

| Bill of Reinforcing for One Headwall 45° Skew Span x Culvert Height | | | | | | | | | | | | | | |
|---|-----------------------------|-------|--------------|------------------|-----|----------|------------------|-----|--------------|------------------|-----|----------|--|--|
| Bar | Location | Shape | 8' x 6' | | | 8' x 5' | | | 8' x 4' | | | Bar | | |
| | | | 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 | 5fa | | |
| 4b1 | Wingwall, B.F.H., Long | | 1 | 41'-4" | 29 | 1 | 35'-6" | 24 | 1 | 29'-8" | 20 | 4b1 | | |
| 4b2 | Wingwall, B.F.H., Short | | 1 | 26'-7" | 18 | 1 | 23'-1" | 15 | 1 | 19'-7" | 13 | 4b2 | | |
| 4b3 | Wingwall, B.F.H., Long | | 4 Var. | 21'-1 to 38'-7" | 80 | 3 Var. | 21'-1 to 32'-9" | 54 | 2 Var. | 21'-1 to 26'-11" | 32 | 4b3 | | |
| 4b4 | Wingwall, B.F.H., Short | | 4 Var. | 14'-6 to 24'-11" | 53 | 3 Var. | 14'-6 to 21'-5" | 36 | 2 Var. | 14'-6 to 17'-11" | 22 | 4b4 | | |
| 5b5 | Wingwall, F.F.H., Long | | 1 | 41'-4" | 46 | 1 | 35'-6" | 37 | 1 | 29'-9" | 31 | 5b5 | | |
| 5b6 | Wingwall, F.F.H., Short | | 1 | 26'-7" | 28 | 1 | 23'-1" | 24 | 1 | 19'-7" | 20 | 5b6 | | |
| 5b7 | Wingwall, F.F.H., Long | | 5 Var. | 15'-4 to 38'-7" | 141 | 4 Var. | 15'-4 to 32'-9" | 100 | 3 Var. | 15'-4 to 26'-11" | 66 | 5b7 | | |
| 5b8 | Wingwall, F.F.H., Short | | 5 Var. | 11'-0 to 25'-0" | 94 | 4 Var. | 11'-0 to 21'-6" | 68 | 3 Var. | 11'-0 to 18'-0" | 45 | 5b8 | | |
| 5b9 | Interior Wall, Both F.H. | | 9 Var. | 7'-1 to 20'-10" | 131 | 7 Var. | 7'-3 to 18'-0" | 92 | 5 Var. | 7'-5 to 15'-1" | 59 | 5b9 | | |
| 4c1 | Wingwall, F.F.V., Long | | 37 Var. | 2'-7 to 8'-10" | 141 | 31 Var. | 2'-7 to 7'-9" | 107 | 25 Var. | 2'-7 to 6'-9" | 78 | 4c1 | | |
| 4c2 | Wingwall, F.F.V., Short | | 22 Var. | 2'-8 to 8'-8" | 83 | 19 Var. | 2'-8 to 7'-10" | 67 | 15 Var. | 2'-8 to 6'-8" | 47 | 4c2 | | |
| 4c3 | Wingwall, F.F.V., Long | | -- | -- | -- | -- | -- | -- | -- | -- | -- | 4c3 | | |
| 4c4 | Wingwall, F.F.V., Short | | -- | -- | -- | -- | -- | -- | -- | -- | -- | 4c4 | | |
| 4c5 | Wingwall, F.F.V., Long | | 1 | 7'-7" | 5 | 2 | 6'-7" | 4 | 2 | 5'-7" | 7 | 4c5 | | |
| 4c6 | Wingwall, F.F.V., Short | | 2 | 7'-7" | 10 | 1 | 6'-7" | 9 | 2 | 5'-7" | 7 | 4c6 | | |
| 4c7 | Interior Wall, Both F.V. | | 2 | 3'-11" | 5 | 2 | 3'-11" | 5 | 2 | 3'-11" | 5 | 4c7 | | |
| 4c8 | Interior Wall, Both F.V. | | 33 Var. | 1'-8 to 6'-4" | 88 | 27 Var. | 1'-8 to 5'-3" | 62 | 22 Var. | 1'-8 to 4'-4" | 44 | 4c8 | | |
