



PRESENTED BY TEXAS TECH UNIVERSITY

TAMEST NATURAL HAZARDS SUMMIT

*Responding
to and
Mitigating
the Impacts*

PART II: LUBBOCK

05.16.2022

#NATURALHAZARDSSUMMIT

Plenary:

Emergency Response and Recovery



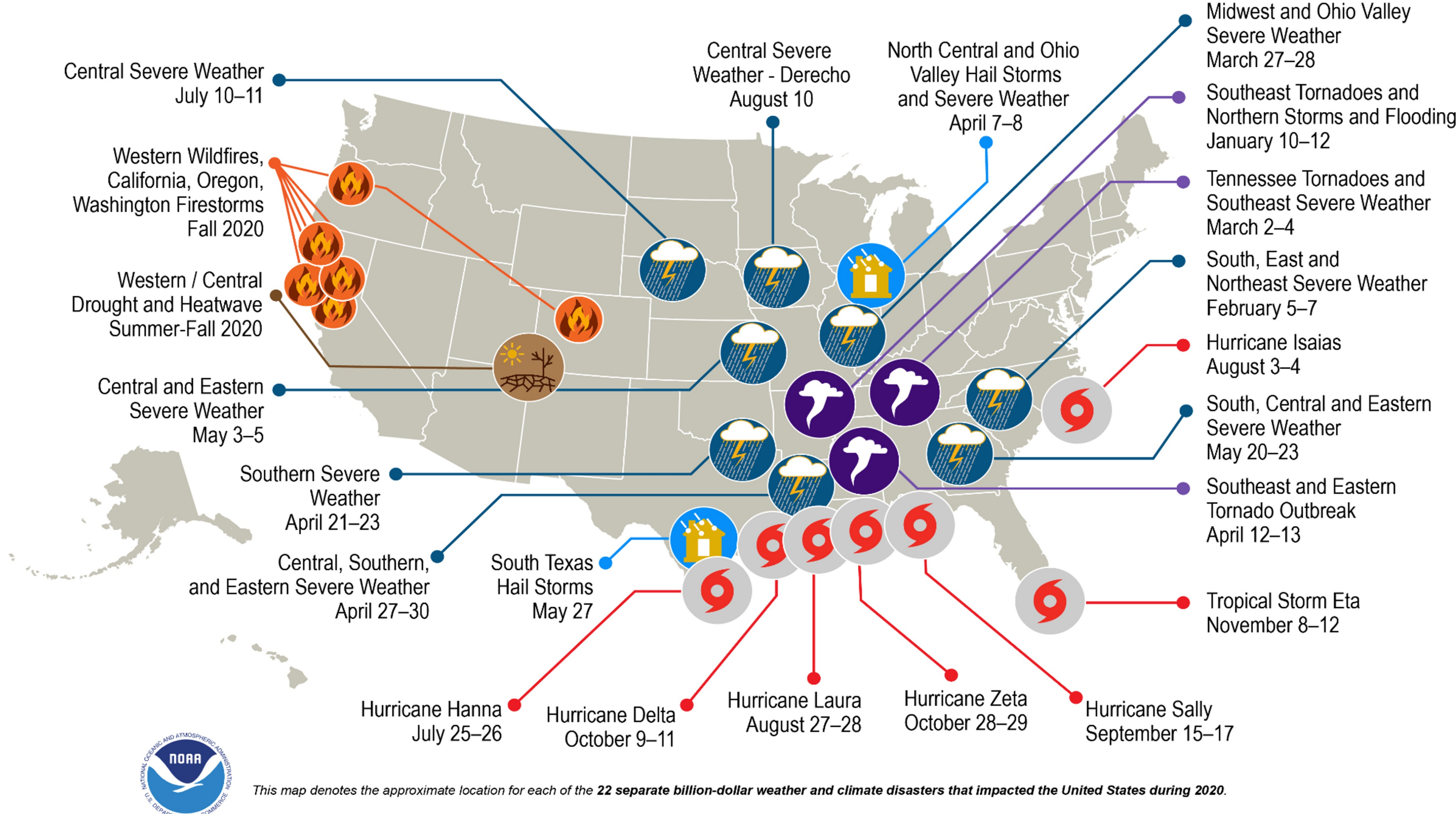
**TRACY
KIJEWSKI-CORREA, PH.D.**

Linbeck Chair and Associate Professor, College of
Engineering & Keough School of Global Affairs
University of Notre Dame



MOTIVATION

U.S. 2020 Billion-Dollar Weather and Climate Disasters



POTENTIAL DRIVERS	
<input checked="" type="checkbox"/>	Hazard Exposure
<input checked="" type="checkbox"/>	Inventory Vulnerability
<input checked="" type="checkbox"/>	Regulatory Context
<input checked="" type="checkbox"/>	Information Channels
<input checked="" type="checkbox"/>	Incentive Structures

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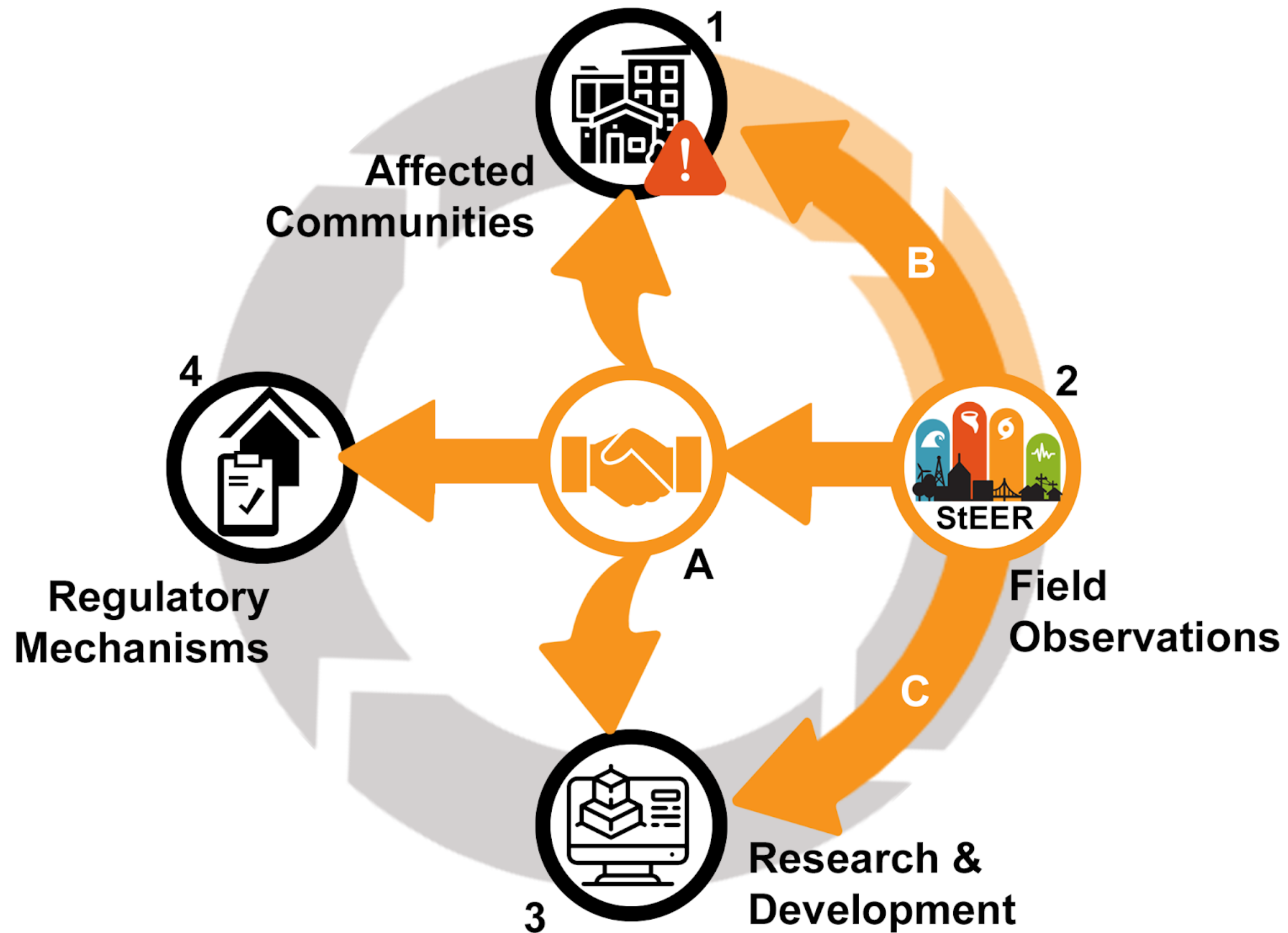
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DATA-TO-KNOWLEDGE LIFE CYCLE



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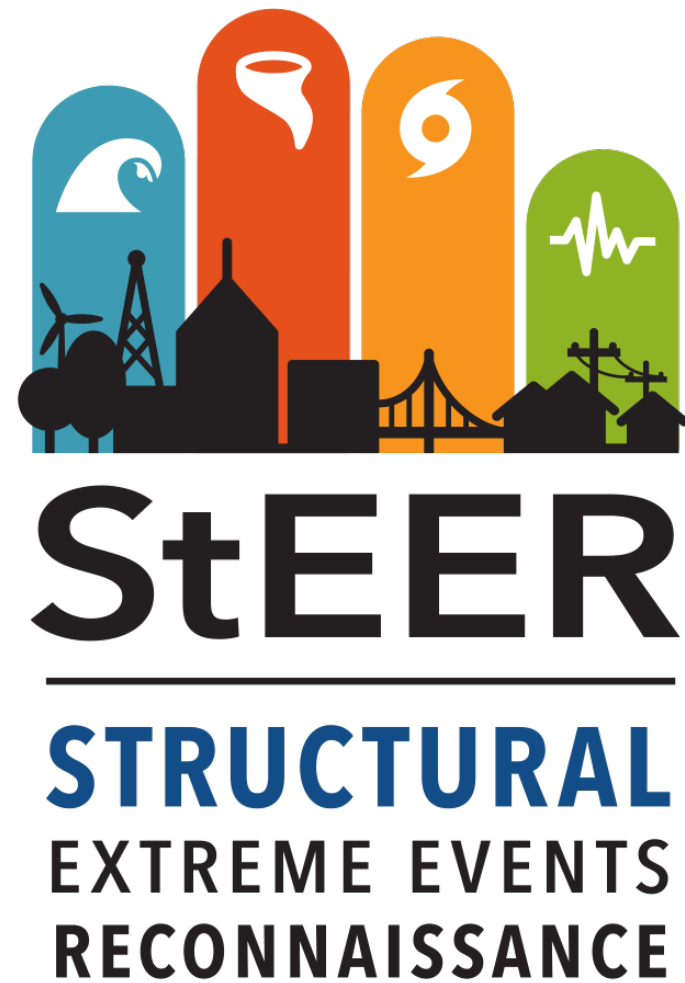
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APPROACH



CAPACITY

promoting **community-driven standards**, best practices, and training for field reconnaissance

COORDINATION

facilitating **early, efficient and impactful** event responses

COLLABORATION

broadly engaging communities of **research, practice and policy** to accelerate learning from natural hazard events

PRIMARY OUTCOMES:

- ☐ High-quality communal datasets documenting performance of built environment, intended for broad re-uses
- ☐ Synthesis of collective knowledge, spur ongoing research, uptake into policy and practice
- ☐ Requires **TIMLEY** capture of **RELIABLE** data that is **ACCESSIBLE**



