

# PennDOT e-Notification

Bureau of Solutions Management  
Highway Applications Division



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## STLRFD

No. 015  
August 19, 2020

## Release of Version 2.6.0.0

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The Department's LRFD Steel Girder Design and Rating (STLRFD) program has been revised as described in the attached "Summary of July 2020 Revisions – Version 2.6.0.0".

The new version has been placed on PennDOT servers for use by the Districts. Consultants and others, who have a current license agreement for **STLRFD Version 2.5.0.0**, can obtain the updated version by submitting an [Update Request Form](#) along with the **update fee of \$500 for private organizations or \$50 for governmental agencies**. Updates for **STLRFD Version 2.4.0.0 or earlier** will require an **additional fee**. For update fee details, refer to the [STLRFD Fee Schedule](#). The update fee is waived for federal and state transportation agencies.

Once payment is received, an e-mail will be sent with download instructions. A valid e-mail address must be provided on the Update Request Form to receive the download instructions.

Please direct any questions concerning the above to:

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Attachment

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## SUMMARY OF JULY 2020 REVISIONS - VERSION 2.6.0.0

Since the release of STLRFD Version 2.5.0.0 several revision requests and user requested enhancements have been received. This release of STLRFD Version 2.6.0.0 contains the following revisions and enhancements.

### Specification Related Revisions

1. Uplift checks have been added to the cumulative reaction output reports for the deck pour analysis. Also, as part of this request, the Service-I limit state has been removed from the program as it does not apply to steel girders (Request 688).
2. Chief Bridge Engineer Warnings will now print in the program output for locations at the beginning or end of a web depth variation that does not have a transverse stiffener defined at the beginning or end location of the web depth variation (Request 790).
3. The program has been revised to directly use the neutral axis of the section consisting of the steel section plus slab reinforcement to calculate the depth of web in compression ( $D_c$ ) for negative bending. The program previously used the factored stress in the flanges to determine  $D_c$  (Request 811).
4. The calculated lateral stress due to wind is no longer limited to the yield stress of the flange of interest. The lateral stress will be calculated and reported according to the LRFD Specifications and DM-4 (Request 815).
5. The Fatigue-I and Fatigue-II limit state load factors have been revised to 1.75 and 0.80, respectively, due to revisions in the LRFD Specifications, 8th Edition. Because of this update, the program input for Pennsylvania Traffic Factor has been removed as per the 2019 Edition of DM-4. Finally, the ADTT limits for the application of Fatigue-I versus Fatigue-II have been updated to take the number of cycles per truck passage into account. Previously, the program did not take the number of cycles per truck passage into account when applying the ADTT limits (Request 825).
6. The load factors for wind loads and the calculations for the application of wind loads have been revised to match those in the LRFD Specifications, 8th Edition and 2019 Edition of DM-4. As part of this, the WIND CONDITION and PERMANENT WIND SPEED parameters of the WIND PROGRAM DEFINED (WPD) command are no longer used by the program. The WPD command also has two new parameters, WIND EXPOSURE CATEGORY and DESIGN 3 SECOND GUST, needed by the program for the new wind load calculations (Request 826).

**NOTE: As a result of these changes, existing input files with a WPD command will not run until the two new WPD input parameters have been entered.**

7. The "Cycles per Truck Passage" (LRFD Specifications Table 6.6.1.2.5-2) calculation has been revised to use the simpler set of values in the LRFD Specifications, 8th Edition. There is no longer a span length specification, and the only possible values are 1.0 or 1.5 cycles per passage (Request 827).

8. The maximum spacing of shear connectors has been increased to 48 inches, as per the LRFD Specifications, 8th Edition (Request 828).
9. Sidewalks will now be considered as an additional loaded lane for the purposes of calculating distribution factors and multiple presence factors (when applicable) (Request 831).
10. The MINIMUM NEGATIVE FLEXURE CONCRETE DECK REINFORCEMENT output report has been revised to check the stress in the deck assuming that the concrete is effective under negative bending for Service-II and deck pour loads, using short term “n” section properties. The deck reinforcement checks are only done for analysis points where the factored stress in the deck exceeds the factored modulus of rupture of the concrete (Request 834).
11. The methods for calculating the elastic modulus of the deck concrete and the modular ratio between the deck concrete and deck reinforcement have been revised to match the LRFD Specifications, 8th Edition, and the tables of values in the 2019 DM-4 Sections 5.4.2.1 and 5.4.2.4. Along with these changes, the SLB command has been enhanced with additional input checks, and upper and lower limits changed for consistency with the LRFD Specifications and DM-4 (Request 839).

