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Briefing Paper

Post-disaster construction and sustainability – An account from the Philippines

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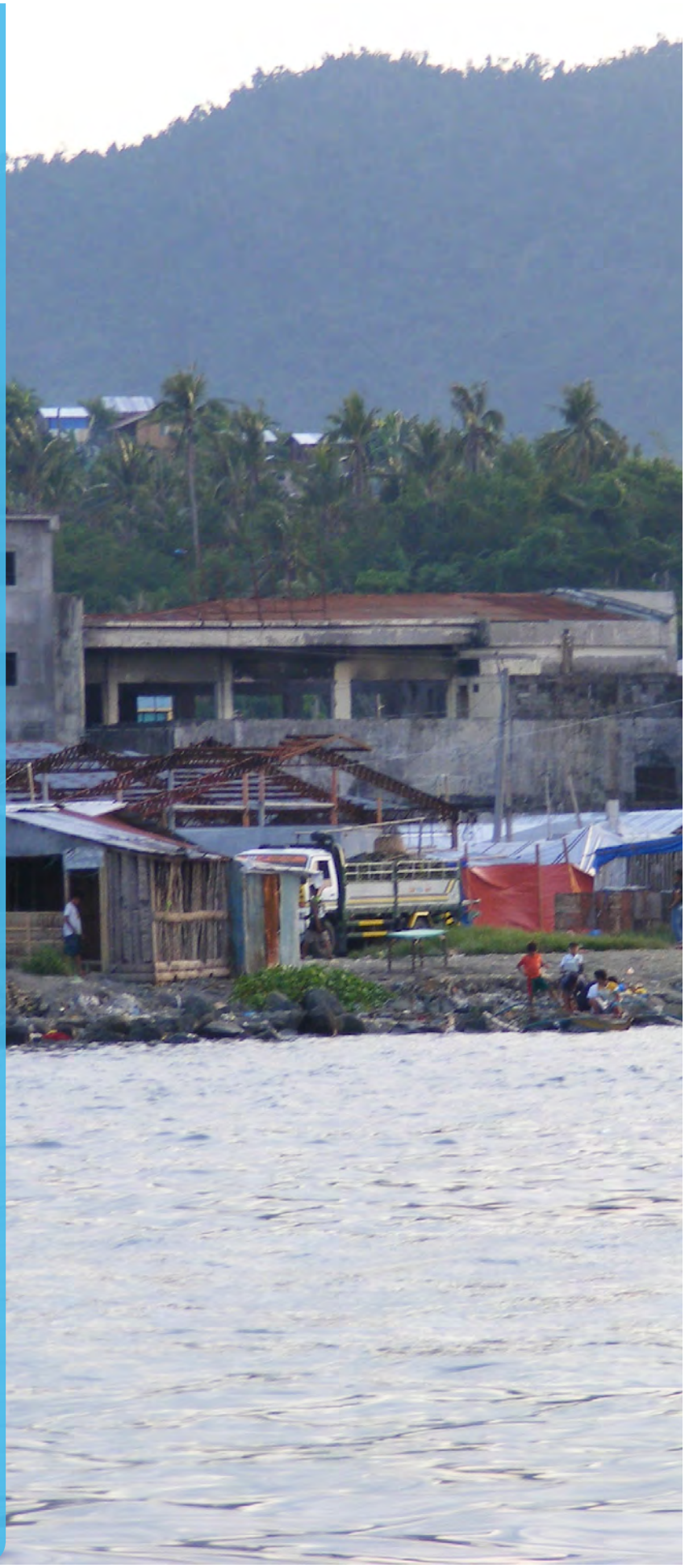
Contents

On the 8th November 2013, one of the strongest storms ever known to landfall, Typhoon Haiyan, locally referred as Yolanda, hit the Eastern Visayas region in the Philippines. It destroyed over a million homes, displacing 4.1 million people*, equivalent to over half the population of London.

Nine months later, I had the privilege of travelling to the Typhoon affected areas as a Technical Advisor to support the Shelter Cluster Philippines. The purpose of my deployment was to undertake the research needed to develop technical briefing papers on the most commonly used construction materials in shelters, that are concrete, concrete hollow blocks, coco lumber, Nipa (mangrove palm) and Amakan (bamboo matting). My site visits and discussions made it clear as to why this guidance was required to support the recovery process. This briefing paper outlines my experience and observations from travelling, discussions with people who were directly affected from Yolanda and humanitarians who are helping to rebuild the affected communities.



