Road & Bridge Design Publications

Monthly Update – May 2023

Revisions for the month of **May** are listed and displayed below and will be included in projects submitted for the **September** letting. The special detail index from **April** will remain in effect.

E-mail road related questions to MDOT-Road-Design-Standards@michigan.gov.
E-mail bridge related questions to MDOT-Bridge-Design-Standards@michigan.gov.

Road Design Manual

7.01.50: Temporary Beam Guardrail: Revised a pay item description

Bridge Design Manual

2.05.05: Deleted section "C. The Quality Assurance and Quality Control Process Guide for Project Managers". This information is not current and will be reintroduced into future guidelines for project managers. Re-lettered remaining sections.

7.02.15 C.: With the recent change in MDOT's policy to salvage and reuse existing stud type shear connectors it was necessary to provide guidance on how to incorporate the existing shear developers into the interface shear design for partial and complete deck replacement projects. For all projects the shear developers should be designed for an infinite fatigue life.

Bridge Design Guides

5.47.01: Updated the designation of the aggregate drainage layer. Added local abutment scour requirement/check to the sheet piling per NCHRP method. Changed word "header" to "apron" to be more in line with current engineering terminology. Designers are reminded to follow and include the Special Provision for Articulating Concrete Block System with the use of spill-through abutments.

6.60.03, 6.65.02, 6.65.02A & 6.65.02B: Updated units for Y_{BOT}, Y_T and Y_B.

Updates to the MDOT Cell Library, Sample Plans, and other automated tools may be required in tandem with some of this month's updates. Until such updates can be made, it is the designer's/detailer's responsibility to manually incorporate any necessary revisions to notes and plan details to reflect these revisions.

7.01.50 (revised 5-22-2023)

Temporary Beam Guardrail

Beam guardrail may be used for temporary barrier applications when deemed appropriate based on intended usage, site conditions, and economic feasibility. Materials, including posts, may be of salvaged origin, and removal is included in the pay item. It is primarily used on construction projects where traffic is maintained along the existing road. While temporary concrete barrier is now used to a great extent, temporary guardrail may be a viable alternative provided proper guardrail installation is feasible based on site conditions. Temporary beam guardrail must be called for on plans when so requested by the Region/TSC. If specific installation locations are not shown on plans, a lump sum quantity and general note should be provided for the entire project on the Note Sheet, as follows:

Guardrail, Temp, Type __, __ inch Post __ ft
(To be used as directed by the Engineer)

In general, avoid estimating less than 200' total for a project, since a very small quantity may result in an exorbitant unit price.

Temporary beam guardrail has the same placement and installation requirements as permanent guardrail, but is usually not placed less than 6'-0" from the edge of traffic-carrying lanes. It may be used in areas where the pavement is located 20'-0" or less from the edge of excavations that exceed 5'-0" in depth, and which have a vertical face or slope of 1:2 or steeper.

7.01.50 (continued)

Temporary beam guardrail endings are handled in a similar manner as permanent guardrail endings. When a temporary beam guardrail ending is within the clear zone of approaching traffic, a crashworthy guardrail approach terminal or anchorage shall be used. Temporary guardrail departing terminals may be used when located beyond the clear zone of approaching traffic. Include the appropriate temporary guardrail approach terminal, departing terminal, and anchorage pay items and quantities, as needed. The temporary beam guardrail pay items are identified in Section 807 of the Standard Specifications for Construction.

2.05.05

References and Other Sources of Information (5-22-2023)

A. MDOT Bridge Design Manual

The procedures involved in preparing bridge plans, quality control and quality assurance are interlaced within Chapters 2 – 6 as well as Chapter 15.

B. MDOT Road Design Manual

Specifications and Special Provisions guidance are addressed in Chapter 11. (12-17-2018)

Procedures for plan preparation are addressed in Chapter 14.

C. Preconstruction Process Documentation (PPD) Task Manual (5-22-2023)

Documents the preconstruction process as it pertains to project development. Networks based on the PPD Tasks are used to plan and to track virtually every aspect of a project design schedule.

D. Guidelines For Bridge Plan Preparation (MDOT Sample Plans Bridge)

Bridge sample plans including plan sheet examples of typical plan set detailing preferred details and drafting procedures.

