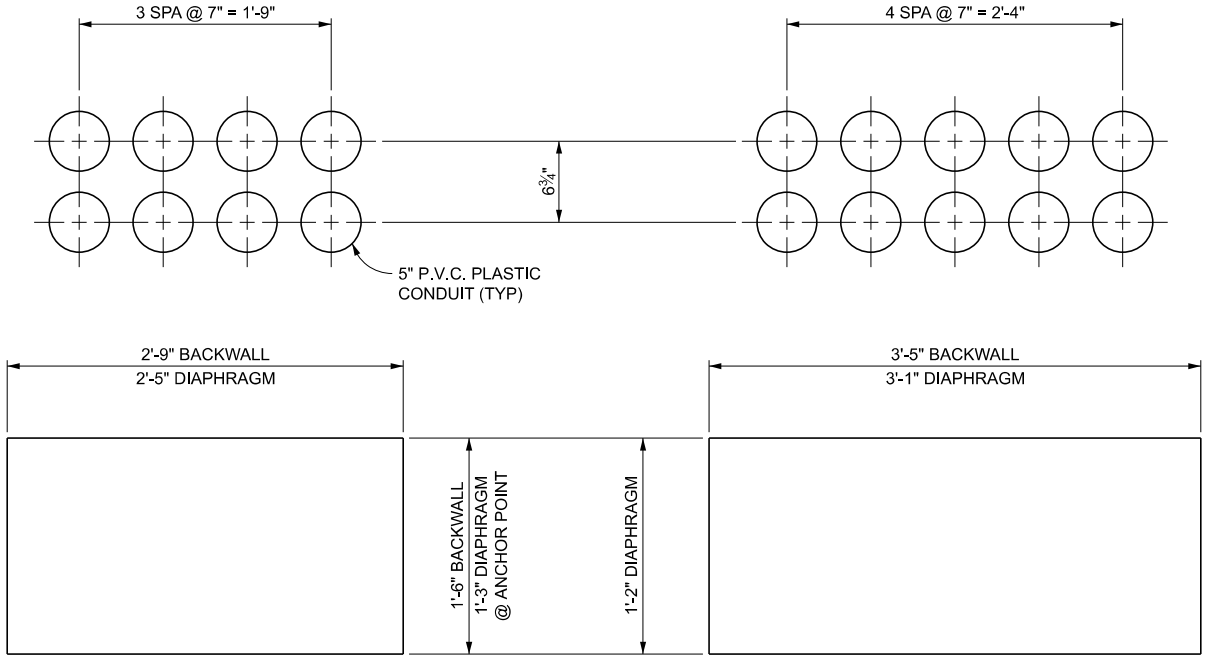
PREPARED BY DESIGN DIVISION	9.21.05

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT DIMENSIONS FOR 5 IN. P.V.C. ELECTRICAL CONDUITS	ISSUED: 11/27/01 SUPERSEDES: 04/15/95



6 DUCT SECTION

12 DUCT SECTION

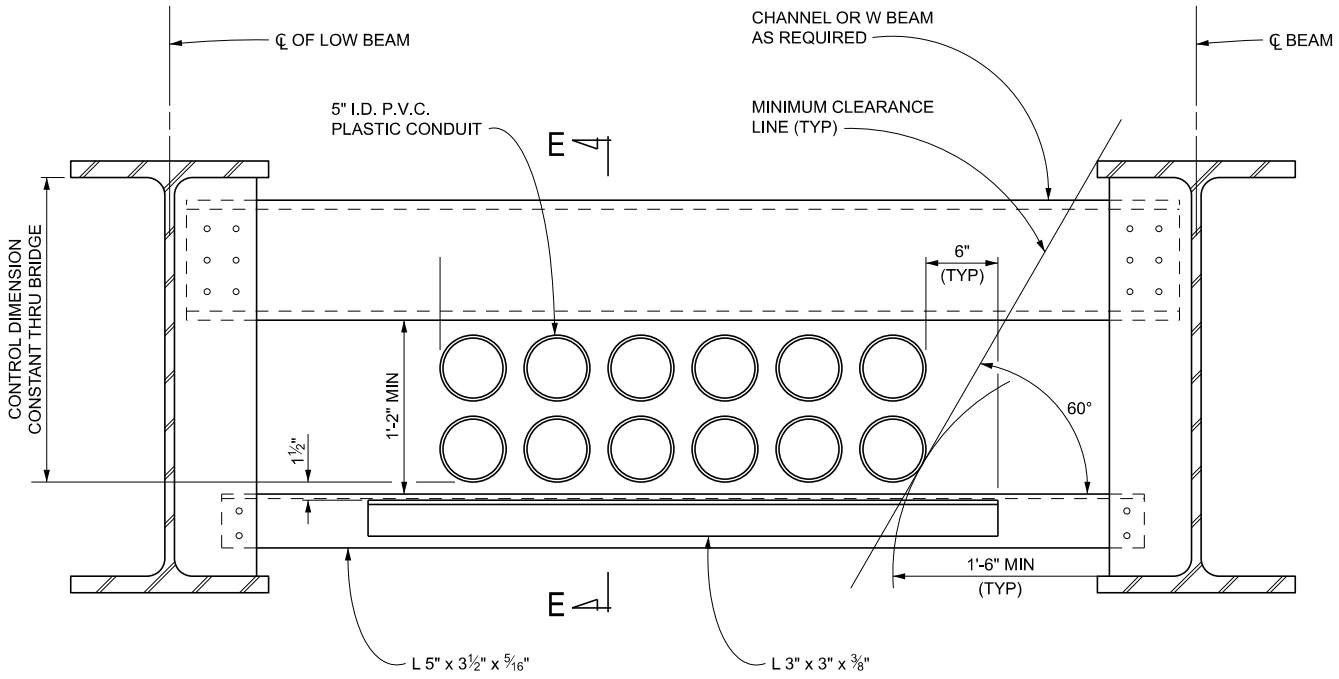


8 DUCT SECTION

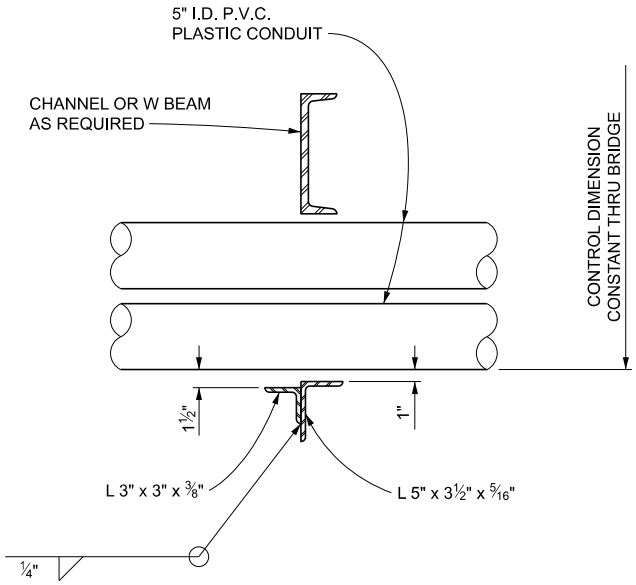
10 DUCT SECTION

PREPARED BY DESIGN DIVISION	9.22.01

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STRUCTURAL STEEL DIAPHRAGM DETAILS FOR 5 IN. P.V.C. ELECTRICAL CONDUITS	ISSUED: 11/27/01 SUPERSEDES: 04/15/95



END DIAPHRAGM



SECTION E-E

NOTES:

