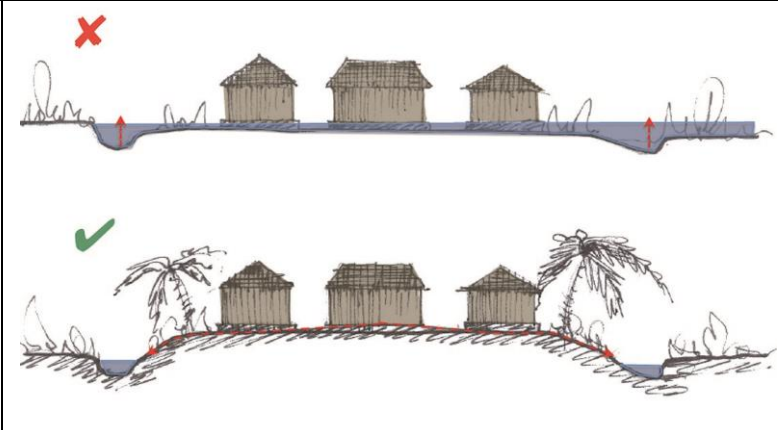
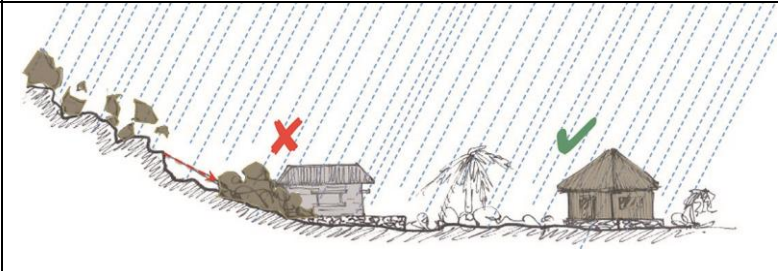
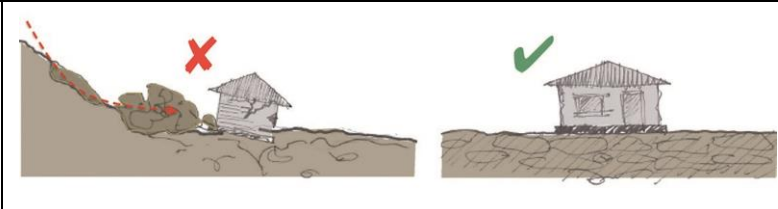


## Key Shelter Safety Messages- 2015 Malawi Floods and Storms

**Siting and settlement:** *The most important way to protect shelter from floods is to build in a place that is unlikely to be flooded.*

Key Messages	Reason	
<p>Shelters and settlements should be sited above the highest recorded flood level, or should be protected by existing embankments that have proved to be sufficiently high and strong enough.</p> <p>Consult the advice of the District Council and Civil Protection Committee when planning new settlements to ensure that houses are built in a safe area</p>	<p>Building in low lying areas or depressions greatly increases exposure to flood waters and ponding of stormwater</p>	
<p>Shelters and settlements should be sited away from steep slopes.</p>	<p>During heavy rains, or in the event of an earthquake, the house will be more exposed to flash floods and /or landslides.</p>	
<p>Shelters and settlements should be built on stable ground.</p>	<p>Building on landfill, loose or uncompacted soil increases the risk of collapse and exposure to landslides during flooding and earthquakes.</p>	



