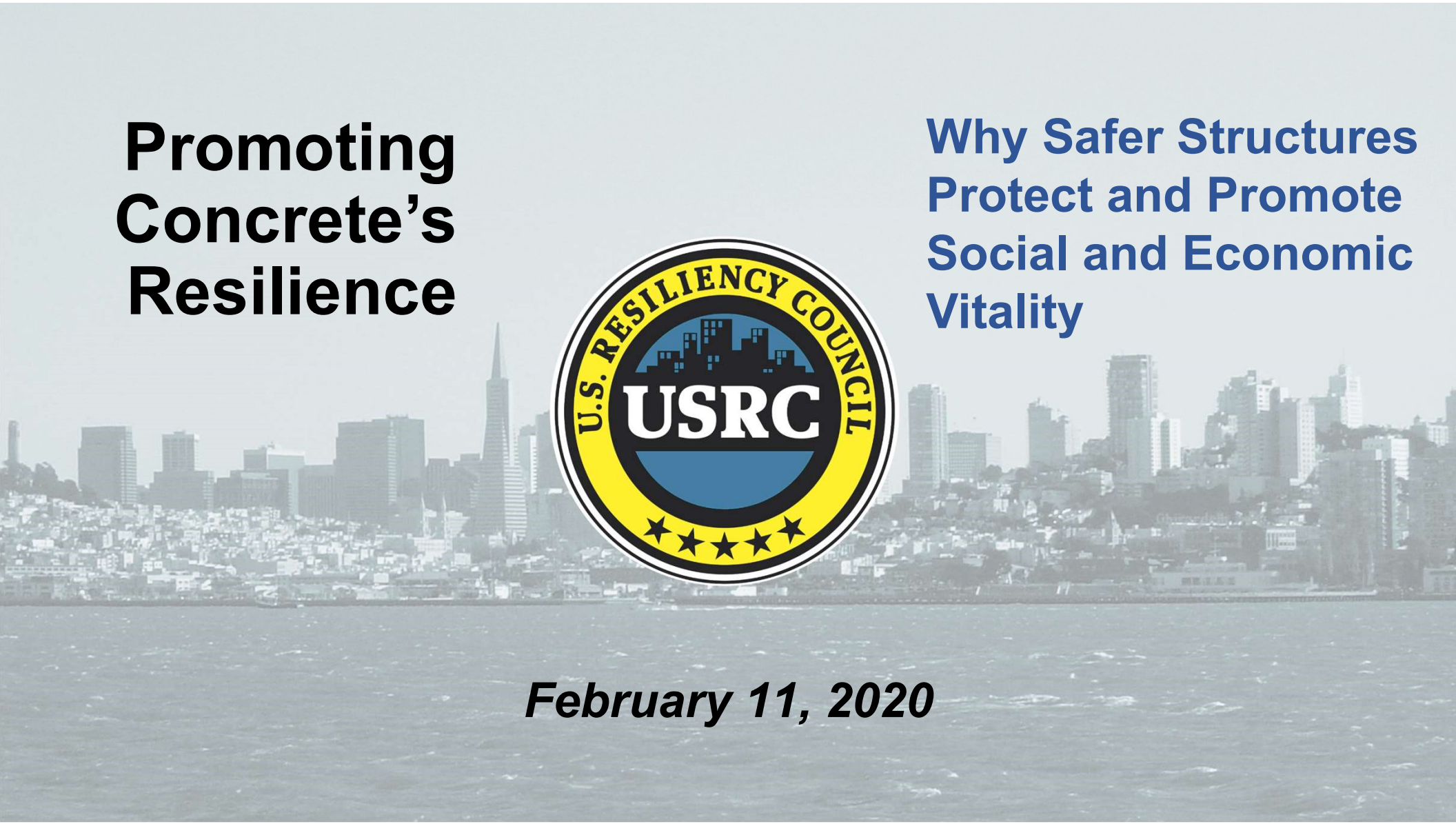
Promoting Concrete's Resilience

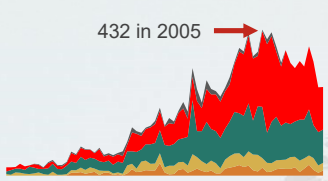
Why Safer Structures Protect and Promote Social and Economic Vitality



February 11, 2020

Natural disasters are a growing problem worldwide

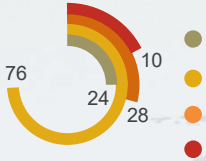
Every year they kill hundreds of thousands, leave tens of millions homeless, impact billions and cause hundreds of billions in loss…