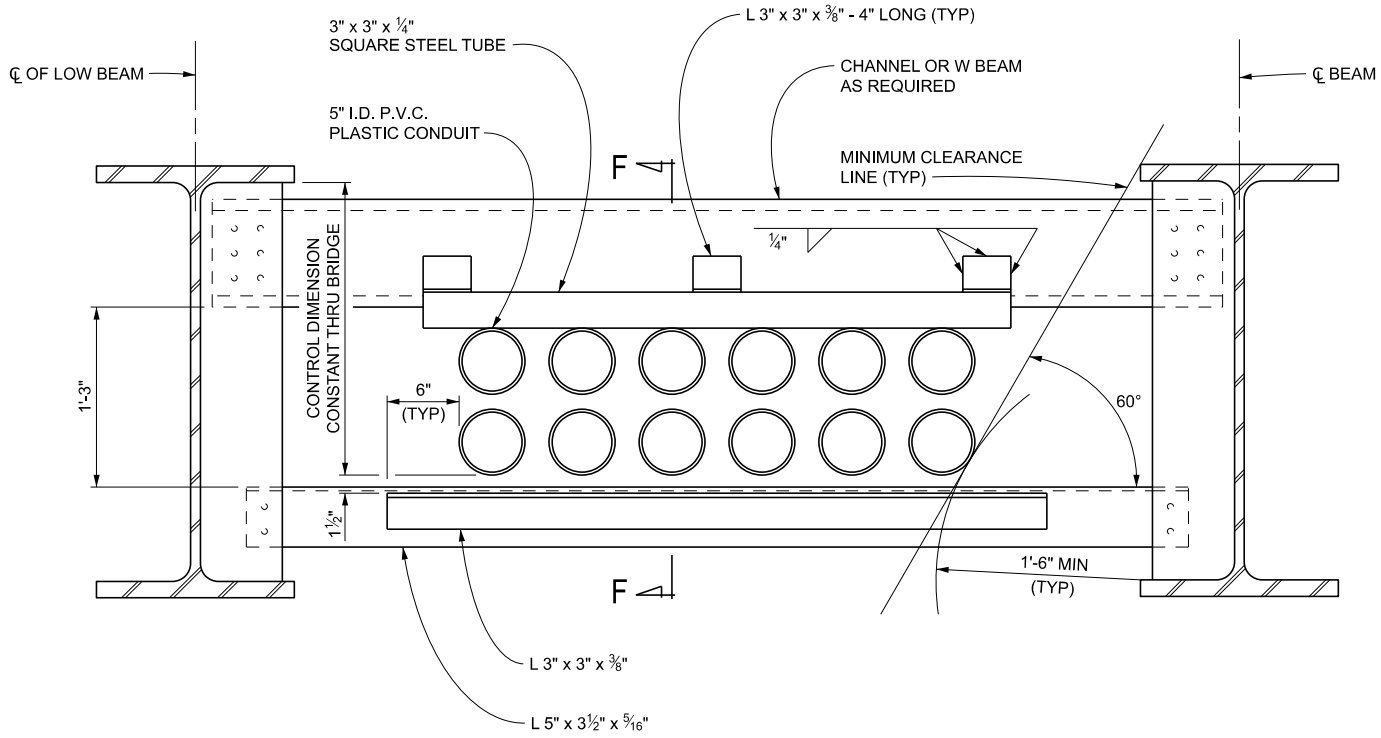
DESIGN DUCTS AS LOW IN BAY AS POSSIBLE TO PROVIDE COVER FOR CONDUIT LEAVING BRIDGE AND TO PROVIDE CLEARANCE FOR BRIDGE DECK REPAIR AT A LATER DATE.

TO MAINTAIN VERTICAL ALIGNMENT, THE "CONTROL DIMENSION" FROM THE BOTTOM OF THE TOP FLANGE OF THE BEAM TO THE BOTTOM OF THE BOTTOM DUCT SHALL BE MAINTAINED THROUGHOUT THE BRIDGE. ALIGNMENT AT EXPANSION JOINT IS VERY CRITICAL.

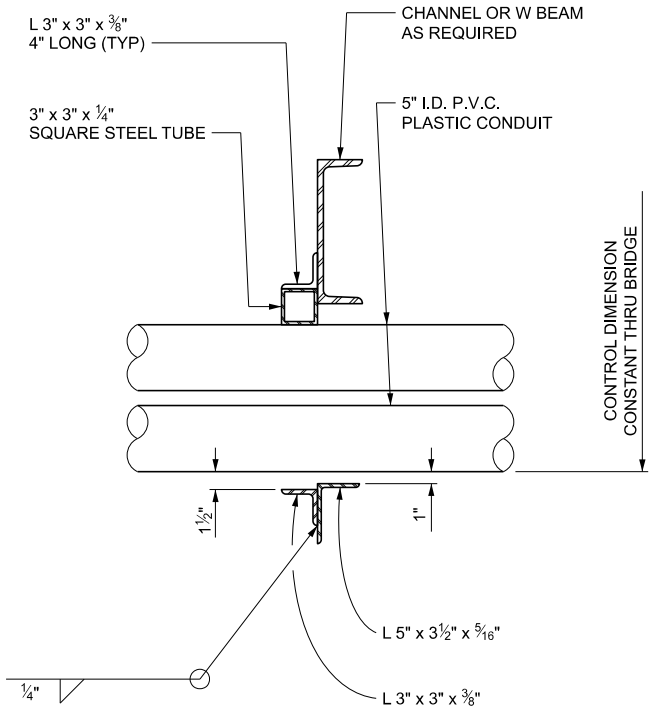
THE MAXIMUM DISTANCE BETWEEN SUPPORTS IS NOT TO EXCEED 8'.

PREPARED BY DESIGN DIVISION	9.22.02

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STRUCTURAL STEEL DIAPHRAGM DETAILS FOR 5 IN. P.V.C. ELECTRICAL CONDUITS	ISSUED: 11/27/01 SUPERSEDES: 04/15/95



END DIAPHRAGM AT ANCHOR POINT



SECTION F-F

NOTES:

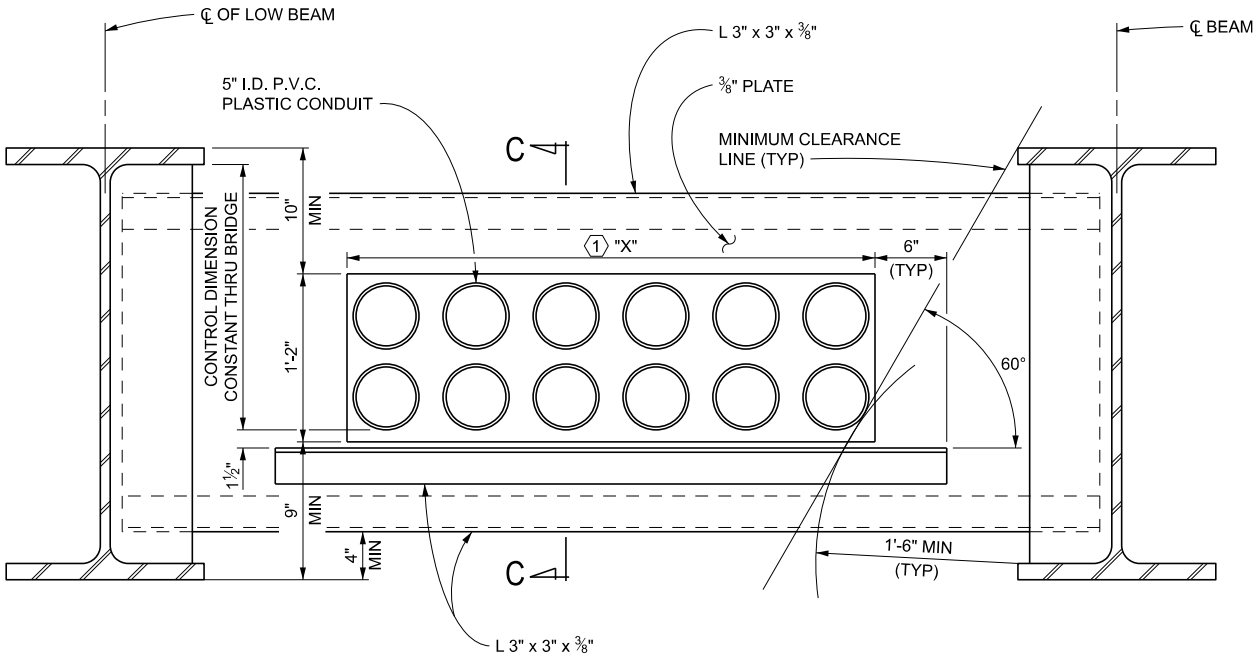
DESIGN DUCTS AS LOW IN BAY AS POSSIBLE TO PROVIDE COVER FOR CONDUIT LEAVING BRIDGE AND TO PROVIDE CLEARANCE FOR BRIDGE DECK REPAIR AT A LATER DATE.

TO MAINTAIN VERTICAL ALIGNMENT, THE "CONTROL DIMENSION" FROM THE BOTTOM OF THE TOP FLANGE OF THE BEAM TO THE BOTTOM OF THE BOTTOM DUCT SHALL BE MAINTAINED THROUGHOUT THE BRIDGE. ALIGNMENT AT EXPANSION JOINT IS VERY CRITICAL.

