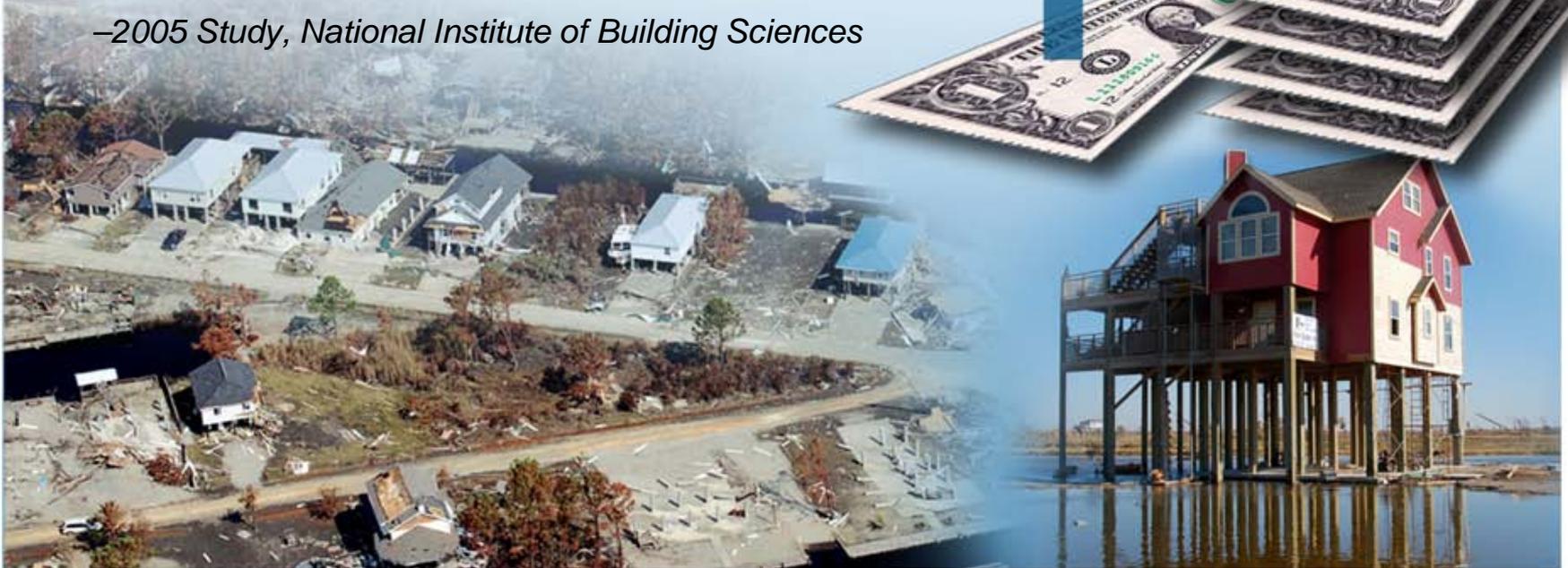




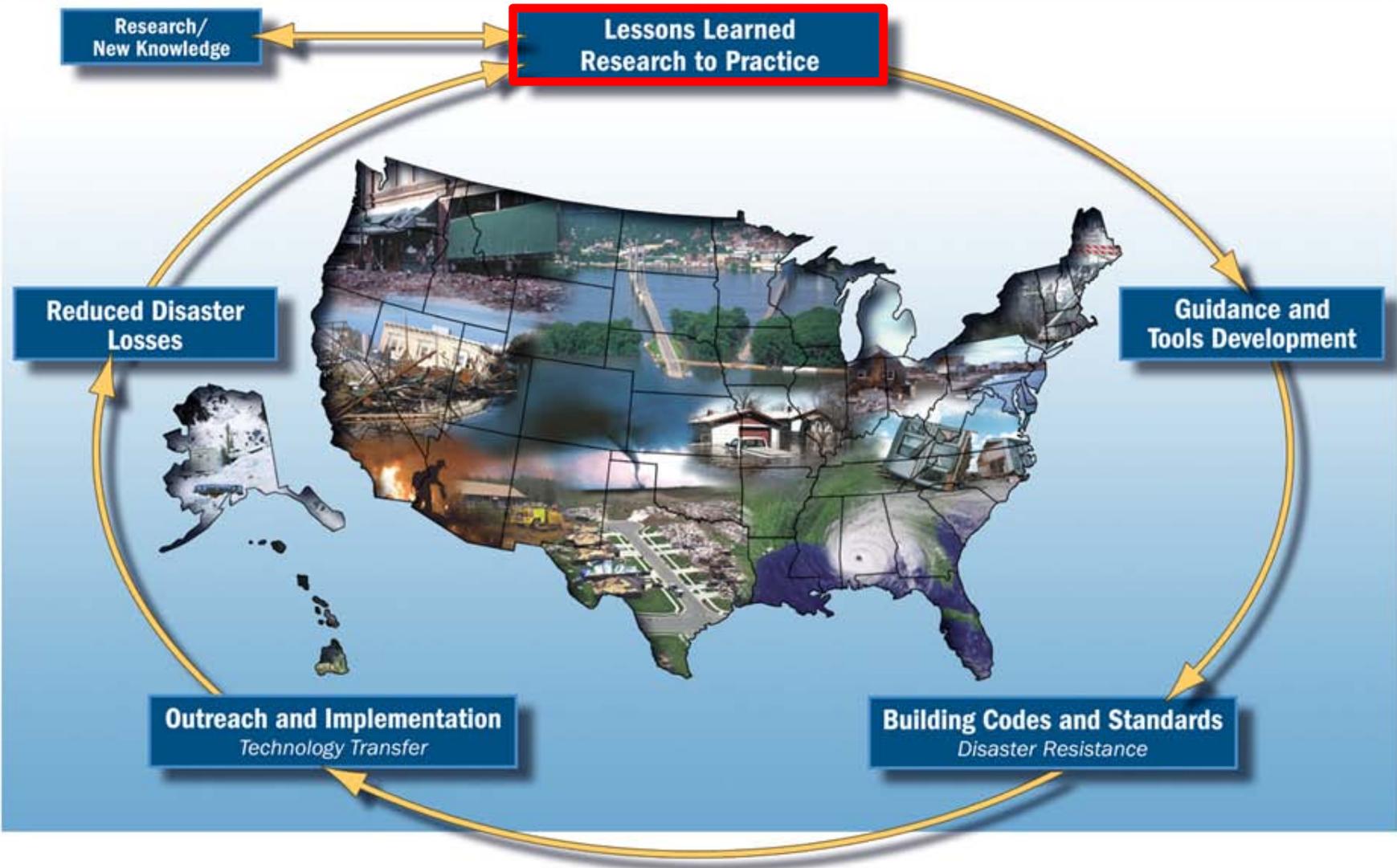
# Why is Building Science Important?

***For every dollar spent on hazard mitigation, approximately four dollars are saved in reduced losses.***

*—2005 Study, National Institute of Building Sciences*