Wildfire
Flood
Extreme weather
Earthquake
Drought

Number of disasters by year

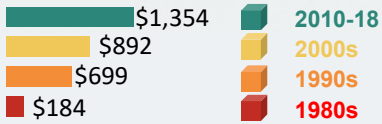
Worldwide by hazard 1950-2018*



1980s
1990s
2000s
2010-2018

Homelessness caused by disasters

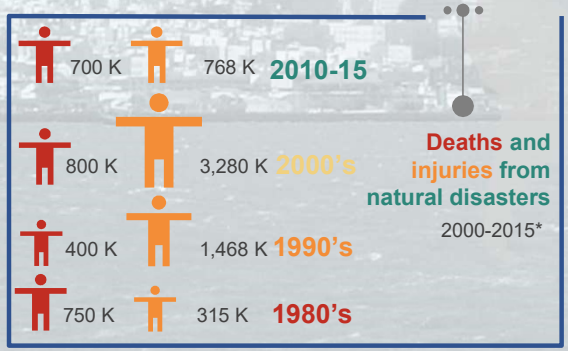
In millions worldwide*



Losses by decade

Worldwide, In billions of dollars US*

01 02 03 04 05 06



Deaths and injuries from natural disasters

2000-2015*

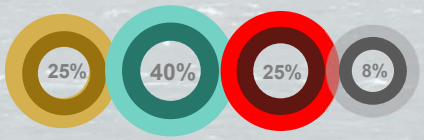
Population exposed to extreme hazards

In millions 1975 vs 2015**

Earthquake
Flood
Storm

Losses by disaster type

1950-2017*

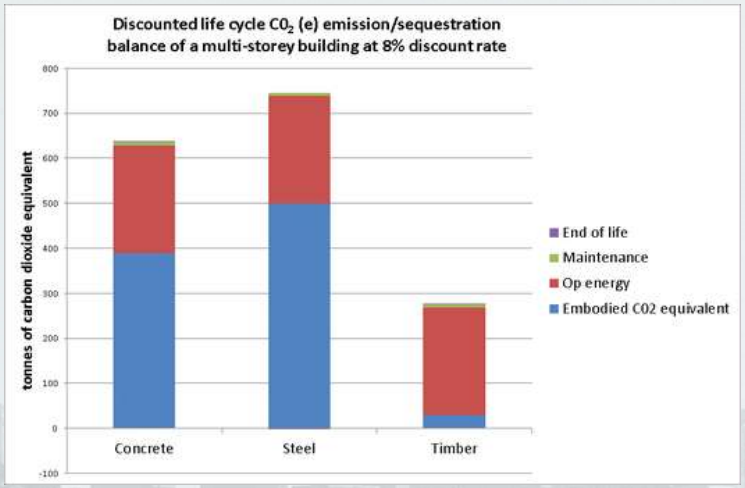


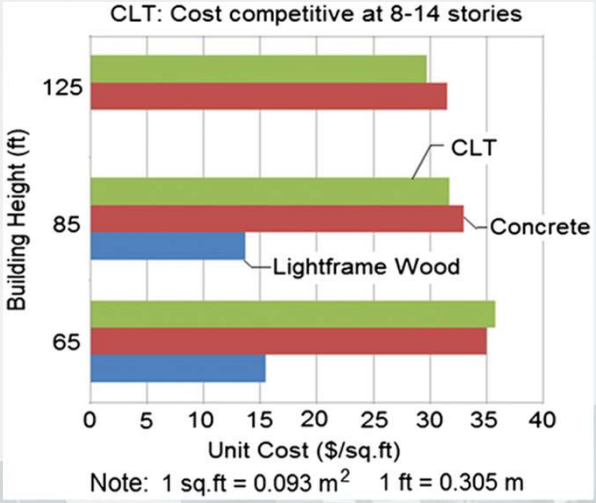
Earthquake
Storm
Flood
Temperature

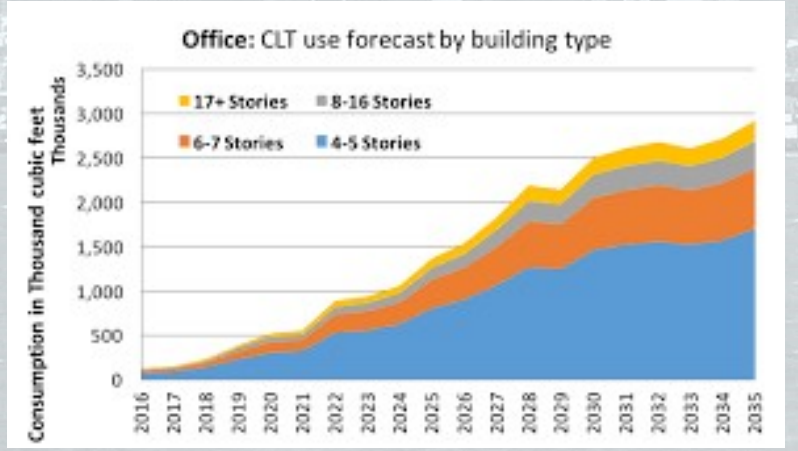
