# Exercise 6. Structure Design: Rountree Tributary

The premise of stream simulation is to design a streambed then "wrap" the structure around it. In previous exercises, you selected a design alignment, profile, channel cross-section and bedmix. In this exercise you will use the design cross-section graph provided below and the profile graph from exercise 4 to select a structure and determine its dimensions.

First choose a structure width that will span bankfull width and also provide room for banks and any floodplain you plan to provide. The cross-section graph is located at the center of the structure and includes 2.5 ft of bank on each side. You can shorten or extend this depending on your objectives and hydraulic modeling results to be performed. Objectives in addition to passing fish, wood, sediment and water might include passage of reptiles, amphibians, small and large mammals and people.

Banfull width (ft): ____ Bank/floodplain width (ft): ____ Structure width (ft): ____

Now identify the LVAP elevation and select an elevation for the invert or bottom of footer that extends down below the LVAP. Draw this on the cross-section and profile graphs.

Invert/bottom of footer elev (ft): center_____ upstream_____ downstream_____

Next identify the types of structures that would work including open bottom and enclosed structures. Select a preliminary structure and dimensions from the information provided below and taking into account the elevation of the road. Determine the minimum and maximum cover limits for the structure. Check to make sure the structure will extend below the LVAP and meet cover requirements. For open bottom structures, determine the top elevation of the footers. Ideally the top of the footers will extend up to bankfull elevation to allow the streambed to be constructed prior to setting the structure. Draw the structure on the cross-section.

Structure: Type _____ Material _____ Width (ft) _____ Height (ft)_____

Minimum cover (ft): _____ Maximum cover (ft): _____ Available cover (ft):_____

Top of footer elev (ft): center_____ upstream_____ downstream_____

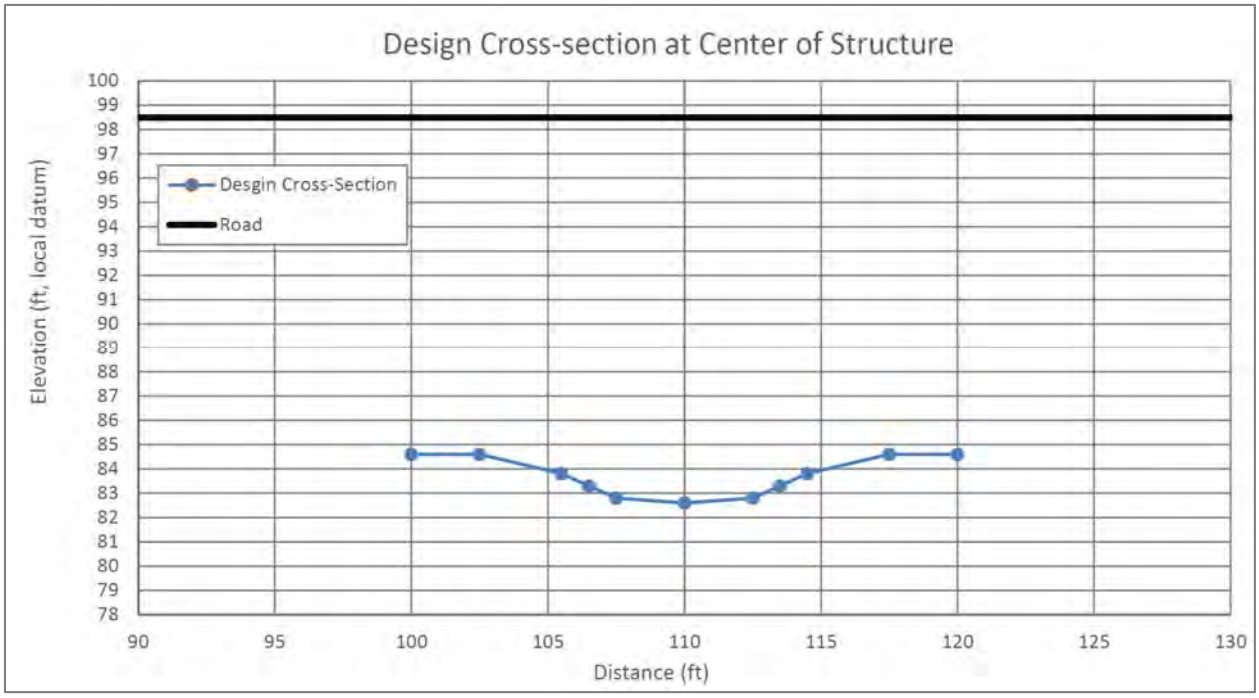
Then using the design slope, draw the structure on the profile graph. Now determine the total length of the structure. Assume you will keep the existing road width, choose an embankment slope (e.g. 2:1, 3:1, 4:1, headwalls), and sketch in your embankment if it differs from the existing. The current embankment slope is about 1½:1. The embankments should reach out from the road shoulder down to your chosen invert elevation. You can use a headwall to shorten the structure with associated cost considerations. Finally determine the total length of the structure.

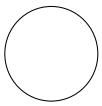
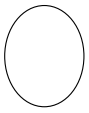
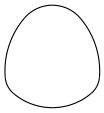
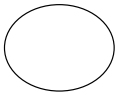
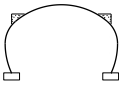
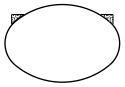
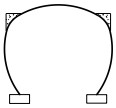
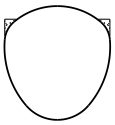
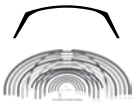
End Treatment: headwall/bevel/square Side slope: _____ To: invert/top headwall

Design slope (ft/ft): _____ Final structure length (ft): ____

The final steps are to check hydraulic capacity to ensure the structure will pass at least the 100-yr flood with a HW/D<0.8. Then perform a sediment mobility and stability check and adjust streambed sediment sizes accordingly.

# Exercise 6. Structure Design: Rountree Tributary



| STRUCTURE SHAPE GEOMETRY | | | | | | |
|---|---|---|---|---|---|---|
| Shapes | | Sizes=Span x Rise | Common Uses | Steel | Aluminum | Trade Name |
| Round |  | 5′ to 50′-6″ | Culverts, storm sewers, aggregate tunnels, vehicular and pedestrian tunnels and stream enclosures. Functions well in all applications, but especially in those with high cover | x<br>x | | MULTI-PLATE<br>BridgeCor |
| | | | | | x | Aluminum Structure Plate |
| Vertical Ellipse |  | 4′-8″ x 5′-2″<br>to<br>25′ x 27′-8″ | Culverts, storm sewers, service tunnels, recovery tunnels and stream enclosures. Works well in higher cover applications. | x | | MULTI-PLATE |
| | | | | | x | Aluminum Structure Plate |
| Underpass |  | 12′-2″ x 11′-0″<br>to<br>20′-4″ x 17′-9″ | Offers efficient shape for passage of pedestrians or livestock, vehicular traffic and bicycles with minimal buried invert. | x | | MULTI-PLATE |
| | | | | | x | Aluminum Structure Plate |
| Pipe-Arch | | 6′-1″ x 4′-7″<br>to<br>20′-7″ x 13′-2″ | Limited headroom. Has hydraulic advantages at low flow levels. Culverts, storm sewer, underpass and stream enclosures. | x | | MULTI-PLATE |
| | | | | | x | Aluminum Structure Plate |
| Horizontal Ellipse |  | 7′-4″ x 5′-6″<br>to<br>14′-11″ x 11′-2″ | Culverts, bridges, low cover applications, wide centered flow, good choice when poor foundations are encountered. | x | | MULTI-PLATE |
| | | | | | x | Aluminum Structure Plate |
| Arch (single radius) | | 6′ x 1′-10″<br>to<br>54′-4" x 27′-2″ | Low clearance, large waterway opening. Aesthetic shapes and open natural bottoms for environmentally-friendly crossings. | x<br>x | | MULTI-PLATE<br>BridgeCor |
| | | | | | x | Aluminum Structure Plate |
| Arch (2-radius) | | 18′-5″ x 8′-4″<br>to<br>50′-7″ x 19′-11″ | Low clearance, large waterway opening. Aesthetic shapes and open natural bottoms for environmentally-friendly crossings. | x | | BridgeCor |
| Low-Profile Arch* | | 19′-5″ x 6′-9″<br>to<br>45′-0″ x 18′-8″ | Culvert, storm sewers, low headroom and large opening. Bridge structures, stream enclosures. Aesthetic shapes and open natural bottoms for environmentally friendly crossings. | x | | SUPER-SPAN |
| | | | | | x | SUPER-PLATE*** |
| High-Profile * |  | 20′-1″ x 9′-1″<br>to<br>35′-4″ x 20′-0″ | Culverts, storm sewers, bridges, Higher rise, large area opening. Open natural bottoms for environmentally friendly crossings. | x | | SUPER-SPAN |
| | | | | | x | SUPER-PLATE |
| Horizontal Ellipse |  | 19′-4″ x 12′-9″<br>to<br>37′-2″ x 22′-2″ | Larger culverts and bridges. Low headroom, wide-centered flow, good choice when poor foundations are encountered. | x | | SUPER-SPAN |
| | | | | | x | SUPER-PLATE |
| Pear-Arch |  | 23′-11″ x 23′-4″<br>to<br>30'-4" x 25'-10" | Railroad underpasses or large clearance areas. Open natural bottoms for environmentally friendly crossings. | x | | SUPER-SPAN |
| Pear |  | 23′-8″ x 25′-5″<br>to<br>29'-11" x 31'-3" | Railroad underpasses or large clearance areas. | x | | SUPER-SPAN |
| Box Culvert | | 8′-9″ x 2′-6″<br>to<br>35′-3″ x 13′-7″ | Very low, wide bridges, culverts and stream enclosures, with limited headroom. Functions well as a fast small-span bridge replacement. | x | | BridgeCor |
| | | | | | x | Aluminum Box Culvert |
| Elliptical/Circular Arch ** |  | 12′ to 102′ | Culverts, bridges, tunnels, wetlands crossings, overpass/ underpass, underground containment, wine/cheese cellars and shelters. | | | CON/SPAN®<br>BEBO®<br>(concrete) |
| Vehicular **<br>Pedestrian ** | | spans up to 300′<br>spans up to 300′ | County, city, parks, industrial complexes.<br>Recreational, overpasses, industrial conveyor, pipe support. | x | | U.S. Bridge®<br>Vehicular Truss<br>Continental®<br>Pedestrian Truss |

* Larger steel sizes are available up through 65-foot spans with our BridgeCor® product line. Call your local Contech representative for more information.
** The design process for these bridge structures is not covered by this document. Call your local Contech representative for more information.
*** Low-Profile Arch SUPER-PLATE is only available up to 38'-8" x 15'-9".

## SINGLE RADIUS ARCH

| Span Feet | Rise Ft.-In. | Area Ft.$^2$ |
|---|---|---|
| 6.0 | 1′-10″ | 7.9 |
| | 2′-4″ | 10.0 |
| | 3′-2″ | 15.0 |
| 7.0 | 2′-5″ | 12.0 |
| | 2′-10″ | 15.0 |
| | 3′-8″ | 20.0 |
| 8.0 | 2-11″ | 17.0 |
| | 3′-4″ | 20.0 |
| | 4′-2″ | 26.6 |
| 9.0 | 2′-11″ | 19.0 |
| | 3′-11″ | 26.5 |
| | 4′-8″ | 33.6 |
| 10.0 | 3′-6″ | 25.0 |
| | 4′-5″ | 34.0 |
| | 5′-3″ | 41.0 |
| 11.0 | 3′-6″ | 27.8 |
| | 4′-6″ | 37.0 |
| | 5′-9″ | 50.0 |
| 12.0 | 4′-1″ | 35.0 |
| | 5′-0″ | 45.0 |
| | 6′-3″ | 59.0 |
| 13.0 | 4′-1″ | 38.0 |
| | 5′-1″ | 49.0 |
| | 6′-9″ | 70.0 |
| 14.0 | 4′-8″ | 47.0 |
| | 5′-7″ | 58.5 |
| | 7′-3″ | 80.7 |
| 15.0 | 4′-8″ | 50.0 |
| | 5′-8″ | 62.8 |
| | 7′-9″ | 92.6 |
| 16.0 | 5′-3″ | 60.0 |
| | 7′-1″ | 86.0 |
| | 8′-4″ | 105.0 |
| 17.0 | 5′-3″ | 63.0 |
| | 7′-2″ | 92.0 |
| | 8′-10″ | 119.0 |
| 18.0 | 5′-9″ | 75.0 |
| | 7′-8″ | 104.6 |
| | 8′-11″ | 126.0 |
| 19.0 | 6′-4″ | 87.0 |
| | 8′-3″ | 118.0 |
| | 9′-5″ | 140.7 |
| 20.0 | 6′-4″ | 91.0 |
| | 8′-3″ | 124.0 |
| | 10′-0″ | 156.0 |
| 21.0 | 6′-11″ | 104.6 |
| | 8′-10″ | 139.0 |
| | 10′-6″ | 172.0 |
| 22.0 | 6′-11″ | 109.0 |
| | 8′-11″ | 146.0 |
| | 11′-0″ | 190.0 |
| 23.0 | 8′-0″ | 134.0 |
| | 9′-10″ | 171.0 |
| | 11′-6″ | 208.0 |
| 24.0 | 8′-6″ | 149.0 |
| | 10′-4″ | 188.0 |
| | 12′-0″ | 226.6 |
| 25.0 | 8′-7″ | 155.0 |
| | 10′-10″ | 206.0 |
| | 12′-6″ | 246.0 |
| 26.0 | 8′-7″ | 161.2 |
| | 11′-0″ | 214.9 |
| | 13′-1″ | 266.7 |

