STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
DESIGN DIVISION
NASHVILLE, TENNESSEE 37243-0348

INSTRUCTIONAL BULLETIN NO. 11-21

Regarding Revised Standard Drawings

Effective for the March 23, 2012 letting, the revised Standard Drawings are to be printed with the plans. These drawings shall be identified on the lower left side of the index sheet **"To be printed with plans"** until the drawings are formally distributed.

DRAWING NUMBER	CURRENT REVISION DATE	DESCRIPTION
T-WZ-21	03-15-2011	LANE CLOSURE WITH LEFT HAND MERGE AND LANE SHIFT
RP-H-3	04-13-2011	HANDICAP RAMP AND TRUNCATED DOME SURFACE DETAIL
RP-H-4	04-13-2011	PERPENDICULAR CURB RAMP
RP-H-5	04-13-2011	PARALLEL CURB RAMP
RP-H-6	04-13-2011	MEDIAN CROSSING
RP-H-7	04-13-2011	PERPENDICULAR HANDICAP RAMP FOR 20' THRU 75' RADIUS
RP-H-8	04-13-2011	PERPENDICULAR HANDICAP RAMP FOR 20' THRU 75' RADIUS
RP-H-9	04-13-2011	PARALLEL HANDICAP RAMP FOR 20' THRU 75' RADIUS
T-L-4	05-25-2011	STANDARD LIGHTING DETAILS CANDUIT, CABLE INSTALLATION
S-GR-14	06-06-2011	W-BEAM BARRIER FASTENING HARDWARE AND BRIDGE APPROACH DELINIATORS
S-MB-1	06-06-2011	STANDARD CONCRETE MEDIAN BARRIER
T-S-11	06-06-2011	DELINEATOR AND MILEPOST DETAILS
D-NSD-1		BOULDER CLUSTERS
D-NSD-2		ROCK VANES
D-NSD-3		LOG DEFLECTORS AND LOG VANES
D-NSD-4		LOG DROPS AND STEP POOLS
D-NSD-5		BOULDER RIFFLES
D-NSD-6		CONSTRUCTED RIFFLES
D-NSD-7		COCONUT FIBER ROLLS AND LIVE SILTATION
D-NSD-8		LIVE FASCINES AND WILLOW CUTTINGS
D-NSD-9		BRUSH MATTRESS
D-NSD-10		LARGE WOODY DEBRIS
D-NSD-11		VEGETATED RIPRAP AND GABIONS
D-NSD-12		VEGETATED MSE WALLS
D-NSD-13		LONGITUDINAL STONE TOE AND ARTICULATED CONCRETE MAT
RD-L-8		STANDARD LEGEND FOR NATURAL STREAM DESIGN

Copies of the revised standard drawings are attached.

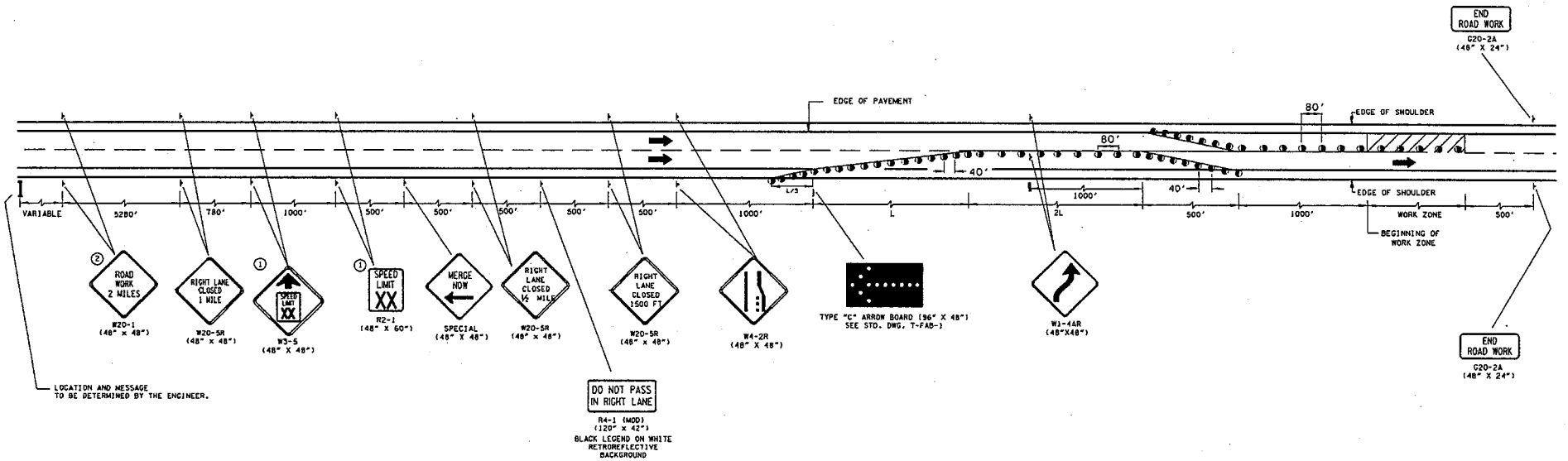
Carolyn Stonecipher

Carolyn Stonecipher, P.E.,
Civil Engineering Director
Design Division

December 13, 2011
CS:ARH
Attachment

- REV. 9-1-05: REMOVED TYPE "C" WARNING LIGHTS FROM FLEXIBLE DRUMS IN TAPER.
- REV. 3-15-11: CHANGED SIGN (R2-5A) TO SIGN (W3-5) AND CHANGED FOOTNOTE (1). REVISED FLEXIBLE DRUM SPACING AND COMPUTION FOR DISTANCE. REMOVED SIGN R4-1 (MOD).

TRAFFIC CONTROL FOR ONE LANE CLOSURE ON MULTI-LANE DIVIDED HIGHWAY (WITH EARLY MERGE)



FOOTNOTES

(1) APPROVAL OF THE STATE TRAFFIC ENGINEER IS REQUIRED BEFORE PLACING THE "REDUCED SPEED AHEAD" (W3-5) AND THE "SPEED LIMIT" (R2-1) SIGNS.

(2) ADDITIONAL "ROAD WORK" (W20-1) SIGNS MAY BE USED FOR LONG TRAFFIC QUEUES.

COMPUTATION FOR DISTANCE L

$L = W \times S$ (FOR $S \geq 45$ mph)

$L = WS^2 / 60$ (FOR $S \leq 40$ mph)

L = TAPER LENGTH IN FEET
W = WIDTH OF OFFSET IN FEET
S = POSTED SPEED IN MPH

CHANNELIZATION DEVICE LEGEND

- FLEXIBLE DRUMS
- SIGN SUPPORT
- DIRECTION OF TRAFFIC
- WORK SITE
- FLASHING YELLOW ARROW BOARD (SEE STD. DWG. NO. T-FAB-1, FOR DETAILS AND SPECIFICATIONS)
- PORTABLE MESSAGE BOARDS

GENERAL NOTES

(A) PORTABLE BARRIER RAIL WILL BE REQUIRED WHERE DROP OFFS EXCEED 18 INCHES. PORTABLE BARRIER RAIL MAY BE USED WHERE DROP OFFS EXCEED 6 INCHES. FOR MORE SPECIFIC INFORMATION SEE TDOT DROP-OFF POLICY OR TRAFFIC CONTROL NOTES.

(B) SEE STANDARD DRAWING NO. T-WZ-10 FOR OTHER NEEDED ADVANCE SIGNING.

(C) PORTABLE MESSAGE BOARD SHOULD ONLY BE USED ONLY WHEN TRAFFIC CONDITIONS WARRANT.

(D) THIS DETAIL IS TO BE USED FOR WORK ZONES IN BOTH THE LEFT AND RIGHT LANES. WHEN THE WORK ZONE IS IN THE RIGHT LANE, THE "LANE SHIFT" (W1-4AR) SIGN AND THE LANE SHIFT SHALL BE DELETED.

(E) REFER TO STANDARD DRAWING NO. T-WZ-11 FOR PORTABLE BARRIER RAIL PLACEMENT, TAPERS, AND END TREATMENT.

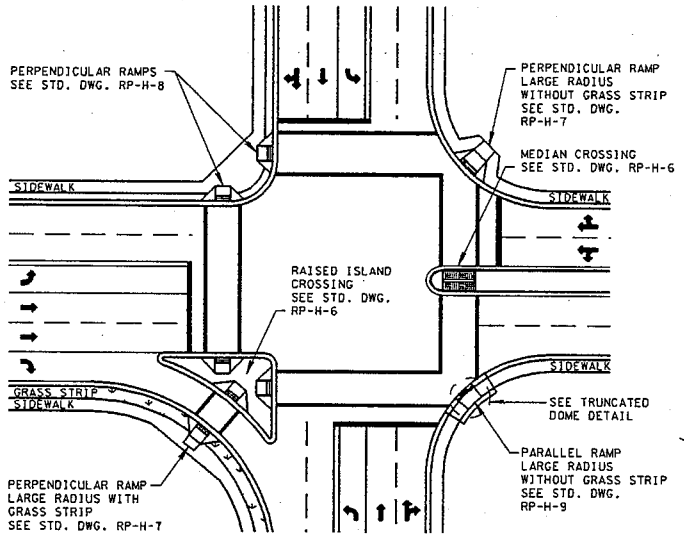
☐ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

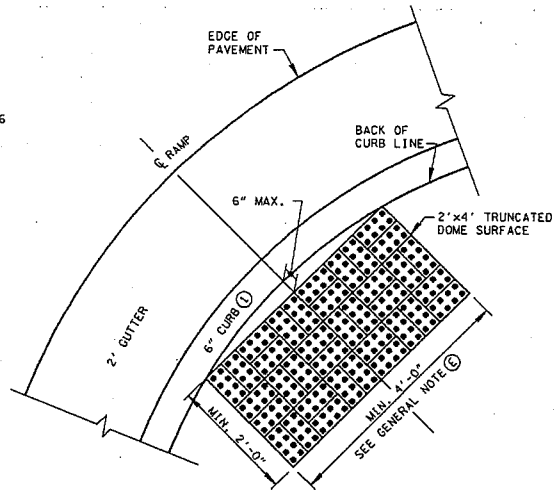
LANE CLOSURE WITH LEFT HAND MERGE AND LANE SHIFT

11-11-04 | T-WZ-21

- REV. 7-17-07: REVISED SIZE AND SPACING OF TRUNCATED DOMES, ADDED NOTE Ⓒ MODIFIED SPECIAL PAVER NOTES.
- REV. 4-13-11: ADDED LOWERED CURB FOOTNOTE Ⓘ TO TRUNCATED DOME DETAIL. MISC. EDITS TO DRAWING.

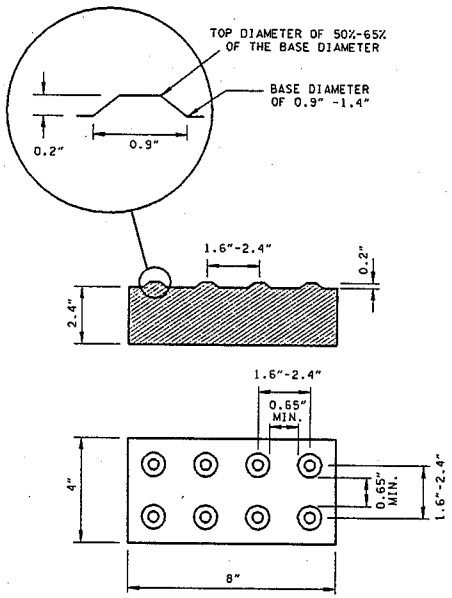


PLAN VIEW
(4-WAY INTERSECTION)



NOTE Ⓘ : CURB SHALL BE LOWERED ACROSS ENTIRE WIDTH OF RAMP

DETAIL OF TRUNCATED DOME SURFACE IN RADIUS



CONCRETE PAVER WITH TRUNCATED DOME SURFACE
(SEE SPECIAL PAVER NOTES)

SPECIAL PAVER NOTES

① CONCRETE PAVER UNITS SHALL MEET ALL REQUIREMENTS OF ASTM C-936. 4"X8" CONCRETE PAVERS SHALL BE PLACED IN A BASKET WEAVE PATTERN, AS SHOWN. CONCRETE PAVERS OF OTHER DIMENSIONS ARE ALSO ACCEPTABLE PROVIDED THE PAVERS CAN BE PLACED IN A 2'X4' DIMENSION WITHOUT CUTTING THE PAVERS AND PAVER DEPTH IS 2.4".

② COMPOSITE TILES WITH NOMINAL DEPTH OF 0.4" MAY BE USED INSTEAD OF CONCRETE PAVERS. COMPOSITE TILES SHALL BE INSTALLED SO THAT DOMES ARE ALIGNED IN A SQUARE GRID PATTERN.

③ CONCRETE PAVER UNITS SHALL HAVE A TRUNCATED DOME TOP SURFACE FOR DETECTABLE WARNING TO PEDESTRIANS.

④ CONCRETE PAVER UNITS OR COMPOSITE TILES SHALL BE A TRADITIONAL BRICK RED COLOR UNLESS SHOWN OTHERWISE IN THE PLANS.

⑤ CONCRETE PAVER UNITS SHALL BE SAW CUT ONLY AND CUT UNITS SHALL NOT BE LESS THAN 25 PERCENT OF A FULL UNIT.

⑥ ALL PRODUCTS LISTED ON THE QUALIFIED PRODUCTS LIST ARE ACCEPTABLE.

⑦ PLACE A MINIMUM TOTAL PAVER WIDTH OF 2'-0" ADJACENT TO CURB LINE.

GENERAL NOTES

Ⓐ DETAILS SHOWN ON THIS PLAN APPLY TO THE CONSTRUCTION OR RECONSTRUCTION OF STREETS, CURBS, OR SIDEWALKS.

Ⓑ CURB RAMPS ARE TO BE LOCATED AS SHOWN ON THE PLANS.

Ⓒ RAMPS SHALL BE PROVIDED AT ALL CORNERS OF STREET INTERSECTIONS WHERE THERE IS EXISTING OR PROPOSED SIDEWALK AND CURB. RAMPS SHALL ALSO BE PROVIDED AT WALK LOCATIONS IN MID-BLOCK AND ACROSS FROM CORNER RAMPS AT T-INTERSECTIONS.

Ⓓ THE FIRST TWO FEET OF RAMP MUST CONSIST OF A TRUNCATED DOMED SURFACE. RAMPS SHALL INCLUDE THE TRUNCATED DOME SURFACE TO PROVIDE A DETECTABLE WARNING FOR VISUALLY IMPAIRED PEDESTRIANS.

Ⓔ THE DETECTABLE WARNING SHOULD EXTEND THE FULL WIDTH OF THE CURB RAMP (EXCLUSIVE OF FLARED SIDES).

Ⓕ THE DETECTABLE WARNING SURFACES SHALL PROVIDE A 70 PERCENT CONTRAST IN LIGHT REFLECTANCE WITH THE ADJOINING SURFACE.

Ⓖ CARE SHALL BE TAKEN TO ASSURE A UNIFORM GRADE ON THE RAMP. THE GRADE SHALL BE FREE OF SAGS AND SHORT GRADE CHANGES.

Ⓗ DRAINAGE STRUCTURES SHALL NOT BE PLACED IN LINE WITH RAMPS.

Ⓘ THE NORMAL GUTTER LINE PROFILE SHALL BE MAINTAINED THROUGH THE AREA OF THE RAMP.

Ⓙ CROSSWALK MARKINGS, IF USED, SHALL BE LOCATED AS SHOWN ON THE APPLICABLE HANDICAP RAMP STD. DWG. SEE STD. DWG. T-M-4 FOR TYPICAL STOP LINE PLACEMENT AND STANDARD CROSS WALK MARKING.

Ⓚ COST OF THE LOWERED CURB AND GUTTER TO BE INCLUDED IN THE PRICE OF ITEM NO. 702-01, CONCRETE CURB OR ITEM NO. 702-03, CONCRETE COMBINED CURB & GUTTER.

Ⓛ ENGINEER SHOULD BE NOTIFIED FOR ASSESMENT IF THE HANDICAP RAMP SIDE FLARES EXCEED 10' IN LENGTH DUE TO THE LONGITUDINAL ROADWAY GRADE.

Ⓜ ALL COST OF INSTALLING HANDICAP RAMPS INCLUDING TRUNCATED DOME IN EXISTING SIDEWALK AREAS INCLUDING REMOVAL OF THE EXISTING SIDEWALK SHALL BE BID FOR UNDER THE FOLLOWING PAY ITEM:

701-02.01, CONCRETE HANDICAP RAMP (RETROFIT) PER SQUARE FOOT.

PAYMENT SHALL INCLUDE ALL MATERIALS, EQUIPMENT, AND LABOR NECESSARY FOR CONSTRUCTION OF THE HANDICAP RAMP(S).

Ⓝ ALL COST OF INSTALLING HANDICAP RAMPS INCLUDING TRUNCATED DOME IN NEWLY CONSTRUCTED SIDEWALK AREAS SHALL BE BID FOR UNDER THE FOLLOWING PAY ITEM:

701-02.03, CONCRETE HANDICAP RAMP PER SQUARE FOOT.

PAYMENT SHALL INCLUDE ALL MATERIALS, EQUIPMENT, AND LABOR NECESSARY FOR CONSTRUCTION OF THE HANDICAP RAMP(S).

Ⓞ SURFACE TEXTURE TO BE OBTAINED BY A COURSE BROOMING TRANSVERSE TO THE SLOPE OF RAMP.

Ⓟ FOR SIGNALIZED INTERSECTIONS THAT REQUIRE PEDESTRIAN SIGNAL PUSH BUTTONS, SEE TDOT TRAFFIC DESIGN MANUAL FOR PLACEMENT AND DETAILS.

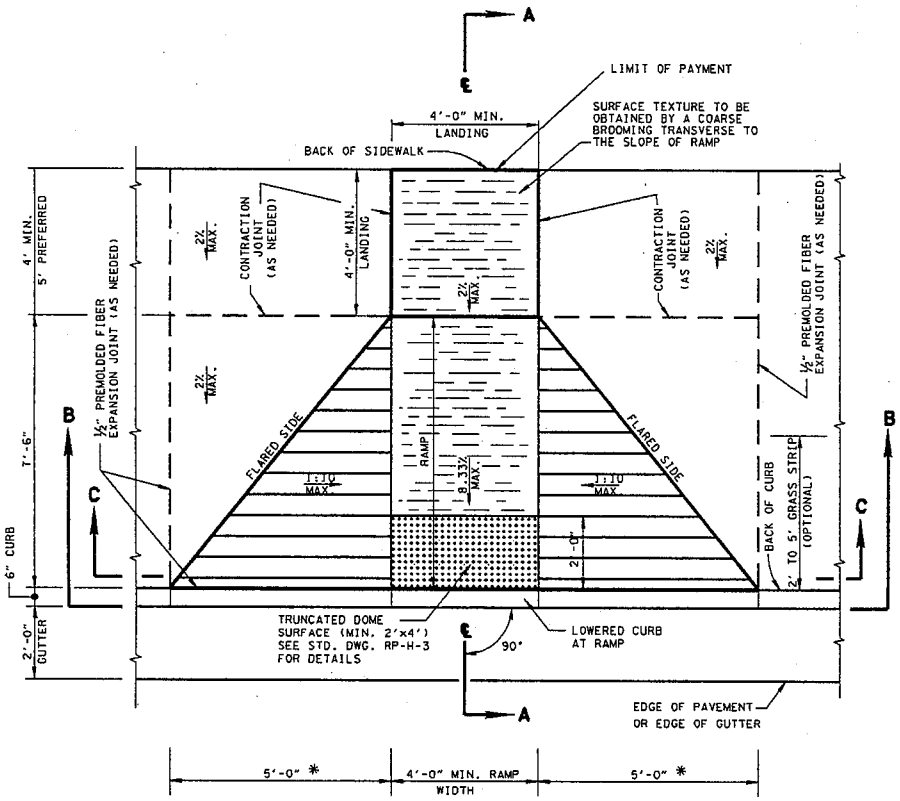
- MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

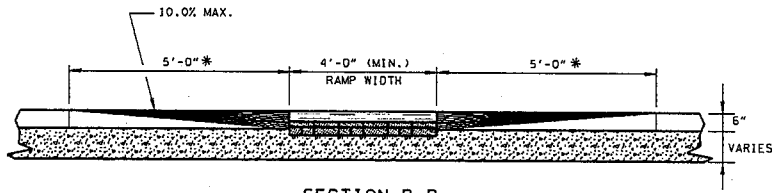
HANDICAP RAMP AND TRUNCATED DOME SURFACE DETAIL

1-15-07 | RP-H-3

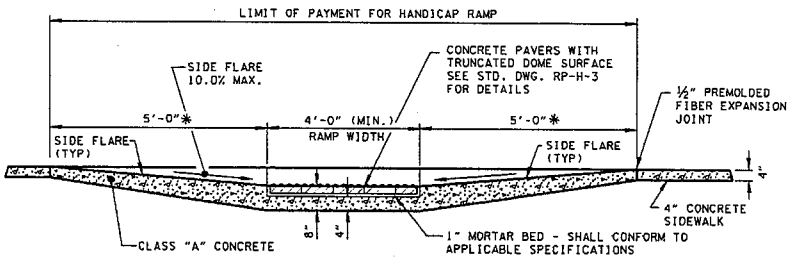
REV. 4-13-11: ADDED CURB NOTE AND REVISED RAMP DIMENSION IN SECTION A-A. ADDED FOOTNOTE ①, MISC. EDITS TO DRAWING.



PLAN VIEW

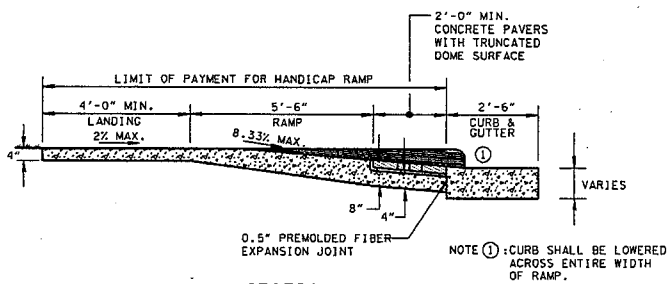


SECTION B-B

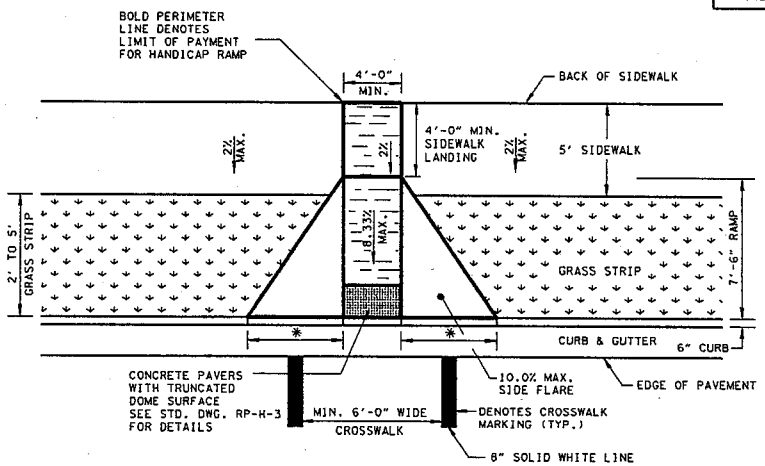


SECTION C-C

* DIMENSION VARIES RELATIVE TO LONGITUDINAL ROADWAY GRADE SEE GENERAL NOTE ① ON RP-H-3



SECTION A-A



TANGENT SECTION WITH GRASS STRIP

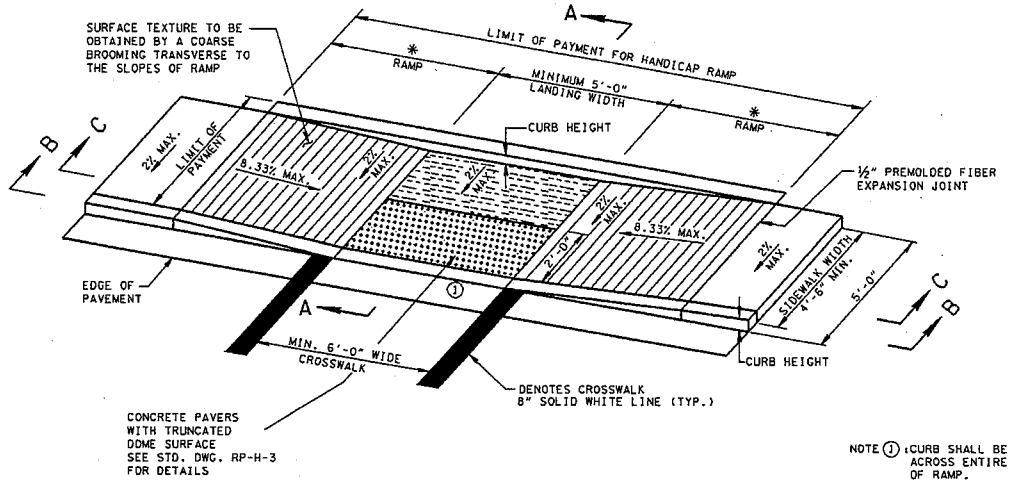
MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

PERPENDICULAR CURB RAMP

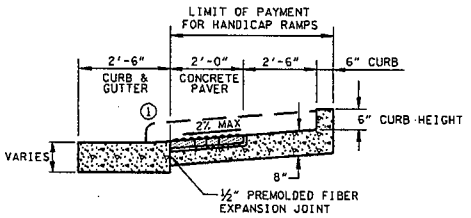
1-15-07 | RP-H-4

REV. 4-13-11: ADDED FOOTNOTE (J), ADJUSTED DIMENSIONS IN RAMP DETAIL, MISC. EDITS TO DRAWING.



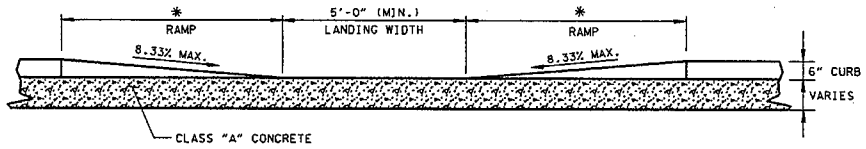
PARALLEL CURB RAMP DETAIL

NOTE (J): CURB SHALL BE LOWERED ACROSS ENTIRE WIDTH OF RAMP.

