# Safety Effects of Horizontal Curve and Grade Combinations on Rural Two-Lane Highways
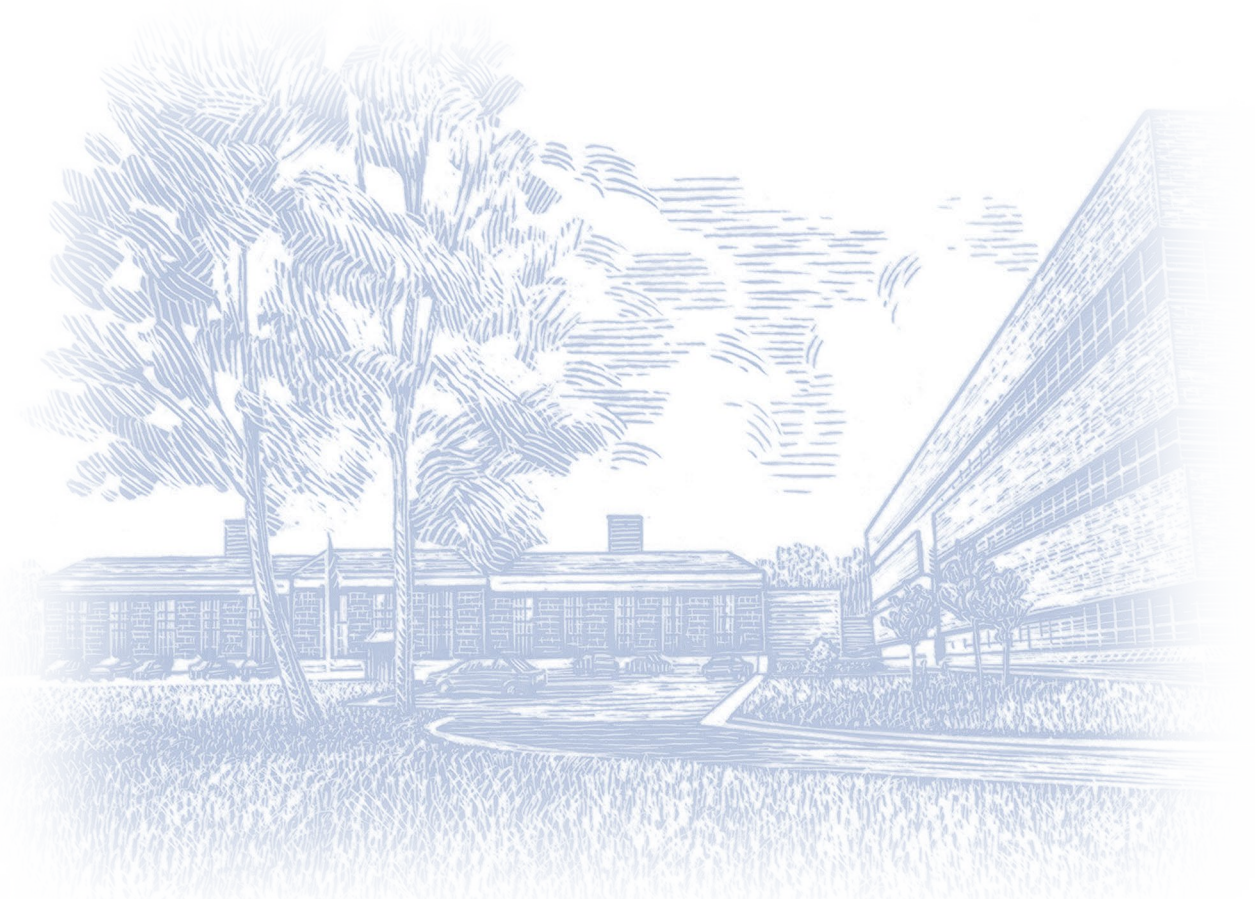
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**Download Excel Calculator Tool Here (2.10 MB)**

This is an .xlsm file which can only be opened using Microsoft® Excel®.

| Report - FHWA-HRT-13-077 | Summary Report - FHWA-HRT-13-078 | Excel Calcuator Tool - HRTM 2130 |
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This spreadsheet tool calculates crash modification factors (CMFs) for the combined effect of curves and grades. CMFs are calculated for fatal and injury (FI) crashes ($CMF_{FI}$), property damage only (PDO) crashes ($CMF_{PDO}$), and total crashes ($CMF_{TOT}$). Use the following instructions to analyze a variety of roadway segments.

**Step 1**: Select the appropriate CMF calculation worksheet from the four available worksheets by clicking on the tabs at the bottom of the screen display. The worksheet selected should be appropriate for the specific combination of horizontal and vertical alignment for which a CMF is to be calculated. The alignment combinations addressed include the following:

- Tangents on straight grades.

- Horizontal curves on straight grades.

- Tangents at vertical curves.

- Horizontal curves at vertical curves.

**Step 2**: Enter the applicable input data describing the horizontal and vertical alignment in the orange boxes in the data input table. The text immediately above the data input table on each worksheet gives guidance on typical ranges of input values. Default values based on chapter 10 of the American Association of State Highway and Transportation Officials (AASHTO) *Highway Safety Manual* (HSM) are provided for the proportions of FI and PDO crashes, $P_{FI}$ and $P_{PDO}$, which must sum to 1.0. Users may substitute local values for $P_{FI}$ and $P_{PDO}$ defaults.

**Step 3**: Click "Run." The computed CMF values, along with a summary of the input data, will appear on a new row added at the bottom of the results table. The final CMFs, $CMF_{FI}$, $CMF_{PDO}$, and $CMF_{TOT}$, are shown in the blue boxes in those rows. You may now enter new values into the orange cells to analyze a different set of conditions. Each time you click the "Run" button, data are saved into the next row of the results report. Clicking "Reset" will refresh the results table by deleting all displayed rows.

Thank you for using the CMF calculator for curves and grades!

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