## PIPE ARCH

| | Span Ft.-In. | Rise Ft.-In. | Area Ft.$^2$ |
|---|---|---|---|
| $R_C$ Corner Radius = 18″ | 6′-1″ | 4′-7″ | 22 |
| | 6′-4″ | 4′-9″ | 24 |
| | 6′-9″ | 4′-11″ | 26 |
| | 7′-0″ | 5′-1″ | 29 |
| | 7′-3″ | 5′-3″ | 31 |
| | 7′-8″ | 5′-5″ | 33 |
| | 7′-11″ | 5′-7″ | 36 |
| | 8′-2″ | 5′-9″ | 38 |
| | 8′-7″ | 5′-11″ | 41 |
| | 8′-10″ | 6′-1″ | 43 |
| | 9′-4″ | 6′-3″ | 46 |
| | 9′-6″ | 6′-5″ | 49 |
| | 9′-9″ | 6′-7″ | 52 |
| | 10′-3″ | 6′-9″ | 55 |
| | 10′-8″ | 6′-11″ | 58 |
| | 10′-11″ | 7′-1″ | 61 |
| | 11′-5″ | 7′-3″ | 64 |
| | 11′-7″ | 7′-5″ | 68 |
| | 11′-10″ | 7′-7″ | 71 |
| | 12′-4″ | 7′-9″ | 74 |
| | 12′-6″ | 7′-11″ | 78 |
| | 12′-8″ | 8′-1″ | 82 |
| | 12′-10″ | 8′-4″ | 85 |
| $R_C$ Corner Radius = 31″ | 13′-3″ | 9′-4″ | 98 |
| | 13′-6″ | 9′-6″ | 102 |
| | 14′-0″ | 9′-8″ | 106 |
| | 14′-2″ | 9′-10″ | 111 |
| | 14′-5″ | 10′-0″ | 115 |
| | 14′-11″ | 10′-2″ | 120 |
| | 15′-4″ | 10′-4″ | 124 |
| | 15′-7″ | 10′-6″ | 129 |
| | 15′-10″ | 10′-8″ | 134 |
| | 16′-3″ | 10′-10″ | 138 |
| | 16′-6″ | 11′-0″ | 143 |
| | 17′-0″ | 11′-2″ | 148 |
| | 17′-2″ | 11′-4″ | 153 |
| | 17′-5″ | 11′-6″ | 158 |
| | 17′-11″ | 11′-8″ | 163 |
| | 18′-1″ | 11′-10″ | 168 |
| | 18′-7″ | 12′-0″ | 174 |
| | 18′-9″ | 12′-2″ | 179 |
| | 19′-3″ | 12′-4″ | 185 |
| | 19′-6″ | 12′-6″ | 191 |
| | 19′-8″ | 12′-8″ | 196 |
| | 19′-11″ | 12′-10″ | 202 |
| | 20′-5″ | 13′-0″ | 208 |
| | 20′-7″ | 13′-2″ | 214 |

## ROUND

| Span Ft. | Diameter Pl | Area Ft.$^2$ |
|---|---|---|
| 5 | 60 | 19.1 |
| 8 | 96 | 50.0 |
| 11 | 132 | 95.7 |
| 14 | 168 | 156.0 |
| 17 | 204 | 231.0 |
| 20 | 240 | 320.6 |
| 23 | 276 | 425.0 |
| 26 | 312 | 543.9 |

*This is a partial list, please see Contech Engineered Solutions Plate Design Guide for complete details, includes BridgeCor.*

## ALUMINUM BOX CULVERT

| Structure Number | Span Ft.-In. | Rise Ft.-In. | Area Ft.$^2$ |
|---|---|---|---|
| 1 | 8′-9″ | 2′-6″ | 18.4 |
| 3 | 9′-7″ | 4′-1″ | 32.6 |
| 5 | 10′-6″ | 5′-7″ | 48.1 |
| 7 | 11′-4″ | 7′-2″ | 65.0 |
| 8 | 10′-2″ | 2′-8″ | 23.0 |
| 10 | 10′-11″ | 4′-3″ | 39.5 |
| 12 | 11′-8″ | 5′-9″ | 57.2 |
| 14 | 12′-5″ | 7′-4″ | 76.0 |
| 15 | 11′-7″ | 2′-10″ | 28.1 |
| 17 | 12′-3″ | 4′-5″ | 46.9 |
| 20 | 13′-3″ | 6′-9″ | 76.9 |
| 21 | 13′-0″ | 3′-0″ | 33.8 |
| 23 | 13′-7″ | 4′-7″ | 64.8 |
| 25 | 14′-1″ | 6′-2″ | 76.6 |
| 26 | 14′-5″ | 3′-3″ | 40.0 |
| 28 | 14′-10″ | 4′-10″ | 63.2 |
| 30 | 15′-4″ | 6′-5″ | 87.2 |
| 33 | 15′-10″ | 3′-6″ | 46.8 |
| 34 | 16′-0″ | 4′-3″ | 59.5 |
| 36 | 16′-4″ | 5′-11″ | 85.2 |
| 38 | 16′-6″ | 6′-8″ | 98.3 |
| 39 | 16′-10″ | 8′-3″ | 124.8 |
| 40 | 17′-9″ | 3′-10″ | 54.4 |
| 42 | 18′-7″ | 5′-4″ | 82.5 |
| 44 | 19′-5″ | 6′-11″ | 111.9 |
| 46 | 20′-3″ | 8′-5″ | 142.6 |
| 47 | 19′-1″ | 4′-2″ | 63.3 |
| 49 | 19′-9″ | 5′-8″ | 93.6 |
| 51 | 20′-6″ | 7′-3″ | 125 |
| 53 | 21′-2″ | 8′-10″ | 157.6 |
| 54 | 20′-4″ | 4′-6″ | 73.1 |
| 56 | 20′-11″ | 6′-1″ | 105.5 |
| 58 | 21′-6″ | 7′-8″ | 139.0 |
| 60 | 22′-1″ | 9′-3″ | 173.3 |
| 61 | 21′-7″ | 4′-11″ | 83.8 |
| 63 | 22′-1″ | 6′-6″ | 118.4 |
| 65 | 22′-6″ | 8′-1″ | 153.7 |
| 67 | 23′-0″ | 9′-8″ | 189.8 |
| 68 | 22′-9″ | 5′-4″ | 95.5 |
| 70 | 23′-2″ | 6′-11″ | 132.1 |
| 72 | 23′-6″ | 8′-6″ | 169.3 |
| 74 | 23′-10″ | 10′-1″ | 207.0 |
| 75 | 24′-0″ | 5′-9″ | 108.2 |
| 77 | 24′-3″ | 7′-4″ | 146.8 |
| 79 | 24′-5″ | 8′-11″ | 185.7 |
| 81 | 24′-8″ | 10′-6″ | 225 |
| 82 | 25′-2″ | 6′-2″ | 122.0 |
| 84 | 25′-3″ | 7′-9″ | 162.4 |
| 86 | 25′-4″ | 9′-5″ | 202.9 |
| 87 | 25′-5″ | 10′-2″ | 223.3 |
| 88 | 26′-7″ | 5′-5″ | 111.6 |
| 90 | 27′-5″ | 7′-0″ | 153.4 |
| 92 | 28′-3″ | 8′-7″ | 196.5 |
| 94 | 29′-1″ | 10′-1″ | 241.0 |
| 95 | 27′-10″ | 5′-10″ | 125.4 |
| 97 | 28′-7″ | 7′-5″ | 169.4 |
| 99 | 29′-4″ | 9′-0″ | 214.6 |
| 101 | 30′-1″ | 10′-7″ | 260.9 |
| 102 | 29′-1″ | 6′-4″ | 140.2 |
| 104 | 29′-8″ | 7′-11″ | 186.4 |
| 106 | 30′-4″ | 9′-5″ | 233.6 |
| 108 | 31′-0″ | 11′-0″ | 281.8 |
| 109 | 30′-3″ | 6′-9″ | 156.1 |
| 111 | 30′-10″ | 8′-4″ | 204.4 |
| 113 | 31′-4″ | 9′-11″ | 253.5 |
| 115 | 31′-11″ | 11′-6″ | 303.5 |
| 116 | 31′-5″ | 7′-3″ | 173.1 |
| 118 | 31′-10″ | 8′-10″ | 223.4 |
| 120 | 32′-4″ | 10′-4″ | 274.4 |
| 122 | 32′-9″ | 12′-0″ | 326.1 |
| 123 | 32′-7″ | 7′-9″ | 191.3 |
| 125 | 32′-11″ | 9′-4″ | 243.4 |
| 127 | 33′-3″ | 10′-11″ | 296.4 |
| 129 | 33′-8″ | 12′-6″ | 349.5 |
| 130 | 33′-8″ | 8′-3″ | 210.5 |
| 132 | 33′-11″ | 9′-10″ | 264.5 |
| 134 | 34′-2″ | 11′-5″ | 319.0 |
| 136 | 34′-5″ | 13′-1″ | 373.8 |
| 137 | 34′-9″ | 8′-9″ | 230.9 |
| 139 | 34′-11″ | 10′-4″ | 286.7 |
| 141 | 35′-1″ | 12′-0″ | 342.7 |
| 143 | 35′-3″ | 13′-7″ | 399.0 |

## MPSS - LOW PROFILE ARCH

| Structure Number | Maximum Span | Rise Ft.-In. | Approx. Area Ft.$^2$ |
|---|---|---|---|
| 69A15 | 19′-5″ | 6′-9″ | 105 |
| 75A18 | 21′-6″ | 7′-9″ | 133 |
| 81A18 | 23′-0″ | 8′-1″ | 147 |
| 87A18 | 24′-6″ | 8′-3″ | 161 |
| 93A18 | 25′-11″ | 8′-7″ | 176 |
| 99A21 | 28′-1″ | 9′-6″ | 212 |
| 102A21 | 28′-10″ | 9′-8″ | 220 |
| 108A24 | 30′-11″ | 9′-11″ | 237 |
| 111A30 | 32′-4″ | 12′-3″ | 319 |
| 117A24 | 33′-2″ | 11′-1″ | 289 |
| 123A24 | 34′-7″ | 11′-4″ | 308 |
| 126A24 | 35′-4″ | 11′-5″ | 318 |
| 129A30 | 37′-10″ | 12′-11″ | 383 |
| 129A36 | 39′-4″ | 14′-4″ | 441 |
| *138A39 | *42′-3″ | 15′-5″ | 510 |
| *144A51 | *45′-0″ | 18′-8″ | 675 |

* Structures require additional transverse stiffeners

## MPSS - HIGH PROFILE ARCH

| Structure Number | Maximum Span | Rise Ft.-In. | Approx. Area Ft.$^2$ |
|---|---|---|---|
| 69A15-9 | 20′-1″ | 9′-1″ | 152 |
| 75A15-18 | 21′-6″ | 11′-8″ | 215 |
| 78A15-18 | 22′-3″ | 11′-10″ | 224 |
| 81A15-18 | 23′-0″ | 11′-11″ | 234 |
| 81A18-15 | 23′-8″ | 11′-10″ | 238 |
| 87A15-24 | 24′-6″ | 13′-9″ | 288 |
| 87A21-15 | 25′-9″ | 12′-10″ | 280 |
| 90A21-24 | 26′-6″ | 15′-3″ | 347 |
| 93A21-15 | 27′-3″ | 13′-2″ | 301 |
| 99A21-15 | 28′-9″ | 13′-5″ | 323 |
| 99A24-24 | 29′-5″ | 16′-5″ | 412 |
| 102A24-30 | 30′-1″ | 18′-0″ | 466 |
| 108A24-30 | 31′-7″ | 18′-4″ | 496 |
| 111A24-18 | 32′-4″ | 15′-5″ | 420 |
| 114A30-18 | 34′-4″ | 17′-0″ | 490 |
| 117A30-18 | 35′-1″ | 17′-1″ | 504 |
| 123A30-18 | 36′-7″ | 17′-4″ | 533 |
| 126A30-18 | 37′-4″ | 17′-6″ | 547 |

## HORIZONTAL ELLIPSE

| Structure Number | Span Ft.-In. | Rise Ft.-In. | Approx. Area Ft.$^2$ |
|---|---|---|---|
| 24E15 | 7′-4″ | 5′-6″ | 31.6 |
| 30E18 | 9′-2″ | 6′-9″ | 48.2 |
| 33E15 | 9′-7″ | 6′-4″ | 46.7 |
| 36E18 | 10′-8″ | 7′-3″ | 60.1 |
| 36E21 | 11′-0″ | 8′-0″ | 68.2 |
| 39E21 | 11′-8″ | 8′-3″ | 75.1 |
| 39E24 | 12′-0″ | 8′-11″ | 84.1 |
| 42E21 | 12′-5″ | 8′-6″ | 82.2 |
| 42E24 | 12′-9″ | 9′-2″ | 91.7 |
| 45E21 | 13′-2″ | 8′-9″ | 89.6 |
| 45E24 | 13′-6″ | 9′-6″ | 99.6 |
| 48E24 | 14′-3″ | 9′-9″ | 107.8 |
| 48E27 | 14′-7″ | 10′-5″ | 118.7 |
| 48E30 | 14′-11″ | 11′-2″ | 129.9 |

**MPSS = MULTI-PLATE SUPERSPAN**



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CON/SPAN® BRIDGE SYSTEMS

| STANDARD CON/SPAN® BRIDGE UNITS | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | WATERWAY AREA (FT.$^2$) | | | | | | | | | | | | WEIGHT (TONS/FT.) | | | | | | | | | | | |
| RISE (FT.) | SPAN (FEET) | | | | | | | | | | | | SPAN (FEET) | | | | | | | | | | | |
| | 12 | 14 | 16 | 20 | 24 | 28 | 32 | 36 | 42 | 48 | 54 | 60 | 12 | 14 | 16 | 20 | 24 | 28 | 32 | 36 | 42 | 48 | 54 | 60 |
| 3 | 30 | * | * | * | * | * | * | * | * | * | * | * | .94 | * | * | * | * | * | * | * | * | * | * | * |
| 4 | 42 | 50 | 55 | 65 | * | * | * | * | * | * | * | * | 1.04 | 1.14 | 1.59 | 1.73 | * | * | * | * | * | * | * | * |
| 5 | 54 | 64 | 71 | 85 | 95 | * | * | * | * | * | * | * | 1.14 | 1.24 | 1.71 | 1.86 | 2.05 | * | * | * | * | * | * | * |
| 6 | 66 | 78 | 87 | 105 | 119 | 139 | * | * | * | * | * | * | 1.24 | 1.34 | 1.83 | 1.99 | 2.18 | 2.84 | * | * | * | * | * | * |
| 7 | 78 | 92 | 103 | 125 | 143 | 167 | 184 | * | * | * | * | * | 1.34 | 1.44 | 1.96 | 2.12 | 2.31 | 2.99 | 3.56 | * | * | * | * | * |
| 8 | 90 | 106 | 119 | 145 | 167 | 195 | 216 | 232 | * | * | * | * | 1.44 | 1.54 | 2.09 | 2.24 | 2.44 | 3.14 | 3.71 | 4.06 | * | * | * | * |
| 9 | 102 | 120 | 135 | 165 | 191 | 223 | 248 | 268 | * | * | * | * | 1.54 | 1.64 | 2.21 | 2.36 | 2.57 | 3.29 | 3.86 | 4.23 | * | * | * | * |
| 10 | 114 | 134 | 151 | 185 | 215 | 251 | 280 | 304 | 334 | 387 | 435 | * | 1.64 | 1.74 | 2.33 | 2.49 | 2.69 | 3.44 | 4.01 | 4.40 | 4.87 | 5.27 | 6.52 | * |
| 11 | * | * | * | * | 239 | 279 | 312 | 340 | 376 | 435 | 489 | * | * | * | * | * | 2.81 | 3.59 | 4.16 | 4.58 | 5.04 | 5.48 | 6.72 | * |
| 12 | * | * | * | * | * | * | 344 | 376 | 418 | 483 | 543 | 578 | * | * | * | * | * | * | 4.31 | 4.76 | 5.21 | 5.67 | 6.92 | 7.76 |
| 13 | * | * | * | * | * | * | * | 412 | 460 | 531 | 599 | 638 | * | * | * | * | * | * | * | 4.93 | 5.38 | 5.88 | 7.12 | 7.98 |
| 14 | * | * | * | * | * | * | * | 448 | 501 | 579 | 652 | 698 | * | * | * | * | * | * | * | 5.11 | 5.58 | 6.08 | 7.32 | 8.21 |