THE MAXIMUM DISTANCE BETWEEN SUPPORTS IS NOT TO EXCEED 8'.

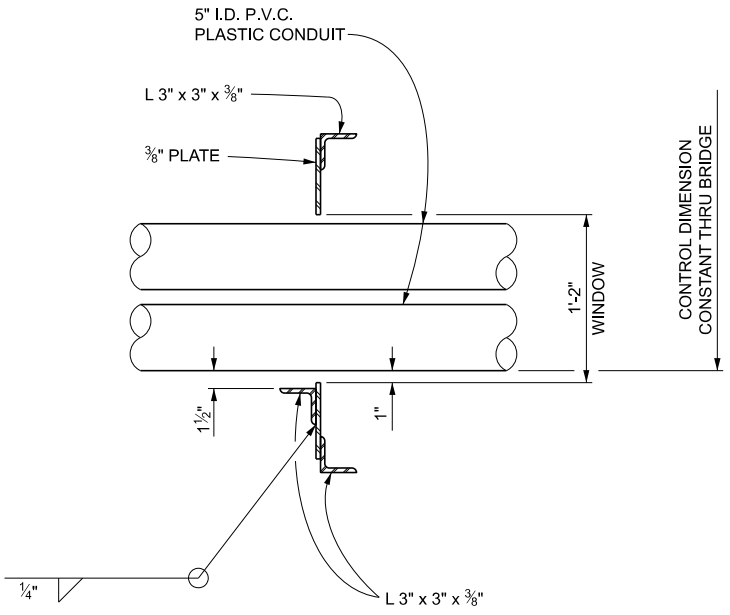
PREPARED BY DESIGN DIVISION	9.22.03

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STRUCTURAL STEEL DIAPHRAGM DETAILS FOR 5 IN. P.V.C. ELECTRICAL CONDUITS	ISSUED: 08/15/03 SUPERSEDES: 11/27/01



INTERMEDIATE DIAPHRAGM

1 FOR VALUES OF "X" SEE BRIDGE DESIGN GUIDE 9.22.01



SECTION C-C

NOTES:

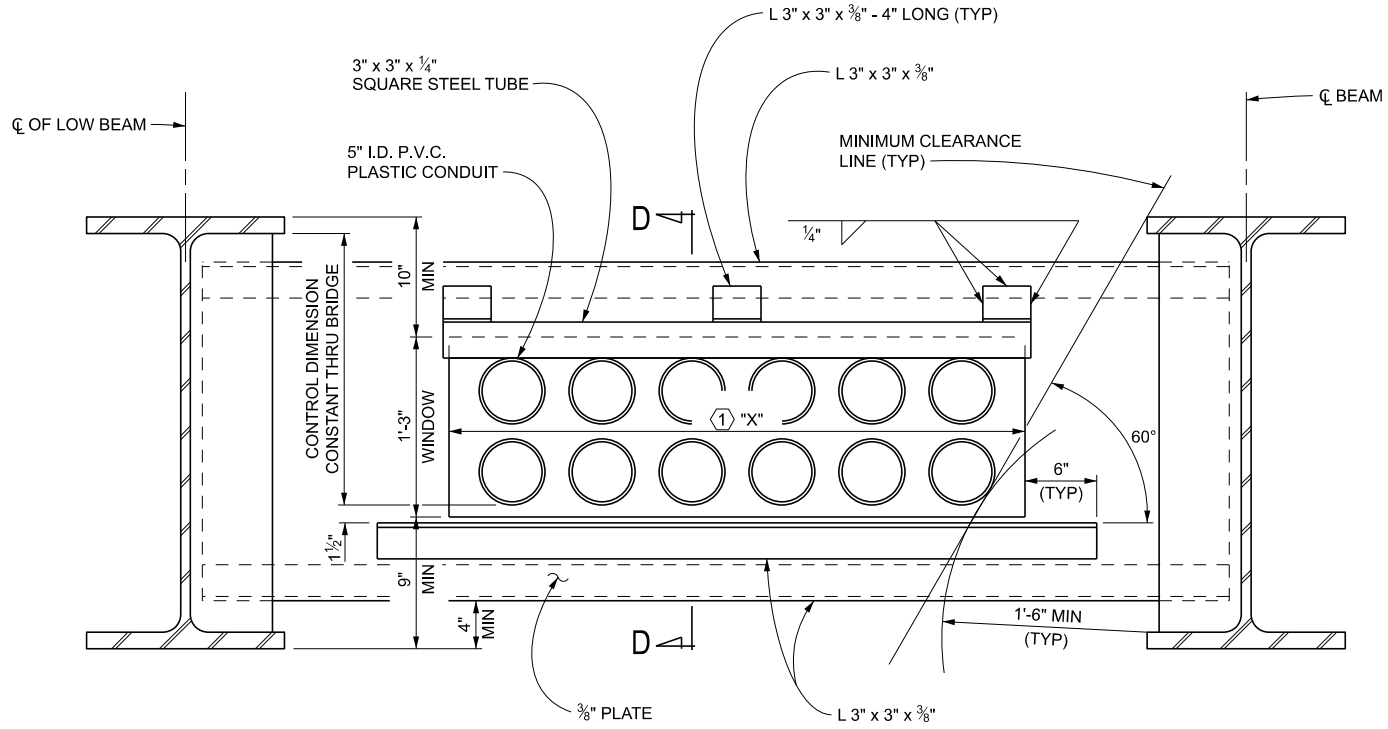
DESIGN DUCTS AS LOW IN BAY AS POSSIBLE TO PROVIDE COVER FOR CONDUIT LEAVING BRIDGE AND TO PROVIDE CLEARANCE FOR BRIDGE DECK REPAIR AT A LATER DATE.

TO MAINTAIN VERTICAL ALIGNMENT, THE "CONTROL DIMENSION" FROM THE BOTTOM OF THE TOP FLANGE OF THE BEAM TO THE BOTTOM OF THE BOTTOM DUCT SHALL BE MAINTAINED THROUGHOUT THE BRIDGE. ALIGNMENT AT EXPANSION JOINT IS VERY CRITICAL.

THE MAXIMUM DISTANCE BETWEEN SUPPORTS IS NOT TO EXCEED 8'.

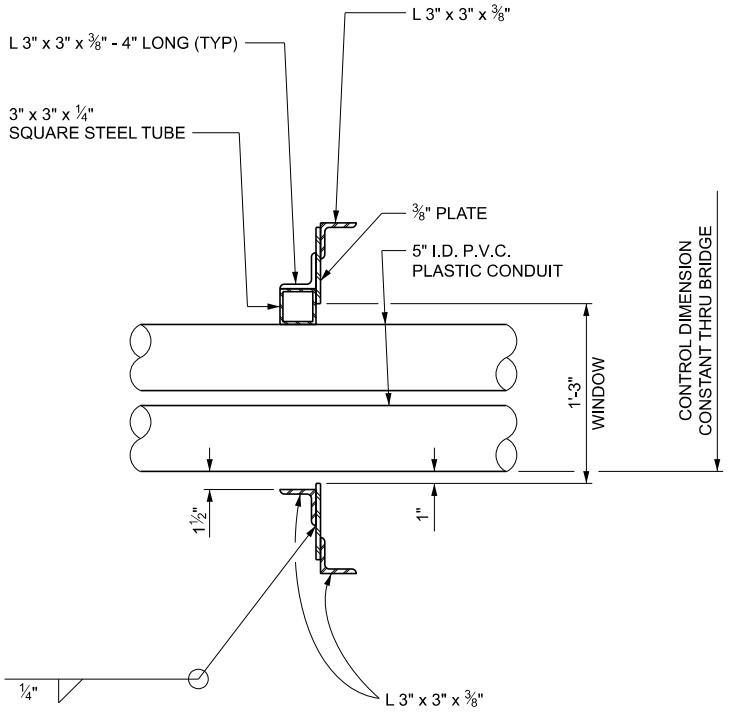
PREPARED BY DESIGN DIVISION	9.22.04

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STRUCTURAL STEEL DIAPHRAGM DETAILS FOR 5 IN. P.V.C. ELECTRICAL CONDUITS	ISSUED: 08/15/03 SUPERSEDES: 11/27/01



