Coordinating After Natural Hazard Events to Document the Performance of the Built Environment: The Structural Extreme Events Reconnaissance (StEER) Network

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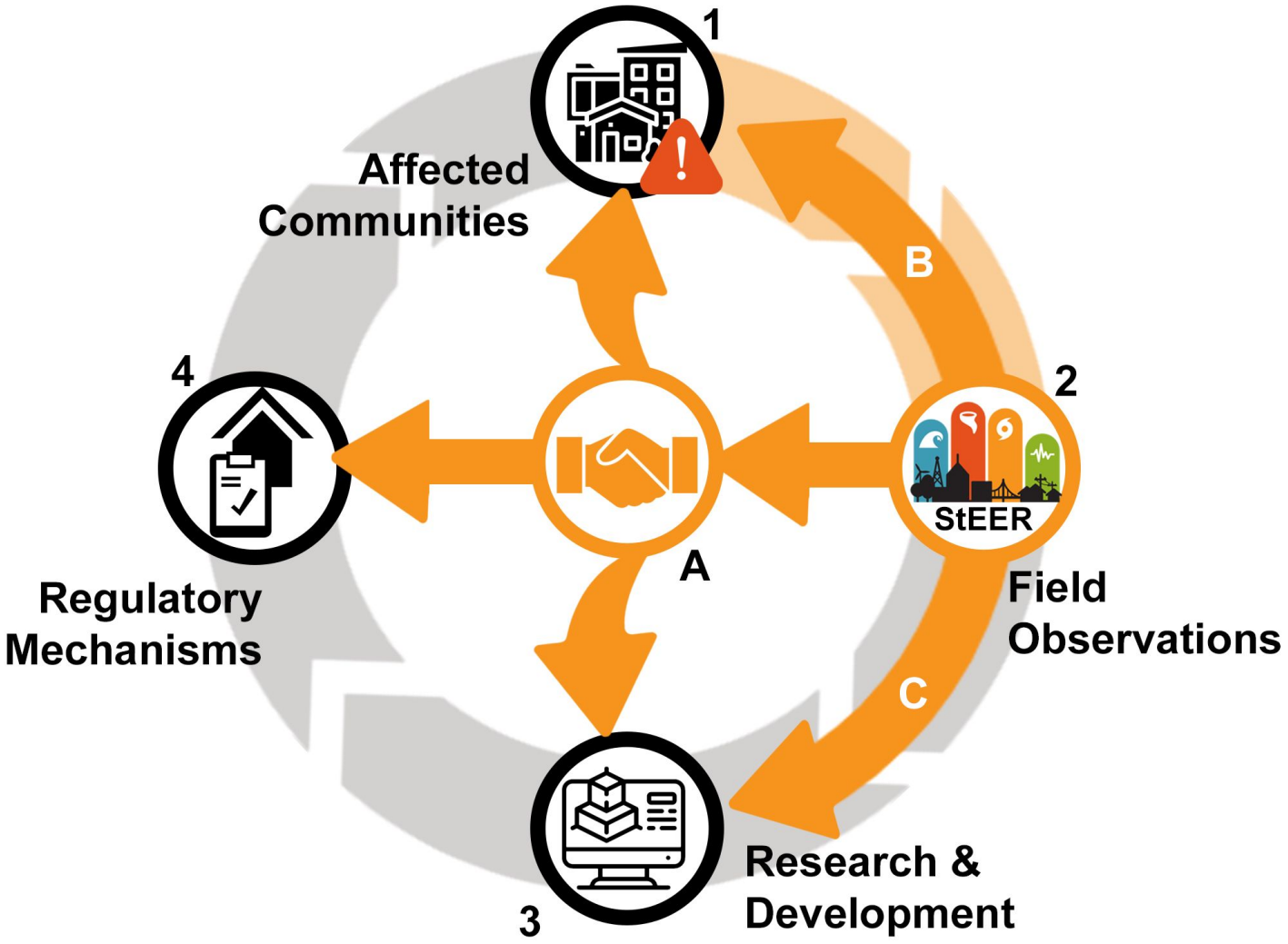
WEBINAR LEARNING OBJECTIVES

Through this webinar you will learn:

- StEER's approach and event response models
- Modes for member engagement through field and virtual structural assessment teams
- Assessment methodologies/technologies
- Role of data standards in delivering well-documented, quality controlled data suitable for diverse re-uses

DATA-TO-KNOWLEDGE LIFE CYCLE



APPROACH

StEER

STRUCTURAL EXTREME EVENTS RECONNAISSANCE

CAPACITY	COORDINATION	COLLABORATION
promoting **community-driven standards**, best practices, and training for field reconnaissance	coordinating **early, efficient and impactful** event responses	broadly engaging communities of **research, practice and policy** to accelerate learning from disasters

