DESIGNSAFE-CI
A NATURAL HAZARDS ENGINEERING COMMUNITY

Lessons Learned from Developing a Comprehensive CI for Natural Hazards

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What is DesignSafe?

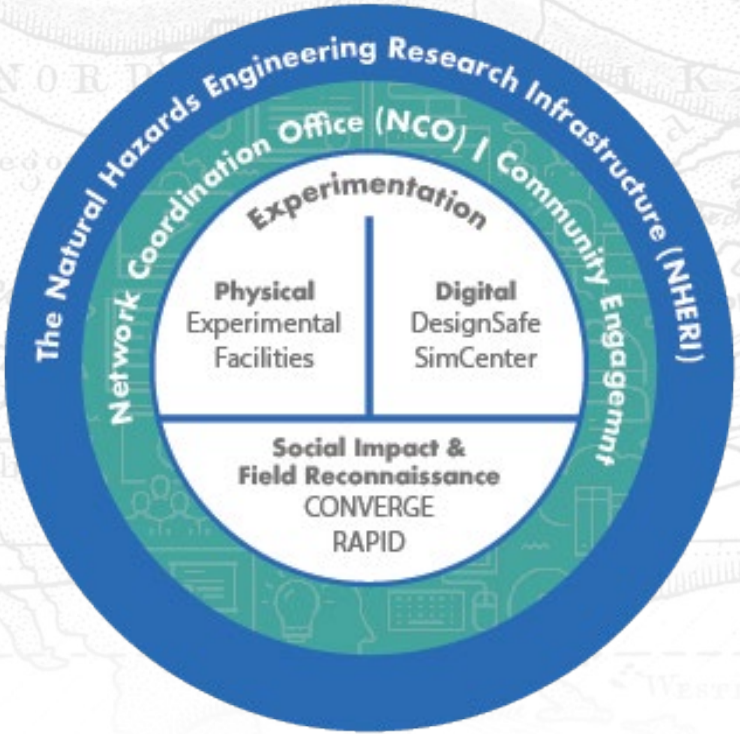
- A web-based research platform that enables transformative research that protects human life and reduces damage during natural hazard events

DesignSafe Vision

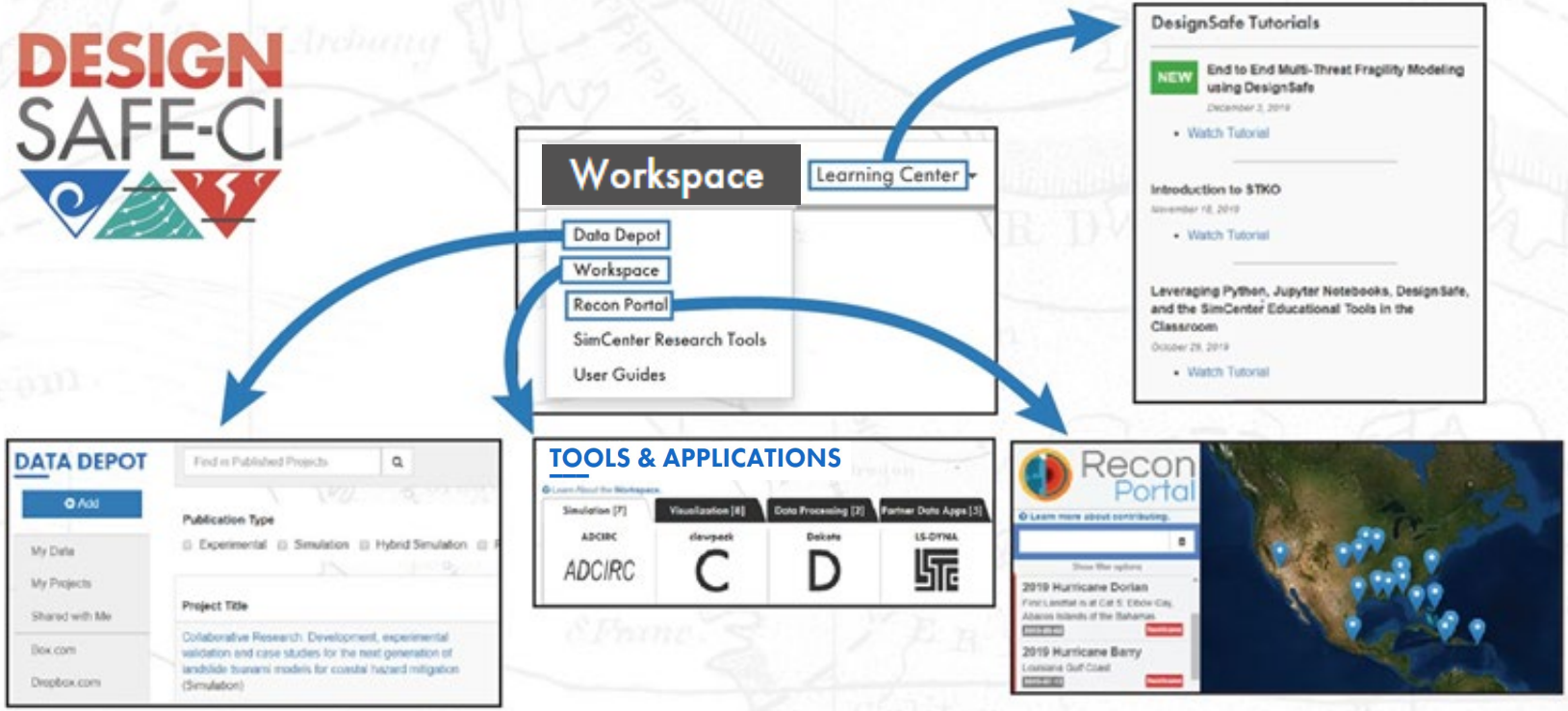
- A cyberinfrastructure (CI) that is an integral part of research discovery
  - Provide a platform for data sharing/publishing
  - Enable research workflows and access to high performance computing (HPC)
  - Deliver cloud-based tools that support the analysis, visualization, and integration of diverse data types
- Amplify and link the capabilities of natural hazards researchers in the US and abroad

