**PA STRUCTURE MOUNTED GUIDE RAIL**

**ELEVATION ALONG TOP SLAB OF CULVERT**

- For curb reinforcement see Sheet 1
- Top slab reinforcement as designed

**NOTES**

1. 2'-6" min., 1' max. P3" hex head bolts for TS 7"x3"x' (TYP.)
2. See detail 8 on Sheet 1 for alternate detail
3. See RC-801M for barrier reinforcement and expansion details

**SECTION A-A**

- See Note 12, Sheet 1
- Curb reinforcement shown for clarity, see RC-801M
- See RC-801M for pipe 8"P3" detail
- Reinforcement shown at post locations only, see Sheet 8 for slab reinforcement bar details

**LEGEND**

- See note 12, Sheet 1
- Reinforcement shown for clarity, see RC-801M
- See RC-801M for pipe 8"P3" detail
- Reinforcement required at post locations only, see Sheet 8 for slab reinforcement bar details

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**DEPARTMENT OF TRANSPORTATION**

**BUREAU OF PROJECT DELIVERY**

**STANDARD**

**R.C. BOX CULVERT**

**HEADWALL DETAILS**

**CAST-IN-PLACE**

**RECOMMENDED AUG. 30, 2019**

**BD-632M**
A typical page of a technical document, possibly related to civil engineering. The content is technical and involves detailed planning for the construction of box culverts, including specifications for threaded inserts, joint sealing materials, and other components. The document is specific to the Commonwealth of Pennsylvania Department of Transportation, Bureau of Project Delivery. The page emphasizes the use of precast concrete elements and detailed construction techniques, ensuring structural integrity and adherence to standards for drainage systems.
**ALTERNATIVE CUTOFF WALL WITH GROUTED ROCK**

**SHEET 6 OF 15**

**AUG. 30, 2019**

**ACTING CHIEF BRIDGE ENGINEER**

**ACT. DIR., BUR. OF PROJECT DELIVERY**

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**R.C. BOX CULVERT**

- **PRECAST CULVERT WITH CAST-IN-PLACE WINGWALLS**
- **DETAIL A (WITHOUT APRON)**
- **DETAIL B (WITH APRON)**

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**NOTE:**

- Designers to modify amount of compacted No. 2A Coarse Aggregate or Flowable Backfill to provide adequate protection against piping of stream bottom slab.
- Flow through fill at inlet end of culvert.
- Top of April & Existing Stream Bed. Schlips to Collar/Curb Reinforcement.
- Baffle to the limit of the rock lining.
- Compacted No. 19 coarse aggregate fill to collar. Length equals and at top sheet wingwall.
- Flow through fill at inlet end of culvert.

---

**DETAIL A (WITHOUT APRON)**

- To bottom of Killwall footing or bottom of rock lining which ever is deeper 3'-6" Min. Pull Voids in rock with vibrated class A concrete.
- Concrete 0" of slab to bottom of rock. Pull research of rock with natural streambed material.

**DETAIL B (WITH APRON)**

- To bottom of Killwall footing or bottom of rock lining which ever is deeper 3'-6" Min. Pull Voids in rock with vibrated class A concrete.
- Concrete 0" below streambed to bottom of Rock.
- TOP OF ROCK OR R-6 MIN. ROCK LINING (PUB. 408, BY DESIGN) AS REQUIRED. SEE DETAIL A THIS SHEET.
- AN ALTERNATIVE CUTOFF WALL WITH GROUTED ROCK IS PERMITTED, SEE DETAIL B THIS SHEET.
- An alternative cutoff wall with grouted rock is permitted. See detail A this sheet.
GENERAL NOTES:
1. Every post-tensioning strand must be per R.C. Box Culvert Design.
2. Epoxy bonding compound and fill with non-shrink grout.
3. Wall reinforcement can be adjusted to accommodate needs. Do not cut reinforcement.
4. Cast-in-place concrete is permitted in any portion of the post-tensioned end sections, only if height or width of end sections are restricted due to shipping restraints.