Hurricanes



Tornadoes &
Other
Windstorms



Earthquakes



Storm Surge
and Tsunami

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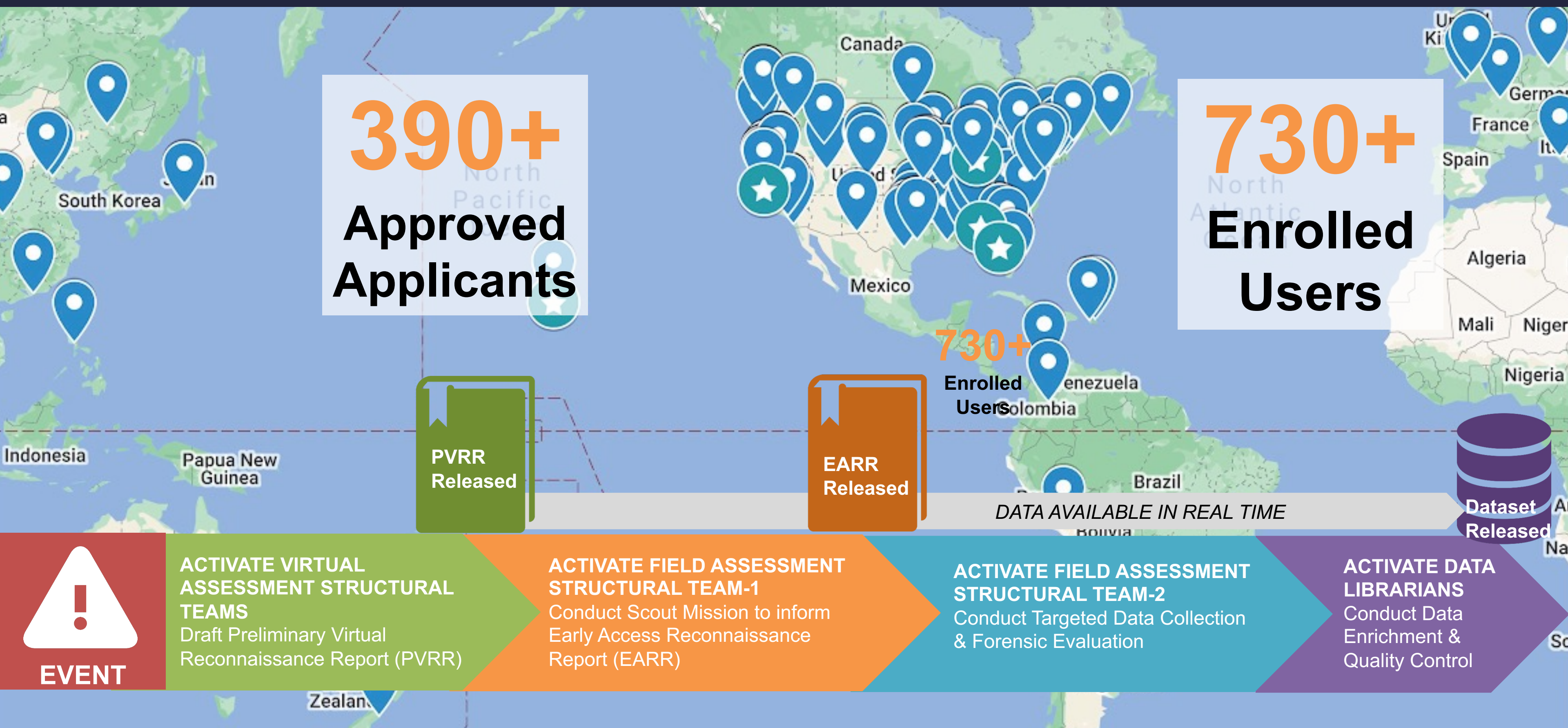
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CHRONOLOGY AND GEOGRAPHIC COVERAGE



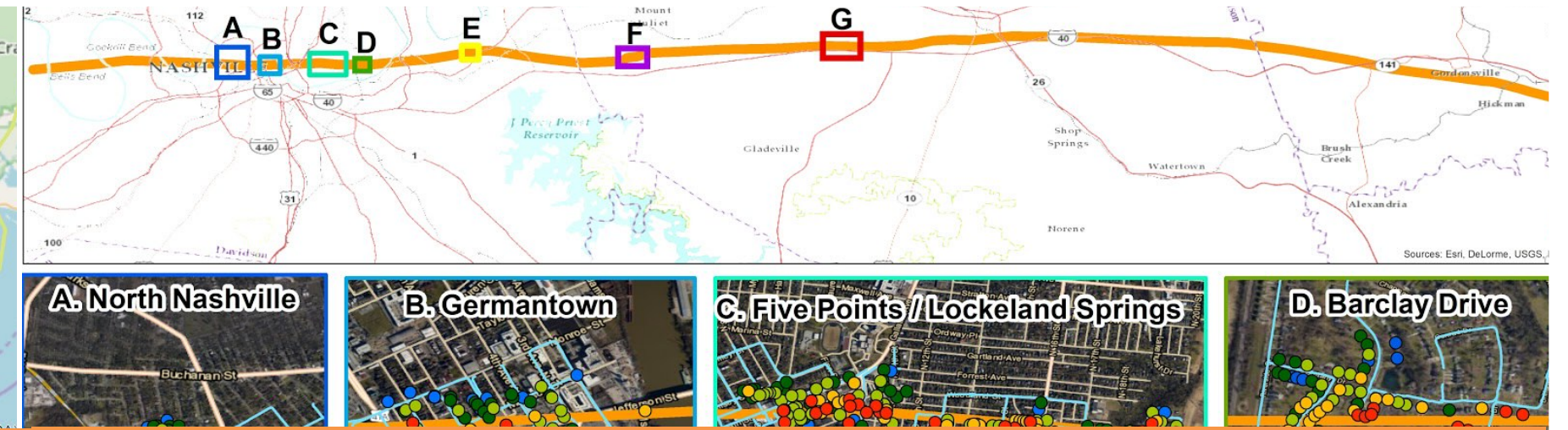
TIERED EVENT RESPONSE MODEL



MISSION DESIGNS



Hazard Gradient Survey: Hurricane Michael



Hazard Gradient Survey: Nashville Tornadoes



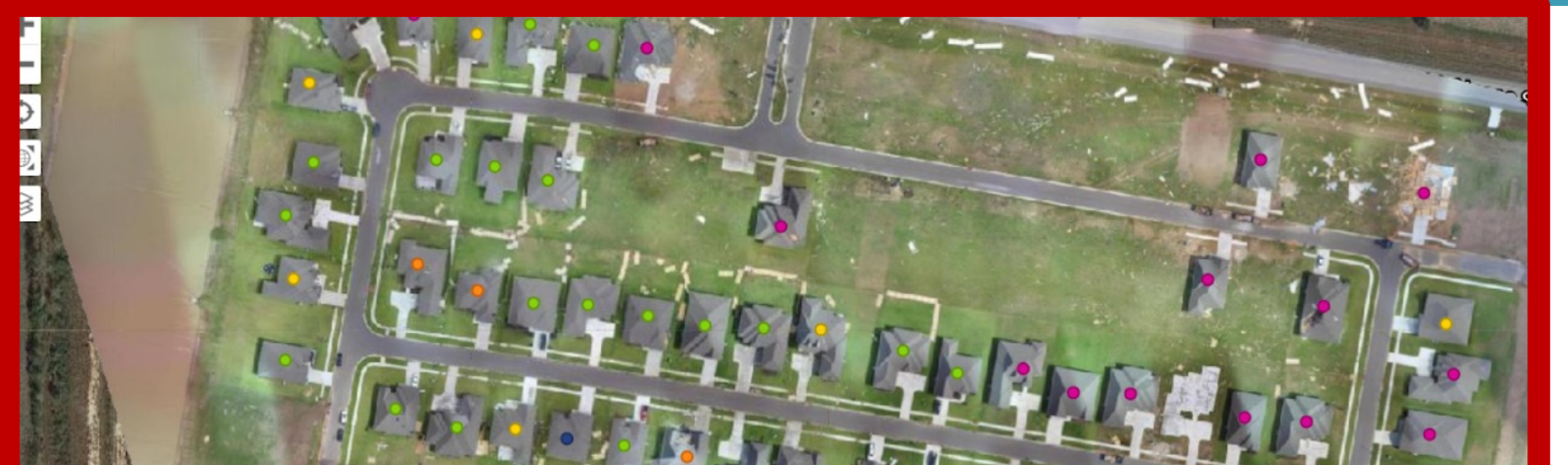
Representative Performance Study: Palu Tsunami



Targeted Case Studies: Puerto Rico Earthquakes



Phased Multi-Hazard Investigation: H. Dorian



Rapid Survey + Virtual Assessment: H. Laura

TYPICAL ASSESSMENT TECHNOLOGIES

Performance Assessments



Unmanned Aerial Systems



Street-level 360 imaging platforms



Terrestrial Scanning Technologies



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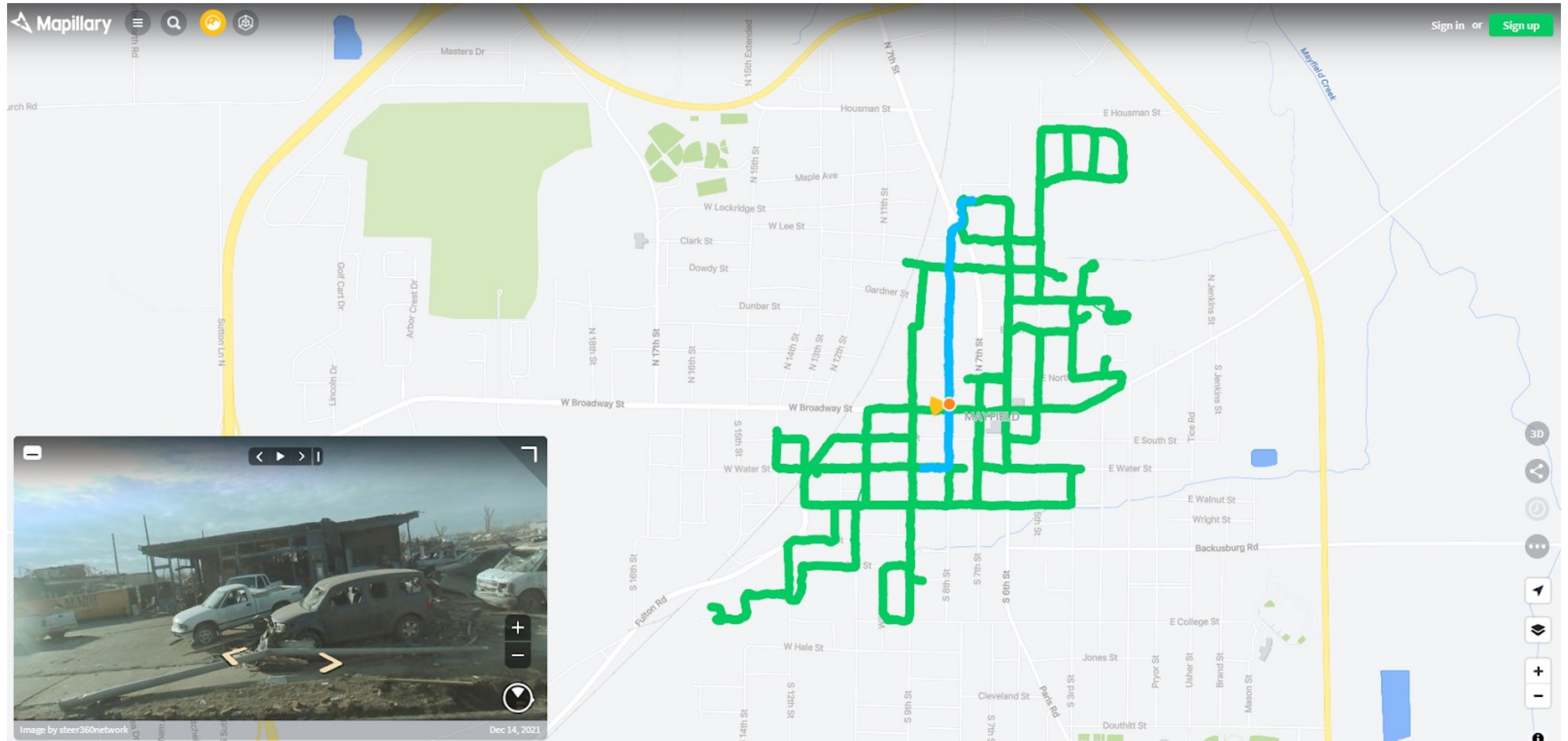
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EXAMPLE: QUAD-STATE TORNADO OUTBREAK (MAYFIELD, KY)



