

Bill of Reinforcing for One Headwall 15° Skew Span x Culvert Height

| Bar | Location | Shape | 10' x 7' | | | 10' x 6' | | | 10' x 5' | | | 10' x 4' | | | Bar | | |
|----------------------|-----------------------------|-------|--------------|------------------|-----|--------------|------------------|-----|--------------|------------------|-----|--------------|------------------|-----|--------------|--|--|
| | | | No. | Length | Wt. | No. | Length | Wt. | No. | Length | Wt. | No. | Length | Wt. | | | |
| 5fa | Fence Anchor (Galv.) | | 2 | 2'-10" | 6 | 2 | 2'-10" | 6 | 2 | 2'-10" | 6 | 2 | 2'-10" | 6 | 5fa | | |
| 4b1 | Wingwall, B.F.H. Long | | 1 | 28'-6" | 19 | 1 | 25'-1" | 17 | 1 | 21'-7" | 14 | 1 | 18'-2" | 12 | 4b1 | | |
| 4b2 | Wingwall, B.F.H. Short | | 1 | 25'-4" | 17 | 1 | 22'-4" | 15 | 1 | 19'-4" | 13 | 1 | 16'-4" | 11 | 4b2 | | |
| 4b3 | Wingwall, B.F.H. Long | | 5 Var. | 13'-2 to 26'-11 | 67 | 4 Var. | 13'-2 to 23'-6 | 49 | 3 Var. | 13'-2 to 20'-1 | 33 | 2 Var. | 13'-2 to 16'-7 | 20 | 4b3 | | |
| 4b4 | Wingwall, B.F.H. Short | | 5 Var. | 11'-11 to 23'-11 | 60 | 4 Var. | 11'-11 to 20'-11 | 44 | 3 Var. | 11'-11 to 17'-11 | 30 | 2 Var. | 11'-11 to 14'-11 | 18 | 4b4 | | |
| 5b5 | Wingwall, F.F.H. Long | | 1 | 28'-6" | 30 | 1 | 25'-1" | 26 | 1 | 21'-8" | 23 | 1 | 18'-3" | 19 | 5b5 | | |
| 5b6 | Wingwall, F.F.H. Short | | 1 | 25'-4" | 26 | 1 | 22'-4" | 23 | 1 | 19'-4" | 20 | 1 | 16'-4" | 17 | 5b6 | | |
| 5b7 | Wingwall, F.F.H. Long | | 6 Var. | 9'-0 to 26'-11 | 115 | 5 Var. | 9'-0 to 23'-6 | 87 | 4 Var. | 9'-0 to 20'-1 | 62 | 3 Var. | 9'-0 to 16'-8 | 41 | 5b7 | | |
| 5b8 | Wingwall, F.F.H. Short | | 6 Var. | 9'-0 to 24'-0 | 103 | 5 Var. | 9'-0 to 21'-0 | 78 | 4 Var. | 9'-0 to 18'-0 | 56 | 3 Var. | 9'-0 to 15'-0 | 38 | 5b8 | | |
| 5b9 | Interior Wall, Both F.H. | | 11 Var. | 5'-8 to 18'-2 | 137 | 9 Var. | 5'-9 to 16'-1 | 102 | 7 Var. | 5'-10 to 14'-0 | 72 | 5 Var. | 6'-0 to 11'-10 | 47 | 5b9 | | |
| 4c1 | Wingwall, F.F.V. Long | | 25 Var. | 2'-9 to 9'-9 | 104 | 22 Var. | 2'-9 to 8'-11 | 86 | 18 Var. | 2'-9 to 7'-9 | 63 | 15 Var. | 2'-9 to 6'-10 | 48 | 4c1 | | |
| 4c2 | Wingwall, F.F.V. Short | | 22 Var. | 2'-9 to 9'-9 | 92 | 19 Var. | 2'-9 to 8'-9 | 73 | 16 Var. | 2'-9 to 7'-9 | 56 | 13 Var. | 2'-9 to 6'-9 | 41 | 4c2 | | |
| 4c3 | Wingwall, F.F.V. Long | | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 4c3 | | |
| 4c4 | Wingwall, F.F.V. Short | | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | 4c4 | | |
| 4c5 | Wingwall, F.F.V. Long | | 2 | 8'-8" | 12 | 1 | 7'-8" | 5 | 2 | 6'-8" | 9 | 1 | 5'-8" | 4 | 4c5 | | |
| 4c6 | Wingwall, F.F.V. Short | | 2 | 8'-8" | 12 | 2 | 7'-8" | 10 | 2 | 6'-8" | 9 | 2 | 5'-8" | 8 | 4c6 | | |
