Lessons from Aceh

Key Considerations in Post-Disaster Reconstruction

Jo da Silva

ARUP

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Foreword

On December 26th 2004, a tsunami triggered by an earthquake off Indonesia struck South East Asia. Many lives were lost, and the scale of the physical destruction was beamed into living rooms across the world in the middle of the Christmas period.

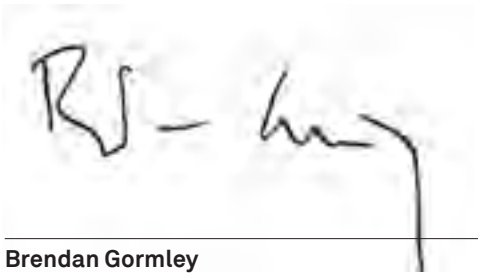
The Disaster and Emergency Committee (DEC) immediately launched an appeal for funds, which was met with an unprecedented response by the British public. Thanks to their huge generosity a total of £392 million has been distributed by the DEC. This has been used to save lives and rebuild homes and livelihoods across seven countries.

In recognitions of the scale of the problem, the DEC Trustees agreed to extend the period in which funds could be used from their usual eighteen months to three years. Final expenditure was invested in measures to make communities more resilient to future disasters.

Although the extra time was invaluable, aid agencies were still faced with a monumental challenge: more than reconstruction, many areas required wholesale construction, normally the province of Governments or the private sector. This was uncharted territory for agencies more prepared for humanitarian crises of smaller proportions and meant, as the report says, "that most implementing agencies climbed a steep learning curve".

While we hope that the world will never witness another catastrophe of this magnitude, events such as the Kashmir earthquake of 2005 and earthquakes off Sumatra in 2009 demonstrate that aid agencies will be involved in further post-disaster construction programmes. For this reason, it is recognised that agencies need to capture and share the invaluable lessons from Aceh.

The DEC is therefore delighted with the collaboration with Arup in the development of this *Lessons from Aceh* publication, and is proud to contribute to the growing body of knowledge relating to humanitarianism and the built environment.



Brendan Gormley
Chief Executive Officer
Disasters Emergency Committee

November 2009

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Valuable feedback on the initial draft was received from participants at the UK Shelter Forum (www.shelterforum.org.uk). We are also grateful for the advice and expertise provided by a number of external reviewers, notably Tom Corsellis and Antonella Vitale (Shelter Centre), Graham Saunders (IFRC) and Ian Hamilton (UN-Habitat Programme Manager for the Aceh-Nias Settlements Support Programme (ANSSP) from 2005-6).

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November 2009

Unless otherwise stated all the photos in this report have been taken by Arup staff.










Introduction

Background

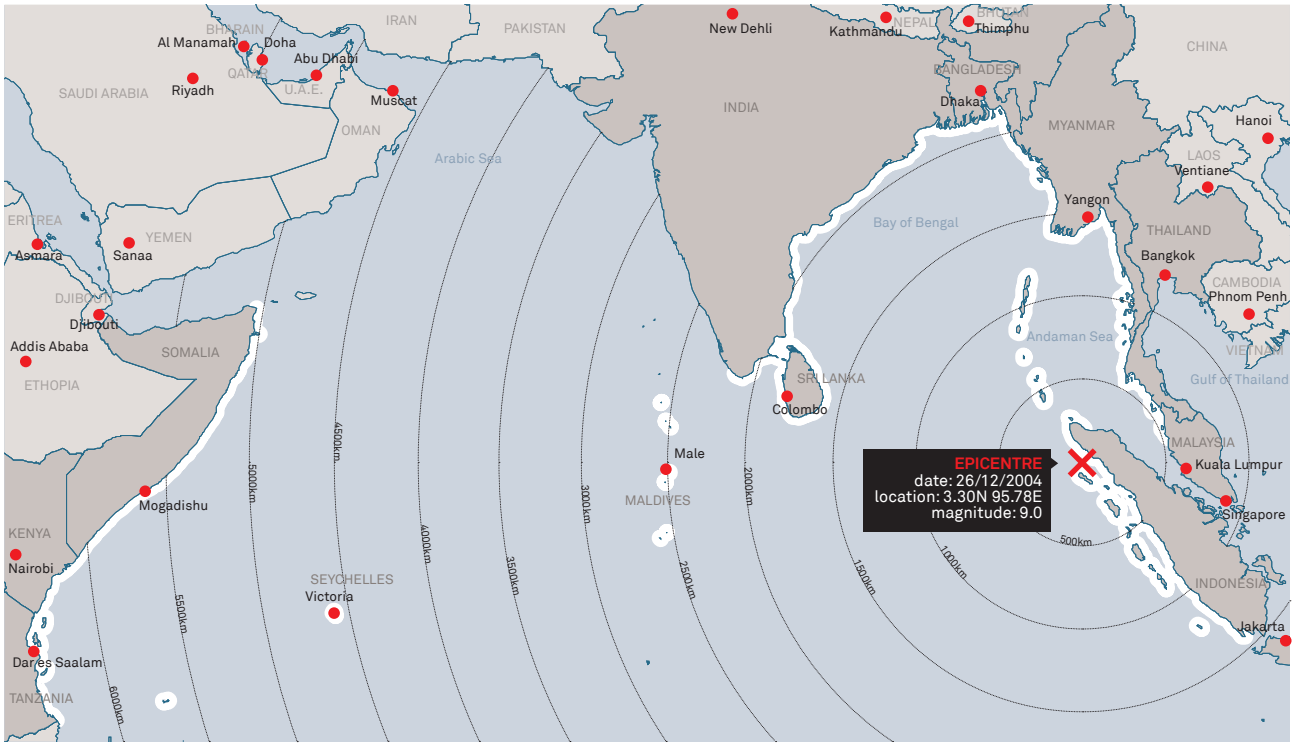
On 26 December 2004, an earthquake on the Sunda trench fault line 240 km off the coast of Indonesia triggered a massive tsunami. This caused devastation of coastal areas in several countries in the region including India, Sri Lanka, Thailand and Indonesia and affected several countries in east Africa. The greatest destruction was in Aceh Province, at the northern end of the Indonesian island of Sumatra. In this region, 167,000 people were reported dead or missing, more than 500,000 were displaced and over 800 km of coastline was destroyed. The challenges posed by the scale of destruction were compounded by the practicalities of both reaching affected communities and managing a dispersed response. In addition, Aceh, one of Indonesia's poorer areas, had suffered from almost 30 years of civil conflict and was arguably the area most limited in its capacity to recover.

The Disasters Emergency Committee (DEC) raised £350 million which alongside additional funds from gift aid and interest resulted in an overall fund of £382 million. DEC decided that due to the scale of destruction the funds should be spent over three years (rather than eighteen months) in order to secure lives in the short term and to rebuild communities and livelihoods in the longer term. Over the three year period from 2005-7, 42% of DEC Tsunami Appeal funds were spent in Aceh, the majority of which were spent on reconstruction. Collectively, DEC Member Agencies constructed over 13,700 houses, 55 schools and 68 health centres using DEC funds and an additional 6,200 houses using funds from other sources. The total number of houses constructed by DEC Member Agencies was therefore almost 20,000. This equates to approximately 15% of the overall requirements for housing and represents a very significant contribution to post-disaster reconstruction in Aceh.

In October 2007, almost three years after the tsunami, the DEC commissioned experts from Arup to carry out a short mission to Aceh to review the post-tsunami reconstruction programme undertaken by DEC Member Agencies. The aim of the mission was to provide assurance on the quality of construction and that the programmes would be completed satisfactorily. Arup's mission report highlighted many of the key challenges that DEC Member Agencies faced in delivering reconstruction programmes and lessons learned in the process. In their responses to the report, several DEC Member Agencies felt there was potential to use this material to promote inter-agency learning or to develop a best practice guide. As a result, this publication has been created with the intention of capturing key characteristics of the response and lessons learned, in a widely available format. It is intended to provide a valuable reference in future disaster responses.

Scope

Post-disaster reconstruction is a complex process. It requires multi-sectoral involvement, very significant resources and a wide range of skills. Many of these skills are not typically available within humanitarian organisations. For a humanitarian agency, the decision to engage in reconstruction (and what type of assistance to provide) needs to be taken cognisant of the complexities and must recognise the need for expert advice. At the outset of the tsunami response, there was limited specific



guidance readily available to provide a framework for reconstruction. This, combined with lack of institutional knowledge and poor coordination between agencies, meant that most implementing agencies climbed a steep learning curve.

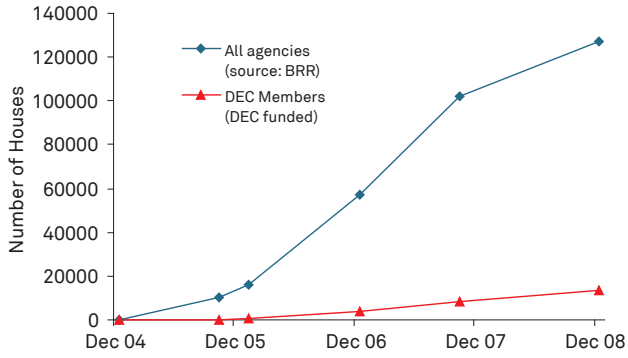
Since then, *Transitional Settlement and Reconstruction after Natural Disasters* (UN, 2008) has been published as a field guide for testing. A final edition, which will be entitled *Shelter after Disaster: Transitional Settlement and Reconstruction* will be published by the UN in 2010. This 300 page book provides a comprehensive reference to assist all stakeholders in navigating the transition from emergency survival shelter to durable solutions. Reconstruction is identified as a way in which humanitarian and development organisations can support families who have not been displaced, or as in Aceh, were encouraged to return home or were able to relocate to live in a new location.

Lessons from Aceh is intended to complement this and other publications on the tsunami response by providing specific guidance on reconstruction using illustrative examples of the challenges faced by DEC Member Agencies in Aceh and how these were addressed. It is targeted at senior managers, decision-makers and programme advisors in implementing agencies as opposed to technical field personnel. Its focus therefore spans the breadth of issues which need to be considered in order to make informed decisions, manage expectations and reduce risk.

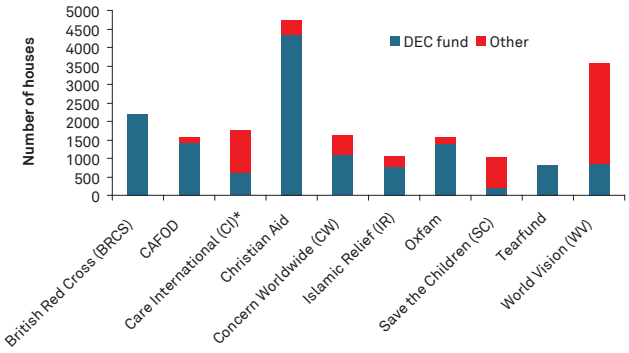
Every post-disaster situation is unique and Aceh was perhaps even more so, due to the scale of devastation and unprecedented levels of funding available. This publication is therefore not intended to be a dictate as to 'how to do it' but to illustrate 'how it was done.' Aceh is used as a case study to illustrate the range of activity and practical realities of delivering a successful programme, highlighting best and worst practice and recognising that there is validity in different approaches within the same response.

The content is based on the DEC Assurance Mission (Arup, 2007) as well as the authors observations and experiences on previous assignments in Aceh during the post-tsunami response. This is supported by further research and consultation, additional information provided by DEC Member Agencies and other documentation of the response. The views expressed are those of the authors.

The material has been arranged in three key sections: Planning, Design and Construction. The individual chapters provide a checklist of key topics. Each chapter begins with a brief summary of key considerations and concludes with key questions that should be considered in future responses. These are collated in the Executive summary which also includes a checklist for rapid reference. The key considerations are illustrated within the main text and boxed case studies by what happened in Aceh. The *Sphere Standards* (Sphere, 2004) are also highlighted throughout. Although the focus of this publication is the reconstruction



FOUR YEARS OF HOUSE CONSTRUCTION IN ACEH



HOUSES CONSTRUCTED BY DEC MEMBER AGENCIES

of permanent housing (and to a lesser extent schools and health centres) much of it is also applicable to transitional shelter programmes.

Summary

The tendency in Aceh was for government, donors and the media to focus on the number of houses constructed as a measure of achievement. However, the most successful programmes acted as a catalyst for recovery from both the tsunami and 30 years of conflict paving the way for future development. Although more could have been done to generate local economic activity, develop skills and create employment opportunities, efforts were made to minimise environmental impact and 'build back better' by reducing vulnerability to natural hazards and achieving wider access to services. DEC Member Agencies also engaged with beneficiaries and local partners in a way which built trust, ownership and responsibility. Their reconstruction programmes have left a legacy that is more than just bricks and mortar. This is an important theme throughout *Lessons from Aceh* and highlights the wider role reconstruction plays in early recovery and the need for an integrated, coordinated and multi-sectoral approach.

Executive summary

Source: Prathiwi Widyatmi / Oxfam GB

Source: Arup

Source: Arup

Overview

Post-disaster reconstruction is a complex process. It requires multi-sectoral involvement, very significant resources and a wide range of skills. For a humanitarian agency the decision to engage in reconstruction - and what type of assistance to provide - needs to be taken cognisant of the complexities and must recognise the need for expert advice.

Lessons from Aceh has been arranged in three key sections: Planning, Design and Construction. The individual chapters provide a checklist of topics. Each chapter begins with a summary of key issues and concludes with key questions that should be considered in future responses. These are illustrated within the main text and boxed case studies by what happened in Aceh and by reference to the *Sphere Standards* (Sphere, 2004).

Although the three sections are arranged chronologically, the chapters within each section are not. Planning and design development is an iterative process and requires an understanding of multiple parameters and an appreciation of the trade-offs which need to be made. Decisions made later in the project cycle may require the revision of earlier assumptions. Thus the establishment of a robust system of review and evaluation, and sufficient flexibility within the programme plan to be able to incorporate the findings, is an essential part of developing a reconstruction programme.

The first section – Planning – deals with overarching issues which should be considered before deciding whether and how to contribute to reconstruction; and which should be monitored and revised throughout the reconstruction programme. Key considerations in this section include:

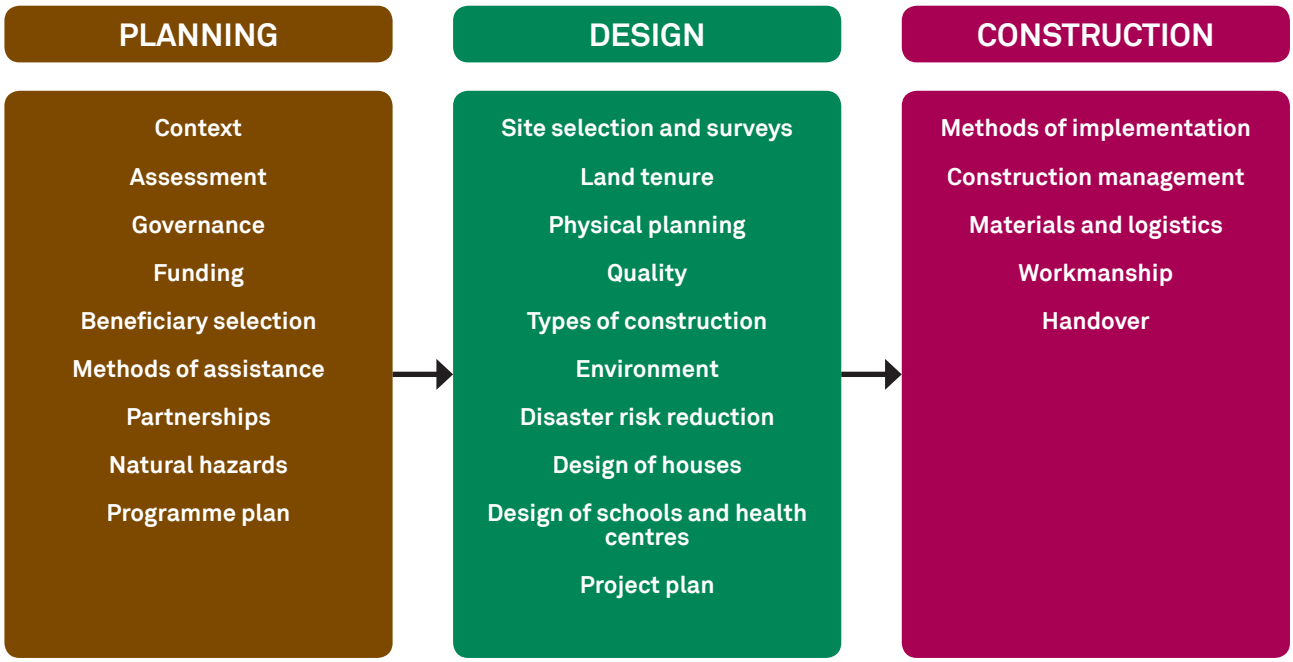
- understanding the context and impact of the disaster
- understanding the local governance structures, regulatory framework and establishing methods of coordination
- understanding funding steams and timescales
- identifying beneficiaries
- determining which method of assistance is most appropriate
- establishing partnerships with other stakeholders in order to provide assistance
- recognising natural hazards which pose a future risk
- capturing the objectives, timescales, resources and risks in the programme plan.

The second section – Design – deals with the detailed design of a reconstruction project once a decision has been taken to provide shelter or housing. Key considerations in this section include:

- selection of appropriate sites for reconstruction
- resolving issues of land tenure
- physical planning of settlements
- definition of appropriate quality for reconstruction
- identifying appropriate types of construction
- minimising the environmental impact of reconstruction
- incorporating disaster risk reduction strategies
- design of houses, schools and health centres
- capturing the scope of works, programme, human resources, cost plan and risk management plans into a detailed project plan to inform construction.

