South Carolina
Department of Transportation

Office of Engineering Support
803-737-1377 | 803-766-1022 Fax

STRUCTURAL DRAWINGS AND DETAILS
Instructional Memorandum 702-FS
Reinforced Concrete Flat Slabs
June 26, 2024

General

The flat slab details are available in superstructure lengths of 30 feet, 60 feet, 74 feet, 90 feet, 100 feet, 120 feet (3 span), 120 feet (4 span), 150 feet, and 160 feet. Drawings are provided for bridge roadway widths of 34 feet, 40 feet, and 44 feet, and include the MASH Barrier Parapet along each side. The flat slab standards are available for a no skew condition.

Design Criteria and Assumptions

Design Specifications: AASHTO LRFD Bridge Design Specifications, 9th Edition | 2020 (herein referred to as BDS)

Live Load: AASHTO HL-93 Loading

The reinforced concrete flat slabs were designed according to the provisions of BDS Article 4.6.2.3 for an equivalent strip width of longitudinal strips per lane for moment. Flexural resistance and minimum reinforcement were designed in accordance with BDS Article 5.6.3.2 and 5.6.3.3, respectively. Fatigue check of the reinforcement design was performed in accordance with BDS Article 5.5.3.2. Shear design was not performed. As discussed in BDS Article 5.12.2.1, slab bridges designed for moment are considered satisfactory for shear. The longitudinal edge beams of the flat slabs were designed in accordance with BDS Article 4.6.2.1.4b for moment. The required tension development length and tension lap splices of the longitudinal reinforcement was determined in accordance with BDS Article 5.10.8.2.1a and 5.10.8.4, respectively. The tension lap splices accounted for Class B splices.

The maximum allowable reinforcement spacing to control cracking was based on Class 2 exposure condition per BDS Article 5.6.7 for top and bottom slab reinforcement. Top transverse shrinkage and temperature reinforcement was designed in accordance with the provisions of BDS Article 5.10.6. Bottom transverse distribution reinforcement required was determined in accordance with BDS Article 5.12.2.1.

The top ¼” of the slabs were considered sacrificial. This depth was deducted from the overall depth of the deck for purposes of computing section properties and strength; however, the full deck thickness was included in the dead load.

The non-continuous reinforcement for positive and negative moment was extended beyond the point where it was no longer required per BDS Article 5.10.8.1.2a. In addition, the required length of the non-continuous reinforcement was increased to provide a 2-foot stagger of the bar ends at their termination.

Additional transverse drop-in reinforcing bars are included in the design of the flat slabs in the top mat of steel along the edges of the deck. Because the standard transverse shrinkage and temperature reinforcement provide minimal development from the gutter line to the edge of the slab, the drop-in reinforcing bars are included to reinforce the edge of the flat slab and minimize

(or prevent) damage resulting from the extreme event collision load transferring from the barrier parapet to the slab. Barrier design forces were performed in accordance with BDS Article A13.2.

The design included the following assumptions:

- Final 28-day concrete strength is 4.0 ksi
- Unit weight of reinforced concrete is 150 pcf for dead loads
- Unit weight of reinforced concrete is 145 pcf for modulus of elasticity
- Reinforcement yield strength is 60 ksi
- Future wearing surface loading is 15 psf
- 34'-0" clear roadway width, 36'-3" total slab width
- 40'-0" clear roadway width, 42'-3" total slab width
- 44'-0" clear roadway width, 46'-3" total slab width
- 2½" Top slab concrete clear cover (includes ¼" sacrificial wearing surface)
- 2" Bottom slab concrete clear cover
- MASH Barrier Parapet load is uniformly distributed across the entire flat slab width.

The plain elastomeric bearing pads were assumed to perform as leveling pads.

Load Rating Criteria

Load Rating Procedures: SCDOT Load Rating Guidance Document, 2019, including Technical Notes through February 14, 2024.

Load rating of the spans was performed using the following assumptions:

- Per Technical Note 07 (Item 3), an extra dead load of 0.015 KSF was applied to the load rating model to account for the possibility of a future wearing surface.
- The start and end locations of the non-continuous reinforcement for positive and negative moment are taken at the average distance of the staggered bar locations as detailed in the structural drawings and details.
- A two directional bridge was assumed having an ADT of 50,000 vpd and 20% trucks.