PRIMARY OUTCOMES:

- High-quality communal datasets documenting performance of built environment, intended for broad re-uses
- Synthesis of collective knowledge disseminated to wide audiences

Hurricanes

Tornadoes

Earthquakes

Storm Surge and Tsunami

StEER MEMBERSHIP STRUCTURE

300+
Approved Applicants

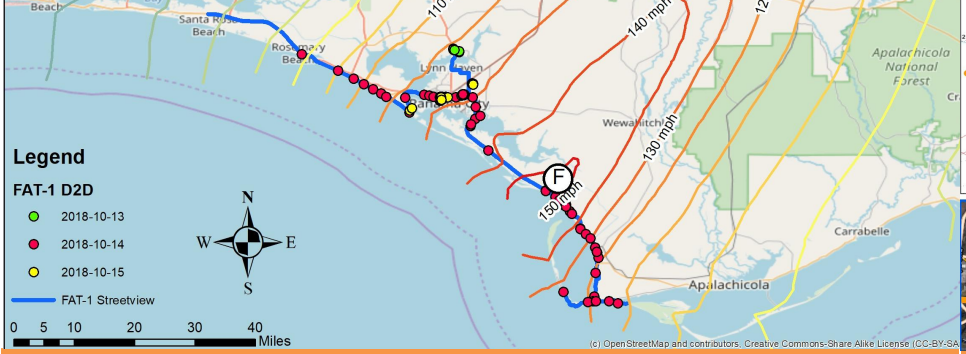
140+
Responding Members

380+
Enrolled Users

	Level 1	Level 2	Level 3	Level 4
VAST: VIRTUAL ASSESSMENT STRUCTURAL TEAM	✓	✓	✓	✓
FAST: FIELD ASSESSMENT STRUCTURAL TEAM		✓ Trainee	✓	✓ Lead
Working Groups			✓	✓
Leadership Team				✓

RESPONSE LEVELS & PRODUCT TMELINE

TIER 1: Major hazard event with little potential to generate new knowledge	• No VAST or FAST • **Event Briefing**
TIER 2: Major hazard event with potential to generate new knowledge	• Activate VAST • **Preliminary Virtual Reconnaissance Report (PVRR)**
TIER 3: Major hazard event with ability to generate new knowledge	• Continue with VAST, Activate FAST • **Early Access Reconnaissance Report (EARR)** • **Curated dataset**



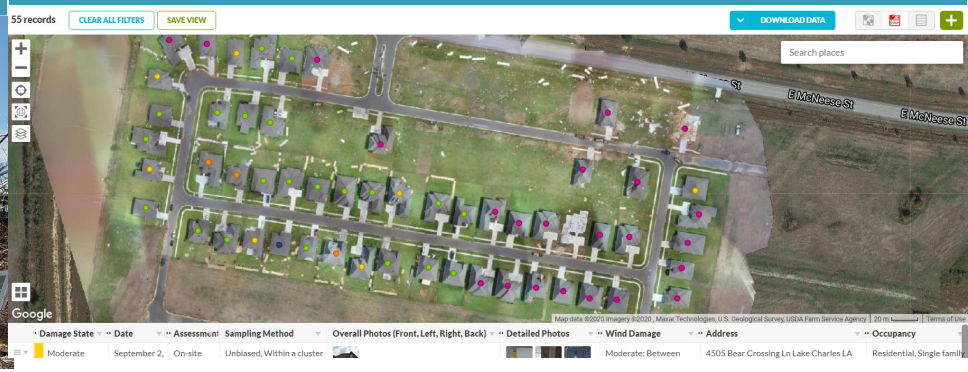
Hazard Gradient Survey: Hurricane Michael

