OHIO DEPARTMENT OF TRANSPORTATION

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

July 19, 2013

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: 2013 Third Quarter Revisions

Revisions have been made to the ODOT Bridge Design Manual, July 2007. These revisions shall be implemented on all Department projects begin Stage 2 plan development date after July 19, 2013. 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/HighwayOps/Structures/standard/Pages/default.aspx

Attached is a brief description of each revision.

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Summary of Revisions to the July 2007 ODOT BDM

BDM Section	Affected Pages	Revision Description
303.4.2.6	3-65	This change reflects the Department's consolidation of geotechnical expertise into the Office of Geotechnical Engineering.
304.2	3-74 through 3-75	These changes reflect the Department's release of updated and new Standard Bridge Drawings for concrete barriers.
306.2.3	3-83 through 3-83.2	This change resulted from the Department's release of a new supplemental specification for Polymer Modified Asphalt Expansion Joints which replaced the Office of Structural Engineering Plan Insert Sheet for the same product.
606.2	6-15	This change to note [606.2-4] reflects the Department's consolidation of geotechnical expertise into the Office of Geotechnical Engineering.
606.5	6-17	This change to note [606.5-1] permits the note to be used with either the 2010 or 2013 C&MS.
606.6	6-18	This change to note [606.6-2] reflects the Department's consolidation of geotechnical expertise into the Office of Geotechnical Engineering.
610.3	6-24	Note [610.3-1] has been retired with the release of updated and new Standard Bridge Drawings for concrete barriers.
1013	10-29	These changes reflect the Department's release of updated and new Standard Bridge Drawings for concrete barriers.

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necessary to avoid settlement due to group action by increasing the periphery of the soil mass.

In order to avoid the effects of downdrag, no battered piles shall be driven into new embankments until a waiting period for in-situ soil consolidation has concluded. Consult the Office of Structural Engineering for more information.

Abutment piles should be battered normal to the centerline of bearings.

Piles less than 15 ft [5 m] in length and driven to refusal on bedrock should not be battered.

A plan note is available in BDM Section 600 to establish the driving criteria for battered friction piles.

303.4.2.5 PILE DESIGN LOADS

Refer to BDM Section 202.2.3.2 for specific plan requirements.

Factored pile loads approaching the maximum factored structural resistance as specified in BDM Sections 202.2.3.2.a or the maximum Ultimate Bearing Value as specified in BDM 202.2.3.2.b should be utilized to minimize the number of piles.

303.4.2.6 PILES, STATIC LOAD TEST

The Designer shall specify a Static Load Test when the total pile order length for an individual structure exceeds 10,000 ft [3000 m] for piling of the same size and Ultimate Bearing Value. Static load testing is not required for piling driven to refusal on bedrock.

The Designer shall specify one subsequent static load test for each additional 10,000 ft [3000 m] increment of pile order length. Each static load test requires two dynamic testing items and two restrike items. Restrikes are a useful tool to determine if a driven pile gains or loses capacity over time.

The results of both the static and dynamic testing shall be forwarded to the Office of Geotechnical Engineering to the attention of the Foundations Engineer. Refer to Section 600 for a General Note to include in the plans.

303.4.2.7 PILES, DYNAMIC LOAD TEST

The Department now requires dynamic load testing to establish the driving criteria (i.e. blow count) for all piling not driven to refusal on bedrock. The dynamic testing and resulting wave analysis has replaced the Engineering News Record Formula, used in previous issues of the CMS.

For an individual structure, the Designer shall specify one dynamic load testing item for each

pile size. If multiple pile capacities are required for a given pile size, the Designer shall specify one testing item for each Ultimate Bearing Value. When static load tests are required, provide two dynamic load testing items and two restrike items for each static load test item.

The driving criteria for battered piles will be determined in the field as a function of a dynamically tested vertical pile of the same Ultimate Bearing Value. When battered piles are specified, refer to Section 600 for a General Note to include in the plans.

One dynamic load testing item consists of testing a minimum of 2 piles and performing a CAPWAP analysis on one of the two piles. One restrike item consists of performing dynamic testing on two piles and performing CAPWAP analysis on one of the two piles.

