

**STRUCTURAL DRAWINGS AND DETAILS**  
**Instructional Memorandum 704-ACS**  
**Adjacent Prestressed Concrete Cored Slabs**  
 June 26, 2024

**General**

The cored slab details are available in standard span lengths of 30 feet, 40 feet, 50 feet, 60 feet, and 70 feet. Typical sections are provided for bridge roadway widths of 27'-10", 33'-10", and 39'-10" and include the MASH Barrier Parapet along each side. The standards are available in +15 degree skew, no skew, and -15 degree skew.

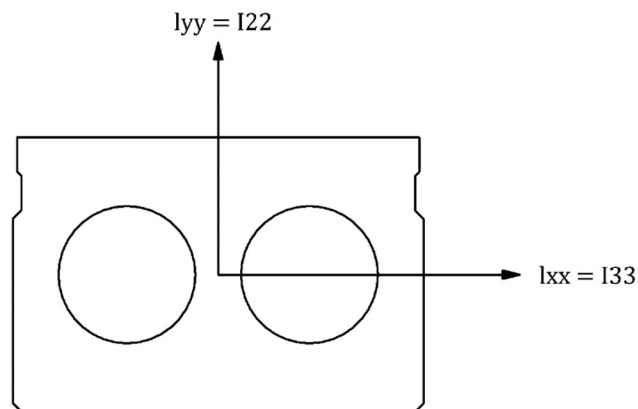
**Design Criteria and Assumptions**

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

Live Load: AASHTO HL-93 Loading

Table 1 contains the section properties that were used in design. The 30-ft, 40-ft, and 50-ft spans were designed using the (SC) CS 21 section and the 60-ft and 70-ft spans were designed using the (SC) CS 24 section.

Table 1 – Section Properties for Prestressed Sections							
Section	(in <sup>2</sup> ) Area	Vol/Surf	(in <sup>4</sup> ) I <sub>33</sub> =I <sub>xx</sub>	(in <sup>4</sup> ) I <sub>22</sub> =I <sub>yy</sub>	(in <sup>4</sup> ) J=Torsional Constant	(in) H nominal	(in) CG to bottom
(SC) CS 21 Ext L	525.2	3.49	25479	63681	59594	21	10.46
(SC) CS 21 Ext R	525.2	3.49	25479	63681	59594	21	10.46
(SC) CS 21 Int	521.7	3.45	25326	62595	58967	21	10.42
(SC) CS 24 Ext L	633.2	4.05	39056	75346	83006	24	11.96
(SC) CS 24 Ext R	633.2	4.05	39056	75346	83006	24	11.96
(SC) CS 24 Int	629.7	4.01	38829	74259	82309	24	11.91



**Cored Slab Section**



Table 2 contains the asphalt thicknesses that were used to calculate the dead load of the wearing surface for stress considerations. A unit weight of 140 pcf was used for the asphalt wearing surface. A camber of zero was assumed at the final stage when calculating the dead load and no allowance was made for vertical curvature. The dead load of the asphalt wearing surface was distributed equally among all the slabs in the span.

Table 2 – Asphalt Thicknesses Used to Determine Design Dead Load of the Wearing Surface		
Span Length/Roadway Width	Asphalt Thickness at Gutter Line (inches)	Asphalt Thickness at Crown Point of Roadway (inches)
30' Span, 27'-10" Roadway	2.375	5.75
30' Span, 33'-10" Roadway	2.375	6.4375
30' Span, 39'-10" Roadway	2.375	7.1875
40' Span, 27'-10" Roadway	2.8125	6.1875
40' Span, 33'-10" Roadway	2.8125	6.875
40' Span, 39'-10" Roadway	2.8125	7.625
50' Span, 27'-10" Roadway	3.8125	7.1875
50' Span, 33'-10" Roadway	3.8125	7.875
50' Span, 39'-10" Roadway	3.8125	8.625
60' Span, 27'-10" Roadway	3.75	7.125
60' Span, 33'-10" Roadway	3.75	7.8125
60' Span, 39'-10" Roadway	3.75	8.5625
70' Span, 27'-10" Roadway	4.5	7.875
70' Span, 33'-10" Roadway	4.5	8.5625
70' Span, 39'-10" Roadway	4.5	9.3125

It is assumed that the existing asphalt will be removed and replaced with the same thickness in the event of roadway resurfacing. Therefore, no allowance was made for a future wearing surface loading.

