South Carolina
Department of Transportation

BRIDGE DESIGN MEMORANDUM – DM0114

TO: RPG Structural Engineers
Design Consultants

DATE: January 31, 2014

RE: Jointless Bridges
Sections 12.2.4.1, 12.2.8, 12.4.2.2, 12.4.2.5, 12.7.8, 17.4.2, 20.2.7.2, 21.1.1.1, and 21.1.1.10 and Figure 21.1-1 of the *SCDOT Bridge Design Manual*

Sections 12.2.4.1, 12.2.8, 12.4.2.2, 12.4.2.5, 12.7.8, 17.4.2, 20.2.7.2, 21.1.1.1, and 21.1.1.10 and Figure 21.1-1 of the *SCDOT Bridge Design Manual* are hereby revised to address maintenance issues that SCDOT has experienced with jointless bridges. Most of the maintenance issues have occurred in the coastal region of the State and most involve erosion at the approach slab/approach roadway interface when deck drainage was omitted due to environmental restrictions or at grade separations where open deck drainage could not be detailed. Additionally, problems have occurred when sleeper slabs were constructed in stages. Although jointless bridges offer structural benefits, site-specific conditions such as deck drainage restrictions, staged construction, and varying soil conditions can sometimes make it preferable to detail bridges with expansion joints. Please update your copy of the *Manual* as noted below.

Delete Section 12.2.4.1 and replace with the following:

12.2.4.1 General

Jointless bridges offer structural benefits and should be considered in design when practical. However, there are sometimes site-specific conditions that make it preferable to detail bridges with expansion joints in lieu of detailing a jointless bridge. Joints can be eliminated with special consideration to:

- load path;
- gravity and longitudinal loads;
- effects of concrete creep and shrinkage;
- effects of temperature variations;
- stability of superstructure and substructure during construction and service;
- effects of staged construction;

Post Office Box 191
Columbia, South Carolina 29202-0191

Phone: (803) 737-2314
TTY: (803) 737-3870

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- effects of skew and curvature;
- the superstructure-end bent-foundation connection design and details;
- effects of superstructure and substructure stiffness;
- effects of settlement and earth pressure;
- effects of varying soil properties and type of foundation; and
- effects of approach slab and its connection to the bridge and interaction with the approach roadway.

In addition to the considerations listed above, the designer should consult with the appropriate District Maintenance Engineer to determine if there are additional regional considerations that should be made.

Delete Section 12.2.8 and replace with the following:

12.2.8 Sleeper Slabs

A sleeper slab is a foundation slab, inverted tee-beam, or L-beam placed transversely to the roadway to support the end of the approach slab away from the bridge. Sleeper slabs should be used to provide an off-bridge joint at the end of the approach slab, where:

- a jointless bridge exceeds 240 ft total length for steel girder bridges or 300 ft total length for prestressed concrete beam bridges;
- the distance from an integral or semi-integral end bent to the nearest expansion joint exceeds 240 ft for steel girder bridges or 300 ft for prestressed concrete beam bridges; or
- an integral or semi-integral end bent is used and the end of approach slab interfaces with a moment slab and railing.

Sleeper slabs shall be used when an integral or semi-integral end bent is used and the roadway pavement is constructed of concrete.

Sleeper slabs shall not be used when staged construction is required or when a future widening is anticipated.

The embankment beneath the sleeper slab shall be designed to prevent differential settlement along the length of the sleeper slab.

Delete the sixth paragraph of Section 12.4.2.2 and replace with the following paragraph:

A jointless flexible end bent, either integral or semi-integral, is preferred. However, free-standing end bents shall be used where the roadway approach pavement is constructed of concrete and either staged construction is required or a future widening is anticipated. Free-standing end bents shall also be used where the anticipated translational movements of the piles are too great. The force effects of these displacements shall be included in the design.

Delete the first sentence of the second paragraph of Section 12.4.2.5 and replace with the following sentence:

Use free-standing end bents where integral and semi-integral end bents cannot accommodate the anticipated translational movements or where the roadway approach pavement is constructed of concrete and either staged construction is required or a future widening is anticipated.

In Section 12.7.8, insert the following sentence after the second sentence of Item 1:

However, due to site conditions, jointless bridges may not always be appropriate.

In Section 17.4.2, delete the second sentence of Item 6 and replace it with the following two sentences:

Where asphalt pavement is used for the approaching roadway and sleeper slabs are not detailed, approach slabs shall be constructed 2 in below grade. If sleeper slabs are detailed, approach slabs shall be constructed at grade.

In Section 20.2.7.2, delete Item 2 and replace it with the following:

2. Loads/Forces. The following steps should be considered in the analysis of integral or semi-integral end bents:

    - Establish the point of zero superstructure movement by considering the elastic resistance of all substructures and bearing devices.
    - Consider the effects of creep, shrinkage, and temperature.

- Assume that the longitudinal movement at any point along the superstructure is proportional to its distance to the point of zero superstructure movement. For example, the longitudinal movement at a point 50 ft from the point of zero movement should be considered to be one-half of the horizontal movement at a point 100 ft from the point of zero movement.
- Neglect the lateral curvature of the superstructure if it satisfies the provisions of LRFD Article 4.6.1.2.
- Distribute the vertical force effects in the end bents among the piles based upon static equilibrium as axial loads.
- Consider the lateral soil resistance in establishing the force effects and buckling resistance of piles.
- Combine the force effects in accordance with the provisions of LRFD Article 3.4.1.

In Section 21.1.1.1, insert the following sentence after the first sentence of Item 1:

However, due to site conditions, jointless bridges may not always be appropriate.

Modify Figure 21.1-1 by deleting "and Sleeper Slabs" from the Usage column of the Silicone Rubber Sealant row.

In Section 21.1.1.10, delete the second sentence and replace it with the following sentence:

SCDOT practice is to use this system for joints of cored slab bridges.

The above revisions apply to all projects where design has not advanced beyond the preliminary design phase.

James W. Kendall, Jr.

James W. Kendall, Jr., P.E.
Preconstruction Support Engineer

JWK:afg
ec: Bridge Construction Engineer
Bridge Maintenance Engineer
FHWA Structural Engineer
File:PC/BWB

Preconstruction Support Managers
Regional Production Engineers
RPG Design Managers