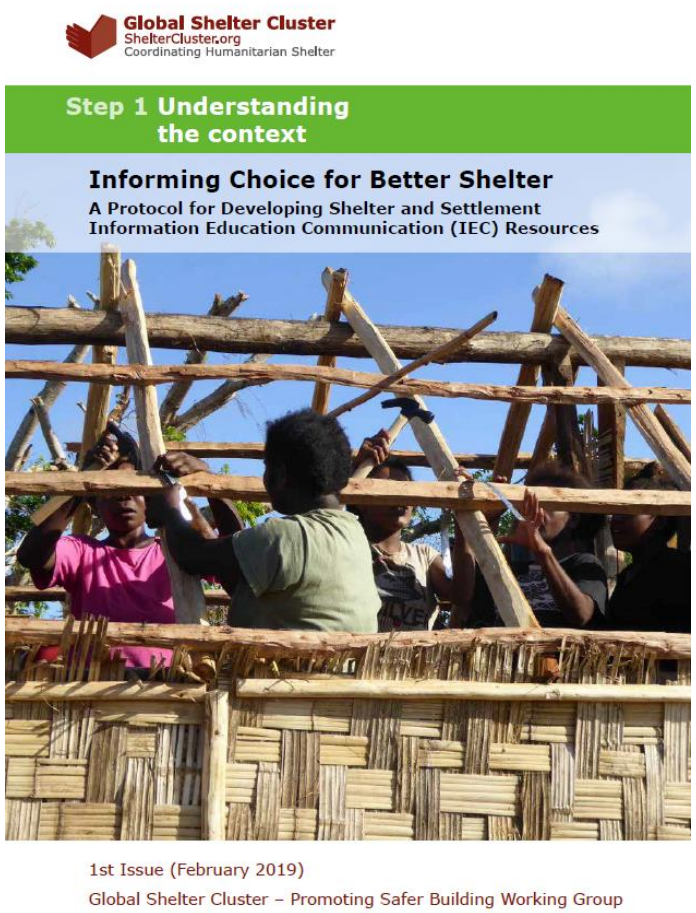
SOME STRENGTHS OF LOCAL CONSTRUCTION

PROTOCOL; A pilot phase with CADECOM / CRS / CARDS; then consolidation with support of the TWG and others Malawi Partners			
Protocol – Step 0:		**Forming TWIG**	**Already done**
Protocol – Step 1:	*Activity 1*	**Shelter Response Profile**	**August - November 2020**
	Activity 2	**Understand context**	**August - November 2020**
Protocol – Step 2:		**Defining EIC objectives**	**September – December 2020**
Protocol – Step 3:		**Identifying stakeholders and audiences**	**October – November 2020**
Protocol – Step 4:		**Communication channel analysis**	**September – November 2020**
Protocol – Step 5:	*Activity 1*	**Define Technical Assistance Strategy**	**November – December 2020**
	Activity 2	**Adapted EIC material to channels and audience**	**November – December 2020**
Protocol – Step 6:		**Rolling-out Strategy**	**December 2020 – February 2021**
Protocol – Step 7:		**Monitoring and Evaluation**	**January - March 2021**

https://www.sheltercluster.org/working-group/promoting-safer-building-working-group/documents

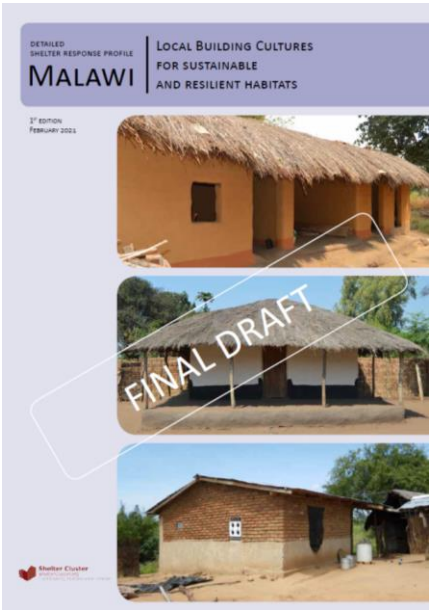


Step 1 – Activity 1

Shelter response profiles (scale of Malawi – 1st stage)

- A 80 pages A4 document
- Objectives: Help actors understand the relevance of Local Building Cultures and integrate them into their projects after more accurate and localized context analysis

To find the existing SRP: https://www.sheltercluster.org/promoting-safer-building-working-group/library/shelter-response-profiles



Step 1 – Activity 2

Context analysis (scale of the locality – 2nd stage)

- A methodology for localized context analysis regarding Local Building Cultures, with Focus Group Discussions, site visits, report writing…
- Objectives: Help actors in understanding local context and assessing Local Building Cultures and integrating them into their projects

4.3. CONSTRUCTION MATERIALS AND TECHNIQUES

Sources: Cleantech Malawi (2012), CRS (2018, 2020), Culture Grams (2018), Eco Matters Ltd. (2016), MacLean (s.d.), Nerymbaeva (2015), Ngoma & Sassu (2004), Ngwira & Watanabe (2019), Pullaniikkatil et al. (2016), Richardson (2010), Tara (2014), Twingi (s.d. a), UN-Habitat (2010), Wambua & Malunga (2014), Yager (2016)

A. FORMAL AND INFORMAL SECTORS

All the building materials used by the informal sector, and many used by the formal sector builders are locally available in Malawi (UN-Habitat, 2010). Steel and cement are sourced from the formal sector, but most other materials come from the informal manufactures (Tara, 2014).

