Two-unit Temporary Shelter for IDPs in Tigray

Shelter Cluster
ShelterCluster.org
Coordinating Humanitarian Shelter

This document was prepared by the ES/NFI Cluster TWiG with the support of

ECC-SDCOAdB

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What is this document?

- This document was prepared by the ES/NFI Cluster Technical Working Group (TWiG) as a complementary resource to the Shelter Standardization Guideline
- This document aims to support partners in planning and implementing temporary shelter programs for IDPs in the Tigray crisis.
- The proposed design is not prescriptive in nature and may be adapted by partners. However, only one shelter design should be used in one site to avoid generating tensions in the IDPs community.
- The monitoring documents in this package are not prescriptive and rather provided to support partners and technical staff planning and implementing shelter construction. Partners may select, use and adapt what is relevant for their own programming.

What does this document include?

- This package includes:
  1) Design principles
  2) Detailed construction drawings
  3) Bill of Quantities
  4) Material specifications
  5) Material delivery form
  6) Site monitoring checklist
  7) Step-by-step construction guide
  8) Construction site safety during C-19

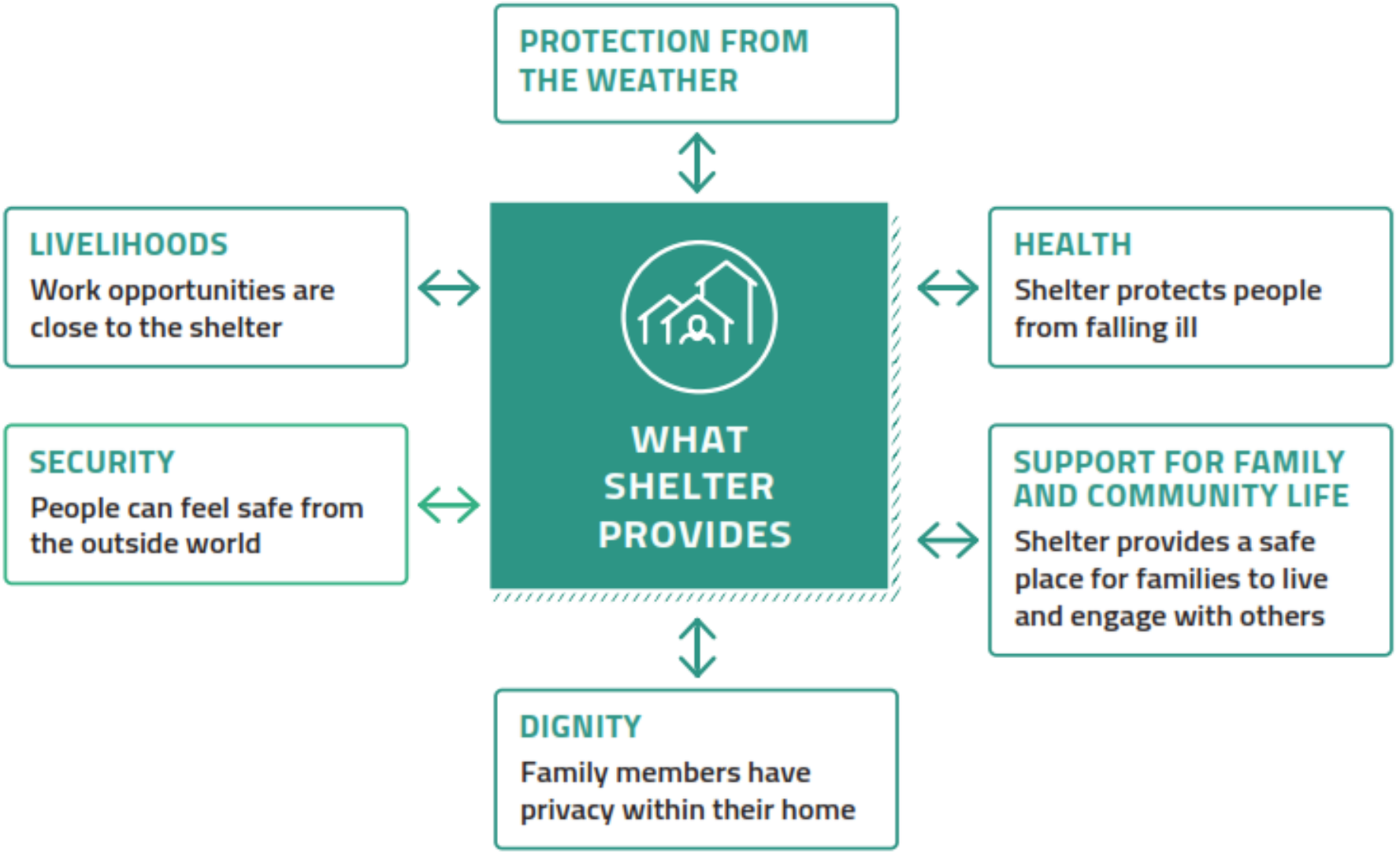
1) Design principles

What does shelter provide?

PROTECTION FROM THE WEATHER

WHAT SHELTER PROVIDES

What does shelter provide?



Shelter programming – phases

Emergency

Temporary/Transitional

Permanent

Sheltering is a process

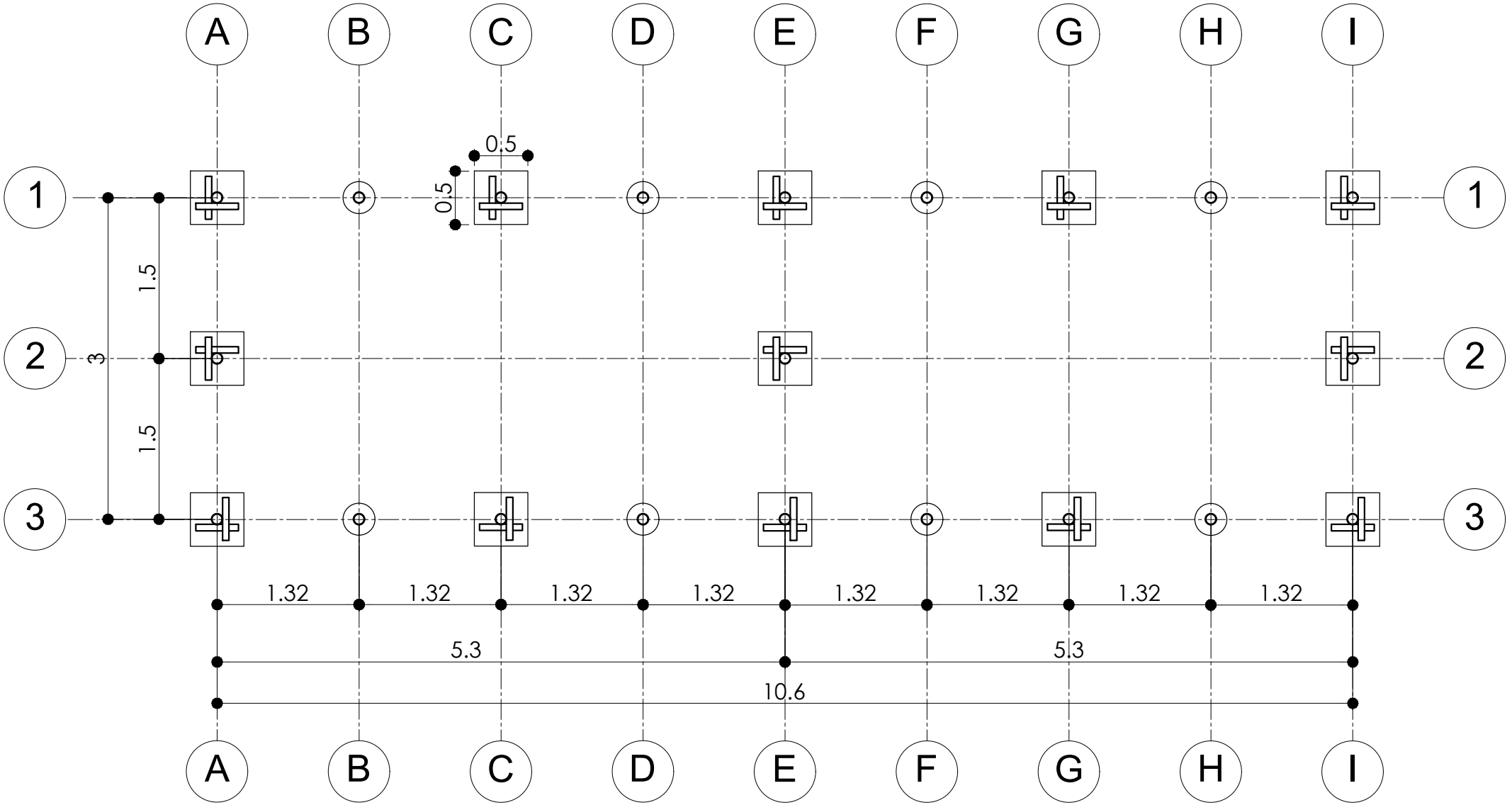
General principles

- Aspire to meet SPHERE standards
- 17,5 sq.mt floor area (5 family members)
- Construction benefit both host and IDP communities
- Provides privacy between 2HHs and within a shelter unit
- Cost-effective solution
- Tailored to local climate and weather
- Promotes cross ventilation
- Maximized use of materials to reduce environmental impact
- Quick to build
- Can be easily repaired and upgraded in phases
- Lockable windows and doors
- Provides durable structure to allow improvements in the mid-term

Disaster Risk Reduction principles

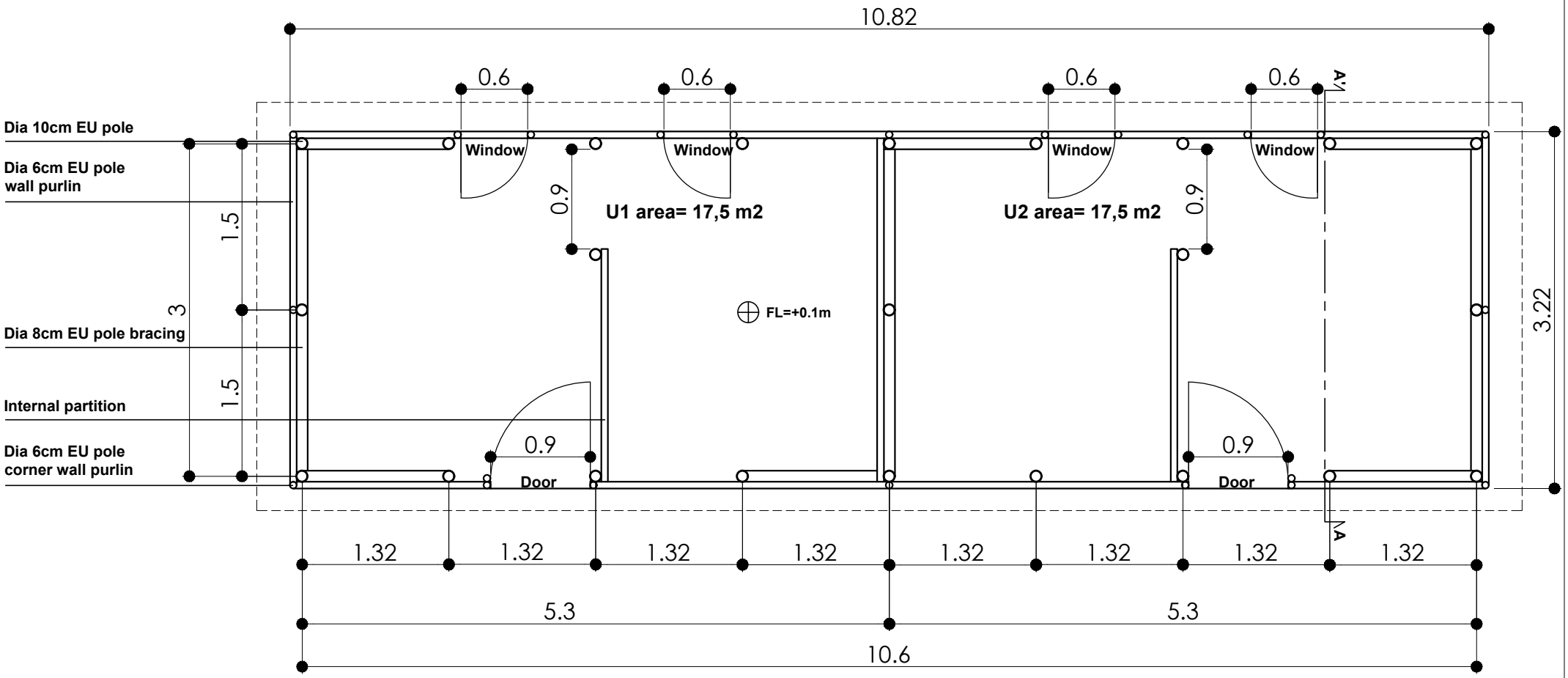
- Raised plinth to protect from flooding and animals
- Bottom part of poles and cross anchoring painted with burned oil to prevent termites/insect infestation and to increase durability
- Posts anchored to the ground through cross fixing and compaction in layers
- Corner and center bracing at wall level
- Coherent load path from roof to foundation: strong connections between purlins, rafters, wall plate, posts and foundations
- Metal straps to strengthen wall plate-post connection
- Tie wire to tie down purlins to rafters and rafters to wall plate
- High quality humanitarian grade tarpaulin used for roof and walls (can be easily upgraded)
- Roof tarpaulins tightly sewn with three folded connection to prevent leakages and two-fold connection between wall tarpaulins

2) Detailed Construction Drawings



*Dimensions to be adjusted to field conditions

CATHOLIC RELIEF SERVICES / ECC-SDCOAdB	DESIGNED BY: CRS / TECHNICAL WORKING GROUP RECOMMENDED BY: ESNFI Cluster	PROJECT TITLE: DOUBLE UNIT TEMPORARY SHELTER VERSION: V2 - FOR CONSTRUCTION - JUNE 2021	PAGE TITLE: FOUNDATION PLAN 1:50 printed on A4	PREPARED BY: CRS - FR NOTED BY: CRS - EA	APPROVED BY:	A SHEET NO: 1



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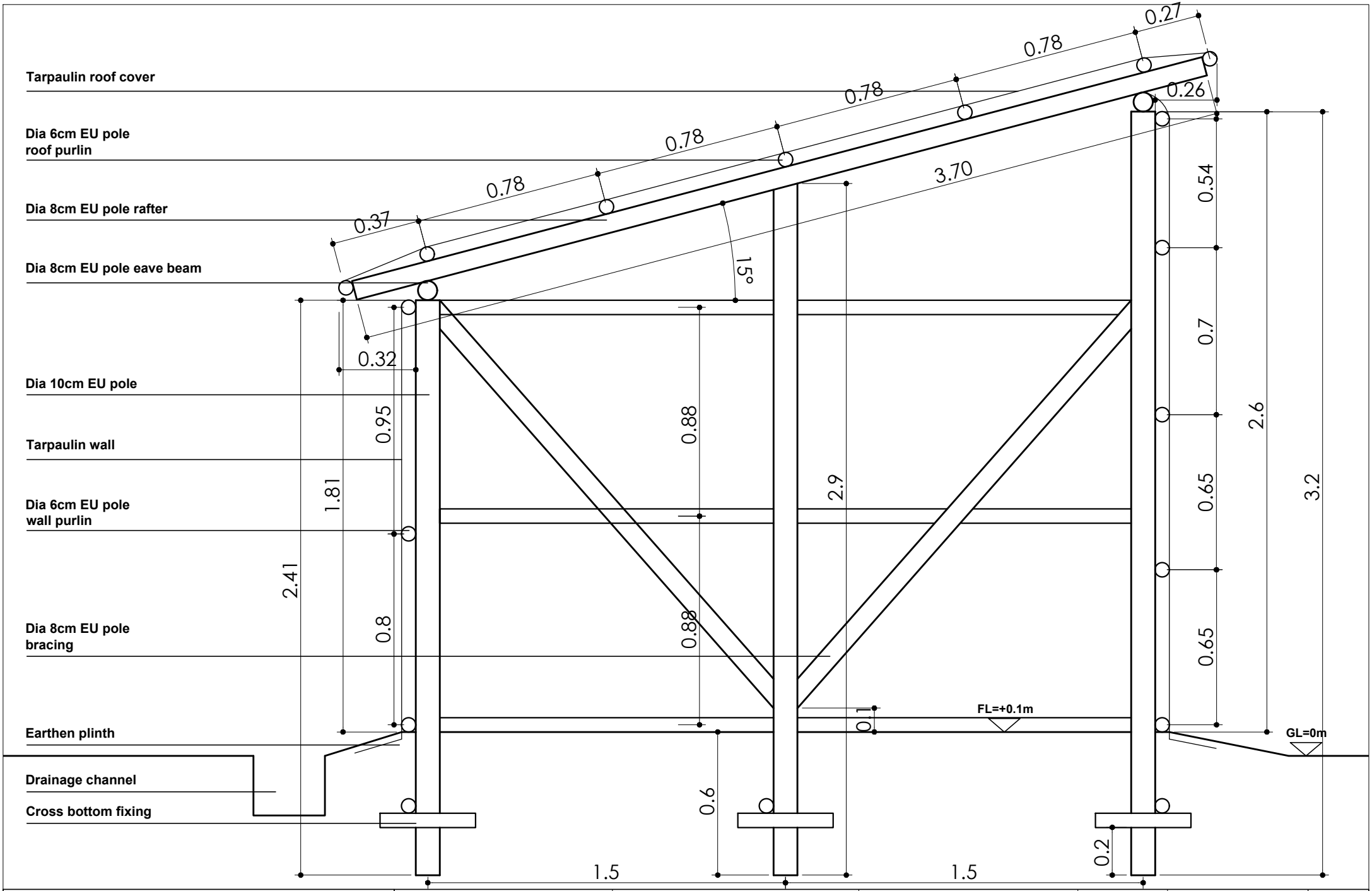

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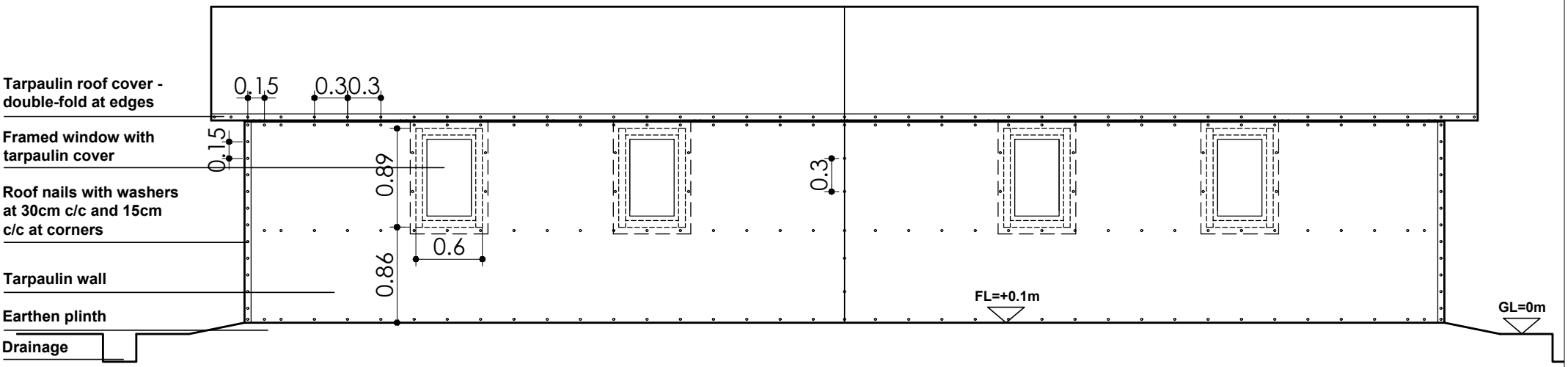
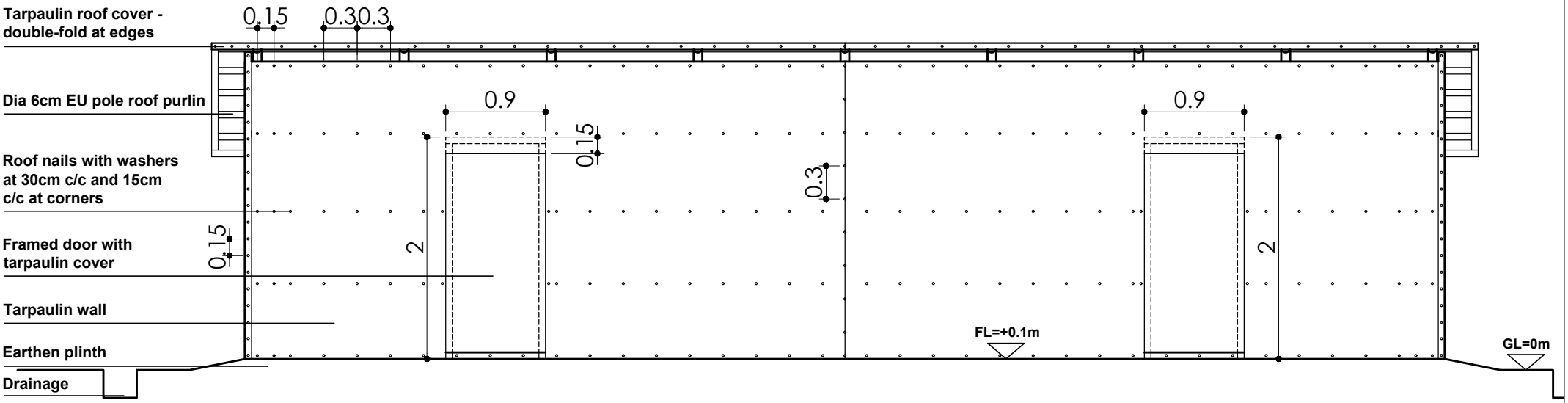


