



For Riverine Flooding, Designing to Exceed 2015 Codes Provides \$5 Benefit for Each \$1 Invested

Introduction

Natural hazards present significant risks to many communities across the United States. Fortunately, there are measures governments, building owners, developers, tenants and others can take to reduce the impacts of such events. These measures—commonly called mitigation—can result in significant savings in terms of safety, prevent property loss and disruption of day-to-day life.

The National Institute of Building Sciences Multihazard Mitigation Council (MMC) undertook a study in 2017 to update and expand upon the findings of its *2005 Mitigation Saves* study on the value of mitigation. In the *2017 Interim Report* (now included into the *2018 Interim Report*), the project team analyzed two areas of mitigation programs:

- **Federal grants:** The impacts of 23 years of federal grants made by the Federal Emergency Management Agency (FEMA), Economic Development Administration (EDA) and the Department of Housing and Urban Development (HUD), resulting in a national benefit of \$6 for every \$1 invested.
- **Beyond code requirements:** Designing new structures to exceed select provisions of the *2015 International Building Code* (IBC) and *International Residential Code* (IRC) and the adoption of the *2015 International Wildland-Urban Interface Code* (IWUIC). This resulted in a national benefit of \$4 for every \$1 invested.

Results of Exceeding Code for Riverine Flooding

The cost to build all new buildings 5 feet above the base flood elevation (BFE) for one year is approximately \$900 million. This would produce approximately \$4.2 billion in benefits, for an aggregate benefit-cost ratio (BCR) of approximately 5:1, e.g., \$5 saved for every \$1 spent to build new buildings higher out of the floodplain.

Table 1 provides BCRs for each natural hazard the project team examined. Figure 1 shows the overall ratio of costs to benefits for the design of new buildings to exceed riverine flooding requirements of the 2015 IBC. The strategy to exceed minimum requirements of the 2015 Codes for riverine flooding is to build new buildings in the 1% annual chance floodplain higher above base flood elevation (BFE) than required by the 2015 IBC. The project team aggregated state and local BCRs to determine the national-level BCR. The costs reflect only the added cost relative to the 2015 IBC.

The stringency of codes adopted at the state and local level varies widely. The project team used the unamended 2015 IBC and IRC as the baseline minimum codes for this study. While minimum codes provide a significant level of safety, society can save more by designing some new buildings to exceed minimum requirements of the 2015 Codes. Where communities have an older code or no code in place, additional costs and benefits will accrue. If all new buildings built the year after were also designed to exceed select I-Code requirements, the benefits would be that much greater, in proportion to the quantity of new buildings.

National Benefit-Cost Ratio Per Peril <small>*BCR numbers in this study have been rounded</small>		Federally Funded	Beyond Code Requirements
Overall Hazard Benefit-Cost Ratio		6:1	4:1
 Riverine Flood		7:1	5:1
 Hurricane Surge		Too few grants	7:1
 Wind		5:1	5:1
 Earthquake		3:1	4:1
 Wildland-Urban Interface Fire		3:1	4:1

Table 1. Benefit-Cost Ratio by Hazard and Mitigation Measure.

Benefit: \$15.5 billion

- 43% – Property: \$6.7
- 22% – Additional living expenses & direct business interruption: \$3.5
- 13% – Casualties & PTSD: \$2.0
- 12% – Indirect business interruption: \$1.8
- 10% – Insurance: \$1.5

billions 2016 USD

Cost: \$3.6 billion

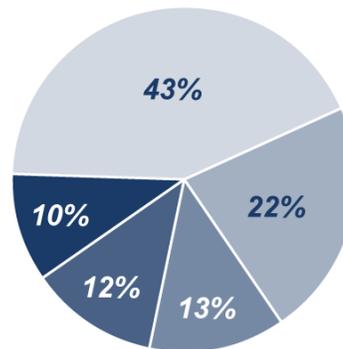


Figure 1. Nationwide benefits by category for designing to exceed 2015 I-Code requirements for flood.