Chapter 07

REINFORCING STEEL (REBAR)

Chapter 07 – Reinforcing Details

SECTION 01

BAR LAPS (REBAR-BL)

LOCATION CATEGORY A								
BAR SIZE	CENTER TO CENTER SPACING							
	3''		4''		5''		≥ 6''	
#4	2'-5''	3'-1''	2'-5''	2'-10''	2'-5''	2'-10''	2'-5''	2'-10''
#5	3'-1''	4'-0''	3'-0''	3'-10''	3'-0''	3'-7''	3'-0''	3'-7''
#6	4'-5''	5'-9''	3'-7''	4'-8''	3'-7''	4'-8''	3'-7''	4'-8''
#7	6'-0''	7'-10''	4'-6''	5'-11''	4'-2''	5'-5''	4'-2''	5'-5''
#8	7'-10''	10'-3''	5'-11''	7'-8''	4'-9''	6'-2''	4'-9''	6'-2''
#9	10'-0''	13'-0''	7'-6''	9'-9''	6'-0''	7'-10''	5'-10''	7'-8''
#10	-	-	9'-6''	12'-5''	7'-7''	9'-11''	7'-2''	9'-5''
#11	-	-	11'-8''	15'-3''	9'-4''	12'-3''	8'-8''	11'-4''

Location Category A - Bars in horizontal layers in top of pour with 12'' or more of concrete below them such as in: footings, pier caps, etc.

LOCATION CATEGORY B								
BAR SIZE	CENTER TO CENTER SPACING							
	3''		4''		5''		≥ 6''	
#4	1'-10''	2'-9''	1'-10''	2'-2''	1'-10''	2'-2''	1'-10''	2'-2''
#5	2'-5''	3'-7''	2'-4''	3'-5''	2'-4''	2'-9''	2'-4''	2'-9''
#6	3'-5''	5'-1''	2'-9''	4'-1''	2'-9''	4'-1''	2'-9''	4'-1''
#7	4'-8''	6'-11''	3'-6''	5'-3''	3'-2''	4'-9''	3'-2''	4'-9''
#8	6'-1''	9'-1''	4'-7''	6'-10''	3'-8''	5'-5''	3'-8''	5'-5''
#9	7'-8''	11'-6''	5'-9''	8'-8''	4'-8''	6'-11''	4'-6''	6'-9''
#10	-	-	7'-4''	10'-11''	5'-10''	8'-9''	5'-7''	8'-4''
#11	-	-	9'-0''	13'-6''	7'-2''	10'-9''	6'-8''	10'-0''

Location Category B - All bars not in Location Category A.

= Non-epoxy coated = Epoxy coated

Note:

1. When bar lap is not specified on the Plans, the above dimensions shall be used.
2. These bar laps do not apply when bar is in lightweight concrete. Greater lengths are required for this material.
3. These bar laps only apply where the General Notes indicate Reinforcing Steel Design, fy = 60 ksi, and Concrete Design, f'c = 3000 psi.
4. These bar laps assume cover of 2''. Greater lap lengths will be required for cover less than 2''.
5. These bar laps are Class B splices based on the development lengths in Det. No. REBAR-DL-101. Class B splices are 1.3 times the development length.
6. Class A splices may be used when (a) the area of reinforcement provided is at least twice that required by analysis over the entire length of the lap splice and (b) one-half or less of the total reinforcement is spliced within the required lap splice length. Class A splices are 1.0 times the development length.

APPROVAL

Glenn C. Vaughan DIRECTOR OFFICE OF STRUCTURES

DATE: 03/21/2017

VERSION

1.0

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

BAR LAP DIMENSIONS FOR GRADE 60 REINFORCING STEEL IN MIX NO.3 (3500 P.S.I.) CONCRETE

DETAIL NO. REBAR-BL-101 SHEET 1 OF 1

REBAR - BAR LAP

LOCATION CATEGORY A								
BAR SIZE	CENTER TO CENTER SPACING							
	3''		4''		5''		≥ 6''	
#4	2'-4''	3'-0''	2'-4''	2'-9''	2'-4''	2'-9''	2'-4''	2'-9''
#5	3'-0''	3'-11''	2'-11''	3'-9''	2'-11''	3'-6''	2'-11''	3'-6''
#6	4'-4''	5'-8''	3'-6''	4'-6''	3'-6''	4'-6''	3'-6''	4'-6''
#7	5'-11''	7'-8''	4'-5''	5'-9''	4'-1''	5'-3''	4'-1''	5'-3''
#8	7'-8''	10'-0''	5'-9''	7'-6''	4'-7''	6'-0''	4'-7''	6'-0''
#9	9'-9''	12'-9''	7'-4''	9'-7''	5'-10''	7'-8''	5'-9''	7'-6''
#10	-	-	9'-3''	12'-1''	7'-5''	9'-8''	7'-1''	9'-3''
#11	-	-	11'-5''	14'-11''	9'-2''	11'-11''	8'-6''	11'-1''

Location Category A - Bars in horizontal layers in top of pour with 12'' or more of concrete below them such as in: footings, pier caps, etc.

LOCATION CATEGORY B								
BAR SIZE	CENTER TO CENTER SPACING							
	3''		4''		5''		≥ 6''	
#4	1'-10''	2'-8''	1'-10''	2'-2''	1'-10''	2'-2''	1'-10''	2'-2''
#5	2'-4''	3'-6''	2'-3''	3'-4''	2'-3''	2'-8''	2'-3''	2'-8''
#6	3'-4''	5'-0''	2'-8''	4'-0''	2'-8''	4'-0''	2'-8''	4'-0''
#7	4'-6''	6'-9''	3'-5''	5'-1''	3'-2''	4'-8''	3'-2''	4'-8''
#8	5'-11''	8'-10''	4'-5''	6'-8''	3'-7''	5'-4''	3'-7''	5'-4''
#9	7'-6''	11'-3''	5'-8''	8'-5''	4'-6''	6'-9''	4'-5''	6'-7''
#10	-	-	7'-2''	10'-8''	5'-9''	8'-7''	5'-5''	8'-2''
#11	-	-	8'-10''	13'-2''	7'-1''	10'-7''	6'-6''	9'-9''

Location Category B - All bars not in Location Category A.

= Non-epoxy coated = Epoxy coated

Note:

1. When bar lap is not specified on the Plans, the above dimensions shall be used.
2. These bar laps only apply to 4500 psi lightweight concrete.
3. These bar laps only apply where the General Notes indicate Reinforcing Steel Design, fy = 60 ksi, and Concrete Design, f'c = 4000 psi.
4. The unit weight of the lightweight concrete was assumed to be 118 pcf when calculating the Concrete Density Modification Factor.
5. These bar laps assume cover of 2''. Greater lap lengths will be required for cover less than 2''.
6. These bar laps are Class B splices based on the development lengths in Det. No. REBAR-DL-102. Class B splices are 1.3 times the development length.
7. Class A splices may be used when (a) the area of reinforcement provided is at least twice that required by analysis over the entire length of the lap splice and (b) one-half or less of the total reinforcement is spliced within the required lap splice length. Class A splices are 1.0 times the development length.

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STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

BAR LAP DIMENSIONS FOR GRADE 60 REINFORCING STEEL IN MIX NO.10 (4500 P.S.I.) LIGHTWEIGHT CONCRETE

DETAIL NO. REBAR-BL-102 SHEET 1 OF 1

REBAR - BAR LAP

LOCATION CATEGORY A								
BAR SIZE	CENTER TO CENTER SPACING							
	3''		4''		5''		≥ 6''	
#4	2'-1''	2'-8''	2'-1''	2'-6''	2'-1''	2'-6''	2'-1''	2'-6''
#5	2'-8''	3'-6''	2'-7''	3'-4''	2'-7''	3'-1''	2'-7''	3'-1''
#6	3'-10''	5'-0''	3'-1''	4'-0''	3'-1''	4'-0''	3'-1''	4'-0''
#7	5'-3''	6'-10''	3'-11''	5'-1''	3'-7''	4'-8''	3'-7''	4'-8''
#8	6'-10''	8'-11''	5'-1''	6'-8''	4'-1''	5'-4''	4'-1''	5'-4''
#9	8'-8''	11'-3''	6'-6''	8'-6''	5'-2''	6'-9''	5'-1''	6'-7''
#10	-	-	8'-3''	10'-9''	6'-7''	8'-7''	6'-3''	8'-2''
#11	-	-	10'-1''	13'-3''	8'-1''	10'-7''	7'-6''	9'-9''

Location Category A - Bars in horizontal layers in top of pour with 12'' or more of concrete below them such as in: footings, pier caps, etc.