BACK ELEVATION



FRONT ELEVATION

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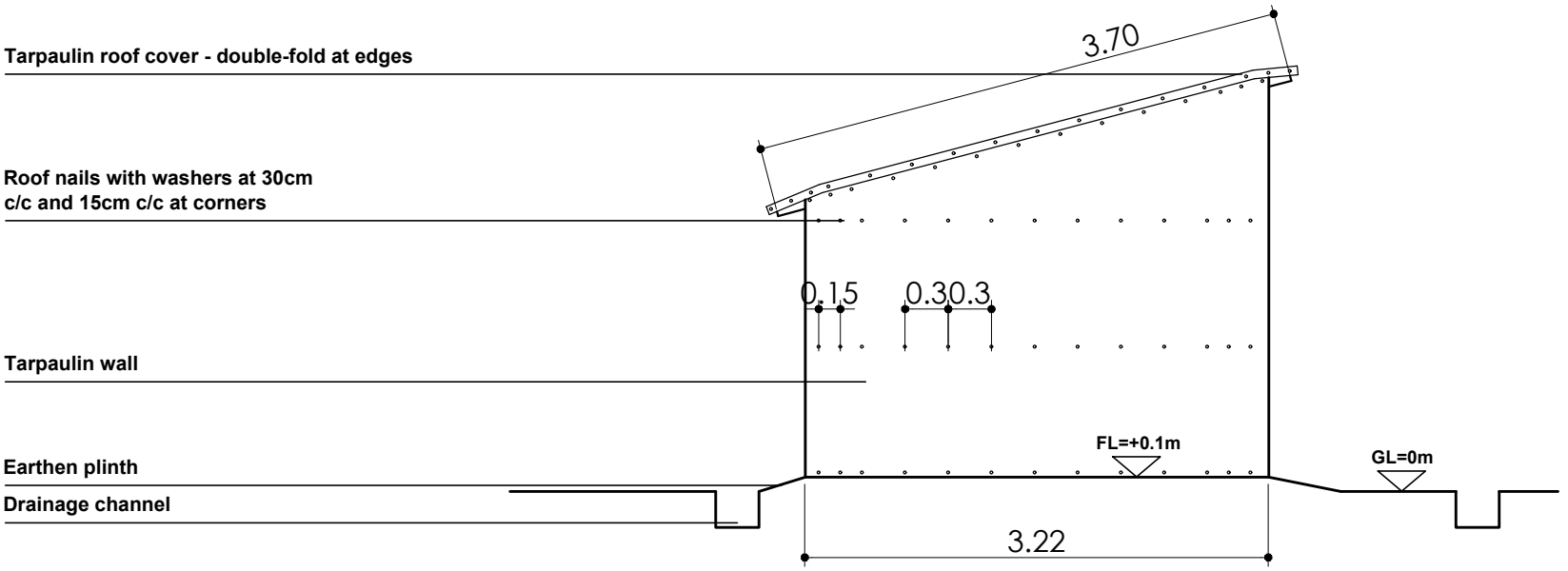
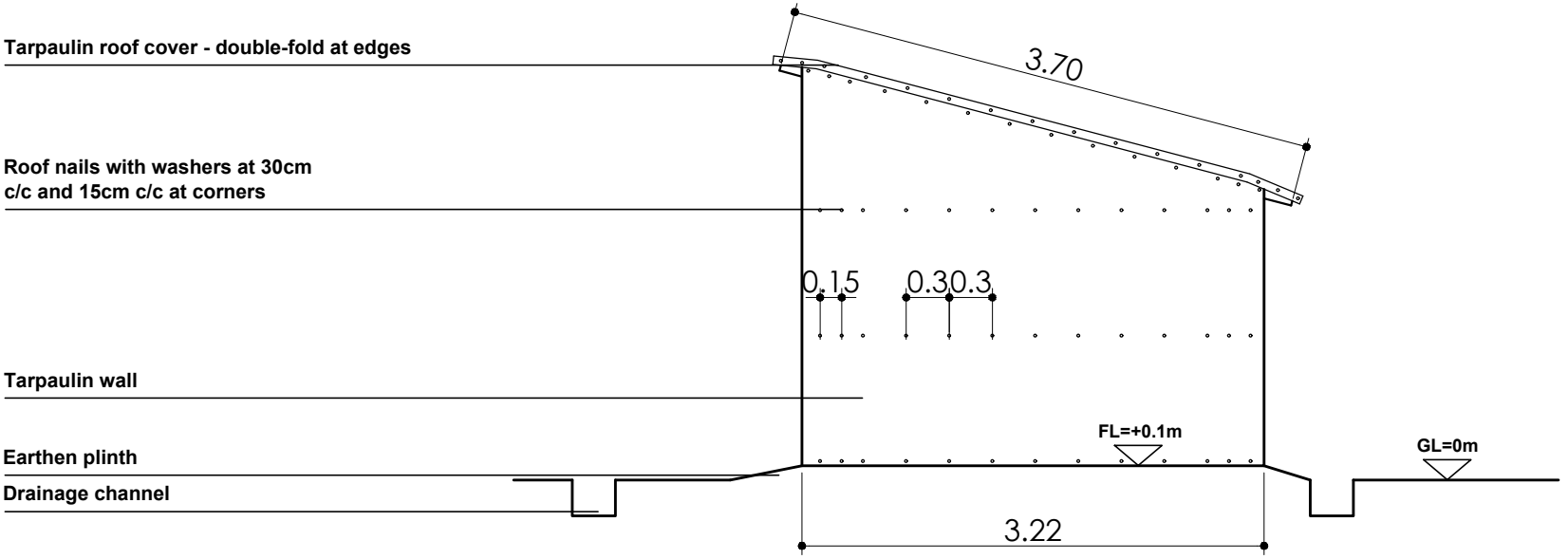


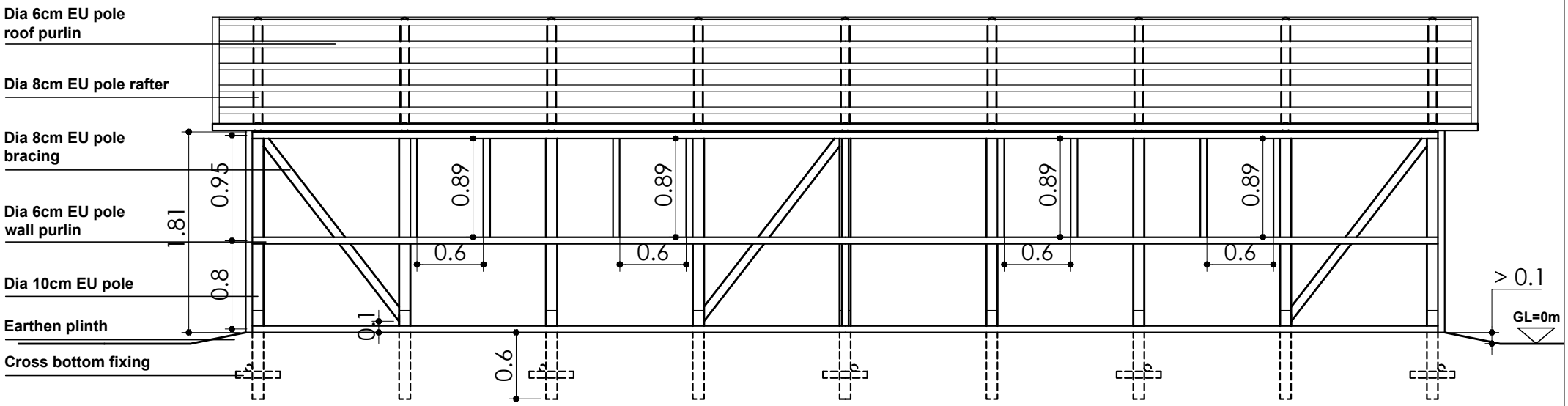
SIDE ELEVATION



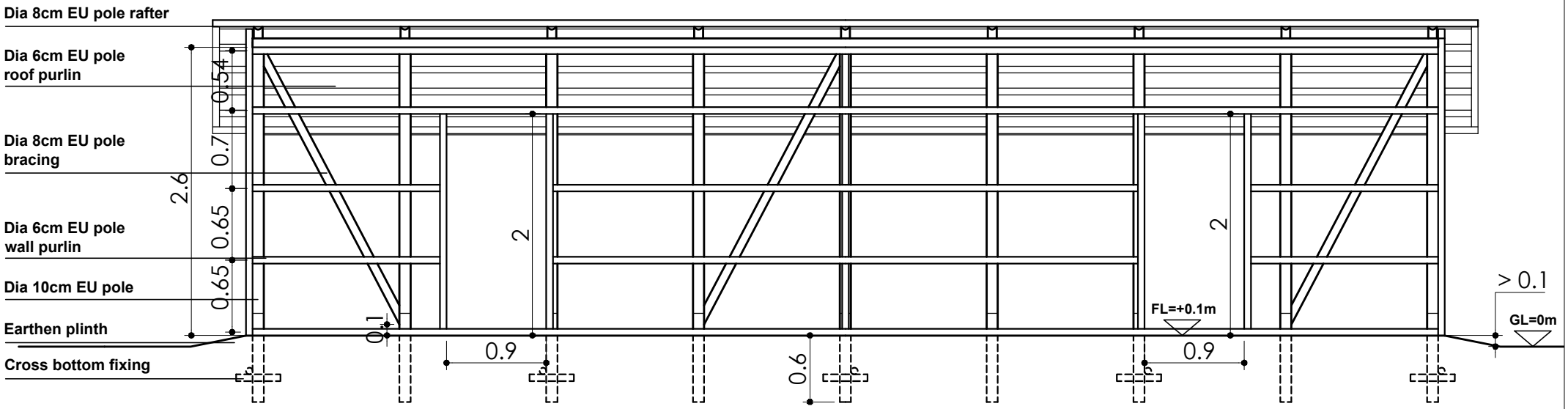
SIDE ELEVATION

*Dimensions to be adjusted to field conditions

CRS CATHOLIC RELIEF SERVICES / ECC-SDCOAdB	DESIGNED BY: CRS / TECHNICAL WORKING GROUP RECOMMENDED BY: ESNFI Cluster	PROJECT TITLE: DOUBLE UNIT TEMPORARY SHELTER VERSION: V2 - FOR CONSTRUCTION - JUNE 2021	PAGE TITLE: SHORT SIDE ELEVATIONS 1:50 printed on A4	PREPARED BY: CRS - FR NOTED BY: CRS - EA	APPROVED BY:	A SHEET NO: 5



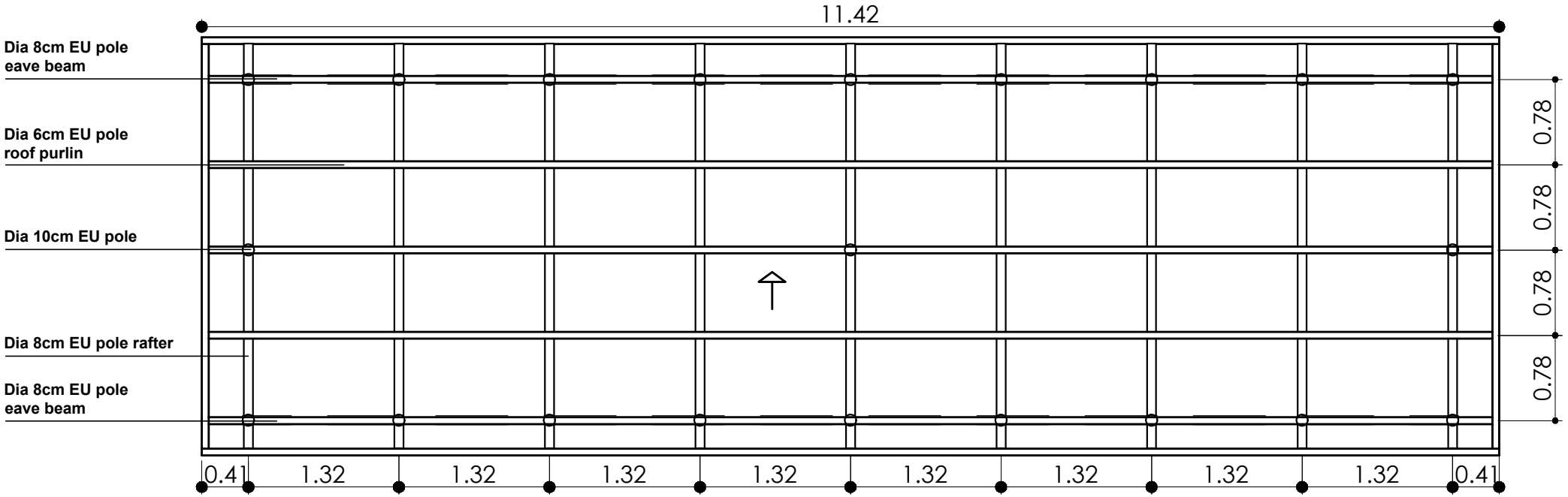
BACK ELEVATION



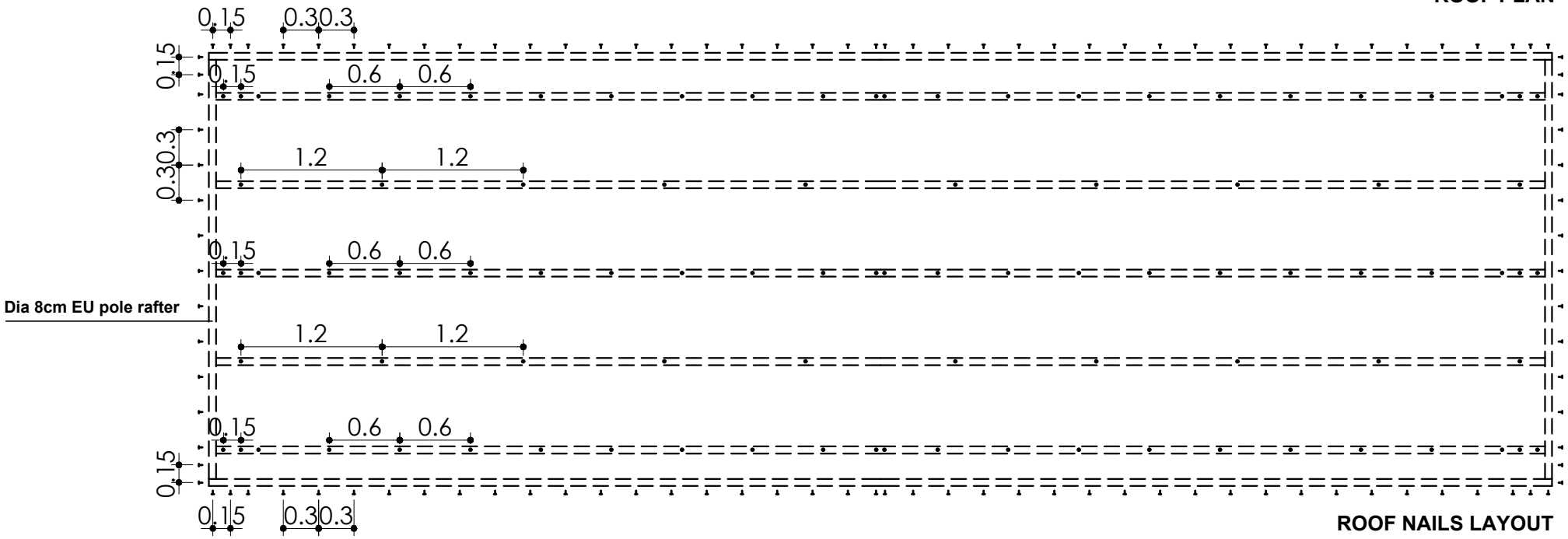
FRONT ELEVATION

*Dimensions to be adjusted to field conditions

CATHOLIC RELIEF SERVICES / ECC-SDCOAdB	DESIGNED BY: CRS / TECHNICAL WORKING GROUP RECOMMENDED BY: ESNFI Cluster	PROJECT TITLE: DOUBLE UNIT TEMPORARY SHELTER VERSION: V2 - FOR CONSTRUCTION - JUNE 2021	PAGE TITLE: STRUCTURE - LONG SIDE ELEVATIONS 1:50 printed on A4	PREPARED BY: CRS - FR NOTED BY: CRS - EA	APPROVED BY:	A SHEET NO: 6



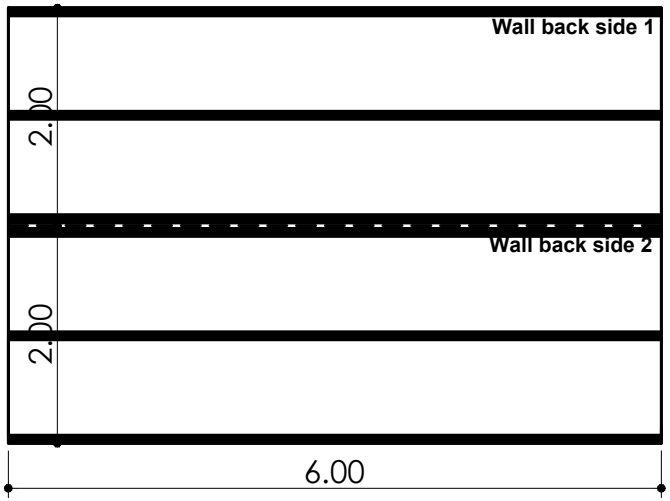
ROOF PLAN



ROOF NAILS LAYOUT

CATHOLIC RELIEF SERVICES / ECC-SDCOAdB	DESIGNED BY: CRS / TECHNICAL WORKING GROUP RECOMMENDED BY: ESNFI Cluster	PROJECT TITLE: DOUBLE UNIT TEMPORARY SHELTER VERSION: V2 - FOR CONSTRUCTION - JUNE 2021	PAGE TITLE: ROOF PLAN AND NAILS LAYOUT 1:50 printed on A4	PREPARED BY: CRS - FR NOTED BY: CRS - EA	APPROVED BY:	A SHEET NO: 7