Tara (2014) states several aspects on the division of formal and informal sectors. For example, there are a few large companies that provide materials especially for roofing and flooring. However, almost the entire walling and about 60% of the other products market is accounted for with the informal sector. The informal sector makes use of labour-intensive, local technologies and materials costing very little or nothing (e.g. adobe bricks made from the site soil).

Production of adobe bricks in a peri-urban area near Blantyre. CC- Carmichael C.

B. MATERIALS AND TECHNIQUES

EARTH

There is a great tradition of earth construction in Malawi. Earth is used for the walls of most houses in rural areas (adobe brick, wattle and daub or rammed earth walls) and for many houses in peri-urban areas (mostly adobe bricks). It is also the most used material for floors and it is very much used in plasters.

Earth construction in Malawi has a wide range of qualities. Good quality models and constructions have been developed and adapted to local needs and ways of life over centuries (see chapter 5 for examples of good local practices). Despite this fact, nowadays earth is mostly associated with low income status (Richardson, 2010). For instance, the Malawi Bureau of Standards did not recommend earth as suitable material for urban structures' development (UN-Habitat, 2010). Good quality earth constructions are suitable for modern living standards, and there is a need to dissociate the image of poverty from earth construction. In fact, safe earth houses that meet people's living requirements can be built in a fraction of the time required for building a burnt brick house, enabling families to use their funds for the development of livelihoods (Richardson, 2010).

Earth is used in different forms:

Adobe or sun-dried bricks (*zidina*): these raw earth bricks with or without organic matter (straw, cowdung, etc.) are very common in the informal sector in both rural and urban Malawi. UN-Habitat (2020) stated different aspects of adobe production: they are usually produced on or close to the building site, often by the owner (sometimes particularly by women) and, therefore, they commonly have no or very little cost. Once the bricks are dry, they are set in earth mortar and sometimes plastered with earth or earth and lime mortar to improve durability.

Wattle and daub or earth on frame (*yomata*): a mixture of earth, water and sometimes organic fibres applied to a formwork is a common construction technique in some areas. Twingi (s.d. a) explains the ways in which frames are made using wood poles, reeds and bamboo, depending on the available materials in each place. Wood branches of all sizes are used as vertical and horizontal members, while wood poles are used as supports, especially on the corners. Stalks of bamboo are placed into the ground as vertical supports, while horizontal members are usually cut in half. Reeds are also used to construct these formworks.

Rammed earth (*mdindo*): rammed earth constructions are common in some areas and they are a living technique. Rammed earth walls are built compacting layers of a damp mixture of earth with suitable proportions of sand, gravel, clay, and sometimes stabilizer into a formwork (an externally supported frame or mold). In Malawi, the formworks are usually made of three pieces of wood joined together, usually with a bicycle chain (Twingi, s.d. a).

Wattle and daub house under construction in Chipita, Karonga. Bamboo framework and earth mortar. © Jon Twingi.

Rammed earth house under construction in Chimombo, Ntchisi. © Jon Twingi.

Woman plastering her house with earth plaster in Nkhombe, Kasungu. © Jon Twingi.

Earth plasters: earth plastering or smearing is a final layer (or layers) of mortar used to protect walls and floors against the elements. The mortar is usually made of earth and water, and sometimes it has additives such as organic matter or lime. Plastering is very common throughout the country and is usually completed once a year with earth from the place. In many cases it was stated that the earth was gathered from a place off site, what is done to have a specific or colour (Twingi, s.d. a).

Earth paintings: decorations with paintings on the side of walls are quite common, and the colours are usually from the local soils (Twingi, s.d. a).

Earth floors: the floor of the house receives little attention by most families, even when upgrading a house. Most rural homes have earth floors (Tara, 2014).

Stabilised Soil Blocks (SSB) / Compressed Stabilised Earth Blocks (CSEB): they are made with a mixture of earth (soil) and a small portion of cement or lime. Their use in housing is not widespread. The amount of cement required for stabilizing depends on the nature of the soil. According to MacLean (s.d.), the blocks are compacted very often using a manual press and the field tests for selecting soils are well understood and that completed blocks are also tested for compressive strength using simple tests on site. The blocks are more often used in single thickness walls with the blocks laid in stretcher bond and therefore rely on having a concrete ring beam to prevent cracking and increase stability (MacLean, s.d.).

The use of CSEBs is concentrated in infrastructures (especially health and education buildings) funded by international organisations in Malawi with the objective of mitigating deforestation and other effects of climate change (Wambua & Malunga, 2014). Nonetheless, the Malawi Housing Corporation is also starting to use these blocks as they move away from the use of burnt bricks (Tara, 2014).

Woman applying a red earth based painting in Chisi, Nzimbe. © Jon Twingi.

Well maintained earth floor in Chitungulu, Nkhata Bay. © Jon Twingi.

BURNT BRICKS AND CERAMIC PRODUCTS

There is a strong tradition of manufacturing and building with burnt bricks (Tara, 2014). As reported by UN-Habitat (2010) burnt brick is the main material for formal housing and is also much used in the informal sector. Richardson (2010) states that with changing times, most people aspire to live in burnt brick houses. Bricks are often used for the construction of **walls** and **foundations** close to the place of manufacture to save in the cost of transportation (UN-Habitat, 2010). Even reducing transportation costs, an average burnt brick was sold between MK 3.50 to 5 in 2012 while a good quality product was sold between MK 15 to 25 (Cleantech Malawi, 2012), and therefore poor housholds can take up to 15-20 years to gather the funds to build a brick house (Richardson, 2010).

