FBLRFD	**Release of Version 1.6.0.0**
No. 006	
July 2, 2018	

The Department's Floorbeam Analysis and Rating (FBLRFD) program has been revised as described in the attached "Summary of November 2017 Revisions – Version 1.6.0.0".

The new version has been placed on PENNDOT servers for use by the Districts. Consultants and others, who have a current license agreement for **FBLRFD Version 1.5.0.0**, can obtain the updated version by submitting an Update Request Form along with an **update fee of $500 for private organizations and $50 for governmental agencies**. Updates for **FBLRFD Version 1.4.0.0 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

Since the release of FBLRFD Version 1.5.0.0 several revision requests and user requested enhancements have been received. This release of FBLRFD Version 1.6.0.0 contains the following revisions and enhancements.

General Programming Revisions

1. FBLRFD analysis point tolerances are updated to 0.1 inches and 2.54 mm to match with tolerances set in Department's Continuous Beam Analysis (CBA) program (Request 086).

2. Rolled beam section properties were reported incorrectly when section losses were entered. Computation of rolled beam section properties when section losses are entered has been corrected (Request 095).

3. The BSP source code used by FBLRFD has been updated to BSP version 2.0.2.0 (from 2.0.0.2) (Request 394).

4. The list of invalid characters for input file names has been reduced to \ / : * ? " < > |. The previous list also included characters that were actually acceptable for Windows file names (Request 400).

5. Changes how the compiler handles floating point values have been made to ensure similar program results when running FBLRFD from a command prompt as well as from EngAsst (Request 405)

6. The program is now compiled with Intel Parallel Studio XE 2017 Update 4 using Visual Studio 2017 (Request 434).

Lateral Torsional Buckling Revisions

7. The lateral torsional buckling calculations have been revised per LRFD Specification 6.10.8.2.3 and A6.3.3 to report the smallest lateral torsional buckling resistance along an unbraced length as the resistance for all analysis locations in that unbraced length. Combined with this, FBLRFD now also reports the maximum applied flexural stress in an unbraced length as the factored stress for lateral torsional buckling calculations over the entire unbraced length. Finally, FBLRFD now sets C_b, the moment gradient factor, to 1.0 for unbraced lengths that are nonprismatic.

   Also, the LRFD Specifications Article 6.10.8.2.3 and Appendix A calculations are implemented for all analysis points where the Appendix A criteria are met. The rating factors (or performance ratios) are calculated for the Article 6.10.8.2.3 and Appendix A resistances, and the combination creating the larger rating factor is selected as the governing calculation for the analysis point. Appendix A calculations are only considered inside an unbraced length if the Appendix A criteria are satisfied at every analysis point in the unbraced length.

   In addition, the following revisions have been made: sections with section holes are no longer automatically treated as noncompact for the purposes of lateral torsional buckling calculations; the net section fracture resistance results are no longer reported on the STRESS FLEXURAL CAPACITY output report because they are presented on the NET SECTION FRACTURE CHECK output report; and the Appendix A criteria are now considered for the construction and uncured slab specification checks.

If the calculated scaled governing Appendix A lateral torsional buckling capacity at a given analysis point is larger than the local calculated Appendix A lateral torsional buckling capacity at the analysis point, the local value will be reported as the governing capacity at the analysis point. This can occur because when the Appendix A capacity governs in a non-prismatic section, the moment capacity at the governing location is scaled by the ratio of (Sxc,current location) / (Sxc,governing location).

The moments due to the beam self-weight are now used in order to determine which end of a given unbraced length has the smaller moment. This change now allows the methodology to be consistent between the staging/uncured slab conditions and final conditions. This change was also necessary to correct the calculations for the staging/uncured slab checks for the lateral torsional buckling capacities.

A change in web thickness will not cause an unbraced length to be considered nonprismatic. Changes in flange dimensions or web depth will continue to cause a section to be considered nonprismatic.

LRFD Specifications Section 6 Appendix A calculations are no longer considered for the constructability checks reported in the uncured slab and staged construction output.

A floorbeam with a transition from a larger section to a smaller section in the 20% range at the end of an unbraced length with the smaller section continuing past the 20% range will have the larger section ignored so that the floorbeam can be considered to be prismatic and have Cb > 1.0. If there are other transitions in the floorbeam outside the 20% range, the larger section will NOT be ignored.