# Building Science Mission



# Mitigation Assessment Teams (MAT)



Assess causes of structural failure and success

Provide recommendations to reduce future damages

# CNN House stands, ±200 destroyed



# Wind Damage in Houston

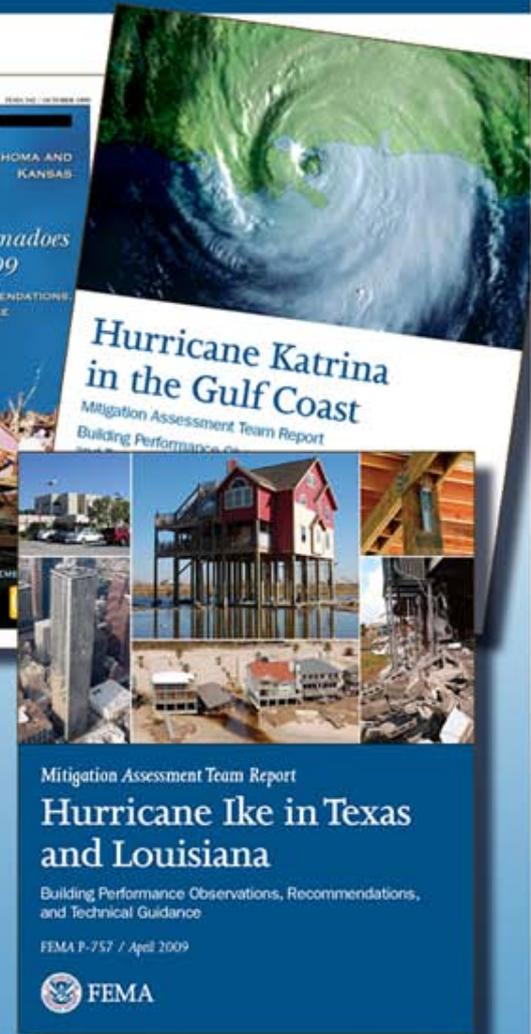
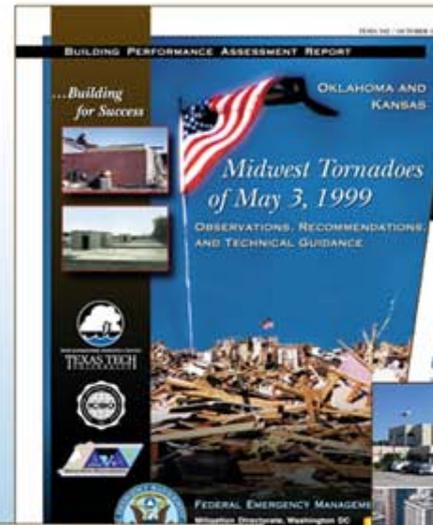
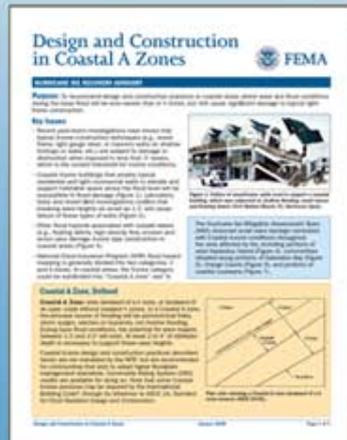