The final section – Construction – deals with the implementation of reconstruction programmes. Key considerations in this section include:

- different methods of implementation
- management of construction projects
- specification, procurement and transportation of materials
- management of labour and workmanship
- handover, maintainance and post-occupancy evaluation of completed projects.



Planning

Context

Every post-disaster situation is unique. Critical issues depend on the characteristics of the country as well as the type and impact of the disaster. Understanding the local context in terms of geography, society, economics, politics, climate and hazards is a key consideration in developing an appropriate strategy for recovery and reconstruction. This information provides the overall context for the plans of individual agencies and is essential background information for all individuals contributing to planning and implementation of disaster relief.

Assessment

Assessment of damage and loss is essential to understanding the extent and distribution of impact in terms of loss of life, property, infrastructure, livelihoods and impact on the economy. It should involve as many stakeholders and data sources as possible. It should be an iterative process where qualitative and quantitative information at regional or district level is progressively refined to establish accurate information across a broad set of parameters at a local level. Participatory assessments enable the needs and aspirations of those affected to be articulated and are essential in ensuring that the humanitarian response is flexible and appropriate.

The type of transitional settlement or reconstruction that is possible, and the timescales in which it can be realised, will depend heavily on the availability of materials and skills. The latter includes the capacity of the public works department, built environment professionals, local NGOs and contractors as well as the affected communities. It is therefore essential to carry out a strategic assessment of the construction capacity, and the potential of local markets to provide necessary materials at the outset.

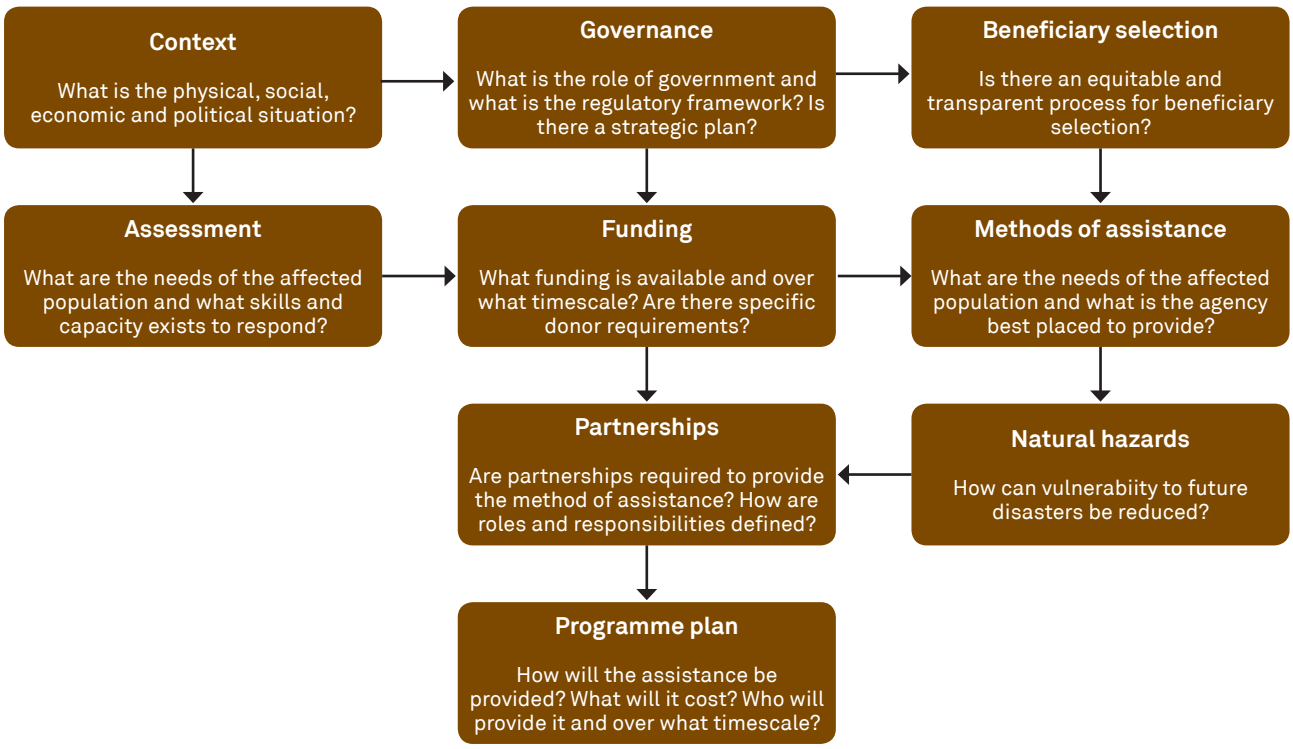
Governance

An effective institutional and policy framework is key to delivering transitional settlement and reconstruction programmes and projects. Central to this is the development of a strategic plan for the shelter sector which sets out the objectives of assistance, the respective responsibilities of government and the humanitarian and development agencies and relevant laws and standards. The strategic plan is the responsibility of government and the mandated coordinator.

Sufficient resources must be dedicated to contributing to the development of the strategic plan and this should form the basis of individual agencies' programmes and projects to ensure their response is appropriate, coordinated and meets the needs of the entire affected population.

Funding

Implementing agencies are accountable to beneficiaries, donors and government. A key challenge is satisfying the requirements of all parties as to how funds are spent. Significant funding constraints include the total amount of money available, the timescales over which it can be spent, and other donor requirements. Typically, funds raised through emergency appeals must be spent within the ▶



first nine to twelve months after a disaster. This generally precludes reconstruction and places greater emphasis on emergency and transitional settlement options.

Beneficiary selection

Assistance should be provided equitably, and the needs of the most vulnerable must be met. It is therefore critical to agree a clear policy on eligibility and responses across all agencies. The selection of individual beneficiaries should involve the whole community in a transparent process, and beneficiary lists should be coordinated and approved by government to avoid duplication. This can be a time-consuming and resource-intensive process involving village leaders and local government. The decision to work in several districts or sub-districts may also impact on mobilisation costs and programme.

Methods of assistance

There are many different ways in which shelter assistance can be provided to support reconstruction. Selection of an appropriate method of assistance depends both on the needs of the affected communities and on the type of assistance a particular agency is best placed to provide. The latter is based on the agency's capacity, institutional knowledge and available resources and includes how reconstruction may overlap with other sectoral capacities within the organisation (e.g. livelihoods, WAT-SAN, education). Different methods of assistance should be combined to create specific programmes tailored to the needs of the affected communities and individual households. These may be uni-sectoral or multi-sectoral but should reflect the strengths of the agency whilst recognising the need to recruit additional technical expertise or partner with others to fill skills gaps.

Partnerships

It is highly unlikely that a single agency will be able to deliver all aspects of a transitional settlement or reconstruction programme themselves. Aspects which fall outside their remit or core strengths will require partnerships with government, other agencies or local organisations. It is essential that the responsibility of each partner in contributing to the common goal of reconstruction is clearly defined and communicated. A shared understanding of timescales and risk allows expectations to be managed. This applies equally to the communities receiving assistance who are key partners in the process.

Natural hazards

Post-disaster reconstruction provides an opportunity to reduce vulnerability to future events. This requires an understanding of what natural hazards are likely to occur, their potential impact and appropriateness of various risk reduction strategies. Volcanoes and tsunami are extreme, infrequent events which are most effectively mitigated through early warning systems and evacuation plans. In contrast the more immediate risk posed by flooding, storms and earthquakes can be substantially mitigated through improved land-use planning, design practices, building methods and building regulations.

Future disaster risk reduction should be integral to the reconstruction process. This requires a strategy which capitalises on the availability of funds and political will, and includes social and financial measures relating to awareness raising and preparedness. The opportunity to rationalise urban plans to include evacuation routes and strategically address services provision and the location of critical infrastructure should be considered rather than rebuilding urban communities by repeating the pattern of organic growth and siting public buildings as before.

Programme plan

A programme plan is required which clearly describes the rationale for providing shelter assistance: who is to be assisted, the desired outcomes, how they are to be achieved through various inter-linked projects, and over what timescale. The initial plan will be informed by the issues discussed in the previous chapters but should be considered as a live document, updated regularly as new information becomes available. It should reflect the overall strategic plan for the shelter sector and as far as possible should be structured consistently in order to optimise both coordination and information management. The programme plan is an important document which should provide sufficient information to enable senior managers to give approval to proceed cognisant of the context, the capabilities of their organisation and availability of resources. The programme plan can also be used as the basis for coordination within the humanitarian sector and with government. It enables a shared understanding of the proposed shelter programme at all levels within an agency and across sectors. This is particularly important as shelter programmes catalyse recovery most effectively when integrated with livelihoods programmes. ■

Design

Site selection and surveys

Families generally prefer to rebuild on their own land, as this enables them to more easily resume their lives and livelihoods. However, if this is not possible, land must then be identified for resettlement sites. Whether rebuilding houses where they were previously located or relocating communities to resettlement sites the suitability of the site for reconstruction should be verified. Adequate site selection procedures must be put in place to ensure access to services and livelihoods and to identify vulnerability to natural hazards. More detailed surveys may also be required in order to identify specific requirements for environmental protection, enabling works and infrastructure before the construction of housing can occur.

Detailed physical planning relies upon accurate initial physical surveys. In particular topographical, geotechnical and hydrological physical surveys are important when locating housing and infrastructure to ensure that land is suitable for reconstruction, as they can highlight areas subject to hazards such as landslides, areas with soil or geological instability or areas with high water tables. Understanding the topography is also important as it determines drainage patterns, and an appreciation of ground conditions is needed to decide on the type of foundations, and limitations on excavation for toilet pits or settlement tanks.

Land tenure

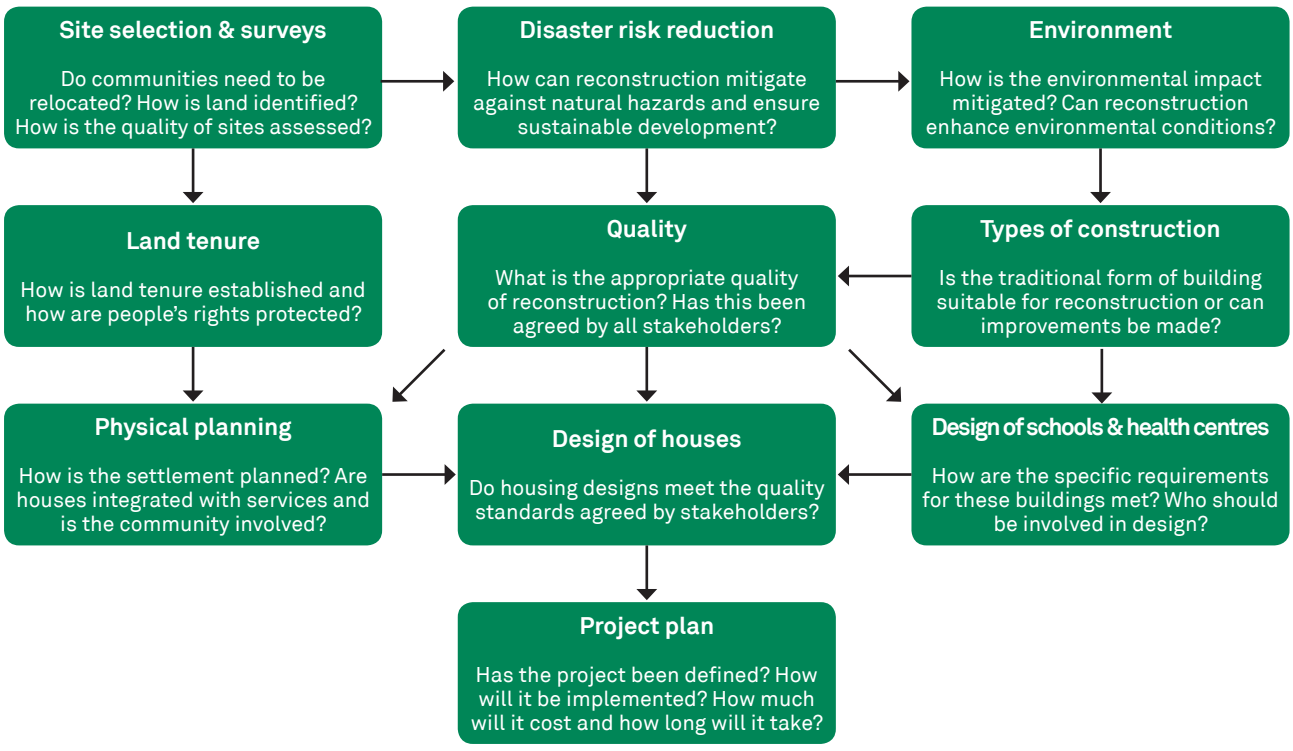
Legal certification of land is a pre-requisite to reconstruction yet the system for certification pre-disaster may not have been comprehensive and key documents on land titles or local knowledge may have been lost as a result of the disaster. Land tenure arrangements vary from country to country and land may have been owned individually, communally or by the government. Establishing land titles based on both existing records and community-driven processes is a time consuming process but critical to longer-term sustainable development. Inheritance rights need to be considered as does certification for adjacent communities so as not to exacerbate differences in land values. Specific consideration must also be given to the rights of tenants or informal dwellers that were not previously land owners.

Physical planning

Housing should be seen in the context of reconstructing settlements and rebuilding communities. Adequate time must be allowed for participatory planning processes to ensure that the reconstruction process is community-driven. An integrated approach to planning should be adopted which address both short term and long term needs whereby houses are coordinated spatially and programmatically with access to services, public buildings and livelihood facilities. This will prevent houses being left unoccupied after completion and create sustainable communities in the longer term.

Quality

Quality, cost and timescales are the three key elements of a reconstruction programme that need to be carefully managed. Typically pressure to commence reconstruction and limited resources means that budgets and timescales ▶



prevail and insufficient consideration is given to establishing a clear definition of quality. It is important that quality is understood from the occupant's perspective which requires extensive consultation. Their primary concern will be factors that contribute to the habitability or functionality (protection from the weather, internal comfort, safety and security, sufficient space, access to services), though longer term there may be additional considerations such as durability and adaptability.

Once the occupant's requirements are captured in a design brief or performance specification they can be used as the basis on which a variety of designs can be developed. This is preferable to a prescriptive specification which makes various parameters mandatory (size, number of rooms, construction type). Reference should also be made to international standards and pre-disaster housing provides a useful benchmark for what might be considered acceptable quality. Coordination is essential to ensure that all stakeholders have a shared understanding of quality so as to avoid inequitable and/or inadequate responses.

Types of construction

The choice of building system must reflect the capabilities of the community and capacity of the local market. Local building practices may be difficult to scale-up due to shortfalls in skilled labour and materials, or may require modifications to achieve an acceptable level of quality and safety. Post-disaster reconstruction presents an opportunity to invest in the introduction of improved building practices or new materials and technologies. However, this must be balanced against cultural acceptability, requirements for skilled labour, future adaptability and the timescale of the response. Technical expertise should be sought when determining what type of building system to adopt so that the relative advantages and disadvantages can be assessed.

Environment

In addition to loss of life, livelihoods and damage to property disasters may also cause significant environmental damage. Loss of ecosystems and fertile soil, contamination of water sources and damage to coastal mangroves can all leave the population vulnerable in the longer-term. It is essential that further environmental degradation is avoided in the reconstruction phase. Mitigating the environmental impact of reconstruction must be considered as an integral part of the design process; material sourcing leading to over exploitation of natural resources, the use and disposal of toxic substances, inadequate consideration of water and sanitation and wholesale removal of trees and vegetation are examples of negative impacts. There may also be wider opportunities to enhance local environmental management practices or to introduce 'green' building technologies and approaches.

Disaster risk reduction

Vulnerability to natural hazards can be very significantly mitigated, and even prevented, through appropriate site location, design and construction. Consequently a step change in disaster risk reduction can be achieved, often without significant cost implications, if disaster risk reduction strategies are considered an integral part of the reconstruction process. Appropriate specialist technical expertise should be sought and relevant national and international standards and best practice guidelines adhered to. As well as 'building back better' there is an opportunity to influence local building practices and planning processes so that they support safer construction in the long term. Availability of funds and political will post-disaster may also provide scope for introducing social or financial mechanisms related to awareness raising, disaster preparedness, or risk transfer.

Design of houses

House designs must meet relevant national and international standards, be culturally and climatically appropriate, durable and easy to maintain, allow for future adaptation and be developed in partnership with the intended occupants. While architects may be best placed to advise on building form, engineering expertise is required to carry out surveys and to ensure structural integrity, particularly in areas of high seismic activity. Services such as water, sanitation and electricity must be included in housing design to ensure houses are not left unoccupied after completion. Standardisation and optimisation of designs can improve performance, minimise costs and facilitate speed of delivery and scaling-up. However, this must be balanced against the requirements of specific households and the limitations of individual plots.

Design of schools and health centres

Schools and health centres are larger and more complicated buildings, with higher occupancy, and play a critical role in the community. It is therefore essential that they are fit for purpose and built soundly. This requires consultation with the relevant government departments and staff and a higher level of technical design expertise and site supervision. Their operation is dependent on provision of specialist services, equipment and trained personnel which need to be integrated into the building design and included in an operation and maintenance plan. Since these building types are deemed to be critical infrastructure they need to be designed and constructed to higher specifications than housing, and to include built-in redundancy to ensure continuity of operation following a future disaster.