Hazard Gradient Survey: Nashville Tornadoes

Representative Performance Study: Palu Tsunami

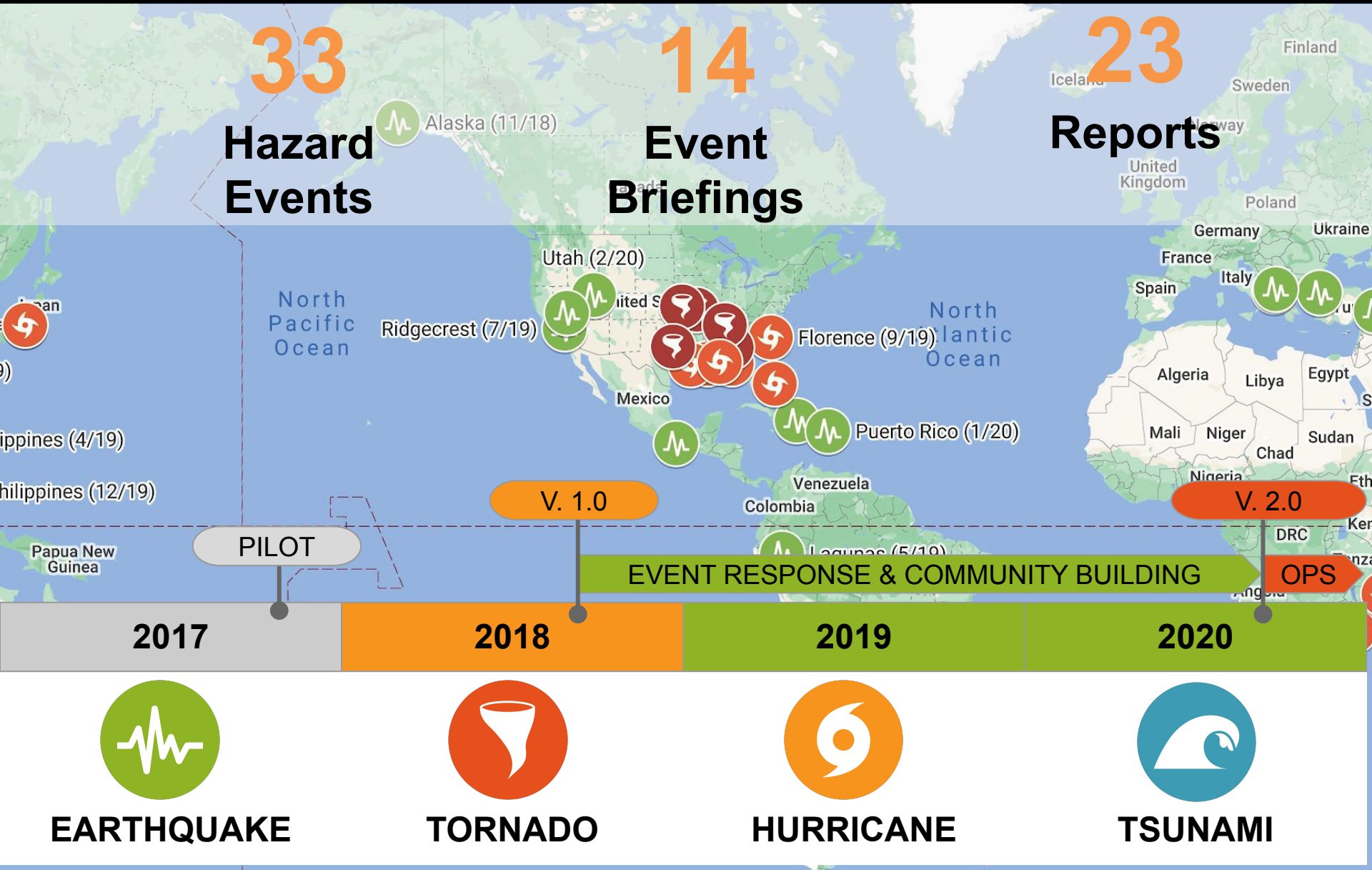
Targeted Case Studies: Puerto Rico Earthquakes

