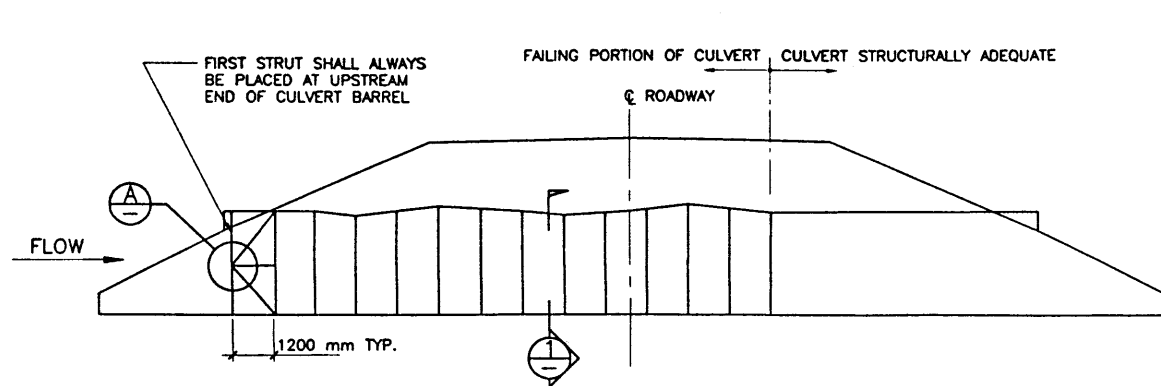
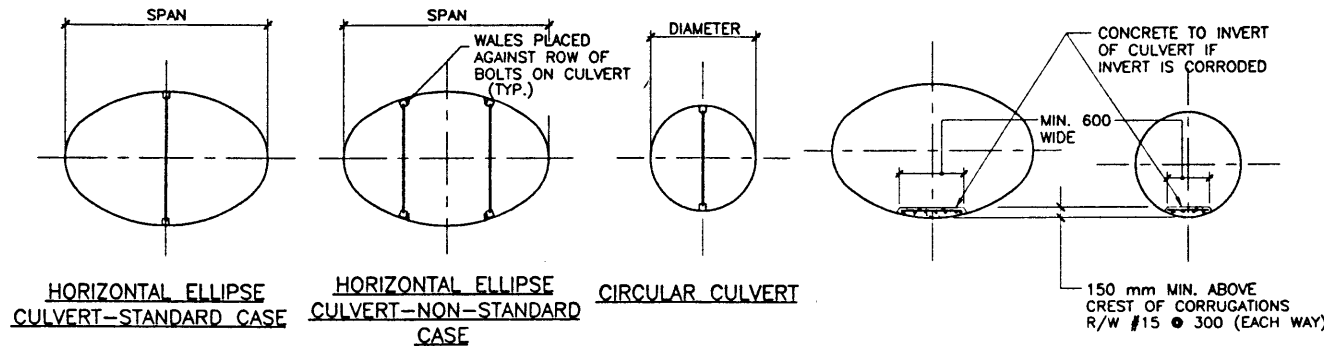




LONGITUDINAL SECTION THROUGH CULVERT
N.T.S.



HORIZONTAL ELLIPSE CULVERT-STANDARD CASE
HORIZONTAL ELLIPSE CULVERT-NON-STANDARD CASE
CIRCULAR CULVERT

1 SECTIONS SHOWING STRUT LOCATIONS N.T.S.

NOTE:
IN LARGER HORIZONTAL ELLIPSE PIPES, THE INSTALLER MAY ELECT TO PLACE TWO ROWS OF STRUTS AS SHOWN. THIS TYPE OF INSTALLATION IS CONSIDERED TO BE NON-STANDARD AND ENGINEERING ADVICE SHOULD BE SOUGHT PRIOR TO IMPLEMENTATION.

