



South Carolina
Department of Transportation

BRIDGE DESIGN MEMORANDUM – DM0320

TO: RPG Structural Design Engineers
Structural Design Consultants

DATE: May 8, 2020

RE: Reinforcing Steel Development Lengths for Bars in Tension and Reinforcing Steel Splice Lengths for Bars in Tension - Revisions to Figures 15.3-4, 15.3-5, and 15.3-6 and Sections 15.3.1.6 and 15.3.1.7 of the SCDOT Bridge Design Manual

Apply these updated requirements to all projects where design has not advanced beyond the preliminary design phase.

Due to revisions of the *AASHTO LRFD Bridge Design Specifications (AASHTO)* concerning reinforcing steel development and splice lengths, *SCDOT Bridge Design Manual (Manual)* Figure 15.3-4 – Development Lengths for Straight Bars in Tension (4 ksi), and Figure 15.3-6 – Splice Lengths for Bars in Tension (4 ksi) shall be superseded by the Tables included in this Design Memorandum:

- Table 1: Straight Bar Development Length, ℓ_d [in], for Horizontal Bars with $> 12"$ Concrete Cast Below; $f'_c = 4$ ksi.; $f_y = 60$ ksi.
- Table 2: Straight Bar Development Length, ℓ_d [in], for Horizontal Bars with $\leq 12"$ Concrete Cast Below, or Other Bars; $f'_c = 4$ ksi.; $f_y = 60$ ksi.
- Table 3: Tension Lap Splice Length, ℓ_{st} [in], for Horizontal Bars with $> 12"$ Concrete Cast Below; $f'_c = 4$ ksi.; $f_y = 60$ ksi.
- Table 4: Tension Lap Splice Length, ℓ_{st} [in], for Horizontal Bars with $\leq 12"$ Concrete Cast Below, or Other Bars; $f'_c = 4$ ksi.; $f_y = 60$ ksi.

Notes:

Tables include modification factors for reinforcement location, normal weight concrete, and reinforcement confinement as specified in *AASHTO* Articles 5.10.8.2.1b and 5.10.8.2.1c.



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The following tables are applicable to both uncoated bars and galvanized bars.

Reinforcement confinement factor is conservatively calculated by taking the transverse reinforcement index as 0.

Excess reinforcement factor is taken conservatively as 1.0.

Tension lap splice lengths are based on *AASHTO* Article 5.10.8.4.3.

Concrete clear cover is defined as the cover to the bar being considered.

Development Lengths of #14[43], and #18[57] bars are calculated using the equations from *AASHTO* 6th Edition Articles 5.11.2.1.1 – Tension Development Length, 5.11.2.1.2 – Modification Factors which Increase ℓ_d , and 5.11.2.1.3 – Modification Factors which Decrease ℓ_d .

For Development Lengths of #14[43], and #18[57] bars, a factor of 0.8 is applied where reinforcement being developed is spaced laterally not less than 6.0 in. center-to-center, with not less than 3.0 in. clear cover measured in the direction of the spacing.

Use Table 1 and Table 2 to determine development lengths of bars in tension unless the designer performs more refined calculations of development lengths as specified in *AASHTO* Article 5.10.8.2.1. For concrete clear cover or bar spacing that falls between the table values, the development length for the smaller concrete clear cover or bar spacing shall be used unless more refined calculations are performed using *AASHTO* Article 5.10.8.2.1.

Use Table 3 and Table 4 to determine lap splice lengths for bars in tension unless the designer performs more refined calculations of lap splices as specified in *AASHTO* Article 5.10.8.4.3a. For concrete clear cover or bar spacing that falls between the table values, the development length for the smaller concrete clear cover or bar spacing shall be used unless more refined calculations are performed using *AASHTO* Article 5.10.8.4.3a.

Use Class B splices unless the designer performs more refined calculations as specified in *AASHTO* Article 5.10.8.4.3a.

