STATE OF TENNESSEE
DEPARTMENT OF TRANSPORTATION
ROADWAY DESIGN DIVISION
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CLAY BRIGHT
COMMISSIONER

BILL LEE
GOVERNOR

INSTRUCTIONAL BULLETIN NO. 20-22

Regarding Various Revised and New Standard Drawings

Effective May 7, 2021 letting (February 24, 2021 Turn-in), the following Standard Drawings have been revised and are new. The revised and new standard drawings have been revised in the Roadway Design Guidelines, Chapter 10, Index of Standard Drawings and are available online.

New Standard Drawings:

10-107.00 DESIGN – TRAFFIC CONTROL

10-107.02 WORK ZONES

DRAWING NUMBER	REVISION DATE	DESCRIPTION
T-WZ-61		ROLLING ROADBLOCK DETAIL FOR DIVIDED HIGHWAYS

10-105.00 MULTIMODAL

10-105.03 SAFETY RAIL

DRAWING NUMBER	REVISION DATE	DESCRIPTION
MM-BPR-3		BARRIER SLOPED END TREATMENT

Revised Standard Drawings:

10-101.00 PIPE CULVERTS AND ENDWALLS

10-101.03 SAFETY SIDE DRAIN ENDWALLS

DRAWING NUMBER	REVISION DATE	DESCRIPTION
D-PB-1	11-30-20	STANDARD DETAILS FOR CONCRETE PIPE INSTALLATION
D-PB-2	11-30-20	STANDARD DETAILS FOR FLEXIBLE PIPE INSTALLATION
D-PB-3	11-30-20	INDUCED TRENCH SOIL EMBANKMENT FOR PIPE CULVERT INSTALLATION

10-103.00 NATURAL STREAM DESIGN

10-103.01 DEFLECTORS, VANES, AND ENERGY DISSIPATORS

DRAWING NUMBER	REVISION DATE	DESCRIPTION
D-NSD-26	11-30-20	LOG VANES, ROOT WADS, AND BOULDER J-HOOK
D-NSD-27	11-30-20	LOG AND BOULDER STEP POOLS
D-NSD-28A	11-30-20	LOG RIFFLES

10-107.00 DESIGN - TRAFFIC CONTROL

10-107.01 PAVEMENT MARKINGS

DRAWING NUMBER	REVISION DATE	DESCRIPTION
T-M-4A	11-30-20	STANDARD UNSIGNALIZED MID-BLOCK CROSSING
T-M-4B	11-30-20	STANDARD SIGNALIZED MID-BLOCK CROSSING

10-107.00 DESIGN – TRAFFIC CONTROL

10-107.02 WORK ZONES

DRAWING NUMBER	REVISION DATE	DESCRIPTION
T-WZ-32	11-30-20	TRAFFIC CONTROL PLAN SIGNAL LAYOUT FOR TRAFFIC SIGNAL AT TWO LANE BRIDGE RECONSTRUCTION SITE
T-WZ-56	11-30-20	TRANSVERSE RUMBLE STRIP USE WITHIN WORK ZONES

10-108.00 EROSION PREVENTION AND SEDIMENT CONTROL

10-108.03 DITCH DEVICES

DRAWING NUMBER	REVISION DATE	DESCRIPTION

EC-STR-6 11-30-20 ROCK CHECK DAM

These standard drawings are located on the web site and in Chapter 10 of the Design Guidelines and can be found in the following links.

Standard Drawings:
https://www.tn.gov/content/tn/tdot/roadway-design/standard-drawings-library/standard-roadway-drawings.html

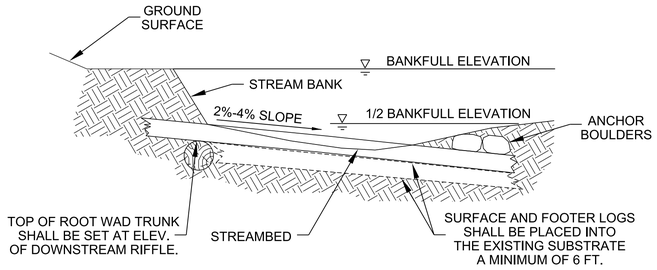
Chapter 10 - Index of Standard Drawings is available online at this location:

https://www.tn.gov/content/dam/tn/tdot/roadway-design/documents/design_guidelines/DG-C10.pdf

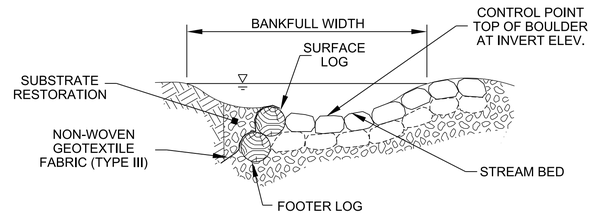
Jennifer Lloyd

Jennifer Lloyd, PE
Civil Engineering Director
Roadway Design Division

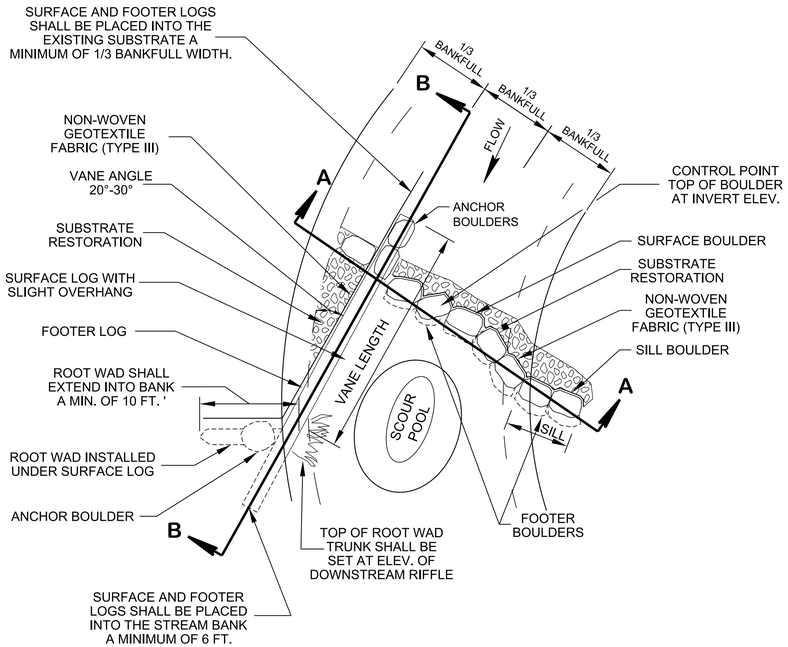
KJL:ARH:RBB:TD
December 18, 2020



SECTION B-B



SECTION A-A



PLAN VIEW

LOG VANES, ROOT WADS AND BOULDER J-HOOK NOTES

NOT TO SCALE

REV. 9-15-17: MODIFIED THE STREAM MITIGATION PLAN LEGEND SYMBOL. MODIFIED THE STREAM MITIGATION PLAN LEGEND.

REV. 05-01-20: REDREW SHEET.

REV. 11-30-20: REVISED NON-WOVEN GEOTEXTILE FABRIC NOTE ON PLAN AND SECTION A-A.

LOG VANES, ROOT WADS AND BOULDER J-HOOK NOTES

(A) LOG VANES AND LOG VANES WITH J-HOOKS ARE HYDRAULIC CONTROL MEASURES THAT ARE USED ALONG THE OUTSIDE BANKS OF MEANDER BENDS TO DIRECT FLOW AWAY FROM THE STREAM BANK, CONCENTRATE FLOWS INTO THE CENTER OF THE CHANNEL, AND ENHANCE HABITAT. WHEN BOULDER J-HOOKS ARE USED IN COMBINATION WITH LOG VANES, THEY ALSO PROVIDE GRADE CONTROL. ROOT WADS ARE USED AS A SILL TO PREVENT FLOW DIVERSION AND TO PROVIDE COVER HABITAT FOR FISH AND OTHER AQUATIC ORGANISMS IN THE DOWNSTREAM SCOUR POOL.

(B) LOG VANES, ROOT WADS, AND J-HOOKS SHOULD BE PLACED AT THE STATIONS, OFFSETS, ELEVATIONS, AND CONFIGURATION INDICATED ON THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS, STREAM MITIGATION PLAN, OR AS DIRECTED BY THE ENGINEER. AT A MINIMUM, THE BANKFULL WIDTH; MINIMUM LOG AND BOULDER DIMENSIONS; VANE, J-HOOK, AND SILL LENGTHS AND INVERT ELEVATIONS; SHOULD BE SPECIFIED IN THE STREAM MITIGATION DATA TABLE.

(C) REFER TO STANDARD DRAWING D-NSD-37 "SPECIAL NOTES FOR NATURAL STREAM DESIGN".

(D) LOGS SHALL BE RELATIVELY STRAIGHT, RECENTLY HARVESTED AND DECAY RESISTANT SPECIES SUCH AS CEDAR, WHITE OAK, ETC.

(E) BOULDERS PRESENT IN THE EXISTING STREAM MEETING THE SPECIFIED TYPE AND SIZE SHOULD BE USED IN THE RESTORED CHANNEL SEGMENT.

(F) THE LOG VANE SHALL EXTEND FROM THE STREAM BOTTOM ELEVATION AT ITS INSERTION INTO THE STREAM BED 1/3 BANKFULL WIDTH TO HALF THE BANKFULL ELEVATION AT ITS INSERTION INTO THE STREAM BANK (6-FOOT MINIMUM). THE SURFACE LOG SHALL BE PLACED ON ONE OR MORE FOOTER LOGS ALONG ITS LENGTH AND A ROOT WAD AT ITS INSERTION INTO THE BANK. ROOT WAD SHALL BE PLACED BENEATH THE SURFACE LOG AND PLACED SO THAT IT LOCKS THE SURFACE LOG INTO THE BANK SURFACE AND FOOTER LOGS AND ROOT WAD SHALL BE TIED SECURELY INTO THE BANK ALONG WITH A CUT-OFF SILL (6-FOOT MINIMUM) TO PREVENT THE POSSIBILITY OF STREAM FLOW DIVERTING AROUND THEM.

(G) ANCHOR THE UPSTREAM END OF THE LOG VANE WITH BOULDERS PLACED ON TOP OF THE SURFACE LOG AND AT THE CHANNEL INVERT ELEVATION.

(H) THE BOULDER J-HOOK SHOULD BE CONSTRUCTED FROM THE UPSTREAM END OF THE LOG VANE, ACROSS THE REMAINING TWO-THIRDS OF THE BANKFULL CHANNEL, TERMINATING WITH A BOULDER SILL. THE SURFACE BOULDERS IN THE CENTER OF THE J-HOOK ARE SET AT THE INVERT ELEVATION OF THE STRUCTURE.

(I) CONSTRUCT LOG VANES, ROOT WADS, AND BOULDER J-HOOK BY:

(1) FIRST SHAPE THE CHANNEL AND FLOODPLAIN TO THE SPECIFIED GRADES AND DIMENSIONS.

(2) NEXT, EXCAVATE ENOUGH BED MATERIAL TO PLACE THE LOGS AND/OR BOULDERS, NON-WOVEN GEOTEXTILE FABRIC (TYPE III) AND ALLUVIUM OR SELECT MATERIAL BACKFILL.

(3) PLACE FOOTER LOG OR BOULDERS AND SURFACE BOULDERS AT THE CHANNEL INVERT, WITH THE SURFACE LOG OR BOULDERS SLIGHTLY UPSTREAM OF THE FOOTER LOG OR BOULDERS. SURFACE AND FOOTER LOGS SHOULD EXTEND A MINIMUM OF SIX FEET INTO EACH BANK AND THE STREAM BED.

(4) PLACE NON-WOVEN GEOTEXTILE FABRIC (TYPE III) ALONG THE ENTIRE UPSTREAM FACE OF THE STRUCTURE, EXTENDING FROM THE BOTTOM OF THE FOOTER TO THE FINISHED GRADE ELEVATION. ONLY GEOTEXTILE FABRIC (TYPE III) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED. FOR LOGS, NAIL GEOTEXTILE FABRIC (TYPE III) TO THE SURFACE LOG APPROXIMATELY ONE QUARTER OF THE CIRCUMFERENCE DOWN FROM THE TOP OF THE SURFACE LOG USING TWO-INCH GALVANIZED ROOFING NAILS ON ONE-FOOT' SPACING ALONG THE ENTIRE LENGTH OF THE LOG.

(5) BACKFILL STRUCTURE AND NON-WOVEN GEOTEXTILE FABRIC (TYPE III) WITH EXCAVATED ON-SITE STREAM ALLUVIUM (IF AVAILABLE), OTHERWISE USE THE SPECIFIED SELECT MATERIAL. SOIL SHALL BE COMPACTED WELL AROUND BURIED PORTIONS OF THE STRUCTURE, WHILE CREATING A SMALL ALLUVIAL BAR BETWEEN THE LOG VANE AND THE OUTSIDE BANK. TRIM ANY EXPOSED NON-WOVEN GEOTEXTILE FABRIC (TYPE III).

(6) ONCE THE STRUCTURE IS INSTALLED, EXCAVATE THE DOWNSTREAM SCOUR POOL AND PLACE SELECT MATERIAL AS REQUIRED.

(7) A MIXTURE OF SELECT MATERIALS, AS SPECIFIED ON THE STREAM MITIGATION PLAN SHEETS, SHOULD BE USED FOR SUBSTRATE RESTORATION IN RIFFLE AND RUN HABITATS AND TO FILL GAPS IN THE VANE LOGS AND J-HOOK BOULDERS. COARSE ALLUVIUM EXCAVATED FROM THE EXISTING STREAM BED, WHICH MEETS THE SPECIFIED SIZE CLASSIFICATION, IS THE PREFERRED MATERIAL TO USE FOR SUBSTRATE RESTORATION. REFER TO D-NSD-30 AND D-NSD-37 FOR ADDITIONAL SUBSTRATE RESTORATION INFORMATION.

(J) RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.

(K) THE SURFACE OF LOG VANES, ROOT WADS, AND J-HOOKS SHALL BE FINISHED TO A NEAT AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE PLANS. THE DEGREE OF FINISH FOR INVERT ELEVATIONS SHALL BE WITHIN 0.10 FOOT OF THE GRADES AND ELEVATIONS INDICATED, OR AS DIRECTED BY THE ENGINEER. ALL GAPS OR VOIDS SHALL BE PLUGGED WITH SELECT MATERIAL TO FORM A TIGHT-FITTING SEAL.

(L) ALL MATERIALS ARE TO BE APPROVED BY ENGINEER OR ENGINEER'S ON-SITE CONSTRUCTION OBSERVER.

(M) PAYMENT FOR THE LOG VANES, ROOT WADS AND BOULDER J-HOOK SYSTEMS SHALL INCLUDE ALL MATERIALS, EQUIPMENT, AND LABOR FOR CONSTRUCTION, AND SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBERS:

209-03.34,	STREAM MITIGATION - LOG VANES,	L.F.
209-03.38,	STREAM MITIGATION - J-HOOK,	EACH
209-03.62,	STREAM MITIGATION - ROOT WAD,	EACH.

STREAM MITIGATION PLAN LEGEND: **LOG VANES, ROOT WADS AND BOULDER J-HOOK**

MATERIAL SHOWN ARE ONLY A GRAPHICAL REPRESENTATION AND DO NOT DEPICT THE ACTUAL DEPTH OR QUANTITY OF MATERIALS TO APPROPRIATELY CONSTRUCT OR STABILIZE THE CHANNEL.

STATE OF TENNESSEE
STANDARD DRAWING
DEPARTMENT OF TRANSPORTATION

LOG VANES, ROOT WADS, AND BOULDER J-HOOK

11-01-2016 | D-NSD-26

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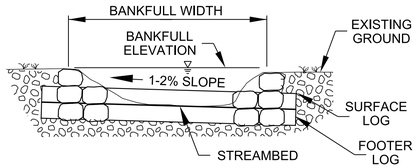
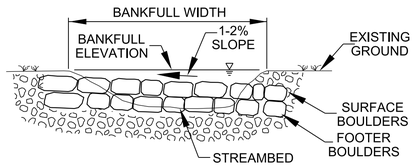


SECTION A-A



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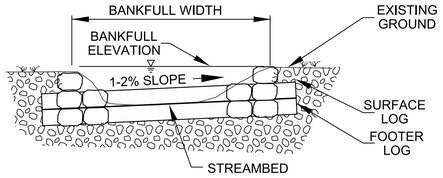

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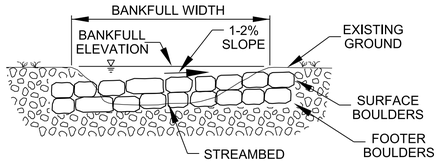

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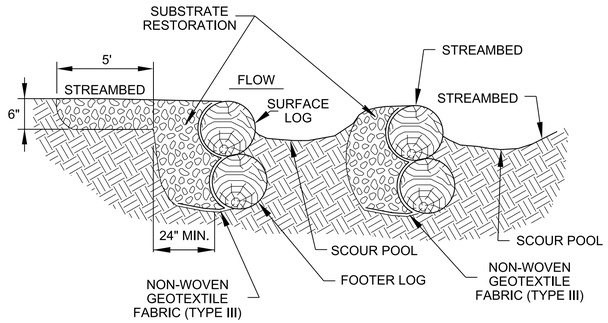

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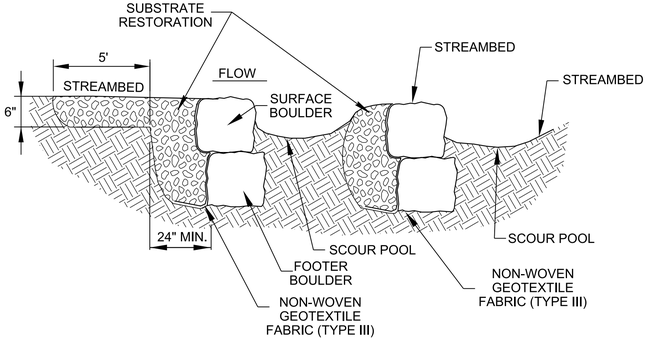

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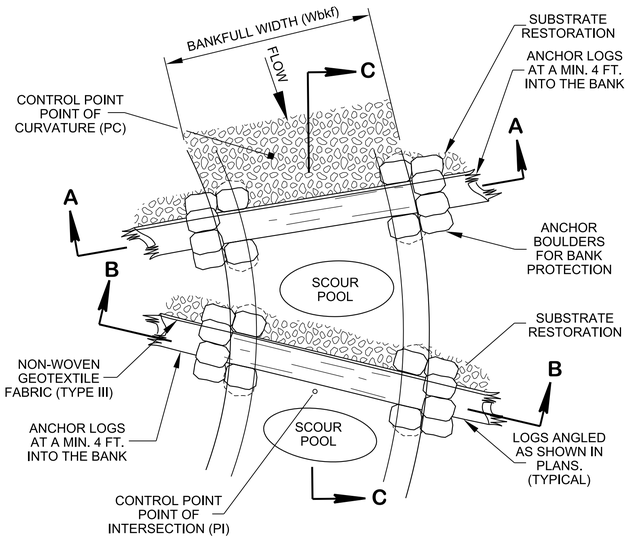
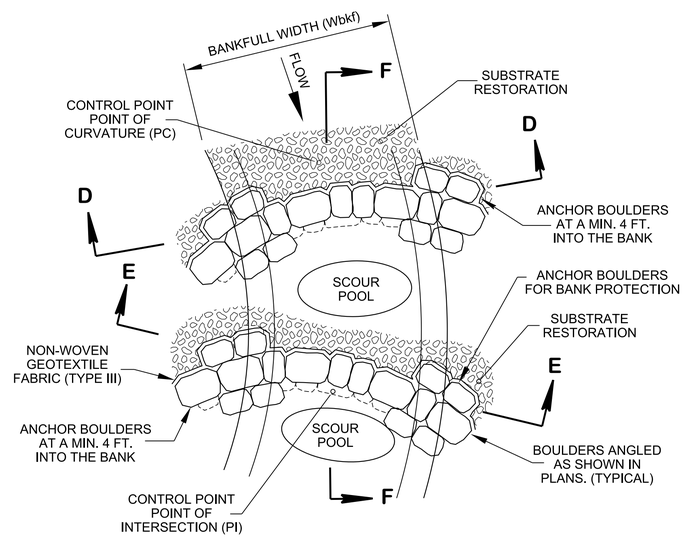


PLAN VIEW

LOG STEP POOL



PLAN VIEW

BOULDER STEP POOL

BOULDER SHOWN ARE A GRAPHICAL REPRESENTATION AND DOES NOT REPRESENT ACTUAL # OF BOULDERS TO BE USED.