The typical cross section was considered to be Type (g) as shown in Table 4.6.2.2.1-1 of the BDS. Moment and shear distribution factors were calculated based on the condition of the slabs being connected only enough to prevent relative vertical displacement at the interface, but not sufficiently to act as a unit.

Design Tension Stresses (Stresses at Service III Limit State after Losses) in the Precompressed Tensile Zone, assuming uncracked sections, was limited to 0 ksi (no tension) at mid-span.

The tensile stresses at release were limited to 0.2 ksi to minimize the potential for cracking at the top of the ends of the slabs.

For stress considerations, the Hand Formed Mash Barrier Parapet, having a cross sectional area of 3.5 ft<sup>2</sup> and a unit weight of 0.525 kips per linear foot, was distributed equally to the 3 outermost slabs on each side of the span (0.175 kips per linear foot per slab along the entire length of span). When determining deflection values to be placed on the plans, the dead load from the Hand Formed Mash Barrier Parapets was distributed equally to all slabs of the span.

Prestress losses were determined in accordance with BDS Article 5.9.3 for pretensioned members. The prestress losses include the following assumptions:

- Relative humidity of 70%,
- Initial concrete strength,  $f'_{ci} = 4.0$  ksi for the 30-ft and 40-ft spans,
- Initial concrete strength,  $f'_{ci} = 4.8$  ksi for the 50-ft and 60-ft spans,
- Initial concrete strength,  $f'_{ci} = 6.0$  ksi for the 70-ft span,
- Final 28-day concrete strength,  $f'_c = 5.0$  ksi for the 30-ft and 40-ft spans,
- Final 28-day concrete strength,  $f'_c = 6.0$  ksi for the 50-ft and 60-ft spans,
- Final 28-day concrete strength,  $f'_c = 8.0$  ksi for the 70-ft span,
- Unit weight of unreinforced concrete,  $\gamma_c = 145$  pcf for the 30-ft and 40-ft spans, based on BDS Table 3.5.1-1,
- Unit weight of unreinforced concrete,  $\gamma_c = 146$  pcf for the 50-ft and 60-ft spans, based on BDS Table 3.5.1-1,
- Unit weight of unreinforced concrete,  $\gamma_c = 148$  pcf for the 70-ft span, based on BDS Table 3.5.1-1,
- Modulus of elasticity of prestressing strand of 28,500 ksi,
- 0.6-inch Diameter ( $A_{ps} = 0.217$  in<sup>2</sup>), Grade 270, Low-Relaxation prestressing strand, and
- Long-term losses based on approximate methods per BDS Article 5.9.3.3.

Table 3 contains camber and deflections that were used to calculate the wearing surface thickness. For a span having a constant grade, normal crown, and 0-degree skew, the asphalt thicknesses given in Table 3 accommodate the required minimum 2 inches of asphalt thickness.

Table 3 – Asphalt Thicknesses and Deflection Values for Spans with a Constant Grade and Normal Crown				
Span Length / Roadway Width	Camber at Erection (inches)	DL Deflection Due to Parapets and Asphalt (inches)	*Asphalt Thickness at Gutter Line (inches)	*Asphalt Thickness at Crown Point of Roadway (inches)
30' Span 27'-10" Roadway	0.3750	0.0625	2.3125	5.6250
30' Span 33'-10" Roadway	0.3750	0.0625	2.3125	6.3750
30' Span 39'-10" Roadway	0.3750	0.0625	2.3125	7.0625
40' Span 27'-10" Roadway	0.8750	0.1250	2.7500	6.0625
40' Span 33'-10" Roadway	0.8750	0.1250	2.7500	6.8125
40' Span 39'-10" Roadway	0.8750	0.1250	2.7500	7.5000
50' Span 27'-10" Roadway	2.0000	0.3125	3.6875	7.0000

