Effective Flange Width Computation Method

How BrDR Computes the Effective Flange Width

Std Effective Flange Width

BrDR computes Std effective flange width based on *AASHTO Standard Specifications for Highway Bridges*, Article 8.10.1 [α,b,c], Article 9.8.3, and Article 10.38.3.1 [d]. Article 9.8.3 is used only for prestressed I beams with wide top flange type.

The Std effective flange width is dependent on the span length of the girder, the spacing of girders, and the least thickness of the slab [e]. For prestressed I beams with wide top flanges, the Std effective flange width is also dependent on the effective web width of the beam.

[α] BrDR interprets the second sentence of Article 8.10.1.1 to mean that the thickness of the web is added to the six times the thickness of the slab for prestressed I beams with narrow top flanges. The web thickness is not added to the six times the thickness of the slab for steel beams or prestressed box beams.

[b] For prestressed I beams with wide top flange and prestressed tee beams, BrDR interprets the "clear distance to the next web" in Article 8.10.1.1 as the clear distance between the tops of the webs. For steel beams and reinforced concrete beams, BrDR uses the average girder spacing.

[c] BrDR does not interpret Article 8.10.1.2 and Article 10.38.3.2 as being for exterior beams.

[d] BrDR checks the effective flange width overhanging on each side of the web against six times the thickness of the slab or one-half the clear distance to the next web even though Article 10.38.3.1 does not specify that.

[e] The least thickness of the slab is taken as the entered structural deck thickness.

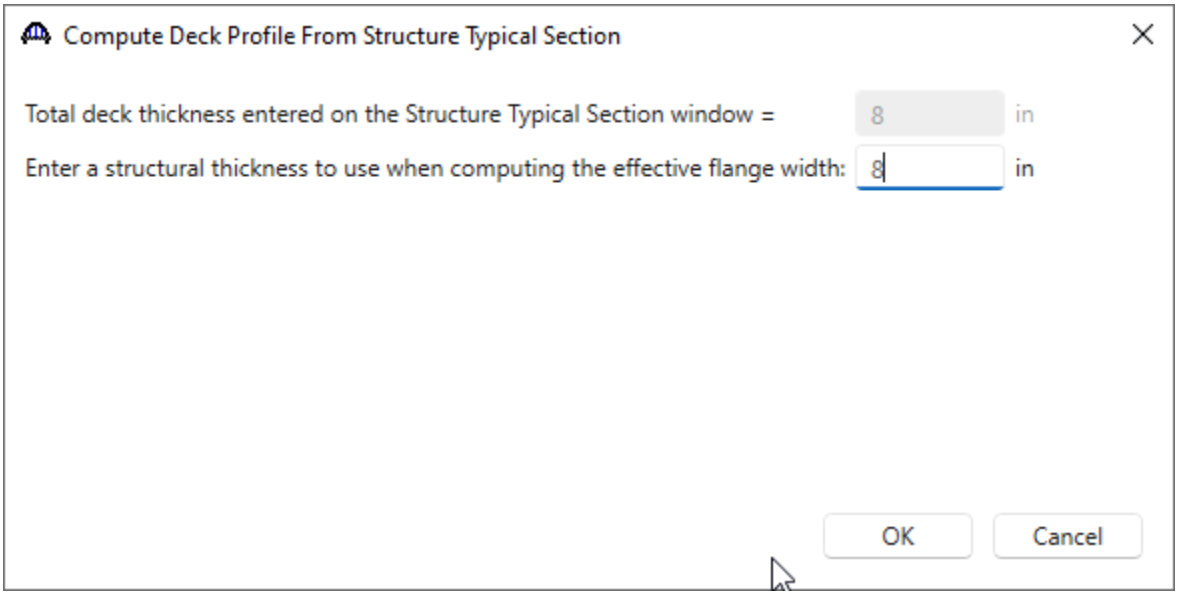
LRFD Effective Flange Width

BrDR computes LRFD effective flange width based on *AASHTO LRFD Bridge Design Specifications*, Article 4.6.2.6.1.

The LRFD effective flange width is dependent on the effective span length of the girder $^{\alpha}$, the average thickness of the slab ^{b}, the width of the girder web and top flange, and the average spacing of adjacent beams. In addition, the LRFD effective flange width of exterior girder is dependent on the effective flange width of the adjacent interior girder.

$^{\alpha}$ The effective span length of the girder is taken as the actual span for simply supported span and computed based on the entered points of contra flexure percentages for continuous span.

^{b} The average slab thickness is taken as the entered structural deck thickness.



Example 1

TrainingBridge1 (BID1) is a one-span concrete-on-steel plate I-beam bridge. The bridge is 161 ft long (3 @ 13 ft) and 47.5 ft wide, and has a -35 degree skew. The superstructure consists of a 10 in deck on top of 4 steel plate I-beams. The thickness of the web is 0.5 in and the width of the top flange is 22 in. The structural thickness of the deck is 9.5 in.

Std effective flange width for G2:

1. One-fourth of the span length of the girder
   0.25 x 161 ft = 40.25 ft
2. The distance center to center of girder = 13 ft
3. Twelve times the least thickness of the slab
   12 x 9.5 in = 9.5 ft
4. 2 x Six times the thickness of the slab
   2 x (6 x 9.5 in) = 9.5 ft
5. 2 x One-half the clear distance to the next web
   2 x (0.5 x 13 ft) = 13 ft

Std effective flange width is the least of 1, 2, 3, 4, and 5 = 9.5 ft or 114 in

LRFD effective flange width for G2:

1. The average spacing of adjacent beam = 13 ft

LRFD effective flange width is = 13 ft

Example 2

PCITrainingBridge6 (BID9) is a three-span concrete-on-prestressed I-beam bridge. The length of the first and last spans is 110 ft and the length of the second span is 120 ft. The bridge is 340 ft long (3 @ 12 ft) and 44.5 ft wide. The superstructure consists of a 8 in deck on top of 4 prestressed I-beams with wide top flange type. The thickness of the web is 6 in. The width of the top flange is 42 in and the maximum thickness of the top flange is 5.5 in. The width of the fillet is 2 in. The structural thickness of the deck is 7.5 in. The points of contra flexure for the second span are at 30% and 70% of the span.

Std effective flange width for G2:

1. Six times the maximum thickness of the flange (excluding fillets) on either side of the web plus the web and fillets
   6 x 5.5 in + 6 in + 2 x 2 in = 3.5833 ft
2. The total width of top flange = 3.5 ft

Effective web width is the lesser of 1 and 2 = 3.5 ft or 42 in

1. One-fourth of the span length of the girder
   0.25 x 120 ft = 30 ft
2. 2 x Six times the thickness of the slab of each side of the effective web width plus the effective web width
   2 x (6 x 7.5 in) + 42 in = 11 ft
3. 2 x One-half the clear distance on each side of the effective web width plus the effective web width
   2 x (0.5 x (144in - 42 in)) + 42 in = 12 ft

Std effective flange width is the least of 1, 2 and 3 = 11 ft or 132 in

LRFD effective flange width for G2 (Span 2):

1. The average spacing of adjacent beam = 12 ft

LRFD effective flange width is = 12 ft