LIMITATIONS OF DRAWING AND CONDITIONS FOR USE

- MAXIMUM CULVERT DIAMETER = 4000 mm
- MAXIMUM CULVERT N = 52 (HORIZONTAL ELLIPSE CULVERTS)
- MAXIMUM COVER = 15.0 m
- ASSESS STREAM FOR ICE AND DRIFT CRITERIA. STRUTS ARE NOT APPROPRIATE FOR CULVERTS ON STREAMS WITH A SIGNIFICANT ICE RUN OR DRIFT. INSTALLATION OF DRIFT CATCHERS MAY BE APPROPRIATE FOR SOME INSTALLATIONS. SEEK ENGINEERING ADVICE REGARDING POSSIBLE INSTALLATION OF DRIFT CATCHERS.
- CARRY OUT INSPECTION OF CULVERT. CULVERTS WITH A B.I.M. BARREL RATING OF 3 OR HIGHER CAN BE CONSIDERED FOR STRUTTING. DO NOT STRUT CULVERTS WITH A B.I.M. BARREL RATING OF LESS THAN 3 AND ONLY STRUT CULVERTS WITH A B.I.M. BARREL RATING OF 3 AFTER ENGINEERING ADVICE HAS BEEN PROVIDED.
- IF SIGNIFICANT CORROSION (20% OF INVERT PLATE THICKNESS LOST) IS FOUND, PLACE CONCRETE SLAB ON THE INVERT AS SHOWN ON THIS DRAWING.

PROCEDURE

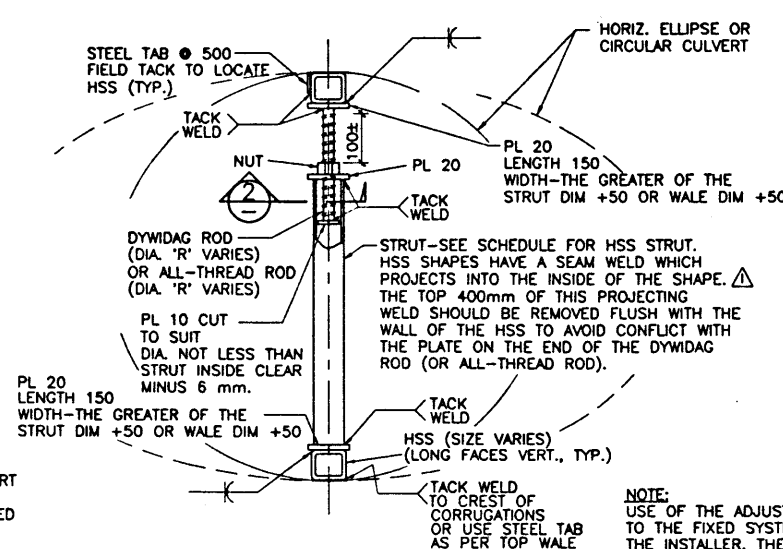
1. ASSESS WHICH PORTION OF THE CULVERT IS TO BE STRUTTED. REGARDLESS OF THE LOCATION OF THIS PORTION, STRUTTING SHALL ALWAYS BE EXTENDED TO THE UPSTREAM END OF THE CULVERT.
2. INSTALL LOWER WALES AND TACK WELD IN PLACE.

EITHER ADJUSTABLE SYSTEM OF STRUTS

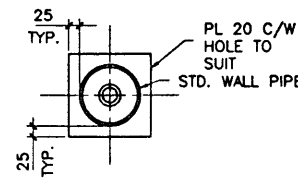
3. CUT PIPE (OR HSS) AND DYWIDAG ROD (OR ALL-THREAD ROD) TO CORRECT SIZE TO PERMIT STRUTS TO BE INSTALLED AT PRE-DETERMINED LOCATIONS.
4. STRUTS SHOULD BE CUT TO ALLOW A NOMINAL 50 TO 75 mm EXTENSION OF DYWIDAG ROD AND RODS SHOULD BE CUT TO A LENGTH OF APPROX. 450 mm.
5. PLACE TOP WALE IN PLACE, TACK WELDING IT TO THE CULVERT. HOLD WALE IN PLACE USING TEMPORARY BLOCKING AND/OR A ROLLING SCAFFOLD AS REQUIRED. WALES SHOULD PREFERABLY BE CONTINUOUS OVER AT LEAST THREE STRUTS.
6. PLACE AND WELD STRUT ASSEMBLY IN PLACE. STRUT SPACING IS 1200 mm NOMINAL BUT CAN VARY (± 200 mm) AS REQUIRED.
7. SNUG UP NUT ON STRUT.
8. SNUG UP NUTS ON THE LAST TWO STRUTS PREVIOUSLY PLACED.

OR FIXED SYSTEM OF STRUTS

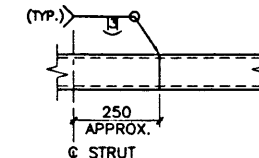
3. CUT STRUTS TO LENGTH ALLOWING FOR AN ADDITIONAL LENGTH OF 25 mm. i.e. STRUT IS CUT 25 mm TOO LONG.
4. REPEAT STEP 4 ABOVE.
5. USING A 25 TON JACK IN CONJUNCTION WITH TEMPORARY STRUT EXTENSION AND ROLLING SCAFFOLD AS REQUIRED, JACK UP TOP WALE AND SET AND WELD STRUT ASSEMBLY IN PLACE.



