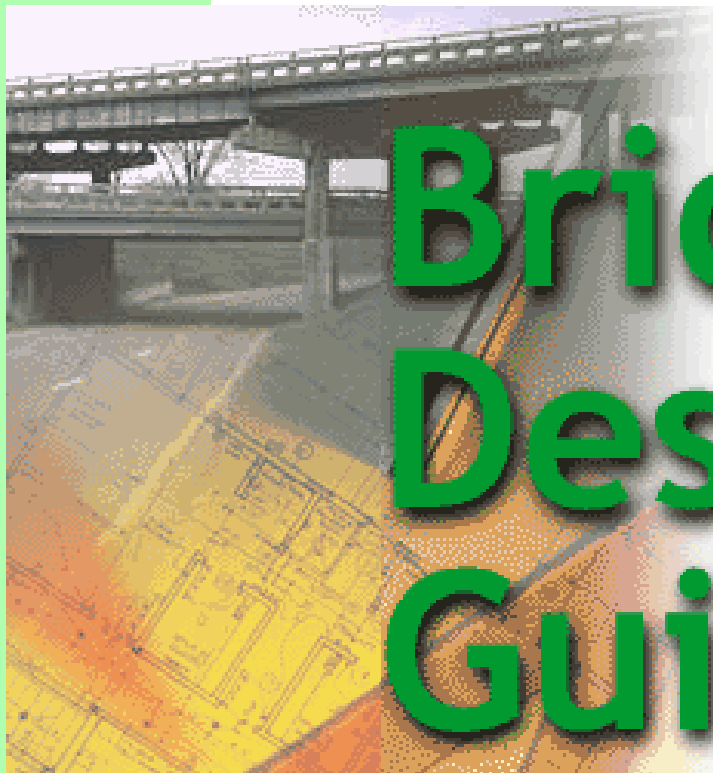




# MDOT

Michigan Department of Transportation

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# Bridge Design Guides



**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**

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 APPROVED BY: *TBF*

MICHIGAN DEPARTMENT OF TRANSPORTATION-BUREAU OF HIGHWAYS  
 DECIMAL PARTS OF A FOOT AND INCH

ISSUED: 11/27/01  
 SUPERSEDES: CAVEMEN

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

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 BUREAU OF DEVELOPMENT

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FACTORS FOR BRIDGE ESTIMATES

STEEL REINFORCEMENT WEIGHTS

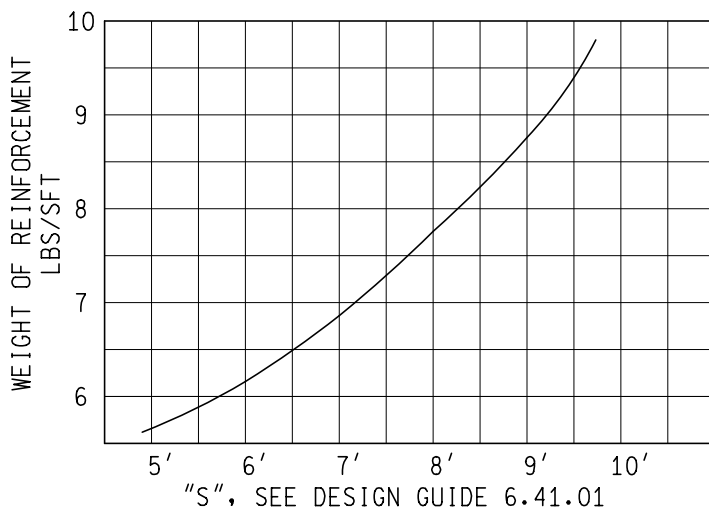
SUBSTRUCTURE UNIT	LBS/CYD OF CONC.
CANTILEVER ABUTMENT	50
COUNTERFORT ABUTMENT	100
GRAVITY ABUTMENT	15
CURTAIN WALL ABUTMENT	50
COLUMN & GIRDER PIER (HWY.)	120
COLUMN & GIRDER PIER (R.R.)	160
GRAVITY PIER	15
PILE CAP	70
SUBSTRUCTURE UNIT	LBS/CONC. UNIT
STANDARD SLAB (ON STRINGERS)	SEE GRAPH BELOW
SIMPLE 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	* 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 1	646
BRIDGE BARRIER RAILING AESTHETIC TYPE 6, DET 2	615
BRIDGE BARRIER RAILING, TYPE 7	414
BRIDGE BARRIER RAILING AESTHETIC TYPE 7, DET 1	449
BRIDGE BARRIER RAILING AESTHETIC TYPE 7, DET 2	428
BRIDGE RAILING, 1 TUBE	10
BRIDGE RAILING, 2 TUBE (TUBE & POST ONLY)	** 51
BRIDGE RAILING, 2 TUBE (WITH BRUSHBLOCK)	** 185
BRIDGE RAILING, 3 TUBE WITH PICKETS (SIDEWALK)	** 86
BRIDGE RAILING, 3 TUBE WITH PICKETS (BRUSHBLOCK)	** 270
BRIDGE RAILING, 4 TUBE (BICYCLE)	** 265
BRIDGE RAILING, 4 TUBE (PEDESTRIAN)	** 80
BRIDGE RAILING, 5 TUBE	** 70
BRIDGE RAILING, AESTHETIC PARAPET TUBE	** 320

\* INCLUDES WEIGHT OF BRIDGE RAILING, 1-TUBE.

\*\* VARIES BASED UPON VERTICAL POST SPACING.



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 DESIGN DIVISION

1.21.01



# **3. WATERWAY & DRAINAGE**

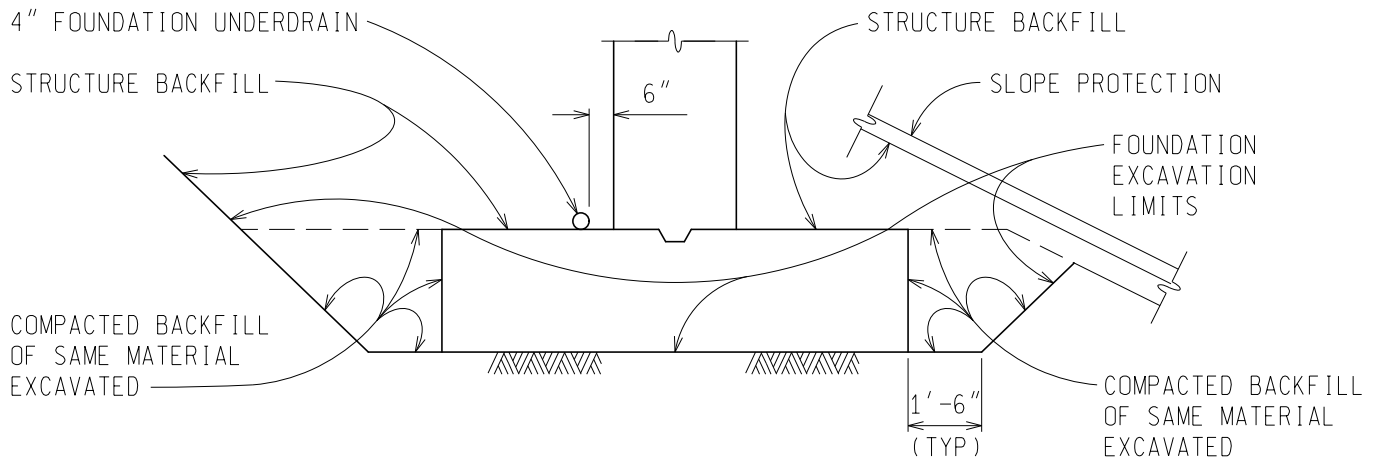


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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

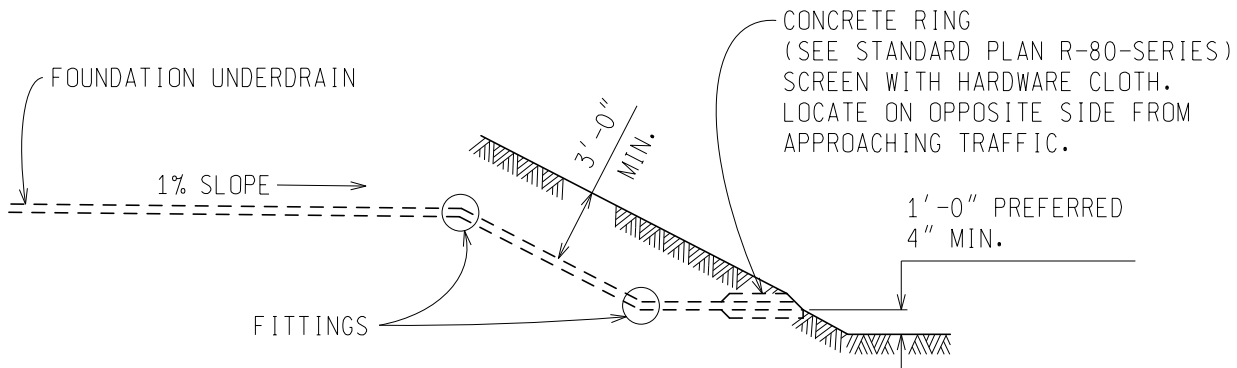
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 SUPERSEDES: 08/15/03

DRAINAGE DETAILS FOR  
 ABUTMENTS IN CUT



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, 4 INCH .....	FT
UNDERDRAIN OUTLET, 4 INCH .....	FT
* UNDERDRAIN, OUTLET ENDING, 4 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).

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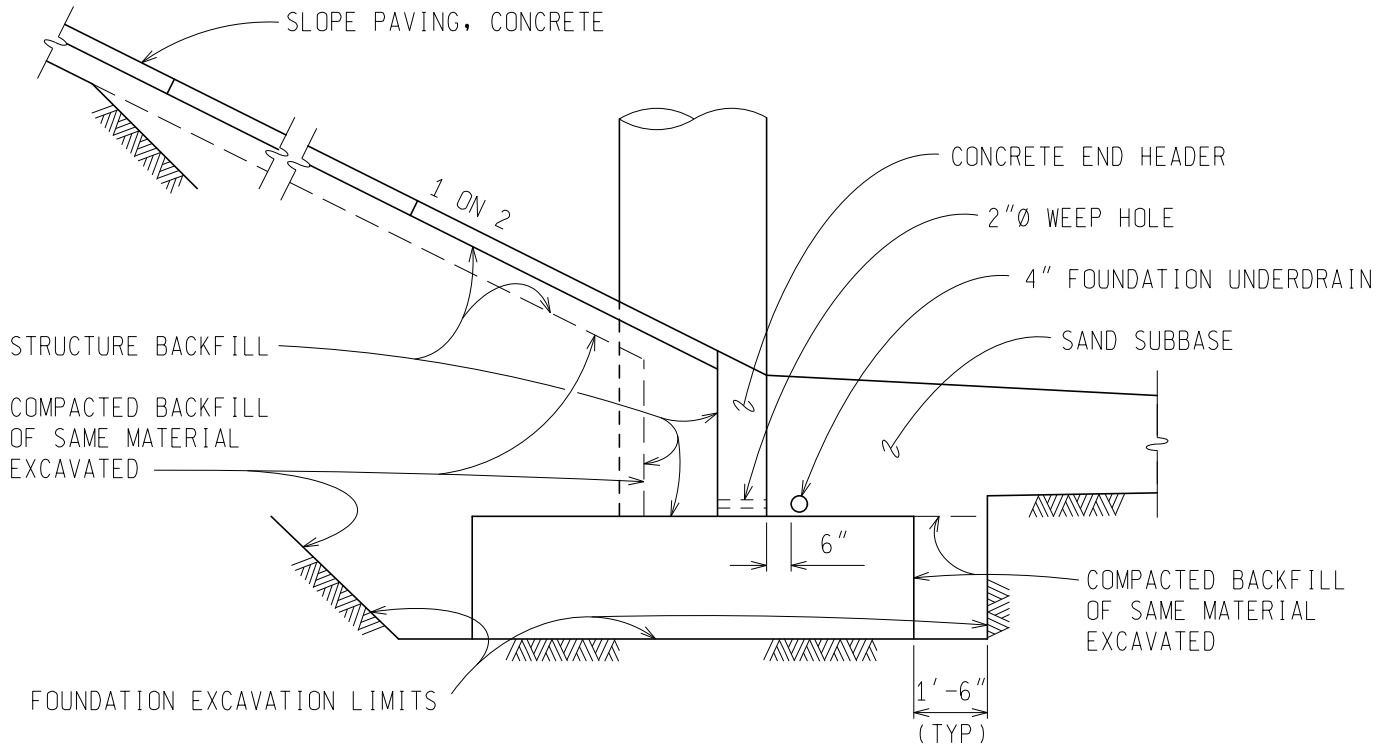
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

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DRAINAGE DETAILS AT SIDE PIERS



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

BID ITEMS:

UNDERDRAIN, FDN, 4 INCH ..... FT  
 UNDERDRAIN OUTLET, 4 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.

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 DESIGN DIVISION

3.25.03

## **4. APPROACHES**

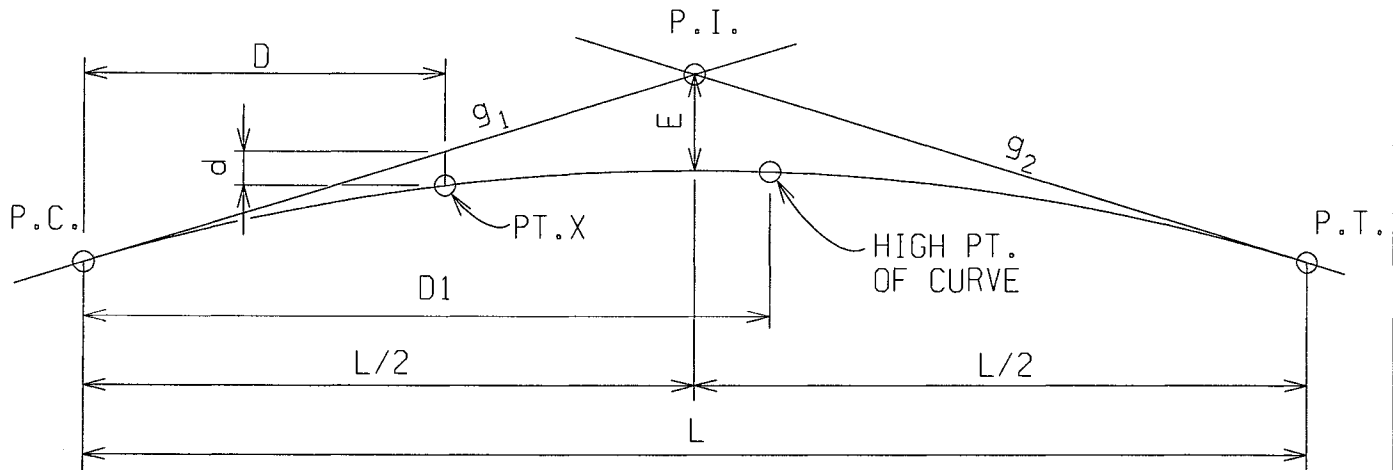


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 CHECKED BY: VZ  
 APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES

ISSUED: 11/27/01  
 SUPERSEDES: 04/15/95

VERTICAL CURVE CALCULATIONS



L = LENGTH IN FEET

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

G = ALGEBRAIC DIFFERENCE =  $g_1 - g_2$

D1 = SUBTANGENT TO HIGH PT. 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:  $E = \frac{GL}{8} = \frac{(0.05)(400 \text{ FT})}{8} = 2.5 \text{ FT}$

FIND EL. @ X USING D = 100 FT

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

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

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

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

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

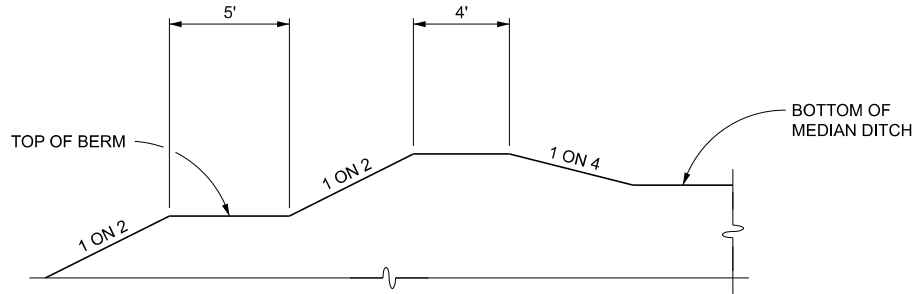
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 DESIGN DIV.

4.11.01

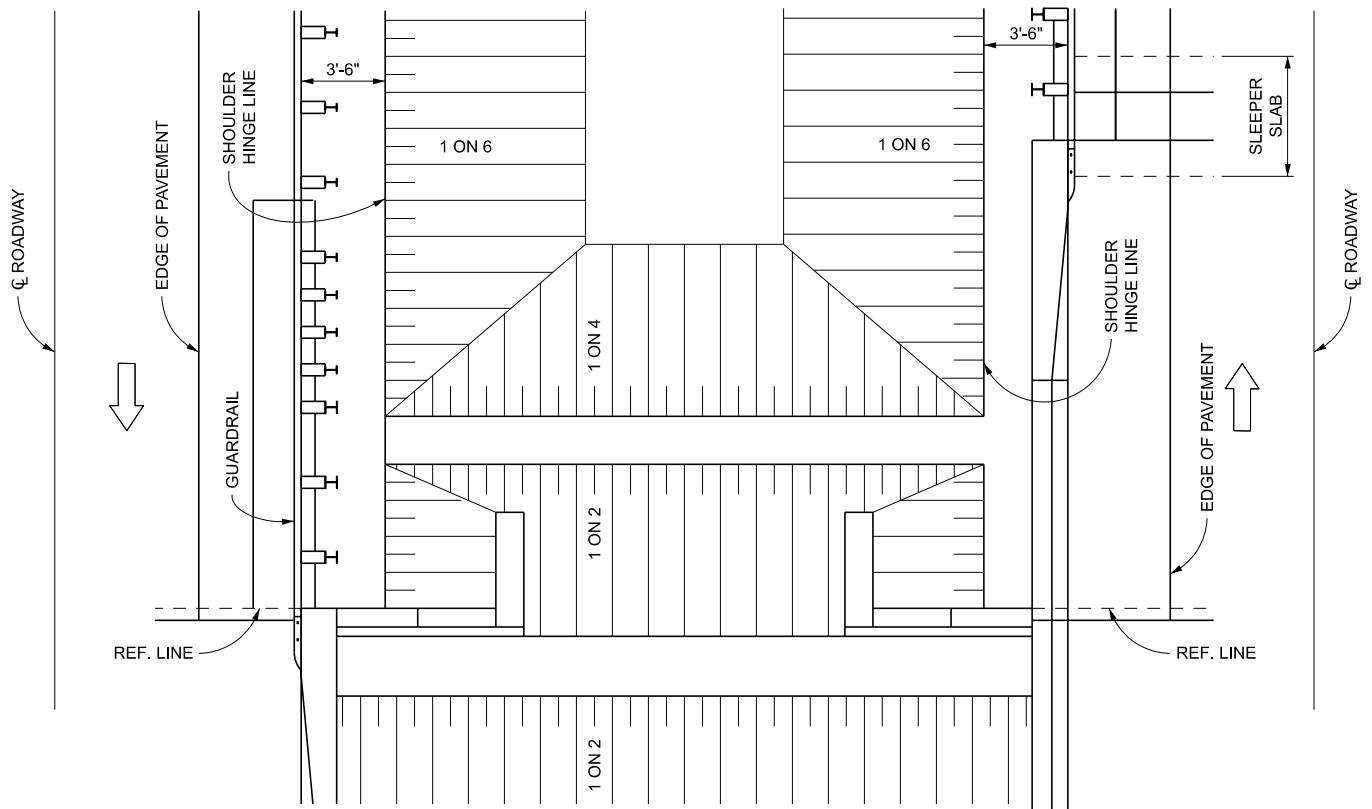
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APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT  
MEDIAN TREATMENT AT DUAL STRUCTURES  
WITH SEPARATE ABUTMENTS

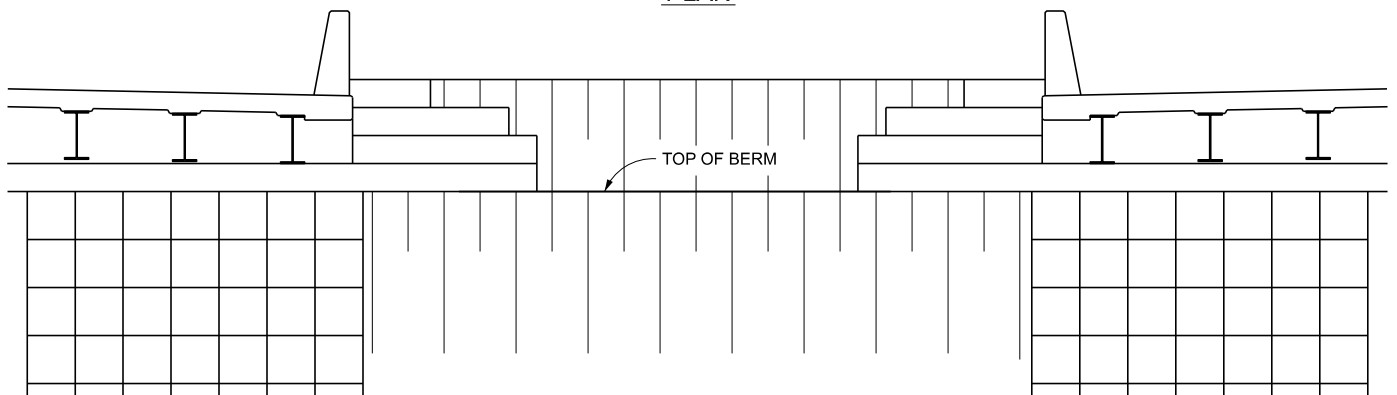
ISSUED: 04/22/24  
SUPERSEDES: 12/16/19



LONGITUDINAL APPROACH SECTION



PLAN



ELEVATION

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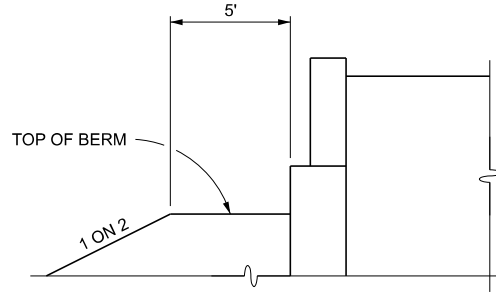
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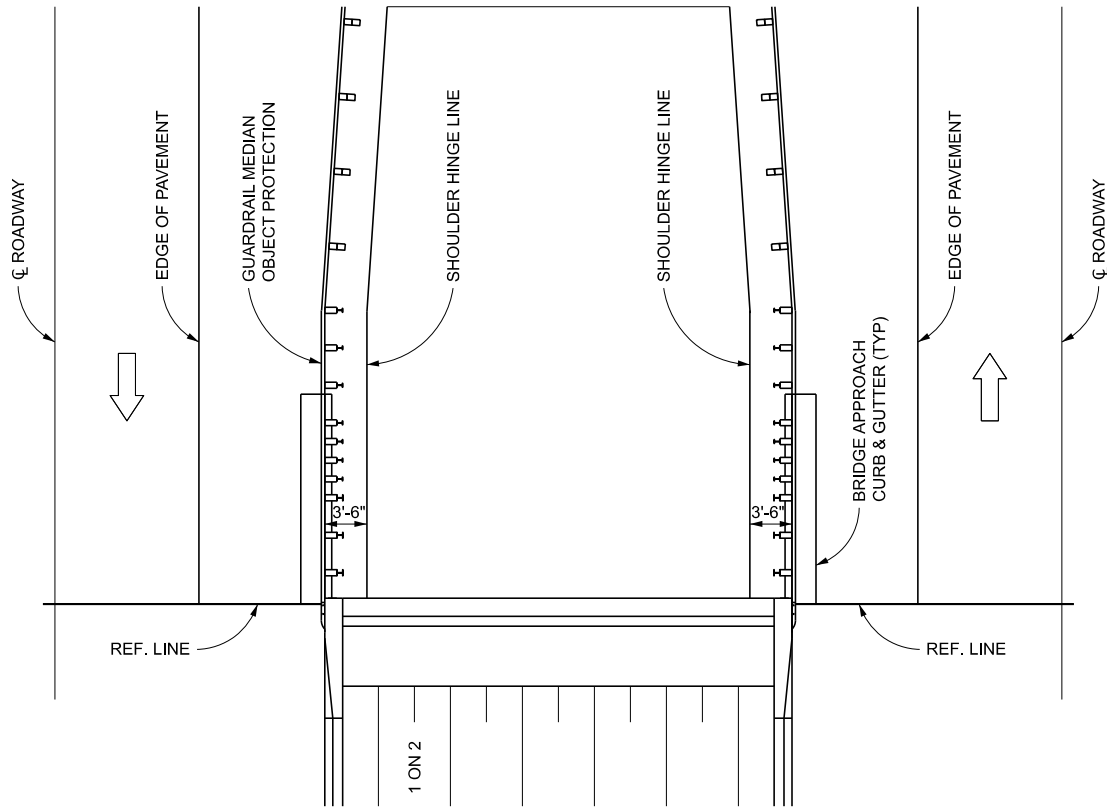
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT  
INTEGRAL AND SEMI-INTEGRAL ABUTMENT  
PARTIAL BACKWALL DETAILS

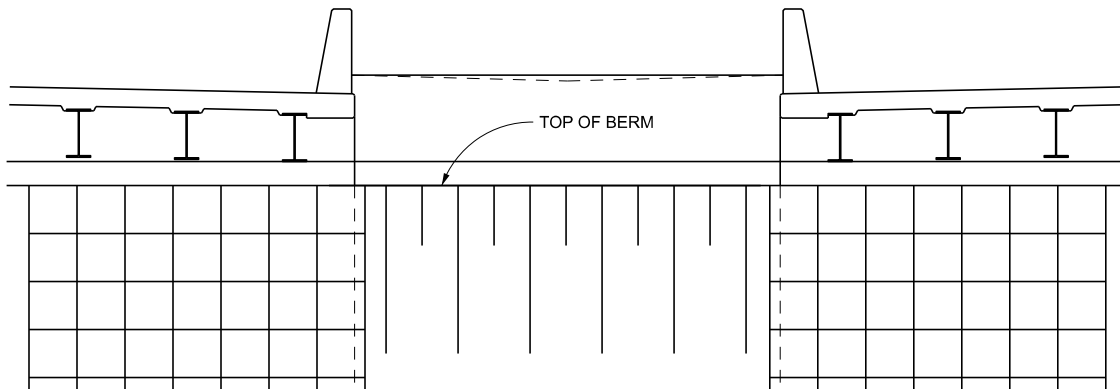
ISSUED: 04/22/24  
SUPERSEDES: 01/27/20



LONGITUDINAL APPROACH SECTION



PLAN



ELEVATION

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4.23.02



# 5. SUBSTRUCTURE



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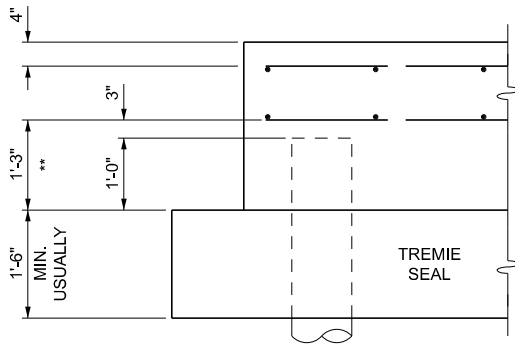
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT

CANTILEVER ABUTMENT REINFORCING

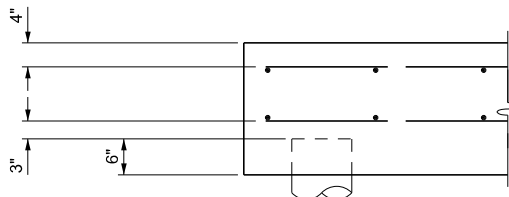
ISSUED: 12/26/23

SUPERSEDES: 05/04/06

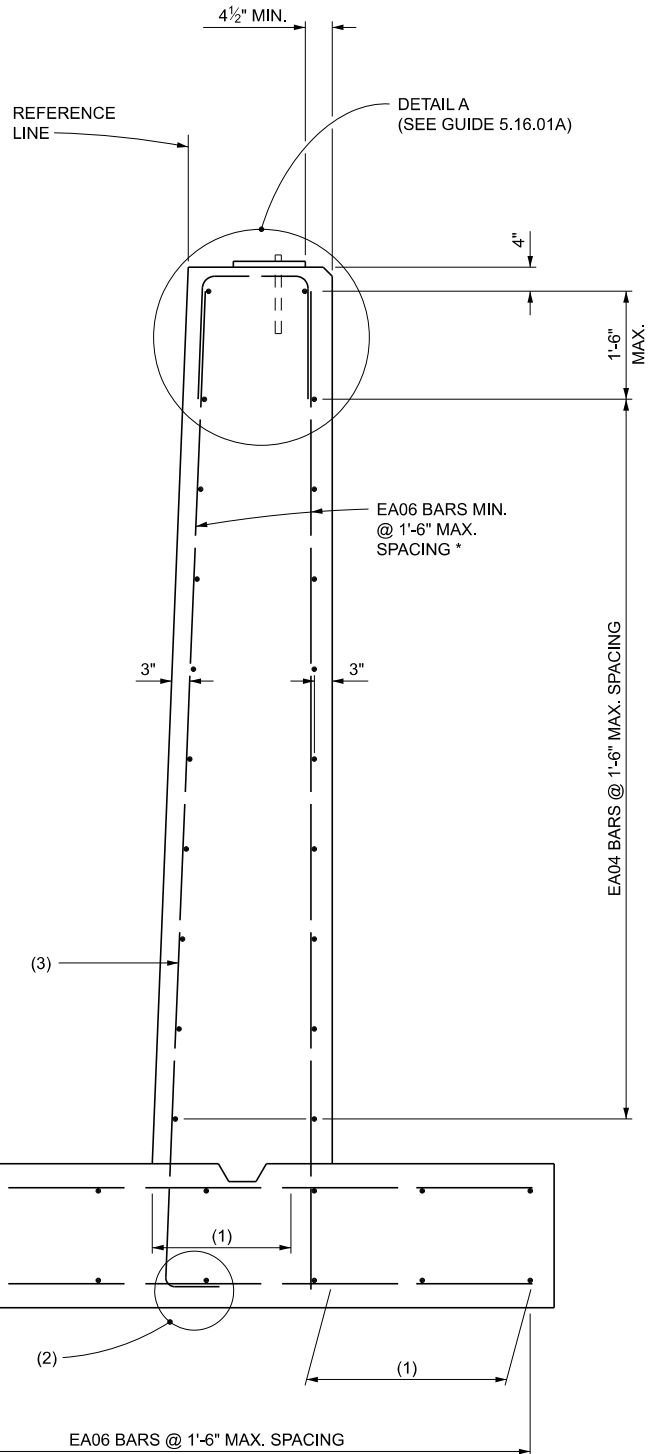


FOOTING WITH TREMIE SEAL

\*\* 9" WHEN PILES NOT USED



FOOTING ON PILES



EA06 BARS MIN. @  
1'-6" MAX. SPACING

- (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.

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DESIGN DIVISION

5.16.01

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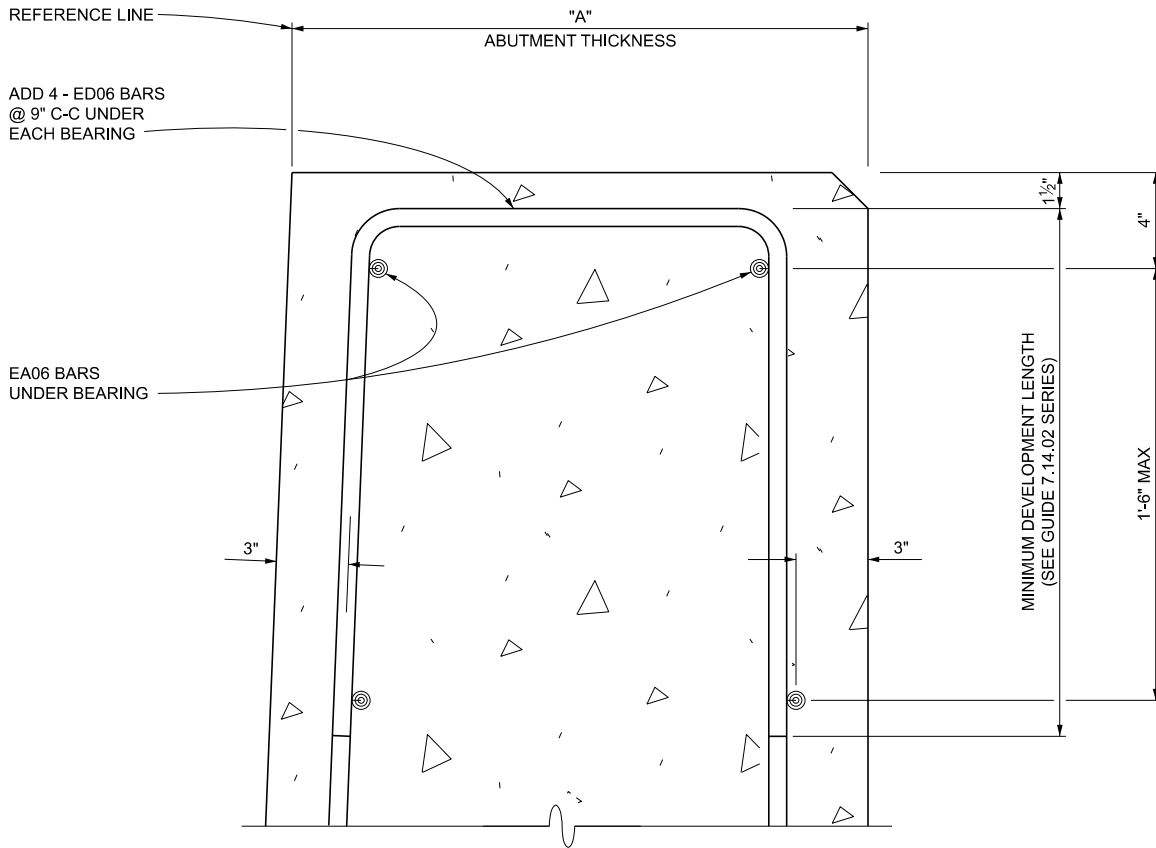
APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT

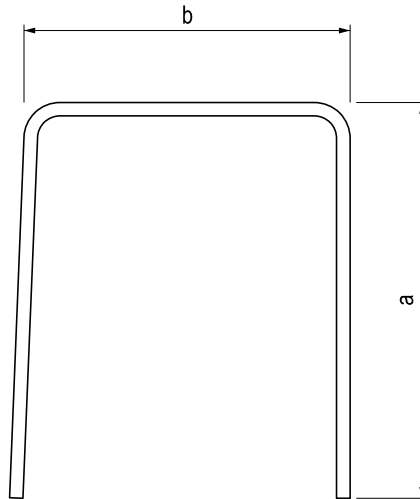
CANTILEVER ABUTMENT REINFORCING

ISSUED: 12/26/23

SUPERSEDES: 05/04/06



DETAIL A



EA06 BAR

a = MINIMUM DEVELOPMENT LENGTH  
(SEE GUIDE 7.14.02 SERIES)  
b = A - 5 1/2"

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

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DESIGN DIVISION

**5.16.01A**

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MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT  
SLOPEWALL DETAILS

ISSUED: 04/22/24  
SUPERSEDES: 11/27/01

RAILING  
CLEARANCE LINE

SIDEWALK

3'-6"

P.I.  
4" V.C.

3/4" BEVEL

\* 1/2" JOINT FILLER

OMIT MOLDING BEHIND WALL (TYP)

3/4" BEVEL

4"  
(TYP)

3/4" BEVEL

6"

FINISHED GROUND LINE AT  
BACK FACE OF SLOPEWALL

EQUAL SPACES  
1'-6" MAX

\* USE 1/2" JOINT FILLER WITH DEPENDENT  
BACKWALL. USE OPTIONAL CONSTRUCTION  
JOINT WITH INDEPENDENT BACKWALL.

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DESIGN DIVISION

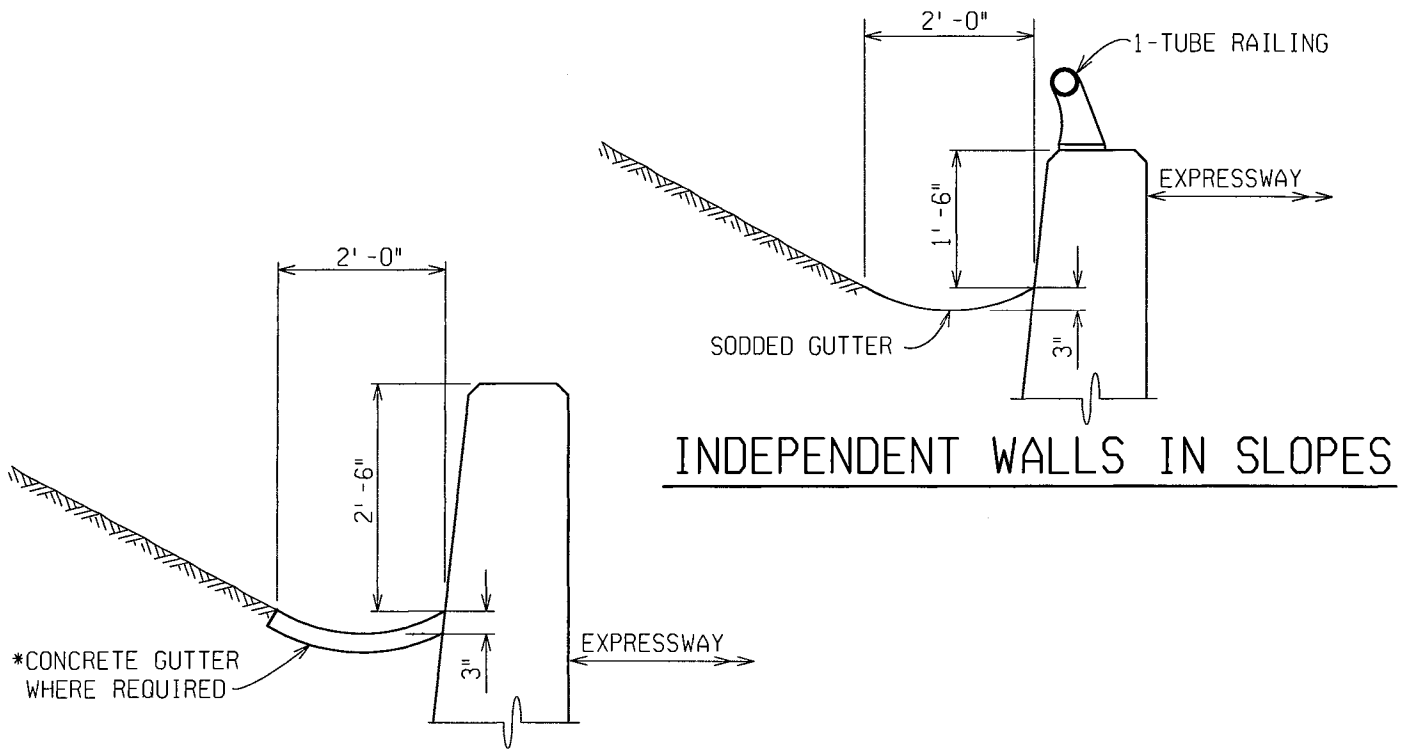
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY TECHNICAL SERVICES

ISSUED: 11/27/01  
SUPERSEDES: 04/15/95

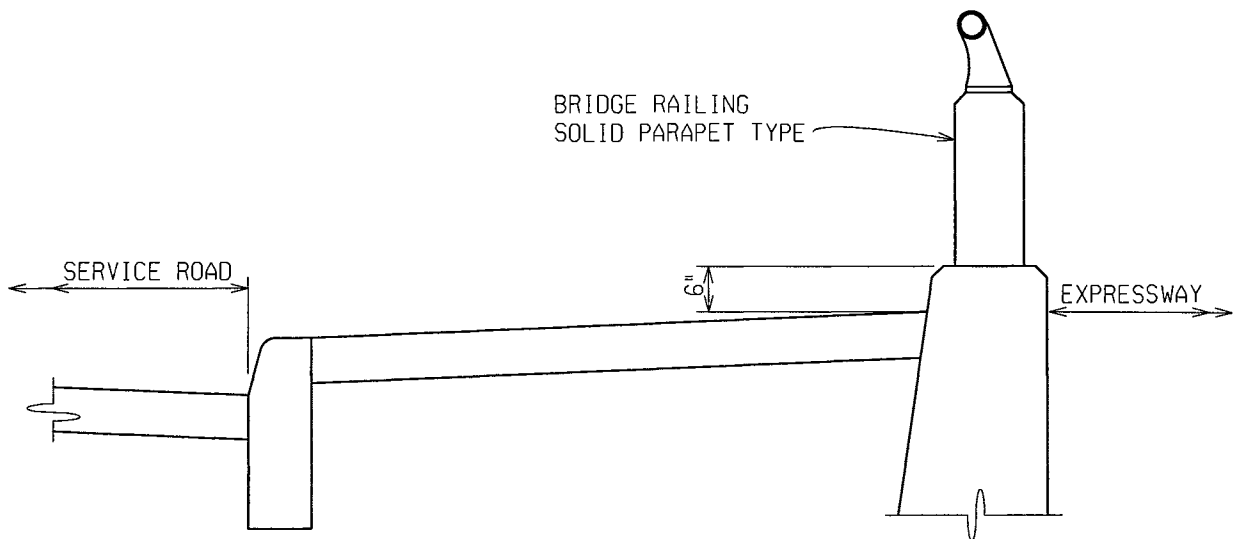
RETAINING WALL TREATMENTS



INDEPENDENT WALLS IN SLOPES

SLOPING WALLS ADJACENT TO BRIDGE

\*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

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DESIGN DIV.

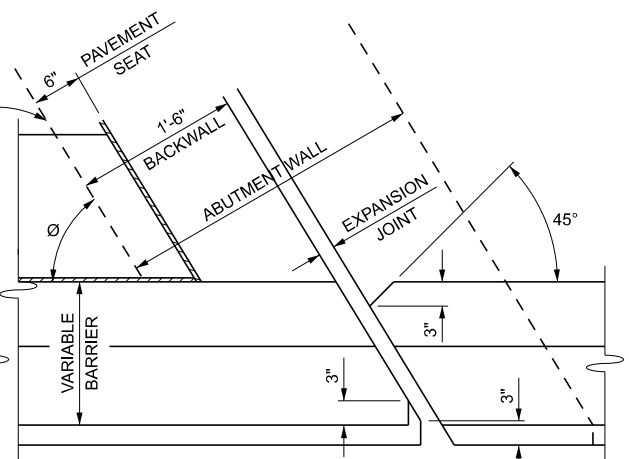
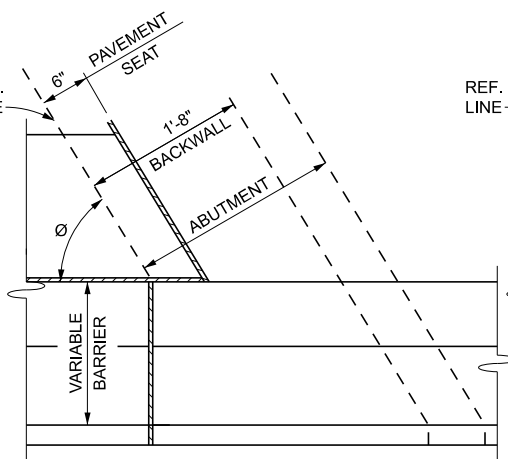
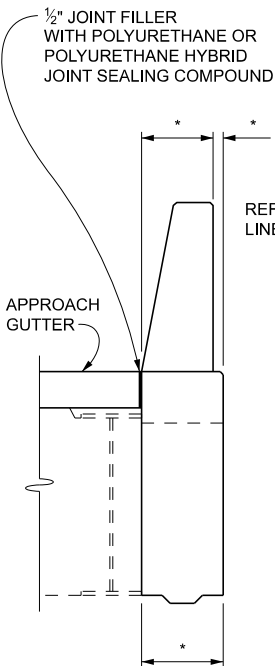
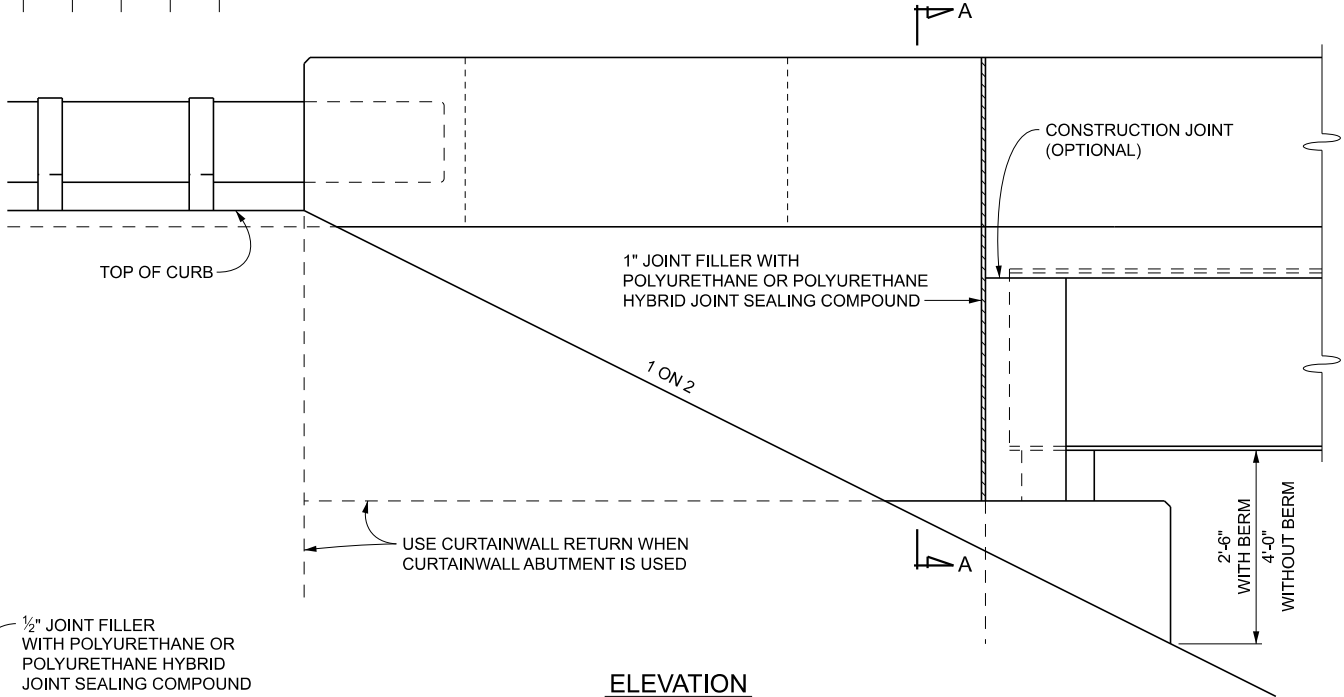
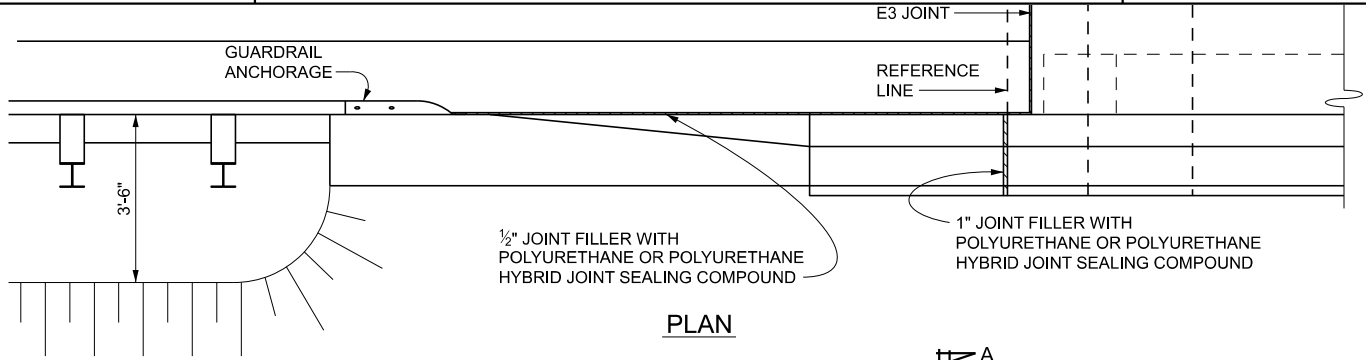
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 RETURN WALL DETAILS  
 COUNTY ROAD OVER TRUNKLINES

ISSUED: 04/22/24  
 SUPERSEDES: 01/27/20



\* DIMENSIONS VARIABLE, DEPENDENT UPON BARRIER TYPE AND AESTHETIC TREATMENT

WHEN  $70^\circ < \theta < 110^\circ$ , CARRY JOINT STRAIGHT THROUGH BARRIER

WHEN  $70^\circ < \theta < 110^\circ$  OMIT 3" BEVELS

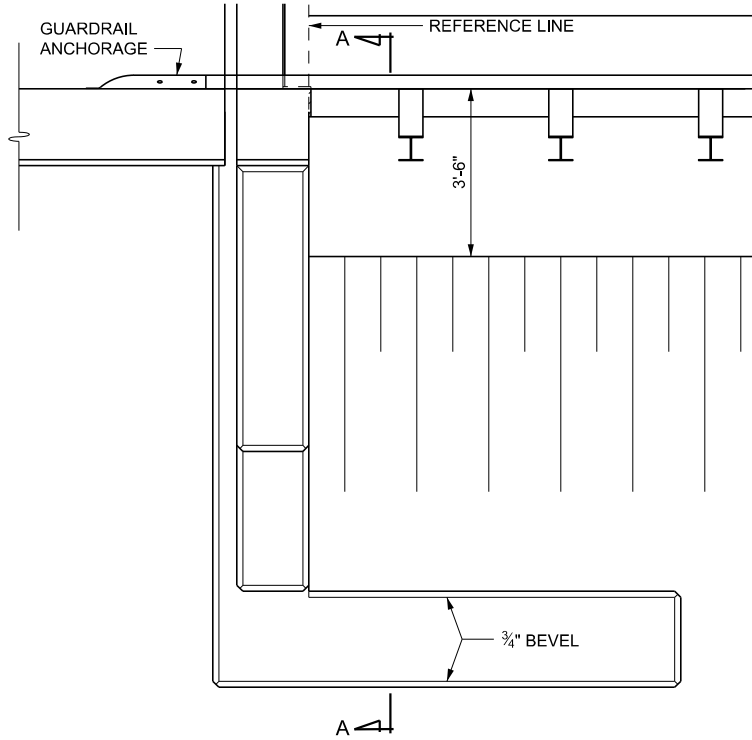
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5.17.05

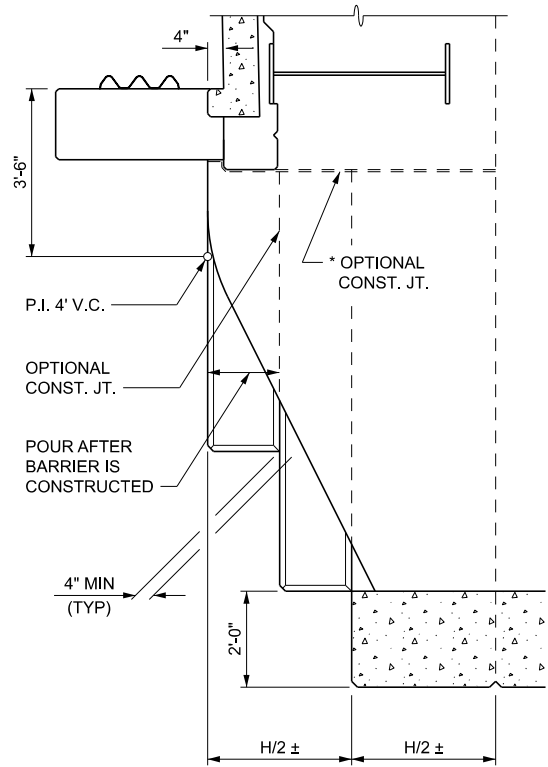
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 WINGWALL TREATMENT - TRUNKLINE OVER  
 (SECTION THRU STUB ABUTMENT)

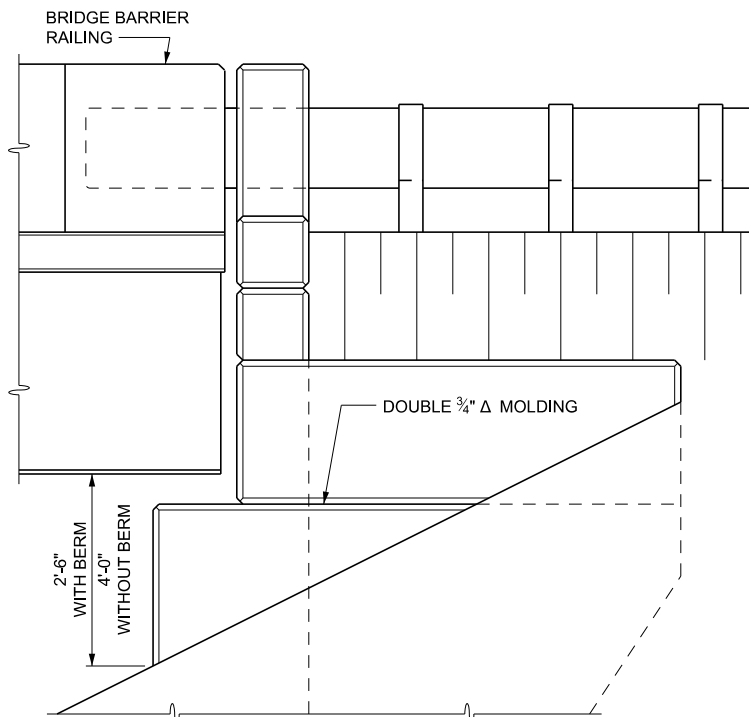
ISSUED: 04/22/24  
 SUPERSEDES: 12/16/19



PLAN VIEW



SECTION A-A



ELEVATION

NOTES:

FOR ADDITIONAL SLOPE WALL DETAILS, SEE GUIDE 5.17.01.

\* USE WITH INDEPENDENT BACKWALL ONLY; USE 1/2" JOINT FILLER WITH DEPENDENT BACKWALL.

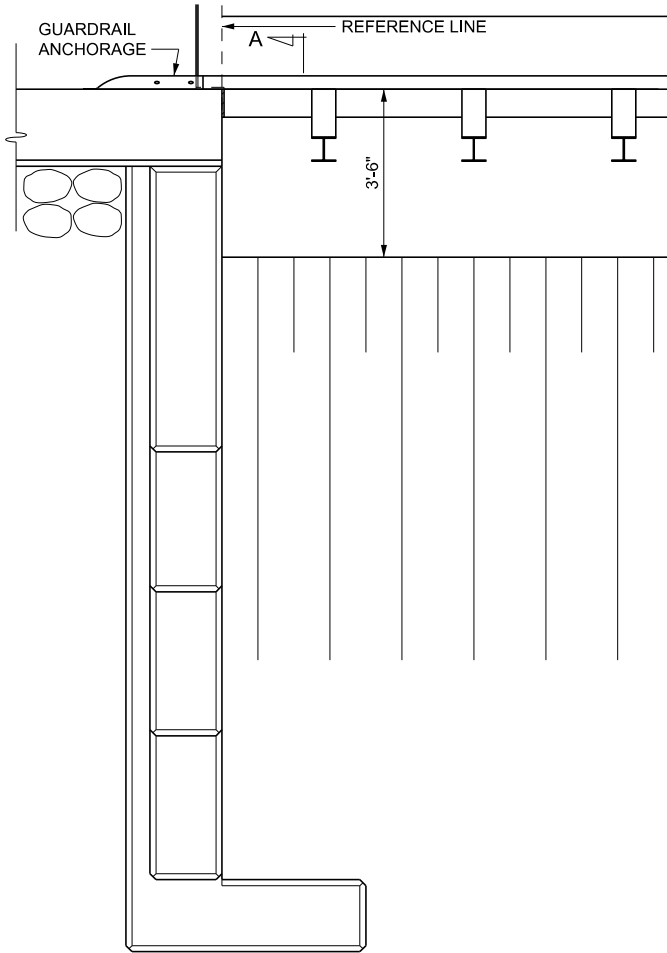
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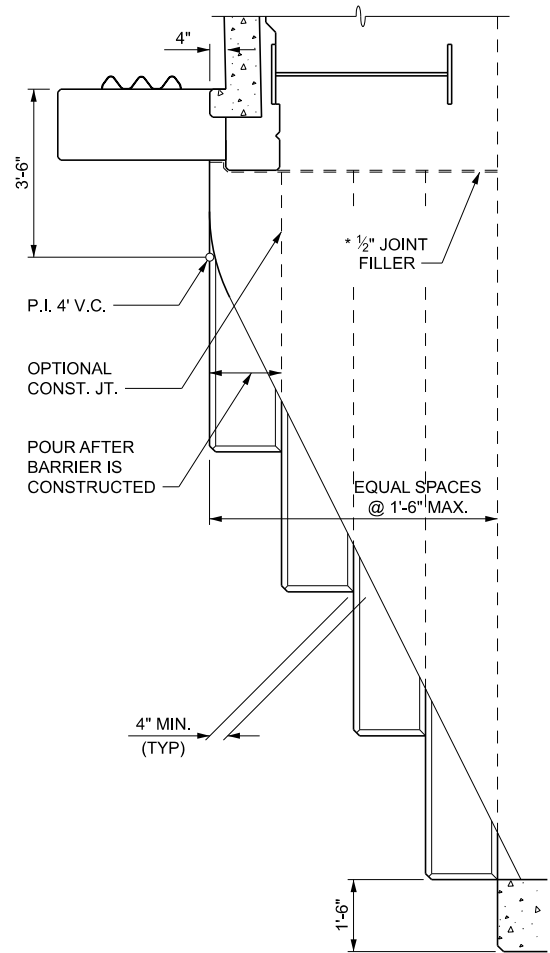
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 WINGWALL TREATMENT  
 STREAM CROSSING

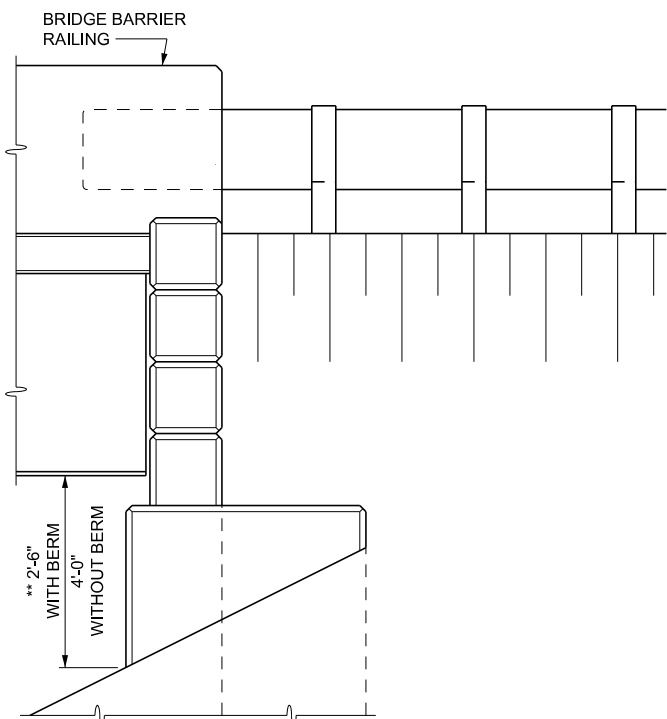
ISSUED: 04/22/24  
 SUPERSEDES: 12/16/19



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.

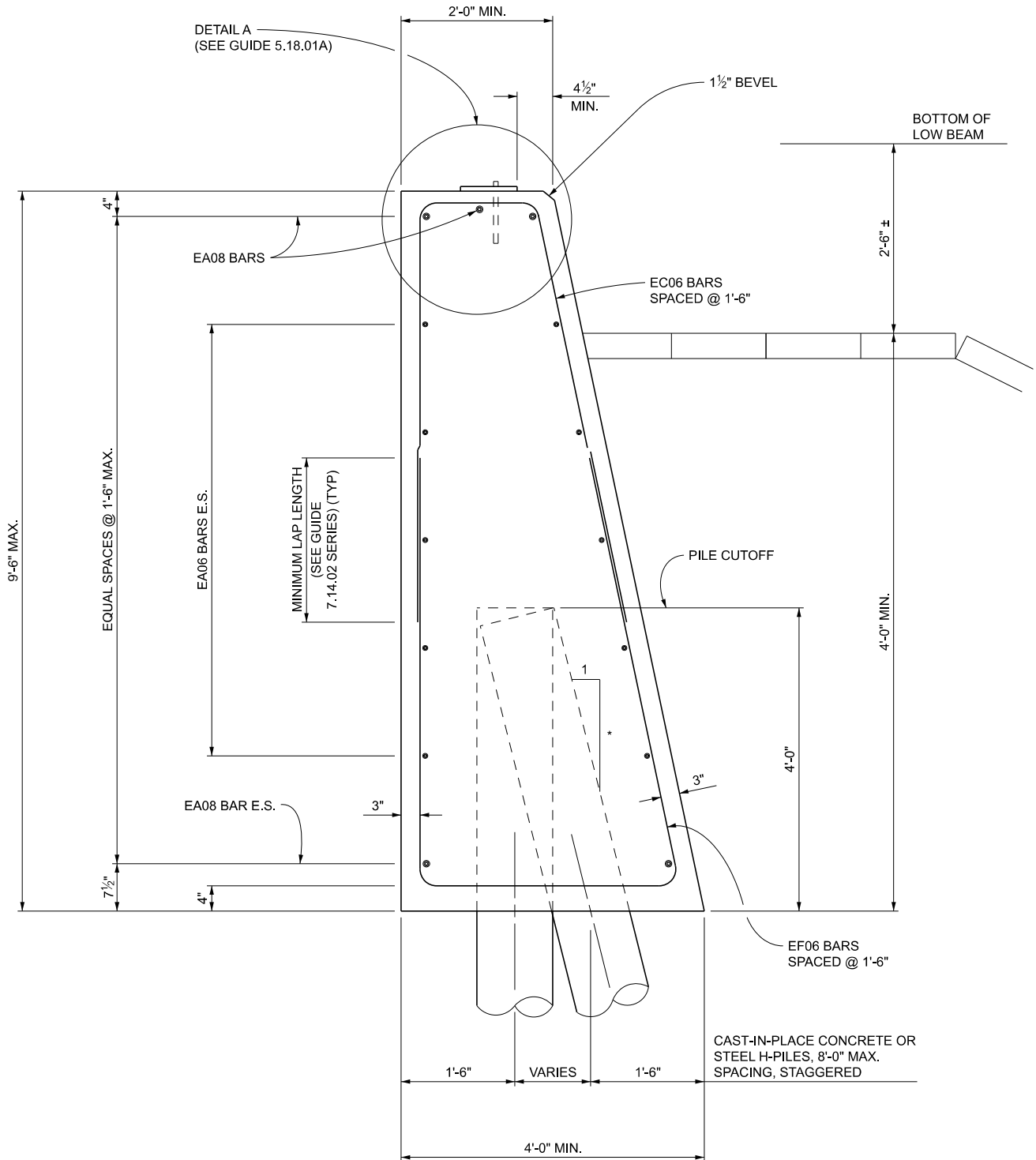
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 CURTAINWALL ABUTMENT

ISSUED: 12/26/23  
 SUPERSEDES: 11/27/01



\* FOR PILE BATTER, SEE BRIDGE DESIGN MANUAL 7.03.09  
 FOR ADDITIONAL REINFORCING DETAILS, SEE GUIDES 6.20.01 AND 6.20.03.

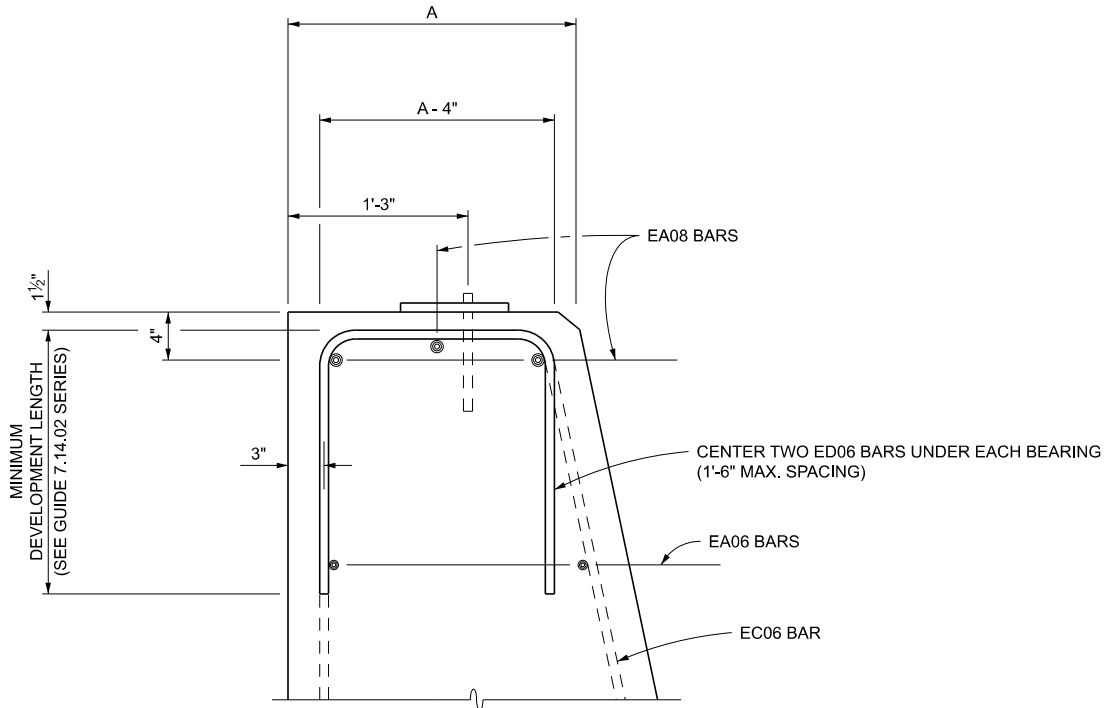
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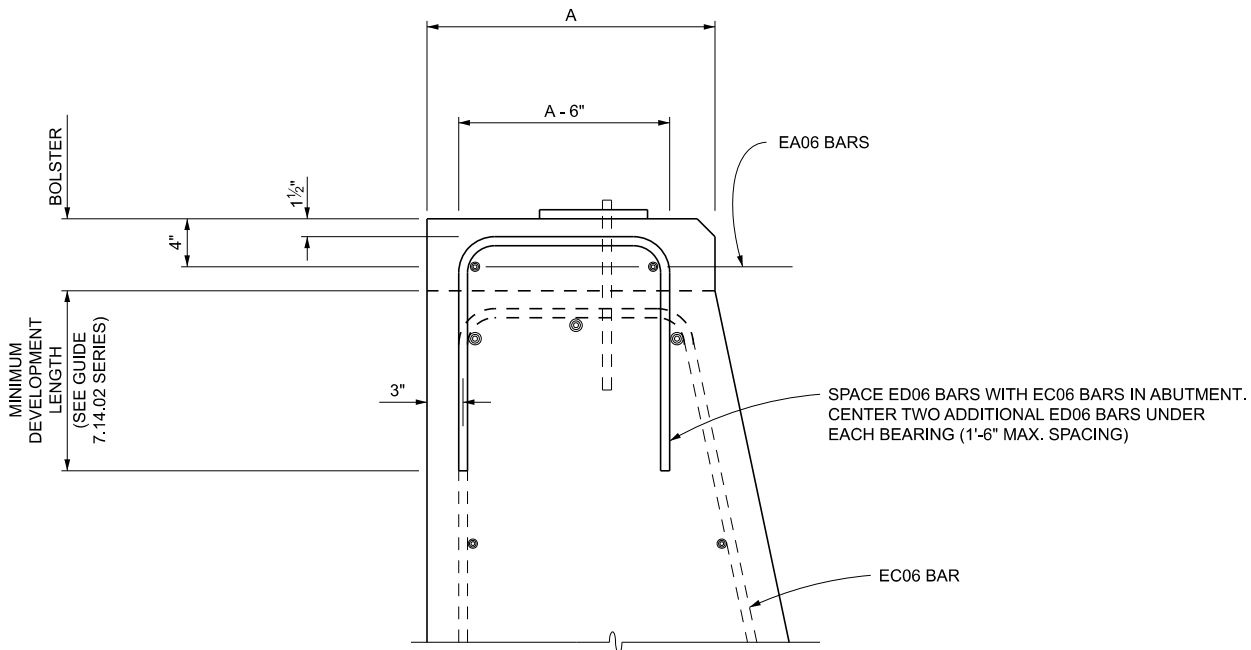
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 CURTAINWALL ABUTMENT REINFORCEMENT

ISSUED: 12/26/23  
 SUPERSEDES: 11/27/01



DETAIL A



DETAIL A  
 (AT BOLSTER)

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

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 DESIGN DIVISION

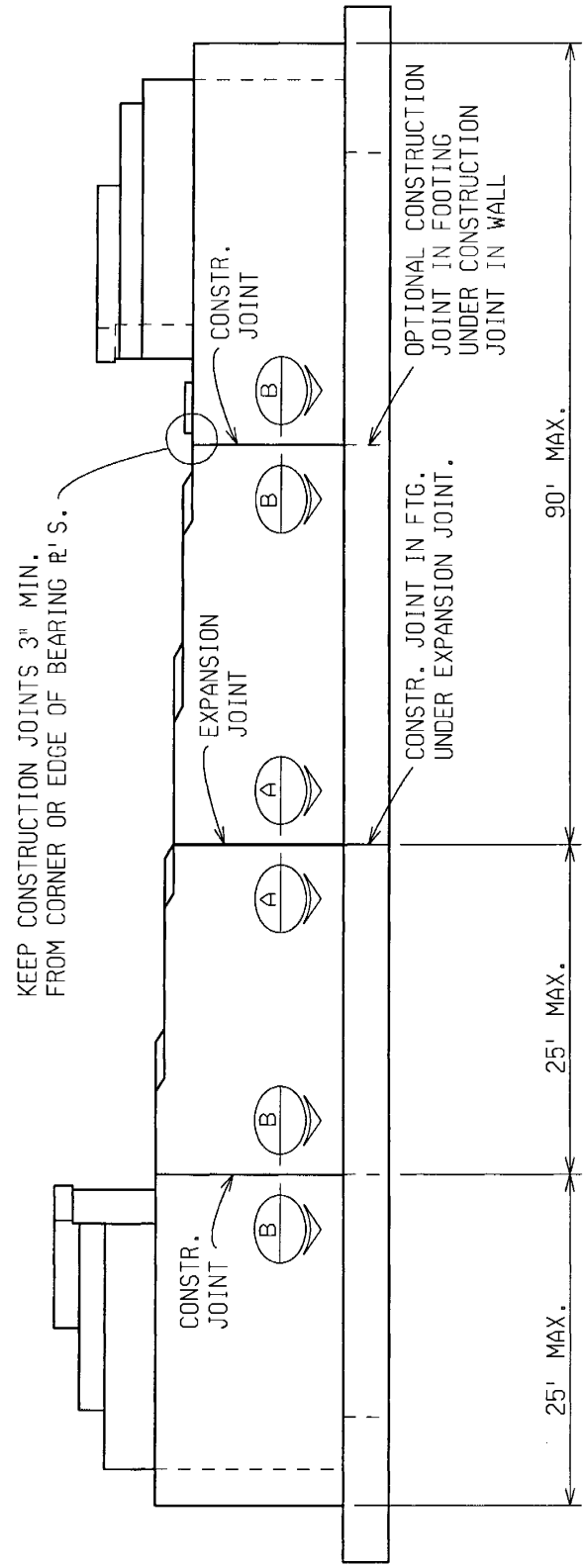
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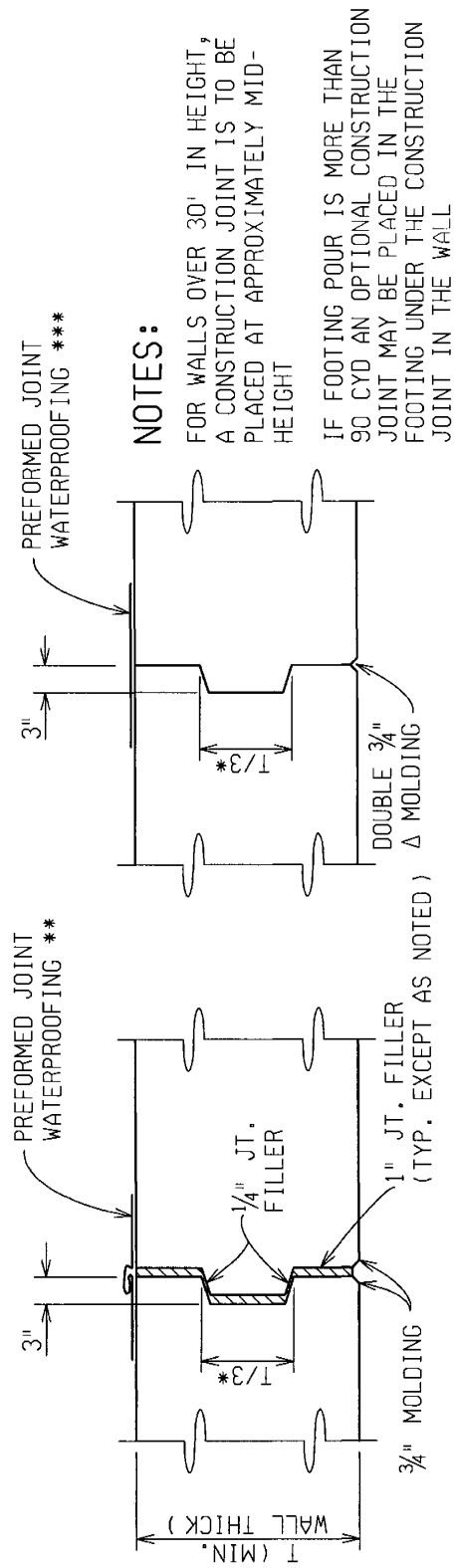
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

ISSUED: 05/04/06  
 SUPERSEDES: 08/15/03

ABUTMENT JOINTS



TYPICAL ABUTMENT ELEVATION



\*\*EXCEPT WHEN EXPANSION JOINT DRAIN IS USED.

\*\*\* JOINT WATERPROOFING MEMBRANE (J.W.P.) MAY BE USED AS AN ALTERNATE.

SECTION B-B

SECTION A-A

\* ROUND T/3 TO EVEN 2" INCREMENT (NOMINAL DIMENSION, E.G., 3" X 8" KEY)

PREPARED BY  
 DESIGN SUPPORT AREA

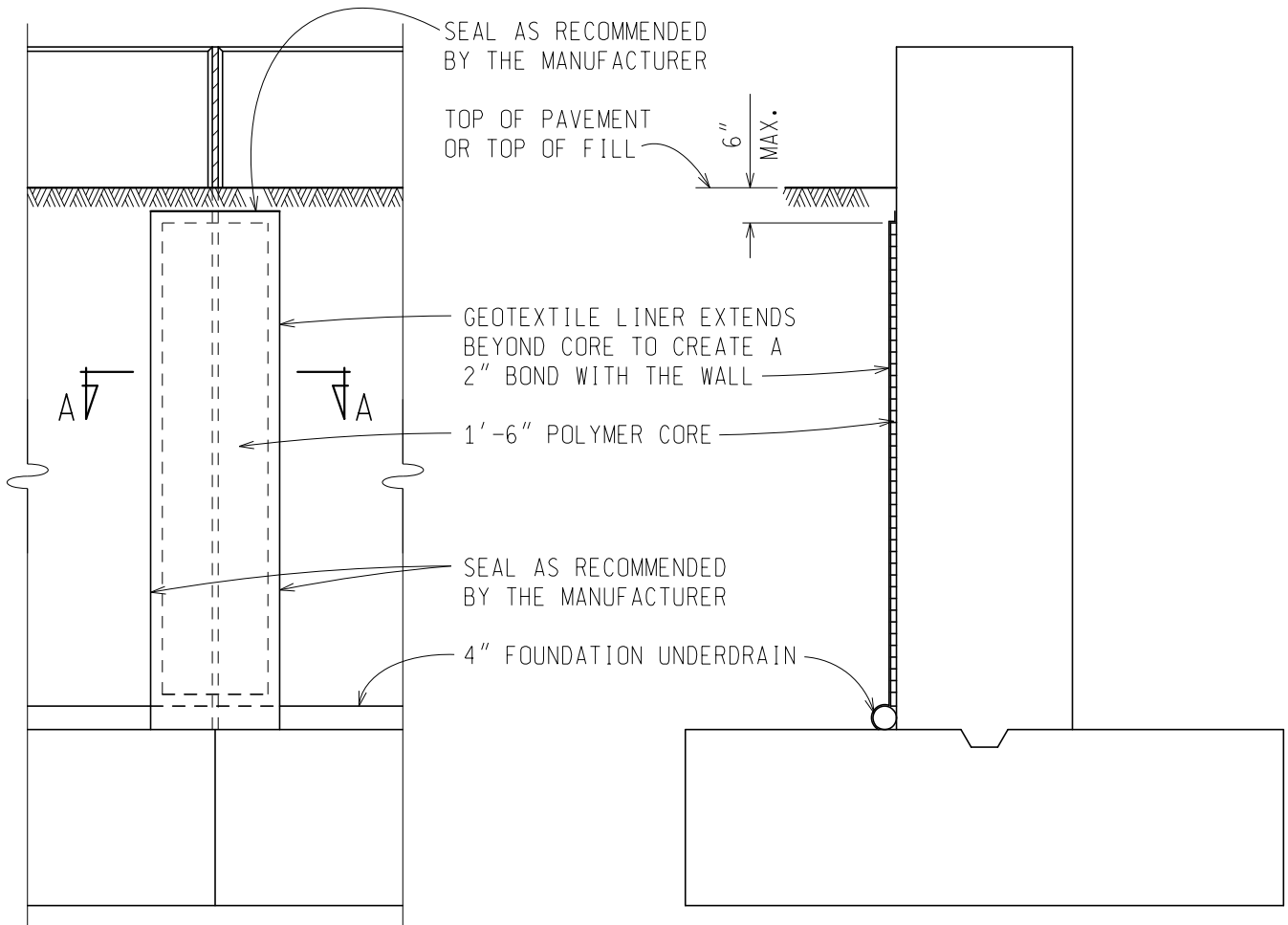
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

ISSUED: 06/25/12  
 SUPERSEDES: 02/14/11

WALL EXPANSION JOINT DRAIN



WALL ELEVATION

WALL SECTION

NOTE TO DETAILER:

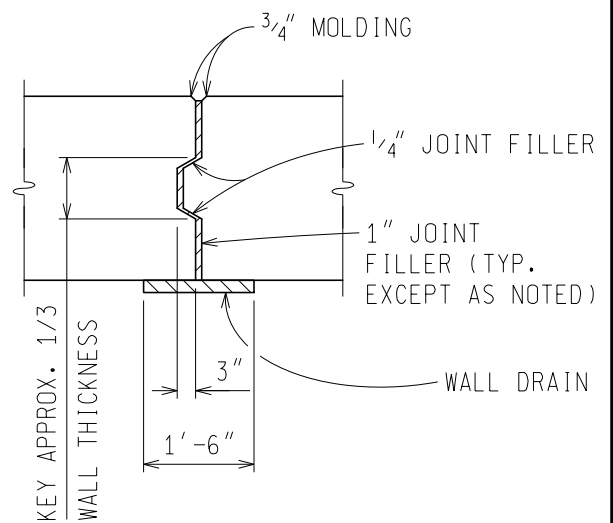
WALL DRAINS SHOULD BE USED AT EXPANSION JOINTS IN RETAINING WALLS AND FULL HEIGHT ABUTMENTS BUT SHOULD NOT BE PLACED ON STRUCTURES CROSSING WATERWAYS.

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, 4 INCH."



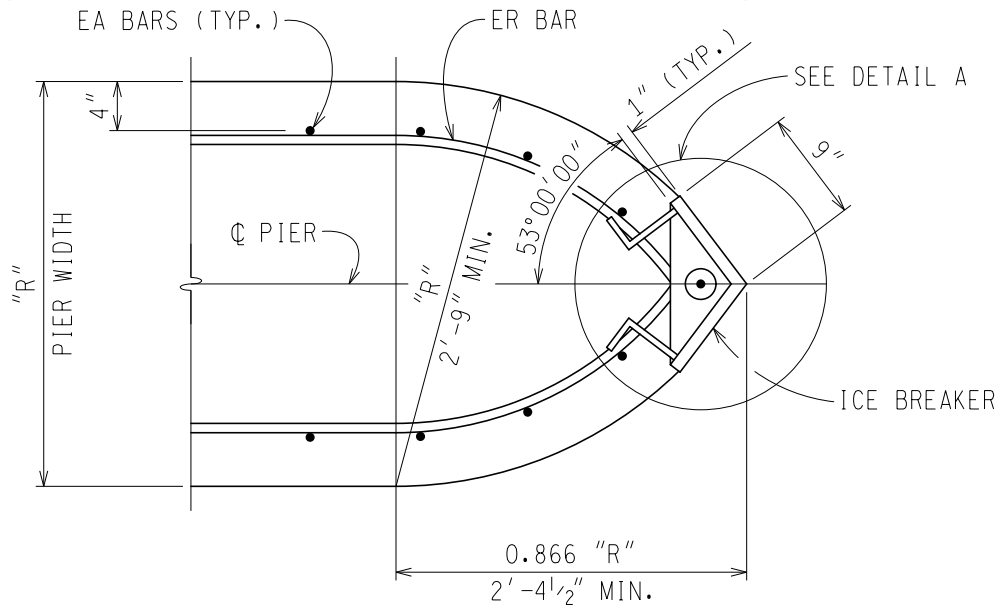
SECTION A-A

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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

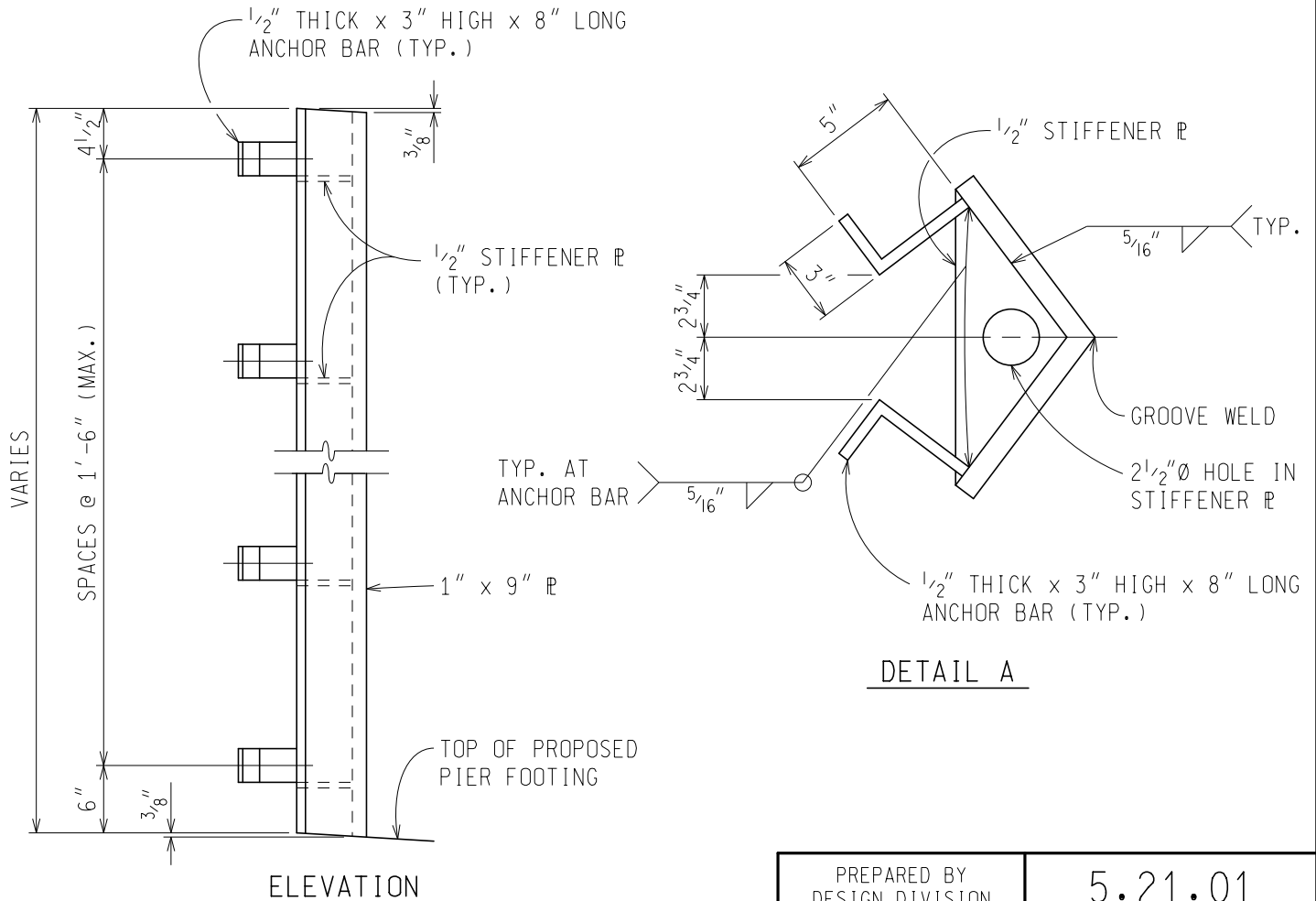
ISSUED: 11/28/11  
 SUPERSEDES: 11/27/01

PIER NOSING DETAIL



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.



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5.21.01

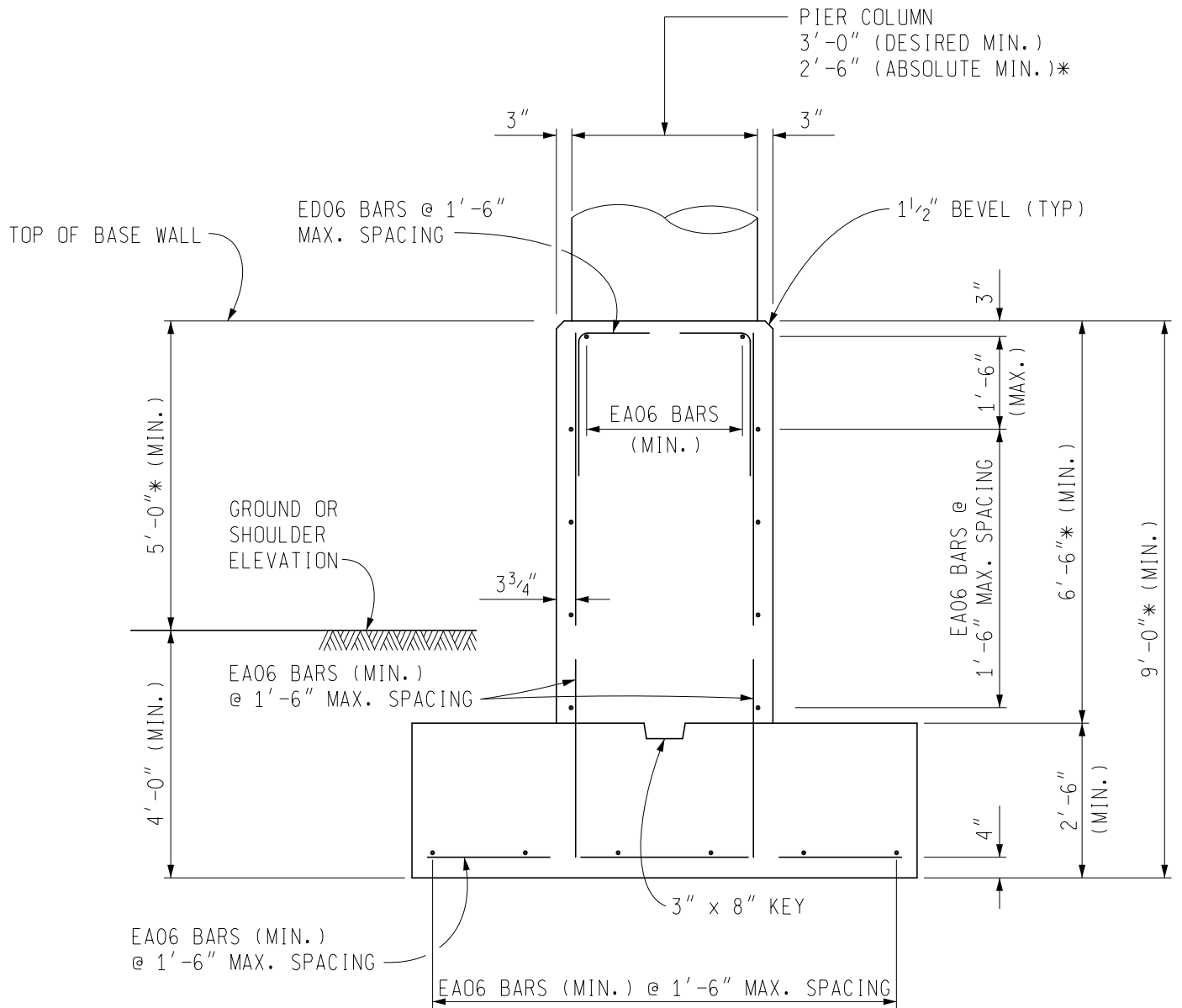


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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

ISSUED: 07/24/23  
 SUPERSEDES: 02/14/11

BASE WALL DETAILS FOR  
 PIER ADJACENT TO ROADWAY



\* 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.

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 DESIGN DIVISION

5.22.01

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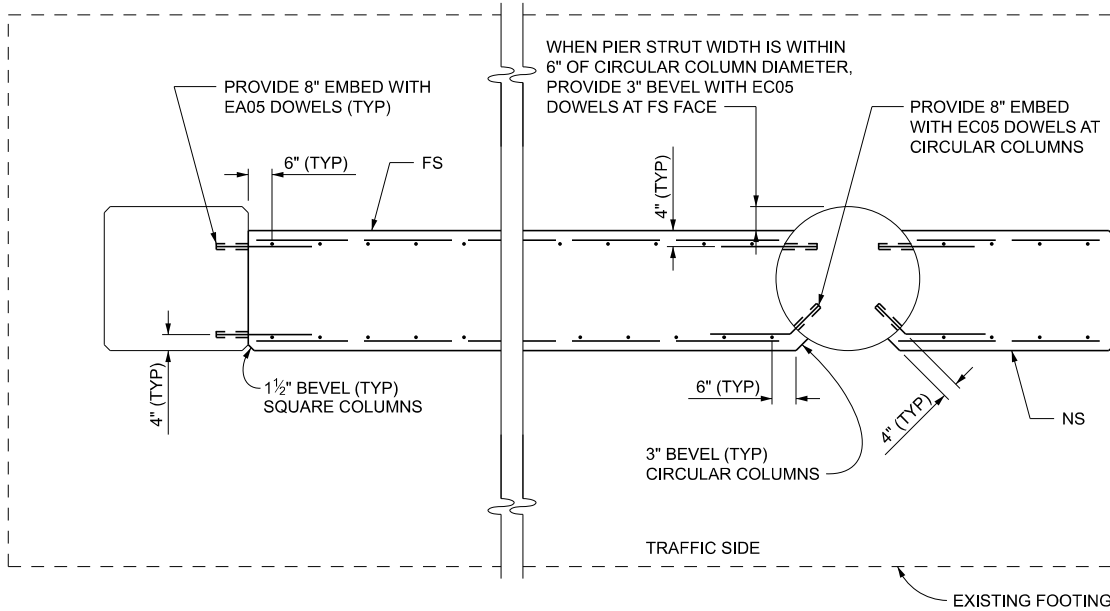
APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT

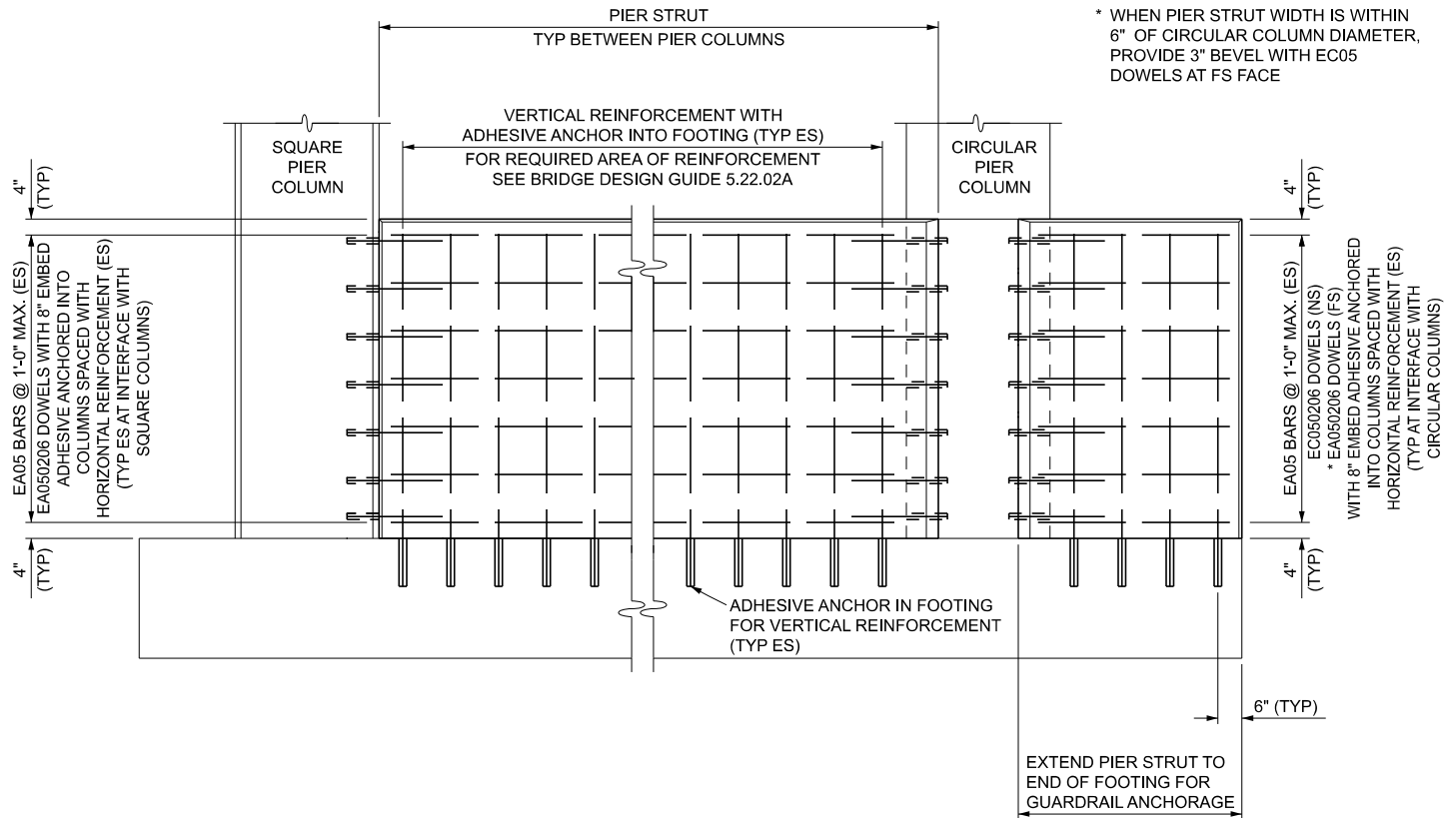
PIER STRUT RETROFIT

ISSUED: 02/26/24

SUPERSEDES:



PIER STRUT PLAN



PIER STRUT ELEVATION

PREPARED BY  
DESIGN DIVISION

5.22.02

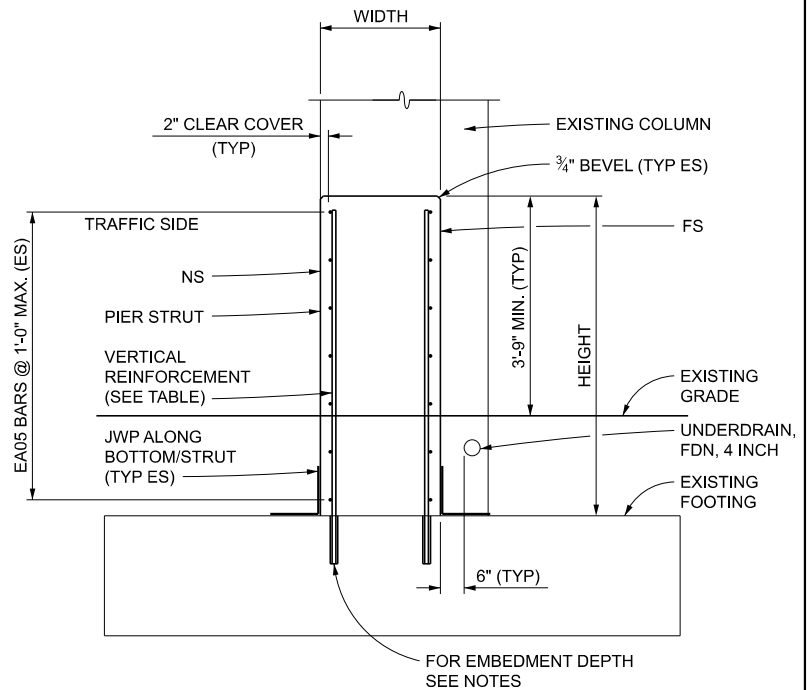
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 PIER STRUT RETROFIT

ISSUED: 02/26/24  
 SUPERSEDES:

PIER STRUT RETROFIT  
 REINFORCED CONCRETE DESIGN

HEIGHT (FT)	WIDTH (FT)	VERTICAL REINFORCEMENT (IN <sup>2</sup> /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 ( $L_c$ ). IF THE LENGTH OF THE PIER STRUT EXCEEDS  $L_c$ , DESIGN THE REINFORCEMENT IN ACCORDANCE WITH AASHTO LRFD SECTION A13.3.1. FOR DEFINITIONS OF YIELD LINE MECHANISM AND  $L_c$  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 1/2" 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.

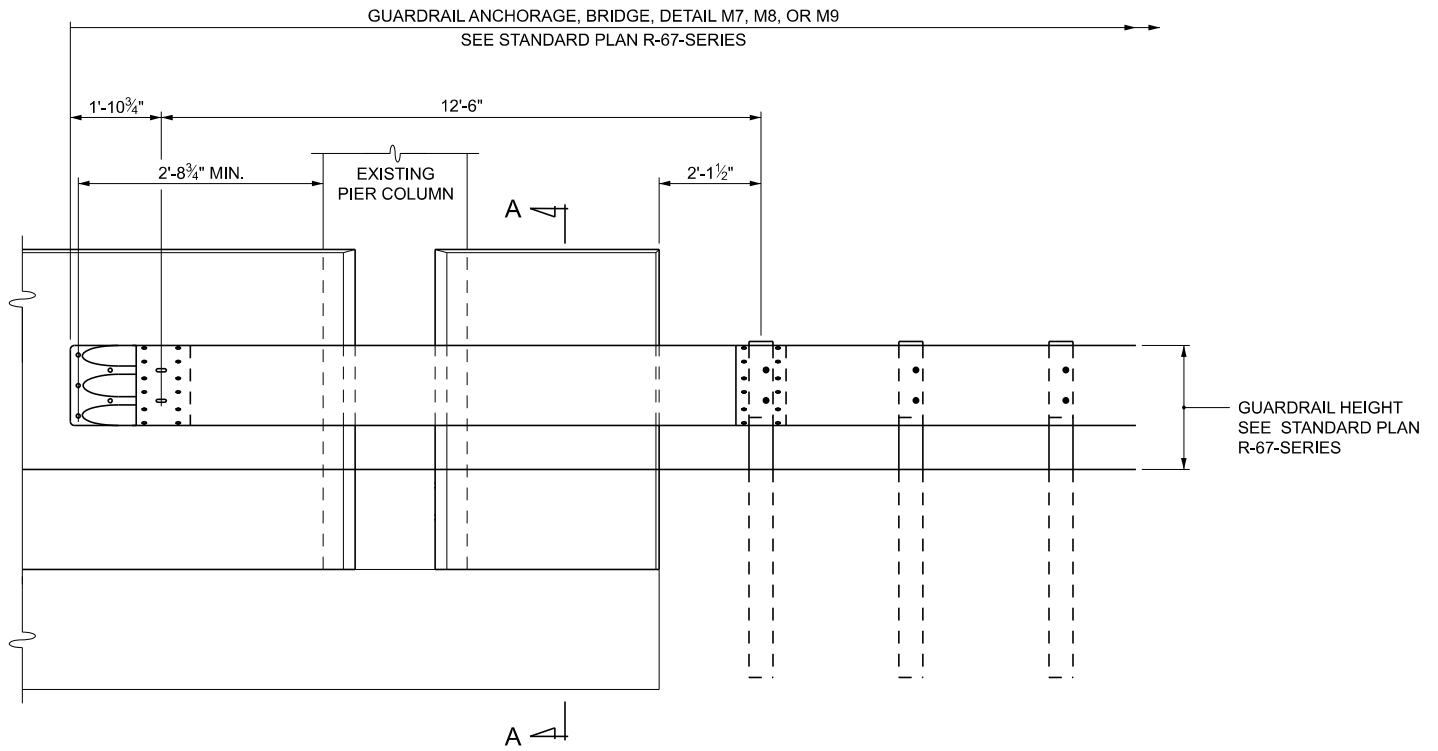
PREPARED BY  
 DESIGN DIVISION

5.22.02A

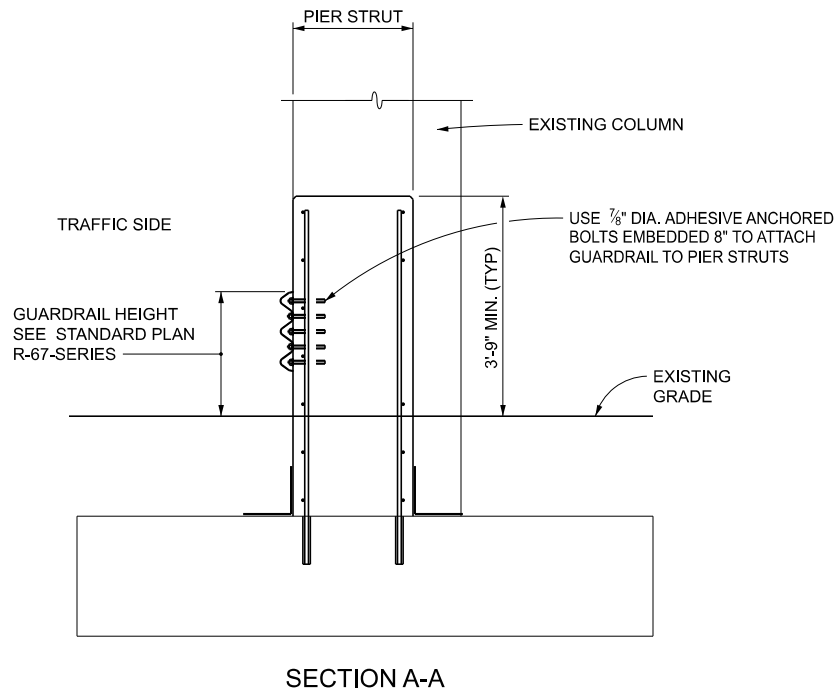
DRAWN BY: BLT  
CHECKED BY: VZ  
APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT  
PIER STRUT RETROFIT

ISSUED: 02/26/24  
SUPERSEDES:



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



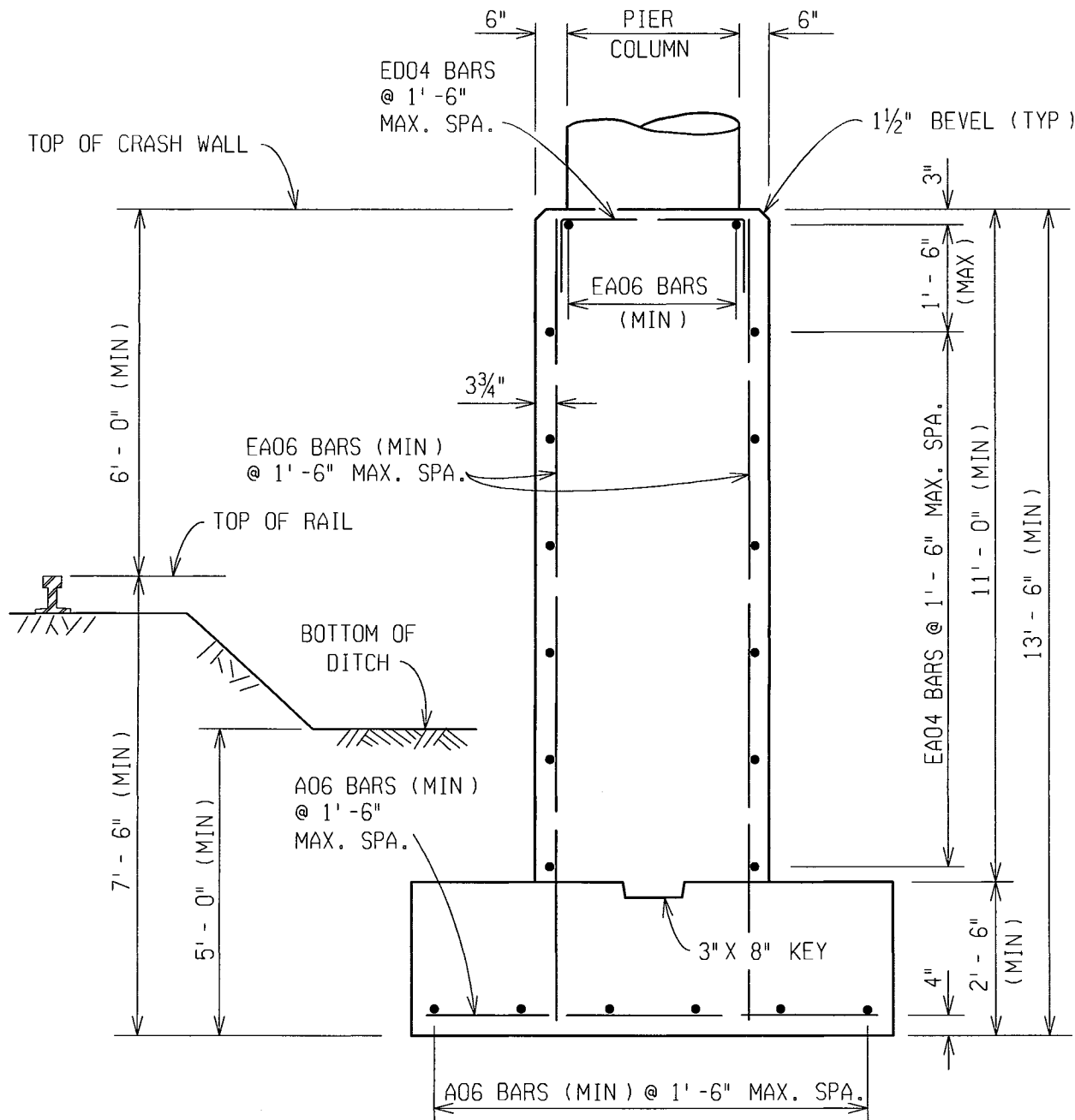
PREPARED BY  
DESIGN DIVISION

5.22.02B

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: T&F

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT  
**BASE WALL DETAILS FOR  
 PIER ADJACENT TO RAILROAD**

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



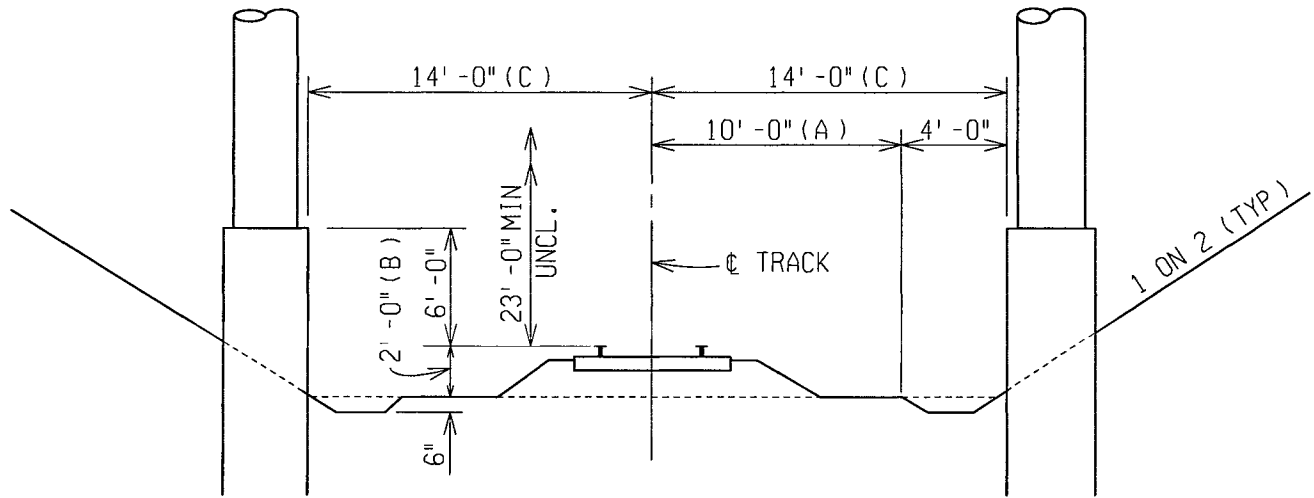
**SECTION OF STANDARD CRASH WALL  
 AT RIGHT ANGLES TO TRACK**

DRAWN BY: MJB  
CHECKED BY: VZ  
APPROVED BY: TGF

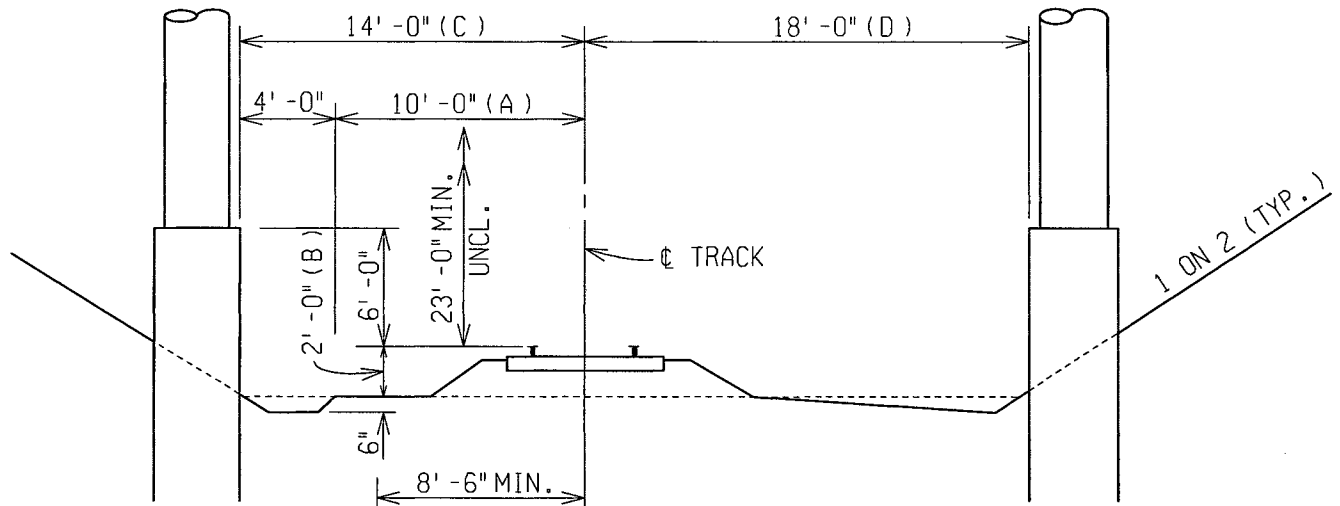
MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY TECHNICAL SERVICES

RAILROAD SIDE CLEARANCES  
SINGLE TRACK UNDER

ISSUED: 11/27/01  
SUPERSEDES: 04/15/95



WITHOUT PROVISION FOR OFF-TRACK  
MAINTENANCE EQUIPMENT



WITH PROVISION FOR OFF-TRACK  
MAINTENANCE EQUIPMENT

SUBFTG, FTG, OR STEEL  
SHEET PILING LINE

PREPARED BY  
DESIGN DIV.

