



Making Mitigation Work: A Webinar Series

Natural Hazards Center and FEMA Webinar Series “Making Mitigation Work”
Written Questions and Answers after the Sept 10, 2019 Webinar
Ethical and Efficient Infrastructure Resilience; The Battle for Better Building Codes

Keith Porter, University of Colorado Boulder, September 11, 2019

Question from Anonymous: Will a copy of presentation slides be available?

Speaker response: okay by me.

Question from Balakrishnan Balachandran: Does the estimation of benefit cost ratio consider the changing profile of risk in many places due to climate change?

Speaker response: We only considered sea level rise, not changes in riverine flooding or changes in fire conditions.

Question from Gregory Knoop: Would that be similar in cases of terrorist events? The design issues are similar.

Speaker response: don't know to what “that” refers. We did not consider terrorist events. Benefit-cost analysis for terrorism would require either a model of frequency and severity or conditioning on a particular event. The former seems hard to construct with any validity. The latter would change the analysis from a benefit-cost analysis (in the sense meant here) to something else.

Question from Anonymous: I think we all agree, but how do we get our elected community leaders to actually adopt better codes and regulations? Is there a good guide of talking points to get them to realize this? We can lead them to the waters of resilience, but we can't make them drink it!

Speaker response: A hard problem. However, having BCA information accessible, well disseminated, and in some sense broadly agreed upon, helps them to make better informed mitigation decisions.

Question from April O'Leary: Mr. Porter engineers keep telling me that they cannot engineer for 500- 1,000 year flood event. We only design to the 25-year flood event. What would you recommend Flooded families ask for that's reasonable?

Speaker response: If you mean new design, the engineers' statement is probably false. The I-Codes adopt ASCE 24 by reference, which requires most new buildings to have 1 foot of freeboard above the 100-year flood elevation. If you mean retrofit of an existing, flooded building to raise it above whatever it was designed for, whether the 25-year flood or something else, that can be costly—\$50,000 or more for an ordinary-sized house—but not so much that it isn't done; it can actually be cost-effective in some circumstances. If it is important, you could ask for a short written statement citing evidence that “we only design to the 25-year flood event.” I suspect you will find that the engineers begin to demur, hedge, and add vague conditions that allow them to limit their statement to fairly unusual conditions. I have heard similar baseless assertions and cost exaggerations from

structural engineers when it comes to greater earthquake resistance, hence my defense in depth of the 1% figure during the talk. The false claims often come in the form of a false dichotomy: we cannot make new buildings resist all earthquakes, so let's just do the minimum possible, as if there were nothing in between. Watch for such a false dichotomy in your future conversations with engineers.

Question from Michael Edwards: As a Southern California resident and Emergency Management professional who has heard Dr. Lucy Jones speak many times in person, has Keith considered partnering with her speaking on this topic?

Speaker response: Dr. Jones and I have worked together on and off for the last 12 years, since the development of the ShakeOut scenario. She hired me (indirectly) to lead the engineering for ShakeOut and I hired her (indirectly) to peer review *Natural Hazard Mitigation Saves*. We frequently speak at the same events, and have been making the case both together and separately that California can afford better buildings.

Question from Chris Johnston: Will the slides be available?

Speaker response: Okay by me.

Question from Megan Plog: Are the construction job data available in the Mitigation Saves study?

Speaker response: Yes. Download the report from www.nibs.org/page/mitigationsaves and search for the word "jobs."

Question from Nicole Nakata: Are mitigation engineers working with urban planners to make sure that resilient buildings are being well utilized and contribute to overall social resilience in a community?

Speaker response: If you mean design of new buildings to exceed life-safety minima, a very small number of new resilient buildings are being designed, but only with that building's resilience in mind, not that of the whole community. I am aware of no joint effort between engineers and urban planners to make new buildings resilient for the sake of an entire community.

Question from Balakrishnan Balachandran: Would the additional cost of retrofitting existing buildings be much higher than the incremental cost in new buildings?

Speaker response: the pound of cure is almost always more expensive than the ounce of prevention, by which I mean it is almost always less expensive to build a new building to be stronger than code requires (or even just to meet code) than to strengthen an existing, weaker one to the same level. Even so, in many cases, retrofit can be cost effective, meaning that the benefits of retrofit can still exceed the cost. Watch for a new edition to *Natural Hazard Mitigation Saves*, to be published in the next few months, that will include private-sector retrofit of existing buildings.

Question from Carolina Gomez: Are there vulnerability assessments? the effect of disasters impact people different, some people would have insurance and be able to rebuild but others cannot afford and may lose all they have. Do you have some numbers to share with us?

