

BAR BENDING DETAILS

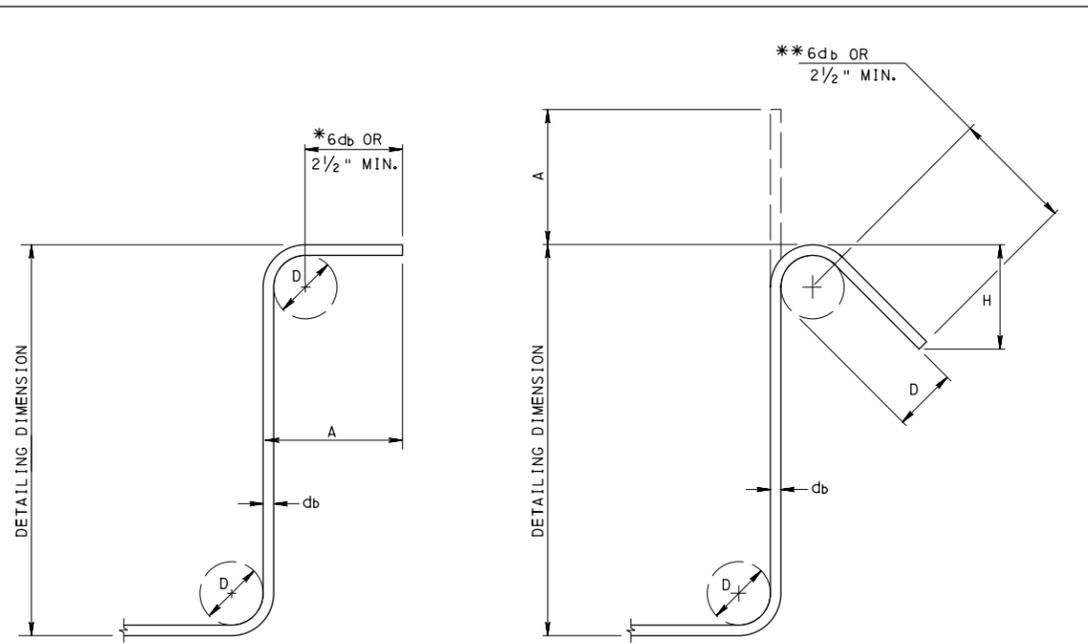
UNLESS OTHERWISE NOTED, DIAMETER D IS THE SAME FOR ALL BENDS AND HOOKS ON A BAR.

STANDARD REINFORCEMENT BARS

BAR SIZE	WEIGHT (LBS./FT.)	NOMINAL DIAMETER (INCHES)	NOMINAL CROSS SECTION AREA (SQ. IN.)	NOMINAL PERIMETER (INCHES)
#3	.376	.375	.11	1.178
#4	.668	.500	.20	1.571
#5	1.043	.625	.31	1.963
#6	1.502	.750	.44	2.356
#7	2.044	.875	.60	2.749
#8	2.670	1.000	.79	3.142
#9	3.400	1.128	1.00	3.544
#10	4.303	1.270	1.27	3.990
#11	5.313	1.410	1.56	4.430
#14	7.650	1.693	2.25	5.320
#18	13.600	2.257	4.00	7.090

GENERAL NOTES:

- ALL REINFORCEMENT STEEL BARS SHOWN MEET THE REQUIREMENTS OF ASTM A 615M, A 996M OR A 706M.
- DESIGNATE REINFORCEMENT BARS AS FOLLOWS TO AVOID ANY MISINTERPRETATION.
 - REFER DEFORMED REINFORCEMENT BAR SIZES BY NUMBER, FOR EXAMPLE, #3, #4, #5, ETC.
 - INDICATE PLAIN REINFORCEMENT BAR SIZES BY DIAMETER IN FRACTIONS OF AN INCH, FOR EXAMPLE, 3/8"Ø, 1/2"Ø, 5/8"Ø, ETC.
 - INDICATE STEEL WIRE FABRIC BY A LETTER (W FOR SMOOTH WIRE, D FOR DEFORMED WIRE) FOLLOWED BY A NUMBER WHICH INDICATES THE AREA OF THE WIRE IN HUNDREDTHS OF A SQUARE INCH, FOR EXAMPLE, W16 OR D16.
 - INDICATE SMOOTH STEEL WIRE FABRIC THUS: WWF6x9-W10xW12 (DENOTES LONGITUDINAL WIRES ARE 6 INCHES ON CENTERS, TRANSVERSE WIRES ARE 9 INCHES ON CENTERS). THE AREA OF THE LONGITUDINAL WIRE IS 0.10 SQUARE INCHES AND THE AREA OF THE TRANSVERSE WIRE IS 0.12 SQUARE INCHES.) FOR DEFORMED WELDED WIRE FABRIC, DESIGNATE WWF6x9-D10xD12.
 - ALL REINFORCEMENT DIMENSIONS ARE MEASURED OUT-TO-OUT OF THE BAR EXCEPT THE "A" DIMENSION ON STANDARD 180° AND 135° HOOKS.
- SPLICING & LAPPING:
 - SPLICE BARS ONLY AS SHOWN ON THE DESIGN DRAWINGS OR AS AUTHORIZED BY THE ENGINEER. WHEN LAP SPLICING IS SHOWN ON THE DESIGN DRAWINGS, LAP THE REINFORCEMENT BARS FOR A LENGTH ACCORDING TO AASHTO LRFD ARTICLE 5.11.5 AND SECURELY WIRE TOGETHER.
 - SPLICE WELDED WIRE FABRIC IN ACCORDANCE WITH AASHTO LRFD ARTICLE 5.11.6.
 - INCREASE THE BAR LAPS BY 20% FOR A THREE BAR BUNDLE. ADD 33% FOR A FOUR BAR BUNDLE. DO NOT OVERLAP INDIVIDUAL BAR SPLICES WITHIN THE BUNDLE.
- CONFORM REINFORCEMENT BARS TO THE DIMENSIONS SHOWN ON THE DRAWINGS AND WITHIN THE FABRICATION TOLERANCES AS SHOWN IN THE CURRENT "MANUAL OF STANDARD PRACTICE FOR REINFORCED CONCRETE CONSTRUCTION" AS PUBLISHED BY THE CONCRETE REINFORCING STEEL



90° HOOKS

135° HOOKS

STIRRUPS (TIES SIMILAR)

D = 4db FOR #3 THROUGH #5 BARS
D = 6db FOR #6 BARS

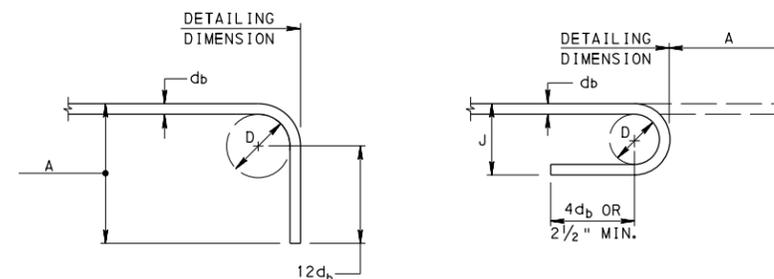
RECOMMENDED STIRRUP AND TIE HOOK DIMENSIONS

- * 6db FOR #3, #4, AND #5
- 12db FOR #6.
- ** FOR SEISMIC HOOKS USE 6db OR 3" MIN.

RECOMMENDED END HOOK DIMENSIONS

ALL GRADES

BAR SIZE	90° HOOKS		180° HOOKS		
	D	A	D	A	J
#3	2 1/4"	6"	2 1/4"	5"	3"
#4	3"	8"	3"	6"	4"
#5	3 3/4"	10"	3 3/4"	7"	5"
#6	4 1/2"	1'-0"	4 1/2"	8"	6"
#7	5 1/4"	1'-2"	5 1/4"	10"	7"
#8	6"	1'-4"	6"	11"	8"
#9	9 1/2"	1'-7"	9 1/2"	1'-3"	11 3/4"
#10	10 3/4"	1'-10"	10 3/4"	1'-5"	1'-1 1/4"
#11	12"	2'-0"	12"	1'-7"	1'-2 3/4"
#14	18 1/4"	2'-7"	18 1/4"	2'-3"	1'-9 3/4"
#18	24"	3'-5"	24"	3'-0"	2'-4 1/2"



90° HOOKS

180° HOOKS

D = 6db FOR #3 THROUGH #8
D = 8db FOR #9, #10, AND #11
D = 10db FOR #14 AND #18

BARS THAT ARE REQUIRED TO BE BENT TO A LARGER RADIUS THAN SHOWN IN THE FOLLOWING TABLE MAY BE BENT IN THE FIELD.

