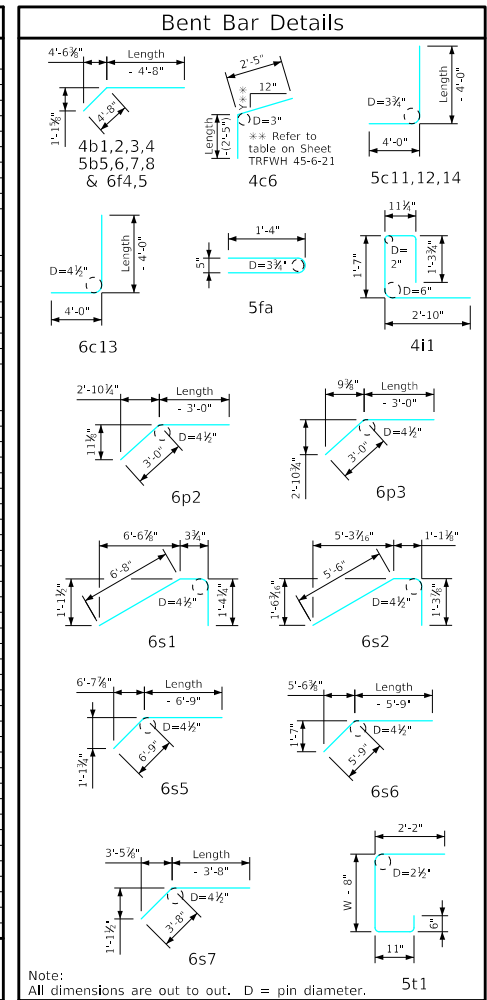


| Bill of Reinforcing for One Headwall 45° Skew Span x Culvert Height |                             |       |              |                              |      |          |                               |         |          |                              |     |          |                              |     |
|---|-----------------------------|-------|--------------|------------------------------|------|----------|-------------------------------|---------|----------|------------------------------|-----|----------|------------------------------|-----|
| Bar   | Location                    | Shape | 10' x 7'     |                              |      | 10' x 6' |                               |         | 10' x 5' |                              |     | 10' x 4' |                              |     |
|   |                             |       | 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   |
| 4b1   | Wingwall, B.F.H, Long       |       | 1            | 47'-2"                       | 33   | 1        | 41'-4"                        | 29      | 1        | 35'-6"                       | 24  | 1        | 29'-8"                       | 20  |
| 4b2   | Wingwall, B.F.H, Short      |       | 1            | 30'-1"                       | 20   | 1        | 26'-7"                        | 18      | 1        | 23'-1"                       | 15  | 1        | 19'-7"                       | 13  |
| 4b3   | Wingwall, B.F.H, Long       |       | 5 Var.       | 21'-2" to 44'-5"             | 111  | 4 Var.   | 21'-1" to 38'-7"              | 80      | 3 Var.   | 21'-1" to 32'-9"             | 54  | 2 Var.   | 21'-1" to 26'-11"            | 32  |
| 4b4   | Wingwall, B.F.H, Short      |       | 5 Var.       | 14'-6" to 28'-5"             | 72   | 4 Var.   | 14'-6" to 24'-11"             | 53      | 3 Var.   | 14'-6" to 21'-5"             | 36  | 2 Var.   | 14'-6" to 17'-11"            | 22  |
| 5b5   | Wingwall, F.F.H, Long       |       | 1            | 47'-2"                       | 52   | 1        | 41'-4"                        | 46      | 1        | 35'-6"                       | 37  | 1        | 29'-9"                       | 31  |
| 5b6   | Wingwall, F.F.H, Short      |       | 1            | 30'-1"                       | 31   | 1        | 26'-7"                        | 28      | 1        | 23'-1"                       | 24  | 1        | 19'-7"                       | 20  |
| 5b7   | Wingwall, F.F.H, Long       |       | 6 Var.       | 15'-4" to 44'-5"             | 189  | 5 Var.   | 15'-4" to 38'-7"              | 141     | 4 Var.   | 15'-4" to 32'-9"             | 100 | 3 Var.   | 15'-4" to 26'-11"            | 66  |
| 5b8   | Wingwall, F.F.H, Short      |       | 6 Var.       | 11'-0" to 28'-6"             | 124  | 5 Var.   | 11'-0" to 25'-0"              | 94      | 4 Var.   | 11'-0" to 21'-6"             | 68  | 3 Var.   | 11'-0" to 18'-0"             | 45  |
| 5b9   | Interior Wall, Both F.V.    |       | 22 Var.      | 2 Each<br>7'-0" to<br>23'-8" | 352  | 18 Var.  | 2 Each<br>7'-1" to<br>20'-10" | 262     | 14 Var.  | 2 Each<br>7'-3" to<br>18'-0" | 184 | 10 Var.  | 2 Each<br>7'-5" to<br>15'-1" | 117 |
| 4c1   | Wingwall, F.F.V, Long       |       | 43 Var.      | 2'-8" to 9'-11"              | 181  | 37 Var.  | 2'-8" to 8'-11"               | 143     | 31 Var.  | 2'-8" to 7'-10"              | 109 | 25 Var.  | 2'-8" to 6'-5"               | 79  |
| 4c2   | Wingwall, F.F.V, Short      |       | 26 Var.      | 2'-9" to 9'-11"              | 110  | 22 Var.  | 2'-9" to 8'-9"                | 85      | 19 Var.  | 2'-9" to 7'-11"              | 68  | 15 Var.  | 2'-9" to 6'-9"               | 48  |
| 4c3   | Wingwall, F.F.V, Long       |       | --           | --                           | --   | --       | --                            | --      | --       | --                           | --  | --       | --                           | --  |
