

# PennDOT e-Notification

Bureau of Solutions Management  
Highway Applications Division



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## **BXLRFD**

No. 017  
November 19, 2018

## **Release of Version 2.8.0.0**

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The Department's LRFD Box Culvert Design and Rating (BXLRFD) program has been revised as described in the attached "Summary of September 2018 Revisions – Version 2.8.0.0".

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 2.7.0.0**, can obtain the updated version by submitting an [Update Request Form](#) along with an **update fee of \$400 for private organizations and \$50 for governmental agencies**. Updates for **BXLRFD Version 2.6.0.0 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](mailto:ryashinsky@pa.gov)*

Attachment

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Archived copies of all previously distributed e-Notifications can be obtained from the PennDOT LRFD and Engineering Programs website at <http://penndot.engrprograms.com/home> and clicking on "e-Notification" and then "Mailing List Archives."

## SUMMARY OF SEPTEMBER 2018 REVISIONS - VERSION 2.8.0.0

Since the release of BXLRFD Version 2.7.0.0 several revision requests and user requested enhancements have been received. This release of BXLRFD Version 2.8.0.0 contains the following revisions and enhancements.

### Input Revisions

1. A problem was fixed with the WVA command where an error was returned when more than one shear reinforcement range was entered. (Request 258)
2. An inconsistency between the valid MAT Alpha parameter values and the BXLRFD User Manual documentation was corrected. The LOWER LIMIT for Alpha was changed from 0.0 to 1.0 degree. A default value of 90 degrees for Alpha was added. (Request 268)

### Output Revisions

3. A new output table called MINIMUM REINFORCEMENT CHECK has been added to the program for both Analysis and Design runs to report the various reinforcement steel areas at each POI that are used to determine the minimum required reinforcement area. Reinforcement areas reported are: cracking moment,  $\frac{4}{3}$ \*ultimate moment,  $\rho_{\min}$  area, temperature and shrinkage area, and 0.002\*gross concrete area (A12.11.4.3.2). (Request 065)
4. A problem which caused some incorrect phi-factor 'Zone' values to be displayed in the LIVE LOAD RATING output tables for certain Wall components has been fixed. (Request 282, also see Request 253 below)

### Specification Revisions

5. The calculation of  $\phi$  factor has been revised to use the new strain-based equation from AASHTO Section 5.5.4.2 for the situations where loading causes the strain in the section to be between the tension-controlled and compression-controlled regions. Also, calculations for computing and considering the moment resistance and axial resistance for the compression-controlled strain condition of the section have been added to BXLRFD moment axial interaction calculations. (Request 244)
6. The program no longer considers sections to be under-reinforced or over-reinforced. Previously, sections having a "c/de" ratio greater than 0.42 were considered to be over-reinforced as defined in AASHTO Article 5.7.3.3.1. AASHTO Article 5.7.3.3 notes that Article 5.7.3.3.1 was deleted in 2005. The  $\phi$  factor value computed by the program to determine if the reinforcement is sufficient, has been added for each POI to the LIVE LOAD RATING and FLEXURAL REINFORCEMENT DESIGN output tables. The current column titled 'Phi Factor' has been renamed, more appropriately, to 'Zone'. (Request 253)

7. The FAST Act live load vehicles EV2, EV3, and SU6TV have been added to the program for Analysis runs using Live Load code "G" on the LDC command. (Request 254)
8. The PA2016-13 permit live load vehicle has been added to the program for Design runs using Live Load code "F" on the LDC command, and for Analysis runs using Live Load codes "H or I" on the LDC command. (Request 255)
9. The Strength IA Load Factors for the live load earth surcharge (LS), approach slab live load (AL), and live load vehicle with dynamic load allowance (LLIM) Load Types used in the BXLRFD program have been updated from 1.10 to 1.35 to reflect the 2012 DM-4 updated values. (Request 272)
10. A fix has been made to the Shear Rating Factor calculations for certain input conditions which would cause the program to stop responding. The program had been oscillation indefinitely between two rating factors. If oscillation is detected then a second iteration is performed starting from the lower shear rating factor, ending at the higher shear rating factor. (Request 289)

### **General Program Revisions**

11. A "Division by zero" problem which only occurred in certain Analysis run input files with Live Load Code "D" has been fixed. (Request 271)
12. A problem has been fixed for certain Design runs with live load code "E". It was found that when two such runs were compared -- one with a 1.99' Fill and one with a 2.00' Fill -- the top slab bottom face and the bottom slab top face reinforcement areas varied by more than 65%. The ELAT value was found to be calculated incorrectly in the 2.00' case and was corrected. (Request 265)
13. A problem was fixed where the P-82 vehicle Maximum Dynamic Load Allowance (LDC Command Parameter 17) was not being applied correctly for Design run loading code "E". For Design run loading code "E" the Dynamic Load Allowance for the P-82 vehicle was computed as 0.0, which would then zero out the P-82 live load results. (Request 275)

### **User Manual Revisions**

14. BXLRFD User Manual Figure 7.4.3-1 has been revised to more accurately reflect the current output of the program. (Request 250)
15. The description of the folder structure on the Start Menu has been modified in the BXLRFD User Manual Section 4.4 to correctly reflect the program installation. (Request 252)

16. Sections 5.10.21 and 6.10.21 of the BXLRFD User Manual have been updated to clarify how the user may distribute the barrier dead load over the culvert design width. (Request 256)
17. Additional explanation has been added to BXLRFD User Manual Section 5.10.26, LDC command, Number of Precast Shear Transfer Segments providing direction on what value the user should enter. (Request 259)
18. A reference to the obsolete "Example Problem Manual" was removed from BXLRFD User Manual Section 8.1. (Request 260)

### **Programming Revisions**

19. The BXLRFD program is now compiled with the Intel FORTRAN Parallel Studio XE 2017 Update 5 Composer Edition using Microsoft Visual Studio 2017. (Request 264)