#4	15 FT.	#8	80 FT.
#5	25 FT.	#9	110 FT.
#6	40 FT.	#10	130 FT.
#7	60 FT.	#11	150 FT.

#14 & #18 - ALL BENDING PREFABRICATED.

COMMON STOCK STYLES OF WELDED WIRE FABRIC

STYLE DESIGNATION	STEEL AREA SQ. IN. PER FT.		WEIGHT APPROX. LBS. PER 100 S.F.
	LONGIT.	TRANS.	
ROLLS			
6x6-W1.4xW1.4	.028	.028	21
6x6-W2.0xW2.0	.040	.040	29
6x6-W2.9xW2.9	.058	.058	42
6x6-W4.0xW4.0	.080	.080	58
4x4-W1.4xW1.4	.042	.042	31
4x4-W2.0xW2.0	.060	.060	43
4x4-W2.9xW2.9	.087	.087	62
4x4-W4.0xW4.0	.120	.120	85
SHEETS			
6x6-W2.9xW2.9	.058	.058	42
6x6-W4.0xW4.0	.080	.080	58
6x6-W5.5xW5.5	.110	.110	80
4x4-W4.0xW4.0	.120	.120	85

COMMONWEALTH OF PENNSYLVANIA DEPARTMENT OF TRANSPORTATION BUREAU OF DESIGN

STANDARD REINFORCEMENT BAR FABRICATION DETAILS

RECOMMENDED OCT.26, 2010
Thomas P. Macione
CHIEF BRIDGE ENGINEER

RECOMMENDED OCT.26, 2010
Bruce S. Thompson
DIRECTOR, BUREAU OF DESIGN

SHEET 1 OF 3
BC-736M

GRADES 40 AND 60 KSI

BAR SIZE	D	90° HOOK		135° HOOK
		A	A	APPROXIMATE H
#3	1 1/2"	4"	4"	2 1/2"
#4	2"	4 1/2"	4 1/2"	3"
#5	2 1/2"	6"	5 1/2"	3 3/4"
#6	4 1/2"	1'-0"	8"	4 1/2"

GRADES 40 AND 60 KSI

BAR SIZE	D	SEISMIC STIRRUP AND TIE 135° HOOK	
		A	APPROXIMATE H
#3	1 1/2"	4 1/4"	3"
#4	2"	4 1/2"	3"
#5	2 1/2"	5 1/2"	3 3/4"
#6	4 1/2"	8"	4 1/2"

DEVELOPMENT LENGTH AND LAP SPLICE LENGTH OF DEFORMED BARS IN COMPRESSION

DEVELOPMENT LENGTH AND LAP SPLICE LENGTH OF DEFORMED BARS IN TENSION

AASHTO LRFD SPECIFICATIONS, ARTICLES 5.11.2.1.1, 5.11.2.1.2 AND 5.11.5.3.1

TABLE A
f'c = 3000 PSI (CLASS A)

BAR SIZE	BAR CROSS SECTION AREA (SQ. IN.)	fy = 40 KSI (GRADE 40)						fy = 60 KSI (GRADE 60)										
		ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS							
		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)						
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C				
#3	0.11	12	12	12	12	12	12	12	12	15	12	12	12	16	13	13	17	22
#4	0.20	12	12	12	14	12	12	15	20	12	12	16	21	17	17	22	29	
#5	0.31	12	12	13	17	14	14	19	24	15	15	20	26	21	21	28	36	
#6	0.44	13	13	17	22	18	18	24	31	20	20	25	33	27	27	35	46	
#7	0.60	18	18	23	30	25	25	32	42	26	26	34	45	37	37	48	62	
#8	0.79	23	23	30	39	32	32	42	55	35	35	45	59	48	48	63	82	
#9	1.00	29	29	38	50	41	41	53	69	44	44	57	74	61	61	79	104	
#10	1.27	37	37	48	63	52	52	67	88	55	55	72	94	77	77	101	131	
#11	1.56	46	46	59	77	64	64	82	108	68	68	88	115	95	95	123	161	
#14	2.25	63	63	81	108	88	88	111	144	94	94	121	158	131	131	170	222	
#18	4.00	81	81	104	138	114	114	144	192	122	122	158	204	170	170	222	288	