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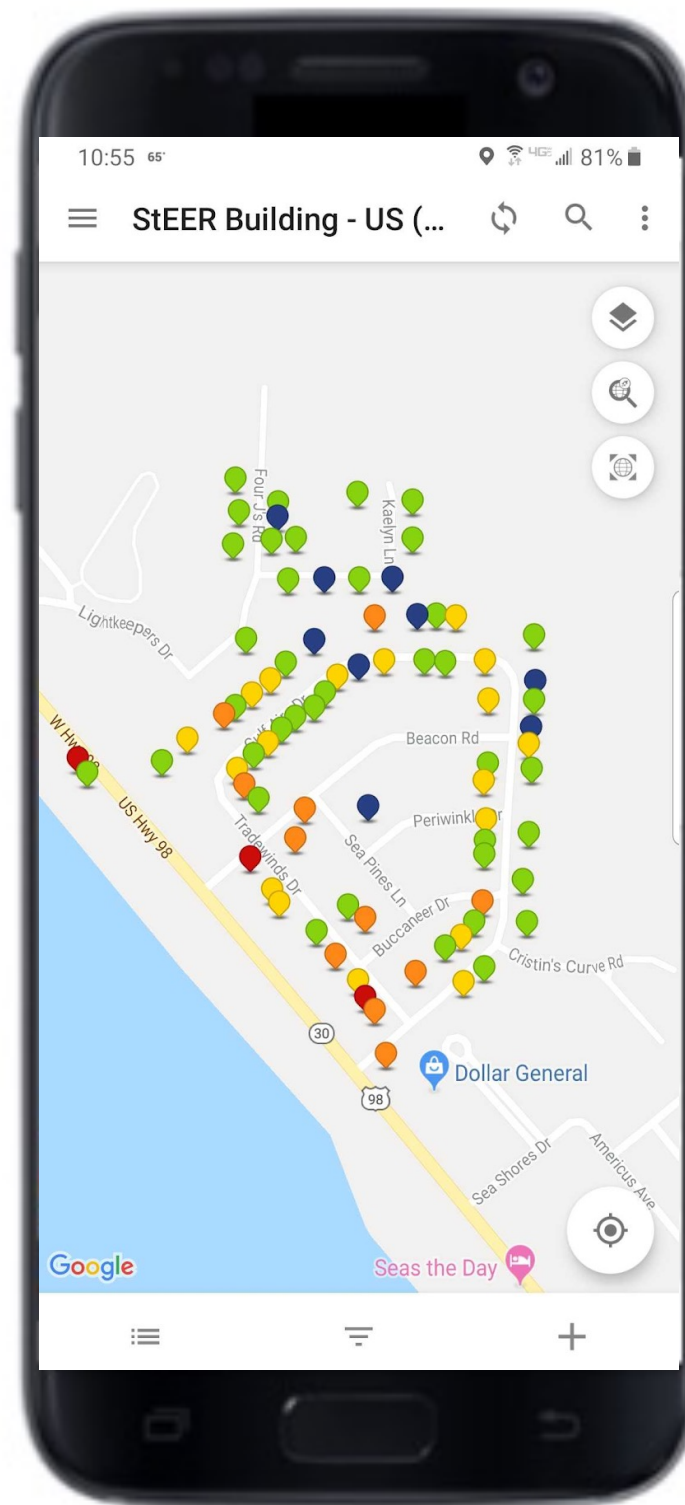
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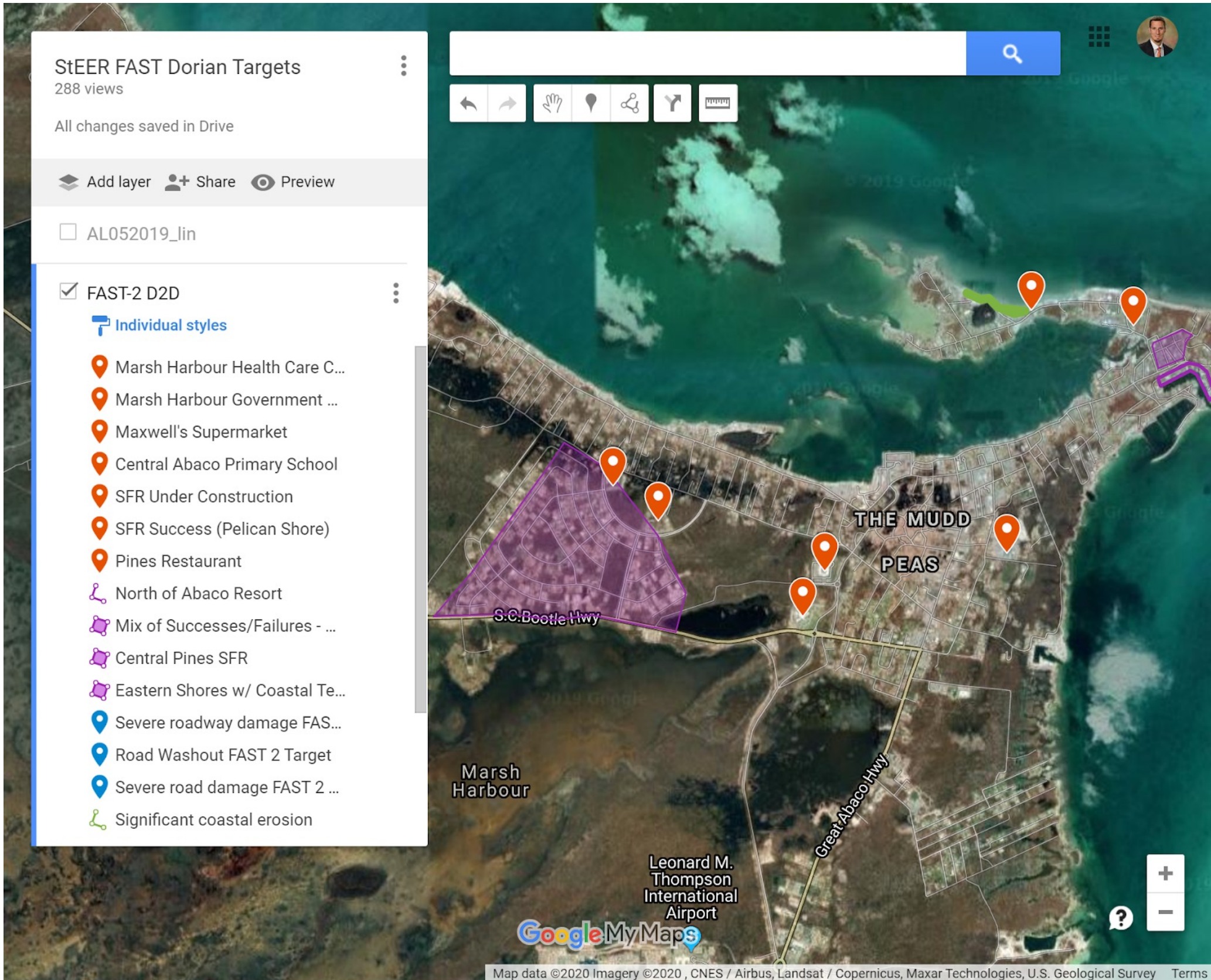
LEVERAGING MOBILE APPS IN PERFORMANCE ASSESSMENT



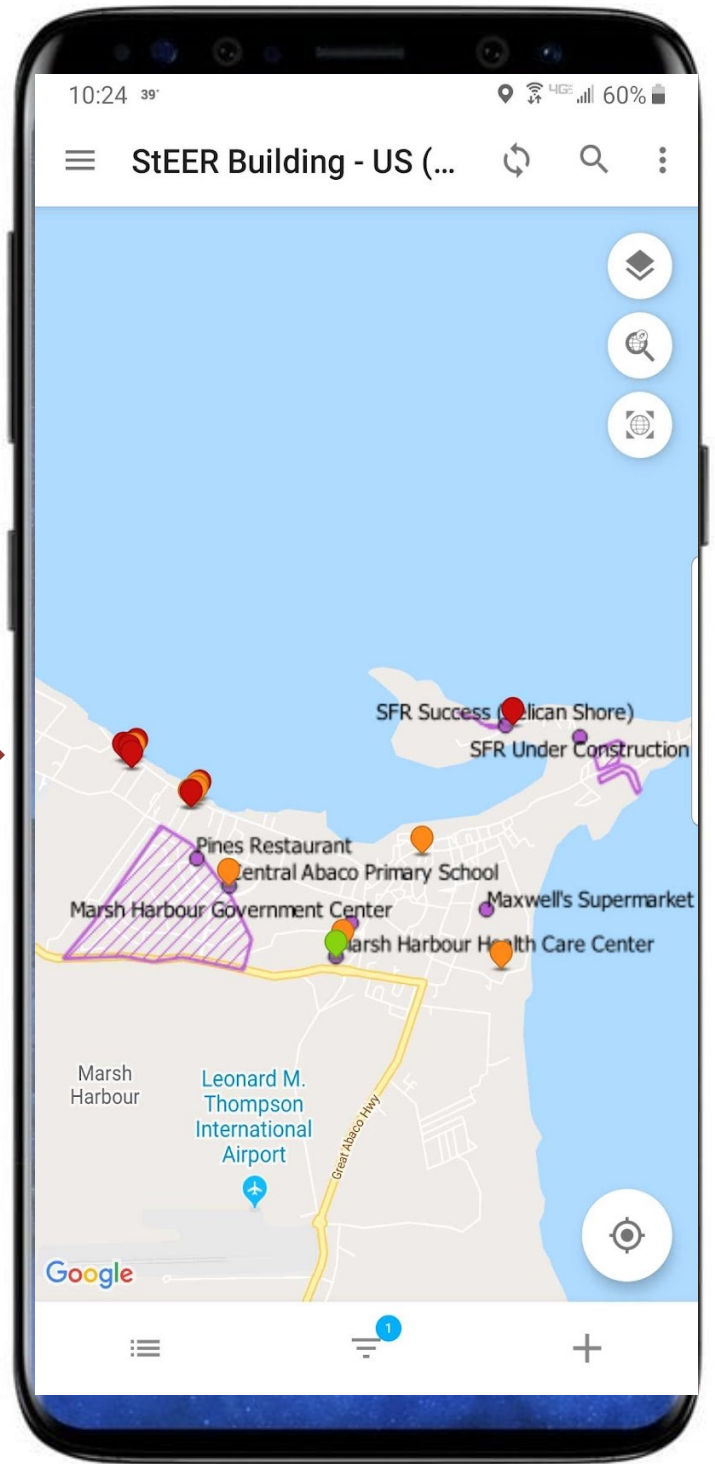
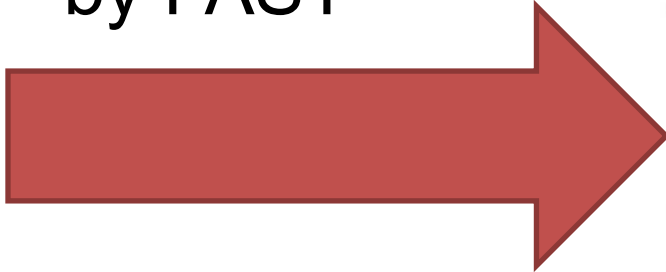
Single geolocated record with rich multi-media content, exportable to common formats: Excel, ESRI Shapefile, GeoJSON, etc.

Photographs		
	Audio	
		Free-form Text
	Standardized Data Fields	
		Investigation Notes
		Building Attributes
		Structural Attributes
		Walls and Foundation
		Fenestration
		Roof Structure
		Wind-induced Damage
		Surge-induced Damage

TARGETEDED FOLLOW-UP DATA COLLECTION



Targets
synced to
Fulcrum for
offline access
by FAST



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MIXED-METHODOLOGICAL STRATEGY

Overlapping data collection technologies ensure FASTs can sample efficiently in the field while still capturing the context and broad damage patterns

Surface-level panoramas



UAS for structure-from-motion models



Door-to-door Assessments



BUILDING PERFORMANCE DATABASE

Record Metadata	Building Attributes	Structural Details		Damage Details	
Project	Attribute Notes	Structural Notes		Overall Damage	Wind Damage Details
Lat/Lon	Address	Structural System		Overall Damage Notes	Wind Damage Details
Created Time	Occupancy	Walls and Foundation	Roof	Hazards Present	Roof Structure Dmg (%)
Created By	Number of Stories	Foundation Type	Roof System Type	Wind Damage Rating	Roof Substrate Dmg (%)
	Understory (% Footprint)	Wall Anchorage	R2W Attachment	Surge Damage Rating	Roof Cover Dmg (%)
Assessment Metadata	First Floor Elevation (ft)	Wall Substrate	Roof Substrate	Rainwater Ingress Rating	Wall Structure Dmg (%)
Name of Investigator	Year Built	Wall Cladding	Roof Cover	Damage Indicator	Wall Substrate Dmg (%)
Date	Roof Shape	Soffit Type	Secondary Water Barrier	Degree of Damage	Wall Cladding Dmg (%)
General Notes	Roof Slope	Fenestration	Overhang Length		Damaged Fenestration (%)
Assessment Type	Orientation	Fenestration Protection	Parapet Height (inches)	Surge Damage Details	Location Dmg Fenestration
		Fenest. Protection Type		Water-Induced Dmg Notes	Large Door Failure
Media / Imagery		Large Door Present?		% Footprint Eroded	Soffit Damage (%)
All Photos		Large Door Location		% Dmg Understory	Fascia Damage (%)
Audio		Large Door Type		Max Scour Depth	Stories w/ Damage
				% Piles Missing/Collapsed	
				% Piles Leaning/Broken	
				Cause of Found. Dmg.	