* Typhoon Haiyan Strategic Response Plan, The Philippines, Philippines Humanitarian Country Team (December 2013), http://reliefweb.int/sites/reliefweb.int/files/resources/SRP_2013-2014_Philippines_Typhoon_Haiyan.pdf

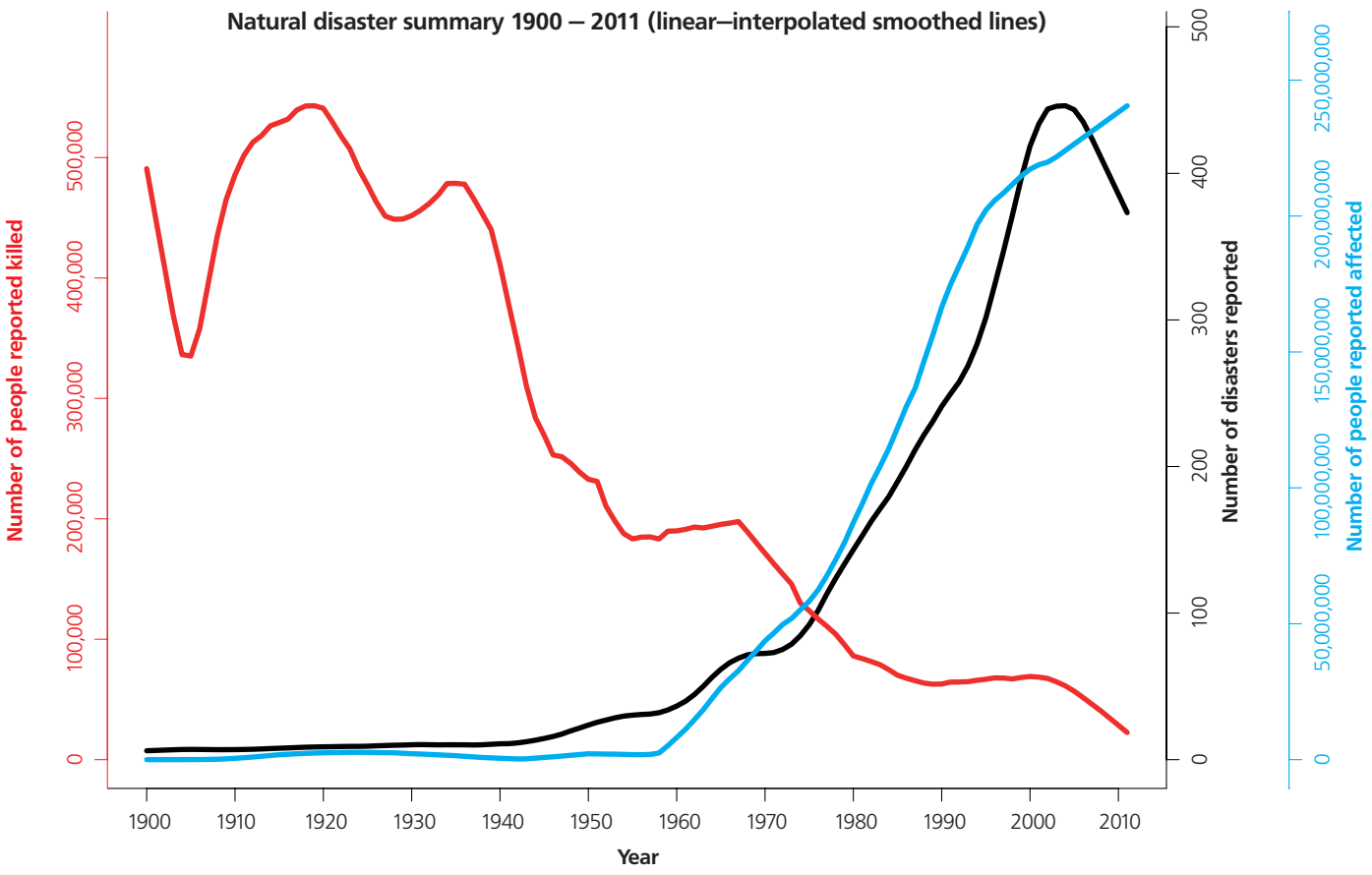
Context

> "The greatest glory in living lies not in never falling, but in rising every time we fall."
> Nelson Mandela

The Philippines is a country which is prone to an average of 20 storms a year. The Office of Foreign Disaster Assistance (OFDA)/Centre for Research on the Epidemiology of Disasters (CRED) (International Disaster Database estimated the economic damage as a result of Typhoon Haiyan at $10billion*. The Philippines Government requested $788million as aid to support emergency relief and the recovery process[1].

