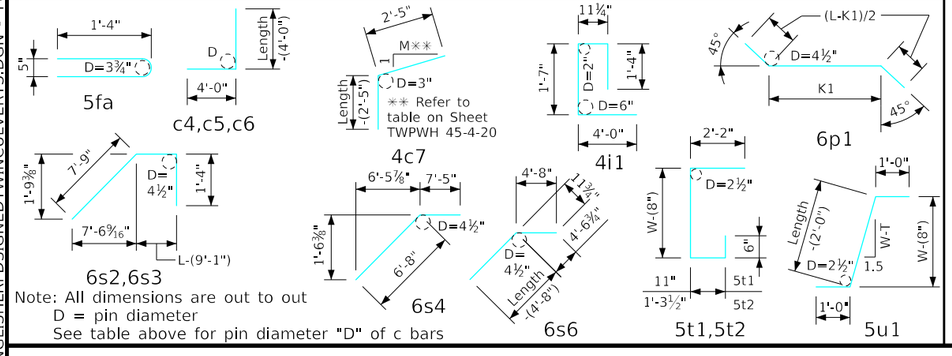
# Bill of Reinforcing for One Headwall 45° Skew Span x Culvert Height

| Location | Shape | 8' x 10' | | | | 8' x 9' | | | | 8' x 8' | | | | 8' x 7' | | | | 8' x 6' | | | | 8' x 5' | | | | 8' x 4' | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Bar | No. | Length | Wt. | Bar | No. | Length | Wt. | Bar | No. | Length | Wt. | Bar | No. | Length | Wt. | Bar | No. | Length | Wt. | Bar | No. | Length | Wt. | Bar | No. | Length | Wt. |
| Fence Anchor (Galv.) | | 5fa | 2 | 2'-10 | 6 | 5fa | 2 | 2'-10 | 6 | 5fa | 2 | 2'-10 | 6 | 5fa | 2 | 2'-10 | 6 | 5fa | 2 | 2'-10 | 6 | 5fa | 2 | 2'-10 | 6 | 5fa | 2 | 2'-10 | 6 |
| Wingwall, F.F.H. | | 5b1 | 2 | 47'-8 | 104 | 5b1 | 2 | 43'-5 | 96 | 5b1 | 2 | 39'-2 | 82 | 5b1 | 2 | 34'-11 | 73 | 5b1 | 2 | 30'-9 | 64 | 5b1 | 2 | 26'-6 | 55 | 5b1 | 2 | 22'-3 | 46 |
| Wingwall, F.F.H. | | 5b2 | 18 Var. | 2 Each 11'-9 to 45'-9 | 550 | 5b2 | 16 Var. | 2 Each 11'-9 to 41'-6 | 449 | 5b2 | 14 Var. | 2 Each 11'-9 to 37'-3 | 358 | 5b2 | 12 Var. | 2 Each 11'-9 to 33'-0 | 280 | 5b2 | 10 Var. | 2 Each 11'-9 to 28'-9 | 211 | 5b2 | 8 Var. | 2 Each 11'-9 to 24'-6 | 151 | 5b2 | 6 Var. | 2 Each 11'-9 to 20'-3 | 100 |
| Wingwall, B.F.H. | | 4b3 | 2 | 48'-1 | 67 | 4b3 | 2 | 43'-10 | 62 | 4b3 | 2 | 39'-7 | 53 | 4b3 | 2 | 35'-3 | 47 | 4b3 | 2 | 31'-0 | 41 | 4b3 | 2 | 26'-9 | 36 | 4b3 | 2 | 22'-6 | 30 |
| Wingwall, B.F.H. | | 4b4 | 16 Var. | 2 Each 16'-5 to 46'-1 | 340 | 4b4 | 14 Var. | 2 Each 16'-5 to 41'-10 | 276 | 4b4 | 12 Var. | 2 Each 16'-5 to 37'-7 | 216 | 4b4 | 10 Var. | 2 Each 16'-4 to 33'-3 | 166 | 4b4 | 8 Var. | 2 Each 16'-4 to 29'-1 | 121 | 4b4 | 6 Var. | 2 Each 16'-4 to 24'-10 | 82 | 4b4 | 4 Var. | 2 Each 16'-4 to 20'-7 | 49 |
| Interior Wall, Both F.H. | | 5b5 | 17 Var. | 8'-8 to 46'-11 | 500 | 5b5 | 15 Var. | 8'-9 to 42'-8 | 407 | 5b5 | 13 Var. | 8'-10 to 38'-5 | 320 | 5b5 | 11 Var. | 8'-10 to 34'-2 | 247 | 5b5 | 9 Var. | 9'-0 to 29'-10 | 182 | 5b5 | 7 Var. | 9'-2 to 25'-7 | 127 | 5b5 | 5 Var. | 9'-6 to 21'-3 | 80 |
