

# Mitigation Saves: Designing to Exceed 2015 Codes Provides \$4 Benefit for Each \$1 Invested

## EVERY AMERICAN FACES NATURAL HAZARDS, AND THE RISK IS GROWING

U.S. disaster losses from wind, floods, earthquakes, and fires now average \$100 billion per year, and in 2017 exceeded \$300 billion—25% of the \$1.3 trillion building value put in place that year. Fortunately, there are affordable and highly cost-effective strategies that policymakers, building owners, and the building industry can deploy to reduce these impacts. These strategies include adopting and strengthening building codes, upgrading existing buildings, and improving utilities and transportation systems. The benefits and costs associated with these mitigation measures have been identified through the most exhaustive benefit-cost analysis of natural hazard mitigation to date and documented in Natural Hazard Mitigation Saves. The study was funded by three federal agencies and four private-sector sponsors and produced by the National Institute of Building Sciences – the nation’s Congressionally chartered convener of experts from the building professions, industry, labor, consumer interests, and government. For the report and accompanying fact sheets, see [www.nibs.org/mitigationsaves](http://www.nibs.org/mitigationsaves). This fact sheet summarizes the study findings and significant savings associated with various mitigation measures.

- Adopting the latest building code requirements is affordable and saves \$11 per \$1 invested. Building codes have greatly improved society’s disaster resilience, while adding only about 1% to construction costs relative to 1990 standards. The greatest benefits accrue to communities using the most recent code editions.
- Above-code design could save \$4 per \$1 cost. Building codes set minimum requirements to protect life safety. Stricter requirements can cost-effectively boost life safety and speed functional recovery.
- Private-sector building retrofits could save \$4 per \$1 cost. The country could efficiently invest over \$500 billion to upgrade residences with 15 measures considered here, saving more than \$2 trillion.
- Lifeline retrofit saves \$4 per \$1 cost. Society relies on telecommunications, roads, power, water, and other lifelines. Case studies show that upgrading lifelines to better resist disasters helps our economy and society.
- Federal grants save \$6 per \$1 cost. Public-sector investment in mitigation since 1995 by FEMA, EDA, and HUD cost the country \$27 billion but will ultimately save \$160 billion, meaning \$6 saved per \$1 invested.

National Institute of BUILDING SCIENCES™		ADOPT CODE	ABOVE CODE	BUILDING RETROFIT	LIFELINE RETROFIT	FEDERAL GRANTS
<b>Overall Benefit-Cost Ratio</b>		<b>11:1</b>	<b>4:1</b>	<b>4:1</b>	<b>4:1</b>	<b>6:1</b>
<b>Cost (\$ billion)</b>		<b>\$1/year</b>	<b>\$4/year</b>	<b>\$520</b>	<b>\$0.6</b>	<b>\$27</b>
<b>Benefit (\$ billion)</b>		<b>\$13/year</b>	<b>\$16/year</b>	<b>\$2200</b>	<b>\$2.5</b>	<b>\$160</b>
 <b>Riverine Flood</b>		<b>6:1</b>	<b>5:1</b>	<b>6:1</b>	<b>8:1</b>	<b>7:1</b>
 <b>Hurricane Surge</b>		not applicable	<b>7:1</b>	not applicable	not applicable	not applicable
 <b>Wind</b>		<b>10:1</b>	<b>5:1</b>	<b>6:1</b>	<b>7:1</b>	<b>5:1</b>
 <b>Earthquake</b>		<b>12:1</b>	<b>4:1</b>	<b>13:1</b>	<b>3:1</b>	<b>3:1</b>
 <b>Wildland-Urban Interface Fire</b>		not applicable	<b>4:1</b>	<b>2:1</b>	not applicable	<b>3:1</b>

Copyright © 2019 The National Institute of Building Sciences

**TABLE 1.** Nationwide average benefit-cost ratio by hazard and mitigation measure. BCRs can vary geographically and can be much higher in some places. Find more details in the report.

## Mitigation Saves:

# Designing to Exceed 2015 Codes Provides \$4 Benefit for Each \$1 Invested

### RESULTS OF EXCEEDING CODE

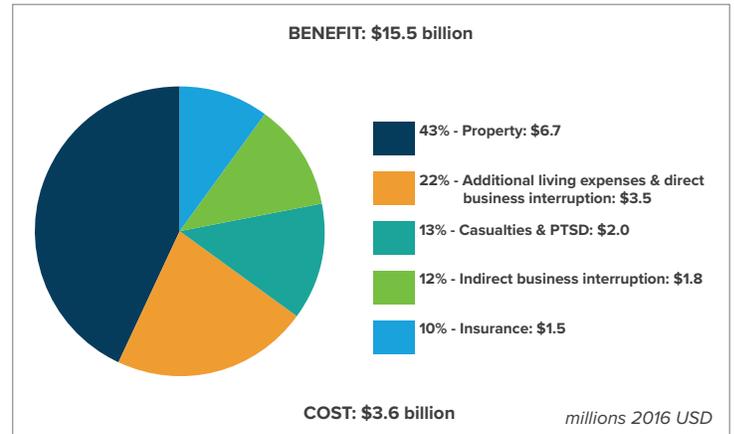
If all new buildings were built to the incrementally efficient maximum (IEMax) design to exceed select requirements of the 2015 IBC and IRC and compliance with the 2015 IWUIC for one year, new construction would save approximately \$4 in avoided future losses for every \$1 spent on additional, up-front 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.

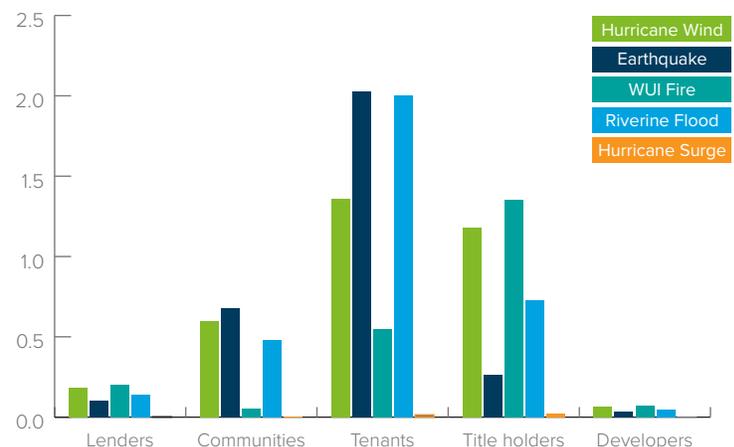
The national-level BCRs aggregate study findings across natural hazards and across state and local BCRs. The Interim Study examined four specific natural hazards: riverine and coastal flooding, hurricanes, earthquakes and fires at the wildland-urban interface (WUI). Discussion of each hazard and the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



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

### 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.



**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.