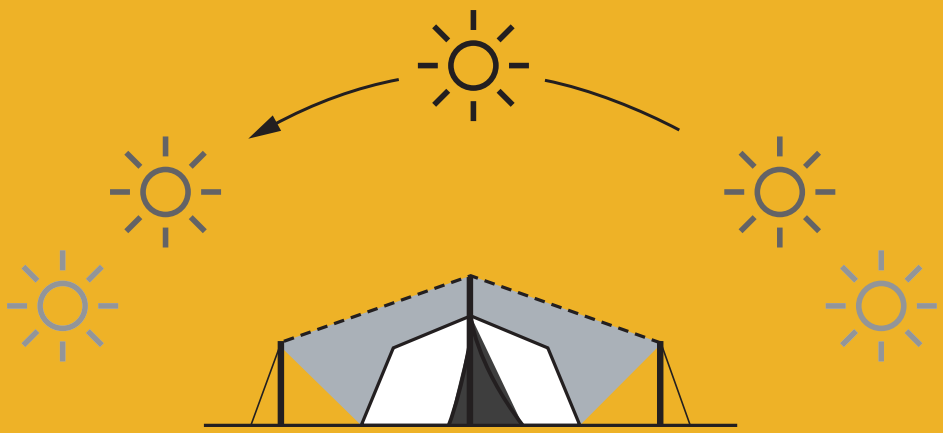
shade nets

use, deployment and procurement of shade net in humanitarian relief environments



MEDECINS SANS FRONTIERES

shelter centre

shade nets: use and deployment in humanitarian relief environments

This booklet is the result of a collaborative project between Médecins Sans Frontières and Shelter Centre.

acknowledgements and contributors

Médecins Sans Frontières (www.msf.org)

MSF is an independent humanitarian medical aid agency committed to two objectives: providing medical aid wherever needed, regardless of race, religion, politics or sex; and raising awareness of the plight of the people we help.

Shelter Centre (www.sheltercentre.org)

Shelter Centre is a humanitarian non-government organisation concerned with the transitional settlement and shelter of populations affected by conflict and natural disasters, supporting human rights, dignity, protection, health, environment and livelihoods.

Shelter Centre maintains the Shelter Library (www.shelterlibrary.org), an on-line resource of material from a wide range of humanitarian organisations. It also runs Shelter Training (www.sheltertraining.org), an educational resource for the transitional shelter sector.

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contents

1 introduction

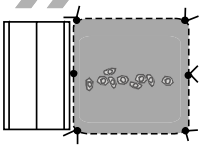
In hot climates, shade offers protection from overheating and UV radiation. It can protect people and structures, as well as supporting the effective use of external spaces. The use of fencing in security, privacy, windbreaks and organisation of crowds is invaluable in emergency operations.

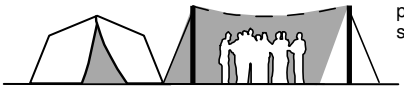
This booklet provides advice on the range of applications and benefits of using shade net in the transitional settlement and shelter of communities affected by natural disasters and conflicts, whether in camps or self-settled.

The four main uses of shade net:

extension shading

see 3.1



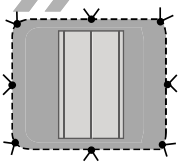


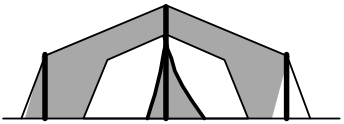
allows the extension of workable space

provides a flexible and useful space

shaded infrastructure

see 3.2



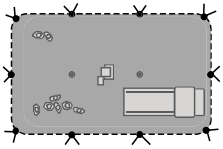


protects the tent / temporary structure from sunlight degradation

reduces the internal temperature

shaded external spaces

see 3.3



external shaded areas shield people, supplies and vehicles from UV radiation and heat

waiting areas and storage

fencing

see chapter 4

wind breaks

screens

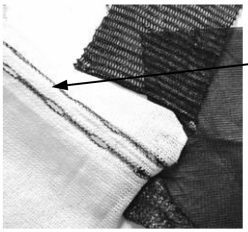
fences

2 shade net

Shade net is an air and water permeable fabric which blocks out a certain percentage of the light, defined by the shade factor. It differs in a number of ways including: colour, material, fabrication method, density and fibre type.

2.1 variation in shade net material

material selection
see chapters 6 and 7



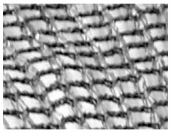
cutting strip

different weaves

different colours

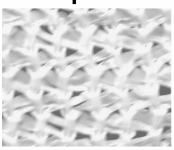
there are two types of weave:

knitted



round threads provide a maximum shade factor of 60%

flat tape



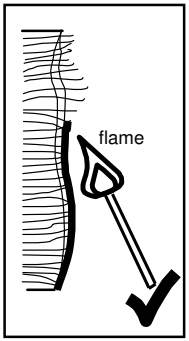
flat tape allows less light through than knitted, up to 90% shade factor

! avoid camouflage net

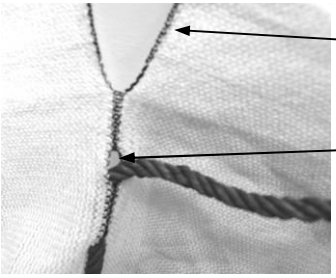
full color comparison
see chapter 6

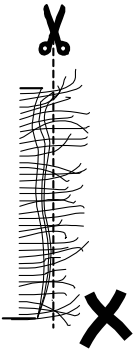
factors affecting shade net	
density	depends on the tightness of the knit or weave: close or loose knit/woven plays a major role in the shade factor so is very important in material selection
material	most commercial shade net is made from synthetic fibres such as polypropylene (PP) and polyethylene (PE) but natural fibres are also available
fibre type	PE and PP fibres can be either flat tape or threads
fabrication	can be woven or knitted in various ways
colour	dark colours shade more effectively white shade net has a maximum shade factor of 60% unless coated red shade net fades rapidly to white/pink reducing its shade factor significantly the use of camouflage netting or green netting for shading is dangerous as it is associated with military organisations

2.2 cutting



Reinforcement bands containing holes, or eyelets, usually run around the edge of shade net. Sometimes a double band runs along the netting, forming a strip that can be cut to divide the net into two pieces. These are often at 2m intervals, so for structures requiring different widths, cutting will have to be done outside the cutting strip, into the material.