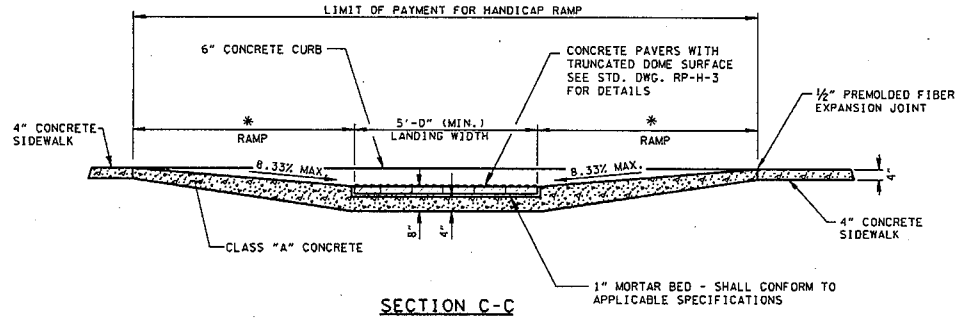


SECTION A-A

* DIMENSION VARIES RELATIVE TO LONGITUDINAL ROADWAY GRADE SEE GENERAL NOTE (K) ON RP-H-3



SECTION B-B



SECTION C-C

GENERAL NOTES

(A) THE FIRST TWO FEET OF RAMP MUST CONSIST OF A TRUNCATED DOMED SURFACE. RAMPS SHALL INCLUDE THE TRUNCATED DOME SURFACE TO PROVIDE A DETECTABLE WARNING FOR VISUALLY IMPAIRED PEDESTRIANS.

(B) THE COST OF THE LOWERED CURB AND GUTTER TO BE INCLUDED IN THE PRICE OF ITEM NO. 702-01, CONCRETE CURB OR ITEM NO. 702-03, CONCRETE COMBINED CURB & GUTTER.

(C) ALL COST OF INSTALLING HANDICAP RAMPS IN NEWLY CONSTRUCTED SIDEWALK AREAS SHALL BE BID FOR UNDER THE FOLLOWING PAY ITEM:

701-02.03 CONCRETE HANDICAP RAMP PER SQUARE FOOT.

PAYMENT SHALL INCLUDE ALL MATERIALS (INCLUDING TRUNCATED DOME SURFACE), INTREGAL BACK CURB, EQUIPMENT, AND LABOR NECESSARY FOR CONSTRUCTION OF THE HANDICAP RAMP(S).

(D) CONCRETE PAVER SHALL MEET THE REQUIREMENTS OF ASTM C-936 AND SHALL BE LAID IN TWO BY TWO UNITS BASKET WEAVE PATTERN, UNLESS OTHERWISE SHOWN ON THE PLANS.

(E) SEE SPECIAL PAVER NOTES ON STD. DWG. RP-H-3.

(F) DESIGN/CONSTRUCTION MODIFICATIONS MAY BE REQUIRED FOR HANDICAP RAMPS TO BE INSTALLED ALONG A ROADWAY WITH LONGITUDINAL GRADES EXCEEDING FIVE PERCENT.

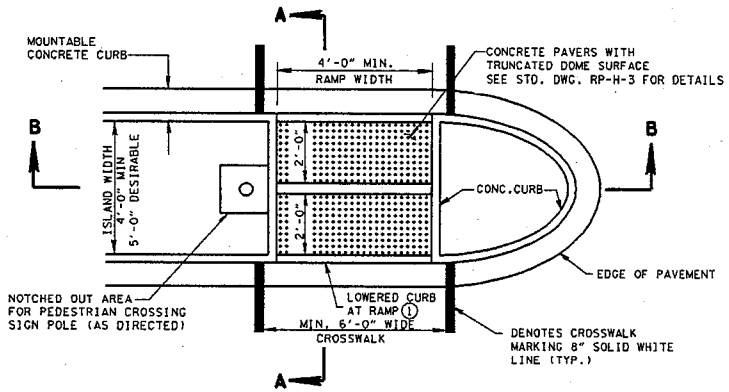
MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

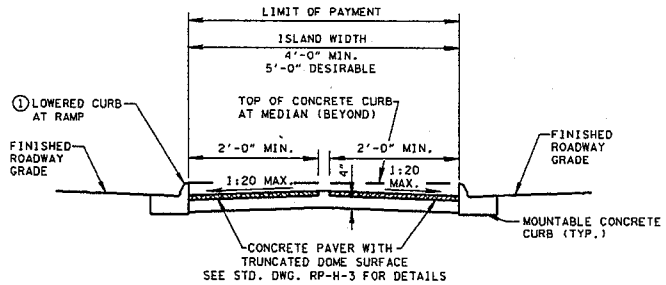
PARALLEL CURB RAMP

1-15-07 RP-H-5

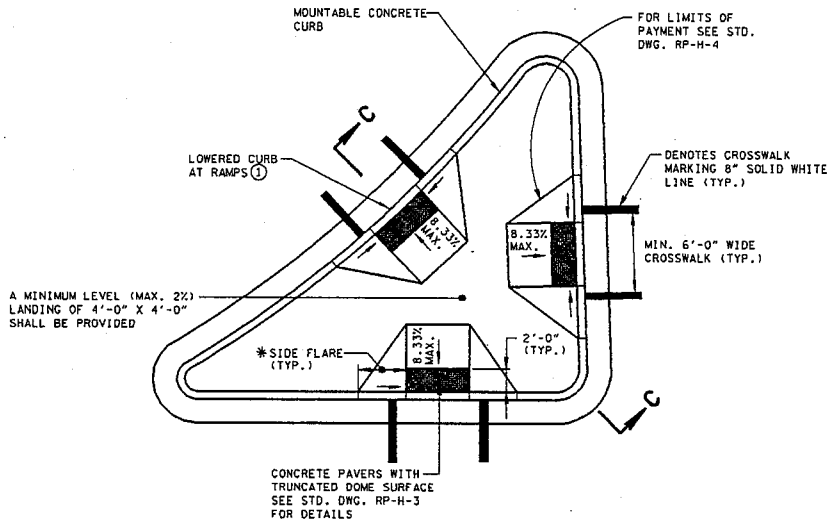
REV. 4-13-11: CHANGED CURB TYPE, ADJUSTED CROSSWALK MARKINGS, ADDED FOOTNOTE ①, MISC. EDITS TO DRAWING.



MEDIAN CROSSING PLAN VIEW

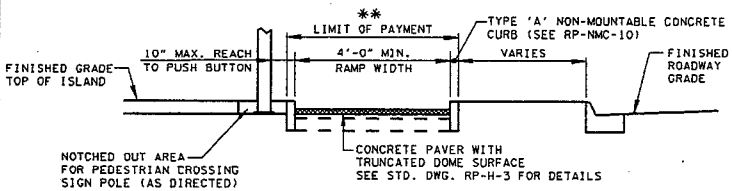


MEDIAN CROSSING SECTION A-A

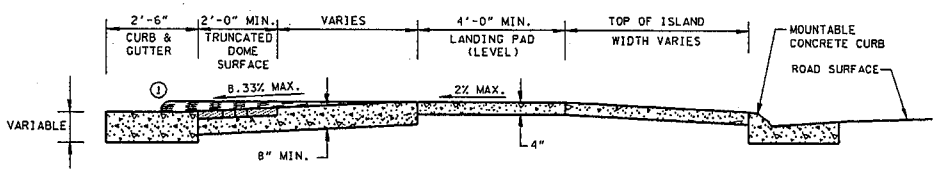


RAISED RIGHT TURN CHANNELIZATION ISLAND PLAN VIEW

* DIMENSION VARIES RELATIVE TO LONGITUDINAL ROADWAY GRADE 10.0% MAX. (8.33% DESIRABLE)



MEDIAN CROSSING SECTION B-B



SECTION C-C

** SEE NOTE Ⓒ ON RP-H-5

NOTE ①: CURB SHALL BE LOWERED ACROSS ENTIRE WIDTH OF RAMP.

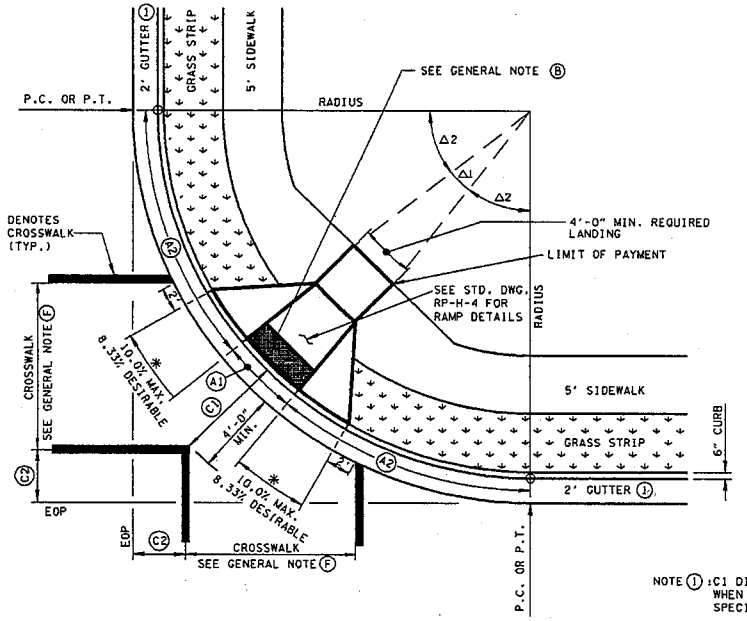
MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

MEDIAN CROSSING

1-15-07 RP-H-6

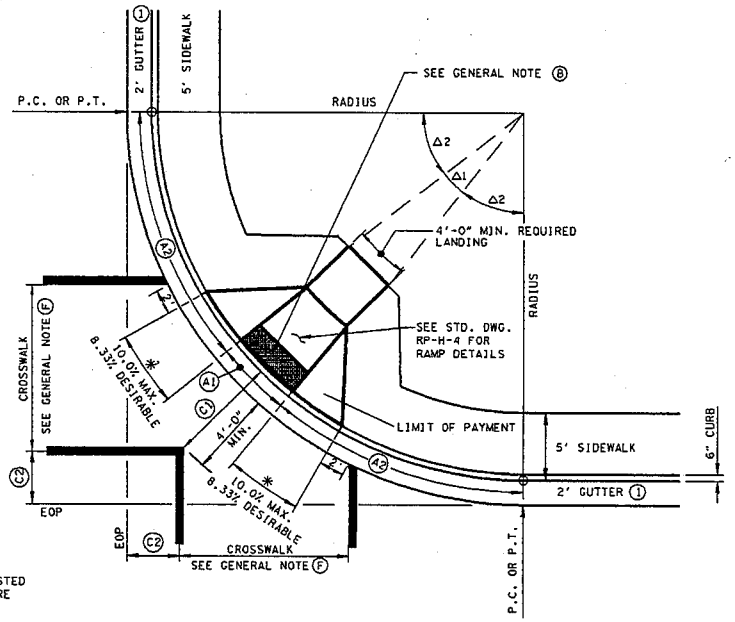
■ REV. 4-13-11; REVISED TABLE DIMENSIONS, ADDED NOTE (1), AND ADDED GUTTER TO CROSSWALK INTERSECTION DIMENSION.



TYPE 1
RAMP IN RADIUS (WITH GRASS STRIP)

* DIMENSION VARIES RELATIVE TO LONGITUDINAL ROADWAY GRADE

NOTE (1): C1 DIMENSION SHALL BE ADJUSTED WHEN OTHER GUTTER WIDTHS ARE SPECIFIED ON PLANS.



TYPE 1 ALTERNATE
RAMP IN RADIUS (SIDEWALK ADJACENT CURB & GUTTER)

* DIMENSION VARIES RELATIVE TO LONGITUDINAL ROADWAY GRADE

TABLE OF DIMENSIONS (1)
PERPENDICULAR RAMPS - RADIUS OF 20' TO 75'

R RADIUS (FEET)	(A1) (FEET)	(A2) (FEET)	(C1) (FEET)	(C2) (FEET)	Δ1	Δ2	ESTIMATED QUANTITY (SQUARE FEET)
20	9.55	10.54	6.00	3.62	28°04'21"	30°57'50"	113
25	7.48	15.50	6.00	5.08	17°29'32"	36°15'14"	103
30	6.53	19.90	6.00	6.54	12°40'49"	38°39'35"	98
35	5.98	24.11	6.00	8.01	9°56'22"	40°01'49"	95
40	5.63	28.21	6.00	9.47	8°10'16"	40°54'52"	93
45	5.39	32.26	6.00	10.94	6°56'11"	41°31'54"	91
50	5.21	36.27	6.00	12.40	6°01'32"	41°59'14"	90
55	5.07	40.27	6.00	13.87	5°19'34"	42°20'13"	90
60	4.96	44.25	6.00	15.33	4°46'19"	42°36'51"	89
65	4.87	48.22	6.00	16.80	4°19'20"	42°50'20"	89
70	4.79	52.19	6.00	18.26	3°57'00"	43°01'30"	88
75	4.73	56.15	6.00	19.72	3°38'12"	43°10'54"	88

(1) VALUES SHOWN IN TABLE ARE BASED ON A 90° INTERSECTION ON 0.0% ROADWAY GRADE AND ARE APPROXIMATE ONLY.

GENERAL NOTES

(A) FOR SIGNALIZED INTERSECTIONS THAT REQUIRE PEDESTRIAN SIGNAL PUSH BUTTONS, SEE TDOT TRAFFIC DESIGN MANUAL FOR PLACEMENT DETAILS.

(B) SEE STANDARD DRAWING RP-H-3 FOR TRUNCATED DOMED SURFACE DETAILS.

(C) 5'-0" SIDEWALK WIDTH INCLUDES 6" CONCRETE CURB.

(D) GRATES FOR STORM DRAINS SHALL NOT BE PLACED IN THE ACCESSIBLE ROUTE.

(E) C1 DIMENSIONS SHALL NOT BE LESS THAN 4'.

(F) CROSS WALK MARKINGS SHALL BE CALCULATED BY USING THE DIMENSIONS FROM THE TABLES ON A CASE BY CASE BASIS, UNLESS SPECIFIED.

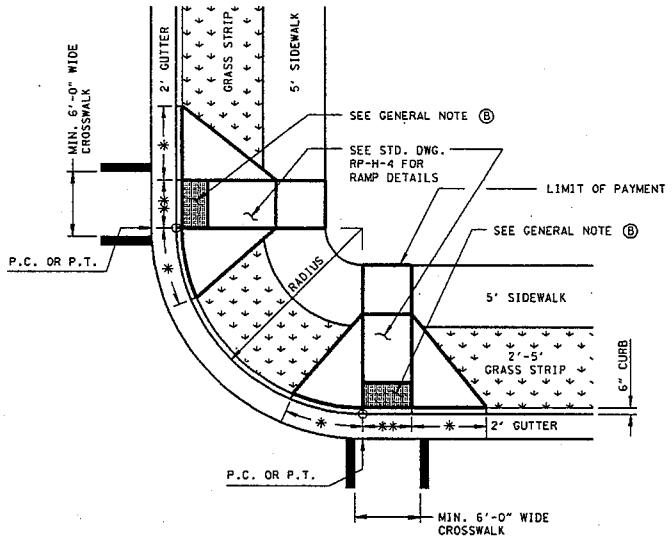
□ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

PERPENDICULAR HANDICAP RAMP FOR 20' THRU 75' RADIUS

1-15-07 | RP-H-7

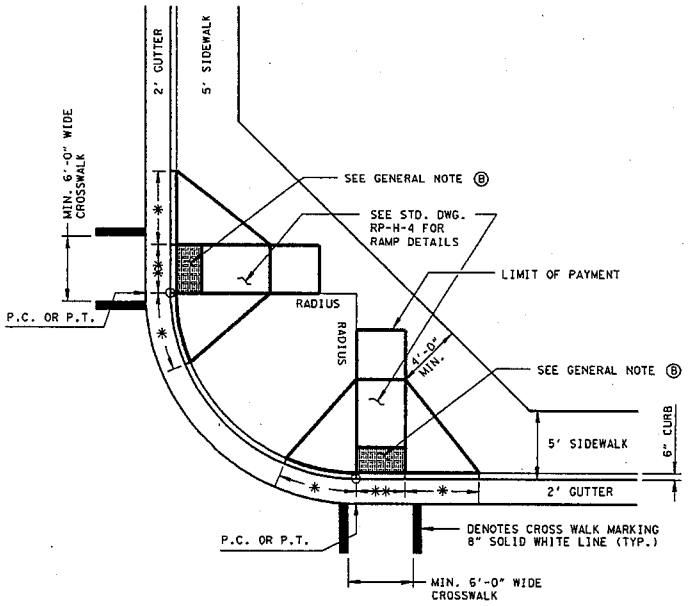
REV. 4-13-11; ADJUSTED CROSSWALK MARKINGS. ADDED TYPE 2 SIDEWALK DIMENSION, MISC. EDITS TO DRAWING.



TYPE 2
RAMP OUTSIDE RADIUS (WITH GRASS STRIP)

* DIMENSION VARIES RELATIVE TO LONGITUDINAL ROADWAY GRADE 10.0% MAX.(8.33% DESIRABLE)

** 4'-0" MINIMUM REQUIRED



TYPE 2 ALTERNATE
RAMP OUTSIDE RADIUS (SIDEWALK ADJACENT TO CURB & GUTTER)

* DIMENSION VARIES RELATIVE TO LONGITUDINAL ROADWAY GRADE 10.0% MAX.(8.33% DESIRABLE)

** 4'-0" MINIMUM REQUIRED

GENERAL NOTES

(A) FOR SIGNALIZED INTERSECTIONS THAT REQUIRE PEDESTRIAN SIGNAL PUSH BUTTONS, SEE TDOT TRAFFIC DESIGN MANUAL FOR PLACEMENT DETAILS.

(B) SEE STANDARD DRAWING RP-H-3 FOR TRUNCATED DOMED SURFACE DETAILS.

(C) 5'-0" SIDEWALK WIDTH INCLUDES 6" CONCRETE CURB.

(D) GRATES FOR STORM DRAINS SHALL NOT BE PLACED IN THE CROSSWALK OR IN FRONT OF THE HANDICAP RAMP.

(E) DESIRABLE DIMENSIONS SHALL BE USED UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

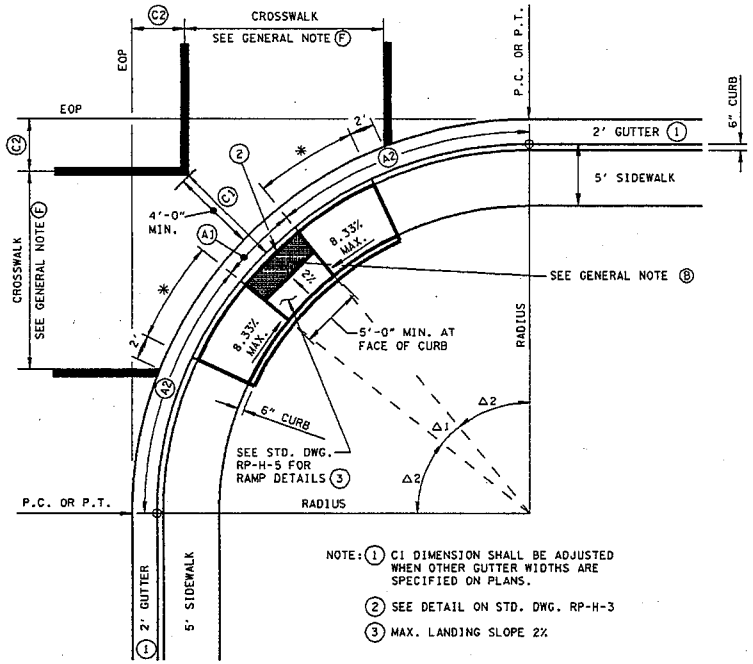
MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

PERPENDICULAR HANDICAP RAMP FOR 20' THRU 75' RADIUS

1-15-07 | RP-H-8

REV. 4-13-11: ADJUSTED CROSSWALK MARKINGS, ADDED NOTE (1). REVISED TABLE DIMENSIONS, ADDED GUTTER TO CROSSWALK INTERSECT DIMENSION, OTHER MISC. EDITS TO DRAWINGS.

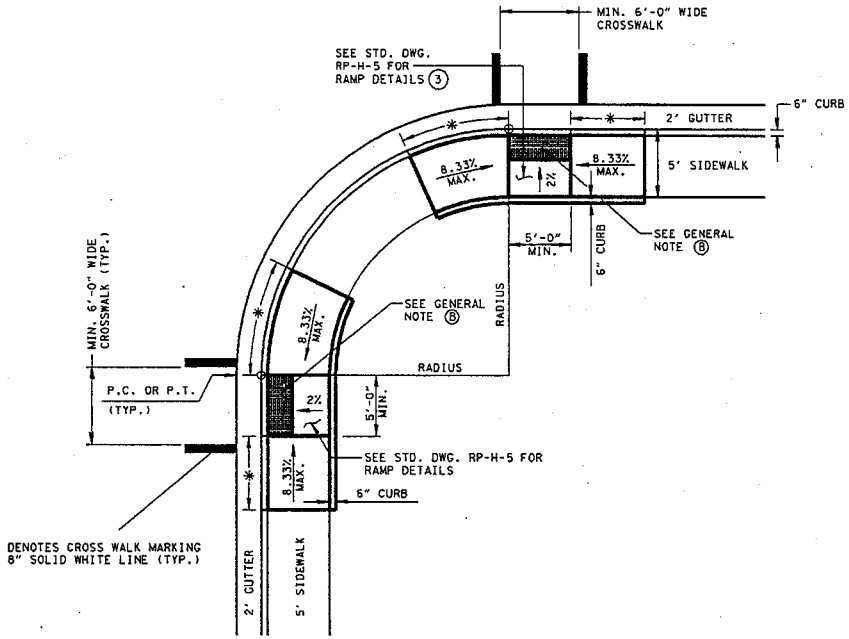


NOTE: (1) C1 DIMENSION SHALL BE ADJUSTED WHEN OTHER GUTTER WIDTHS ARE SPECIFIED ON PLANS.
(2) SEE DETAIL ON STD. DWG. RP-H-3
(3) MAX. LANDING SLOPE 2%

TYPE 3
(RAMP IN RADIUS)

(CONSTRUCTION IN RADIUS)

* DIMENSION VARIES RELATIVE TO LONGITUDINAL ROADWAY GRADE



TYPE 4
(RAMP OUTSIDE RADIUS)

* DIMENSION VARIES RELATIVE TO LONGITUDINAL ROADWAY GRADE

TABLE OF DIMENSIONS (1)
PARALLEL HANDICAP RAMPS - RADIUS OF 20' TO 75'

R RADIUS (FEET)	(A1) (FEET)	(A2) (FEET)	(C1) (FEET)	(C2) (FEET)	Δ1	Δ2	ESTIMATED QUANTITY (SQUARE FEET)
20	6.50	12.07	6.00	3.62	19°05'55"	35°27'03"	96
25	6.13	16.18	6.00	5.08	14°19'26"	37°50'17"	94
30	5.90	20.22	6.00	6.54	11°27'33"	39°16'14"	92
35	5.75	24.22	6.00	8.01	9°32'57"	40°13'31"	91
40	5.64	28.20	6.00	9.47	8°11'06"	40°54'27"	90
45	5.56	32.17	6.00	10.94	7°09'43"	41°25'08"	89
50	5.50	36.13	6.00	12.40	6°21'58"	41°49'01"	89
55	5.45	40.08	6.00	13.87	5°43'46"	42°08'07"	88
60	5.41	44.03	6.00	15.33	5°12'31"	42°23'44"	88
65	5.38	47.97	6.00	16.80	4°46'29"	42°36'46"	88
70	5.35	51.91	6.00	18.26	4°24'27"	42°47'47"	88
75	5.32	55.85	6.00	19.72	4°05'33"	42°57'13"	87

(1) VALUES SHOWN IN TABLE ARE BASED ON A 90° INTERSECTION ON 0.0% ROADWAY GRADE AND ARE APPROXIMATE ONLY.

GENERAL NOTES

(A) FOR SIGNALIZED INTERSECTIONS THAT REQUIRE PEDESTRIAN SIGNAL PUSH BUTTONS, SEE TDOT TRAFFIC DESIGN MANUAL FOR PLACEMENT DETAILS.

(B) SEE STANDARD DRAWING RP-H-3 FOR TRUNCATED DOMED SURFACE DETAILS.

(C) 5'-0" SIDEWALK WIDTH INCLUDES 6" CONCRETE CURB.

(D) GRATES FOR STORM DRAINS SHALL NOT BE PLACED IN THE CROSSWALK OR IN FRONT OF THE HANDICAP RAMP.

(E) DESIRABLE DIMENSIONS SHALL BE USED UNLESS OTHERWISE DIRECTED BY THE ENGINEER.

(F) CROSS WALK MARKINGS SHALL BE CALCULATED BY USING THE DIMENSIONS FROM THE TABLE ON A CASE BY CASE BASIS, UNLESS SPECIFIED.

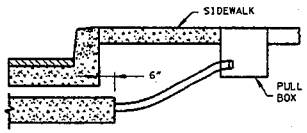
MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

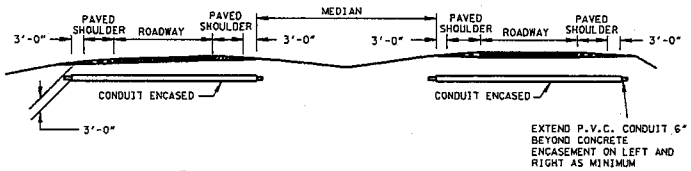
PARALLEL HANDICAP RAMP FOR 20' THRU 75' RADIUS

1-15-07 | RP-H-9

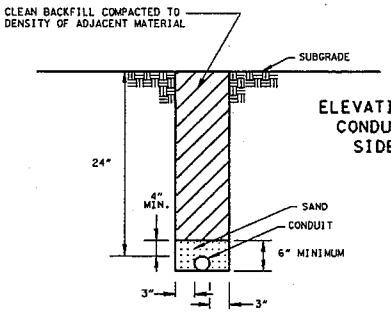
- REV. 5-25-11: ADDED CONDUIT RISER ATTACHMENT DETAIL FOR SHARED USE UTILITY POLES.
- REV. 7-29-96: REDREW SHEET ON CADD AND MADE MINOR CHANGES.
  REV. 12-16-03: DELETED SPLICING DETAIL AND ADDED COMM/POWER BACKBONE TRENCH LAYOUT.
- REV. 7-29-04: ADDED TRENCH LAYOUT FOR COMM/ POWER BACKBONE DETAIL. DELETE DIRECT BURIAL DETAIL & TYPICAL SPLICING TAPING DETAILS.



