South Carolina
Department of Transportation

BRIDGE DESIGN MEMORANDUM – DM0213

TO: RPG Structural Engineers
Design Consultants

DATE: July 29, 2013

RE: Vehicular Collision Force and Bent Protection
Section 13.3.2.7 of the *SCDOT Bridge Design Manual*

Section 13.3.2.7 of the *SCDOT Bridge Design Manual* applies for bridges designed in accordance with the fifth or earlier editions of the AASHTO *LRFD Bridge Design Specifications* (*LRFD Specifications*). For designs utilizing later editions of the *LRFD Specifications*, use the following requirements in lieu of those specified in Section 13.3.2.7.

Bents located within a distance of 30 ft to the edge of a roadway should have provisions for redirecting or absorbing a collision load in accordance with the *LRFD Specifications*. If this is not practical, the bent shall be designed with either:

- a minimum of three columns. Each column in the bent must have a solid reinforced concrete cross section with a minimum diameter of three ft and a maximum column spacing of 20 ft; **or**

- solid reinforced concrete pier walls having a minimum thickness of 2.5 ft and a length of 20.0 ft; solid, reinforced concrete single columns having a minimum of 4.0 ft by 12.5 ft dimensions; or any other solid reinforced concrete sections having an minimum cross sectional area of 50 ft^2 and a minimum thickness of 2.5 ft.

In addition, bents located within a distance of 30 ft to the edge of a roadway that do not have provisions for redirecting or absorbing a collision load shall be designed for a collision force in accordance with the *LRFD Specifications* unless site conditions qualify for exemption. When investigating whether site conditions qualify for exemption, assume that any bridge having an Operational Classification of I or II for seismic design considerations is classified as "Critical or Essential" and determine the ADTT based on the design year traffic data on the lower roadway. In addition, any bridge crossing a highway on the Interstate system, US 17, US 378 from SC 441 east to I-95, I-20 Spur from I-95 east to US 76, or US 76 from I-20 Spur east to North Carolina

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shall also be considered as "Critical or Essential" for the purposes of collision protection.

The collision force specified by the *LRFD Specifications* may be considered as a point load on the column, with no distribution of force due to frame action within the bent, foundation, and superstructure. When determining the point of application of the load on the column, assume that the finished ground elevation may be two feet lower or higher than what is detailed on the plans. For the vehicle collision load combination, the column may be designed for shear only, assuming failure along two shear planes inclined at 45 degree angles above and below the point of force application. Further analysis of the foundation elements, footing, and bent cap is not required. Because this is an extreme event load combination, a resistance factor of 1.00 may be utilized.

Interior bents adjacent to a railroad track that are located 25 ft to 50 ft from the centerline of the railroad track shall be designed with either:

- a minimum of three columns. Each column in the bent must have a solid reinforced concrete cross section with a minimum diameter of three ft and a maximum column spacing of 20 ft; **or**

- solid reinforced concrete pier walls having a minimum thickness of 2.5 ft and a length of 20.0 ft; solid, reinforced concrete single columns having a minimum of 4.0 ft by 12.5 ft dimensions; or any other solid reinforced concrete sections having an minimum cross sectional area of 50 ft^2 and a minimum thickness of 2.5 ft.

Original Signed by James W. Kendall, Jr.
on July 29, 2013

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Preconstruction Support Engineer

JWK:afg
ec: Bridge Construction Engineer
Bridge Maintenance Engineer
FHWA Structural Engineer
Preconstruction Support Managers
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