Cutting across the roll is always done into the material, as there are no cutting strips.

When cutting outside of the cutting strips, heat sealing is usually needed to prevent the fabric from fraying or unravelling. Some weaves of shade net will be more resistant to fraying than others.

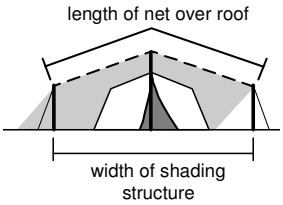
2.3 MSF specification – CSHENET80

Refer to MSF logistics catalogue for most recent specification

further material information
see chapter 6

MSF shade net specification - CSHENET80
• HDPE, monofilament trame + tape knitted.
• polyester eyelets (0.5 cm x 1.5 cm)
• width: 4 m
• length: 50 m
• weight: 140g/m²
• row of eyelets every 100 cm, double in the middle
• anti-UV treated, 3%
• colour: anything except dark green
• fire retardent treated

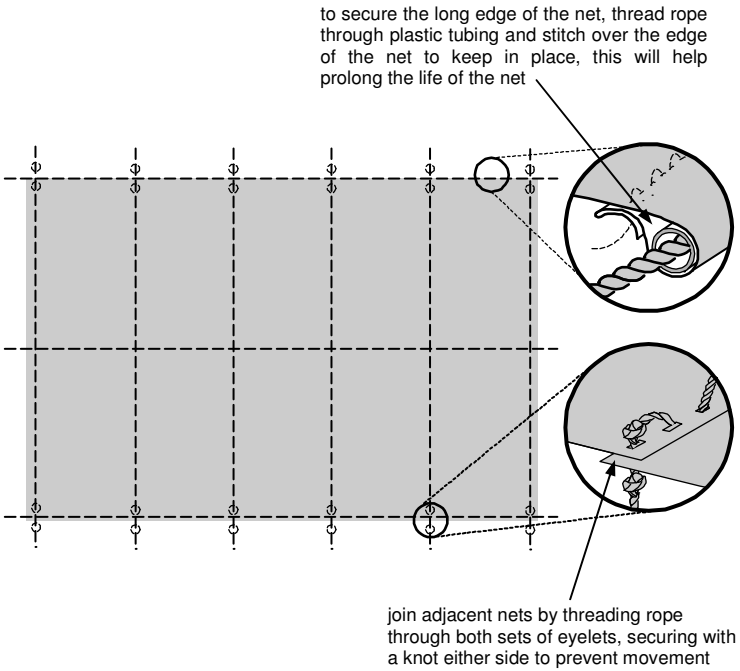
2.4 net construction



Cut adequate shade net from the roll, so there is enough to join it to the structure. This should be at least one metre onto the length to allow for joining.

For an approximate length of shade net needed for each strip, multiply the width of the shading structure by 1.5 to account for the slope and the extra required for stitching. For example, if the width of the footprint is 5m then use 7.5m of shade net.

suggested method of joining shade nets

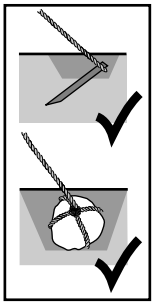


more building tips see 4.2

2.5 fixing shade net to the ground

Shade nets require pegs and guy ropes; when arranging these there are two main issues to consider:

stability related to pegs and anchors

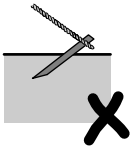


To make best use of pegs, and to reduce the safety hazards they present, pegs should be buried. This means that pegs are not a trip hazard and are secured firmly in the ground. The top soil is usually looser than the soil 30cm below. Therefore it is advised that you bury the peg at least 30cm below the surface, using the following three steps:

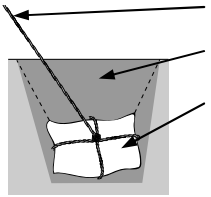
i. dig a hole

ii. hammer the peg into the bottom of the hole

iii. backfill the hole and compact the soil



Sandbags and rocks form good anchors. These should be buried for extra stability and safety. The stability of an anchor in the ground is determined by:



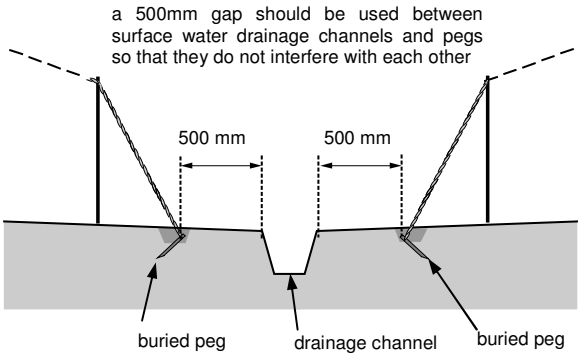
i. the strength of the rope

ii. the amount of soil above the anchor

iii. the weight of the anchor

surface water drainage may interfere with pegs and guy ropes

securing poles
see 4.2



2.6 use of local resources

Shade net is not the only method of providing shade. Local materials should also be considered, such as grass thatch, leaves and branches. These can be used alone or in combination with shade net, although care should be taken to avoid local materials damaging the net. The use of local skills and materials will make the solution more sustainable, as it can be repaired and altered by the local community. The use of locally procured materials can be bad for the local environment however, and this should be considered. Care should be taken to ensure that materials can be harvested sustainably from the local environment. Also, some materials, such as grass thatch may require a more robust structure than shade net.

local shade net

see chapter 8

thatch for shading is replaceable and uses local skills and materials

shading infrastructure

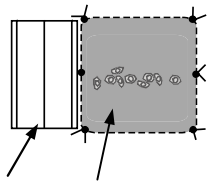
see section 3.2

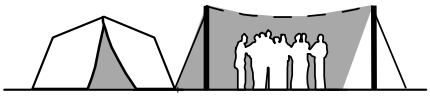
use any natural shading available, for example do not allow trees to be cut unnecessarily, either as part of preparing sites for camps, or for use as fire wood

3 shade solutions

Creating shade can have important implications for improving people's health. It can help prevent dehydration and overheating, which can be particularly dangerous to vulnerable people. Creating shaded space can also provide additional space for working and socialising.