NHERI

Natural Hazards Engineering Research Infrastructure

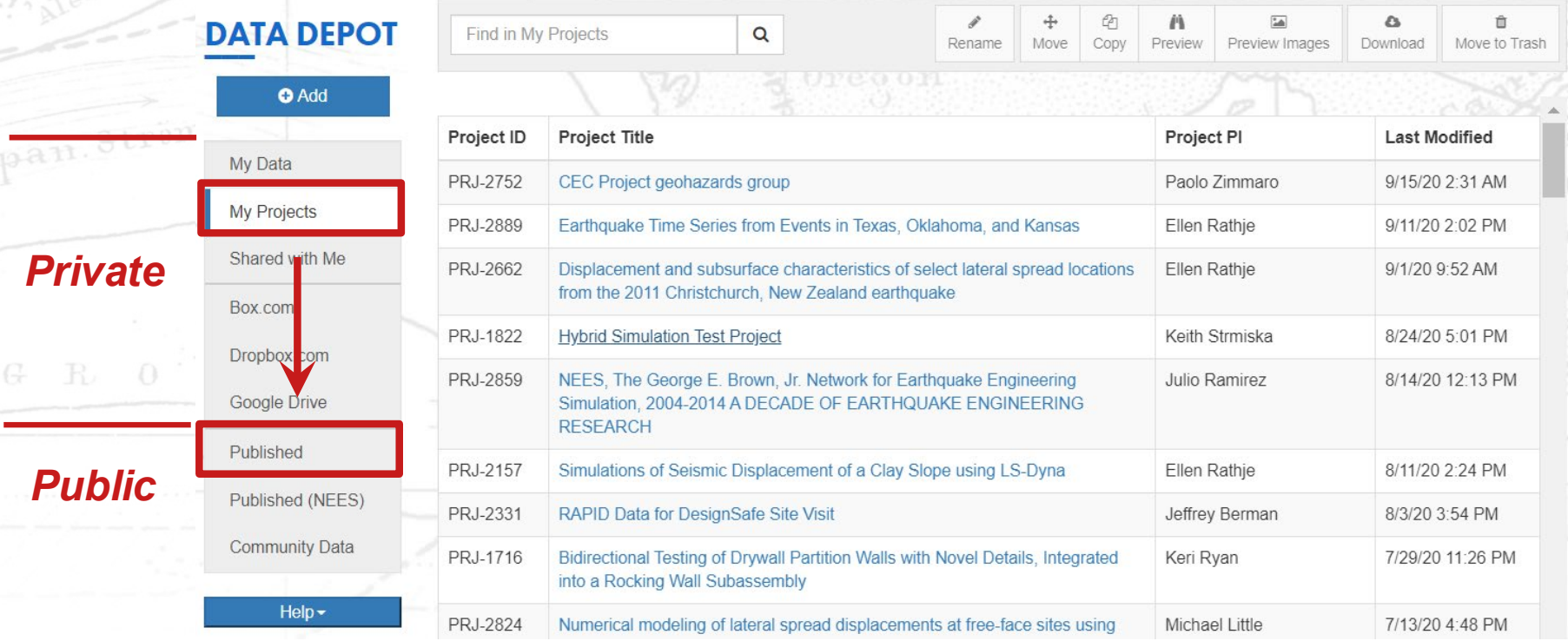


DESIGN SAFE-CI



www.designsafe-ci.org

Data Depot


DATA DEPOT
Add
My Data
My Projects
Shared with Me
Box.com
Dropbox.com
Google Drive
Published
Published (NEES)
Community Data
Help
Private
Public
Find in My Projects
Rename
Move
Copy
Preview
Preview Images
Download
Move to Trash
Project ID
Project Title
Project PI
Last Modified
PRJ-2752
CEC Project geohazards group
Paolo Zimmaro
9/15/20 2:31 AM
PRJ-2889
Earthquake Time Series from Events in Texas, Oklahoma, and Kansas
Ellen Rathje
9/11/20 2:02 PM
PRJ-2662
Displacement and subsurface characteristics of select lateral spread locations from the 2011 Christchurch, New Zealand earthquake
Ellen Rathje
9/1/20 9:52 AM
