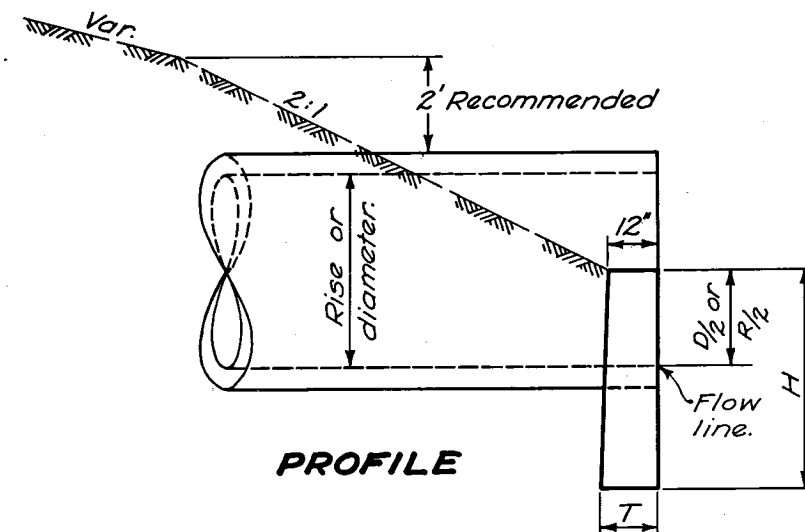
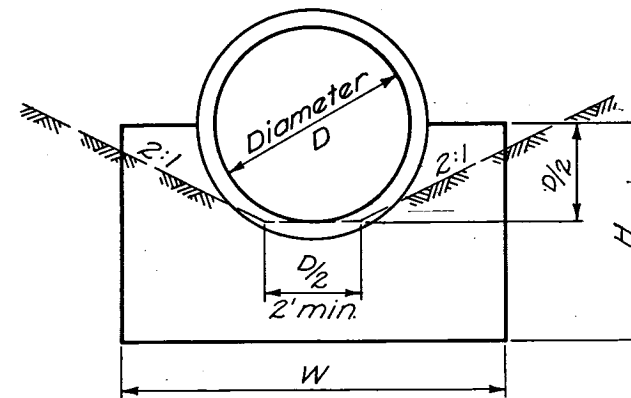
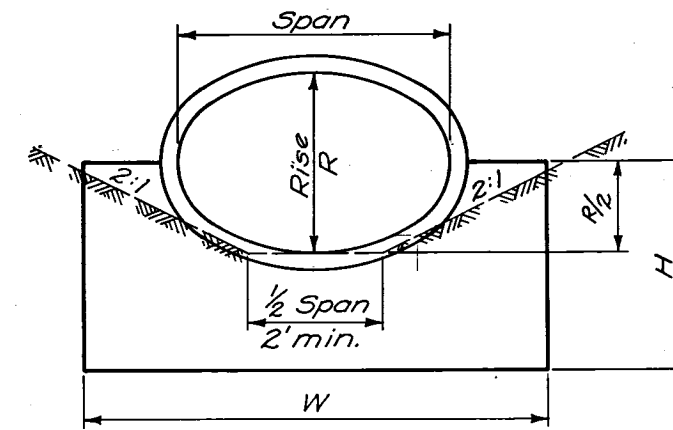