ELEVATION VIEW SHOWING CONDUIT PLACEMENT IN SIDEWALK SECTION

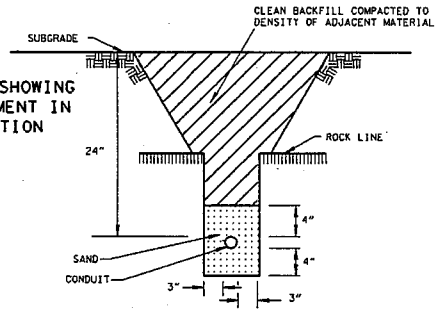


ELEVATION VIEW SHOWING CONDUIT PLACEMENT IN ROADWAY WITH PAVED SHOULDERS

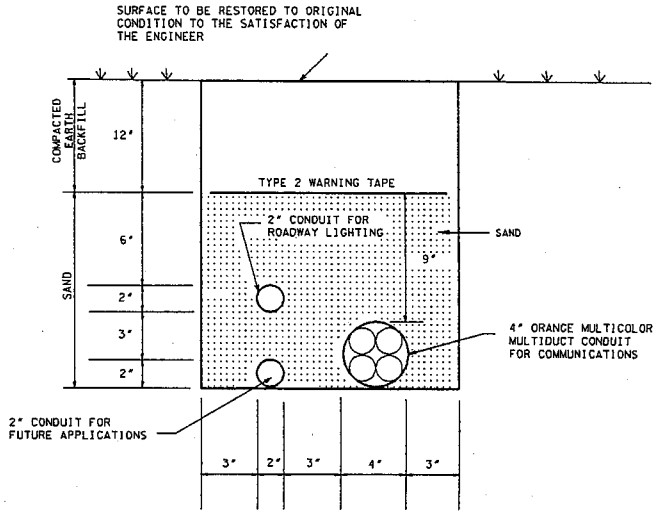


ELEVATION VIEW SHOWING CONDUIT PLACEMENT IN SIDEWALK SECTION

DIRECT BURIAL CONDUIT DETAILS IN EARTH

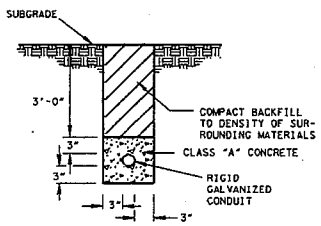


DIRECT BURIAL CONDUIT DETAILS IN ROCK

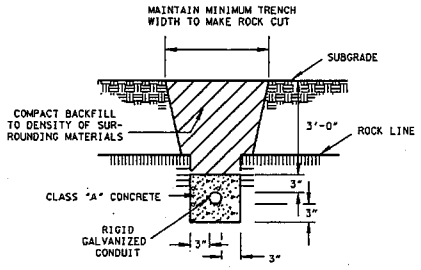


TYPICAL TRENCH LAYOUT FOR COMM/ POWER BACKBONE

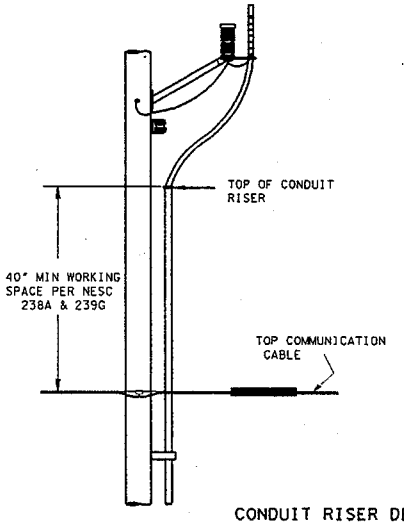
NOTE : WHERE THERE IS MORE THAN ONE CONDUIT PER TRENCH, CONDUITS SHALL NOT BE PLACED CLOSER THAN 203 mm CENTER TO CENTER.

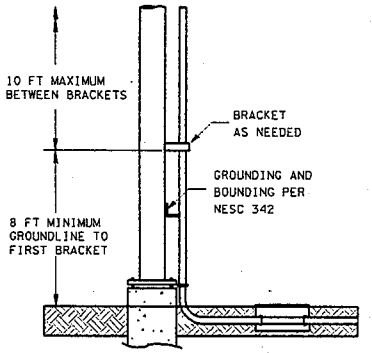


CONCRETE ENCASED CONDUIT IN EARTH



CONCRETE ENCASED CONDUIT IN ROCK





CONDUIT RISER DETAIL FOR SHARED USE POLE

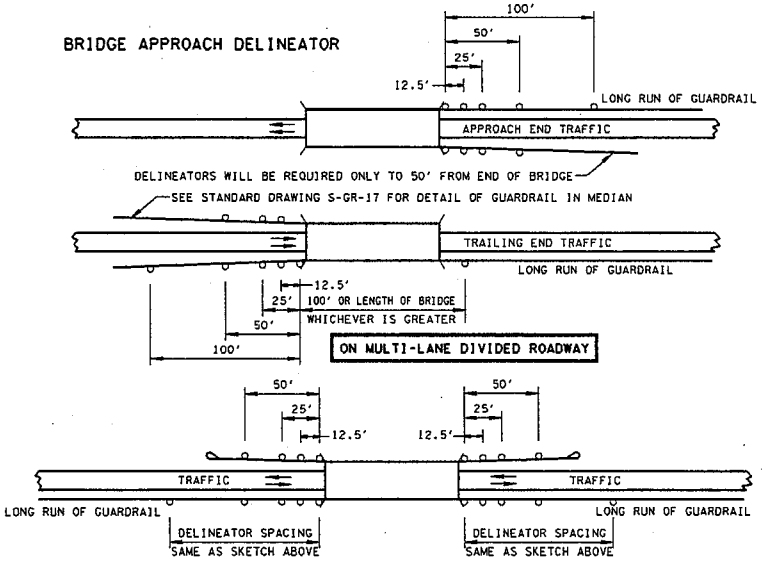
- MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

STANDARD LIGHTING DETAILS CONDUIT, CABLE INSTALLATION

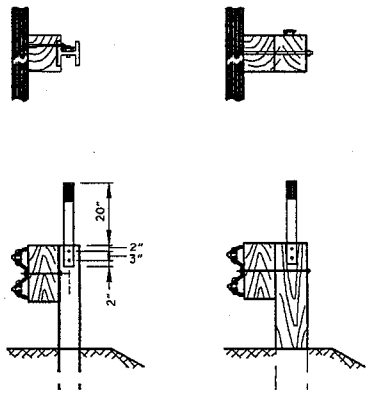
T-L-4

BRIDGE APPROACH DELINEATOR



LOCATION OF BRIDGE APPROACH GUARDRAIL DELINEATORS

NOTE: "o" DENOTES GUARDRAIL DELINEATORS. (SHOULDER LINES AND GUARDRAIL POSTS NOT INDICATED.)



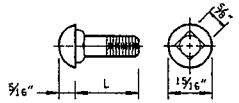
TYPICAL GUARDRAIL FLEXIBLE DELINEATOR INSTALLATION

NOTE: SEE STANDARD DRAWING T-S-11 FOR OTHER DETAILS. DELINEATOR MAY BE FULL LENGTH BEHIND POST AS AN ALTERNATE.

FLEXIBLE DELINEATOR GENERAL NOTES

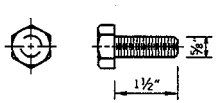
- (A) DELINEATORS SHALL CONFORM TO NOTES AND DETAILS SPECIFIED ON STANDARD DRAWING T-S-11.
- (B) DELINEATORS SHALL BE INSTALLED ACROSS BRIDGES ONLY WHEN GUARDRAIL IS CONTINUOUS ACROSS BRIDGES. SPACING ON BRIDGES SHALL BE AT 12'-6" INTERVALS.
- (C) THE COLOR OF DELINEATORS SHALL CONFORM TO THE COLOR OF EDGELINES STIPULATED IN SECTION 3B-6 OF THE MUTCD (CURRENT EDITION).
- (D) DELINEATORS SHALL BE FACED TOWARD THE APPROACHING TRAFFIC IN LANE ADJACENT TO THE GUARDRAIL AT ALL LOCATIONS.
- (E) THE GUARDRAIL DELINEATORS WILL BE SECURED TO THE WOOD POST BY TWO (2) 16 PENNY NAILS AND TO THE STEEL POST BY TWO (2) 2-PIECE CHERRY MATE RIVETS (MODEL: BALM-8-BP12) OR EQUIVALENT. A ⅜" GALVANIZED FLANGED NUT WILL BE PLACED BETWEEN THE DELINEATOR AND THE POST ON EACH OR RIVET.
- (F) THE TWO HOLES IN THE STEEL GUARDRAIL POSTS USED TO ATTACH THE DRILLED IN THE FIELD. IF THE HOLES ARE SHOP DRILLED IT SHALL BE DELINEATOR SHALL BE ¼" IN DIAMETER AND SHALL BE SHOP DRILLED OR BE DONE PRIOR TO GALVANIZING THE POST. IF THE HOLES ARE FIELD DRILLED THEY SHALL BE THOROUGHLY PAINTED WITH A TOUCH-UP GALVANIZING SPRAY PAINT PRIOR TO ATTACHING THE DELINEATOR POST.
- (G) THE COST OF FURNISHING AND INSTALLING THESE BRIDGE APPROACH GUARDRAIL DELINEATORS SHALL BE INCLUDED IN THE PRICE BID FOR THE ITEMS OF GUARDRAIL TO WHICH THE DELINEATORS ARE ATTACHED.
- (H) ONLY DELINEATORS LISTED ON THE QPL, LIST 1, SECTION G.2 GUARDRAIL POST DELINEATION, MAY BE USED.

W-BEAM BARRIER FASTENING HARDWARE



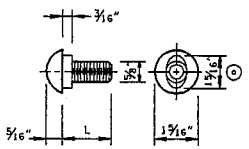
⅜" DIAMETER CARRIAGE BOLT

THIS WASHER IS TO BE USED UNDER ALL BOLT HEADS AND NUTS SUBJECT TO TURNING WHEN TORQUED. ROUND WASHERS SHALL BE STEEL, GALVANIZED IN ACCORDANCE WITH AASHTO M232 SPECIFICATION.



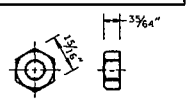
⅜" DIAMETER HEX BOLT

(FOR FASTENING STEEL POST BLOCK-OUTS TO POSTS AND TO SPLICE TUBULAR W-BEAM RAIL ELEMENTS)

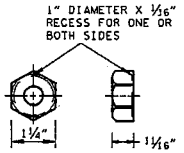


⅜" DIAMETER BUTTON HEAD BOLT

ⓞ TOLERANCES +1/16" AND -1/64"

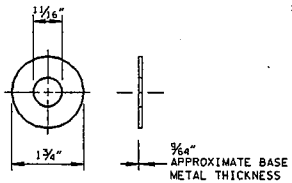


⅜" DIAMETER HEX NUT



⅜" DIAMETER RECESS NUT

THIS NUT IS TO BE USED AS AN ALTERNATE TO SPLICE TUBULAR W-BEAM RAIL ELEMENTS (NO WASHER REQUIRED)



STEEL WASHER

SPECIFICATIONS

- (S1) BOLTS SHALL CONFORM TO THE REQUIREMENTS OF ASTM A307 AND NUTS TO THE REQUIREMENTS OF ASTM A563M, GRADE "A" OR BETTER, AND BE GALVANIZED IN ACCORDANCE WITH ASTM A153.
- (S2) DIMENSIONAL TOLERANCES NOT SHOWN OR IMPLIED ARE INTENDED TO BE THOSE CONSISTENT WITH THE PROPER FUNCTIONING OF THE PART, INCLUDING ITS APPEARANCE, AND ACCEPTED MANUFACTURING PRACTICES.

CARRIAGE BOLTS

L	THREAD LENGTH	INTENDED USE
1½"	FULL LENGTH THREAD	THIS BOLT IS A SPLICE BOLT FOR THE CHANNEL RUB RAIL ELEMENTS.
3"	1½" MINIMUM THREAD LENGTH	THIS BOLT IS FOR FASTENING CHANNEL RUB RAIL ELEMENTS TO STEEL POST.
11"	1¾" MINIMUM THREAD LENGTH	THIS BOLT IS FOR FASTENING CHANNEL RUB RAIL ELEMENTS TO WOOD POST.
14"	1¾" MINIMUM THREAD LENGTH	THIS BOLT IS FOR FASTENING RUB RAIL ELEMENTS TO WOOD POST WHEN USED FOR MEDIAN DIVIDERS.

BUTTON HEAD BOLTS

L	THREAD LENGTH	INTENDED USE
1¼"	FULL LENGTH THREAD	THIS BOLT IS FOR FASTENING "W" BEAM RAIL ELEMENTS AT JOINTS.
9½"	1¾" MINIMUM THREAD LENGTH	THIS BOLT IS FOR FASTENING "W" BEAM RAIL ELEMENTS TO METAL POST WITH WOOD BLOCK-OUTS.
18"	2½" MINIMUM THREAD LENGTH	THIS BOLT IS FOR FASTENING "W" BEAM RAIL ELEMENTS TO WOOD POST WITH WOOD BLOCK-OUTS.
25"	2" MINIMUM THREAD LENGTH	THIS BOLT IS FOR FASTENING "W" BEAM RAIL ELEMENTS TO WOOD POST WITH WOOD BLOCK-OUTS WHEN USED FOR MEDIAN DIVIDERS.

REV. 5-1-85: REDREW SHEET AND CHANGED GUARDRAIL MOUNTED DELINEATOR TO FLEXIBLE DELINEATOR.

REV. 11-14-85: CHANGED ⅝" BOLT AND NUT DETAILS.

REV. 3-1-86: ADDED TO DELINEATOR NOTE.

REV. 11-4-87: ADDED ⅜" RECESS NUT TO DRAWING.

REV. 10-26-91: REDREW AND REORGANIZED SHEET. UPDATED DRAWING TO 1991 STANDARDS.

□ REV. 1-19-92: MODIFIED CODING SYSTEM ON GENERAL NOTES AND SPECIFICATIONS.

REV. 7-29-98: CHANGED FLEXIBLE DELINEATOR INSTALLATION DETAIL.

REV. 9-5-98: CHANGED CARRIAGE AND BUTTON HEAD BOLT NOTES. DELETED DETAIL FOR SQUARE WASHER FOR BUTTON HEAD BOLTS.

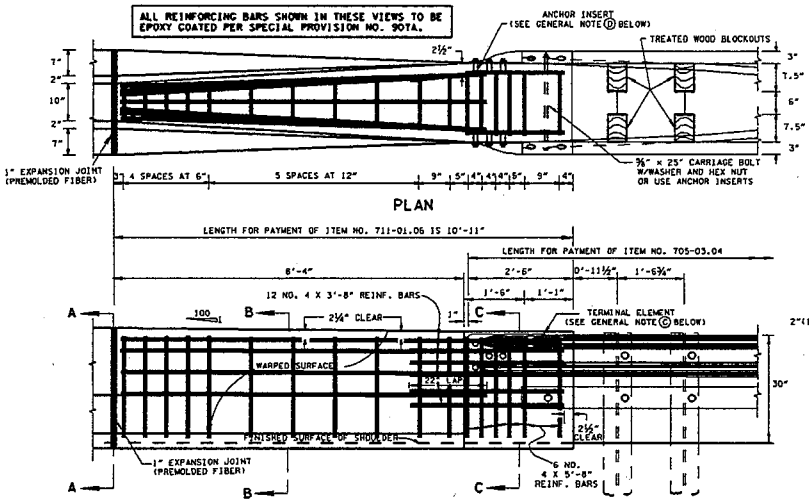
REV. 6-6-11: REORGANIZED SHEET AND ADDED GENERAL NOTE (H).

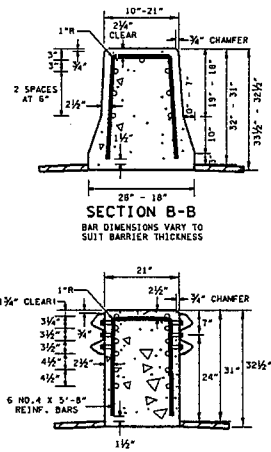
□ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

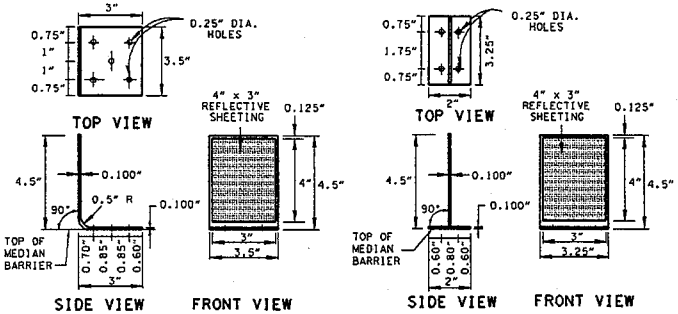
STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

W-BEAM BARRIER FASTENING HARDWARE AND BRIDGE APPROACH DELINEATORS

S-GR-14







REV. 7-29-98: MODIFIED PLAN VIEW, SECTION B-B AND SECTION C-C.

REV. 9-5-98: MODIFIED GENERAL NOTES (I) AND (J).

REV. 1-19-99: CHANGED TYPE OF MEDIAN BARRIER DELINEATORS AND MODIFIED GENERAL NOTES ACCORDINGLY.

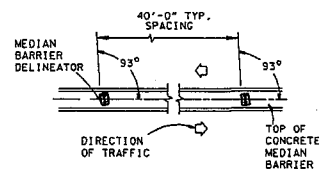
REV. 5-27-99: MODIFIED DIMENSION ON SIDE VIEW OF LEFT GROUP OF MEDIAN BARRIER DELINEATORS.

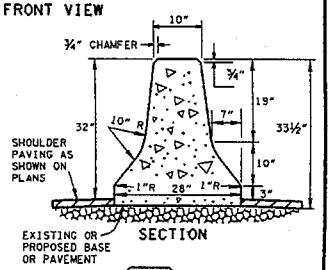
REV. 10-26-99: MODIFIED GENERAL NOTE (J).

REV. 5-27-01: CHANGED ITEM NO. 705-01.06 TO 705-03.04 IN ELEVATION VIEW. CHANGED GENERAL NOTE (F).

REV. 01-31-06: MODIFIED GENERAL NOTE (J).

REV. 6-6-11: ADDED GENERAL NOTES (M).





DETAIL OF TRANSITION FROM CONCRETE MEDIAN BARRIER TO METAL MEDIAN DIVIDER GUARDRAIL

GENERAL NOTES

(A) CONCRETE MEDIAN BARRIER SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION, SECTION 711 AND/OR THE SPECIAL PROVISIONS.

(B) SEE STANDARD DRAWING S-GR-20 FOR DETAILS OF MEDIAN DIVIDER GUARDRAIL AND FOR TERMINATING CONCRETE MEDIAN BARRIER.

(C) SEE STANDARD DRAWING S-GR-15 FOR DETAILS OF TERMINAL ELEMENT FOR ANCHOR BLOCK AND BRIDGE CONNECTIONS.

(D) SEE GENERAL NOTES ON STANDARD DRAWING S-GR-19 FOR REQUIREMENTS OF ANCHOR INSERTS.

(E) IF SAWED CONTRACTION JOINTS ARE USED, THE JOINTS MUST BE SAWED WITHIN FOUR (4) HOURS AFTER THE CONCRETE IS PLACED UNLESS DUE TO COOL WEATHER THE ENGINEER EXTENDS THIS TIME PERIOD. IN NO CASE WILL THE TIME PERIOD BE LONGER THAN EIGHT (8) HOURS.

(F) THE CONTRACTION JOINTS ARE TO BE SPACED AT 20 TO 25 FOOT INTERVALS WHEN CONSTRUCTED ON ASPHALT PAVEMENT. WHEN THE CONCRETE MEDIAN BARRIER IS ATTACHED TO CONCRETE PAVEMENT, THE CONTRACTION JOINTS WILL CORRESPOND TO THE JOINTS IN THE CONCRETE PAVEMENT. THE COST OF MATERIAL AND LABOR FOR THE JOINT INSTALLATION SHALL BE INCLUDED IN THE BID PRICE FOR CONCRETE MEDIAN BARRIER.

(G) THE TWO (2) INCH OPEN EXPANSION JOINTS SHALL BE PLACED AT A MAXIMUM SPACING NOT TO EXCEED 400 FEET. IF FIXED OBJECTS SUCH AS BRIDGE PIERS, BRIDGE ENDS, OVERHEAD SIGN SUPPORTS, OR OTHER FEATURES PROJECTING THROUGH, INTO OR AGAINST THE BARRIER EXIST THAT REQUIRE TWO INCH OPEN EXPANSION JOINTS, THEN THE DISTANCE BETWEEN THE EXPANSION JOINTS IS TO BE REDUCED IN ORDER TO ALLOW AN EQUAL DISTANCE BETWEEN JOINTS THAT IS LESS THAN 400 FEET. ALL ADDITIONAL STEEL REQUIRED AT EXPANSION JOINTS TO BE EPOXY COATED REINFORCING STEEL. THE COST OF MATERIAL AND LABOR FOR THE JOINT INSTALLATION SHALL BE INCLUDED IN THE BID PRICE FOR CONCRETE MEDIAN BARRIER.

(H) THE CONCRETE MEDIAN BARRIER SHALL BE GIVEN AN APPLIED TEXTURE FINISH. THE COLOR OF THE FINISH SHALL BE WHITE, FEDERAL SPECIFICATION NO. 37886. THE COST OF MATERIAL AND LABOR FOR THE TEXTURE FINISH SHALL BE INCLUDED IN THE BID PRICE FOR CONCRETE MEDIAN BARRIER.

(I) MEDIAN BARRIER DELINEATOR REFLECTIVE SHEETING SHALL MEET ASTM D4956, TYPE V SPECIFICATIONS. DELINEATORS WITH DIMENSIONS OTHER THAN 4" X 3" MAY BE USED IF THE PRODUCT IS ON THE APPROVED PRODUCTS LIST. THE VARIATIONS IN DELINEATOR DIMENSION SHOULD NOT EXCEED ± 10%. DIFFERENT SIZE OR MANUFACTUREED MEDIAN BARRIER DELINEATORS SHOULD NOT BE MIXED IN THE SAME LINE.

(J) MEDIAN BARRIER DELINEATORS SHALL BE HIGH IMPACT, UV-STABILIZED, ENGINEERED THERMOPLASTIC OR POLYCARBONATE SUBSTRATE. SEE TDOT APPROVED QUALIFIED PRODUCT LISTS FOR ACCEPTABLE PRODUCTS.

(K) MEDIAN BARRIER DELINEATORS WILL NOT BE REQUIRED IN AREAS WHERE ROADWAY IS LIGHTED.

(L) SINGLE WHITE REFLECTIVE SHEETING WILL BE SUBSTITUTED FOR THE DOUBLE YELLOW REFLECTIVE SHEETING WHEN TRAFFIC ON EACH SIDE OF THE BARRIER IS GOING IN THE SAME DIRECTION.

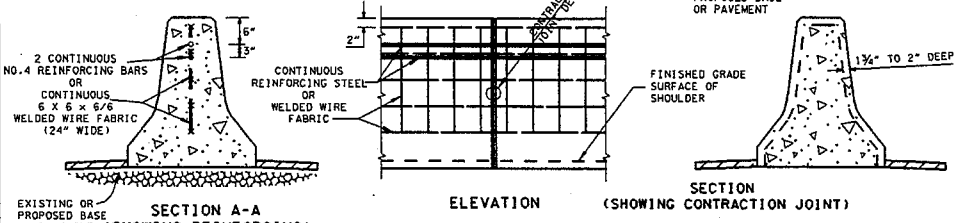
(M) THE COST OF FURNISHING AND INSTALLING MEDIAN BARRIER DELINEATORS, INCLUDING ALL MATERIALS, LABOR, AND INCIDENTALS NECESSARY TO COMPLETE THE INSTALLATION, SHALL BE INCLUDED IN BID PRICE FOR CONCRETE MEDIAN BARRIER.

(N) MEDIAN BARRIER DELINEATORS SHALL BE MOUNTED TO THE CONCRETE MEDIAN BARRIER WITH A ONE COMPONENT ADHESIVE AS RECOMMENDED BY THE MANUFACTURER. THEY SHALL BE INSTALLED NO EARLIER THAN THREE WEEKS AFTER THE TEXTURE COATING HAS BEEN APPLIED.

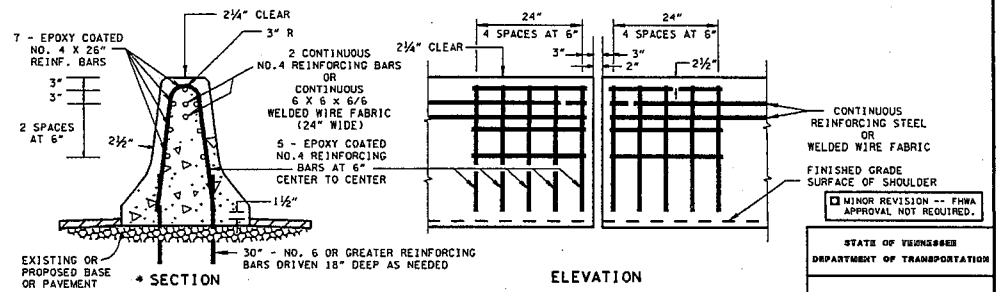
(O) ALONG TOP EDGES OF CONCRETE MEDIAN BARRIER THE CONTRACTOR MAY USE ¾" RADIUS IN LIEU OF ¾" CHAMFER SHOWN ON THIS DRAWING.

(P) PAYMENT WILL BE MADE UNDER ITEM NO. 711-01, CONCRETE MEDIAN BARRIER, PER LINEAR FOOT AND ITEM NO. 711-01.06, CONCRETE MEDIAN BARRIER (TYING TO GUARDRAIL), PER LINEAR FOOT.