PRJ-1822
Hybrid Simulation Test Project
Keith Strmiska
8/24/20 5:01 PM
PRJ-2859
NEES, The George E. Brown, Jr. Network for Earthquake Engineering Simulation, 2004-2014 A DECADE OF EARTHQUAKE ENGINEERING RESEARCH
Julio Ramirez
8/14/20 12:13 PM
PRJ-2157
Simulations of Seismic Displacement of a Clay Slope using LS-Dyna
Ellen Rathje
8/11/20 2:24 PM
PRJ-2331
RAPID Data for DesignSafe Site Visit
Jeffrey Berman
8/3/20 3:54 PM
PRJ-1716
Bidirectional Testing of Drywall Partition Walls with Novel Details, Integrated into a Rocking Wall Subassembly
Keri Ryan
7/29/20 11:26 PM
PRJ-2824
Numerical modeling of lateral spread displacements at free-face sites using
Michael Little
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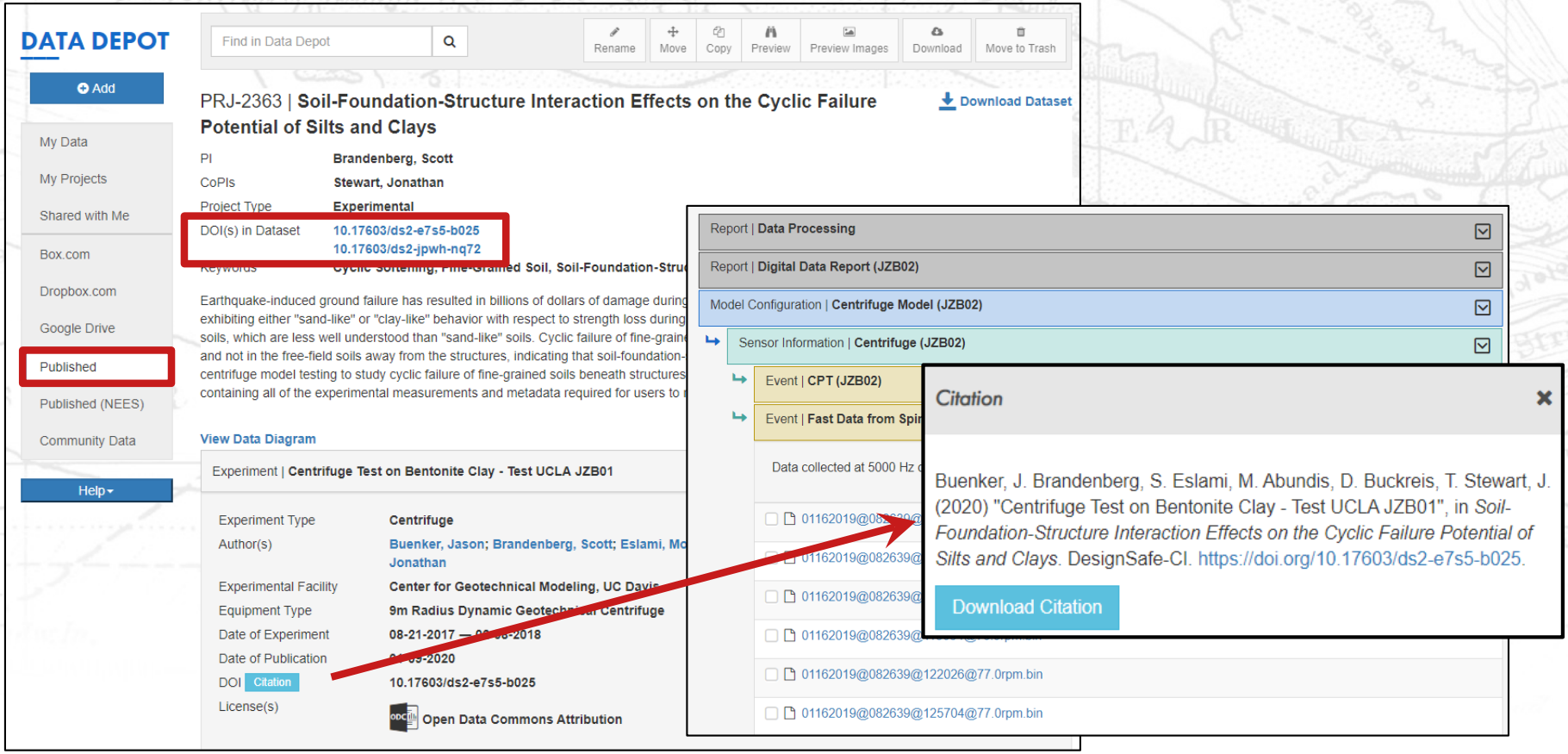


