

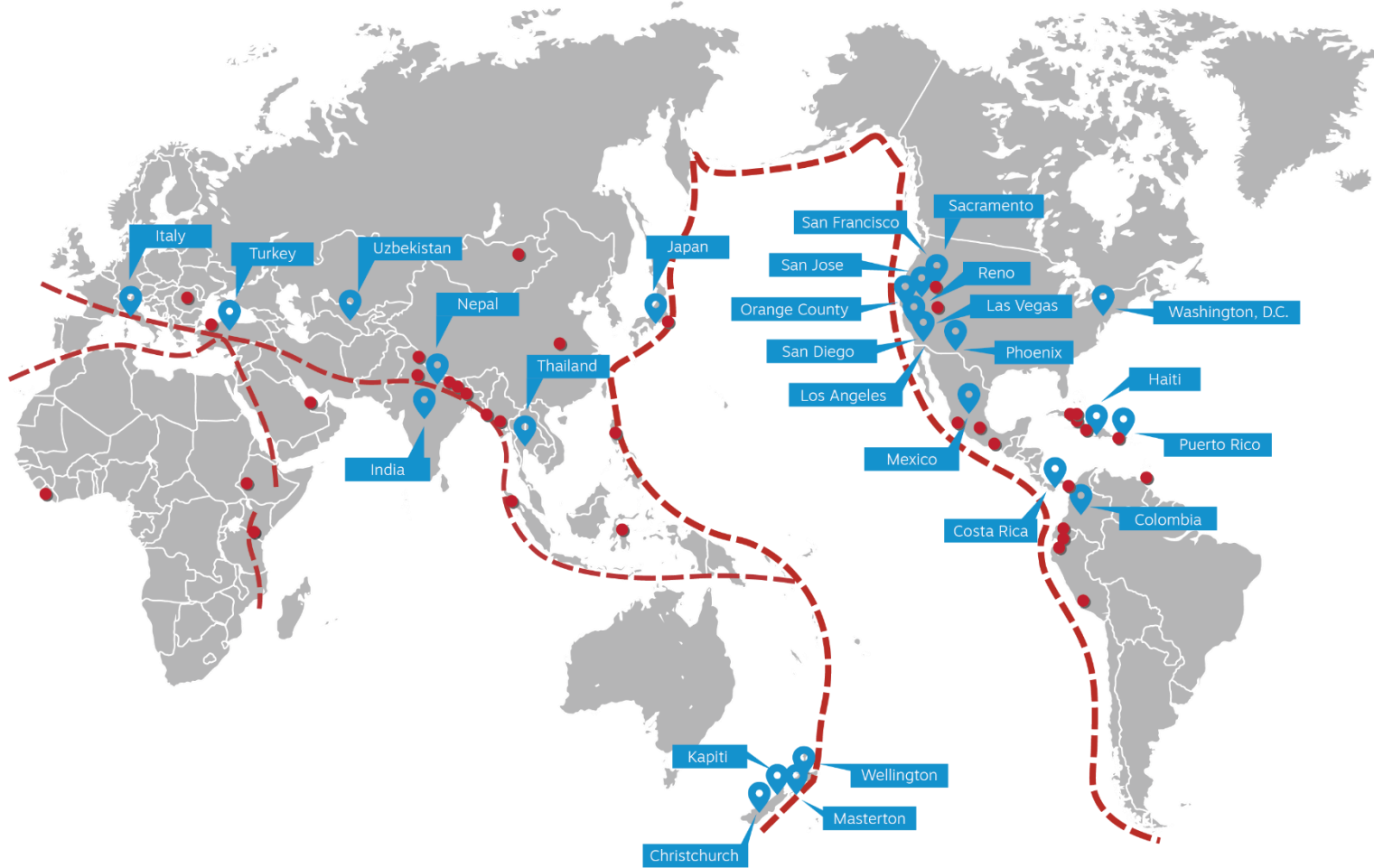
A photograph of a man in a brown shawl and light blue pants walking past a mud-brick building. In the foreground, there is a large pile of rubble and a blue pipe. The sky is overcast.

Engineering for Humanity Cases in Afghanistan and Ukraine

Dr. Kit Miyamoto

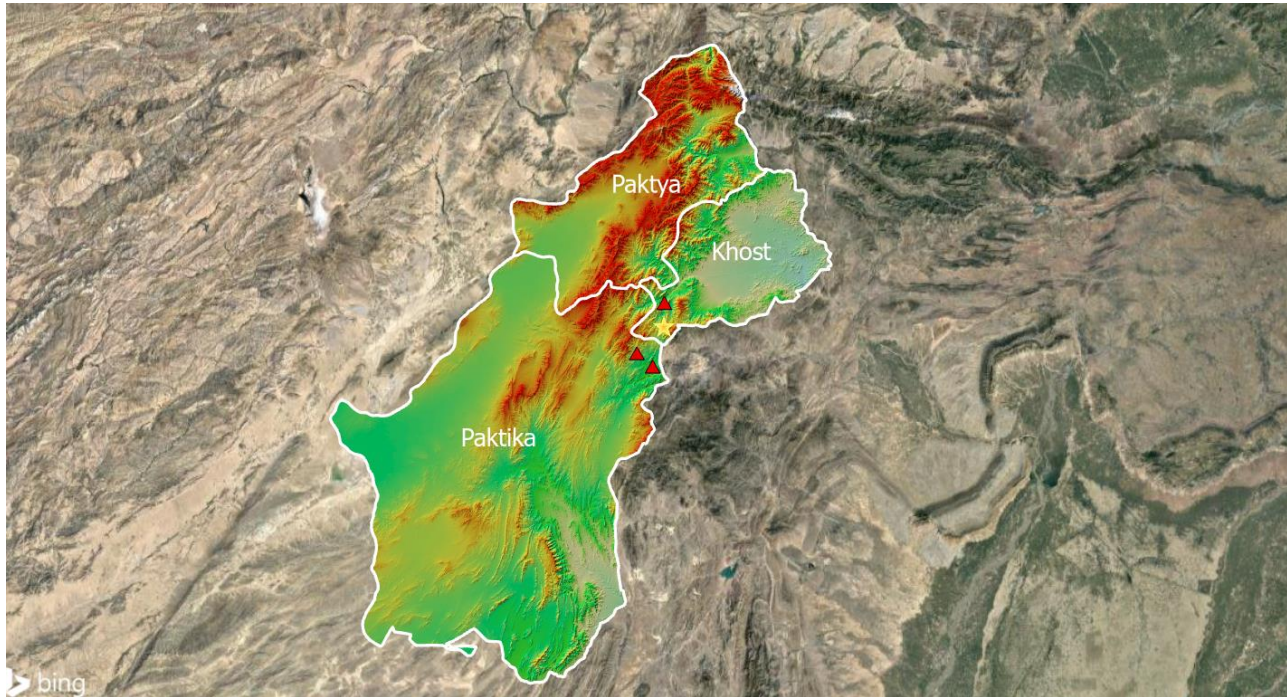
miyamoto.