# Flooding in Cedar Rapids, Iowa

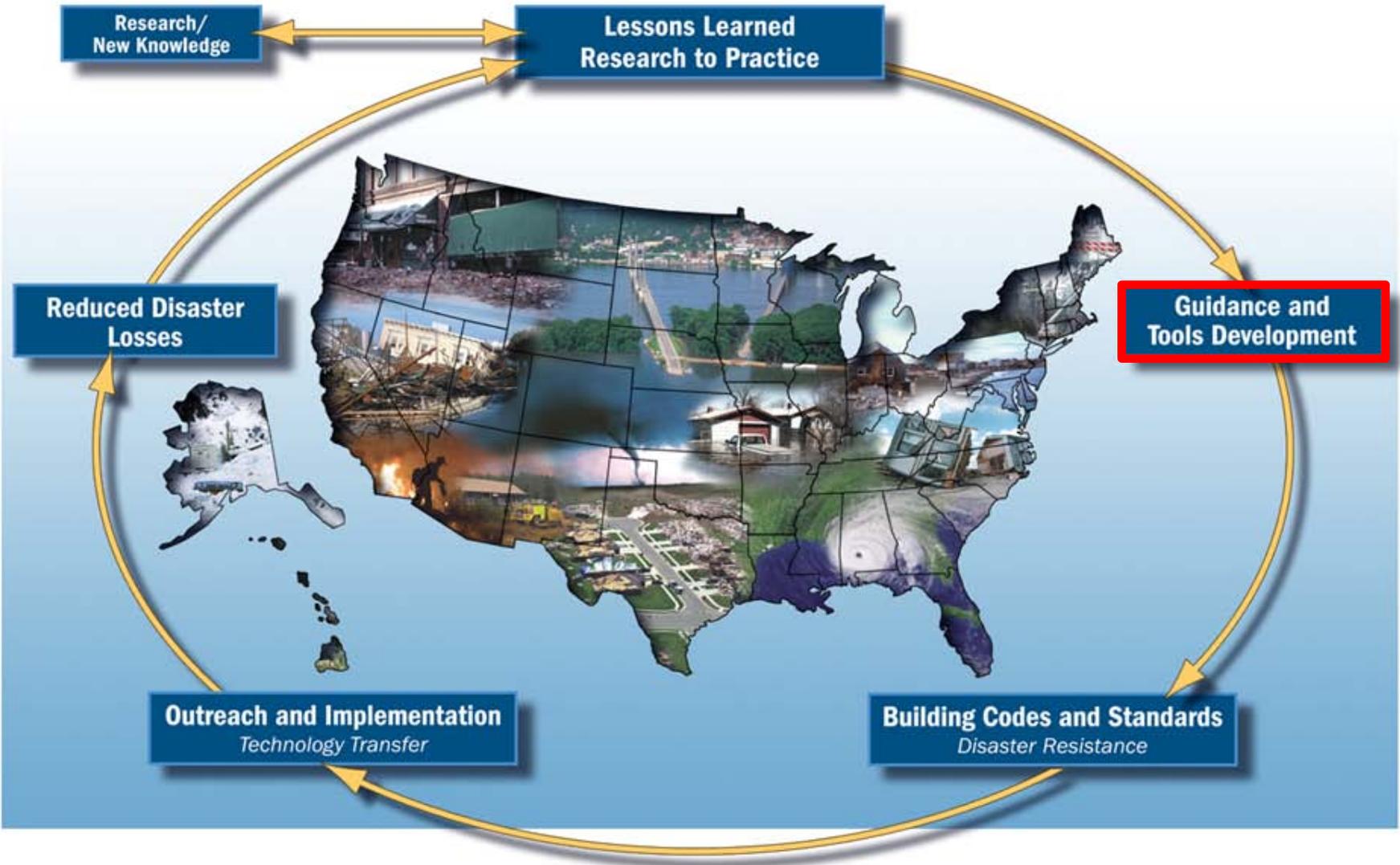


# MAT Reports and Recovery Advisories

By studying disasters, we can take action to prevent future damages

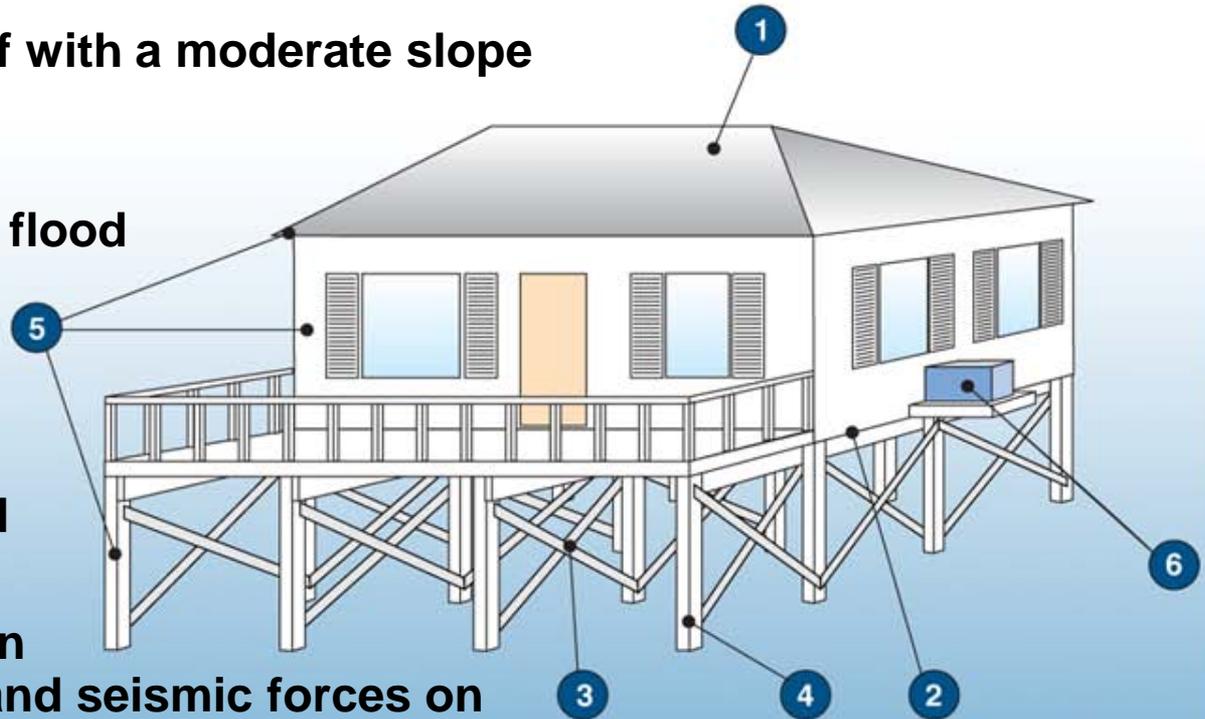


# Building Science Mission



# Proven Building Tips

1. Choose a hip roof with a moderate slope (4/12 to 6/12)
2. Add “freeboard” above the design flood elevation (DFE)
3. Keep area below DFE unobstructed and open
4. Embed foundation to transfer wind and seismic forces on upper stories to the ground, and resist scour and debris forces
5. Be sure key connections including roof sheathing, roof-to-wall, wall-to-wall, and walls-to-foundation are to code
6. Elevate and position HVAC equipment to avoid flood and wind



# Resources

## for Property Owners & Building Professionals

### **Coastal Construction Manual:**

Principles and Practices of Planning, Siting, Designing, Constructing, and Maintaining Residential Buildings in Coastal Areas, (FEMA 55, Edition 3)

