A break-even hazard mitigation metric

PROBLEM

In 2015 alone, the National Weather Service estimated that weather hazards caused $4.2 billion in property damage across the United States. In addition to the significant economic impact, families and communities experience intangible losses. Even though it is in society's interest to invest in more hazard resistant buildings, tools that can aid building designers and owners in better risk-informed decision making are not readily available.

APPROACH

CSHub researchers developed the Break Even Mitigation Percent (BEMP) to answer the question: "How much should be invested in mitigation for a particular building?" The BEMP quantifies the investment in mitigation in an enhanced design (E) expressed as a percentage of the initial cost of the baseline design (B). It considers the expected hazard damage-loss ratio of the baseline design (H_B) and the reduced damage-loss ratio of the enhanced design (H_E):

$$BEMP = \frac{Mitigation\ Investment_E}{Initial\ Cost_B} = \frac{1 + H_B}{1 + H_E} - 1$$

For this case study, researchers created a model based on the FEMA Benefit Cost Analysis V5.2.1 tool to estimate the BEMP for hurricane wind damage across the Gulf Coast and East Coast. They modeled a 4-story midrise apartment building comprising 32 apartments using two building types. The baseline design was a non-engineered wood structure with a durable roof (type WMUH3), and the enhanced design was an engineered concrete structure with a durable roof (type CERBM). A default 7 percent discount rate and 50-year period were assumed and only structural damage was modeled.

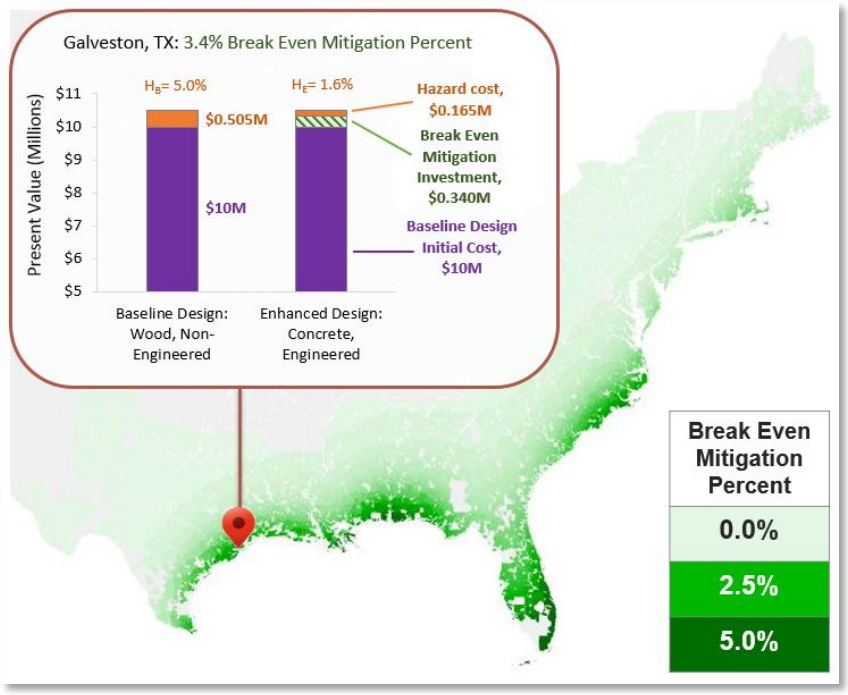

Figure: Illustration of variation of Break Even Mitigation Percent, the percent that should be invested on top of initial cost of baseline design (non-engineered wood midrise apartment building) to mitigate with concrete enhanced design. Assumes 7% discount rate over 50-year time period. In Galveston, if the building cost is $10M initially, the owner invested up to $340,000 (3.4%) and breakeven.

FINDINGS

In the figure, the BEMP for hurricane wind damage was mapped for all available zip codes. Figures were higher near the coasts (as indicated by darker green), but it was shown that some communities many miles inland would also benefit from hurricane wind mitigation efforts. In Galveston, TX, for example, the BEMP was found to be 3.4 percent, meaning $340,000 could be spent on mitigation for a $10M midrise apartment building, and break even over the building life. A lower discount rate would enable a larger investment.

IMPACT

Simple, practical metrics such as the BEMP can be incorporated into tools to support building designers, property owners, and community leaders as they compare mitigation options in anticipation of hazard damage.

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