

Frequently Asked Technical Questions (FATQs) for the Typhoon Haiyan/Yolanda Response

This document is a compilation of some of the *technical* questions most commonly raised by agencies during the emergency and recovery phases of the Typhoon Haiyan/Yolanda response in the Philippines from November 2013 until November 2014. It is recommended that shelter agencies use this document as a general guide, and in conjunction with the services of certified construction professionals such as civil/structural engineers and the advice of relevant Philippine Government Authorities.

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PROGRAMMATIC CONSIDERATIONS

BENEFICIARY SELECTION

Q: Are there guidelines for the selection of beneficiaries?

A: Yes, the Shelter Cluster in cooperation with the Protection, CCCM, Early Recovery, WaSH, Health, Education, Nutrition, Logistics, Food Security and Emergency Telecommunications clusters has developed a series of documents (see links below) to assist shelter agencies in the process of beneficiary selection.

FURTHER READING:

Vulnerability Criteria

<http://sheltercluster.org/sites/default/files/docs/Vulnerability%20Criteria.pdf>

Beneficiary Prioritization Tool

<http://sheltercluster.org/sites/default/files/docs/140414%20shelter%20prioritisation%20tool%20-%20final%20%2814%20Apr%202014%29.pdf>

Beneficiary Selection Criteria (background document 1 to the Beneficiary Prioritisation Tool)

<http://sheltercluster.org/sites/default/files/docs/Beneficiary%20Selection%20Criteria%20-%20Background%20Document%201.pdf>

Methodology Beneficiary Selection (background document 2 to the Beneficiary Prioritisation Tool)

<http://sheltercluster.org/sites/default/files/docs/Methodology%20Beneficiary%20Selection%20-%20Background%20Document%202.pdf>

Household Assessment Tool (background document 3 to the Beneficiary Prioritisation Tool)

<http://sheltercluster.org/sites/default/files/docs/Household%20Assessment%20Tool%20-%20Background%20Document%203.pdf>

SHELTER PROGRAMMING

Q: What are some of the different shelter options applicable to the Philippine context?

A: As typhoon Haiyan/Yolanda swept across such a wide region, it caused damage to a large range of different housing types. In response, agencies are carrying out a variety of shelter programs to assist the affected population. The type of shelter assistance offered should respond to the specific needs of the household, considering the extent of damage, the technical and financial capacity of the family to recover and rebuild, location (is it in a high risk or low risk area?), which type of shelter the family had before the disaster, special needs of the household, the security of land tenure (if the family doesn't have secure tenure, a temporary solution might be a more appropriate but if they own their land then a permanent solution might be more appropriate) and other such considerations.

The Shelter Cluster's *Recovery Shelter Guidelines* were developed through a consultative process with agencies and government to support organisations in developing their shelter programs. The shelter options listed in the guidelines are a reflection of the actual work being carried out in the field and include:

1. Emergency Shelter Replacement and Upgrade
2. Temporary Shelter
3. Sharing Program
4. Rental Support

5. Bunkhouse Program
6. Repair and Retrofit
7. Core House
8. Permanent House
9. Settlement Planning (in conjunction with a housing option)

The Recovery Shelter Guidelines also outline some of the key principles and parameters to be considered when delivering shelter assistance such as self-recovery, building back safer, gender and diversity, vulnerability, house land and property issues, safety, adequacy, appropriateness and access to services such as cooking, water, sanitation, livelihoods and communal facilities.

FURTHER READING:

Recovery Shelter Guidelines, Shelter Cluster

<http://sheltercluster.org/sites/default/files/docs/Recovery%20Shelter%20Guidelines.pdf>

Recovery Shelter Options, Shelter Cluster

<http://sheltercluster.org/sites/default/files/docs/Recovery%20Shelter%20Options.pdf>

Q: How big should a shelter be?

A: According to the SPHERE Guidelines on Minimum Standards in Shelter, Settlement and Non-Food Items, Shelter and Settlement Standard 3: Covered Living Space, all affected individuals have an initial floor area of 3.5m² (For a family of 5, this equates to 18m²/HH undercover space).

Regarding the plot size, enough space should be allowed for access, (paths, stairs, ramps etc.), future expansion of the shelter, cooking and sanitation facilities and recreation space, suitable distances from neighbouring buildings necessary for privacy and safety, drainage of surface water and grey water from the site and provision for connection to utilities such as water, electricity, gas and telecommunications. It is recommended to consult local planning authorities for requirements regarding minimum lot areas relevant to your project and location.

For Socialized and Economic Housing (forms of permanent housing), refer to Philippine Building codes (e.g. BP220) for minimum lot areas and other site planning requirements.

FURTHER READING:

The Sphere Handbook: Humanitarian Charter and Minimum Standards in Humanitarian Response

<http://www.sphereproject.org>

Humanitarian Shelter Working Group Recovery Shelter Guidelines

<http://sheltercluster.org/sites/default/files/docs/Recovery%20Shelter%20Guidelines.pdf>

BP 220: Rules and Standards for Economic and Socialized Housing, Philippines; November 2008

http://old.hlurb.gov.ph/uploads/laws-issuances/BP220IRR/Revised_IRR_BP220_2008.pdf

Q: What is a temporary shelter?

A: Temporary shelter programs aim to provide safe adequate, appropriate shelter for households whose permanent housing solution is not yet resolved and may not be easily be resolved in the foreseeable future. To ensure a smooth transition on to permanent solutions at a later point in time, temporary shelters should ideally be designed to be re-locatable, resalable, and reusable. It is recommended that they include risk reducing measures as per the Shelter Cluster's 8 Build Back Safer Key Messages and ensure access to water, sanitation and hygiene

(WaSH) and cooking facilities though they may not necessarily provide them directly. These services could be provided by means of a complimentary program, or in partnership with another organisation or the household itself depending on their financial capacity. It is encouraged that temporary shelter programs in higher risk areas include additional risk mitigating measures such as preparedness and evacuation plans.

It is recommended that temporary shelter programs meet all key shelter principles, parameters and minimum standards noted in the Recovery Shelter Guidelines and Sphere Guidelines.

FURTHER READING:

Recovery Shelter Guidelines, Shelter Cluster

<http://sheltercluster.org/sites/default/files/docs/Recovery%20Shelter%20Guidelines.pdf>

Recovery Shelter Options, Shelter Cluster

<http://sheltercluster.org/sites/default/files/docs/Recovery%20Shelter%20Options.pdf>

8 Build Back Safer Key Messages, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

The Sphere Handbook: Humanitarian Charter and Minimum Standards in Humanitarian Response

<http://www.sphereproject.org>

Q: What are some of the key points to keep in mind when designing a core house?

A: Core House programs aim to provide households with the core of their future house: one room, or the frame of a permanent house with a room to inhabit. Core house programs are targeted at households located on permanent sites with security of tenure and the capacity to extend and upgrade in the future. They may include a combination of implementation modalities (built by beneficiary, contractor, government or a combination of these modalities) using materials, cash, labour and technical training and support. Core house programs should meet all key shelter principles, parameters and minimum standards.

It is important that the design of core houses should allow for growth and extension of the shelter over time as the family acquires resources to modify it, so it is important to consider this in the design phase. Some typical design features allowing this expansion might include:

- Designing a shelter with 2 doors so that the family won't have to demolish any part of the wall structure in order to extend
- Not installing cross bracing under windows which the family might cut or remove them to make way for a new door during future renovation/extension works, consequently compromising the lateral strength of the wall and its ability to resist strong winds. Instead, it is recommended to design the bracing so that it finishes beside the window.
- Designing a higher roofed shelter so that future extensions can easily be built around the core, with separate, lower roofs.
- Carefully siting the core house on the site so that future extensions can be logically added
- Selecting a site which is large enough for future expansion
- Preparing a sketch plan with the beneficiary which suggests ideas for how the shelter can be extended in the future.

The Recovery Shelter Guidelines suggest that for a core shelter, materials with a durability of at least 9 years be used and likewise that the beneficiary has access/security of tenure of at least 9 years. Selecting good quality materials and taking steps to protect them from the natural elements and termites will help to increase the durability of the shelter.

It is recommended that core house programs meet all key shelter principles, parameters and minimum standards noted in the Recovery Shelter Guidelines and Sphere Guidelines.

FURTHER READING:

Recovery Shelter Guidelines, Shelter Cluster

<http://sheltercluster.org/sites/default/files/docs/Recovery%20Shelter%20Guidelines.pdf>

Recovery Shelter Options, Shelter Cluster

<http://sheltercluster.org/sites/default/files/docs/Recovery%20Shelter%20Options.pdf>

8 Build Back Safer Key Messages, (page 3), Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

The Sphere Handbook: Humanitarian Charter and Minimum Standards in Humanitarian Response

<http://www.sphereproject.org>

Q: What is the definition of a permanent house?

A: In the context of the Haiyan/Yolanda response, the Recovery Shelter Guidelines suggest that permanent housing programs should aim to provide households with a complete house that could still be extended and upgraded in the future. Permanent housing programs should be targeted at families who do not face further relocation and may not have the capacity to self-recover, they include at least one bedroom, one living space, dedicated WaSH and cooking facilities and ensure access to appropriate livelihoods and other social services.

