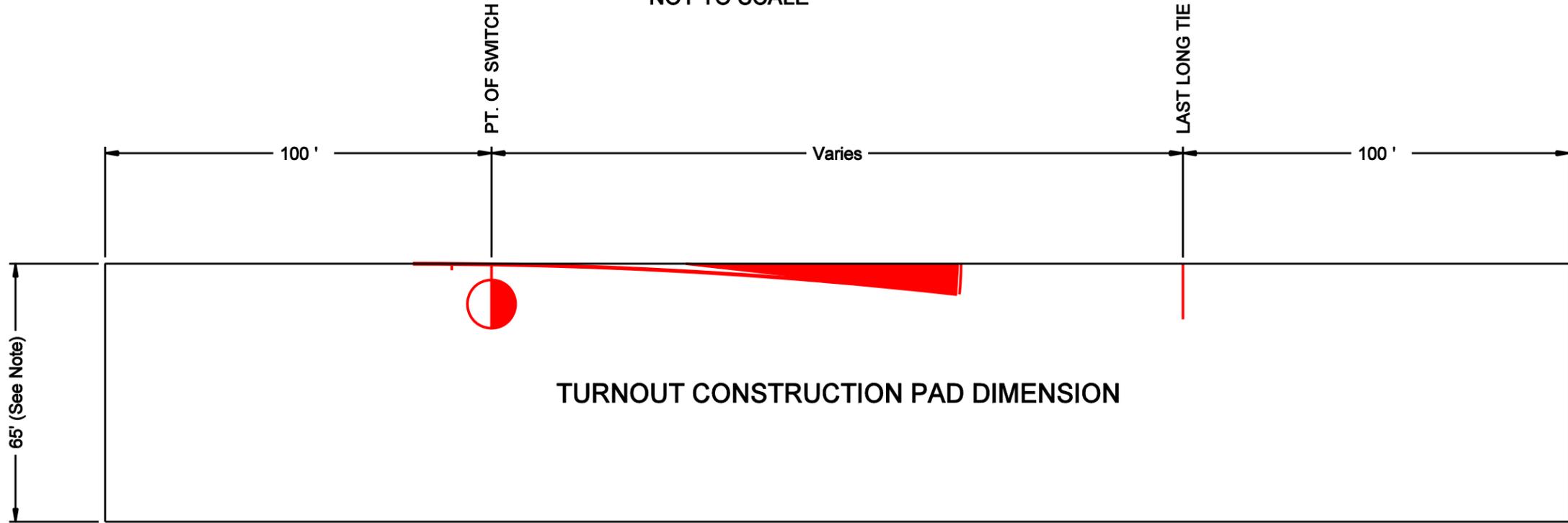
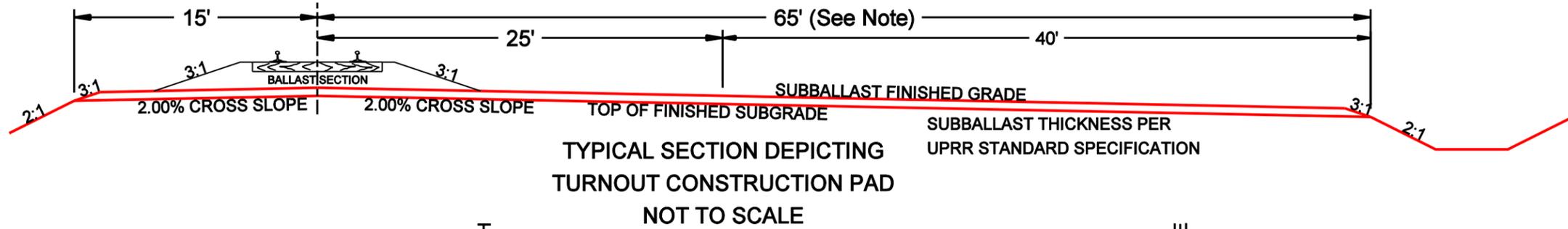


NOTE: ALL CHANGES WILL REQUIRE APPROVAL BY UPRR AUTHORIZED ENGINEERING REPRESENTATIVE. WIDTH AND LOCATION MAY VARY DUE TO RIGHT OF WAY AND LOCAL CONDITIONS. IT MAY BE NECESSARY TO INSTALL DRAINAGE FACILITIES AND/OR REMOVE PAD AFTER CONSTRUCTION TO FACILITATE DRAINAGE.



**UNION PACIFIC RAILROAD
ENGINEERING STANDARDS**

**INDUSTRIAL CONSTRUCTION
TURNOUT
PAD DETAILS**



EXHIBIT

T.O. PAD

\$\$\$color:table\$\$\$
 \$\$\$pentable:\$\$\$
 filename.dgn
 \$\$\$model:\$\$\$
 \$\$\$date:\$\$\$
EXHIBIT
T.O. PAD

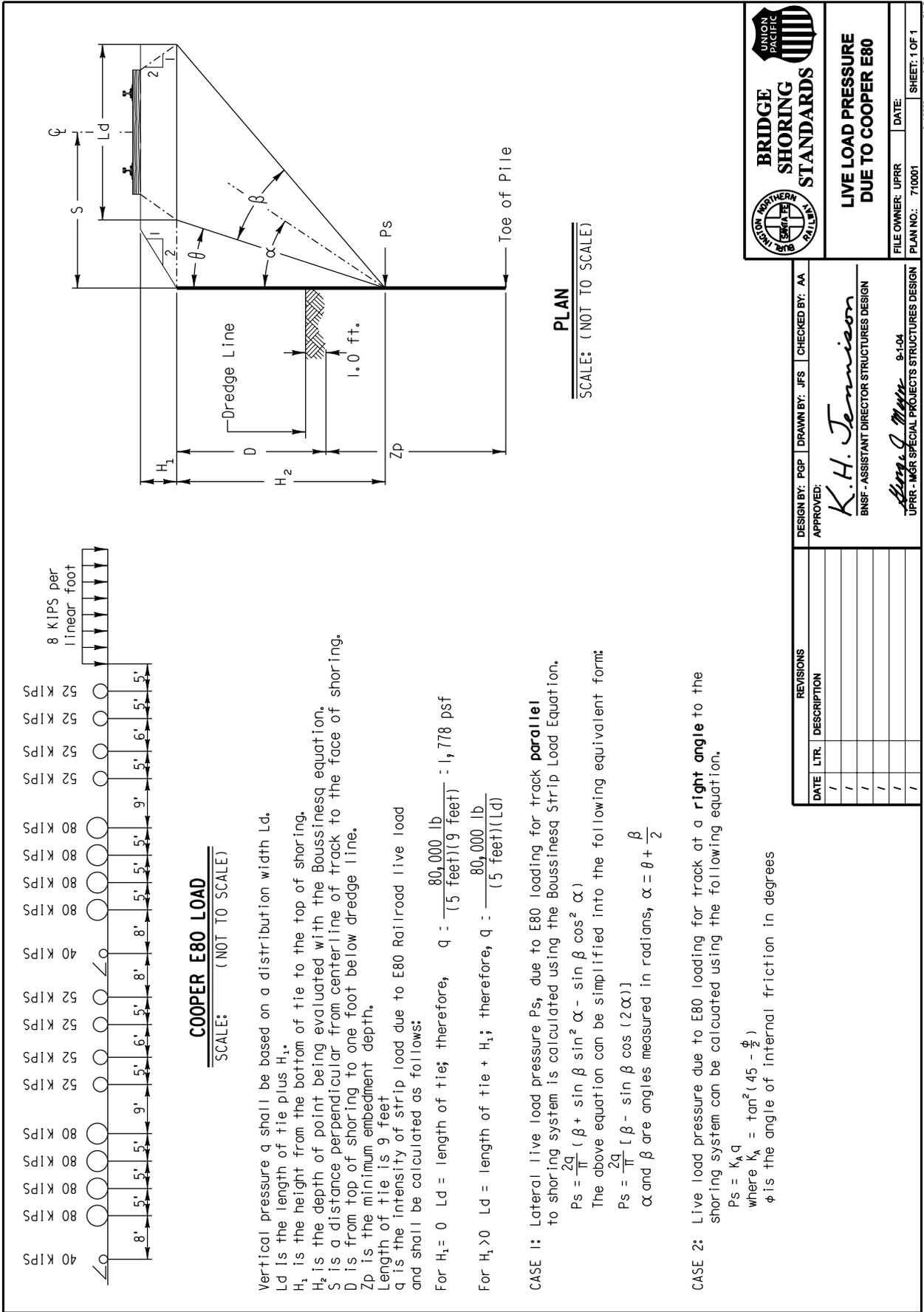
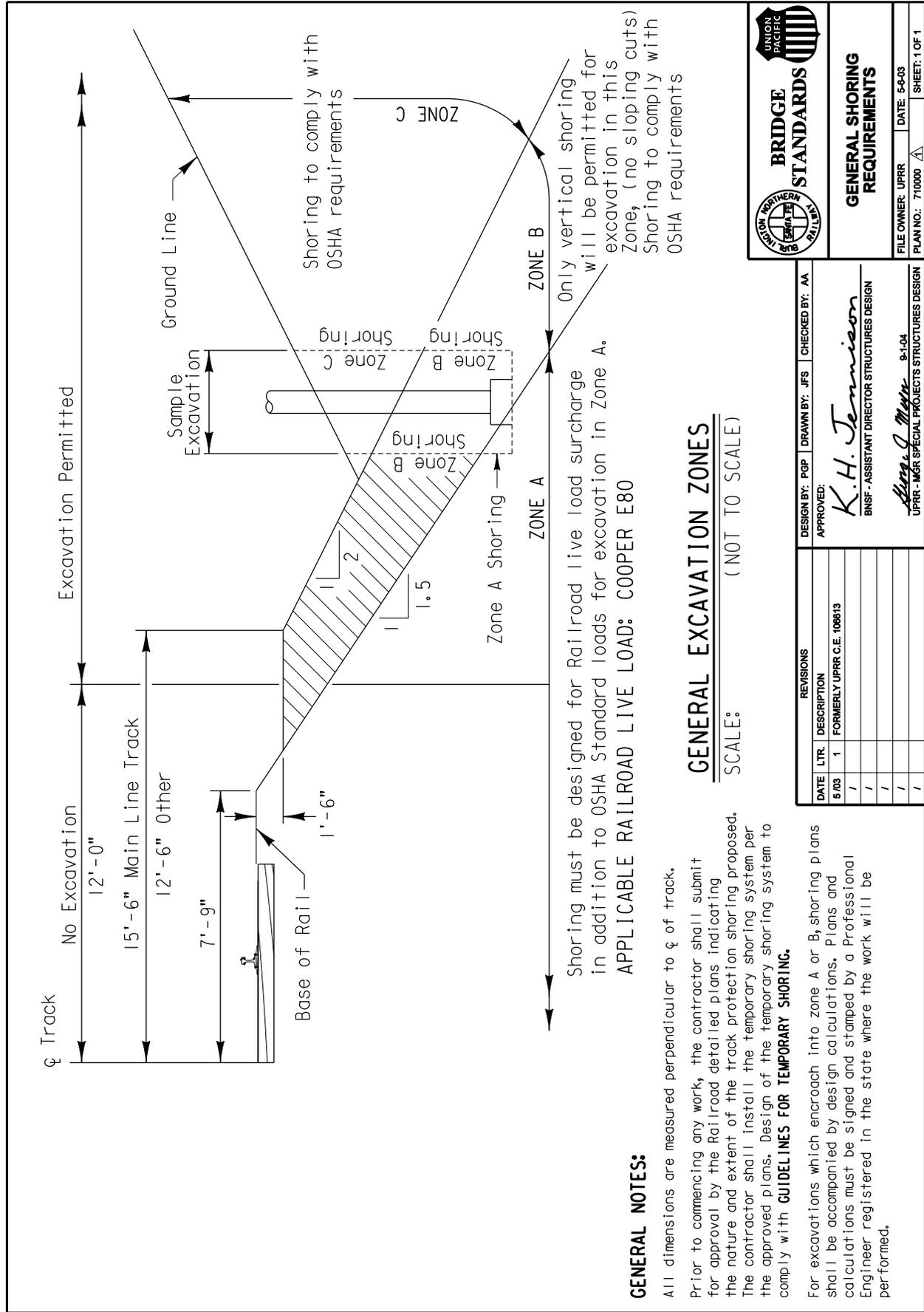