Delete Figure 15.3-5 –Development Lengths For Hooked Bars In Tension (4 ksi) of the Manual and use the requirements of *AASHTO* Article 5.10.8.2.4.

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Delete the LRFD Article referenced in Section 15.3.1.6.1 of the *Manual* and replace with the following:

Reference: LRFD Article 5.10.8.2

Delete the first paragraph of Section 15.3.1.6.1 of the *Manual* and replace with the following:

The development of bars in tension involves calculating the basic development length, ℓ_{db} , which is modified by factors to reflect bar spacing, cover, reinforcement location, type of aggregate, and the ratio of required area to provide the area of reinforcement to be developed.

Delete the third paragraph of Section 15.3.1.6.1 of the *Manual* and use Tables 1 and 2 below.

Delete the LRFD Article referenced in Section 15.3.1.6.3 of the *Manual* and replace with the following:

Reference: LRFD Article 5.10.8.2.4

Delete the last sentence of the first paragraph in Section 15.3.1.6.3 of the *Manual*.

Delete the third paragraph of Section 15.3.1.6.3 of the *Manual* and replace with the following:

Refer to LRFD Figure C5.10.8.2.4a-1 in the commentary for hooked-bar details for the development of standard hooks. Use the same figure for both uncoated and galvanized bars.

Delete the LRFD Article referenced in Section 15.3.1.7 of the *Manual* and replace with the following:

Reference: LRFD Article 5.10.8.4

Delete the LRFD Article referenced in Section 15.3.1.7.2 of the *Manual* and replace with the following:

Reference: LRFD Article 5.10.8.4.3

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Delete the first paragraph of Section 15.3.1.7.2 of the *Manual* and replace with the following:

Many of the same factors that affect development length affect splice length. Consequently, tension lap splices are a function of the bar development length (ℓ_d). Tension lap splices are classified, based upon the ratio of provided steel to required steel and the percent of steel spliced, into two classes — Class A and Class B. Designers are encouraged to splice bars at points of minimum stress.

Delete the third paragraph of Section 15.3.1.7.2 of the *Manual* and use Tables 3 and 4 below.

Delete the LRFD Articles referenced in Section 15.3.1.7.4 of the *Manual* and replace with the following:

Reference: LRFD Article 5.10.8.4.2b, 5.10.8.4.3b and 5.10.8.4.5b

Delete the LRFD Articles referenced in Section 15.3.1.7.6 of the *Manual* and replace with the following:

Reference: LRFD Article 5.10.8.4.3b and 5.10.8.4.4



Table 1: Straight Bar Development Length, ℓ_d [in], for Horizontal Bars with > 12" Concrete Cast Below; $f'_c = 4$ ksi.; $f_y = 60$ ksi.