| Wingwall, F.F.V. | | 4c1 | 88 Var. | 2 Each 2'-5 to 12'-6 | 438 | 4c1 | 80 Var. | 2 Each 2'-5 to 11'-7 | 374 | 4c1 | 94 Var. | 2 Each 2'-5 to 10'-6 | 406 | 4c1 | 82 Var. | 2 Each 2'-5 to 9'-6 | 326 | 4c1 | 72 Var. | 2 Each 2'-5 to 8'-7 | 265 | 4c1 | 46 Var. | 2 Each 2'-5 to 7'-7 | 154 | 4c1 | 36 Var. | 2 Each 2'-5 to 6'-5 | 106 |
| Wingwall, F.F.V. | | 4c2 | 32 Var. | 2 Each 8'-10 to 12'-5 | 227 | 4c2 | 24 Var. | 2 Each 8'-10 to 11'-6 | 163 | c2 | -- | -- | -- | c2 | -- | -- | -- | c2 | -- | -- | -- | c2 | -- | -- | -- | c2 | -- | -- | -- |
| Wingwall, F.F.V. (O) | | 4c3 | 2 | 12'-10 | 17 | 4c3 | 2 | 11'-10 | 16 | 4c3 | 2 | 10'-10 | 14 | 4c3 | 2 | 9'-10 | 13 | 4c3 | 2 | 8'-10 | 12 | 4c3 | 2 | 7'-10 | 10 | 4c3 | 2 | 6'-10 | 9 |
| Wingwall, F.F.V. (A) | | 4c3 | 3 | 12'-10 | 26 | 4c3 | 3 | 11'-10 | 24 | 4c3 | 3 | 10'-10 | 22 | 4c3 | 3 | 9'-10 | 20 | 4c3 | 3 | 8'-10 | 18 | 4c3 | 3 | 7'-10 | 16 | 4c3 | 3 | 6'-10 | 14 |
| Wingwall, B.F.V. | | 5c4 | 88 Var. | 2 Each 6'-7 to 16'-8 | 1067 | 5c4 | 80 Var. | 2 Each 6'-7 to 15'-9 | 932 | 5c4 | 70 Var. | 2 Each 6'-7 to 14'-7 | 773 | 5c4 | 62 Var. | 2 Each 6'-7 to 13'-8 | 655 | 5c4 | 54 Var. | 2 Each 6'-7 to 12'-8 | 542 | 5c4 | 60 Var. | 2 Each 6'-7 to 11'-8 | 571 | 5c4 | 48 Var. | 2 Each 6'-7 to 10'-8 | 432 |
| Wingwall, B.F.V. (O) | | 5c5 | 1 | 16'-10 | 18 | 5c5 | 1 | 15'-10 | 17 | 5c5 | 1 | 14'-10 | 15 | 5c5 | 1 | 13'-10 | 14 | 5c5 | 1 | 12'-10 | 13 | 5c5 | 1 | 11'-10 | 12 | 5c5 | 1 | 10'-10 | 11 |
| Wingwall, B.F.V. (A) | | 5c5 | 4 | 16'-10 | 70 | 5c5 | 4 | 15'-10 | 66 | 5c5 | 4 | 14'-10 | 62 | 5c5 | 4 | 13'-10 | 58 | 5c5 | 4 | 12'-10 | 54 | 5c5 | 4 | 11'-10 | 49 | 5c5 | 4 | 10'-10 | 45 |
| Wingwall, B.F.V. | | 6c6 | 50 | 9'-0 | 676 | 6c6 | 42 | 9'-0 | 568 | 5c6 | 34 | 9'-0 | 319 | 5c6 | 26 | 9'-0 | 244 | 5c6 | 16 | 9'-0 | 150 | c6 | -- | 9'-0 | -- | c6 | -- | 9'-0 | -- |
| Interior Wall, Both F.V | | 4c7 | 2 | 3'-7 | 5 | 4c7 | 2 | 3'-7 | 5 | 4c7 | 2 | 3'-7 | 5 | 4c7 | 2 | 3'-7 | 5 | 4c7 | 2 | 3'-7 | 5 | 4c7 | 2 | 3'-7 | 5 | 4c7 | 2 | 3'-7 | 5 |
| Interior Wall, Both F.V | | 4c8 | 85 Var. | 1'-3 to 10'-1 | 322 | 4c8 | 76 Var. | 1'-3 to 9'-0 | 260 | 4c8 | 68 Var. | 1'-3 to 8'-1 | 212 | 4c8 | 59 Var. | 1'-3 to 7'-0 | 163 | 4c8 | 51 Var. | 1'-3 to 6'-0 | 123 | 4c8 | 42 Var. | 1'-3 to 5'-0 | 88 | 4c8 | 34 Var. | 1'-3 to 4'-0 | 60 |