NOT TO SCALE

LOG AND BOULDER STEP POOLS NOTES

(A) LOG AND BOULDER STEP POOLS ARE HYDRAULIC AND GRADE CONTROL MEASURES THAT ARE USED TO MAINTAIN GRADE, CONTROL FLOW VELOCITY, DISSIPATE ENERGY, AND DEVELOP RIFFLE-RUN-STEP POOL HABITAT IN STREAMS WITH SLOPES GREATER THAN 2%. THIS DETAIL CAN BE USED FOR CONSTRUCTING A SINGLE LOG OR BOULDER STEP POOL OR A SERIES OF MULTIPLE STEP POOLS.

(B) LOG AND BOULDER STEP POOL STRUCTURES AND ASSOCIATED POOL HABITAT ENHANCEMENTS AND BANK STABILIZATION MEASURES (ROOT WADS, BRUSH LAYERING, LIVE STAKING, ETC.) SHOULD BE PLACED AT THE STATIONS, OFFSETS, ELEVATIONS, AND GEOMORPHIC POSITIONS INDICATED ON THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS, STREAM MITIGATION PLAN, OR AS DIRECTED BY THE ENGINEER. AT A MINIMUM, THE BANKFULL WIDTH, MINIMUM LOG AND BOULDER DIMENSIONS, INVERT ELEVATIONS, ESTIMATED SCOUR DEPTH AND SELECT MATERIAL CLASSIFICATION SHOULD BE PECIFIED IN THE STREAM MITIGATION DATA TABLE.

(C) REFER TO STANDARD DRAWING D-NSD-37 "SPECIAL NOTES FOR NATURAL STREAM DESIGN".

(D) LOGS SHALL BE RELATIVELY STRAIGHT, RECENTLY HARVESTED AND DECAY RESISTANT SPECIES SUCH AS CEDAR, WHITE OAK, ETC.

(E) BOULDERS PRESENT IN THE EXISTING STREAM MEETING THE SPECIFIED TYPE AND SIZE SHOULD BE USED IN THE RESTORED CHANNEL SEGMENT.

(F) LOCATE LOG OR BOULDER STEP STRUCTURES IN THE CHANNEL AT THE POINTS OF CURVATURE AND TANGENCY IN MEANDER BENDS, AND ALIGN THE STRUCTURE ALONG THE AXIS OF THE RADIUS.

(G) CONSTRUCT STEP STRUCTURES WITH A MAXIMUM DROP OF A HALF FOOT (SIX INCHES) AND A SLOPE BETWEEN ONE PERCENT (1%) AND FOUR PERCENT (4%).

(H) CONSTRUCT LOG OR BOULDER STEPS STRUCTURES BY:

(1) FIRST SHAPE THE CHANNEL AND FLOODPLAIN TO THE SPECIFIED GRADES AND DIMENSIONS.

(2) NEXT, EXCAVATE ENOUGH BED MATERIAL TO PLACE THE LOGS AND/OR BOULDERS, NON-WOVEN GEOTEXTILE FABRIC (TYPE III) AND ALLUVIUM OR SELECT MATERIAL BACKFILL.

(3) PLACE FOOTER LOG OR BOULDERS AND SURFACE BOULDERS AT THE CHANNEL INVERT, WITH THE SURFACE LOG OR BOULDERS SLIGHTLY UPSTREAM OF THE FOOTER LOG OR BOULDERS. SURFACE AND FOOTER LOGS SHOULD EXTEND A MINIMUM OF FOUR FEET INTO EACH BANK AND LOG STEPS SHOULD BE PINCHED OR ANCHORED INTO THE BANKS WITH BOULDERS.

(4) THE FOLLOWING GUIDELINES APPLY WHEN INSTALLING MULTIPLE STEP POOL STRUCTURES IN SEQUENCE:

(a) THE INVERT ELEVATION OF THE DOWNSTREAM STEP SHALL BE AT OR ABOVE THE TOP OF THE FOOTER FOR THE UPSTREAM STRUCTURE.

(b) ALTERNATE INVERTS OF THE STRUCTURES FROM SIDE TO SIDE IN THE CHANNEL TO CREATE A MEANDERING FLOW PATH ACROSS THE STRUCTURES.

(5) USE SURVEY EQUIPMENT TO CHECK THE ELEVATIONS OF THE INVERTS IN ACCORDANCE WITH THE STREAM MITIGATION PLANS.

(6) ONCE THE INVERTS HAVE BEEN ESTABLISHED, FILL THE VOIDS BETWEEN LOGS OR BOULDERS ON THE UPSTREAM SIDE OF THE STRUCTURE.

(7) PLACE NON-WOVEN GEOTEXTILE FABRIC (TYPE III) ALONG THE ENTIRE UPSTREAM FACE OF THE STRUCTURE, EXTENDING FROM THE BOTTOM OF THE FOOTER TO THE FINISHED GRADE ELEVATION. ONLY GEOTEXTILE FABRIC (TYPE III) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED. FOR LOGS, NAIL GEOTEXTILE FABRIC (TYPE III) TO THE SURFACE LOG APPROXIMATELY ONE QUARTER OF THE CIRCUMFERENCE DOWN FROM THE TOP OF THE SURFACE LOG USING TWO-INCH GALVANIZED ROOFING NAILS ON ONE-FOOT SPACING ALONG THE ENTIRE LENGTH OF THE LOG.

(8) BACKFILL STRUCTURE AND NON-WOVEN GEOTEXTILE FABRIC (TYPE III) WITH EXCAVATED ON-SITE STREAM ALLUVIUM (IF AVAILABLE), OTHERWISE USE THE SPECIFIED SELECT MATERIAL. SOIL SHALL BE COMPACTED WELL AROUND BURIED PORTIONS OF THE STRUCTURE. TRIM ANY EXPOSED NON-WOVEN GEOTEXTILE FABRIC (TYPE III).

(9) ONCE THE STRUCTURE IS INSTALLED, EXCAVATE THE DOWNSTREAM SCOUR POOL AND PLACE SELECT MATERIAL AS REQUIRED.

(10) RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.

(I) A MIXTURE OF SELECT MATERIALS, AS SPECIFIED ON THE STREAM MITIGATION PLAN SHEETS, SHOULD BE USED FOR SUBSTRATE RESTORATION IN RIFFLE AND RUN HABITATS AND TO FILL GAPS IN THE VANE BOULDERS. COARSE ALLUVIUM EXCAVATED FROM THE EXISTING STREAM BED, WHICH MEETS THE SPECIFIED SIZE CLASSIFICATION, IS THE PREFERRED MATERIAL TO USE FOR SUBSTRATE RESTORATION. REFER TO D-NSD-30 AND D-NSD-37 FOR ADDITIONAL SUBSTRATE RESTORATION INFORMATION.

(J) THE SURFACE OF LOG AND BOULDER STEP POOL SHALL BE FINISHED TO A NEAT AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES AND CROSS SECTIONS OR ELEVATIONS SHOWN ON THE PLANS. THE DEGREE OF FINISH FOR INVERT ELEVATIONS SHALL BE WITHIN 0.10 FOOT OF THE GRADES AND ELEVATIONS INDICATED, OR AS DIRECTED BY THE ENGINEER. ALL GAPS OR VOIDS SHALL BE PLUGGED WITH SELECT MATERIAL TO FORM A TIGHT-FITTING SEAL.

(K) ALL MATERIALS ARE TO BE APPROVED BY ENGINEER OR ENGINEER'S ON-SITE CONSTRUCTION OBSERVER.

(L) PAYMENT FOR THE LOG AND BOULDER STEP POOLS SYSTEM SHALL INCLUDE ALL MATERIALS, EQUIPMENT, AND LABOR FOR CONSTRUCTION, ANS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-03.36, STREAM MITIGATION - STEP POOL, EACH

STREAM MITIGATION PLAN LEGEND:  **LOG STEP POOLS,**  **BOULDER STEP POOLS**

REV. 9-15-17: MODIFIED THE STREAM MITIGATION PLAN LEGEND SYMBOLS.

REV. 05-01-20: REDREW SHEET.

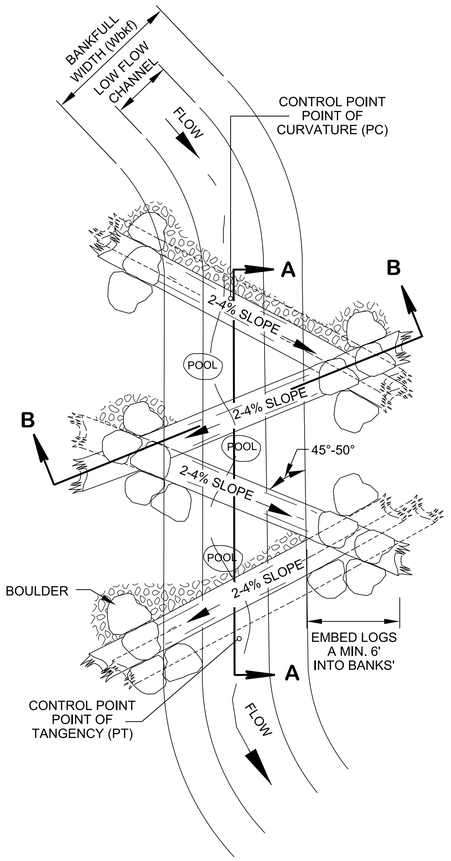
REV. 11-30-20: REVISED NON-WOVEN GEOTEXTILE FABRIC NOTE ON PLANS AND SECTIONS.

MATERIAL SHOWN ARE ONLY A GRAPHICAL REPRESENTATION AND DO NOT DEPICT THE ACTUAL DEPTH OR QUANTITY OF MATERIALS TO APPROPRIATELY CONSTRUCT OR STABILIZE THE CHANNEL.

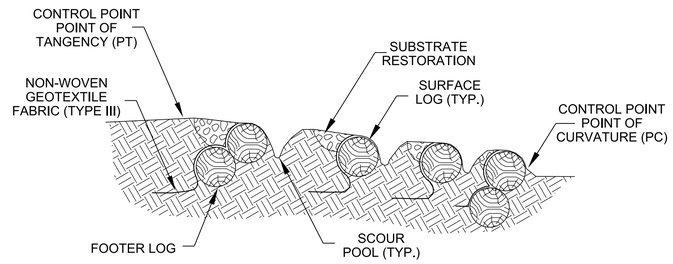
STATE OF TENNESSEE
STANDARD DRAWING
DEPARTMENT OF TRANSPORTATION

LOG AND BOULDER STEP POOLS

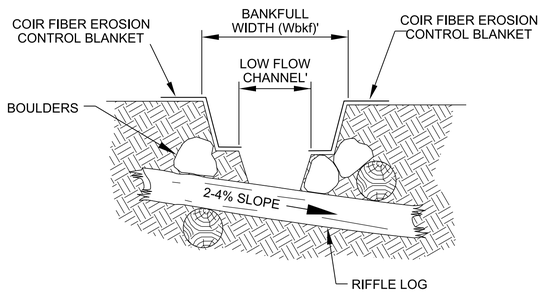
11-01-2016 | D-NSD-27



PLAN VIEW



SECTION A-A



SECTION B-B

LOG RIFFLE

LOG RIFFLES NOTES

(A) LOG AND BOULDER RIFFLES ARE GRADE CONTROL AND HABITAT ENHANCEMENT MEASURES THAT ARE USED TO MAINTAIN GRADE OF UPSTREAM POOLS, OXYGENATE WATER, AND PROVIDE HABITAT FOR EPIFAUNA AND FISH. THESE STRUCTURES ARE TYPICALLY USED IN LOWER GRADIENT STREAMS WITH SLOPES LESS THAN 3%. THIS DETAIL CAN BE USED FOR CONSTRUCTING RIFFLES USING BOULDERS, LOGS, OR A COMBINATION OF BOULDERS AND LOGS.

(B) LOG AND BOULDER RIFFLES SHOULD BE PLACED AT THE STATIONS, OFFSETS, ELEVATIONS, AND GEOMORPHIC POSITIONS INDICATED ON THE STREAM MITIGATION DATA TABLE IN THE PROJECT PLANS, STREAM MITIGATION PLAN, OR AS DIRECTED BY THE ENGINEER. AT A MINIMUM, THE BANKFULL WIDTH, MINIMUM LOG AND/OR BOULDER DIMENSIONS, INVERT ELEVATIONS, AND SELECT MATERIAL CLASSIFICATION SHOULD BE SPECIFIED IN THE STREAM MITIGATION DATA TABLE.

(C) REFER TO STANDARD DRAWING D-NSD-37 "SPECIAL NOTES FOR NATURAL STREAM DESIGN".

(D) LOGS SHALL BE RELATIVELY STRAIGHT, RECENTLY HARVESTED AND DECAY RESISTANT SPECIES SUCH AS CEDAR, WHITE OAK, ETC.

(E) BOULDERS PRESENT IN THE EXISTING STREAM MEETING THE SPECIFIED TYPE AND SIZE SHOULD BE USED IN THE RESTORED CHANNEL SEGMENT.

(F) LOCATE LOG OR BOULDER RIFFLE STRUCTURES (RIFFLE LOGS AND BOULDER MINI-VANES) AT EQUALLY SPACED INTERVALS IN THE STRAIGHT SECTIONS OF THE CHANNEL BETWEEN MEANDER BENDS (I.E., BETWEEN UPSTREAM POINT OF TANGENCY AND DOWNSTREAM POINT OF CURVATURE), AS INDICATED ON THE STREAM MITIGATION PLANS.

(G) THE MAXIMUM AMOUNT OF DROP IN INVERT FROM ONE RIFFLE LOG OR BOULDER MINI-VANE TO THE NEXT SHALL BE NO GREATER THAN 0.10 FOOT. THE COMBINED AMOUNT OF DROP OVER ALL THE MINI-VANES SHALL NOT EXCEED THE TOTAL AMOUNT OF FALL IN THE RIFFLE SLOPE. THE INVERT IN RIFFLE LOGS AND MINI-VANES SHALL ALTERNATE LEFT AND RIGHT OF CENTERLINE TO PRODUCE A MEANDERING FLOW PATTERN IN THE RIFFLE.

(H) CONSTRUCT LOG RIFFLE STRUCTURES BY:

(1) SHAPE THE CHANNEL AND FLOODPLAIN TO THE SPECIFIED GRADES AND DIMENSIONS.

(2) LOG RIFFLE STRUCTURES ARE BUILT STARTING WITH THE DOWNSTREAM LOG AND PROCEEDING UPSTREAM. LOGS ARE SLOPED DOWN TWO PERCENT (2%) TO FOUR PERCENT (4%) AT THEIR UPSTREAM END.

(3) RIFFLE LOGS SHALL OVERLAP IN THE STREAM BANK, WITH THE DOWNSTREAM END OF THE UPSTREAM LOG PLACED ON TOP OF THE UPSTREAM END OF THE DOWNSTREAM LOG, THEREBY HELPING TO ANCHOR THE DOWNSTREAM LOG. ADDITIONALLY, THE RIFFLE LOGS ARE ANCHORED WITHIN THE BANKS BY PINCHING BOTH SIDES OF THE LOG WITH BOULDERS.

(4) EXCAVATE ENOUGH BED AND BANK MATERIAL TO PLACE THE RIFFLE LOGS, ANCHOR BOULDERS, NON-WOVEN GEOTEXTILE FABRIC (TYPE III), AND ALLUVIUM OR SELECT MATERIAL BACKFILL. SURFACE AND FOOTER LOGS SHOULD EXTEND A MINIMUM OF SIX FEET INTO EACH BANK.

(5) THE UPSTREAM RIFFLE LOG IS BUILT WITH A LOG FOOTER. THE DOWNSTREAM RIFFLE LOGS ARE INSTALLED WITHOUT FOOTERS.

(6) LOG RIFFLES SHALL ALL BE DESIGNED TO BE SUBMERGED OR COVERED AT LOW FLOWS TO REDUCE THE RATE OF WOOD DECOMPOSITION. INSTALL LOGS AT THE INVERTS SPECIFIED IN THE PLANS AND THEN CHECK THE ELEVATIONS OF THE INVERTS WITH SURVEY EQUIPMENT. PLACE THE FOOTER AND SURFACE LOGS AT THE UPSTREAM END OF THE RIFFLE TO MINIMIZE VOIDS AND TO PRODUCE A SMOOTH COMPACT SURFACE.

(7) ONCE THE INVERTS HAVE BEEN ESTABLISHED, FILL THE VOIDS BETWEEN THE UPSTREAM FOOTER AND SURFACE LOG ON THE UPSTREAM SIDE WITH COARSE ALLUVIUM OR SPECIFIED SELECT MATERIAL.

(8) PLACE NON-WOVEN GEOTEXTILE FABRIC (TYPE III) ALONG THE ENTIRE UPSTREAM FACE OF EACH RIFFLE LOG. THE GEOTEXTILE SHALL EXTEND FROM THE BOTTOM OF THE FOOTER (WHERE PRESENT) TO THE FINISHED GRADE ELEVATION OF THE SURFACE LOG. ONLY GEOTEXTILE FABRIC (TYPE III) LISTED ON THE QUALIFIED PRODUCTS LIST SHALL BE USED. NAIL GEOTEXTILE FABRIC (TYPE III) TO THE SURFACE LOG APPROXIMATELY ONE QUARTER OF THE CIRCUMFERENCE DOWN FROM THE TOP OF THE SURFACE LOG USING TWO-INCH GALVANIZED ROOFING NAILS ON ONE-FOOT SPACING ALONG THE ENTIRE LENGTH OF THE LOG.

(9) BACKFILL STRUCTURE AND NON-WOVEN GEOTEXTILE FABRIC (TYPE III) WITH EXCAVATED ON-SITE STREAM ALLUVIUM (IF AVAILABLE), OTHERWISE USE THE SPECIFIED SELECT MATERIAL. SOIL SHALL BE COMPACTED WELL AROUND BURIED PORTIONS OF THE STRUCTURE. TRIM ANY EXPOSED NON-WOVEN GEOTEXTILE FABRIC (TYPE III).

(I) THE SURFACE OF LOG AND BOULDER RIFFLES SHALL BE FINISHED TO A NEAT AND COMPACT SURFACE IN ACCORDANCE WITH THE LINES, GRADES AND CROSS-SECTIONS OR ELEVATIONS SHOWN ON THE PLANS. THE DEGREE OF FINISH FOR INVERT ELEVATIONS SHALL BE WITHIN 0.10 FOOT OF THE GRADES AND ELEVATIONS INDICATED, OR AS DIRECTED BY THE ENGINEER. ALL GAPS OR VOIDS BETWEEN FOOTER AND SURFACE BOULDERS AND LOGS SHALL BE PLUGGED WITH SELECT MATERIAL TO FORM A TIGHT-FITTING SEAL.

(J) RE-DRESSING OF CHANNEL AND BANKFULL BENCH/FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF IN-STREAM STRUCTURES AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION.

(K) A MIXTURE OF SELECT MATERIALS, AS SPECIFIED ON THE STREAM MITIGATION PLAN SHEETS, SHOULD BE USED FOR SUBSTRATE RESTORATION IN RIFFLE AND RUN HABITATS AND TO FILL GAPS BETWEEN LOGS. COARSE ALLUVIUM EXCAVATED FROM THE EXISTING STREAM BED, WHICH MEETS THE SPECIFIED SIZE CLASSIFICATION, IS THE PREFERRED MATERIAL TO USE FOR SUBSTRATE RESTORATION. REFER TO D-NSD-30 AND D-NSD-37 FOR ADDITIONAL SUBSTRATE RESTORATION INFORMATION.

(L) COIR FIBER EROSION CONTROL BLANKET SHALL BE INSTALLED ABOVE THE INNER-BERM STAGE AND NOT IN THE LOW-FLOW CHANNEL OF THE RIFFLE. SEE TYPICAL CROSS-SECTION DATA IN STREAM MITIGATION PLANS FOR INNER BERM INFORMATION.

