

**NOTES**

**APPLICATION:** Provide Full Height Headwalls for skewed and non-skewed culverts having a diameter or rise of 42" to 84" inclusive. Use Type "A" when the skew angle ( $\theta$ ) is ten degrees or less and Type "B" when the skew angle is over ten degrees.

**DESIGN DATA:** The following design data is assumed:

- Internal Angle of Friction of Backfill Soil,  $\phi_{br} = 30^\circ$
- Total Unit Weight of Backfill Soil = 120 pcf
- Internal Angle of Friction (Drained), Foundation Soil,  $\phi_r = 28^\circ$
- Undrained Shear Strength (Cohesive), Foundation Soil,  $S_{ur} = 1500$  psf
- Unit Weight of Concrete = 150 pcf
- Slope of Backfill = 2:1

Concrete Class QC1 - Compressive Strength = 4000 psi

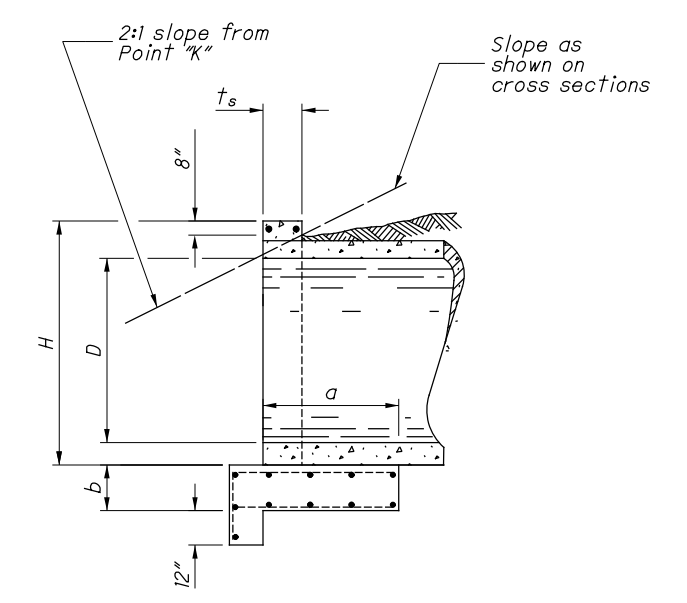
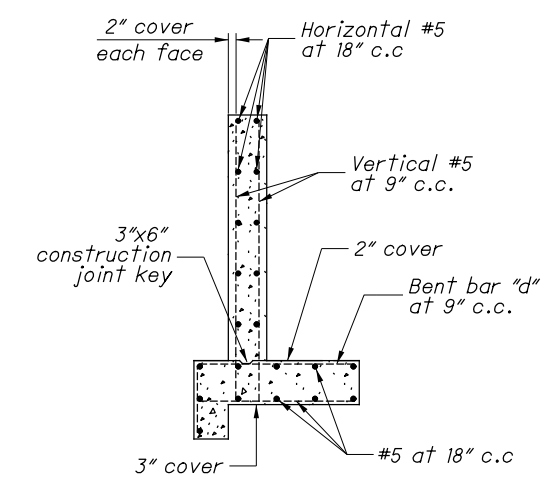
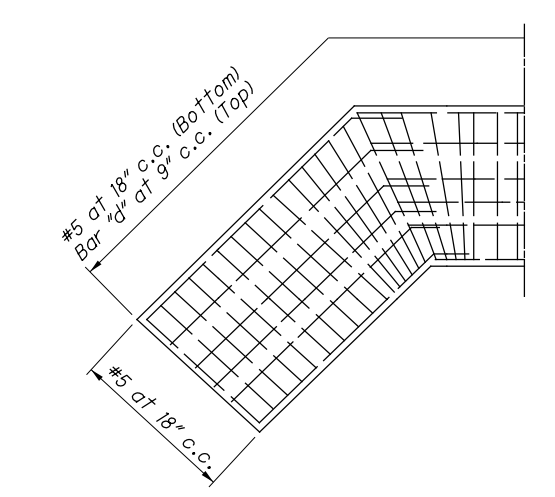
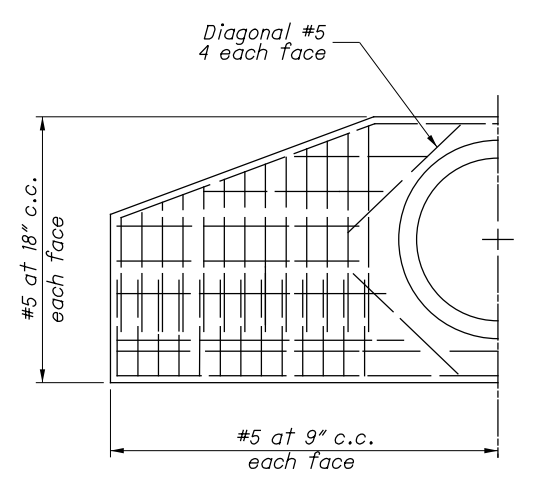
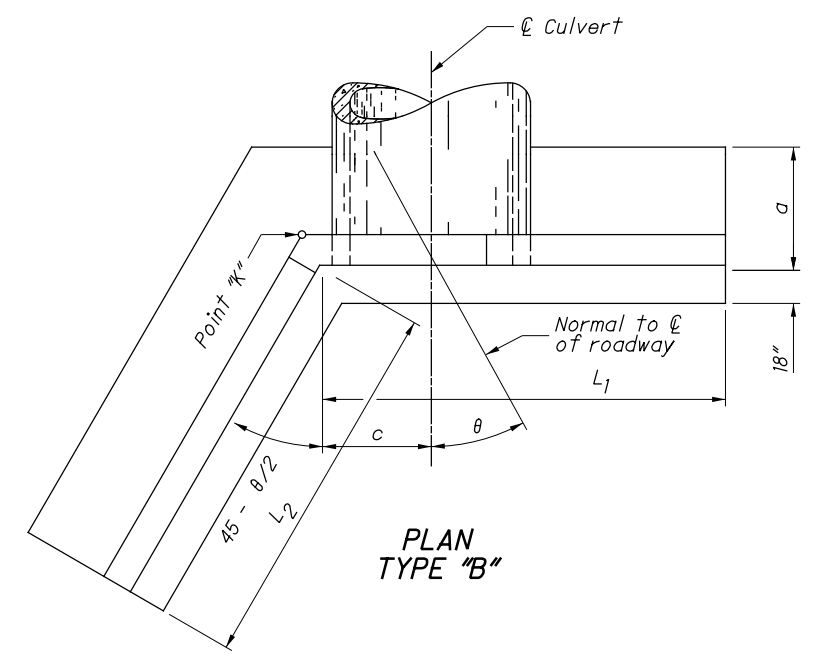
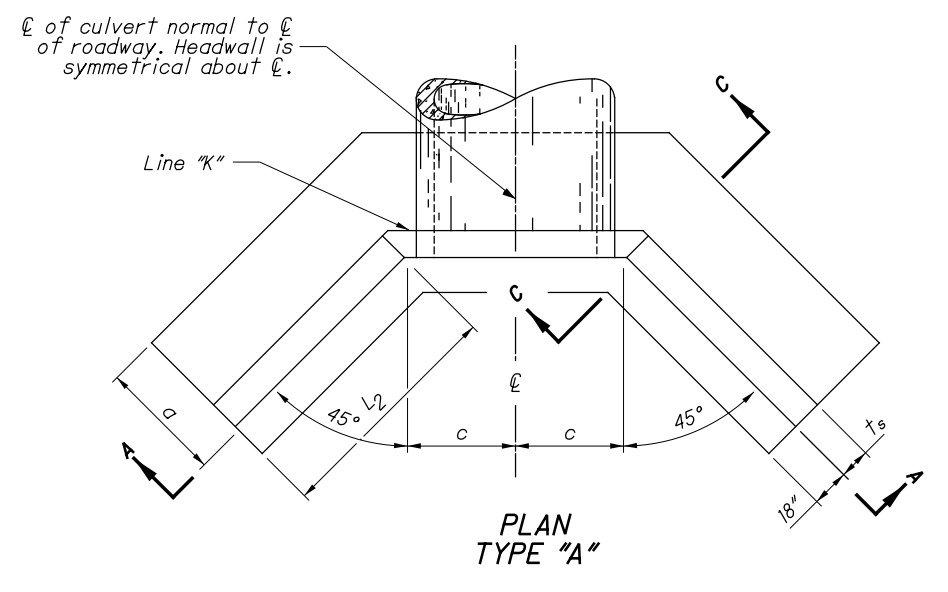
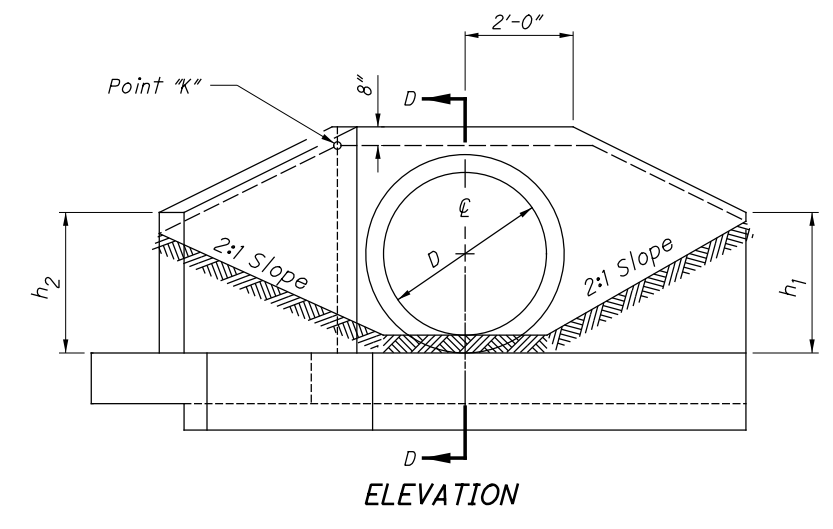
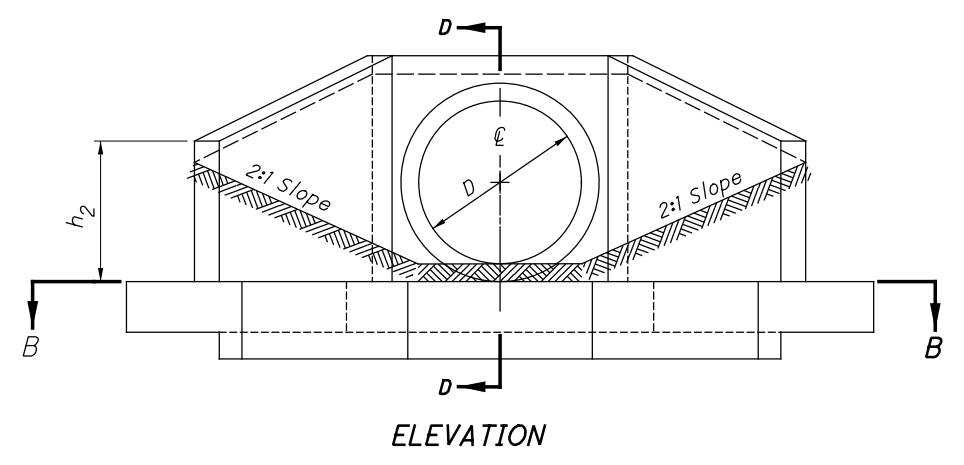
Reinforcing Steel - Grade 60 Minimum Yield Strength  
60,000 psi (All Reinforcing Shall be Epoxy Coated.)

