

### Bill of Reinforcing for One Headwall 30° Skew Span x Culvert Height

| Bar                  | Location                    | Shape | 10' x 12'       |           | 10' x 11' |                 | 10' x 10' |          | 10' x 9'        |          | 10' x 8' |                 | Bar |        |
|----------------------|-----------------------------|-------|-----------------|-----------|-----------|-----------------|-----------|----------|-----------------|----------|----------|-----------------|-----|--------|
|                      |                             |       | No.             | Length    | Wt.       | No.             | Length    | Wt.      | No.             | Length   | Wt.      | No.             |     | Length |
| 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     | 55'-2           | 38        | 1         | 51'-0           | 36        | 1        | 46'-10          | 33       | 1        | 42'-8           | 30  | 4b1    |
| 4b2                  | Wingwall, B.F.H. Short      | 1     | 42'-2           | 30        | 1         | 39'-1           | 26        | 1        | 36'-0           | 24       | 1        | 32'-10          | 22  | 4b2    |
| 4b3                  | Wingwall, B.F.H. Long       | 10    | 15'-8 to 53'-3  | 237       | 9         | 15'-8 to 49'-1  | 199       | 8        | 15'-8 to 44'-11 | 165      | 7        | 15'-8 to 40'-9  | 134 | 4b3    |
| 4b4                  | Wingwall, B.F.H. Short      | 10    | 12'-11 to 40'-9 | 181       | 9         | 12'-11 to 37'-8 | 152       | 8        | 12'-11 to 34'-7 | 127      | 7        | 12'-10 to 31'-5 | 103 | 4b4    |
| 5b5                  | Wingwall, F.F.H. Long       | 1     | 55'-3           | 60        | 1         | 51'-1           | 56        | 1        | 46'-11          | 51       | 1        | 42'-9           | 47  | 5b5    |
| 5b6                  | Wingwall, F.F.H. Short      | 1     | 42'-3           | 46        | 1         | 39'-2           | 41        | 1        | 36'-0           | 38       | 1        | 32'-11          | 34  | 5b6    |
| 5b7                  | Wingwall, F.F.H. Long       | 11    | 11'-7 to 53'-4  | 382       | 10        | 11'-7 to 49'-1  | 324       | 9        | 11'-7 to 44'-11 | 270      | 8        | 11'-7 to 40'-9  | 221 | 5b7    |
| 5b8                  | Wingwall, F.F.H. Short      | 11    | 9'-10 to 40'-10 | 293       | 10        | 9'-10 to 37'-9  | 248       | 9        | 9'-10 to 34'-7  | 208      | 8        | 9'-10 to 31'-6  | 172 | 5b8    |
| 5b9                  | Interior Wall, Both F.H.    | 21    | 6'-0 to 31'-4   | 409       | 19        | 6'-0 to 29'-1   | 348       | 17       | 6'-0 to 26'-9   | 290      | 15       | 6'-0 to 24'-5   | 238 | 5b9    |
| 4c1                  | Wingwall, F.F.V. Long       | 51    | 2'-9 to 14'-9   | 298       | 47        | 2'-9 to 13'-9   | 259       | 43       | 2'-9 to 12'-10  | 224      | 39       | 2'-9 to 11'-10  | 190 | 4c1    |
| 4c2                  | Wingwall, F.F.V. Short      | 38    | 2'-9 to 14'-8   | 221       | 35        | 2'-9 to 13'-8   | 192       | 32       | 2'-9 to 12'-9   | 166      | 29       | 2'-9 to 11'-9   | 140 | 4c2    |
| 4c3                  | Wingwall, F.F.V. Long       | 23    | 9'-7 to 14'-10  | 188       | 19        | 9'-7 to 13'-11  | 149       | 15       | 9'-7 to 12'-11  | 113      | 11       | 9'-7 to 12'-0   | 79  | 4c3    |
| 4c4                  | Wingwall, F.F.V. Short      | 18    | 9'-4 to 14'-10  | 145       | 15        | 9'-4 to 13'-10  | 116       | 12       | 9'-4 to 12'-10  | 89       | 9        | 9'-4 to 11'-11  | 64  | 4c4    |
| 4c5                  | Wingwall, F.F.V. Long       | 2     | 13'-8           | 18        | 2         | 12'-8           | 17        | 2        | 11'-8           | 16       | 1        | 10'-8           | 14  | 4c5    |
| 4c6                  | Wingwall, F.F.V. Short      | 2     | 13'-8           | 18        | 2         | 12'-8           | 17        | 2        | 11'-8           | 16       | 2        | 10'-8           | 14  | 4c6    |
