Release Notes

MERLIN-DASH V10.14 (WIN 6.2)

March 2022

LRFD

1. Allow AASHTO vehicles other than ‘HL’ (e.g. ‘HS’, ‘H’,…etc.) for LRFD & LRFR
2. Auto design filler plates and calculate reduction factors accordingly for top and bottom flanges, respectively, in splice design tables.
3. Compatible to the latest AASHTO LRFD Bridge Design Specifications 9th Edition.

July 2019

LRFD

1. Update fatigue limit state factors to the latest 0.8 & 1.75
2. Take care of internal handling of left and right exterior girders
3. Report individual truck load rating instead of just list the governing truck load rating.

September 2018

LRFD

1. Add sidewalk in the LRFD load rating.
2. Fix service load II flange allowable for hybrid sections.
3. In code check Table 1.2.22.9A use bottom section modulus instead of the smaller section modulus in the negative moment region.
4. Fix variable theta angle in the bottom stress calculation for the parabolic haunch members.
5. Update splice design.

July 2017

LRFD

1. Removed double count of skew effect for reaction.
2. Minor justified fatigue stress categories E & F report.
3. Fixed prestressed beam reporting maximum moments for LRFD non-AASHTO truck + lane loading.
4. Fixed splice design for rolled beam splice plate with shim plate.
5. Modified algorithm for the input of distribution factors to allow multi-line DF definition.
6. Modified default values for N1 and N2 in the input to be consistent with user’s manual and Help menu.
7. Fixed Service II Inventory and Operating Rating values.

LFD

1. Fixed the LFD fatigue report.

2. Fixed reporting overload moments and shears.

July 2016

Input (see attachment item 1)

1. Data Type 03012: Add Exterior Left & Exterior Right option for different left & right overhang and curb distances.
2. Data Type 06012: Allow AASHTO loading designation blank. Other live loading, such as sidewalk or non-AASHTO loading will still be used.
3. Data Type 11022: Add pop up window for quick calculation and auto-filling of lateral bending stress (for demonstration see attachment item 2)
4. Data Type 12012: Add input for filler plate area

LRFD

1. Remove multiple presence factors from LRFD live load deflection results in Tables 1.2.6.2 and 1.2.34.1.
2. The C_b value reported incorrectly for cases of prismatic section with splice. It has been fixed.
3. The shear distribution factors with skew angle did not apply correctly to only Table 1.2.22.17 shear capacity values. It has been corrected.
4. The shear skew correction factors for both interior and exterior girders with a special vehicle were applied twice in Tables 1.2.6.3, 1.2.7.1 and 1.2.7.2. It has been fixed.
5. The “Z” value of “G” formula (AASHTO Eq. 4.6.2.2.4-1) has been changed back from 1.2 to 1.0 when the lever rule used for a single lane live load distribution factor.
6. The maximum moments and shears did not show consistent values for the option “Included in maximum design load case” in Data Type 06032 on some tables. It has been corrected to make it consistent.
7. Follow algorithms are used in the program and have been verified for different combinations:
    a. For Service II without the option “Included in maximum design load case”, the maximum values (moment or shear) are selected from HL-93, D, M, and G vehicles.
    b. For Service II with the option, the maximum values are picked up from HL-93, D, “M + Lane load”, and ”G + Lane Load”.
    c. For Strength II without the option, the maximum values are chosen from HL-93, M, and “HL-93 & G side-by-side”.
    d. For Strength II with the option, the maximum value is selecting from HL-93, “M + Lane Load”, or “HL-93 & ‘G + Lane load’ side-by-side”.
    e. For Strength I or Service I with or without the option, the maximum values are always chosen from HL-93.

8. Fix Q & I values in the negative moment area to exclude concrete and include reinforcement, if any, in Tables 1.2.6.3B & C

LFD/WSD

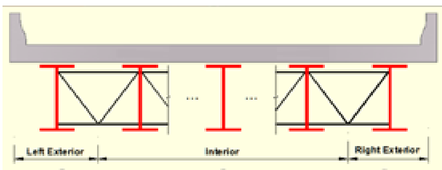
1. The LL moments appear incorrect in Table 1.2.5.3 for a non-composite hinged girder. It has been fixed.

