Concrete Slab LRFD Excel Input
Example Bridge: B-56-183
2-Span Linear Haunch Slab
Last Updated by DVB – 5/10/2013

FIRST - - - ENABLE MACROS

General Inputs

Engineer

Enter the initials of the engineer/rater who is performing the rating

= *DVB*

Bridge ID

Enter the bridge ID number. Format should be B-XX-XXXX or B-XX-XXXX-XXXX (unit bridge).

= *B-56-0183*

Number of Spans

Enter the total number of spans (max 10).

= *2*

Slab Type

Enter "1" for a flat slab, "2" for a linear haunched slab, or "3" for a parabolic haunched slab.

= *2 (linear haunch)*

Equivalent Strip Width for Live Load Deflection

This value equals the [out-to-out slab width]÷ [# lanes*multiple-presence factor]. The number of lanes equals the clear raodway-width divided by 12, rounded down to the nearest integer. The multiple presence factor is 1.2 for 1 lane, 1 for 2 lanes, 0.85 for 3 lanes, and 0.65 for four or more lanes.

Out-to-Out Slab Width = 41.5 ft
Number of Lanes = 36 ft ÷ (12ft/lane) = 3 lanes
Multiple Presence Factor = 0.85 (3 lanes)
*Equivalent Strip Width for Live Load Deflection = 41.5 ft ÷ [3*0.85] =16.28 ft*

Skew Angle

Enter the skew angle from the bridge bearing line. Both RHF and LHF skews are given as positive.

= *10 deg*

f'c

Enter the compressive strength of the concrete in the slab.

= 4 ksi

Fy

Enter the tensile yield strength of the steel reinforcement in the slab.

= 60 ksi

Dead Load Inputs

DC Dead Load of the ½" Integral Wearing Surface

Enter the weight of the ½" wearing surface for a 1 ft slab width.

= [0.5in*(1ft/12in)]*1ft*0.150kip/ft^3= 0.00625 kip/ft

DC Dead Load Curb, Parapet, Median, and Raised Sidewalk

Enter the weight of the curb, parapet, median, and sidewalk distributed equally to the entire slab.

Curb: 0 k/ft (no curb)
Parapet: 2[0.34kip/ft] = 0.68 kip/ft (Type "A" parapet weight found in rail standard details)*
Railing: 2[0.022kip/ft] = 0.044 kip/ft (Type "C1 railing weight found in standard details)*
*Raised Sidewalk: [0.667 ft*7 ft*0.150 k/ft³] = 0.7 kip/ft*
Total: 1.424 kip/ft

= (1.424 kip/ft) ÷ (41.5 ft) = 0.034 k/ft/ft

DC Dead Load Curb, Parapet, Median, and Raised Sidewalk on LEFT Exterior

Enter the weight of the curb, parapet, median, and sidewalk of the left side of the structure distributed equally to the left exterior strip width. See explanation on calculating exterior strip width on page 6.

Parapet: 0.34 kip/ft
Rail: 0.022 kip/ft
Total: 0.362 kip/ft

= (0.362 kip/ft) ÷ (4.96 ft) = 0.073 kip/ft/ft

DC Dead Load Curb, Parapet, Median, and Raised Sidewalk on RIGHT Exterior

Enter the weight of the curb, parapet, median, and sidewalk on the right side of the structure distributed equally to the right exterior strip width. See explanation on calculating exterior strip width on page 6.

Parapet: 0.34 kip/ft
Railing: 0.022 kip/ft
Sidewalk: 0.7 kip/ft
Total: 1.062 kip/ft

= 1.062 kip/ft ÷3.5 ft = 0.30 kip/ft

DW Dead Load Overburden

Enter the weight of overburden for a 1 ft slab width (distribute equally over entire width). There is no overburden on this particular bridge.

= 0 kip/ft

DW Dead Load Utilities

Enter the weight of the utilities (water pipes, electrical conduits, etc.) that are attached to the bridge, distributed equally over the entire slab width. There are no utilities attached to this particular bridge.

= 0 kip/ft

DW Dead Load Utilities on LEFT/RIGHT Exterior

Enter the weight of the utilities attached to the left/right side of the structure distributed equally over the left/right exterior strip width. See explanation on calculating exterior strip width on page 5. There are no utilities attached to this particular bridge.

= 0 kip/ft

Pedestrian Live Load on LEFT/RIGHT Exterior

Enter the weight of the pedestrian live load on the left/right side of the structure distributed over the left/right exterior strip width. This parameter is usually ignored when rating and can be entered as zero.

= 0 kip/ft

Equivalent Strip Inputs

Equivalent Strip Width for HL-93 Loads for Moment and Shear

Enter the controlling equivalent strip width for HL-93 loads for moment and shear. Use the smaller of multi-lane and single-lane strip widths. See WisDOT LRFD Bridge Manual 18.4.5.1.

Single-Lane Loading: $E = 10.0 + 5.0 (L_1 * W_1)^{1/2}$
Multi-Lane Loading: $E = 84.0 + 1.44(L_1 * W_1)^{1/2} \leq 12.0(W)/N_L$
Where:

- E = equivalent distribution width (in)
- L_1 = modified span length taken equal to the lesser of the actual span or 60 ft
- W_1 = modified edge to edge width of bridge taken to be equal to the lesser of the actual width or 60.0 ft for multi-lane loading, or 30.0 ft for single-lane loading
- W = edge to edge width of bridge (ft)
- N_L = number of design lanes as specified in LRFD [3.6.1.1.1] (also as specified above)

Single Lane:

Spans 1 and 2: $E = 10in + 5*[39 ft*30 ft]^{1/2} = 181.0$ in =15.09 ft

Multi Lane:

Spans 1 and 2: $E = 84in + 1.44[39 ft*41.5 ft]^{1/2} = 141.9$ in = 11.83 ft
*≤ [12*41.5 ft] ÷ 3 = 166 in = 13.83 ft*

= 11.83 ft (lesser of all values)

Equivalent Strip Width for Fatigue Truck for Moment and Shear

Enter the controlling equivalent strip for Fatigue Truck for moment and shear. The equivalent strip width for the Fatigue Truck is equal to 1.2 multiplied by the single-lane equivalent strip width for HL-93. See Equivalent Strips Excel worksheet.