Figure 2



GENERAL NOTES:

All dimensions are measured perpendicular to ϕ of track. Prior to commencing any work, the contractor shall submit for approval by the Railroad detailed plans indicating the nature and extent of the track protection shoring proposed. The contractor shall install the temporary shoring system per the approved plans. Design of the temporary shoring system to comply with **GUIDELINES FOR TEMPORARY SHORING.**

For excavations which encroach into Zone A or B, shoring plans shall be accompanied by design calculations. Plans and calculations must be signed and stamped by a Professional Engineer registered in the state where the work will be performed.

GENERAL EXCAVATION ZONES

SCALE: _____ (NOT TO SCALE)

REVISIONS	
DATE	DESCRIPTION
5/03	1 FORMERLY UPRR C.E. 106613
/	/
/	/
/	/
/	/

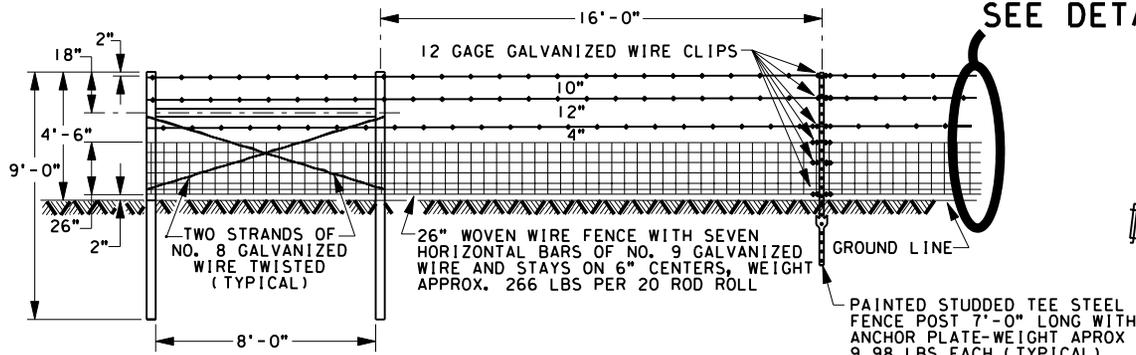
DESIGN BY: PGP DRAWN BY: JFS CHECKED BY: AA
 APPROVED:
K.H. Jenkinson
 BNSF - ASSISTANT DIRECTOR STRUCTURES DESIGN
Berg J. Mann 9-104
 UPRR - MGR SPECIAL PROJECTS STRUCTURES DESIGN



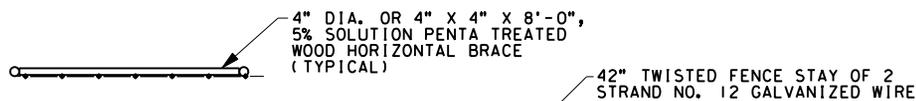
GENERAL SHORING REQUIREMENTS

FILE OWNER: UPRR DATE: 5-6-03 SHEET: 1 OF 1
 PLAN NO.: 710000 PLOTTED: \$\$\$DATE\$\$\$ \$TIME

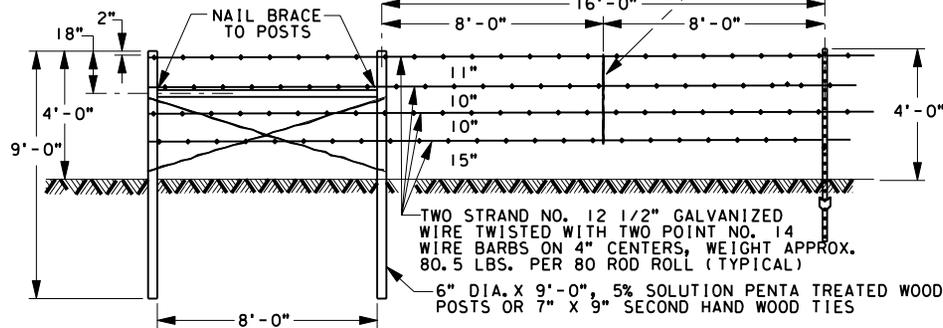
Figure 1



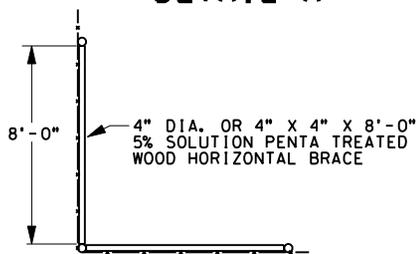
STANDARD HOG TIGHT FENCE



STANDARD BARBED WIRE FENCE

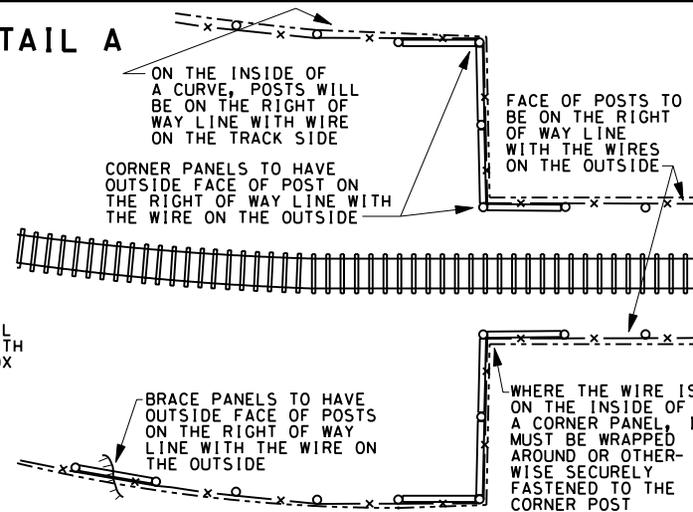


POWDER RIVER H. D. STOCKYARD GATE



CORNER PANEL

SEE DETAIL A



GENERAL ARRANGEMENT

NOTES:
HOG TIGHT FENCE TO BE INSTALLED WHERE REQUESTED BY THE ADJACENT PROPERTY OWNER AND THE OTHER SIDES OF THE ENCLOSURE ARE SIMILARLY PROTECTED.

DIMENSIONS OF WOOD PANEL POST AND BRACES SHALL NOT VARY MORE THAN 1/2" UNDERSIZE OR 1" OVERSIZE IN DIA. OR 3" IN LENGTH.

WHEN SECOND HAND TIES ARE USED FOR PANEL POST, THEY SHALL BE SET TO EXTEND ABOVE THE GROUND LINES AS SHOWN, REGARDLESS OF THEIR LENGTH.

BRACE PANELS TO BE INSTALLED AT ALL GRADE BREAKS, END OF FENCE, EACH SIDE OF GATE OPENINGS AT CATTLE GUARDS AND NOT MORE THAN 500' APART.

GATE SHALL BE 182 LBS., 52" HIGH, 15'-10 3/4" LONG. FRAME TO BE ONE PIECE 1 5/8" DIA. STEEL TUBE, .066" WALL. RAILS TO BE HIGH STRENGTH 16 GAGE S-BEND SHAPE. STAYS TO BE ROLL-FORMED 12 GAGE WELDED IN PAIRS. LATCH DOUBLE PIN 1/2" X 1" STEEL WITH LOCK AND SADDLE HORSE TYPE HANDLE. HINGE TO BE FULL WRAP OMEGA STYLE 1/4" STEEL, BOTTOM IN FIXED POSITION AND TOP WILL ADJUST VERTICALLY 5" BETWEEN RAILS. LATCH PLATE TO BE ONE PIECE 4" X 4". LATCH PIN TO BE 1 1/2" X 1 3/4" AND NOTCH POST TO ACCOMMODATE LATCH PIN. LATCH PIN EXTENDS 3" PAST TUBE.

REF. PREVIOUS U.P. STD PAGE NO. 301A.

