Early Recovery Cluster

Technical Working Group on

MATERIALS FOR TRANSITIONAL SHELTER

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Guide to this Document: This document is intended to provide practical information for agencies contemplating transitional shelter in response to the Yogyakarta, Java Earthquake. The document has four main sections:

The Recommendations section lists what materials are available, available prices, notes on using the materials and which materials are recommended. The Technical Breakdown gives quantities and prices for various designs as well as sketches and photos.

Assumptions:

- Need for rapid supply of materials, tools and education for Transitional Shelter to vulnerable groups.
- There is no single material package appropriate for all Transitional Shelter solutions.
- Guidelines on appropriate materials may help inform Sector in decision making process
- Communities should be supported to recycle materials, use locally available resources and use their own skills It is also important to recognise that the scale of the disaster overloads local capacity in terms of both materials and skilled trades people and that additional supply from external sources should be sought to support local efforts
- As far as is possible, given restricted funding and the need for speed, materials for Transitional Shelter activities should encourage the construction of future permanent housing
- Materials for Transitional Shelter should minimise the risk of natural hazards, giving particular attention to the onset of the rainy season in next 2-3 months and the possibility of further earthquakes.
- Materials used in T-Shelters should have an expected in-use lifespan of at least 24 months, and preferably longer for reuse in permanent structure. Those used in core shelter construction should last for minimum 10 years and be Tectonic resistant and appropriate.
- Materials for T-Shelters should allow for rapid construction – one to two days, whilst Core shelters may take longer but still should be designed for rapid construction.

Guidelines:

- Toward a Strategic Framework on Transitional Shelter, Yogyakarta, 23 June 2006.
- SPHERE Minimum Standards in Shelter, for example, material quantities provided should allow for the minimum construction of 3.5m2 per person of undercover space, with at least one internal division for privacy.

Recommendations:

- To allow for maximum versatility recommendations are for separate components of a transitional shelter – walls, roof, frame, floor, foundations and fastenings.

Walls

Available Materials

Material	Unit	Price	Usage notes
Gedheg	2x3 metres	35 000Rp	• Available in at least two qualities made from the inside or outside of bamboo. Both considered suitable for 1-2 years usage. Price has risen and market availability is limited. Possible community manufacturing, through training and capacity building
Pandan			• Similar to gedheg but lower quality and lower availability.
Mendong			• Similar to gedheg but lower quality and lower availability.
Brick	Pce	Recycled/200-400Rp/each Price variable and inflated.	• Often available already. Can form the base of a wall which has other material above, eg. Gedheg supported by bamboo. • For part-brick walls the brick should be no higher than one metre from the ground. • Safe building practices for permanent housing should be followed and appropriate reinforcements used if the walls are higher than one meter. Techtronic advice should be provided
Tarpaulin	Pce Roll 60m x 4m	$20 $150	• Often available already from previous distributions. Should ideally meet SPHERE standards. Care should be taken with fastening so as to reduce flapping and prevent ripping. • Can be cut to length.
Muslin			• Can be used for top part of external walls protected by roof and internal walls
Plywood	Pce	New / recycled	• New plywood is not recommended due to

			environmental concerns over illegal logging. Also concerns over warping when exposed to rain.

Recommended Materials

Gedheg, Brick, Tarpaulin, Muslin
Note: Many woven products such as Muslin, Gedheg, mendong, may be suitable for rendering for increased privacy and permanency

Roof

Available Materials

Material	Unit	Price	Usage notes
Tarpaulin	Pce		• See above
Clay Tile	Unit		• Preferred option for many communities • Often available on site • Readily available in markets • 3 Quality levels available • Roof pitch must be adequate for drainage above 12 degrees • Roof and wall structure must be able to sustain the weight of the tiles. • Important safety considerations.
Cement tiles			• Local availability • Higher quality, similar cost, larger • Extra structural considerations due to greater weight than clay tiles.
Pressed cement tiles			• Light weight alternative to Cement tiles • Presses must be imported, so slightly higher initial cost, but a possible *Livelihoods* option.
Gedheg and Tarpaulin	2x3 metres	35 000Rp	• See above. For roofing gedheg should be used under a tarpaulin or rendered.
Asbes/ asbestos			• STRONGLY NOT RECOMMENDED for health reasons (normally does contain asbestos). • May be chosen by community as light weight and a cheaper alternative to Zinc.
Corrugated Iron	Pce 0.2mm, 0.3, 0.4 x 900mm	24000Rp – 50000Rp for 0.2mm Price inflated.	• Different lengths, thicknesses and qualities available. The thinnest has less than 5 year life span. The thickest up to 25 years. • High price variance according to quality and

