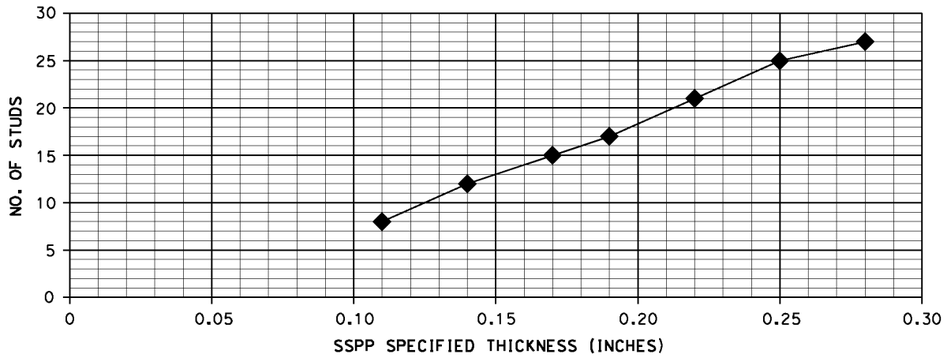
DIST	COUNTY	ROUTE	POST MILES TOTAL PROJECT	SHEET No.	TOTAL SHEETS
X	X	X	X	X	X

REGISTERED CIVIL ENGINEER — X DATE

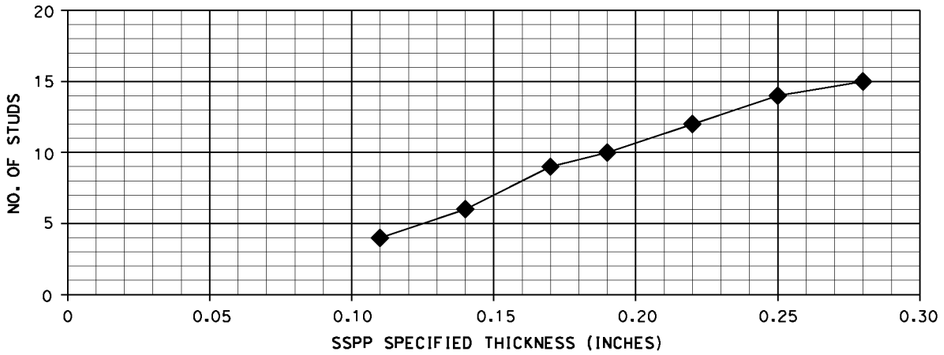
PLANS APPROVAL DATE

REGISTERED PROFESSIONAL ENGINEER — X — No. X — Exp. X — CIVIL — STATE OF CALIFORNIA

The State of California or its officers or agents shall not be responsible for the accuracy or completeness of electronic copies of this plan sheet.



REQ'D. NO. OF WELDED HEADED STUDS (3/8" DIA)



REQ'D. NO. OF WELDED HEADED STUDS (1/2" DIA)

SHEAR STUD SELECTION CHARTS

Headed Stud Dimension			Concrete Strength, fc' (psi)		
Diameter x min. length (inch)			3000	3500	4000
3/8	X	2	5.37	6.03	6.67
1/2	X	2	9.55	10.72	11.85

LRFD NOMINAL SHEAR CAPACITY, KIPS FOR ASTM C33 AGGREGATE

STEPS IN USING WELDED HEADED STUDS SELECTION CHARTS:

1. Locate on the horizontal axis the specified thickness of the structural metal plate pipe. Refer to HDM 854.6 for details.
2. Move vertically to the intersection of the graph.
3. Move horizontally to the vertical axis and read the required number of studs per linear foot to transfer the pipe thrust into invert paving.
4. The selected number of Welded Headed Studs attached to the corrugated culvert crest will provide a safety factor of 2.
5. Minimum number of studs shall be 8 circumferentially, 4 on each side of invert trough.
6. Recommended minimum plate thickness without burn-through for a 3/8in. dia. headed stud is 0.0747in (14 g); for a 1/2 in. dia. stud it is 0.1196 in. (11ga).
7. Seam strengths of 0.170 through 0.280 in thick wall plates exceed the culvert wall strength Maximum load designs shall be limited by wall strength, and the selected no. of studs shall be checked by wall strength.

PROCEDURES FOR CORRUGATED STEEL PIPE (CSP) CULVERT INVERT REPAIR:

1. Obtain applicable Culvert Investigation Corrosion Report thru Corrosion Technology Branch (METS) and Soils Report from Geotechnical Engineer. Determine existing pipe wall thickness structural steel plate pipe (SSPP) or CMP 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 inches above the pipe crest.
4. Choose proper size of stud connectors. Stud connectors shall be welded to the pipe crest equally spaced on both sides of the invert transversly, minimum spacing between studs circumferentially shall be 3 inches.
5. In cross section, limits of placement of the repair shall be made to subtend a minimum central angle of 120 degrees (to the 4 o'clock and 8 o'clock positions of a circular culvert), but may be extended up to 180 degrees (to 3 o'clock and 9 o'clock positions), or to a lesser central angle if deemed necessary.
6. Minimum concrete cover above shear studs shall be 1 1/2 inches, and studs shall have at least 1 1/2 inches of lateral concrete cover.
7. Provide welded wire fabric (WWF) to meet the temperature and shrinkage requirements for concrete pad, tack weld WWF to pipe crests at 12 in. spacing minimum each way.
8. WWF shall be placed with a minimum of 4 inches clear cover from the edge of concrete and shall be lapped 6 inches minimum.
9. For specific examples of Culvert Thrust and Shear Stud Capacity calculations, contact the Culverts and Underground Structures Senior Specialist.

STANDARD DRAWING

FILE NO. xs17-060-1x

APPROVAL DATE July 2011

STATE OF CALIFORNIA
DEPARTMENT OF TRANSPORTATION

DIVISION OF ENGINEERING SERVICES

BRIDGE NO. X

POST MILE X

X

CULVERT - CORRUGATED METAL
PROCEDURES FOR INVERT REPAIR

DS OSD 2147A (ENGLISH STANDARD DRAWING "XS" BORDER REV. (02-02-11)

ORIGINAL SCALE IN INCHES FOR REDUCED PLANS 0 1 2 3

UNIT: X
PROJECT NUMBER & PHASE: X
CONTRACT NO.: X

DISREGARD PRINTS BEARING EARLIER REVISION DATES →

REVISION DATES | SHEET X | OF X

FILE => $REQUEST

USERNAME => $USER DATE PLOTTED => $DATE TIME PLOTTED => $TIME