*Spans 1 and 2: 1.2*15.09 ft = 18.1 ft*

= 18.1 ft

Equivalent Strip Width for LEFT/RIGHT Side of Slab

Enter the equivalent strip width for the left/right side of the slab for HL-93 loads for moment and shear.

Without Raised Sidewalk – Exterior strip width is equal to the lesser of:

1) [The distance between the edge of the slab and the inside face of the barrier)] + 1 ft + 0.25 multiplied by the controlling strip width for HL-93]
2) ½ of the controlling strip width for HL-93
3) 6 ft

With Raised Sidewalk – Exterior strip width is equal to 6 ft.

Left Exterior Strip:

*1) = 1 ft + 1 ft +[0.25*11.83 ft] = 4.96 ft*
*2) = 0.5*11.83 ft = 5.92 ft*
3) = 6 ft

= 4.96 ft (lesser of all values)

Right Exterior Strip:

1) = 6 ft

SWL for LEFT/RIGHT Side of Slab

For no raised sidewalk: This value is equal to the equivalent strip width less the distance from edge-of-slab to the inside face of roadway barrier.

For raised sidewalk: This value is equal to the equivalent strip width less the distance from edge-of-slab to the inside face of sidewalk.

Left SWL:
= 4.96 ft – 1 ft = 3.96 ft

Right SWL:
= 6 ft – 4.5 ft = 1.5 ft

Span Inputs

Span Length

Enter the length of the span.

Span 1 = 39 ft
Span 2 = 39 ft

Number of Interior Top Steel Inputs

Enter the number of ranges of different, top-mat interior-steel configurations of reinforcement spacing or bar size.

Span 1 = 2
Span 2 = 2

Number of Interior Bottom Steel Inputs

Enter the number of ranges of different, bottom-mat interior-steel configurations of reinforcement spacing or bar size.

Span 1 = 3
Span 2 = 3

Number of Exterior LEFT/RIGHT Top Steel Inputs

Enter the number of ranges of top-mat of left/right exterior-steel configurations of reinforcement spacing or bar size.

Span 1 = 2
Span 2 = 2

Number of Exterior LEFT/RIGHT Bottom Steel Inputs

Enter the number of ranges of bottom-mat of left/right exterior-steel configurations of reinforcement spacing or bar size.

Span 1 = 3
Span 2 = 3

Number of Depth Inputs

Enter the number of ranges for different depths of slab.

Span 1 = 3
Span 2 = 3

Steel/Depth Inputs

End of Range Distance: Distance from left end of span to end of range being entered.
Bar Size: Size of reinforcement in range (ex. 4,5,6,7,8, 9,10,11)
Bar Spacing: Spacing of reinforcement in range

Since interior and exterior steel is identical for this structure, only the inputs for interior steel will be shown here. However, all steel both interior and exterior must be input for every structure.

Interior **TOP** Steel

Span 1

Range 1 = 39 ft – 15 ft = 24 ft
Bar Size 1 = 4
Bar Spacing 1 = 12 in
Range 2 = 39 ft
Bar Size 2 = 9
Bar Spacing 2 = 6 in

Span 2 (symmetric to span 1)

Range 1 = 15 ft
Bar Size 1 = 9
Bar Spacing 1 = 6 in
Range 2 = 39 ft
Bar Size 2 = 4
Bar Spacing 2 = 12 in

Interior **BOTTOM** Steel

Span 1

Range 1 = 3 ft
Bar Size 1 = 10
Bar Spacing 1 = 12 in
Range 2 = 39 ft – 11.5 ft = 27.5 ft
Bar Size 2 =10
Bar Spacing 2 = 6 in
Range 3 = 39 ft
Bar Size 3 =10
Bar Spacing 3 = 12 in

Span 2

Range 1 = 11.5 ft
Bar Size 1 = 10
Bar Spacing 1 = 12 in
Range 2 = 39 ft – 3 ft = 36 ft
Bar Size 2 = 10
Bar Spacing 2 = 6 in
Range 3 = 39 ft
Bar Size 3 = 10
Bar Spacing 3 = 12 in

Depth Input:

End of Range Distance: Distance from left end of span to end of range being entered
Slab Depth at Left: Effective depth (total depth minus ½ in) at left end of range
Slab Depth at Right (end): Effective depth (total depth minus ½ in) at right end of range

Span 1

End of Range Distance 1 = 31 ft
Slab Depth at Left 1 = 17.5 in
Slab Depth at Right 1 = 17.5 in
End of Range Distance 2 = 37.5 ft
Slab Depth at Left 2 = 17.5 in
Slab Depth at Right 2 = 28.5 in
End of Range Distance 3 = 39
Slab Depth at Left 3 = 28.5 in
Slab Depth at Right 3 = 28.5 in

Span 2

End of Range Distance 1 = 1.5 ft
Slab Depth at Left 1 = 28.5 in
Slab Depth at Right 1 = 28.5 in
End of Range Distance 2 = 8 ft
Slab Depth at Left 2 = 28.5 in
Slab Depth at Right 2 = 17.5 in
End of Range Distance 3 = 39
Slab Depth at Left 3 = 17.5 in
Slab Depth at Right 3 = 17.5 in