Automatically filled in by app

Required for FAST

FAST on-site priorities

VAST/Data Librarians

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SUPPLEMENTAL DATA SOURCES FOR DE/QC

Field Observations (Fulcrum)



Sampling Method * Biased ▶ Other

Elevations Assessed	All
---------------------	-----

Media Attachments

Use photographs and audio intelligently to capture as much information as is practical. Photographs should include all accessible sides of the structure.

Overall Photos (Front, Left, Right, Back)

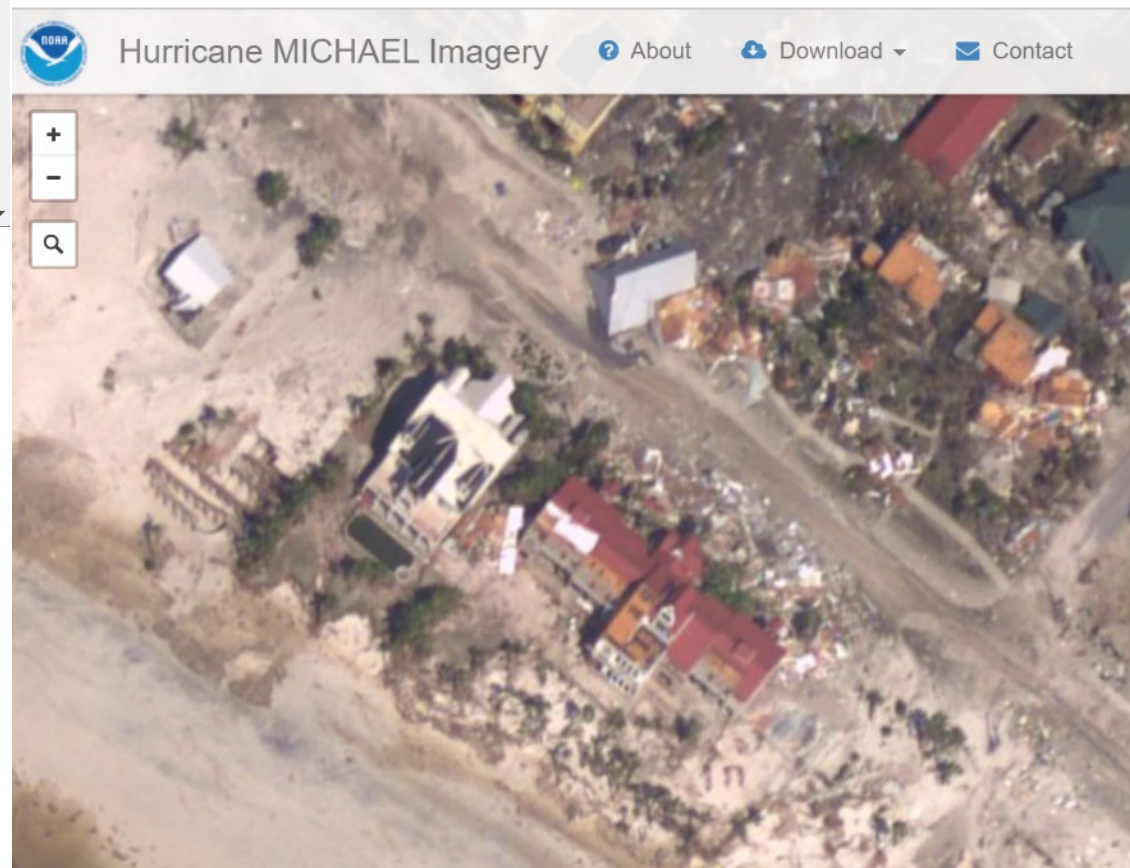
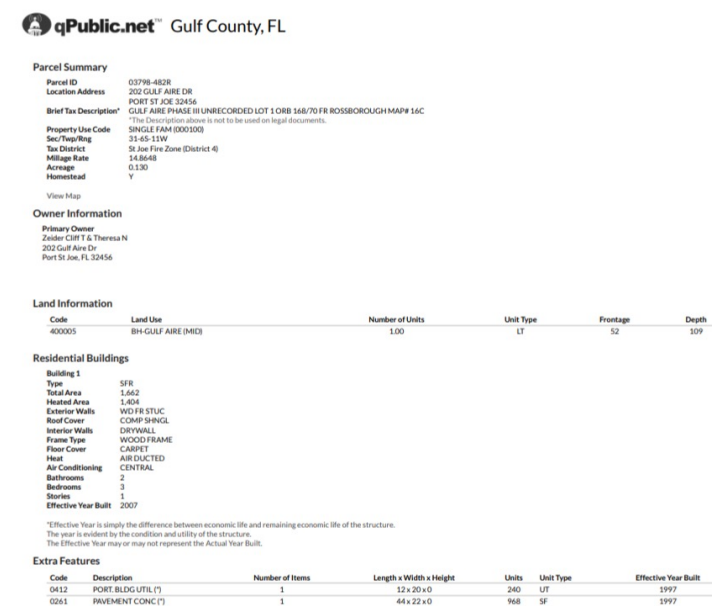


CONNECTEXPLORER™



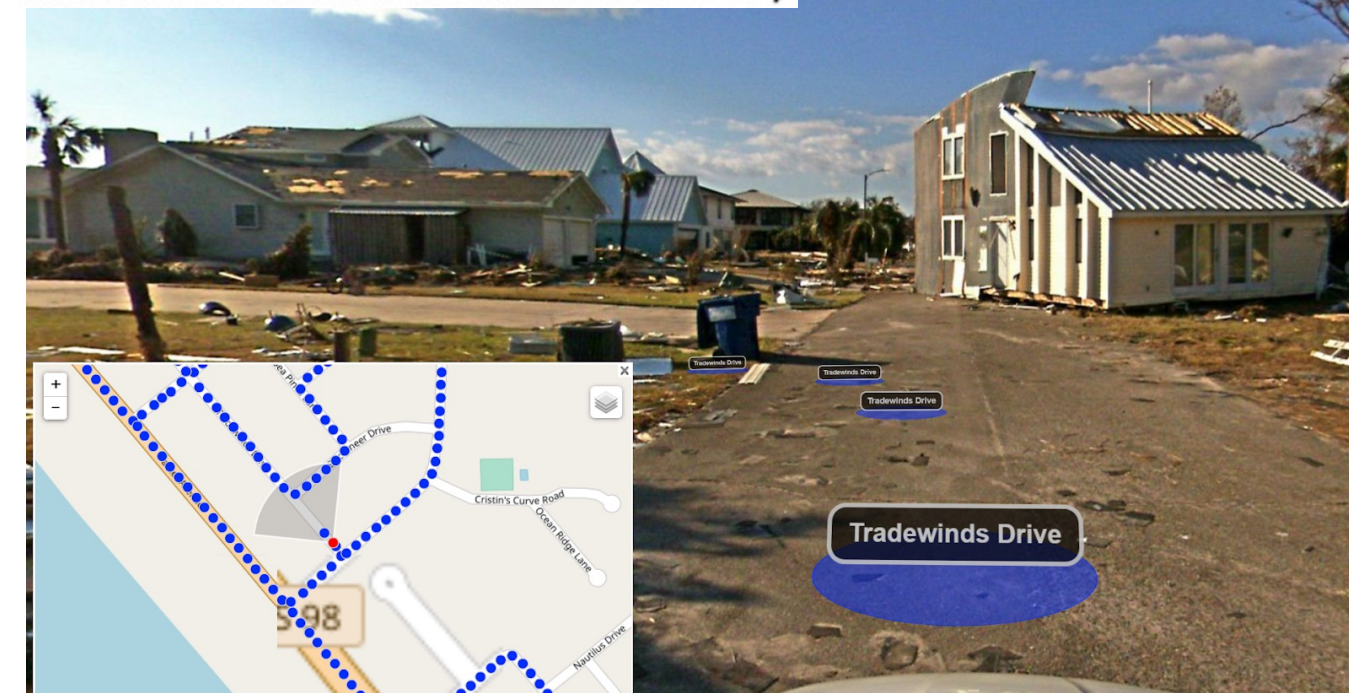
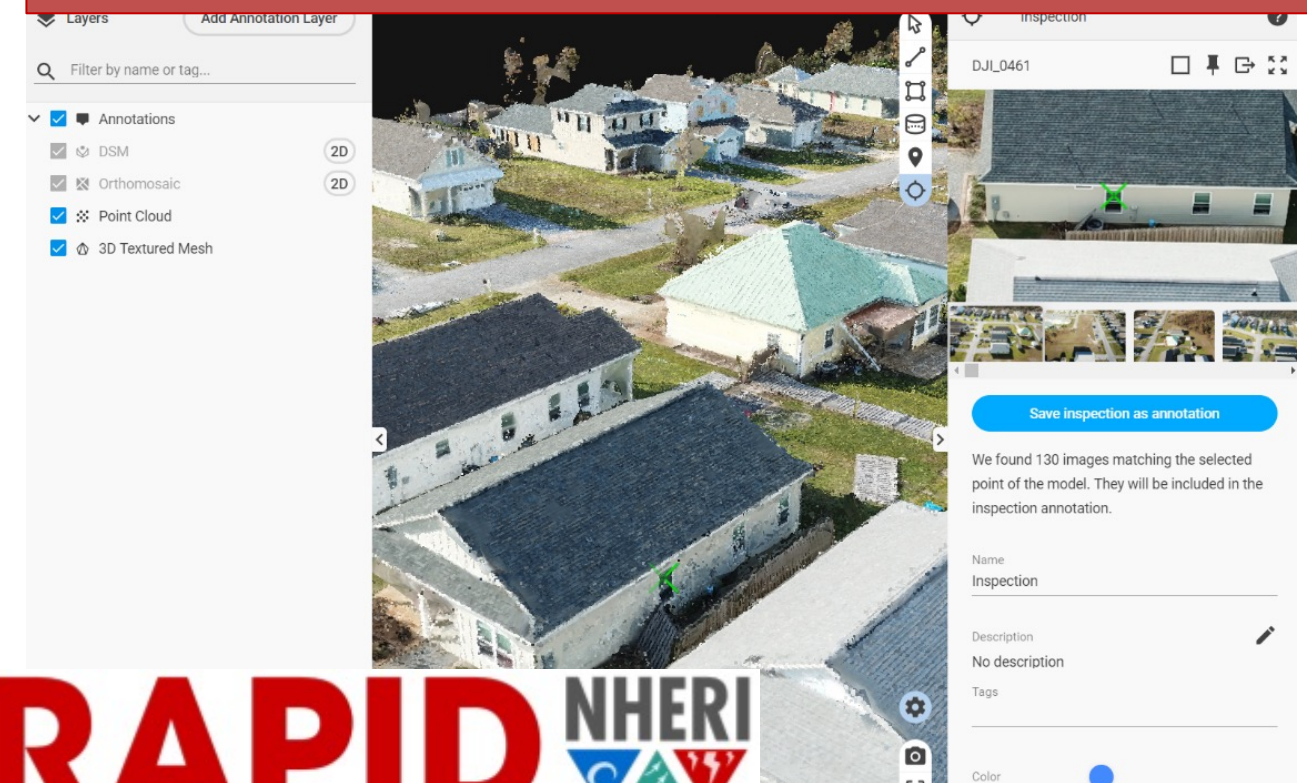
Oblique Imagery

Parcel Records



NOAA Nadir Imagery

SfM Models / Point Clouds



Street-level Panoramas

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DISSEMINATION OF DATA AND KNOWLEDGE