Project plan

In order to plan the implementation phase, and mobilise necessary resources, there needs to be a Project Plan which clearly defines the reconstruction project (whether it is permanent housing or transitional shelter) and the means to deliver it. The Project Plan should either be an extension to, or read in conjunction with, the Programme plan. It should comprise a cost plan, resource plan and programme for procurement and construction based on a detailed scope of works or activity schedule for each site or community. In addition it should also highlight key risks that might negatively impact on the delivery process so that they can be proactively managed. The Project Plan should form the basis on which a decision to proceed with construction is made. It can also be used as the baseline for monitoring budget and programme during construction and managing expectations regarding quality and timeliness of delivery. ■

Construction

Methods of implementation

The most appropriate method of implementation (self or community-build, contractor-build or direct implementation) is dependant on the skills and capacity of the affected population, local material availability, the complexity of the housing design and type of construction, the timescale for reconstruction and the availability of funding. A single programme may include different methods of implementation, for example communities may self-build their own housing while contractors may be more appropriate for settlement wide infrastructure. The method of implementation is critical in determining the social and economic impact of the reconstruction programme. Each option has benefits in terms of skills transfer, economic and livelihood recovery and these may be experienced at a local, regional or national level depending on where cash, skills training or materials are provided. Ownership of the completed programme is also a key issue and mechanisms must be put in place to ensure that communities are adequately engaged in the decision-making process. This helps to ensure beneficiary satisfaction and occupancy of the completed housing.

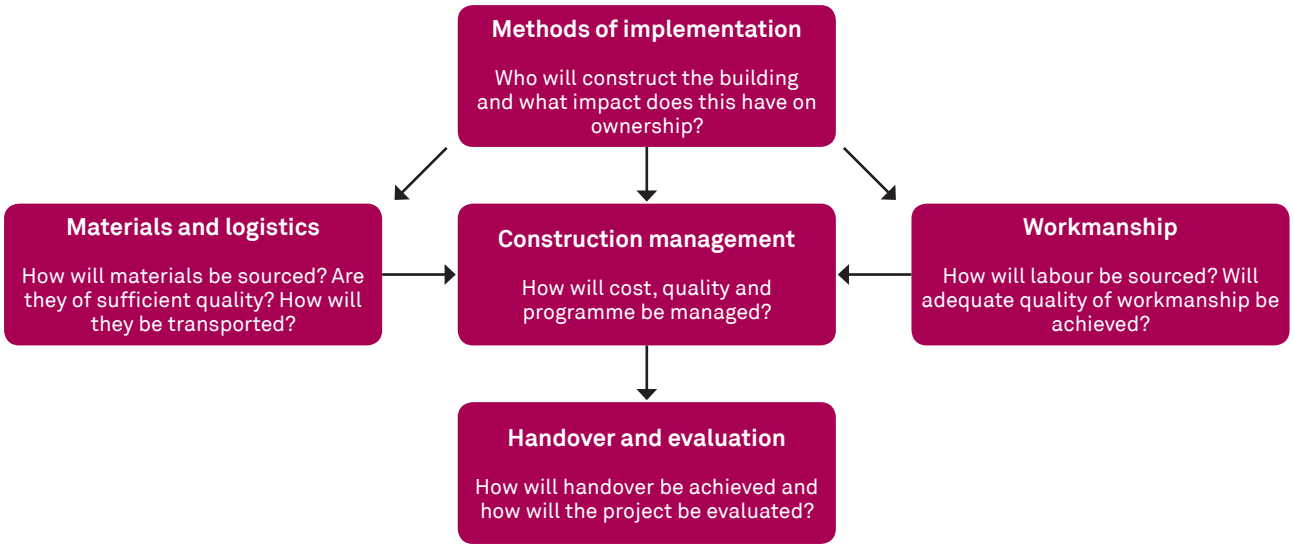
Construction management

Effective construction management is critical to the timely delivery of good quality housing while ensuring available funds are spent efficiently and effectively. The challenge is to maintain progress, manage expectations with respect to both programme and quality and remain within budget in an environment where inevitably there are numerous causes for delay and resources are limited. Construction management therefore requires capabilities in financial, programme, personnel and supply-chain management and a sound understanding of quality and risk. These must be informed by previous experience of delivering construction programmes of a similar scale. While some of these capabilities may already exist within an agency, it is likely that national and international consultants will need to be recruited or partnerships formed with the private sector or specialist NGOs. Various tools and practices can be used to manage construction. The most important of these is the construction programme, which should identify key milestones, the inter-relationships between activities, and critical path items. It can be used to monitor progress and assess the implications of delays. Other common tools include the cost plan, risk register, quality assurance, and health and safety procedures. Construction is a collective effort and the responsibilities, lines of communication and authority for decision making need to be clear and practicable with ultimate responsibility residing in one person – the designated Construction Manager or Country Director.

Materials and logistics

The availability of good quality construction materials in sufficient quantities is critical to the timely delivery of high quality reconstruction programmes. In post disaster situations, construction materials are typically subject to high inflation, and the quality deteriorates as production processes becomes overstretched in order to meet the large scale demand. Implementing agencies may also face pressure to purchase sub-standard materials from local suppliers. Care is needed to ensure that materials used in construction are consistent with the design specification. This requires verification on delivery, appropriate storage and testing.

A strategic assessment of local resources should be undertaken when planning a reconstruction programme to assess limitations in supply, identify alternative sources and prevent delays during implementation. Working with local suppliers and manufacturers provides opportunities for enhancing small scale building product manufacturing as a livelihoods approach to reconstruction. Alternatively materials may need to be transported considerable distances requiring warehouses to store materials or to assemble building components.



Workmanship

Good quality workmanship plays a key role in ensuring the structural integrity of buildings, and providing the ability to withstand extreme events including earthquakes, floods, and cyclones. It also directly affects the visual appearance of the building and therefore perception of quality and durability. Workmanship depends on the availability of suitably skilled labour, which may be limited due to a combination of small local capacities and high demand. This can lead to competition between agencies and contractors hiring labour resulting in high staff turnover. It is therefore essential to assess the construction skills of the local population and capacity of the construction industry at the outset so that sufficient resources can be dedicated to recruitment and training. Equally important is understanding who is responsible for ensuring the quality of workmanship. Quality assurance procedures must be implemented, to identify sub-standard workmanship at key stages during the construction process so that immediate corrective action can be taken. This avoids having to demolish sub standard buildings or carry out extensive remedial works but requires significant numbers of field staff to carry out on-site supervision and monitoring.

Handover

The end of a reconstruction programme is marked by handover of the houses or facilities to their future owners and end-users. At this point in time they take ownership and accept responsibility for the building. It is important to facilitate this transition by agreeing a finite period during which the agency will remain responsible for addressing defects. There needs to be a shared understanding between the agency and community as to the point at which handover will occur. This may be before the building is fully complete, for instance if the priority is to provide a safe 'core' house, or where families are able to carry out finishing works themselves.

For schools and hospitals a longer handover period may be needed to allow for equipment to be installed and the facility to become functional. Occupancy provides a good initial indication of acceptance and satisfaction but an evaluation should also be carried out to ensure that the programme realised its objectives and to identify any shortcomings. The evaluation should indicate whether the reconstruction has succeeded in acting as a catalyst for recovery, or where there are further requirements for assistance.

Check list

Planning

Context

- ☐ What is the geography and climate and how will this impact on logistics and timescales?
- ☐ How is responsibility divided between local and national government? What effect will this have on decision making, policy and flows of funds?
- ☐ What are the main economic activities and what does this mean in terms of available skills and materials or potential to develop livelihoods?
- ☐ Is there a history of conflict or social unrest and what does this imply in terms of social networks and institutional capacity?
- ☐ Is there a history of previous natural disasters and are there risks that should be mitigated as part of the response?

Assessment

- ☐ What is the extent of damage and loss of life, livelihoods, property and infrastructure?
- ☐ What are the affected communities' needs and priorities for assistance? How is this translated into government policy and a strategic plan for the sector?
- ☐ What materials are available locally? Do the necessary skills exist within affected communities or the construction industry?
- ☐ What capacity exists within professionals, institutions and government to manage and support the reconstruction programme? What effect does this have on local, national or international recruitment?

Governance

- ☐ Who in government is responsible for post-disaster response and recovery? If this is a new entity, how long will it take to become effective?
- ☐ Who in the humanitarian sector is responsible for assisting and supporting the government? Has a UN agency been identified to coordinate the shelter sector?
- ☐ Has shelter been identified as a critical need/main priority? Does a strategic plan exist for the sector, and to what extent have implementing agencies been consulted? Does it provide a robust foundation to ensure appropriateness and consistency of response?
- ☐ What are the key shelter policies? Are there gaps which need to be addressed?
- ☐ What is the regulatory framework? Are there gaps in the national standards, or inconsistencies with international law, and locally and internationally accepted principles and standards?
- ☐ What mechanisms are in place to ensure effective coordination exists across all stakeholders and at all levels of the response?

Funding

- ☐ What scale of funding is available to provide humanitarian assistance? What is the timescale?
- ☐ How can funds be best spent to address the needs of the affected population?
- ☐ Are there any specific donor requirements and how are these being incorporated in the transitional settlement and reconstruction strategy?

Beneficiary selection

- ☐ How are beneficiaries identified? Are consistent criteria being applied across agencies?
- ☐ Is the community involved in selecting individual households? Have community as well as household needs been considered?
- ☐ Has a complaints procedure been established? Who is ultimately responsible for the verification of beneficiary lists?
- ☐ Have specific measures been taken to identify and meet the needs of vulnerable groups?

Methods of assistance

- ☐ What are the needs of the affected population? What are the objectives of the strategic plan?
- ☐ Is there continuity of assistance from emergency to durable housing solutions? Is assistance needed to support families to return to their land?
- ☐ What is your organisation's experience in this sector? What is their overlap with other sectoral capabilities within the organisation?
- ☐ What capacity exists within the organisation to specify, procure, transport and distribute NFIs?
- ☐ What capacity exists within the organisation to design, procure or manage the construction of transitional shelter or permanent houses on behalf of affected communities?

- ☐ Is there capability within the organisation to provide financial assistance in the form of cash-for-work, vouchers or loans?
- ☐ Is there capability within the organisation to provide assistance with purchasing materials, mobilising community labour or contracting labour?
- ☐ Is there capability within the organisation to establish local information centres or carry out information campaigns?
- ☐ Is there capability to provide training or technical expertise to support the reconstruction process?

Partnerships

- ☐ Is the government able to fulfil their responsibility to provide land and certify land tenure?
- ☐ Does the Public Works department have the capacity and sufficient funds to clear land, provide site access and carry out enabling works?
- ☐ Who is responsible for providing electricity and water connections? On what basis has agreement been reached to connect to these utilities?
- ☐ Are there opportunities to partner with local humanitarian and development organisations?
- ☐ Are there aspects of the reconstruction programme (e.g. WAT-SAN) which are outside the core strengths or resources of your agency? Is there scope to partner with other agencies to deliver these?
- ☐ Are there aspects of the reconstruction programme which require technical expertise? What opportunities exist to partner with local universities or the private sector?
- ☐ Has agreement been reached with the community as to the level of assistance to be provided and extent to which they are contributing? Has this been formalised so that expectations on both sides are clear?

Natural hazards

- ☐ What natural hazards exist? What is the risk that they will cause another disaster and how can this be reduced?
- ☐ If there is risk of earthquakes or flooding are additional surveys required to identify areas where reconstruction should be avoided?
- ☐ If there is a risk of earthquakes or cyclones which national and international standards should be followed in designing buildings?
- ☐ If there is a risk of earthquakes what knowledge of seismic design and construction practice exists locally? Is there an opportunity to introduce safer construction techniques?
- ☐ If there is a risk of landslides, has this been considered in locating buildings? Is the necessary technical expertise available to carry out enabling works?
- ☐ If there is a risk of volcanoes or tsunami, has an early warning system been introduced? Has scenario planning been carried out with the community?
- ☐ Can settlement plans be rationalised to include evacuation routes, strategically address services provision and the location of critical infrastructure?

Programme plan

- ☐ What is the rational to provide shelter assistance based on needs, policy and capability of the agency? Is this founded on a substantive level of information or is there a level of uncertainty?
- ☐ What are the programme objectives? Do they support the overall strategic objectives of government and the Shelter Cluster? What are the links to other sectors; particularly wat-san, livelihoods and protection?
- ☐ What are the key constraints and opportunities? Are there factors which rule out options for assistance? Are there critical gaps that need to be addressed?
- ☐ What type of assistance is to be provided? Who is assistance being provided to? How will they be selected? Where are they located now and where will they be located?
- ☐ What are the anticipated timescales and budget? Are these consistent with donor, community, media and government expectations in relation to quality, cost and timescales? Are they realistic and what are the key risks that may effect delivery?
- ☐ What measures are proposed to engage the community throughout the process?
- ☐ How is progress to be monitored? How is the on-going relevance of the programme to be reviewed? How is performance against the objectives to be evaluated?

■ Design

Site selection and surveys

- ☐ Can the affected communities rebuild on their existing land? Has it been destroyed or become unsafe as a result of the disaster and do they need or want to be relocated?
- ☐ How will land for relocation be provided? By whom by and over what timescale?
- ☐ How will resettlement impact on the social networks and livelihood opportunities of affected communities?
- ☐ Are proposed reconstruction and resettlement sites vulnerable to natural hazards?
- ☐ Do the sites have adequate access to livelihoods and public services?

- ☐ Is there a system in place for carrying out technical surveys of proposed reconstruction or resettlement sites?
- ☐ Have sufficient surveys been undertaken to identify requirements for the provision of regional or village level environmental protection, enabling works or infrastructure to make a site suitable for reconstruction?

Land tenure

- ☐ What was the pre-disaster system for land ownership certification? Was land owned communally, by individuals or by government?
- ☐ Has documentation or local knowledge been lost in the disaster?
- ☐ How will land titles be established and how will the community be involved? How long will this take and how will disputes be resolved?
- ☐ How will community-driven processes be approved by government agencies?
- ☐ How will formal land titling affect land values and markets in the longer term? Will distortion occur between disaster-affected and host populations?

Physical Planning

- ☐ How are communities involved in the planning process? Is this sufficient to ensure reconstruction is owner driven?
- ☐ How long will this process take? What assistance will they require and are appropriate built environment professionals involved?
- ☐ Are communities directly involved in risk mapping and identifying risk reduction strategies?
- ☐ How are public buildings, livelihood facilities, infrastructure and risk reduction strategies incorporated into settlement plans?
- ☐ Who will provide the land and who will provide the buildings/infrastructure? Can partnerships be established?
- ☐ What is the most appropriate settlement layout? Individual houses, streets or clusters?
- ☐ Will the pre-disaster settlement be reconstructed as before, or is there an opportunity for improvement?

Quality

- ☐ What were the pre-disaster housing conditions of the affected population? What is the vernacular housing?
- ☐ Does contemporary housing vary significantly between rural and urban populations?
- ☐ What are the essential requirements of housing in terms of occupant comfort, environmental protection, safety, health, ability to carry out normal household activities and dignity?
- ☐ How has quality been defined based on these requirements? Does the definition of quality refer to national and international standards?
- ☐ Is there a shared understanding of quality amongst key stakeholders? Is it based on community consultation?
- ☐ How do these requirements translate into a brief for the design of the house, and requirements for water, sanitation and energy?

Types of construction

- ☐ What is the traditional type of house construction? Is this appropriate for reconstruction or are there alternatives?
- ☐ Do sufficient material supplies and skilled labourers exist locally in this type of construction? Or will they have to be sourced from elsewhere? How will this impact on lead in times and relationships with the community?
- ☐ Do national or international standards specify the type of construction which can be used?
- ☐ Is there potential to use prefabrication of building components to speed up construction? Or to set up manufacturing of building components as a related livelihood programme?
- ☐ Will beneficiaries have the appropriate skills to maintain, adapt or extend their homes?

Environment

- ☐ How did the disaster affect the environment? How can reconstruction protect, repair and enhance ecosytems?
- ☐ Is there potential to re-use or recycle waste materials generated by the disaster? Can transitional shelters be re-used or incorporated into permanent housing?
- ☐ What materials are available locally and are they sustainably sourced and certified? Is there potential to introduce new materials or manufacturing processes which have less environmental impact?
- ☐ How are building components manufactured? Do they require energy intensive processes or create toxic waste products?
- ☐ What is the source of potable water? Has this been affected by the disaster? How can sanitation and solid waste management be designed to protect and enhance water sources?
- ☐ Is there potential to incorporate rainwater harvesting, renewable energy, composting or biogas toilets? Are these appropriate and would they be maintained?

Disaster risk reduction

- ☐ Is reconstruction in an area where earthquakes, floods or cyclones are prevalent? Have hazards and vulnerabilities been identified through participatory processes?
- ☐ What national standards and best practice guidance exist? Do they reflect best practice? Is there consensus as to which are applicable?
- ☐ Are hazard maps available or are additional surveys required?
- ☐ Do settlement plans mitigate the impacts of hazards? Can hazard mitigation be included in planning and approval processes?
- ☐ If buildings must be built in vulnerable areas are engineering works required to reduce the risk?
- ☐ Has advice been sought from local or national universities, institutions or the private sector?
- ☐ Is designing for natural hazards a specialist skill? Do your technical advisors have appropriate experience and qualifications?
- ☐ Can existing coordination mechanisms and coping strategies be identified and supported?
- ☐ Can training be used to raise awareness and improve construction practices?
- ☐ To what extent do affected communities have access to finance to enable them to recover quickly or contribute to reconstruction?