PROFILE



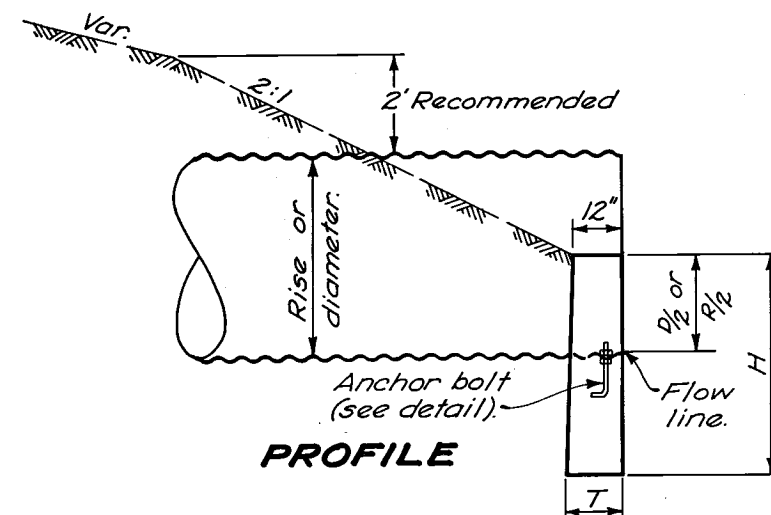
CIRCULAR
CONCRETE PIPE



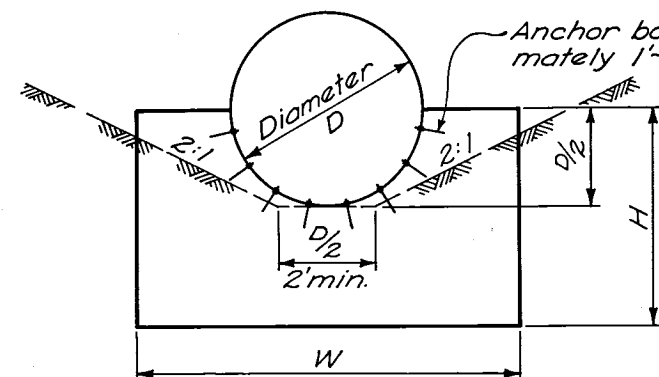
ELLIPTICAL

HEADWALL FOR CONCRETE PIPE									
CIRCULAR					ELLIPTICAL				
D	W	H	T	Conc. Cu. Yds.	Span	Rise	W	H	T
12"	2'-0"	3'-0"	12"	.20					
15"	2'-6"	3'-2"	12"	.25					
18"	3'-0"	3'-3"	12"	.31	23"	14"	3'-5"	3'-2"	12"
21"	3'-6"	3'-4"	12"	.37					
24"	4'-0"	3'-6"	12"	.43	30"	19"	4'-2"	3'-4"	12"
27"	4'-6"	3'-8"	12"	.49	34"	22"	4'-7"	3'-5"	12"
30"	5'-0"	3'-9"	12"	.56	38"	24"	5'-0"	3'-6"	12"
33"	5'-6"	3'-10"	12"	.62	42"	27"	5'-5"	3'-7"	12"
36"	6'-0"	4'-0"	12"	.69	45"	29"	5'-10"	3'-8"	12"
39"	6'-6"	4'-2"	12"	.77	49"	32"	6'-6"	3'-10"	12"
42"	7'-0"	4'-3"	12"	.84	53"	34"	7'-2"	4'-0"	14"
48"	8'-0"	4'-6"	14"	1.09	60"	38"	8'-5"	4'-2"	14"
54"	9'-3"	4'-9"	14"	1.32	68"	43"	9'-8"	4'-4"	16"
60"	10'-6"	5'-6"	16"	1.93	76"	48"	11'-0"	5'-0"	16"
66"	11'-9"	5'-9"	18"	2.42	83"	53"	12'-4"	5'-2"	18"
72"	13'-0"	6'-0"	18"	2.77	91"	58"	13'-7"	5'-5"	18"
78"	14'-3"	6'-3"	20"	3.37	98"	63"	14'-10"	5'-7"	20"
84"	15'-6"	6'-6"	22"	4.05	106"	68"	16'-2"	5'-10"	20"
90"	16'-9"	6'-9"	22"	4.51	113"	72"	17'-6"	6'-0"	22"
96"	18'-0"	7'-0"	24"	5.31					
102"	19'-3"	7'-3"	26"	6.20					
108"	20'-6"	7'-6"	26"	6.78					
114"	21'-9"	7'-9"	28"	7.81					
120"	23'-0"	8'-0"	30"	8.93					

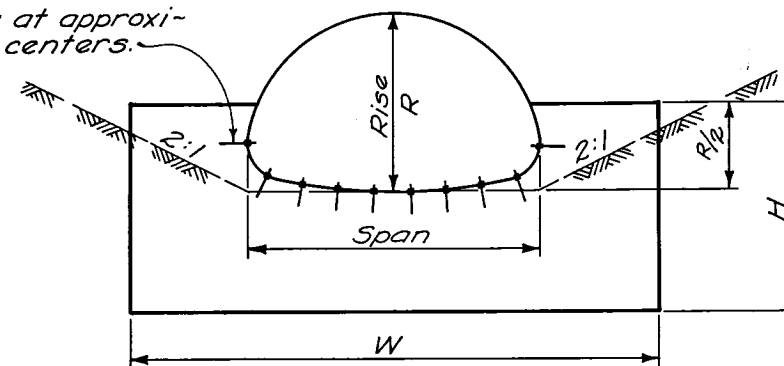
HEADWALL FOR CORRUGATED METAL PIPE											
CIRCULAR					PIPE ARCH						
D	W	H	T	Conc. Cu. Yds.	Span	Rise	W	H	T	Conc. Cu. Yds.	
12"	2'-0"	3'-0"	12"	.21							
15"	2'-6"	3'-2"	12"	.27	18"	11"	3'-0"	3'-0"	12"	.31	
18"	3'-0"	3'-3"	12"	.33	22"	13"	3'-6"	3'-0"	12"	.37	
21"	3'-6"	3'-4"	12"	.39	25"	16"	4'-0"	3'-2"	12"	.43	
24"	4'-0"	3'-6"	12"	.46	29"	18"	4'-6"	3'-3"	12"	.48	
27"	4'-6"	3'-8"	12"	.53							
30"	5'-0"	3'-9"	12"	.60	36"	22"	5'-6"	3'-5"	12"	.61	
33"	5'-6"	3'-10"	12"	.68							
36"	6'-0"	4'-0"	12"	.76	43"	27"	6'-6"	3'-7"	12"	.74	
39"	6'-6"	4'-2"	12"	.84							
42"	7'-0"	4'-3"	12"	.92	50"	31"	7'-8"	3'-9"	12"	.90	
48"	8'-0"	4'-6"	12"	1.10	58"	36"	9'-0"	4'-0"	12"	1.09	
54"	9'-3"	4'-9"	12"	1.33	65"	40"	10'-0"	4'-2"	12"	1.25	
60"	10'-6"	5'-6"	12"	1.78	72"	44"	11'-0"	4'-4"	12"	1.43	
66"	11'-9"	5'-9"	12"	2.06	73"	55"	13'-0"	4'-9"	12"	1.84	
72"	13'-0"	6'-0"	12"	2.37	87"	63"	15'-6"	5'-2"	14"	2.56	
78"	14'-3"	6'-3"	14"	2.94	103"	71"	18'-6"	5'-6"	16"	3.50	
84"	15'-6"	6'-6"	14"	3.30	114"	77"	20'-0"	5'-9"	18"	4.18	
90"	16'-9"	6'-9"	16"	4.00							
96"	18'-0"	7'-0"	16"	4.40							
102"	19'-3"	7'-3"	18"	5.28							
108"	20'-6"	7'-6"	20"	6.21							
114"	21'-9"	7'-9"	22"	7.25							
120"	23'-0"	8'-0"	24"	8.38							