			sheet size. • Effective product but may face community reluctance to use, due to perceived cultural inappropriateness. • More expensive than roof tiles per m2. • Thermally less suitable than tiles, particularly in non mountain regions.
Alang Alang (Grass style roof)			• Uncommon in central java but useful • Limited local skills • Ideal for use on top of tarps to increase UV resistance

Recommended Materials

For cost reasons Tarpaulin (with or without gedheg) or alang alang, otherwise tile or corrugated iron.

Frame

Available Materials

Material	Unit	Price	Usage notes
Bamboo	6m pole 6m large diameter	5000Rp 35000	• Bamboo poles should reach the floor not just the top of brick half walls to ensure structural integrity. • Consult safe building guidelines. • Appropriate Jointing systems are critical, for both strength and durability.
Steel framing or roof trusses			• High cost solution. • High environmental cost • Rapid deployment and construction, though possibly slow procurement.
New Timber			• Some plantation supplies are available of Rubber wood and Coconut. Ideal for posts and structural beams especially. • Other timbers not recommended due to prevalence of illegal logging and limited timeframe for T-Shelter projects to check legality.
Recycled Timber			• An appropriate material for many applications. • May be available on site, particularly suited to larger structural elements such as posts and ridge beams.

			• Care should be taken in selection of recycled timber for reuse as much may be termite affected or earthquake damaged.
Concrete			• Need to consult safe building guidelines for permanent structures. • Quality of local manufacture and joining techniques is low and should be addressed through technical education. • Higher price than bamboo and longer construction time so may not be suitable for most T-shelter projects, though may suit core house.

Recommended Materials

Bamboo, quality recycled timber, bamboo and rubber wood.

Floor

Available Materials

Material	Unit	Price	Usage notes
Original Floor			• Consider possible drainage issues, such as the need for base walls or sealing of T-Shelter walls to slab
Bricks		See above	• Often available already. Bricks used as a paved flooring will provide good drainage, though may require matting above
Bamboo	6m pole 6m large diameter	5000Rp 35000	• Uses a lot of materials. Therefore not generally recommended. except in damp areas where raised flooring is required
Plywood	Pce		• High cost and high potential for negative environmental impact due to illegal logging.

Recommended Materials

Original floor with bricks or other drainage solution. Other solutions that protect from water influx and allow for airflow.

Foundations

Available Materials

Material	Unit	Price	Other notes
Brick under bamboo or timber poles			• Quick, temporary solution •
Timber or Bamboo imbedded into dirt			• Quick, temporary solution • Drainage and durability must be considered • Post may first be dipped in motor oil or bituminous tar to deter termites
Existing floor			• Take care with drainage • Timber Spreader plate under Bamboo or timber Poles to spread load on existing slab
Concrete foot			• Moulded in a bucket, inverted and secured to bamboo/timber post.
Anchor bamboo in original floor			• Good, quick, temporary solution.

Recommended Materials

Existing foundations where possible or concrete feet

Fastenings

Available Materials

Material	Unit	Price	Usage notes
Wire	.5 kg	6000	14g adequate for most bamboo construction, 10-12g may be required for timber joints
Bolts			Suitable for bamboo jointing although special techniques are required. Suitable for timber frame construction following accepted practices.
Nails	1 kg	9000Rp	Must supply relevant style and sizes for proposed usage Variety per unit is generally important Not appropriate for bamboo jointing
Tali-Ijuk (local fibre)			Suitable for Bamboo T-Shelter
Bamboo striping			Suitable for Bamboo T-Shelter joints Allows flexibility of joint if required
Motorcycle tyre rubber			Suitable for Bamboo T-Shelter

Recommended Materials

Any material must last as long as the material being fastened

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Technical Breakdown

JRS

Prices and Quantities for one 4 x 6 meter Transitional Shelter.

