



**Florida Department of Transportation**

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SECRETARY

**STRUCTURES DESIGN BULLETIN 18-01**

*(FHWA Approved: April 17, 2018)*

DATE: April 18, 2018

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

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

COPIES: Brian Blanchard, Courtney Drummond, Tim Lattner, David Sadler, Rudy Powell, Amy Tootle, Daniel Scheer, Gregory Schiess, SDO Staff, Hector Laureano (FHWA)

SUBJECT: Redundancy, Ductility and Operational Importance

**REQUIREMENTS**

1. Replace *Structures Design Guidelines* Section 2.10 with the following:

A. Redundancy [1.3.4]

Delete the redundancy factor values for the strength limit state,  $\eta_R$ , in *LRFD* [1.3.4] and use  $\eta_R = 1.0$  unless a revised value is established in the tables below.

Redundancy Factors, $\eta_R$	
Component	$\eta_R$
Steel I-Girders in Two Girder Cross Sections <sup>1</sup>	1.20
Members in Two or more Truss/Arch Bridges	1.20
Floor beams with Spacing > 12 feet and Non-Continuous Deck	1.20
Floor beams with Spacing > 12 feet and Continuous Deck	1.10
Steel Piers (Caps, Columns, C-Piers, Straddle or Integral pier caps, etc.)	1.20
Concrete C-Piers and Straddle Bents/Piers	1.05

Redundancy Factors for Steel Box Girders <sup>2</sup> , $\eta_R$		
Number of Box Girders in Cross Section	$\eta_R$	
	With Exterior Diaphragms <sup>1</sup>	Without Exterior Diaphragms
2	1.05	1.20
3	1.00	1.10

- 1 With at least three evenly spaced intermediate cross-frames/diaphragms or floor beams (excluding end diaphragms) in each span.
- 2 For top flange spacing more than 14', submit redundancy factor for SDO approval.

The following requirements are applicable to the redundancy factor:

- a. Applied at the component level. For girder components, the redundancy factor shall not be applied to the girder reactions for the bearing, substructure and foundation designs. For the substructure components including straddle or integral pier caps, the redundancy factor shall not be applied to the foundation if they are separate components (e.g. in a C-pier supported by a pile cap and piles, the redundancy factor is not applied to the pile design). For steel non-framed straddle or integral pier caps, the redundancy factor shall not be applied to the column and foundation designs.
- b. Applied to flexural and axial effects of the component. For girder components, the redundancy factor is applied to splices, connections and cross-frames/diaphragms or floor beams designs.
- c. Applied to the Strength I, II, and IV Limit States.
- d. Applicable to Pedestrian bridges.
- e. Not Applicable to **LRFD** 3.4.2, Load Factors for Construction Loads.

For special structures (e.g. cable, suspension, and other structures not normally used by FDOT), submit a redundancy factor to the SDO for approval.

**B. Ductility [1.3.3] and Operational Importance [1.3.5]**

Delete the values for Ductility,  $\eta_D$ , and Operational Importance,  $\eta_I$ , in **LRFD** [1.3.3 and 1.3.5] and use  $\eta_D = 1.0$  and  $\eta_I = 1.0$ .

Modification for Non-Conventional Projects:
Delete <b>SDG</b> 2.10.B and see the RFP for requirements.

**COMMENTARY**

The redundancy factor section first appeared in the **SDG** by the implementation of Temporary Design Bulletin C06-01 and was revised in subsequent years. The original and current intent is to apply the redundancy factor only at the component level. Furthermore, research through several NCHRP reports (e.g. 406 and 776) have addressed redundancy in highway bridge superstructures. Due to NCHRP Report 776 findings that continuous steel girders with non-

compact negative moment areas may not substantiate a decreased redundancy factor, the previous distinction between simple and continuous girders has been eliminated for now.

## **BACKGROUND**

The SDO Plans Review Group has encountered several design projects that revealed inconsistencies in applying the redundancy factor in structure designs; namely because of the use of proprietary software. Therefore, the additional language included in this SDB clarifies the application of the redundancy factor. Additionally, the “Redundancy Factor for Steel Bridges” table was renamed and revised by decreasing the number of redundancy factors and improves it for software application.

## **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.

## **CONTACT**

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