The intensity and impact from natural disasters is growing, undoing decades of development and destroying livelihoods. At a global level, it is estimated 226 million people globally are affected on average by disasters associated with natural hazards every year (Figure 1). This number is only likely to grow as 70 per cent of the world's population will be living in urban areas by 2050, many of which are areas already prone to earthquakes, cyclones, floods and droughts.

While hazards from geo-physical events (e.g. earthquakes, tsunamis and volcanos) and hydro-meteorological events (e.g. floods, cyclones, droughts) are natural, the risks from disasters including: loss of life, damage to property, infrastructure and livelihoods need to be managed to reduce the impact on communities. Sharing the learning from recovery and rebuilding actions after a disaster is vital in developing long term policies and implementing practical national and global actions in building resilient communities.



EM–DAT: The OFDA/CRED International Disaster Database – www.emdat.be
Université Catholique de Louvain, Brussels – Belgium

Figure 1 Natural disaster summary 1900-2011 (Source: http://www.emdat.be/natural-disasters-trends)

* http://www.emdat.be/result-country-profile?disgroup=natural&country=phl&period=1900$2014

Since Typhoon Haiyan

The Strategic Operational Framework (March 2014) reported in the 100 days following Typhoon Haiyan that humanitarian agencies provided emergency shelter supplies such as tents, tarpaulins to 570,000 households. So far, over 55,000 families have received tools and roofing materials to repair their own homes. More than 3,600 carpenters have been trained in the 'build back safer' method using a set of 8 key construction principles. Permanent or core shelters, of approximately 20 m^2 that can be extended by the beneficiaries, have been received by 2,000 families (10,000 people). *See 'Definitions' section at the end of this briefing paper for an explanation of what constitutes emergency, transitional, core and permanent shelters.*

In the Philippines, the majority of humanitarian agency activities are coordinated through the Shelter Cluster. This is led by the Department of Social Welfare and Development (DSWD) and supported by the International Federation of Red Cross and Red Crescent Societies (IFRC) for natural disasters and the International Organisation for Migration (IOM) as cluster co-leads.

The Strategy Response Plan (SRP) adopted for this typhoon response was to maximise the coverage of support for self-recovery through provision of shelter materials, additional monetary support and training assistance (Figure 2) rather than providing completed homes. The cash grants were either conditional on compliance with Building Back Safer standards, or unconditional for local purchase of tools, nails, coco lumber and Corrugated Galvanised Iron (CGI) sheets.

The Shelter Cluster in the Philippines coordinated the shelter response of agencies for the first year. Partners continue to deliver, safe, dignified and appropriate shelter to the affected population.

Figure 2 Training of women carpenters Source: © Shelter Cluster, Philippines

Shelters: Construction materials and methods

One of the fundamental challenges in delivering shelters is sourcing of good quality construction materials including coco lumber, concrete hollow blocks, aggregates, CGI sheets, hurricane straps, nails, and wire. The materials available in the open market are below the minimum specification recommended by the humanitarian agencies. The other challenge has been the local construction supply chain's lack of knowledge of techniques to build typhoon resistant shelters, such as the use of hurricane straps.

The volume of rebuilding needed after the typhoon also inevitably exerts additional pressure on natural resources. The construction material needed for recovery operations of roads, schools, hospitals and eventual rebuilding of permanent houses will coincide with the current construction boom experienced in major cities such as Manila. Many construction materials, such as sand and gravel, are currently extracted from sensitive ecological systems, such as rivers and streams that are already in a highly degraded state.

In the light of these challenges, the following section summarises the information gathered on some of the commonly used construction materials in shelters.

