



# 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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DECIMAL PARTS OF A FOOT							Deci	male						
Inchos	DECIMAL PARTS OF A FOOT								of an	Inch				
Inches	0 0000	0.0833	0 1667	0.2500	4	0.4167	0 5000	0 5833	0 6667	0 7500	0 8333	0.0167	UI all	
1/32	0.0026	0.0000	0.1693	0.2526	0.3359	0.4103	0.5026	0.5859	0.6693	0.7526	0.8359	0.0107	1/32	0.0313
1/16	0.0052	0.0885	0.1000	0.2552	0.3385	0.4219	0.5052	0.5885	0.6719	0.7552	0.8385	0.9219	1/16	0.0625
3/32	0.0078	0.0000	0.1745	0.2578	0.3411	0.4245	0.5078	0.5000	0.6745	0.7578	0.8411	0.9245	3/32	0.0023
0/02	0.001.0	0.0011	0.1/40	0.2070	0.0411	0.4240	0.0070	0.0011	0.0740	0.1010	0.0111	0.02-10	0/02	0.0000
1/8	0.0104	0.0938	0 1771	0 2604	0 3438	0 4271	0 5104	0 5937	0.6771	0 7604	0 8437	0 9271	1/8	0 1250
5/32	0.0130	0.0964	0.1797	0.2630	0.3464	0.4297	0.5130	0.5964	0.6797	0.7630	0.8464	0.9297	5/32	0.1563
3/16	0.0156	0.0990	0,1823	0.2656	0.3490	0.4323	0.5156	0.5990	0.6823	0.7656	0.8490	0.9323	3/16	0.1875
7/32	0.0182	0.1016	0.1849	0.2682	0.3516	0.4349	0.5182	0.6016	0.6849	0.7682	0.8516	0.9349	7/32	0.2188
			Ender and a contract of the second		<b>Filgad</b>							•		
1/4	0.0208	0.1042	0.1875	0.2708	0.3542	0.4375	0.5208	0.6042	0.6875	0.7708	0.8542	0.9375	1/4	0.2500
9/32	0.0234	0.1068	0.1901	0.2734	0.3568	0.4401	0.5234	0.6068	0.6901	0.7734	0.8568	0.9401	9/32	0.2813
5/16	0.0260	0.1094	0.1927	0.2760	0.3594	0.4427	0.5260	0.6094	0.6927	0.7760	0.8594	0.9427	5/16	0.3125
11/32	0.0286	0.1120	0.1953	0.2786	0.3620	0.4453	0.5286	0.6120	0.6953	0.7786	0.8620	0.9453	11/32	0.3438
									1000 W/ 1111					
3/8	0.0313	0.1146	0.1979	0.2813	0.3646	0.4479	0.5312	0.6146	0.6979	0.7812	0.8646	0.9479	3/8	0.3750
13/32	0.0339	0.1172	0.2005	0.2839	0.3672	0.4505	0.5339	0.6172	0.7005	0.7839	0.8672	0.9505	13/32	0.4063
7/16	0.0365	0.1198	0.2031	0.2865	0.3698	0.4531	0.5365	0.6198	0.7031	0.7865	0.8698	0.9531	7/16	0.4375
15/32	0.0391	0.1224	0.2057	0.2891	0.3724	0.4557	0.5391	0.6224	0.7057	0.7891	0.8724	0.9557	15/32	0.4688
				<u> </u>			a marine and a second				and the second	·		
1/2	0.0417	0.1250	0.2083	0.2917	0.3750	0.4583	0.5417	0.6250	0.7083	0.7917	0.8750	0.9583	1/2	0.5000
17/32	0.0443	0.1276	0.2109	0.2943	0.3776	0.4609	0.5443	0.6276	0.7109	0.7943	0.8776	0.9609	17/32	0.5313
9/16	0.0469	0.1302	0.2135	0.2969	0.3802	0.4635	0.5469	0.6302	0.7135	0.7969	0.8802	0.9635	9/16	0.5625
19/32	0.0495	0.1328	0.2161	0.2995	0.3828	0.4661	0.5495	0.6328	0.7161	0.7995	0.8828	0.9661	19/32	0.5938
5/8	0.0521	0.1354	0.2187	0.3021	0.3854	0.4688	0.5521	0.6354	0.7187	0.8021	0.8854	0.9687	5/8	0.6250
21/32	0.0547	0.1380	0.2214	0.3047	0.3880	0.4714	0.5547	0.6380	0.7214	0.8047	0.8880	0.9714	21/32	0.6563
11/16	0.0573	0.1406	0.2240	0.3073	0.3906	0.4740	0.5573	0.6406	0.7240	0.8073	0.8906	0.9740	11/16	0.6875
23/32	0.0599	0.1432	0.2266	0.3099	0.3932	0.4766	0.5599	0.6432	0.7266	0.8099	0.8932	0.9766	23/32	0.7188
2/4	0.0625	0 1 1 5 9	0 2202	0 2125	0 2059	0 4702	0.5625	0 6 4 5 9	0.7202	0 9125	0.9059	0.0702	2/4	0 7500
3/4	0.0025	0.1450	0.2292	0.3125	0.3930	0.4792	0.5625	0.6494	0.7292	0.0125	0.0950	0.9792	314	0.7912
13/16	0.0677	0.1404	0.2310	0.3131	0.3904	0.4010	0.5677	0.0404	0.7344	0.8177	0.0904	0.9010	13/16	0.7015
27/32	0.0703	0.1536	0.2370	0.3177	0.4036	0.4044	0.5703	0.6536	0.7370	0.8203	0.9010	0.9044	27/32	0.8/38
21102	0.0100	0.1000	<u></u>	0.0200	0.7000	510/0	0.0100	0.0000	0.7010	0.0200	0.0000	0.0070	21/32	0.0400
7/8	0.0729	0.1562	0.2396	0.3229	0.4063	0.4896	0.5729	0.6562	0.7396	0.8229	0.9062	0.9896	7/8	0.8750
29/32	0.0755	0.1589	0.2422	0.3255	0.4089	0.4922	0.5755	0.6589	0.7422	0.8255	0.9089	0.9922	29/32	0.9063
15/16	0.0781	0.1615	0.2448	0.3281	0.4115	0.4948	0.5781	0.6615	0.7448	0.8281	0.9115	0.9948	15/16	0.9375
31/32	0.0807	0.1641	0.2474	0.3307	0.4141	0.4974	0.5807	0.6641	0.7474	0.8307	0.9141	0.9974	31/32	0.9688