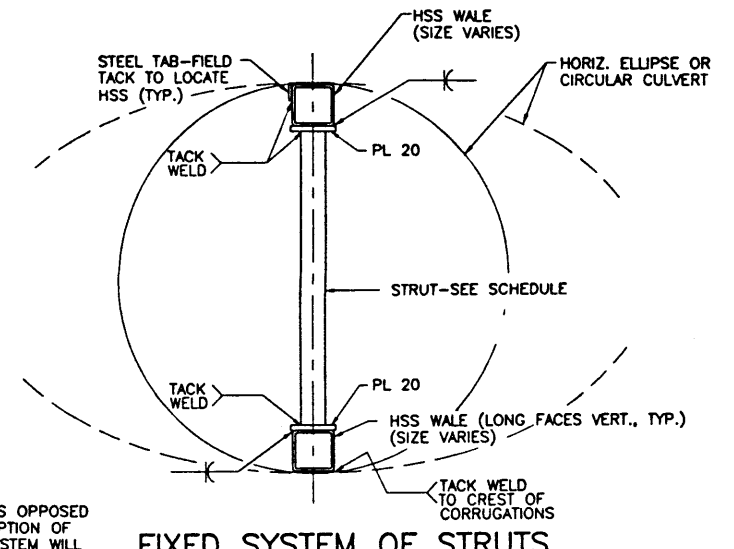
ADJUSTABLE SYSTEM OF STRUTS
N.T.S.



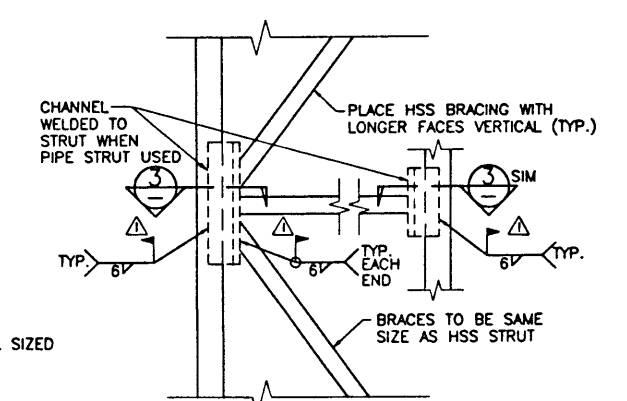
2 SECTION
N.T.S.



DETAIL-HSS WALE SPLICE
N.T.S.



FIXED SYSTEM OF STRUTS
N.T.S.