…and the trends are only getting worse

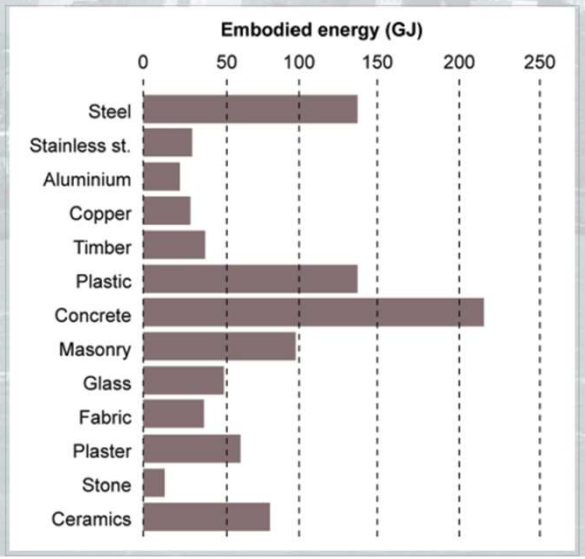
* Source Our World Data
** Source EU JRC Science for Policy Report

Sustainability has largely been defined in terms of CARBON







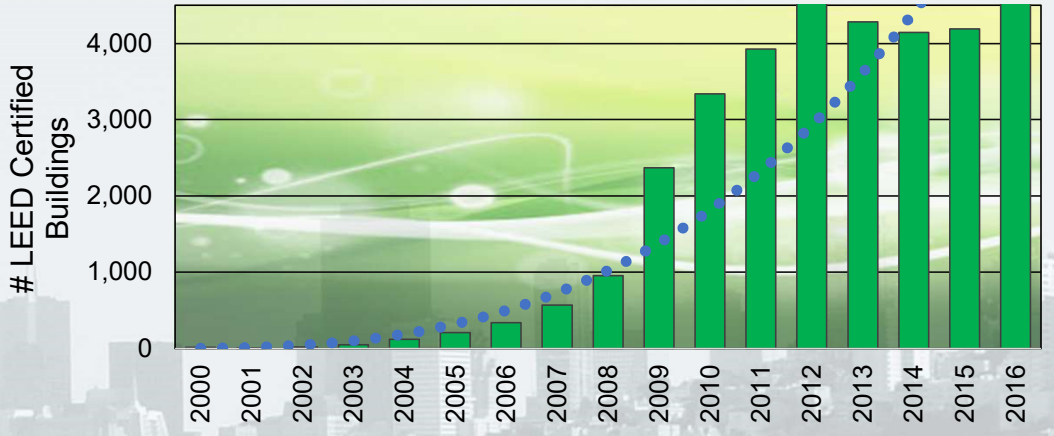


Green design Is not delivering on the sustainability promise

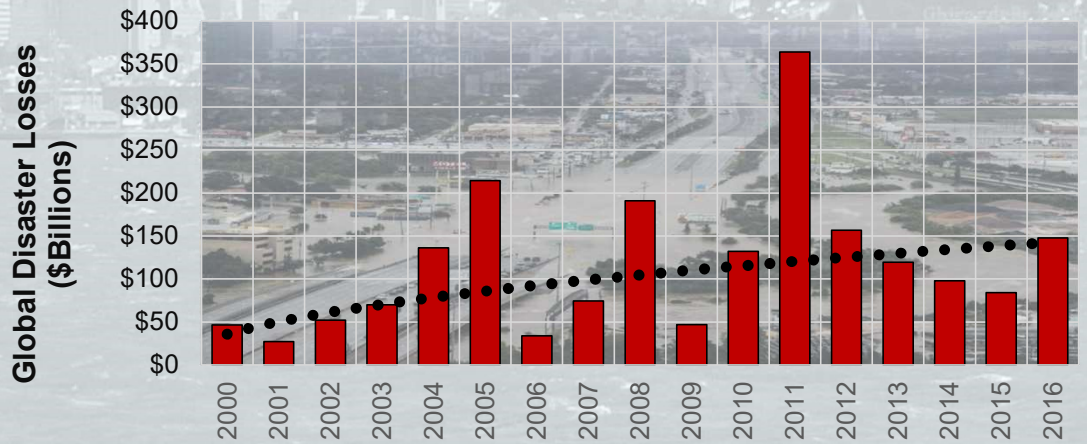
“Disaster Resilience is a National Imperative”

- National Academies of Sciences, Engineering, Medicine

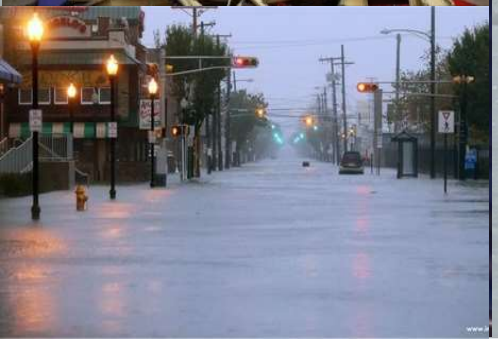
Green buildings continue to be the focus of most “sustainable design”



But disasters still typically cost more than $100 billion per year and claim tens of thousands of lives



Resilience Is Different than "Green Design"

