



INDIANA DEPARTMENT OF TRANSPORTATION

Design Memo No. 26-03

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TO: All Design Personnel and Consultants

FROM: /s/ Elizabeth P. Mouser
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Standards and Policy Director

SUBJECT: Pipe Backfill Calculator – Updated Program

REVISES: *Indiana Design Manual*/Sections 17-3.02 and -3.03, Figure 17-3A

EFFECTIVE: Immediately

The pipe backfill calculator has been updated and is available to download from the INDOT [Standards and Specifications webpage](#). The calculator was originally created in 2007 as part of Design Memo 07-04, and hand calculations were added to IDM Chapter 17.

Pipe Backfill Calculator Program (MS Excel)

The updated program aims to be more user-friendly; however, the methodology is largely unchanged from the previous version. Updates include

- Macros have been removed. The new program uses embedded custom functions enabled by the latest version of Microsoft Excel.
- All structures are entered on a single input form. As structures are entered, real-time output provides feedback to the user, alerting to inadequate cover or unexpected overruns, indicating an error in the input or design. These outputs can be mapped back to the structure data sheet.
- Color coding is used to guide the user to the input and output fields, preventing unintentional overwriting of the formulas the program requires to operate.
- Graphic pop-ups are included for each input for quick reference.
- The output report is generated automatically as project information and structure data are entered. The user should only need to go to the Output tab and select either Print from the File menu or use a Print Preview command.
- The help tab includes information on how to use the program and who to contact for issues encountered or update requests.

Sample Calculations, Structure Backfill, Circular Pipe

Sample calculations for all three methods using a circular pipe have been posted with the program. Each calculation provides a sample for a standard drawing series 715-BKFL sheet, and

the sheet is referenced in the sample calculation header. The calculations include a graphical representation of the variables, a step-by-step guide to computing areas and volumes, and example inputs and outputs. The example inputs have been entered into the program to show that they are computed using the same process as the hand calculations.

IDM Revisions

The referenced sections of IDM [Chapter 17](#) have been revised to account for the 2:1 sloped backfill, for other minor backfill calculation revisions, and to update references to the pipe backfill calculator program information section. A more detailed summary of revisions is included at the end of this memo.

Questions

Questions regarding this design memo should be directed to the Standards and Policy Division at designmanualinquiries@indot.in.gov.

IDM Revisions Summary

Section 17-3.02(01), Hand Calculation of Backfill Quantities, Circular Pipe, Earth Foundation. Revised to account for the 2:1 slope at the ends of the backfill limits, as shown on the elevation view in the Standard Drawings series 715-BKFL, for all three backfill methods. The wall thickness definition, noted as C_t , has been expanded to accommodate thicker-walled pipes.

Section 17-3.02(02), Hand Calculation of Backfill Quantities, Circular Pipe, Rock Foundation. Revised to account for the different Area B_F length in method 3 and has been corrected to compute CYS rather than ft^3 .

Section 17-3.02(03), Hand Calculation of Backfill Quantities, Deformed Pipe, Earth Foundation. U Revised to remove duplicate calculations by referencing the circular pipe, except for the three different variables and their associated calculations. The pipe area has been simplified to use the deformed pipe's radii, eliminating the need to enter the pipe opening area and perimeter. The area calculation is an approximate representation of the actual pipe opening and provides a standardized procedure for computing the structure backfill for a deformed pipe.

Section 17-3.03, Computer Program for Determining Backfill Quantities. Revised to provide information about the new program and to use a more generalized link to access the program and the example calculations.

Figure 17-3A, Values Required for Determining Backfill Quantities. Revised for readability, and note 3 has been added, indicating that the pipe embedment, $0.1H_c$, is not used in the backfill area calculations.