Design of houses

- ☐ Does the house design meet the requirements of local, national and international standards?
- ☐ Have architects and engineers been involved in the design and detailing of the houses? Who is responsible for the design? Do they have the appropriate qualifications and experience? Is the design safe and buildable?
- ☐ How are beneficiaries involved in design?
- ☐ Is the size and spatial arrangement of the house culturally and climatically appropriate? Does it incorporate appropriate facilities for washing, cooking and livelihood activities?
- ☐ Are houses easily accessible?
- ☐ How can the design be developed to optimise performance and minimise costs? What is the potential for standardisation?
- ☐ How is standardisation balanced against the requirements for adaptation to suit the requirements of individual households or non-standard plot sizes?
- ☐ Are households allowed to use their own funds to adapt or extend their homes during design and construction? Does individual adaptation have cost or programme implications?
- ☐ Will the completed houses be durable and easy to maintain? Do they allow for future adaptations and extensions?

Design of schools and health centres

- ☐ Are there standard designs and specifications or accommodation and equipment schedules?
- ☐ How do standard designs relate or compare to international standards?
- ☐ Do standard designs need to be modified to meet specific site or functional requirements?
- ☐ Have partnerships been established with appropriate government ministries?
- ☐ Have the principals and staff who will use these facilities been involved in the design process?
- ☐ Who will provide equipment and training?
- ☐ Who will fund operation and maintenance of the building after completion?
- ☐ What are the specialist requirements in terms of water, sanitation and solid waste disposal, specialist equipment and staff accommodation?
- ☐ Are schools and health centres located, designed and constructed to remain operational during and after a future disaster?
- ☐ Has appropriate technical expertise been obtained?

Project plan

- ☐ Is there a comprehensive set of drawings which describe the building works in sufficient detail for the works to be procured and constructed?
- ☐ Has a preliminary implementation programme been developed? Does it identify key milestones and inter-relationships between activities?
- ☐ Has the scope of works and programme been used as the basis for estimating human resources? Is additional recruitment required?
- ☐ Is there a shared understanding of roles, responsibilities and lines of communication?
- ☐ Is there a comprehensive bill of quantities based on a defined scope of works? Does this include inflation and contingency allowances?
- ☐ Has value engineering or cost-benefit analysis verified that funds are being well spent?

- ☐ Have residual programme risks which might jeopardise the success of the programme been identified so they can be managed?
- ☐ Has a monitoring and evaluation strategy been agreed upon by all parties? Is there a process for incorporating recommendations?

Construction

Methods of implementation

- ☐ Are affected communities willing to engage in a self-build programme? Do they have sufficient skills and capacity?
- ☐ Are the timescales for reconstruction compatible with self-building? Is the quality of construction required to reduce vulnerability to future disasters achievable?
- ☐ Are there sufficient capabilities within the agency to manage contractor-build or direct implementation? Has partnering with the private sector or a specialist NGO been considered?
- ☐ What mechanisms can be put in place to engage the community in contractor-build and direct implementation programmes?
- ☐ How can the process for selecting and appointing contractors ensure that expectations with respect to quality and costs will be realised?

Construction management

- ☐ What experience of delivering construction programmes exists within the agency? Do local, national or international staff need to be recruited? Have partnerships with the private sector or specialist agencies been considered?
- ☐ Who is responsible for building and maintaining a relationship with the community and local authorities? Are they recognised as an integral part of the construction team?
- ☐ Has a detailed programme been developed which identifies key dependencies and the critical path? Has scenario planning been used and is the overall programme realistic?
- ☐ Have key milestones been identified? Are key construction stages for individual buildings being monitored against agreed targets?
- ☐ Who is responsible for managing cost? Are there systems in place for processing payments? How are donor requirements and timescales for release of funds being addressed?
- ☐ Is there a detailed cost plan which can be used as the baseline for cost management? Does it allow for contingencies and inflation?
- ☐ Has a risk register been developed? Have mitigation measures been identified that minimise cost and programme implications?
- ☐ Have health and safety assessments been carried out and steps taken to manage risks?

Materials and logistics

- ☐ Have materials been properly specified?
- ☐ Are materials of the appropriate quality and sufficient quantity available locally or do they need to be imported?
- ☐ Is investment in enhancing local manufacturing capacity required?
- ☐ Is demand for materials likely to affect the supply chain or cause inflation?
- ☐ Is warehousing needed to store materials? Are materials being stored appropriately to ensure they do not deteriorate?
- ☐ Have mechanisms been put in place to ensure the quality of materials delivered to site and used in construction is as specified by the designers?
- ☐ Are supply routes compromised by loss of infrastructure?

Workmanship

- ☐ What capacity exists locally in terms of both skilled and unskilled labour?
- ☐ Do skilled labourers need to be recruited nationally? Or could training programmes increase the availability and quality of skilled labour?
- ☐ What procedures have been put in place to monitor or evaluate the quality of construction at key stages? Do they include checklists or guidance?
- ☐ Has overall construction been sub-divided into key stages and method statements developed for each stage identifying the sequence of activity, materials, labour and equipment required?
- ☐ Is there potential for off-site pre-fabrication of standard building components to reduce the need for skilled labour and site supervision?
- ☐ Who is supervising construction and who is ultimately responsible for ensuring quality of workmanship?
- ☐ Who has authority to condemn poor quality construction and require it to be demolished?
- ☐ How will the quality of construction be monitored? Have quality assurance systems been put in place?

Planning

This section is targeted at senior managers, decision makers and programme advisors faced with making strategic decisions as to the type of assistance their organisation is able to provide; including whether or not to reconstruct, and which of the methods of assistance is most appropriate. It identifies the critical parameters that need to be understood before embarking on a reconstruction programme, in order to develop a response that is appropriate to the needs on the ground, based on available resources and the capability and capacity of their organisation and recognises the importance of housing (and the process of reconstruction) in terms of early recovery and capacity building. This includes consideration of constraints in relation to funding, land availability and local capacity, as well as the opportunity to build back better and mitigate against future disasters. The output of this phase should be a decision as to whether and how to participate in reconstruction cognisant of the context, capabilities of the organisation and availability of resources. If so, clear objectives for a reconstruction programme, initial timescales and an appreciation of the risks and resources required should be articulated as a Programme Plan.

Planning

Source: Arup

Source: Rumana Kabir / Oxfam GB

Source: BRR

1 | Context

Every post disaster situation is unique. Critical issues depend on the characteristics of the country as well as the type and impact of the disaster. Understanding the local context in terms of geography, society, economics, politics, climate and hazards is a key consideration in developing an appropriate strategy for recovery and reconstruction. This information provides the overall context for the plans of individual agencies and is essential background information for all individuals contributing to planning and implementation of disaster relief.

1.1 | Geography, society and economy

The province of Aceh (*Nanggröe Aceh Darussalam*) in Indonesia is geographically isolated (over 2500 km from Jakarta) and is located on the northern tip of the island of Sumatra a few degrees north of the equator. The population of 4.5 million is predominantly Muslim and Islamic (*sharia*) law was formally introduced in 2003. It is designated as a special territory with some autonomy from central government. Although responsibility for the tsunami response was quickly shifted from Jakarta to the provincial capital in Banda Aceh, the remoteness of central government impeded the timely allocation and release of funds and policy making.

The centre of Aceh is mountainous and therefore the majority of people are located in a narrow strip of flat, fertile ground around the coast pursuing fishing and agriculture. The proximity of the population to the coast meant that livelihoods as well as property were severely damaged by the tsunami. The majority of people lived in simple timber houses and construction skills within communities were limited. Although masonry and reinforced concrete construction was more prevalent in the port towns such as Banda Aceh, Meulaboh, Calang, Lhokseumawe and Singkil the construction industry was not well established.

Ports are the economic driving force of the region with a coastal road providing the main transport artery. However, both the coastal road and eight key ports were destroyed in the tsunami and this cut off the west coast from Banda Aceh, crippled the supply and distribution of materials, and made it very difficult to reach and support many communities. Although reinstatement of the coastal road was a priority, it took over two years to complete. During this time the only access to the west coast was a mountainous road from Medan or airplane to Meulaboh, making logistics a key strategic issue.

1.2 | Politics

Aceh has a history of political independence and fierce resistance to control by outsiders, including Dutch colonists and the Indonesian government. The Free Aceh Movement (GAM) was established in 1976 and proclaimed Acehenese independence. This was followed by almost 30 years of conflict characterised by the presence of Indonesian central government troops, disputes over allocation of natural resources revenues and human rights abuses. Several attempts had been made to bring peace to the province but the most recent agreement reached in 2002 had failed to last. The conflict had resulted in high levels of corruption, weak local government and underinvestment in public services despite a relatively high level of GDP per capita as a result of the substantial natural resources including oil and gas.

Conflict

There had been conflict in Aceh between the Government of Indonesia (GoI) and the Free Aceh Movement (GAM) for almost 30 years. In May 2003 the government declared a state of emergency and subsequently over 40,000 soldiers were stationed in the province. Many agencies experienced difficulties operating in this environment as national staff faced pressure from both sides. This hampered their freedom of movement and jeopardised their impartially, particularly in remote areas. The situation improved once the memorandum of understanding was signed between the GoI and GAM on 15 August 2005. However, concerns remained over inequity of assistance to tsunami- and conflict-affected communities. In December 2006, Irwandi Yusuf (whose core supporters include ex-GAM members) was elected provincial governor. His progressive social agenda focused on economic development, poverty reduction and the environment.

Source: Rumana Kabir / Oxfam GB

The tsunami helped to trigger peace negotiations between the Government of Indonesia (GoI) and the Free Aceh Movement which led to a memorandum of understanding on August 15 2005. However, the legacy of conflict in terms of institutional capacity, distrust and poor relationships inevitably overshadowed the first year or more of the tsunami response. Many agencies embarked on post-tsunami reconstruction without fully appreciating the complexities of a post-conflict situation and the negative impact on institutional structures, industry and relationships between communities as a result of Aceh's recent history.

1.3 | Climate and natural hazards

The climate is hot and humid in coastal areas, although the mountains are cooler. Prevailing winds change seasonally with westerly winds from June to November and easterly winds from December to May. Although winds can be strong the province does not suffer from cyclones. Average rainfall on the coast is around 1,600 mm per year with the principal rainy season being between September and January. These conditions meant that tents were not likely to be a viable solution for longer than six to nine months and that more consideration should have been given to supporting transitional shelter options such as barracks, host families and provision of individual transitional shelters. This would have allowed displaced families to return to their own land, providing an interim solution pending reconstruction.

High seasonal rainfall exacerbated by upstream deforestation has left areas adjacent to rivers and at the foot of the mountains highly vulnerable to flooding. Coastal areas are also vulnerable to tidal flooding. Along the west coast this significantly increased following the tsunami, due to changes in topography as well as the loss of sea defences. Aceh is also an area of high seismicity, as the Sumatran fault runs through the centre of the province and the Sunda trench (which experiences some of the world's largest earthquakes including the one which triggered the tsunami) follows the coastline.

The risks posed by flooding and earthquakes and the need for appropriate surveys, site selection and seismic resilient design was not strategically addressed as part of the overall response, leaving families vulnerable to future events. The Disaster Risk Reduction (DRR) agenda focused on the provision of early warning systems to reduce the risk of future tsunami although this highly infrequent event poses a much lower risk in the long term. Surveys to map flood risk and identify land suitable for reconstruction were not always carried out and a significant proportion of houses were constructed without any consideration of seismic design. Coastal defences were not reinstated, leaving areas that were previously protected exposed to tidal flooding. ■

MAP OF ACEH AND NIAS

KEY QUESTIONS

- **What is the geography and climate and how will this impact on logistics and timescales?**
- **How is responsibility divided between local and national government? What effect will this have on decision making, policy and flows of funds?**
- **What are the main economic activities and what does this mean in terms of available skills and materials or potential to develop livelihoods?**
- **Is there a history of conflict or social unrest and what does this imply in terms of social networks and institutional capacity?**
- **Is there a history of previous natural disasters and are there risks that should be mitigated as part of the response?**

2 | Assessment

Assessment of damage and loss is essential to understanding the extent and distribution of impact in terms of loss of life, property, infrastructure, livelihoods and impact on the economy. It should involve as many stakeholders and data sources as possible. It should be an iterative process where qualitative and quantitative information at regional or district level is progressively refined to establish accurate information across a broad set of parameters at a local level. Participatory assessments enable the needs and aspirations of those affected to be articulated and are essential in ensuring that the humanitarian response is flexible and appropriate.

The type of transitional settlement or reconstruction that is possible, and the timescales in which it can be realised, will depend heavily on the availability of materials and skills. The latter includes the capacity of the public works department, built environment professionals, local NGOs and contractors as well as the affected communities. It is therefore essential to carry out a strategic assessment of the construction capacity, and the potential of local markets to provide necessary materials at the outset.

2.1 | Damage, loss and needs

In the immediate aftermath of the tsunami, rapid damage and loss assessment was undertaken by the government with support from donors, the UN and NGOs, and published in *Indonesia: Preliminary Damage and Loss Assessment* on January 19, 2005 (BAPPENAS and International Partners). This used information from government ministries, agencies on the ground, satellite imagery, aerial photography and pre-tsunami survey data. It was intended to convey the scale of the damage both to national and international communities in order to secure funding and inform strategic planning. In economic terms, the cost of damage was estimated at 41.4 trillion Indonesian Rupiah (US$4.45 billion); equivalent to 97% of Aceh's GDP. Of this, 66% was damage to public or private property (with housing being the most affected sector) while 34% was loss of public assets or revenue within the economy. Not surprisingly, shelter was identified as a critical sector and it was estimated that 120,000 new houses were needed to replace those destroyed. Other priorities were rebuilding livelihoods and the economy, providing public services, assisting vulnerable groups and rebuilding communities.

In February 2005 the International Organisation for Migration (IOM) led a multi-agency assessment to determine the shelter and livelihood needs and aspirations of those displaced by the tsunami. This identified five key priorities for assistance:

- to return to their villages in order to resume livelihoods and regain normalcy and dignity;
- if return was not possible to be relocated as a community near their former villages so that they could maintain their community and re-establish existing livelihoods;

Damage assessment

The scale of damage caused by the tsunami is illustrated by these statistics from the damage assessment in April 2005 (IOM, 2005):

- Damaged housing and settlements
  - Settlement areas: 173,673 ha (34.8% destroyed)
  - Houses: 116,880 units (57% destroyed)

- Damaged public buildings
  - Health facilities: 693 units (66% destroyed)
  - School buildings: 1,662 units (46% destroyed)
  - Government buildings: 1,412 units (70.6% destroyed)
  - Markets/kiosks: 1,416 units (75% destroyed)

- Damaged infrastructure
  - Arterial roads: 654 km (27.5% destroyed)
  - Provincial highways: 603 km (38% destroyed)
  - Bridges: 2,267 units (66.5% destroyed)

Source: http://www.unep.org

- to be provided with transitional/permanent housing with basic facilities, particularly private baths and toilets;
- to be provided with construction materials (wood, cement);
- to be provided with land and housing with clear assurance of legal ownership.

Many of these priorities were incorporated into shelter policy, including the principle of supporting return to existing settlements and support in terms of land certification and housing provision. However, the range of assistance options identified by the affected communities (including transitional shelter and NFI distribution) were overlooked in the race to provide permanent housing. Additionally, this assessment focused only on the needs of IDPs, and the lack of comprehensive assessment, covering the entire affected area (including both urban environments and more remote areas) meant that the needs of many people were overlooked.

2.2 | Materials and local capacity

Availability of materials became a critical issue in Aceh, with most agencies experiencing multiple difficulties obtaining a sufficient quality and quantity of materials from legal sources. This impacted negatively on the quality of construction and the agencies' ability to respond quickly. WWF/Greenomics Indonesia conducted a preliminary materials assessment which highlighted the lack of locally sourced timber in March 2005 (WWF/Greenomics Indonesia, 2005). However, collective measures to overcome the issues associated with local illegally logged poor quality timber, ensure adequate supply and prevent inflation by bulk purchasing through national or international supply chains were not undertaken. Instead, smaller agencies sourced materials independently, generating intense local competition and inflation, whilst larger agencies resorted to purchasing materials from Medan or further afield. Strategic initiatives such as the World Food Programme (WFP) shipping service, established towards the end of 2005, provided coordinated logistics and facilitated sea delivery of materials for reconstruction for UN agencies, BRR and humanitarian agencies, but these were insignificant given the scale of the reconstruction programme.

Strategic assessment of local capacity would also have highlighted the shortfall in local skills and capacity in the construction sector. This made it very difficult for implementing agencies to identify local partners to provide technical expertise, placing greater reliance on staff recruitment or international consultants with consequences for budgets and programme. Although numerous contracting firms established themselves after the tsunami there was no process of certification to guarantee their competency. Some agencies had to terminate agreements mid-contract due to poor workmanship or faced expensive remedial works. There were also shortfalls in the resources within the public works department, other key ministries and local government. This caused severe delays with land identification, site clearance and utilities connections. ■

Source: http://ioc3.unesco.org

DAMAGE IN BANDA ACEH

Initial assessment

Assessments provide an understanding of the disaster situation and a clear analysis of threats to life, dignity, health and livelihoods to determine, in consultation with the relevant authorities, whether an external response is required and, if so, the nature of the response.