Speaker response: I'm not sure what you mean by vulnerability assessments. You may be using a social-science term of art, one that does not mean the same thing to structural engineers or catastrophe risk modelers. We estimated what catastrophe risk modelers call vulnerability functions for a wide variety of buildings, utilities, and transportation infrastructure. It means a quantitative relationship between degree of environmental excitation (such as shaking intensity) and degree of

loss (such as the probability distribution of building repair cost conditioned on a certain level of shaking). I suspect you mean something like a relationship between the distress suffered by a person or group when subjected to a monetary economic loss, and how that distress varies with social, economic, or cultural attributes of the person or group. In which case, regrettably, no, we did no vulnerability assessment in that sense. Benefit-cost analysis, as we did it, fails to account for how \$1 of property repair cost to a poor person causes more misery than \$1 loss to a rich person. That is a shortcoming of benefit-cost analysis: it substitutes money (which we can quantify) for Bentham's pleasure (which we can't) and the US Constitution's general welfare (ditto). It is a shortcoming that I would like to overcome but did not do in this study.

Question from Megan Plog: Do the construction costs include energy installation/resilience improvement costs?

Speaker response: We estimated neither the benefits nor costs of changes in energy requirements. We only considered seismic loads, flooding, fire at the wildland-urban interface, hurricane winds, and to a limited degree, tornado winds. When we estimate the costs and benefits of code development over the last 30 years, we consider only certain narrow code provisions related to these loads, such as greater seismic strength and stiffness, how those provisions affect the material, labor, and equipment costs of new construction, and how the improved building experiences a lower degree of future loss as a consequence. With minor exceptions, we considered the costs and benefits for different perils separately, independently.

Question from Balakrishnan Balachandran: How well does the general public understand the benefit cost ratio of resilience? Are there good studies on it?

Speaker response: An excellent question, but one for which I don't have a scholarly answer. However, I have read most of 250 articles in the public press that mention the *Mitigation Saves* study, and have seen almost no confusion on the reporters' behalf of what "benefit-cost ratio" means on its surface. If the typical reporter understands what BCR means, the public does too, again at least superficially. That's not to say that if you grilled a reporter on how those benefits or costs were calculated, they would be able to describe the underlying process. Few reporters would be able to say anything about the theorem of total probability, how some people will enjoy benefits and others won't, how the benefits may actually accrue in a long-distant disaster, etc.

Question from David Powers: Statement that increased costs harm the economy is not as significant as the cost of the disasters, etc. How do we equate the "certainty" of costs for building better, versus the "slight probability that a disaster will occur?"...and if it does, it will be socialized (federally funded), so our costs are minimized?

Speaker response: Who ultimately bears future losses when they occur is complicated. In *Natural Hazard Mitigation Saves*, we dealt at least on a superficial level with *who* bears the cost, splitting the bearers into five broad groups (tenants, owners, lenders, etc.). We dealt with *when* those costs occur and *how much* using a standard but fancy mathematical loss-estimation technique involving the theorem of total probability. The technique allows one to account for slight probabilities of high losses, moderate probabilities of moderate losses, high probabilities of low losses, etc.

But to your point about "if it [the disaster] does [occur], it will be ... federally funded," that assertion is mostly false. The federal government pays to repair public-sector assets—hospitals, libraries, that sort of thing, not private-sector assets, which account for most of the total monetary catastrophe losses. If your home gets flooded and you don't have flood insurance, the federal government will not make you whole. You will bear most of the loss, with a modest amount of emergency living-expense support from the federal government if you have the wherewithal to get it. You may be able to get an

SBA loan to get back on your feet, but you have to pay that back. If you default on your mortgage, your bank will bear the part of the loss in excess of your equity, plus their cost to dispose of the damaged asset. The government will not make the bank whole either. Similar statements can be made about earthquakes. Most private-sector assets are insured for wind and fire, but their owners *actually* bear those costs through their insurance payments, not the government.

Also, there is nothing “slight” about the possibility that a disaster will occur. The U.S. experiences \$100 billion in disaster losses annually (and that’s just their monetary part), with the number of billion-dollar losses per year rising into double digits. Each of those disasters produces indirect economic losses that reach all of us through higher market costs that we personally bear, in addition to the costs we share through government recovery funding. Disasters *frequently* occur and we *all* bear their costs. We are all in this together. It is hard to make that clear, but we ought to try. Doing so will help make the public and policymakers realize that the losses are as immediate as the costs, eliminating the sense that it’s somebody else’s problem, or that I probably won’t be affected for a long time.

The disconnect that you may be trying to get at is that costs and benefits have very low temporal correlation when the frame of reference is very small—one house, one workplace, etc. The law of small numbers works against the argument for mitigation. I pay to retrofit my house now, but may never enjoy benefits from my expenditure on my house, because I’ll sell it before a hurricane blows it down. But the law of large numbers can eliminate that disconnect if we can apply it: improve *all* new buildings with better codes, and the present costs to each person go down while the annual benefits to each person go up, even when viewed solely through one person’s bank balance.

Question from Elise Gatti: Is the grant program limited to researchers based in American institutions?

Speaker response: I’m unsure to which grant program you refer. If you mean the funding sources that paid for the *Natural Hazard Mitigation Saves*, I can tell you who sponsored the project, but not from what monies or their constraints; NIBS handled that. Little of the federally funded mitigation grant money goes to research—most pays for actual mitigation—and I suspect that the small fraction that pays for applied research to improve mitigation mostly goes to US institutions, though I can’t provide any particulars.

Comments, Suggestions, or Questions? Please contact: katherine.murphy-1@colorado.edu.

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