



OHIO DEPARTMENT OF TRANSPORTATION
CENTRAL OFFICE, 1980 W. BROAD ST., COLUMBUS, OHIO 43216-0899

July 20, 2018

To: Users of the Bridge Design Manual

From: Tim Keller, Administrator, Office of Structural Engineering

By: Sean Meddles, Assistant Administrator, Office of Structural Engineering

Re: 2018 Third Quarter Revisions

Revisions have been made to the ODOT Bridge Design Manual, July 2007. These revisions shall be implemented on all Department projects that begin Stage 2 plan development date after July 19, 2018. Implementation of some or all of these revisions for projects further along the development process should be considered on a project-by-project basis.

This package contains the revised pages. The revised pages have been designed to replace the corresponding pages in the book and are numbered accordingly. Revisions, additions, and deletions are marked in the revised pages by the use of one vertical line in the right margin. The header of the revised pages is dated accordingly.

To keep your Manual correct and up-to-date, please replace the appropriate pages in the book with the pages in this package.

To ensure proper printing, make sure your printer is set to print in the 2-sided mode.

The July 2007 edition of the Bridge Design Manual may be downloaded at no cost using the following link:

<http://www.dot.state.oh.us/Divisions/Engineering/Structures/Pages/default.aspx>

Attached is a brief description of each revision.

Summary of Revisions to the July 2007 ODOT BDM

BDM Section	Affected Pages	Revision Description
203.5	2-24.2	The determination of the design flow to be maintained for a TAF has been moved to the L&D Vol. 2, Section 1012.
305.2	3-78	Bridges that carry freeways as defined in the Ohio Revised Code have been exempted from fencing. Bridges carrying non-freeway routes over county and township routes will require fencing.
305.6	3-80 through 3-81	This new section provides design information related to temporary vandal protection fencing.
610.8	6-26	This new section provides a plan note to install permanent fencing for bridges built with phase construction before opening each phase to traffic. Since the same note is now included on VPF-1-90, this note is intended for non-standard fence configurations.
610.9	6-26	This new section provides a plan note for allowing a precast concrete option for cast-in-place wingwalls and headwalls for 4-sided box culverts, 3-sided flat top culverts, arch culverts and circular arch culverts.

- B. Drawings and/or mapping submitted with a permit application
- C. Specialized conditions associated with the waterway permits

The designer and the project manager shall confirm that the bridge design plans meet the requirements in the project waterway SPP (e.g. Sections 404 and 401 conditions, and infrequently Sections 9 and 10) and shall ensure the project waterway SPP is submitted with the Final Plan Package.

203.5 TEMPORARY ACCESS FILLS

A Temporary Access Fill (TAF) is a fill or structure that allows a contractor access to work on roads or bridges located within bodies of water. Examples of TAF's include: cofferdams; temporary structures for maintaining traffic; causeways and workpads; and demolition debris. The placement of all TAF's in "Waters of the United States" must be performed in accordance with the special provisions for waterway permits.

A contractor's means and methods of construction will dictate the TAF required for a project. However, the Department must estimate the potential impacts to "Waters of the United States" during project development to enable all permits to be in-place during contract letting. For most projects, the waterway permits are in place prior to sale. There may be instances where unforeseen delays dictate that the waterway permits will not be acquired until after sale and/or award. In those instances it is imperative that the waterway permits be obtained prior to the contractor beginning any work within any Waters of the United States. Furthermore, it is incumbent upon the Department that these permits provide all bidding contractors the ability to construct the project without resulting in expensive delays, change orders or fines. To that end, the Department partnered with the Ohio Contractor's Association to develop the following guidance to estimate the size of TAF's:

- A. The TAF shall provide access to all piers located within the Ordinary High Water Mark (OHWM) of the waterway from at least one bank of the waterway.

Access may be provided by construction staging of the TAF. When considering the constructability of staged TAF's, typical superstructure erection plans for lifting lengths of 50-ft or more require two cranes. Unless the access for member delivery is from an adjacent structure, the TAF must provide access to each end of the lift from one bank. In the case of staging, the permit application shall reflect the construction stage that impacts the largest area of the waterway.

- B. The TAF shall be located directly beneath the superstructure. The surface width of the TAF shall be equal to the out-to-out width of the superstructure plus 50'-0" outboard on one side of the structure and 20'-0" outboard on the other side of the structure.
- C. The TAF shall extend at least 40'-0" beyond the furthest pier accessed by the TAF.
- D. Side slopes of the TAF shall be no steeper than 1.5:1 (H:V).
- E. The top surface of the TAF shall be located 1'-0" above the OHWM.