Structural elements

Coco lumber

15 million coconut trees were damaged beyond recovery and of the remaining damaged trees only 40% were assessed to be suitable for construction (Howe.C.2014). Post Haiyan, the industry processing coconut trees has seen a significant growth to cater for different needs, from construction to turning waste timber into charcoal. The Shelter Cluster's Draft Strategic Operational Framework (2014) for Transition post-Haiyan estimated that 4.5 million trees will need to be processed before the next typhoon season to aid self-recovery. The key findings were:

- Low grade coconut timber is not suitable for structural elements in shelter construction but it is suitable for other components like joists, doors, and window frames. No on-site tests can reliably differentiate various grades of lumber other than a visual inspection of vein structure, darkness of the wood, density and weight.
- Site visits indicated increased availability of low cost sub-standard timber (Figure 3) and use of this compromising the quality of shelters delivered. To overcome the issue of quality a number of agencies are choosing to procure coco lumber in bulk directly from licensed saw mills, or setting up fabrication yards to process locally sourced lumber on-site.
- Elements made using coco lumber (trusses, purlins, battens) need to have an adequate amount of ties to provide resistance to typhoons. This is achieved by tying the lumber to various elements within the shelter, including floor joists bottom plate of the wall, roof beam, battens and purlins. This was the most commonly identified issue across the Philippines with inadequately tied down shelters facing a high risk of the roofing lifting off and walls collapsing.

Figure 3 Examples of poor quality coco lumber for structural elements
Source: © Shelter Cluster, Philippines

Concrete

Concrete is widely used in shelter construction for foundations, columns, beams and ground floor slabs and screed. The key findings were:

- Sites visited during my deployment highlighted a mixed range of construction from well-managed, technically good quality concrete to poorly executed construction (Figure 4).
- The barriers were in ensuring the quality of concrete by selecting good quality aggregates, following recommended proportion of ingredients for mixing, compacting and curing to right period of time. It was common to find aggregates sourced from rivers, sea and coral, used which contain salt , or rich in lime for manufacturing concrete affecting the quality of construction.
- A number of core shelter projects had experienced local engineers with the knowledge of the national building code and design experience using concrete. This could be seen in the quality of finish and on-site quality control methods used to achieve the results.
- There are agencies adopting alternative construction methods such as lime plastering, where it is locally available, and bamboo reinforcements (Figure 5) in place of steel in concrete foundations are also installed in some of the core shelter projects

External walls

Concrete hollow blocks

Concrete Hollow Blocks (CHB), are one of the most extensively used walling materials in the Philippines. The key findings were:

- Core Shelters delivered by the agencies typically install CHBs between reinforced concrete columns to the window sill level, with lightweight walling materials such as timber framing cladded with amakan, plywood or bamboo installed above.
- The challenge is in making sure the wall is built to resist lateral loads from typhoon or earthquake. This is done by adding steel reinforcing bars vertically and horizontally to increase resistance of the building to lateral loads.
- Alternatives to concrete blocks are compressed earth or lime blocks, where these products are locally available (Figure 6). This also provides an opportunity to up-skill local labourers. This method requires close monitoring of manufacturing processes to ensure consistency with the quality of the blocks produced.

Figure 4 Examples of challenges using concrete – compaction, curing and lack of ties with blocks Source: © Shelter Cluster, Philippines

Figure 5 Example of bamboo foundation Source: © Kiru Balson, BRE

Figure 6 Compressed lime blocks ©Kiru Balson,BRE

Amakan (bamboo matting)

Amakan or woven bamboo matting has been used as a walling material for centuries in the Philippines. The key findings were:

- It works extremely well in the tropical humid climate. It is typically fixed to timber wall framing with external bamboo/coco lumber (1"x1") battens (Figure 7). The longevity of amakan can be improved by storing it dry, treating with insect resistant coating (some dip in sea water before installation), and then varnished.
- Due to its permeability, amakan walling helps to balance internal pressure within shelters during strong winds, potentially reducing damage to roofs.
- Although amakan is seen as a viable option for providing transitional shelters, some agencies are using amakan in core shelters.
- In spite of its merits, in terms of performance and ease of repair and replacement, there is a social stigma favouring materials such as plywood.

Plywood

Plywood is by far the most commonly used walling material by the agencies. The key findings were:

- The market availability of a wide range of products along with the ease of handling and assembly mean this a preferred option for external walling by many. Ironically, over half a century of extensive logging in the Philippines, since in the 1930s, has resulted in the Philippines becoming a net importer of wood and no longer able to export plywood.
- The challenge with using plywood is that if untreated, it can rapidly warp and decay (Figure 8). This can be seen widely in many shelters.
- The poor breathability of plywood, that is the ability to allow adequate ventilation, means the internal comfort levels are compromised. Therefore it is not surprising how uncomfortable the air quality and temperature is inside a typical plywood shelter of 18m^2, which is normally built for a family of five.