In 2012, there were only three organized brick industry producing good quality bricks (Cleantech Malawi, 2012). In fact, the production is very usually made on small scale traditional industries where the bricks are hand moulded in wooden moulds and fired in traditional clamps (UN-Habitat, 2010). Most of the clamps are small ranging from around 10,000 to 50,000 bricks capacity and there is no control over the firing process (Cleantech Malawi, 2012).

According to Cleantech Malawi (2012), the two major concerns in the brick sector (formal or informal) are increased deforestation due to use of fuelwood and poor brick quality, as due to high demand, all bricks produced are sold irrespective of quality.

Regarding the soils, in some cases black coloured plastic clays are used to produce good quality bricks, but on the other hand extremely poor quality sandy soils are also used (Cleantech Malawi, 2012). Cleantech Malawi also state that there are neither proper testing facilities nor knowledge on the suitability of soils in brick making.

Some technical issues in the burnt brick production include the following, as reported by Cleantech Malawi (2012). The bricks have different strengths depending on the intensity and time of firing and their position in the clamp. Faulty mould design and high water content deforms the just moulded bricks.

Bricks are hand moulded in wooden moulds. Brick production in Benga, Mchinji. © Jon Twingi.

Traditional clamp in Zomba district. © Jon Twingi.

4.6. LOCAL HOUSING TYPES AND LOCAL AFFORDABLE OR SELF-BUILT HOUSING

Sources: Bremner (2009), Culture Grams (2018), Huang (2017), Kloukinas et al. (2019a), Malawi, Ministry of Lands, Housing and Urban Development (2015), Mpanga (s.d.), National Statistical Office (2017, 2019), Ngoma & Sassu (2004), Nowell et al. (2019), Tara (2014), Twingi (s.d. a), UN-Habitat (s.d., 2010, 2020a)

A. OVERVIEW ON PAST MODELS OF CONSTRUCTION

PAST MODELS DIFFER FROM CONTEMPORARY VERNACULAR HOUSING

It is necessary to make the difference among past models and vernacular housing. Past models of architecture are not anymore built or used even if they may have left some influences in present models, while contemporary vernacular architecture is alive and is part of the living practices of many people.

SOME PAST MODELS: MOST BUILDINGS WERE NOT DESIGNED TO LAST

In the past, sedentary population usually lived in buildings which were not intended to last indefinitely (Huang, 2017). Many times, what remained was the place, the site of the plot. As stated by Huang (2017), the courtyard as the hearth of the family could last for many generations, but the cases intended for individuals were only meant to serve for a certain stage of life or for one generation. In the social and cultural plans, family structures and the addition of children and in-laws required a great deal of adaptability in house construction (Huang, 2017).

Apart from this limited durability of sedentary housing and the need of adaptability, Huang (2017) explains that whenever the soil used for farming was not particularly good, nutrient depletion gradually required whole villages to sometimes migrate to clear new land, and so buildings were optimally designed and built to serve this conscious temporality.

Hereafter are presented only some known past models of construction that have disappeared now, but there are certainly others.

Wattle and daub walls with earth flat roofs: a common model was made of wattle and daub walls (timber frames and earth fill) and flat roofs made of earth (Huang, 2017). The roofs required repair or even full replacement after every rainy season according to Huang (2017).

Conical huts with continuous thatch cover for walls and roofs: there was another common building model consisting of conical structures with continuous thatch cover from walls to roof (Bremner, 2009). According to Bremner (2009), this type of architecture was present at least in the Shire River valley and surrounding highlands circa 1865 as reported in the Memoirs of Bishop Mackenzie (Cambridge, 1865) who was part of the UMCA (Universities' Mission to Central Africa) mission station at Magomero (southern Malawi).

PAST AND PRESENT MODELS

Some models have persisted until our days. For example wattle and daub walls with thatched roofs are a contemporary building model in Malawi and was also an existing model in the past (Huang, 2017). Round shape buildings with conical roofs were very common and they continue to exist but are not very used anymore apart from in kitchens or latrines (UN-Habitat, s.d.).

INFLUENCE OF COLONISATION IN SHAPES AND MATERIALS

Round shape with conical roof has been mostly replaced by square/rectangular shapes, as a result of British colonial influence (UN-Habitat, s.d.). Bremner (2009) reported that a chronicler called Rowley, part of the mission station at Magomero circa 1865, pointed out that the orthogonal plans of the mission buildings were starting to have an influence over local inhabitants, who had started swifting from circular to regular plans in their houses.

British colonialism also introduced in Malawi the use of fired red bricks as main structure for walls masonry, but also regular and paced windows and doors, concrete or burnt bricks lintels and high pitch roofs covered with corrugated iron sheets (UN-Habitat, s.d.).

