

Guidance for Modeling Aluminum Box Culvert (ABC) in HEC-RAS

Since the Corrugated Metal Box Culvert shape in HEC-RAS does not match the actual area of the ABC when the span and rise of the ABC is input into the HEC-RAS model, the following methodology should be used to model the ABC. The span of the ABC should be reduced while maintaining the rise until the effective area of the ABC is approximated in the HECRAS model. It should be noted that although this methodology is not considered to be exact, for most situations it should provide a more conservative answer.

ABC's should be modeled in HEC-RAS as Corrugated Metal Box Culvert's using the Culvert Data Editor as follows:

Select culvert Shape as Box. The Span should be reduced as necessary (by trial and error) to provide a culvert area opening that is reflective of the effective open area of the culvert. Use the ABC Size Chart (attached) to determine the actual area of the ABC. If the culvert is buried or altered by other means such as sills/baffles, low flow floodplain benches etc., then determine the effective open area by subtracting out the blockage from the actual area of the ABC. The Rise should be the actual rise of the proposed ABC and should not be adjusted. The computed open area of the culvert can then be compared to the effective open area of the ABC. Chart # should be 16, 17, 18 or 19 depending on the rise/span ratio noted in HDS-5 for the particular chart. The rise/span ratio should be based on the actual dimensions of the ABC (do not use the reduced span length). Scale # 1 should be used based on 90 degree headwall. All other information should be appropriately filled in based on the proposed culvert.

Example: 15'-9" X 8'-0" ABC, buried 1' below stream bed.

Actual culvert area from ABC Chart = 111.8 ft², rise/span ratio = 0.5079, use Chart # 19, 90 degree headwall, use scale #1.

Effective open area of culvert = Actual Culvert area – blockage.

15.75' bottom span x 1' (bury depth) = 15.75 ft² blockage.

Effective open area = 111.8 ft² - 15.75 ft² = 96.05 ft², say 96 ft²

Computed open area in HEC-RAS if modeled as a 15'-9" x 8'-0' Corrugated Metal Box Culvert buried 1' (1' blocked in Culvert Data Editor) = 110.25 ft² (Note effective open area of culvert over estimated by 14 ft²)

Adjust span length by trial and error to reach effective open area of culvert = 96 ft²

Use span length = 13.72', Computed open area in HEC-RAS = 96.04 ft², say 96 ft²

Therefore, Model in HEC-RAS as a 13.72' x 8' Corrugated Metal Box Culvert buried 1'

Box Culvert Shell-Plate and Rib Data (H-25, HS-25)