MIYAMOTO GLOBAL CAPACITY



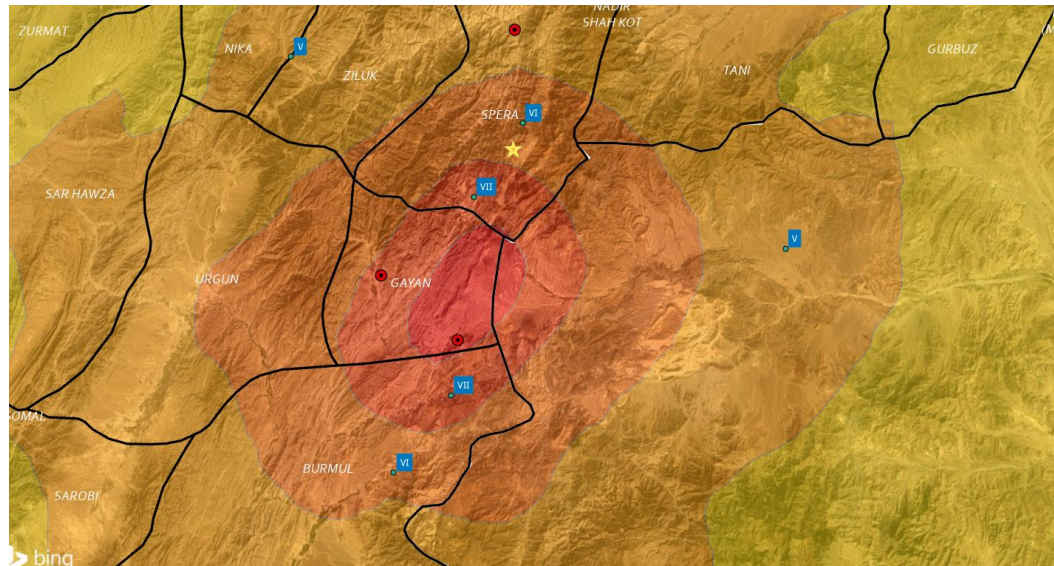
Earthquake Damage

This event caused 80,000 to 100,000 people homeless and will be exposed to severe winter



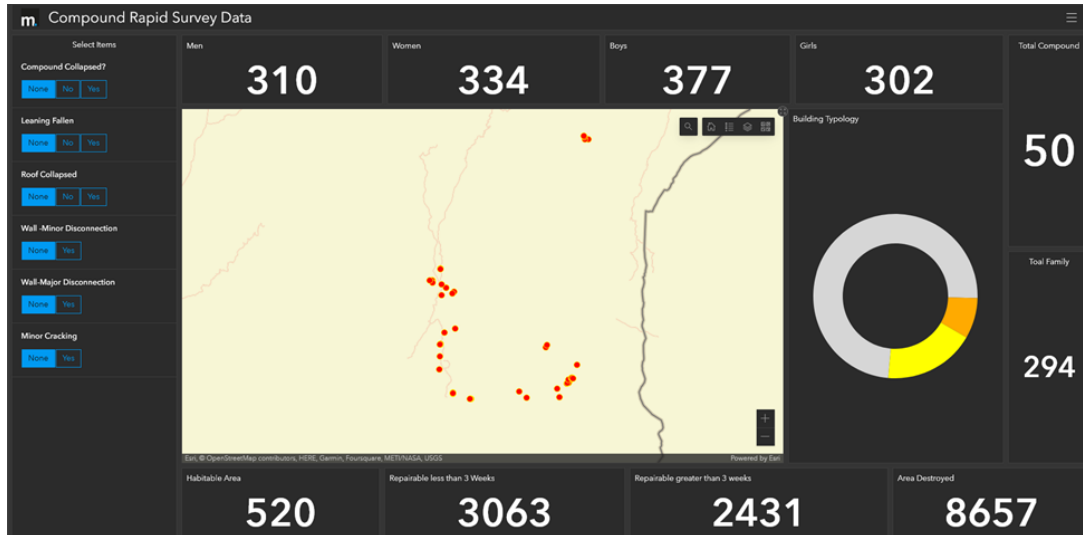
Supplemental Habitability Assessment

Structural Rapid Assessment of randomly selected 550 compounds(2700 families, over 15,000 people)



Habitability Assessment Results

ARC GIS platform and Survey123 app developed



4:14 Search

Assessment

miyamoto.

General Information

Assessment Date *
Monday, August 1, 2022 4:13 PM

GPS Coordinate *
Click for Guide
34°33'N 69°17'E ± 35 m

Compound Area (square meters) *

Number of Men *

Number of Women *

Number of Boys *


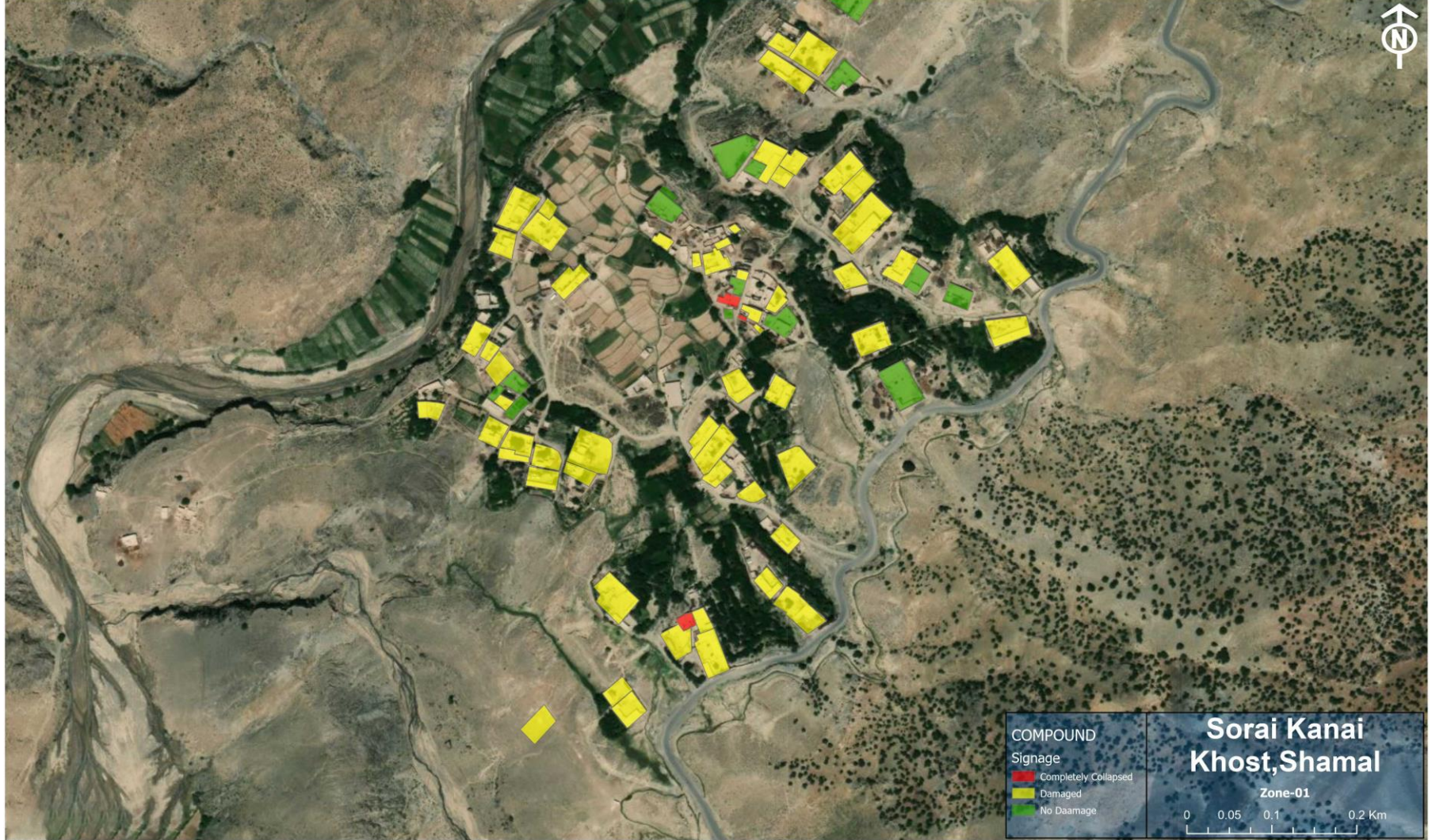
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 76 Compound
 320 Families
 Occupancy factor Presently: 4.4 Sq. m/Family