(M) ALL MATERIALS ARE TO BE APPROVED BY ENGINEER OR ENGINEER'S ON-SITE CONSTRUCTION OBSERVER.

(N) PAYMENT FOR THE LOG RIFFLE SYSTEM SHALL INCLUDE ALL MATERIALS, EQUIPMENT, AND LABOR FOR CONSTRUCTION, AND SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-03.40, STREAM MITIGATION - LOG RIFFLE, L.F.

(O) FOR BOULDER RIFFLE DETAIL, SEE STANDARD DRAWING D-NSD-28.

STREAM MITIGATION PLAN LEGEND: **LOG RIFFLE**

REV. 9-15-17: MODIFIED THE STREAM MITIGATION PLAN LEGEND SYMBOL. MODIFIED LEGEND SYMBOL, MODIFIED NOTES. ADDED SLOPE DESIGNATION ON PLAN VIEW.

REV. 05-01-20: REDREW SHEET.

REV. 11-30-20: REVISED NON-WOVEN GEOTEXTILE FABRIC NOTE ON SECTION A-A.

MATERIAL SHOWN ARE ONLY A GRAPHICAL REPRESENTATION AND DO NOT DEPICT THE ACTUAL DEPTH OR QUANTITY OF MATERIALS TO APPROPRIATELY CONSTRUCT OR STABILIZE THE CHANNEL.

STATE OF TENNESSEE
STANDARD DRAWING
DEPARTMENT OF TRANSPORTATION

LOG RIFFLES

11-01-2016 D-NSD-28A

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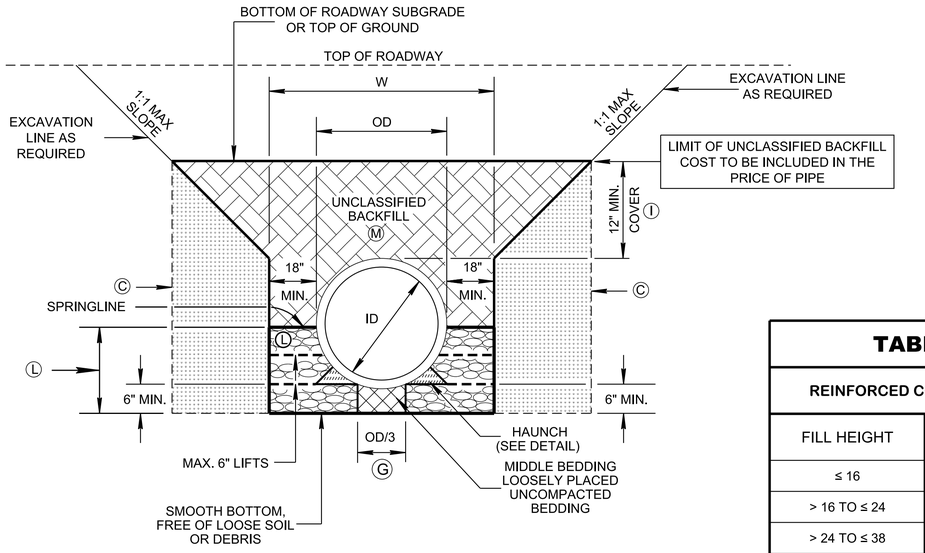


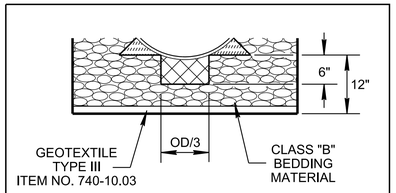
STANDARD TRENCH INSTALLATION

(PIPE CULVERT INSTALLATION DETAIL)
NOTE: CENTER PIPE IN TRENCH
SEE GENERAL NOTE (B)

TABLE A

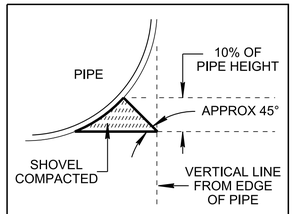
REINFORCED CONCRETE PIPE

FILL HEIGHT	CLASSIFICATION (AASHTO M170)
≤ 16	III
> 16 TO ≤ 24	IV
> 24 TO ≤ 38	V
> 38	SPECIAL DESIGN

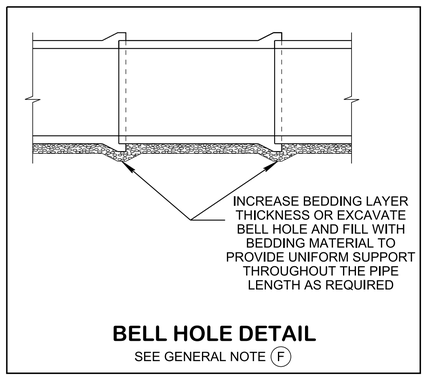


IMPROVED FOUNDATION DETAIL

SEE GENERAL NOTE (G)



HAUNCH AREA DETAIL



BELL HOLE DETAIL

SEE GENERAL NOTE (F)

TABLE B

CONCRETE PIPE CULVERT				CLASS "B" BEDDING MATERIAL (CY/LF)	UNCLASSIFIED BACKFILL MATERIAL (CY/LF)
PIPE DIA	PAYMENT ITEM NO (PER L.F.)	CLASS**	MIN.* W		
18"	607-03.02 THRU 607-03-04	III THRU V	59"	0.149	0.336
24"	607-05.02 THRU 607-05-04	III THRU V	66"	0.192	0.479
30"	607-06.02 THRU 607-06.04	III THRU V	73"	0.239	0.581
36"	607-07.02 THRU 607-07.04	III THRU V	80"	0.289	0.683
42"	607-08.02 THRU 607-08.04	III THRU V	87"	0.343	0.787
48"	607-09.02 THRU 607-09.04	III THRU V	94"	0.400	0.891
54"	607-10..02 THRU 607-10.04	III THRU V	101"	0.461	0.989
60"	607-11.03 THRU 607-11.05	III THRU V	108"	0.525	1.105

* FOR " WALL B" WALL THICKNESS.

** NOTE: CONCRETE PIPE CLASSES FOR REQUIRED D-LOAD CAPACITY. MINIMUM CLASS III SHALL BE USED UNDER ROADWAYS.

LEGEND

ID = INSIDE DIAMETER
OD = OUTSIDE DIAMETER

- CLASS "B" BEDDING COMPACTED TO 90% STANDARD PROCTOR DENSITY
- CLASS "B" BEDDING UNCOMPACTED
- FIRM INSITU SOIL OR CLASS "B" BEDDING COMPACTED TO 90% STANDARD PROCTOR DENSITY
- HAUNCH AREA, SHOVEL COMPACTED
- UNCLASSIFIED BACKFILL (FINE COMPACTABLE SOIL)

GENERAL NOTES

PIPE MATERIALS:

(A) REINFORCED CONCRETE PIPE SHALL MEET THE REQUIREMENTS OF AASHTO M-170. THE WALL THICKNESS SHALL BE "WALL B" (EXPECT: FOR STRUCTURES DEEPER THAN THE MINIMUM DEPTH, "WALL C" MAY BE USED) AND THE RCP CLASS SHALL BE AS LISTED IN "TABLE A". ALL PIPE MANUFACTURING PLANTS SHALL BE CERTIFIED BY EITHER ACPA OR NPCA. REFER SOP 5-3 FOR MORE INFORMATION.

INSTALLATIONS REQUIREMENTS:

(B) FOR EMBANKMENT AREAS OR WHERE TRENCH CONDITIONS DO NOT EXIST, AN INDUCED TRENCH SOIL EMBANKMENT SHALL BE CONSTRUCTED SEE D-PB-3.

(C) FOR TRENCHES WITH IN SITU SOIL WALLS, THE SOIL SHALL BE AT LEAST AS FIRM AS THE MAJORITY OF THE SUBGRADE AS DETERMINED BY THE ENGINEER. SOIL NOT MEETING THIS REQUIREMENT SHALL BE REMOVED AND REPLACED.

(D) FOR ADDITIONAL INSTALLATION INFO SEE SECTION 27 "CONCRETE CULVERTS" OF THE AASHTO STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES AND ASTM C-1479-10.

(E) ONLY AS MUCH TRENCH AS CAN BE SAFELY MAINTAINED SHALL BE OPENED. ALL TRENCHES SHALL BE BACKFILLED AND COMPACTED TO THE MINIMUM COVER DEPTH 12" ABOVE THE PIPE AS SOON AS PRACTICABLE, BUT NOT LATER THAN THE END OF EACH WORKING DAY IN ACCORDANCE WITH THE COMPACTED REQUIREMENTS.

(F) JOINTS BETWEEN PIPES REQUIRE A RUBBER GASKET MEETING ASTM C443. AT CONNECTIONS TO STRUCTURES USE NON-SHRINK GROUT OR RUBBER GASKET PER C923 OR C1478.
WHERE PIPE WITH BELLS ARE INSTALLED, BELL HOLES SHALL BE EXCAVATED IN BEDDING TO SUCH DIMENSIONS THAT THE ENTIRE LENGTH OF THE BARREL OF THE PIPE WILL BE SUPPORTED BY THE BEDDING WHEN PROPERLY INSTALLED AS SHOWN IN BELL HOLE DETAIL.

(G) WHERE THE TRENCH FOUNDATION IS FOUND UNACCEPTABLE OR LOCATION WHERE THE WATER TABLE IS FOUND HIGH:

(1) IMPROVED FOUNDATION OR EXCAVATABLE FLOWABLE FILL (EFF) MAY BE USED AT ENGINEER'S INSTRUCTION AS SHOWN ON THIS SHEET AND THE COST WILL BE INCLUDED IN THE UNIT PRICE OF THE PIPE.

(2) FIELD ENGINEER SHALL REVIEW SITE CONDITIONS TO CONFIRM TYPICAL BEDDING AS SHOWN IS ADEQUATE TO PROVIDE STRUCTURAL SUPPORT OR FOUNDATION IMPROVEMENT IS REQUIRED.

(H) FOR MULTIPLE PIPES MINIMUM SPACING BETWEEN PIPES IS:

36" PIPES AND SMALLER: EQUAL TO THE OUTSIDE DIAMETER OF THE LARGEST PIPE.

PIPES LARGER THAN 36": EQUAL TO HALF THE OUTSIDE DIAMETER OF THE LARGEST PIPE.

(I) FOR MINIMUM COVER DEPTHS FOR CONSTRUCTION LOADS SEE D-PB-3.

(J) CLASS "B" BEDDING MAY NOT BE REQUIRED UNDER SIDE DRAINS FOR PRIVATE DRIVES, FILED ENTRANCES, PIPES OUTSIDE THE SHOULDER LIMITS OF INTERCHANGE RAMPS, OR PIPES OUTSIDE NORMAL SLOPE LINES BEDDING TYPE AS PER STANDARD SPECIFICATION 204-10.B.

(K) ARCH AND OVAL SHAPED PIPE CULVERTS SHALL BE INSTALLED THE SAME AS CIRCULAR WITH O.D. EQUAL TO THE WIDEST HORIZONTAL DIMENSION ON THE PIPE. TO ESTIMATE BEDDING MATERIAL FOR THESE PIPES WITH INTERNAL WIDTH THE SAME AS DIAMETER IN THE TABLE, MULTIPLY BEDDING QUANTITY BY 0.5 FOR THE SHOWN MINIMUM TRENCH DIMENSIONS.

BEDDING AND BACKFILL REQUIREMENTS:

(L) CLASS "B" BEDDING MATERIAL MEETING THE REQUIREMENTS OF CONSTRUCTION SPECIFICATION SUBSECTION 204.04 SHALL BE PLACED IN LIFTS, NOT TO EXCEED 6 INCHES, TO THE PIPE SPRINGLINE. A MINIMUM COMPACTION LEVEL OF 90% OF THE STANDARD PROCTOR DENSITY PER AASHTO T99 SHALL BE ACHIEVED BY USE OF VIBRATORY PLATE.

(M) UNCLASSIFIED BACKFILL SHALL BE PLACED AND COMPACTED IN LAYERS NOT EXCEEDING A 8 INCH LOOSE LIFT THICKNESS AND BROUGHT UP EVENLY AND SIMULTANEOUSLY ON BOTH SIDES OF THE PIPE TO AN ELEVATION NOT LESS THAN ONE FOOT ABOVE THE TOP OF THE PIPE.

UNCLASSIFIED BACKFILL TO THE LIMIT OF PIPE BACKFILL LINE SHALL BE COMPACTED IN ACCORDANCE TO STANDARD SPECIFICATION 204.11. HYDRO-HAMMER TYPE OF COMPACTORS MAY BE USED AROUND THE PIPE HOWEVER THEY SHALL NOT BE USED DIRECTLY OVER THE PIPE TO PREVENT ANY DAMAGE. ALL COMPACTION EQUIPMENT USED SHALL BE APPROVED BY THE ENGINEER.

(N) PLACE 6 INCHES MINIMUM OF CLASS "B" BEDDING MATERIAL, ALONG WITH SUFFICIENT ADDITIONAL CLASS "B" BEDDING MATERIAL ACCURATELY SHAPED AS SHOWN IN HAUNCH AREA DETAIL.

(O) **END TREATMENTS:**

(1) ALL CROSS DRAINS (PERPENDICULAR) PLACED UNDER A MAINLINE ROADWAY, REQUIRE TYPE U ENDWALLS CONFORMING TO THE ROADWAY FILL SLOPE AS SHOWN ON STANDARD DRAWINGS D-PE-15A THROUGH D-PE-48A FOR END WALL GEOMETRY AND D-PE-99 FOR GRATE DETAILS. ALL CULVERT ENDWALLS LOCATED WITHIN THE CLEAR ZONE (S-CZ-1) REQUIRE A SAFETY GRATE (18" OR 24" PIPE ENDWALLS MAY OMIT THE STEEL GRATE). ALL CROSS DRAIN CULVERTS LARGER THAN 48" MUST BE PROTECTED BY A GUARDRAIL OR ENDWALL OR MUST BE PLACED OUTSIDE THE CLEAR ZONE. CROSS DRAIN ENDWALLS PLACED OUTSIDE THE CLEAR ZONE MAY USE TYPE A (D-PE-1), TYPE B (D-PE-9 THRU 9F), OR STRAIGHT HEADWALL (D-PE-4) IN LIEU OF TYPE U OR IF THE PIPE END WALL IS PROTECTED BY A GUARDRAIL.

(2) ALL SIDE DRAINS (PARALLEL) PLACED UNDER A SIDE ROAD, DRIVEWAY, OR FIELD ENTRANCE, ETC. THAT INTERSECT A MAINLINE ROADWAY, REQUIRE SAFETY ENDWALLS AS SHOWN ON THE D-SEW- SERIES STANDARD DRAWINGS WITH SAFETY GRATE (D-SEW-1A) WITH A MAXIMUM 6:1 TAPER IF THE CULVERT ENDWALLS ARE LOCATED INSIDE THE CLEAR ZONE (S-CZ-1).

(3) ALL MEDIAN CROSSOVER SIDE DRAINS (LONGITUDINAL) PLACED UNDER MEDIAN OPENINGS REQUIRE SAFETY ENDWALLS AS SHOWN ON D-SEW-12D STANDARD DRAWING WITH SAFETY GRATE (D-SEW-1A) WITH MAXIMUM 12:1 TAPER IF THE CULVERT ENDWALLS ARE LOCATED INSIDE THE CLEAR ZONE (S-CZ-1).

(P) **INSPECTION REQUIREMENTS:**

ALL PIPES SHALL UNDERGO INSPECTION ACCORDING TO SECTION 607.09 OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION OR PER SECTION 27 OF AASHTO STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES OR PER ASTM C1840.

(Q) **PAYMENT:**

EXCAVATION FOR PIPE WILL NOT BE MEASURED AND PAID FOR DIRECTLY AND ANY SOIL NOT MEETING REQUIREMENT FOR TRENCHES SHALL BE REMOVED AND REPLACED. ALL COST OF THIS WORK WILL BE INCLUDED IN THE COST OF THE PROPOSED PIPE CULVERT. SEE TABLE B FOR PIPE CULVERT ITEM NUMBERS.

PAYMENT FOR CLASS "B" BEDDING MATERIAL, UNCLASSIFIED BACKFILL TO THE LIMIT LINE, AND/OR IF REQUIRED EXCAVATABLE FLOWABLE FILL AND BEDDING MATERIAL WILL BE INCLUDED IN THE UNIT PRICE OF THE PIPE.

GEOTEXTILE TYPE III TO BE USED ONLY IF IMPROVED FOUNDATION IS REQUIRED, AND WILL BE PAID UNDER ITEM NO.

740-10.03 GEOTEXTILE (TYPE III)(EROSION CONTROL) PER S.Y.

☐ REV. 7-12-07: REVISED GENERAL NOTE (J).

REV. 6-1-09: REVISED GENERAL NOTE (I) AND TITLE NAME. ADDED GENERAL NOTE (J).

REV.2-1-12: REVISED DRAWING NAME ADDED EFF DETAIL. REVISED GENERAL NOTES AND TABLE. ADDED MINIMUM COVER TABLE.

REV. 8-21-12: REVISED GENERAL NOTES. CHANGED BACKFILL MATERIAL.

REV. 1-2-13: REVISED TRENCH DETAILS REVISED BEDDING TABLE.

REV. 3-16-17: CLARIFIED PAYMENT ITEM NO. IN TABLE B.

REV. 06-28-19: REVISED DETAIL FOR STANDARD TRENCH INSTALLATION, TABLE A AND GENERAL NOTES. REDREW SHEET.

REV. 11-30-20: REVISED DETAIL FOR STANDARD TRENCH INSTALLATION, TABLE B AND GENERAL NOTES. ADDED BELL HOLE DETAIL.

☐ APPROVED BY FHWA
(ALL OTHERS APPROVED BY TDOT)

STATE OF TENNESSEE
STANDARD DRAWING
DEPARTMENT OF TRANSPORTATION

STANDARD DETAILS FOR CONCRETE PIPE INSTALLATION

D-PB-1

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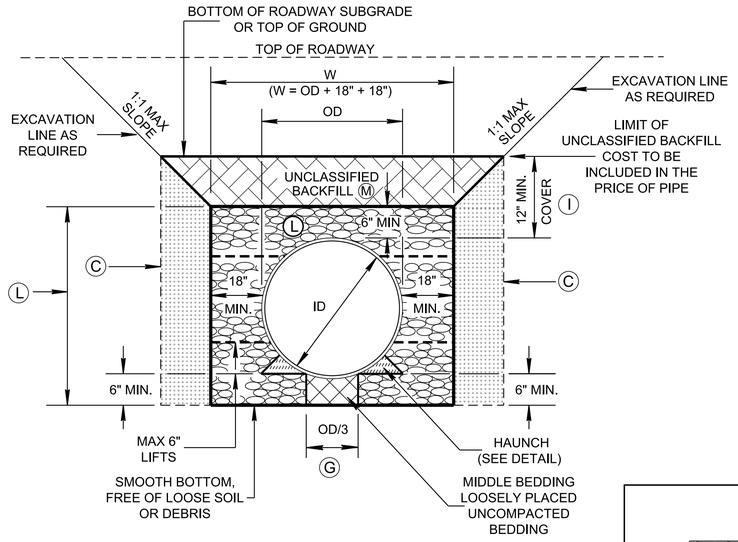
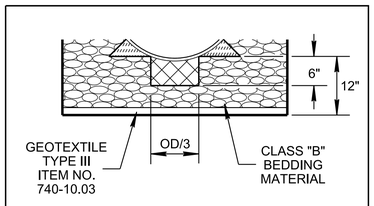


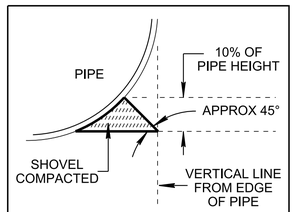
STANDARD TRENCH INSTALLATION

(PIPE CULVERT INSTALLATION DETAIL)
NOTE: CENTER PIPE IN TRENCH
SEE GENERAL NOTE (B)

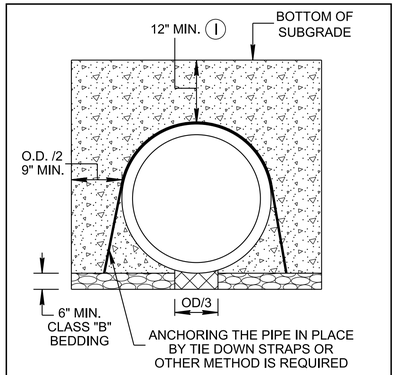


IMPROVED FOUNDATION DETAIL

SEE GENERAL NOTE (G)



HAUNCH AREA DETAIL

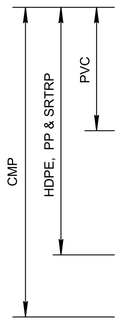


ALTERNATE BACKFILL DETAIL USING EXCAVATABLE FLOWABLE FILL (EFF)

SEE GENERAL NOTE (G)

TABLE A

PIPE CULVERT		CLASS "B" BEDDING MATERIAL (CY/LF)	UNCLASSIFIED BACKFILL MATERIAL (CY/LF)
PIPE DIA	PAYMENT ITEM NO		
18"	607-03.30	0.313	0.095
24"	607-05.30	0.382	0.104
30"	607-06.30	0.497	0.117
36"	607-07.30	0.626	0.127
42"	607-08.30	0.767	0.137
48"	607-09.30	0.969	0.148
54"	607-10.30	1.141	0.158
60"	607-11.30	1.588	0.168
66"	607-12.30	1.805	0.178
72"	607-13.30	2.035	0.188



NOTE: SEE TDOT DESIGN DIVISION DRAINAGE MANUAL SECTION 6, APPENDIX, TABLE 6A-1 FOR PIPE SELECTION CRITERIA BASED ON SYSTEM AND FILL HEIGHT.