The huts with their conical forms were typical of domestic dwellings in the Shire River valley and highlands circa 1865. The incomplete church of St. Paul in the mission station at Magomero (southern Malawi) is shown far right. CC- Memoirs of Bishop Mackenzie

The orthogonal plans of the British colonial buildings had an influence over local inhabitants, who started swifting from circular to regular plans in their houses Watercolor sketch of Chibisas village. CC- Charles Mellor

British colonialism also introduced in Malawi the use of fired red bricks, regular and paced windows and doors, concrete or burnt bricks lintels and roofs covered with corrugated iron sheets Mission in building in Blantyre. CC- Carmichael C.

Mandala house in Blantyre. CC- butforthesky.com

B. OFFICIAL CLASSIFICATION OF HOUSING UNITS

In Malawi, the Population and Housing Census (National Statistical Office, 2019) classifies a housing unit as traditional, semi-permanent or permanent depending on the materials used for its construction, but it has not been found in the Census the actual characteristics of these three types of housing units. The definition varies depending on authors:

Traditional: according to Kloukinas et al. (2019a), a traditional house has rammed earth, wattle and daub or timber walls and thatched roofs. UN-Habitat (s.d.) and Mpanga (s.d.) widen the description to any house built with raw earth, including adobe.

Semi-permanent: UN-Habitat (s.d.) describes a semi-permanent house as one that has generally been built using modern and partial lasting materials, but Kloukinas et al. (2019a) say that a house made of unburnt clay bricks and thatched roofs would be semi-permanent.

Permanent: Mpanga (s.d.) says that permanent structures are made with concrete, stone, or burnt brick walls and iron sheet, concrete or asbestos roofs. Other authors give less inclusive definitions. For example Kloukinas et al. (2019a) say it is made of burnt clay brick and iron sheet roofs.

In 2018, there were 4,805,431 housing units enumerated in Malawi. Of these housing units, 41.1% were permanent, 23.0% were semi-permanent and 35.9% were traditional (National Statistical Office, 2019).

IS THERE PRECISE DATA ON THIS CLASSIFICATION?

Type of Housing Units	Malawi		Northern Region		Central Region		Southern Region	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Total Housing Units	4,805,431	100.0	569,331	100.0	2,094,353	100.0	2,141,747	100.0
Permanent	1,974,611	41.1	334,588	58.8	704,277	33.6	935,746	43.7
Semi-permanent	1,107,447	23.0	148,491	26.1	463,829	22.1	494,907	23.1
Traditional	1,723,373	35.9	112,052	19.6	930,247	44.4	661,072	30.8

Types of housing units in 2018. © National Statistical Office (2019)

There are many intermediate combinations of materials and it seems difficult to define houses following the precedent classification. In any case, there is a clear evolution regarding the shares of the different types of housing units. According to the National Statistical Office (2017 and 2019), in 2010, 42% of the housing units were traditional, while in 2018 the share had dropped to 36%. At the same time semi-permanent houses had remained more or less the same in terms of share, from 27% in 2010 to 26% in 2018. Finally, permanent housing units have increased in share from 31% in 2010 to 41% in 2018.

In this document, we will make a different classification: vernacular, precarious and globalized housing. There will also be a small introduction on history of constructions in Malawi.

Background characteristics	Permanent			Semi-permanent			Traditional		
	2010	2013	2016	2010	2013	2016	2010	2013	2016
Malawi	30.9	35.8	32.6	26.9	28.4	35.3	42.2	35.8	32.1
Place of residence									
Urban	49.9	54.9	60.7	35.4	34.9	32.7	14.7	10.3	6.6
Rural	23.0	28.4	22.4	23.4	25.9	36.2	53.6	45.7	41.4

%age distribution of dwelling units by type of construction materials in 2010, 2013 and 2016. © National Statistical Office (2017)

This is a traditional house according to the official classification of housing units (Simwaka, Nkhotakota). © Jon Twingi

These two houses would be semi-permanent according to different authors as they are built with a mix of materials. The one on top has burnt bricks and thatched roof (Kachopetsonga, Nkhata Bay- © Jon Twingi). The other one has adobe brick walls and metallic roof (Lilongwe- © Urbanopolista)

This is a permanent house according to the official classification of housing units (Chisutu, Mulanje). © Jon Twingi

5. Learning from local building cultures

5.1. Hazard-resistant practices

Sources: Bureau TNM (2016), CRS (2018, 2020), Government of Malawi (2010, 2019), Kloukinas et al. (2019a), Kloukinas et al. (2019b), Moles et al. (2017), Nowell (2018), Sassu (2011), Shelter Cluster Malawi (2015), Trogrlić et al. (2018), UN-Habitat (s.d.), World Bank Group, et al. (2019)

A. Integral approach

Thinking about hazards, there is a need to take into account all the hazards that may affect a given area, and not only the one that can be seen as prevailing.

The choice of the construction site is crucial for safety. Whenever it is possible to choose there are several important aspects that must be taken into consideration according to the Safer House Construction Guidelines of Malawi (Bureau TNM, 2016). One of the most important issues described is to take into consideration local knowledge, historical data, and district's advise on whether the area is prone to a specific risk. Also, when selecting the site for a new construction it is important to consider that the soil type influences the building's performance. It is crucial to build on relatively stiff and compact soil so the building does not move.

Also, after a disaster, rebuilding efforts increase the rate of resource extraction for building materials. This degrades the environment and increases risk with greater erosion, deforestation, landslides and floods. This may deprive communities of essential livelihood resources and put people, infrastructure, and ecosystems at greater risk of future disasters (WWF, 2018).