It is important to note that permanent housing must comply with National Building Codes and municipal legislation, and that minimum lot sizes exist.

FURTHER READING:

Building Code of the Philippines

Arellano V. Busto. (2014) *Building Code of the Philippines*. Manila, Philippines: A.V.B Printing Press

Recovery Shelter Guidelines, Shelter Cluster

<http://sheltercluster.org/sites/default/files/docs/Recovery%20Shelter%20Guidelines.pdf>

Recovery Shelter Options, Shelter Cluster

<http://sheltercluster.org/sites/default/files/docs/Recovery%20Shelter%20Options.pdf>

Q: Repairs and retrofits: What is the recommended quantity of building materials to offer to the beneficiary?

A: Ideally, the beneficiary should receive enough building materials to be able to achieve a complete and safe shelter. This should include enough materials for all basic building elements which need to be repaired/replaced/upgraded such as foundation materials (cement, sand, gravel, steel anchors, steel bars, etc), columns, floor structure, wall structure, wall cladding, windows and doors, beams, bracings, tie-downs, roof timbers and roof sheeting. The exact type and quantity of materials offered will differ from beneficiary to beneficiary depending on the extent of repair and retrofit work required. Ideally, the type and quantity of materials should be determined by the assessment, taking into account the level of damage of the structure, any construction materials which the family may already have on hand and the financial and technical capacity of the family to self-recover.

Q: What is the maximum recommended shelter cash grant?

A: The Shelter Cluster's *Recovery Shelter Guidelines* developed through a consultative process with agencies and government, outline budget recommendations for various types of shelter responses. The amount of the cash grant offered to the beneficiary could be determined keeping these values, combined with the value of other types of support already offered to the beneficiary (construction materials, logistical, labour, etc.) in mind.

The main aim of stating these indicative values is to assist agencies in the design of their shelter programs. These values should be taken as indicative, as cost and availability of materials and labour can vary from one region to another. Please note that these budget values do not include transportation or WaSH facilities.

One of the main challenges in this response has been that in the early days agencies were commonly distributing repair kits for both partially damaged and totally destroyed houses as a support to self-recovery, and the budget for these kits was generally around 10k. This was considered reasonable in the emergency/early recovery phase, however in the recovery phase it has been recommended that agencies should instead be aiming, where possible to prioritize permanent assistance by providing safe, adequate and durable shelter solutions. This implies that all repair programs provided now should ensure that the minimum standards agreed by the Shelter Cluster in terms of safety, adequacy, appropriateness and access (refer to the Recovery Shelter Guidelines) are achieved.

FURTHER READING

Recovery Shelter Guidelines, Shelter Cluster

<http://sheltercluster.org/sites/default/files/docs/Recovery%20Shelter%20Guidelines.pdf>

Recovery Shelter Options, Shelter Cluster

<http://sheltercluster.org/sites/default/files/docs/Recovery%20Shelter%20Options.pdf>

Q: What are the daily rates for skilled and unskilled workers?

A: The daily rate for labours seems to vary only slightly depending on geographical location. There is however a greater difference on daily rates depending on how skilled workers are, whether they are accredited by TESDA, whether they are carpenters, masons, foremen, semi-skilled or unskilled construction workers.

Defining the cost of labour per housing unit depends on many factors which may vary from one project to another. These factors may include the peculiarities of the labour market in your area (supply and demand), specific design and construction details and the level of skills required to achieve the quality of construction, timeframe, option of lump sum contract (pay for the product rather than day by day), etc.

It is also worth mentioning the *bayanihan system* (community spirit), which is widely used in the reconstruction process in the Philippines whereby the community come together for the reconstruction.

For specific information about the current labour rates in your municipality, it is recommended to consult other agencies working nearby and relevant government bodies such as the Department of Labor and Employment.

FURTHER READING:

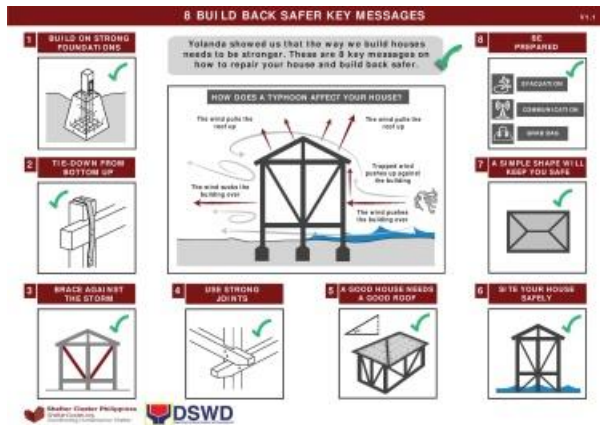
Department of Labor and Employment: National Wages and Productivity Commission

<http://www.nwpc.dole.gov.ph/rtwpb.html>

BUILDING BACK SAFER

BUILDING BACK SAFER GUIDELINES

Q: What are the 8 Build Back Safer Key Messages about?



A: The 8 Build Back Safer Key Messages were developed through a consultative process with shelter agencies and government and can be seen as a minimum checklist of disaster risk reduction construction techniques for owner-driven self-recovery in non-engineered, non-architecturally designed lightweight structures that most agencies are dealing with. The primary goal of the 8 BBS Key Messages has been to ensure common understanding amongst cluster members around simple accessible advice to families on how they can improve their makeshift shelter or simple home no matter how minimal their budget. Rather than promoting a one off perfect solution that is simply unaffordable for most of

the affected population, the messages provide advice for the owner driven incremental approach that the majority of the affected community are engaged in.

The cluster has not recommended any one construction material or design system over another. Rather the Recovery Shelter Guidelines as agreed by members focus on simple pragmatic parameters and principles, leaving design, material, construction and implementation methodology choices up to agencies and the communities that they work with.

The 8 BBS Key Messages are available in 6 different languages in A0 banner size and A3 format on the Shelter Cluster website:

<http://sheltercluster.org/library/technical-resources>

FURTHER READING:

8 Build Back Safer Key Messages, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Q: Can agencies use the 8 Build Back Safer Key Messages posters in their training guidelines, project proposals, communication materials developed for beneficiaries, etc?

A: Yes, these materials were developed through a collaborative process with shelter agencies and government for use in shelter programs and we would encourage you to use them as you see fit. Some agencies have already added their logos to the posters and have extracted specific images and messages for use within their training guidelines and project proposals.



Above: An example of an organisation (IOM in this case) adding their logo to the Build Back Safer Key Messages posters. (Photo: R. Dodds)

Q: If shelters are designed in accordance with the 8 Build Back Safer Key Messages, which category of typhoon will it resist?

A: The 8 BBS Key Messages describe 'rules of thumb' for constructing lightweight buildings in typhoon prone areas, but aren't overly prescriptive, (i.e.: they don't specify the size of the concrete foundations, the cross-sectional areas of the lumber, the type of lumber, the length of the screws, the gauge and quantity of the nails, the spacing of main structural elements etc). They are simple guidance for communities, describing a range of technical options on how to build back safer. They give an idea of the relative effectiveness of a range of technical details, for example, from STRONG to STRONGEST for the foundations comparing no foundations with heavy concrete foundations, tie-down details, bracing, jointing and shape of the house.

The strength and wind-speed rating of the shelter will vary depending on other factors not specified in the 8 BBS Key Messages such as the composition, quality and mode of installation of structural elements, location, soil type, size, height, surrounding structures, material quality, build quality etc. For example, buildings located on the top of hills are generally more exposed to strong winds, and the quality and type of the soil and the method of anchoring the building to the ground can vary greatly from one site to another.

In order to design a structure which achieves a specific strength and wind-speed rating, it is therefore recommended that the 8 BBS Key Messages be used in conjunction with the advice of a qualified civil/structural engineer or other equivalent technical professional who will take into consideration all site-specific factors relevant to the particular program and provide detailed specifications for sizing of structural elements and construction techniques necessary to achieve this.

Q: Is there a checklist available for monitoring/inspections of shelters during construction?

A: The Shelter Cluster Technical Team has developed a brief checklist (see link below) for use during technical visits to agencies' shelter programs. Please feel free to use this as a base document from which to create your own project-specific monitoring checklist, tailored to suit the shelter type, technical design, implementation modality, etc.

FURTHER READING:

Shelter inspection check list

<http://sheltercluster.org/sites/default/files/docs/site%20visit%20checklist.pdf>

SAFETY AND HEALTH ON CONSTRUCTION SITES



safety

Q: What are shelter agencies' obligations towards the safety and health of workers on construction sites and within the workplace?

A: All shelter agencies which employ staff are responsible for their health and safety in the workplace. It is encouraged that agencies offer basic training and guidance to their employees on Safety and Health in the workplace, and provide basic safety gear to construction workers. For further information, please refer to the Philippine Occupational Safety and Health Standards.

