

# Minimum standards for new construction of standalone transitional solutions in Gaza

This includes a **range of transitional solutions** with different structures, featuring different types of cladding, roofing and flooring, including prefabs and may include one or two- storey shelters.

*With the support of Bath University for thermal comfort and ventilation and Kindling for fire safety*



**TSA  
TWG**

Standard	Performance requirement	Rationale	Considerations
<p><b>Living space</b></p>	<p>Minimum 3.5 sq.m per person, excluding cooking space, bathing area and sanitation facility.</p> <p>5.0 sq.m per person including cooking space and bathing and sanitation facilities.</p> <p>Internal floor-to-ceiling height of at least 2.2 m at the lowest point</p>	<p>Sphere living space standard.</p> <p><b>The total living space should be proportionate to the HH size.</b></p>	<p>Accessible for persons with disabilities.</p> <p>Small initial modules with the possibility of scaling up if necessary.</p> <p>Open space around the shelters to allow for expansion.</p>

Standard	Performance requirement	Rationale	Considerations
<b>Privacy</b>	At least 1 internal partition	<p>Sphere cultural practices, safety and privacy.</p> <p><b>Respect existing practices and customs and how these affect the design of the dwelling.</b></p>	<p>Installation of internal partitions, whether fixed or movable to ensure privacy.</p> <p>Ensure privacy for windows (whether transparent or translucent options are preferred).</p>

Standard	Performance requirement	Rationale	Considerations
<p><b>Thermal insulation and shading</b></p>	<p>U-values of 0.72W/m<sup>2</sup>K for walls, roof and floor.</p> <p>U- values of 2W/m<sup>2</sup>K for doors and windows.</p> <p>Summer window shading.</p>	<p>In summer, <b>overheating</b> in Gaza during the daytime is likely so active cooling is needed.</p>	<p>No glazing on the roof.</p> <p>Shading the roof during summer.</p> <p>Shaded external space.</p> <p>Critical winterization needs through safe heating and NFIs.</p>

Standard	Performance requirement	Rationale	Considerations
<p><b>Ventilation</b></p>	<p>Minimum ventilation rate of 10 ac/hr</p> <p>2 windows 60cm x 60cm or a pair of other equivalent holes on opposite walls</p> <p>Fan or other active cooling device (1 per room)</p>	<p>Need for <b>cross-ventilation</b> through openings and active cooling (fans) are necessary</p>	<p>Additional vents at a high level (30x15 cm) improves ventilation.</p> <p>All openings must be easily closable and openable.</p> <p>If cooking inside the dwelling, a chimney is recommended when burning biomass.</p>

<b>Standard</b>	<b>Performance requirement</b>	<b>Rationale</b>	<b>Considerations</b>
<b>Lifespan</b>	<b>Minimum 5 years</b> with basic maintenance	In the context of Gaza transitional shelters are foreseen to be used for much longer.	<p>Corrosion protection for steel</p> <p>Resistance to moisture and mold accumulation</p> <p>Operable windows and doors</p> <p>Flooring raised from the ground</p> <p>Foundation appropriate to the terrain type and the loads.</p> <p>Special attention to prevent wind</p>

Standard	Performance requirement	Rationale	Considerations
<p><b>Fire safety</b></p>	<p>If prefabricated: Shelter materials should be tested in accordance with ISO EN 13823, with classification of B-s1-d0 at minimum.</p> <p>If locally constructed: Shelter materials, particularly the wall and roof facades, should be non-combustible where possible.</p> <p>If using combustible materials, more attention to other shelter/settlement factors.</p>	<p>At least 3m <b>separation to prevent fire spread.</b></p> <p>Larger separation when using combustible or low- quality facades, in multiple stories and in areas with high winds.</p>	<p>Two exit doors if possible.</p> <p>Internal door lock mechanisms should be easy to operate.</p> <p>Chimneys should be a non-combustible material.</p>

Standard	Performance requirement	Rationale	Considerations
<p><b>Electricity</b></p>	<p>Electrical installation based on the electrical loads required.</p> <p>Estimated HH electricity consumption (5kWh/day).</p> <p>Electrical systems are properly protected and earthed.</p>	<p>Compliance with local standards.</p>	<p>Regular maintenance checks.</p> <p>Connection to solar panels in the roof with battery or connection to an electricity grid.</p>