Phased Multi-Hazard Investigation: Hurricane Dorian



Rapid Survey + Virtual Assessment: Hurricane Laura

CHRONOLOGY & GEOGRAPHIC COVERAGE



WORKFLOWS

TYPICAL ASSESSMENT TECHNOLOGIES

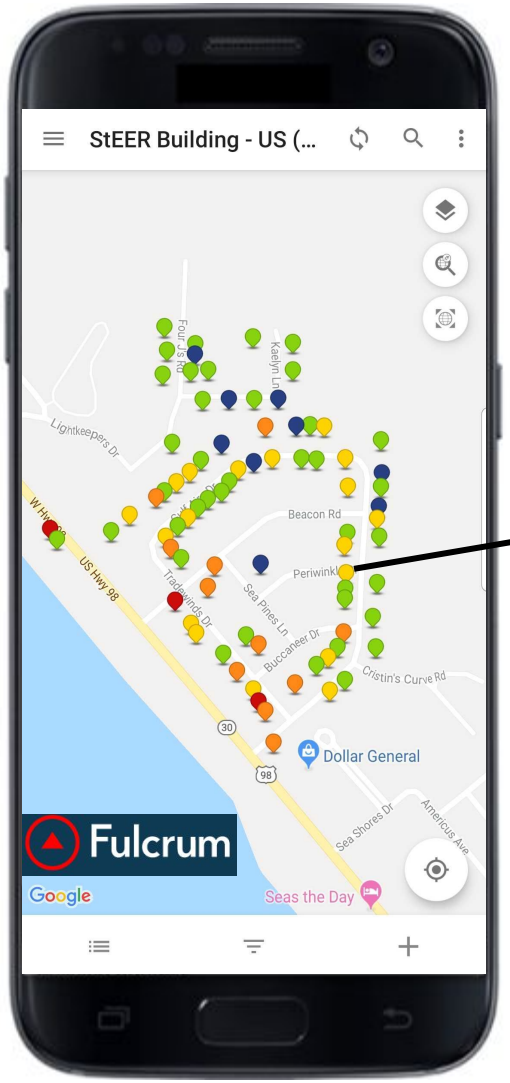
Damage Assessments using Mobile Apps

Unmanned Aerial Systems

Street-level 360 imaging platforms

Terrestrial Scanning Technologies

LEVERAGING MOBILE APPS IN DISASTER RECONNAISSANCE



Photographs

Audio

Free-form Text

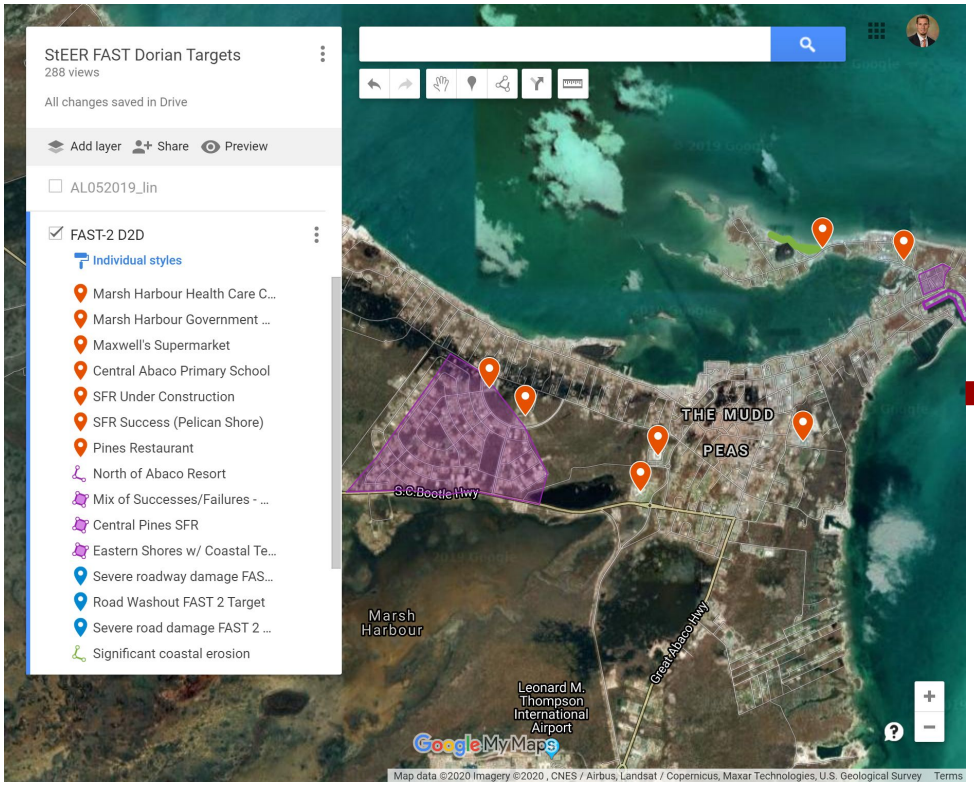
Upper story soffits gone
Garage door gone
Siding failure on right and left wall
Right wall window damaged

Standardized Data Fields

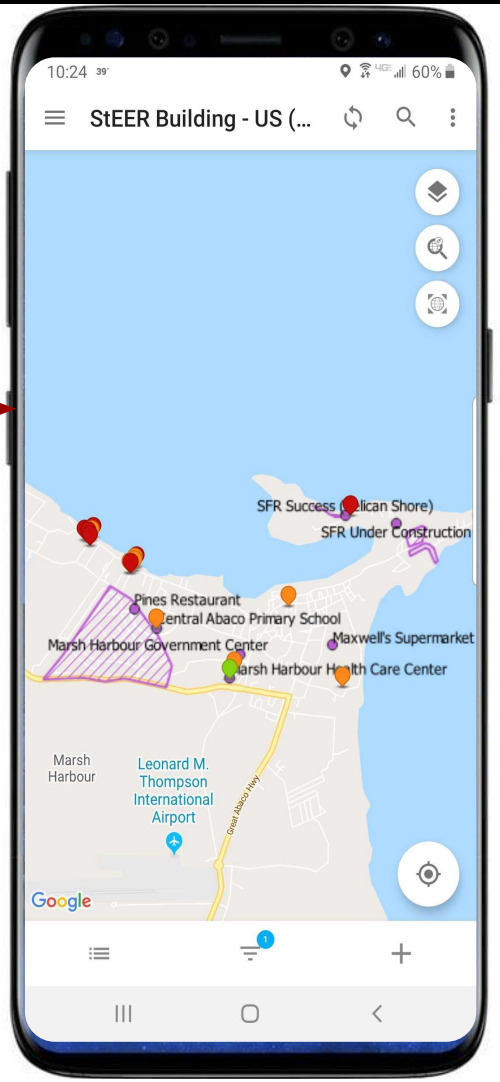
- Investigation Notes
- Building Attributes
- Structural Attributes
- Walls and Foundation
- Fenestration
- Roof Structure
- Wind-induced Damage
- Surge-induced Damage