MAPILLARY/GOOGLE STREET VIEW

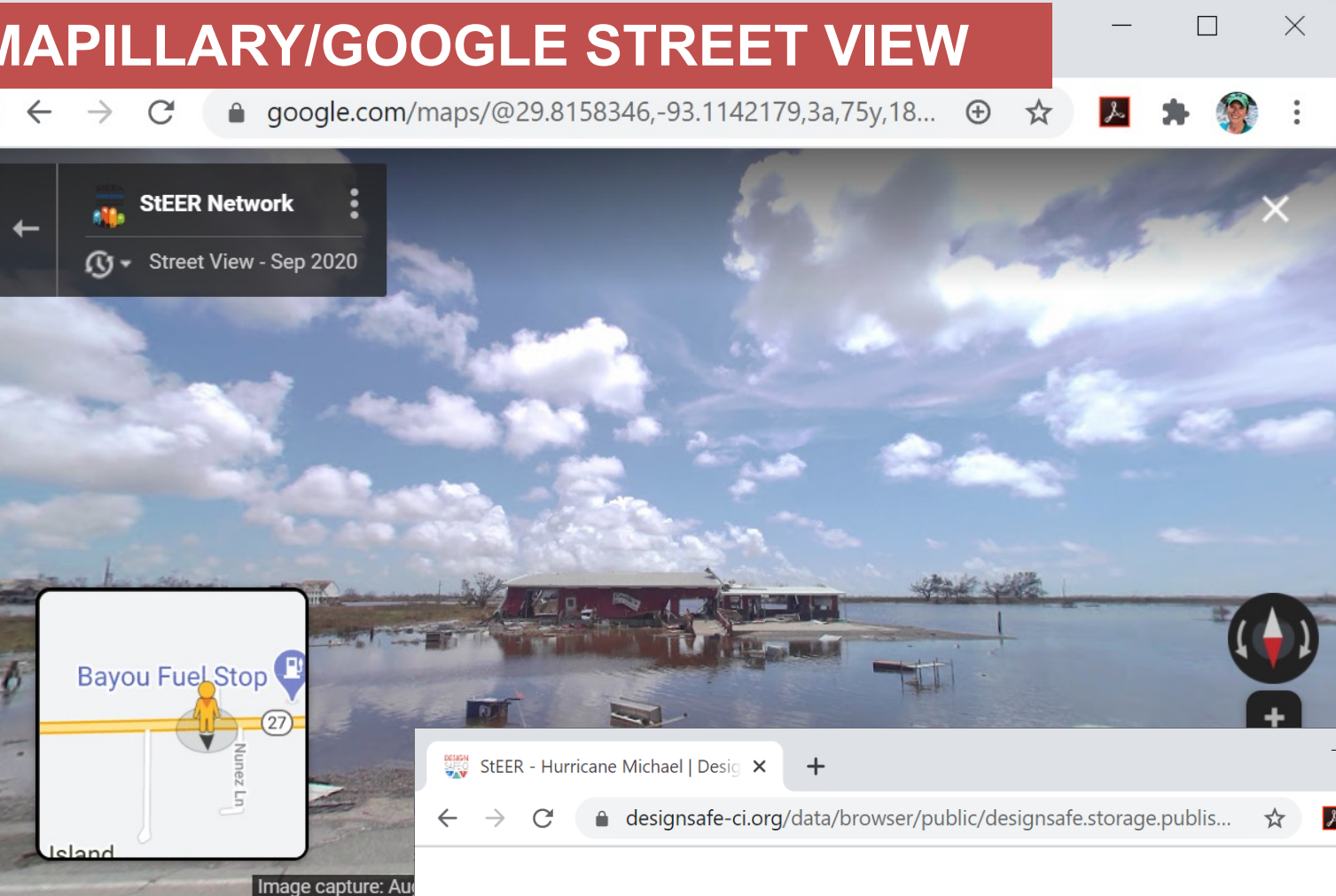


Image capture: Aug

StEER - Hurricane Michael | DesignSafe

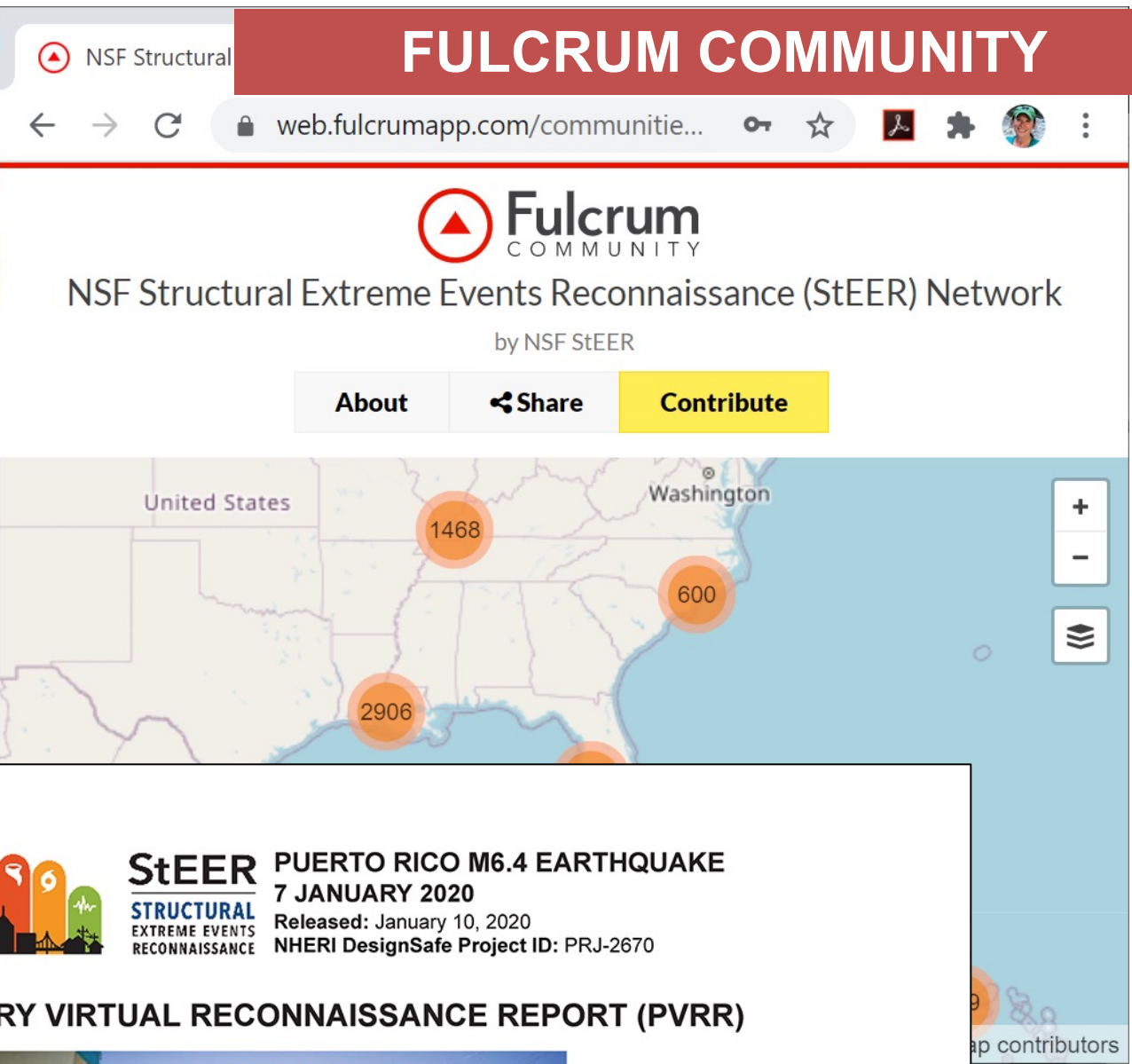
designsafe-ci.org/data/browser/public/designsafe.storage.publis...

Observing damage and documenting successful performance of buildings. Classes include residential, commercial and institutional. Methodologies include detailed damage assessments in Fulcrum, UAS and Applied StreetView.

Engineering/Geosciences Collection StEER: Daily Summaries	<input checked="" type="checkbox"/>
Research Planning Collection Data Report	<input checked="" type="checkbox"/>
Research Planning Collection Planning Documentation	<input checked="" type="checkbox"/>
Engineering/Geosciences Collection StEER: Other Ground-Based Imagery	<input checked="" type="checkbox"/>
Engineering/Geosciences Collection StEER: Unmanned Aerial Survey	<input checked="" type="checkbox"/>
Engineering/Geosciences Collection StEER: Applied StreetView Technology	<input checked="" type="checkbox"/>
Engineering/Geosciences Collection StEER: Damage Assessments	<input checked="" type="checkbox"/>

QUALITY-CONTROLLED DATASETS

FULCRUM COMMUNITY



NSF Structural

Fulcrum COMMUNITY

NSF Structural Extreme Events Reconnaissance (StEER) Network
by NSF StEER

About Share Contribute

United States Washington

1468 600 2906

map contributors

NSF StEER STRUCTURAL EXTREME EVENTS RECONNAISSANCE

PUERTO RICO M6.4 EARTHQUAKE
7 JANUARY 2020
Released: January 10, 2020
NHERI DesignSafe Project ID: PRJ-2670

PRELIMINARY VIRTUAL RECONNAISSANCE REPORT (PVRR)



