OHIO DEPARTMENT OF TRANSPORTATION

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

July 21, 2017

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: 2017 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 21, 2017. 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.

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Summary of Revisions to the July 2007 ODOT BDM

BDM Section	Affected Pages	Revision Description
301.4.4.2.b	3-3.3	Design guidance has been provided for the use of Fiber Reinforced Polymer (FRP) wrap systems to improve the ductility of existing concrete columns.

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permanent load.

For restraint provided in multiple directions, *LRFD 3.10.8* applies.

The tributary permanent load defined in *LRFD 3.10.9.2* represents the factored dead load of the superstructure applying load to the device or object providing the directional restraint. If every bearing supporting the superstructure provides transverse restraint, the tributary permanent load applied to each restraint would equal the factored dead load reaction at each bearing. If only one transverse restraint was provided at each substructure unit, the tributary permanent load applied to each restraint would equal the sum of the factored dead load reactions for each bearing at the substructure unit. If only one transverse restraint was provided for the entire superstructure unit, the tributary permanent load applied to the restraint would equal the sum of the factored dead load reactions of every bearing. Longitudinal restraint connection forces would be determined similarly.

Because a structure in Seismic Performance Zone 1 is assumed to be able to carry the loads within the elastic strength range of its members, or is assumed to be properly detailed to prevent collapse beyond the elastic strength range of its members, analysis of the superstructure, substructure and foundation for the load effects resulting from the connection force is not required.

Crossframes to resist the horizontal connection force at the Extreme Event Limit state shall be provided to create a direct load path from the point of horizontal connection force application to the deck.

301.4.4.1.c REQUIREMENTS FOR BEARINGS

Unrestrained bearings that sustain irreparable damage during a seismic event are permissible provided loss of span is prevented by the design for the Horizontal Connection Force in BDM Section 301.4.4.1.b.

301.4.4.2 EXISTING STRUCTURES

Seismic vulnerability of a structure shall be considered for rehabilitation projects requiring complete deck or superstructure replacements. New substructure units shall be designed in accordance with *LRFD 3.10.9.2, 4.7.4.4* and *5.7.4.6*. If sufficient geotechnical information is not available, Designers may assume:

A. $A_S > 0.05$

B. $S_{D1} < 0.10$.

301.4.4.2.a SUPERSTRUCTURE

For projects where seismic vulnerability is considered, at bearing locations that will transmit the

horizontal connection force from the substructure to the superstructure, crossframes designed to resist the horizontal connection force shall be provided to create a direct load path to the deck. For supports not in compliance with *LRFD 4.7.4.4*, seismic restrainers designed for the Horizontal Connection Force, specified in BDM Section 301.4.4.1.b, shall be provided.

301.4.4.2.b SUBSTRUCTURE

For projects where seismic vulnerability is considered, concrete columns at piers that transfer the seismic horizontal connection force, according to BDM Section 301.4.4.1.b, shall meet the spiral and tie ductility requirements of *LRFD 5.7.4.6*. Designers may consider releasing restraint provided by existing pier bearings as a viable seismic retrofit provided the abutments can accommodate the additional horizontal Strength and Service loadings. Otherwise, Designers shall provide the required confinement of the primary steel in the axially loaded substructure members.

One acceptable method to increase the amount of confinement provided in an existing concrete column is through the use of Fiber Reinforced Polymer (FRP) wrap systems. These systems are a viable alternative for dry columns supported on pile caps, spread footings and drilled shafts. Research has shown that providing a confining stress of 0.300 ksi in regions where plastic hinges may form at the top and bottom of columns as defined in *LRFD 5.10.11.4.1e* and providing a confining stress of 0.150 ksi outside of the plastic hinge regions is sufficient to prevent buckling of the longitudinal reinforcement.

ODOT has a Proposal Note for Composite Fiber Wrap Systems which references the International Code Council Evaluation Service website (www.icc-es.org) for acceptable FRP wrap products. Refer to the Designer Notes for plan information associated with this work.

For bridges located in regions with an acceleration coefficient, $S_{D1} < 0.10$, Designers shall specify a confining stress due to FRP jacket (f_l) of 0.150 ksi for the entire height of the column from the top of the footing/drilled shaft to the bottom of the cap. For bridges located in regions with an acceleration coefficient, $S_{D1} \geq 0.10$, Designers shall specify a confining stress due to FRP jacket (f_l) of 0.300 ksi in the plastic hinge regions as defined in *LRFD 5.10.11.4.1e* and 0.150 ksi in the remaining portions of the columns. The plans shall show an elevation view of the columns with these confining stress regions clearly defined.

301.4.5 APPLICATION OF LONGITUDINAL FORCES

For bearing types that permit rotation about the transverse axis of the bridge, all longitudinal load types shall be applied at the bearing elevation and moments resulting from eccentricity shall be ignored. The total factored longitudinal loading applied to the substructure at each expansion bearing shall not exceed the bearing's nominal (i.e. **unfactored**) resistance to longitudinal loading. Resistance in this instance is nominal because it is applied to the substructure as a loading.