303.4.2.8 PILE FOUNDATION – DESIGN EXAMPLE

The following example for a 6-span bridge shall be used as a guide for specifying pile testing and estimated quantities for pile foundations.

Rear Abutment ~

30 - 12" C.I.P. Reinforced Concrete Piles

20 piles installed vertical & 10 piles battered

Ultimate Bearing Value = 152 kip

Estimated Length = 65 ft

Order Length = 70 ft (Total Length = 2100 ft)

Requires 1 dynamic load-testing item.

Piers 1, 2, 3, & 4 ~

80 - 14" C.I.P. Reinforced Concrete Piles at each pier

56 piles installed vertical & 24 piles battered

Ultimate Bearing Value = 250 kip

Estimated Length = 70 ft

Order Length = 75 ft (Total Length = 24,000 ft)

The total length (24,000 ft) requires 1 static load test item and 1 subsequent static load test. Each static load test requires 2 dynamic load testing items and 2 restrike items.

Bridge Railing Testing Criteria	Acceptance Equivalencies					
NCHRP 350	TL-1	TL-2	TL-3	TL-4	TL-5	TL-6
NCHRP 230		MSL-1 MSL-2		MSL-3		
AASHTO Guide Specification		PL-1		PL-2	PL-3	

The AASHTO Guide Specification provides a Performance Level Selection Criteria for bridge railings that is considered an acceptable alternative to NCHRP Report 350 and may be used for railing designs on any project.

Section 304.2 of this Manual lists standard ODOT bridge railing types available along with the corresponding NCHRP 350 level of acceptability. For non-standard railing designs, a review submission, concurrent with the Structure Type Study, shall be made to the Office of Structural Engineering as stated in Section 201 of this Manual. The design of all non-standard railing systems shall be based on the NCHRP 350 or MASH level of acceptability. Designers may be required to submit actual crash test report data to verify the level of acceptability of a proposed design.

Modifications to the ODOT standard railing types or other NCHRP 350 or MASH approved railing system should be avoided. Additional structural steel tubing added to satisfy pedestrian concerns does not require additional crash testing provided these elements do not protrude nearer to the roadway than the rail elements on the tested design and they do not present any type of snagging potential to an impacting vehicle. If an accepted crash tested railing system is modified, the face geometry (i.e. offset, rail height, spacing, etc.) shall match the tested design and the static strength and deflections shall remain at least equal to the tested design. Include with the preliminary design submission to the Office of Structural Engineering, strength and deflection calculations to support these modifications. The calculations shall follow the procedure defined in the *AASHTO LRFD Bridge Design Specifications, Sections A13.1-3*. The intent of any modification shall be to maintain the original NCHRP 350 or MASH acceptability level.

All railing elements fabricated with ASTM A500 steel tubing shall specify a drop-weight tear test per CMS 707.10. Provisions shall be made at tube splices for expansion and contraction. Steel railing systems shall also allow for structural movement at expansion joints without adversely affecting the system's level of acceptability.

Aesthetically pleasing railing systems have been successfully crash tested but are for use only where TL-2 acceptability requirements are allowed. These systems include the Texas Classic Traffic Railing, Type T411 with open windows, a smooth stone masonry barrier with reinforced concrete core wall and an artificial stone precast concrete barrier. Detailed information regarding the latter two systems may be found in FHWA Report No. FHWA-RD-90-087 "Guardrail Testing Program: Final Report", June 1990 and FHWA Report No. FHWA-SA-91-051 "Summary Report on Selected Aesthetic Bridge Rails and Guardrails", June 1992.

The recommended railing design for bridges with combination vehicular and pedestrian traffic is detailed in Standard Bridge Drawing BR-2-98. Other designs are allowed as previously mentioned above, provided the following requirements are met:

A. The curb height shall be 8".

B. The sidewalk width shall be 5'-0" or greater.

A pedestrian railing may be used in lieu of a crash tested barrier at the deck edge provided a crash tested barrier system meeting the minimum requirements for the specific location is used to separate the vehicular and pedestrian traffic. Pedestrian railing shall be designed in accordance with AASHTO.