3.1 shaded extensions

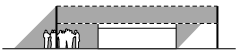




Adding a shaded area to an existing building or structure can significantly increase the workable area available.

Shaded extensions can be used for the storage of vehicles and supplies or to create waiting areas for distribution centres and clinics.

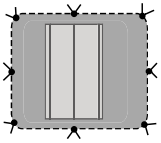
A building or tent can offer privacy and some security. There will be functions that require this, like storage of commodities and equipment. Many other traditional functions of buildings however can be transferred to external shaded space. Provision of this flexible space should increase the capacity of the building.


shading around structures can be used to shade people


the inside of buildings and tents become hot during the day

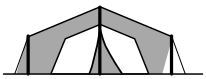
shading supports a better use of outdoor spaces next to buildings and tents for activities such as childcare and food preparation

3.2 shaded infrastructure



Shading of infrastructure is important for the well-being of the people that use it. It can also be used to create waiting areas surrounding the infrastructure, which will be needed in cases such as clinics, and distribution centres where queues often form.

shaded tents



protects the tent from degradation in sunlight

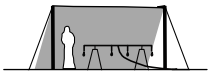
reduces the internal temperature of the tent

may provide additional shaded waiting areas

a frame identical to that of the tent can be used to support shade net

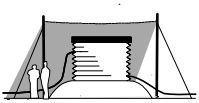
here the second frame is too close and the air gap is too small

shaded water collection point



facilities such as water collection points and feeding centres require people to wait for long periods, placing them at risk of dehydration in high temperatures

shaded water storage tanks



heat reduces the effectiveness of chlorination

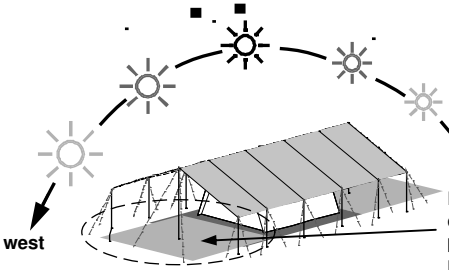
shading the water tank will prevent evaporation from the surface, and help save water.

shaded waiting areas

waiting areas can be created by using the shade gained next to a shaded structure, or by extending the shade structure to increase the external shading. This can also extend the usable space of a building.

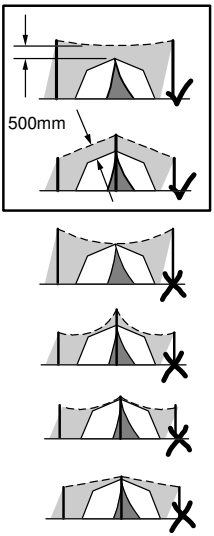
orientation of waiting areas

orientation
see 3.3



Here the waiting area is clear of tent pegs, reducing potential trip hazards. This is not the orientation that gives the most constant shading however

maintaining a 500mm ventilation gap between the net and the tent



When shading tents and temporary structures, it is very important that there is a gap of 500mm between the tent and the shade net to allow enough ventilation.

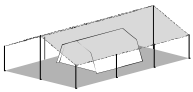
If the poles are not long enough, or if the net is not tight enough, the 500mm gap between the tent and shade will be compromised and ventilation will be less effective.

a poorly erected shade net.

if the shade net is too loose the gap will be less than 500mm and the tent will get too hot

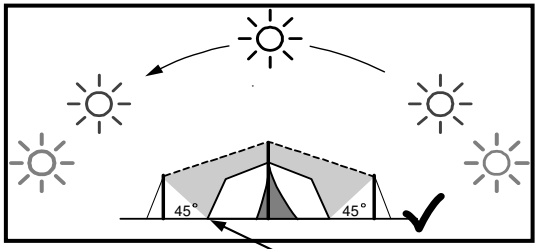
here the gap is less than 500mm; it is not touching the tent however, so it still gives some shade

ensuring coverage of the shaded structure



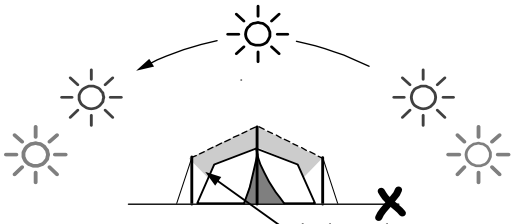
In order to provide sufficient shade, you will need to cover an area much larger than the structure or area itself.

side areas can be used as waiting areas



the shaded area is sufficient to cover the whole tent during the hottest hours of the day

here much of the tent remains in direct sunlight

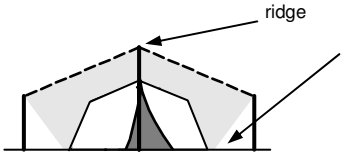


shade net does not cover a large enough area to provide adequate cover

The area that a shaded structure is required to cover can be significantly reduced by continuing the shade net down the sides of the structure, creating vertical walls.

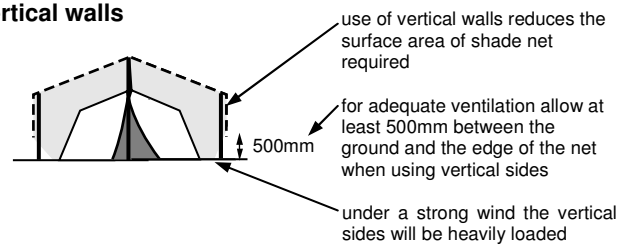
ridge profile without vertical walls

vertical walls are not needed if there is a large overhang

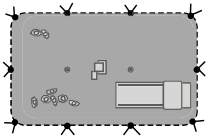


ridge profile with vertical walls

side walls may restrict access

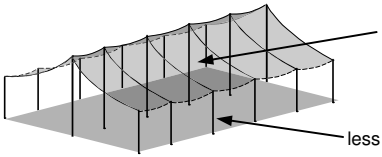


3.3 shading external spaces



separate shading provided for daytime activity

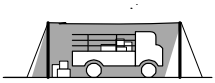
A separate shade structure can be used instead of a building in some climates. This is often easier to implement than a new building.