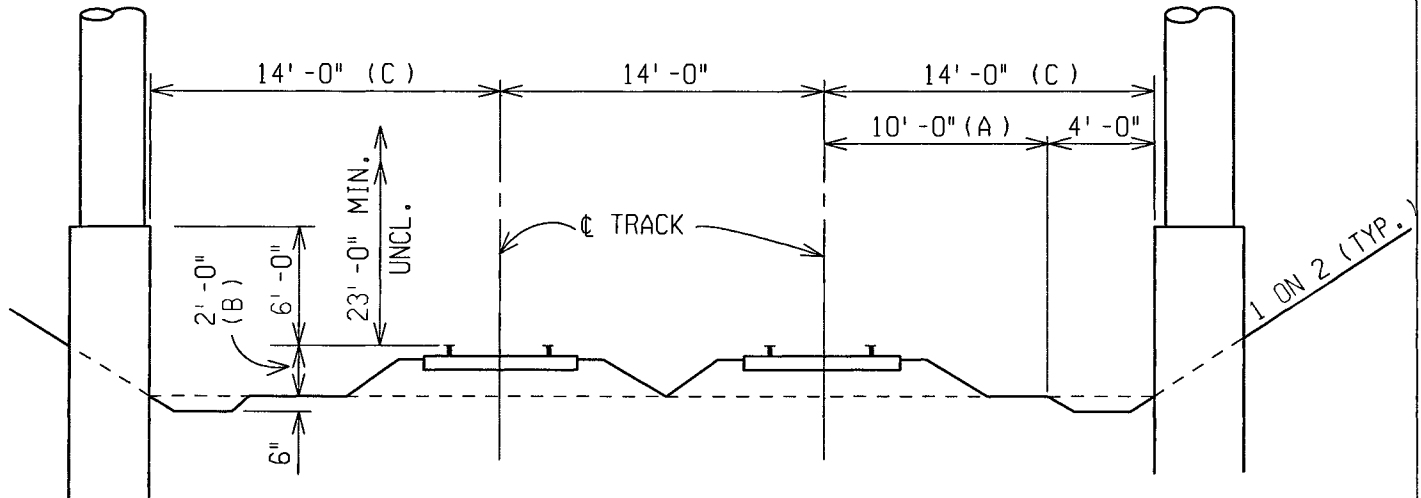
5.24.03

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

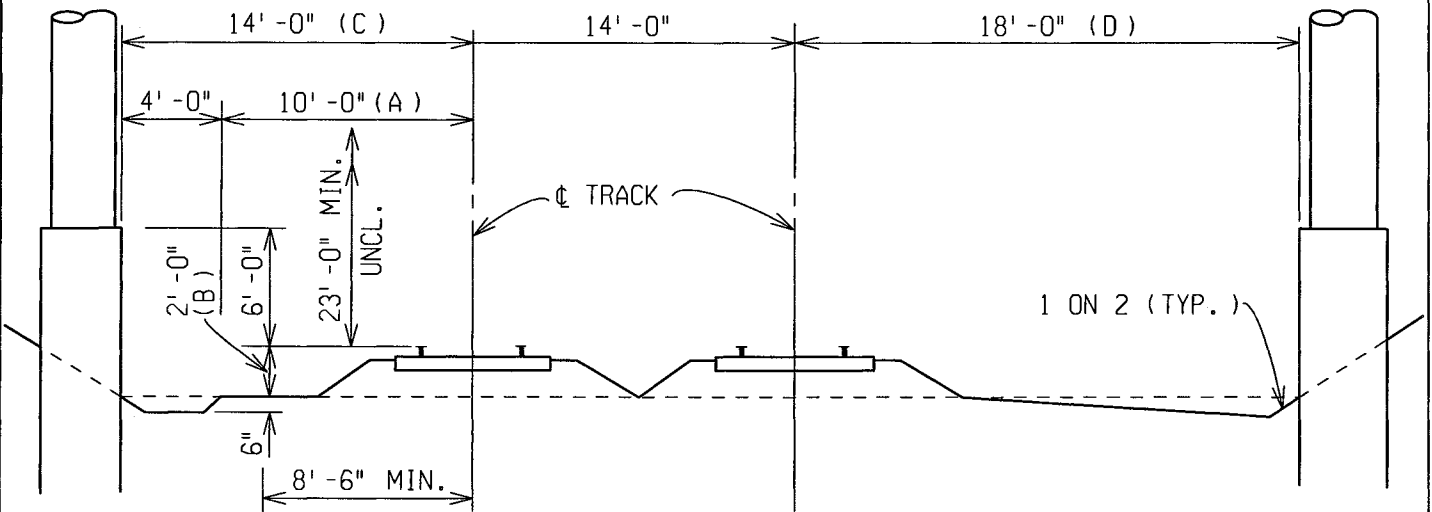
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

RAILROAD SIDE CLEARANCES  
 DOUBLE TRACK UNDER

ISSUED: 08/15/03  
 SUPERSEDES: 11/27/01



WITHOUT PROVISION FOR OFF-TRACK  
 MAINTENANCE EQUIPMENT



WITH PROVISION FOR OFF-TRACK  
 MAINTENANCE EQUIPMENT

SUBFTG, FTG, OR STEEL  
 SHEET PILING LINE

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

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

ABOVE VIEWS ARE AT RIGHT ANGLES TO TRACK

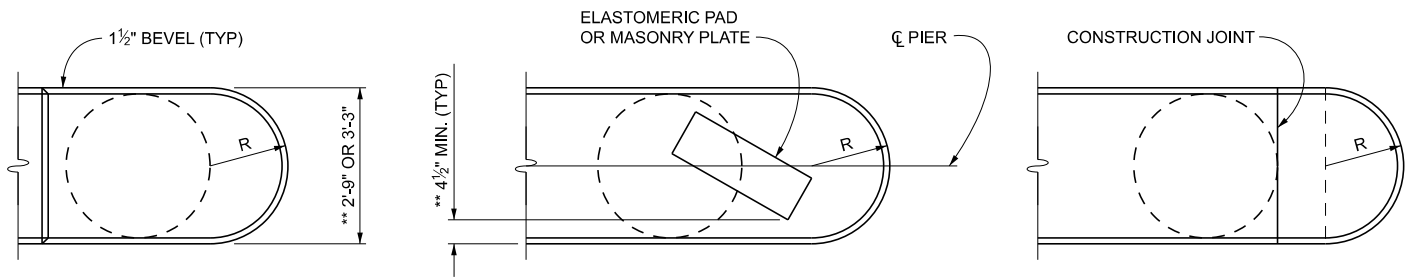
PREPARED BY  
 DESIGN SUPPORT AREA

5.24.04

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 PIER CAP DETAILS  
 ROUND COLUMN PIERS

ISSUED: 12/26/23  
 SUPERSEDES: 11/27/01



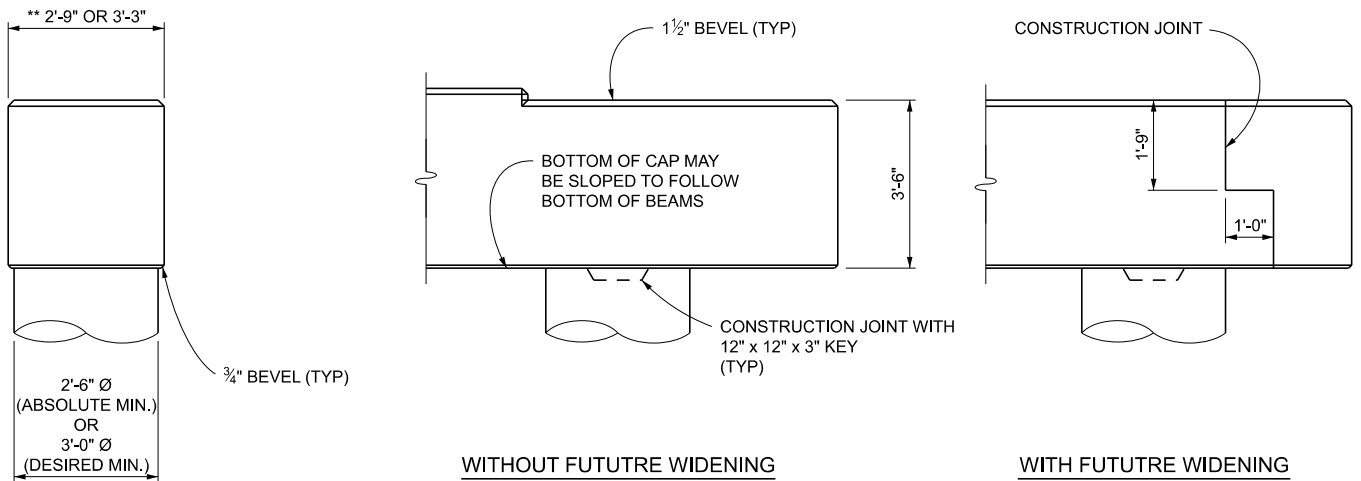
MIN. CANTILEVER WITHOUT FUTURE WIDENING

MIN. CANTILEVER WITH STRINGER ON CANTILEVER

MIN. CANTILEVER WITH FUTURE WIDENING

PLAN OF CAP

\*\* INCREASE WIDTH AS REQUIRED TO PROVIDE 4 1/2" CLEARANCE

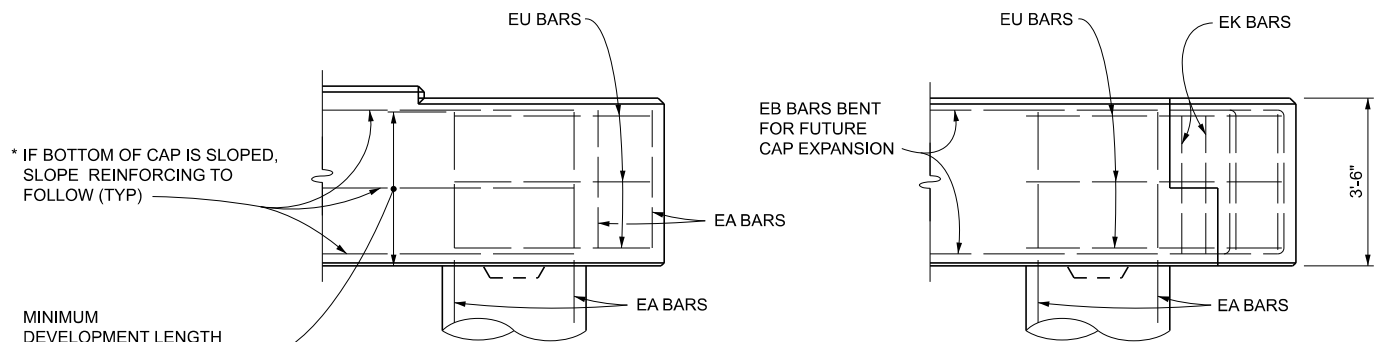


END VIEW

SIDE VIEW AT END OF CAP

WITHOUT FUTURE WIDENING

WITH FUTURE WIDENING



\* IF BOTTOM OF CAP IS SLOPED, SLOPE REINFORCING TO FOLLOW (TYP)

MINIMUM DEVELOPMENT LENGTH (SEE GUIDE 7.14.02 SERIES)

\* 1'-0" MAXIMUM SPACING

WITHOUT FUTURE WIDENING

WITH FUTURE WIDENING

CAP REINFORCEMENT

PREPARED BY  
 DESIGN DIVISION

5.27.03



DRAWN BY: MJB  
CHECKED BY: VZ  
APPROVED BY: TGF

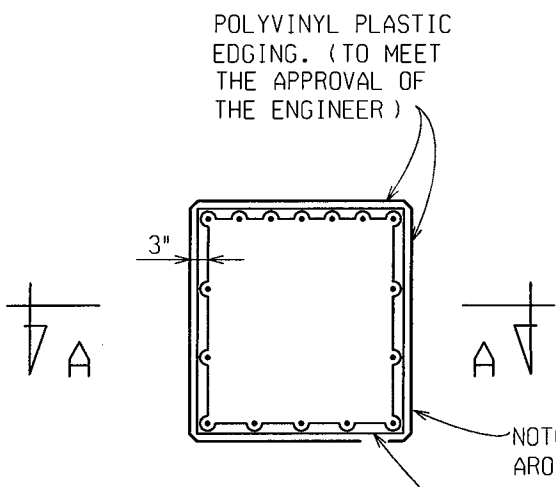
MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY TECHNICAL SERVICES

PARTIAL METAL BULKHEAD FOR  
PIER CAP CONSTRUCTION JOINT

ISSUED: 11/27/01  
SUPERSEDES: 04/15/95

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.

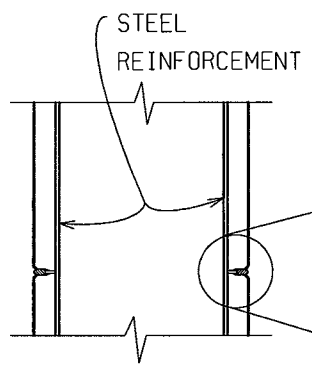


POLYVINYL PLASTIC EDGING. (TO MEET THE APPROVAL OF THE ENGINEER)

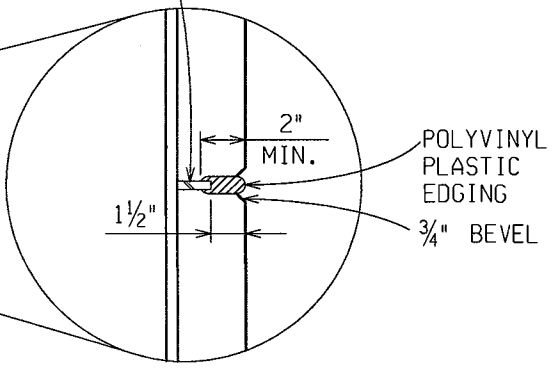
NOTCH METAL STRIP TO FIT AROUND REINFORCING STEEL.

SECTION THRU PIER CAP

STEEL OR ALUMINUM STRIP (16 GAGE TO 10 GAGE) SECURELY HELD IN PLACE (NO TACK WELDING TO REINFORCING STEEL).



SECTION A-A



PREPARED BY  
DESIGN DIV.

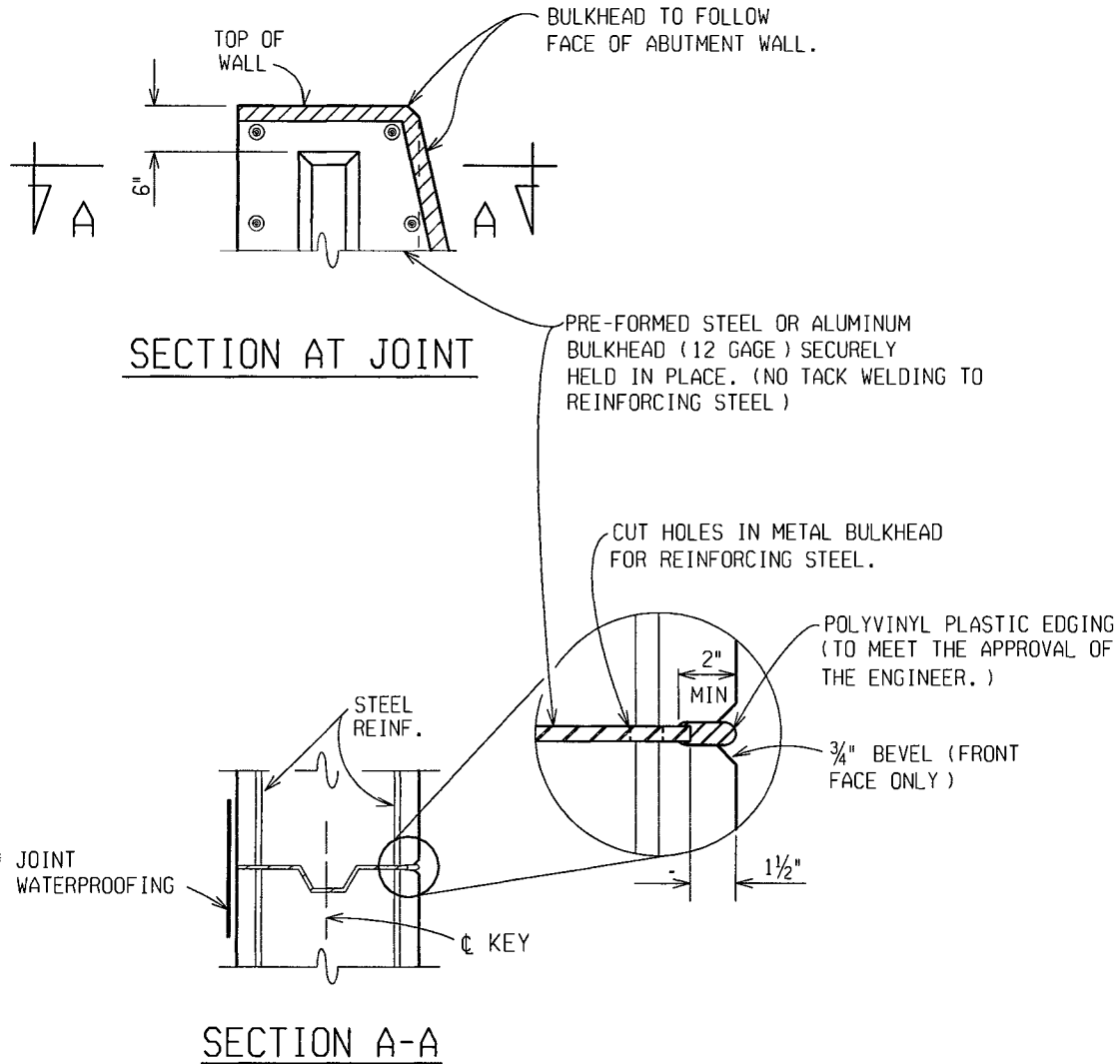
5.27.04

DRAWN BY: MJB  
CHECKED BY: VZ  
APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY TECHNICAL SERVICES

ISSUED: 11/27/01  
SUPERSEDES: 04/15/95

### METAL BULKHEAD FOR ABUTMENT CONSTRUCTION JOINT



#### 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.

\* PREFORMED WATERPROOFING MEMBRANE MAY BE USED AS AN ALTERNATE.

PREPARED BY  
DESIGN DIV.

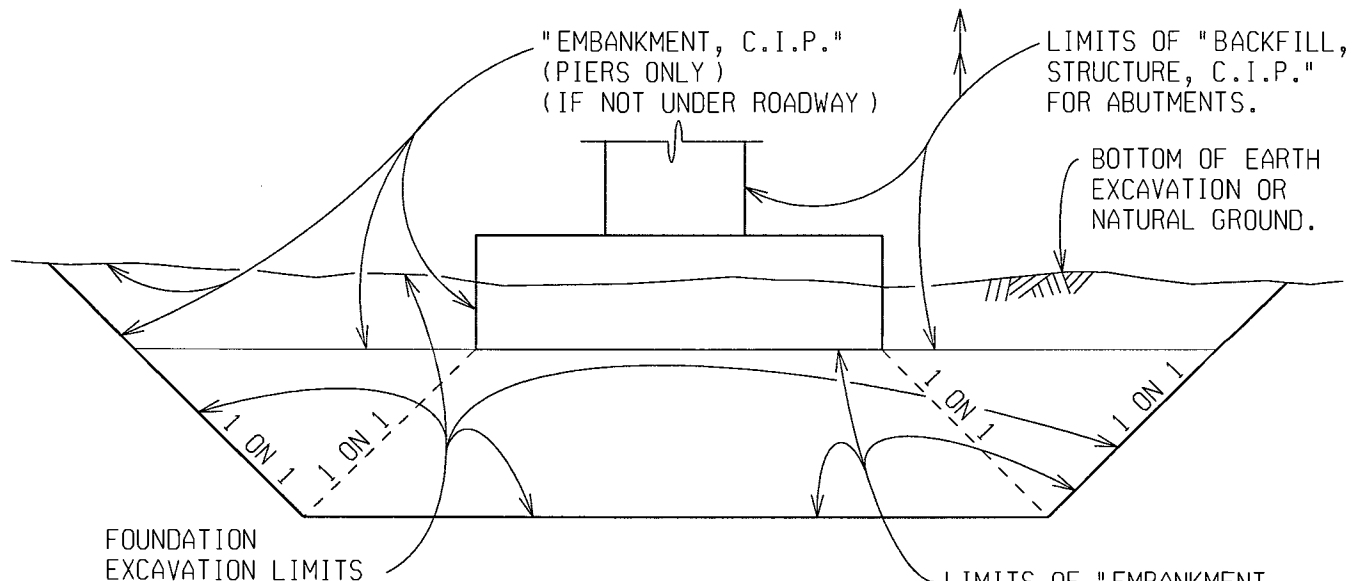
5.27.05

DRAWN BY: MJB  
 CHECKED BY: VZ  
 APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES

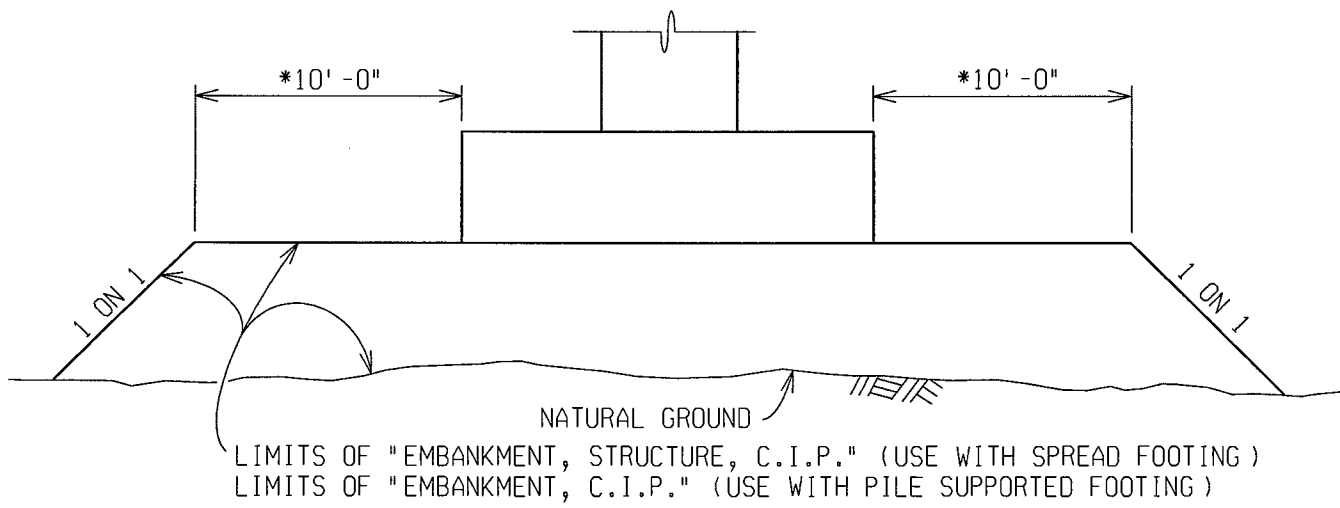
ISSUED: 11/27/01  
 SUPERSEDES: 05/24/99

COMPACTED MOUND UNDER FOOTING



SOIL CLASSIFIED AS \_\_\_ SHALL BE UNDERCUT AND REPLACED WITH "EMBANKMENT, STRUCTURE, C.I.P." 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

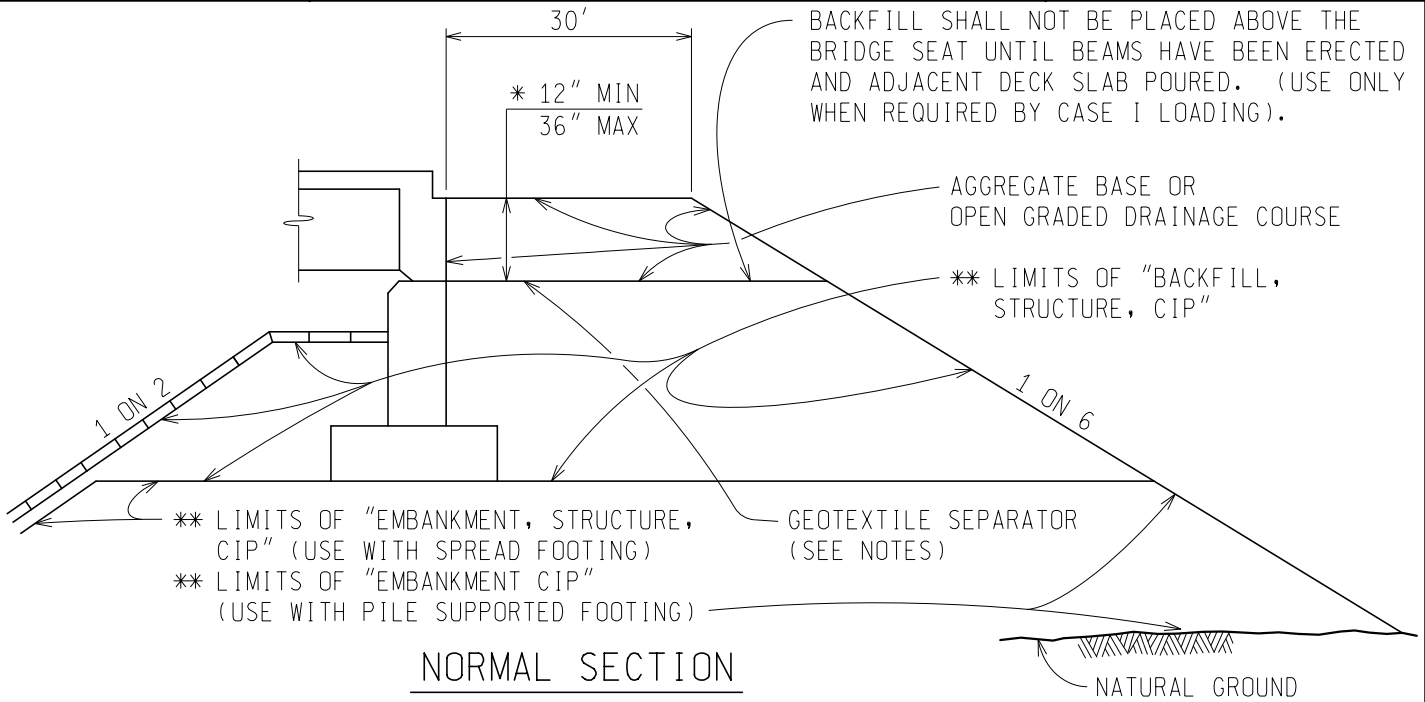
\* LIMITS FOR PIERS. FOR LIMITS FOR ABUTMENT, SEE GUIDE 5.46.01.

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

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: DAJ

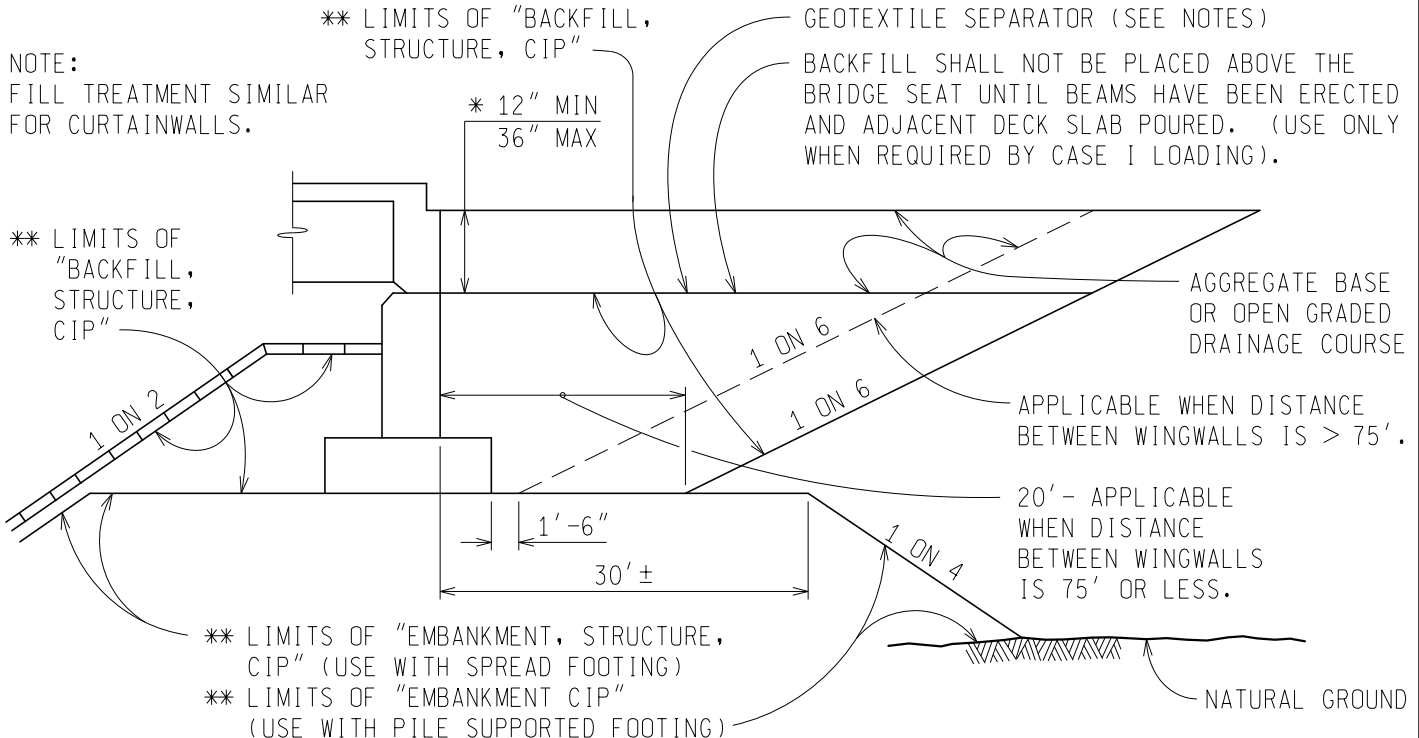
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT  
 STRUCTURE BACKFILL AND EMBANKMENT  
 ABUTMENTS ON FILL

ISSUED: 02/18/14  
 SUPERSEDES: 11/27/01



**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%.

\* 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.  
 \*\* QUANTITIES ARE INCLUDED IN BRIDGE QUANTITIES.

PREPARED BY  
 DESIGN DIVISION

5.46.01

DRAWN BY: MJB  
 CHECKED BY: VZ  
 APPROVED BY: TGF

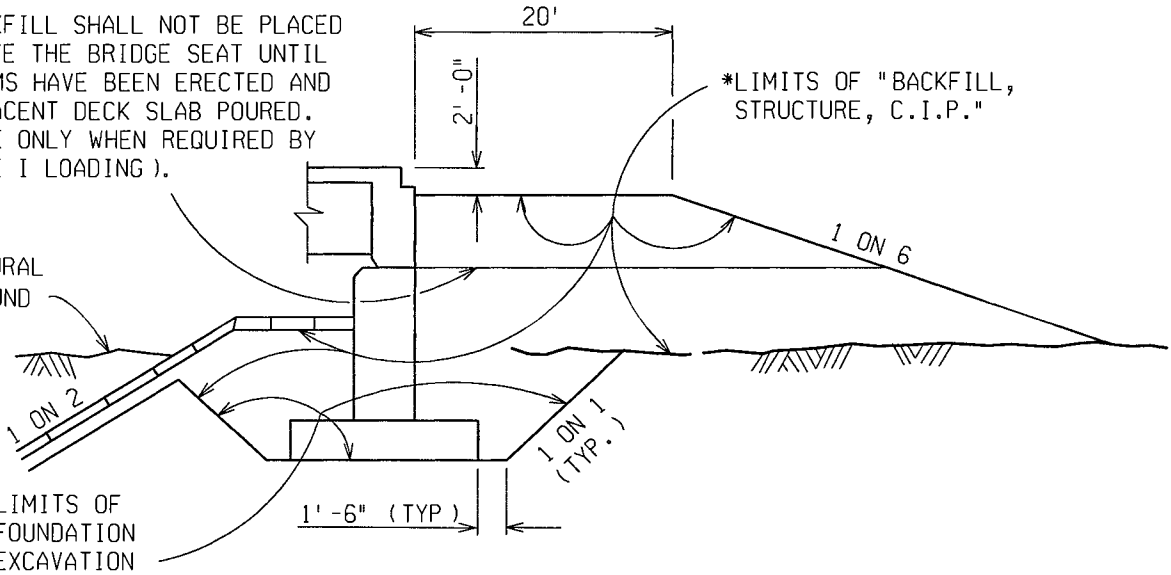
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES

ISSUED: 11/27/01  
 SUPERSEDES: 04/15/95

STRUCTURE BACKFILL AND EMBANKMENT  
 ABUTMENTS IN CUT

BACKFILL SHALL NOT BE PLACED ABOVE THE BRIDGE SEAT UNTIL BEAMS HAVE BEEN ERECTED AND ADJACENT DECK SLAB POURED. (USE ONLY WHEN REQUIRED BY CASE I LOADING).

NATURAL GROUND

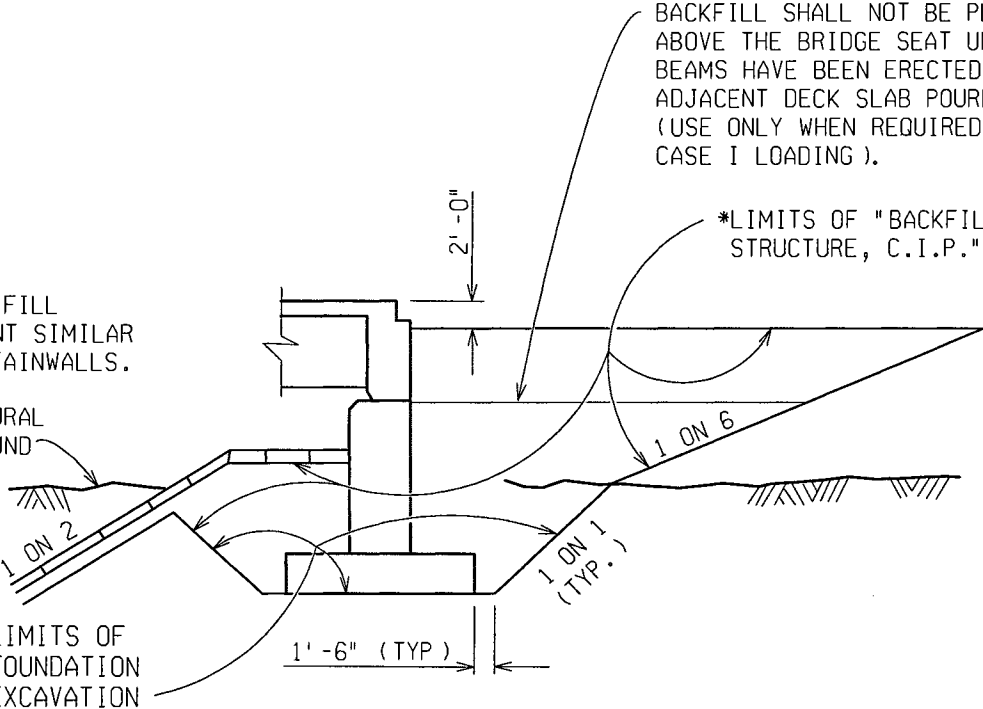


NORMAL SECTION

BACKFILL SHALL NOT BE PLACED ABOVE THE BRIDGE SEAT UNTIL BEAMS HAVE BEEN ERECTED AND ADJACENT DECK SLAB POURED. (USE ONLY WHEN REQUIRED BY CASE I LOADING).

NOTE:  
 CUT AND FILL TREATMENT SIMILAR FOR CURTAINWALLS.

NATURAL GROUND



SPECIAL SECTION IF REQUESTED BY CONSTRUCTION

NOTES:

\* QUANTITIES ARE INCLUDED IN BRIDGE QUANTITIES.

FOR ADDITIONAL INFORMATION SEE GUIDE 3.25.01.

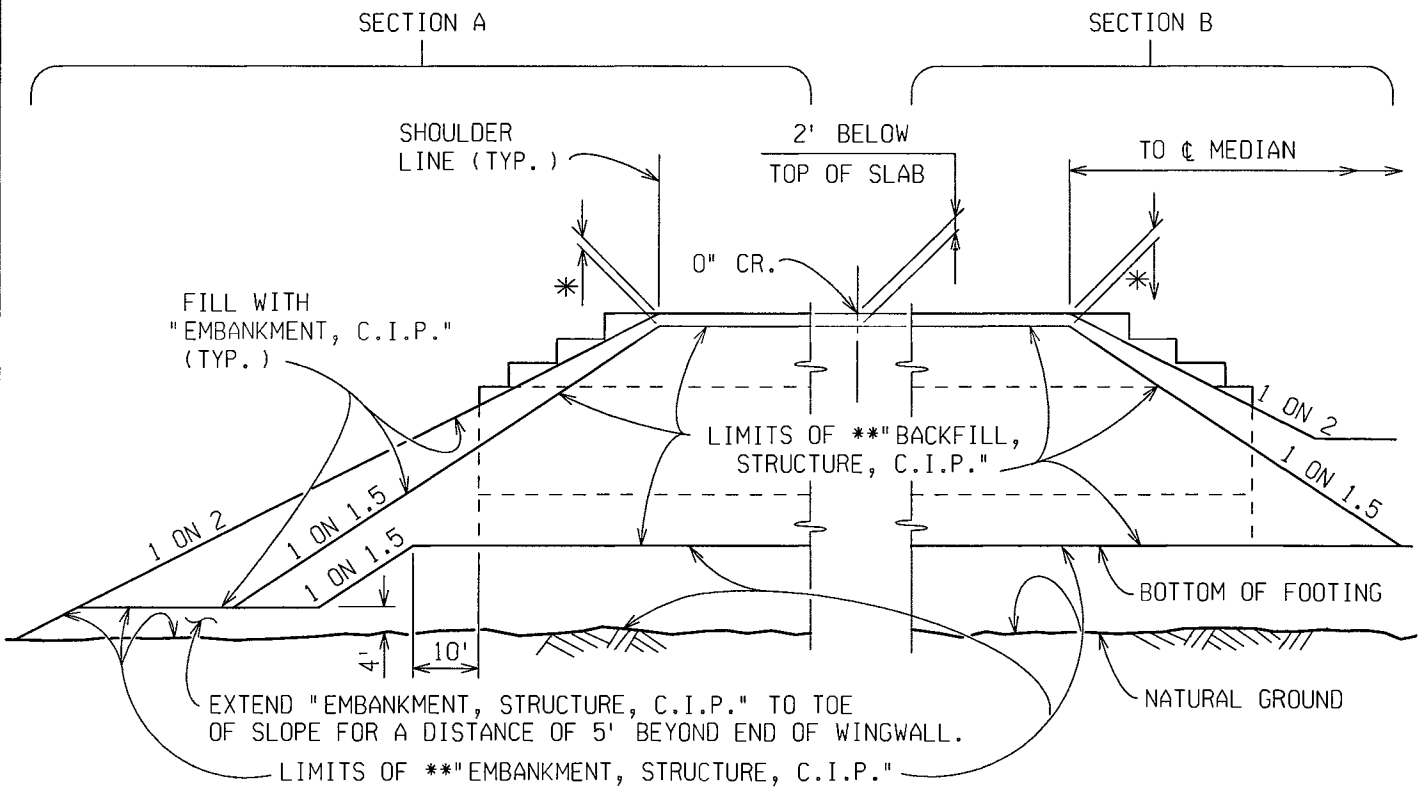
PREPARED BY  
 DESIGN DIV.

5.46.02

DRAWN BY: MJB  
 CHECKED BY: VZ  
 APPROVED BY: TGF

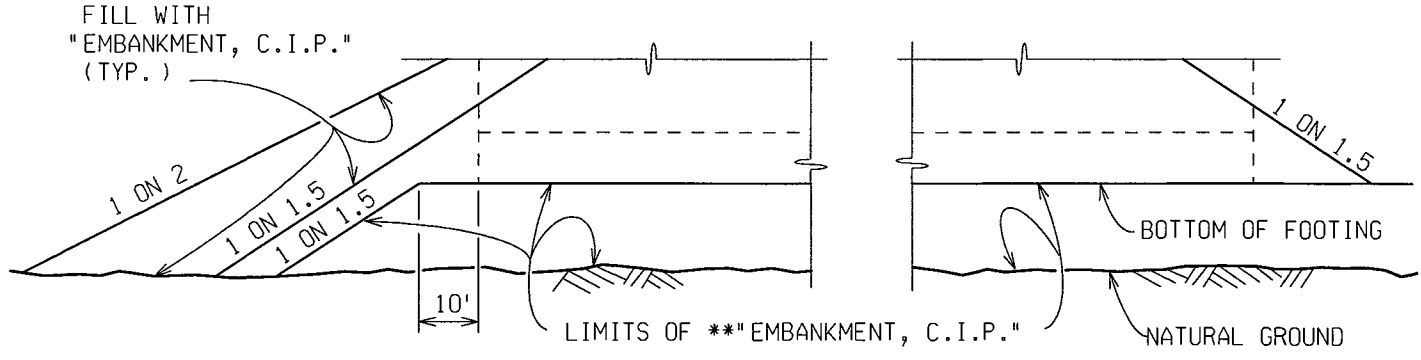
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES  
 STRUCTURE BACKFILL AND EMBANKMENT  
 FOR ABUTMENTS ON FILL (SLOPE WALLS)

ISSUED: 11/27/01  
 SUPERSEDES: 05/24/99



**SECTION THRU BACKFILL NEAR ABUTMENTS**

USE WITH SPREAD FOOTING



**SECTION THRU BACKFILL NEAR ABUTMENTS**

USE WITH PILE SUPPORTED FOOTING

**NOTES:**

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

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

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

FOR SINGLE ROADWAY - SECTION A SHOULD APPEAR ON PLANS.

\*\*QUANTITIES ARE INCLUDED IN BRIDGE QUANTITIES.

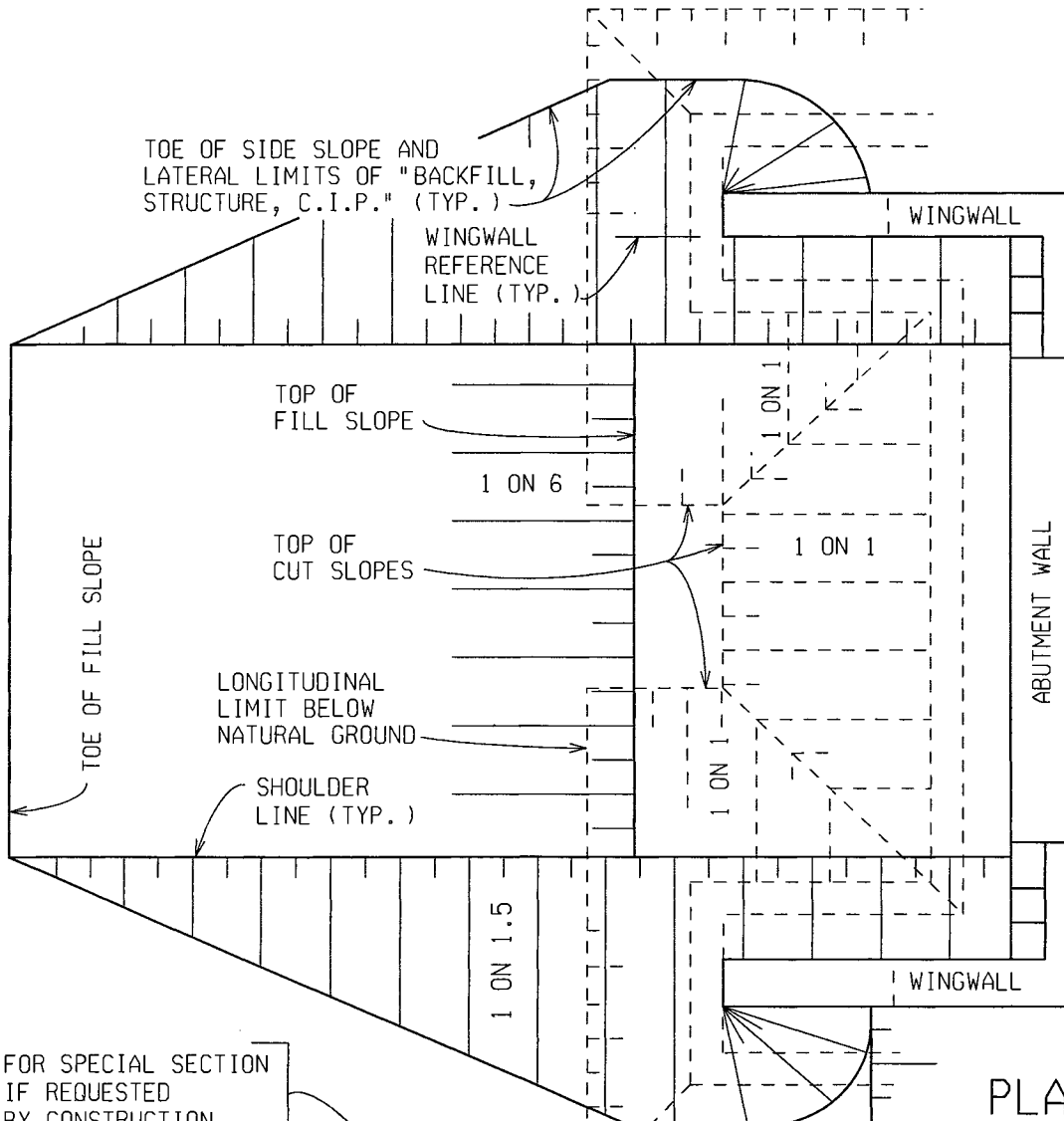
PREPARED BY DESIGN DIV. 5.46.03

DRAWN BY: MJB  
CHECKED BY: VZ  
APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY TECHNICAL SERVICES

STRUCTURE BACKFILL FOR  
ABUTMENTS IN CUT

ISSUED: 11/27/01  
SUPERSEDES: 04/15/95

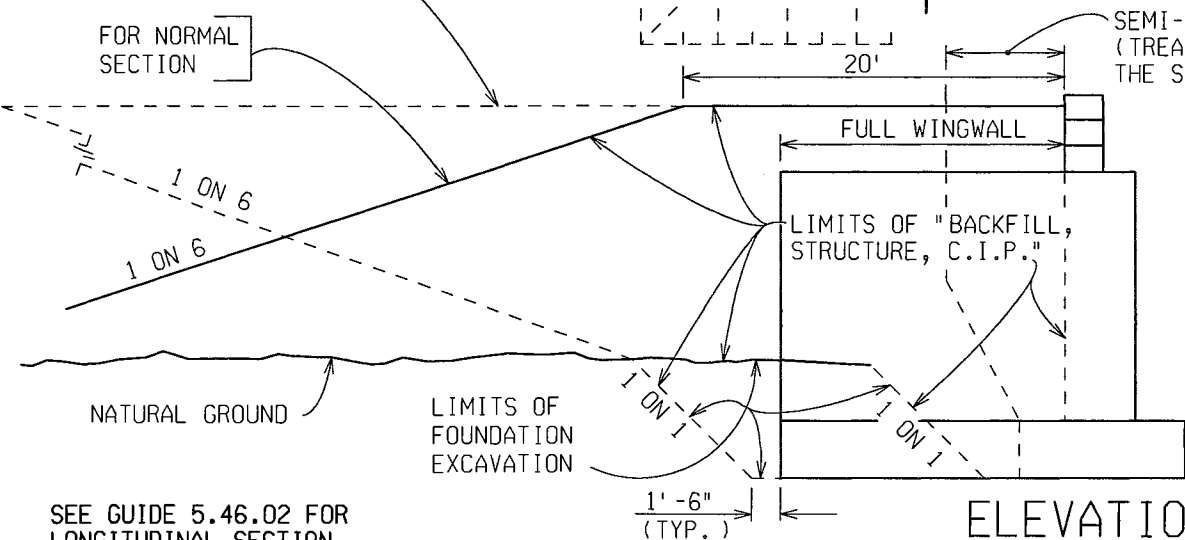


PLAN VIEW

FOR SPECIAL SECTION  
IF REQUESTED  
BY CONSTRUCTION

FOR NORMAL  
SECTION

SEMI-RETURN WINGWALL  
(TREAT FILL LIMITS  
THE SAME)



ELEVATION VIEW

SEE GUIDE 5.46.02 FOR  
LONGITUDINAL SECTION

PREPARED BY  
DESIGN DIV.

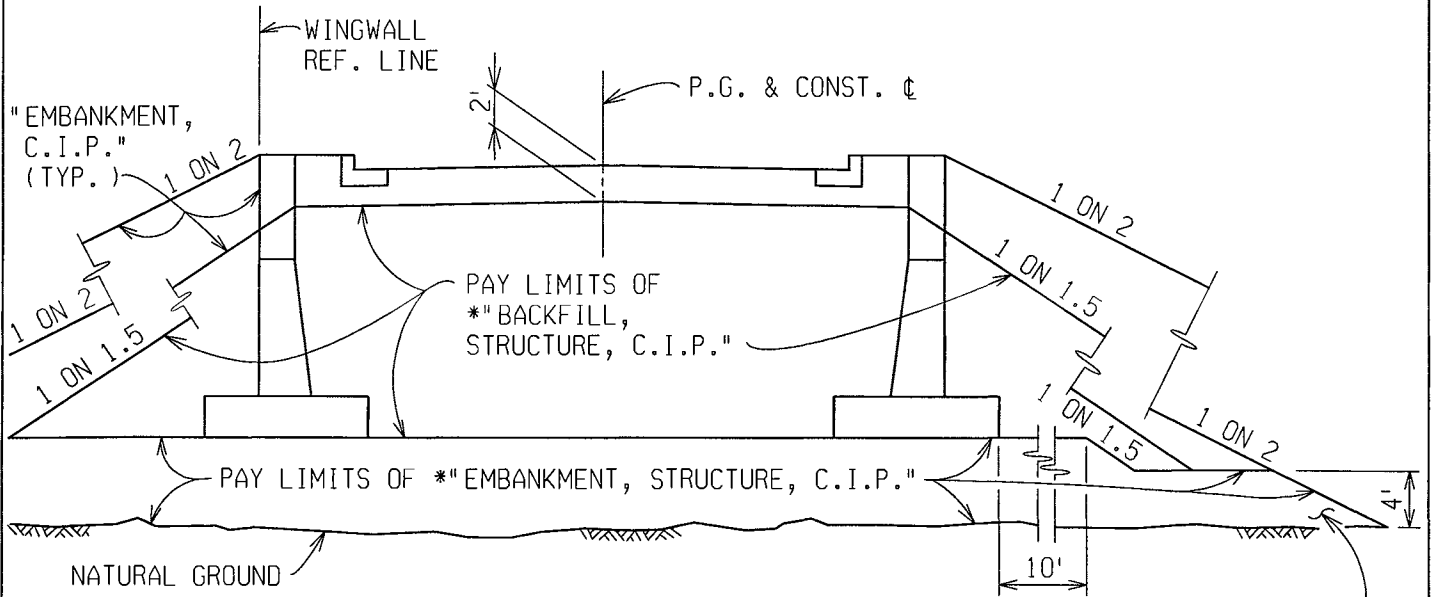
5.46.04

DRAWN BY: MJB  
 CHECKED BY: VZ  
 APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES

STRUCTURE BACKFILL AND EMBANKMENT FOR  
 ABUTMENT WITH RETURN WINGS & ON FILL

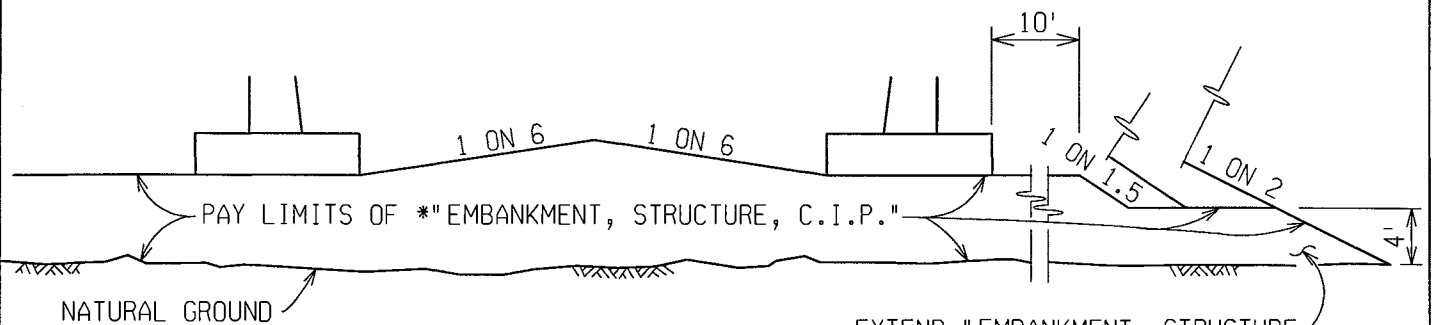
ISSUED: 11/27/01  
 SUPERSEDES: 05/24/99



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.

EXTEND "EMBANKMENT, STRUCTURE,  
 C.I.P." TO TOE OF SLOPE FOR  
 A DISTANCE OF 5' BEYOND END  
 OF RETURN WINGS.



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' .

EXTEND "EMBANKMENT, STRUCTURE,  
 C.I.P." TO TOE OF SLOPE FOR  
 A DISTANCE OF 5' BEYOND END  
 OF RETURN WINGS.

NOTES:

\*QUANTITIES ARE INCLUDED IN BRIDGE QUANTITIES.

PREPARED BY  
 DESIGN DIV.

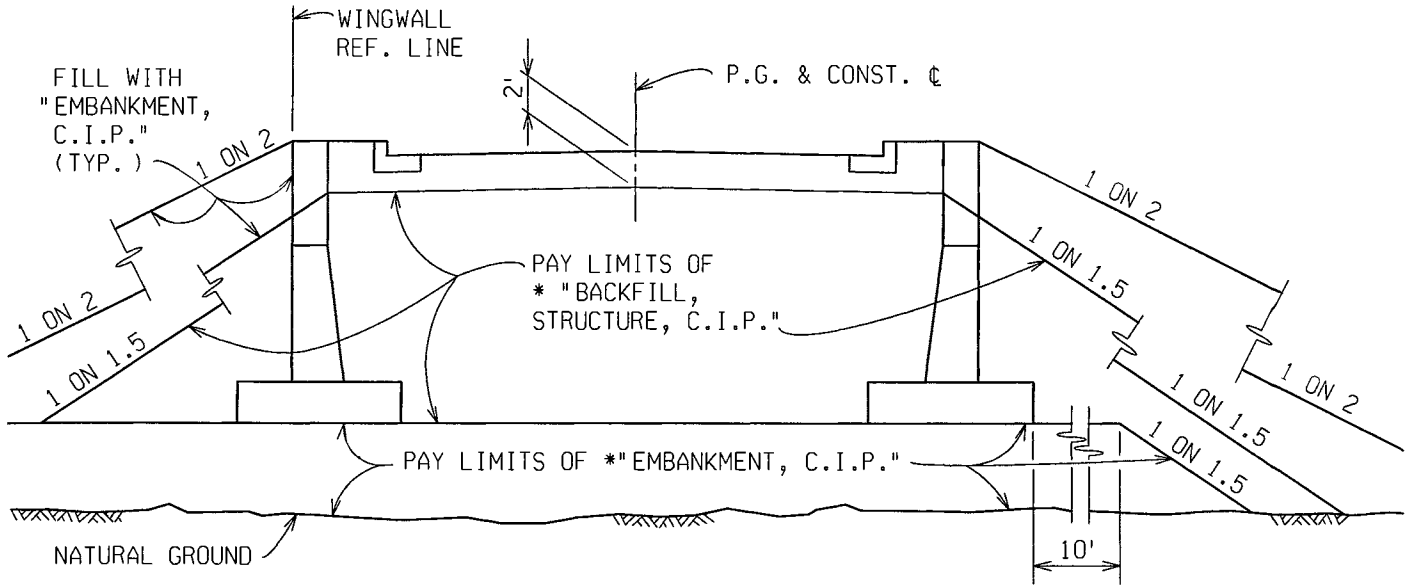
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 CHECKED BY: VZ  
 APPROVED BY: TGF

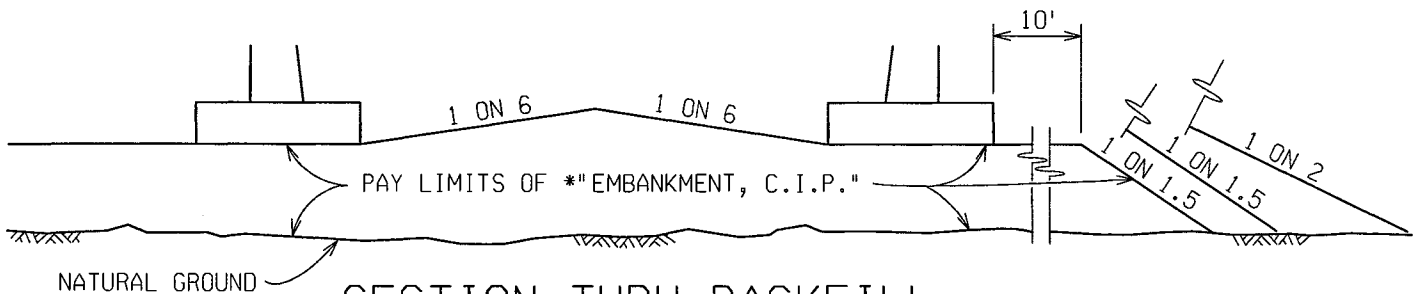
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES  
 STRUCTURE BACKFILL AND EMBANKMENT FOR  
 ABUTMENT WITH RETURN WINGS & ON FILL

ISSUED: 11/27/01  
 SUPERSEDES: 05/24/99



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, C.I.P." IS USED, PLANS SHOULD SHOW DETAILS AND QUANTITIES FOR FOUNDATION DRAINS. SEE GUIDE 3.25.01 FOR PLACEMENT DETAILS.

\* QUANTITIES ARE INCLUDED IN BRIDGE QUANTITIES.

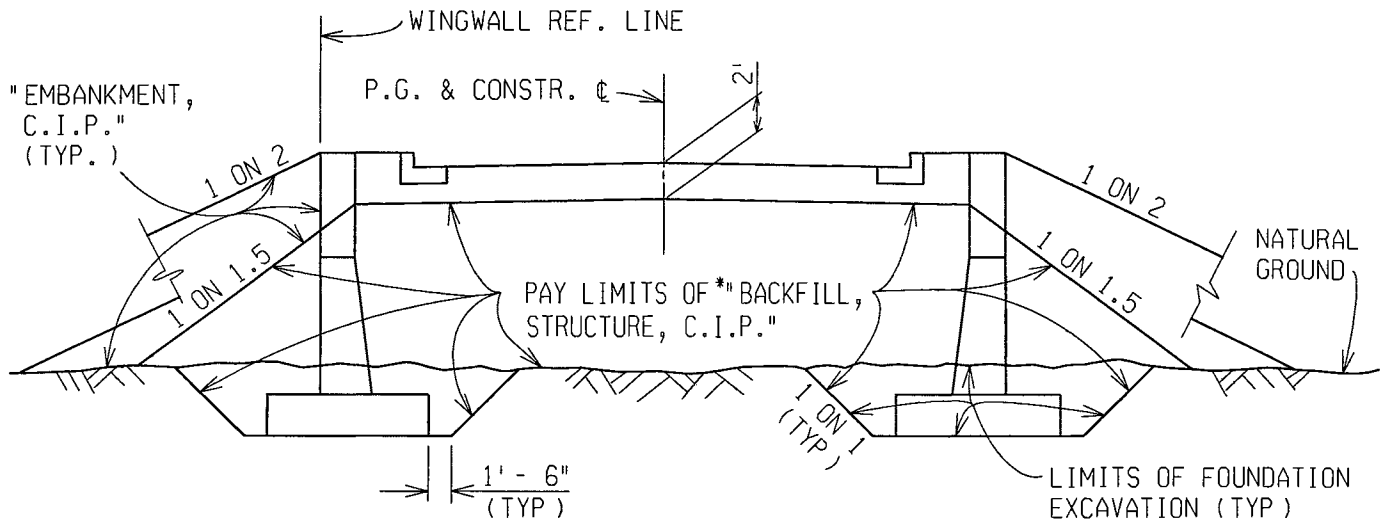
PREPARED BY  
 DESIGN DIV.

5.46.05A

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CHECKED BY: VZ  
APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY TECHNICAL SERVICES  
STRUCTURE BACKFILL AND FOUNDATION EXCAVATION  
FOR ABUTMENT WITH RETURN WINGS & IN CUT

ISSUED: 11/27/01  
SUPERSEDES: 04/24/99



SECTION THRU BACKFILL

NOTES:  
\*QUANTITIES ARE INCLUDED IN BRIDGE QUANTITIES

PREPARED BY  
DESIGN DIV.

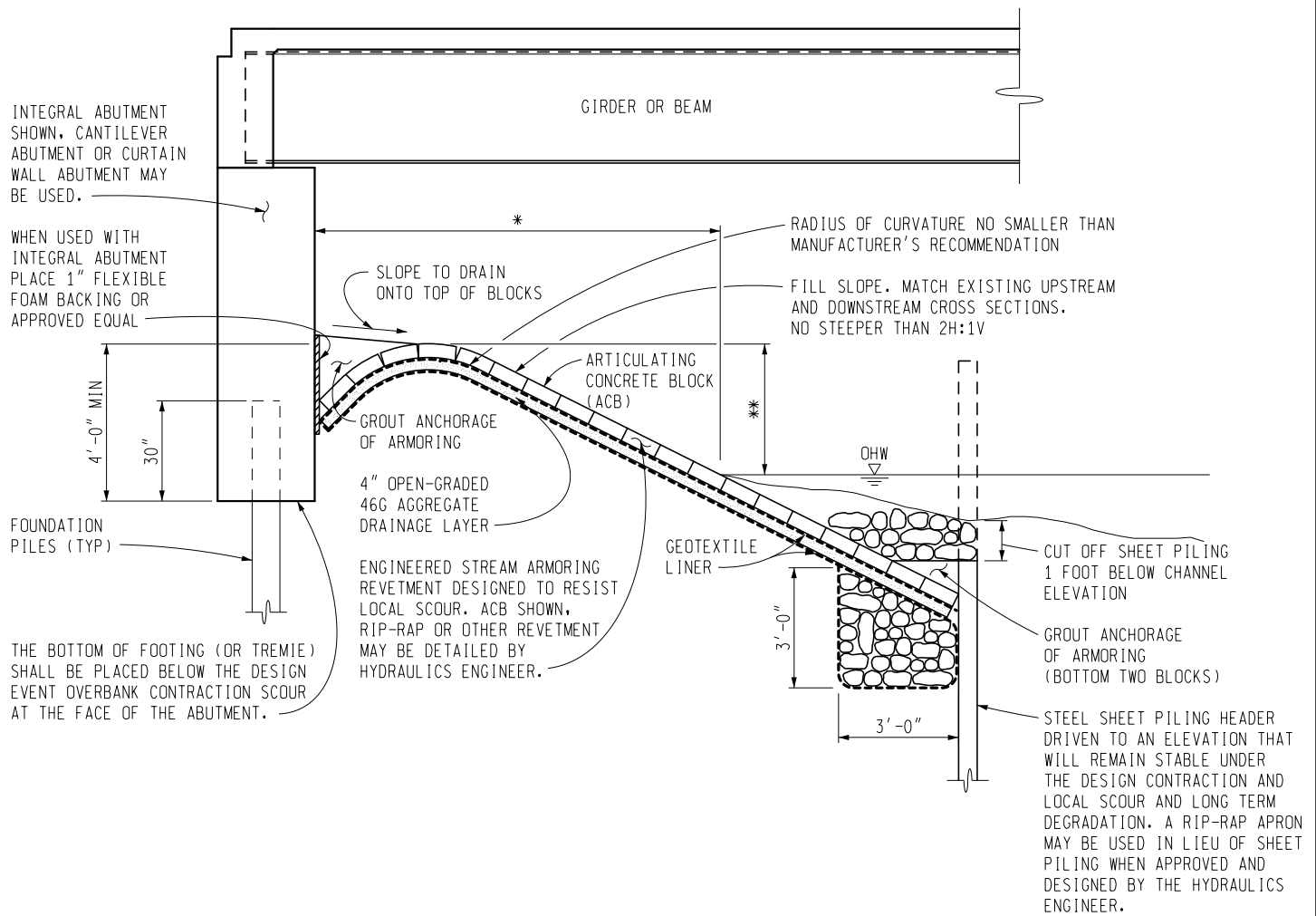
5.46.06

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 CHECKED BY: VZ  
 APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

PROTECTION OF  
 SPILL-THROUGH ABUTMENT

ISSUED: 05/22/23  
 SUPERSEDES: 09/24/18



**PROTECTION OF SPILL-THROUGH ABUTMENT**

- \* 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).
- \*\* 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:

BLANK

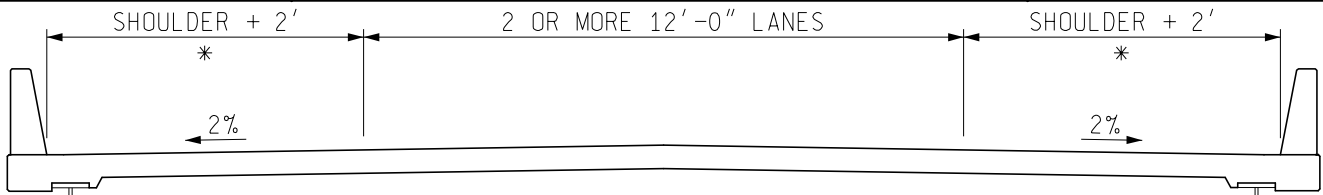
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DESIGN DIVISION

DRAWN BY: BLT  
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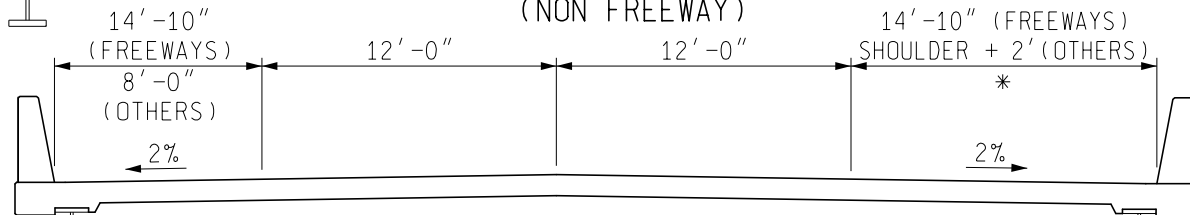
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 BRIDGE CROSS SECTIONS  
 NEW CONSTRUCTION/RECONSTRUCTION

ISSUED: 12/16/19  
 SUPERSEDES: 01/28/19



2 OR MORE LANES TWO-WAY

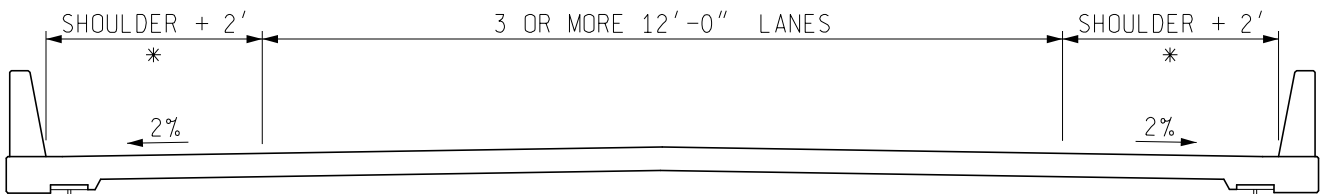
(NON FREEWAY)



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

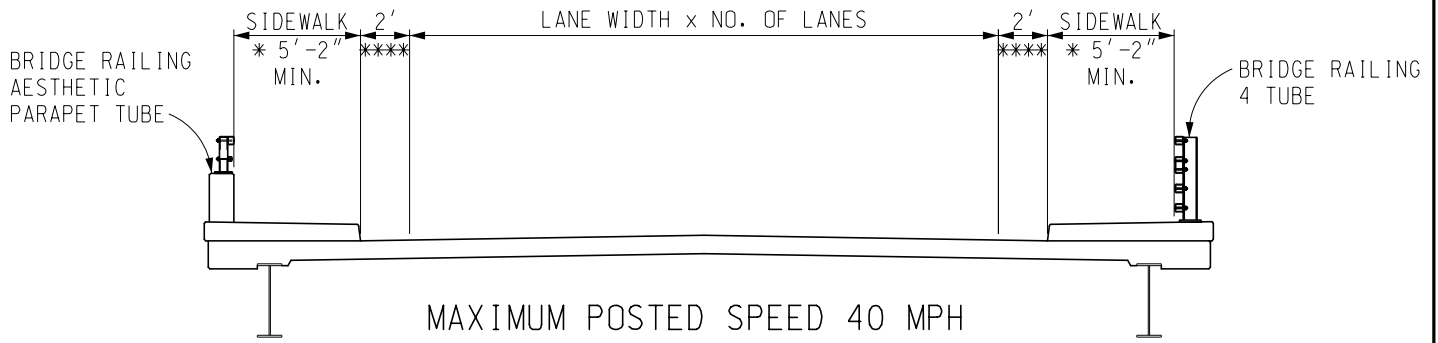
6.05.01A



DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: BMW

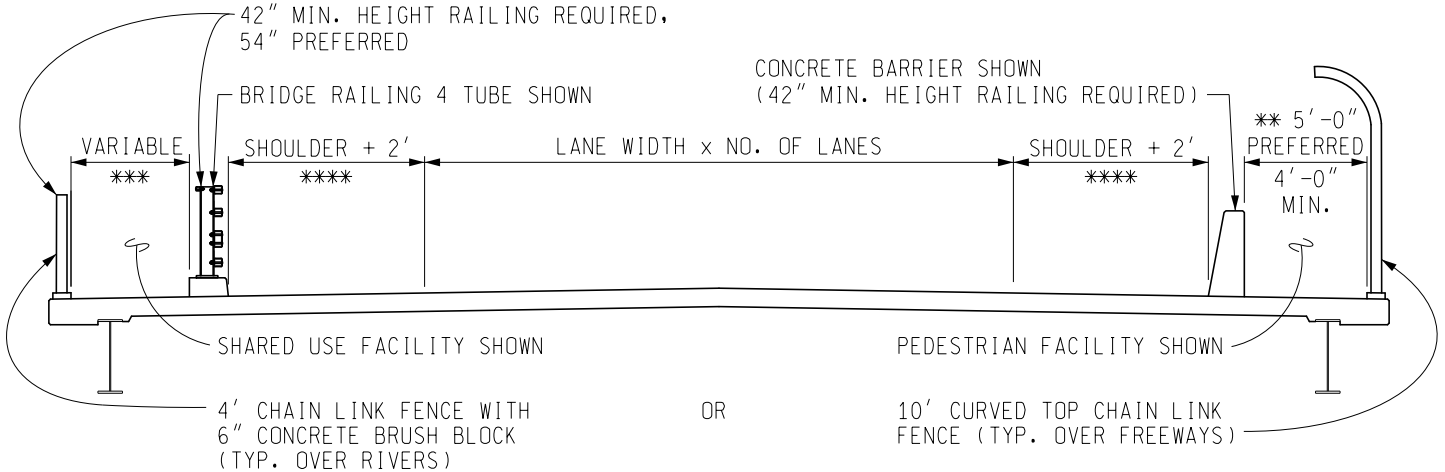
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 BRIDGE CROSS SECTIONS  
 TRUNKLINE, COUNTY & CITY BRIDGES

ISSUED: 12/16/19  
 SUPERSEDES: 08/21/17

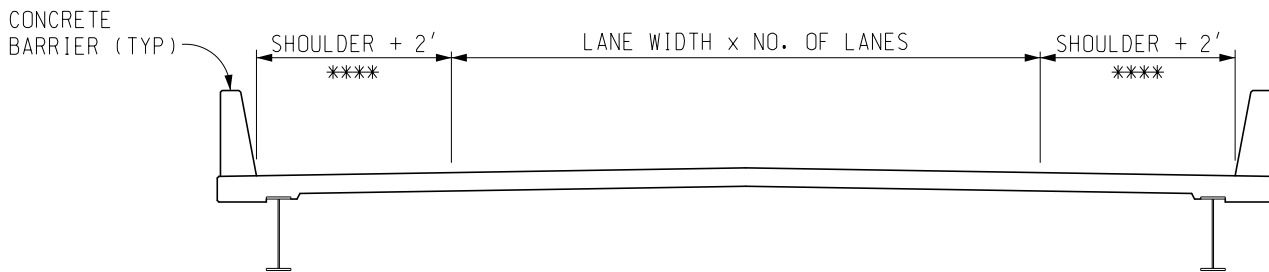


**MAXIMUM POSTED SPEED 40 MPH  
 PEDESTRIAN FACILITY REQUIRED**

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 THROUGHOUT.

\*\*\* 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 MDT JURISDICTIONAL FACILITY/ROADWAY.

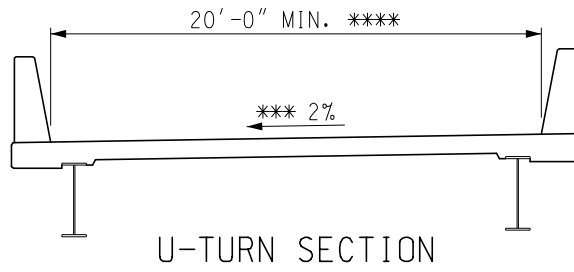
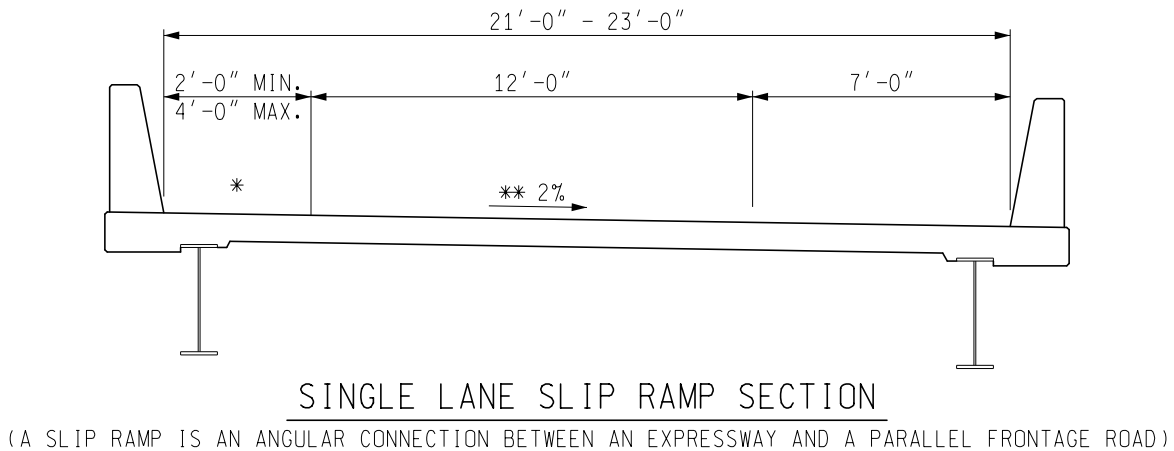
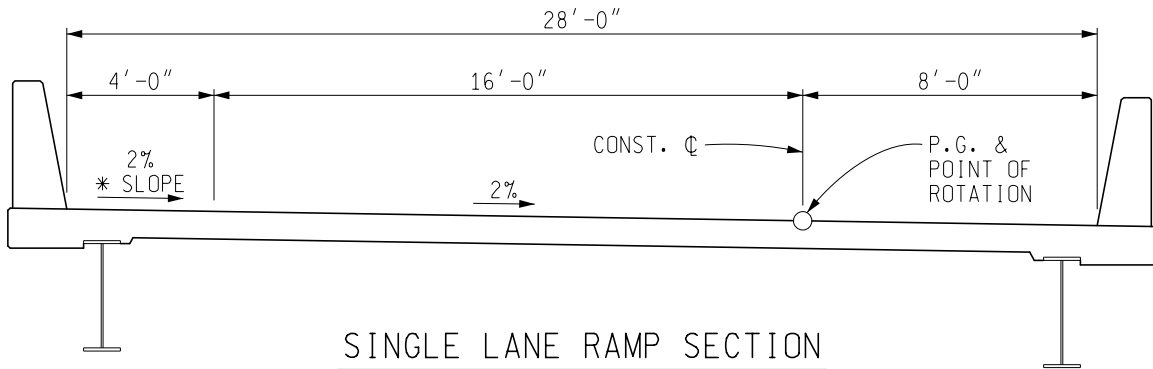
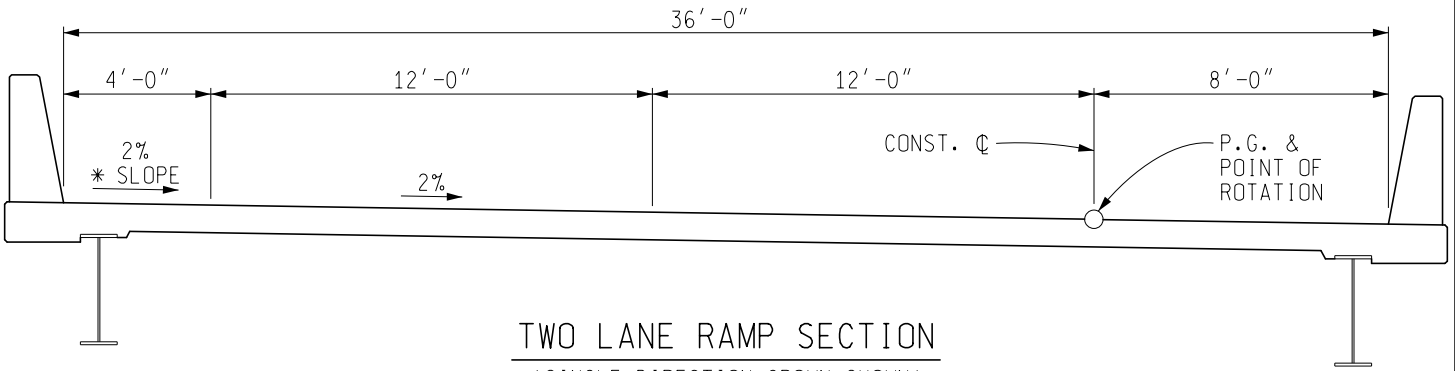
WHERE AN AUXILIARY LANE ON THE STRUCTURE IS A CONTINUATION OF A RAMP, MATCH THE RAMP SHOULDER AS THE LATERAL CLEARANCE TO THE BRIDGE RAIL. USE 4' (TOTAL) MAX ON LEFT AND 8' (TOTAL) MAX. ON RIGHT.

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



**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

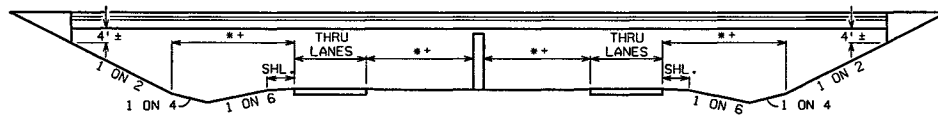
6.05.03

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

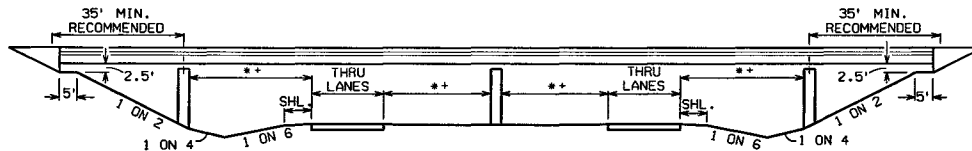
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

SUBSTRUCTURE CLEARANCES  
 RURAL STATE TRUNKLINES

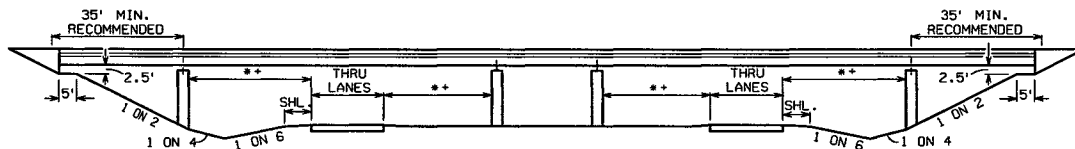
ISSUED: 08/15/03  
 SUPERSEDES: 11/27/01



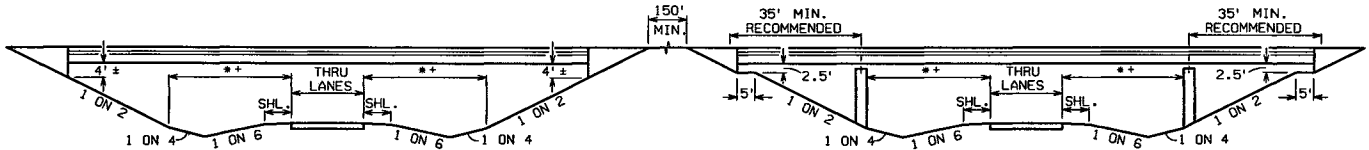
90° CROSSING OR MODERATELY SKEWED



SHARPLY SKEWED



SPREAD ROADWAYS - SINGLE STRUCTURE



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 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.

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.

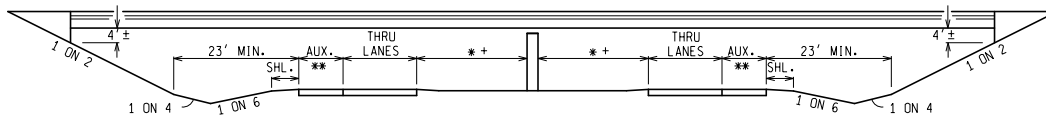
ALL DIMENSIONS ARE AT RIGHT ANGLES TO ROADWAY

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: T&F

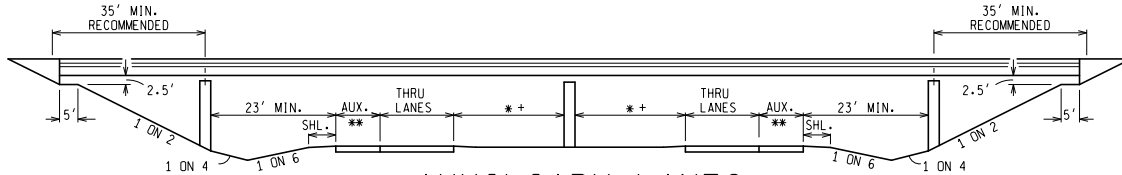
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

SUBSTRUCTURE CLEARANCES  
 RURAL STATE TRUNKLINES

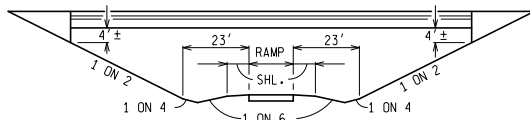
ISSUED: 02/14/11  
 SUPERSEDES: 08/15/03



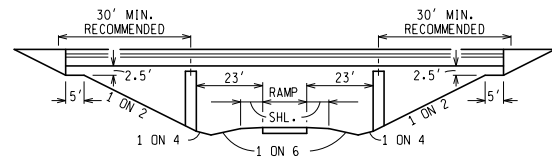
AUXILIARY LANES  
 90° CROSSING OR MODERATELY SKEWED



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

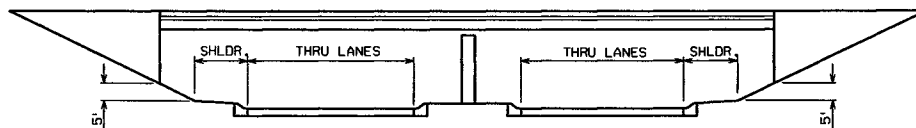
6.06.02

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

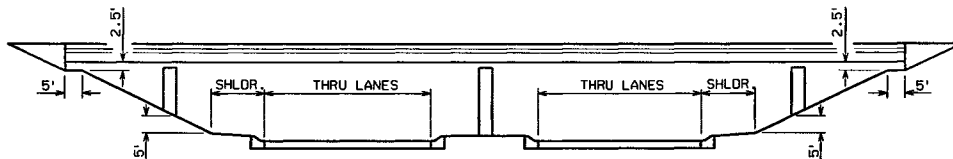
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

SUBSTRUCTURE CLEARANCES  
 URBAN STATE TRUNKLINES

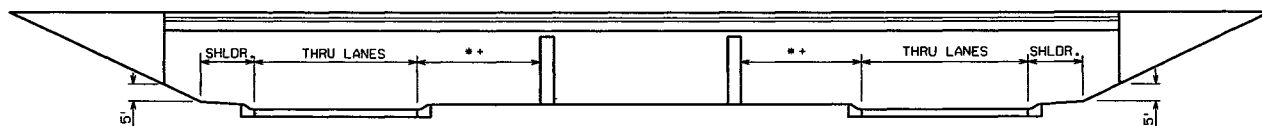
ISSUED: 08/15/03  
 SUPERSEDES: 11/27/01



90° CROSSING OR MODERATELY SKEWED



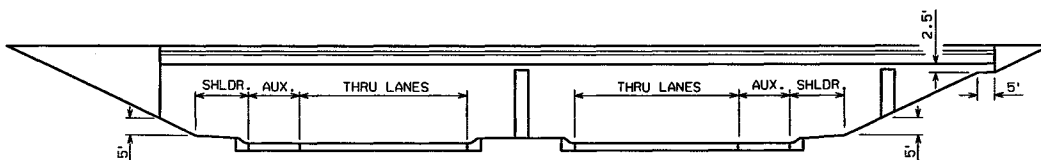
SHARPLY SKEWED



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.

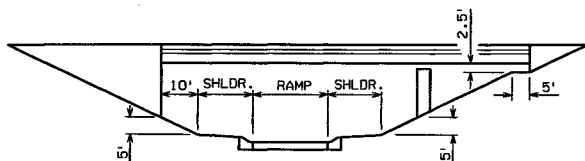
+ IF DISTANCE TO PIER OR TOE OF 1-ON-2 SLOPE IS LESS THAN THE CLEAR ZONE DISTANCE PROVIDE GUARDRAIL PROTECTION OF PIER OR SLOPE.



WITHOUT TAIL SPANS

WITH TAIL SPANS

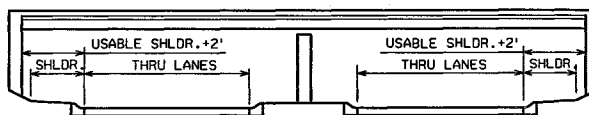
AUXILIARY LANES



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.

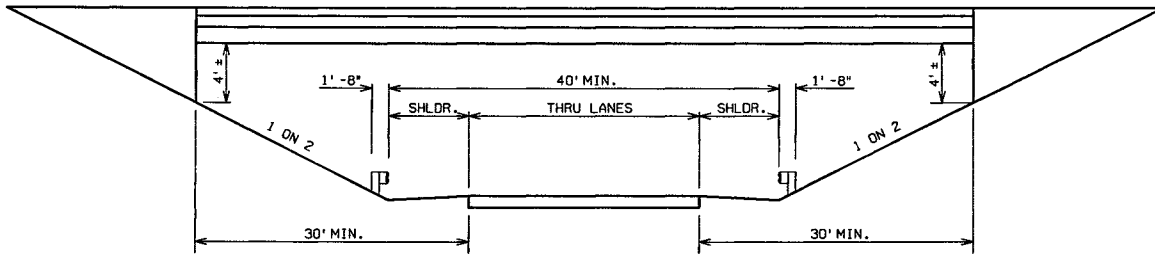
PREPARED BY  
 DESIGN SUPPORT AREA

6.06.03

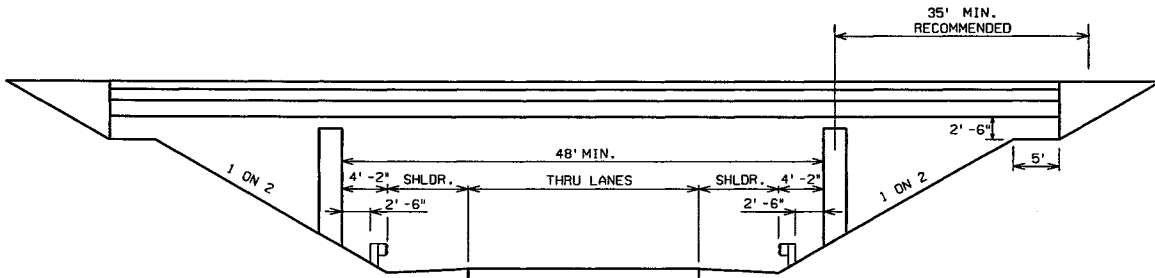
DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT  
 SUBSTRUCTURE CLEARANCES  
 COUNTY ROAD AND CITY STREET UNDER

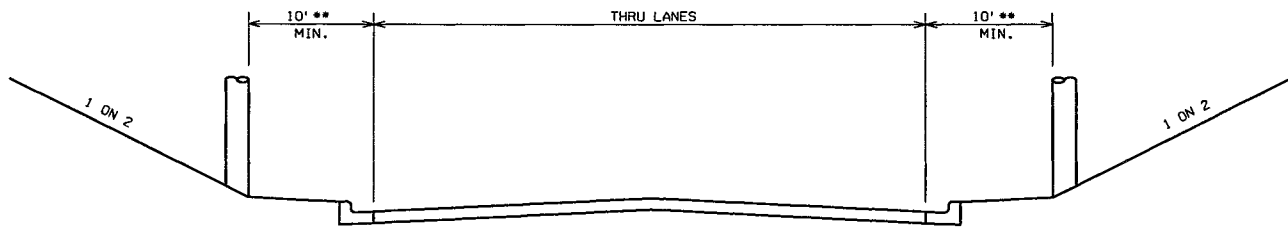
ISSUED: 08/15/03  
 SUPERSEDES: 11/27/01



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.

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

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

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

STRAIGHT LINE SUPERELEVATION

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

RADIUS Feet	30 mph		35 mph		40 mph		45 mph		50 mph		55 mph		60 mph		65 mph		70 mph		75 mph		Urban Freeways and Urban Ramps			
	e	Δ%	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.	--	N.C.	--
17000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--
14000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--
12000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--
10000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--
8000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--
6000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--
5000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--
4000	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--
3500	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--	N.C.	--
3000	2.0	0.50	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45
2500	2.0	0.50	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45
2050	2.0	0.50	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45
1800	2.0	0.50	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45
1675	2.0	0.50	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45
1425	2.0	0.50	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45	2.0	0.45
1350	2.0	0.50	2.0	0.45	2.2	0.41	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																						
Δ% max		0.66		0.62		0.58		0.54		0.50		0.47		0.45		0.43		0.40		0.38				
Rmin		232		340		485		643		833		1061		1333		1657		2042		2500				1412

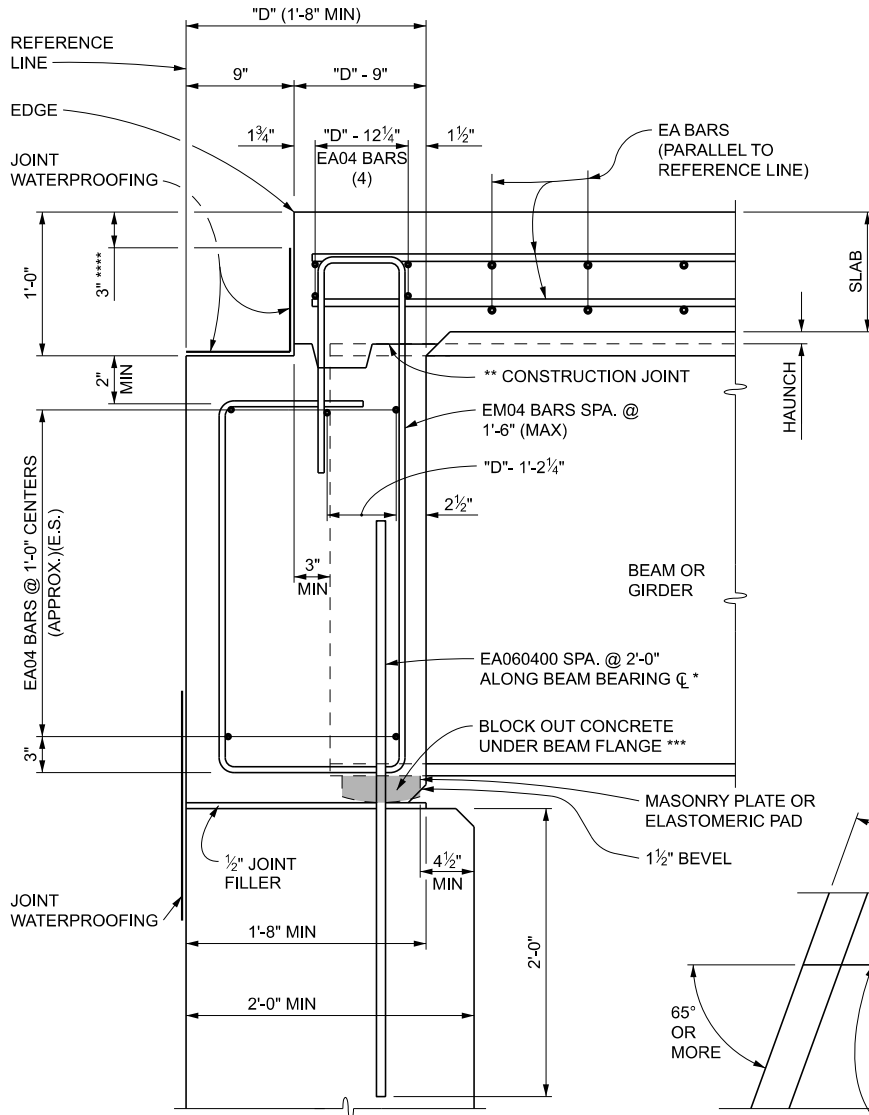
Use 7% superelevation for loop ramps (see Standard Plan R-107-Series). However, special consideration should be given to curves which approach a ramp terminal (stopping condition). If relative gradient (Δ%) values from the tables cannot be obtained for the design radius, use Δ% max for the corresponding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



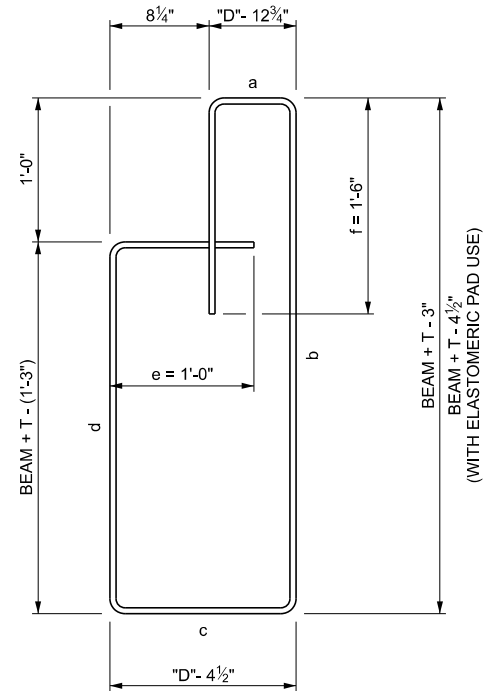
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 CHECKED BY: VZ  
 APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 TYPICAL SECTION THRU DEPENDENT BACKWALL

ISSUED: 06/24/24  
 SUPERSEDES: 01/23/23

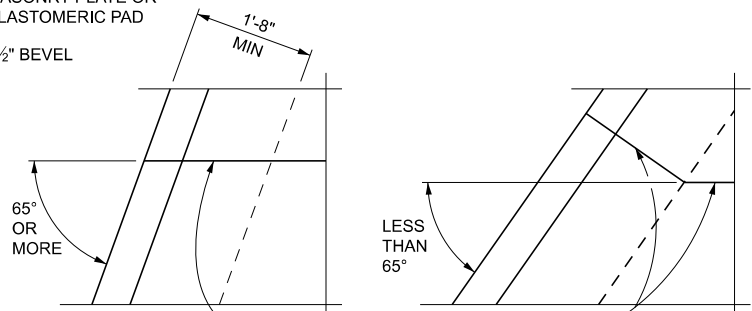


**BACKWALL SECTION**



**EM04 BAR**

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



CONSTRUCTION JOINT IN SLAB AND BACKWALL

**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 1/2 THE BEARING WIDTH -- (FOR 90° CROSSINGS).
- 2) 1'-8" OR THE BEARING DIMENSION PLUS THE PRODUCT OF 1/2 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.

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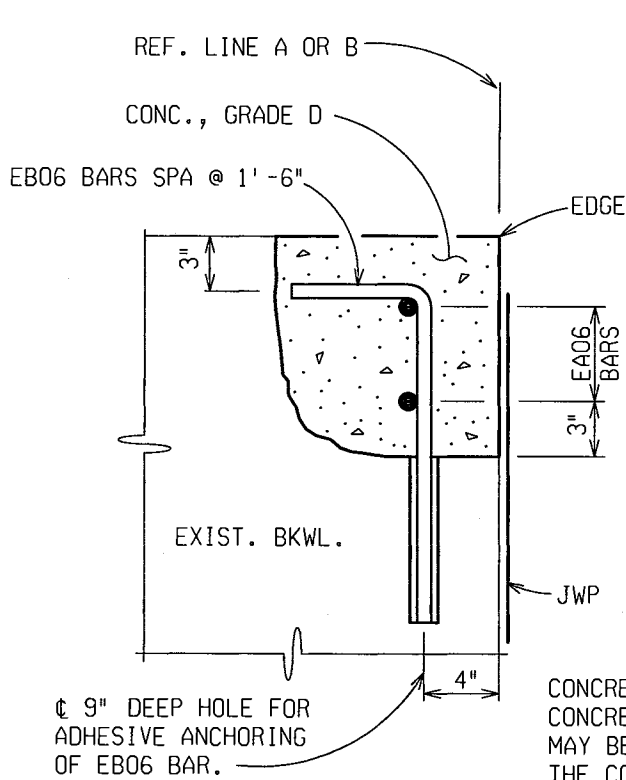
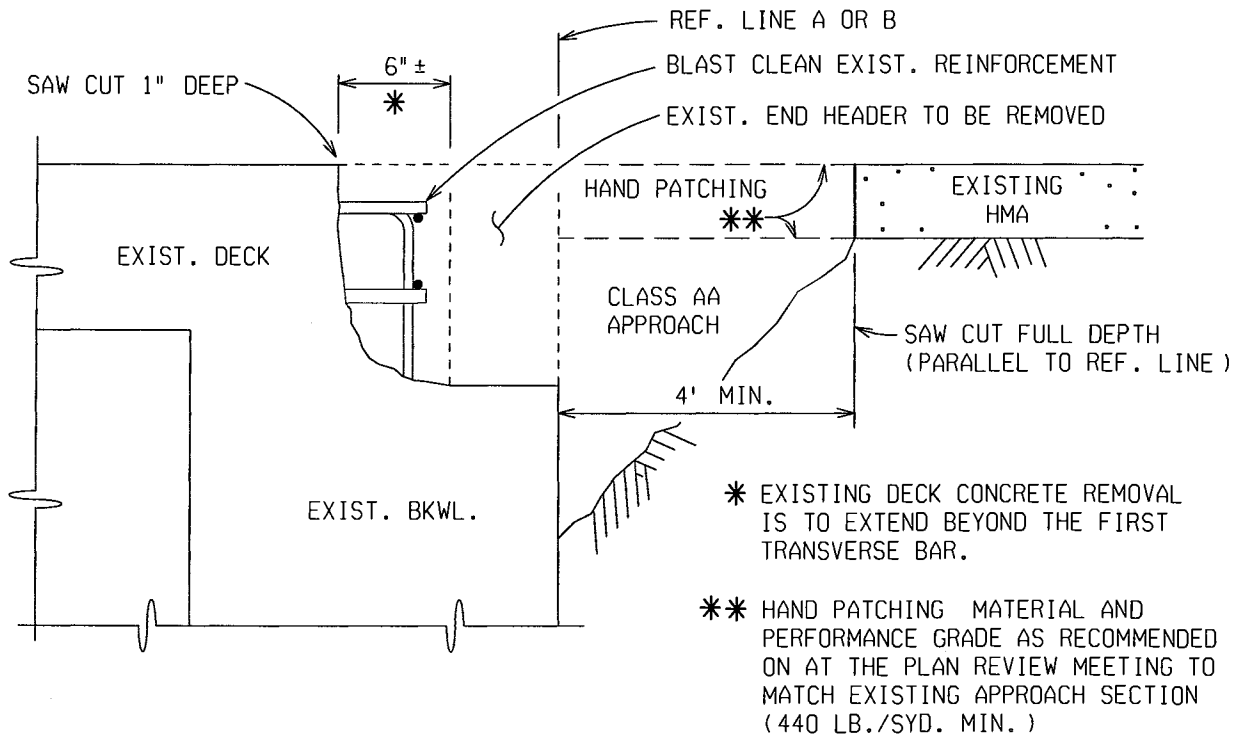
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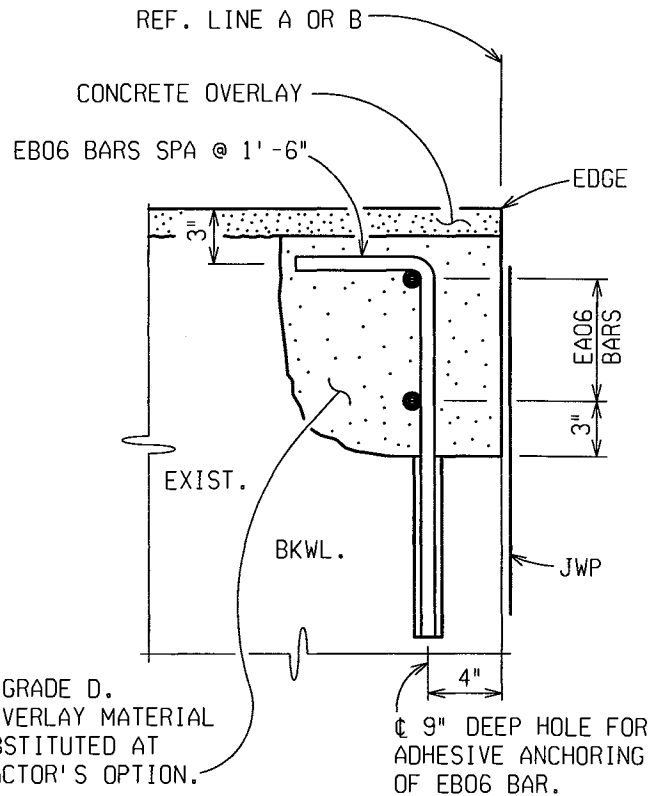
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

REPLACEMENT OF  
 EXISTING END HEADER

ISSUED: 08/15/03  
 SUPERSEDES: 11/27/01



WITHOUT OVERLAY

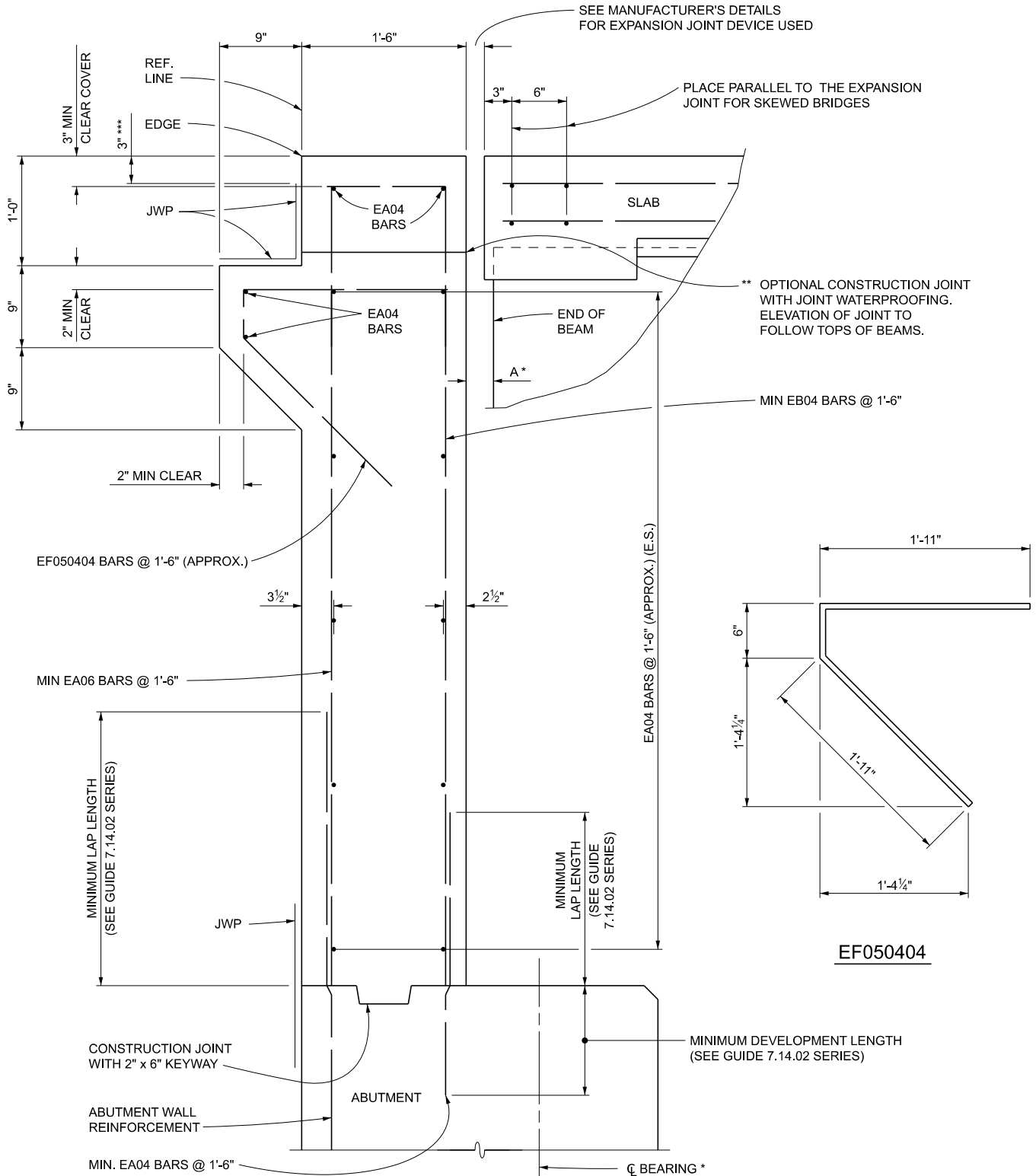


WITH OVERLAY

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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 TYPICAL SECTION THRU  
 INDEPENDENT BACKWALL

ISSUED: 06/24/24  
 SUPERSEDES: 12/26/23



\* TO ESTABLISH  $\bar{C}$  BEARING, USE "A" =  $\frac{1}{2}$  TOTAL MOVEMENT PARALLEL TO  $\bar{C}$  BEAM PLUS 1". FOR SKEWED BRIDGES, "A" IS MEASURED AT CORNER OF FLANGE.

