

Making the Economic Case for Cost-Plus Construction



2017 National Disaster Resilience Conference

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FEMA



Building Science Branch



Outline

- “Mitigation Saves 2.0”
 - An Independent Study on Savings Associated with Public and Private Mitigation
- Nationwide Building Code Loss Avoidance Study
 - Phase 4: National Study
- A few words about Texas, Florida, Puerto Rico, and the Virgin Islands

“Mitigation Saves 2.0”

An Independent Study on Savings Associated with Public and Private Mitigation

Regarding the original *Mitigation Saves* study:

- In 2005, a study by the National Institute of Building Sciences (NIBS) titled “Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities” (“MSv1”) quantified the future savings from FEMA’s natural hazard mitigation grant efforts.
- The study looked at hazard mitigation activities funded through FEMA’s Hazard Mitigation Grant Program, Project Impact program, and the Flood Mitigation Assistance Program.
- The original study demonstrated that on average, for every public dollar spent on mitigation, society saves \$4.



Mitigation Saves 2.0 (MSv2”): The Update

- The new study is funded in part by FEMA, as well as other public and private sector entities with involvement in hazard mitigation activities.
- The scope of MSv2 is more ambitious than the first study, with 8 modules, listed below.
- **Modules**
 - Module 1: Overall methodology and integration
 - Module 2A: Mitigation beyond code requirements
 - Module 2B: Applying later editions of code requirement
 - Module 3: Retrofit
 - Module 4: Business continuity planning and disaster recovery
 - Module 5: Utilities and transportation lifelines
 - Module 6A: Federal agency mitigation grants
 - Module 6B: Federal actions (weather watches, dam and levee safety, etc.)

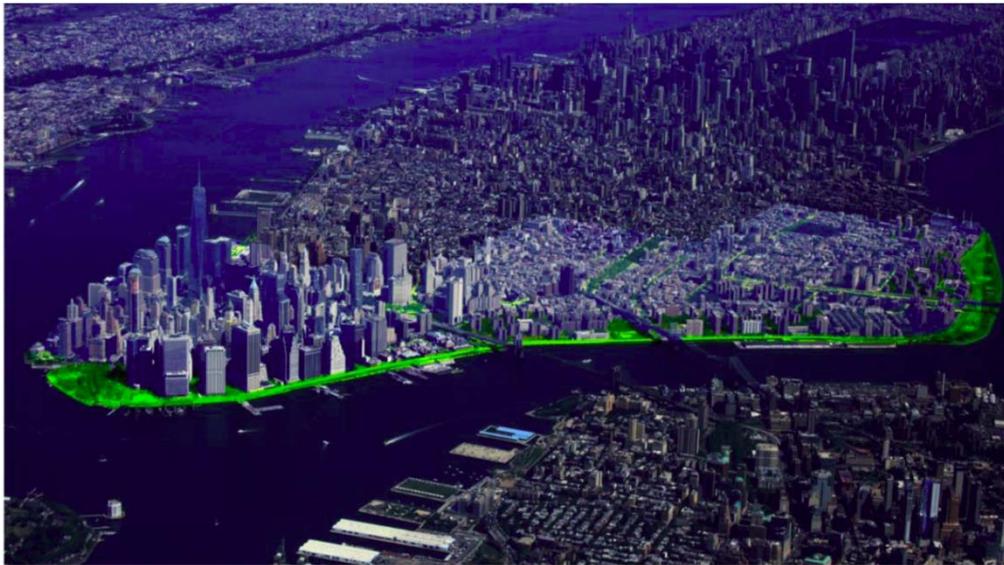
Module 1: Overall Framework and Integration requirements

- Objective: to provide a framework for integrating mitigation strategy modules into an overall statement of the benefits of mitigation efforts
- Module 1 includes the following tasks:
 - Initial Meeting
 - Identify & document common procedures that apply across multiple modules
 - Perform the cost-benefit analysis using input from other modules
 - Develop the Report and disseminate to project sponsors and archival journals

Module 2A: Enhanced flood, wind, seismic and wildfire-urban interface design requirements

- Objective: quantify the benefits & costs of above code design (in new construction)
- Stakeholders include lenders, insurers, Small Business Administration, local, state and federal government (FEMA is investing in Module 2A)
- This module involves calculating risk under current code requirements and under assumed enhancements to those code requirements. NIBS will then estimate the potential aggregate benefits and costs from widespread adoption of above-code design requirements.