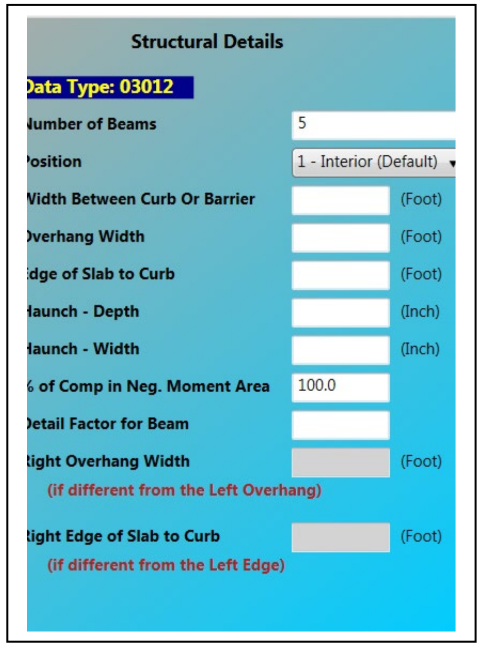
ATTACHMENT

1. Addendum to Merlin-DASH User's Manual and Online Help Menu

Data Type 03012

(Replace the figure with the following two figures)





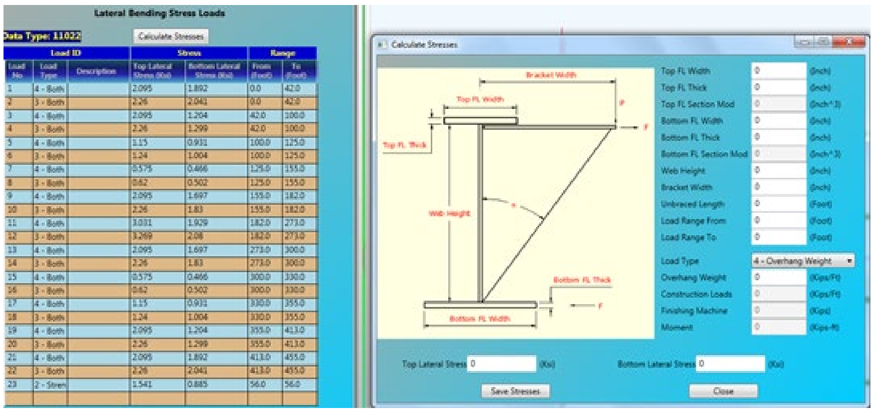
DATA TYPE	INPUT ITEM/DESCRIPTION	UNITS	MODE	REQ/ OPT	REF
03012	***Position:*** 1 = Interior (Default) 2 = Exterior (Left) 3 = Exterior (Right)	NONE	INT.	REQ	
	Right Overhang Width: the distance from the centerline of a right exterior beam or girder to the outside edge of the bridge.	ft (m)	REAL	OPT	
	Right Edge of the Slab to Curb: the distance from the right outside edge of the bridge to the curb line.	ft (m)	REAL	OPT	

Data Type 06012

(Insert at the end of NOTE: for H, HS and LL Loading Designation)

If both fields are blank, no AASHTO loading is applied. Other live loading, such as sidewalk or non-AASHTO loading will still be used.

Data Type 11022



For the Pop up window

DATA TYPE	INPUT ITEM/DESCRIPTION	UNITS	MODE	REQ/ OPT	REF
11022 **(Pop-up Windows)**	***Top FL Width:*** the width of top flange	**in**	**REAL**	**REQ**	
	Top FL Thick: the thickness of top flange	**in**	**REAL**	**REQ**	
	Top FL Section Mod: the section modulus of top flange calculated by the program automatically.	**in^3**	**REAL**	**---**	
	Bottom FL Width: the width of bottom flange	**in**	**REAL**	**REQ**	
	Bottom FL Thick: the thickness of bottom flange	**in**	**REAL**	**REQ**	
	Bottom FL Section Mod: the section modulus of bottom flange calculated by the program automatically.	**in^3**	**REAL**	--	
	Web Height: The clear distance between top flange and bottom flange	**in**	**REAL**	**REQ**	
	Bracket Width: the distance from the center of the web to the end of the bracket	**in**	**REAL**	**REQ**	
		in	***REAL***	**REQ**	

	Unbraced Length: lateral unbraced length between load range from and to	**in**	**REAL**	**REQ**	
	Load Range From/Load Range To: input the same value for the concentrated load				
	Load Type: 2 – Finishing Machine 3 – Overhang Construction Loads 4 – Overhang Weight	**NONE**	**INT.**	**REQ**	
	Overhang Weight: input required only for load type 4	**kips/ft**	**REAL**	**OPT**	
	Construction Loads: input required only for load type 3	**kips/ft**	**REAL**	**OPT**	
	Fishing Machine: input required only for load type 2	**kips**	**REAL**	**OPT**	
	Moment: calculated by the program automatically.	**kip-ft**	**REAL**	**--**	
	Top Lateral Stress/Bottom Lateral Stress: calculated by the program automatically.	**ksi**	**REAL**	**--**	
	Save Stresses: click on this button will save the top and bottom lateral stresses to the corresponding input fields.				
	Close: click on this button will close the pop up window.				