A check has been added to the program to generate a Chief Bridge Engineer warning for bracing ranges that have analysis points in negative flexure, a varying web depth, and flange transitions further than one foot from either end of the unbraced length (Request 403). **Note that these changes will result in significantly lower ratings for floorbeams that are governed by their lateral torsional buckling resistance.**

Program Input Revisions

8. When the bearing stiffeners were entered out of order, bearing stiffeners were not displayed in locations where they were supposed to be. Bearing stiffeners are now sorted and displayed even when the bearing stiffeners are entered out of order. (Request 180)

9. The upper limit of concentrated loads has been changed to 30 in the User's Manual to reflect the program's capability. Also, the description of the TST command has been modified to indicate that the parameters of the command cannot be repeated. (Request 231)

10. A new program input, "DC1S Percentage" has been added to the CTL command to allow the user to specify a percentage of steel self-weight to be applied to the floorbeam as a DC1S load. This load will be in addition to any DC1S loads specified by the user on the DLD or CLD commands (Request 375).

11. The User's Manual and configuration files for the Engineering Assistant have been revised to consistently describe how many instances of each command are allowed, and how to define these instances (Request 416).

12. Documentation of the values on the FGV command has been added to Section 6.33 of the User's Manual (Request 417).

13. The upper limits on year values have been increased on the FTL command (Request 418).

14. The upper limits on the number of trucks on the FGV command have been increased (Request 419).

15. Subscripts for values on the SLS command are now properly assigned so that the varying web depth is correctly calculated (Request 420).

16. Information on the SLS and SHO commands is now mirrored properly for symmetrical floorbeams (Request 424).

17. The FDL and SDL commands will now allow negative values for load magnitudes when entering these values through EngAsst. FBLRFD has always allowed negative values for these magnitudes, but they could not be entered through EngAsst (Request 446).

Program Output Revisions

18. A warning has been added to the program output to advise the user that section holes defined on the web of a cross section are always ignored, and will not affect program output (Request 421).

User's Manual Revisions

19. The parameter descriptions in several STLRFD Engineering Assistant configuration files have been updated to match the parameter descriptions in the User's Manual. (Request 188)

20. Notes have been added to Chapter 2 of the FBLRFD User's Manual to indicate that blast loading is not considered by FBLRFD (Request 407).

21. References to "ADTT" on the FTL command have been changed to "$(ADTT)_{SL}$" (Request 413).

22. On the SAL command, the description has been modified to let the user know that the axle spacing following the last axle must be entered as 0.0 (Request 415).

23. The description of the folder structure on the Start Menu has been modified in Chapter 4 to correctly reflect the program installation (Request 425).

Specification Checking Revisions

24. The method of computing the minimum factored reactions has been revised. The factored reactions are computed by component. If a component (DC1, DC2, DW, etc.) is positive (downward), then the reaction component is multiplied by the minimum load factor and then is divided by the eta (η) factor to compute the minimum factored reaction. If the component is negative (upward), then the reaction component is multiplied by the maximum load factor and eta (η) factor to compute the minimum factored reaction. (Request 107)

25. It has been verified that the program already requires transverse stiffeners to be defined along the length of any longitudinal stiffeners (LRFD Specifications 6.10.11.1.1). No changes were required (Requests 376, 409).

26. The fatigue stress range calculations now only include live load effects, with the section properties used to compute the stresses determined based on the sign of the live load moments. Previously, unfactored dead load effects were included with the live load effects in order to determine the section properties to use in computing the stresses (Request 387).

27. For floorbeams that are entirely in negative bending, the shear connector design ranges will be broken up at the location of the smallest magnitude negative moment (rather than looking for the maximum positive moment) (Request 390).

28. The program has been modified to use unfactored moments to compute the stress in the slab to determine which section properties to use for calculating factored flexural stresses (LRFD Specifications 6.10.1.1.1b) (Request 408).

29. The load factors for DC, DW and LL for the construction and uncured slab limit states have been increased to 1.4 from 1.25 (Request 410).

30. It was verified that the program neglects any concrete on the tension side of the neutral axis when the neutral axis is located in the slab. The program neglects this for all limit states, not just the strength limit states (LRFD Specifications 6.10.1.1.1b) (Request 411).

31. The use of hybrid sections with web yield strength greater than flange yield strength (DM-4 Article 6.10.1.3) and the use of girders with variable web depth (DM-4 Article 6.10.1.4) now require District Bridge Engineer approval, rather than Chief Bridge Engineer approval (Request 412).

32. The calculation for the constant amplitude fatigue threshold for straight reinforcement has been updated to follow the 2014 LRFD Specifications (Article 5.5.3.2) (Request 431).