Module 6A: Cost-Benefit Analysis of Public-Sector Mitigation Grants and Loans



- Objective: benefits & costs of public sector mitigation grants & loans
- Stakeholders: Agencies with particular interest would include those whose programs are being addressed including DHS, FEMA, HUD, SBA, DOT, USACE, Commerce and Interior.
 - Image: Lower Manhattan Project and Connect Project (US Department of Housing and Urban Development 2016)



Current Status of the Mitigation Saves 2.0 Study

- FEMA- funded portion of Study began in October of 2016 (Modules 1, 2A and 6A)
- Analyses are complete and results and conclusions have been gathered and formulated
- Report has gone through a 70% draft review by Stakeholders and Oversight Committee
- 95% draft review comments are currently being incorporated into report
- FEMA-funded portion of report to be delivered Fall of 2017
- Partnership support efforts are ongoing to complete the remaining study modules



Value of the Study

- Identifying mitigation opportunities that provide the best value
- Creation of a common methodology for quantifying future losses in both the public and private sectors.
- Will show value of mitigation to current administration
- Inform decision-makers at all level and drive the public conversation on mitigation

Nationwide Hazus Building Code Loss Avoidance Study

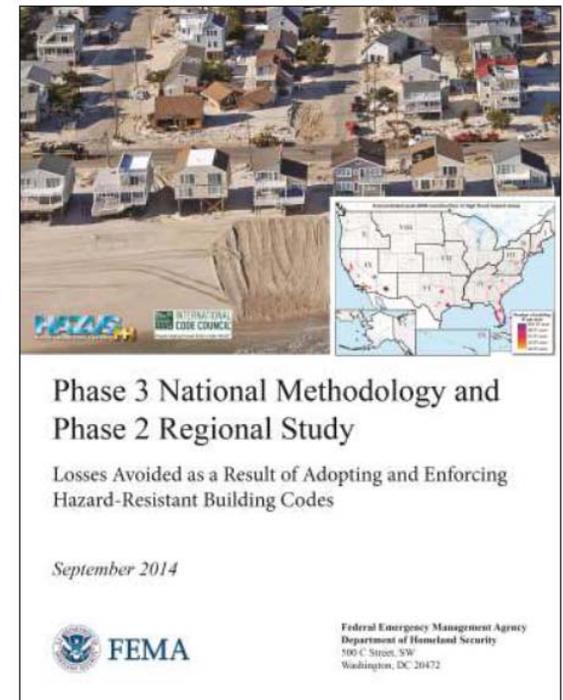
Phase 4: National Study

Nationwide Hazus LAS in progress

- 6 step process, 18 month schedule
- Challenges by hazard (flood, wind, seismic)
 - Data gaps
 - Damage function modifications
- Meta data management

Results Analytics

- Losses vs losses avoided vs AAL
- Data enhancements - dynamic economics, recovery analytics
- C/B A, scenarios, sensitivity analysis, code adoption priorities
- Other decision tools





Hazus Building Code LAS to date

- **Background:** Purpose of Hazus Losses Avoided Study (LAS): Quantify economic impact of modern building code adoption in losses avoided.
- **Concept:** Model losses avoided at the parcel level where modern hazard-resistant building codes are adopted in areas of high wind, flood, seismic hazard
- **Phase 1 Pilot Study 2011:** Charleston County, SC, and Salt Lake County, UT
- **Phase 2 Regional Study 2012:** FEMA Region IV, used as demonstration study area
- **Phase 3 National Methodology 2013:** Develop National methodology including lessons learned from Phase 1 & 2
- **Phase 4 National Study 2017:** Underway