Agripina Seda School in Guánica,

WRITTEN PRODUCTS

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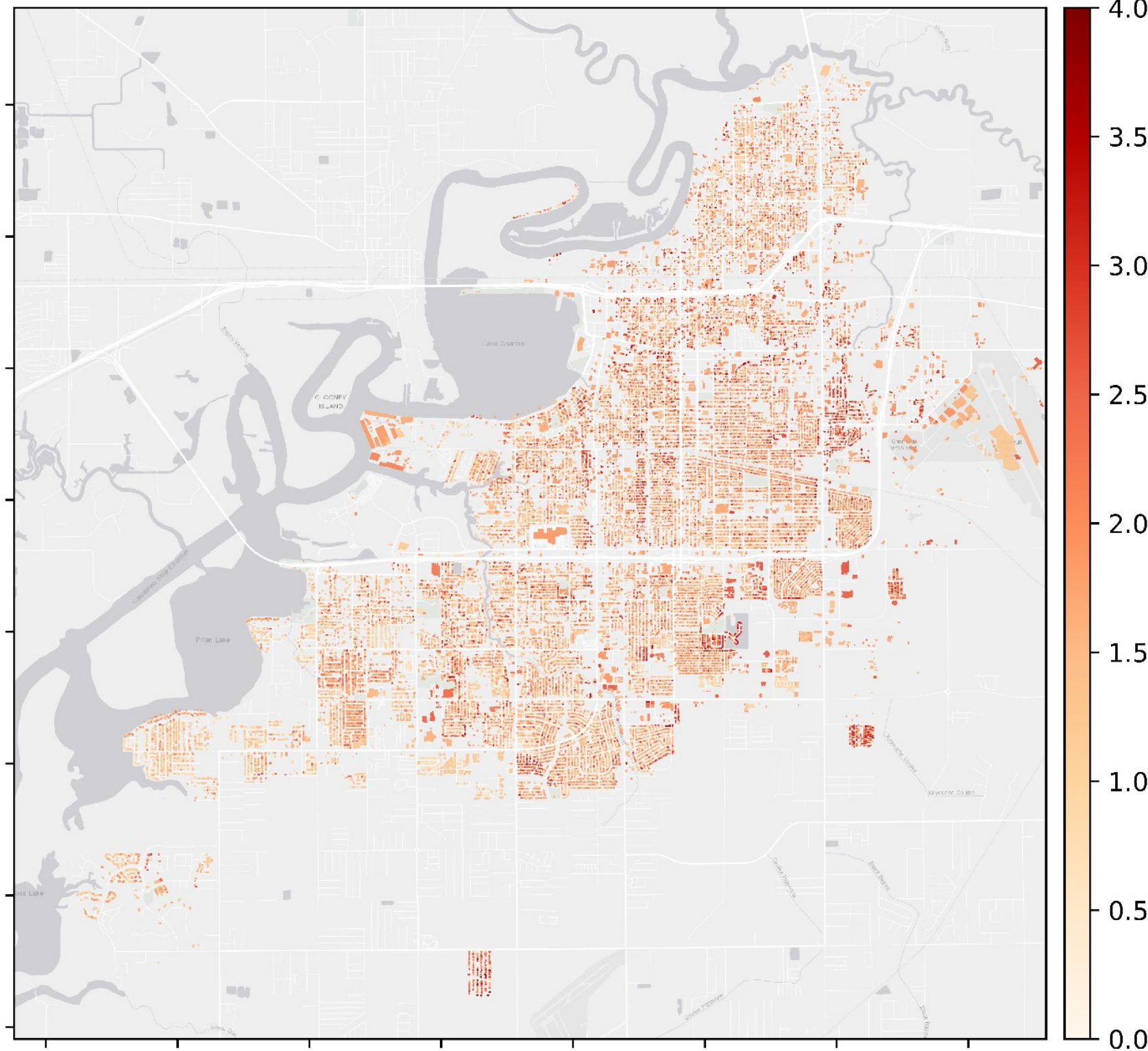
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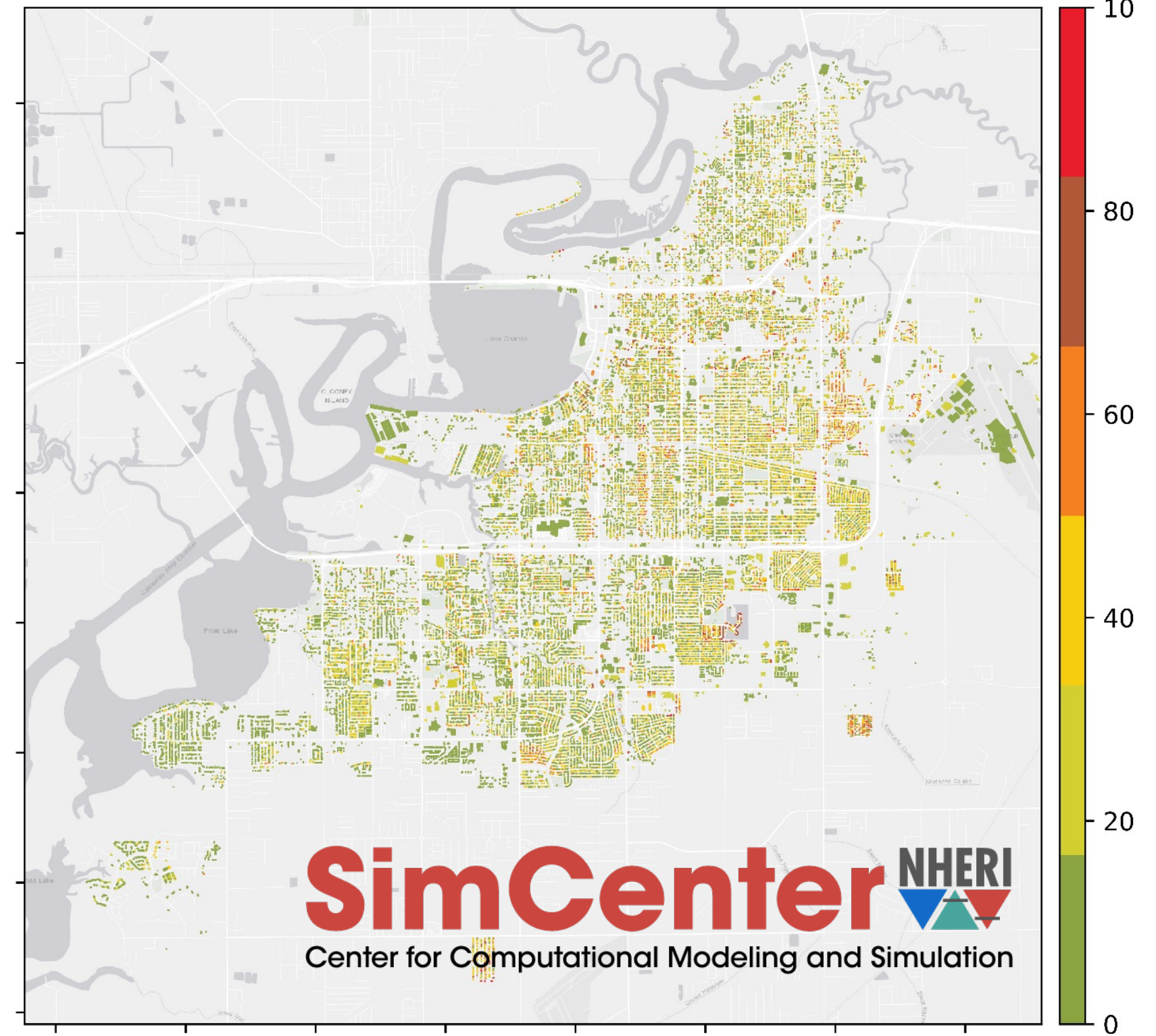


SIMULATION-INFORMED MITIGATION DECISIONS

(a) Expected DS (NSI)



(b) Expected loss ratio (%) (NSI)



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AUGMENTING PARCEL RECORDS

Buy

Rent

Sell

Mortgages

Agent finder

Advice

Home design

More

St. Louis

LISTING TYPE

ANY PRICE

0+ BEDS

CONTACT AGENT

SAVE

SHARE

MORE

EXPAND

CLOSE

Only showing 500 homes. Zoom in, or use filters to narrow your search.

VIEW LARGER

CONTACT AGENT

Peter Lu

Recent sales

RE/MAX SELECT

Your Name

Phone

Email

Premier Lender

Tom Mueller

NMLS 295467

☒ I am interested in information on financing.

Contact Agent

Learn how to appear as the agent

4 beds · 4 baths · 3,700 sqft

FOR SALE

\$699,900

Price cut: -\$25,100 (8/28)

Estimate[®]: \$708,686

EST. MORTGAGE

\$2,580/mo

See current rates

Equifax Credit Score - Get Yours Today!

qPublic.net

Gulf County, FL

Parcel Summary

Parcel ID

03798-482R

Location Address

202 GULF AIRE DR
PORT ST JOE 32456

Brief Tax Description

GULF AIRE PHASE III UNRECORDED LOT 1 ORB 168/70 FR ROSSBOROUGH MAP# 16C
*The Description above is not to be used on legal documents.

Property Use Code

SINGLE FAM (000100)

Sec/Twp/Rng

31-65-11W

Tax District

96 Joe Fire Zone (District 4)

Millage Rate

14.86-48

Acres

0.130

Homestead

Y

View Map

Owner Information

Primary Owner

Zeider Cliff T & Theresa N
202 Gulf Aire Dr
Port St Joe, FL 32456

Land Information

Code	Land Use	Number of Units	Unit Type	Frontage	Depth
400005	BH-GULF AIRE (MID)	1.00	LT	52	109

Residential Buildings

Building 1

Type

SFR

Total Area

1,662

Heated Area

1,404

Exterior Walls

W/ DFR STUC

Roof Cover

COMP SHINGL

Interior Walls

DRYWALL

Frame Type

WOOD FRAME

Floor Cover

CARPET

Heat

AIR DUCTED

Air Conditioning

CENTRAL

Bathrooms

2

Bedrooms

3

Stories

1

Effective Year Built

2007

*Effective Year is simply the difference between economic life and remaining economic life of the structure.

The year is evident by the condition and utility of the structure.

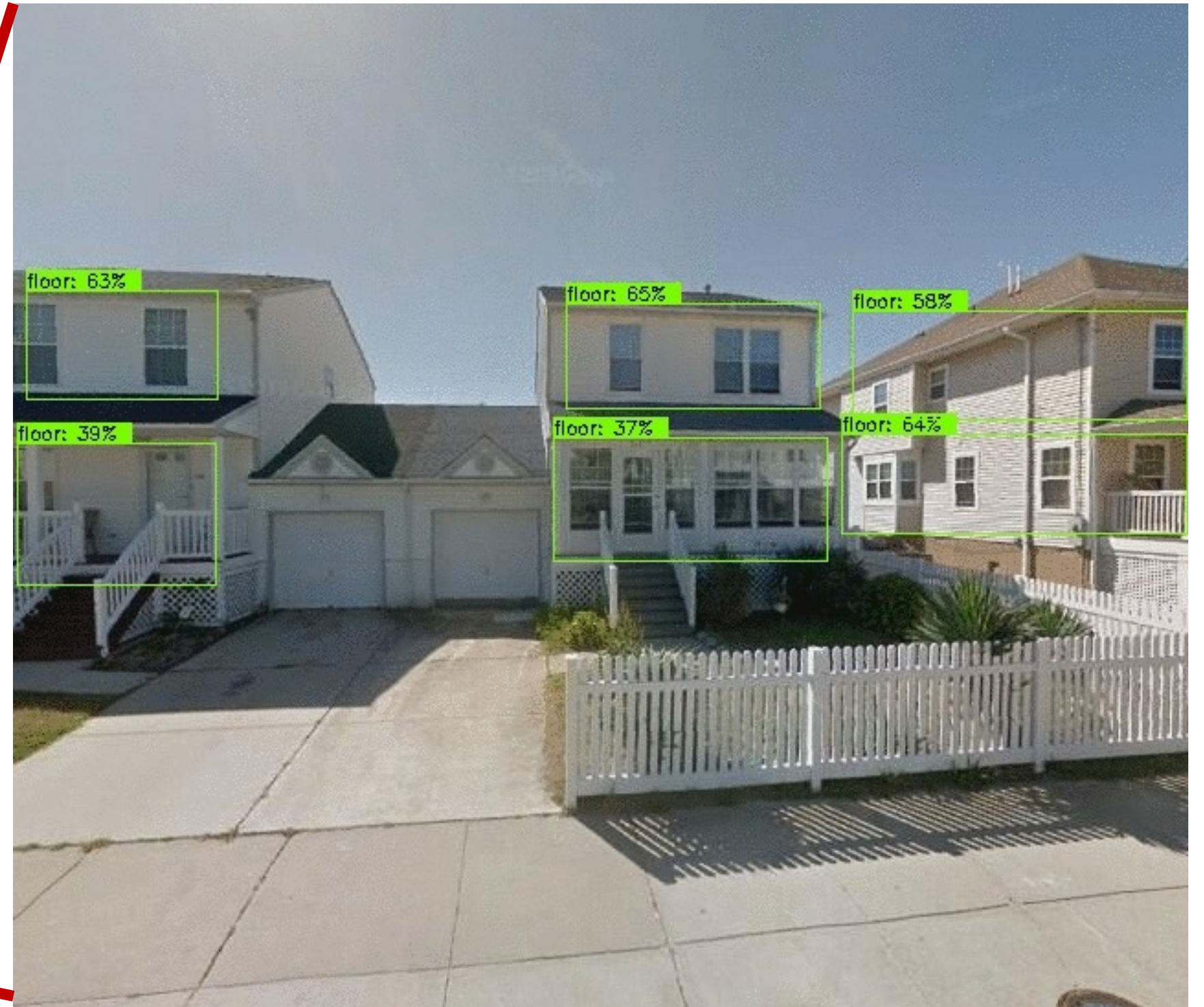
The Effective Year may or may not represent the Actual Year Built.