POST-TENSIONING NOTES:
1. Extend bottom row of post-tensioning strands through the bottom slab of precast concrete inlet and outlet end section.
2. Box segments and end sections are post-tensioned in stages. The contractor is required to submit a plan for post-tensioning sequence to the department for approval prior to setting any segments.
3. Post-tensioning boxes are first, then provided.
4. Mechanical splice on bottom strand to connect with the inlet/outlet end sections and post-tension bottom strands through the end sections.
5. Slabs on ends of end section shall not exceed 12".
6. Provide full contact with the joint sealing material around the bottom edge between the end sections and the box section.
7. After post-tensioning is approved, cut strands to provide a minimum of 2" clearance between face of concrete and cast plates.
8. Epoxy bonding compound and fill with non-shrink grout.
9. The number of post-tensioning strands may be increased and their locations may be adjusted by the fabricator.
10. Precast concrete segment lengths to be determined by the fabricator.
11. Staging, spacing and post-tension force to be shown on fabricator's shop drawings.

NOTE: See BC-798M, SHEET 1 FOR ADDITIONAL POST-TENSIONING NOTES.
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H A U N C H SECTION DETAIL

TYPICAL HAUNCH SECTION DETAIL

ALTERNATE HAUNCH SECTION DETAIL

KEYED CONSTRUCTION JOINT

CONSTRUCTION JOINT DETAIL

ALTERNATE SHIP-LAP CONSTRUCTION JOINT

DETAIL E

CONFIGURATION FOR SLAB/WALL WITH POST-TENSIONING

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STANDARD
R.C. BOX CULVERT
MISCELLANEOUS DETAILS
PRECAST

RECOMMENDED: AUG. 30, 2019
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Sheet 9 of 15
BD-632M

NOTE: PLACE POST-TENSIONING DUCTS ONLY IN CORNER ANCHORED WHEN WALL THICKNESSES ARE 13".
1. The opening in the interior baffles should be equal to 1/3 the average normal width of the stream.

2. The baffles should be spaced at the average normal stream width plus a minimum of 6 ft. Minimum is 3 ft. The first interior baffle at the outlet should be located as close to the downstream end of culvert as possible and spaced accordingly from that point to the inlet.

3. The opening in the interior baffles should be equal to 1/2 the average normal width of the stream.

4. Baffles should be spaced at the average normal stream width plus a minimum of 6 ft. Minimum is 3 ft. The first interior baffle at the outlet should be located as close to the downstream end of culvert as possible and spaced accordingly from that point to the inlet.

5. If baffles spaced more than 1 ft. Baffles should be spaced at the average normal stream width plus a minimum of 6 ft. Minimum is 3 ft. The first interior baffle at the outlet should be located as close to the downstream end of culvert as possible and spaced accordingly from that point to the inlet.

6. The opening in the interior baffles should be equal to 1/3 the average normal width of the stream. The baffles should be spaced at the average normal stream width plus a minimum of 6 ft. Minimum is 3 ft. The first interior baffle at the outlet should be located as close to the downstream end of culvert as possible and spaced accordingly from that point to the inlet.

7. The slope of the new structure should match the streambed elevation with 90° hooks, rotate alternating hooks 180°. #5 @ 1'-0". #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°.

8. The slope of the new structure should match the streambed elevation with 90° hooks, rotate alternating hooks 180°. #5 @ 1'-0". #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°.

9. The slope of the new structure should match the streambed elevation with 90° hooks, rotate alternating hooks 180°. #5 @ 1'-0". #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°.

10. The slope of the new structure should match the streambed elevation with 90° hooks, rotate alternating hooks 180°. #5 @ 1'-0". #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°.

11. The slope of the new structure should match the streambed elevation with 90° hooks, rotate alternating hooks 180°. #5 @ 1'-0". #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°.

12. The slope of the new structure should match the streambed elevation with 90° hooks, rotate alternating hooks 180°. #5 @ 1'-0". #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°. #5 @ 90° hooks, rotate alternating hooks 180°.
1. The baffles should be placed at the average normal stream width of the structure. The first interior baffles should be placed at the downstream end of the culvert and spaced accordingly from that point to the face of the box. The longer apron, baffles should be spaced not less than 8'-0" spacing.

2. The opening in the interior baffles should be equal to 1/3 the average normal width of the stream. The opening width of a 6'-0" stream should exceed the first interior baffles. The first interior baffles should be placed at the downstream end of the culvert and spaced accordingly from that point to the face of the box. The longer apron, baffles should be spaced not less than 8'-0" spacing.

3. If baffling spacing needs adjusted due to box segments, the spacing should be shorter not longer than calculated spacing.

