Enhancement to Homeland Security Grant Program Terrorism Risk Methodology: Threat, Vulnerability, and Consequence Constraints

Overview

The current Terrorism Risk Methodology (TRM) was constructed to create “weights” or ratios between the Threat (T), Vulnerability (V) and Consequence (C) components, while accounting for component multiplication. The approach was established early in the TRM creation to try to mimic additive weights within components. The weights were added to allow for a measure of control of the ratios of T, V and C to best match the changing U.S. terrorism risk. To create component-level weights, constraint ranges were chosen to represent percentages applying relative range sizes or vector lengths that are then multiplied together.

How FEMA Applies the Constraints

The ratio of T, V and C is used where the total of all three must add up to 100. In fiscal year (FY) 2022, it was 25% T, 25% V and 50% C. Raw component values of T and V are mapped to final values through a constraining process. For FY 2022, these values were 0.5 for the minimum and 1.0 for the maximum for both T and V. C was not constrained, but rather allowed to range between 0 and 1. This gives the 25-25-50 ratio when the ranges are reduced to a common denominator with ranges of 0.5 for T, 0.5 for V, and 1.0 for C.

The set ranges of .5 to 1 for T and V establish that T or V, individually, can at most half the value of C. This means that with this method of calculation the influence that C has to reduce the overall risk score is almost double that of the influence T or V individually have on the overall risk score.

Benefits to Using Current Constraints

The current methodology is familiar to stakeholders, with range details shown in risk graphics and risk profiles. The use of constraints establishes floors for components while keeping the maximum at 1.0 and those floors can be adjusted based on the changing U.S. terrorism landscape. This allows for T, V and C ratios that can change based on the changing U.S. terrorism landscape.

Limitations to Using Current Constraints

There is confusion around the mathematical relationship between T, V and C. The percentages displayed on risk graphics and risk profiles can be misleading, as they are similar to the notation for an additive model. The use of constraints creates a background step that is not clear or easily understandable. The constraint calculation adds complexity and confusion on risk result changes. There is direct interconnectedness of each floor due to the need for T, V, and C ratios to add to 100%. If there is a change in a “weight” of T, V or C it requires updates to all T, V and C floors.