PREPARED BY DESIGN DIV. 1.11.01

DRAWN BY: BLT MI CHECKED BY: VZ APPROVED BY: BMW	CHIGAN DEPARTMENT BUREAU OF D	OF TRANSPORTATION IS EVELOPMENT SU IDGE ESTIMATES	ISSUED: 12/16/19 SUPERSEDES:08/15/03			
STEEL REINFORCEME	NT WEIGHTS	RAILING V	NEIGHTS			
SUBSTRUCTURE UNIT	LBS/CYD OF CONC.	RAILING TYPE	LBS/FT			
CANTILEVER ABUTMENT	50	SOLID PARAPET RAILING	* 357			
COUNTERFORT ABUTMENT	100	BRIDGE BARRIER RAILING,	TYPE 4 475			
GRAVITY ABUTMENT	15	BRIDGE BARRIER RAILING,	TYPE 5 392			
CURTAIN WALL ABUTMENT	50	BRIDGE BARRIER RAILING,	TYPE 6 601			
COLUMN & GIRDER PIER (HWY.)	120	BRIDGE BARRIER RAILING AESTHETIC TYPE 6, DET 1	646			
GRAVITY PIER	15	BRIDGE BARRIER RAILING AFSTHETIC TYPE 6, DET 2	615			
PILE CAP	70	BRIDGE BARRIER RAILING,	TYPE 7 414			
SUBSTRUCTURE UNIT	LBS/CONC. UNIT	BRIDGE BARRIER RAILING AFSTHETIC TYPE 7, DET 1	449			
SIMPLE SPAN T-BEAM	250 CYD	BRIDGE BARRIER RAILING AESTHETIC TYPE 7, DET 2	428			
CONTINUOUS SLAB	260 CYD	BRIDGE RAILING, 1 TUBE	10			
CONTINUOUS T-BEAM SIMPLE SPAN SLAB	350 CYD 170 CYD	BRIDGE RAILING, 2 TUBE (TUBE & POST ONLY)	** 51			
BURIED T-BEAM RIGID FRAME	200 CYD 175 CYD	BRIDGE RAILING, 2 TUBE (WITH BRUSHBLOCK)	** 185			
SOLID PARAPET RAILING	14/FT	14/FT BRIDGE RAILING, 3 TUBE 25/FT WITH PICKETS (SIDEWALK)				
BARRIER RAILING, TYPE 5	257FT 21/FT	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 BF	RIDGE RAILING, 1-TUBE.			
VEIGHT OF REINFORCEMENT LBS/SFT 6 6 6 7 7 7 7 7 7 7 7 7 7 7 7 7		** VARIES BASED UPON VEF	≀TICAL POST SPACING.			