Clear Cover	Bar Size US [M]	Reinforcement Spacing										
		4"	4 ½"	5"	5 ½"	6"	6 ½"	7"	7 ½"	8"	8 ½"	≥ 9"
1"	#3 [10]	15	15	15	15	15	15	15	15	15	15	15
	#4 [13]	19	19	19	19	19	19	19	19	19	19	19
	#5 [16]	28	28	28	28	28	28	28	28	28	28	28
	#6 [19]	39	39	39	39	39	39	39	39	39	39	39
	#7 [22]	50	50	50	50	50	50	50	50	50	50	50
	#8 [25]	63	63	63	63	63	63	63	63	63	63	63
	#9 [29]	77	77	77	77	77	77	77	77	77	77	77
	#10 [32]	93	93	93	93	93	93	93	93	93	93	93
	#11 [36]	110	110	110	110	110	110	110	110	110	110	110
#14 [43]	N/A	114	114	114	114	114	114	114	114	114	114	
#18 [57]	N/A	N/A	N/A	N/A	N/A	147	147	147	147	147	147	
1 ½"	#3 [10]	15	15	15	15	15	15	15	15	15	15	15
	#4 [13]	19	19	19	19	19	19	19	19	19	19	19
	#5 [16]	24	24	24	24	24	24	24	24	24	24	24
	#6 [19]	29	29	29	29	29	29	29	29	29	29	29
	#7 [22]	37	37	37	37	37	37	37	37	37	37	37
	#8 [25]	47	47	47	47	47	47	47	47	47	47	47
	#9 [29]	60	58	58	58	58	58	58	58	58	58	58
	#10 [32]	76	71	71	71	71	71	71	71	71	71	71
	#11 [36]	94	85	85	85	85	85	85	85	85	85	85
#14 [43]	N/A	114	114	114	114	114	114	114	114	114	114	
#18 [57]	N/A	N/A	N/A	N/A	N/A	147	147	147	147	147	147	
2"	#3 [10]	15	15	15	15	15	15	15	15	15	15	15
	#4 [13]	19	19	19	19	19	19	19	19	19	19	19
	#5 [16]	24	24	24	24	24	24	24	24	24	24	24
	#6 [19]	29	29	29	29	29	29	29	29	29	29	29
	#7 [22]	36	33	33	33	33	33	33	33	33	33	33
	#8 [25]	47	42	38	38	38	38	38	38	38	38	38
	#9 [29]	60	53	48	47	47	47	47	47	47	47	47
	#10 [32]	76	68	61	58	58	58	58	58	58	58	58
	#11 [36]	94	83	75	69	69	69	69	69	69	69	69
#14 [43]	N/A	114	114	114	114	114	114	114	114	114	114	
#18 [57]	N/A	N/A	N/A	N/A	N/A	147	147	147	147	147	147	
2 ½"	#3 [10]	15	15	15	15	15	15	15	15	15	15	15
	#4 [13]	19	19	19	19	19	19	19	19	19	19	19
	#5 [16]	24	24	24	24	24	24	24	24	24	24	24
	#6 [19]	29	29	29	29	29	29	29	29	29	29	29
	#7 [22]	36	33	33	33	33	33	33	33	33	33	33
	#8 [25]	47	42	38	38	38	38	38	38	38	38	38
	#9 [29]	60	53	48	44	43	43	43	43	43	43	43
	#10 [32]	76	68	61	55	51	49	49	49	49	49	49
	#11 [36]	94	83	75	68	63	59	59	59	59	59	59
#14 [43]	N/A	114	114	114	114	114	114	114	114	114	114	
#18 [57]	N/A	N/A	N/A	N/A	N/A	147	147	147	147	147	147	
≥ 3"	#3 [10]	15	15	15	15	15	15	15	15	15	15	15
	#4 [13]	19	19	19	19	19	19	19	19	19	19	19
	#5 [16]	24	24	24	24	24	24	24	24	24	24	24
	#6 [19]	29	29	29	29	29	29	29	29	29	29	29
	#7 [22]	36	33	33	33	33	33	33	33	33	33	33
	#8 [25]	47	42	38	38	38	38	38	38	38	38	38
	#9 [29]	60	53	48	44	43	43	43	43	43	43	43
	#10 [32]	76	68	61	55	51	48	48	48	48	48	48
	#11 [36]	94	83	75	68	63	58	54	53	53	53	53
#14 [43]	N/A	114	114	114	114	92	92	92	92	92	92	
#18 [57]	N/A	N/A	N/A	N/A	N/A	118	118	118	118	118	118	

Note: N/A refers to cases where the clear spacing between bars does not meet the minimum spacing requirements for cast-in-place concrete, LRFD 5.10.3.1, using a maximum aggregate size of 1.5".