TABLE 49. SHELL DATA – H-25, HS-25 LOADING																
PLATE AND RIB COMBINATIONS WITH ALLOWABLE HEIGHT OF COVER																
Structure Number	Span "A" (Fl.-In.)	Rise "B" (Fl.-In.)	Area (Sq. Ft.)	D6				E6				F6				Max. Shell Wt./Ft. (Lbs.)
				HG/CG (Gauge)	HRS/CRS (Inches)	Min. (Feet) ⁽⁹⁾	Max.	HG/CG (Gauge)	HRS/CRS (Inches)	Min. (Feet) ⁽⁹⁾	Max.	HG/CG (Gauge)	HRS/CRS (Inches)	Min. (Feet) ⁽⁹⁾	Max.	
STRUCTURES 1 THROUGH 20 HAVE TYPE II HAUNCH AND TYPE IV CROWN RIBS																
1	8-9	2-6	18.4	2/2	54/18	1.7	5.0	3/3	54/18	1.4	5.0					49
2	9-2	3-3	25.4	2/2	54/18	2.0	5.0	3/3	54/18	1.4	5.0					57
3	9-7	4-1	32.6	2/2	54/18	2.0	5.0	3/3	54/18	1.4	5.0					62
4	10-0	4-10	40.2	2/2	54/18	2.5	5.0	2/2	54/9	1.4	5.0					67
5	10-6	5-7	48.1	2/2	54/18	2.5	5.0	2/2	54/9	1.4	5.0					71
6	10-11	6-4	56.4	2/2	54/18	3.0	5.0	2/2	54/9	2.0	5.0	3/3	54/9	1.4	5.0	85
7	11-4	7-2	65.0	2/2	54/18	3.0	5.0	2/2	27/18	2.5	5.0	3/3	54/9	1.4	5.0	90
8	10-2	2-8	23.0	2/2	54/18	2.5	5.0	3/3	54/18	1.7	5.0	4/4	54/18	1.4	5.0	66
9	10-7	3-5	31.1	2/2	54/18	3.0	5.0	3/3	54/18	2.0	5.0	3/3	27/18	1.4	5.0	73
10	10-11	4-3	39.5	2/2	54/18	3.0	5.0	3/3	54/18	2.5	5.0	3/3	54/9	1.4	5.0	84
11	11-4	5-0	48.2	2/2	54/18	3.0	5.0	3/3	54/18	2.5	5.0	3/3	54/9	1.4	5.0	88
12	11-8	5-9	57.2	2/2	54/18	3.0	5.0	3/3	54/18	2.5	5.0	3/3	54/9	1.4	5.0	93
13	12-1	6-7	66.4	3/3	54/18	3.0	5.0	3/3	27/18	2.5	5.0	3/3	27/9	1.4	5.0	105
14	12-5	7-4	76.0	2/2	27/18	3.0	5.0	2/2	27/9	2.0	5.0	3/3	27/9	1.4	5.0	110
15	11-7	2-10	28.1	2/2	54/18	3.0	5.0	3/3	54/18	2.5	5.0	3/3	54/9	1.4	5.0	85
16	11-11	3-7	37.4	3/3	54/18	3.0	5.0	3/3	27/18	2.5	5.0	3/3	54/9	1.4	5.0	90
17	12-3	4-5	46.9	3/3	54/18	3.0	5.0	4/4	54/18	2.5	5.0	4/4	54/9	1.4	5.0	104
18	12-7	5-2	56.6	3/3	54/18	3.0	5.0	3/3	27/18	2.5	5.0	4/4	54/9	1.4	5.0	109
19	12-11	6-0	66.6	3/3	27/18	3.0	5.0	2/2	27/9	2.0	5.0	4/4	27/9	1.4	5.0	123
20	13-3	6-9	76.9	2/2	18/18	3.0	5.0	2/2	27/9	2.5	5.0	3/3	18/9	1.4	5.0	125
STRUCTURES 21 THROUGH 39 HAVE TYPE II HAUNCH AND TYPE VI CROWN RIBS⁽¹⁰⁾																
21	13-0	3-0	33.8	3/3	54/18	2.3	5.0	2/2	27/18	1.6	5.0	3/3	27/18	1.4	5.0	100
22	13-4	3-10	44.2	3/3	54/18	2.5	5.0	2/2	27/18	1.7	5.0	4/4	27/18	1.4	5.0	114
23	13-7	4-7	54.8	3/3	54/18	2.7	5.0	2/2	27/18	1.9	5.0	3/3	18/18	1.4	5.0	118