| 5c9 | Wingwall, B.F.V., Long | | 15 Var. | 2'-7 to 5'-0" | 59 | 15 Var. | 2'-7 to 5'-0" | 59 | 15 Var. | 2'-7 to 5'-0" | 59 | 5c9 | | |
| 5c10 | Wingwall, B.F.V., Short | | 4 Var. | 2'-8 to 3'-6" | 13 | 4 Var. | 2'-8 to 3'-6" | 13 | 4 Var. | 2'-8 to 3'-6" | 13 | 5c10 | | |
| 5c11 | Wingwall, B.F.V., Long | | 22 Var. | 9'-2 to 12'-10" | 252 | 16 Var. | 9'-2 to 11'-9" | 175 | 10 Var. | 9'-2 to 10'-9" | 104 | 5c11 | | |
| 5c12 | Wingwall, B.F.V., Short | | 18 Var. | 7'-10 to 12'-8" | 192 | 15 Var. | 7'-10 to 11'-10" | 154 | 11 Var. | 7'-10 to 10'-8" | 106 | 5c12 | | |
| 6c13 | Wingwall, B.F.V., Long | | 12 | 10'-6" | 189 | -- | -- | -- | -- | -- | -- | 6c13 | | |
| 6c13 | Wingwall, B.F.V., Short | | 7 | 10'-6" | 110 | -- | -- | -- | -- | -- | -- | 6c13 | | |
| 5c14 | Wingwall, B.F.V., Long | | 1 | 11'-7" | 12 | 2 | 10'-7" | 22 | 2 | 9'-7" | 20 | 5c14 | | |
| 5c14 | Wingwall, B.F.V., Short | | 2 | 11'-7" | 24 | 1 | 10'-7" | 11 | 2 | 9'-7" | 20 | 5c14 | | |
| 4d1 | Apron, Longit., Bott. | | 11 | 21'-7" | 159 | 11 | 18'-9" | 138 | 11 | 15'-11" | 117 | 4d1 | | |
| 4d2 | Apron, Longit., Bott, Long | | 3 | 33'-11" | 68 | 3 | 28'-1" | 56 | 3 | 22'-3" | 45 | 4d2 | | |
| 4d3 | Apron, Longit., Bott, Short | | 3 | 21'-7" | 43 | 3 | 18'-1" | 36 | 3 | 14'-7" | 29 | 4d3 | | |
| 6f1 | Apron, Longit., Top | | 16 | 21'-7" | 519 | 16 | 18'-9" | 451 | 16 | 15'-11" | 383 | 6f1 | | |
| 6f2 | Apron, Longit., Top Long | | 7 Var. | 5'-7 to 17'-10" | 123 | 5 Var. | 6'-10 to 15'-0" | 82 | 4 Var. | 6'-0 to 12'-2" | 55 | 6f2 | | |
| 6f3 | Apron, Longit., Top Short | | 4 Var. | 7'-11 to 18'-2" | 78 | 3 Var. | 8'-6 to 15'-4" | 54 | 2 Var. | 9'-1 to 12'-6" | 32 | 6f3 | | |
| 6f4 | Apron, Longit., Top Long | | 1 | 41'-4" | 66 | 1 | 35'-6" | 53 | 1 | 29'-9" | 45 | 6f4 | | |
| 6f5 | Apron, Longit., Top Short | | 1 | 26'-7" | 40 | 1 | 23'-1" | 35 | 1 | 19'-7" | 29 | 6f5 | | |
| 4l1 | Parapet, Vertical | | 33 | 6'-8" | 147 | 33 | 6'-8" | 147 | 33 | 6'-8" | 147 | 4l1 | | |
| 7j1 | Parapet, Horizontal | | 4 | 25'-4" | 207 | 4 | 25'-4" | 207 | 4 | 25'-4" | 207 | 7j1 | | |
| 6m1 | Apron, Trans., Top | | 13 Var. | 20'-3 to 22'-6" | 417 | 11 Var. | 20'-3 to 22'-1" | 350 | 7 Var. | 20'-3 to 21'-4" | 219 | 6m1 | | |
| 6m2 | Apron, Trans., Top | | 2 Var. | 22'-9 to 23'-2" | 69 | 2 Var. | 16'-1 to 16'-10" | 49 | 6 Var. | 13'-3 to 17'-0" | 136 | 6m2 | | |