4. The slope of the new structure should match the natural stream slope.

5. Additional twin cell details are shown in Sheet 12.

6. Baffles may be skewed relative to the direction of flow in order to be parallel to the section ends.

7. The slope of the new structure should match the natural stream slope.

8. Roadway cross slope should be offset by 4'-0", or 6", whichever is greater. The first interior baffles should be placed at the downstream end of the culvert and spaced accordingly from that point to the face of the box. The longer apron, baffles should be spaced not less than 8'-0" spacing.

9. There may be unusual circumstances in which the calculated baffles will not adequately prevent erosion. The design guidance for baffles is based on the absence of data for PennDOT infiltration with normal stream flow. BAFFLES should be spaced at the average normal stream width of the structure. The first interior baffles should be placed at the downstream end of the culvert and spaced accordingly from that point to the face of the box. The longer apron, baffles should be spaced not less than 8'-0" spacing.

10. The slope of the new structure should match the natural stream slope.

11. Additional twin cell details are shown in Sheet 12.

12. Baffles may be skewed relative to the direction of flow in order to be parallel to the section ends.
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**STANDARD**

**R.C. BOX CULVERT**

**MISCELLANEOUS TWIN CELL DETAILS**

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**TYP. PRECAST SECTION (NORMAL)**

SYMMETRICAL

**TYP. PRECAST SECTION (NORMAL)**

SYMMETRICAL - OPTION TO WEIR

**SECTION N-N**

CONCRETE PLUG

---

**CAST-IN-PLACE BOX CULVERT**

TYPICAL WEIR DETAIL

ALL STREAM GRADES

**PRECAST BOX CULVERT**

TYPICAL WEIR DETAIL (NORMAL)

ALL STREAM GRADES

---

**NOTE:**

DO NOT PLACE R.C. BOX CULVERTS C 6" APART.

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**DESIGN NOTE:**

TYPICAL WEIR DETAIL

FOR CAST-IN-PLACE WEIR

REINFORCEMENT, HEX D. AT EACH END OF WEIR.

---

**PROFILE**

WEIR DETAIL

PRECAST REINFORCEMENT SHOWN, CAST-IN-PLACE REINFORCEMENT SIMILAR EXCEPT AS NOTED ON THIS STANDARD.
RECOMMENDED SHEET 13 OF 15

OPPOSING BAFFLES LESS THAN 2'-0"

AUG.30, 2019
2" CLR. (TYP.)

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OPPOSING BAFFLES LESS THAN 1'-0"

ALTERNATING #5 90° HOOK BARS.

BY 8" LONG #5 BARS TIED TO

STREAM GRADES   4%

9" MAX.

THAN 2'-0", REPLACE 2-#5 BARS
THAN 1'-0", CAST ADJACENT

INSERTS 7" ON CENTER FOR

THE 2 - #5 90° HOOK BARS.

FOR OPPOSING BAFFLES LESS
3" CLR.

3. FOR OPPOSING BAFFLES LESS
THAN 2', USE 8" LONG #5 BARS
WITH A 45° BAR SUPPORTED
2'-6" LONG BEYOND TOP OF BAFFLE.

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ALTERNATING #5 90° HOOK BARS.

BY 8" LONG #5 BARS TIED TO

SECTION K-K

OPPOSING BAFFLE NOTES 1.
PRESSURE DEAMAGEMENT SHOWN.
EACH IN-PLACE REINFORCEMENT NOTE DESCRIBED ON SHEET 10.

2. FOR OPPOSING BAFFLE LESS THAN 1'-0", CAST ALTERNATING NOTES TO SHEET 10.

3. FOR OPPOSING BAFFLES LESS THAN 2', USE 8" LONG #5 BARS WITH A 45° BAR SUPPORTED

2'-6" LONG BEYOND TOP OF BAFFLE.

ROADWAY CROSS SLOPE

EXISTING STREAMBED ELEV.

SECTION J-J

ELEVATION

ROADWAY PROFILE GRADE

NOTE 11 (TYP.)

FLAT AT THE TOP OF THE BAFFLE TO THE CULVERT BOTTOM, NOT THE TOP OF THE BAFFLES. STREAMBED MATERIAL. THE ROCK SHOULD BE FLUSH WITH THE ROADWAY PROFILE GRADE.

