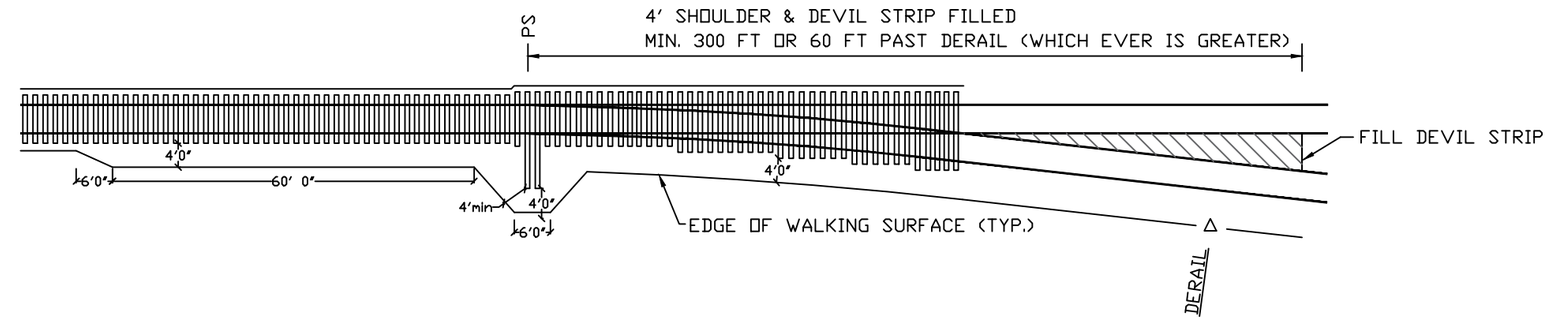
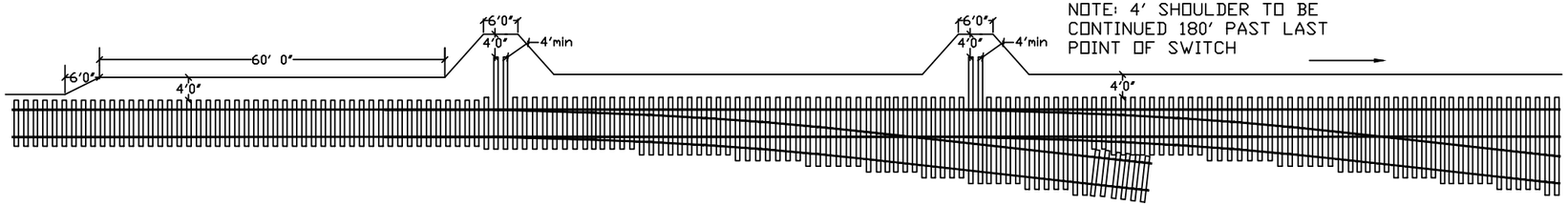


BALLAST ARRANGEMENT FOR MAIN TRACK TURNOUTS AND DERAILS

SCALE: N.T.S.



BALLAST ARRANGEMENT FOR TURNOUTS ON LADDERS

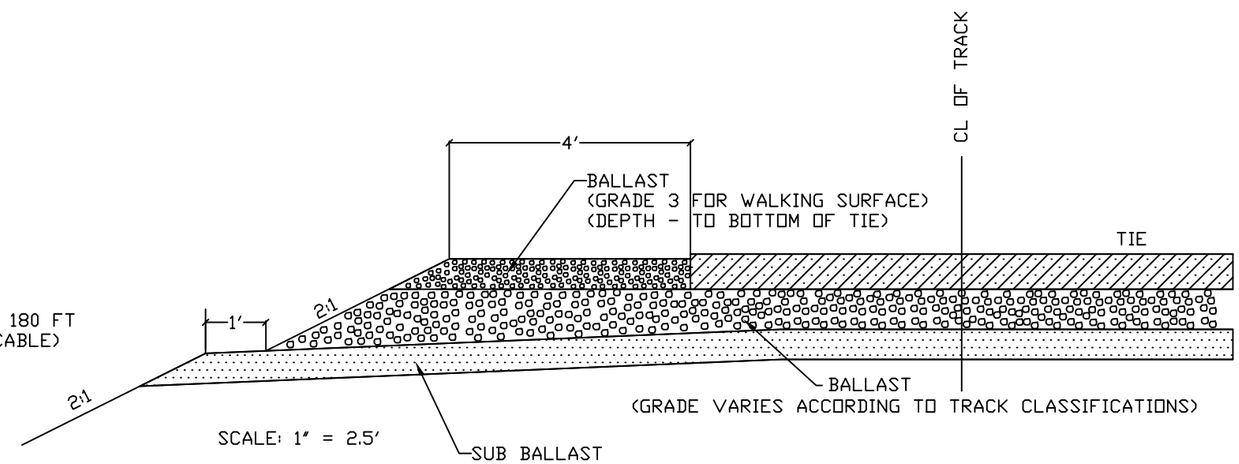
SCALE: N.T.S.

NOTE: SHOULDER TO BE CONTINUED 180 FT OR 60 FT PAST DERAIL (IF APPLICABLE) WHICH EVERY IS GREATER

BALLAST ARRANGEMENT FOR SINGLE YARD TURNOUTS

SCALE: N.T.S.

NOTE: FOR DERAILS LOCATED OUTSIDE THESE LIMITS, BALLAST SECTION SHOULD BE EXTENDED ACCORDINGLY



NOTE: BALLAST AND SUB BALLAST THICKNESS MAY VARY TO SUIT TRACK CLASSIFICATIONS AND SOIL CONDITIONS

TYPICAL SECTION

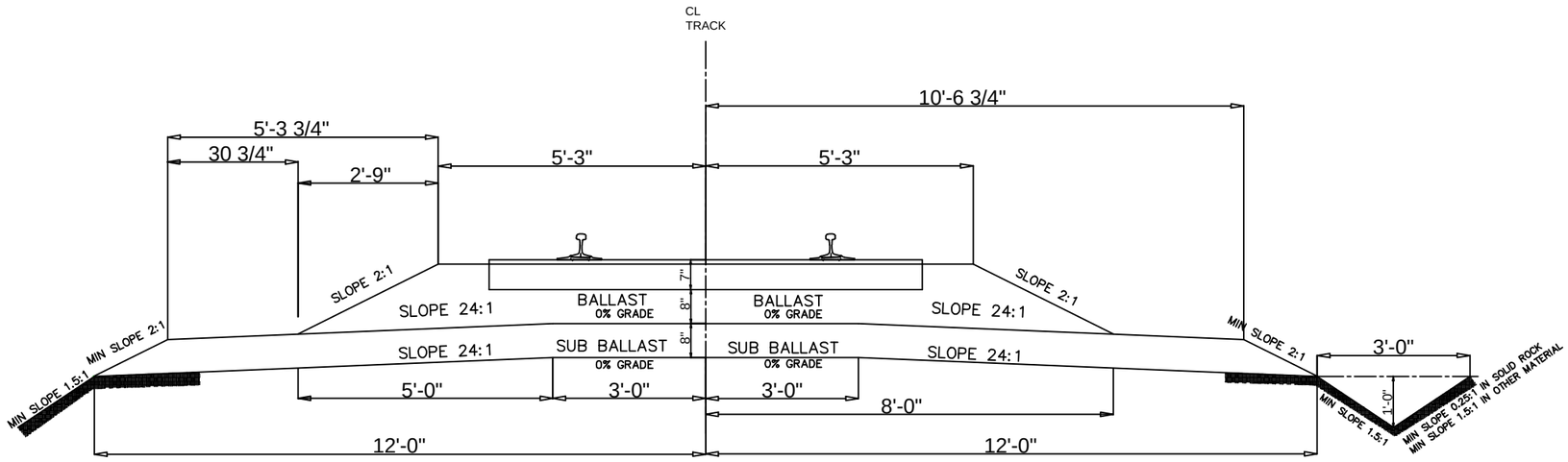
CANADIAN PACIFIC
ENGINEERING PROJECTS

INDUSTRIAL TRACK GUIDELINES
WALKING SURFACE GUIDELINES FOR TURNOUTS & DERAILS

No.	DATE	REVISION	BY
C	JUNE 23/17	UPDATED TITLE BLOCK TO GUIDELINES	KSM
B	JULY 29/16	UPDATED TITLE BLOCK, COLOURS	KSM
A	DEC 3/12	UPDATED TITLE BLOCK	JWM