TARPAULIN 1



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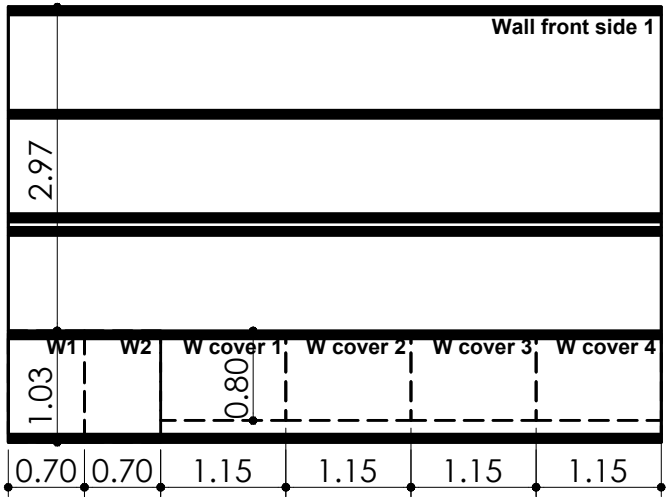
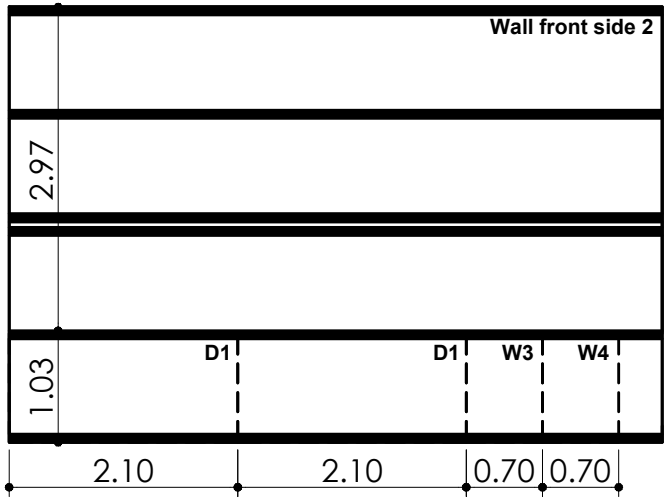
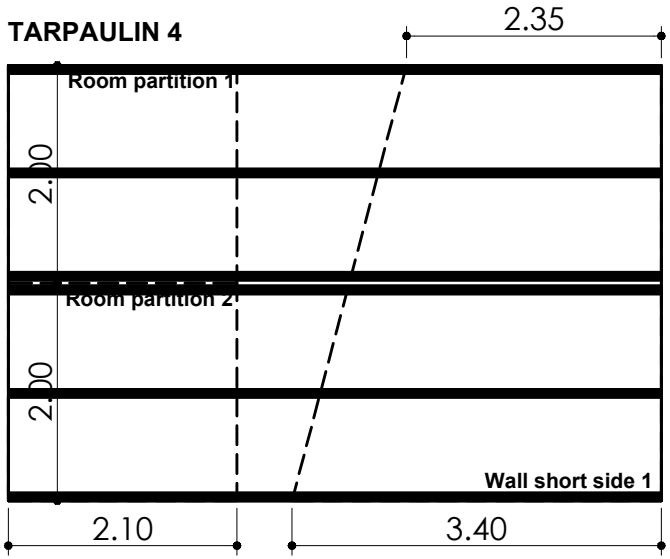


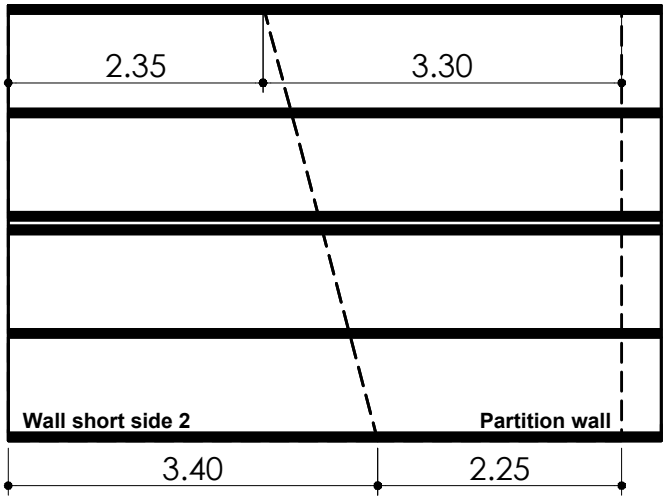
TARPAULIN 3



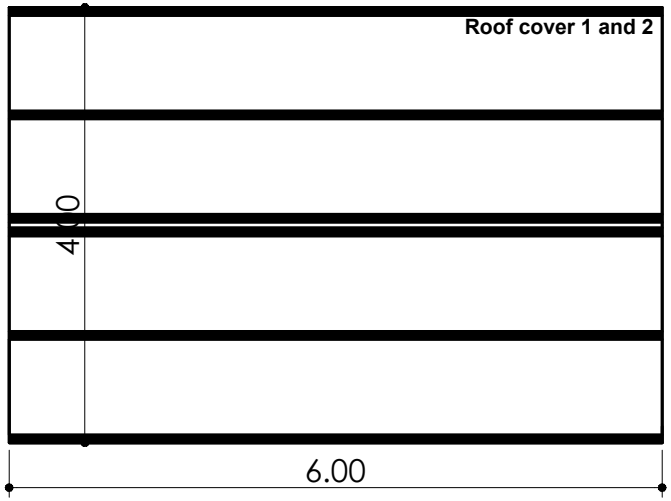
TARPAULIN 4



TARPAULIN 5



TARPAULINS 6 AND 7



*Dimensions to be adjusted to field conditions

DESIGNED BY:	PROJECT TITLE:	PAGE TITLE:	PREPARED BY:	APPROVED BY:	A
CRS / TECHNICAL WORKING GROUP	DOUBLE UNIT TEMPORARY SHELTER	TARPAULIN CUT	CRS - FR		SHEET NO:
RECOMMENDED BY:			NOTED BY:		8
ESNFI Cluster	VERSION: V2 - FOR CONSTRUCTION - JUNE 2021	Not to scale	CRS - EA		

CATHOLIC RELIEF SERVICES

ECC-SDCOAdB

3) Bill of Quantities

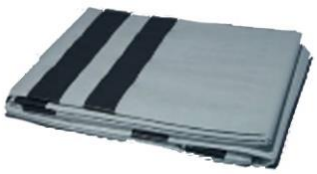
Two-unit temporary shelter - Bill of Quantities

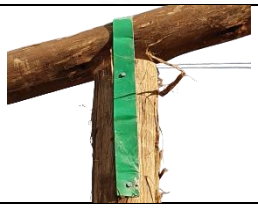
1 USD = 43 ETB

Two-unit temporary shelter								
Item	**Specification**	**Unit**	**Quantity**	**Unit cost (ETB)**	**Cost (ETB)**	**Unit cost (USD)**	**Cost (USD)**	**Notes**
Required in-kind materials								
EU pole Ø 10cm	Minimum Ø10 cm at the lower end and Ø9 cm at the upper end of the pole. Length 5m minimum.	piece	18	120.00	2,160.00	2.79	50.23	Vertical frame, bracing
EU pole Ø 8cm	Minimum Ø8 cm at the lower end and Ø7 cm at the upper end of the pole. Length 5m minimum.	piece	22	100.00	2,200.00	2.33	51.16	Eave beams, bracing, rafters
EU pole Ø 6cm	Minimum Ø6 cm at the lower end and Ø5,5 cm at the upper end of the pole. Length 5m minimum.	piece	41	75.00	3,075.00	1.74	71.51	Pegs, wall & roof purlins, doors and windows
Tarpaulin	Humanitarian grade tarpaulin. 4 x 6 meter ±1%.	piece	7	630.00	4,410.00	14.65	102.56	Roof and wall cover
No.12 Nail	Regular nail 12cm long	KG	1	95.00	95.00	2.21	2.21	
No.10 Nail	Regular nail 10cm long	KG	3	95.00	285.00	2.21	6.63	
No.9 Nail	Regular nail 9cm long	KG	4	95.00	380.00	2.21	8.84	
No.8 Nail	Regular nail 8cm long	KG	1	95.00	95.00	2.21	2.21	
No.6 Nail	Regular nail 6cm long	KG	1	95.00	95.00	2.21	2.21	
Roofing nails	Galvanized roofing nails, smooth shank. 4cm long	KG	6	120.00	720.00	2.79	16.74	
Washer	Rubber washer for roofing nail. 125 washers/bag	bag	12	6.00	72.00	0.14	1.67	
GI tie wire 14 gauge	Low carbon steel, hot-dip galvanized tie wire 14 gauge	KG	1	90.00	90.00	2.09	2.09	To strengthen connections
Metal strap	Recycled metal straps. Width 30mm.	KG	1	85.00	85.00	1.98	1.98	To strengthen connections
T-bolt lock – large size	Stainless steel T-bolt lock – large size for door	piece	4	40.00	160.00	0.93	3.72	
T-bolt lock – medium size	Stainless steel T-bolt lock – medium size for window	piece	4	25.00	100.00	0.58	2.33	
T-Hinge 4"	Galvanized 4" T-Hinge	piece	8	30.00	240.00	0.70	5.58	
T-Hinge 6"	Galvanized 6" T-Hinge	piece	4	30.00	120.00	0.70	2.79	
Pad lock	Durable padlock with 2 keys	piece	2	100.00	200.00	2.33	4.65	
IN-KIND MATERIALS TOTAL					14,582.00		339.12	
Labor								
Labor	Incuding all construction activities: setting out, site clearing, excavations, foundations, erection of main structure, roof cover, wall cover, compacted elevated plinth, doors & windows, perimeter drainage, provision of burned oil	lump sum	1	4,000.00	4,000.00	93.02	93.02	
LABOR TOTAL					4,000.00		93.02	
TOTAL COST					18,582.00		432.14	
Optional materials								
Soil	Clean, minimum 1.2 FM	CFT	7	100	700.00	2.33	16.28	For raised plinth
Rope 3mm	Polypropylene or similar, diameter: 3mm or similar. Average 50mt length.	bundle	0.1	100	10.00	2.33	0.23	To sew roof tarpaulins
Mesh wire	Common galvanized chicken wire	SQM	7	100	700.00	2.33	16.28	For internal partition

4) Material Specifications

Two-unit Temporary Shelter Construction
Material Specifications

#	Item	Description	Unit	Price (ETB)	Picture
Required materials					
1	EU pole Ø 10cm	Minimum Ø10 cm at the lower end and Ø9 cm at the upper end of the pole. Length 5m minimum. Required species: Eucalyptus. Minimal zigzag along the length of the pole and max. 5cm bend across a pole. Dry timber. No insect damages. No cracks, no split.	piece		
2	EU pole Ø 8cm	Minimum Ø8 cm at the lower end and Ø7 cm at the upper end of the pole. Length 5m minimum. Required species: Eucalyptus. Minimal zigzag along the length of the pole and max. 5cm bend across a pole. Dry timber. No insect damages. No cracks, no split.	piece		
3	EU pole Ø 6cm	Minimum Ø6 cm at the lower end and Ø5,5 cm at the upper end of the pole. Length 5m minimum. Required species: Eucalyptus. Minimal zigzag along the length of the pole and max. 5cm bend across a pole. Dry timber. No insect damages. No cracks, no split.	piece		
4	Tarpaulin	4 x 6 meter ±1%. 200 grams per square meter ±5% under ISO 3801. Woven high density polyethylene [HDPE] black fibers fabric laminated on both sides with low polyethylene [LDPE] coating. Reinforced with 6 bands of 7.5 cm +/- 3% width made of woven black HDPE fibers fabric and coated grey LDPE on the outside.	piece		
5	No.12 Nail	Regular nail 12cm long	KG		
6	No.10 Nail	Regular nail 10cm long	KG		
7	No.9 Nail	Regular nail 9cm long	KG		
8	No.8 Nail	Regular nail 8cm long	KG		
9	No.6 Nail	Regular nail 6cm long	KG		
10	Roofing nails	Galvanized roofing nails, smooth shank. 6cm long	KG		
11	Washer	Rubber washer for roofing nail. 125 washers/bag	bag		

12	GI tie wire 14 gauge	Low carbon steel, hot-dip galvanized tie wire 14 gauge (Ø1,63 mm)	KG		
13	Metal strap	Recycled metal straps. Width 3cm.	KG		
14	T-bolt lock – large size	Stainless steel T-bolt lock – large size for door	Piece		
15	T-bolt lock – medium size	Stainless steel T-bolt lock – medium size for window	Piece		
16	T-Hinge 4”	Galvanized 4” T-Hinge	Piece		
17	T-Hinge 6”	Galvanized 6” T-Hinge	Piece		
18	Pad lock	Durable padlock with 2 keys	piece		
19	Rope 3mm	Polypropylene or similar, diameter: 3mm or similar. Average 50mt length. Woven with 3 strands, with the possibility of being unraveled. To sew roof tarpaulins together.	Bundle		
Optional materials					
20	Soil	Clean, minimum 1.2 FM	CFT		
21	Mesh wire	Common galvanized chicken wire	M2		

5) Material Delivery Form

Two-unit Temporary Shelter Construction
Materials Delivery Form

Woreda: _____ **Shelter number:** _____

Kebele: _____ **Site Engineer in charge:** _____

Resettlement site: _____ **Site Supervisor in charge:** _____

Plot number: _____ **Contractor name:** _____

#	Item	Unit	Total quantity	Deliver 1	Deliver 2 (if any)	Deliver 3 (if any)	Deliver 4 (if any)	Total quantity delivered	Notes
1	EU pole Ø 10cm	piece	18					___/18	
2	EU pole Ø 8cm	piece	22					___/22	
3	EU pole Ø 6cm	piece	41					___/41	
4	Tarpaulin	piece	7					___/7	
5	No.12 Nail	KG	1					___/1	
6	No.10 Nail	KG	3					___/3	
7	No.9 Nail	KG	4					___/4	
8	No.8 Nail	KG	1					___/1	
9	No.6 Nail	KG	1					___/1	
10	Roofing nails	KG	6					___/6	
11	Washer	bag	12					___/12	
12	GI tie wire 14 gauge	KG	1					___/1	
13	Metal strap	KG	1					___/1	
14	T-bolt lock – large size	piece	4					___/4	
15	T-bolt lock – medium size	piece	4					___/4	
16	T-Hinge 4”	piece	8					___/8	
17	T-Hinge 6”	piece	4					___/4	
18	Pad lock	piece	2					___/2	
19	Rope 3mm	bundle	0.1					___/0.1	
20	Soil	CFT	7					___/7	

All the materials were delivered YES NO

Name and signature of the site engineer _____ Date:

Name and signature of the supervisor _____ Date:

Name and signature of the warehouse keeper _____ Date:

Name and signature of the contractor or field representative _____ Date:

6) Site Monitoring Checklist

Two-unit Temporary Shelter Construction
Site Monitoring Checklist

Woreda: _____ **Shelter number:** _____

Kebele: _____ **Site Engineer in charge:** _____

Resettlement site: _____ **Site Supervisor in charge:** _____

Plot number: _____ **Contractor name:** _____

#	Description	Completed & checked	Date checked	Correction measures (if any)
1	**Setting out and site clearing**			
1.1	The 4 corners of the plot are pegged out according to the site plan			
1.2	The site is cleared, top layer of organic soil is removed and free of roots			
1.3	The site is flat and checked by water level tube			
1.4	Setting out is prepared as per plan, well levelled and squared			
2	**Excavation**			
2.1	Excavation is performed at the right depth (min 60cm from estimated floor level) and width			
2.2	The bottom of each pit is compacted			
2.3	Foundation pits are executed respecting the spacing between poles and as per drawings			
3	**Vertical structure**			
3.1	Ø10cm poles are used for vertical poles			
3.2	The bottom 80cm of all vertical poles is painted with burnt oil and allowed enough time to dry (at least one day with no rain)			
3.3	40cm long pieces of Ø8cm poles are cut to length, painted with burnt oil, and let dry (26x)			
3.4	The cross fixing is added to bottom of 13x Ø10cm poles starting at 20 cm from the end, nailed diagonally to the poles with 2x nails and 1x nail connecting the two pieces together			
3.5	Straight and long enough poles are selected for the high long wall			
3.6	Poles used for the low long wall are obtained cutting poles into two			
3.7	The spacing between poles is as per drawings			
3.8	Each pole is aligned on both directions			
3.9	Each pole is plumb (checked by plumb bob)			
3.10	Foundation is backfilled compacting firmly and in layers			
3.11	Poles are cut to length at the right height (checked by water level tube)			
3.12	The future floor level is measured and marked			
4	**Eave beam**			

4.1	Ø8cm poles are used for eave beams			
4.2	Pole sections are connected through a half-lap joint on top of a vertical pole			
4.3	Eave beams are squared and nailed to each vertical pole			
4.4	A metal strap connecting the eave beam to the vertical poles is firmly nailed to every other vertical pole			
5	**Wall bracing**			
5.1	Ø8cm poles or Ø10 offcuts are used for wall bracing			
5.2	The bottom of the bracing is 10cm above the future floor level			
5.3	Bracing is done on all sides (two diagonal poles on each short side, and three on each long side), and well connected to the vertical poles			
5.4	Bracing is shaped to ensure good fit and strong connection with the vertical poles			
5.5	Bracing is firmly connected to vertical poles by 2x nails in diagonal			
6	**Wall purlins**			
6.1	Ø6cm poles are used for wall purlins			
6.2	Spacing between wall purlins is as per drawings			
6.3	Vertical wall purlins are placed at all corners, doors and windows' openings and at middle posts where tarpaulins are joined			
6.4	The purlins at the bottom of the walls are painted with burned oil			
6.5	Nails are bent over			
7	**Roof structure**			
7.1	Ø8cm poles are used for rafters and Ø6cm poles for roof purlins			
7.2	Rafters are spaced as per drawing			
7.3	Rafters are nailed diagonally to the eave beam			
7.4	Rafters at both ends and the middle one are connected to the middle vertical poles with a metal strap			
7.5	Rafters are cut to length using alignment rope and considering overhang as per drawings			
7.6	Each connection between rafters and eave beams is strengthened using GI wire folded 3 times			
7.7	Roof pitch is 15°			
7.8	Purlins are spaced as per drawings			
7.9	Connection between rafters and purlins is strengthened using GI wire folded 2 times, at every other joint			
7.10	Purlins are placed at each roof end at the same plane of the rafters			
7.11	Joint between purlins is placed over a rafter and levelled			
7.12	Nails are bent over			
8	**Roof cover**			
8.1	Two tarpaulins are tightly sewn together with a double overlap			
8.2	Tarpaulins are installed starting from the higher end of the roof			

8.3	Tarpaulins are firmly stretched and there is no sign of sagging			
8.4	Roofing nails layout is as per drawings			
8.5	Roofing nail washers are sufficiently compressed			
8.6	On all sides, the tarpaulin is folded twice before being nailed to the purlin			
8.7	Sharp edges on wooden elements are smoothed or a piece of cardboard/cloth is placed underneath the tarpaulin			
8.8	Roofing nails are bent over			
9	**Windows and doors**			
9.1	The dimensions and position of the doors are as per drawings			
9.2	Door is sturdy, braced and well connected to the frame through two hinges, with bolt lock installed both externally and internally			
9.3	The dimensions and position of the windows are as per drawings			
9.4	Windows are sturdy and well connected to the frame through 2 hinges, with bolt locks installed internally			
9.5	Windows screenings are installed as per drawings			
10	**Wall cover**			
10.1	Tarpaulins are cut as per drawings			
10.2	On the long sides, two tarpaulins are properly connected with a two-fold connection as per recommendations			
10.3	Tarpaulins are installed starting from the top part of the wall and from corners towards the center			
10.4	Tarpaulins are firmly stretched and there is no sign of sagging			
10.5	Roofing nails layout is as per drawings			
10.6	Roofing nail washers are sufficiently compressed			
10.7	At corners, tarpaulins are overlapped based on prevalent wind direction and tarpaulins are folded twice before being nailed to the wall purlin			
10.8	The bottom part of the tarpaulin is folded outwards prior to backfilling the plinth			
10.9	Cut in the tarpaulins for doors and windows is offset as per drawings			
10.10	Nails are bent over			
11	**Internal partitions**			
11.1	Tarpaulin and wall purlins are installed between two units and run from bottom to top			
11.2	2x partitions within units are installed and run from bottom to the door level			
11.3	90cm spacing is left between the partition and the wall to facilitate the future installation of a door			
12	**Plinth & drainage**			
12.1	Earthen plinth is raised at least 10cm and extends outside the shelter for 30-40cm, and is well compacted			
12.2	Household-level drainage is excavated around the shelter and connected to secondary drainage			