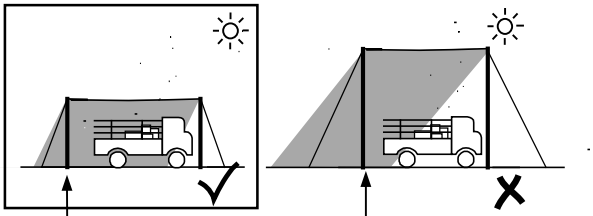
Old or unused tent frames can provide a quick and mobile frame for support of shading.

area created for shading people

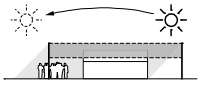
vehicle shading area



importance of pole height



orientation



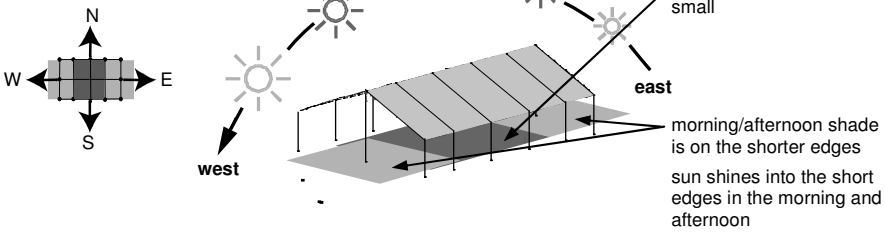
Where possible, shade nets should be as close to the temporary structure or infrastructure that is being shaded, while maintaining the 500mm ventilation gap.

The position of shade varies as the position of the sun changes. This depends on the time of day, time of year and geographical position.

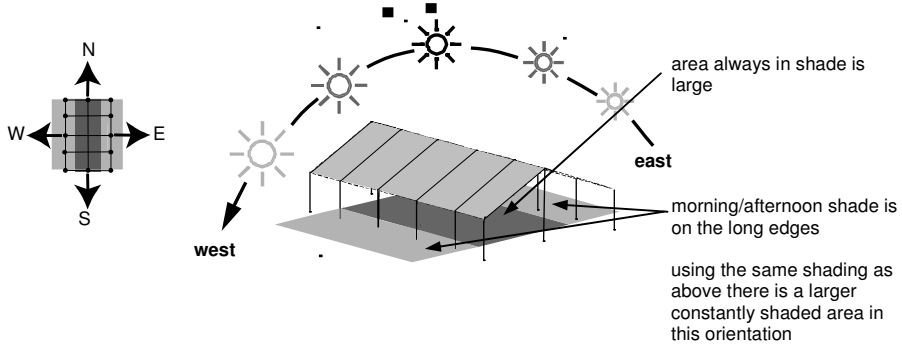
If the shade structure to be constructed is not square, the orientation of the structure with respect to the sun path is important. It will effect the size of the constantly shaded areas and the areas that are only shaded in the morning or afternoon.

If waiting areas are placed on the north- and south-facing sides, the area will remain approximately constant and the central part will be shaded throughout the day; this is useful for shading infrastructure such as water collection points or reception centres.

east to west orientation



north to south orientation

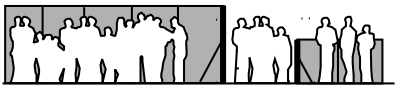


4 fencing

Fences formed from shade net can have several uses, such as security screens and wind breaks. Other common field materials can also be used for fencing.

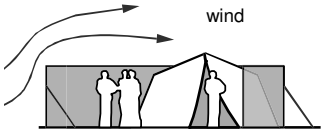
4.1 uses of fencing

screens and fences



fencing can improve circulation of people through and around infrastructure such as reception and distribution centres

wind breaks

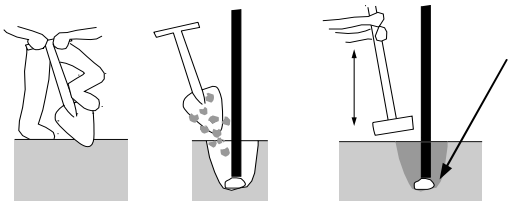


fencing can protect people and structures from strong winds

4.2 constructing fences

erecting fence

more building tips
see 2.4



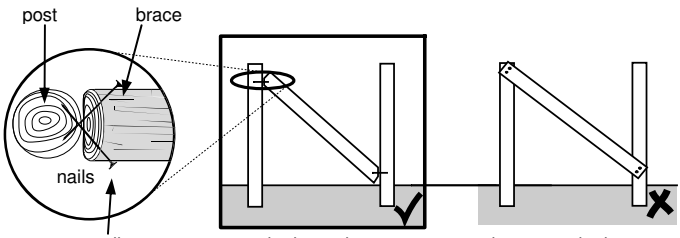
1.dig a hole

2. place a post in the hole and fill with earth

3. compact the earth around the post

joints

note: joints are usually the weakest point in structures – ensure that at least two nails are used on every joint and that the nails are the right length to fit without splitting the timber.