| Interior Wall, Both F.V | | 4c9 | 2 | 10'-4 | 14 | 4c9 | 2 | 9'-4 | 12 | 4c9 | 2 | 8'-4 | 11 | 4c9 | 2 | 7'-4 | 10 | 4c9 | 2 | 6'-4 | 8 | 4c9 | 2 | 5'-4 | 7 | 4c9 | 2 | 4'-4 | 6 |
| Apron, Longit., Bott. | | 4d1 | 18 | 47'-6 | 600 | 4d1 | 18 | 43'-3 | 549 | 4d1 | 18 | 39'-0 | 469 | 4d1 | 18 | 34'-9 | 418 | 4d1 | 18 | 30'-6 | 367 | 4d1 | 18 | 26'-3 | 316 | 4d1 | 18 | 22'-0 | 265 |
| Apron, Longit., Top | | 6f1 | 18 | 47'-6 | 1350 | 6f1 | 18 | 43'-3 | 1235 | 6f1 | 18 | 39'-0 | 1054 | 6f1 | 18 | 34'-9 | 940 | 6f1 | 18 | 30'-6 | 825 | 6f1 | 18 | 26'-3 | 710 | 6f1 | 18 | 22'-0 | 595 |
| Parapet, Vertical | | 4i1 | 33 | 7'-10 | 173 | 4i1 | 33 | 7'-10 | 173 | 4i1 | 33 | 7'-10 | 173 | 4i1 | 33 | 7'-10 | 173 | 4i1 | 33 | 7'-10 | 173 | 4i1 | 33 | 7'-10 | 173 | 4i1 | 33 | 7'-10 | 173 |
| Parapet, Horiz. | | 7j1 | 4 | 25'-8 | 210 | 7j1 | 4 | 25'-8 | 210 | 7j1 | 4 | 25'-8 | 210 | 7j1 | 4 | 25'-4 | 207 | 7j1 | 4 | 25'-4 | 207 | 7j1 | 4 | 25'-4 | 207 | 7j1 | 4 | 25'-4 | 207 |
| Apron, Trans., Top | | 5m1 | 73 | 18'-8 | 1421 | 5m1 | 65 | 18'-8 | 1266 | 5m1 | 56 | 18'-8 | 1090 | 5m1 | 48 | 18'-5 | 922 | 5m1 | 39 | 18'-5 | 749 | 5m1 | 21 | 18'-5 | 403 | 5m1 | 15 | 18'-5 | 288 |
| Apron, Trans., Top | | 5m2 | 32 Var. | 2'-0 to 17'-6 | 325 | 5m2 | 31 Var. | 2'-3 to 17'-3 | 315 | 5m2 | 32 Var. | 2'-0 to 17'-6 | 325 | 5m2 | 31 Var. | 2'-2 to 17'-2 | 313 | 5m2 | 31 Var. | 2'-5 to 17'-5 | 321 | 5m2 | 20 Var. | 2'-8 to 16'-11 | 204 | 5m2 | 21 Var. | 2'-2 to 17'-2 | 212 |
| Apron, Trans., Bott. | | 5m3 | 61 | 21'-8 | 1378 | 5m3 | 55 | 21'-8 | 1243 | 6m3 | 25 | 22'-5 | 842 | 5m3 | 22 | 21'-4 | 490 | 5m3 | 19 | 21'-4 | 423 | 5m3 | 16 | 21'-4 | 356 | 5m3 | 13 | 21'-4 | 289 |
| Curtain, Horiz. | | 6p1 | 6 | 25'-7 | 231 | 6p1 | 6 | 25'-7 | 231 | 6p1 | 6 | 25'-7 | 231 | 6p1 | 5 | 25'-4 | 190 | 6p1 | 5 | 25'-4 | 190 | 6p1 | 5 | 25'-4 | 190 | 6p1 | 5 | 25'-4 | 190 |
| Wing Slope, Both F. | | 6s1 | 4 | 39'-7 | 238 | 6s1 | 4 | 35'-3 | 212 | 6s1 | 4 | 30'-10 | 185 | 6s1 | 4 | 26'-6 | 159 | 6s1 | 4 | 22'-2 | 133 | 6s1 | 4 | 17'-9 | 107 | 6s1 | 4 | 13'-5 | 81 |