6' 7' 8' 9' 10' "S", SEE DESIGN GUIDE 6.41.01

PREPARED BY DESIGN DIVISION 1.21.01

**3. WATERWAY & DRAINAGE** 





**4. APPROACHES** 







# **5. SUBSTRUCTURE**




























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

	REIN	PIER STRUT RETRO	DFIT E 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 (Lc). IF THE LENGTH OF THE PIER STRUT EXCEEDS Lc, DESIGN THE REINFORCEMENT IN ACCORDANCE WITH AASHTO LRFD SECTION A13.3.1. FOR DEFINITIONS OF YIELD LINE MECHANISM AND Lc SEE AASHTO LRFD A13.3.1.

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

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

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

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

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

PREPARED BY DESIGN DIVISION 5.22.02A



































## 6. SUPERSTRUCTURE

DRAWN BY: Checked by: Approved by:	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: SUPERSEDES:
	BLAN PAGE	
	PREPARED I DESIGN DIVI	BY SION











## 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
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## 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)	( nı )	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(ın)	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

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WN CK	BY: ED E	sΥ	9	BL VZ	Т			М	ICI	H I I	g ai Jri	N E A	DE U	РА OF	R T F	ME I I C	N Generation	Г ( VА`	DF Y [	TI DE	RA VE	NS L O	P0 PM	R T E N	A T T	IC	N			I S SU	Sl Pe	JE E R	D: Se	E D	ES	( 5:(	02/1 05/0
20	VED	Βì	.1	G	_				S	TR	A 1	G	ΗT	· [	_ I	NE	-	SL	JP	ER	El	_E	VA	ΥT	IC	IN											
	an ys and Ramps	hdn	$\Delta\%$	I	:	:	0.36	0.36	0.36	0.36	0.36	0.36	0.36	0.37	0.38	0.39	0.40	0.41	0.43																0.45	12	guic
	Urb Freewa Urban F	60 n	ө	N.C.	N.C.	N.C.	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.4	2.8	3.4	3.9	4.2	5.0																	14	al (stop
		hdi	$\Delta\%$	:	0.30	0.30	0.30	0.30	0.30	0.31	0.32	0.34	0.35	0.36	0.38															-		-			0.38	0	termina
	ays	75 m	Φ	N.C.	2.0	2.0	2.0	2.0	2.0	2.5	3.0	3.8	4.3	5.0	6.0																	_				250	a ramp
	Freew	hd	$\Delta\%$	:	:	0.31	0.31	0.31	0.31	0.31	0.32	0.33	0.34	0.36	0.38	0.40											_								0.40	5	proach peed.
		70 m	e	N.C.	N.C.	2.0	2.0	2.0	2.0	2.0	2.5	3.1	3.5	4.1	4.9	6.0							-													204	vhich ag lesign s
	hq	<u> </u>	$\Delta\%$	:	1	0.32	0.32	0.32	0.32	0.32	0.32	0.33	0.34	0.36	0.37	0.40	0.42	0.43					-												0.43	7	curves v onding c
	65 m		e	N.C.	N.C.	2.0	2.0	2.0	2.0	2.0	2.0	2.5	2.8	3.3	4.0	4.8	5.5	5.9														-				165	ven to ( correspo
NO	4		∿∆	:	:	:	0.36	0.36	0.36	0.36	0.36	0.36	0.37	0.38	0.39	0.40	0.42	0.42	0.44	0.45									_						0.45	e	ld be gi for the c
VATI	60 m		θ	N.C.	N.C.	N.C.	2.0	2.0	2.0	2.0	2.0	2.0	2.3	2.7	3.2	3.9	4.4	4.8	5.6	5.9																133	on shou ∆% <sub>max</sub> t
RELE	55 mph	<u> </u>	%⊽	:	:	:	1	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.39	0.40	0.41	0.42	0.44	0.44	0.46	0.47	-										- <u></u>		0.47	-	isiderati ius, use
SUPE			e	N.C.	N.C.	N.C.	N.C.	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.5	3.1	3.5	3.8	4.5	4.7	5.5	5.9	-	-								-				106	sign rad
INE (	50 mph		%⊽	:	:	:	1	:	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.41	0.42	0.42	0.44	0.44	0.46	0.47	0.50										- <u></u>		0.50	s spi	ver, spe the des
НТ L			Ð	N.C.	N.C.	N.C.	N.C.	N.C.	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.4	2.8	3.0	3.5	3.7	4.3	4.7	5.9	-								-				833	. Howe ined for ∆% <sub>max</sub> .
<b>FRAID</b>	Чd		∿∿	:	:	;	1	1	:	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.41	0.41	0.42	0.43	0.45	0.46	0.49	0.49	0.50	0.52	0.54								0.54		-Series) be obta <sup>max</sup> and
S	45 m		υ	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.3	2.7	2.9	3.4	3.6	4.5	4.7	4.8	5.4	5.9									643	R-107 cannot use e
	Ча		$\Delta\%$	:	:	:	1	1	:	:	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.41	0.42	0.43	0.46	0.47	0.47	0.49	0.51	0.53	0.57						0.58	10	ard Plar e tables an Rmir
	40 m		Ð	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.2	2.5	2.7	3.4	3.5	3.6	4.0	4.5	4.8	5.8							485	e Stand from th less tha
	hq		$\Delta\%$	1	1	:	1	:	1	:	1	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.47	0.47	0.47	0.49	0.50	0.51	0.54	0.56	0.58	0.62			0.62	_	mps (se ) values (but not
	35 m		ш	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.4	2.5	2.6	2.8	3.1	3.4	4.1	4.5	5.1	5.9			<u> </u>	34(	loop rai ∋nt (∆%) ⊃ulated
	hq		$\Delta\%$	:	:	:	1	:	:	:	1	:	:	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.51	0.51	0.53	0.54	0.56	0.58	0.61	0.66	0.66	01	tion for e gradie hose tal
	30 m		Ð	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	N.C.	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.1	2.3	2.8	3.1	3.5	4.0	4.6	6.0		232	oereleva If relativ ss than t
	RADIUS	Feet		20000	17000	14000	12000	10000	8000	6000	5000	4000	3500	3000	2500	2050	1800	1675	1425	1350	1150	1075	850	820	800	720	650	600	500	450	400	345	300	232	$\Delta\%_{\rm max}$	Rmin	Use 7% sur condition). For radii les
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## 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  $\frac{1}{4}$ " 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.