### **Program Input Revisions**

12. The concentrated load (CLD), distributed load (DLD), and lateral bending stress (LAS) commands have been revised to allow the user to specify noncomposite and composite utility loads (UT1 and UT2). The DW load factor is applied to both of these loads (Request 640).
13. The consistency checking of the brace point (BRP) command has been enhanced to allow the program to return error messages without crashing the program, when brace points have not been defined along the entire girder. The program will also provide more detailed information about required brace spacing, when the input brace spacing does not equally divide into the brace range length (Request 653).
14. A new input parameter, MINIMUM WEB THICKNESS, has been added to the DESIGN PLATE GIRDER, PART 2 (DP2) command. This parameter allows the user to enter a minimum web thickness to be used in the design of a plate girder (Request 655).
15. An additional input parameter, VEHICLE TYPE, has been added to the SPECIAL LIVE LOAD (SLL) command to allow the user to specify whether to apply the Design dynamic load allowance or the Permit dynamic load allowance to the specified special live load (Request 781).
16. When a bearing stiffener design is requested through use of a BEARING STIFFENER DESIGN (BSD) command, the program will now generate a separate output file with a BDH file extension (Bearing Stiffener History) that contains a description of the bearing stiffener design process and the calculations done for the design (Request 800).

17. A CLASSIFICATION STRENGTH OF BEARING STIFFENER WELD input parameter has been added to the BEARING STIFFENER (BST) command to allow the program to output the required stiffener-to-web weld size (Request 801).
18. The user can now enter the SKEW ANGLE (SKW) command along with the USER DEFINED REACTION DISTRIBUTION FACTOR (URF) command, regardless of the location of the commands in the program input file. Previously, entering the SKW command before the URF command would result in an input error. Also, the error messages that print when the user enters a COMPUTED DISTRIBUTION FACTOR (CDF) command and a USER DEFINED DISTRIBUTION FACTOR (UDF) command in the same input file have been revised to make it clearer that the user needs to enter one or the other, and not both (Request 819).
19. New input checks have been added to the ACTUAL SLAB THICKNESS and EFFECTIVE SLAB THICKNESS input parameters on the SLAB (SLB) command, in order to be consistent with the BD-601M, Change 2 standard. Additionally, the program can now determine a default value for ACTUAL SLAB THICKNESS if the EFFECTIVE SLAB THICKNESS has been entered. Previously the program would only calculate a default for EFFECTIVE SLAB THICKNESS if the ACTUAL SLAB THICKNESS was entered (Request 842).
20. The LOAD FACTOR (LDF) command has been revised to reflect which load factors are not used in the program. The Fatigue-I, Fatigue-II and Deflection load factors are never used for the MC1, MC2, or SLL loads. Construction-I and Construction-II load factors are not used for MC2 or SLL loads, and Strength-III and Strength-IV load factors are not used for the SLL loads. If the user enters a load factor for any of these combinations, the program will print a warning and ignore the input value (Request 846).

### **Program Output Revisions**

21. The WEB-TO-FLANGE WELD DESIGN: WELD CAPACITY output report will no longer print a warning when the calculated weld size is smaller than the minimum required weld size. An additional column for designed weld size has been added to the report. This is the larger value of the calculated weld size or the minimum required weld size (Request 780).
22. The deflection distribution factor will now print as N/A on the DISTRIBUTION FACTORS FOR FATIGUE VEHICLE output report as deflection due to the fatigue is not needed or checked by the program (Request 783).
23. Some of the headings on the DESIGN - PLATE GIRDER output report have been realigned with the output and changed from abbreviations to full words to clarify the program output (Request 784).
24. Output reports not directly related to rating factor calculations, will no longer print with vehicles that are included in a program run for rating purposes only. For example, for analysis live load code A, the ML-80, HS20, H20, and TK527 vehicles are rating-only vehicles and previously had output reports and specification checks included in the output, such as, TRANSVERSE STIFFENERS CHECK or WEB-TO-FLANGE WELD DESIGN which are not utilized to calculate a rating for those rating vehicles (Request 788).

