

**Example of Combining Crash Reduction Factors for Multiple Countermeasures
where Crash Reduction Factors are in Different Formats**

**The proposed method is to weight the CRF for each injury severity category by the number of crashes present in each severity category to get a CRF that can be applied to total crashes*

Project:

- Install paved shoulders, rumble strips, and guardrail to an existing bridge

Crash History:

<i>Severity</i>	<i># ROR Crashes</i>	<i>%</i>
Fatal	1	4%
Inj	9	38%
PDO	14	58%
Total	24	100%

Crash Reduction Factors:

- Paved Shoulders: 18% Total ROR Crashes
- Rumble Strips: 29% Total ROR Crashes
- Guardrail: 55% Fatal ROR Crashes, 20% Injury ROR Crashes, -50% PDO ROR Crashes

Combine Crash Reduction Factors:

- Combine guardrail CRF's broken down by severity to get a CRF for guardrail that can be applied to total crashes. The total guardrail CRF should be weighted by the percentage of target crashes present in each severity category.

$$CRF_{TotalSev} = \left(\frac{\# \text{ Fatal Target Crashes}}{\# \text{ Total Target Crashes}} \right) (CRF_{Fatal}) + \left(\frac{\# \text{ Injury Target Crashes}}{\# \text{ Total Target Crashes}} \right) (CRF_{Injury}) + \left(\frac{\# \text{ PDO Target Crashes}}{\# \text{ Total Target Crashes}} \right) (CRF_{PDO})$$

$$CRF_{TotalSev} = \left(\frac{1}{24} \right) (0.55) + \left(\frac{9}{24} \right) (0.2) + \left(\frac{14}{24} \right) (-0.5) = -0.19$$

- Combine CRF's for paved shoulders, rumble strips, and guardrail

$$CRF_{Ti} = 1 - \left[(1 - CRF_{1i}) * (1 - CRF_{2i}) * \dots * (1 - CRF_{ni}) \right]$$

$$CRF_{TROR} = 1 - [(1 - 0.18) * (1 - 0.29) * (1 - -0.19)] = 0.31$$

Results

- The end result is a combined CRF of 31% for the above described project