LOCATION CATEGORY B								
BAR SIZE	CENTER TO CENTER SPACING							
	3''		4''		5''		≥ 6''	
#4	1'-7''	2'-5''	1'-7''	1'-11''	1'-7''	1'-11''	1'-7''	1'-11''
#5	2'-1''	3'-1''	2'-0''	3'-0''	2'-0''	2'-5''	2'-0''	2'-5''
#6	3'-0''	4'-5''	2'-5''	3'-7''	2'-5''	3'-7''	2'-5''	3'-7''
#7	4'-0''	6'-0''	3'-0''	4'-6''	2'-9''	4'-2''	2'-9''	4'-2''
#8	5'-3''	7'-10''	3'-11''	5'-11''	3'-2''	4'-9''	3'-2''	4'-9''
#9	6'-8''	10'-0''	5'-0''	7'-6''	4'-0''	6'-0''	3'-11''	5'-10''
#10	-	-	6'-4''	9'-6''	5'-1''	7'-7''	4'-10''	7'-2''
#11	-	-	7'-10''	11'-8''	6'-3''	9'-4''	5'-9''	8'-8''

Location Category B - All bars not in Location Category A.

= Non-epoxy coated = Epoxy coated

Note:

1. When bar lap is not specified on the Plans, the above dimensions shall be used.
2. These bar laps do not apply when bar is in lightweight concrete. Greater lengths are required for this material.
3. These bar laps only apply where the General Notes indicate Reinforcing Steel Design, fy = 60 ksi, and Concrete Design, f'c = 4000 psi.
4. These bar laps assume cover of 2''. Greater lap lengths will be required for cover less than 2''.
5. These bar laps are Class B splices based on the development lengths in Det. No. REBAR-DL-103. Class B splices are 1.3 times the development length.
6. Class A splices may be used when (a) the area of reinforcement provided is at least twice that required by analysis over the entire length of the lap splice and (b) one-half or less of the total reinforcement is spliced within the required lap splice length. Class A splices are 1.0 times the development length.

APPROVAL

Tom Chrapan DIRECTOR OFFICE OF STRUCTURES

DATE: 03/21/2017

VERSION

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STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

BAR LAP DIMENSIONS FOR GRADE 60 REINFORCING STEEL IN MIX NO.6 (4500 P.S.I.) CONCRETE

DETAIL NO. REBAR-BL-103 SHEET 1 OF 1

REBAR - BAR LAP

Chapter 07 – Reinforcing Details

SECTION 02

DEVELOPMENT LENGTH (REBAR-DL)

LOCATION CATEGORY A								
BAR SIZE	CENTER TO CENTER SPACING							
	3''		4''		5''		≥ 6''	
#4	1'-10''	2'-5''	1'-10''	2'-2''	1'-10''	2'-2''	1'-10''	2'-2''
#5	2'-5''	3'-1''	2'-4''	3'-0''	2'-4''	2'-9''	2'-4''	2'-9''
#6	3'-5''	4'-5''	2'-9''	3'-7''	2'-9''	3'-7''	2'-9''	3'-7''
#7	4'-8''	6'-1''	3'-6''	4'-7''	3'-2''	4'-2''	3'-2''	4'-2''
#8	6'-1''	7'-11''	4'-7''	5'-11''	3'-8''	4'-9''	3'-8''	4'-9''
#9	7'-8''	10'-0''	5'-9''	7'-6''	4'-8''	6'-0''	4'-6''	5'-11''
#10	-	-	7'-4''	9'-6''	5'-10''	7'-8''	5'-7''	7'-3''
#11	-	-	9'-0''	11'-9''	7'-2''	9'-5''	6'-8''	8'-8''

Location Category A - Bars in horizontal layers in top of pour with 12'' or more of concrete below them such as in: footings, pier caps, etc.

LOCATION CATEGORY B								
BAR SIZE	CENTER TO CENTER SPACING							
	3''		4''		5''		≥ 6''	
#4	1'-5''	2'-1''	1'-5''	1'-8''	1'-5''	1'-8''	1'-5''	1'-8''
#5	1'-10''	2'-9''	1'-9''	2'-8''	1'-9''	2'-1''	1'-9''	2'-1''
#6	2'-8''	3'-11''	2'-1''	3'-2''	2'-1''	3'-2''	2'-1''	3'-2''
#7	3'-7''	5'-4''	2'-8''	4'-0''	2'-6''	3'-8''	2'-6''	3'-8''
#8	4'-8''	7'-0''	3'-6''	5'-3''	2'-10''	4'-2''	2'-10''	4'-2''
#9	5'-11''	8'-10''	4'-5''	6'-8''	3'-7''	5'-4''	3'-6''	5'-2''
#10	-	-	5'-8''	8'-5''	4'-6''	6'-9''	4'-3''	6'-5''
#11	-	-	6'-11''	10'-4''	5'-7''	8'-4''	5'-2''	7'-8''

Location Category B - All bars not in Location Category A.

= Non-epoxy coated = Epoxy coated

Note:

1. When development length is not specified on the Plans, the above dimensions shall be used.
2. These development lengths do not apply when bar is in lightweight concrete. Greater lengths are required for this material.
3. These development lengths only apply where the General Notes indicate Reinforcing Steel Design, fy = 60 ksi, and Concrete Design, f'c = 3000 psi.
4. These development lengths assume cover of 2''. Greater development lengths will be required for cover less than 2''.
5. The Excess Reinforcement Factor was assumed to be 1.0 when calculating these dimensions.
6. Atr was assumed to be 0 when calculating the Reinforcement Confinement Factor.
7. If depth of member does not allow bar development length indicated in Location Categories A and B; then hooks shall be added to all bars not conforming, as per D, E, and F per Det. No. REBAR-DL-201.

APPROVAL

Glenn C. Vaughan DIRECTOR OFFICE OF STRUCTURES

DATE: 03/21/2017

VERSION

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STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

DEVELOPMENT LENGTH DIMENSIONS FOR GRADE 60 REINFORCING STEEL IN MIX NO.3 (3500 P.S.I.) CONCRETE

DETAIL NO. REBAR-DL-101 SHEET 1 OF X

REBAR - DEVELOPMENT LENGTH

LOCATION CATEGORY A								
BAR SIZE	CENTER TO CENTER SPACING							
	3''		4''		5''		≥ 6''	
#4	1'-10''	2'-4''	1'-10''	2'-2''	1'-10''	2'-2''	1'-10''	2'-2''
#5	2'-4''	3'-1''	2'-3''	2'-11''	2'-3''	2'-8''	2'-3''	2'-8''
#6	3'-4''	4'-4''	2'-8''	3'-6''	2'-8''	3'-6''	2'-8''	3'-6''
#7	4'-6''	5'-11''	3'-5''	4'-5''	3'-2''	4'-1''	3'-2''	4'-1''
#8	5'-11''	7'-9''	4'-5''	5'-10''	3'-7''	4'-8''	3'-7''	4'-8''
#9	7'-6''	9'-10''	5'-8''	7'-4''	4'-6''	5'-11''	4'-5''	5'-9''
#10	-	-	7'-2''	9'-4''	5'-9''	7'-6''	5'-5''	7'-1''
#11	-	-	8'-10''	11'-6''	7'-1''	9'-2''	6'-6''	8'-6''

Location Category A - Bars in horizontal layers in top of pour with 12'' or more of concrete below them such as in: footings, pier caps, etc.

LOCATION CATEGORY B								
BAR SIZE	CENTER TO CENTER SPACING							
	3''		4''		5''		≥ 6''	
#4	1'-5''	2'-1''	1'-5''	1'-8''	1'-5''	1'-8''	1'-5''	1'-8''
#5	1'-10''	2'-8''	1'-9''	2'-7''	1'-9''	2'-1''	1'-9''	2'-1''
#6	2'-7''	3'-10''	2'-1''	3'-1''	2'-1''	3'-1''	2'-1''	3'-1''
#7	3'-6''	5'-3''	2'-8''	3'-11''	2'-5''	3'-7''	2'-5''	3'-7''
#8	4'-7''	6'-10''	3'-5''	5'-2''	2'-9''	4'-1''	2'-9''	4'-1''
#9	5'-10''	8'-8''	4'-4''	6'-6''	3'-6''	5'-3''	3'-5''	5'-1''
#10	-	-	5'-6''	8'-3''	4'-5''	6'-7''	4'-2''	6'-3''
#11	-	-	6'-9''	10'-2''	5'-5''	8'-2''	5'-0''	7'-6''

Location Category B - All bars not in Location Category A.

= Non-epoxy coated = Epoxy coated

Note:

1. When development length is not specified on the Plans, the above dimensions shall be used.
2. These development lengths only apply to 4500 psi lightweight concrete.
3. These development lengths only apply where the General Notes indicate Reinforcing Steel Design, fy = 60 ksi, and Concrete Design, f'c = 4000 psi.
4. The unit weight of the lightweight concrete was assumed to be 118 pcf when calculating the Concrete Density Modification Factor.
5. The splitting tensile strength of the lightweight concrete was assumed to be not specified when calculating the Concrete Density Modification Factor.
6. These development lengths assume cover of 2''. Greater development lengths will be required for cover less than 2''.
7. The Excess Reinforcement Factor was assumed to be 1.0 when calculating these dimensions.
8. Atr was assumed to be 0 when calculating the Reinforcement Confinement Factor.
9. If depth of member does not allow bar development length indicated in Location Categories A and B; then hooks shall be added to all bars not conforming, as per D, E, and F per Det. No. REBAR-DL-202.