Standard	Performance requirement	Rationale	Considerations
<p><b>Sanitation facilities</b></p>	<p>Each HH has access to sanitation facilities.</p> <p>If HH-level sanitation facilities are not possible, separate facilities for men and women and within 50m from the dwelling min 1 for 20 people.</p> <p>Each sanitation facility should include hand washing facilities</p>	<p>Sphere standards for non-emergency context.</p> <p>For additional technical considerations , please refer to the WASH cluster.</p>	<p>Consult with the users.</p> <p>Consider access to hot water for bathing and laundry during specific contexts and during climatic variations.</p> <p>In Gaza people are likely to improve privacy by assigning each toilet in a communal block to a</p>

<b>Standard</b>	<b>Performance requirement</b>	<b>Rationale</b>
<b>Water supply</b>	<p>Protected source within 500m, through communal tapstands, supplied by water trucking given the lack of suitable groundwater.</p> <p>HH water tanks will also be required.</p> <p>Quantity required for emergency context is minimum 15L/p/d but to avoid significant health issues this will need to be increased.</p>	<p>Sphere standards for non-emergency context</p> <p>Water quality should be ensured and monitored in accordance with WHO and national standards</p>

# Emergency Shelter Kits

- ESK consists of timber posts, sealing off materials, and toolkits
- TSA TWG has developed multiple ESK packages as a flexible household-led emergency assistance for a) building stand-alone shelters, b) extensions, and c) sealing off partially damaged buildings
- ESK is designed as an incremental assistance.  
The current IEC has been developed for an expanded version of the kit. It is to outline techniques to assemble the IEC, not a specific shelter design.
- Partners can adapt the IEC to correspond to their specific ESK programming

# Emergency Shelter Kit

This IEC indicates techniques to assemble a shelter and does not prescribe a specific shelter design. Partners are encouraged to modify the quantities based on the materials, resources, and space available to them.

For a video demonstration, refer to the [ESK: Shelter Kit Construction Video | Shelter Cluster](#)

## Expanded ESK IEC materials

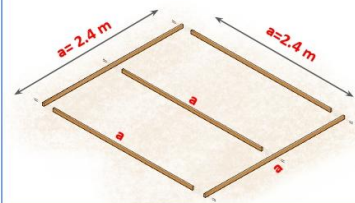


Essential Components			
Component	Unit	Quantity	Indicative Picture
<b>Timber</b> , untreated, essential for frame construction, required to be at least 2.4 meters in length. This IEC is for cross-sections of <b>5cm x 2.5cm</b>	Pcs	114	
<b>Tarpaulins</b> , woven plastic, available in sizes of 6x4 meters, 5x4 meters, or as a roll of 4 meters width. They can be used for roofing, walls and flooring.	Pcs	3	
<b>Nails</b> , 5 cm nails for timber connections. Used for structural joints and fixing cover-battens.	Kg	1.6	
<b>Rope</b> , Minimum 30 meters length, in roll, 6mm thickness.	Lm	30	
<b>Hand saw</b> , total length 60 cm, for wood, good quality, tempered, hardened and set teeth. Unbreakable handle.	Pcs	2-3	
<b>Measuring tape</b> , 3 meters, graduated in centimeters.	Pcs	1	
<b>Hammer</b> , metal or fiberglass handle.	Pcs	1	

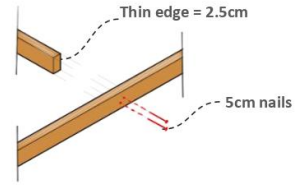
Optional Components			
<b>Timber sheet (Plywood or OSB)</b> , Approx. 1 cm thick, used for creating beams, trusses, doors, bracing, raised floors, and internal cladding.	Pcs	3	
<b>Plastic sheet</b> , 0.3mm thick, roll is up to 50 sqm per shelter. Minimum width 4 m.	Sqm	50	

# Expanded ESK IEC materials

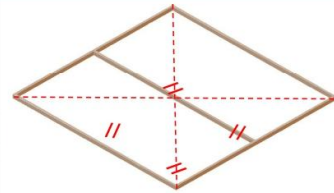
## How to Build Wall Panels



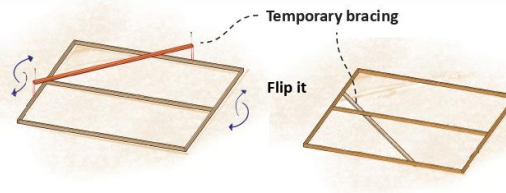
1. Lay out the pieces of timber, standing them up on the thin edge.



