A ASSISTANCE PACKAGES [1]

Earthquake Response Khost & Paktika

Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter

This document aims to introduce the local typologies (their spatial as well as social aspects), explain the vernacular construction pinciples and display examples and tips for repair and (re)construction of the various building elements such as foundation, walls, roof and more.

The Shelter Matrix on the right displays the different assistance packages recommended based on the report by Miyamoto International (also available).

A critical factor in determining appropriate assistance packages in this response are the two predominant typologies for local housing; compound housing and non-compound housing.

A second important factor is the level of damage and desired building performance to better address varying households' risk exposure. Although some risks, like that of future earthquakes or aftershocks, apply generally across the entire affected area, other risks may be more site-specific, thus seismic upgrading or Housing, Land and Property rights (HLP) support for alternative solutions may be more appropriate.

All Areas	Housing Type		Performance Level	Mild Damage	Heavy Damage	Total destruction
1 Public Outreach on Key Message 2 Winterisation Assistance	Compound Predominant Housing form, Est 90%+	3 Privacy Screening 4 Compound Wall Repairs	**Average** This performance level is adequate for an estimated 90%+ of all rooms	5 Vernacular Room Repairs	5 Vernacular Room Repairs OR 6 Vernacular New Rooms	6 Vernacular New Rooms
			High (Low percentage)	5 Vernacular Room Repairs	5 Vernacular Room Repairs OR 6 Vernacular New Rooms + 7 Vernacular seismic upgrades	6 Vernacular New Rooms + 7 Vernacular Seismic upgrades OR 9 HLP support
	Non Compound Secondary housing form. 5-10% (TBC)	3 Possible need for some Privacy Screening	**Average** (Low percentage)	5 Vernacular Room Repairs	5 Vernacular Room Repairs OR 6 Vernacular New Rooms	6 Vernacular New Rooms
			High (Lowest percentage)	5 Vernacular Room Repairs	6 Vernacular New Rooms + 8 Seismic upgrades Or 9 HLP support	6 Vernacular New Rooms + 8 Seismic upgrades OR 9 HLP support

This is a living document which will be updated throughout the earthquake response. Version: 24 August 2022

A ASSISTANCE PACKAGES [2]

Earthquake Response Khost & Paktika

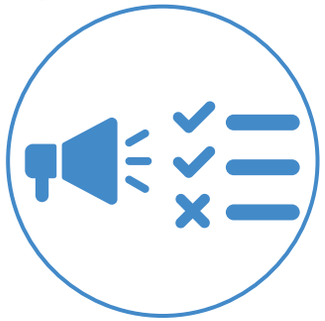
Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter

The images on the right are a visual representation of the recommended shelter assistance packages (SAPs) mentioned in the shelter matrix and the report by Miyamoto International.

To get an understanding of which package may fit a certain beneficiary better, an assessment of the housing in question should be done by someone (local or international) with knowledge and experience with the local vernacular construction techniques.

Miyamoto International aims to support the ESNFI Cluster and its implementing partners in this reponse by providing Trainings of Trainers (ToT) in the vernacular architecture, as well as providing training for skilled labourers, involving local skilled labourers, in the best techniques for site-specific vernacular construction (as these may vary from valley to valley). Additionally information will be shared to raise awareness on the importance of building maintenance related to safety and health at the household level to improve knowledge and skills.

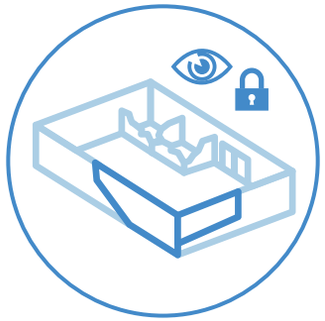
1 Public Outreach and Key Messages



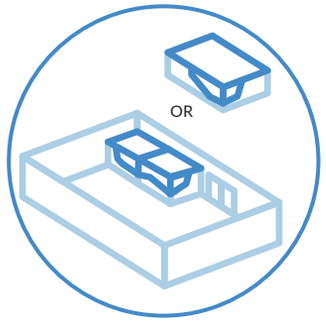
2 Winterization Assistance

3 Emergeny Compound Screening

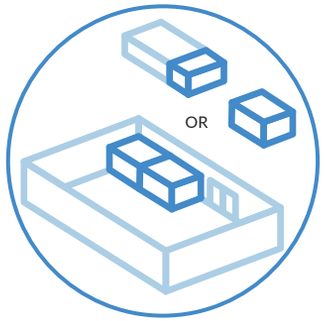
4 Compound Wall Repairs



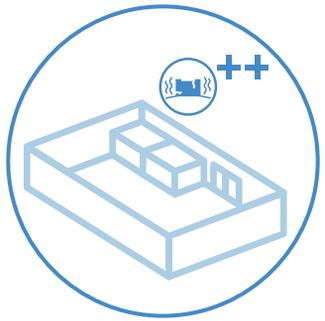
5 Vernacular Room Repair



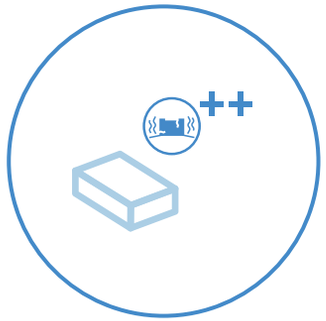
6 Vernacular New Room Construction



7 Vernacular Seismic Upgrade



8 Seismic Upgrades



9 House, Land and Property right support

This is a living document which will be updated throughout the earthquake response. Version: 24 August 2022

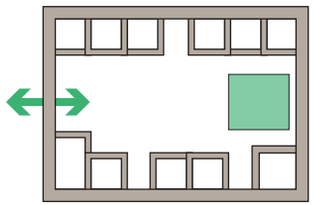
B INTRODUCTION TO LOCAL TYPOLOGY [1]

The compound house; introduction

Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter

It is important to understand that the compound wall is one of the most important aspects of this typology. The compound wall offers the possibility for protection and privacy for families, especially for women and girls. Each compound usually houses multiple households and/or extended families.

Quick representation of Traditional local compound house, as seen from above. More information about the following aspects of this traditional typology is still in process. Input from partners on this is welcome.