(Q) ONLY DELINEATORS LISTED ON THE QPL, LIST 1, SECTION G.1 BARRIER WALL DELINEATION, MAY BE USED.



DETAILS OF REINFORCING AND CONTRACTION JOINT FOR CONCRETE MEDIAN BARRIER



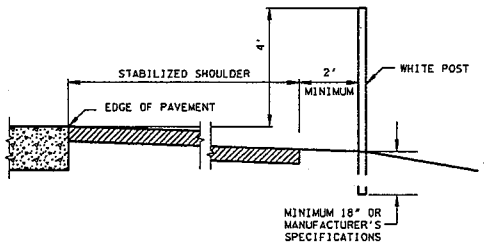
DETAILS OF REINFORCING AT EXPANSION JOINT FOR CONCRETE MEDIAN BARRIER

☐ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

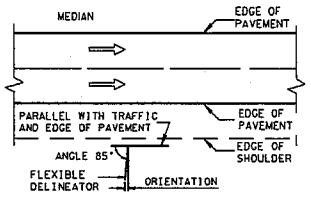
STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

STANDARD CONCRETE MEDIAN BARRIER

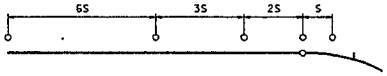
11-18-82 | S-MB-1



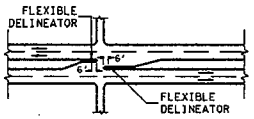
FLEXIBLE DELINEATOR MOUNTING DETAIL



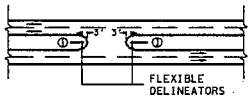
ANGLE OF FLEXIBLE DELINEATOR TO APPROACHING TRAFFIC DETAIL



DELINEATOR SPACING DETAIL FOR APPROACHING A CURVE



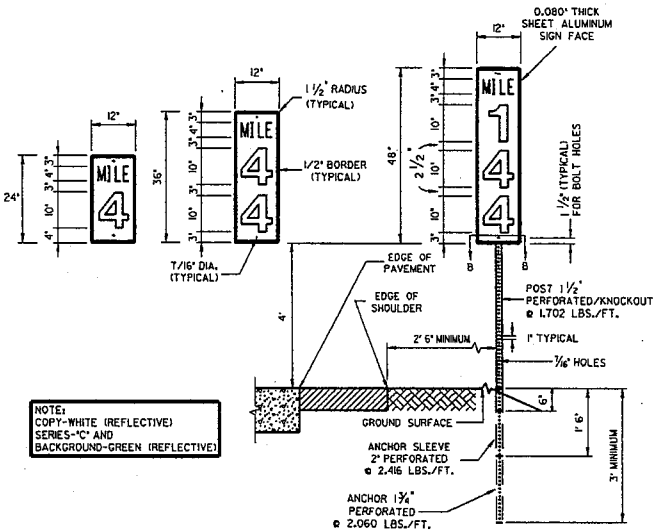
INTERSECTING ROADWAY WITH MEDIAN DETAIL
DELINEATOR LOCATION FOR



DELINEATOR LOCATION FOR MEDIAN CROSS-OVER DETAIL

(WHITE REFLECTIVE SHEETING ON NEAR SIDE APPROACH FACE AND YELLOW REFLECTIVE SHEETING ON FAR SIDE APPROACH FACE BOTH CASES.)

① DELINEATOR TO BE PLACED IN CENTER OF MEDIAN



MILEPOST SIGN DETAILS
(INTERSTATE ONLY)

REV. 2-12-85: REDREW SHEET. CHANGED FROM STEEL POST DELINEATOR TO FLEXIBLE DELINEATORS. CHANGED ITEM NUMBER OF WRONG WAY ARROW.

REV. 3-29-85: CHANGED ITEM NUMBERS OF FLEXIBLE DELINEATORS.

REV. 6-7-85: CHANGED ITEM DESCRIPTION ON WRONG WAY PAVEMENT ARROW DETAILS NOTE.

REV. 2-13-86: CHANGED DESCRIPTION OF PAY ITEMS FOR FLEXIBLE DELINEATORS.

REV. 9-4-87: DETAILS REGARDING DELINEATORS LOCATED IN MEDIAN ADDED. TYPE B POST ADDED.

REV. 5-24-88: CHANGED SECTION ON TYPE "A" POST FLEXIBLE DELINEATOR.

REV. 10-26-90: REDREW, REORGANIZED AND CHANGED NAME OF DRAWING. CHANGED MINIMUM DEPTH OF "U"-POST IN GROUND FROM 3' TO 3'6".

REV. 12-7-90: CHANGED CONNECTION DETAIL FOR PERFORATED/KNOCKOUT SQUARE TUBE POST.

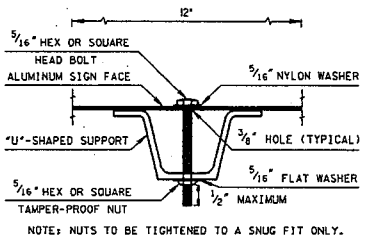
☒ REV. 12-18-93: REMOVED REFERENCE TO TYPE A AND TYPE B DELINEATOR POST, AS WELL AS SECTION "A-A" FOR TYPE A DELINEATOR POST. ELIMINATED OLD GENERAL NOTE (07).

☒ REV. 1-30-00: ADDED NEW GENERAL NOTE (07). CHANGED DESIGNATION OF OLD GENERAL NOTE (07) TO (08).

☒ REV. 12-12-00: MOVED WRONG WAY PAVEMENT ARROW DETAILS TO STD. DWG. NO. T-M-9. CHANGED DRAWING NAME.

☒ REV. 5-27-01: CHANGED DESCRIPTIONS FOR ITEM NOS. 713-02.14, 713-02.15 AND 713-02.16.

REV. 6-6-11: REORGANIZED SHEET AND ADDED GENERAL NOTE (09).

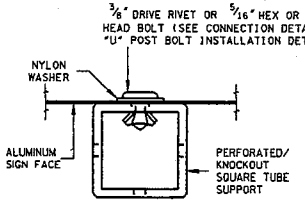


NOTE: NUTS TO BE TIGHTENED TO A SNUG FIT ONLY.

CONNECTION DETAIL FOR "U" POST

GALVANIZED STEEL POST WITH WEIGHT OF 2 LBS./FT. MUST BE PLACED A MINIMUM DEPTH BELOW GROUND OF 3'6".

SECTION B-B



CONNECTION DETAIL FOR PERFORATED/KNOCKOUT SQUARE TUBE POST

GALVANIZED PERFORATED/KNOCKOUT SQUARE TUBE POST WITH WEIGHT OF 1.702 LBS./FT. MUST BE PLACED A MINIMUM DEPTH BELOW GROUND OF 3'.

SECTION B-B

DELINEATOR SPACING ON HORIZONTAL CURVE TABLE

RADIUS IN FEET	SPACING ON CURVE IN FEET	RADIUS IN FEET	SPACING ON CURVE IN FEET	RADIUS IN FEET	SPACING ON CURVE IN FEET
50	20	1700	125	3500	215
150	30	1800	130	3600	220
200	35	1900	135	3700	225
250	40	2000	140	3800	230
300	50	2100	145	3900	235
400	55	2200	150	4000	240
500	65	2300	155	4100	245
600	70	2400	160	4200	250
700	75	2500	165	4300	255
800	80	2600	170	4400	260
900	85	2700	175	4500	265
1000	90	2800	180	4600	270
1100	95	2900	185	4700	275
1200	100	3000	190	4800	280
1300	105	3100	195	4900	285
1400	110	3200	200	5000	290
1500	115	3300	205	5100	295
1600	120	3400	210	5200	300

IF RADIUS IS MORE THAN 5200 FEET, USE SPACING OF 300 FEET. DISTANCE S IN BELOW DETAIL IS THE SAME AS SPACING ON CURVE IN TABLE. DESIGNATION 6S, 3S, 2S, AND S ARE TO NEVER EXCEED 300 FEET. AFTER SPACING DESIGNATION OF 6S ON BEGINNING OR END OF CURVE RESUME 528 FEET SPACING AS USED ON TANGENTS.

FLEXIBLE DELINEATOR GENERAL NOTES

(01) THE COLOR OF DELINEATORS SHALL CONFORM TO THE COLOR OF EDGE LINES STIPULATED IN SUBSECTION 3B-6 (PAGE 3B-8 AND 3B-11) OF THE CURRENT EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.

(02) THE WHITE REFLECTOR UNIT SHALL BE PLACED CONTINUOUSLY ON ALL EXPRESSWAYS AND FREEWAYS, EXCEPT ON THOSE SECTIONS BETWEEN INTERCHANGES WHERE FIXED LIGHTING IS INSTALLED AND IN OPERATION.

(03) DELINEATORS ARE TO BE INSTALLED ON ALL ROADWAYS WITHIN INTERCHANGES (LIGHTED OR NOT).

(04) THE DELINEATORS SHALL BE PLACED ALONG THE RIGHT SIDE OF THE THROUGH EXPRESSWAYS AND FREEWAYS, TWO FEET BEYOND THE OUTER EDGE OF THE ROADWAY SHOULDER OR THE FACE OF AN UNMOUNTABLE CURB, OR IN THE LINE OF THE GUARDRAIL.

(05) AT INTERCHANGES, DELINEATORS SHALL BE LOCATED ALONG THE OUTSIDE OF THE CURVE OF TURNING RAMPS, ON THE LEFT SIDE FOR RIGHT CURVING RAMPS AND ON THE RIGHT FOR OTHERS.

(06) ALONG THE THROUGH ROADWAYS, THE WHITE DELINEATORS SHALL BE SPACED AT 528 FEET ON TANGENTS. ON HORIZONTAL CURVES THE SPACING SHOULD BE ACCORDING TO THE HORIZONTAL CURVE TABLE ON THIS SHEET. THE RAMP DELINEATORS AT INTERCHANGES SHALL BE SPACED AT A MAXIMUM OF 100 FEET. THE TABLE AT LEFT SHOULD BE USED AS A GUIDE.

(07) SEE TDOT STANDARD SPECIFICATION 916.08 REGARDING SPECIFICATIONS FOR FLEXIBLE DELINEATOR POST AND HIGH GRADE REFLECTIVE SHEETING BONDED TO THEIR SURFACE AREA.

(08) PAYMENT FOR FLEXIBLE DELINEATORS IN PLACE WILL BE MADE AS FOLLOWS:
ITEM NUMBER 713-02.14, FLEXIBLE DELINEATOR (WHITE) PER EACH.
ITEM NUMBER 713-02.15, FLEXIBLE DELINEATOR (YELLOW) PER EACH.
ITEM NUMBER 713-02.16, FLEXIBLE TYPE II OBJECT MARKER PER EACH.

(09) ONLY FLEXIBLE DELINEATORS LISTED ON THE OPL, LIST 1, SECTION G, MAY BE USED.

MILEPOST SIGN GENERAL NOTES

(M1) PAYMENT FOR MILEPOST IN PLACE WILL BE MADE UNDER ITEM NUMBER 713-02.04, DELINEATOR (MILE MARKER) AND STEEL POST PER EACH.

(M2) THE SUPPORT SHALL BE EITHER "U"-CHANNEL OR PERFORATED/KNOCKOUT SQUARE TUBE.

(M3) PERFORATED/KNOCKOUT POSTS SHALL BE SQUARE TUBE FORMED FROM 0.105" USS GAGE ASTM A-446 COLD ROLLED CARBON STEEL. THE SQUARE TUBES SHALL BE WELDED DIRECTLY IN THE CORNER BY HIGH FREQUENCY RESISTANCE WELDING OR EQUAL. THE POSTS TO BE EXTERNALLY SCARFED TO AGREE WITH STANDARD CORNER RADII OF 5/32±1/64.

(M4) PERFORATED/KNOCKOUT POSTS SHALL BE GALVANIZED TO CONFORM TO ASTM A-525.

(M5) ALL HARDWARE SHALL CONFORM TO THE REQUIREMENTS OF ASTM A-307, CLASS A.

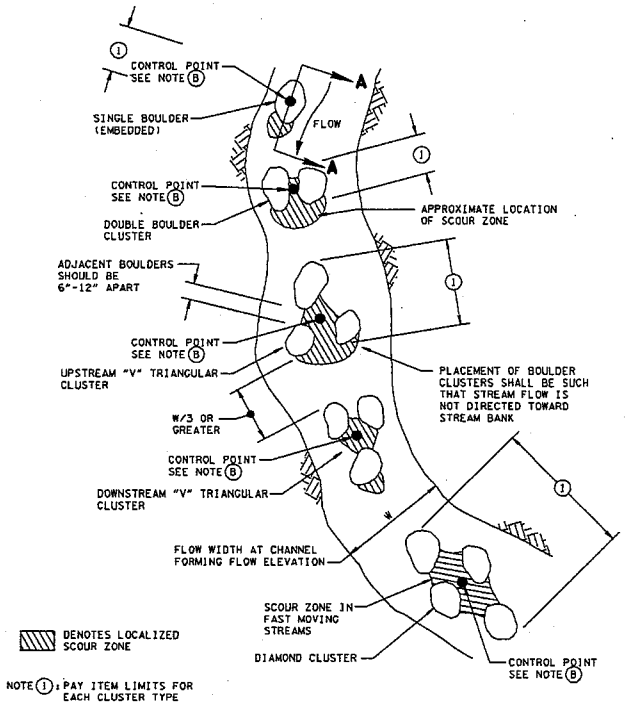
(M6) ALL HARDWARE SHALL BE GALVANIZED TO CONFORM TO THE REQUIREMENTS OF ASTM A-153 OR CADIUM PLATED TO CONFORM TO THE REQUIREMENTS OF ASTM A-165.

☒ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

DELINEATOR AND MILEPOST DETAILS

T-S-11



PLAN VIEW
BOULDER CLUSTER CONFIGURATIONS

BOULDER CLUSTERS GENERAL NOTES

(A) BOULDER CLUSTERS ARE HYDRAULIC CONTROL MEASURES CONSISTING OF A GROUP OF ONE OR MORE LARGE IMMOBILE ROCKS STRATEGICALLY ARRANGED IN A STREAM. THEY SHOULD BE USED TO DUPLICATE BOULDERS WHICH MAY BE PRESENT IN A STREAM TO BE RELOCATED.

(B) PLACE CLUSTERS AT THE STATIONS AND OFFSETS INDICATED ON THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS. PLACE BOULDERS IN THE CONFIGURATIONS SHOWN ON THE STREAM MITIGATION PLAN SHEET TO CREATE A MEANDERING FLOW PATH FOR LOW FLOWS OR AS DIRECTED BY THE ENGINEER. BOULDERS SHOULD NOT BE PLACED IN AREAS SUBJECT TO DEPOSITION OF SEDIMENT.

(C) BOULDERS SHOULD BE PLACED SUCH THAT THE SCOUR CREATED BY ONE BOULDER WILL NOT OVERLAP THE LOCATION OF ANOTHER BOULDER CLUSTER. IN FAST MOVING STREAMS, THE SCOUR ZONE WILL TEND TO OCCUR ALONG THE SIDES AND DOWNSTREAM OF THE BOULDER CLUSTER. IN SLOWER MOVING STREAMS, THE SCOUR ZONE WILL TEND TO FORM UPSTREAM OF THE BOULDER CLUSTER. TO DISCOURAGE UPSTREAM SCOUR, THE LONGEST DIMENSION OF THE BOULDER SHOULD BE ALIGNED WITH THE STREAM FLOW.

(D) BOULDER CLUSTERS SHOULD BE PLACED IN STREAMS WHERE THE CHANNEL MATERIALS CONSIST OF A COMBINATION OF GRAVEL AND COBBLES AND THE AVERAGE FLOW VELOCITY IS AT LEAST 2 FEET PER SECOND. THEY SHOULD NOT BE APPLIED IN SANDY STREAMS, WHERE SCOUR COULD LEAD TO THE FAILURE OF THE MEASURE.

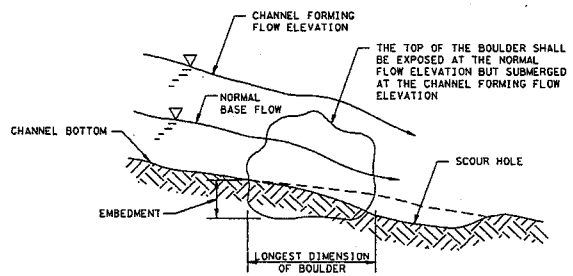
(E) BOULDER CLUSTERS SHOULD NOT BE UTILIZED IN LOCATIONS THAT EXPERIENCE HEAVY LOADS OF DEBRIS OR SEDIMENT TRANSPORT.

(F) BOULDERS SHALL BE OF THE SIZE INDICATED ON THE PLANS OR AS DIRECTED BY THE ENGINEER. IN SMALL CHANNELS, THE MINIMUM HORIZONTAL DIMENSION PERPENDICULAR TO THE FLOW MAY RANGE FROM 9 INCHES TO 20% OF THE CHANNEL WIDTH (UP TO 30% IS ALLOWABLE IN SMALL STREAMS WITH STEEP SLOPES). IN LARGER CHANNELS, THE BOULDER SIZE MAY VARY FROM 12 INCHES TO 20% OF THE CHANNEL WIDTH. WHERE POSSIBLE, BOULDERS PRESENT IN THE EXISTING STREAM SHOULD BE USED IN THE RELOCATED CHANNEL SEGMENT.

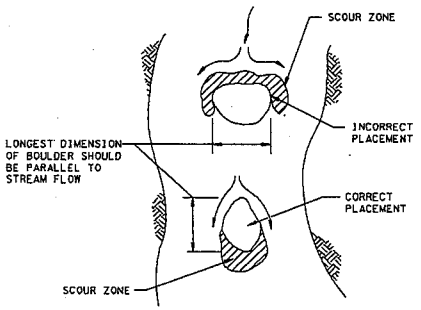
(G) BOULDER CLUSTERS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-03.32 STREAM MITIGATION - BOULDER CLUSTERS PER EACH

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR THE CONSTRUCTION OF EACH BOULDER CLUSTER.



SECTION A-A



CORRECT BOULDER PLACEMENT

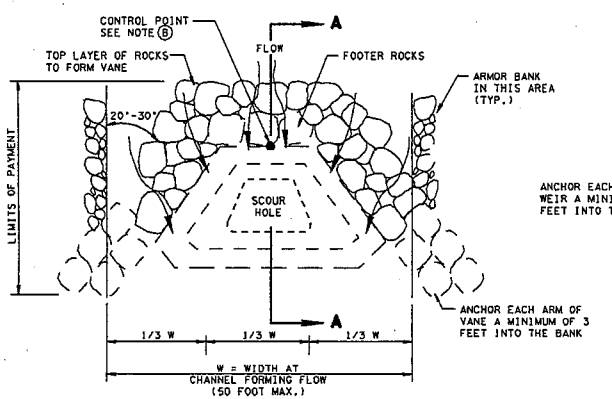
STREAM MITIGATION PLAN LEGEND: BOULDER CLUSTER (SHOW CONFIGURATION)

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

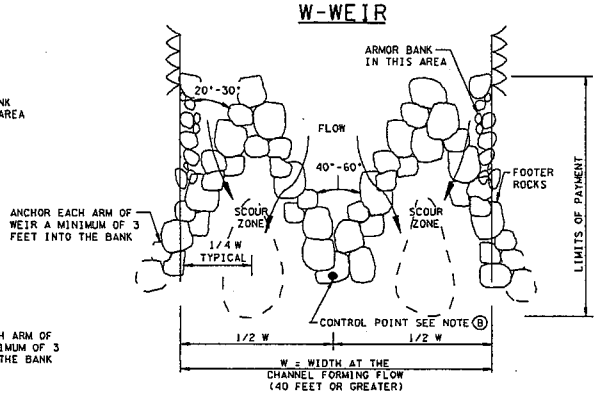
BOULDER CLUSTERS

NOT TO SCALE | 8-01-11 | D-NSD-1

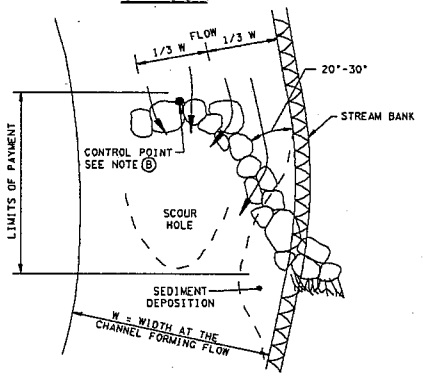
CROSS VANE



W-WEIR



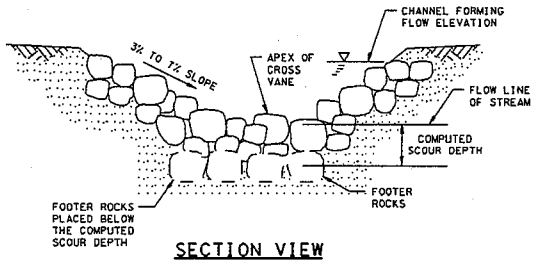
J-HOOK

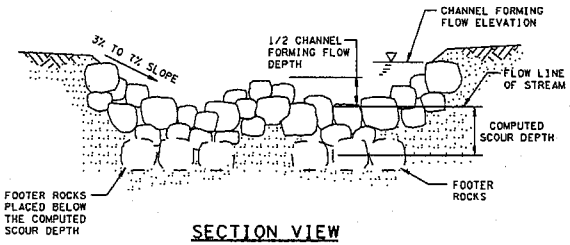


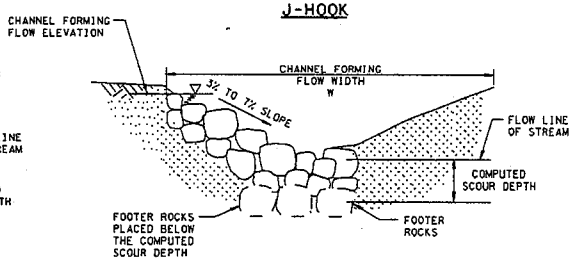
PLAN VIEW CROSS VANE

PLAN VIEW W-WEIR

PLAN VIEW J-HOOK



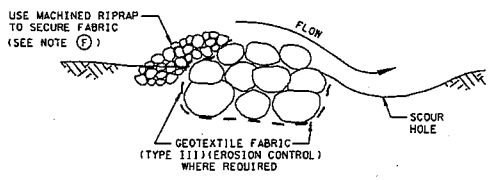




SECTION VIEW CROSS VANE

SECTION VIEW W-WEIR

SECTION VIEW J-HOOK



SECTION A-A

STREAM MITIGATION PLAN LEGEND: ROCK VANE

STREAM MITIGATION PLAN LEGEND: CROSS VANE

STREAM MITIGATION PLAN LEGEND: W-WEIR

STREAM MITIGATION PLAN LEGEND: J-HOOK

ROCK VANE GENERAL NOTES

(A) ROCK VANES ARE HYDRAULIC CONTROL MEASURES THAT MAY BE USED TO DIRECT FLOW AWAY FROM THE CHANNEL BANK, CONCENTRATE FLOWS INTO THE CENTER OF THE CHANNEL AND ENHANCE HABITAT. THEY MAY CONSIST OF STRAIGHT VANES, CROSS VANES, "W" WEIRS OR "J" HOOKS. STRAIGHT VANES ARE EQUIVALENT TO A SINGLE ARM OF A CROSS VANE.

(B) CONSTRUCT AT THE ELEVATIONS AND STATIONS INDICATED IN THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS OR AS DIRECTED BY THE ENGINEER.

(C) ROCK VANES SHOULD BE APPLIED WITH CAUTION IN STREAMS WITH BEDS COMPOSED OF CLAY, SILT OR OTHER SOFT MATERIAL. THE SIZE AND DEPTH OF THE FOOTER ROCKS MUST BE SUFFICIENT TO ENSURE THAT THE STRUCTURE WILL NOT SUBSIDE. ROCK VANES ALSO ARE NOT SUITABLE FOR STREAMS WITH BEDROCK CHANNELS.

(D) THE STONES USED TO CONSTRUCT THE VANE SHOULD BE SUFFICIENTLY FLAT AND BLOCKY TO ALLOW STACKING WITH LITTLE TO NO GAP WHEN THE STONES ARE BUTTED AGAINST EACH OTHER. THE STONES SHOULD ALSO BE SIZED TO REMAIN STABLE IN THE 50-YEAR STORM EVENT. THE MINIMUM SIZE OF THE STONES WILL BE PROVIDED IN THE STREAM MITIGATION DATA TABLE. LARGER STONES MAY BE REQUIRED FOR THE FOOTER STONES IN ORDER TO PROVIDE A STABLE BASE FOR THE STRUCTURE.

(E) THE LOWEST COURSE OF FOOTER ROCKS SHOULD BE PLACED AT A DEPTH BELOW THE SCOUR HOLE DEPTH INDICATED IN THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS.

(F) WHERE THE STREAM BED IS COMPOSED OF SAND OR FINER MATERIALS, THE BOTTOM AND UPSTREAM FACE OF THE STRUCTURE SHOULD BE LINED WITH GEOTEXTILE FABRIC (TYPE III) (EROSION CONTROL) TO PREVENT THE PIPING OF FINE MATERIALS THROUGH THE STONES. RIPRAP SHOULD THEN BE PLACED ON THE UPSTREAM FACE OF THE STRUCTURE IN ORDER TO SECURE THE GEOTEXTILE FABRIC. THE REQUIRED CLASS OF MACHINED RIPRAP WILL BE INDICATED IN THE PROJECT PLANS. ONLY GEOTEXTILE FABRIC (TYPE III) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.

(G) THE BANK SLOPES UPSTREAM OF THE VANE ARMS SHOULD BE PROTECTED AGAINST EROSION BY THE PLACEMENT OF APPROPRIATE EROSION PREVENTION MEASURES SUCH AS MACHINED RIPRAP, VEGETATED RIPRAP, OR TURF REINFORCEMENT MATS.

(H) THE ENDS OF THE VANE ARMS SHOULD BE KEYED INTO THE BANK A MINIMUM DISTANCE OF 3 FEET OR AS DIRECTED BY THE ENGINEER.