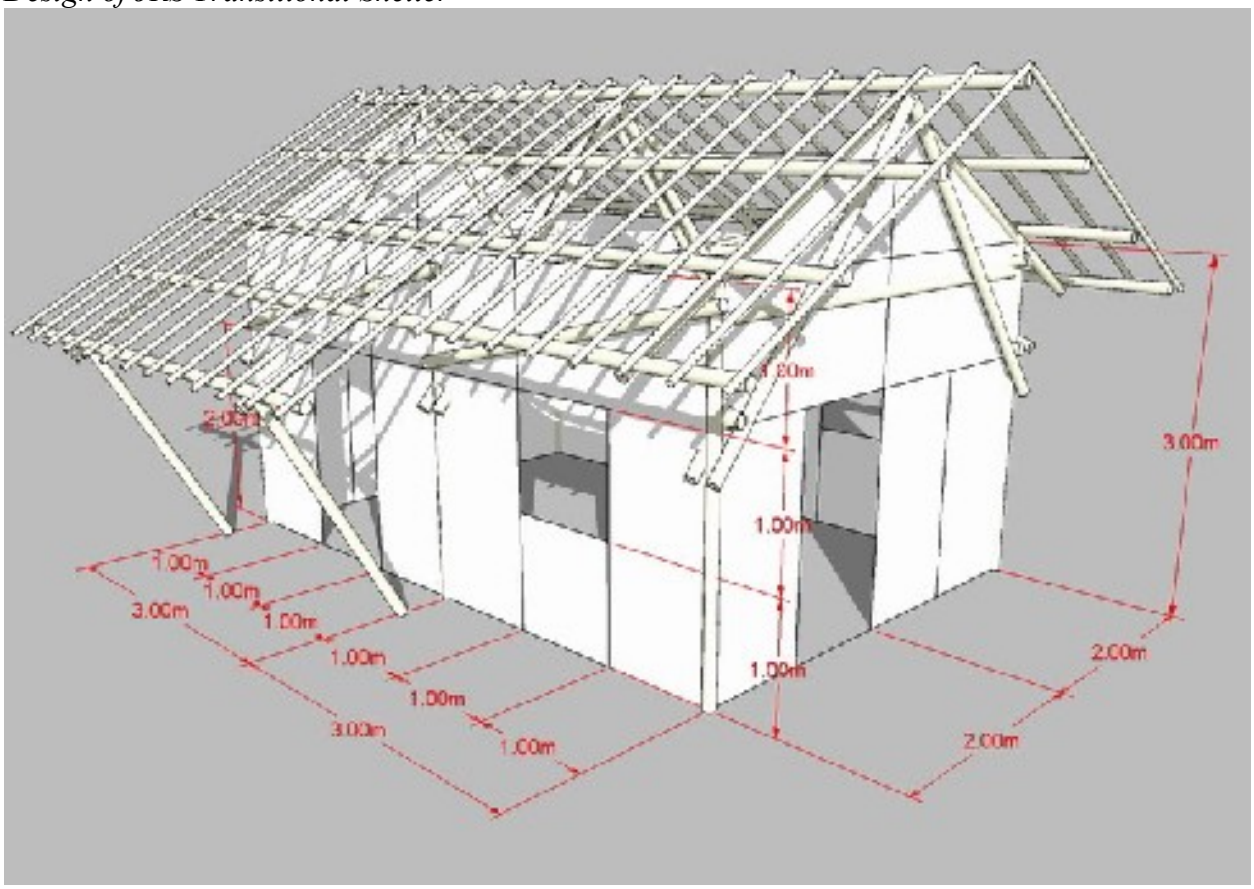
No	Material	size	unit	Quantity	Unit Cost	Total
1	Usuk/Kasau – Roof Bamboo (vertical)	3.5m	Pcs	35	5000	175000
2	Usuk/Kasau utk teras – Roof Bamboo for terrace	4.25m	Pcs	3	5000	15000
3	Gording – Roof bamboo (horizontal)	7.5m	pcs	7	5000	35000
		4.5m	pcs	1	5000	5000
4	Kuda Kuda – Bamboo for slope		Sets	3	5000	15000
5	Kres/Silang pengaku – bracing bamboo	3.5m		8	5000	40000
6	Pengikat Bawah – Floor frame bamboo	4m	pcs	2	5000	10000
		3m	pcs	4	5000	20000
7	Tiang pembagi – horizontal bamboo beams	4m	pcs	8	5000	40000
		3m	pcs	2	5000	10000
8	Tiang teras – terrace bamboo	3m	pcs	2	5000	10000
9	Rangka pintu & jendela – window and door frame	3m	pcs	2	5000	10000
10	Pelepet/Bingkai/Gapit – horizontal pieces between frames	various	4m Bamboo	4	5000	20000
11	Reng – horizontal roof small bamboo stripes	320m				0
12	Gedheg kulit – bamboo skin gedheg (high quality)	2x3m2	Sheets	11	78000	858000
13	Tali Ijuk – organic wire		Rolls	85	1250	106250
14	Besi Kawat – fencing wire	2m	Roll	1	1000	1000
15	Paku usuk – short roof nails		Kg	2	7000	14000
16	Paku reng – long roof nails		Kg	3	7000	21000
17	Bamboo cadangan – extra bamboo	4m	pcs	3	5000	15000
					TOTAL	**1420250**