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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.

\*\*\* 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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I.D. DENOTES INSIDE DIAMETER.

PREPARED BY DESIGN DIVISION 6.60.12B
















			_			- 1	- 0	-
in	in	lbs/ft	in²	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

PREP	ARED	ΒY
DESIGN	DIVI	[SION

6.65.02

DRAWN BY: BLT CHECKED BY: VZ APPROVED BY: KCK	MICHIGAN P 21″&	n departn bureau ( RESTRES 27″BO	MENT OF DF DEVEL SSED CO X BEAM	TRANSPOI OPMENT DNCRETE PROPEI	RTATION	ISS SUP	UED: ERSEDES	05/22/23 :12/17/18
<u>21" BEAM - 36" WIDE</u> 27" BEAM - 36" WIDE 21" BEAM - 36" WIDE	5 " 4 <sup>1</sup> / <sub>2</sub> "	EVEL (TYP	26 " 27 "		5" 4 <sup>1</sup> / <sub>2</sub> "	B " " " " " " " " " " " " " " " " " " "	A C A C A C A C A C A C A C A C A C A C	TYP) 21″ BEAMS
27" BEAM - 48" WIDE	4"	BFAM	40" PROPFI	RTIES	4"			
DEPTH WI	DTH WEIGHT	AREA	Υ <sub>T</sub>	Y <sub>R</sub>	ST	Sr	Ι	
l in l	in Ibs/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 7.36	707	13.59	13.41	4970	5030	67.500	
		101	10.00	10 <b>•</b>  1			01,000	

PREPARED BY DESIGN DIVISION 6.65.02A



	BEAM PROPERTIES									
DEPTH	WIDTH	WEIGHT	AREA	Υ <sub>T</sub>	Υ <sub>B</sub>	ST	S <sub>B</sub>	Ι		
in	in	lbs/ft	in²	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		