Sphere (2004) Common Standard 2

KEY QUESTIONS

- **What is the extent of damage and loss of life, livelihoods, property and infrastructure?**
- **What are the affected communities' needs and priorities for assistance? How is this translated into government policy and a strategic plan for the sector?**
- **What materials are available locally? Do the necessary skills exist within affected communities or the construction industry?**
- **What capacity exists within professionals, institutions and government to manage and support the reconstruction programme? What effect does this have on local, national or international recruitment?**

3 | Governance

An effective institutional and policy framework is key to delivering transitional settlement and reconstruction programmes and projects. Central to this is the development of a strategic plan for the shelter sector which sets out the objectives of assistance, the respective responsibilities of government and the humanitarian and development agencies and relevant laws and standards. The Strategic Plan is the responsibility of government and the mandated coordinator.

Sufficient resources must be dedicated to the development and maintenance of the Strategic Plan, including travel to affected areas to gather, share and feed back information between agencies. It should form the basis of individual agencies' programmes and projects to ensure their response is appropriate, coordinated and meets the needs of the entire affected population.

3.1 | Responsibility

In the first three months after the tsunami, the Indonesian government attempted to coordinate the relief and reconstruction effort from Jakarta through The National Coordinating Agency for Natural Disaster and Refugee Relief (BAKORNAS PBP). However, as BAKORNAS was inadequately prepared to coordinate a disaster response, the emergency phase of the relief operation was largely ad hoc with international agencies initiating and coordinating their own efforts (TEC, 2006).

The National Planning Agency (BAPPENAS) was responsible for coordinating longer-term recovery and reconstruction and they put in place two strategic elements in the reconstruction process. The first was the *Master Plan for the Rehabilitation and Reconstruction of Aceh and Nias* (the *Master Plan* or *Blueprint*), which was set in law on the 15 April 2005. This was followed by the establishment of the Rehabilitation and Reconstruction Agency (BRR), tasked with coordinating the implementation of the *Master Plan* in recognition that the weak local government had been crippled by the tsunami.

BRR was established on 16 April 2005 with a four year mandate to coordinate and implement the *Master Plan* reporting directly to the president. BRR's mission was 'to restore livelihoods and strengthen communities in Aceh and Nias by designing and implementing a coordinated, community-driven reconstruction and development program with the highest professional standards' (BRR, 2005a). Its main functions were planning, approval, matching needs to resources, facilitation, disbursement of funds, monitoring and evaluation. Inevitably, it took some time to establish BRR, which created a temporary vacuum for much of the first year in respect to policy, coordination and planning approvals. Many NGOs had started reconstruction before the establishment of BRR and continued their activities regardless of the new organisation.

Slow progress in reconstruction activities led to the expansion of BRR's mandate at the end of 2005 to include implementation in addition to its previous roles. This created a conflict of interest since BRR's overall mandate was to coordinate reconstruction. It also placed BRR in competition with implementing agencies for local contractors, labour and materials. In July 2006 BRR began a process of decentralisation through the establishment of several district offices. This supported capacity building of local government, in preparation for eventual handover, and began the process of returning decision-making power to the traditional district and sub-district authorities.

3.2 | Strategic plan

The strategic planning process leading to the *Master Plan* was not used as a coordination tool to engage all stakeholders as much of this work took place in Jakarta and did not involve agencies already working with communities in the field, who in turn did not dedicate resources to this process. Consequently, the *Master Plan* did not represent a consensus decision on the objectives of the response, the type of assistance or timescales and was not clear as to the roles and responsibilities of each stakeholder and the standards that apply. This limited its use by agencies and meant that it did not provide a robust foundation to ensure appropriateness or consistency of response. However, the five principles it established were adopted by most agencies: community-oriented; participatory as well as sustainable; holistic and integrated; efficient, transparent and accountable; in accordance with the legal status of Aceh; targeted to the most vulnerable and the most affected regions (BRR, 2005a).

3.3 | Policy

Shelter policy was not developed within the overall context of the journey from emergency shelter to durable solutions, and over the first six months there was considerable confusion and no clear policy as to the type of shelter assistance required. In June 2005, BRR announced that families should be encouraged to return to their own land or to voluntarily resettle on land purchased by communities themselves or by BRR. They also stated that each affected household would be eligible for a permanent 36m^2 house, with an expectation that this could be realised within a year, in the belief that in the interim affected communities were adequately housed in barracks, transitional shelter or with host families. Agencies who had already constructed 'semi-permanent' houses were faced with having to upgrade or replace housing, as these

were no longer deemed adequate. This timeline proved unrealistic and did not reflect the realities on the ground, led to false expectations by the media, donors, government and beneficiaries and placed considerable pressure on implementing agencies.

This 'one size fits all' policy, whereby everyone affected was entitled to a house, reflected the large amount of funding available, rather than needs of the affected population, and was articulated in terms of reconstruction rather than recovery. This led to an emphasis on providing houses rather than assistance to reconstruct. The focus was on physical construction rather than responding to the way that the process of rebuilding can lead to economic activity, or the role that shelter plays in meeting needs and allowing families to return home and carry out their livelihoods. Numerous agencies engaged in reconstruction of houses, despite having no previous experience in this area, while other options for assistance were overlooked or abandoned.

Further policy evolved as needs and gaps were identified. Land tenure and the assistance of renters and squatters became key issues. Land tenure was significant as the tsunami destroyed not only the built environment but personal identification documents, land boundary markers and almost all records of land ownership. To address this, the Indonesian government, in partnership with the World Bank, set up the *Reconstruction of Land Administration Systems in Aceh and Nias* (RALAS) programme in August 2005.

Renters and squatters were overlooked in the original *Master Plan* and by 2006 it became clear that their needs were not being addressed. BRR introduced a policy of cash grants for renters and squatters in June 2006 (BRR, 2006) but this still left them severely disadvantaged and it wasn't until February 2007, over two years after the tsunami, that a policy of free land and housing for renters and squatters was finally announced (UN, 2008). Identification of the number of people in each of the six transitional reconstruction categories (UN, 2008) in the initial stages of the response would have highlighted the number of renters and squatters and enabled their needs to be addressed.

3.4 | Regulatory framework

BRR required construction to be in accordance with the legal status of Aceh but there was confusion as to whether this referred to the normal Indonesian building codes or the *Building Code for Aceh*. National standards existed covering the specification, methods and testing of concrete, aggregates, cement, timber, structure and building safety. There is also an Indonesian seismic code (SNI.03-1726-2002) based on the American Universal Building Code.

BRR published the *Building Code of the Province of Nanggröe Aceh Darussalam* in July 2005 (UNHIC, 2005) and this provided detailed technical requirements for houses. Specifications included: minimum size (36m^2), minimum space/person (9m^2), type and minimum dimensions of foundations, and types of concrete mixes permissible. However, this prescriptive matrix of requirements provided no guidance on seismic resilient design and made no reference to national or international standards. Evidence on the ground suggested that neither were being enforced and that many houses being built, including those of BRR, did not comply with national standards. Although in principle BRR was meant to approve housing designs and site plans prior to implementation, they did not have the necessary resources or technical expertise to do so.

The *Building Code for Aceh* did not refer to UN guidelines, *Sphere Standards* or other international standards. The DEC reporting procedures encouraged consideration of ▶

Response

A humanitarian response is required in situations where the relevant authorities are unable and/or unwilling to respond to the protection and assistance needs of the population on the territory over which they have control, and when assessment and analysis indicate that these needs are unmet.

Sphere (2004) Common Standard 3

KEY QUESTIONS

- **Who in government is responsible for post-disaster response and recovery? If this is a new entity, how long will it take to become effective?**
- **Who in the humanitarian sector is responsible for assisting and supporting the government? Has a UN agency been identified to coordinate the shelter sector?**
- **Has shelter been identified as a critical need/main priority? Does a strategic plan exist for the sector, and to what extent have implementing agencies been consulted? Does it provide a robust foundation to ensure appropriateness and consistency of response?**
- **What are the key shelter policies? Are there gaps which need to be addressed?**
- **What is the regulatory framework? Are there gaps in the national standards, or inconsistencies with international law, and locally and internationally accepted principles and standards?**
- **What mechanisms are in place to ensure effective coordination exists across all stakeholders and at all levels of the response?**

- *Sphere Standards* (Sphere, 2004). Chapter four provides six standards for shelter and settlement in post-disaster response. Some DEC Member Agencies felt that these standards related to emergency and transitional shelter only and were not directly applicable to permanent housing. Consequently, DEC Member Agencies reported against the common standards only (which cover participation, assessment, need for humanitarian response, targeting of vulnerable groups, monitoring, evaluation, staff competency, supervision and support of personnel) rather than the specific shelter standards.

The *Guiding Principles on Internal Displacement* (UN/OCHA, 1998), otherwise known as *Deng's Principles*, identifies rights and guarantees relevant to the protection of internally displaced populations (IDPs) during displacement, as well as during return or resettlement. Although an Indonesian version of these existed pre-tsunami, and there were government/NGO/UN projects to use these in other areas of Indonesia, there was little evidence of them being applied in Aceh. Indeed, due to the pre-existing conflict displaced population, the IDP 'identity' of tsunami survivors became politically sensitive and government officials and international humanitarian organisations sometimes referred to tsunami survivors as 'homeless' (Couldrey and Morris,2005).

The *Pinheiro Principles* (COHRE, 2004) also provide standards for housing, land and property rights for displaced populations. They are intended to provide practical guidance to states, UN agencies and the international community on how best to address the legal and technical issues surrounding housing, land and property restitution.

3.5 | Coordination

UNHCR and UN/OCHA were initially responsible for the coordination of the Shelter Sector. This responsibility passed over to UN-Habitat in April 2005. In partnership with the Public Works Department they formed the Shelter Working Group and chaired weekly coordination meetings. However, these meetings were uni-sectoral, focused only on the vicinity of Banda Aceh and held separately in Indonesian and English. They also ceased in May 2006 when many international and national staff were transferred as a result of the Yogyakarta earthquake. Increasingly local coordination meetings took place between agencies at district level. BRR, government and UN-led coordination groups operated independently in Banda Aceh, Medan, Meulaboh and Jakarta as well as locally in the districts. Implementing agencies felt that there was confusion as to role and responsibilities, and too many layers of coordination.

UNHIC produced a *Shelter Data Pack* in July 2005 which included a list of NGOs working on shelter, guidelines on community land mapping and village planning, the *Building Code for Aceh*, a list of preferred material suppliers and a pricelist. UN-Habitat, in partnership with BRR, also developed guidelines on various topics including: land mapping, pricing indicators, equitable rights, options for renters and squatters and community-empowered resettlement and UNDP also contributed other guidelines. Multiple guidelines caused confusion as to what was deemed appropriate, rather than providing clarity as to which codes and standards should apply.

The post-tsunami response was on a very large scale and the difficulties in access and the number of agencies involved made coordination difficult. Time pressure and competition for funding meant that agencies initially focused on internal problem solving, but over the course of the reconstruction, the dynamic shifted gradually from competition to cooperation. There was sharing of information between DEC Member Agencies to help improve quality (e.g. contractor blacklists, material suppliers), and the UK Shelter Forums in November 2006 and June 2007 (www.shelterforum.org.uk) provided valuable opportunities for sharing approaches and recognising key issues. Considerably more could have been done in-country in terms of pooling knowledge and addressing common issues collectively. ■

Strategic coordination

There were several instances where reconstruction of larger scale strategic infrastructure impacted on housing but was not properly coordinated or prioritised. For example, BRR had to compensate families who received houses from one DEC Member Agency in 2006 which then had to be abandoned due to widening and re-alignment of the USAID road between Banda Aceh and Meulaboh. Repeated delays to the completion of this road also perpetuated the challenge of delivering building materials to the area around Calang. Delay in the reconstruction of sea walls and coastal protection meant that many communities remained vulnerable to flooding, and such protection measures were not identified in the expenditure of the Multi-Donor Fund which was fully committed by early 2008. In Pasir one DEC Member Agency lost several reconstructed houses due to very high tides shortly after they were constructed since the sea wall had not yet been reinstated.

Source: Arup

4 | Funding

Implementing agencies are accountable to beneficiaries, donors and government. A key challenge is satisfying the requirements of all parties as to how funds are spent. Significant funding constraints include the total amount of money available, the timescales over which it can be spent, and other donor requirements. Typically, funds raised through emergency appeals must be spent within the first nine to twelve months after a disaster. This generally precludes reconstruction and places greater emphasis on emergency and transitional settlement options.

4.1 | Appeals

In Aceh, the decision that everyone should be entitled a 36m^2 permanent house and the scale of reconstruction supported by humanitarian agencies was a result of the considerable sums of money raised. This was through a combination of international appeals including those of the Disasters Emergency Committee, the International Federation of Red Cross and Red Crescent Societies (IFRC) and the UN Flash Appeal. Initial pledges by foreign governments initially exceeded $5 bn and substantial sums were donated directly to humanitarian agencies. All these appeals were launched within days of the tsunami, well before any kind of humanitarian assessment of needs could be undertaken. They resulted in an unprecedented response, possibly due to the tsunami coinciding with the Christmas holiday or the countries affected being popular tourist destinations.

The sums of money raised created a unique scenario of there being too much rather than too little money available. This led to competition between donors and implementing agencies to identify ways in which it could be effectively spent. It is questionable whether the experiences in Aceh will set a precedent for future humanitarian responses as it is unlikely that similar levels of funding will be available or channelled through humanitarian agencies. Funding in most post-disaster situations is normally only sufficient to provide emergency or transitional shelter, with more emphasis placed on providing resource centres and developing skills to allow durable housing solutions to materialise in due course as part of the recovery process.

4.2 | Donor accountability

The DEC *Tsunami Earthquake Appeal Strategic Framework* (June, 2005) identified provision of permanent housing and the re-establishment of social infrastructure such as schools and clinics as funding priorities. This was set within the context of an overall vision that encompassed addressing peoples' needs and reducing vulnerability to future disasters so that 'donors to the appeal will know they have made a lasting difference.' DEC also recognised the need to extend the funding term to three years rather than eighteen months and allowed different approaches to delivery. This depended on the balance chosen by each agency of the number of houses they were constructing, quality, cost and programme. Unfortunately, these aspirations were not reflected in their three monthly reporting requirements and in-country teams and programme managers were often unaware of the specific objectives of the DEC fund. Thus, despite DEC's stated objective to reduce vulnerability, some agencies initially considered seismic resilience as an optional rather than an essential requirement.

In some cases housing programmes were funded by multiple donors with different reporting requirements which complicated donor accountability. Equally, considerable sums were donated directly to NGOs, who were then playing a dual role of donor and implementer without there always being a clear distinction between the two. Some agencies chose to work with or through local agencies and a key question that arose was the extent to which agencies felt they were accountable for the performance of local partners. ■

KEY QUESTIONS

- **What scale of funding is available to provide humanitarian assistance? What is the timescale?**
- **How can funds be best spent to address the needs of the affected population?**
- **Are there any specific donor requirements and how are these been incorporated in the transitional settlement and reconstruction strategy?**

5 | Beneficiary selection

Assistance should be provided equitably, and the needs of the most vulnerable must be met. It is therefore critical to agree a clear policy on eligibility and responses across all agencies. The selection of individual beneficiaries should involve the whole community in a transparent process, and beneficiary lists should be coordinated and approved by government to avoid duplication. This can be a time-consuming and resource-intensive process involving village leaders and local government. The decision to work in several districts or sub-districts may also impact on mobilisation costs and programme.

5.1 | Identification

Communities affected by the tsunami were from both urban and rural locations and a wide range of socio-economic backgrounds. Many were provided with emergency shelter in the form of tents or barracks, but these were not always close to where people had previously lived. Fear, and delays in shelter assistance, often prevented communities returning to their land and they were forced to find their own interim solutions such as renting or residing with host families.

Identifying affected communities and establishing who was eligible for assistance was an iterative process and the decision by some agencies to provide assistance to communities and others to individual households further complicated this process. Agreement to provide assistance to specific communities by reconstructing houses was generally reached between the head of the village (*kepala desa* or *geucik*), the head of the sub-district (*camat*) and implementing agencies. BRR provided overall coordination and identified outstanding needs and gaps which they either addressed themselves or passed on to another agency.

Some agencies chose to provide assistance to individual households rather than communities. This resulted in several agencies working within one community and intense competition as beneficiaries tried to get the best house as quickly as possible by signing up with more than one agency. This tended to occur where social networks were weak as a result of conflict, in urban areas or where agencies targeted specific households who fulfilled their mandate. Most DEC Member Agencies chose to work in several districts but one focused all their efforts on 16 villages in one sub-district with the advantage of being able to centralise their administrative and logistical arrangements.

5.2 | Verification

The process of identifying and verifying beneficiaries was a key tool in engaging the affected communities. Often, Community Construction Committees, involving both men and women, were formed to act as a focal point for consultation. Lists of eligible households provided by village leaders or BRR were verified with each community and eligibility criteria were agreed to ensure equity and minimise conflict. The resulting lists of eligible households were publicised locally and the community given an opportunity to challenge claimants. This process often had to be repeated several times before final lists were agreed, but it helped to assure communities that it was a transparent and equitable process. It also generated valuable base information to inform programme design such as the number of people affected, their location, the level of damage, their needs and vulnerabilities and their land tenure situation.

Beneficiary identification and verification was prone to corruption. In one case the head of the village sold family

Working with women

One DEC Member Agency made women the primary decision makers in their house building programme. Their original village had become flood prone after the tsunami so initially the women had to decide whether or not to relocate their entire community. Once a new location had been identified they took a leading role in the participatory planning process for their new community. Within their individual plots they chose the location of their houses and the position of water and sanitation facilities. They also made decisions regarding the internal layouts of their houses and types of finishes. Involving women in this way ensured that the village plans and housing designs were culturally appropriate and avoided many of the problems experienced by other agencies.