Table 2: Straight Bar Development Length, ℓ_d [in], for Horizontal Bars with $\leq 12''$ Concrete Cast Below, or Other Bars; $f'_c = 4 \text{ ksi.}; f_y = 60 \text{ ksi.}$												
Clear Cover	Bar Size US [M]	Reinforcement Spacing										
		4"	4 ½"	5"	5 ½"	6"	6 ½"	7"	7 ½"	8"	8 ½"	≥ 9"
1"	#3 [10]	12	12	12	12	12	12	12	12	12	12	12
	#4 [13]	15	15	15	15	15	15	15	15	15	15	15
	#5 [16]	22	22	22	22	22	22	22	22	22	22	22
	#6 [19]	30	30	30	30	30	30	30	30	30	30	30
	#7 [22]	39	39	39	39	39	39	39	39	39	39	39
	#8 [25]	48	48	48	48	48	48	48	48	48	48	48
	#9 [29]	59	59	59	59	59	59	59	59	59	59	59
	#10 [32]	72	72	72	72	72	72	72	72	72	72	72
	#11 [36]	84	84	84	84	84	84	84	84	84	84	84
#14 [43]	N/A	81	81	81	81	81	81	81	81	81	81	
#18 [57]	N/A	N/A	N/A	N/A	105	105	105	105	105	105	105	
1 ½"	#3 [10]	12	12	12	12	12	12	12	12	12	12	12
	#4 [13]	15	15	15	15	15	15	15	15	15	15	15
	#5 [16]	18	18	18	18	18	18	18	18	18	18	18
	#6 [19]	22	22	22	22	22	22	22	22	22	22	22
	#7 [22]	29	29	29	29	29	29	29	29	29	29	29
	#8 [25]	36	36	36	36	36	36	36	36	36	36	36
	#9 [29]	46	45	45	45	45	45	45	45	45	45	45
	#10 [32]	59	55	55	55	55	55	55	55	55	55	55
	#11 [36]	72	65	65	65	65	65	65	65	65	65	65
#14 [43]	N/A	81	81	81	81	81	81	81	81	81	81	
#18 [57]	N/A	N/A	N/A	N/A	105	105	105	105	105	105	105	
2"	#3 [10]	12	12	12	12	12	12	12	12	12	12	12
	#4 [13]	15	15	15	15	15	15	15	15	15	15	15
	#5 [16]	18	18	18	18	18	18	18	18	18	18	18
	#6 [19]	22	22	22	22	22	22	22	22	22	22	22
	#7 [22]	28	26	26	26	26	26	26	26	26	26	26
	#8 [25]	36	32	29	29	29	29	29	29	29	29	29
	#9 [29]	46	41	37	36	36	36	36	36	36	36	36
	#10 [32]	59	52	47	45	45	45	45	45	45	45	45
	#11 [36]	72	64	58	53	53	53	53	53	53	53	53
#14 [43]	N/A	81	81	81	81	81	81	81	81	81	81	
#18 [57]	N/A	N/A	N/A	N/A	105	105	105	105	105	105	105	
2 ½"	#3 [10]	12	12	12	12	12	12	12	12	12	12	12
	#4 [13]	15	15	15	15	15	15	15	15	15	15	15
	#5 [16]	18	18	18	18	18	18	18	18	18	18	18
	#6 [19]	22	22	22	22	22	22	22	22	22	22	22
	#7 [22]	28	26	26	26	26	26	26	26	26	26	26
	#8 [25]	36	32	29	29	29	29	29	29	29	29	29
	#9 [29]	46	41	37	34	33	33	33	33	33	33	33
	#10 [32]	59	52	47	43	39	38	38	38	38	38	38
	#11 [36]	72	64	58	53	48	45	45	45	45	45	45
#14 [43]	N/A	81	81	81	81	81	81	81	81	81	81	
#18 [57]	N/A	N/A	N/A	N/A	105	105	105	105	105	105	105	
≥ 3"	#3 [10]	12	12	12	12	12	12	12	12	12	12	12
	#4 [13]	15	15	15	15	15	15	15	15	15	15	15
	#5 [16]	18	18	18	18	18	18	18	18	18	18	18
	#6 [19]	22	22	22	22	22	22	22	22	22	22	22
	#7 [22]	28	26	26	26	26	26	26	26	26	26	26
	#8 [25]	36	32	29	29	29	29	29	29	29	29	29
	#9 [29]	46	41	37	34	33	33	33	33	33	33	33
	#10 [32]	59	52	47	43	39	37	37	37	37	37	37
	#11 [36]	72	64	58	53	48	45	41	41	41	41	41
#14 [43]	N/A	81	81	81	65	65	65	65	65	65	65	
#18 [57]	N/A	N/A	N/A	N/A	84	84	84	84	84	84	84	

Note: N/A refers to cases where the clear spacing between bars does not meet the minimum spacing requirements for cast-in-place concrete, LRFD 5.10.3.1, using a maximum aggregate size of 1.5".



