# SDG 4:

# Slab Design

Chapter 4

Tennessee Department of Transportation October 7, 2024

# Table of Contents



# List of Tables

# Section 1 Design Guidance

## 4-101.00 Terminology and Design Approach

The terms "deck" and "slab" are synonymous and are used interchangeably. Reinforced concrete bridge decks shall be designed based on traditional design methods. Empirical slab design based on AASHTO 9.7.2 shall not be permitted.

## 4-102.00 Reinforcement Type

All slab reinforcement shall be epoxy-coated unless an alternate bar protection system is approved by the Director.

## 4-103.00 Minimum Slab Thickness

The slab thickness shall be as needed for design but shall not be less than the minimum thickness determined using Table 1. The slab thicknesses given in Table 1 provide a clear distance between the top and bottom reinforcement mats not less than the greater of 1.5" and 1.5 times the diameter of the largest top longitudinal bar.

| Transverse Bar Size | Largest Longitudinal Bar Size | | | | | | |
|---|---|---|---|---|---|---|---|
| #5 | #5 | #6 | #7 | #8 | #9 | #10 | |
| #6 | | #5 | #6 | #7 | #8 | #9 | #10 |
| **Minimum Slab Thickness** | **8.25"** | **8.25"** | **8.25"** | **8.25"** | **8.50"** | **8.75"** | **9"** |

**Table 1. Minimum Slab Thickness**

## 4-104.00 Concrete Cover

Concrete cover to the top of the slab shall be 2 ½" for top slab bars. Concrete cover to the bottom of the slab shall be 1" for bottom slab bars.

## 4-105.00 Concrete Class

Use Class D concrete for bridge decks with the following exceptions. Use Class DS concrete for interstate bridges and bridges carrying part or all of a 4 lane (or greater) system (including one or both directions of traffic). When Class DS concrete is not required, Class L (lightweight) concrete may be used when needed.

## 4-106.00 Concrete Compressive Strength

Class D, DS, and L concrete all require a minimum 28-day compressive strength of 4 ksi (See Table 604.03-1 of the Standard Specifications.) In the past, the slab concrete compressive strength was assumed to be 3 ksi for design purposes. This assumption is no longer permitted. Use 4 ksi as the design compressive strength.

### 4-107.00 Haunch (Filler) Thickness

See SDG 5 and SDG 6 for information regarding minimum haunch (filler) thickness.

### 4-108.00 Transverse Slab Reinforcement Orientation

Transverse slab reinforcement shall be placed perpendicular to the beams when the skew angle is less than 75 degrees. Transverse slab reinforcement shall be placed parallel to the skew when the skew angle is between 75 degrees and 90 degrees. The skew angle is the angle between the centerline of survey and the centerline of the substructures. This is the complementary angle of the skew angle as defined by AASHTO.

### 4-109.00 Negative Moment Slab Reinforcement

Multi-span bridges with prestressed beams shall be made continuous for live loads and composite dead loads by the use of continuity diaphragms between beam ends at interior supports and negative moment slab reinforcement. For continuous steel girder bridges, negative moment slab reinforcement shall be provided in accordance with AASHTO 6.10.1.7. For negative moment slab reinforcement, bars sizes may change at different locations throughout the bridge length based on the design requirements, but mixing of bar sizes in an individual layer at any location is not permitted except in bar splice locations.

### 4-110.00 Additional Slab Reinforcement

In the acute corners of highly skewed bridges, the transverse slab reinforcement may not have enough room to be fully developed when placed perpendicular to the centerline of survey. In this case, place a minimum of three bars in both the top and bottom of the slab parallel to the skew. These bars shall extend at least a development length past the centerline of the exterior beam. The designer shall determine the bar size and if more than three bars in the top and bottom of the slab are required.

## Section 2 Deck Forms and Panels

### 4-201.00 Stay-in-Place Metal Deck Forms

Stay-in-place metal deck forms are the most commonly used permanent deck forms in Tennessee. When contractors elect to use these forms, they shall submit shop drawings and calculations to the Structures Section for review and approval. Both the shop drawings and calculations shall be stamped by an Engineer licensed in Tennessee.

## 4-202.00 Partial Depth Prestressed Concrete Deck Panels

Partial depth prestressed concrete deck panels are another option for deck forms. These panels contain reinforcement that replaces the bottom mat of reinforcement in the slab. All partial depth prestressed concrete deck panels shall be in accordance with standard drawings STD-4-1, STD-4-2, STD-4-3, and STD-4-4. For negative moment slab design, it is permissible to include the bottom longitudinal slab reinforcement in the total provided area of negative moment reinforcement, but prestressed concrete deck panels shall not be used for the bridge. Use note 10 in SDG 11 on the general notes of the bridge plans to prohibit the use of precast concrete deck panels.

## 4-203.00 Full Depth Prestressed Concrete Deck Panels

Full depth prestressed concrete deck panels are commonly used for accelerated bridge construction projects. Panels are placed with gaps between them and having reinforcing steel projecting into the gap areas. Closure pours are then made to fill all the gaps and create a uniform slab. Panels may be oriented in either the longitudinal or transverse directions along the bridge. Transverse panels also require voids to be cast in the projected stirrup or shear connector locations to enable proper placement. These voids are also filled with closure pours to create a composite section.

# Works Cited

AASHTO, *LRFD Bridge Design Specifications.* 9th. Washington, D. C.: American Association of State Highway and Transportation Officials, 2020.

PCI, *Bridge Design Manual*. 3rd. Chicago, IL: Precast/Prestressed Concrete Institute, 2014