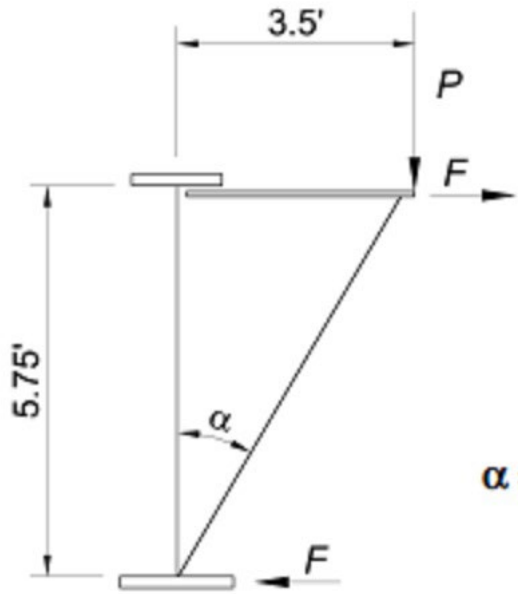
Data Type 12012

DAAT TYPE	**INPUT ITEM/DESCRIPTION**	**UNITS**	**MODE**	**REQ/ OPT**	**REF**
12012	***Filler Plate area:*** Total filler plate area of top and bottom flanges.	**In^2**	**REAL**	**OPT**	

2. Demonstration of Lateral Bending Stress Calculation based on FHWA-NHI-08-048

The concrete deck overhang loads are usually supported by cantilever bracket spaced at 3 to 4 feet along the exterior girder during the construction of steel girder bridges. The bracket loads include either uniformed loads (overhang weight, overhang deck forms, screed rail, railing, and walkway) or concentrated load (finishing machine).

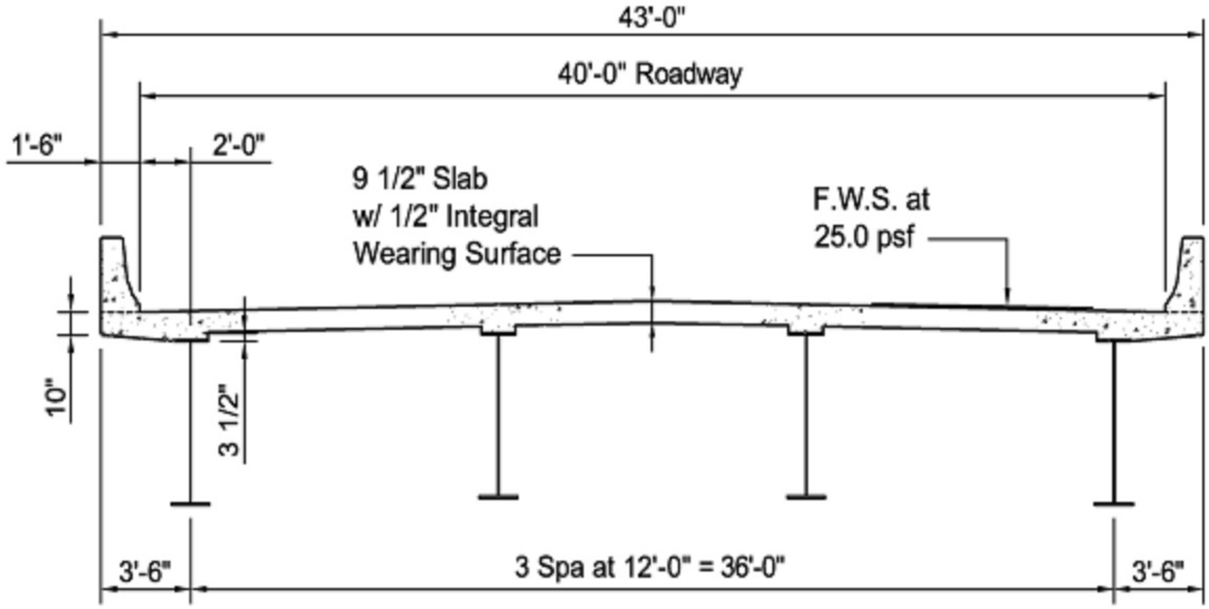
A typical deck overhang bracket is shown in the following figure.