cross nail as shown to give the brace a higher strength

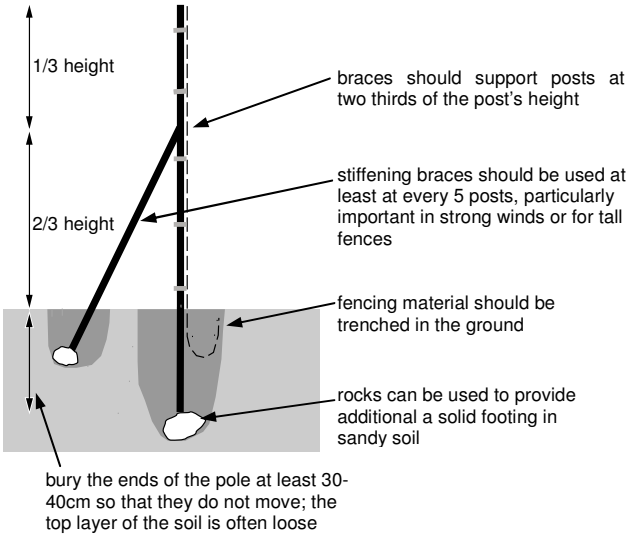
put the brace between the posts

cut the ends to create a flat surface for nailing to the post

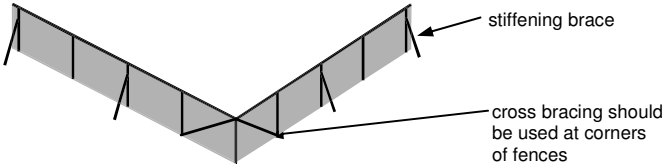
do not put the brace on the outside of the posts as its strength is then determined by the quality of the nails used

fence bracing

a wire net fence showing a stiffening brace



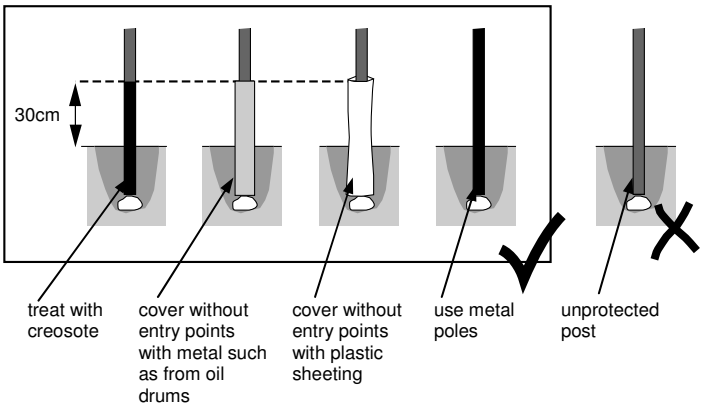
shade net fence, showing a well constructed cross brace



protection of wooden posts

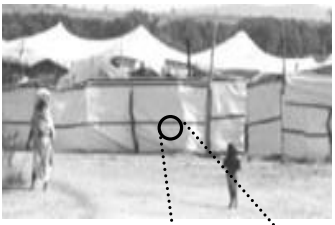
Wooden posts should be protected against damage from termites and white ants.

! termite damage occurs rapidly on unprotected posts



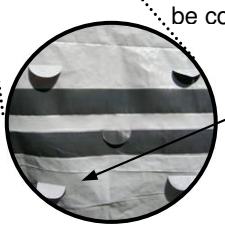
4.3 other fencing materials

plastic sheeting



Fences constructed from plastic sheeting provide increased privacy. Semi-circular holes may be cut into the material to allow wind to pass though, and to reduce the risk of theft of the sheeting.

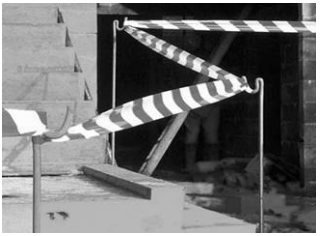
Plastic sheeting is expensive so using it for fencing may not be cost effective.



barrier netting

Barrier netting can be used to create visible fencing. It is useful in isolating safety hazards, or protecting areas, such as water sources.

hazard tape



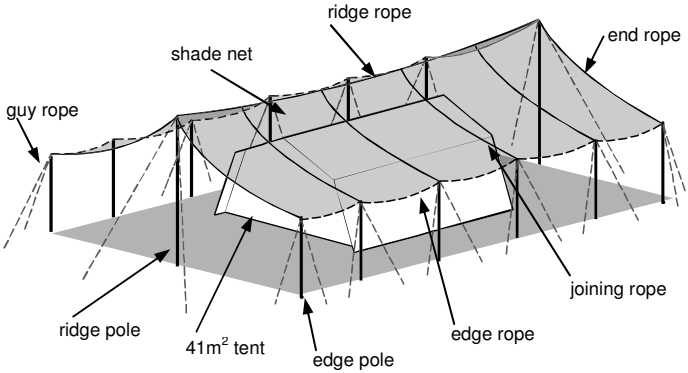
Hazard tape can be used quickly in directing the flow of people, such as during registration and distribution processes.

5 shading a 41m^2 tent

In this chapter step-by-step instructions and dimensions necessary to shade a standard 41m^2 tent are given. 41m^2 tents are commonly used for clinics and feeding centres, or as part of a more complex emergency medical infrastructure.

There are 7 steps to shading a 41m^2 tent:

step 1. source the required materials



In order to build a shade structure as above for a 41m^2 tent you will need approximately:

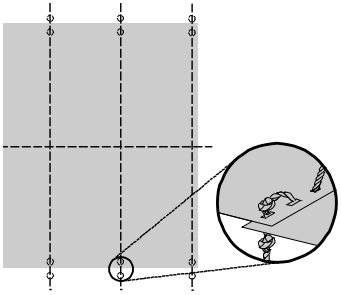
• 1 roll of shade net	3m x 50m
• 200m of rope	approximately 20mm diameter
• 12 strong poles	2.5m long about 100mm wide
• 2 ridge poles	5m long about 150mm wide
• 28 tent pegs or stakes	500mm long
• 35m strong twine	6mm min thick (for stitching)
• some fencing staples or bent nails	
• 32m water pipe	38mm diameter (optional)

step 2. preparing the net

Cut sheets to length (10m), and lay side by side.

joining net
see 2.4

Take eyelets on adjacent edges, and thread the joining rope through both sheets, tying knots either side of the eyelets to prevent movement.