| Wing Slope, Both F. (O) | | 6s2 | 2 | 9'-7 | 29 | 6s2 | 2 | 9'-7 | 29 | 6s2 | 2 | 9'-7 | 29 | 6s2 | 2 | 9'-8 | 29 | 6s2 | 2 | 9'-8 | 29 | 6s2 | 2 | 9'-8 | 29 | 6s2 | 2 | 9'-8 | 29 |
| Wing Slope, Both F. (A) | | 6s3 | 2 | 10'-5 | 31 | 6s3 | 2 | 10'-5 | 31 | 6s3 | 2 | 10'-5 | 31 | 6s3 | 2 | 10'-5 | 31 | 6s3 | 2 | 10'-5 | 31 | 6s3 | 2 | 10'-5 | 31 | 6s3 | 2 | 10'-5 | 31 |
| Wing Slope, F.F. | | 6s4 | 2 | 14'-1 | 42 | 6s4 | 2 | 14'-1 | 42 | 6s4 | 2 | 14'-1 | 42 | 6s4 | 2 | 14'-1 | 42 | 6s4 | 2 | 14'-1 | 42 | 6s4 | 2 | 14'-1 | 42 | 6s4 | 2 | 14'-1 | 42 |
| Wing Slope, F.F. | | 6s5 | 2 | 37'-2 | 112 | 6s5 | 2 | 32'-9 | 98 | 6s5 | 2 | 28'-5 | 85 | 6s5 | 2 | 24'-1 | 72 | 6s5 | 2 | 19'-8 | 59 | 6s5 | 2 | 15'-4 | 46 | 6s5 | 2 | 11'-0 | 33 |
| Interior Wall, Both F. | | 6s6 | 2 | 48'-5 | 153 | 6s6 | 2 | 44'-0 | 139 | 6s6 | 2 | 39'-8 | 119 | 6s6 | 2 | 35'-5 | 106 | 6s6 | 2 | 31'-1 | 93 | 6s6 | 2 | 26'-8 | 80 | 6s6 | 2 | 22'-4 | 67 |
| Curtain, Vert. | | 5t1 | 24 | 7'-5 | 186 | 5t1 | 24 | 7'-2 | 179 | 5t1 | 24 | 6'-11 | 173 | 5t1 | 24 | 6'-8 | 167 | 5t1 | 24 | 6'-5 | 161 | 5t1 | 24 | 6'-5 | 161 | 5t1 | 24 | 6'-5 | 161 |
| Curtain, Vert. Ends | | 5t2 | 4 | 7'-10 | 33 | 5t2 | 4 | 7'-7 | 32 | 5t2 | 4 | 7'-4 | 31 | 5t2 | 4 | 7'-1 | 30 | 5t2 | 4 | 6'-10 | 29 | 5t2 | 4 | 6'-10 | 29 | 5t2 | 4 | 6'-10 | 29 |
| Bracket, Vert. | | 5u1 | 4 | 6'-1 | 25 | 5u1 | 4 | 5'-11 | 25 | 5u1 | 4 | 5'-8 | 24 | 5u1 | 4 | 5'-5 | 23 | 5u1 | 4 | 5'-3 | 22 | 5u1 | 4 | 5'-3 | 22 | 5u1 | 4 | 5'-3 | 22 |
| Estimated Quantities One Headwall | Reinf. Steel | | | 10,984 LB | | | | 9742 LB | | | | 7987 LB | | | | 6639 LB | | | | 5669 LB | | | | 4475 LB | | | | 3713 LB | |
| | Concrete Parapet Δ | | 2.8 | 65.0 CY | | | 2.8 | 57.3 CY | | | 2.8 | 50.0 CY | | | 2.7 | 41.2 CY | | | 2.7 | 35.0 CY | | | 2.7 | 29.5 CY | | | 2.7 | 24.4 CY | |
| | Concrete Wingwalls | | 25.4 | | | | 21.0 | | | | 17.0 | | | | 12.1 | | | | 9.2 | | | | 6.7 | | | | 4.5 | | |
| | Concrete Apron ✳ | | 36.8 | | | | 33.5 | | | | 30.2 | | | | 26.4 | | | | 23.1 | | | | 20.1 | | | | 17.2 | | |