(I) CROSS VANES AND J-HOOKS MAY BE USED IN COMBINATION WITH STEP POOLS. SEE STANDARD DRAWING D-NSD-4.

(J) ROCK VANES AND J-HOOKS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBERS:

209-03.37 STREAM MITIGATION - CROSS VANE STRUCTURE PER EACH
209-03.38 STREAM MITIGATION - J-HOOK PER EACH
209-03.39 STREAM MITIGATION - W-WEIR PER EACH
209-03.52 STREAM MITIGATION - J-HOOK WITH STEP PER EACH
209-03.54 STREAM MITIGATION - CROSS VANE STRUCTURE WITH STEP PER EACH
209-03.60 STREAM MITIGATION - ROCK VANE PER EACH

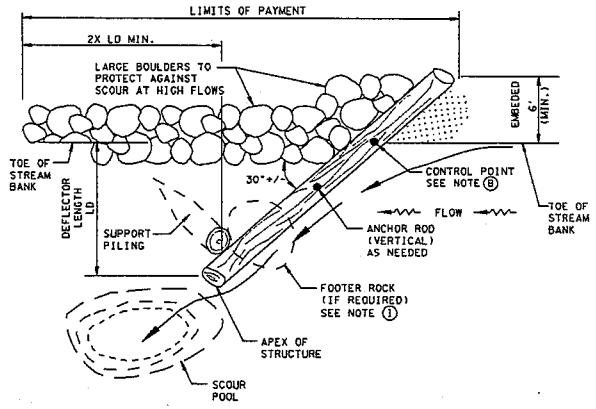
PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION OF THE VANE STRUCTURE.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

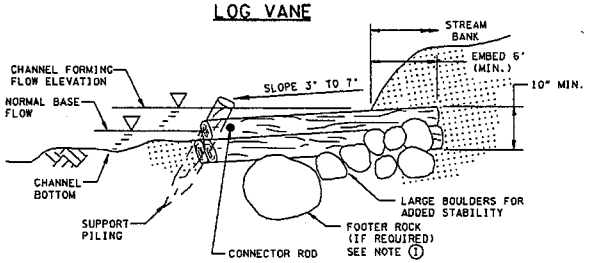
ROCK VANES

NOT TO SCALE | 8-01-11 | D-NSD-2

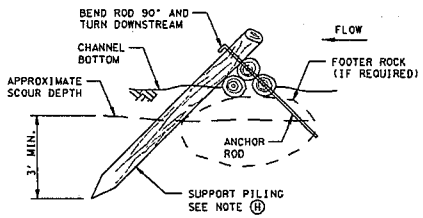
LOG VANE



PLAN VIEW
LOG VANE

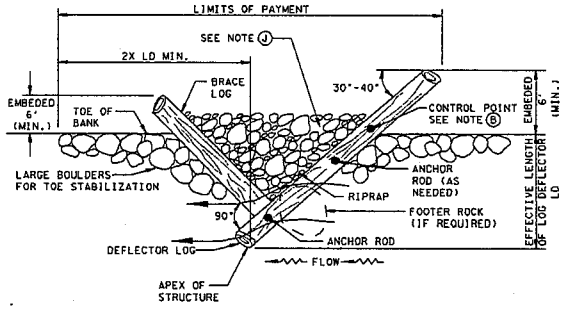


SECTION VIEW
LOG VANE
SHOWING MULTIPLE LOGS

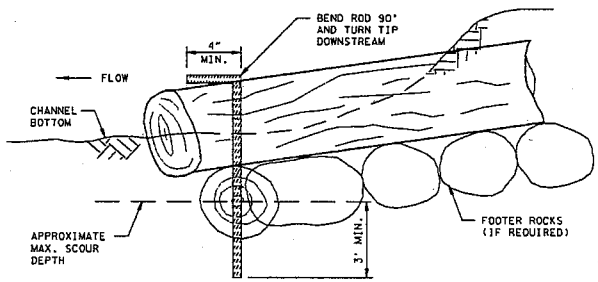


ELEVATION VIEW
SUPPORT PILING INSTALLATION
(SINGLE OR MULTIPLE LOGS)

LOG DEFLECTOR



PLAN VIEW
LOG DEFLECTOR



ANCHOR ROD
INSTALLATION DETAIL
FOR LOG DEFLECTOR

LOG DEFLECTORS AND VANES GENERAL NOTES

(A) LOG DEFLECTORS AND VANES ARE HYDRAULIC CONTROL MEASURES THAT EXTEND FROM THE BANK INTO THE STREAM TO REDUCE THE WIDTH TO DEPTH RATIO OF THE BANKFULL CHANNEL. THEY MAY BE USED IN WIDE, SHALLOW, AND SLUGGISH CHANNELS UP TO 30 FEET WIDE TO CREATE SCOUR POOLS, DEEPEN THE CHANNEL, CREATE A MEANDERING ALIGNMENT OR DEFLECT CURRENT FROM AN ERODING CHANNEL BANK ON THE OUTSIDE OF A BEND.

(B) DEFLECTORS AND VANES SHALL BE INSTALLED AT THE CONTROL POINT STATIONS AND OFFSETS INDICATED IN THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS. THE TABLE WILL ALSO PROVIDE THE REQUIRED DEFLECTION LENGTH, LD.

(C) LOGS SHOULD BE TAKEN FROM LOCALLY AVAILABLE, DECAY-RESISTANT SPECIES SUCH AS CEDAR, WHITE OAK, ETC. THE MINIMUM LOG DIAMETER SHALL BE 10 INCHES. WHERE SUFFICIENTLY LARGE LOGS ARE NOT AVAILABLE, THREE SMALLER LOGS MAY BE STACKED AS SHOWN ON THIS DRAWING. USE ANCHOR RODS DRIVEN AT A MAXIMUM SPACING OF 6 FEET ON CENTERS TO ATTACH AND SECURE THE LOGS.

(D) THE TIP OF THE LOG AT THE APEX SHALL BE EMBEDDED INTO THE CHANNEL BED A DISTANCE EQUAL TO HALF OF ITS DIAMETER AND SHOULD BE NO MORE THAN 6 INCHES ABOVE THE NORMAL BASE FLOW ELEVATION.

(E) THE DISTANCE LD SHALL BE NO MORE THAN 50% OF THE CHANNEL WIDTH FOR AN ALTERNATING LAYOUT OR 25% FOR AN OPPOSITE LAYOUT AS SHOWN IN THE DRAINAGE MANUAL.

(F) LARGE NATURAL STONES SHOULD BE USED FOR EROSION PREVENTION ON THE STREAM BANK DOWNSTREAM OF THE STRUCTURE. OPTIONAL MEANS OF PROVIDING EROSION PROTECTION INCLUDE ROOT WADS OR VEGETATED RIPRAP. EROSION PROTECTION SHOULD EXTEND A MINIMUM DISTANCE OF 2X LD FROM THE APEX OF THE STRUCTURE.

(G) ANCHOR RODS SHOULD CONSIST OF #6 REBAR PINS AND SHOULD BE DRIVEN INTO FIRM MATERIAL A MINIMUM OF 3 FEET BELOW THE APPROXIMATE SCOUR DEPTH. ANCHOR RODS SHOULD BE DRIVEN VERTICALLY EXCEPT WHERE USED TO CONNECT A SUPPORT PILING.

(H) SUPPORT PILINGS FOR LOG VANES SHOULD BE DRIVEN AT AN ANGLE TO PREVENT DISPLACEMENT AND UPLIFT OF THE LOGS. THEY SHOULD BE DRIVEN TO A DEPTH OF 3 FEET BELOW THE APPROXIMATE SCOUR DEPTH.

(I) FOOTER ROCKS SHOULD BE USED WHERE THE CHANNEL BOTTOM CONSISTS OF ERODIBLE MATERIALS SUCH AS SAND THAT COULD ALLOW THE STRUCTURE TO BECOME UNDERMINED. THE ROCKS SHOULD BE NATURAL BOULDERS SUFFICIENTLY LARGE TO EXTEND A MINIMUM OF 2 FEET BELOW THE APPROXIMATE SCOUR DEPTH.

(J) FILL MATERIAL FOR A LOG DEFLECTOR SHALL CONSIST OF MACHINED OR VEGETATED RIPRAP ON GEOTEXTILE FABRIC (TYPE III) (EROSION CONTROL). THE REQUIRED CLASS OF MACHINED RIPRAP WILL BE INDICATED IN THE STREAM MITIGATION DATA TABLE. ONLY GEOTEXTILE FABRIC (TYPE III) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.

(K) LOG DEFLECTORS AND VANES SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBERS:

209-03.33 STREAM MITIGATION - LOG STRUCTURES AND DEFLECTORS PER LINEAR FOOT
209-03.34 STREAM MITIGATION - LOG VANES PER LINEAR FOOT

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR THE CONSTRUCTION AND MAINTENANCE OF THE LOG DEFLECTOR OR VANE INCLUDING EROSION PREVENTION MEASURES DOWNSTREAM OF THE STRUCTURE.

STREAM MITIGATION PLAN LEGEND: LOG VANE

STREAM MITIGATION PLAN LEGEND: LOG DEFLECTOR

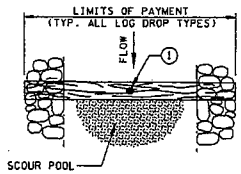
STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

LOG DEFLECTORS AND LOG VANES

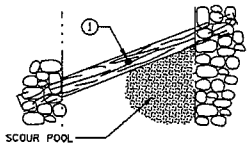
NOT TO SCALE | 8-01-11 | D-NSD-3

LOG DROP STRUCTURES

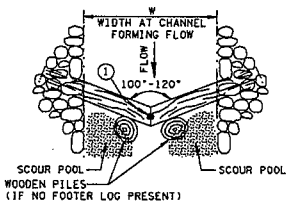
NOTE (1) : CONTROL POINT SEE LOG DROP NOTE (B)



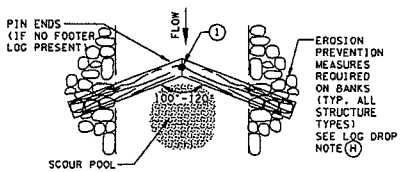
PLAN VIEW - STRAIGHT WEIR



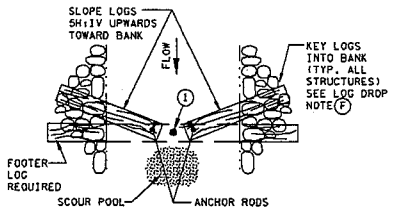
PLAN VIEW - DIAGONAL WEIR



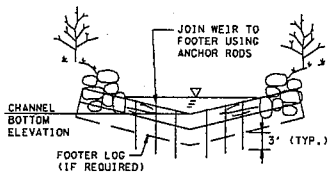
PLAN VIEW
"VEE" WEIR DOWNSTREAM



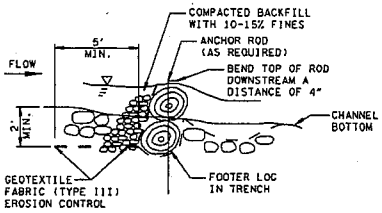
PLAN VIEW
"VEE" WEIR UPSTREAM



PLAN VIEW - "K" WEIR

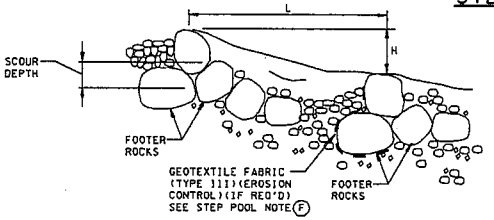


SECTION VIEW
OF "VEE" WEIR

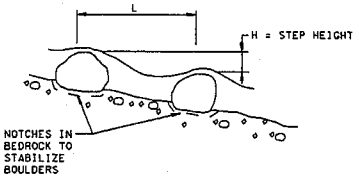


ELEVATION VIEW
DETAIL WITH FOOTER LOG
AND STRUCTURE SEALING
IF REQUIRED - SEE LOG DROP NOTE (G)

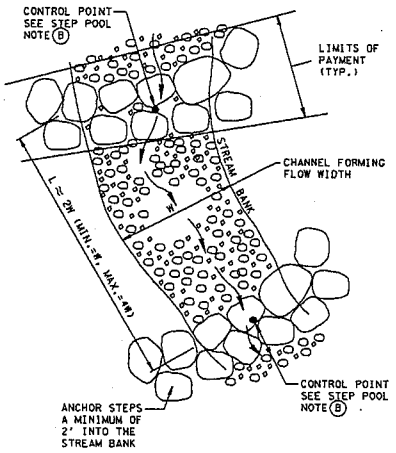
STEP POOLS



INSTALLATION IN
ALLUVIAL CHANNEL



INSTALLATION ON
BEDROCK CHANNEL



PLAN VIEW
STEP POOLS IN SERIES

LOG DROP GENERAL NOTES

(A) LOG DROPS ARE HYDRAULIC CONTROL MEASURES THAT MAY BE USED TO MAINTAIN THE ELEVATION OF THE STREAM BED, DIRECT FLOWS AWAY FROM ERODIBLE CHANNEL BANKS, OR ENCOURAGE THE FORMATION OF SCOUR HOLES IN THE CHANNEL TO ENHANCE HABITAT. LOG DROPS MAY BE USED IN STREAMS WITH SLOPES RANGING FROM 1% TO 3%.

(B) CONSTRUCT AT THE ELEVATIONS, STATIONS AND OFFSETS INDICATED ON THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS OR AS DIRECTED BY THE ENGINEER. "VEE" WEIRS MAY BE EITHER SYMMETRICAL (WITH THE APEX AT THE CENTER OF THE CHANNEL) OR ASYMMETRICAL. THE LOCATION OF THE APEX SHOULD ALSO BE INDICATED ON THE TABLE.

(C) LOGS SHOULD BE TAKEN FROM LOCALLY AVAILABLE ROT-RESISTANT SPECIES SUCH AS CEDAR. THE MINIMUM LOG DIAMETER IS 16 INCHES.

(D) FOOTER LOGS ARE OPTIONAL FOR ALL CONFIGURATIONS EXCEPT THE "K" WEIR. FOOTER LOGS SHOULD BE PROVIDED AS A CUTOFF WHERE THE DOWNSTREAM SCOUR HOLE WILL BE BELOW THE BOTTOM OF THE WEIR LOG. FOOTER LOGS MAY ALSO BE USED TO PROVIDE ADDITIONAL STABILITY FOR THE WEIR LOG AND SHOULD BE ATTACHED BY MEANS OF STEEL ANCHOR RODS CONSISTING OF NO. 6 REBAR.

(E) STRAIGHT OR DIAGONAL WEIRS SHOULD BE EMBEDDED INTO THE CHANNEL BOTTOM TO A DEPTH EQUAL TO HALF OF THE LOG DIAMETER. THE FOOTER LOG OF A "K" WEIR AND THE VERTEX OF A "VEE" WEIR SHOULD BOTH BE AT THE CHANNEL BOTTOM ELEVATION. THE WEIR LOGS OF "VEE" AND "K" WEIRS SHOULD SLOPE UPWARD FROM THE CENTER OF THE CHANNEL INTO THE STREAM BANKS.

(F) AT A MINIMUM, LOGS SHOULD BE KEYED INTO THE CHANNEL BANKS A DISTANCE EQUAL TO 0.4 X THE WIDTH (W) OF THE CHANNEL FORMING FLOW, BUT NO LESS THAN 5 FEET.

(G) WHERE THE CHANNEL SUBSTRATE IS COMPOSED OF COARSE SEDIMENTS, THE STRUCTURE SHOULD BE SEALED TO ENCOURAGE LOW FLOWS TO PASS OVER THE LOG RATHER THAN THROUGH THE MATERIALS BENEATH IT. PLACE GEOTEXTILE FABRIC (TYPE III) (EROSION CONTROL) ON THE UPSTREAM FACE OF THE STRUCTURE AND BACKFILL WITH A SUITABLE COMPACTED MIXTURE OF GRAVEL AND FINE SEDIMENTS. ONLY GEOTEXTILE FABRIC (TYPE III) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.

(H) THE BANK SLOPES ADJACENT TO THE WEIR SHOULD BE PROTECTED AGAINST EROSION BY THE PLACEMENT OF APPROPRIATE EROSION PREVENTION MEASURES SUCH AS VEGETATED RIPRAP, NATURAL BOULDERS, OR BRUSH MATTRESSES.

(I) LOG DROPS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-03.35, STREAM MITIGATION - LOG DROP STRUCTURE, PER LINEAR FOOT

PAYMENT SHALL INCLUDE ALL MATERIAL AND LABOR NECESSARY FOR THE CONSTRUCTION OF THE LOG DROP STRUCTURE.

STEP POOL GENERAL NOTES

(A) STEP POOLS ARE HYDRAULIC CONTROL MEASURES THAT MAY BE USED TO MAINTAIN GRADE, CONTROL FLOW VELOCITY, AND DISSIPATE ENERGY IN STREAMS WITH SLOPES GREATER THAN 3%.

(B) STEP POOLS SHOULD BE CONSTRUCTED AT THE ELEVATIONS AND STATIONS INDICATED ON THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS OR AS DIRECTED BY THE ENGINEER. MINIMUM REQUIRED BOULDER DIAMETER SHOULD ALSO BE INDICATED ON THE TABLE.

(C) THE ROCKS USED TO CONSTRUCT A STEP POOL SHOULD BE SUFFICIENTLY FLAT AND BLOCKY TO ALLOW STACKING WITH LITTLE TO NO GAP WHEN THE ROCKS ARE BUTTED AGAINST EACH OTHER. LARGER ROCKS MAY BE REQUIRED FOR THE FOOTER ROCKS IN ORDER TO PROVIDE A STABLE BASE FOR THE STRUCTURE.

(D) IN AN ALLUVIAL STREAM, THE LOWEST COURSE OF FOOTER ROCKS SHOULD BE PLACED BELOW THE SCOUR DEPTH PROVIDED IN THE STREAM MITIGATION DATA TABLE.

(E) THE STEP HEIGHT (H) SHOULD BE NO MORE THAN 12 INCHES. IF THIS IS NOT POSSIBLE, SMALL GAPS SHOULD BE LEFT BETWEEN THE ROCKS.

(F) WHERE THE CHANNEL SUBSTRATE IS SUFFICIENTLY FINE TO PASS BETWEEN THE ROCKS IN THE STEP POOL, THE STRUCTURE SHOULD BE PLACED ON A LAYER OF GEOTEXTILE FABRIC (TYPE III) (EROSION CONTROL) LOCATED UNDERNEATH AND ON THE UPSTREAM SIDE OF THE STRUCTURE. ABOVE THE FLOW LINE, A LAYER OF RIPRAP MAY BE USED TO HOLD THE FABRIC IN PLACE. THE REQUIRED CLASS OF MACHINED RIPRAP WILL BE INDICATED IN THE STREAM MITIGATION DATA TABLE. ONLY GEOTEXTILE FABRIC (TYPE III) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.

(G) STEP POOLS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-03.36 STREAM MITIGATION - STEP POOL PER EACH

PAYMENT SHALL INCLUDE ALL MATERIAL AND LABOR NECESSARY FOR THE CONSTRUCTION OF THE STEP POOL.

STREAM MITIGATION PLAN LEGEND: STEP POOL

STREAM MITIGATION PLAN LEGEND: —S— STRAIGHT WEIR LOG DROP

STREAM MITIGATION PLAN LEGEND: —D— DIAGONAL WEIR LOG DROP

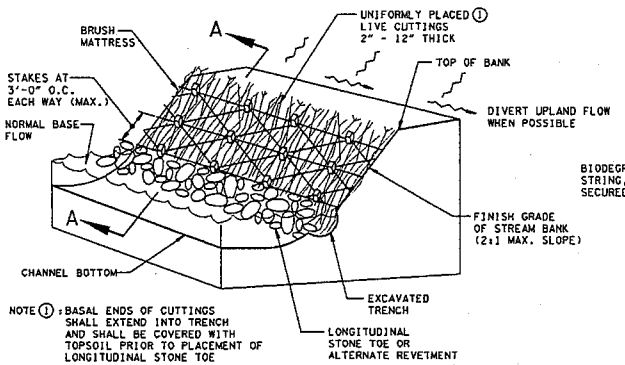
STREAM MITIGATION PLAN LEGEND: "VEE" WEIR LOG DROP (SHOW ORIENTATION)

STREAM MITIGATION PLAN LEGEND: "K" WEIR LOG DROP

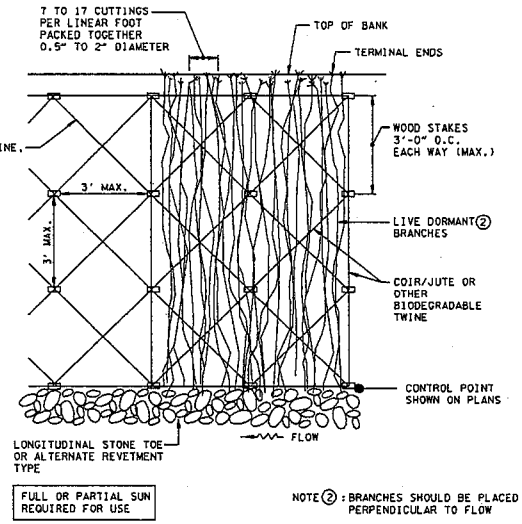
STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

LOG DROPS
AND
STEP POOLS

NOT TO SCALE | 8-01-11 | D-NSD-4



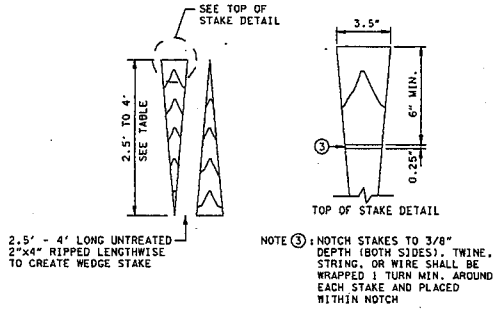
ISOMETRIC VIEW



FULL OR PARTIAL SUN REQUIRED FOR USE

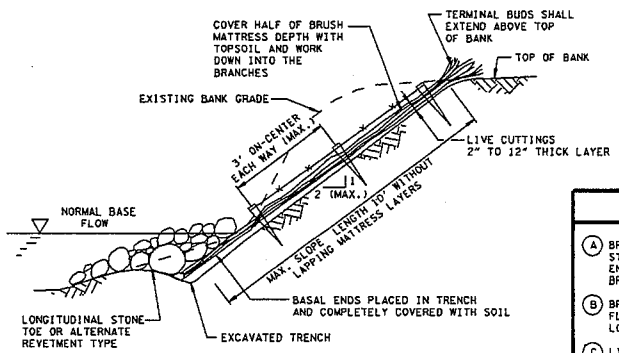
NOTE ②: BRANCHES SHOULD BE PLACED PERPENDICULAR TO FLOW

PLAN VIEW

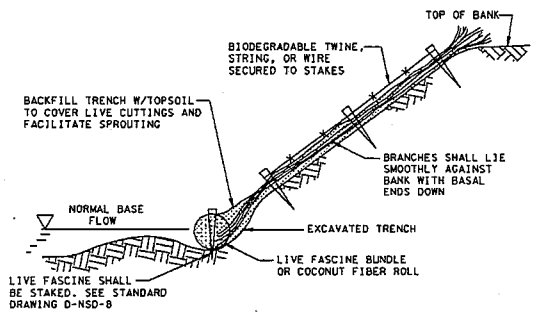


BRUSH MATTRESS STAKE DETAIL

STAKE LENGTH	
SOIL TYPE	LENGTH (FEET)
CLAY	2.5
SILT	3.0
SAND	4.0
LOAM	2.5



SECTION A-A



ALTERNATE REVETMENT AT TOE OF SLOPE

STREAM MITIGATION PLAN LEGEND: BRUSH MATTRESS

BRUSH MATTRESS GENERAL NOTES

(A) BRUSH MATTRESS IS A BANK STABILIZATION PRACTICE THAT PROTECTS A STREAMBANK FROM EROSION, CAPTURES SEDIMENT DURING HIGH FLOWS, AND ENHANCES THE ESTABLISHMENT AND GROWTH OF NATIVE VEGETATION USING LIVE BRANCHES AND CUTTINGS ANCHORED TO THE STREAM BANK.

(B) BRUSH MATTRESSES SHOULD NOT BE USED WHERE PERENNIAL (YEAR ROUND) STREAM FLOW IS NOT PRESENT OR ALONG STREAMS WITH ANTICIPATED HIGH SEDIMENT LOADS.

(C) LIVE DORMANT CUTTINGS SHALL BE PLACED ON THE SLOPE PERPENDICULAR TO THE STREAM AND THE MATTRESS SHALL BE BETWEEN 2 INCHES AND 12 INCHES THICK. CUTTINGS SHALL BE STRAIGHT, FLEXIBLE BRANCHES OF WILLOW, SHRUB DOGWOOD, OR OTHER APPROVED SPECIES.

(D) LIVE DORMANT CUTTINGS OR BRANCHES SHALL BE A MINIMUM OF 0.5-INCHES IN DIAMETER AT THE BASAL END AND NO GREATER THAN 2 INCHES. BASAL ENDS OF THE BRANCHES SHOULD BE CUT AT A 30 TO 45 DEGREE ANGLE AND SHALL BE INSTALLED BELOW THE NORMAL BASE FLOW ELEVATION IN THE TRENCH.

(E) MAXIMUM GRADE OF SLOPE FOR BRUSH MATTRESS SHALL BE 2H:1V OR FLATTER AND SHALL BE UNIFORMLY GRADED AND SHAPED TO PROVIDE ADEQUATE SOIL TO STEM CONTACT. MAXIMUM FACE LENGTH OF SLOPE SHALL BE 10 FEET. WHERE LONGER SLOPES ARE PRESENT, USE MULTIPLE ROWS OF BRUSH MATTRESS WITH MINIMUM 1 FOOT OVERLAP. TERMINAL ENDS OF LOWER ROW SHALL LAP OVER THE BASAL ENDS OF UPPER ROW.

(F) CARE SHOULD BE TAKEN WHEN INSTALLING LONGITUDINAL STONE TOE, COCONUT FIBER ROLLS OR LIVE FASCINES IN TRENCH TO AVOID PUTTING THE BRANCHES IN TENSION AND LIFTING THEM FROM THE STREAMBANK.