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

PLAN NOTE:  
 \*\*\* ON THE VERTICAL FACE OF THE PAVEMENT SEAT, STOP THE JOINT WATERPROOFING 3" BELOW THE TOP OF BACKWALL.

\*\* IF CONSTRUCTION JOINT IS USED, THERE WILL BE NO PAYMENT FOR THE REQUIRED JOINT WATERPROOFING.

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 DESIGN DIVISION

6.20.03

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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 TYPICAL SECTION THRU  
 INDEPENDENT BACKWALL WITH SLIDING SLAB

ISSUED: 12/26/23  
 SUPERSEDES: 09/25/26

\* EXTEND OGDC OR AGGREGATE BASE 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.

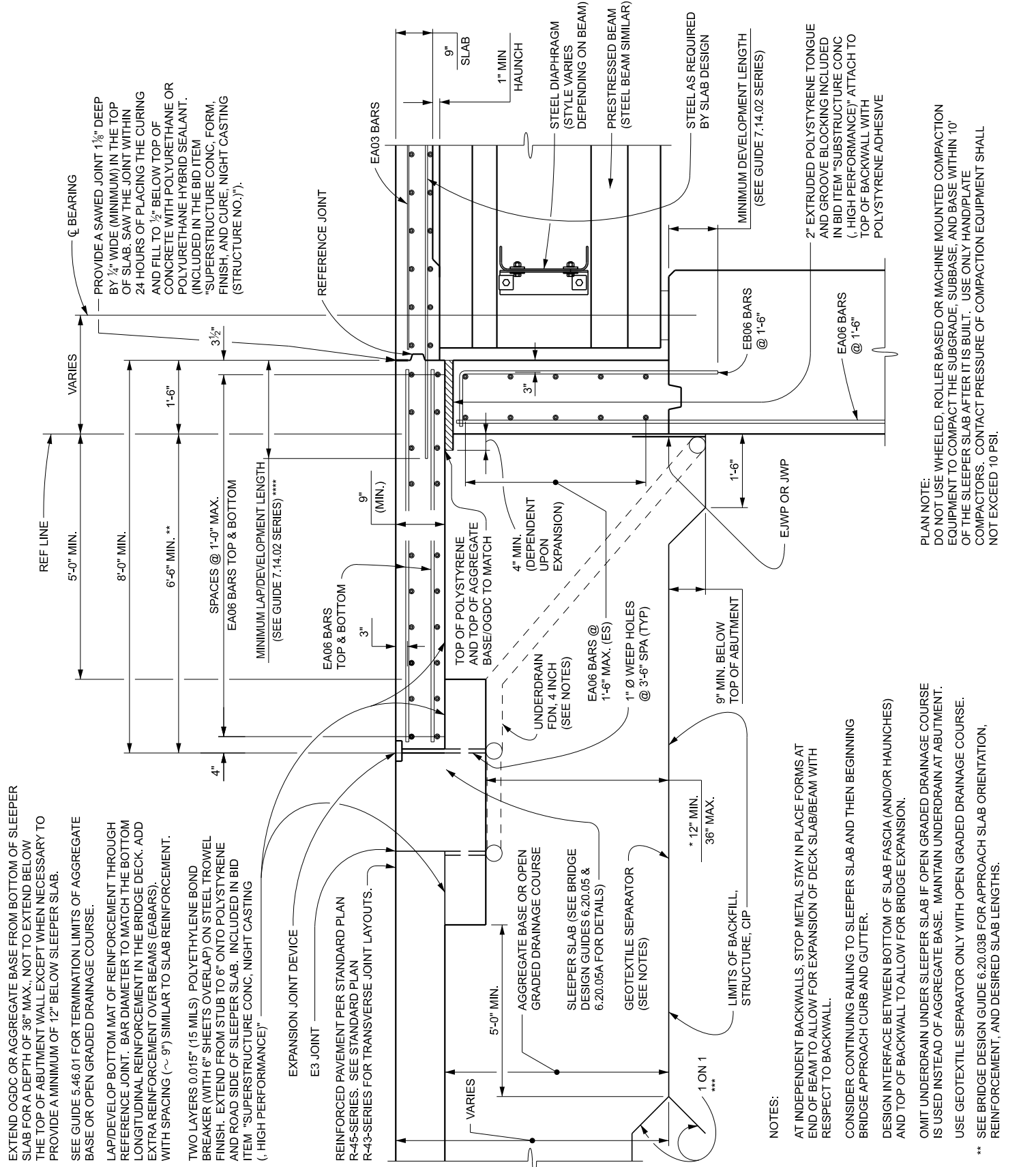
\*\*\* SEE GUIDE 5.46.01 FOR TERMINATION LIMITS OF AGGREGATE BASE OR OPEN GRADED DRAINAGE COURSE.

\*\*\*\* 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 (EA06BARS) 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)".

EXPANSION JOINT DEVICE  
 E3 JOINT

REINFORCED PAVEMENT PER STANDARD PLAN R-45-SERIES. SEE STANDARD PLAN R-43-SERIES FOR TRANSVERSE JOINT LAYOUTS.



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.

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

USE GEOTEXTILE SEPARATOR ONLY WITH OPEN GRADED DRAINAGE COURSE.

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

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.

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6.20.03A

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MICHIGAN DEPARTMENT OF TRANSPORTATION

BUREAU OF DEVELOPMENT

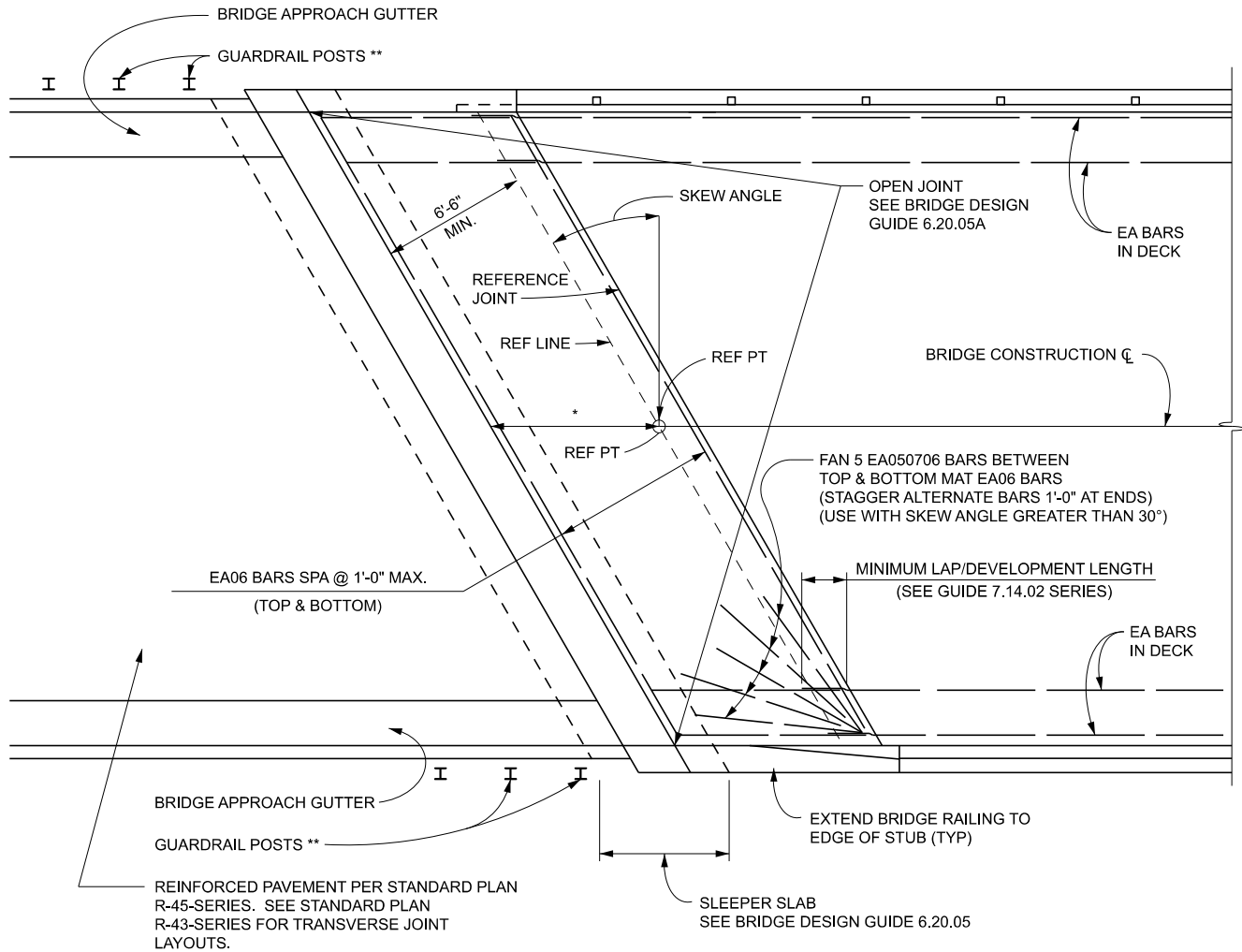
INDEPENDENT BACKWALL

SLIDING SLAB DETAILS

ISSUED: 12/26/23

SUPERSEDES: 07/25/22

\* FOR DESIGN SPEEDS GREATER THAN 45 MPH (POSTED > 40 MPH), THE DESIGNER MAY CONSIDER LENGTHS UP TO 20 FEET IN LENGTH (MEASURED ALONG  $\phi$ ) 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 COMPACTION. CONTACT PRESSURE OF COMPACTION EQUIPMENT SHALL NOT EXCEED 10 PSI.

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DESIGN DIVISION

6.20.03B

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BUREAU OF DEVELOPMENT

ISSUED:

SUPERSEDES:

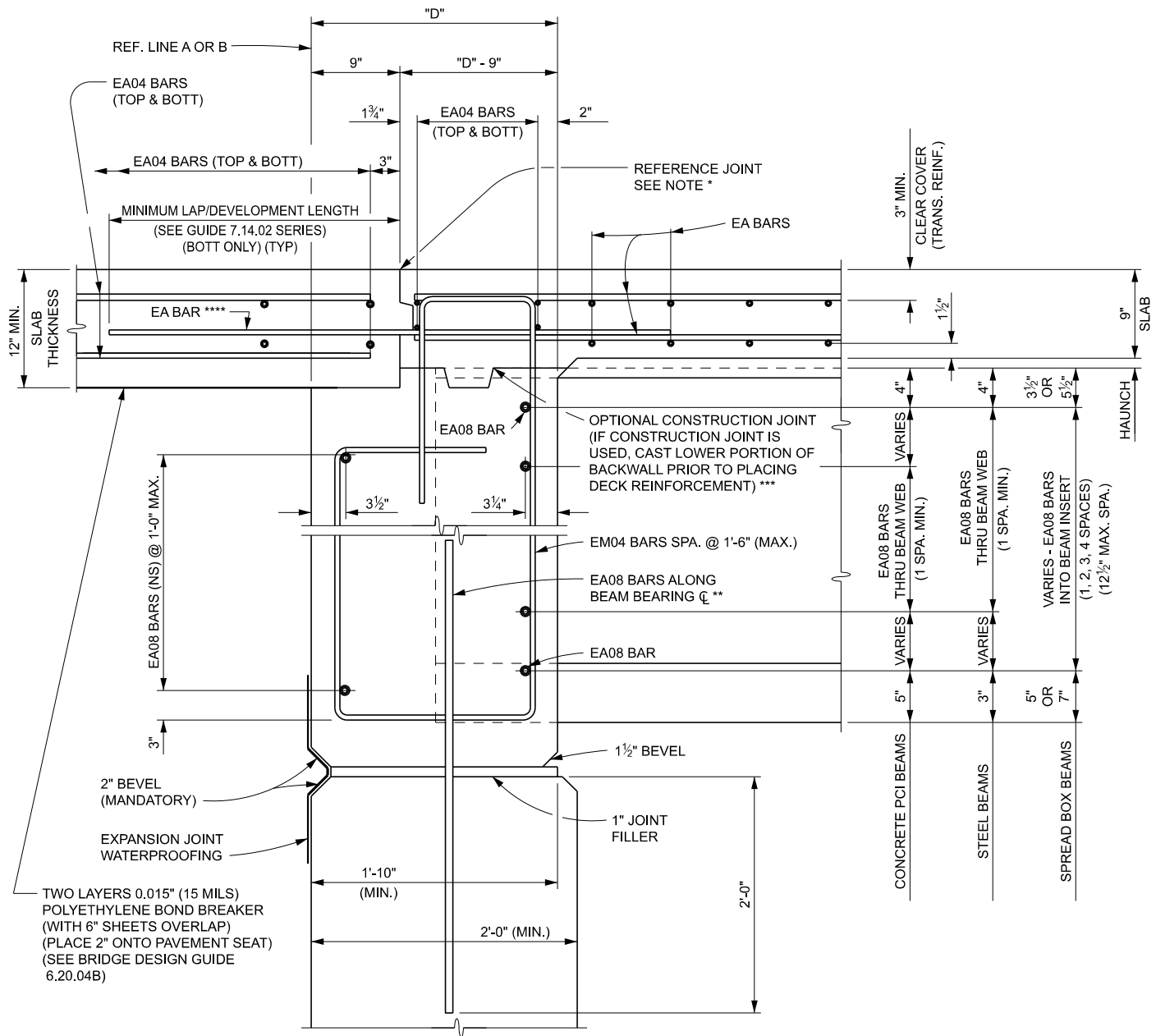
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 INTEGRAL AND SEMI-INTEGRAL  
 ABUTMENT BACKWALL

ISSUED: 12/26/23  
 SUPERSEDES: 06/26/23



PLAN NOTES:

\*\*\* WHERE OPTIONAL CONSTRUCTION JOINTS ARE USED, THERE WILL BE NO PAYMENT FOR THE REQUIRED JOINT WATERPROOFING.

\* 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.)").

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.

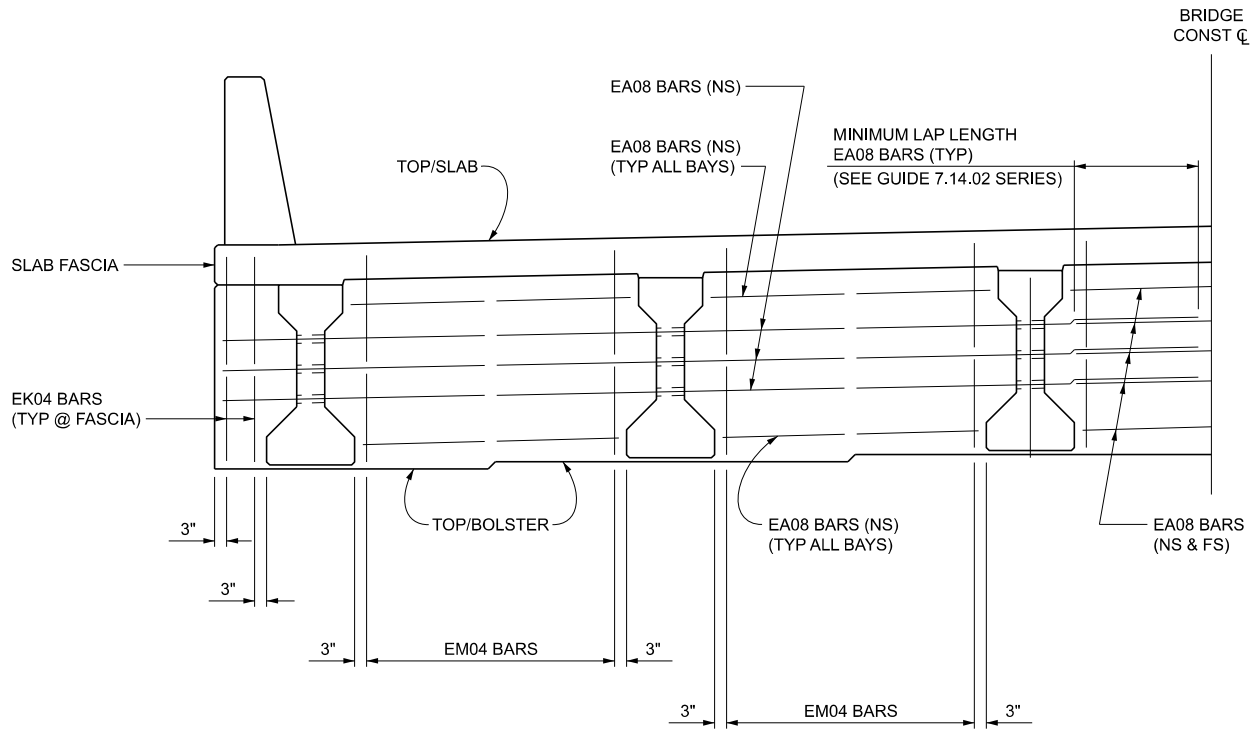
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6.20.04

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MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT  
INTEGRAL AND SEMI-INTEGRAL ABUTMENT  
PARTIAL BACKWALL DETAILS

ISSUED: 12/26/23  
SUPERSEDES: 01/27/20



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".

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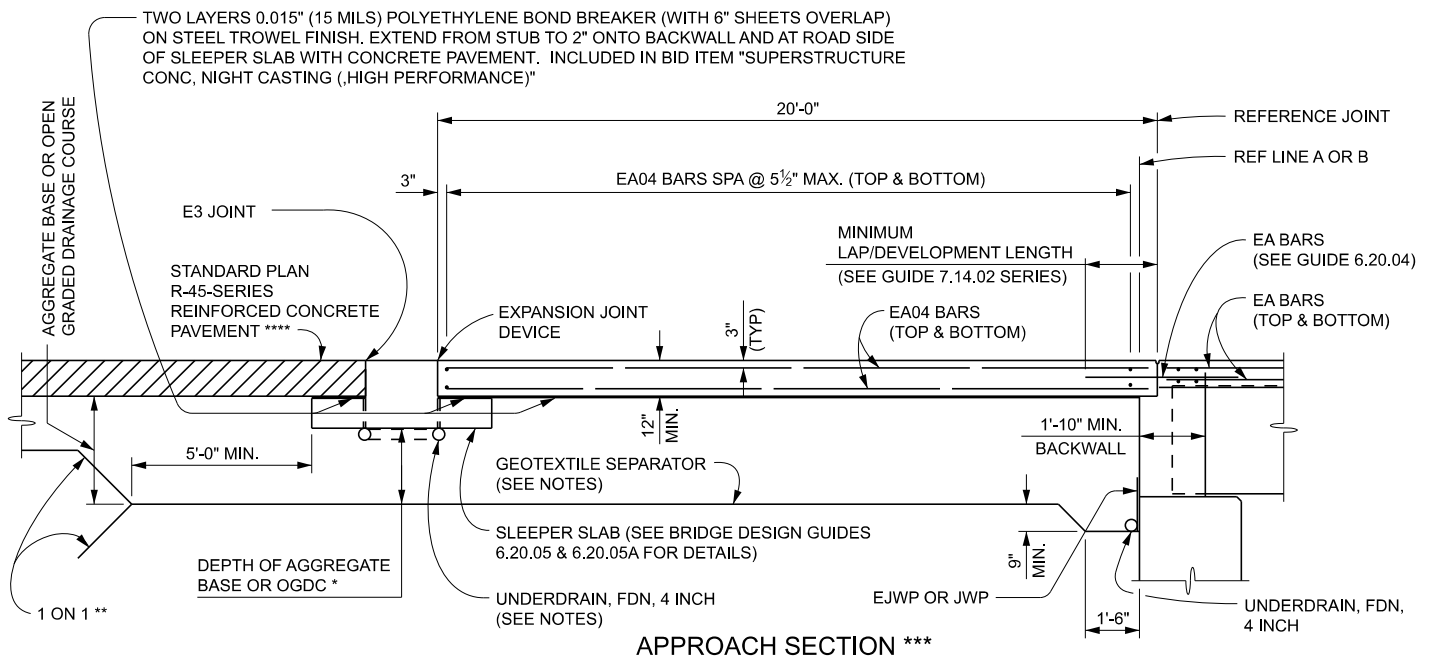
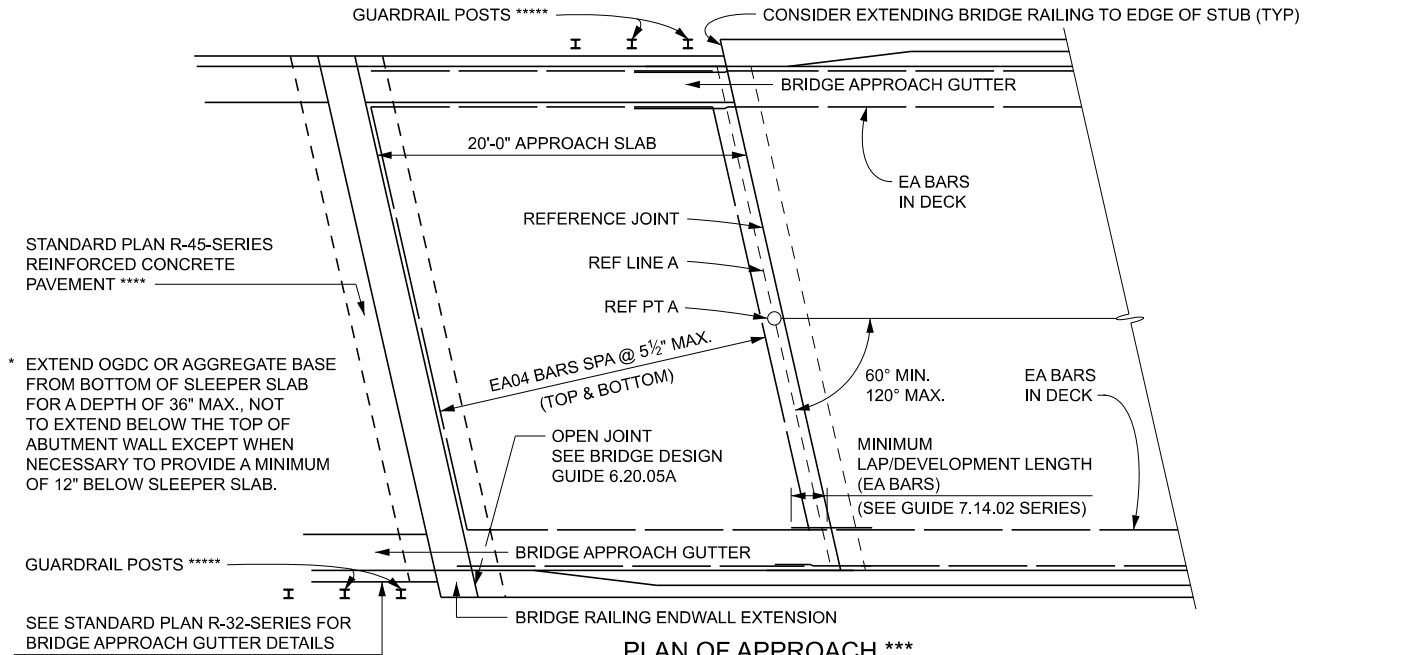
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 INTEGRAL AND SEMI-INTEGRAL ABUTMENT  
 EMPIRICAL APPROACH SLAB DETAILS

ISSUED: 12/26/23  
 SUPERSEDES: 07/25/22



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.

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

\*\*\* THE DETAILED BRIDGE APPROACH SLAB IS 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.

\*\*\*\* 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.

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

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 DESIGN DIVISION

**6.20.04B**

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BUREAU OF DEVELOPMENT

ISSUED:

SUPERSEDES:

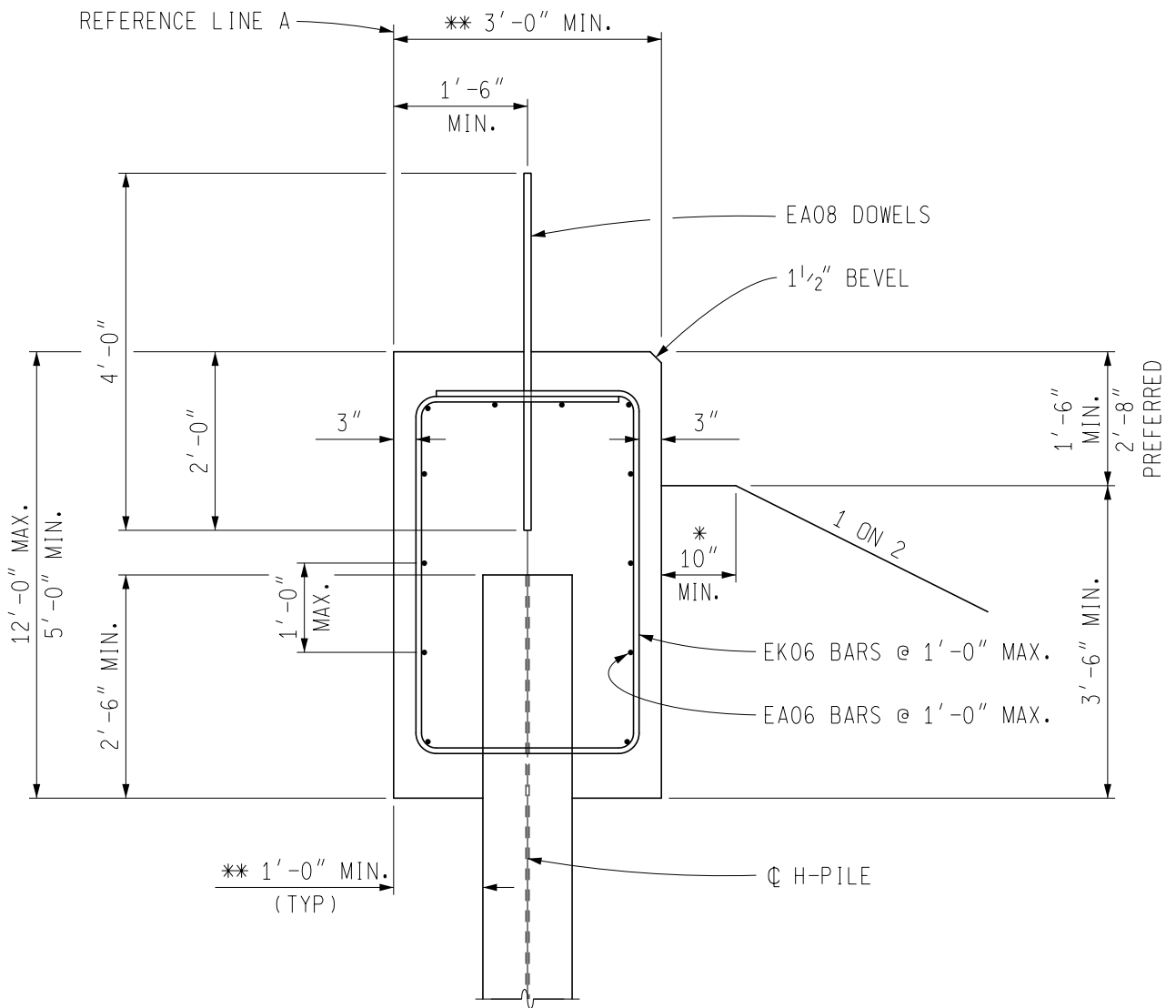
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 INTEGRAL ABUTMENT - SINGLE ROW OF PILES  
 (SECTION THRU STUB ABUTMENT)

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 EMBEDDED 2'-6" INTO THE ABUTMENT WALL.

UPON RECOMMENDATION 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.

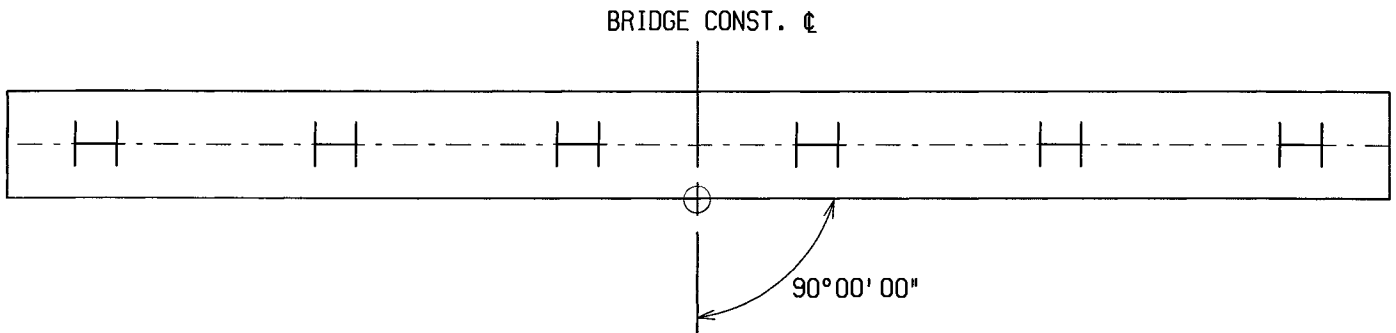
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 DESIGN DIVISION

6.20.04D

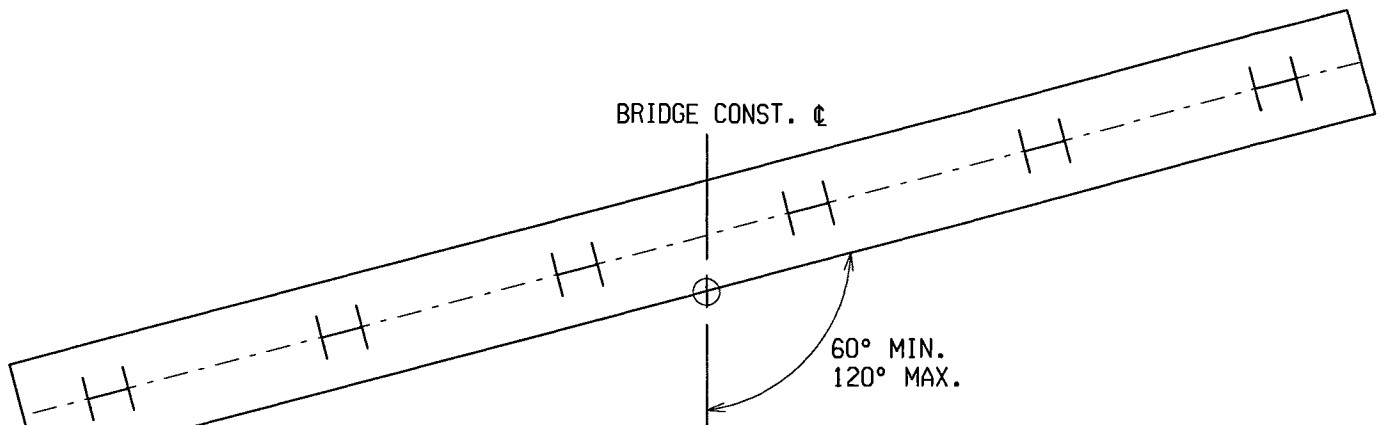
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY TECHNICAL SERVICES  
INTEGRAL ABUTMENT - SINGLE ROW OF PILES  
(PILE ORIENTATION)

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.

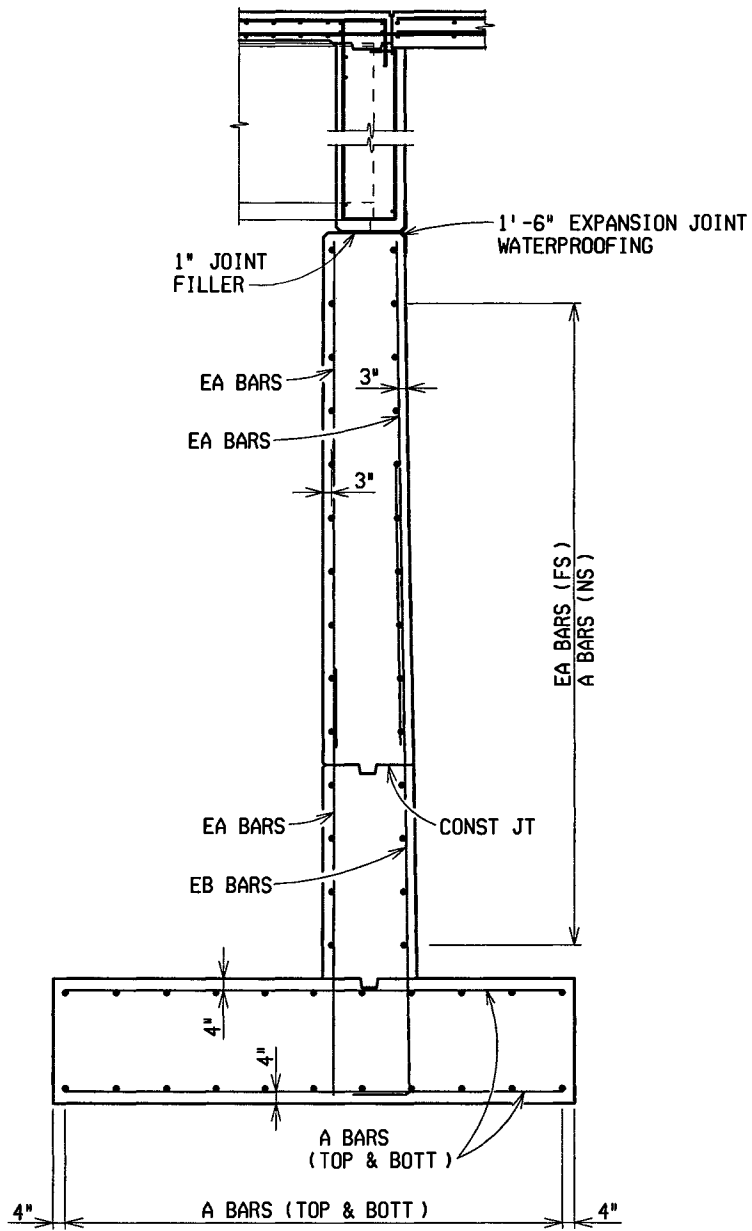
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY DEVELOPMENT  
SEMI-INTEGRAL ABUTMENT - SLIDING BACKWALL  
(SECTION THRU ABUTMENT)

ISSUED: 08/15/03  
SUPERSEDES: 11/27/01



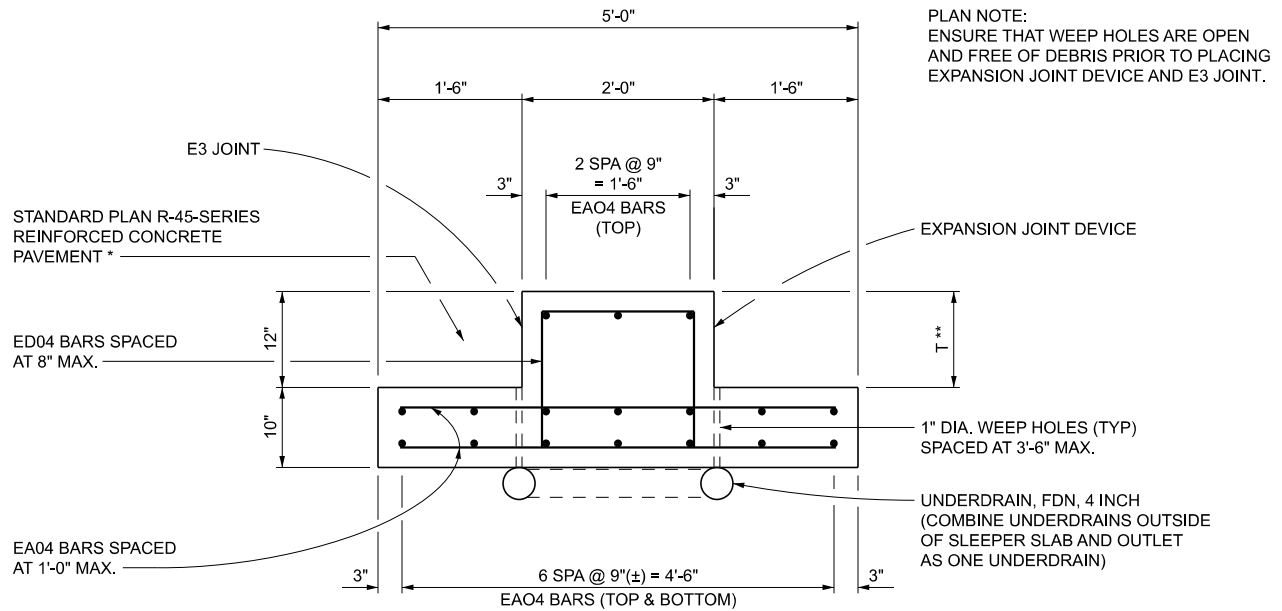
SEMI-INTEGRAL ABUTMENT  
(SLIDING BACKWALL)

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

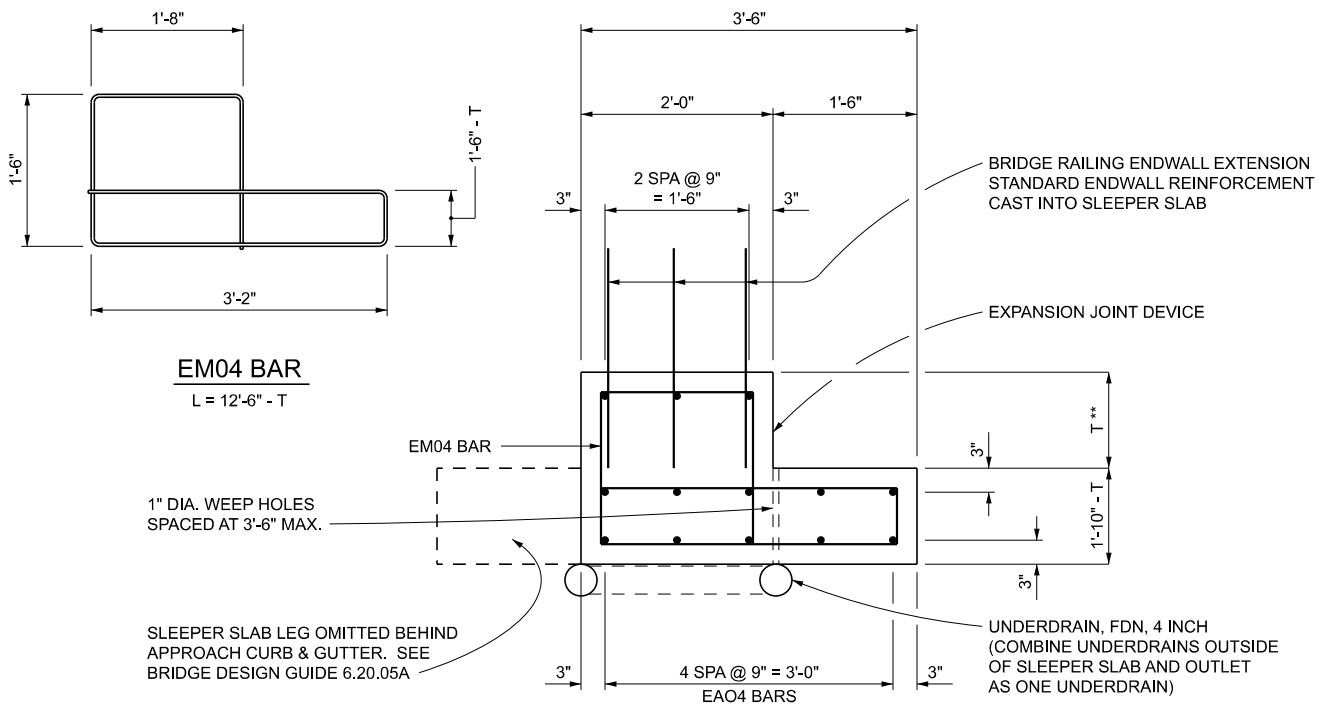
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 SLEEPER SLAB DETAILS

ISSUED: 12/26/23  
 SUPERSEDES: 07/25/22



TYPICAL SECTION THRU SLEEPER SLAB



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.

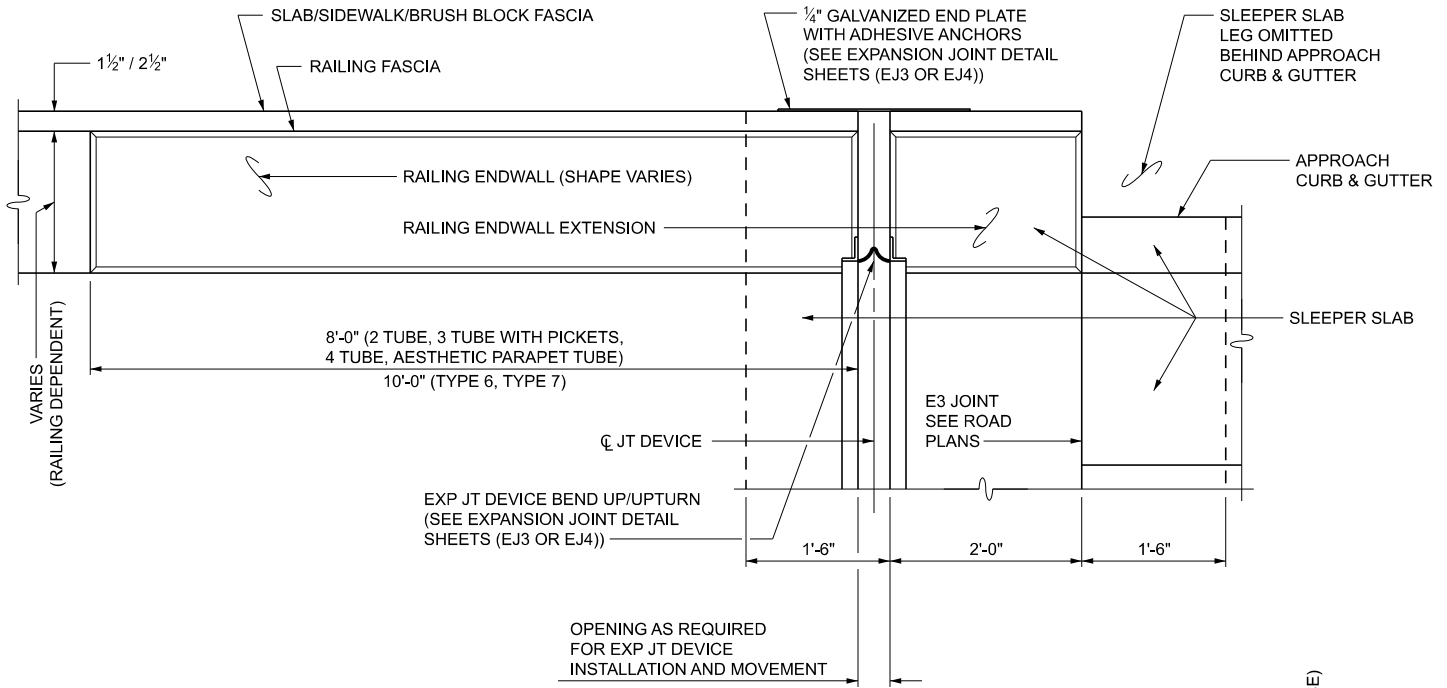
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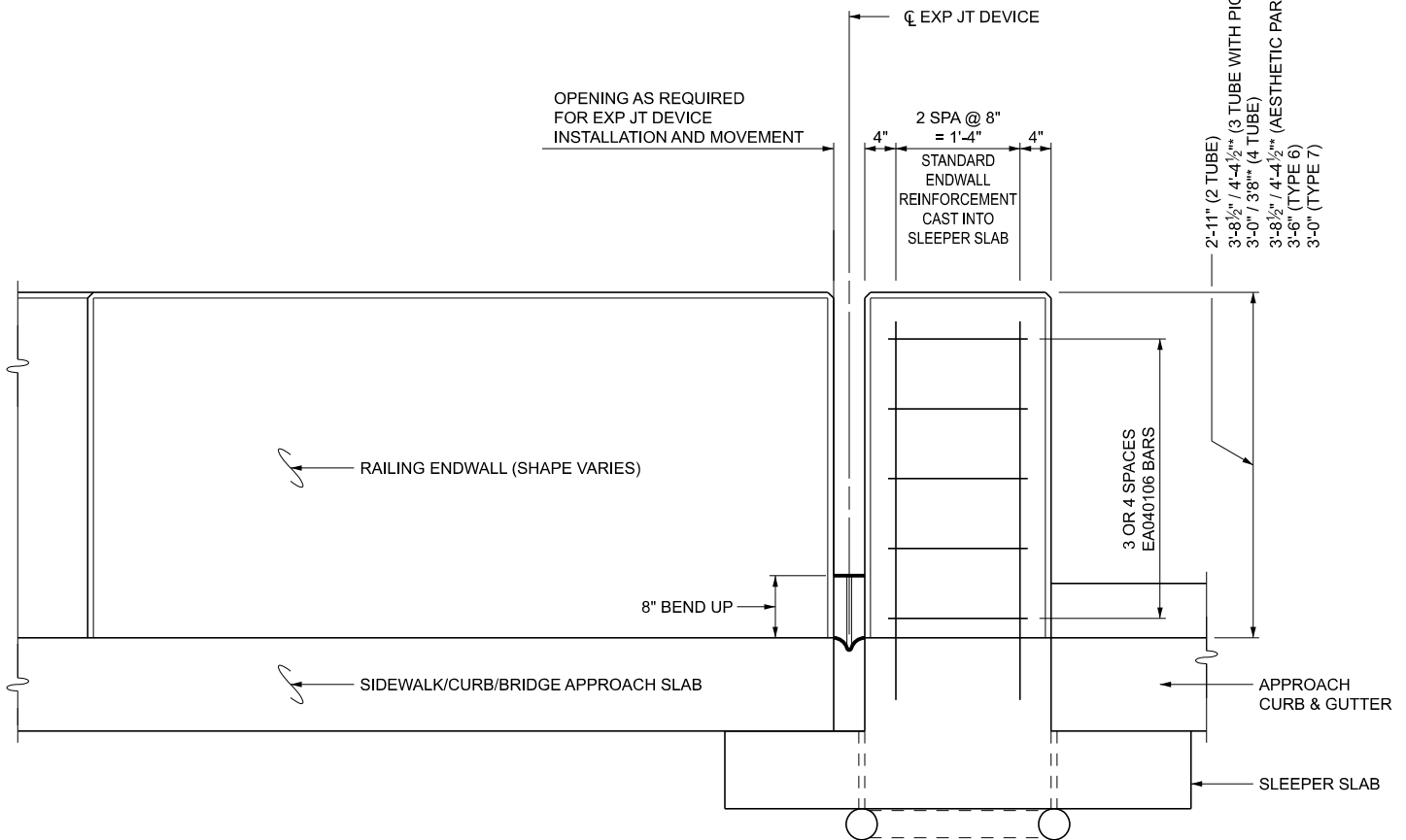
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 SLEEPER SLAB DETAILS

ISSUED: 12/26/23  
 SUPERSEDES: 07/25/22



PLAN - ENDWALL EXTENSION DETAIL



ENDWALL EXTENSION DETAIL

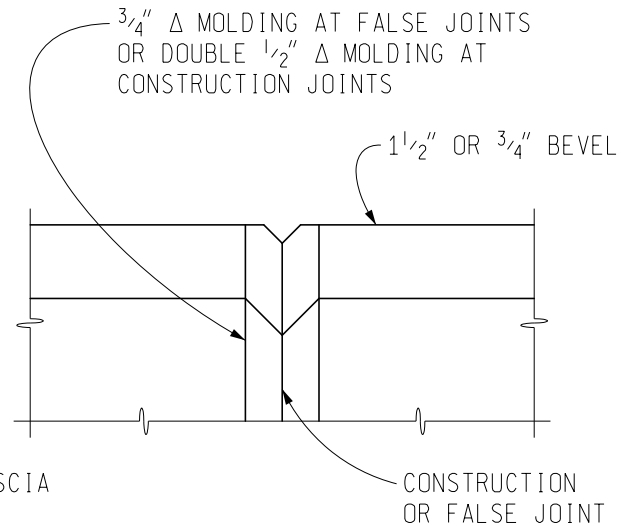
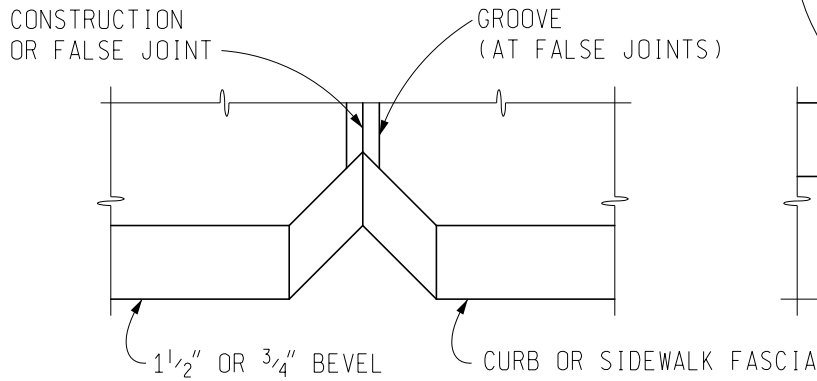
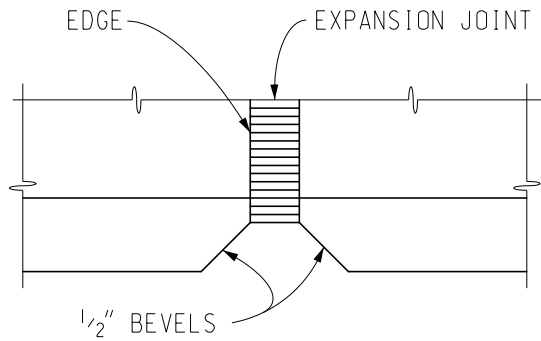
\* HEIGHT WITH SIDEWALK

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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

CONSTRUCTION, EXPANSION AND  
 FALSE JOINT DETAILS

ISSUED: 06/26/23  
 SUPERSEDES: 11/27/01

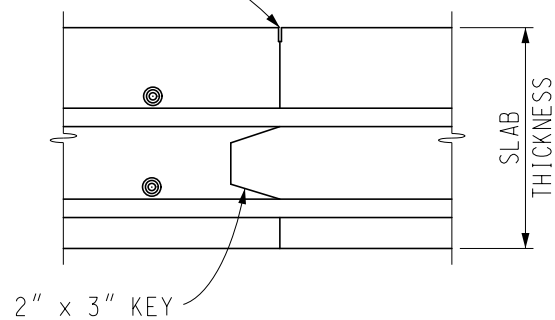
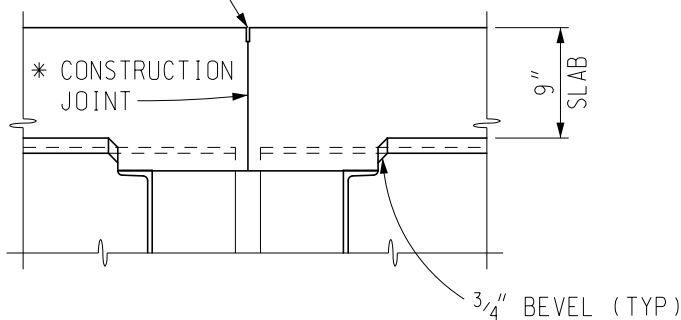


PLAN

ELEVATION

MOLDING DETAILS

PROVIDE A SAWED JOINT  $1\frac{1}{8}$ " 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.)").



CONSTRUCTION JOINT IN  
 SLAB OVER PIER OR  
 AT FIXED HANGER

LONGITUDINAL  
 CONSTRUCTION  
 JOINT IN SLAB

\* DO NOT EXTEND SLAB REINFORCEMENT THROUGH CONSTRUCTION JOINT

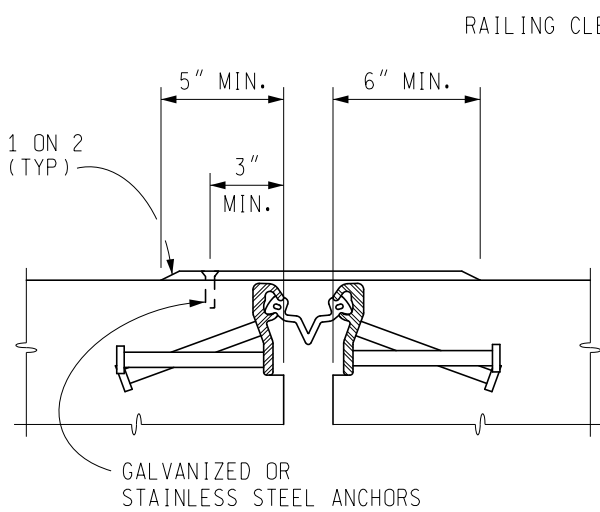


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 CHECKED BY: VZ  
 APPROVED BY: KCK

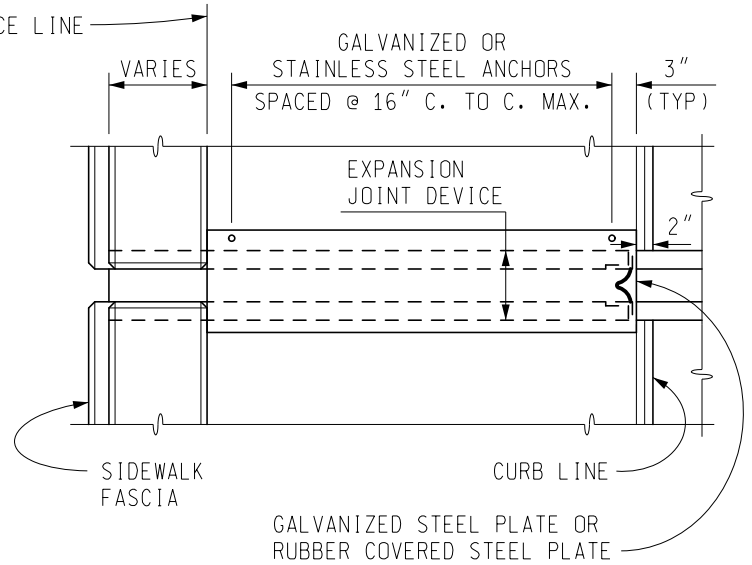
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

ISSUED: 01/23/23  
 SUPERSEDES: 12/24/11

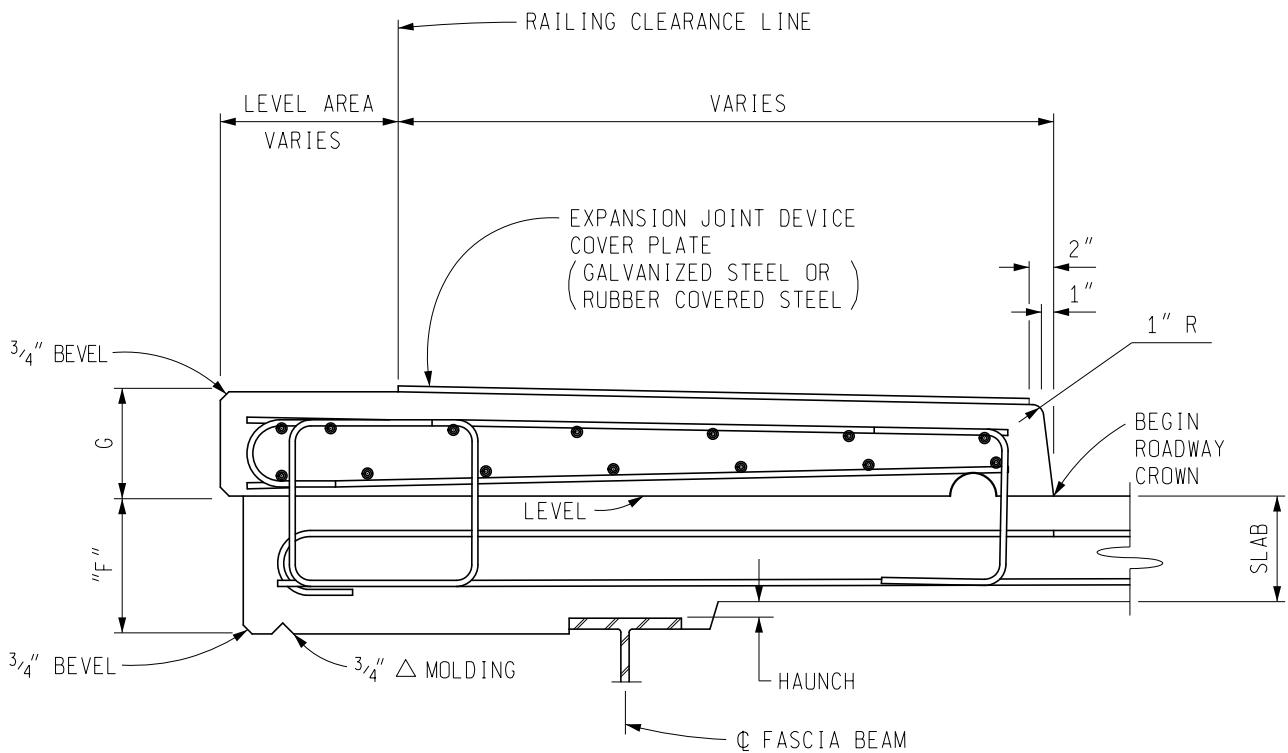
EXPANSION JOINT COVER RETROFIT



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.

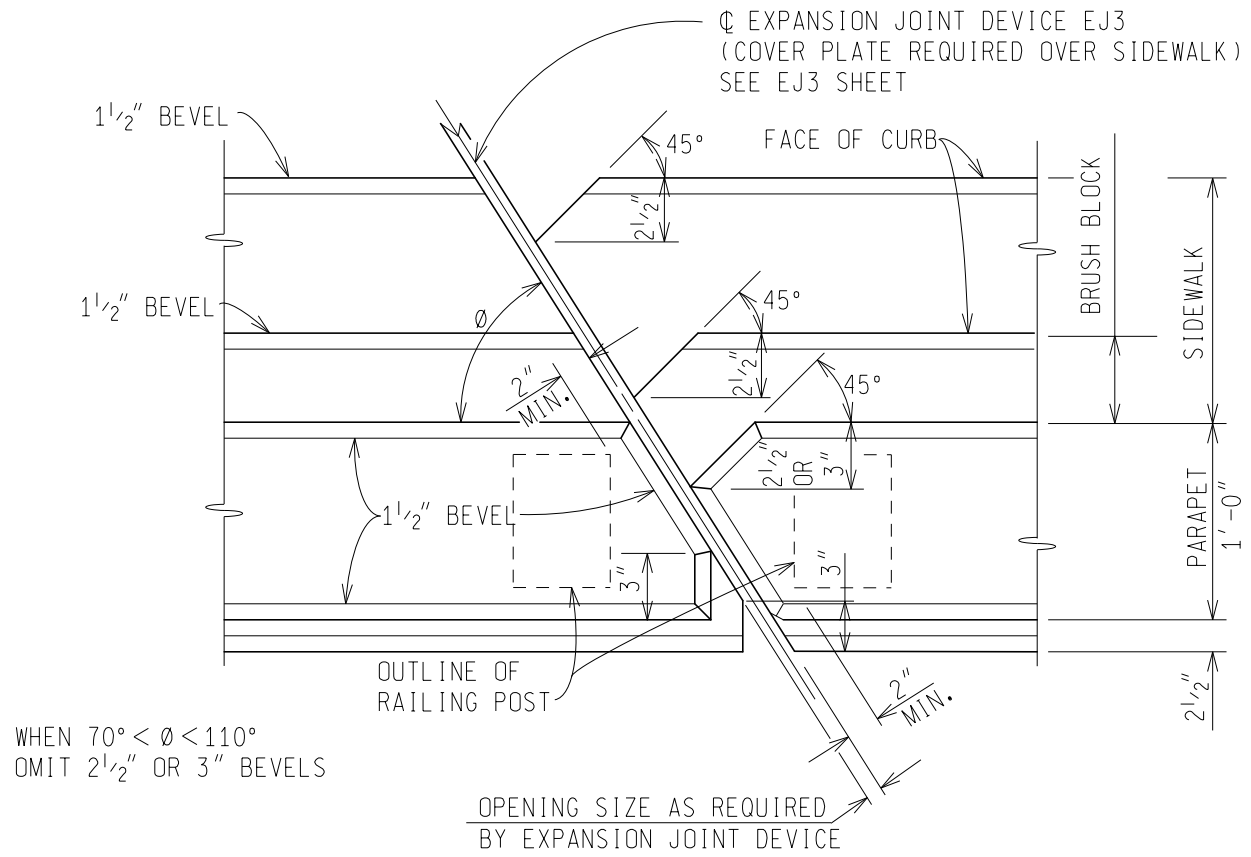
PREPARED BY  
 DESIGN DIVISION

6.28.06

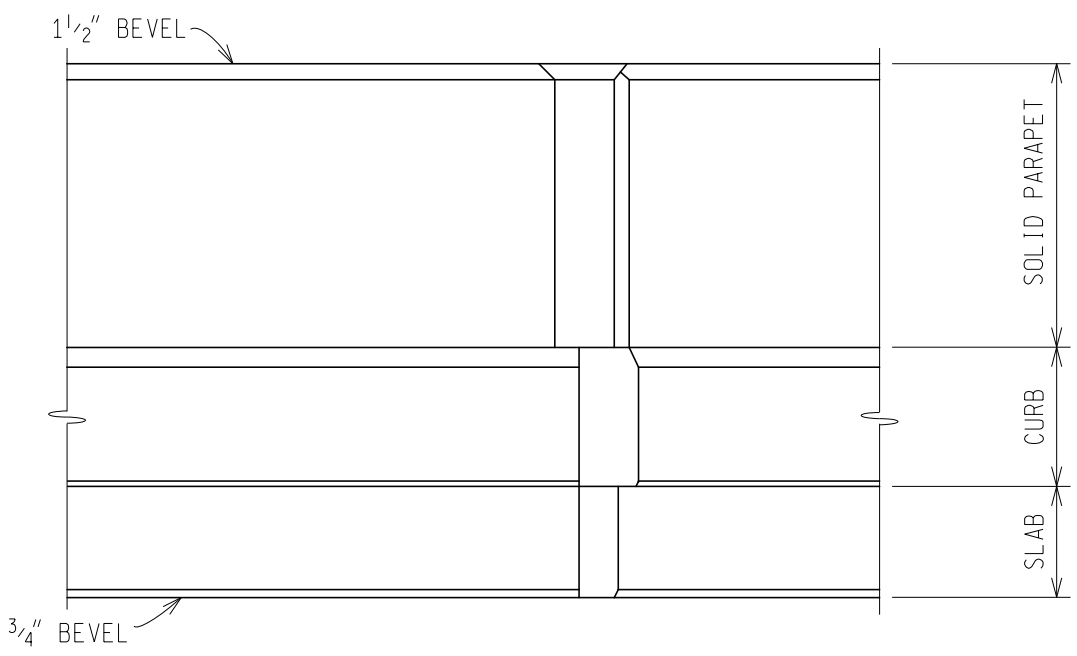
DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: TGF

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

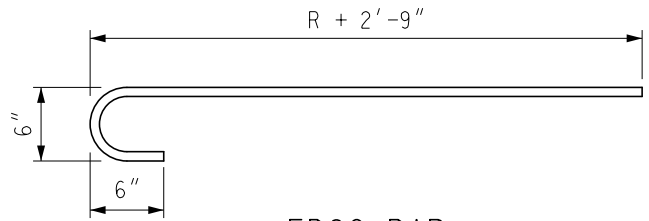
6.29.05

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

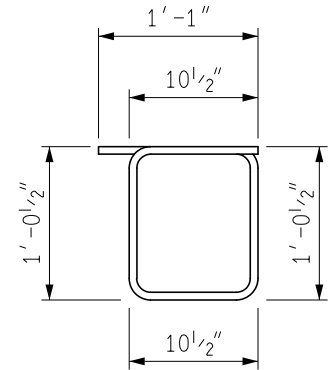
ISSUED: 03/27/23  
 SUPERSEDES: 02/14/11

BRIDGE RAILING, 2 TUBE

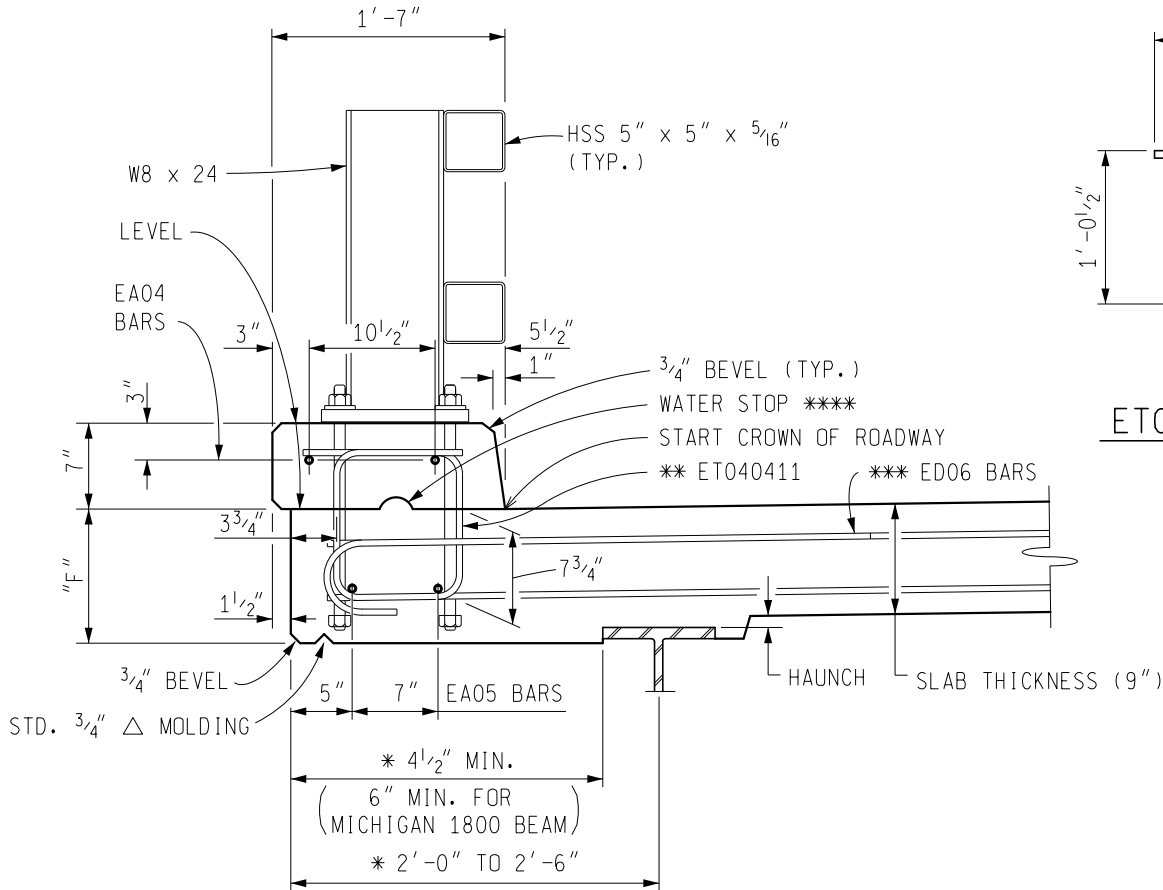


ED06 BAR

R =  $\phi$  BEAM TO SLAB FASCIA DISTANCE



ET040411 BAR



NOTES:

"F" CONSTANT EQUALS SLAB THICKNESS PLUS THICKEST FASCIA BEAM FLANGE PLUS 1/2" 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.

\* IT IS PREFERRED TO POSITION THE FASCIA BEAM TO CARRY THE SCREED RAIL WHICH WILL BE APPROXIMATELY 1'-0" FROM THE ET BAR. HOWEVER, 4 1/2" MINIMUM WILL APPLY TO CURVED GIRDERS ONLY.

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

\*\*\* AT EACH POST PLACE 7 - ED060409 BARS SPACED AT 9".

\*\*\*\* 2" HIGH x 4" LONG ( $\pm$ ). FORMING NOT REQUIRED.

PREPARED BY  
 DESIGN DIVISION

6.29.06

DRAWN BY:  
CHECKED BY:  
APPROVED BY:

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT

ISSUED:  
SUPERSEDES:

BLANK

PAGE

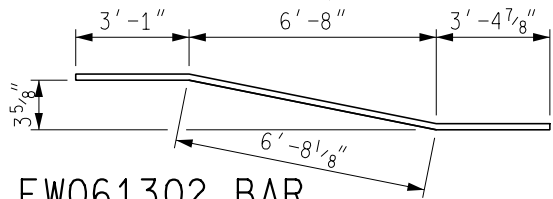
PREPARED BY  
DESIGN DIVISION

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 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

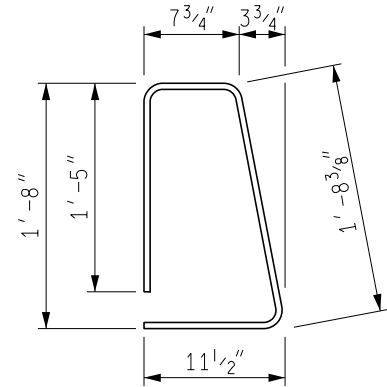
BRIDGE BARRIER RAILING TYPE 7

ISSUED: 12/16/19  
 SUPERSEDES: 02/14/11

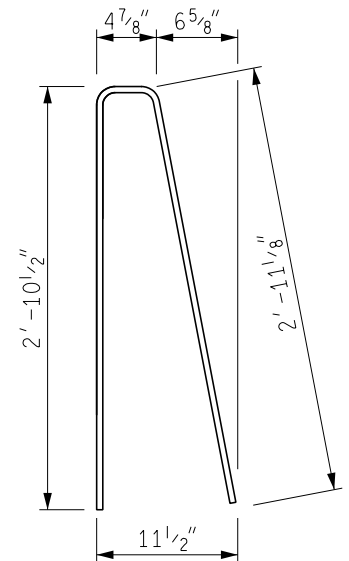
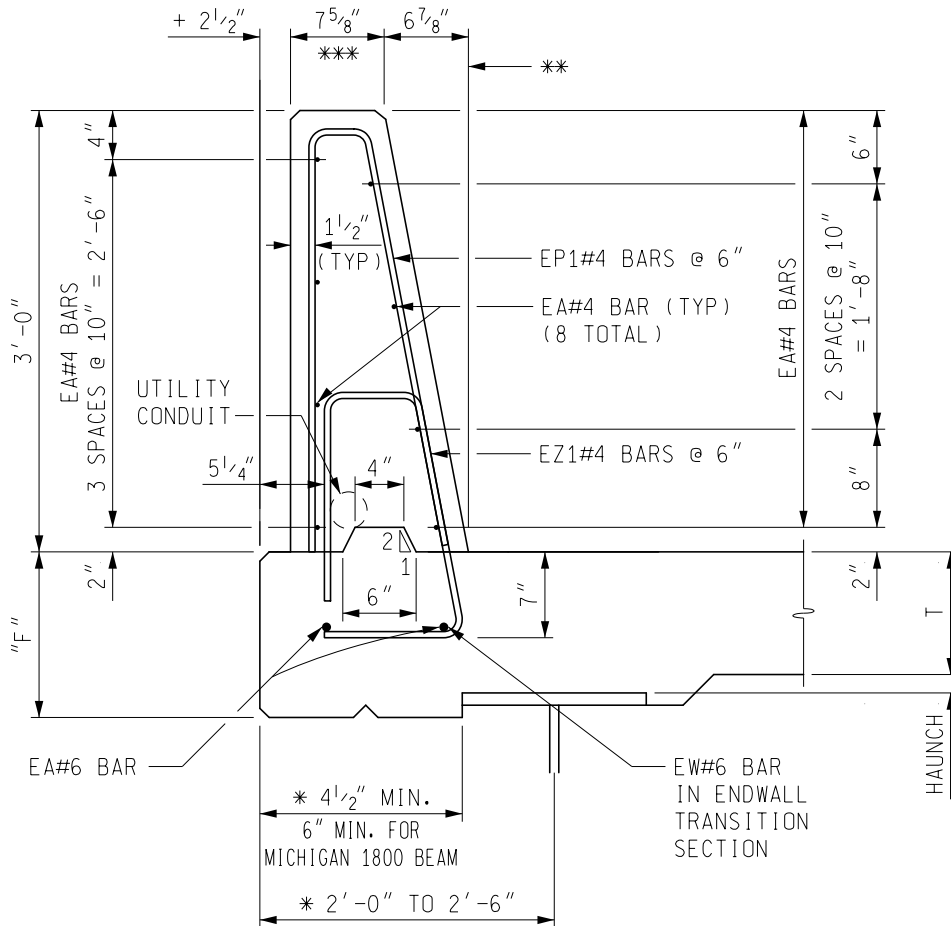


**EW061302 BAR**

WEIGHT =  
 414 LBS/LFT (BRIDGE BARRIER RAILING TYPE 7)  
 449 LBS/LFT (BRIDGE BARRIER RAILING AESTHETIC TYPE 7, DET 1)  
 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 1/2" 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.

\* 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.

\*\*\* 8 5/8" BRIDGE BARRIER RAILING AESTHETIC TYPE 7, 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

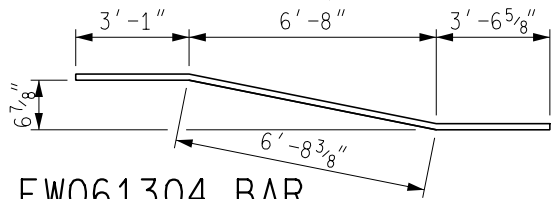
6.29.08

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

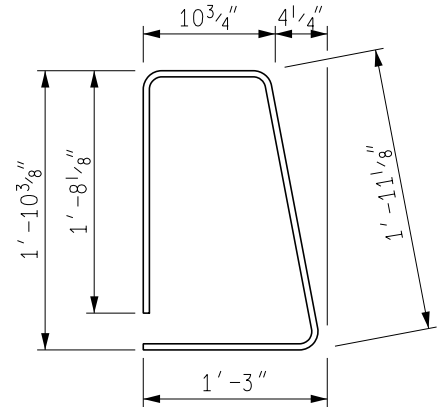
ISSUED: 12/16/19  
 SUPERSEDES: 02/14/11

BRIDGE BARRIER RAILING TYPE 6

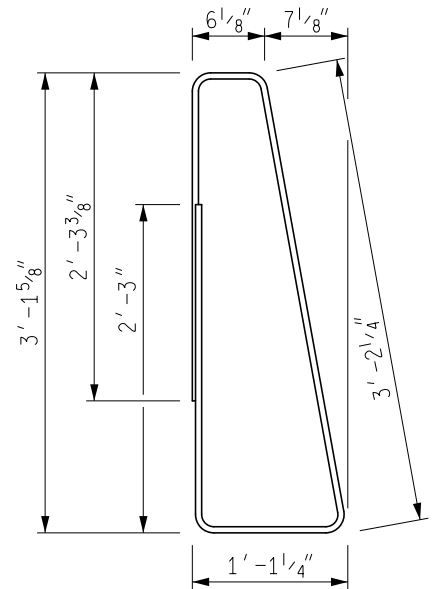


**EW061304 BAR**

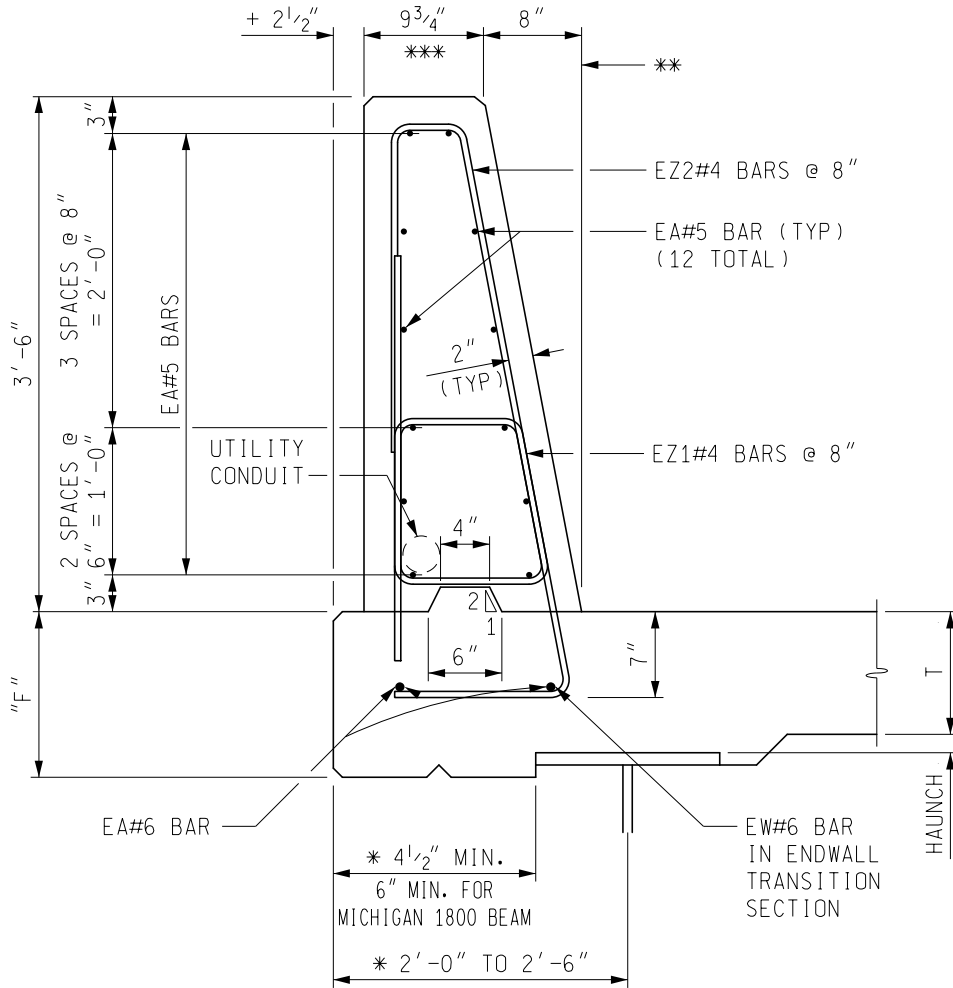
WEIGHT =  
 601 LBS/LFT (BRIDGE BARRIER RAILING TYPE 6)  
 646 LBS/LFT (BRIDGE BARRIER RAILING AESTHETIC TYPE 6, DET 1)  
 615 LBS/LFT (BRIDGE BARRIER RAILING AESTHETIC TYPE 6, DET 2)



**EZ1#4 BAR**



**EZ2#4 BAR**



**NOTE:**

"F" EQUALS SLAB THICKNESS PLUS THICKEST FASCIA BEAM FLANGE PLUS 1/2" 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.

\* 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.

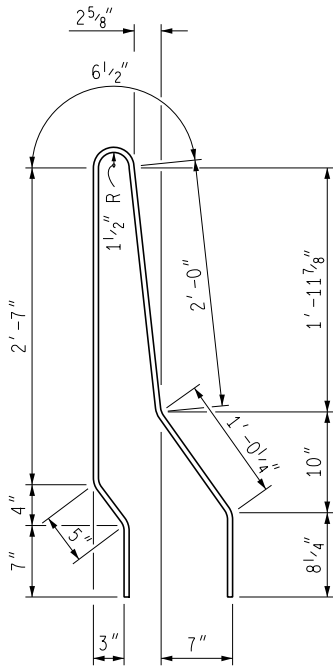
\*\*\* 10 3/4" BRIDGE BARRIER RAILING AESTHETIC TYPE 6, DET 2.

+ 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.

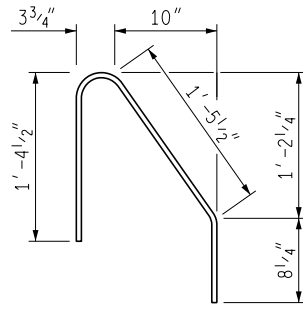
DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 BRIDGE BARRIER RAILING, TYPE 4 (MOD.)  
 FOR RAILING REPLACEMENT

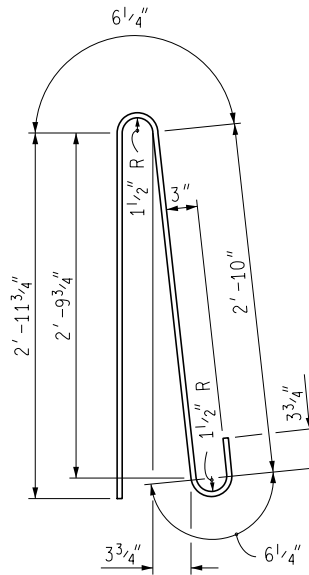
ISSUED: 08/27/18  
 SUPERSEDES: 12/26/17



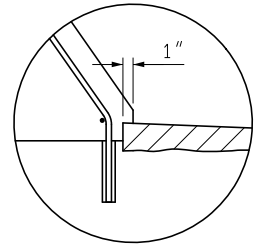
EG040710



EZ040310

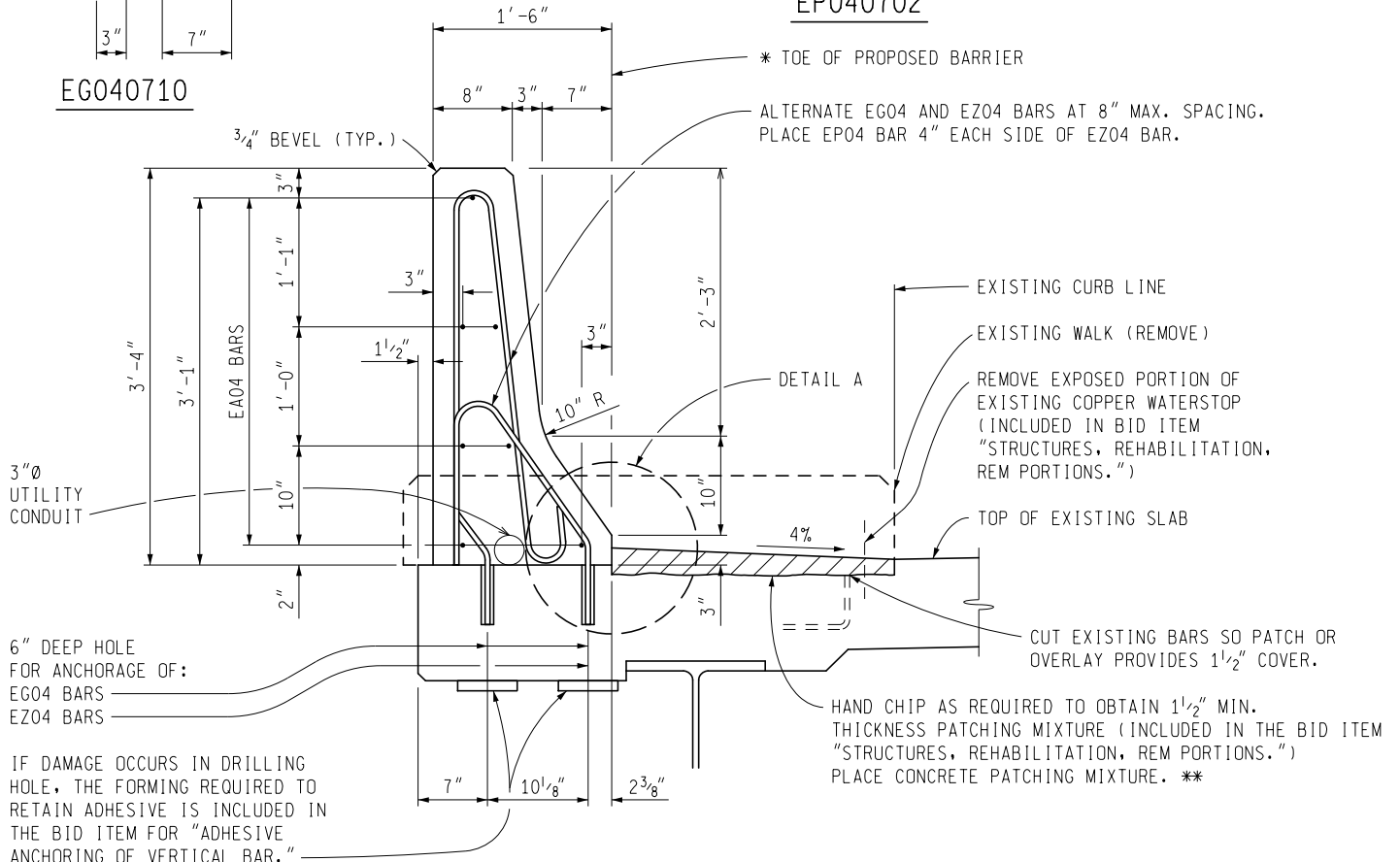


EP040702



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."

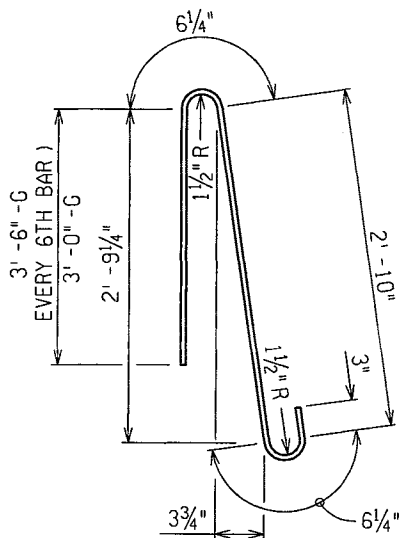
PREPARED BY  
 DESIGN DIVISION

6.29.09A

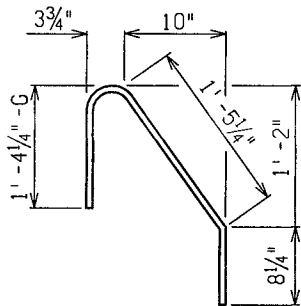
DRAWN BY: MJB  
 CHECKED BY: VZ  
 APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES  
 BRIDGE BARRIER RAILING, TYPE 4 (MOD.)  
 FOR RAILING REPLACEMENT

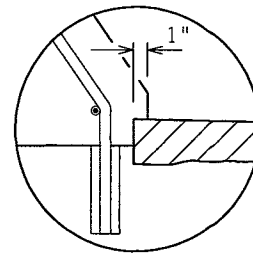
ISSUED: 11/27/01  
 SUPERSEDES: 08/08/96



EPO4

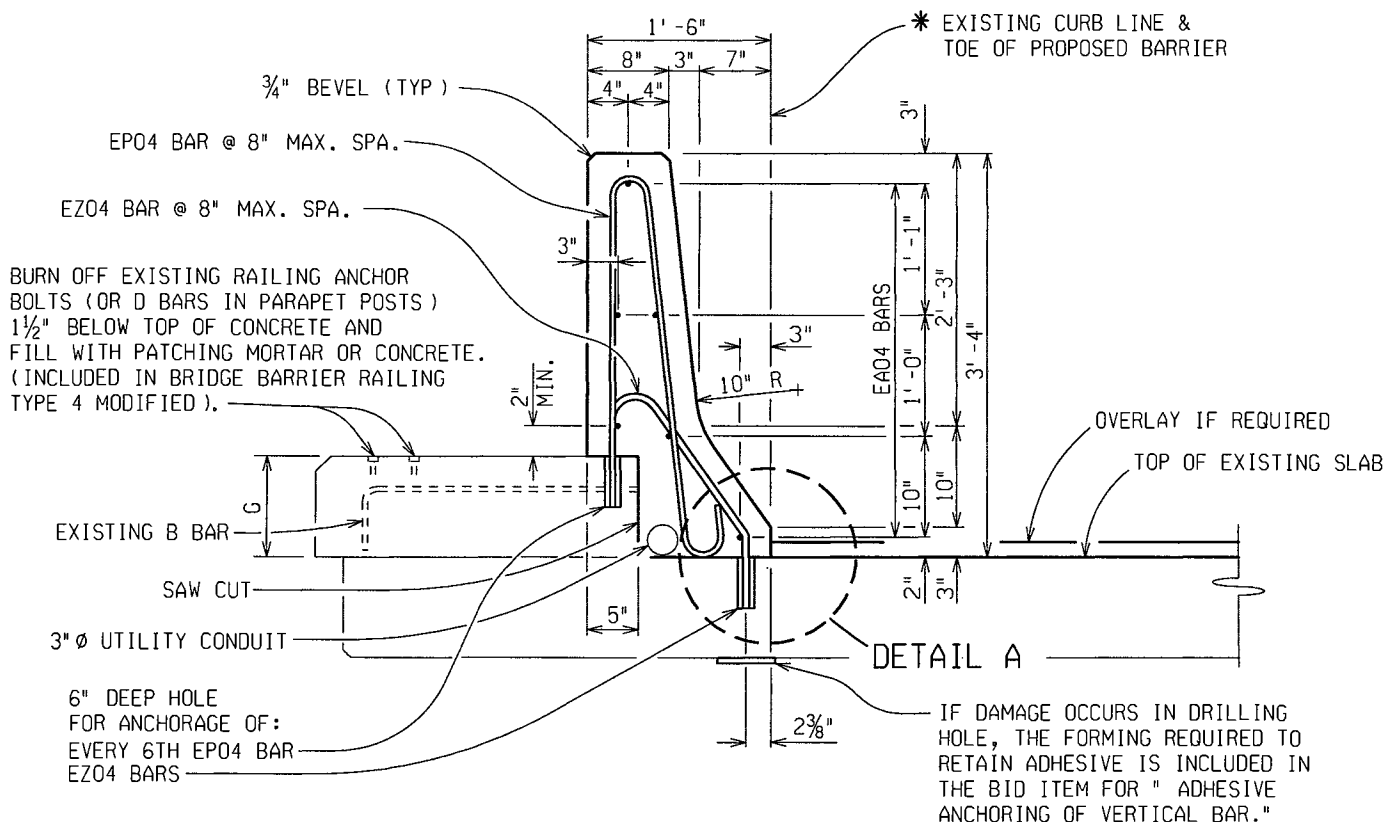


EZO4



DETAIL A  
 (OPTIONAL)

CONTRACTOR MAY PLACE  
 OVERLAY PRIOR TO PLACE-  
 MENT OF BARRIER. ADDI-  
 TIONAL OVERLAY MATERIAL  
 NEEDED SHALL BE AT CON-  
 TRACTOR'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.

PREPARED BY  
 DESIGN DIV.

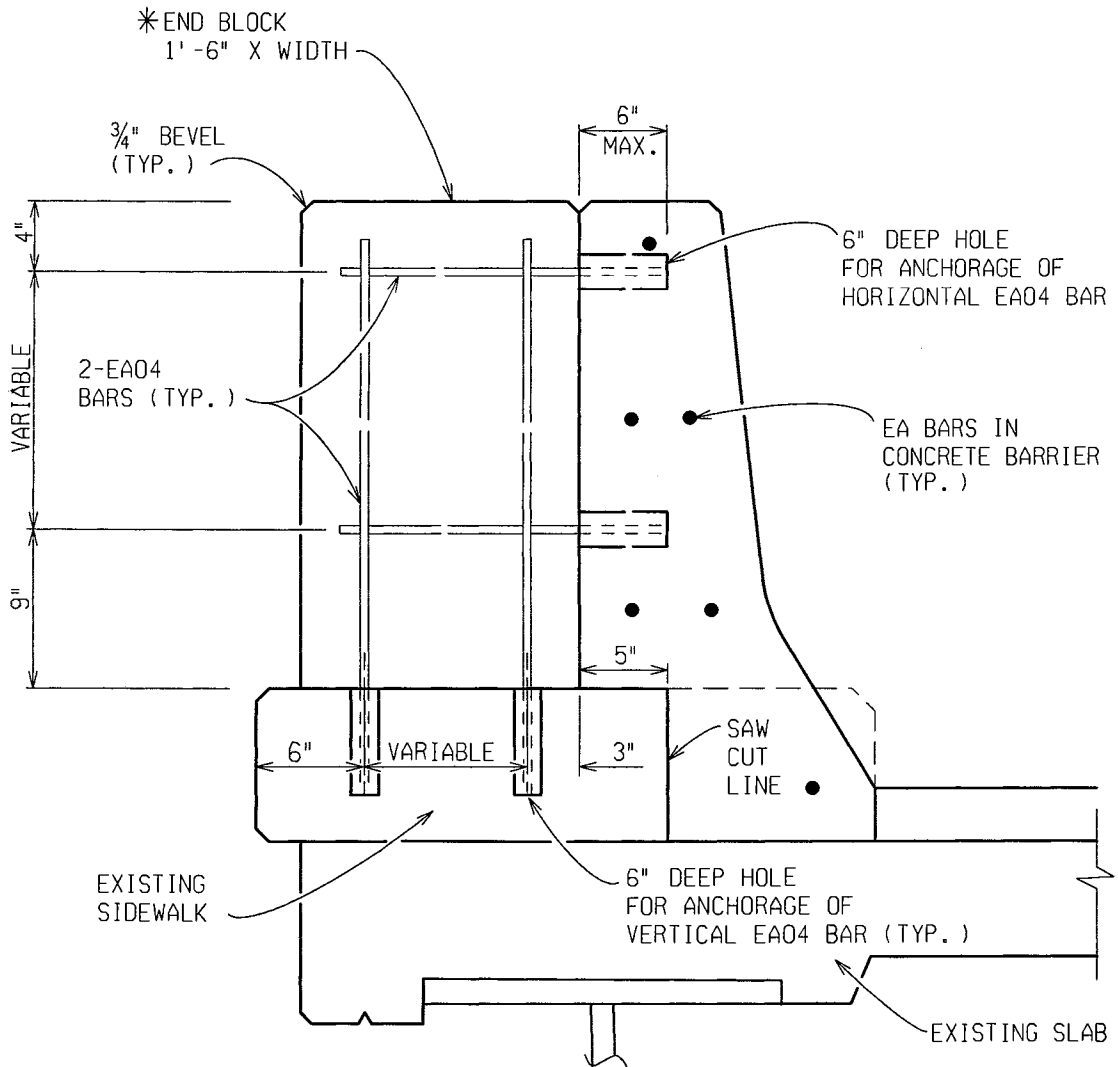
6.29.09B



DRAWN BY: MJB  
CHECKED BY: VZ  
APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY TECHNICAL SERVICES  
BRIDGE BARRIER RAILING, TYPE 4 (MOD.)  
FOR RAILING REPLACEMENT

ISSUED: 11/27/01  
SUPERSEDES: 08/08/96



NOTES:

\* END BLOCK SHALL BE USED WHENEVER THE WIDTH EXCEEDS 9".

PLAN NOTES:

CONCRETE FOR END BLOCK IS INCLUDED IN THE BID ITEM "BRIDGE BARRIER RAILING, TYPE 4 (MODIFIED)."

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: BMW

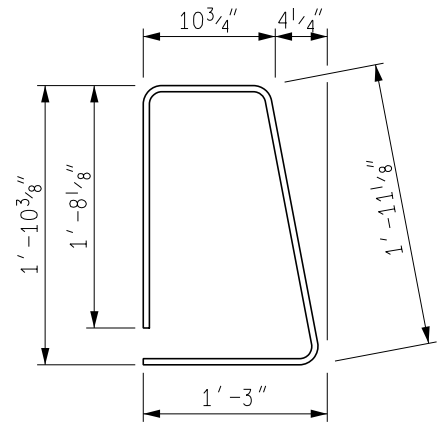
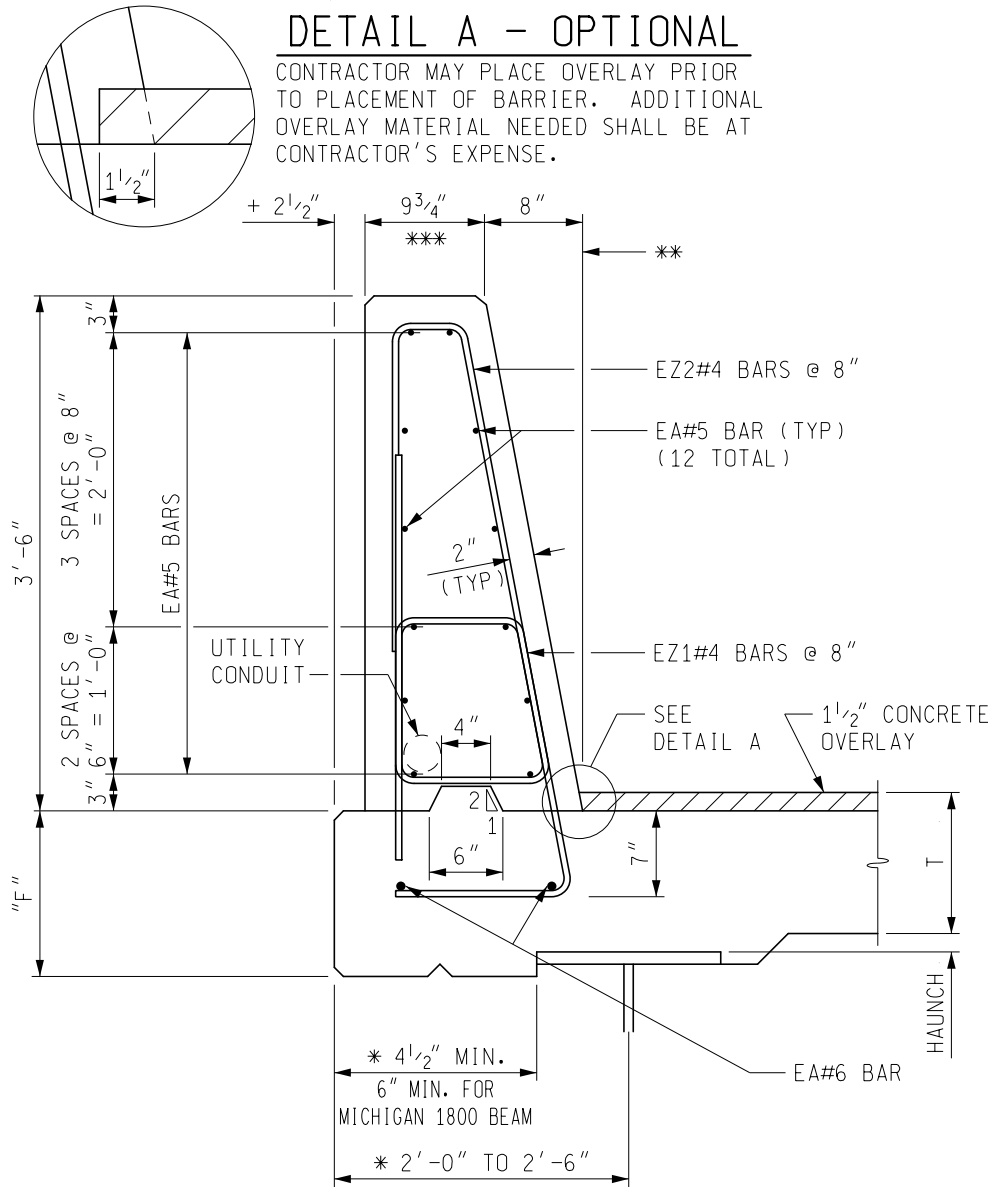
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

BRIDGE BARRIER RAILING TYPE 6  
 TWO STAGE DECK

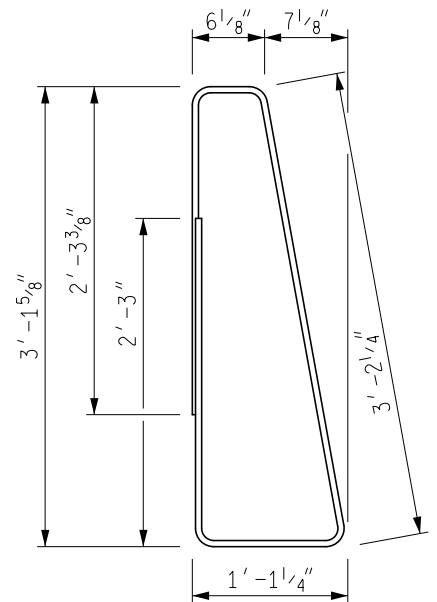
ISSUED: 12/16/19  
 SUPERSEDES: 02/14/11

**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  
 CHECKED BY: VZ  
 APPROVED BY: KCK

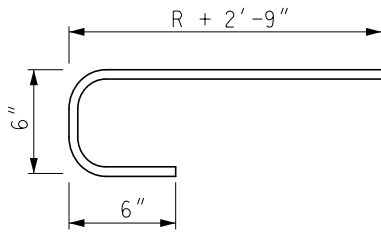
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

BRIDGE RAILING,  
 AESTHETIC PARAPET TUBE

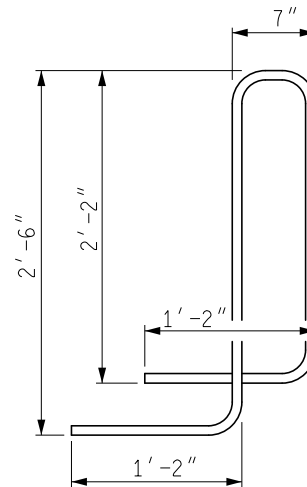
ISSUED: 03/27/23  
 SUPERSEDES: 02/14/11

WEIGHT = 320 LBS/FT

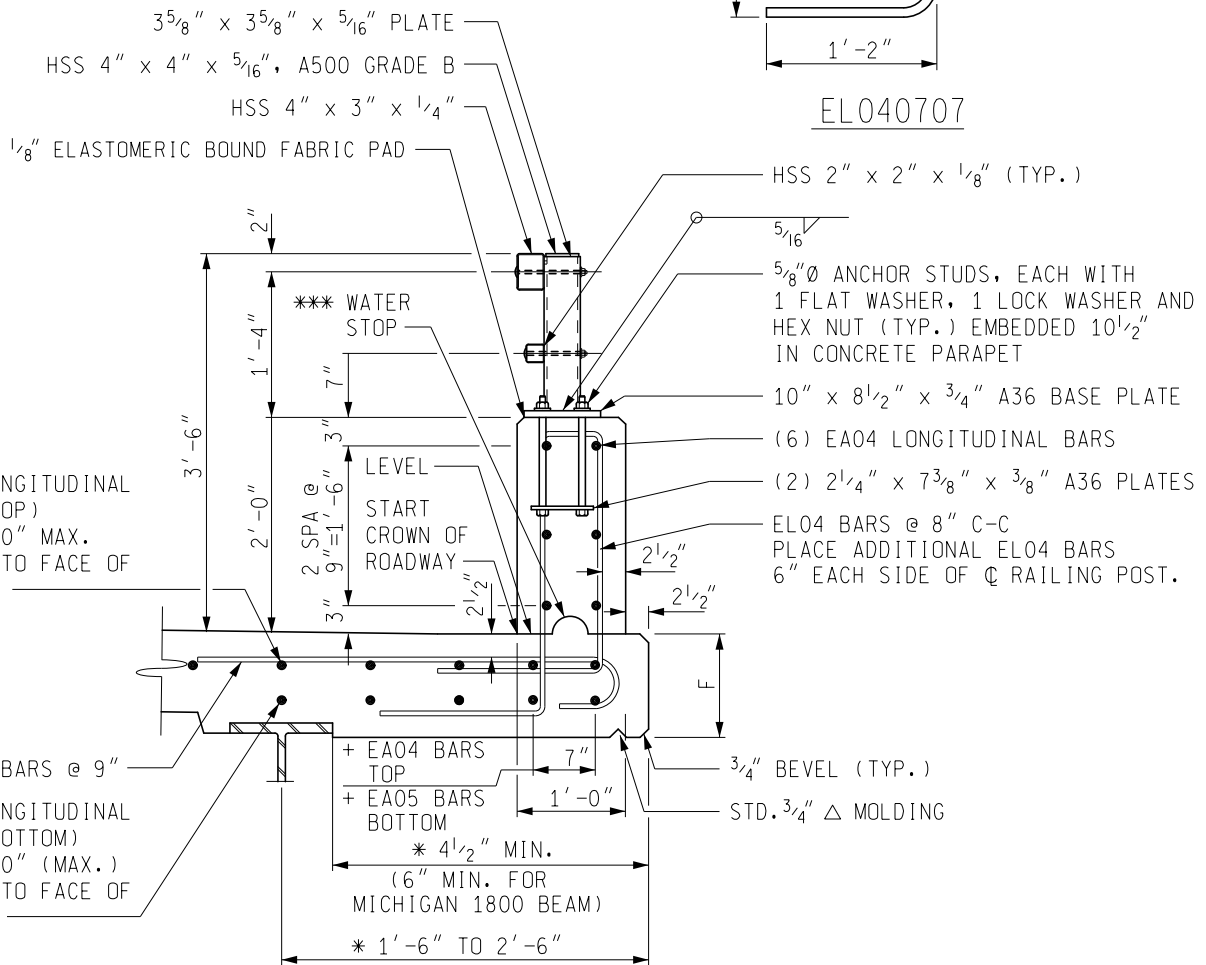
R =  $\phi$  BEAM TO SLAB FASCIA DISTANCE



\*\* ED06 BAR



ELO40707



FLUSH MOUNT BRIDGE RAILING

NOTES:

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

\*\*\* 2" HIGH x 4" WIDE ( $\pm$ ). FORMING NOT REQUIRED.

+ 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.

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.