| 4c7 | Interior Wall, Both F.V. | | 2 | 4'-1" | 5 | 2 | 4'-1" | 5 | 2 | 4'-1" | 5 | 2 | 4'-0" | 5 | 4c7 | | |
| 4c8 | Interior Wall, Both F.V. | | 28 Var. | 1'-10 to 7'-3 | 85 | 24 Var. | 1'-10 to 6'-3 | 65 | 20 Var. | 1'-10 to 5'-4 | 48 | 16 Var. | 1'-9 to 4'-4 | 33 | 4c8 | | |
| 5c9 | Wingwall, B.F.V. Long | | 9 Var. | 2'-9 to 5'-1 | 37 | 9 Var. | 2'-9 to 5'-1 | 37 | 9 Var. | 2'-9 to 5'-1 | 37 | 9 Var. | 2'-9 to 5'-1 | 37 | 5c9 | | |
| 5c10 | Wingwall, B.F.V. Short | | 6 Var. | 2'-9 to 4'-5 | 22 | 6 Var. | 2'-9 to 4'-5 | 22 | 6 Var. | 2'-9 to 4'-5 | 22 | 6 Var. | 2'-9 to 4'-5 | 22 | 5c10 | | |
| 5c11 | Wingwall, B.F.V. Long | | 16 Var. | 9'-5 to 13'-9 | 193 | 13 Var. | 9'-5 to 12'-11 | 151 | 9 Var. | 9'-5 to 11'-9 | 99 | 6 Var. | 9'-5 to 10'-10 | 63 | 5c11 | | |
| 5c12 | Wingwall, B.F.V. Short | | 16 Var. | 8'-9 to 13'-9 | 188 | 13 Var. | 8'-9 to 12'-9 | 146 | 10 Var. | 8'-9 to 11'-9 | 107 | 7 Var. | 8'-9 to 10'-9 | 71 | 5c12 | | |
| 6c13 | Wingwall, B.F.V. Long | | 10 | 10'-6" | 158 | 7 | 10'-6" | 110 | -- | -- | -- | -- | -- | -- | 6c13 | | |
| 6c13 | Wingwall, B.F.V. Short | | 9 | 10'-6" | 142 | 6 | 10'-6" | 95 | -- | -- | -- | -- | -- | -- | 6c13 | | |
| 5c14 | Wingwall, B.F.V. Long | | 2 | 12'-8" | 26 | 1 | 11'-8" | 12 | 2 | 10'-8" | 22 | 1 | 9'-8" | 10 | 5c14 | | |
| 5c14 | Wingwall, B.F.V. Short | | 2 | 12'-8" | 26 | 2 | 11'-8" | 24 | 2 | 10'-8" | 22 | 2 | 9'-8" | 20 | 5c14 | | |
| 4d1 | Apron, Longit., Bott. | | 13 | 18'-6" | 161 | 13 | 16'-5" | 143 | 13 | 14'-4" | 124 | 13 | 12'-4" | 107 | 4d1 | | |
| 4d2 | Apron, Longit., Bott. Long | | 3 | 23'-1" | 46 | 3 | 19'-8" | 39 | 3 | 16'-3" | 33 | 3 | 12'-10" | 26 | 4d2 | | |
| 4d3 | Apron, Longit., Bott. Short | | 3 | 20'-5" | 41 | 3 | 17'-5" | 35 | 3 | 14'-5" | 29 | 3 | 11'-5" | 23 | 4d3 | | |
| 6f1 | Apron, Longit., Top | | 20 | 18'-6" | 556 | 20 | 16'-5" | 493 | 20 | 14'-4" | 431 | 20 | 12'-4" | 370 | 6f1 | | |
| 6f2 | Apron, Longit., Top Long | | 4 Var. | 7'-7 to 15'-3 | 69 | 4 Var. | 5'-6 to 13'-2 | 56 | 3 Var. | 5'-11 to 11'-1 | 38 | 2 Var. | 6'-5 to 9'-0 | 23 | 6f2 | | |
| 6f3 | Apron, Longit., Top Short | | 4 Var. | 6'-7 to 15'-4 | 66 | 4 Var. | 4'-5 to 13'-3 | 53 | 3 Var. | 5'-3 to 11'-2 | 37 | 2 Var. | 6'-2 to 9'-1 | 23 | 6f3 | | |
| 6f4 | Apron, Longit., Top Long | | 1 | 28'-6" | 43 | 1 | 25'-1" | 38 | 1 | 21'-8" | 33 | 1 | 18'-3" | 27 | 6f4 | | |
| 6f5 | Apron, Longit., Top Short | | 1 | 25'-4" | 38 | 1 | 22'-4" | 34 | 1 | 19'-4" | 29 | 1 | 16'-4" | 25 | 6f5 | | |
| 4f1 | Parapet, Vertical | | 41 | 6'-2" | 169 | 41 | 6'-2" | 169 | 41 | 6'-2" | 169 | 41 | 6'-2" | 169 | 4f1 | | |