7.02.15

Shear Developers

Shear developers shall be used in all steel beam spans. See Section 7.02.31 D. for the treatment of existing shear developers when replacing a deck. (12-27-2022)

A. Type Used (6-27-2022)

Shear developers shall be the stud type shown in Bridge Design Guide 8.07.01. Details and spacing for ¾" studs shall be shown on the plans. Generally, shear developers are 12" or less in length. Provide additional longitudinal reinforcement when haunch becomes greater than 6" and longer than 12" shear developers are required.

B. Spacing

1. Standard Bridge Slabs

   The spacing is to be constant along the beam as required by the design. Shear developers are not to be used in areas of negative moment. They should extend through the positive moment area and to, or slightly beyond, the point of contraflexure. This point should be determined for the loading condition that will place it closest to the support over which negative moment will occur. In the event of a special case in which shear developers are used in negative moment areas, maximum tensile stress at the point of attachment is not to exceed that which is allowed by the current AWS specifications.

   Shear developers (acting as slab ties) shall be placed in at least one half of all spans regardless of contraflexure points and moment orientations. In end spans with all negative moments place shear developers from abutment towards pier at 24" spacing. In interior spans with all negative moments place shear developers in middle half of span at 24" spacing. (12-5-2005)

7.02.15 (continued)

2. Empirical Bridge Slabs (6-27-2022)

   For empirical bridge slabs, the studs shall be placed on the entire length of beams. This includes the negative moment regions. The design of the studs shall be based on the positive moment area as critical. (5-6-99)

   A minimum of two shear connectors at 24" shall be provided in the negative moment regions of continuous steel superstructure (AASHTO LRFD 9.7.2.4). Where composite girders are noncomposite for negative flexure, additional shear connectors shall be provided in the region of points of permanent load contraflexure. The additional shear connectors shall be placed within a distance equal to one-third of the effective slab width on each side of the point of permanent load contraflexure.

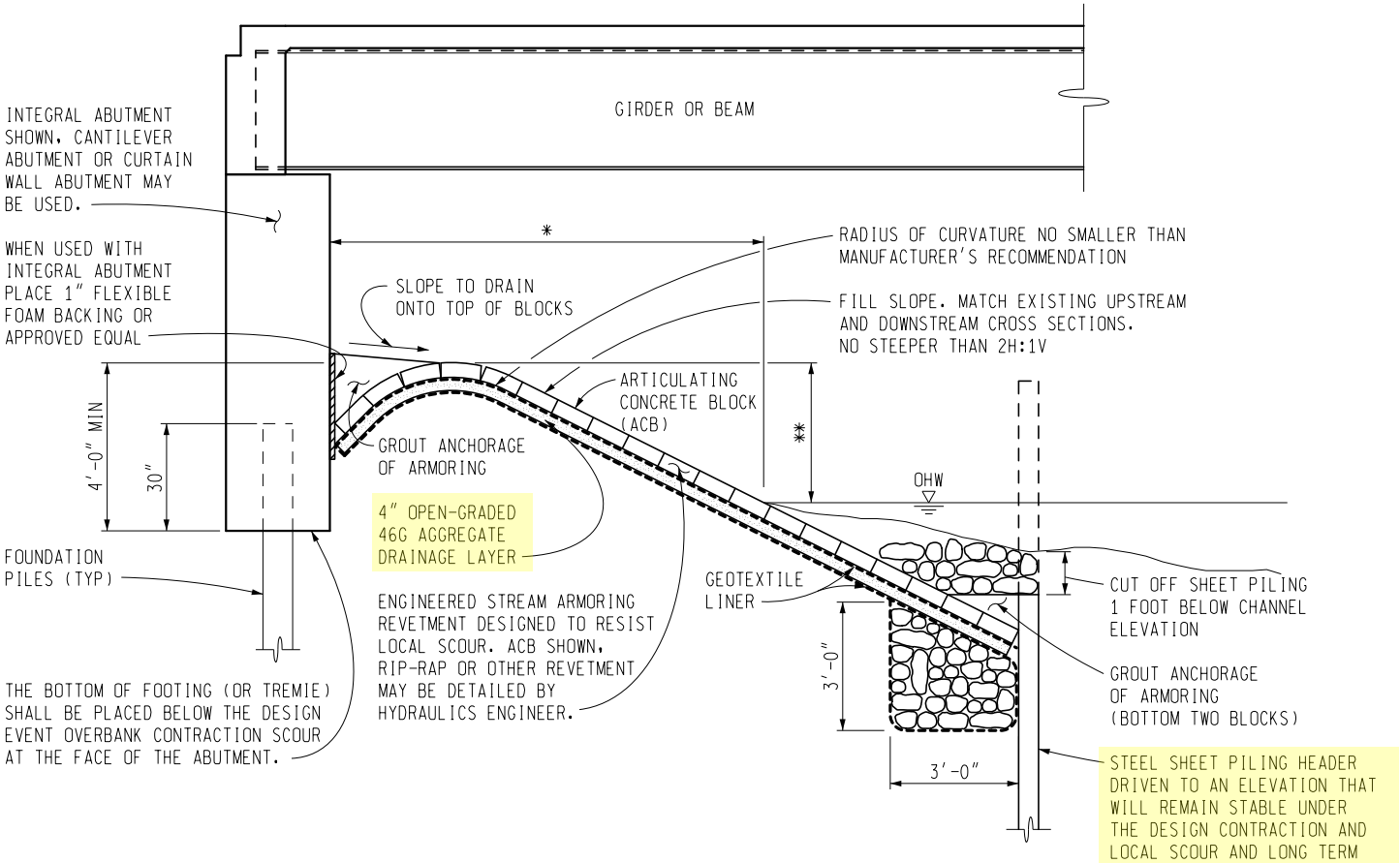
   Field splices should be placed so that they do not interfere with the shear connectors.