FURTHER READING:

Occupational Safety and Health Standards 1989, Department of Labor and Employment, Philippines

http://www.oshc.dole.gov.ph/UserFiles/oshc2010/file/OSH_Standards_Amended_1989_Latest.pdf

Q: Are there any health risks posed by asbestos?

A: Yes, there are significant health risks posed by asbestos which is commonly present in rubble and debris after natural disasters. Unfortunately, asbestos is widely used throughout the world, particularly in construction materials. When inhaled, asbestos fibers can remain in the lungs for long periods of time, leading to fatal lung diseases.

If asbestos is discovered, authorities should be notified and adequate steps must be taken for its proper handling and safe disposal. All people involved in this process must be fully informed of the risks and be provided with adequate personal protection, and warning signs such as that pictured on the right should be installed, warning the general public.



Please refer to the following references for further information.

FURTHER READING:

Recommendations for Occupational Health and Safety Following Disasters: Asbestos exposure and handling after disasters. World Health Organization.

http://www.wpro.who.int/philippines/typhoon_haiyan/media/asbestos_exposure_and_handling.pdf

Asbestos in Emergencies 2010: Safer Handling and Breaking the Cycle.

<http://sheltercluster.org/sites/default/files/docs/Asbestos%20in%20Emergencies%202010.pdf>

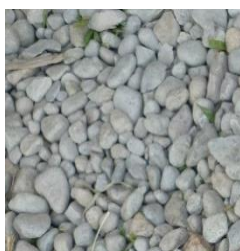
Occupational Safety and Health Standards 1989 by the Department of Labor and Employment, Philippines
http://www.oshc.dole.gov.ph/UserFiles/oshc2010/file/OSH_Standards_Amended_1989_Latest.pdf

BUILDING ON STRONG FOUNDATIONS

Q: How can the quality of concrete foundations be improved? Why is curing important?

A: Below are some quality control measures which could be taken to improve the quality of concrete foundations:

- **Avoid using too much water:** Adding too much water to the mix will weaken the concrete. As a guide, a commonly used mix for class A concrete is $\frac{1}{2}$ a bucket of water for 1 bucket of cement: 2 buckets of coarse sand : 3 buckets of gravel. It's important to check the required design strength with your engineer as this will determine the quantities of each of these materials.
- **Use the correct mix of ingredients:** The ratio of water, cement, sand and gravel in the concrete is an important factor in determining the strength of the concrete. Some mixes more commonly used for the construction of concrete footings are 1 bucket of cement : 2 buckets of coarse sand : 4 buckets of gravel or 1 bucket of cement : 2 buckets of coarse sand : 3 buckets of gravel, depending on the strength of concrete required. Your engineer can advise how strong your foundations and other structural elements such as columns and beams need to be, depending on the loads and forces that they will have to withstand, considering factors such as the weight of the building, the conditions of the ground and the location and exposure of the site.
- **Select appropriate aggregates:** A mix of crushed gravel (instead of round river pebbles) in sizes ranging from 10mm to 50mm should be used. The size of gravel will differ depending on whether you are constructing a concrete foundation, slab, column or beam. It is important that the gravel is able to fit between the steel reinforcing and the shuttering, so that pockets of air (weak points) are not formed in the concrete.



Above Left: Round river pebbles should be avoided. **Above Right:** A piece of aggregate (perhaps limestone) with high amount of calcium content, sourced from coastal region/coral stones in the Philippines. This particular sample has a high amount of voids and other impurities and shouldn't be used in the manufacture of concrete.

- **Only clean materials are used:** all materials used (water, cement, sand, gravel) should be clean and free of salt which will rust the steelwork and organic materials which will rot and break down over time, leaving voids (weak points) in the concrete. Fresh clean water should be used, sand taken from near salt water bodies should be avoided, and sand and gravel should be sifted to remove any organic materials. Mixing of concrete should be done on a clean surface such as in a wheelbarrow, on a concrete slab or piece of flat sheet metal.

- **The concrete is well compacted:** the concrete should be well compacted in order to make sure that any air which is trapped in the concrete (weak points) is removed. A mechanical concrete vibrator is the most effective tool for this but if this isn't available, a steel rod may be used instead. As the concrete is vibrated, air bubbles rise to the surface. The time required to compact the concrete will depend on how solid and workable it is, but a good indication that it has been adequately compacted can be when air bubbles stop rising to the surface.
- **The steel is well covered:** It is important to make sure that the steelwork is fully covered by the concrete so that it is protected from the natural elements and won't rust, weakening the concrete. Ideally, it should be covered by a layer of at least 30mm of concrete. Accurately placing the steel in the shuttering, the use of concrete spacers between the steelwork and shuttering and a good compaction process and can help to achieve this.
- **The concrete is well cured (toughened or hardened).** A controlled curing process ensures that the concrete remains damp and protected from direct sun and wind, leading to less cracking and a stronger, harder, denser and more durable concrete. Concrete continues to strengthen well after it has been poured into place and compacted, reaching 90% of its potential strength after approximately 10 days. After pouring, the concrete must be cured for at least 7 days, ensuring that it:
 - is protected from direct sun and wind. A temporary sun-shading barrier may need to be erected to achieve this.
 - remains damp. To achieve this, a few layers of hessian cloth (or other breathable material which holds water) can be wrapped around the concrete (better for vertical concrete structure) or a thin layer of sand added on top (better for horizontal structures such as concrete slabs). This must be sprayed with water regularly (more regularly in a hot climate), ensuring that it is kept damp.



Left: hessian cloth has been wrapped around reinforced concrete columns during the curing process in order to keep the concrete damp.

- **Well-constructed shuttering is used:** Well-constructed shuttering ensures that well-formed concrete structures are produced. Ensure that:
 - A space of at least 30mm is left between the steelwork at the formwork.
 - The formwork is rigid and doesn't bend or break during pouring, eg: Thick plywood and external ribbing is used.
 - The formwork is easily removable (screw connections) not causing damage to the concrete when being taken off. Some indicative timeframes for stripping of shuttering/formwork and shores are:

Foundations	24 Hours
Beams	14 Days

FURTHER READING:

Building Code of the Philippines

Arellano V. Busto. (2014) *Building Code of the Philippines*. Manila, Philippines: A.V.B Printing Press.

Specifications and Contract

Max B. Fajardo Jr. (1999) *Specifications and Contract*. Philippines.

Key messages for commonly used shelter materials: Concrete

<http://sheltercluster.org/sites/default/files/docs/Key%20Messages%20Concrete%20V1.1.pdf>

Q: What is the typical strength of concrete required for shelter projects?

A: There is no one simple answer to this question. Generally, the strength required for concrete varies from building to building, shelter to shelter, depending on the specificities of the site (considering the forces on the building, location and exposure) and the design (spacing and size of structural elements, height of the building, use of the building, type of materials used, etc.). To determine the required concrete strength for your project, it is recommended to consult both the Building Code of the Philippines and a qualified civil/structural engineer for further guidance.

Existing standards for concrete construction in the Philippines at a glance:

Reinforced Concrete	National Building Code of the Philippines requirements for reinforced concrete (ACI 318), Standard Code for Arc and Gas Welding Society.
Portland Cement	ASTM C-150; Type III for high early strength Portland cement
Fine aggregates	ASTM C-33 or C-330
Gravel	Maximum size shall be 1/5 of the nearest dimension between sides of formwork, or ¾ of the minimum clear spacing between reinforcement bars and formwork, whichever is smaller
Reinforcements	ASTM A-615;
Admixture	Air entraining admixtures - ASTM C-260 Water reducing admixtures – ASTM C-494 Must be free from Chlorides conforming to ASTM C-494-651 and to be used as per manufacturers specifications

FURTHER READING:

Building Code of the Philippines

Arellano V. Busto. (2014) *Building Code of the Philippines*. Manila, Philippines: A.V.B Printing Press.

Specifications and Contract

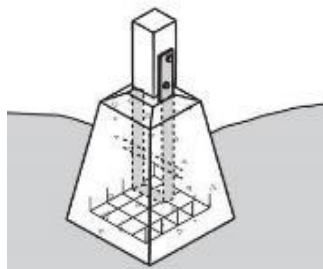
Max B. Fajardo Jr. (1999) *Specifications and Contract*. Philippines.

Key messages for commonly used shelter materials: Concrete

<http://sheltercluster.org/sites/default/files/docs/Key%20Messages%20Concrete%20V1.1.pdf>

Q: What is meant by ‘incorporating drainage in the concrete foundation’? Why is this necessary?

Steel strap bolted to post with gap to avoid rotting



A: In most cases for temporary shelters, this means simply sloping the top of the concrete footing away from the timber post, encouraging water to flow away instead of pooling on top of the footing and under the timber post. This is necessary as over time, pooling of water will lead to rotting and deterioration of the post, and eventual failure of the joint (refer to photo below). This will leave the shelter highly susceptible to uplift and lateral forces of strong winds.



In order to further improve this construction detail and longevity of the timber post, consider raising it a few centimetres above the concrete footing by bolting it into a steel bracket cast in to the footing. This will create an air gap between the post and concrete footing, greatly reducing the likelihood of the base of the post becoming wet and rotting.