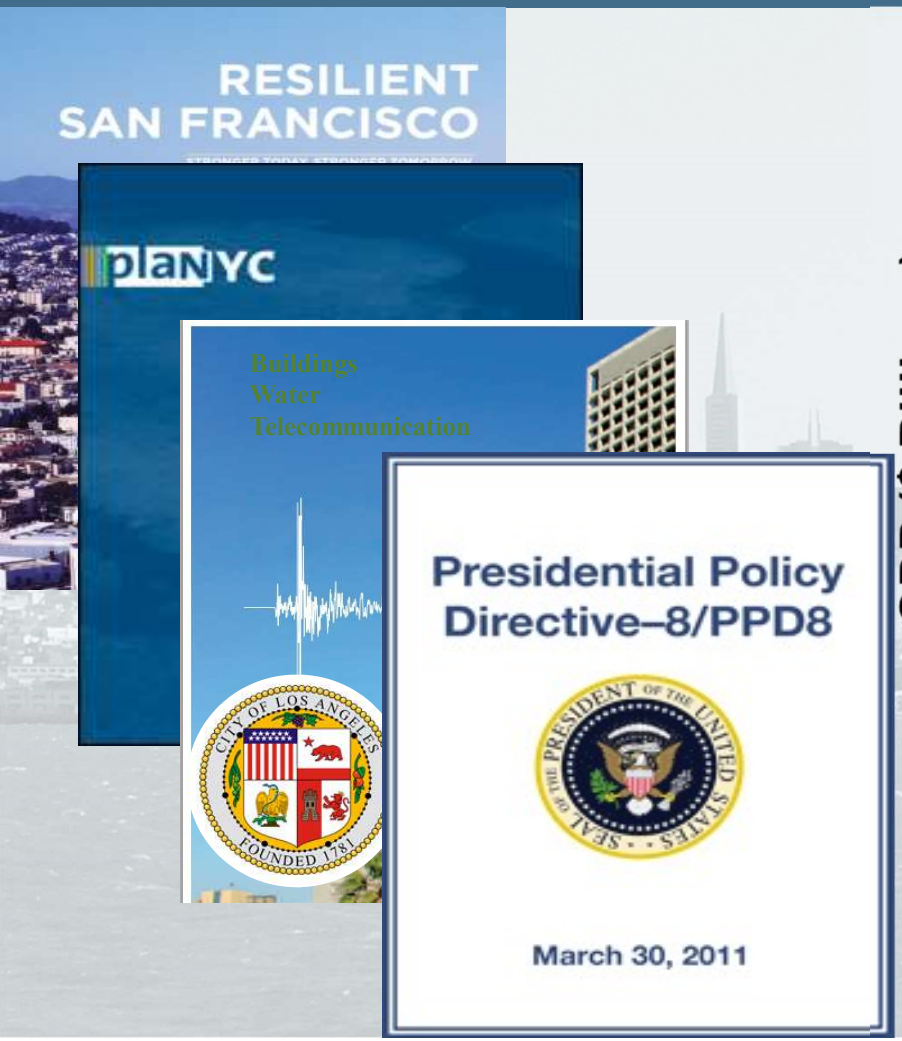


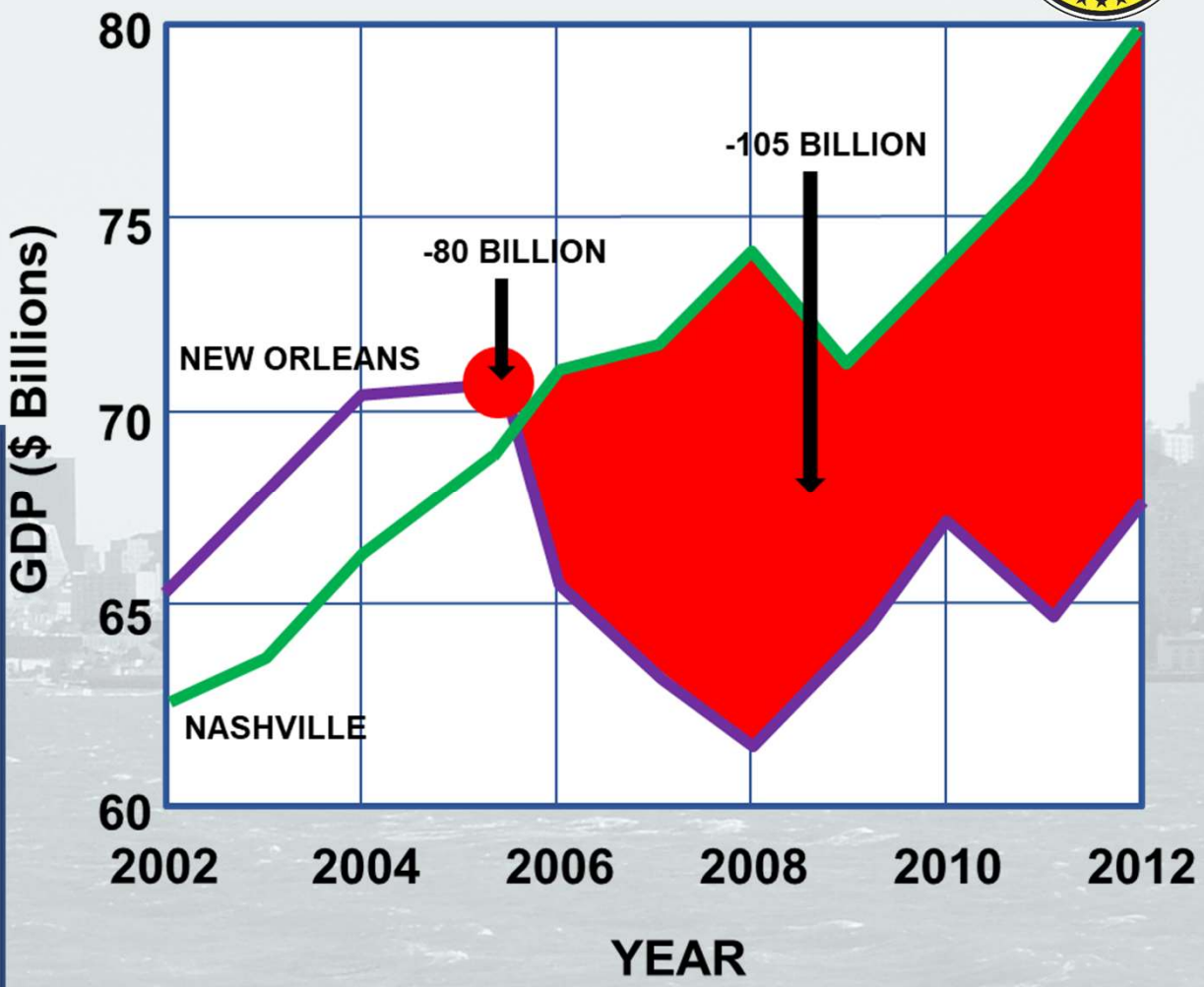
LEED certified buildings in Superstorm Sandy were designed to have a low impact on the environment…

…but not for the environment to have a low impact on them.

Superstorm Sandy	
Deaths	>200 in 7 countries
Buildings damaged or destroyed	380,000 in NY, NY, CT
Estimated cost	$71 billion in NY & NJ.
Insured losses	$16 billion to $22 billion.
Estimated business losses	$25 billion
Homes without power	8.5 million
Debris generated	> 10 million cubic yards

Trends Toward Resilience





Consequences of Miscommunication

Christchurch Earthquake, NZ – 2010 & 2011

"Design Level and Max. Credible Events"

Only 2 buildings collapsed

50% of buildings in downtown had to be demolished

Were expectations met? Depends on who you ask!

Micro Level Impacts of Disasters

1

Unemployment
Homelessness
Family Disruption

2

Loss of Home Equity
Bankruptcy
Neighborhood Blight

3

Death/Injury
Looting / Crime
Social Chaos

Buildings As Part of A Resilient Community

Benefits of Mitigation and Enhanced Design

National Institute of BUILDING SCIENCES

Natural Hazard Mitigation Saves:
2018 Interim Report

Federal grants can save the nation, on average, $6 in future disaster costs, for every $1 spent on hazard mitigation.

Investments in hazard mitigation measures that exceed 2015 model building codes can save the nation, on average, $4 for every $1 spent.

National Benefit-Cost Ratio Per Peril *BCR numbers in this study have been rounded	Federally Funded	Beyond Code Requirements