Multiple data types contained within a single, geolocated record that is easily exportable to common formats: Excel, ESRI Shapefile, GeoJSON, etc

PRE-DEPLOYMENT MISSION DESIGN



Targets synced to Fulcrum for offline access by FAST



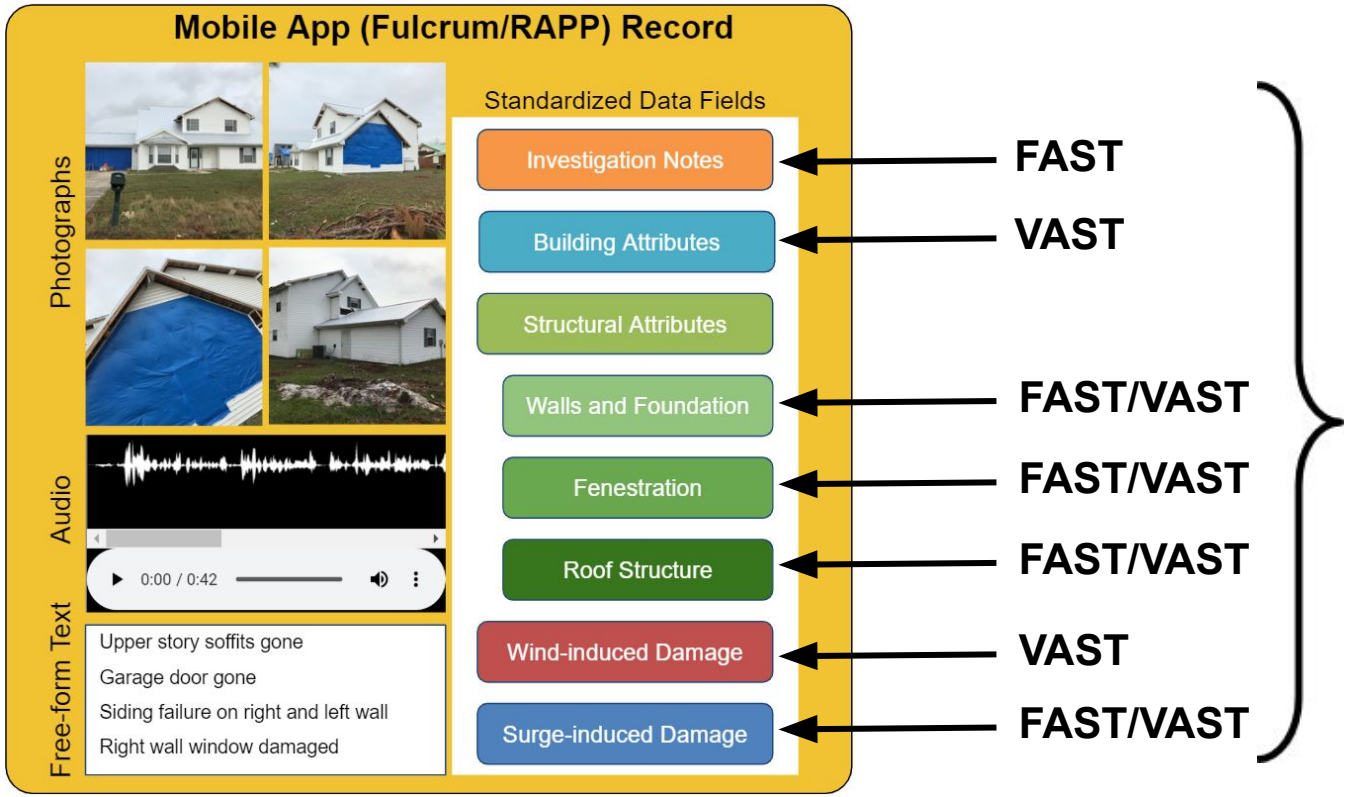
- Satellite imagery, social media used to identify points of interest (successes and failures)
- Representative samples chosen across a diversity of structure typologies
- Typologies matched with expertise of FAST members where possible
- **Pre-selected targets are recommendations - not absolute**

MIXED-METHODOLOGICAL STRATEGY

Overlapping data collection technologies ensure D2D teams can sample efficiently in the field while still capturing the context and broad damage patterns

DATA ENRICHMENT AND QUALITY CONTROL

Field Priority data is captured by FAST on-site. Remaining data is collected by the VAST using the FAST data (all contained within the Fulcrum record) and any available supplemental data.