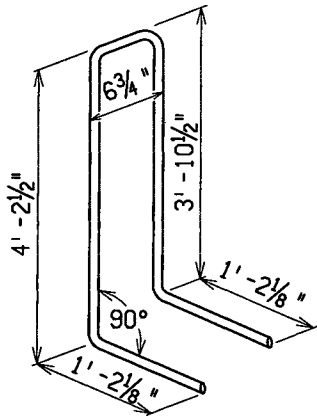
PREPARED BY  
 DESIGN DIVISION

6.29.10

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

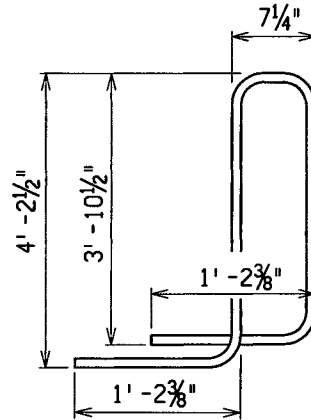
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT  
 BRIDGE RAILING, AESTHETIC PARAPET TUBE  
 END WALLS DETAILS

ISSUED: 08/15/03  
 SUPERSEDES: 11/27/01



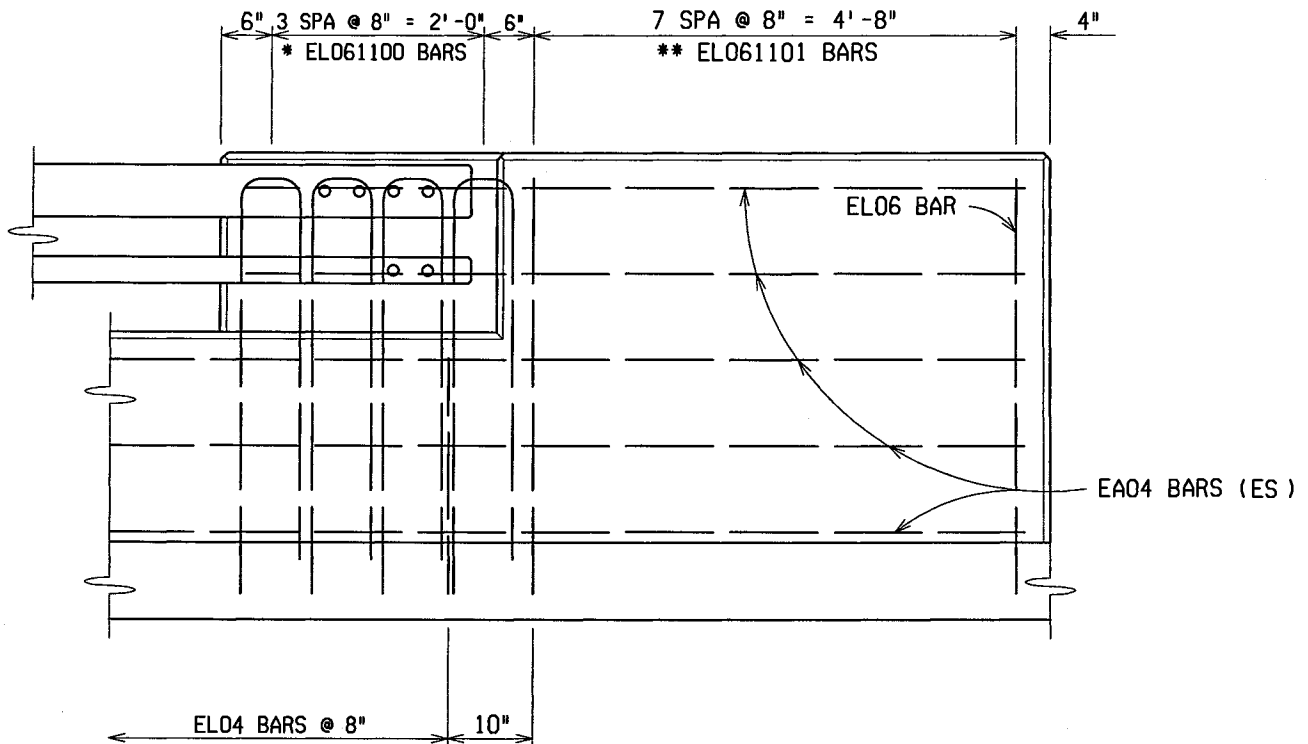
\* ELO61100

$L = a+b+c+d+e = 11'-0''$   
 $a = 3'-10\frac{1}{2}''$   $b = 6\frac{3}{4}''$   $c = 4'-2\frac{1}{2}''$   
 $d = 1'-2\frac{1}{8}''$   $e = 1'-2\frac{1}{8}''$   $f = 0$   
 $g = 6\frac{3}{4}''$



\*\* ELO61101

$L = a+b+c+d+e = 11'-1''$   
 $a = 4'-2\frac{1}{2}''$   $b = 7\frac{1}{4}''$   $c = 3'-10\frac{1}{2}''$   
 $d = 1'-2\frac{3}{8}''$   $e = 1'-2\frac{3}{8}''$   $f = 7\frac{1}{4}''$   
 $g = 0$



END WALL DETAIL

NOTE:

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

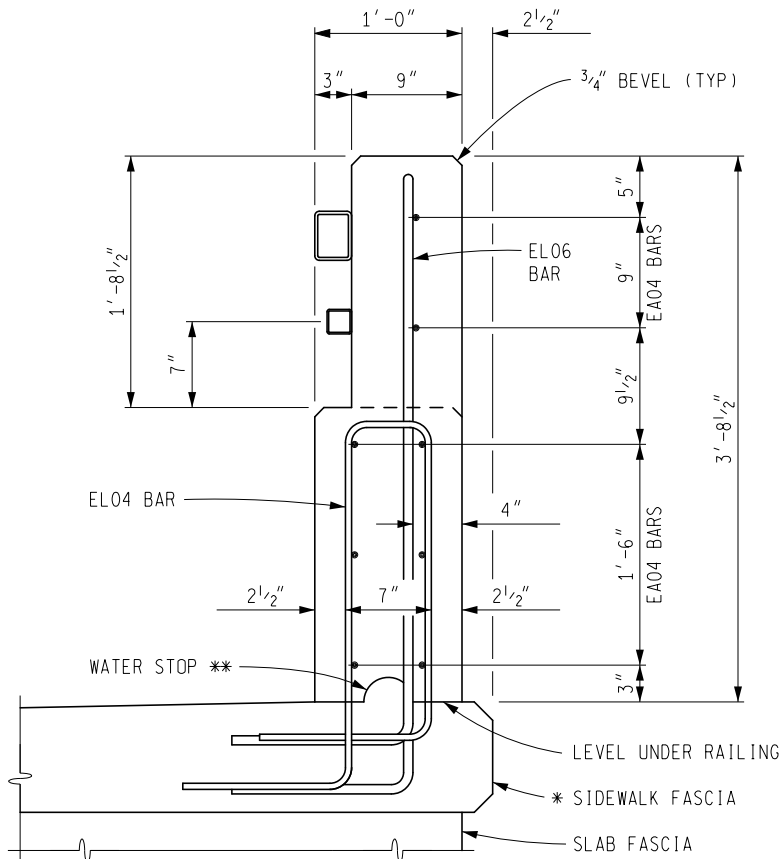
PREPARED BY  
 DESIGN SUPPORT AREA

6.29.10A

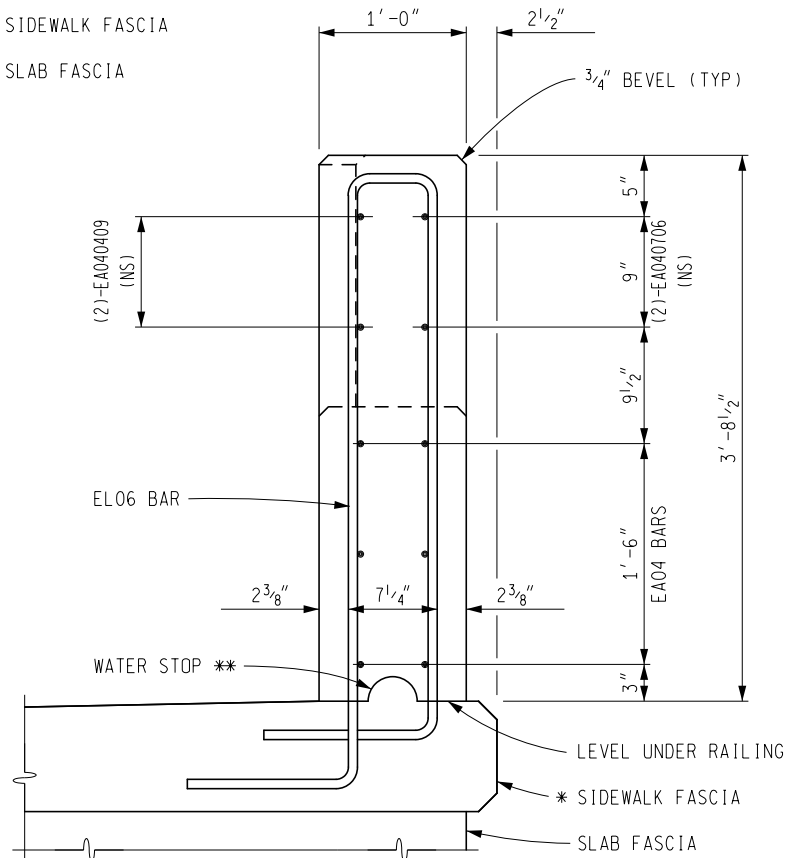
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 CHECKED BY: VZ  
 APPROVED BY: DAJ

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT  
 BRIDGE RAILING, AESTHETIC PARAPET TUBE  
 END WALL SECTIONS

ISSUED: 05/23/16  
 SUPERSEDES: 12/22/11



**SECTION AT END WALL**  
 (TUBE CONNECTION AREA)



**SECTION AT END WALL**  
 (FULL CONCRETE AREA)

**NOTE:**

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

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

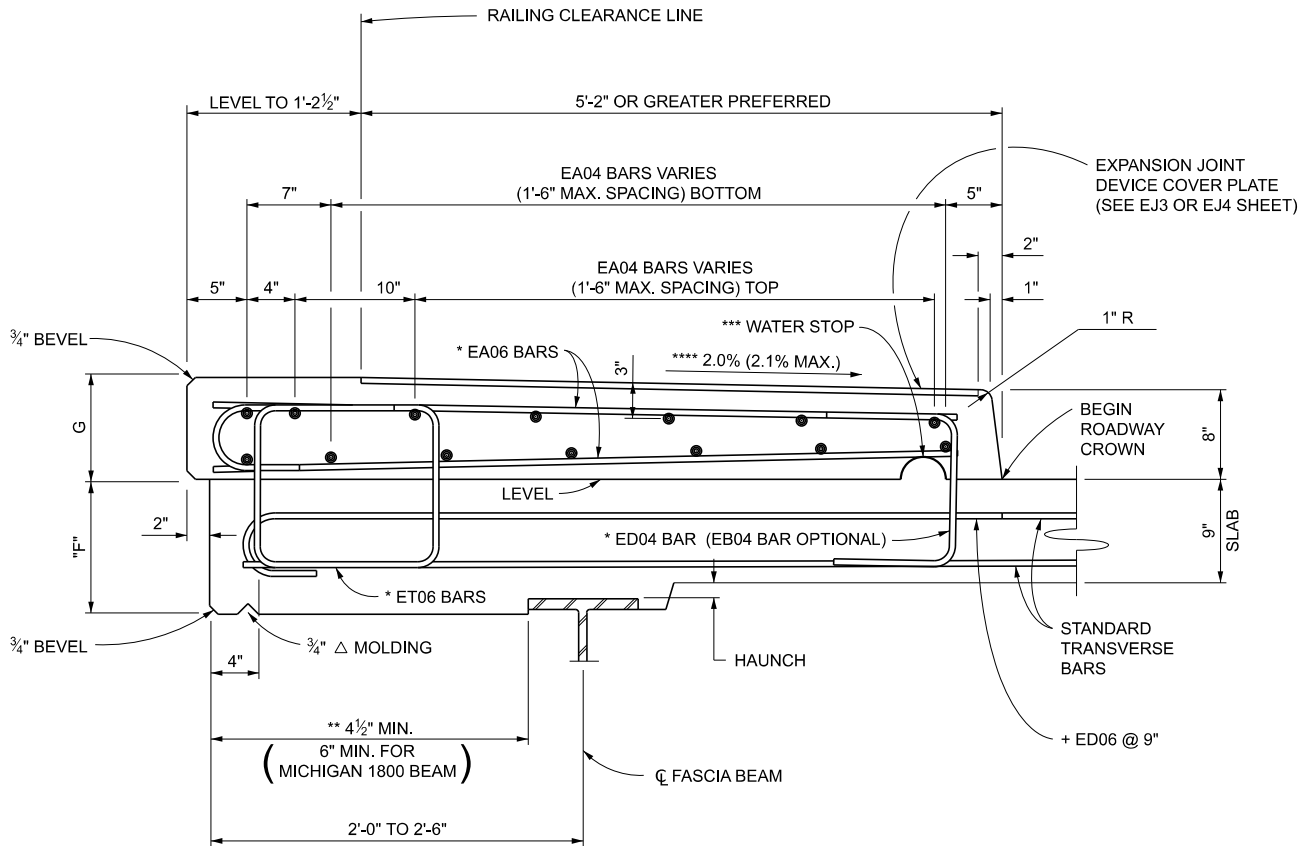
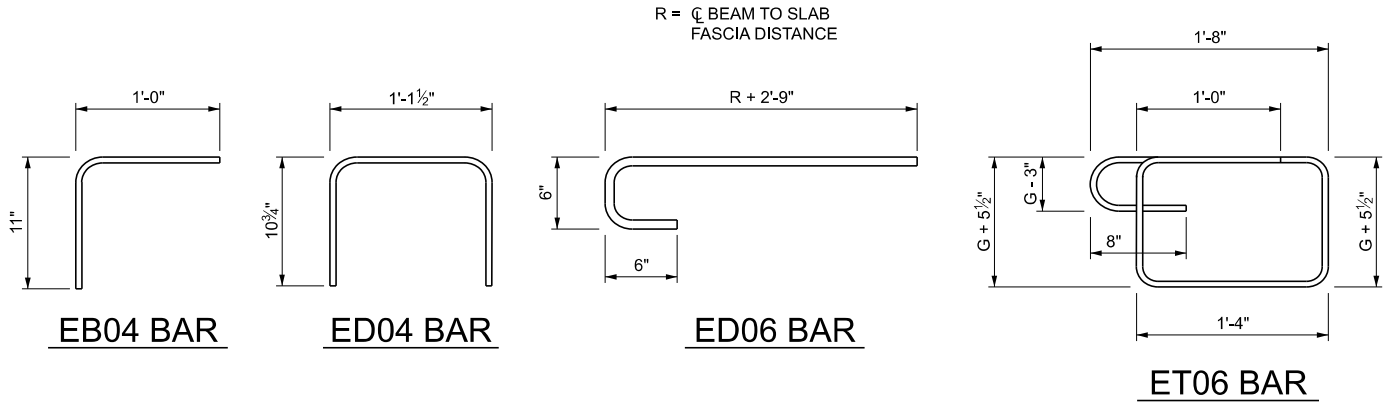
PREPARED BY  
 DESIGN DIVISION

6.29.10B

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 BRIDGE RAILING, AESTHETIC PARAPET TUBE  
 SIDEWALK SECTION

ISSUED: 02/26/24  
 SUPERSEDES: 11/27/23



NOTES:

"F" CONSTANT EQUALS SLAB THICKNESS PLUS HAUNCH PLUS THICKEST FASCIA BEAM FLANGE PLUS 1/2" 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). 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.

\* 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 CL RAILING POST.

\*\* APPLIES TO CURVED BRIDGES ONLY.

\*\*\* 2" HIGH x 4" LONG (±). FORMING NOT REQUIRED.

\*\*\*\* 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:  
CHECKED BY:  
APPROVED BY:

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT

ISSUED:  
SUPERSEDES:

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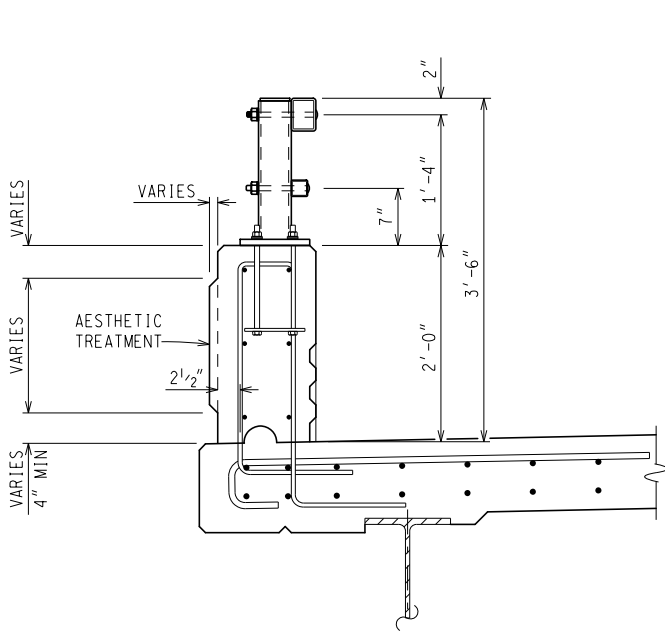
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PREPARED BY  
DESIGN DIVISION

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: T&F

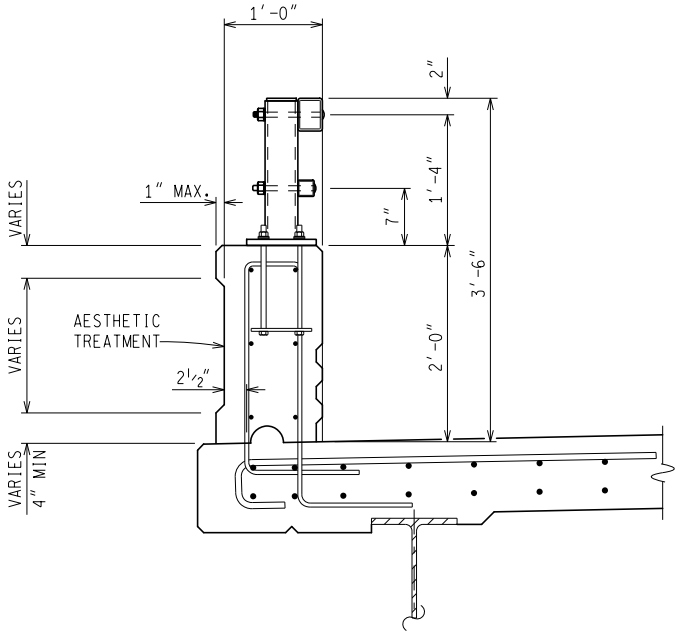
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT  
 BRIDGE RAILING, AESTHETIC PARAPET TUBE  
 AESTHETIC

ISSUED: 02/14/11  
 SUPERSEDES: / /



PAY ITEM

BRIDGE RAILING, AESTHETIC PARAPET TUBE, DET 1



PAY ITEM

BRIDGE RAILING, AESTHETIC PARAPET TUBE, DET 2

CONSTRUCT RAILINGS IN THE SAME MANNER AS STANDARD BRIDGE RAILING, AESTHETIC PARAPET TUBE. EXCEPT ADJUST THE WIDTH ACCORDING TO THE DETAILS ON THE PLAN TO ACCOMMODATE FORM LINERS TO ACCOMPLISH CONCRETE TEXTURING ON THE BACK OF THE BRIDGE RAILING. USE LONGER ANCHOR BOLTS AND A 14" x 26" x 3/8" PLATE TO ATTACH THE GUARDRAIL TO THE BARRIER. REFER TO THE CONTRACT DOCUMENTS FOR REQUIREMENTS FOR TEXTURING CONCRETE.

SLIP FORMING BRIDGE RAILING, AESTHETIC, PARAPET TUBE, DET \_\_ IS NOT ALLOWED.

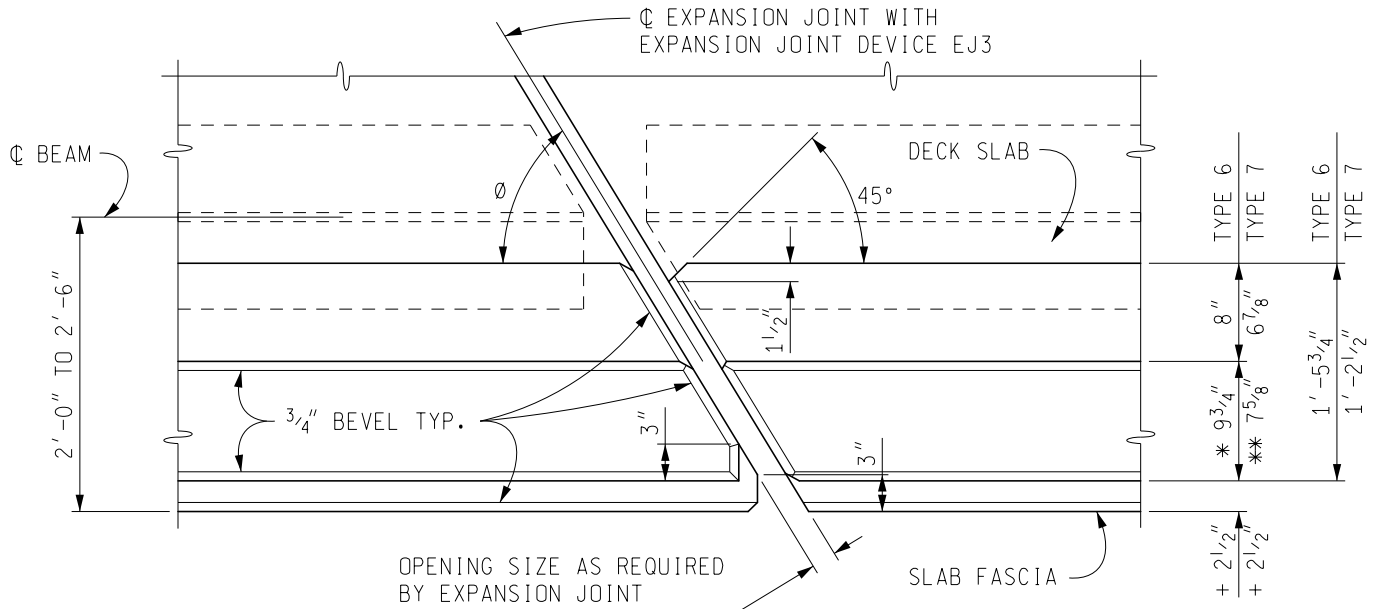


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 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

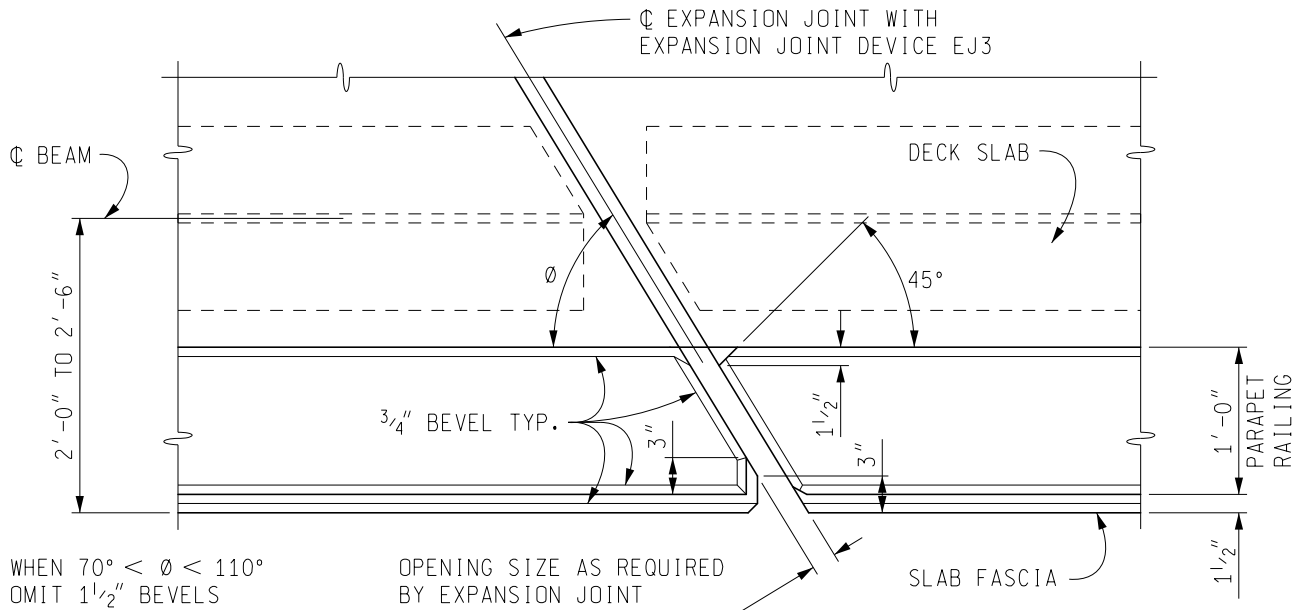
ISSUED: 01/27/20  
 SUPERSEDES: 12/16/19

JOINT DETAIL FOR BRIDGE  
 BARRIER RAILING WITH EXPANSION JOINT



PLAN VIEW  
 JOINT WITH EJ3 EXPANSION JOINT

SEE EJ3 STANDARD SHEET FOR EXPANSION JOINT DEVICE DETAILS



WHEN  $70^\circ < \theta < 110^\circ$   
 OMIT  $1\frac{1}{2}$ " BEVELS

PLAN VIEW  
 JOINT WITH EJ3 EXPANSION JOINT

SEE EJ3 STANDARD SHEET FOR EXPANSION JOINT DEVICE DETAILS

- \*  $10\frac{3}{4}$ " BRIDGE BARRIER RAILING AESTHETIC TYPE 6, DET 2
- \*\*  $8\frac{5}{8}$ " BRIDGE BARRIER RAILING AESTHETIC TYPE 7, DET 2
- + BACK OF BARRIER TO SLAB FASCIA MAY BE DECREASED TO  $1\frac{1}{2}$ " (FROM  $2\frac{1}{2}$ ") AND TOE OF BARRIER SHIFTED ACCORDINGLY TO ACCOMMODATE THE NEED FOR INCREASED OR MAINTAINING SHOULDER WIDTHS. DISTANCE TO BE DETAILED ON THE PLANS.

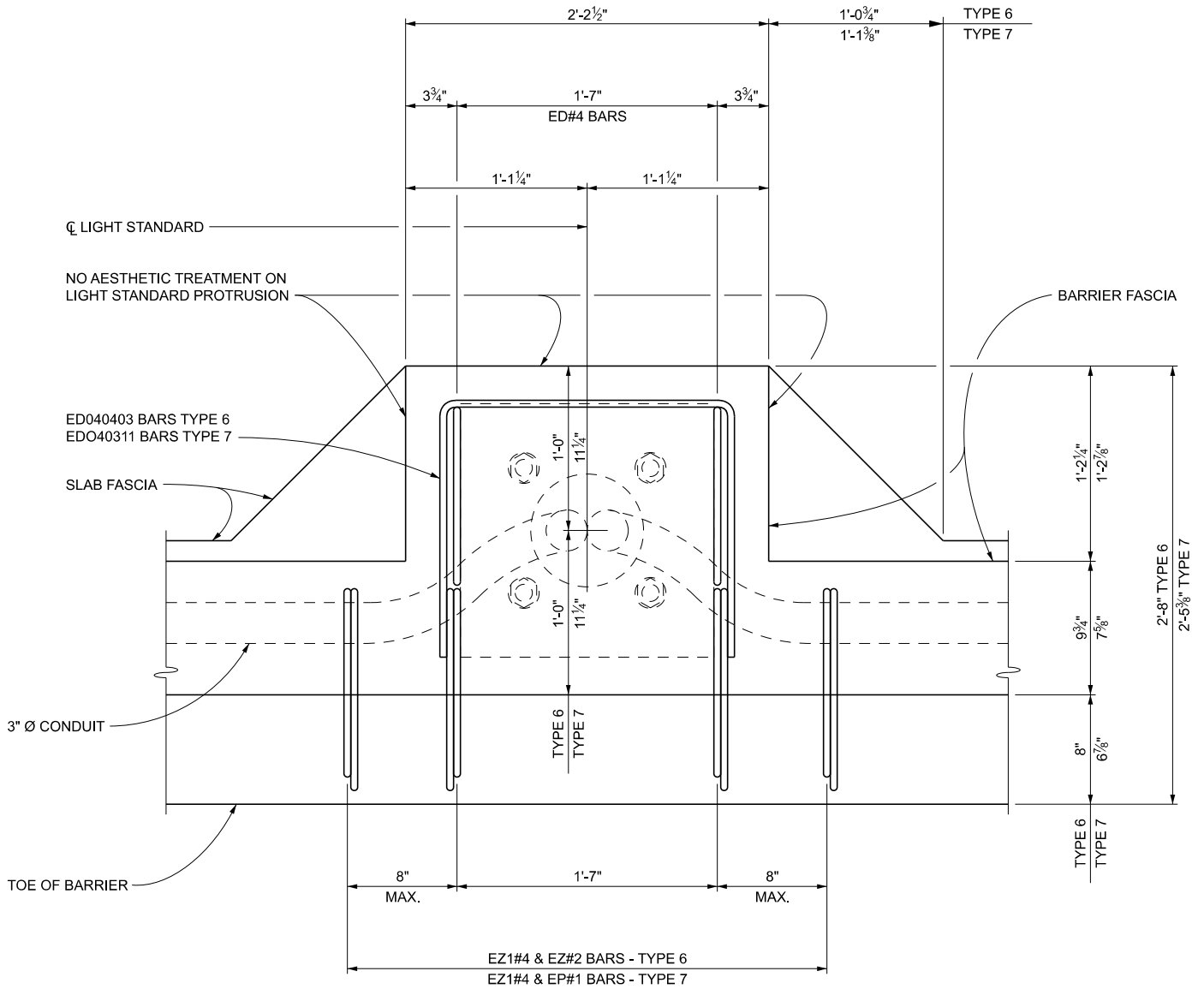
PREPARED BY  
 DESIGN DIVISION

6.29.11

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 BARRIER RAILING DETAILS  
 AT LIGHT STANDARD

ISSUED: 01/29/24  
 SUPERSEDES: 12/16/19



**PLAN VIEW**  
 TYPE 6 SHOWN

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

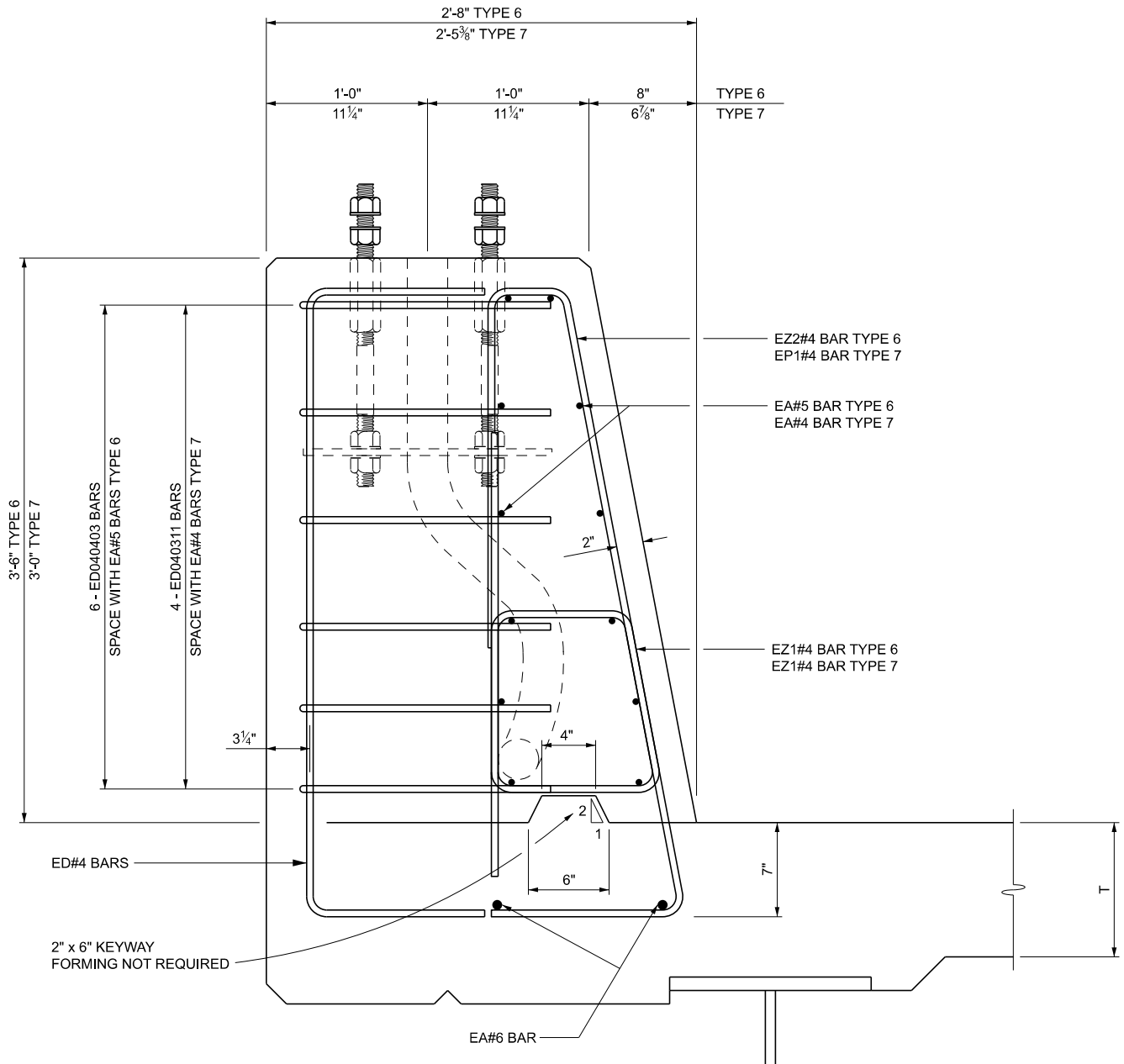
PREPARED BY  
 DESIGN DIVISION

**6.29.13**

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CHECKED BY: VZ  
APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT  
BARRIER RAILING DETAILS  
AT LIGHT STANDARD

ISSUED: 01/29/24  
SUPERSEDES: 12/16/19



**SECTION**  
TYPE 6 SHOWN

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

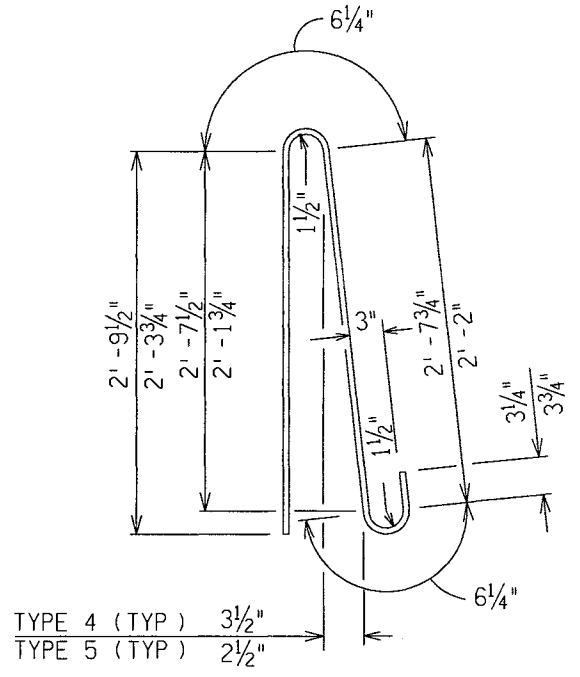
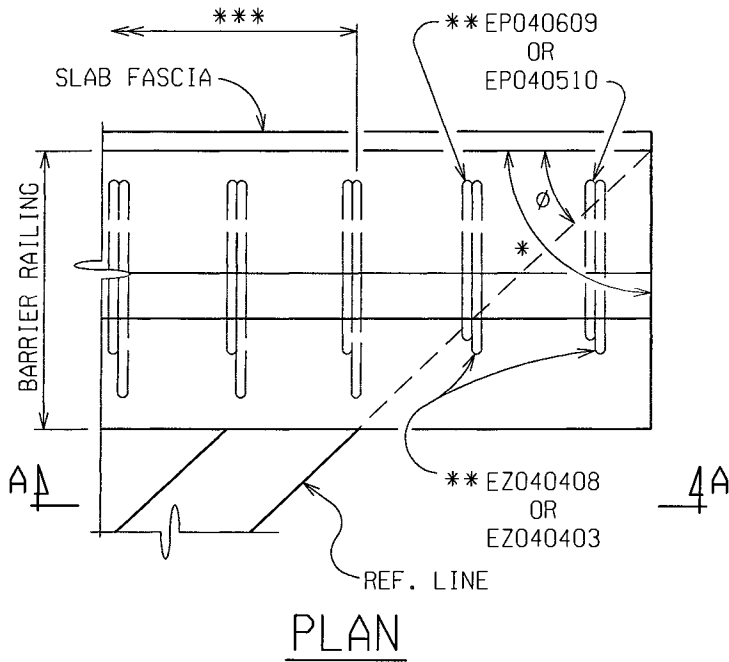
PREPARED BY  
DESIGN DIVISION

6.29.13A

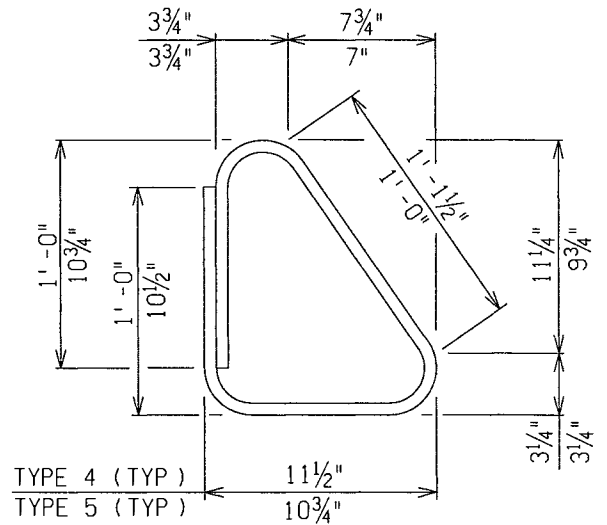
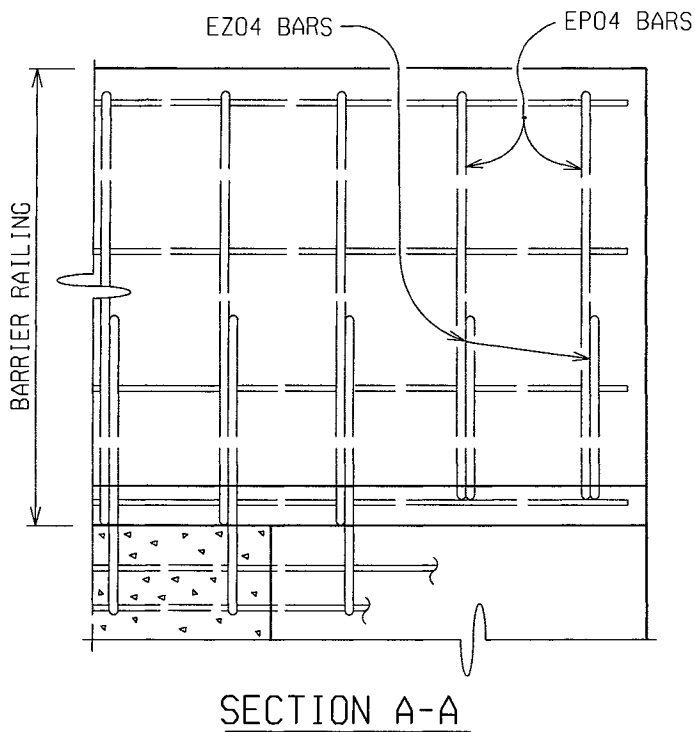
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 APPROVED BY: TCF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES  
**BARRIER RAILING DETAILS  
 AT DEPENDENT BACKWALL**

ISSUED: 11/27/01  
 SUPERSEDES: 08/08/96



**EP040609 (TYPE 4)**  
**EP040510 (TYPE 5)**



**EZ040408 (TYPE 4)**  
**EZ040403 (TYPE 5)**

\* CAST SQUARE WHEN  $\phi < 70^\circ$  OR  $\phi > 110^\circ$ ; CAST PARALLEL TO REF. LINE WHEN  $70^\circ \leq \phi \leq 110^\circ$ .

\*\* 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.

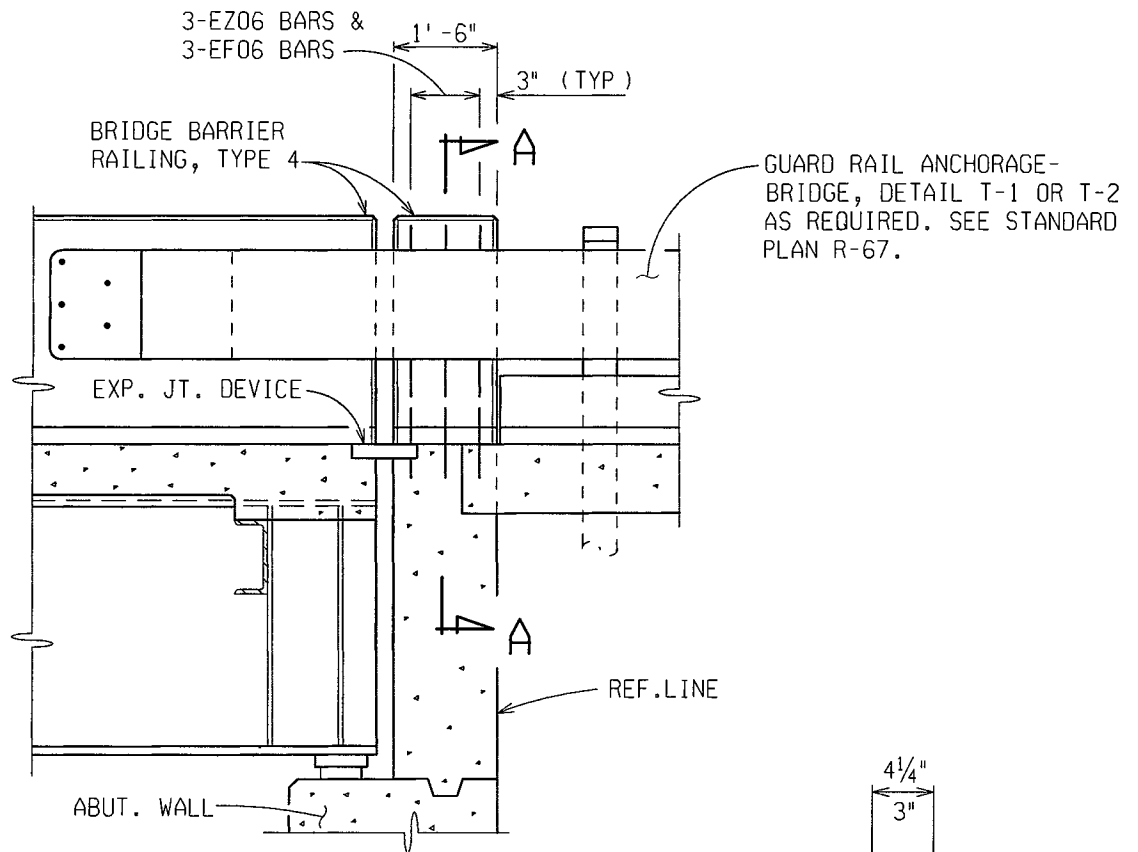
PREPARED BY  
 DESIGN DIV.

6.29.15

DRAWN BY: MJB  
 CHECKED BY: VZ  
 APPROVED BY: TGF

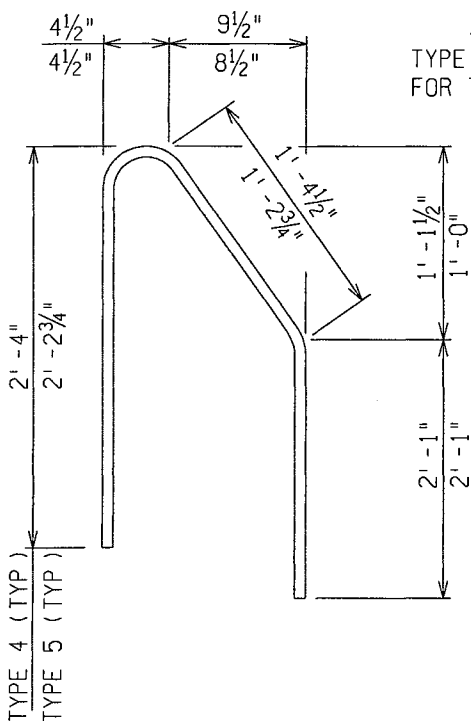
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES  
 BARRIER RAILING DETAILS  
 AT INDEPENDENT BACKWALL

ISSUED: 11/27/01  
 SUPERSEDES: 08/08/96

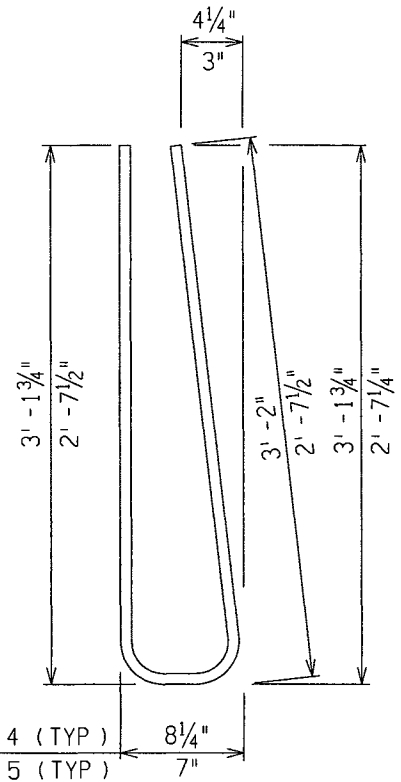


**ELEVATION**

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.

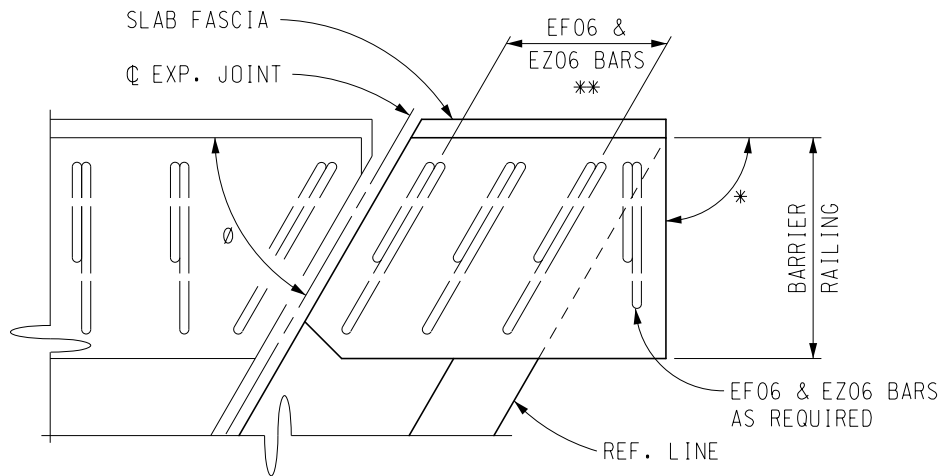
6.29.16

DRAWN BY: BLT  
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 APPROVED BY: DAJ

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

ISSUED: 05/23/16  
 SUPERSEDES: 05/04/06

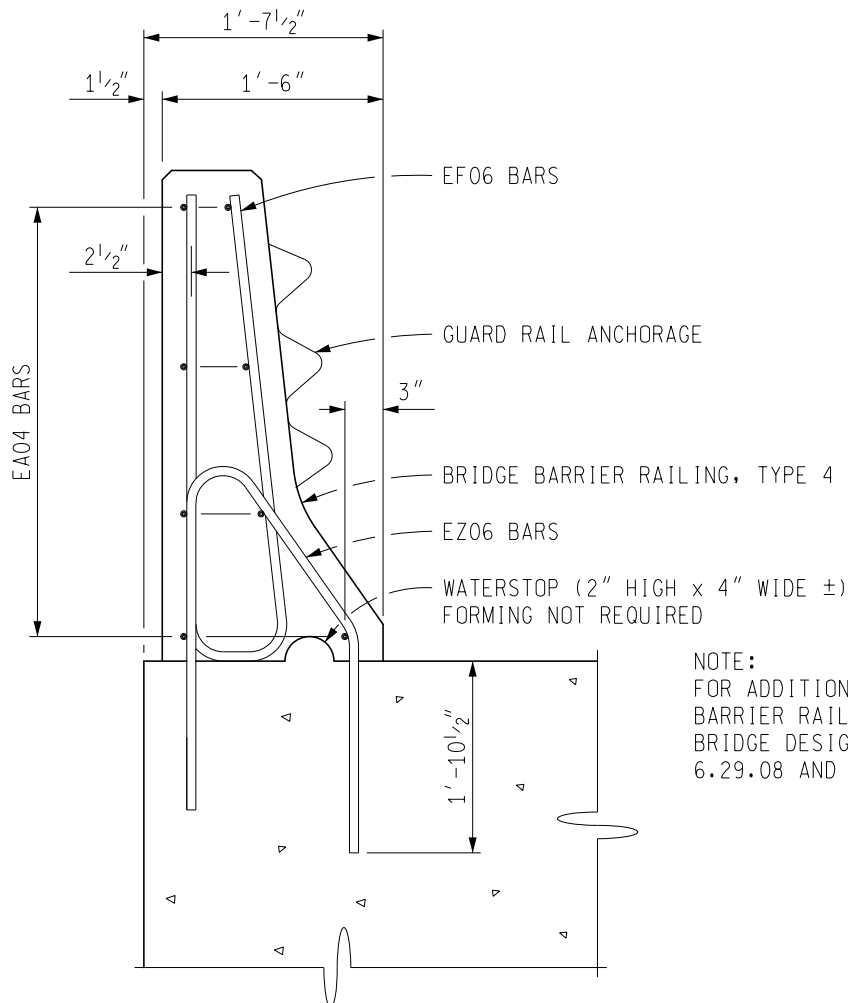
BARRIER RAILING DETAILS  
 AT INDEPENDENT BACKWALL



PLAN

\* WHEN  $\theta \leq 70^\circ$  OR  $\theta \geq 110^\circ$ , CAST BARRIER END SQUARE; OTHERWISE CAST PARALLEL TO REFERENCE LINE.

\*\* WHEN  $\theta \leq 80^\circ$  OR  $\theta \geq 100^\circ$ , 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

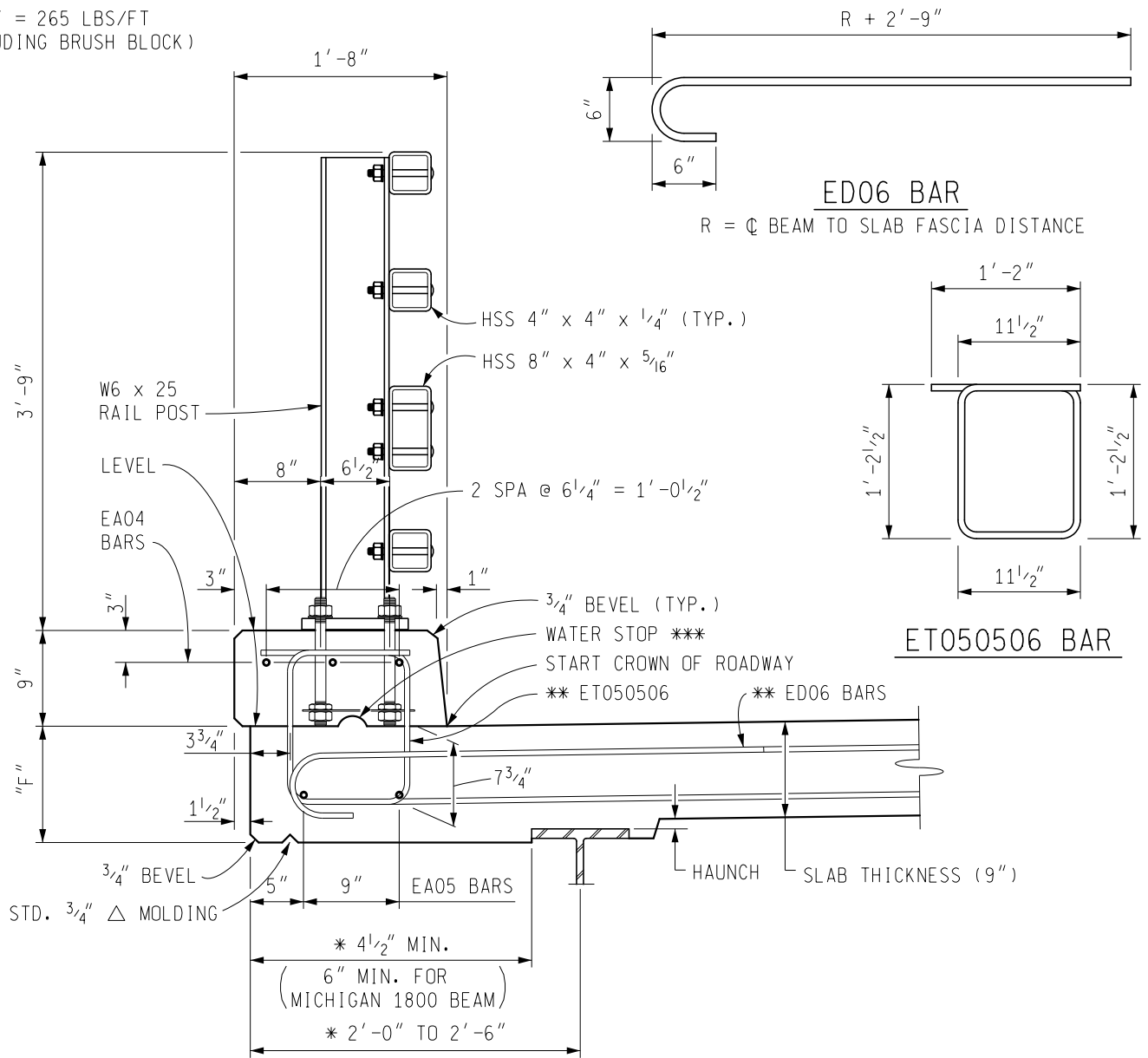
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 CHECKED BY: VZ  
 APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

BRIDGE RAILING, 4 TUBE  
 BICYCLE RAILING OPTION

ISSUED: 03/27/23  
 SUPERSEDES: 02/14/11

WEIGHT = 265 LBS/FT  
 (INCLUDING BRUSH BLOCK)



NOTES:

"F" CONSTANT EQUALS SLAB THICKNESS PLUS THICKEST FASCIA BEAM FLANGE PLUS 1/2" 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.

\* IT IS PREFERRED TO POSITION THE FASCIA BEAM TO CARRY THE SCREED RAIL WHICH WILL BE APPROXIMATELY 1'-0" FROM THE ET BAR. HOWEVER, 4 1/2" MINIMUM WILL APPLY TO CURVED GIRDERS ONLY.

\*\* 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.

\*\*\* 2" HIGH x 4" LONG (±). FORMING NOT REQUIRED.

PREPARED BY  
 DESIGN DIVISION

6.29.17

DRAWN BY:  
CHECKED BY:  
APPROVED BY:

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT

ISSUED:  
SUPERSEDES:

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DESIGN DIVISION

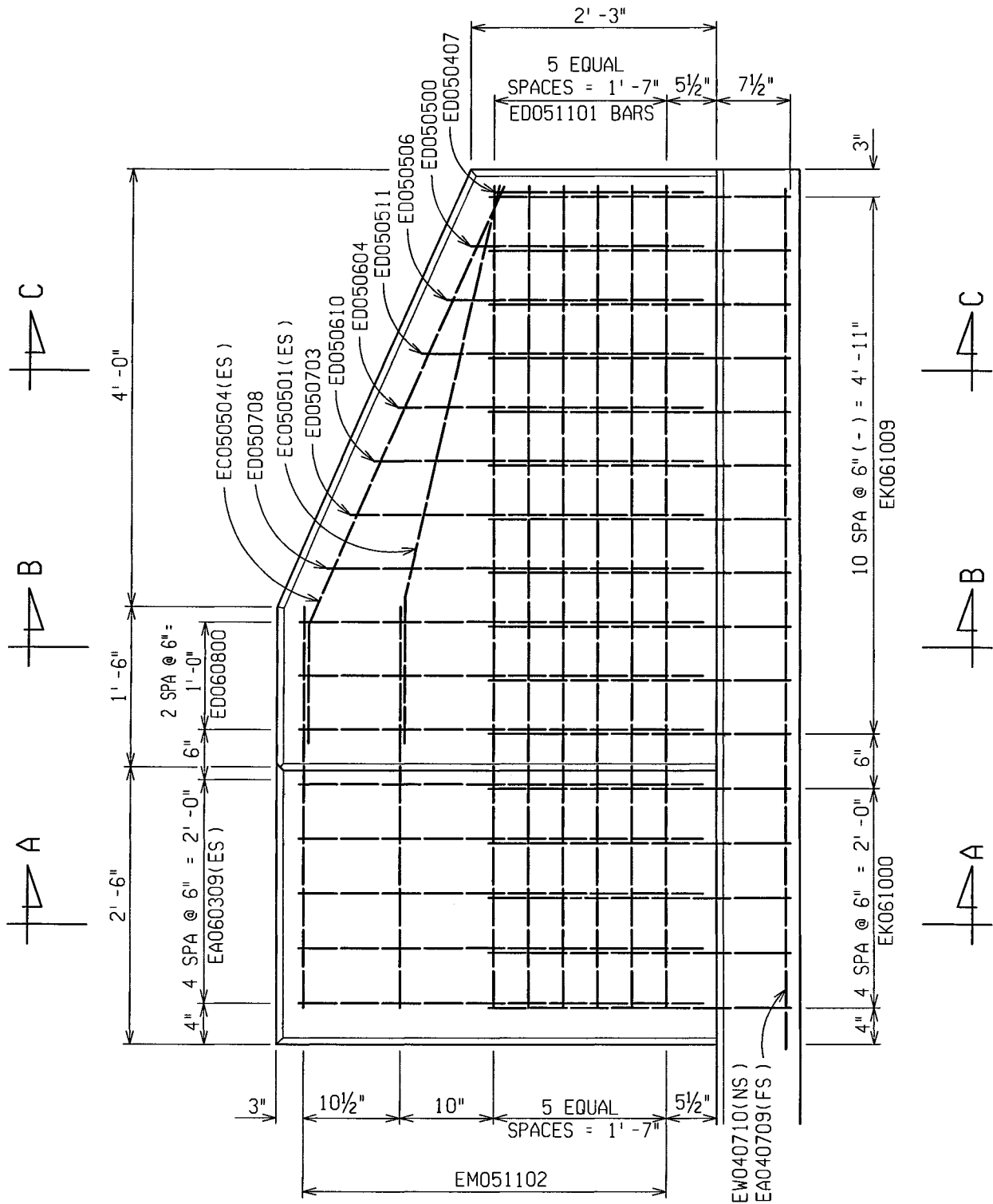


DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: TGF

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

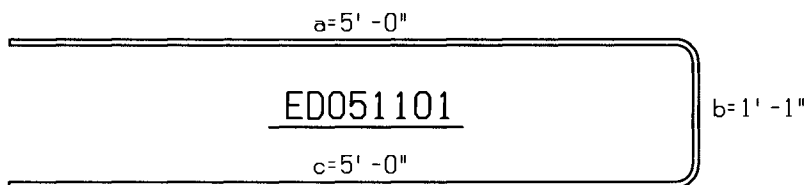
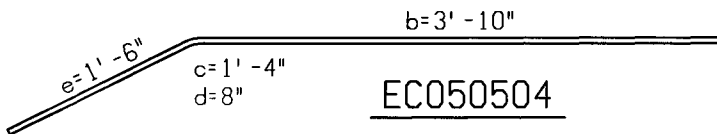
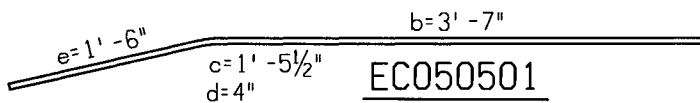
6.29.17B

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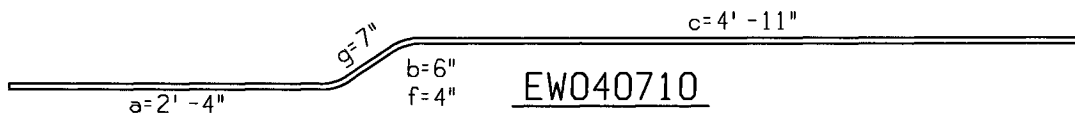
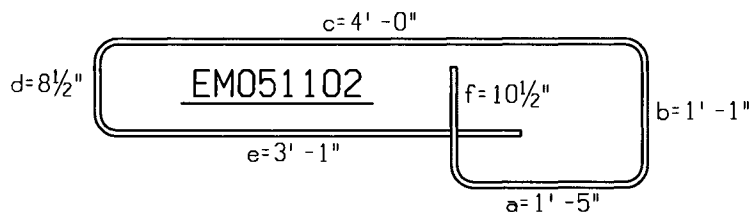
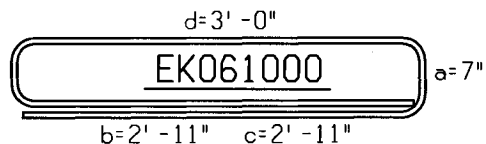
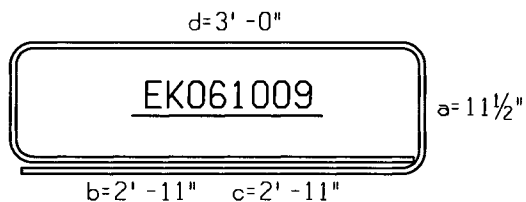
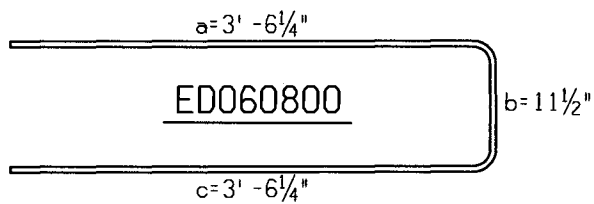
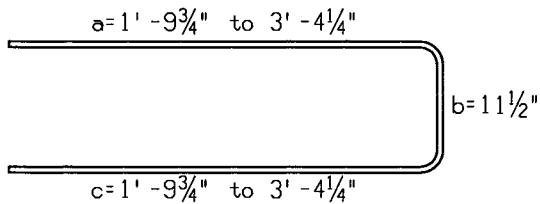
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

BRIDGE RAILING, 4 TUBE  
 BICYCLE RAILING OPTION END WALL

ISSUED: 08/15/03  
 SUPERSEDES: / /



ED050407  
 ED050500  
 ED050506  
 ED050511  
 ED050604  
 ED050610  
 ED050703  
 ED050708



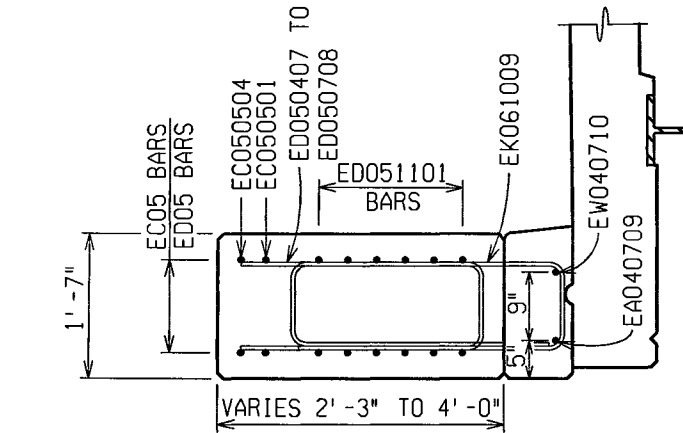
PREPARED BY  
 DESIGN SUPPORT AREA

6.29.17C

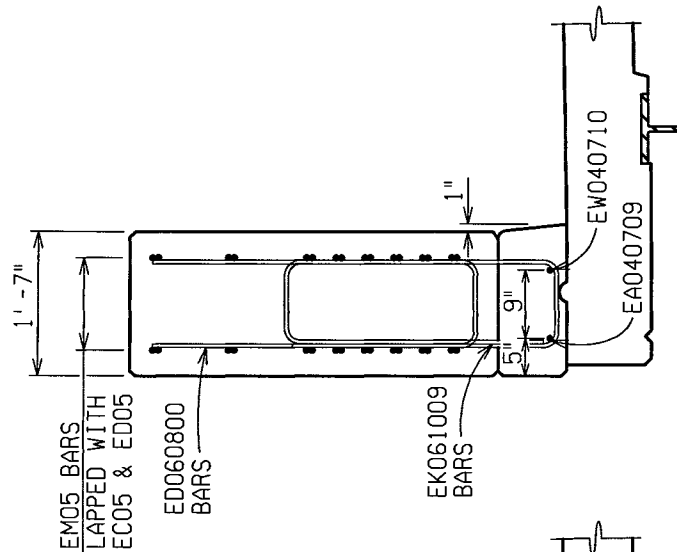
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT  
 BRIDGE RAILING, 4 TUBE  
 BICYCLE RAILING SECTIONS

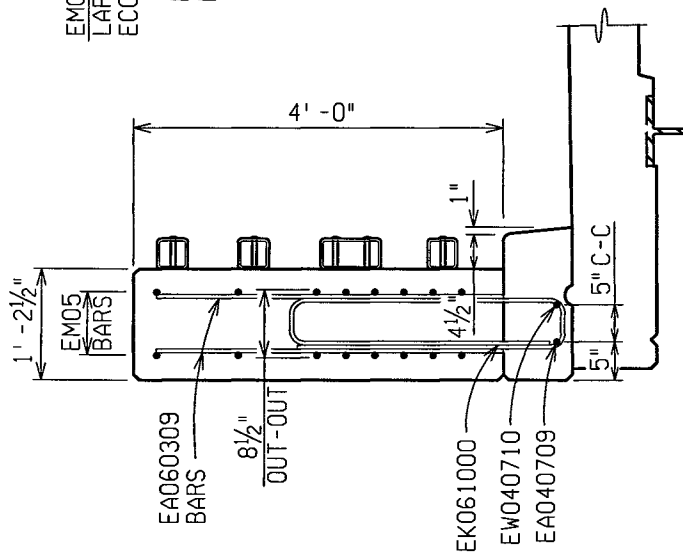
ISSUED: 08/15/03  
 SUPERSEDES: / /



SECTION C-C



SECTION B-B



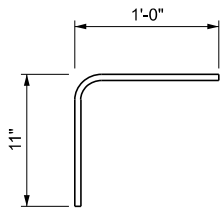
SECTION A-A

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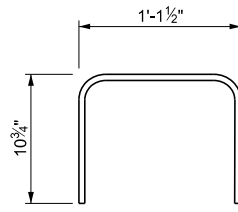
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 BRIDGE RAILING, 4 TUBE - SIDEWALK SECTION  
 PEDESTRIAN RAILING OPTION

ISSUED: 02/26/24  
 SUPERSEDES: 11/27/23

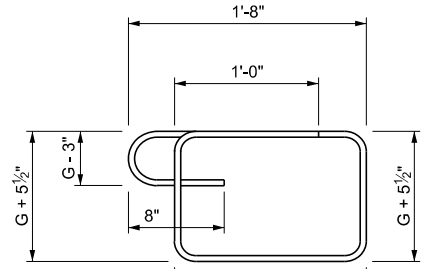
WEIGHT = 80 LBS/FT



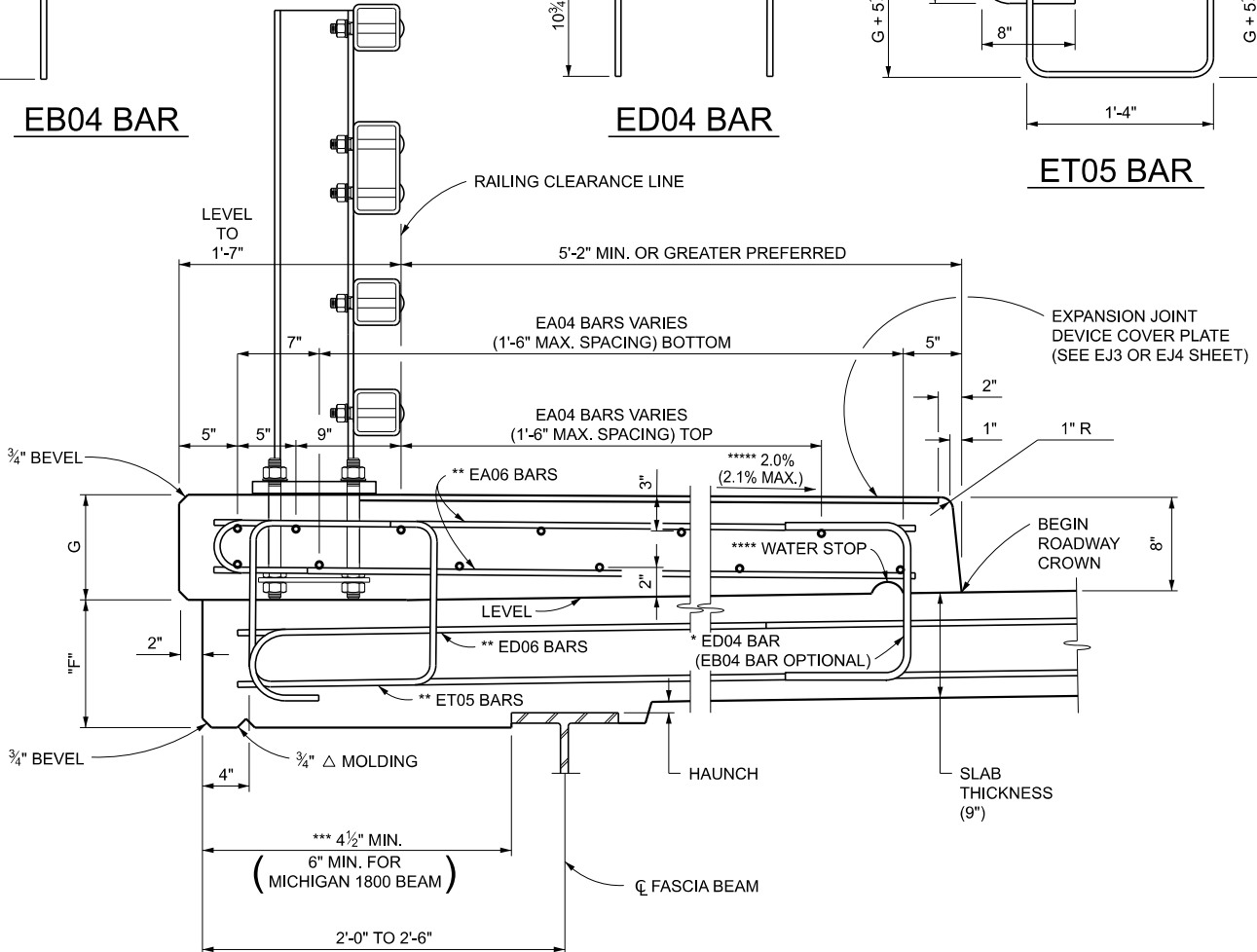
**EB04 BAR**



**ED04 BAR**



**ET05 BAR**



**NOTES:**

"F" CONSTANT EQUALS SLAB THICKNESS PLUS HAUNCH PLUS THICKEST FASCIA BEAM FLANGE PLUS 1/2" 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.

\* EB04 BAR MAY BE ADHESIVE ANCHORED INTO 6" DEEP HOLE INSTEAD OF ED04 BAR. SPACE WITH ALTERNATE TRANSVERSE SLAB BARS (1'-6" MAX.).

\*\* AT EACH POST PLACE 7 - ET05 BARS SPACED AT 6", ED06 BARS (SEE GUIDE 6.29.17) AND EA06 BARS WITH ALTERNATE ET05 BARS. PLACE ET05 BARS, ED06 BARS AND EA06 BARS AT 12" MAXIMUM IN REMAINING AREAS.

\*\*\* APPLIES TO CURVED BRIDGES ONLY.

\*\*\*\* 2" HIGH x 4" LONG (±), FORMING NOT REQUIRED.

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

PREPARED BY  
 DESIGN DIVISION

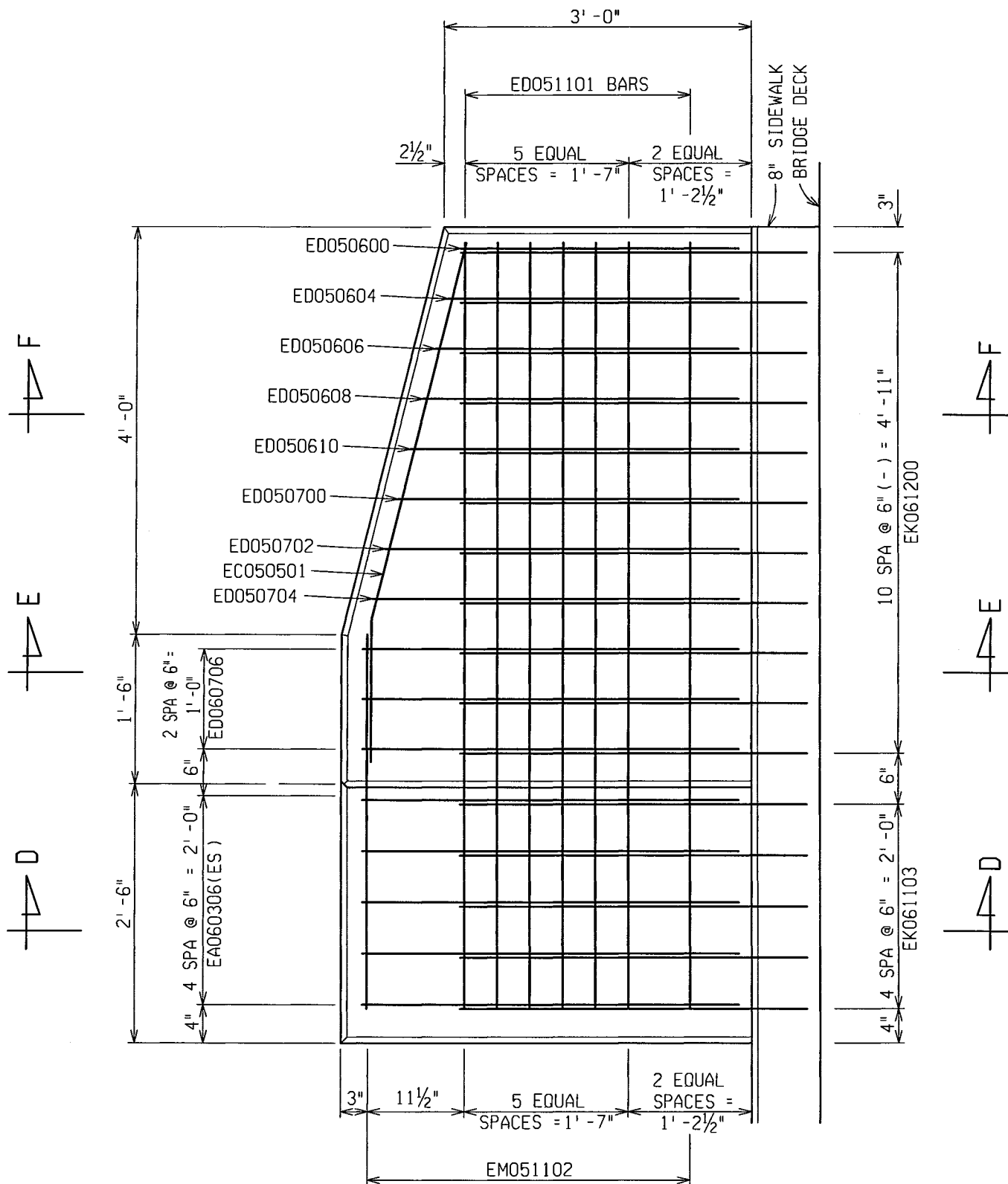
**6.29.17E**

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 CHECKED BY: VZ  
 APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

ISSUED: 08/15/03  
 SUPERSEDES: / /

BRIDGE RAILING, 4 TUBE  
 PEDESTRIAN RAILING OPTION END WALL



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

PREPARED BY  
 DESIGN SUPPORT AREA

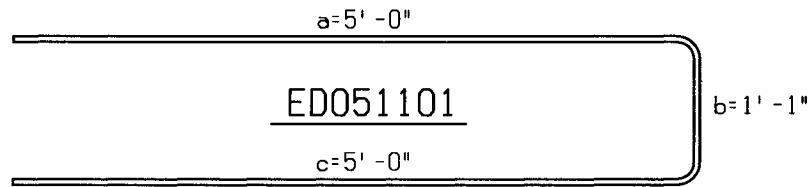
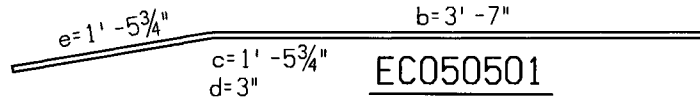
6.29.17F

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CHECKED BY: VZ  
APPROVED BY: TGF

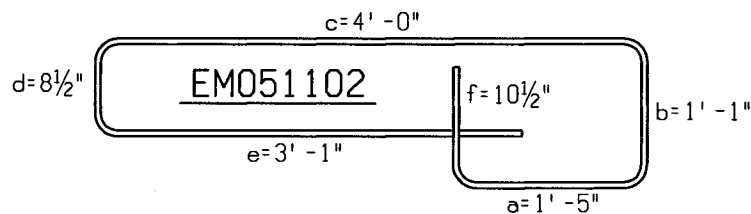
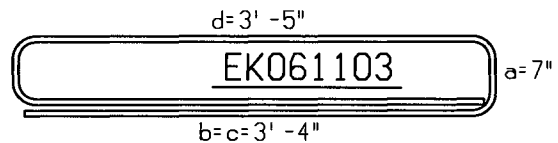
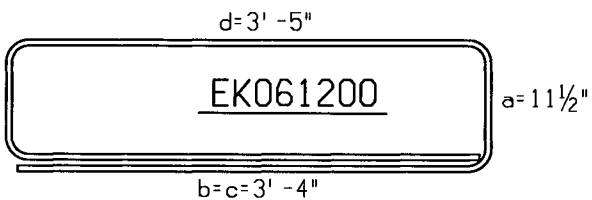
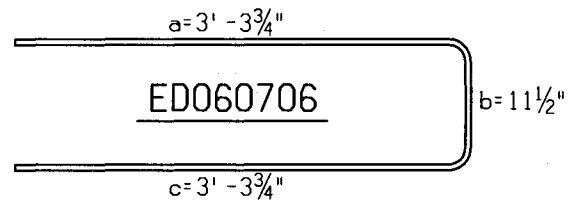
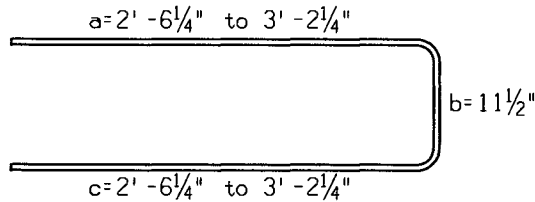
MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY DEVELOPMENT

BRIDGE RAILING, 4 TUBE  
PEDESTRIAN RAILING OPTION END WALL

ISSUED: 08/15/03  
SUPERSEDES: / /



ED050600  
ED050604  
ED050606  
ED050608  
ED050610  
ED050700  
ED050702  
ED050704

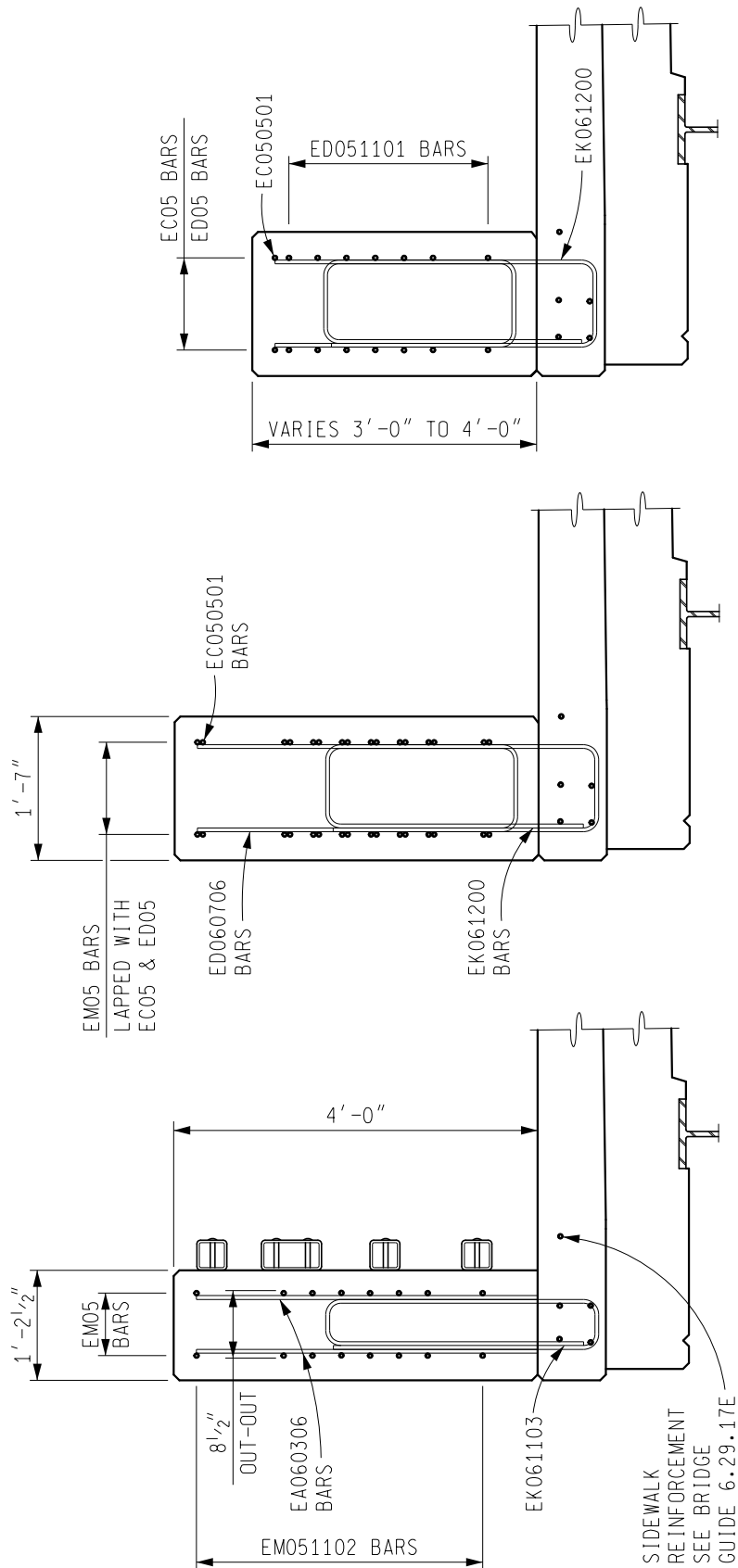


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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

BRIDGE RAILING, 4 TUBE  
 PEDESTRIAN RAILING SECTION

ISSUED: 05/23/16  
 SUPERSEDES: 08/15/03



SECTION F-F

SECTION E-E

SECTION D-D

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 DESIGN DIVISION

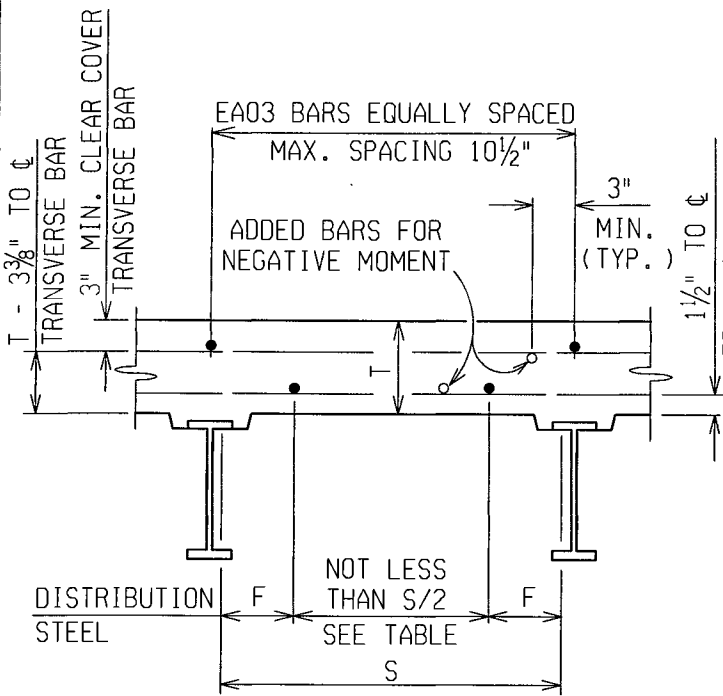
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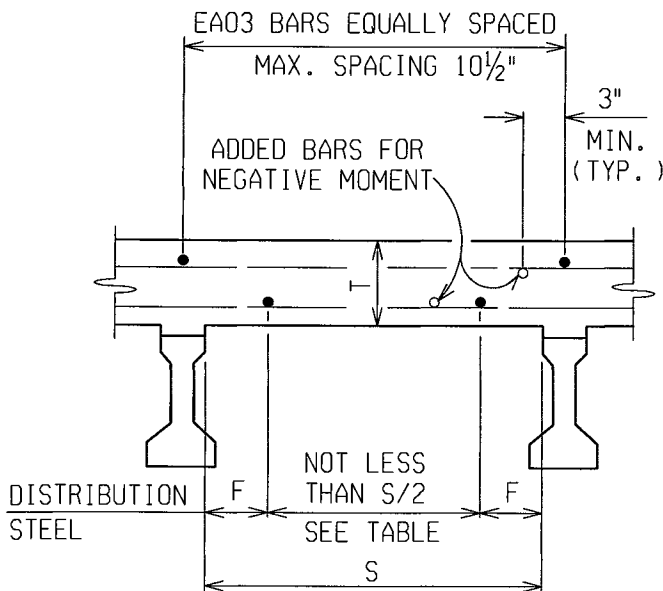
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

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

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 ( $f_s = 24,000$  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  $\epsilon$  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)		TRANSVERSE STEEL (BOTTOM)		DISTRIBUTION STEEL	
	BAR SIZE	SPACE in	BAR SIZE	SPACE in	BAR SIZE	SPACE in
9' - 10" to 10' - 2"	06	7 1/2"	06	7 1/2"	05	8 1/2"
9' - 6" to 9' - 10"	06	7 1/2"	06	7 1/2"	05	8 1/2"
9' - 2" to 9' - 6"	06	8"	06	8"	05	8 1/2"
8' - 10" to 9' - 2"	06	8"	06	8"	05	9"
8' - 6" to 8' - 10"	06	8 1/2"	06	8 1/2"	05	9"
8' - 2" to 8' - 6"	06	8 1/2"	06	8 1/2"	05	9 1/2"
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	7 1/2"
6' - 10" to 7' - 2"	05	7 1/2"	05	7 1/2"	04	7 1/2"
6' - 6" to 6' - 10"	05	8"	05	8"	04	8"
6' - 2" to 6' - 6"	05	8"	05	8"	04	8 1/2"
5' - 10" to 6' - 2"	05	8 1/2"	05	8 1/2"	04	8 1/2"
5' - 6" to 5' - 10"	05	9"	05	9"	04	9"
5' - 3" to 5' - 6"	05*	9 1/2"	05	9 1/2"	04	9 1/2"
4' - 11" to 5' - 3"	05*	9 1/2"	05	9 1/2"	04	10"
4' - 7" to 4' - 11"	05*	10 1/2"	05	10"	04	10"

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

FOR 70" PRESTRESSED I-BEAMS AND MICHIGAN 1800 GIRDER,  
 S = BEAM SPACING MINUS 1/2 TOP FLANGE WIDTH.

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

PREPARED BY  
 DESIGN SUPPORT AREA

6.41.01

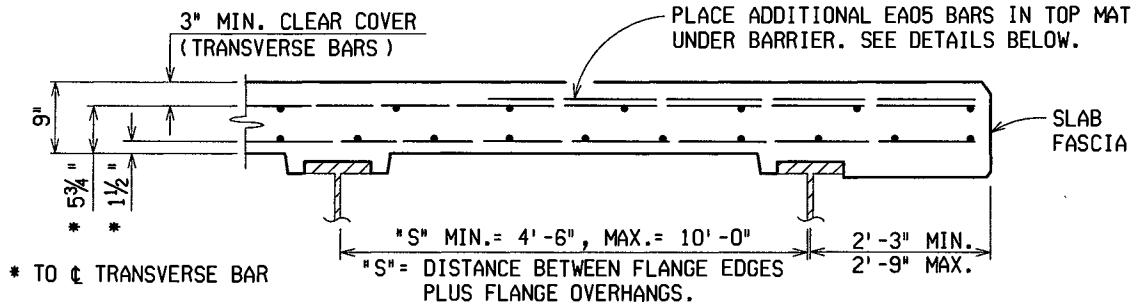


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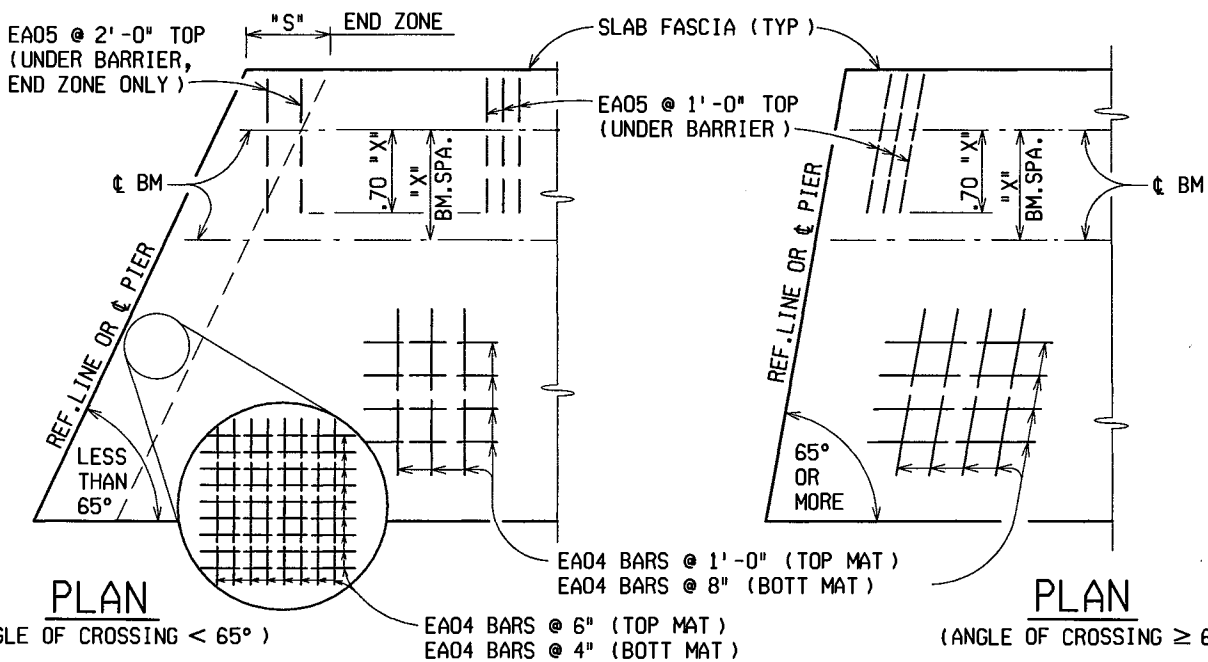
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAYS TECHNICAL SERVICES

STANDARD BRIDGE SLAB  
 (EMPIRICAL DESIGN)

ISSUED: 11/27/01  
 SUPERSEDES: 05/28/99



SECTION THRU DECK



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  $\epsilon$  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 WIDTH CONSTRUCTION, THE OVERHANG AND ADJACENT BAY SHALL BE REINFORCED WITH THE EQUIVALENT REINFORCEMENT OF A CONVENTIONAL BRIDGE DECK.

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

PREPARED BY  
 DESIGN DIV.

6.41.02

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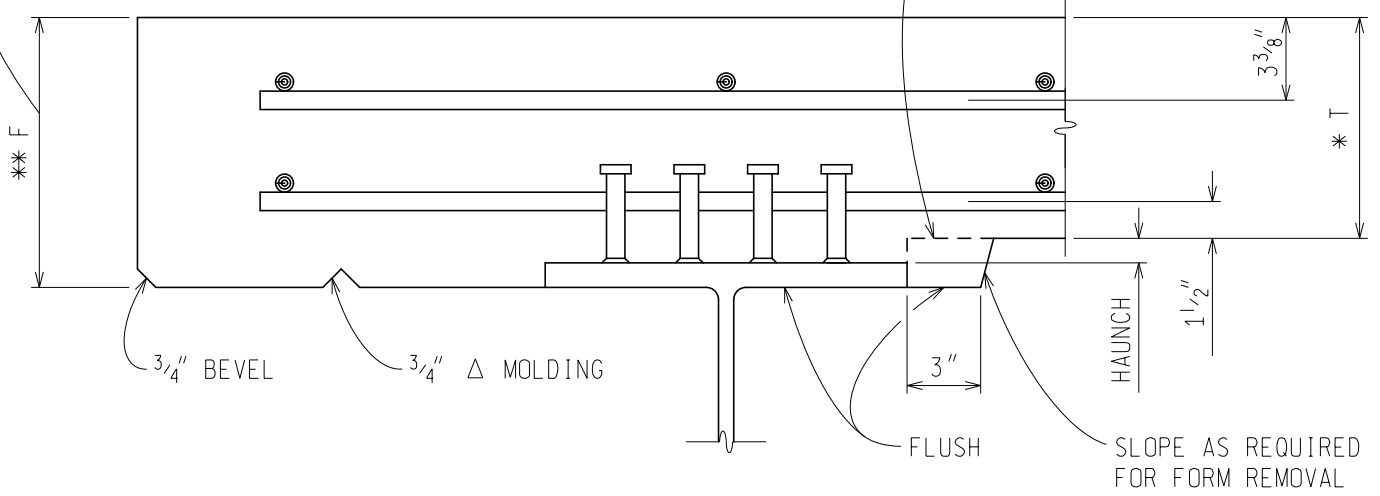
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

ISSUED: 12/22/11  
 SUPERSEDES: 11/27/01

SLAB HAUNCH AND  
 REINFORCEMENT COVER

UNIFORM FASCIA = T + HAUNCH (1") + THICKEST FASCIA BEAM FLANGE + 1/2" + AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN MINIMUM SLAB THICKNESS AT CURB LINE.

METAL STAY IN PLACE FORMS

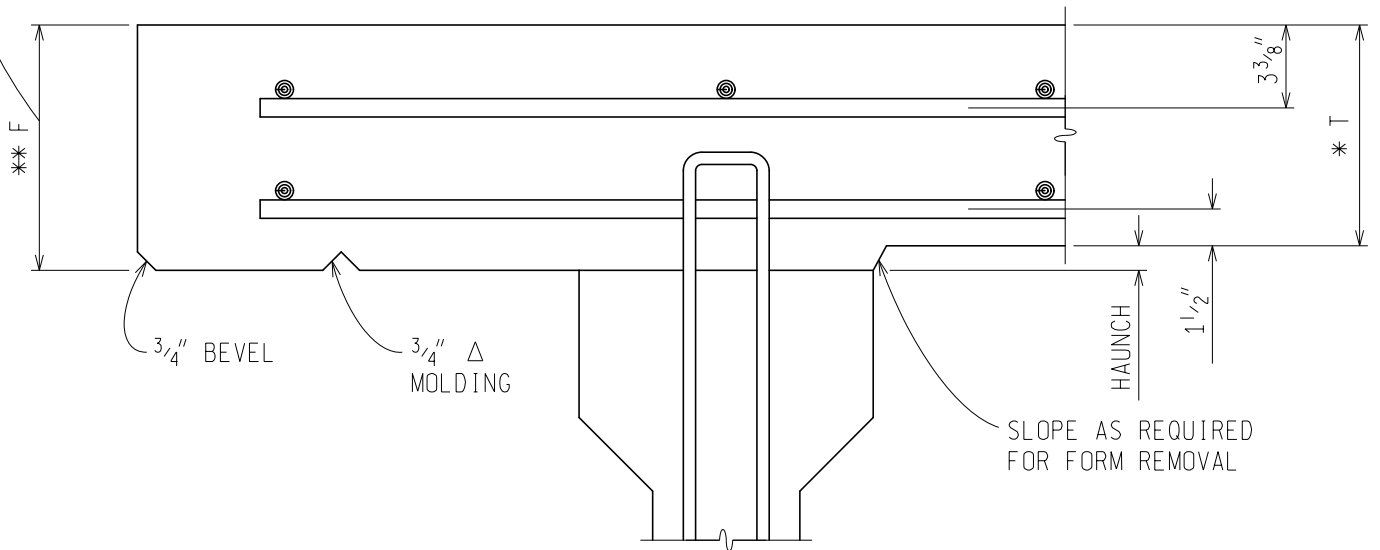


FASCIA

INTERIOR

STEEL BEAM AND GIRDERS

UNIFORM FASCIA = T + HAUNCH (1") + 1/2" + AMOUNT OF FASCIA BEAM DROP REQUIRED TO MAINTAIN MINIMUM SLAB THICKNESS AT CURB LINE.



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.

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 DESIGN DIVISION

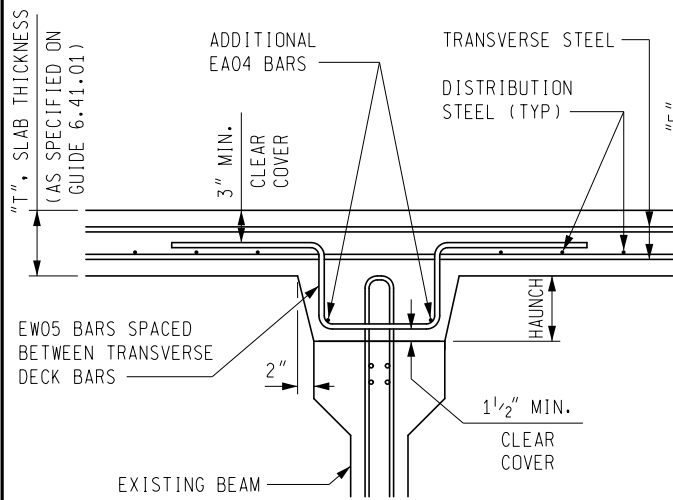
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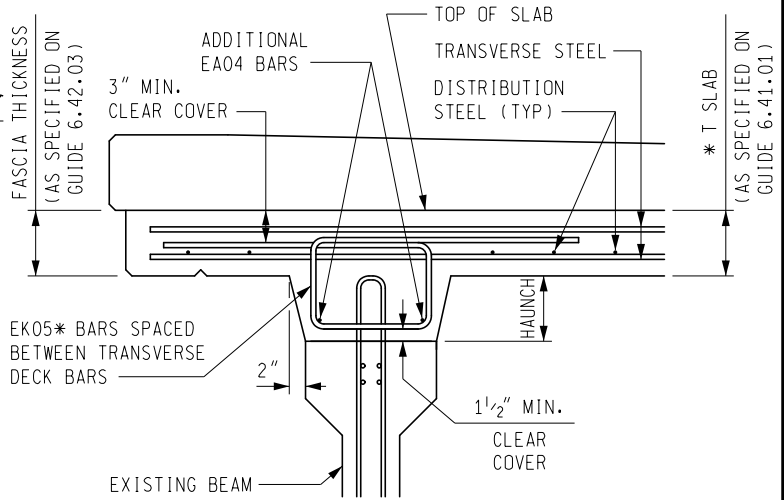
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

DEEP HAUNCH DETAILS -  
 CONCRETE BEAMS

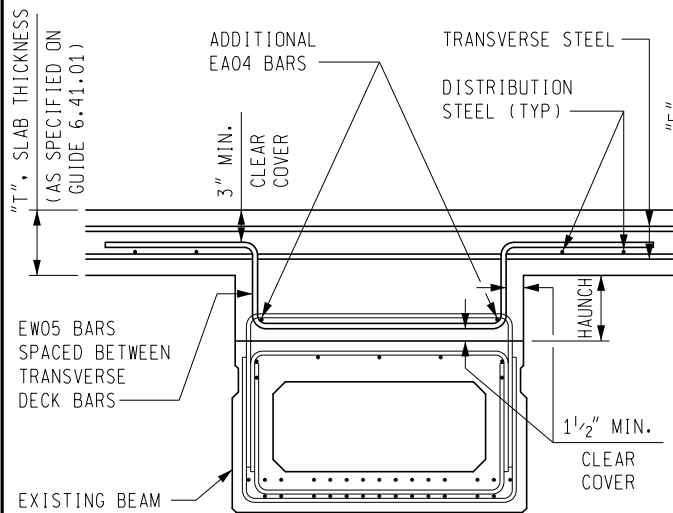
ISSUED: 09/25/17  
 SUPERSEDES: 12/19/16



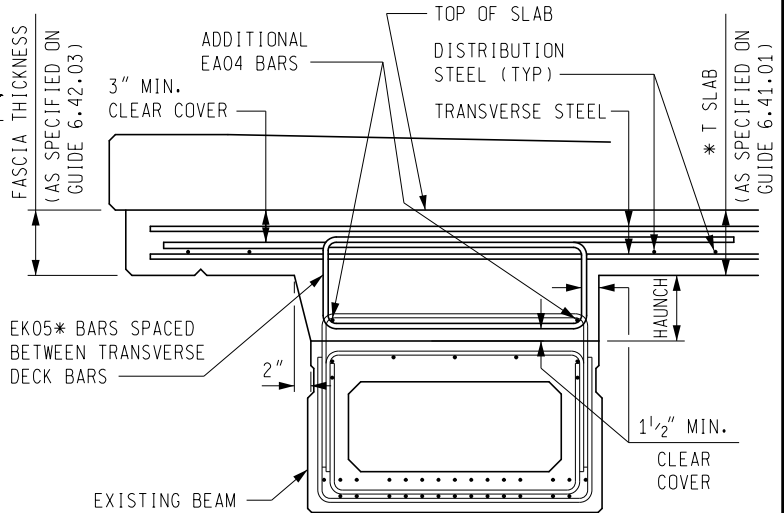
INTERIOR BEAM HAUNCH > 4" DETAIL \*\*  
 CONVENTIONAL FORMS



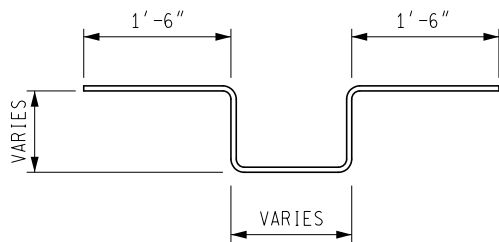
FASCIA BEAM HAUNCH > 4" DETAIL \*\*  
 CONVENTIONAL FORMS



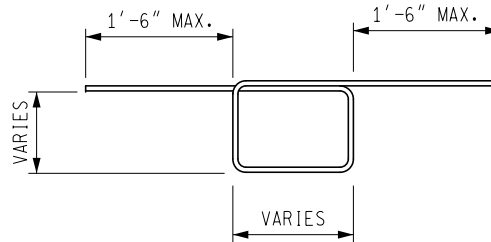
INTERIOR BEAM HAUNCH > 4" DETAIL \*\*  
 METAL STAY IN PLACE FORMS



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

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BUREAU OF DEVELOPMENT

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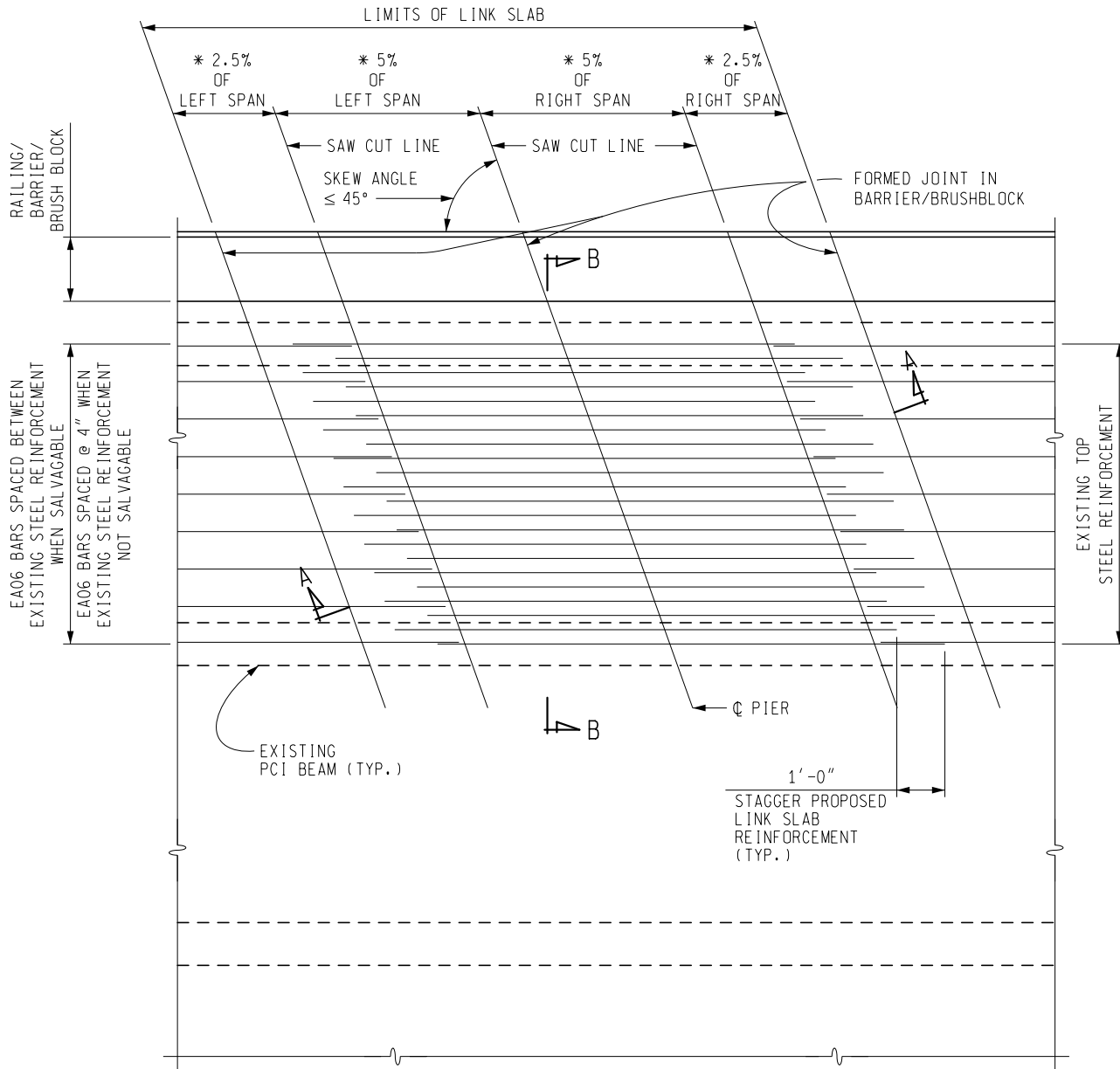
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT

ISSUED: 01/25/21  
SUPERSEDES: / /

LINK SLAB DETAILS



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.

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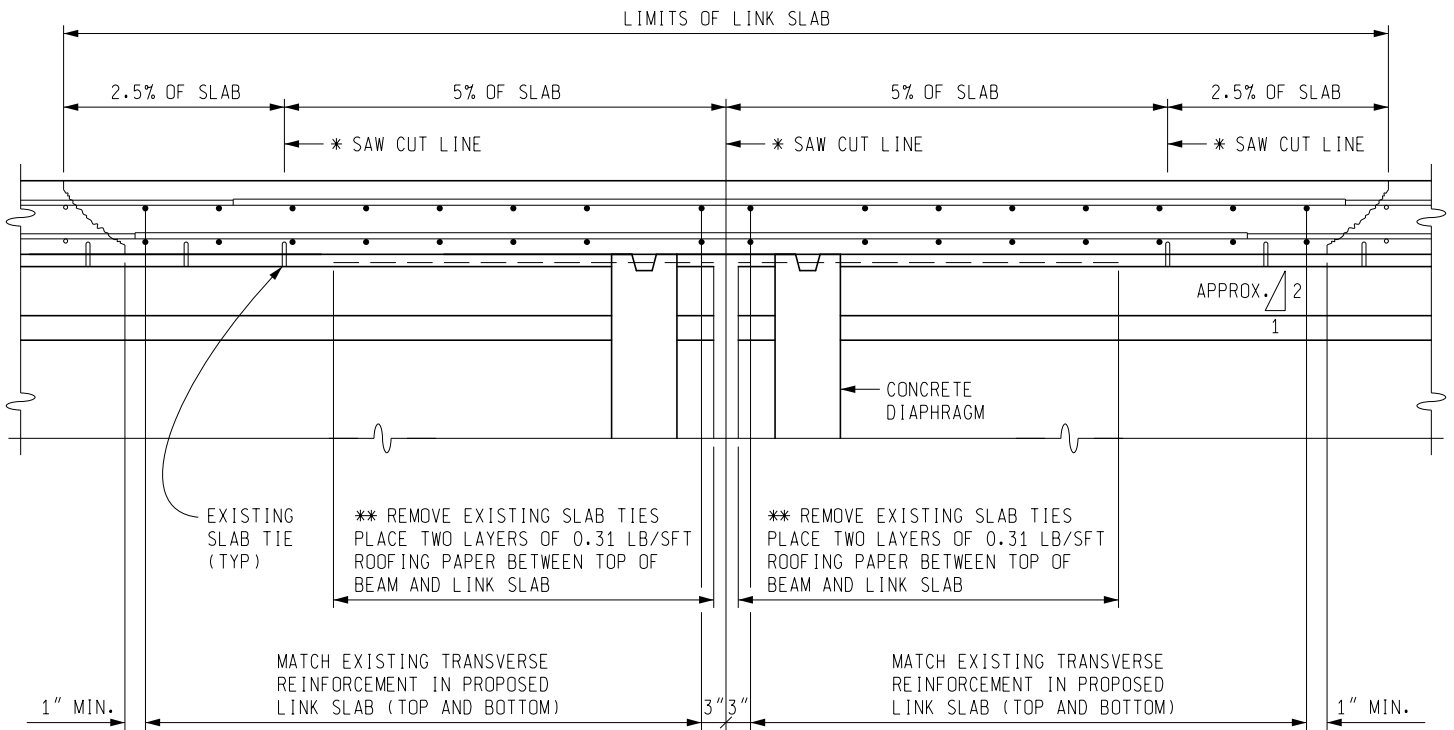
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 BUREAU OF DEVELOPMENT

ISSUED: 06/26/23  
 SUPERSEDES: 01/25/21

LINK SLAB DETAILS



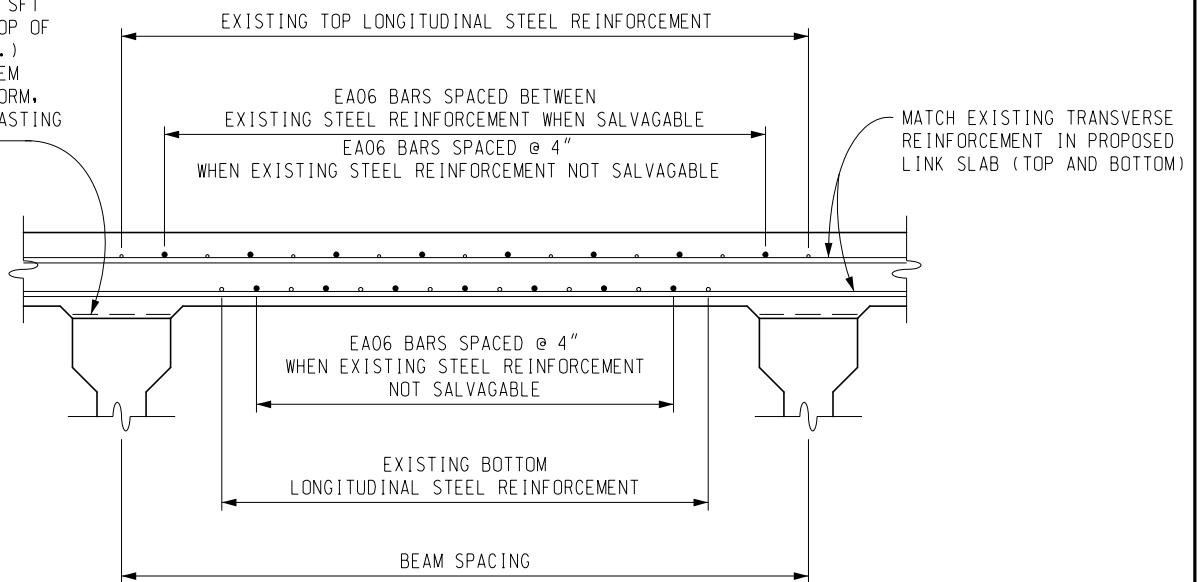
\* PROVIDE A SAWED JOINT 1 1/8" DEEP BY 1/4" WIDE (MINIMUM) IN THE TOP OF SLAB. SAW THE JOINT WITHIN 24 HOURS OF PLACING THE CURING AND FILL TO 1/2" BELOW TOP OF CONCRETE WITH POLYURETHANE OR POLYURETHANE HYBRID SEALANT. (INCLUDED IN THE BID ITEM "SUPERSTRUCTURE CONC, FORM, FINISH, AND CURE, NIGHT CASTING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

\*\* 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)

TWO LAYERS OF 0.31 LB / SFT ROOFING PAPER BETWEEN TOP OF BEAM AND LINK SLAB (TYP.) (INCLUDED IN THE PAY ITEM "SUPERSTRUCTURE CONC, FORM, FINISH AND CURE, NIGHT CASTING (STRUCTURE NO. 1)").