 415
 454
 1055

 Habitable 8459 Sq. m
 Repairable 3791 Sq. m
 Destroyed 307 Sq. m

15 compound is in good condition
 58 compound need to be repaired
 3 compound destroyed

COMPOUND Signage
 Completely Collapsed
 Damaged
 No Daamage


Sorai Kanai Khost, Shamal
Zone-01
 0 0.05 0.1 0.2 Km

 87 Compound
 333 Families
 Occupancy factor Presently: 3.28 Sq. m/Family

 454
 401
 1100

 Habitable
6411 Sq. m
 Repairable
6860 Sq. m
 Destroyed
517 Sq. m

4 compound is in good condition
 82 compound need to be repaired
 1 compound destroyed




COMPOUND
Signage
 Completely Collapsed
 Damaged
 No Damage

Kharguri
Khost, Spira
Zone-02
 0 0.05 0.1 0.2 Km

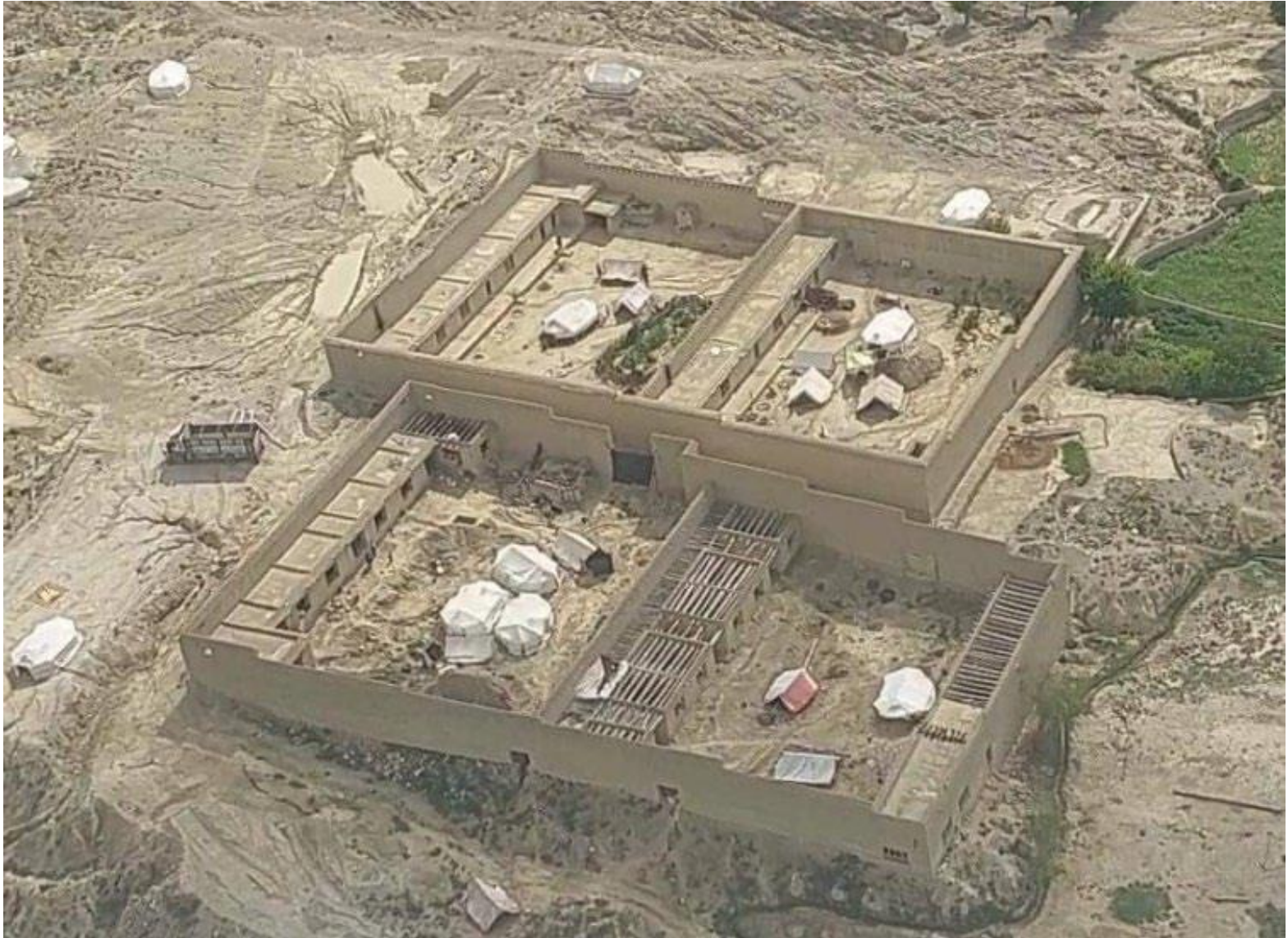
Habitability Assessment Results

- Collapse(Red) 17%
 - Repairable(Yellow) 51%
 - Habitable(Green) 32%
1. Repair per room is average less than a month.
 2. Reconstruction per room using vernacular method is less than 2 months.
 3. Over 50,000 can be sheltered through repairing and/or constructed new by winter.

Compounds



Social Structure



Vernacular construction

Compound Wall Typology

- Pakhsa



Vernacular construction

Interior Wall Typologies

- Pakhsa (Top Right)
- Pakha-Khashta (Lower Left)



Vernacular construction

Why does earth construction work?