LEGEND

ID = INSIDE DIAMETER
OD = OUTSIDE DIAMETER

- CLASS "B" BEDDING COMPACTED TO 90% STANDARD PROCTOR DENSITY
- CLASS "B" BEDDING UNCOMPACTED
- FIRM INSITU SOIL OR CLASS "B" BEDDING COMPACTED TO 90% STANDARD PROCTOR DENSITY
- HAUNCH AREA, SHOVEL COMPACTED
- UNCLASSIFIED BACKFILL (FINE COMPACTABLE SOIL)
- EXCAVATABLE FLOWABLE FILL (EFF)

GENERAL NOTES

PIPE MATERIALS:

(A) FLEXIBLE PIPE MATERIALS ARE HDPE, PVC, CMP, SRTRP, AND PP.

ALL HIGH DENSITY POLYETHYLENE (HDPE) PIPE USED FOR CULVERT AND STORM DRAIN APPLICATIONS SHALL CONFORM TO THE REQUIREMENTS OF AASHTO M294, TYPE S, CURRENT EDITION ALL HDPE PIPE DELIVERED AND USED SHALL BE A PARTICIPANT IN NTPEP. MAX. PIPE DIA. FOR HDPE PIPE IS 60".

POLY VINYL CHLORIDE (PVC) PROFILE WALL DRAINAGE PIPE SHALL MEET AASHTO DESIGNATION M-304. THE MAXIMUM PIPE DIAMETER FOR PVC PIPE IS 36".

STEEL REINFORCED THERMOPLASTIC RIBBED PIPE (SRTRP) SHALL MEET AASHTO DESIGNATION M335, THE MAXIMUM PIPE DIAMETER FOR THE PIPE IS 60".

CORRUGATED METAL PIPE (CMP) SHALL BE ALUMINIZED COATED CORRUGATED METAL PIPE AND SHALL MEET AASHTO M274, MAXIMUM DIA IS 72".

POLYPROPYLENE PIPE (PP) SHALL MEET AASHTO DESIGNATION M-330, THE MAXIMUM PIPE DIAMETER IS 60".

INSTALLATIONS REQUIREMENTS:

(B) FOR EMBANKMENT AREAS OR WHERE TRENCH CONDITIONS DO NOT EXIST, AN INDUCED TRENCH SHALL BE CONSTRUCTED. SEE STD. DWG. NO. D-PB-3.

(C) FOR TRENCHES WITH IN SITU SOIL WALLS, ANY PORTION OF THE WALL SHALL BE AT LEAST AS FIRM AS THE MAJORITY OF THE SUBGRADE. SOIL NOT MEETING THIS REQUIREMENT SHALL BE REMOVED AND REPLACED.

(D) FOR ADDITIONAL INSTALLATION INFORMATION SEE AASHTO SECTION 30 OR ASTM D2321. ALL PIPES SHALL BE ASSEMBLED AND INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. PIPE SHALL BE PLACED IN THE BED STARTING AT THE DOWNSTREAM END.

(E) ONLY AS MUCH TRENCH AS CAN BE SAFELY MAINTAINED SHALL BE OPENED. ALL TRENCHES SHALL BE BACKFILLED AND COMPACTED TO THE MINIMUM COVER DEPTH OF 12" ABOVE THE PIPE AS SOON AS PRACTICABLE, BUT NOT LATER THAN THE END OF EACH WORKING DAY IN ACCORDANCE WITH THE COMPACTION REQUIREMENTS.

(F) JOINTS FOR FLEXIBLE PIPE SHALL MEET THE PERFORMANCE REQUIREMENT OF ASTM D3212. JOINTS SHALL BE INSTALLED SO THAT THE CONNECTION OF PIPE SECTION FOR A CONTINUOUS LINE WILL BE FREE FROM IRREGULARITIES IN THE FLOW LINE. JOINTS BETWEEN PLASTIC FLEXIBLE PIPE AND STRUCTURE SHALL HAVE A GASKET MEETING ASTM F2510. FOR CMP PIPE TO STRUCTURE CONNECTIONS OR PLASTIC PIPE AT A SKEW GREATER THAN 15°, WHERE A GASKET WILL NOT WORK, NON-SHRINK GROUT APPLIED IN TWO STAGES SHALL BE USED.

(G) ONLY WHERE THE TRENCH FOUNDATION IS FOUND UNACCEPTABLE OR LOCATION WHERE THE WATER TABLE IS FOUND HIGH:

(1) IMPROVED FOUNDATION OR EXCAVATABLE FLOWABLE FILL (EFF) MAY BE USED AT ENGINEER'S INSTRUCTION AND THE COST WILL BE INCLUDED IN THE UNIT PRICE OF THE PIPE.

(2) FIELD ENGINEER SHALL REVIEW SITE CONDITIONS INCLUDING THE POSSIBLE EFFECTS OF WATER TABLE TO CONFIRM TYPICAL BEDDING AS SHOWN IS ADEQUATE TO PROVIDE STRUCTURAL SUPPORT OR FOUNDATION IMPROVEMENT IS REQUIRED.

(H) MINIMUM SPACING BETWEEN MULTIPLE PIPES ARE:

36" PIPES AND SMALLER: EQUAL TO THE OUTSIDE DIAMETER OF THE LARGEST PIPE.

PIPES LARGER THAN 36": EQUAL TO HALF THE OUTSIDE DIAMETER OF THE LARGEST PIPE.

(I) FOR MINIMUM COVER DEPTHS FOR CONSTRUCTION LOADS SEE D-PB-3.

(J) MAXIMUM ALLOWABLE FILL HEIGHTS ARE AS DEFINED IN THE DRAINAGE MANUAL SECTION 6, APPENDIX, TABLE 6A-1.

BEDDING AND BACKFILL REQUIREMENTS:

(K) PLACE 6 INCHES MINIMUM OF CLASS B BEDDING MATERIAL, ALONG WITH SUFFICIENT ADDITIONAL CLASS "B" BEDDING MATERIAL ACCURATELY SHAPED AS SHOWN IN HAUNCH AREA DETAIL.

(L) CLASS "B" BEDDING MATERIAL MEETING THE REQUIREMENTS OF CONSTRUCTION SPECIFICATION SUBSECTION 204.04 SHALL BE PLACED IN LIFTS AND UP TO 6 INCHES ABOVE THE TOP OF PIPE. A MINIMUM COMPACTION LEVEL OF 90% OF THE STANDARD PROCTOR DENSITY PER AASHTO T99 SHALL BE ACHIEVED BY USE OF VIBRATORY PLATE.

(M) UNCLASSIFIED BACKFILL SHALL BE PLACED AND COMPACTED IN LAYERS NOT EXCEEDING A 8 INCH LOOSE LIFT THICKNESS STARTING FROM THE CLASS B BEDDING, 6 INCHES ABOVE THE TOP OF PIPE, TO AN ELEVATION NOT LESS THAN ONE FOOT ABOVE THE TOP OF THE PIPE.

(N) **END TREATMENTS:**

(1) ALL CROSS DRAINS (PERPENDICULAR) PLACED UNDER A MAINLINE ROADWAY, REQUIRE TYPE U ENDWALLS CONFORMING TO THE ROADWAY FILL SLOPE AS SHOWN ON STANDARD DRAWINGS D-PE-15A THROUGH D-PE-48A FOR END WALL GEOMETRY AND D-PE-99 FOR GRATE DETAILS. ALL CULVERT ENDWALLS LOCATED WITHIN THE CLEAR ZONE (S-CZ-1) REQUIRE A SAFETY GRATE (18" OR 24" PIPE ENDWALLS MAY OMIT THE STEEL GRATE). ALL CROSS DRAIN CULVERTS LARGER THAN 48" MUST BE PROTECTED BY A GUARDRAIL OR ENDWALL OR MUST BE PLACED OUTSIDE THE CLEAR ZONE. CROSS DRAIN ENDWALLS PLACED OUTSIDE THE CLEAR ZONE MAY USE TYPE A (D-PE-1), TYPE B (D-PE-9 THRU 9F), OR STRAIGHT HEADWALL (D-PE-4) IN LIEU OF TYPE U OR IF THE PIPE END WALL IS PROTECTED BY A GUARDRAIL.

(2) ALL SIDE DRAINS (PARALLEL) PLACED UNDER A SIDE ROAD, DRIVEWAY, OR FIELD ENTRANCE, ETC. THAT INTERSECT A MAINLINE ROADWAY, REQUIRE SAFETY ENDWALLS AS SHOWN ON THE D-SEW- SERIES STANDARD DRAWINGS WITH SAFETY GRATE (D-SEW-1A) WITH A MAXIMUM 6:1 TAPER IF THE CULVERT ENDWALLS ARE LOCATED INSIDE THE CLEAR ZONE (S-CZ-1).

(3) ALL MEDIAN CROSSOVER SIDE DRAINS (LONGITUDINAL) PLACED UNDER MEDIAN OPENINGS REQUIRE SAFETY ENDWALLS AS SHOWN ON D-SEW- 12D STANDARD DRAWING WITH SAFETY GRATE (D-SEW-1A) WITH MAXIMUM 12:1 TAPER IF THE CULVERT ENDWALLS ARE LOCATED INSIDE THE CLEAR ZONE (S-CZ-1).

(O) **INSPECTION REQUIREMENTS:**

ALL PIPES SHALL UNDERGO INSPECTION ACCORDING TO SECTION 607.09 OF THE STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION OR PER SECTION 30 OF AASHTO STANDARD SPECIFICATIONS FOR HIGHWAYS AND BRIDGES CURRENT EDITION.

(P) **PAYMENT:**

EXCAVATION FOR PIPE WILL NOT BE MEASURED AND PAID FOR DIRECTLY AND ANY SOIL NOT MEETING REQUIREMENT FOR TRENCHES SHALL BE REMOVED AND REPLACED. ALL COST OF THIS WORK WILL BE INCLUDED IN THE COST OF THE PROPOSED PIPE CULVERT. SEE TABLE A FOR PIPE CULVERT ITEM NUMBERS.

PAYMENT FOR CLASS "B" BEDDING MATERIAL, UNCLASSIFIED BACKFILL TO THE LIMIT LINE, AND/OR IF REQUIRED EXCAVATABLE FLOWABLE FILL, TIE DOWN STRAPS AND BEDDING MATERIAL WILL BE INCLUDED IN THE UNIT PRICE OF THE PIPE.

GEOTEXTILE TYPE III TO BE USED ONLY IF IMPROVED FOUNDATION IS REQUIRED, AND WILL BE PAID UNDER ITEM NO.

740-10.03	GEOTEXTILE (TYPE III)(EROSION CONTROL)	PER S.Y.

☐ REV. 7-12-07: REVISED GENERAL NOTE (J).

REV. 6-1-09: REVISED GENERAL NOTE (I) AND TITLE NAME. ADDED GENERAL NOTE (J).

REV.2-1-12: REVISED DRAWING NAME ADDED EFF DETAIL. REVISED GENERAL NOTES AND TABLE. ADDED MINIMUM COVER TABLE.

REV. 8-21-12: REVISED GENERAL NOTES. CHANGED BACKFILL MATERIAL.

REV. 1-2-13: REVISED TRENCH AND ADDED FILL DETAIL.

REV. 1-29-14: ADDED PP, RE LETTERED AND REVISED NOTES.

REV. 06-28-19: REVISED DETAIL FOR STANDARD TRENCH INSTALLATION, AND GENERAL NOTES. REMOVED TABLE A AND RENAMED TABLE B TO A. REVISED TABLE A CONTENT AND LEGEND. REDREW SHEET.

REV. 11-30-20: REVISED DETAIL FOR STANDARD TRENCH INSTALLATION, TABLE A AND GENERAL NOTES.

☐ APPROVED BY FHWA
(ALL OTHERS APPROVED BY TDOT)

STATE OF TENNESSEE
STANDARD DRAWING
DEPARTMENT OF TRANSPORTATION

STANDARD DETAILS FOR FLEXIBLE PIPE INSTALLATION

3-15-07 | D-PB-2

NOT TO SCALE

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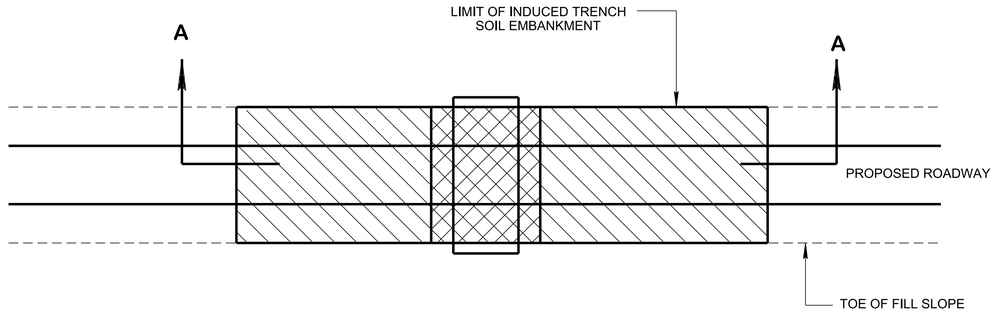
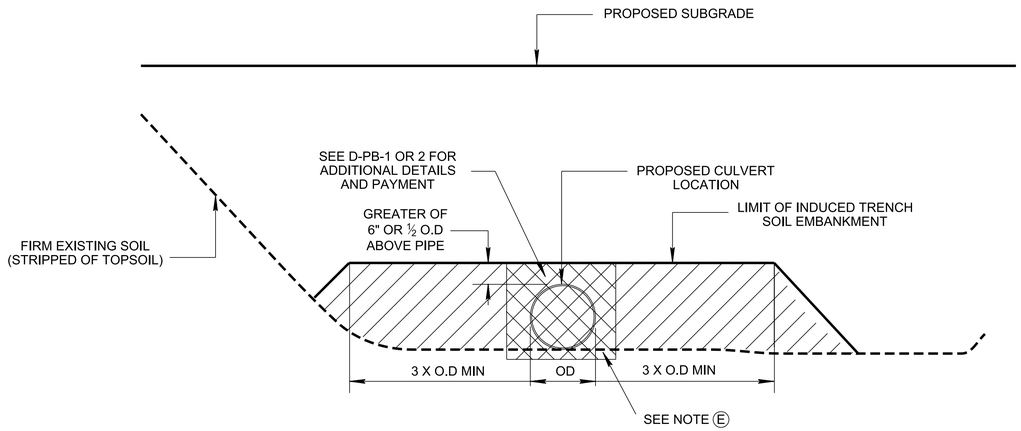
REV. 06-28-19: REDREW SHEET.

REV. 11-30-20: REVISED SECTION A-A AND GENERAL NOTES. ADDED AASHTO REFERENCE.



PLAN VIEW

TO BE USED FOR PIPE CULVERT INSTALLATION IN FILL AREAS



SECTION A-A

PIPE FILL MINIMUM COVER DEPTHS, DURING CONSTRUCTION FOR INDICATED AXLE LOADS, (IN.)				
NOMINAL PIPE DIA. FT	**18.0-50.0 KIP**	**50.0-75.0 KIP**	**75.0-110.0 KIP**	**110.0-150.0 KIP**
2.0-3.0	24.0	30.0	36.0	36.0
3.5-4.0	36.0	36.0	42.0	48.0
4.5-5.0	36.0	36.0	42.0	48.0

(AASHTO LRFD BRIDGE CONSTRUCTION SPECIFICATIONS CURRENT EDITION, SECTION 30)

SOIL EMBANKMENT

AREA TO BE EXCAVATED FOR TRENCH AS SHOWN ON D-PB-1 (CONCRETE) OR D-PB-2 (FLEXIBLE)

GENERAL NOTES

(A) INDUCED TRENCH DETAIL MAY BE USED WHEN IN SITU SOIL IS FOUND UNACCEPTABLE OR NO TRENCH EXISTS, SUCH AS OVERFLOW PIPE INSTALLATION AND WILDLIFE CROSSING.

(B) IF FIRM EXISTING SOIL IS FOUND WITHIN THE EMBANKMENT ZONE IT SHALL BE LEFT IN PLACE.

(C) FILL FOR THE INDUCED TRENCH TO BE TO A MINIMUM DEPTH OF THE GREATER OF 6" OR ½ OD OVER THE PIPE.

(D) SOIL EMBANKMENT SHALL BE COMPACTED TO MEET SUBGRADE COMPACTION REQUIREMENTS IN STANDARD SPECIFICATION 207.04.

(E) ONCE SOIL EMBANKMENT IS PLACED AND COMPACTED AS SHOWN, STANDARD DETAILS FOR CONCRETE OR FLEXIBLE PIPE STANDARDS SHALL BE FOLLOWED TO COMPLETE THE INSTALLATION.

(F) **PAYMENT:**

SOIL THAT IS EXCAVATED FOR PIPE INSTALLATION WILL BE INCLUDED IN THE COST OF THE PIPE.

SOIL EMBANKMENT THAT IS TO REMAIN IN PLACE WILL BE PAID FOR IN ITEM NO.

203-01 ROAD & DRAINAGE EXCAVATION (UNCLASSIFIED) PER C.Y.