SECTION B-B

(CONCRETE BEAM SHOWN STEEL BEAM SIMILAR)

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 DESIGN DIVISION

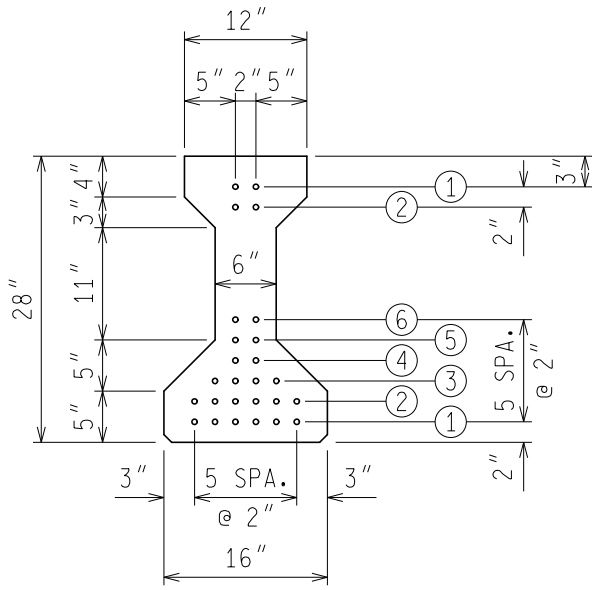
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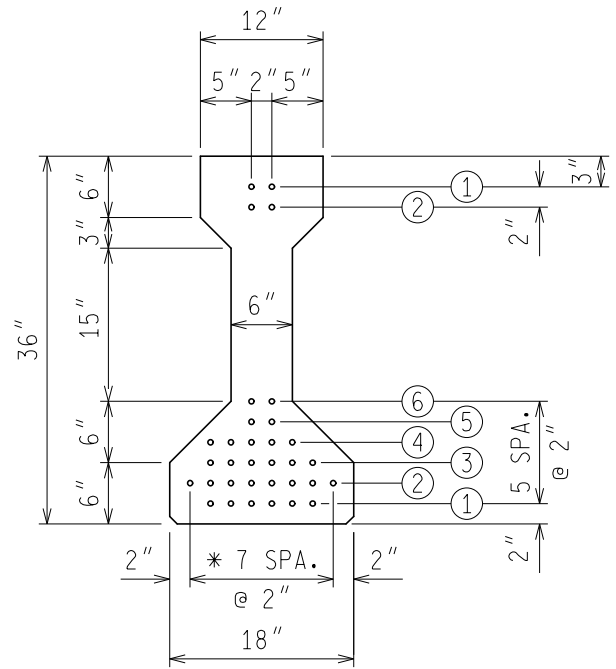
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

PRESTRESSED CONCRETE  
 I-BEAM DETAILS

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

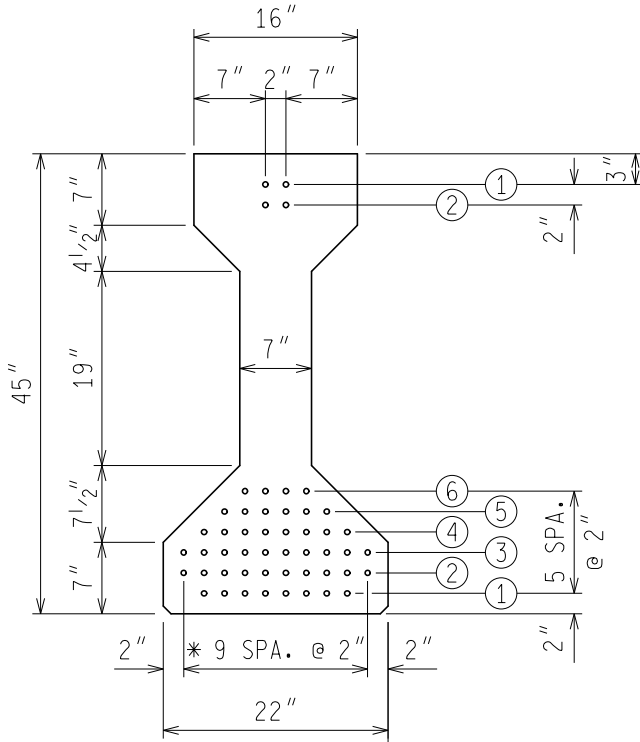


TYPE I



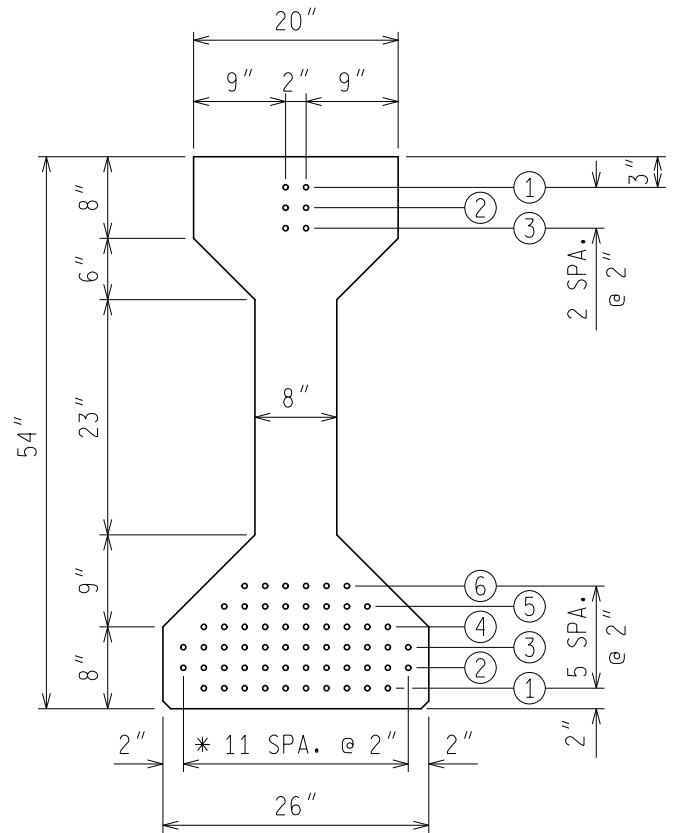
TYPE II

\* 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 <sup>2</sup>	S <sub>T</sub> in <sup>3</sup>	S <sub>B</sub> in <sup>3</sup>	I in <sup>4</sup>
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

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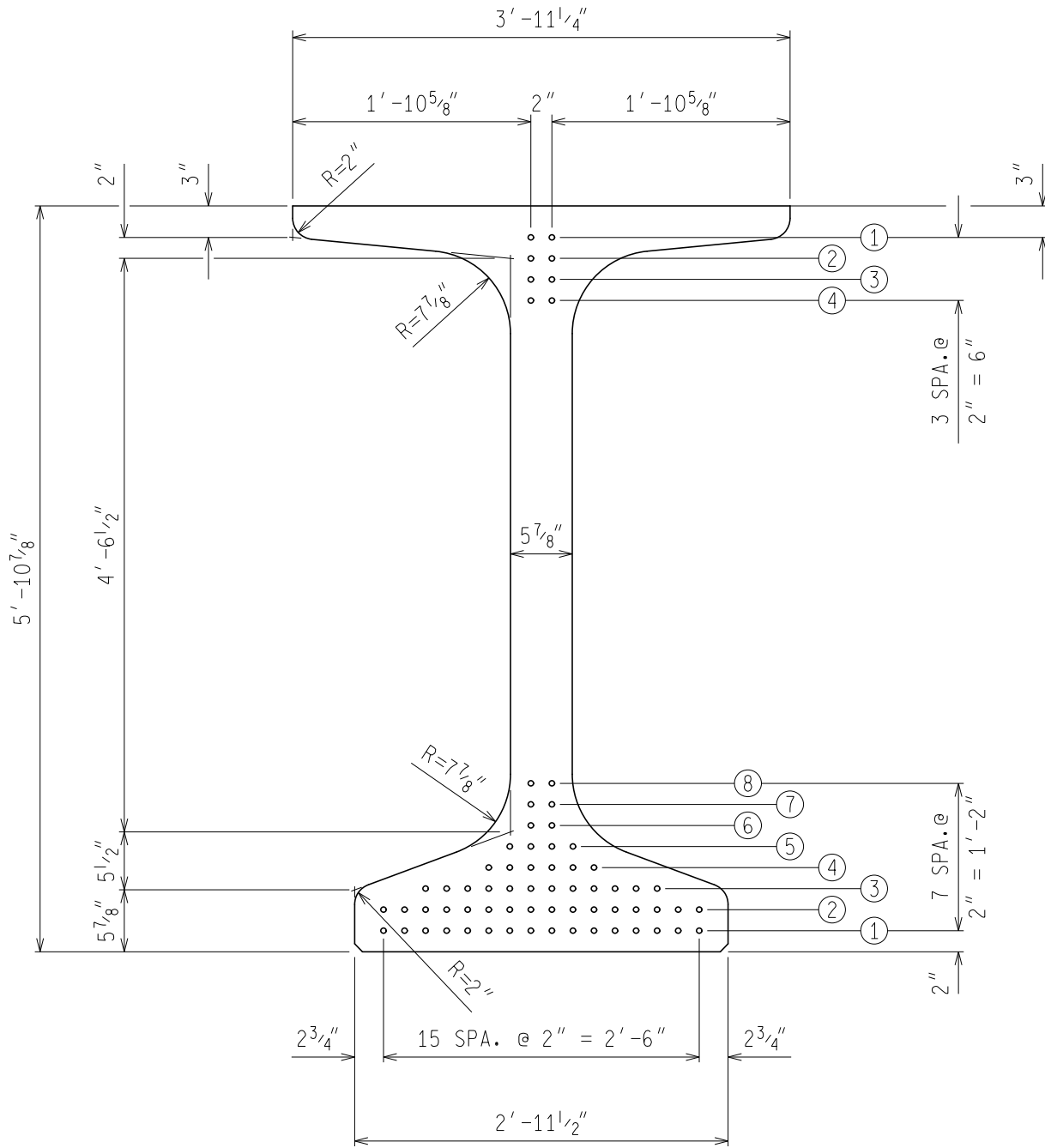
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 APPROVED BY: T&F

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

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

MICHIGAN 1800 GIRDER



SECTION

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

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6.60.02

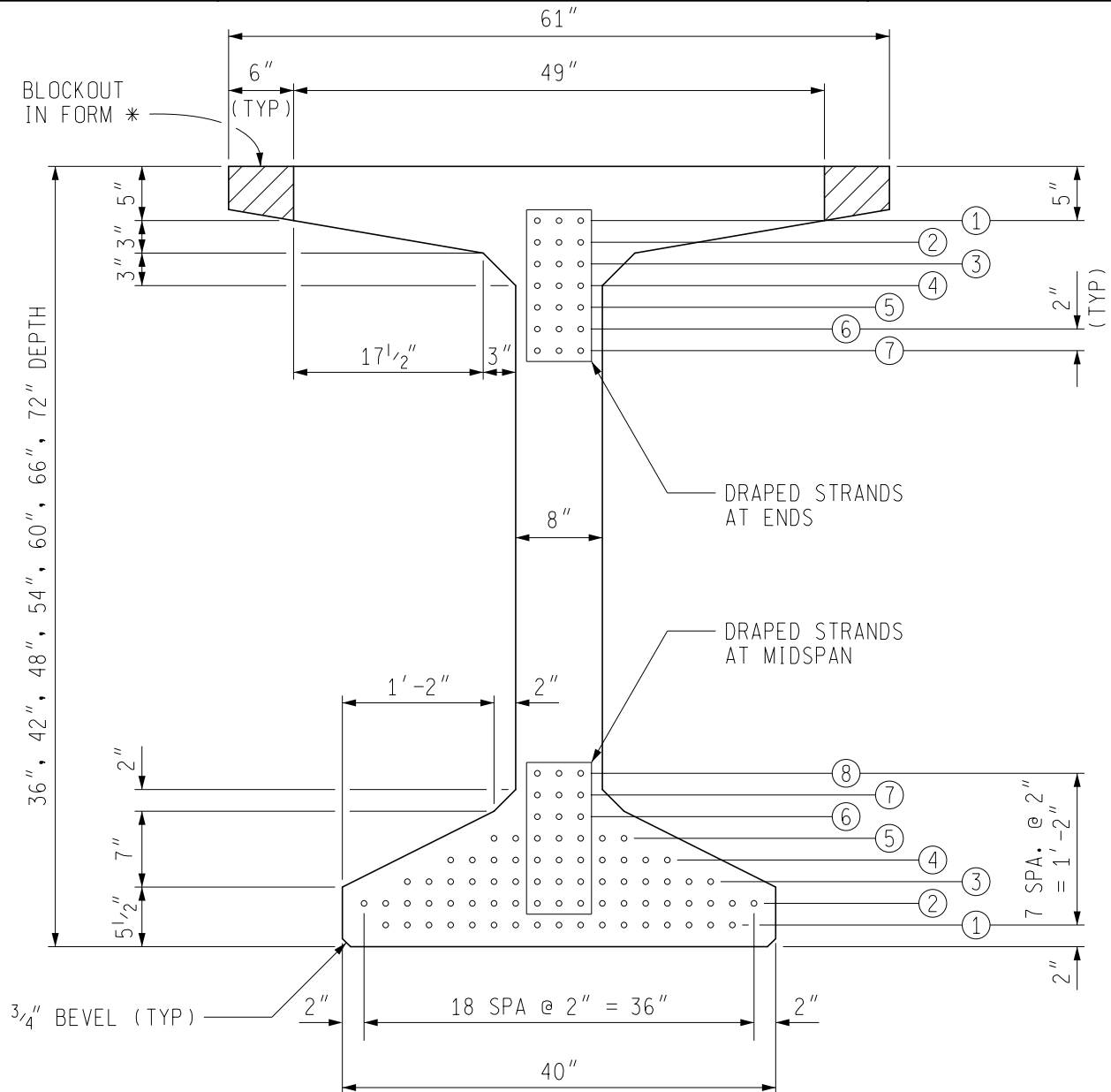


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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

ISSUED: 05/22/23  
 SUPERSEDES: 04/17/17

BULB TEE  
 BEAM PROPERTIES



BEAM PROPERTIES								
DEPTH	49" TOP FLANGE WIDTH				61" TOP FLANGE WIDTH			
	WEIGHT	AREA	Y <sub>BOT</sub>	I <sub>xx</sub>	WEIGHT	AREA	Y <sub>BOT</sub>	I <sub>xx</sub>
in	lbs/ft	in <sup>2</sup>	in	in <sup>4</sup>	lbs/ft	in <sup>2</sup>	in	in <sup>4</sup>
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.

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 DESIGN DIVISION

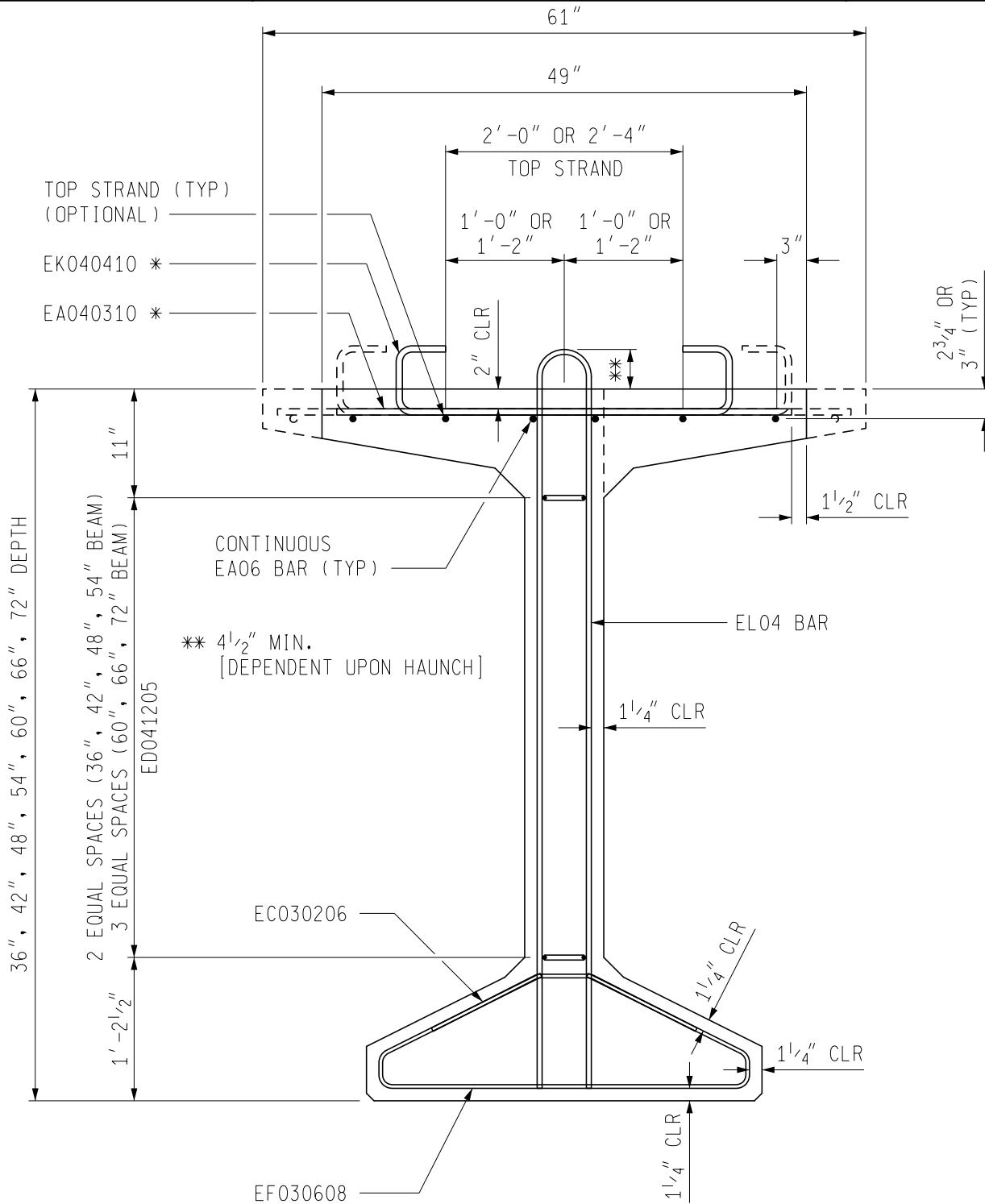
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 BUREAU OF DEVELOPMENT

ISSUED: 01/23/23  
 SUPERSEDES: 09/26/22

BULB TEE  
 BEAM REINFORCEMENT



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.

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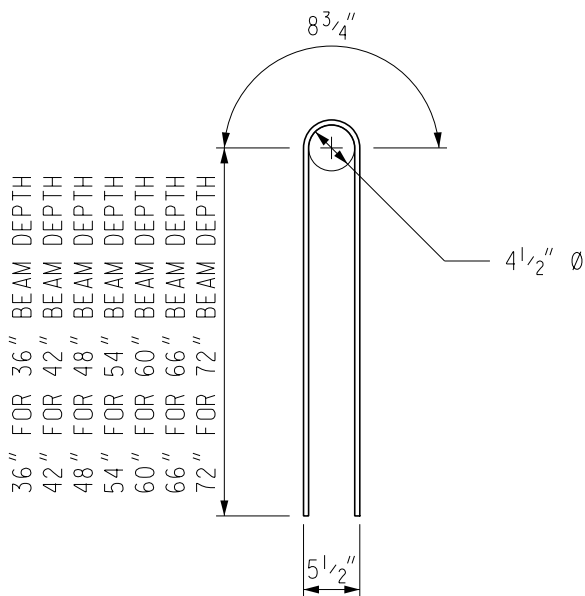
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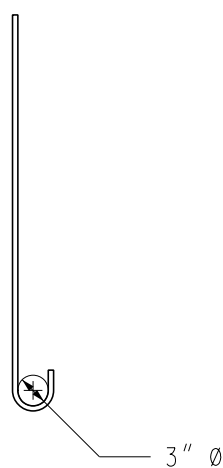
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

BULB TEE  
 BEAM REINFORCEMENT

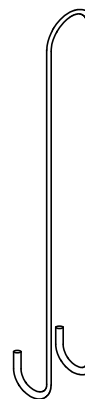
ISSUED: 01/27/20  
 SUPERSEDES: 04/17/17



END VIEW

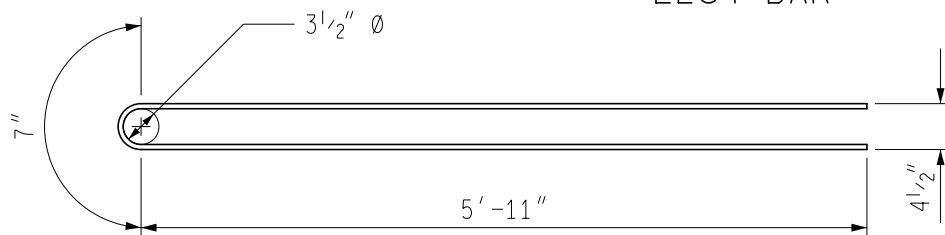


SIDE VIEW

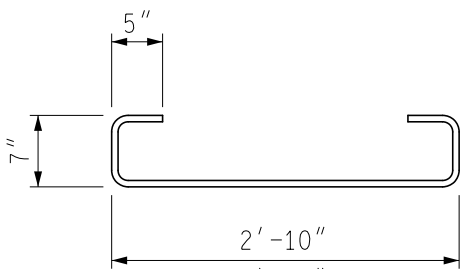


ISOMETRIC VIEW

ELO4 BAR



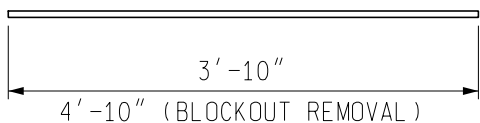
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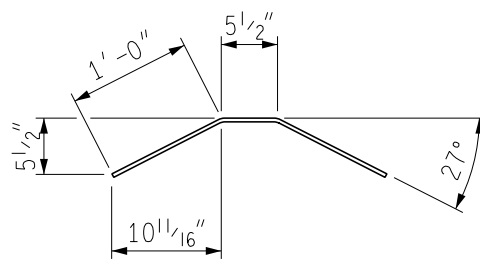
(BLOCKOUT REMOVAL)

EK040410  
 (EK040510)

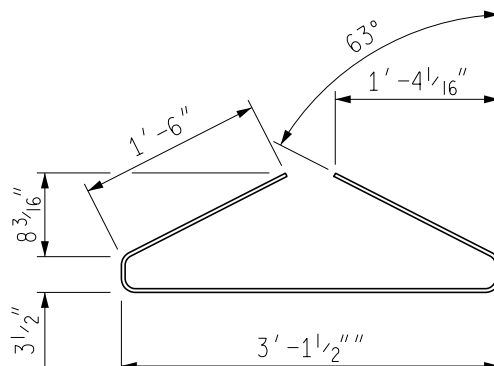
USE FOR SHEAR/COMPOSITE ACTION  
 OR BLOCKOUT REMOVAL



EA040310  
 (EA040410)



EC030206



EF030608

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 DESIGN DIVISION

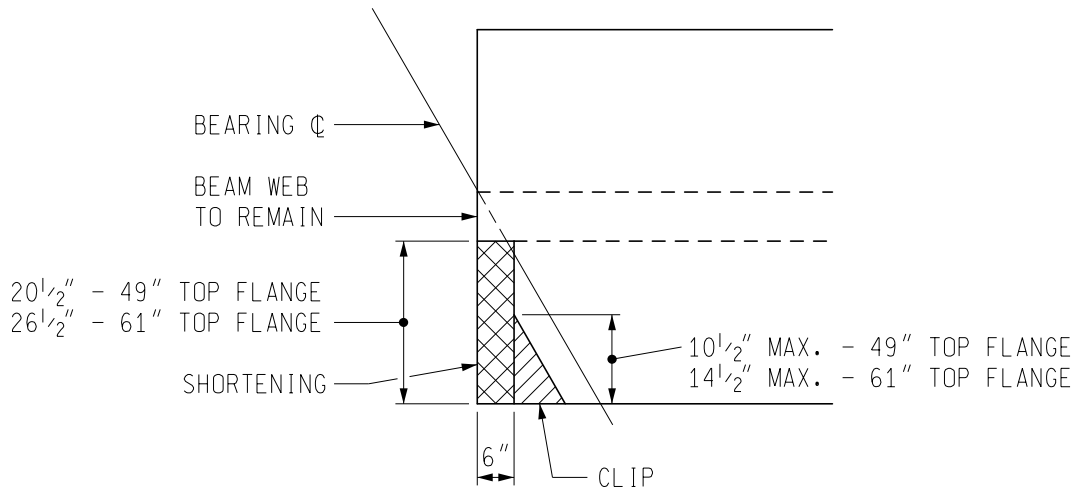
6.60.03B

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

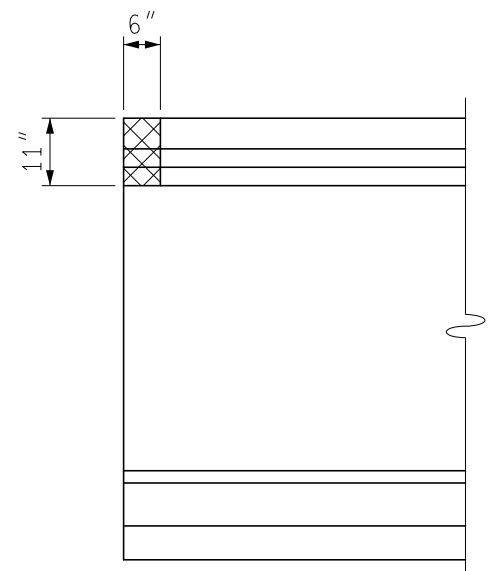
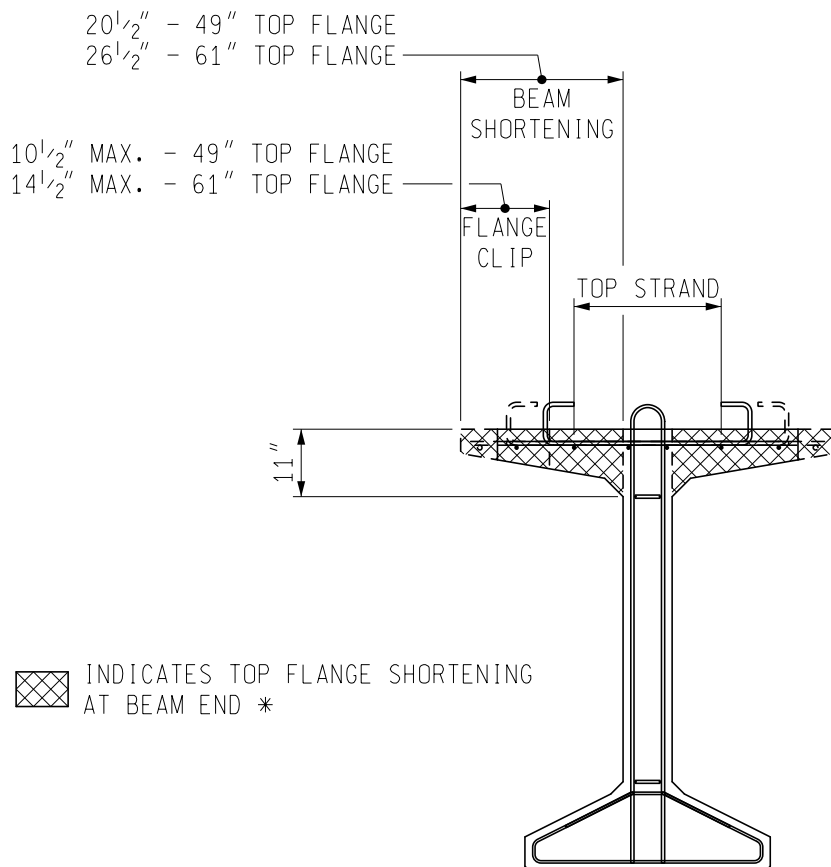
ISSUED: 01/23/23  
 SUPERSEDES: 04/17/17

BULB TEE  
 BEAM FLANGE SHORTENING & CLIP DETAILS



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

TOP FLANGE



INDICATES TOP FLANGE SHORTENING AT BEAM END \*

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.

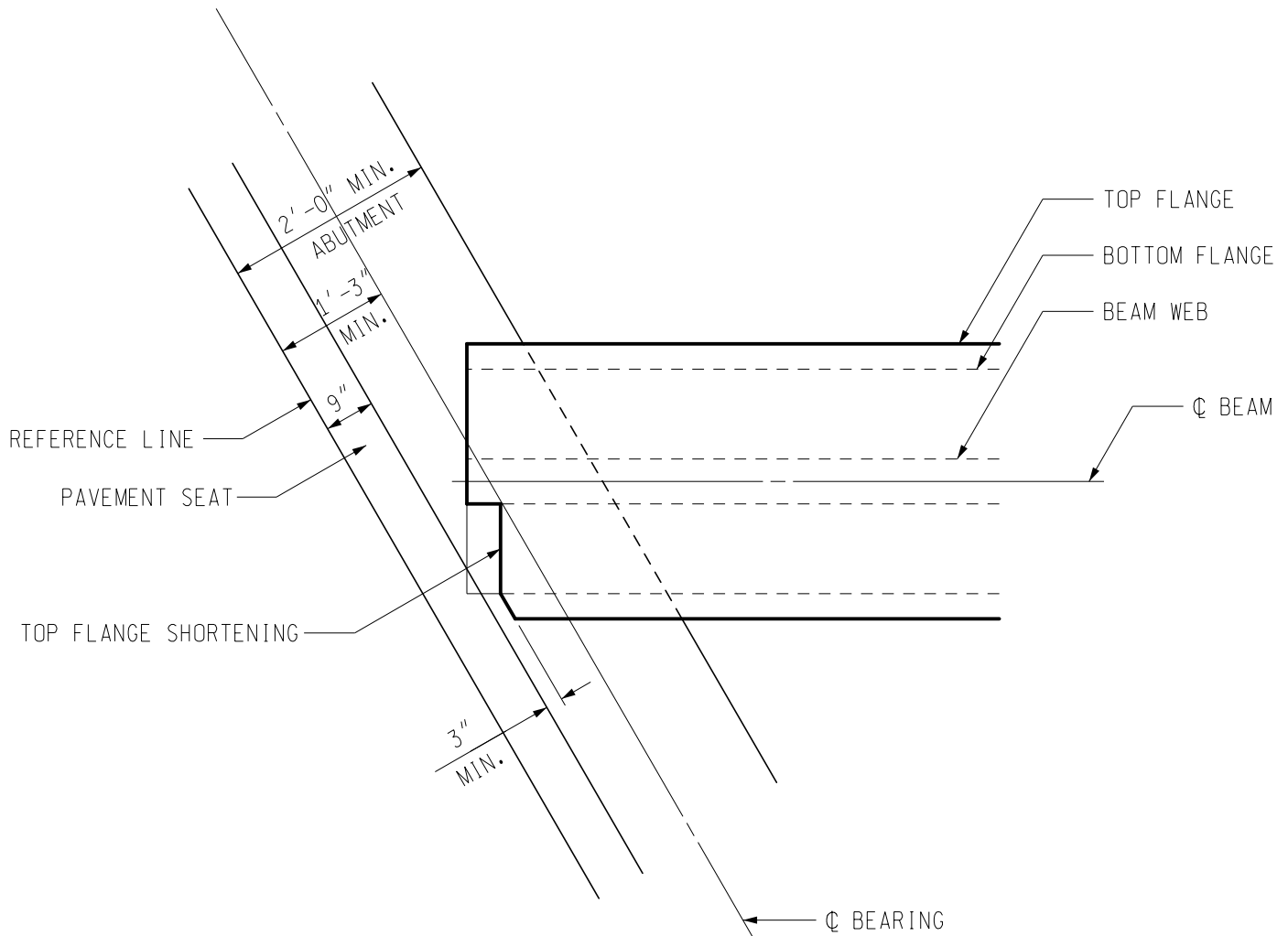
PREPARED BY  
 DESIGN DIVISION

6.60.03C

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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.

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6.60.03D

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APPROVED BY:

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BUREAU OF DEVELOPMENT

ISSUED:  
SUPERSEDES:

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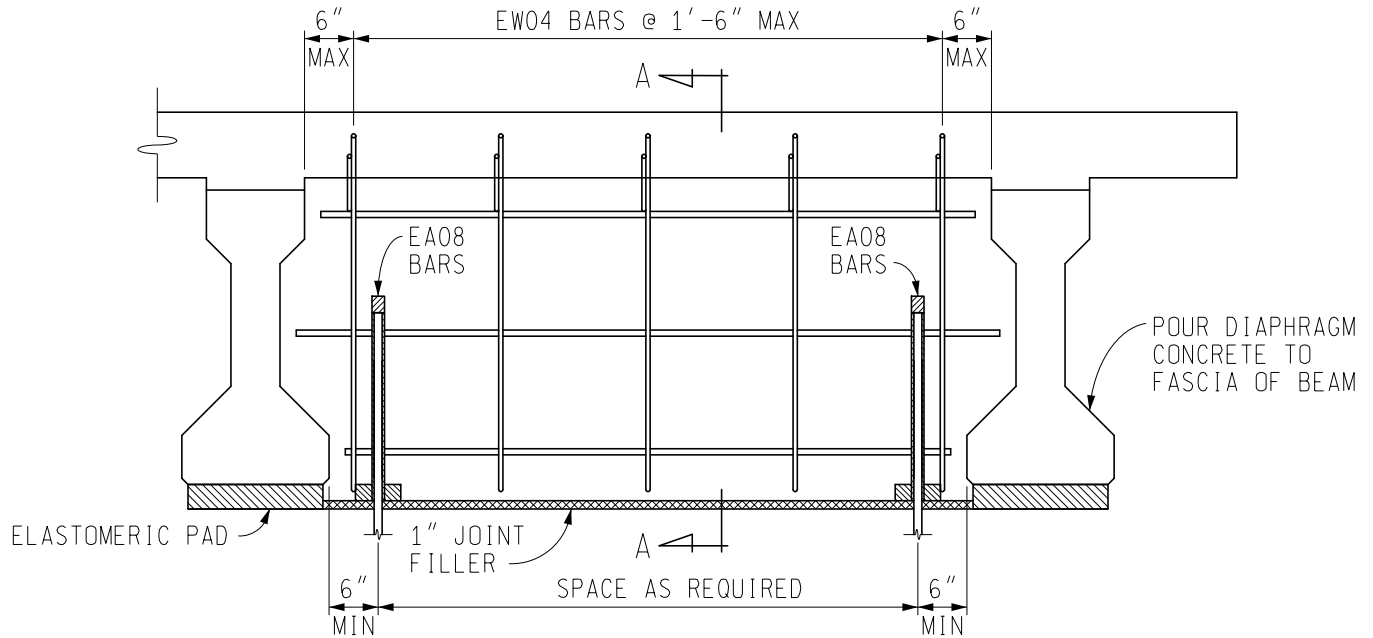
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 PIER DIAPHRAGMS FOR PRESTRESSED CONCRETE  
 BEAMS CONTINUOUS FOR LIVE LOAD

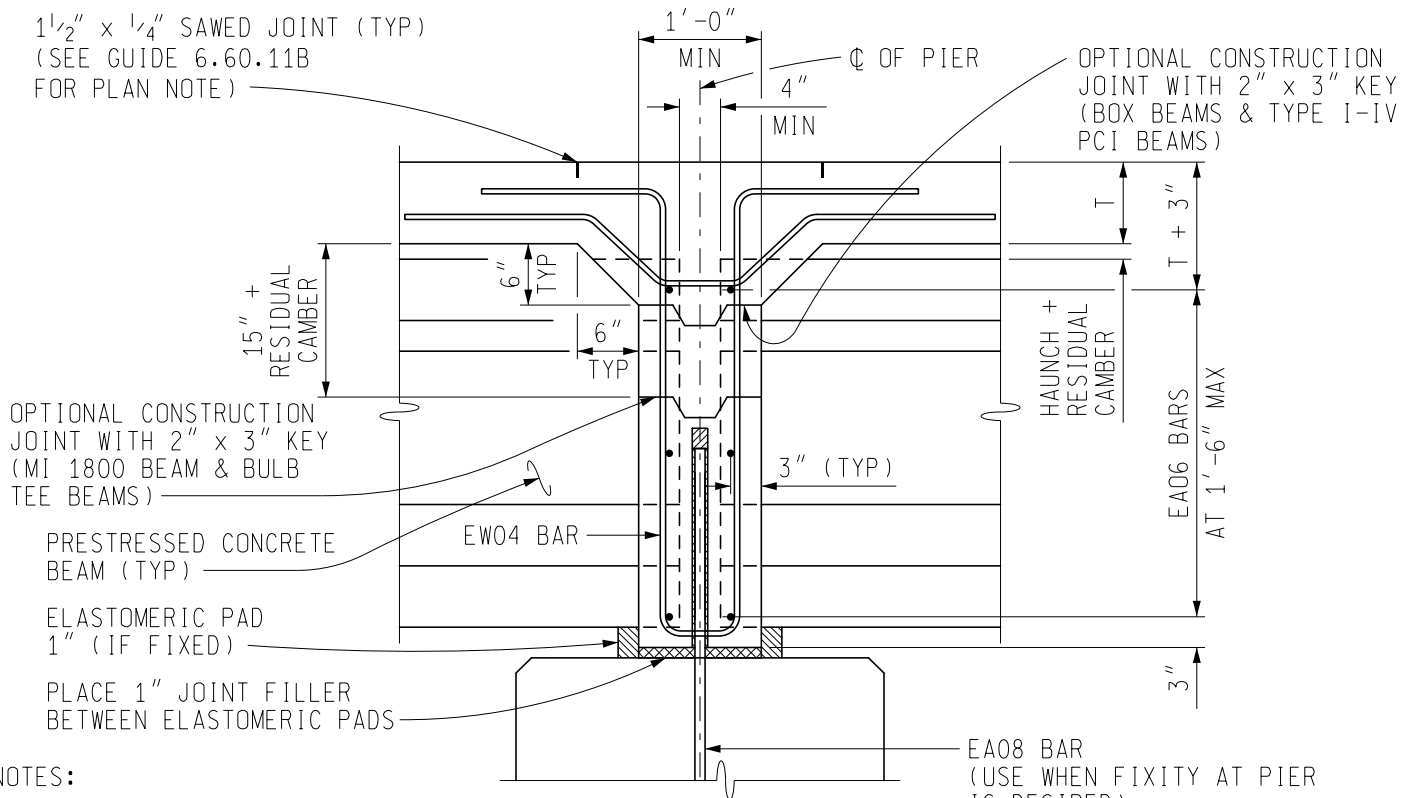
ISSUED: 07/24/23  
 SUPERSEDES: 06/26/23



**PIER DIAPHRAGM ELEVATION**

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

1 1/2" x 1/4" SAWED JOINT (TYP)  
 (SEE GUIDE 6.60.11B  
 FOR PLAN NOTE)



**NOTES:**

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.

EA08 BAR  
 (USE WHEN FIXITY AT PIER IS DESIRED)  
 SEE DETAIL B ON GUIDE 6.60.11B

**SECTION A-A**

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.

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 DESIGN DIVISION

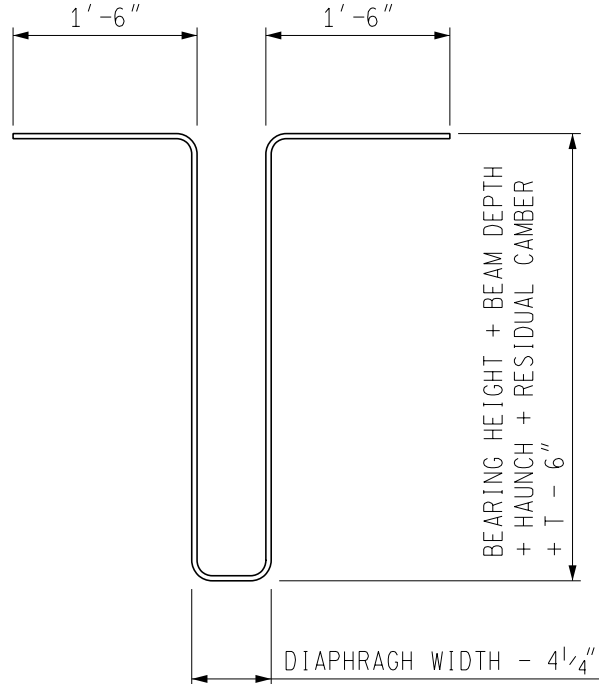
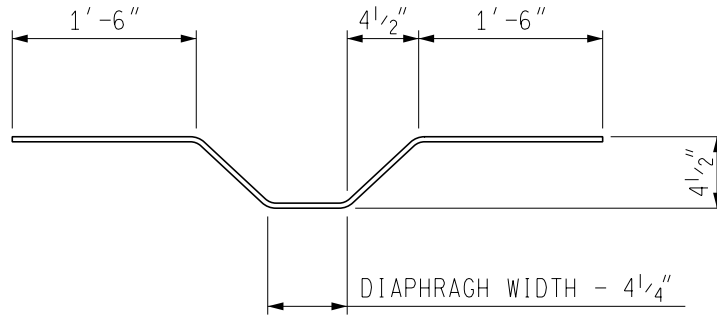
6.60.11

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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

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DESIGN DIVISION

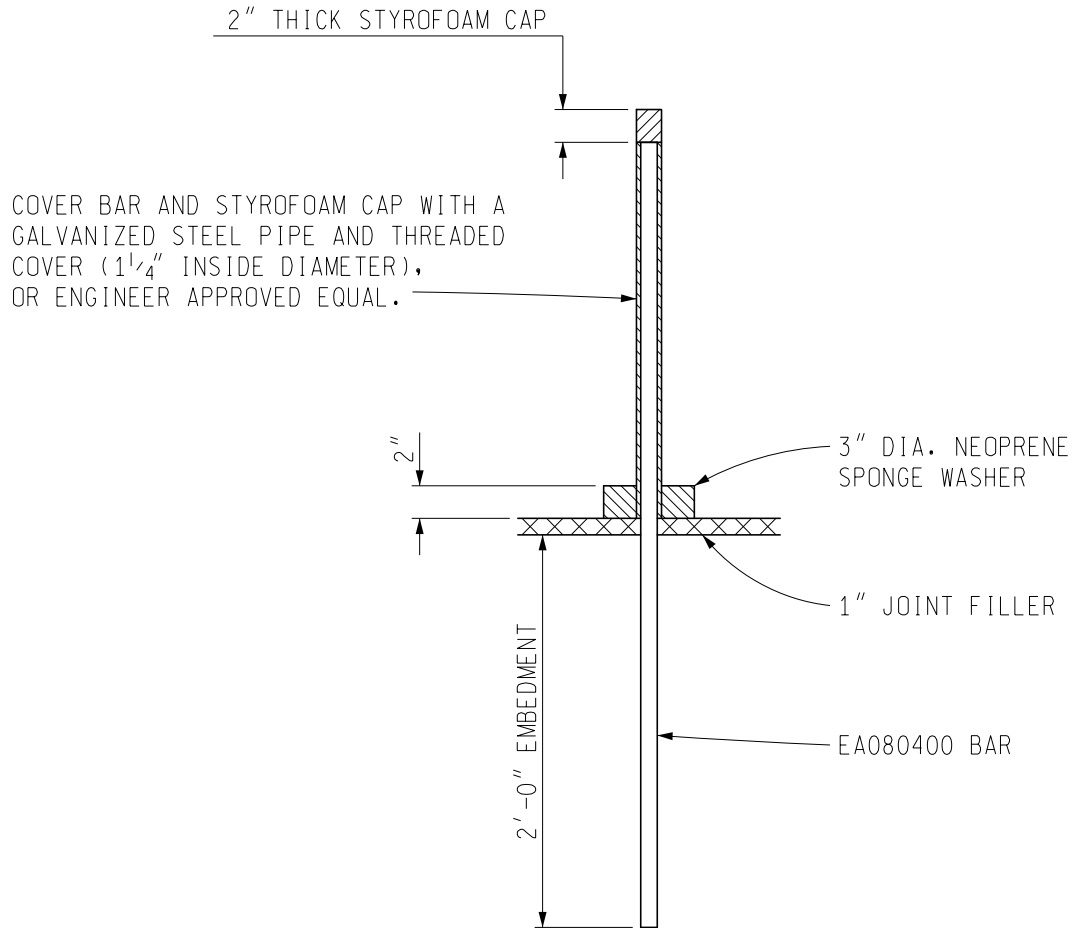
6.60.11A



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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 1 1/2" DEEP BY 1/4" 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 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.)").

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DESIGN DIVISION

6.60.11B

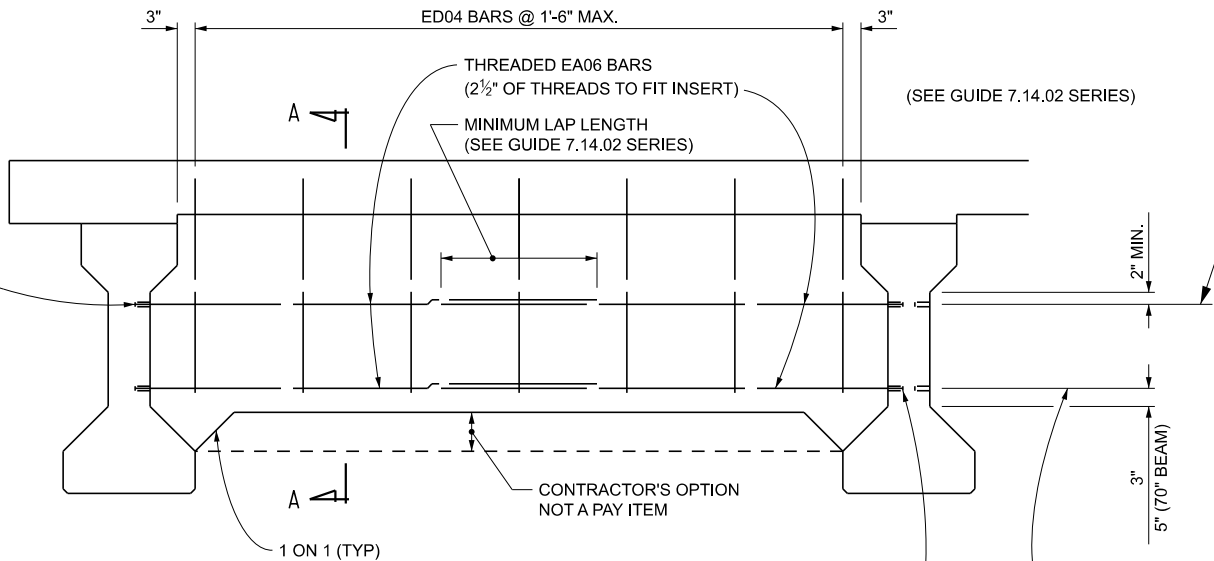
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 CHECKED BY: VZ  
 APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 CONCRETE DIAPHRAGMS FOR  
 PRESTRESSED CONCRETE BEAMS/GIRDERS

ISSUED: 12/26/23  
 SUPERSEDES: 08/27/18

3/4" Ø CONCRETE INSERT  
 DAYTON SUPERIOR TYPE B-18,  
 WILLIAMS FORM C19, MEADOW BURKE CX-4,  
 OR EQUAL (TYP.) (INCIDENTAL)

☉ THREADED EA06 BARS  
 REQUIRED FOR 45" & 54"  
 BEAMS ADDITIONAL BARS  
 REQUIRED FOR 70" BEAM &  
 MICHIGAN 1800 GIRDER.

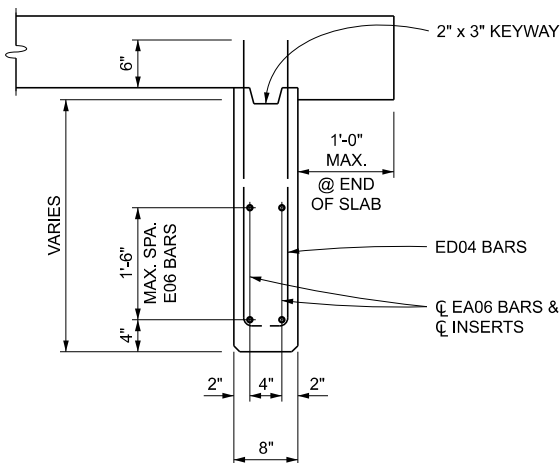


3/4" Ø DAYTON SUPERIOR TYPE B-1 HEAVY OR TYPE B-18, WILLIAMS FORM  
 TYPE C12 OR C19, MEADOW BURKE TYPE CT-2 OR CX-4 OR EQUAL.  
 INSERTS AT ENDS OF BEAM SHALL BE STAGGERED AND AT MIDSPAN MAY BE  
 CONTINUOUS OR STAGGERED. THREADED REINFORCEMENT SHALL BE BENT  
 TO THE REQUIRED ANGLE PRIOR TO INSTALLATION. BENT REINFORCEMENT  
 MAY REQUIRE INSTALLATION BEFORE BEAM IS ERECTED. (TYP) (INCIDENTAL)

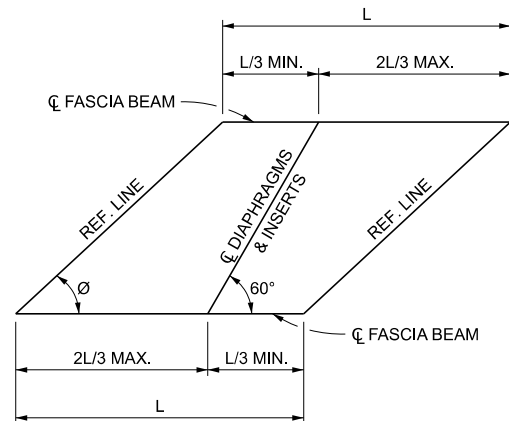
**CONCRETE DIAPHRAGM ELEVATION**

NOTES:

- ① USE WHEN CONCRETE DIAPHRAGMS PREFERRED. USE WITH SIMPLE SPANS (NOT CONTINUOUS FOR LIVE LOAD) AT PIERS AND INDEPENDENT BACKWALLS WITH NO SLIDING SLAB. PLACE DIAPHRAGMS PARALLEL TO REF. LINE.
- ② USE ONE INTERMEDIATE DIAPHRAGM AT MID-POINT.
- ③ FOR  $60^\circ \leq \theta \leq 90^\circ$ , PLACE INTERMEDIATE DIAPHRAGMS PARALLEL TO REF. LINE.
- ④ FOR ANGLE OF CROSSING  $< 60^\circ$ , SEE PLAN.
- ⑤ DO NOT POUR DECK UNTIL DIAPHRAGM CONCRETE ATTAINS A COMPRESSIVE STRENGTH OF 3000 PSI.



SECTION A-A



PLAN

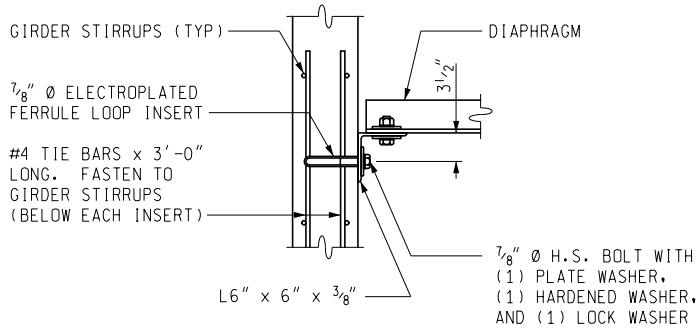
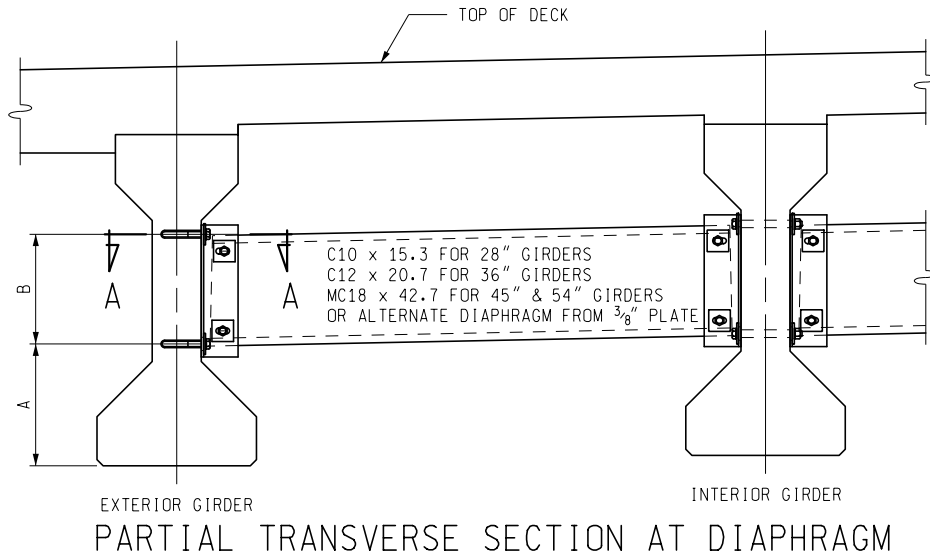
PREPARED BY  
 DESIGN DIVISION

**6.60.12**

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 CHECKED BY: VZ  
 APPROVED BY: BMW

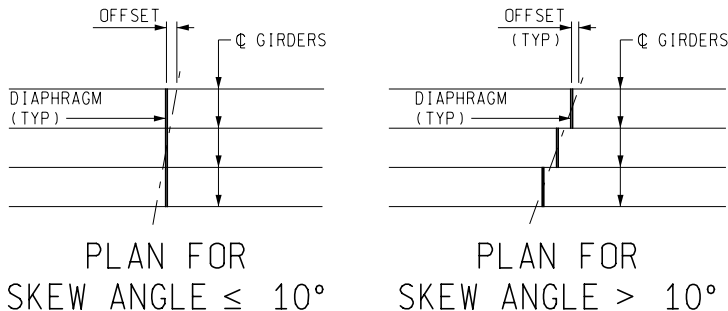
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
**STEEL DIAPHRAGMS FOR  
 28" THROUGH 54" PRESTRESSED GIRDERS**

ISSUED: 08/27/18  
 SUPERSEDES: 02/14/11



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

SECTION A-A



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.

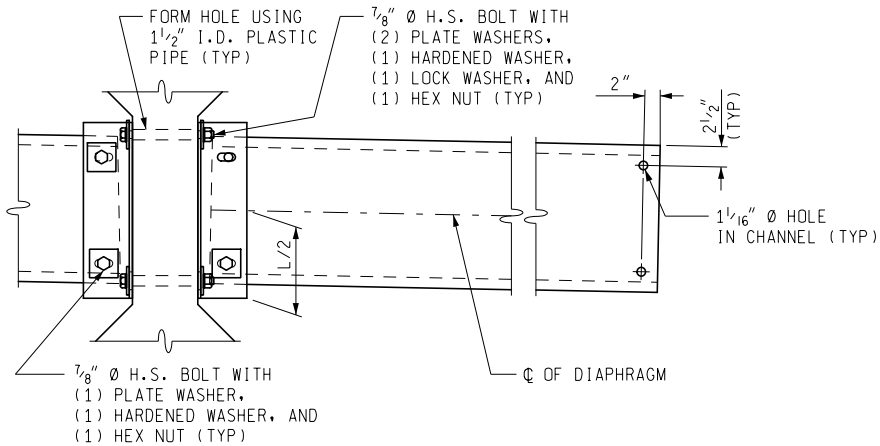
USE STEEL DIAPHRAGMS AT MIDPOINT AND AT INDEPENDENT BACKWALLS WITH SLIDING SLAB.

APPLY AASHTO REQUIREMENTS WHEN DETERMINING NEED FOR DIAPHRAGMS.

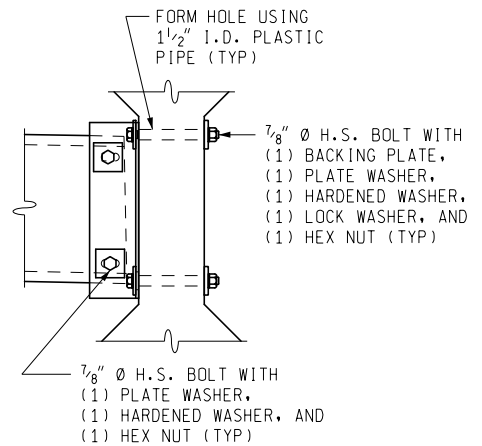
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 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 STEEL DIAPHRAGMS FOR  
 28" THROUGH 54" PRESTRESSED GIRDERS

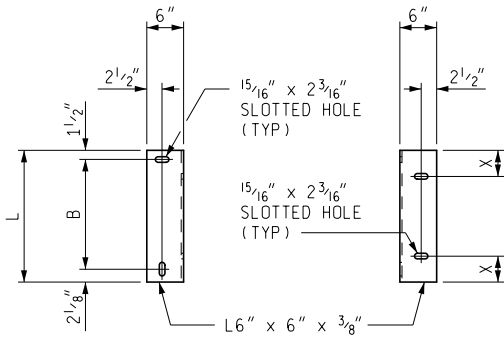
ISSUED: 11/28/22  
 SUPERSEDES: 08/27/18



CONNECTION DETAIL  
 (SKEW ANGLES  $\leq 10^\circ$ )



CONNECTION DETAIL  
 (SKEW ANGLES  $> 10^\circ$ )



CLIP ANGLE

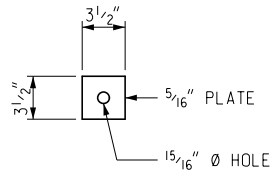
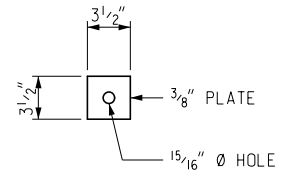
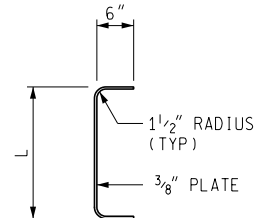


PLATE WASHER



BACKING PLATE

DIMENSION TABLE			
GIRDER HEIGHT	B	L	*X
28"	5 7/8"	9 1/2"	2 1/4"
36"	9 7/8"	1' - 1 1/2"	3 1/4"
45"	1' - 1 7/8"	1' - 5 1/2"	2 1/4"
54"	1' - 5 7/8"	1' - 9 1/2"	4 1/4"
* X = 2 1/2" 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.

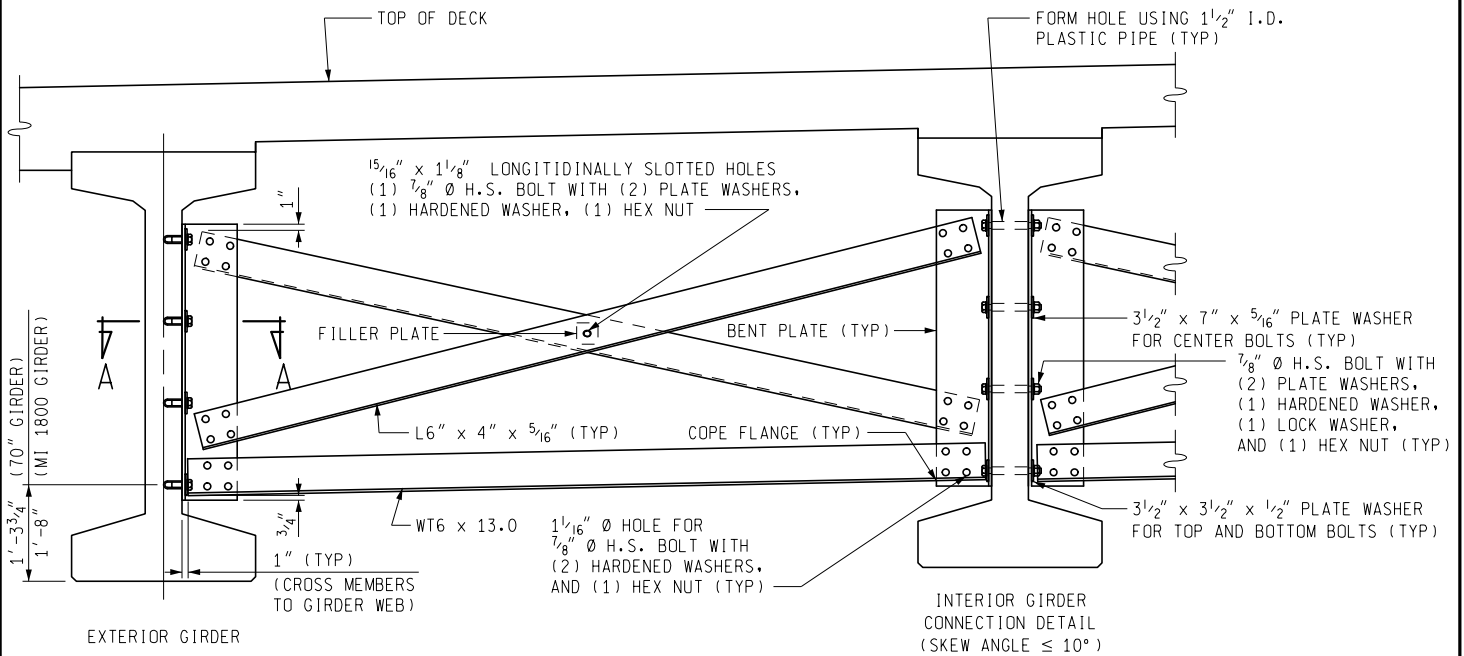
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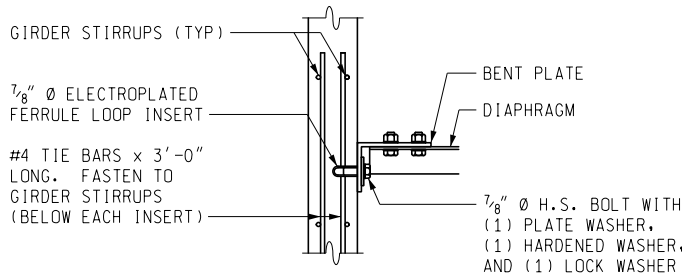
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 STEEL DIAPHRAGMS FOR  
 70" & MI 1800 PRESTRESSED GIRDERS

ISSUED: 11/28/22  
 SUPERSEDES: 08/27/18



PARTIAL TRANSVERSE SECTION AT DIAPHRAGM  
 70" GIRDER SHOWN, MI 1800 GIRDER SIMILAR



SECTION A-A

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.

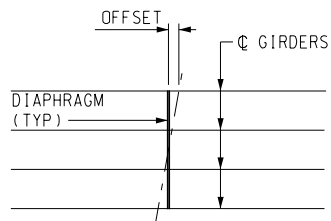
H.S. DENOTES HIGH STRENGTH BOLTS.

I.D. DENOTES INSIDE DIAMETER.

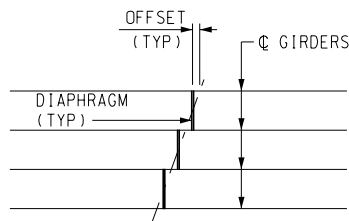
MINIMUM DISTANCE BETWEEN CENTERS OF FASTENERS FOR BENT PLATE AND ANGLE CONNECTIONS SHALL BE 3 1/8" AND THE MINIMUM EDGE DISTANCE SHALL BE 1 1/2".

USE STEEL DIAPHRAGMS AT MIDPOINT AND AT INDEPENDENT BACKWALLS WITH SLIDING SLAB.

APPLY AASHTO REQUIREMENTS WHEN DETERMINING NEED FOR DIAPHRAGMS.



PLAN FOR SKEW ANGLE ≤ 10°

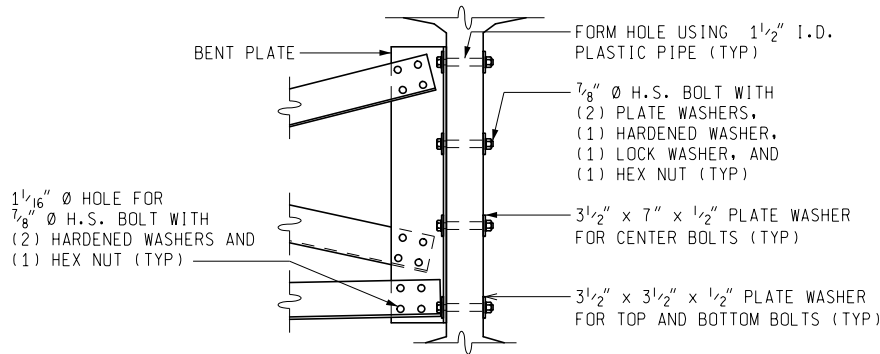


PLAN FOR SKEW ANGLE > 10°

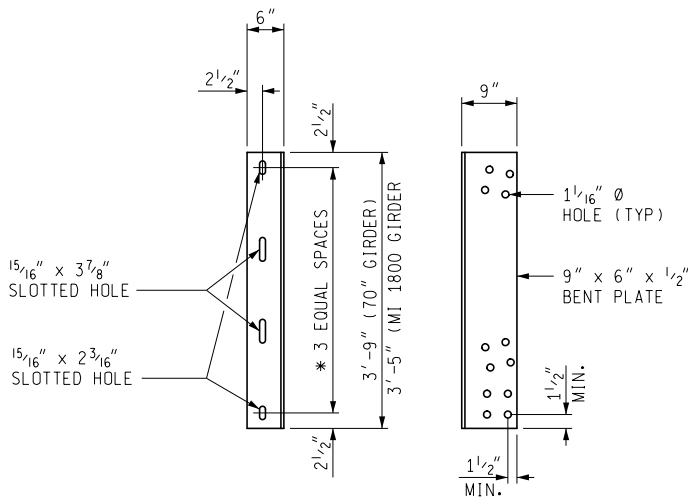
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 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 STEEL DIAPHRAGMS FOR  
 70" & MI 1800 PRESTRESSED GIRDERS

ISSUED: 11/28/22  
 SUPERSEDES: 08/27/18

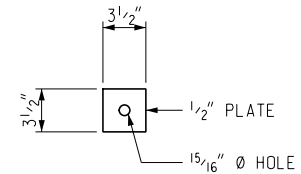


CONNECTION DETAIL  
 (SKEW ANGLE > 10°)

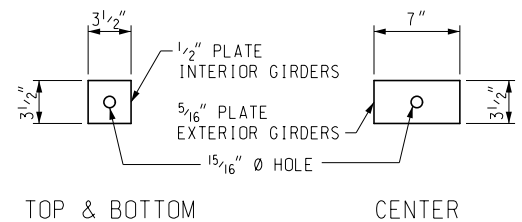


BENT PLATE

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



FILLER PLATE



TOP & BOTTOM  
 CENTER  
 PLATE WASHERS

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".

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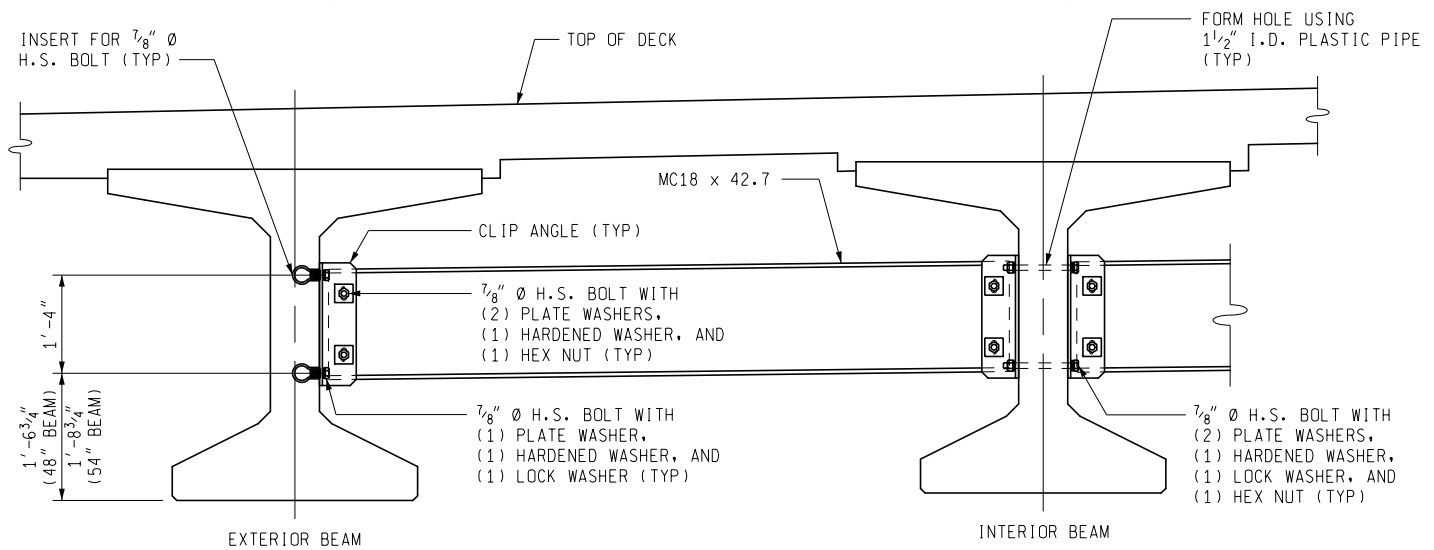
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 APPROVED BY: BMW

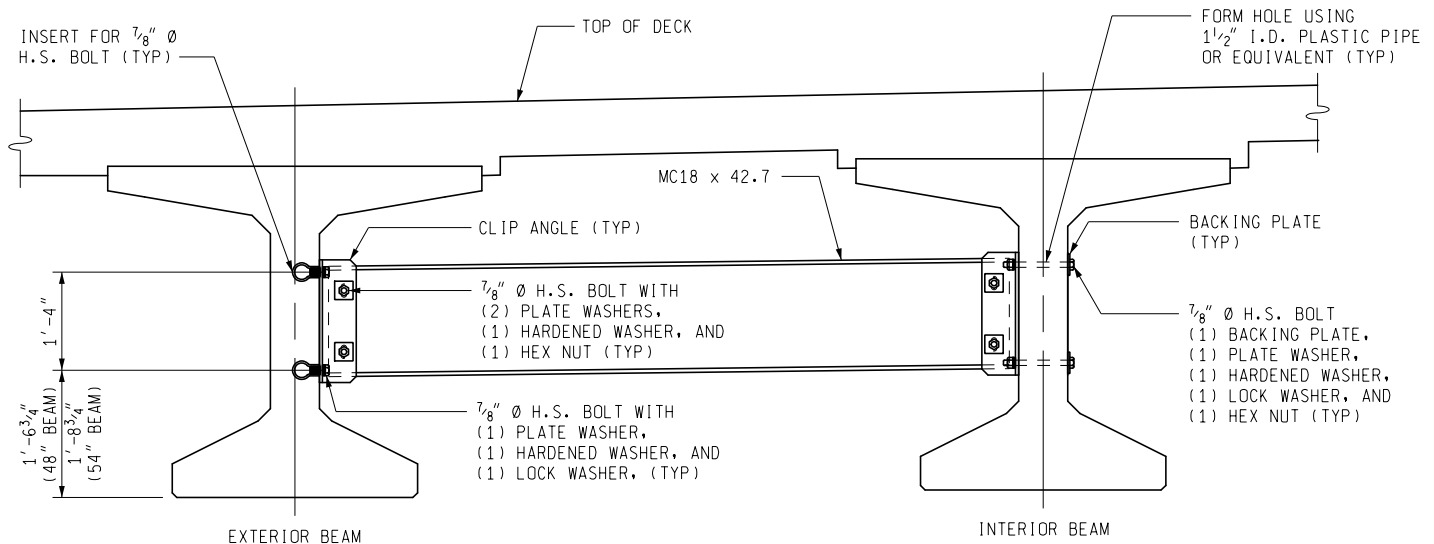
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

STEEL DIAPHRAGMS FOR  
 48" AND 54" BULB TEE BEAMS

ISSUED: 11/28/22  
 SUPERSEDES: 08/27/18



PARTIAL TRANSVERSE SECTION AT DIAPHRAGM  
 SKEW ANGLE  $\leq 10^\circ$



PARTIAL TRANSVERSE SECTION AT DIAPHRAGM  
 SKEW ANGLE  $> 10^\circ$

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.

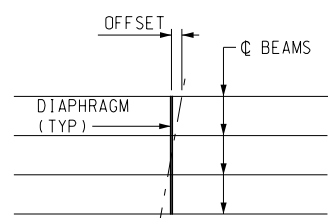
BOLTS CONNECTING THE CLIP ANGLES TO DIAPHRAGMS MUST BE TIGHTENED BY THE TURN OF NUT METHOD PER SUBSECTION 707.03.D OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.

H.S. DENOTES HIGH STRENGTH BOLTS.

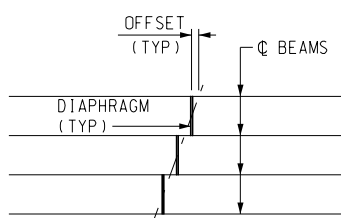
I.D. DENOTES INSIDE DIAMETER.

USE STEEL DIAPHRAGMS AT MIDPOINT AND AT INDEPENDENT BACKWALLS WITH SLIDING SLAB.

APPLY AASHTO REQUIREMENTS WHEN DETERMINING NEED FOR DIAPHRAGMS.



PLAN FOR  
 SKEW ANGLE  $\leq 10^\circ$



PLAN FOR  
 SKEW ANGLE  $> 10^\circ$

PREPARED BY  
 DESIGN DIVISION

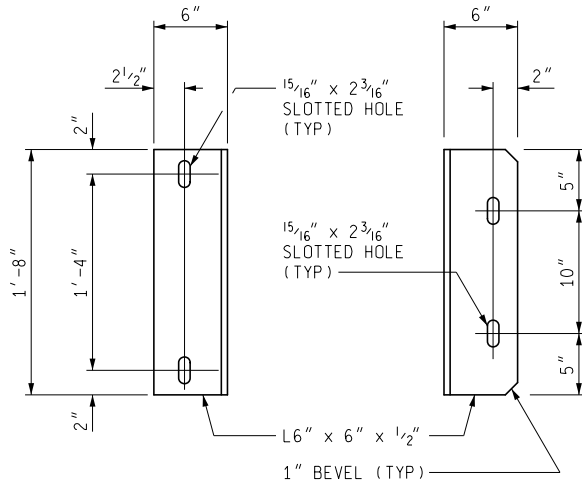
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DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: BMW

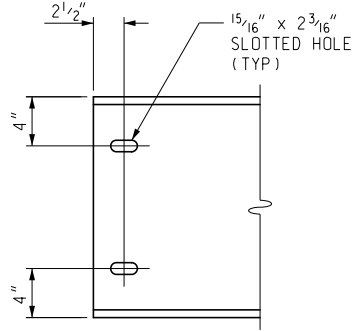
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

STEEL DIAPHRAGMS FOR  
 48" AND 54" BULB TEE BEAMS

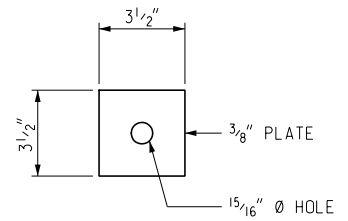
ISSUED: 08/27/18  
 SUPERSEDES: / /



CLIP ANGLE



CHANNEL END



BACKING PLATE  
 SKEW ANGLE > 10° ONLY

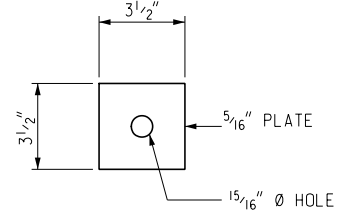
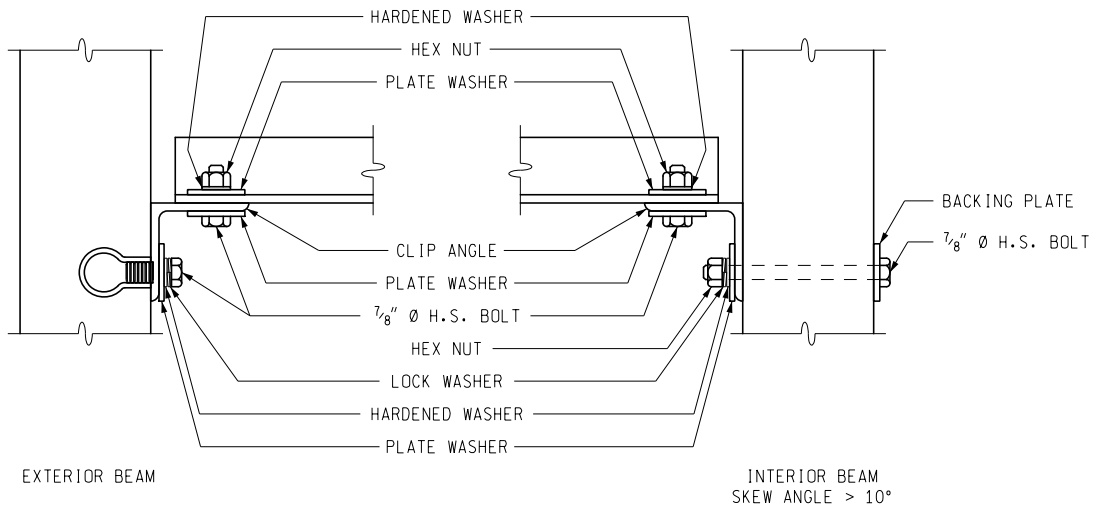
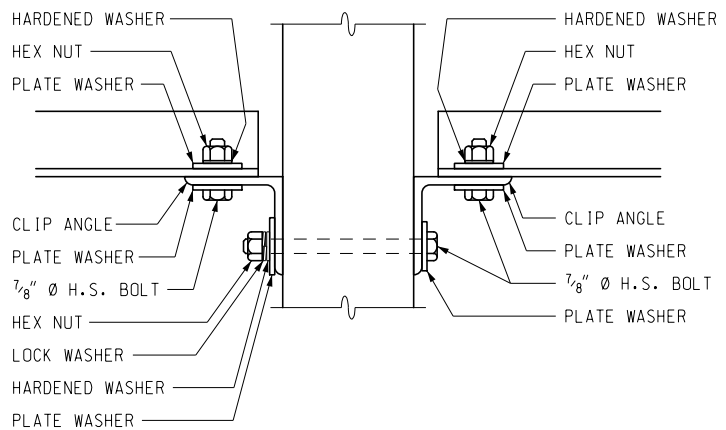


PLATE WASHER



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

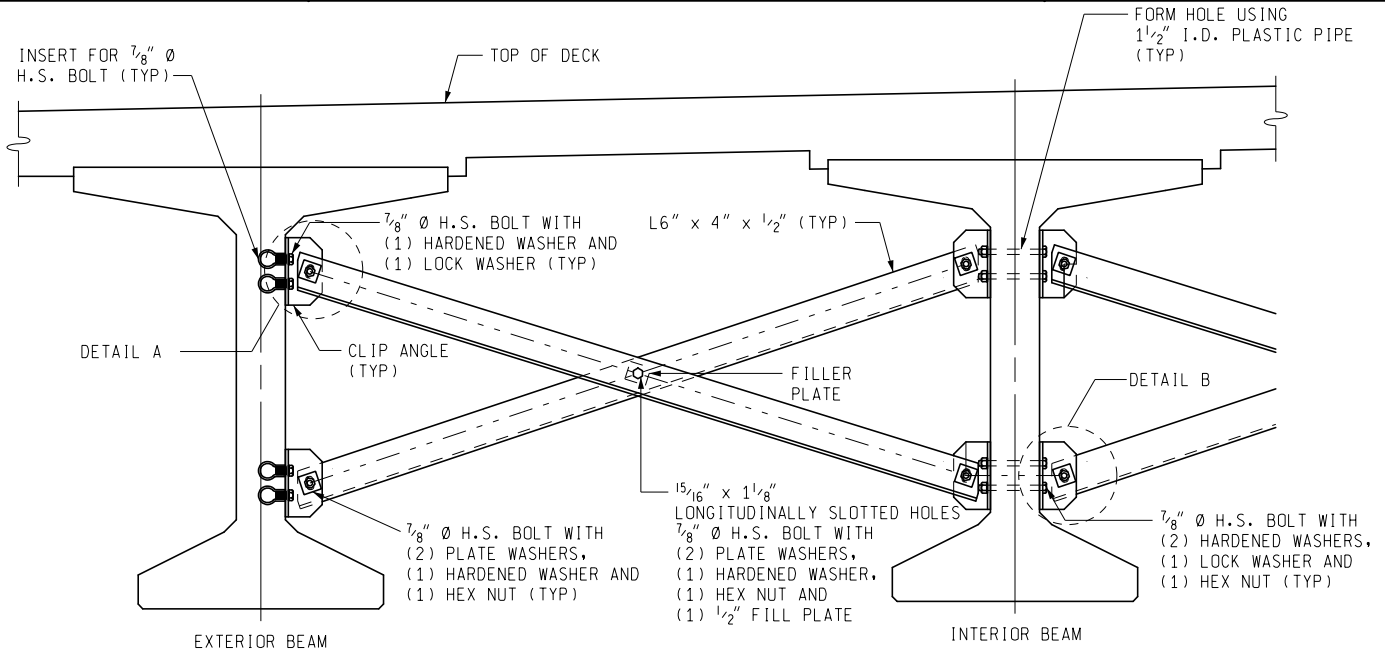


DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

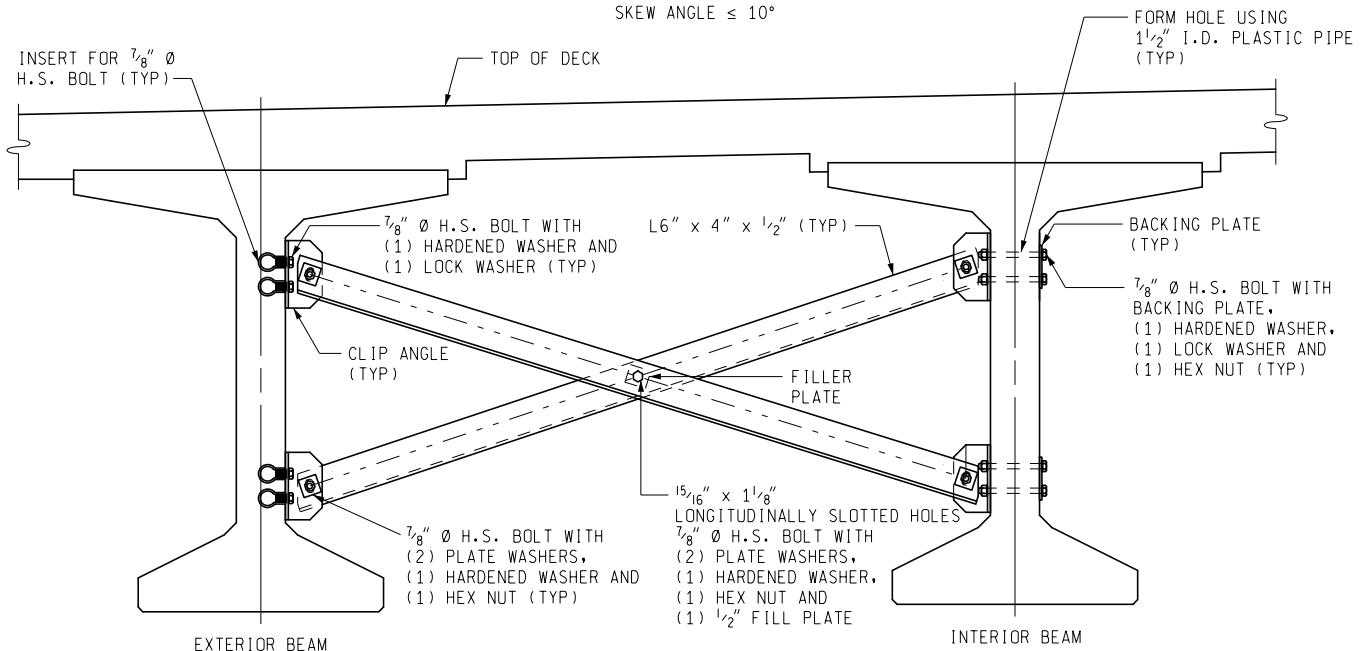
STEEL DIAPHRAGMS FOR  
 60", 66" AND 72" BULB TEE BEAMS

ISSUED: 11/28/22  
 SUPERSEDES: 08/27/18



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.

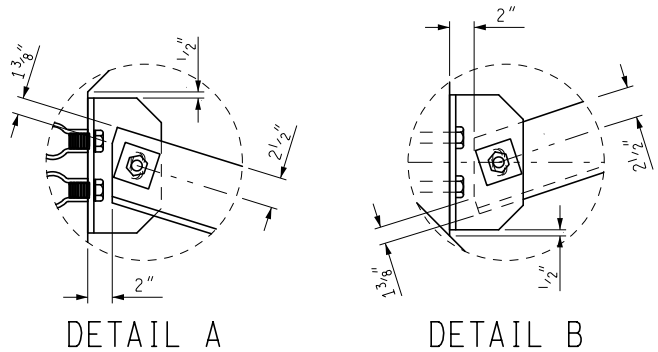
BOLTS CONNECTING THE CLIP ANGLES TO DIAPHRAGMS MUST BE TIGHTENED BY THE TURN OF NUT METHOD PER SUBSECTION 707.03.D OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION.

H.S. DENOTES HIGH STRENGTH BOLTS.

I.D. DENOTES INSIDE DIAMETER.

USE STEEL DIAPHRAGMS AT MIDPOINT AND AT INDEPENDENT BACKWALLS WITH SLIDING SLAB.

APPLY AASHTO REQUIREMENTS WHEN DETERMINING NEED FOR DIAPHRAGMS.



DETAIL A

DETAIL B

PREPARED BY  
 DESIGN DIVISION

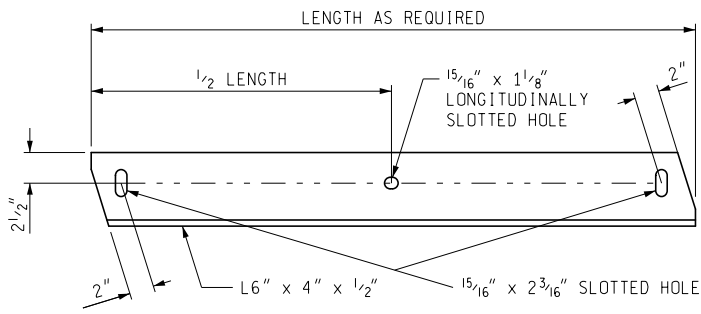
6.60.12G

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: BMW

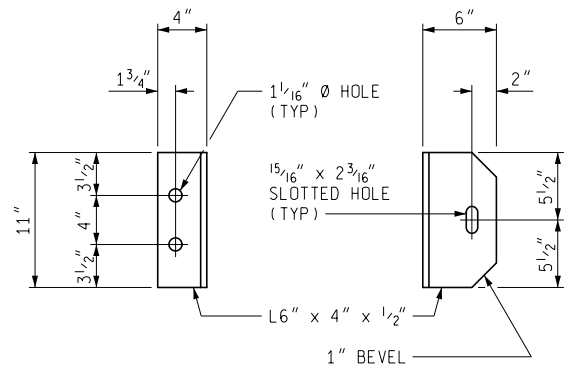
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

STEEL DIAPHRAGMS FOR  
 60", 66" AND 72" BULB TEE BEAMS

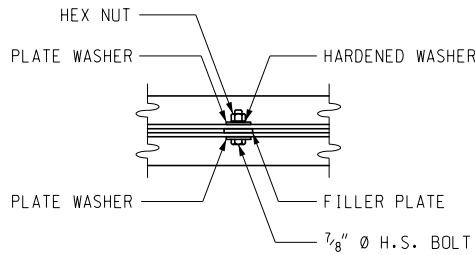
ISSUED: 08/27/18  
 SUPERSEDES: / /



CROSS ANGLE



CLIP ANGLE



CROSS ANGLES

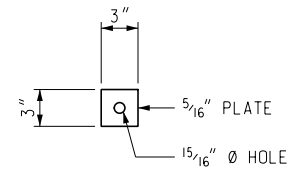
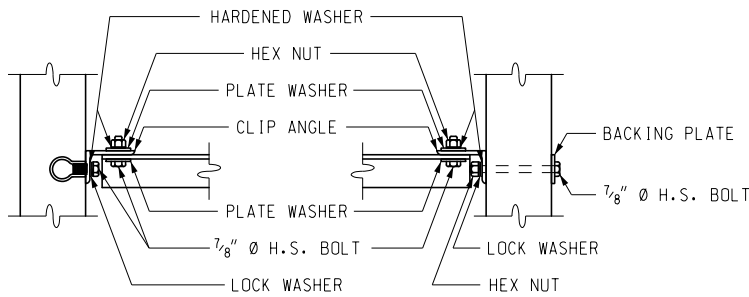
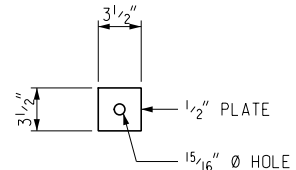


PLATE WASHER

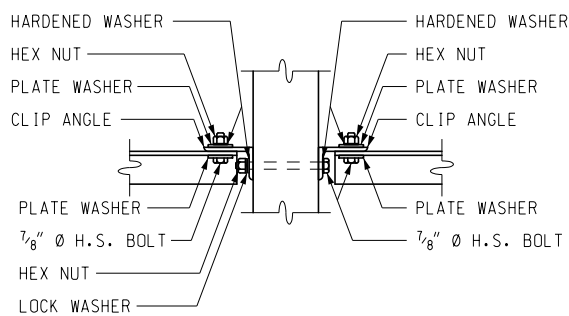


EXTERIOR BEAM

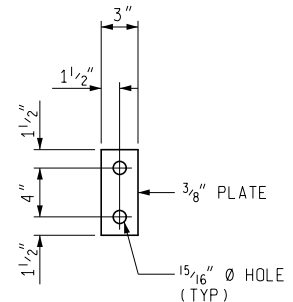
INTERIOR BEAM  
 SKEW ANGLE  $> 10^\circ$



FILLER PLATE

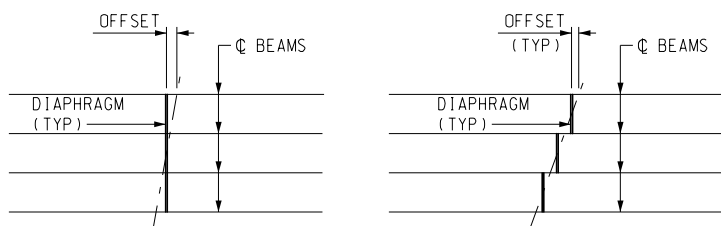


INTERIOR BEAM  
 SKEW ANGLE  $\leq 10^\circ$



BACKING PLATE  
 SKEW ANGLE  $> 10^\circ$  ONLY

CONNECTION DETAILS



PLAN FOR  
 SKEW ANGLE  $\leq 10^\circ$

PLAN FOR  
 SKEW ANGLE  $> 10^\circ$

NOTES:

WORK THIS GUIDE WITH 6.60.12G.

H.S. DENOTES HIGH STRENGTH BOLTS.

PREPARED BY  
 DESIGN DIVISION

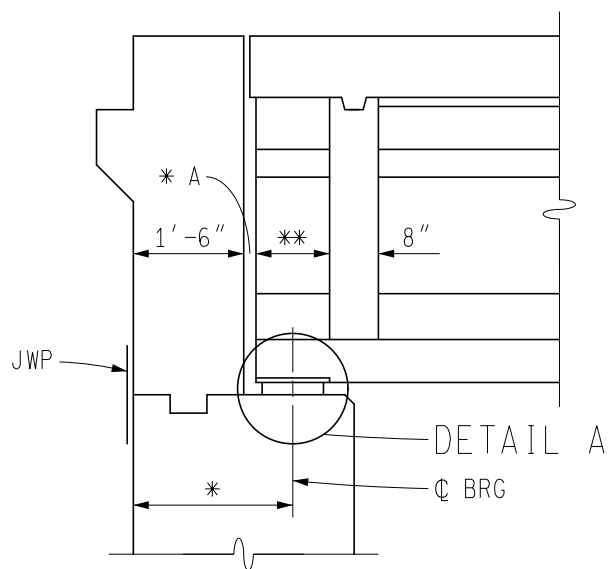
6.60.12H

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 APPROVED BY: VZ  
 CHECKED BY: KCK

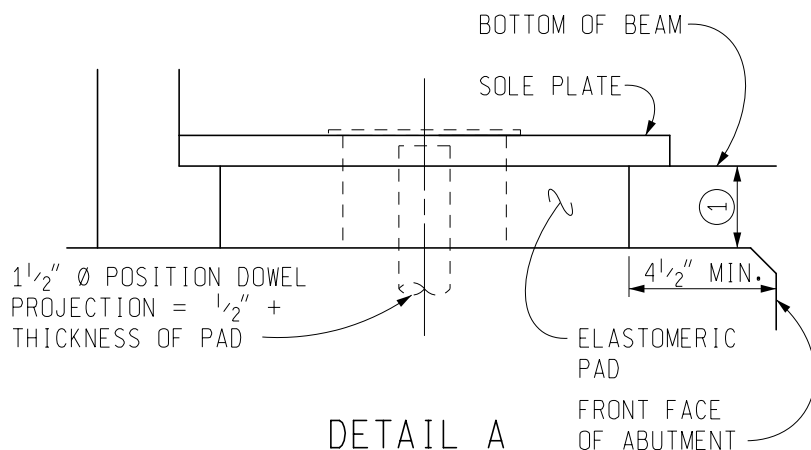
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

DETAILS AT ABUTMENTS FOR  
 PRESTRESSED CONCRETE I-BEAMS

ISSUED: 01/23/23  
 SUPERSEDES: 11/27/01



INDEPENDENT BACKWALL

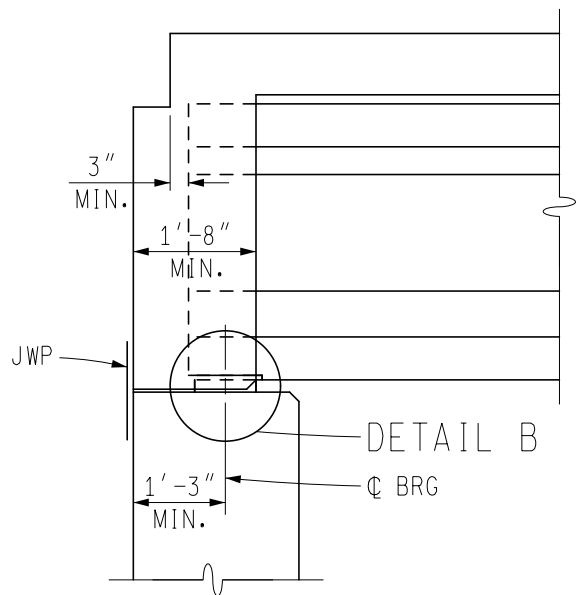


DETAIL A

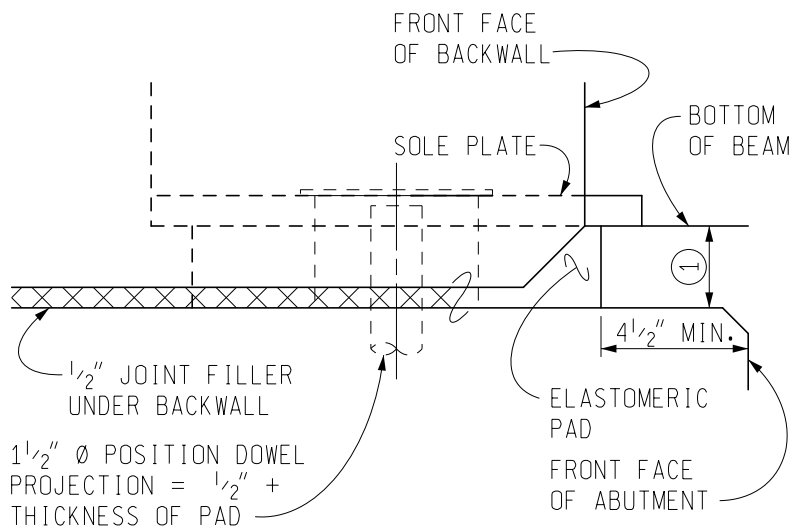
ALSO APPLIES AT PIERS

\* TO ESTABLISH C BRG., USE "A" =  $1/2$  TOTAL MOVEMENT (PARALLEL TO C BEAM) PLUS  $1''$ . FOR SKEWED BRIDGES "A" IS MEASURED AT CORNER OF BOTTOM FLANGE.

\*\*  $10''$  TO  $1' - 0''$



DEPENDENT BACKWALL



DETAIL B

① INCREASE ELASTOMERIC PAD THICKNESS AS REQUIRED TO PROVIDE CLEARANCE FOR STRUCTURES ON GRADE AND/OR SKEW.

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

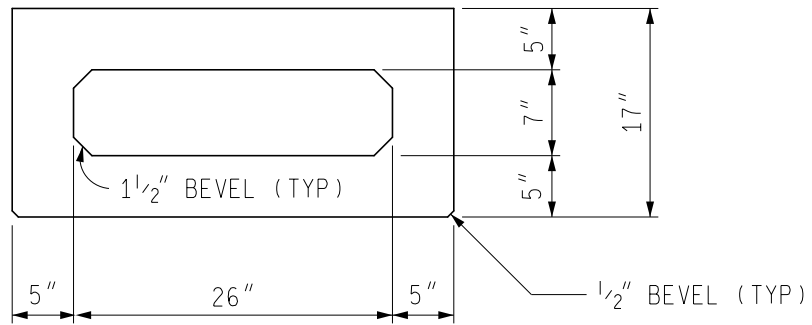
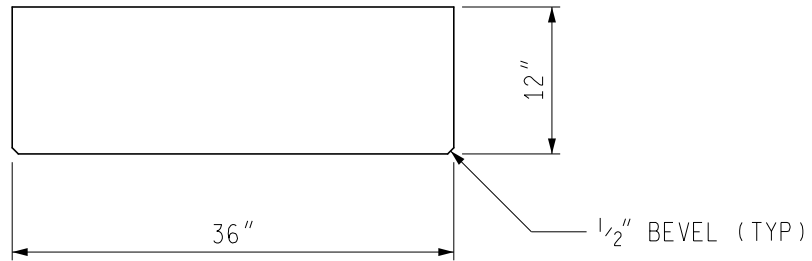
FOR BEARING DETAILS SEE DESIGN GUIDE 8.43.01.

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	WIDTH	WEIGHT	AREA	Y <sub>T</sub>	Y <sub>B</sub>	S <sub>T</sub>	S <sub>B</sub>	I
in	in	lbs/ft	in <sup>2</sup>	in	in	in <sup>3</sup>	in <sup>3</sup>	in <sup>4</sup>
12	36	442	424	6.04	5.96	848	860	5,120
17	36	445	427	8.58	8.42	1610	1640	13,800

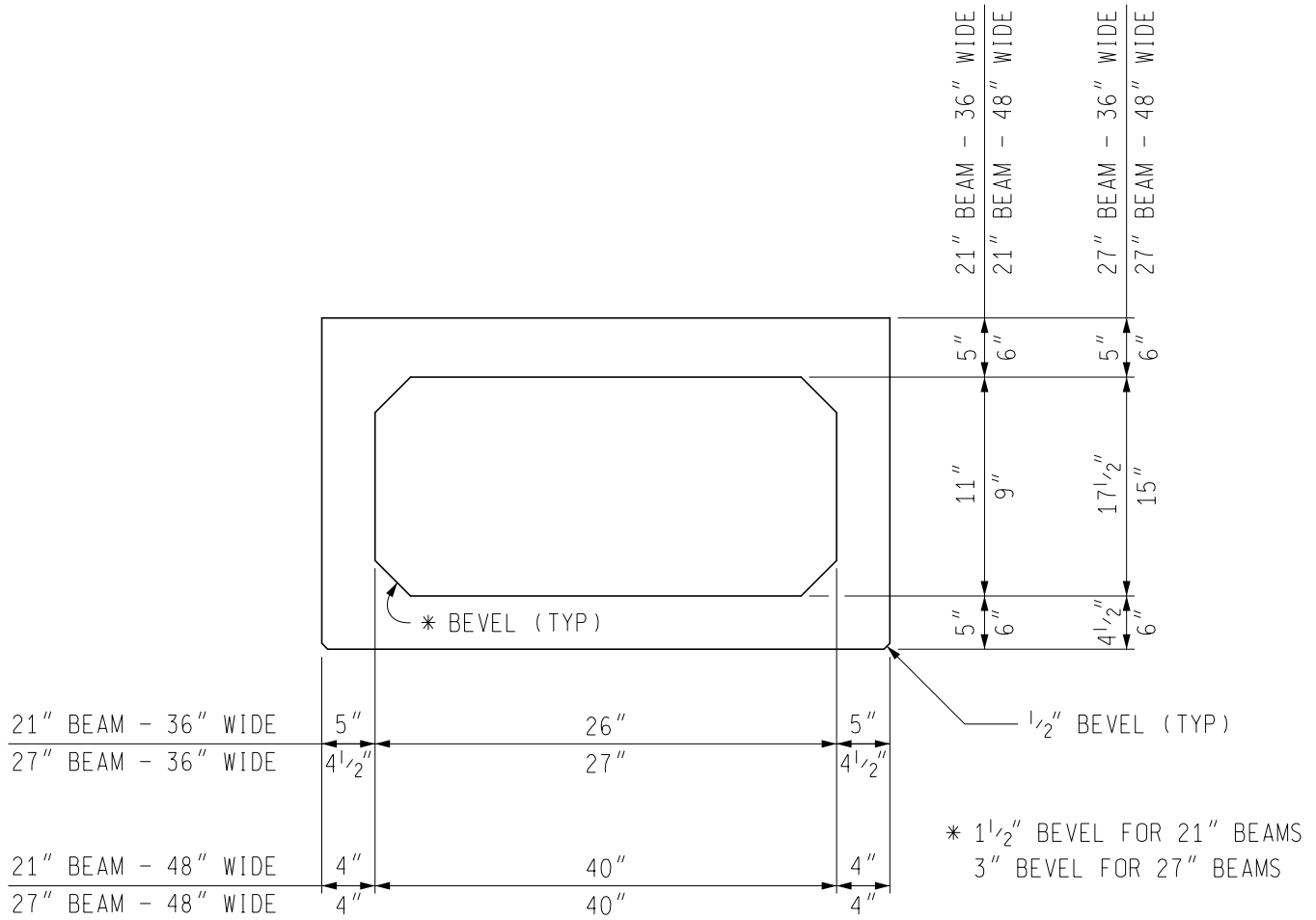
PREPARED BY  
 DESIGN DIVISION

6.65.02

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 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

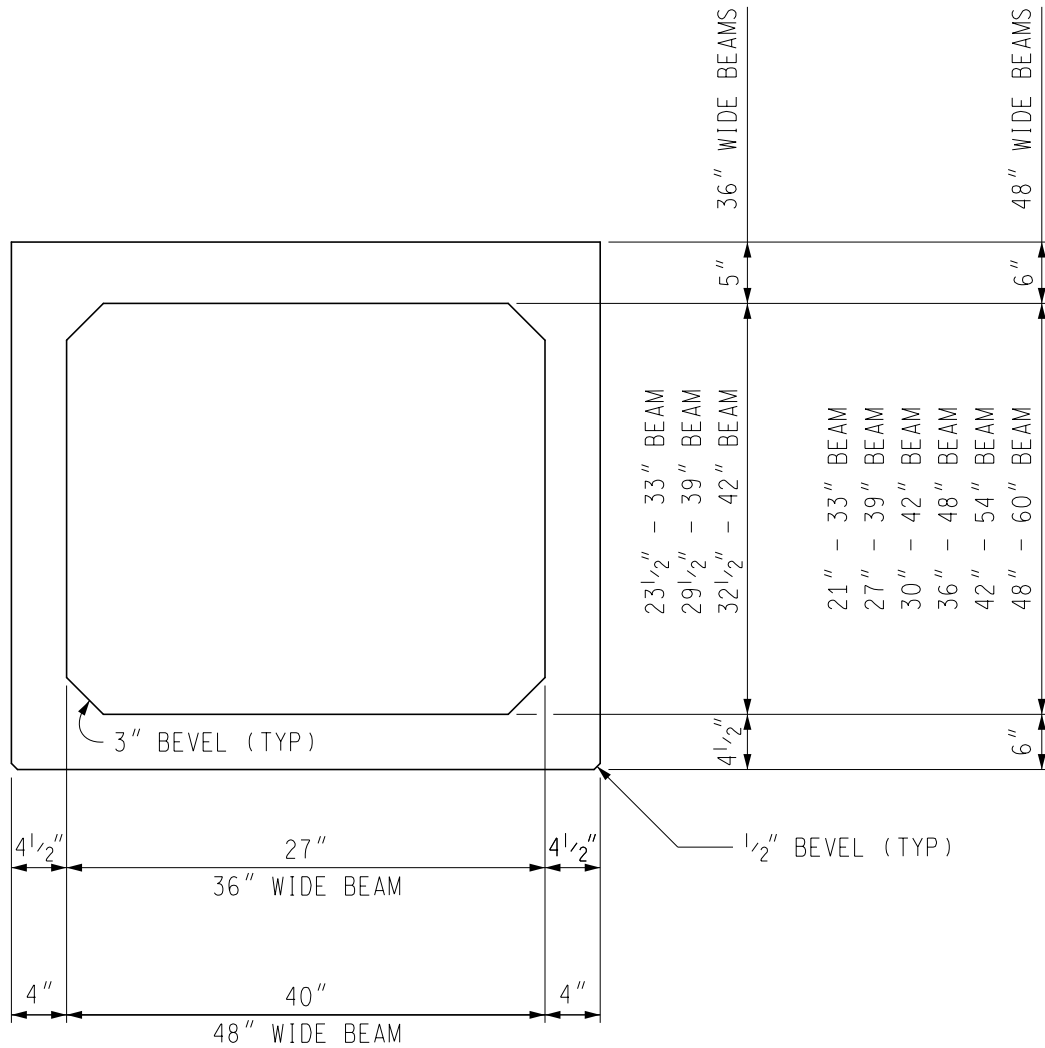


BEAM PROPERTIES								
DEPTH	WIDTH	WEIGHT	AREA	Y <sub>T</sub>	Y <sub>B</sub>	S <sub>T</sub>	S <sub>B</sub>	I
in	in	lbs/ft	in <sup>2</sup>	in	in	in <sup>3</sup>	in <sup>3</sup>	in <sup>4</sup>
21	36	486	467	10.60	10.40	2320	2360	24,600
21	48	686	659	10.58	10.42	3260	3310	34,500
27	36	530	509	13.43	13.57	3520	3480	47,300
27	48	736	707	13.59	13.41	4970	5030	67,500

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	WIDTH	WEIGHT	AREA	$Y_T$	$Y_B$	$S_T$	$S_B$	$I$
in	in	lbs/ft	in <sup>2</sup>	in	in	in <sup>3</sup>	in <sup>3</sup>	in <sup>4</sup>
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:  
CHECKED BY:  
APPROVED BY:

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT

ISSUED:  
SUPERSEDES:

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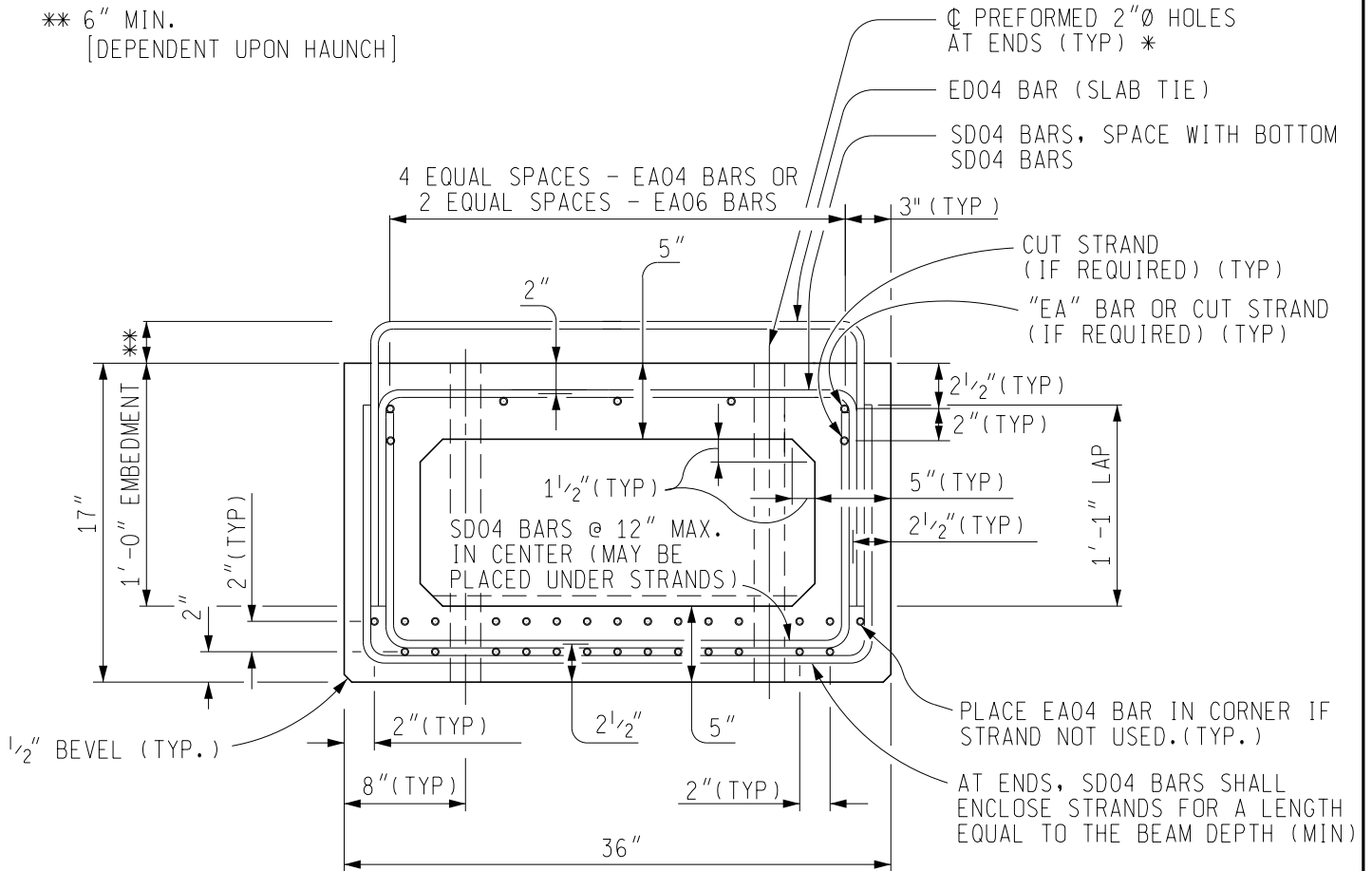
PREPARED BY  
DESIGN DIVISION

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

PRESTRESSED CONCRETE 3' WIDE  
 BOX BEAM REINFORCEMENT DETAILS

ISSUED: 09/26/22  
 SUPERSEDES: 12/27/21



TYPICAL SECTION - 17" BEAMS

PLAN NOTES:

WHERE REQUIRED, DECREASE VOID BOXES HEIGHT TO PROVIDE 1 1/2" CLEAR COVER FOR PRESTRESSING STRANDS IN UPPER ROW.