Vernacular construction

Cement concrete



Clay concrete



Vernacular construction

Cement concrete

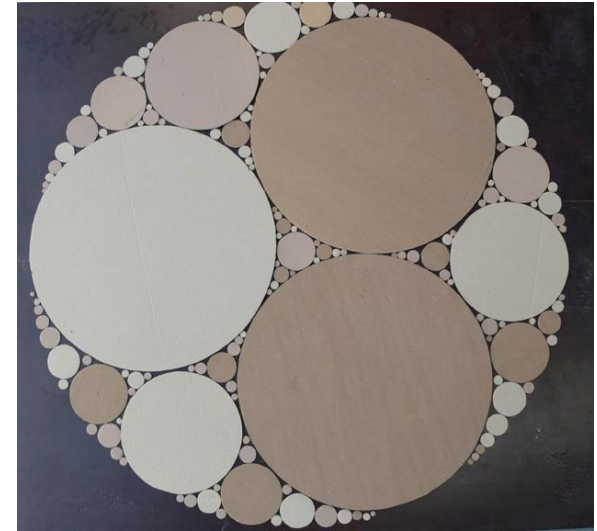
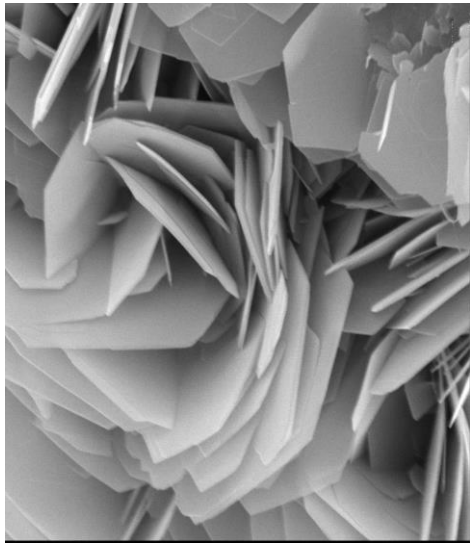


Clay concrete



Vernacular construction

Why does earth construction work?

