PennDOT e-Notification

Bureau of Solutions Management
Highway Applications Division

pennsylvania
DEPARTMENT OF TRANSPORTATION

BXLRFD
No. 018
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Release of Version 2.9.0.0

The Department's LRFD Box Culvert Design and Rating (BXLRFD) program has been revised as described in the attached "Summary of January 2021 Revisions – Version 2.9.0.0".

The new version has been placed on PennDOT servers for use by the Districts. Consultants and others, who have a current license agreement for **BXLRFD Version 2.8.0.0**, 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 **BXLRFD Version 2.7.0.0 or earlier** will require an **additional fee**. For BXLRFD update fee details, refer to the BXLRFD 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:

Robert F. Yashinsky, P.E.
PA Office of Administration | Infrastructure and Economic Development
Bureau of Solutions Management | Highway Applications Division
Phone: (717) 787-8407 | Fax: (717) 705-5529
e-mail: ryashinsky@pa.gov

Attachment

SUMMARY OF JANUARY 2021 REVISIONS - VERSION 2.9.0.0

Since the release of BXLRFD Version 2.8.0.0 several revision requests and user requested enhancements have been received. This release of BXLRFD Version 2.9.0.0 contains the following revisions and enhancements.

Specification Related Revisions

1. AASHTO / DM-4 references in BXLRFD have been updated to the 8th Edition AASHTO LRFD Specifications / 2019 DM-4 (Request 315).

2. The concrete density modification factor (λ) has been added to shear resistance calculations, as specified in the 8th Edition LRFD Specifications or 2019 DM-4 revisions. (Request 316)

3. The methods for calculating the elastic modulus of concrete and the modular ratio between the concrete and 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 MAT command has been enhanced with additional input checks, and upper and lower limits changed for consistency with the LRFD Specifications and DM-4 (Request 317).

4. The calculation of development length for hooks in tension has been updated to match the notation and equation of the 8th Edition LRFD Specifications. The only numerical differences will be for culverts with lightweight concrete (Request 318).

5. The calculation for the modulus of rupture of concrete has been revised to include the concrete density modification factor, and to now use a single equation for both lightweight and normal weight concrete (Request 320).

6. A new factor, α_1, has been added to the program to replace the previous stress block factor of 0.85, as specified in LRFD Specifications Section 5.6.2.2. The new factor is only less than 0.85 for concrete strengths greater than 10 ksi, decreasing linearly to a minimum value of 0.75 at 15 ksi (Request 326).

7. The "Rho Min Area" check on the MINIMUM REINFORCEMENT CHECK output table is no longer calculated for precast culverts with less than 16 ft. segment lengths, matching the description of the checks in Section 3.5.1.2.1 of the User's Manual which follow the LRFD Specifications 12.11.5.3.2 (Request 328).

8. When calculating the required flexural resistance to find the minimum reinforcement, the coefficient of 4/3 times the factored moment has been updated to 1.33 times the factored moment, to match DM-4 Section 5.6.3.3 (Request 329).

9. The PA Traffic Factor has been removed from DM-4. As a result, the program has been changed so this input is no longer used by the program. Also, the EngAsst Field help for the Fatigue Dynamic Load Allowance and Load Factor Fatigue input parameters has been removed because these input values are not used by the program (Request 303).

Program Input Revisions

10. Up to eight special live load vehicles can now be analyzed and rated in a single run of the program. See the updated User's Manual pages for the new required input on the SLL and SAL commands (Request 257).

    NOTE: This change requires that any previously existing input files using special live loads be updated because of additional input now required.

11. An input check has been added to ensure that all reinforcement commands consistently enter either size and spacing of all reinforcement, or area for all reinforcement. The user cannot combine commands that specify the reinforcement by size and spacing, with commands that specify the reinforcement by area (Request 261).

12. A new input parameter, STRIP FOOTING PC OR CIP has been added to the CTL command to allow the user to specify the type of strip footing being used. This allows the program to choose the correct phi factors to use for the strip footing (Request 284).

    NOTE: This change will require that any previously existing input files for precast frame culverts be modified to enter this input value. Cast in place frame culverts will default to cast in place strip footings.

