National Institute of BUILDING SCIENCES

Mitigation Saves:

Utilities and Transportation Infrastructure Investments Can Provide Significant Returns

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, and prevent property loss and disruption of day-to-day life.

The National Institute of Building Sciences (Institute) began a study in 2017 to update and expand upon its well-known 2005 study, *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities,* which looked at the value of mitigation. In October 2018, the Institute released the second in a series of interim results. This latest report, *Natural Hazard Mitigation Saves: Utilities and Transportation Infrastructure,* examines the potential benefits associated with mitigation investments made on select utility and transportation infrastructure.

Utility and Transportation Infrastructure Mitigation

The project team sought to use Economic Development Administration (EDA) grants to look at how the agency's mitigation efforts to address four potential perils and four categories of utilities and infrastructure might benefit communities. Of the 859 EDA grants the project team reviewed, only 16 related to natural-hazard mitigation of utilities and transportation lifelines. Of these, the team acquired sufficient data to estimate benefit cost ratios (BCRs) for 12 mitigation investments.

Because too few EDA grants were available to provide statistical value, the project team modified its objectives to analyze the grants as case studies. Since the grants did not represent all common retrofit measures (particularly in regard to earthquakes), the project team also analyzed potential mitigation measures to address the gaps.

The EDA grants studied by the project team included:

- Flood mitigation for roads and railroads (five grants), with BCRs ranging between 2.0 and 11.0 for four grants, and one grant exhibiting a BCR of 0.2.
- Flood mitigation for water and wastewater facilities (four grants), which produced BCRs between 1.3 and 31.0.
- Wind mitigation for electric and telecommunications (two grants). These grants were estimated to produce BCRs of approximately 8.5.
- Flood mitigation for electric and telecommunications (one grant). This grant produced an estimated BCR of 9.4.

Note: While not statistically valid, these grants, when viewed as case studies, offer anecdotal evidence of the potential value of such types of mitigation.

Mitigation Saves: Utilities and Transportation Infrastructure Investments Can Provide Significant Returns

In light of the unexpectedly limited grant data, the project team supplemented the analysis of grants by studying a few leading options for natural-hazard mitigation of utilities and transportation infrastructure. These included:

- Replace specific water supply pipeline segments to create a "resilient water-supply grid" that better resists earthquakes. (At least two West Coast water utilities are designing a resilient grid.) The project team estimated this measure would save up to $8 per $1 spent, depending on local seismic hazard.
- Strengthen electric substation equipment to better resist earthquake loads and to create a "resilient electric grid." (At least three West Coast electric utilities have been developing a resilient electric grid.) The project team estimated this measure would save up to $8 per $1 spent, depending on local seismic hazard.
- Strengthen highway bridges to better resist earthquake loads. The project team estimated this measure would produce a benefit of $3 per $1 spent.
- Perform prescribed burns in the watershed of water utilities to reduce wildfire and inhibit soil-carrying runoff that can cause turbidity in reservoirs. The project team found that this measure is unlikely to be cost effective, and that water utilities have less-expensive options available to address turbidity resulting from runoff after wildfires.

In addition to the specific projects examined, the study provides new analysis methods that can be readily applied to other projects to support consistent means for determining BCRs.

HAZARD	PROJECT DESCRIPTION	BCR
Flood (from actual EDA grants)	Elevate rail, Iowa	2:1
	Elevate rail, Missouri	2:1
	Elevate road, Nebraska	7:1
	Elevate road and reconstruct bridge, Iowa	11:1
	Reconstruct bridge, New Mexico	0.2:1
	Elevate water treatment plant equipment, Virginia	10:1
	Relocate water treatment plant, Iowa	1:1
	Relocate wastewater treatment plant, Iowa	4:1
	Protect water and wastewater treatment plants, North Carolina	31:1
	Mitigate electric and telecommunications substation, Wisconsin	9:1
Wind (from actual EDA grants)	Replace aboveground power lines, Vermont	6:1
	Improve electric power lines, Texas	6:1
Earthquake (based on project team analysis)	Implement resilient water distribution grid, San Francisco, CA	8:1
	Implement resilient water distribution grid, Los Angeles, CA	6:1
	Implement resilient water distribution grid, Portland, OR	0.6:1
	Implement resilient water distribution grid, Seattle, WA	2:1
	Retrofit electric substations, San Francisco, CA	8:1
	Retrofit electric substations, Los Angeles, CA	8:1
	Retrofit electric substations, Portland, OR	6:1
	Retrofit electric substations, Seattle, WA	2:1
	Improve columns and footings of highway bridges, California	3:1

Table 1. *BCRs for select infrastructure mitigation measures (based on actual EDA grants and project team analysis for potential resilience initiatives).*