Left: This is a good example of how to protect the base of the timber post. The concrete footing has not only drainage incorporated into it, but also a locally-fabricated galvanised steel termite/ant cap which provides another barrier making it more difficult for termites to reach the timber post. The timber post itself has been elevated more than 30cm off the ground, further separating it from moisture and possible termite attack. Credit: Grünhelme Project Philippines (Photo: Fabian Leipold)



Left: This timber post, which had rotted at the base due to inadequate drainage and pooling of water, was destroyed by typhoon Haiyan/Yolanda. (Photo: R. Dodds)

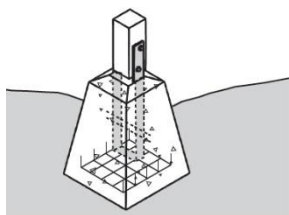
FURTHER READING:

8 Build Back Safer Key Messages, Page 1, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

TYING-DOWN THE BUILDING

Q: How can the building be adequately tied down to the foundations?



A: A good way to do this is by bolting the post to a galvanised steel anchor cast into a concrete footing. If galvanised steel isn't available, other locally fabricated options can also be employed such as reinforcing steel which is bent into shape and nailed. All steel elements can be further protected by painting them with anti-corrosive paint.

Left: A timber post is tied down by being bolted to metal straps embedded in a concrete foundation.

Strongest 



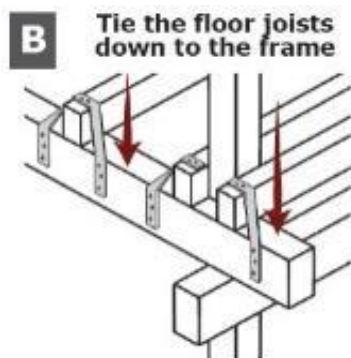
Left: The timber post is bolted to steel brackets cast into the concrete footing. Credit: CRS Owner-Driven Shelter construction, Barangay 58 Tacloban City (Photo: J. Girsang).

FURTHER READING:

8 Build Back Safer Key Messages, Page 2, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Q: How can floor joists be tied down? Why is this important?



A: Tying down the floor joists is often neglected and as a result the building is susceptible to the uplift forces of strong winds at the level of the floor. To remedy this, it is recommended to connect the floor joists to the bearers/floor beams below with galvanized metal strapping, custom-fabricated or proprietary galvanized steel fixings, timber cleats or thick galvanized wire.

Left: Floor joists are tied down to the floor beam with metal fixings.

FURTHER READING:

8 Build Back Safer Key Messages, Page 2, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Q: How can the bottom plate of the wall be tied-down? Why is this important?

A: The bottom plate of the wall can be tied down to the floor structure with galvanized metal strapping, timber cleats, steel bars or by notching it into the posts and connecting it with nails or bolts. This is important in countering uplift forces of the strong winds at the base of the walls.



Left: Bottom plate to slab/concrete wall detail. The reinforcing bar from the concrete below penetrates the bottom plate of the wall framing, and is then bent over and nailed down adding further resistance. Credit: LandsAid housing project, San Remigio, Cebu. (Photo R. Dodds)

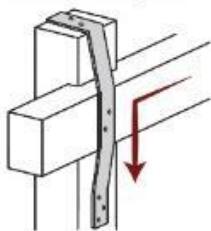
FURTHER READING:

8 Build Back Safer Key Messages, Page 2, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Q: How can the roof beam/top plate of the wall be tied down? Why is this important?

C Tie the roof beams down to the posts



A: The roof beam/top plate of the wall should be adequately tied down to the wall structure to hold the roof down, decreasing the likelihood of the roof being lifted off the walls by strong winds. This can be achieved with various locally available materials such as galvanized steel strapping, steel bars, timber cleats, or by notching the roof beam into the posts and connecting it with nails or bolts.

Left: The roof beam is notched in to the column and held down with a galvanised steel strap which is nailed into place.

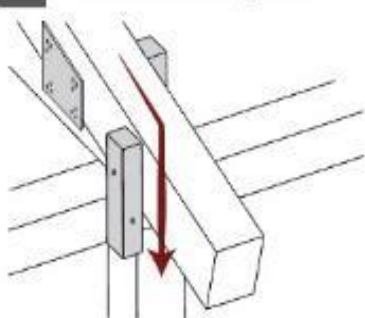
FURTHER READING:

8 Build Back Safer Key Messages, Page 2, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Q: How can the roof framing be tied down? Why is this important?

D Tie the roof frame down to the posts



A: The roof framing (trusses and rafters) should be adequately tied down to the roof beam/wall structure in order to hold the roof down, decreasing the likelihood of the roof being lifted off the walls by strong winds. To achieve this, it is recommended to tie the trusses and rafters to the roof beam/wall structure with galvanized metal strapping, steel bars, custom-fabricated or proprietary galvanized steel fixings, timber cleats or thick galvanised wire, or to connect it with bolts.

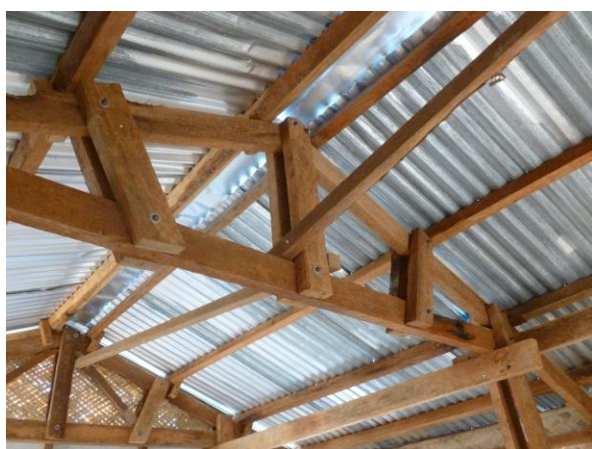
Left: The truss is connected to the roof beam with a timber cleat which is nailed to both the truss and roof beam.



Left: Example of a locally-fabricated tie-down strap nailed to the roof truss and roof beam. Credit: Shelter Self Recovery Assistance to Haiyan Affected Communities by GREEN Mindanao in partnership with Oxfam. (Photo: R. Dodds)



Above: One of the most effective and strongest ways of tying the roof structure to the wall structure is by bolting it together. I-siguro Da-an transitional shelter. ("I-siguro Da-an" is a Cebuano phrase that means "To Secure First"), University of San Carlos, Institute for Planning and Design (IPD) Cebu. (Photo: IPD, University of San Carlos).



Above: an example of the I-siguro Da-an transitional shelter constructed on Bantayan Island by University of San Carlos, Institute for Planning and Design (IPD) Cebu. (Photo: R. Dodds)

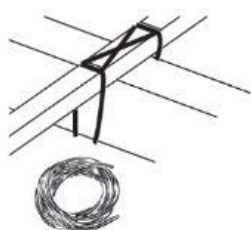
FURTHER READING:

8 Build Back Safer Key Messages, Page 2, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Q: How can the purlins and battens be tied down to the trusses and/or rafters? Why is this important?

**Thick galvanized wire
(multiple layers)**



A: The main job of the purlins is to secure the roof sheeting (CGI, nipa etc). They should be adequately tied down to the trusses and/or rafters in order to decrease the likelihood of the roof sheeting and purlins being lifted off the building by strong winds. This can be achieved with galvanized metal strapping, custom-fabricated or proprietary galvanized steel fixings, timber cleats, rope, nylon fishing wire or thick galvanized wire.



Left: The timber roofing batten has been tied-down to the timber rafter with galvanised tie wire. Credit: LandsAid housing project, San Remigio, Cebu. (Photo: W. Lechner).



Left: The timber roofing purlins are tied down to the rafters of this shelter using salvaged pieces of steel strapping. Credit: YPDR/PAH Phase 3 housing project, Bantayan Island, Cebu. (Photo: R. Dodds)



Left: A sample of thick PVC coated galvanised wire found in Tacloban. (Photo: R. Dodds)

FURTHER READING:

8 Build Back Safer Key Messages, Page 2, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

BRACING THE BUILDING

Q: Why is it recommended to install bracing between the posts of raised shelters?

D When on stilts, brace between the posts



A: Raising a building on stilts can result in increased lateral loading on the structure caused by strong winds, earthquakes, flooding, etc. Bracing between the posts therefore needs to be considered in order to increase the building's resistance to lateral forces, reducing the likelihood of the building toppling sideways off its base.

FURTHER READING:

8 Build Back Safer Key Messages, Page 3, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Q: How can the walls of the building braced? Why is this important?

A Brace each wall



A: This type of bracing increases the building's overall resistance to lateral forces (caused by earthquakes and typhoons), reducing the likelihood of the walls of the building deforming like a parallelogram (refer to photo below). This deformation can typically lead to collapse of the shelter as the walls lose their structural integrity and are no longer able to support the weight of the roof. Cross bracing should be installed as indicated in the diagram, from a strong connection (such as at the connection of post and roof beam) to another strong connection, at an angle of approximately 45 degrees.



(Photo: W. Lechner).

FURTHER READING:

8 Build Back Safer Key Messages, Page 3, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Q: Can plywood be used to brace walls?