APPROVAL	STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
Glenn C. Dunphy DIRECTOR OFFICE OF STRUCTURES DATE: 03/21/2017	DEVELOPMENT LENGTH DIMENSIONS FOR GRADE 60 REINFORCING STEEL IN MIX NO.10 (4500 P.S.I.) LIGHTWEIGHT CONCRETE
VERSION: 1.0	DETAIL NO. REBAR-DL-102 SHEET 1 OF 1

REBAR - DEVELOPMENT LENGTH

LOCATION CATEGORY A								
BAR SIZE	CENTER TO CENTER SPACING							
	3''		4''		5''		≥ 6''	
#4	1'-7''	2'-1''	1'-7''	1'-11''	1'-7''	1'-11''	1'-7''	1'-11''
#5	2'-1''	2'-8''	2'-0''	2'-7''	2'-0''	2'-5''	2'-0''	2'-5''
#6	3'-0''	3'-10''	2'-5''	3'-1''	2'-5''	3'-1''	2'-5''	3'-1''
#7	4'-0''	5'-3''	3'-0''	3'-11''	2'-9''	3'-7''	2'-9''	3'-7''
#8	5'-3''	6'-10''	3'-11''	5'-2''	3'-2''	4'-1''	3'-2''	4'-1''
#9	6'-8''	8'-8''	5'-0''	6'-6''	4'-0''	5'-3''	3'-11''	5'-1''
#10	-	-	6'-4''	8'-3''	5'-1''	6'-7''	4'-10''	6'-3''
#11	-	-	7'-10''	10'-2''	6'-3''	8'-2''	5'-9''	7'-6''

Location Category A - Bars in horizontal layers in top of pour with 12'' or more of concrete below them such as in: footings, pier caps, etc.

LOCATION CATEGORY B								
BAR SIZE	CENTER TO CENTER SPACING							
	3''		4''		5''		≥ 6''	
#4	1'-3''	1'-10''	1'-3''	1'-6''	1'-3''	1'-6''	1'-3''	1'-6''
#5	1'-7''	2'-5''	1'-6''	2'-3''	1'-6''	1'-10''	1'-6''	1'-10''
#6	2'-3''	3'-5''	1'-10''	2'-9''	1'-10''	2'-9''	1'-10''	2'-9''
#7	3'-1''	4'-8''	2'-4''	3'-6''	2'-2''	3'-2''	2'-2''	3'-2''
#8	4'-0''	6'-0''	3'-0''	4'-6''	2'-5''	3'-8''	2'-5''	3'-8''
#9	5'-2''	7'-8''	3'-10''	5'-9''	3'-1''	4'-7''	3'-0''	4'-6''
#10	-	-	4'-11''	7'-4''	3'-11''	5'-10''	3'-9''	5'-7''
#11	-	-	6'-0''	9'-0''	4'-10''	7'-2''	4'-5''	6'-8''

Location Category B - All bars not in Location Category A.

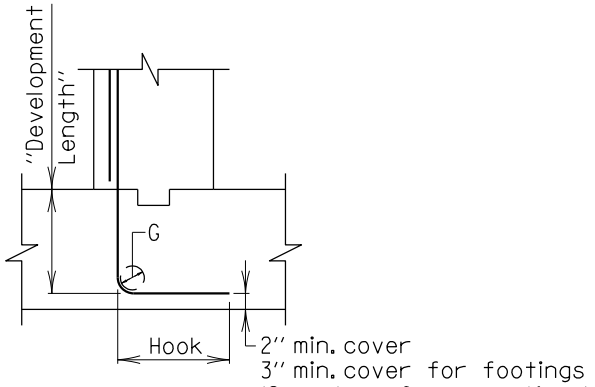
□ = Non-epoxy coated ▨ = Epoxy coated

Note:

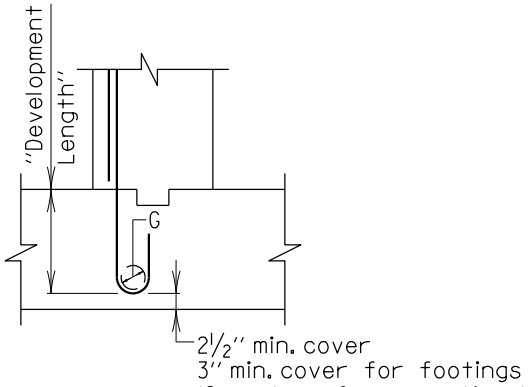
1. When development length is not specified on the Plans, the above dimensions shall be used.
2. These development lengths do not apply when bar is in lightweight concrete. Greater lengths are required for this material.
3. These development lengths only apply where the General Notes indicate Reinforcing Steel Design, fy = 60 ksi, and Concrete Design, f'c = 4000 psi.
4. These development lengths assume cover of 2''. Greater development lengths will be required for cover less than 2''.
5. The Excess Reinforcement Factor was assumed to be 1.0 when calculating these dimensions.
6. Atr was assumed to be 0 when calculating the Reinforcement Confinement Factor.
7. If depth of member does not allow bar development length indicated in Location Categories A and B; then hooks shall be added to all bars not conforming, as per D, E, and F per Det. No. REBAR-DL-203.

APPROVAL	STATE OF MARYLAND DEPARTMENT OF TRANSPORTATION STATE HIGHWAY ADMINISTRATION OFFICE OF STRUCTURES
Glenn C. Vaughan DIRECTOR OFFICE OF STRUCTURES DATE: 03/21/2017	DEVELOPMENT LENGTH DIMENSIONS FOR GRADE 60 REINFORCING STEEL IN MIX NO.6 (4500 P.S.I.) CONCRETE
VERSION 1.0	DETAIL NO. REBAR-DL-103 SHEET 1 OF 1

REBAR - DEVELOPMENT LENGTH



STANDARD 90° HOOK



STANDARD 180° HOOK

BAR SIZE	* LOCATION CATEGORY		
	D	E	F
#4	8"	11"	9"
#5	10"	1'-2"	11"
#6	1'-0"	1'-5"	1'-2"
#7	1'-2"	1'-8"	1'-4"
#8	1'-4"	1'-10"	1'-6"
#9	1'-6"	2'-1"	1'-8"
#10	1'-8"	2'-4"	1'-11"
#11	1'-10"	2'-7"	2'-1"

Note:
For Hook Dimensions and Bends, see Detail No. REBAR-BB-102.

* LOCATION CATEGORY:

D- All bars terminating with a standard 180° hook with side cover (normal to plane of hook) not less than 2½", and for 90° deg. hook, cover on bar extension beyond hook not less than 2".
E- All bars not in Category D.
F- All bars with hook enclosed vertically or horizontally within ties or stirrup-ties spaced along the full development length not greater than 3d where d is the diameter of the hooked bar.

Note:
1. When development length is not specified on the Plans, the above dimensions shall be used.
2. These development lengths do not apply when bar is in lightweight concrete or any other strength of concrete.
3. These development lengths only apply where the General Notes indicate Reinforcing Steel Design, fy = 60 ksi. and Concrete Design, f'c = 3000 psi.
4. If depth of member does not allow bar development length indicated in Categories A, B, and C: Detail No. REBAR-DL-101; then hook shall be added to all bars not conforming, as per D, E & F.

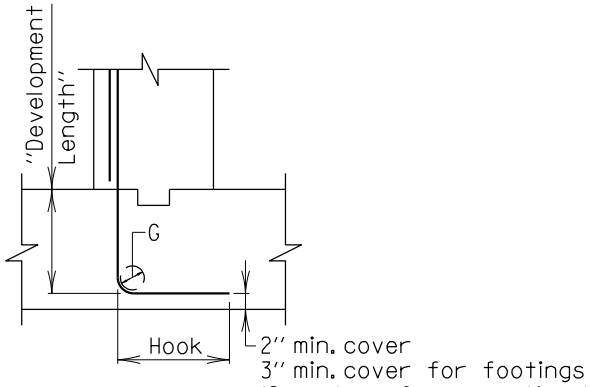
APPROVAL
E.S. Freedman DIRECTOR OFFICE OF STRUCTURES
DATE: 05/10/2011
VERSION
1.0

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

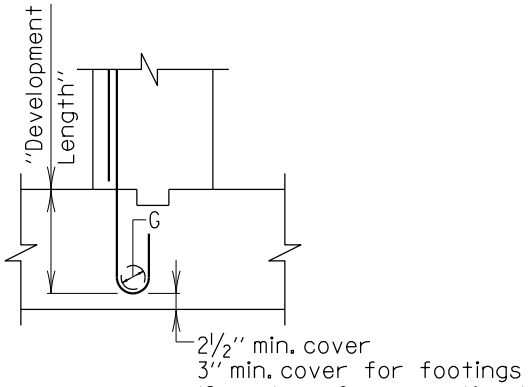
DEVELOPMENT LENGTH DIMENSIONS OF HOOKED BARS FOR GRADE 60 REINFORCING STEEL IN MIX NO.3 (3500 P.S.I.) CONCRETE NON-EPOXY COATED REINFORCING

DETAIL NO. REBAR-DL-201 SHEET 1 OF 1

REBAR - DEVELOPMENT LENGTH



STANDARD 90° HOOK



STANDARD 180° HOOK

BAR SIZE	* LOCATION CATEGORY		
	D	E	F
#4	9"	1'-1"	10"
#5	11"	1'-4"	1'-1"
#6	1'-1"	1'-7"	1'-3"
#7	1'-4"	1'-10"	1'-6"
#8	1'-6"	2'-1"	1'-8"
#9	1'-8"	2'-4"	1'-11"
#10	1'-10"	2'-8"	2'-2"
#11	2'-1"	2'-11"	2'-4"

Note:
For Hook Dimensions and Bends, see Detail No. REBAR-BB-102.