**UNION PACIFIC RAILROAD
ENGINEERING STANDARDS**

**STANDARD RIGHT OF
WAY FENCE**



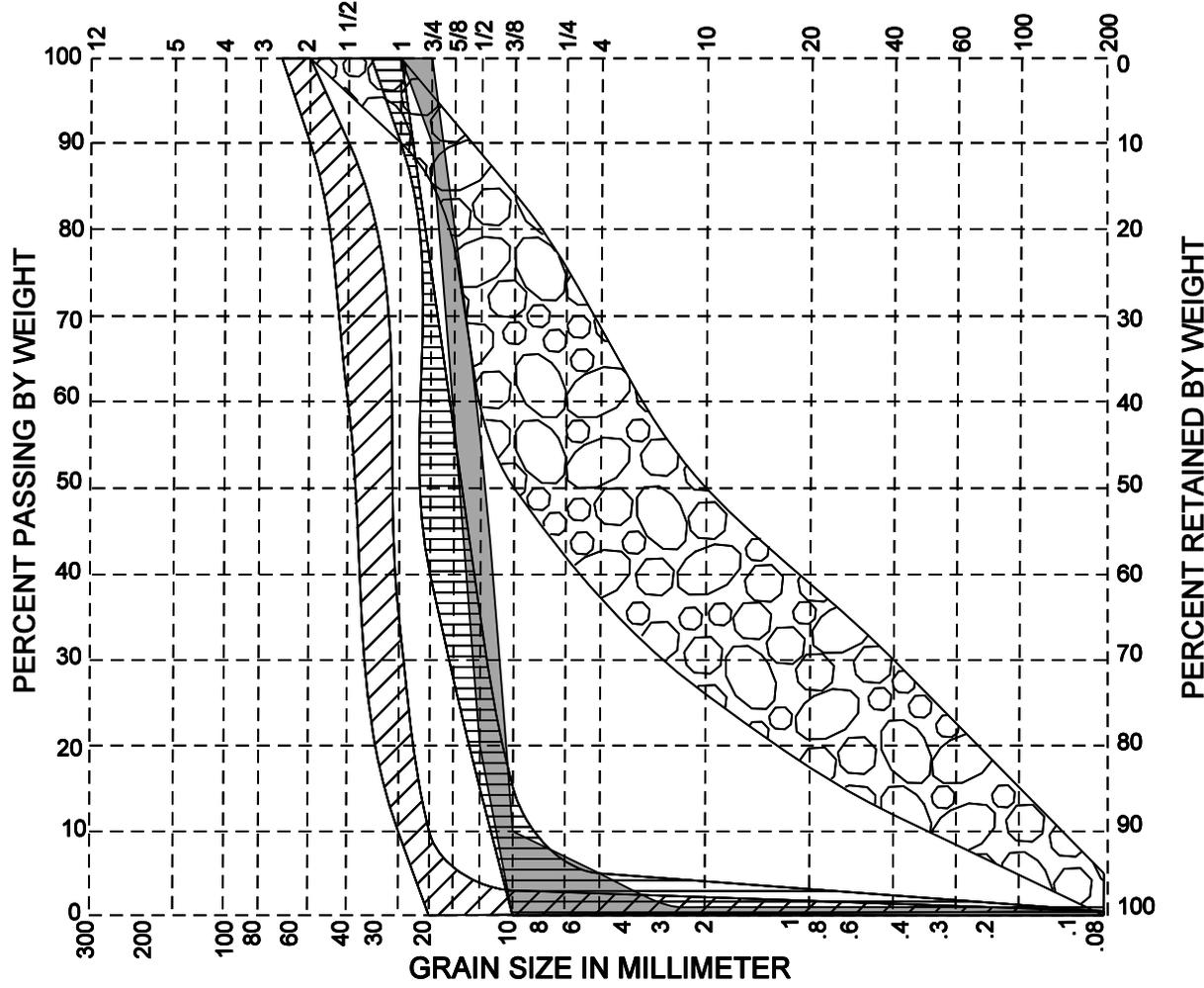
ADOPTED: MAY 14, 1930
REVISED: DEC. 30, 1996
FILE NO.: 0075

**STD DWG
0075**

0075
STD DWG

0010C
STD DWG

SIEVE ANALYSIS	
SIZE OF OPENING IN INCHES	NUMBER OF MESH PER INCH, U.S. STANDARD



COBBLES	COARSE	FINE	COARSE	MEDIUM	FINE
	GRAVEL		SAND		

- CLASS 1 BALLAST FOR MAIN TRACK (OLD "D")
- CLASS 2 BALLAST FOR SECONDARY MAIN, BRANCH AND YARD TRACK (OLD "C")
- CLASS 3 BALLAST SCREENINGS FOR SIGNAL MOUNDS, ETC..
- SELECT MATERIAL (SUB BALLAST - SEE NOTE)

BALLAST CLASS	ITEM NO.
1	562-0766
2	562-1432
3	562-2098
SUB BALLAST	562-5428

SQUARE OPENING	UP BALLAST CLASS			SUB BALLAST
	1	2	3	
2'-3/4"	100	—	—	—
2 1/2"	100	—	—	—
2"	90-100	—	—	100
1 3/4"	—	—	—	—
1 1/2"	60-90	—	—	—
1 1/4"	—	100	—	—
1"	10-35	90-100	100	90-100
3/4"	0-10	40-75	90-100	—
1/2"	—	15-35	20-55	—
3/8"	0-3	0-15	0-10	50-84
No.4	—	0-5	0-5	—
No.8	—	—	0-1	—
No.10	—	—	—	26-50
No.40	—	—	—	12-30
No.200	0-5	0-5	0-1	0-5

PERCENT PASSING (BY WEIGHT)
[ALL AGGREGATE SAMPLING AND TESTING PER
ASTM LATEST REVISION.]

NOTES:
FOR STANDARD CROSS SECTIONS, SEE STD DWG
0001A, OR STD DWG 0002A.

SELECT MATERIAL TO BE USED AS SUB BALLAST
IN POOR NATIVE SOIL CONDITIONS WHERE
SPECIFIED BY CHIEF ENGINEER.

CLASS 1 AND CLASS 2 BALLAST MATERIALS ARE
REQUIRED TO BE WASHED PRIOR TO LOADING.

**UNION PACIFIC RAILROAD
ENGINEERING STANDARDS**

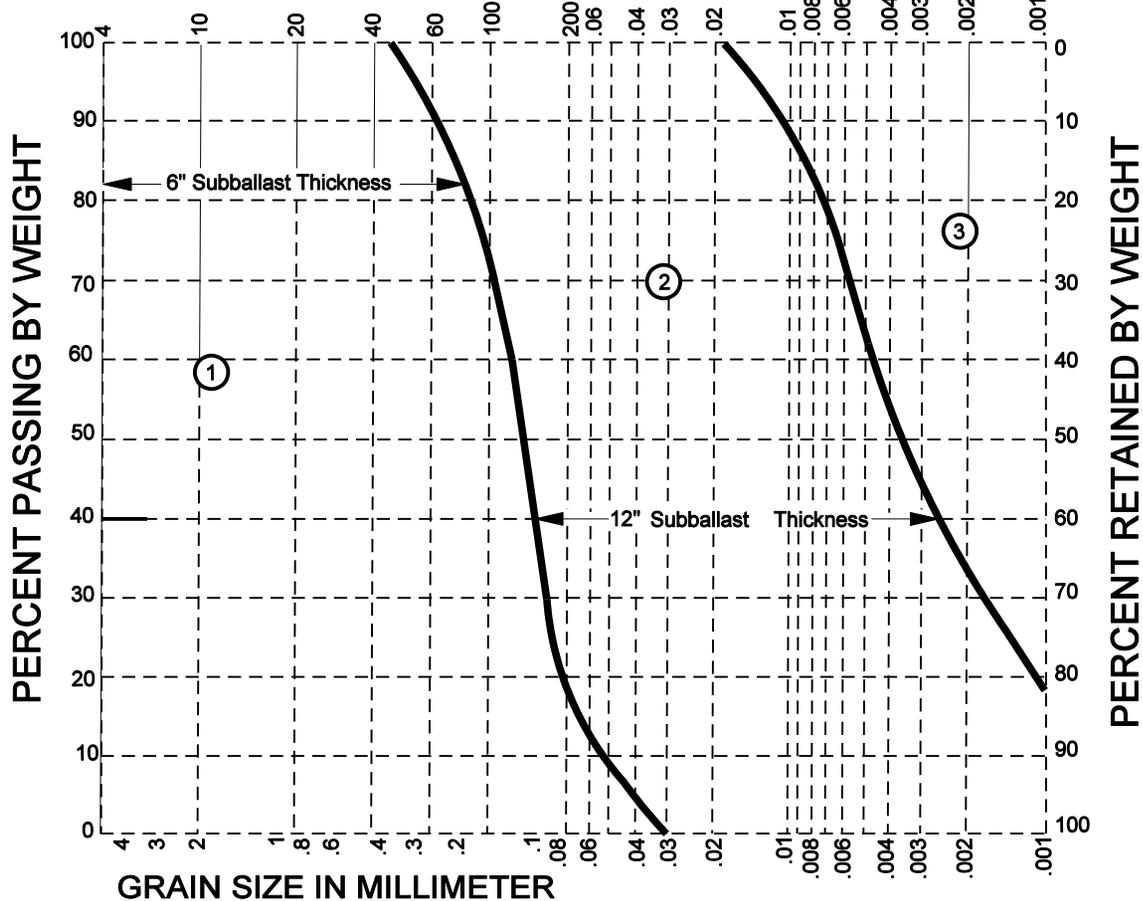
**BALLAST & SUBBALLAST
GRADATION TABLE**



ADOPTED: DEC. 31, 1996
REVISED: FEB. 13, 2006
FILE NO.: 0010C

STD DWG
0010C

SIEVE ANALYSIS	HYDROMETER ANALYSIS
NUMBER OF MESH PER INCH, U.S. STANDARD	GRAIN SIZE IN MM



COARSE	MEDIUM	FINE	FINES
SAND			

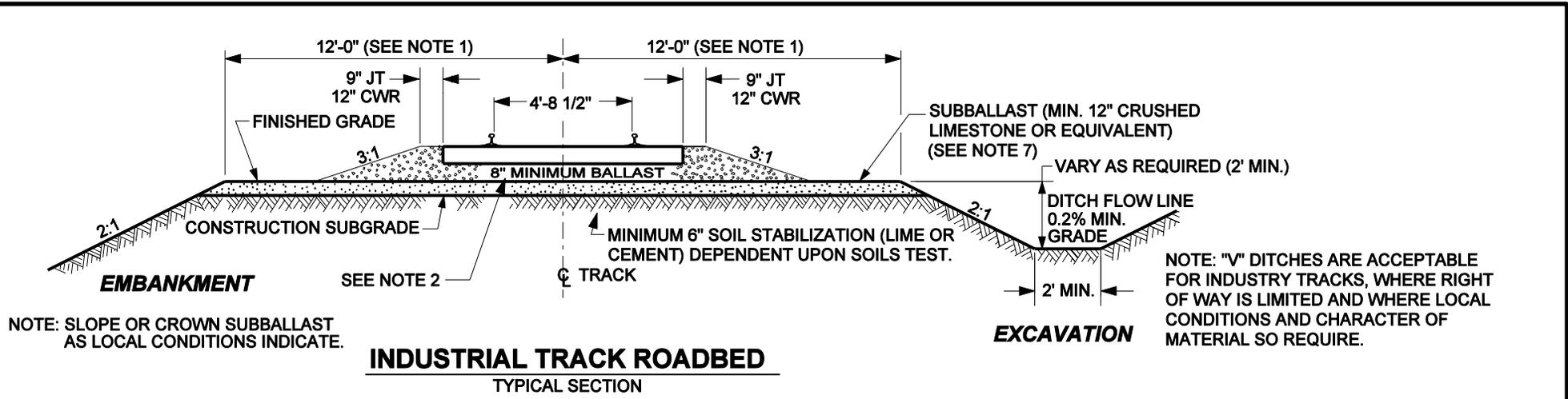
SIEVE SIZE	GRADATION CURVE	
	6" LIMIT	12" LIMIT
No. 40	100	—
No. 60	92	—
No. 100	72	—
No. 200	19	—
.015	—	100
.006	—	72
.004	—	54
.001	—	19

PERCENT PASSING (BY WEIGHT)
 [ALL AGGREGATE SAMPLING AND TESTING PER
 ASTM LATEST REVISION.]