NOTES:

MINIMUM REINFORCEMENT SHOWN.

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

PLACE SPREAD BOX BEAM DIAPHRAGM/BACKWALL INSERTS AT 5" OR 7" UP FROM BOTTOM OF BEAM AND 3 1/2" OR 5 1/2" 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.

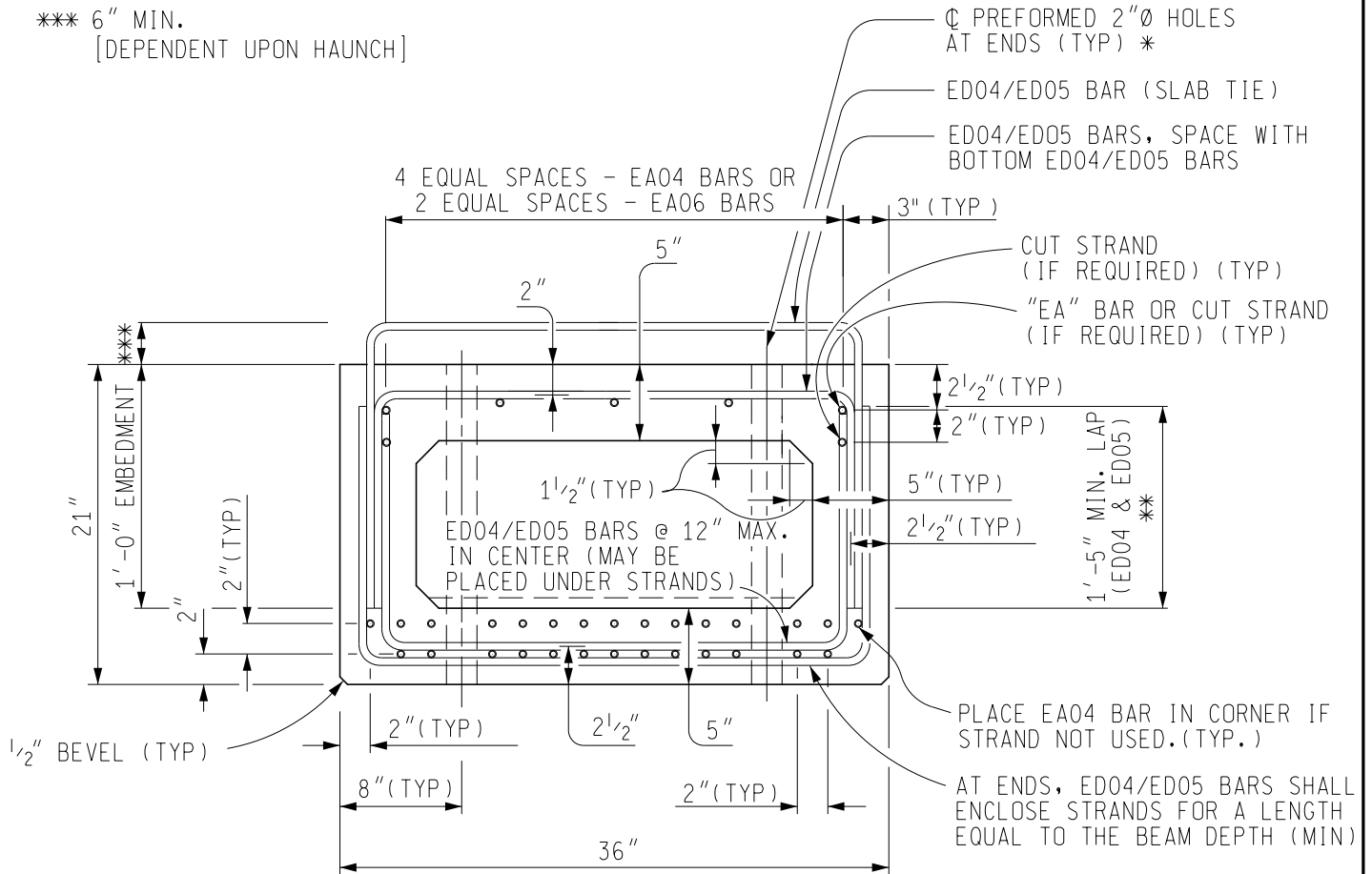


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 CHECKED BY: VZ  
 APPROVED BY: BMW

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 - 21" BEAMS

PLAN NOTES:

WHERE REQUIRED, DECREASE VOID BOXES HEIGHT TO PROVIDE 1 1/2" CLEAR COVER FOR PRESTRESSING STRANDS IN UPPER ROW.

NOTES:

MINIMUM REINFORCEMENT SHOWN.

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

PLACE SPREAD BOX BEAM DIAPHRAGM/BACKWALL INSERTS AT 5" OR 7" UP FROM BOTTOM OF BEAM AND 3 1/2" OR 5 1/2" DOWN FROM TOP OF BEAM.

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

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.

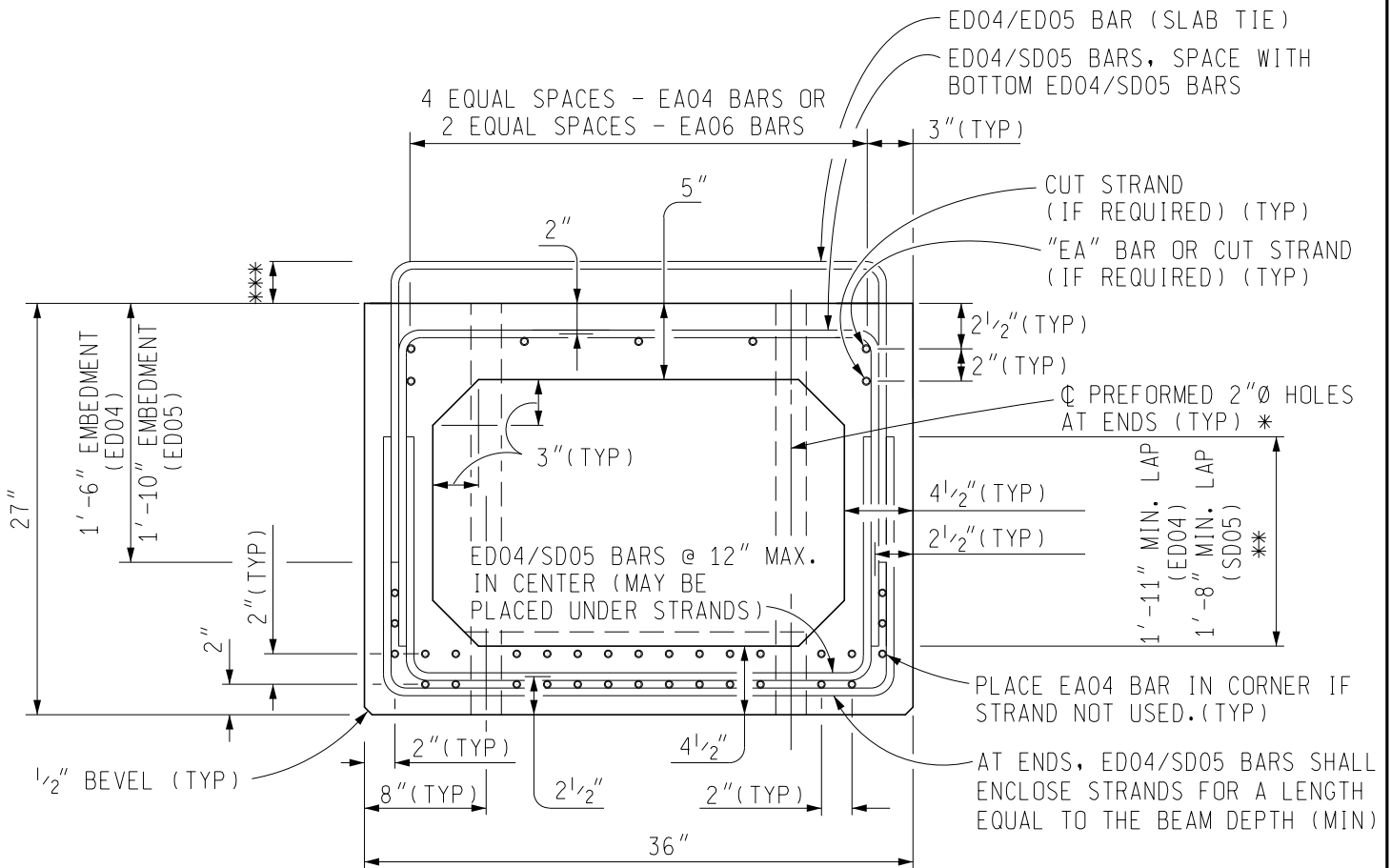
DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

PRESTRESSED CONCRETE 3' WIDE  
 BOX BEAM REINFORCEMENT DETAILS

ISSUED: 09/26/22  
 SUPERSEDES: 12/27/21

\*\*\* 6" MIN.  
 [DEPENDENT UPON HAUNCH]



**TYPICAL SECTION - 27" BEAMS**

**PLAN NOTES:**

WHERE REQUIRED, DECREASE VOID BOXES HEIGHT TO PROVIDE 1 1/2" CLEAR COVER FOR PRESTRESSING STRANDS IN UPPER ROW.

**NOTES:**

MINIMUM REINFORCEMENT SHOWN.

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

PLACE SPREAD BOX BEAM DIAPHRAGM/BACKWALL INSERTS AT 5" OR 7" UP FROM BOTTOM OF BEAM AND 3 1/2" OR 5 1/2" DOWN FROM TOP OF BEAM.

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

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

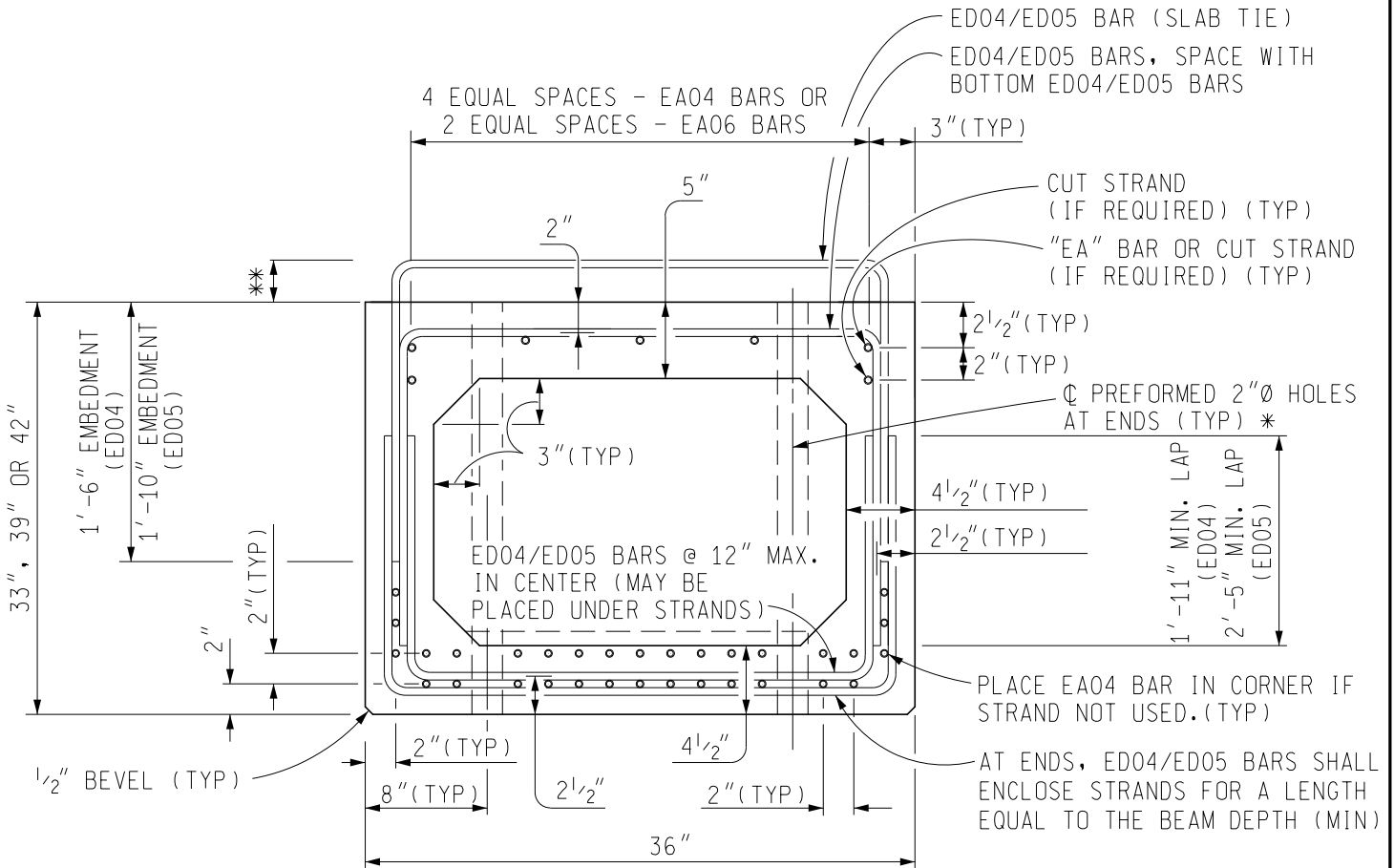
DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

PRESTRESSED CONCRETE 3' WIDE  
 BOX BEAM REINFORCEMENT DETAILS

ISSUED: 09/26/22  
 SUPERSEDES: 12/27/21

\*\* 6" MIN.  
 [DEPENDENT UPON HAUNCH]



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

**PLAN NOTES:**

WHERE REQUIRED, DECREASE VOID BOXES HEIGHT TO PROVIDE 1 1/2" CLEAR COVER FOR PRESTRESSING STRANDS IN UPPER ROW.

**NOTES:**

MINIMUM REINFORCEMENT SHOWN.

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

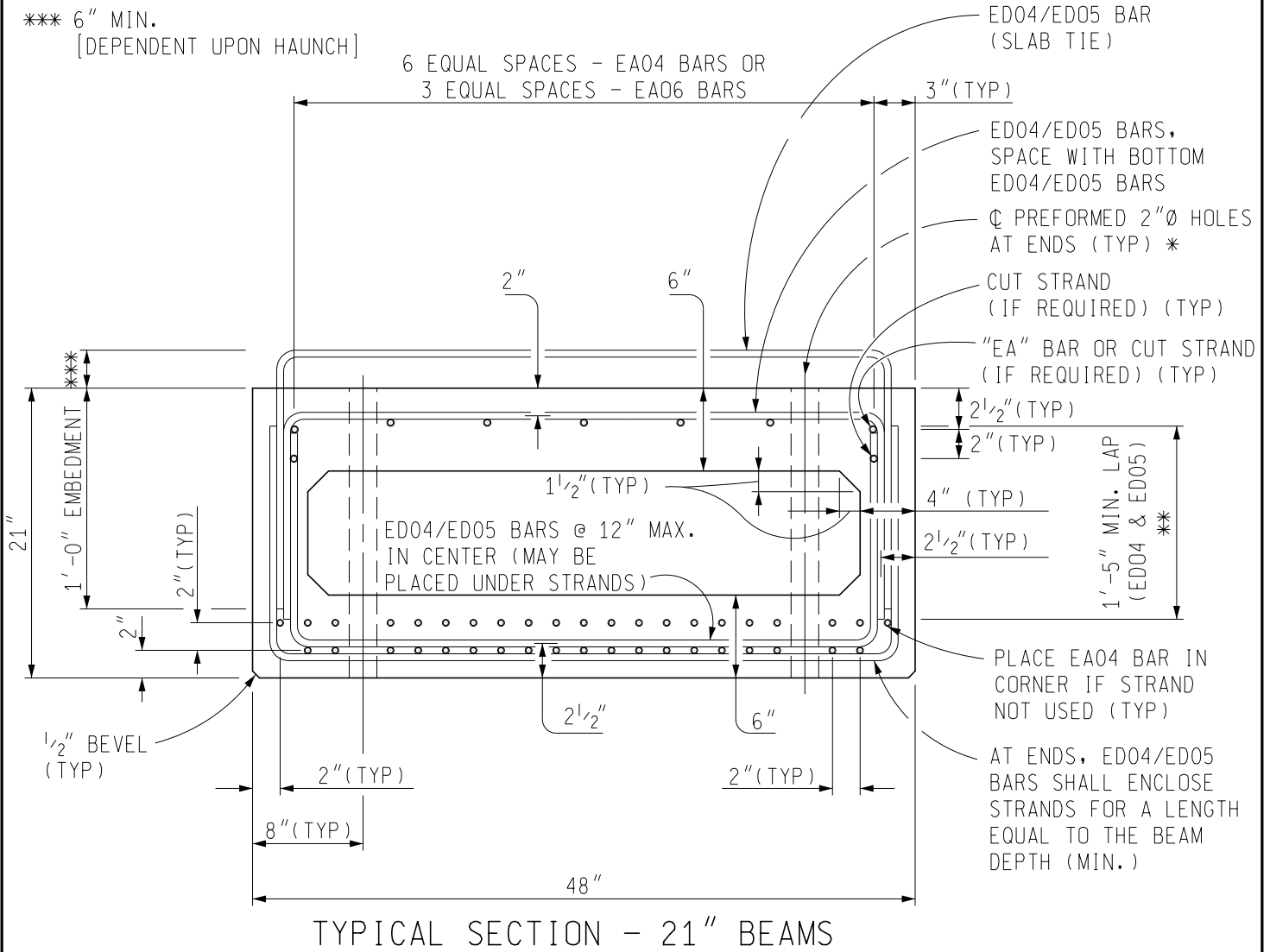
PLACE SPREAD BOX BEAM DIAPHRAGM/BACKWALL INSERTS AT 5" OR 7" UP FROM BOTTOM OF BEAM AND 3 1/2" OR 5 1/2" DOWN FROM TOP OF BEAM.

EA AND ED ARE GRADE 60 (ksi) STEEL.

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 PRESTRESSED CONCRETE 4' WIDE  
 BOX BEAM REINFORCEMENT DETAILS

ISSUED: 09/26/22  
 SUPERSEDES: 12/27/21



TYPICAL SECTION - 21" BEAMS

PLAN NOTES:

WHERE REQUIRED, DECREASE VOID BOXES HEIGHT TO PROVIDE 1 1/2" CLEAR COVER FOR PRESTRESSING STRANDS IN UPPER ROW.

NOTES:

MINIMUM REINFORCEMENT SHOWN.

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

PLACE SPREAD BOX BEAM DIAPHRAGM/BACKWALL INSERTS AT 5" OR 7" UP FROM BOTTOM OF BEAM AND 3 1/2" OR 5 1/2" DOWN FROM TOP OF BEAM.

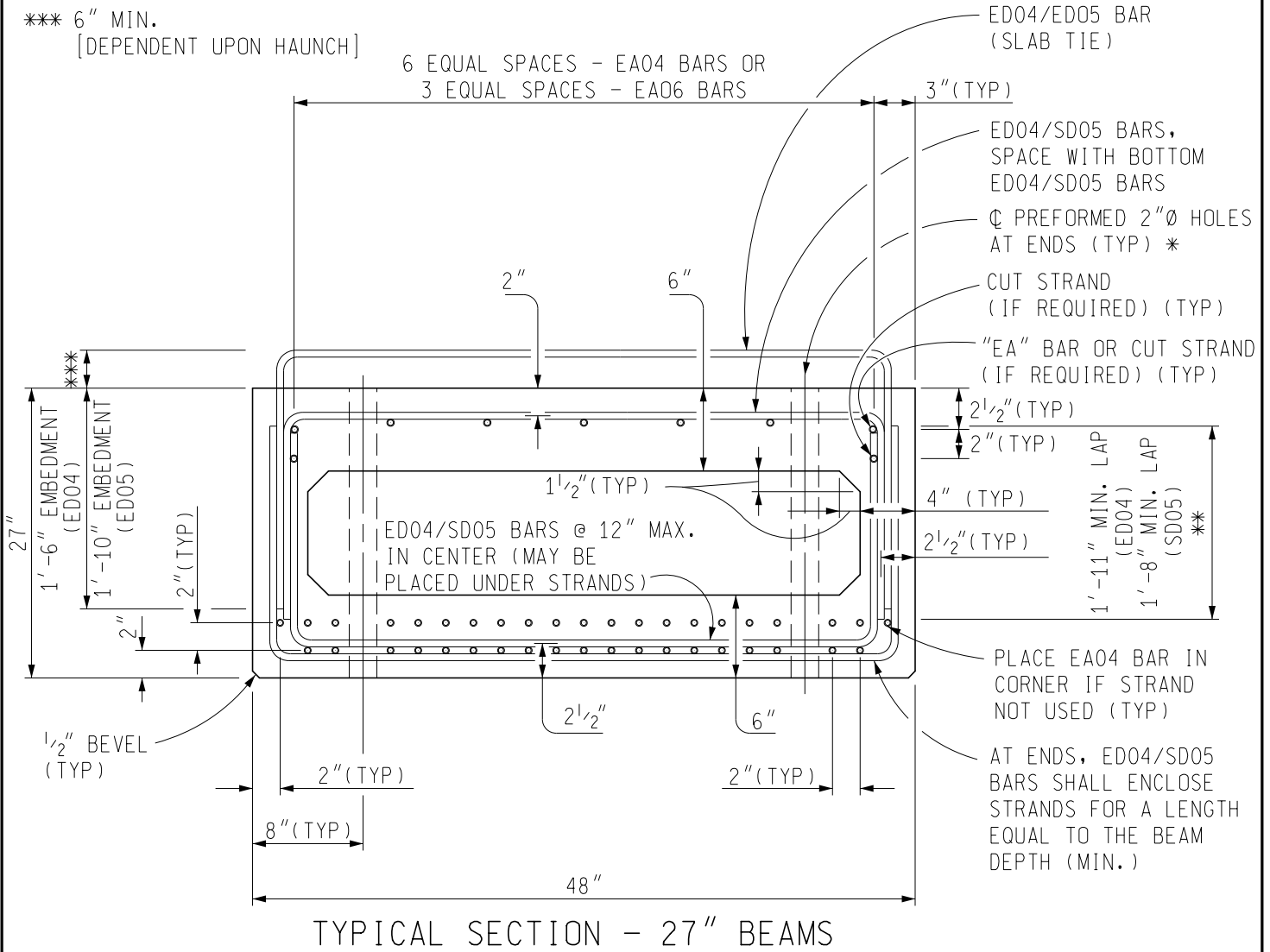
\*\* IF REQUIRED FOR SHEAR, USE ED05 BARS AND MINIMUM CONCRETE COMPRESSIVE STRENGTH OF 7600 PSI FOR BEAM DESIGN.

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.

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 PRESTRESSED CONCRETE 4' WIDE  
 BOX BEAM REINFORCEMENT DETAILS

ISSUED: 09/26/22  
 SUPERSEDES: 12/27/21



TYPICAL SECTION - 27" BEAMS

PLAN NOTES:

WHERE REQUIRED, DECREASE VOID BOXES HEIGHT TO PROVIDE 1 1/2" CLEAR COVER FOR PRESTRESSING STRANDS IN UPPER ROW.

NOTES:

MINIMUM REINFORCEMENT SHOWN.

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

PLACE SPREAD BOX BEAM DIAPHRAGM/BACKWALL INSERTS AT 5" OR 7" UP FROM BOTTOM OF BEAM AND 3 1/2" OR 5 1/2" DOWN FROM TOP OF BEAM.

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

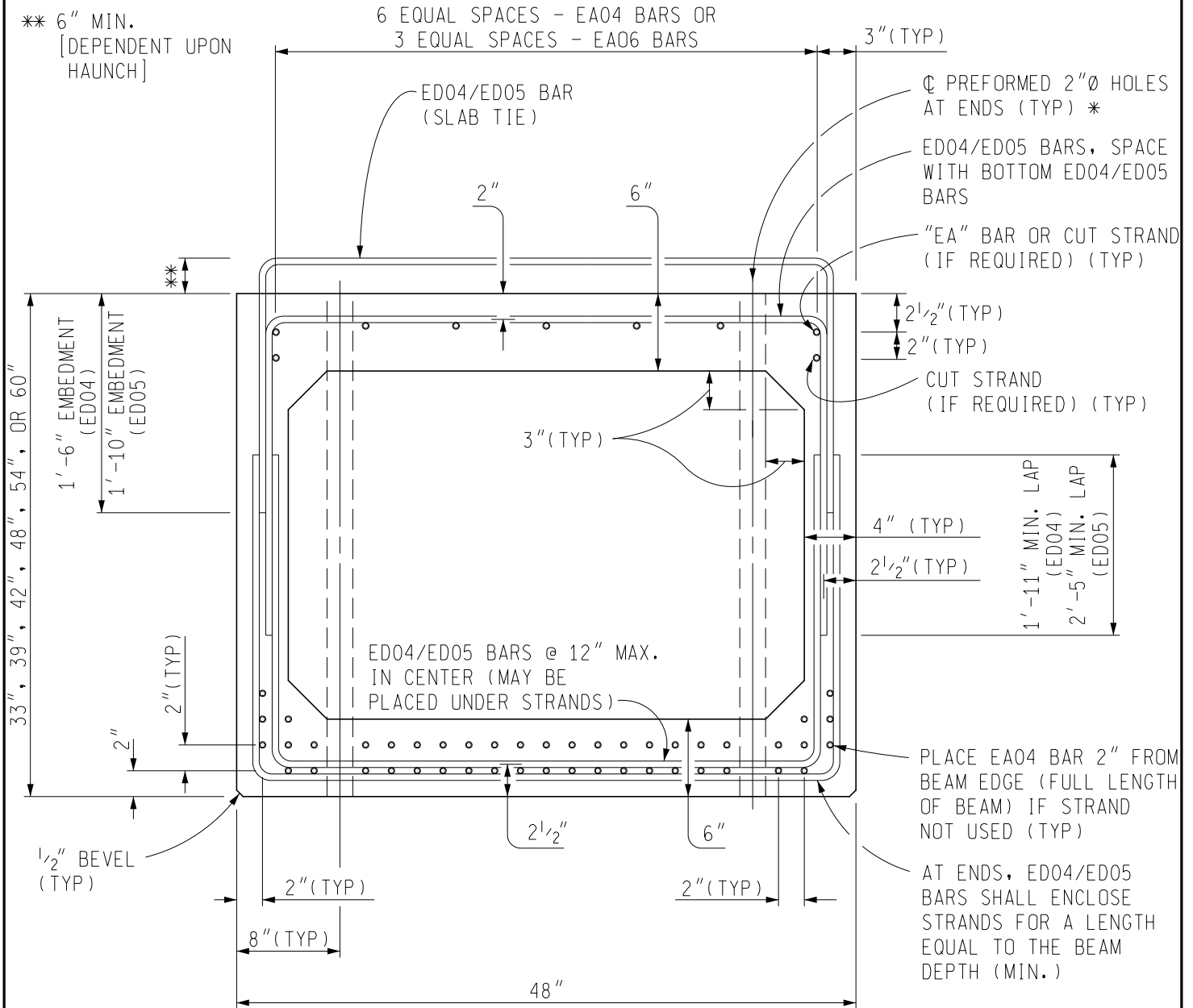
EA AND ED BARS ARE GRADE 60 (ksi) STEEL.  
 SD BARS ARE GRADE 60 (ksi) STAINLESS STEEL.

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

PRESTRESSED CONCRETE 4' WIDE  
 BOX BEAM REINFORCEMENT DETAILS

ISSUED: 09/26/22  
 SUPERSEDES: 12/27/21



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

PLAN NOTES:

WHERE REQUIRED, DECREASE VOID BOXES HEIGHT TO PROVIDE 1 1/2" CLEAR COVER FOR PRESTRESSING STRANDS IN UPPER ROW.

NOTES:

MINIMUM REINFORCEMENT SHOWN.

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

PLACE SPREAD BOX BEAM DIAPHRAGM/BACKWALL INSERTS AT 5" OR 7" UP FROM BOTTOM OF BEAM AND 3 1/2" OR 5 1/2" DOWN FROM TOP OF BEAM.

EA AND ED ARE GRADE 60 (ksi) STEEL.

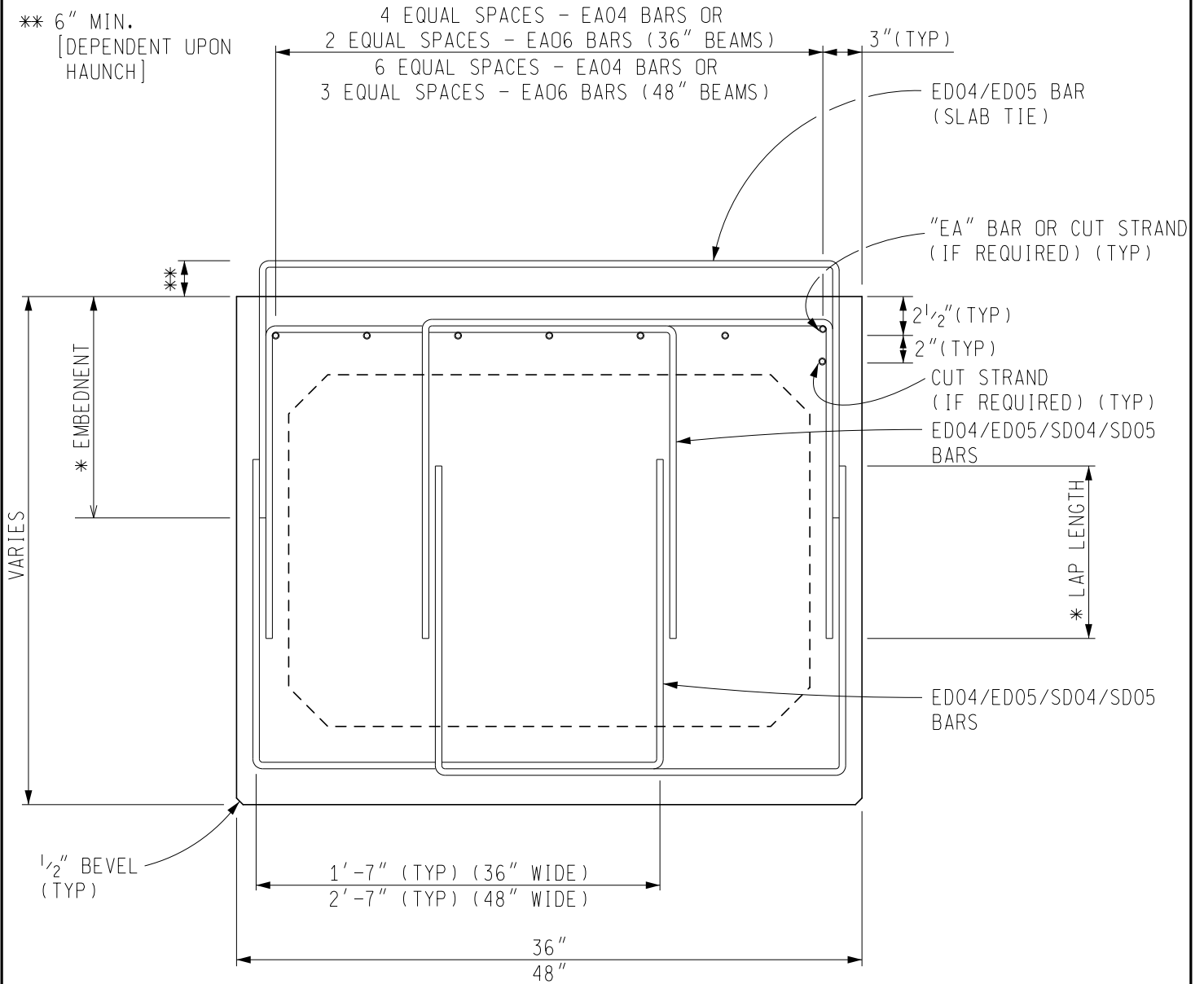
PREPARED BY  
 DESIGN DIVISION

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:

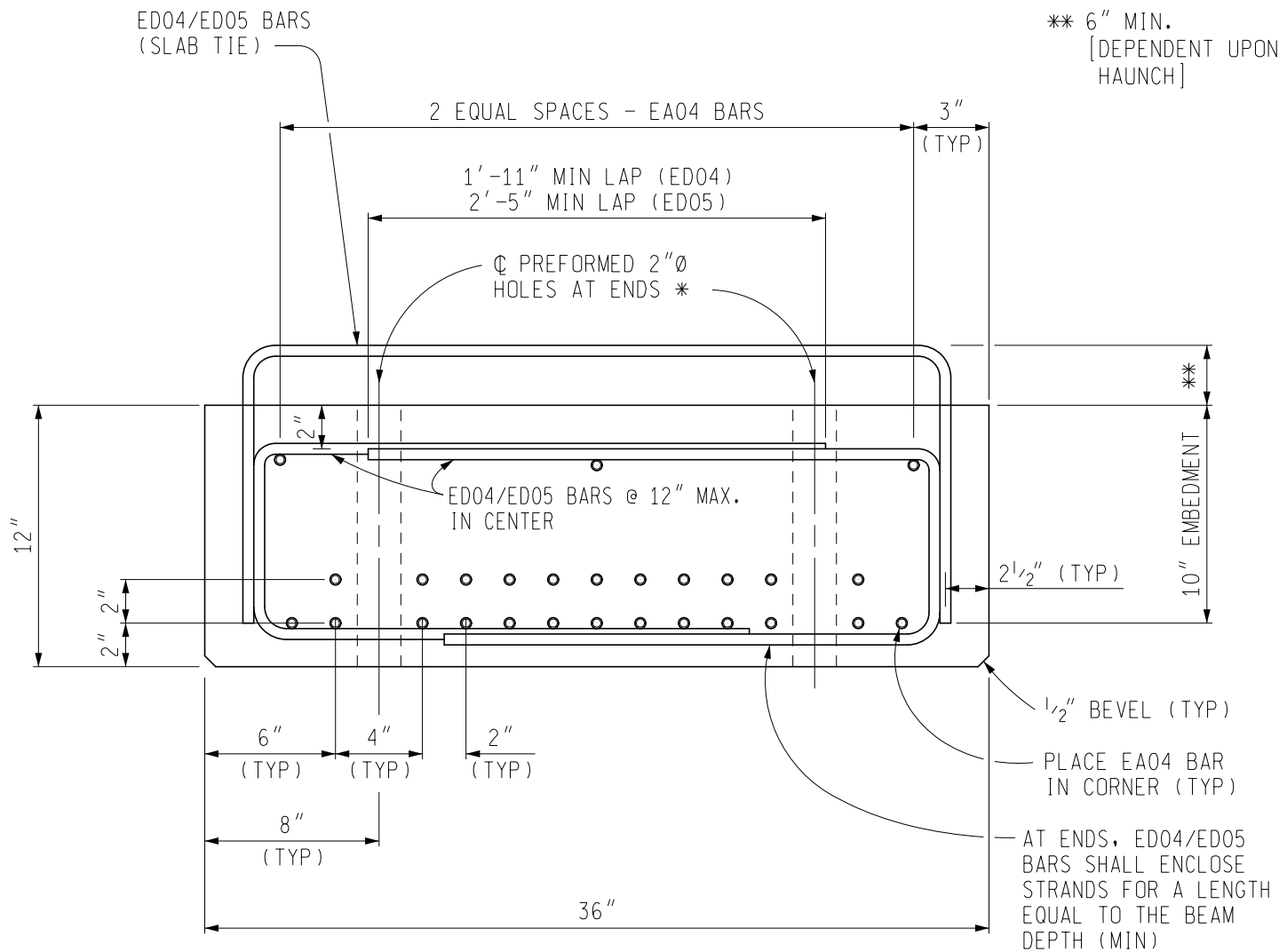
- \* SEE GUIDES 6.65.10 - 6.65.10F FOR APPLICABLE EMBEDMENTS, LAP LENGTHS AND APPLICABLE STEEL GRADES.
- EXTEND BOX BEAM END BLOCK TO A MINIMUM OF 3" BEYOND LAST DOUBLE STIRRUP.

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 SUB ABUTMENTS.

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



DRAWN BY:  
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT

ISSUED:  
SUPERSEDES:

B L A N K

P A G E

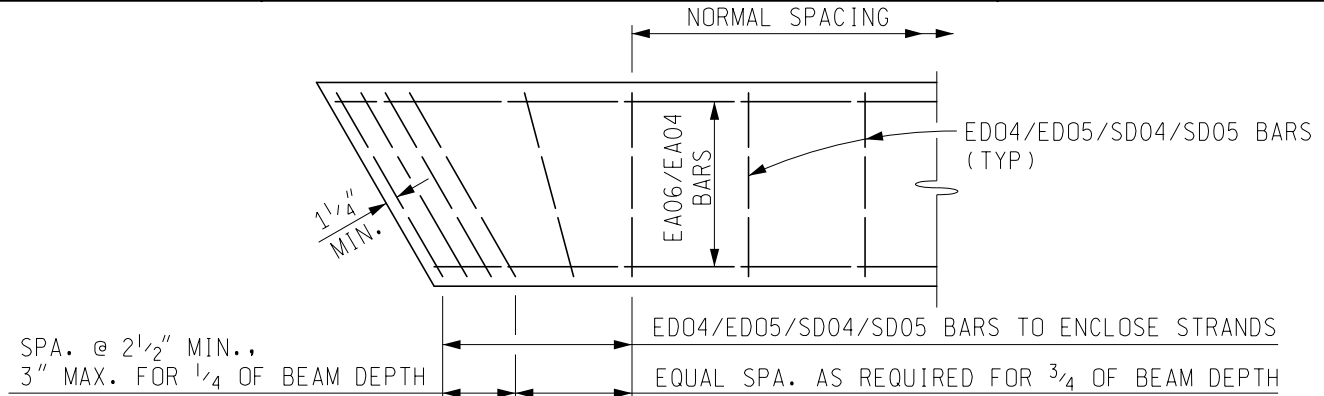
PREPARED BY  
DESIGN DIVISION

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

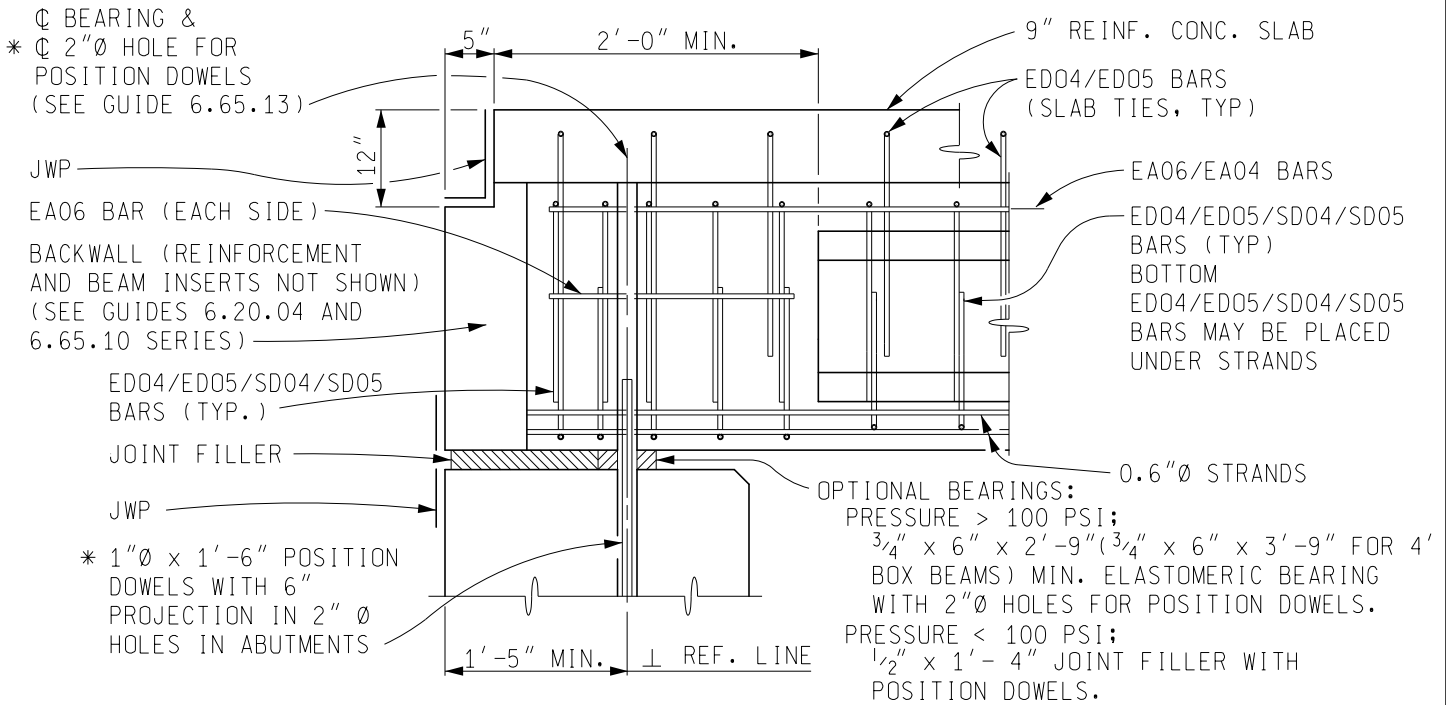
PRESTRESSED CONCRETE BOX BEAM  
 DETAILS - SPREAD BOX BEAMS

ISSUED: 12/27/21  
 SUPERSEDES: 12/17/18



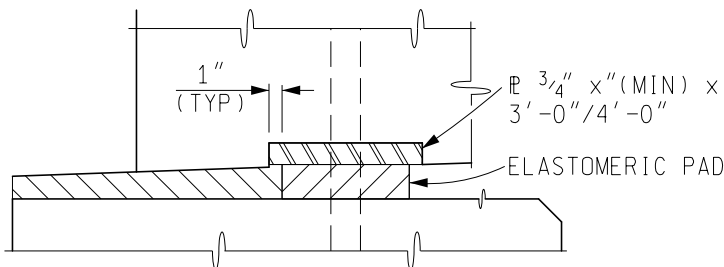
### PLAN AT END

SPACE EDO4/EDO5/SD04/SD05 BARS TO CLEAR HOLES FOR POSITION DOWELS



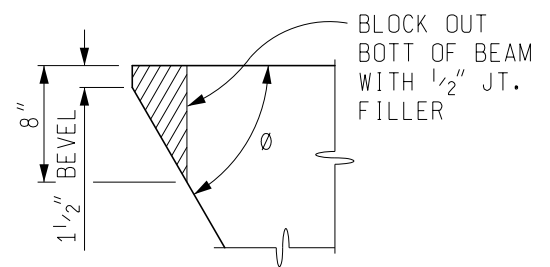
### SECTION THROUGH END BLOCK AT ABUTMENT

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



### ALTERNATE BEARING DETAILS

USE 3/4" STEEL PLATE CAST IN BEAM AND TILTED AS  
 REQUIRED WHEN CALCULATED BEVEL EXCEEDS 1%.  
 PROVIDE 1/4" x 2" x 4" ANCHORS OR 1/2"  $\emptyset$  SHEAR STUD  
 FOR 3/4" PLATE  
 (SEE GUIDE 8.43.01A FOR DETAILS)



### CORNER BLOCKING DETAIL

USE WHEN  $\theta < 70^\circ$

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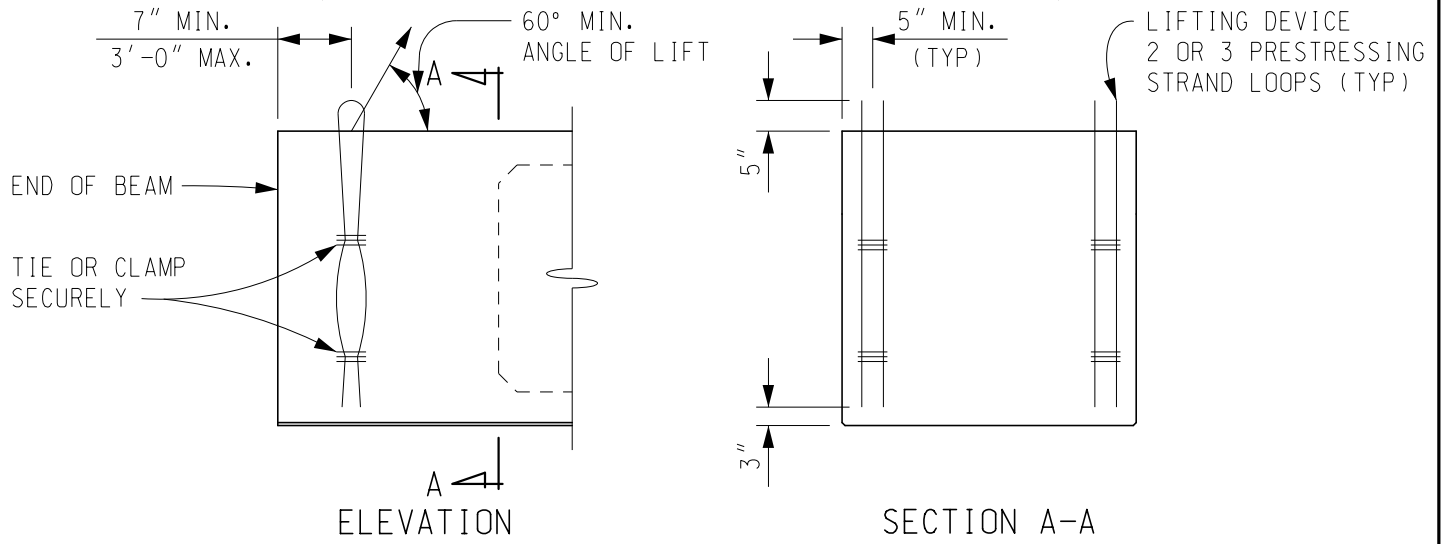
6.65.12A

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 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

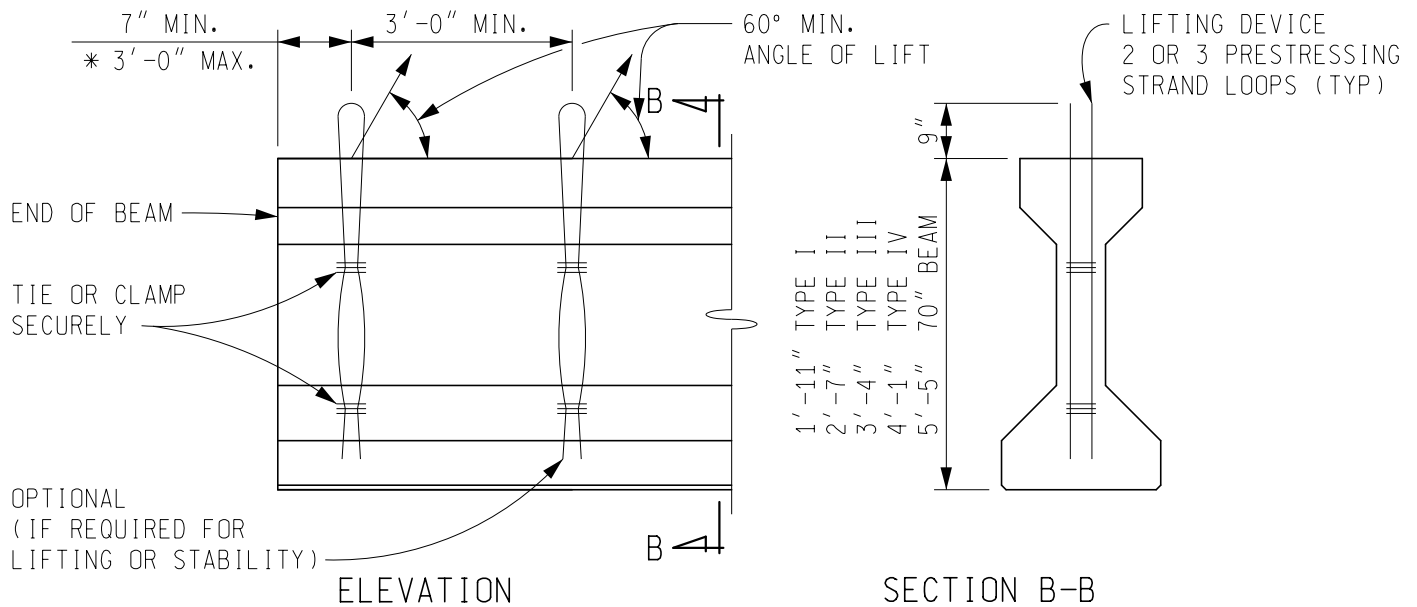
ISSUED: 11/28/22  
 SUPERSEDES: 09/26/22

PRESTRESSED CONCRETE BEAM  
 LIFTING DEVICE DETAILS



ELEVATION SECTION A-A

DETAILS FOR BOX BEAMS



ELEVATION SECTION B-B

DETAILS FOR I-BEAMS

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

\* MAXIMUM FOR 70" BEAMS IS AS REQUIRED TO MAKE BEAM LATERALLY STABLE DURING HANDLING.

PLAN NOTE:

LIFTING DEVICES SHALL BE REMOVED. REMOVAL IS INCLUDED IN THE BID ITEM "PREST CONC BOX BEAM, ERECT, -- INCH" OR "PREST CONC I BEAM, ERECT, -- INCH".

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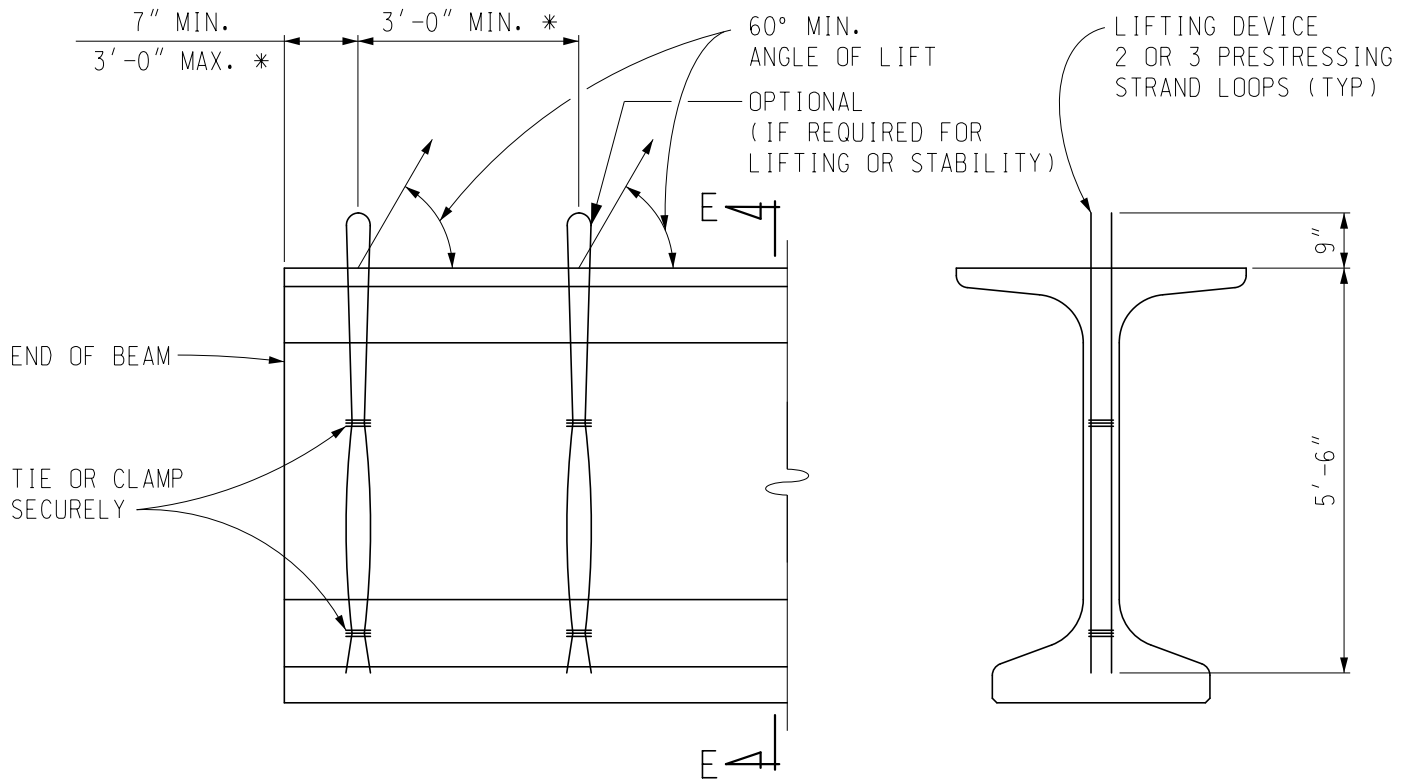
6.65.14

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

PRESTRESSED CONCRETE BEAM  
 LIFTING DEVICE DETAILS

ISSUED: 11/28/22  
 SUPERSEDES: 09/26/22



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

\* INCREASE IF REQUIRED TO MAKE BEAM LATERALLY STABLE DURING HANDLING.

PLAN NOTE:

LIFTING DEVICES SHALL BE REMOVED. REMOVAL IS INCLUDED IN THE BID ITEM "PREST CONC 1800 BEAM, ERECT."

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 DESIGN DIVISION

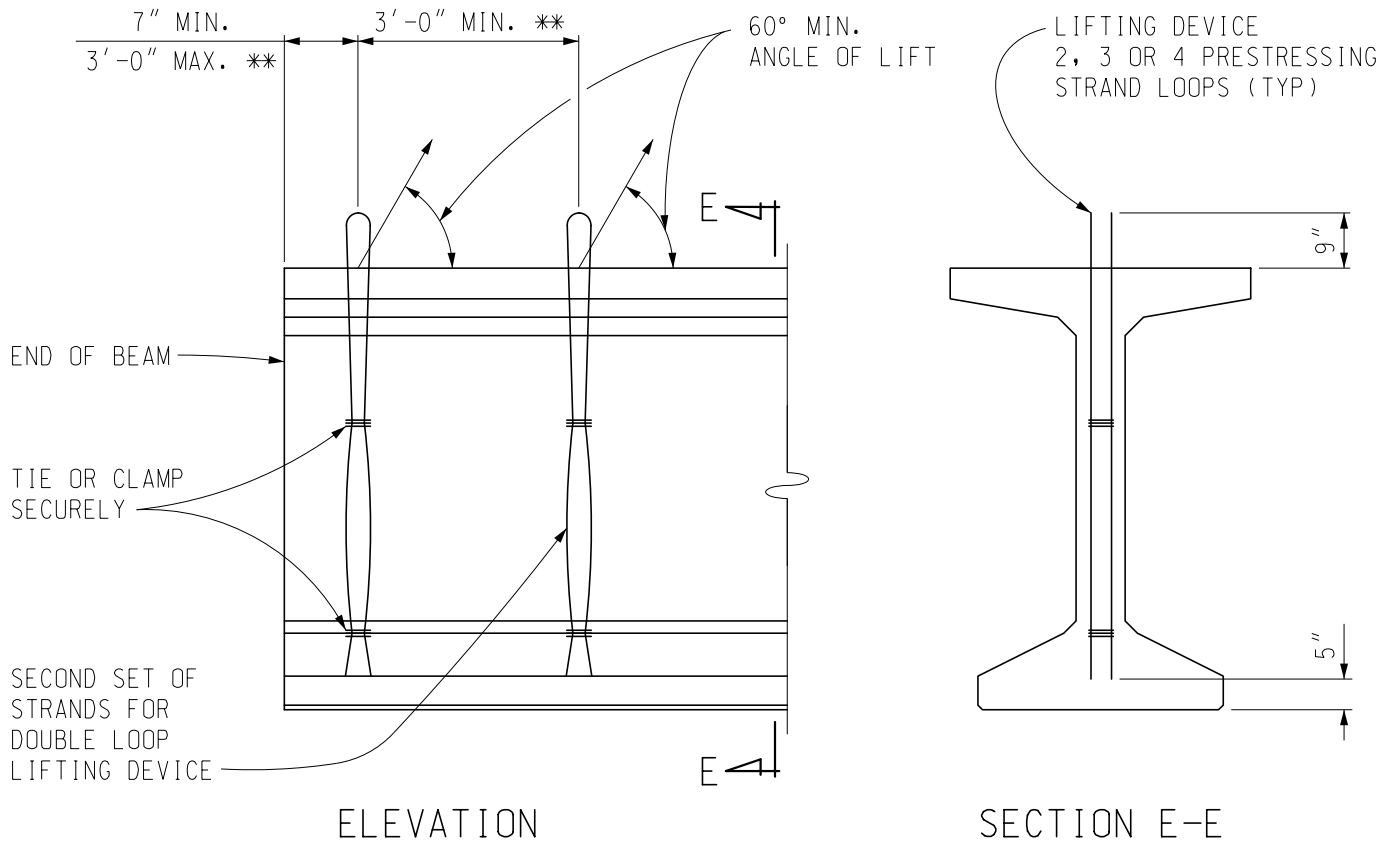
6.65.14A

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 CHECKED BY: VZ  
 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

PRESTRESSED CONCRETE BEAM  
 LIFTING DEVICE DETAILS

ISSUED: 11/28/22  
 SUPERSEDES: 04/17/17



DETAILS FOR BULB TEE BEAMS

BEAM DEPTH (INCHES)	NUMBER OF STRANDS AND SIZE					
	3 - 1/2"	3 - 0.6"	4 - 1/2"	4 - 0.6"	6 - 1/2" *	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.

\*\* INCREASE AS REQUIRED TO MAKE BEAM LATERALLY STABLE DURING HANDLING.

PLAN NOTE:

LIFTING DEVICES SHALL BE REMOVED. 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 HIGHWAY TECHNICAL SERVICES

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 <sup>2</sup> )
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

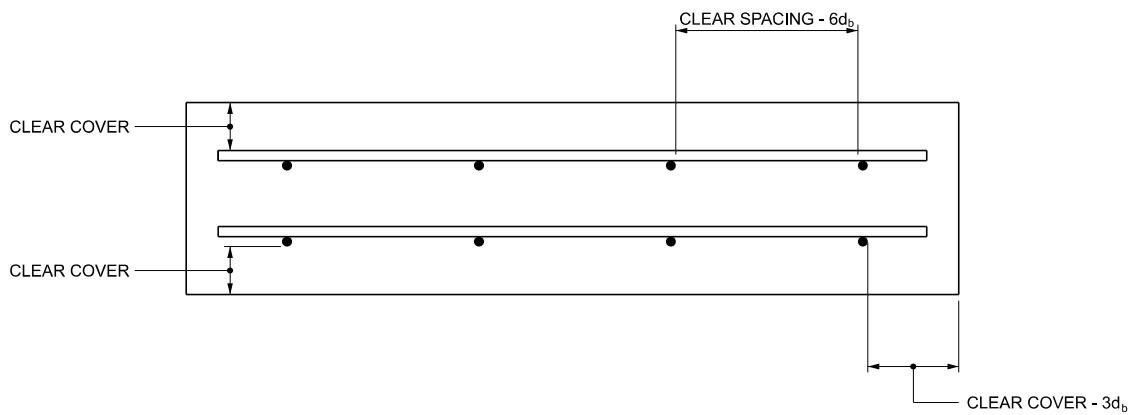
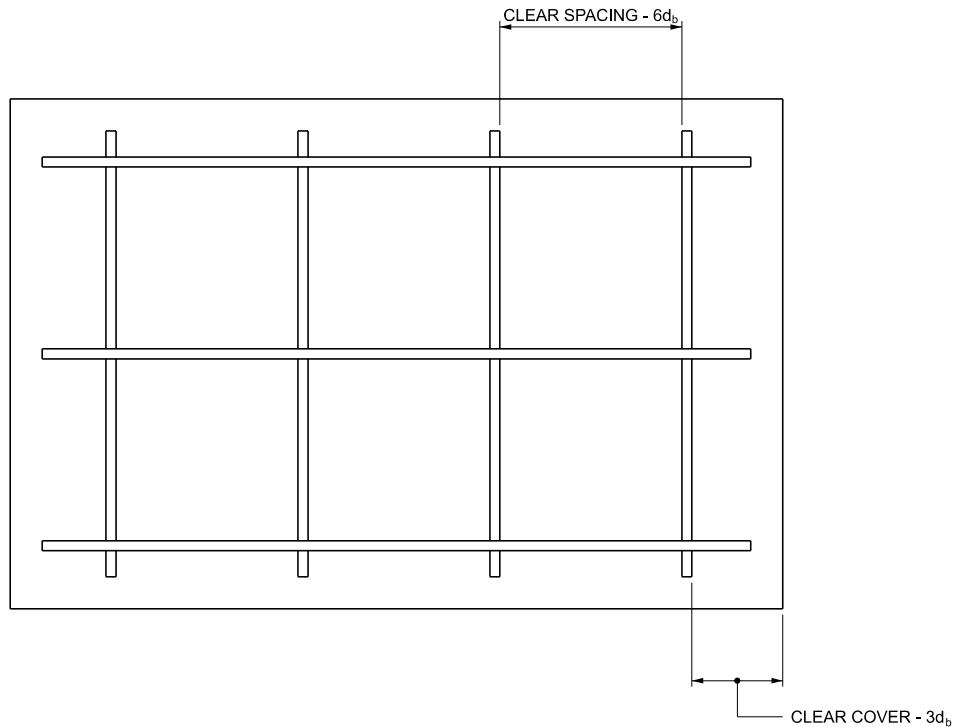
PREPARED BY  
DESIGN DIV.

7.11.01

DRAWN BY: BLT  
CHECKED BY: VZ  
APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT  
TENSION DEVELOPMENT AND LAP SPLICE LENGTHS  
SPACING THRESHOLDS

ISSUED: 12/26/23  
SUPERSEDES:



$d_b$  = DIAMETER OF REINFORCING BAR

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

PREPARED BY  
DESIGN DIVISION

7.14.02

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: KCK

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 TENSION DEVELOPMENT AND LAP SPLICE LENGTHS FOR  
 SUBSTRUCTURE

ISSUED: 12/26/23  
 SUPERSEDES: 11/27/01

EPOXY COATED REINFORCEMENT

$F'_c = 3.0$  ksi  
 $F_y = 60.0$  ksi

BAR SIZE	SPACING THRESHOLD *		BASIC DEVELOPMENT LENGTH (in) **	TENSION DEVELOPMENT LENGTH			
	3d <sub>b</sub> (in)	6d <sub>b</sub> (in)		≤ 12" OF CONCRETE BELOW		> 12" OF CONCRETE BELOW	
				CLEAR COVER ≥ 3d <sub>b</sub> & CLEAR SPACING ≥ 6b <sub>d</sub> (in)	ALL OTHER CASES (in)	CLEAR COVER ≥ 3d <sub>b</sub> & CLEAR SPACING ≥ 6b <sub>d</sub> (in)	ALL OTHER CASES (in)
3	1 1/8	2 1/4	32	16	20	20	22
4	1 1/2	3	42	21	26	27	29
5	1 7/8	3 3/4	52	25	32	33	36
6	2 1/4	4 1/2	63	31	38	40	43
7	2 5/8	5 1/4	73	36	44	46	50
8	3	6	84	41	51	53	58
9	3 3/8	6 3/4	94	46	57	59	64
10	3 3/4	7 1/2	104	50	63	65	71
11	4 1/8	8 1/4	115	56	69	72	79

BAR SIZE	SPACING THRESHOLD *		TENSION LAP LENGTH			
	3d <sub>b</sub> (in)	6d <sub>b</sub> (in)	≤ 12" OF CONCRETE BELOW		> 12" OF CONCRETE BELOW	
			CLEAR COVER ≥ 3d <sub>b</sub> & CLEAR SPACING ≥ 6b <sub>d</sub> (in)	ALL OTHER CASES (in)	CLEAR COVER ≥ 3d <sub>b</sub> & CLEAR SPACING ≥ 6b <sub>d</sub> (in)	ALL OTHER CASES (in)
3	1 1/8	2 1/4	20	26	26	29
4	1 1/2	3	27	33	35	38
5	1 7/8	3 3/4	33	41	43	46
6	2 1/4	4 1/2	40	50	52	56
7	2 5/8	5 1/4	46	57	60	65
8	3	6	53	66	69	75
9	3 3/8	6 3/4	59	74	77	84
10	3 3/4	7 1/2	65	82	85	92
11	4 1/8	8 1/4	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 ( $\lambda_{ef} = 1.0$ ).

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

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.

PREPARED BY  
 DESIGN DIVISION

7.14.02A

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 *		BASIC DEVELOPMENT LENGTH (in) **	TENSION DEVELOPMENT LENGTH			
	3d <sub>b</sub> (in)	6d <sub>b</sub> (in)		≤ 12" OF CONCRETE BELOW		> 12" OF CONCRETE BELOW	
				CLEAR COVER ≥ 3d <sub>b</sub> & CLEAR SPACING ≥ 6b <sub>d</sub> (in)	ALL OTHER CASES (in)	CLEAR COVER ≥ 3d <sub>b</sub> & CLEAR SPACING ≥ 6b <sub>d</sub> (in)	ALL OTHER CASES (in)
3	1 1/8	2 1/4	27	13	17	17	19
4	1 1/2	3	36	18	22	23	25
5	1 7/8	3 3/4	45	22	27	29	31
6	2 1/4	4 1/2	54	26	33	34	37
7	2 5/8	5 1/4	63	31	38	40	43
8	3	6	72	35	44	45	49
9	3 3/8	6 3/4	81	39	49	51	56
10	3 3/4	7 1/2	90	46	57	59	65
11	4 1/8	8 1/4	99	55	69	72	78

BAR SIZE	SPACING THRESHOLD *		TENSION LAP LENGTH			
	3d <sub>b</sub> (in)	6d <sub>b</sub> (in)	≤ 12" OF CONCRETE BELOW		> 12" OF CONCRETE BELOW	
			CLEAR COVER ≥ 3d <sub>b</sub> & CLEAR SPACING ≥ 6b <sub>d</sub> (in)	ALL OTHER CASES (in)	CLEAR COVER ≥ 3d <sub>b</sub> & CLEAR SPACING ≥ 6b <sub>d</sub> (in)	ALL OTHER CASES (in)
3	1 1/8	2 1/4	17	22	22	24
4	1 1/2	3	23	29	30	32
5	1 7/8	3 3/4	29	36	37	40
6	2 1/4	4 1/2	34	43	44	48
7	2 5/8	5 1/4	40	50	52	56
8	3	6	45	57	59	64
9	3 3/8	6 3/4	51	64	66	72
10	3 3/4	7 1/2	59	74	77	84
11	4 1/8	8 1/4	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.

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

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.

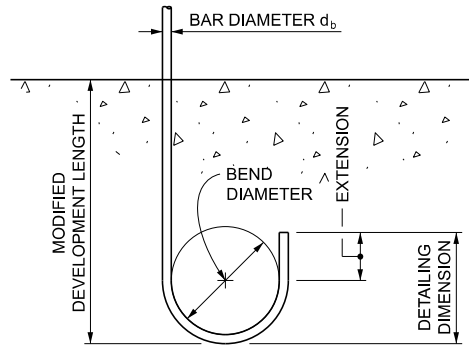
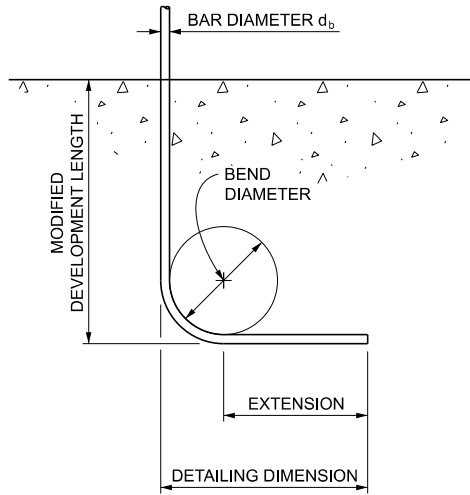
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7.14.02B

DRAWN BY: BLT  
 CHECKED BY: VZ  
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 MINIMUM DIMENSIONS FOR STANDARD HOOKS IN TENSION

ISSUED: 12/26/23  
 SUPERSEDES: 11/27/01



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 $\geq 2\frac{1}{2}"$			CLEAR SIDE COVER $\leq 2\frac{1}{2}"$		
	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 ( $\lambda_{gr} = 1.0$ ).

PREPARED BY  
 DESIGN DIVISION

7.14.03

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APPROVED BY:

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF DEVELOPMENT

ISSUED:

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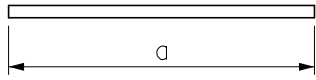
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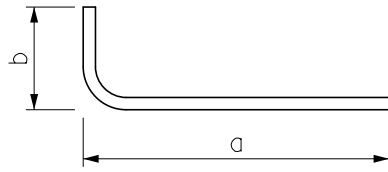
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

ISSUED: 09/28/20  
 SUPERSEDES: 09/22/14

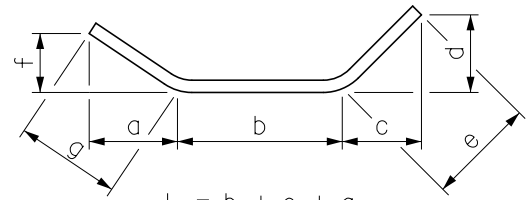
STANDARD REINFORCING BAR TYPES



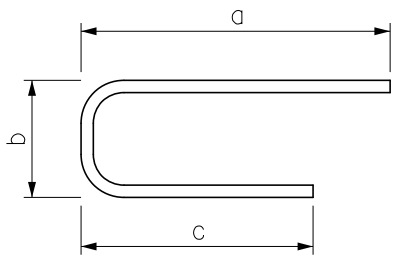
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 (A)



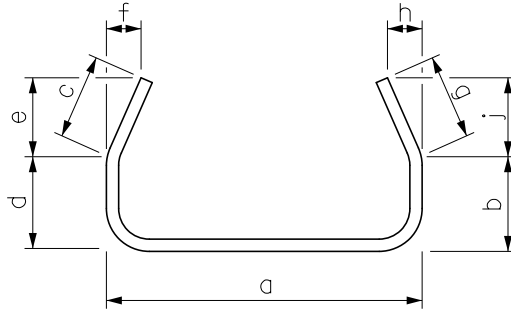
$L = a + b$   
 (B)



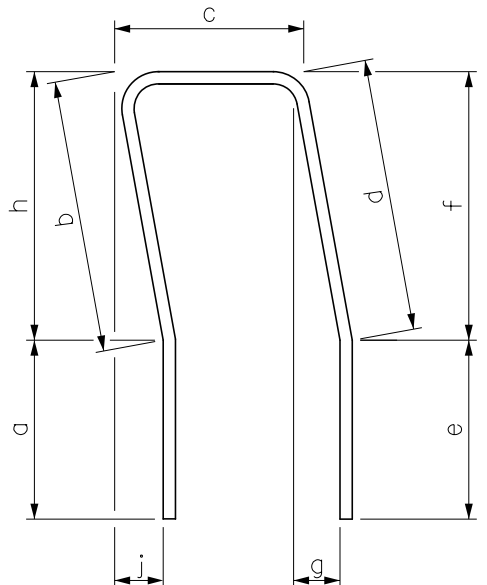
$L = b + e + g$   
 (C)



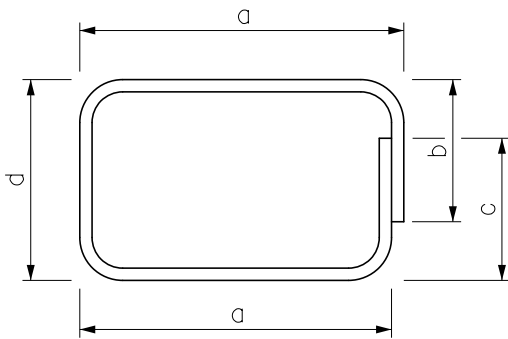
$L = a + b + c$   
 (D)



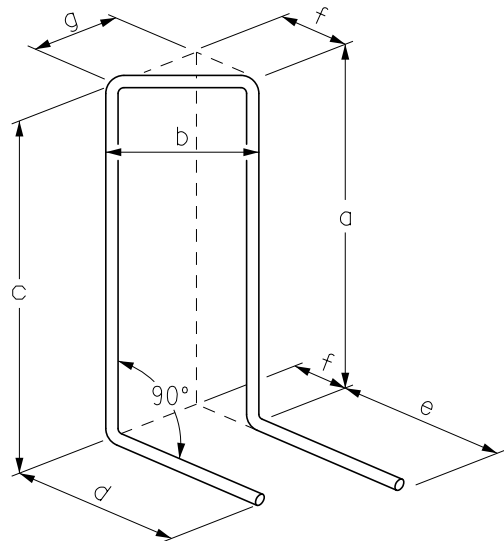
$L = a + b + c + d + g$   
 (E)



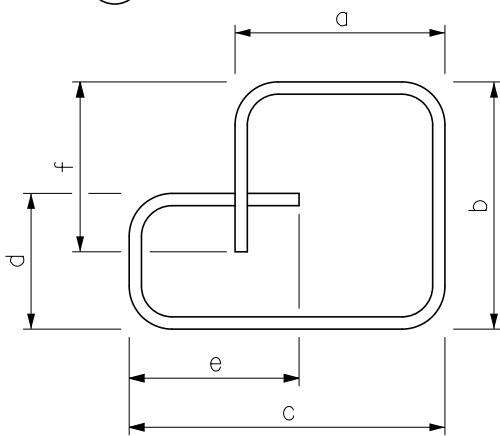
$L = a + b + c + d + e$   
 (F)



$L = 2a + b + c + d$   
 (G)



$L = a + b + c + d + e$   
 (H)



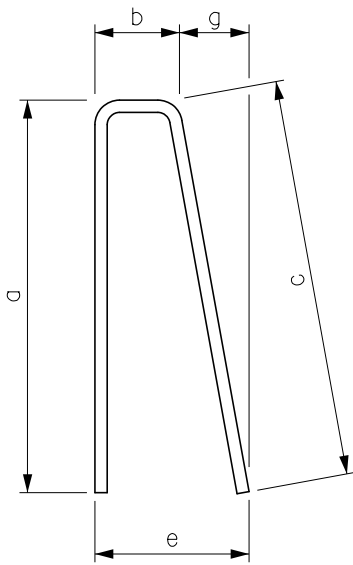
$L = a + b + c + d + e + f$   
 (I)

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 APPROVED BY: BMW

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

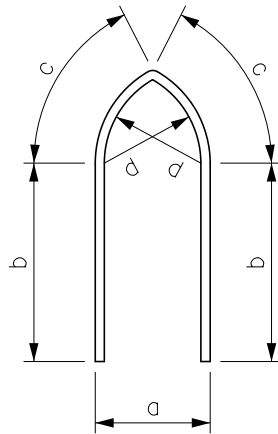
ISSUED: 09/28/20  
 SUPERSEDES: 11/26/18

STANDARD REINFORCING BAR TYPES



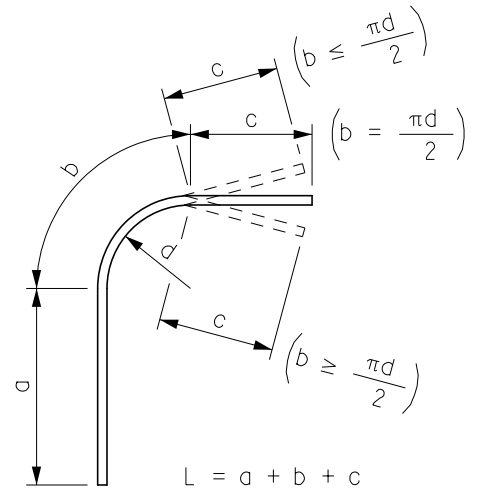
$L = a + b + c$

(P)



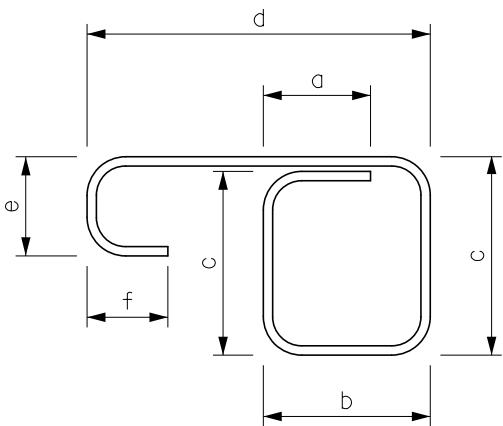
$L = 2b + 2c$

(R)



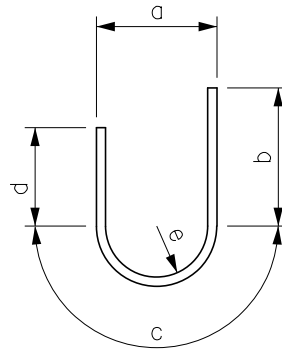
$L = a + b + c$

(S)



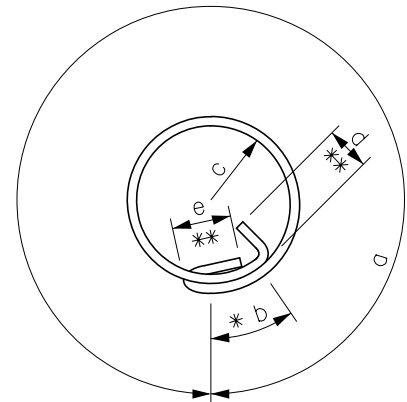
$L = a + b + 2c + d + e + f$

(T)



$L = b + c + d$

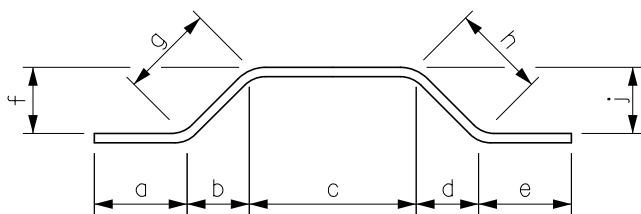
(U)



$L = a + b + d + e$

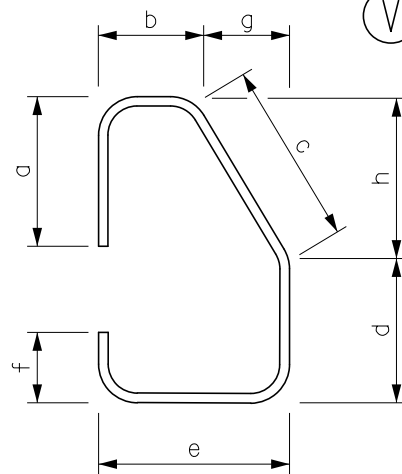
\* b = 6" MIN. OR REQUIRED LAP LENGTH  
 \*\* USE EITHER 180° OR 135° HOOKS AS REQUIRED

(V)



$L = a + c + e + g + h$

(W)



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

(Z)



# 8. STRUCTURAL STEEL

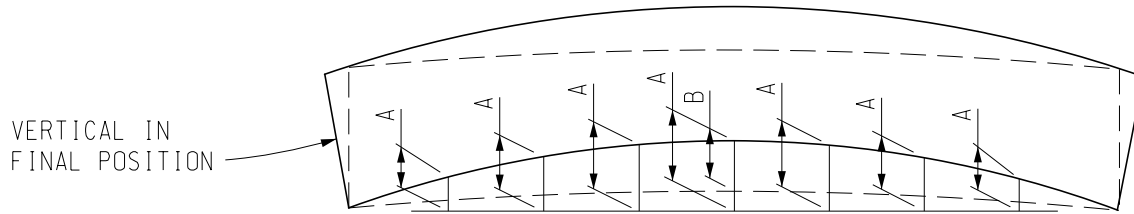


DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: DAJ

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

WELDED GIRDER, CAMBER DIAGRAM  
 AND STIFFENER DETAILS

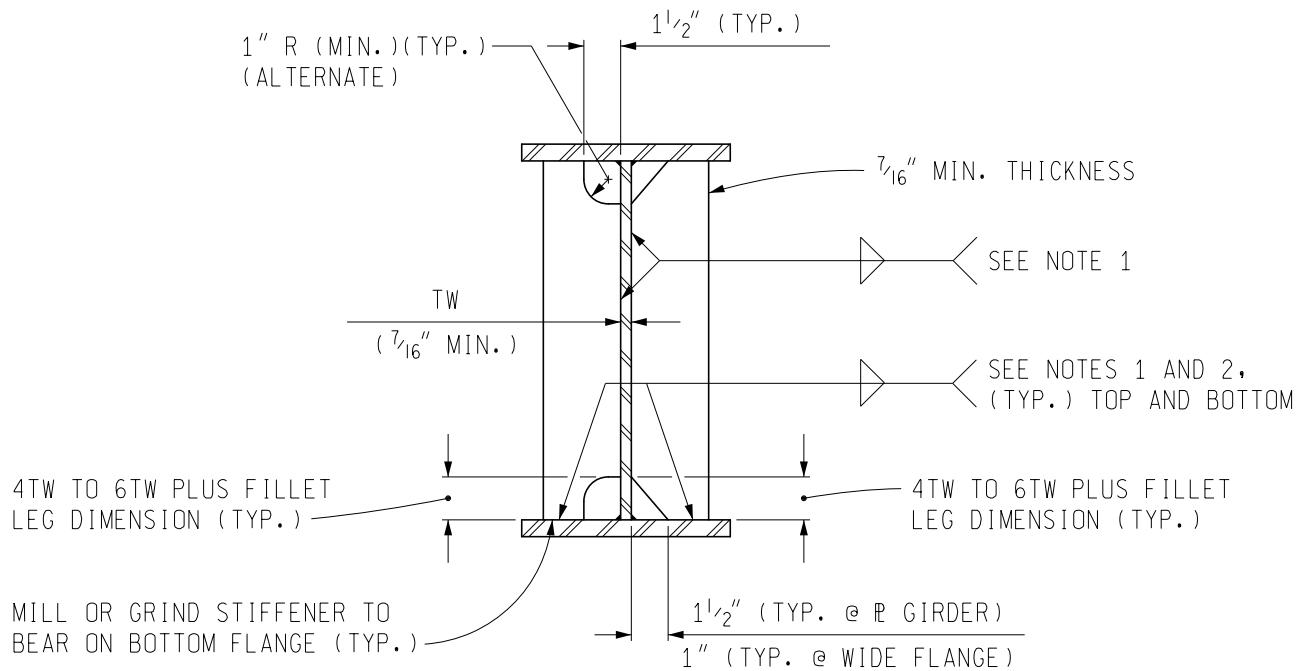
ISSUED: 02/16/16  
 SUPERSEDES: 05/04/06



### 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 R GIRDER DUE TO ITS OWN WEIGHT, CENTER ONLY.



### BEARING STIFFENERS

NOTE 1: STOP WELD  $\frac{1}{4}$ " 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.

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 DESIGN DIVISION

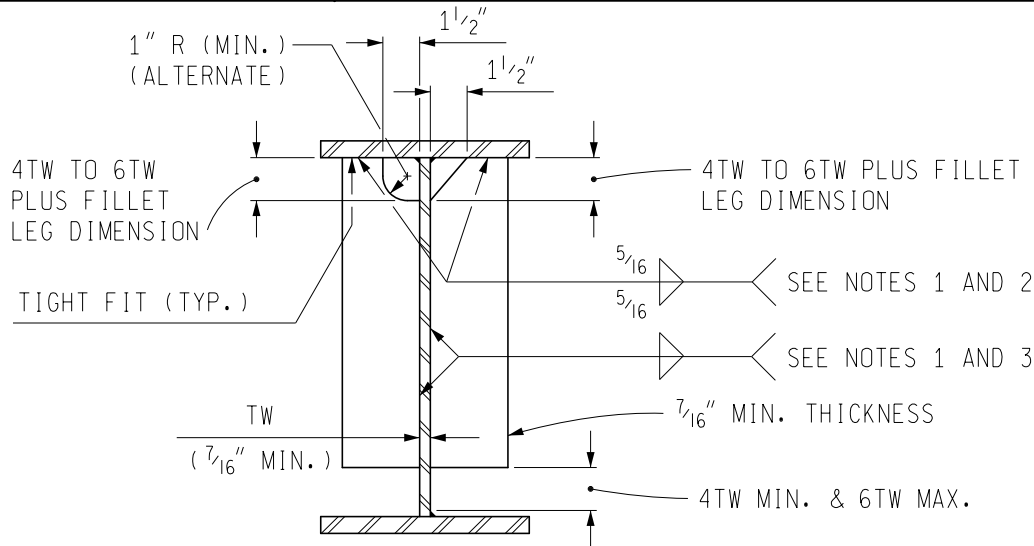
8.06.02

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 APPROVED BY: DAJ

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 BUREAU OF HIGHWAY DEVELOPMENT

ISSUED: 02/16/16  
 SUPERSEDES: 05/04/06

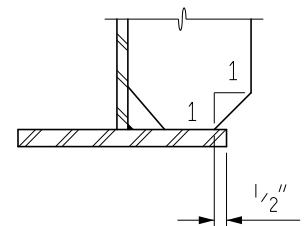
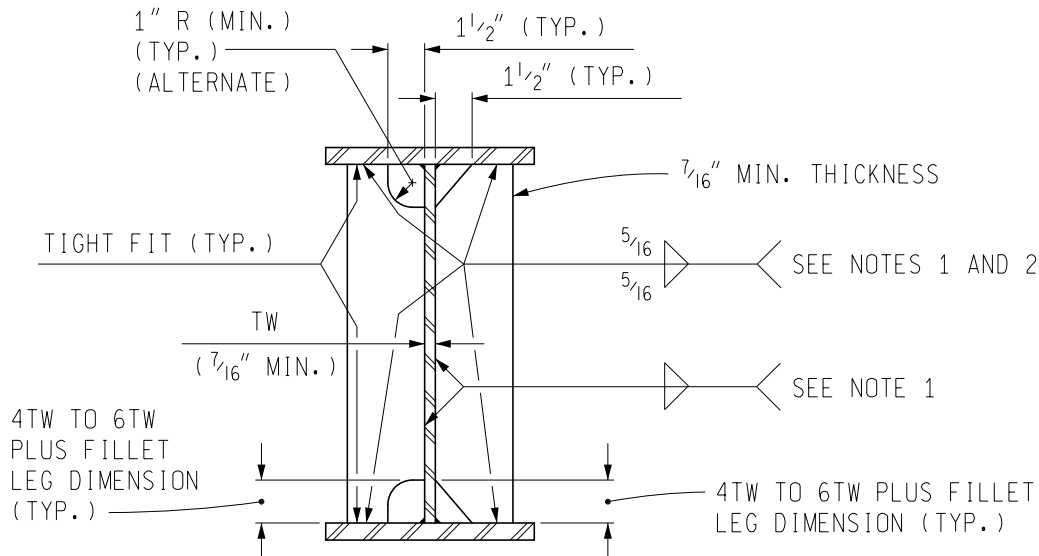
WELDED GIRDER AND  
 STIFFENER DETAILS



INTERMEDIATE TRANSVERSE STIFFENERS

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

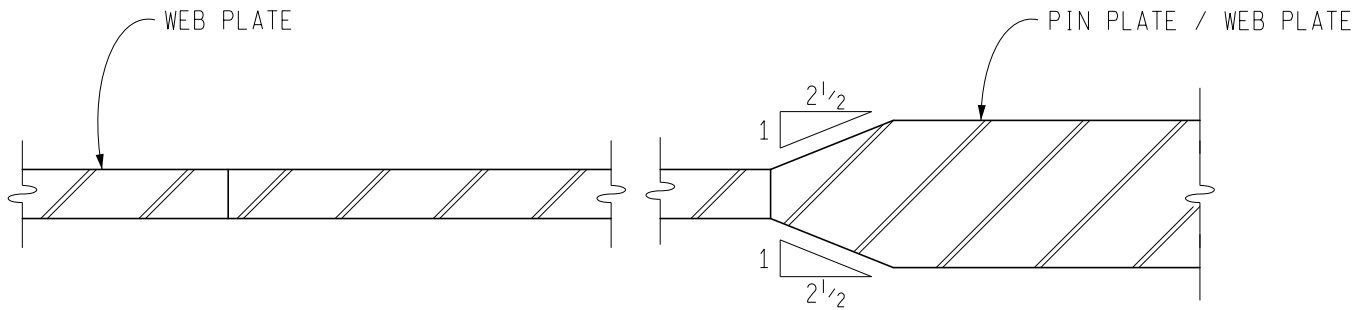
NOTES:  
 DESIGNER MUST INSURE THAT THE FATIGUE REQUIREMENTS OF AASHTO ARE MET.  
 USE DETAIL A IF CONNECTION PLATE STIFFENER EXTENDS BEYOND FLANGE.  
 EITHER BEVEL OR J COPE HOLES MUST BE USED ON A PARTICULAR PROJECT.

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CHECKED BY: VZ  
APPROVED BY: DAJ

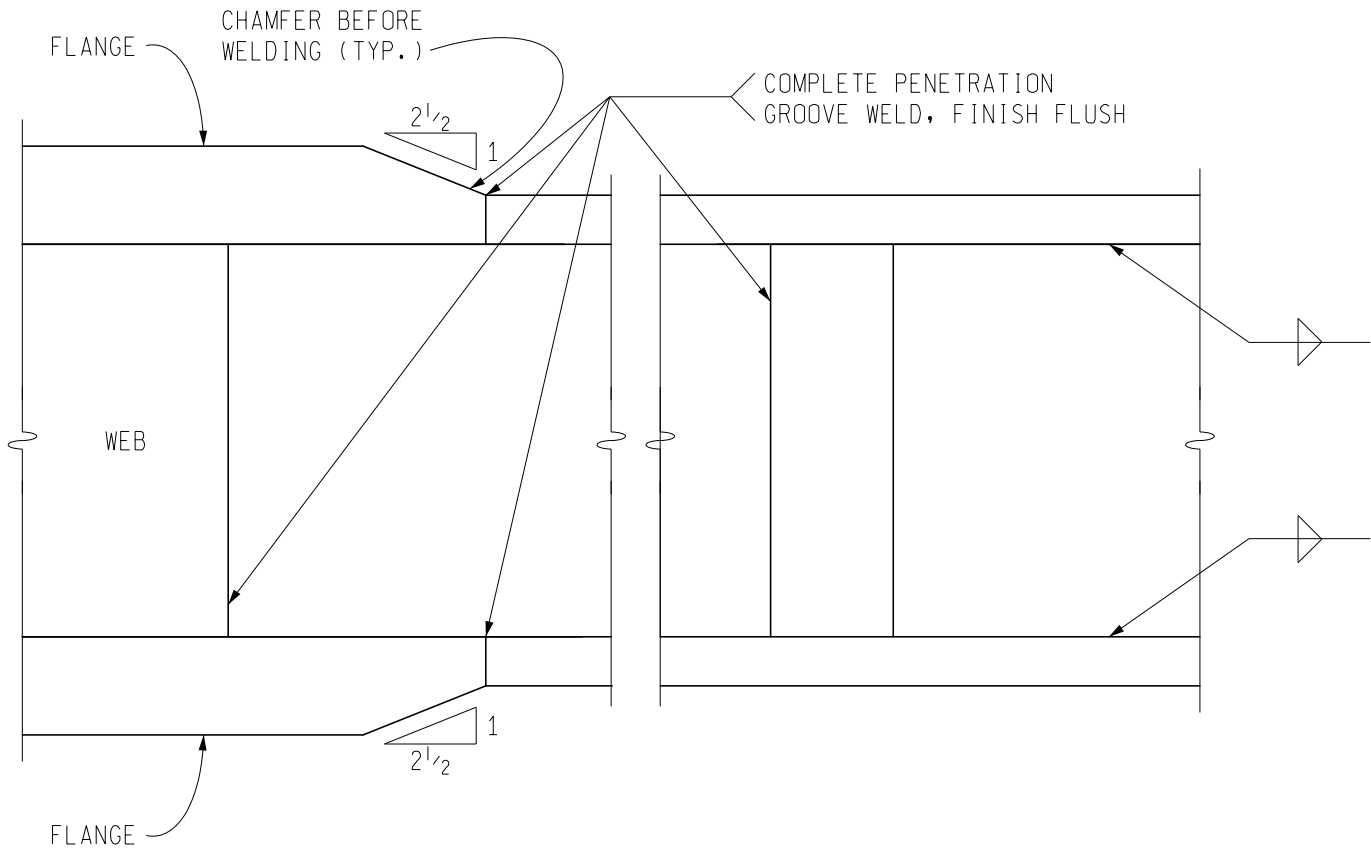
MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY DEVELOPMENT

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

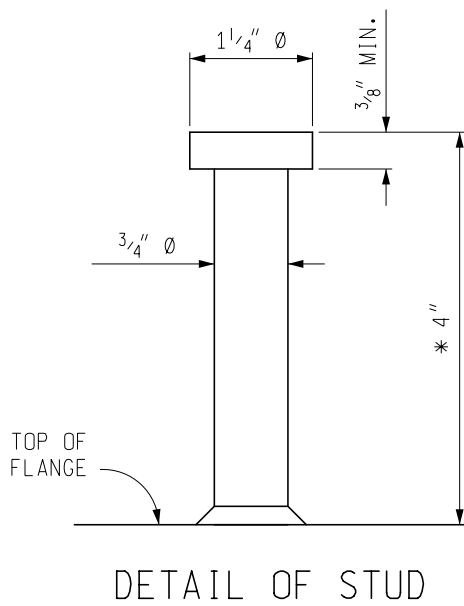
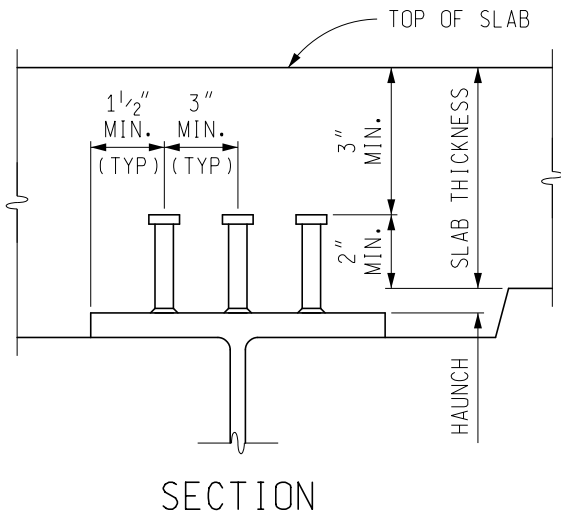
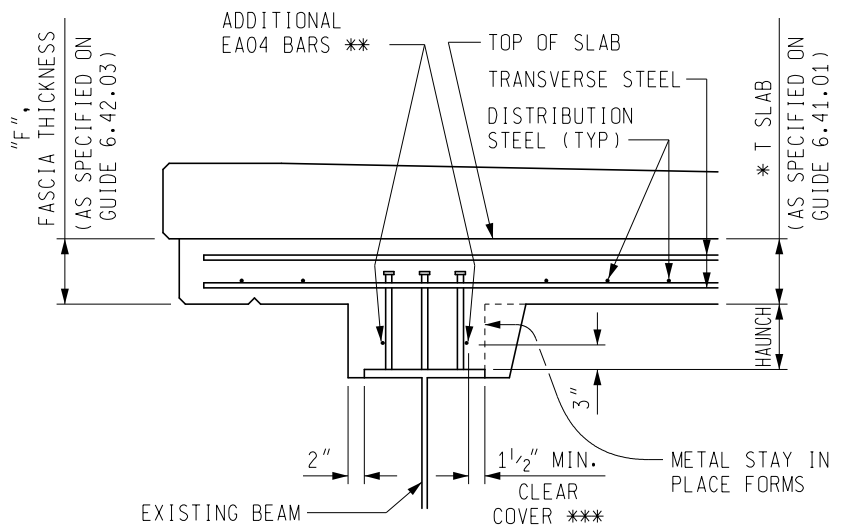
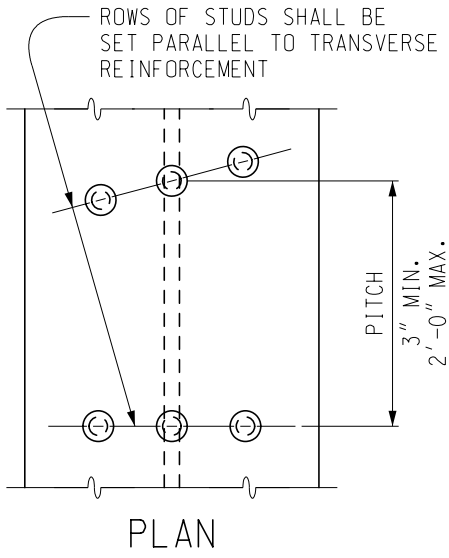
8.06.03

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

NOTES:

\* 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".

\*\* 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.

\*\*\* 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.

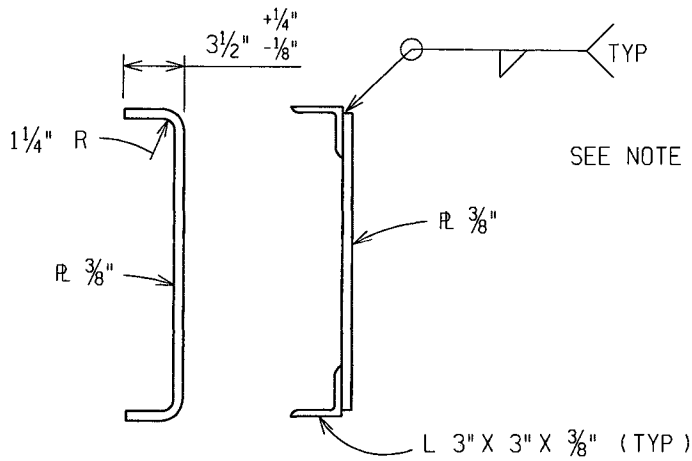
FOUR STUDS PER ROW MAY BE USED WHEN REQUIRED.

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

DRAWN BY: MJB  
 CHECKED BY: VZ  
 APPROVED BY: TGF

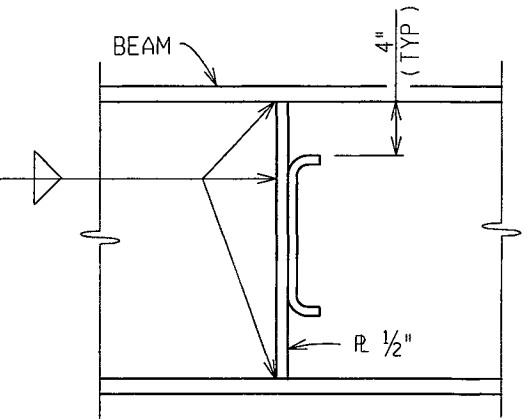
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES  
**DIAPHRAGM AND CONNECTION  
 PLATE DETAILS**

ISSUED: 11/27/01  
 SUPERSEDES: 04/15/95



ALTERNATE

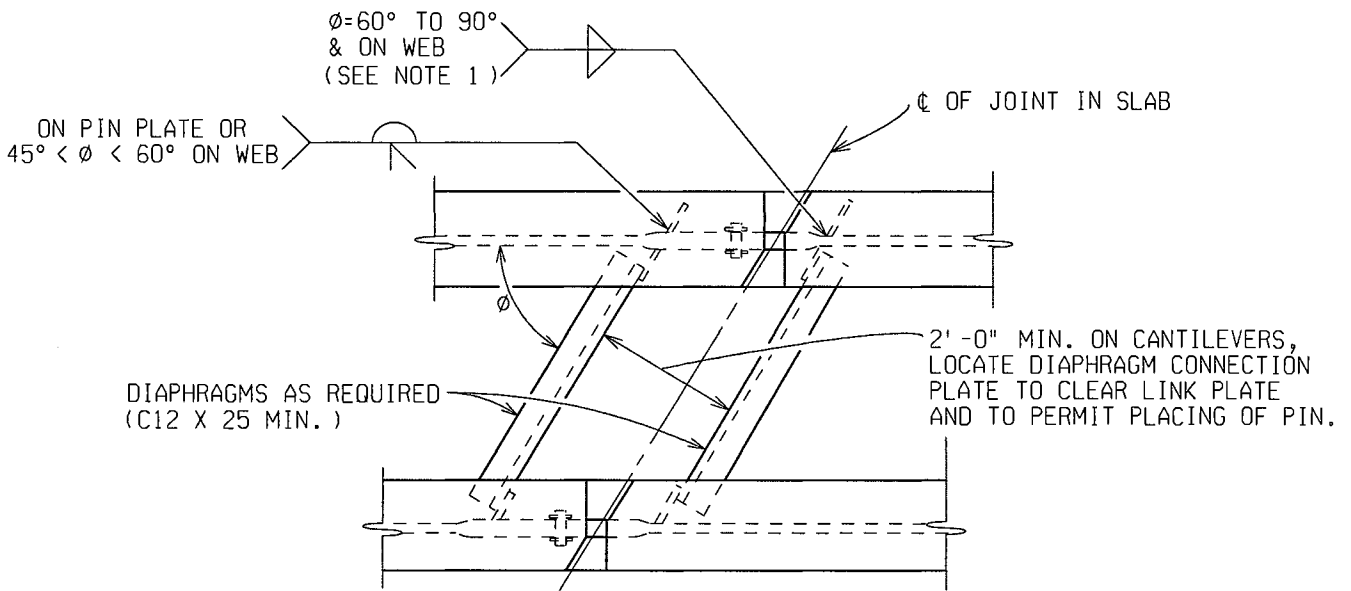
INTERMEDIATE DIAPHRAGM



WELDED DIAPHRAGM CONNECTION  
 PLATE DETAIL

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

INTERMEDIATE DIAPHRAGMS							
BEAM DEPTH	21"	24"	27"	30"	33"	36"	42"
DIAPH. DEPTH	10"	12"	16"	18"	22"	24"	30"



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.

PREPARED BY  
 DESIGN DIV.

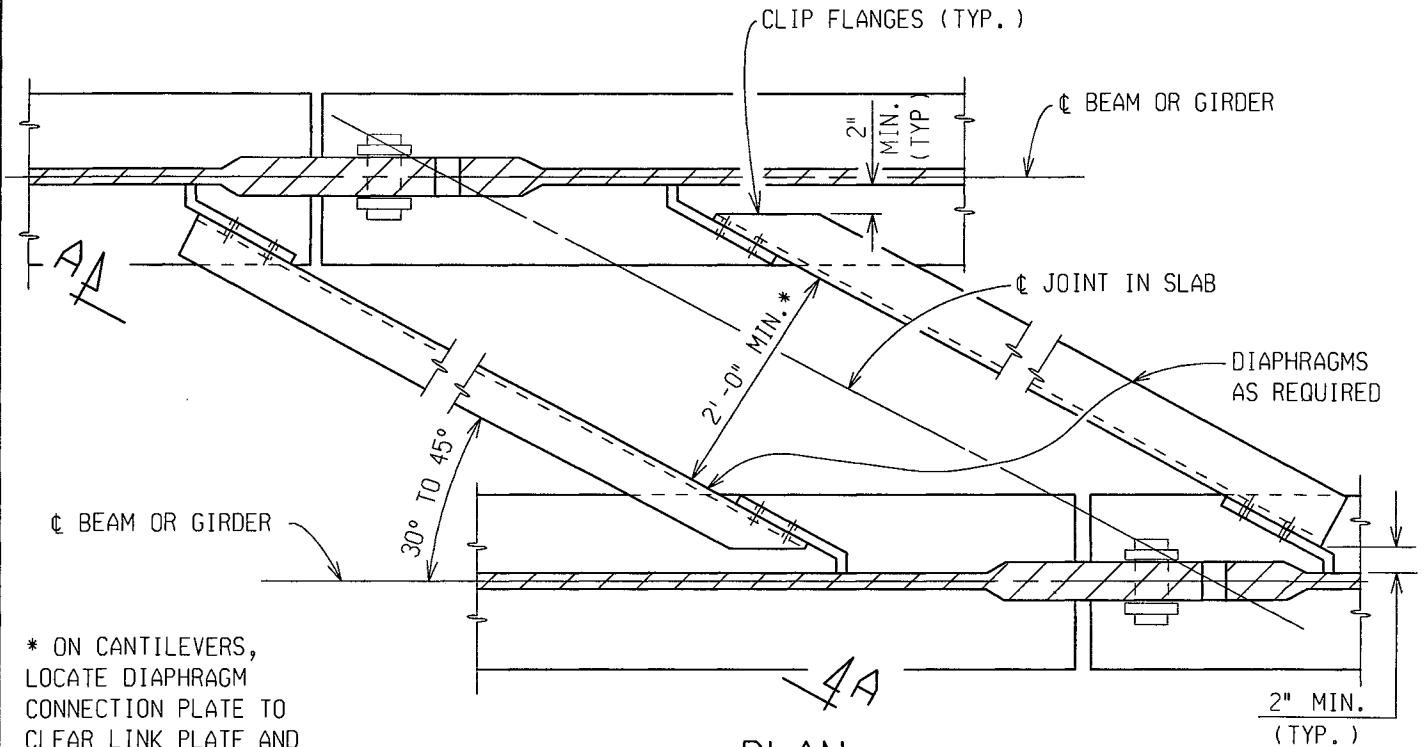
8.11.03

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 CHECKED BY: VZ  
 APPROVED BY: T&F

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES

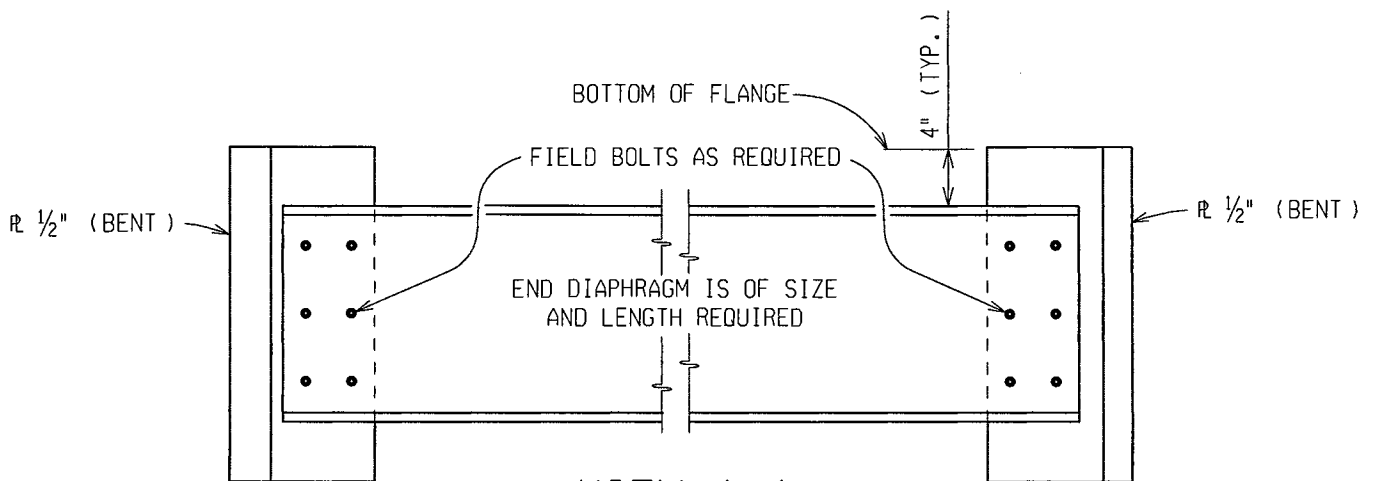
END DIAPHRAGM CONNECTION  
 DETAILS 30° TO 45°

ISSUED: 11/27/01  
 SUPERSEDES: 04/15/95



\* 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 DIV.