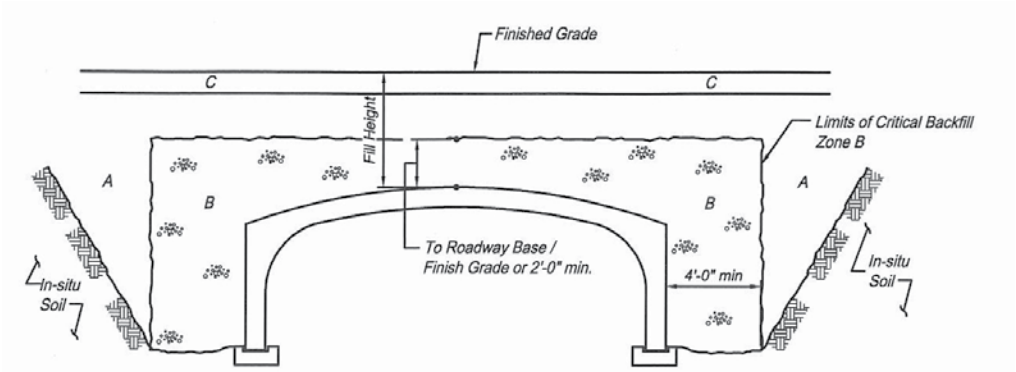
**ARCH LAY LENGTHS (Nominal)**

| | |
|---|---|
| 12'-24' SPAN | 8' LAY LENGTH |
| 28'-42' SPAN | 6' LAY LENGTH |
| 48'-60' SPAN | 4' LAY LENGTH |

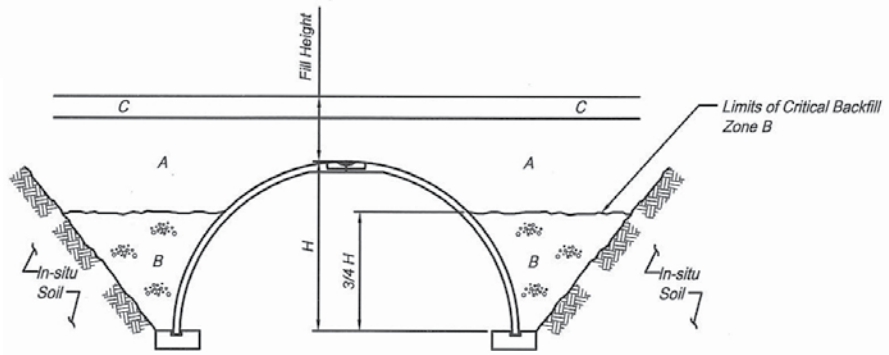
*1/4" Joints between Precast Concrete Units

# Backfill Requirements

Backfill is a key component of any buried structure.
Please refer to the precast element specifications for detailed requirements.




CON/SPAN® Arch




BEBO® Arch

1. In-situ material must be sufficiently stable to allow support of the precast units.
2. Zone A: Embankment or overfill material shall be properly graded and compacted, per project specifications.
3. Zone B: Structural backfill material per CON/SPAN® or BEBO® specifications. (Generally, a well-graded angular sand or gravel placed in 8" lifts and compacted to 95% of the maximum dry density, per AASHTO T-99 specification.)
4. Zone C: Roadway base and surface materials, per project specifications.

BEBO® Arch Systems

## E-Series Single Leaf

| BEBO SERIES | SPAN (FEET) | RISE (FEET) | WATERWAY AREA (SF) | WEIGHT PER FOOT LENGTH (TONS) |
|---|---|---|---|---|
| E12 | 11'-2" | 3'-6" | 28 | 0.74 |
| E12 | 11'-9 1/2" | 4'-6" | 40 | 0.84 |
| E12 | 12'-0" | 5'-6" | 52 | 0.95 |
| E12 | 12'-0" | 6'-6" | 64 | 1.06 |
| E16 | 14'-4 1/2" | 3'-10" | 40 | 0.88 |
| E16 | 15'-3 1/2" | 4'-10" | 54 | 1.00 |
| E16 | 15'-10" | 5'-10" | 70 | 1.11 |
| E16 | 16'-0" | 6'-10" | 86 | 1.21 |
| E16 | 16'-0" | 7'-10" | 102 | 1.31 |
| E20 | 18'-7" | 5'-2" | 70 | 1.16 |
| E20 | 19'-4 1/2" | 6'-2" | 89 | 1.27 |
| E20 | 19'-10" | 7'-2" | 108 | 1.37 |
| E20 | 20'-0" | 8'-2" | 128 | 1.48 |
| E20 | 20'-0" | 9'-2" | 148 | 1.58 |
| E24 | 22'-9" | 6'-6" | 108 | 1.42 |
| E24 | 23'-5 1/2" | 7'-6" | 132 | 1.53 |
| E24 | 23'-10 1/2" | 8'-6" | 155 | 1.64 |
| E24 | 24'-0" | 9'-6" | 179 | 1.74 |
| E24 | 24'-0" | 10'-6" | 203 | 1.84 |
| E24 | 24'-0" | 11'-6" | 227 | 1.94 |
| E30 | 28'-11 1/2" | 8'-6" | 182 | 2.27 |
| E30 | 29'-6 1/2" | 9'-6" | 211 | 2.43 |
| E30 | 29'-11" | 10'-6" | 241 | 2.56 |
| E30 | 30'-0" | 11'-6" | 271 | 2.69 |
| E30 | 30'-0" | 12'-6" | 301 | 2.81 |
| E30 | 30'-0" | 13'-6" | 331 | 2.94 |
| E36 | 34'-8 1/2" | 9'-2" | 235 | 2.63 |
| E36 | 35'-4 1/2" | 10'-2" | 270 | 2.78 |
| E36 | 35'-9 1/2" | 11'-2" | 305 | 2.91 |
| E36 | 36'-0" | 12'-2" | 341 | 3.05 |
| E36 | 36'-0" | 13'-2" | 377 | 3.16 |
| E42 | 40'-8 1/2" | 10'-2" | 307 | 3.05 |
| E42 | 41'-4 1/2" | 11'-2" | 348 | 3.20 |
| E42 | 41'-9 1/2" | 12'-2" | 389 | 3.33 |
| E42 | 42'-0" | 13'-2" | 431 | 3.46 |
| E48 | 47'-4" | 12'-1" | 431 | 3.96 |
| E48 | 47'-9" | 13'-1" | 479 | 4.10 |

## T-Series Single Leaf

| BEBO SERIES | SPAN (FEET) | RISE (FEET) | WATERWAY AREA (SF) | WEIGHT PER FOOT LENGTH (TONS) |
|---|---|---|---|---|
| T22 | 22 | 2'-7 1/4" | 39.1 | 1.49 |
| T24 | 24 | 3'-2 1/4" | 53.4 | 1.64 |
| T26 | 26 | 3'-2 1/2" | 56.1 | 1.58 |
| T28 | 28 | 3'-9" | 71.0 | 1.71 |
| T30 | 30 | 4'-4 1/4" | 88.6 | 1.84 |
| T32 | 32 | 5'-0 1/4" | 109.2 | 1.97 |
| T34 | 34 | 4'-0 1/2" | 92.0 | 2.27 |
| T36 | 36 | 4'-6 1/2" | 110.2 | 2.41 |
| T38 | 38 | 5'-1" | 130.8 | 2.55 |
| T40 | 40 | 5'-8 1/4" | 154.1 | 2.70 |
| T42 | 42 | 6'-4" | 180.4 | 2.85 |
| T44 | 44 | 5'-4" | 158.4 | 3.51 |
| T46 | 46 | 5'-10 1/2" | 182.3 | 3.68 |
| T48 | 48 | 6'-5 1/4" | 208.7 | 3.85 |
| T50 | 50 | 7'-0" | 237.8 | 4.03 |
| T52 | 52 | 7'-8" | 269.7 | 4.20 |
| T54 | 54 | 6'-8" | 242.9 | 4.29 |
| T56 | 56 | 7'-3" | 272.5 | 4.46 |
| T58 | 58 | 7'-9" | 304.6 | 4.64 |
| T60 | 60 | 8'-4" | 339.5 | 4.81 |
| T62 | 62 | 9'-0" | 377.2 | 4.99 |

**ARCH LAY LENGTHS (Nominal)**

| | |
|---|---|
| E12 - E24: | 8' LAY LENGTH |
| E30 - E66T: | 6' LAY LENGTH |
| E72T - E84T: | 4' LAY LENGTH |
| C30T - C54T: | 6' LAY LENGTH |
| T22 - T24: | 6' LAY LENGTH |
| T26 - T42: | 8' LAY LENGTH |
| T44 - T52: | 6' LAY LENGTH |
| T54 - T62: | 4' LAY LENGTH |
| T64 - T82: | 6' LAY LENGTH |
| T84 - T102: | 4' LAY LENGTH |

*1/2" Joints between Precast Concrete Units

## C-Series Twin Leaf

| BEBO SERIES | SPAN (FEET) | RISE (FEET) | WATERWAY AREA (SF) | WEIGHT PER FOOT LENGTH (TONS) |
|---|---|---|---|---|
| C30T | 29'-4" | 11'-4" | 260 | 2.61 |
| C30T | 29'-9" | 12'-4" | 290 | 2.73 |
| C30T | 29'-11" | 13'-4" | 319 | 2.86 |
| C30T | 30'-0" | 14'-4" | 349 | 2.98 |
| C30T | 30'-0" | 15'-4" | 379 | 3.11 |
| C30T | 30'-0" | 16'-4" | 409 | 3.24 |
| C30T | 30'-0" | 17'-4" | 439 | 3.36 |
| C30T | 30'-0" | 18'-4" | 469 | 3.49 |
| C36T | 35'-6" | 14'-4" | 397 | 3.53 |
| C36T | 35'-9 1/2" | 15'-4" | 433 | 3.67 |
| C36T | 35'-11 1/2" | 16'-4" | 469 | 3.81 |
| C36T | 36'-0" | 17'-4" | 505 | 3.94 |
| C36T | 36'-0" | 18'-4" | 541 | 4.08 |
| C36T | 36'-0" | 19'-4" | 577 | 4.22 |
| C36T | 36'-0" | 20'-4" | 613 | 4.36 |
| C36T | 36'-0" | 21'-4" | 648 | 4.50 |
| C36T | 36'-0" | 22'-4" | 685 | 4.64 |
| C36T | 36'-0" | 23'-4" | 721 | 4.77 |
| C42T | 41'-7" | 17'-0" | 549 | 4.57 |
| C42T | 41'-10" | 18'-0" | 590 | 4.72 |
| C42T | 41'-11 1/2" | 19'-0" | 632 | 4.87 |
| C42T | 42'-0" | 20'-0" | 674 | 5.02 |
| C42T | 42'-0" | 21'-0" | 716 | 5.17 |
| C42T | 42'-0" | 22'-0" | 758 | 5.32 |
| C42T | 42'-0" | 23'-0" | 800 | 5.47 |
| C42T | 42'-0" | 24'-0" | 842 | 5.63 |
| C42T | 42'-0" | 25'-0" | 884 | 5.78 |
| C42T | 42'-0" | 26'-0" | 926 | 5.93 |
| C54T | 52'-7 1/2" | 20'-4" | 819 | 5.95 |
| C54T | 53'-0 1/2" | 21'-4" | 871 | 6.11 |
| C54T | 53'-5" | 22'-4" | 925 | 6.28 |
| C54T | 53'-8" | 23'-4" | 978 | 6.45 |
| C54T | 53'-10" | 24'-4" | 1032 | 6.62 |
| C54T | 53'-11 1/2" | 25'-4" | 1086 | 6.79 |
| C54T | 54'-0" | 26'-4" | 1140 | 6.96 |