Extra Features

Code	Description	Number of Items	Length x Width x Height	Units	Unit Type	Effective Year Built
0412	PORT BLDG UTIL (T)	1	12 x 20 x 0	240	UT	1997
0261	PAVEMENT CONC (T)	1	44 x 22 x 0	968	SF	1997

3700+ sqft great open y home is stting granite ces, and replace to

(b)



SimCenter 
Center for Computational Modeling and Simulation

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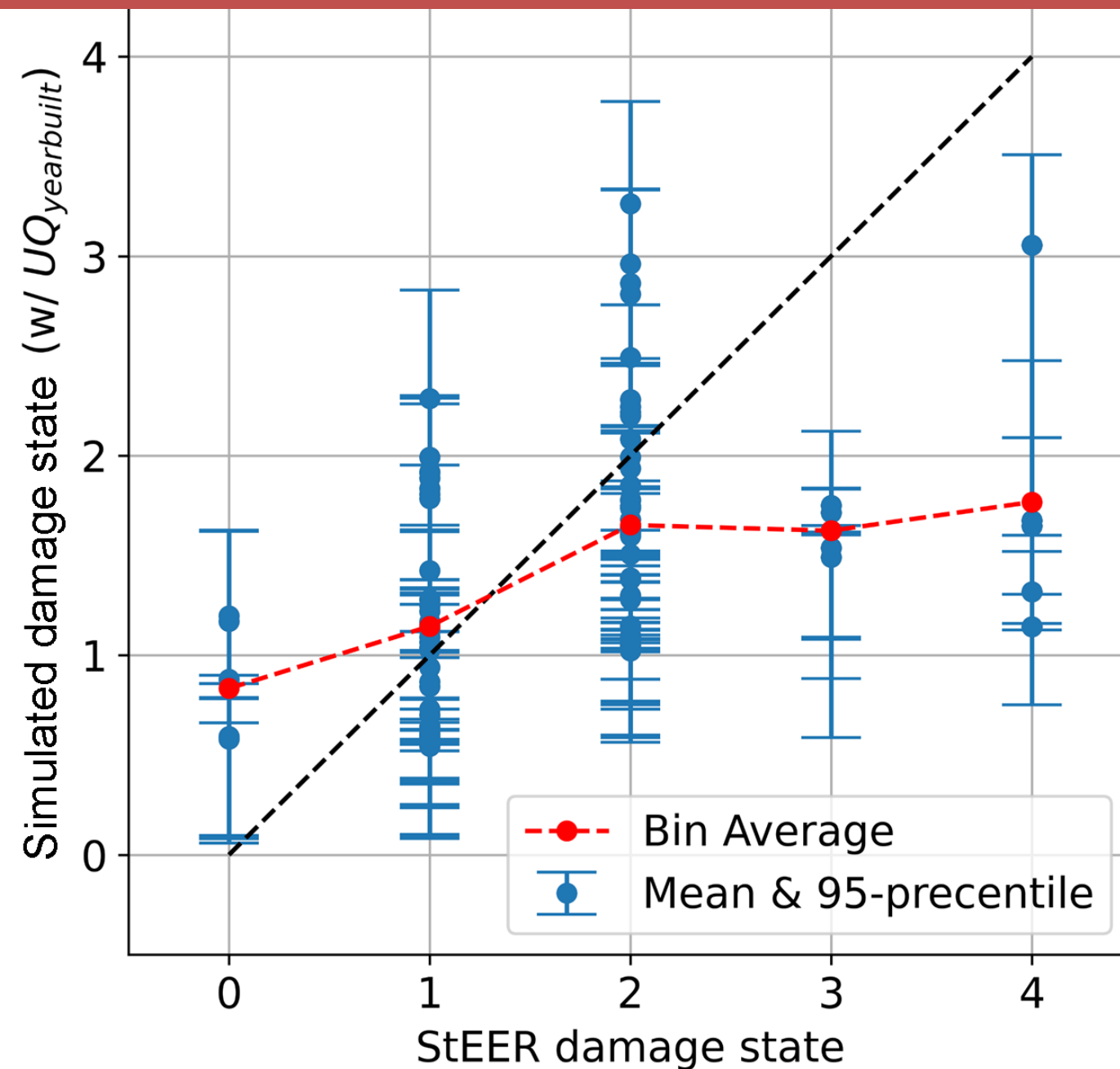
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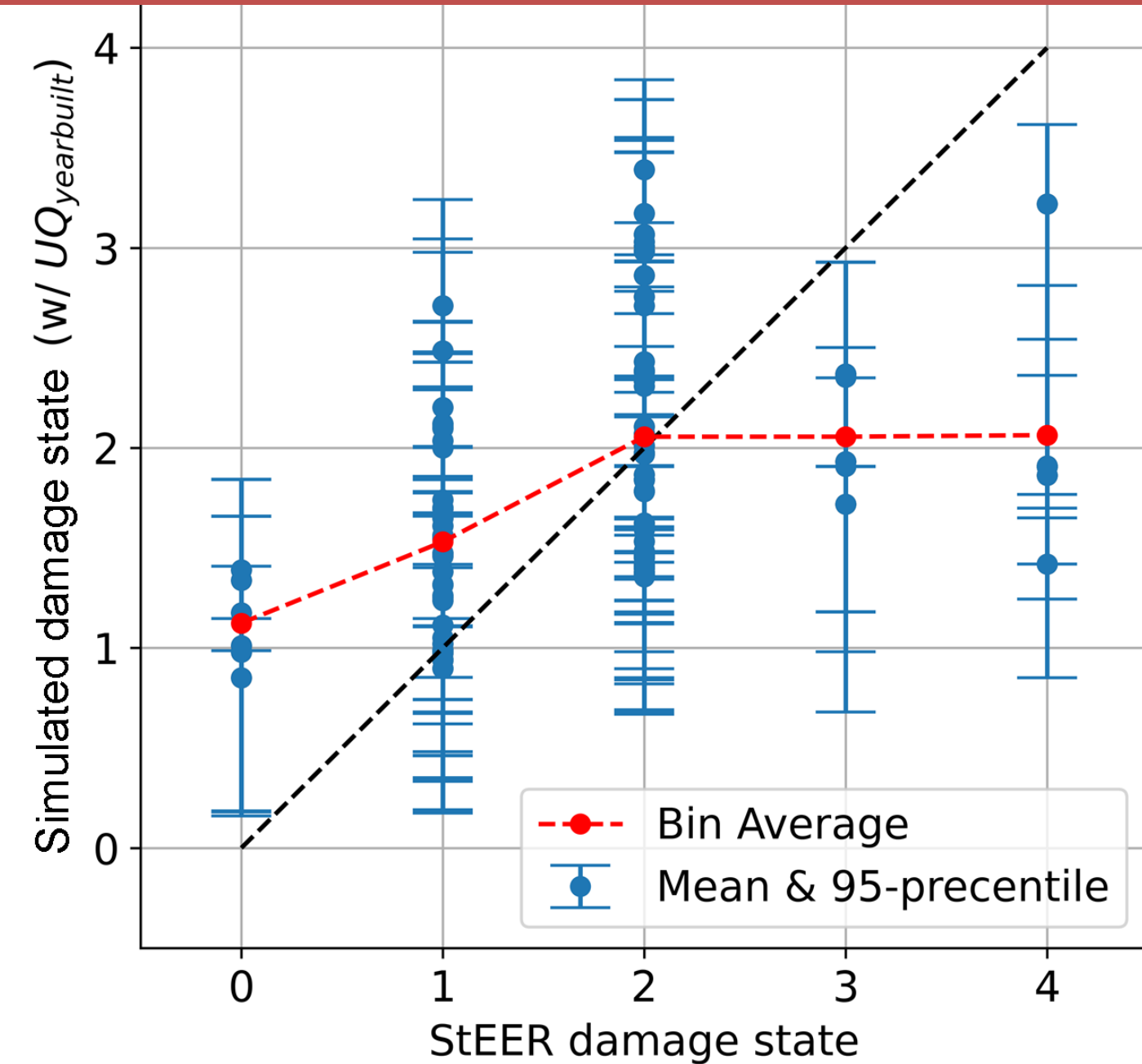
The logo of the University of Houston, featuring a stylized red and white 'UH' monogram.

VALIDATION OF LOSS ESTIMATION TOOLS

UNCERTAINTY IN YEAR BUILT **WITH**
SHUTTERING COMPLIANCE



UNCERTAINTY IN YEAR BUILT **WITHOUT**
SHUTTERING COMPLIANCE



KEEPING HUMANS IN THE LOOP

Barriers and drivers of mitigation actions?

Fusion and rapid processing of open data

Targeted household surveys

Protocols for rapid baselining and post-event data collection (human & built environments)



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QUANTIFYING MITIGATION UPTAKE