DWG. BY: R. KLOPP CHK BY: H. ROBINSON
ENGINEER: R. HORSMAN
MGR. TECHNICAL SERVICES

OFFICE FILE: PSSTD002c.DWG
SCALE: AS NOTED
DATE: NOV. 26 2001
PLAN No. PSSTD-002 C



FILL SECTION

CUT SECTION

TYPICAL SECTION
(8'-6" TIES)

NOTES :

ROADBED & BALLAST SECTION ON CURVES:

SECTION WIDTHS SHALL BE INCREASED ON THE HIGH RAIL SIDE OF THE CURVE ONLY, BY 4 INCHES FOR EVERY INCH OF CURVE ELEVATION.

DITCH SHOWN IS MIN. REQUIRED. WIDTH & DEPTH MAY NEED TO BE INCREASED TO SUIT SITE CONDITIONS

NOTE :

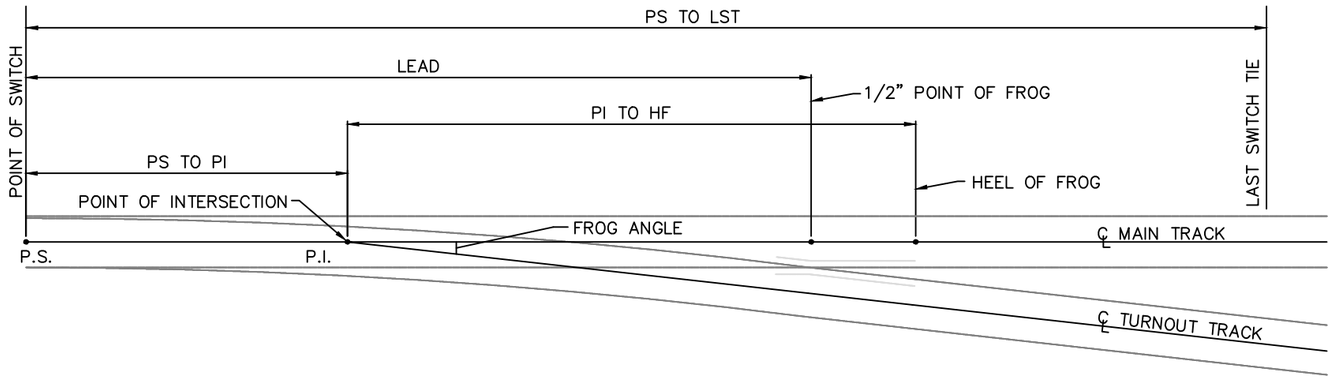
No.	DATE	REVISION	BY
C	JUNE 23/17	UPDATED TITLE BLOCK TO GUIDELINES	KSM
B	JULY 28/16	8" BALLAST, 8"SUB-BALLAST, ETC	KSM
A	DEC 3/12	UPDATED TITLE BLOCK	JWM

CANADIAN PACIFIC

ENGINEERING PROJECTS

INDUSTRIAL TRACK GUIDELINES
MINIMUM TYPICAL SECTION

DWG. BY: JWM CHK BY:	OFFICE FILE: PSSTD003C.DWG
	SCALE: NTS
ENGINEER:	DATE: SEPT 23 2010
SR. ENGINEER PROJECTS:	PLAN No. PSSTD-003 Rev. C



LAYOUT DIAGRAM OF TURNOUT (RIGHT HAND SHOWN)

	#9	#11	#15
P.S. TO P.I.	29' 7 1/2"	42' 1 3/16"	39' 11 7/16"
P.I. TO H.F.	52' 4 1/2"	62' 9 1/2"	88' 8 5/16"
P.S. TO L.S.T.	104' 5"	133' 4"	166' 9 1/2"
LEAD	72' 4 1/2"	94' 4 3/16"	111' 2 3/4"
FROG ANGLE	6° 21' 35"	5° 12' 18"	3° 49' 06"
SIDING CURVE	9° 30'	6° 00'	3° 30'

NOTE :

No.	DATE	REVISION	BY
B	June23/17	UPDATED TITLE BLOCK TO GUIDELINES	KSM
A	July29/16	UPDATED TITLE BLOCK,COLOURS	KSM

CANADIAN PACIFIC

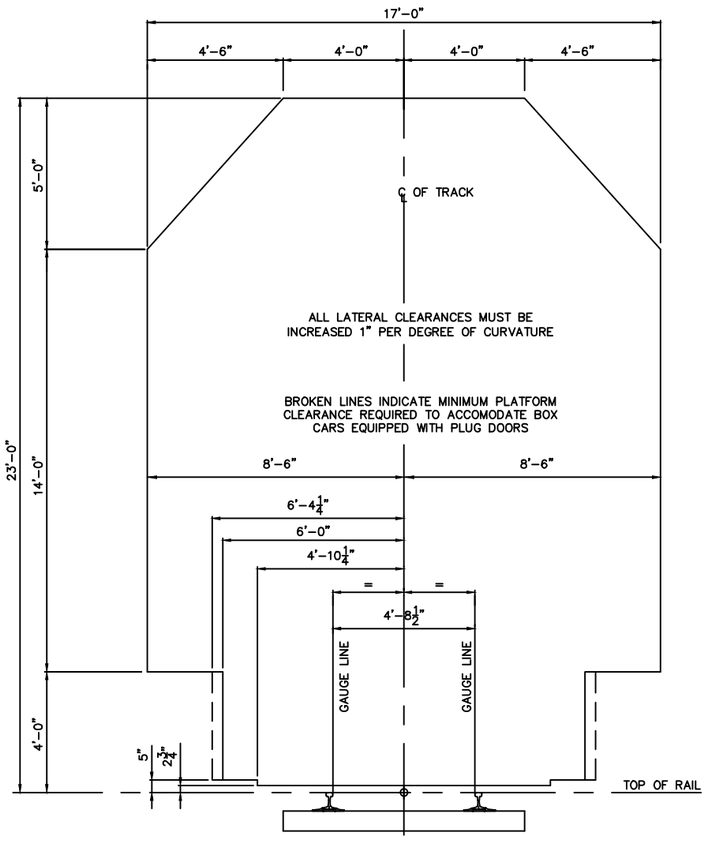
ENGINEERING PROJECTS

INDUSTRIAL TRACK GUIDELINES
LAYOUT GEOMETRY OF COMMON TURNOUTS

DWG. BY: KSM CHK BY:	OFFICE FILE: PSSTD004b.DWG
	SCALE: NTS
ENGINEER:	DATE: NOV 27 2012
MGR. PROJECT SERVICES WEST	PLAN No. PSSTD-004 Rev. B

NOTE :

1. NO PORTION OF ANY BUILDING, POLE, SIGN, MATERIAL OR OTHER OBSTRUCTION SHALL BE PERMITTED WITHIN THE LIMITS OF THE CLEARANCE DIAGRAM UNLESS AUTHORIZED BY STANDARD OR SPECIAL PLAN.