- ① Zone of subgrade materials requiring 6" of subballast.
- ② Zone of subgrade materials requiring 12" of subballast.
- ③ Additional measures will be required per recommendations of an engineering soils analysis.

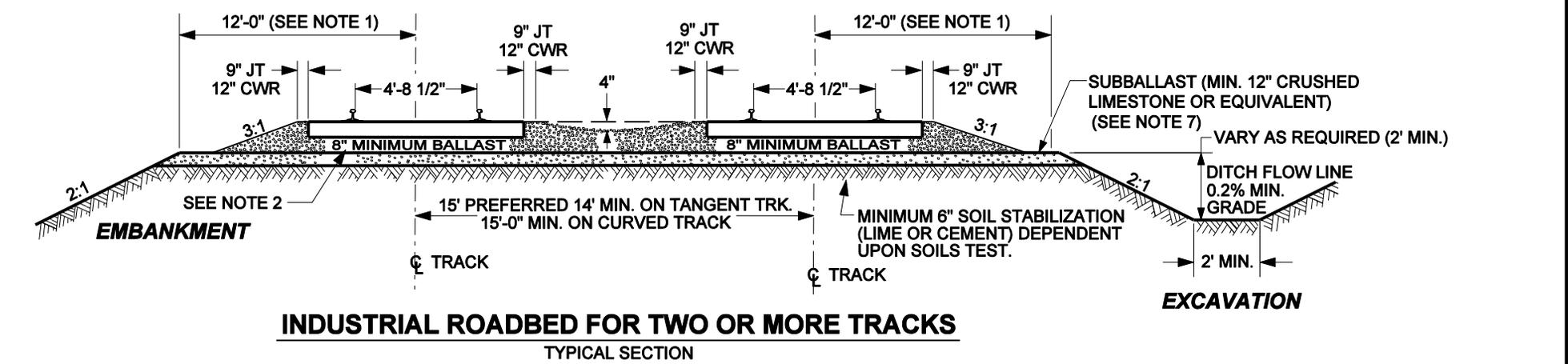
STD DWG
 0013A

UNION PACIFIC RAILROAD ENGINEERING STANDARDS	
GRAIN SIZE DISTRIBUTION FOR SUBGRADE SOILS	
	ADOPTED: JAN. 21, 2004 REVISED: FEB. 13, 2006 FILE NO.: 0013A
STD DWG 0013A	



NOTE: SLOPE OR CROWN SUBBALLAST AS LOCAL CONDITIONS INDICATE.

NOTE: "V" DITCHES ARE ACCEPTABLE FOR INDUSTRY TRACKS, WHERE RIGHT OF WAY IS LIMITED AND WHERE LOCAL CONDITIONS AND CHARACTER OF MATERIAL SO REQUIRE.



- NOTES:
- 12' SHOULDER WIDTH STANDARD. 11' SHOULDER MUST BE APPROVED BY CHIEF ENGINEER.
 - IF USING CONCRETE TIES - 10" MINIMUM BALLAST UNDER TIES.
 - PREFERABLY TRACKS WILL NOT BE DEPRESSED BELOW GROUND LEVEL PARTICULARLY IN SNOW AND HIGH RUNOFF TERRITORIES, TRACKS CONSTRUCTED AT OR BELOW GROUND LEVEL MUST HAVE FULL STANDARD ROADBED DITCHES.
 - ALL NECESSARY DRAINAGE FACILITIES TO DIVERT RUNOFF WATER AWAY FROM TRACKS ARE TO BE PROVIDED AS APPROVED BY UNION PACIFIC RAILROAD'S CHIEF ENGINEER OF DESIGN.
 - WALKWAYS WILL BE CONSTRUCTED TO COMPLY WITH STATE REQUIREMENTS.
 - THESE STANDARDS DO NOT APPLY TO ORE AND COAL LINES OR OTHER HEAVILY USED TRACKS.
 - REFER TO EXHIBIT "H" IF LESS THAN 12" OF SUBBALLAST IS TO BE USED.

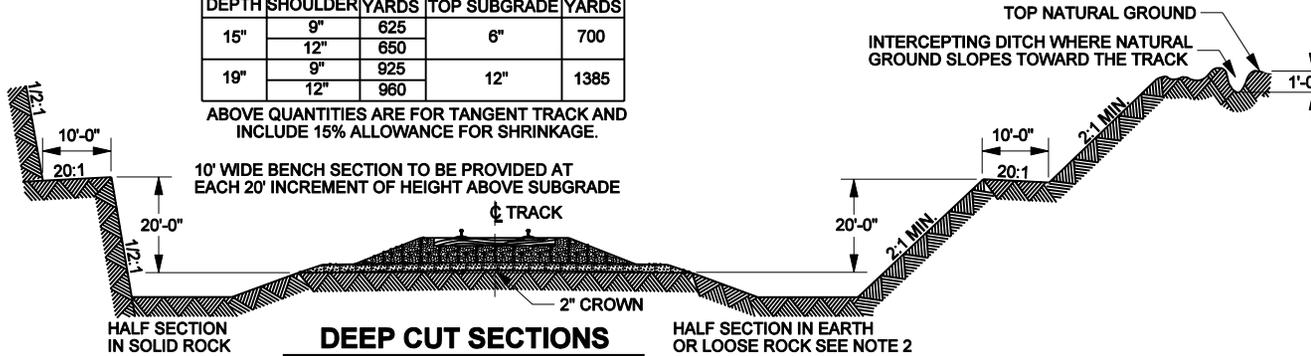
UNION PACIFIC RAILROAD ENGINEERING STANDARDS	
ROADBED SECTION FOR INDUSTRIAL TRACK CONSTRUCTION	
 ADOPTED: AUG. 31, 2004 REVISED: FILE NO.: 0003	STD DWG 0003

STD DWG
0003

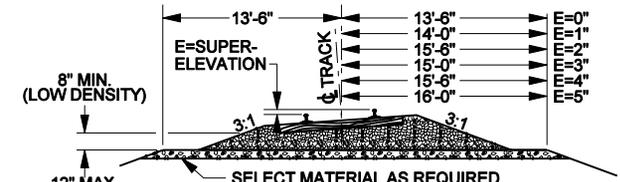
MATERIAL REQUIRED FOR 1000 FEET OF SINGLE TRACK				
BALLAST		SELECTED MATERIAL		
DEPTH	SHOULDER	CUBIC YARDS	DEPTH ABOVE TOP SUBGRADE	CUBIC YARDS
15"	9"	625	6"	700
	12"	650		
19"	9"	925	12"	1385
	12"	960		

ABOVE QUANTITIES ARE FOR TANGENT TRACK AND INCLUDE 15% ALLOWANCE FOR SHRINKAGE.

10' WIDE BENCH SECTION TO BE PROVIDED AT EACH 20' INCREMENT OF HEIGHT ABOVE SUBGRADE



DEEP CUT SECTIONS

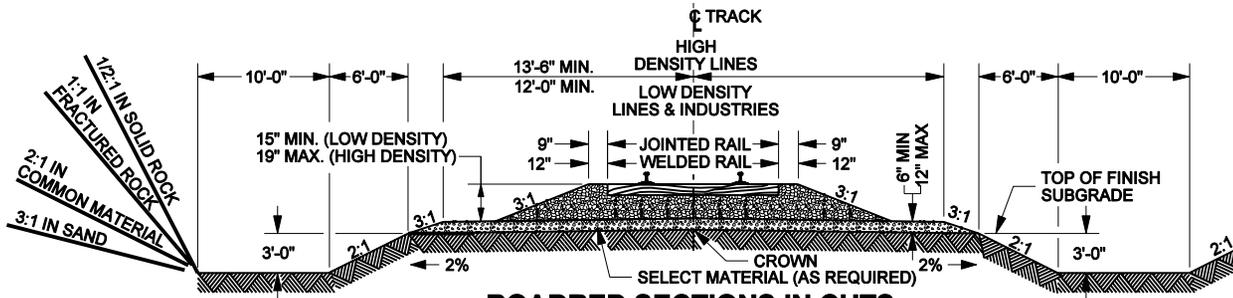


ROADBED SECTION AT CURVED TRACK

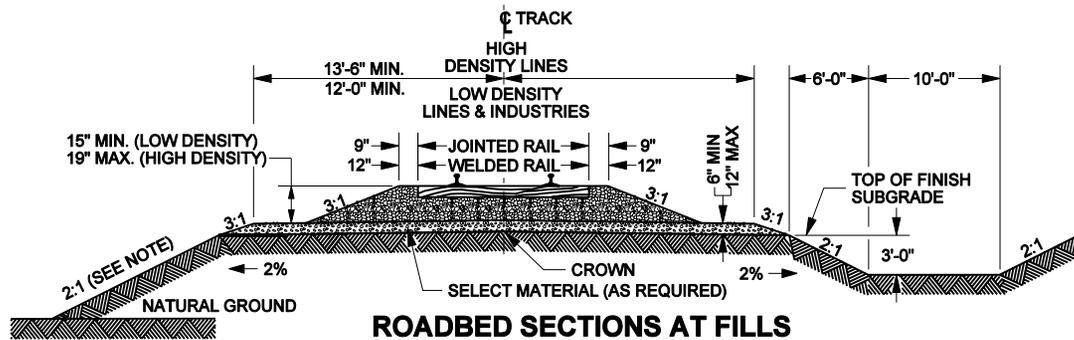
FOR DETAILS NOT SHOWN, SEE CUT AND FILL SECTIONS ELSEWHERE ON THIS SHEET

NOTES:

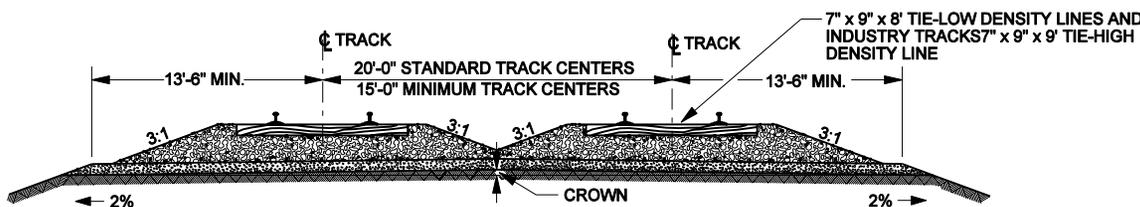
1. THE DEPTH OF BALLAST AND DEPTH OF SELECTED MATERIAL SHALL BE DECIDED ON THE BASIS OF VOLUME OF TRAFFIC AND THE QUALITY OF SELECTED MATERIAL AND SUBGRADE DETERMINED BY THE RAILROAD'S ENGINEER SUBJECT TO THE APPROVAL OF THE CHIEF ENGINEER.
2. SLOPES SHOWN FOR BANKS IN CUTS AND ON FILLS SHALL BE CONSIDERED STANDARD AND GENERALLY USED, BUT MAY BE MODIFIED AS REQUIRED BY LOCAL CONDITIONS AND CHARACTER OF MATERIAL.
3. BALLAST MUST BE EQUALIZED IN ADVANCE OF DRESSING SO THAT FINAL SECTION WILL CONFORM TO SLOPE REQUIREMENTS AND CHARACTER OF MATERIAL.
4. WHERE OFF-TRACK ROADWAY IS TO BE PROVIDED, ADD 10'-0" ADDITIONAL WIDTH TO THE ROADBED SECTION AT TOP OF SELECTED MATERIAL ELEVATION.
5. ALL FILL SLOPES SHALL BE FACED WITH COVER OF MATERIAL SUITABLE FOR GROWING GRASS AND HAVING A THICKNESS OF APPROXIMATELY 6 INCHES. THE OUTER SURFACE OF THIS COVER SHALL COINCIDE WITH THE DESIGN SLOPE OF THE EMBANKMENT. MATERIAL FOR THIS COVER MAY BE OBTAINED FROM STRIPPING.
6. FLOW LINE ON 0.2% MINIMUM GRADE DITCHES AND BENCHES.
7. FLAT BOTTOM DITCHES ARE REQUIRED FOR HIGH DENSITY LINES, HOWEVER A "V" DITCH IS ACCEPTABLE FOR INDUSTRY TRACKS WHEN RIGHT-OF-WAY IS LIMITED AND WHERE LOCAL CONDITIONS AND CHARACTER OF MATERIAL SO REQUIRE.
8. REF U.P. STD DWG PAGE 0001.



ROADBED SECTIONS IN CUTS



ROADBED SECTIONS AT FILLS



BALLAST SECTION FOR TWO TRACKS

STD DWG
0001B

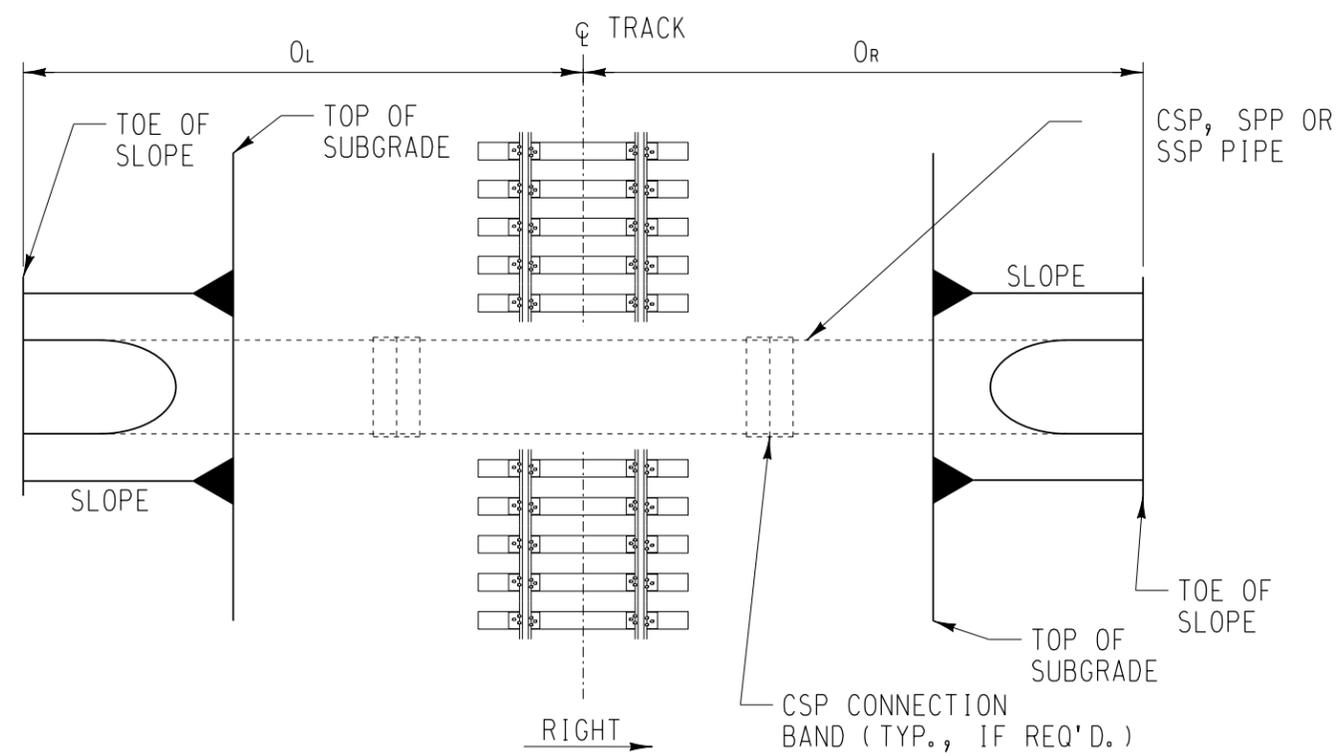
**UNION PACIFIC RAILROAD
ENGINEERING STANDARDS**

**ROADBED SECTION
FOR WOOD TIE
TRACK CONSTRUCTION**

ADOPTED: JAN. 21, 1927
REVISED: SEPT 29, 2006
FILE NO.: 0001B

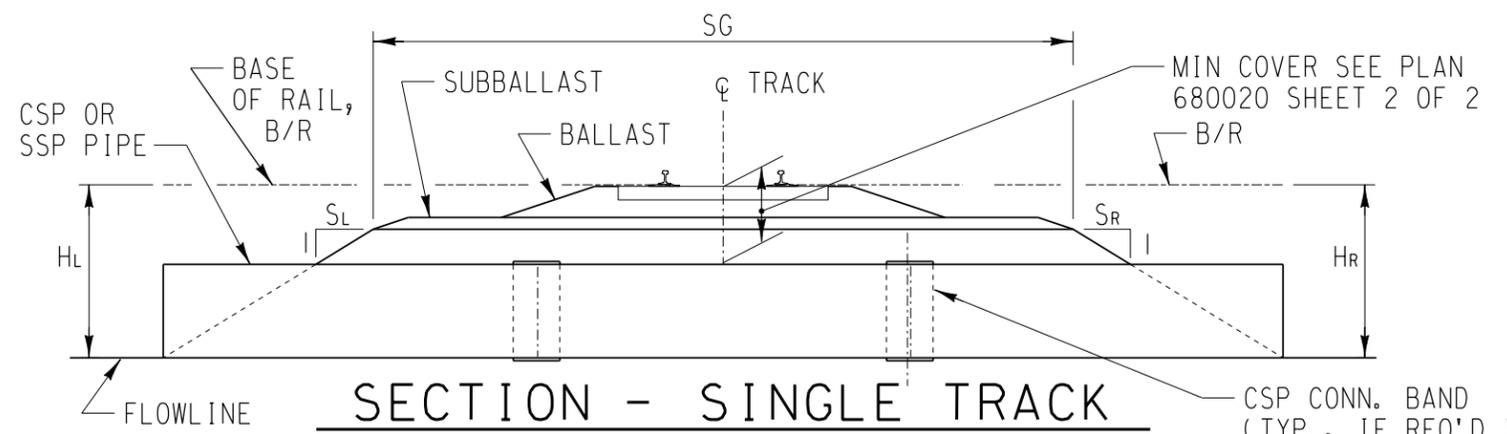
STD DWG
0001B

FILE NAME: p:\ustation\dgn\std\pipe culvert\steel\p ip. dgn



PLAN - SINGLE TRACK

SCALE: NONE



SECTION - SINGLE TRACK

SCALE: NONE

CULVERT LENGTH EQUATION:

$$PL = O_L + O_R = SG + (H_L - 2.0')S_L + (H_R - 2.0')S_R$$

- KEY:**
- H = AVERAGE HEIGHT - BASE OF RAIL TO FLOWLINE
 - H_L = HEIGHT - BASE OF RAIL TO FLOWLINE LEFT OF TRACK
 - H_R = HEIGHT - BASE OF RAIL TO FLOWLINE RIGHT OF TRACK
 - SG = WIDTH OF SUBGRADE = 2 SHOULDER + TRACK CENTER SPACING
 - S_L = SLOPE LEFT OF TRACK
 - S_R = SLOPE RIGHT OF TRACK
 - PL = PIPE LENGTH
 - O_L = OFFSET LEFT
 - O_R = OFFSET RIGHT
- Assume SG = 30'