304.2 STANDARD RAILING TYPES

Drawing No.	Description	NCHRP Level
BR-1-13	36" New Jersey Shape Concrete Bridge Railing	TL-4
	42" New Jersey Shape Concrete Bridge Railing	TL-5
BR-2-98	Bridge Sidewalk Railing with Concrete Parapet	TL-4
DBR-2-73	Deep Beam Bridge Guardrail	TL-2
DBR-3-11	Deep Beam Bridge Retrofit Railing	TL-3
PCB-91	Portable Concrete Barrier (Fully Anchored)	TL-4
	Portable Concrete Barrier (Unanchored)	TL-3
SBR-1-13	42" Single Slope Concrete Bridge Railing	TL-5
SBR-2-13	57” Single Slope Concrete Median (Unreinforced)	TL-3
	57” Single Slope Concrete Median (Fully Reinforced)	TL-5
TST-1-99	Twin Steel Tube Bridge Railing	TL-4

304.3 WHEN TO USE

304.3.1 PARAPET TYPE (BR-1-13, SBR-1-13 & SBR-2-13)

The Department currently has three (3) standard concrete parapet type bridge railing systems for

use at deck edges: a 36" New Jersey shape, a 42" New Jersey shape and a 42" single slope shape. These systems are for use on roadway and railroad overpass structures with no sidewalks and structures where the finished deck surface is 25-ft or more above the ground line or water surface. Details for these parapet types, including end transitions to terminal assemblies, are provided in the Standard Bridge Drawings. The transition section may be placed on a structure's turned back wingwalls, widened approach slab or directly on the actual structure.

The 36" barrier section is for use on structures located on two (2) lane routes with an ADTT in one direction less than 2500.

The 42" barrier sections are for use on structures located on interstates, divided highways of four (4) lanes or more, and two (2) lane routes with an ADTT in one direction of 2500 or more. Final decision of which section to use rests with the districts and should be finalized during the preliminary structural design review. The single slope barrier section is unaffected by the placement of future overlays, but weighs 23% more than the 42" New Jersey type parapet.

A Standard Bridge Drawing detailing a 57" single slope median barrier is available for use on structures where protection against oncoming headlight glare is required.

For each of the above listed barrier types, designers are required to confirm the structural adequacy of the concrete deck slab as described in the "Concrete Deck Design" Section 302.2 of this manual.

For all concrete parapet type barriers including the 14'-0" transition, the project plans shall include the following information: plan views, elevation views, cross-sections, deflection joint spacing, deflection joint details, reinforcing marks, reinforcing bending diagrams and reinforcing weights. Reference in the plans to the Standard Bridge Drawings shall be made for historical purposes only.

304.3.2 DEEP BEAM BRIDGE GUARDRAIL (DBR-2-73)

This railing configuration does not meet the Department's minimum NCHRP 350 acceptance criteria (i.e. TL-3) for use on any project unless supported by the selection procedures described in Section 304.1 of this manual and upgraded to DBR-3-11. In no case, shall this railing system be used on an overpass structure or a project where the finished deck surface is greater than 25 feet above the normal water surface elevation or final ground line.

The standard configuration for this rail type does not meet the minimum requirements specified by AASHTO for pedestrian and bicycle railings and shall not be used where pedestrian or bicycle traffic is expected. A modified railing design meeting these requirements and using the Type 1 post design may be justified.

Use of Type A anchors, as detailed on the Standard Bridge Drawing, is not recommended. The Type B alternative is recommended because they are easier to install in a deck or box beam and easier to replace if damaged in a collision.

Designers should recognize that variable post lengths may be required along the length of a structure due to beam camber. A design data sheet is available from the Office of Structural Engineering to address these concerns.