Table 3 (Continued)				
Span Length / Roadway Width	Camber at Erection (inches)	DL Deflection Due to Parapets and Asphalt (inches)	*Asphalt Thickness at Gutter Line (inches)	*Asphalt Thickness at Crown Point of Roadway (inches)
50' Span 33'-10" Roadway	2.0000	0.3125	3.6875	7.7500
50' Span 39'-10" Roadway	2.0000	0.3125	3.6875	8.4375
60' Span 27'-10" Roadway	2.0625	0.4375	3.6250	6.9375
60' Span 33'-10" Roadway	2.0625	0.4375	3.6250	7.6875
60' Span 39'-10" Roadway	2.0625	0.4375	3.6250	8.3750
70' Span 27'-10" Roadway	3.0000	0.7500	4.2500	7.5625
70' Span 33'-10" Roadway	3.0000	0.7500	4.2500	8.3125
70' Span 39'-10" Roadway	3.0000	0.7500	4.2500	9.0000

\* Maximum thickness shown at centerline of slab bearings. Thickness typically varies along length of slab due to camber.

The elastomeric bearing pads were designed in accordance with BDS Article 14.7.6 (Method A).

### 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:

- 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.
- A Final Allowable Tension limit of  $0.0948 \cdot \sqrt{f'c}$  was used for Load Rating.
- A two directional bridge was assumed having an ADT of 10,000 vpd and 15% trucks.

## Instructions to Designer

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

- Review the vertical profile of the roadway through the cored slab bridge. Considering the camber of the slabs and skew effects, determine the asphalt wearing surface thickness needed to maintain a minimum thickness of 2 inches. If thicknesses are increased beyond the values listed in Table 2, reevaluate the design of the slabs.
- Wherever “X” or “#” is used, replace with project specific values.
- Input missing information on the “PRESTRESSED CONCRETE CORED SLAB TYPICAL SUPERSTRUCTURE SECTION” sheet:
  - Input values needed for wearing surface thickness based on profile, skew, and camber. A minimum thickness of 2 inches must be maintained. For spans having a constant grade, the values shown in Table 3 may be used.
  - On the “PRESTRESSED CONCRETE CORED SLAB TYPICAL SUPERSTRUCTURE SECTION” sheet, input missing span lengths in the sheet references for “PRESTRESSED CONCRETE CORED SLABS XX’ SPAN DETAILS” and “PRESTRESSED CONCRETE CORED SLAB XX’ SPAN – PLAN”. If more than one span length is required for the project, add sheet references for each additional span length used.
- Input the missing information in the “Dead Load Deflection & Camber” table on the “PRESTRESSED CONCRETE CORED SLAB XX’ SPAN - PLAN” sheet. Input the value needed for deflection due to barrier parapets and asphalt wearing surface. For spans having a constant grade, the values shown in Table 3 may be used. Then subtract the deflection from the camber and input the final camber value.
- Verify that bicycle or sidewalk accommodation is not a project requirement. If the bridge needs to be designed to accommodate bicyclists or sidewalks, a redesign of the slabs and rails will be required.
- The combination of profile grade, skew, and roadway cross slope can sometimes result in theoretical bent cap elevations that would twist the cored slabs. Verify that the longitudinal and transverse bent cap slopes will permit proper seating of the cored slabs. In some cases, the slabs may need to be superelevated to ensure the bottoms of the slabs in an individual span remain in the same plane.
- If the roadway is superelevated, transversely slope the slabs and provide a uniformly thick asphalt wearing surface across the cross slope.
- Revise the barrier reinforcement details if the cross slope of the superelevated slabs is greater than 2%.
- On the “PRESTRESSED CONCRETE CORED SLAB GENERAL DETAILS 1 OF 2” sheet, input the appropriate Bearing Design Load. The details shown on the plans and values shown on Table 2 result in the following values for maximum dead load plus live load (without Impact):
  - 30-ft Span = 37 KIPS
  - 40-ft Span = 42 KIPS
  - 50-ft Span = 48 KIPS
  - 60-ft Span = 55 KIPS



