# Global Shelter Cluster Working Document
# 3R Options for Shelter Components

**Introduction**
This working document provides options to reuse, repurpose or recycle ("3R") materials used in emergency and transitional shelters. The document is expected to be revised and updated as additional information and examples on reusing, repurposing or recycling shelter materials become available. Development of the 3R table was supported through a grant from UNHCR to WWF/US, funded by ECHO.[1]

**Background to the 3R Table**
Options to reuse, repurpose or recycle shelter materials are provided in the **Reuse, Repurposing and Recycling Options for Common Emergency and Transitional Shelter Materials** table, below. The table was developed based on the following types of shelters:

- Grass or palm leaf roof with wood frame and palm or other local material walls.
- Plastic sheeting over metal or wood / bamboo frame.
- Plastic sheeting roof, with plastic sheeting walls on metal or wood frame.
- Tent, with metal or wood frame, including internal dividers and floor.
- Metal sheeting roof on metal or wood frame with plastic sheeting walls.
- Metal sheeting rood with wood frame and walls.
- Any combination of the above.

The 3R information provided below also applies to materials used in other emergency or transitional humanitarian structures, including latrines, clinics, community spaces and schools, among others.

To reduce repetition, the shelter materials used in different types of shelter are combined into a single table and listed by the expected frequency a material will be used for shelter. Gray boxes indicate no information is currently available.

Specifications, where formally established, are indicated in footnotes. The two main sources of footnotes are IFRC and UNHCR. Additional sources of information include:

- Plastic Sheeting, A guide to the specification and use of plastic sheeting in humanitarian relief.
- Tents: A Guide to the use and logistics of family tents in humanitarian relief.
- Building Materials Selection and Use: And environmental guide.

Wood that has been chemically treated generally limits reuse or repurposing. Treated wood cannot be recycled and requires disposal in a hazardous waste facility.

When considering recycling, a due diligence assessment is needed to ensure that the recycling process meets acceptable standards in terms of environmental impacts and human rights. Expert advice is recommended when deciding whether to establish a new recycling program or upgrading an existing operation to acceptable standards.

Comments on or additions to the 3R table are welcome and should be sent to environmentoperations@sheltercluster.org.

[1] Use of organizational logos does not imply official approval of this document.

| Reuse, Repurposing and Recycling Options for Common Emergency and Transitional Shelter Materials | | | | | |
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| **Item** | **Specification** | **Reuse** | **Repurposing** | **Recycling** | **Notes** |
| Grass or other low density organic materials | Specifications are defined locally, generally based on local use. | Generally limited; materials often degrade during use (e.g., grass used for roofing). | Can be composted (preferred) or burned if not chemically treated. Note that burned materials may have some benefit as natural fertilizer, i.e., similar to burning grass or other vegetation before planting. | Limited and would depend on the state of natural degradation.<br><br>Note that ash from burned materials can be used for odor control in latrines. | This type of construction material is often used to a point where it has degraded significantly through natural processes.<br><br>Consider fire risk in planning and design since thatch is very flammable |
| Plastic sheet, including liner and ground sheet. | Plastic Tarpaulins 6x4m with pre-punched reinforcement bands. See link to specifications in this footnote[2]. | • Use to repair other plastic sheets.<br>• Sew several smaller sheets together to make one usable sheet | • Use to make sun shades.<br>• Use to make privacy walls, e.g., around clinics.<br>• Make into school or other bags.<br>• Combine several damaged sheets to make covers, for vehicles. | • Limited opportunities.<br>• Need to collect significant quantities to justify transport to recycling facility.<br>• See WREC for possible recycling companies. | Plastic sheet should be clean before reuse or repurposing.<br><br>Similar options can be considered for plastic sheeting from other uses, for instance as latrine walls. |

[2] https://itemscatalogue.redcross.int/upload/products_data/files/HSHETARP.pdf.