## Key Shelter Safety Messages- 2015 Malawi Floods and Storms

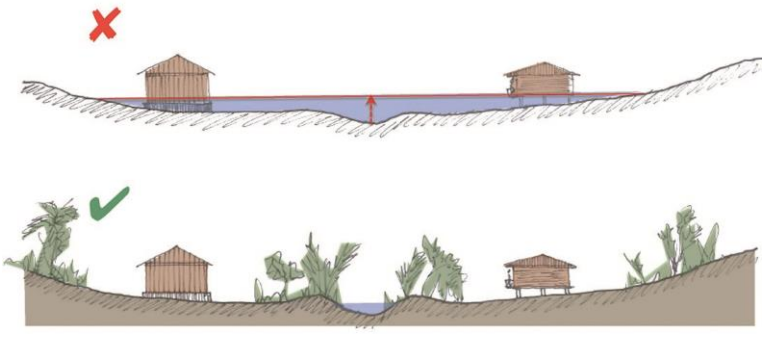
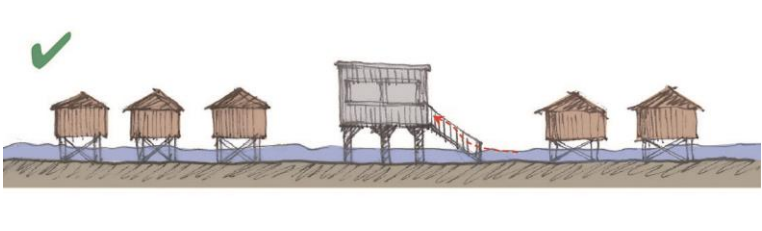
<p>Shelters and settlements should be sited a safe distance from the gullies, streams, rivers and other known and potential watercourses.</p>	<p>During flash flooding, the house will be at increased risk of flooding if located too close to these known and potential water courses.</p>	
<p>Consider orienting the house with the shortest side facing the direction of prevailing winds or likely flooding</p>	<p>The shortest side of the building is the strongest and most able to resist the forces of flash floods and strong winds.</p>	
<p>Plan new settlements allowing access between the buildings for easy access in the event of evacuation or rescue.</p>	<p>Spacing between buildings with highly combustible elements should ideally be twice the height of the tallest building</p>	



## Key Shelter Safety Messages- 2015 Malawi Floods and Storms

<p>There should be an adequate and well-maintained drainage system in the settlement. Residents should be encouraged to maintain the drainage system on a regular basis, ensuring there are no blockages.</p>	<p>The main function of a drain is to carry storm and flood water away from the buildings. Blocked drains contribute to floods and damage housing, roads and other infrastructure.</p>	
<p>Protect shelters and settlements from erosion using ground-cover plants.</p> <p>Consider planting trees close to the river banks and on steep slopes in order to stabilise the soil.</p>	<p>Unstable soil can be easily washed away by flood waters.</p> <p>Ask the District Engineer for advice on which plants to use.</p>	

## Key Shelter Safety Messages- 2015 Malawi Floods and Storms

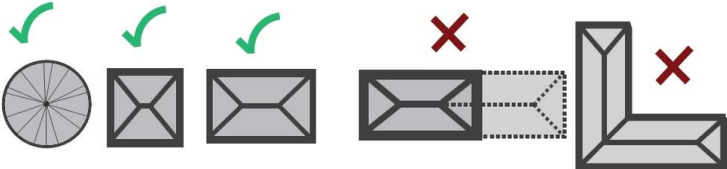
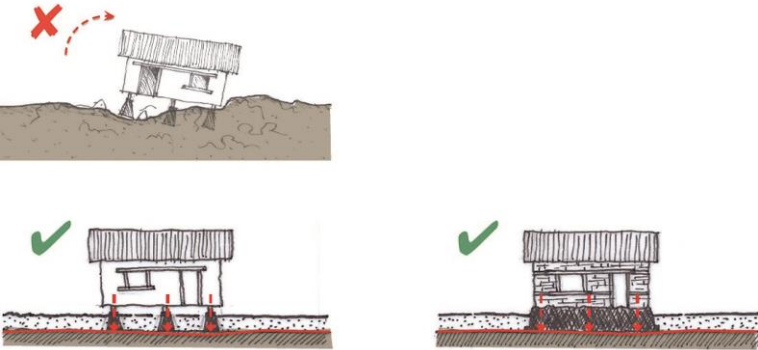
<p>Plant lines of trees and bushes to create barriers to river and tidal surges.</p>		
<p>Collective buildings such as evacuation centres which are used by the public during flooding should be easily accessible for all, sited above known flood levels, and be resistant to floods and storms.</p>	<p>People stay in these buildings during the floods, so they must be safe places which are able to resist the forces of flood waters, strong wind, driving rains and hail.</p>	



## Key Shelter Safety Messages- 2015 Malawi Floods and Storms

**House construction:** The next most important point is to build a strong building that can withstand the forces created by the moving water, and which will not collapse when wet. Below are some measures to reduce the vulnerability of shelter to floods.