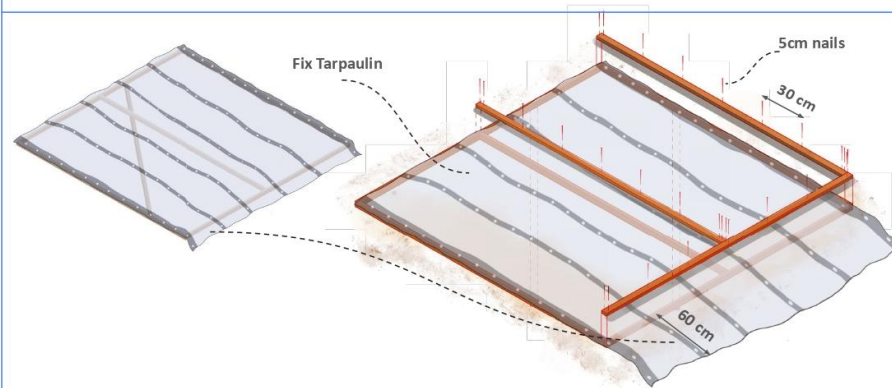
2. Nail the timber together using 5cm nails.



To check if the panel is square: measure the two diagonal measurements, should be equal.



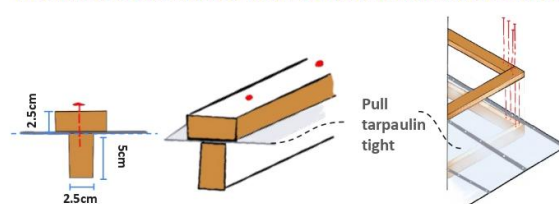
3. Add temporary bracing, of any size, to hold it square then flip it to fix the tarpaulin on the frame.



4. Lay the tarpaulin over the frame. Leaving a 60cm outside the bottom edge of the frame, to avoid filtration and to favor the anchorage.

5. Fix on the 5 x 2.5cm cover battens with 5 cm nails every 30cm.

The frame is constructed as a T-section which makes it strong

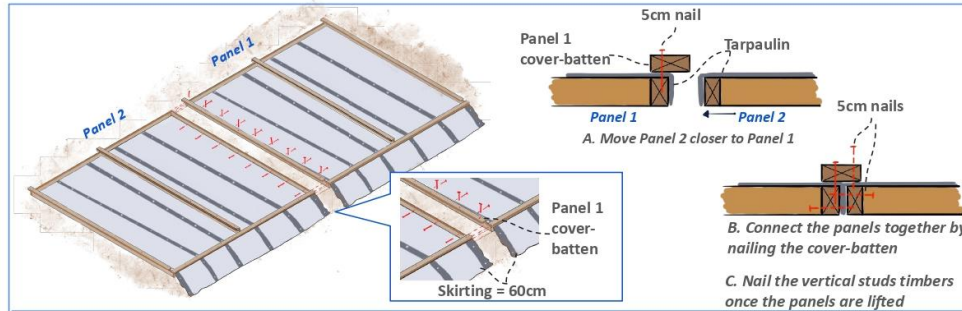


The tarpaulin holds the frame square and so should be pulled tight, but not so tight that it bends the timber.

Tarpaulin fixed  
= Panel held square  
= Remove temporary bracing

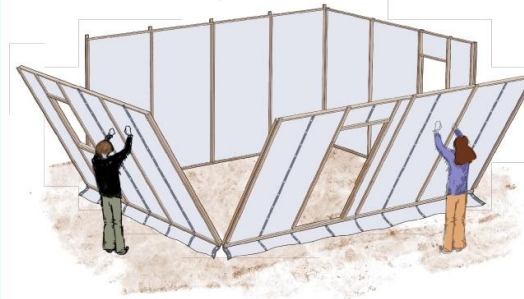
# Expanded ESK IEC materials

## How to Connect Wall Panels



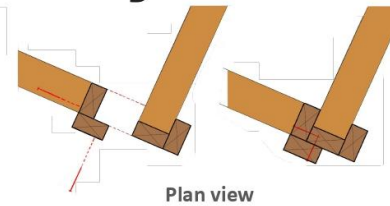
The panels are connected together while still flat on the ground. The cover-batten is used to make a strong connection. Once the wall panel has been lifted into position, then the two vertical studs must also be nailed together.