CLEARANCE DIAGRAM
NTS

No.	DATE	REVISION	BY
A	June23/17	UPDATED TITLE BLOCK TO GUIDELINES	KSM

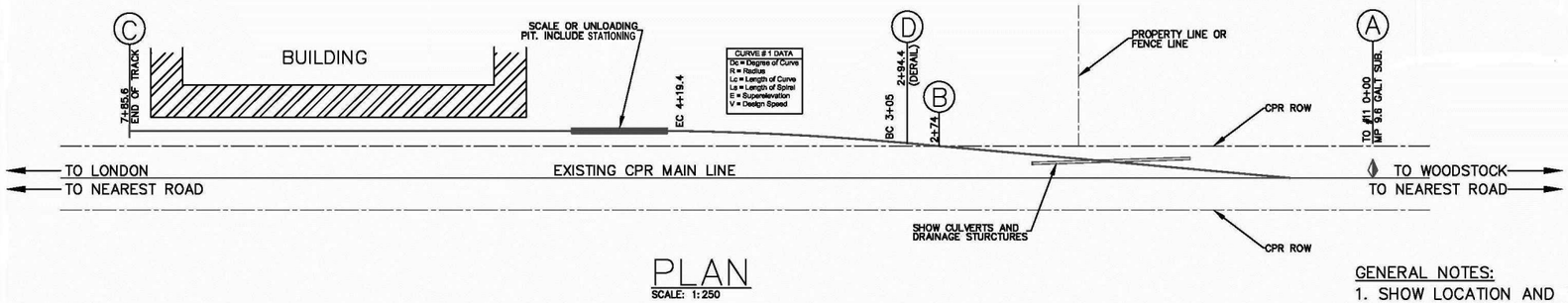
CANADIAN PACIFIC

ENGINEERING PROJECTS

INDUSTRIAL TRACK GUIDELINES
CLEARANCE DIAGRAM

DWG. BY: KSM CHK BY:	OFFICE FILE: PSSTD005a.DWG
	SCALE: NTS
ENGINEER:	DATE: SEPT 26 2016
SR. ENGINEER PROJECTS	PLAN No. PSSTD–005 Rev. A

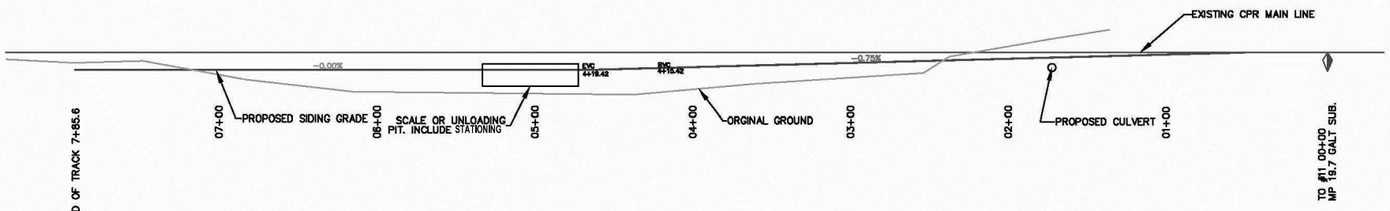
KEY PLAN



PLAN
SCALE: 1:250

GENERAL NOTES:

1. SHOW LOCATION AND ALL CULVERTS, STRUCTURES (PITS, BUILDINGS, SCALE, ETC.) ROAD CROSSINGS AND FENCING.
2. ADD HERE ANY IDENTIFICATION NOTES OR A LEGEND.
3. SUBMIT 11"x17" DRAWING SIZE
4. SCALES INDICATED ARE EXAMPLES ONLY
5. STATIONING IS TO BE INDICATED IN FEET



VERTICAL PROFILE
SCALE V:
SCALE H:

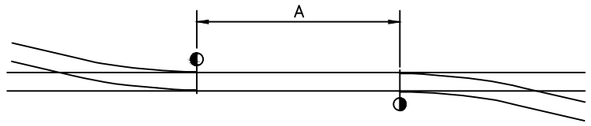
No.	DATE	REVISION	BY
A	June23/17	UPDATED TITLE BLOCK TO GUIDELINES	KSM

CANADIAN PACIFIC

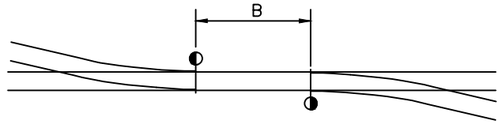
ENGINEERING PROJECTS

INDUSTRIAL TRACK GUIDELINES
EXAMPLE SIDING AGREEMENT PLAN

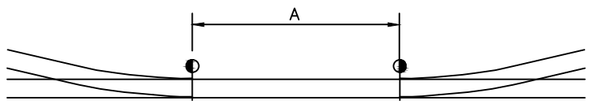
DWG. BY: KSM CHK BY:	OFFICE FILE: PSSTD006a.DWG
	SCALE: NTS
ENGINEER:	DATE: SEPT 26 2016
SR. ENGINEER PROJECTS	PLAN No. PSSTD-006 Rev. A



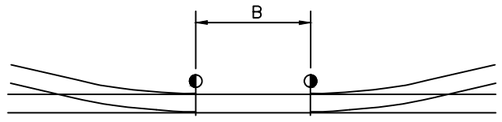
SAME HANDED TURNOUTS
PREFERRED ARRANGEMENT



SAME HANDED TURNOUTS
MINIMUM ARRANGEMENT



OPPOSITE HANDED TURNOUTS
PREFERRED ARRANGEMENT



OPPOSITE HANDED TURNOUTS
MINIMUM ARRANGEMENT

SAME HANDED TURNOUTS		
TURNOUT	A	B
9	100 Ft	80 Ft
11	100 Ft	80 Ft
15	125 Ft	90 Ft
20	160 Ft	120 Ft

OPPOSITE HANDED TURNOUTS		
TURNOUT	A	B
9	100 Ft	80 Ft
11	100 Ft	80 Ft
15	125 Ft	90 Ft
20	160 Ft	120 Ft

NOTES :
1. INSULATED JOINTS MAY BE REQUIRED AT CERTAIN LOCATIONS. SIGNAL SPACING AND CIRCUITS WILL GOVERN.
2. FOR RAIL JOINT LOCATIONS THROUGH THE TURNOUT AREAS SEE CP STANDARD PLAN FOR APPLICABLE TURNOUT BEING USED.
3. WHERE IT APPEARS THAT GROUND CONDITIONS REQUIRE A DEVIATION FROM THE ARRANGEMENTS SHOWN, APPROVAL WILL BE CONSIDERED UPON WRITTEN REQUEST TO THE CHIEF ENGINEER, SETTING FORTH SUCH SIGNIFICANT REASONS.