### **Recommended Residential Construction for the Gulf Coast:**

Building on Safe and Strong Foundations, (FEMA 550)

### **Taking Shelter From the Storm:**

Building a Safe Room for Your Home or Small Business, (FEMA 320)

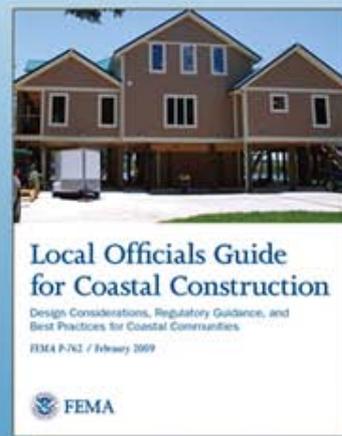
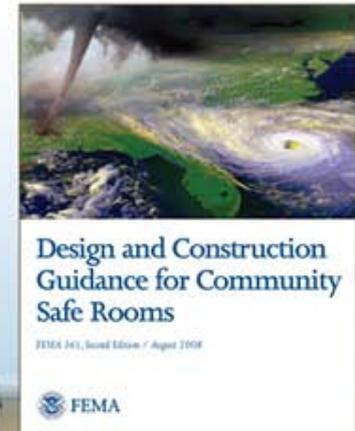