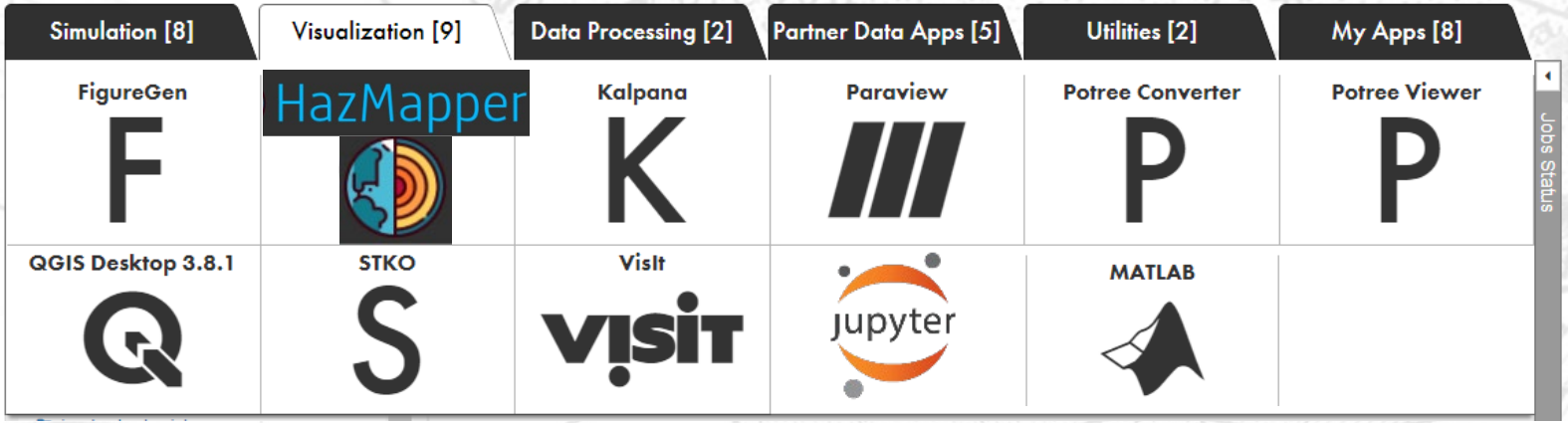
NSF | DESIGNSAFE-CI NHERI: NATURAL HAZARDS ENGINEERING RESEARCH INFRASTRUCTURE | TEXAS The University of Texas at Austin | UCLA | TACC | RICE | Florida Tech

DesignSafe Data Models

Structured, yet ***flexible***, data models for different types of research

- **Experimental Project**
  For physical work, typically done at an experimental facility or in the field.
- **Simulation Project**
  For numerical and/or analytical work, done with software.
- **Hybrid Simulation Project**
  For work using both physical and numerical components.
- **Field Research Project**
  For work done by observation in areas affected by a natural hazard.
- **Other Project**
  For work other than the project types above.