Photos of JRS Transitional Shelter

Els Coolen, JRS "for roofs, the light "kampung" roof tiles are reused, with JRS supporting extra tiles as needed. The gotong royong is supervised by our staff, so roof tiles are decently attached

Bamboo and gedheg we procure from a couple of nearby villages, we made a deal with head of the RTs to provide the amount needed for a fixed price"

Design of JRS Transitional Shelter



CHF

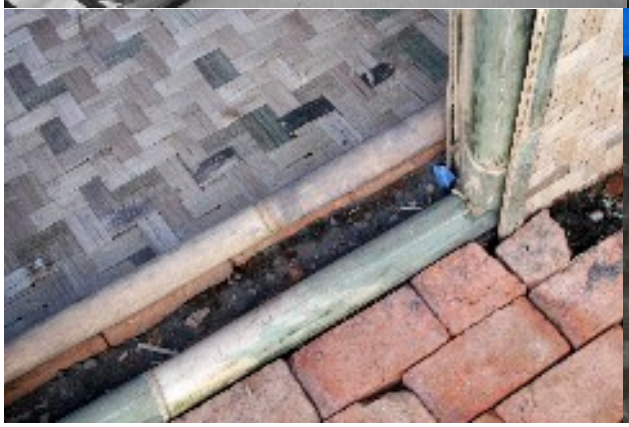
Prices and Quantities for one 3 x 6 meter Transitional Shelter.

No.	Material		Size	Unit	Quantity	Unit cost	Total
1	Bamboo (large size)		6m	pcs	14	7000	98000
2	Bamboo (medium size)		6m	pcs	36	6000	216000
3	Bamboo partition (gedheg)		2x3m	pcs	8	35000	280000
4	Terpal cap gajah	Tarpaulin	6x8m	pcs	1	190000	190000
5	Blacu textile (white)	Muslin	1x1.5	m2	25	5000	125000
6	Reng bambu nail	Nails	2"	kg	3	8000	24000
7	Usuk bambu nail	Nails	3"	kg	3	8000	24000
8	Usuk kayu nail	Nails	5"	kg	3	8000	24000
9	Tire rubber (ban sayatan)		1kg	kg	3	5000	15000
						TOTAL	**996000**

1. Bambu besar diameter min. 10 cm panjang min. 6 m jenis APUS.
2. Bambu sedang diameter min. 7 cm panjang min. 6 m jenis APUS.
3. Gedhek ukuran 2x3 m bukan kulitan (aten), kualitas baik.
4. Terpal merek Gajah ukuran min 6x8 m, warna biru.
5. Ban sayatan digunakan untuk memperkuat sambungan antar bambu.