## E-Series Twin Leaf

| BEBO SERIES | SPAN (FEET) | RISE (FEET) | WATERWAY AREA (SF) | WEIGHT PER FOOT LENGTH (TONS) |
|---|---|---|---|---|
| E54T | 53'-7" | 14'-0" | 588 | 4.96 |
| E54T | 53'-11" | 15'-0" | 641 | 5.12 |
| E54T | 54'-0" | 16'-0" | 695 | 5.28 |
| E54T | 54'-0" | 17'-0" | 749 | 5.41 |
| E54T | 54'-0" | 18'-0" | 803 | 5.58 |
| E54T | 54'-0" | 19'-0" | 857 | 5.73 |
| E54T | 54'-0" | 20'-0" | 911 | 5.88 |
| E60T | 59'-11" | 17'-0" | 807 | 6.65 |
| E60T | 60'-0" | 18'-0" | 867 | 6.80 |
| E60T | 60'-0" | 19'-0" | 927 | 7.01 |
| E60T | 60'-0" | 20'-0" | 987 | 7.18 |
| E60T | 60'-0" | 21'-0" | 1047 | 7.36 |
| E60T | 60'-0" | 22'-0" | 1107 | 7.53 |
| E66T | 65'-11" | 19'-0" | 992 | 7.36 |
| E66T | 66'-0" | 20'-0" | 1058 | 7.54 |
| E66T | 66'-0" | 21'-0" | 1124 | 7.72 |
| E66T | 66'-0" | 22'-0" | 1190 | 7.89 |
| E66T | 66'-0" | 23'-0" | 1256 | 8.07 |
| E66T | 66'-0" | 24'-0" | 1322 | 8.24 |
| E72T | 71'-8 1/2" | 19'-10" | 1121 | 9.02 |
| E72T | 71'-11" | 20'-10" | 1192 | 9.23 |
| E72T | 72'-0" | 21'-10" | 1264 | 9.44 |
| E72T | 72'-0" | 22'-10" | 1336 | 9.64 |
| E72T | 72'-0" | 23'-10" | 1408 | 9.84 |
| E72T | 72'-0" | 24'-10" | 1480 | 10.04 |
| E72T | 72'-0" | 25'-10" | 1552 | 10.24 |
| E78T | 77'-9" | 21'-10" | 1137 | 9.84 |
| E78T | 77'-11" | 22'-10" | 1415 | 10.04 |
| E78T | 78'-0" | 23'-10" | 1493 | 10.25 |
| E78T | 78'-0 | 24'-10" | 1571 | 10.45 |
| E78T | 78'-0 | 25'-10" | 1649 | 10.65 |
| E78T | 78'-0 | 26'-10" | 1727 | 10.85 |
| E78T | 78'-0 | 27'-10" | 1805 | 11.05 |
| E84T | 83'-5 1/2" | 22'-10" | 1489 | 11.70 |
| E84T | 83'-9" | 23'-10" | 1572 | 11.94 |
| E84T | 83'-11" | 24'-10" | 1656 | 12.18 |
| E84T | 84'-0" | 25'-10" | 1740 | 12.41 |
| E84T | 84'-0" | 26'-10" | 1824 | 12.64 |
| E84T | 84'-0" | 27'-10" | 1908 | 12.86 |
| E84T | 84'-0" | 28'-10" | 1992 | 13.09 |
| E84T | 84'-0" | 29'-10" | 2076 | 13.31 |

## T-Series Twin Leaf

| BEBO SERIES | SPAN (FEET) | RISE (FEET) | WATERWAY AREA (SF) | WEIGHT PER FOOT LENGTH (TONS) |
|---|---|---|---|---|
| T64T | 64 | 7'-5" | 340 | 5.51 |
| T66T | 66 | 7'-11" | 375 | 5.70 |
| T68T | 68 | 8'-6" | 413 | 5.88 |
| T70T | 70 | 9'-1" | 454 | 6.07 |
| T72T | 72 | 9'-8" | 497 | 6.26 |
| T74T | 74 | 8'-9" | 460 | 6.86 |
| T76T | 76 | 9'-4" | 504 | 7.06 |
| T78T | 78 | 9'-10" | 545 | 7.26 |
| T80T | 80 | 10'-5" | 592 | 7.47 |
| T82T | 82 | 11'-1" | 641 | 7.67 |
| T84T | 84 | 10'-0" | 599 | 8.82 |
| T86T | 86 | 10'-7" | 646 | 9.04 |
| T88T | 88 | 11'-2" | 695 | 9.27 |
| T90T | 90 | 11'-9" | 747 | 9.50 |
| T92T | 92 | 12'-4" | 802 | 9.74 |
| T94T | 94 | 11'-5" | 755 | 11.04 |
| T96T | 96 | 11'-11" | 808 | 11.30 |
| T98T | 98 | 12'-6" | 863 | 11.56 |
| T100T | 100 | 13'-1" | 921 | 11.82 |
| T102T | 102 | 13'-8" | 982 | 12.08 |



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# HEC-RAS/ HEC-2/ WSPRO COORDINATES

| 12' SPAN | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **RISE \ X** | **0.00** | **0.01** | **0.52** | **1.80** | **3.88** | **6.00** | **8.12** | **10.20** | **11.48** | **11.99** | **12.00** |
| **4** | 0.00 | 1.00 | 2.55 | 3.40 | 3.85 | 4.00 | 3.85 | 3.40 | 2.55 | 1.00 | 0.00 |
| **5** | 0.00 | 2.00 | 3.55 | 4.40 | 4.85 | 5.00 | 4.85 | 4.40 | 3.55 | 2.00 | 0.00 |
| **6** | 0.00 | 3.00 | 4.55 | 5.40 | 5.85 | 6.00 | 5.85 | 5.40 | 4.55 | 3.00 | 0.00 |
| **7** | 0.00 | 4.00 | 5.55 | 6.40 | 6.85 | 7.00 | 6.85 | 6.40 | 5.55 | 4.00 | 0.00 |
| **8** | 0.00 | 5.00 | 6.55 | 7.40 | 7.85 | 8.00 | 7.85 | 7.40 | 6.55 | 5.00 | 0.00 |
| **9** | 0.00 | 6.00 | 7.55 | 8.40 | 8.85 | 9.00 | 8.85 | 8.40 | 7.55 | 6.00 | 0.00 |
| **10** | 0.00 | 7.00 | 8.55 | 9.40 | 9.85 | 10.00 | 9.85 | 9.40 | 8.55 | 7.00 | 0.00 |

| 14' SPAN | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **RISE \ X** | **0.00** | **0.01** | **0.50** | **1.80** | **6.00** | **7.00** | **8.00** | **12.20** | **13.50** | **13.99** | **14.00** |
| **4** | 0.00 | 1.00 | 2.50 | 3.40 | 4.00 | 4.00 | 4.00 | 3.40 | 2.50 | 1.00 | 0.00 |
| **5** | 0.00 | 2.00 | 3.50 | 4.40 | 5.00 | 5.00 | 5.00 | 4.40 | 3.50 | 2.00 | 0.00 |
| **6** | 0.00 | 3.00 | 4.50 | 5.40 | 6.00 | 6.00 | 6.00 | 5.40 | 4.50 | 3.00 | 0.00 |
| **7** | 0.00 | 4.00 | 5.50 | 6.40 | 7.00 | 7.00 | 7.00 | 6.40 | 5.50 | 4.00 | 0.00 |
| **8** | 0.00 | 5.00 | 6.50 | 7.40 | 8.00 | 8.00 | 8.00 | 7.40 | 6.50 | 5.00 | 0.00 |
| **9** | 0.00 | 6.00 | 7.50 | 8.40 | 9.00 | 9.00 | 9.00 | 8.40 | 7.50 | 6.00 | 0.00 |
| **10** | 0.00 | 7.00 | 8.50 | 9.40 | 10.00 | 10.00 | 10.00 | 9.40 | 8.50 | 7.00 | 0.00 |

| 16' SPAN | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **RISE \ X** | **0.00** | **0.01** | **0.48** | **1.77** | **4.86** | **8.00** | **11.14** | **14.23** | **15.52** | **15.99** | **16.00** |
| **4** | 0.00 | 0.47 | 2.10 | 3.21 | 3.80 | 4.00 | 3.80 | 3.21 | 2.10 | 0.47 | 0.00 |
| **5** | 0.00 | 1.47 | 3.10 | 4.21 | 4.80 | 5.00 | 4.80 | 4.21 | 3.10 | 1.47 | 0.00 |
| **6** | 0.00 | 2.47 | 4.10 | 5.21 | 5.80 | 6.00 | 5.80 | 5.21 | 4.10 | 2.47 | 0.00 |
| **7** | 0.00 | 3.47 | 5.10 | 6.21 | 6.80 | 7.00 | 6.80 | 6.21 | 5.10 | 3.47 | 0.00 |
| **8** | 0.00 | 4.47 | 6.10 | 7.21 | 7.80 | 8.00 | 7.80 | 7.21 | 6.10 | 4.47 | 0.00 |
| **9** | 0.00 | 5.47 | 7.10 | 8.21 | 8.80 | 9.00 | 8.80 | 8.21 | 7.10 | 5.47 | 0.00 |
| **10** | 0.00 | 6.47 | 8.10 | 9.21 | 9.80 | 10.00 | 9.80 | 9.21 | 8.10 | 6.47 | 0.00 |

| 20' SPAN | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **RISE \ X** | **0.00** | **0.01** | **0.48** | **1.77** | **5.83** | **10.00** | **14.17** | **18.23** | **19.52** | **19.99** | **20.00** |
| **5** | 0.00 | 0.87 | 2.50 | 3.61 | 4.65 | 5.00 | 4.65 | 3.61 | 2.50 | 0.87 | 0.00 |
| **6** | 0.00 | 1.87 | 3.50 | 4.61 | 5.65 | 6.00 | 5.65 | 4.61 | 3.50 | 1.87 | 0.00 |
| **7** | 0.00 | 2.87 | 4.50 | 5.61 | 6.65 | 7.00 | 6.65 | 5.61 | 4.50 | 2.87 | 0.00 |
| **8** | 0.00 | 3.87 | 5.50 | 6.61 | 7.65 | 8.00 | 7.65 | 6.61 | 5.50 | 3.87 | 0.00 |
| **9** | 0.00 | 4.87 | 6.50 | 7.61 | 8.65 | 9.00 | 8.65 | 7.61 | 6.50 | 4.87 | 0.00 |
| **10** | 0.00 | 5.87 | 7.50 | 8.61 | 9.65 | 10.00 | 9.65 | 8.61 | 7.50 | 5.87 | 0.00 |
| **11** | 0.00 | 6.87 | 8.50 | 9.61 | 10.65 | 11.00 | 10.65 | 9.61 | 8.50 | 6.87 | 0.00 |

| 24' SPAN | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **RISE \ X** | **0.00** | **0.01** | **0.48** | **1.77** | **6.77** | **12.00** | **17.23** | **22.23** | **23.52** | **23.99** | **24.00** |
| **5** | 0.00 | 0.07 | 1.70 | 2.81 | 4.45 | 5.00 | 4.45 | 2.81 | 1.70 | 0.07 | 0.00 |
| **6** | 0.00 | 1.07 | 2.70 | 3.81 | 5.45 | 6.00 | 5.45 | 3.81 | 2.70 | 1.07 | 0.00 |
| **7** | 0.00 | 2.07 | 3.70 | 4.81 | 6.45 | 7.00 | 6.45 | 4.81 | 3.70 | 2.07 | 0.00 |
| **8** | 0.00 | 3.07 | 4.70 | 5.81 | 7.45 | 8.00 | 7.45 | 5.81 | 4.70 | 3.07 | 0.00 |
| **9** | 0.00 | 4.07 | 5.70 | 6.81 | 8.45 | 9.00 | 8.45 | 6.81 | 5.70 | 4.07 | 0.00 |
| **10** | 0.00 | 5.07 | 6.70 | 7.81 | 9.45 | 10.00 | 9.45 | 7.81 | 6.70 | 5.07 | 0.00 |
| **11** | 0.00 | 6.07 | 7.70 | 8.81 | 10.45 | 11.00 | 10.45 | 8.81 | 7.70 | 6.07 | 0.00 |

CON/SPAN® BRIDGE SYSTEMS

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# HEC-RAS/ HEC-2/ WSPRO COORDINATES

| 28' SPAN | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **RISE \ X** | **0.00** | **0.01** | **1.17** | **5.24** | **9.59** | **14.00** | **18.41** | **22.76** | **26.83** | **27.99** | **28.00** |
| **6** | 0.00 | 0.25 | 3.07 | 5.03 | 5.76 | 6.00 | 5.76 | 5.03 | 3.07 | 0.25 | 0.00 |
| **7** | 0.00 | 1.25 | 4.07 | 6.03 | 6.76 | 7.00 | 6.76 | 6.03 | 4.07 | 1.25 | 0.00 |
| **8** | 0.00 | 2.25 | 5.07 | 7.03 | 7.76 | 8.00 | 7.76 | 7.03 | 5.07 | 2.25 | 0.00 |
| **9** | 0.00 | 3.25 | 6.07 | 8.03 | 8.76 | 9.00 | 8.76 | 8.03 | 6.07 | 3.25 | 0.00 |
| **10** | 0.00 | 4.25 | 7.07 | 9.03 | 9.76 | 10.00 | 9.76 | 9.03 | 7.07 | 4.25 | 0.00 |
| **11** | 0.00 | 5.25 | 8.07 | 10.03 | 10.76 | 11.00 | 10.76 | 10.03 | 8.07 | 5.25 | 0.00 |
| **12** | 0.00 | 6.25 | 9.07 | 11.03 | 11.76 | 12.00 | 11.76 | 11.03 | 9.07 | 6.25 | 0.00 |

| 32' SPAN | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **RISE \ X** | **0.00** | **0.01** | **1.17** | **5.13** | **10.51** | **16.00** | **21.49** | **26.87** | **30.83** | **31.99** | **32.00** |
| **7** | 0.00 | 0.49 | 3.31 | 5.49 | 6.62 | 7.00 | 6.62 | 5.49 | 3.31 | 0.49 | 0.00 |
| **8** | 0.00 | 1.49 | 4.31 | 6.49 | 7.62 | 8.00 | 7.62 | 6.49 | 4.31 | 1.49 | 0.00 |
| **9** | 0.00 | 2.49 | 5.31 | 7.49 | 8.62 | 9.00 | 8.62 | 7.49 | 5.31 | 2.49 | 0.00 |
| **10** | 0.00 | 3.49 | 6.31 | 8.49 | 9.62 | 10.00 | 9.62 | 8.49 | 6.31 | 3.49 | 0.00 |
| **11** | 0.00 | 4.49 | 7.31 | 9.49 | 10.62 | 11.00 | 10.62 | 9.49 | 7.31 | 4.49 | 0.00 |
| **12** | 0.00 | 5.49 | 8.31 | 10.49 | 11.62 | 12.00 | 11.62 | 10.49 | 8.31 | 5.49 | 0.00 |
| **13** | 0.00 | 6.49 | 9.31 | 11.49 | 12.62 | 13.00 | 12.62 | 11.49 | 9.31 | 6.49 | 0.00 |