NOTE :

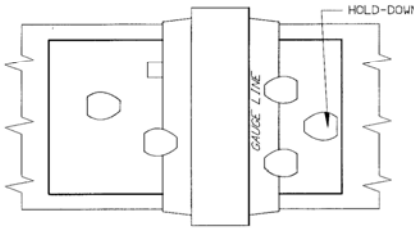
No.	DATE	REVISION	BY
A	June23/17	UPDATED TITLE BLOCK TO GUIDELINES	KSM

CANADIAN PACIFIC

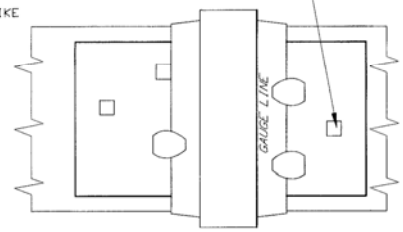
ENGINEERING PROJECTS

INDUSTRIAL TRACK GUIDELINES FACING POINT TURNOUT ARRANGEMENT

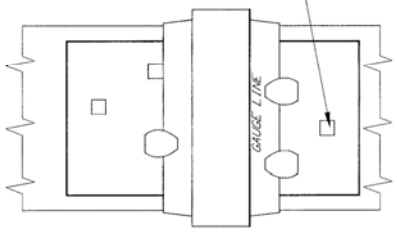
DWG. BY: KSM CHK BY:	OFFICE FILE: PSSTD008a.DWG
	SCALE: NTS
ENGINEER:	DATE: MAY 4 2017
DIR. PROJECTS & PUBLIC WORKS	PLAN No. PSSTD-008 Rev. A



SPIKING PATTERN FOR ECCENTRIC TIE PLATES ON CURVES AND SPIRALS WHERE ELEVATION IS 1/2" OR GREATER

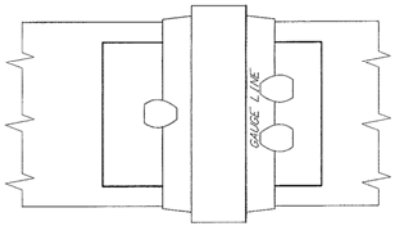


SPIKING PATTERN FOR DOUBLE SHOULDER TIE PLATES ON CURVES AND SPIRALS WHERE ELEVATION IS 1/2" OR LESS



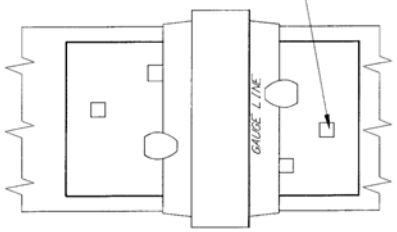
SPIKING PATTERN FOR DOUBLE SHOULDER TIE PLATES ON CURVES AND SPIRALS

FOR CURVES LESS THAN 3 DEGREES

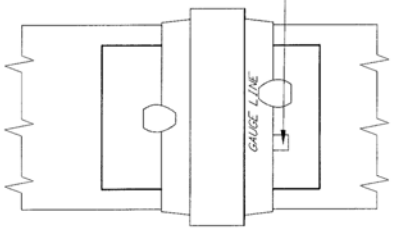


SPIKING PATTERN FOR SINGLE SHOULDER TIE PLATES ON CURVES AND SPIRALS

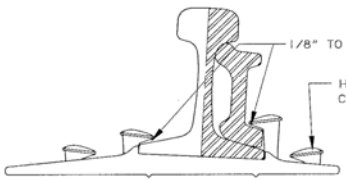
FOR CURVES 3 DEGREES AND GREATER



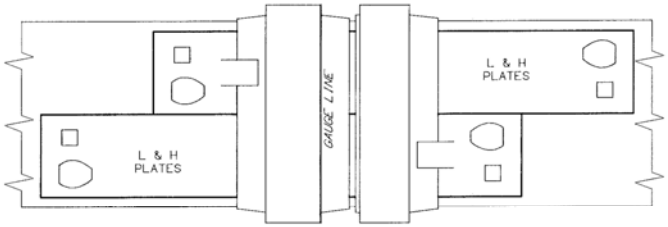
SPIKING PATTERN FOR DOUBLE SHOULDER TIE PLATES IN TANGENTS

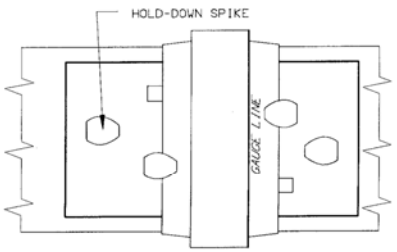


SPIKING PATTERN FOR SINGLE SHOULDER TIE PLATES IN TANGENTS

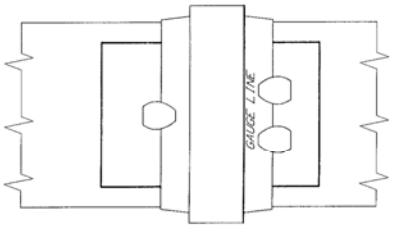


SIDE ELEVATION

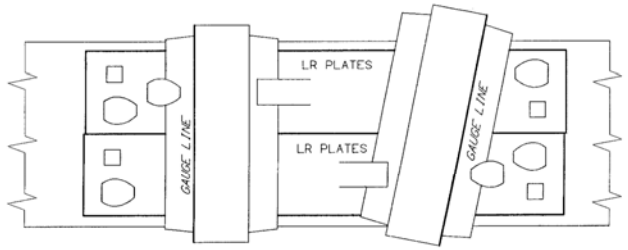




SPIKING PATTERN FOR FLAT SEAT DOUBLE SHOULDER TIE PLATES IN TURNOUTS



SPIKING PATTERN FOR SINGLE SHOULDER TIE PLATES IN TURNOUTS



SPIKING PATTERN FOR HOOK TWIN TIE PLATES IN TURNOUTS

FILED IN PLAN ROOM
MAY 29 2001
ENGINEERING SERVICES CALGARY ALBERTA

NOTES

SPIKING PATTERNS SHALL APPLY TO ALL MAIN TRACKS AND SIDINGS.

SPIKING PATTERNS SHALL BE THE SAME ON HIGH AND LOW RAILS.

ALL SPIKES SHALL BE STARTED AND DRIVEN VERTICALLY AND SQUARE WITH THE RAIL AND SO DRIVEN AS TO ALLOW 1/8" TO 3/16" BETWEEN THE UNDERSIDE OF THE HEAD OF THE SPIKE AND THE TOP OF THE BASE OF RAIL OR THE TOE OF THE JOINT BAR.

HOLD-DOWN SPIKES SHALL BE DRIVEN DOWN SO AS TO CONTACT THE TIE PLATE.

IN NO CASE SHALL THE SPIKES BE OVERDRIVEN OR STRAIGHTENED WHILE BEING DRIVEN.

ADDITIONAL SPIKES MAY BE USED WHERE NECESSARY TO MAINTAIN PROPER GAUGE.

WHEN A SPIKE IS WITHDRAWN, THE SPIKE HOLE MUST BE PLUGGED. THE TIE PLUG SHOULD BE DRIVEN DOWN TO THE FULL DEPTH, WITH THE WIDENED HEAD PARALLEL WITH THE TIE. AS AN ALTERNATE A CHEMICAL COMPOUND, APPROVED BY THE MANAGER, TRACK STANDARDS, MAY BE USED INSTEAD OF TIE PLUGS.

SPIKES SHALL NOT BE DRIVEN AGAINST THE ENDS OF JOINT BARS.

ALL TRACK SPIKES UTILIZED SHALL BE 6" LONG. SEE PLAN R-14-4-6 FOR LENGTH OF SHIMMING SPIKES REQUIRED WITH VARYING SHIM THICKNESS.

SEE PLAN R-14-4-9 FOR LENGTH OF SCREWSPIKES REQUIRED.

SEE PLAN R-14-57-19 FOR SCREWSPIKE PATTERN TO BE USED ON CPR ROLLED TIE PLATE.

SEE PLANS R-14-57-16 AND R-14-57-21 FOR SPIKING PATTERN TO BE USED ON BRIDGE TIE PLATES.