Phase 2 Regional Study Results

Results Summary

	AL	FL	GA	KY	MS	NC	SC	TN	Total ¹
■ Seismic Losses Avoided (x \$1,000,000)				0.03			0.85	0.06	0.94 ²
■ Hurricane Losses Avoided (x \$1,000,000)	2.90	376.30	0.96		3.60	5.60	12.80		402.16 ³
■ Flood Losses Avoided (x \$1,000,000)	0.83	87.63	10.10	0.42	1.30	7.30	10.08	0.94	118.60

Phase 2 results

	Building		Contents		Building + Contents	
	Pre-I-Code	Pre-I-Code	Pre-I-Code	Pre-I-Code	Pre-I-Code	Pre-I-Code
Florida Losses (\$k)	888,463	404,796	295,235	65,055	1,183,698	469,851
Losses Avoided (\$k)		483,667		230,180		713,847
Losses Avoided (\$k)		-54%		-78%		-60%

Note: For Simplicity. Modeling assumes all post-2000 Florida construction was built to current codes

Calibration example: Hurricane Charley Phase 2 study



Nationwide Hazus Building Code LAS

Proposed Methodology

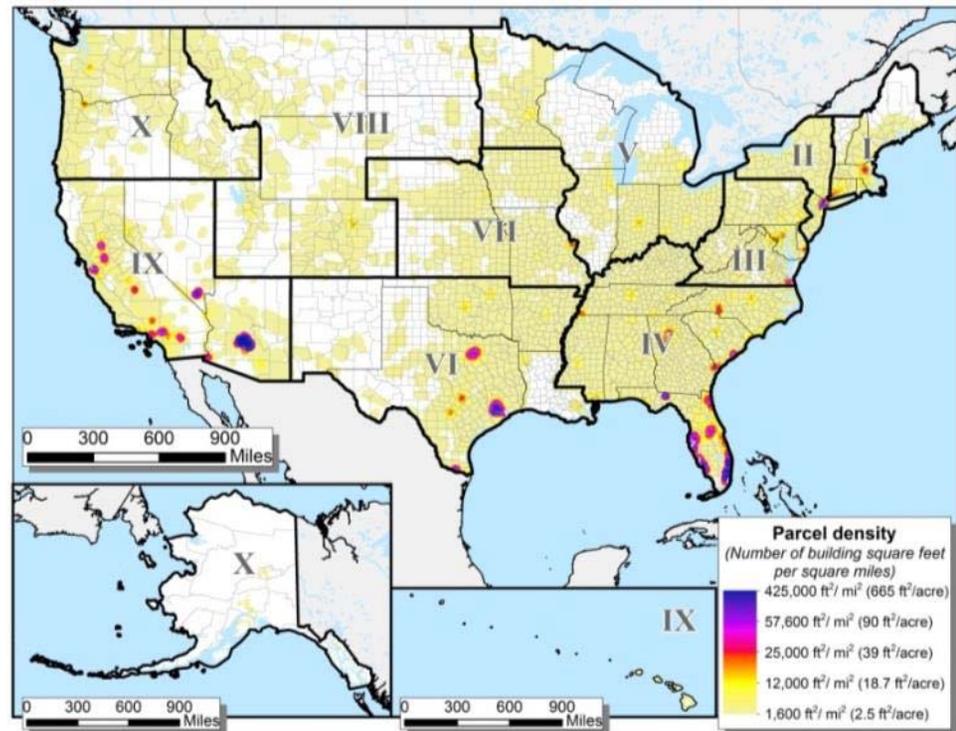
- Step 1. Perform data collection and screening (CoreLogic & ISO)
- Step 2. Input data into Hazus (v4.1)
- Step 3. Adapt damage curves (flood, wind, seismic)
- Step 4. Compute and analyze losses avoided
- Step 5. Evaluate findings
- Step 6. Perform QA

Schedule ~6mos per step pairs.
E/W Teams sweep to Miss River

Study Focus

- Areas of growth and exposure
- Buildings constructed after I-Code adoption

Post 2000 growth
Ref. CoreLogic data





LAS Modeling Challenges

- Flood
 - Determining FFE & freeboard
 - Confirming regulatory vs non-reg maps & BFE for construction
 - Confirming regulatory boundaries (in vs out)
 - Calibrating new coastal and riverine D-Firm's in Hazus
- Wind
 - Determining wind building characteristics (WBC)s,
 - Determining wind map adoption history (prob vs determ; WBDR)
 - Damage function mods to code & wind map versions (transitional)
- Seismic: (6 western states, use Hazus AEBM)
 - Determining code adoption history & design level maps
 - Assign/create model building type (interviews)
 - Damage function mods (design category A-E & post 2008 new fragilities- fundamental research). Automate AAL(8 return periods)



Benefits

What are the benefits of performing a nationwide parcel level study?