CULVERT PIPE LENGTH (PL) FOR STANDARD CROSS SECTIONS

H - B/R TO FLOWLINE (FT.)	SINGLE TRACK			13' TRACK CENTERS			20' TRACK CENTERS		
	SLOPE			SLOPE			SLOPE		
	1.5:1	2:1	3:1	1.5:1	2:1	3:1	1.5:1	2:1	3:1
4	36	38	42	50	52	56	58	60	64
5	40	42	48	52	56	62	60	64	70
6	42	46	54	56	60	68	64	68	76
7	46	50	60	58	64	74	66	72	82
8	48	54	66	62	68	80	70	76	88
9	52	58	72	64	72	86	72	80	94
10	54	62	78	68	76	92	76	84	100
11	58	66	84	70	80	98	78	88	106
12	60	70	90	74	84	104	82	92	112
13	64	74	96	76	88	110	84	96	118
14	66	78	102	80	92	116	88	100	124
15	70	82	108	82	96	122	90	104	130
16	72	86	114	86	100	128	94	108	136
17	76	90	120	88	104	134	96	112	142
18	78	94	126	92	108	140	100	116	148
19	82	98	132	94	112	146	102	120	154
20	84	102	138	98	116	152	106	124	160
21	88	106	144	100	120	158	108	128	166
22	90	110	150	104	124	164	112	132	172
23	94	114	156	106	128	170	114	136	178
24	96	118	162	110	132	176	118	140	184
25	100	122	168	112	136	182	120	144	190
26	102	126	174	116	140	188	124	148	196

LENGTHS ARE ROUNDED TO THE NEAREST EVEN NUMBER OF FEET
 TABLE ASSUMES 15'-0" SHOULDER FOR SINGLE TRACK AND 13' CENTERS,
 15'-6" SHOULDER FOR 20' TRACK CENTERS,
 ADD 10' FOR EACH ACCESS ROAD,
 LENGTHS SHOWN ARE FOR STANDARD CROSS SECTIONS FOR TANGENT TRACK,
 ADD 2' TO PIPE LENGTH (TO OUTSIDE OF CURVE) IF SUPER ELEVATION IS 2" OR GREATER.

REVISIONS			DESIGN BY: CLJ	DRAWN BY: KDM	CHECKED BY: CLJ
DATE	LTR.	DESCRIPTION	APPROVED:		
/			 UPRR - MGR'SPECIAL PROJECTS STRUCTURES DESIGN		
/					
/					
/					
/					
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BRIDGE STANDARDS

GENERAL NOTES AND DETAILS FOR ROUND STEEL PIPE CULVERTS

FILE OWNER: UPRR DATE: _____

PLAN NO.: 680000 SHEET: 1 OF 2

GENERAL NOTES

CORROSION PROTECTION:

The engineer shall obtain site specific information on corrosiveness of the soil which may require an increase in material thickness or protective coatings based on local experience.

WELL COMPACTED FILL:

Well compacted fill shall be well graded granular soil free of any organic material, stones larger than 1/2 inches, frozen lumps, debris or excessive moisture. Fill shall be compacted to 95% of maximum dry density as defined in ASTM International D1557 (Modified Proctor). Fill shall be placed and compacted in layers not to exceed 6 inches. Fill shall be placed simultaneously on both sides of the pipe and between multiple pipes. CLSM may be used in lieu of well compacted fill.

CONTROLLED LOW-STRENGTH MATERIAL (CLSM) FILL:

Controlled Low-Strength Material is a self-compacting, cementitious fill material with an unconfined compressive strength of 50 to 300 psi. The mixture shall consist of water, Portland cement, fly ash, and sound fine or coarse aggregate or both. The mix design shall allow adequate flowability without segregation of aggregates. Hardening time is of prime importance and CLSM should develop 50 psi in about one hour. The maximum layer of thickness for CLSM shall be 3 feet. Additional layers shall not be placed until the CLSM has lost sufficient moisture to be walked on without indenting more than two inches. Pipe spacing may be reduced with CLSM.

PIPE BEDDING:

Pipe bedding shall be granular material such as aggregates ordinarily specified and used in the construction of highway base and subbase. These aggregates include crushed stone, natural or crushed gravel, natural or manufactured sands, crushed slag or a homogeneous mixture of these materials. Pipe bedding shall be compacted to 95% of maximum dry density as defined in ASTM International D1557 (Modified Proctor). Recommended gradation is as follows:

SCREEN SIZE	% PASSING (BY WEIGHT)
1 inch	100
1/2 inch	60-90
3/8 inch	20-40
No. 4	10-20
No. 200	less than 5%

Union Pacific sealant ballast, item no. 562-5428, may be used.

FIBER OPTIC CABLE:

Contact the Union Pacific "Call Before You Dig" number 90 days (no less than 60 days) prior to the proposed construction start date. Prior to construction, confirm that all necessary relocations have been completed. The CBYD number is: 1-800-336-9193.

RIPRAP:

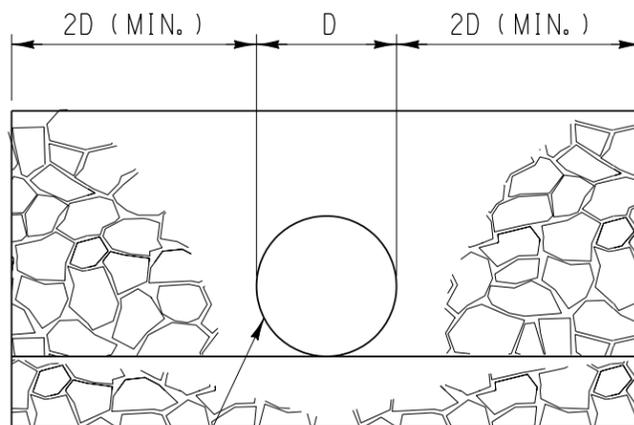
Class of riprap shall be specified by the engineer. Riprap shall be placed in such a manner as to avoid segregation of various sizes of rock, and distributed so that there will be no large accumulation of either the larger or smaller sizes of stone. Individual rocks shall be placed in tight contact with one another in such a way to produce the least amount of void spaces. Riprap shall be solid, unfractured rock or concrete, bulky in shape with sharp angular edges.

Individual rocks shall vary as shown:

RIPRAP CLASS	AVERAGE WEIGHT PER STONE (LBS.)	DIMENSION (INCHES)	ITEM NO.	UNIT OF MEASURE	LAYER THICKNESS	TYPICAL VELOCITIES
I	50 to 200	9 to 14	562-2764	Ton	1'-6"	6 - 8 fps
II	200 to 1,000	14 to 24	562-3430	Ton	2'-0"	8 - 12 fps
III	1,000 to 4,000	24 to 38	562-4096	Ton	3'-0"	> 12 fps
IV	> 4,000	> 38	562-4762	Ton	4'-0"	SPECIAL CASES

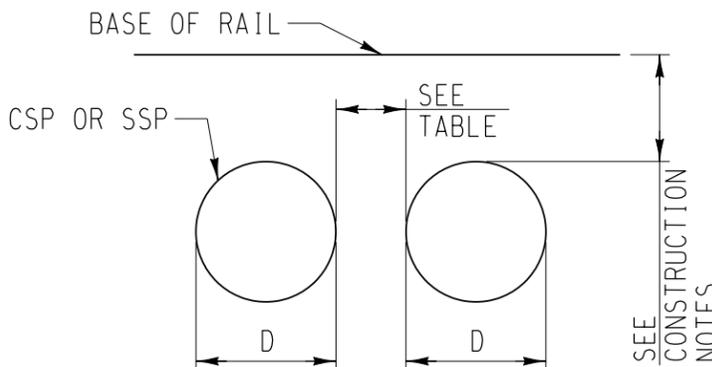
The entire mass of riprap shall well distributed within the limits specified. However, the following allowances shall be acceptable to produce the required riprap protection:

- Riprap Class I - No allowances are permitted
- Riprap Class II - 15% of Riprap Class I.
- Riprap Class III - 15% of Riprap Class I and 15% of Riprap Class II.
- Riprap Class IV - 15% of Riprap Class I, 15% of Riprap Class II, and 15% of Riprap Class III.