# Resources

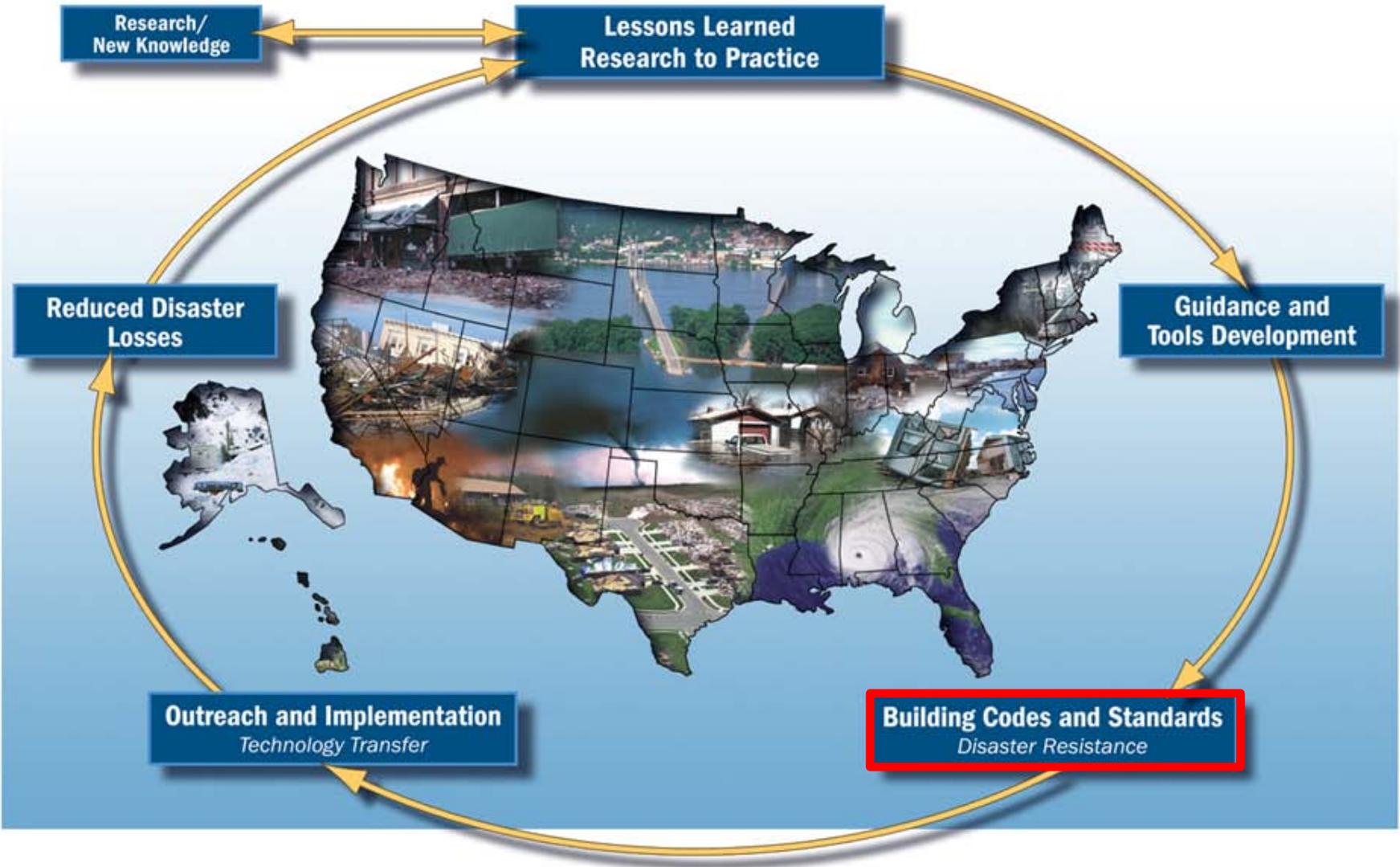
## for Community Officials

**Design Guidance for Community Safe Rooms:**  
(FEMA 361, Edition 2)

**Local Officials Guide for Coastal Construction:**  
Design Considerations, Regulatory Guidance,  
and Best Practices for Coastal Construction,  
(FEMA P-762)