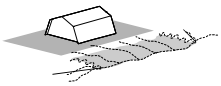
Pull both sheets tight, line up the eyelets and thread the rope through both sets of eyelets, along the edge of the sheets.

Continue all the way along, and tie knots as before.

Lay the net out straight, and find the centre line; thread the ridge rope through each eyelet band, at right angles to the joining ropes.

step 3.

attach the ridge poles to the net



Securely attach the middle of the threaded end ropes to the top of the ridge poles.

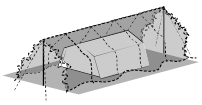
Dig the holes for the ridge poles either side of the tent. These should be approximately 0.8m deep, along the line of the ridge and 16m apart.

securing poles
see 4.2

Securely attach the ridge rope to the top of the ridge pole at one end. Pull the ridge rope until it is tight and tie it at the other end above the end rope.

step 4.

erect the ridge poles



Securely attach the middle of the two long guy ropes to the top of the ridge poles.

Dig holes for the pegs approximately 2m out from the ridge poles.

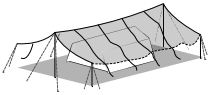
Place the ridge poles in the holes and drape the shade net across the tent. You may wish to attach spare ropes to the long edges of the shade nets to help with this, as this will make it easier to pull the net over the structure.

pegs and anchors
see 2.5

Peg out the guy ropes at each end and tension them.

If the ridge rope is sufficiently tight, fill in the hole around each pole and pack it in; if not, bring the net down and adjust the ridge rope until it is tight.

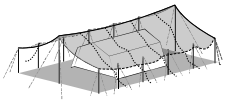
step 5. tension the net along the ridge



Dig holes 0.4m deep at the corners, in line with the ridge poles, and 1m from the edge of the tent. Place four end poles in them, back-filling the holes and guying out as for the ridge poles.

Pull the end ropes tight and secure them near the top of the corner poles, using staples or bent nails to stop them sliding down.

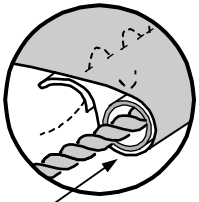
step 6. erect the edge poles and ropes



Dig holes in the position of the remaining poles and place the poles in these. Fill and pack around them, and then attach them as for the corner poles.

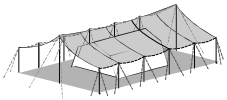
Cut the water pipe to fit the spacing between the poles, and thread it onto the edge ropes.

Fix the edge rope at the top of one corner pole, and then tension the rope along each segment in turn, attaching the rope to every edge pole.



water pipe protects the rope from erosion

step 7. attaching the net to the edge ropes



Pull the joining ropes tight on each side and attach them near the top of the edge poles.

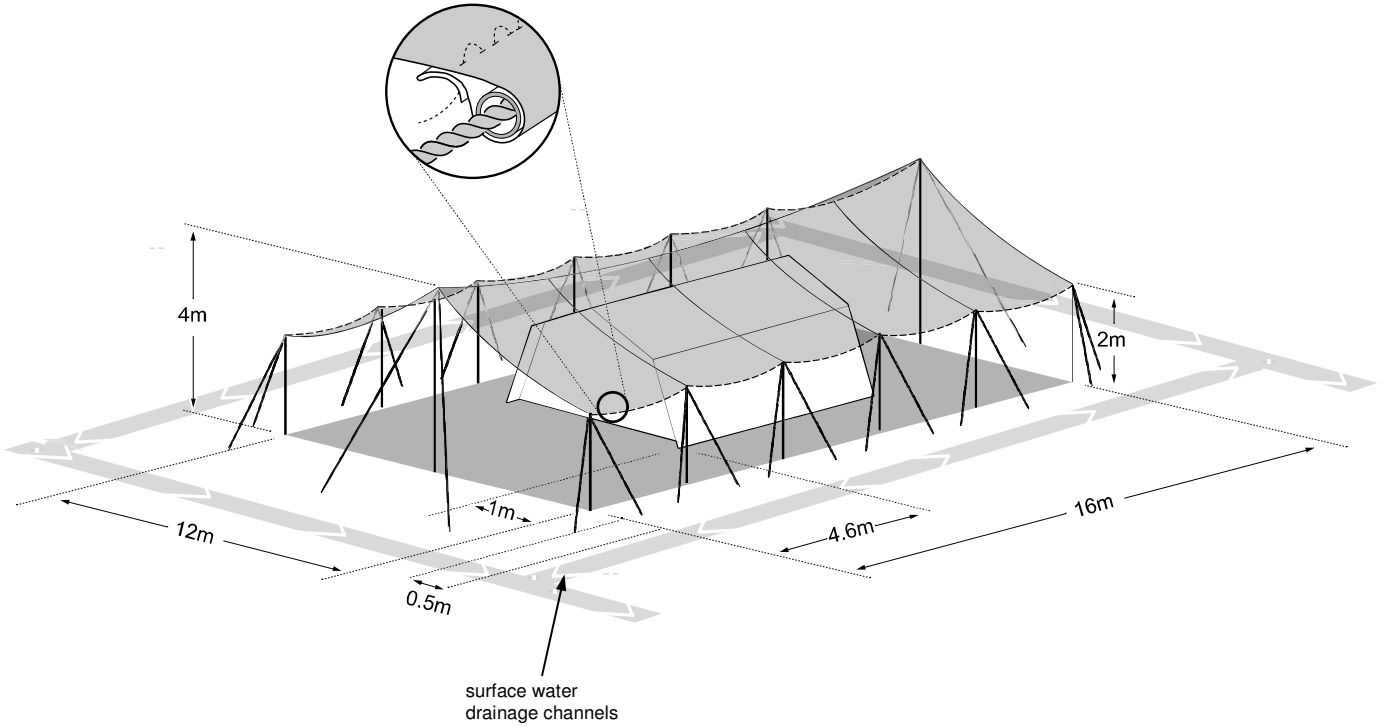
Stretch the net tight along one edge, and wrap it over the piping.