Overall Hazard Benefit-Cost Ratio	6:1	4:1
Riverine Flood	7:1	5:1
Hurricane Surge	Too few grants	7:1
Wind	5:1	5:1
Earthquake	3:1	4:1
Wildland-Urban Interface Fire	3:1	4:1

Every Day Rating/Ranking Systems

BEST HIGH SCHOOLS

U.S. NEWS & WORLD REPORT
U.S.News
RANKINGS

2014
Forbes
TRAVEL GUIDE

Newly Rated
One of the Finest
Four Star Properties in the World

GOVERNMENT SAFETY RATINGS

Frontal Crash	Driver	★★★★★
	Passenger	★★★★★

Star ratings based on the risk of injury in a frontal impact.
Frontal ratings should ONLY be compared to other vehicles of similar size and weight.

Side Crash	Front seat	★★★★★⚠
	Rear seat	Not Rated

Star ratings based on the risk of injury in a side impact.
⚠ Safety concern: Visit www.safercar.gov or call 1-888-327-4236 for more details.

Rollover ★★★★★

Star ratings based on the risk of rollover in a single vehicle crash.

Star ratings range from 1 to 5 stars (★★★★★) with 5 being the highest.

Source: National Highway Traffic Safety Administration (NHTSA).

www.safercar.gov or 1-888-327-4236

The US Resiliency Council

VISION -

A world in which people have the information they need about how buildings will perform in natural disasters

MISSION –

Educate, advocate, and organize to promote better tools for assessing and communicating building performance

Implement rating systems that describe the performance of buildings during natural disasters

ROLES AND RESPONSIBILITIES -

Educate the public to increase market demand for better performing buildings.