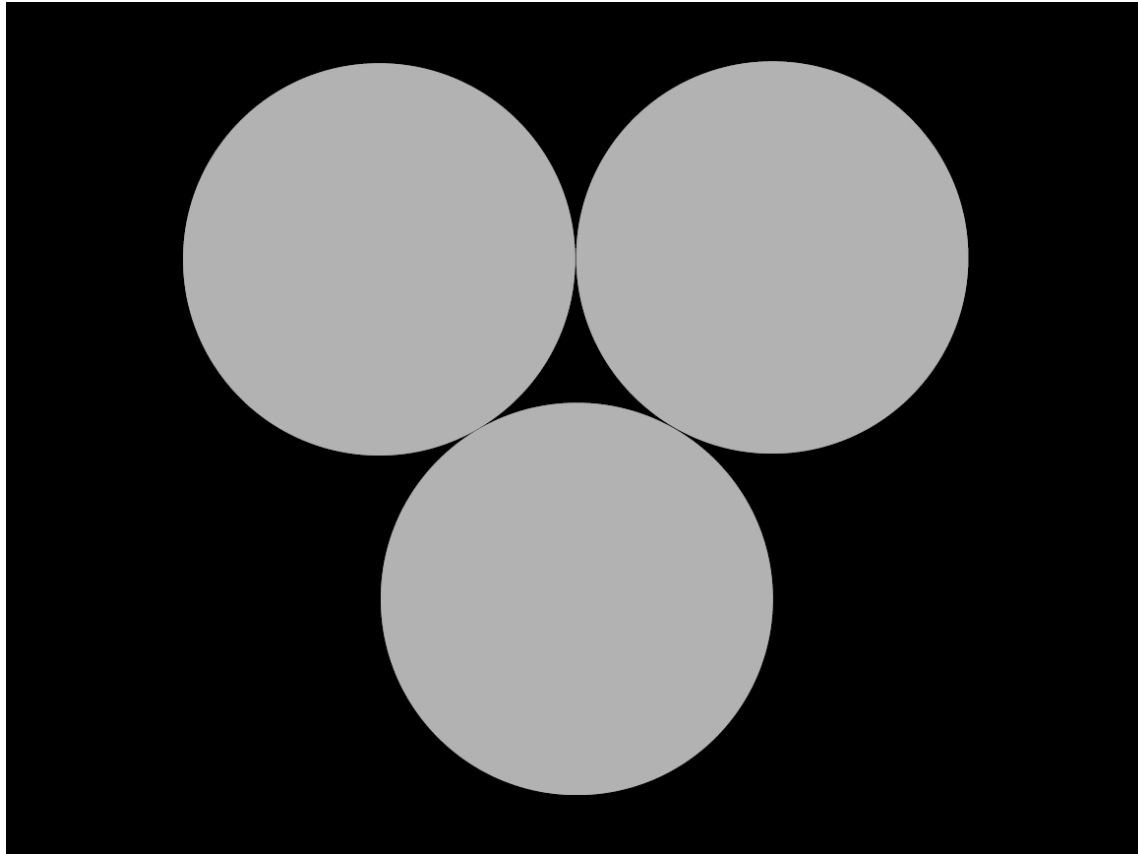


Clay

Water

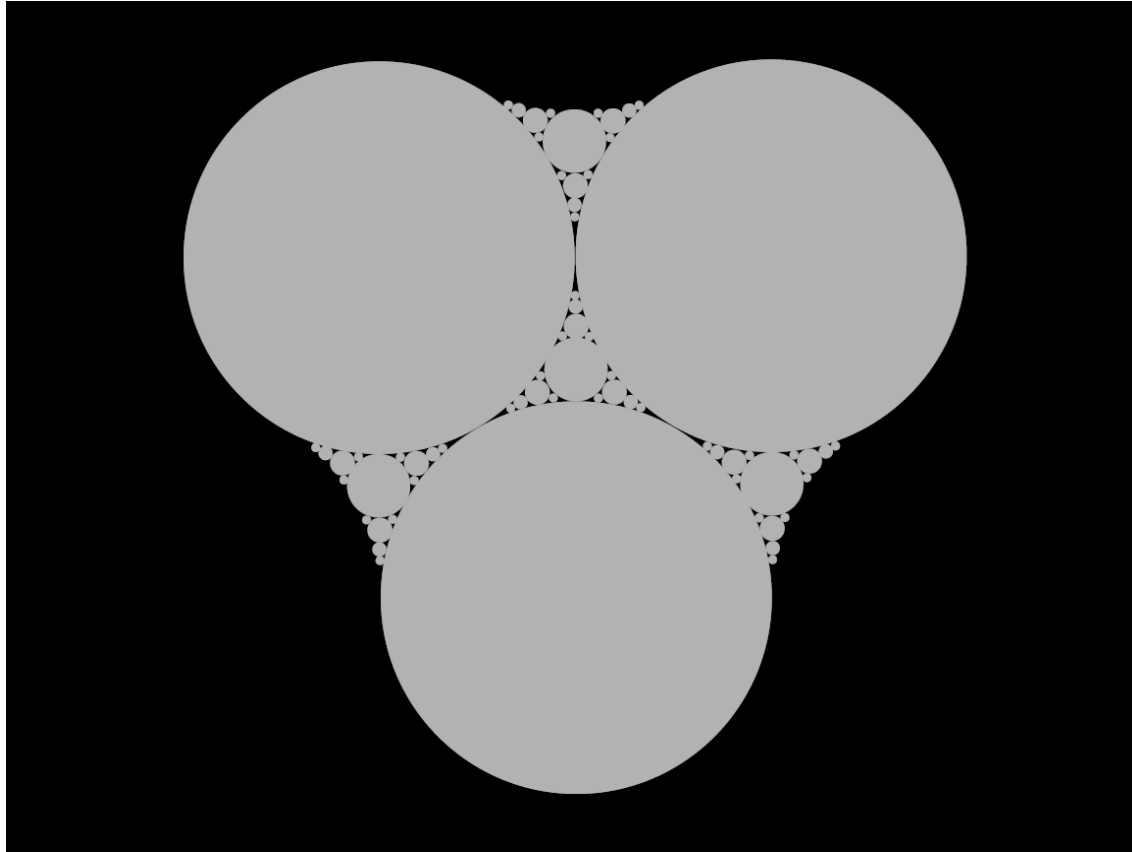
Aggregates

Vernacular construction



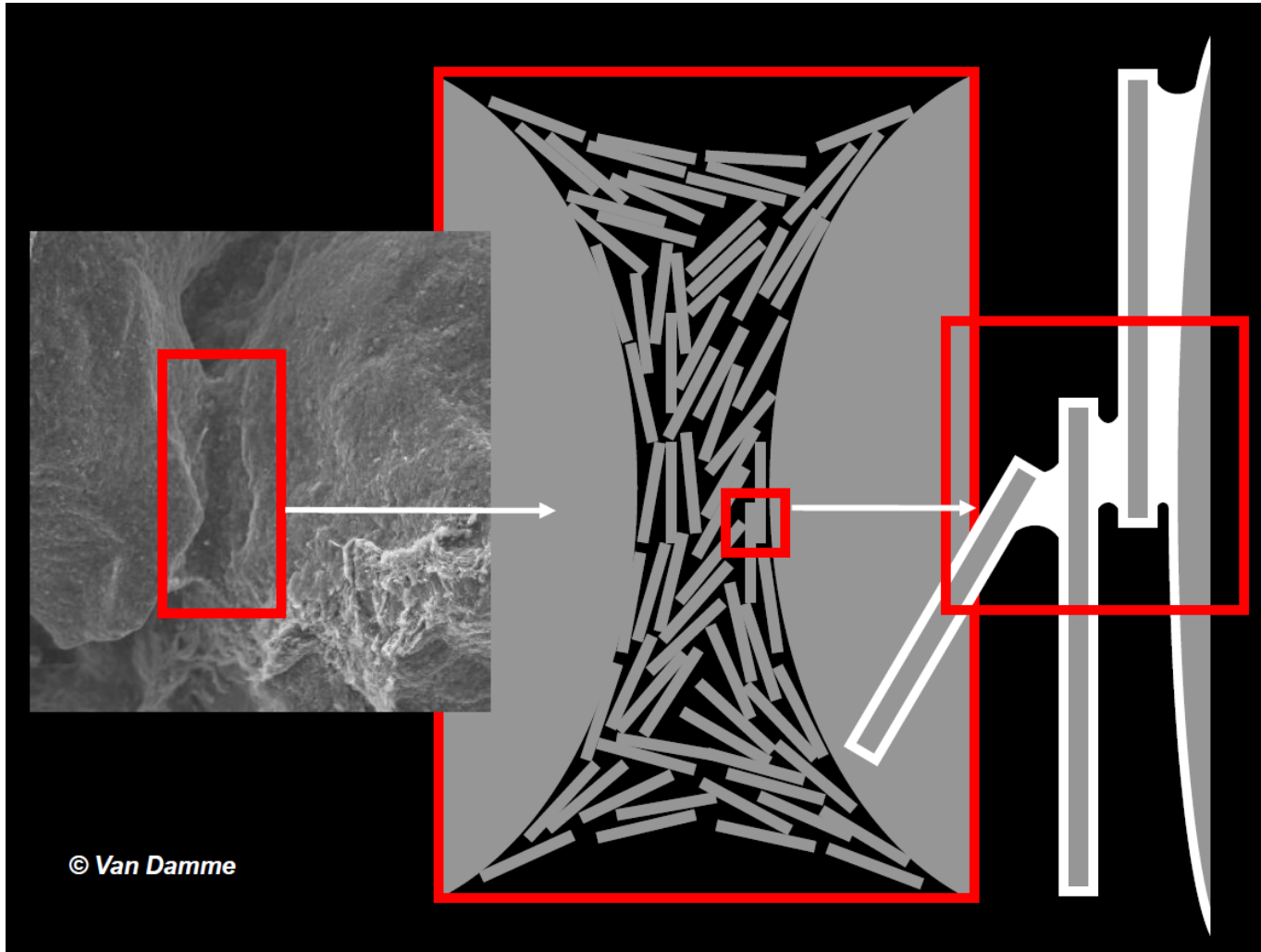
aggregate composition

Vernacular construction



Rich and homogeneous aggregate composition

Vernacular construction



Vernacular construction



Hydrating the Soil:

- Activating the Clay Particles (plastic)

Vernacular construction



Hydrating the Soil:

- Activating the Clay Particles (plastic)

Vernacular construction

Cohesion Test (cigar test)

- Typical requirement is 5 cm to 8cm, 20cm was observed without failure.



Vernacular construction

- Grains composition
 - Clay wash out



Vernacular construction

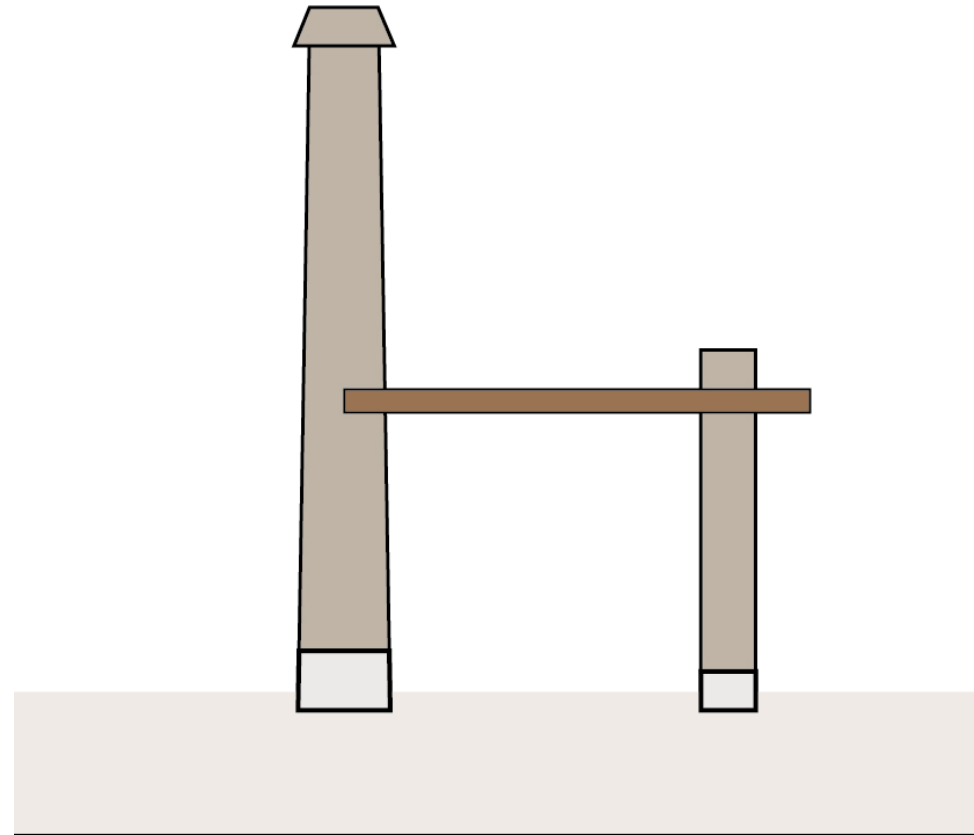
- Grains composition
 - Resulting excellent aggregates composition