$$F = P \tan \alpha$$

$$\alpha = \tan^{-1}\left(\frac{3.5\ \text{ft}}{5.75\ \text{ft}}\right) = 31.3^{\circ}$$

The torsional moments apply on the exterior girder due to the eccentricity of the overhang weight and other loads which generate the lateral bending stresses for the top and bottom flanges. The example to calculate the lateral bending stresses due to overhang weight and other load can be found in pages 2-137 to 2-146 of FHWA-NHI-08-048. This example is a three span continuous I-girder steel bridge and the cross section is shown in the figure below.



The DASH program has a pop up utility to help calculating the lateral bending stresses of the top and bottom flanges within the unbraced length in Data Type 11022 input screen.

In Data Type 11022, the user can input the entire row manually if all the input stresses and distances are known. Alternatively, the stress calculation utility may be used if the user needs to simplify the stress calculation processes. By pressing the calculate stresses button on this screen, the user can pop up the window utility to calculate the needed stresses. In this popup utility, the user should input the width and thickness for the top and bottom flanges. The required section modulus for the stresses will be calculated by the utility automatically. The user also needs to input web height, bracket width, unbraced length, load range from, and load range to.

For concentrated load, the load range from and to should input the same value. There are three types of loads (finishing machine, overhang construction load, and overhang weight) can be selected for this utility. The corresponding input for these three types of loads is right underneath the input for the load type. The rest of the information will be calculated by the utility automatically.

Please check all the input information before click the “save stresses” button which will save the calculated stresses into all the fields of this row. The user can input all the needed rows before close this utility.

For uniformed load F, the moment (M) is equal to $F*L_b^2/12$ and stress of top and bottom flanges can be calculated by using moment divided by section modulus (S). The L_b is the lateral bracing distance. For concentrated load P, the moment is equal to $P*L_b/8$ and the stress of top and bottom flanges should be M/S.

The calculation of the lateral bending stresses of top and bottom flanges for this example along the entire bridge is listed in the following Spread sheet.

Lateral Bending Stress Input Calculation

Dead load	Deck Overhang Weight	255.00	lbs/ft	Construction Loads except Finishing Machine	
Construction Loads	Overhang Deck Forms	40.00	lbs/ft		
	Screed Rail	85.00	lbs/ft		
	Railing	25.00	lbs/ft		
	Walkway	125.00	lbs/ft	275.00	lbs/ft
	Finishing Machine	3000.00	lbs		

	0' - 42' & 413' - 455'	42' - 100' & 355' - 413'	100' - 125' & 330' - 355'	125' - 155' & 300' - 330'	155' - 182' & 273' - 300'	182' - 273'
Top Flange						
Width (in)	16.00	16.00	18.00	18.00	18.00	16.00
Thickness (in)	1.0000	1.0000	1.0000	2.0000	1.0000	0.8750
Bottom Flange						
Width (in)	18.00	18.00	20.00	20.00	20.00	16.00
Thickness (in)	0.8750	1.3750	1.0000	2.0000	1.0000	1.3750
L_b (ft)	24.00	24.00	20.00	20.00	27.00	27.00
Dead Load						
P (lbs/ft)	255.00	255.00	255.00	255.00	255.00	255.00
F_l (lbs/ft)	155.04	155.04	155.04	155.04	155.04	155.04
M_l (kip-ft)	7.44	7.44	5.17	5.17	9.42	9.42
Stress - Top Flange (ksi)	2.093	2.093	1.148	0.574	2.093	3.027
Stress - Bot Flange (ksi)	1.890	1.203	0.930	0.465	1.695	1.927
Construction Loads						
P (lbs/ft)	275.00	275.00	275.00	275.00	275.00	275.00
Fl (lbs/ft)	167.20	167.20	167.20	167.20	167.20	167.20
Ml (kip-ft)	8.03	8.03	5.57	5.57	10.16	10.16
Stress - Top Flange (ksi)	2.257	2.257	1.239	0.619	2.257	3.265
Stress - Bot Flange (ksi)	2.038	1.297	1.003	0.502	1.828	2.078
Finishing Machine						
P (lbs) @56'		3000.00				
Fl (lbs)		1824.03				
Ml (kip-ft)		5.47				
Stress - Top Flange (ksi)		1.539				
Stress - Bot Flange (ksi)		0.884				