NOTE 11 (TYP.)

ROCK LINING AT THE INLET AND OUTLET SHOULD BE BENEATH THE CULVERT. BOTTOM OF CUTOFF WALL IS TO EQUAL THE SPACING SHOULD BE SHORTER NOT LONGER THAN CALCULATED SPACING.

NOTE 11 (TYP.)

MEASUREMENTS SHOULD NOT BE TAKEN WHERE THE CHANNEL BEYOND) SECONDARY CELL FORMS A DIAGONALベWINGWALL MATERIAL SALVAGED FROM EXCAVATION FOR THE BOX CULVERT calculated SPACING.

NOTE 11 (TYP.)

THE SLOPE OF THE NEW STRUCTURE SHOULD MATCH THE NATURAL STREAM SLOPE.

NOTE 11 (TYP.)

CUTOFF WALL IS TO ENSURE STREAMFLOW DOES NOT PASS THE SPACING SHOULD BE SHORTER NOT LONGER THAN 1'-0" (TYP.)

NOTE 11 (TYP.)

THE BAFFLE SPACING AND OPENINGS SHOULD BE BASED ON THE AVERAGE NORMAL WIDTH OF THE STREAM.

NOTE 11 (TYP.)

CUTOFF WALL, Fill SECONDARY CELL PRIMARY CELL Section K-K

ROADWAY PROFILE GRADE ELEVATION

ROADWAY CROSS SLOPE

NOTE 11 (TYP.)

FILL SECONDARY CELL PRIMARY CELL Section K-K

ROADWAY PROFILE GRADE ELEVATION

ROADWAY CROSS SLOPE

NOTE 11 (TYP.)

MEASUREMENTS SHOULD NOT BE TAKEN WHERE THE CHANNEL BEYOND) SECONDARY CELL FORMS A DIAGONAL BEYOND) SECONDARY CELL FORMS A DIAGONAL BEYOND) SECONDARY CELL FORMS A DIAGONAL BEYOND) SECONDARY CELL FORMS A DIAGONAL BEYOND) SECONDARY CELL FORMS A DIAGONAL BEYOND) SECONDARY CELL FORMS A DIAGONAL BEYOND) SECONDARY CELL FORMS A DIAGONAL BEYOND) SECONDARY CELL FORMS A DIAGONAL BEYOND) SECONDARY CELL FORMS A DIAGONAL BEYOND) SECONDARY CELL FORMS A DIAGONAL BEYOND) SECONDARY CELL FORMS A DIAGONAL BEYOND) SECONDARY CELL FORMS A DIAGONAL BEYOND) SECONDARY CELL FORMS A DIAGONAL
**DESIGN EXAMPLE:**

**SKEW ANGLE > 75°**

**SKEW ANGLE < 75° - OPTION 1**

**SKEW ANGLE < 75° - OPTION 2**

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**R.C. BOX CULVERT**

**PRECAST CONCRETE SEGMENT JOINT DETAILS**

**END SEGMENT**

**(END SECTION)**

**INTERMEDIATE SEGMENT (TYP.)**

**END SEGMENT (TYP.)**

**END SEGMENT (TYP.)**

**END SEGMENT (TYP.)**

**INTERMEDIATE SEGMENT (TYP.)**

**INTERMEDIATE SEGMENT (TYP.)**

**INTERMEDIATE SEGMENT (TYP.)**

**INTERMEDIATE SEGMENT (TYP.)**

**INTERMEDIATE SEGMENT (TYP.)**

**INTERMEDIATE SEGMENT (TYP.)**

**BOX CULVERT (STEEL FORM) - MINIMUM SKEW ANGLE**

**WALL SIZES:** 6 FT. AND 10 FT.
DESIGN NOTES:
1. The layout of the concrete slope transitions should be based on the required grading around the wing walls.
2. Construct concrete slope transitions using Class I Cement Concrete.
3. Use this detail in coordination with DEP and PAFBC during Pre-app Meeting.

STANDARD
PRECAST BOX CULVERT WITH APRONS
C.I.P CONCRETE WEDGE
TRANSITION (TYP.)

SECTION R-R
NO SCALE

SECTION Q-Q
NO SCALE

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PRECAST BOX CULVERT WITH APRONS
C.I.P CONCRETE WEDGE
TRANSITION

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