13. Input checks were added to TSA, TSR, BSA, BSR, WLA, WLR, FTA, and FTR commands to ensure that sufficient data has been entered to define the reinforcement at the top and bottom (or left and right) of each component. If consistent input is not provided, the program will now stop with an error (Request 300).

14. The EngAsst configuration files for the SID command were revised to allow for alphanumeric input for the Span ID parameter (Request 307).

15. The input parameter MULTIPLE PRESENCE REDUCTION on the load control (LDC) command has been revised to be consistent with other input parameters that are no longer used by the program. The parameter is not to be entered by the user because DM-4 does not allow for the reduction of the multiple presence factor based on low ADTT. If the parameter is entered, a warning will be generated and the input value will be ignored (Request 330).

Program Output Revisions

16. On the SERVICEABILITY SPACING CHECK output report, an asterisk indicating a CRACK CONTROL SPACING failure will now print immediately adjacent to the CRACK CONTROL SPACING column for clarity, rather than at the end of the line (Request 274).

17. The size of the output field for HEIGHT OF FILL on the LOAD CONTROL output report has been increased to allow output of fill heights greater than 99.99 feet (Request 285).

18. A tolerance has been added to resistance/demand ratio check on the DEAD LOAD EFFECTS AND CAPACITIES output report. A resistance/demand ratio between 0.995 and 1.0 will no longer indicate a failure (Request 287).

19. Top slab output or warnings will no longer be displayed on the SERVICEABILITY SPACING SUMMARY output report for U-Channel structures (Request 294).

20. For precast culverts with a strip footing, the bottom slab top and bottom cover values have been changed to "N/A" (from 0.0), and the instructions for entering these values as zero has been removed from the program documentation (Request 310).

Program Documentation Revisions

21. The alpha value (angle of bent up bars for shear reinforcement) has been changed from 45 degrees to the more commonly used 90 degrees for all delivered example input files (Request 270).

22. The revision request forms provided with the program and in the User's Manual have been revised to remove the mailing address. The email address, phone number, and FAX number have been retained (Request 293).

23. A section number incorrectly specified as "19.10.6" has been changed to the correct value of "6.10.6" in the User's Manual (Request 297).

24. 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 299).

25. Chapters 3 of the User's Manual was revised to update the structural model boundary conditions that BXLRFD uses as well as to document the EH1 and EH2 loads. Chapter 7 was revised and extended to define the positive sign conventions of the finite element model, as well as showing the direction of positive forces and moments that act on strip footings (Request 305).

26. 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 306).

27. Additional direction and description have been added to Chapters 5 and 6 of the User's Manual regarding the entry of the Height of Fill and Overlay Thickness parameters of the Load Control (LDC) command. The program also now computes a horizontal earth load EH2 due to the Overlay Thickness (see Section 3.3.5 of the User's Manual). Also, the User's Manual now documents what the calculated EH1 and EH2 horizontal earth loads represent (Request 286, 313).

28. Section 3.5.3.1 of the User's Manual has been modified to document that DM-4 Sections 5.10.3.2 and 5.10.6.1P are the source for the program's maximum bar spacing limits.

Programming Revisions

29. A tolerance has been added to the maximum bar spacing checks on the SERVICEABILITY SPACING CHECK output report to avoid situations where the calculated maximum spacing and input spacing appear to be equal but show a specification failure. This situation will no longer result in a failure (Request 298).

30. BXLRFD has been revised to use Visual Studio 2019 and Intel Parallel Studio XE 2019 Fortran Update 5 for compilation and linking (Request 301).

31. Fatigue-related source code that is no longer used by the program has been removed from the project files and source code repository (Request 319).

32. The functions SIFSACC and SIZ were removed from the program as they were no longer needed by the program (Request 321).

APRAS Requests

33. For APRAS runs, the program will no longer produce any OUI, FEM, FER, MM, OR ANN files (Request 296).

34. 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 revisions have been provided to support APRAS (Request 302).

35. The parameter DLLERR text and appropriate return code (0 or 1) are now returned by the program to external calling programs (such as APRAS) (Request 308).