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| Cotton-Synthetic Material (including tenting material). | Cotton alone (e.g., cotton canvas, not part of a tent) is not often used for shelters. The most likely specifications are for a cotton-synthetic blend material, often used for tenting material. See link to specifications at this footnote[3]. | • Use to repair other canvas sheets. (Because canvas can degrade in storage and use patching sheets (tents) may be a recurrent activity.<br>• Sew several smaller sheets together to make one usable sheet | • Use to make larger sunshades.<br>• Use to make privacy walls, e.g., around clinics, bathing areas, latrines, etc.<br>• Make into school or other bags.<br>• Make into clothes, e.g., pants, jackets, etc. | • Limited opportunities.<br>• Need to collect significant quantities to justify transport to recycling facility.<br>• See WREC for possible recycling companies. | Should be clean before reuse or repurposing. |
| Rope, hemp | Sisal Rope, 30m length<br>Margin of tolerance:<br>Length: 30m (± 0.5 m).<br>Thickness: 5 mm (± 0.1 mm)<br>Type: Natural Fiber | Noted or braded together for use as rope. | • Fire starter (if unbraided and not treated with chemicals)<br>• Use in nets and woven into sun shades. | May be compostable. | Rope will degrade over time and reuse or repurposing needs to consider possible loss of strength. |
| Rope, Plastic | Polypropylene, black, 3mm diam., twisted, UV treated | Re-braided and used as rope. | Used in physical art installations. | • Depends on local recycling market.<br>• May be recycled through local collectors or NGOs. | |

[3] https://sheltercluster.s3.eu-central-1.amazonaws.com/public/docs/unhcr_core_relief_items_catalogue_0.pdf.

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| Metal pipe, steel, often uses for tent poles. | 1.2mm thick galvanized or painted.[4] | • Repair of other tent frames. | • Use in building furnishings and tools, including chairs, tables, dish drying frames, carts, wagons, light stands, etc.<br>• Use as frames for sunshades, expanding shelter structures or other reuses or repurposing of other shelter materials. | • Possibly significant opportunities.<br>• Need to collect significant quantities to justify transport to recycling facility.<br>• Likely people already engaged in collecting metal scrap.<br>• See WREC for possible recycling companies. | • There may be local NGOs which organize scrap metal collection on a regular or ad hoc basis, for fundraising or as part of environmental or waste management programs.<br>• Using an existing recycling system is generally better than creating a new system.<br>• Technical support can be provided to existing recycling systems to improve quality of work and products (e.g., washing and packaging materials) and livelihood opportunities. |
| Metal pipe, aluminum, often used for tent poles. | Various sizes. | | | | |
| Wood, hard[5] | Generally, hard wood requires significant force to drive a nail into, or for which drilling is needed before a screw is inserted.<br><br>There may be local definitions of hard wood. | • Repairs to structures, including shelters and other buildings. | • Can be used as fuel.<br>• Can be composted or chipped. | Relatively good recycle potential, including for market sales (scape lumber) and commercial uses (e.g., a fuel for power generators). | • Wood used in emergency or transitional shelters should not be chemically treated against pests. If treated, the wood needs to be handled as a hazardous material. It cannot |

[4] https://itemscatalogue.redcross.int/upload/products_data/files/HSHETENT07.pdf.
[5] "Hardwood" is a biological definition and is not the same as hard wood. See https://www.fpl.fs.usda.gov/documnts/fplgtr/fpl_gtr190.pdf

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| Wood, soft[6] | Generally, soft wood does not take significant force to drive a nail into, or for which drilling is needed before a screw is inserted.<br><br>There may be local definitions of soft wood. | • Made into furniture, e.g., tables, chairs or benches. | | | be burned, cannot be used in locations where it can come in contact with people and needs to be disposed of in a hazardous material disposal facility.<br>• Training and tools may be required for reuse/repurposing and can be considered as a livelihoods support activity.<br>• Wood extraction can cause deforestation, landslides, land degradation, and habitat destruction and can increase flood risk. |
| Bamboo | Specifications may be defined locally or in national legislation. | • Repairs to structures, including shelters and other buildings.<br>• Made into furniture, e.g., tables, chairs or benches. | • Can be used as fuel.<br>• Can be composted or chipped. | May have limited recycling potential but can be used as fuel if dried and not treated with toxic chemicals. | |
| Zinc coated steel[7] (also Corrugated Galvanized Iron – CGI – sheet) | • For general roofing: Thickness of 0.551 to 0.7 mm/gauge 24-26.<br>• For roofing in locations where snow is possible: 0.4 to 0.475 mm, gauge 28-30. | • Roofing for new structures.<br>• Roofing for smaller structures or to provide shade.<br>• For protective fencing. | • Manufactured into toys or household utensils or containers. | Generally highly recyclable through recycling market. | • Zinc sheeting tends to have a relatively long use life – in excess of 20 years. It is likely to be highly prized by those who have receive it as assistance and removed and transported to new shelter locations or sold if there is a need for funds.<br>• Making containers or utensils from Zinc sheeting may require solder which result in items which are not food safe. |