PREPARED BY DESIGN DIVISION 6.65.02B

DRAWN BY: Checked by: Approved by:	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF DEVELOPMENT	ISSUED: SUPERSEDES:
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APPROVED BY:		

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PREPARED BY DESIGN DIVISION

6.65.14B

# 7. STEEL REINFORCEMENT

DRAWN	BY: MJB	MICHIGAN I BUREAU OF	DEPARTMENT OF TRANS	PORTATION SERVICES	ISSUED: 11/2	7/01
APPROV	ed by: vz Ed by: <b>tgf</b>	ENGLIS	H REINFORCIN	G BARS	SUPERSEDES:08/0	8796
	RAR SIZE I					
	DHN JIZE L			DIAMETED		
	ENGLISH	METRIC	(lbs/ft)		$(1n^2)$	
	03	10	0.376	0.375	0.11	
	04	13	0.668	0.500	0.20	
	05	16	1.043	0.625	0.31	
	06	19	1.502	0.750	0.44	
	07	22	2.044	0.875	0.60	
	08	25	2.670	1.000	0.79	
	09	29	3.400	1.128	1.00	
	10	32	4.303	1.270	1.27	
	11	36	5.313	1.410	1.56	
	14	43	7.650	1.693	2.25	
	18	57	13.600	2.257	4.00	



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

### EPOXY COATED REINFORCEMENT

F'<sub>c</sub> = 3.0 ksi

F<sub>y</sub> = 60.0 ksi

BAR	SFACING II	INESHOLD		≤ 12" OF CONC	RETE BELOW	> 12" OF CONCRETE BELOW				
SIZE	3d₅ (in)	6d₅ (in)	BASIC DEVELOPMENT LENGTH (in) **	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 ≥ 6bd (in)	ALL OTHER CASES (in)			
3	11/8	21⁄4	32	16	20	20	22			
4	1½	3	42	21	26	27	29			
5	1 1 %	3¾	52	25	32	33	36			
6	21⁄4	4½	63	31	38	40	43			
7	2%	5¼	73	36	44	46	50			
8	3	6	84	41	51	53	58			
9	33%	6¾	94	46	57	59	64			
10	33/4	7½	104	50	63	65	71			
11	41/8	81⁄4	115	56	69	72	79			

			TENSION LAP LENGTH					
BAR	SPACING T	IKESHULD	≤ 12" OF CONC	CRETE BELOW	> 12" OF CONCRETE BELOW			
SIZE	3d₀ (in)	6d₀ (in)	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	11/8	21⁄4	20	26	26	29		
4	1½	3	27	33	35	38		
5	1%	3¾	33	41	43	46		
6	2¼	4½	40	50	52	56		
7	2%	5¼	46	57	60	65		
8	3	6	53	66	69	75		
9	3%	6¾	59	74	77	84		
10	10 33/4 71/2		65	82	85	92		
11	41/8	81⁄4	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 (  $\lambda_{er}$  = 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	MICHIGAN DEPARTMENT OF TRANSPORTATION	ISSUED:	12/26/23
	BUREAU OF DEVELOPMENT		
CHECKED BY: VZ	TENSION DEVELOPMENT AND LAP SPLICE LENGTHS FOR	SUPERSEDES:	11/27/01
APPROVED BY: KCK	SUPERSTRUCTURE		

### EPOXY COATED REINFORCEMENT

F'<sub>c</sub> = 4.0 ksi

F<sub>y</sub> = 60.0 ksi

				TEN	ISION DEVELOPMENT LENG	GTH	
BAR	R			≤ 12" OF CONC	CRETE BELOW	> 12" OF CONCRETE BELOW	
SIZE	3d⊾ (in)	6d₅ (in)	BASIC DEVELOPMENT LENGTH (in) **	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 ≥ 6bd (in)	ALL OTHER CASES (in)
3	11/8	21⁄4	27	13	17	17	19
4	1½	3	36	18	22	23	25
5	1 1 %	3¾	45	22	27	29	31
6	21⁄4	4½	54	26	33	34	37
7	2%	5¼	63	31	38	40	43
8	3	6	72	35	44	45	49
9	3 <sup>3</sup> /8	6¾	81	39	49	51	56
10	33/4	7½	90	46	57	59	65
11	41/8	81⁄4	99	55	69	72	78