PROFILE



CIRCULAR
CORRUGATED METAL PIPE

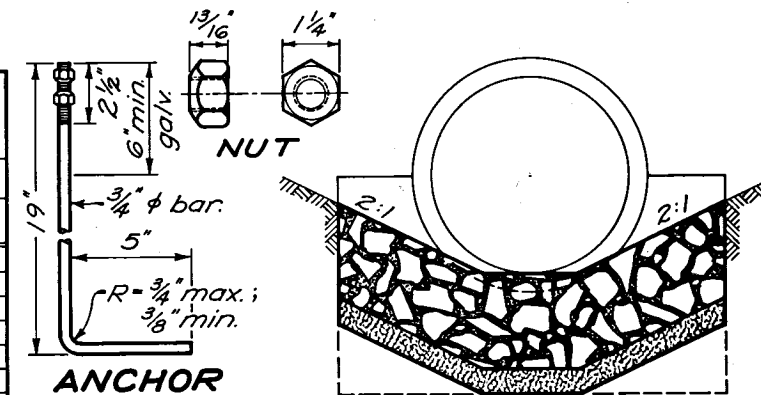


PIPE ARCH

NOTES

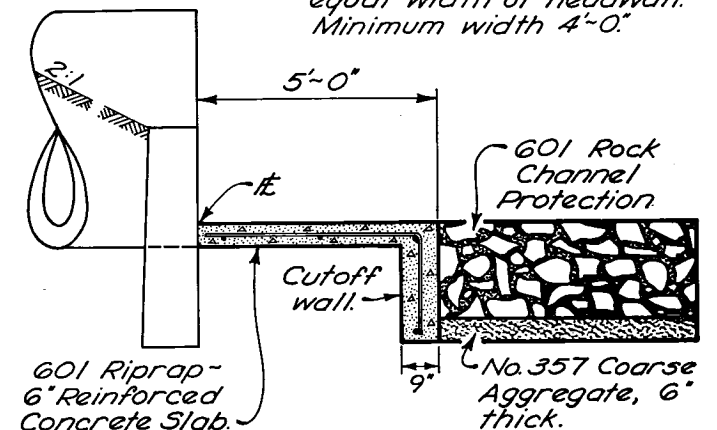
CONCRETE for headwalls shall be Class C.

ANCHOR BOLTS (as detailed) for anchoring upstream end of metal pipes shall meet ASTM A307. The top 6" min. of bolt shall be galvanized according to ASTM A153. Nuts (as detailed) shall meet ASTM A325 and A153. Cost of anchors shall be included in the unit price bid per linear foot of 603 Conduit. Unless otherwise specified, anchor bolts shall be used only on pipes with span or rise greater than 24 inches.



ANCHOR BOLT

Width of protection shall equal width of headwall. Minimum width 4'-0".



CHANNEL PROTECTION DETAIL

Cutoff wall depth (2'-6" min.) is variable to match required thickness of rock.

BUREAU OF LOCATION AND DESIGN
OHIO DEPARTMENT OF HIGHWAYS

HEADWALLS

STANDARD CONSTRUCTION DRAWING
HW-4
APPROVED *R.E. Balth* ENGR. L. & D.