Develop consensus among diverse stakeholders and technical experts.

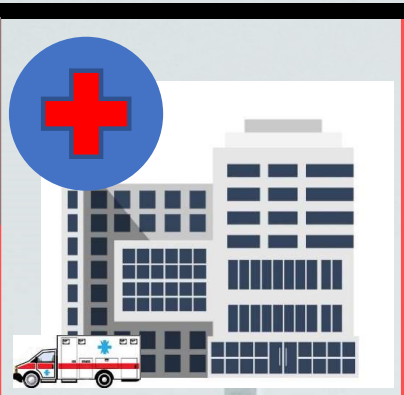
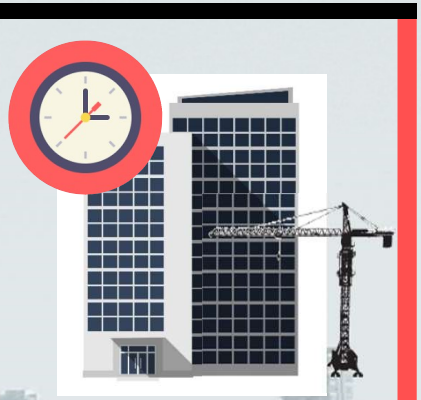
Promote integrity, stability, consistency and transparency of rating systems.

US Resiliency Council - Members

92 including:

- Engineering companies
- Architects
- Professional organizations
- Industry suppliers
- Builders
- Software firms

US Resiliency Council

USRC BUILDING RATING SYSTEM	 SAFETY	 DAMAGE	 RECOVERY
★★★★★	Blocking exit paths unlikely	Minimal Damage (<5%)	Immediate to Days
★★★★	Serious injuries unlikely	Moderate Damage (<10%)	Within days to weeks
★★★	Loss of life unlikely	Significant Damage (<20%)	Within weeks to months
★★	Isolated loss of life	Substantial Damage (<40%)	Within months to a year
★	Loss of life likely	Severe Damage (40%+)	More than a year

CODE BASED DESIGN

RESILIENCE BASED DESIGN

+0-3% Cost

Modern Codes

Sample of buildings with USRC earthquake ratings

60 to date, including

- ❑ Low income housing
- ❑ Boutique hotels
- ❑ Mixed use retail
- ❑ National retailers
- ❑ Civic buildings
- ❑ High rise residential
- ❑ Religious buildings
- ❑ New buildings
- ❑ Seismic retrofits
- ❑ Office buildings

Case Study: 4-Story Mixed-Use Civic Building

CODE BASED DESIGN ACHIEVED HIGHEST USRC RATING

Safety ★★★★★

- Conditions unlikely to cause injuries or to keep people from exiting the building.

Damage ★★★★★

- The mean repair cost is less than 5% of building replacement cost.

Recovery ★★★★★

- The median recovery time to regain basic function is less than one week.

INCREASING COMMUNITY RESILIENCE

Case Study: 9-Story Affordable Housing

ADDITIONAL RESILIENCE COST: 0.24%

Safety ★★★★

- Conditions unlikely to cause injuries

Damage ★★★★

- The mean repair cost is less than 10% of building replacement cost.

Recovery ★★★★

- The median recovery time to regain basic function is less than one month.

MAKING VULNERABLE POPULATIONS RESILIENT

Case Study: CA State Office Building

USRC RATING WAS AN ENHANCEMENT IN RFP THAT IMPROVED BIDDERS' SCORE

Safety ★★★★★
- Conditions unlikely to cause injuries or to keep people from exiting the building.

Damage ★★★★★
- The mean repair cost is less than 5% of building replacement cost.

Recovery ★★★★★
- The median recovery time to regain basic function is less than one week.

BUILDERS WINNING MORE PROJECTS

Case Study: 5-Story Office Building

STIFFER BUILDING REDUCED REQUIRED GAP BETWEEN ADJACENT BUILDINGS, INCREASING RENTABLE SPACE THAT PAID FOR THE COST OF ADDITIONAL STEEL

Safety ★★★★
- Conditions unlikely to cause injuries

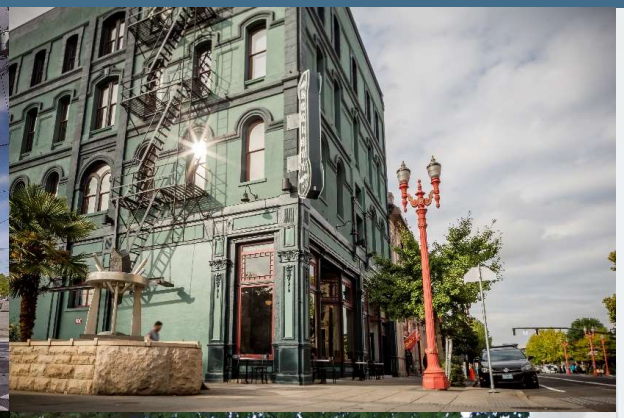
Damage ★★★★
- The mean repair cost is less than 10% of building replacement cost.