Instructions to Designer

The Engineer must determine if the standard design and details for the flat slabs are adequate for project specific use. At a minimum, consider the following items:

- ☐ Wherever "X" or "#" is used, replace with project specific values.
- ☐ Confirm the roadway width and skew needed for the project. Revise the detailing of the standard flat slabs as necessary for project-specific use.
- ☐ Verify that sidewalk accommodation is not a project requirement. If the bridge needs to be designed to accommodate sidewalks, a redesign of the flat slab will be required.
- ☐ If a different barrier parapet or railing is detailed, a redesign of the flat slab will be required.
- ☐ Revise deck drain type or eliminate deck drain details if necessary for site conditions.
- ☐ Where multiple lanes of heavier versions of a "low boy" type vehicle are considered probable, investigate negative moment at interior supports for pairs of the design tandem spaced from 26.0 ft to 40.0 ft apart, combined with the design lane load, as discussed in BDS Article C3.6.1.3.1.

South Carolina
Department of Transportation

Office of Engineering Support
803-737-1377 | 803-766-1022 Fax

- If staged construction is required for project-specific use, verify the adequacy of the design and revise the detailing of the standard flat slabs as necessary.

Post Office Box 191
955 Park Street, Room 409
Columbia, SC 29202-0191

South Carolina
Department of Transportation

Office of Engineering Support
803-737-1377 | 803-766-1022 Fax

Applicable Drawings

DGN File Name	Drawing Number	Sheet Title
702_FS_030	702-FS.S030.1SP.R34	30' Flat Slab Unit (End Span), Superstructure, (34'-0"-0" Roadway)
	702-FS.S030.1SP.R40	30' Flat Slab Unit (End Span), Superstructure, (40'-0" Roadway)
	702-FS.S030.1SP.R44	30' Flat Slab Unit (End Span), Superstructure, (44'-0" Roadway)
702_FS_SSDTLS	702-FS.S030.1SP.R34.SSD01	30' Flat Slab Unit (End Span), Superstructure Details, (34'-0" Roadway)
	702-FS.S030.1SP.R40.SSD01	30' Flat Slab Unit (End Span), Superstructure Details, (40'-0" Roadway)
	702-FS.S030.1SP.R44.SSD01	30' Flat Slab Unit (End Span), Superstructure Details, (44'-0" Roadway)
702_FS_060	702-FS.S060.2SP.R34	60' Flat Slab Unit (End Span), Superstructure, (34'-0" Roadway)
	702-FS.S060.2SP.R40	60' Flat Slab Unit (End Span), Superstructure, (40'-0" Roadway)
	702-FS.S060.2SP.R44	60' Flat Slab Unit (End Span), Superstructure, (44'-0" Roadway)
702_FS_SSDTLS	702-FS.S060.2SP.R34.SSD01	60' Flat Slab Unit (End Span), Superstructure Details, (34'-0" Roadway)
	702-FS.S060.2SP.R40.SSD01	60' Flat Slab Unit (End Span), Superstructure Details, (40'-0" Roadway)
	702-FS.S060.2SP.R44.SSD01	60' Flat Slab Unit (End Span), Superstructure Details, (44'-0" Roadway)
702_FS_074	702-FS.S074.3SP.R34	74' Flat Slab Unit (3 Span), Superstructure, (34'-0" Roadway)
	702-FS.S074.3SP.R40	74' Flat Slab Unit (3 Span), Superstructure, (40'-0" Roadway)
	702-FS.S074.3SP.R44	74' Flat Slab Unit (3 Span), Superstructure, (44'-0" Roadway)
702_FS_SSDTLS	702-FS.S074.3SP.R34.SSD01	74' Flat Slab Unit (3 Span), Superstructure Details, (34'-0" Roadway)
	702-FS.S074.3SP.R40.SSD01	74' Flat Slab Unit (3 Span), Superstructure Details, (40'-0" Roadway)
	702-FS.S074.3SP.R44.SSD01	74' Flat Slab Unit (3 Span), Superstructure Details, (44'-0" Roadway)
702_FS_090	702-FS.S090.3SP.R34	90' Flat Slab Unit (3 Span), Superstructure, (34'-0" Roadway)
	702-FS.S090.3SP.R40	90' Flat Slab Unit (3 Span), Superstructure, (40'-0" Roadway)
	702-FS.S090.3SP.R44	90' Flat Slab Unit (3 Span), Superstructure, (44'-0" Roadway)
702_FS_SSDTLS	702-FS.S090.3SP.R34.SSD01	90' Flat Slab Unit (3 Span), Superstructure Details, (34'-0" Roadway)
	702-FS.S090.3SP.R40.SSD01	90' Flat Slab Unit (3 Span), Superstructure Details, (40'-0" Roadway)
	702-FS.S090.3SP.R44.SSD01	90' Flat Slab Unit (3 Span), Superstructure Details, (44'-0" Roadway)
702_FS_100	702-FS.S100.3SP.R34	100' Flat Slab Unit (3 Span), Superstructure, (34'-0" Roadway)
	702-FS.S100.3SP.R40	100' Flat Slab Unit (3 Span), Superstructure, (40'-0" Roadway)
	702-FS.S100.3SP.R44	100' Flat Slab Unit (3 Span), Superstructure, (44'-0" Roadway)
702_FS_SSDTLS	702-FS.S100.3SP.R34.SSD01	100' Flat Slab Unit (3 Span), Superstructure Details, (34'-0" Roadway)
	702-FS.S100.3SP.R40.SSD01	100' Flat Slab Unit (3 Span), Superstructure Details, (40'-0" Roadway)
	702-FS.S100.3SP.R44.SSD01	100' Flat Slab Unit (3 Span), Superstructure Details, (44'-0" Roadway)