f'c = 3500 PSI (CLASS AA)

BAR SIZE	BAR CROSS SECTION AREA (SQ. IN.)	fy = 40 KSI (GRADE 40)						fy = 60 KSI (GRADE 60)										
		ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS							
		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)						
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C				
#3	0.11	12	12	12	12	12	12	12	15	12	12	12	16	13	13	17	22	
#4	0.20	12	12	12	14	12	12	15	20	12	12	16	21	17	17	22	29	
#5	0.31	12	12	13	17	14	14	19	24	15	15	20	26	21	21	28	36	
#6	0.44	12	12	16	21	17	17	22	29	18	18	24	31	26	26	33	43	
#7	0.60	17	17	21	28	23	23	30	39	25	25	32	41	34	34	44	58	
#8	0.79	22	22	28	36	30	30	39	51	32	32	42	54	45	45	58	76	
#9	1.00	27	27	35	46	38	38	49	64	41	41	53	69	57	57	73	96	
#10	1.27	34	34	45	58	48	48	62	81	51	51	67	87	72	72	93	122	
#11	1.56	42	42	55	71	59	59	76	100	63	63	82	107	88	88	114	149	
#14	2.25	58	58	74	98	81	81	101	134	87	87	111	144	122	122	158	204	
#18	4.00	75	75	96	128	105	105	131	174	113	113	144	186	158	158	204	264	

f'c = 4000 PSI (CLASS AAA)

BAR SIZE	BAR CROSS SECTION AREA (SQ. IN.)	fy = 40 KSI (GRADE 40)						fy = 60 KSI (GRADE 60)										
		ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS							
		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)						
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C				
#3	0.11	12	12	12	12	12	12	12	15	12	12	12	16	13	13	17	22	
#4	0.20	12	12	12	14	12	12	15	20	12	12	16	21	17	17	22	29	
#5	0.31	12	12	13	17	14	14	19	24	15	15	20	26	21	21	28	36	
#6	0.44	12	12	16	21	17	17	22	29	18	18	24	31	26	26	33	43	
#7	0.60	15	15	20	26	21	21	28	36	23	23	30	39	32	32	41	54	
#8	0.79	20	20	26	34	28	28	36	47	30	30	39	51	42	42	54	71	
#9	1.00	25	25	33	43	35	35	46	60	38	38	49	64	53	53	69	90	
#10	1.27	32	32	42	54	45	45	58	76	48	48	62	81	67	67	87	114	
#11	1.56	39	39	51	67	55	55	71	93	59	59	77	100	82	82	107	140	
#14	2.25	54	54	70	92	76	76	95	124	81	81	103	134	114	114	149	192	
#18	4.00	70	70	89	116	98	98	124	161	105	105	131	170	147	147	192	248	