Quantifying Protection, Action and Intentions

HPI: HOME PROTECTION INDEX

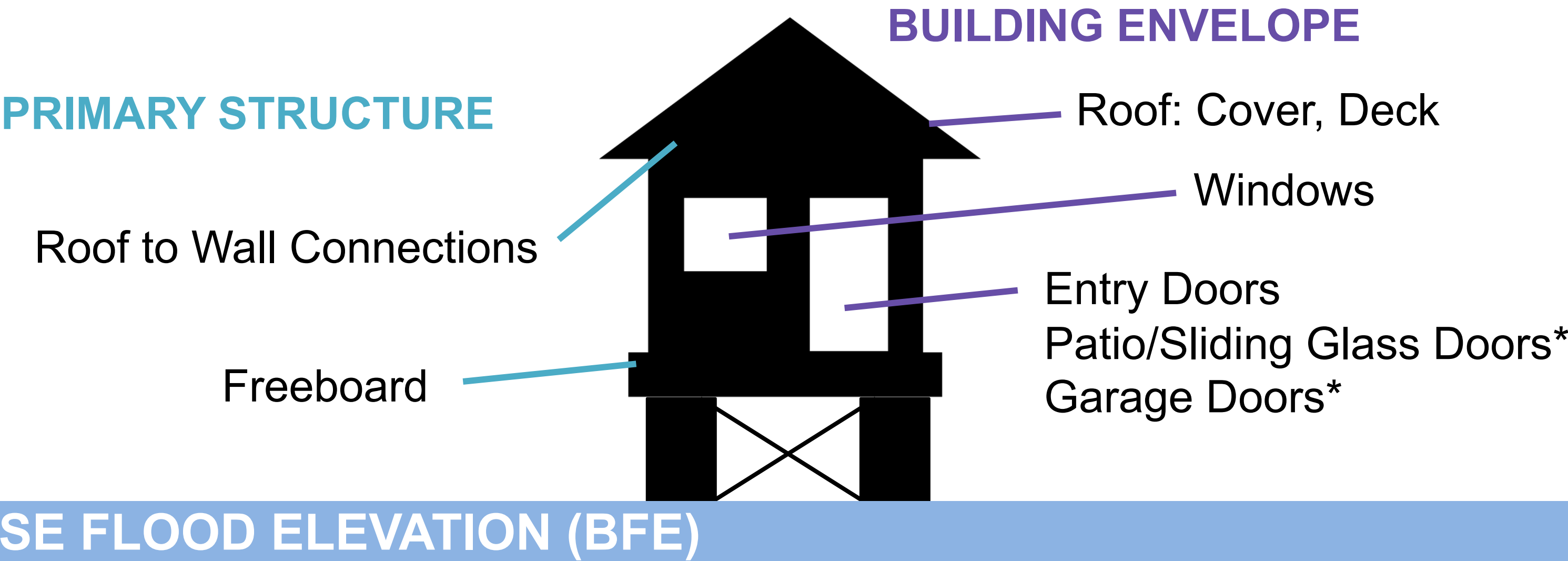
As purchased

HAI: HOMEOWNER ACTION INDEX

Past remodeling/retrofits

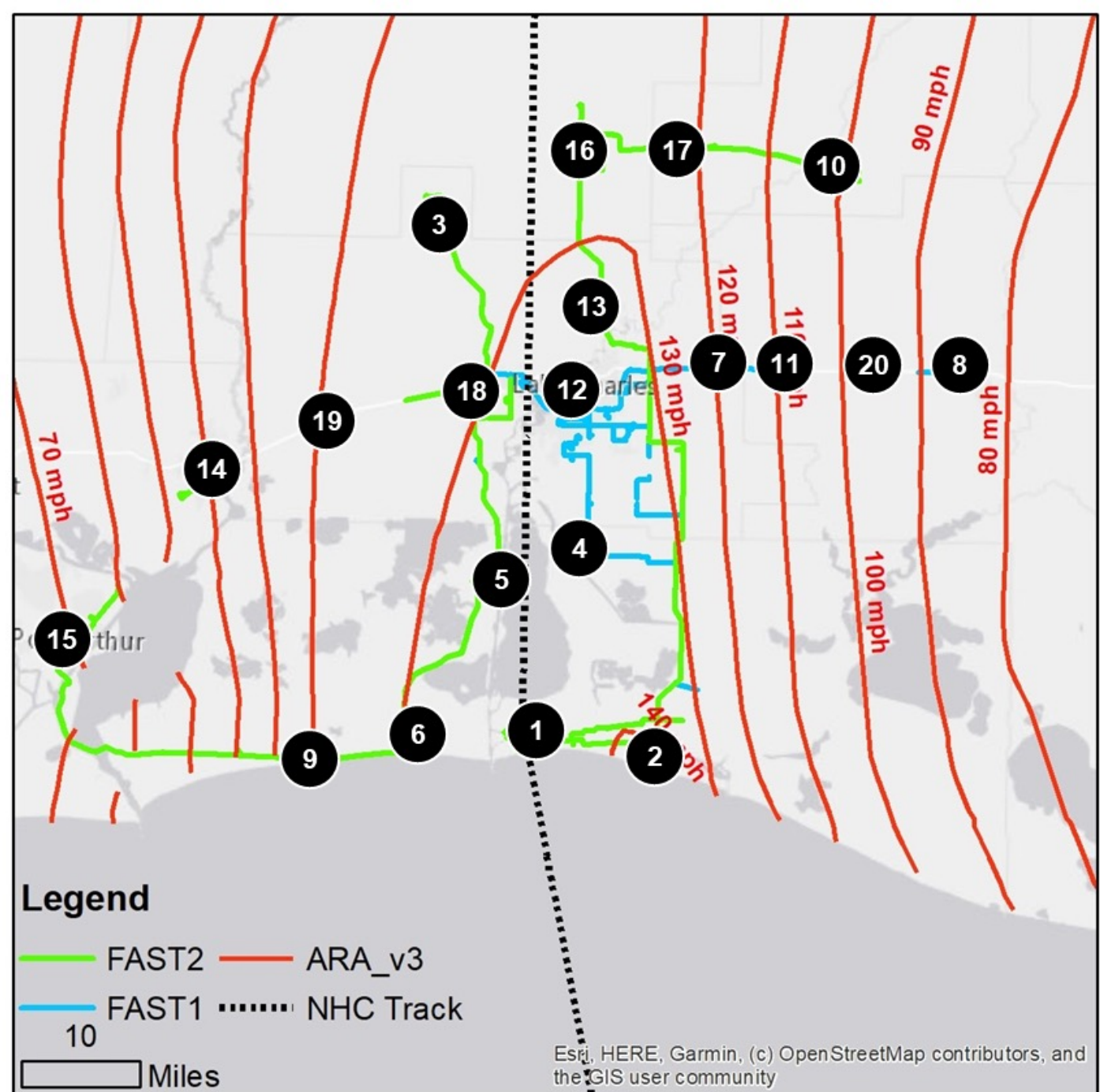
HII: HOMEOWNER INTENTION INDEX

Planned remodeling/retrofits

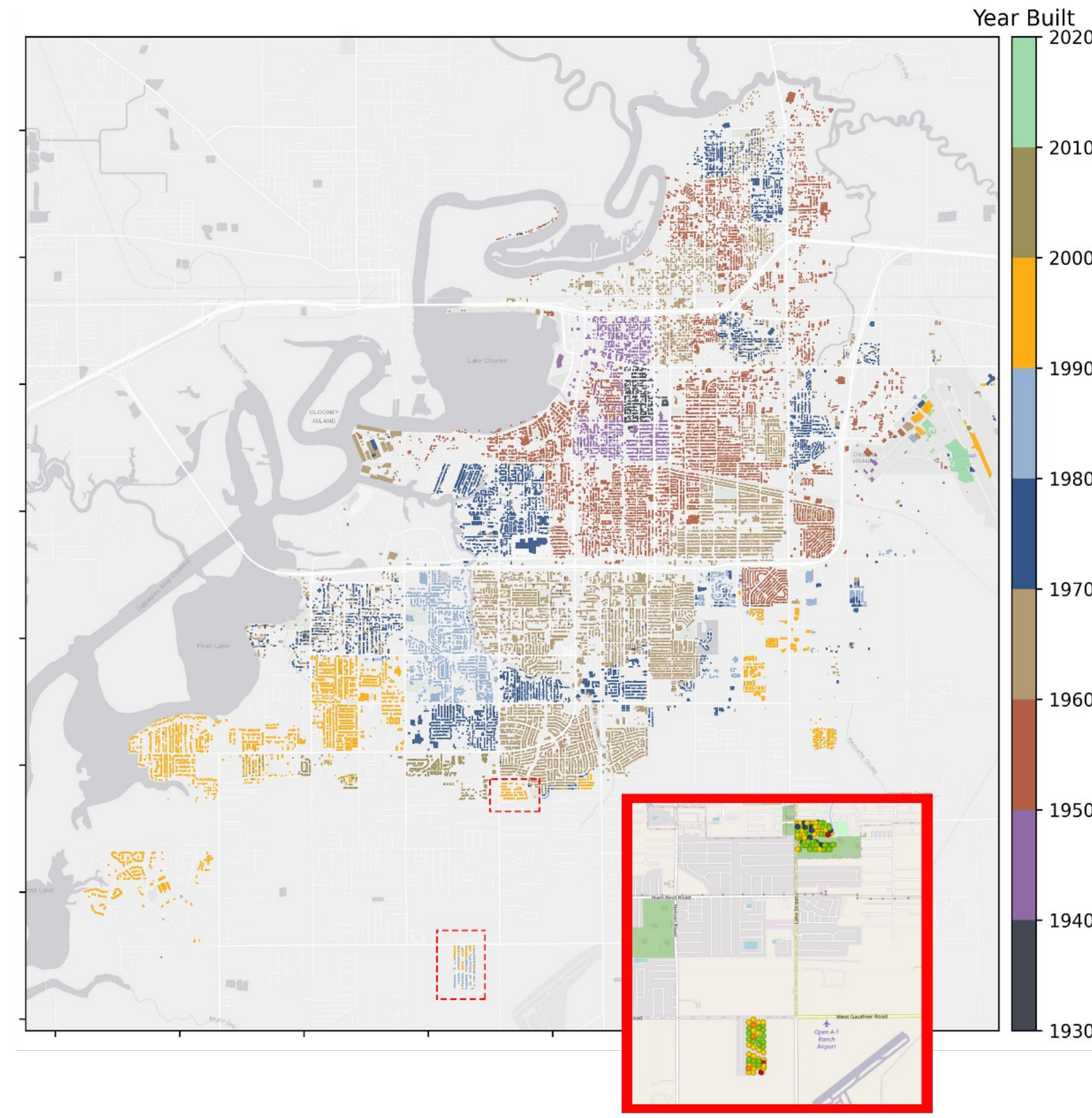


Javeline, D. and **Kijewski-Correa, T.** (2019) “Coastal Homeowners in a Changing Climate,” *Climatic Change*. 152(2): 259-276 <https://doi.org/10.1007/s10584-018-2257-4>

STRENGTHENING AMERICAN INFRASTRUCTURE: LAKE CHARLES, LA



- | | | | |
|---------------|------------------|------------------|-------------|
| 1. Cameron | 6. Holly Beach | 11. Lacassine | 16. Ragley |
| 2. Creole | 7. Iowa | 12. Lake Charles | 17. Reeves |
| 3. DeQuincy | 8. Jennings | 13. Moss Bluff | 18. Sulphur |
| 4. Grand Lake | 9. Johnson Bayou | 14. Orange | 19. Vinton |
| 5. Hackberry | 10. Kinder | 15. Port Arthur | 20. Welsh |



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Stemming mounting disaster losses requires...

Field observations driving a critical learning loop: **RESEARCH NEEDS** and **INTERVENTION OPPORTUNITIES**

Loop must capture observations **EFFICIENTLY**, in a manner that is **RELIABLE**, and is **RAPIDLY** disseminated to relevant actors

Will never come full circle without **HUMANS** in the loop



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ACKNOWLEDGEMENTS

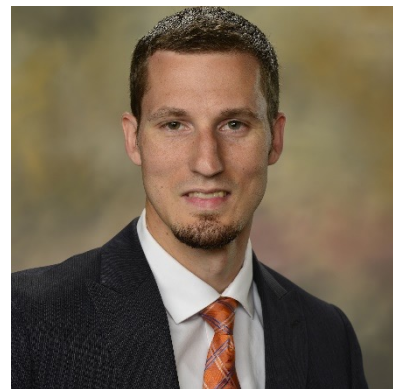


StEER is funded by the National Science Foundation Awards: CMMI 18-41667, CMMI 2103550
Strengthening American Infrastructure (SAI) Project in Lake Charles, LA is also funded by the National Science Foundation:

Any opinions, findings, and conclusions or recommendations expressed are those of the author(s) and do not necessarily reflect the views of the National Science Foundation

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 - Ian Robertson, Associate Director for Coastal Hazards
 - David Roueche, Associate Director for Data Standards
- CONVERGE node and wider Extreme Events consortium
- NHERI RAPID Facility, DesignSafe-CI and SimCenter
- Spatial Networks Inc. (Fulcrum Community)
- Network of organizations & agencies responding to and learning from natural hazard events
- Our Research Associates (M. Alam, A. Safiey), Hazard Advisory Boards, members and their institutions
- Angela Chesler, Debra Javeline, William Kakenmaster



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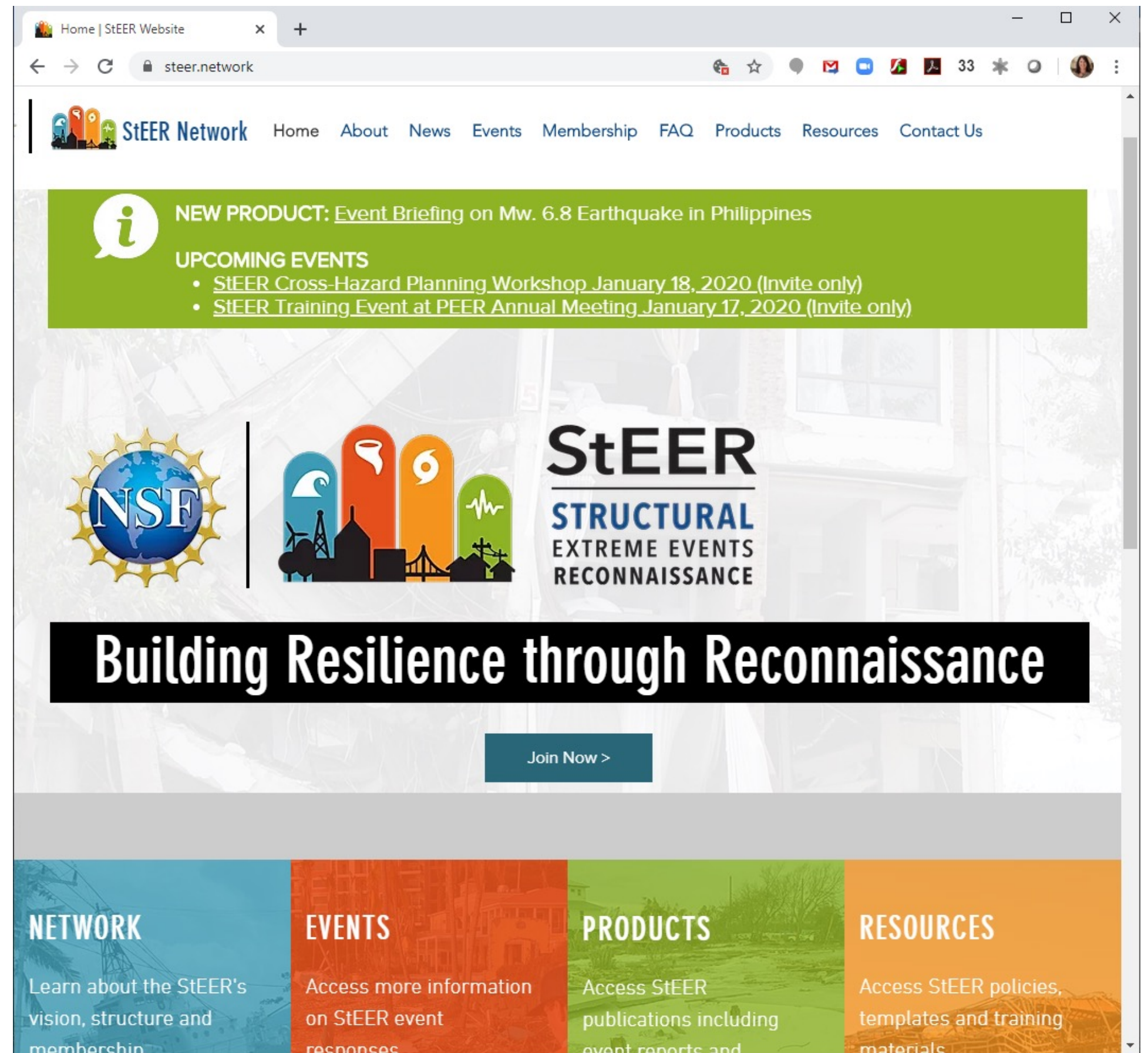
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COLLABORATION OPPPORTUNITIES

- Learn more at www.StEER.network
- Become a member:
 - ✓ Create a DesignSafe account
 - ✓ Activate your Slack account
 - ✓ Complete membership form at www.StEER.network
 - ✓ Review Member Guidelines and accept terms
- Monitor [#steer](#) channel on Slack, email announcements
- Email: admin@steer.network



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