Tools and Applications



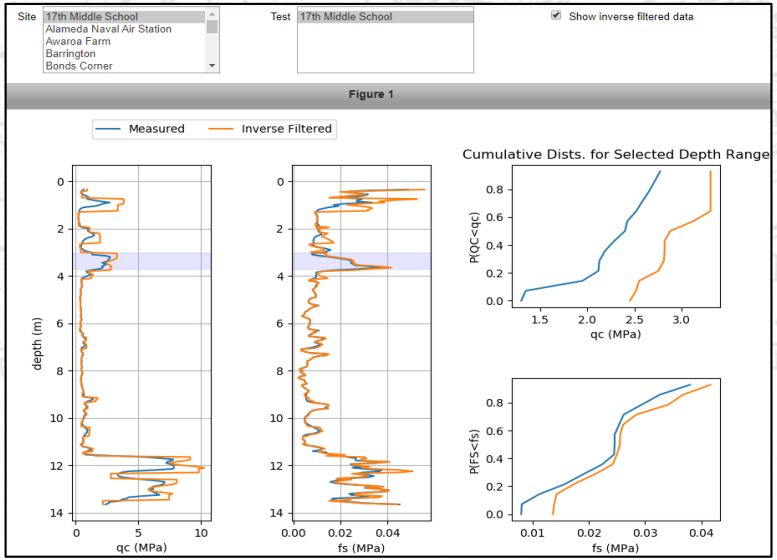
- Simulation codes on high performance computing (HPC) resources
  - OpenSees, LS-Dyna, ADCIRC + SWAN, OpenFOAM
- Cloud-based tools for data analysis and visualization

Jupyter Notebooks

- Electronic notebooks in Python or R
- JupyterHub in DesignSafe
  - Access to Data Depot files
- Interactive data viewer
- Can write scripts for data processing, AI or machine learning
- Publish for use by others
- Accelerates data reuse, adoption of approaches into practice