| 4c7                  | Interior Wall, Both F.V.    | 2     | 4'-1            | 5         | 2         | 4'-1            | 5         | 2        | 4'-1            | 5        | 2        | 4'-1            | 5   | 4c7    |
| 4c8                  | Interior Wall, Both F.V.    | 54    | 1'-10 to 12'-3  | 254       | 50        | 1'-10 to 11'-5  | 221       | 45       | 1'-10 to 10'-4  | 183      | 41       | 1'-10 to 9'-5   | 154 | 4c8    |
| 5c9                  | Wingwall, B.F.V. Long       | 11    | 2'-9 to 5'-2    | 45        | 11        | 2'-9 to 5'-2    | 45        | 11       | 2'-9 to 5'-2    | 45       | 11       | 2'-9 to 5'-2    | 45  | 5c9    |
| 5c10                 | Wingwall, B.F.V. Short      | 5     | 2'-9 to 4'-1    | 18        | 5         | 2'-9 to 4'-1    | 18        | 5        | 2'-9 to 4'-1    | 18       | 5        | 2'-9 to 4'-1    | 18  | 5c10   |
| 5c11                 | Wingwall, B.F.V. Long       | 40    | 9'-5 to 18'-9   | 588       | 36        | 9'-5 to 17'-9   | 510       | 32       | 9'-5 to 16'-10  | 438      | 28       | 9'-5 to 15'-10  | 369 | 5c11   |
| 5c12                 | Wingwall, B.F.V. Short      | 33    | 8'-5 to 18'-8   | 466       | 30        | 8'-5 to 17'-8   | 408       | 27       | 8'-5 to 16'-9   | 354      | 24       | 8'-5 to 15'-9   | 302 | 5c12   |
| 6c13                 | Wingwall, B.F.V. Long       | 33    | 10'-6           | 520       | 29        | 10'-6           | 457       | 25       | 10'-6           | 394      | 21       | 10'-6           | 331 | 6c13   |
| 6c13                 | Wingwall, B.F.V. Short      | 25    | 10'-6           | 394       | 22        | 10'-6           | 347       | 19       | 10'-6           | 300      | 16       | 10'-6           | 252 | 6c13   |
| 5c14                 | Wingwall, B.F.V. Long       | 2     | 17'-8           | 37        | 2         | 16'-8           | 35        | 2        | 15'-8           | 33       | 1        | 14'-8           | 15  | 5c14   |
| 5c14                 | Wingwall, B.F.V. Short      | 2     | 17'-8           | 37        | 2         | 16'-8           | 35        | 2        | 15'-8           | 33       | 2        | 14'-8           | 15  | 5c14   |
| 4d1                  | Apron, Longit., Bott.       | 15    | 31'-11          | 320       | 13        | 29'-7           | 257       | 13       | 27'-3           | 237      | 13       | 25'-0           | 217 | 4d1    |
| 4d2                  | Apron, Longit., Bott. Long  | 3     | 48'-9           | 102       | 3         | 44'-7           | 94        | 3        | 40'-5           | 86       | 3        | 36'-3           | 73  | 4d2    |
| 4d3                  | Apron, Longit., Bott. Short | 3     | 37'-3           | 75        | 3         | 34'-2           | 68        | 3        | 31'-0           | 62       | 3        | 27'-11          | 56  | 4d3    |
| 6f1                  | Apron, Longit., Top         | 20    | 31'-11          | 959       | 20        | 29'-7           | 889       | 20       | 27'-3           | 819      | 20       | 25'-0           | 751 | 6f1    |
| 6f2                  | Apron, Longit., Top Long    | 11    | 5'-4 to 28'-6   | 279       | 10        | 5'-4 to 26'-2   | 237       | 9        | 5'-4 to 23'-10  | 197      | 8        | 5'-4 to 21'-7   | 162 | 6f2    |
| 6f3                  | Apron, Longit., Top Short   | 8     | 7'-0 to 28'-8   | 214       | 7         | 7'-9 to 26'-5   | 180       | 7        | 5'-5 to 24'-1   | 155      | 6        | 5'-4 to 21'-9   | 126 | 6f3    |
| 6f4                  | Apron, Longit., Top Long    | 1     | 55'-3           | 86        | 1         | 51'-1           | 80        | 1        | 46'-11          | 74       | 1        | 42'-9           | 68  | 6f4    |
| 6f5                  | Apron, Longit., Top Short   | 1     | 42'-3           | 67        | 1         | 39'-2           | 59        | 1        | 36'-0           | 54       | 1        | 32'-11          | 49  | 6f5    |
| 4f1                  | Parapet, Vertical           | 43    | 6'-4            | 182       | 41        | 6'-4            | 173       | 41       | 6'-4            | 173      | 41       | 6'-4            | 173 | 4f1    |