-Social use of spaces

-The use of transitional space between indoor/outdoor

-Latrines

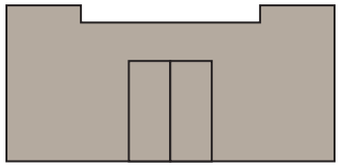
-Tandoor (food preparation/heating)

-Chimney?

-Animals (chickens, etc)

-Gardens (food)

Quick representation of Traditional local compound house, as seen from the side



B INTRODUCTION TO LOCAL TYPOLOGY [2]

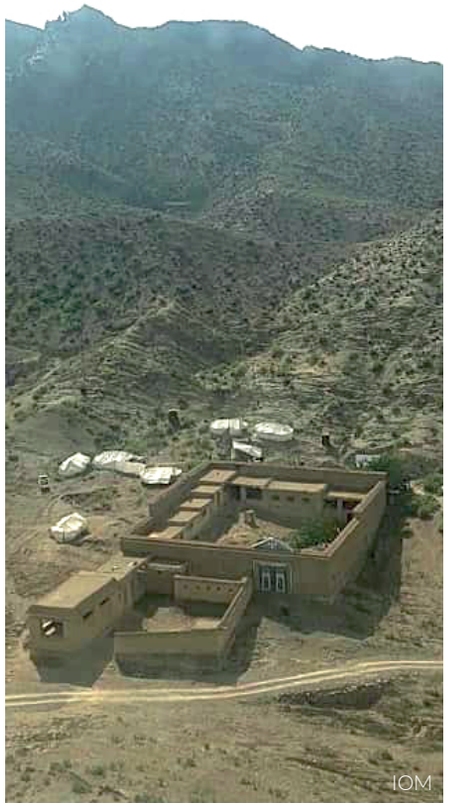
The compound house; construction principles

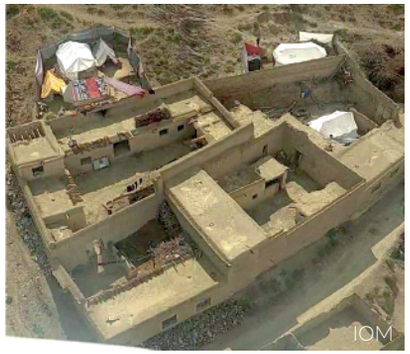
Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter

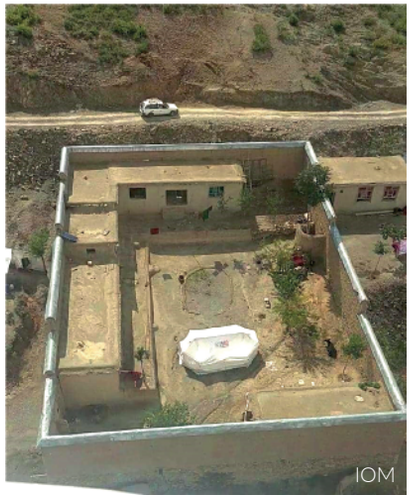
The image on the top-right shows a simple 3D model of a compound house and how the rooms on the inside are all attached to the outer wall.

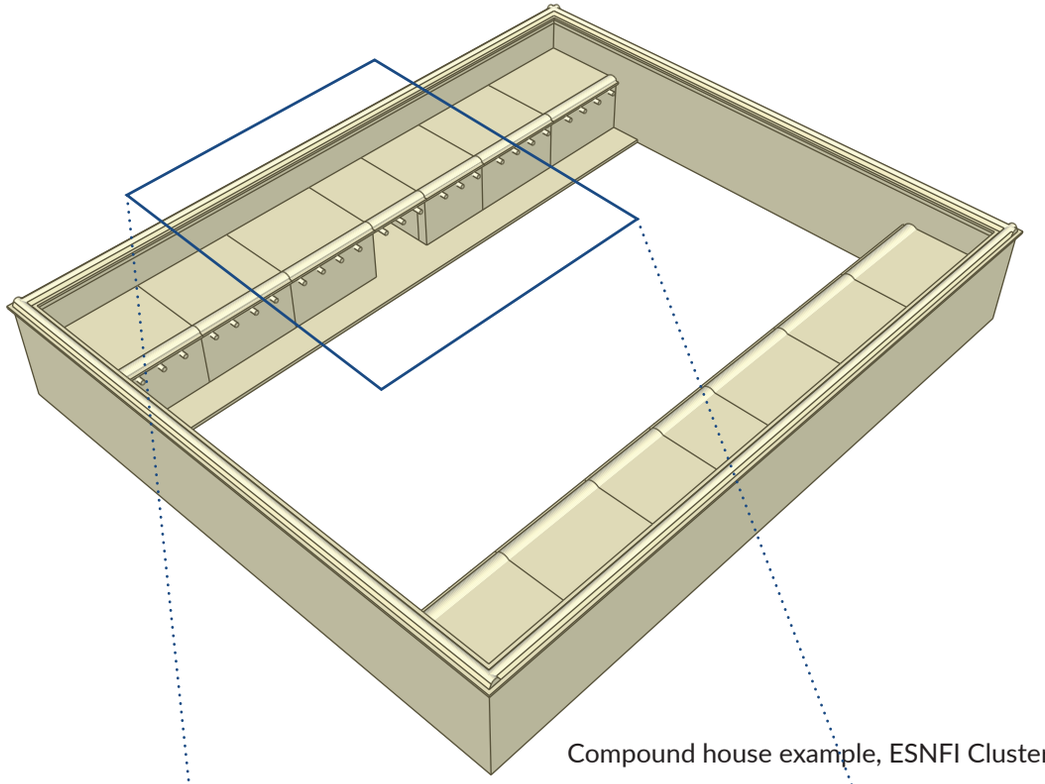
The image on the bottom-right is a simple example rendering of two vernacular rooms within a compound.

Below are a few images taken of existing compound houses in the area.









Compound house example, ESNFI Cluster

Two vernacular rooms example, ESNFI Cluster

B INTRODUCTION TO LOCAL TYPOLOGY [3]

The compound house; construction principles

Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter

The next pages show plans, elevations and sections of an example of what two vernacular rooms within a compound can look like.