Source: Prathiwi Widyatmi/Oxfam GB

ID cards to outsiders making them eligible to receive housing assistance at the expense of the rest of the village (ACARP, 2007). In other cases, households received multiple houses by playing off one agency against another or including relatives returned from other areas of Indonesia to lay claims to land or titles. Although BRR held ultimate responsibility to verify lists of eligible households they found this challenging and welcomed the pro-active approach taken by many DEC Member Agencies. However, many agencies found that even when complete information was presented they experienced delays in obtaining BRR approval.

5.3 | Vulnerable groups

All agencies implemented policies to identify and support vulnerable groups throughout the reconstruction process. Recommendations were made to the head of the village and BRR to prioritise single parents, the elderly, disabled and orphans. Some agencies implemented specific programmes to recognise the needs of vulnerable groups and safeguard their interests. Widows were eligible to inherit property under both Islamic (*Sharia*) and customary (*adat*) law, but agencies expressed concern that this procedure was not followed in practice (Oxfam International, 2006). The position of women was strengthened when BRR announced that women could legally own property jointly with men in September 2006.

Orphans were also eligible for inheritance, and consequently new permanent houses, however, problems arose over the status of guardians and where there was more than one sibling. Mobile *Sharia* court teams were set up to protect the rights of women and orphans, who could otherwise end up losing land they were entitled to. On the whole this programme was successful, but initially people found the system difficult to understand. Criticisms included a lack of proactivity in identifying orphans and delays due to the number of witnesses required.

The needs of renters and squatters were initially overlooked and eighteen months after the tsunami they represented over a third of the population still living in barracks (UN, 2008). In June 2006, as a result of advocacy by various agencies, BRR issued regulations which stated that renters and squatters would receive cash grants. However, delays in implementation combined with inflation of 40% meant the cash grant was not sufficient (Oxfam International, 2006). Frustration led to major demonstrations outside BRR's head office in Banda Aceh and finally, in February 2007, a policy of free land and housing for renters and squatters was announced. BRR developed Labuy, near Banda Aceh, as a resettlement site specifically for this group and they provided assistance to 1,000-2,000 renters elsewhere who bought land but required help to build a house.

Some agencies were concerned that families displaced by the conflict but unaffected by the tsunami, or families whose houses were partially damaged, were excluded from assistance. This created local tensions and inequalities both within and between communities. There also remained an ongoing issue of sub-standard housing in areas not affected by the tsunami and the provision of shelter beyond the directly affected areas. ■

Participation

The affected population actively participates in the assessment, design, implementation, monitoring and evaluation of the assistance programme.

Sphere (2004) Common Standard 1

Targeting

Humanitarian assistance or services are provided equitably and impartially, based on the vulnerability and needs of individuals or groups affected by disaster.

Sphere (2004) Common Standard 4

KEY QUESTIONS

- **How are beneficiaries identified? Are consistent criteria being applied across agencies?**
- **Is the community involved in selecting individual households? Have community as well as household needs been considered?**
- **Has a complaints procedure been established? Who is ultimately responsible for the verification of beneficiary lists?**
- **Have specific measures been taken to identify and meet the needs of vulnerable groups?**

6 | Methods of assistance

There are many different ways in which shelter assistance can be provided to support reconstruction. Selection of an appropriate method of assistance depends both on the needs of the affected communities and on the type of assistance a particular agency is best placed to provide. The latter is based on the agency's capacity, institutional knowledge and available resources and includes how reconstruction may overlap with other sectoral capacities within the organisation (e.g. livelihoods, WAT-SAN, education). Different methods of assistance should be combined to create specific programmes tailored to the needs of the affected communities and individual households. These may be uni-sectoral or multi-sectoral but should reflect the strengths of the agency whilst recognising the need to recruit additional technical expertise or partner with others to fill skills gaps.

6.1 | Shelter

Emergency shelter in Aceh was initially provided in the form of tents and barracks and the government assumed that people would move directly from tents and barracks into permanent houses. However, the government aimed to house 140,000 displaced people in barracks, but by December 2005 had achieved less than half of this (BRR and International Partners, 2005b). In contrast, transitional shelter was identified as a priority in the early stages of the Sri Lankan response and within nine months of the tsunami over 100,000 transitional shelters had already been provided.

Some agencies distributed shelter Non Food Items (NFIs) to assist families to build their own temporary shelters while others started to provide simple semi-permanent shelters to enable people to return quickly to their own land. However, after six months the agenda leapt to reconstruction as a result of BRR policy. The provision of 'semi-permanent' shelter quickly became unpopular as policy shifted towards provision of permanent housing and issues arose over the durability of timber that had been used. Comprehensive provision of transitional shelter kits did not take place until 15 months after the tsunami. Transitional shelters provided through IFRC were delayed and many families did not receive these until the latter part of 2006. As a result, they had no assistance to return to their own land. Recognising that the provision of permanent housing would take longer than anticipated, some agencies chose to distribute IFRC transitional shelters as an interim measure to communities where they had already pledged to provide permanent housing.

Many people in Aceh offered shelter to displaced relatives and neighbours and by the end of 2005 about 75,000 people were living with host families (BRR and International Partners, 2005b). Although people living with host families did not require emergency assistance, they did need help in rebuilding their lives and livelihoods and their invisibility made reaching them a challenge for humanitarian agencies. Over time, displaced people became a burden to their hosts and required alternative solutions. Assistance to host families was provided by government through cash grants but it proved difficult to determine who was eligible as household sizes tended to fluctuate as a result of extended families and returning relatives.

Transitional shelter

The Temporary Shelter Plan of Action was launched in September 2005 but many families did not receive transitional shelter kits until 2006. These comprised a 25m^2 lightweight steel-frame, timber cladding and a metal roof and were designed to be easily anchored to the ground and assembled by a small team of people in less than a day. They were imported and distributed by the IFRC and erected by partner NGOs either on the beneficiaries' land or on land identified by government. The quality and cost of the IFRC shelters (originally developed as housing for the Mekong Delta in Vietnam) was comparable to the quality of shelter many fishermen lived in pre-tsunami and higher quality than much of the housing in mountain villages. This led to concerns over cost and equity of assistance particularly as many families affected by the tsunami received both a transitional shelter and a house.

Source: Arup

6.2 | Labour

Most agencies initially attempted to carry out self- or community-build programmes and agencies provided assistance in the form of remuneration (cash for work), tools and equipment, or health and safety measures. Community and self-help projects are most appropriate where housing or shelter design is relatively simple, communities have a tradition of self-building and there are no strict time pressures. However, none of these conditions were present in Aceh. As the lack of construction skills became apparent most agencies either hired skilled labour directly or appointed contractors but continued to support the community as unskilled labourers.

Analysis and evidence from many post-disaster contexts illustrates that the role of shelter as an overall platform for increasing incomes – with links to key ingredients for income improvement such as credit, training, agricultural support, small business development – is underappreciated by many aid agencies. In Aceh, several agencies had livelihoods programmes but they did not usually inter-relate to their construction programmes; yet the shortage of skilled labour and contractors required agencies to provide training on most housing projects. Larger scale vocational training programmes could have been implemented as a means to strategically address the immediate shortfalls in skilled labour and fuel longer term development of a local construction industry. However, there were only a limited number of projects aiming to build local construction capacity, with an increasing proportion of labour being imported.

6.3 | Materials

In the first two months after the tsunami one DEC Member Agency distributed Shelter Non Food Items (NFIs) including toolkits, cement and wheel barrows to affected families. This enabled many communities to return to their villages and either repair their damaged homes or build transitional shelters on their own land. This began the early recovery process as communities which were able to return to their own homes found it much easier to rebuild their livelihoods and social support networks. Early distribution of NFIs also helped the agency to build trust within the community and this established partnerships which were invaluable in the later stages of the recovery programme.

Most agencies provided assistance in the form of construction materials but almost always as part of an overall assistance package to reconstruct houses. There was very limited supply of local materials and larger agencies who had procurement and logistics capability were able to more readily source materials nationally and internationally. Some agencies found they did not have the technical expertise to correctly specify structural grade or durable timber and resorted to using what was locally available. However, this included illegally logged poor quality hardwood and untreated softwoods. The opportunity to provide assistance by supporting manufacturing of construction materials (e.g. blocks) or building elements (e.g. doors and windows) was mostly overlooked.

6.4 | Finance

UN-Habitat used cash disbursements in Aceh for the construction of permanent housing, although this approach was not common. Funds were released to clusters of households in stages, with clusters responsible for the purchase materials and labour. Concurrently, UN-Habitat facilitators provided training, monitored the quality of construction and provided technical assistance as required. The traditional model for construction was to hire a local skilled labourer (*tukang*) to manage the purchase of materials and the supply of unskilled labourers as required. Each household could chose whether to employ a tukang and a small team, just employ labour as required and complete some sections themselves (often ▶

KEY QUESTIONS

- **What are the needs of the affected population? What are the objectives of the strategic plan?**
- **Is there continuity of assistance from emergency to durable housing solutions? Is assistance needed to support families to return to their land?**
- **What is your organisation's experience in this sector? What is their overlap with other sectoral capabilities within the organisation?**
- **What capacity exists within the organisation to specify, procure, transport and distribute NFIs?**
- **What capacity exists within the organisation to design, procure or manage the construction of transitional shelter or permanent houses on behalf of affected communities?**
- **Is there capability within the organisation to provide financial assistance in the form of cash-for-work, vouchers or loans?**
- **Is there capability within the organisation to provide assistance with purchasing materials, mobilising community labour or contracting labour?**
- **Is there capability within the organisation to establish local information centres or carry out information campaigns?**
- **Is there capability to provide training or technical expertise to support the reconstruction process?**

painting and interior finishes) or self-build the entire house. Each option had benefits in terms of cost, time and quality of construction and it was up to each household to decide based on their individual requirements. Problems were experienced with sourcing materials and labour in a competitive market. These might have been reduced though the distribution of vouchers to be exchanged for building materials or skilled labour.

6.5 | Technical expertise

Most agencies sought to assist with reconstruction by providing technical expertise to plan, design, procure and construct houses. However, they were mostly unfamiliar with the complexities of reconstruction and under-estimated the need for technical expertise within their own organisation to identify the need for and coordinate professional inputs, to develop terms of reference and take responsibility for key decisions. Considerable reliance was placed on international consultants, many of whom had never previously worked in a post-disaster situation and frequently were only available for six to twelve months. Architects and engineers were employed from the local private sector. Many of these had only recently graduated and had no practical experience or knowledge of seismic design. Recruiting capable professionals such as surveyors, engineers, planners and architects who were able to advise and train others on damage assessment, hazard-resistant construction, settlement layout, building design, infrastructure and project management remained a challenge throughout.

An alternative method of assistance would have been the establishment of resource centres in each district; making a relatively limited amount of technical expertise available to a large number of organisations. This would have been an alternative to engaging directly in building houses and perhaps better suited to the capabilities and capacity of some agencies. In other post-disaster responses, resource centres supporting the construction process have been established to provide a wide-ranging service to communities.

6.6 | Information and advocacy

Disaster-affected communities often did not know what assistance was available to them and needed support to understand both the types of assistance available and the mechanisms for receiving assistance. This was particularly important for vulnerable groups, who were not always able to participate in group meetings and make their priorities heard. The Architecture Clinic and UN-Habitat comic book *Rumah Impian Ioen* was a good example of the type of information required. It was targeted at affected communities, published in Acehnese, and distributed by numerous agencies. Radio Suara Muhammadiyah also established a radio network in IDP camps across Aceh in the immediate aftermath of the tsunami.

Equally important is the advocacy role humanitarian organisations play in ensuring that the needs of communities are heard and in influencing policy. In Aceh, agencies were instrumental in lobbying BRR to ensure that vulnerable groups were accounted for including women, children, the elderly, renters and squatters. ■

Livelihood support projects

Some agencies implemented cash for work schemes to rebuild infrastructure and one agency provided micro-finance for manufacturing construction materials. One DEC Member Agency provided cash grants to revive a local brick factory and this helped to generate employment for people within their own village. Although this approach can be very beneficial to communities in the long term, it was not widely used in Aceh because of a lack of coordination between the shelter and livelihoods sectors. Even in instances where materials were manufactured locally, communities experienced reluctance from procurement departments within agencies to purchase their materials. This was because procurement officers preferred to make bulk purchases from large scale suppliers who could provide products at a lower price and were able to guarantee quality.

Source: Rumana Kabir / Oxfam GB

Twelve common assistance methods for disaster-affected populations

Adapted from *Transitional Settlement and Reconstruction after Natural Disasters* (UN, 2008)

The review of these guidelines has identified a further five assistance methods and led to the removal of transitional shelter as an assistance method. These will be included in the final publication *Shelter after Disaster: Transistional Settlement and Reconstruction* in 2010 and have, in the interim, been published in *Selecting NFIs for Shelter* (IASC ESC, 2008).

Transitional shelter

Transitional shelter provides a habitable covered living space and a secure, healthy living environment, with privacy and dignity, to those within it, during the period between a conflict or natural disaster and the achievement of a durable shelter solution.

Community labour

Self- or community-build projects are possible when labour is available, the housing or transitional shelter design is relatively simple, communities have a tradition of self-building and there are no strict time pressures.

Household NFIs

Household NFIs, such as cooking sets and blankets, are usually distributed in both the emergency and recovery phases. A series of standard packages should be agreed, the contents of which are either standardised or determined by assessment and continual monitoring.

Information centre

Local information centres can offer a constant presence and service in affected communities over the duration of the response. They should provide advice and guidance on what assistance is on offer and how to access it, provide opportunities for consultation and may offer additional services such as cash disbursement.

Cash

Cash disbursements may be made directly to beneficiaries and combined with cash disbursement with technical expertise such as building inspectors or damage assessors. Disbursement may be phased to ensure that agreed goals are met before continuing to the next stage.

Loans

When affected populations still have access to relatively stable supplies of materials and services, and where later repayment and collection are feasible, emergency loans are sometimes used to help people buy household and shelter NFIs. Emergency loans are most useful if available immediately following a disaster.

Contracted labour

Contracted labour is often used for projects after the emergency phase such as: large or complex engineered buildings, infrastructure, construction which requires specialist skills or risk-reduction measures, assisting vulnerable families or providing additional capacity.

Direct labour

Humanitarian organisations may hire and manage labour directly to undertake a small project, for example in the emergency phase when rapid response is essential.

Shelter NFIs

Shelter NFIs, such as construction timber and tools, are usually distributed in standardised packages, the contents of which are determined by assessment and contiual monitoring. Distribution is often phased, to ensure that materials are used for the activity agreed.

Technical expertise

Technical expertise from humanitarian organisations or the private sector may be made available to support all assistance methods. Expertise may take the form of damage and risk assessors, technical inspectors, built environment professionals (architects, engineers, planners and surveyors) and skilled craftsmen.

Vouchers

Vouchers can be exchanged for defined materials and services provide an alternative to cash disbursement or NFI distribution. They can be useful in situations with security concerns, lack of banking facilities, to control price inflation, to meet donor requirements or to ensure a particular material or service is used.

Capacity building

Capacity building should comprise medium-term support that integrates training and the training of trainers with participatory workshops and additional capacity. Clear objectives and indicators should be agreed that define and measure impact upon reconstruction, rather than the number of persons trained.

7 | Partnerships

It is highly unlikely that a single agency will be able to deliver all aspects of a transitional settlement or reconstruction programme themselves. Aspects which fall outside their remit or core strengths will require partnerships with government, other agencies or local organisations. It is essential that the responsibility of each partner in contributing to the common goal of reconstruction is clearly defined and communicated. A shared understanding of timescales and risk allows expectations to be managed. This applies equally to the communities receiving assistance who are key partners in the process.

7.1 | Government

The success of the reconstruction programme in Aceh relied on there being an effective partnership between BRR and the humanitarian sector. However their respective contributions on any particular project was generally not formalised or shared with the community, often generating misunderstandings and delays. Agencies were blamed for not delivering housing programmes quickly enough or for houses remaining unoccupied when they were reliant on government or third parties to deliver critical components, such as land titles, site clearance or piped water connections.

The *Reconstruction of Land Administration Systems in Aceh and Nias* (RALAS) programme was initiated by government, in partnership with the World Bank, in August 2005 to fast track land certification in recognition that personal identification documents, land boundary markers and almost all records of land ownership had been destroyed by the tsunami. This programme relied on humanitarian agencies assisting with cadastral mapping but land certificates still had to be issued by the government. Administrative delays in Jakarta meant that by mid-2006 only 2,608 land certificates had been issued out of 300,000 parcels of land affected by the tsunami. In most cases reconstruction proceeded based on the agreement of ownership reached with the community in anticipation of the land certificates being issued.

BRR recognised that they were responsible on behalf of the government for providing and clearing land, carrying out enabling works and ensuring access to essential services through the Public Works Department. However, there was very limited capacity in the Public Works either to manage or implement necessary infrastructure, and sufficient government funding was not always available. The majority of DEC Member Agencies experienced delays in provision of access roads and drainage, and in some cases larger agencies who had sufficient resources took this responsibility on board themselves.

Certainly BRR was heavily reliant on the humanitarian community and the funds they had at their disposal. They increasingly saw their role as filling gaps in this area which humanitarian agencies could not fill rather than the opposite. BRR negotiated agreement with the electricity and water boards to provide free connection to tsunami houses, but responsibility for notifying the electricity and water boards where connections were required was not clear. DEC Member Agencies expected this to be done by BRR and themselves tended only to make a recommendation to connect once the houses were completed. Consequently, supplies were seldom in place when the houses were first occupied. It often took several months for connections to be made which affected occupancy rates. There were instances of communities living in new houses but relying on a combination of purchased bottled water, tankered water and non-potable well water whilst they awaited a connection.