STATE OF TENNESSEE
STANDARD DRAWING
DEPARTMENT OF TRANSPORTATION

INDUCED TRENCH SOIL EMBANKMENT FOR PIPE CULVERT INSTALLATION

01-02-2013 | D-PB-3

NOT TO SCALE

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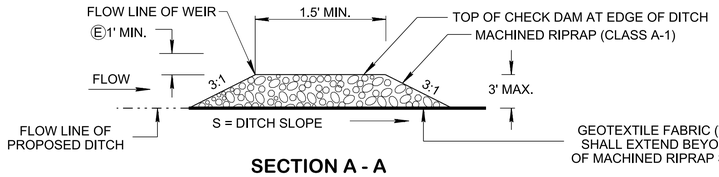
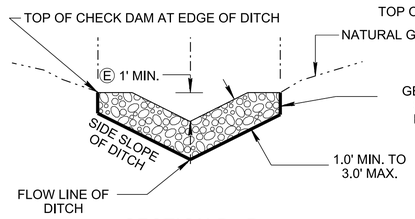
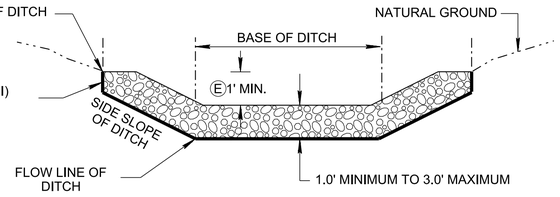


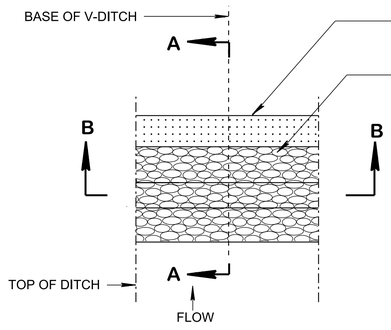
SECTION A - A



SECTION B - B

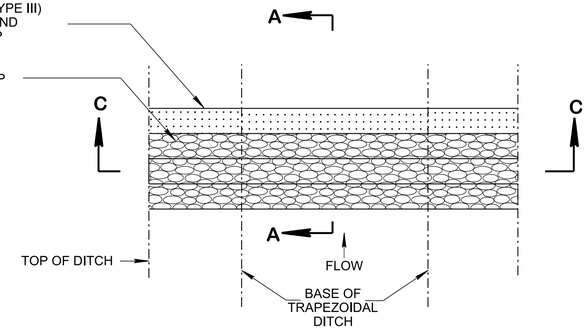


SECTION C - C



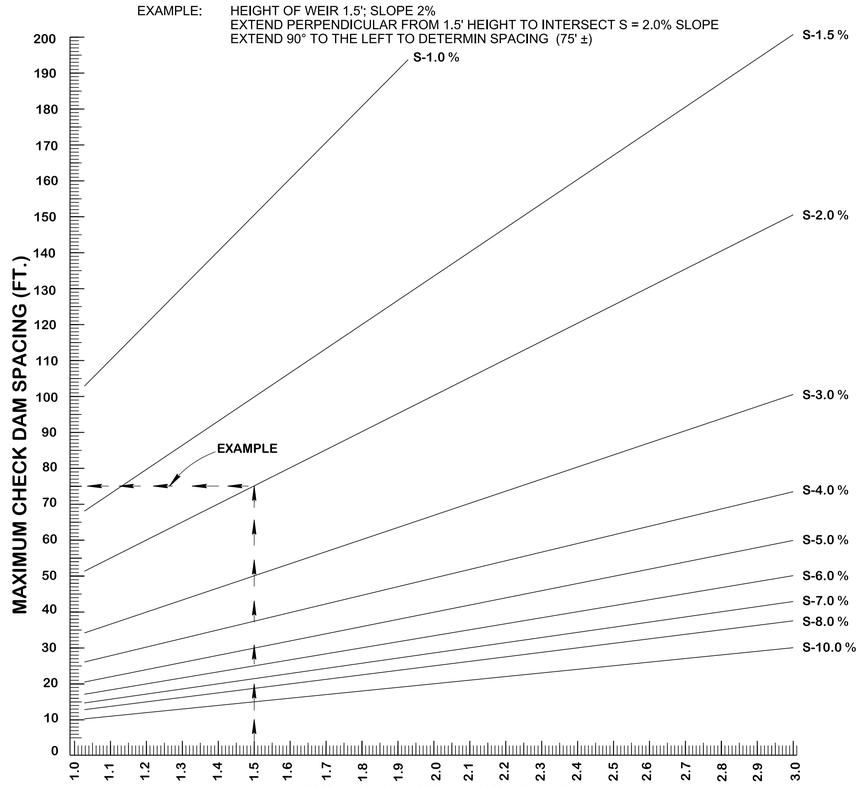
PLAN VIEW

DETAIL FOR V-DITCH

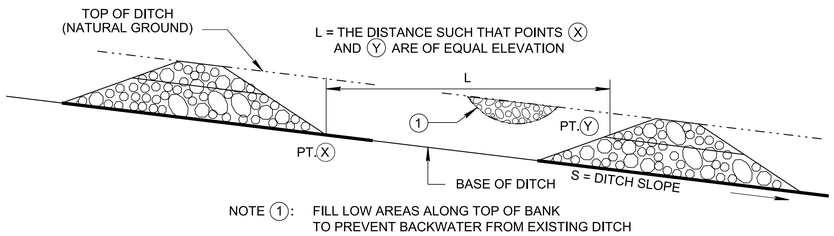


PLAN VIEW

DETAIL FOR TRAPEZOIDAL DITCH



ROCK CHECK DAM SPACING



NOTE (1): FILL LOW AREAS ALONG TOP OF BANK TO PREVENT BACKWATER FROM EXISTING DITCH

DETAIL FOR SPACING BETWEEN CHECK DAMS

ROCK CHECK DAM ESTIMATED QUANTITIES

	2:1 DITCH SLOPE			3:1 DITCH SLOPE			4:1 DITCH SLOPE		
V-DITCH (2)	HEIGHT FT	RIP RAP TON	GEOTEXTILE SF	HEIGHT FT	RIP RAP TON	GEOTEXTILE SF	HEIGHT FT	RIP RAP TON	GEOTEXTILE SF
	1.5	6.5	16.8	1.5	9.2	23.7	1.5	12.0	30.9
	2.0	13.0	24.6	2.0	18.4	34.8	2.0	24.1	45.4
	2.5	22.8	33.9	2.5	32.3	48.0	2.5	42.1	62.5
	3.0	36.5	44.7	3.0	51.7	63.2	3.0	67.3	82.5
TRAPEZOIDAL DITCH (3)	HEIGHT FT	RIP RAP TON	GEOTEXTILE SF	HEIGHT FT	RIP RAP TON	GEOTEXTILE SF	HEIGHT FT	RIP RAP TON	GEOTEXTILE SF
	1.5	8.9	22.8	1.5	11.6	29.7	1.5	14.4	36.9
	2.0	16.9	31.9	2.0	22.3	42.1	2.0	27.9	52.7
	2.5	28.7	42.6	2.5	38.1	56.6	2.5	47.9	71.2
	3.0	44.7	54.7	3.0	59.8	73.2	3.0	75.5	92.4

(2) ESTIMATED QUANTITIES BASED ON 4:1 SIDE SLOPES. QUANTITIES WILL VARY BASED ON ACTUAL DITCH CONFIGURATION.

(3) ESTIMATED QUANTITIES BASED ON 4 FT BOTTOM WIDTH, AND 4:1 SIDE SLOPES. QUANTITIES WILL VARY BASED ON ACTUAL DITCH CONFIGURATION.

EROSION CONTROL PLAN LEGEND : ROCK CHECK DAM (V-DITCH), ROCK CHECK DAM (TRAPEZOIDAL DITCH)

NOT TO SCALE

ROCK CHECK DAM GENERAL NOTES

(A) ROCK CHECK DAMS ARE TO BE USED FOR VELOCITY REDUCTION AND EROSION PREVENTION IN AREAS WHERE CONCENTRATED FLOW EXISTS. ROCK CHECK DAMS SHALL NOT BE USED IN STREAMS OR OTHER NATURAL WATER RESOURCES. ROCK CHECK DAMS ARE NOT TO BE USED FOR SEDIMENT CONTROL AND SHOULD NOT BE CONSIDERED A SEDIMENT TRAPPING DEVICE.

(B) THE DRAINAGE AREA FOR THE ROCK CHECK DAMS SHALL BE 10 ACRES OR LESS.

(C) ROCK CHECK DAMS MAY REMAIN IN PLACE AS PERMANENT CHECK DAMS, IF SHOWN IN THE PLANS OR AS DIRECTED BY THE ENGINEER.

(D) THE CENTER OF THE ROCK CHECK DAM MUST BE AT LEAST ONE (1) FOOT LOWER THAN THE OUTER EDGES.

(E) THE DEPTH OF FLOW ON THE CENTER OF THE STRUCTURE SHALL BE COMPUTED FOR THE PEAK FLOW RATE GENERATED BY THE 2-YEAR, 24-HOUR STORM IN ORDER TO ENSURE THAT THE TOP OF THE STRUCTURE WILL NOT BE OVERTOPPED. FOR SITES WHICH DRAIN TO EXCEPTIONAL TENNESSEE WATERS OR SEDIMENT-IMPARIED STREAMS, THE DEPTH SHOULD BE DETERMINED FOR THE 5-YEAR, 24-HOUR PEAK FLOW RATE. THIS WILL ELIMINATE THE ROCK-SOIL FAILURE POINT WHERE THE ROCK CHECK DAM AND NATURAL GROUND MERGE.

(F) FOR SITES WHICH DRAIN TO EXCEPTIONAL TENNESSEE WATERS OR SEDIMENT-IMPAIRED STREAMS, THE MINIMUM HEIGHT OF THE STRUCTURE ABOVE THE DITCH BOTTOM SHALL BE INCREASED TO 2 FEET.

(G) THE MAXIMUM SPACING BETWEEN ROCK CHECK DAMS SHOULD BE SUCH THAT THE TOE OF THE UPSTREAM DAM IS AT THE SAME ELEVATION AS THE FLOW LINE OF THE WEIR OF THE DOWNSTREAM DAM (SEE ROCK CHECK SPACING GRAPH THIS SHEET).

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

(I) PRODUCTS LISTED ON THE QUALIFIED PRODUCTS LIST FOR FILTER SOCK DITCH APPLICATION (SEE STANDARD DRAWING EC-STR-8) MAY BE USED AND SHALL BE PAID UNDER FOLLOWING ITEM NUMBER:

209-08.09, FILTER SOCK CHECK DAM, EACH.

(J) ROCK CHECK DAMS SHALL BE PAID FOR UNDER THE FOLLOWING ITEM NUMBER:

209-08.07, ROCK CHECK DAM, EACH.

PAYMENT SHALL INCLUDE ALL MATERIALS AND LABOR NECESSARY FOR CONSTRUCTION, MAINTENANCE, AND REMOVAL OF ROCK CHECK DAMS.

(K) SEDIMENT SHALL BE REMOVED FROM BEHIND THE ROCK CHECK DAMS WHEN IT HAS ACCUMULATED TO ONE-HALF THE ORIGINAL HEIGHT OF THE DAM AND PAID FOR UNDER ITEM NUMBER:

209-05, SEDIMENT REMOVAL, C.Y.

REV. 12-18-95: CHANGED DRAWING NO. FROM ESC-STR-6 TO EC-STR-6.

REV. 7-29-96: MADE MINOR CORRECTIONS TO GENERAL NOTES.

REV. 4-15-98: CHANGED PAY ITEMS FOR CHECK DAMS.

REV. 5-27-01: CHANGED DESCRIPTION FOR GEOTEXTILE FABRIC (TYPE III, CLASS A) TO GEOTEXTILE FABRIC (TYPE III).

REV. 12-18-02: CHANGED GENERAL NOTE (G).

REV. 1-22-03: CORRECTED NOTE IN SECTION A-A.

REV. 4-15-06: REFORMATTED SHEET, REVISED NOTES, MISC. EDITS TO DRAWING.

REV. 4-1-08: REMOVED TEMPORARY REFERENCE, REVISED NOTES, MISC. EDITS TO DRAWING, MODIFIED SPACING CHART.

REV. 8-1-12: MINOR EDITS TO GENERAL NOTES.

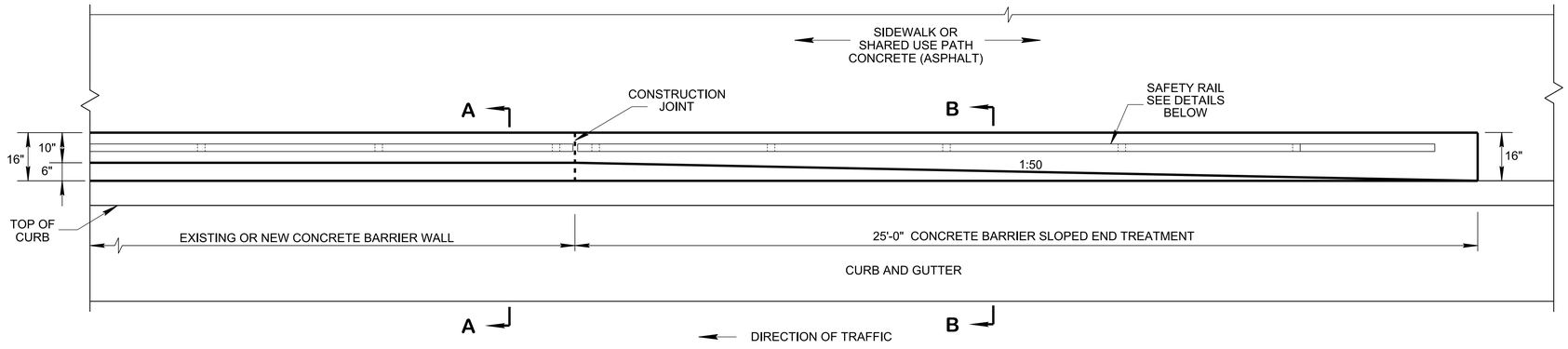
REV. 5-6-16: REVISED QUANTITIES TABLE, REVISED GENERAL NOTE (I). REVISED DITCH DETAIL.

REV. 11-30-20: REDREW SHEET. REVISED GENERAL NOTE (J)ITEM DESCRIPTION.

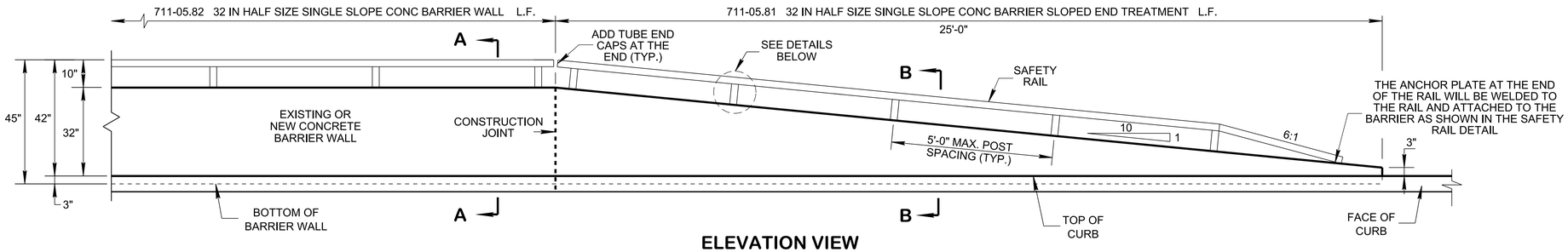
STATE OF TENNESSEE
STANDARD DRAWING
DEPARTMENT OF TRANSPORTATION

ROCK CHECK DAM

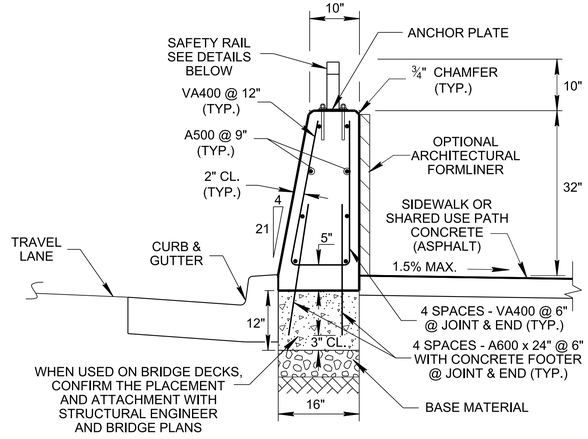
10-26-1992 | EC-STR-6



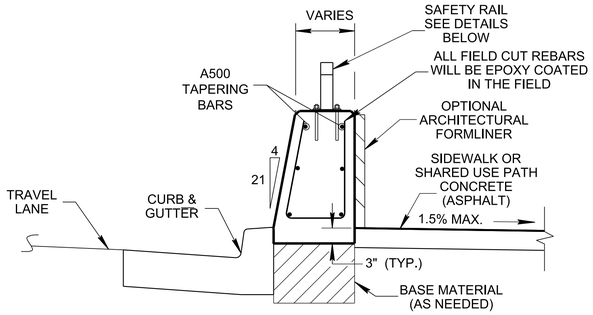
PLAN VIEW



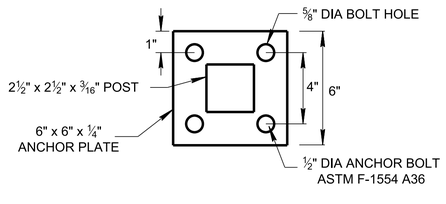
ELEVATION VIEW



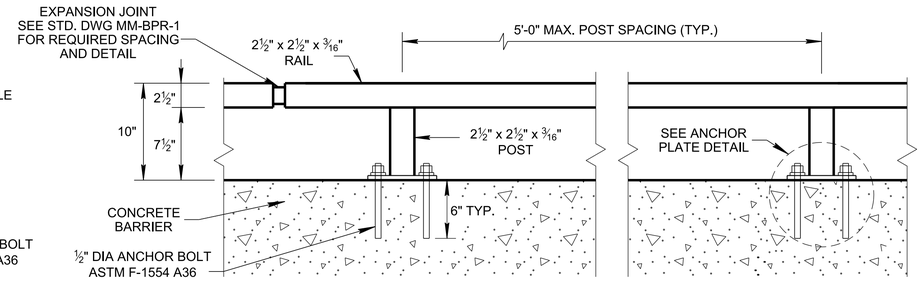
SECTION A-A
BEGIN TRANSITION



SECTION B-B
INTERMEDIATE TRANSITION



ANCHOR PLATE DETAIL



SAFETY RAIL DETAIL

GENERAL NOTES

(A) THE EXPOSED BLUNT END OF THE HALF SIZE CONCRETE BARRIER, INSTALLED TO PROTECT VULNERABLE USERS, MAY BE PROTECTED BY THE INSTALLATION OF A SLOPED END TREATMENT TO REDUCE CRASH SEVERITY AT URBAN CONTEXT WITH SPEEDS AROUND 35 MPH.

(B) THE USE OF A HALF SIZE CONCRETE BARRIER SHALL BE LIMITED TO LOCATIONS WITH POSTED SPEEDS LESS THAN OR EQUAL TO 45 MPH.

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

(D) CONCRETE: F_C = 4,000 POUNDS PER SQUARE INCH AT 28 DAYS
REINFORCING STEEL: ASTM A615, F_Y= 60,000 POUNDS PER SQUARE INCH
ALL REINFORCING IS TO BE INSTALLED AS DETAILED ON THIS DRAWING.

(E) REFER TO STD. DWG. MM-SERIES AND RD11-SERIES FOR ADDITIONAL DETAILS.

(F) REHABILITATION PROJECTS MAY REQUIRE DRAINAGE STRUCTURE LOCATIONS WHERE STORM DRAINAGE DOES NOT EXISTING.

(G) THE TOP AND END EDGES OF THE CONCRETE BARRIER WILL HAVE A 3/4" CHAMFER. ROUNDED EDGES MAY BE USED INSTEAD OF THE CHAMFER.

(H) THE ARCHITECTURAL FORMLINER SHOWN ON THE DRAWING IS OPTIONAL. WHEN FORMLINE IS USED, THE COST FOR CONSTRUCTION OF THE FORMLINER WILL BE INCLUDED IN 32" HALF SIZE SLOPE BARRIER RAIL ITEM NUMBER.

(I) ALL REINFORCING STEEL BARS ARE TO BE EPOXY COATED MEETING ALL REQUIREMENTS OF ASTM D3963.

(J) SAFETY RAIL STEEL TUBES AND ANCHOR BOLTS SHALL CONFORM TO ASTM A36. WELD ALL COMPONENTS USE 3/16" FILET WELD. GRIND WELDS AND CONNECTIONS AS REQUIRED TO PROVIDE A SMOOTH SURFACE, FREE OF BURRS. SEE STD. DWG. MM-BPR-1 FOR ADDITIONAL SAFETY RAIL DETAILS.

(K) THE CONCRETE BARRIER WALL SHALL BE GIVEN AN APPLIED TEXTURE FINISH. THE COLOR OF THE FINISH SHALL BE WHITE, FEDERAL SPECIFICATION NO. 37886. OR MATCH EXISTING CONCRETE BARRIER WALL TEXTURE. THE COST OF MATERIALS AND LABOR FOR THE TEXTURE FINISH SHALL BE INCLUDED IN THE BID PRICE FOR CONCRETE MEDIAN BARRIER.

(L) PAYMENT:

ALL COST ASSOCIATED WITH THE SAFETY RAIL, FURNISHING, INSTALLING AND PAINTING TO BE INCLUDED IN THE COST OF CONCRETE BARRIER WALL ITEM NUMBER.