304.3.3 TWIN STEL TUBE BRIDGE RAILING (TST-1-99)

This railing configuration was developed as a replacement to the Deep Beam Bridge Guardrail system on projects requiring a higher NCHRP acceptance level. The Twin Steel Tube Bridge Railing is for use over rural stream crossings on two (2) lane routes with an ADTT in one direction less than 2500 where the finished deck surface is less than 25 feet above the normal water surface elevation or final ground line. This system shall not be used on an overpass structure.

The standard configuration for this rail type does not meet the minimum requirements specified by AASHTO for pedestrian and bicycle railings and shall not be used where pedestrian or bicycle traffic is expected. A modified railing design meeting these requirements may be justified.

The required bridge terminal assembly section used to transition from Type 5 or 5A approach roadway guardrail to the bridge railing is detailed on Standard Construction Drawing GR-3.6.

The typical post spacing is 6'-3". The standard drawing enables the designer to reduce the first, last and one additional post spacing per span on each side of the bridge to account for construction clearances. The designer should carefully review the position of the posts that are near the corner of a structure for possible interference with wingwalls, tie rods, etc. For box beam bridge types, post spacing dimensions shall be referenced to each box beam end.

The site plan shall show the station of the center of the first inlet-mounted post on each corner of the bridge.

304.3.4 PORTABLE CONCRETE BARRIER (PCB-91)

This system is for use on construction projects to protect project personnel and to provide a temporary barrier system when a permanent bridge railing system does not exist. Application guidelines for PCB-91 are provided in Design Data Sheet, PCB-DD, available at the Office of Structural Engineering web site.

The designer is required to detail the installation requirements, including the number of anchor bolts per barrier, in the bridge plans. The pay item for this barrier system is Item 622 - Portable Concrete Barrier, 32 inch, Bridge Mounted. Although temporary railing is to be specified and completely described in the bridge plans, temporary railing is a roadway item and shall be included in the roadway quantities.

306.2.2 ABUTMENT JOINTS AS PER AS-1-81

A group of no or small movement joints used for sealing and rotational purposes are detailed on Standard Bridge Drawing, AS-1-81.

306.2.3 EXPANSION JOINTS USING POLYMER MODIFIED ASPHALT BINDER

This device is for use on structures with concrete or asphalt overlays and where total expected movement is 0 to 1½". The Department has a Supplemental Specification for the Polymer Modified Asphalt Expansion Joint System.

Thickness of the polymer-modified joint shall be between 2" and 5”. The design plans shall show a plan view and cross-section of each polymer modified asphalt expansion joint location on the bridge. The plan view shall provide the station of the joint centerline at the centerline of construction, skew angle and dimension its length as measured along the centerline of the joint. The cross-section shall dimension the width and thickness of the joint, width of the expansion gap and other significant joint details.

306.2.4 STRIP SEAL EXPANSION DEVICES

The seal size is limited to a 5" [125 mm] maximum. Unpainted A588[M] weathering steel should not be used in the manufacture of this type expansion device as A588[M] does not perform well in the atmospheric conditions an expansion device is subjected to. Standard Bridge Drawings, EXJ-4-87, EXJ-5-93 and EXJ-6-95, are available. The designer must ensure that all details are covered in the plans because the standard drawing is not inclusive for all structure types.

The strip seal shall be of one piece across the total width of the structure. No splices will be acceptable.

306.2.5 COMPRESSION SEAL EXPANSION DEVICES

Maximum allowable seal size is 4" [100 mm]. A 5" [125 mm] wide seal shall not be used since installation problems have been encountered. Compression seal expansion devices are limited to structures with a maximum skew of 15 degrees. Movement should be limited so that the seal is not compressed greater than 60 percent or less than 20 percent.

The compression seal shall be of one piece across the total width of the structure. No splices will be acceptable. Standard Bridge Drawings EXJ-2-81 & EXJ-3-82 give generally used details.

306.2.6 STEEL SLIDING PLATE ENDDAMS, RETIRED STANDARD DRAWING SD-1-69

In general steel sliding plate enddams are not recommended for new structures. This expansion device is limited to total movement of 4" [100 mm], including movement in both directions.

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Sliding plates should be configured to prevent binding and bearing when the superstructure is supported on elastomeric bearings.