Recovery ★★★★
- The median recovery time to regain basic function is less than one month.

U.S. RESILIENCY COUNCIL
EARTHQUAKE 2016
Safety ★★★★★
Damage ★★★★
Recovery ★★★★
GOLD

INCREASING RENTAL REVENUE

Case Study: Seismic Retrofit – Portland, OR



RETROFITTING BRICK BUILIDNGS REMOVES PUBLIC STIGMA

Safety ★★★
- Conditions unlikely to cause death.

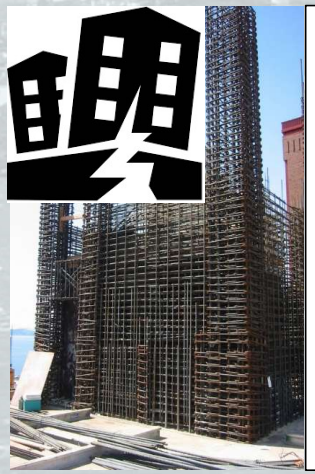
Damage ★★★
- The mean repair cost is less than 20% of building replacement cost.

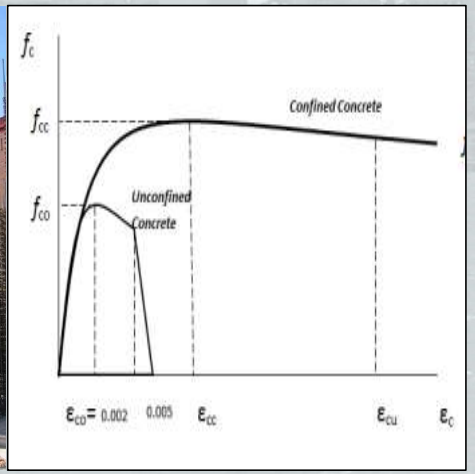
Recovery ★★★
- The median recovery time to regain basic function is less than six months.

U.S. RESILIENCY COUNCIL
EARTHQUAKE
2019
SILVER

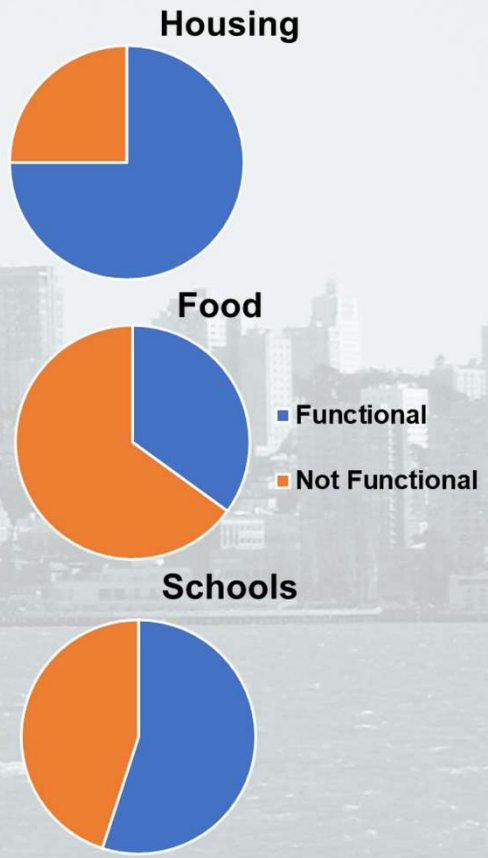
PRESERVING HISTORY AND LIVES

Concrete's unique multi-hazard resilience





Community Design Guidelines



The Role of Incentives in Resilient Design

Many stakeholders benefit from more resilient buildings

- **Cities:** benefit from communities that can recover more quickly. **Expedited permitting**
- **Counties:** more resilient buildings preserve the critical tax base after a disaster. **Tax breaks**
- **State and Federal Government:** save on emergency housing assistance following a natural disaster and post disaster public assistance costs. **Mitigation grants**
- **Lenders:** better performing buildings reduce risk of borrower default. **Mortgage discounts**
- **Insurers:** reduced building damage results in lower claims liability. **Insurance discounts**