F. The TAF shall be designed to maintain the Waterway Permit Discharge (WPD) as detailed in L&D, Volume 2, Section 1012.

This information is intended for permit application purposes only and should not be included in the project plan set. However, to assist the OES-WPU in the determination process, Designers should use the guidance above to develop a plan view and cross-section and determine waterway impacts of a TAF. An example plan view and cross-section are shown in Figure 203.5-1. These details should be provided to the DEC along with a completed copy of the checklist shown in Figure 203.5-2. The minimum flow to be maintained during construction should be calculated according to item F above. Designers will need to estimate whether this flow can be maintained through conduits or if open channels will be required.

204 SUBSTRUCTURE INFORMATION

204.1 FOOTING ELEVATIONS

Substructure footing elevations shall be shown on the Final Structure Site Plan. Refer to BDM 202.2.3.1 for Spread Footing elevation requirements. The top of footing (e.g. pile and drilled shaft caps) shall be a minimum of one foot below the finished ground line and shall be at least one foot below the bottom of any adjacent drainage ditch. The bottom of footing (e.g. pile and drilled shaft caps) shall not be less than four feet below and measured normal to the finished groundline.

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On projects where maintaining minimum lane widths during a construction phase is not possible due to limited bridge width, the use of a top mounted steel post and tubular steel rail system, similar to the Twin Steel Tube bridge guardrail, may be justified. The railing, post and anchorage designs of these systems are to be in accordance with the *AASHTO LRFD Bridge Design Specifications, Sections A13.1-3*.

304.3.5 BRIDGE SIDEWALK RAILING WITH CONCRETE PARAPETS (BR-2-15)

This railing system is for use on bridges with sidewalks at least 5'-0" wide and a curb height of 8 inches. Although this system is essentially a combination railing system, it may also be used without a sidewalk in applications where pedestrian traffic is not a concern.

Where Vandal Protection Fencing is required, the fencing shall be installed behind the steel tubing as shown in Figure 305.3-2. However, the steel tubing may be omitted if the concrete parapet height is 32" or greater. See Figure 305.3-1. If the tubing is omitted, the fencing should extend the full length of the concrete parapet and the additional 18" parapet height at each end, as detailed in the standard, is not required.

The concrete parapet shall be designed and detailed as follows:

- A. All horizontal reinforcing steel shall be detailed as continuous for the total length of the structure.
- B. Crack control joints shall be sawed into the concrete parapets. The distance between the saw-cut joints on the structure shall be between 6'-0" and 10'-0". The detailed locations of the crack control joints and vertical reinforcing bars shall be shown in the contract plans.
- C. The saw-cut crack control joint shall be detailed as 1 ¼ inch deep and shall be filled with a polyurethane or polymeric material conforming to ASTM C920, Type S. The bottom one-half inch of both the inside and outside face shall be left unsealed to allow any water that enters the joint to escape. This requirement is established in the Standard Bridge Drawing; however, a plan note is required for special designs. See Section 600.

305 FENCING

305.1 GENERAL

The primary purposes of protective fencing are to provide for the security of pedestrians and to discourage the throwing or dropping of objects from bridges onto traffic below.

The Vandal Protection Fencing Standard Bridge Drawing provides standard details for fencing attached to bridges. The designer may need to enhance this standard to deal with requirements for the specific structure.

305.2 WHEN TO USE

Fencing shall be installed on all bridges over vehicular and pedestrian traffic except as noted herein. Fencing shall be installed on bridges over rail traffic if required in an agreement with the affected railroad. Bridges that carry freeways as defined in the ORC 4511.01 where pedestrians are prohibited per ORC 4511.051 shall be exempt from fencing, unless otherwise specified in the Scope of Services. For facilities not defined as freeways by the ORC, use the table below. For existing bridges, fencing shall be provided when new concrete or refaced concrete barriers are installed. At locations where fencing will adversely affect public safety (e.g. reduced sight distance), submit a written request for exemption to the Administrator of the Office of Structural Engineering. An exemption request form is available as a Design Data Sheet on the Office of Structural Engineering web page. The request for exemption shall include supporting documentation.