SEE PLANS R-14-82-1 AND R-14-82-3 FOR SPIKING PATTERNS TO BE USED ON APPROACHES AND EXITS TO BRIDGES.

FOR OTHER INFORMATION REFER TO SPC TRACK #16-TIE PLATES AND SPC # 18-SPIKING.

NO.	DATE	REVISION	BY
	MAY 25, 2001	PLAN REDRAWN CLARIFYING SPIKING PATTERNS ON CURVES	MJH L.P.
	~~SEPT. 9, 1991~~	SPIKING PATTERNS REVISED & 5 1/2" LG. SPIKES DELETED	MH EHT
	~~APR. 28, 1986~~	TANGENT SPIKING PATTERNS REVISED	MH EHT
	~~AUG. 1, 1977~~		

CANADIAN PACIFIC RAILWAY

NOTE: THIS PLAN SUPERSEDES X-10-16-221.

TRACK SPIKING PATTERNS

MANAGER, TRACK STANDARDS
ENGINEERING & MECHANICAL SERVICES, CALGARY, ALBERTA

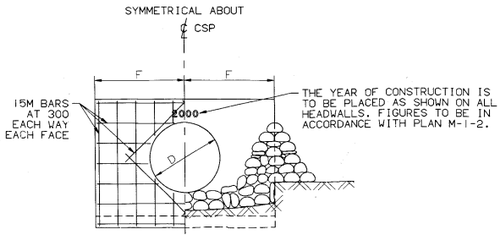
OFFICE FILE NO. VMT0024(TROXFAST) VMT0019(TROXFAST)

PLAN NO. R-14-4-8

SCALE: 3"=1'-0"

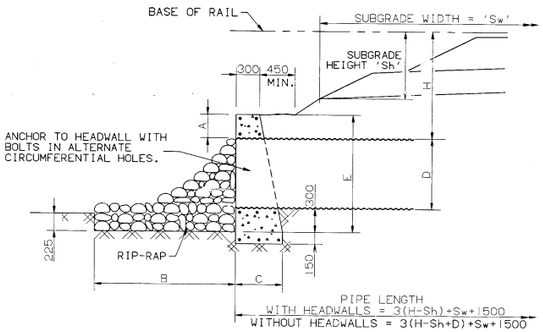
DR: MJH CH: E.H.T.

This drawing, information, specifications and designs represented are the exclusive property of the Canadian Pacific Railway. This drawing shall not be copied, partially reproduced or used in any way in whole or in part for the manufacture of any item or for the construction of any work or for any purpose whatsoever without the written consent of the Canadian Pacific Railway.

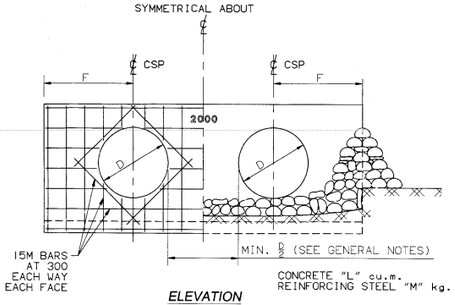


ELEVATION ONE PIPE

CONCRETE "G" cu.m.
REINFORCING STEEL "K" kg.

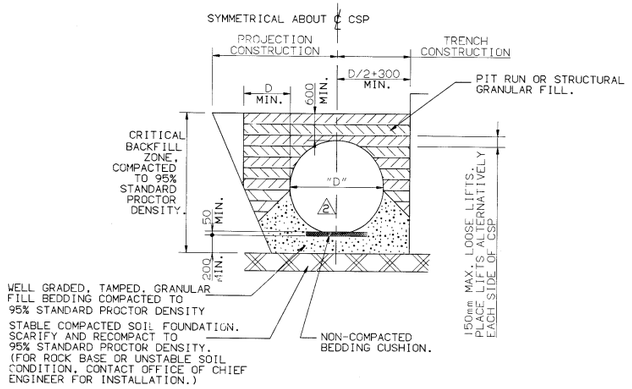


TYPICAL SECTION



CONCRETE "L" cu.m.
REINFORCING STEEL "M" kg.

ELEVATION TWO PIPES



DETAILS OF BEDDING & TYPES OF CONSTRUCTION

GENERAL NOTES:

SCOPE: THIS PLAN SPECIFIES THE REQUIREMENTS FOR PERMANENT CORRUGATED STEEL PIPE (CSP) CULVERTS INSTALLED UNDER CANADIAN PACIFIC RAILWAY TRACKS. CSP INSTALLATIONS SHOWN ON THIS PLAN APPLY TO NATURAL SURFACE DRAINAGE ONLY; AND ARE NOT INTENDED FOR APPLICATIONS WHERE CORROSIVE OR ABRASIVE LIQUIDS ARE TRANSPORTED, OR CORROSIVE SOILS EXIST. THIS PLAN DOES NOT APPLY TO THE INSTALLATION OF STRUCTURAL PLATE CORRUGATED STEEL PIPE (SPCSP) CULVERTS, PIPE-ARCHES OR UNDERPASS STRUCTURES.

CULVERT SIZES IN TABLE 1 HAVE BEEN DEVELOPED BASED ON STRENGTH AND NORMAL DURABILITY REQUIREMENTS FOR NEUTRAL SITE CULVERT INSTALLATIONS. CULVERT STRENGTH IS BASED ON COOPER'S E80 LOADING PLUS 50% IMPACT, IN ACCORDANCE WITH A.R.E.M.A. CH.1, PART 4. CULVERT DURABILITY IS BASED ON A 75 YEAR SERVICE LIFE (EXCEPT CULVERT INSTALLATIONS WITH A DEPTH OF COVER OF LESS THAN 2.5m WHICH ARE DESIGNED FOR A 50 YEAR SERVICE LIFE) IN ACCORDANCE WITH THE CORROSION LOSS MODEL OF AASHTO 11.9.8.

ALL CSP INSTALLATIONS THAT DO NOT CONFORM TO THE REQUIREMENTS OF TABLE 1 SHALL BE REFEREED TO THE OFFICE OF THE CHIEF ENGINEER FOR DESIGN OR APPROVAL.

A SPECIFIC DESIGN CONSIDERING CULVERT DURABILITY IS REQUIRED WHERE WATER AND/OR SOIL IS CORROSIVE OR ABRASIVE. CSP INSTALLATIONS IN BRACKISH, SALT OR CONTAMINATED DRAINAGE WATER; AND/OR IN CLAY, CLAY LOAM, PEAT AND ORGANIC SOILS SHOULD BE TESTED FOR WATER AND SOIL CORROSIVENESS. WHERE A CORROSIVE ENVIRONMENT EXISTS, RESISTIVITY AND pH TESTING IN ACCORDANCE WITH CALIFORNIA TEST METHOD 643B SHALL BE PERFORMED BY A QUALIFIED MATERIALS TESTING COMPANY.
CSP IN A CORROSIVE OR ABRASIVE ENVIRONMENT SHALL BE DESIGNED FOR A 75 YEAR SERVICE LIFE IN ACCORDANCE WITH ACCEPTED METHODS OF FUNCTIONAL DESIGN. DURABILITY DESIGN AND PROTECTIVE COATING ASSESSMENT.

EXISTING CSP CULVERTS CAN BE EXTENDED WITH CSP OF IMPERIAL PIPE DIMENSIONS THAT CONFORM TO THE NEAREST SIZE OF METRIC PIPE IN TABLE 1.

CSP INSTALLATIONS UNDER ROADWAYS ON CANADIAN PACIFIC RAILWAY PROPERTY SHALL BE INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF THE LOCAL ROAD AUTHORITY.