7.2 | Humanitarian organisations

Most DEC Member Agencies had not worked in Aceh previously, and did not intend to stay beyond the relief and recovery phase. The importance of local partnerships to capacity building, strengthening existing structures and ensuring ownership was recognised. However, as very few Acehnese NGOs existed, there was limited potential for partnering.

One DEC Member Agency benefitted from partnering with a national NGO with extensive experience in house building elsewhere in Indonesia prior to the tsunami. They were able to draw on regional resources, mobilise quickly and had a good understanding of what was appropriate and achievable from the outset. Other DEC Member Agencies chose to partner with the few specialist NGOs who had specific experience in construction. This enabled them to improve the quality of reconstruction and scale up their programmes. However, out of over 100 agencies engaged in reconstruction most had no previous experience (UN-Habitat, 2007) and there were only a handful who identified construction as core competencies.

Provision of toilets and access to water for washing, cooking and drinking is an essential part of any housing programme. Mostly, agencies provided toilets and wells themselves as part of an integrated shelter, water and sanitation programme, with the option to connect to piped water supplies where this was available. Where this was outside their area of expertise, they formed partnerships with other NGOs who committed to constructing toilets and providing water. However, this was often problematic. Partner agencies had other priorities, and were not always able to coordinate provision of facilities and services with completion of the houses.

7.3 | Institutions and the private sector

Universities are a source of technical expertise and local knowledge and therefore potentially an important partner. The architecture department at Syiah Kuala University in Banda Aceh partnered with UN-Habitat to carry out a survey of the quality of houses constructed in the first year after the tsunami, but the engineering department was not approached by the humanitarian community until well into 2006. Subsequently, they provided advice on design, materials, earthquake resistance and remedial works to various agencies. There was recognition of Bandung University as a centre of excellence in Indonesia for technical design and some agencies sought ad-hoc advice from them or used their shake table to test the performance of structural systems. However, the opportunity to involve Syiah Kuala or Bandung University strategically in developing guidance on seismic design or material specifications was overlooked.

The ability of agencies to form partnerships with local consultants was hampered by the legacy of the conflict, which meant there was a lack of local organisations and technical expertise. Most agencies resorted to building in-house teams and recruiting local or national staff directly under the direction of international consultants. However one DEC Member Agency formed an effective and successful partnership with a national engineering consultancy from Jakarta. Thus they were able to combine their own understanding of post-disaster situations and ability to engage directly with the community, with the engineering consultancy's in-depth knowledge of the planning, design and construction management of significant infrastructure programmes.

7.4 | Community

All DEC Member Agencies perceived the communities they were assisting as key partners, recognising the need to work with them, as well as on behalf of them. Most DEC Member Agencies signed memorandums of understanding with house owners and community leaders prior to working on reconstruction projects. They involved the affected community throughout and responded to any demands or complaints. This approach was not without difficulties (e.g. unreasonable demands, lack of capacity, resources required to deal with complaints and concerns) but in general, communities were satisfied with their level of involvement and as a result felt a high degree of ownership over the completed housing. ■

Source: Arup

CONSULTATION WITH FEMALE TEACHERS

KEY QUESTIONS

- **Is the government able to fulfil their responsibility to provide land and certify land tenure?**
- **Does the Public Works department have the capacity and sufficient funds to clear land, provide site access and carry out enabling works?**
- **Who is responsible for providing electricity and water connections? On what basis has agreement been reached to connect to these utilities?**
- **Are there opportunities to partner with local humanitarian and development organisations?**
- **Are there aspects of the reconstruction programme (e.g. WAT-SAN) which are outside the core strengths or resources of your agency? Is there scope to partner with other agencies to deliver these?**
- **Are there aspects of the reconstruction programme which require technical expertise? What opportunities exist to partner with local universities or the private sector?**
- **Has agreement been reached with the community as to the level of assistance to be provided and extent to which they are contributing? Has this been formalised so that expectations on both sides are clear?**

8 | Natural hazards

Post-disaster reconstruction provides an opportunity to reduce vulnerability to future events. This requires an understanding of what natural hazards are likely to occur, their potential impact and appropriateness of various risk reduction strategies. Volcanoes and tsunami are extreme, infrequent events which are most effectively mitigated through early warning systems and evacuation plans. In contrast the more immediate risk posed by flooding, storms and earthquakes can be substantially mitigated through improved land-use planning, design practices, building methods and building regulations.

Future disaster risk reduction should be integral to the reconstruction process. This requires a strategy which capitalises on the availability of funds and political will, and includes social and financial measures relating to awareness raising and preparedness. The opportunity to rationalise urban plans to include evacuation routes and strategically address services provision and the location of critical infrastructure should be considered rather than rebuilding urban communities by repeating the pattern of organic growth and siting public buildings as before.

8.1 | Hazard assessment

In the aftermath of the tsunami the desire to mitigate against the possibility of future disasters by considering disaster risk reduction (DRR) as part of the reconstruction process was not initially matched by an informed understanding as to the types of hazard and the degree of risk they represent. Aceh has a long history of geological hazards including volcanoes, earthquakes and tsunami as well as hydro-meteorological hazards floods, storms and landslides. A multi-hazard assessment was not carried out to identify which of these posed the most significant risk; and because the disaster had been caused by a tsunami this was initially seen by many as the primary concern.

Even though the tsunami had been triggered by a huge earthquake this was not perceived as significant as buildings that were unaffected by the tsunami did not exhibit earthquake damage. Although the earthquake registered at MW 9.3, it was on the Sunda Trench which lies to the west of Aceh and occurred under the ocean. This meant that the the ground accelerations felt in Aceh were not significant. An earthquake on the Sumatran fault poses a much higher risk and could generate ground accelerations of 4.8 m/s^2 (Arup, 2006).

Detailed and accurate site assessment can prevent the location of settlements in hazardous areas. Topographical, geotechnical and hydrological mapping should inform the location and design of settlements, as they can highlight areas subject to hazards such as landslides, areas with soil or geological instability, areas with high water tables or prone to flooding. However this type of information was rarely available in Aceh.

8.2 | Volcanoes and tsunami

Volcanoes and tsunami are infrequent extreme events which are best mitigated through early warning systems and evacuation plans. In Aceh, the proximity to the fault line where the tsunami originated meant there was only 15 minutes between the earthquake and the tsunami hitting the coastline. Evacuation onto immediately adjacent higher ground might have been possible in some villages if the alarm had been raised immediately. Appropriate mitigation measures include a combination of monitoring of geological activity and radio-based warning systems and raising awareness within communities so that they themselves can identify signs of an impending event and respond appropriately.

In some villages agencies introduced disaster risk reduction programmes involving participatory community planning processes to identify potential hazards, develop scenarios for different types of emergency and agree on evacuation routes.

8.3 | Earthquakes

Aceh is in an area of high seismicity and the Sumatran fault runs through the centre of the province. It lies to the east of the Sunda trench, which experiences some of the world's largest earthquakes including the one which triggered the tsunami.

Earthquakes cause ground shaking. This places very significant lateral loads on buildings and can also lead to liquefaction of the soil and landslides. The very significant threat posed by earthquakes can be significantly reduced by locating, designing and constructing buildings for seismic resilience. In Aceh, communities had grown organically and geo-seismic mapping to highlight areas that might be subject to liquefaction or are close to the fault line had not informed land use planning. Pressure to build back quickly and for families to return to where they had lived previously meant this was not seen as an important issue post-tsunami.

Seismic resilience of buildings, particularly for concrete and masonry structures, relies on appropriate structural design and detailing. However this was not standard practice among Acehnese consultants, the Indonesian

Seismic Code excluded single storey dwellings and the *Building Code for Aceh* issued by BRR (UNHIC, 2005) did not include basic seismic design principles. This lack of clarity, and an unsubstantiated view that seismic design would be considerably more expensive, meant that BRR did not enforce the need for seismic design and themselves built houses and schools which did not incorporate seismic resilience. Most DEC Member Agencies ultimately did adopt seismic design approaches but this was not always matched by quality construction and the design intent was compromised by poor quality materials and workmanship on site. In some cases remedial works and retro-fitting was needed to create a safe structure.

8.4 | Flooding

Areas adjacent to rivers and at the foot of the mountains were already vulnerable to flooding as a result of high rainfall exacerbated by deforestation. Vulnerability to tidal flooding along the west coast increased following the tsunami due to changes in topography, as well as the loss of sea defences. The Sunda Plate sank by approximately one meter with respect to sea level and around Singkil in the south-west large areas were either completely or partially submerged. As a result, many villages were completely destroyed or deemed uninhabitable.

There was insufficient coordinated strategic assessment to identify areas prone to flood risk and prioritise flood defences. The need to relocate communities was set against displaced people's desire to return home and reconstruct in their original locations. This left some communities highly vulnerable to flooding. Failure to mitigate flood risk through land use planning meant that most agencies reduced vulnerability to flooding at a site specific level. Typically this meant storm drainage, building up land or raising houses on stilts in flood prone areas.

8.5 | Landslides

In Aceh the land immediately behind the coastal areas is mountainous with steep slopes prone to landslides, particularly in areas where deforestation has occurred. Bulldozers were used to clear slopes of vegetation to create sites for post-tsunami housing. This left unstable slopes which were very vulnerable to collapse in periods of heavy rainfall. Civil engineering works, including retaining walls and site drainage, were needed to stabilise slopes. However, the capacity of the Public Works department to carry out such works was limited.

8.6 | Storms

Although Aceh experiences strong winds, it is not subject to tropical storms or cyclones. Design wind loads can be minimised by orientation of the building, elevation and roof pitch. In Aceh, these loads were insignificant compared to the lateral loading from earthquakes and were not a key consideration. ■

Source: UNEP, 2007

NATURAL HAZARDS AND IMPACTS OF THE TSUNAMI

KEY QUESTIONS

- **What natural hazards exist? What is the risk that they will cause another disaster and how can this be reduced?**
- **If there is risk of earthquakes or flooding are additional surveys required to identify areas where reconstruction should be avoided?**
- **If there is a risk of earthquakes or cyclones which national and international standards should be followed in designing buildings?**
- **If there is a risk of earthquakes what knowledge of seismic design and construction practice exists locally? Is there an opportunity to introduce safer construction techniques?**
- **If there is a risk of landslides, has this been considered in locating buildings? Is the necessary technical expertise available to carry out enabling works?**
- **If there is a risk of volcanoes or tsunami, has an early warning system been introduced? Has scenario planning been carried out with the community?**
- **Can settlement plans be rationalised to include evacuation routes, strategically address services provision and the location of critical infrastructure?**

9 | Programme plan

A Programme Plan is required which clearly describes the rationale for providing shelter assistance: who is to be assisted, the desired outcomes, how they are to be achieved through various inter-linked projects and over what timescale. The initial plan will be informed by the issues discussed in the previous chapters but should be considered as a live document, updated regularly as new information becomes available. It should reflect the overall strategic plan for shelter during a response. Strategic planning is the responsibility of the government and as far as possible, should be structured consistently in order to optimise both coordination and information management.

The Programme Plan is an important document which should provide sufficient information to enable senior managers to give approval to proceed cognisant of the context, the capabilities of their organisation and availability of resources. The programme plan can also be used as the basis for coordination within the humanitarian sector and with government. It enables a shared understanding of the proposed shelter programme at all levels within an agency and across sectors. This is particularly important as shelter programmes catalyse recovery most effectively when integrated with livelihoods programmes.

9.1 | Background

In Aceh, the post-disaster situation was characterised by the number of people displaced and in need of assistance; the length of coastline affected and loss of critical infrastructure; the legacy of conflict combined with the scale of human losses which negatively affected local capacity, availability of materials and social networks; a weak local government resulting in the need to form of a new organisation (BRR) to oversee the reconstruction; and the unprecedented amount of funding available leading to an overwhelming humanitarian response and competition between over one hundred agencies involved in reconstruction.

Although initial needs assessments undertaken immediately after the tsunami identified shelter assistance as a priority this did not translate into a policy which included vulnerable groups, and ensured continuity of assistance from emergency shelter to durable solutions. Instead BRR policy encouraged families to return home or relocate to land provided by the government, promising a 36m^2 house to all those affected.

This "one size fits all" policy meant that shelter assistance quickly polarised on construction of houses. Other options for assistance were overlooked. Humanitarian agencies effectively became quasi-developers or contractors taking it upon themselves to design and construct houses on behalf of individuals or communities. Many decision makers at country or programme level within agencies had no previous experience of providing shelter or contributing to post-disaster reconstruction. This had two critical consequences - they were not able to recognise the gaps and shortfalls in the policy framework, and the importance of coordination was over-shadowed by competition between agencies.

These circumstances had a significant impact on the ability of agencies to respond effectively. However they were largely unappreciated until commitments had been made and programmes had commenced. This illustrates the importance of providing sufficient background information on the post-disaster situation as part of the programme plan. This information enables managers to make informed decisions about proposed activities in relation to the capabilities of their organisation and the particular context.

Likewise information should be included on the legal framework, policy and strategic planning objectives so that managers and advisors can take a view as to the contribution of their organisation within the overall humanitarian response and specifically the shelter sector.

Source: UN, 2008

COMMON ACTIVITIES IDENTIFIED TO STRUCTURE STRATEGIC, PROGRAMME AND PROJECT PLANNING

9.2 | Constraints, risk and opportunity

Key constraints in Aceh related to land, availability of materials and building skills within the affected communities, construction quality and dependency on others to deliver particular components of the response. However, many organisations based their planning on incomplete information and/or very high level assessments. As a result, these key issues did not become self evident until long after agencies had committed to substantial reconstruction programmes and commenced construction. A critical omission was the lack of multi-hazard assessment which meant that the seismic risk and opportunity to 'build back better', reducing vulnerability to earthquakes, was overlooked by many agencies, including BRR. This oversight occurred despite the issue being identified as an objective of the DEC appeal.

The few agencies that developed comprehensive programme plans based on systematic qualitative and quantitative assessments were much better placed to identify constraints and opportunities. They were also able to manage quality and programme expectations.

However, most were new to reconstruction and climbed a steep learning curve in the first year or so. Everyone began building houses immediately, when their efforts might have been better spent using the post-disaster window of opportunity to build the capacity of the construction sector through vocational training programmes, establishing manufacturing plants for building components or establishing information resource centres.

Most agencies found the constantly changing situation in Aceh very challenging and programmes would have perhaps gone more smoothly had there been a more proactive approach to managing uncertainty. Few agencies made use of standard tools such as risk registers and scenario planning. These are recommended in guidance on development of humanitarian programme plans and are standard practice in the construction industry.

9.3 | Objectives

Many agencies operating in Aceh focused on the singular objective of building houses in response to BRR policy rather than identifying multiple objectives. This wider perspective recognises the role that shelter and housing play in meeting immediate needs for protection, as well as acting as a catalyst for recovery and reducing vulnerability in the longer term.

The most successful reconstruction programmes had several clearly stated objectives, which reflected donor and BRR requirements and the mandate of their organisation as well as the needs of the affected communities. These objectives then translated into a combination of methods of assistance to assist families in their journey from emergency shelter to durable housing. ▶

Monitoring

The effectiveness of the programme in responding to problems is identified and changes in the broader context are continually monitored, with a view to improving the programme, or to phasing it out as required.

Sphere (2004) Common Standard 5

Strategic planning

Existing shelter and settlement solutions are prioritised through the return or hosting of disaster affected households, and security, health, safety, and well-being of the affected population are ensured.

Sphere (2004) Shelter & Settlement Standard 1

KEY QUESTIONS

- **What is the rational to provide shelter assistance based on needs, policy and capability of the agency? Is this founded on a substantive level of information or is there a level of uncertainty?**
- **What are the programme objectives? Do they support the overall strategic objectives of government and the Shelter Cluster? What are the links to other sectors; particularly wat-san, livelihoods and protection?**
- **What are the key constraints and opportunities? Are there factors which rule out options for assistance? Are there critical gaps that need to be addressed?**
- **What type of assistance is to be provided? Who is assistance being provided to? How will they be selected? Where are they located now and where will they be located?**
- **What are the anticipated timescales and budget? Are these consistent with donor, community, media and government expectations in relation to quality, cost and timescales? Are they realistic and what are the key risks that may effect delivery?**
- **What measures are proposed to engage the community throughout the process?**
- **How is progress to be monitored? How is the on-going relevance of the programme to be reviewed? How is performance against the objectives to be evaluated?**

- Participation of the community was a key objective of all DEC Members programmes whether targeted at individuals, families or communities. Less clear was the perceived role of agencies, which varied from acting as enabler providing technical expertise and funding, to being a developer or even main contractor acting on behalf of the community.

9.4 | Implementation

Most agencies were working with several different communities, often in very different parts of the province. This meant that their overall reconstruction programme included several individual projects. Implementation strategies therefore divided into programme and project level activities across a wide range of methods of assistance. These included: providing transitional shelter to assist families to return home; support on resolving land boundary disputes and obtaining land certification; employing technical expertise in the form of local architects and engineers to design houses in consultation with the communities; purchasing materials and employing skilled labour for reconstruction or procuring the building works through a contractor; training of local labour and partnering with other agencies to provide water and sanitation; education on earthquake risk and safe construction techniques; and advocacy on behalf of vulnerable groups. This extremely varied range of activities highlights the complexity of reconstruction programmes, and therefore the importance of the programme plan in providing a foundation for estimating resources and timescales.