Under Bridge Feature	Fence Required
Interstate	Yes
US Route	Yes
State Route	Yes
County\Township Route	Yes
City Route	Yes
Railroad	Yes/No (Based on RR agreement)
Waterway	No
Bike/Walking path	No

305.3 FENCING CONFIGURATIONS

For structures without sidewalks, the top of fence shall be a minimum height of 8-ft above the pavement surface. For structures with sidewalks, the top of fence shall be a minimum height of 8-ft above the sidewalk. For a greater degree of protection against objects being thrown from the bridge, the fence may be curved to overhang the sidewalk. For curved fence the posts shall be vertical for at least 8-ft above the sidewalk before curving inward over the sidewalk. The overhang shall be at least 1-ft less than the width of the sidewalk. See Figures 305.3-1 & 305.3-2.

For pedestrian bridges, use bent pipe frames with pipe bend radii of 24" at the upper corners and the start of the radii about 8-ft above the sidewalk surface. The fabric shall start at the deck line, top of curb or parapet and may stop at the upper end of the bent portion of the frame. Fabric on the top horizontal area of the frame is not required to prevent an individual from walking on the top of the enclosure. See Figure 305.3-3 for an illustration of this configuration. Alternatively, the frame may be designed to form a peak at the center of the structure, similar to a house

roofline.

The maximum gap at the bottom of the fence shall be 1-in. A detail to close the bottom of a fencing section is included on the standard bridge drawing.

Posts and frames may be either plumb or perpendicular to the longitudinal grade of the bridge, subject to considerations of aesthetics or practicality of construction. Complete details of base plates, pipe inserts or other types of base anchorage shall be provided on the plans. If applicable to the specific project, details from the standard bridge drawing may be referred to in the project plans.

Fencing on the bridge shall extend between its End Posts placed at the locations selected from the following list that creates the shortest length:

- A. 30-ft \pm 2.5-ft beyond the under bridge route's edge of traveled way nearest the fence terminal
- B. The centerline of the abutment expansion joint (-2.5-ft, + 0-ft)
- C. The end of the bridge barrier (-2.5-ft, +0-ft)

Designers shall also place fence on structures parallel to traffic and that carry sidewalks located 30-ft or less from the nearest edge of the traveled way below.

For bridges where a snooper truck will be used for inspection, use only straight fence with the top of the fence located 10-ft or less above the deck.

305.4 SPECIAL DESIGNS

The design loading for non-standard fence designs shall be in accordance with LRFD 15.8.

For fence installation projects on new structures, the installation of a traffic railing (steel tubing) is not required if the top concrete parapet or concrete wall is 36-in above roadway for structures without sidewalks or 36-in above the top of sidewalk for structures with sidewalks. See Figure 305.3-1.

Where the standard gray chain link fence mesh detracts from a project's aesthetic enhancements, designers may select an optional color from the following: green, olive green, brown and black. Designers shall consider the welded wire fabric, BDM Section 305.5.B, for additional color options. Color coating of posts and rails shall utilize a two coat shop applied epoxy/urethane system in accordance with C&MS 708.02. Plan notes for this coating system are available from OSE upon request.

For special fence designs, plan notes shall be required to define non-standard color, materials, traffic maintenance, construction procedures and other requirements. The designer should follow the example of standard bridge drawing for development of required notes.

305.5 FENCE DESIGN GENERAL REQUIREMENTS

Fencing mesh shall consist of either of the following materials:

- A. Chain-link wire mesh with one inch diamonds. The core wire shall be 11 gage with a Polyvinyl chloride coating. (C&MS 710.03)
- B. Welded wire fabric with ½” x 3” opening size. The core wire shall be 10.5 gage; galvanized after welding (1.2 oz zinc/ft²), and PVC coated (10 mil).

Brace and bottom rails shall be clamped to posts or post frames.

The top rail, if any, of a free-standing fence shall be continuous over two or more posts and suitable cap fittings provided.

Bent pipe frames for narrow pedestrian bridges are permitted. Bent pipe frames for narrow pedestrian bridges shall be fabricated in two or more sections and field spliced at the top with sleeves bolted to the frame sections.

To prevent pipe blow-ups during galvanizing, both ends of pipe shall be open. Therefore base plates shall have holes in them almost equal to the pipes' inside diameter.

305.5.1 WIND LOADS

The design wind loading for non-standard fence designs shall be in accordance with LRFD 15.8.2.

The projected area for wind forces on 11 gage polyvinyl chloride coated with one inch diamond wire mesh shall be 20% of the gross horizontally projected area.