[6] "Softwood" is a biological definition and is not the same as soft wood. See https://www.fpl.fs.usda.gov/documnts/fplgtr/fpl_gtr190.pdf.
[7] https://itemscatalogue.redcross.int/relief--4/shelter-and-construction-materials--23/construction-materials--25/corrugated-galvanised-iron-cgi-sheets--EBUIBSHE.aspx

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| | | | | | • If used for roofing, high noise will be produced during rainfall, and insulators will be needed.<br>• Avoid using in extreme temperatures, else use insulators along with it |
| Wood, for roof structures or to support roof or walls (e.g., vertical posts). | • Generally hard wood but can be soft wood (not preferred).<br>• Can include whole trees (e.g., for wall posts) or palm logs for wall posts and, split palm logs for roofing. | Use for wall posts or roofing. | Use for other wood items, including furniture. | • Wood can be composted. Metal can be recycled commercially, including through local artisans, e.g., manufactured into utensils or other household items.<br>• Can be burned if not treated. | • Use of local wood for wall posts or roof structure can lead to damage to local forests. However, in some locations, wood for wall posts and roof structures is cultivated on the edge of fields.<br>• Considerable reuse potential through recovering wood from damaged or destroyed houses and using to repair or in new housing. |
| Wood, for door or window frame (attached to wall), with metal or wood panels. | Generally hard wood but can be soft wood (not preferred).<br><br>For metal, see Zinc coated steel. | Use for other doors or windows, including repairs. | Use for other wood items, including furniture. | • Wood can be composted. Metal can be recycled commercially, including through local artisans, e.g., manufactured into utensils or other household items.<br>• Can be burned if not treated. | Note that whole doors units (frame and door unit) can be reused as a single unit. |
| Wood, solid planks, used for walls. | Generally hard wood but can be soft wood (not preferred). | | | | |
| Nails, common | Round iron wire common nail, made of polished low-carbon steel, cold processed, not heat treated except for galvanization. | Limited to good quality nails. | | • Possibly significant opportunities. | |

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| | teel galvanized | | | • Need to collect significant quantities to justify transport to recycling facility.<br>• Likely people already engaged in collecting metal scrap.<br>• See WREC for possible recycling companies. | |
| Nail, roofing | • Round iron wire common nail, made of polished low-carbon steel, cold processed, not heat treated except for galvanized steel.<br>• Spiral rolled or twisted shank, sealed umbrella-type springhead. Attached rubber washer with each nail. | Limited to good quality nails. | | | Need to remove rubber washer before recycling. Limited 3R options for washer. |
| Stakes, metal, steel | Steel, 350 mm, angle iron and welded top | If good to fair quality. | Use in building furnishings and tools, including chairs, tables, dish drying frames, carts, wagons, light stands, etc. May require welding. | | |
| Eyelets, steel (in outside or inside covering) | | | | | |
| Wire, binding or tie | Low carbon steel, hot dip galvanized with minimum 40g/m2. | If good to fair quality. | Use in building furnishings and tools, including chairs, tables, dish drying frames, carts, wagons, light stands, etc. | | |
| Latches, hinges and nails | Steel, either treated or untreated. | Reuse for other doors or windows. | | | Can be made locally by blacksmiths from recycled metal, but quality can vary considerably. |

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| Plastic pipe | Generally, -- mm polyvinyl chloride (PVC) pipe, normally used in household water supply systems. | • Can be used to repair damaged water pipes or, in some cases, shelter frameworks.<br>• Can be made into non-weight carrying furnishings (drying racks, coat hangers, wall hooks, etc.) | • Several sections can be assembled to make 3 to 4 meter sections of (water) pipe.<br>• Use as water piping (combining several sections) for household water supplies (e.g., roof tanks, rainwater collection). | • Depends on local recycling market.<br>• May be recycled through local collectors or NGOs. | • The glue used to attach two pieces of pipe can be toxic during use and should be handled with care.<br>• The skill level needed to attach pipe pieces is not high but can require practice.<br>• PVS pipe can degrade in sunlight and should be protected (e.g., buried, placed in a casing) when used. |
| Plywood | Generally, several layers of thin wood with the grain of each piece placed at right angles to each other and bonded with glue.<br><br>Not all plywood is appropriate for outside use.<br><br>For more information different plywood types and specifications see https://www.apawood.org/plywood. | Use of solid pieces for shelter construction, e.g., pieced together for walls or floors. | Use in building furnishings and tools, including chairs, tables, dish drying frames, carts, wagons, light stands, etc. | None. Due to chemicals used in plywood, it generally needs to be disposed of in a land fill or incinerated in a hazardous waste incinerator. | Can also be used for flooding. |