   When detailing empirical slabs on plans designate them as an "Empirical Slab". (9-27-2021)

C. Fatigue Life (5-22-2023)

Design shear developers for an infinite fatigue life on all structures regardless of the projected Average Daily Truck Traffic (ADTT). When determining if additional shear developers are needed to meet the interface shear requirements for partial or complete deck replacement projects assume that the existing stud type shear developers to remain in place were initially designed for an infinite fatigue life (over 2,000,000 cycles). A reduction in the fatigue capacity of the existing stud type shear developers to remain in place is not necessary to account for the fatigue cycles the existing shear developers have already experienced.

DRAWN BY: BLT 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).

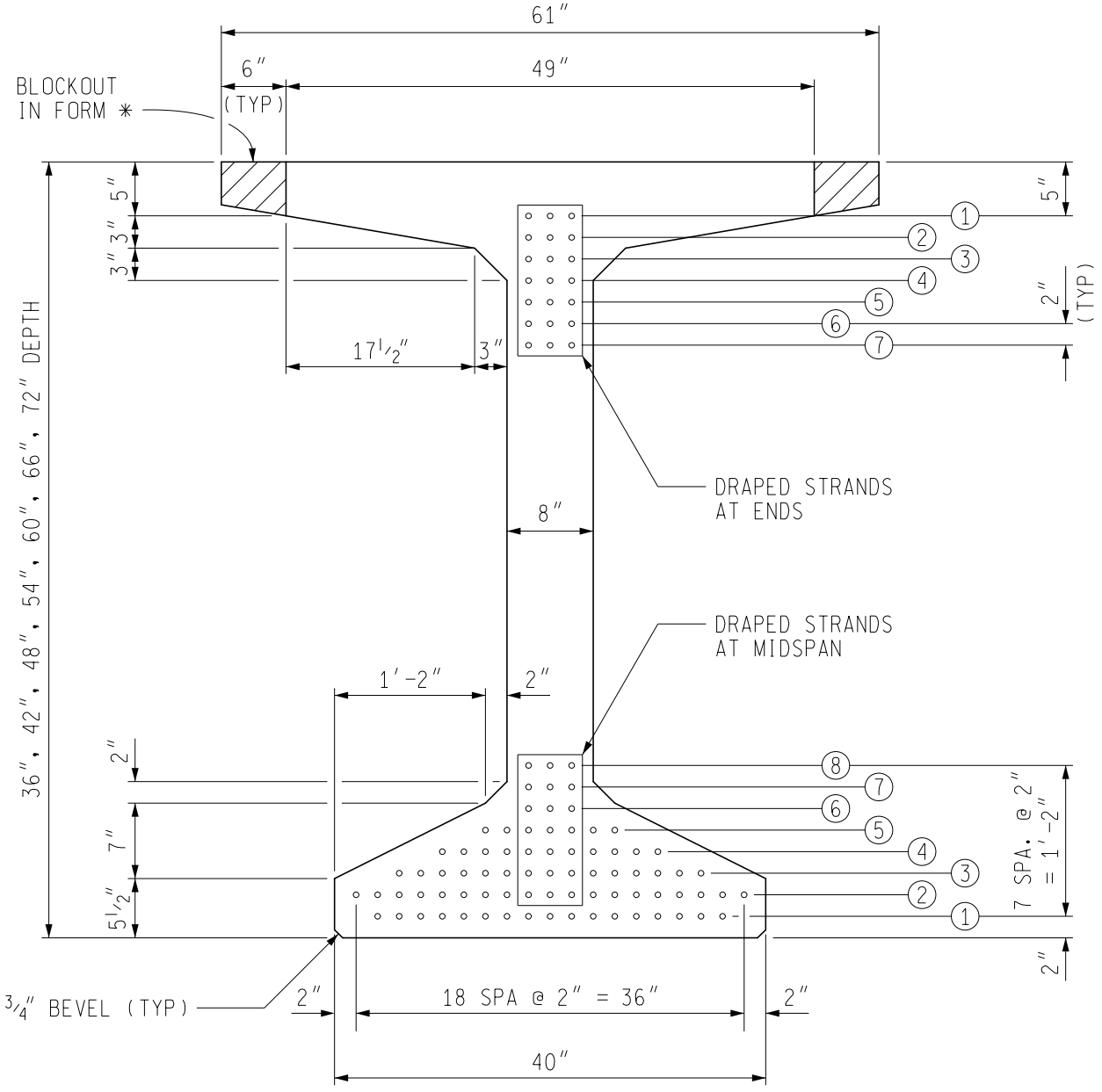
** COUNTERMEASURES SHOULD BE EXTENDED 2' ABOVE THE DESIGN FLOOD ELEVATION, WHENEVER PRACTICAL.

NOTES:

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

PREPARED BY DESIGN DIVISION	5.47.01

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



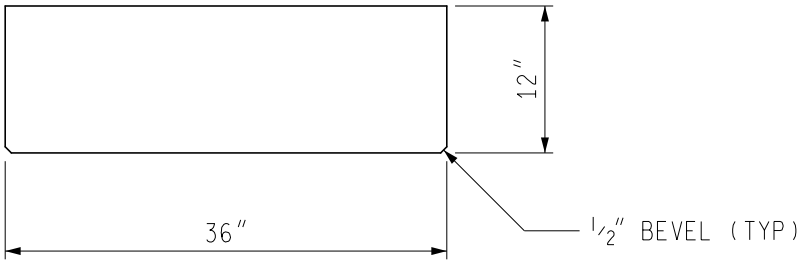
BEAM PROPERTIES

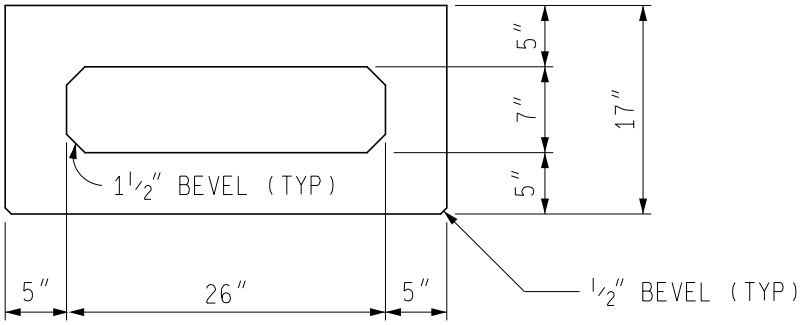
	49″ TOP FLANGE WIDTH				61″ TOP FLANGE WIDTH			
DEPTH	WEIGHT	AREA	Y_{BOT}	I_{xx}	WEIGHT	AREA	Y_{BOT}	I_{xx}
in	lbs/ft	in^2	in	in^4	lbs/ft	in^2	in	in^4
36	915	878.3	18.2	145,592	972	932.4	19.1	158,022
42	965	926.3	21.1	217,461	1022	980.4	22.1	235,306
48	1015	974.3	24.0	305,994	1072	1028.4	25.2	330,233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