Additional area for posts, rails and other hardware need not be considered.

305.6 TEMPORARY VANDAL PROTECTION FENCING

The intent of temporary vandal protection fencing is to discourage pedestrians from dropping or throwing heavy objects off the side of the bridge onto traffic below during construction. Use the Design Data Sheet, TVPFDD-1-18, Temporary Vandal Protection Fencing to determine the fencing requirements on bridges during construction.

Standard Bridge Drawing, TVPF-1-18, Temporary Vandal Protection Fencing, provides details for:

- A. Type A – Fencing installed on existing barrier systems and on the existing deck surface near the phased construction joint
- B. Type B – Fencing installed on the back side of the PCB. Refer to BDM Section 304.3.4 for PCB anchoring requirements. As a minimum, provide at least one anchor per PCB segment

on the traffic side of the barrier.

- C. Type C – Fencing installed along the phased construction joint side of a newly constructed deck.

The length of each type of temporary vandal protection fencing installation shall be in accordance with the minimum tolerance lengths defined in BDM Section 305.3.

The Department will utilize permanent vandal protection fencing where possible to minimize costs for temporary fencing. Therefore, new permanent fence installations shall be placed prior to shifting traffic onto that phase of construction. Temporary vandal protection fencing installed on existing barrier shall be left in place until the barrier is removed from the bridge. All other types of temporary vandal protection fencing shall remain in place until the Engineer determines that it is no longer necessary. Once removed, reinstallation of temporary vandal protection fencing is not required.

The plans shall provide pay item(s) in the Estimated Quantities; shall show the limits and location of each temporary vandal protection fencing installation; and shall show the appropriate temporary vandal protection fencing type on the Maintenance of Traffic Transverse Sections. If necessary, the plans shall also provide all non-standard connection and fence details; address special installation sequencing; and include all other special notes. Provide details for temporary vandal protection fencing across intermediate expansion joints.

306 EXPANSION DEVICES

306.1 GENERAL

Expansion devices should provide a total seal against penetration and moisture. Standard bridge drawings are available for expansion devices for typical bridge superstructure types.

For fabricated steel expansion devices, the designer should specify the type of steel required. Type of steel should be included as a plan note if requirements in the plans are not covered by a selected standard bridge drawing.

To protect steel expansion devices, metallizing of the exposed surfaces with a 100% zinc coating shall be specified. Standard bridge drawings define the requirements for metallizing. The design agency will need to develop plan notes for special expansion devices, such as finger joints and modular joints. Use the note for shop-applied metallizing located in the appendix as a guideline. Consult the Office of Structural Engineering for recommendations prior to completion of the project plans.

306.1.1 PAY ITEM

Expansion devices, except as specifically listed in this section, shall be paid for as Item 516.

For sealed expansion devices the elastomeric seal, either strip or compression, shall be included in the pay Item 516.

The plans shall clearly show what components are included with the expansion devices, Item 516. As an example, cross frames, which are field welded to both the superstructure girders and the expansion devices, are part of the 513 structural steel item. The seal is considered part of the expansion device and should be included in the 516 pay item.

306.1.2 EXPANSION DEVICES WITH SIDEWALKS

On structures with sidewalks, the expansion devices shall be the same type as furnished for main bridge deck expansion joint.

Sidewalk details for standard expansion devices (strip seals) are shown on the standards. For non-standard devices, a curb plate and sidewalk cover plate will be required. The Curb and sidewalk plates should be separated at the interface of the sidewalk and curb. See details on Standard Bridge Drawings: EXJ-2-81, EXJ-3-82, EXJ-4-87, EXJ-5-93 and EXJ-6-17 for sidewalk plates.

306.1.3 EXPANSION DEVICES WITH STAGE CONSTRUCTION

On projects involving stage construction, joints in the seal armor must be located and shown in the plans. At the stage construction lines, expansion devices should require complete penetration welded butt joints. If butt welds will be in contact with a sealing gland the butt-welded joint shall be ground flush at the contact area.

306.2 EXPANSION DEVICE TYPES

306.2.1 ABUTMENT JOINTS IN BITUMINOUS CONCRETE, BOX BEAM BRIDGES

This poured joint seal system is capable of small expansion movements, up to 3/16". Refer to AS-1-15 Sheet 2, Detail A. This joint system requires including the following bid item in the structure estimated quantities: Item 409 - Sawing and Sealing Bituminous Concrete Joints.