Table 3: Tension Lap Splice Length, ℓ_{st} [in] for Horizontal Bars with > 12" Concrete Cast Below; $f'_c = 4$ ksi.; $f_y = 60$ ksi.

Clear Cover	Bar Size US [M]	Reinforcement Spacing																	
		4"		4 1/2"		5"		5 1/2"		6"		6 1/2"		7"		7 1/2"		≥ 8"	
		Class		Class		Class		Class		Class		Class		Class		Class		Class	
		A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
1"	#3 [10]	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19
	#4 [13]	19	25	19	25	19	25	19	25	19	25	19	25	19	25	19	25	19	25
	#5 [16]	28	37	28	37	28	37	28	37	28	37	28	37	28	37	28	37	28	37
	#6 [19]	39	50	39	50	39	50	39	50	39	50	39	50	39	50	39	50	39	50
	#7 [22]	50	65	50	65	50	65	50	65	50	65	50	65	50	65	50	65	50	65
	#8 [25]	N/A	N/A	63	82	63	82	63	82	63	82	63	82	63	82	63	82	63	82
	#9 [29]	N/A	N/A	N/A	N/A	77	99	77	99	77	99	77	99	77	99	77	99	77	99
	#10 [32]	N/A	N/A	N/A	N/A	93	121	93	121	93	121	93	121	93	121	93	121	93	121
	#11 [36]	N/A	N/A	N/A	N/A	N/A	N/A	110	142	110	142	110	142	110	142	110	142	110	142
1 1/2"	#3 [10]	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19
	#4 [13]	19	25	19	25	19	25	19	25	19	25	19	25	19	25	19	25	19	25
	#5 [16]	24	31	24	31	24	31	24	31	24	31	24	31	24	31	24	31	24	31
	#6 [19]	29	37	29	37	29	37	29	37	29	37	29	37	29	37	29	37	29	37
	#7 [22]	37	49	37	49	37	49	37	49	37	49	37	49	37	49	37	49	37	49
	#8 [25]	N/A	N/A	47	61	47	61	47	61	47	61	47	61	47	61	47	61	47	61
	#9 [29]	N/A	N/A	N/A	N/A	58	76	58	76	58	76	58	76	58	76	58	76	58	76
	#10 [32]	N/A	N/A	N/A	N/A	71	92	71	92	71	92	71	92	71	92	71	92	71	92
	#11 [36]	N/A	N/A	N/A	N/A	N/A	N/A	85	110	85	110	85	110	85	110	85	110	85	110
2"	#3 [10]	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19
	#4 [13]	19	25	19	25	19	25	19	25	19	25	19	25	19	25	19	25	19	25
	#5 [16]	24	31	24	31	24	31	24	31	24	31	24	31	24	31	24	31	24	31
	#6 [19]	29	37	29	37	29	37	29	37	29	37	29	37	29	37	29	37	29	37
	#7 [22]	36	47	33	43	33	43	33	43	33	43	33	43	33	43	33	43	33	43
	#8 [25]	N/A	N/A	42	55	38	49	38	49	38	49	38	49	38	49	38	49	38	49
	#9 [29]	N/A	N/A	N/A	N/A	48	62	47	61	47	61	47	61	47	61	47	61	47	61
	#10 [32]	N/A	N/A	N/A	N/A	61	79	58	75	58	75	58	75	58	75	58	75	58	75
	#11 [36]	N/A	N/A	N/A	N/A	N/A	N/A	69	90	69	90	69	90	69	90	69	90	69	90
2 1/2"	#3 [10]	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19
	#4 [13]	19	25	19	25	19	25	19	25	19	25	19	25	19	25	19	25	19	25
	#5 [16]	24	31	24	31	24	31	24	31	24	31	24	31	24	31	24	31	24	31
	#6 [19]	29	37	29	37	29	37	29	37	29	37	29	37	29	37	29	37	29	37
	#7 [22]	36	47	33	43	33	43	33	43	33	43	33	43	33	43	33	43	33	43
	#8 [25]	N/A	N/A	42	55	38	49	38	49	38	49	38	49	38	49	38	49	38	49
	#9 [29]	N/A	N/A	N/A	N/A	48	62	44	57	43	55	43	55	43	55	43	55	43	55
	#10 [32]	N/A	N/A	N/A	N/A	61	79	55	72	51	66	49	63	49	63	49	63	49	63
	#11 [36]	N/A	N/A	N/A	N/A	N/A	N/A	68	88	63	81	59	76	59	76	59	76	59	76
≥ 3"	#3 [10]	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19
	#4 [13]	19	25	19	25	19	25	19	25	19	25	19	25	19	25	19	25	19	25
	#5 [16]	24	31	24	31	24	31	24	31	24	31	24	31	24	31	24	31	24	31
	#6 [19]	29	37	29	37	29	37	29	37	29	37	29	37	29	37	29	37	29	37
	#7 [22]	36	47	33	43	33	43	33	43	33	43	33	43	33	43	33	43	33	43
	#8 [25]	N/A	N/A	42	55	38	49	38	49	38	49	38	49	38	49	38	49	38	49
	#9 [29]	N/A	N/A	N/A	N/A	48	62	44	57	43	55	43	55	43	55	43	55	43	55
	#10 [32]	N/A	N/A	N/A	N/A	61	79	55	72	51	66	48	62	48	62	48	62	48	62
	#11 [36]	N/A	N/A	N/A	N/A	N/A	N/A	68	88	63	81	58	75	54	70	53	69	53	69

