PennDOT e-Notification

Bureau of Solutions Management
Highway Applications Division

pennsylvania
DEPARTMENT OF TRANSPORTATION

FBLRFD No. 007 January 25, 2021	**Release of Version 1.7.0.0**

The Department's Floorbeam Analysis and Rating (FBLRFD) program has been revised as described in the attached "Summary of October 2020 Revisions – Version 1.7.0.0".

The new version has been placed on PENNDOT servers for use by the Districts. Consultants and others, who have a current license agreement for **FBLRFD Version 1.6.0.0**, can obtain the updated version by submitting an Update Form along with an **update fee of $500 for private organizations and $50 for governmental agencies**. Updates for **FBLRFD Version 1.5.0.0 or earlier** will require an **additional fee**.   For FBLRFD update fee details, refer to the FBLRFD 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 Form to receive the download instructions.

Please direct any questions concerning the above to:

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Attachment

SUMMARY OF OCTOBER 2020 REVISIONS - VERSION 1.7.0.0

Since the release of FBLRFD Version 1.6.0.0 several revision requests and user requested enhancements have been received. This release of FBLRFD Version 1.7.0.0 contains the following revisions and enhancements.

<u>Specification Related Revisions</u>

1. The calculations of the LRFD Specifications, Section 6, Appendix D have been added to the program. For some girder configurations, Appendix D will lead to a larger lateral torsional buckling capacity (Request 404).

2. Three vehicles specified as part of the FAST Act (EV2, EV3, and SU6TV) have been added as a live load option to the program (Live Load Code H) (Request 426).

3. Rating factors governed by lateral torsional buckling for live load placement runs (Live Load Code F) will now include the live load effects for the non-rating vehicle as part of the dead load effects, as defined in the User's Manual Live Load Ratings section (Request 428).

4. 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 (DC) for negative bending. The program previously used the factored stress in the flanges to determine DC (Requests 435, 475).

5. If both flanges of a section are in tension, the program will now report 0.0 in as the depth of web in compression (Request 451).

6. 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 as required by the GIRDER HAUNCH STIFFENER DETAIL shown in BC-753M (Requests 467, 508).

7. Moment of inertia check failures on the TRANSVERSE STIFFENERS CHECK output report will now properly cause the report title to appear on the SPECIFICATION CHECK FAILURES report at the end of the output file (Request 470).

8. 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 480).

9. 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 482).

10. The maximum spacing of shear connectors has been increased to 48 inches, as per the LRFD Specifications, 8th Edition (Request 483).

11. Sidewalks will now be considered as an additional loaded lane for the purposes of calculating distribution factors and multiple presence factors (when applicable) (Request 484).

12. 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 487).

13. An error in the calculation of moment and shear effects from a sidewalk live load applied outboard of the outermost stringer has been resolved. Previously, the concurrent effects were occasionally larger than the reported maximum effects (Request 445).

Program Input Revisions

14. The error messages regarding the limits of the floorbeam overhang distance with respect to the deck edge limits have been revised to more clearly indicate that the floorbeam cannot extend past the deck edges. The User's Manual and configuration files have also been revised to make this clear (Request 127).

15. Rules have been defined for use with the Engineering Assistant program to enable and disable FBLRFD input tabs based on program input (for example, the rolled beam and built up section commands are disabled if the user chooses plate girder for the floorbeam type on the CTL command) (Request 266).

16. 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 406).

17. New input checks were added to the BEARING STIFFENER (BST) command. The user no longer has to enter SPACING BETWEEN PAIRS when only one pair is present, and CLEARANCE is only required at the actual ends of the floorbeam, not at supports, for all floorbeam types (Request 440).

18. 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 443).

19. The user now has the ability to enter a separate set of load factors via the Load Factor (LDF) command for each special live load entered by the user. The user still has the ability to enter one set of load factors to be applied to every special live load, or for all special live loads that do not have separate live load factors entered (Request 444).

20. A parameter has been added to the CTL command to allow the user to choose to disregard LRFD Specifications Section 6, Appendix A calculations for flexural capacity (Request 449).

21. The upper limit on transverse stiffener spacing has been increased from 18 feet to 25 feet (Request 462).

22. An input parameter, AUTOMATIC BRACE POINTS AT SUPPORTS, has been added to the CTL command to allow the user to choose whether the program automatically adds brace points at supports. Previously, the program would always add brace points at supports regardless of whether the BRP command defined the brace points or not (Request 469).

23. A program error was fixed that caused the program to occasionally not properly check if holes defined on the SHO command were located within the flange. The program will now stop if a hole is not located within the flange (Request 471).

24. 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 488).

25. 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 load factors are not used for MC2 or 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 494).

26. An input check has been added to prevent users from entering Live Load Definition (LLD) or Live Load Assignment (LLA) commands if a Live Load option other than F (Multiple Live Load Placement) has been specified on the CTL command (Request 505).

Program Output Revisions

27. 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 441).

28. Output reports that are turned off by the user, but have errors or warnings on them will now have an asterisk (*) after the name of the report on the SPECIFICATION CHECK WARNINGS or SPECIFICATION CHECK FAILURES reports at the end of the program output. In addition, output reports with required Chief or District Bridge Engineer approvals are also indicated on the SPECIFICATION CHECK WARNINGS and FAILURES output reports (Request 454).

29. An error in calculating the total DC2 and FWS stresses for the Strength-IP limit state on the UNFACTORED FLEXURAL STRESSES output report has been fixed. Previously, the FWS stress in the top flange, and the DC2 and FWS stresses in the bottom flange were double-counting some stresses and omitting others (Request 465).

30. The name of the BEARING STIFFENER CHECK output report has been changed to USER INPUT BEARING STIFFENER ANALYSIS. The description of Code Check B on the USER INPUT BEARING STIFFENER ANALYSIS output report has also been revised for clarity (Request 473).

31. 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 474).

32. 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 493).

33. Some pagination issues (some pages overflowing onto the following page, some pages not filled as much as they could be) have been resolved for the output of example problems 1 and 3 (Request 511).

Program Documentation Revisions

34. A new section (3.4.7) was added to the User's Manual describing how the loading effects are calculated for a Multiple Live Load placement run of the program (Live Load code F on the CTL command) (Request 429).

35. The contact information and revision request form in Chapter 9 of the User's Manual have been revised (Requests 448 and 477).

36. For plate or built-up sections that start with a varying-depth web, Chapter 5 of the User Manual has been revised to inform the user that the first defined cross section must have a constant-depth web in order to set the web depth at support number one. This range can be very short, but it must be entered at the start of the floorbeam (Request 459).

Programming Revisions

37. The calculation of k, the bend buckling coefficient for webs with longitudinal stiffeners, no longer uses a tolerance comparison when checking if ds/Dc is less than 0.4, because the tolerance comparison caused the comparison to incorrectly fail when ds/Dc was close to 0.4 (Request 461).

38. FBLRFD has been revised to use Microsoft Visual Studio 2019 and Intel Parallel Studio XE 2019 Fortran Update 5 for compilation and linking (Request 478).

39. The PennDOT BEAM SECTION PROPERTIES (BSP) program version 2.0.2.0, and the CONTINUOUS BEAM ANALYSIS (CBA) program version 3.7.0.0 have been incorporated into FBLRFD (Request 486).

40. Some variables related to the factored uncured slab lateral torsional buckling stress were added to a common block to ensure they retain their value across subroutines (Request 490).

APRAS Requests

41. The program is now compatible with APRAS NextGen (Request 274).

42. APRAS runs will no longer generate a PDF output file (Request 455).

43. 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 479).