PAYMENT FOR CONCRETE BARRIER WILL BE MADE UNDER PAY ITEM NUMBER:

711-05.81	32 IN HALF SIZE SINGLE SLOPE CONCRETE BARRIER WALL	L.F.
711-05.82	32 IN HALF SIZE SINGLE SLOPE CONC BARRIER SLOPED END TREATMENT	L.F.

STATE OF TENNESSEE
STANDARD DRAWING
DEPARTMENT OF TRANSPORTATION

32 IN HALF SIZE SINGLE SLOPE BARRIER WALL & SLOPED END TREATMENT

11-30-2020 | MM-BPR-3

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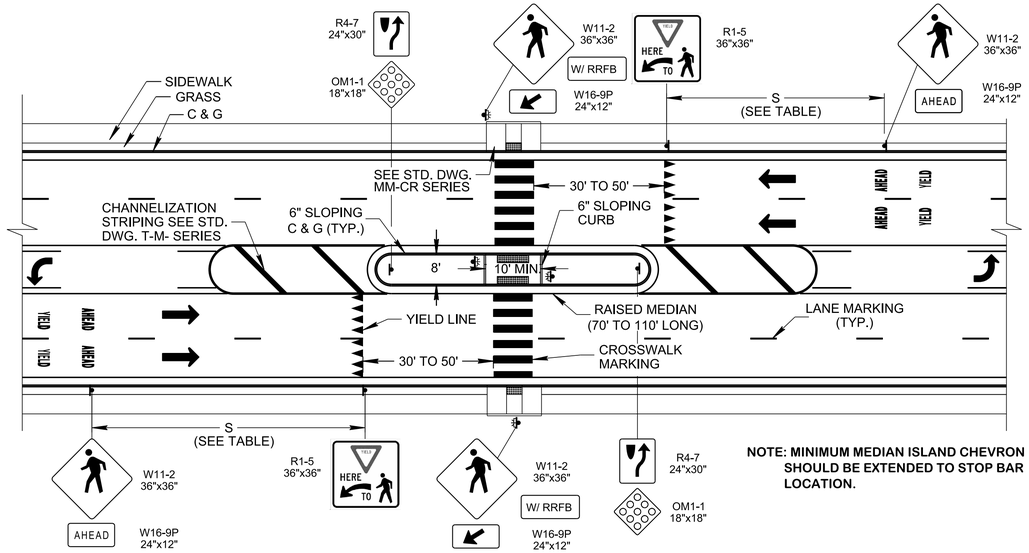


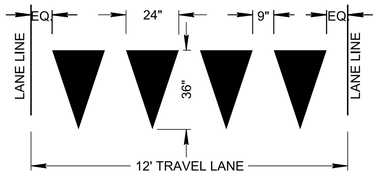
5 LANES WITH RECTANGULAR RAPID FLASHING BEACON MID-BLOCK CROSSING

NOTE: MINIMUM MEDIAN ISLAND CHEVRON SHOULD BE EXTENDED TO STOP BAR LOCATION.

MINIMUM ADVANCE PLACEMENT OF PEDESTRIAN WARNING SIGNS	
POSTED SPEED	WARNING SIGNS MINIMUM ADVANCE PLACEMENT DISTANCE - S
20 MPH	100 FT
25 MPH	100 FT
30 MPH	100 FT
35 MPH	100 FT
40 MPH	125 FT

NOTE: WHERE THE SPEED LIMIT EXCEEDS 40 MPH, MARKED CROSSWALKS ALONE SHOULD NOT BE USED AT UNSIGNALIZED (NO SIGNAL) LOCATIONS.

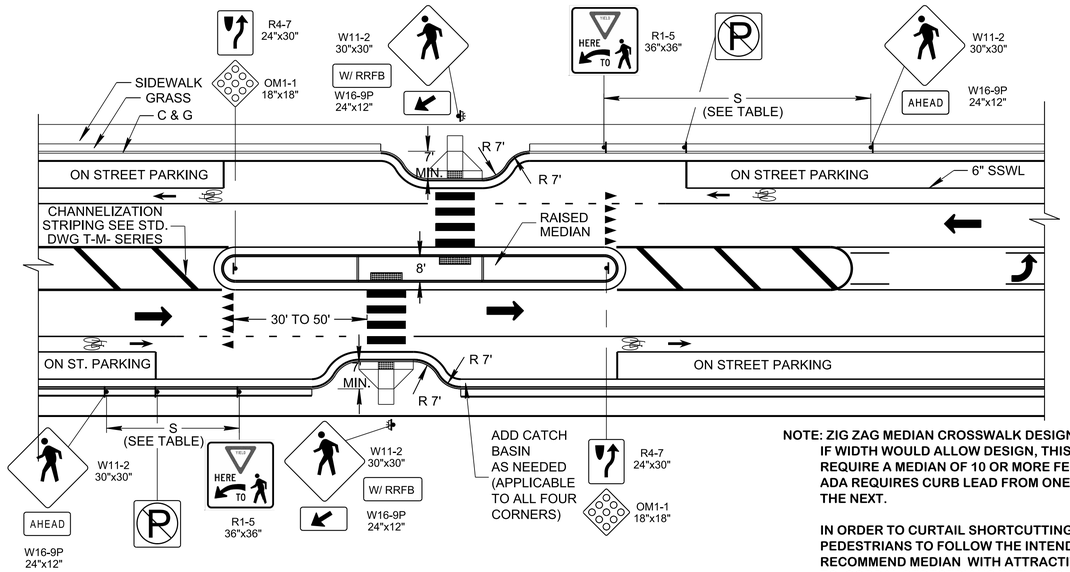
LEGEND	
	GROUND MOUNT SIGN
	COUNTDOWN PEDESTRIN SIGNAL HEAD WITH PUSH BUTTON AND SIGN
	DETECTABLE WARNING SURFACE



RECOMMENDED YIELD LINE LAYOUTS

NOTES: YIELD LINES MAY BE SMALLER THAN SUGGESTED WHEN INSTALLED ON MUCH NARROWER, SLOW SPEED FACILITIES SUCH AS SHARED -USE PATHS.

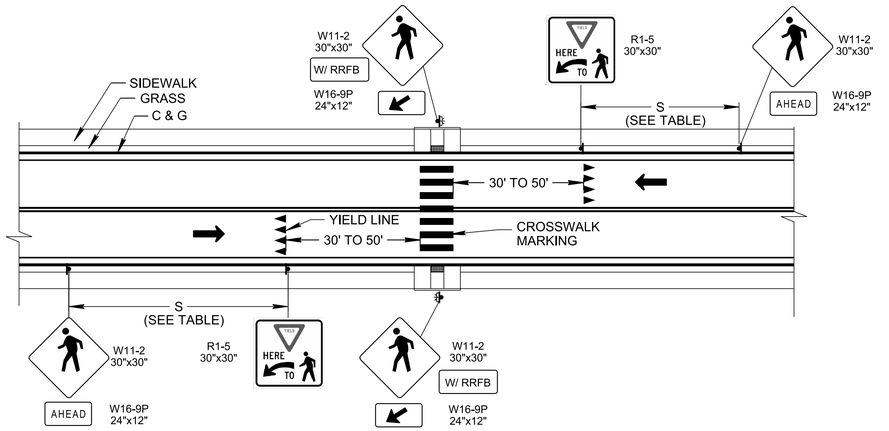
AREA OF EACH TRIANGLE A BASE OF 24 INCHES AND A HEIGHT OF 36 INCHES IS = 3 SF.



2 LANES WITH RECTANGULAR RAPID FLASHING BEACON ALT. MID-BLOCK CROSSING

NOTE: ZIG ZAG MEDIAN CROSSWALK DESIGN ONLY ALLOWED IF WIDTH WOULD ALLOW DESIGN, THIS MAY REQUIRE A MEDIAN OF 10 OR MORE FEET WIDE. ADA REQUIRES CURB LEAD FROM ONE RAMP TO THE NEXT.

IN ORDER TO CURTAIL SHORTCUTTING AND FORCE PEDESTRIANS TO FOLLOW THE INTENDED PATH, RECOMMEND MEDIAN WITH ATTRACTIVE FENCING TO CORRAL PEDESTRIANS IN THE CORRECT DIRECTION.



2 LANES WITH RECTANGULAR RAPID FLASHING BEACON MID-BLOCK CROSSING

GENERAL NOTES

Ⓐ DETAILS SHOWN ON THIS STANDARD DRAWING APPLY TO THE CONSTRUCTION OR RECONSTRUCTION OF MID-BLOCK CROSSINGS AND MODIFICATION OF STREETS, CURBS, OR SIDEWALKS ASSOCIATED WITH IT. SEE TDOT-RDG FOR ADDITIONAL INFORMATION FOR SITE SELECTION, NEW CONSTRUCTION OR RECONSTRUCTION DURING PEDESTRIAN SAFETY INITIATIVE, SPOT SAFETY IMPROVEMENTS AT LOCATIONS MAX 45 MPH. OTHER LOCATIONS WILL NEED SITE SPECIFIC ANALYSIS.

Ⓑ FOR NEW CONSTRUCTION A TRAFFIC ENGINEERING STUDY WILL HAVE TO BE CONDUCTED TO DETERMINE IF A MID-BLOCK CROSSING IS WARRANTED. MID-BLOCK CROSSINGS SHALL BE INSTALLED DURING RECONSTRUCTION PROJECTS AND REPAVING PROJECTS AT LOCATIONS WHERE EXISTING PEDESTRIAN SAFETY IS A CONCERN.

Ⓒ PEDESTRIAN IN CROSSWALK SIGNS (W11-2) SHALL BE INSTALLED AT EACH END OF THE CROSSWALK LOCATION. THE SIGNS SHALL BE PLACED IN ADVANCE OF THE CROSSWALK ADJACENT TO THE TRAVEL LANE AND FACING THE DRIVER. REFER TO THE MUTCD ADDITIONAL FOR WARNING SIGNS, TYPE AND LOCATION.

Ⓓ FOR CURB RAMPS, THE DETECTABLE WARNING SURFACE, PAVEMENT MARKINGS, AND CROSSWALK MARKING DETAILS, SEE STD. DWG. SERIES MM-CR AND MM-PM RESPECTIVELY. FOR MARKING STANDARDS AND CONCRETE CURB AND GUTTER SEE STD. DWG T-M- SERIES AND RP-VC SERIES RESPECTIVELY.

Ⓔ FOR PEDESTRIAN SIGNAL PUSH BUTTONS, HAWK, RRFB AND PHB, SEE TDOT TRAFFIC DESIGN MANUAL.

Ⓕ YIELD LINES SHOULD BE PLACED AT A SUFFICIENT DISTANCE (30' TO 50') FROM THE CROSSWALK TO ENSURE VISIBILITY IS PROVIDED FOR BOTH MOTORISTS AND PEDESTRIANS.
YIELD LINES SHALL CONSIST OF A ROW OF SOLID WHITE ISOSCELES TRIANGLES POINTING TOWARD APPROACHING VEHICLES EXTENDING ACROSS APPROACH LANES TO INDICATE THE POINT AT WHICH THE YIELD IS INTENDED OR REQUIRED TO BE MADE. YIELD LINES CONSIST OF WHITE TRIANGLES WHICH FACE TRAFFIC.
WHEN A BIKE LANE IS PRESENT, ADD ONE ADDITIONAL TRIANGLE IN THE CENTER OF BIKE LANE.

Ⓖ IF YIELD LINES ARE USED AT A CROSSWALK THAT CROSSES AT AN UNCONTROLLED MULTI-LANE APPROACH, YIELD HERE FOR PEDESTRIANS (R1-5 SERIES) SIGNS SHALL BE USED.

Ⓗ A DEVICE THAT MAY BE USED TO ASSIST PEDESTRIANS CROSSING IN A MARKED CROSSWALK AT AN UNSIGNALIZED INTERSECTION IS A RECTANGULAR RAPID FLASHING BEACON (RRFB). RRFB'S ARE PARTICULARLY EFFECTIVE AT MULTILANE CROSSINGS WITH SPEED LIMITS LESS THAN 40 MPH. CONSIDER THE PEDESTRIAN HYBRID BEACON (PHB) INSTEAD OF RRFBS FOR ROADWAYS SPEED LIMITS ARE EQUAL TO OR GREATER THAN 40 MPH.

Ⓘ A MEDIAN SHOULD BE AT LEAST 8.0 FEET WIDE TO ALLOW THE PEDESTRIAN TO WAIT COMFORTABLY IN THE CENTER. IF THE DESIRED 8 FEET CANNOT BE ACHIEVED, USE A MINIMUM WIDTH OF 6 FEET. THE PEDESTRIAN CROSSWALK MEDIAN ISLAND ARE ADA-APPROVED RAMPS (1:12 GRADE) SHOULD BE USED. IT IS BEST TO PROVIDE A SLIGHT GRADE 2 PERCENT TO PERMIT WATER AND SILT TO DRAIN FROM THE AREA.
DRAINAGE STRUCTURES SHALL NOT BE PLACED IN LINE WITH RAMPS. INSTALL CATCH BASINS ON UPSTREAM SIDE OF RAMP FOR ROADS WITH GRADES LESS THAN 2%.

Ⓙ PARKING AND OTHER SIGHT OBSTRUCTIONS SHOULD BE PROHIBITED FOR AT LEAST 100 FEET IN ADVANCE OF AND AT LEAST 20 FEET BEYOND THE MARKED CROSSWALK, OR SITE ACCOMMODATIONS SHOULD BE MADE THROUGH CURB EXTENSIONS OR OTHER TECHNIQUES TO PROVIDE ADEQUATE SIGHT DISTANCE. THE INSTALLATION SHOULD INCLUDE SUITABLE STANDARD SIGNS AND PAVEMENT MARKINGS.

Ⓚ STREETLIGHTS SHOULD BE INSTALLED AT THE CROSSWALK ON BOTH SIDES ROAD TO IMPROVE PEDESTRIAN COMFORT, SECURITY, AND SAFETY DURING DARK AND BAD WEATHER CONDITIONS.
FLUORESCENT YELLOW- GREEN SIGNS PROVIDE SUPERIOR VISIBILITY AND ARE EASILY NOTICEABLE IN DAYLIGHT AND DARK CONDITIONS. USE FLUORESCENT YELLOW- GREEN SIGNS FOR PEDESTRIAN AND BICYCLE WARNING TO HELP KEEP PEDESTRIANS AND DRIVERS SAFE.

Ⓛ MIDBLOCK CROSSWALKS SHOULD BE LOCATED AT LEAST 100 FEET FROM THE NEAREST SIDE STREET OR DRIVEWAY SO THAT DRIVERS TURNING ONTO THE MAJOR STREET HAVE A CHANCE TO NOTICE PEDESTRIANS AND PROPERLY YIELD TO PEDESTRIANS WHO ARE CROSSING THE STREET.

Ⓜ ADD CHANNELIZING DEVICES AT MID-BLOCK PEDESTRIAN CROSSINGS IN CONJUNCTION WITH IN STREET PEDESTRIAN CROSSING (R1-6 SERIES) SIGNS AS NEEDED.

Ⓝ PAYMENT

702-01,	CONCRETE CURB,	PER C.Y.,
702-03,	CONCRETE COMBINED CURB AND GUTTER,	PER C.Y.,
716-02.03	PLASTIC PAVEMENT MARKING (CROSS-WALK),	PER L.F.,
716-02.04,	PLASTIC PAVEMENT MARKING (CHANNELIZATION STRIPNG),	PER S.Y.,
716-02.05,	PLASTIC PAVEMENT MARKING (STOP LINE),	PER L.F.,
716-04.12,	PLASTIC PAVEMENT MARKING (YIELD LINE),	PER S.F.,
713-15.40,	SIGN INSTALLATION (DESCRIPTION),	PER LS,
730-26.07,	FLASHING WARNING BEACON (DESCRIPTION),	PER EACH.

REV. 07-17-20: REMOVED RIGHT TURN ARROWS FROM THE MIDDLE LANE.

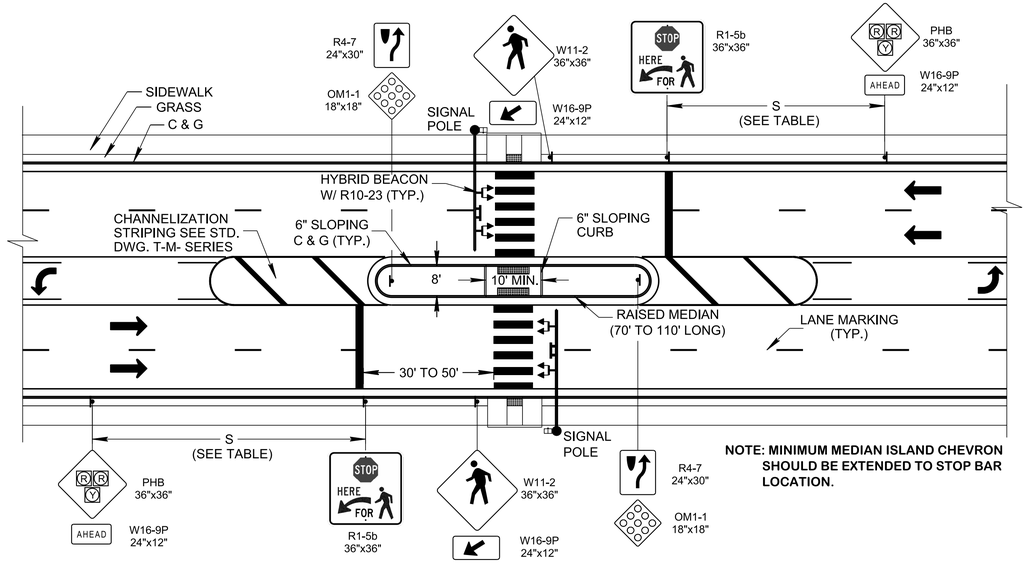
REV. 11-30-20: REVISED CROSSWALK SIGN ON GENERAL NOTE Ⓒ. ADDED GENERAL NOTE Ⓜ

STATE OF TENNESSEE
STANDARD DRAWING
DEPARTMENT OF TRANSPORTATION

STANDARD
UNSIGNALIZED
MID-BLOCK CROSSING

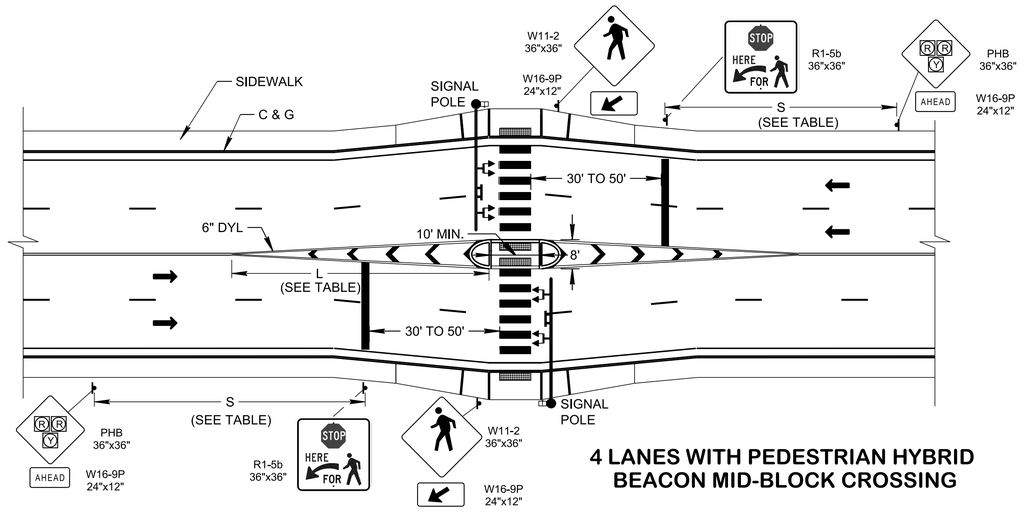
04-08-2020 | T-M-4A

NOT TO SCALE



NOTE: MINIMUM MEDIAN ISLAND CHEVRON SHOULD BE EXTENDED TO STOP BAR LOCATION.

5 LANES WITH PEDESTRIAN HYBRID BEACON MID-BLOCK CROSSING



4 LANES WITH PEDESTRIAN HYBRID BEACON MID-BLOCK CROSSING

REV. 07-17-20: REMOVED RIGHT TURN ARROWS FROM THE MIDDLE LANE.