(G) ROCK FOR LONGITUDINAL STONE TOE SHALL BE SIZED ACCORDING TO COMPUTED FLOW VELOCITY AND SHEAR STRESS ALONG THE BANK. FOR ADDITIONAL DETAILS OF LONGITUDINAL STONE TOE SEE STANDARD DRAWING D-NSD-13. FOR DETAILS OF LIVE FASCINES SEE STANDARD DRAWING D-NSD-8.

(H) WOOD STAKES MAY BE STANDARD COMMERCIAL GRADE UNTREATED LUMBER CUT TO LENGTH, RIPPED LENGTHWISE TO PRODUCE TWO WEDGE SHAPED STAKES, AND NOTCHED AT THE TOP TO ACCEPT 1 TURN OF THE TWINE, STRING, OR WIRE WITHIN THE NOTCH. WHERE DORMANT LIVE STAKES ARE USED INSTEAD OF DEAD STAKES, NOTCH FOR TWINE SHALL BE OMITTED. NON-BIODEGRADABLE STAKES ARE NOT PERMITTED FOR USE WITH BRUSH MATTRESS.

(I) TYPICAL INSTALLATION SEQUENCE:

1. COLLECT AND SOAK LIVE BRANCHES A MINIMUM OF 24 HOURS. 5-7 DAYS PREFERRED. LEAVE SIDE BRANCHES INTACT.
2. EXCAVATE BANK TO DESIRED GRADE CLEARING AWAY LARGE DEBRIS.
3. EXCAVATE AN 8 TO 12-INCH DEEP HORIZONTAL TRENCH AT THE TOE OF SLOPE.
4. LAY CUTTINGS FLAT AGAINST THE SLOPE WITH BASAL ENDS PLACED DEEPLY IN THE TRENCH EXPOSED TO MOIST SOIL.
5. INSTALL WEDGE STAKES OR LIVE STAKES LEAVING APPROXIMATELY 12 INCHES OF THE TOP OF STAKE EXPOSED. DISCARD AND REPLACE SHATTERED STAKES.
6. TIE TWINE, STRING, OR OTHER BIODEGRADABLE WIRE AROUND STAKES IN A DIAGONAL PATTERN BETWEEN EACH ROW OF STAKES.
7. DRIVE THE STAKES IN FURTHER TO COMPRESS THE MATTRESS AGAINST THE SLOPE LEAVING A MINIMUM OF 6 INCHES OF THE STAKE ABOVE THE MATTRESS.
8. INSTALL LONGITUDINAL STONE TOE OR OTHER APPROVED ALTERNATE IN TRENCH.
9. BACKFILL IN AND BETWEEN THE BRANCHES WITH LOOSE MATERIAL UNTIL APPROXIMATELY HALF THE MATTRESS REMAINS EXPOSED. WET THE SURFACE TO WASH SOIL DOWN BETWEEN THE BRANCHES.

(J) ALL TWINE, STRING, WIRE OR OTHER MEASURES USED FOR SECURING MATTRESS TO STAKES SHALL BE BIODEGRADABLE. WHERE COIR TWINE IS USED, IT SHALL BE MACHINE SPUN BRISTLE COIR OF 0.2 TO 0.25-INCH THICKNESS WITH BREAK STRENGTH OF 70 TO 100 POUNDS. JUTE OR OTHER BIODEGRADABLE MATERIAL IS ACCEPTABLE.

(K) BRANCHES SHALL BE FLEXIBLE ENOUGH TO CONFORM TO ANY SLOPE SURFACE IRREGULARITIES AND SHOULD BE INSTALLED DURING DORMANT SEASON.

(L) BRUSH MATTRESS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-03.59 STREAM MITIGATION - BRUSH MATTRESS PER SQUARE YARD

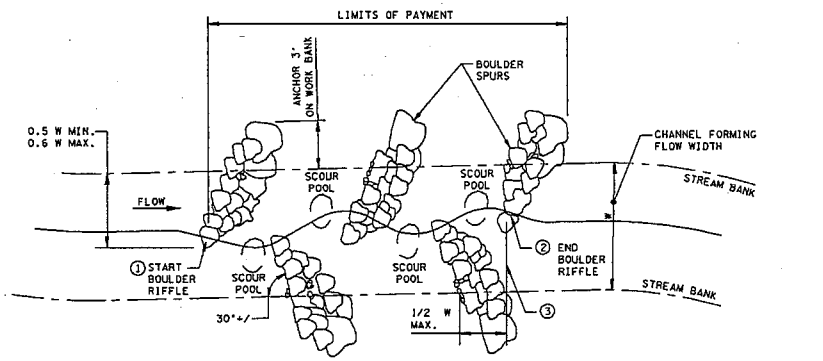
LONGITUDINAL STONE TOE, COCONUT FIBER ROLL, AND LIVE FASCINE BUNDLES SHALL BE PAID FOR ACCORDING TO THEIR RESPECTIVE STANDARD DRAWINGS.

PAYMENT FOR BRUSH MATTRESS SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR THE CONSTRUCTION OF THE MATTRESS.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

BRUSH MATTRESS

NOT TO SCALE | 8-01-11 | D-NSD-9



NOTE ①: CONTROL POINT BEGINNING OF RIFFLE SEE NOTE (B)

NOTE ②: CONTROL POINT END OF RIFFLE SEE NOTE (B)

NOTE ③: SEE NOTE (H)

PLAN VIEW

BOULDER RIFFLE GENERAL NOTES

(A) BOULDER RIFFLES ARE HYDRAULIC CONTROL MEASURES THAT MAY BE USED TO RECREATE HABITAT IN A RELOCATED STREAM BY CREATING POOLS AND A MEANDERING PATH FOR LOW FLOWS. THEY ALSO CREATE FLOW TURBULENCE WHICH HELPS TO INCREASE DISSOLVED OXYGEN. THEY CONSIST OF BOULDER SPURS KEYED INTO THE CHANNEL BANK AND EXTENDING TO AT LEAST THE CENTER OF THE CHANNEL.

(B) ELEVATIONS, STATIONS AND OFFSETS FOR THE BEGINNING AND ENDING POINTS OF THE BOULDER RIFFLE WILL BE INDICATED IN THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS. BOULDER SPURS SHOULD BE PLACED AT AN EVEN SPACING BETWEEN THESE POINTS OR AS DIRECTED BY THE ENGINEER.

(C) BOULDER RIFFLES SHOULD BE APPLIED WITH CAUTION IN STREAMS WITH BEDS COMPOSED OF CLAY, SILT OR OTHER SOFT MATERIAL. THE SIZE AND DEPTH OF THE FOOTER ROCKS MUST BE SUFFICIENT TO ENSURE THAT THE STRUCTURE WILL NOT SUBSIDE.

(D) THE ROCKS USED TO CONSTRUCT BOULDER RIFFLES SHOULD BE SIZED TO REMAIN STABLE IN THE 50-YEAR STORM EVENT. THE MINIMUM SIZE OF THE ROCKS WILL BE PROVIDED IN THE PROJECT PLANS. LARGER STONES MAY BE REQUIRED FOR THE FOOTER ROCKS IN ORDER TO PROVIDE A STABLE BASE FOR THE STRUCTURE.

(E) THE LOWEST COURSE OF FOOTER ROCKS SHALL BE PLACED AT A DEPTH BELOW THE SCOUR HOLE DEPTH INDICATED IN THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS.

(F) WHERE THE STREAM BED IS COMPOSED OF SAND OR FINER MATERIALS, THE BOTTOM AND UPSTREAM FACE OF EACH SPUR SHALL BE LINED WITH GEOTEXTILE FABRIC (TYPE III)(EROSION CONTROL) TO PREVENT THE PIPING OF FINE MATERIALS THROUGH THE ROCKS. ONLY GEOTEXTILE FABRIC (TYPE III) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED. REFER TO SECTION A-A ON STANDARD DRAWING D-NSD-2.

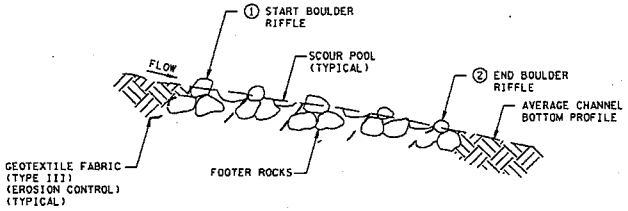
(G) THE ENDS OF THE SPURS SHALL BE KEYED INTO THE BANK A MINIMUM DISTANCE OF 3 FEET OR AS DIRECTED BY THE ENGINEER.

(H) THE TIP OF AN INDIVIDUAL BOULDER SPUR SHALL BE ALIGNED WITH THE POINT AT WHICH THE EDGE OF THE NEXT UPSTREAM SPUR INTERSECTS THE STREAM BANK.

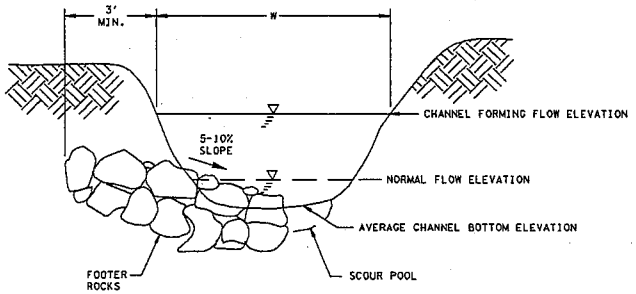
(I) BOULDER RIFFLES SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-03.41 STREAM MITIGATION - BOULDER RIFFLE PER LINEAR FOOT

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR THE CONSTRUCTION OF THE BOULDER RIFFLE.



PROFILE VIEW



SECTION VIEW

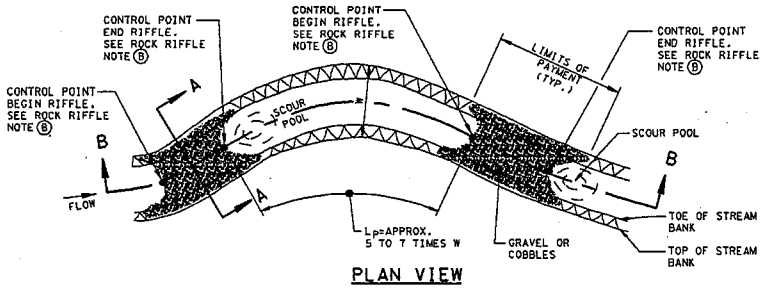
STREAM MITIGATION PLAN LEGEND: BOULDER RIFFLE

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

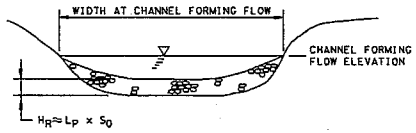
BOULDER RIFFLES

NOT TO SCALE | 8-01-11 | D-NSD-5

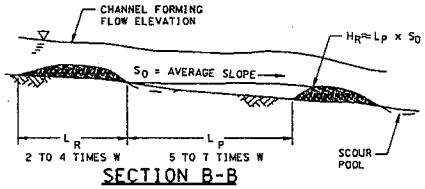
ROCK RIFFLE



PLAN VIEW
ROCK RIFFLES



SECTION A-A



SECTION B-B

ROCK RIFFLE GENERAL NOTES

(A) ROCK RIFFLES ARE HYDRAULIC CONTROL MEASURES THAT MAY BE USED TO RECREATE THE POOL AND RIFFLE PROFILE PRESENT IN THE EXISTING STREAM THAT IS TO BE RELOCATED.

(B) CONSTRUCT RIFFLES AT THE BEGINNING AND ENDING CONTROL POINT LOCATIONS INDICATED IN THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS OR AS DIRECTED BY THE ENGINEER.

(C) RIFFLES SHOULD BE CONSTRUCTED IN STRAIGHT REACHES OF THE STREAM RATHER THAN IN THE BENDS. CONSTRUCT FROM THE SIDES OF THE CHANNEL, PLACING THE ROCKS IN THE CENTER LAST. THE CENTER OF THE RIFFLE SHOULD BE LOWER THAN THE SIDES IN ORDER TO HELP CONCENTRATE LOW FLOWS TO THE MIDDLE OF THE CHANNEL. THE RIFFLE HEIGHT (H_R) SHOULD NOT BE GREATER THAN THE WATER DEPTH AT NORMAL FLOW.

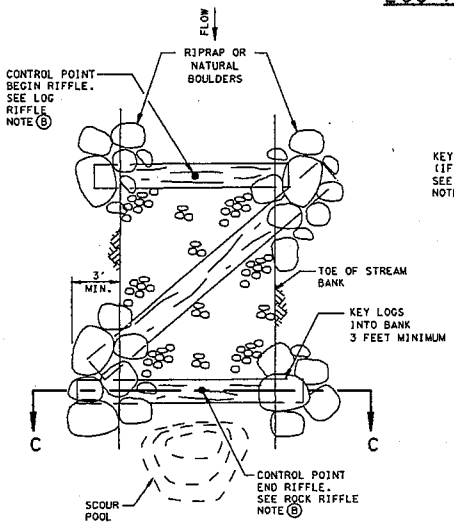
(D) THE MATERIALS USED TO CONSTRUCT A RIFFLE IN THE RELOCATED CHANNEL SHOULD HAVE A PARTICLE SIZE DISTRIBUTION SIMILAR TO THE MATERIALS FOUND IN NATURALLY OCCURRING RIFFLES ON THE STREAM. WHERE POSSIBLE, USE RIFFLE MATERIALS FROM THE STREAM BEING RELOCATED TO CONSTRUCT RIFFLES IN THE RELOCATED CHANNEL REACH. OTHERWISE THE D_{50} OF THE MATERIAL TO BE USED WILL BE PROVIDED IN THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS.

(E) ROCK RIFFLES SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

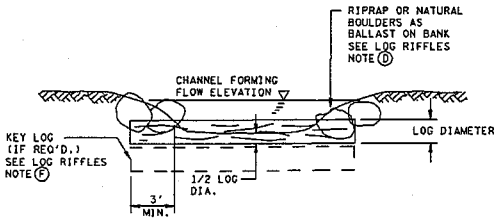
709-05.81 ROCK RIFFLES PER LUMP SUM

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR THE CONSTRUCTION OF THE ROCK RIFFLE.

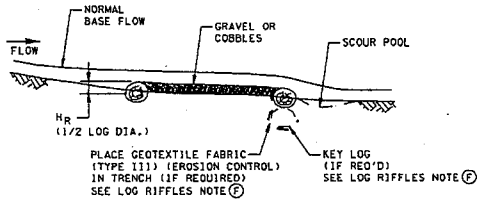
LOG RIFFLE



PLAN VIEW
LOG RIFFLE



SECTION C-C



SECTION VIEW
LOG RIFFLE

LOG RIFFLES GENERAL NOTES

(A) LOG RIFFLES ARE HYDRAULIC CONTROL MEASURES THAT MAY BE USED TO RECREATE THE POOL AND RIFFLE PROFILE PRESENT IN THE EXISTING STREAM THAT IS TO BE RELOCATED AS WELL AS TO ADD OXYGEN TO THE WATER AND PROVIDE SUBSTRATE FOR AQUATIC ORGANISMS.

(B) CONSTRUCT LOG RIFFLES AT THE BEGINNING AND ENDING CONTROL POINT LOCATIONS INDICATED IN THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS OR AS DIRECTED BY THE ENGINEER. THE TABLE WILL ALSO INDICATE THE MINIMUM REQUIRED LOG DIAMETER AND THE D_{50} OF THE GRAVEL AND COBBLES PLACED BETWEEN THE LOGS. THE RIFFLE HEIGHT, H_R, SHALL GENERALLY BE EQUAL TO HALF OF THE LOG DIAMETER.

(C) GRAVEL OR COBBLES PLACED BETWEEN THE LOGS SHOULD CORRESPOND TO THE MATERIAL PRESENT IN RIFFLES IN THE EXISTING STREAM. IF POSSIBLE USE THE EXISTING MATERIAL TO CONSTRUCT THE RIFFLES IN THE RELOCATED STREAM.

(D) THE LOGS SHOULD BE KEYED INTO THE BANKS A MINIMUM OF 3 FEET AND NATURAL BOULDERS OR RIPRAP USED TO PROVIDE EXTRA BALLAST. ADDITIONAL STONE SHOULD BE PLACED ABOVE THE ENDS OF THE LOGS IN ORDER TO PROVIDE MATERIAL THAT WILL FILL IN THE VOIDS LEFT AS THE LOGS DECAY.

(E) SELECT LOGS FROM LOCALLY AVAILABLE WOOD SPECIES THAT DECAY RELATIVELY SLOWLY, SUCH AS CEDAR OR WHITE OAK.

(F) WHERE THE CHANNEL IS CHARACTERIZED BY NON-COHESIVE MATERIALS SUCH AS SAND OR SILT, PLACE A KEY LOG BENEATH THE DOWNSTREAM RIFFLE LOG TO PREVENT UNDERMINING. THE TRENCH WITH THIS LOG SHOULD BE LINED WITH GEOTEXTILE FABRIC (TYPE 111)(EROSION CONTROL) TO SEAL THE STRUCTURE. ONLY GEOTEXTILE FABRIC (TYPE 111) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.

(G) LOG RIFFLES SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

709-05.80 LOG RIFFLES PER EACH

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR THE CONSTRUCTION OF THE LOG RIFFLES.

STREAM MITIGATION PLAN LEGEND: LOG RIFFLE

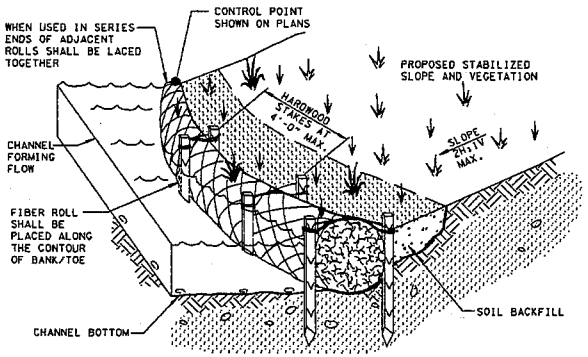
STREAM MITIGATION PLAN LEGEND: ROCK RIFFLE

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

CONSTRUCTED RIFFLES

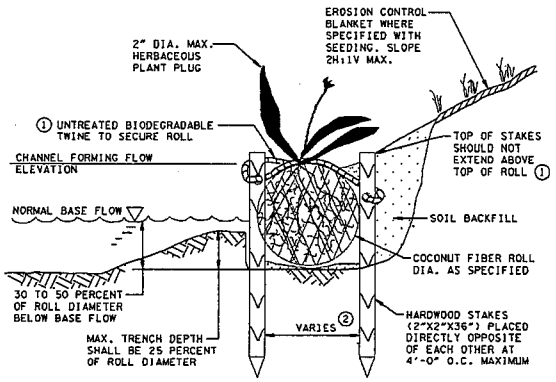
NOT TO SCALE | 8-01-11 | D-NSD-6

COCONUT FIBER ROLL



ISOMETRIC VIEW
COCONUT FIBER ROLL

FULL OR PARTIAL SUN REQUIRED FOR USE



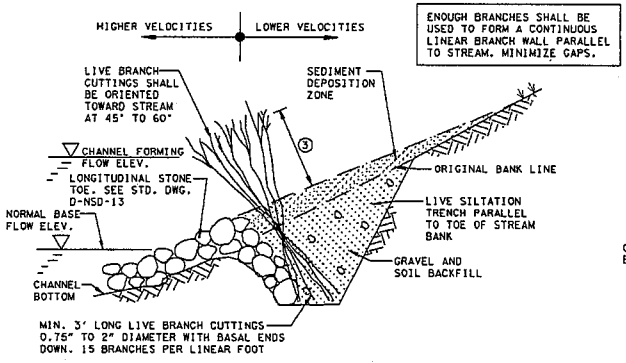
SECTION VIEW
COCONUT FIBER ROLL

NOTE ① : DRIVE STAKES AS NEEDED SO TWINE IS SECURED AGAINST TOP OF ROLL.

NOTE ② : SPACING VARIES BASED ON ROLL DIAMETER 8, 12, 16, 18, 20-INCH (TYPICAL)

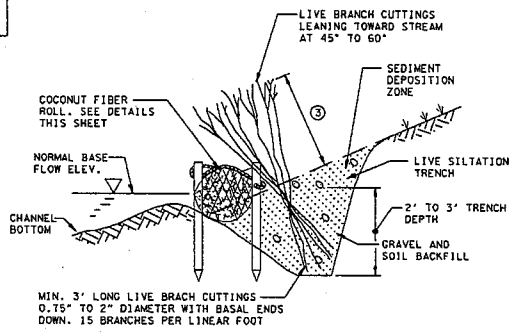
STREAM MITIGATION PLAN LEGEND: ⁂ROLL⁂ROLL⁂ROLL⁂ COCONUT FIBER ROLLS

LIVE SILTATION



SECTION VIEW - LIVE SILTATION
WITH STONE TOE

NOTE ③ : 1/3 OF THE BRANCH LENGTH SHALL BE ABOVE TRENCH



SECTION VIEW - LIVE SILTATION
WITH COCONUT FIBER ROLL

NOTE ③ : 1/3 OF THE BRANCH LENGTH SHALL BE ABOVE TRENCH

STREAM MITIGATION PLAN LEGEND: ⩛⩛ LS⩛⩛ LS⩛⩛ LS⩛⩛ LIVE SILTATION

COCONUT FIBER ROLL GENERAL NOTES

(A) COCONUT FIBER ROLLS ARE A FLEXIBLE BANK STABILIZATION MEASURE CONSISTING OF INTERWOVEN COCONUT HUSK FIBERS THAT CAN BE FITTED TO THE CURVATURE OF A STREAM BANK PROVIDING IMMEDIATE TOE PROTECTION AND BANK STABILIZATION. COCONUT FIBER ROLLS ARE USED TO ENHANCE THE ESTABLISHMENT AND GROWTH OF NATIVE VEGETATION ALONG THE STREAM BANK BY TRAPPING SEDIMENT BEHIND THE ROLL PROVIDING A SUBSTRATE FOR PLANT GROWTH. EFFECTIVE LIFE 2 TO 3 YEARS.

(B) COCONUT FIBER ROLLS ARE AN ACCEPTABLE MITIGATION PRACTICE FOR USE IN STREAMS AND ALONG THE SHORELINE OF PONDS AND WETLANDS.

(C) COCONUT FIBER ROLLS MAY BE USED IN COMBINATION WITH LONGITUDINAL STONE TOES, ROOT WADS, LIVE SILTATION, OR OTHER BANK STABILIZATION MEASURES.

(D) COCONUT FIBER ROLLS SHOULD NOT BE USED WHEN CHANNEL FLOW VELOCITY EXCEEDS 10 FEET PER SECOND, WHERE CHANNEL SHEAR STRESSES ARE MODERATE TO HIGH ALONG THE BANK, IN BEDROCK CHANNELS, IN CHANNELS WHERE SCOUR IS PRESENT OR EXPECTED, OR IN STREAMS WHERE SIGNIFICANT DEBRIS LOAD IS EXPECTED.

(E) COCONUT FIBER ROLLS SHOULD BE CONSTRUCTED AT THE TOE OF A STREAM BANK TO A HEIGHT EQUAL TO THE CHANNEL FORMING FLOW ELEVATION.

(F) COCONUT FIBER ROLLS SHALL BE SEATED IN A SHALLOW HAND-CUT TRENCH SLIGHTLY BELOW THE CHANNEL BOTTOM ELEVATION. COCONUT FIBER ROLL SHALL BE IN CONTACT WITH THE WATER, SUBMERGED FROM ONE-HALF TO TWO-THIRDS OF THE ROLL DIAMETER.

(G) ENDS OF COCONUT FIBER ROLLS SHALL BE TURNED IN AND BURIED WITHIN THE BANK TO PREVENT WATER FROM INTRUDING BEHIND THE ROLL.

(H) VEGETATION (SPECIES) USED FOR HERBACIOUS PLUGS TO BE INSTALLED IN THE TOP OF COCONUT FIBER ROLLS SHALL BE APPROVED BY THE ENVIRONMENTAL DIVISION. LIVE DORMANT STAKES MAY BE USED FOR PLUGS.

(I) COCONUT FIBER ROLLS SHALL BE KEPT DRY PRIOR TO INSTALLATION.

(J) COCONUT FIBER ROLLS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-03.31 STREAM MITIGATION - COCONUT FIBER ROLLS (SIZE) PER LINEAR FOOT

EROSION CONTROL BLANKETS SHALL BE PAID FOR ACCORDING TO THEIR RESPECTIVE ITEM NUMBERS.

PAYMENT FOR COCONUT FIBER ROLLS SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR THE INSTALLATION OF THE COCONUT FIBER ROLL.

LIVE SILTATION GENERAL NOTES

(A) LIVE SILTATION IS A BANK STABILIZATION MEASURE THAT NATURALLY REBUILDS A STREAM BANK THAT HAS ERODED BY SLOWING THE FLOW VELOCITY RESULTING IN THE DEPOSITION OF SEDIMENT DURING HIGH FLOWS. LIVE SILTATION ALSO ENHANCES THE ESTABLISHMENT AND GROWTH OF NATIVE VEGETATION ALONG THE STREAM BANK BY TRAPPING SEED AND ORGANIC MATERIAL ALONG THE SHORE LINE.

(B) LIVE SILTATION SHOULD BE CONSTRUCTED AT THE TOE OF A STREAM BANK BEHIND ANY OTHER TOE OF SLOPE PROTECTION AND AT THE NORMAL BASE FLOW ELEVATION.

(C) LIVE SILTATION SHOULD BE USED IN COMBINATION WITH LONGITUDINAL STONE TOE, ROOT WADS, OR COCONUT FIBER ROLLS.

(D) ALLOWABLE VELOCITY OF FLOW FOR USING LIVE SILTATION SHALL BE 0.8 FT/SEC TO A MAXIMUM OF 6.6 FT/SEC WHEN USED WITH OTHER TOE STABILIZATION MEASURES, LIVE SILTATION MAY BE USED FOR FLOWS UP TO 12 FT/SEC MAXIMUM.

(E) LIVE SILTATION MAY BE USED AT THE INSIDE OF A MEANDER BEND, WITHIN A SIDE CHANNEL, IN AREAS WHERE BANK SCOUR HAS OCCURRED, OR AT LOCATIONS WHERE THE FORMATION OF A NEW BANK IS DESIRED.

