Florida Department of Transportation

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STRUCTURES DESIGN BULLETIN 20-01
(FHWA Approved: April 17, 2020)

DATE: April 23, 2020

TO: District Directors of Transportation Operations, District Directors of Transportation Development, District Design Engineers, District Construction Engineers, District Structures Design Engineers, Structures Manual Holders

FROM: Robert V. Robertson, P.E., State Structures Design Engineer

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COPIES: Courtney Drummond, Will Watts, Tim Lattner, Dan Hurtado, Scott Arnold, Ben Goldsberry, SDO Staff, Rafiq Darji (FHWA)

SUBJECT: Exterior Intermediate Diaphragm Requirements for Steel Box Girder Bridges

REQUIREMENTS

1. Replace Footnote (2) located below the second table of ***Structures Design Guidelines*** Section 2.10.A with the following:

   2 With at least three evenly spaced exterior intermediate diaphragms (excluding end diaphragms) in each span. See ***SDG 5.6.3*** for additional requirements.

2. Add new paragraph "D" to ***Structures Design Guidelines*** Section 5.6.3 with the following:

   D. Exterior intermediate diaphragms required by ***SDG 2.10*** shall be plate diaphragms complying with the following:

      1. Diaphragms shall be full-width connecting the box girders. Each box girder shall have an interior plate diaphragm colinear with each exterior diaphragm. The interior plate diaphragm top flange size shall be equal to or greater than the exterior diaphragm top flange size. The interior diaphragm top flange shall be connected to the exterior diaphragm top flange.
      2. Diaphragms shall be I-shaped, full-depth, and have a web thickness equal to or larger than the smallest used in the outer box girder. A full-depth diaphragm is defined as having its web top and bottom aligned with the top and bottom of the box girder web.
      3. The diaphragms shall have top and bottom flanges, each flange having a size that is equal to or larger than the smallest top flange used in the outer box girder.
      4. Provide a minimum of two rows of shear studs on the diaphragm top flange at a maximum pitch of 12-inches and embedded into the concrete deck.

5. The diaphragm connection to the boxes shall be designed for all applicable limit states for the calculated force effects but not less than the 75 percent resistance provision of ***LRFD*** *6.13.1*.

Commentary: Minimum component sizes for the exterior intermediate diaphragms are based on the recommendations provided in the following report: Connor, R.J. et al. 2019. A Simplified Approach for Designing SRMs in Composite Continuous Twin-Tub Girder Bridges, Purdue University.

BACKGROUND

SDG 2.10 includes a table with Redundancy Factors in which it distinguishes between steel box girder systems that have exterior intermediate bracing (cross-frames/diaphragms) and those that do not. If the box girder system includes 3 or more exterior intermediate cross-frames/diaphragms per span, the redundancy factor, η_R, reduces from 1.20 to 1.05 for a two-box girder system, and from 1.10 to 1.00 for a three-box girder system; however, minimum requirements for exterior intermediate diaphragms are not defined. Recently, a report titled "*A Simplified Approach for Designing SRMs in Composite Continuous Twin-Tub Girder Bridges*" authored by Connor et al. (2019) contains recommendations for minimum component sizes for exterior intermediate diaphragms. Although the Department does not recognize SRMs (Structurally Redundant Members), this bulletin implements minimum requirements for exterior intermediate diaphragms, as recommended in the report by Connor et al, in order to use the reduced redundancy factors.

IMPLEMENTATION

These requirements are effective immediately on all design-bid-build projects at 30% plans or less. These requirements may be implemented immediately on all other design-bid-build projects at the discretion of the District.

These requirements are effective immediately on all design-build projects for which the final RFP has not been released. Design-build projects that have had the final RFP released are exempt from these requirements unless otherwise directed by the District.

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