* LOCATION CATEGORY:

D- All bars terminating with a standard 180° hook with side cover (normal to plane of hook) not less than 2½", and for 90° deg. hook, cover on bar extension beyond hook not less than 2".
E- All bars not in Category D.
F- All bars with hook enclosed vertically or horizontally within ties or stirrup-ties spaced along the full development length not greater than 3d where d is the diameter of the hooked bar.

Note:
1. When development length is not specified on the Plans, the above dimensions shall be used.
2. These development lengths only apply to 4500 P.S.I. lightweight concrete.
3. These development lengths only apply where the General Notes indicate Reinforcing Steel Design, fy = 60 ksi. and Concrete Design, f'c = 4000 psi.
4. If depth of member does not allow bar development length indicated in Categories A, B, and C: Detail No. REBAR-DL-102; then hook shall be added to all bars not conforming, as per D, E & F.

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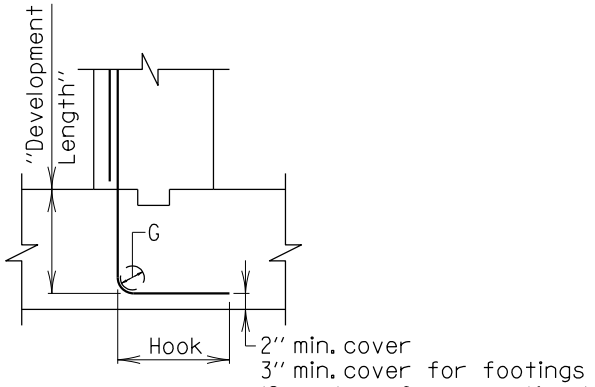
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

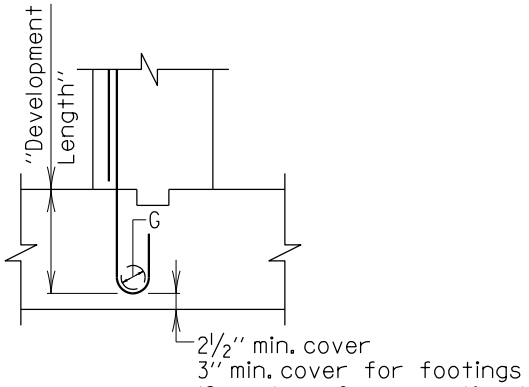
DEVELOPMENT LENGTH DIMENSIONS OF HOOKED BARS FOR GRADE 60 REINFORCING STEEL IN LIGHTWEIGHT (4500 P.S.I.) CONCRETE NON-EPOXY COATED REINFORCING

DETAIL NO. REBAR-DL-202 SHEET 1 OF 1

REBAR - DEVELOPMENT LENGTH



STANDARD 90° HOOK



STANDARD 180° HOOK

BAR SIZE	* LOCATION CATEGORY		
	D	E	F
#4	7"	10"	8"
#5	9"	1'-0"	10"
#6	10"	1'-3"	1'-0"
#7	1'-0"	1'-5"	1'-2"
#8	1'-2"	1'-7"	1'-4"
#9	1'-4"	1'-10"	1'-6"
#10	1'-5"	2'-1"	1'-8"
#11	1'-7"	2'-3"	1'-10"

Note:
For Hook Dimensions and Bends, see Detail No. REBAR-BB-102.

* LOCATION CATEGORY:

D- All bars terminating with a standard 180° hook with side cover (normal to plane of hook) not less than 2½", and for 90° deg. hook, cover on bar extension beyond hook not less than 2".
E- All bars <u>not</u> in Category D.
F- All bars with hook enclosed vertically or horizontally within ties or stirrup-ties spaced along the full development length not greater than 3d where d is the diameter of the hooked bar.

Note:
1. When development length is not specified on the Plans, the above dimensions shall be used.
2. These development lengths do not apply when bar is in lightweight concrete or any other strength of concrete.
3. These development lengths only apply where the General Notes indicate Reinforcing Steel Design, fy = 60 ksi. and Concrete Design, f'c = 4000 psi.
4. If depth of member does not allow bar development length indicated in Categories A, B, and C: Detail No. REBAR-DL-103; then hook shall be added to all bars not conforming, as per D, E & F.

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DEVELOPMENT LENGTH DIMENSIONS OF HOOKED BARS FOR GRADE 60 REINFORCING STEEL IN MIX NO.6 (4500 P.S.I.) CONCRETE NON-EPOXY COATED REINFORCING

DETAIL NO. REBAR-DL-203 SHEET 1 OF 1

REBAR - DEVELOPMENT LENGTH

Chapter 07 – Reinforcing Details

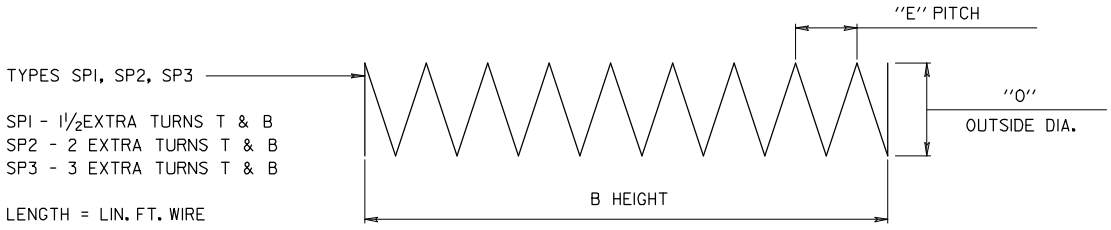
SECTION 03

BAR BENDS (REBAR-BB)

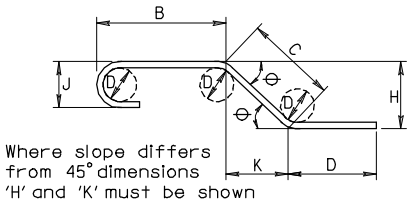
TYPICAL BAR BENDS

DETAILS AND NOTES

SPIRAL



Unless otherwise noted diameter D is the same for all bends and hooks on a bar



Where slope differs from 45° dimensions 'H' and 'K' must be shown

ENLARGED VIEW SHOWING BAR BENDING DETAILS

Notes:

1. All dimensions are out-to-out of bar or to tangent points for 135° and 180° hooks.
2. 'J' dimensions on 180° hooks to be shown only where necessary to restrict hook size. Otherwise standard hooks are to be used.
3. Where 'J' is not shown, "J" will be kept equal to or less than 'H' on truss bars. Where 'J' can exceed 'H' it should be shown.
4. 'H' dimension on stirrups to be shown where necessary to fit within concrete.
5. Where bars are to be bent more accurately than standard bending tolerances, bending dimensions which require closer fabrication should have limits indicated.

