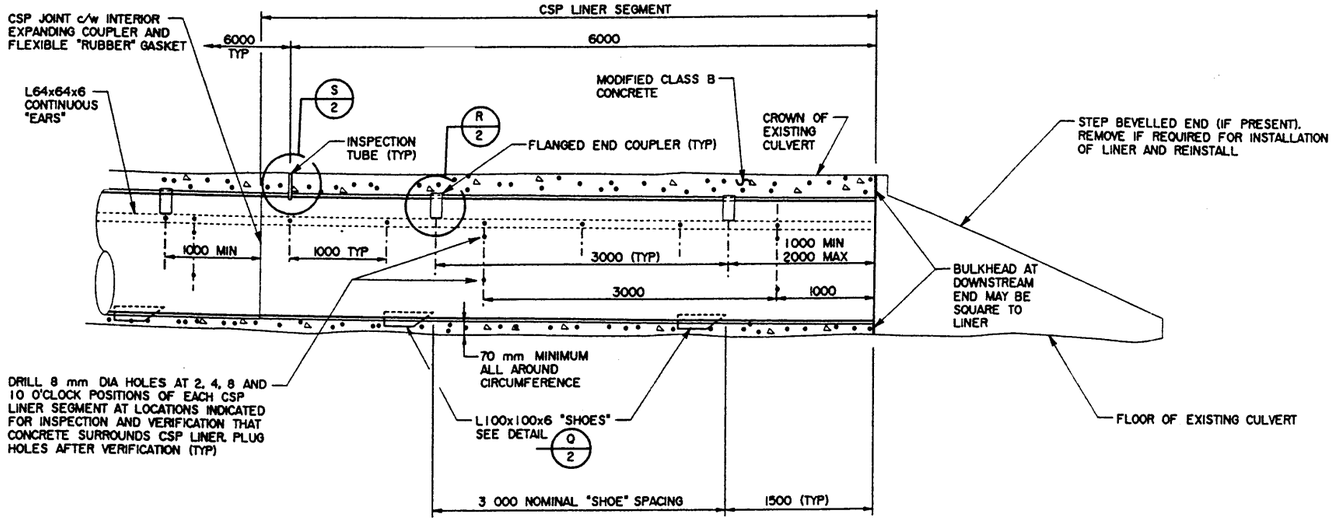

P DETAIL
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GENERAL NOTES

- THESE DRAWINGS PROVIDE GENERAL INFORMATION ONLY AND MAY BE MODIFIED AS REQUIRED TO SUIT SPECIFIC SITE CONDITIONS. IT MAY BE SUPPLEMENTED WITH AND/OR SUPERSEDED BY DETAILS PROVIDED BY AN ENGINEER.
- DIMENSIONS ARE GIVEN IN MILLIMETRES UNLESS NOTED OTHERWISE.
- ALL CSP MATERIAL SHALL CONFORM TO THE CURRENT VERSION OF CSA STANDARD G401, CORRUGATED STEEL PIPE PRODUCTS.
- ALL WELDING SHALL CONFORM TO THE REQUIREMENTS OF THE CURRENT VERSION OF CSA STANDARD W59, WELDED STEEL CONSTRUCTION (METAL ARC WELDING).