24	13-10	5-5	65.6	3/3	54/18	2.9	5.0	2/2	27/18	2.0	5.0	3/3	18/18	1.4	5.0	122
25	14-1	6-2	76.6	2/2	27/18	2.3	5.0	2/2	18/18	1.7	5.0	3/3	18/18	1.4	5.0	126
26	14-5	3-3	40.0	2/2	27/18	2.5	5.0	2/2	18/18	1.8	5.0	4/4	18/18	1.4	5.0	121
27	14-8	4-1	51.5	2/2	27/18	2.8	5.0	2/2	18/18	2.0	5.0	4/5	18/18	1.4	5.0	140
28	14-10	4-10	63.2	2/2	27/18	2.8	5.0	2/2	18/18	2.0	5.0	4/6	18/18	1.4	5.0	137
29	15-1	5-8	75.1	2/2	27/18	3.0	5.0	2/2	18/18	2.1	5.0	4/7	18/18	1.4	5.0	145
30	15-4	6-5	87.2	3/3	27/18	2.6	5.0	2/2	18/18	2.3	5.0	5/7	18/18	1.4	5.0	157
31	15-6	7-3	99.4	3/3	27/18	2.6	5.0	2/2	18/18	2.3	5.0	5/7	18/18	1.4	5.0	163
32	15-9	8-0	111.8	3/3	27/18	2.6	5.0	2/2	18/18	2.5	5.0	5/7	18/18	1.4	5.0	169
33	15-10	3-6	46.8	2/2	18/18	2.4	5.0	6/2	18/18	1.7	5.0	7/5	18/18	1.4	5.0	149
34	16-0	4-3	59.5	2/2	18/18	2.5	5.0	6/2	18/18	1.8	5.0	7/6	18/18	1.4	5.0	159
35	16-2	5-1	72.3	2/2	18/18	2.5	5.0	6/2	18/18	1.8	5.0	7/7	18/18	1.4	5.0	170
36	16-4	5-11	85.2	2/2	18/18	2.6	5.0	6/2	18/18	1.9	5.0	7/7	18/18	1.4	5.0	176
37	16-6	6-8	98.3	2/2	18/18	2.6	5.0	6/2	18/18	2.0	5.0	4/5	9/18	1.4	5.0	178
38	16-8	7-6	111.5	2/2	18/18	2.7	5.0	6/2	18/18	2.0	5.0	4/7	9/18	1.4	5.0	197
39	16-10	8-3	124.8	2/2	18/18	2.8	5.0	6/2	18/18	2.1	5.0	4/7	9/18	1.4	5.0	202
STRUCTURES 40 THROUGH 87 USE ALL TYPE VI RIBS⁽¹⁰⁾																
40	17-9	3-10	54.4	2/2	54/18	2.8	5.0	2/2	27/18	2.0	5.0	2/2	18/18	1.4	5.0	135
41	18-2	4-7	68.3	2/2	27/18	2.2	5.0	2/2	18/18	1.5	5.0	2/3	18/18	1.4	5.0	147
42	18-7	5-4	82.5	2/2	27/18	2.3	5.0	2/2	18/18	1.6	5.0	2/5	18/18	1.4	5.0	163
43	19-0	6-1	97.1	2/2	27/18	2.4	5.0	2/2	18/18	1.8	5.0	2/6	18/18	1.4	5.0	174
44	19-5	6-11	111.9	2/2	27/18	2.6	5.0	2/2	18/18	1.8	5.0	2/7	18/18	1.4	5.0	186
45	19-10	7-8	127.1	2/2	27/18	2.7	5.0	2/2	18/18	1.9	5.0	2/7	18/18	1.4	5.0	181
46	20-3	8-5	142.6	2/2	27/18	2.9	5.0	2/2	18/18	2.0	5.0	2/2	18/9	1.4	5.0	214
47	19-1	4-2	63.3	2/2	27/18	2.6	5.0	2/2	18/18	1.8	5.0	2/2	18/9	1.4	5.0	194
48	19-5	4-11	78.3	2/2	27/18	2.6	5.0	2/2	18/18	1.8	5.0	2/2	18/9	1.4	5.0	203
49	19-9	5-8	93.6	2/2	27/18	2.7	5.0	2/2	18/18	1.9	5.0	2/2	18/9	1.4	5.0	211
50	20-1	6-6	109.2	2/2	27/18	2.9	5.0	2/2	18/18	1.9	5.0	2/2	18/9	1.4	5.0	218
51	20-6	7-3	125	2/2	27/18	3.0	5.0	2/2	18/18	2.0	5.0	2/2	18/9	1.4	5.0	222