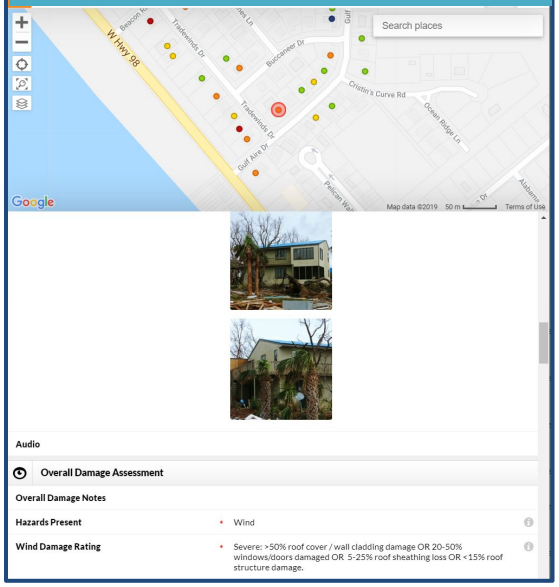


After all data is collected, VAST perform a rigorous Quality Control process on all data to ensure consistency, accuracy, and validity of the data.

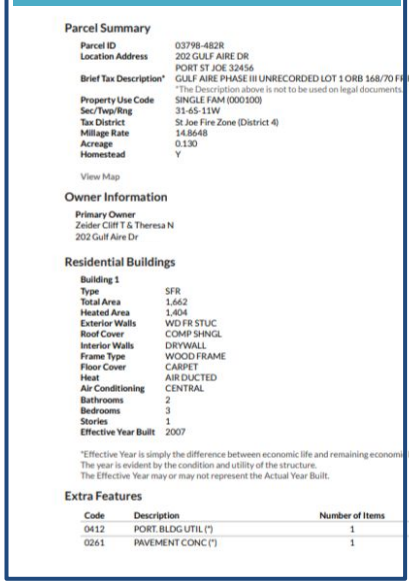
Data Enrichment and Quality Control (DEQC) process is an excellent training opportunity for StEER Level 1 and 2 members and students.