LIMITATIONS AND CONDITIONS FOR USE

- 1200 mm ≤ CSP LINER ID ≤ 3600 mm. LINERS LARGER THAN 3600 mm ID REQUIRE A SPECIAL DESIGN, AS CSP MATERIAL IS UNAVAILABLE. SEE TABLE 1.
- CULVERTS TO BE LINED SHALL BE ROUND CSP OR SPCSP STRUCTURES. THE LINER SHALL EXTEND THE FULL CROWN LENGTH (APPROX.) OF THE CULVERT. CULVERTS WITH ABRUPT AND/OR IRREGULAR CHANGES IN SLOPE OR ALIGNMENT MAY NOT BE SUITABLE FOR LINING. THE USE OF PARTIAL LENGTH LINER REQUIRES THE ADVICE OF AN ENGINEER.
- HEADWATER ELEVATION WITH LINER IN PLACE MAY EXCEED THAT EXPECTED FOR EXISTING CULVERT. CONSEQUENCES OF FLOODING ON ROADWAY OR ADJACENT PRIVATE PROPERTY MUST BE ASSESSED.
- INLET, OUTLET, AND BARREL VELOCITIES ARE EXPECTED TO INCREASE AFTER LINER IS IN PLACE. ENSURE SIZE AND COVERAGE OF RIPRAP IS ADEQUATE FOR EXPECTED CONDITIONS. LINER MAY NOT BE SUITABLE IF FISH PASSAGE IS A CONCERN. OBTAIN APPROPRIATE ENVIRONMENTAL APPROVALS FOR PROPOSED LINER.
- IT IS THE INTENT OF THIS DRAWING THAT THE MINIMUM THICKNESS OF CONCRETE BETWEEN THE EXTERIOR CRESTS OF THE LINER CORRUGATIONS AND THE INTERIOR CRESTS OF THE CULVERT CORRUGATIONS SHALL BE 70 mm AT ANY LOCATION AROUND THE CIRCUMFERENCE OF THE LINER.
- CULVERTS ON STEEP SLOPES MAY REQUIRE MORE CONCRETE POURS, MORE INSPECTION HOLES, AND CLOSER MONITORING.

INITIALIZATION PROCEDURE

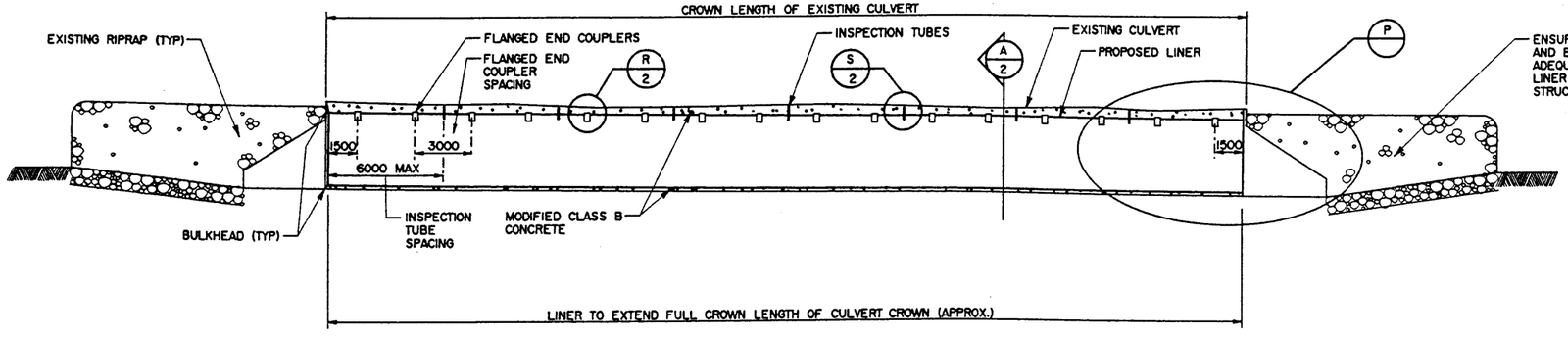
- CONFIRM BY SURVEY THAT ELEVATION OF STREAMBED/RIPRAP AND CHANNEL CONFIGURATION AT CULVERT ENDS WILL NOT RESTRICT INSTALLATION OF LINER.
- CONDUCT LEVEL 2 BIM INSPECTION OF CULVERT. OBTAIN SUFFICIENT RISE, SPAN, AND OTHER INSIDE DIAMETER (ID) MEASUREMENTS (CREST TO CREST) TO DETERMINE THE CURRENT MINIMUM CULVERT ID AND THE LOCATIONS OF ANY BULGES OR OTHER IRREGULARITIES AS REQUIRED.
- LINER ID = MINIMUM CULVERT ID − 200 mm, ROUNDED DOWN TO THE NEAREST 100 mm INCREMENT. FOR EXAMPLE, IF MINIMUM CULVERT ID = 2437 mm − 200 mm = 2237 mm; USE 2200 mm ID CSP LINER.
- CONFIRM THAT PROPOSED POSITION OF "EARS" AND "SHOES" (SECTION A AND TABLE 2) PROVIDES ADEQUATE CLEARANCE TO ANY DEFLECTIONS, BULGES, OR IRREGULARITIES NOTED ALONG LENGTH OF CULVERT. OBTAIN THE APPROVAL OF AN ENGINEER TO RELOCATE "EARS" OR "SHOES".