REV. 11-30-20: REVISED CROSSWALK SIGN ON GENERAL NOTE Ⓒ. ADDED GENERAL NOTE Ⓟ.

MINIMUM ADVANCE PLACEMENT OF PEDESTRIAN WARNING SIGNS	
POSTED SPEED	WARNING SIGNS MINIMUM ADVANCE PLACEMENT DISTANCE - S
20 MPH	100 FT
25 MPH	100 FT
30 MPH	100 FT
35 MPH	100 FT
40 MPH	125 FT
45 MPH	175 FT

NOTE: WHERE THE SPEED LIMIT EXCEEDS 40 MPH, MARKED CROSSWALKS ALONE SHOULD NOT BE USED AT UNSIGNALIZED (NO SIGNAL) LOCATIONS.

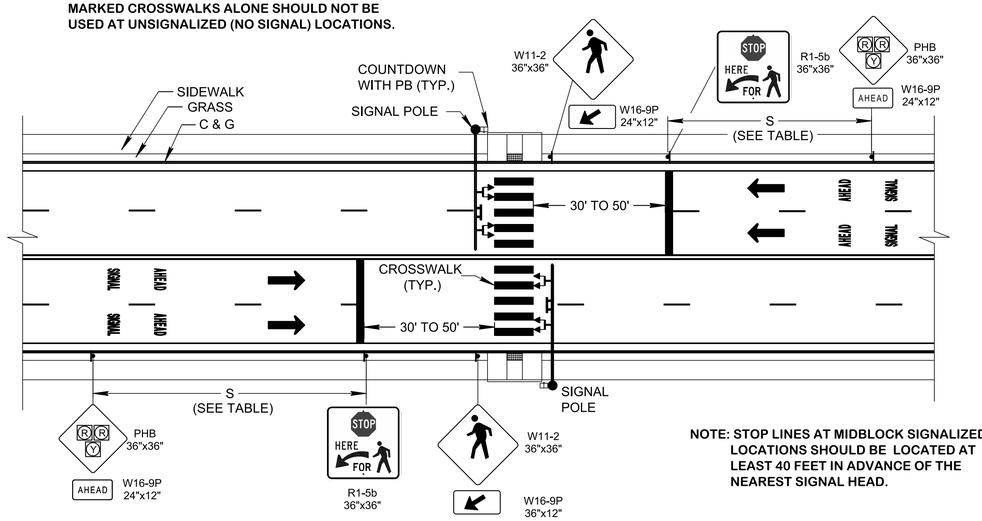
THE APPROPRIATE TAPER LENGTH (L)

$L = \frac{WS^2}{60}$	40 MPH OR LESS
L = WS	45 MPH OR MORE

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

LEGEND

- PEDESTRIAN HYBRID BEACON
- GROUND MOUNT SIGN
- MAST ARM SIGNAL POLE
- COUNTDOWN PEDESTRIN SIGNAL HEAD WITH PUSH BUTTON AND SIGN
- DETECTABLE WARNING SURFACE



NOTE: STOP LINES AT MIDBLOCK SIGNALIZED LOCATIONS SHOULD BE LOCATED AT LEAST 40 FEET IN ADVANCE OF THE NEAREST SIGNAL HEAD.

4 LANES WITH PEDESTRIAN HYBRID BEACON MID-BLOCK CROSSING

GENERAL NOTES

Ⓐ DETAILS SHOWN ON THIS STANDARD DRAWING APPLY TO THE CONSTRUCTION OR RECONSTRUCTION OF MID-BLOCK CROSSINGS AND MODIFICATION OF STREETS, CURBS, OR SIDEWALKS ASSOCIATED WITH IT. SEE TDOT-RDG FOR ADDITIONAL INFORMATION FOR SITE SELECTION, NEW CONSTRUCTION OR RECONSTRUCTION DURING PEDESTRIAN SAFETY INITIATIVE, SPOT SAFETY IMPROVEMENTS AT LOCATIONS MAX 45 MPH. OTHER LOCATIONS WILL NEED SITE SPECIFIC ANALYSIS.

Ⓑ FOR NEW CONSTRUCTION A TRAFFIC ENGINEERING STUDY WILL HAVE TO BE CONDUCTED TO DETERMINE IF A MID-BLOCK CROSSING IS WARRANTED. MID-BLOCK CROSSINGS SHALL BE INSTALLED DURING RECONSTRUCTION PROJECTS AND REPAVING PROJECTS AT LOCATIONS WHERE EXISTING PEDESTRIAN SAFETY IS A CONCERN.

Ⓒ PEDESTRIAN IN CROSSWALK SIGNS (W11-2) SHALL BE INSTALLED AT EACH END OF THE CROSSWALK LOCATION. THE SIGNS SHALL BE PLACED IN ADVANCE OF THE CROSSWALK ADJACENT TO THE TRAVEL LANE AND FACING THE DRIVER. REFER TO THE MUTCD FOR ADDITIONAL WARNING SIGNS, TYPE AND LOCATION.

Ⓒ FOR CURB RAMPS, THE DETECTABLE WARNING SURFACE, PAVEMENT MARKINGS, AND CROSSWALK MARKING DETAILS, SEE STD. DWG. SERIES MM-CR AND MM-PM RESPECTIVELY. FOR MARKING STANDARDS AND CONCRETE CURB AND GUTTER SEE STD. DWG T-M- SERIES AND RP-VC SERIES RESPECTIVELY.

Ⓓ FOR PEDESTRIAN SIGNAL PUSH BUTTONS, HAWK, RRFB AND PHB, SEE TDOT TRAFFIC DESIGN MANUAL. IF THE PEDESTRIAN CLEARANCE TIME IS SUFFICIENT ONLY TO CROSS FROM THE CURB OR SHOULDER TO A MEDIAN OF SUFFICIENT WIDTH FOR PEDESTRIANS TO WAIT AND THE SIGNALS ARE PEDESTRIAN ACTUATED, AN ADDITIONAL PEDESTRIAN DETECTOR SHALL BE PROVIDED IN THE MEDIAN.

Ⓔ STOP LINES SHOULD BE PLACED AT A SUFFICIENT DISTANCE (30' TO 50') FROM THE CROSSWALK TO ENSURE VISIBILITY IS PROVIDED FOR BOTH MOTORISTS AND PEDESTRIANS. STOP LINES AT MID-BLOCK SIGNALIZED LOCATIONS SHOULD BE PLACED AT LEAST 40 FEET IN ADVANCE OF THE NEAREST SIGNAL INDICATION.

Ⓕ STOP LINES SHALL CONSIST OF SOLID WHITE LINES EXTENDING ACROSS APPROACH LINES TO INDICATE THE POINT AT WHICH THE STOP IS INTENDED OR REQUIRED TO BE MADE. IF STOP LINES ARE USED AT A CROSSWALK THAT CROSSES AT AN UNCONTROLLED MULTI-LANE APPROACH, STOP HERE FOR PEDESTRIANS (R1-5 SERIES) SIGNS SHALL BE USED.

Ⓘ THE PLACEMENT OF MID-BLOCK SIGNALS. THE PRIMARY SIGNALIZED TREATMENT THAT SHOULD BE CONSIDERED AT MID-BLOCK OR NON- INTERSECTION CROSSINGS IS THE HIGH INTENSITY ACTIVATED CROSSWALK (HAWK) PEDESTRIAN HYBRID BEACON (PHB). A HAWK PEDESTRIAN HYBRID BEACON SHOULD BE EXAMINED WHERE THE PPH EXCEEDS 20 AND MOTOR VEHICULAR SPEEDS EXCEED 35 MPH.

Ⓙ ADDITIONAL DEVICE THAT MAY BE USED TO ASSIST PEDESTRIANS CROSSING IN A MARKED CROSSWALK AT AN UNSIGNALIZED INTERSECTION IS A RECTANGULAR RAPID FLASHING BEACON (RRFB). RRFB'S ARE PARTICULARLY EFFECTIVE AT MULTILANE CROSSINGS WITH SPEED LIMITS LESS THAN 40 MPH. CONSIDER THE PHB INSTEAD OF RRFBS FOR ROADWAYS SPEED LIMITS ARE EQUAL TO OR GREATER THAN 40 MPH.

Ⓚ A MEDIAN SHOULD BE AT LEAST 8.0 FEET WIDE TO ALLOW THE PEDESTRIAN TO WAIT COMFORTABLY IN THE CENTER, IF THE DESIRED 8 FEETCANNOTBE ACHIEVED, USE A MINIMUM WIDTH OF 6 FEET. THE PEDESTRIAN CROSSWALK MEDIAN ISLAND ARE ADA-APPROVED RAMPS (1:12 GRADE) SHOULD BE USED. IT IS BEST TO PROVIDE A SLIGHT GRADE 2 PERCENT TO PERMIT WATER AND SILT TO DRAIN FROM THE AREA. DRAINAGE STRUCTURES SHALL NOT BE PLACED IN LINE WITH RAMPS. INSTALL CATCH BASINS ON UPSTREAM SIDE OF RAMP FOR ROADS WITH GRADES LESS THAN 2%.

Ⓛ WHEN A PEDESTRIAN HYBRID BEACON IS USED, A CROSSWALK STOP ON RED (R10-23) SIGN SHALL BE MOUNTED ADJACENT TO A PEDESTRIAN HYBRID BEACON FACE ON EACH MAJOR STREET APPROACH. THE PEDESTRIAN HYBRID BEACON SHOULD BE INSTALLED AT LEAST 100 FEET FROM SIDE STREETS OR DRIVEWAYS THAT ARE CONTROLLED BY STOP OR YIELD SIGNS.

Ⓜ PARKING AND OTHER SIGHT OBSTRUCTIONS SHOULD BE PROHIBITED FOR AT LEAST 100 FEET IN ADVANCE OF AND AT LEAST 20 FEET BEYOND THE MARKED CROSSWALK, OR SITE ACCOMMODATIONS SHOULD BE MADE THROUGH CURB EXTENSIONS OR OTHER TECHNIQUES TO PROVIDE ADEQUATE SIGHT DISTANCE. THE INSTALLATION SHOULD INCLUDE SUITABLE STANDARD SIGNS AND PAVEMENT MARKINGS.

Ⓝ STREETLIGHTS SHOULD BE INSTALLED AT THE CROSSWALK ON BOTH SIDES ROAD TO IMPROVE PEDESTRIAN COMFORT, SECURITY, AND SAFETY DURING DARK AND BAD WEATHER CONDITIONS. FLUORESCENT YELLOW-GREEN SIGNS PROVIDE SUPERIOR VISIBILITY AND ARE EASILY NOTICEABLE IN DAYLIGHT AND DARK CONDITIONS. USE FLUORESCENT YELLOW-GREEN SIGNS FOR PEDESTRIAN AND BICYCLE WARNING TO HELP KEEP PEDESTRIANS AND DRIVERS SAFE.

Ⓞ MIDBLOCK CROSSWALKS SHOULD BE LOCATED AT LEAST 100 FEET FROM THE NEAREST SIDE STREET OR DRIVEWAY SO THAT DRIVERS TURNING ONTO THE MAJOR STREET HAVE A CHANCE TO NOTICE PEDESTRIANS AND PROPERLY YIELD TO PEDESTRIANS WHO ARE CROSSING THE STREET.

Ⓟ ADD CHANNELIZING DEVICES AT MID-BLOCK PEDESTRIAN CROSSINGS IN CONJUNCTION WITH IN STREET PEDESTRIAN CROSSING (R1-6 SERIES) SIGNS AS NEEDED.

Ⓠ PAYMENT

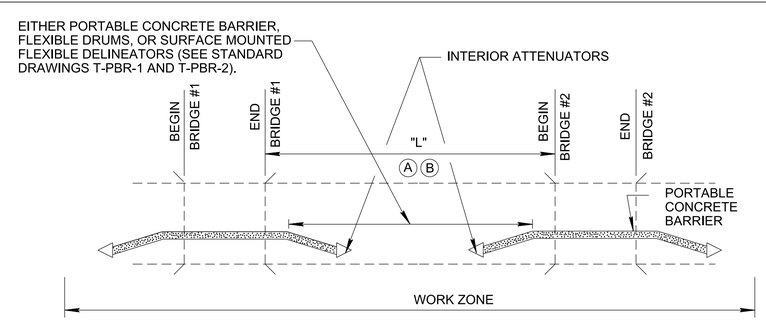
702-01,	CONCRETE CURBPER,	PER C.Y.,
702-03,	CONCRETE COMBINED CURB AND GUTTERPER,	PER C.Y.,
716-02.03	PLASTIC PAVEMENT MARKING (CROSSWALK),	PER L.F.,
716-02.04,	PLASTIC PAVEMENT MARKING (CHANNELIZATION STRIPING),	PER S.Y.,
716-02.05,	PAVEMENT MARKING (STOP LINE),	PER L.F.,
713-15.40,	SIGN INSTALLATION (DESCRIPTION),	PER LS,
730-26.01,	PEDESTRIAN SIGNAL DISPLAY,	PER EACH.

STATE OF TENNESSEE
STANDARD DRAWING
DEPARTMENT OF TRANSPORTATION

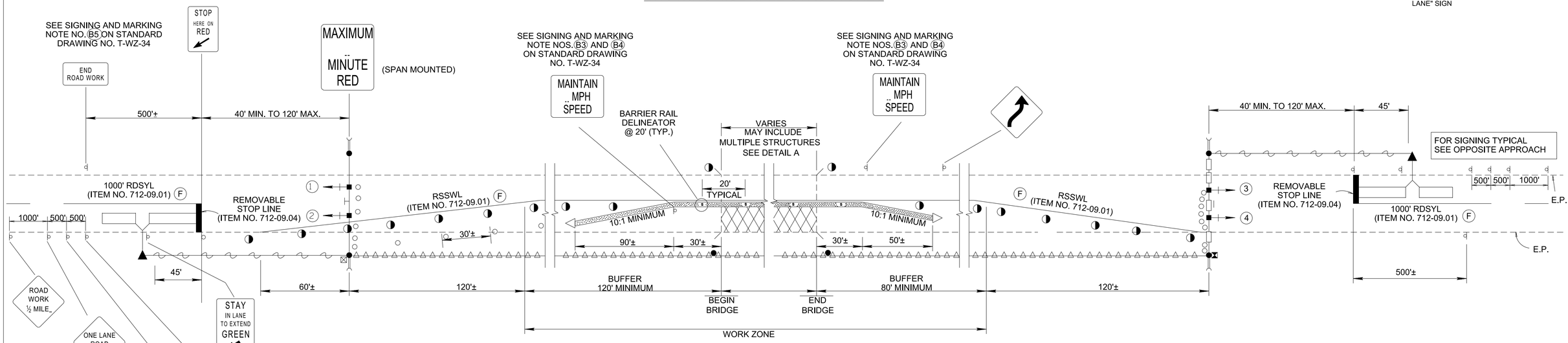
STANDARD
SIGNALIZED
MID-BLOCK CROSSING

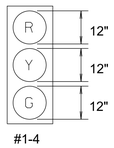
04-08-2020 T-M-4B

NOT TO SCALE



DETAIL A
SHOWING MULTIPLE STRUCTURES

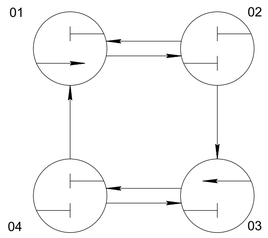




SIGNAL HEAD DETAIL

ALL SIGNAL HEADS SHALL HAVE BACKPLATES AND TETHER WIRES.

PLACEMENT OF SIGNAL HEADS SHALL BE IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (CURRENT EDITION).



PHASING DIAGRAM DETAIL

PHASE	INTERVAL		SIGNAL HEAD NO. & DISPLAY 1	2	3	4
			R Y G	R Y G	R Y G	R Y G
			SIGNAL HEAD NO. & SEQUENCE 1	2	3	4
1	R/W		G	G	R	R
	CLEAR TO	2	Y	Y	R	R
		3	DIRECT CLEARANCE PROHIBITED			
		4	DIRECT CLEARANCE PROHIBITED			
2	R/W		R	R	R	R
	CLEAR TO	3	R	R	R	R
		4	DIRECT CLEARANCE PROHIBITED			
		1	R	R	R	R
3	R/W		R	R	G	G
	CLEAR TO	4	R	R	Y	Y
		1	DIRECT CLEARANCE PROHIBITED			
		2	DIRECT CLEARANCE PROHIBITED			
4	R/W		R	R	R	R
	CLEAR TO	1	R	R	R	R
		2	DIRECT CLEARANCE PROHIBITED			
		3	R	R	R	R
** FLASH			R	R	R	R

** SEE SIGNAL OPERATION NOTES ON STANDARD DRAWING NO. T-WZ-34 FOR TIMES WHEN YELLOW FLASH IS USED.

GENERAL NOTES

(A) IF DISTANCE "L" IS 250' OR LESS, PORTABLE CONCRETE BARRIER SHALL BE CONTINUOUS.

(B) IF DISTANCE "L" IS GREATER THAN 250' THE CONTRACTOR MAY USE CONTINUOUS PORTABLE CONCRETE BARRIER IN LIEU OF THE INTERIOR ATTENUATORS SHOWN IN THIS DETAIL. IF INTERIOR ATTENUATORS ARE USED, FLEXIBLE DRUMS OR SURFACE MOUNTED FLEXIBLE DELINEATORS SHALL BE USED TO MAINTAIN ONE LANE OF TRAFFIC.

(C) SEE THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) FOR BUFFER LENGTH GUIDANCE.

(D) 7 OR 12 CONDUCTOR SIGNAL CABLE FROM DETECTOR CABINET TO CONTROLLER MAY BE RUN OVERHEAD (USING WOOD POLES AND MESSENGER WIRE), UNDERGROUND (DIRECT BURIED) OR ANY METHOD APPROVED BY THE ENGINEER.

(E) BARRIER RAIL DELINEATORS (ITEM NO.712-04.50) SHALL BE USED ON PORTABLE BARRIER RAIL. REFER TO THE QUALIFIED PRODUCT LIST FOR APPROVED BARRIER RAIL DELINEATORS. DIFFERENT TYPES OF BARRIER RAIL DELINEATORS SHOULD NOT BE MIXED IN THE SAME LINE.

(F) 712-09.02 REMOVABLE PAVEMENT MARKING (8" BARRIER LINE) OR 712-09.08 REMOVABLE PAVEMENT MARKING (6" LINE) MAY ALSO BE USED.

LEGEND

- FOUR OR EIGHT PHASE POLE MOUNTED CONTROLLER
- 6' X 45' LOOP WITH LEAD-IN
- 12 INCH SIGNAL HEAD WITH BACKPLATE ON SPANWIRE
- GUYING DEVICE VERTICAL ANCHOR (7/16" DIAMETER)
- SHIELDED DETECTOR CABLE ON SPAN WIRE
- WOOD POLE
- 7 CONDUCTOR (FOUR PHASE) OR 12 CONDUCTOR (EIGHT PHASE) FOR LOOPS & SIGNALS
- 5 CONDUCTOR SIGNAL CABLE
- FLEXIBLE DRUMS
- BARRIER RAIL DELINEATOR (ITEM NO. 712-04.50, PER EACH)
- PORTABLE CONCRETE BARRIER
- RSSWL REMOVABLE PAVEMENT MARKING (SINGLE SOLID WHITE LINE)
- RDSYL REMOVABLE PAVEMENT MARKING (DOUBLE SOLID YELLOW LINE)
- E.P. EDGE OF PAVEMENT
- DETECTOR AMPLIFIER CABINET
- WATERPROOF SPLICE
- SHIELDED DETECTOR CABLE (DIRECT BURIED)
- L DISTANCE
- ATTENUATOR

- REV. 5-27-98: CHANGED DRAWING NO. FROM T-CP-1 TO T-WZ-32. MODIFIED LEGEND.
- REV. 4-15-99: MODIFIED LEGEND.
  REV.12-18-99: ADDED SECOND NOTE TO PORTABLE CONCRETE BARRIER NOTES.
- REV. 9-1-05: REMOVED TYPE "C" WARNING LIGHTS FROM FLEXIBLE DRUMS IN TAPER.
- REV. 3-3-06: REPLACED VERTICAL PANEL WITH BARRIER RAIL DELINEATORS. ADDED GENERAL NOTES (F)
- REV. 10-29-13: CHANGED PAY ITEM FOR BARRIER RAIL DELINEATORS.
- REV. 03-05-17: ADDED ITEM NO. 712-09.01 OR 712-09.02 AND 712-09.04.
- REV. 11-30-20: ADDED GENERAL NOTE (F)

- REV. 9-17-82: CLARIFIED WORK ZONE. ADDED DETAIL "A". REMOVED SIGNS AT RIGHT END.
  REV. 10-7-82: ADDED 1" CONDUIT & 7/16 " DIAMETER GUY.
  REV. 3-22-85: GENERAL REVISIONS.
  REV. 10-24-86: GENERAL REVISIONS.
  REV. 5-27-91: REDREW SHEET AND REORGANIZED SHEET.
- REV. 1-19-92: GENERAL REVISION.
- REV. 4-1-92: CHANGED SECOND NOTE ON DETAIL A DELETING USE OF TYPE C WARNING LIGHTS.
- REV. 5-16-94: CHANGED CONSTRUCTION SIGNS TO CONFORM TO REVISED PART VI, M.U.T.C.D., DATED 9-3-93.
- REV. 9-5-94: CHANGED G20-2 TO G20-2A CONSTRUCTION SIGN. ADDED W1-4aR CONSTRUCTION SIGN.
- REV. 12-1-95: ADDED "STAY IN LANE" SIGN

☐ MINOR REVISION -- FHWA APPROVAL NOT REQUIRED.