# Building Science Mission



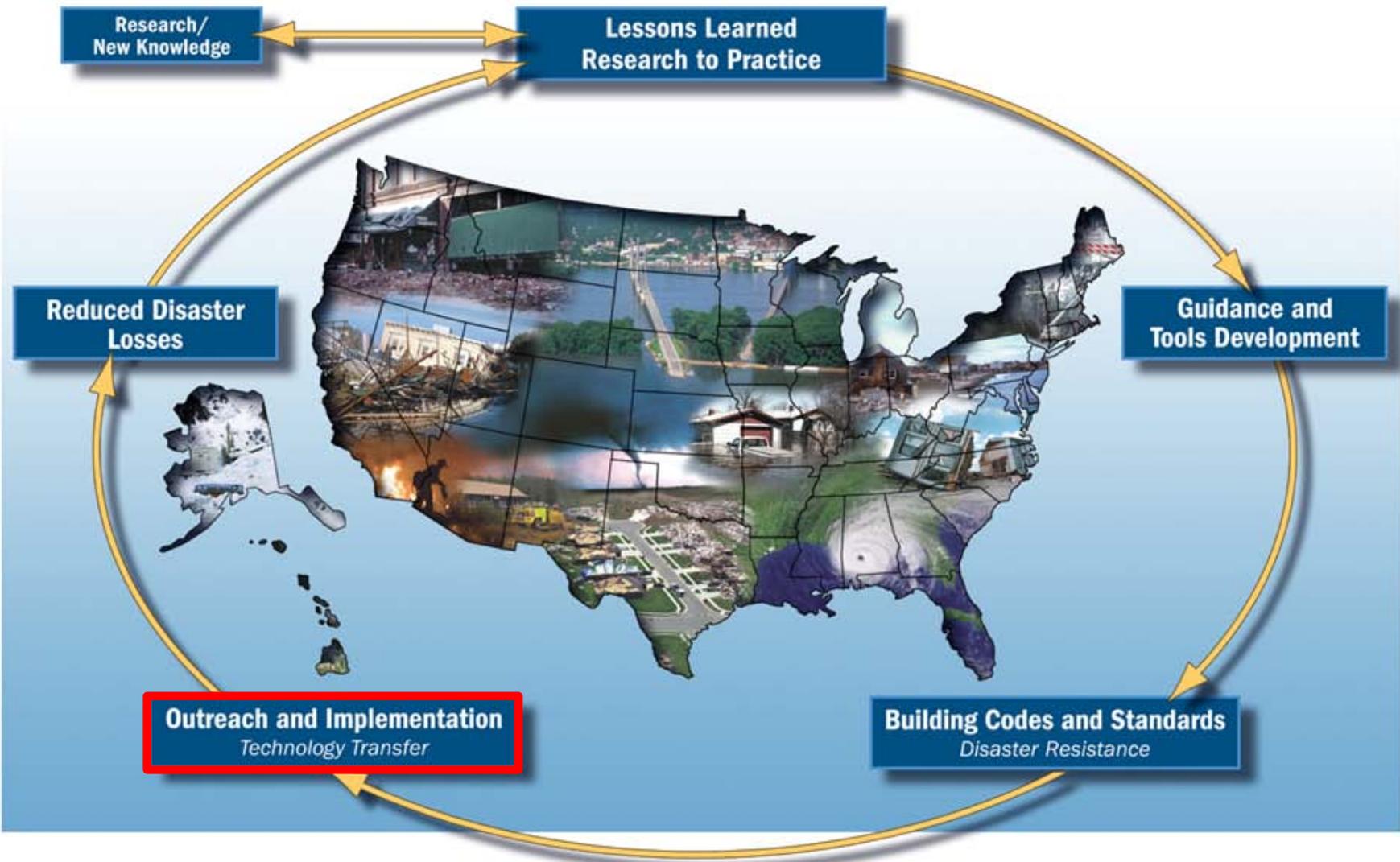
# Research to Practice

Previous MAT Findings	Improved Building Code: Standard or Practice
Homes built to minimum flood elevation remain vulnerable	Homes incorporated with freeboard per the International Code and ASCE 24
Aggregate (gravel) on flat commercial roofs	Wind-resistant membrane roofs
Single pane windows in wood frame	Double insulated pane, impact-resistant glass and shutters
Homes and critical facilities are vulnerable to tornado events	FEMA safe room guides 320 & 361 and the new International Code Council 500 shelter standard

# Hazard Risk Resistance is Built In



# Building Science Mission



# Outreach and Implementation

Conference Presentations & Booth Displays

Demonstration Projects

Training Courses

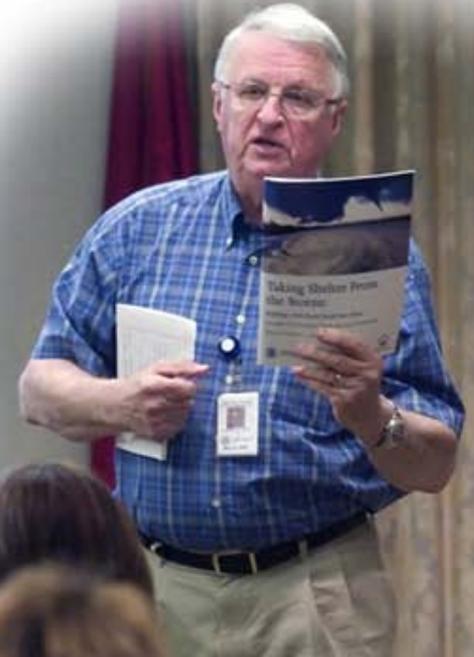
Committee Meetings

Website & eMail Updates

Trade Magazine & Journal Articles

Support to Partner Outreach

*Bring us your innovative outreach ideas!*



# Building Science Help is Available

## **Website:**

<http://www.fema.gov/rebuild/buildingscience/>

**Library:** <http://www.fema.gov/library/> or  
(800) 480-2520 to order printed copies

**Safe Room:** (866) 222-3580 or  
[saferoom@dhs.gov](mailto:saferoom@dhs.gov)

**Flood/Wind:** 866-927-2104 or  
[FEMA-Buildingsciencehelp@dhs.gov](mailto:FEMA-Buildingsciencehelp@dhs.gov)

# BUILDING SCIENCE FOR DISASTER-RESILIENT COMMUNITIES

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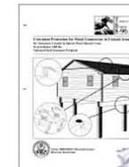
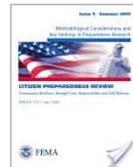
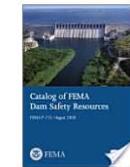