### House shape, foundations and drainage

Key Messages	Reason	
<p>Consider constructing a round building instead of a long rectangular building.</p> <p>Avoid constructing long or L-shaped and C-shaped buildings that 'trap' the wind.</p>	<p>Round buildings are more aerodynamic and are stronger against winds and flooding.</p> <p>The aim is to minimise wind-resistance.</p>	
<p>Build the shelter on foundations or pilings that rest on stable ground</p>	<p>Unstable ground or loose soil can be easily washed away by flood waters, causing the house to collapse and be washed away with the flood.</p>	



### Key Shelter Safety Messages- 2015 Malawi Floods and Storms

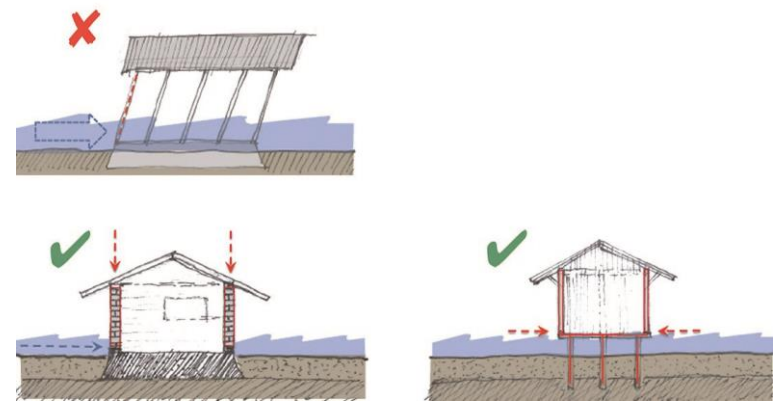
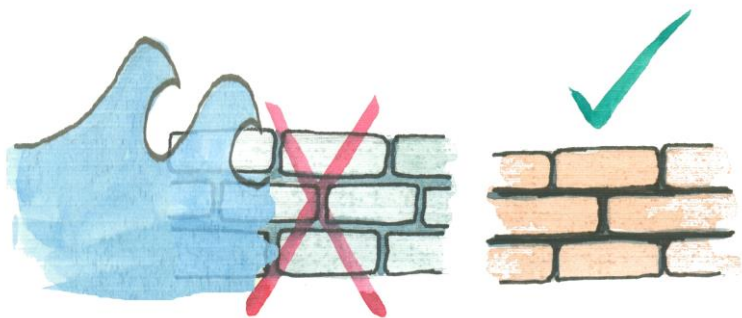
<p>Provide good drainage to the shelter and settlement</p>	<p>Good drainage minimises erosion of foundations. Badly maintained drainage systems cause saturation of the ground leading to instability of the house.</p>	
<p>Provide drainage close to the foundations, and slope the soil next to the house away from the building.</p>	<p>Drainage reduces the water pressure on the foundations and the floor of the building, reducing damage and deterioration over time.</p>	
<p>Build the shelter on water-resistant foundations and footings or piling, using plastic sheeting or other waterproof materials as a barrier (damp proof course) between the earth and the building.</p>	<p>Water can weaken the base of the walls and floors (rising damp).</p> <p>The problem is best avoided by using reinforced concrete or stone and cement for the footings, and fired bricks or concrete blocks for the foundation walls.</p> <p>Lay a damp proof course (DPC) above the foundation and lay a damp proof membrane (DPM) below the floor.</p> <p>Ensure that the DPC and DPM meet to form a continuous barrier against damp.</p>	