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

PREPARED BY DESIGN DIVISION	6.60.03

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

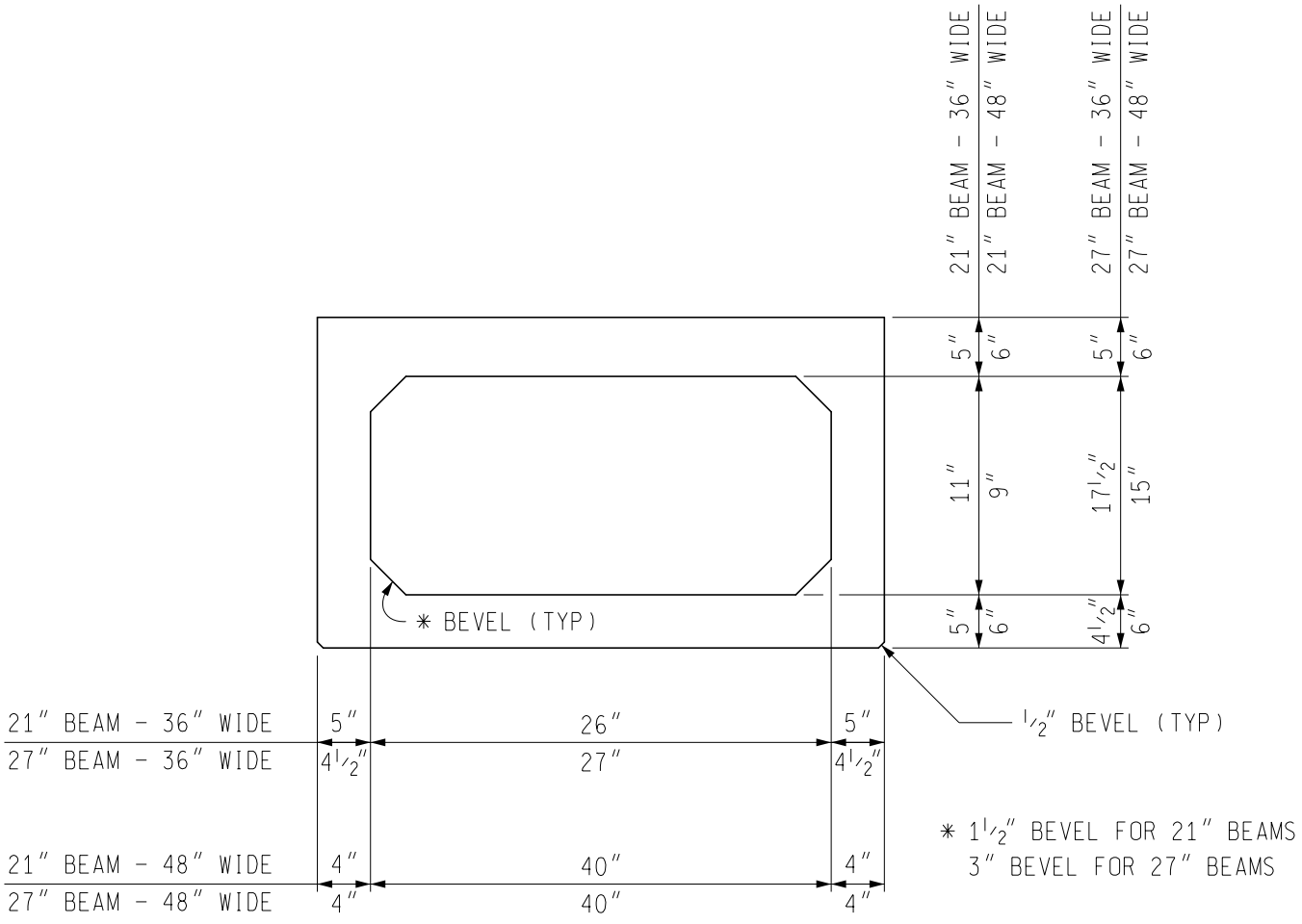




BEAM PROPERTIES								
DEPTH in	WIDTH in	WEIGHT lbs/ft	AREA in^2	Y_T in	Y_B in	S_T in^3	S_B in^3	I in^4
12	36	442	424	6.04	5.96	848	860	5,120
17	36	445	427	8.58	8.42	1610	1640	13,800