### Lift the panels together

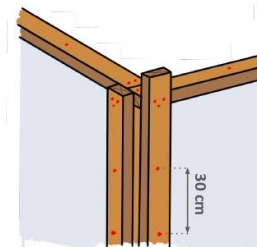
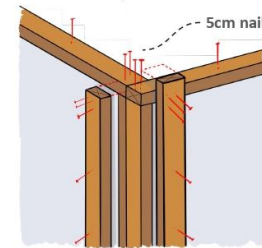


Is the shelter square? Measure the diagonals, should be the same.

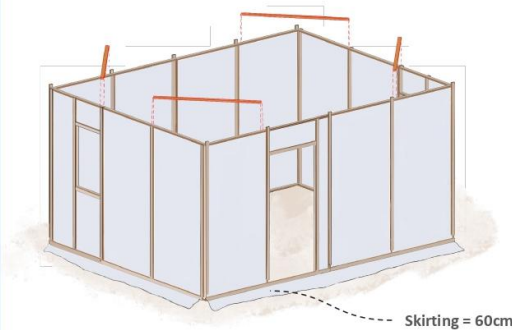
### How the corner is joined together?



Connect the corners securely using:

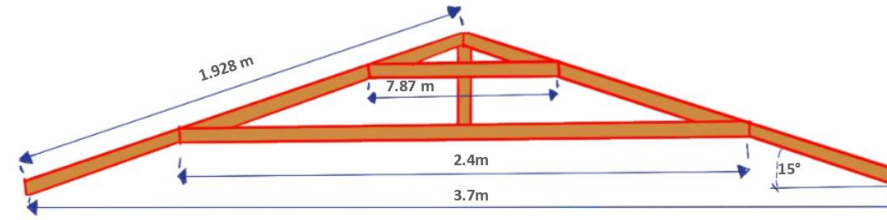


### Add corner bracing

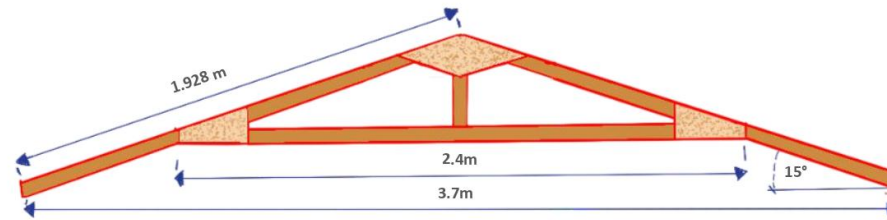


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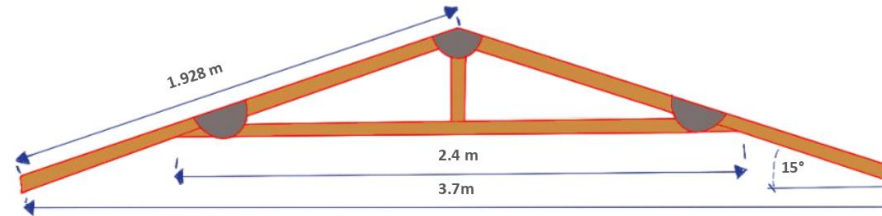
## Roofing: Pitched Roof



The horizontal pieces of timber are doubled, one on either side.



If OSB or plywood is available, then this truss with 'gusset plates' is a good option with strong connections.