INTERMEDIATE DIAPHRAGM AT ANCHOR POINT

1 FOR VALUES OF "X" SEE BRIDGE DESIGN GUIDE 9.22.01



SECTION D-D

NOTES:

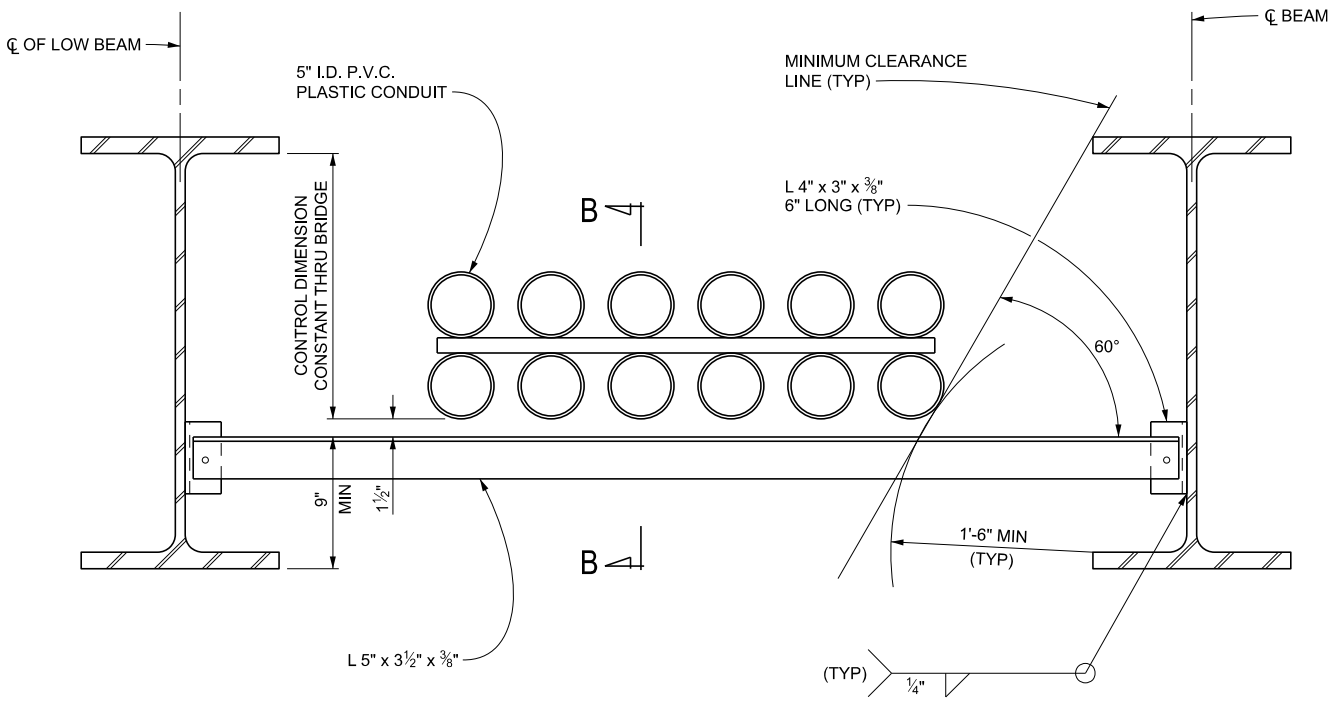
DESIGN DUCTS AS LOW IN BAY AS POSSIBLE TO PROVIDE COVER FOR CONDUIT LEAVING BRIDGE AND TO PROVIDE CLEARANCE FOR BRIDGE DECK REPAIR AT A LATER DATE.

TO MAINTAIN VERTICAL ALIGNMENT, THE "CONTROL DIMENSION" FROM THE BOTTOM OF THE TOP FLANGE OF THE BEAM TO THE BOTTOM OF THE BOTTOM DUCT SHALL BE MAINTAINED THROUGHOUT THE BRIDGE. ALIGNMENT AT EXPANSION JOINT IS VERY CRITICAL.

THE MAXIMUM DISTANCE BETWEEN SUPPORTS IS NOT TO EXCEED 8'.

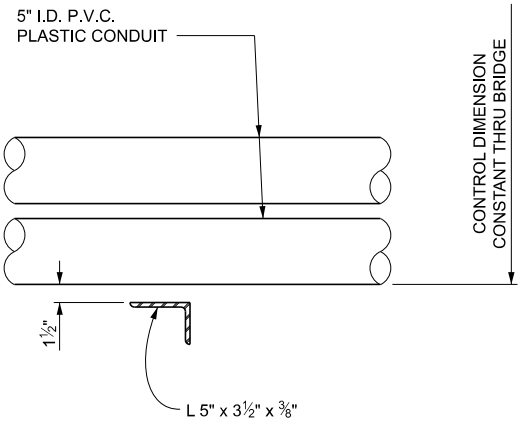
PREPARED BY DESIGN DIVISION	9.22.05

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STRUCTURAL STEEL DIAPHRAGM DETAILS FOR 5 IN. P.V.C. ELECTRICAL CONDUITS	ISSUED: 11/27/01 SUPERSEDES: 04/15/95



INTERMEDIATE DUCT SUPPORT

BETWEEN DIAPHRAGMS



SECTION B-B

NOTES:

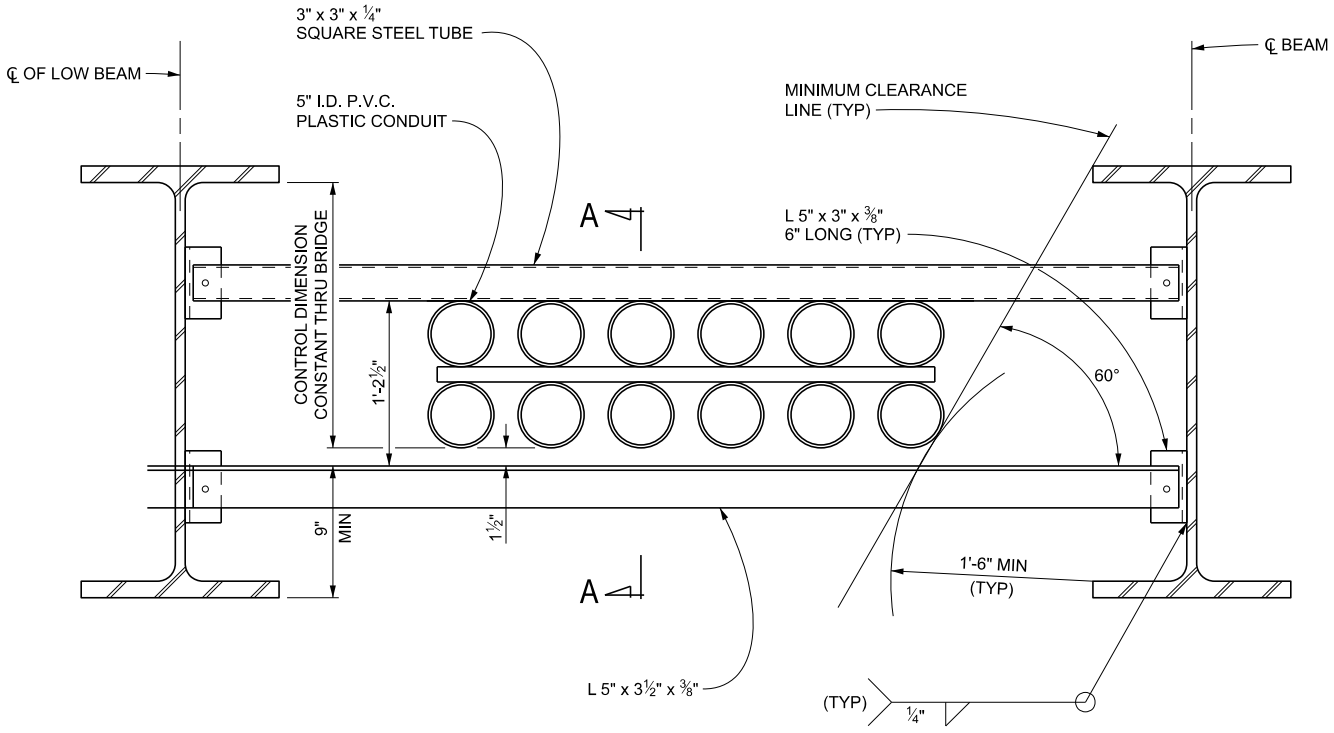
DESIGN DUCTS AS LOW IN BAY AS POSSIBLE TO PROVIDE COVER FOR CONDUIT LEAVING BRIDGE AND TO PROVIDE CLEARANCE FOR BRIDGE DECK REPAIR AT A LATER DATE.