RECOMMENDED INSTALLATION PROCEDURE

- INCIDENTAL EQUIPMENT SUPPLIED BY THE CONTRACTOR MAY INCLUDE, BUT IS NOT LIMITED TO, CRAWLER TRACTORS, BACKHOES, ROLLING SCAFFOLDING, BLOCK AND TACKLE, TIRFORS, HYDRAULIC JACKS, CLAMPS, CABLES, CHAINS, COME-ALONGS, LIGHTING, HEATING, AND VENTILATING EQUIPMENT, WELDING AND CUTTING EQUIPMENT, AND DEWATERING MECHANISMS.
- DEWATER CULVERT AND CLEAN INTERIOR OF ALL SEDIMENT AND DEBRIS.
- TACK WELD LINER SEGMENTS AND INSTALL 600 mm WIDE INTERIOR EXPANDING COUPLERS AND MINIMUM 150 mm WIDE x MINIMUM 5 mm THICK FLEXIBLE GASKET AT JOINTS. ALL JOINTS BETWEEN CSP SEGMENTS SHALL BE SUFFICIENTLY TIGHT TO PREVENT CONCRETE FROM SEEPING INTO THE LINER.
- WELD OR BOLT "EARS" (c/w HEX NUTS) AND "SHOES" TO OUTSIDE OF LINER (SECTION A AND TABLE 2). "EARS" SHALL BE CONTINUOUS. ENSURE CONCRETE LEAKAGE DOES NOT OCCUR AT HOLES MADE BY THE CONTRACTOR. ALL WELDS AND TORCH CUT SECTIONS TO BE COATED WITH AN APPROVED ZINC-RICH PAINT.
- CUT CIRCULAR HOLES AND WELD 102.3 mm ID FLANGED END COUPLERS TO CROWN OF LINER AT MAXIMUM 3000 mm SPACING (SECTION A AND DETAIL R).
- DRILL 28 mm DIA. HOLES IN CROWN OF LINER AT 6000 mm INTERVALS TO RECEIVE INSPECTION TUBES. DRILL 8 mm DIA. INSPECTION HOLES AT MAXIMUM 3000 mm SPACING ALONG SIDES OF LINER AT 2, 4, 8, AND 10 O'CLOCK POSITIONS (DETAIL P). POSITION INSPECTION HOLES AND TUBES AWAY FROM FLANGED END COUPLERS TO AVOID CONCRETE SPRAY.
- PUSH/PULL LINER SEGMENT(S) INTO CULVERT, ENSURING SEGMENTS REMAIN IN COMPRESSION DURING INSTALLATION. REPEAT ABOVE STEPS AS REQUIRED UNTIL LINER IS IN FINAL POSITION.
- INSERT THREADED RODS IN HEX NUTS WELDED TO "EARS" AND EXTEND RODS OUT TO CULVERT WALL TO LIMIT LINER MOVEMENT DURING PUMPING (SECTION A).
- INSERT 19 mm ID INSPECTION TUBES IN 25 mm HOLES AND EXTEND UP TO CROWN OF CULVERT (DETAIL S). WELD/AFFIX TUBES TO LINER.
- CONSTRUCT BULKHEADS AT ENDS OF LINER.