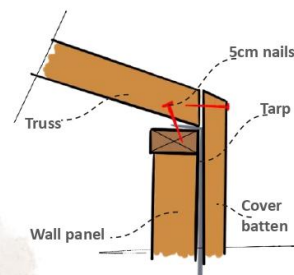
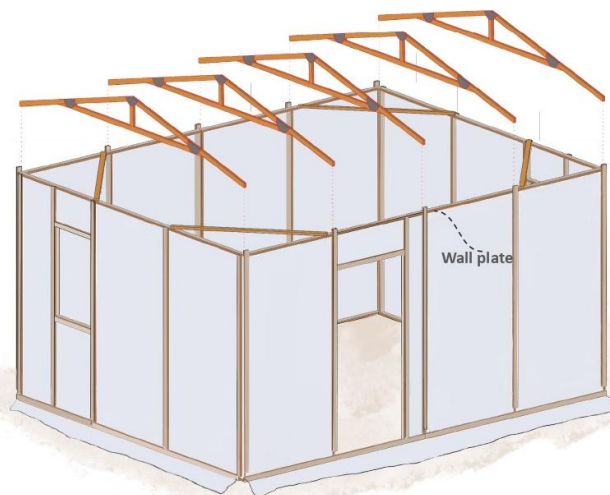
If short of timber, this is a good option. Strong connections are made with pieces of used tin cans.

### HELPFUL TIP

To ensure uniformity and save time, construct all trusses simultaneously by stacking them one on top of the other or using one as a template. This approach guarantees that each truss is identical and reduces the risk of errors during the assembly process.

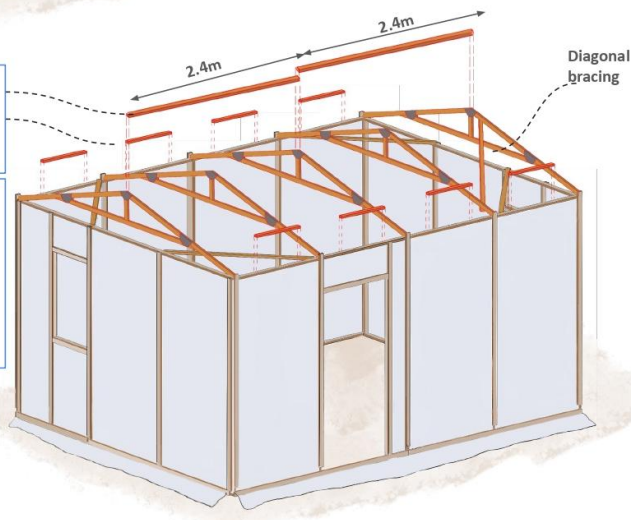
## How to Build Roof Trusses

The trusses are placed one by one and fixed to the wall plate



The short off-cuts and cover battens are there to secure the top of the tarpaulin.

The long horizontal piece at the ridge of the roof should be 2 x 2.4m lengths. They join the trusses together and also provide a support for the tarpaulin.



Diagonal braces need to be fixed, one at either end. These are fixed to the underside of the first and second truss and the final two trusses.

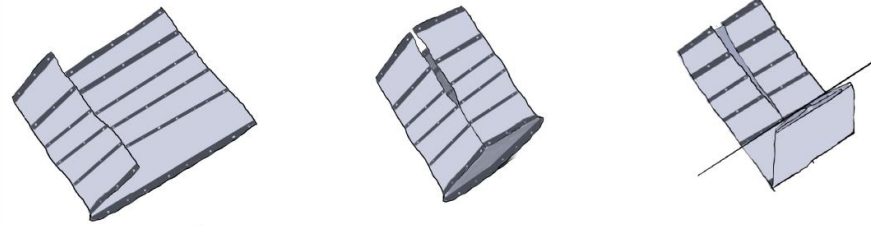


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## How to Cover the Roof

### 1. Fold the Tarpaulin to facilitate its raising to the roof



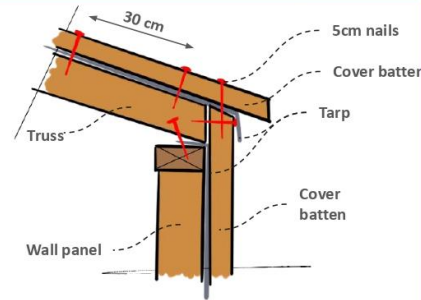
**First fold:** Fold the left-hand edge towards the centre line