(F) MULTIPLE ROWS OF LIVE SILTATION MAY BE USED PARALLEL TO THE STREAM BANK AND TO EACH OTHER. SPACING OF ROWS SHALL BE 5 TO 10 FEET.

(G) CONSTRUCTION OF LIVE SILTATION SHOULD BE PERFORMED DURING THE DORMANT SEASON AND DURING LOW FLOW CONDITIONS.

(H) LIVE SILTATION SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-03.46 STREAM MITIGATION - LIVE SILTATION (SPECIES) PER CUBIC YARD

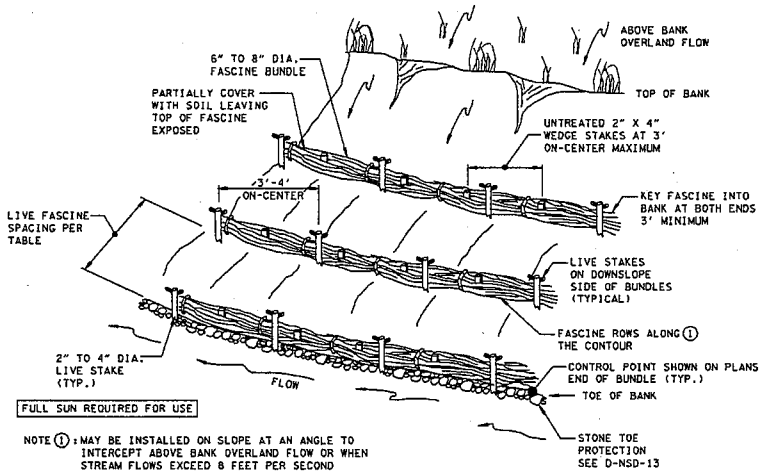
LONGITUDINAL STONE TOE SHALL BE PAID FOR ACCORDING TO ITS RESPECTIVE STANDARD DRAWING.

PAYMENT FOR LIVE SILTATION SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR THE CONSTRUCTION OF THE LIVE SILTATION SYSTEM.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

COCONUT FIBER ROLLS AND LIVE SILTATION

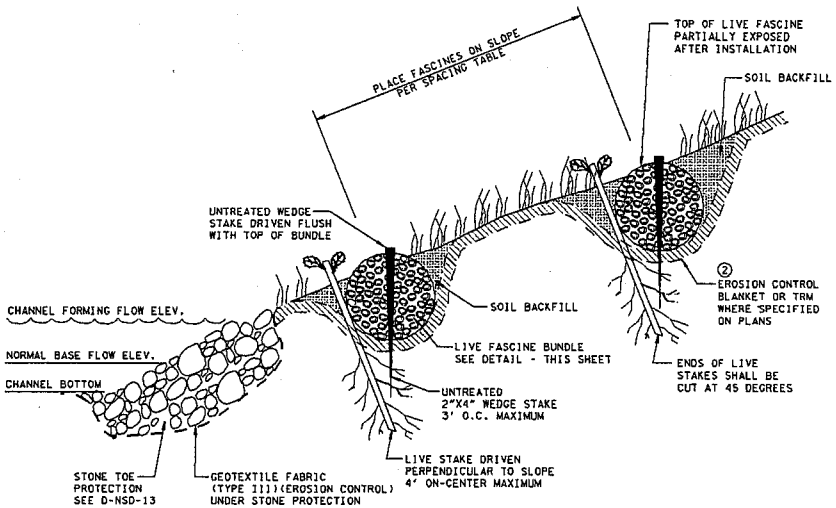
NOT TO SCALE | 8-01-11 | D-NSD-7



NOTE ①: MAY BE INSTALLED ON SLOPE AT AN ANGLE TO INTERCEPT ABOVE BANK OVERLAND FLOW OR WHEN STREAM FLOWS EXCEED 8 FEET PER SECOND

ISOMETRIC VIEW

SHOWN ON SURFACE FOR CLARITY
FASCINES SHALL BE TRENCHED IN AS SHOWN IN SECTION VIEW



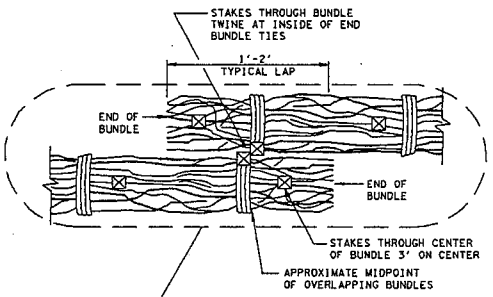
SECTION VIEW

NOTE ②: WHEN EROSION CONTROL BLANKETS OR TURF REINFORCED MATS ARE SPECIFIED ON SLOPES THEY SHALL BE CONTINUED THROUGH THE TRENCH FOR EACH ROW OF FASCINES

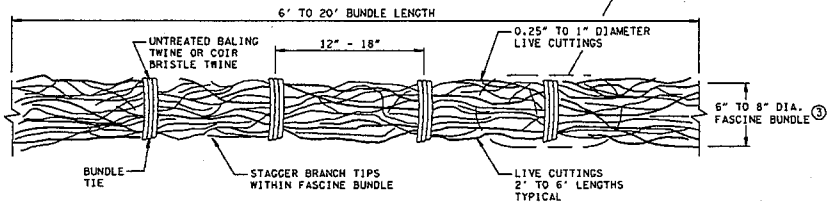
LIVE FASCINE SPACING (FEET)

SLOPE	SOIL TYPE	
	COHESIVE	NON-COHESIVE
1H:1V	3 *	NA
1H:1V-2H:1V	3-4 *	NA
2H:1V-3H:1V	4-5 *	3-4 *
3H:1V-4H:1V	5-6	4-5 *
4:1 OR FLATTER	6-8	5-7

*USE OF AN EROSION CONTROL BLANKET BETWEEN THE LIVE FASCINE AND BANK RECOMMENDED



OVERLAP DETAIL



LIVE FASCINES DETAIL

SEE OVERLAP DETAIL

NOTE ③: FINAL DIAMETER WHEN FIRMLY COMPRESSED AND TIED

STREAM MITIGATION PLAN LEGEND: LIVE FASCINE

LIVE FASCINES GENERAL NOTES

(A) LIVE FASCINES ARE CYLINDRICAL BUNDLES OF LIVE BRANCH CUTTINGS USED AS A BANK STABILIZATION MEASURE TO PROTECT A BANK AND TOE FROM SURFACE EROSION, TRAP SEDIMENTS, AND INCREASE SLOPE STABILITY WITH A DEVELOPED ROOT SYSTEM. FASCINES ARE USED ABOVE THE BASE FLOW ELEVATION OF A SLOPE TO TRAP SEED AND SEDIMENT AND TO ENHANCE CONDITIONS FOR COLONIZATION OF NATIVE VEGETATION USED IN THE BUNDLES.

(B) CONSTRUCTION OF FASCINES ON SLOPES SHALL CONFORM TO ASTM D6599.

(C) THIS MEASURE MAY BE COMBINED WITH OTHER SLOPE STABILIZATION MEASURES INCLUDING LIVE STAKES, EROSION CONTROL BLANKET, TURF REINFORCED MAT, BRUSH MATTRESSES, AND LONGITUDINAL STONE TOE.

(D) NOT SUITABLE FOR USE ON SLOPES COMPRISED OF SAND, GRAVEL, OR ROCK, OR ON SLOPES THAT ARE NOT IN FULL SUNLIGHT. FASCINES SHALL NOT BE USED WHERE THEY WILL BE SUBJECTED TO CONCENTRATED FLOW FROM ABOVE THE STREAMBANK OR WHERE CHANNEL FLOW VELOCITIES EXCEED 12 FEET PER SECOND.

(E) FASCINES SHALL BE PLACED ON A SLOPE ALONG THE CONTOUR AND SHALL BE KEYED INTO BANK AT BOTH ENDS OF THE FASCINE ROW.

(F) FASCINE BUNDLES SHALL BE CONSTRUCTED OF LIVE DORMANT BRANCH CUTTINGS RANDOMLY BOUND TOGETHER WITH UNTREATED TWINE EVERY 12 TO 18 INCHES. BASAL (CUT) ENDS OF BRANCHES SHALL BE ALTERNATING WITHIN THE FASCINE BUNDLE.

(G) FASCINES SHALL BE OVERLAPPED AT THE ENDS A MINIMUM OF ONE FOOT.

(H) UNTREATED WEDGE STAKES SHALL BE INSTALLED FLUSH WITH THE TOP OF THE FASCINE BUNDLES AND SHALL BE SPACED AT 3 FEET ON-CENTER MAXIMUM.

(I) FASCINE BRANCHES SHALL BE OBTAINED FROM LOCAL SOURCES APPROVED BY THE ENGINEER.

(J) LIVE FASCINES SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-03.45 STREAM MITIGATION - LIVE FASCINES (SPECIES) PER LINEAR FOOT

EROSION CONTROL BLANKETS AND TURF REINFORCED MATS SHALL BE PAID FOR ACCORDING TO THEIR RESPECTIVE ITEM NUMBERS.

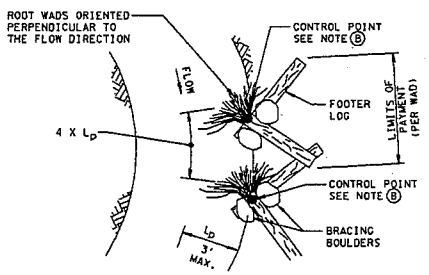
PAYMENT FOR LIVE FASCINES SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR THE CONSTRUCTION OF THE LIVE FASCINE.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

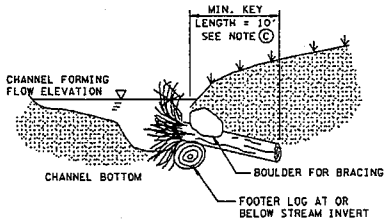
LIVE FASCINES AND WILLOW CUTTINGS

NOT TO SCALE | 8-01-11 | D-NSD-8

ROOT WAD

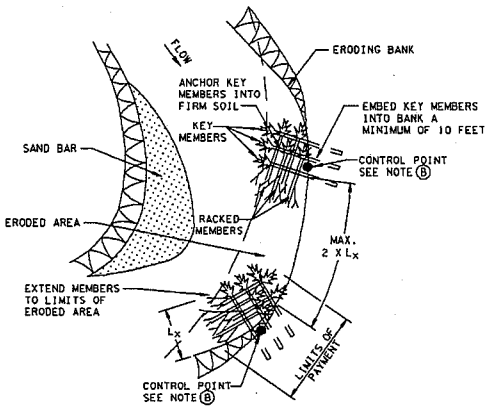


PLAN VIEW
ROOT WAD REVETMENT



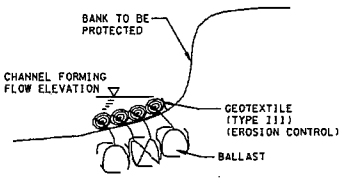
SECTION VIEW
ROOT WAD

RACK STRUCTURE

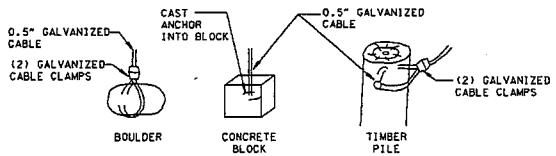


PLAN VIEW
RACK STRUCTURES

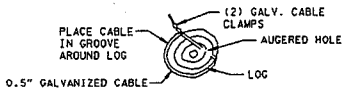
LOG REVETMENT



SECTION VIEW
LOG REVETMENT

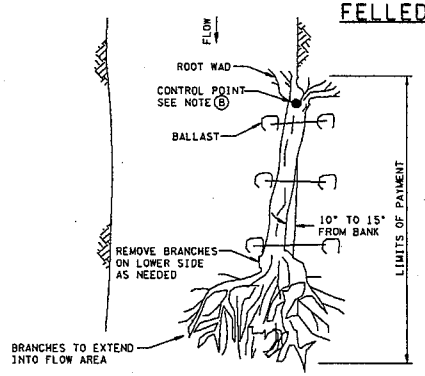


BALLAST TYPES FOR ANCHORS

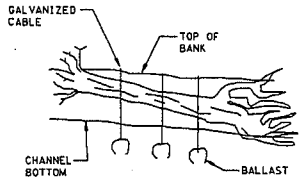


ANCHOR CONNECTION
LOG REVETMENT

FELLED TREE



PLAN VIEW
FELLED TREE



TREE PLACEMENT
ON BANK

LARGE WOODY DEBRIS GENERAL NOTES

(A) LARGE WOODY DEBRIS MAY HAVE A VARIETY OF CONFIGURATIONS BASED ON THE PURPOSE OF THE INSTALLATION. ROOT WADS, LOG REVETMENTS AND FELLED TREES MAY BE USED TO PREVENT EROSION ON AN OUTSIDE CHANNEL BEND WHILE ALSO PROVIDING HABITAT OPPORTUNITIES. RACK STRUCTURES CAN PREVENT EROSION AND ALSO HELP ENCOURAGE THE DEPOSITION OF SEDIMENT TO REBUILD AN ERODED BANK. LARGE WOODY DEBRIS SHOULD NOT BE PLACED ON STREAMS THAT DO NOT ALREADY HAVE SIGNIFICANT RIPARIAN TREE COVER.

(B) STATIONS, OFFSETS AND REQUIRED ANCHOR STRENGTH FOR LARGE WOODY DEBRIS INSTALLATIONS WILL BE PROVIDED IN THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS. CONSTRUCT AS INDICATED ON THE PLANS OR AS DIRECTED BY THE ENGINEER. CONSTRUCT LARGE WOODY DEBRIS STRUCTURES WITH LOCALLY AVAILABLE ROT RESISTANT TREE SPECIES SUCH AS CEDAR OR WHITE OAK.

(C) ROOT WADS SHALL BE PLACED SO THAT THE ROOT FAN IS NO MORE THAN 3 FEET FROM THE BANK. WHERE THE CHANNEL WIDTH IS LESS THAN 15 FEET, THE TRUNK SHOULD BE KEYED INTO THE BANK A MINIMUM DISTANCE OF 10 FEET. IN LARGER STREAMS, THE KEY LENGTH SHOULD BE INCREASED TO 20 FEET. CONSTRUCT KEYS BY EXCAVATING A TRENCH IN THE STREAM BANK AND BURYING THE TRUNK. ROOT WADS SHOULD BE SUPPORTED ON FOOTER LOGS PLACED IN A TRENCH AT THE BANK LINE. LARGE BOULDERS MAY BE PLACED ON TOP OF THE LOG TO PROVIDE INCREASED STABILITY.

(D) RACK STRUCTURES SHALL BE USED ONLY WHERE THE UNDERLYING SOILS OFFER SUFFICIENT STRENGTH TO FIRMLY HOLD THE ANCHORS. THE KEY MEMBERS SHOULD BE KEYED INTO THE BANK AS DESCRIBED IN NOTE (C) WITH THE ROOT FANS FACING THE CHANNEL. RACKED MEMBERS SHOULD INTERLOCK WITH THE KEY MEMBERS WITH ROOT FANS FACING UPSTREAM. THE ENTIRE STRUCTURE SHOULD BE ANGLED SO THAT THE FLOW INTERSECTS THE RACKED MEMBERS AT AN ANGLE OF 15 DEGREES. THE STRUCTURE SHALL ALSO BE ANCHORED AS DESCRIBED IN NOTE (G). THE TOP OF THE STRUCTURE SHOULD BE AT THE CHANNEL FORMING FLOW ELEVATION WHILE THE LOWEST MEMBERS SHOULD BE BELOW THE ANTICIPATED SCOUR DEPTH.

(E) EACH LOG IN A LOG REVETMENT SHALL BE SECURED AT BOTH ENDS BY APPROPRIATE ANCHORS AS DESCRIBED IN NOTE (G). ANCHORS SHOULD BE PLACED THROUGH HOLES BORED IN THE LOGS AND TIED WITH TWO GALVANIZED CABLE CLAMPS. LOGS SHALL BE PLACED ON GEOTEXTILE FABRIC (TYPE III) (EROSION CONTROL). ONLY GEOTEXTILE (TYPE I|I) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.

(F) FELLED TREES SHALL BE PLACED SO THAT THE ROOT FAN IS NEAR THE TOP OF BANK. THE TRUNK SHOULD BE PLACED AT AN ANGLE OF 10 TO 15 DEGREES WITH THE BANK LINE SO THAT THE BRANCHES EXTEND INTO THE ACTIVE FLOW OF THE STREAM. BRANCHES MAY BE REMOVED AS NEEDED FROM THE UNDERSIDE OF THE TREE TO FACILITATE PLACEMENT IN THE CHANNEL. BRANCH REMOVAL SHALL BE KEPT TO A MINIMUM.

(G) ANCHORS SHALL CONSIST OF GALVANIZED CABLE. THE GAUGE OF CABLE, TYPE OF BALLAST AND CLAMPS SHALL BE SELECTED BY THE CONTRACTOR BASED ON THE REQUIRED ANCHOR TENSILE STRENGTH SHOWN IN THE STREAM MITIGATION TABLE IN THE PROJECT PLANS. ANCHORS SHALL BE BALLASTED BY MEANS OF BOULDERS, CONCRETE BLOCKS OR TIMBER PILES BURIED IN WELL COMPACTED SOILS AT A LEVEL BELOW THE EXPECTED SCOUR DEPTH.

(H) LARGE WOODY DEBRIS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBERS:

209-03.62	STREAM MITIGATION - ROOT WAD (SIZE) PER EACH
209-03.63	STREAM MITIGATION - RACK STRUCTURE (SIZE) PER EACH
209-03.64	STREAM MITIGATION - FELLED TREE (SIZE) PER EACH
209-03.65	STREAM MITIGATION - LOG REVETMENTS (DESCRIPTION) PER LINEAR FOOT

NOTE: SIZE IS DEFINED BY THE AVERAGE DIAMETER OF THE TREE TRUNK.

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION OF THE SPECIFIED WOODY DEBRIS STRUCTURE.

(I) ALL HARDWARE SHALL BE LISTED ON THE QUALIFIED PRODUCT LIST OR APPROVED BY TDOT IN ADVANCE OF IT'S USE AND INTENDED PURPOSE.

STREAM MITIGATION PLAN LEGEND: —LR— LOG REVETMENT

STREAM MITIGATION PLAN LEGEND: # RACK STRUCTURE

STREAM MITIGATION PLAN LEGEND: ROOT WAD

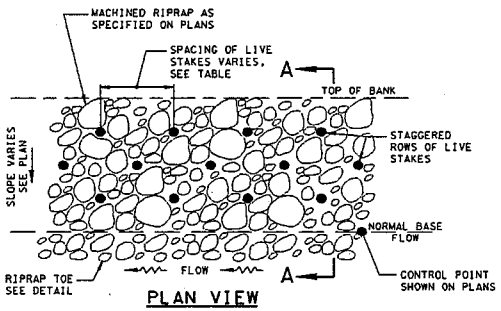
STREAM MITIGATION PLAN LEGEND: FELLED TREE

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

LARGE WOODY DEBRIS

NOT TO SCALE | 8-01-11 | D-NSD-10

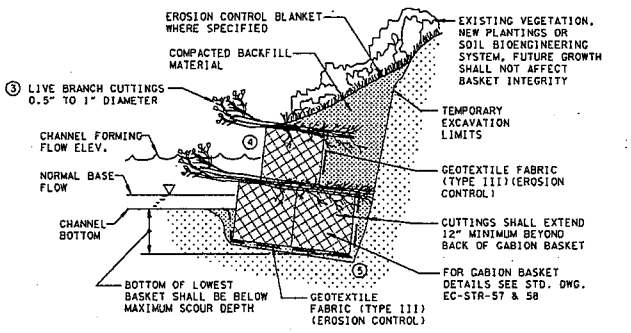
VEGETATED RIPRAP



PLAN VIEW
VEGETATED RIPRAP

● DENOTES LIVE STAKE

VEGETATED GABIONS



NOTE ③: BRANCHES MAY BE INSTALLED WITHIN BASKETS DURING THE FILLING OF THE GABION. ROOT SYSTEM SHALL EXTEND TO SOIL BEHIND GABION BASKET.

NOTE ④: STACKED GABIONS SHALL BE TILTED TOWARD THE SLOPE A MINIMUM OF 6 DEGREES

NOTE ⑤: GABIONS SHALL BE CONSTRUCTED ON STABLE, NON-ERODING FOUNDATION

SECTION VIEW
VEGETATED GABION

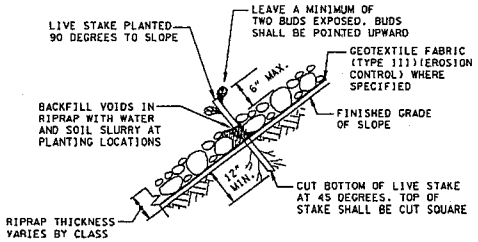
CONTROL POINT (BEGIN AND END) FOR GABIONS SHALL BE PROVIDED ON THE STREAM MITIGATION PLANS

LIVE STAKE SPACING TABLE

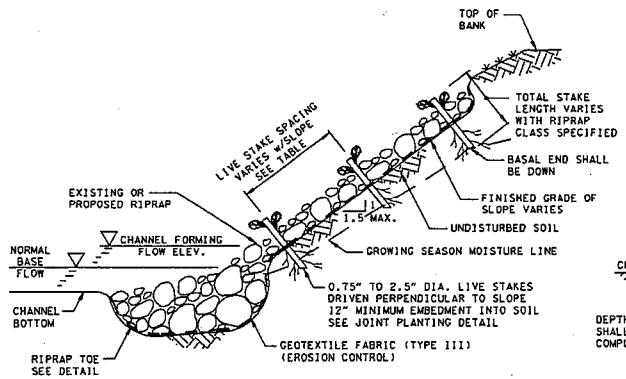
SLOPE STEEPNESS ① H:V	SPACING IN FEET ②	
	SOILS	
	COHESIVE	NON-COHESIVE
1.5:1	1.5 TO 2.5	1 TO 2
2:1	1.5 TO 3	1.5 TO 2
3:1	3 TO 5	2 TO 4
FLATTER	AS DIRECTED BY ENGINEER	

NOTE ①: ASSUMES SLOPE IS STABLE

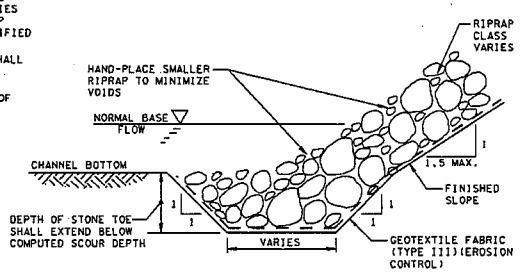
NOTE ②: ON-CENTER, EACH WAY



LIVE STAKE RIPRAP JOINT PLANTING DETAIL



SECTION A-A



RIPRAP TOE DETAIL

STREAM MITIGATION PLAN LEGEND: VEGETATED GABIONS

STREAM MITIGATION PLAN LEGEND: VEGETATED RIPRAP

VEGETATED RIPRAP GENERAL NOTES

(A) VEGETATED RIPRAP IS A BANK STABILIZATION PRACTICE THAT PROTECTS A STREAMBANK FROM EROSION, REDUCES LOCAL FLOW VELOCITIES, TRAPS SEDIMENT DURING HIGH FLOWS, AND ENHANCES THE ESTABLISHMENT AND GROWTH OF NATIVE VEGETATION USING LIVE BRANCHES AND CUTTINGS ANCHORED TO THE SLOPES.

(B) VEGETATED RIPRAP FOR STREAM MITIGATION SHOULD BE LIMITED TO LOCATIONS WHERE HARD ARMORING IS REQUIRED SUCH AS THE OUTSIDE OF A STREAM BEND.

(C) RIPRAP SHALL BE KEYED INTO THE STREAM BED TO AN ELEVATION BELOW THE COMPUTED SCOUR DEPTH TO AVOID UNDERMINING AT THE TOE OF SLOPE.

(D) LIVE STAKES SHALL BE IN CONTACT WITH THE SOIL BELOW THE RIPRAP AND ANY GEOTEXTILE PRESENT BELOW THE RIPRAP A MINIMUM OF 12 INCHES. PLANTING OF CUTTINGS DURING THE DORMANT SEASON OF THE PLANT SPECIES IS PREFERRED.

(E) LIVE STAKES SHALL BE 0.75 INCHES TO 2.5 INCHES IN DIAMETER AND GENERALLY 2.5 TO 4 FEET LONG WITH SIDE BRANCHES CLEANLY REMOVED.

(F) THE BOTTOM (BASAL) END OF LIVE STAKES SHALL BE CLEANLY CUT AT A 45 DEGREE ANGLE. THE TOP OF ALL LIVE STAKES SHALL BE CUT SQUARE (FLAT). ALL PLANTINGS SHALL BE INSTALLED PERPENDICULAR TO THE SLOPE.

(G) LIVE STAKES FOR VEGETATED RIPRAP MAY BE INSTALLED THE DAY THEY ARE HARVESTED IF WATERED. SOAKING FOR A MINIMUM 24 HOURS IS REQUIRED WHEN PLANTING IS DELAYED.

(H) LIVE STAKES FOR VEGETATED RIPRAP MAY BE INSTALLED LEAVING A FEW INCHES ABOVE THE TOP OF THE RIPRAP OR CUT FLUSH WITH THE TOP OF THE RIPRAP. AT LEAST TWO BUDS OR BUD SCARS SHALL BE PRESENT ON THE STAKE WHEN INSTALLED.

(I) VOIDS IN RIPRAP WHERE LIVE STAKES ARE INSTALLED SHALL BE BACKFILLED WITH A WATER AND SOIL SLURRY MIXTURE TO A MINIMUM DEPTH OF HALF THE RIPRAP LAYER THICKNESS.

(J) ONLY GEOTEXTILE FABRIC (TYPE III) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.

(K) VEGETATED RIPRAP SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-03.43	STREAM MITIGATION - VEGETATED RIPRAP (DESCRIPTION) PER CUBIC YARD
740-10.03	GEOTEXTILE (TYPE III) (EROSION CONTROL) PER SQUARE YARD

PAYMENT FOR VEGETATED RIPRAP SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR THE CONSTRUCTION OF THE RIPRAP AND VEGETATION (LIVE STAKES).