SUPPLEMENTAL DATA SOURCES FOR DE/QC

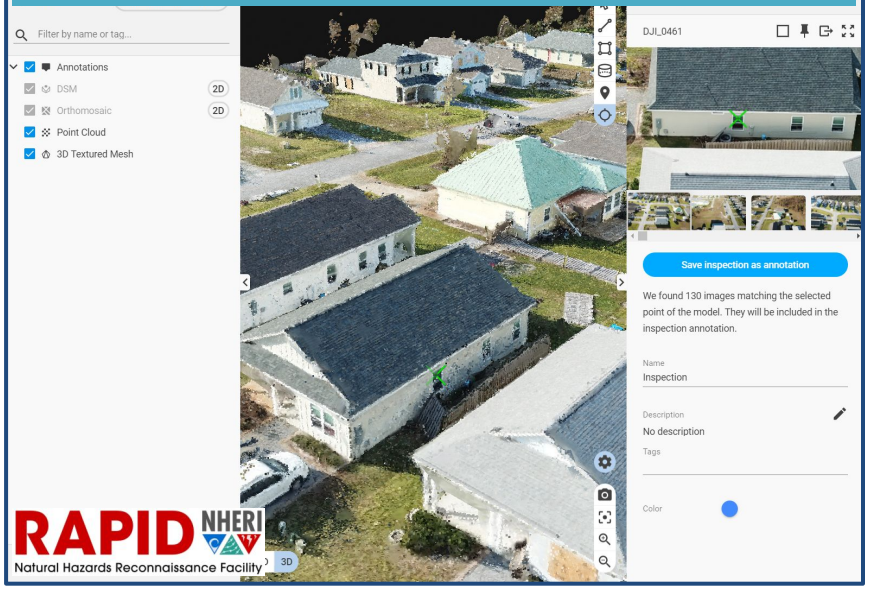
Fulcrum

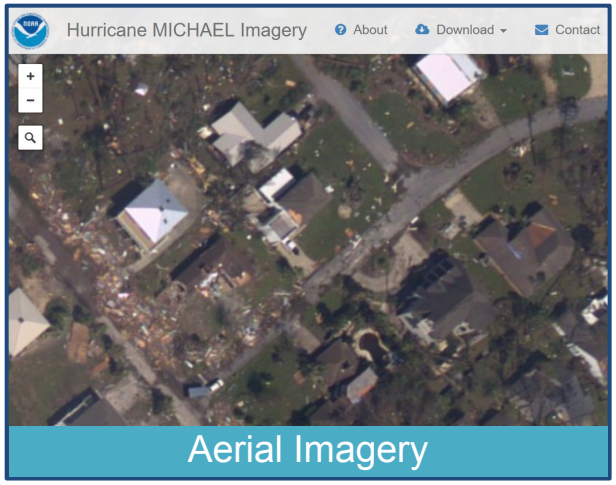


County Records

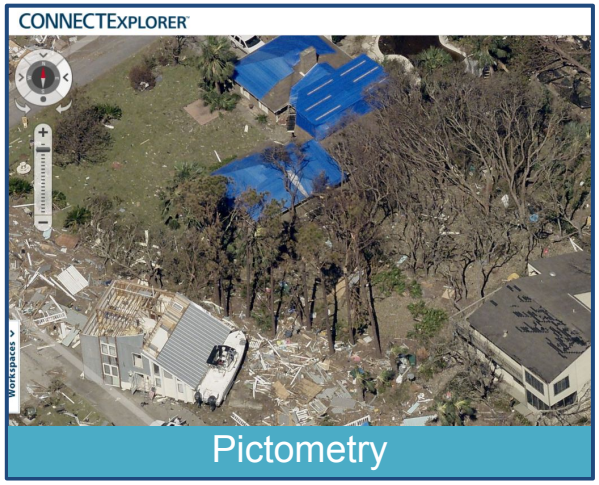


SfM Models / Point Clouds





Aerial Imagery



Pictometry

Street-level 360 Panoramas

DISSEMINATION OF DATA AND KNOWLEDGE

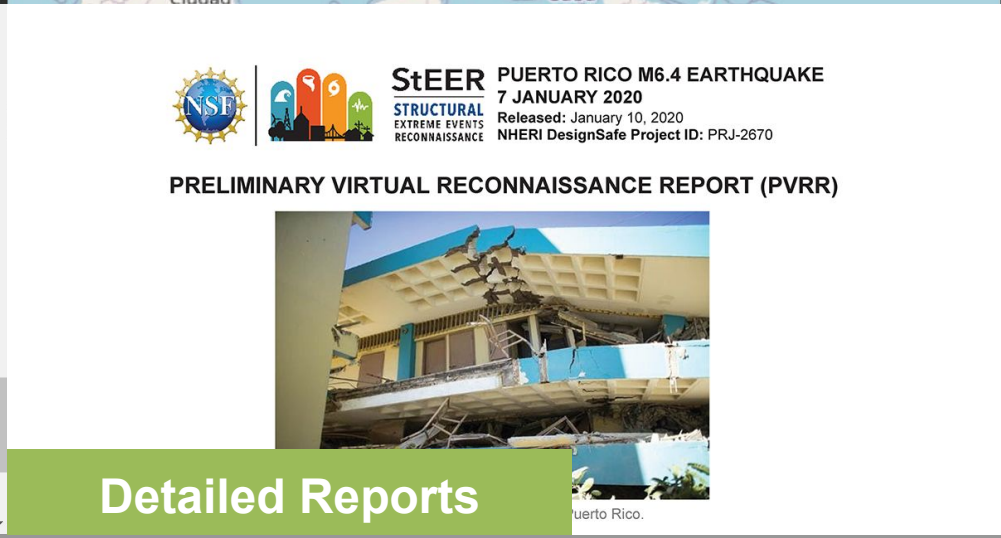
Google Maps/Mapillary

Fulcrum Community

DesignSafe Datasets

ildings. Classes include residential,
ge assessments in Fulcrum, UAS and

- Engineering/Geosciences Collection | **StEER: Daily Summaries**
- Research Planning Collection | **Data Report**
- Research Planning Collection | **Planning Documentation**
- Engineering/Geosciences Collection | **StEER: Other Ground-Based Imagery**
- Engineering/Geosciences Collection | **StEER: Unmanned Aerial Survey**
- Engineering/Geosciences Collection | **StEER: Applied StreetView Technology**
- Engineering/Geosciences Collection | **StEER: Detailed Damage Assessments**



Detailed Reports

CLOSING REMARKS

OUR DISTINCTIVE APPROACH

EARLY	EFFICIENT	IMPACTFUL
Centralized event response with strategic mission objectives	Leveraging virtual reconnaissance	Enriched, standardized and quality controlled data suitable for diverse re-uses