| 36' SPAN | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **RISE \ X** | **0.00** | **0.01** | **1.17** | **5.00** | **11.41** | **18.00** | **24.59** | **31.00** | **34.83** | **35.99** | **36.00** |
| **8** | 0.00 | 0.61 | 3.43 | 5.83 | 7.45 | 8.00 | 7.45 | 5.83 | 3.43 | 0.61 | 0.00 |
| **9** | 0.00 | 1.61 | 4.43 | 6.83 | 8.45 | 9.00 | 8.45 | 6.83 | 4.43 | 1.61 | 0.00 |
| **10** | 0.00 | 2.61 | 5.43 | 7.83 | 9.45 | 10.00 | 9.45 | 7.83 | 5.43 | 2.61 | 0.00 |
| **11** | 0.00 | 3.61 | 6.43 | 8.83 | 10.45 | 11.00 | 10.45 | 8.83 | 6.43 | 3.61 | 0.00 |
| **12** | 0.00 | 4.61 | 7.43 | 9.83 | 11.45 | 12.00 | 11.45 | 9.83 | 7.43 | 4.61 | 0.00 |
| **13** | 0.00 | 5.61 | 8.43 | 10.83 | 12.45 | 13.00 | 12.45 | 10.83 | 8.43 | 5.61 | 0.00 |
| **14** | 0.00 | 6.61 | 9.43 | 11.83 | 13.45 | 14.00 | 13.45 | 11.83 | 9.43 | 6.61 | 0.00 |

| 42' SPAN EC | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **RISE \ X** | **0.00** | **0.01** | **0.67** | **5.00** | **12.83** | **21.00** | **29.17** | **37.00** | **41.33** | **41.99** | **42.00** |
| **10** | 0.00 | 0.81 | 3.02 | 6.66 | 9.16 | 10.00 | 9.16 | 6.66 | 3.02 | 0.81 | 0.00 |
| **11** | 0.00 | 1.81 | 4.02 | 7.66 | 10.16 | 11.00 | 10.16 | 7.66 | 4.02 | 1.81 | 0.00 |
| **12** | 0.00 | 2.81 | 5.02 | 8.66 | 11.16 | 12.00 | 11.16 | 8.66 | 5.02 | 2.81 | 0.00 |
| **13** | 0.00 | 3.81 | 6.02 | 9.66 | 12.16 | 13.00 | 12.16 | 9.66 | 6.02 | 3.81 | 0.00 |
| **14** | 0.00 | 4.81 | 7.02 | 10.66 | 13.16 | 14.00 | 13.16 | 10.66 | 7.02 | 4.81 | 0.00 |
| **15** | 0.00 | 5.81 | 8.02 | 11.66 | 14.16 | 15.00 | 14.16 | 11.66 | 8.02 | 5.81 | 0.00 |
| **16** | 0.00 | 6.81 | 9.02 | 12.66 | 15.16 | 16.00 | 15.16 | 12.66 | 9.02 | 6.81 | 0.00 |

CON/SPAN® BRIDGE SYSTEMS

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# HEC-RAS/ HEC-2/ WSPRO COORDINATES

| 42' SPAN - NEW | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RISE \ X** | **0.00** | **0.01** | **0.67** | **2.03** | **5.00** | **12.83** | **21.00** | **29.17** | **37.00** | **39.97** | **41.33** | **41.99** | **42.00** |
| **8** | 0.00 | 0.54 | 2.73 | 4.25 | 5.62 | 7.39 | 8.00 | 7.39 | 5.62 | 4.25 | 2.73 | 0.54 | 0.00 |
| **9** | 0.00 | 1.54 | 3.73 | 5.25 | 6.62 | 8.39 | 9.00 | 8.39 | 6.62 | 5.25 | 3.73 | 1.54 | 0.00 |
| **10** | 0.00 | 2.54 | 4.73 | 6.25 | 7.72 | 9.39 | 10.00 | 9.39 | 7.72 | 6.25 | 4.73 | 2.54 | 0.00 |
| **11** | 0.00 | 3.54 | 5.73 | 7.25 | 8.72 | 10.39 | 11.00 | 10.39 | 8.72 | 7.25 | 5.73 | 3.54 | 0.00 |
| **12** | 0.00 | 4.54 | 6.73 | 8.25 | 9.72 | 11.39 | 12.00 | 11.39 | 9.72 | 8.25 | 6.73 | 4.54 | 0.00 |
| **13** | 0.00 | 5.54 | 7.73 | 9.25 | 10.72 | 12.39 | 13.00 | 12.39 | 10.72 | 9.25 | 7.73 | 5.54 | 0.00 |
| **14** | 0.00 | 6.54 | 8.73 | 10.25 | 11.72 | 13.39 | 14.00 | 13.39 | 11.72 | 10.25 | 8.73 | 6.54 | 0.00 |
| **15** | 0.00 | 7.54 | 9.73 | 11.25 | 12.72 | 14.39 | 15.00 | 14.39 | 12.72 | 11.25 | 9.73 | 7.54 | 0.00 |

| 48' SPAN | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RISE \ X** | **0.00** | **0.01** | **0.67** | **1.89** | **5.00** | **14.23** | **24.00** | **33.77** | **43.00** | **46.11** | **47.33** | **47.99** | **48.00** |
| **9.5** | 0.00 | 0.77 | 2.95 | 4.36 | 6.02 | 8.62 | 9.50 | 8.62 | 6.02 | 4.36 | 2.95 | 0.77 | 0.00 |
| **10** | 0.00 | 1.27 | 3.45 | 4.86 | 6.52 | 9.12 | 10.00 | 9.12 | 6.52 | 4.86 | 3.45 | 1.27 | 0.00 |
| **11** | 0.00 | 2.27 | 4.45 | 5.86 | 7.52 | 10.12 | 11.00 | 10.12 | 7.52 | 5.86 | 4.45 | 2.27 | 0.00 |
| **12** | 0.00 | 3.27 | 5.45 | 6.86 | 8.52 | 11.12 | 12.00 | 11.12 | 8.52 | 6.86 | 5.45 | 3.27 | 0.00 |
| **13** | 0.00 | 4.27 | 6.45 | 7.86 | 9.52 | 12.12 | 13.00 | 12.12 | 9.52 | 7.86 | 6.45 | 4.27 | 0.00 |
| **14** | 0.00 | 5.27 | 7.45 | 8.86 | 10.52 | 13.12 | 14.00 | 13.12 | 10.52 | 8.86 | 7.45 | 5.27 | 0.00 |
| **15** | 0.00 | 6.27 | 8.45 | 9.86 | 11.52 | 14.12 | 15.00 | 14.12 | 11.52 | 9.86 | 8.45 | 6.27 | 0.00 |

CON/SPAN® BRIDGE SYSTEMS

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TABLE 24. MULTI-PLATE® ARCH 6″ X 2″
AASHTO HEIGHT OF COVER LIMITS H-20, HS-20, H-25, HS-25 LIVE LOADS

| Span (Ft.-In.) | Rise (Ft.-In.) | Minimum Cover (Inches) | Thickness in Inches (Gage) (Maximum Cover Height Shown In Feet) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 0.111 (12 Ga.) | 0.140 (10 Ga.) | 0.170 (8 Ga.) | 0.188 (7 Ga.) | 0.218 (5 Ga.) | 0.249 (3 Ga.) | 0.280 (1 Ga.) | 0.318 (5/16) | 0.380 (3/8) |
| 6-0 | 1-10<br>2-4<br>3-2 | 12 | 39 | 57 | 75 | 86 | 103 | 122 | 133 | 214 | 257 |
| 7-0 | 2-5<br>2-10<br>3-8 | 12 | 34 | 49 | 64 | 73 | 88 | 104 | 114 | 183 | 220 |
| 8-0 | 2-11<br>3-4<br>4-2 | 12 | 29 | 43 | 56 | 64 | 77 | 91 | 100 | 160 | 192 |
| 9-0 | 2-11<br>3-11<br>4-8 | 18 | 26 | 38 | 50 | 57 | 69 | 81 | 88 | 142 | 171 |
| 10-0 | 3-6<br>4-5<br>5-3 | 18 | 23 | 34 | 45 | 51 | 62 | 73 | 80 | 128 | 154 |
| 11-0 | 3-6<br>4-6<br>5-9 | 18 | 21 | 31 | 40 | 46 | 56 | 66 | 72 | 116 | 140 |
| 12-0 | 4-1<br>5-0<br>6-3 | 18 | 19 | 28 | 37 | 43 | 51 | 61 | 66 | 107 | 128 |
| 13-0 | 4-1<br>5-1<br>6-9 | 24 | 18 | 26 | 34 | 39 | 47 | 56 | 61 | 98 | 118 |
| 14-0 | 4-8<br>5-7<br>7-3 | 24 | 17 | 24 | 32 | 36 | 44 | 52 | 57 | 91 | 110 |
| 15-0 | 4-8<br>5-8<br>6-7<br>7-9 | 24 | 15 | 22 | 30 | 34 | 41 | 48 | 53 | 85 | 102 |
| 16-0 | 5-3<br>7-1<br>8-4 | 24 | 14 | 21 | 28 | 32 | 38 | 45 | 50 | 80 | 96 |
| 17-0 | 5-3<br>7-2<br>8-10 | 30 | 14 | 20 | 26 | 30 | 36 | 43 | 47 | 75 | 90 |
| 18-0 | 5-9<br>7-8<br>8-11 | 30 | 13 | 19 | 25 | 28 | 34 | 40 | 44 | 71 | 85 |
| 19-0 | 6-4<br>8-3<br>9-5 | 30 | 12 | 18 | 23 | 27 | 32 | 38 | 42 | 67 | 81 |
| 20-0 | 6-4<br>8-3<br>10-0 | 30 | | 17 | 22 | 25 | 31 | 36 | 40 | 64 | 77 |
| 21-0 | 6-11<br>8-10<br>10-6 | 36 | | 16 | 21 | 24 | 29 | 34 | 38 | 61 | 73 |
| 22-0 | 6-11<br>8-11<br>11-0 | 36 | | | 20 | 23 | 28 | 33 | 36 | 58 | 70 |
| 23-0 | 8-0<br>9-10<br>11-6 | 36 | | | 19 | 22 | 27 | 31 | 34 | 55 | 67 |
| 24-0 | 8-6<br>10-4<br>12-0 | 36 | | | 18 | 21 | 25 | 30 | 33 | 53 | 64 |
| 25-0 | 8-7<br>10-10<br>12-6 | 42 | | | | 20 | 24 | 29 | 32 | 49 | 60 |
| 26-0 | 8-7<br>11-0<br>13-1 | 42 | | | | | 23 | 28 | 30 | 46 | 56 |

Notes:
1. Tables based upon AASHTO Sec. 12 Standard Specifications for Highway Bridges.
2. H-20, HS-20, H-25, HS-25 Live Loads.
3. Minimum cover is defined as the vertical distance from the top of the corrugated structure to the bottom of flexible or top of rigid pavement.
4. Minimum cover for off highway construction loads must be checked.
5. Footing reactions can be provided by supplier.