RIPRAP - ELEVATION

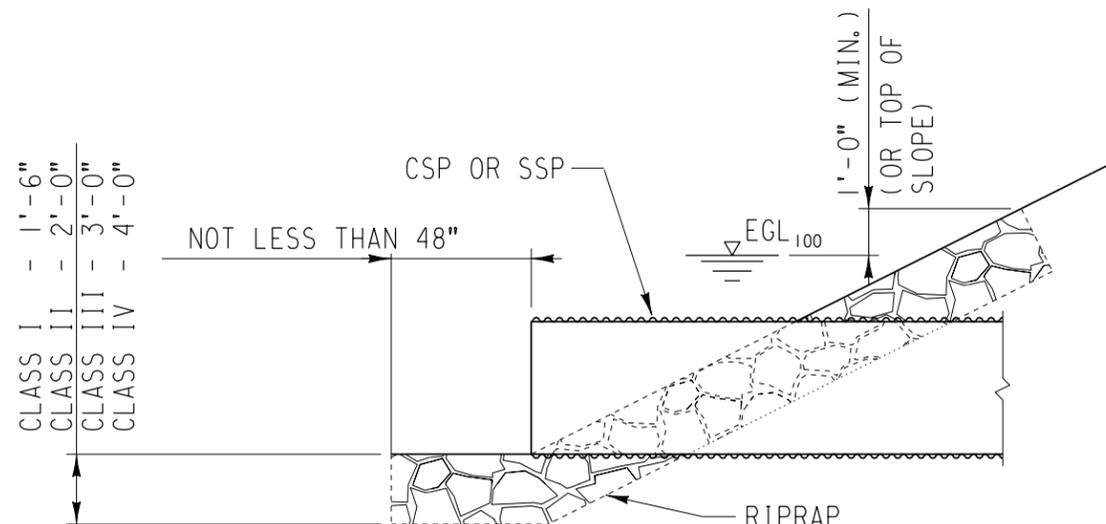
SCALE: NONE



MINIMUM PIPE SPACING AND COVER

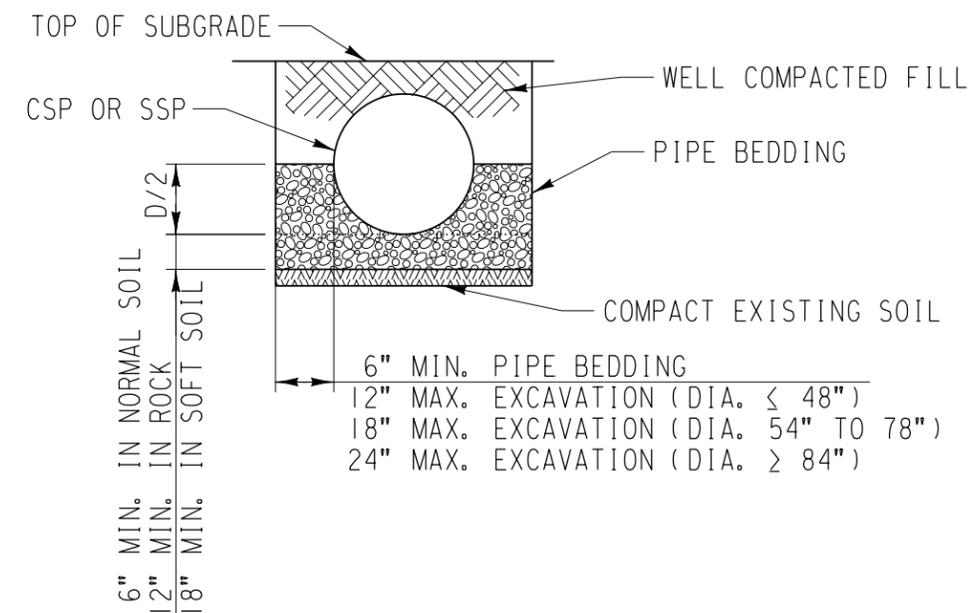
SCALE: NONE

SPACING CHART	
PIPE DIAMETER	MIN. SPACING BETWEEN PIPES
12" to 24"	12"
24" to 96"	D/2
96" OR MORE	48"



RIPRAP - SECTION

SCALE: NONE



EXCAVATION AND FILL LIMITS

SCALE: NONE

REVISIONS			DESIGN BY: CLJ	DRAWN BY: KDM	CHECKED BY: CLJ
DATE	LTR.	DESCRIPTION	APPROVED:		
/			 UPRR - MGR SPECIAL PROJECTS STRUCTURES DESIGN		
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BRIDGE STANDARDS

GENERAL NOTES AND DETAILS FOR ROUND STEEL PIPE CULVERTS

FILE OWNER: UPRR DATE: _____
 PLAN NO.: 680000 SHEET: 2 OF 2

FILE NAME: p:\ustation\dgn\std\Pipe culvert\steel\pip.dgn

CONSTRUCTION NOTES

GENERAL:

These structures are designed for Cooper E80 live load with impact, and cover as shown in Table 1.

Generally, 30 inch diameter and larger Corrugated Steel Pipe (CSP) is preferred for mainline culverts. Smaller pipes are to be used for local drainage.

Table 1 indicates the minimum required gage thickness for structural stability.

INSTALLATION:

1. Installation of CSP shall conform to the current American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering, Chapter 1, Part 4. Culvert lengths are to be based on standard mainline roadbed sections.
2. These standards are for installation in soil with a pH of 5-9 and resistivity $\geq 1,500$ ohm-cm. Pipes located in soils outside this range shall have additional corrosion protection as specified by the engineer.
3. Wire or timber strutting used during installation must be removed immediately after installation and backfill are complete.
4. Pipe culverts will generally be joined using 2 foot wide locking corrugated metal connecting bands. The inside of corrugated connecting bands and the outside of pipe culverts to be joined by corrugated connecting bands shall be kept clean and free of all rust, dirt or gravel. The corrugations on the connecting bands and the pipe culvert shall fit snugly as the connecting bands are tightened.
5. Corrugated steel pipe culverts must be placed with the inside circumferential laps pointing downstream.
6. Culverts resting on rock foundation need not be cambered. Unless otherwise specified by the engineer all other CSP culverts shall be cambered in accordance with the following:
 - A. Embankments up to 8 feet high (measured base of rail to flowline) require a $1\frac{1}{2}$ inch camber.
 - B. Embankments 8 feet to 12 feet high require a $2\frac{1}{2}$ inch camber.
 - C. Embankments 12 feet to 18 feet high require a 4 inch camber.

In no case shall the culvert be cambered so high in the center that water will be pocketed at the inlet end of the pipe.

PIPE MATERIAL SPECIFICATIONS, FABRICATION AND TOLERANCE:

1. CSP material shall be in accordance with the current AREMA Manual for Railway Engineering, Chapter 1, Part 4, Section 3.
2. The pipe shall be fabricated, assembled into sections and furnished as follows:

12", 18", 21", AND 24" DIAMETER ONLY:

Class 1 with $2\frac{2}{3}$ " x $\frac{1}{2}$ " annular corrugations. Shape 1, vertical elongation is not required. Single riveted longitudinal seams.

30" DIAMETER AND GREATER:

Class 1 with 3" x 1" annular corrugations (30 inch pipes may have $2\frac{2}{3}$ " x $\frac{1}{2}$ " annular corrugations). Shape 2, factory elongated with vertical length 5% greater than the nominal diameter. Double riveted seams.

ALL CSP DIAMETERS:

Square cut ends.
Two lifting lugs per preassembled section.
Lifting hardware for erection and installation.
Aluminized Type 2 per American Association of State Highway and Transportation Officials (AASHTO) M274 (96 inch diameter pipes shall be galvanized).

3. Permanently attach an identification plate inside the pipe near the end of the segment. The plate is to contain the following information in at least $\frac{1}{4}$ inch high letters:
 - Name of manufacturer and plant location
 - Date assembled
 - Gage
 - Diameter
 - Length

The same information plus the lifting weight shall be stenciled on the outside face of the pipe.
4. The inside diameter of the circular pipe shall not vary more than $\frac{1}{2}$ inch from the nominal diameter when measured on the inside crest of the corrugations for diameters through 48 inches, and 1% for diameters greater than 48 inches. In no case shall the difference in the diameter of the abutting pipe ends be more than $\frac{1}{2}$ inch.
5. The minimum width of the longitudinal lap is $1\frac{1}{2}$ inches for all pipes with nominal inside diameter of 12 to 21 inches, 2 inches for pipes with nominal inside diameter of 24 inches or 30 inches, and 3 inches for all pipes with nominal inside diameter of 36 inches or greater.

6. Riveted Seams:

- A. All 14 gage pipe shall have at least $\frac{5}{16}$ inch diameter rivets. All 12 gage and thicker pipe shall have at least $\frac{7}{16}$ inch diameter rivets.
 - B. Longitudinal seams shall be riveted with one rivet in each corrugation valley for all pipes 24 inches in diameter and smaller. Longitudinal seams shall be riveted with two rivets in each corrugation valley for all pipes larger than 24 inches. Circumferential seams shall be riveted with a maximum rivet spacing of six inches.
 - C. All rivets shall be cold driven in such a manner that the metal shall be drawn tightly together throughout the entire lap. The center of each rivet shall not be closer than two rivet diameters from the edge of the sheet. All rivets shall have full hemispherical heads or heads of a form acceptable to the engineer. They shall be driven in a workmanlike manner to completely fill the hole without bending.
 - D. Rivets shall conform to the specifications of ASTM International A31, Grade A and shall be electroplated in accordance with the specifications of ASTM International A164, Type RS.
7. Pipes shall be jointed with locking coupling bands in accordance with the provisions of the AREMA Manual for Railway Engineering Chapter 1, Part 4, Section 4.3.4. Coupling bands shall be of the same base metal and finish as the pipe. Coupling bands shall be 24 inches wide for pipes 30 inch diameter and larger. Smaller pipes may use 7 inch wide bands. Coupling band thickness is shown in Table 1.

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	BRIDGE STANDARDS
CONSTRUCTION NOTES AND TABLE FOR CORRUGATED STEEL PIPE CULVERTS	
FILE OWNER: UPRR	DATE:
PLAN NO.: 680020	SHEET: 1 OF 2

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TABLE I - ROUND CORRUGATED STEEL PIPE (CSP)

INSIDE PIPE DIAMETER	GAGE	THICKNESS (IN.)	WEIGHT (LB./FT.)	COVER *		10'-0" LENGTH		12'-0" LENGTH		14'-0" LENGTH		16'-0" LENGTH		18'-0" LENGTH		20'-0" LENGTH		22'-0" LENGTH		24'-0" LENGTH		CONNECTING BANDS	
				MIN. (FT.)	MAX. (FT.)	ITEM NO.	WEIGHT (LB.)	ITEM NO.	WEIGHT (LB.)														
12"	14	0.079	12	1'-6"	18'-0"	510-2975	120	510-2976	144	-	168	-	192	-	216	510-2977	240	-	264	510-2978	288	-	16
18"	14	0.079	18	1'-6"	18'-0"	510-2979	180	510-2980	216	-	252	-	288	-	324	510-2981	360	-	396	510-2982	432	-	16
21"	14	0.079	21	1'-6"	18'-0"	510-2983	210	510-2984	252	-	294	-	336	-	378	510-2985	420	-	462	510-2986	504	-	16
24"	14	0.079	24	1'-6"	18'-0"	510-2987	240	510-2988	288	-	336	-	384	-	432	510-2989	480	-	528	510-2990	576	510-3123	16
30"	14	0.079	30	1'-6"	18'-0"	-	300	-	360	510-3045	420	510-3046	480	510-3047	540	510-3048	600	510-3049	660	510-0345	720	510-3124	16
36"	14	0.079	41	2'-6"	18'-0"	-	410	-	492	510-3055	574	510-3065	656	510-3066	738	510-3067	820	510-3068	902	510-3069	984	510-3130	16
42"	14	0.079	47	2'-6"	18'-0"	-	470	-	564	510-3073	658	510-3074	752	510-3075	846	510-3077	940	510-3078	1,034	510-3079	1,128	510-3132	16
48"	12	0.109	74	2'-6"	18'-0"	-	740	-	888	510-3081	1,036	510-3082	1,184	510-3083	1,332	510-3084	1,480	510-3085	1,628	510-3086	1,776	510-3138	14
60"	12	0.109	92	2'-6"	18'-0"	-	920	-	1,104	510-3087	1,288	510-3088	1,472	510-3089	1,656	510-3091	1,840	510-3092	2,024	510-3093	2,208	510-3150	14
72"	10	0.138	140	3'-6"	18'-0"	-	1,400	-	1,680	510-3100	1,960	510-3101	2,240	510-3102	2,520	510-3103	2,800	510-3104	3,080	510-3105	3,360	510-3158	12
84"	10	0.138	164	3'-6"	18'-0"	-	1,640	-	1,968	510-3114	2,296	510-3115	2,624	510-3110	2,952	510-3117	3,280	510-3118	3,608	510-3113	3,936	510-3176	12
96"	8	0.168	228	3'-6"	18'-0"	-	2,280	-	2,736	510-3181	3,192	510-3182	3,648	510-3183	4,104	510-3184	4,560	510-3185	5,016	510-3186	5,472	510-3188	10

* COVER TO BE MEASURED FROM BASE OF RAIL TO TOP OF PIPE

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BRIDGE STANDARDS

CONSTRUCTION NOTES AND TABLE FOR CORRUGATED STEEL PIPE CULVERTS

FILE OWNER: UPRR DATE: _____
 PLAN NO.: 680020 SHEET: 2 OF 2

CONSTRUCTION NOTES

GENERAL:

These structures are designed for Cooper E80 Live Load with impact, and cover as shown in Table 1.