f'c = 4500 PSI

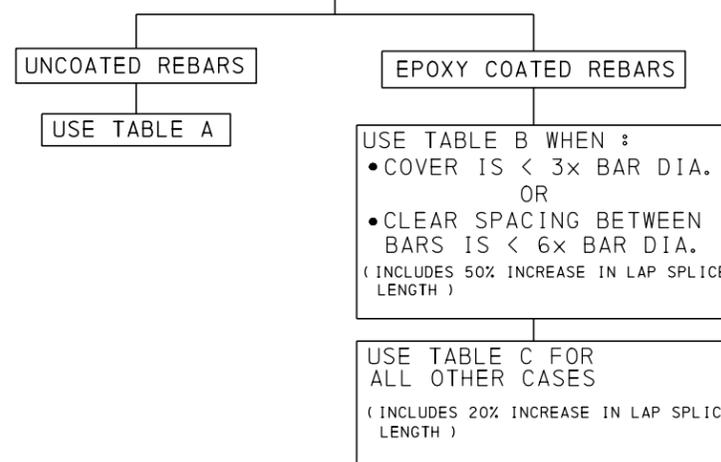
BAR SIZE	BAR CROSS SECTION AREA (SQ. IN.)	fy = 40 KSI (GRADE 40)						fy = 60 KSI (GRADE 60)										
		ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS							
		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)		DEVELOP. LENGTH (IN.)	LENGTH OF LAP SPLICE (IN.)						
A	B	C	A	B	C	A	B	C	A	B	C	A	B	C				
#3	0.11	12	12	12	12	12	12	12	15	12	12	12	16	13	13	17	22	
#4	0.20	12	12	12	14	12	12	15	20	12	12	16	21	17	17	22	29	
#5	0.31	12	12	13	17	14	14	19	24	15	15	20	26	21	21	28	36	
#6	0.44	12	12	16	21	17	17	22	29	18	18	24	31	26	26	33	43	
#7	0.60	15	15	19	25	20	20	26	34	22	22	28	37	30	30	39	51	
#8	0.79	19	19	25	32	27	27	34	45	28	28	37	48	40	40	51	67	
#9	1.00	24	24	31	41	33	33	43	57	36	36	46	61	50	50	65	85	
#10	1.27	30	30	39	51	42	42	55	72	45	45	59	77	63	63	82	107	
#11	1.56	37	37	48	63	52	52	67	88	56	56	72	94	78	78	101	132	
#14	2.25	51	51	66	87	72	72	90	118	77	77	98	128	107	107	139	181	
#18	4.00	66	66	84	110	93	93	115	150	99	99	125	164	139	139	181	232	

AASHTO LRFD SPECIFICATIONS, ARTICLES 5.11.2.2.1 AND 5.11.5.5.1

BAR SIZE	DIA. OF BAR db (IN.)	f'c = 3,000 PSI (CLASS A)				f'c = 3,500 PSI (CLASS AA)				f'c = 4,000 PSI (CLASS AAA)				f'c = 4,500 PSI			
		fy = 40 KSI (GRADE 40)		fy = 60 KSI (GRADE 60)		fy = 40 KSI (GRADE 40)		fy = 60 KSI (GRADE 60)		fy = 40 KSI (GRADE 40)		fy = 60 KSI (GRADE 60)		fy = 40 KSI (GRADE 40)		fy = 60 KSI (GRADE 60)	
		DEVELOP. LENGTH (IN.)	SPLICE LENGTH (IN.)	DEVELOP. LENGTH (IN.)	SPLICE LENGTH (IN.)	DEVELOP. LENGTH (IN.)	SPLICE LENGTH (IN.)	DEVELOP. LENGTH (IN.)	SPLICE LENGTH (IN.)	DEVELOP. LENGTH (IN.)	SPLICE LENGTH (IN.)	DEVELOP. LENGTH (IN.)	SPLICE LENGTH (IN.)	DEVELOP. LENGTH (IN.)	SPLICE LENGTH (IN.)	DEVELOP. LENGTH (IN.)	SPLICE LENGTH (IN.)
#3	0.375	8	12	9	12	8	12	8	12	8	12	8	12	8	12	8	12
#4	0.500	8	12	11	15	8	12	11	15	8	12	10	15	8	12	9	15
#5	0.625	10	13	14	19	9	13	13	19	8	13	12	19	8	13	12	19
#6	0.750	11	15	17	23	11	15	16	23	10	15	15	23	9	15	14	23
#7	0.875	13	18	20	27	12	18	18	27	12	18	17	27	11	18	16	27
#8	1.000	15	20	22	30	14	20	21	30	13	20	19	30	12	20	18	30
#9	1.128	17	23	25	34	16	23	23	34	15	23	22	34	14	23	21	34
#10	1.270	19	26	28	39	18	26	26	39	16	26	24	39	16	26	23	39
#11	1.410	21	29	31	43	19	29	29	43	18	29	27	43	17	29	26	43
#14	1.693	25	34	37	51	23	34	35	51	22	34	32	51	21	34	31	51
#18	2.257	33	46	50	68	31	46	46	68	29	46	43	68	28	46	41	68