(L) OTHER VARIATIONS MAY BE USED SUCH AS RIPRAP WITH BRUSH LAYERING AND POLE PLANTING, BENT POLE (HORIZONTAL) METHOD, OR WILLOW BUNDLE METHOD.

VEGETATED GABIONS GENERAL NOTES

(A) VEGETATED GABIONS ARE RECTANGULAR WIRE BASKETS OR MATTRESSES FILLED WITH ROCK AND USED AS A BANK STABILIZATION PRACTICE TO PROTECT A STEEP STREAMBANK FROM EROSION IN LOCATIONS WHERE THE BANK IS TOO STEEP FOR RIPRAP OR OTHER MEASURES AND STRUCTURAL SUPPORT IS REQUIRED. VEGETATED GABIONS ENHANCE THE ESTABLISHMENT AND GROWTH OF NATIVE VEGETATION USING LIVE BRANCHES AND CUTTINGS COMBINED WITH THE WIRE BASKETS.

(B) VEGETATED GABIONS FOR STREAM MITIGATIONS SHOULD BE LIMITED TO LOCATIONS WHERE HARD ARMORING IS REQUIRED SUCH AS THE OUTSIDE OF A STREAM BEND AND WHERE LIMITED SPACE IS AVAILABLE AND STRUCTURAL SUPPORT IS REQUIRED.

(C) GABIONS SHALL BE KEYED INTO THE STREAM BED SO THAT THE BOTTOM ELEVATION OF THE LOWEST BASKET IS BELOW THE EXPECTED MAXIMUM COMPUTED SCOUR DEPTH OF THE STREAM.

(D) LIVE BRANCH CUTTINGS SHALL BE 0.5 INCHES TO 1.5 INCHES MAX. DIAMETER AND A MINIMUM OF 4 FEET LONG WITH SIDE BRANCHES CLEANLY REMOVED. LENGTH OF CUTTING WILL VARY BASED ON GABION WALL LAYOUT.

(E) LIVE BRANCH CUTTINGS MAY BE INSTALLED BETWEEN HORIZONTAL LAYERS OF GABIONS OR ANYWHERE WITHIN THE BASKET DURING THE FILLING OF THE BASKET WITH ROCK. WHERE INSTALLED WITHIN A BASKET, THE STONES SHALL BE HAND-PLACED TO AVOID DAMAGE TO THE LIVE BRANCH CUTTINGS.

(F) LIVE BRANCH CUTTINGS SHALL BE PLACED PERPENDICULAR TO THE SLOPE WITH GROWING TIPS SLIGHTLY PROTRUDING FROM THE FRONT OF THE GABION WALL.

(G) LIVE BRANCH CUTTINGS SHALL BE IN CONTACT WITH THE SOIL BEHIND THE GABION BASKETS OR MATTRESSES AND THROUGH THE GEOTEXTILE PRESENT BEHIND THE GABION A MINIMUM OF 12 INCHES (PREFERABLY TO THE UNDISTURBED BANK SOIL).

(H) GABION CONSTRUCTION AND ASSEMBLY SHALL BE AS PROVIDED ON STANDARD DRAWINGS EC-STR-57 AND EC-STR-58.

(I) WHERE GABION MATTRESSES ARE SPECIFIED, PLANTING OF LIVE BRANCHES OR STAKES SHALL BE SIMILAR TO VEGETATED RIPRAP.

(J) ONLY GEOTEXTILE FABRIC (TYPE III) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.

(K) VEGETATED GABIONS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

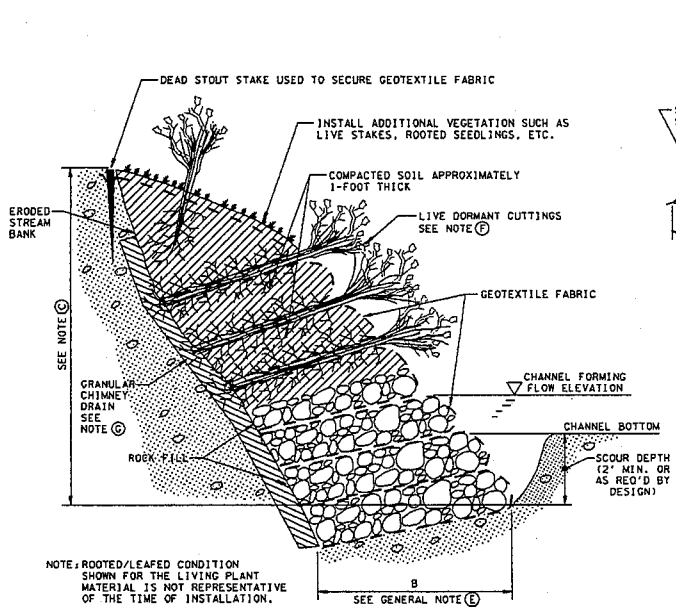
209-03.48	STREAM MITIGATION - VEGETATED GABIONS (DESCRIPTION) PER CUBIC YARD
740-10.03	GEOTEXTILE (TYPE III) (EROSION CONTROL) PER SQUARE YARD

PAYMENT FOR VEGETATED GABIONS SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR THE CONSTRUCTION OF THE GABIONS AND VEGETATION.

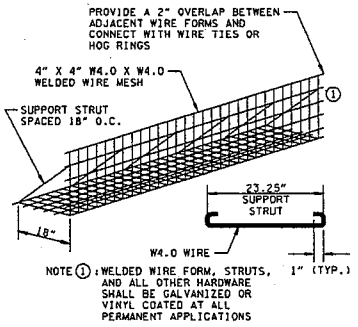
STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

VEGETATED RIPRAP AND GABIONS

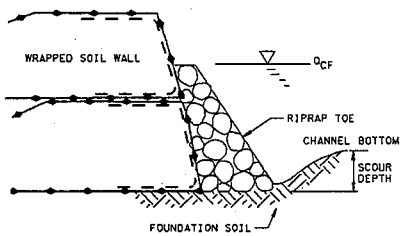
NOT TO SCALE | 8-01-11 | D-NSD-11



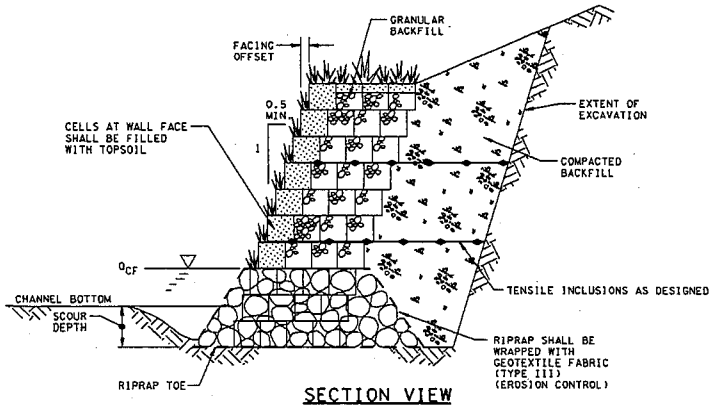
SECTION VIEW
WRAPPED SOIL GEOTEXTILE WALL



WELDED WIRE FORM DETAIL

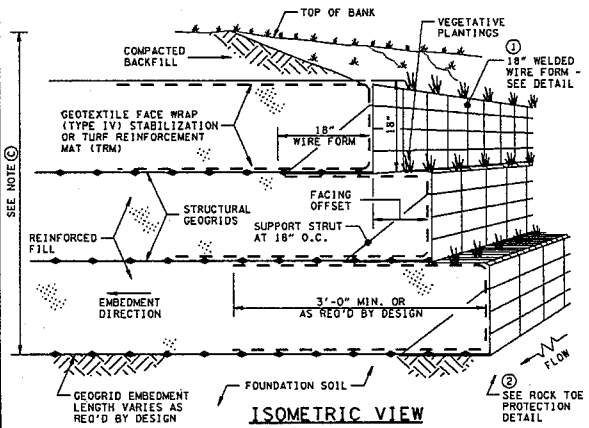


(2) ROCK TOE PROTECTION DETAIL



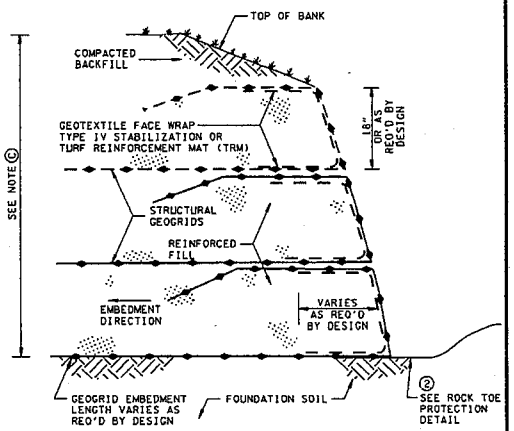
SECTION VIEW
SOIL REINFORCED GEOCELLULAR WALL

NOTE: MATERIALS AND DIMENSIONS TYPICAL AND MAY VARY PER INDIVIDUAL DESIGNS.



ISOMETRIC VIEW
WRAPPED SOIL WELDED WIRE WALL
STEP FACE EXAMPLE

NOTE: STEPPED WALL SHOWN - MAY BE STEPPED, VERTICAL OR SLOPING FACE. MATERIALS AND DIMENSIONS TYPICAL AND MAY VARY PER INDIVIDUAL DESIGNS.



SECTION VIEW
WRAPPED SOIL GEOGRID WALL
SLOPING FACE EXAMPLE

NOTE: SLOPING WALL SHOWN - MAY BE STEPPED, OR SLOPING FACE. MATERIALS AND DIMENSIONS TYPICAL AND MAY VARY PER INDIVIDUAL DESIGNS.

STREAM MITIGATION PLAN LEGEND: —— VMSEW —— VMSEW —— VMSEW —— VEGETATED MSE WALLS

VEGETATED MSE WALLS GENERAL NOTES

(A) VEGETATED MECHANICAL STABILIZED EARTH (MSE) WALLS MAY BE USED FOR STREAM SLOPE STABILIZATION WHERE HORIZONTAL CONSTRAINTS SUCH AS THE ROADWAY ITSELF OR RIGHT-OF-WAY LIMITS LEAVE LITTLE ROOM FOR A SLOPING CHANNEL BANK. VEGETATED MSE WALLS INCORPORATE VEGETATION TO PROVIDE HABITAT VALUES SUCH AS SHADING AND TO PROVIDE A MORE NATURAL AESTHETIC. THE VEGETATION CAN ALSO ASSIST IN PREVENTING EROSION AT THE FACE OF THE WALL.

(B) A VEGETATED MSE WALL IS A COMPLEX STRUCTURE WHICH WILL REQUIRE SPECIALIZED DESIGN. VEGETATED MSE WALLS SHALL BE DESIGNED IN ACCORDANCE WITH TDOT STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION AND THE CURRENT AASHTO STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES WITH INTERIMS. EXAMPLES DEPICTED ON THIS SHEET ARE REPRESENTATIVE OF TYPICAL APPLICATIONS. VEGETATED MSE WALLS SHALL BE INDIVIDUALLY DESIGNED ON A CASE-BY-CASE BASIS.

(C) MSE WALL DESIGN INCLUDING WALL HEIGHT AND LENGTH AND SPACING OF TENSILE INCLUSIONS SHALL BE COORDINATED WITH THE GEOTECHNICAL ENGINEERING SECTION. TYPICAL WALL HEIGHTS ARE UP TO 10-FT. WALL HEIGHTS OF UP TO 20 FEET ARE ALLOWABLE IF ECONOMICALLY JUSTIFIED. THE SLOPE OF THE WALL FACE MAY VARY FROM 0.5H:1V TO 1H:1V. PROPRIETARY DESIGN SYSTEMS SHALL BE CONSTRUCTED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATIONS AND SPECIFICATIONS.

(D) ROCK FILL SHALL BE KEYED INTO THE STREAM BED TO AN ELEVATION BELOW THE COMPUTED SCOUR DEPTH TO AVOID UNDERMINING AT THE TOE OF SLOPE.

(E) THE WIDTH AT THE BASE OF A WRAPPED SOIL WALL (B) SHALL BE BASED ON SITE CONDITIONS AND AS RECOMMENDED BY THE GEOTECHNICAL ENGINEERING SECTION, BUT NOT LESS THAN 3 FEET.

(F) LIVE DORMANT CUTTINGS MAY BE INSTALLED BETWEEN HORIZONTAL LAYERS OF A WRAPPED SOIL MSE WALL. PLANTING OF CUTTINGS DURING THE DORMANT SEASON IS PREFERRED. THE LIVE BRANCHES SHALL BE BETWEEN 0.5 INCHES TO 1.5 INCHES. IN DIAMETER AND A MINIMUM OF 4 FEET LONG WITH SIDE BRANCHES CLEANLY REMOVED AND SHALL BE IN CONTACT WITH THE SOIL A MINIMUM OF 12 INCHES. THE BOTTOM (BASAL) ENDS OF LIVE CUTTINGS SHALL BE CLEANLY CUT AT A 45 DEGREE ANGLE AND THE TOPS SHALL BE CUT SQUARE (FLAT). ALL PLANTINGS SHALL BE INSTALLED PERPENDICULAR TO THE SLOPE. LIVE CUTTINGS MAY NOT BE REQUIRED FOR FLATTER SLOPES AND SHORT WALL HEIGHTS.

(G) WRAPPED SOIL MSE WALLS SHALL BE PROVIDED WITH CHIMNEY DRAINS SUFFICIENT TO RELIEVE PORE PRESSURE AT THE BOUNDARY BETWEEN NATIVE SOIL AND THE MSE WALL MATERIALS. THESE DRAINS WILL TYPICALLY BE COMPOSED OF COARSE AGGREGATE, BUT OTHER MATERIALS ARE ALLOWABLE WHERE LIVE DORMANT CUTTINGS ARE NOT INCORPORATED INTO THE WALL.

(H) THE GEOCELLS USED FOR A STACKED GEOCELL MSE WALLS SHALL BE PERFORATED EXCEPT AT THE FRONT FACE WHICH SHALL BE SOLID. THE GEOCELLS SHALL BE BACK FILLED WITH SOIL SUITABLE TO SUPPORT THE ESTABLISHMENT OF VEGETATION AND BE SEEDED WITH SMALL PLANTS, VINES, AND GRASSES. THE EXPOSED FACE OF THE WALL SHALL BE PROTECTED FROM EROSION BY MEANS OF AN HYDRAULICALLY APPLIED MULCH COMPOSED OF NATURAL FIBERS AND ORGANIC TACKIFIERS.

(I) ONLY GEOTEXTILE FABRIC (TYPE III) AND (TYPE IV) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED. ONLY TRM'S LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.

(J) VEGETATED MSE WALLS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-03.49 STREAM MITIGATION - VEGETATED MSE WALLS (DESCRIPTION) PER SQUARE FOOT

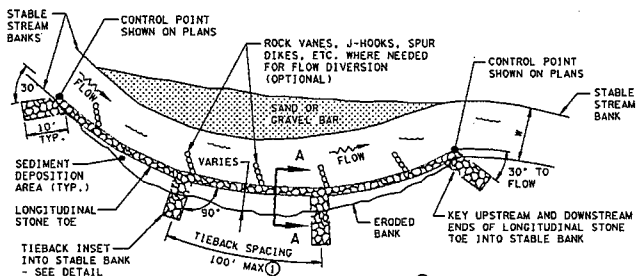
PAYMENT FOR VEGETATED MSE WALLS SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR THE CONSTRUCTION OF THE WALL AND VEGETATION.

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

VEGETATED MSE WALLS

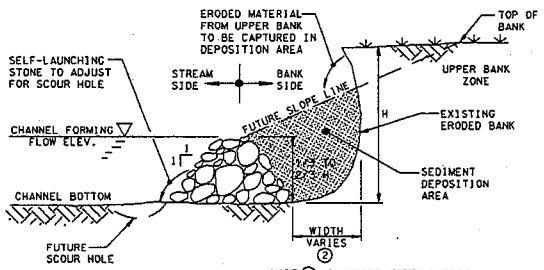
NOT TO SCALE | 8-01-11 | D-NSD-12

LONGITUDINAL STONE TOE



NOTE (1): FOR LARGER STREAMS OR RIVERS, TIEBACKS SHALL BE SPACED AT 2X THE CHANNEL FORMING FLOW WIDTH (W)

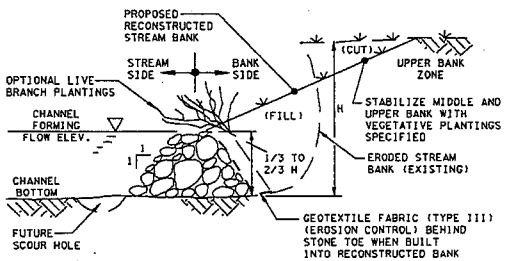
PLAN VIEW



NOTE (2): BANKSIDE WIDTH VARIES TO PROVIDE SMOOTH ALIGNMENT THROUGH THE CHANNEL BEND

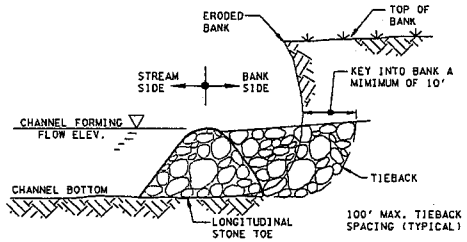
SECTION A-A
STONE TOE IN FRONT OF BANK

(SEDIMENT DEPOSITION AREA FILLS NATURALLY OVER TIME)



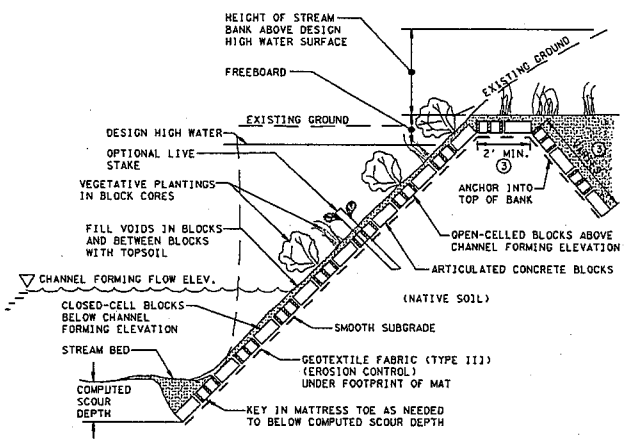
SECTION A-A
STONE TOE BUILT INTO RECONSTRUCTED BANK

(SEDIMENT DEPOSITION AREA FILLED DURING CONSTRUCTION)



TIEBACK DETAIL

ARTICULATED CONCRETE MAT



SECTION VIEW

CONTROL POINTS FOR ARTICULATED CONCRETE MAT SHALL BE PROVIDED ON THE STREAM MITIGATION PLANS

NOTE (3): ANCHOR LENGTHS VARY AND SHALL BE PER MANUFACTURE'S SPECIFICATIONS

LONGITUDINAL STONE TOE GENERAL NOTES

(A) LONGITUDINAL STONE TOE IS A LOWER BANK STABILIZATION MEASURE THAT IS PLACED AT THE TOE OF AN ERODING BANK, OR STREAM SIDE OF THE TOE, TO PROVIDE HARD ARMORING AGAINST FURTHER EROSION, PROVIDE AN AREA FOR SEDIMENT DEPOSITION AND NATURAL RECONSTRUCTION OF THE TOE, AND ENCOURAGE THE GROWTH OF ADDITIONAL VEGETATION AS THE BANK SLOPE STABILIZES.

(B) LONGITUDINAL STONE TOE IS ACCEPTABLE FOR USE IN STABLE ALLUVIAL CHANNELS WHERE THE LOWER BANK IS FAILING BUT THE MID AND UPPER SLOPES ARE FAIRLY STABLE.

(C) USE OF THIS IN-STREAM MEASURE SHALL NOT ADVERSELY AFFECT THE HYDRAULIC CAPACITY OF THE CHANNEL.

(D) LONGITUDINAL STONE TOE SHOULD NOT BE USED IN BEDROCK CHANNELS.

(E) LONGITUDINAL STONE TOE MAY BE USED IN COMBINATION WITH OTHER HYDRAULIC CONTROL STRUCTURES (J-HOOKS, VANES, ETC.), AND MOST OTHER BANK STABILIZATION MEASURES.

(F) MACHINED RIPRAP CLASS SELECTED FOR CONSTRUCTING LONGITUDINAL STONE TOE SHALL BE SELECTED BASED ON CRITERIA IN SECTION 11.04.6 OF THE DRAINAGE MANUAL.

(G) WHEN THE STONE TOE IS BUILT INTO A RECONSTRUCTED BANK, GEOTEXTILE (TYPE III) (EROSION CONTROL) SHALL BE PLACED BEHIND THE ROCK TO PREVENT SOIL MIGRATION THROUGH THE STRUCTURE.

(H) THE TOP ELEVATION OF THE STRUCTURE SHALL BE NO LOWER THAN THE CHANNEL FORMING FLOW ELEVATION OF THE STREAM.

(J) ACCESS TO THE STREAMBANK AREA SHALL BE PROVIDED FOR HEAVY EQUIPMENT, MONITORING, AND MAINTENANCE.

(J) ONLY GEOTEXTILE FABRIC (TYPE III) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.

(K) LONGITUDINAL STONE TOE SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBERS:

209-03.47	STREAM MITIGATION - LONGITUDINAL STONE TOE (DESCRIPTION) PER CUBIC YARD
740-10.03	GEOTEXTILE (TYPE III) (EROSION CONTROL) PER SQUARE YARD

PAYMENT FOR LONGITUDINAL STONE TOE SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR THE CONSTRUCTION OF THE TOE PROTECTION SYSTEM.

ARTICULATED CONCRETE MAT GENERAL NOTES

(A) ARTICULATED CONCRETE MATS ARE A BANK STABILIZATION REVETMENT MADE UP OF MULTIPLE CONCRETE BLOCKS BOUND TOGETHER BY STEEL CABLE OR INTERLOCKING BLOCK THAT IS USED TO RESIST EROSIVE FORCES EXERTED BY HIGH ENERGY FLOWS. ARTICULATED BLOCKS ARE NORMALLY HOLLOW-CORED ABOVE THE CHANNEL FORMING FLOW ELEVATION SO THAT TOPSOIL AND VEGETATION CAN BE INSTALLED WITHIN THE CORES ALLOWING FOR A PARTIALLY VEGETATED STREAM BANK.

(B) ARTICULATED CONCRETE BLOCK MATS ARE BEST SUITED FOR THRESHOLD STREAMS WHERE VELOCITIES EXCEED 12 FEET PER SECOND, AND ON THE OUTSIDE BEND OF HIGH GRADIENT STREAMS. MAY BE USED IN ALLUVIAL STREAMS WHERE APPROPRIATE.

(C) SEE HEC-23 FOR DETAILED DESIGN GUIDANCE FOR ARTICULATED CONCRETE BLOCK MAT SYSTEMS.

(D) AT A MINIMUM, INDIVIDUAL CONCRETE BLOCKS USED FOR THE REVETMENT SYSTEM SHALL BE CONSTRUCTED OF CLASS D CONCRETE (f'c 4000 PSI).

(E) ALL ARTICULATED BLOCK REVETMENT SYSTEMS SHALL BE KEYED INTO THE BANK AT BOTH THE CONTROL POINTS (UPSTREAM AND DOWNSTREAM ENDS) OF THE INSTALLATION.

(F) BOTTOM OF BLOCK MAT SHALL EXTEND BELOW THE COMPUTED SCOUR DEPTH OF THE CHANNEL BOTTOM. TOP OF MAT SHALL BE ANCHORED IN STABLE SOIL.

(G) TOP OF MAT AT THE TOP OF THE STREAM BANK SHALL BE KEYED INTO THE SOIL A MINIMUM OF 3 BLOCKS ALONG THE ENTIRE LENGTH OF THE INSTALLATION.

(H) ONLY BLOCK SYSTEMS LISTED ON THE QUALIFIED PRODUCTS LIST MAY BE USED.

(J) BLOCKS SHALL MEET THE PHYSICAL REQUIREMENTS OF ASTM D6684.

(J) ONLY GEOTEXTILE FABRIC (TYPE III) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED.

(K) ARTICULATED CONCRETE MAT SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBERS:

209-03.53	STREAM MITIGATION - ARTICULATED CONCRETE MAT PER SQUARE YARD
740-10.03	GEOTEXTILE (TYPE III) (EROSION CONTROL) PER SQUARE YARD

PAYMENT FOR ARTICULATED CONCRETE MAT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR THE CONSTRUCTION OF THE REVETMENT SYSTEM.

(L) ARTICULATED CONCRETE MATS SHALL BE INSTALLED ACCORDING TO MANUFACTURER'S SPECIFICATIONS.

STREAM MITIGATION PLAN LEGEND: TOE TOE TOE TOE LONGITUDINAL STONE TOE

STREAM MITIGATION PLAN LEGEND: ARTICULATED CONCRETE MAT

NOT TO SCALE

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

LONGITUDINAL STONE TOE AND ARTICULATED CONCRETE MAT

8-01-11 D-NSD-13

STANDARD LEGEND

BOULDER CLUSTER (SHOW CONFIGURATION)

ROCK VANE

CROSS VANE

W-WEIR

J-HOOK

LOG VANE

LOG DEFLECTOR

STRAIGHT WEIR
LOG DROP

DIAGONAL WEIR
LOG DROP

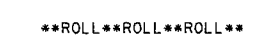
"VEE" WEIR LOG DROP
(SHOW ORIENTATION)

"K" WEIR
LOG DROP

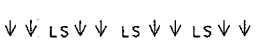
BOULDER RIFFLE

LOG RIFFLE

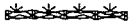
ROCK RIFFLE



COCONUT FIBER ROLLS



LIVE SILTATION



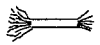
LIVE FASCINE

BRUSH MATTRESS

LOG REVETMENT

RACK STRUCTURE

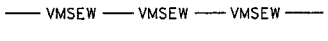
ROOT WAD



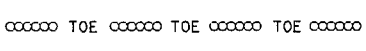
FELLED TREE

VEGETATED GABIONS

VEGETATED RIPRAP



VEGETATED MSE WALLS



LONGITUDINAL STONE TOE

ARTICULATED CONCRETE MAT

STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION

STANDARD LEGEND
FOR
NATURAL STREAM
DESIGN

9-1-11 | RD-L-8