Table 1 indicates the minimum required thickness.

INSTALLATION:

Installation of Smooth Steel Pipe (SSP) shall conform to the current American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering, Chapter 1, Part 4. Culvert lengths are to be based on standard mainline roadbed sections.

JACKING:

Where indicated, pipe to be bored and jacked into place. Bore hole diameter shall be essentially the same as the outside diameter of the pipe. If voids should develop or if the bored hole diameter is greater than the outside diameter of the pipe by more than 1 inch, notify the Office of AVP Engineering Design. Boring operations shall not be stopped if such a stoppage would be detrimental to the railroad. A survey crew shall continually monitor the elevation and alignment of the railroad track(s) above during the jacking procedures. If track movement or loss of ballast exceeds 1/4 inch during jacking or boring operations, all work must stop and the Railroad notified. The Railroad may take any action necessary to ensure safe passage of trains. The contractor must immediately submit a corrective plan of action to the Railroad for review and approval. The Railroad must review and approve the proposed repair procedure. The finished repair must be inspected by the Railroad before the track can be placed back into service, and the construction proceed.

BORED AND JACKED TOLERANCE:

The permitted tolerance of a true line is +/- 2". Adjustment to the line and level should be gradual to ensure that the pipe manufacture's stated angular deflection is not exceeded at any joint.

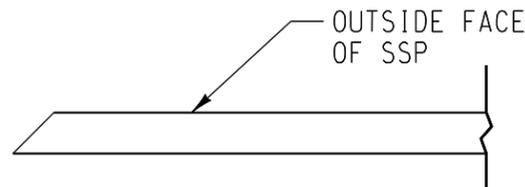
FIELD WELDING:

Welders must possess valid certification.

MATERIALS:

Pipe shall be in accordance with ASTM International A139. Pipe to be Grade B and steel shall have a minimum yield strength of 35 ksi. A hydrostatic test is not required.

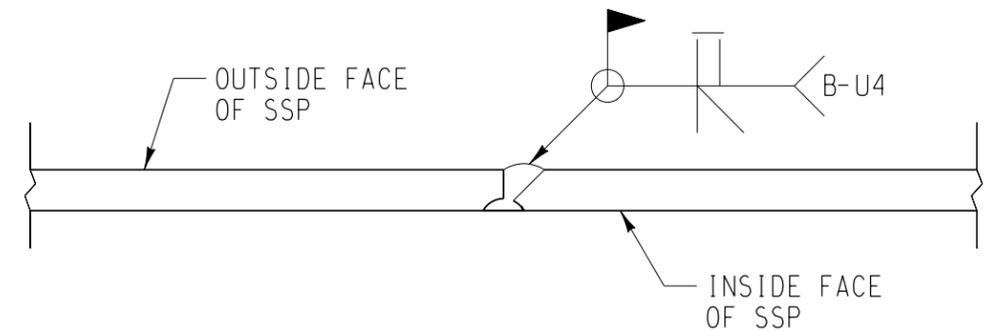
Smooth steel pipe shall have a welded straight longitudinal seam. The ends of each section of pipe shall be square cut. One end shall be suitably beveled for field welding sections together.



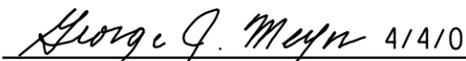
PIPE END BEVEL DETAIL

OUTSIDE PIPE DIAMETER	THICKNESS (IN.)	WEIGHT (LB./FT.)	COVER *		20'-0" LENGTH	
			MIN. (FT.)	MAX. (FT.)	STORE ITEM NUMBERS	WEIGHT (LB.)
12"	3/16	24	1'-6"	18'-0"	-	480
18"	1/4	48	1'-6"	18'-0"	-	960
21"	5/16	69	1'-6"	18'-0"	-	1,380
24"	5/16	80	1'-6"	18'-0"	-	1,600
30"	3/8	119	1'-6"	18'-0"	-	2,380
36"	1/2	190	1'-6"	18'-0"	510-3285	3,800
42"	1/2	222	1'-6"	18'-0"	-	4,440
48"	5/8	317	1'-6"	18'-0"	510-3293	6,340
60"	3/4	475	1'-6"	18'-0"	-	9,500
72"	7/8	666	1'-6"	18'-0"	-	13,320
84"	1	888	1'-6"	18'-0"	-	17,760
96"	1 1/4	1,267	1'-6"	18'-0"	-	25,340

* COVER TO BE MEASURED FROM BASE OF RAIL TO TOP OF PIPE



PIPE END WELD DETAIL

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 BRIDGE STANDARDS	
CONSTRUCTION NOTES AND TABLE FOR SMOOTH STEEL PIPE CULVERTS	
FILE OWNER: UPRR	DATE:
PLAN NO.: 680010	SHEET: 1 OF 1

FILE NAME: p:\ustation\dgn\std\Pipe culvert\steel\ip.dgn

CONSTRUCTION NOTES

GENERAL:

These structures are designed for Cooper E80 Live Load with impact, and cover as shown in Table 1.

Table 1 indicates the minimum required thickness for structural stability based on the assumptions listed below. The required gage thickness for structural steel plate pipe includes an allowance for corrosion.

DESIGN ASSUMPTIONS:

Backfill Unit Weight = 120 pcf.
 Factors of Safety: Seam Strength = 3, Wall Area = 2, Buckling = 2
 Minimum Yield Point: Steel = 33 ksi.
 Modulus of Elasticity: Steel = 29,000 ksi.
 Minimum Tensile Strength: Steel = 45 ksi

INSTALLATION:

- Installation of SPP shall conform to the current American Railway Engineering and Maintenance-of-Way Association (AREMA) Manual for Railway Engineering, Chapter 1, Part 4. Culvert lengths are to be based on standard mainline roadbed sections.
- These standards are for installation in soil with a pH of 5-9 and resistivity $\geq 1,500$ ohm-cm. Pipes located in soils outside this range shall have additional corrosion protection as specified by the engineer.
- Wire or timber strutting used during installation must be removed immediately after installation and backfill are complete.
- Structural plate pipe culverts must be placed with the inside circumferential laps pointing downstream.
- Culverts resting on rock foundation need not be cambered. Unless otherwise specified by the engineer all other SPP culverts shall be cambered in accordance with the following:
 - Embankments up to 8 feet high (measured base of rail to flowline) require a 1/2 inch camber.
 - Embankments 8 feet to 12 feet high require a 2/2 inch camber.
 - Embankments 12 feet to 24 feet high require a 4 inch camber.
 - Embankments 24 feet to 36 feet high require a 6 inch camber.

In no case shall the culvert be cambered so high in the center that water will be pocketed at the inlet end of the pipe.

MATERIALS:

- SPP material and connecting material shall be in accordance with the current AREMA Manual for Railway Engineering, Chapter 1, Part 4, Section 6.
- The pipe shall be fabricated, assembled into sections and furnished as follows:
 - 6" x 2" annular corrugations.
 - 5% vertical elongation.
 - A minimum of 4 steel bolts per foot
- Permanently attach an identification plate inside the pipe near the end of each pipe run. The plate is to contain the following information in at least 1/4 inch high letters:
 - Name of manufacturer and plant location
 - Date manufactured
 - Gage
 - Diameter
 - Length

STRUCTURAL PLATE PIPE - STEEL GAGE TABLE FOR E-80 LOADS

DIA. (IN.)	HEIGHT OF COVER (FT.) - BASE OF RAIL TO TOP OF PIPE														
	3 1/2-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75
60	10	10	10	10	10	10	10	10	10	8	8	8	8	7	7
66	10	10	10	10	10	10	10	10	8	8	8	8	7	7	7
72	10	10	10	10	10	10	10	8	8	8	8	7	7	7	5
78	10	10	10	10	10	10	10	8	8	8	7	7	7	5	5
84	10	10	10	10	10	10	8	8	8	7	7	7	5	5	3
90	8	10	10	10	10	10	8	8	8	7	7	5	5	3	3
96	8	10	10	10	10	8	8	8	7	7	7	5	3	3	1
102	8	10	10	10	10	8	8	8	7	7	5	5	3	1	1
108	8	10	10	10	8	8	8	7	7	5	5	3	1	1	
114	8	8	10	10	8	8	8	7	7	5	3	3	1	1	
120	8	8	10	10	8	8	7	7	5	5	3	1	1		
126	7	8	10	8	8	8	7	7	5	3	3	1			
132	7	8	10	8	8	8	7	7	5	3	1	1			
138	7	8	10	8	8	7	7	5	3	3	1				
144	7	8	8	8	8	7	7	5	3	1	1				
150	7	8	8	8	8	7	7	3	3	1					
156	7	8	8	8	7	7	5	3	1	1					
162	5	7	8	8	7	7	5	3	1						
168	5	7	8	8	7	5	3	3	1						
174	5	7	8	7	7	5	3	1	1						
180	5	7	8	7	7	5	3	1							
186	3	7	8	7	7	5	3	1							
192	3	7	8	7	7	3	3	1							
198	3	7	8	7	5	3	1								
204	1	5	7	7	5	3	1								
210	1	5	7	7	3	1									
216		3	7	5	3	1									
222		3	7	5	3	1									
228		3	5	3	1										
234		1	5	3	1										
240		1	3	1											

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APPROVED:

George J. Meyer 4/4/08

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BRIDGE STANDARDS

CONSTRUCTION NOTES AND TABLE FOR STRUCTURAL PLATE PIPE CULVERTS

FILE OWNER: UPRR DATE:

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