Figure 7 Shelter using Amkan walling © Shelter Cluster, Philippines

Figure 8 Untreated plywood close to the ground starting to warp
© Kiru Balson, BRE

Roofing

Nypa

Farming of Nypa Fruticans, also known as nypa palm or mangrove palm, is a vital part of rural economy in the Philippines. The Nypa farming supports multiple livelihoods by combining shrimp farming and using the leaves as roofing material (Figure 9). It has been classified as a species of 'Least Concern'*. The farming is regulated through environmental regulations and harvesting permits. However, challenges of fair payment for shingle manufacturers and use of child labour remain an issue. The key findings were:

- In general, Nypa is often overlooked for corrugated Galvanised Iron (CGI) roofing which is more socially acceptable, lower fire risk and a lower maintenance option for the beneficiaries. However, there are number of positive features (e.g. low cost, ease of installation, thermally efficient in tropics) which make Nypa an attractive option. The leaves are harvested at 2-3 month intervals, although delivery varies depending on the rate of harvest (Figure 10).
- Although it is available all year round, shelter agencies should consider ordering additional sheets in advance for contingency during typhoon seasons as this will help agencies to plan supply frequency. Alternatives to Nypa are Anahaw leaves (Livistonia roundifolia), Cogon leaves, Kaong (Arenga pinnate or sugar palm) and Rattan palm.

Figure 9 A transitional shelter with coco lumber framing and nypa roofing
© Kiru Balson, BRE

Figure 10 Nypa habitat near Tacloban City, Leyte © Kiru Balson, BRE

* International Union for Conservation of Nature and Natural Resources, http://eol.org/pages/1137487/details

Building Back Safer

A campaign called 'Building Back Safer' was launched following the typhoon to raise public awareness of efficient methods of construction to protect buildings from storms, position buildings safely and improve disaster preparedness. The campaign was structured under the following eight key messages:

1 Build on a strong foundation
2 Tie down from bottom up (Figure 11)
3 Brace against the storm
4 Use strong joints
5 A good house needs a good roof
6 Site your house safely
7 A simple shape keeps you safe
8 Be prepared

Using these principles, humanitarian agencies are training communities to build safer and durable shelters (Figure 12). A monitoring and assessment report (September 2014) published by the Shelter Cluster Philippines reported that only 30% of shelters built by beneficiaries who received non-emergency type support can be classified as being 'fairly safe' or' safe'. This highlights the need for increasing the level of support provided by the agencies, in particular technical assistance, hands-on training and rising public awareness on construction techniques through the 'building back safer' messages.

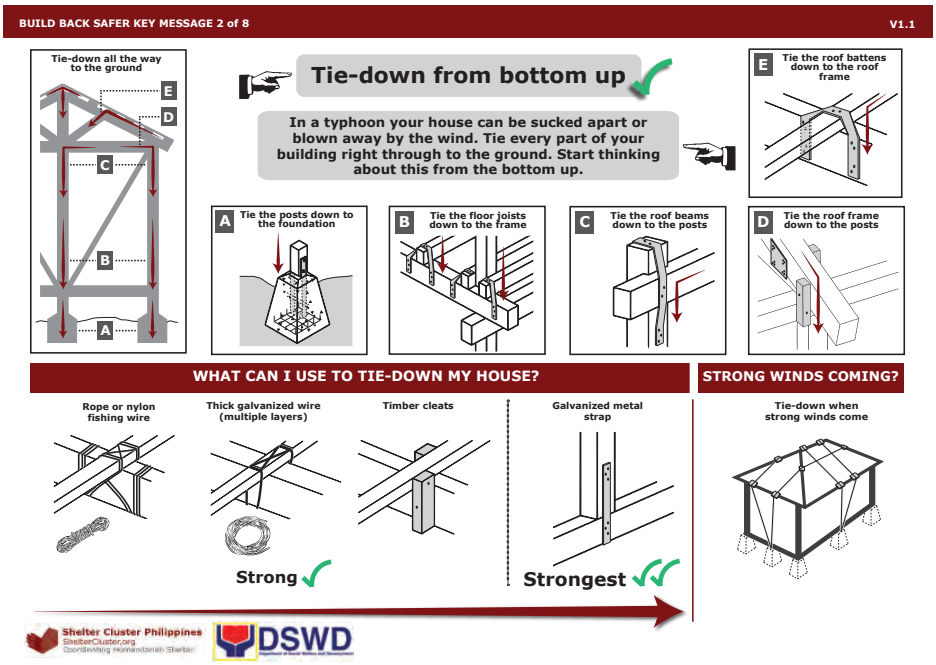


Figure 11 Build back safer messages by DSWD and Shelter Cluster Philippines

Figure 12 Community training on building back safer techniques © Kiru Balson, BRE