## Key Shelter Safety Messages- 2015 Malawi Floods and Storms

<p>Build sufficiently deep foundations which bear on solid ground.</p> <p>If available and affordable, build foundations using reinforced concrete or burnt bricks and cement mortar. Avoid using sun-dried (adobe) bricks and mud mortar in foundations.</p>	<p>Flood waters easily wash under shallow foundations and liquify sun-dried bricks and mud mortar, leading to collapse of the house.</p>	
<p>Ensure that the ground below the house and the foundations is well-compacted before constructing the foundations, so that the house will rest on solid ground.</p> <p>This is particularly important where the householder has placed additional earth on the site in order to raise the level of the ground.</p>	<p>Flood waters can easily wash away loose and uncompacted soil, undermining the house's foundations, causing structural failure.</p>	

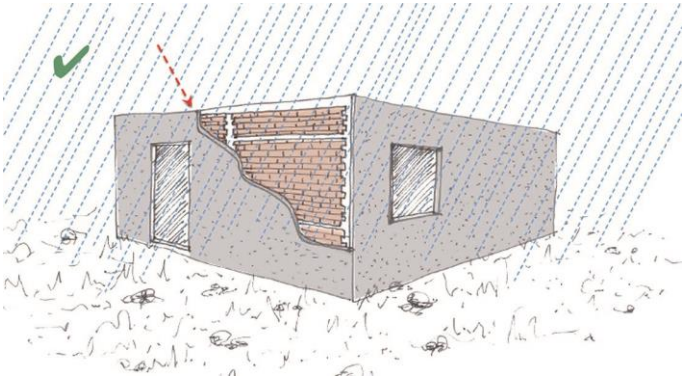
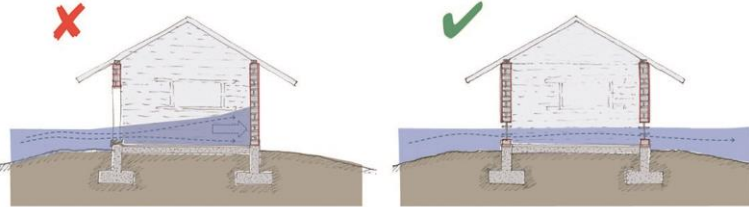
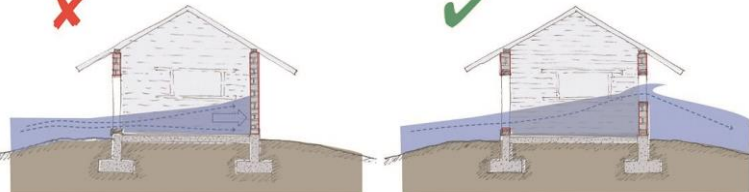
## Key Shelter Safety Messages- 2015 Malawi Floods and Storms

Walls and openings		
Key Messages	Reason	
<p>Build with heavy walls, or ensure that light walls are well anchored to foundations or piling, and braced to ensure lateral stability.</p>	<p>It is important that walls are strong enough to resist pressure from flood waters.</p> <p>Alternatively, walls can be designed to allow water to pass through the building.</p>	
<p>Consider using burnt bricks bound with cement mortar for the foundation and base of the wall up to at least the maximum flood level.</p> <p>Avoid using sun-dried (adobe) bricks and mud mortar at levels exposed to flood water.</p>	<p>Flood waters easily melt or liquify walls made of sun-dried bricks and mud mortar, leading to collapse of the house.</p>	