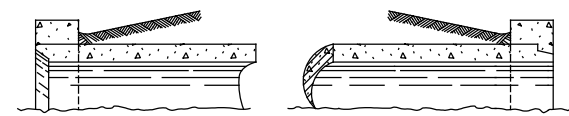
Based on the assumed design data, the headwalls for the standard design achieve factored bearing resistances that are greater than their respective factored bearing pressures. If a backfill material with a higher internal angle of friction or a lighter total unit weight is used; or if a foundation soil with a higher drained internal angle of friction or a higher undrained shear strength is encountered; then the stability of the wall is satisfactory.

**DETAILS AND QUANTITIES:** Are shown for circular sections only. When used with reinforced elliptical concrete pipe or corrugated metal pipe arches, adjust dimensions and quantities to conform to those listed for the nearest size circular pipe. Apply the dimensions established by vertical diameter to span. Round all calculated dimensions established by horizontal diameter to the nearest 1". Chamfer all exposed corners  $\frac{3}{4}$ ".

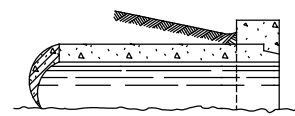
**HEADWALL LOCATION:** Determine by intersection of the embankment slope at the back of the headwall at point "K". Provide 2:1 slopes adjacent to the headwall.