8.11.04

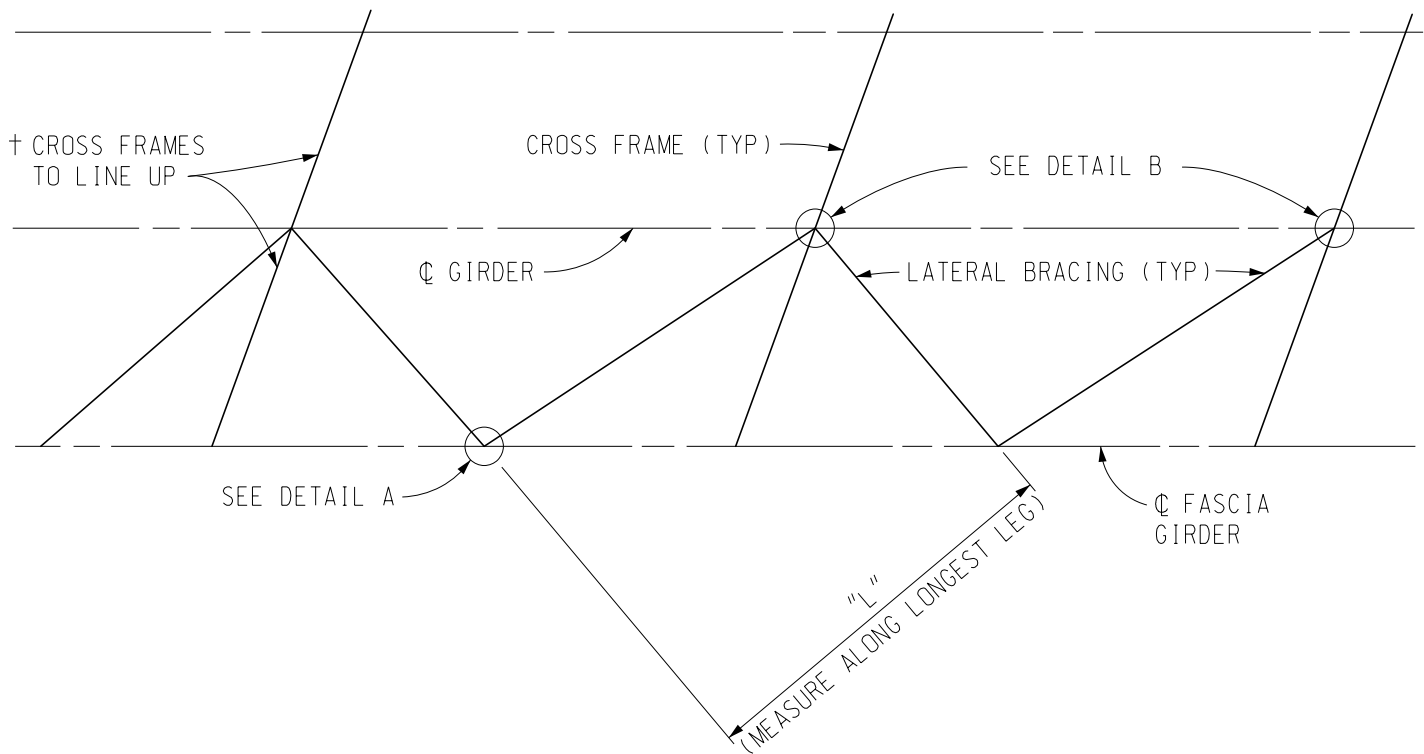


DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: DAJ

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

ISSUED: 06/19/17  
 SUPERSEDES: 11/27/01

LATERAL BRACING DETAILS



LATERAL BRACING TABLE

LATERAL BRACING LENGTH "L"	STRUCTURAL TEE SIZE	* BOLTS REQUIRED WEB CONNECTION	** 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:

\* NUMBER OF  $\frac{3}{4}$ "  $\emptyset$  ASTM F 3125 GRADE A 325 BOLTS REQUIRED TO BOLT ANGLE OR BENT PLATE TO GIRDER WEB.

\*\* NUMBER OF  $\frac{3}{4}$ "  $\emptyset$  ASTM F 3125 GRADE A 325 BOLTS REQUIRED TO BOLT TEE TO ANGLE OR BENT PLATE.

† 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 OR LRFD BRIDGE DESIGN SPECIFICATIONS. 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.

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 DESIGN DIVISION

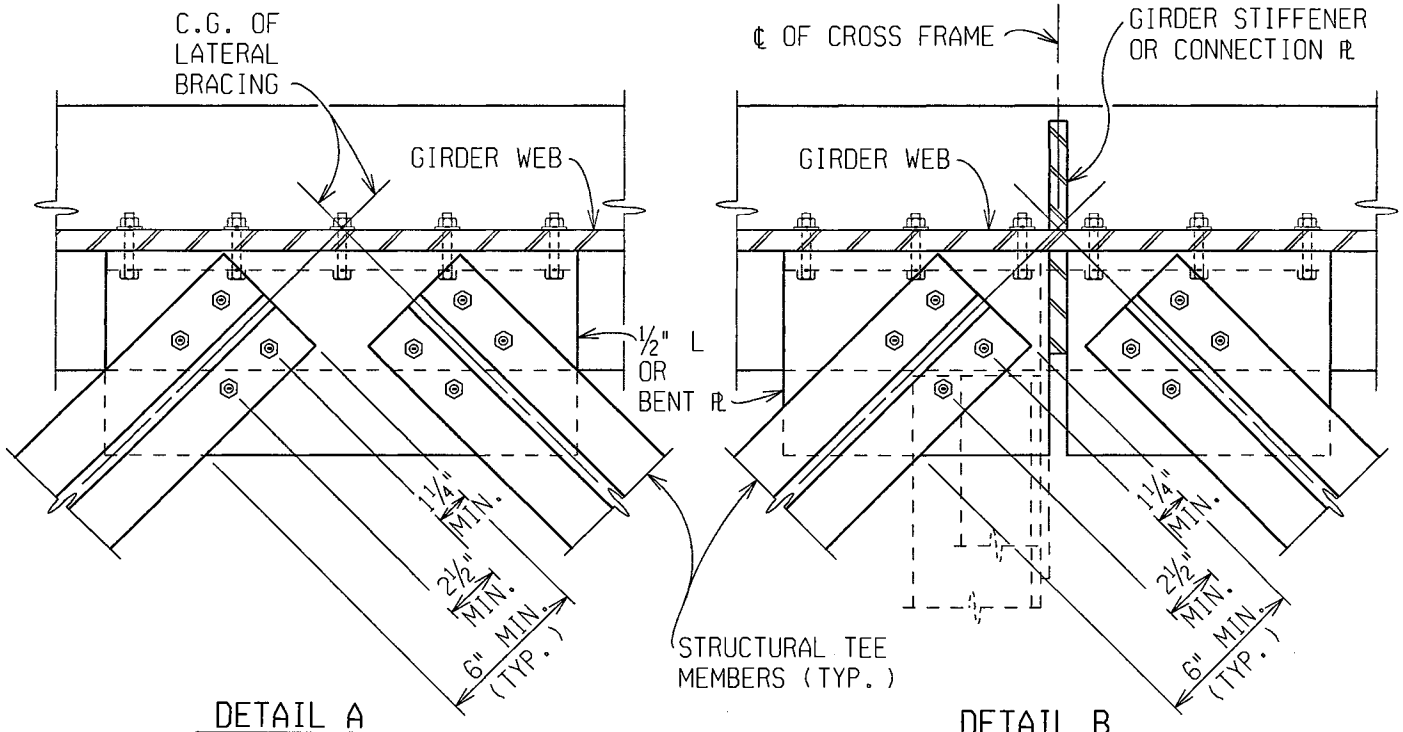
8.11.05

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 APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES

ISSUED: 11/27/01  
 SUPERSEDES: 04/15/95

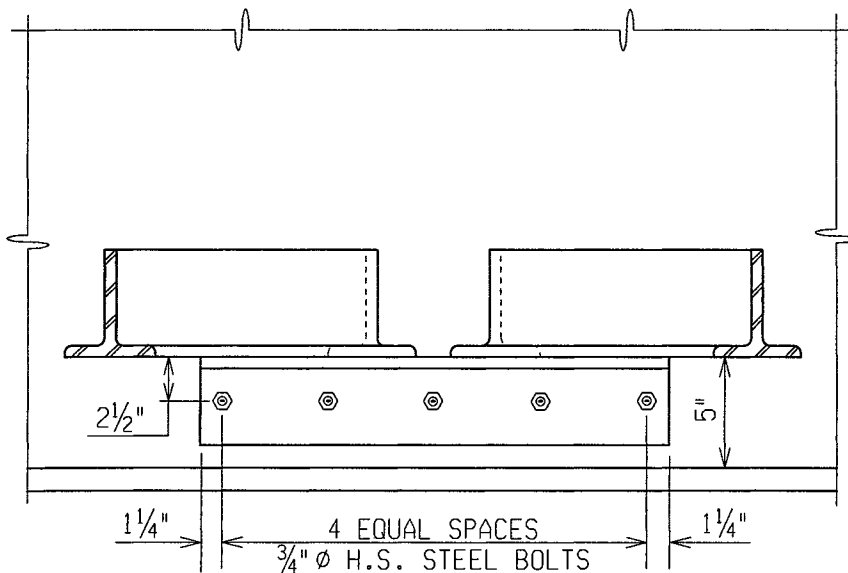
LATERAL BRACING DETAILS



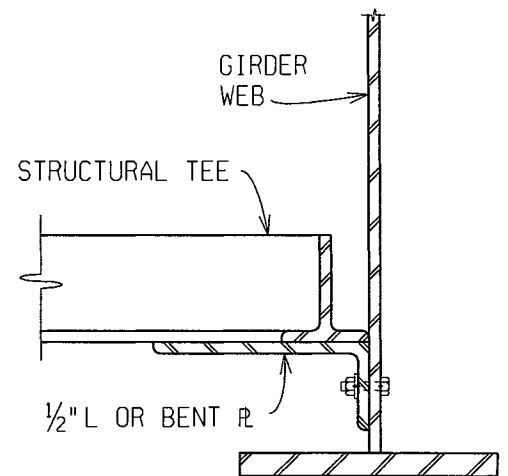
**DETAIL A**  
 (ROTATED 180°)  
 (FASCIA GIRDERS)

**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

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 DESIGN DIV.

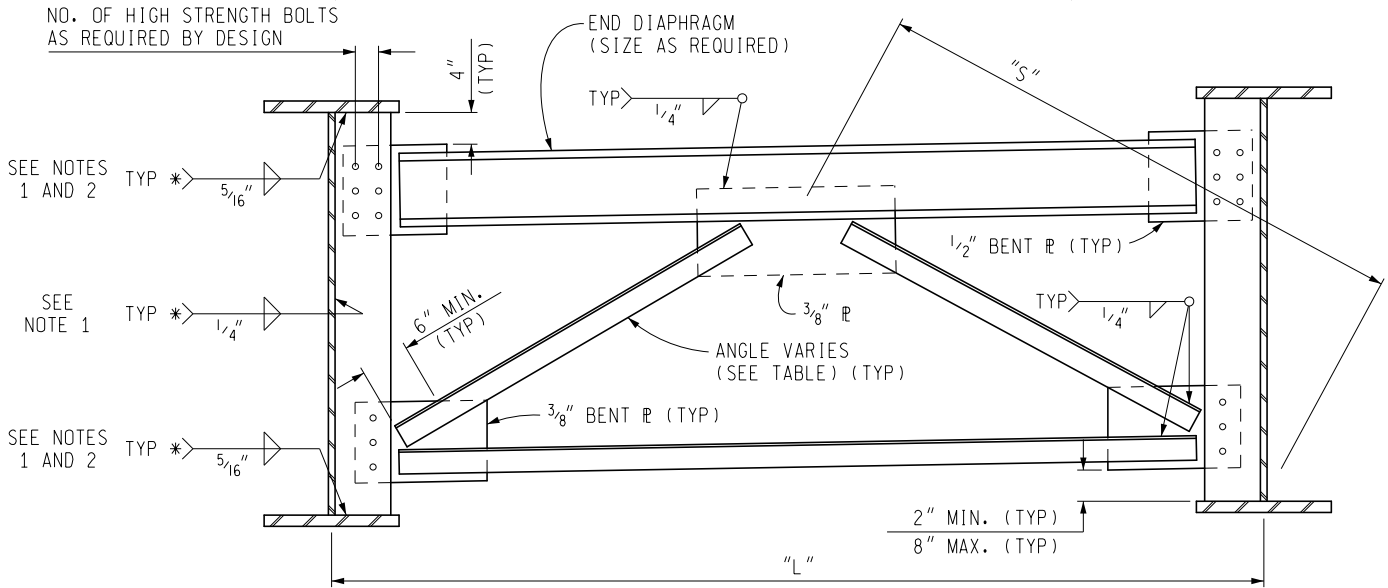
8.11.05A

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 CHECKED BY: VZ  
 APPROVED BY: DAJ

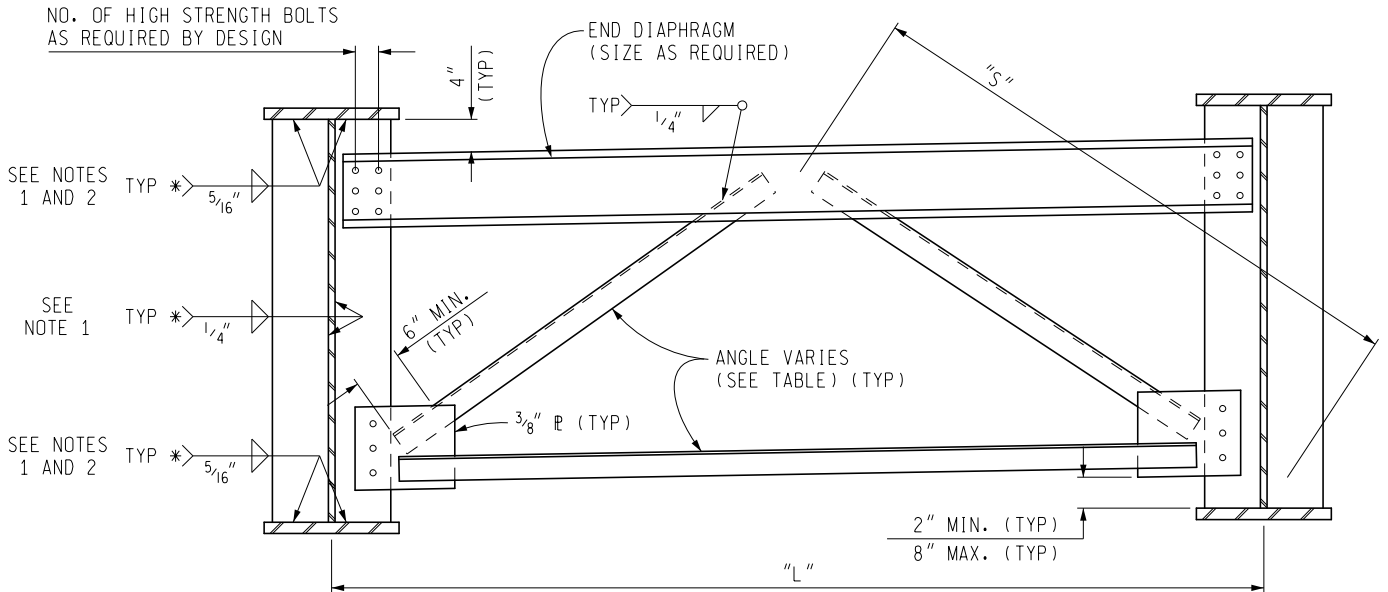
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

ISSUED: 11/27/17  
 SUPERSEDES: 06/25/12

END CROSS FRAMES



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

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.  
 \* 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 R DETAILS IF FATIGUE LIMITATIONS CONTROL.

STRAIGHT GIRDERS	
"L" OR "S"	MIN. 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"

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

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 CHECKED BY: VZ  
 APPROVED BY: DAJ

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT  
 INTERMEDIATE AND PIER CROSS FRAMES

ISSUED: 11/27/17  
 SUPERSEDES: 06/25/12

NOTES:

USE FULL DEPTH STIFFENERS OR 1/2" 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.

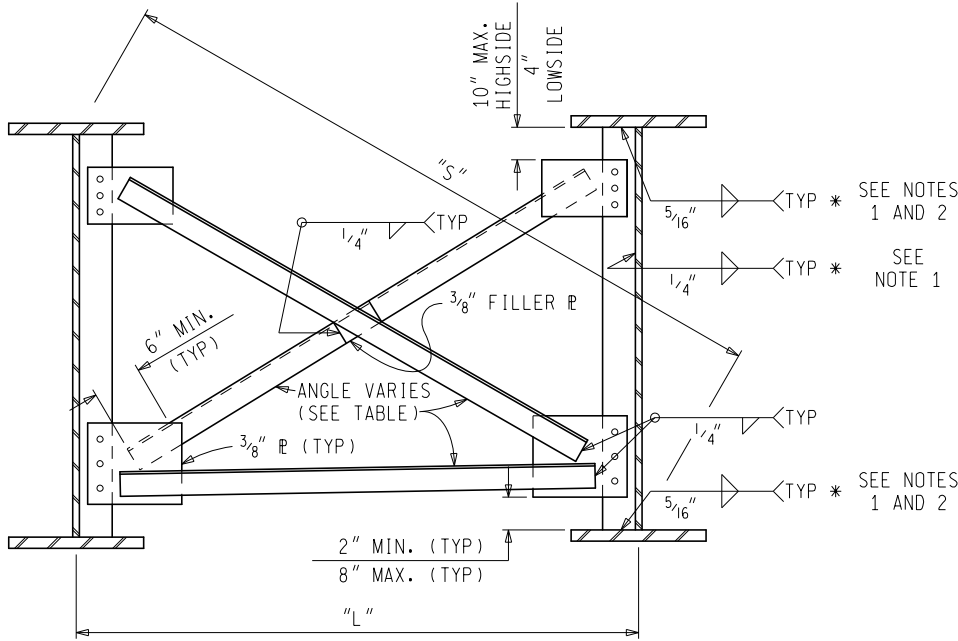
USE DETAIL A, GUIDE 8.06.02 IF CONNECTION PLATE EXTENDS BEYOND FLANGE. INTERMEDIATE CROSS FRAMES TO BE IN LINE.

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

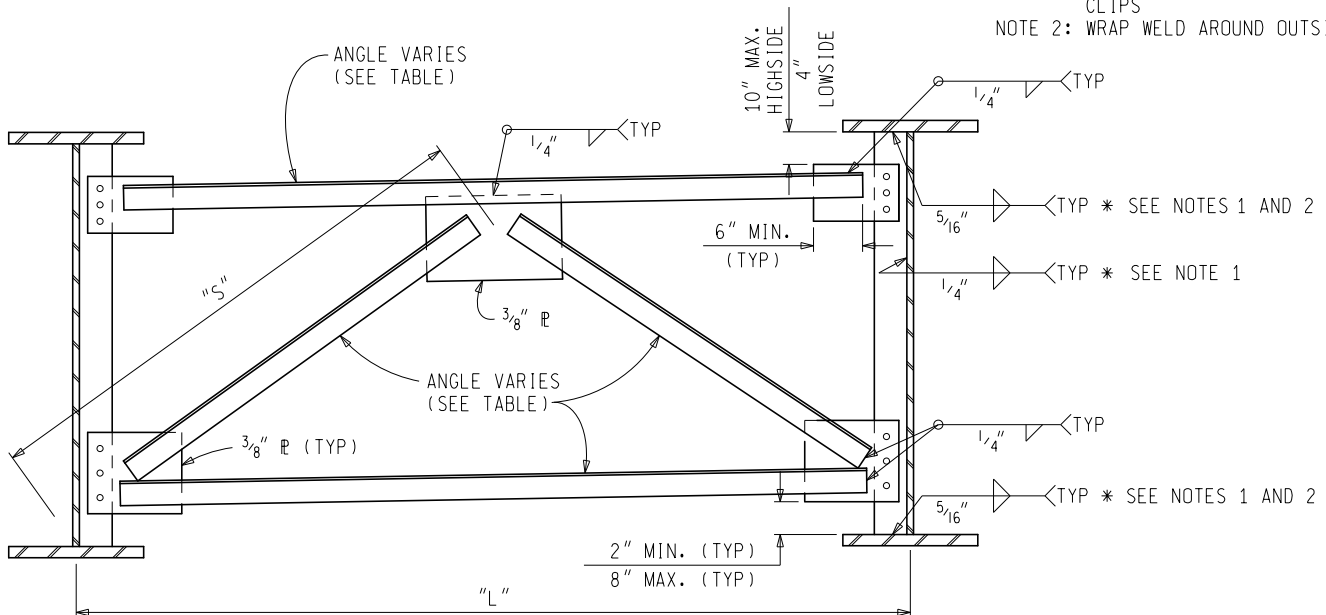
USE DIAPHRAGMS FOR WEB DEPTHS < 48". (30" DIAPHRAGM FOR 42" WEB DEPTH.) SEE GUIDE 8.11.03 FOR DETAILS.

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



PIER AND INTERMEDIATE CROSS FRAMES



PIER CROSS FRAMES  
 BEAM SPACING > 12'-6"

STRAIGHT GIRDERS	
"L" OR "S"	MIN. 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"

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 DESIGN DIVISION

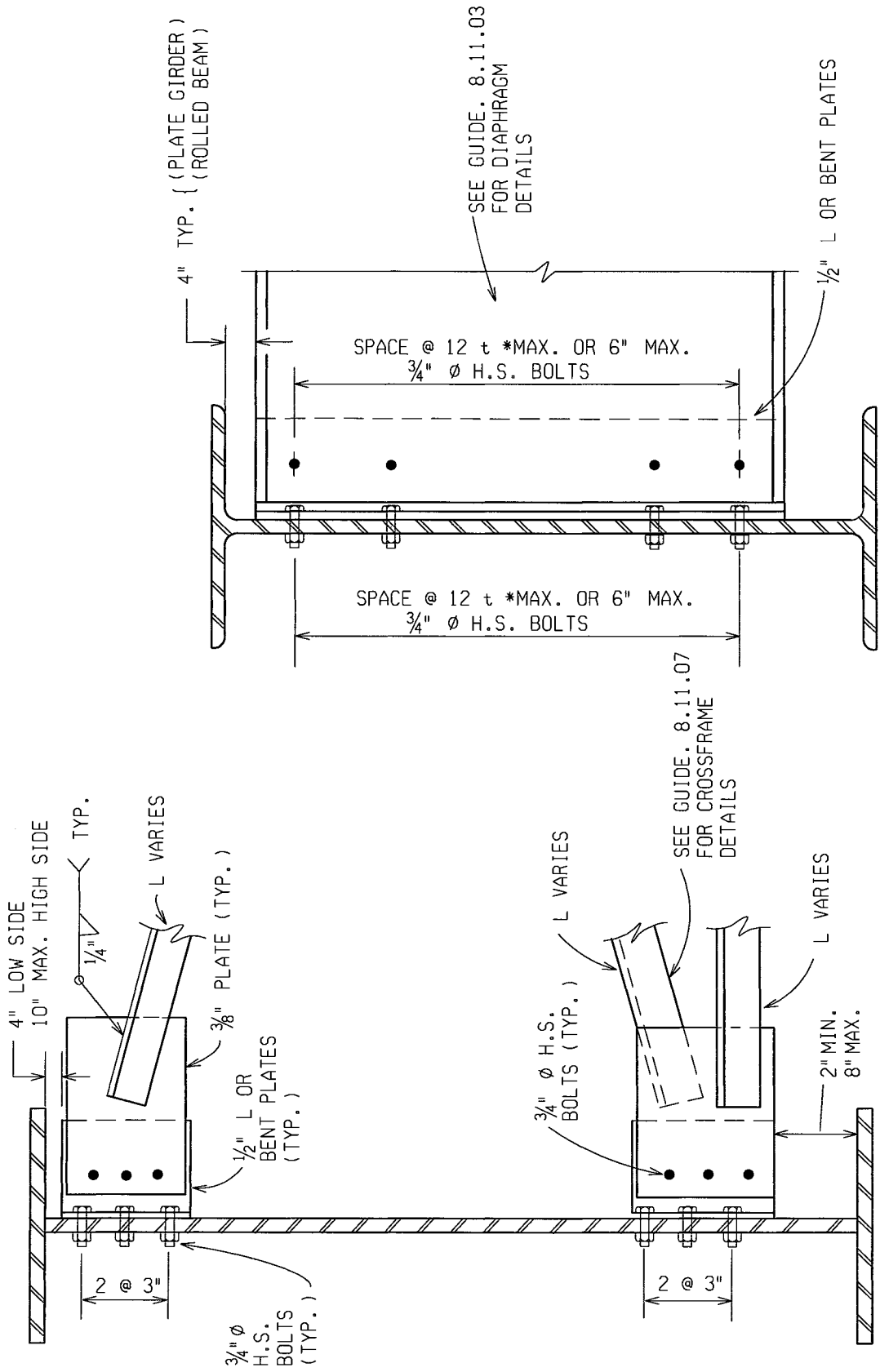
8.11.07

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 CHECKED BY: VZ  
 APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

**BOLTED CONNECTIONS FOR INTERMEDIATE  
 DIAPHRAGMS AND CROSSFRAMES**

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



INTERMEDIATE DIAPHRAGM

INTERMEDIATE CROSSFRAME

\*t= THICKNESS OF THINNER PART JOINED.

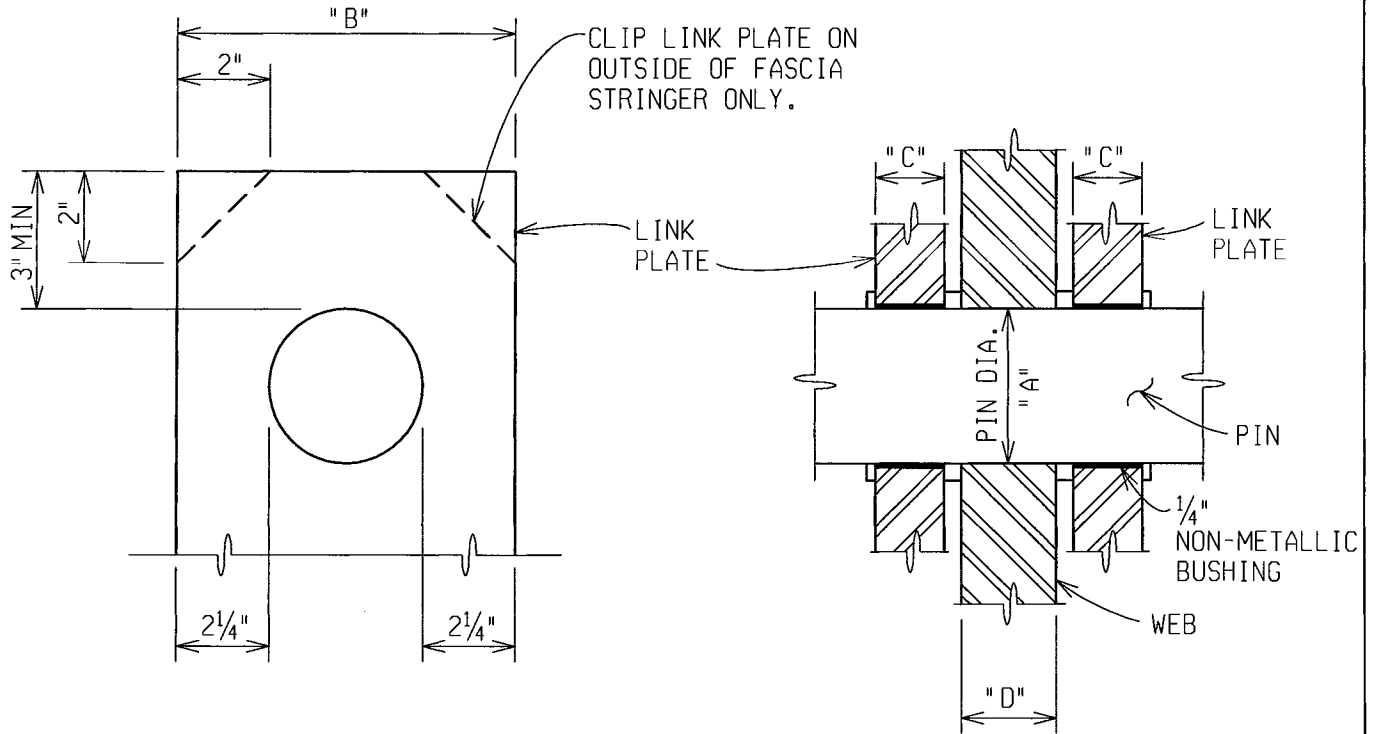
TO BE USED ON SHORT ANCHOR SPANS OR TRANSVERSELY UNSTIFFENED CONTINUOUS SPANS WHERE  
 FATIGUE LIMITATIONS DO NOT PERMIT A WELDED CONNECTION.

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

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

BEAM OR GIRDER  
 SUSPENDER DESIGN TABLE

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



REACTION "KIPS"	PIN DIA. "A"	LINK PLATE		WEB "D"
		"B"	"C"	
80	4"	*	*	1"
100	4"	*	*	1 1/4"
120	4"	*	*	1 1/2"
140	4"	*	*	1 3/4"
157	5"	*	*	1 3/4"
180	5"	*	*	2"
202	5"	*	*	2 1/4"

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

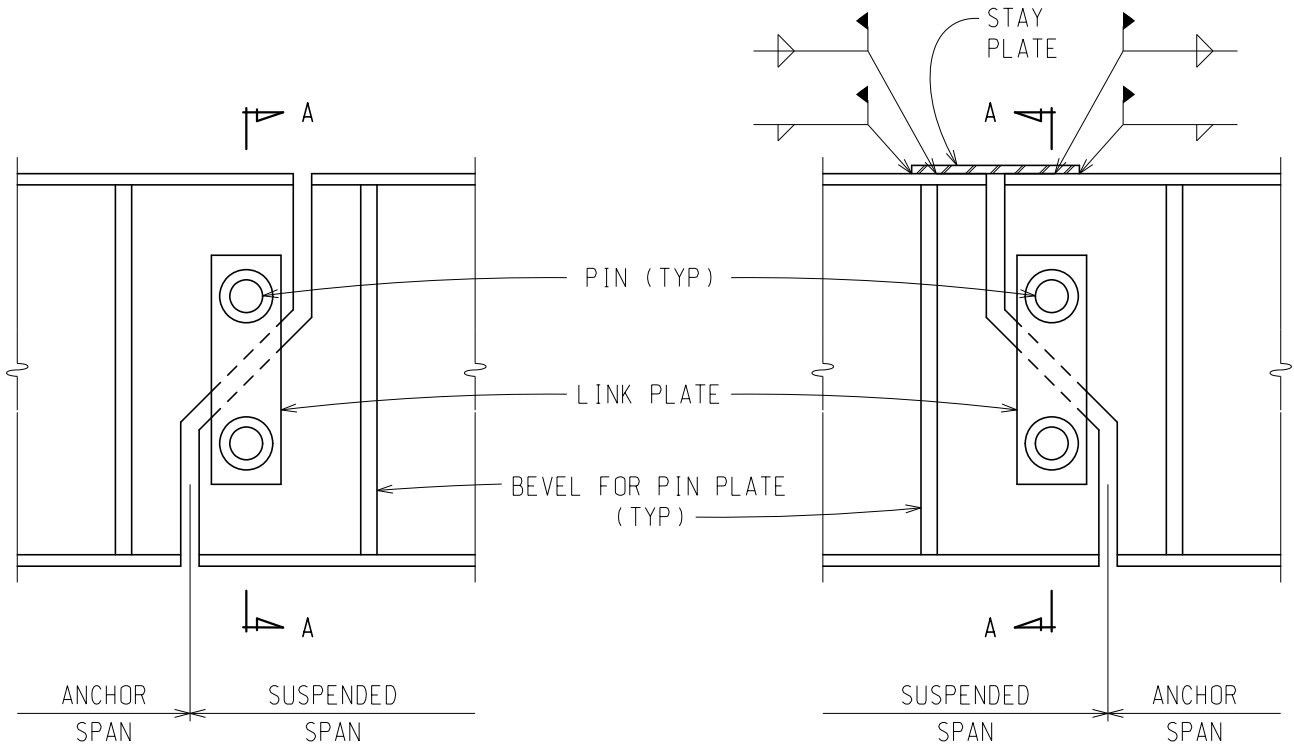
\* LINKS PLATES SHALL BE DESIGNED ACCORDING TO THE CURRENT AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, SECTION 10.

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 CHECKED BY: VZ  
 APPROVED BY: DAJ

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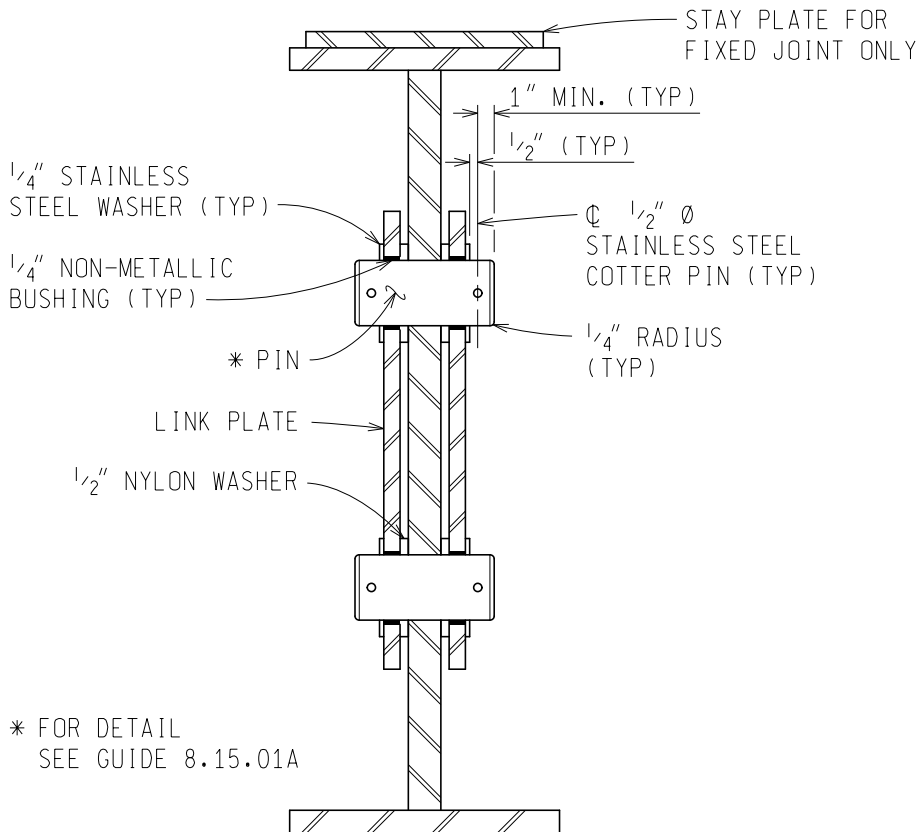
ISSUED: 06/25/12  
 SUPERSEDES: 05/04/06

SUSPENDER DETAILS FOR  
 CANTILEVERED PLATE GIRDERS



ELEVATION  
 EXPANSION JOINT

ELEVATION  
 FIXED JOINT



\* FOR DETAIL  
 SEE GUIDE 8.15.01A

SECTION A-A

PREPARED BY  
 DESIGN DIVISION

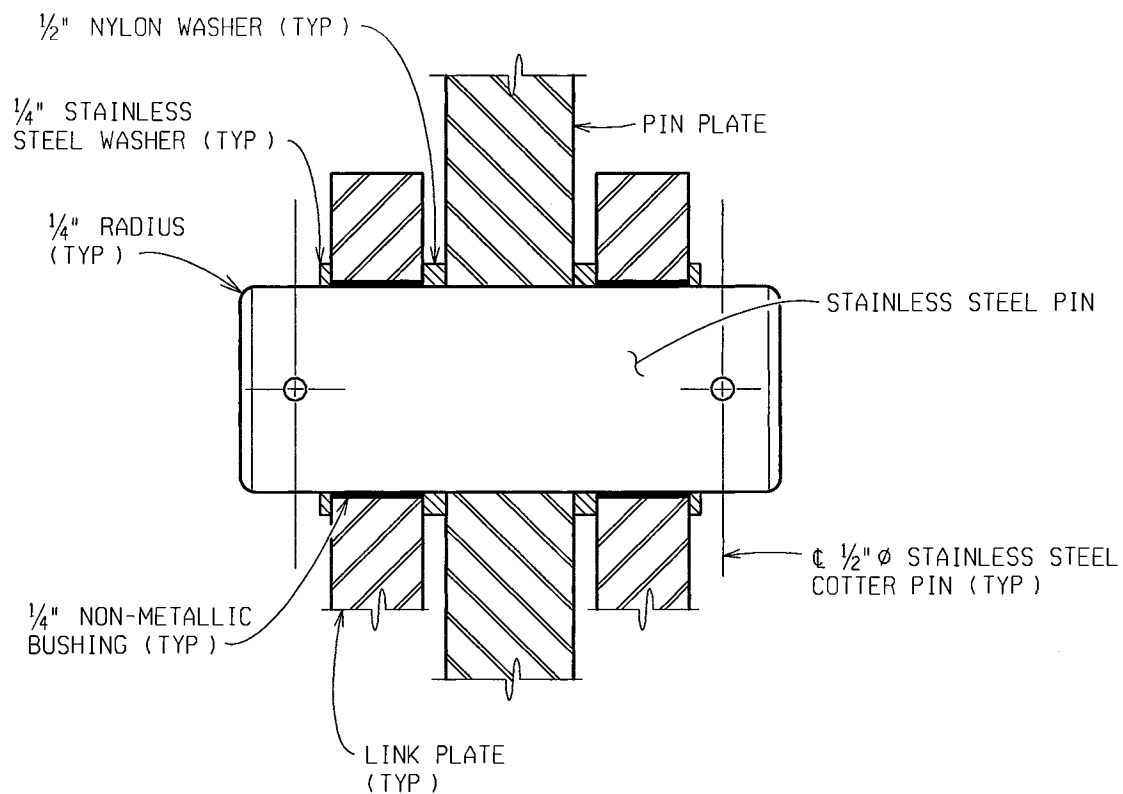
8.15.01

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CHECKED BY: VZ  
APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY DEVELOPMENT

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

PIN DETAIL



PIN DETAIL

NOTE:  
SEE GUIDE 8.16.02 FOR WASHER DETAILS.

PREPARED BY  
DESIGN SUPPORT AREA

8.15.01A

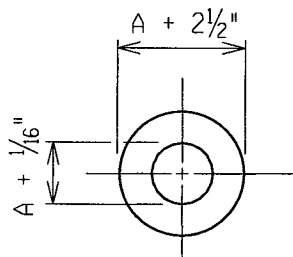


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 CHECKED BY: VZ  
 APPROVED BY: TGF

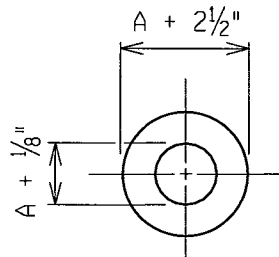
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

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

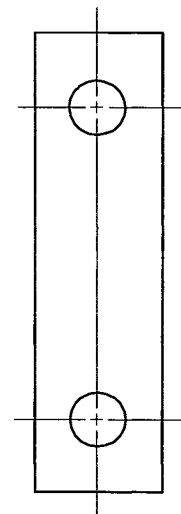
**SUSPENDER DETAILS  
 FOR ROLLED BEAMS**



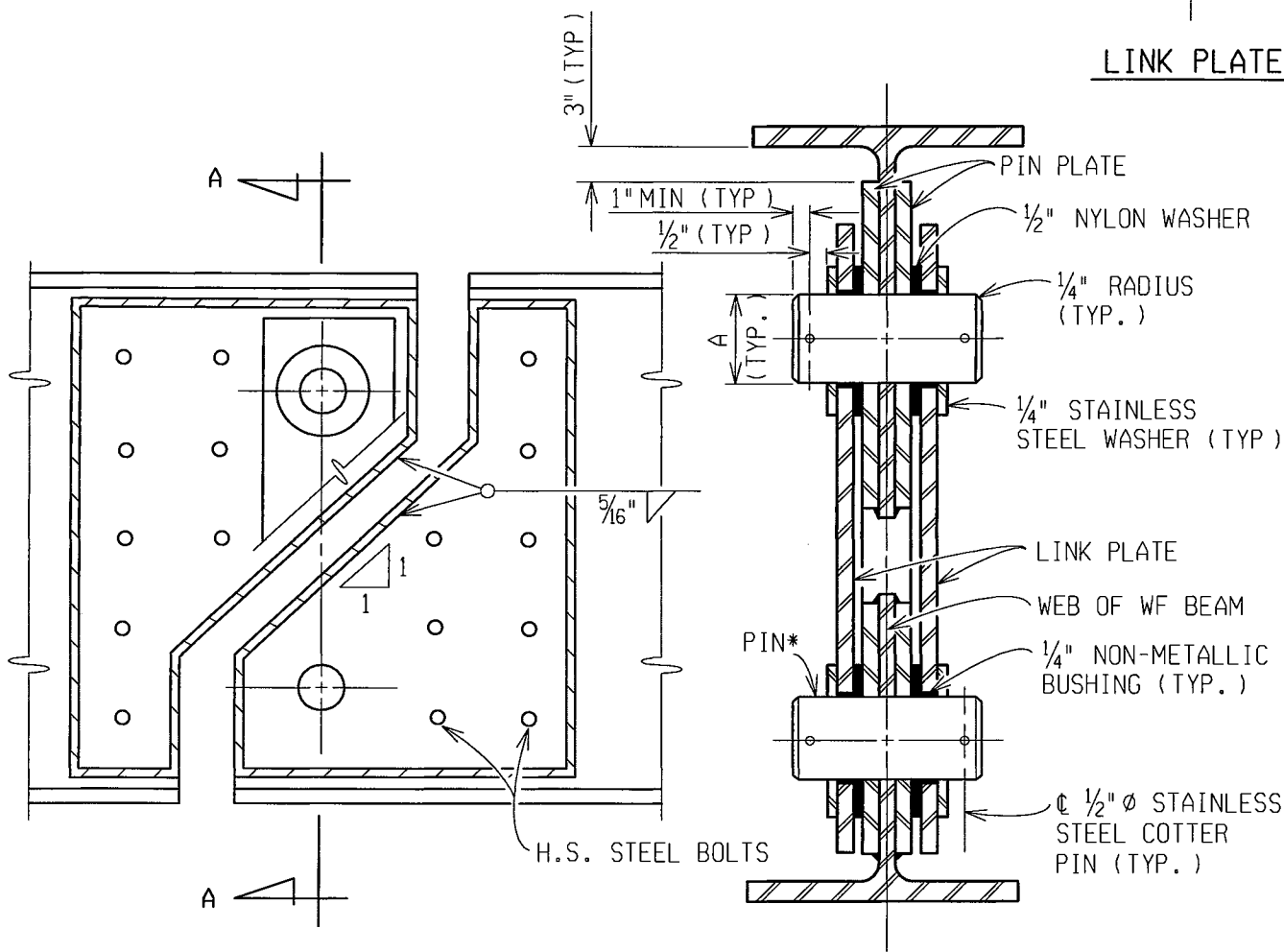
1/4" STAINLESS  
 STEEL WASHER



1/2" NYLON WASHER  
 INCLUDED IN THE BID ITEM "STRUCTURAL  
 STEEL, -----, FURN AND FAB."



LINK PLATE



WELDED PIN PLATES

SECTION A-A

\*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 SUPPORT AREA

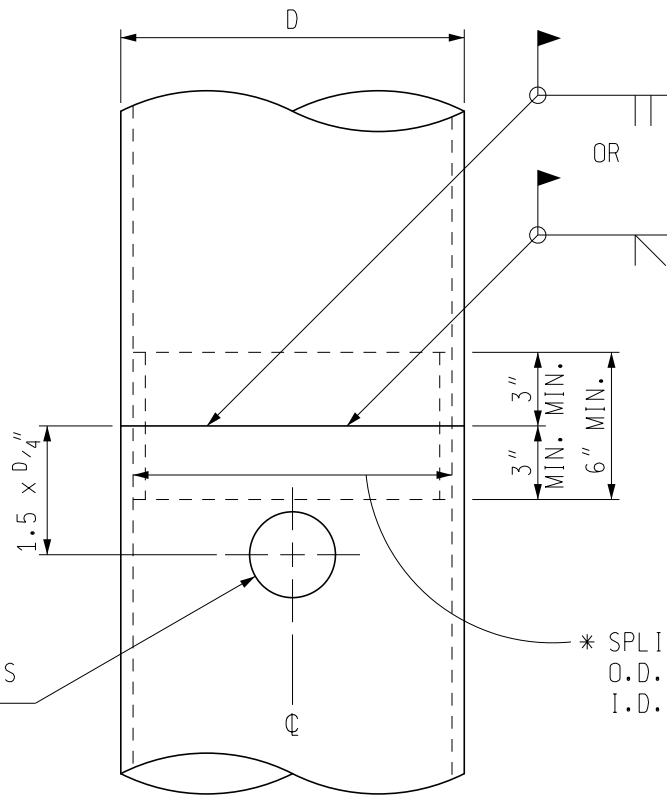
8.16.02

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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

ISSUED: 03/16/15  
 SUPERSEDES: 02/14/11

CIP PILE SPLICES



\*\*  $D/4$ "  $\emptyset$  MAX. HANDLING HOLES  
 2 HOLES MAX., 180° APART

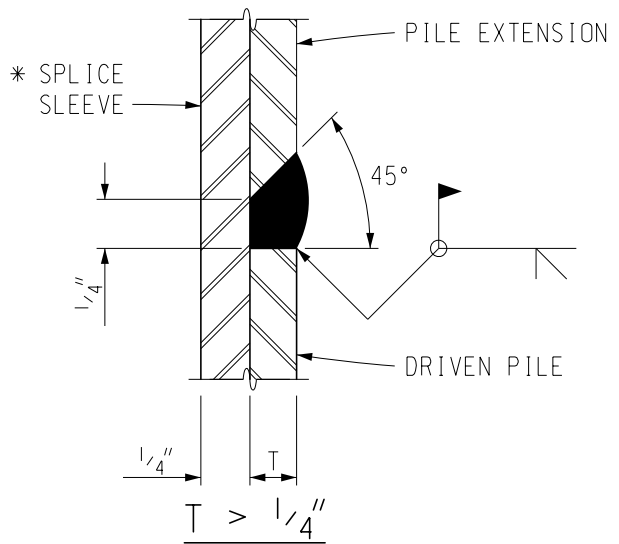
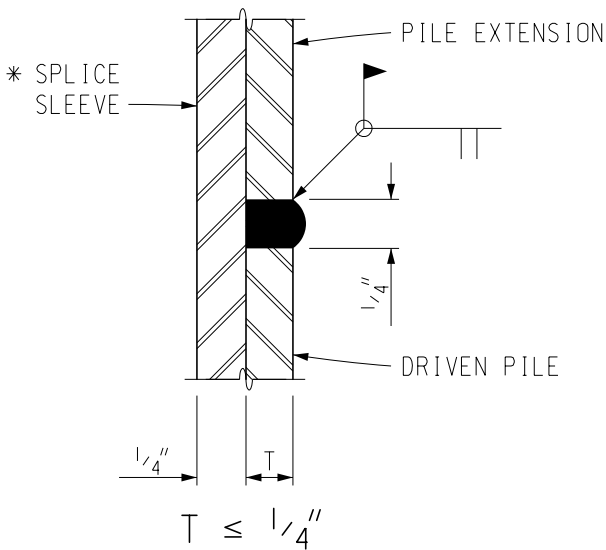
\* SPLICE SLEEVE  
 O.D. TO FIT  
 I.D. OF PILE

SPLICE DETAILS

FOR SPIRAL WELDED AND SEAMLESS PIPE SHELLS

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

\*\* 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.



NOTE:

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

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 DESIGN DIVISION

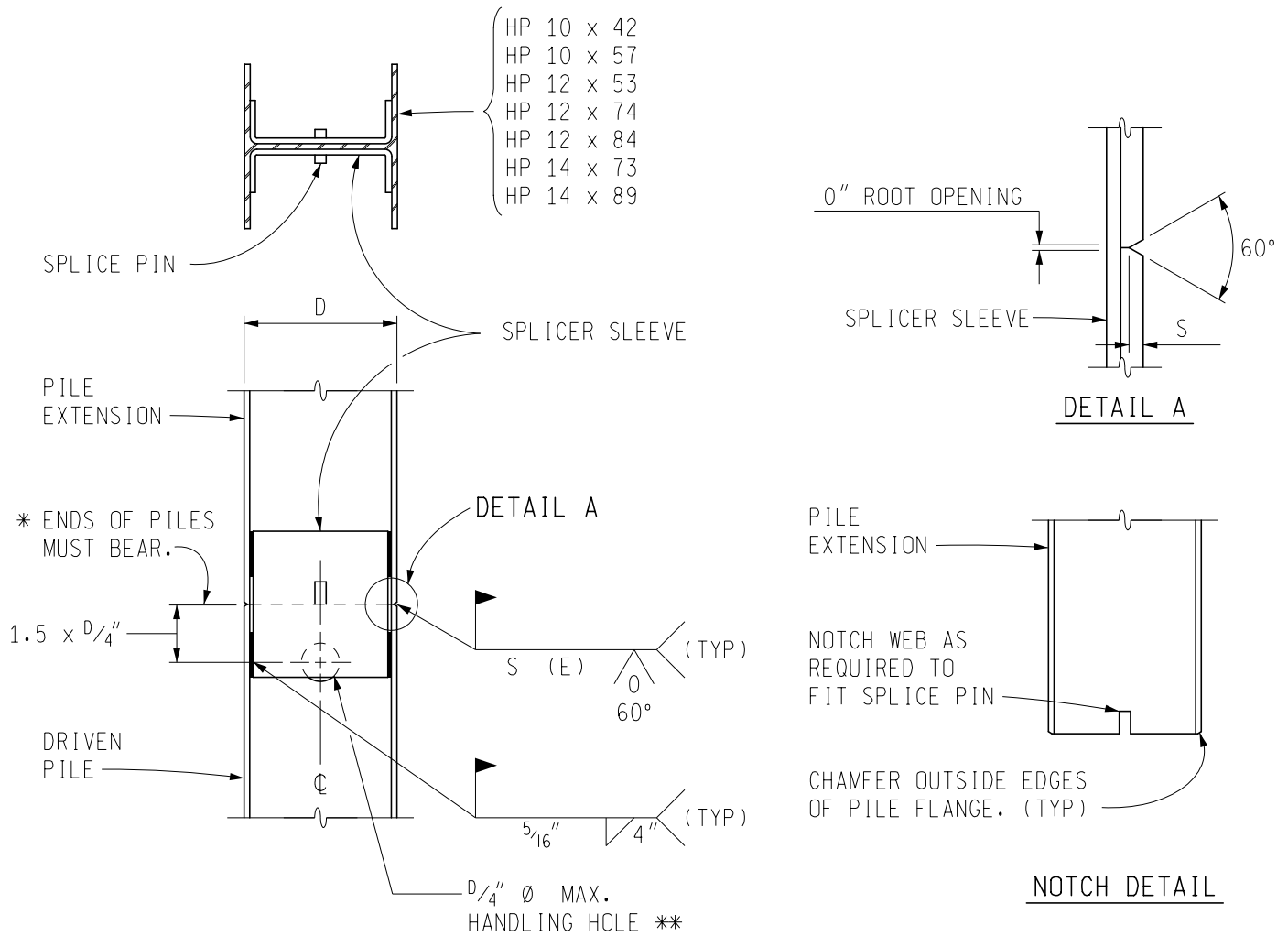
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

ISSUED: 08/22/16  
 SUPERSEDES: 03/16/15

H PILE  
 ALTERNATE SPLICE DETAILS



ALTERNATE SPLICE DETAILS

PILE	WELD SIZE (E)	BEVEL DEPTH (S)
HP 10 x 42	5/16"	5/16"
HP 10 x 57	5/16"	5/16"
HP 12 x 53	5/16"	5/16"
HP 12 x 74	3/8"	3/8"
HP 14 x 73	3/8"	3/8"
HP 14 x 89	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:

\* SET PILE EXTENSION IN PLACE WITH SPLICER SLEEVE ATTACHED, TAP SEVERAL TIMES WITH THE HAMMER TO IMPROVE BEARING CONTACT, THEN COMPLETE WELDING OF SLEEVES TO LOWER SECTION.

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.

\*\* 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

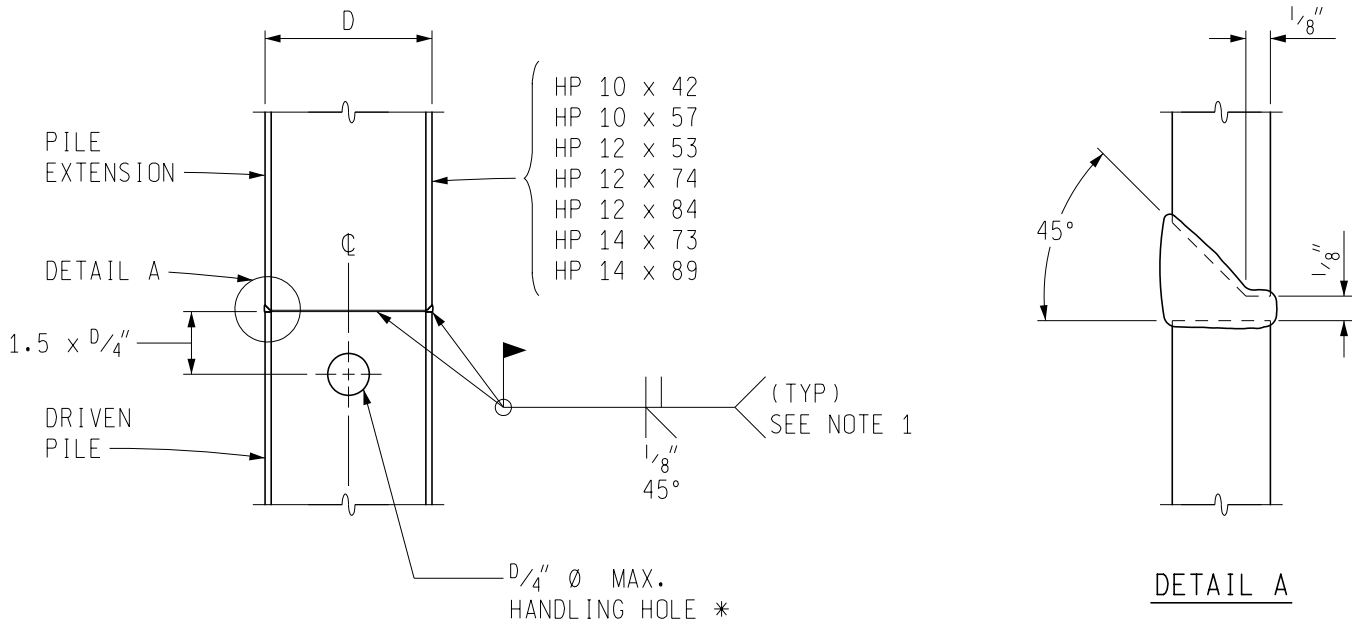
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 CHECKED BY: VZ  
 APPROVED BY: DAJ

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

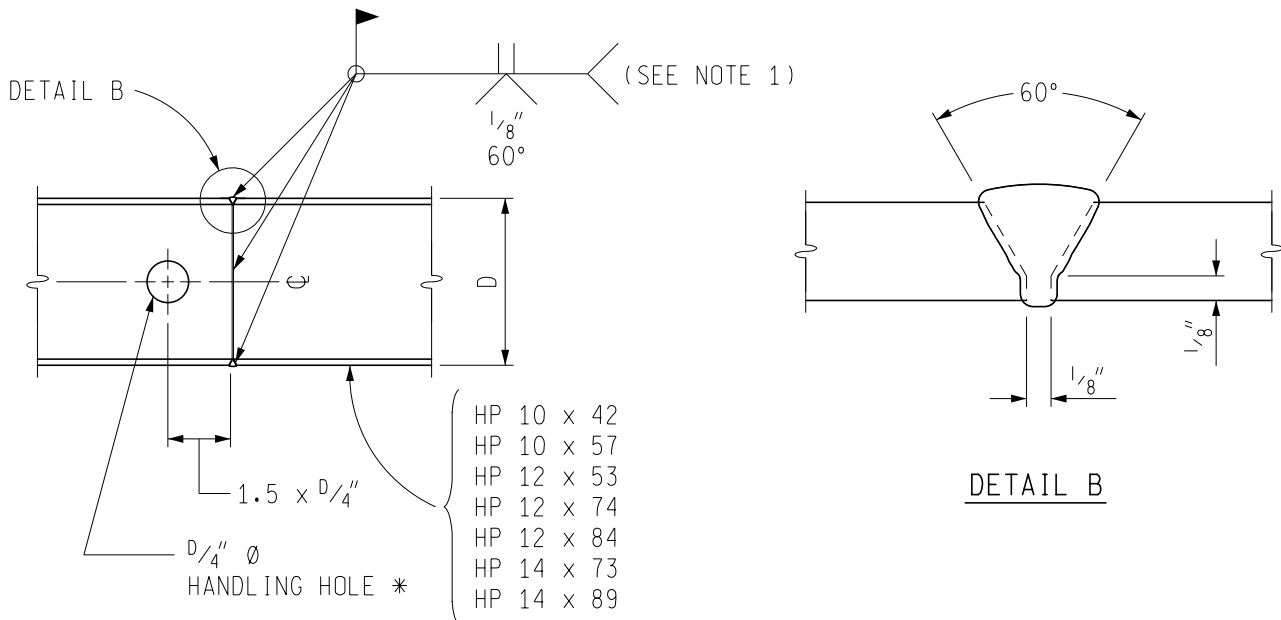
ISSUED: 03/16/15  
 SUPERSEDES: 01/23/12

H PILE SPLICE  
 (FULL PENETRATION BUTT WELD)



SPLICE DETAILS

FOR PILES IN PLACE (HORIZONTAL JOINT)



SPLICE DETAILS

FOR PILES IN HORIZONTAL POSITION

NOTE 1: BACK GOUGE AND GRIND EDGE PREPARATION SMOOTH.

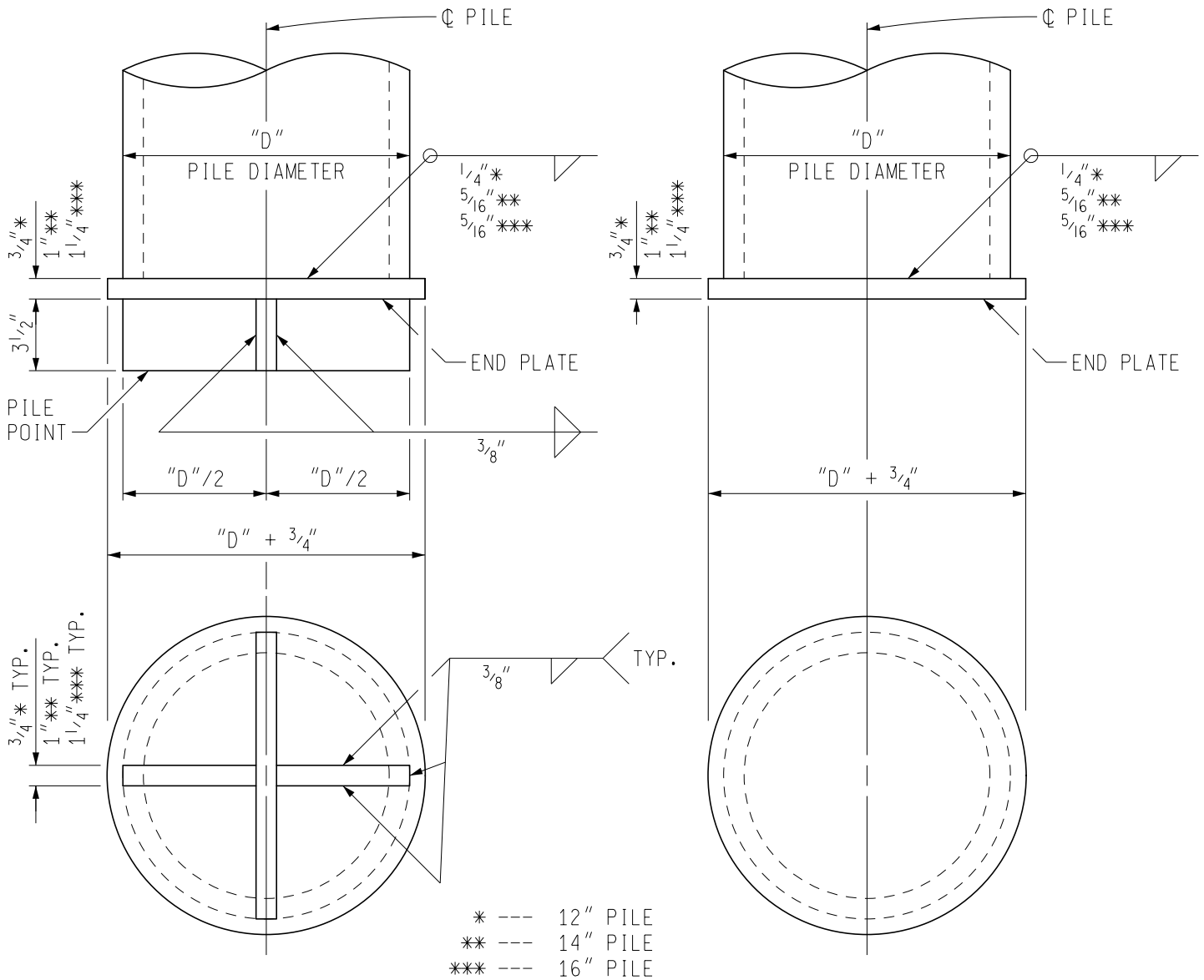
\* DRILL OR FLAME CUT CIRCULAR HANDLING HOLE. GRIND FLAME CUT HOLE TO MAKE CIRCULAR AND REMOVE HARDENED EDGE OR CUT OFF SECTION OF PILE WITH FLAME CUT HOLE PRIOR TO SPLICING OR CONCRETE PLACEMENT. HOLES IN FLANGES ARE PERMITTED FOR HANDLING ONLY IF THAT PORTION OF THE PILE IS CUT OFF PRIOR TO SPLICING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

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 CHECKED BY: VZ  
 APPROVED BY: DAJ

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

ISSUED: 12/26/17  
 SUPERSEDES: 10/17/16

CIP PILE POINT/END PLATE DETAILS



CIP PILE POINT DETAILS

CIP PILE END PLATE DETAILS

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

NOTE TO DESIGNER:

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

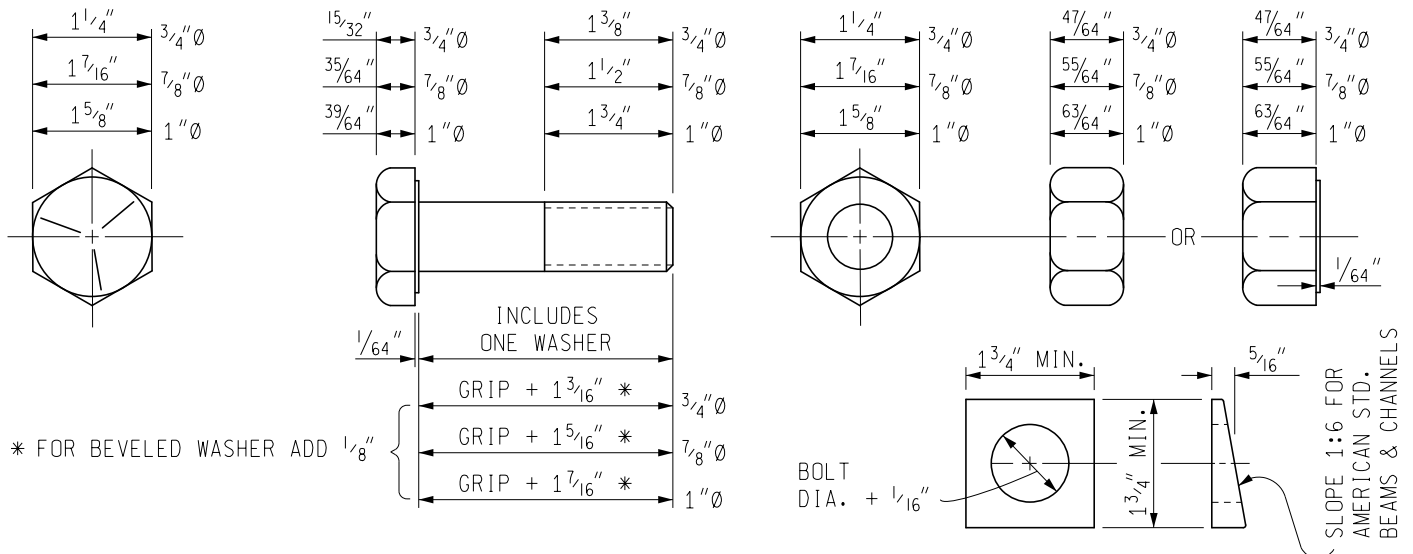
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 CHECKED BY: VZ  
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT  
 FASTENER DETAILING MINIMUMS FOR  
 ASTM F 3125 GRADE A 325 BOLTS & NUTS

ISSUED: 06/19/17  
 SUPERSEDES: 11/27/01

### ASTM F 3125 GRADE A 325 STRUCTURAL BOLTS & NUTS

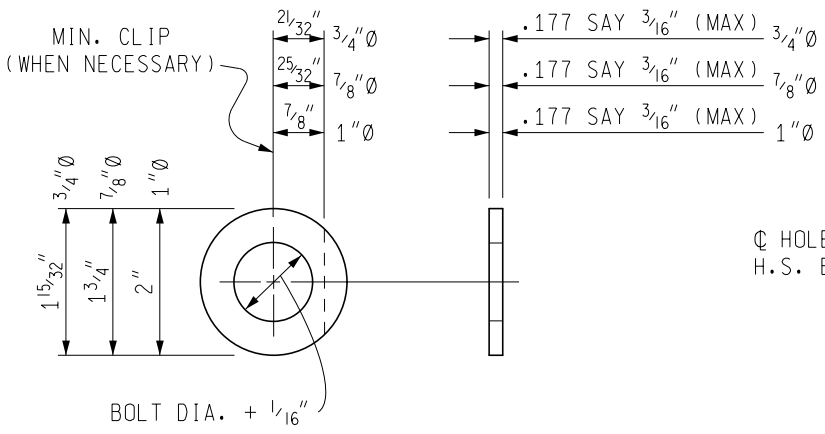
DIMENSIONS SHOWN ARE NOMINAL EXCEPT AS NOTED



\* FOR BEVELED WASHER ADD 1/8"

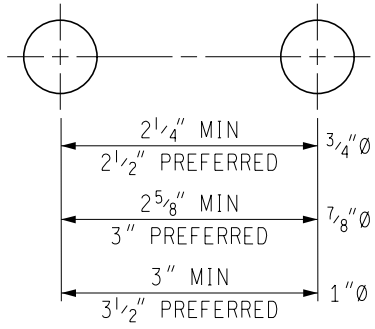
#### BEVELED WASHER FOR 3/4"Ø, 7/8"Ø, & 1"Ø BOLTS

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



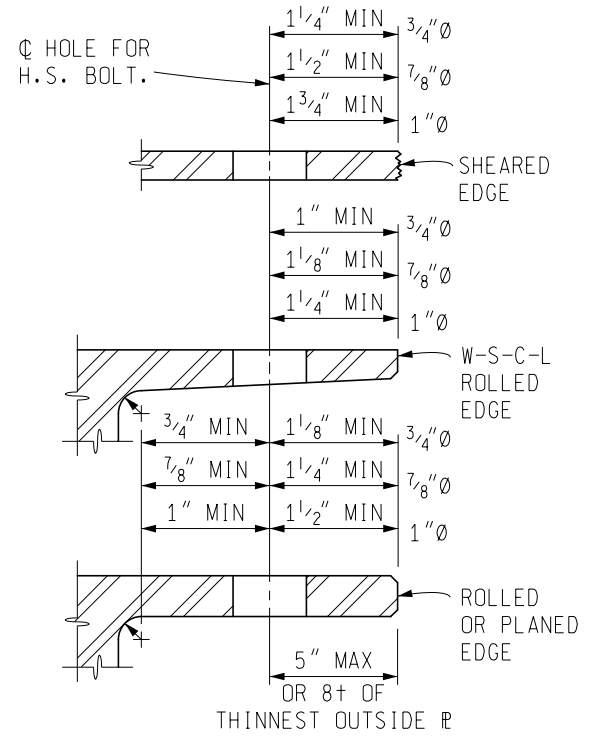
#### CIRCULAR FLAT WASHER

FOR 3/4"Ø WASHERS, USE 4.8# PER 100  
 FOR 7/8"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

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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

GUIDE FOR SELECTION OF BEARING  
 TYPES FOR STEEL STRUCTURES

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

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.

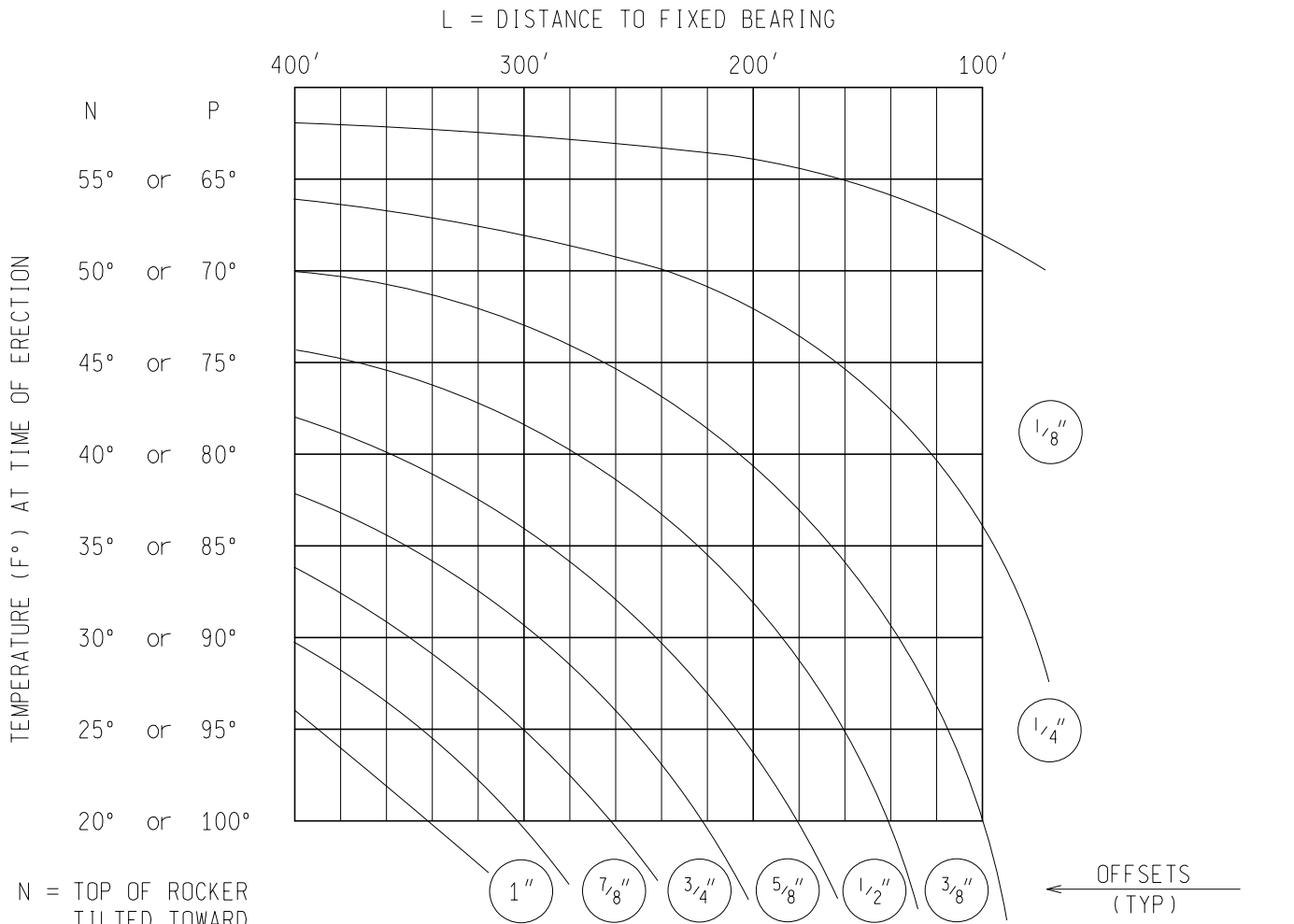
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8.31.01

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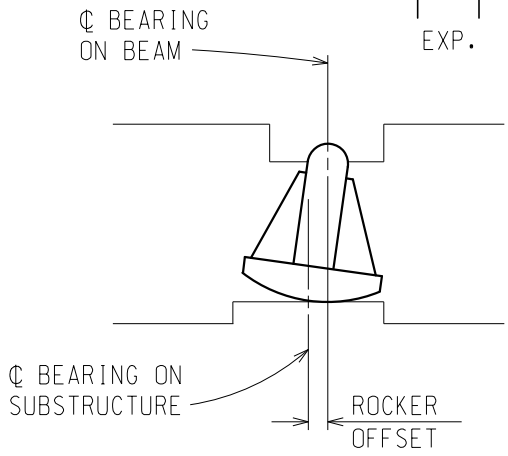
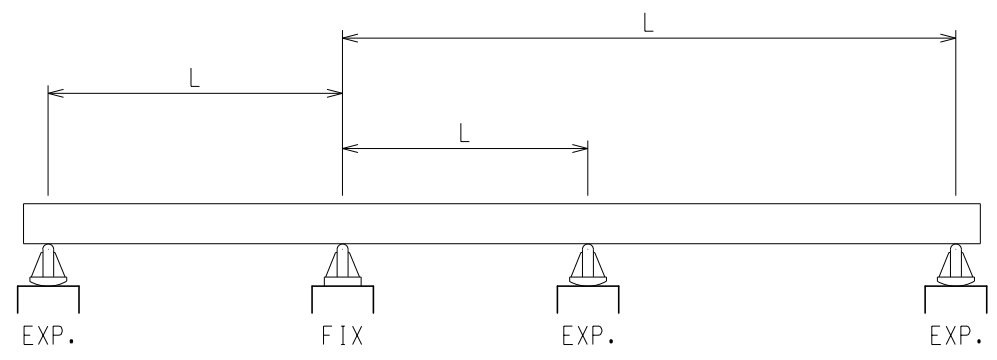
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT  
 OFFSET DIMENSIONS FOR ROCKER TILT

ISSUED: 02/14/11  
 SUPERSEDES: 11/27/01



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.

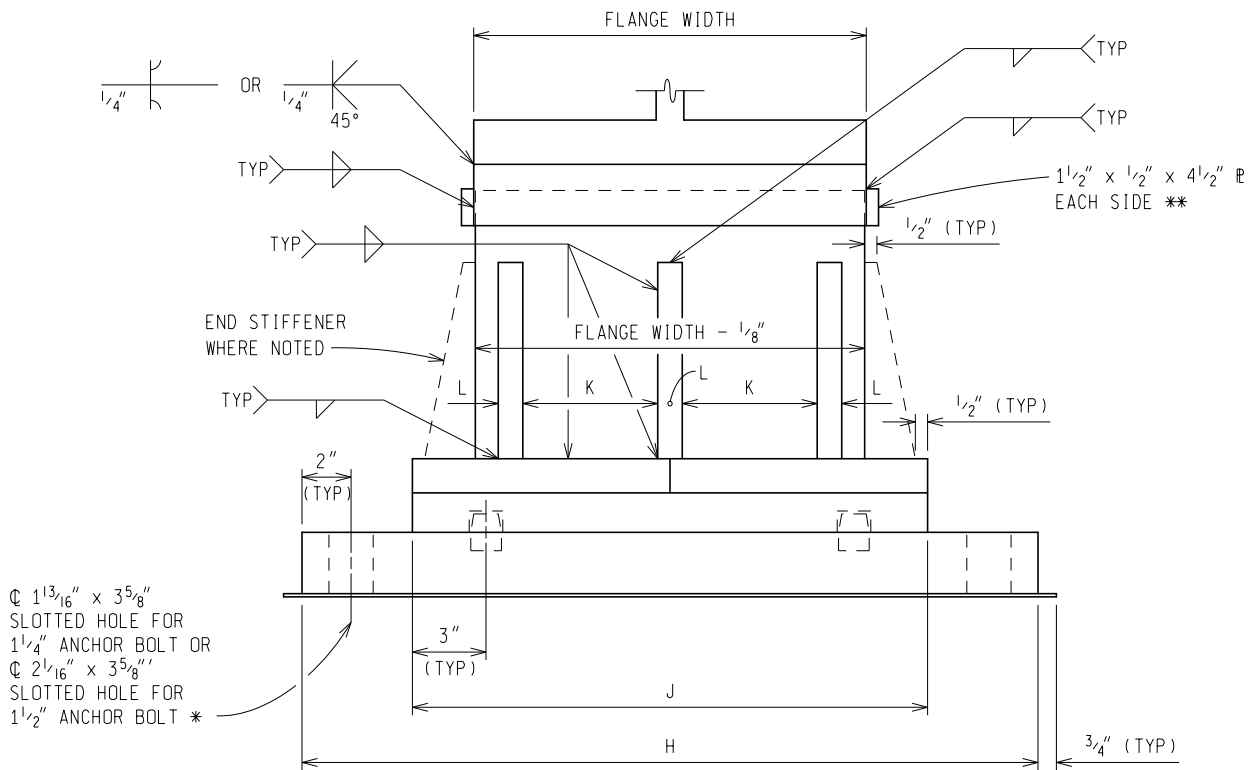


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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

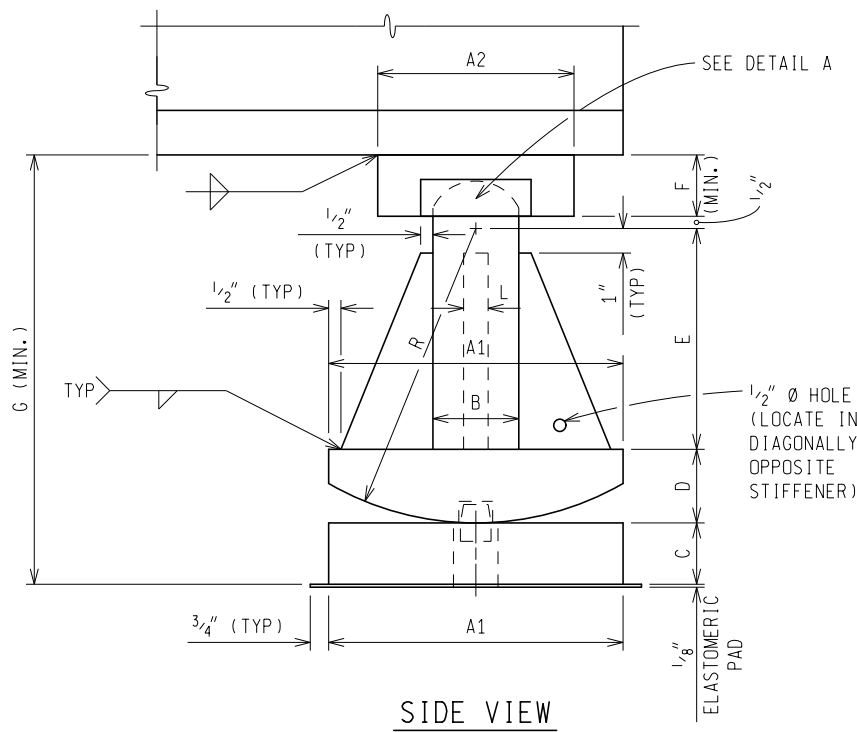
ISSUED: 02/14/11  
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EXPANSION ROCKER

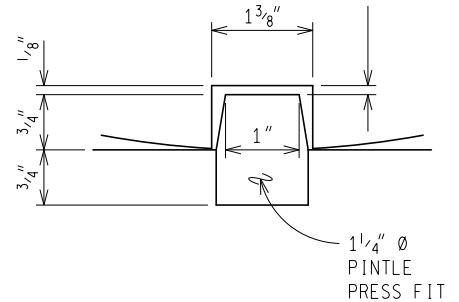


NOTE: ANCHOR BOLTS SHALL BE FURNISHED WITH 1/4" x 3" x 6 1/2" R WASHERS.

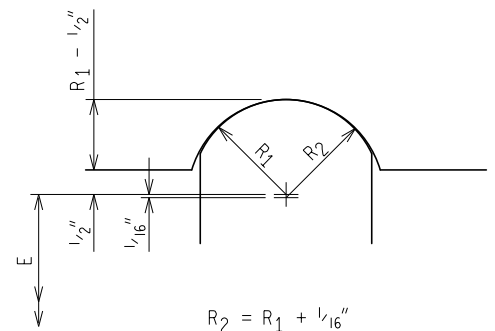
END VIEW



SIDE VIEW



PINTLE DETAIL



DETAIL A

NOTES:

SEE GUIDE 8.32.02 FOR TABULATION OF BEARING DIMENSIONS

\* USE 1 1/2" ANCHOR BOLT FOR SPANS OVER 100'

\*\* USE 2" x 1/2" x 5 1/2" R WHEN R1 = 1 15/16"

PREPARED BY  
 DESIGN DIVISION

8.32.01

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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

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

ROCKER BEARING  
 DIMENSIONS

MAX LOAD (ksp)	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 (lb)
100	12	6	6	2 1/2	1 3/4	1 1/2	6 1/2	2	12 1/4	22	13	4	5/8		1 7/16	8	200
100	14	6	6	2 1/2	1 3/4	1 1/4	6 3/4	2	12 1/4	24	15	5	5/8		1 7/16	8	225
100	16	6	6	2 1/2	1 3/4	1 1/4	6 3/4	2	12 1/4	26	17	6	5/8		1 7/16	8	250
125	12	7	6	2 1/2	2	1 3/4	6 1/4	2	12 1/2	22	13	4	3/4		1 7/16	8	230
125	14	7	6	2 1/2	2	1 3/4	6 1/4	2	12 1/2	24	15	5	3/4		1 7/16	8	260
125	16	7	6	2 1/2	1 3/4	1 3/4	6 1/4	2	12 1/4	26	17	6	3/4		1 7/16	8	280
150	12	8	6	2 1/2	2	2	6	2	12 1/2	23	14	4	3/4		1 7/16	8	260
150	14	8	6	2 1/2	2	2	6	2	12 1/2	24	15	5	3/4		1 7/16	8	285
150	16	8	6	2 1/2	2	2	6	2	12 1/2	26	17	6	3/4		1 7/16	8	320
175	12	9	6	2 1/2	2 1/4	2 1/4	9 3/4	2	16 3/4	22	13	4	3/4		1 7/16	12	340
175	14	9	6	2 1/2	2 1/4	2 1/4	9 3/4	2	16 3/4	24	15	5	3/4		1 7/16	12	380
175	16	9	6	2 1/2	2	2 1/4	9 3/4	2	16 1/2	26	17	6	3/4		1 7/16	12	410
200	12	10	6	2 1/2	2 1/2	2 1/2	9 1/2	2	17	22	13	4	3/4		1 7/16	12	380
200	14	10	6	2 1/2	2 1/4	2 1/2	9 1/2	2	16 3/4	24	15	5	3/4		1 7/16	12	410
200	16	10	6	2 1/2	2 1/4	2 1/2	9 1/2	2	16 3/4	26	17	6	3/4		1 7/16	12	460
250	14	11	8	3 1/2	2 1/2	3	9	2 1/2	17 1/2	24	15	5	3/4		1 15/16	12	540
250	16	11	8	3 1/2	2 1/2	3	9	2 1/2	17 1/2	26	17	6	3/4		1 15/16	12	600
300	16	12	8	3 1/2	2 1/2	3	9	2 1/2	17 1/2	30	21	5 1/2	1		1 15/16	12	700
300	18	12	8	3 1/2	2 1/2	3	9	2 1/2	17 1/2	28	19	6 1/2	1		1 15/16	12	695
350	16	13	8	3 1/2	2 3/4	3	9	2 1/2	17 3/4	33	24	5 1/2	1	*	1 15/16	12	825
350	18	13	8	3 1/2	2 3/4	3	9	2 1/2	17 3/4	33	24	6 1/2	1		1 15/16	12	845
400	16	14	8	3 1/2	2 3/4	3 1/2	8 1/2	2 1/2	17 3/4	35	26	5 1/2	1	*	1 15/16	12	950
400	18	14	8	3 1/2	2 3/4	3 1/2	8 1/2	2 1/2	17 3/4	35	26	6 1/2	1	*	1 15/16	12	975
400	20	14	8	3 1/2	2 3/4	3 1/2	8 1/2	2 1/2	17 3/4	35	26	7 1/2	1		1 15/16	12	995
450	18	15	8	3 1/2	3	3 1/2	8 1/2	2 1/2	18	37	28	6	1 1/4	*	1 15/16	12	1110
450	20	15	8	3 1/2	3	3 1/2	8 1/2	2 1/2	18	37	28	7	1 1/4	*	1 15/16	12	1140
450	22	15	8	3 1/2	3	3 1/2	8 1/2	2 1/2	18	37	28	8	1 1/4		1 15/16	12	1155

\* DENOTES END STIFFENERS ARE REQUIRED

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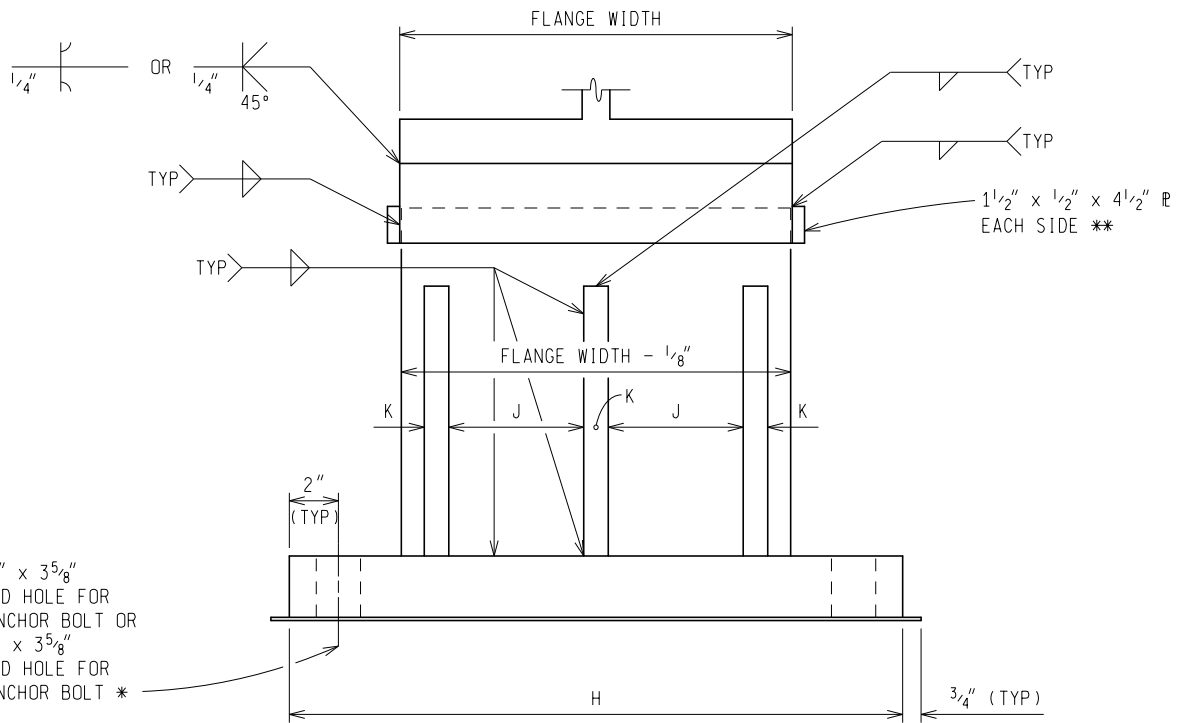
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 BUREAU OF HIGHWAY DEVELOPMENT

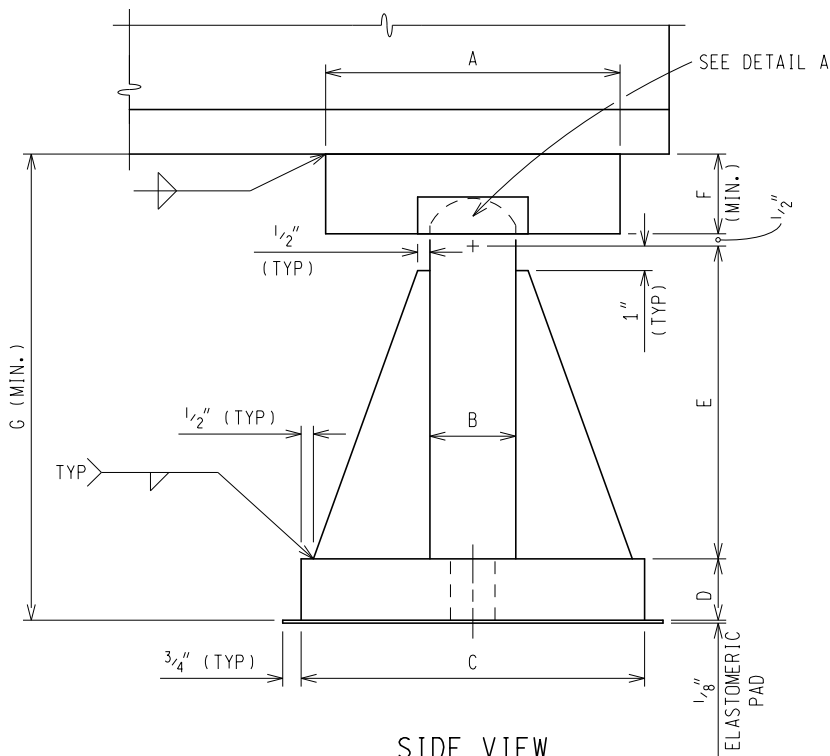
ISSUED: 02/14/11  
 SUPERSEDES: 11/27/01

FIXED BEARING

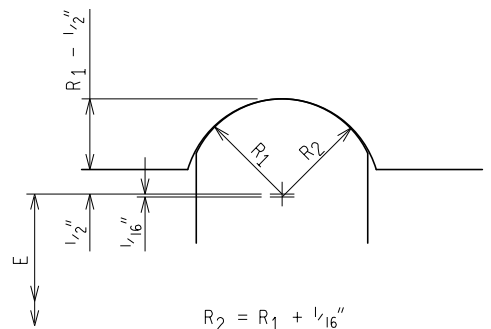


NOTE: ANCHOR BOLTS SHALL BE FURNISHED WITH  $\frac{1}{4}$ " x 3" x  $6\frac{1}{2}$ " R WASHERS.

END VIEW



SIDE VIEW



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

DETAIL A

NOTES:

SEE GUIDE 8.32.04 FOR TABULATION OF BEARING DIMENSIONS

\* USE  $1\frac{1}{2}$ " ANCHOR BOLT FOR SPANS OVER 100'

\*\* USE 2" x  $\frac{1}{2}$ " x  $5\frac{1}{2}$ " R 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

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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

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

FIXED BEARING  
 DIMENSIONS

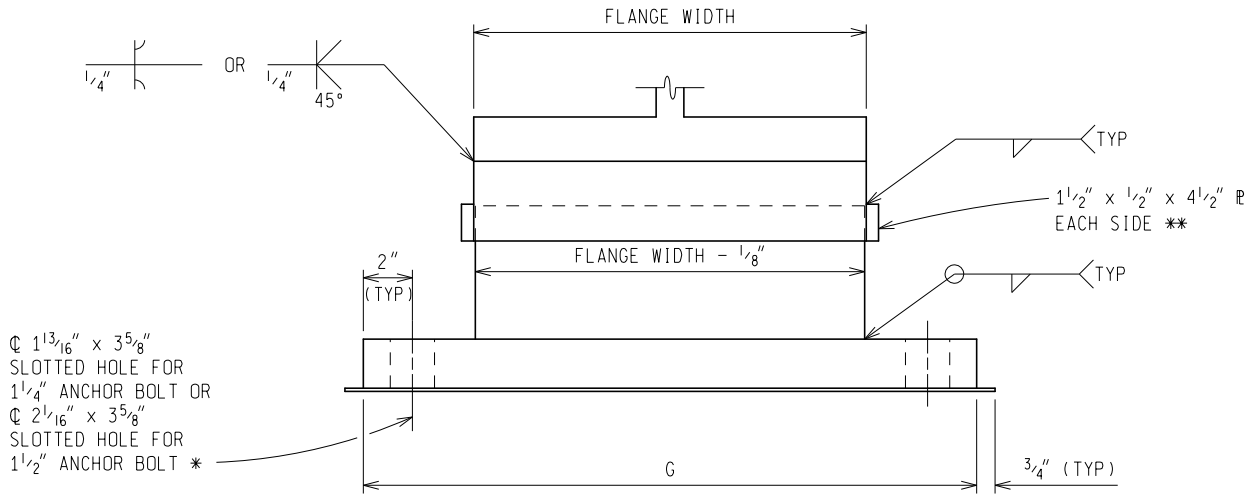
MAX LOAD (kips)	FLANGE WIDTH (in)	A (in)	B (in)	C (in)	D (in)	E (in)	F MIN. (in)	G MIN. (in)	H (in)	J (in)	K (in)	R1 (in)	WEIGHT OF STEEL (lbs)
100	12	6	2 1/2	7	1 1/2	8 1/4	2	12 1/4	21	4	3/4	1 7/16	185
100	14	6	2 1/2	6	1 1/2	8 1/4	2	12 1/4	23	5	3/4	1 7/16	200
100	16	6	2 1/2	6	1 1/2	8 1/4	2	12 1/4	25	6	3/4	1 7/16	225
125	12	7	2 1/2	8	1 5/8	8 3/8	2	12 1/2	21	4	3/4	1 7/16	215
125	14	7	2 1/2	7	1 5/8	8 3/8	2	12 1/2	23	5	3/4	1 7/16	230
125	16	7	2 1/2	7	1 5/8	8 1/8	2	12 1/4	25	6	3/4	1 7/16	250
150	12	8	2 1/2	9	1 3/4	8 1/4	2 1/2	13	21	4	3/4	1 7/16	250
150	14	8	2 1/2	8	1 3/4	8 1/4	2	12 1/2	23	5	3/4	1 7/16	255
150	16	8	2 1/2	8	1 3/4	8 1/4	2	12 1/2	25	6	3/4	1 7/16	285
175	12	9	2 1/2	11	1 3/4	12 1/2	2 1/2	17 1/4	21	4	3/4	1 7/16	330
175	14	9	2 1/2	10	1 3/4	12 1/2	2 1/2	17 1/4	23	5	3/4	1 7/16	360
175	16	9	2 1/2	9	1 3/4	12 1/4	2 1/2	17	25	6	3/4	1 7/16	380
200	12	10	2 1/2	12	1 3/4	12 3/4	3	18	21	4	3/4	1 7/16	375
200	14	10	2 1/2	11	1 3/4	12 1/2	2 1/2	17 1/4	23	5	3/4	1 7/16	355
200	16	10	2 1/2	10	1 3/4	12 1/2	2 1/2	17 1/4	25	6	3/4	1 7/16	410
250	14	11	3 1/2	13	1 3/4	12 3/4	3 1/4	18 1/4	23	5	3/4	1 15/16	505
250	16	11	3 1/2	12	1 3/4	12 3/4	3	18	25	6	3/4	1 15/16	540
300	16	12	3 1/2	14	1 3/4	12 3/4	3 1/4	18 1/4	25	5 1/2	1	1 15/16	610
300	18	12	3 1/2	13	1 3/4	12 3/4	3 1/4	18 1/4	27	6 1/2	1	1 15/16	655
350	16	13	3 1/2	16	1 3/4	13	3 3/8	18 5/8	25	5 1/2	1	1 15/16	675
350	18	13	3 1/2	15	1 3/4	13	3 1/4	18 1/2	27	6 1/2	1	1 15/16	715
400	16	14	3 1/2	19	1 3/4	13	3 1/2	18 3/4	25	5 1/2	1	1 15/16	750
400	18	14	3 1/2	18	1 3/4	13	3 3/8	18 5/8	27	6 1/2	1	1 15/16	795
400	20	14	3 1/2	16	1 3/4	13	3 1/4	18 1/2	29	7 1/2	1	1 15/16	820
450	18	15	3 1/2	20	1 3/4	13 1/4	3 3/4	19 1/4	27	6	1 1/4	1 15/16	905
450	20	15	3 1/2	19	1 3/4	13 1/4	3 1/2	19	29	7	1 1/4	1 15/16	940
450	22	15	3 1/2	17	1 3/4	13 1/4	3 1/4	18 3/4	31	8	1 1/4	1 15/16	955

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: DAJ

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

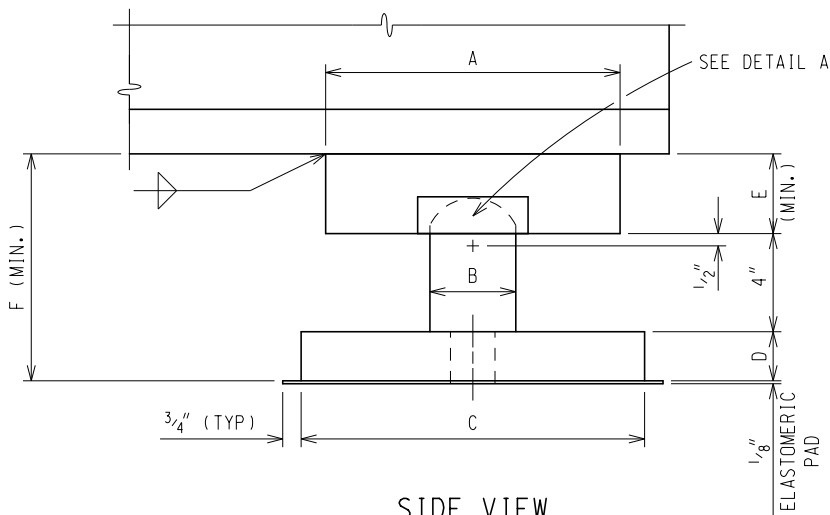
ISSUED: 03/26/12  
 SUPERSEDES: 02/14/11

FIXED SHOE

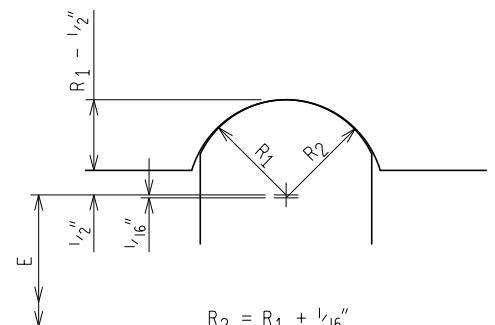


NOTE: ANCHOR BOLTS SHALL BE FURNISHED WITH 1/4" x 3" x 6 1/2" R WASHERS.

END VIEW



SIDE VIEW



$$R_2 = R_1 + 1/16"$$

DETAIL A

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.

\* USE 1 1/2" ANCHOR BOLT FOR SPANS OVER 100'

\*\* USE 2" x 1/2" x 5 1/2" R WHEN R1 = 1 15/16"

EQUIV. d FOR BEARING CHECK:

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

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 CHECKED BY: VZ  
 APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

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

FIXED SHOE  
 DIMENSIONS

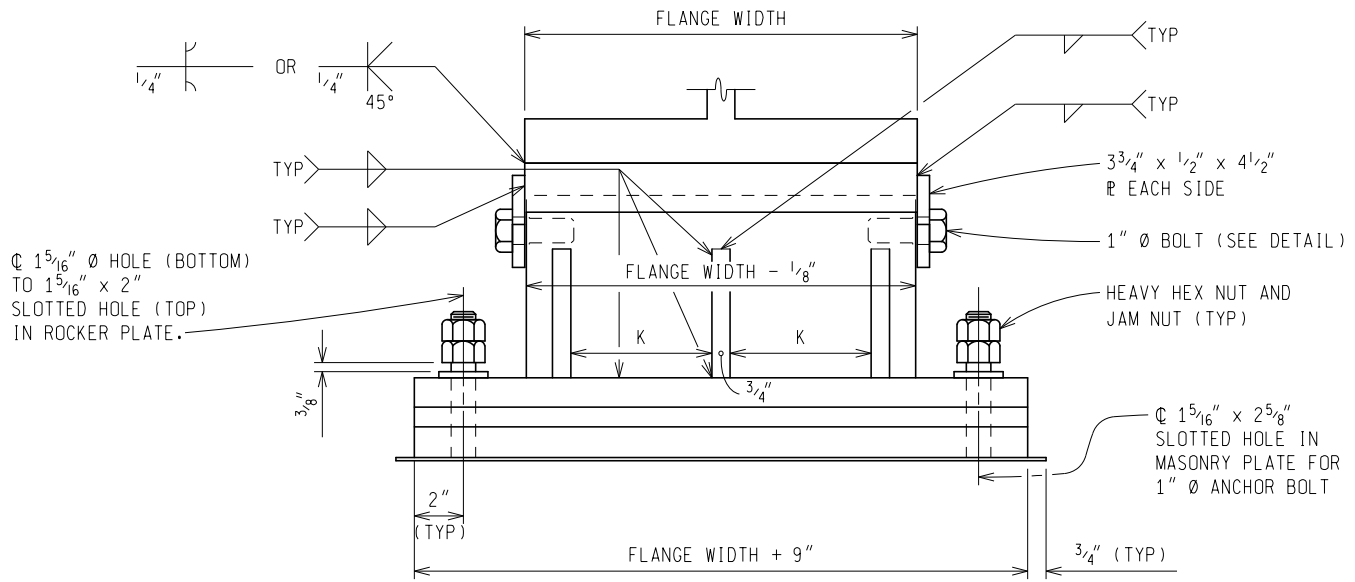
MAX LOAD (kips)	FLANGE WIDTH (in)	A (in)	B (in)	C (in)	D (in)	E (in)	F MIN. (in)	G (in)	R1 (in)	WEIGHT OF STEEL (lbs)
100	12	6	2 1/2	6	2	2	8	21	1 7/16	150
100	14	6	2 1/2	6	2	2	8	23	1 7/16	170
100	16	6	2 1/2	6	2	2	8	25	1 7/16	185
125	12	7	2 1/2	7	2	2	8	21	1 7/16	165
125	14	7	2 1/2	7	2	2	8	23	1 7/16	190
125	16	7	2 1/2	7	2	2	8	25	1 7/16	210
150	12	8	2 1/2	8	2	2 1/2	8 1/2	21	1 7/16	200
150	14	8	2 1/2	8	2	2	8	23	1 7/16	210
150	16	8	2 1/2	8	2	2	8	25	1 7/16	235
175	12	9	2 1/2	10	2 1/4	2 1/2	8 3/4	21	1 7/16	245
175	14	9	2 1/2	9	2 1/4	2 1/2	8 3/4	23	1 7/16	265
175	16	9	2 1/2	9	2 1/4	2 1/2	8 3/4	25	1 7/16	295
200	12	10	2 1/2	11	2 1/2	3	9 1/2	21	1 7/16	300
200	14	10	2 1/2	10	2 1/4	2 1/2	8 3/4	23	1 7/16	290
200	16	10	2 1/2	10	2 1/4	2 1/2	8 3/4	25	1 7/16	320
250	14	11	3 1/2	12	2 1/2	3 1/4	9 3/4	23	1 15/16	395
250	16	11	3 1/2	12	2 1/2	3	9 1/2	25	1 15/16	425
300	16	12	3 1/2	13	2 1/2	3 1/4	9 3/4	25	1 15/16	470
300	18	12	3 1/2	13	2 1/2	3 1/4	9 3/4	27	1 15/16	520
350	16	13	3 1/2	15	3	3 3/8	10 3/8	25	1 15/16	580
350	18	13	3 1/2	14	2 3/4	3 1/4	10	27	1 15/16	585
400	16	14	3 1/2	17	3 1/4	3 1/2	10 3/4	25	1 15/16	680
400	18	14	3 1/2	16	3 1/4	3 3/8	10 5/8	27	1 15/16	715
400	20	14	3 1/2	15	3	3 1/4	10 1/4	29	1 15/16	710
450	18	15	3 1/2	18	3 1/2	3 3/4	11 1/4	27	1 15/16	850
450	20	15	3 1/2	17	3 1/2	3 1/2	11	29	1 15/16	870
450	22	15	3 1/2	16	3 1/2	3 1/2	11	31	1 15/16	915

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: T&F

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

ISSUED: 02/14/11  
 SUPERSEDES: 11/27/01

EXPANSION ROCKER WITH  
 PROVISION FOR UPLIFT

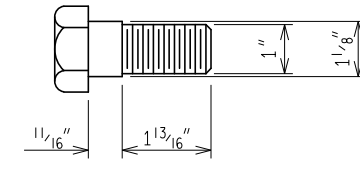
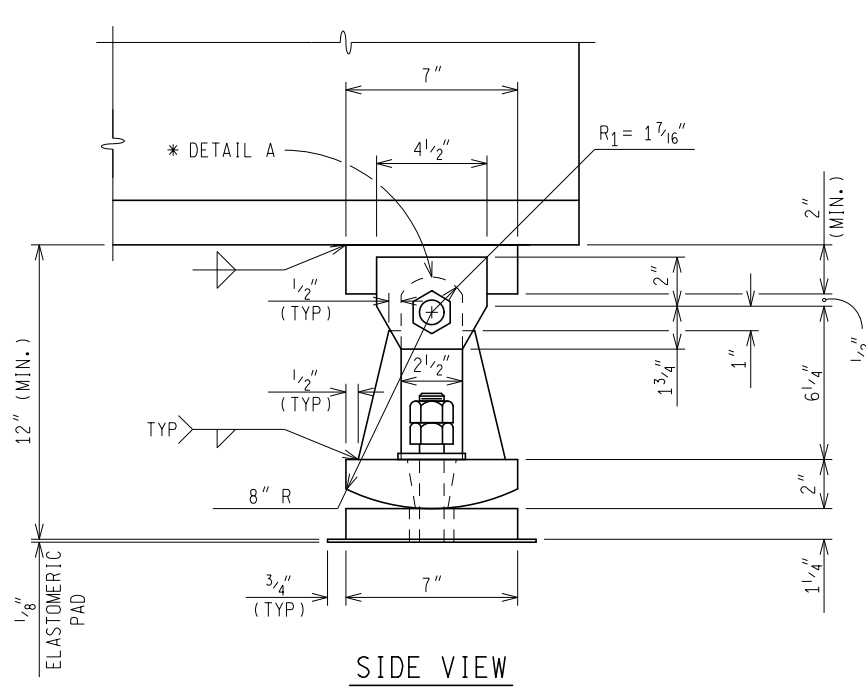


Ø 1<sup>5</sup>/<sub>16</sub>" Ø HOLE (BOTTOM)  
 TO 1<sup>5</sup>/<sub>16</sub>" x 2"  
 SLOTTED HOLE (TOP)  
 IN ROCKER PLATE.

Ø 1<sup>5</sup>/<sub>16</sub>" x 2<sup>5</sup>/<sub>8</sub>"  
 SLOTTED HOLE IN  
 MASONRY PLATE FOR  
 1" Ø ANCHOR BOLT

NOTE: ANCHOR BOLTS SHALL BE FURNISHED WITH  
 1/4" x 2" x 3 1/2" R WASHERS  
 WITH 1 3/16" Ø HOLES.

END 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.