Reduced insurance rates

More resilient buildings = Less insurance risk, lower loan default rates

U.S. Resiliency Council
Resilient Underwriting

FM Global

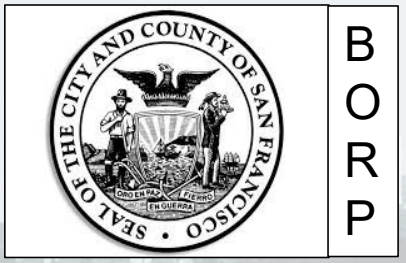
RMS

U.S. Resiliency Council
Resilience Advantage Mortgage

FannieMae

Expedited permitting

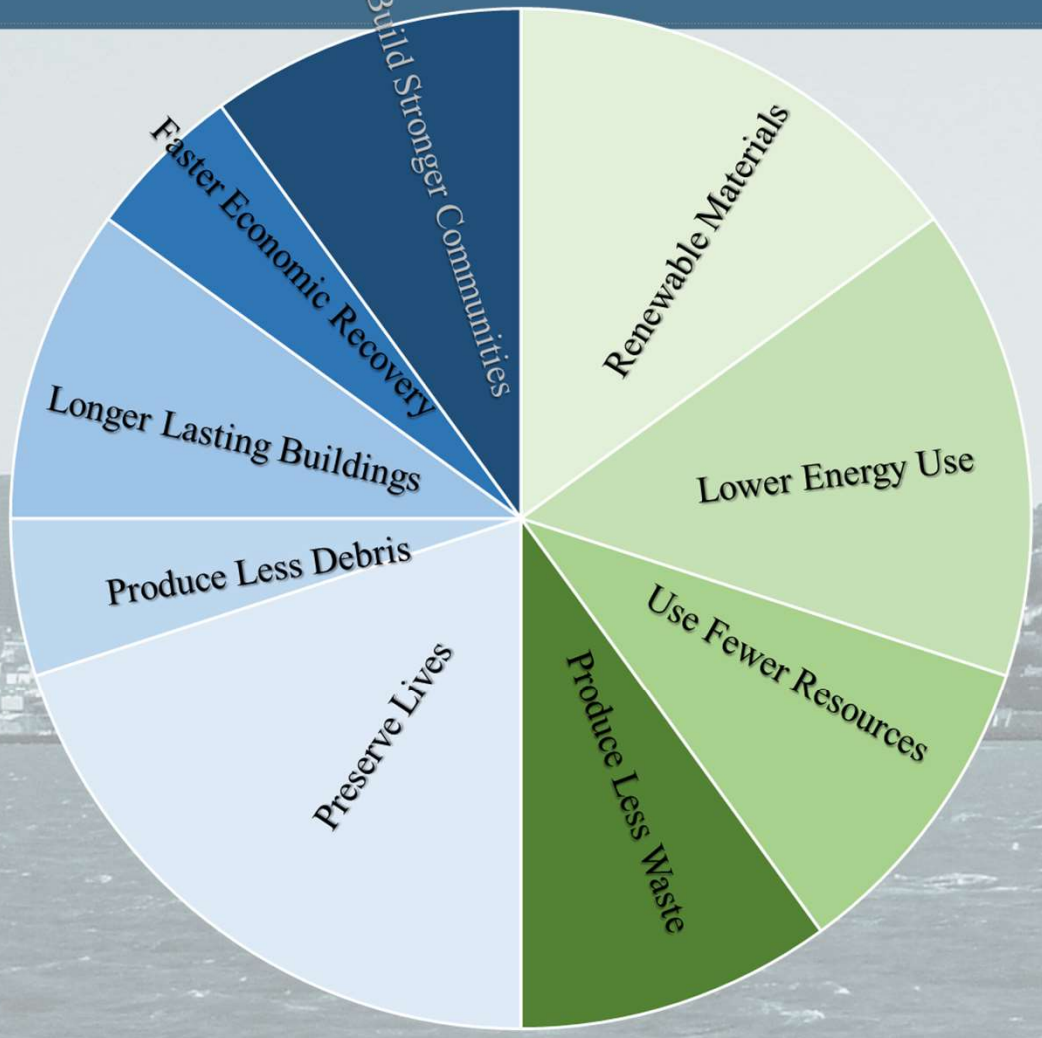
More resilient buildings = More resilient cities



Property tax waivers

More resilient buildings = Property tax security, less disaster aid

“Green” and Resilient Design are Two Sides of Sustainability



Firing with both barrels – a strategy for resilience

- *Understand the place that buildings have in community, corporate and family resilience*
- *Quantify the social and economic returns of resilient design to all stakeholder groups*
- *Expand LCA to consider the reduction in Nat Cat impacts from resilient design*
- *Calculate expected building costs to achieve higher performance levels*

USRC collaborations

- *MIT Concrete Sustainability Hub - Planning More Resilient Cities*
- *Alliance For National and Community Resilience – Resilience Benchmarks*
- *USRC Members include: PCA, PCI, NRMCA, Cal Portland, CNCA, NCC/PNBRC, BASF, Clark Pacific, CMACN*
- *USRC - Concrete Industry Partners Committee*
- *Applied Technology Council Building Wildfire Rating System*
- *Pilot project with Fannie Mae on resilient mortgages for multi-family construction*

How do you get involved?

- *Explain to your clients the difference between green and resilient design – social and economic benefits*
- *Talk about how USRC ratings can quantify DAMAGE and RECOVERY TIME – protect your investment and your business*
- *Discuss incentives that are being developed for USRC rated buildings – see immediate ROI*
- *Offer USRC ratings for projects you build – concrete contractors gain marketing PR*

Thank You!

For more information on
The USRC, Ratings and Membership

www.usrc.org

www.usrc.org/membership