Unpainted A588[M]/A709[M] Grade 50W materials are not recommended for construction of this type of joint.

306.2.7 MODULAR EXPANSION DEVICES

Modular expansion devices may be required for structures when total required movements exceed movement capacity of a strip or compression seal. Consult the Office of Structural Engineering for recommendations prior to completion of the project plans.

Modular devices main load bearing beams, support beams and welds shall be designed for fatigue.

The manufacturer of the expansion device shall be required by plan note to submit design calculations showing that the device can meet the impact and fatigue design requirements.

Modular devices have been known to fail at connections due to welding and fatigue. Therefore it is recommended the following general requirements be included in any project plan notes:

A. Spacing of support beams shall be limited to 3'-0" [1000 mm] centers under main load bearing beams unless fatigue testing of the actual welding connection details has been performed to show that a greater spacing is acceptable. Fatigue resistance shall be determined according to *LRFD 6.6.1.2.5* and BDM Section S*6.6.1.2.5*.

B. Shop or field welds splicing main beams, or connections to the main beams shall be full penetration welded and 100 percent non-destructively tested in accordance with AWS D1.5 Bridge Welding Code. Any required field splices or joints and non-destructive testing shall be located and defined in the plans.

C. Fabricators of modular devices shall be pre-qualified 513 Level UF fabricators. Review Section 302.4.1.3 and contact the Office of Structural Engineering for recommendations.

D. Approved manufacturer/fabricator shall supply a qualified technical representative to the jobsite during all installation procedures.

E. Seals shall be one continuous piece through the total length of the structure.

Design of support for the modular device and deck thickness should allow for multiple styles or designs of modular devices. Contact suppliers and become familiar with the modular devices available.

Contact the Office of Structural Engineering for sample notes used on other projects.

(5) Specify the order length according to BDM Section 202.2.3.2.c and 303.4.2.1.

(6) Specify the number of dynamic load testing items according to BDM Section 303.4.2.7.

Provide the following note when Static Load Testing is required according to Section 303.4.2.5. Modify the note as necessary to fit the specific condition.

[606.2-4] STATIC LOAD TEST: Perform dynamic testing on the first two production piles to determine the required blow count for the specified Ultimate Bearing Value. Perform the static load test on either pile. Do not over-drive the selected pile. Drive the third and fourth production piles to 75% and 85% of the determined blow count, respectively and perform dynamic testing on each. The test piles and the reduced capacity piles shall not be battered. After installation of the first four production piles, cease all driving operations on piling represented by the static load testing for a minimum of 7 days. After the waiting period, perform pile restrikes on the four piles (two restrike test items). The Engineer will review the results of the pile restrikes and establish the driving criteria for the remaining piling represented by the testing. Submit all test results to the Office of Geotechnical Engineering.

For subsequent static load tests, upon completion of a 10,000 ft increment of driven length, repeat the above procedure for the initial static load test. If necessary, the Engineer will revise the driving criteria for the remaining piling accordingly.

When performing the restrike, if the pile has not reached the blow count determined for the plan specified Ultimate Bearing Value, continue driving the pile until this capacity is achieved.

The following note, modified to fit the specific conditions for the foundation required, will apply when uplift loads control the design of the pile. In this case, the piles are typically driven to a pile tip elevation and dynamic load testing of the pile is not performed.

[606.2-5] Note Retired – See Appendix

[606.2-6] PILES DRIVEN TO TIP ELEVATION FOR UPLIFT: Drive the piles to the pile tip elevation shown on the plans. Do not perform dynamic load testing on piles driven to a tip elevation. Select the hammer size to achieve the required depth. Provide plain cylindrical casings with a minimum pile wall thickness of (1) inch for piles driven to a tip elevation.

Abutment piles:

(2) piles (3) feet long, order length

NOTE TO DESIGNER:

(1) Specify the minimum pile wall thickness for cast-in-place reinforced concrete piles. Determine the minimum pile wall thickness from a pile drivability analysis. Remove this sentence if the piles are H-piles.