Note: N/A refers to cases where the clear spacing between bars does not meet the minimum spacing requirements for cast-in-place concrete, LRFD 5.10.3.1, using a maximum aggregate size of 1.5".



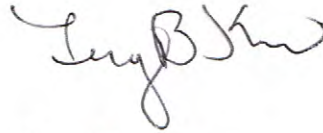
Clear Cover	Bar Size US [M]	Reinforcement Spacing																	
		4"		4 ½"		5"		5 ½"		6"		6 ½"		7"		7 ½"		≥ 8"	
		Class		Class		Class		Class		Class		Class		Class		Class		Class	
		A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
1"	#3 [10]	12	15	12	15	12	15	12	15	12	15	12	15	12	15	12	15	12	15
	#4 [13]	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19
	#5 [16]	22	28	22	28	22	28	22	28	22	28	22	28	22	28	22	28	22	28
	#6 [19]	30	39	30	39	30	39	30	39	30	39	30	39	30	39	30	39	30	39
	#7 [22]	39	50	39	50	39	50	39	50	39	50	39	50	39	50	39	50	39	50
	#8 [25]	N/A	N/A	48	63	48	63	48	63	48	63	48	63	48	63	48	63	48	63
	#9 [29]	N/A	N/A	N/A	N/A	59	77	59	77	59	77	59	77	59	77	59	77	59	77
	#10 [32]	N/A	N/A	N/A	N/A	72	93	72	93	72	93	72	93	72	93	72	93	72	93
#11 [36]	N/A	N/A	N/A	N/A	N/A	N/A	84	110	84	110	84	110	84	110	84	110	84	110	
1 ½"	#3 [10]	12	15	12	15	12	15	12	15	12	15	12	15	12	15	12	15	12	15
	#4 [13]	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19
	#5 [16]	18	24	18	24	18	24	18	24	18	24	18	24	18	24	18	24	18	24
	#6 [19]	22	29	22	29	22	29	22	29	22	29	22	29	22	29	22	29	22	29
	#7 [22]	29	37	29	37	29	37	29	37	29	37	29	37	29	37	29	37	29	37
	#8 [25]	N/A	N/A	36	47	36	47	36	47	36	47	36	47	36	47	36	47	36	47
	#9 [29]	N/A	N/A	N/A	N/A	45	58	45	58	45	58	45	58	45	58	45	58	45	58
	#10 [32]	N/A	N/A	N/A	N/A	55	71	55	71	55	71	55	71	55	71	55	71	55	71
#11 [36]	N/A	N/A	N/A	N/A	N/A	N/A	65	85	65	85	65	85	65	85	65	85	65	85	
2"	#3 [10]	12	15	12	15	12	15	12	15	12	15	12	15	12	15	12	15	12	15
	#4 [13]	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19
	#5 [16]	18	24	18	24	18	24	18	24	18	24	18	24	18	24	18	24	18	24
	#6 [19]	22	29	22	29	22	29	22	29	22	29	22	29	22	29	22	29	22	29