NOTE: A FACTOR OF 0.75 CAN BE APPLIED IF THE REINFORCEMENT IS ENCLOSED WITHIN A SPIRAL COMPOSED OF BARS NOT LESS THAN 1/4" IN DIAMETER AND SPACED AT NOT MORE THAN 4" PITCH. BUT THE DEVELOPMENT LENGTH CANNOT BE LESS THAN 8" AND SPLICE LENGTH CANNOT BE LESS THAN 12".

GUIDELINES FOR USE OF DEVELOPMENT LENGTH AND SPLICE LENGTH OF DEFORMED BARS IN TENSION



NOTES FOR DEFORMED BARS IN TENSION (TABLES A, B AND C):

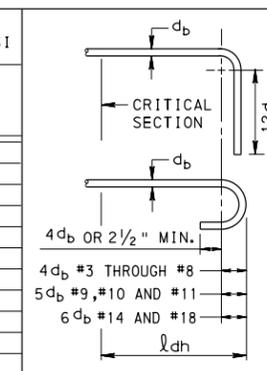
- DEVELOPMENT LENGTH:
 - REFER TO AASHTO/LRFD FOR APPLICABLE MODIFICATION FACTORS.
 - TABLES ARE BASED ON NORMAL-WEIGHT CONCRETE.
 - TOP HORIZONTAL OR NEARLY HORIZONTAL REINFORCEMENT HAVE MORE THAN 12 INCHES OF FRESH CONCRETE CAST BELOW THE REINFORCEMENT.
 - INCREASE THE DEVELOPMENT LENGTH, l_d , BY 2.0 FOR BARS WITH A COVER OF BAR DIAMETER OR LESS, OR WITH A CLEAR SPACING OF 2x BAR DIAMETER OR LESS.
 - DECREASE THE DEVELOPMENT LENGTH, l_d , BY 0.8 FOR BARS SPACED LATERALLY AT LEAST 6 IN. ON CENTER WITH AT LEAST 3 IN. CLEAR COVER FROM FACE OF MEMBER TO EDGE OF BAR MEASURED IN THE DIRECTION OF THE SPACING, BUT THE SPLICE CANNOT BE LESS THAN 12 IN.
- LAP SPLICE LENGTH:
 - CLASSES OF TENSION LAP SPLICES:

RATIO OF (AS AS PROVIDED) / (AS AS REQUIRED)	PERCENT OF AS SPLICED WITH REQUIRED LAP LENGTH		
	50%	75%	100%
≥ 2	A	A	B
< 2	B	C	C
 - ASSUME CLASS C SPLICES IN THE ABSENCE OF DESIGN ANALYSIS.
 - AS IS THE AREA OF REINFORCEMENT REQUIRED BY ANALYSIS AT THE SPLICE LOCATION
- FOR TABLES B AND C, SEE SHEET 3.

DEVELOPMENT LENGTH OF STANDARD HOOKS IN TENSION

FOR REINFORCING STEEL GRADES 40 AND 60 AASHTO LRFD SPECIFICATION, ARTICLE 5.11.2.4.1

BAR SIZE	DIA. OF BAR db (IN.)	f'c = 3,000 PSI	f'c = 3,500 PSI	f'c = 4,000 PSI	f'c = 4,500 PSI
		ALL BARS l_{dh} (IN.)			
#3	0.375	9	8	8	7
#4	0.500	11	11	10	9
#5	0.625	14	13	12	12
#6	0.750	17	16	15	14
#7	0.875	20	18	17	16
#8	1.000	22	21	19	18
#9	1.128	25	23	22	21
#10	1.270	28	26	25	23
#11	1.410	31	29	27	26
#14	1.693	38	35	33	31
#18	2.257	50	46	43	41



