Attachment B: Specific Reference Data

Superstructure Depth:

SCDOT BDM Section 12.2.2

> 12.2.2.1 General: The LRFD Specifications states that the traditional live-load deflection criteria is optional for bridges both with and without sidewalks because static live-load deflection is not a good measure of dynamic excitation. Nonetheless, in the absence of a better criterion and because of concerns on durability, SCDOT has determined that it is appropriate to limit live-load deflections.
>
> 12.2.2.2 Criteria Live-load deflections shall be limited based upon the span-length-based criteria of LRFD Article 2.5.2.6.2 with consideration to either the presence or the absence of pedestrian traffic. The minimum superstructure depth limits of LRFD Article 2.5.2.6.3 shall also be met.

AASHTO Article 2.5.2.6.2
In the absence of other criteria, these limits may be applied to steel, aluminum and/or concrete bridges:

Load	Limit
General vehicular load	Span/800
Vehicular and/or pedestrian load	Span/1000
Vehicular load on cantilever arms	Span/300
Vehicular and/or pedestrian load on cantilever arms	Span/375

AASHTO Article 2.5.2.6.3
Table 2.5.2.6.3-1 Traditional Minimum Depths for Constant Depth Superstructures

Superstructure		Minimum Depth (Including Deck) When variable depth members are used, values may be adjusted to account for changes in relative stiffness of positive and negative moment sections	
Material	Type	Simple Spans	Continuous Spans
Reinforced concrete	Slabs with main reinforcement parallel to traffic	$\frac{1.2(S+10)}{30}$	$\frac{S+10}{30} \geq 0.54\,ft.$
	T-Beams	$0.070L$	$0.065L$
	Box Beams	$0.060L$	$0.055L$
	Pedestrian Structure Beams	$0.035L$	$0.033L$
Prestressed Concrete	Slabs	$0.030L \geq 6.5\,in.$	$0.027L \geq 6.5\,in.$
	CIP Box Beams	$0.045L$	$0.040L$
	Precast I-Beams	$0.045L$	$0.040L$
	Pedestrian Structure Beams	$0.033L$	$0.030L$
	Adjacent Box Beams	$0.030L$	$0.025L$
Steel	Overall Depth of Composite I-Beam	$0.040L$	$0.032L$
	Depth of I-Beam Portion of Composite I-Beam	$0.033L$	0.027
	Trusses	$0.100L$	$0.100L$

SCDOT BDM Section 15.5.5

Standard prestressed concrete cored slab cross sections are 3′-0″ by 1′-9″ or 3′-0″ by 2′-0″. Prestressed concrete cored slab bridges of 30-ft, 40-ft, 50-ft, and 60-ft span lengths are presented in the SCDOT Bridge Design Drawings and Details (available at the SCDOT website) which provide typical plans, elevations, sections, and details.

AASHTO Table 3.4.1-1

Load Combination Limit State	*DC DD DW EH EV ES EL PS CR SH*	*LL IM CE BR PL LS*	*WA*	*WS*	*WL*	*FR*	*TU*	*TG*	*SE*	Use One of These at a Time				
										EQ	*BL*	*IC*	*CT*	*CV*
Strength I (unless noted)	γ_p	1.75	1.00	—	—	1.00	0.50/1.20	γ_{TG}	γ_{SE}	—	—	—	—	—
Strength II	γ_p	1.35	1.00	—	—	1.00	0.50/1.20	γ_{TG}	γ_{SE}	—	—	—	—	—
Strength III	γ_p	—	1.00	1.40	—	1.00	0.50/1.20	γ_{TG}	γ_{SE}	—	—	—	—	—
Strength IV	γ_p	—	1.00	—	—	1.00	0.50/1.20	—	—	—	—	—	—	—
Strength V	γ_p	1.35	1.00	0.40	1.0	1.00	0.50/1.20	γ_{TG}	γ_{SE}	—	—	—	—	—
Extreme Event I	γ_p	γEQ	1.00	—	—	1.00	—	—	—	1.00	—	—	—	—
Extreme Event II	γ_p	0.50	1.00	—	—	1.00	—	—	—	—	1.00	1.00	1.00	1.00
Service I	1.00	1.00	1.00	0.30	1.0	1.00	1.00/1.20	γ_{TG}	γ_{SE}	—	—	—	—	—
Service II	1.00	1.30	1.00	—	—	1.00	1.00/1.20	—	—	—	—	—	—	—
Service III	1.00	0.80	1.00	—	—	1.00	1.00/1.20	γ_{TG}	γ_{SE}	—	—	—	—	—
Service IV	1.00	—	1.00	0.70	—	1.00	1.00/1.20	—	1.0	—	—	—	—	—
Fatigue I— *LL, IM & CE* only	—	1.50	—	—	—	—	—	—	—	—	—	—	—	—
Fatigue II— *LL, IM & CE* only	—	0.75	—	—	—	—	—	—	—	—	—	—	—	—

Bridge Length:

SCDOT HDS Section 1.1.1

The design discharge for establishing bridge location and bridge geometry for secondary roads is the 25-year discharge. For primary and interstate routes, the design discharge is the 50-year discharge. All stream crossings are to be analyzed for the 100-year flood to insure that one (1) foot or less of backwater is caused by the proposed bridge when compared to unrestricted or natural conditions.