(2) Specify the size of pile (e.g. HP 10 x 42 or 12 inch diameter).

(3) Specify the order length according to BDM Section 202.2.3.2.b and 303.4.2.1.

606.3 STEEL PILE POINTS

[606.3-1] Note Retired – See Appendix

606.4 PILE SPLICES

Provide the following note when H-piles are specified.

[606.4-1] PILE SPLICES: In lieu of using the full penetration butt welds specified in CMS 507.09 to splice steel H-piles, the Contractor may use a manufactured H-pile splicer. Furnish splicers from the following manufacturer:

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Associated Pile and Fitting Corporation

8 Wood Hollow Rd. Plaza 1

Parsippany, New Jersey 07054

Install and weld the splicer to the pile sections in accordance with the manufacturer's written assembly procedure supplied to the Engineer before the welding is performed.

606.5 PILE ENCASEMENT

The following note shall be used where capped pile piers and steel "H" piles are being used for a bridge structure crossing a waterway. The exposed steel piling corrodes at the waterline, or near there. The note should not be used if the capped pile pier standard drawing is being used as standard drawing already specifies pile encasement methods.

[606.5-1] ITEM SPECIAL - PILE ENCASEMENT

Encase all steel H-piles for the capped pile piers in concrete conforming to C&MS 511 (F′c = 4.0 ksi). Provide a concrete slump between 6 to 8 inches with the use of a superplasticizer. Place the concrete within a form that consists of polyethylene pipe (707.33), or PVC pipe (707.42). The encasement shall extend from 3 feet below the finished ground surface up to the concrete pier cap. Position the pipe so that at least 3 inches of concrete cover is provided around the exterior of the pile.

In lieu of encasing the pile in concrete, galvanize the piles according to 711.02. The galvanizing shall be continuous from a minimum of 3 feet below the finish ground surface up to the concrete pier cap. The galvanized coating thickness shall be a minimum of 4 mils. Repair all gouges, scrapes, scratches or other surface imperfections caused by the handling or the driving of the pile to the satisfaction of the Engineer.

The Department will measure pile encasement by the number of feet. The Department will determine the sum as the length measured along the axis of each pile from the bottom of the encasement to the bottom of the pier cap. The Department will not pay for galvanizing provided beyond the project requirements. The Department will pay for accepted quantities at the contract price for Item - Special, Pile Encasement.

606.6 SPREAD FOOTING FOUNDATIONS

Provide the following note, with the blanks filled in as appropriate for each individual project, if there are abutments or piers which are supported by spread footings.

[606.6-1] FOUNDATION BEARING RESISTANCE: _(1)_ footings, as designed, produce

a maximum Service Load pressure of __(2)__ kips per square foot and a maximum Strength Load pressure of __(2)__ kips per square foot. The factored bearing resistance is __(3)__ kips per square foot.

NOTE TO DESIGNER:

(1) Specify the location of the spread footing.

(2) Specify the maximum factored bearing pressures.

(3) Specify the factored bearing resistance according to *LRFD 10.6.3* and BDM Section 202.2.3.1.

When abutments or piers are supported by spread footings on soil, include the following note to require that reference monuments be constructed in each footing. The purpose of the reference monuments is to document the performance of the spread footings, both short and long term.

[606.6-2] ITEM 511, CLASS __*__ CONCRETE, __*__ , AS PER PLAN : * In addition to the requirements of Item 511*, install a reference monument at each end of each spread footing. The reference monument shall consist of a #8, or larger, epoxy coated rebar embedded at least 6" into the footing and extended vertically 4 to 6 inches above the top of the footing. Install a six inch diameter, schedule 40, plastic pipe around the reference monument. Center the pipe on the reference monument and place the pipe vertical with its top at the finished grade. The pipe shall have a removable, schedule 40, plastic cap. Permanently attach the bottom of the pipe to the top of the footing.

Establish a benchmark to determine the elevations of the reference monuments at various monitoring periods throughout the length of the construction project. The benchmark shall be the same throughout the project and shall be independent of all structures.

Record the elevation of each reference monument at each monitoring period shown in the table below.