Findings

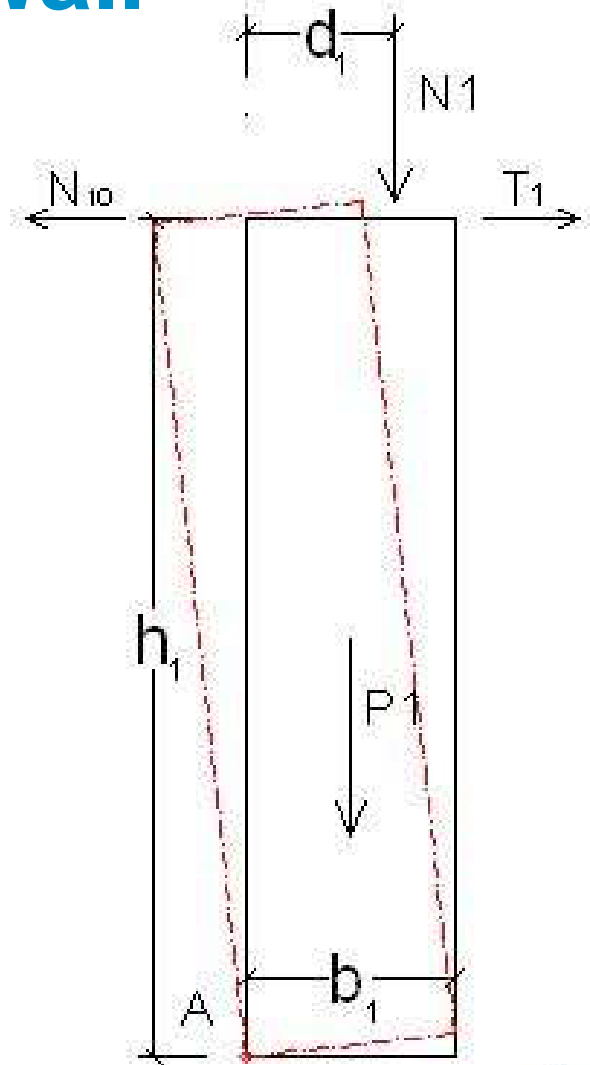
The traditional housing vernacular is unique and has evolved to suit the:

- Specific seismic risk in the area,
- Available materials,
- Harsh climate
- Local culture



Rocking Wall

- 0.15G acceleration to activate the overturning of the wall
- 0.33G acceleration to cause the overturning collapse
- 0.5G acceleration to cause 50% probability of collapse

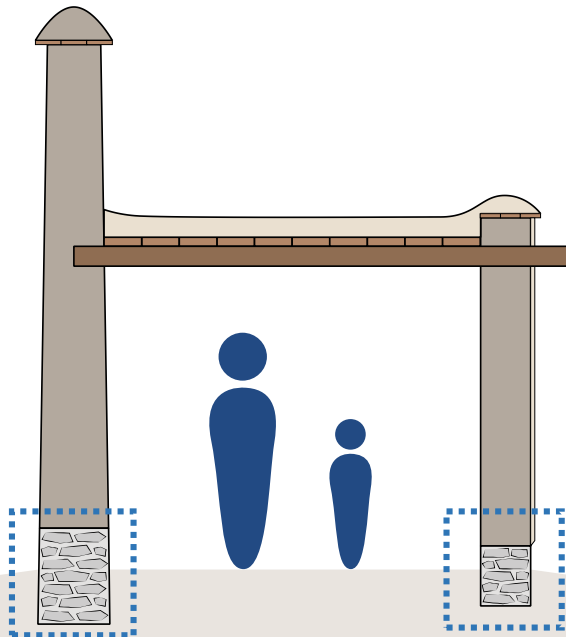


Vernacular construction

Integrity of each compound's element

- Walls

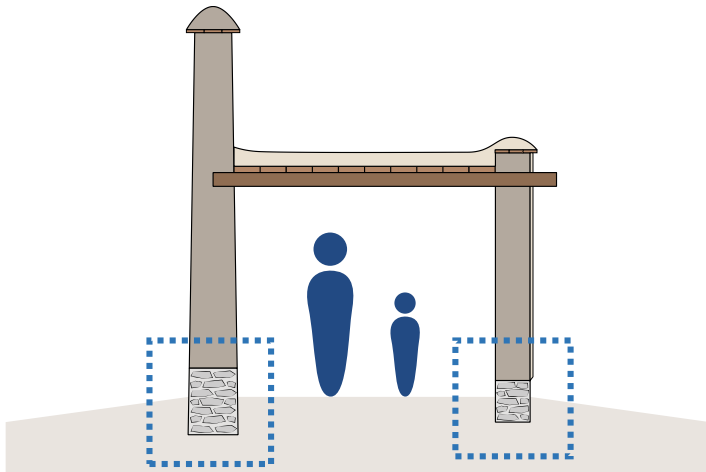
- Foundation / Stem wall
- Earth wall
- Capping



Vernacular construction

- Walls

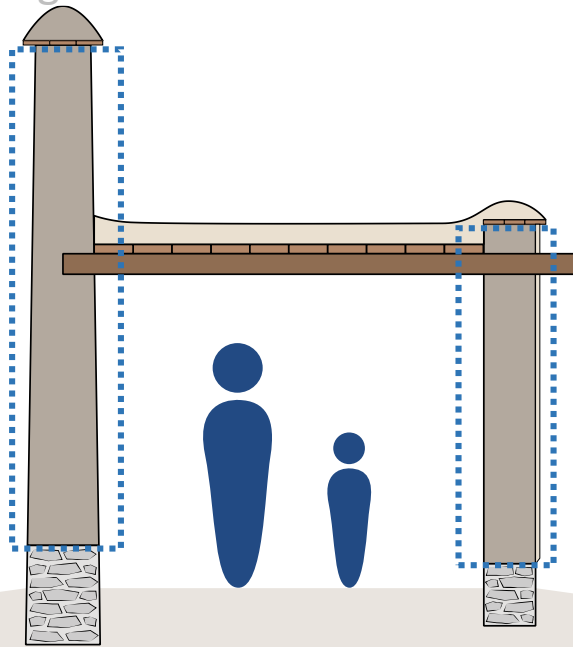
- Foundation / Stem wall
- Earth wall
- Capping