Fold the edge over to form a double layer, and stitch the net together, as illustrated above.

Repeat this procedure on the other edge of the net.

a fully constructed shade net for a 41m^2 tent

note: this is an illustration of an ideal shade net. Solutions that do not look like this can still provide adequate shade.



6 procuring shade net

Where shade net is required, it is important to identify a reliable source of appropriate material. This chapter outlines what to look for when procuring shade net. A method of assessing the quality of shade net in the field is presented in chapter 7.

There are two ways of obtaining shade net:

i. from a stockpile/regular supply from international manufacturers

- recommended for large scale purchase
- ensures strength, UV durability, shade factor and strength meet specified standards and are consistent
- generally better equipped for large scale, emergency response

ii. local procurement

- may be necessary when supply from international manufacturers is not possible or accessible
- rigorous checks should be made to assess the quality of the netting

assessment tools see chapter 7

6.1 shade net properties and requirements

shade factor

Shade factor should be between 70% and 80% for most applications for a combination of strength, shading and air permeability.

70 – 80% shade factor can be achieved by layering shade net. This can often produce greater water permeability and sometimes a stronger mesh, but will require a stronger support structure and may be an inefficient use of materials.

coating / colouring

For shading applications, aluminised netting performs best. Aluminised netting is standard plastic netting that has been coated with a metallic finish, which reflects sunlight.

Where aluminised netting is not suitable, or for non-shade applications, black is best, as it performs best in terms of shading, UV protection and durability.

types of plastic fibre

The two types of plastics usually used in these nets are polyethylene (PE) and polypropylene (PP). It is not possible to tell which plastic is used from the appearance of the netting; however, it should be specified by the manufacturer. Netting with a high proportion of PP is best. For large-scale use of shade net, PE or PP netting is recommended as it can be stockpiled in large quantities and will need less testing in terms of strength and shade factor.

assessment tools
see chapter 7

Locally procured netting can be useful. However, it will not usually be available on a large scale and will require thorough testing before use. Both durability and environmental impact should be considered before using large quantities of locally procured netting.

use of local resources
see 2.6

Alternative materials to plastic netting include grass thatch and cotton sheeting. Environmental impacts must be assessed if these are used in large quantities.

net variations
see 2.1

flat or round plastic fibres

Round fibres are best for the warp, as they are stronger.

Flat fibres are best for the weft, as they increase the surface area providing shade.

knitted or woven plastic fibres

Knitted fabric is generally stronger than woven

If using woven fabric, try to ensure that it is woven using a 'full-lockstitch' (refer to manufacturer's specifications).

Warp spacing (the distance between continuous lengthways fibres) should be no more than 5mm.

use of eyelets
see 2.4

eyelets and holes

Good net has a number of reinforced fixing holes or eyelets. The best net has eyelets along 2 parallel reinforced bands, spaced every 2m. This allows the net to be cut between the reinforcing bands and divided, to be used in 2m wide lengths.

available colours/ coatings	UV properties	cooling/shading	cost	military association
beige	**medium**	**good:** medium reflection and opacity	**medium:** not readily available	**possible** in the desert
black	**very good:** both UV protection and lifetime	**good:** very high opacity content, but very low reflection	**low:** very common, low weight for given shade factor	**possible**
dark blue	**good**	**medium:** high opacity, but poor reflection	**medium:** not readily available	**no**
dark green	**good**	**medium:** as dark blue	**low:** very common	**yes**
light green	**medium**	**medium:** some reflection, medium opacity	**low:** readily available	**no**
red	**medium** (will fade in time)	**medium:** as light green	**medium:** not readily available	**no**
silver (aluminised)	**very good**	**very good:** very high opacity, very good reflection	**high:** coating adds to cost	**no**
white	**very poor:** (short lifetime, little protection)	**good:** low opacity but good reflection	**low:** readily available	**no**

7 assessment of material

In this section a flow chart is provided for testing the suitability of material samples for shading purposes. The test is specific to plastic net samples and should not be used for other material types.

Go through the flow diagram and arrive at a shade net factor.

60% is acceptable
70% and over is good

The test will also tell you about the impacts of air permeability, colour and coating.

step 1
air permeability

if pressed to your face can you blow through the sample material?

YES — sample is air permeable

NO — discard the sample choose a new one and start again[1]