## Box Culvert Shell-Plate and Rib Data (H-20, HS-20)

TABLE 48A. SHELL DATA — H-20, HS-20 LOADING
PLATE AND RIB COMBINATIONS WITH ALLOWABLE HEIGHT OF COVER

| Structure Number | Span "A" (Ft.-In.) | Rise "B" (Ft.-In.) | Area (Sq. Ft.) | A6 HG/CG (Gage) | A6 HRS/CRS (Inches) | A6 Min. (Feet)[9] | A6 Max. (Feet)[9] | B6 HG/CG (Gage) | B6 HRS/CRS (Inches) | B6 Min. (Feet)[9] | B6 Max. (Feet)[9] | C6 HG/CG (Gage) | C6 HRS/CRS (Inches) | C6 Min. (Feet)[9] | C6 Max. (Feet)[9] | Max. Shell Wt./Ft. (Lbs.) | "D" Dimension ("N") |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| STRUCTURES 1 THROUGH 26 HAVE TYPE II HAUNCH AND TYPE IV CROWN RIBS | | | | | | | | | | | | | | | | | |
| 1 | 8-9 | 2-6 | 18.4 | 2/2 | 54/18 | 1.4 | 5.0 | | | | | | | | | 43 | 0.5 |
| 2 | 9-2 | 3-3 | 25.4 | 2/2 | 54/18 | 1.4 | 5.0 | | | | | | | | | 50 | 1.5 |
| 3 | 9-7 | 4-1 | 32.6 | 2/2 | 54/18 | 1.4 | 5.0 | | | | | | | | | 54 | 2.5 |
| 4 | 10-0 | 4-10 | 40.2 | 2/2 | 54/18 | 1.4 | 5.0 | | | | | | | | | 58 | 3.5 |
| 5 | 10-6 | 5-7 | 48.1 | 2/2 | 54/18 | 1.7 | 5.0 | 3/3 | 54/18 | 1.4 | 5.0 | | | | | 71 | 4.5 |
| 6 | 10-11 | 6-4 | 56.4 | 2/2 | 54/18 | 2.0 | 5.0 | 2/2 | 27/18 | 1.4 | 5.0 | | | | | 74 | 5.5 |
| 7 | 11-4 | 7-2 | 65.0 | 2/2 | 54/18 | 2.5 | 5.0 | 2/2 | 54/9 | 1.4 | 5.0 | | | | | 79 | 6.5 |
| 8 | 10-2 | 2-8 | 23.0 | 2/2 | 54/18 | 1.7 | 5.0 | 3/3 | 54/18 | 1.4 | 5.0 | | | | | 60 | 0.5 |
| 9 | 10-7 | 3-5 | 31.1 | 2/2 | 54/18 | 2.0 | 5.0 | 3/3 | 54/18 | 1.4 | 5.0 | | | | | 65 | 1.5 |
| 10 | 10-11 | 4-3 | 39.5 | 2/2 | 54/18 | 2.0 | 5.0 | 3/3 | 54/18 | 1.4 | 5.0 | | | | | 70 | 2.5 |
| 11 | 11-4 | 5-0 | 48.2 | 2/2 | 54/18 | 2.5 | 5.0 | 3/3 | 54/18 | 1.7 | 5.0 | 2/2 | 54/9 | 1.4 | 5.0 | 79 | 3.5 |
| 12 | 11-8 | 5-9 | 57.2 | 2/2 | 54/18 | 2.5 | 5.0 | 3/3 | 54/18 | 1.7 | 5.0 | 2/2 | 54/9 | 1.4 | 5.0 | 83 | 4.5 |
| 13 | 12-1 | 6-7 | 66.4 | 2/2 | 54/18 | 3.0 | 5.0 | 2/2 | 27/18 | 2.0 | 5.0 | 2/2 | 54/9 | 1.4 | 5.0 | 86 | 5.5 |
| 14 | 12-5 | 7-4 | 76.0 | 2/2 | 54/18 | 3.0 | 5.0 | 2/2 | 27/18 | 2.5 | 5.0 | 2/2 | 27/9 | 1.4 | 5.0 | 98 | 6.5 |
| 15 | 11-7 | 2-10 | 28.1 | 2/2 | 54/18 | 2.5 | 5.0 | 3/3 | 54/18 | 1.7 | 5.0 | 3/3 | 27/18 | 1.4 | 5.0 | 75 | 0.5 |
| 16 | 11-11 | 3-7 | 37.4 | 2/2 | 54/18 | 2.5 | 5.0 | 3/3 | 54/18 | 2.0 | 5.0 | 4/4 | 54/18 | 1.4 | 5.0 | 81 | 1.5 |
| 17 | 12-3 | 4-5 | 46.9 | 2/2 | 54/18 | 3.0 | 5.0 | 3/3 | 54/18 | 2.0 | 5.0 | 3/3 | 27/18 | 1.4 | 5.0 | 87 | 2.5 |
| 18 | 12-7 | 5-2 | 56.6 | 2/2 | 54/18 | 3.0 | 5.0 | 2/2 | 27/18 | 2.5 | 5.0 | 2/2 | 27/9 | 1.4 | 5.0 | 98 | 3.5 |
| 19 | 12-11 | 6-0 | 66.6 | 2/2 | 54/18 | 3.0 | 5.0 | 2/2 | 27/18 | 2.5 | 5.0 | 2/2 | 27/9 | 1.4 | 5.0 | 102 | 4.5 |
| 20 | 13-3 | 6-9 | 76.9 | 3/3 | 54/18 | 2.5 | 5.0 | 3/3 | 27/18 | 2.0 | 5.0 | 2/2 | 27/9 | 1.4 | 5.0 | 105 | 5.5 |
| 21 | 13-0 | 3-0 | 33.8 | 3/3 | 54/18 | 2.5 | 5.0 | 4/4 | 54/18 | 2.0 | 5.0 | 4/4 | 27/18 | 1.4 | 5.0 | 91 | 0.5 |
| 22 | 13-4 | 3-10 | 44.2 | 3/3 | 54/18 | 3.0 | 5.0 | 3/3 | 27/18 | 2.0 | 5.0 | 3/3 | 54/9 | 1.4 | 5.0 | 102 | 1.5 |
| 23 | 13-7 | 4-7 | 54.8 | 3/3 | 54/18 | 3.0 | 5.0 | 3/3 | 27/18 | 2.5 | 5.0 | 3/3 | 54/9 | 1.4 | 5.0 | 107 | 2.5 |
| 24 | 13-10 | 5-5 | 65.6 | 2/2 | 27/18 | 3.0 | 5.0 | 3/3 | 27/18 | 2.5 | 5.0 | 3/3 | 54/9 | 1.4 | 5.0 | 112 | 3.5 |
| 25 | 14-1 | 6-2 | 76.6 | 3/3 | 54/18 | 3.0 | 5.0 | 3/3 | 27/18 | 2.5 | 5.0 | 2/2 | 18/9 | 1.4 | 5.0 | 121 | 4.5 |
| 26 | 14-5 | 3-3 | 40.0 | 3/3 | 27/18 | 3.0 | 5.0 | 4/4 | 27/18 | 2.5 | 5.0 | 5/5 | 18/18 | 1.4 | 5.0 | 114 | 0.5 |
| STRUCTURES 27 THROUGH 39 HAVE TYPE II HAUNCH AND TYPE VI CROWN RIBS[10] | | | | | | | | | | | | | | | | | |
| 27 | 14-8 | 4-1 | 51.5 | 2/2 | 27/18 | 1.4 | 5.0 | | | | | | | | | 100 | 1.5 |
| 28 | 14-10 | 4-10 | 63.2 | 2/2 | 27/18 | 1.4 | 5.0 | | | | | | | | | 112 | 2.5 |
| 29 | 15-1 | 5-8 | 75.1 | 3/2 | 27/18 | 1.4 | 5.0 | | | | | | | | | 117 | 3.5 |
| 30 | 15-4 | 6-5 | 87.2 | 3/2 | 27/18 | 1.4 | 5.0 | | | | | | | | | 121 | 4.5 |
| 31 | 15-6 | 7-3 | 99.4 | 3/2 | 27/18 | 1.4 | 5.0 | | | | | | | | | 125 | 5.5 |
| 32 | 15-9 | 8-0 | 111.8 | 2/2 | 27/18 | 2.0 | 5.0 | 3/2 | 18/18 | 1.4 | 5.0 | | | | | 138 | 6.5 |
| 33 | 15-10 | 3-6 | 46.8 | 2/2 | 27/18 | 2.1 | 5.0 | 3/2 | 18/18 | 1.4 | 5.0 | | | | | 115 | 0.5 |
| 34 | 16-0 | 4-3 | 59.5 | 2/2 | 27/18 | 2.3 | 5.0 | 3/2 | 18/18 | 1.4 | 5.0 | | | | | 122 | 1.5 |
| 35 | 16-2 | 5-1 | 72.3 | 2/2 | 27/18 | 2.4 | 4.9 | 3/2 | 18/18 | 1.4 | 5.0 | | | | | 129 | 2.5 |
| 36 | 16-4 | 5-11 | 85.2 | 2/2 | 27/18 | 2.6 | 4.5 | 3/2 | 18/18 | 1.4 | 5.0 | | | | | 133 | 3.5 |
| 37 | 16-6 | 6-8 | 98.3 | 3/2 | 27/18 | 1.8 | 5.0 | 4/2 | 18/18 | 1.4 | 5.0 | | | | | 146 | 4.5 |
| 38 | 16-8 | 7-6 | 111.5 | 3/2 | 27/18 | 1.9 | 5.0 | 4/2 | 18/18 | 1.4 | 5.0 | | | | | 151 | 5.5 |
| 39 | 16-10 | 8-3 | 124.8 | 3/2 | 27/18 | 2.0 | 5.0 | 4/2 | 18/18 | 1.4 | 5.0 | | | | | 165 | 6.5 |
| STRUCTURES 40 THROUGH 87 USE ALL TYPE VI RIBS[10] | | | | | | | | | | | | | | | | | |
| 40 | 17-9 | 3-10 | 54.4 | 2/2 | 54/18 | 2.0 | 5.0 | 2/2 | 27/18 | 1.4 | 5.0 | | | | | 124 | 0.5 |
| 41 | 18-2 | 4-7 | 68.3 | 2/2 | 54/18 | 2.2 | 5.0 | 2/2 | 27/18 | 1.4 | 5.0 | | | | | 131 | 1.5 |
| 42 | 18-7 | 5-4 | 82.5 | 2/2 | 54/18 | 2.4 | 5.0 | 2/2 | 27/18 | 1.4 | 5.0 | | | | | 138 | 2.5 |
| 43 | 19-0 | 6-1 | 97.1 | 2/2 | 54/18 | 2.6 | 5.0 | 2/2 | 27/18 | 1.4 | 5.0 | | | | | 142 | 3.5 |
| 44 | 19-5 | 6-11 | 111.9 | 2/2 | 54/18 | 2.8 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 154 | 4.5 |
| 45 | 19-10 | 7-8 | 127.1 | 2/2 | 54/18 | 2.9 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 164 | 5.5 |
| 46 | 20-3 | 8-5 | 142.6 | 2/2 | 27/18 | 1.9 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 167 | 6.5 |
| 47 | 19-1 | 4-2 | 63.3 | 2/2 | 54/18 | 2.6 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 133 | 0.5 |
| 48 | 19-5 | 4-11 | 78.3 | 2/2 | 54/18 | 2.8 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 153 | 1.5 |
| 49 | 19-9 | 5-8 | 93.6 | 2/2 | 54/18 | 2.9 | 4.8 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 162 | 2.5 |
| 50 | 20-1 | 6-6 | 109.2 | 2/2 | 27/18 | 1.9 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 165 | 3.5 |
| 51 | 20-6 | 7-3 | 125.0 | 2/2 | 27/18 | 2.0 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 169 | 4.5 |
| 52 | 20-10 | 8-1 | 141.2 | 2/2 | 27/18 | 2.1 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 173 | 5.5 |
| 53 | 21-2 | 8-10 | 157.6 | 2/2 | 27/18 | 2.2 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 176 | 6.5 |
| 54 | 20-4 | 4-6 | 73.1 | 2/2 | 27/18 | 2.0 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 153 | 0.5 |
| 55 | 20-7 | 5-3 | 89.2 | 2/2 | 27/18 | 2.1 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 162 | 1.5 |
| 56 | 20-11 | 6-1 | 105.5 | 2/2 | 27/18 | 2.2 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 171 | 2.5 |
| 57 | 21-3 | 6-10 | 122.1 | 2/2 | 27/18 | 2.3 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 174 | 3.5 |
| 58 | 21-6 | 7-8 | 139.0 | 2/2 | 27/18 | 2.3 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 178 | 4.5 |
| 59 | 21-10 | 8-5 | 156.0 | 2/2 | 27/18 | 2.5 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 182 | 5.5 |
| 60 | 22-1 | 9-3 | 173.3 | 2/2 | 27/18 | 2.5 | 4.8 | 2/3 | 18/18 | 1.4 | 5.0 | | | | | 190 | 6.5 |
| 61 | 21-7 | 4-11 | 83.8 | 2/2 | 27/18 | 2.4 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 162 | 0.5 |
| 62 | 21-10 | 5-8 | 101.0 | 2/2 | 27/18 | 2.5 | 5.0 | 2/2 | 18/18 | 1.4 | 5.0 | | | | | 171 | 1.5 |
| 63 | 22-1 | 6-6 | 118.4 | 2/2 | 27/18 | 2.5 | 4.8 | 2/3 | 18/18 | 1.4 | 5.0 | | | | | 185 | 2.5 |
| 64 | 22-3 | 7-3 | 135.9 | 2/2 | 27/18 | 2.6 | 4.6 | 2/3 | 18/18 | 1.4 | 5.0 | | | | | 188 | 3.5 |
| 65 | 22-6 | 8-1 | 153.7 | 2/2 | 27/18 | 2.7 | 4.4 | 2/3 | 18/18 | 1.4 | 5.0 | | | | | 192 | 4.5 |
| 66 | 22-9 | 8-10 | 171.6 | 2/2 | 27/18 | 2.8 | 4.2 | 2/4 | 18/18 | 1.4 | 5.0 | | | | | 201 | 5.5 |
| 67 | 23-0 | 9-8 | 189.8 | 2/2 | 27/18 | 2.8 | 4.0 | 2/4 | 18/18 | 1.4 | 5.0 | | | | | 204 | 6.5 |
| 68 | 22-9 | 5-4 | 95.5 | 2/2 | 27/18 | 2.8 | 4.2 | 2/4 | 18/18 | 1.4 | 5.0 | | | | | 181 | 0.5 |
| 69 | 23-0 | 6-1 | 113.7 | 2/2 | 27/18 | 2.8 | 4.0 | 2/4 | 18/18 | 1.4 | 5.0 | | | | | 190 | 1.5 |
| 70 | 23-2 | 6-11 | 132.1 | 3/3 | 27/18 | 2.6 | 4.4 | 2/5 | 18/18 | 1.4 | 5.0 | | | | | 203 | 2.5 |
| 71 | 23-4 | 7-8 | 150.6 | 3/3 | 27/18 | 2.6 | 4.3 | 2/5 | 18/18 | 1.4 | 5.0 | | | | | 207 | 3.5 |
| 72 | 23-6 | 8-6 | 169.3 | 3/3 | 27/18 | 2.7 | 4.2 | 2/5 | 18/18 | 1.4 | 5.0 | | | | | 211 | 4.5 |
| 73 | 23-8 | 9-3 | 188.1 | 3/3 | 27/18 | 2.7 | 4.0 | 2/5 | 18/18 | 1.4 | 5.0 | | | | | 214 | 5.5 |
| 74 | 23-10 | 10-1 | 207.0 | 3/3 | 27/18 | 2.8 | 3.9 | 2/5 | 18/18 | 1.4 | 5.0 | | | | | 218 | 6.5 |
| 75 | 24-0 | 5-9 | 108.2 | 2/2 | 18/18 | 1.7 | 5.0 | 2/5 | 18/18 | 1.4 | 5.0 | | | | | 196 | 0.5 |
| 76 | 24-1 | 6-6 | 127.5 | 2/2 | 18/18 | 1.7 | 5.0 | 2/6 | 18/18 | 1.4 | 5.0 | | | | | 211 | 1.5 |
| 77 | 24-3 | 7-4 | 146.8 | 2/2 | 18/18 | 1.8 | 5.0 | 2/6 | 18/18 | 1.4 | 5.0 | | | | | 220 | 2.5 |
| 78 | 24-4 | 8-2 | 166.2 | 2/2 | 18/18 | 1.8 | 5.0 | 2/6 | 18/18 | 1.4 | 5.0 | | | | | 224 | 3.5 |
| 79 | 24-5 | 8-11 | 185.7 | 2/2 | 18/18 | 1.8 | 5.0 | 2/6 | 18/18 | 1.4 | 5.0 | | | | | 227 | 4.5 |
| 80 | 24-7 | 9-9 | 205.3 | 2/2 | 18/18 | 1.8 | 5.0 | 2/6 | 18/18 | 1.4 | 5.0 | | | | | 231 | 5.5 |
| 81 | 24-8 | 10-6 | 225.0 | 2/2 | 18/18 | 1.8 | 5.0 | 2/6 | 18/18 | 1.4 | 5.0 | | | | | 234 | 6.5 |
| 82 | 25-2 | 6-2 | 122.0 | 2/2 | 18/18 | 1.9 | 4.9 | 2/6 | 18/18 | 1.4 | 5.0 | | | | | 214 | 0.5 |
| 83 | 25-2 | 7-0 | 142.2 | 2/2 | 18/18 | 1.9 | 4.9 | 2/7 | 18/18 | 1.4 | 5.0 | | | | | 226 | 1.5 |
| 84 | 25-3 | 7-9 | 162.4 | 2/2 | 18/18 | 1.9 | 4.9 | 2/7 | 18/18 | 1.4 | 5.0 | | | | | 235 | 2.5 |
| 85 | 25-4 | 8-7 | 182.6 | 2/2 | 18/18 | 1.9 | 4.8 | 2/7 | 18/18 | 1.4 | 5.0 | | | | | 238 | 3.5 |
| 86 | 25-4 | 9-5 | 202.9 | 2/2 | 18/18 | 1.9 | 4.8 | 2/7 | 18/18 | 1.4 | 5.0 | | | | | 242 | 4.5 |
| 87 | 25-5 | 10-2 | 223.3 | 2/2 | 18/18 | 2.0 | 4.5 | 2/7 | 18/18 | 1.4 | 5.0 | | | | | 245 | 5.5 |