| 4c4   | Wingwall, F.F.V, Short      |       | --           | --                           | --   | --       | --                            | --      | --       | --                           | --  | --       | --                           | --  |
| 4c5   | Wingwall, F.F.V, Long       |       | 1            | 8'-8"                        | 6    | 1        | 7'-8"                         | 5       | 2        | 6'-8"                        | 9   | 2        | 5'-8"                        | 8   |
| 4c5   | Wingwall, F.F.V, Short      |       | 1            | 8'-8"                        | 6    | 2        | 7'-8"                         | 10      | 1        | 6'-8"                        | 4   | 2        | 5'-8"                        | 8   |
| 4c6   | Interior Wall, Both F.V.    |       | 4            | 4'-0"                        | 11   | 4        | 4'-0"                         | 11      | 4        | 4'-0"                        | 11  | 4        | 4'-0"                        | 11  |
| 4c7   | Interior Wall, Both F.V.    |       | 76 Var.      | 2 Each<br>1'-9" to<br>7'-4"  | 231  | 66 Var.  | 2 Each<br>1'-9" to<br>6'-5"   | 180     | 54 Var.  | 2 Each<br>1'-9" to<br>5'-4"  | 128 | 44 Var.  | 2 Each<br>1'-9" to<br>4'-5"  | 91  |
| 4c8   | Interior Wall, Both F.V.    |       | 6            | 7'-6"                        | 30   | 6        | 6'-6"                         | 26      | 6        | 5'-6"                        | 22  | 6        | 4'-6"                        | 18  |
| 5c9   | Wingwall, B.F.V, Long       |       | 15 Var.      | 2'-8" to 5'-1"               | 61   | 15 Var.  | 2'-8" to 5'-1"                | 61      | 15 Var.  | 2'-8" to 5'-1"               | 61  | 15 Var.  | 2'-8" to 5'-1"               | 61  |
| 5c10  | Wingwall, B.F.V, Short      |       | 4 Var.       | 2'-9" to 3'-7"               | 13   | 4 Var.   | 2'-9" to 3'-7"                | 13      | 4 Var.   | 2'-9" to 3'-7"               | 13  | 4 Var.   | 2'-9" to 3'-7"               | 13  |
| 5c11  | Wingwall, B.F.V, Long       |       | 28 Var.      | 9'-3" to 13'-11"             | 338  | 22 Var.  | 9'-3" to 12'-11"              | 254     | 16 Var.  | 9'-3" to 11'-10"             | 176 | 10 Var.  | 9'-3" to 10'-10"             | 105 |
| 5c12  | Wingwall, B.F.V, Short      |       | 22 Var.      | 7'-11" to 13'-11"            | 250  | 18 Var.  | 7'-11" to 12'-9"              | 194     | 15 Var.  | 7'-11" to 11'-11"            | 155 | 11 Var.  | 7'-11" to 10'-9"             | 107 |
| 6c13  | Wingwall, B.F.V, Long       |       | 18           | 10'-6"                       | 284  | 12       | 10'-6"                        | 189     | --       | --                           | --  | --       | --                           | --  |
| 6c13  | Wingwall, B.F.V, Short      |       | 11           | 10'-6"                       | 173  | 7        | 10'-6"                        | 110     | --       | --                           | --  | --       | --                           | --  |
| 5c14  | Wingwall, B.F.V, Long       |       | 1            | 12'-8"                       | 13   | 1        | 11'-8"                        | 12      | 2        | 10'-8"                       | 22  | 2        | 9'-8"                        | 20  |
| 5c14  | Wingwall, B.F.V, Short      |       | 1            | 12'-8"                       | 13   | 2        | 11'-8"                        | 24      | 1        | 10'-8"                       | 11  | 2        | 9'-8"                        | 20  |
| 4d1   | Apron, Longit., Bott.       |       | 21           | 24'-5"                       | 343  | 21       | 21'-7"                        | 303     | 21       | 18'-9"                       | 263 | 21       | 15'-11"                      | 223 |