TO MAINTAIN VERTICAL ALIGNMENT, THE "CONTROL DIMENSION" FROM THE BOTTOM OF THE TOP FLANGE OF THE BEAM TO THE BOTTOM OF THE BOTTOM DUCT SHALL BE MAINTAINED THROUGHOUT THE BRIDGE. ALIGNMENT AT EXPANSION JOINT IS VERY CRITICAL.

THE MAXIMUM DISTANCE BETWEEN SUPPORTS IS NOT TO EXCEED 8'.

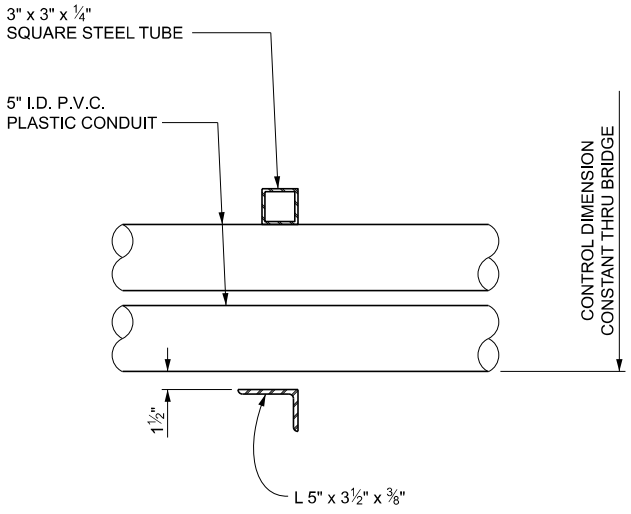
PREPARED BY DESIGN DIVISION	9.22.06

DRAWN BY: MJB CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STRUCTURAL STEEL DIAPHRAGM DETAILS FOR 5 IN. P.V.C. ELECTRICAL CONDUITS	ISSUED: 11/27/01 SUPERSEDES: 04/15/95



INTERMEDIATE DUCT SUPPORT AT ANCHOR POINT

BETWEEN DIAPHRAGMS



SECTION A-A

NOTES:

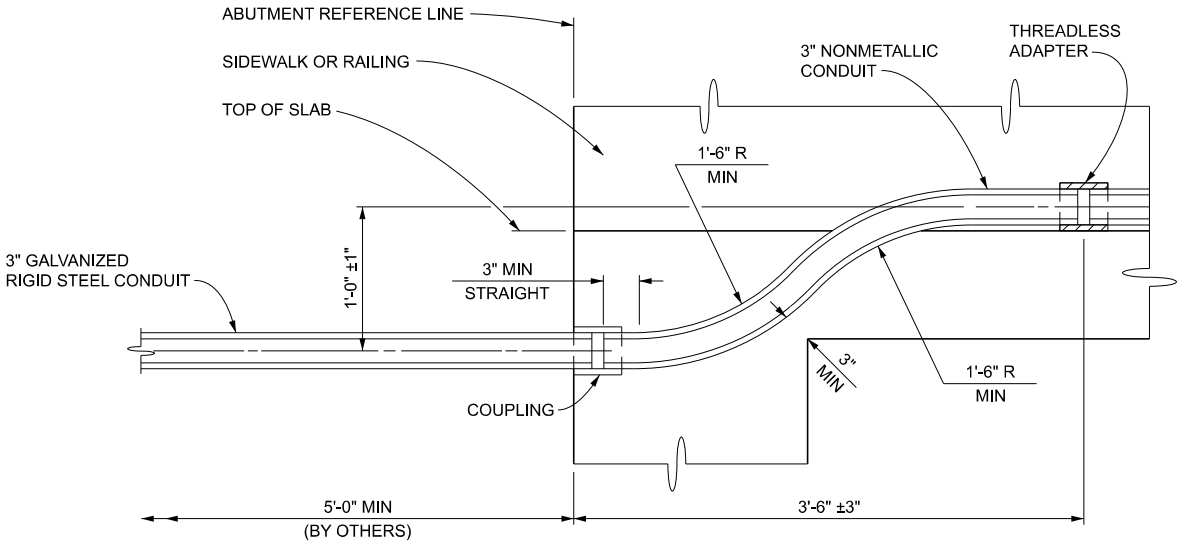
DESIGN DUCTS AS LOW IN BAY AS POSSIBLE TO PROVIDE COVER FOR CONDUIT LEAVING BRIDGE AND TO PROVIDE CLEARANCE FOR BRIDGE DECK REPAIR AT A LATER DATE.

TO MAINTAIN VERTICAL ALIGNMENT, THE "CONTROL DIMENSION" FROM THE BOTTOM OF THE TOP FLANGE OF THE BEAM TO THE BOTTOM OF THE BOTTOM DUCT SHALL BE MAINTAINED THROUGHOUT THE BRIDGE. ALIGNMENT AT EXPANSION JOINT IS VERY CRITICAL.

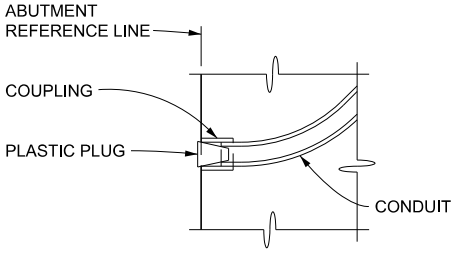
THE MAXIMUM DISTANCE BETWEEN SUPPORTS IS NOT TO EXCEED 8'.

PREPARED BY DESIGN DIVISION	9.22.07

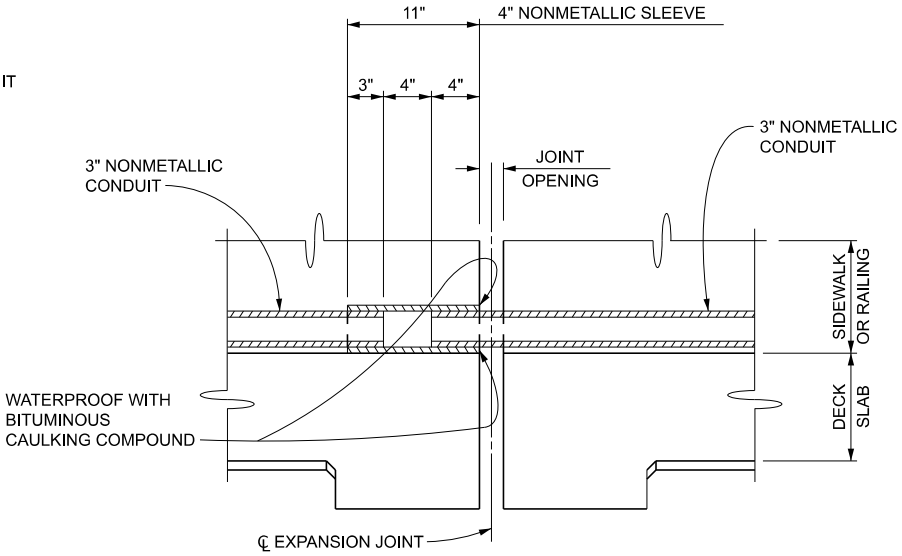
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 08/15/03
CHECKED BY: VZ	NONMETALLIC CONDUITS IN SIDEWALK	SUPERSEDES: 11/27/01
APPROVED BY: TGF		



SECTION AT BACKWALL



INSTALLATION FOR FUTURE USE



SECTION AT TRANSVERSE EXPANSION JOINT

NOTE:

IF THE LIGHTING IS NOT A CONTRACT ITEM,
ADD THE FOLLOWING NOTE TO THE PLANS:

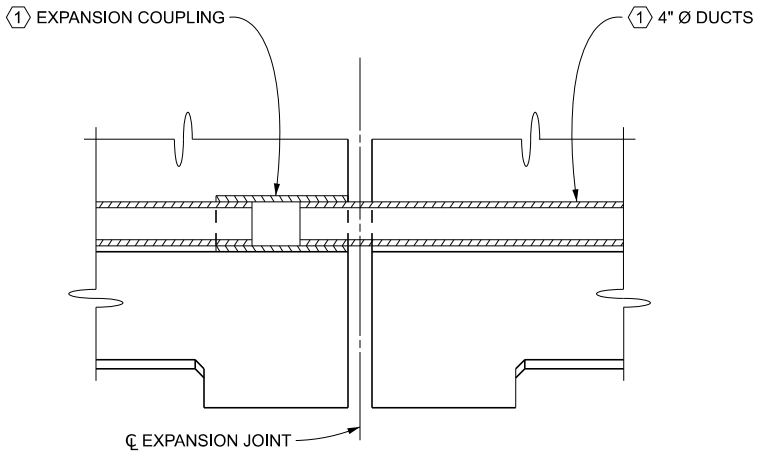
CONDUITS WILL BE FURNISHED AND PLACED BY _____ COMPANY.