**Second fold:** Fold again to the centre. Repeat for the right-hand edge

**Finally:** Fold to the centre as shown.

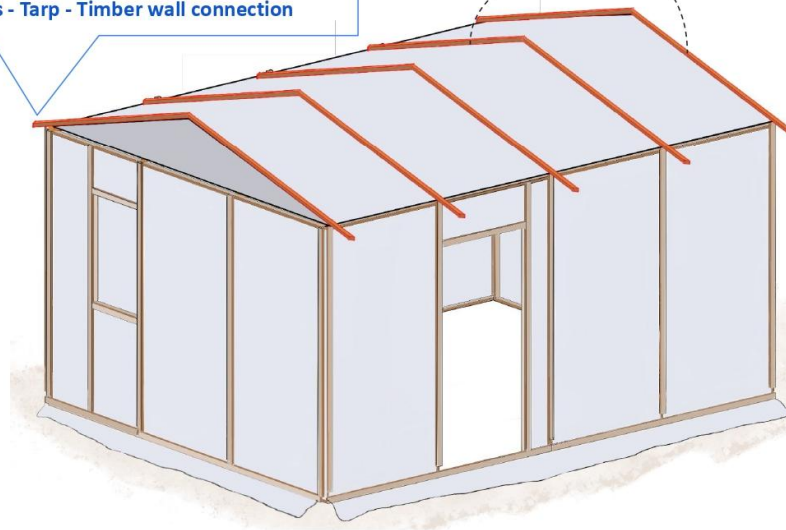
### 2. Progressively unroll the tarpaulin over the roof structure - start from middle

### 3. Add timber cover battens and short off-cuts to pin roof tarp



Truss - Tarp - Timber wall connection

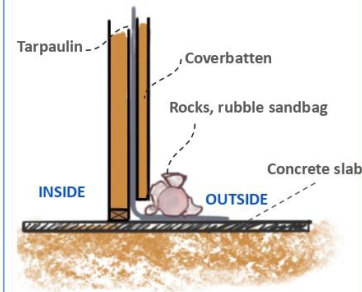
The cover battens are there to secure the top of the tarpaulin.



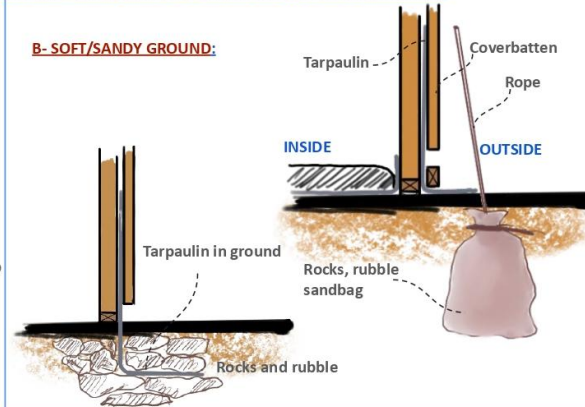
# How to Fix Shelter on Ground

The type of anchoring, or foundation, will depend on the ground conditions.

## A- SOFT/SANDY GROUND AND HARD SURFACE:

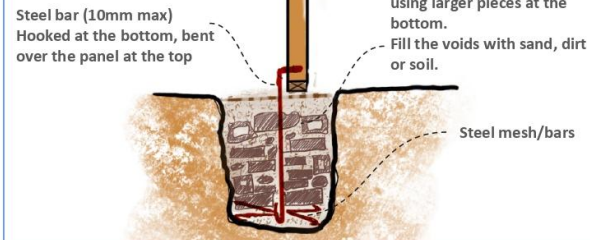


## B- SOFT/SANDY GROUND:



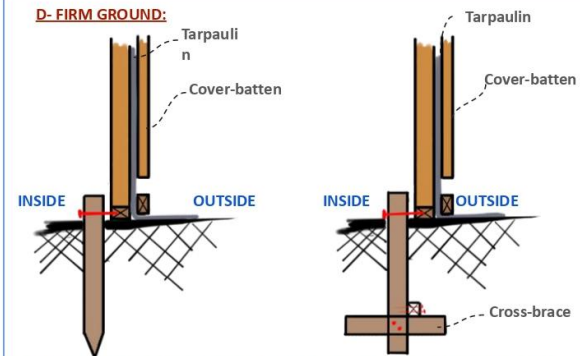
Weighing down the tarpaulin "skirt" is the simplest method and suitable for soft or sandy ground, and a concrete slab. Buried sandbags at each corner, or close to each corner, is another option for sandy ground

## C- SOFT/SANDY GROUND:

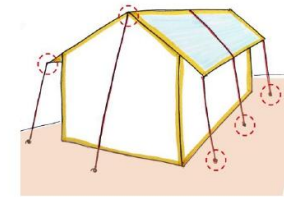


With rubble and old rebar available, this is an appropriate anchoring or foundation detail.