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- 70-ft Span = 62 KIPS  
If more than one span length is used for the bridge, include the load for the longer span. Do not show more than one load for a bridge.
- Revise decks drains if necessary for site conditions.
- For each span, ensure that one end has fixed bearings, and the other end has expansion bearings. This is detailed on the bridge plan and profile sheet.
- Verify that the A07 dowels detailed on the "PRESTRESSED CONCRETE CORED SLAB GENERAL DETAILS 2 OF 2" sheet are adequate to meet the project specific requirements. Increase the size of the dowels and modify the bearing details if necessary.

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**Applicable Drawings**

DGN File Name	Drawing Number	Sheet Title
704_ACS_030	704-ACS.S030.R28.SK-15	Prestressed Concrete Cored Slab 30' Span, 27'-10" Roadway (-15° Skew)
	704-ACS.S030.R28.SK000	Prestressed Concrete Cored Slab 30' Span, 27'-10" Roadway (0° Skew)
	704-ACS.S030.R28.SK015	Prestressed Concrete Cored Slab 30' Span, 27'-10" Roadway (+15° Skew)
	704-ACS.S030.R34.SK-15	Prestressed Concrete Cored Slab 30' Span, 33'-10" Roadway (-15° Skew)
	704-ACS.S030.R34.SK000	Prestressed Concrete Cored Slab 30' Span, 33'-10" Roadway (0° Skew)
	704-ACS.S030.R34.SK015	Prestressed Concrete Cored Slab 30' Span, 33'-10" Roadway (+15° Skew)
	704-ACS.S030.R40.SK-15	Prestressed Concrete Cored Slab 30' Span, 39'-10" Roadway (-15° Skew)
	704-ACS.S030.R40.SK000	Prestressed Concrete Cored Slab 30' Span, 39'-10" Roadway (0° Skew)
	704-ACS.S030.R40.SK015	Prestressed Concrete Cored Slab 30' Span, 39'-10" Roadway (+15° Skew)
	704-ACS.S030.SK-15.D01	Prestressed Concrete Cored Slab 30' Span Details (-15° Skew)
	704-ACS.S030.SK000.D01	Prestressed Concrete Cored Slab 30' Span Details (0° Skew)
	704-ACS.S030.SK015.D01	Prestressed Concrete Cored Slab 30' Span Details (+15° Skew)
704_ACS_040	704-ACS.S040.R28.SK-15	Prestressed Concrete Cored Slab 40' Span, 27'-10" Roadway (-15° Skew)
	704-ACS.S040.R28.SK000	Prestressed Concrete Cored Slab 40' Span, 27'-10" Roadway (0° Skew)
	704-ACS.S040.R28.SK015	Prestressed Concrete Cored Slab 40' Span, 27'-10" Roadway (+15° Skew)
	704-ACS.S040.R34.SK-15	Prestressed Concrete Cored Slab 40' Span, 33'-10" Roadway (-15° Skew)
	704-ACS.S040.R34.SK000	Prestressed Concrete Cored Slab 40' Span, 33'-10" Roadway (0° Skew)
	704-ACS.S040.R34.SK015	Prestressed Concrete Cored Slab 40' Span, 33'-10" Roadway (+15° Skew)
	704-ACS.S040.R40.SK-15	Prestressed Concrete Cored Slab 40' Span, 39'-10" Roadway (-15° Skew)
	704-ACS.S040.R40.SK000	Prestressed Concrete Cored Slab 40' Span, 39'-10" Roadway (0° Skew)
	704-ACS.S040.R40.SK015	Prestressed Concrete Cored Slab 40' Span, 39'-10" Roadway (+15° Skew)
	704-ACS.S040.SK-15.D01	Prestressed Concrete Cored Slab 40' Span Details (-15° Skew)
	704-ACS.S040.SK000.D01	Prestressed Concrete Cored Slab 40' Span Details (0° Skew)
	704-ACS.S040.SK015.D01	Prestressed Concrete Cored Slab 40' Span Details (+15° Skew)
704_ACS_050	704-ACS.S050.R28.SK-15	Prestressed Concrete Cored Slab 50' Span, 27'-10" Roadway (-15° Skew)
	704-ACS.S050.R28.SK000	Prestressed Concrete Cored Slab 50' Span, 27'-10" Roadway (0° Skew)
	704-ACS.S050.R28.SK015	Prestressed Concrete Cored Slab 50' Span, 27'-10" Roadway (+15° Skew)
	704-ACS.S050.R34.SK-15	Prestressed Concrete Cored Slab 50' Span, 33'-10" Roadway (-15° Skew)
	704-ACS.S050.R34.SK000	Prestressed Concrete Cored Slab 50' Span, 33'-10" Roadway (0° Skew)