NOTE TO FABRICATOR

BENDING TOLERANCE NOTE

TIES AND STIRRUPS SHALL BE BENT WITH A PLUS ZERO INCH (+0") MINUS (-) NORMAL ACI BENDING TOLERANCES

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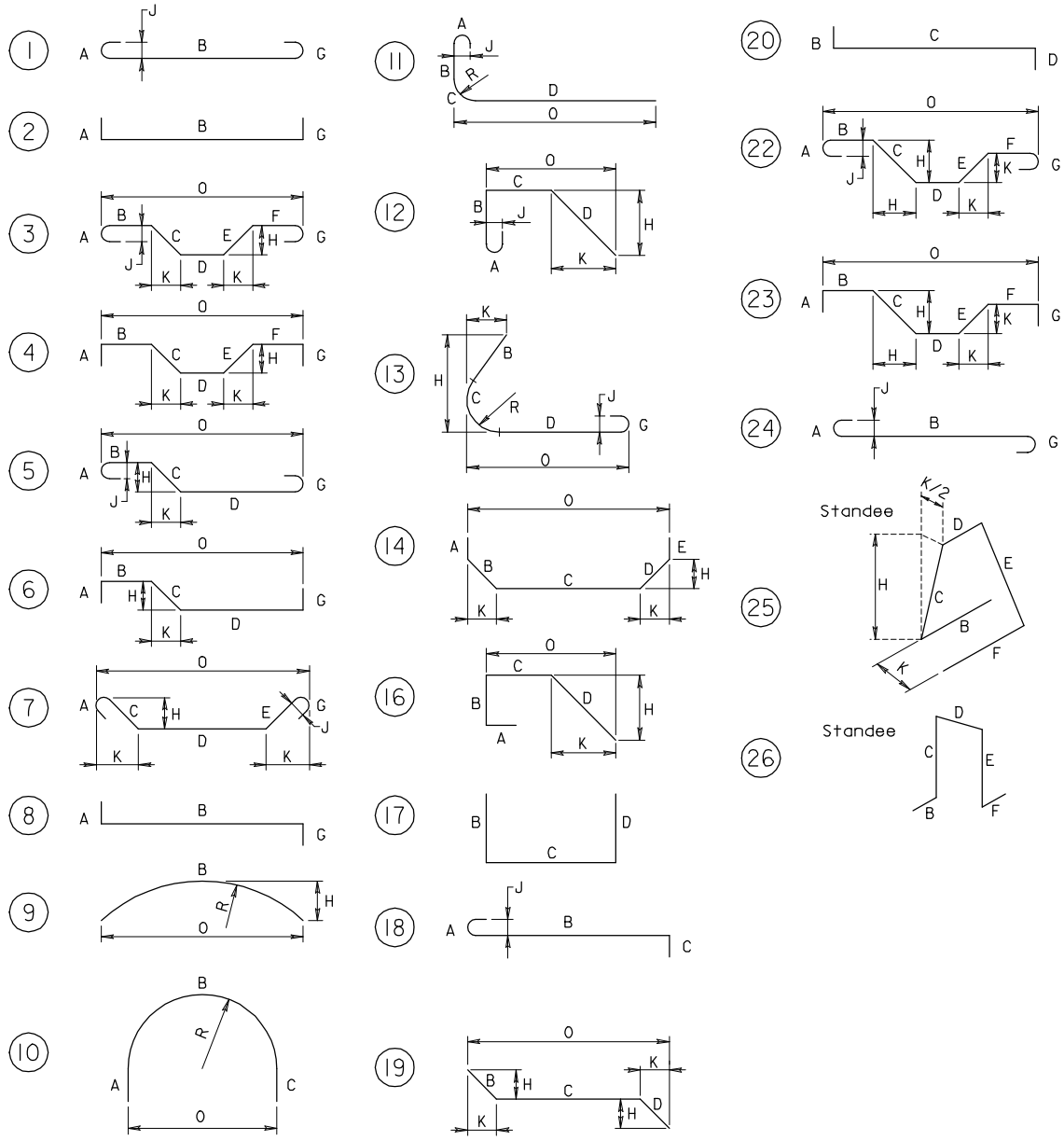
BAR BEND TYPES
GENERAL NOTES

DETAIL NO. REBAR-BB-101 SHEET 1 OF 8

REBAR BAR BENDS

ACI TYPICAL BAR BENDS

STANDARD PIN BENDING



NOTE TO FABRICATOR

BENDING TOLERANCE NOTE

TIES AND STIRRUPS SHALL BE BENT WITH A PLUS ZERO INCH (+0'') MINUS (–) NORMAL ACI BENDING TOLERANCES

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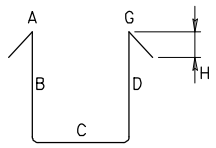
BAR BEND TYPES
ACI - STANDARD PIN BENDING

DETAIL NO. REBAR-BB-101 SHEET 2 OF 8

REBAR BAR BENDS

ACI TYPICAL BAR BENDS

TIES AND STIRRUPS



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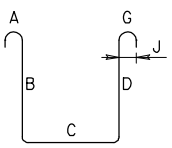

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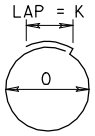

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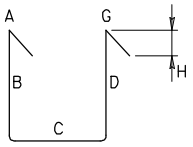

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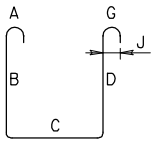

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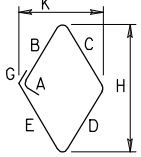

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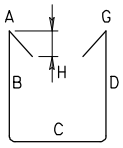

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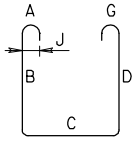

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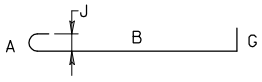

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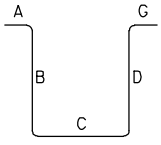

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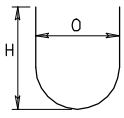

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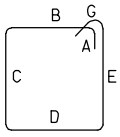

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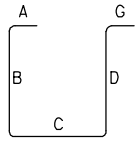

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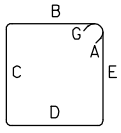

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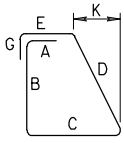

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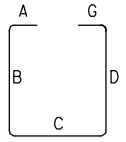

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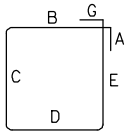

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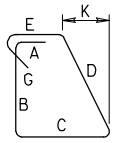

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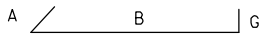

T9

NOTE TO FABRICATOR

BENDING TOLERANCE NOTE

TIES AND STIRRUPS SHALL BE BENT WITH A PLUS ZERO INCH (+0'') MINUS (–) NORMAL ACI BENDING TOLERANCES

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BAR BEND TYPES
ACI- TIES A

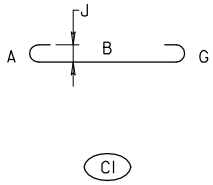
DETAIL NO. REBAR-BB-101

SHEET 3 OF 8

REBAR BAR BENDS

SHA TYPICAL BAR BENDS

TIES AND STIRRUPS



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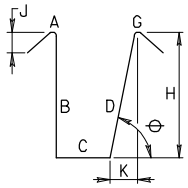

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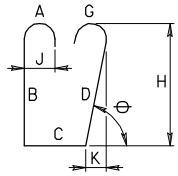

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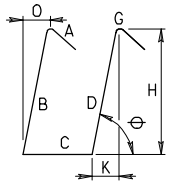

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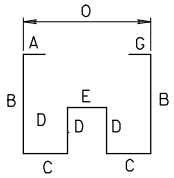

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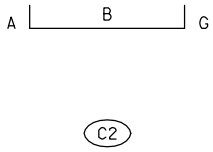

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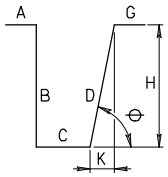

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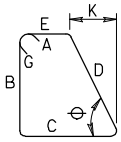

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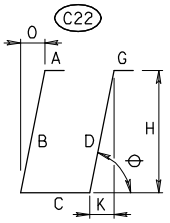

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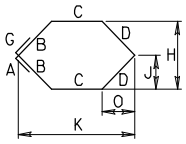

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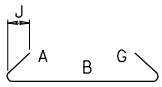

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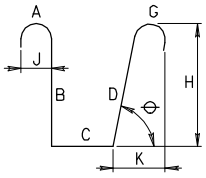

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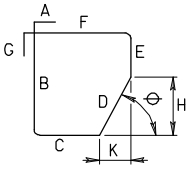

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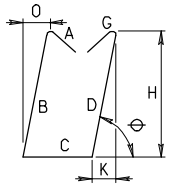

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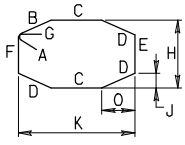

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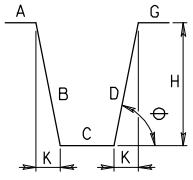

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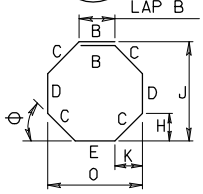

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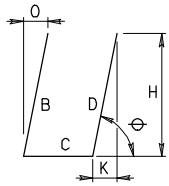

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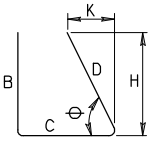

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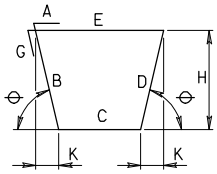

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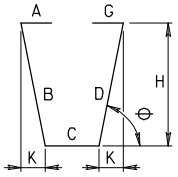

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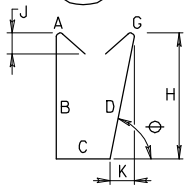

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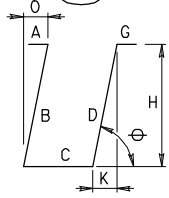

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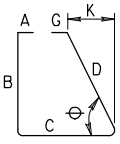

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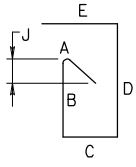

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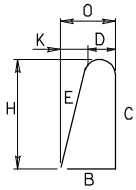

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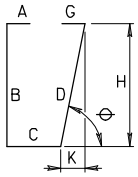

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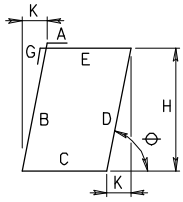

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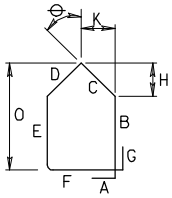

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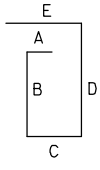

C43

NOTE TO FABRICATOR

BENDING TOLERANCE NOTE

TIES AND STIRRUPS SHALL BE BENT WITH A PLUS ZERO INCH (+0'') MINUS (–) NORMAL ACI BENDING TOLERANCES

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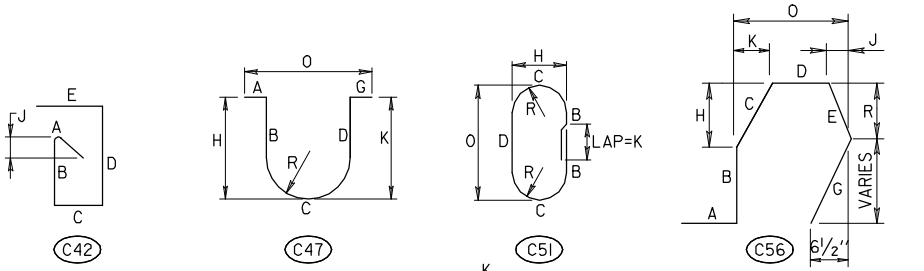
BAR BEND TYPES
SHA - TIES AND STIRRUPS

DETAIL NO. REBAR-BB-101 SHEET 4 OF 8

REBAR BAR BENDS

SHA TYPICAL BAR BENDS

TIES AND STIRRUPS



For Wing Wall Parapet

NOTE TO FABRICATOR

BENDING TOLERANCE NOTE

TIES AND STIRRUPS SHALL BE BENT WITH A PLUS ZERO INCH (+0'') MINUS (-) NORMAL ACI BENDING TOLERANCES

* Measured to Tangents of Curves.

