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# Collaborative Research: 3D Ambient Noise Tomography (3D ANT) for Natural Hazards Engineering

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## Data Management Plan

**Types of Data:** The expected data from the proposed research will primarily consist of seismic waveforms collected from a 2D grid of surface sensors during ambient noise and active-source excitation. These waveforms will be saved in miniseed file and SEG2 formats. Data will be archived in the NHERI *DesignSafe-CI* data depot (https://www.designsafe-ci.org/data/browser/public/nees.public/) and posted as open-access for use by any other interested parties in the future.

The data will also be used to create derivative products such as graphs, tables, plots, and 3D subsurface models, which will eventually form the basis for conference and journal papers. Graphs, tables, plots, etc. will be created in Excel, MATLAB, Python, and/or other software. In addition to these source files, we will generate final copies of such products as .pdf files. Documents will be stored in Microsoft Word and PowerPoint, or other similar file types, as appropriate.

The 3D Ambient noise tomography (3D ANT) algorithm developed in this project will be archived as both source code (e.g., MATLAB, Python) and compiled executables. These will include guidelines on how to use the 3D ANT program (e.g., "README" files) as well as sample data files.

**Data and Metadata Standards:** In order for the data developed as part of this study to be retrievable, accessible, and re-usable for project team members and others wishing to use the data for subsequent studies, we will make use of the *DesignSafe-CI* data and metadata protocols. The *DesignSafe-CI* platform will allow for easy data storage (in the Data Depot), data tagging, and metadata extraction. The new data model mapping protocol will assist in illustrating the intended workflow for retrieval and access of deposited data. Data will be readily citable using the new DataCite metadata scheme developed by the *DesignSafe-CI* team.

**Policies for Access and Sharing:** All data collected and generated will be deposited in the *DesignSafe* Data Depot from the inception of the research project. During research activities, data will be shared with the research team members directly through the Data Depot. Team members will be responsible for curating the data developed as part of their tasks in a progressive manner using the tools and facilities provided by *DesignSafe* for the purpose of keeping track, describing, and organizing the data and while conducting analysis using the *DesignSafe* Discovery Workspace. Data in the *DesignSafe* Data Depot will be version controlled to prevent the possibility of overwriting previous observations and analyses. The *DesignSafe-CI* includes a public data repository that supports searching, browsing, sharing, downloading and reusing free and unrestricted (beyond citation requirements) data and supporting documents. After data are curated and ready to be published, they will receive a DOI for persistent identification, citation, and sharing.

**Policies for Reuse and Redistribution:** The PIs will share the results of the proposed activity with other researchers within a reasonable time in order to conform to the NSF policy on dissemination and sharing of research results. To ensure the quality of the data, the PIs will only release data after the peer review process has been completed. The results will also be accessible through publications, seminars, and workshop slides. Specifically, the research findings of the proposed activity will be presented promptly in local, regional, and international conferences. The PIs will publish the outcomes of the research through journal papers. Candidate journals include: *Geophysics*, *ASCE Journal of Geotechnical and Geoenvironmental Engineering, Earthquake Spectra,* and *Soil Dynamics and Earthquake Engineering,* or other research journals of similar

quality. The PIs will also publicize the research results on their websites via images, multimedia slides, or video presentations. All data will be uploaded and secured using the *DesignSafe-CI* Data Depot prior to release to the broader community.

During data upload to the *DesignSafe-CI*, a data license will be acquired as part of the Data Depot standard. The *DesignSafe* Data Depot is an open repository and therefore offers the following licenses:

- For datasets: ODC-PDDL and ODC-BY (described at opendatacommons.org)
- For copyrightable materials (for example, documents, workflows, designs, etc.): CC0 and CC-BY(described at creativecommons.org)
- For code: any open, non-commercial license (GNU General public license)

**Archival and Preservation**: The *DesignSafe* Data Depot has been developed to meet NSF requirements for archival and preservation. The *DesignSafe-CI* will maintain all uploaded data in the cyber infrastructure supported by the Texas Advanced Computing Center, which is redundant and geographically replicated. The Texas Advanced Computing Center has put in place those features that will ensure the authenticity, integrity, security and persistence of the datasets for open access. The *DesignSafe-CI* is committed to the continuity of data preservation and will ensure preservation beyond the conclusion of the *DesignSafe* project.

**Post-award monitoring**: After an award is made, data management will be monitored primarily through the normal annual and final report process to NSF.