ACKNOWLEDGEMENTS

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  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
- **CONVERGE node and wider Extreme Events consortium:**
  - Geotechnical Extreme Events Reconnaissance (GEER)
  - Nearshore Extreme Event Reconnaissance (NEER)
  - Interdisciplinary Science and Engineering Extreme Events Research (ISEEER)
  - Operations and Systems Engineering Extreme Events Research (OSEER)
  - Social Science Extreme Events Research (SSEER)
  - Sustainable Material Management Extreme Events Research (SUMMEER)
  - NHERI RAPID equipment facility
  - NHERI DesignSafe CI
  - NHERI Network Coordination Office (NCO)
- **Spatial Networks Inc.** (Fulcrum Community)
- **Our members and their institutions**

NHERI
Natural Hazards Engineering Research Infrastructure

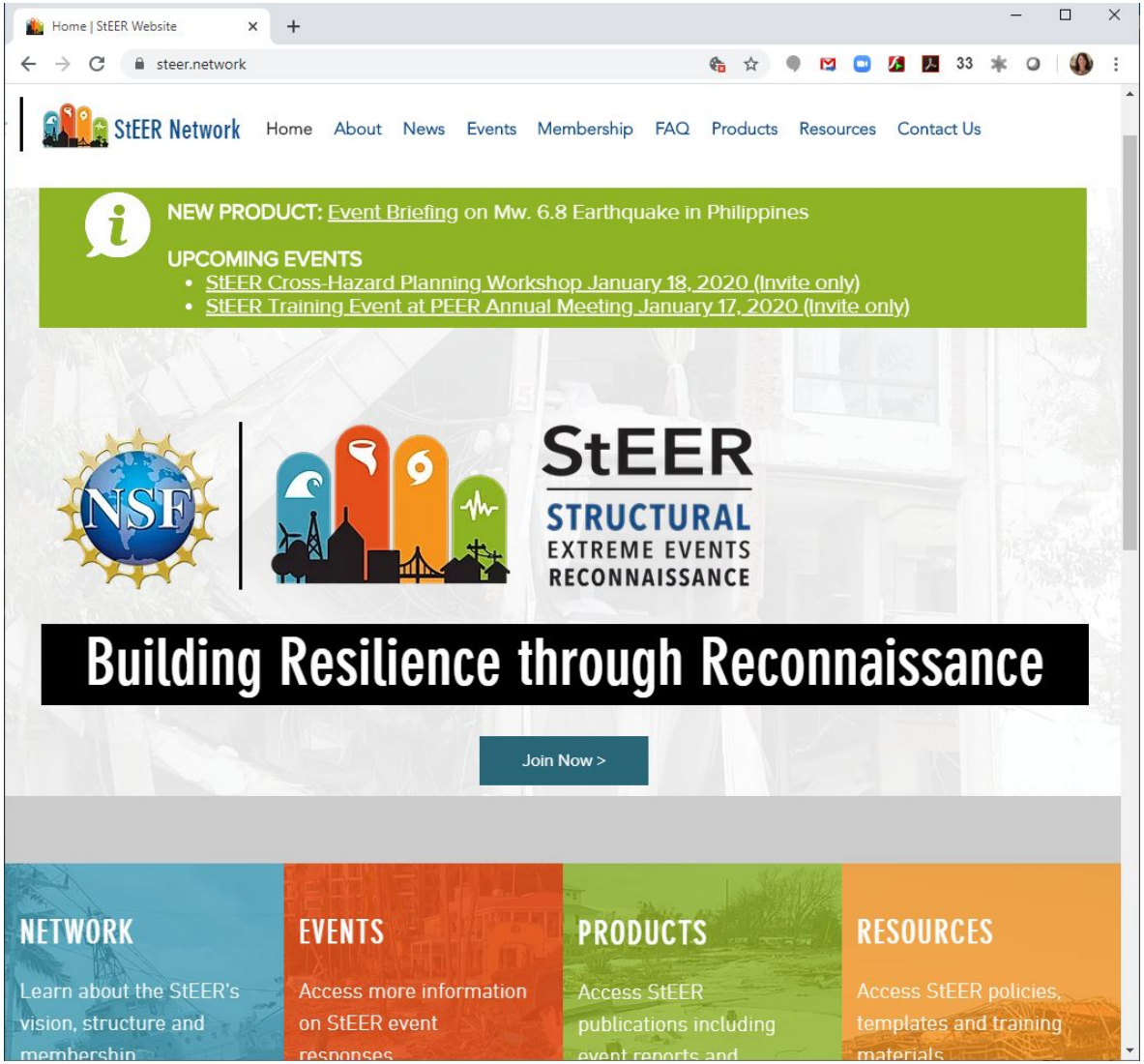
Fulcrum

JOIN OUR EFFORTS

➢ 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

➢ Expanded operations in 2021