Vernacular construction

- Walls

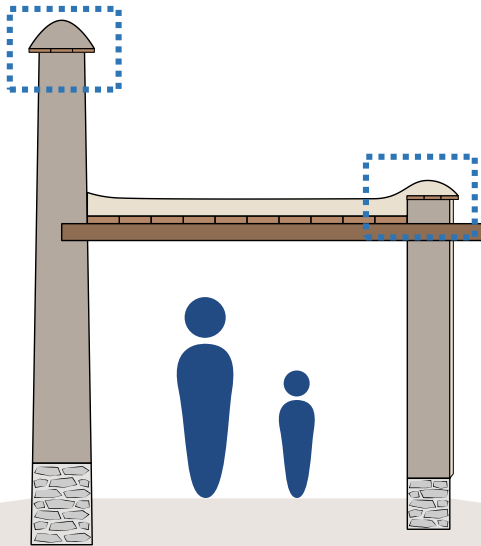
- Foundation / Stem wall
- Earth wall
- Capping



Vernacular construction

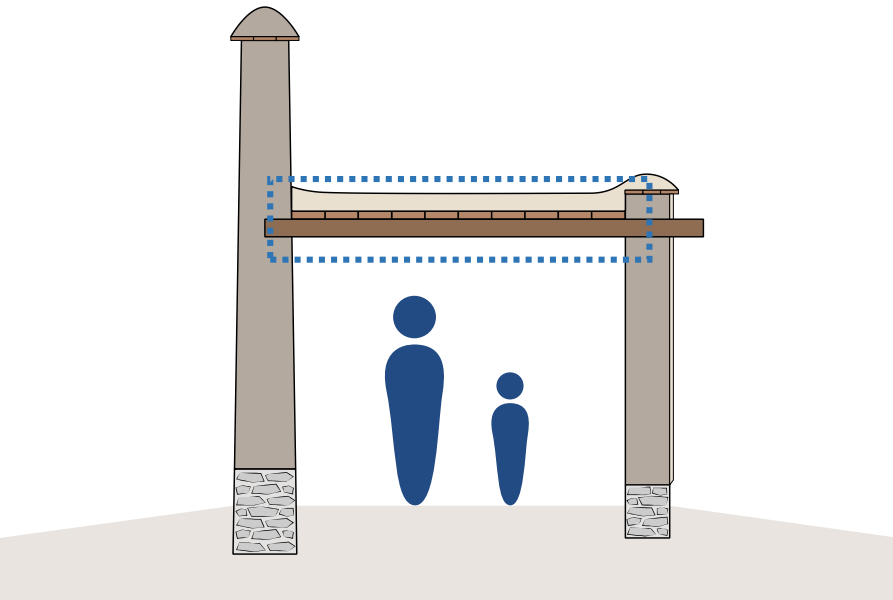
- Walls

- Foundation / Stem wall
- Earth wall
- Capping



Vernacular construction

- Soil Cover
 - Draining
 - Timber structure

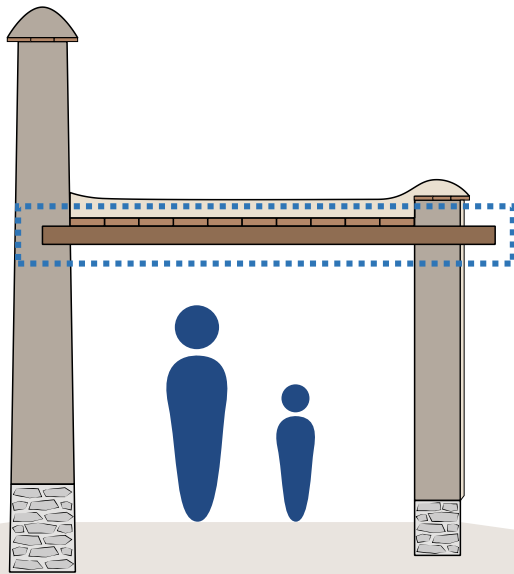


Vernacular construction

- Soil Cover

- Draining

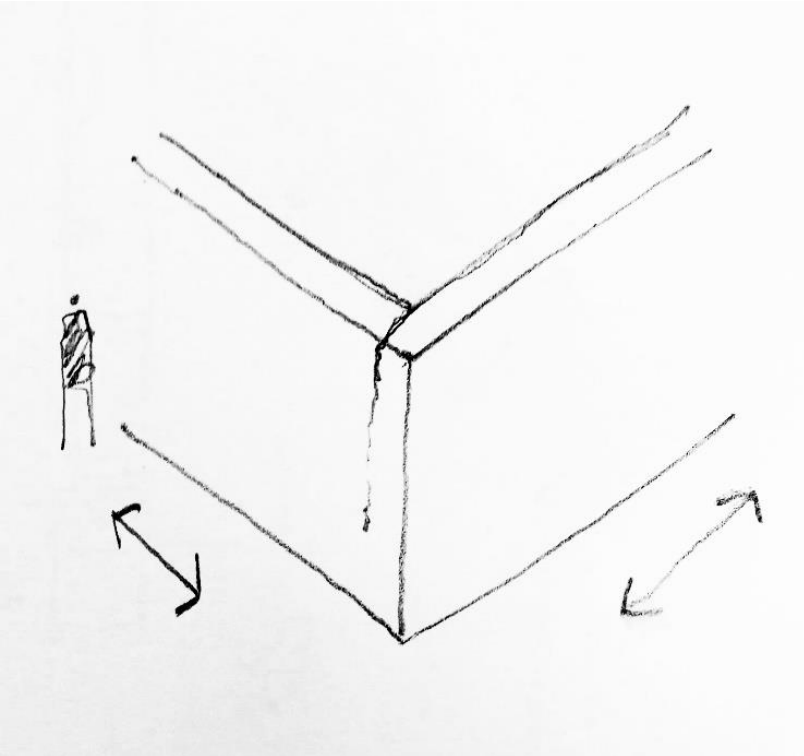
- Timber structure



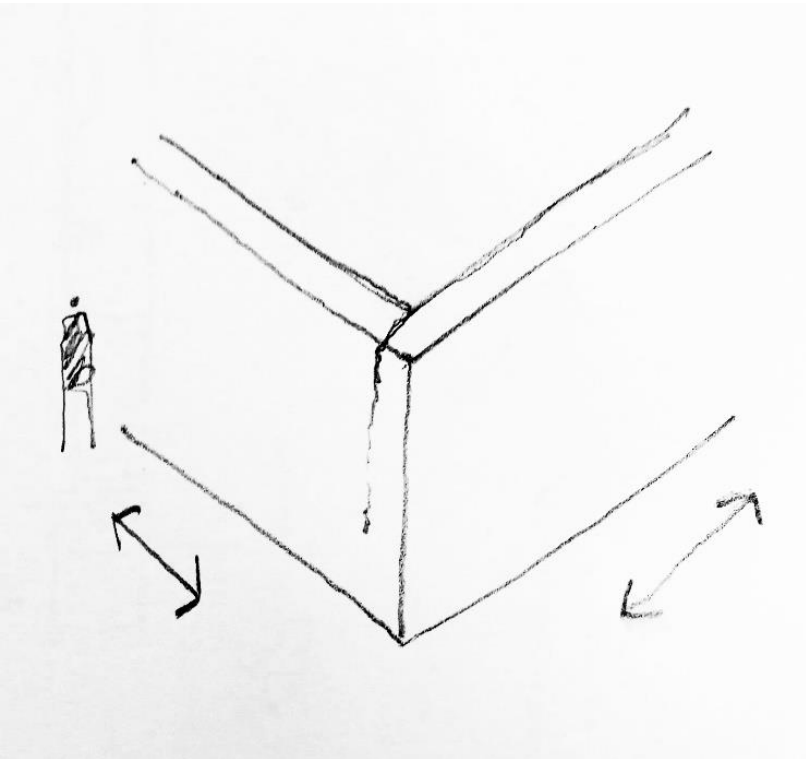
Vernacular construction

Interaction between compound elements

- Wall to wall connection
 - Flexible connection



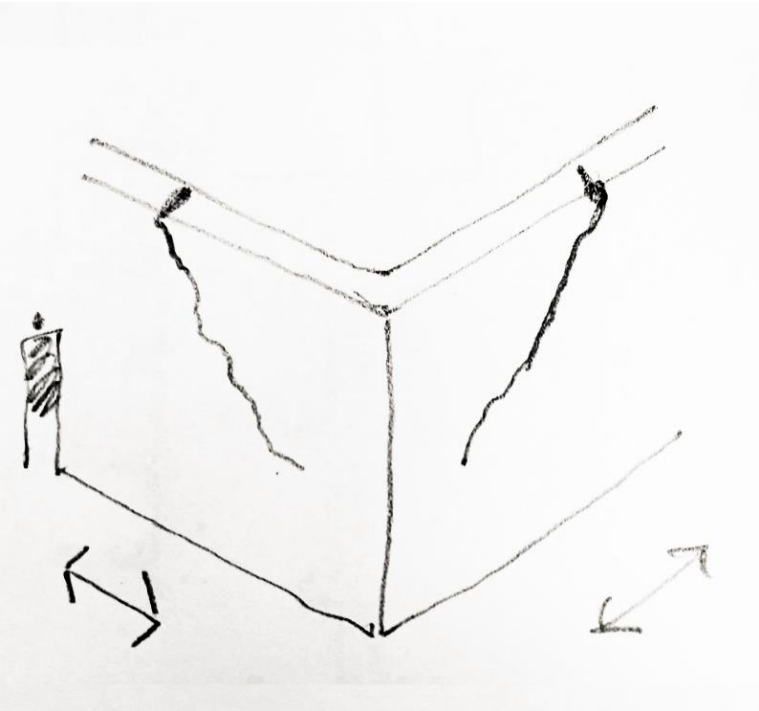
Vernacular construction



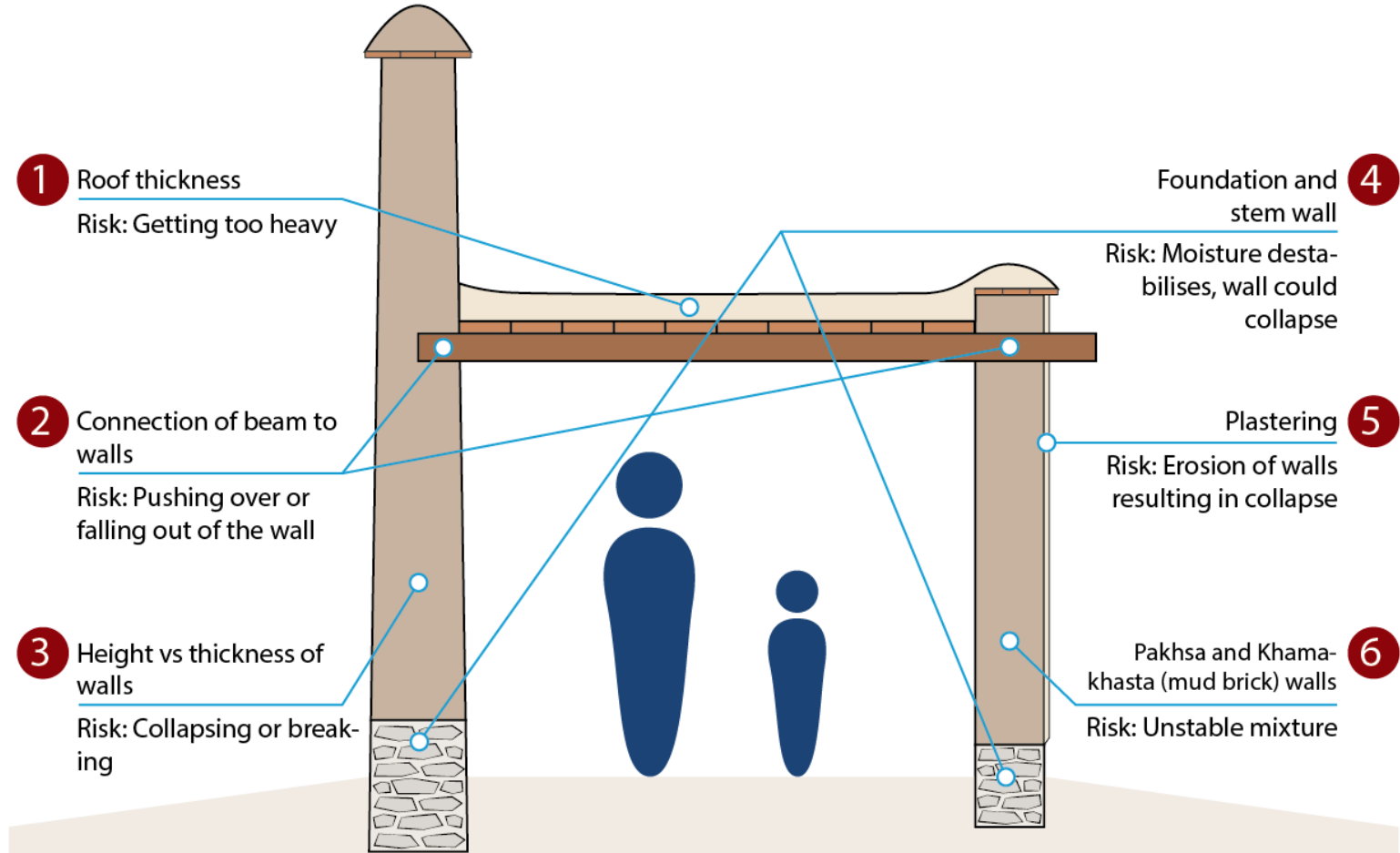
Vernacular construction

Interaction between compound elements

- Wall to wall connection
 - Stiff connection



Key Technical Messages



"KEY MESSAGES ARE TO SAVE LIVES BY REDUCING RISKS & IMPROVING STRUCTURAL PERFORMANCE"













Earthquake Response Snapshot ; September 4 (Families)

	Needs	Capacities	Gap	Response
Emergency shelter support (tents)	14,420	40,330	NA	13,313
Construction of resilient shelters	14,420	8033	6387	0





























An aerial photograph of a city at sunset. The sun is low on the horizon, casting a warm glow over the buildings. A prominent church with a golden dome is visible on the left. The sky is filled with scattered clouds, and the overall atmosphere is peaceful and hopeful.

Help Ukraine Rebuild Now

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More than 150,000 housing units have been damaged

- Housing \$69 billion
 - Education \$9.2 billion
 - Health \$15.1 billion
- (June 2022)

























































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RELIEF

Help Ukraine Rebuild

Repair war-damaged house
\$2000 or less per family

Miyamoto Relief Ukraine Support
Page



www.miyamotorelief.org/causes/ukraine

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