CSP SPECIFICATION: CSP SHALL BE PLAIN GALVANIZED CORRUGATED STEEL PIPE IN ACCORDANCE WITH C.S.A. STANDARD CAN3-G401-M, "CORRUGATED STEEL PIPE PRODUCTS".

CSP COUPLERS FOR FIELD JOINTS IN CULVERT PIPES SHALL BE STANDARD ANNULAR CORRUGATED BANDS WITH NEOPRENE SLEEVE GASKET. COUPLERS SHALL BE FABRICATED FROM THE SAME BASE MATERIAL AS THE CSP WITH EQUIVALENT CORROSION PROTECTION. COUPLING BANDS MAY BE FABRICATED FROM THE NEXT THICKNESS LIGHTER THAN THE CSP THICKNESS, BUT NOT LESS THAN 1.6mm THICK.
COUPLING BAND WIDTH TO BE 600mm MINIMUM. TWO PIECE COUPLERS SHALL BE USED ON CSP WITH DIAMETERS GREATER THAN 1200mm.
NEOPRENE GASKET TO BE 9.5mm THICK AND 178mm MINIMUM WIDTH.

HELICAL CSP SHALL HAVE ENDS RECORRUGATED WITH SUFFICIENT ANNULAR CORRUGATIONS TO PERMIT INSTALLATION OF A STANDARD CORRUGATED COUPLING BAND AND SLEEVE GASKET.

INSTALLATION: CSP SHALL BE INSTALLED IN ACCORDANCE WITH BRIDGE SPECIFICATION NO. 202 "SPECIFICATION FOR THE INSTALLATION OF CORRUGATED METAL PIPES" OR OTHER APPROVED CONSTRUCTION SPECIFICATION FOR THE INSTALLATION OF CULVERTS.

COVER: THE MINIMUM HEIGHT AND MAXIMUM HEIGHT OF COVER FOR VARIOUS CULVERT SIZES AND SPECIFIED WALL THICKNESSES ARE GIVEN IN TABLE 1.

MULTIPLE PIPE INSTALLATIONS: THE CLEARANCE BETWEEN CULVERTS FOR MULTIPLE CULVERT INSTALLATIONS SHALL NOT BE LESS THAN 1/2 THE PIPE DIAMETER, BUT NEED NOT BE GREATER THAN 900mm UNLESS REQUIRED FOR SPECIFIC CONSTRUCTION COMPACTION METHODS AND EQUIPMENT.

END TREATMENT: WHERE REQUIRED TO PREVENT, EROSION, UNDERMINING, DRIFT AND DEBRIS DETENTION AT THE INLET AND/OR OUTLET; OR WHERE REQUIRED TO INCREASE HYDRAULIC CAPACITY, THE ENGINEER SHALL SPECIFY AN APPROPRIATE CULVERT PIPE END TREATMENT. END TREATMENTS MAY CONSIST OF SLOPE RIP-RAP, GABIONS, STANDARD STEEL CULVERT APRONS, BEVELLED PIPE ENDS OR CONCRETE HEADWALLS WITH RIP-RAP APRONS. △2
CONCRETE HEADWALL REQUIREMENTS ARE SHOWN IN TABLE 2.

CONCRETE: CONCRETE USED FOR HEADWALLS SHALL CONFORM TO THE REQUIREMENTS OF C.S.A. STANDARD A23.1, LATEST EDITION; EXCEPT THAT CONCRETE SHALL BE MADE WITH LOW ALKALI (LESS THAN 3kg/cu.m. SODIUM MONOXIDE EQUIVALENTS) TYPE 10 PORTLAND CEMENT. LOW ALKALI TYPE 50 SULPHATE-RESISTANT PORTLAND CEMENT SHALL BE USED WHERE CONCRETE HEADWALLS ARE IN CONTACT WITH SULPHATES IN WATER OR SOIL.

MAXIMUM WATER/CEMENT RATIO SHALL BE 0.45, EXCEPT FOR TYPE 50 PORTLAND CEMENT WHERE MAXIMUM WATER/CEMENT RATIO SHALL BE 0.40. MAXIMUM AGGREGATE SIZE TO BE 20mm. SLUMP AT POINT OF DISCHARGE TO BE BETWEEN 70 AND 90mm.

MINIMUM 28 DAY COMPRESSIVE STRENGTH TO BE 35MPa, WITH 5% TO 7% AIR ENTRAINMENT.

MINIMUM CLEAR CONCRETE COVER TO REINFORCING STEEL TO BE 50mm FOR EXPOSED SURFACES AND 75mm FOR SURFACES CAST AGAINST SOIL.

CHAMFER ON EXPOSED SURFACES TO BE 25mm.

CONCRETE FINISH TO BE SMOOTH-FORM IN ACCORDANCE WITH C.S.A. STANDARD A23.1.

REINFORCING STEEL: TO BE IN ACCORDANCE WITH CAN/CSA-G30.18-M92, GRADE 400R, USING DEFORMED BARS.
SPLICE LENGTHS TO BE MINIMUM 300mm. △2

DIMENSION: ARE METRIC AND ARE SHOWN IN MILLIMETRES.UNLESS NOTED OTHERWISE.

TABLE 1: CSP CULVERT REQUIREMENTS

	CULVERT SIZE (mm) (INSIDE DIA.)	CORRUGATION PROFILE (mm)	H MIN. (m)	H MAX. (m) SPECIFIED WALL THICKNESS (mm) 1.6	2.0	2.8	3.5	4.2
△2	•300	68x13	900	2.5	19.0	-	-	-
△2	•600	68x13	900	2.5	10.0	35.0	-	-
	900	68x13	900	2.5	5.5	22.0	24.0	25.5
	1000	68x13	1200	2.5	4.5	21.0	22.0	23.0
	1200	68x13	1500	-	2.5	17.0	18.5	19.0
	1200	76x25	1500	-	2.5	19.5	-	-
	1200	125x26	1500	-	2.5	17.0	-	-
	1400	68x13	1500	-	-	15.0	16.0	16.5
	1400	76x25	1500	-	2.5	16.0	26.0	-
	1400	125x26	1500	-	2.5	14.5	24.0	-
	1600	68x13	2000	-	-	13.0	14.0	14.5
	1600	76x25	1500	-	2.5	14.0	23.0	31.5
	1600	125x26	1500	-	2.5	12.5	20.0	28.0
	1800	76x25	2000	-	2.5	12.5	20.0	28.0
	1800	125x26	2000	-	2.5	11.0	18.0	25.0

△2 • MINIMUM SIZE OF CSP CULVERT TO BE 900mm. 300mm AND 600mm DIAMETER CSP CULVERTS ARE ONLY TO BE USED IN SITUATIONS WHERE REQUIRED DUE TO SPECIAL CIRCUMSTANCES.

NOTE: 125x26 CORRUGATION PROFILES SHOULD BE USED WHEREVER POSSIBLE.

TABLE 2: CONCRETE HEADWALL REQUIREMENTS

D	END AREA (m^2)	A	B	C	E	F	G	K	L MIN.	M MIN.	D
900	0.64	300	1800	600	1500	1150	1.47	100	2.22	145	900
1000	0.79	300	2100	700	1600	1250	1.87	115	2.83	170	1000
1200	1.13	300	2400	700	1800	1500	2.45	145	3.69	220	1200
1400	1.54	400	2700	850	2100	1750	3.79	195	5.74	295	1400
1600	2.01	400	3000	850	2300	2000	4.64	240	6.97	360	1600
1800	2.54	600	4000	1000	2700	2250	6.92	310	10.41	470	1800

△2

FILED IN PLAN ROOM
MAR 23 2000
ENGINEERING SERVICES
CALGARY, ALBERTA

THIS PLAN SUPERCEDES PLAN B-14-64.