| 7j1                  | Parapet, Horizontal         | 4     | 26'-2           | 214       | 4         | 25'-10          | 211       | 4        | 25'-7           | 209      | 4        | 25'-7           | 209 | 7j1    |
| 6m1                  | Apron, Trans., Top          | 10    | 24'-6 to 26'-2  | 381       | 10        | 24'-3 to 25'-11 | 377       | 10       | 23'-11 to 25'-8 | 372      | 10       | 23'-11 to 25'-8 | 372 | 6m1    |
| 6m2                  | Apron, Trans., Top          | 22    | 26'-6 to 34'-5  | 1006      | 19        | 26'-3 to 33'-0  | 845       | 15       | 26'-0 to 30'-2  | 645      | 12       | 26'-0 to 29'-0  | 506 | 6m2    |
| 6m3                  | Apron, Trans., Top          | 15    | 9'-2 to 24'-8   | 381       | 15        | 8'-4 to 23'-11  | 363       | 16       | 7'-7 to 24'-3   | 383      | 16       | 6'-11 to 23'-7  | 366 | 6m3    |
| 6m4                  | Apron, Trans., Bott.        | 24    | 19'-3 to 34'-11 | 976       | 22        | 19'-2 to 33'-5  | 869       | 20       | 19'-1 to 32'-0  | 767      | 18       | 19'-1 to 30'-7  | 671 | 6m4    |
| 6p1                  | Curtain, Horizontal         | 4     | 24'-5           | 147       | 4         | 24'-4           | 146       | 4        | 24'-3           | 146      | 4        | 24'-3           | 146 | 6p1    |
| 6p2                  | Curtain, Horizontal, Long   | 4     | 28'-0           | 168       | 4         | 26'-0           | 156       | 4        | 24'-0           | 144      | 4        | 22'-0           | 132 | 6p2    |
| 6p3                  | Curtain, Horizontal, Short  | 4     | 15'-11          | 96        | 4         | 14'-11          | 90        | 4        | 13'-10          | 83       | 4        | 12'-10          | 77  | 6p3    |
| 6s1                  | Wing Slope, Both F., Long   | 2     | 8'-0            | 24        | 2         | 8'-0            | 24        | 2        | 8'-0            | 24       | 2        | 8'-0            | 24  | 6s1    |
| 6s2                  | Wing Slope, Both F., Short  | 2     | 6'-11           | 21        | 2         | 6'-11           | 21        | 2        | 6'-11           | 21       | 2        | 6'-11           | 21  | 6s2    |
| 6s3                  | Wing Slope, Both F., Long   | 2     | 48'-11          | 154       | 2         | 44'-7           | 141       | 2        | 40'-4           | 128      | 2        | 36'-0           | 108 | 6s3    |
| 6s4                  | Wing Slope, Both F., Short  | 2     | 38'-0           | 114       | 2         | 34'-9           | 104       | 2        | 31'-6           | 95       | 2        | 28'-2           | 85  | 6s4    |
| 6s5                  | Wing Slope, F.F. Long       | 1     | 55'-0           | 86        | 1         | 50'-9           | 80        | 1        | 46'-5           | 73       | 1        | 42'-2           | 67  | 6s5    |
| 6s6                  | Wing Slope, F.F. Short      | 1     | 43'-4           | 68        | 1         | 40'-1           | 64        | 1        | 36'-9           | 55       | 1        | 33'-6           | 50  | 6s6    |
| 6s7                  | Interior Wall, Both F.H.    | 2     | 33'-3           | 100       | 2         | 30'-10          | 93        | 2        | 28'-4           | 85       | 2        | 25'-10          | 78  | 6s7    |
| 5t1                  | Curtain, Vertical           | 44    | 7'-11           | 363       | 42        | 7'-8            | 336       | 39       | 7'-5            | 302      | 37       | 7'-2            | 277 | 5t1    |
| Estimated Quantities |                             |       | Reinf. Steel    | 11,534 LB |           | 10,239 LB       |           | 9,042 LB |                 | 7,900 LB |          | 6,737 LB        |     |        |
| One Headwall         |                             |       | Concrete        | 96.5 CY   | 82.5 CY   |                 | 69.8 CY   |          | 60.7 CY         |          | 52.2 CY  |                 |     |        |