step 2
shade factor test

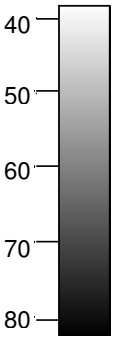
shade factor test

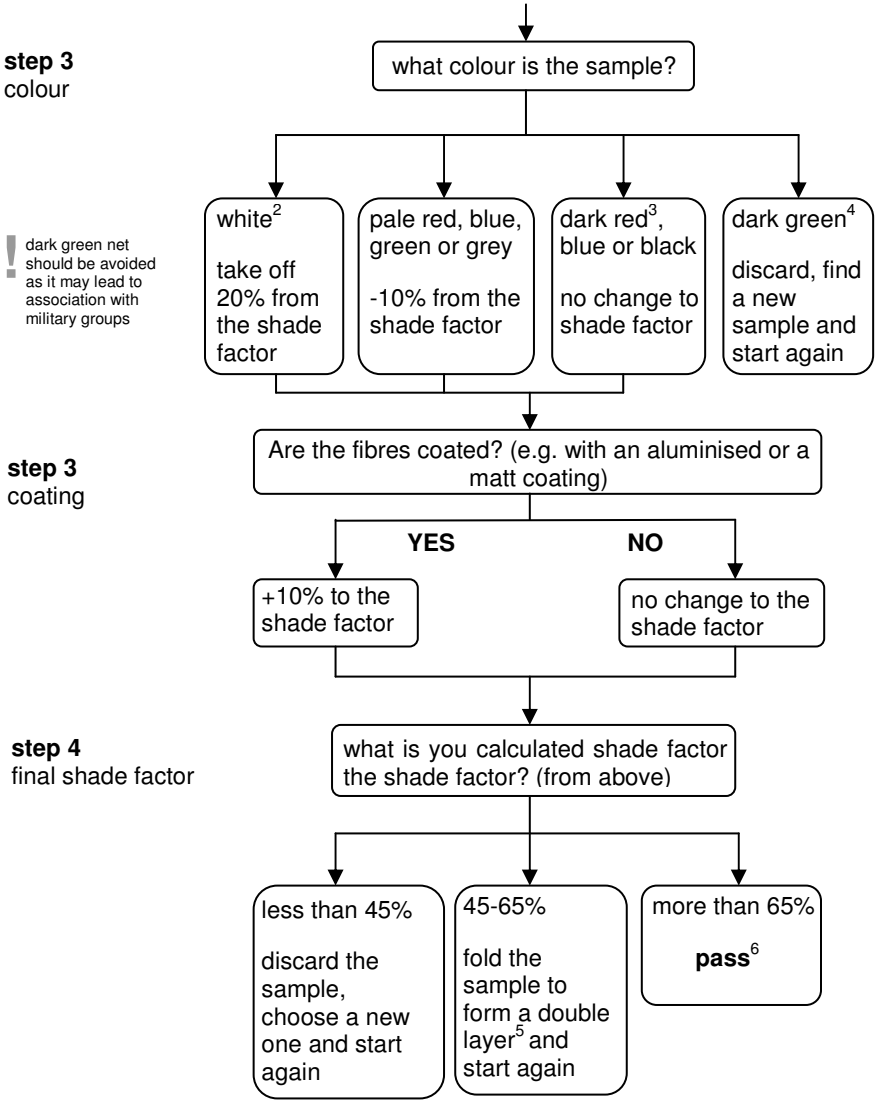
i. Place the sample in direct contact with a page of text in this booklet.

ii. Position yourself directly over the sample and keep still.

iii. Try to read the text through the sample.

iv. Use the scale to make an estimate of the shade factor of the sample.





example

step 1. – I can blow through it, so continue.

step 2. – I can see parts of letters through the sample, so I estimate the shade factor to be 70%.

step 3. – The netting is not coated so the shade factor remains the same.

step 4. – The shade factor is still 70% so the sample passes the assessment.

assessment notes
[1] Non-air-permeable materials, such as plastic sheeting, can be used if they are all that is available but will require increased ventilation and stronger support, due to increased rain and wind loads.
[2] White shade net will never achieve a shade factor of greater than 60%. It has poor UV qualities and should only be used if nothing else is available.
[3] Red net will fade very quickly in sunlight, which will reduce its shade factor.
[4] Dark green net should be avoided as it may lead to association with military groups.
[5] Netting with a very low shade factor can be layered a number of times if necessary, but this often proves more complex to erect and more expensive. It is a last resort. Although a gap between the layers is advised when erected, the shade factor for two layers can be determined by folding the netting so that the layers are on top of each other
[6] This test is intended as a quick visual check only, and is not definitive.

glossary

aluminised	Coated or covered with aluminium or aluminium paint.
extension shading	Shading partly supported by, or built directly next to a temporary or permanent structure.
infrastructure	The basic facilities, services, and installations needed for the functioning of a community or society.
knitted	Fabric made by intertwining yarn or thread in a series of connected loops either by hand, with knitting needles, or on a machine.
natural ventilation	The movement of air caused by natural temperature and pressure changes.
passive cooling	The removal of heat from a space without using auxiliary power.
PP	Polypropylene
PE	Polyethylene
shade factor	The percentage of visible light prevented from passing through the net (e.g. 60% shade factor allows 40% of the visible light through). 'Shade factor' does not correspond directly with heat reduction.
shaded external space	This is shading which is separate from other structures. The area of shading alone fulfils the required function.
shaded infrastructure	Shade provided to protect infrastructure and those using infrastructure.
transitional settlement	Settlement and shelter resulting from conflict and natural disasters, ranging from emergency response to durable solutions.
UV	Ultra-Violet (light)
warp	The threads that go along the length of the net.
woven	A cloth or material produced by the process of weaving, in which strips or strands of material are interlaced.
weft	The thread that is shuttled back and forth across the warp to create a woven fabric.

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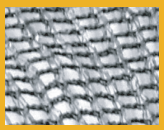
Camp Planning Toolkit (currently under development by Shelter Centre in collaboration with Médecins Sans Frontières, to be published in 2008)

Shelter After Disaster – Guidelines for assistance (currently under revision by Shelter Centre in collaboration with UN/OCHA, to be re-published by UN/OCHA in 2008)

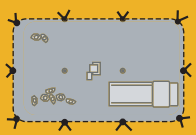
notes:

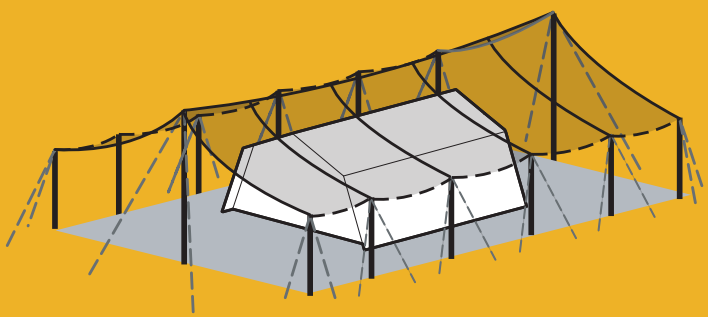
Shade net is used in hot climates to shade field tents and temporary structures from solar radiation and unwanted heat gain.



This field booklet offers guidance on the use, deployment and procurement of shade netting in humanitarian relief environments.
This booklet includes:

- an introduction to shade net
- a description of the materials used for shade net
- a breakdown of the various applications of shade net
- principles and rules of thumb for using and deploying shade net
- a step-by-step guide on planning and building a standard MSF 41m^2 tent
- a simple field test for identifying the suitability of a shade net sample.





This project is a collaboration between Médecins Sans Frontières and Shelter Centre.

This booklet is downloadable at www.shelterlibrary.org

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