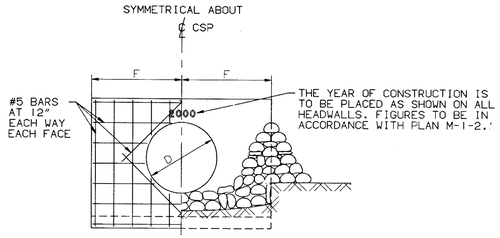
No.	DATE	REVISION	BY
2	21 MAR '00	GENERAL	BL/JFU
1	8 SEPT. '99	ADDITIONAL CSP SIZES	BL/JFU
	19-08-99	SIGNED & ISSUED	

CANADIAN PACIFIC RAILWAY
Engineering Services - Structures & Projects
STRUCTURES PLANNING & DESIGN
CALGARY, ALBERTA

INSTALLATION OF CORRUGATED STEEL PIPE (CSP) CULVERTS △2 - CANADA -

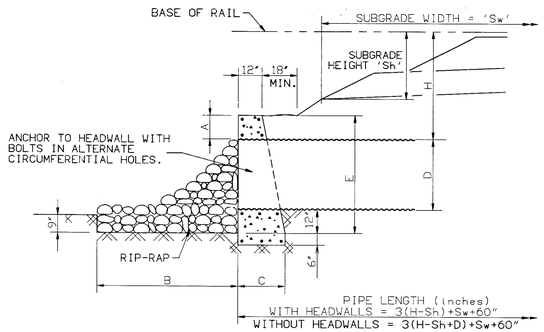
DWG. BY: BTL CHK. BY: JFU OFFICE FILE: XC
SCALE: NONE
DATE: AUGUST 19, 1999
PLAN No. B-1-4950-1

ENGINEER
MANAGER, STRUCTURES PLANNING & DESIGN

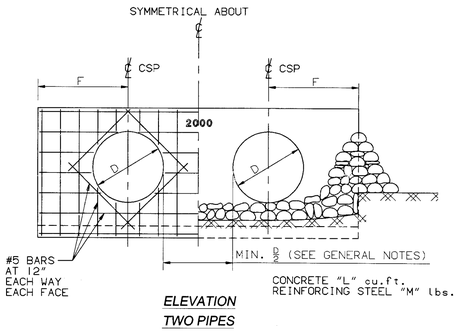


ELEVATION ONE PIPE

CONCRETE "G" cu.ft.
REINFORCING STEEL "K" lbs.

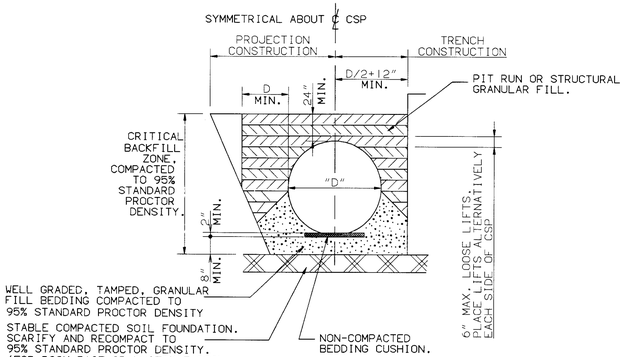


TYPICAL SECTION



CONCRETE "L" cu.ft.
REINFORCING STEEL "M" lbs.

ELEVATION TWO PIPES



DETAILS OF BEDDING & TYPES OF CONSTRUCTION

GENERAL NOTES:

SCOPE: THIS PLAN SPECIFIES THE REQUIREMENTS FOR PERMANENT CORRUGATED STEEL PIPE (CSP) CULVERTS INSTALLED UNDER CANADIAN PACIFIC RAILWAY TRACKS. CSP INSTALLATIONS SHOWN ON THIS PLAN APPLY TO NATURAL SURFACE DRAINAGE ONLY, AND ARE NOT INTENDED FOR APPLICATIONS WHERE CORROSIVE OR ABRASIVE LIQUIDS ARE TRANSPORTED; OR CORROSIVE SOILS EXIST. THIS PLAN DOES NOT APPLY TO THE INSTALLATION OF STRUCTURAL PLATE CORRUGATED STEEL PIPE (SPCSP) CULVERTS, PIPE-ARCHES OR UNDERPASS STRUCTURES.

CULVERT SIZES IN TABLE 1 HAVE BEEN DEVELOPED BASED ON STRENGTH AND NORMAL DURABILITY REQUIREMENTS FOR NEUTRAL SITE CULVERT INSTALLATIONS. CULVERT STRENGTH IS BASED ON COOPER'S E80 LOADING PLUS 50% IMPACT, IN ACCORDANCE WITH A.R.E.M.A. CH. 1, PART 4. CULVERT DURABILITY IS BASED ON A 75 YEAR SERVICE LIFE (EXCEPT CULVERT INSTALLATIONS WITH A DEPTH OF COVER OF LESS THAN 8 ft. WHICH ARE DESIGNED FOR A 50 YEAR SERVICE LIFE) IN ACCORDANCE WITH THE CORROSION LOSS MODEL OF AASHTO 11.9.8.

ALL CSP INSTALLATIONS THAT DO NOT CONFORM TO THE REQUIREMENTS OF TABLE 1 SHALL BE REFEREED TO THE OFFICE OF THE CHIEF ENGINEER FOR DESIGN OR APPROVAL.

A SPECIFIC DESIGN CONSIDERING CULVERT DURABILITY IS REQUIRED WHERE WATER AND/OR SOIL IS CORROSIVE OR ABRASIVE. CSP INSTALLATIONS IN BRACKISH, SALT OR CONTAMINATED DRAINAGE WATER; AND/OR IN CLAY, CLAY LOAM, PEAT AND ORGANIC SOILS SHOULD BE TESTED FOR WATER AND SOIL CORROSIVENESS. WHERE A CORROSIVE ENVIRONMENT EXISTS, RESISTIVITY AND pH TESTING IN ACCORDANCE WITH CALIFORNIA TEST METHOD 643B SHALL BE PERFORMED BY A QUALIFIED MATERIALS TESTING COMPANY.
CSP IN A CORROSIVE OR ABRASIVE ENVIRONMENT SHALL BE DESIGNED FOR A 75 YEAR SERVICE LIFE IN ACCORDANCE WITH ACCEPTED METHODS OF FUNCTIONAL DESIGN. DURABILITY DESIGN AND PROTECTIVE COATING ASSESSMENT.

EXISTING CSP CULVERTS CAN BE EXTENDED WITH CSP OF IMPERIAL PIPE DIMENSIONS THAT CONFORM TO THE NEAREST SIZE OF METRIC PIPE IN TABLE 1.

CSP INSTALLATIONS UNDER ROADWAYS ON CANADIAN PACIFIC RAILWAY PROPERTY SHALL BE INSTALLED IN ACCORDANCE WITH THE REQUIREMENTS OF THE LOCAL ROAD AUTHORITY.

CSP SPECIFICATION: CSP SHALL BE PLAIN GALVANIZED CORRUGATED STEEL PIPE IN ACCORDANCE WITH AASHTO M-218, ASTM A760, ASTM A31 AND ASTM A164 TYPE RS, LATEST EDITIONS.