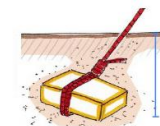
## D- FIRM GROUND:



Driving, or burying, wooden stakes into the ground is only suitable for firm ground.



Anchoring with sandbags can be replaced with:



Brick/ hollow blocks/ or concrete

In exposed areas, the use of guy-ropes is recommended

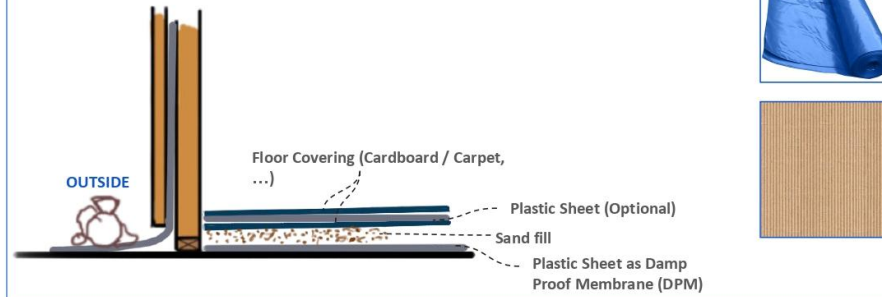
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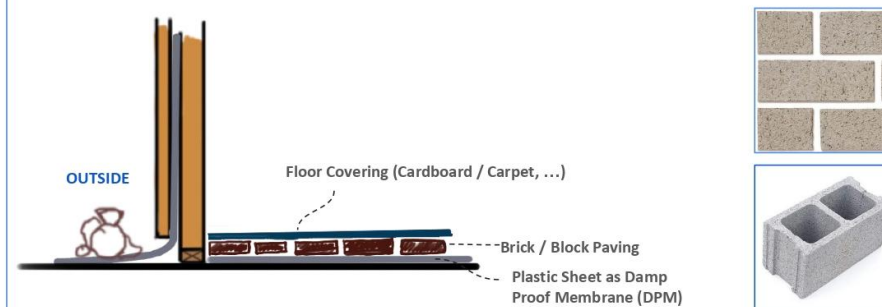
## How to Cover the Shelter Floor

It is a good idea to have a raised floor inside the shelter that is kept dry and contained by a plastic sheet (a damp-proof membrane - DPM).

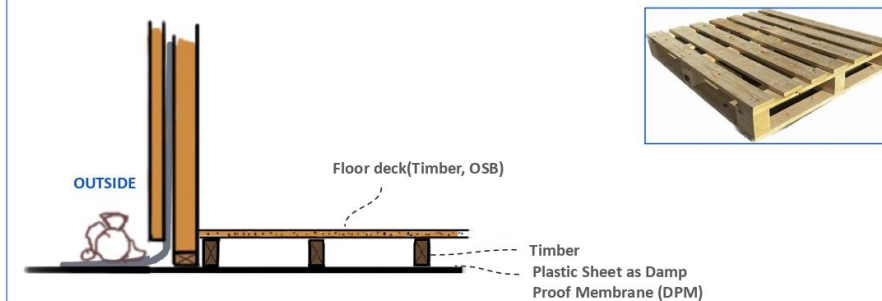
This can be achieved in a number of ways:



1. Simply covering the inside with plastic sheet, carpet or even cardboard.



2. Raising the ground level with rubble, bricks, broken blocks; filling the gaps with sand; and covering with a suitable flooring. A plastic sheet DPM is advised if available.



3. A good solution would be to use wooden pallets to construct a level raised floor.

# **Technical meeting on ESK and transitional shelter standards**

On 12 March at 11:30-12:45 Gaza time, online on Teams.

Agenda is on the presentation and discussion around -

- ESK IEC
- ESK program guidance
- Transitional Shelter Standards

Open to TSA TWG and shelter partners interested in implementing ESK and transitional shelters in Gaza.