

TENSION DEVELOPMENT LENGTH

Grade 60 reinforcement; 4000 psi concrete

5.11.2.1.1 TENSION DEVELOPMENT LENGTH

MODIFICATION FACTORS FOR OTHER PLAIN BARS

(1)	Lateral c-c spacing $\geq 6"$ & cover along spacing $\geq 3"$	0.80
(2)	Enclosed by spiral with diam $> 0.25"$ & pitch $\leq 4"$	0.75

PLAIN BARS - OTHER

	3	4	5	6	7	8	9	10	11	14	18
	Development Length - inches										
Basic Ldb	12	12	15	18	23	30	38	48	59	81	105
(1)	12	12	12	15	18	24	30	39	47	65	84
(2)	12	12	12	14	17	23	29	36	44	61	79
(1) & (2)	12	12	12	12	14	18	23	29	36	49	63

MODIFICATION FACTORS FOR TOP PLAIN BARS

(1)	Lateral c-c spacing $\geq 6"$ & cover along spacing $\geq 3"$	0.80
(2)	Enclosed by spiral with diam $> 0.25"$ & pitch $\leq 4"$	0.75
	Top Bar	1.40

PLAIN BARS - TOP

	3	4	5	6	7	8	9	10	11	14	18
	Development Length - inches										
Basic Ldb	13	17	21	26	32	42	53	67	82	114	147
(1)	12	14	17	21	26	34	42	54	66	91	118
(2)	12	13	16	19	24	32	40	51	62	86	111
(1) & (2)	12	12	13	16	19	25	32	41	50	69	89

TENSION DEVELOPMENT LENGTH

Grade 60 reinforcement; 4000 psi concrete

MODIFICATION FACTORS - OTHER EPOXY BARS

(1)	Cover $\leq 3 \cdot D_b$	1.50
(2)	Cover $> 3 \cdot D_b$	1.20
(3)	Clear spacing $\leq 6 \cdot D_b$	1.50
(4)	Clear spacing $> 6 \cdot D_b$	1.20
(5)	Lateral c-c spacing $\geq 6"$ & cover along spacing $\geq 3"$	0.80
(6)	Enclosed by spiral with diam $> 0.25"$ & pitch $\leq 4"$	0.75

EPOXY BARS - OTHER

	3	4	5	6	7	8	9	10	11	14	18
3*Db	1.125	1.500	1.875	2.250	2.625	3.000	3.384	3.810	4.230	5.079	6.771
6*Db	2.250	3.000	3.750	4.500	5.250	6.000	6.768	7.620	8.460	10.158	13.542
	Development Length - inches										
(1)	14	18	23	27	34	45	57	72	88	122	158
(2)	12	15	18	22	27	36	45	58	71	98	126
(3)	14	18	23	27	34	45	57	72	88	122	158
(4)	12	15	18	22	27	36	45	58	71	98	126
(1) & (5)	12	15	18	22	27	36	45	58	71	98	126
(2) & (5)	12	12	15	18	22	29	36	46	57	78	101
(1) & (6)	12	14	17	21	26	34	43	54	66	92	119
(2) & (6)	12	12	14	17	21	27	34	43	53	73	95
(3) & (6)	12	14	17	21	26	34	43	54	66	92	119
(4) & (6)	12	12	14	17	21	27	34	43	53	73	95
(1) & (5) & (6)	12	12	14	17	21	27	34	43	53	73	95
(2) & (5) & (6)	12	12	12	13	17	22	27	35	43	59	76

MODIFICATION FACTORS - TOP EPOXY BARS

(1)	Cover $\leq 3 \cdot D_b$	1.50
(2)	Cover $> 3 \cdot D_b$	1.20
(3)	Clear spacing $\leq 6 \cdot D_b$	1.50
(4)	Clear spacing $> 6 \cdot D_b$	1.20
(5)	Lateral c-c spacing $\geq 6"$ & cover along spacing $\geq 3"$	0.80
(6)	Enclosed by spiral with diam $> 0.25"$ & pitch $\leq 4"$	0.75
	Top Bars	1.40