The images show guiding measurements, which have to be adapted (size of windows, location of doors, length of room, etc), depending on the needs and wishes of the household that is receiving the technical support.

This is not a blueprint, rather an example!

As this is meant to support households in repairing/rebuilding their own homes, there are no one-size-fits-all measurements.

Important!
Since the local vernacular construction techniques rely on walls moving along independently during an earthquake to dissipate the seismic energy,

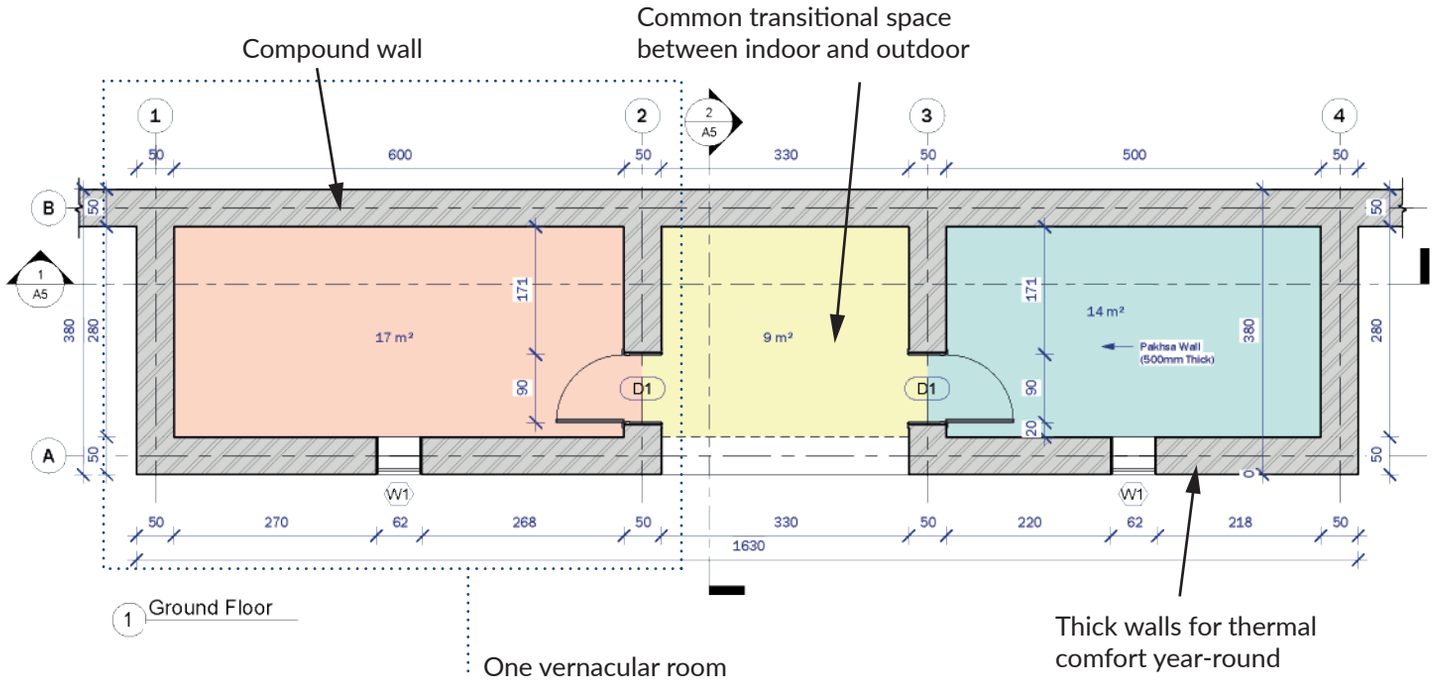
Mixing in new, non-vernacular materials into the vernacular mixtures

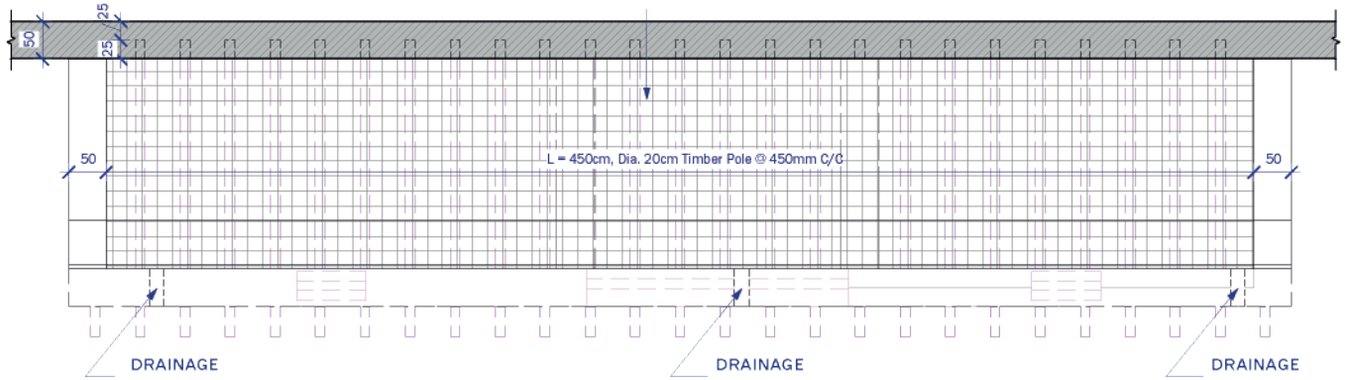
OR

Using non-vernacular materials to construct new rooms against vernacularly constructed walls

Will likely have an adverse effect on the vernacular construction, resulting in breakage during a future earthquake.

Therefore, stiffening of any type in the vernacular construction is **NOT reccommended**.