- Incentivizes priority code adoption and mitigation opportunities
- Identifies key loss drivers of community hazard profiles and buildings
- Quantifies substantial return on investment of building codes
- Encourages innovation on code enhancements and parcel data
- Provides clear national perspective comparing growth patterns, hazard exposures and loss drivers



Measuring economic impacts

- Results Analytics: Quantification of risk and impacts
 - Losses vs losses avoided vs AAL
 - C/B A
 - Decision tools – code adoption, scenarios, critical facilities
 - Data enhancements, benchmarking (exist Hazus use)
- Hindcasting: DRR, enforcement effects
- Forecasting / resilience and capital planning
- Investment / Private sector partnerships
- Monitoring & Evaluation- periodic updates

Benefit-Cost Analysis

Robert T. Stafford Disaster Relief and Emergency Act

The Stafford Act authorizes the President to establish a program to provide technical and financial assistance to state and local governments to assist in the implementation of hazard mitigation measures that are **cost effective** and designed to substantially reduce injuries, loss of life, hardship, or the risk of future damage and destruction of property.

- The BCA program consists of guidelines, methodologies and software modules for a range of major natural hazards including:
 - Flood (Riverine, Coastal Zone A, Coastal Zone V)
 - (551, Job Aid No. 1.3: Elevation)
 - Hurricane Wind (P-804)
 - Hurricane Safe Room (P-320, P-361)
 - Damage-Frequency Assessment
 - Tornado Safe Room (P-320, P-361)
 - Earthquake
 - Wildfire
 - Drought

Hurricane Irma Florida Pre-Mitigation Assessment Team (MAT) JFO Out-Brief



An Overview of the Pre-MAT Observations and Next Steps
September 29, 2017



FEMA

Building Science Branch



MAT Program Background

Mitigation Assessment Team (MAT)

- Observes building performance under severe hazard events
- Determines causes of building damage, failure and success
- Evaluates performance of mitigation projects
- Provides design and construction strategic recommendations for reducing damage and protecting lives in hazard areas
- Draws on combined resources of federal, state, local, academia, and private sectors
- Supports building science/building code elements of NDRF





Building Science Support to Disasters/Recovery

- Building performance assessment
 - Perform a problem-focused study on a given issue of importance for mitigating damages or minimizing injuries and fatalities via building science
- Develop disaster specific technical guidance
- A/E support for Building Science curriculum - training
- A/E services for Building Science support of FEMA programs
- Building codes and standards support, including the new FEMA's Building code Directive



Purpose of the Pre-MAT

- Following certain events, the Building Science Branch funds the deployment of a Pre-MAT to
 - evaluate building performance and recommend whether a MAT should be deployed
 - what potential topics should be studied
 - what the composition of the team should be
 - how many sub-teams might be needed
 - where to go, where there is no need to go
 - general situational awareness, any impediments to avoid
 - damage or sites of interest
- Based on the Pre-MAT findings, a full MAT can be deployed and develop a full report. In some cases, a small-scale focused study can be recommended with a team deployed to study an issue(s).



Next Steps

- Topics of concern -
 - Dry floodproofing effectiveness
 - Performance of impact resistant glazing
 - HMA/PA HM Projects (possibly with My Safe Florida, FORTIFIED, etc.)
 - Building envelope performance
 - Shutter installation and performance
 - Performance of manufactured homes
 - Shelter performance/operations, Emergency power at Critical Facilities
 - Continue to analyze / assess info to evaluate what best supports recovery



Next Steps

- Products - Recovery Advisory/Fact Sheet/Problem Focused Study Report



Questions?