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DGN File Name (Continued)	Drawing Number (Continued)	Sheet Title (Continued)
704_ACS_050	704-ACS.S050.R34.SK015	Prestressed Concrete Cored Slab 50' Span, 33'-10" Roadway (+15° Skew)
	704-ACS.S050.R40.SK-15	Prestressed Concrete Cored Slab 50' Span, 39'-10" Roadway (-15° Skew)
	704-ACS.S050.R40.SK000	Prestressed Concrete Cored Slab 50' Span, 39'-10" Roadway (0° Skew)
	704-ACS.S050.R40.SK015	Prestressed Concrete Cored Slab 50' Span, 39'-10" Roadway (+15° Skew)
	704-ACS.S050.SK-15.D01	Prestressed Concrete Cored Slab 50' Span Details (-15° Skew)
	704-ACS.S050.SK000.D01	Prestressed Concrete Cored Slab 50' Span Details (0° Skew)
	704-ACS.S050.SK015.D01	Prestressed Concrete Cored Slab 50' Span Details (+15° Skew)
704_ACS_060	704-ACS.S060.R28.SK-15	Prestressed Concrete Cored Slab 60' Span, 27'-10" Roadway (-15° Skew)
	704-ACS.S060.R28.SK000	Prestressed Concrete Cored Slab 60' Span, 27'-10" Roadway (0° Skew)
	704-ACS.S060.R28.SK015	Prestressed Concrete Cored Slab 60' Span, 27'-10" Roadway (+15° Skew)
	704-ACS.S060.R34.SK-15	Prestressed Concrete Cored Slab 60' Span, 33'-10" Roadway (-15° Skew)
	704-ACS.S060.R34.SK000	Prestressed Concrete Cored Slab 60' Span, 33'-10" Roadway (0° Skew)
	704-ACS.S060.R34.SK015	Prestressed Concrete Cored Slab 60' Span, 33'-10" Roadway (+15° Skew)
	704-ACS.S060.R40.SK-15	Prestressed Concrete Cored Slab 60' Span, 39'-10" Roadway (-15° Skew)
	704-ACS.S060.R40.SK000	Prestressed Concrete Cored Slab 60' Span, 39'-10" Roadway (0° Skew)
	704-ACS.S060.R40.SK015	Prestressed Concrete Cored Slab 60' Span, 39'-10" Roadway (+15° Skew)
	704-ACS.S060.SK-15.D01	Prestressed Concrete Cored Slab 60' Span Details (-15° Skew)
	704-ACS.S060.SK000.D01	Prestressed Concrete Cored Slab 60' Span Details (0° Skew)
	704-ACS.S060.SK015.D01	Prestressed Concrete Cored Slab 60' Span Details (+15° Skew)
704_ACS_070	704-ACS.S070.R28.SK-15	Prestressed Concrete Cored Slab 70' Span, 27'-10" Roadway (-15° Skew)
	704-ACS.S070.R28.SK000	Prestressed Concrete Cored Slab 70' Span, 27'-10" Roadway (0° Skew)
	704-ACS.S070.R28.SK015	Prestressed Concrete Cored Slab 70' Span, 27'-10" Roadway (+15° Skew)
	704-ACS.S070.R34.SK-15	Prestressed Concrete Cored Slab 70' Span, 33'-10" Roadway (-15° Skew)
	704-ACS.S070.R34.SK000	Prestressed Concrete Cored Slab 70' Span, 33'-10" Roadway (0° Skew)
	704-ACS.S070.R34.SK015	Prestressed Concrete Cored Slab 70' Span, 33'-10" Roadway (+15° Skew)
	704-ACS.S070.R40.SK-15	Prestressed Concrete Cored Slab 70' Span, 39'-10" Roadway (-15° Skew)
	704-ACS.S070.R40.SK000	Prestressed Concrete Cored Slab 70' Span, 39'-10" Roadway (0° Skew)
	704-ACS.S070.R40.SK015	Prestressed Concrete Cored Slab 70' Span, 39'-10" Roadway (+15° Skew)
	704-ACS.S070.SK-15.D01	Prestressed Concrete Cored Slab 70' Span Details (-15° Skew)