Finally, collective buildings such as evacuation centres or schools which are used by communities during and after disasters should be easily accessible for all, located in a safe place (e.g. above known flood levels, far from instable slopes...), and be resistant to different hazards (Shelter Cluster Malawi, 2015).

COMPLETE

TO FIND OUT MORE

- Guidelines for Safer House Construction: Technical Manual
  -> Government of Malawi (2010)
- Repair and Retrofit Handbook for dwellings in Malawi
  -> Malawi Shelter Cluster (2015)
- Indigenous knowledge and early warning systems in the Lower Shire Valley in Malawi
  -> Trogrlić et al. (2018)

Houses constructed using adobe bricks, render and earth mortar like this one (Chisoka, Rumphi District) responded well to the important floods in 2015 (CRS, 2020) as the design developed over centuries provides protection from the elements. Other than some minor repairs, some of these houses were in good condition and allowed the families to return to their homes once the floods had subsided. © Jon Twingi

B. Floods

Settlement and preparedness practices

- Most communities are used to build at a safe distance from watercourses, which is the best option to prevent damages due to flooding. In places such as Ndamela (Nsanje District) most structures are also built on higher land to avoid impacts of flooding (CRS).
- In some villages, when the water levels are increasing, people living in the lowlands, close to the river banks position a stick in the river banks and monitor the speed at which waters are increasing. Based on this observation, the decision on possible evacuation will be made (Trogrlić et al., 2018).
- Communities in the Lower Shire Valley build physical barriers by filling empty sacks with sand and place them next to the river before floods (Trogrlić et al., 2018). ANY PICTURES AVAILABLE?
- Some families in the Lower Shire Valley report that they store food in their second homes in the uplands as a strategy to reduce the potential impact of flooding (Trogrlić et al., 2018).

Stone foundation and plinth (Chimwendo, Karonga) protecting the walls from humidity and floods. © Jon Twingi

Treatment of the surroundings of the building

- Within a settlement, adequate and well-maintained drainage systems are usual. Blocked drains contribute to floods and damage housing (Shelter Cluster Malawi, 2015). Some communities have a good understanding of this issue and so dig and maintain drains. For example, communities in the Lower Shire Valley make gullies in the ground to divert the flood waters flow (Trogrlić et al., 2018).
- Drainage channels are dug to take surface water away from the building. Sloping the surface around the house to evacuate water from the walls is also a good practice.
- Vegetation cover around the houses protect them from strong winds and erosion, but also from floods effects thanks to the roots system. The roots promote the penetration of water into the soil. Low vegetation slows down the speed of water flow and also helps reduce soil erosion. On the other hand, low vegetation too close to the walls will keep humidity near the buildings and lead to rising damp problems. Trees can also be used as food suppliers, as building materials or for firewood. Some communities organise and strengthen river banks by planting trees and grass (Trogrlić et al., 2018) ANY PICTURES AVAILABLE?

Plastic membrane protecting the wall from humidity in Masako, Dowa (bottom). © Jon Twingi

Raised platforms and raised constructions

- In flood prone areas, many houses are constructed on raised earth or earth and stone platforms which help protect the core structure from erosion. This is accomplished by raising up an earthen mound above the average annual flood level. The edges of the earthen platform work as a sacrificial mass in case of floods. This solution is very effective and it can be done at minor cost with earth from the site. Regular maintenance is required to ensure its effectiveness.
- Some families protect the ends of the raised earthen mound with fired bricks or stones. The idea is to slow down erosion in the event of a «flash flood» but also to confine the plinth. Also, some families protect these mounds with earth-based plasters.
- A strategy to reduce impacts of flooding in the Lower Shire Valley is building a *sanja* or *nthandala* in homes, a raised platform used to store food and seeds, thus preventing them to be damaged by floods and heavy rains (Trogrlić et al., 2018).
- Elevated granaries which help to protect crops against moisture and floods are common in some areas.
- The impact of floods on livestock and small animals is a challenge for communities, since replacement of animals is very often beyond families financial capacity. In many parts of the country, chicken and goats are kept in raised platforms made out of local materials like wood or bamboo with the goal of ensuring safety during floods (Trogrlić et al., 2018). These are called *kraals* in areas such as the Lower Shire Valley. Animals are protected from floods and moisture, but also from possible predators and steal.
- *Chete* is a local name in the Lower Shire Valley (at least in Nsanje) for raised temporary shelter made out of locally available wood and grass. *Chetes* will be constructed in the flood prone areas, and during the rainy season, families will be residing in these temporary shelters (Trogrlić et al., 2018). ANY PICTURES OF THIS PRACTICE?

The earthen mounds are strengthened before the rainy season. The foundations are improved with an extra layer of mud. House in Chaima, Dowa District. © Jon Twingi

Some families protect the ends of the raised earthen mound with fired bricks or stones. House in Mteteru. CC- Fireaka.