| 7j1 | Parapet, Horizontal | | 4 | 22'-8" | 185 | 4 | 22'-8" | 185 | 4 | 22'-8" | 185 | 4 | 22'-8" | 185 | 7j1 | | |
| 6m1 | Apron, Trans., Top | | 5 Var. | 22'-11 to 23'-8 | 175 | 5 Var. | 22'-11 to 23'-8 | 175 | 5 Var. | 22'-11 to 23'-8 | 175 | 5 Var. | 22'-11 to 23'-8 | 175 | 6m1 | | |
| 6m2 | Apron, Trans., Top | | 13 Var. | 23'-11 to 28'-5 | 511 | 10 Var. | 23'-11 to 27'-4 | 385 | 7 Var. | 23'-11 to 26'-2 | 263 | 5 Var. | 23'-11 to 25'-5 | 185 | 6m2 | | |
| 6m3 | Apron, Trans., Top | | 7 Var. | 6'-3 to 21'-11 | 148 | 8 Var. | 3'-9 to 22'-1 | 155 | 8 Var. | 3'-11 to 22'-2 | 157 | 7 Var. | 4'-0 to 19'-8 | 124 | 6m3 | | |
| 6m4 | Apron, Trans., Bott. | | 14 Var. | 17'-1 to 24'-1 | 433 | 12 Var. | 17'-1 to 23'-0 | 361 | 10 Var. | 17'-1 to 21'-11 | 293 | 8 Var. | 17'-1 to 20'-10 | 228 | 6m4 | | |
| 6p1 | Curtain, Horizontal | | 4 | 21'-9" | 131 | 4 | 21'-8" | 130 | 4 | 21'-8" | 130 | 4 | 21'-8" | 130 | 6p1 | | |
| 6p2 | Curtain, Horizontal, Long | | 4 | 14'-2" | 85 | 4 | 12'-8" | 76 | 4 | 11'-2" | 67 | 4 | 9'-8" | 58 | 6p2 | | |
| 6p3 | Curtain, Horizontal, Short | | 4 | 11'-3" | 68 | 4 | 10'-2" | 61 | 4 | 9'-1" | 55 | 4 | 7'-11" | 48 | 6p3 | | |
| 6s1 | Wing Slope, Both F., Long | | 2 | 6'-11" | 21 | 2 | 6'-11" | 21 | 2 | 6'-11" | 21 | 2 | 6'-11" | 21 | 6s1 | | |
| 6s2 | Wing Slope, Both F., Short | | 2 | 6'-6" | 20 | 2 | 6'-6" | 20 | 2 | 6'-6" | 20 | 2 | 6'-6" | 20 | 6s2 | | |
| 6s3 | Wing Slope, Both F., Long | | 2 | 23'-5" | 70 | 2 | 19'-10" | 60 | 2 | 16'-3" | 49 | 2 | 12'-8" | 38 | 6s3 | | |
| 6s4 | Wing Slope, Both F., Short | | 2 | 21'-1" | 63 | 2 | 17'-11" | 54 | 2 | 14'-9" | 44 | 2 | 11'-7" | 35 | 6s4 | | |
| 6s5 | Wing Slope, F.F. Long | | 1 | 28'-6" | 43 | 1 | 25'-0" | 38 | 1 | 21'-5" | 32 | 1 | 17'-10" | 27 | 6s5 | | |
| 6s6 | Wing Slope, F.F. Short | | 1 | 23'-10" | 39 | 1 | 22'-8" | 34 | 1 | 19'-6" | 29 | 1 | 16'-4" | 25 | 6s6 | | |
| 6s7 | Interior Wall, Both F.H. | | 2 | 19'-4" | 58 | 2 | 17'-1" | 51 | 2 | 14'-9" | 44 | 2 | 12'-6" | 38 | 6s7 | | |
| 5t1 | Curtain, Vertical | | 28 | 8'-8" | 195 | 26 | 8'-5" | 174 | 24 | 8'-5" | 161 | 22 | 8'-5" | 147 | 5t1 | | |
| Estimated Quantities | | | Reinf. Steel | | | Reinf. Steel | | | Reinf. Steel | | | Reinf. Steel | | | Reinf. Steel | | |
| One Headwall | | | Concrete | | | Concrete | | | Concrete | | | Concrete | | | Concrete | | |
| | | | Parapet Δ | | | Parapet Δ | | | Parapet Δ | | | Parapet Δ | | | Parapet Δ | | |
| | | | Wingwalls | | | Wingwalls | | | Wingwalls | | | Wingwalls | | | Wingwalls | | |
| | | | Apron * | | | Apron * | | | Apron * | | | Apron * | | | Apron * | | |
| | | | 37.6 CY | | | 31.5 CY | | | 26.4 CY | | | 21.5 CY | | | | | |
| | | | 22.5 | | | 19.1 | | | 15.8 | | | | | | | | |