CSP COUPLERS FOR FIELD JOINTS IN CULVERT PIPES SHALL BE STANDARD ANNULAR CORRUGATED BANDS WITH NEOPRENE SLEEVE GASKET. COUPLERS SHALL BE FABRICATED FROM THE SAME BASE MATERIAL AS THE CSP WITH EQUIVALENT CORROSION PROTECTION. COUPLING BANDS MAY BE FABRICATED FROM THE NEXT THICKNESS LIGHTER THAN THE CSP THICKNESS, BUT NOT LESS THAN 0.064 in. THICK.
COUPLING BAND WIDTH TO BE 24 in. MINIMUM. TWO PIECE COUPLERS SHALL BE USED ON CSP WITH DIAMETERS GREATER THAN 48 in.
NEOPRENE GASKET TO BE 3/8 in. THICK AND 7 in. MINIMUM WIDTH.

HELICAL CSP SHALL HAVE ENDS RECORRUGATED WITH SUFFICIENT ANNULAR CORRUGATIONS TO PERMIT INSTALLATION OF A STANDARD CORRUGATED COUPLING BAND AND SLEEVE GASKET.

INSTALLATION: CSP SHALL BE INSTALLED IN ACCORDANCE WITH BRIDGE SPECIFICATION NO. 202 "SPECIFICATION FOR THE INSTALLATION OF CORRUGATED METAL PIPES" OR OTHER APPROVED CONSTRUCTION SPECIFICATION FOR THE INSTALLATION OF CULVERTS.

COVER: THE MINIMUM HEIGHT AND MAXIMUM HEIGHT OF COVER FOR VARIOUS CULVERT SIZES AND SPECIFIED WALL THICKNESSES ARE GIVEN IN TABLE 1.

MULTIPLE PIPE INSTALLATIONS: THE CLEARANCE BETWEEN CULVERTS FOR MULTIPLE CULVERT INSTALLATIONS SHALL NOT BE LESS THAN 1/2 THE PIPE DIAMETER; BUT NEED NOT BE GREATER THAN 3 feet UNLESS REQUIRED FOR SPECIFIC CONSTRUCTION COMPACTION METHODS AND EQUIPMENT.

END TREATMENT: WHERE REQUIRED TO PREVENT, EROSION, UNDERMINING, DRIFT AND DEBRIS DETENTION AT THE INLET AND/OR OUTLET; OR WHERE REQUIRED TO INCREASE HYDRAULIC CAPACITY, THE ENGINEER SHALL SPECIFY AN APPROPRIATE CULVERT PIPE END TREATMENT. END TREATMENTS MAY CONSIST OF SLOPE RIP-RAP, GABIONS, STANDARD STEEL CULVERT APRONS, BEVELLED PIPE ENDS OR CONCRETE HEADWALLS WITH RIP-RAP APRONS.
CONCRETE HEADWALL REQUIREMENTS ARE SHOWN IN TABLE 2.

CONCRETE: CONCRETE USED FOR HEADWALLS SHALL CONFORM TO THE REQUIREMENTS OF A.R.E.M.A. CHAPTER 8, PART 1, LATEST EDITION; EXCEPT THAT CONCRETE SHALL BE MADE WITH LOW ALKALI (LESS THAN 0.20 lb/cu. ft. SODIUM MONOXIDE EQUIVALENTS) TYPE I PORTLAND CEMENT. LOW ALKALI TYPE V SULPHATE-RESISTANT PORTLAND CEMENT SHALL BE USED WHERE CONCRETE HEADWALLS ARE IN CONTACT WITH SULPHATES IN WATER OR SOIL.

MAXIMUM WATER/CEMENT RATIO SHALL BE 0.45; EXCEPT FOR TYPE V PORTLAND CEMENT WHERE MAXIMUM WATER/CEMENT RATIO SHALL BE 0.40. MAXIMUM AGGREGATE SIZE TO BE 3/4 in. SLUMP AT POINT OF DISCHARGE TO BE BETWEEN 2 1/2 in. AND 3 1/2 in.

MINIMUM 28 DAY COMPRESSIVE STRENGTH TO BE 5000 psi. WITH 5% TO 7% AIR ENTRAINMENT.

MINIMUM CLEAR CONCRETE COVER TO REINFORCING STEEL TO BE 2 in. FOR EXPOSED SURFACES AND 3 in. FOR SURFACES CAST AGAINST SOIL.

CHAMFER ON EXPOSED SURFACES TO BE 1 in.

CONCRETE FINISH TO BE SMOOTH-FORM IN ACCORDANCE WITH A.R.E.M.A. MANUAL, CHAPTER 8, SECTION 1.18.

REINFORCING STEEL: TO BE IN ACCORDANCE WITH ASTM A-615 GRADE 60, USING DEFORMED BARS. SPLICE LENGTHS TO BE MINIMUM 12 in.

TABLE 1: CSP CULVERT REQUIREMENTS

CULVERT SIZE (in.) (INSIDE DIA.)	CORRUGATION PROFILE (in.)	H MIN. (ft.)	H MAX. (ft.) SPECIFIED WALL THICKNESS (in.) 0.064 (16 ga)	0.079 (14 ga)	0.109 (12 ga)	0.138 (10 ga)	0.168 (8 ga)
*12	2⅔x½	3	8	62	-	-	-
*24	2⅔x½	3	8	32	100	-	-
36	2⅔x½ or 3x1	3	8	18	72	78	82
42	2⅔x½ or 3x1	4	8	15	70	72	75
48	2⅔x½	5	-	8	56	60	62
48	3x1	5	-	8	64	-	-
48	5x1	5	-	8	56	-	-
54	2⅔x½	5	-	-	50	52	54
54	3x1	5	-	8	52	85	-
54	5x1	5	-	8	48	78	-
60	2⅔x½	6.5	-	-	42	46	48
60	3x1	5	-	8	46	75	100
60	5x1	5	-	8	40	65	92
72	3x1	6.5	-	8	40	65	92
72	5x1	6.5	-	8	36	60	82

* MINIMUM SIZE OF CSP CULVERT TO BE 36 INCHES. 12 INCH AND 24 INCH DIAMETER CSP CULVERTS ARE ONLY TO BE USED IN SITUATIONS WHERE REQUIRED DUE TO SPECIAL CIRCUMSTANCES.

NOTE: 5x1 CORRUGATION PROFILES SHOULD BE USED WHEREVER POSSIBLE.

TABLE 2: CONCRETE HEADWALL REQUIREMENTS

D	END AREA (ft²)	A	B	C	E	F	G	K	L MIN.	M MIN.	D
36"	7.07	12"	72"	24"	60"	45"	52	220	79	319	36"
42"	9.62	12"	84"	28"	63"	48"	66	253	100	374	42"
48"	12.57	12"	96"	28"	72"	60"	87	319	130	485	48"
54"	15.90	16"	108"	34"	84"	69"	134	428	203	650	54"
60"	19.63	16"	120"	34"	90"	78"	164	528	246	790	60"
72"	28.27	24"	156"	40"	108"	90"	244	682	368	1030	72"

THIS PLAN SUPERCEDES ALL PREVIOUS STANDARD PLANS FOR CULVERT INSTALLATIONS.

No.	DATE	BY
	21/03/00	SIGNED & ISSUED

CANADIAN PACIFIC RAILWAY
Engineering Services - Structures & Projects
STRUCTURES PLANNING & DESIGN
CALGARY, ALBERTA

INSTALLATION OF CORRUGATED STEEL PIPE (CSP) CULVERTS - USA -

DWG. BY: BTL	CHK BY: JFU	OFFICE FILE:	XC
		SCALE:	NONE
ENGINEER		DATE:	MAR. 21, 2000
MANAGER, STRUCTURES PLANNING & DESIGN		PLAN No.	B-1-4950-2