Raised platforms inside the houses are used to store food and seeds, preventing them to be damaged by floods. House in Chakhutupa, Chitipa. © Jon Twingi

Protection of the wall base and construction details

- Constructions sometimes present deep and water resistant foundations and elevated plinths built using burnt bricks or stones and cement mortar. Water resistant plinths should be built at least above the average level of floods.
- Rising damp (water from the soil) can weaken the base of the walls and floors. Some houses have plastic sheeting or other waterproof materials as a barrier above the foundation or plinth, and less usually a damp proof membrane below the floor as well (Shelter Cluster Malawi, 2015). These barriers are useful to fight against rising damp.
- The roof structure is sometimes borne by an independent timber frame. In case of damage to the walls during floods or earthquakes, the frame can withstand autonomously, hence preserving the roof which is often the most expensive part of the construction. Moreover, the space under the withstanding roof can be used as an emergency shelter.
- For the TWiG-> is it possible to document local knowledge/practices relating to this section
- COMPLETE

Raised constructions help protect small animals like goats or chicken from floods. These constructions are very common throughout the country. This is an example of raised goat pen at Naming'azi Farm Training Centre. CC- Carmichael C.

5.3. LIFESPAN, MAINTENANCE AND ADAPTATION

Sources: Bureau TNM (2016), CRS & CADECOM (2015), Culture Grams (2018), Moles et al. (2017), Shelter Cluster Malawi (2015), Twingi (s.d. a.), UN-Habitat (2010),

LIFESPAN AND MAINTENANCE

- Many families undertake maintenance in a regular basis, as it is crucial to have more lasting houses. It may include small reparations or structural works. When the walls and the surroundings of the building (drainage) are well maintained, they provide additional protection from floods. When the roof is well maintained, it provides protection from storms and strong winds.
- The drainage channels are maintained keeping them free of any object that could obstruct the water flow (Bureau TNM, 2016).
- Fired bricks are very usually set in mud mortar and for more durability are plastered with a mortar of mud and lime for added durability (UN-Habitat, 2010). Burnt brick walls need regular maintenance of mortar joints where the masonry is not protected by plaster. Deteriorated mortar joints can be restored through pointing (Bureau TNM, 2016), using the same mortar used to build (earthen or cement based mortars). Sometimes, when using an earth based mortar, pointing can be done with cement mortar what protects the earth mortar while reducing the cost of masonry.
- Plastering is one of the works that is done more regularly, in walls, floors and verandas, particularly in earthen houses. Plaster in the walls protects the building against erosion and moisture, and plaster in the floor provides better conditions of use and hygiene.
- Women are very involved in plastering. This task is completed once a year as water hitting an earthen surface has a great impact on the structure (Twingi, s.d. a) following the rainy season cycle, ideally using the same mud used to plaster the wall originally (Bureau TNM, 2016).
- In Ndungunya (Phalombe District), women are responsible for mud smearing (*kuzila*) as a routine maintenance which happens weekly depending on availability of resources (time, labour and soil) whilst major maintenances such as roofing or fixing of walls and doors is done by men in the community annually. In a scenario where the women don't have any male figure around, they usually have to use hired labour (CADECOM).
- Natural additives like straw and cow manure are added to the mud plaster to make it more durable increasing the resistance to moisture of the mud, thus preventing the occurrence of fissures during the drying process (Bureau TNM, 2016). IS THIS A COMMON PRACTICE OR A RECOMENDATION?
- The exteriors of homes are often whitewashed (Culture Grams, 2018).
- Tarpaulins distributed after disasters (e.g. floods of 2015), are usually employed to repair the remaining parts of the houses: temporary walls, roofing, etc. (Global Shelter Cluster, 2017).
- Thatch roofs are repaired when necessary, even once a year, in order to preserve waterproofing. In some zones, the grass for thatching is prepared in conical bundles which are simply laid onto the roof structure without being tied, except for the first layers at the bottom. When one bundle is rotten, it can be easily pulled out and replaced by driving another bundle at its place. This practice facilitates maintenance allowing for a fast and a very localized replacement of damaged parts (Moles et al., 2017). VERIFY, CONCLUSION FROM PICTURES.
- There is an evolution of thatched roofs that is becoming common. A plastic membrane is fitted prior to thatch providing additional protection especially at times when there is a shortage of thatching material (CRS, CADECOM, 2015). QUESTION-> Can this solution accelerate the rotting of the straw?

Woman cladding a wall with earth plaster. CC-Gregory S.

Woman plastering a floor in Mawudzi, Salima. © Jon Twingi

Thatched roofs are repaired when necessary. This house in Chome (Rumphi) presents thatch bundles which can be easily replaced when they get rotten. © Jon Twingi

Extensions are very common. More often, new constructions are built in the same plot completely separated from the existing ones. This house is in Mwamkenja, Chitipa. © Jon Twingi

ADAPTATION

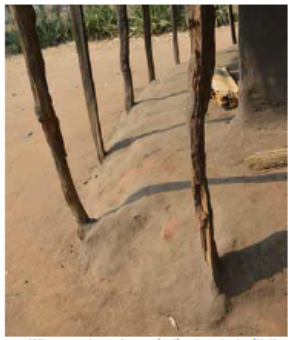
- There is often an evolution process involved in housing. In the early years, the floor will be made of earth and the roof thatched. As soon as families can afford it, they change to corrugated iron sheets (*malata*) and concrete floors. The adobe bricks may also be replaced with burnt brick with cement plaster some time later (UN-Habitat, 2010).
- Extensions are very usual, and they permit people adapt houses to needs and to means available.
- COMPLETE

LIFESPAN AND MAINTENANCE

- Timber poles rarely stand on waterproof elements (e.g. stones, fired bricks), what decreases the structure durability allowing posts rotting.
- Timber and wooden members are not always treated against termites for lack of means. Renewal of the treatment presents the same problem. As a result of this, timber is attacked by termites, carpenter bees and various other wood boring and eating insects (MacLean, s.d.).
- Thatch roofs have good qualities, but they also require frequent maintenance moreover if they are not properly executed. Thatched roofs also have the disadvantage of being flammable and they may be a nesting place for insects.
- CGI sheets are dangerous in the event of strong winds. When sharp and quite heavy CGI sheets are uplifted by winds they start flying and become a potential cause of damages to persons, animals and goods.
- Corrugated metal sheets get rusted with the time and need to be replaced. Also, metal sheets need to be sufficiently thick (gauge ≤ 30) and they should be replaced with suitable ones when it is not the case (Bureau TNM, 2016). This is not always done by lack of means.
- CGI sheeting is imported and expensive to replace when needed.