| 4d2   | Apron, Longit., Bott. Long  |       | 3            | 39'-9"                       | 80   | 3        | 33'-11"                       | 68      | 3        | 28'-1"                       | 56  | 3        | 22'-3"                       | 45  |
| 4d3   | Apron, Longit., Bott. Short |       | 3            | 25'-1"                       | 50   | 3        | 21'-7"                        | 43      | 3        | 18'-1"                       | 36  | 3        | 14'-7"                       | 29  |
| 6f1   | Apron, Longit., Top         |       | 31           | 24'-5"                       | 1137 | 31       | 21'-7"                        | 1005    | 31       | 18'-9"                       | 873 | 31       | 15'-11"                      | 741 |
| 6f2   | Apron, Longit., Top Long    |       | 8 Var.       | 6'-5" to 20'-8"              | 163  | 7 Var.   | 5'-7" to 17'-10"              | 123     | 5 Var.   | 6'-10" to 15'-0"             | 82  | 4 Var.   | 6'-0" to 12'-2"              | 55  |
| 6f3   | Apron, Longit., Top Short   |       | 5 Var.       | 7'-4" to 21'-0"              | 106  | 4 Var.   | 7'-11" to 18'-2"              | 78      | 3 Var.   | 8'-6" to 15'-4"              | 54  | 2 Var.   | 9'-1" to 12'-6"              | 32  |
| 6f4   | Apron, Longit., Top Long    |       | 1            | 47'-2"                       | 74   | 1        | 41'-4"                        | 66      | 1        | 35'-6"                       | 53  | 1        | 29'-9"                       | 45  |
| 6f5   | Apron, Longit., Top Short   |       | 1            | 30'-1"                       | 45   | 1        | 26'-7"                        | 40      | 1        | 23'-1"                       | 35  | 1        | 19'-7"                       | 29  |
| 7j1   | Parapet, Vertical           |       | 63           | 6'-8"                        | 281  | 63       | 6'-8"                         | 281     | 63       | 6'-8"                        | 281 | 63       | 6'-8"                        | 281 |
| 4j1   | Parapet, Horizontal         |       | 4            | 46'-2"                       | 397  | 4        | 46'-2"                        | 397     | 4        | 46'-2"                       | 397 | 4        | 46'-2"                       | 397 |
| 6m1   | Apron, Trans., Top          |       | 9 Var.       | 36'-10" to 38'-4"            | 508  | 5 Var.   | 36'-10" to 37'-7"             | 279     | 1        | 36'-10"                      | 55  | 23 Var.  | 13'-2" to 29'-8"             | 740 |
| 6m2   | Apron, Trans., Top          |       | 14 Var.      | 21'-8" to 31'-5"             | 558  | 18 Var.  | 18'-10" to 31'-7"             | 682     | 22 Var.  | 16'-0" to 31'-9"             | 789 | 16 Var.  | 4'-1" to 12'-6"              | 199 |
| 6m3   | Apron, Trans., Top          |       | 27 Var.      | 6'-5" to 21'-0"              | 556  | 23 Var.  | 5'-10" to 18'-2"              | 415     | 20 Var.  | 4'-8" to 15'-4"              | 300 | --       | --                           | --  |
| 6m4   | Apron, Trans., Bott.        |       | 14 Var.      | 38'-1" to 52'-0"             | 991  | 12 Var.  | 38'-1" to 49'-10"             | 829     | 10 Var.  | 38'-1" to 47'-9"             | 674 | 8 Var.   | 38'-1" to 45'-7"             | 524 |
| 6p1   | Curtain, Horizontal         |       | 4            | 44'-6"                       | 282  | 4        | 44'-6"                        | 282     | 4        | 44'-5"                       | 281 | 4        | 44'-5"                       | 281 |
| 6p2   | Curtain, Horizontal, Long   |       | 4            | 26'-6"                       | 159  | 4        | 23'-4"                        | 140     | 4        | 20'-2"                       | 121 | 4        | 17'-0"                       | 102 |