Δ Includes top of wingwall quantities.
 * Assumes apron and floor are equal thickness, adjust concrete quantities for transition where apron and floor thickness are not equal.

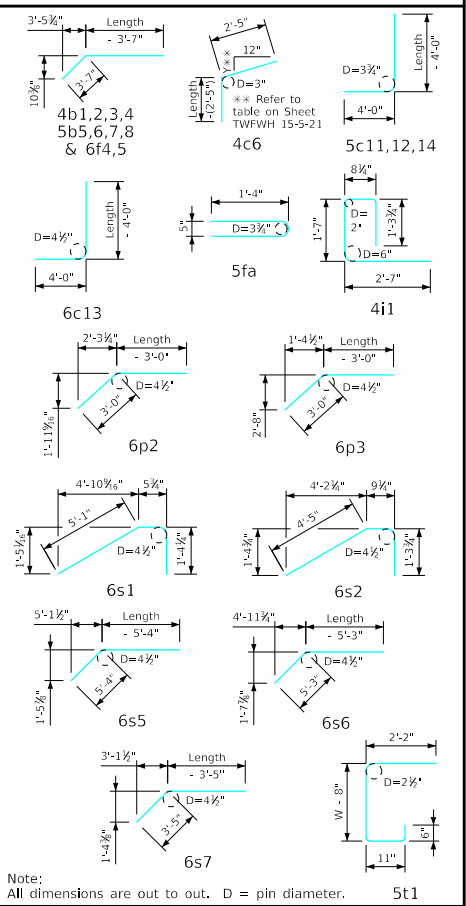
Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap. Lengths shown for bars over 40'-0" long do not include lap.

"Short" Denotes Short Wingwall
 "Long" Denotes Long Wingwall

Headwall Notes:

- See Sheet TWFHW G1-21 for General Notes, Specifications, and Design Stresses.
- This headwall is based on a 3:1 slope normal to centerline of roadway.
- The sides of the apron are to be formed to ensure correct line and grade.
- All apron reinforcing steel is to be supported by bar chairs at intervals of not more than 3'-0" in either direction as outlined in the Standard Specifications.
- Clear distance from face of concrete to near reinforcing bar is to be 2" unless otherwise noted or shown. Clearance to the bottom ends of vertical bars shall be 3 inches.
- Concrete quantities are estimated from back of parapet.
- Horizontal tails of bars "b" & "s" estimated to extend 2'-5" beyond back of parapet (into end of barrel). Longitudinal bars "d", "6f1", "6f4" and "6f5" estimated to project into end section of barrel a minimum of 2'-5" beyond back of parapet. The "length" column reflects total number of feet necessary to meet these requirements.
- Dimensions are in feet and inches unless otherwise noted.

Bent Bar Details



LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

Standard Design - Twin Reinforced Concrete Box Culverts

Flared Wing Headwalls

February, 2021

| | |
|--|----------------------------------|
| Quantity Tabulation 10'-0" Span 15° Skew | TWFHW 15-7-21 Sheet 2 of 2 |
|--|----------------------------------|