IF THE LIGHTING IS A CONTRACT ITEM,
THE CONTRACTOR WILL FURNISH AND PLACE ALL MATERIALS. ADD THE FOLLOWING NOTE TO THE PLANS:

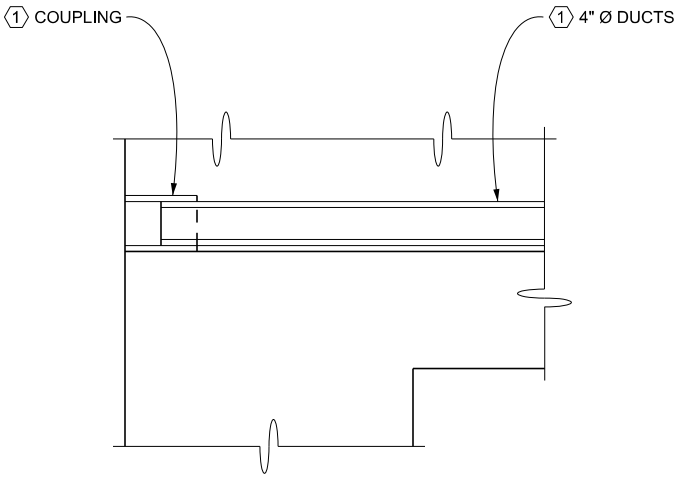
SLEEVES, ADAPTERS, COUPLINGS, GALVANIZED STEEL CONDUIT, PLUGS AND WATERPROOFING ARE INCLUDED IN THE BID ITEM "CONDUIT, 3 INCH".

PREPARED BY DESIGN DIVISION	9.31.01

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT TELEPHONE COMPANY DUCTS IN SIDEWALK	ISSUED: 05/04/06 SUPERSEDES: 11/27/01



SECTION THRU SIDEWALK
AT EXPANSION JOINT

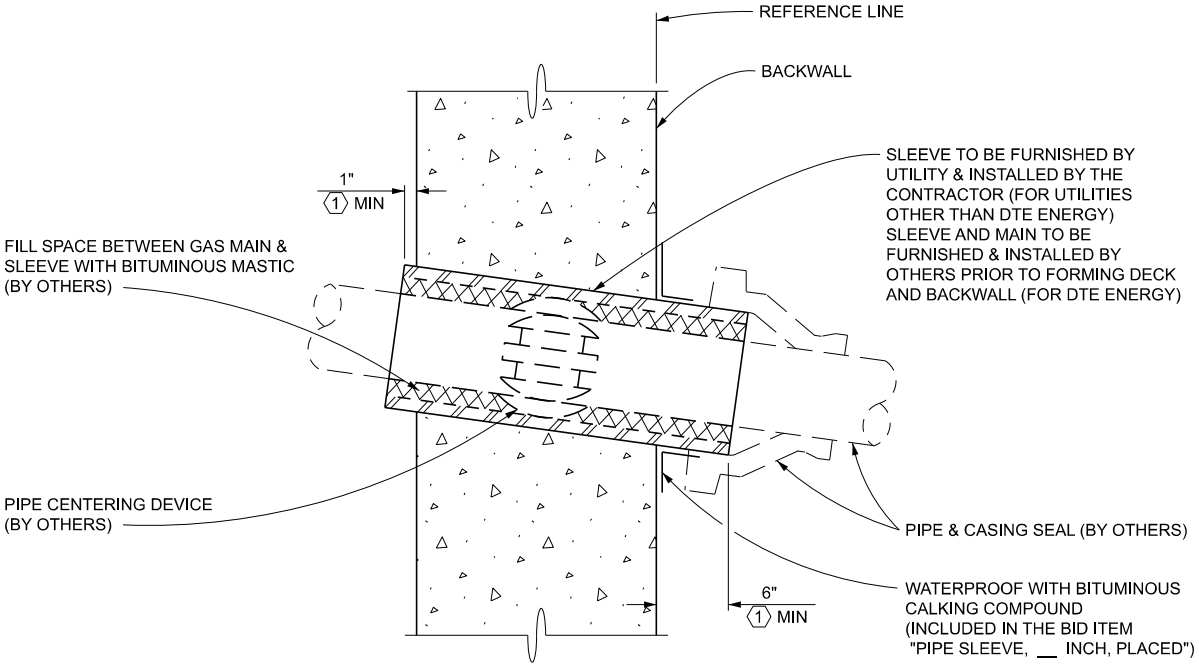


SECTION THRU SIDEWALK
AT REFERENCE LINE

1 FURNISHED AND INSTALLED BY TELEPHONE COMPANY.

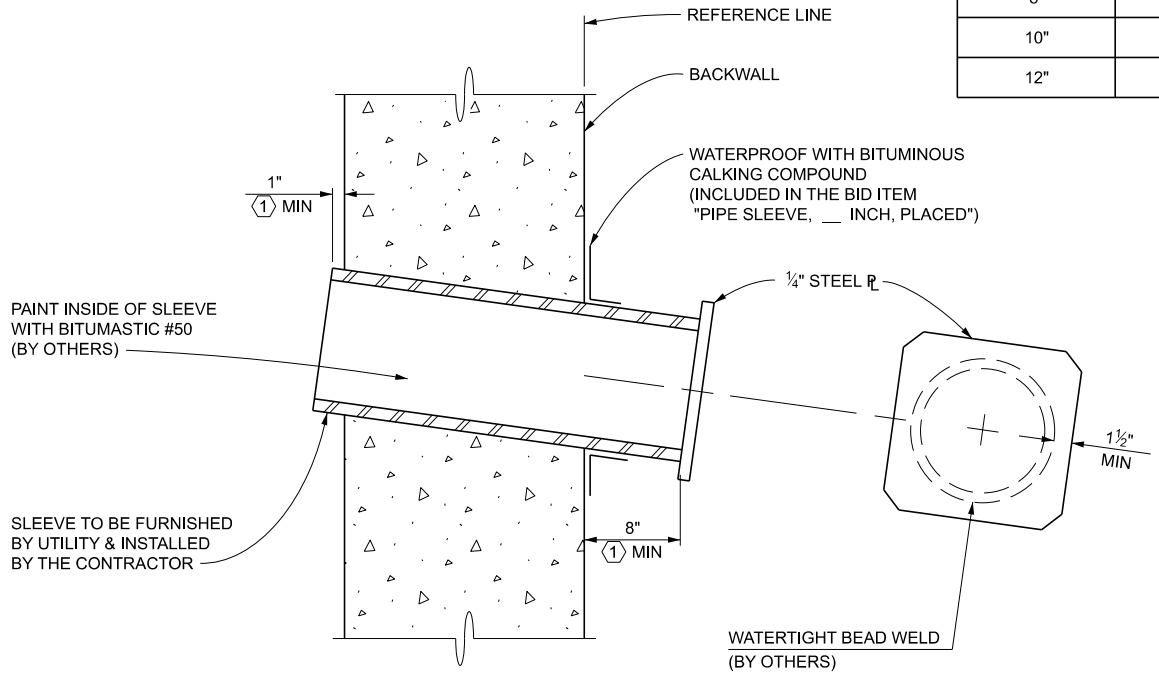
PREPARED BY DESIGN DIVISION	9.33.01

DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 05/04/06
CHECKED BY: VZ	GAS MAIN THROUGH BACKWALL	SUPERSEDES: 08/15/03
APPROVED BY: TGF		