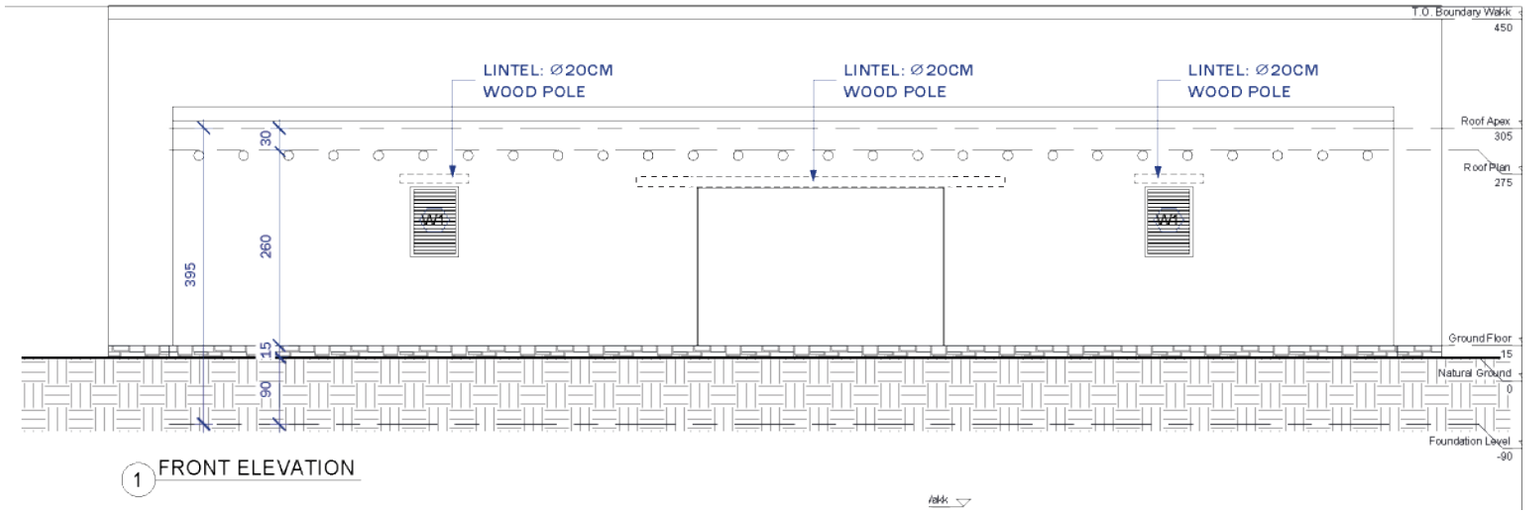




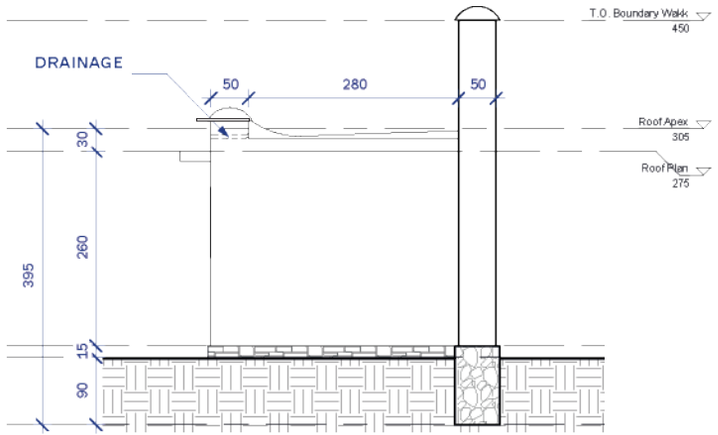
1 Roof Framing Plan

Compound house example, ESNFI Cluster

Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter



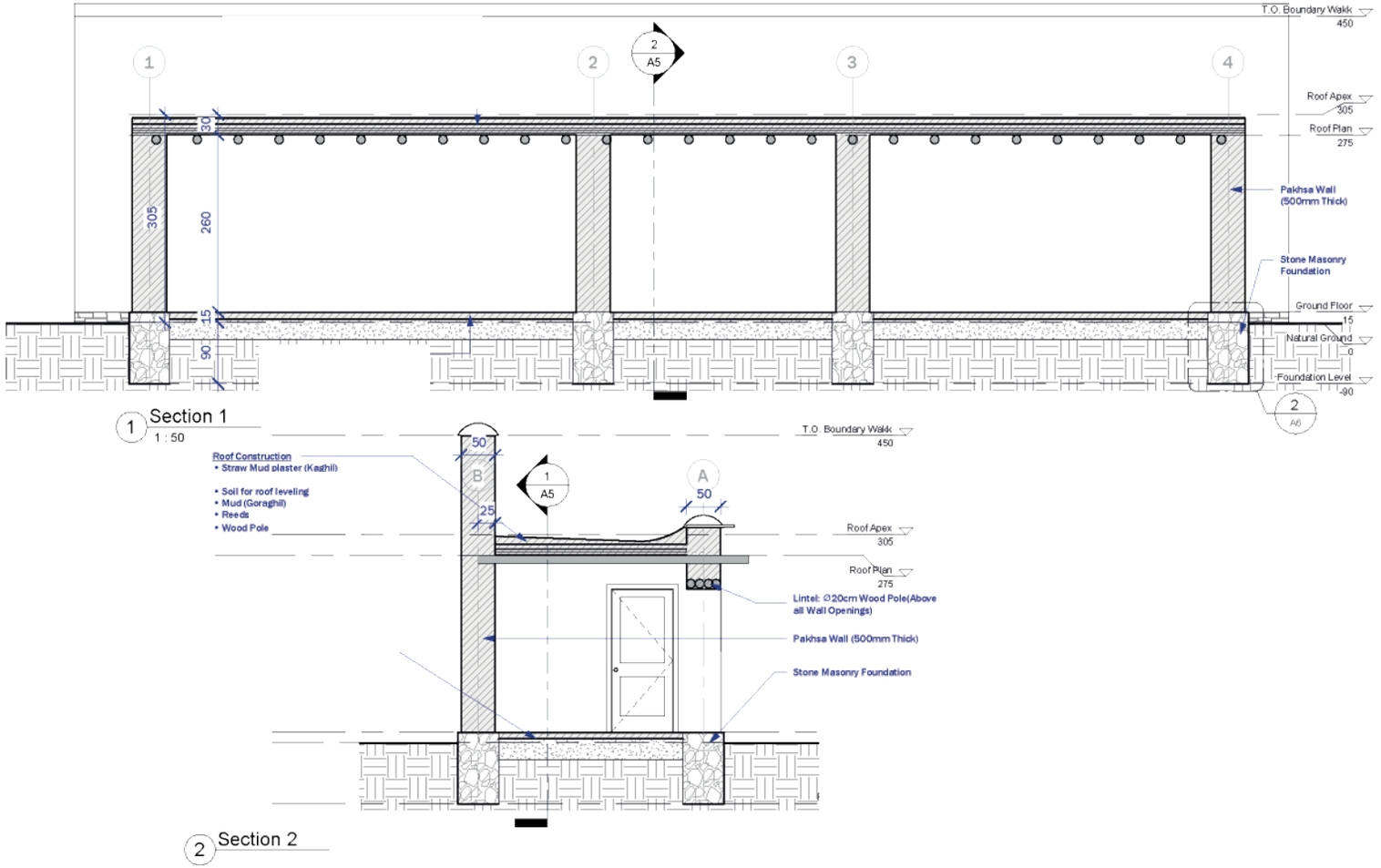
1 FRONT ELEVATION



2 RIGHT ELEVATION

Compound house example, ESNFI Cluster

Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter



Compound house example, ESNFI Cluster

B INTRODUCTION TO LOCAL TYPOLOGY [6]

Non-compound houses; introduction

Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter

Most of the houses in the area of Khost and Paktika are of the compound typology. However, there are some houses that are not; these are referred to in this document as non-compound houses.

The non-compound houses are constructed with the same materials as the compound houses; mostly pakhsa, mud brick or stones.

C 1. TIPS FOR A SAFE SITE

Key Messages Earthquake Response Khost & Paktika: Message 1 (8)

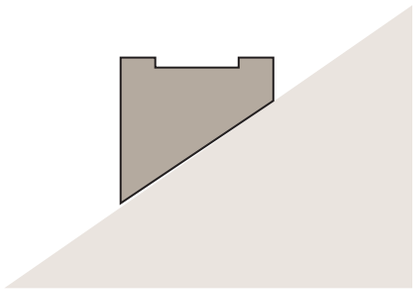
Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter

Some sites are more dangerous than others; this means that repairs/(re)construction should take necessary precautions to mitigate risk, as for most families choosing a less dangerous site is not a possibility.

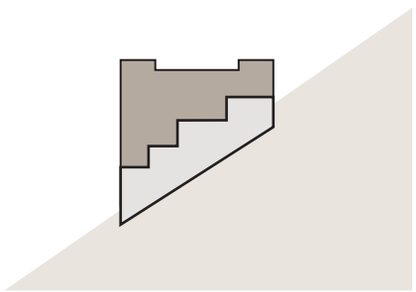
If (re)construction on a different part of a plot is a possibility, then care can be taken when choosing a location.

