National Institute of BUILDING SCIENCES

Mitigation Saves:

Designing to Exceed 2015 Codes Provides $4 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 incorporated 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

If all new buildings were built to the incrementally efficient maximum (IEMax) design to exceed select requirements of the 2015 IBC and IRC and compliance with the 2015 IWUIC for one year, new construction would save approximately $4 in avoided future losses for every $1 spent on additional, up-front construction cost. Such measures are estimated to prevent approximately 32,000 nonfatal injuries, 20 deaths and 100 cases of PTSD.

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 the select I-Code requirements that the project team studied. The costs reflect only the added cost relative to the 2015 IBC and IRC. 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.

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. Minimum codes provide a significant level of safety, however, society can save more by designing some new buildings to exceed minimum requirements of the 2015 Codes. Strategies to exceed minimum requirements of the 2015 Codes studied here include:

- For flood resistance (to address riverine flooding and hurricane surge), build new homes higher above base flood elevation (BFE) than required by the 2015 IBC.
- For resistance to hurricane winds, build new homes to comply with the Insurance Institute for Business

& Home Safety (IBHS) FORTIFIED Home Hurricane standards.

- For resistance to earthquakes, build new buildings stronger and stiffer than required by the 2015 IBC.
- For fire resistance in the wildland-urban interface, build new buildings to comply with the 2015 IWUIC.

The national-level BCRs aggregate study findings across natural hazards and across state and local BCRs. The *Interim Study* examined four specific natural hazards: riverine and coastal flooding, hurricanes, earthquakes and fires at the wildland-urban interface (WUI). Discussion of each hazard and the associated BCRs are provided in separate summaries.

All Stakeholders Benefit from Mitigation Investments

All major stakeholder groups, including developers, title holders, lenders, tenants and the community, enjoy net benefits from new design to exceed the code requirements studied. See Figure 2. All of society wins when builders make new buildings meet an IEMax level of design exceeding 2015 I-Code requirements where it makes financial sense, on a societal level, to do so. The benefits to tenants and owners only accrue to those who own or occupy buildings designed to exceed 2015 I-Code requirements, not for example to the people who live or work in buildings not designed to exceed I-Code requirements. However, even those who do not own or occupy those buildings enjoy a share of the community benefits.

National Benefit-Cost Ratio Per Peril *BCR numbers in this study have been rounded	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.

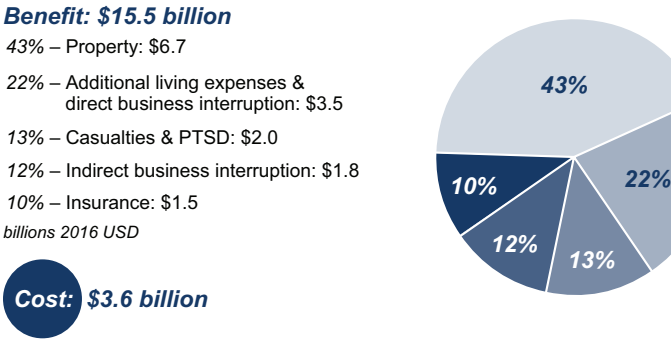

Figure 1. Total costs and benefits of new design to exceed 2015 I-Code requirements.

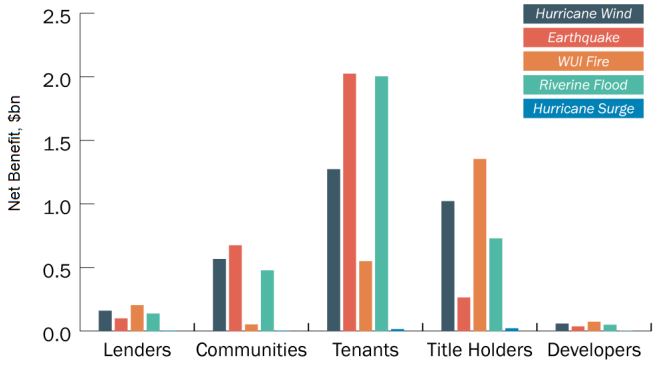

Figure 2. Stakeholder net benefits resulting from one year of constructing all new buildings to exceed select 2015 IBC and IRC requirements or to comply with 2015 IWUIC.