A: Yes, this is a common construction detail in residential construction around the world **but should only be done with structural plywood**. Typically, structural plywood is labelled and certified as such and has a thickness greater than 10mm. This can vary from one manufacturer to another depending on technologies used in the production of the plywood. To effectively brace the walls, the plywood should be fixed to studs spaced at a certain interval with a nailing pattern (considering size and quantity) prescribed by a civil/structural engineer.

Plywood which is less than 10mm thick and not designed for structural use will not effectively brace timber framed walls. Furthermore, if it is installed onto the exterior wall of the building and not painted, it will rapidly warp and degrade due to repeated exposure to moisture and sunlight.

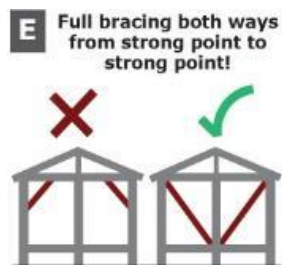
It is therefore recommended to consider using more traditional bracing techniques in shelter construction such as those indicated in the 8 Build Back Safer Key Messages.

FURTHER READING:

Key messages for commonly used shelter materials: Plywood

<http://sheltercluster.org/sites/default/files/docs/Key%20Messages%20Plywood%20V1.1.pdf>

Q: Why is full-height bracing recommended over knee bracing?



A: The diagram on the left illustrates two techniques used to brace timber framed walls: knee bracing and full-height bracing. Both techniques work against wind loads, but full-height bracing is generally more efficient and effective.

Full-height bracing reduces the demands in the connections quite significantly as the lateral load is absorbed by the entire wall plane. Ideally, the braces should be nailed into studs and posts as they traverse the wall, in order to lessen the loads on the joints.

Knee bracing can induce bending in the columns and beams to which it is attached, leading to their failure during earthquakes and typhoons. The columns and beams could be oversized to resist bending induced by the knee bracing but this may not be the optimal solution if using coco lumber considering that it is quite weak in bending and increasing the cross sectional area of the beam or column might not be possible due to the composition of coconut palms and the soft, non-construction grade lumber found in the centre of the palm.

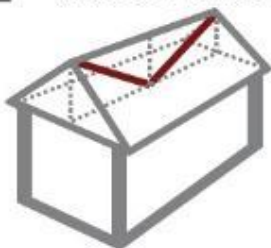


Left: Bracing has been installed from strong point to strong point. Tagpuro Transitional Site, Leyte - All Hands Volunteers in partnership with IOM, Operation Blessing and Samaritans Purse. (Photo: R. Dodds).

FURTHER READING:

Q: Why is bracing in between trusses important?

C **Brace between roof trusses or rafters**



A: This type of bracing helps prevent the trusses from being pushed over or pulled apart by strong winds and other lateral forces, particularly in gable-ended structures.



Left: Cross bracing has been installed between the trusses of this gable-roofed structure. PRCS/IFRC Haiyan Core Shelter Programme, San Remigio, Cebu (Photo: R. Dodds).

FURTHER READING:

8 Build Back Safer Key Messages, Page 3, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Q: Why is it recommended to install bracing below the roof in the plane of the roof sheeting?

B **Brace below the roof**



A: This type of bracing installed under or between the top chords of the trusses, from the apex of one truss to the end of the other, provides overall stability to the roof and helps prevent lateral buckling of the top chords during strong winds.



Left: Bracing has been installed below the roof, in the plane of the roof sheeting. PRCS/IFRC Haiyan Core Shelter Programme, Tabontabon, Leyte. (Photo: R. Dodds)

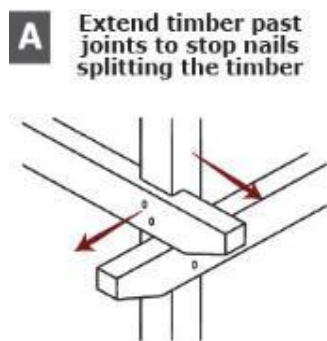
FURTHER READING:

8 Build Back Safer Key Messages, Page 3, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

USE STRONG JOINTS

Q: How can the floor and roof beams be strongly jointed to the columns?



A: One of the key points to keep in mind for this connection is not to cut too much timber away from the column when notching in the floor and roof beams, as this will significantly reduce the strength of the column. In the diagram on the left, a maximum of one third of the thickness of the column has been cut away where the beams are notched in. One beam is placed below the other, the beam below effectively supporting part of the weight of the beam above. The beams extend beyond the column so that the connections (nailed or bolted) don't occur too close to the end, reducing the likelihood of splitting the timber.



Left: An example of floor beams not extending past the column, and being nailed too close to the end of the piece of coco lumber, causing it to split, consequently losing strength.



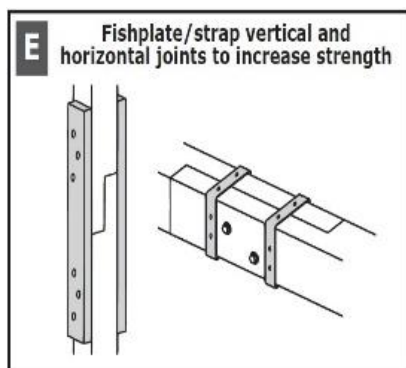
Left: A good example of how to connect floor and roof beams to the top of concrete columns. Here, a galvanised steel anchor has been cast into the top of the column and will be bolt-connected to the timber beam.

FURTHER READING:

8 Build Back Safer Key Messages, Page 4, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Q: What are some methods for joining timber beams together in order to extend them?



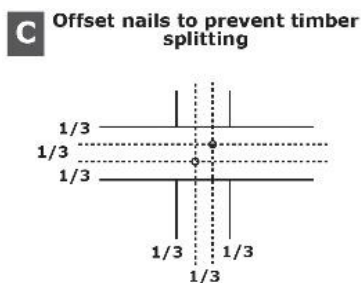
A: Sometimes it's necessary to join 2 pieces of timber together, particularly when spanning large distances. If not carefully jointed, these timber elements might not perform well against lateral wind and earthquake loads which will typically pull them apart. When connecting two pieces of timber together in order to extend their length, consider nailing or bolting timber cleats (fishplates), steel plates or wrapping steel strapping over the connection in order to achieve a strong joint.

FURTHER READING:

8 Build Back Safer Key Messages, Page 4, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Q: What are some tips to minimise splitting of lumber while nailing?



A: As illustrated in the diagram to the left, splitting of timber can be reduced by avoiding in-line nailing, and nailing too close to the end of the piece of timber. As a rule of thumb, try offsetting the nailing pattern (one up, one down), with nails spaced at $\frac{1}{3}$ the thickness of the timber.



Left: An example of in-line nailing and nailing too close to the edge, causing the coco lumber cleats to split. (Photo: R. Dodds)

FURTHER READING:

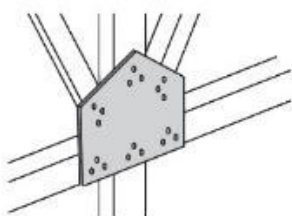
8 Build Back Safer Key Messages, Page 4, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

A GOOD HOUSE NEEDS A GOOD ROOF

Q: How can the members of trusses be strongly jointed? Why is this important?

F Use gusset plates to strengthen joints



A: In order to strengthen the trusses of the shelter, consider installing gusset plates and an adequate quantity of nails at every connection between web members and top and bottom chords. This will help to hold the truss together, countering forces of strong winds.



Left: Large plywood gusset plates have been installed on this timber truss, strengthening every connection between the web members and top and bottom chords. “Building Back Better in Tacloban: Post Haiyan Community Rehabilitation,” Plan International, Tacloban (Photo: C. Dewast)



Left: Example of a timber truss in Tacloban whose web members were ripped apart by Typhoon Haiyan/Yolanda. This might have been prevented had the joints been reinforced with adequately nailed gusset plates. (Photos: R. Dodds)



Left: Salvaged pieces of steel have been used as gusset plates in this temporary shelter. Credit: Shelter Self Recovery Assistance to Haiyan Affected Communities by GREEN Mindanao in partnership with Oxfam (Photo: R. Dodds)

FURTHER READING:

8 Build Back Safer Key Messages, Pages 4 and 5, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Q: Why is it important to support the trusses with columns directly below?

A: In order to more effectively transfer the loads of the trusses to the ground and create a stronger joint, more resistant to uplift forces of strong winds, consider positioning full-height vertical wall studs or columns directly below the roof trusses. Galvanized steel strapping (or equivalent tie-down material) can then be wrapped around the top of the truss and nailed down the sides of the column or stud.

FURTHER READING:

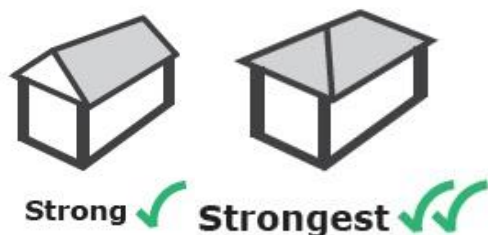
8 Build Back Safer Key Messages, Pages 4 and 5, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Q: What is the best roof shape and why?