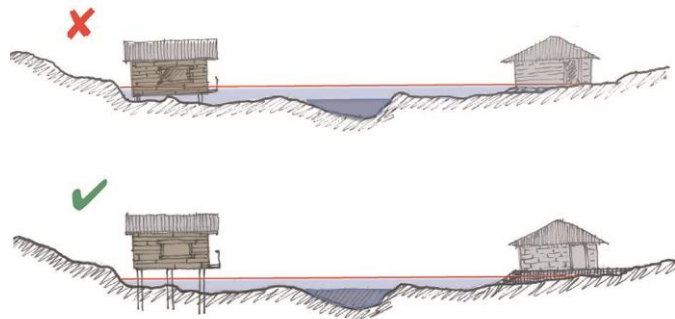

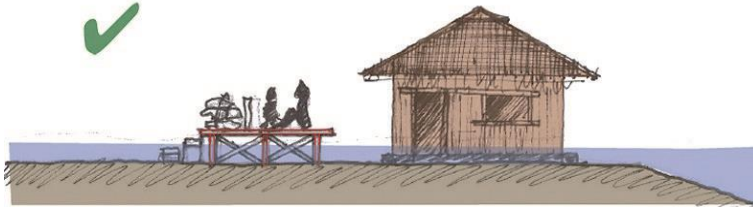




## Key Shelter Safety Messages- 2015 Malawi Floods and Storms

<p>Use water-resistant wall materials, or add a protective coating to the external walls of the house.</p> <p>In this case, consider the risk of long-term damage to earth walls if they cannot 'breathe'.</p> <p>Applying a waterproof plaster mix with sharp or coarse sand to a wall will create a barrier against severe weather.</p>	<p>Waterproof coatings help to increase the resistance against flood waters, heavy rains and waterlogging.</p> <p>For walls made from fired brick use a cement based plaster.</p> <p>For walls made from adobe blocks or rammed earth, use dambo sand or a lime based plaster.</p>	
<p>In some cases, if the floor of the house is not located above the line of the highest known flood level, consider adding openings near the bottom of walls.</p> <p>Remember that it is always better to locate the house above the line of the highest known flood level.</p>	<p>This may allow flood waters to move through the house without causing it to collapse.</p>	
<p>Place doors and windows in opposite walls of the house.</p>	<p>This will allow water from flash floods to flow out of the house, easing pressure of the flood waters on the walls.</p>	

## Key Shelter Safety Messages- 2015 Malawi Floods and Storms

Floors		
Key Messages	Reason	
Raise ground floors above the highest recorded flood levels.	To prevent flood water from entering the house.	
Build the shelter on stilts where appropriate.	To prevent flood water from entering the house.	
Consider building a raised platform in or beside the shelter. The roof space can also be utilised for this purpose – make sure you can get out through the roof if you do so!	A raised platform allows storage of possessions and vital supplies above the flood level and provides a safe refuge for people during floods.	



## Key Shelter Safety Messages- 2015 Malawi Floods and Storms

Roof		
Key Messages	Reason	
<p>With thatched roofs, consider extending the roof timbers far past the edge of the walls, forming eaves which channel the water into shallow drainage trenches below. For malata roofs use separate khonde not connected to the roof structure to achieve the same effect.</p> <p>If possible, consider installing rainwater gutters and downpipes which carry rainwater away from the building.</p>	<p>Extended eaves help to keep the rain off the walls of the house, protecting the top and base of walls from heavy rains.</p> <p>Rainwater gutters, downpipes and shallow trenches further protect the walls and foundations, carrying water away from the building.</p>	
<p>Consider planting trees at a safe distance around the house.</p>	<p>Trees can protect the roof by reducing the strength of strong winds.</p> <p>Trees further protect the walls from wind-blown rain which caused so much damage and destruction of many houses in the 2015 floods and cyclonic weather.</p>	



## Key Shelter Safety Messages- 2015 Malawi Floods and Storms

<p>For thatched roofs, consider increasing the angle of construction to approximately 45 degrees.</p>	<p>This slope will encourage more water to run off the roof and less to be absorbed by the thatch.</p>	
<p>Avoid inserting timber poles directly in the ground. Treat all exposed timber surfaces with the locally available product solignum or equivalent.</p>	<p>Treating the timber against termite and fungal attack can protect the structure against deterioration and potential collapse.</p>	
<p><b>Environmental management</b></p>		
<p><b>Key Messages</b></p>	<p><b>Reason</b></p>	
<p>Use only sustainably harvested milled timber or eucalyptus poles.</p> <p>Don't cut down trees without permission of the District Council and the Department of Forestry, Ministry of Natural Resources, Energy and Mining.</p>	<p>Tree roots bind the soil, making the ground stronger and more resistant to flooding. Cutting down trees and vegetation can lead to landslides and erosion, particularly on steep slopes, increasing the risk of flooding.</p>	