CROSS REFERENCE DRAWINGS FOR THIS SHEET: T-WZ-33, T-WZ-34 AND T-WZ-35.

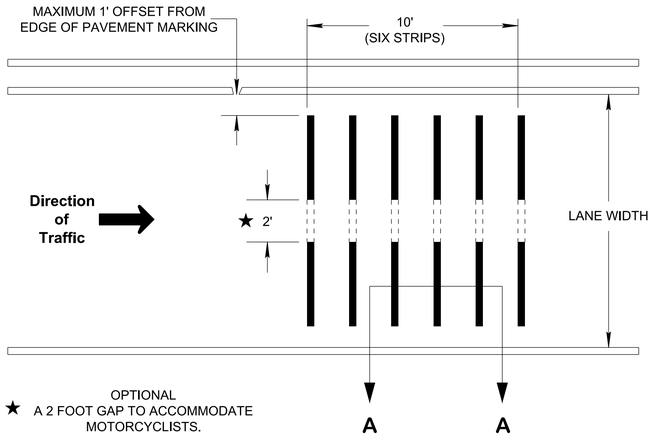
SHEET NOT TO SCALE

STATE OF TENNESSEE DEPARTMENT OF TRANSPORTATION

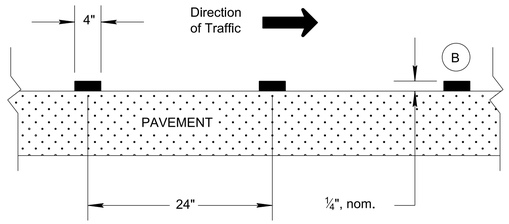
TRAFFIC CONTROL PLAN SIGNAL LAYOUT FOR TRAFFIC SIGNAL AT TWO LANE BRIDGE RECONSTRUCTION SITE

5-27-98 | T-WZ-32

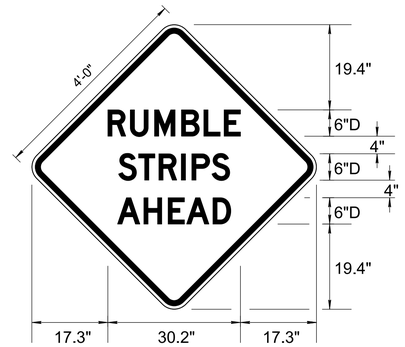
REV. 11-30-20: REMOVED TEMPORARY RUMBLE STRIPS DRAWING



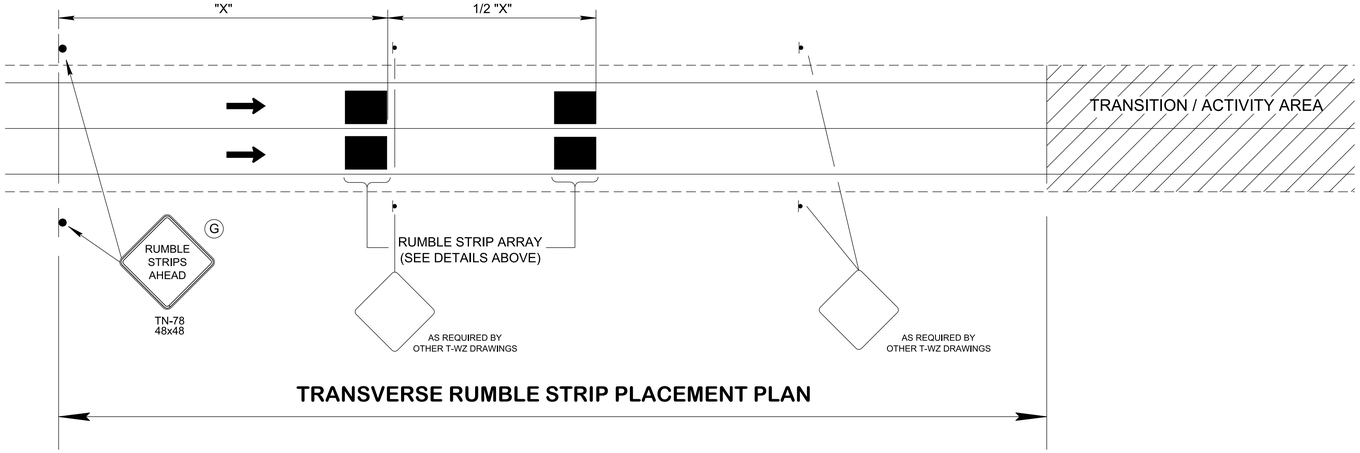
SURFACE APPLIED TRANSVERSE RUMBLE STRIPS
PERMANENT / SEMI PERMANENT
THERMOPLACTIC OR APPROVED ADHESIVE PRODUCT



SECTION A-A



SPECIAL SIGN DETAIL
TN-78 (48" x 48")



TRANSVERSE RUMBLE STRIP PLACEMENT PLAN

SPECIAL NOTE

PRECISE PLACEMENT AND SPACING OF ARRAYS AND WARNING SIGN MAY BE ADJUSTED IN ORDER TO BEST ACCOMIDATE PROJECT NEEDS AND SPECIFIC ROAD CONDITIONS. INTENT OF THESE ARRAYS IS TO ALERT DRIVERS OF TEMPORARY ROAD CONDITIONS OF INCREASED RISK SUCH AS TRAFFIC MERGING, REDUCED HORIZONTAL ALIGNMENT, ABRUPT SHIFTS, OR THE LIKE. THESE ARRAYS ARE INTENDED TO LOWER TRAFFIC SPEED AND INCREASE DRIVER AWARENESS.

GENERAL NOTES

(A) STATE TRAFFIC ENGINEER APPROVAL IS REQUIRED PRIOR TO INSTALLATION. SEE TDOT TRAFFIC MANUAL FOR FURTHER INFORMATION (SECTION 6.27.3, PAGES 6-59). FOR PLACEMENT DIMENSIONS SEE TABLE.

(B) WHITE, BLACK AND ORANGE COLORED MATERIAL IS APPROVED FOR TEMPORARY RUMBLE STRIPS (SEE QPL).

(C) MULTIPLE LANE ROADWAYS SHALL HAVE RUMBLE STRIP ARRAYS IN EACH THRU LANE.

(D) DO NOT PLACE RUMBLE STRIPS WITHIN LANE SHIFTING OR MERGING TAPER.

(E) PAYMENT

712-10.02, TEMPORARY TRANSVERSE RUMBLE STRIPS, L.F.

(F) FOR OTHER SIGN REQUIREMENTS SEE STANDARD DRAWING T-WZ- SERIES AND CURRENT EDITION OF M.U.T.C.D.

(G) TN-78 SIGN MAY BE ADJUSTED TO ALLOW FOR APPROPRIATE SPACING FROM OTHER SIGNS.

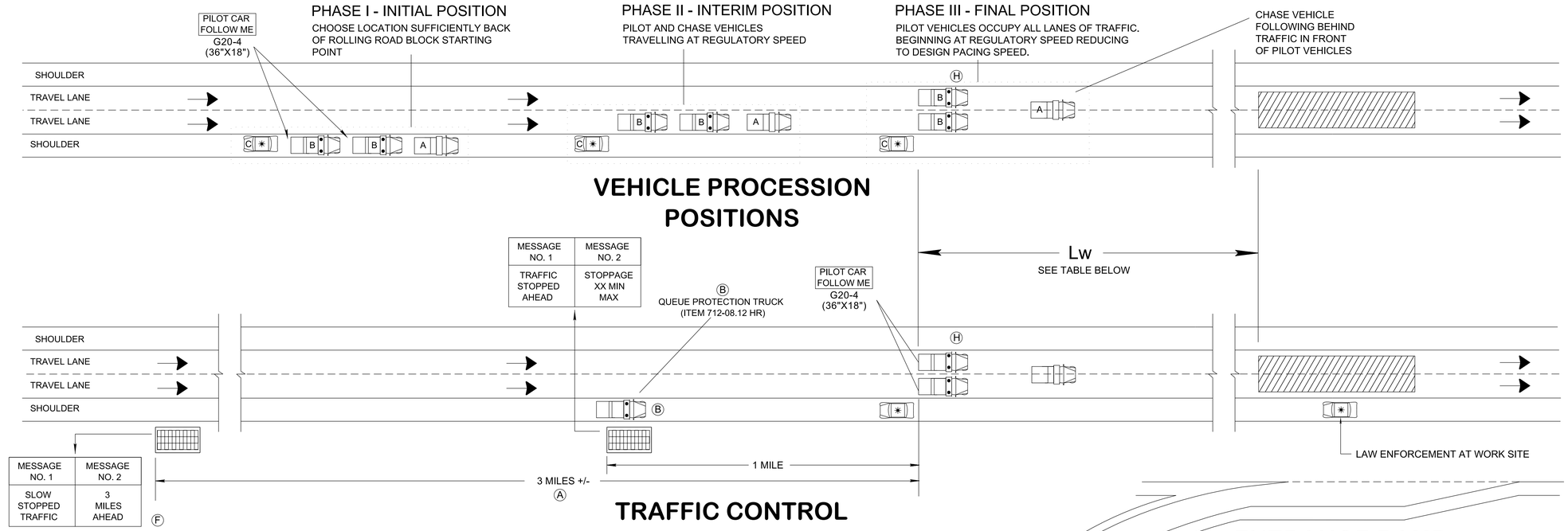
FHWA
APPROVAL NOT REQUIRED

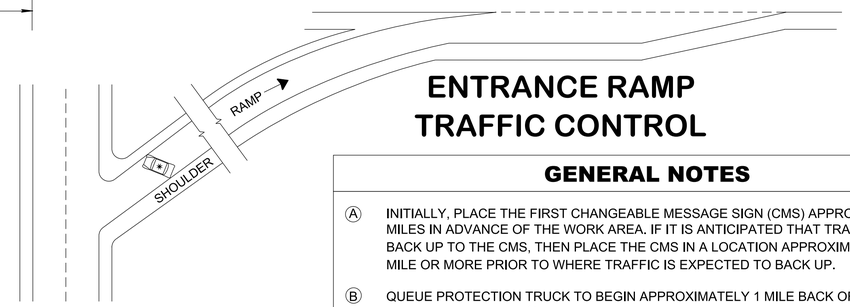
STATE OF TENNESSEE
STANDARD DRAWING
DEPARTMENT OF TRANSPORTATION

TRANSVERSE RUMBLE STRIP USE WITHIN WORK ZONES

06-28-2019 T-WZ-56

NOT TO SCALE





ENTRANCE RAMP TRAFFIC CONTROL

GENERAL NOTES

Ⓐ INITIALLY, PLACE THE FIRST CHANGEABLE MESSAGE SIGN (CMS) APPROXIMATELY 3 MILES IN ADVANCE OF THE WORK AREA. IF IT IS ANTICIPATED THAT TRAFFIC WILL BACK UP TO THE CMS, THEN PLACE THE CMS IN A LOCATION APPROXIMATELY ½ MILE OR MORE PRIOR TO WHERE TRAFFIC IS EXPECTED TO BACK UP.

Ⓑ QUEUE PROTECTION TRUCK TO BEGIN APPROXIMATELY 1 MILE BACK OF PILOT VEHICLES. MAINTAIN ½ TO 1 MILE DISTANCE FROM BACK OF QUEUE.

Ⓒ START ROLLING ROAD BLOCK BY HAVING ALL VEHICLES LEAVE THE OUTSIDE SHOULDER AND ACCELERATE TO NORMAL ROADWAY SPEEDS. WHEN NORMAL ROADWAY SPEEDS ARE ATTAINED, THE PILOT VEHICLES (B) WILL POSITION THEMSELVES SIDE BY SIDE AND THEN DECELERATE TO THE SPECIFIED ROLLING ROAD BLOCK SPEED. THE CHASE VEHICLE(S) (A) WILL CONTINUE TO TRAVEL AT NORMAL ROADWAY SPEEDS BEHIND ANY VEHICLES IN FRONT OF THE ROLLING ROAD BLOCK. CLOSE ON-RAMPS/ LOOPS OR STOP TRAFFIC ON SAME BETWEEN PILOT VEHICLES (B) AND THE WORK AREA. LAW ENFORCEMENT MAY BE USED AS A SUBSTITUTE FOR ANY VEHICLE(S). CONSTRUCTION SHALL NOT COMMENCE IN ANY LOCATION WITHIN THE WORK AREA UNTIL THE CHASE VEHICLE(S) (A) HAS CLEARED THAT LOCATION

Ⓓ COMMUNICATION SHALL BE REQUIRED BETWEEN PILOT VEHICLE, CHASE CAR, AND WORK CREW.

Ⓔ LAW ENFORCEMENT SHALL BE REQUIRED TO BE PART OF ANY ROLLING ROAD BLOCK PROCESSION AND AT THE WORK SITE AS ENFORCEMENT. AFFECTED ENTRANCE RAMPS SHALL BE CLOSED BY USE OF LAW ENFORCEMENT OR AS DIRECTED BY ENGINEER.

Ⓕ CMS SHALL BE IN POSITION APPROXIMATELY 7 DAYS AHEAD OF WORK. MESSAGE SHALL DISPLAY PROPOSED DATE AND TIME OF ROLLING ROAD BLOCKS. MESSAGE WILL BE CHANGED JUST PRIOR TO WORK OCCURRING.

Ⓖ ROLLING ROAD BLOCK TIME OF PERFORMANCE SHOULD BE CAREFULLY CONSIDERED TO HAVE A MINIMAL IMPACT ON TRAFFIC. NIGHT TIME AND OTHER OFF-PEAK HOURS SHOULD BE SELECTED.

Ⓗ PILOT VEHICLES ARE REQUIRED TO OCCUPY EACH LANE OF THROUGH TRAFFIC FOR THE DURATION OF ROLLING ROAD BLOCK. VEHICLES MUST BE EQUIPPED WITH FLASHING LIGHTS AND "PILOT CAR FOLLOW ME" SIGN (G20-4).

Ⓘ COST FOR PLANNING, SETUP AND EXECUTION OF ROLLING ROAD BLOCKS TO BE PAID FOR UNDER 712-01 TRAFFIC CONTROL (LS) EXCEPT FOR QUEUE PROTECTION TRUCKS, LAW ENFORCEMENT, AND ADDITIONAL PORTABLE MESSAGE BOARDS IF NEEDED.

Ⓙ ROLLING ROAD BLOCKS SHALL BE COORDINATED AND APPROVED THROUGH REGIONAL TRAFFIC ENGINEER OR TDOT REGIONAL DIRECTOR.

NOTES FOR TABLE:

WORK DURATION (Tw) IS THE TOTAL TIME ALLOWED FOR WORK ACTIVITY IN MINUTES. THIS TIME STARTS JUST AFTER THE LAST VEHICLE TRAVELING AT THE PRE-PACING REGULATORY SPEED CLEARS THE WORK AREA AND ENDS JUST AS THE PACING OPERATION REACHES THE WORK AREA. Tw MUST INCLUDE THE TIME REQUIRED TO CLEAR THE ROADWAY OF EQUIPMENT, MATERIALS, AND PERSONNEL.

HOURLY TRAFFIC REQUIREMENTS SHALL BE BASED ON ESTIMATED REAL TIME CONDITIONS AND NOT EXTRAPOLATED FROM AADT. DATA MAY BE REQUIRED TO ACCURATELY CALCULATE HOURLY DIRECTIONAL TRAFFIC VOLUMES. HOURLY TRAFFIC VOLUMES MAY BE CONVERTED TO pcphpl USING THE FOLLOWING:

PASSENGER CARS PER HOUR PER LANE (pcphpl) = (HOURLY DIRECTIONAL VOLUME/ # LANES EACH DIRECTION) * HEAVY VEHICLE FACTOR

Sr = REGULATORY SPEED (MPH)
Sp = PACING SPEED (MPH)
Tw = WORK DURATION (MIN)
L = TOTAL PACING DISTANCE IN MILES

L = (tw/60) * Sp ((Sp / (SR-Sp)) +1)
L = Lc + Lw

Lc = DISTANCE PACED VEHICLES MUST TRAVEL BEFORE THE VEHICLES AT REGULATORY SPEED HAVE CLEARED THE WORK ZONE

Lc = (((tw/60)*Sp^2) / (Sr-Sp))

Lw = DISTANCE PACED VEHICLES TRAVEL WHILE WORK IS PERFORMED

Lw = ((tw/60)*Sp)

Fhv = HEAVY VEHICLE FACTOR

Fhv = 1 + ((Pt/100)*0.5)

Pt = % TRUCKS

TOTAL TRAFFIC PACING DISTANCES Lw (MILES)

Sp = 20; pcphpl <= 1,750

Sr \ Tw	5 min	10 min	15 min	20 min	25 min	30 min
70 mph	2.3	4.7	7.0	9.3	*	*
65 mph	2.4	4.8	7.2	9.6	*	*
60 mph	2.5	5.0	7.5	10.0	*	*
55 mph	2.6	5.2	7.9	*	*	*
50 mph	2.8	5.6	8.3	*	*	*

* DISTANCE NOT RECOMMENDED DUE TO EXCESSIVE WORK TIMES AND TRAFFIC QUEUES POSSIBLE. APPROVAL OF WORK ZONE DESIGN DEVIATION IS REQUIRED

Sp = 15; pcphpl <= 1,440

Sr \ Tw	5 min	10 min	15 min	20 min	25 min	30 min
70	1.6	3.2	4.8	6.4	*	*
65	1.6	3.3	4.9	6.5	*	*
60	1.7	3.3	5.0	6.7	*	*
55	1.7	3.4	5.2	6.9	*	*
50	1.8	3.6	5.4	7.1	*	*

* DISTANCE NOT RECOMMENDED DUE TO EXCESSIVE WORK TIMES AND TRAFFIC QUEUES POSSIBLE. APPROVAL OF WORK ZONE DESIGN DEVIATION IS REQUIRED

SPECIAL NOTES

IF THE MINIMUM DESIGN REQUIREMENTS OF THIS STANDARD DRAWING CANNOT BE MET, A WORK ZONE DESIGN DEVIATION MUST BE SUBMITTED TO AND APPROVED BY THE STATE WORK ZONE ENGINEER.

CHANNELIZATION DEVICE LEGEND

DIRECTION OF TRAFFIC

WORK SPACE

PILOT VEHICLE

CHASE VEHICLE

LAW ENFORCEMENT (ITEM N0 712-08.01 HR)

CHANGEABLE MESSAGE SIGN (ITEM NO 713-16.01 EA)

NOT TO SCALE

STATE OF TENNESSEE
STANDARD DRAWING
DEPARTMENT OF TRANSPORTATION

ROLLING ROADBLOCK DETAIL FOR DIVIDED HIGHWAYS

12-8-2020 T-WZ-61