The shelter is approved for completion certificate	YES	NO	
Name and signature of the site engineer	_____		Date:
Name and signature of the supervisor	_____		Date:
Name and signature of the contractor or field representative	_____		Date:
If not approved, comments and recommendations from the site engineer	_____		

7) Step-by-step Construction Guide

A) Getting started

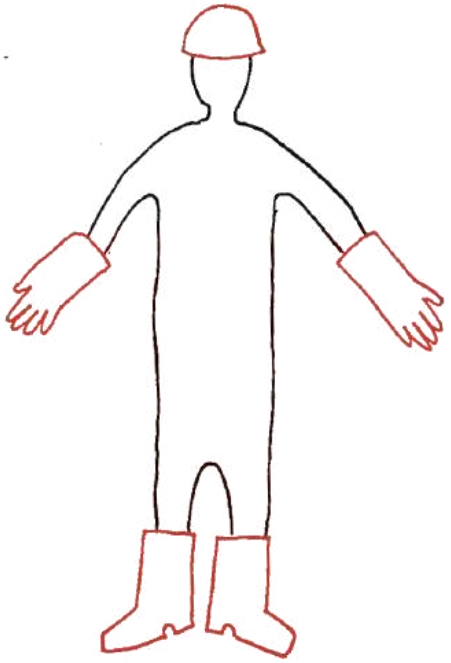
Documentation

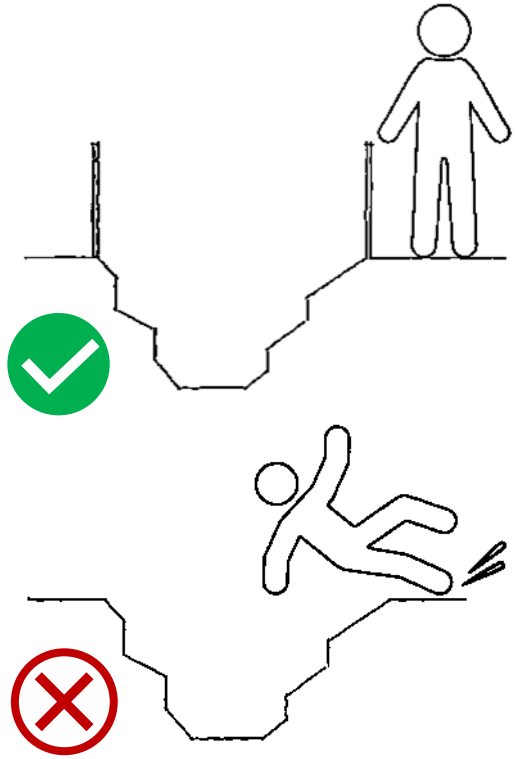
- The key documents you need to monitor the construction of temporary shelters are:
  1) Construction drawings
  2) Site plan
  3) Construction guide
  4) Material specifications
  5) Material delivery form
  6) Site monitoring form

- You will also need:
  1) A measuring tape
  2) A pen and booklet

Health and Safety

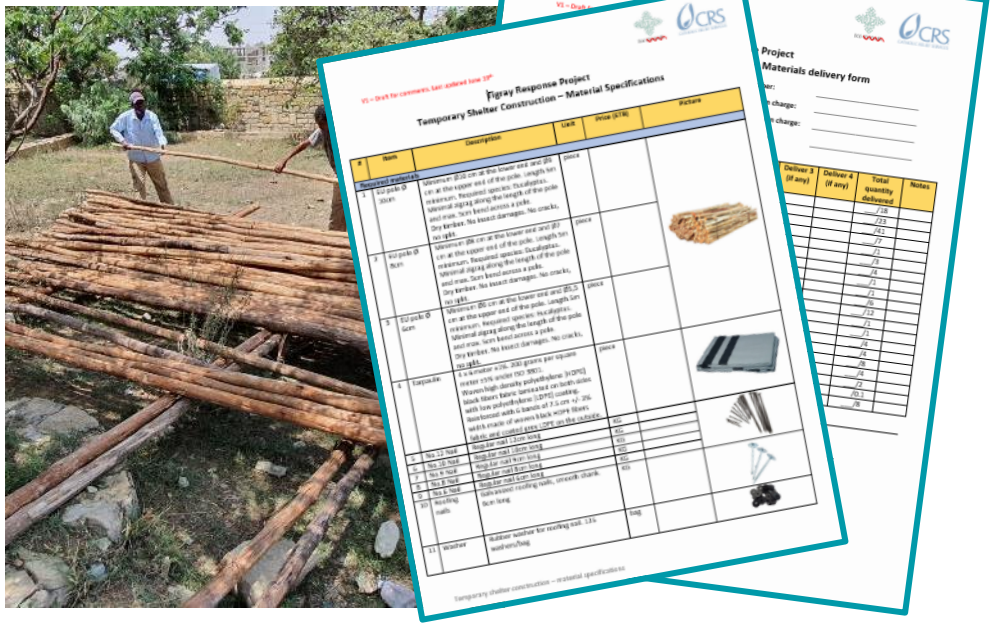
- Workers and staff on site must always wear basic protecting gear such as reinforced boots, gloves and helmet
- All tools and sharp materials must be safely stored in a closed and locked place
- Pits must be fenced to avoid accidents
- All construction activities must be performed with appropriate tools and equipment, especially when working at heights





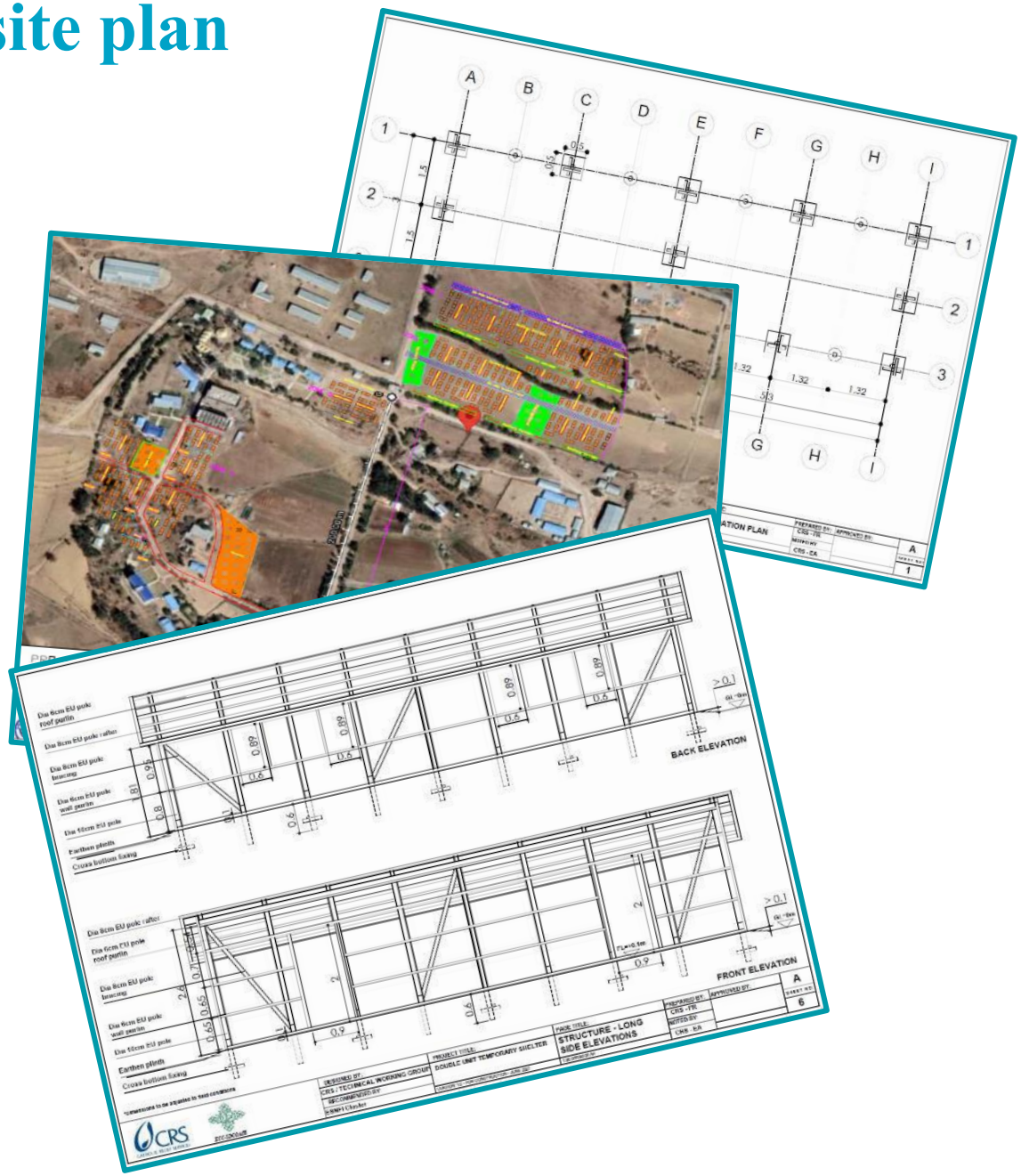
Construction materials

- Quality of construction materials should be checked when loading and offloading, using the material specifications' document
- Construction materials and tools must be stored in a dry, locked and guarded space
- Wooden poles must be raised off the ground
- The materials delivery form should be used to track materials delivered to the construction crews



Detailed design and site plan

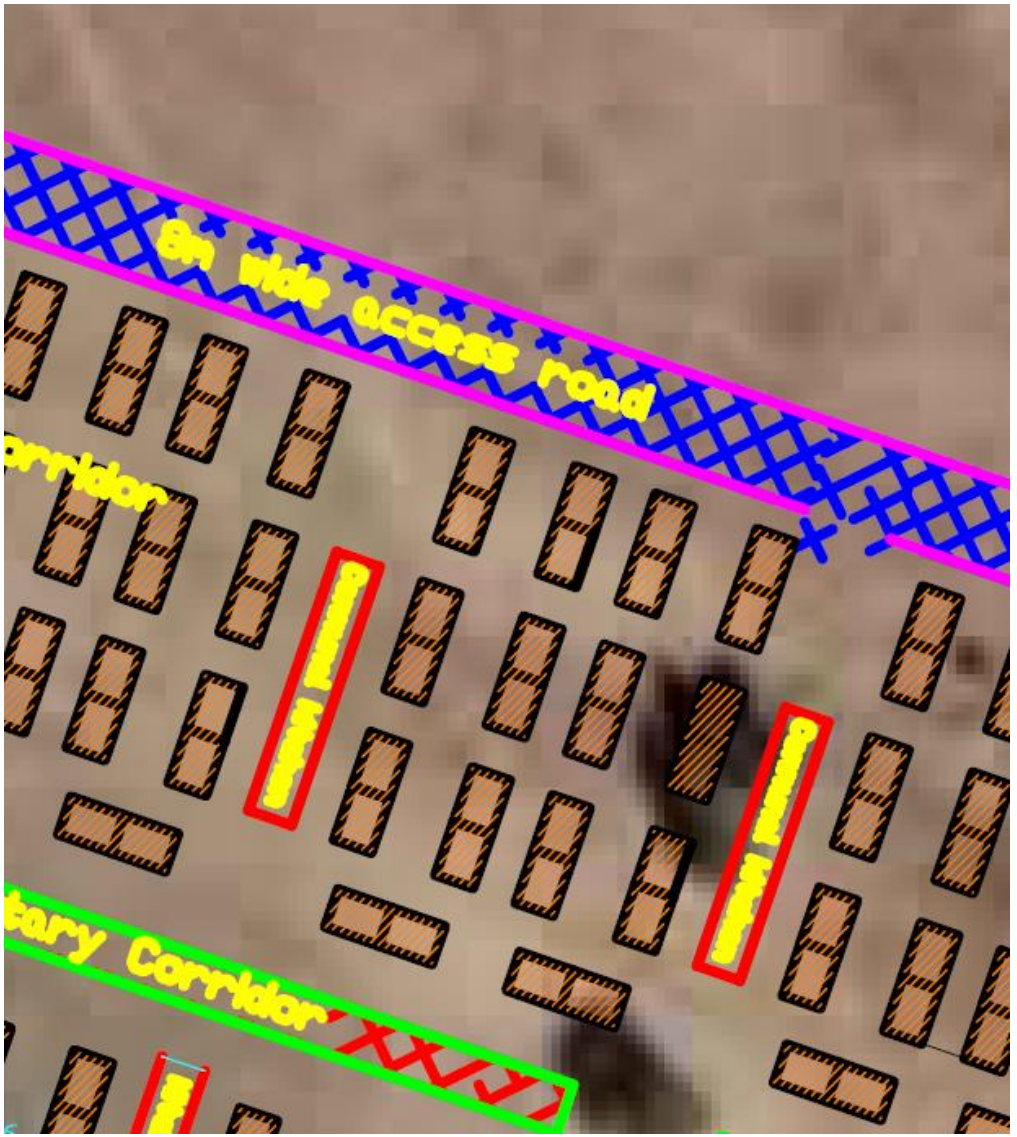
- Familiarize yourself with the latest set of drawings
- Ensure the contractor prints out one copy of the drawings per each construction crew. If this is not possible, consider printing it out yourself at the office
- Ensure you have the latest version of the site plan double checking with the CCCM partner



B) Step-by-step guide

1) Setting out of the plot

- Setting out the plot must be conducted by the shelter partner together with the CCCM site planner and the contractor
- Together with the site planner, set out the 4 corners of the first plot according to the GPS coordinates of the site plan
- From there, set out the remaining plots in the zone, and then double check the GPS coordinates when moving to the next zone
- Ensure to leave enough room for sanitary corridors, communal kitchens, community centers and fire breaks

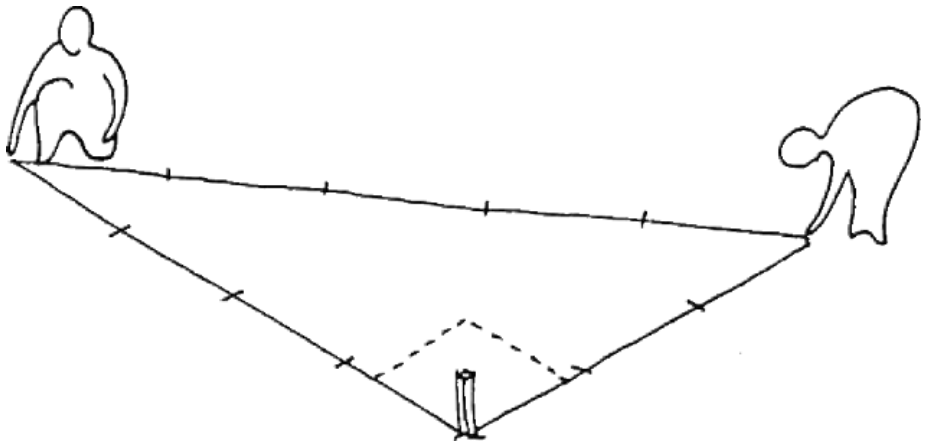


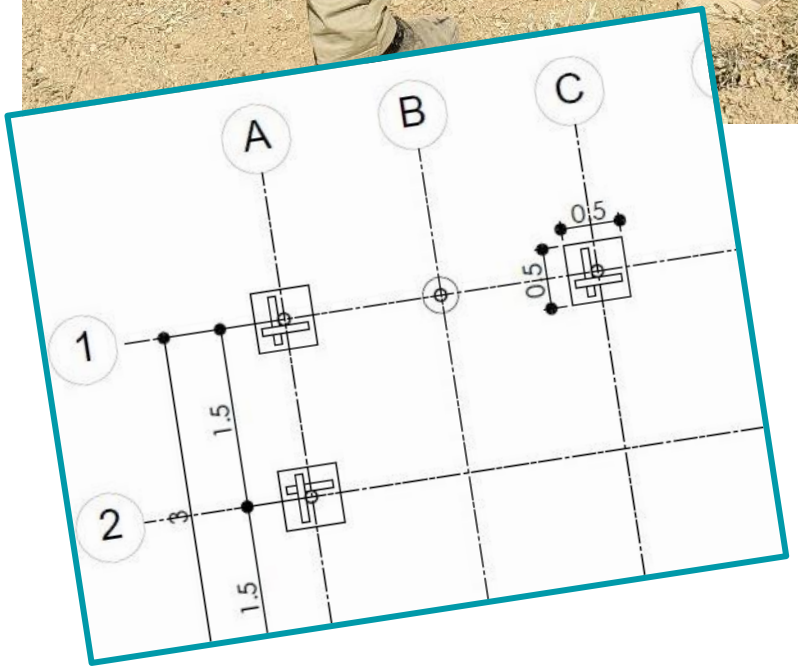
2) Site clearing and levelling

- Once the plot is set out, the contractor can start working
- Remove the organic layer and roots (usually 5-10cm depending on the location), up to 50 cm offset of the shelter dimension
- Check that the ground is levelled and compacted

3) Mark the foundation for excavation

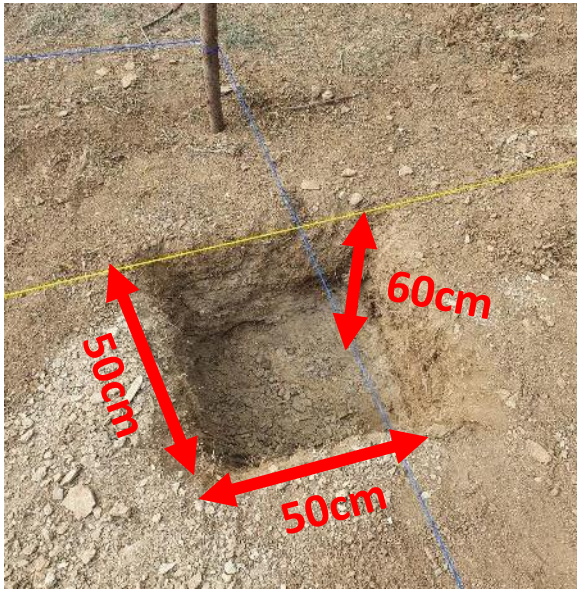
- Using strings, plumb, and chalk mark the position of the posts for excavation of the pits
- Remember – 13x posts require a 50x50x60cm pit, while the middle ones only to dig dia 15-20cm to install the posts
- Regularly check the dimensions are square using the 3/4/5 rule





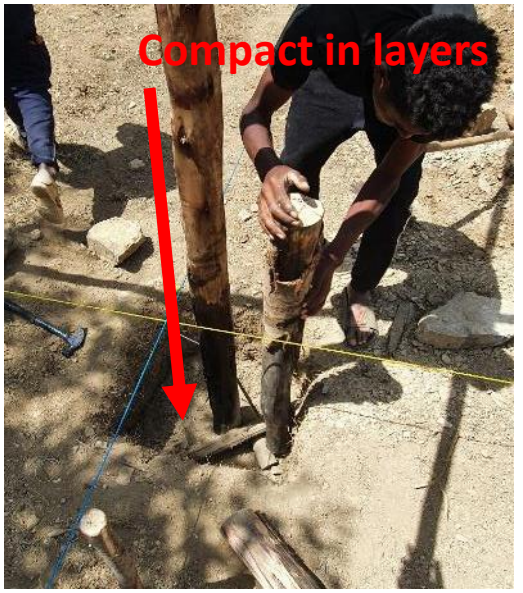
4) Excavate the pit and prepare the posts