3 SECTION
1:10

A DETAIL
1:10

STRUT AND WALE SELECTION SCHEDULE AND FACTORED DESIGN LOADS							
COVER (m)	MIN. COVER (SEE BELOW)	1.4 m	3.0 m	6.0 m	10.0 m	15.0 m	
1500 1525 1600	DESIGN LOAD-STRUT STRUT (D)-PIPE OR HSS DYWIDAG ROD (R) WALE (HSS)	COVER 0.3 m 131kN 2 1/2" STD. 76x76x4.78 43 mm 127x76x4.8	34kN 2 1/2" STD. 76x76x4.78 43 mm 102x76x4.8	45kN 2 1/2" STD. 76x76x4.78 43 mm 102x76x4.8	81kN 2 1/2" STD. 76x76x4.78 43 mm 102x76x4.8	132kN 2 1/2" STD. 76x76x4.78 43 mm 127x76x4.8	197.4kN 3" STD. 76x76x4.78 43 mm 152x102x4.8
1800 1810 2000 2120 2200	DESIGN LOAD-STRUT STRUT (D)-PIPE OR HSS DYWIDAG ROD (R) WALE (HSS)	COVER 0.4 m 129kN 2 1/2" STD. 76x76x4.78 43 mm 127x76x4.8	47kN 2 1/2" STD. 76x76x4.78 43 mm 102x76x4.8	62kN 2 1/2" STD. 76x76x4.78 43 mm 102x76x4.8	111kN 2 1/2" STD. 76x76x4.78 43 mm 127x76x4.8	181kN 3" STD. 76x76x4.78 43 mm 152x102x4.8	271kN 3 1/2" STD. 76x76x4.78 43 mm 203x102x6.35
2400 2430 2700 2740	DESIGN LOAD-STRUT STRUT (D)-PIPE OR HSS DYWIDAG ROD (R) WALE (HSS)	COVER 0.52 m 117kN 2 1/2" STD. 76x76x4.78 43 mm 127x76x4.8	58kN 2 1/2" STD. 76x76x4.78 43 mm 102x76x4.8	77kN 2 1/2" STD. 76x76x4.78 43 mm 102x76x4.8	139kN 3" STD. 76x76x4.78 43 mm 152x102x4.8	226kN 3 1/2" STD. 76x76x4.78 43 mm 203x102x4.8	338kN 4" STD. 88.9x88.9x4.78 57 mm 203x102x6.35
3000 3050 3000 3360	DESIGN LOAD-STRUT STRUT (D)-PIPE OR HSS DYWIDAG ROD (R) WALE (HSS)	COVER 0.52 m 143kN 3" STD. 76x76x4.78 43 mm 152x102x4.8	72kN 2 1/2" STD. 76x76x4.78 43 mm 102x76x4.8	95kN 3" STD. 76x76x4.78 43 mm 102x76x4.8	170kN 3 1/2" STD. 76x76x4.78 43 mm 152x102x4.8	277kN 4" STD. 88.9x88.9x4.78 57 mm 203x102x6.35	414kN
3600 3670	DESIGN LOAD-STRUT STRUT (D)-PIPE OR HSS DYWIDAG ROD (R) WALE (HSS)	COVER 0.52 m 156kN 3 1/2" STD. 88.9x88.9x4.78 43 mm 152x102x4.8	78kN 3" STD. 76x76x4.78 43 mm 102x76x4.8	103kN 3" STD. 76x76x4.78 43 mm 127x76x4.8	186kN 3 1/2" STD. 88.9x88.9x4.78 57 mm 152x102x4.8	303kN	453kN
3990	DESIGN LOAD-STRUT STRUT (D)-PIPE OR HSS DYWIDAG ROD (R) WALE (HSS)	COVER 0.62 m 138kN 3 1/2" STD. 88.9x88.9x4.78 43 mm 152x102x4.8	85kN 3" STD. 76x76x4.78 43 mm 102x76x4.8	112kN 3" STD. 76x76x4.78 43 mm 127x76x4.8	202kN 4" STD. 88.9x88.9x4.78 57 mm 152x102x4.8	329kN	492kN

NOMINAL/ACTUAL PIPE DIMENSIONS		
NOMINAL DESIGNATION	ACTUAL O.D.(mm)	ACTUAL THICKNESS (mm)
2-1/2" STD. WALL	73.03	5.156
3" STD. WALL	88.90	5.486
3 1/2" STD. WALL	101.6	5.740
4" STD. WALL	114.3	6.020

GENERAL NOTES

1. LIVE LOAD CS600
2. STRUT SYSTEM DESIGNED FOR 30% OF TOTAL DEAD LOAD AND LIVE LOAD IMPOSED ON THE CULVERT.
3. MATERIALS TO CONFORM TO THE FOLLOWING:
 - PIPE: ASTM A53-GRADE B WITH 240 MPa YIELD STRUCTURAL GRADE ACCEPTABLE
 - HSS: CAN/CSA G40.21 GRADE 350W
 - DYWIDAG RODS: CSA G3018-M1982 GRADE 75, 516 MPa YIELD C/W MATCHING NUT OR AS AN ALTERNATIVE ALL-THREAD ROD: ASTM A193-GRB7, 860 MPa YIELD C/W GRADE 2H NUT
 - PLATES: CSA G40.21 GRADE 300W.
4. DYWIDAG RODS AND NUTS AVAILABLE FROM EXISTING STOCK FROM DYWIDAG SYSTEMS INTERNATIONAL CANADA LTD. (D.S.I.), SURREY, B.C.
5. CONCRETE TO BE CLASS D.

BPTEC ENGINEERING GROUP LTD. 6810-104 STREET EDMONTON, AB FAX (403)435-4843 PH. (403)436-5376		FEB 27/98 GENERAL REVISION REV DATE REVISIONS BY DAH		PERMIT TO PRACTICE BP - TEC ENGINEERING GROUP LTD Signature: <i>[Signature]</i> Date: Mar 2/98 PERMIT NUMBER: P0132 The Association of Professional Engineers Geologists and Geophysicists of Alberta		DESIGNER CHECKER DATE STREAM LOCATION HIGHWAY FILE SHEET DRAWING		Alberta TRANSPORTATION AND UTILITIES MAINTENANCE PROCEDURE FOR STEEL STRUTTING OF METAL CULVERTS 1 of 1 S-1620	
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