SECTION SHOWING SLEEVE FOR EXISTING MAIN

PIPE SIZE	USUAL SLEEVE SIZE
6"	10"
8"	12"
10"	14"
12"	16"

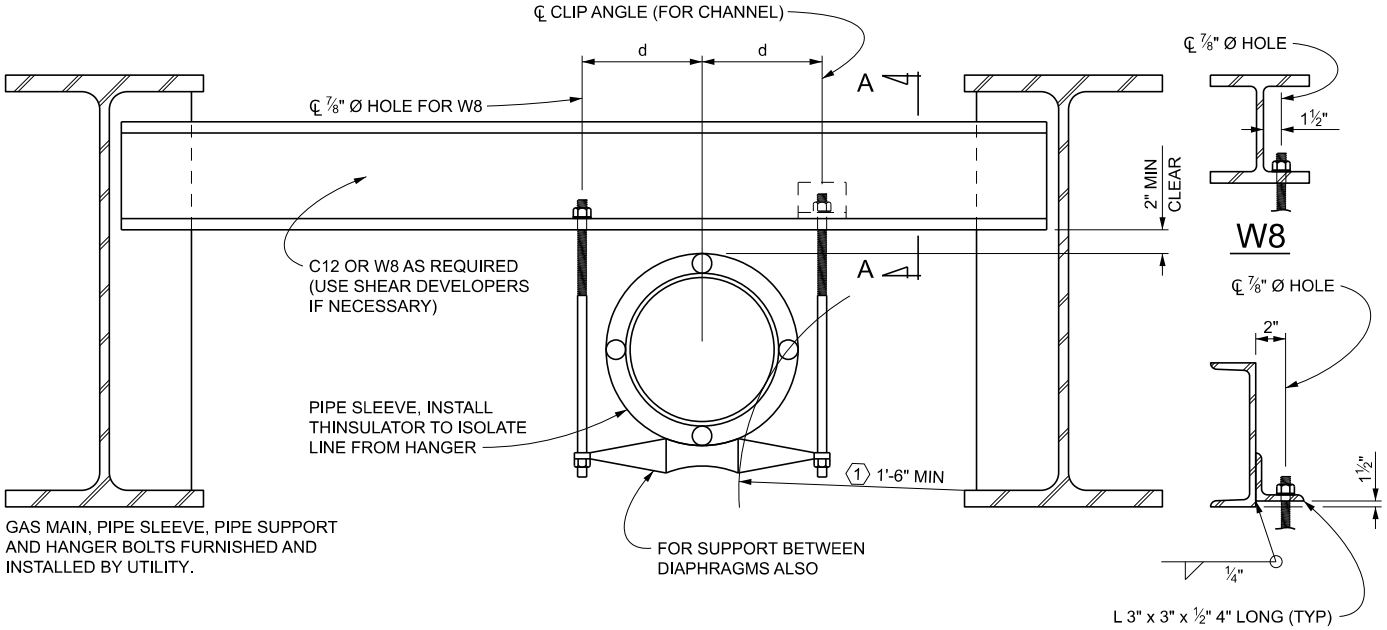


SECTION SHOWING SLEEVE FOR FUTURE MAIN

① 1'-0" MINIMUM FOR DTE ENERGY

PREPARED BY DESIGN DIVISION	9.40.01

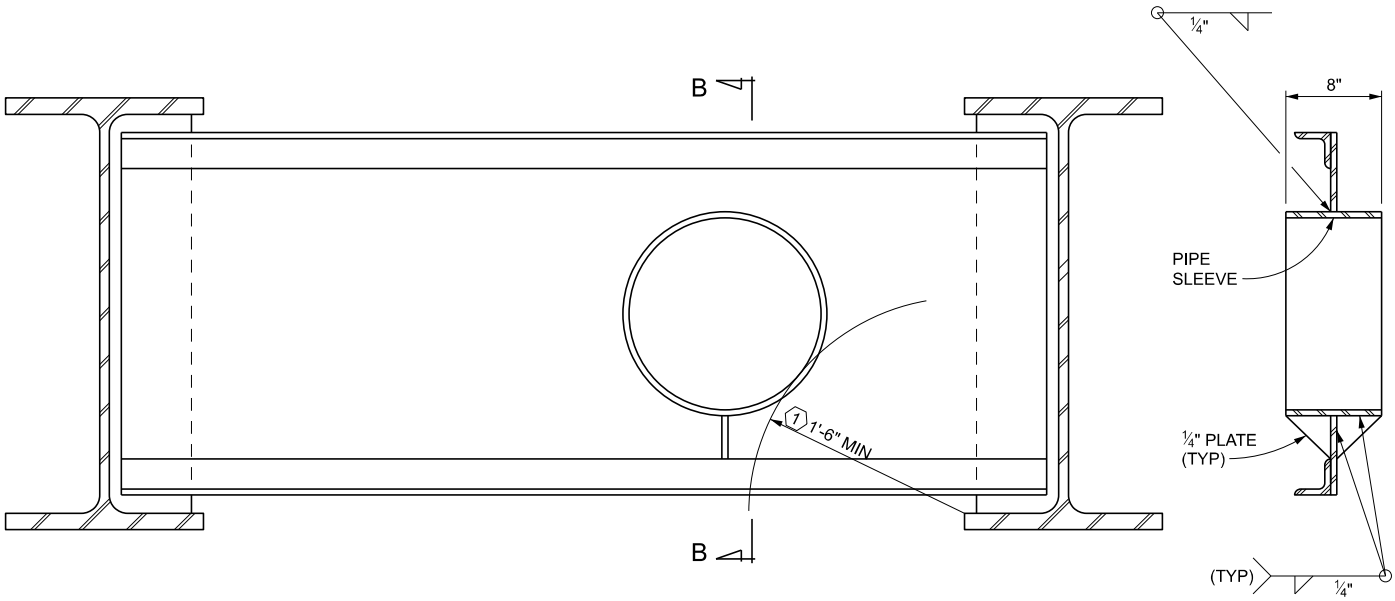
DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: 05/04/06
CHECKED BY: VZ	STRUCTURAL STEEL DIAPHRAGM DETAILS CONSUMERS ENERGY GAS MAINS	SUPERSEDES: 11/27/01
APPROVED BY: TGF		



C12

END DIAPHRAGM

SECTION A-A



INTERMEDIATE DIAPHRAGM

SECTION B-B

CLIP ANGLES AND PIPE SLEEVES INCLUDED IN STRUCTURAL STEEL WEIGHTS.

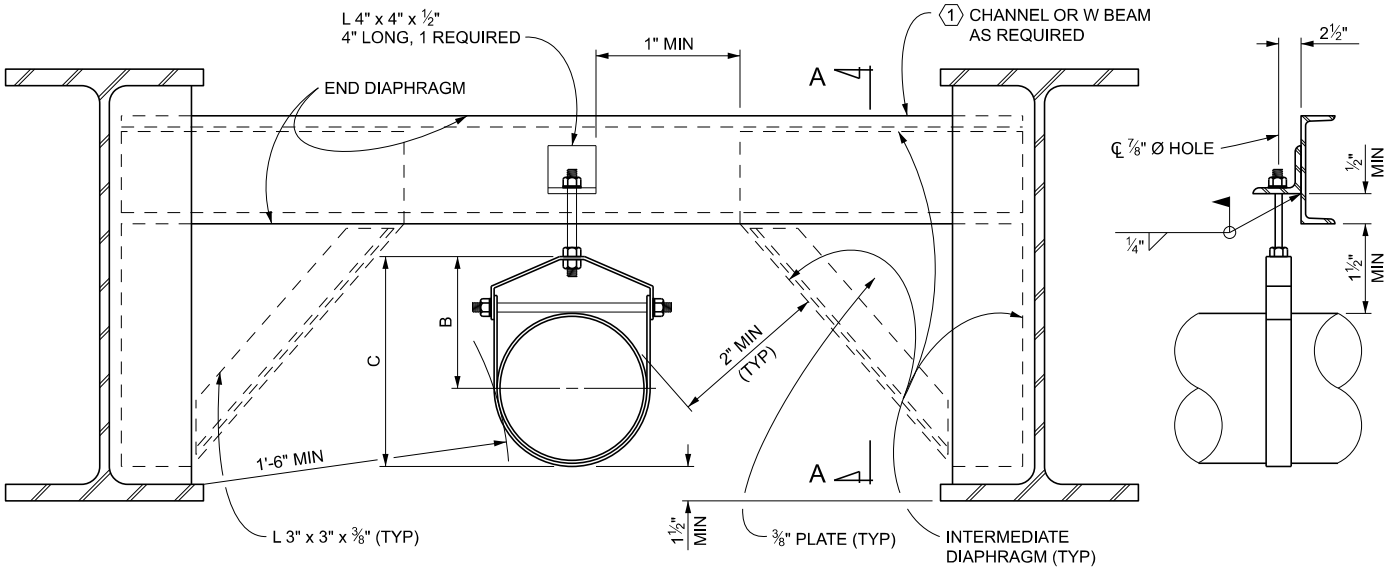
PIPE SIZE	SLEEVE SIZE	d	2 MAX SPACING OF SUPPORTS
4"	8"	6"	168" (14')
6"	10"	7"	208" (17')
8"	12"	8"	244" (20')
10"	16"	9"	268" (22')
12"	16"	10"	292" (24')