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.

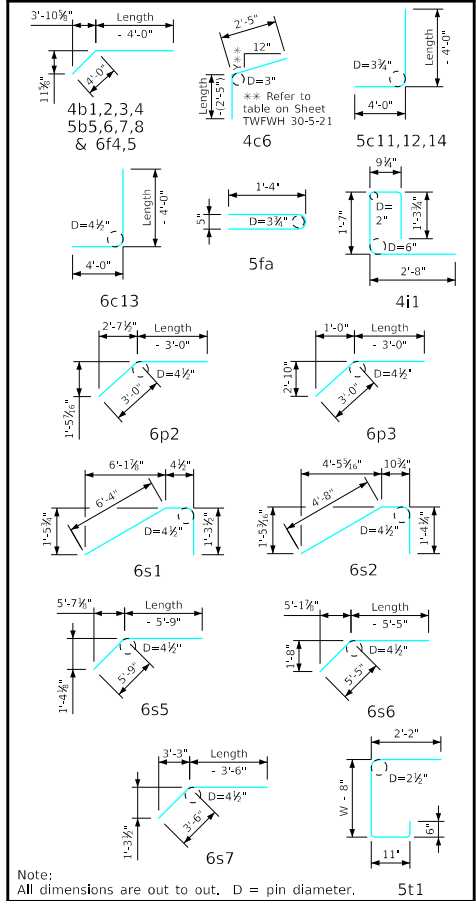
Note: Weight of bars over 40'-0" long include an allowance of 2'-5" for lap. Lengths shown for bars over 40'-0" long do not include lap.

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

#### Headwall Notes:

- See Sheet TWFH 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

|   |  |
|---|--|
| <p>Quantity Tabulation</p> <p>10'-0" Span</p> <p>30° Skew</p> | <p>TWFH</p> <p>30-7-21</p> <p>Sheet 1 of 2</p> |
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