- Check the size and depth of each pit
- Compact the bottom of the pit
- Paint the bottom 80cm of each pole with burned oil and allow enough time to dry
- Cut 4x pieces of 40cm from 9x Ø8cm poles, paint them with burned oil and nail them 20cm from the bottom of each pole



5) Install vertical posts

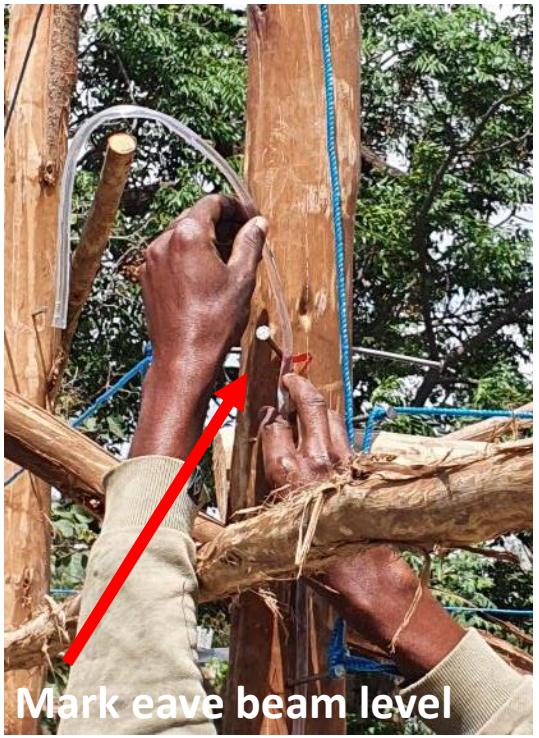
- Select straight Ø10 cm poles for the front wall
- Cut 5x poles into two for the posts of the back wall
- Install the posts, ensure they are aligned with the strings and plumb
- Backfill compacting the soil in layers (max 15cm). If available, use some rocks to provide additional strength



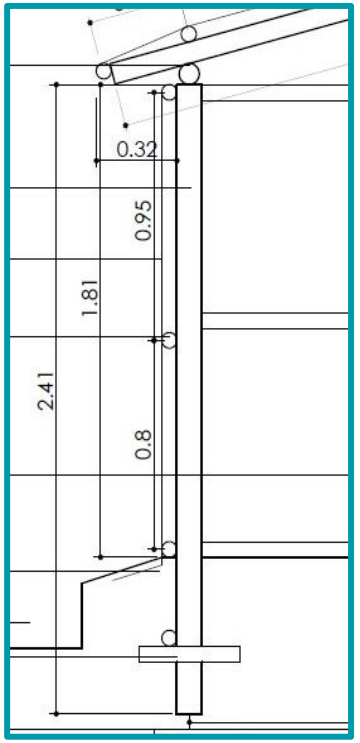
6) Install bottom and top wall purlins

- Determine the future floor level (remember it must be +10cm above the ground level) and mark it on all corners. Pull a string to keep the level visible
- Determine the eave beam level and mark it on all corners using the water tube
- Install the bottom and top wall purlins following the spacing as per drawings
- Ensure the lap between two purlins is located over a post


Mark future floor level


Mark eave beam level


Install bottom and top wall purlins

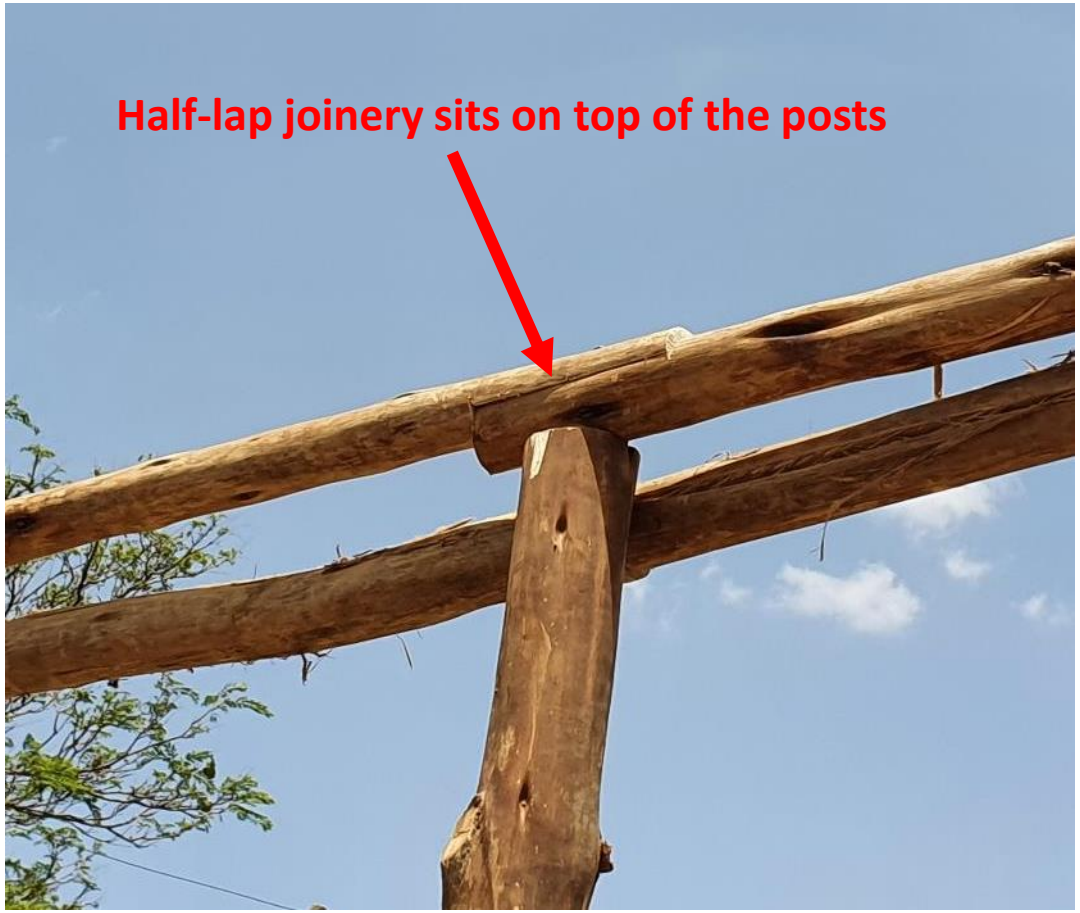


7) Cut the posts to length

- With the help of a string, mark the top end of all vertical posts
- Cut all posts to length

8) Install eave beams

- Place the eave beams making sure the half-lap joinery sits on top of a post
- Nail the eave beams to each posts
- Use the metal straps to fasten the connection between eave beam and posts in every other connection



9) Install bracing

- Install bracing on all sides as per drawings, always starting from the top corner
- Shape the end pole at an angle for strong connection with the post
- Place the bottom part of the bracing at 10cm from the expected floor level
- Nail the bracing to the vertical posts with 2x nails in diagonal

10) Install remaining wall purlins

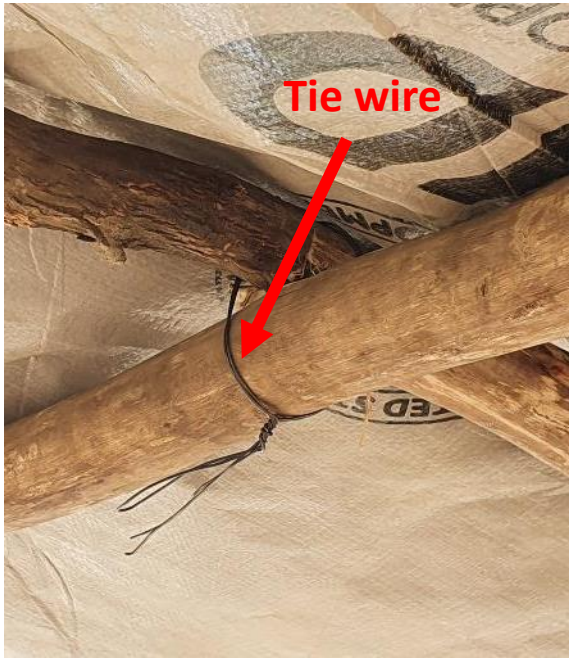
- Install the remaining horizontal wall purlins following the spacing as per drawings. Ensure nails are bent over at 90°
- Install vertical wall purlins at all corners, at doors and windows openings and at middle posts where tarpaulins are joined
- Install the frames for windows and doors

11) Install rafters

- Install 9x Ø8cm rafters on top of the eave beams, spaced as per drawings
- Nail each rafter to the eave beam with 2x nails in diagonal
- Tie each rafter to the eave beam with GI wire folded 3 times
- Connect rafters at both ends and middle one to the posts using a metal strap
- Cut rafters to length using a string, ensuring the overhang as per drawings

12) Install purlins

- Install Ø6cm purlins on top of the rafters, spaced as per drawings. Ensure nails are bent over at 90°
- Always place the lap between two purlins over a rafter and ensure it is levelled
- Place purlins at each roof's end at the same plane of the rafters to ensure proper adherence of the roof tarpaulin
- Tie rafters to purlins with GI wire folded 2 times at every second joint



13) Connect two tarpaulins for roof cover

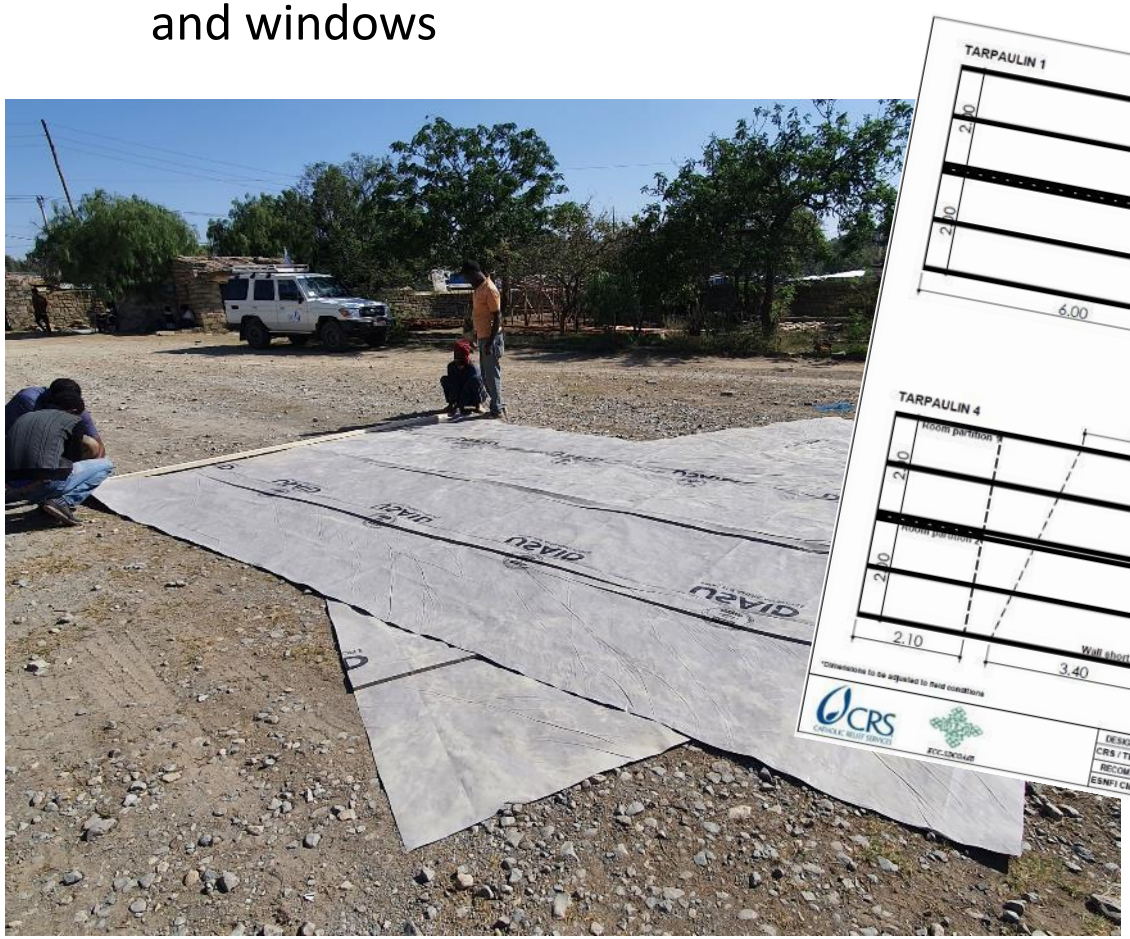
- Place the two sheets on the ground on top of each other on the short side
- If the tarpaulin has a dark and a light side, make sure that the light side is the one facing upward, this will reduce heat in the shelter
- Fold the short side of the tarpaulins three times and then sew it with a big needle and thin rope. You can unravel the rope until you reach a Ø of 1-2mm

14) Install roof cover

- Install the tarpaulin starting from the higher end of the roof, and firmly stretching it during installation to avoid sagging
- Place roofing nails with washers as per nail layout, and ensure the washers are sufficiently compressed. The maximum distance between nails is 30cm. Bend over nails at 90°
- At all ends, fold the tarpaulins twice at the reinforcement bands before nailing to the purlins

15) Cut the tarpaulins for wall cover

- Mark and cut 5x tarpaulins as shown in the drawings, in order to minimize offcuts
- You will get tarpaulins to use for the external walls, internal partitions, doors and windows



16) Install wall cover

- Start from the top end of the wall, and firmly stretch the tarp to avoid sagging. Fold the tarpaulin twice before nailing to the purlins at the top end
- Place roofing nails with washers as per nail layout, and ensure the washers are sufficiently compressed. The maximum distance between nails is 30cm. Bend over nails at 90°
- Whenever possible, nail on the reinforcement bands
- On the long sides, connect two tarpaulins by folding one on the other with a U joint
- At corners, overlap two tarps based on prevailing wind

17) Prepare and install windows and doors

- Prepare sturdy frames for windows and doors with Ø6cm purlins and use tarpaulins as cover
- Firmly connect windows and doors to the wooden frame using hinges
- Install bolt locks internally and externally for doors and internally for windows
- Ensure doors and windows are straight and open/close correctly



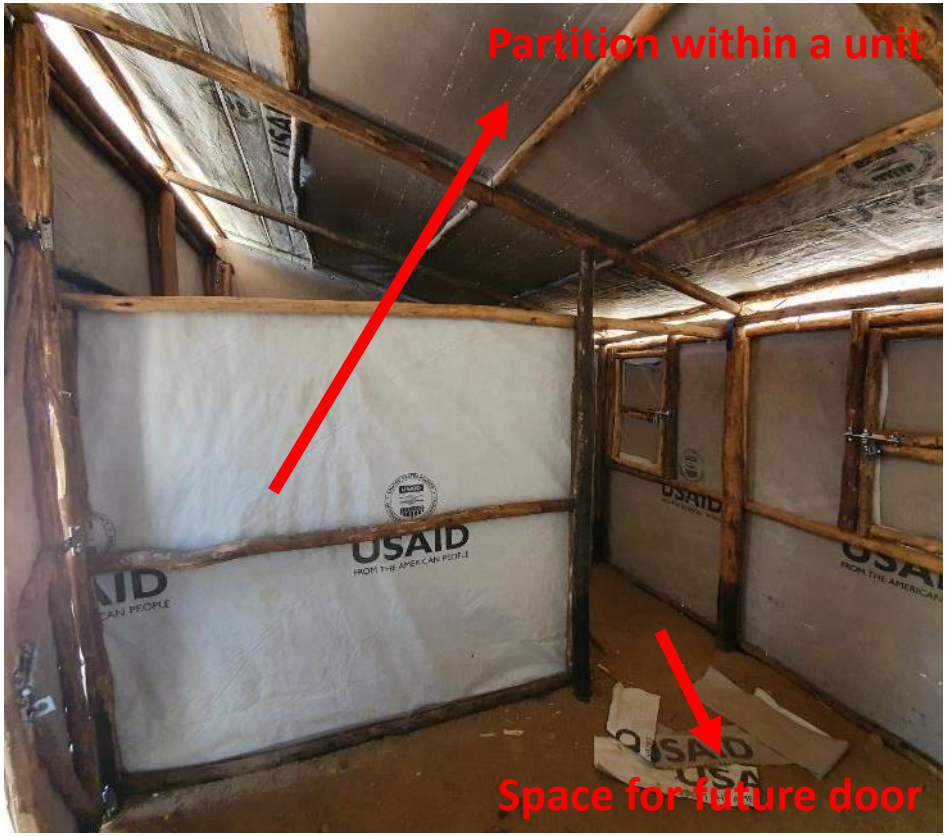


18) Plinth and flooring

- Use clean soil to raise the plinth at least 10cm higher than the ground level. Extend the plinth 30-40cm outside the shelter.
- After a first layer is consolidated, fold the bottom part of the tarpaulins and cover with clean soil to reach the floor level
- Compact the plinth firmly and in layers


19) Internal partitions

- Install a partition wall between the two units, running from top to bottom without leaving holes
- Install one partition in each unit, leaving 90cm for a future door



20) Finishing

- Cut the tarpaulins at the windows' openings with an offset of approximately 15cm on all sides. For doors, leave 15cm of additional tarpaulin on the top end
- Using offcuts, prepare windows screens and install them over the windows

21) Drainage

- Dig an earthen drainage channel around the shelter and connect it to the existing secondary drainage (when available)

Completed shelter

C) Additional recommendations

Proper use of tarpaulin

- If you are using a tarpaulin with a dark and light side, the latter should face outward

- At all corners and at the doors, the tarpaulin should always be nailed onto a curve surface

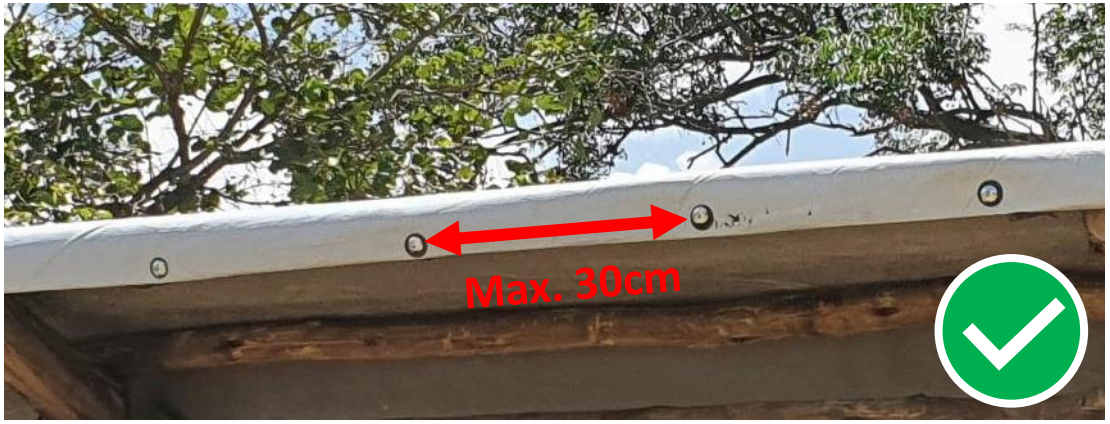
Proper use of tarpaulin

- Ensure the tarpaulin is well stretched to avoid sagging
- Fold the tarpaulin minimum twice before nailing it