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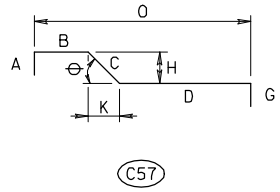
BAR BEND TYPES
SHA - TIES AND STIRRUPS

DETAIL NO. REBAR-BB-101 SHEET 5 OF 8

REBAR BAR BENDS

SHA TYPICAL BAR BENDS

STANDARD PIN BENDING



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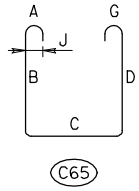

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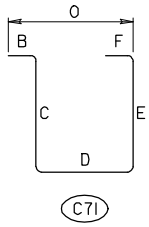

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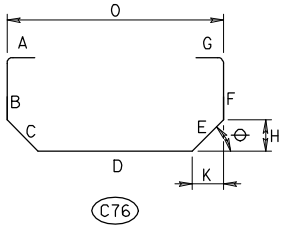

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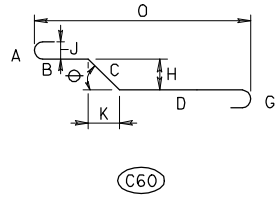

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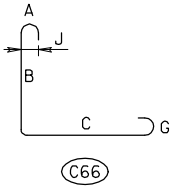

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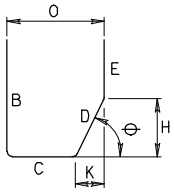

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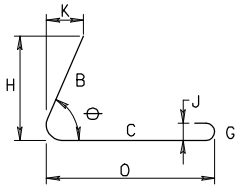

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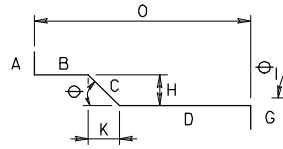

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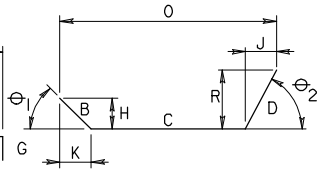

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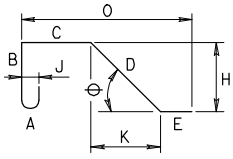

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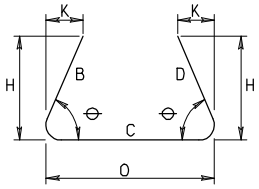

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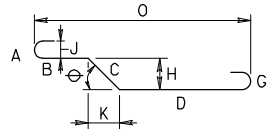

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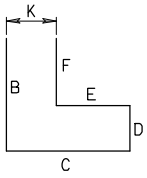

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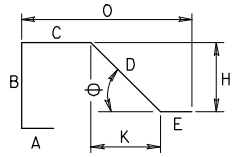

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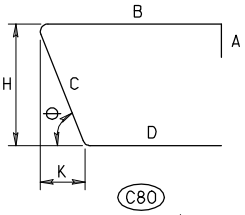

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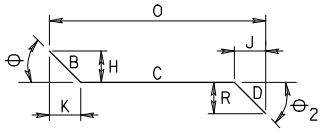

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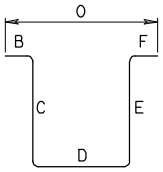

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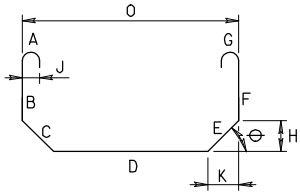

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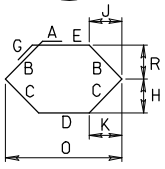

H I

NOTE TO FABRICATOR

BENDING TOLERANCE NOTE

TIES AND STIRRUPS SHALL BE BENT WITH A PLUS ZERO INCH (+0'') MINUS (–) NORMAL ACI BENDING TOLERANCES

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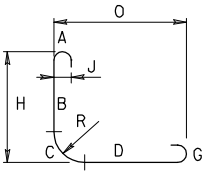
BAR BEND TYPES
SHA - STANDARD PIN BENDING

DETAIL NO. REBAR-BB-101 SHEET 6 OF 8

REBAR BAR BENDS

SHA TYPICAL BAR BENDS

RADIUS BENDING



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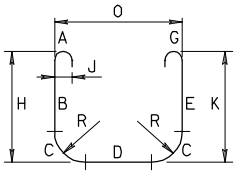

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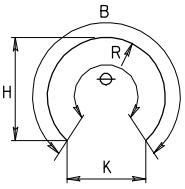

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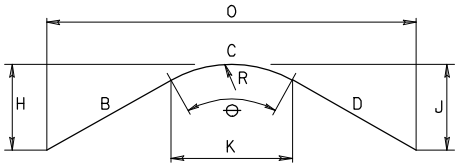

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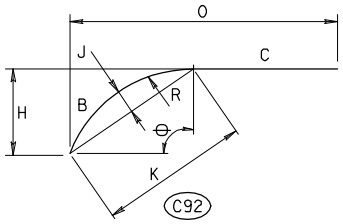

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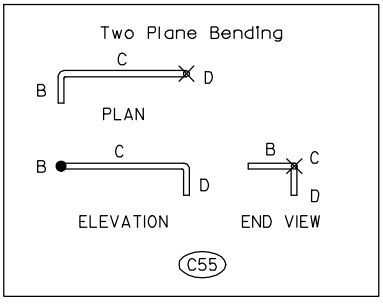

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NOTE TO FABRICATOR

BENDING TOLERANCE NOTE

TIES AND STIRRUPS SHALL BE BENT WITH A PLUS ZERO INCH (+0'') MINUS (–) NORMAL ACI BENDING TOLERANCES

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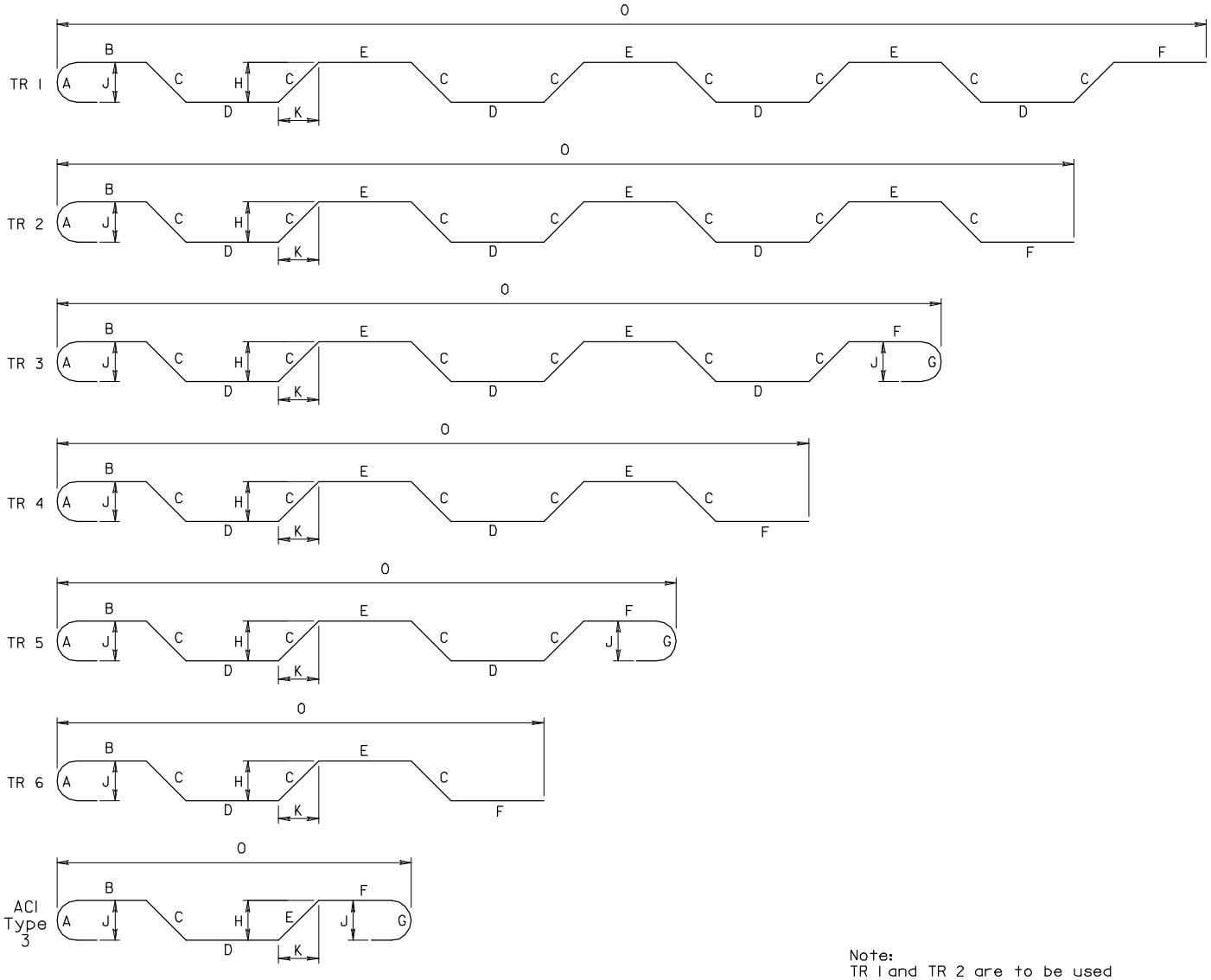
BAR BEND TYPES
SHA - RADIUS BENDING

