Embedment & Laps

2107.2.1 Lap splices. The minimum length of lap splices for reinforcing bars in tension or compression, l_d, shall be

$l_d = 0.002 d_b f_s$ **(Equation 21-1)**

For SI: $l_d = 0.29 d_b f_s$

but not less than 12 inches (305 mm). In no case shall the length of the lapped splice be less than 40 bar diameters.

where:

d_b = Diameter of reinforcement, inches (mm).

f_s = Computed stress in reinforcement due to design loads, psi (MPa).

In regions of moment where the design tensile stresses in the reinforcement are greater than 80 percent of the allowable steel tension stress, F_s, the lap length of splices shall be increased not less than 50 percent of the minimum required length. Other equivalent means of stress transfer

Embedments & Laps

$$l_d = \frac{0.13 d_b^2 f_y \gamma}{K\sqrt{f'_m}}$$

Eq 8-12
MSJC 13
pp C-99

γ
=1.0 for #3 through #5 bar
=1.04 for #6 and #7 bars
=1.2 for #8 and #9 bars

Modified factors for Y (gamma)
approved in the 5th Edition Florida Building Code

Embedment & Laps

Bar Size Specified	Stress in Bar as %	Required Lap Length (72 Bar Diameters per IBC 12)	Bar Size Actually Used	Stress in Bar as %	Lap Length Calculated by .002 $d_b f_s$	Minimum Lap Length (40 db)	Minimum Lap Length in High Wind Zone (48 db)
3	100	27	4	55 < 80	13.2	20	24
4	100	36	5	65 < 80	19.3	25	30
5	100	45	6	70 < 80	25.4	30	36
6	100	54	7	73 < 80	30.8	35	42
7	100	63	7+#4	75 < 80	31.5	35	42
8	100	72	8+#4	79.8 < 80	38.3	40	48
9	100	81.2	9+#5	76<80	41.3	45.1	54.1

If your bar is stressed in excess of 80% increasing the bar by one size results in less lap

You can also bundle an additional bar to your specified bar to drop the stress below 80%

(Your lap will be 40 bar diameters of the larger bar or 48 bar dia if you are in a high wind zone)

Embedments & Laps

Assumptions
- f_y=60,000 psi
- f'm=1,500 psi
- Bar spacing > $5d_b$
- Bars centered in cell

Development Lengths (l_d)

	8" Masonry			12" Masonry		
Bar Size	Historic Lap Per MSJC 02 (48 db)	Lap Per MSJC 13	Lap Per MSJC 13 With 5th Edition Fla Code Mods	Historic Lap Per MSJC 02	Lap Per MSJC 13	Lap Per MSJC 13 With 5 Edition Fla Code Mods
3	18.0	15.1	15.1	18.0	15.1	15.1
4	24.0	20.1	20.1	24.0	20.1	20.1
5	30.0	25.1	25.1	30.0	25.1	25.1
6	36.0	42.8	34.2	36.0	39.3	31.4
7	42.0	59.3	47.4	42.0	45.8	36.6
8	48.0	91.3	73.0	48.0	60.4	48.3
9	54.1	118.3	94.6	54.1	73.2	58.6

K Chart					
Bar Size	5 x db	Cover for 8" Masonry	K for 8" Masonry	Cover for 12" Masonry	K for 12" Masonry
3	1.88	3.63	1.88	5.70	1.88
4	2.50	3.56	2.50	5.66	2.50
5	3.13	3.50	3.13	5.62	3.13
6	3.75	3.44	3.44	5.58	3.75
7	4.38	3.38	3.38	5.54	4.38
8	5.00	3.31	3.31	5.50	5.00
9	5.64	3.25	3.25	5.25	5.25

$$l_d = \frac{0.13 d_b^2 f_y \gamma}{K\sqrt{f'_m}}$$

Eq 8-12
MSJC 13
pp C-99

γ
=1.0 for #3 through #5 bar
=1.04 for #6 and #7 bars
=1.2 for #8 and #9 bars

Embedments & Laps

Assumptions
-f_y=60,000 psi
-f'm=1,500 psi
-Bar spacing > $5d_b$
-Bars centered in cell

Development Lengths (l_d)

	40 Bar Dia (Min allow by Fla. Code)	48 Bar Dia (Historic and Min for High Wind Zones)	72 Bar Dia (Max Required under Fla. Code)	40 Bar Dia for One Size Increase of Bar (12 IBC)	48 Bar Dia for One Size Increase of Bar in High Wind Zone (12 IBC)	MSJC 13 with 5th Edition Fla Code Mods
3	**15**	**18.0**	**27.0**	**(#4 Bar) 20**	**(#4 Bar) 24**	**15.1**
4	**20**	**24.0**	**36.0**	**(#5 Bar) 25**	**(#5 Bar) 30**	**20.1**
5	**25**	**30.0**	**45.0**	**(#6 Bar) 30**	**(#6 Bar) 36**	**25.1**
6	**30**	**36.0**	**54.0**	**(#7 Bar) 35**	**(#7 Bar) 42**	**34.2**
7	**35**	**42.0**	**63.0**	**(+#4 bar) 35**	**(+#4 bar) 42**	**47.4**
8	**40**	**48.0**	**72.0**	**(+#4 bar) 40**	**(+#4 bar) 48**	**73.0**
9	**45.1**	**54.1**	**81.2**	**(+#5 bar) 45**	**(+#5 bar) 54**	**94.6**