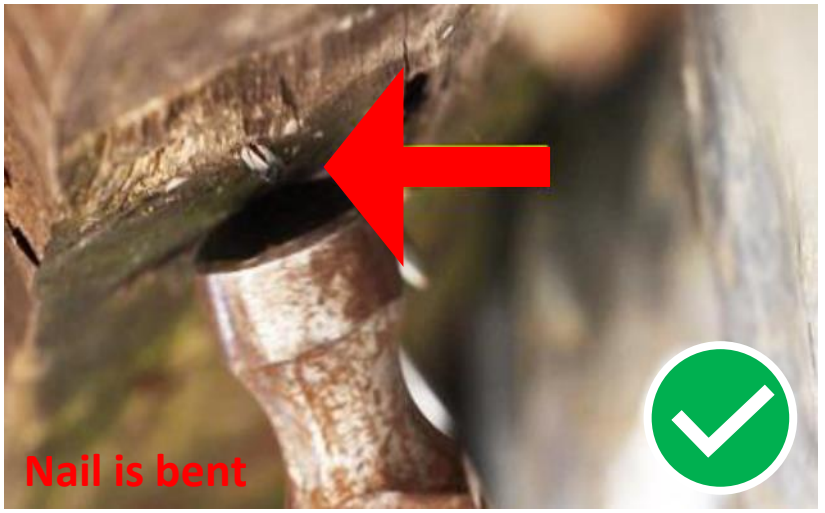
Proper use of tarpaulin

- In case of sharp corners, protect the tarpaulin with a cardboard, paper or a cloth

- Nail the tarpaulin as per layout, ensuring 30 cm between nails and 15cm at corners