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

TABLE 48B. SHELL DATA – H-25, HS-25 LOADING
PLATE AND RIB COMBINATIONS WITH ALLOWABLE HEIGHT OF COVER

| Structure Number | Span "A" (Ft.-In.) | Rise "B" (Ft.-In.) | Area (Sq. Ft.) | D6 HG/CG (Gage) | D6 HRS/CRS (Inches) | D6 Min. (Feet)[9] | D6 Max. (Feet)[9] | E6 HG/CG (Gage) | E6 HRS/CRS (Inches) | E6 Min. (Feet)[9] | E6 Max. (Feet)[9] | F6 HG/CG (Gage) | F6 HRS/CRS (Inches) | F6 Min. (Feet)[9] | F6 Max. (Feet)[9] | Max. Shell Wt./Ft. (Lbs.) | "D" Dimension ("N") |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 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 | 0.5 |
| 2 | 9-2 | 3-3 | 25.4 | 2/2 | 54/18 | 2.0 | 5.0 | 3/3 | 54/18 | 1.4 | 5.0 | | | | | 57 | 1.5 |
| 3 | 9-7 | 4-1 | 32.6 | 2/2 | 54/18 | 2.0 | 5.0 | 3/3 | 54/18 | 1.4 | 5.0 | | | | | 62 | 2.5 |
| 4 | 10-0 | 4-10 | 40.2 | 2/2 | 54/18 | 2.5 | 5.0 | 2/2 | 54/9 | 1.4 | 5.0 | | | | | 67 | 3.5 |
| 5 | 10-6 | 5-7 | 48.1 | 2/2 | 54/18 | 2.5 | 5.0 | 2/2 | 54/9 | 1.4 | 5.0 | | | | | 71 | 4.5 |
| 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 | 5.5 |
| 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 | 6.5 |
| 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 | 0.5 |
| 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 | 1.5 |
| 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 | 2.5 |
| 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 | 3.5 |
| 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 | 4.5 |
| 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 | 5.5 |
| 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 | 6.5 |
| 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 | 0.5 |
| 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 | 1.5 |
| 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 | 2.5 |
| 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 | 3.5 |
| 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 | 4.5 |
| 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 | 5.5 |
| 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 | 0.5 |
| 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 | 1.5 |
| 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 | 2.5 |
| 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 | 3.5 |
| 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 | 4.5 |
| 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 | 0.5 |
| 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 | 126 | 1.5 |
| 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 | 2.5 |
| 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 | 3.5 |
| 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 | 4.5 |
| 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 | 5.5 |
| 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 | 6.5 |
| 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 | 0.5 |
| 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 | 1.5 |
| 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 | 2.5 |
| 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 | 3.5 |
| 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 | 4.5 |
| 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 | 5.5 |
| 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 | 6.5 |
| 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 | 0.5 |
| 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 | 1.5 |
| 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 | 2.5 |
| 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 | 3.5 |
| 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 | 178 | 4.5 |
| 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 | 5.5 |
| 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 | 6.5 |
| 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 | 0.5 |
| 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 | 1.5 |
| 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 | 2.5 |
| 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 | 3.5 |
| 51 | 20-6 | 7-3 | 125.0 | 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 | 4.5 |
| 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 | 5.5 |
| 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 | 6.5 |
| 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 | 0.5 |
| 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 | 1.5 |
| 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 | 2.5 |
| 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 | 3.5 |
| 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 | 4.5 |
| 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 | 5.5 |
| 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 | 6.5 |
| 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 | 0.5 |
| 62 | 21-10 | 5-8 | 101.0 | 2/2 | 18/18 | 2.2 | 5.0 | 2/7 | 18/18 | 1.9 | 5.0 | 2/2 | 18/9 | 1.4 | 5.0 | 234 | 1.5 |
| 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 | 2.5 |
| 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 | 3.5 |
| 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 | 4.5 |
| 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 | 5.5 |
| 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 | 6.5 |
| 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 | 0.5 |
| 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 | 1.5 |
| 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 | 2.5 |
| 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 | 3.5 |
| 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 | 4.5 |
| 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 | 5.5 |
| 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 | 6.5 |
| 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 | 0.5 |
| 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 | 1.5 |
| 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 | 2.5 |
| 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 | 3.5 |
| 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 | 4.5 |
| 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 | 5.5 |
| 81 | 24-8 | 10-6 | 225.0 | 2/2 | 18/18 | 3.0 | 4.0 | 2/7 | 18/18 | 2.5 | 5.0 | 2/2 | 18/9 | 1.4 | 5.0 | 287 | 6.5 |
| 82 | 25-2 | 6-2 | 122.0 | 3/5 | 18/18 | 2.7 | 4.3 | 2/2 | 18/9 | 1.4 | 5.0 | | | | | 272 | 0.5 |
| 83 | 25-2 | 7-0 | 142.2 | 3/5 | 18/18 | 2.7 | 4.3 | 2/2 | 18/9 | 1.4 | 5.0 | | | | | 278 | 1.5 |
| 84 | 25-3 | 7-9 | 162.4 | 3/5 | 18/18 | 2.7 | 4.3 | 2/2 | 18/9 | 1.4 | 5.0 | | | | | 287 | 2.5 |
| 85 | 25-4 | 8-7 | 182.6 | 3/5 | 18/18 | 2.7 | 4.2 | 2/2 | 18/9 | 1.4 | 5.0 | | | | | 291 | 3.5 |
| 86 | 25-4 | 9-5 | 202.9 | 3/5 | 18/18 | 2.7 | 4.2 | 2/2 | 18/9 | 1.4 | 5.0 | | | | | 294 | 4.5 |
| 87 | 25-5 | 10-2 | 223.3 | 3/5 | 18/18 | 2.8 | 4.2 | 2/2 | 18/9 | 1.4 | 5.0 | | | | | 298 | 5.5 |

**See Notes page 65**

| TABLE 70. BRIDGECOR BOX CULVERT 15" X 5½" | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LRFD HEIGHT OF COVER GUIDE (HL-93 LOADING) | | | | | | | | | | | | |
| Dimensions to Inside Corrugation | | | Gage Thickness (Inches) - Height of Cover Shown in Feet<br>Maximum Height of Cover (Minimum Height of Cover) | | | | | | | | | |
| Bottom Span (Ft.-In.) | Rise (Ft.-In.) | Approx. Area (Sq. Ft.) | 10 (0.140) | 8 (0.170) | 7 (0.188) | 5 (0.218) | 3 (0.249) | 1 (0.280) | 5/16 (0.318) | 3/8 (0.380) | Select Fill Width (ft.) | Precon (min Level) |
| 17-6 | 6-10 | 99 | 11 (3.0) | 13 (2.5) | 14 (2.5) | 16 (2.0) | 17 (2.0) | 19 (2.0) | 21 (2.0) | 25 (1.5) | 8.0 | 1 |
| 17-7 | 8-2 | 122 | 11 (3.0) | 13 (2.5) | 14 (2.5) | 15 (2.0) | 17 (2.0) | 19 (2.0) | 21 (2.0) | 24 (1.5) | 8.0 | 1 |
| 17-9 | 9-6 | 146 | 11 (3.0) | 13 (2.5) | 14 (2.5) | 15 (2.0) | 17 (2.0) | 19 (2.0) | 21 (2.0) | 24 (1.5) | 8.0 | 1 |
| 17-10 | 10-10 | 169 | 11 (3.0) | 13 (2.5) | 13 (2.5) | 15 (2.0) | 17 (2.0) | 18 (2.0) | 21 (2.0) | 24 (1.5) | 8.0 | 1 |
| 18-10 | 7-0 | 108 | 10 (3.0) | 11 (2.5) | 12 (2.5) | 14 (2.0) | 15 (2.0) | 17 (2.0) | 19 (2.0) | 22 (1.5) | 8.0 | 1 |
| 18-11 | 8-4 | 134 | 10 (3.0) | 11 (2.5) | 12 (2.5) | 14 (2.0) | 15 (2.0) | 17 (2.0) | 19 (2.0) | 22 (1.5) | 8.0 | 1 |
| 19-1 | 9-8 | 159 | 10 (3.0) | 11 (2.5) | 12 (2.5) | 14 (2.0) | 15 (2.0) | 17 (2.0) | 18 (2.0) | 22 (1.5) | 8.0 | 1 |
| 19-3 | 11-0 | 184 | 10 (3.0) | 11 (2.5) | 12 (2.5) | 13 (2.0) | 15 (2.0) | 16 (2.0) | 18 (2.0) | 21 (1.5) | 8.0 | 1 |
| 20-4 | 8-6 | 145 | 9 (3.0) | 10 (3.0) | 11 (2.5) | 12 (2.5) | 14 (2.0) | 15 (2.0) | 17 (2.0) | 19 (1.5) | 8.0 | 1 |
| 20-5 | 9-10 | 172 | 9 (3.5) | 10 (3.0) | 11 (2.5) | 12 (2.5) | 13 (2.0) | 15 (2.0) | 16 (2.0) | 19 (2.0) | 8.0 | 1 |
| 20-7 | 11-1 | 200 | 8 (3.5) | 10 (3.0) | 11 (2.5) | 12 (2.5) | 13 (2.0) | 15 (2.0) | 16 (2.0) | 19 (2.0) | 8.0 | 1 |
| 21-6 | 7-3 | 128 | 8 (3.5) | 9 (3.0) | 10 (2.5) | 11 (2.5) | 12 (2.0) | 13 (2.0) | 15 (2.0) | 17 (2.0) | 8.0 | 1 |
| 21-8 | 8-7 | 157 | 8 (3.5) | 9 (3.0) | 10 (2.5) | 11 (2.5) | 12 (2.0) | 13 (2.0) | 15 (2.0) | 17 (2.0) | 8.0 | 1 |
| 21-10 | 9-11 | 186 | 8 (3.5) | 9 (3.0) | 9 (2.5) | 11 (2.5) | 12 (2.0) | 13 (2.0) | 15 (2.0) | 17 (2.0) | 8.0 | 1 |
| 22-5 | 11-3 | 215 | 8 (3.5) | 9 (3.0) | 9 (2.5) | 10 (2.5) | 12 (2.0) | 13 (2.0) | 14 (2.0) | 17 (2.0) | 8.0 | 1 |
| 22-9 | 7-5 | 139 | 7 (3.5) | 8 (3.0) | 9 (3.0) | 10 (2.5) | 11 (2.0) | 12 (2.0) | 13 (2.0) | 15 (2.0) | 8.0 | 1 |
| 22-11 | 8-9 | 169 | 7 (3.5) | 8 (3.0) | 9 (3.0) | 10 (2.5) | 11 (2.0) | 12 (2.0) | 13 (2.0) | 15 (2.0) | 8.0 | 1 |
| 23-2 | 10-1 | 200 | 7 (3.5) | 8 (3.0) | 8 (3.0) | 9 (2.5) | 11 (2.0) | 12 (2.0) | 13 (2.0) | 15 (2.0) | 8.0 | 1 |
| 23-4 | 11-5 | 231 | 7 (3.5) | 8 (3.0) | 8 (3.0) | 9 (2.5) | 10 (2.0) | 11 (2.0) | 13 (2.0) | 15 (2.0) | 8.0 | 1 |
| 24-1 | 7-7 | 149 | | 7 (3.0) | 8 (3.0) | 9 (2.5) | 10 (2.5) | 11 (2.0) | 12 (2.0) | 14 (2.0) | 8.0 | 2 |
| 24-3 | 8-7 | 168 | | 7 (3.0) | 8 (2.5) | 9 (2.0) | 9 (2.0) | 10 (1.5) | 12 (1.5) | 14 (1.5) | 8.0 | 2 |
| 24-3 | 8-11 | 181 | 7 (3.0) | 9 (3.0) | 9 (3.0) | 10 (2.5) | 11 (2.5) | 12 (2.0) | 14 (2.0) | 16 (2.0) | 8.0 | 2 |
| 24-5 | 9-11 | 200 | 7 (3.5) | 8 (3.0) | 9 (2.5) | 10 (2.0) | 11 (2.0) | 12 (1.5) | 14 (1.5) | 16 (1.5) | 8.0 | 2 |
| 24-5 | 10-3 | 214 | | 7 (3.0) | 8 (3.0) | 8 (2.5) | 9 (2.5) | 10 (2.0) | 11 (2.0) | 13 (2.0) | 8.0 | 2 |
| 24-6 | 11-3 | 233 | 7 (3.5) | 8 (3.0) | 9 (2.5) | 10 (2.0) | 11 (2.0) | 12 (1.5) | 14 (1.5) | 16 (1.5) | 8.0 | 2 |
| 24-8 | 11-7 | 246 | | 7 (3.5) | 7 (3.0) | 8 (2.5) | 9 (2.5) | 10 (2.0) | 11 (2.0) | 13 (2.0) | 8.0 | 2 |
| 24-8 | 12-7 | 265 | 7 (3.5) | 8 (3.0) | 9 (2.5) | 10 (2.0) | 11 (2.0) | 12 (1.5) | 13 (1.5) | 16 (1.5) | 8.0 | 2 |

Notes:
1. **Not for a specific structural design. Use for budget estimating only. CANDE analyses are required for final design and quotation.**
2. The above table is based upon the general requirements of the AASHTO LRFD Design Specification, Section 12, and:
   a. These tables are based upon a trench condition installation.
   b. Backfill material per AASHTO M 145. For estimating, assume A-1 material.
      With specific site information, alternate backfill materials may be allowed. Refer to Table 69 (pg. 106).
   c. Backfill 120 pcf in density and compacted to a minimum of 90% modified proctor.
   d. The minimum cover is per article 12.8.9.4
   e. The minimum select backfill width (six to eight feet) is measured from outside the maximum span on each side of the structure.
      This width only applies when the material adjacent to the select zone is determined to be competent, well consolidated material.
3. Select backfill width may increase for situations where lower strength fill exists in either the select fill zone or the adjacent embankment zone.
4. This estimate is for single barrel structures. For multiple barrels, more investigation is required.