| 6p3   | Curtain, Horizontal, Short  |       | 4            | 10'-7"                       | 64   | 4        | 9'-6"                         | 57      | 4        | 8'-6"                        | 51  | 4        | 7'-6"                        | 45  |
| 6s1   | Wing Slope, Both F., Long   |       | 2            | 8'-4"                        | 25   | 2        | 8'-4"                         | 25      | 2        | 8'-4"                        | 25  | 2        | 8'-4"                        | 25  |
| 6s2   | Wing Slope, Both F., Short  |       | 2            | 7'-11"                       | 24   | 2        | 7'-11"                        | 24      | 2        | 7'-11"                       | 24  | 2        | 7'-11"                       | 24  |
| 6s3   | Wing Slope, Both F., Long   |       | 2            | 39'-0"                       | 117  | 2        | 33'-1"                        | 99      | 2        | 27'-2"                       | 82  | 2        | 21'-3"                       | 64  |
| 6s4   | Wing Slope, Both F., Short  |       | 2            | 23'-6"                       | 71   | 2        | 19'-10"                       | 60      | 2        | 16'-2"                       | 49  | 2        | 12'-7"                       | 38  |
| 6s5   | Wing Slope, F.F, Long       |       | 1            | 45'-1"                       | 71   | 1        | 39'-2"                        | 59      | 1        | 33'-3"                       | 50  | 1        | 27'-5"                       | 41  |
| 6s6   | Wing Slope, F.F, Short      |       | 1            | 29'-5"                       | 44   | 1        | 25'-10"                       | 39      | 1        | 22'-2"                       | 33  | 1        | 18'-6"                       | 28  |
| 6s7   | Interior Wall, Both F.H.    |       | 4            | 24'-4"                       | 146  | 4        | 21'-4"                        | 128     | 4        | 18'-4"                       | 110 | 4        | 15'-4"                       | 92  |
| 5t1   | Curtain, Vertical           |       | 53           | 6'-8"                        | 369  | 49       | 6'-5"                         | 328     | 47       | 6'-5"                        | 315 | 43       | 6'-5"                        | 288 |
| Estimated Quantities One Headwall                                   |                             |       | Reinf. Steel | 9371 LB                      |      | 7924 LB  |                               | 6426 LB |          | 5329 LB                      |     |          |                              |     |
|   |                             |       | Concrete     | 70.8 CY                      |      | 59.4 CY  |                               | 49.7 CY |          | 40.7 CY                      |     |          |                              |     |
|   |                             |       | Parapet Δ    | 4.4                          |      | 4.4      |                               | 4.4     |          | 4.4                          |     |          |                              |     |
|   |                             |       | Wingwalls    | 14.6                         |      | 11.1     |                               | 8.1     |          | 5.5                          |     |          |                              |     |
|   |                             |       | Apron *      | 51.8                         |      | 43.9     |                               | 37.2    |          | 30.8                         |     |          |                              |     |



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 TRFWH 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.

LATEST REVISION DATE

Standard Design - Triple Reinforced Concrete Box Culverts

## Flared Wing Headwalls

February, 2021

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Quantity Tabulation

10'-0" Span

45° Skew

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