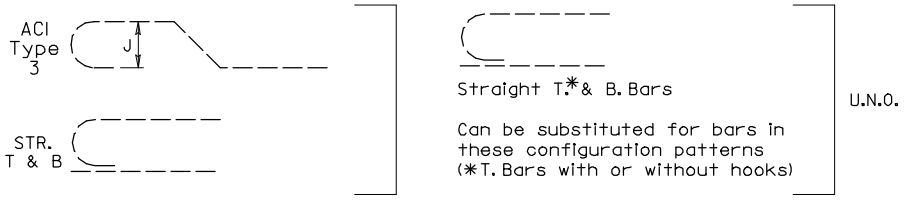
DETAIL NO. REBAR-BB-101 SHEET 7 OF 8

REBAR BAR BENDS

SHA TYPICAL BAR BENDS

TRUSS BAR CONFIGURATIONS





Hooks for truss bars optional.

Straight T.* & B. Bars

Can be substituted for bars in these configuration patterns (*T. Bars with or without hooks)

U.N.O.

Note:
TR 1 and TR 2 are to be used only when there are more than three bays and it is necessary to splice truss bars.

NOTE TO FABRICATOR

BENDING TOLERANCE NOTE

TIES AND STIRRUPS SHALL BE BENT WITH A PLUS ZERO INCH (+0") MINUS (-) NORMAL ACI BENDING TOLERANCES

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BAR BEND TYPES
TRUSS BAR CONFIGURATIONS

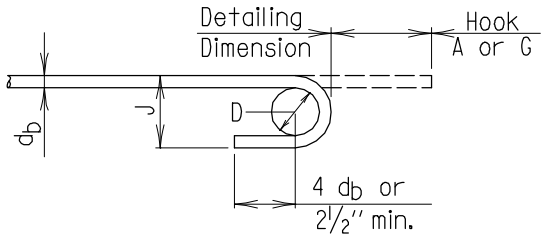
DETAIL NO. REBAR-BB-101

SHEET 8 OF 8

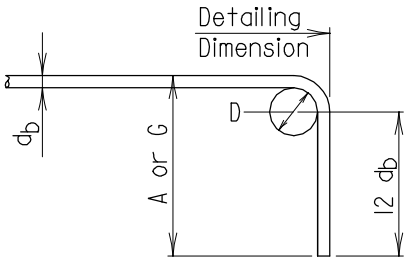
REBAR BAR BENDS

HOOKS
TABLE I
REFERENCES

1. ACI Types 1 thru 26
2. SHA Standard Pin Bending
3. SHA Radius Bending



180°



90°

RECOMMENDED END HOOKS, ALL GRADES				
BAR SIZE	Finished bend diameter D, in.	180 - deg hook A or G in	180 - deg hook J, in.	90 - deg hook A or G in
#3	$2\frac{1}{4}$	5	3	6
#4	3	6	4	8
#5	$3\frac{3}{4}$	7	5	10
#6	$4\frac{1}{2}$	8	6	1-0
#7	$5\frac{1}{4}$	10	7	1-2
#8	6	11	8	1-4
#9	$9\frac{1}{2}$	1-3	$11\frac{3}{4}$	1-7
#10	$10\frac{3}{4}$	1-5	$1\text{-}1\frac{1}{4}$	1-10
#11	12	1-7	$1\text{-}2\frac{3}{4}$	2-0
#14	$18\frac{1}{4}$	2-3	$1\text{-}9\frac{3}{4}$	2-7
#18	24	3-0	$2\text{-}4\frac{1}{2}$	3-5

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VERSION 1.0	DETAIL NO. REBAR-BB-102 SHEET 1 OF 2

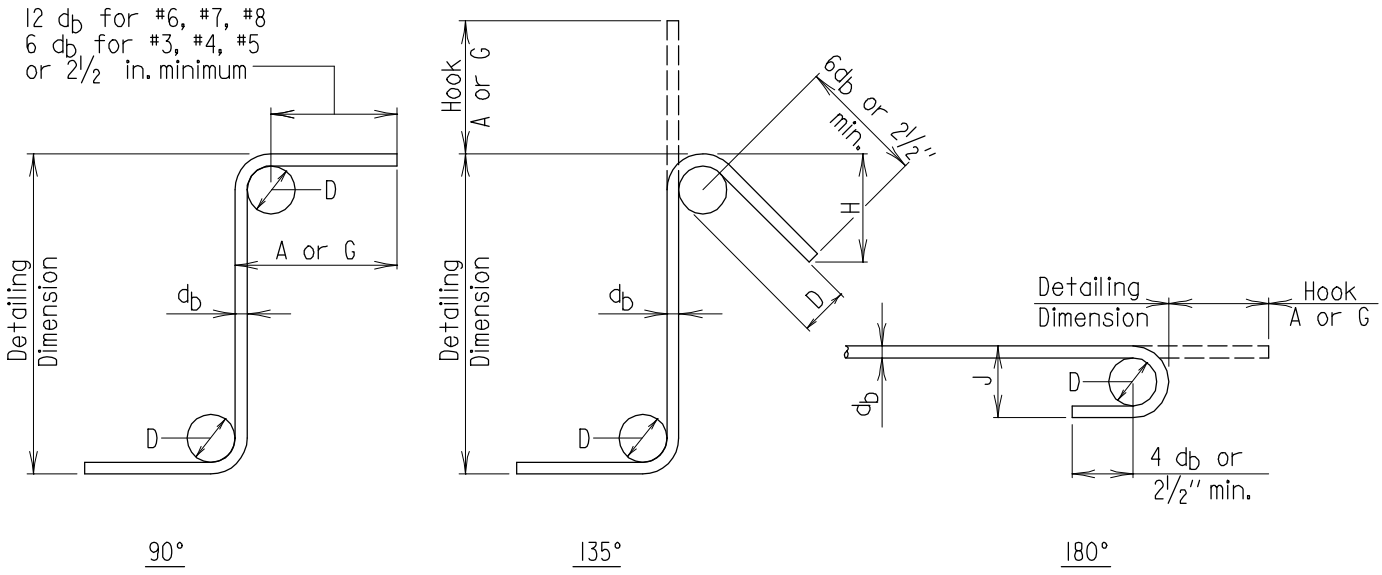
REBAR BAR BENDS

HOOKS
TABLE II
REFERENCES

1. ACI Types S1 thru S11
2. ACI Types T1 thru T8
3. SHA Ties and Stirrups

(Note: Tie and stirrup types supplied in sizes #3-#8)

STIRRUP AND TIE HOOKS



90° 135° 180°

STIRRUP AND TIE HOOK DIMENSIONS, in.				
BAR SIZE	D, in.	90 - deg hook	135 - deg hook	
		A or G	A or G	H, approx
#3	1½	4	4	2½
#4	2	4½	4½	3
#5	2½	6	5½	3¾
#6	4½	1-0	7¾	4½
#7	5¼	1-2	9	5¼
#8	6	1-4	10¼	6

RECOMMENDED END HOOKS, ALL GRADES			
BAR SIZE	Finished bend diameter	180 - deg hook	
	D, in.	A or G in	J, in.
#3	2¼	5	3
#4	3	6	4
#5	3¾	7	5
#6	4½	8	6
#7	5¼	10	7
#8	6	11	8

