

# Hazard Mitigation Assessment Methodologies

## Problem

As damage from natural disasters has increased over time, more and more importance is attached to the improvement of buildings’ response to these events. Different tools and programs that evaluate the impact of hazards on residential structures have been launched over the last decade. They differ in terms of their scope of analysis and methodology, and are led by different governmental and private institutions. As such, it can be difficult to discern similarities and differences among the methods.

## Approach

We are developing a quantitative cost-benefit methodology for hazard resistance of residential structures. A first step in this research is a review of the existing landscape of methodologies that promote the hazard resistance and resilience of residential structures. Whereas resistance implies the ability to prevent damage to a building, resilience is the ability to absorb and limit damage from hazards. We used an assessment framework to evaluate these methods. We also conducted a literature review, a test run of all tools, and interviews with different stakeholders in the insurance, risk modeling, and building industry. The goal was to identify gaps and overlaps between programs to understand how integrating different approaches can result in a more effective, comprehensive methodology that better meets stakeholders’ needs.

## Findings

The table below summarizes our results. Programs differ in terms of their managing organizations (public and private), approach (specific building or general study region), scope (integration or separation of different hazards), focus (retrofitting and new buildings), goal (educate or change), and target group (governmental institutions or homeowners). However, a probabilistic, quantitative, region-dependent methodology for assessing the probability of occurrence, the trade-offs between hazard resistance and resilience, other performance metrics, and costs is still missing. Existing methodologies will serve as a foundation for future work.

## Impact

The intent of our research is to provide a quantitative methodology for integrating hazard resistance as a metric into cost-benefit analyses of residential structures. Such an approach can support decisions among stakeholders in the residential building community when evaluating alternative designs with different levels of hazard resistance, cost, and other performance metrics.

## More

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| Program  | Goal  | Target Audience  | Scope   | Output Format  | Method   |
|--|---|--|---|--|--|
| <br>Federal Alliance for Safe Homes                   | promote life safety, property protection and resilience   | Homeowners and communities   | natural and man-made disasters in relation to residential construction                            | Qualitative information; educational   | Give access to knowledge and resources about man-made and natural disasters and provide educational information about retrofitting and building new homes for disaster resistance.   |
| <br>The Insurance Institute for Business & Home Safety | strengthen existing and new homes through retrofit techniques to reduce the damage from natural disasters | Stakeholders (clients, homeowners, builders, etc.) of residential and light commercial buildings, building professionals, and the insurance industry | natural disasters for a specific building and site  | Qualitative information; building rating system  | Train and certify professionals, and provide resources such as information on qualified builders, inspectors, building materials, standards, etc. to owners so that they can meet requirements for the Fortified Home rating system. Work with insurance industry to provide incentives for Fortified Homes. |
| <b>ReScU</b><br>NCSU; funded by the Department of Homeland Security  | provide a method for scoring the resilience of homes in different regions and for different disasters     | all stakeholders of a property   | wind, flood, earthquake, fire, wildfire, hail, mudslide for a specific building and site          | Quantitative and qualitative information; building score and cost of mitigation strategies | Scoring methodology that is based on site specific and building-specific performance characteristics which are put in contrast with a hazard-dependent, structural threshold.  |
| <br>Federal Emergency Management Agency                | assess potential losses from earthquakes, floods, and hurricanes.   | researchers, government and community planners, emergency specialists  | earthquake, hurricane, floods for a defined study region and building stock                       | Quantitative information; loss and performance data  | Quantify physical damage to residential and commercial buildings, economic loss, and social impacts by comparing building performance with hazard dependent structural requirements.   |
| <b>BIPS 04: IRVS</b><br>Department of Homeland Security  | estimate the level of resilience and disaster risk for buildings based on visual inspections              | Government officials, designer, stakeholders, and first responders (for commercial, residential and industrial buildings)                            | blast; chemical, biological, or radiological releases; natural disasters for an existing building | Qualitative Information; building resilience scoring system                                | Scoring methodology which is based on field assessments of an existing building. The methodology follows an integrated multi-hazards approach to risk and resilience which is built on empirical data.   |



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