A: Between gabled and hipped roofs, there are certain practical advantages that each possess and both are relatively reliable if constructed well to sustain wind loads. For thatched (nipa) roofs, hips seem to be preferred and gable makes sense for corrugated galvanised iron (CGI) sheets as it's less wasteful and easier to install. In

general a gable roof is fine as long it is well built and braced. It is also a good practice to construct the gable panel to be made as one (rather than a rectangular panel with a truss balanced on top).



Above left: a gable roof, **Above right:** a hip roof

FURTHER READING:

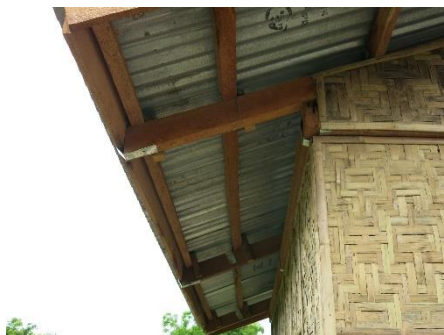
8 Build Back Safer Key Messages, Page 5, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Q: Why is it recommended to use more nails near the edges of the roof sheeting?



A: During a typhoon, the greatest uplift forces, therefore failure of the roof, occur around the perimeter of the roof. A common way to counter these forces is to add more nails and structure to nail in to (roofing purlins & battens) in this area. Consider installing a double purlin/batten at both the bottom and apex of the roof so that more nails can be added. It is preferable to add a second purlin/batten rather than simply adding more nails in the bottom and top purlins as the latter might lead to splitting of the timber and decreased resistance of the roof to uplift forces.



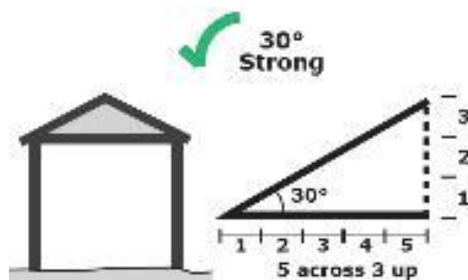
Left: The last 2 roofing battens have been placed closer together so that more nails could be installed near the edge of the roof. Credit: LandsAid housing project, San Remigio, Cebu. (Photo: W. Lechner)

FURTHER READING:

8 Build Back Safer Key Messages, Page 5, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Q: What is the best roof pitch for typhoon prone areas? Is the same pitch recommended for both nipa and corrugated galvanised iron (CGI)?



A: A moderate roof pitch of around 30 degrees has been found to perform better than very low roof pitches and the leeward side of steeply pitched roofs, which are exposed to greater suction forces during typhoons.

If using nipa, a minimum roof pitch of around 40 degrees is necessary to drain

the water off the roof. A pitch less than this may encourage water to soak through the nipa shingles and enter inside the house.

If the householder initially installs nipa shingles on a roof with a pitch of around 40 degrees, then later replaces the nipa for CGI or other non-permeable materials, the roof will become more susceptible to high suction forces during strong winds. Agencies installing nipa shingles during the recovery phase are therefore recommended to inform the beneficiary of this potential future risk.



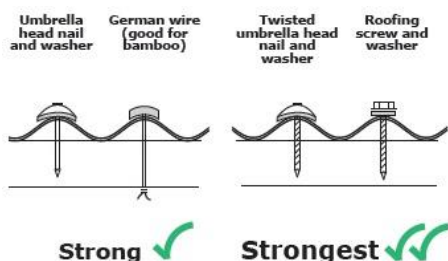
FURTHER READING:

8 Build Back Safer Key Messages, Page 5, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

Key messages for commonly used shelter materials: Nipa

<http://sheltercluster.org/sites/default/files/docs/Key%20Messages%20Nipa%20V1.1.pdf>



Q: Which roofing nails are the most suitable for typhoon prone areas?

A: Roofing screws are often recognised as the strongest method of securing roof sheeting to the roof structure, but are not always available in the marketplace, are more expensive than nails and can be more difficult to install especially without the aid of electricity and

power tools. In the absence of roofing screws, twisted length is selected according to the type of roof sheeting and cross sectional size of roof structure below. German wire (pictured to the right) is recommended for fastening roof sheeting to bamboo structure which might otherwise easily crack when nailed. It is important to carefully install them, making sure that the two ties are long enough and are adequately wound together.

Other options such as regular nails are not recommended as they aren't designed for this purpose. Due to the smoothness of the shank and their small head size, they provide little to no resistance (or support to the CGI sheet) against the uplift forces of strong winds and as a result do not effectively hold the roofing sheets down in strong winds.

FURTHER READING:

8 Build Back Safer Key Messages, Page 5, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

BE PREPARED – DISASTER PREPAREDNESS

Q: Why are evacuation and disaster preparedness plans necessary/recommended?

A: Evacuation and disaster preparedness plans are particularly pertinent for families living in shelters constructed in areas of high risk as they outline potential life-saving steps that should be taken by the family before, during and after natural disasters.

It is highly recommended that these plans are created in collaboration with beneficiaries of shelters as a part of any shelter program but especially in areas of high risk.

FURTHER READING:

8 Build Back Safer Key Messages, Page 9, Shelter Cluster

http://sheltercluster.org/sites/default/files/docs/8%20Key%20Messages%20Posters_Final_V1.1_Light.pdf

SIZING OF TIMBER ELEMENTS

Q: Why is the timber floor bouncy?

A: If the timber floor of a shelter bounces or is flexible when stepped on, it is probable that there isn't enough structure holding the floor up. This may mean that the posts/bearers and joists are spaced too far apart, or the cross sectional area of the timber pieces used in the floor structure is too small. This bounce might encourage the householder to prop the floor up from below with coco lumber stumps, in effect creating easy passage for the entry of termites into the structure.

If the floor is bouncy, consider reducing the spacing of the posts and floor joists or increasing the cross sectional area of the structural floor members.

SHELTER TRAINING

Q: Which training is relevant for my shelter program?

A: The type of training is normally determined by a range of program-specific factors including who will receive the training (skilled and unskilled workers, special needs groups, beneficiaries, volunteers, professionals, trainers, teachers, government staff, etc), and the competencies to be imparted (carpentry skills, knowledge of build-back safer principles, management of teams, training of other team members, monitoring and evaluation, project planning, project management, communication, etc).

Different shelter types, construction systems and implementation modalities will generally require different trainings, for example, if the beneficiary will be responsible for the construction of their house (a lightweight timber framed shelter), a training focussing on build-back safer concepts would be recommended in order to introduce and/or reinforce some of the key messages for constructing more safely in a typhoon prone area.

It is recommended to consider training as an integral part of any shelter program, and to factor it into the project timeframe and budget when planning the program.

FURTHER READING:

Generic Guidelines for Training

<http://sheltercluster.org/sites/default/files/docs/Generic%20Guidelines%20for%20Training%20V2.pdf>

CONSTRUCTION MATERIALS AND TOOLS

DURABILITY AND MAINTENANCE OF SHELTERS

Q: How can the durability of a shelter be increased?

A: The durability of a material is normally dictated by its quality (natural durability), construction detailing and how it is protected and maintained.

In order to ensure that good quality materials are selected, a sound quality control process should be put in place. Ideally, a technical staff member should be assigned to oversee the delivery of construction materials and reject those materials which don't conform to the agreed standards. A common method to set agreed standards with suppliers is to request a sample of each product during the tender phase, against which all materials delivered for the project can be measured. Taking the time to specify good quality materials in the planning and procurement documentation can make a great difference to the durability of the shelter. Conversely, poorly specified materials and lack of attention to these documents will likely lead to the purchase of lower quality materials, greatly reducing the durability of the shelter.

Generally, all timber should be treated in order to protect it from termite infestation and rot. Please refer to the [Timber](#) section for further information on this.

Q: What are some key points for maintenance of shelters?

A: For timber buildings:

- Regular termite inspections (at least once per month) under and inside the building are crucial.
- Start at the **foundations** making sure that the timber isn't in direct contact with the soil and moisture. Check for any mud tunnels on the timber, brushing them off if present. Mud tunnels are a sign that termites are already present and remedial actions should be taken (e.g. bait the termites and repair/replace any damaged sections of timber. Make sure that dirt and mud hasn't covered the concrete foundation and that there is a clear separation between the timber and the ground. Clear away mud and dirt and if the same problem persists, consider raising the height of the concrete footing/pedestal.
- Check for termites inside the building.
- **Posts:** Inspect for rotting, especially at the base and the connection to foundations
- **Anti-termite protection:** Regularly treat posts with locally recognised products such as solignum
- **Painting:** Applying paint to timber structures doesn't guarantee termite protection, it can however protect the timber from the effects of weathering
- **Fastening:** Regularly check that nails, screws and bolts are still adequately fastened, if not re-hammer, re-screw or tighten. Particular attention should be given to the crucial structural elements such as tie-downs, bracing and superstructure
- **Doors and Windows:** Check that they are opening and closing correctly and can be locked shut or easily opened in the event of a storm. Oil hinges, tighten screws, repair fasteners as required
- **Roofing:** Regularly check that nails and screws are still adequately fastened, if not, re-hammer or re-screw them in. Replace or repair any damaged/rusted sheets.
- **Safety:** Remove tall trees around the house, or trim them to a safe height. Make sure that trees aren't undermining the foundations of the house. Do not leave loose, heavy objects in the yard at close proximity to the shelter
- **Environmental Health:** Empty all water catching objects around the house to minimize the risk of dengue

- **Handover maintenance kit:** Consider providing beneficiaries with a kit including basic tools necessary for the maintenance of their house, such as a screwdriver, hammer, wrench etc.
- Develop a **maintenance manual** with the family which outlines key features of their house which need to be maintained, and an indicative timeframe for periodic maintenance (i.e.: daily, monthly, annually). This manual might also describe how the shelter can be safely extended in the future.