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DGN File Name (Continued)	Drawing Number (Continued)	Sheet Title (Continued)
704_ACS_070	704-ACS.S070.SK000.D01	Prestressed Concrete Cored Slab 70' Span Details (0° Skew)
	704-ACS.S070.SK015.D01	Prestressed Concrete Cored Slab 70' Span Details (+15° Skew)
704_ACS_GENDET	704-ACS.TYP.R28	Prestressed Concrete Cored Slab Typical Superstructure Section, 27'-10" Roadway
	704-ACS.TYP.R34	Prestressed Concrete Cored Slab Typical Superstructure Section, 33'-10" Roadway
	704-ACS.TYP.R40	Prestressed Concrete Cored Slab Typical Superstructure Section, 39'-10" Roadway
	704-ACS.GD01.AH00	Prestressed Concrete Cored Slab General Details 1 of 2 (0° Skew)
	704-ACS.GD01.SK15	Prestressed Concrete Cored Slab General Details 1 of 2 (+15° Skew or -15° Skew)
	704-ACS.GD02	Prestressed Concrete Cored Slab General Details 2 of 2

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**Plan Sheet Sequence**

Below are two examples that illustrate the Department’s recommended sequencing of the cored slab superstructure plans.

<i>Single span 50’ with a -15 degree skew and a roadway width of 33’-10”</i>	
704-ACS.S050.R34.SK-15	Prestressed Concrete Cored Slab 50’ Span, 33’-10” Roadway (-15° Skew)
704-ACS.TYP.R34	Prestressed Concrete Cored Slab Typical Superstructure Section, 33’-10” Roadway
704-ACS.S050.SK-15.D01	Prestressed Concrete Cored Slab 50’ Span Details (-15° Skew)
704-ACS.GD01.SK15	Prestressed Concrete Cored Slab General Details 1 of 2 (+15° Skew or -15° Skew)
704-ACS.GD02	Prestressed Concrete Cored Slab General Details 2 of 2

<i>Span arrangement of 40’-70’-50’ with no skew and a roadway width of 39’-10”</i>	
704-ACS.S040.R40.SK000	Prestressed Concrete Cored Slab 40’ Span, 39’-10” Roadway (0° Skew)
704-ACS.S070.R40.SK000	Prestressed Concrete Cored Slab 70’ Span, 39’-10” Roadway (0° Skew)
704-ACS.S050.R40.SK000	Prestressed Concrete Cored Slab 50’ Span, 39’-10” Roadway (0° Skew)
704-ACS.TYP.R40	Prestressed Concrete Cored Slab Typical Superstructure Section, 39’-10” Roadway
704-ACS.S040.SK000.D01	Prestressed Concrete Cored Slab 40’ Span Details (0° Skew)
704-ACS.S070.SK000.D01	Prestressed Concrete Cored Slab 70’ Span Details (0° Skew)
704-ACS.S050.SK000.D01	Prestressed Concrete Cored Slab 50’ Span Details (0° Skew)
704-ACS.GD01.AH00	Prestressed Concrete Cored Slab General Details 1 of 2 (0° Skew)
704-ACS.GD02	Prestressed Concrete Cored Slab General Details 2 of 2

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