



StEER
STRUCTURAL
 EXTREME EVENTS
 RECONNAISSANCE

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PRIORITY RESEARCH AREAS: HURRICANE IAN

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Event Summary: On September 28, 2022, Hurricane Ian made landfall near Cayo Costa, FL as a Category 4 hurricane according to the National Hurricane Center, with peak sustained wind speeds over water estimated at 150 mph, a minimum surface pressure of 940 mb, and preliminary storm surge inundation measurements of 13 ft relative to NAVD88. The results were catastrophic in terms of both damage to infrastructure and loss of human life on the densely-populated west coast of Florida, particularly in the barrier islands off Ft. Myers and Cape Coral.



Available Data: [Street-level panoramas](#) were collected by Site360/StEER's, with UAV collected by the RAPID EF, and performance assessments and High Water Marks (FulcrumApp.com). See <https://www.steer.network/hurricane-ian> for links to all data sources and assets.

Available Briefings/Reports: [PVRR](#)




Priority Proposal Topics: StEER members have been encouraged to develop proposals in the following topical areas.

 = Engineering Study;  : Interdisciplinary Study

TOPIC 1: Performance of Elevated Buildings Subjected to Coastal Hazards		
RAPID Proposal Opportunity	<ul style="list-style-type: none"> ● Gather evidence to quantify uplift (buoyancy and hydrodynamic) forces acting on the floor slabs of elevated buildings due to storm surge and wave action, reviewed in the context of the ASCE 7-22 Chapter 6 Tsunami Loads and Effects and the soon to be released Supplement 3 of ASCE 7-22 Chapter 5 on Flood Loads. ● Document performance of breakaway walls and other surge damage mitigation measures used in coastal buildings. ● Document performance of mechanical, electrical, and plumbing (MEP) systems (e.g., plumbing, electrical, HVAC) in maintaining and restoring functionality in line with performance goals. ● Document evidence of scour and overall performance of foundations and in-situ geotechnical conditions. 	

	<ul style="list-style-type: none"> Document types of floating debris, evidence of impacts and damming of floating debris against structural components that may lead to increased hydrodynamic loads.
Data Re-Use Opportunity	<ul style="list-style-type: none"> Case study selection using street-level panorama data and UAV imagery
TOPIC 2: Characterization and Prediction of Coastal Hazards	
	
Unsolicited Proposal Opportunity	<ul style="list-style-type: none"> Capture field measurements of the depth of inundation, wave heights, flow velocity and debris fields around structures in populated coastlines affected by storm surge. Use these observations to validate and improve existing storm surge models that extend to flow overland to: (1) characterize hazard intensity in support of Topic #1, (2) model debris transport and impact, including source and characteristics of the debris, velocity, and damming effects, (3) capture effects of channeling and sheltering effects due to interaction with built environments, and (4) enable rapid inundation forecasting for emergency management purposes. Continue to advance capabilities to model compound flooding that captures the interaction between storm surge and rainfall-induced inland flooding. Continue to promote the development of risk-consistent storm surge hazard maps that establish an appropriate mean recurrence interval for the design of coastal structures, including examination of the appropriateness of the 100-year floodplain.
Data Re-Use Opportunity	<ul style="list-style-type: none"> High Water Marks (Fulcrum)
TOPIC 3: Performance of Nature-Based Protective Systems	
	
RAPID/ Unsolicited Proposal Opportunity	<ul style="list-style-type: none"> Conduct longitudinal studies to document damage to and recovery of the nature-based protective systems across a gradient of hazard intensities to quantify the fragility of such systems. Document the impacts of the nature-based protective systems in reducing flow velocity, wave heights, and other specific hazard measures and thereby mitigating damage to coastal communities. Sanibel Island may be a particularly rich area for focused study.
Data Re-Use Opportunity	<ul style="list-style-type: none"> High Water Marks (Fulcrum) and UAV imagery



TOPIC 4: Performance of Infrastructure Under Coastal Hazards		
RAPID/ Unsolicited Proposal Opportunity	<ul style="list-style-type: none"> • Conduct in-depth investigations on the performance of coastal infrastructure, focusing on notable case studies such as bridges/roadways serving the affected barrier islands, to enhance understanding of hazard loading and failure mechanisms of critical coastal roadways and other infrastructure. Studies should characterize (i) hydrodynamic loads, (ii) scouring processes, and (iii) anticipated damage levels under different scenarios to inform the development of more resilient protective measures. • Project long-term impacts of coastal hazards on transportation infrastructure and causeway islands, including how sea level rise, increasing storm frequency/intensity, and coastal morphology may change future threats. Studies should explore coastal erosion processes in relation to (a) the direction of the storm surge and wave propagation, (b) the distance of the road from the shore, and (c) the duration of road exposure to storm surge, waves and scour. 	
TOPIC 5: Performance of Power Infrastructure under Combined Hazards		
Unsolicited Proposal Opportunity	<ol style="list-style-type: none"> 1. Quantify physical infrastructure failure probabilities and performance of backup power systems used for other lifelines over areas facing coastal and inland flooding, framed within the context of design hazard levels and overall community resilience objectives. 2. Document the performance of renewable energy sources and systems such as solar panels to enable continuous or immediate functionality, including successes and failures to inform evolving ASCE 7 provisions for resilient design of these systems. 	
Data Re-Use Opportunity	<ul style="list-style-type: none"> • Case study selection using street-level panorama data and UAV imagery 	
TOPIC 6: Data synthesis and processing		
Unsolicited Proposal Opportunity	<ol style="list-style-type: none"> 1. Create machine-augmented visualization and automated processing tools to swiftly synthesize the vast amounts of geospatial data generated by Hurricane Ian (and other storm events) in support of any of the above topics. Capabilities should include methods for feature extraction as well as feature evolution over longitudinally-collected datasets. 2. Create a web-based clearinghouse for Hurricane Ian (similar to EERI Clearinghouses for earthquakes) to catalog the data generated by multiple agencies and organizations collecting hazard and impact data, beginning with the data shared on #hurricane-ian-2022 Slack channel. 	



	<p>Identification of a responsible agency will further ensure that this model can be long-term supported and replicated for future hurricanes and even for legacy events.</p>
Data Re-Use Opportunity	<ul style="list-style-type: none"> • Street-level panorama data and UAV imagery
<p>TOPIC 7: Effects of Hurricane Ian on Risk Perception, Preparedness and Mitigation</p>	
Human Subject Research (RAPID/ Unsolicited Proposal)	<ol style="list-style-type: none"> 1. Despite the successes of the Florida Building Code in delivering resilient new construction, devastating losses in construction that pre-dates these codes warrants human subjects research to determine what defines acceptable performance of coastal residential buildings and the messaging/incentives that can drive voluntary retrofit and/or managed retreat. 2. Significant loss of life in this event suggests a need to understand how evacuation sequencing, risk communication, and risk perception influenced fatal shelter-in-place decisions, as well as potential challenges in evacuating elderly/vulnerable populations without vehicles over short evacuation timelines.
Data Re-Use Opportunity	<ul style="list-style-type: none"> • Street-level panorama data and UAV imagery can be used to determine the level of damage sustained to the respondent's property.



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Research Priorities: Hurricane Ian
 Released: 16 November 2022
Building Resilience through Reconnaissance