EPOXY BARS - TOP

	3	4	5	6	7	8	9	10	11	14	18
3*Db	1.125	1.500	1.875	2.250	2.625	3.000	3.384	3.810	4.230	5.079	6.771
6*Db	2.250	3.000	3.750	4.500	5.250	6.000	6.768	7.620	8.460	10.158	13.542
	Development Length - inches										
(1)	16	21	26	31	39	51	64	81	100	138	179
(2)	16	21	26	31	38	50	63	81	99	137	177
(3)	16	21	26	31	39	51	64	81	100	138	179
(4)	16	21	26	31	38	50	63	81	99	137	177
(1) & (5)	16	21	26	31	38	50	63	81	99	137	177
(2) & (5)	13	17	21	25	31	40	51	65	79	109	142
(1) & (6)	15	19	24	29	36	47	60	76	93	128	166
(2) & (6)	12	16	19	23	29	38	48	61	74	103	133
(3) & (6)	15	19	24	29	36	47	60	76	93	128	166
(4) & (6)	12	16	19	23	29	38	48	61	74	103	133
(1) & (5) & (6)	12	16	19	23	29	38	48	61	74	103	133
(2) & (5) & (6)	12	13	16	19	23	30	38	49	59	82	106

COMPRESSION DEVELOPMENT LENGTH

Grade 60 reinforcement; 4000 psi concrete

MODIFICATION FACTORS

(1)	Basic development length	1.00
(2)	Enclosed by spiral with diam > 0.25" & pitch <= 4"	0.75

	3	4	5	6	7	8	9	10	11	14	18
	Development Length - inches										
(1)	8	10	12	15	17	19	22	25	27	32	43
(2)	8	8	9	11	13	15	16	19	20	24	32

HOOKED TENSION DEVELOPMENT LENGTH

Grade 60 reinforcement; 4000 psi concrete

MODIFICATION FACTORS FOR PLAIN BARS

(1)	Basic hooked development length	1.00
(2)	Side cover for <#14 bar normal to plane of hook $\geq 2.5"$	0.70
(3)	90° hook: Side cover for <#14 bar normal to plane of hook $\geq 2.5"$ & cover on extension beyond hook $\geq 2"$	0.70
(4)	Hooks for <#14 enclosed in stirrups/ties along full development length at a spacing $\leq 3 \cdot D_b$	0.80

PLAIN BARS

	3	4	5	6	7	8	9	10	11	14	18
3*Db	1.125	1.5	1.875	2.25	2.625	3	3.384	3.81	4.23	5.079	6.771
	Development Length - inches										
(1)	8	10	12	15	17	19	22	25	27	33	43
(2)	6	7	9	10	12	14	16	17	19		
(3)	6	7	9	10	12	14	16	17	19		
(4)	6	8	10	12	14	16	18	20	22		
(2) & (4)	6	6	7	8	10	11	13	14	16		
(3) & (4)	6	6	7	8	10	11	13	14	16		

MODIFICATION FACTORS FOR EPOXY BARS

(1)	Basic hooked development length	1.00
(2)	Side cover for <#14 bar normal to plane of hook $\geq 2.5"$	0.70
(3)	90° hook: Side cover for <#14 bar normal to plane of hook $\geq 2.5"$ & cover on extension beyond hook $\geq 2"$	0.70
(4)	Hooks for <#14 enclosed in stirrups/ties along full development length at a spacing $\leq 3 \cdot D_b$	0.80
	Epoxy Bar	1.20

EPOXY BARS

	3	4	5	6	7	8	9	10	11	14	18
3*Db	1.125	1.500	1.875	2.250	2.625	3.000	3.384	3.810	4.230	5.079	6.771
	Development Length - inches										
(1)	9	12	15	18	20	23	26	29	33	39	52
(2)	6	8	10	12	14	16	19	21	23		
(3)	6	8	10	12	14	16	19	21	23		
(4)	7	10	12	14	16	19	21	24	26		
(2) & (4)	6	7	8	10	12	13	15	17	19		
(3) & (4)	6	7	8	10	12	13	15	17	19		