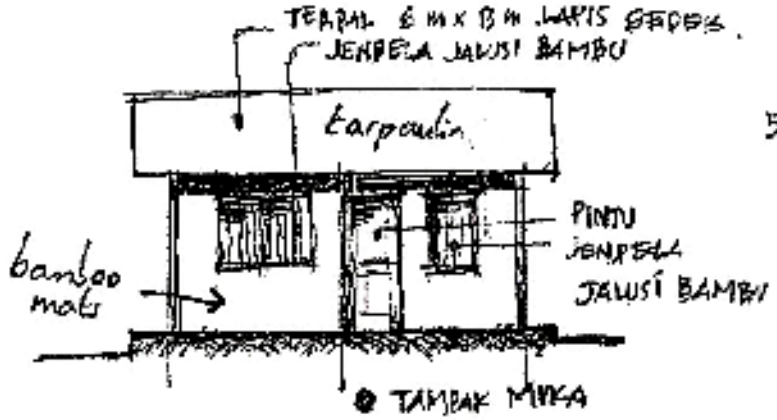
1. Large bamboo with at least 10 cm diameter x 6 metres long. Species APUS
2. Regular bamboo with at least 10 cm diameter x 6 metres long. Species APUS
3. Gedheg with size 2x3 metres, and good quality
4. 6x8m tarpaulin, brand Gajah, colour blue
5. Tire rubber used to bind the bamboo

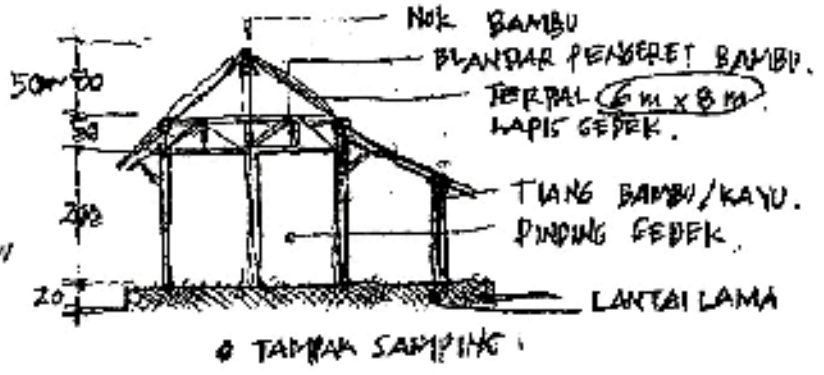

USAID

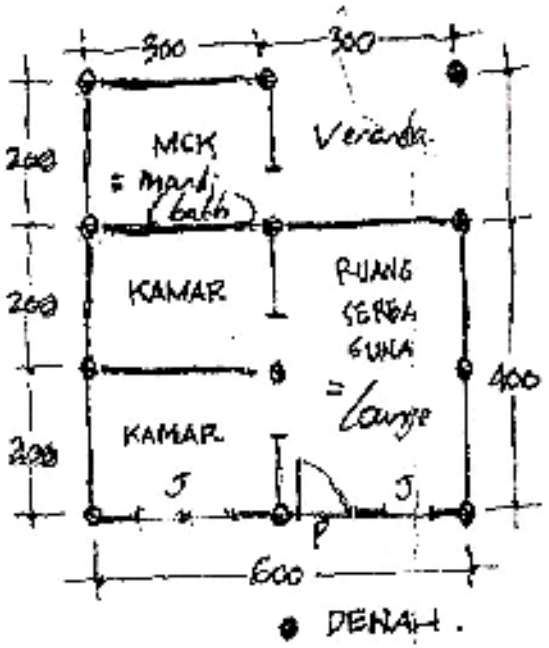


Cordaid

Diagram and picture of 6x6m Transitional Shelter







Terpal : dak van „vrachtwagenzeil",
gezoomd, met ingelaste ogen.

Syarikat
Masyarakat Sanitasi Untuk Advokasi
The Muslim Community for Sanitation Advocacy

Cordaid

design is „Herk approved"

Costs appr Euro 140–160 / unit.

Could be 20–60 if IFRC provide terpal

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