jupyterhub

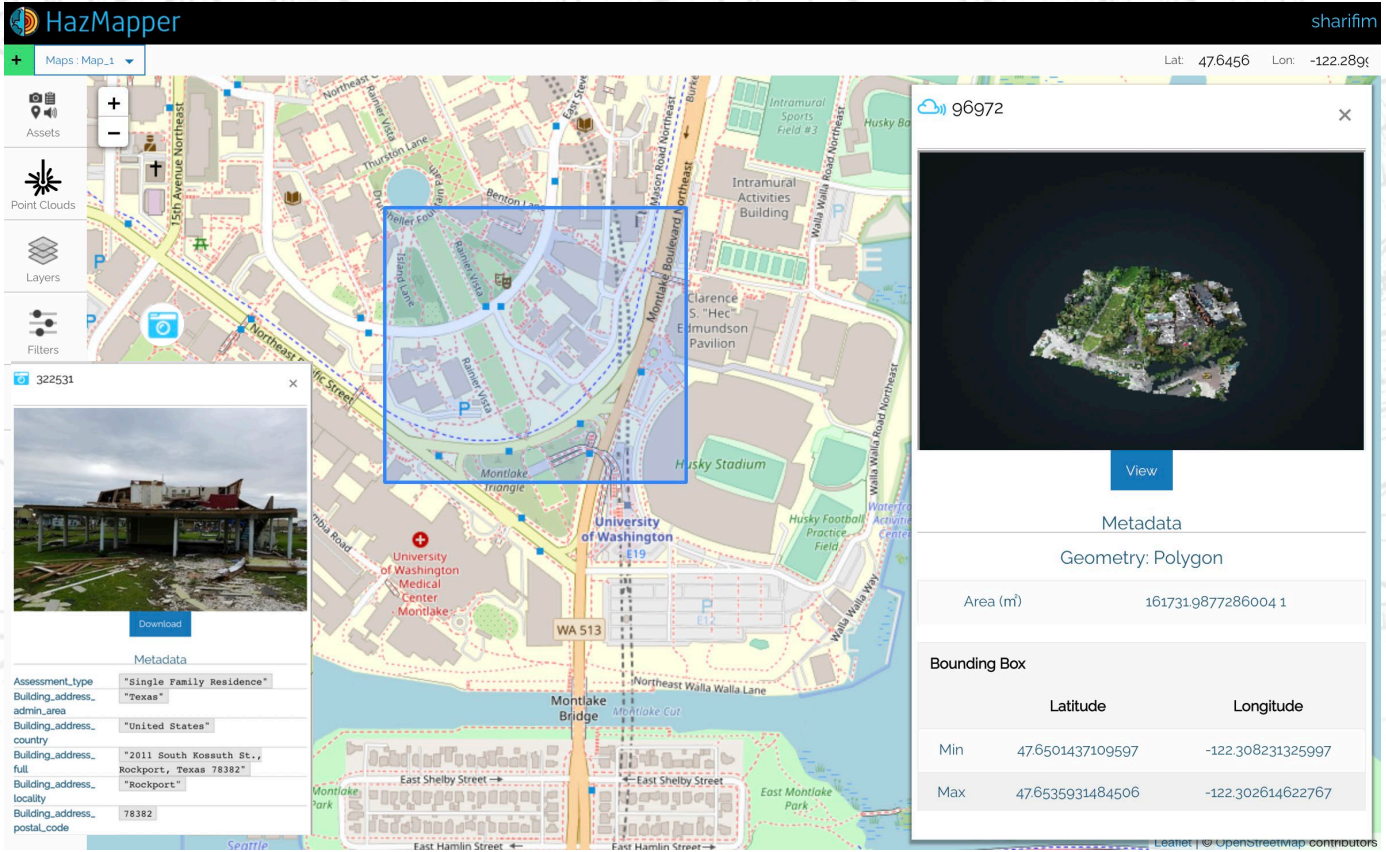
Next Generation Liquefaction



From Scott Brandenberg (UCLA)

HazMapper

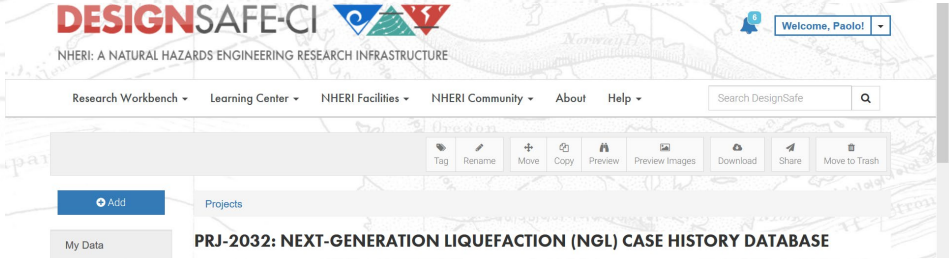
- Easy access to images and point cloud data
- Location and preview exposed
- Link to Potree viewer provided



Support for Structured Databases

- NGL: Community database of liquefaction case histories
- Data housed in SQL database with its own schema
- Database replicated to DesignSafe daily
- Jupyter notebooks to access data available in DesignSafe

NGL NEXT GENERATION LIQUEFACTION



From P. Zimmaro, UCLA

A Little History…

- NEES (for earthquakes) was the predecessor of NHERI
  - 2000-2004: NEES facility and CI development (CI-1)
  - 2004-2009: NEES Operations (CI-2)
  - 2009-2014: NEES Operations recompeted (CI-3)
  - 2015-2020: NHERI-DesignSafe (CI-4)
  - 2020-2025: NHERI-DesignSafe renewal (CI-4)

Lessons Learned: leadership

- Partnership between domain scientists and CI specialists
  - DesignSafe PIs are researchers in natural hazards
  - Leadership team includes PIs and TACC Director/Staff
  - Working with TACC allows us to leverage expertise as needed
- Develop a cyberinfrastructure that can evolve and grow
  - Top down (CI staff → domain) AND bottom up (domain → CI)
  - Don't be afraid to modify your plan (e.g., Jupyter)
  - Being a part of TACC allows us to maintain state-of-the-art CI

Lessons Learned: user needs

- Data publishing and sharing
  - Make data publishing easy ("give me tools not rules")
  - Data publishing as a goal rather than a technical requirement
  - Educate the community about citing data to properly credit others
  - Younger researchers are the most open to sharing (open source generation)
- Broader vision in terms of the goals of the CI
  - Enable research workflows, provide access to HPC, deliver cloud-based tools for analysis, visualization, etc. – what do users want/need?
  - Meet the needs of a diverse user base from novice to power users

Lessons Learned: usage

- Promoting adoption of CI
  - Highlight real research examples that utilize the CI
  - Advanced user support for early adopters
  - Training webinars and online resources

Metric	Year 2	Year 3	Year 4	Year 5+
Registered Users	500	1,942	3,523	5,709
User Data	16.5 TB	45 TB	110 TB	487 TB
Published Datasets	1	41	131	336
Views of training / yr	2,699	15,795	49,724	53,519
Citations of DS	1	8	25	98