- NOTE:
- A FACTOR OF 0.7 CAN BE APPLIED FOR #11 BAR AND SMALLER,

DEVELOPMENT LENGTH AND LAP SPLICE LENGTH OF DEFORMED BARS IN TENSION

AASHTO LRFD SPECIFICATIONS, ARTICLES 5.11.2.1.1, 5.11.2.1.2 AND 5.11.5.3.1

TABLE B

$f'c = 3000$ PSI (CLASS A)

BAR SIZE	BAR CROSS SECTION AREA (SQ. IN.)	$f_y = 40$ KSI (GRADE 40)									$f_y = 60$ KSI (GRADE 60)								
		ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS		
		LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
#3	0.11	12	12	12	16	12	12	14	18	14	14	18	23	16	16	20	27		
#4	0.20	12	12	16	21	14	14	18	24	18	18	24	31	21	21	27	35		
#5	0.31	15	15	20	26	17	17	23	29	23	23	30	39	26	26	34	44		
#6	0.44	20	20	25	33	22	22	29	37	29	29	38	49	33	33	43	56		
#7	0.60	26	26	34	45	30	30	39	51	39	39	51	67	45	45	58	76		
#8	0.79	35	35	45	59	39	39	51	66	52	52	67	88	59	59	76	99		
#9	1.00	44	44	57	74	50	50	64	84	65	65	85	111	74	74	96	126		
#10	1.27	55	55	72	94	63	63	82	106	83	83	108	141	94	94	122	159		
#11	1.56	68	68	88	115	77	77	100	131	102	102	132	173	115	115	150	196		
#14	2.25	94				106				141				159					
#18	4.00	122				138				182				207					

$f'c = 3500$ PSI (CLASS AA)

BAR SIZE	BAR CROSS SECTION AREA (SQ. IN.)	$f_y = 40$ KSI (GRADE 40)									$f_y = 60$ KSI (GRADE 60)								
		ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS		
		LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
#3	0.11	12	12	12	16	12	12	14	18	14	14	18	23	16	16	20	27		
#4	0.20	12	12	16	21	14	14	18	24	18	18	24	31	21	21	27	35		
#5	0.31	15	15	20	26	17	17	23	29	23	23	30	39	26	26	34	44		
#6	0.44	18	18	24	31	21	21	27	35	27	27	36	46	31	31	40	53		
#7	0.60	25	25	32	41	28	28	36	47	37	37	47	62	41	41	54	70		
#8	0.79	32	32	42	54	36	36	47	62	48	48	62	81	54	54	70	92		
#9	1.00	41	41	53	69	46	46	60	78	61	61	79	103	69	69	89	116		
#10	1.27	51	51	67	87	58	58	76	99	77	77	100	130	87	87	113	148		
#11	1.56	63	63	82	107	71	71	93	121	94	94	122	160	107	107	139	181		
#14	2.25	87				99				130				148					
#18	4.00	113				128				169				191					

$f'c = 4000$ PSI (CLASS AAA)

BAR SIZE	BAR CROSS SECTION AREA (SQ. IN.)	$f_y = 40$ KSI (GRADE 40)									$f_y = 60$ KSI (GRADE 60)								
		ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS		
		LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
#3	0.11	12	12	12	16	12	12	14	18	14	14	18	23	16	16	20	27		
#4	0.20	12	12	16	21	14	14	18	24	18	18	24	31	21	21	27	35		
#5	0.31	15	15	20	26	17	17	23	29	23	23	30	39	26	26	34	44		
#6	0.44	18	18	24	31	21	21	27	35	27	27	36	46	31	31	40	53		
#7	0.60	23	23	30	39	26	26	34	44	34	34	44	58	39	39	50	66		
#8	0.79	30	30	39	51	34	34	44	58	45	45	58	76	51	51	66	86		
#9	1.00	38	38	49	64	43	43	56	73	57	57	74	96	64	64	83	109		
#10	1.27	48	48	62	81	54	54	71	92	72	72	93	122	81	81	106	138		
#11	1.56	59	59	77	100	67	67	87	113	88	88	115	150	100	100	130	170		
#14	2.25	81				92				122				138					
#18	4.00	105				119				158				179					