Sustainable development

The Philippines is a country with many environmental challenges including deforestation, marine degradation, soil erosion, poor solid waste management and water pollution. Less than one quarter of the country has forest cover, more than 70% of the coral reefs are threatened and the country produces well in excess of 10 million tonnes of solid waste annually, most of which goes into open or partially controlled landfill sites.

The Philippines Government's Department of Environment and Natural Resources (DENR) is responsible for implementing and overseeing environmental management nationally. A comprehensive environmental governance structure and associated legal provisions are in place. Any construction activity carried out by humanitarian agencies should comply with the local and national environmental regulatory framework.

The Sphere Handbook (2011) supported by international humanitarian agencies, advocates sustainable development of shelters. The handbook has guidance outlining voluntary minimum quality standards and common principles for delivering humanitarian assistance including: water supply, sanitation and hygiene, food security and nutrition, shelter, settlement and non-food items, and health. The shelter and settlement section in the hand book sets out the environmental standard 5 as "Shelter and settlement solutions and the material sourcing and construction techniques used minimise adverse impact on the local natural environment". The scope of this section is in relation to management and enhancement of existing local natural environment and considerate use of materials in shelter construction activities. It recommends that an impact analysis is carried out to identify approaches that are sustainable in the local context.

Recently, in consultation with a number of humanitarian agencies, the Building Research Establishment (BRE) Group, on behalf of IFRC, developed a practical self-assessment tool *'Quantifying Sustainability in the Aftermath of Natural Disasters,* referred as QSAND. The aim is to promote and inform sustainable approaches to relief, recovery and reconstruction after a natural disaster. The role of this tool is to enable humanitarian agencies to identify, prioritise and plan key actions required for sustainable outcomes through all stages of disaster relief and recovery support. The benefits of using the tools include

- Consideration and application of sustainability approaches throughout the process from the early recovery through to reconstruction
- Benchmarking of sustainability outcomes for the project or programme
- Performance information on sustainability issues targeted by the project or programme
- Embedding sustainability thorough the life cycle of the development
- Collation of data for the on-going monitoring of the effected community and its recovery.

The QSAND tool is organised into eight categories within which sustainability issues relating to the reconstruction of a sustainable built environment are assessed (see Table 1). Further detailed information can be found in www.QSAND.org

Table 1

Shelter and community	Settlement	Material and waste	Energy
– Privacy – Internal environment – Community sensitive design – Construction approaches	– Site selection – Security of tenure – Spatial planning – Infrastructure – Water	– Post-disaster waste management – Construction waste management – Operational waste management – Material properties/specification Material sourcing	– Energy demand and supply Energy consumption
Water and sanitation	**Natural Environment**	**Communications**	**Cross-cutting Issues**
– Water demand and supply – Water quality – Sanitation	– Human relationship to Ecosystem services – Ecological Protection – Ecological rehabitation and restoration	– Telecommunication	– Participation – Capability and skills – Security and safety – Economic viability – Community ownership and sustainable management – Livelihoods – Resilience – Access and non-discrimination

Supporting vulnerable groups

The rate of emergency phase support was exceptional after Typhoon Haiyan. However, the pace of delivery of long term recovery programmes is slow. There has been number of challenges in delivering the recovery works.

In the months following Typhoon Haiyan, many families rebuilt their homes using tarpaulins and salvaged wood and tin along vulnerable, battered coastlines, which were classified as 'No Dwell Zones'. Many are building sub-standard unsafe shelters and are highly hazard prone (Figure 13).

These are the areas mostly occupied by low income and vulnerable groups of population who are dependent on fishing, or other service livelihoods. Relocation of these families' inland sites poses economic challenges and added commuting costs. The humanitarian support groups are of the view that relocation should only be the last resort and needs to be based on informed consent.