| TABLE 71. BRIDGECOR BOX CULVERT 15" X 5½" | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LRFD HEIGHT OF COVER GUIDE (HL-93 LOADING) | | | | | | | | | | | | |
| Dimensions to Inside Corrugation | | | Gage Thickness (Inches) - Height of Cover Shown in Feet<br>Maximum Height of Cover (Minimum Height of Cover) | | | | | | | | | |
| Bottom Span (Ft.-In.) | Rise (Ft.-In.) | Approx. Area (Sq. Ft.) | 10 (0.140) | 8 (0.170) | 7 (0.188) | 5 (0.218) | 3 (0.249) | 1 (0.280) | 5/16 (0.318) | 3/8 (0.380) | Select Fill Width (Ft.) | Precon (Min Level) |
| 24-11 | 8-0 | 162 | | 7 (3.5) | 7 (3.0) | 8 (2.5) | 9 (2.5) | 10 (2.0) | 11 (2.0) | 13 (2.0) | 8.0 | 2 |
| 25-7 | 9-1 | 194 | | 6 (3.5) | 7 (3.0) | 8 (2.5) | 8 (2.5) | 9 (2.0) | 10 (2.0) | 12 (2.0) | 6.0 | 2 |
| 25-8 | 8-8 | 179 | 7 (3.5) | 8 (3.0) | 8 (2.5) | 9 (2.5) | 10 (2.0) | 11 (2.0) | 12 (1.5) | 14 (1.5) | 8.0 | 2 |
| 25-10 | 10-0 | 214 | 7 (3.5) | 8 (3.0) | 8 (2.5) | 9 (2.5) | 10 (2.0) | 11 (2.0) | 12 (2.0) | 14 (1.5) | 8.0 | 2 |
| 26-0 | 11-4 | 258 | 7 (3.5) | 8 (3.0) | 8 (2.5) | 9 (2.5) | 10 (2.0) | 11 (2.0) | 12 (2.0) | 14 (1.5) | 8.0 | 2 |
| 26-2 | 12-8 | 283 | 7 (3.5) | 7 (3.0) | 8 (2.5) | 9 (2.5) | 10 (2.0) | 11 (2.0) | 12 (2.0) | 14 (1.5) | 8.0 | 2 |
| 26-4 | 9-6 | 209 | | 6 (3.5) | 6 (3.0) | 7 (3.0) | 8 (2.5) | 9 (2.0) | 10 (2.0) | 11 (2.0) | 6.0 | 2 |
| 26-5 | 10-10 | 244 | | 6 (3.5) | 6 (3.0) | 7 (3.0) | 8 (2.5) | 9 (2.0) | 10 (2.0) | 11 (2.0) | 6.0 | 2 |
| 26-6 | 12-2 | 278 | | | 6 (3.0) | 7 (3.0) | 8 (2.5) | 9 (2.0) | 10 (2.0) | 11 (2.0) | 6.0 | 2 |
| 27-1 | 8-10 | 191 | 6 (3.5) | 7 (3.0) | 7 (2.5) | 8 (2.5) | 9 (2.0) | 10 (2.0) | 11 (2.0) | 13 (1.5) | 8.0 | 2 |
| 27-3 | 10-2 | 227 | 6 (3.5) | 7 (3.0) | 7 (2.5) | 8 (2.5) | 9 (2.0) | 10 (2.0) | 11 (2.0) | 13 (2.0) | 8.0 | 2 |
| 27-5 | 11-6 | 263 | | 7 (3.0) | 7 (3.0) | 8 (2.5) | 9 (2.0) | 10 (2.0) | 11 (2.0) | 13 (2.0) | 8.0 | 2 |
| 27-6 | 8-4 | 185 | | | 6 (3.0) | 7 (3.0) | 7 (2.5) | 8 (2.5) | 9 (2.0) | 10 (2.0) | 6.0 | 3 |
| 27-7 | 12-10 | 300 | | 8 (3.0) | 8 (3.0) | 9 (2.5) | 10 (2.0) | 10 (2.0) | 11 (2.0) | 13 (2.0) | 8.0 | 2 |
| 27-9 | 11-0 | 259 | | | 6 (3.5) | 6 (3.0) | 7 (2.5) | 8 (2.5) | 9 (2.0) | 10 (2.0) | 6.0 | 3 |
| 27-11 | 12-4 | 296 | | | 6 (3.5) | 6 (3.0) | 7 (2.5) | 8 (2.5) | 8 (2.0) | 10 (2.0) | 6.0 | 3 |
| 28-2 | 9-5 | 220 | | | 6 (3.5) | 6 (3.0) | 7 (2.5) | 8 (2.5) | 8 (2.0) | 10 (2.0) | 6.0 | 3 |
| 28-6 | 9-0 | 203 | | 6 (3.0) | 7 (3.0) | 7 (2.5) | 8 (2.0) | 9 (2.0) | 10 (2.0) | 12 (2.0) | 8.0 | 2 |
| 28-8 | 10-4 | 241 | | 6 (3.0) | 7 (3.0) | 7 (2.5) | 8 (2.5) | 9 (2.0) | 10 (2.0) | 11 (2.0) | 8.0 | 2 |
| 28-10 | 8-6 | 197 | | | 5 (3.5) | 6 (3.0) | 7 (2.5) | 7 (2.5) | 8 (2.0) | 9 (2.0) | 6.0 | 3 |
| 28-11 | 11-8 | 280 | | 6 (3.0) | 7 (3.0) | 7 (2.5) | 8 (2.5) | 9 (2.0) | 10 (2.0) | 11 (2.0) | 8.0 | 2 |
| 29-1 | 11-2 | 274 | | | 5 (3.5) | 6 (3.0) | 6 (2.5) | 7 (2.5) | 8 (2.0) | 9 (2.0) | 6.0 | 3 |
| 29-1 | 13-0 | 318 | | 6 (3.5) | 6 (3.0) | 7 (2.5) | 8 (2.5) | 9 (2.0) | 10 (2.0) | 11 (2.0) | 8.0 | 2 |
| 29-3 | 12-6 | 313 | | | | 6 (3.0) | 6 (2.5) | 7 (2.5) | 8 (2.0) | 9 (2.0) | 6.0 | 3 |
| 29-6 | 9-7 | 233 | | | | 6 (3.0) | 6 (2.5) | 7 (2.5) | 8 (2.0) | 9 (2.0) | 8.0 | 3 |
| 29-10 | 9-1 | 216 | | 6 (3.5) | 6 (3.0) | 7 (2.5) | 8 (2.5) | 8 (2.0) | 9 (2.0) | 11 (2.0) | 8.0 | 2 |

Notes:
1. **Not for a specific structural design. Use for budget estimating only. CANDE analyses are required for final design and quotation.**
2. The above table is based upon the general requirements of the AASHTO LRFD Design Specification, Section 12, and:
   a. These tables are based upon a trench condition installation.
   b. Backfill material per AASHTO M 145. For estimating, assume A-1 material.
      With specific site information, alternate backfill materials may be allowed. Refer to Table 69 (pg. 106).
   c. Backfill 120 pcf in density and compacted to a minimum of 90% modified proctor.
   d. The minimum cover is per article 12.8.9.4
   e. The minimum select backfill width (six to eight feet) is measured from outside the maximum span on each side of the structure.
      This width only applies when the material adjacent to the select zone is determined to be competent, well consolidated material.
3. Select backfill width may increase for situations where lower strength fill exists in either the select fill zone or the adjacent embankment zone.
4. This estimate is for single barrel structures. For multiple barrels, more investigation is required.

| TABLE 72. BRIDGECOR BOX CULVERT 15" X 5½" | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LRFD HEIGHT OF COVER GUIDE (HL-93 LOADING) | | | | | | | | | | | | |
| Dimensions to Inside Corrugation | | | Gage Thickness (Inches) - Height of Cover Shown in Feet<br>Maximum Height of Cover (Minimum Height of Cover) | | | | | | | | | |
| Bottom Span (Ft.-In.) | Rise (Ft.-In.) | Approx. Area (Sq. Ft.) | 10 (0.140) | 8 (0.170) | 7 (0.188) | 5 (0.218) | 3 (0.249) | 1 (0.280) | 5/16 (0.318) | 3/8 (0.380) | Select Fill Width (ft.) | Precon (Min Level) |
| 30-1 | 10-5 | 256 | | 6 (3.5) | 6 (3.0) | 7 (2.5) | 7 (2.5) | 8 (2.0) | 9 (2.0) | 10 (2.0) | 8.0 | 2 |
| 30-4 | 11-9 | 296 | | 6 (3.5) | 6 (3.0) | 7 (2.5) | 7 (2.5) | 8 (2.0) | 9 (2.0) | 10 (2.0) | 8.0 | 2 |
| 30-5 | 11-3 | 290 | | | | 5 (3.0) | 6 (2.5) | 6 (2.5) | 7 (2.0) | 8 (2.0) | 8.0 | 3 |
| 30-7 | 12-7 | 331 | | 5 (3.5) | 6 (3.0) | 6 (3.0) | 7 (2.5) | 8 (2.5) | 9 (2.0) | 10 (2.0) | 8.0 | 3 |
| 30-7 | 13-1 | 336 | | | | 5 (3.0) | 6 (2.5) | 6 (2.0) | 7 (2.0) | 8 (2.0) | 8.0 | 3 |
| 30-7 | 8-5 | 206 | | | | 5 (3.0) | 6 (2.5) | 6 (2.5) | 7 (2.0) | 8 (2.0) | 8.0 | 3 |
| 30-8 | 9-7 | 232 | | 5 (3.5) | 6 (3.0) | 6 (3.0) | 7 (2.5) | 8 (2.0) | 9 (2.0) | 10 (2.0) | 8.0 | 2 |
| 30-9 | 10-11 | 272 | | 5 (3.5) | 6 (3.0) | 6 (3.0) | 7 (2.5) | 8 (2.0) | 9 (2.0) | 10 (2.0) | 8.0 | 2 |
| 30-11 | 12-2 | 313 | | | 6 (3.0) | 6 (3.0) | 7 (2.5) | 8 (2.0) | 8 (2.0) | 10 (2.0) | 8.0 | 3 |
| 31-0 | 13-6 | 355 | | | 6 (3.0) | 6 (3.0) | 7 (2.5) | 8 (2.0) | 8 (2.0) | 10 (2.0) | 8.0 | 3 |
| 31-6 | 8-9 | 222 | | | | 5 (3.0) | 6 (3.0) | 6 (2.5) | 7 (2.0) | 8 (2.0) | 8.0 | 3 |
| 31-9 | 11-5 | 306 | | | | 5 (3.0) | 6 (3.0) | 6 (2.5) | 7 (2.0) | 8 (2.0) | 8.0 | 3 |
| 32-0 | 9-8 | 246 | | | 5 (3.5) | 6 (3.0) | 7 (2.5) | 7 (2.5) | 8 (2.0) | 9 (2.0) | 8.0 | 3 |
| 32-2 | 11-0 | 288 | | | 5 (3.5) | 6 (3.0) | 6 (2.5) | 7 (2.5) | 8 (2.0) | 9 (2.0) | 8.0 | 3 |
| 32-4 | 12-4 | 331 | | | 5 (3.5) | 6 (3.0) | 6 (3.0) | 7 (2.5) | 8 (2.0) | 9 (2.0) | 8.0 | 3 |
| 32-6 | 13-8 | 374 | | | 5 (3.5) | 6 (3.0) | 6 (3.0) | 7 (2.5) | 8 (2.0) | 9 (2.0) | 8.0 | 3 |
| 33-5 | 9-10 | 259 | | | | 6 (3.0) | 6 (3.0) | 7 (2.5) | 7 (2.0) | 8 (2.0) | 8.0 | 3 |
| 33-7 | 11-2 | 303 | | | | 5 (3.0) | 6 (3.0) | 7 (2.5) | 7 (2.5) | 8 (2.0) | 8.0 | 3 |
| 33-9 | 12-6 | 348 | | | | 5 (3.0) | 6 (3.0) | 6 (2.5) | 7 (2.5) | 8 (2.0) | 8.0 | 3 |
| 34-0 | 13-10 | 393 | | | | 5 (3.0) | 6 (3.0) | 6 (2.5) | 7 (2.5) | 8 (2.0) | 8.0 | 3 |
| 34-9 | 10-0 | 273 | | | | 5 (3.0) | 6 (3.0) | 6 (2.5) | 7 (2.5) | 8 (2.0) | 8.0 | 3 |
| 34-11 | 11-3 | 318 | | | | 5 (3.0) | 6 (3.0) | 6 (2.5) | 7 (2.5) | 8 (2.0) | 8.0 | 3 |
| 35-2 | 12-7 | 364 | | | | 5 (3.0) | 6 (3.0) | 6 (2.5) | 7 (2.5) | 8 (2.0) | 8.0 | 3 |
| 35-4 | 13-11 | 411 | | | | 5 (3.0) | 6 (3.0) | 6 (2.5) | 7 (2.5) | 8 (2.0) | 8.0 | 3 |
| UP TO 45′ | VARIES | | VARIES | | | | | | | | INQUIRE | INQUIRE |

Notes:
1. **Not for a specific structural design. Use for budget estimating only. CANDE analyses are required for final design and quotation.**
2. The above table is based upon the general requirements of the AASHTO LRFD Design Specification, Section 12, and:
   a. These tables are based upon a trench condition installation.
   b. Backfill material per AASHTO M 145. For estimating, assume A-1 material.
   With specific site information, alternate backfill materials may be allowed. Refer to Table 69 (pg. 106).
   c. Backfill 120 pcf in density and compacted to a minimum of 90% modified proctor.
   d. The minimum cover is per article 12.8.9.4
   e. The minimum select backfill width (six to eight feet) is measured from outside the maximum span on each side of the structure.
   This width only applies when the material adjacent to the select zone is determined to be competent, well consolidated material.
3. Select backfill width may increase for situations where lower strength fill exists in either the select fill zone or the adjacent embankment zone.
4. This estimate is for single barrel structures. For multiple barrels, more investigation is required.