	#7 [22]	28	36	26	33	26	33	26	33	26	33	26	33	26	33	26	33	26	33
	#8 [25]	N/A	N/A	32	42	29	38	29	38	29	38	29	38	29	38	29	38	29	38
	#9 [29]	N/A	N/A	N/A	N/A	37	48	36	47	36	47	36	47	36	47	36	47	36	47
	#10 [32]	N/A	N/A	N/A	N/A	47	61	45	58	45	58	45	58	45	58	45	58	45	58
#11 [36]	N/A	N/A	N/A	N/A	N/A	N/A	53	69	53	69	53	69	53	69	53	69	53	69	
2 ½"	#3 [10]	12	15	12	15	12	15	12	15	12	15	12	15	12	15	12	15	12	15
	#4 [13]	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19
	#5 [16]	18	24	18	24	18	24	18	24	18	24	18	24	18	24	18	24	18	24
	#6 [19]	22	29	22	29	22	29	22	29	22	29	22	29	22	29	22	29	22	29
	#7 [22]	28	36	26	33	26	33	26	33	26	33	26	33	26	33	26	33	26	33
	#8 [25]	N/A	N/A	32	42	29	38	29	38	29	38	29	38	29	38	29	38	29	38
	#9 [29]	N/A	N/A	N/A	N/A	37	48	34	44	33	43	33	43	33	43	33	43	33	43
	#10 [32]	N/A	N/A	N/A	N/A	47	61	43	55	39	51	38	49	38	49	38	49	38	49
#11 [36]	N/A	N/A	N/A	N/A	N/A	N/A	53	68	48	63	45	59	45	59	45	59	45	59	
≥ 3"	#3 [10]	12	15	12	15	12	15	12	15	12	15	12	15	12	15	12	15	12	15
	#4 [13]	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19	15	19
	#5 [16]	18	24	18	24	18	24	18	24	18	24	18	24	18	24	18	24	18	24
	#6 [19]	22	29	22	29	22	29	22	29	22	29	22	29	22	29	22	29	22	29
	#7 [22]	28	36	26	33	26	33	26	33	26	33	26	33	26	33	26	33	26	33
	#8 [25]	N/A	N/A	32	42	29	38	29	38	29	38	29	38	29	38	29	38	29	38
	#9 [29]	N/A	N/A	N/A	N/A	37	48	34	44	33	43	33	43	33	43	33	43	33	43
	#10 [32]	N/A	N/A	N/A	N/A	47	61	43	55	39	51	37	48	37	48	37	48	37	48
#11 [36]	N/A	N/A	N/A	N/A	N/A	N/A	53	68	48	63	45	58	41	54	41	53	41	53	

Note: N/A refers to cases where the clear spacing between bars does not meet the minimum spacing requirements for cast-in-place concrete, LRFD 5.10.3.1, using a maximum aggregate size of 1.5".



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Please note these revisions in your copy of the *SCDOT Bridge Design Manual*.



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