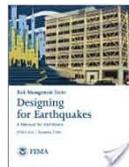
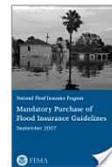
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shown in Figure 3-24. This does not appear to be an engineered connection.

Some designs rely on connections between columns and beams to provide fixity (resistance to rotation), particularly in commercial or multi-family buildings of concrete construction. Figure 3-25 shows one such example—reinforcing steel that will extend into a concrete beam (under construction) and connect columns and beams. The cast-in-place concrete connection will provide resistance to rotation.



Figure 3-26. Reinforcing steel extending from the top of a concrete column (building under construction) (Galveston Island, TX)

The MAT noted instances of other types of foundation load path failures, including those at the point where a column attached to a pile, cap slab, or grade beam. Deterioration of timber piles contributed to load path failures in some foundations (Figure 3-27). The deterioration could have been the result of inadequate preservative treatment or poor design/construction practice. In other cases, deterioration was observed that did not result in foundation failure during Ike; however, such a weakened foundation would be more susceptible to failure in the future (Figure 3-28).

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### 3 PERFORMANCE OF RESIDENTIAL BUILDINGS (FLOOD AND WIND), ONE- TO TWO-FAMILY AND MULTI-FAMILY

Figure 3-27. Deterioration in the wood piling likely contributed to the foundation failure (Bolivar Peninsula, TX).