BAR			TENSION LAP LENGTH							
	SPACING IF	IKESHULD	≤ 12" OF CONC	CRETE BELOW	> 12" OF CONCRETE BELOW					
SIZE	3d₅ (in)	6d <sub>b</sub> (in)	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 ≥ 6bd (in)	ALL OTHER CASES (in)				
3	11/8	21⁄4	17	22	22	24				
4	1½	3	23	29	30	32				
5	17%	3¾	29	36	37	40				
6	2¼	4½	34	43	44	48				
7	2%	5¼	40	50	52	56				
8	3	6	45	57	59	64				
9	3%	6¾	51	64	66	72				
10	3¾	7½	59	74	77	84				
11	41/8	81⁄4	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.

### 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 (  $\lambda_{er}$  = 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





90 DEGREE HOOK				180 DEGREE HOOK END LENGTHS				MINIMUM DIMENSIONS FOR STANDARD HOOKS IN TENSION							
END LENGTHS							[		CLEAR SIDE COVER $\geq 2\frac{1}{2}$ "				CLEAR SIDE COVER ≤ 2½"		
BAR NO.	EXTENSION LENGTH	DETAILING DIMENSION		BAR NO.	EXTENSION LENGTH	DETAILING DIMENSION		NO.	3 KSI CONCRETE	4 KSI CONCRETE	5 KSI CONCRETE	3 KSI CONCRETE	4 KSI CONCRETE	5 KSI CONCRETE	
3	5"	7"		3	3"	5"		3	8"	7"	7"	10"	9"	8"	
4	6"	8"		4	3"	5"	1	4	11"	10"	9"	14"	12"	11"	
5	8"	11"		5	3"	6"	1	5	14"	12"	11"	17"	15"	13"	
6	9"	12"		6	3"	6"	1	6	16"	14"	13"	20"	18"	16"	
7	11"	15"		7	4"	8"		7	19"	16"	15"	24"	20"	18"	
8	12"	16"		8	4"	8"		8	22"	19"	17"	27"	23"	21"	
9	14"	20"		9	5"	11"	1	9	24"	21"	19"	30"	26"	24"	
10	16"	23"		10	6"	13"	1	10	27"	24"	21"	34"	29"	26"	
11	17"	25"		11	6"	14"	1	11	30"	26"	24"	38"	33"	29"	
14	21"	32"		14	7"	18"	1	14	45"	39"	35"	45"	39"	35"	
18	28"	42"		18	10"	24"	1	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 (  $\lambda_{er}$  = 1.0).

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

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PREPARED BY DESIGN DIVISION





## 8. STRUCTURAL STEEL














LATERAL BRACING LENGTH "L"	STRUCTURAL TEE SIZE	* BOLTS REQUIRED WEB CONNECTION	** BOLTS REQUIRED TEE CONNECTION
UP TO 14'-6"	WT 5 × 11.0	5	4
OVER 14'-6" TO 15'-9"	WT 5 × 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 3/4" Ø ASTM F 3125 GRADE A 325 BOLTS REQUIRED TO BOLT ANGLE OR BENT PLATE TO GIRDER WEB.

\*\* NUMBER OF 3/4" Ø 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.

8.11.05





















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

PILE	WELD SIZE (E)	BEVEL DEPTH (S)
HP 10 x 42 HP 10 x 57 HP 12 x 53	5⁄16" 5⁄16" 5⁄16"	5⁄46" 5⁄46" 5⁄16"
HP 12 x 74 HP 14 x 73 HP 14 x 89	%" %" %"	%" %" %"
HP 12 x 84	7⁄16"	7⁄16"
ALL OTHERS	CHECK WITH MDOT CONSTRUCTIO SECTION AND THE BRIDGE FIELD S	N FIELD SERVICES GEOTECHNICAL ERVICES SECTION.

## NOTES:

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

PREPARED BY DESIGN DIVISION







DRAWN BY: BLT	MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT	ISSUED:	02/14/11
APPROVED BY: VZ	GUIDE FOR SELECTION OF BEARING	SUPERSEDES	:05/04/06

## CONTINUOUS AND SIMPLE SPANS

LENGTH OF EXPANSION	TYPE OF MOVEMENT	TYPE OF BEARING	BEVEL SOLE PLATE
	FIXED	CURVED STEEL PLATES (SEE BRIDGE DESIGN GUIDE 8.42.01)	YES
THRU 120	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.