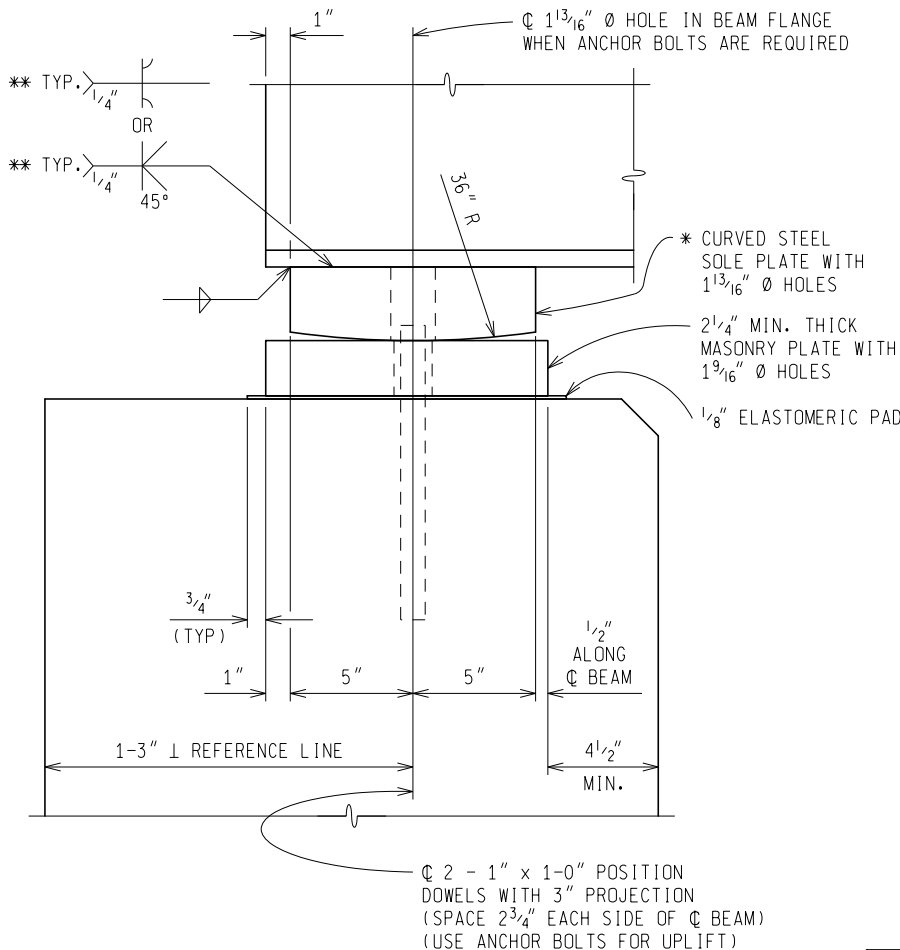
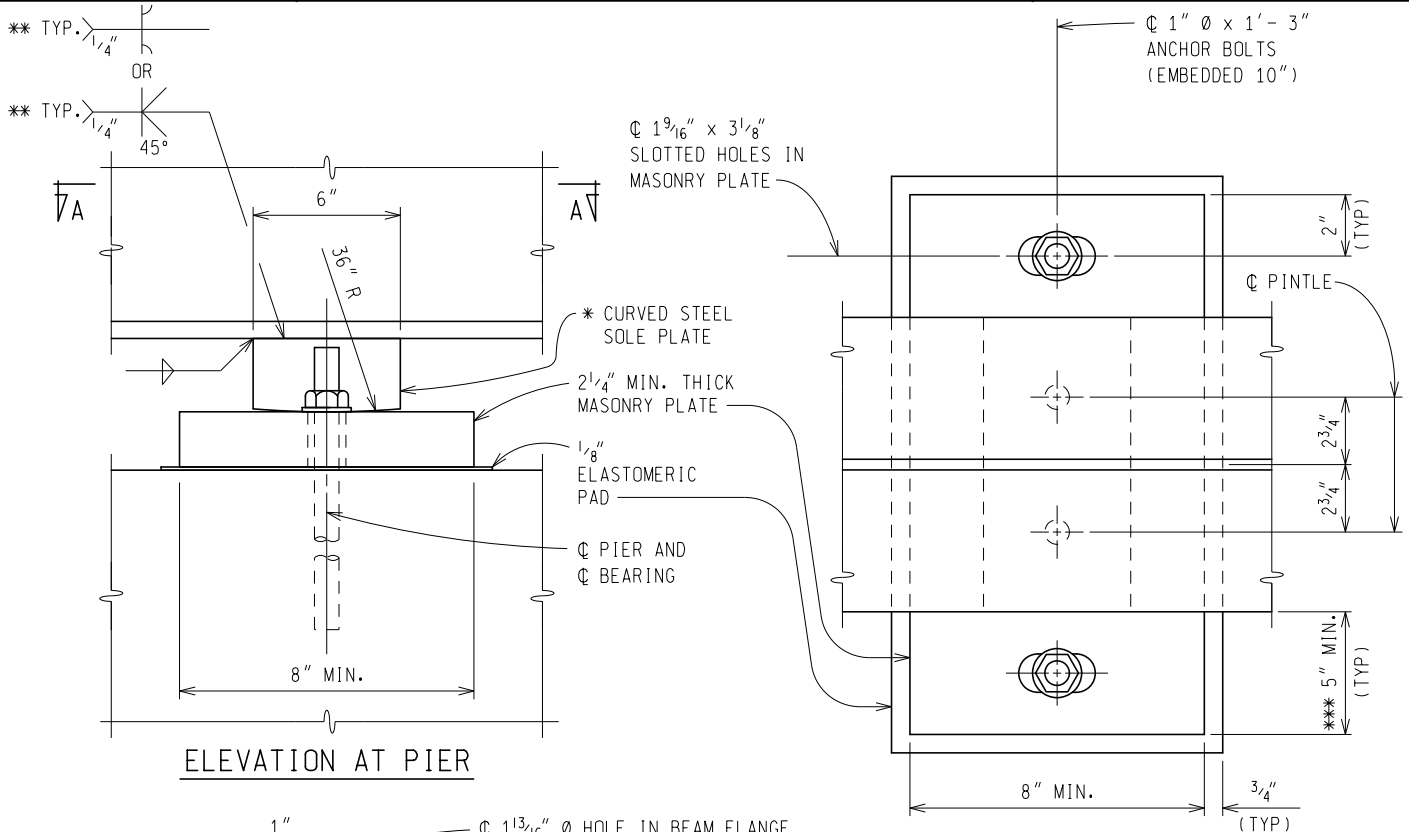
\* SEE GUIDE 8.32.01 FOR DETAIL A.

DRAWN BY: BLT  
 CHECKED BY: VZ  
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MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

ISSUED: 02/14/11  
 SUPERSEDES: 11/27/01

CURVED STEEL PLATE  
 BEARING DETAILS



NOTES:

- \* MINIMUM SOLE PLATE THICKNESS IS  $1^{1/2}''$ , MAXIMUM THICKNESS IS  $6''$ .
- FOR PINTLE DETAILS, SEE GUIDE 8.32.01.
- MAKE SOLE PLATE SAME WIDTH AS FLANGE (MIN.)
- BEVEL SOLE PLATE WHEN REQUIRED BEVEL EXCEEDS  $1/8''$  PER FOOT.
- \*\* USE FILLET WELD WHEN SOLE PLATE IS WIDER THAN FLANGE.
- \*\*\* WHEN MORE THAN  $6''$  IS REQUIRED TO OBTAIN THE ALLOWABLE MASONRY PRESSURE, USE A FIXED SHOE (SEE GUIDE 8.32.05).
- AT ABUTMENTS, USE MASONRY PLATE  $1''$  WIDER THAN SOLE PLATE (MIN.).
- PLATE THICKNESSES SHOWN ON THIS SHEET ARE FOR EITHER A572 OR A36 STEEL.

PREPARED BY  
 DESIGN DIVISION

8.42.01



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 CHECKED BY: VZ  
 APPROVED BY:

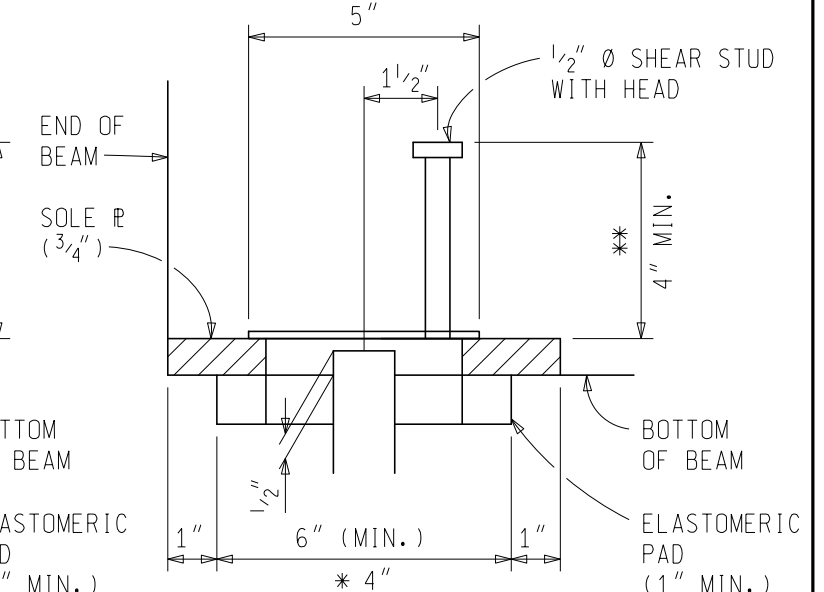
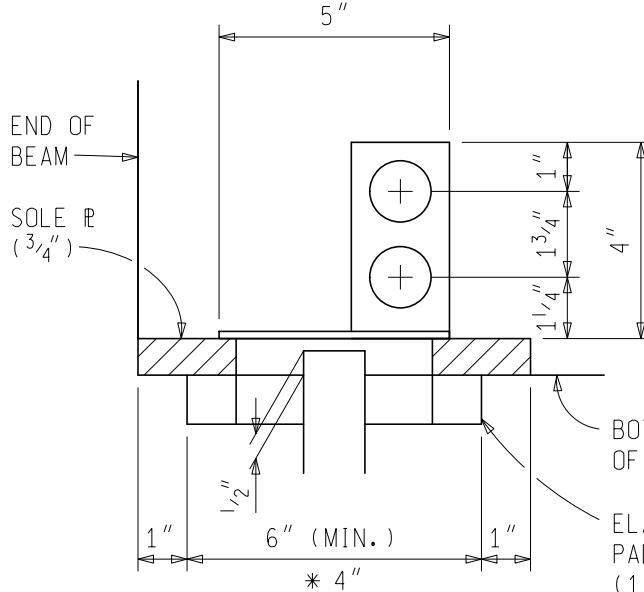
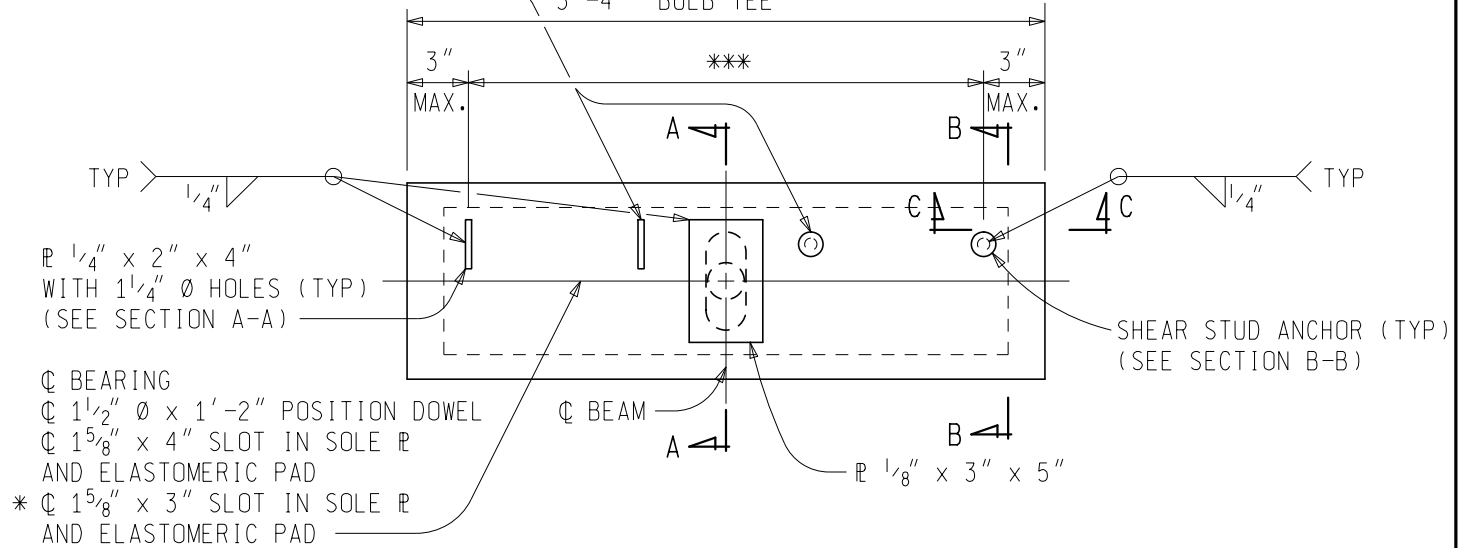
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF DEVELOPMENT

ISSUED: 09/26/22  
 SUPERSEDES: 04/17/17

BEARING DETAILS FOR  
 PRESTRESSED CONCRETE BEAMS

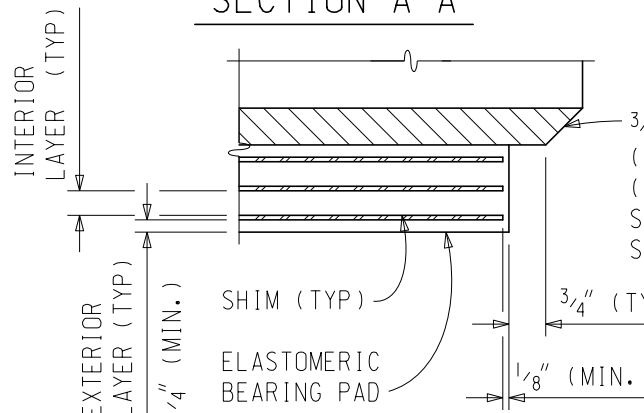
\*\*\* USE 4 ANCHORS FOR 70" I-BEAM, MICHIGAN 1800 AND BULB TEE BEAMS AND USE 2 ANCHORS FOR ALL OTHERS

- 1'-4" TYPE I
- 1'-6" TYPE II
- 1'-10" TYPE III
- 2'-2" TYPE IV AND 70" I-BEAM
- 2'-11<sup>3</sup>/<sub>8</sub>" MICHIGAN 1800
- 3'-4" BULB TEE



SECTION A-A

SECTION B-B



SECTION C-C

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

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

SOLE PLATES SHOULD BE TILTED TO PROVIDE REQUIRED BEVELS WHICH EXCEED 1/8"/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.

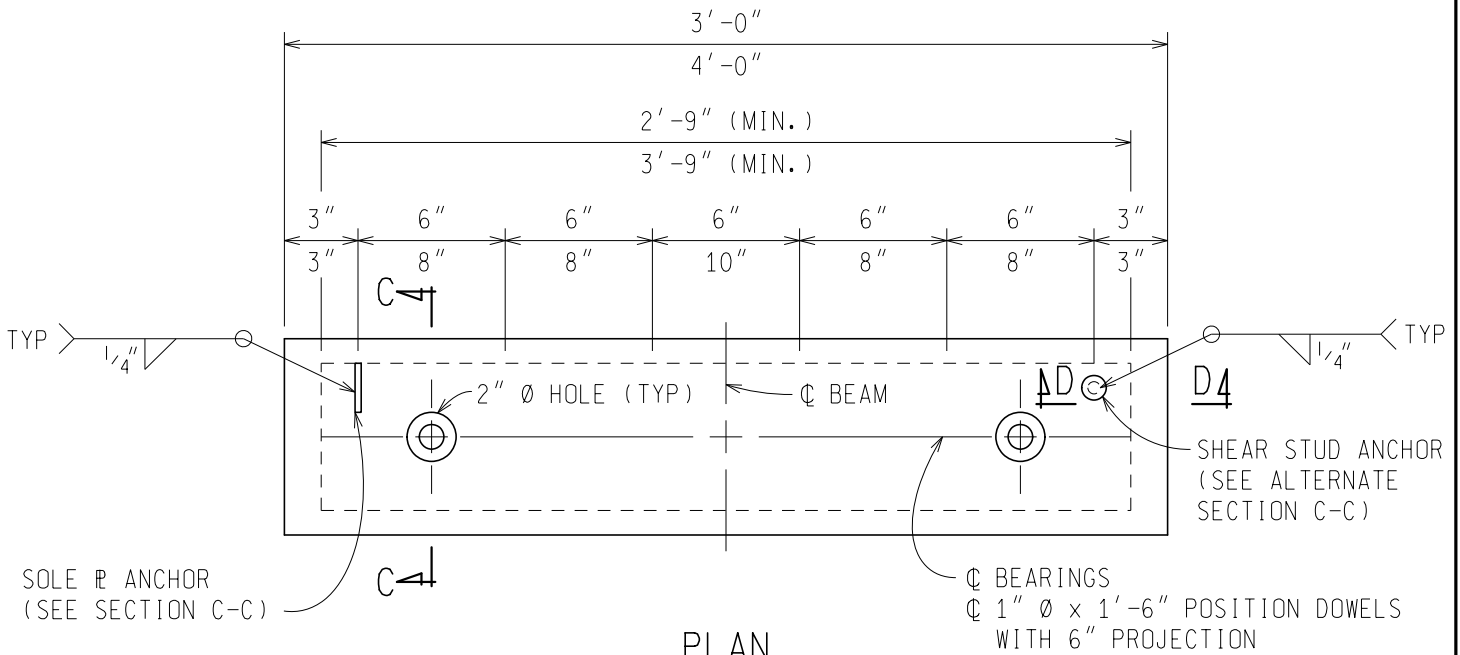
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 DESIGN DIVISION

8.43.01

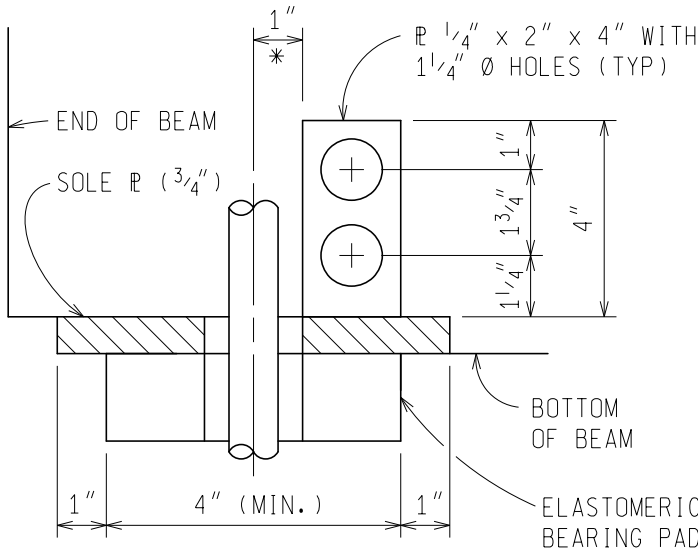
DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: T&F

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT  
 BEARING DETAILS FOR  
 PRESTRESSED CONCRETE BOX BEAMS

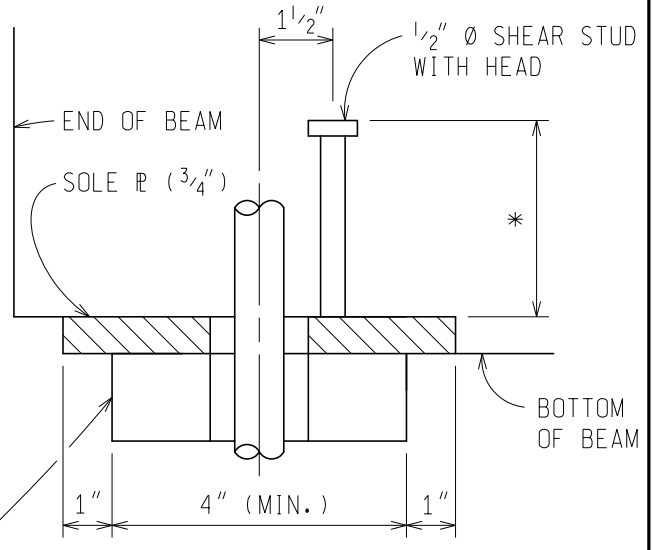
ISSUED: 02/14/11  
 SUPERSEDES: 05/04/06



PLAN



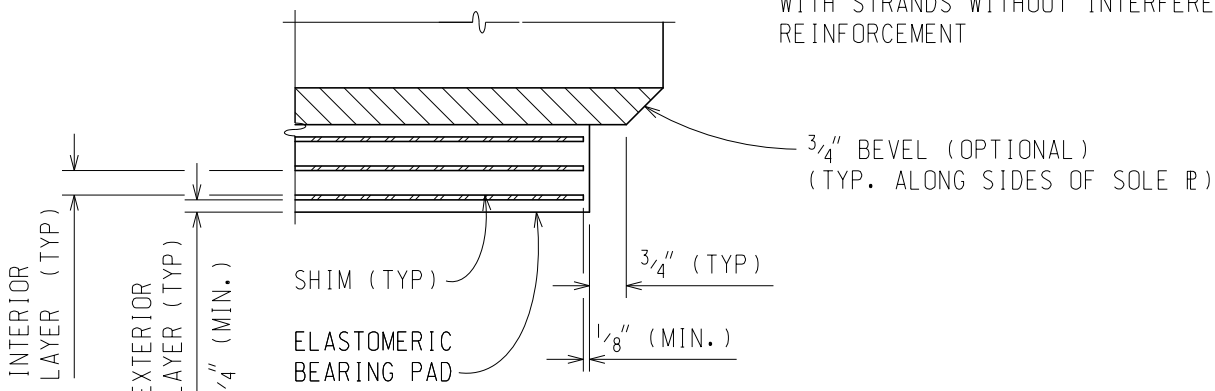
SECTION C-C



ALTERNATE SECTION C-C

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

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



SECTION D-D

## **9. UTILITY DATA**



DRAWN BY: MJB  
 CHECKED BY: VZ  
 APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES

ISSUED: 11/27/01  
 SUPERSEDES: 04/15/95

WEIGHT OF UTILITIES

POUNDS PER LINEAL FOOT

STEEL GAS MAINS						
SIZE ITEM	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							
SIZE ITEM	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							
SIZE ITEM	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	49.60	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	58.40	47.48	58.6	94.0

PREPARED BY  
 DESIGN DIV.

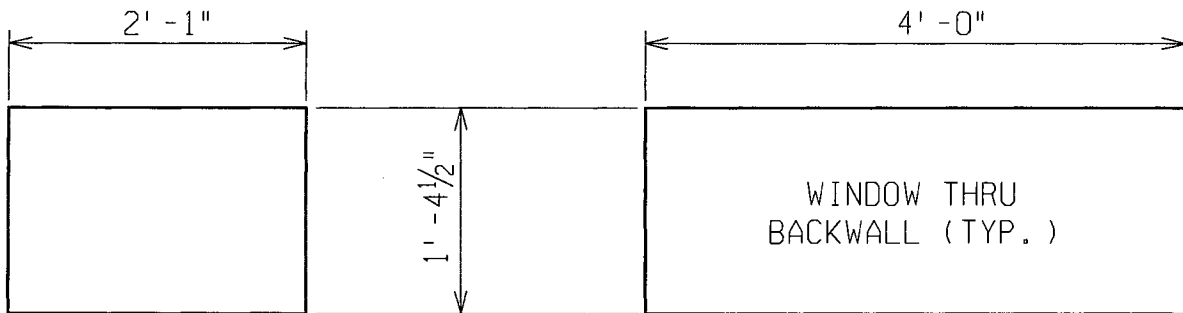
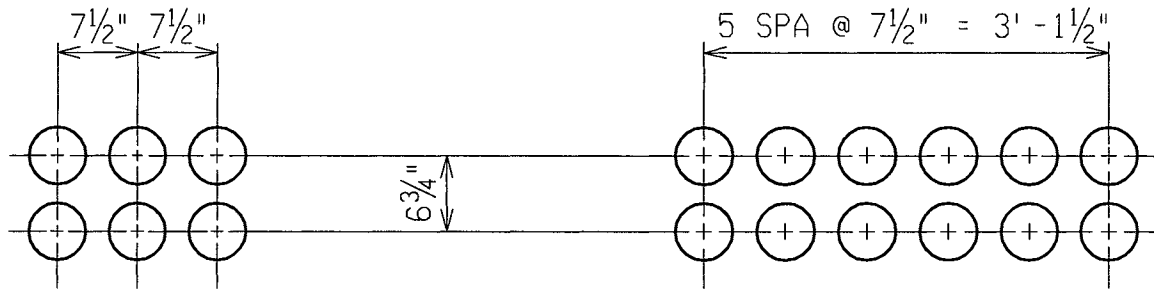
9.12.01

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 CHECKED BY: VZ  
 APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES

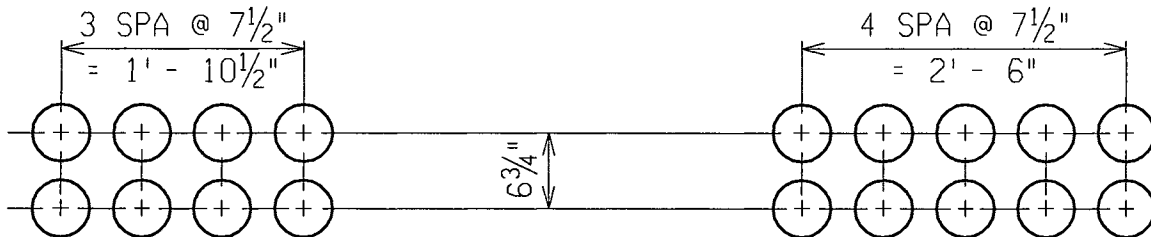
DIMENSIONS FOR 5" STEEL  
 ELECTRICAL CONDUITS

ISSUED: 11/27/01  
 SUPERSEDES: 04/15/95

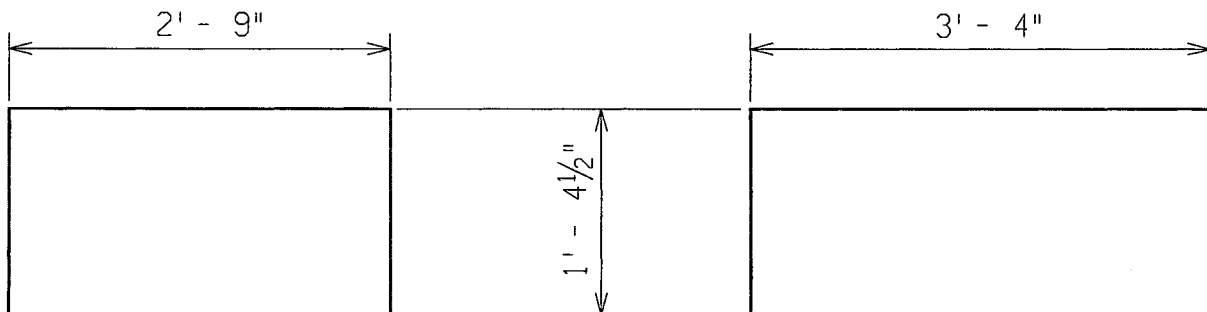


6 DUCT SECTION

12 DUCT SECTION



5" G.I. OR PLASTIC  
 COATED CONDUIT (TYP.)\*



8 DUCT SECTION

10 DUCT SECTION

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

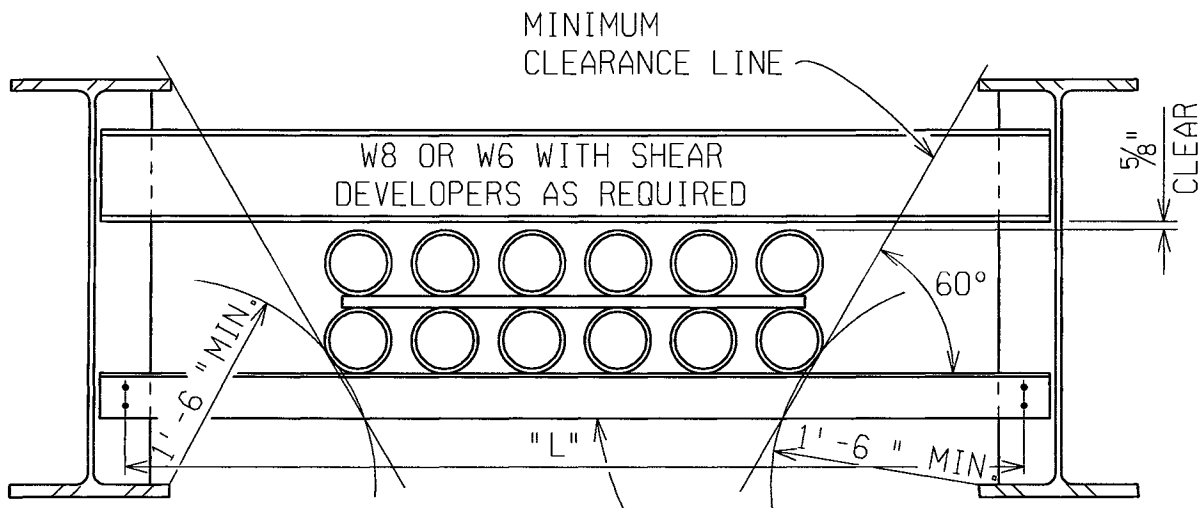
PREPARED BY  
 DESIGN DIV.

9.21.01

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

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT  
**STRUCTURAL STEEL DIAPHRAGM DETAILS  
 FOR 5" STEEL ELECTRICAL CONDUITS**

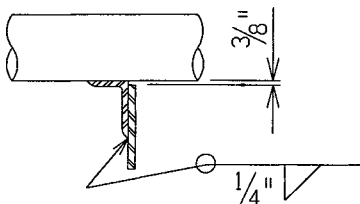
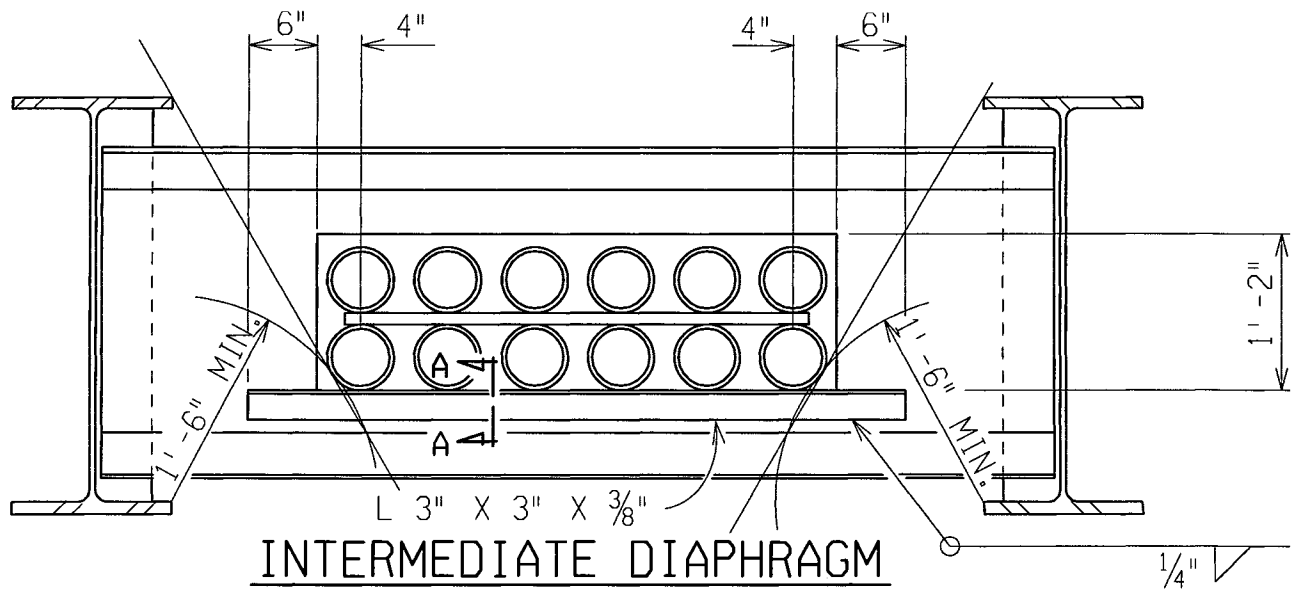
ISSUED: 05/04/06  
 SUPERSEDES: 11/27/01



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**



N \ 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

N = NUMBER OF CONDUITS.

- A - 5" x 3 1/2" x 5/16"
- B - 6" x 3 1/2" x 5/16"
- C - 6" x 3 1/2" 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 1/2"
- H - 8" x 4" x 1/2"
- J - 8" x 6" x 7/16"

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

PREPARED BY  
 DESIGN SUPPORT AREA

9.21.02

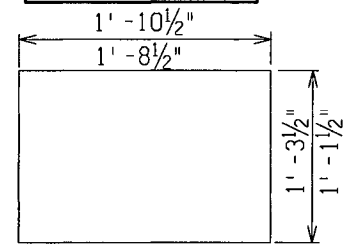
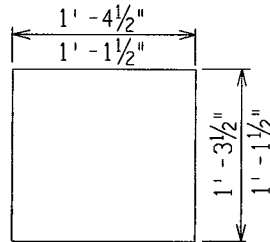
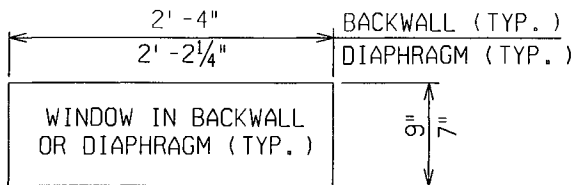
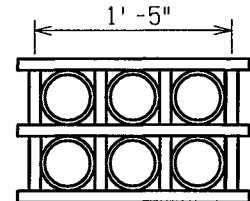
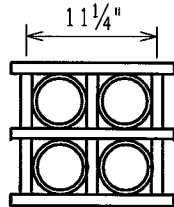
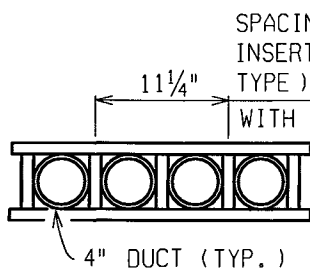
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 CHECKED BY: VZ  
 APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

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

DIMENSIONS FOR  
 TELEPHONE COMPANY 4" DUCTS

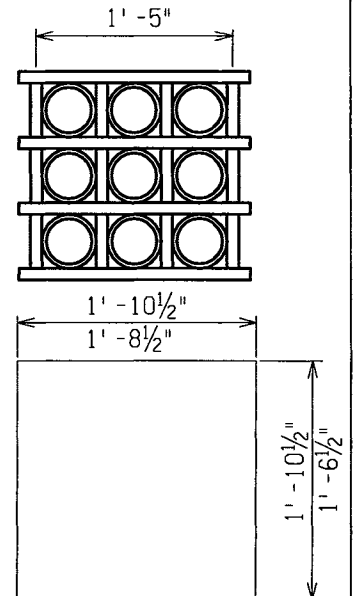
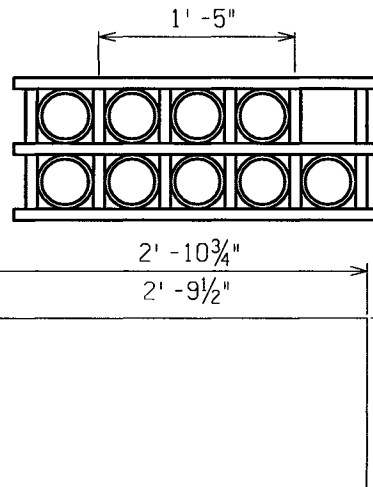
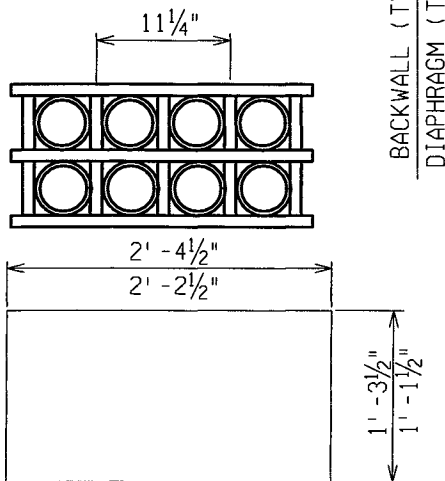
SPACING FOR  $\frac{3}{4}$ "  $\phi$  CONC.  
 INSERTS (DOUBLE NAIL ON  
 TYPE) FILL THREADS  
 WITH GREASE. (TYP.)



4 DUCT FORMATION

4 DUCT FORMATION

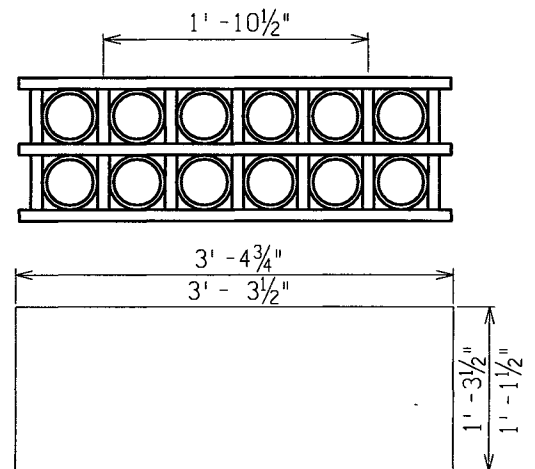
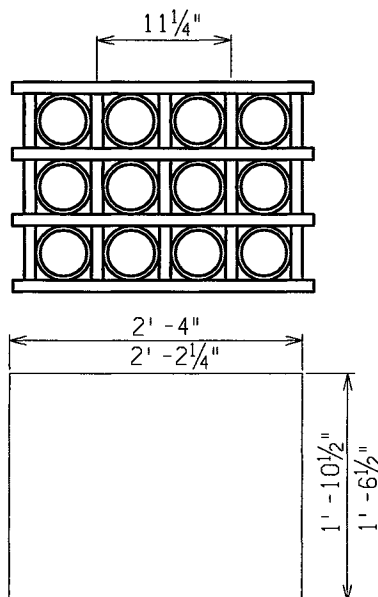
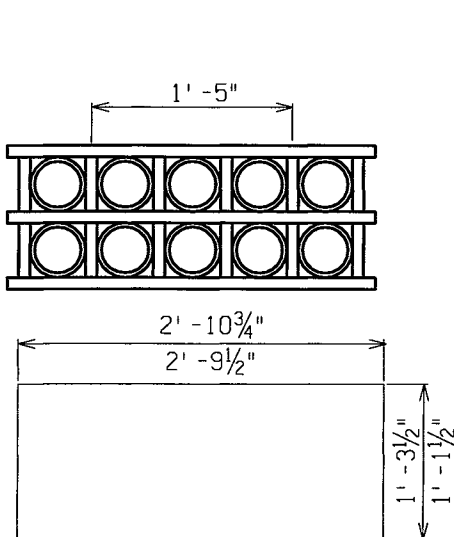
6 DUCT FORMATION



8 DUCT FORMATION

9 DUCT FORMATION

9 DUCT FORMATION



10 DUCT FORMATION

12 DUCT FORMATION

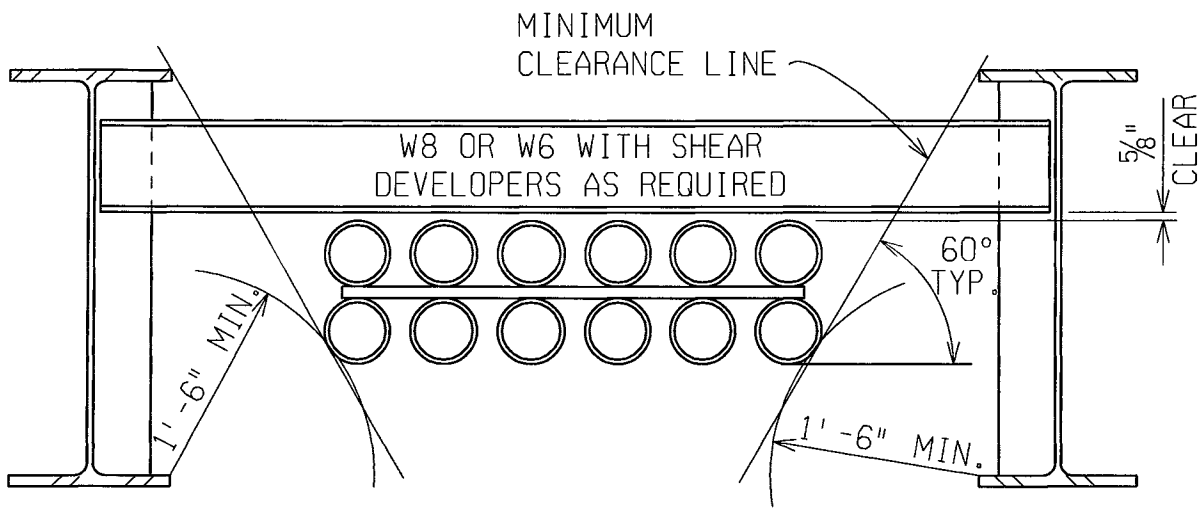
12 DUCT FORMATION



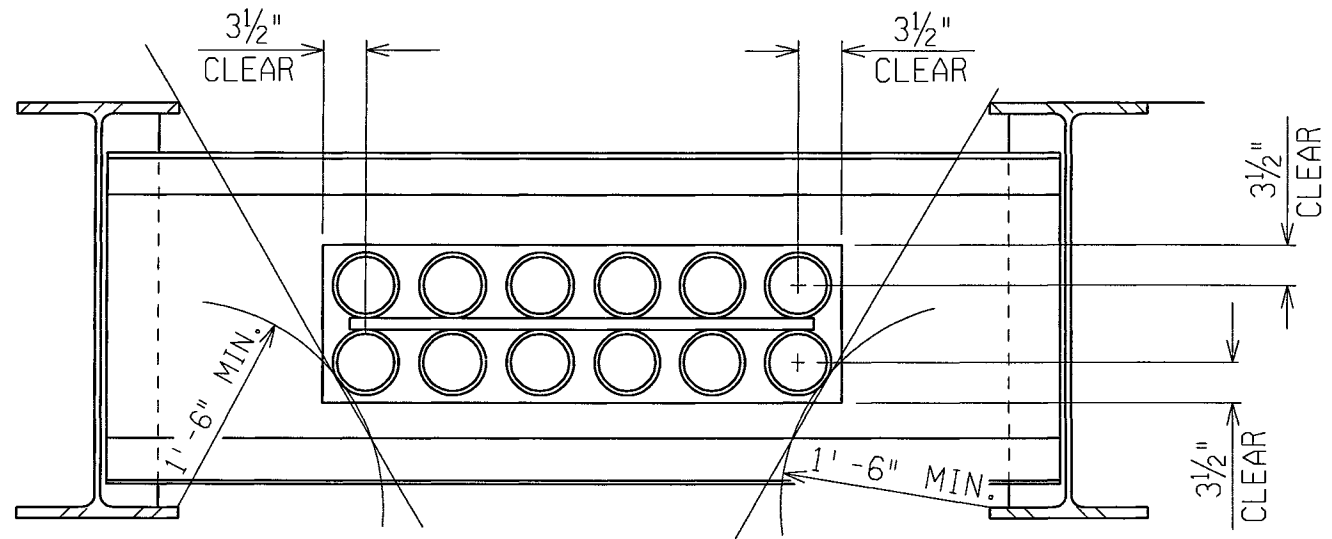
DRAWN BY: BLT  
CHECKED BY: VZ  
APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY 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 SUPPORT AREA

9.21.04

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

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

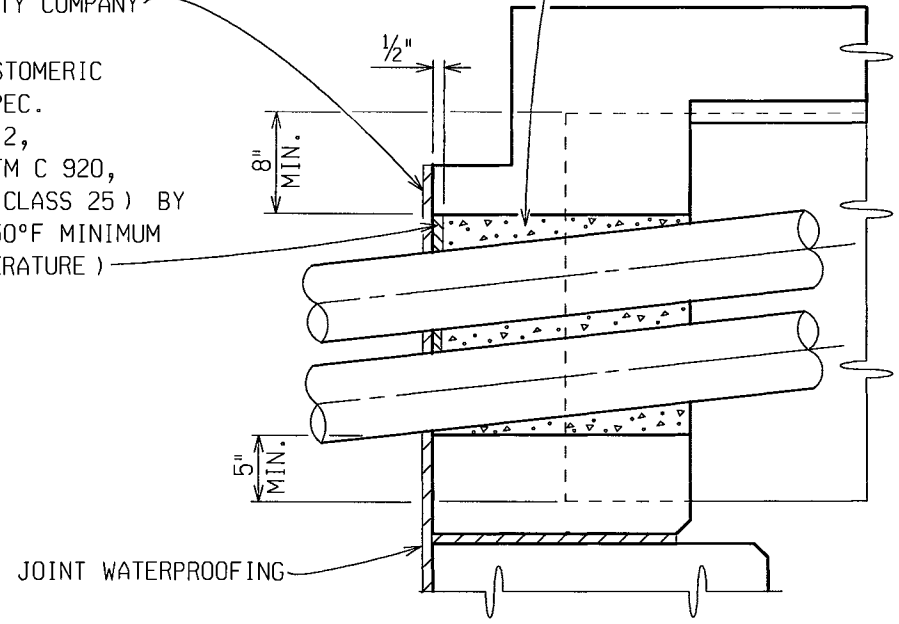
ISSUED: 05/04/06  
 SUPERSEDES: 08/15/03

BACKWALL DETAILS FOR ELECTRICAL  
 AND TELEPHONE CONDUITS

WATERPROOF WITH BITUMINOUS  
 CAULKING COMPOUND AS APPROVED  
 BY THE ENGINEER.  
 APPLY MINIMUM OF ONE WEEK  
 AFTER ELASTOMERIC SEALANT IS PLACED.  
 BY UTILITY COMPANY

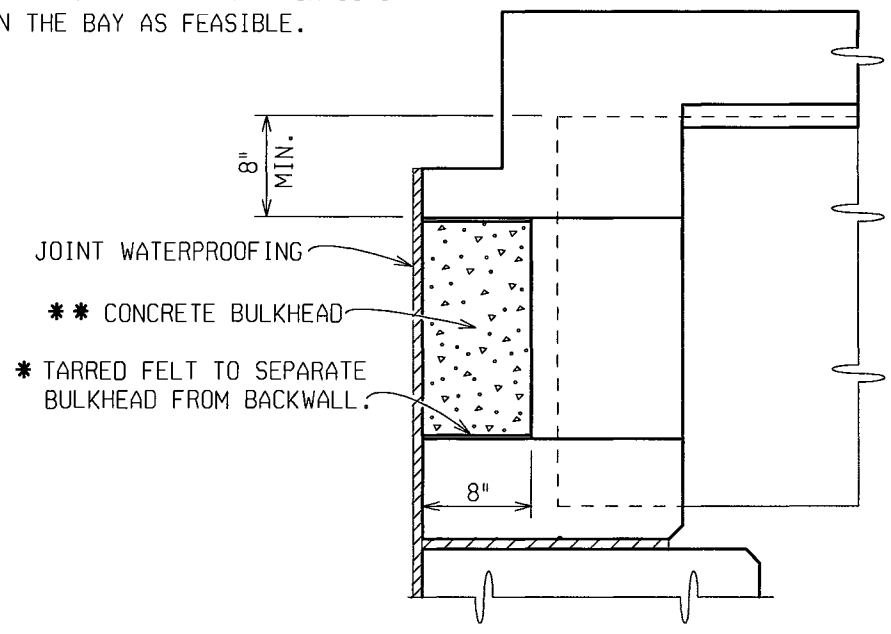
UTILITY TO PLACE CONDUIT AND  
 GROUT IN PLACE WITH A NON-SHRINKING  
 MORTAR (SEE STD. SPECIFICATIONS  
 702.02B)

ONE-COMPONENT ELASTOMERIC  
 SEALANT. (FED. SPEC.  
 TT-S-00230C, TYPE 2,  
 CLASS A OR B; ASTM C 920,  
 TYPE S, GRADE NS, CLASS 25) BY  
 UTILITY COMPANY (50°F MINIMUM  
 INSTALLATION TEMPERATURE)



INITIAL INSTALLATION

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



FUTURE INSTALLATION

- \* INCIDENTAL TO SUPERSTRUCTURE CONCRETE.
- \*\* INCLUDED WITH SUPERSTRUCTURE CONCRETE QUANTITY.

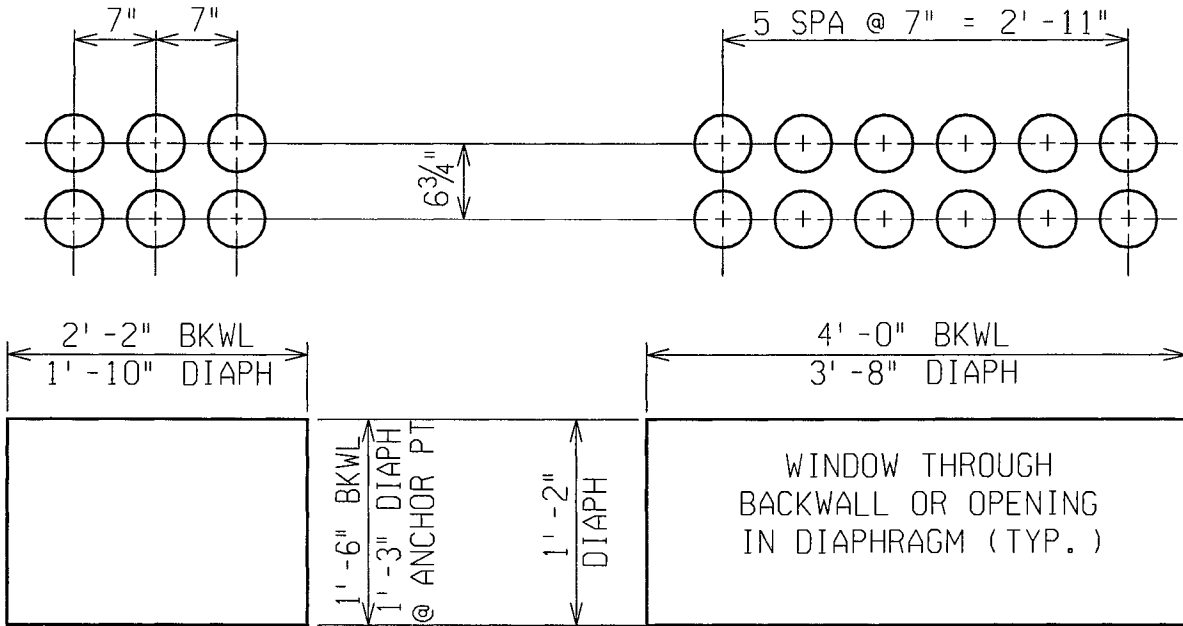
PREPARED BY  
 DESIGN SUPPORT AREA

9.21.05

DRAWN BY: MJB  
 CHECKED BY: VZ  
 APPROVED BY: TGF

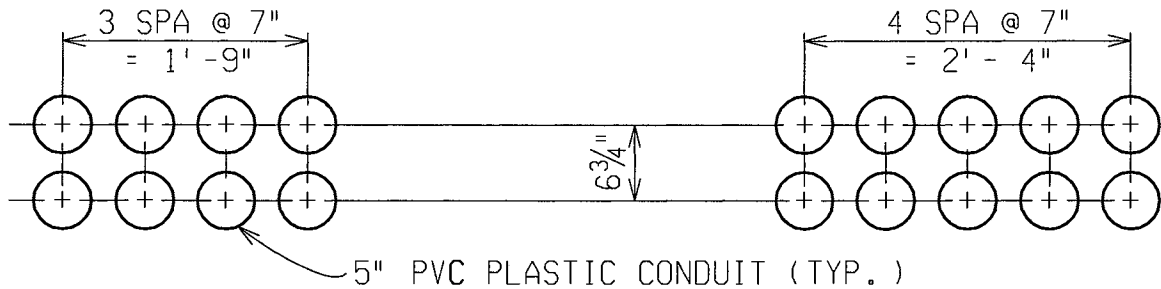
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES  
 DIMENSIONS FOR 5" P.V.C.  
 ELECTRICAL CONDUITS

ISSUED: 11/27/01  
 SUPERSEDES: 04/15/95



6 DUCT SECTION

12 DUCT SECTION



8 DUCT SECTION

10 DUCT SECTION

PREPARED BY  
 DESIGN DIV.

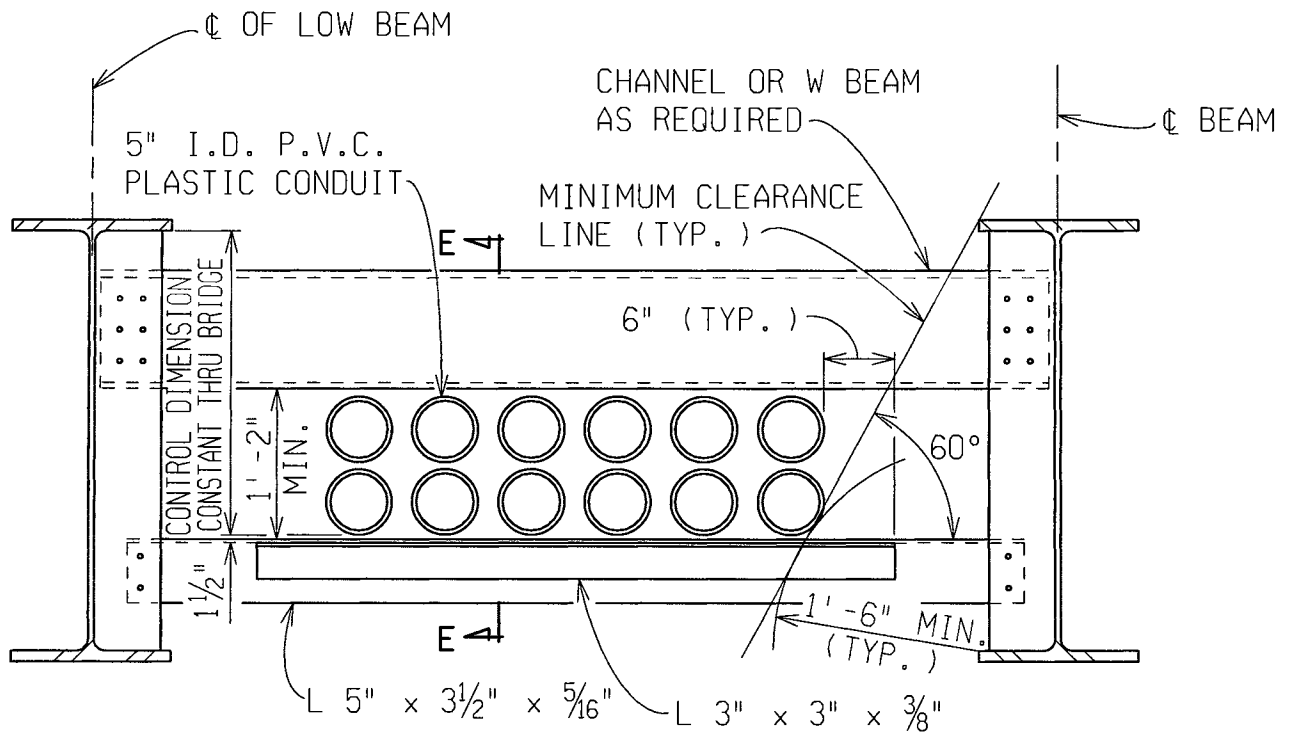
9.22.01

DRAWN BY: MJB  
 CHECKED BY: VZ  
 APPROVED BY: TGF

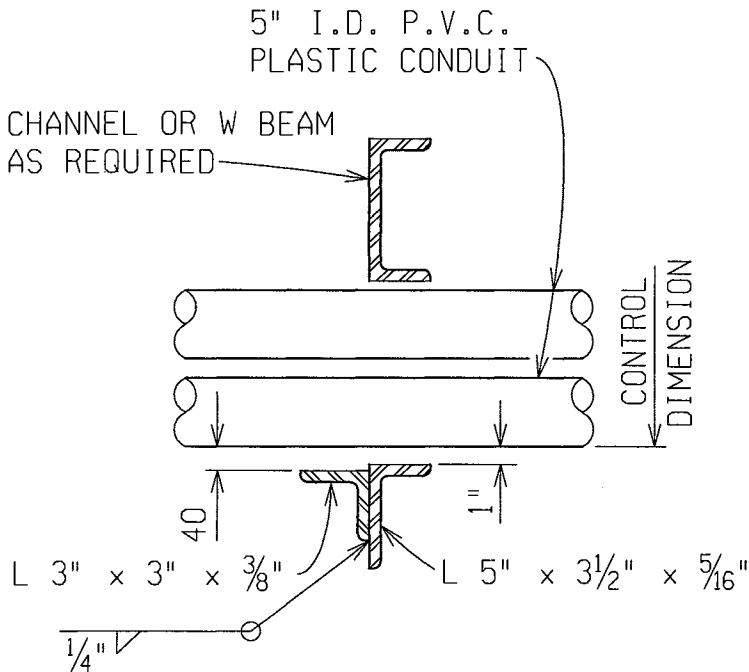
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES

STRUCTURAL STEEL DIAPHRAGM DETAILS  
 FOR 5" 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 DIV.

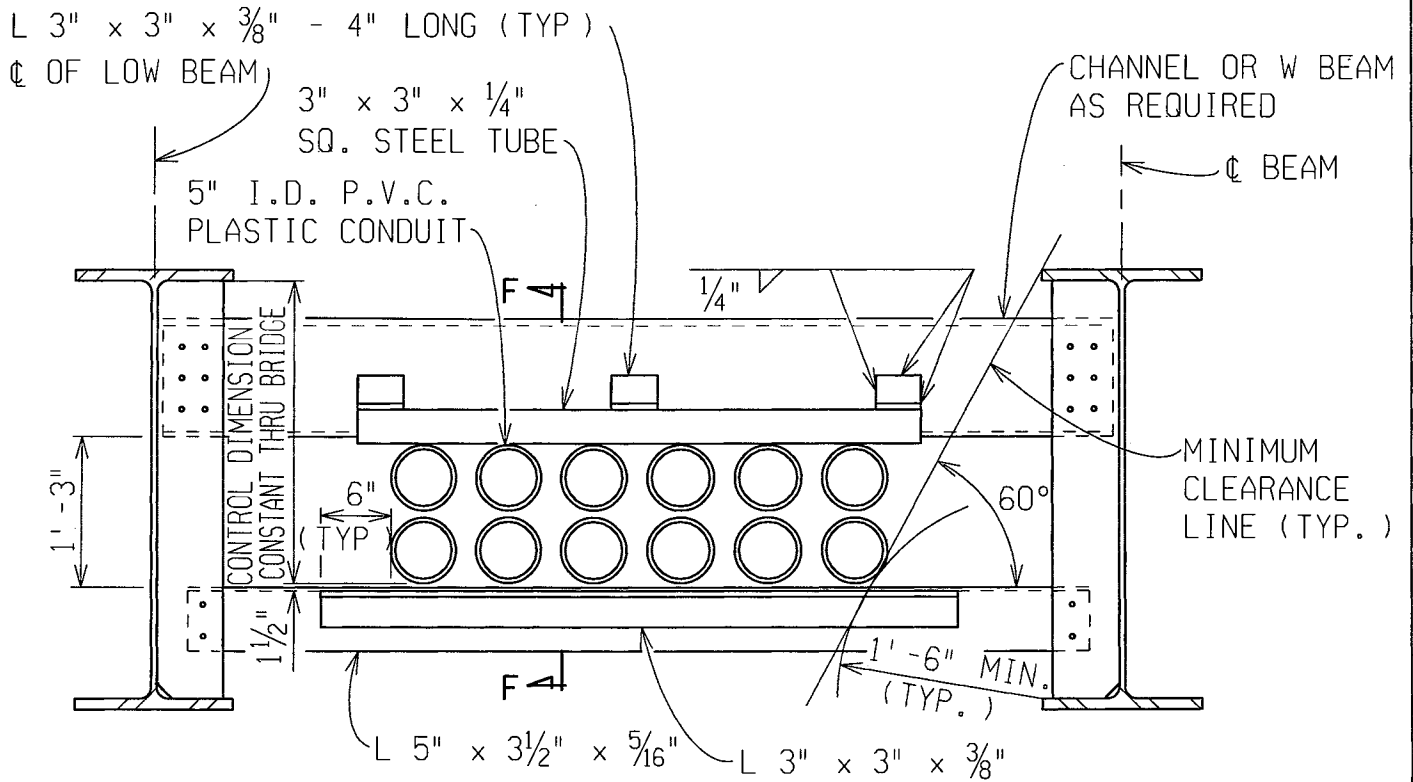
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 CHECKED BY: VZ  
 APPROVED BY: TGF

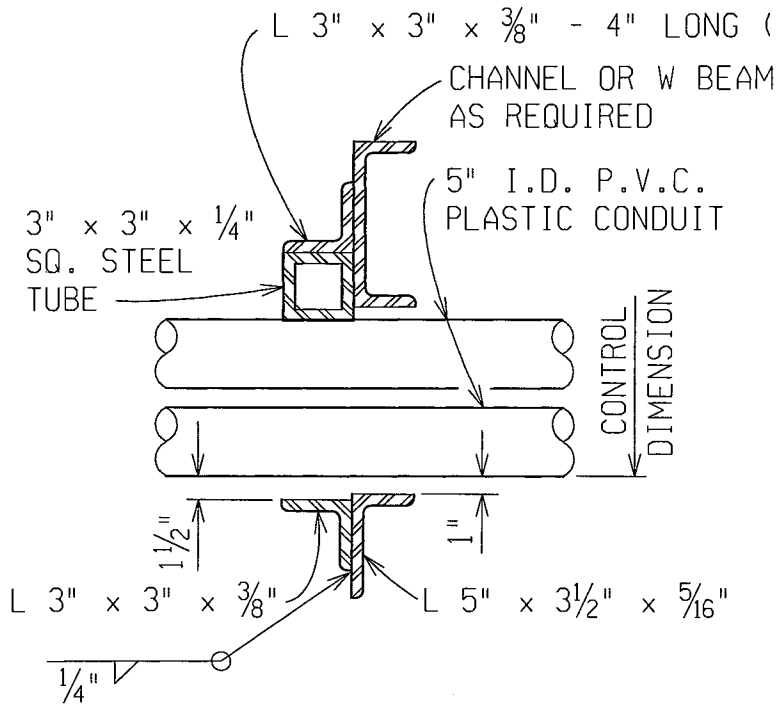
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES

STRUCTURAL STEEL DIAPHRAGM DETAILS  
 FOR 5" P.V.C. ELECTRICAL CONDUITS

ISSUED: 11/27/01  
 SUPERSEDES: 04/15/95



**END DIAPHRAGM @ 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 DIV.

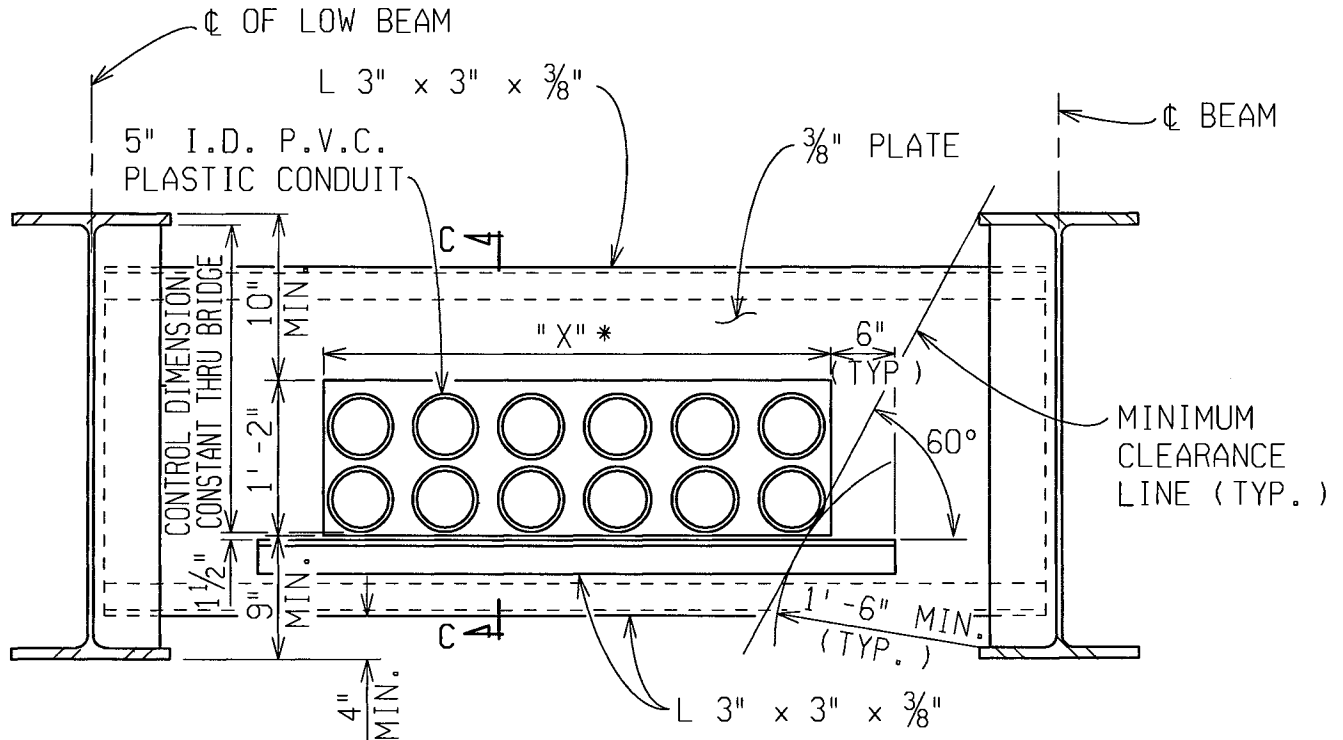
9.22.03

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

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

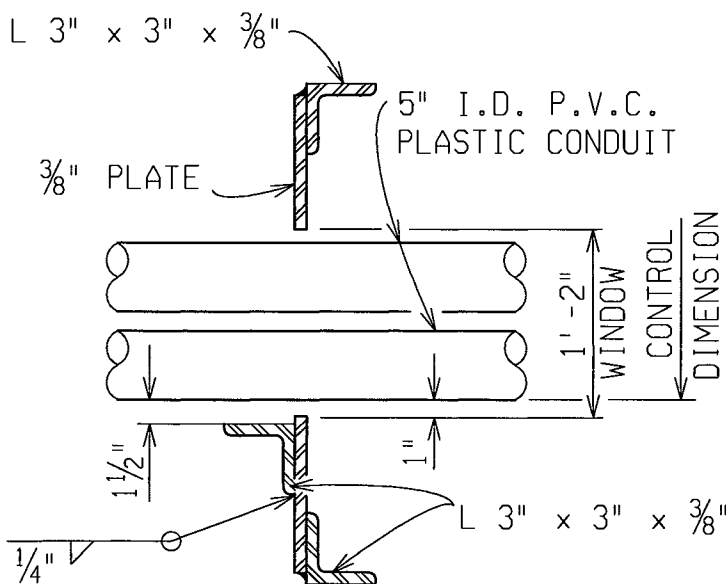
ISSUED: 08/15/03  
 SUPERSEDES: 11/27/01

STRUCTURAL STEEL DIAPHRAGM DETAILS  
 FOR 5" P.V.C. ELECTRICAL CONDUITS



**INTERMEDIATE DIAPHRAGM**

\* 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.

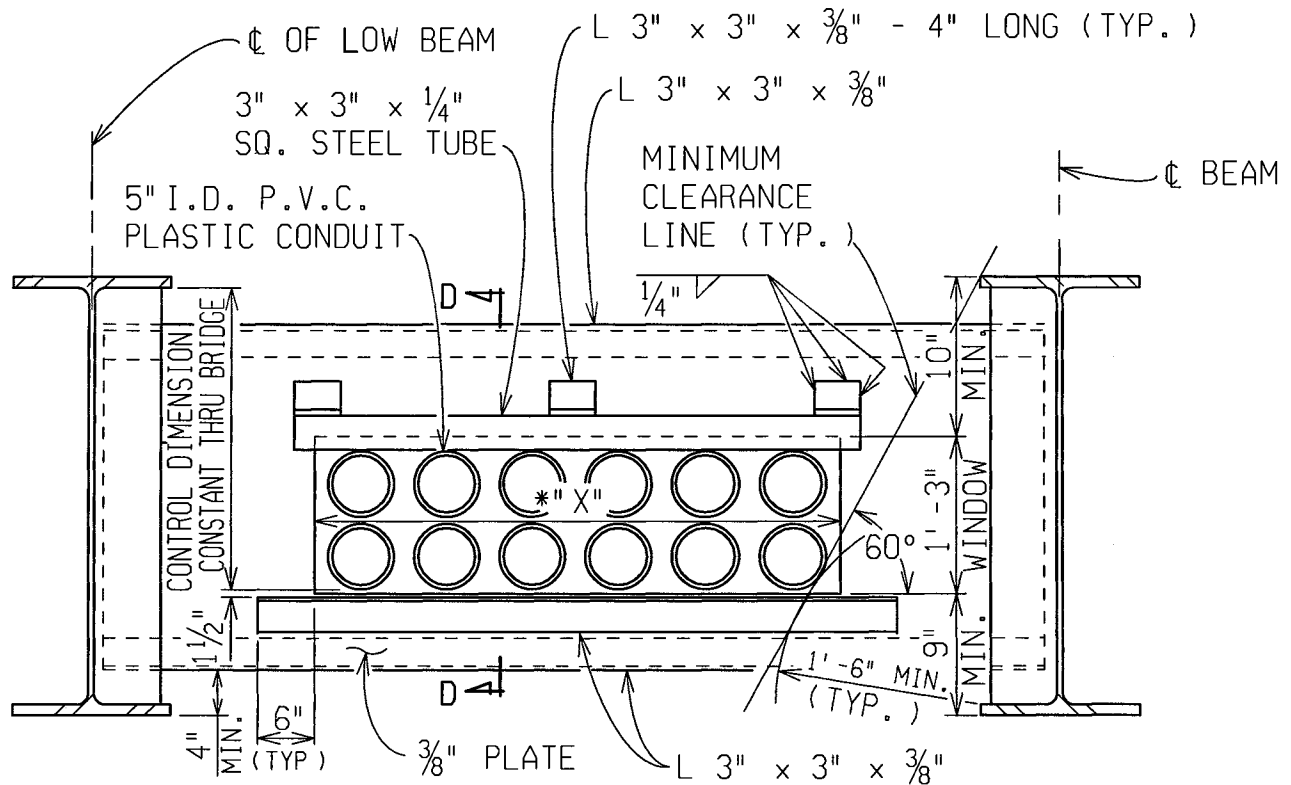
TO MAINTAIN VERTICAL ALIGNMENT, THE "CONTROL DIMENSION" FROM THE BOTTOM OF THE TOP FLANGE OF THE BEAM TO THE BOTTOM OF THE BOTTOM DUCT SHALL BE MAINTAINED THROUGHOUT THE BRIDGE. ALIGNMENT AT EXPANSION JOINT IS VERY CRITICAL.

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

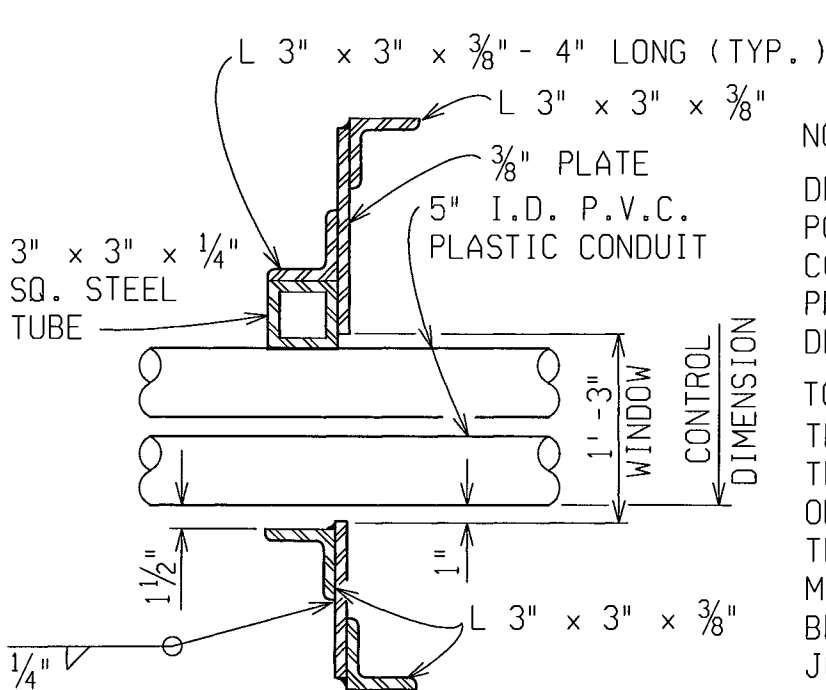
DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT  
**STRUCTURAL STEEL DIAPHRAGM DETAILS  
 FOR 5" P.V.C. ELECTRICAL CONDUITS**

ISSUED: 08/15/03  
 SUPERSEDES: 11/27/01



**INTERMEDIATE DIAPHRAGM @ ANCHOR POINT**



**SECTION D-D**

\* FOR VALUES OF "X" SEE  
 BRIDGE DESIGN GUIDE 9.22.01

**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.

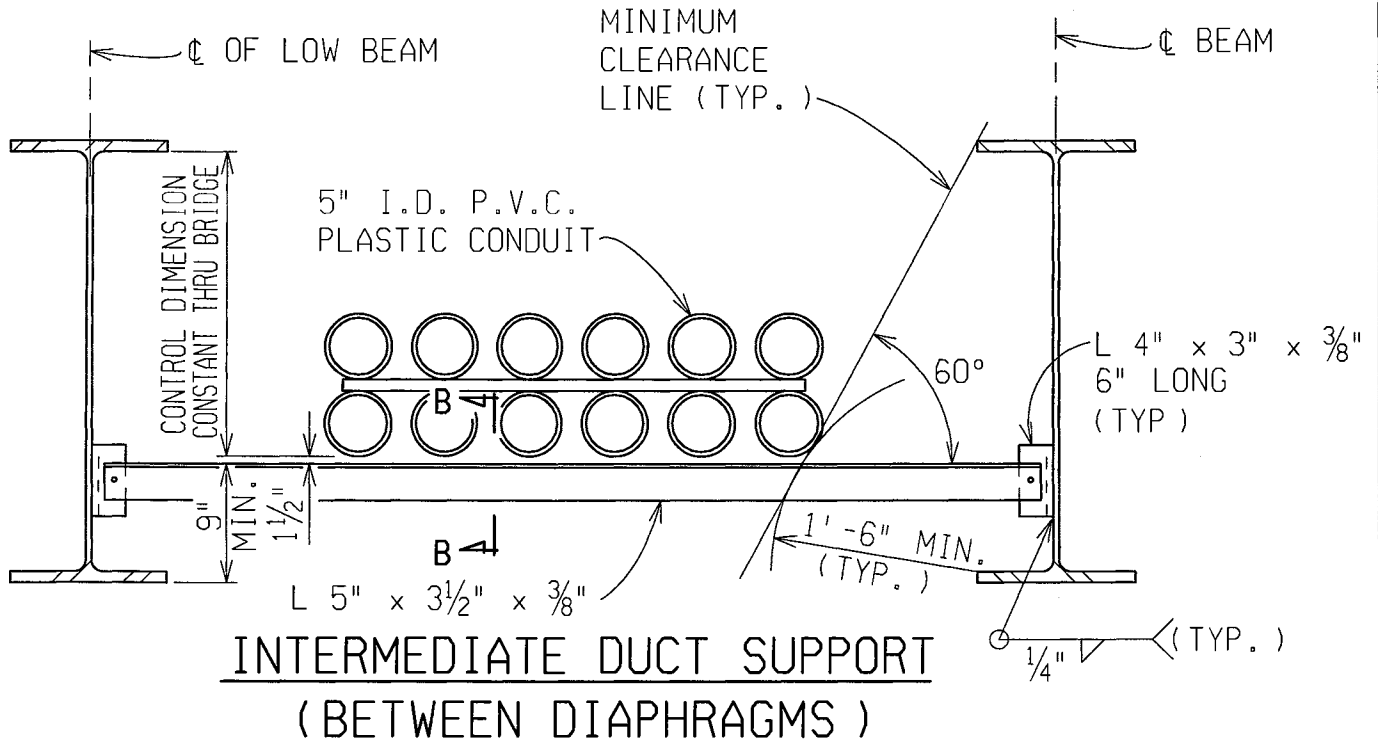
THE MAXIMUM DISTANCE BETWEEN SUPPORTS IS NOT TO EXCEED 8'.

DRAWN BY: MJB  
 CHECKED BY: VZ  
 APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICES

STRUCTURAL STEEL DIAPHRAGM DETAILS  
 FOR 5" P.V.C. ELECTRICAL CONDUITS

ISSUED: 11/27/01  
 SUPERSEDES: 04/15/95

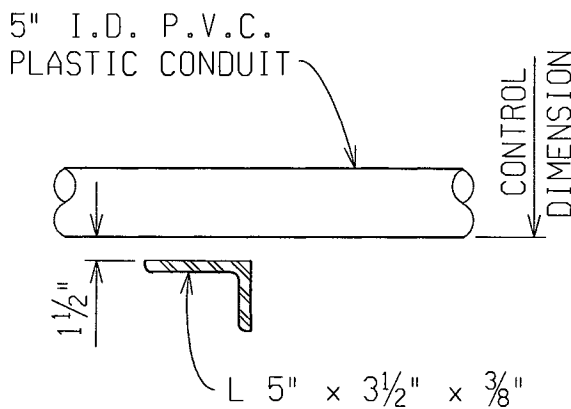


**NOTES:**

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 DIV.

9.22.06

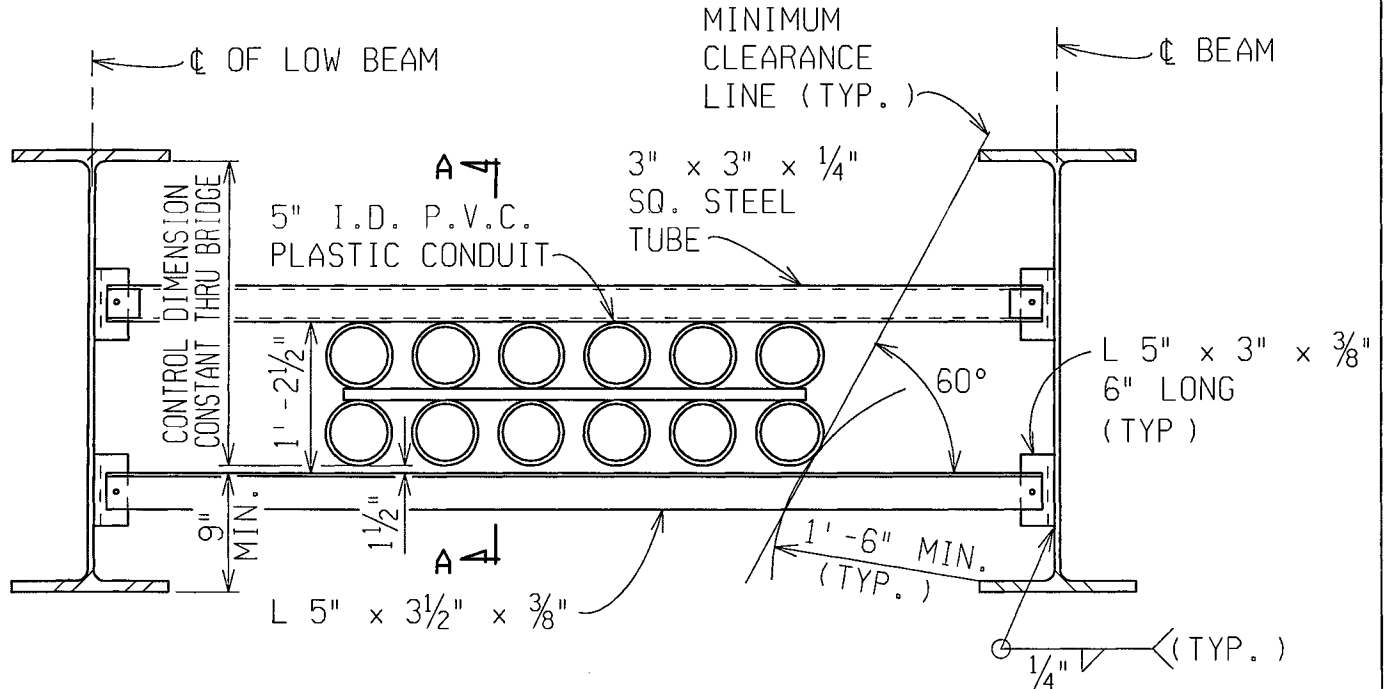


DRAWN BY: MJB  
 CHECKED BY: VZ  
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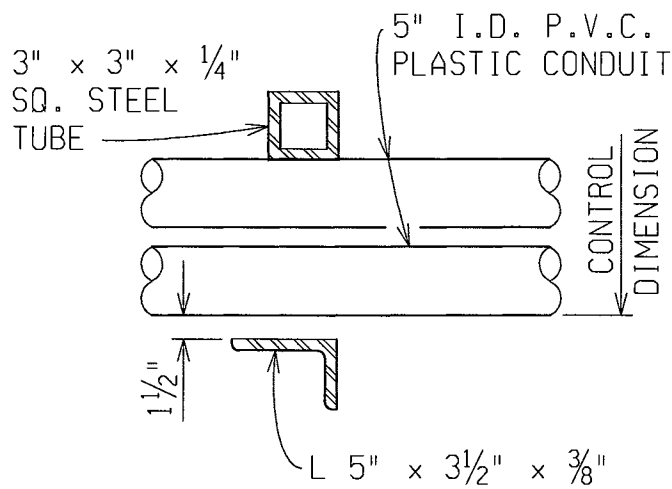
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY TECHNICAL SERVICE

STRUCTURAL STEEL DIAPHRAGM DETAILS  
 FOR 5" P.V.C. ELECTRICAL CONDUITS

ISSUED: 11/27/01  
 SUPERSEDES: 04/15/95



**INTERMEDIATE DUCT SUPPORT @ 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 DIV.

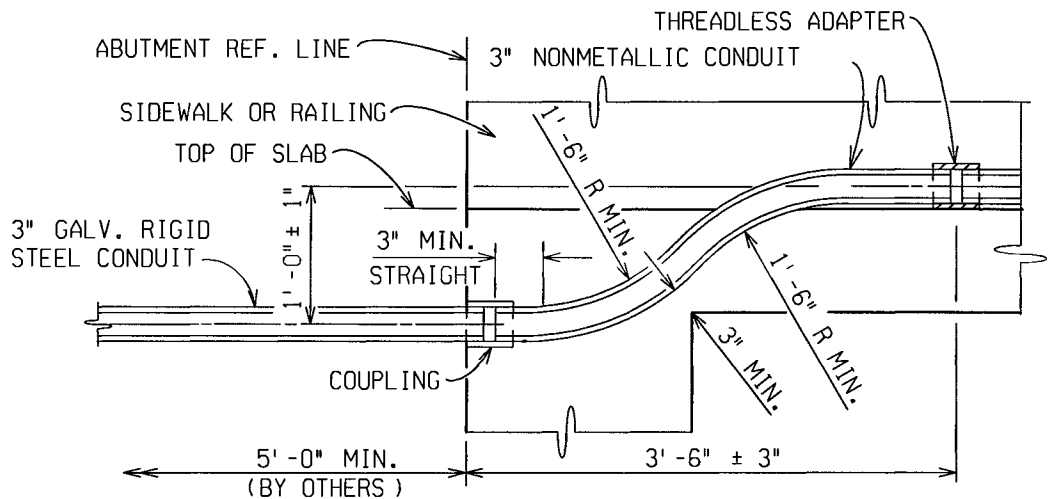
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DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: TGF

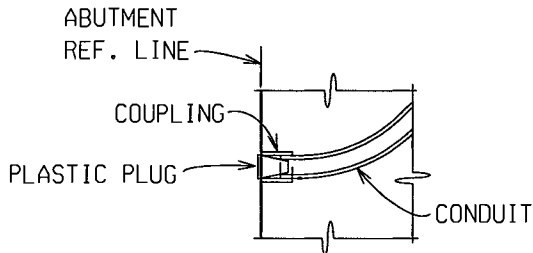
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

NONMETALLIC CONDUITS  
 IN SIDEWALK

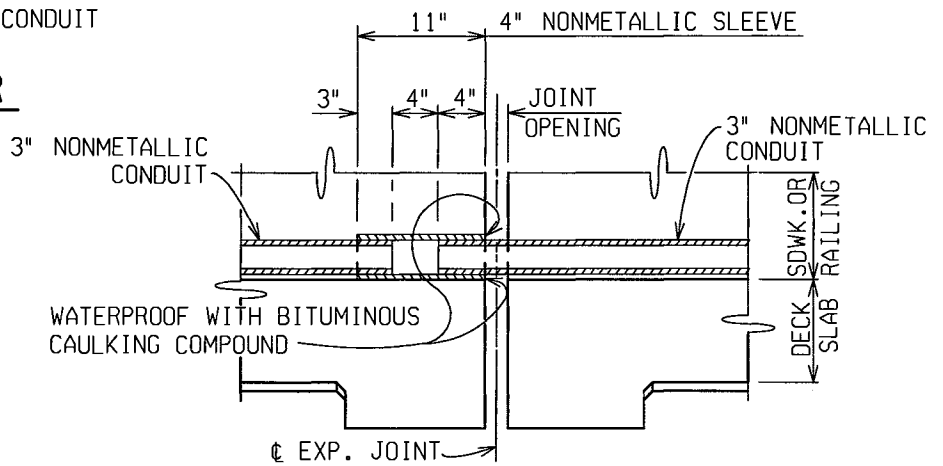
ISSUED: 08/15/03  
 SUPERSEDES: 11/27/01



SECTION AT BACKWALL



INSTALLATION FOR  
 FUTURE USE



SECTION AT TRANSVERSE  
 EXPANSION JOINT

NOTES:

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 SUPPORT AREA

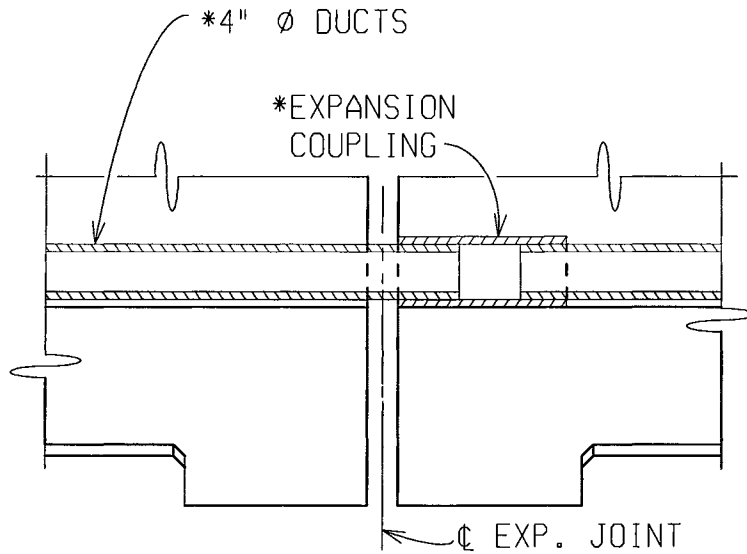
9.31.01

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

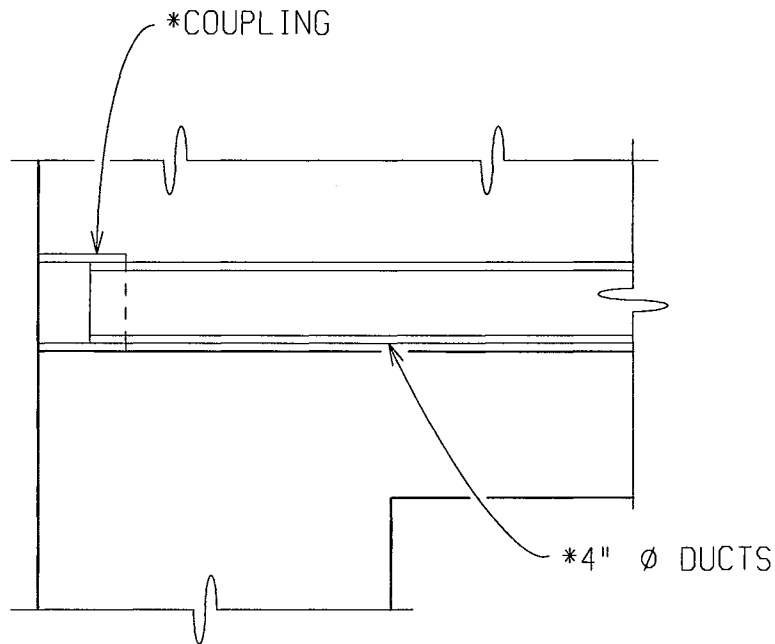
MICHIGAN DEPARTMENT OF TRANSPORTATION  
BUREAU OF HIGHWAY DEVELOPMENT

TELEPHONE COMPANY  
DUCTS IN SIDEWALK

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



SECTION THRU SIDEWALK AT EXP. JTS.



SECTION THRU SIDEWALK AT REF. LINES

\* FURNISHED AND INSTALLED BY  
TELEPHONE COMPANY.

PREPARED BY  
DESIGN SUPPORT AREA

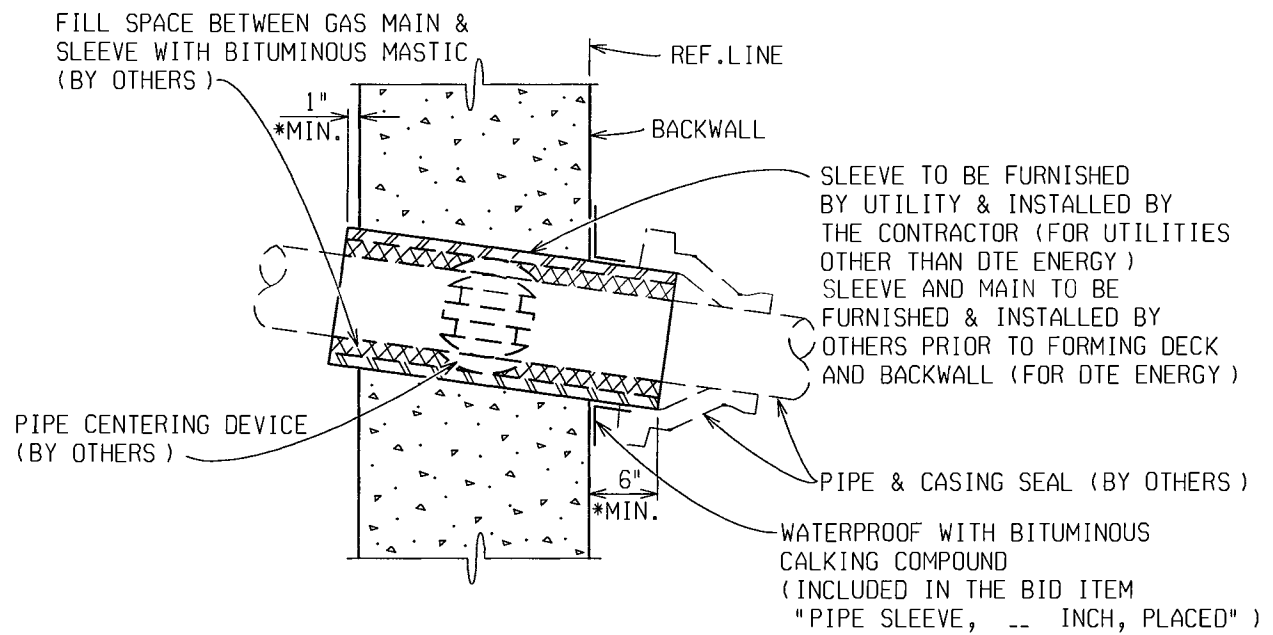
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 APPROVED BY: TGF

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

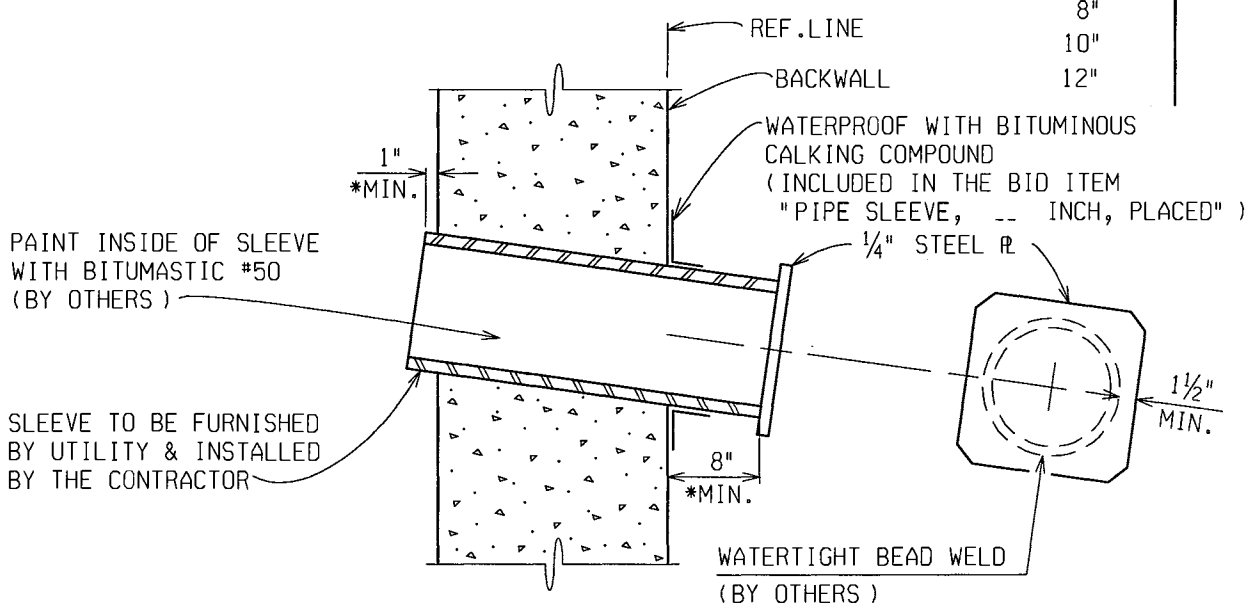
ISSUED: 05/04/06  
 SUPERSEDES: 08/15/03

**GAS MAIN  
 THROUGH BACKWALL**



**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' -0" MINIMUM FOR DTE ENERGY

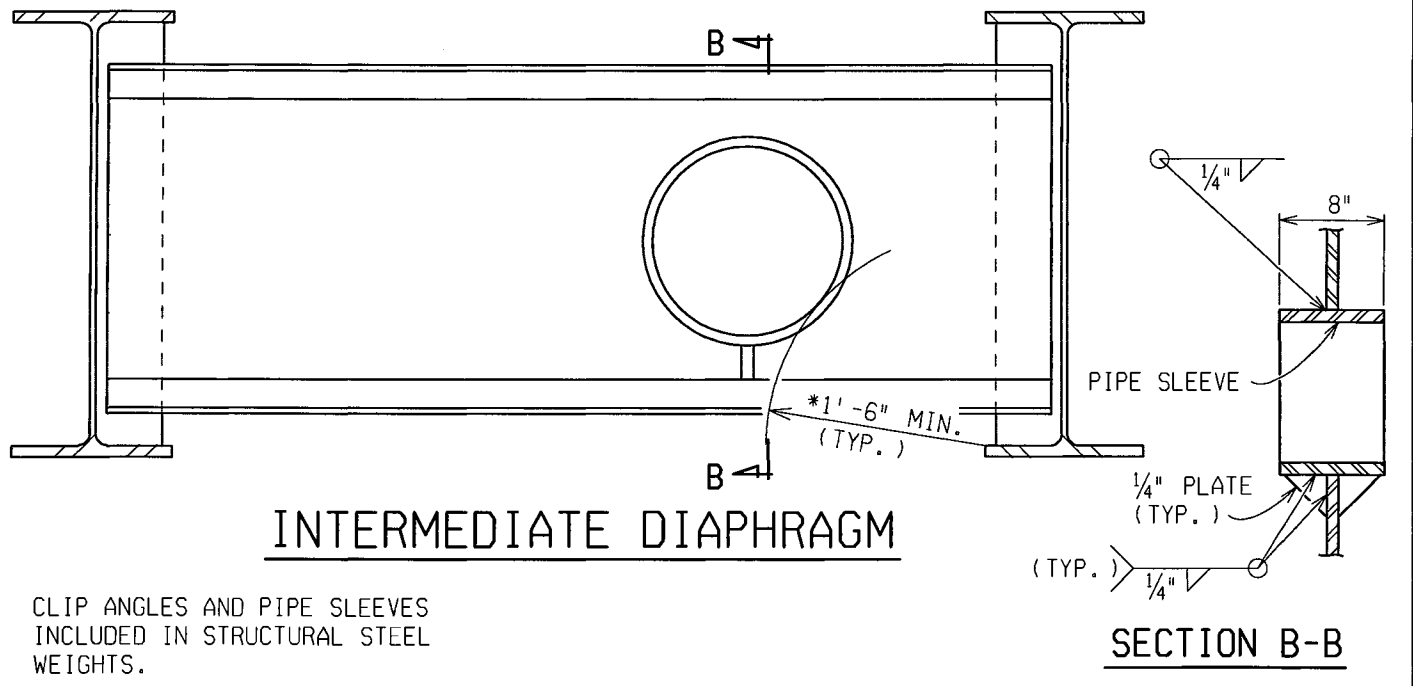
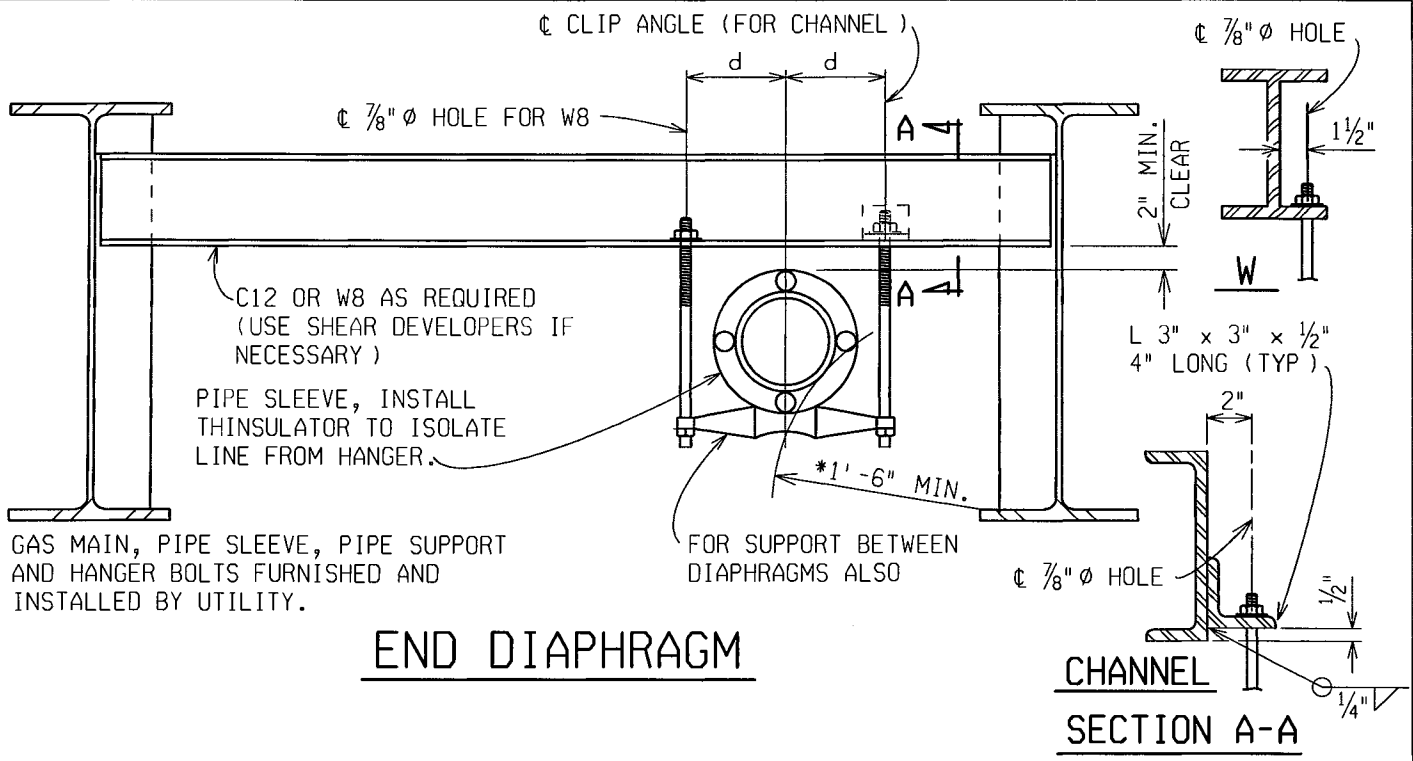
PREPARED BY  
 DESIGN SUPPORT AREA

9.40.01

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

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT  
**STRUCTURAL STEEL DIAPHRAGM DETAILS**  
 CONSUMERS ENERGY GAS MAINS

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



CLIP ANGLES AND PIPE SLEEVES INCLUDED IN STRUCTURAL STEEL WEIGHTS.

PIPE SIZE (in)	SLEEVE SIZE (in)	d (in)	**MAX. SPACING OF SUPPORTS (in)
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')

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

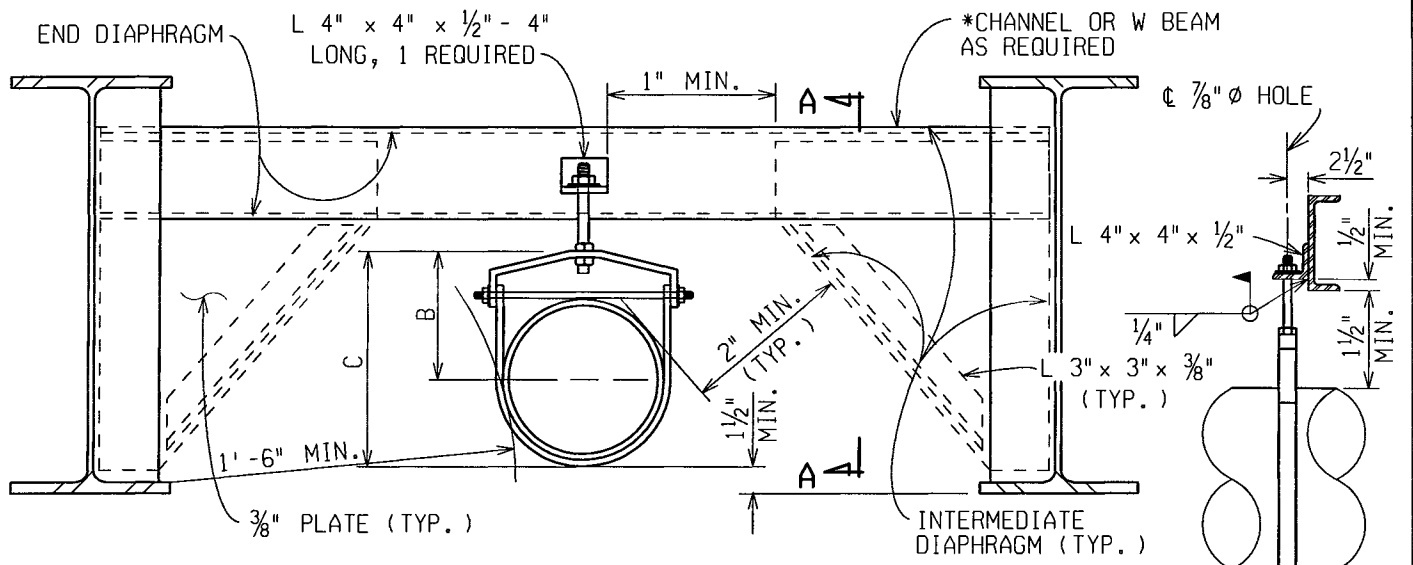
\*\* PROVIDE ADDITIONAL SUPPORTS BETWEEN DIAPHRAGMS WITH CONCRETE INSERTS IN SLAB IF REQUIRED. CONCRETE INSERTS TO BE FURNISHED BY CONSUMERS ENERGY AND INSTALLED BY THE CONTRACTOR.

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

MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

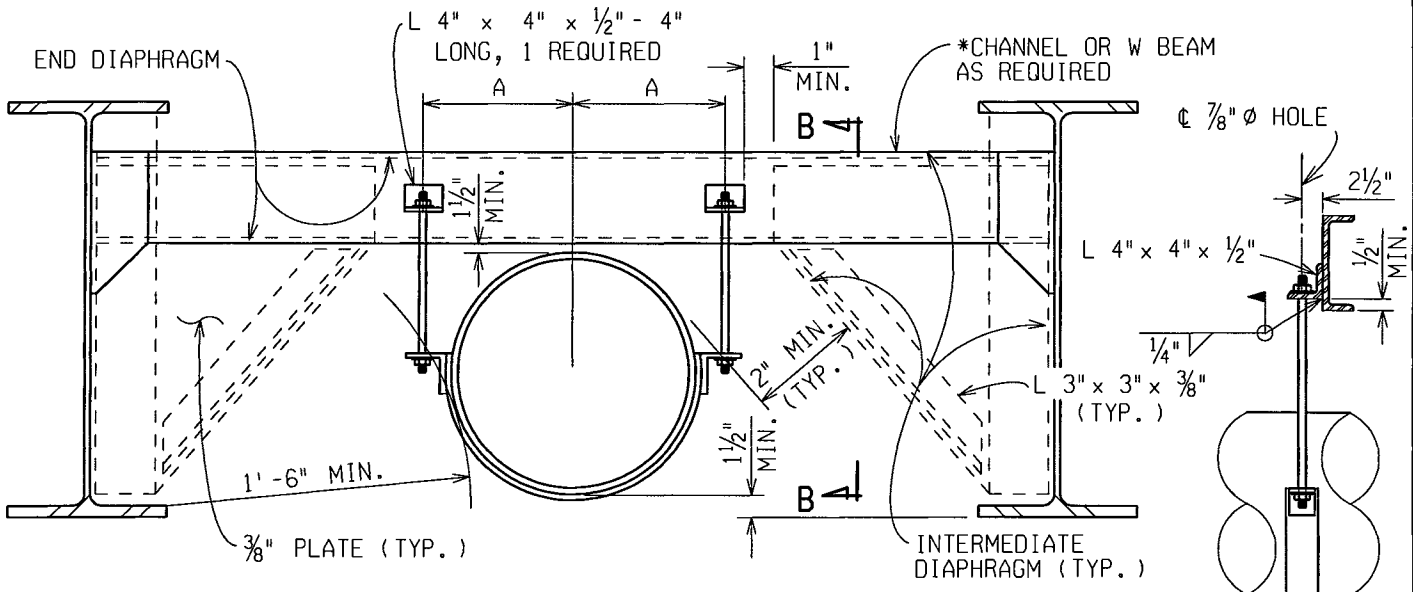
STRUCTURAL STEEL DIAPHRAGM  
 DTE ENERGY GAS MAINS

ISSUED: 05/04/06  
 SUPERSEDES: 08/15/03



FOR GAS MAINS 1'-0" & UNDER

SECTION A-A



FOR GAS MAINS 1'-0" & OVER

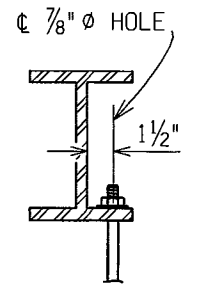
SECTION B-B

PIPE SIZE	DIMENSION		
	A	B	C
4"		5 1/2"	8"
6"		7"	10 1/2"
8"		8"	12 1/2"
12"	8 1/2"	11"	17 1/2"
16"	11"		
22"	14"		
24"	15"		

\* 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

DRAWN BY: BLT  
 CHECKED BY: VZ  
 APPROVED BY: T&F

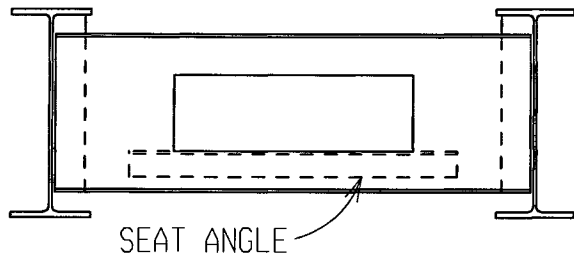
MICHIGAN DEPARTMENT OF TRANSPORTATION  
 BUREAU OF HIGHWAY DEVELOPMENT

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

UTILITY CHARGES

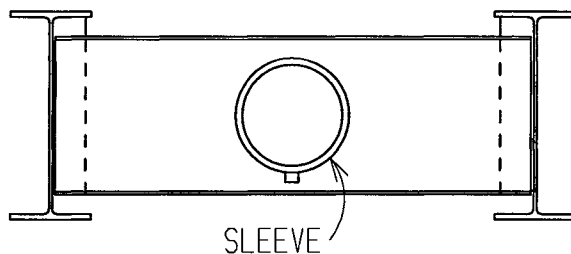
ADDITIONAL DIAPHRAGM FABRICATION COSTS

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



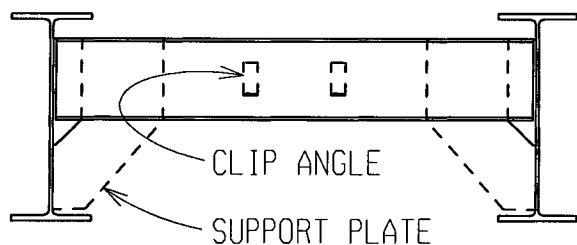
WINDOW IN PLATE DIAPHRAGM

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



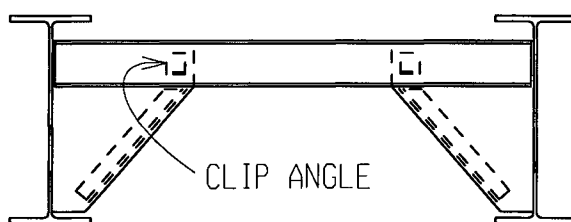
ROUND HOLE IN PLATE DIAPHRAGM

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