| 6m3 | Apron, Trans., Top | | 22 Var. | 5'-4 to 17'-2" | 372 | 20 Var. | 4'-9 to 15'-5" | 303 | 16 Var. | 4'-2 to 12'-7" | 201 | 6m3 | | |
| 6m4 | Apron, Trans., Bott. | | 12 Var. | 17'-3 to 29'-0" | 417 | 10 Var. | 17'-3 to 26'-10" | 331 | 8 Var. | 17'-3 to 24'-9" | 252 | 6m4 | | |
| 6p1 | Curtain, Horizontal | | 4 | 23'-7" | 142 | 4 | 23'-7" | 142 | 4 | 23'-7" | 142 | 6p1 | | |
| 6p2 | Curtain, Horizontal, Long | | 4 | 23'-4" | 140 | 4 | 20'-2" | 121 | 4 | 17'-0" | 102 | 6p2 | | |
| 6p3 | Curtain, Horizontal, Short | | 4 | 9'-6" | 57 | 4 | 8'-6" | 51 | 4 | 7'-6" | 45 | 6p3 | | |
| 6s1 | Wing Slope, Both F., Long | | 2 | 8'-4" | 25 | 2 | 8'-4" | 25 | 2 | 8'-4" | 25 | 6s1 | | |
| 6s2 | Wing Slope, Both F., Short | | 2 | 7'-11" | 24 | 2 | 7'-11" | 24 | 2 | 7'-11" | 24 | 6s2 | | |
| 6s3 | Wing Slope, Both F., Long | | 2 | 33'-1" | 99 | 2 | 27'-2" | 82 | 2 | 21'-3" | 64 | 6s3 | | |
| 6s4 | Wing Slope, Both F., Short | | 2 | 19'-10" | 60 | 2 | 16'-2" | 49 | 2 | 12'-7" | 38 | 6s4 | | |
| 6s5 | Wing Slope, F.F., Long | | 1 | 39'-2" | 59 | 1 | 33'-3" | 50 | 1 | 27'-5" | 41 | 6s5 | | |
| 6s6 | Wing Slope, F.F., Short | | 1 | 25'-10" | 39 | 1 | 22'-2" | 33 | 1 | 18'-6" | 28 | 6s6 | | |
| 6s7 | Interior Wall, Both F.H. | | 2 | 21'-4" | 64 | 2 | 18'-4" | 55 | 2 | 15'-4" | 46 | 6s7 | | |
| 5t1 | Curtain, Vertical | | 33 | 6'-5" | 221 | 31 | 6'-5" | 207 | 27 | 6'-5" | 181 | 5t1 | | |
| Estimated Quantities One Headwall | | | Reinf. Steel | | | Concrete | | | Reinf. Steel | | | Concrete | | |
| | | | 5477 LB | | | 40.4 CY | | | 4286 LB | | | 27.6 CY | | |
| | | | 2.8 | | | 6.9 | | | 2.8 | | | 4.7 | | |
| | | | 9.4 | | | 23.6 | | | 4.7 | | | 20.1 | | |
| | | | 28.2 | | | 23.6 | | | 20.1 | | | 20.1 | | |

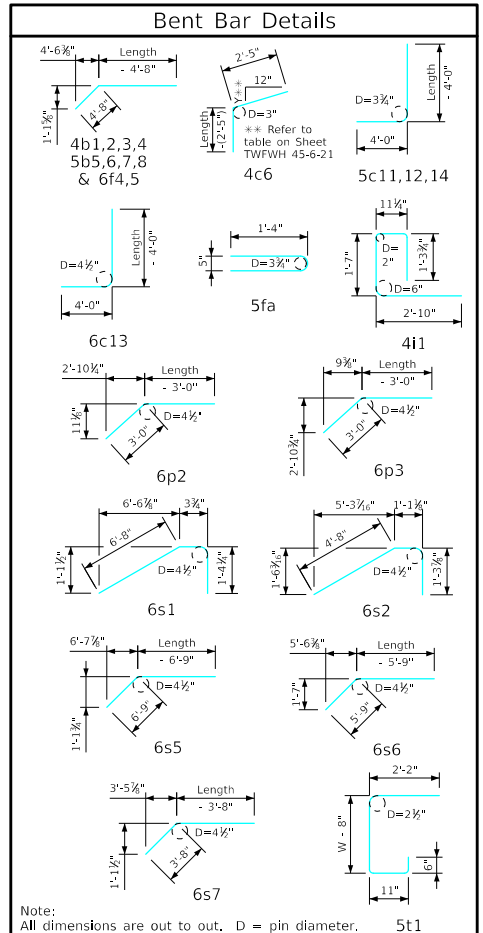
Δ Includes top of wingwall quantities.
 * Assumes apron and floor are equal thickness, adjust concrete quantities for transition where apron and floor thickness are not equal.

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 TWFHWH 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.



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|----------------------|-----------------------------|---|-----------------------------------|
| LATEST REVISION DATE | APPROVED BY BRIDGE ENGINEER | IOWA DOT Highway Division | |
| | | Standard Design - Twin Reinforced Concrete Box Culverts | |
| | | Flared Wing Headwalls | |
| | | February, 2021 | |
| | | Quantity Tabulation 8'-0" Span 45° Skew | TWFHWH 45-9-21 Sheet 2 of 2 |