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610.6 COFFERDAMS AND EXCAVATION BRACING

Use this note when the plans include detail designs for temporary shoring.

- [610.6-1]** ITEM 503, COFFERDAMS AND EXCAVATION BRACING, AS PER PLAN:
The design shown on the plans for temporary support of excavation is one representative design that may be used to construct the project. The Contractor may construct the design shown on the plans or prepare an alternate design to support the sides of excavations. If constructing an alternate design for temporary support of excavation, prepare and provide plans in accordance with C&MS 501.05. The Department will pay for the temporary support of excavation at the contract lump sum price for Cofferdams and Excavation Bracing. No additional payment will be made for providing an alternate design.

610.7 DECK PLACEMENT NOTES

610.7.1 FALSEWORK AND FORMS

Use the following note when web depths greater than 84 in. are specified.

- [610.7.1-1]** ITEM 511, CLASS QC2 CONCRETE, SUPERSTRUCTURE, AS PER PLAN *
Locate the lower contact point of the overhang falsework at least ** inches \pm 2 in. above the top of the girder's bottom flange. The bracket contact point location requirements of C&MS 508 do not apply.

NOTE TO DESIGNER:

- * Modify the pay item description to fit the specific project requirements.
- ** The minimum dimension for the location for the lower point of contact should be 76 in. below the bottom of the top flange. Designers should verify the acceptability of the design within the range of tolerance specified.

610.7.2 DECK PLACEMENT DESIGN ASSUMPTIONS

Use the following note on all projects requiring mechanized finishing machines to place deck concrete.

[610.7.2] DECK PLACEMENT DESIGN ASSUMPTIONS:

The following assumptions of construction means and methods were made for the analysis and design of the superstructure. The Contractor is responsible for the design of the falsework support system within these parameters and will assume

responsibility for superstructure analysis for deviation from these design assumptions.

An eight wheel finishing machine with a maximum wheel load of _____ kips.

A minimum out-to-out wheel spacing at each end of the machine of 103”.

A maximum spacing of overhang falsework brackets of 48 in.

A maximum distance from the centerline of the fascia girder to the face of the safety handrail of 65”.

NOTE TO DESIGNER:

Refer to BDM Section 302.2.7.2.c for design information regarding finishing machine loads.

610.8 VANDAL PROTECTION FENCING

For bridges where non-standard vandal protection fencing is provided in accordance with BDM Section 305.6 and the bridge is constructed in phases, provide the following plan note:

[610.8-1] VANDAL PROTECTION FENCING

Install fencing for each construction phase prior to opening that phase to vehicular and/or pedestrian traffic.

610.9 PRECAST WALLS

Use note **[610.9-1]** for 4-sided box culverts (C&MS 706.05), 3-sided flat top culverts (C&MS 706.051), arch culverts (C&MS 706.052) and circular arch culverts (C&MS 706.053) where the angle between the centerline of the waterway and the exposed face of the wall is 30 degrees or more.

[610.9-1] ITEM 511, CLASS QC1 CONCRETE, RETAINING/WINGWALL NOT INCLUDING FOOTING, AS PER PLAN:

The Department will permit the use of precast concrete in lieu of cast-in-place concrete for headwalls and wingwalls in accordance with C&MS 602.03. The Department will pay for the wingwall and headwall concrete in Square Yard as determined from plan dimensions using the wall heights above the footing and length along the exterior faces of the walls. The Department will consider the reinforcing steel in the wingwalls and headwalls, including the reinforcement that extends into the footings, as incidental to the retaining/wingwall concrete. The total quantity of cast-in-place wingwall and headwall concrete is _____ Cu Yd. The total quantity of cast-in-place wingwall and headwall reinforcing steel is _____

____ Lbs.

NOTE TO DESIGNER: Where note [610.9-1] applies, the Department will pay for the concrete and reinforcing steel in wingwalls and headwalls on a Square Yard basis to avoid the need to non-perform multiple work items associated with the change from cast-in-place to precast concrete. For informational purposes only, include the reinforcing steel for the cast-in-place wingwalls and headwalls in the plan's Reinforcing Steel List and include bending diagrams. The Department will pay for concrete and reinforcing steel in the footings as Item 511 (Cu Yd) and Item 509 (Lb) respectively. The Department will consider the bars that extend from the footing into the wingwalls as wingwall reinforcement. Do not locate foundations for other roadway items (e.g. sign supports) in the soils retained behind wingwalls.

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