Sites that are more dangerous and need extra attention to risk mitigation

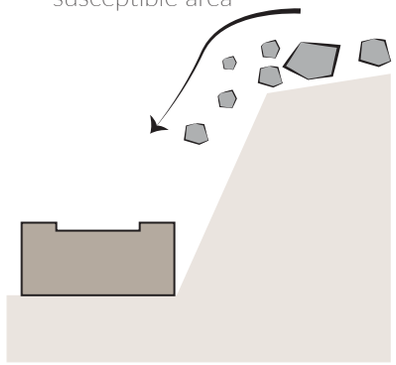
1.1 Steep slope, above 27 degrees



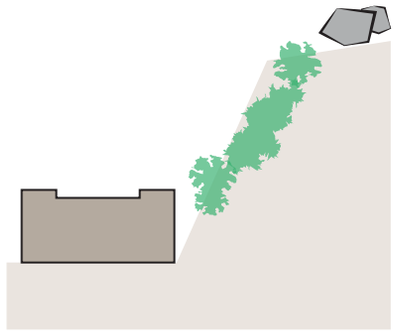
A strong and stepped foundation



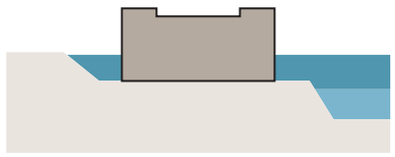
1.2 Loose rocks above/landslide susceptible area



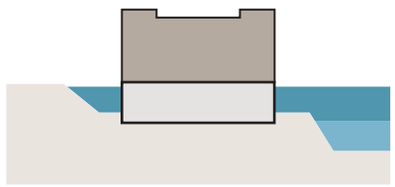
Measures to clear the mountain-side/planting to keep moving dirt in place



1.3 Riverbank, water-logged or flood prone areas

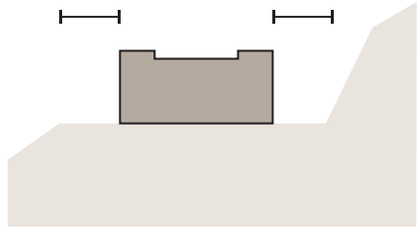


An extra high stone foundation is already often found in locations where inhabitants know they can get hit by flashfloods



Advice only if construction is possible on another part of a plot or if current site is uninhabitable

1.4 Where to build on plot slope; avoid too close to slopes



1.5 Avoid flood-prone areas

C 2. TIPS FOR SAFE FOUNDATIONS

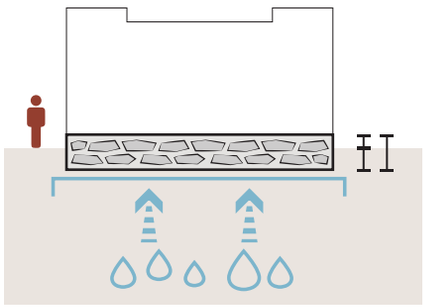
Key Messages Earthquake Response Khost & Paktika: Message 2 (8)

Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter

Foundations of buildings as found in the area are done with dry stone construction. The height of the foundation and how deep into the ground it goes varies based on location and soil type (soft, medium, hard soil) and possibly the amount of storeys planned.

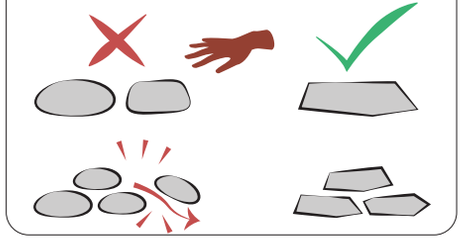
If using an existing foundation, assess if it is built well and conforms to the below.

