Section 17 – Underground Structures--XS17-050

XS Sheet Numbers	XS17-050-1, XS17-050-2 and XS17-050-3
Description of Component	The Cast-In-Place bottomless culverts are mainly used for fish and wildlife passage because they can provide a natural channel bed. These underground structures in XS sheets can have earth cover with a range from 0.0 ft (top exposed to ground) to 20 ft (Max). The spans range from 12 ft to 20 ft.
Standard Drawing Features	There are totally 3 plan sheets including General Configurations, Wall, Slab and Pile Details and Foundation Details.
Design/General Notes	AASHTO LRFD Bridge Design Specifications, 6th Edition and CA Amendments
Additional Drawings Needed to Complete PS&E	District plans of highway drainage design Either XS17-051: Piles/Footings on Soil or XS17-052: Piles/Footings on Rock
Contract Specifications	Standard Specification Sections 19, 49, 51, 52 and 90
Restrictions on Use of Standard Drawings	Potential erosion of the natural bed and potential scouring to the footings could be a major concern for this type of culvert. Geotechnical services should provide investigations and approval for the type selection of bottomless structure. Hydraulic services should provide protection measurements for erosion and scouring as needed.
Special Considerations	The CIP bottomless culvert can also be used for other purposes based on cost and constructability considerations or for protecting an existing utility due to load changes. Bottomless culverts in XS sheets might not be an efficient design alternative when they are buried deeply, for example, when the earth cover is over 25 ft. Other types of bottomless culverts with curved top might be considered in this case, which would be a special design case and need to get approval from Underground Structure Specialist in DES.

Section 17 – Underground Structures—XS17-051

XS Sheet Numbers	XS17-051
Description of Component	The Cast-In-Place bottomless culverts with Piles/Footings on Rock are shown in the plan. These underground structures with rock foundation can have earth cover with a range from 0.0 ft (top exposed to ground) to 20 ft (Max). The spans range from 12 ft to 20 ft.
Standard Drawing Features	There is one single plan sheet: Piles/Footings on Rock. It shows the reinforcement details for the walls and top slabs.
Design/General Notes	AASHTO LRFD Bridge Design Specifications, 6th Edition and CA Amendments
Additional Drawings Needed to Complete PS&E	District plans of highway drainage design XS17-050-1: General Configurations, XS17-050-2: Walls, Slab and Pile Details and XS17-050-3: Foundation Details
Contract Specifications	Standard Specification Sections 49, 51, 52, 90
Restrictions on Use of Standard Drawings	See User Guide for XS17-050 for details.
Special Considerations	See User Guide for XS17-050 for details.

Section 17 – Underground Structures—XS17-052

XS Sheet Numbers	XS17-052
Description of Component	The Cast-In-Place bottomless culverts with Piles/Footings on Soil are shown in the plan. These underground structures with rock foundation can have earth cover with a range from 0.0 ft (exposed to ground) to 20 ft (Max). The spans range from 12 ft to 20 ft.
Standard Drawing Features	There is one single plan sheet: Piles/Footings on Soil. It shows the reinforcement details for the walls and top slabs.
Design/General Notes	AASHTO LRFD Bridge Design Specifications, 6th Edition and CA Amendments
Additional Drawings Needed to Complete PS&E	District plans of highway drainage design XS17-050-1: General Configurations, XS17-050-2: Walls, Slab and Pile Details and XS17-050-3: Foundation Details
Contract Specifications	Standard Specification Sections 49, 51, 52, 90
Restrictions on Use of Standard Drawings	See User Guide for XS17-050 for details.
Special Considerations	See User Guide for XS17-050 for details.

Section 17 – Underground Structures—XS17-060

XS Sheet Numbers	XS17-060
Description of Component	Repair Corrugated Metal Pipe (or Arch) culverts by paving the invert damaged due to corrosion and abrasion.
Standard Drawing Features	The single sheet standard plan shows the details of the invert pavement and construction procedures.
Design/General Notes	AASHTO LRFD Bridge Design Specifications, 6th Edition and CA Amendments
Additional Drawings Needed to Complete PS&E	District plans of highway drainage design
Contract Specifications	Standard Specifications Section 15, 53, SSP 15.6
Restrictions on Use of Standard Drawings	The XS sheet is used for metal pipe invert repair damaged mainly around the invert of the CMP, CMPA, CSSPP and CSSPPA with a maximum central angel of 120 degrees (to the 4 o'clock and 8 o'clock positions of the circular culvert).
Special Considerations	Some special considerations for the procedures and calculations are given below: 1. Obtain applicable Culvert Investigation Corrosion Report thru Corrosion Technology Branch (METS) and Soils Report from Geotechnical Engineer. Determine existing pipe wall thickness of the metal or structural steel plate pipe and the soil backfill density. 2. From Shear Stud Selection Chart, select number of studs required to support the compression ring in the pipe wall. 3. Based on soil and water PH, and abrasion level obtained from District Hydraulics Engineer based on HDM Table 855.2A, determine required concrete patch thickness from HDM Table 855.2F, a minimum of 3" above the pipe crest. 4. Fill voids underneath culvert with slurry cement backfill or grouting. 5. The selected number of Welded Headed Studs attached to the corrugated culvert crest will provide a safety factor of 2.0.