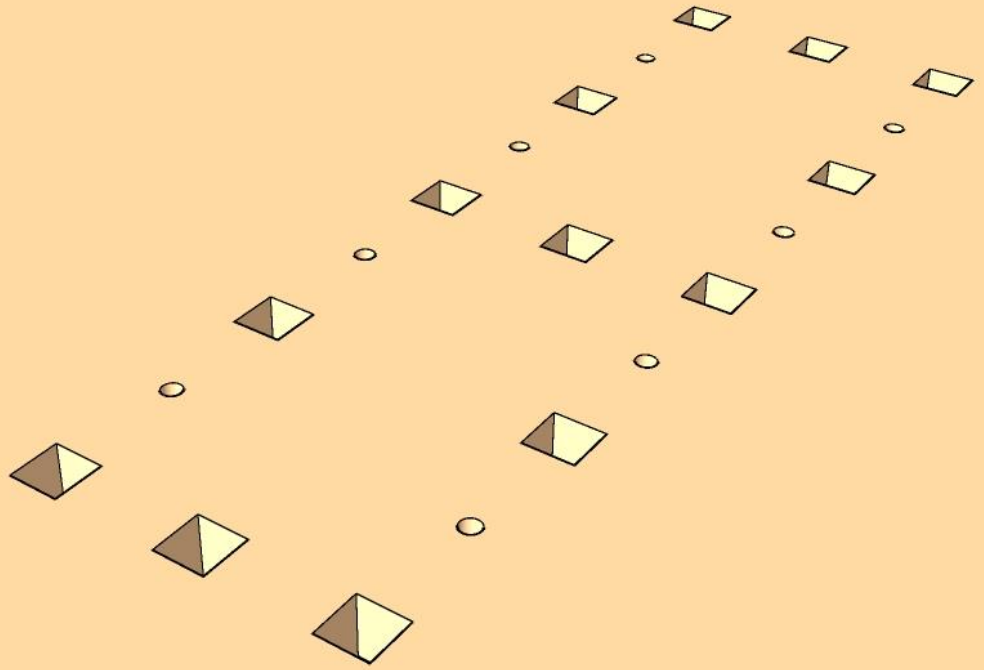


- Bend over nails at 90°

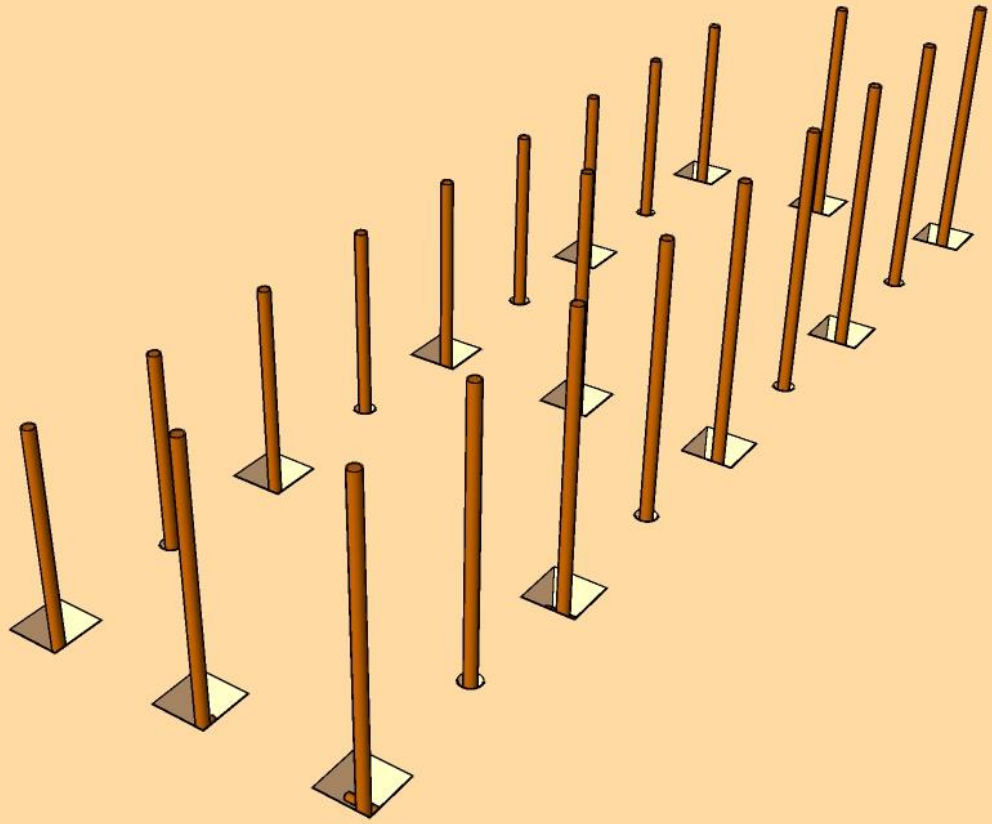


D) Step-by-step 3D visuals

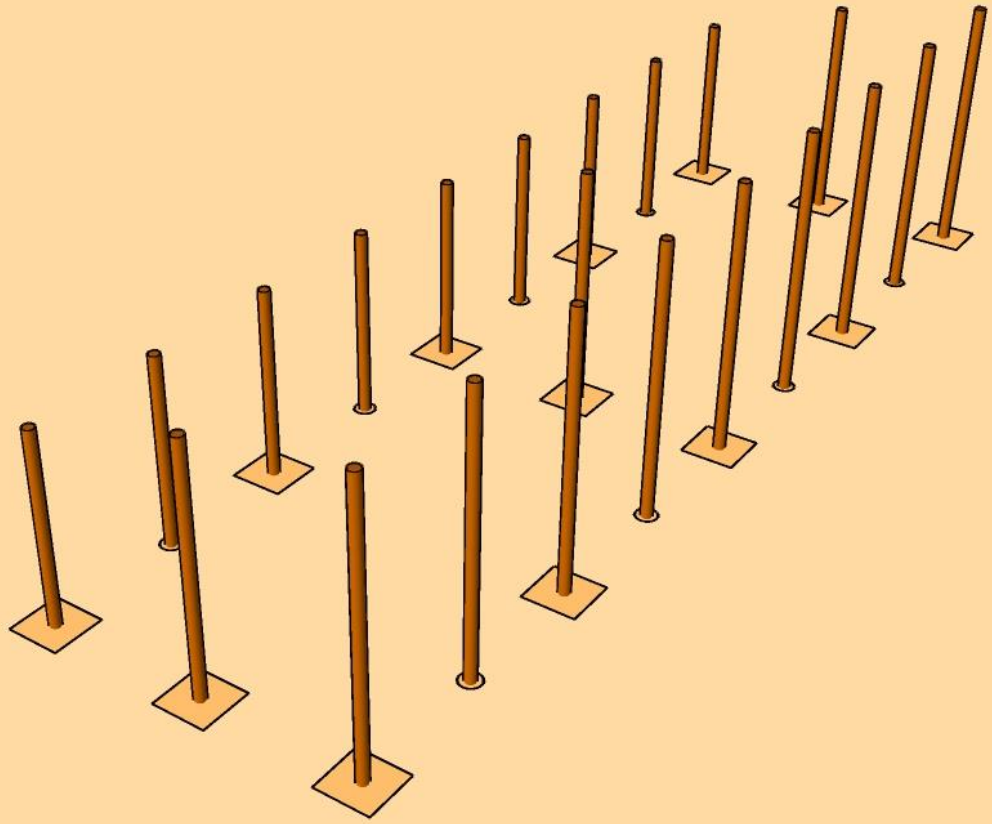
1) Dig the foundation pits



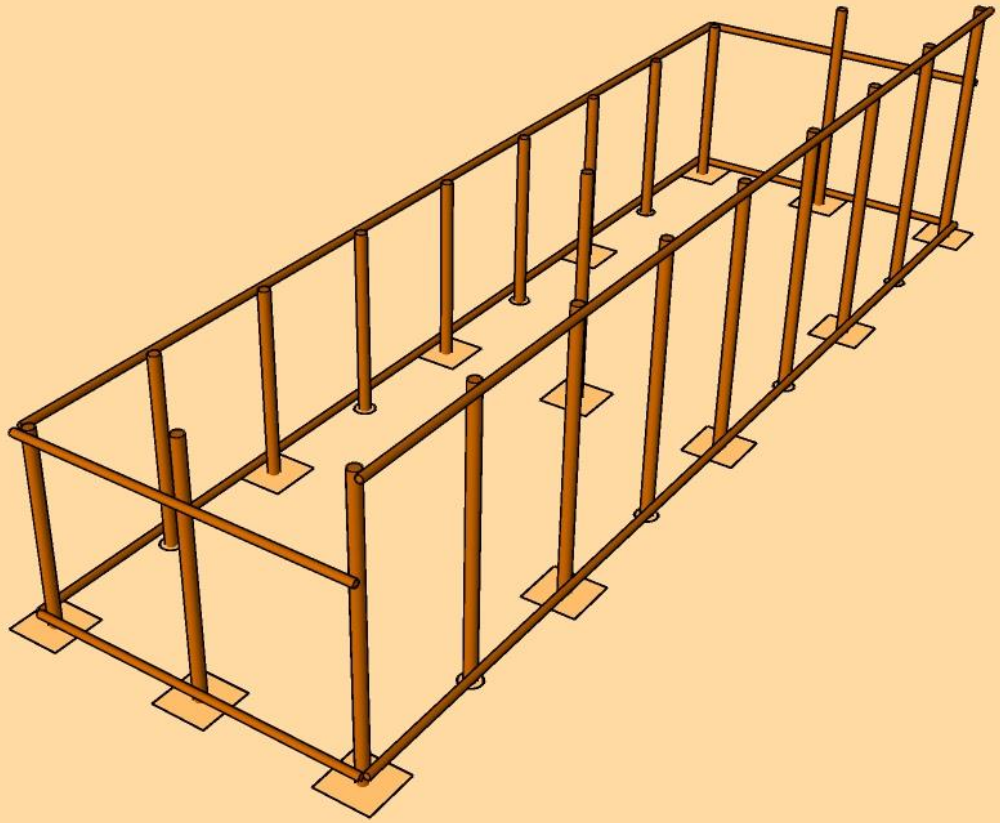
2) Install the vertical poles



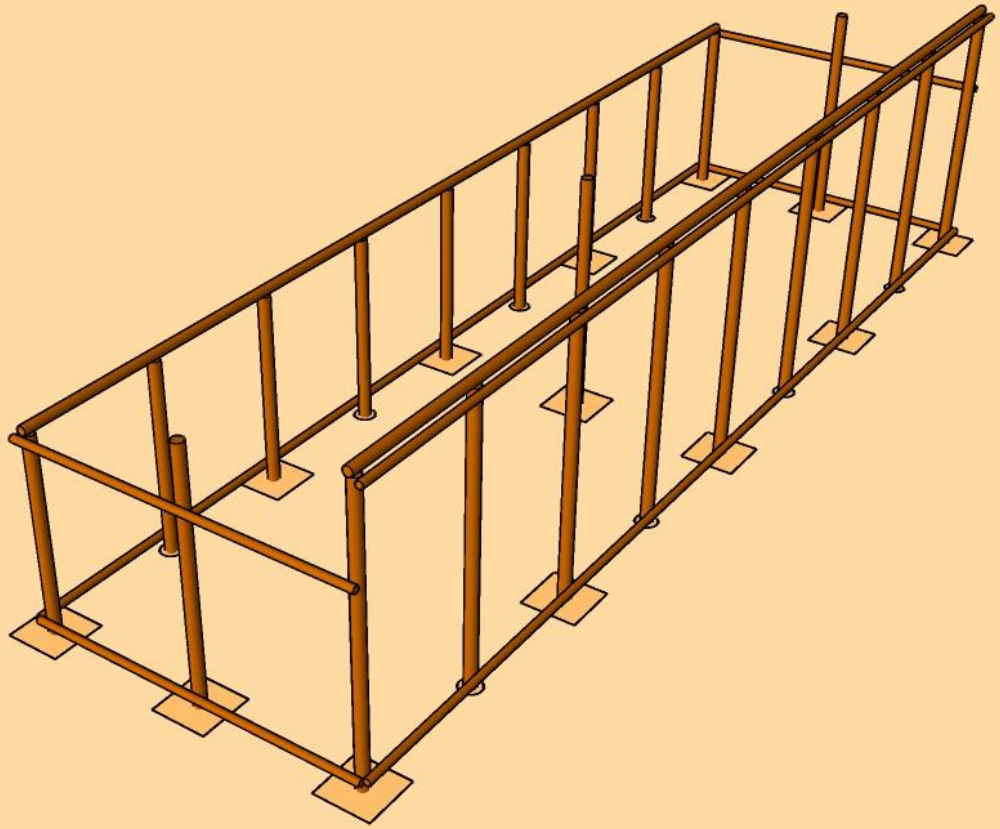
3) Backfill the pits



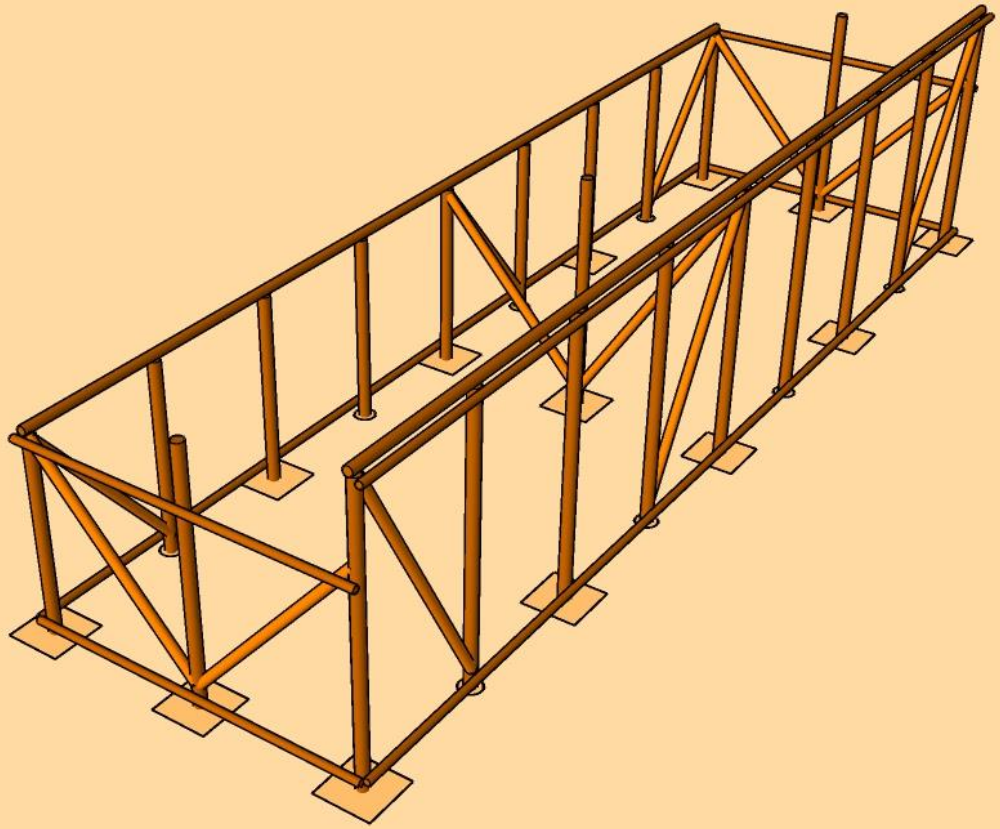
4) Install top and bottom wall purlins



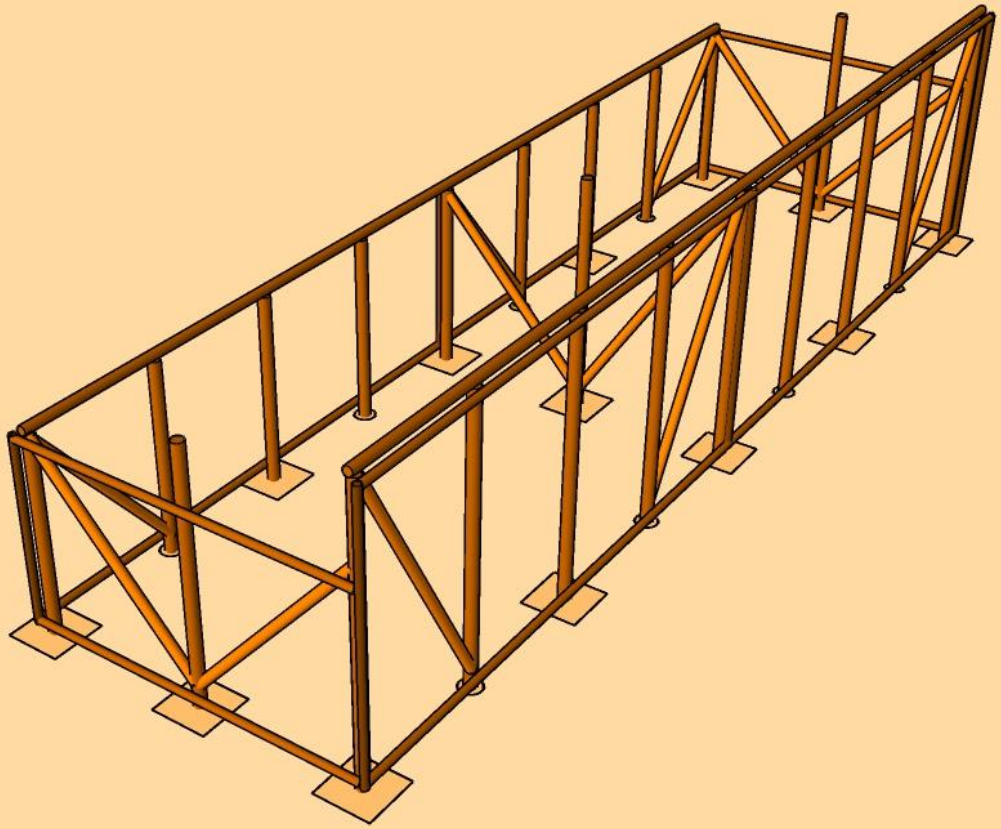
5) Install eave beams



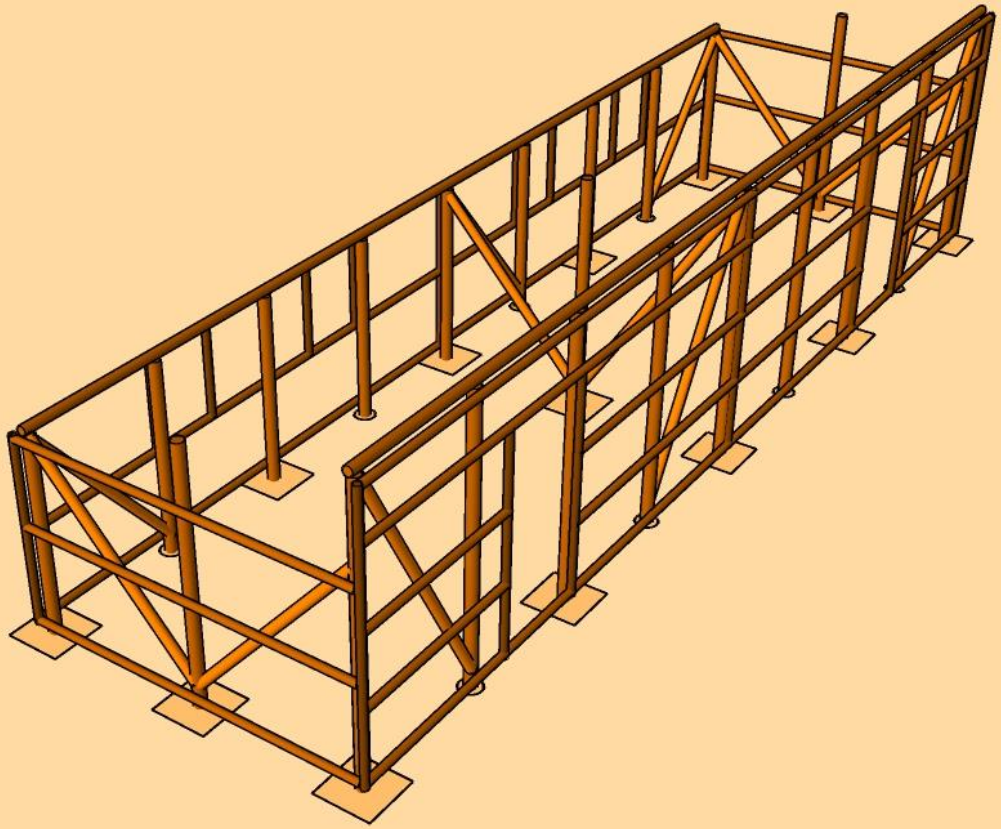
6) Install bracing



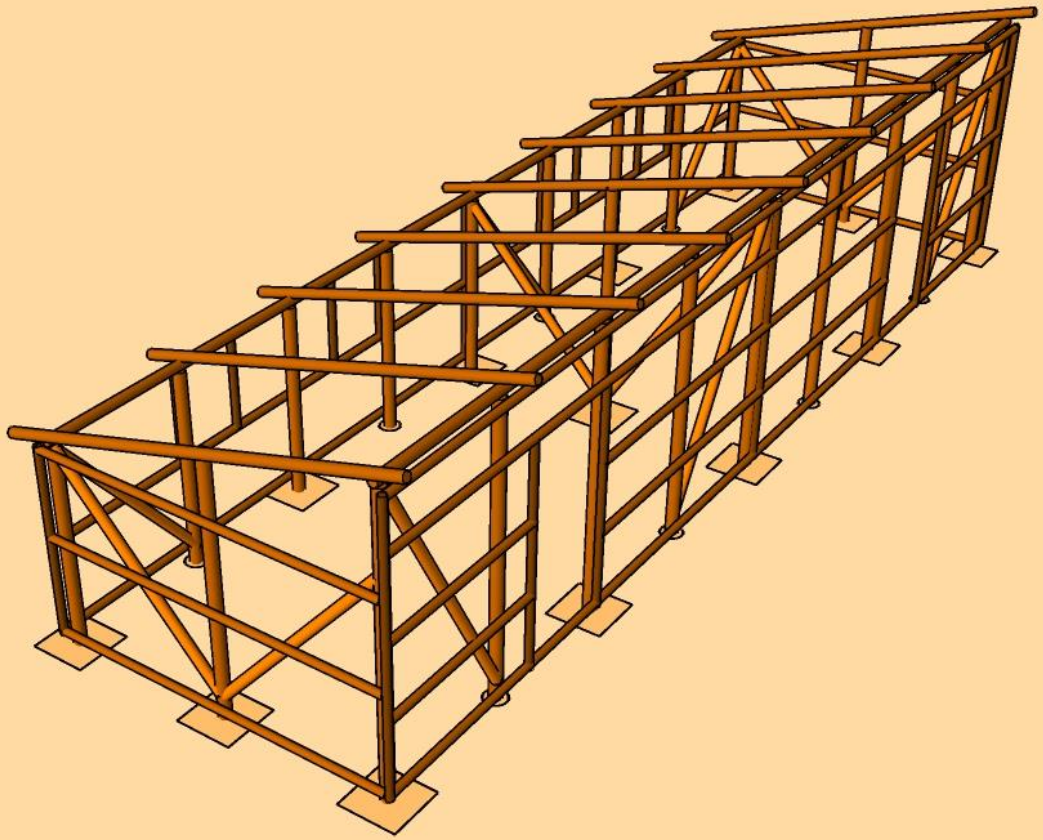
7) Install wall purlins at corners



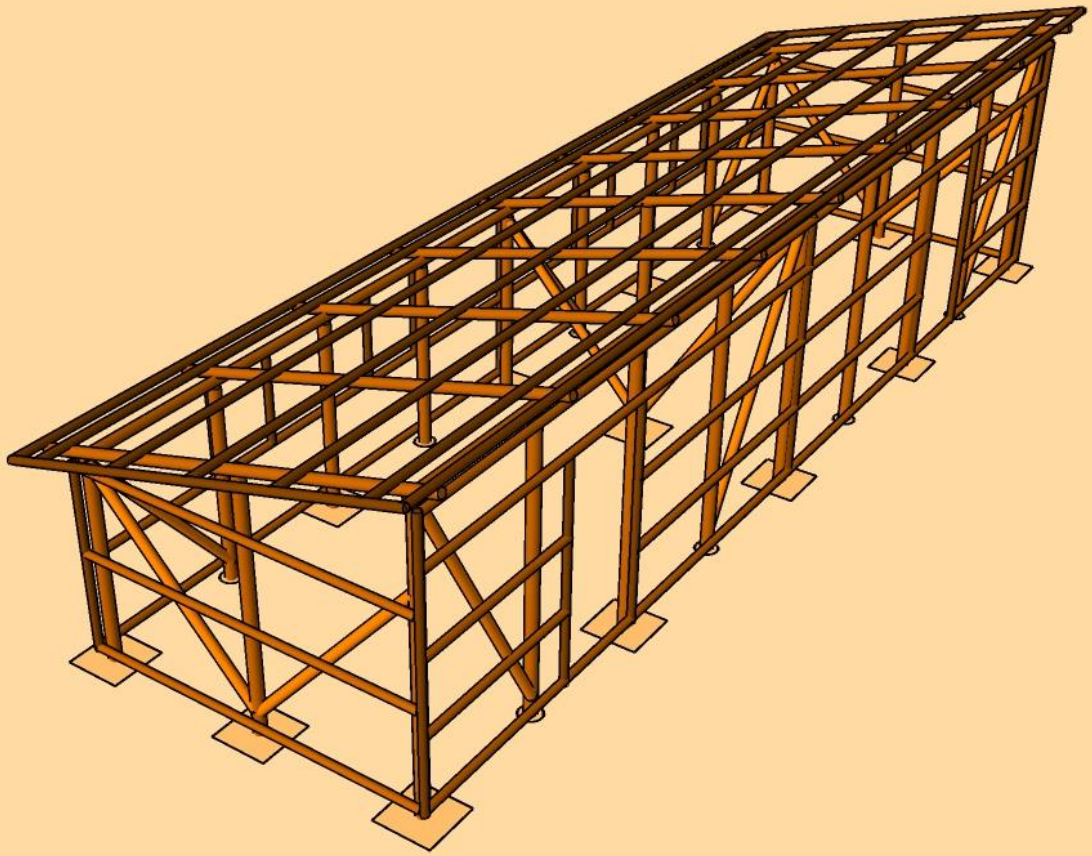
8) Install remaining wall purlins



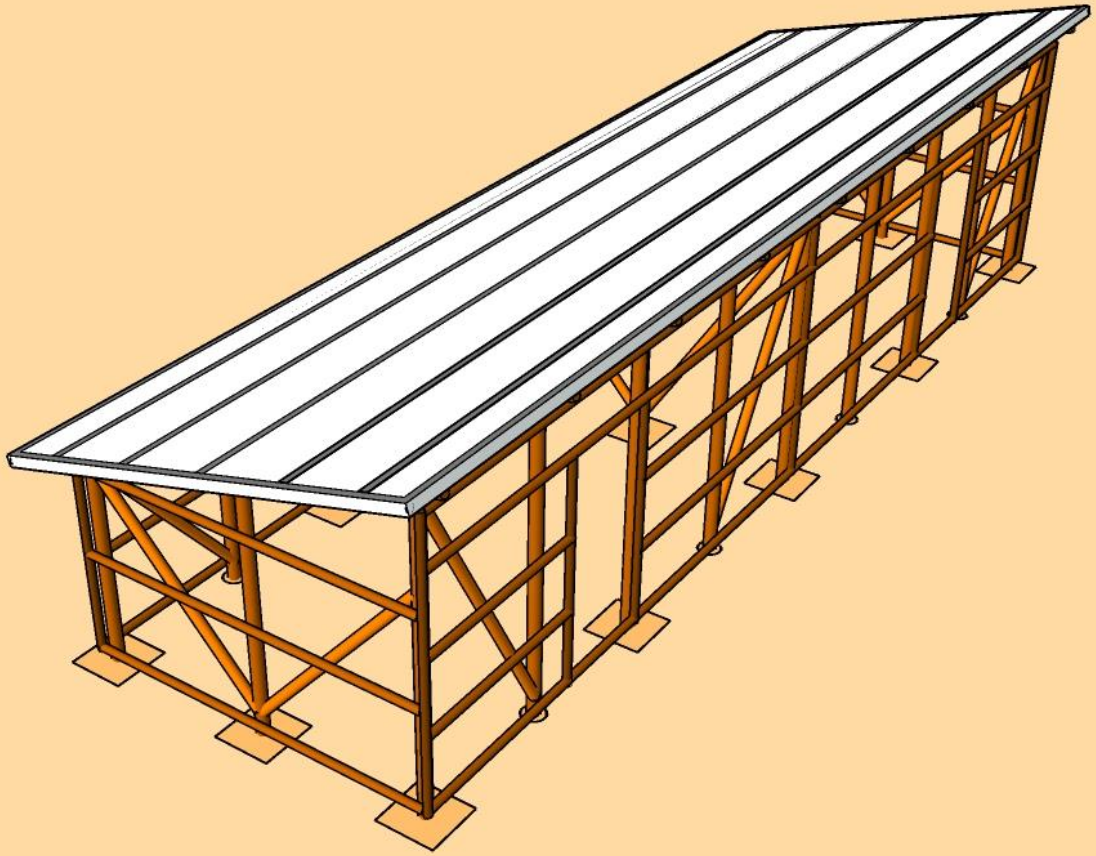
9) Install rafters



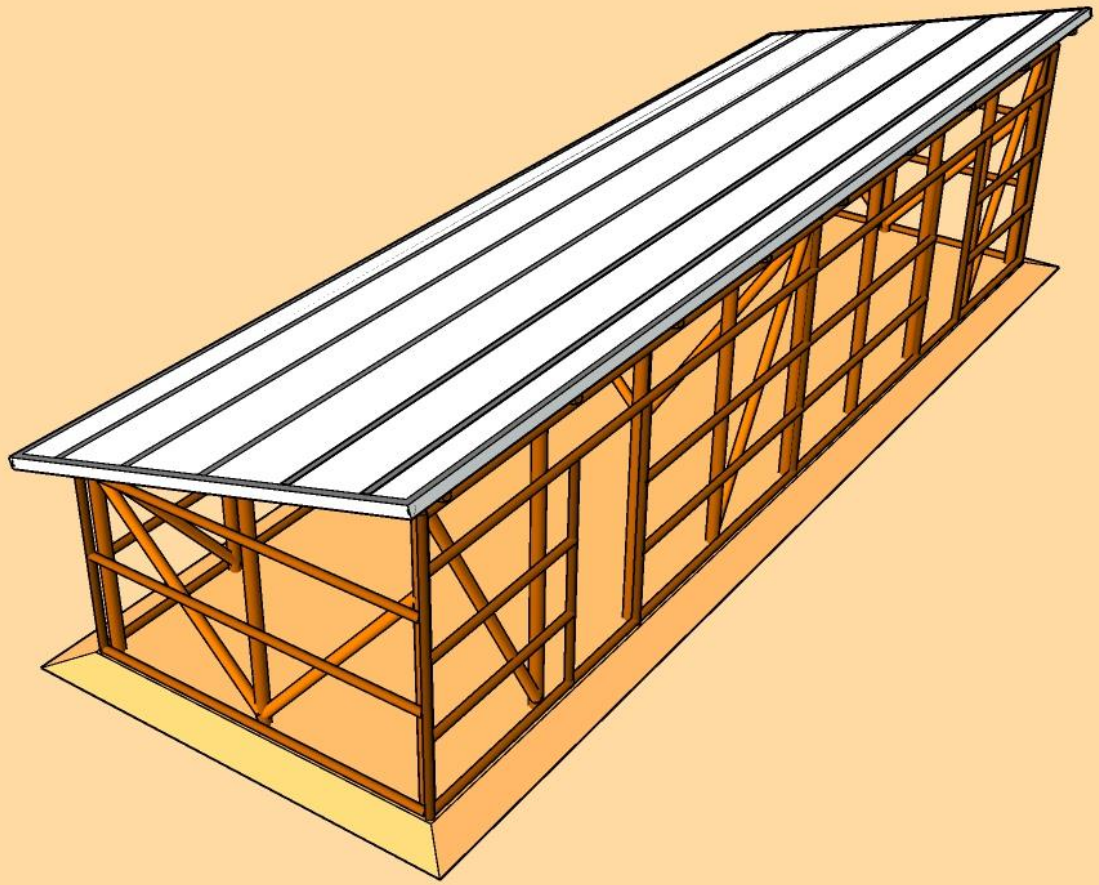
10) Install roof purlins



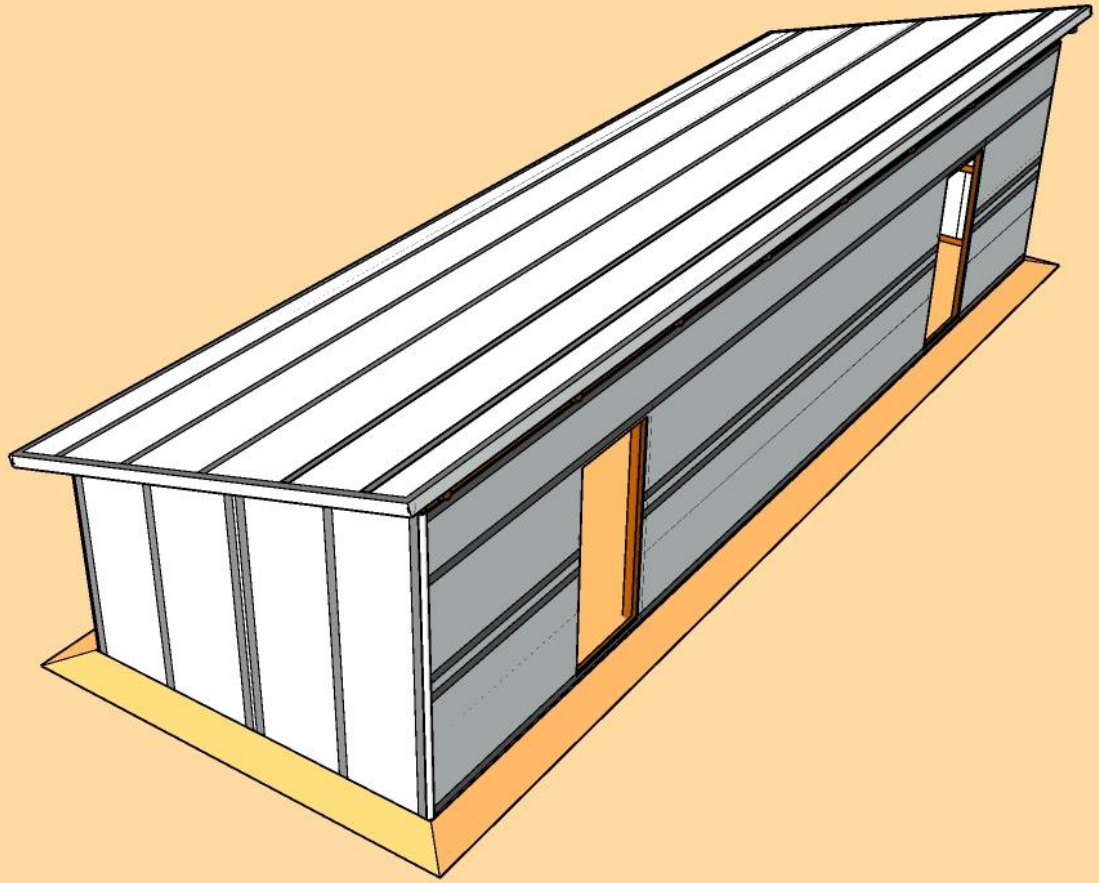
11) Install roof tarp



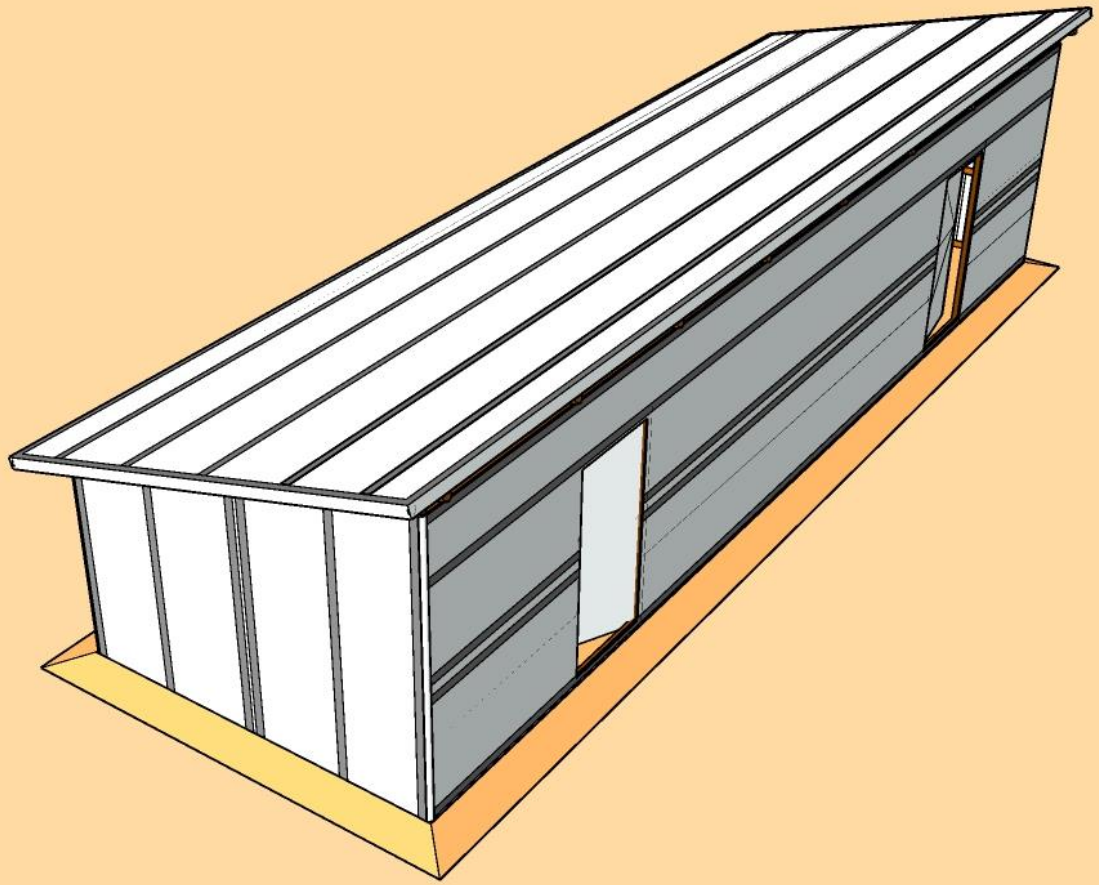
12) Raise plinth and compact flooring



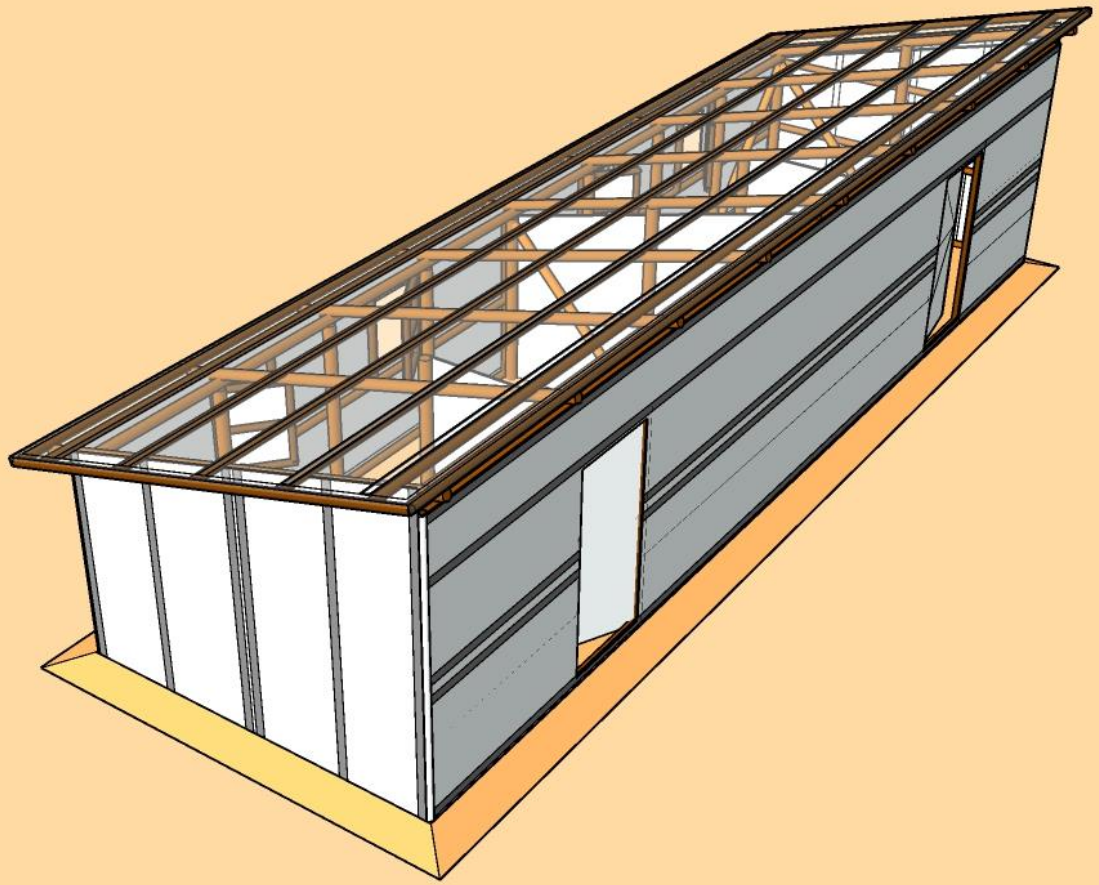
13) Install wall tarpaulins



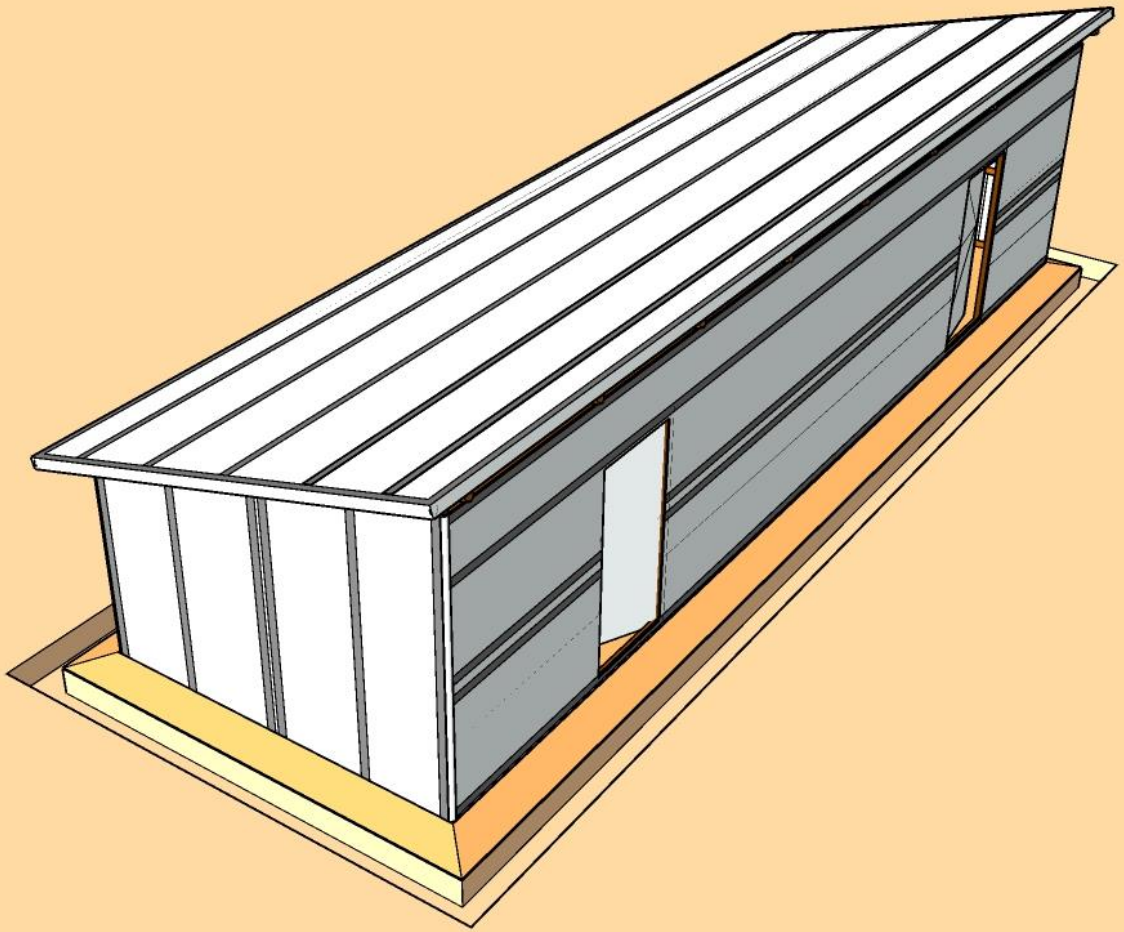
15) Install windows and doors



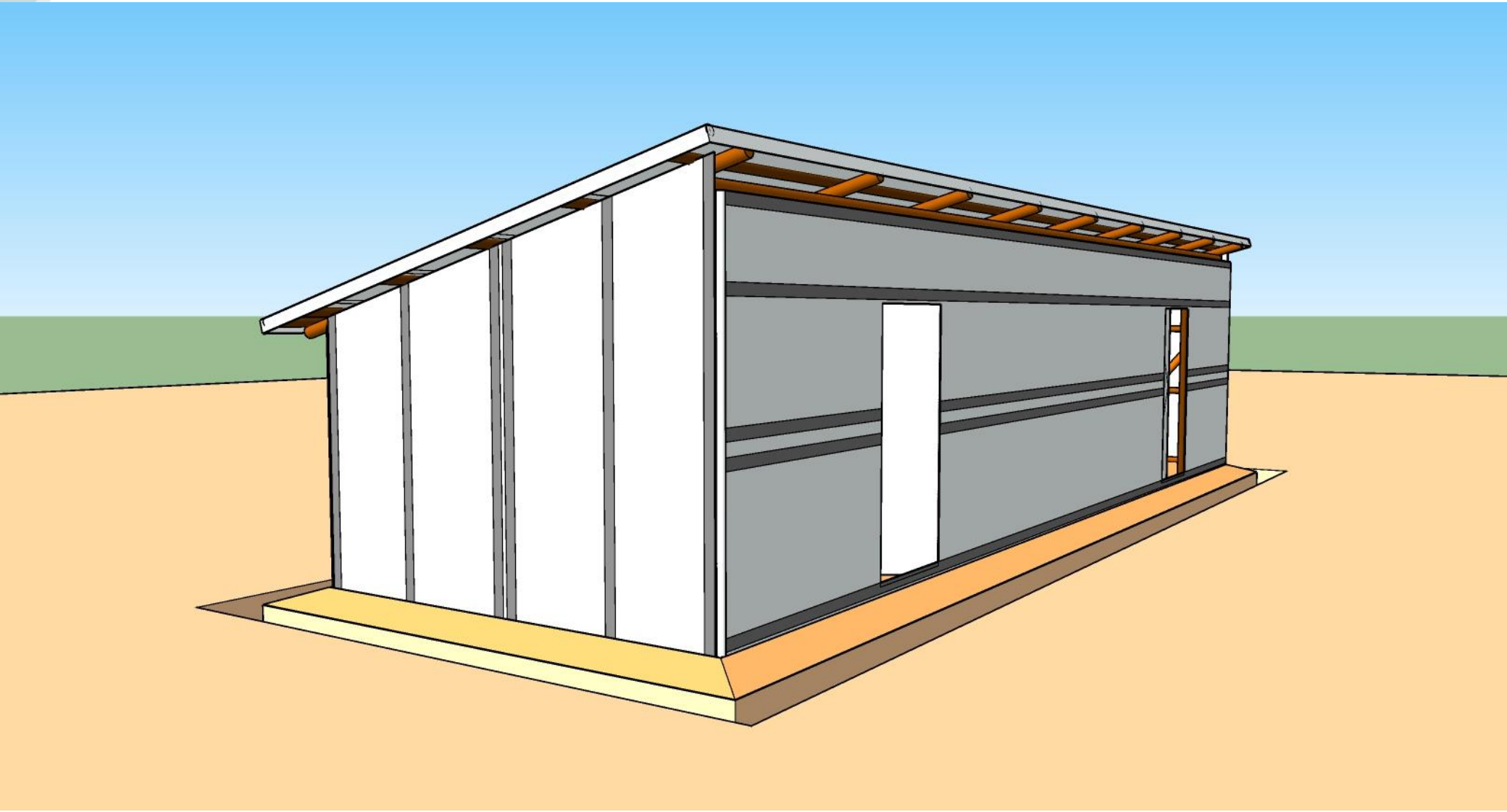
16) Install internal partitions



17) Dig drainage around the shelter



Completed shelter



8) Construction Site Safety during C-19

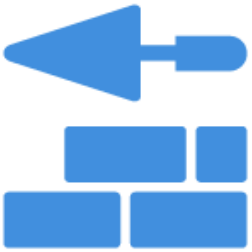
Construction site safety during C-19 pandemic

About this guidance note

- Critical activities such as construction of shelters must continue during the COVID-19 pandemic
- While planning and implementing shelter activities, CRS and AdCS should ensure **all possible steps are taken to protect the workforce and communities**, and to minimize the spread of the infection
- This guidance is based on **WHO's key messages for infection prevention and control**
- Acknowledging the complex, challenging and fast-paced operating environment, the recommendations should be followed to the most possible extent, embracing a **"good enough" approach**
- This guidance does not encompass all aspects of health and safety and should be seen a complement of standard health and safety policy in place for all construction projects. It may be **updated as the situation evolves globally and specifically in the Ethiopian context**

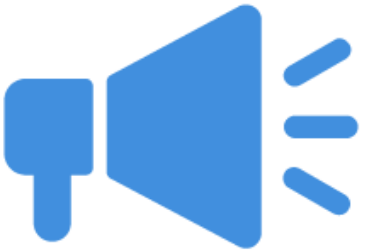
Strategies

Prioritize health and safety of workers and communities



Adapt construction teams to reduce risks

Orient labour to increase awareness and build capacity



Improve communication and convey key messages clearly

1) Planning phase

- Plan construction phases **avoiding large group** of workers and unnecessary overlap of crews. Maximum **5 people in each crew**
- Contractors should provide each worker with **two or more reusable masks**. This may be included in the contractors' contract
- Contractors should provide **hand washing stations** including provision of clean water and soap, together with cleaning and disinfection products for tools
- Preferably, every worker should be provided with a **basic set of tools** needed for the tasks they are assigned to. **Using of the same tool by multiple workers should be avoided.** If tools are shared or stored for later use by another person, they need to be disinfected/cleaned at the end of the day
- Avoid engaging workers from **external communities**
- **Supervision should be strengthened** including COVID-19 prevention principles, and supervisors oriented on their new responsibilities

2) Prepare the workforce

- **An orientation on COVID-19** should be provided to all workers, including description of the disease, symptoms, and key prevention messages
- Workers should be requested to **maintain physical distance of 2 meters** from others as much as possible and to adhere to the other suggested practices:
  - **Wash your hands regularly** with clean water and soap for at least 20 seconds, or clean them with a hand sanitizer;
  - **Avoid touching** your eyes, nose and mouth with unwashed hands;
  - When coughing or sneezing, cover your mouth with tissue. If you do not have a tissue, **cough or sneeze into your flexed elbow**;
  - **Do not spit**.
- If masks are not available, workers should be encouraged to **prepare handmade ones** using household items or clothes materials