There is a need for closer collaboration with the local government departments to identify households from 'non-build zones' who need assistance. The local authorities are currently developing detailed hazard maps showing areas which will be worst affected by future flooding or storm surges. However achieving social and political consensus across all stakeholders means this is going to be a long term process. This will have an implication on how the agencies plan and deliver recovery shelter programmes in future.

Figure 13 Vulnerable shelters in non-build zones

Communication and disaster preparedness

In the run-up to the typhoon, the Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA) issued numerous rain, flood and landslide warnings. This did not emphasise the intensity and the term 'storm surge' was not understood by many. This can be seen from the level of casualties in densely populated areas; 94% of the casualties were in Tacloban, Palo and Tanauan that are areas which were not evacuated. The local authority hazard maps did not account for a storm surge of 7m estimated by PAGASA and the existing maps used for planning the evacuation process were not up to date. All of this meant that the evacuation process was not effective.

Early warning systems and processes play a critical role in disaster preparedness including the language used, accuracy of information to hand and training of local risk management officials to be effective in their means of communication and managing the evacuation process.

The majority of population use radio as the key source for information on weather forecasts and relief information on where to get specific support services. There is a need for frequent and regular communication regarding the recovery programme, build back safer messages and preparedness measures e.g. evacuation routes and centres.

Conclusion

As one walks around Tacloban, one can't help but feel inspired by the positivity and a strong sense of 'get on with it' attitude in people from all walks of life. There are number of remarkable stories of survival and resilience in communities helping each other in a dire situation when all known support structures and technological systems crumbled. The rate at which emergency relief works and recovery operations were delivered in this instance is evidence of the collective international efforts and lessons learned by humanitarian agencies in responding to disasters of this scale.

Despite these efforts there is still much to be done on the road to recovery for those affected by last year's typhoon. United Nations office for the Coordination of Humanitarian Affairs (UNOCHO) reported that 25,000 people living in transitional sites still require livelihoods support, water, sanitation and hygiene (WASH) facilities, and durable shelter solutions. UNOCHO humanitarian Bulletin (October 2014) reported around 95,000 households (475,000 people) are estimated to be living in unsafe or inadequate makeshift shelters.

As indicated in the Monitoring and Assessment Report (September 2014) published by the Shelter Cluster Philippines. the beneficiaries now feel the rate of recovery is lower than what is needed. With a funding gap of $66 million, the shelter recovery activities since Yolanda have reached approximately only 40 per cent of the target households identified for shelter recovery in the Government in the Strategic Response Plan post-Yolanda.

The Monitoring and Assessment report also highlighted that visual inspections show only a small change in the visible improvement to damaged houses in the affected areas. 76% of dwellings were objectively classified as still being very unsafe or fairly unsafe, while 39% were objectively classified as being very inadequate or inadequate. Further intensive training using 'Building Back Safer' messages, technical guidance on materials and on-site assistance on effective construction techniques will benefit both humanitarian agencies and the general public.

With only a few householders reporting they have completed recovery, the report pointed out that the beneficiaries are looking for durable shelters rather than transition solutions. There is a growing expectation for longer-term and more durable housing solutions at this point in the recovery process. It is clear that targeted support aimed at socially and economically vulnerable groups is needed.

Definitions

Transitional Shelter
Rapid, post-disaster household shelters made from materials that can be upgraded or re-used in more permanent structures, or that can be relocated from temporary sites to permanent locations. They are designed to facilitate the transition by affected populations to more durable shelter. Transitional shelters respond to the fact that post-disaster shelter is often undertaken by the affected population themselves, and that this resourcefulness and self-management should be supported.

Progressive Shelter
Post-disaster rapid household shelters planned and designed to be later upgraded to a more permanent status. This is achieved by integrating future transformation and alteration possibilities in the structural basis of the unit.

Core Shelter
Post-disaster household shelters planned and designed as permanent dwelling, to be part of future permanent housing, allowing and facilitating the future process of extension by the household following its own means and resources. The aim is to provide one or two rooms providing safe shelter against reasonable future hazard by reaching permanent housing standards and facilitating development but not completing a full permanent house.

Permanent Shelter
Post disaster support to allow construction of new permanent houses for people who lost their former dwellings due to the impact of disaster. It can be done on a household's previous plot of land or as part of a facilitated resettlement on new land. Owner driven and community driven reconstruction is recommended.

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