DRA	WN	I B	Y:		BL1	_		MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT									ISSUED: 05/04/0						′06						
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 	[]	22	24	26	22	24	26	23	24	26	22	24	26	22	24	26	24	26	30	28	33	33	35	35	35	37	37	37	
MIN.	( II)	121/4	121/4	121/4	121/2	121/2	121/4	121/2	121/2	121/2	16¾	16¾	16½	17	16¾	16¾	171/2	171/2	171/2	1 7 <u>1/</u> 2	173/4	1734	173/	173/	1734	18	18	18	
MIN.	( II )	$\sim$	$\sim$	$\sim$	$\sim$	$\sim$	$\sim$	$\sim$				$\sim$	$\sim$			$\sim$	21/2	21/2	21/2	21/2	21/2	21/2	21/2	21/2	21/2	21/2	21/2	21/2	
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MAX F LOAD	(kıp)	100	100	100	125	125	125	150	150	150	175	175	175	200	200	200	250	250	300	300	350	350	400	400	400	450	450	450	DENOTES EN
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DRAWN BY: BLT								MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT									ISSUED: 05/04/06				1/06							
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	ш (і	81/4	8¼	81/4	8¾	8%	81/8	81/4	81/4	8¼	$121/_{2}$	$121/_{2}$	$12^{1/4}$	12¾	$12\frac{1}{2}$	$12^{1/2}$	$12\frac{3}{4}$	12%	12¾	12¾	13	13	13	13	13	$13^{1}/_{4}$	$13^{1/4}$	131/4
	0 ( ui )	$1^{1}/_{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{5}{8}$	1%	1%	$1\frac{34}{4}$	134	$1\frac{3}{4}$	$1\frac{34}{4}$	1¾	1¾	$1\frac{34}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{34}{4}$	1 34	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{3}{4}$	1¾	$1\frac{3}{4}$	$1\frac{34}{4}$	1¾	$1\frac{3}{4}$
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MAX	LOAD (kips)	100	100	100	125	125	125	150	150	150	175	175	175	200	200	200	250	250	300	300	350	350	400	400	400	450	450	450
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PREPARED BY DESIGN SUPPORT AREA 8.32.04



DRAW	N	BY	-	B	LT		MICHIGAN DEPARTMENT OF TRANSPORTATION BUREAU OF HIGHWAY DEVELOPMENT							IS	SSUE	D:		05/	04/	06				
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																							u	
WEIGHT OF STEEL	(1bs)	150	170	185	165	190	210	200	210 235	245	265	295	300 290	320	395	425	470 520	580 580	680	715	/10	850	915 9	
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	(II)	$\sim$	$\sim$	$\sim$	2	$\sim$	$\sim$	$\sim$		21/4	21/4	21/4	2 <sup>1</sup> / <sub>2</sub>	21/4	21/2	21/2	21/2	с <u>Ж</u>	5 /4 31/4	3¼	<u>.</u>	31/2	3 <sup>1</sup> /2	!
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FLANGE WIDTH	( II )	12	14	16	12	14	16	12	14	12	1,	10	1 1 4 1	16	14	16	16 18	16 1 1	16	18	٦N	18	22 4	
MAX Load	(kips)	100	100	100	125	125	125	150	150 150	175	175	G/ I	200 200	200	250	250	300 300	350 350	400	400	400	450	450	

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8.32.06









## 9. UTILITY DATA

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

## POUNDS PER LINEAL FOOT

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

		TELE	PHONE	DUCTS	,		
SIZE		3"	3	1/2"		4"	
ITEM	ΤΥΡΕ Β	TYPE C	TYPE B	TYPE C	ΤΥΡΕ Β	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 E	STEEL ELECTRICAL CONDUITS & STEAM PIPES												
SIZE	5" CONDUIT	16" STEAM	8" STEAM	8" 120 kv	10" STEAM	12" STEAM	20" STEAM						
PIPE	15.0	63.0	28.55	22.4	40.48	49.60	79.0						
INSULATION OR COATING	$\searrow$	12.0	5.0	14.0	7.0	9.0	15.0						
CABLE	7.0	$\ge$	$\succ$	22.0	$\succ$	$\succ$	$\ge$						
TOTAL	22.0	75.0	33.55	58.40	47.48	58.6	94.0						

PREPARED BY DESIGN DIV.

9.12.01







![](_page_214_Figure_0.jpeg)

![](_page_215_Figure_0.jpeg)
