CONCRETE PLACEMENT

- CONCRETE SHALL BE IN ACCORDANCE WITH THE CURRENT VERSION OF B351 CAST-IN-PLACE CONCRETE, SECTION 4 OF THE BRIDGE CONSTRUCTION SPECIFICATIONS. ENSURE A PUMPABLE MIX IS PROVIDED. CONCRETE TO BE PLACED WITH A CONCRETE PUMP. CONCRETE TO BE MODIFIED CLASS "B", 25 MPa, WITH 14 mm MAXIMUM AGGREGATE SIZE AND 75 mm SLUMP BEFORE PUMPING. ADD SUPERPLASTICIZER ON SITE BEFORE PUMPING TO ATTAIN 200 mm SLUMP.
- CONCRETE TO BE PLACED AT DOWNSTREAM END OF LINER FIRST, AND WORKED TOWARDS THE UPSTREAM END. ATTACH PUMP HOSE TO FLANGED END COUPLER AND SECURE HOSE TO J-HOOK. LIMIT MAXIMUM PUMPING PRESSURE BETWEEN LINER AND CULVERT TO 40 psi (270 KPa) DURING FINAL CONCRETE POUR. DISPLACEMENT OR DEFORMATION OF LINER DURING CONCRETE PLACEMENT WILL NOT BE PERMITTED.
- VERIFY EXTENT OF CONCRETE MOVEMENT FROM VARIOUS INSPECTION HOLES AND TUBES AS REQUIRED. SEAL HOLES AND TUBES AFTER VERIFICATION. USE OF ALTERNATING FLANGED END COUPLERS DURING CONCRETE POURS MAY BE APPROPRIATE PROVIDED THAT MOVEMENT AND SPREAD OF CONCRETE CAN BE CONFIRMED DURING EACH POUR.
- PLACE CONCRETE IN STAGES TO DEPTHS INDICATED FOR EACH CONCRETE POUR (SECTION A). THE DEPTH OF FIRST STAGE POUR SHALL NOT BE ABOVE THE 4 AND 8 O'CLOCK POSITIONS OF LINER. ALLOW MINIMUM 5 HOURS BETWEEN ALL CONCRETE POURS. CLEAN CONCRETE FROM INSIDE FLANGED END COUPLERS IF SUBSEQUENT USE IS REQUIRED. INSERT PADDLE THROUGH COUPLER BEFORE REMOVING HOSE.
- LARGER DIAMETER LINERS (≥ 2800 mm DIA) MAY REQUIRE INTERNAL STRUTS OR SHALLOWER DEPTH OF INITIAL CONCRETE POUR TO AVOID BENDING ALONG LINES OF "EARS".
- THE SHAPE OF THE LINER SHALL BE CONTINUOUSLY MONITORED DURING PUMPING FOR DEFLECTIONS OR DISTORTIONS. IN THE EVENT OF ANY MOVEMENT, ALL PUMPING MUST CEASE AND AN ENGINEER SHALL BE NOTIFIED IMMEDIATELY.
- ALLOW CONCRETE TO SET BEFORE CUTTING OFF THREADED RODS, FLANGED END COUPLERS, AND INSPECTION TUBES.
- THE CONTRACTOR SHALL CONFIRM THAT CONCRETE EXTENDS COMPLETELY AROUND AND ALONG THE FULL LENGTH OF THE LINER. FILL VOIDS WITH GROUT PUMPED UNDER LOW PRESSURE AS DETERMINED BY AN ENGINEER.



LONGITUDINAL SECTION THROUGH ℄ CULVERT/LINER
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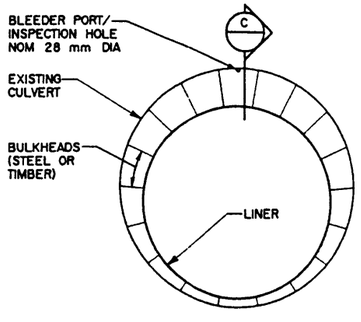

END VIEW
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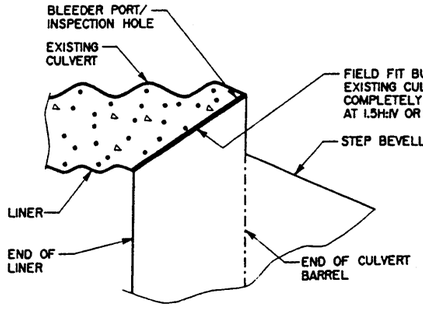

C SECTION
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Signature
Date
PERMIT NUMBER: P 0132
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

DESIGNER — PROFESSIONAL ENGINEER ALBERTA — DATE JAN. 28, 2000
CHECKER — PROFESSIONAL ENGINEER ALBERTA — DATE

Alberta INFRASTRUCTURE

INSTALLATION OF LINERS FOR METAL CULVERTS SHEET 1

CONSULTANT FILE & DRAWING	DRAWN	DATE	STREAM	LOCATION	HIGHWAY	FILE	SHEET	DRAWING
556-19-1	WJW	99-03-10					1 OF 2	S-1621

PLOTTED JAN. 28, 2000 S-1621.DGN