Figure 3-28. Deterioration in wood piling. The foundation did not fail during Ike, but it is weakened and will ha



# Collaborating with Other Organizations



# Research/New Knowledge

Disaster-Resistant  
product testing

Trade group  
recommendations

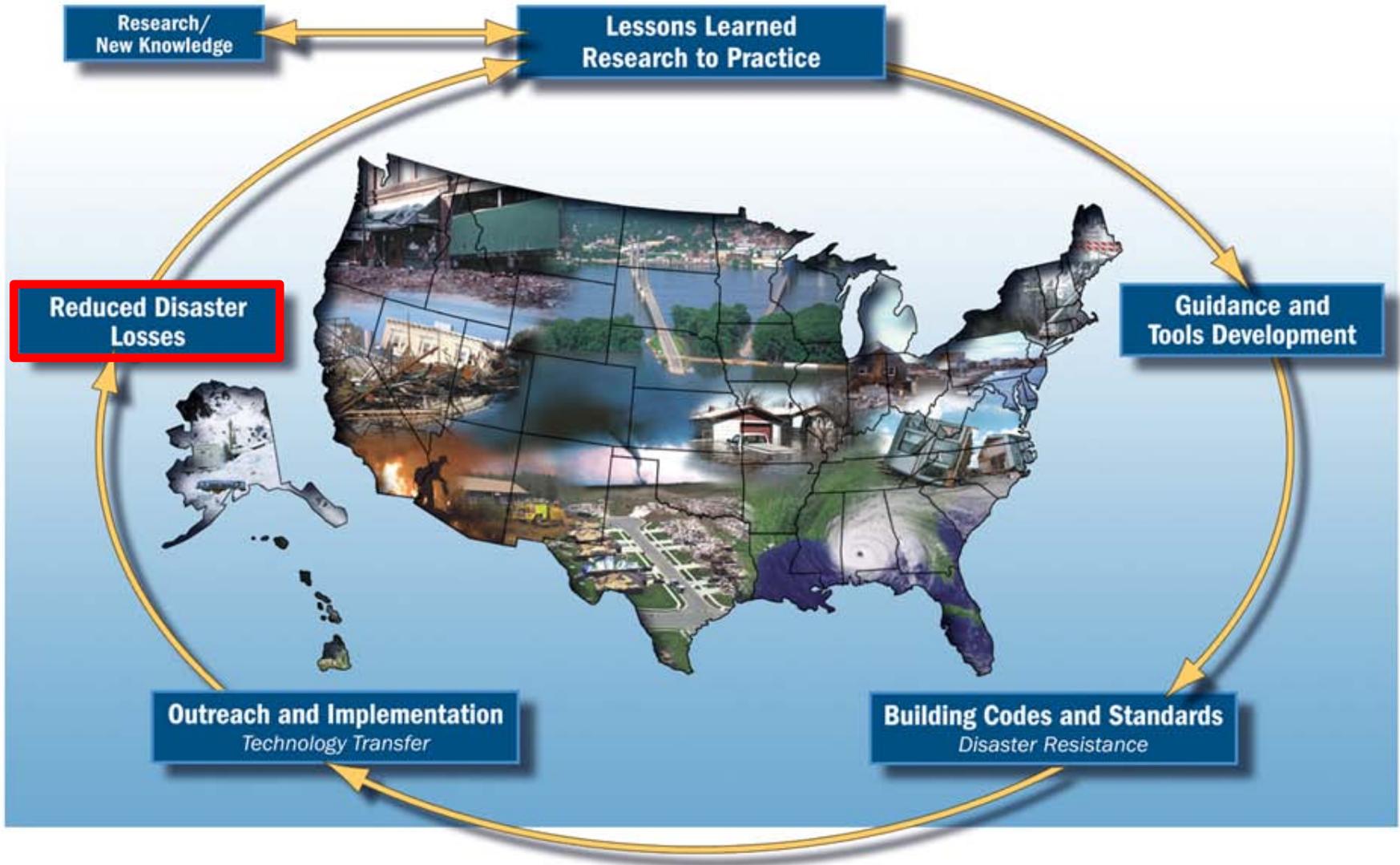
University studies



## BUILDING SCIENCE FOR DISASTER-RESILIENT COMMUNITIES



# Building Science Mission



# Two Homes in Hurricane Ivan





FEMA

<http://www.fema.gov/rebuild/buildingscience/>

[FEMA-Buildingsciencehelp@dhs.gov](mailto:FEMA-Buildingsciencehelp@dhs.gov)

[Jack.Anderson@dhs.gov](mailto:Jack.Anderson@dhs.gov)