ADAPTATION

- There are dangerous extensions, such as heavy-weight porches and roof extensions on isolated pillars, quite common in the surveyed areas (Kloukinas et al. 2019a).
- COMPLETE



When wooden poles are in direct contact with the ground and are not regularly treated or replaced, they are vulnerable to rising damp and decomposition. Veranda in Lifidzi, Salima. © Jon Twingi

Maintenance of roofs is crucial to block water from penetrating the walls and to make them stay stable. House in Mwamwiyo, Karonga. © Jon Twingi

5.4. COMFORT, USE AND AESTHETICS

Sources: Culture Grams (2018), Government of Malawi (2010), MacLean (s.d.), Twingi (s.d. a.)

COMFORT

- Temperature and moisture are crucial for comfort in inner spaces. Earth and thatch help have better conditions regarding these, as thatch is a good insulation material and earth a good controller for moisture.
- Most houses have verandas (*khonde*) and other exterior covered spaces where many daily life activities take place as these shadowed spaces are very comfortable in a tropical climate.
- In Salima, buttresses are used on the outside of the houses to create a space which is not exposed to sun. These elements are generally located on the longest wall of the front side (Novelli, 2018).
- Small openings in the masonry walls allow adequate ventilation in the interior of the buildings in this hot humid country. These openings are particularly important for ventilation in kitchens, where they are very common.

Verandas (*khonde*) and other exterior covered spaces where many daily life activities take place as these shadowed spaces are very comfortable in hot days. House in Penganga, Ntcheu. © Jon Twingi

WE FIND MANY ANSWERS FOR AFFORDABLE AND SAFE ENOUGH HOUSING IN PEOPLE'S PRACTICES AND IN THE INTELLIGENCE OF LOCAL SOLUTIONS

STRENGTHS

Stone bunds are a solution to reduce the speed of surface water and promote the penetration of water into the soil, thus avoiding erosion. Example of stone bunds built by Khole community in Machinga district.

STRENGTHS

Houses constructed using adobe bricks, render and earth mortar like this one (Chisoka, Rumphi District) responded well to the important floods in 2015 (CRS, 2020) as the design developed over centuries provides protection from the elements. Other than some minor repairs, some of these houses were in good condition and allowed the families to return to their homes once the floods had subsided. © Jon Twingi

Some families protect the ends of the raised earthen mound with fired bricks or stones. House in Mtetera.
CC- Firesika.

STRENGTHS

Verandas and large roof overhangs between the interior earth wall and the exterior avoid the risk that changes in humidity associated with rain will swell the soil under the walls. House in Simwaka, Nkhotakota.

This solution is particularly relevant in flood prone zones, but also in Black Cotton Soil zones where a conventional foundation would not solve the problem.

STRENGTHS

Stone foundation and plinth (Chimwendo, Karonga) protecting the walls from humidity and floods.
© Jon Twingi.

Plastic membrane protecting the wall from humidity in Masako, Dowa (bottom). © Jon Twingi

STRENGTHS

House in Mpale, Mangochi (top). House in Dzipusile, Ntcheu (bottom). These two houses have a contact surface between the wall and the roof structure which is minimised using only some bricks to sustain the framework. This permits ventilation, but also allows for a better visual detection of termites paths and thus a better control of their attacks. © Jon Twingi

STRENGTHS

Woman cladding a wall with earth plaster. CC- Gregory S.

Woman plastering a floor in Mawudzi, Salima.
© Jon Twingi

STRENGTHS

Rendering a house in a training by CRS. © CRS

In Ntcheu District (Huang, 2017), for example, there is a cultural habit to help one another build their home, what solidifies social relationships, as host families offer food to neighbours in exchange for labour in a mutually recurring cycle.

SOME STRENGTHS OF LOCAL CONSTRUCTION

ANY OTHER RECENT PROJECTS BASED ON THE EVOLUTION OF LBC APART FROM CRS/CADECOM PROJECT?

6. PROJECTS BASED ON THE EVOLUTION OF LOCAL BUILDING CULTURES

Example illustrating the **reinterpretation and valorisation of local building practices** in affordable housing to reduce vulnerability to local hazards

6.1. MALAWI FLOODS AND RAINS RECOVERY PROGRAM: LEARNING FROM TRADITION

PROJECT BY: CRS & CADECOM

Sources: CRS & CADECOM (2015), CRS (2015; 2018)

PROJECT DESCRIPTION

Project location: Zombe, Phalombe and Machinga districts
Disaster: Floods
Disaster date: January 2015
Project duration: 8 months
Target population: 1,090 families
Material cost per family (in USD): $552 (inclusive of training and dissemination)
Donor: CRS private funds
Partner: Cadecom (Caritas Malawi)

PROJECT PRINCIPLES AND SCOPE

The programme explored and built upon existing local knowledge and practices, which enhanced the ownership and commitment of the residents and ensured that any recommendations were site-appropriate. The resources and information produced were shared with the Shelter Cluster in Malawi, so that other actors could use them. Ultimately, this approach provided a practical, inexpensive and replicable model to respond to similar flood events, in these and other parts of the country.