PREPARED BY DESIGN DIVISION	6.65.02

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

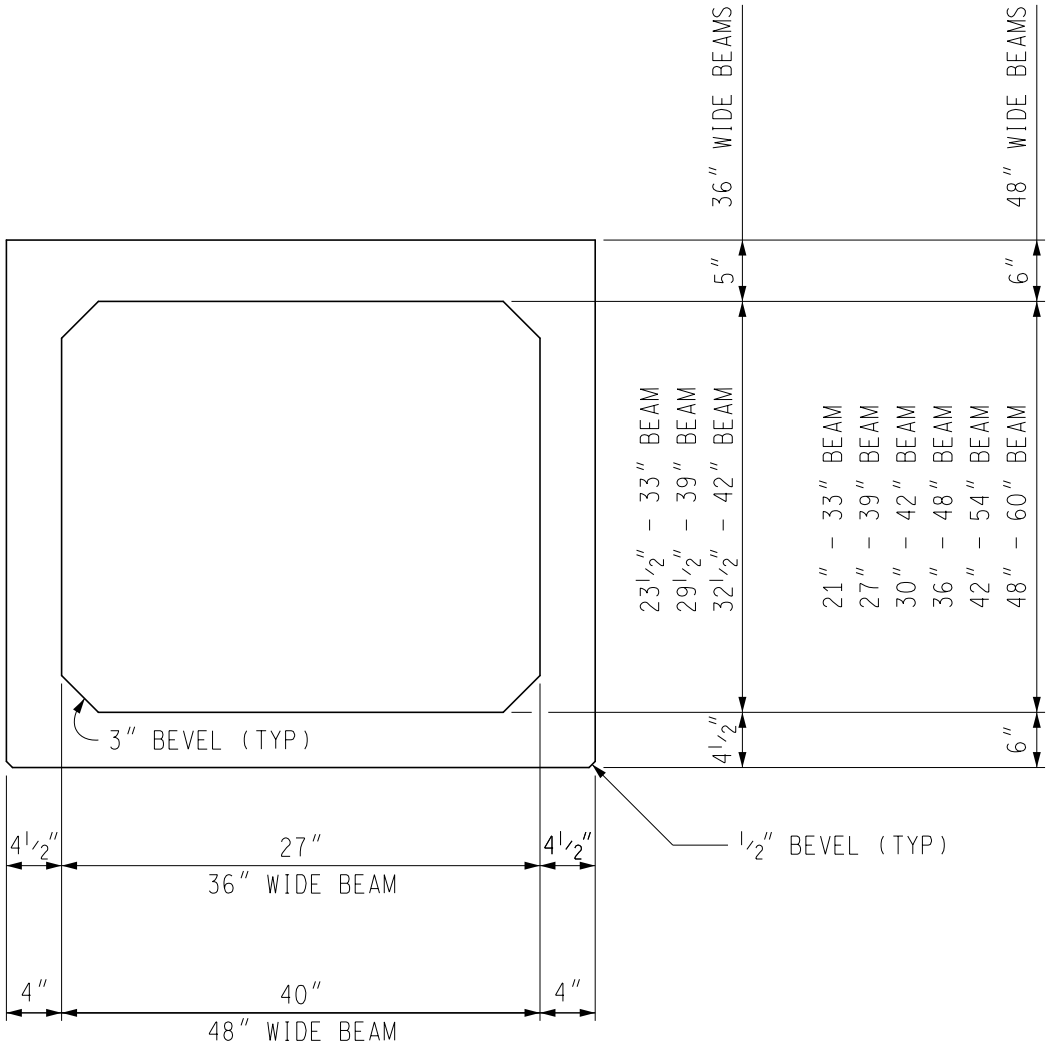


BEAM PROPERTIES

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

PREPARED BY DESIGN DIVISION	6.65.02A

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



BEAM PROPERTIES

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