COCO LUMBER

Q: We would like to use coco lumber in our shelter program. Is there a milling program which can supply us with coco lumber?

A: Yes, UNDP currently have a milling program and you can find out more by getting in contact with them. Please see contact details below:

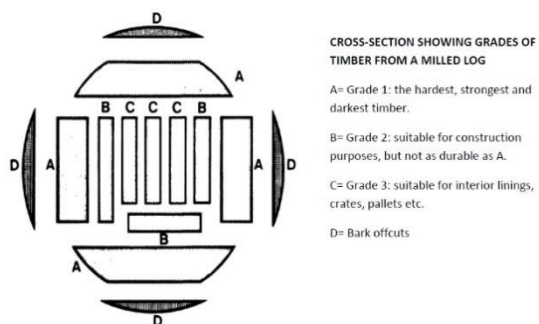
Adam Marlatt
UNDP Coco Lumber Milling Program
amarlatt@globaldirt.org
Adam.marlatt@undp.org
Mobile Number: 0915 841 2572

Q: What is the difference between good and low quality coco lumber?

A: Good, construction-grade coco lumber is that which is typically milled from the base and outer section of older coconut palms. Lower quality coco lumber on the other hand is sourced from younger palms, or the centre and top layers of an older palm, is very soft and not considered to be a construction-grade material. Generally, it will not survive more than 2 years on site and should not be used for structural members.

In order to select good quality coco lumber, it is recommended to put in place a system of quality control, assigning a technical staff member to oversee the selection and delivery of coco lumber to the building site, rejecting pieces which don't conform to the agreed standards.

Selection of good quality, Grade 1 (A) coco lumber will likely increase the overall cost of the shelter.



The diagram above illustrates the various grades of coco lumber, A (Grade 1) around the outside of the tree being the most durable, and C (Grade 3) in the centre of the tree being the softest and not suitable for use in construction.

FURTHER READING:

Coco lumber Technical Working Group Report, Early Recovery and Livelihood Cluster and the Shelter Cluster

<http://sheltercluster.org/sites/default/files/docs/Coconut%20Lumber%20Technical%20Working%20Group%20Report%20Feb%202014.pdf>

Minutes of technical working group meeting on coco lumber

http://sheltercluster.org/sites/default/files/docs/TWIG%20Cocolumber_Minutes%20140616.pdf

PCA cutting patterns

<http://sheltercluster.org/sites/default/files/docs/PCA%20CUTTING%20PATTERN%202014%20compressed.pdf>

TIMBER (LUMBER)

Q: Is it advisable to use oregon and meranti (locally known as lauan) instead of coco lumber?

A: Kiln dried oregon is a conifer and hence a **softwood** and like most softwoods is not suitable for in ground or exposed exterior usage unless treated. This is particularly true for plantation oregon from countries like New Zealand where it grows rapidly and has wide growth rings, reducing its strength grading and rendering it more susceptible to pests.

Meranti is a generic market name for around 25 of the 180 varieties of the **Shorea family** that are sold as commercial timber. It is a rainforest **hardwood**, (angiosperm) found across most of South-east Asia. Generally meranti is not all suitable for unprotected outdoor use whether above or in ground. This is particularly true in the tropics due to a wider variety of pests and higher humidity. There are a few varieties such as dark red meranti from Kalimantan that are more pest-resistant in their old-growth form. But again old growth versions of these timbers are increasingly rare and purchasing them should be avoided.

The difficulty in buying timber is one of the reasons many agencies appear to have turned to concrete for corner posts or community based procurement. The former reduces the flexibility of the structure and should be used in conjunction with ring beams. The latter sheds responsibility to the householder who faces the same dilemma as you and may readily turn to illegal logging.

Sorry there is no easy answer on this one. Again it's one reason why so many agencies have turned to coco lumber which if well selected can be quite durable. Obviously treatment and design for protection from rain and ground water will greatly increase durability.

FURTHER READING:

www.humantiantimber.org

Q: Is hardwood readily available in the Philippines?

A: Before procuring hardwood in the Philippines, it is recommended to contact the DENR (Department of the Environment and Natural Resources) and CENRO (Community Environment and Natural Resources Office) in your area. They will be able to inform you of the appropriate procedures, for sourcing, cutting and transporting hardwoods including which kind of trees are permitted for construction in the Philippines. In some cases they might also have information on certified accredited suppliers or farmers. PRESIDENTIAL DECREE NO. 705 explains the appropriate practices for harvesting, logging, and transporting hardwoods. In most case this practice will required permits from DENR.

It seems that there are two main hardwood species used in the Philippines for construction: mahogany and lauan. The advice is that only plantation timber (farmer trees) may be harvested for construction. Again this should be confirmed by DENR and CENRO.

It is recommended to request certificates (detailing the origin of the tree, how it was harvested, milled and transported) from the suppliers in order to be sure that the trees have been milled in accordance with relevant legislation.

FURTHER READING:

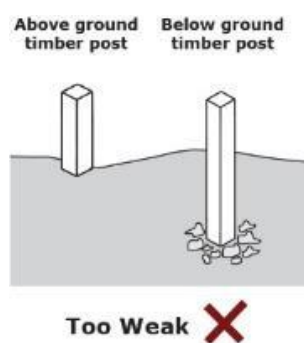
REGISTERED TREE PLANTATION:

http://www.rainforestation.ph/resources/pdf/other/denr_tree_registration.pdf

PRESIDENTIAL DECREE 705 AND SELECTIVE LOGGING OF MAHOGANY:

<http://www.gov.ph/1975/05/19/presidential-decree-no-705-s-1975/>

Q: Why is it necessary to protect timber/lumber? How can this practically be done in the Philippines?



A: When wet, and in contact with soil, timber is very attractive to termites, insects and fungi. Furthermore, constant, repeated exposure to humidity and direct sunlight can greatly decrease its durability.

Timber can be protected and its durability increased by:

- Designing the building to protect the timber elements. For example, ensure that the posts aren't inserted directly into the soil where groundwater and termites can easily enter but instead connected to a concrete footing well above the level of the ground, allow a generous roof overhang where possible in order to protect the walls, ensure that timber is separated from other elements and there aren't any dark corners for termites to hide in, keep the timber dry during construction and carry out routine maintenance.
- Selecting naturally durable timbers
- Protecting it with a timber preservative treatment such as the locally available solignum or painting it with an exterior paint. Both these methods will need to be renewed regularly based on local site conditions and manufacturer's specifications.

FURTHER READING:

Product Specification for Solignum

<http://jardinedistribution.com/wp-content/uploads/2013/04/Solignum.pdf>

CHAINSAWS AND TABLESAWS

Q: Why are chainsaws and table saws regulated in the Philippines?

A: Chainsaws and table saws must be registered with the PCA (Philippine Coconut Association) to reduce the likelihood of illegal logging. Please note that exploiting downed coconut trees also requires a permit from PCA.

FURTHER READING:

Implementing Rules and Regulations of the Chainsaw Act of 2002 (RA 9175)

<http://lamp.denr.gov.ph/pol03/DAO/dao24.PDF>

BAMBOO

Q: What are some of the main types and applications of bamboo in shelter projects in the Philippines?

A: With the tensile strength of mild steel and a three to five year growth cycle per column, when culturally acceptable and regionally available bamboo can be an ideal resource for shelter construction¹

Butung (*Dendrocalamus Asper*): is a species that grows commonly across the whole of Southeast Asia, In Indonesia it is known as Putung though can be referred to simply as asper. It grows 20-30m tall and is around 20cm at base, though commonly 10-15cm along its length. Ideally harvestable after 3 years in a 3-3-3 pattern, it is quite a thick walled species particularly at the base, where it can be up to 3.5cm thick, though averaging more like 1.5-2cm along its length. Butung has an internode spacing of around 30-50cm. The largest bamboo buildings in the world at Bali Green School are built from this species. It's a great bamboo for posts and main beams.