2.1 Dry stone foundation keeps rising damp away from mud construction (pakhsa) wall, heights vary depending on soil

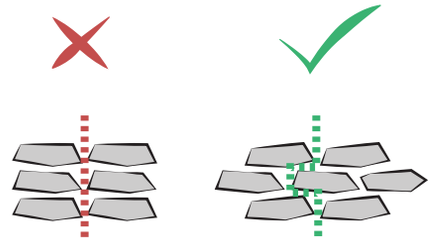


2.2 Select good stones;

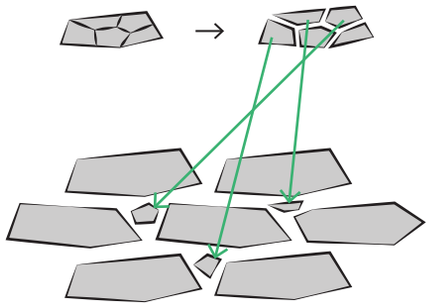
- ✗ Not round/subrounded river stones,
- ✗ Not stones that break easily
- ✓ If riverstones, they must be dressed
- ✓ Square stones
- ✓ Stones that are minimum 50 x 150 mm



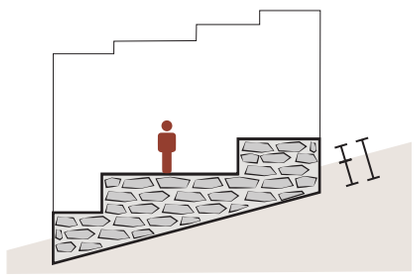
2.3 Ensure good overlapping of the stones for a solid foundation with stable bearing.



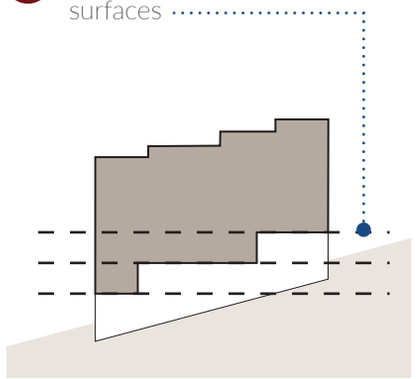
2.4 Choose small stones or cut stones to fill gaps; keep gaps to a minimum.



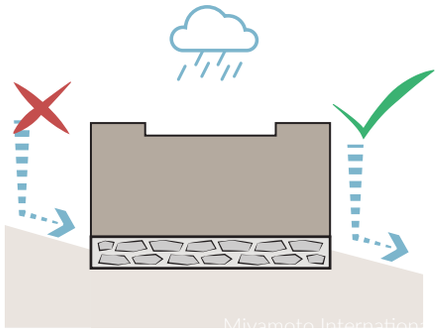
2.6 Stepped foundation to match a sloped surface



2.7 Build the walls on level surfaces



2.8 Ensure that drainage leads away from walls and shelter



This is a living document which will be updated throughout the earthquake response. Version: 24 August 2022

C 3. TIPS FOR PAKHSA COMPOUND WALLS

Key Messages Earthquake Response Khost & Paktika: Message 3 (8)

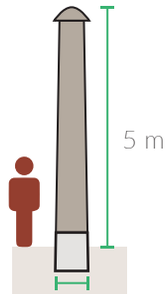
Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter

Pakhsa is used in nearly all cases as the construction method for the outer compound walls. Pakhsa is a vernacular mud-based construction method with a specific construction process. The exact process and material can vary between communities, based on the quality of available mud and clay in various locations. This means that various local experts will need to be brought in to assess the best practice of creating pakhsa walls for each area.

3.1 Material selection; Good clay content, small aggregate not big. Get local vernacular expert input on strong pakhsa mixture, as this varies geographically!

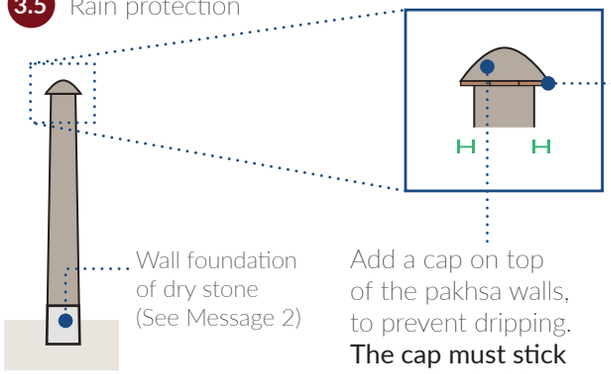
3.2 Material preparation; Working the clay to make it sticky

3.3 External compound walls; Height vs width ratio for Pakhsa walls is 1:8-1:10. They are sometimes tapered. They are usually 4-5 m high



3.4 Drainage away from the foundation.
Connect drainage to existing compound drainage system, if such system exists.

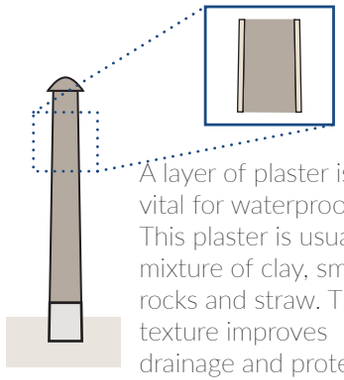
3.5 Rain protection



Wall foundation of dry stone (See Message 2)

Add a cap on top of the pakhsa walls, to prevent dripping. **The cap must stick out on both sides.**

Wood/mud bricks stick out (10-15 cm), they are kept in place with more mud/clay on top.



A layer of plaster is vital for waterproofing. This plaster is usually a mixture of clay, small rocks and straw. The texture improves drainage and protects the wall.

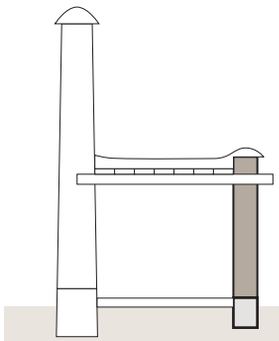
C 4. TIPS FOR INTERNAL/NON-COMPOUND WALLS

Key Messages Earthquake Response Khost & Paktika: Message 4 (8)

Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter

Internal compound walls are often also made with pakhsa, but internal walls of mud brick or stone are also common. All three methods, when constructed well, perform adequately during an earthquake.