SHELTER RECOVERY STRATEGIES

When asked, people said that they intended to repair or reconstruct their homes during the dry season using the same building techniques and materials that they previously used, and were interested in what building methods could make houses more resilient.

Materials such as burnt brick, cement, and corrugated iron sheet roofing are beyond the financial means of the poorest households. To have wider impact, there was a need for assistance to be focussed on Safer Building solutions using local materials that were affordable, replicable, and achievable by the most vulnerable and at risk households.

The program provided:

- Local builder training in Safer Building to support their communities;
- A model house built in each community as an example of Safer Building;
- Information and training provided to each community;
- 1350 vulnerable households provided with tools, materials and technical guidance to build their home and construct latrines.

SHARED LEARNING

Best building practices were identified through theory and practical workshops with local builders. Each workshop culminated in the construction of a Model House using the developed techniques. A training and information curriculum for communities and builders was produced, covering the following themes:

- Hazard and Risk awareness;
- Site Selection and house Orientation;
- Building Design;
- Materials;
- Construction;
- Protection and Maintenance of the house and environment.

The workshops allowed a progression of learning and sharing of ideas. These were tested and reinforced during the practical sessions.

Images of the construction process. © Jamie Richardson (CRS)

74 / 84 DETAILED SHELTER RESPONSE PROFILE: MALAWI | LOCAL BUILDING CULTURES FOR SUSTAINABLE AND RESILIENT HABITATS

HOUSING DESIGN AND TECHNIQUES

Many traditional houses had survived the floods with little or no damage, even after weeks of standing water, including those constructed using earth brick and render. This was because these houses had raised platforms that protected the core structure from erosion, and the veranda and large roof overhangs ensured that the gables and walls were protected. This design, developed over centuries, provided protection from the elements and, other than some minor repairs needed for the veranda and walls, allowed many families to return home once the flood water receded.

In this response, CRS provided technical solutions, including refinements to the traditional house design, so that the roof could continue to be supported by the veranda posts should the earth walls collapse. During the training workshops, soil selection was a key topic for making adobe bricks and for a correct brick-making processes. The reason why many buildings collapsed was due to the quality of the bricks and insufficient thickness of the walls. Therefore, the improved design increased the wall width (from 10 to 15cm) so they were more stable. It also ensured that internal walls had proper foundations and were connected to the outside walls, to further strengthen the structure.

RESULTS

Participation of families: Families prepared latrines with temporary superstructures and cleared sites prior to receiving construction materials. Households also supplied bricks, thatch, and labour.

Construction of model homes: the CADECOM team constructed the model homes in less than 10 days. Model homes were built according to traditional designs.

Floor area (not including verands, and kitchen): 16.5 m²

Total costs of materials: approximately $200. Materials were provided and cash-for-work grants for the 10% most vulnerable households.

Cost of tool kit (shared between 4 families): $80

Durability: building lifespan of around 15 years.

Involvement of communities: the communities were actively involved in the project. Community leaders commended the program for recognising traditional skills and knowledge as an affordable, effective means of coping with heavy rains and flood.

Training and information were provided to the communities, using the model house as an example.

The project should reduce the impact of future flooding and rains upon families and communities by reinforcing and building upon current good practice using local materials and available skills.

Image of the construction process. © Jamie Richardson (CRS)

One of the finalised houses. © Jamie Richardson (CRS)

Materials	Quantity	Unit Cost (USD)	Total Cost (USD)
Ridge Poles	6 Pcs	2.30	13.79
Rafter Poles	30 Pcs		
Wall Post Poles	10 Pcs		
Battens	80 Pcs		
Black Plastic Paper	1 Roll		
Tiewire	1 Roll		
3" Nails	2 Kg		
Timber for Doors	1 Pcs		
Timber for Windows	2 Pcs		
Earth Bricks	2,400		
Thatch	1 Pcs		

One of the finalised houses. © Jamie Richardson (CRS)

TO FIND OUT M

MALAWI: CONSTRUCTIN TRADITIONAL BUILDING FOR LIVING WITH FLOOD -> CRS (2018)

DETAILED SHELTER RESPONSE PROFILE: MALAWI | LOCAL BUILDING CULTURES FOR SUSTAINABLE AND RESILIENT HABITATS

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SOME IDEAS

- ✓ Local building cultures frequently show a high level of adaptation to the most common local risks, and in several cases, demonstrate best-practice in risk reduction both in construction and in settlement layout. They are mostly replicable and affordable.

- ✓ There are some examples of good practices using industrial materials, but there are many examples where the partial or entire use of industrial materials can result in lower resilience to disaster, or even enhance danger to inhabitants and neighbours. This is partly due to the lack of formal training in the use of materials to local tradespeople. Moreover, these materials and techniques are not easily affordable and difficult to correctly replicate.

- ✓ Communities and families usually display a considerable range of adaptation and coping strategies.

THANKS FOR YOUR ATTENTION

ANY QUESTIONS?