Kawayan (*Bambusa Blumeana*): is a smaller species of bamboo used more commonly for rafters, purlins and studs. It grows to around 15-25m with closer internodal spacings of around 25-35cm but it still has quite thick with 2-3cm walls. It's a thorny raggedy plant to grow, nowhere near as majestic as butung, (particularly black butung) but is a good sound structural timber. Ideally harvested in a 4-4-4 regime with 1/4 of the culms harvested each year at 4 years old

Treatment: Whether to treat or not treat bamboo is a common discussion in humanitarian circles. For emergency or even temporary shelters untreated bamboo is more than adequate particularly if the other steps described here to protect and value the material are undertaken. Treatment should be considered for core houses and temporary shelters that are in all likelihood likely to become permanent.

Treating bamboo does not change the need to protect and value the material at all stages of usage as most treatments are water based and will wash out of not protected from rain and ground water.

Treatment can be divided into two types; surface and penetrative. Surface treatments such as the application of solignum, sump oil, paint, varnish or other chemicals are not as effective as penetrative treatments and require regular top up treatments. They should be applied in a diluted form to ensure as deep penetration as possible. Focus should be given to joints, ends, cracks and nodes as this is where most pest infestation will occur.

Penetrative treatments involve soaking the bamboo in a chemical long enough for the chemical to soak through the entire structure of the culm. Toxic pesticides and preservative chemicals such as copper arsenic may be used as may pressure treatment systems. Soaking in a solution of Borax and Boracic acid is a much more common and less harmful method and is generally more suitable to the humanitarian context.

FURTHER READING:

INBAR The International Network for Bamboo and Rattan

<http://www.inbar.int/>

Humanitarian Bamboo: A manual on the Humanitarian Use of Bamboo in Indonesia⁷

<http://humanitarianbamboo.org/wp-content/uploads/20010/04/Humanitarian%20Bamboo%20Draft%20%20small.pdf>

Fact Sheet 1: Bamboo. Dave Hodgkin, Humanitarian Benchmark Consulting, IOM Technical Advisor

<http://humanitarianlibrary.org/sites/default/files/2014/02/Bamboo%20fact%20sheet%202.pdf>

AMAKAN

Q: What are some of the advantages and disadvantages of using amakan for shelter projects?

A: Amakan is a great product whose durability is related to quality of the base material and that is dependent on a range of factors such as time of year and day when it was picked, stored, and installed. It is important to note that compared to plywood that might have some bracing effect, the amakan has none. Amakan will however allow some wind to pass through, reducing wind loads on structures but reducing protection and privacy to families.

FURTHER READING:

Key messages for commonly used shelter materials: Plywood

<http://sheltercluster.org/sites/default/files/docs/Key%20Messages%20Plywood%20V1.1.pdf>

WALL CLADDING OPTIONS

Q: What are some of the advantages and disadvantages of plywood as a cladding material?

A: Some advantages of plywood include ease of handling and assembly, it's readily available in a range of standard sizes and thicknesses and structural plywood can serve the dual functions of cladding and bracing.

Some of the disadvantages include cost (imported plywood can be relatively expensive for the householder to replace), it doesn't allow adequate ventilation in hot and humid climates, it uses hardwood veneers which are depleting in the Philippines, it is bonded with chemical adhesives that can have negative environmental and health consequences, if untreated/not painted, can rapidly warp and decay within a few months, therefore it needs to be painted in order to seal it and to further protect it from the elements, prolonging its life. Again, this might be unaffordable for the householder.

FURTHER READING:

Key messages for commonly used shelter materials: Plywood

<http://sheltercluster.org/sites/default/files/docs/Key%20Messages%20Plywood%20V1.1.pdf>

Consumer's Guide, Product Quality and Safety: Plywood. Bureau of product standards Department of Trade and Industry, Philippines

http://www.bps.dti.gov.ph/information-materials/doc_download/9-consumers-guide-on-plywood.html

CONCRETE HOLLOW BLOCKS

Q: We are using concrete hollow blocks in the comfort room. Is it advisable to render them to stop them disintegrating over time due to constant exposure to water?

A: If the concrete hollow blocks are of a good quality, coming into contact with a bit of water from the latrine and periodic cleaning of the comfort room (CR) over time shouldn't be a huge issue. In saying this, it wouldn't be a bad idea to consider rendering/plastering the wall of the CR to a height of at least 1m, making the surface less porous therefore easier to maintain and clean.

FURTHER READING:

Key messages for commonly used shelter materials: Concrete Hollow Blocks (CHB)

<http://sheltercluster.org/sites/default/files/docs/Key%20Messages%20CHB%20V1.1.pdf>

TENTS AND PLASTIC SHEETING

Q: What are some good practices for installing plastic sheeting?

A: Below are some key recommendations:

1. For many people this might be the entire shelter assistance they receive, so we should use this opportunity to assist people to use the plastic sheeting in a way which ensures it will last as long as possible while they rebuild their new house. Sometimes, this process may take up to 2 years or more.
2. Agencies should ideally aim to deliver plastic sheeting to Barangay level and include orientation sessions with the communities. These sessions can be as short as 15 minutes.
3. Some key messages for use in communication with beneficiaries:
 - Prevent slack: plastic sheets should be fixed properly so they are taut and not destroyed by wind
 - Type of fixing used must spread the load on the sheets (use washers, bottle caps, cut-up rubber sandals, etc, and battens) to avoid tearing the sheet.
 - If reinforced strips in plastic sheeting exist, fixings should be placed within these strips and again should incorporate load spreading items such as washers and battens.
4. As part of the emergency preparedness strategy, it is advisable to keep a stockpile of guidance materials outlining best practice for the installation of plastic sheeting and tarpaulins with the plastic sheeting and tarpaulins, for distribution to beneficiaries. Please refer to the links below for examples of such guidance materials:

English guidance sheet 1:

http://sheltercluster.org/sites/default/files/docs/IEC%20Fixing%20Plastic%20Sheeting_1%20pager.pdf

Tagalog guidance sheet 1:

http://sheltercluster.org/sites/default/files/docs/Fixing_plastic_sheeting_tagalog.pdf

English guidance sheet 2:

<http://sheltercluster.org/sites/default/files/docs/131116%20IEC%20-%20Tarpaulines.pdf>



GROUND MAT: Tarpaulins can be used for walls and floor covering, helping to keep people dry. For more tips on using tarp as ground mat, see page 29 of the IFRC Shelter Kit Guidelines.

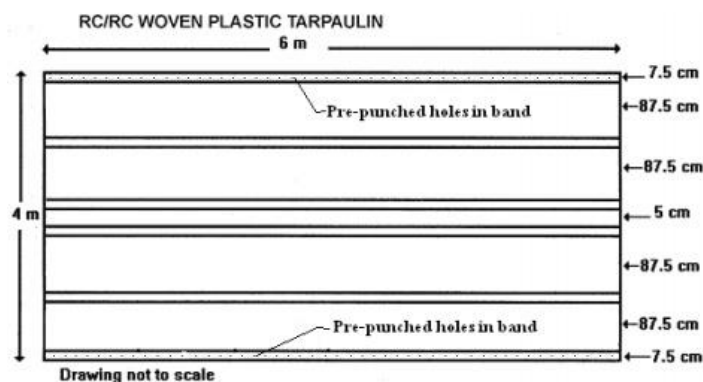
FURTHER READING:

IFRC Shelter Kit Guidelines, page 29 (tarpaulins as ground mats)

<http://www.ifrc.org/PageFiles/95530/Sidebar/171800-IFRC%20shelter%20kit-LR-EN.pdf>

Q: Is there a prescribed minimum standard specification for tarpaulins?

A: Tarpaulins are made of woven plastic and are a key component of the shelter kits of various agencies. They can be used for roofing, walls and floor covering, and sometimes even for rainwater harvesting. Please refer to the linked documents below for some recommended tarpaulin specifications which came out of an inter-agency research project between IFRC and Oxfam.



Left: ICRC/IFRC Plastic Sheeting and Tarpaulin specification

FURTHER READING:

IFRC Shelter Kit Guidelines, page 56 (tarpaulin specification)

<http://www.ifrc.org/PageFiles/95530/Sidebar/171800-IFRC%20shelter%20kit-LR-EN.pdf>

Plastic Sheeting: A guide to the specification and use of plastic sheeting in humanitarian relief

http://plastic-sheeting.org/ref/Plastic_Sheeting_2007.pdf

Q: What are the options for recycling/disposal of tents and plastic tarps?

A: Most tents are made of composite materials that can't easily be recycled, if possible reusing them might be more practical:

1. Tents that are not totally ripped apart can be easily repaired with stitching and taping and used for non-intensive purposes. Local schools and scouting clubs might also be interested in having them. They will have both the time and the knowhow to repair them. However, it's advisable that the tents are cleaned well with water and disinfected before being handed over to someone else for reuse.
2. The tents that are damaged without any hope of repair will still have some valuable material such as zippers, cords, stainless steel rings and even good fabric that local scavengers may be interested in. Best thing is to ask the previous users of the tent whether they know of someone who would take it.
3. Disposal should be the last option. In that case the best is to pack them tightly and hand over to garbage trucks. Tents should not be burnt or buried onsite under any circumstance.

FURTHER READING:

Plastic Sheeting: A guide to the specification and use of plastic sheeting in humanitarian relief

http://plastic-sheeting.org/ref/Plastic_Sheeting_2007.pdf