Post Office Box 191
955 Park Street, Room 409
Columbia, SC 29202-0191

South Carolina
Department of Transportation

Office of Engineering Support
803-737-1377 | 803-766-1022 Fax

DGN File Name (Continued)	Drawing Number (Continued)	Sheet Title (Continued)
702_FS_120	702-FS.S120.3SP.R34	120' Flat Slab Unit (3 Span), Superstructure, (34'-0" Roadway)
	702-FS.S120.3SP.R40	120' Flat Slab Unit (3 Span), Superstructure, (40'-0" Roadway)
	702-FS.S120.3SP.R44	120' Flat Slab Unit (3 Span), Superstructure, (44'-0" Roadway)
	702-FS.S120.4SP.R34	120' Flat Slab Unit (4 Span), Superstructure, (34'-0" Roadway)
	702-FS.S120.4SP.R40	120' Flat Slab Unit (4 Span), Superstructure, (40'-0" Roadway)
	702-FS.S120.4SP.R44	120' Flat Slab Unit (4 Span), Superstructure, (44'-0" Roadway)
702_FS_SSDTLS	702-FS.S120.3SP.R34.SSD01	120' Flat Slab Unit (3 Span), Superstructure Details, (34'-0" Roadway)
	702-FS.S120.3SP.R40.SSD01	120' Flat Slab Unit (3 Span), Superstructure Details, (40'-0" Roadway)
	702-FS.S120.3SP.R44.SSD01	120' Flat Slab Unit (3 Span), Superstructure Details, (44'-0" Roadway)
	702-FS.S120.4SP.R34.SSD01	120' Flat Slab Unit (4 Span), Superstructure Details, (34'-0" Roadway)
	702-FS.S120.4SP.R40.SSD01	120' Flat Slab Unit (4 Span), Superstructure Details, (40'-0" Roadway)
	702-FS.S120.4SP.R44.SSD01	120' Flat Slab Unit (4 Span), Superstructure Details, (44'-0" Roadway)
702_FS_150	702-FS.S150.5SP.R34	150' Flat Slab Unit (5 Span), Superstructure, (34'-0" Roadway)
	702-FS.S150.5SP.R40	150' Flat Slab Unit (5 Span), Superstructure, (40'-0" Roadway)
	702-FS.S150.5SP.R44	150' Flat Slab Unit (5 Span), Superstructure, (44'-0" Roadway)
702_FS_SSDTLS	702-FS.S150.5SP.R34.SSD01	150' Flat Slab Unit (5 Span), Superstructure Details, (34'-0" Roadway)
	702-FS.S150.5SP.R40.SSD01	150' Flat Slab Unit (5 Span), Superstructure Details, (40'-0" Roadway)
	702-FS.S150.5SP.R44.SSD01	150' Flat Slab Unit (5 Span), Superstructure Details, (44'-0" Roadway)
702_FS_160	702-FS.S160.4SP.R34	160' Flat Slab Unit (4 Span), Superstructure, (34'-0" Roadway)
	702-FS.S160.4SP.R40	160' Flat Slab Unit (4 Span), Superstructure, (40'-0" Roadway)
	702-FS.S160.4SP.R44	160' Flat Slab Unit (4 Span), Superstructure, (44'-0" Roadway)
702_FS_SSDTLS	702-FS.S160.4SP.R34.SSD01	160' Flat Slab Unit (4 Span), Superstructure Details, (34'-0" Roadway)
	702-FS.S160.4SP.R40.SSD01	160' Flat Slab Unit (4 Span), Superstructure Details, (40'-0" Roadway)
	702-FS.S160.4SP.R44.SSD01	160' Flat Slab Unit (4 Span), Superstructure Details, (44'-0" Roadway)

Post Office Box 191
955 Park Street, Room 409
Columbia, SC 29202-0191

www.scdot.org
An Equal Opportunity
Affirmative Action Employer
855-GO-SCDOT (855-467-2368)