4.1 Internal compound walls are lower; between 2,5 - 3 m.



The walls are usually thick, with small and few openings, this helps with a optimal thermal comfort inside all year round.

4.2 Pakhsa wall construction

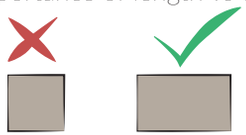
Same as pakhsa outer walls (Message 3); Height vs width ratio for Pakhsa walls is 1:8 - 1:10

4.3 Rain proofing; capping (if pakhsa), drainage away from foundation and good plaster.

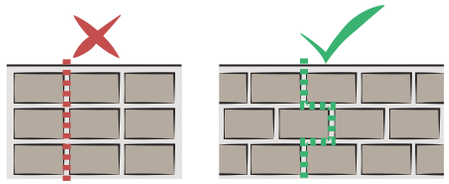
This plaster is usually a mixture of clay, small rocks and straw. (Will update on good plaster mixture)

4.4 Mud brick wall construction

Importance of length vs width



Importance of staggered placement

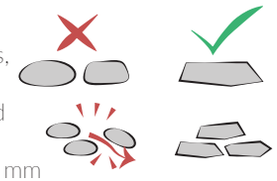


Quality of mortar joint.
Put mortar both horizontally as well as vertically with minimal gaps.

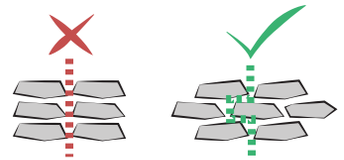
4.5 Stone wall construction

Select good stones;

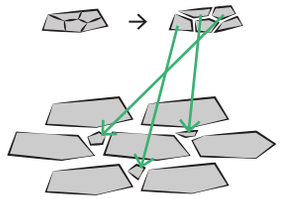
- ✗ Not round/subrounded river stones,
- ✗ Not stones that break easily
- ✓ If riverstones, they must be dressed
- ✓ Square stones
- ✓ Stones that are minimum 50 x 150 mm



Ensure overlapping of the stones.



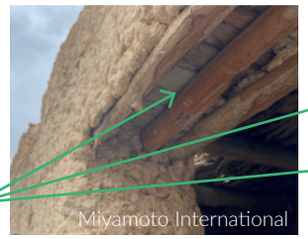
Good (dry) stone construction with minimal gaps



If above ground; mortar can be used to fill gaps when rocks are not angular and as such, suited for dry stone construction.
(Will update on good mortar mixtures)

4.6 Openings; windows and doors

The most important aspect for windows, doors and transitional indoor/outdoor spaces is to make use of lintels that stick out on both sides, to support these openings.



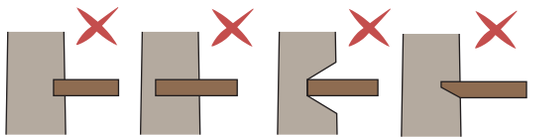
C 5. TIPS FOR A SAFE ROOF [1]

Key Messages Earthquake Response Khost & Paktika: Message 5 (8)

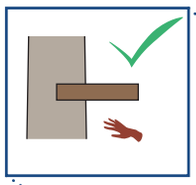
Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter

The vernacular techniques for the roof as seen in the field, when built well, function adequately during seismic activity.
The mechanism is based on the walls behaving like free-standing walls subject to seismic actions, connected with rafters that are allowed to slide back and forth through the internal wall, allowing the entire structure to rock, absorbing seismic energy.

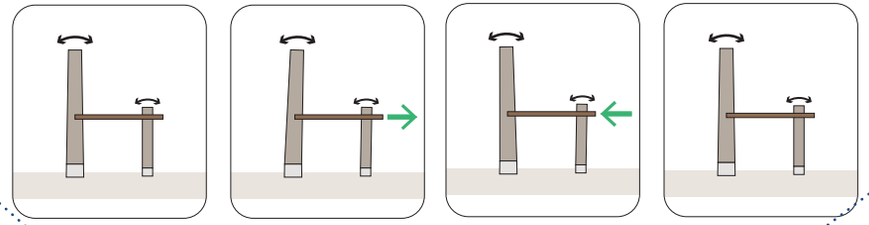
5.1 Connection to compound wall.



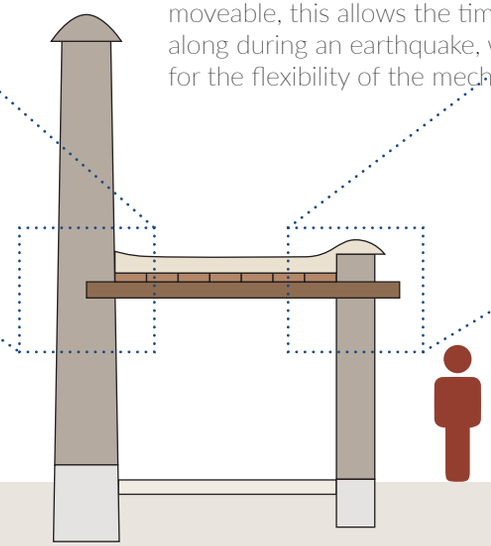
The rafters need to stick into the compound wall halfway for stability. Too deep and they may affect the robust wall, too shallow and they may slip out. Don't cut the wall or rafter for easier access, this can result in the rafters slipping out.



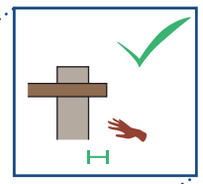
Rafter connections to walls



The rafter connection to the internal wall is moveable, this allows the timber to shake along during an earthquake, which is vital for the flexibility of the mechanism.



5.2 Connection to internal wall.



The rafters need to stick out of the internal wall at least 15-20 cm.

If they are too short, they may fall out of the wall and the roof will come down, or they can push the wall over.