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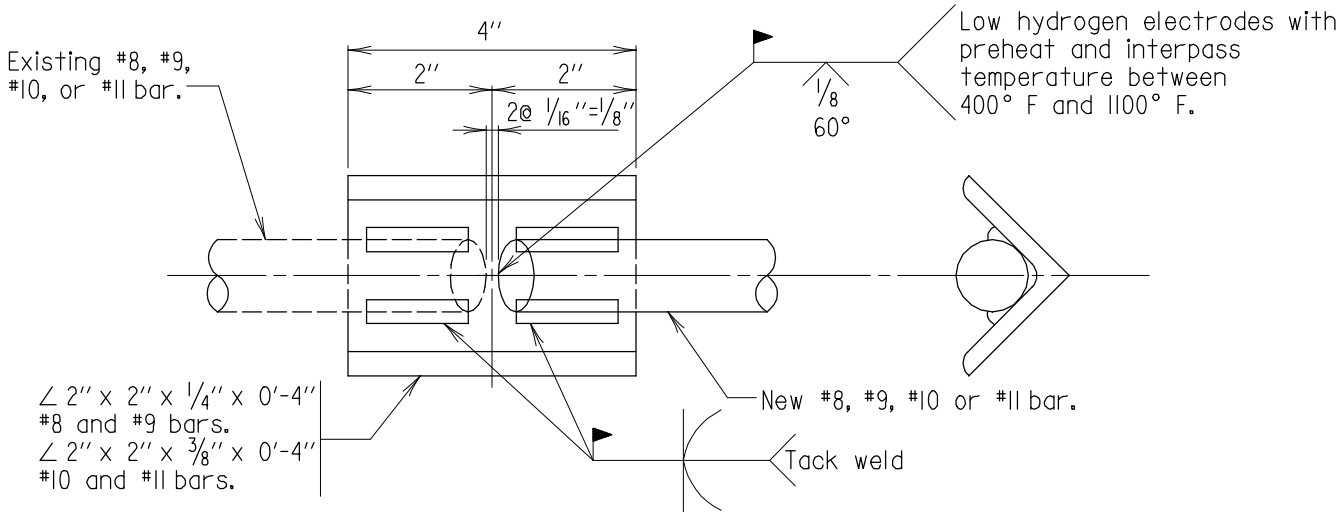
E.S. Freedman DIRECTOR OFFICE OF STRUCTURES DATE: 11/17/1997	REINFORCING STEEL HOOK TABLES AND DIAGRAMS
VERSION 1.0	DETAIL NO. REBAR-BB-102 SHEET 2 OF 2

REBAR BAR BENDS

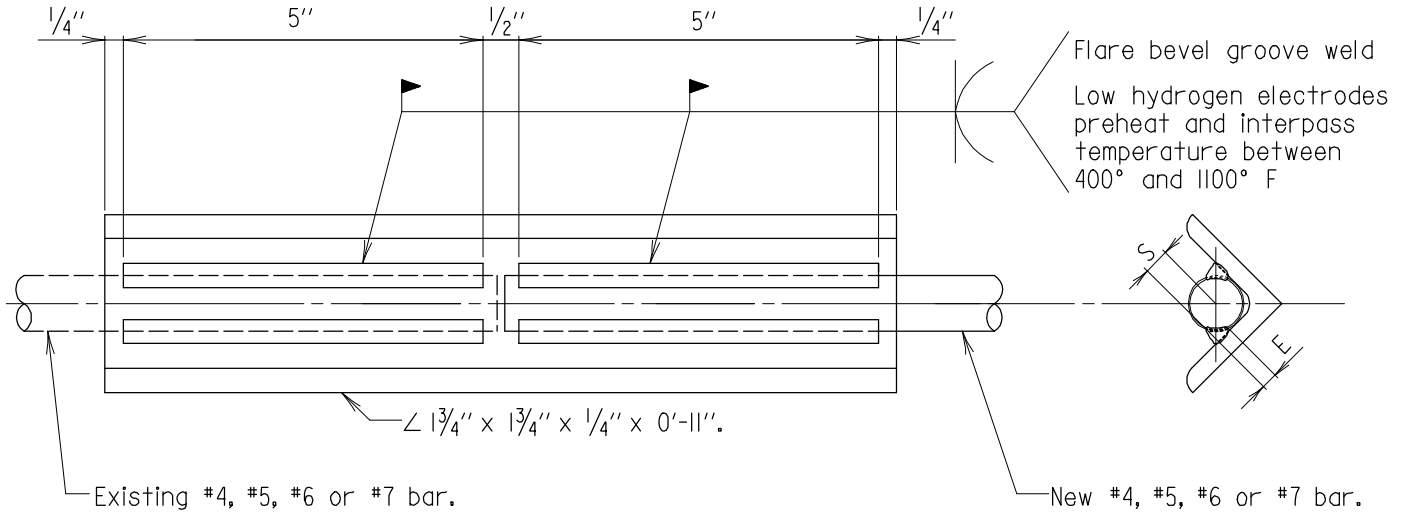
Chapter 07 – Reinforcing Details

SECTION 04

EXISTING REINFORCING (REBAR-ER)



DETAIL FOR WELD SPLICE
FOR #8, #9, #10 OR #11 BARS
Scale: 3/8" = 1"



DETAIL FOR WELD SPLICE
FOR #4, #5, #6 OR #7 BARS
Scale: 3/8" = 1"

E = Effective throat weld

E = .4S

S = Radius rebar

Notes:
1. All welding to be in conformance with ANSI/AWS-latest addition.
2. Prequalification required in conformance with ANSI/AWS-latest addition.
3. Angles shall be made of ASTM A 709 Grade 36 or AISI1010, 1015 or 1020 steel.
4. E7018 electrodes shall be used in making the above welded splices.
5. If sufficient bar lap is not available when existing reinforcing steel is exposed, this detail to extend bars shall be used. Cost of these connections shall be included in contract prices bid on pertinent concrete items.
6. Welded splices shall not be used in decks.

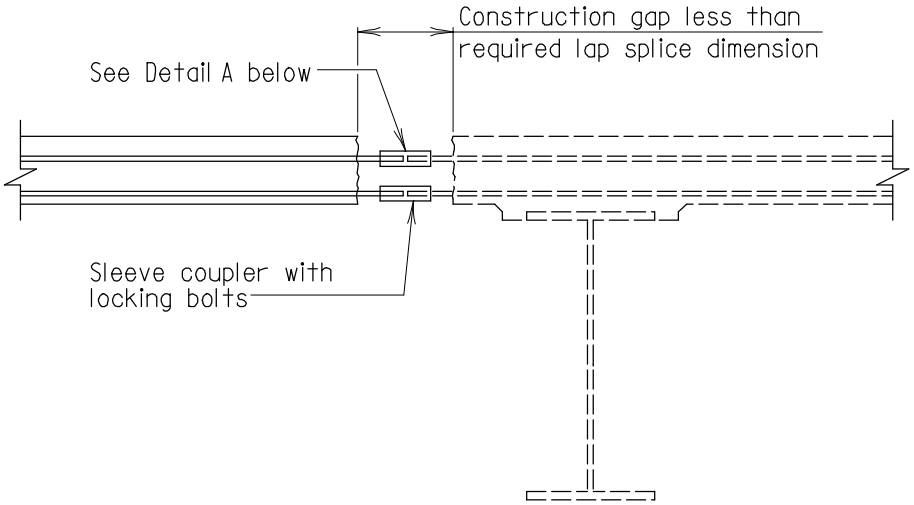
APPROVAL
E.S. Freedman DIRECTOR OFFICE OF STRUCTURES
DATE: 11/26/2007
VERSION
1.0

STATE OF MARYLAND
DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION
OFFICE OF STRUCTURES

SPLICING TO EXISTING REINFORCING STEEL
WELDED SPLICE

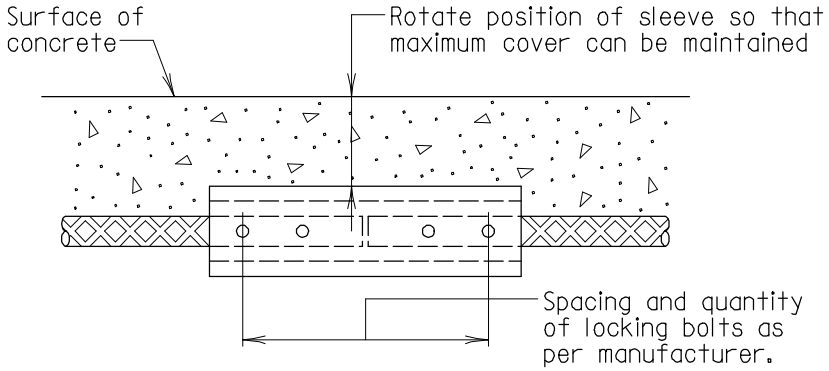
DETAIL NO. REBAR-ER-101 SHEET 1 OF 2

REBAR - EXISTING



SECTION THROUGH SLAB

Scale: 1" = 1'-0"



DETAIL A

Scale: 3" = 1'-0"

Notes:

1. The coupler must develop a minimum of 125% of the specified yield strength of the reinforcing bar being spliced.
2. Couplers used to connect epoxy coated reinforcing bars must be epoxy coated.
3. The uncoated surface of the sheared off indicator bolt must be covered with epoxy prepared from an approved epoxy touchup kit.
4. Longitudinal deck reinforcing steel is not shown.
5. Existing slab shown dashed.
6. These couplers will not be measured for payment, but all costs thereof shall be included in the Contract lump sum price for the pertinent Reinforcing Steel items.

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SPLICING TO EXISTING REINFORCING STEEL
MECHANICAL SPLICE

DETAIL NO. REBAR-ER-101 SHEET 2 OF 2

REBAR - EXISTING