| c Bar Pin Diameter | |
|---|---|
| Bar Size | D |
| 5 | 3¾" |
| 6 | 4½" |

## Bent Bar Details




Note: All dimensions are out to out
D = pin diameter
See table above for pin diameter "D" of c bars

Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap.

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.

(A) - Indicates bar located at acute corner.
(O) - Indicates bar located at obtuse corner.
Refer to Sheet TWPWH 45-1-20 for acute and obtuse corner locations.

## Headwall Notes:

1. This headwall is based on a 3:1 slope normal to centerline of roadway.
2. The sides of the apron are to be formed to ensure correct line and grade.
3. 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.
4. 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.
5. Concrete quantities are estimated from back of parapet.
6. Horizontal tails of bars "b" & "s" estimated to extend 2'-5" beyond back of parapet (into end of barrel). Longitudinal bars "4d1" and "6f1" 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.
7. Dimensions are in feet and inches unless otherwise noted.

LATEST REVISION DATE

APPROVED BY BRIDGE ENGINEER

IOWADOT

Standard Design - Twin Reinforced Concrete Box Culverts

Parallel Wing Headwalls

July, 2020

Quantity Tabulation
8'-0" Span
45° Skew

TWPWH
45-9-20

ENGLISHLRFDSIGNEDTWINCULVERTS.DGN - TWPWH 45-9-20 - THIS SHEET ISSUED 07-2020.