**PAYMENT:** Item 602 Concrete Masonry includes reinforcing.



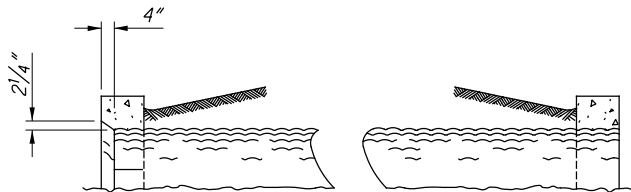


INLET END  
GROOVE OR BELL  
UPSTREAM



OUTLET END

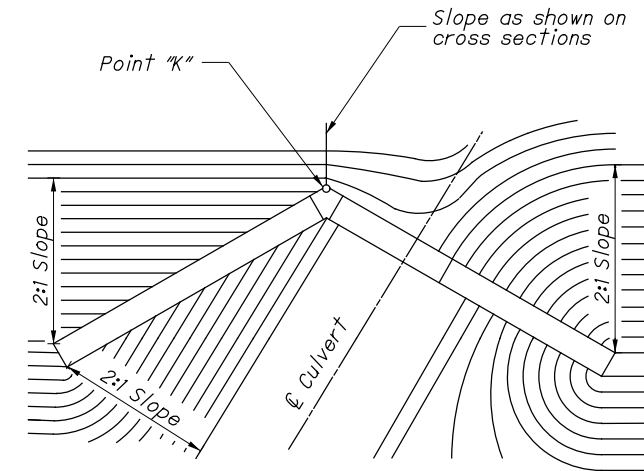
RIGID PIPE



INLET END

OUTLET END

CORRUGATED PIPE  
END TREATMENT OF HEADWALL



LOCATION AND GRADING PLAN FOR  
SKEWED PIPE CULVERT - TYPE B

FULL-HEIGHT HEADWALLS (English)

PIPE DIA. D	H	a	b	c	t <sub>s</sub>	Bar# d	θ ≈ 0°			θ ≈ 15°			θ ≈ 30°			θ ≈ 45°			PIPE DIA. D														
							L <sub>2</sub>	h <sub>2</sub>	Conc. CMP (cy)	Conc. RCP (cy)	Steel (lbs.)	L <sub>1</sub>	L <sub>2</sub>	h <sub>1</sub>	h <sub>2</sub>	Conc. CMP (cy)	Conc. RCP (cy)	Steel (lbs.)		L <sub>1</sub>	L <sub>2</sub>	h <sub>1</sub>	h <sub>2</sub>	Conc. CMP (cy)	Conc. RCP (cy)	Steel (lbs.)							
42"	5'-4"	3'-3"	1'-6"	2'-6"	1'-6"	#5	3'-7"	3'-6"	7.2	7.1	695	8'-9"	4'-6"	4'-1"	3'-7"	7.6	7.5	656	7'-10"	5'-9"	3'-7"	3'-8"	7.8	7.7	688	7'-10"	7'-9"	3'-7"	3'-8"	9.0	8.9	794	42"
48"	5'-10"	3'-6"	1'-6"	2'-9"	1'-6"	#5	4'-4"	3'-9"	8.8	8.6	861	10'-0"	5'-4"	4'-6"	3'-10"	9.3	9.1	806	8'-9"	6'-10"	3'-10"	3'-11"	9.4	9.2	833	8'-9"	9'-2"	3'-10"	4'-0"	10.9	10.8	970	48"
54"	6'-5"	3'-9"	1'-6"	3'-0"	1'-6"	#5	5'-2"	4'-2"	10.8	10.5	1,001	11'-4"	6'-3"	5'-0"	4'-2"	11.3	11.0	977	9'-8"	7'-11"	4'-2"	4'-3"	11.2	11.0	1,002	9'-8"	10'-7"	4'-2"	4'-4"	13.1	12.9	1,149	54"
60"	7'-0"	4'-0"	1'-6"	3'-3"	1'-6"	#5	5'-11"	4'-5"	12.7	12.4	1,151	12'-7"	7'-2"	5'-4"	4'-6"	13.4	13.1	1,127	10'-7"	9'-0"	4'-4"	4'-7"	13.2	12.9	1,124	10'-7"	12'-0"	4'-4"	4'-7"	15.4	15.1	1,306	60"
72"	8'-2"	4'-6"	1'-7"	3'-9"	1'-6"	#7	7'-5"	5'-0"	17.5	17.1	1,808	15'-1"	8'-11"	6'-2"	5'-1"	18.5	18.0	1,803	12'-5"	11'-2"	4'-10"	5'-2"	18.0	17.5	1,770	12'-5"	14'-10"	4'-10"	5'-3"	21.0	20.6	2,080	72"
84"	9'-4"	5'-0"	1'-10"	4'-3"	1'-6"	#8	9'-0"	5'-8"	24.6	24.0	2,608	17'-7"	10'-9"	7'-0"	5'-9"	25.7	25.1	2,563	14'-7"	13'-4"	5'-6"	5'-10"	25.1	24.5	2,559	14'-3"	17'-8"	5'-4"	5'-10"	28.9	28.3	2,943	84"