- **Prevention messages** may be printed and displayed on site

3) Access to site

- Only **essential visitors** (worker, supervisor, manager) should be allowed on site
- **Programme/monitoring visits should be reduced to the minimum** and should be planned when workers are not on site (i.e. lunch time)
- Anyone falling in one of the following categories **should not be allowed on site**:
  - Has a family member suspected COVID-19 patient living in the same household or self-isolating, or if s/he has got in close contact with a confirmed COVID-19 patient in the previous two weeks. S/he should not report on site and self-quarantining at home for two weeks
  - Is showing one or more symptoms related to COVID-19 (high temperature, new persistent cough, shortness of breath). S/he should not report on site, stay home and self-isolate or seek medical care in case of severe symptoms
  - Is a vulnerable person (by virtue of age, clinical/health condition or pregnant)
- All persons should **wash or clean their hands before entering** and leaving the site
- Workers should be encouraged to **reach the site using individual modes of transportation** and avoid public transport when possible

4) During construction

- To the most possible extent, **workers should maintain physical distance of 2 meters** from others. If activities must be conducted in close proximity, workers should wear masks
- **Construction crews should be segregated** and tasks allocated so they do not overlap
- If a worker **develops COVID-19 symptoms on site**, the following actions should be followed:
  - Avoid touching anything. All surfaces and tools s/he may have recently touched should be cleaned and disinfected
  - Cough and sneeze into a tissue and put it in a closed bin, or in their flexed elbow in case they don't have tissues
  - Return home and self-isolate, or seek medical care in case of severe symptoms

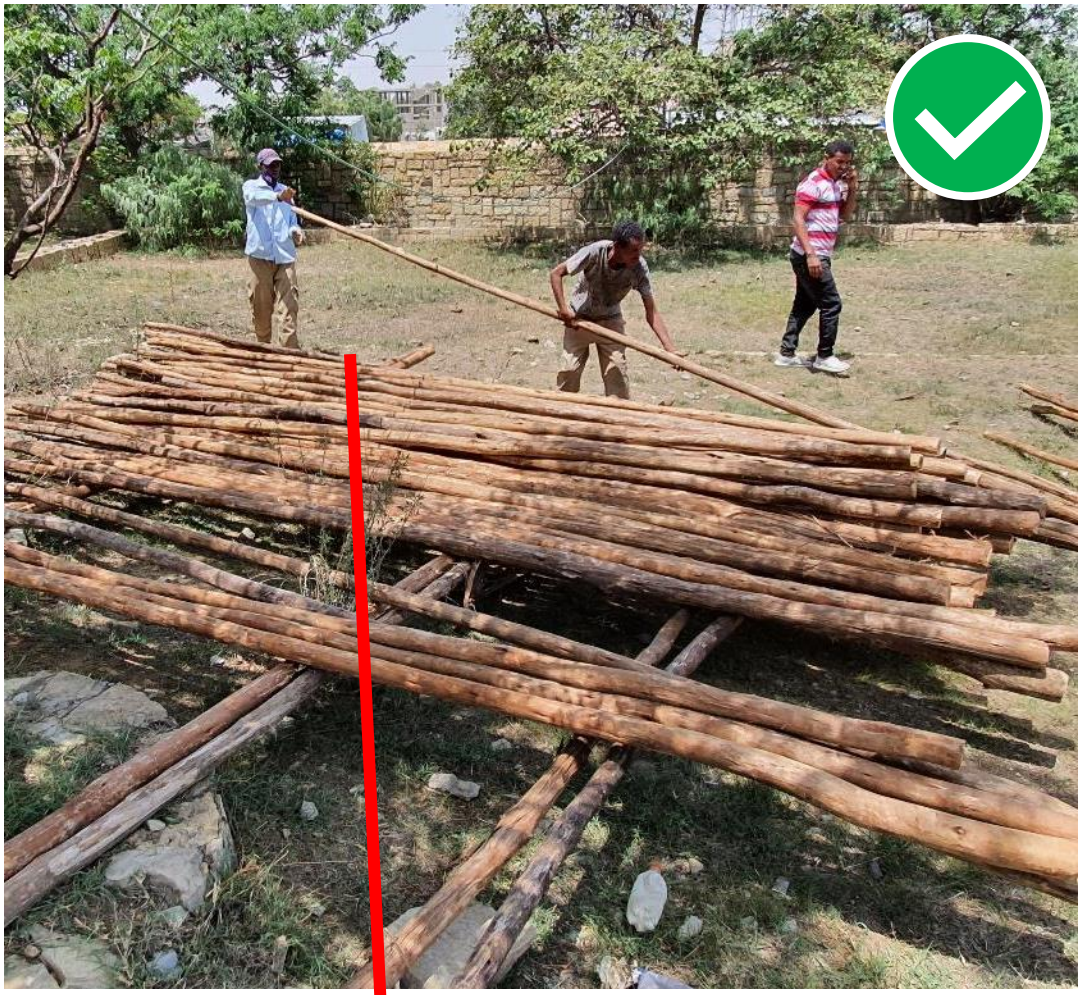
Max. 5 people and respecting physical distancing

If closer interaction is needed, wear a face mask

4) During construction

- In spaces where queuing may consider **marking safe distance of 2 meters on ground or railings**
- **Meetings in closed spaces should be avoided**. Instruction to workers should be given in open spaces and maintaining physical distance
- If construction activities happen in an enclosed space, the site should be **ventilated as much as possible**, for example leaving doors and windows open during the working day
- When **receiving and unloading goods and construction materials:**
  - Workers should keep physical distance from the drivers at all times
  - When possible, drivers should remain in their vehicles. If drivers must unload the goods for safety reasons, they should wash or clean their hands before and after.
  - Any contact between deliverers and receivers should be avoided (including delivery papers and pens for signature). Everyone needing to sign paperwork should have their own pen or wash their hands after.
- Upon completion, **remove all waste** from the site and dispose safely

Provide instructions to crews in a open space



Let the supplier unload the materials

5) Hand washing, hygiene and cleaning

- **Provide adequate hand-washing stations** with water and soap or an alcohol-based hand sanitizer (min. 60% alcohol). Ensure water and soap are topped up regularly
- **Clean the hand washing facilities** regularly during the day, establishing a clear cleaning plan
- Tools, reusable PPE and frequently touched surfaces should be **cleaned and disinfected** frequently
- If possible, **appropriate latrine facilities** should be made available and kept cleaned
- All solid waste (excluding construction materials) should be put immediately in **closed bins or closed bags** and not left for someone else to clear up
- **Separate and collect all solid waste** that could serve as transmission vector. To avoid contact with waste bags, use double plastic bags. Store the waste for at least 72 hours before disposing
- Store leftovers materials for **at least 72 hours before disposing**

Install simple hand washing stations

Mark path on the floor to encourage hand washing

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