# NHERI SimCenter tools

## BRAILS

As the research team started this idea-turned-project we planned to utilize NHERI SimCenter tools and workflows. At 1st, we started using Building Recognition using AI at Large-Scale (BRAILS) <https://simcenter.designsafe-ci.org/backend-components/brails/>. Despite the great promise of creating our own building inventory data, we realized that BRAILS, through a sophisticated combination of OSM and Google Streetmap APIs, was fetching random samples of physical images of the buildings within a requested jurisdiction that subsequently were identified. The unexpected surprise to us was that the process was linear, O(n), which meant that for 1 million and more buildings, the process would’ve taken months of uninterrupted processing; then we stumbled upon a couple of show-stopper defects as outlined on the SimCenter Forum:

[ValueError: zero-size array to reduction operation minimum which has no (designsafe-ci.org)](https://simcenter-messageboard.designsafe-ci.org/smf/index.php?topic=324.0)

[ValueError: attempt to get argmin of an empty sequence (designsafe-ci.org)](https://simcenter-messageboard.designsafe-ci.org/smf/index.php?topic=318.0)

Unfortunately, we had to abandon the idea of using BRAILS for this project.

## NHERI #2023-turkey-earthquakes slack channel

We then focused on obtaining existing data collected by fellow researchers. Fortunately for us, largely thanks to the responsiveness of the #2023-turkey-earthquakes slack channel <https://designsafe-ci.slack.com/archives/C04N8EYHHB7> we were able to download the initial inventory data.

The basis for the 11 provinces was taken from the GFDRR, Work Bank, Global Rapid Post-Disaster Damage Estimation (GRADE) Report of Feb 20, 2023 “In Türkiye, which is the focus of this report, these earthquakes have resulted in widespread damage across 11 provinces, where around 14.01 million (16.5 percent) of Türkiye’s population live, including Adana, Adiyaman, Diyarbakir, Elazig, Gaziantep, Hatay, Kahramanmaras, Kilis, Malatya, Osmaniye and Sanliurfa. As of February 19, 2023, more than 41,020 fatalities have been reported, 108,068 people injured, and more than 1,200,000 people displaced.” We extracted the 11 province IDs corresponding to the 11 affected provinces and filtered spatial inventory data.

## R2D

Finishing our project work is with another NHERI SimCenter tool, Regional Resilience Determination (R2D) <https://simcenter.designsafe-ci.org/research-tools/r2dtool/>.

# Source for inventory data

## Humanitarian OpenStreetMap Team (HOTOSM) Turkey Inventory

<https://data.humdata.org/dataset/hotosm_tur_buildings>

* 4,293,007 buildings in Turkey’s 81 provinces, 100%
* 1,412,830 buildings in the EQ affected 11 provinces, 33%
* 1,333,652 buildings cleaned after the EDA, 31%

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We noticed that the largely Microsoft-based OSM buildings were generous enough to provide footprints. While R2D similarly to Hazus required only the building centroid, defined as the building footprint weight center. For C, L, П and other complex-shaped buildings where the weight center naturally falls outside we had to force the centroid to be within the footprint of the building, but as close to the true weight center as possible to maintain spatial data integrity.

## Humanitarian OpenStreetMap Team (HOTOSM) Turkey Destroyed

<https://data.humdata.org/dataset/hotosm_tur_destroyed_buildings>

* 3451 destroyed buildings in the 11 provinces

# Source for hazard data

M 7.8 - Pazarcik earthquake <https://earthquake.usgs.gov/earthquakes/eventpage/us6000jllz/shakemap/intensity>

M 7.5 - Elbistan earthquake <https://earthquake.usgs.gov/earthquakes/eventpage/us6000jlqa/shakemap/intensity> not used

# Our Project Work on GitHub

<https://github.com/niko-todorov/NHERI-GSC-MC-team1/>