SCDOT HDS Section 1.2

1.2 Level 1: Qualitative and Geomorphic Analysis The qualitative and geomorphic analysis is the first step in a logical progression of analysis in bridge design that moves from the general descriptive to the detailed quantitative design. This approach first defines the design

problem and then evaluates the stream and its geomorphic responses over time. It evaluates qualitatively the possible stream responses to the proposed or existing highway structures.

SCDOT HDS Section 1.2.1

The standard Level 1 procedure is done in a series of steps. A flow diagram of the procedure is presented in Figure No. 1, Section 1.6.4. (See Chapter 3 of HEC-20 for full details on this procedure.) Determine if the stream contains a designated floodway. If it does, obtain a copy of the original computer program data files used to establish the floodway boundaries. If a floodway is present, go to Level 2 analysis.
See pages 115 through 125 of "*HYDRAULIC STUDY FOR THE REPLACEMENT OF THE S-51 BRIDGE OVER BLACK MINGO CREEK"* for:
Step 1 Stream Characteristics
Step 2 Land Use Changes
Step 3 Overall Stability
Step 4 Lateral Stability
Step 5 Vertical stability
Step 6 Debris Potential
Step 7 Stream Response

SCDOT HDS Section 1.3.1- Level 2 Procedures for Riverine Bridges – Slopes for Bridge End Fills

2:1 end slope requirement: "…project the end fill slopes from the finished grade elevation at the end of proposed spans, using 2:1 slopes perpendicular to skew."

SCDOT HDS - Section 1.3.1 -Level 2 Procedures for Riverine Bridges – Bridge End Fills

"A projection of the bridge fills should not extend into the channel and should be at least 5.0 feet behind the channel banks."

Bridge Width:

SCDOT HDM Section 9.4.1.1 – Functional Classification – Relationship to Design

Partial information form this section is included here:

"The functional classification concept is one of the most important determining factors in highway design. In this concept, highways are grouped by the character of service they provide. Functional classification recognizes that the public highway network in South Carolina serves two basic and often conflicting functions — travel mobility and access to property. Each highway or street will provide varying levels of access and mobility, depending upon its intended service. In the functional classification scheme, the overall objective is that the highway system, when viewed in its entirety, will yield an optimum balance between its access and mobility purposes. If this objective is achieved, the benefits to the traveling public will be maximized.

The functional classification system provides the guidelines for determining the geometric design of individual highways and streets. Once the function of the highway facility is defined, the designer can select an appropriate design speed, roadway width, roadside safety elements, amenities and other design values. The SCDOT Highway Design Manual is based upon this systematic concept to determine geometric design.

Road Data Services has functionally classified all public roads and streets within South Carolina that are maintained by the Department. For highway design, it is necessary to identify the predicted functional class of the road or street for the selected design year (e.g., 20 years beyond the project completion date). Road Data Services will provide this information to the designer.

There are three general categories within the functional classification system — arterials, collectors, and local roads and streets. The following sections provide brief definitions for these categories. The AASHTO A Policy on Geometric Design of Highways and Streets provides detailed information on functional classification."

SCDOT HDM Chapter 20 – Rural Highways

This information is available at:
http://www.scdot.org/doing/doingPDFs/HighwayDesign/2003_HDM_with_revisions.pdf
Excerpt:
"Chapter 20 provides guidance in the design of rural two-lane principal arterials, rural multilane principal arterials, rural two-lane minor arterials and collectors on the State Highway System."

SCDOT HDM Figure 20.1E – Geometric Design Criteria for Rural Two-lane Collectors

See Attachment C

SCDOT HDM Figure 20.1G – Alignment Criteria for Rural Collectors

See Attachment C

SCDOT BDM Section 12.6.1.4 - Bridge Roadway Widths

"In general, bridge widths should match the approach roadway widths (traveled way plus shoulders). Figure 12.6-1 provides guidelines for bridge widths. However, in determining the width for major water crossings, consider the cost of the structure, traffic volumes, and potential for future width requirements."

SCDOT BDM Figure 12.6-1 – Guidelines for Bridge Roadway Widths

Approach Roadway	Conditions	Bridge Width (Gutter to Gutter)
Urban Streets (Curb and Gutter)	With or without concrete sidewalk.	Provide a sidewalk on bridge matching roadway gutter hinge points with bridge gutter hinge points.
Freeways and Arterials	12-ft shoulder (10 ft paved + 2 ft unpaved).	Use 12-ft shoulder hinge point for bridge gutter line.
	10-ft shoulder (paved and unpaved).	Use 10-ft shoulder hinge point for bridge gutter line.
	10-ft shoulder (6 ft paved + 4 ft unpaved).	Use 10-ft shoulder hinge point for bridge gutter line on inside of divided highways.
	10-ft shoulder (4 ft paved + 6 ft unpaved).	
Rural Collectors and Local Roads	6- to 8- ft shoulders (2 ft paved + 4 to 6 ft unpaved) with paved roadway.	Use shoulder hinge point for bridge gutter line. Bridge width is equal to width of roadway section (outside shoulder to outside shoulder).
Ramps	In direction of traffic (left) 10-ft shoulder (4 ft paved + 6 ft unpaved).	Use 10-ft shoulder hinge point for bridge gutter line.
	In direction of traffic (right) 10-ft shoulder (6 ft paved + 4 ft unpaved).	Use 10-ft shoulder hinge point for bridge gutter line.

GUIDELINES FOR BRIDGE ROADWAY WIDTHS

Figure 12.6-1