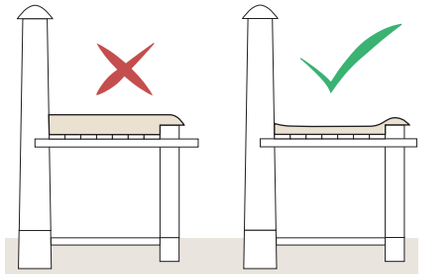
C 5. TIPS FOR A SAFE ROOF [2]

Key Messages Earthquake Response Khost & Paktika: Message 5 (8)

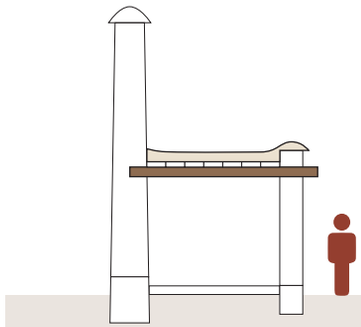
Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter

The roofs are constructed in a simple, yet effective manner. They consist of rafters, planks or reeds and a layers of clay for waterproofing. Good drainage is vital.

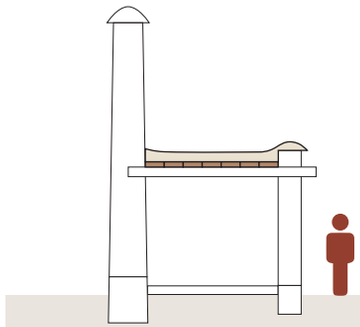
5.1 Layer of water-proof clay Should not be too thick, no more than 15-20 cm is needed



5.2 Wooden rafters stick halfway into the outer wall and must stick out of the inner wall

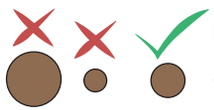


5.3 Wooden planks/reeds are laid perpendicular on top of the rafters.



5.4 Wooden planks are laid perpendicular on top of the rafters. As seen from below.

5.5 Pick good, termite-resistant timber for the rafters



Do not use too big or too small timber for the rafters.

Use well-seasoned hard wood without knots

If needed, treat the rooden rafters to prevent termites and other weathering effects

5.6 Roof drainage; Pipes through clay layer lead the water to other side of the wall, then send it away from foundation/wall.

5.7 When organising the drainage, ensure that it makes sense and potentially links up with the drainage system of the compound

5.8 Do not use plastic sheeting inbetween the clay of the roof; this does not work well over time.

C 6. TIPS FOR SEISMIC UPGRADING

Key Messages Earthquake Response Khost & Paktika: Message 6 (8)

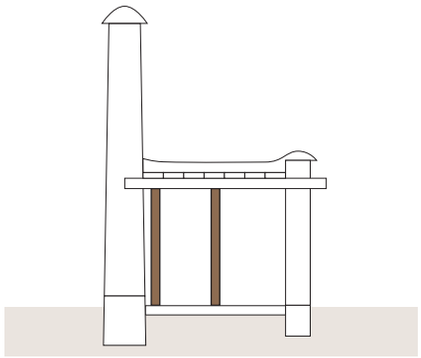
Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter

Not every house will need to be rebuilt, some houses can be upgraded and/or strenghened to better cope with seismic energy. Have a local or international specialist in vernacular architecture help with the assessment.

Below are a few possibilities that may aid in seismic upgrading.

In progress and will be updated with good practice examples during the implementation phase, after more detailed assessments by local vernacular and international specialists

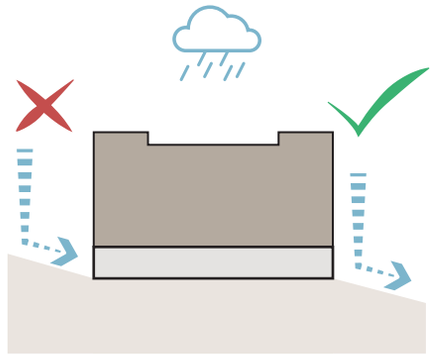
6.1 Consider posts below beams, near the walls or in the middle of rooms.



6.2 Wall capping

The rain protection capping as mentioned in message 3 is very important to protect the walls from rain.

6.3 Improve drainage away from foundations



C 7. TIPS FOR MAINTENANCE

Key Messages Earthquake Response Khost & Paktika: Message 7 (8)

Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter

Staying safe requires regular maintenance and check-ups, to ensure that all the elements of the house maintain their strengh and stability over time. For example wood can rot or become weaker due to termites, waterproof layers can become less effective and need updating, connections between rafters, walls and posts may need reinforcing.

7.1 Maintain plaster

Use straw, small rocks and clay to maintain a regular plaster coating for water proofing

7.2 Trim roofs; Do not let them get too thick

Yearly maintenance is needed for the waterproof layer. Scrape off the previous clay layer before applying a new waterproof clay layer. This way the roof will not become too thick and heavy after a few years.

7.4 Check timbers

Check for rot and termite damage

Apply measures against termites and rot

Replace if needed

7.5 Check the connections of rafters and posts regularly.

7.3 Check the compound walls and internal walls regularly

C 8. HAVE AN EMERGENCY PLAN!

Key Messages Earthquake Response Khost & Paktika: Message 8 (8)

Shelter Cluster Afghanistan
ShelterCluster.org
Coordinating Humanitarian Shelter

It is extremely important that awareness is raised on earthquakes; how to respond during, after but also how to prepare in order to mitigate the impact of a potential future earthquake.

8.1 Aftershocks will happen but will reduce

8.2 But… earthquakes may happen again

Have an evacuation plan!

Ensure that furniture does not stand in the way of a quick exit from rooms.

8.3 DROP, COVER and HOLD

When an earthquake starts, Drop to the ground or lean over as much as possible, away from big heavy objects, Cover your head with your arms and Hold your neck with both hands until the shaking stops.

8.4 As soon as it is possible to walk, go outside to the nearest big open space, as objects can still fall after the shaking has stopped.

Avoid going near big walls and heavy roofs, find safety in an open space

8.5 Keep some emergency shelter or sheeting material nearby, to be used in case of emergency

8.6 Be careful when reentering, assess the safety and stability of the structures first

8.7 Make sure that everyone -children included- know how to respond next time!

Practice earthquake responses with everyone by running outside to the nearest big open spaces