25. Formatted output reports for the OUTPUT OF INPUT DATA (OIN), OUTPUT OF SECTION PROPERTIES (OSP), OUTPUT OF DESIGN TRIALS (ODG), OUTPUT OF ANALYSIS RESULTS (OAN), OUTPUT OF SPECIFICATION CHECKS (OSC), and OUTPUT OF RATING FACTORS (ORF) commands have been added to the program to allow the user to see which output reports have been turned on or off for a given run of the program (Request 793).
26. An output report (NSBA SPLICE INPUT INFORMATION) has been added to collect all STLRFD output that is available to enter on the NSBA LRFD splice design spreadsheet (Request 795).
27. An incorrect indication of a specification check failure from the REMAINING FATIGUE LIFE ESTIMATION output report for a fatigue point at midspan of a symmetrical beam has been resolved (Request 802).
28. The name of the BEARING STIFFENER CHECK output report has been changed to USER INPUT BEARING STIFFENER ANALYSIS to distinguish this output report from the BEARING STIFFENER DESIGN output report. The description of Code Check B on the USER INPUT BEARING STIFFENER ANALYSIS output report has also been revised for clarity (Request 803).
29. The DEFLECTION LIMITS FOR LIVE LOAD output report will now print only for program runs that include the PHL-93 or HL-93 live loads, as these live load combinations are the only ones that include the PennDOT or AASHTO deflection vehicles (Request 810).
30. The LOAD FACTORS AND COMBINATIONS and LIVE LOADING SUMMARY output reports have been revised to present the information in a more concise and clearer manner (Request 838).
31. The program will no longer crash when the user enters a nonzero DC1S PERCENTAGE value on the CTL command and no other distributed dead loads have been entered (Request 841).

#### **Program Documentation Revisions**

32. Figure 5.28-6, "Longitudinal Slab Reinforcement Location" has been revised to show the slab longitudinal reinforcement outside the transverse reinforcement as shown on BD-601M, Sheet 1, TYPICAL SLAB PANEL 2 detail. The description of the reinforcement area on the ABU, APL, and ARB commands has been revised to clarify that the reinforcement area input should only include the longitudinal reinforcement (Request 817).
33. Chapter 9 of the User's Manual has been revised to remove references to providing a program input file on a diskette. Program input files should be provided in an e-mail or as an e-mail attachment (Request 820).
34. A description of the calculations for maximum pitch of shear connectors has been added to Chapter 3 of the User's Manual (Section 3.7.21) (Request 819).
35. The name of the new DM-4 permit vehicle has been changed from "PA2016-13" to "P2016-13" in the User's Manual, configuration files, and program output (Request 836)

## **Programming Revisions**

36. Old source code concerning the calculation of concurrent moment and shear effects when finding the critical shear combination has been removed or bypassed as concurrent moment and shear is no longer needed to calculate the shear capacity of a steel girder (Request 687).
37. The program will now generate information in the DBP.CSV file regarding the analysis points of the program. This file is not currently used by the EngAsst graphing function, but is included for completeness and possible future use (Request 799).
38. STLRFD has been revised to use Visual Studio 2019 and Intel Parallel Studio XE 2019 Fortran Update 5 for compilation and linking (Request 821).
39. A character string length in Text2PDF is now assigned properly before passing the value to a function. Previously, this value was not assigned, leading to the PDF being created with an incorrect font size which caused lines of output to wrap in the PDF file (Request 840).
40. The "/Z7" compiler flag has been added to the Fortran properties to avoid "corrupt PDB file" errors when compiling the program (Request 843).

## **APRAS Requests**

41. For APRAS runs, the program will no longer produce any DBT, DBP, or CSV files (Request 813).
42. For APRAS runs, the program will no longer produce any screen output (Request 822).
43. For APRAS runs, the program will no longer produce an output file if the output filename is left blank. The program will now return a code of "1" for unsuccessful program runs and "0" for a successful program run (Request 837).

The program source code now has the option to build a 64-bit executable (EXE) and dynamic link library (DLL). The program now also has the option to create a 32-bit executable and dynamic link library that uses the Compact Visual Fortran (CVF) calling convention. Both of these revisions have been provided to support APRAS (Request 830).