The original completed tables will become part of the District's project plan records.

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610.3 CONCRETE PARAPET SAWCUT JOINTS

[610.3-1] Note Retired – See Appendix

610.4 BEARING PAD SHIMS, PRESTRESSED

Add the following note to ensure proper seating of prestressed concrete box beams for skewed bridges.

[610.4-1] BEARING PAD SHIMS: Place 1/8" thick preformed bearing pad shims, plan area ___ inches by ___ inches, under the elastomeric bearing pads where required for proper bearing. Furnish two shims per beam. The Department will measure this item by the total number supplied. The Department will pay for accepted quantities at the contract price for Item 516 - 1/8" Preformed Bearing Pads. Any unused shims will become the property of the State.

NOTE TO DESIGNER: The plan area of the shim pad shall be the same as the elastomeric bearing.

610.5 CLEANING STEEL IN PATCHES

Use this note with all concrete patching bid items that refer to the cleaning requirements specified in 519.04

[610.5-1] ITEM 519 - PATCHING CONCRETE STRUCTURES, AS PER PLAN: Prior to the surface cleaning specified in 519.04 and within 24 hours of placing patching material, blast clean all surfaces to be patched including the exposed reinforcing steel. Acceptable methods include high-pressure water blasting with or without abrasives in the water, abrasive blasting with containment, or vacuum abrasive blasting.

Assume the barrier resistance (R) to be the lesser of:

A. 1.33 times the transverse force (F_t) specified in *Table A13.2-1*, or

B. The calculated parapet resistance specified in *Article A13.3.1*

The transverse force selected for design shall be that which corresponds to the barrier's crash tested acceptance level (i.e. Test Level). The following table provides design overhang data for standard ODOT barrier types:

Barrier System	L_C (ft.)	R (kip)	H (ft.)
SBR-1-12	12.7	165.0	3.5
42″ BR-1-13	12.4	165.0	3.5
36″ BR-1-13	8.8	72.0	3.0
BR-2-98	10.0	72.0	2.5 (1)

(1) For BR-2-98, this height represents the maximum effective height of the railing resistance ($\overline{Y}$). Refer to *Article A13.3.3* for more information.

SA13.4.3.1 OVERHANG DESIGN

Refer to BDM Figures 302.2.2-1 and 302.2.2-3 for the deck overhang reinforcement requirements for the TST-1-99 railing system. Alternative railing systems shall be considered for projects that do not meet the design assumptions for BDM Figure 302.2.2-1.

1014 LRFD SECTION 14 – JOINTS AND BEARINGS

S14.5.6 CONSIDERATIONS FOR SPECIFIC JOINT TYPES

Refer to BDM Section 306 for standard ODOT joint types and applications.

S14.6 REQUIREMENTS FOR BEARINGS

Refer to BDM Section 307 for preferred ODOT bearing types and applications.

S14.6.3.2 MOMENT

For elastomeric bearings utilizing 4 anchor bolts connecting load plates to the bearing seat, M_u , shall be taken as specified by *Eq. 14.6.3.2-3*.

For elastomeric bearings without anchor bolts and those with 2 anchor bolts centered at the centerline of bearing, no moment will be transferred from the superstructure to the substructure.

S14.7.5 STEEL-REINFORCED ELASTOMERIC BEARINGS – METHOD B

The preferred design of elastomeric bearings is Method A. Method B is recommended for use when specialized bearings are being considered. Since Method B designs have additional testing requirements versus Method A designs, these additional costs shall be factored into cost comparisons for Method A designs versus Method B designs versus specialized bearing designs.

The contract plans shall specify the method of bearing design. A sample plan note is provided in BDM Section 700.

S14.7.5.3.2 COMPRESSIVE STRESS

The effect of impact shall be ignored.

S14.7.5.3.4 SHEAR DEFORMATION

Designers shall assume the ambient temperature during setting is 60°F [15°C] to calculate Δ_o.

S14.9 CORROSION PROTECTION

Refer to C&MS 516.03 for standard bearing corrosion protection requirements.