1 GAS MAINS TO BE PLACED MID-WAY BETWEEN BEAMS WHENEVER POSSIBLE.

2 PROVIDE ADDITIONAL SUPPORTS BETWEEN DIAPHRAGMS WITH CONCRETE INSERTS IN SLAB IF REQUIRED. CONCRETE INSERTS TO BE FURNISHED BY CONSUMERS ENERGY AND INSTALLED BY THE CONTRACTOR.

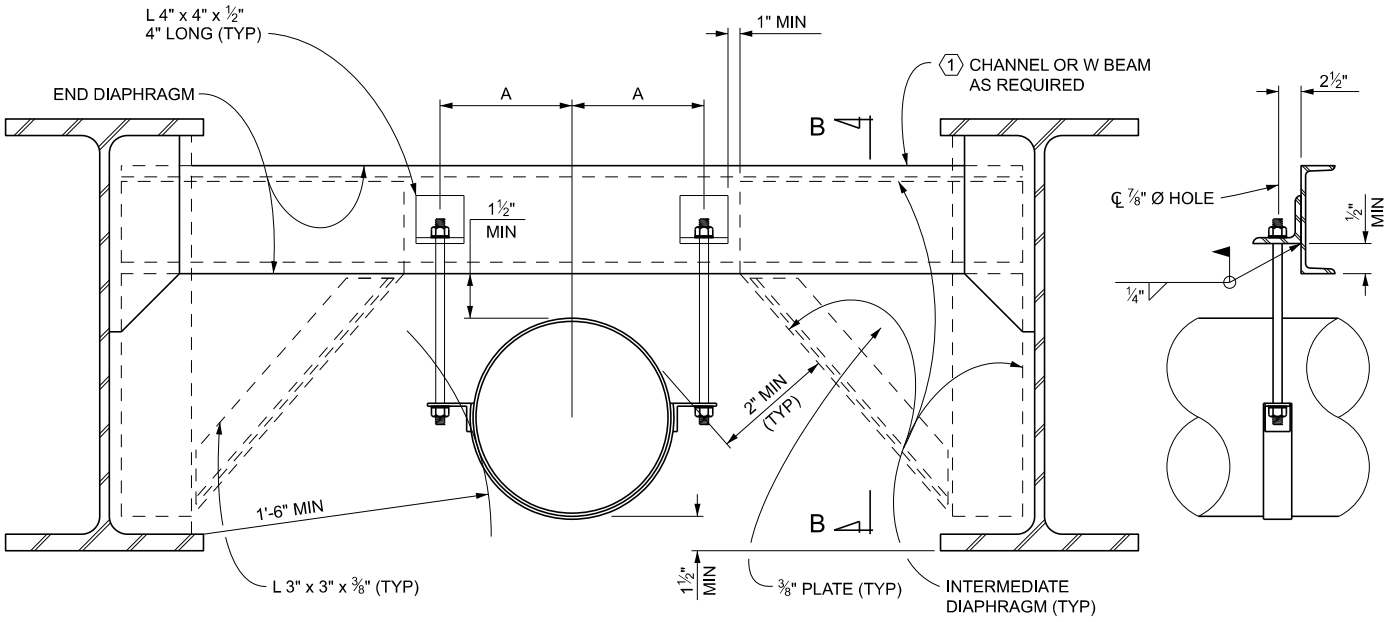
PREPARED BY DESIGN DIVISION	9.40.02

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: TGF	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT STRUCTURAL STEEL DIAPHRAGM DTE ENERGY GAS MAINS	ISSUED: 05/04/06 SUPERSEDES: 08/15/03



FOR GAS MAINS 1'-0" & UNDER

SECTION A-A



FOR GAS MAINS 1'-0" & OVER

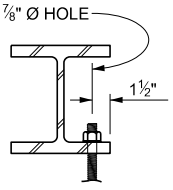
SECTION B-B

PIPE SIZE	DIMENSIONS		
	A	B	C
4"		5½"	8"
6"		7"	10½"
8"		8"	12½"
12"	8½"	11"	17½"
16"	11"		
22"	14"		
24"	15"		

1 SHEAR CONNECTORS MAY BE USED ON END DIAPHRAGMS WHEN NECESSARY.

GAS MAIN PIPE SUPPORT, HANGER BOLTS & CLIP ANGLES FURNISHED & INSTALLED BY DTE ENERGY.

GAS MAINS ARE TO BE PLACED MID-WAY BETWEEN BEAMS WHENEVER POSSIBLE.

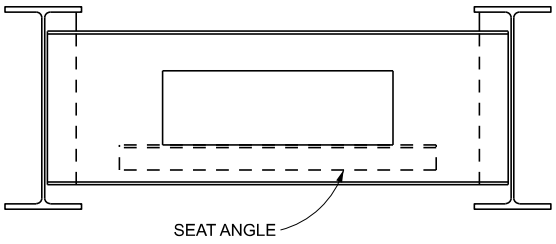


W BEAM DETAIL

PREPARED BY DESIGN DIVISION	9.40.03

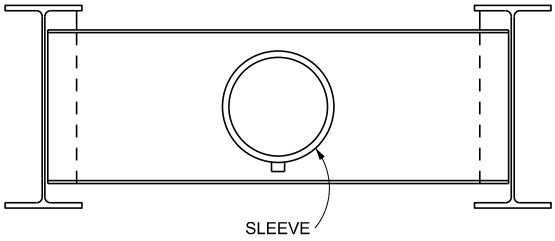
ADDITIONAL DIAPHRAGM FABRICATION COSTS

(FABRICATION COSTS ONLY - ADDITIONAL STEEL WEIGHT INCLUDED IN MATERIALS COST)



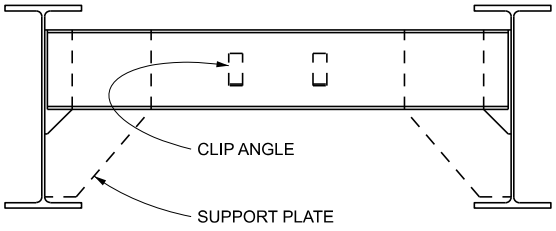
WINDOW IN PLATE DIAPHRAGM

WITHOUT SEAT ANGLE = $60.00
WITH SEAT ANGLE = $120.00



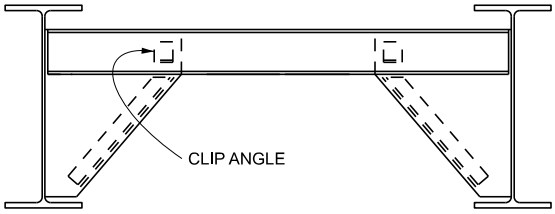
ROUND HOLE IN PLATE DIAPHRAGM

WITHOUT SLEEVE = $45.00
WITH SLEEVE = $105.00



CLIP ANGLES ON CHANNEL DIAPHRAGM

WITHOUT SUPPORT PLATE = $40.00
WITH SUPPORT PLATE = $110.00



BUILT-UP DIAPHRAGM

WITHOUT CLIP ANGLES = $370.00
WITH CLIP ANGLES = $410.00

ADDITIONAL LABOR COSTS

FORMING WINDOW IN BACKWALL = $430.00
FORMING WINDOW IN CONCRETE DIAPHRAGM = $285.00
FORMING WINDOW AND BULKHEADING IN BACKWALL = $520.00
CLEANING AND COATING UTILITY PIPES = $9.00/SFT