$f'c = 4500$ PSI

BAR SIZE	BAR CROSS SECTION AREA (SQ. IN.)	$f_y = 40$ KSI (GRADE 40)									$f_y = 60$ KSI (GRADE 60)								
		ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS		
		LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
#3	0.11	12	12	12	16	12	12	14	18	14	14	18	23	16	16	20	27		
#4	0.20	12	12	16	21	14	14	18	24	18	18	24	31	21	21	27	35		
#5	0.31	15	15	20	26	17	17	23	29	23	23	30	39	26	26	34	44		
#6	0.44	18	18	24	31	21	21	27	35	27	27	36	46	31	31	40	53		
#7	0.60	22	22	28	37	25	25	32	41	32	32	42	55	37	37	47	62		
#8	0.79	28	28	37	48	32	32	42	54	42	42	55	72	48	48	62	81		
#9	1.00	36	36	46	61	41	41	53	69	54	54	69	91	61	61	79	103		
#10	1.27	45	45	59	77	51	51	67	87	68	68	88	115	77	77	100	130		
#11	1.56	56	56	72	94	63	63	82	107	83	83	108	141	94	94	122	160		
#14	2.25	77				87				115				130					
#18	4.00	99				113				149				169					

TABLE C

$f'c = 3000$ PSI (CLASS A)

BAR SIZE	BAR CROSS SECTION AREA (SQ. IN.)	$f_y = 40$ KSI (GRADE 40)									$f_y = 60$ KSI (GRADE 60)								
		ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS		
		LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
#3	0.11	12	12	12	13	12	12	14	18	12	12	15	19	16	16	20	26		
#4	0.20	12	12	13	17	14	14	18	23	15	15	19	25	21	21	27	35		
#5	0.31	12	12	16	21	17	17	22	29	18	18	24	31	26	26	33	43		
#6	0.44	16	16	20	26	22	22	28	37	23	23	30	39	32	32	42	55		
#7	0.60	21	21	28	36	30	30	38	50	32	32	41	53	44	44	57	75		
#8	0.79	28	28	36	47	39	39	50	66	42	42	54	70	58	58	75	98		
#9	1.00	35	35	46	59	49	49	64	83	52	52	68	89	73	73	95	124		
#10	1.27	44	44	58	75	62	62	81	105	66	66	86	113	93	93	121	158		
#11	1.56	55	55	71	92	76	76	99	129	82	82	106	138	114	114	148	193		
#14	2.25	75				105				113				158					
#18	4.00	97				136				146				204					

$f'c = 3500$ PSI (CLASS AA)

BAR SIZE	BAR CROSS SECTION AREA (SQ. IN.)	$f_y = 40$ KSI (GRADE 40)									$f_y = 60$ KSI (GRADE 60)								
		ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS		
		LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
#3	0.11	12	12	12	13	12	12	14	18	12	12	15	19	16	16	20	26		
#4	0.20	12	12	13	17	14	14	18	23	15	15	19	25	21	21	27	35		
#5	0.31	12	12	16	21	17	17	22	29	18	18	24	31	26	26	33	43		
#6	0.44	15	15	19	25	21	21	27	35	22	22	29	37	31	31	40	52		
#7	0.60	20	20	26	33	27	27	36	46	29	29	38	50	41	41	53	69		
#8	0.79	26	26	33	44	36	36	47	61	38	38	50	65	54	54	70	91		
#9	1.00	33	33	42	55	45	45	59	77	49	49	63	82	68	68	88	115		
#10	1.27	41	41	53	70	58	58	75	97	62	62	80	104	86	86	112	146		
#11	1.56	51	51	66	86	71	71	92	120	76	76	98	128	106	106	137	179		
#14	2.25	70				97				104				146					
#18	4.00	90				126				135				189					

$f'c = 4000$ PSI (CLASS AAA)

BAR SIZE	BAR CROSS SECTION AREA (SQ. IN.)	$f_y = 40$ KSI (GRADE 40)									$f_y = 60$ KSI (GRADE 60)								
		ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS			ALL BARS EXCEPT TOP BARS			TOP BARS		
		LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)			LENGTH OF LAP SPLICE (IN.)		
		A	B	C	A	B	C	A	B	C	A	B	C	A	B	C	A	B	C
#3	0.11	12	12	12	1														