52	20-10	8-1	141.2	2/2	27/18	3.2	4.5	2/2	18/18	2.0	5.0	2/2	18/9	1.4	5.0	225
53	21-2	8-10	157.6	2/2	18/18	2.1	5.0	2/7	18/18	1.7	5.0	2/2	18/9	1.4	5.0	229
54	20-4	4-6	73.1	2/2	27/18	3.0	5.0	2/2	18/18	2.0	5.0	2/2	18/9	1.4	5.0	211
55	20-7	5-3	89.2	2/2	27/18	3.1	4.9	2/2	18/18	2.0	5.0	2/2	18/9	1.4	5.0	220
56	20-11	6-1	105.5	2/2	27/18	3.2	4.3	2/2	18/18	2.0	5.0	2/2	18/9	1.4	5.0	229
57	21-3	6-10	122.1	2/2	18/18	2.1	5.0	2/7	18/18	1.7	5.0	2/2	18/9	1.4	5.0	233
58	21-6	7-8	139.0	2/2	18/18	2.2	5.0	2/7	18/18	1.8	5.0	2/2	18/9	1.4	5.0	236
59	21-10	8-5	156.0	2/2	18/18	2.2	5.0	2/7	18/18	1.9	5.0	2/2	18/9	1.4	5.0	240
60	22-1	9-3	173.3	2/2	18/18	2.3	5.0	2/7	18/18	2.0	5.0	2/2	18/9	1.4	5.0	243
61	21-7	4-11	83.8	2/2	18/18	2.2	5.0	2/7	18/18	1.8	5.0	2/2	18/9	1.4	5.0	225
62	21-10	5-8	101	2/2	18/18	2.2	5.0	2/7	18/18	1.9	5.0	2/2	18/9	1.4	5.0	234
63	22-1	6-6	118.4	2/2	18/18	2.3	5.0	2/7	18/18	2.0	5.0	2/2	18/9	1.4	5.0	243
64	22-3	7-3	135.9	2/2	18/18	2.4	5.0	2/7	18/18	2.0	5.0	2/2	18/9	1.4	5.0	247
65	22-6	8-1	153.7	2/2	18/18	2.5	5.0	2/7	18/18	2.0	5.0	2/2	18/9	1.4	5.0	251
66	22-9	8-10	171.6	2/2	18/18	2.6	5.0	2/7	18/18	2.0	5.0	2/2	18/9	1.4	5.0	254
67	23-0	9-8	189.8	2/2	18/18	2.6	5.0	2/7	18/18	2.2	5.0	2/2	18/9	1.4	5.0	258
68	22-9	5-4	95.5	2/2	18/18	2.4	5.0	2/7	18/18	2.1	5.0	2/2	18/9	1.4	5.0	240
69	23-0	6-1	113.7	2/2	18/18	2.5	5.0	2/7	18/18	2.1	5.0	2/2	18/9	1.4	5.0	249
70	23-2	6-11	132.1	2/2	18/18	2.5	5.0	2/7	18/18	2.2	5.0	2/2	18/9	1.4	5.0	258
71	23-4	7-8	150.6	2/2	18/18	2.6	5.0	2/7	18/18	2.2	5.0	2/2	18/9	1.4	5.0	262
72	23-6	8-6	169.3	2/2	18/18	2.6	5.0	2/7	18/18	2.2	5.0	2/2	18/9	1.4	5.0	265
73	23-8	9-3	188.1	2/2	18/18	2.7	4.9	2/7	18/18	2.3	5.0	2/2	18/9	1.4	5.0	269
74	23-10	10-1	207.0	2/2	18/18	2.7	4.8	2/7	18/18	2.3	5.0	2/2	18/9	1.4	5.0	272
75	24-0	5-9	108.2	2/2	18/18	2.7	4.6	2/7	18/18	2.4	5.0	2/2	18/9	1.4	5.0	254
76	24-1	6-6	127.5	2/2	18/18	2.7	4.6	2/7	18/18	2.4	5.0	2/2	18/9	1.4	5.0	263
77	24-3	7-4	146.8	2/2	18/18	2.8	4.4	2/7	18/18	2.4	5.0	2/2	18/9	1.4	5.0	272
78	24-4	8-2	166.2	2/2	18/18	2.8	4.3	2/7	18/18	2.4	5.0	2/2	18/9	1.4	5.0	276
79	24-5	8-11	185.7	2/2	18/18	2.9	4.2	2/7	18/18	2.4	5.0	2/2	18/9	1.4	5.0	280
80	24-7	9-9	205.3	2/2	18/18	2.9	4.1	2/7	18/18	2.4	5.0	2/2	18/9	1.4	5.0	283
81																