9.5 | Timescales

Under intense political and media pressure many agencies in Aceh initially pledged to construct large numbers of houses, very quickly and in multiple locations. These pledges were then scaled back as the challenges became apparent. Relations between BRR and the implementing agencies deteriorated as they were blamed for not building quickly enough when in fact the issue was the totally unrealistic initial expectations. The time required for mobilisation of communities, resolving land issues, establishing satellite offices and warehouses, sourcing and transportation of materials was initially overlooked in the race to complete houses.

Some agencies took a more measured approach and developed pilot projects.These could then be replicated or scaled up once a better understanding had been gained of the process, and of the critical path in terms of decision making or securing resources. A key learning point is the importance of identifying realistic timescales so that expectations can be managed. Typically construction will follow a gentle 'S'-curve where during the initial period the pace of reconstruction is fairly slow as pilot projects are completed and resources mobilised. Speed of construction then picks up and quickly reaches an optimum before levelling off as programmes are completed. Estimating this requires an appreciation of the sequence of activities, and of the relationships between key activities. These must be identified in the initial programme plan, and key milestones then be used to monitor progress.

9.6 | Resources

In Aceh, many agencies significantly under-estimated the complexity of reconstruction and resources required. Such a large scale reconstruction effort demanded significant human capacity with management, coordination and technical skills as well as funding. However, preliminary programme budgets were optimistic global estimates based on the number of houses pledged multiplied by the budget cost per house with only a nominal administrative overhead. Whilst this may be an appropriate way in which to estimate the budgets for Non-Food Items (NFIs), more detailed resource plans are needed for construction of transitional or permanent shelter.

It is recommended that resource plans are based upon a preliminary activity schedule, log-frame analysis or similar; even if initially this is fairly high level. This needs to take account of the range of skills and expertise required and the practicalities in identifying, recruiting or relocating personnel to fulfil key roles. In estimating material requirements consideration should be given to the availability of resources as well as transportation, storage and distribution. It is likely that a number of assumptions will be needed in the initial stages and that these will be subsequently revisited.

9.7 | Participation

All DEC Member Agencies recognised the importance of participation and involved the affected community to varying degrees in the selection of eligible households, cadastral mapping and verification, spatial planning, design of housing, construction and monitoring of implementation. Various strategies for participation were adopted but often Housing Committees or similar were formed and Community Development staff played a crucial role in supporting the affected community throughout the process. This was most successful when local staff were based in the communities, or maintained a regular presence. Identifying how community participation is going to be achieved in the programme plan ensures that the response is appropriate, meets the needs of the affected population and establishes ownership in the longer term.

9.8 | Monitoring and evaluation

Monitoring and evaluation in Aceh focused largely on quantitative indicators such as the number of completed houses and occupancy rates as a proxy for quality or acceptability to beneficiaries. However, when evaluating the impact of a programme, outcomes rather than outputs are more effective indicators. For instance it is more meaningful to consider the number of people no longer needing emergency or transitional shelter, than the number of houses built.

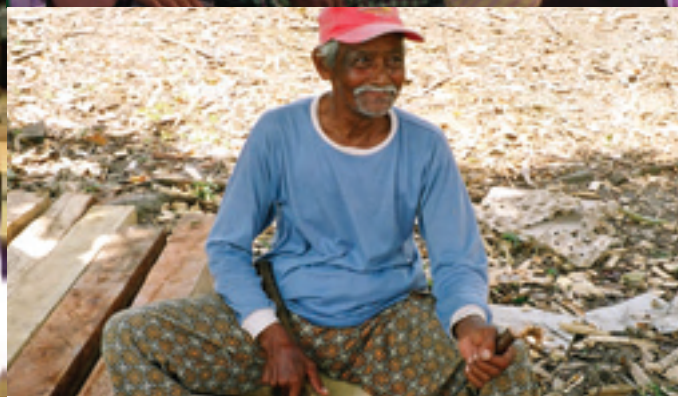
Identifying key performance indicators (associated with both inputs and outputs) in the project plan can provide a useful basis for monitoring and evaluation throughout the project life cycle. This ensures that the response is consistent with the stated objectives and remains appropriate. ■











Design

This section is targeted at country directors, senior programme managers and programme advisors. It assumes that a decision has been made to reconstruct houses (schools and/or health centres), and what is required is to develop spatial plans and a clear definition of the scope of works that needs to be constructed, so as to be able accurately to estimate the required resources (financial and human) involved. Also to understand the overall timescales so that expectations can be managed, and to determine how the environmental impact can be minimised. An important part of this is identifying where construction will take place and the risks and opportunities associated with the site. Also critical to this stage is defining the quality of reconstruction in terms of beneficiary acceptability, as well as engineering good practice and compliance with regulations. Thus, availability of materials and an understanding of local construction practices will inform the building design and cost. Much of the above requires technical expertise and knowledge which is unlikely to exist within most agencies. The output from this phase will be drawings, a resource plan, detailed budget, programme and risk register - the Project Plan.

Design

Source: Arup

Source: Rumana Kabir / Oxfam

Source: Arup

10 | Site selection and surveys

Families generally prefer to rebuild on their own land, as this enables them to more easily resume their lives and livelihoods. However, if this is not possible, land must then be identified for resettlement sites. Whether rebuilding houses where they were previously located or relocating communities to resettlement sites the suitability of the site for reconstruction should be verified. Adequate site selection procedures must be put in place to ensure access to services and livelihoods and to identify vulnerability to natural hazards. More detailed surveys may also be required in order to identify specific requirements for environmental protection, enabling works and infrastructure before the construction of housing can occur.

Detailed physical planning relies upon accurate initial physical surveys. In particular topographical, geotechnical and hydrological physical surveys are important when locating housing and infrastructure to ensure that land is suitable for reconstruction, as they can highlight areas subject to hazards such as landslides, areas with soil or geological instability or areas with high water tables. Understanding the topography is also important as it determines drainage patterns, and an appreciation of ground conditions is needed to decide on the type of foundations, and limitations on excavation for toilet pits or settlement tanks.

10.1 | Rebuild or relocate

Communities preferred to remain in-situ as this enabled them to utilise their existing social networks, re-establish livelihoods and access healthcare and education. However, the earthquake and tsunami significantly altered the coastal topography. Villages and land were left permanently submerged, highly vulnerable to flooding and unsuitable for reconstruction or agriculture. An estimated 25,000 families needed relocating to new land because their land had been submerged or become unsafe, or because they did not own land or housing before the tsunami (Oxfam International, 2006). BRR's strategic planning policy specifically encouraged families to return to, and rebuild on, their own land. Where this was not possible, voluntarily resettlement on land purchased by communities themselves or by BRR was supported.

In theory, site provision was the responsibility of the local government, however, there were significant delays in identifying land and carrying out the necessary enabling works. Some sites were located too far away to allow continuation of existing livelihoods. Many communities preferred to voluntarily re-establish themselves on nearby agricultural land owned by one or more families, but in many cases the selected land was either still too close to the sea, or needed a lot of work to provide essential infrastructure and environmental protection.

Resettlement sites

BRR purchased 700 hectares of land in Labuy and Neuhun; of which 500 hectares were allocated for the relocation of households whose land had been destroyed in the tsunami and 200 hectares were allocated for renters and squatters. BRR prepared a resettlement plan for these areas and agreed to provide access roads, public facilities and livelihood assistance with housing being provided by several agencies, including DEC Member Agencies. However, there were significant challenges with these sites including the distance from Banda Aceh and livelihood opportunities; shortage of potable water; land certification and lack of public transportation. Some agencies chose not to resettle beneficiaries to these areas as they were too far from people's livelihoods. Others expressed concern that social cohesion would be a key issue as the resettled households were not entire communities, but relocated households from all over Aceh (Oxfam International, 2007).

Source: Arup

10.2 | Site assessment

There was no standardised formal process established within local government or BRR for systematically assessing the suitability of a site identified for development. Neither was there a procedure for carrying out the enabling and infrastructure works that might be required to ensure either an existing or a selected site was viable. The extent to which implementing agencies carried out site assessment varied considerably and site wide issues were frequently overlooked due to the focus on individual house construction.

Initial rapid site assessments were carried out by some agencies on a qualitative basis using a simple checklist that covered potential issues such as site boundaries, land tenure, susceptibility to landslide or flooding, access for construction, ability to provide access to water, sanitation and power, and proximity to healthcare, education and livelihood opportunity. From this the site's suitability and the need for enabling works (such as access roads or drainage) or for more detailed surveys could be established. In some cases it was necessary to reconstruct houses in areas prone to flooding or landslides which required substantial engineering works to mitigate these risks.

Source: Arup

MANY HOUSES WERE RECONSTRUCTED IN FLOOD PRONE AREAS

10.3 | Surveys

In Aceh there was limited awareness of the need for surveys and lack of expertise either within agencies or locally to specify or carry these out. The scope of works, terms of reference and outcomes need to be developed and reviewed by skilled professionals such as surveyors or engineers. This, combined with pressure to commence rebuilding, meant that adequate surveys were not systematically completed.

Larger scale surveys and strategic assessments require significant levels of technology and expertise and need to be coordinated between agencies. The onus rested with BRR, the government or specialist agencies to do this as part of the strategic planning process but BRR's limited capacity at the outset and the lack of technical capability amongst the UN and donors advising them resulted in a lack of substantive survey information. As a result construction proceeded on unsuitable sites and strategic infrastructure was not prioritised effectively.

High ground water levels and flood risk were typical challenges in Aceh. One DEC Member Agency commissioned extensive topographical and hydrological surveys so as to be able to map flood risk across 16 villages. They were then able to mitigate this by relocating houses to higher ground, putting the houses on various height plinths or stilts, and using raised reed beds to treat wastewater. However, even on fairly large scale resettlement sites geotechnical investigation was not common and foundations were designed based on assumed bearing capacities without systematic procedures to verify these assumptions during the construction process. ■

KEY QUESTIONS

- **Can the affected communities rebuild on their existing land? Has it been destroyed or become unsafe as a result of the disaster and do they need or want to be relocated?**
- **How will land for relocation be provided? By whom by and over what timescale?**
- **How will resettlement impact on the social networks and livelihood opportunities of affected communities?**
- **Are proposed reconstruction and resettlement sites vulnerable to natural hazards?**
- **Do the sites have adequate access to livelihoods and public services?**
- **Is there a system in place for carrying out technical surveys of proposed reconstruction or resettlement sites?**
- **Have sufficient surveys been undertaken to identify requirements for the provision of regional or village level environmental protection, enabling works or infrastructure to make a site suitable for reconstruction?**

11 | Land tenure

Legal certification of land is a pre-requisite to reconstruction yet the system for certification pre-disaster may not have been comprehensive and key documents on land titles or local knowledge may have been lost as a result of the disaster. Land tenure arrangements vary from country to country and land may have been owned individually, communally or by the government. Establishing land titles based on both existing records and community-driven processes is a time consuming process but critical to longer-term sustainable development. Inheritance rights needs to be considered as does certification for adjacent communities so as not to exacerbate differences in land values. Specific consideration must also be given to the rights of tenants or informal dwellers that were not previously land owners.

'I can think of nothing that will generate more income over the long run for average families in this region than actually having title to the land they own. Then, they will be able to borrow money and build a much more diversified, much more modern economy.'

Bill Clinton, UN Special Envoy for Tsunami Recovery
(BRR and International Partners, 2006)

11.1 | Land title

The tsunami destroyed not only the built environment but personal identification documents, land boundary markers and almost all records of land ownership. 300,000 parcels of land were affected by the tsunami (170,000 in urban areas) and it is estimated that less than 25% of these were secured by title deeds. The majority of unregistered private land in the tsunami-affected areas was held in traditional customary (*adat*) law either by individuals or the community. This has been recognised since the colonial Dutch period as being private land. 80% of all land documents were lost in the tsunami, including all cadastral (land ownership) maps (BRR and International Partners, 2005a). Much of the physical evidence of property boundaries was also destroyed and many people who held this knowledge died in the tsunami.

After the tsunami land was one of the few things that the survivors still owned and almost immediately they marked out boundaries to the plots where their houses once stood. However, a more comprehensive system for establishing land title was required and the Indonesian government, in partnership with the World Bank, set up the *Reconstruction of Land Administration Systems in Aceh and Nias* (RALAS). Starting in August 2005, this involved a process of 'community-driven adjudication' and land titling through the National Land Administration Agency (BPN). The RALAS programme was thorough, but very slow, and reconstruction proceeded based on the agreement

Community-driven relocation

In one village, in one of the regions worst affected by the tsunami, fifty families lost their houses and land. A few months after the tsunami these households began negotiations with landowners in the village in order to purchase land to build houses. By May 2005, 38 of the households had agreed to buy 5,000 square meters of land with a two year loan. One DEC Member Agency assisted the households to survey and map the land, divide it into plots and conduct settlement planning. The success of the project encouraged the other 12 families to move into the new site and reintegrate into their community (Oxfam International, 2006). The purchase of land by the households meant that they were eligible for housing assistance, which the DEC Member Agency was then able to provide. Although this took some time to complete, an interview with the Head of Village, conducted by Arup in 2007, indicated that the community appreciated the assistance they had received.

Source: Arup

of ownership reached through community mapping, in anticipation of land certificates being issued.

11.2 | Community mapping

Assisted by humanitarian agencies, affected communities undertook community land mapping. This included preparing inventories of land owners (and heirs) and marking the boundaries of land parcels. Agencies initially recorded this information in sketches, which were then converted to digital files by agencies using Global Positioning System (GPS) coordinates. Survivors and community leaders signed the map to certify that it was correct.

In remote locations many households did not have land certification prior to the tsunami so legal certification was a significant form of assistance and welcomed by many communities. The process was complicated by land disputes among community members or returning family members, opportunistic land-grabbers and uncertain inheritance rights but on the whole proved effective. Once the community had reached agreement on land ownership and plot boundaries BPN provided professional mapping and issued land ownership certification.

11.3 | Inheritance

Inheritance claims became a significant issue due to the large number of fatalities and the number of family members claiming inheritance rights. Special attention had to be paid to the rights of women, children and orphans. Under both customary (*adat*) and Islamic (*sharia*) law women could inherit property but there was concern as to the extent this occurred in practice. BRR estimated that over 2,000 children were orphaned by the tsunami. Their inheritance and guardianship are governed by sharia law, so mobile courts were set up to protect their rights, and prevent them losing land to which they were entitled. On the whole this programme was successful but initially people found the system difficult to understand. It was also criticised for not being proactive in identifying orphans and slow because of the number of witnesses required.

11.4 | Land values

In general land parcels with titles are worth more than those without. Thus in the short term it was anticipated that land titling in the tsunami affected areas would raise the values of land parcels above those in non-affected areas. To mitigate medium-term land market distortions, the RALAS programme intended to provide titles for 300,000 land parcels adjacent to tsunami-affected areas, in addition to the 300,000 parcels in affected areas. However, as a result of administrative delays in Jakarta by mid-2006 they had only surveyed around 53,000 land parcels and issued 2,608 land certificates (Oxfam International, 2006). ■

Source: Arup

HOUSEHOLDS MARKED THEIR LAND WITH SIMPLE TIMBER CROSSES

KEY QUESTIONS

- **What was the pre-disaster system for land ownership certification? Was land owned communally, by individuals or by government?**
- **Has documentation or local knowledge been lost in the disaster?**
- **How will land titles be established and how will the community be involved? How long will this take and how will disputes be resolved?**
- **How will community-driven processes be approved by government agencies?**
- **How will formal land titling affect land values and markets in the longer term? Will distortion occur between disaster-affected and host populations?**

12 | Physical Planning

Housing should be seen in the context of reconstructing settlements and rebuilding communities. Adequate time must be allowed for participatory planning processes to ensure that the reconstruction process is community-driven. An integrated approach to planning should be adopted which address both short term and long term needs whereby houses are coordinated spatially and programmatically with access to services, public buildings and livelihood facilities. This will prevent houses being left unoccupied after completion and create sustainable communities in the longer term.

12.1 | Participatory processes

It is recognised that community participation helps the community re-focus after the disaster, take ownership of the situation and begin to think about their future development. Therefore, BRR policy made this a requirement for spatial planning in reconstruction. Typically, community liaison officers or physical planning teams, comprising Indonesian and Acehnese staff, were appointed to individual communities. They worked with households on a day-to-day basis to resolve their concerns, facilitate formal consultation processes and provide feedback to the design and construction experts.

Most DEC Member Agencies found that a community-driven reconstruction process was time-consuming and involved substantial resources. Planning and preparation prior to implementation often took between 6 and 12 months. This process included selection of eligible households, appeals processes, plot mapping and regularisation, spatial planning and agreement from the community, government, village and religious leaders. The length of time taken sometimes resulted in frustrations but prevented costly mistakes and helped to ensure the affected community took ownership of the completed houses and they were occupied on completion.

12.2 | Risk mapping

Standing water, mass graves (particularly around Banda Aceh and Meulaboh) or areas with a high risk of flooding complicated the spatial planning process. Communities engaged in risk mapping to identify locations that had become unsuitable or extremely difficult to reconstruct housing or were vulnerable to natural hazards. Several disaster risk reduction strategies to protect against future tsunami, storm surge or severe flooding were incorporated into village plans. These included the identification of buffer zones and evacuation or escape routes as well as post-disaster meeting points and emergency services plans. In low-lying areas, existing hills were identified as evacuation points and where existing hills did not exist BRR advocated constructing public buildings with a second storey and accessible roof so that they could act as man-made evacuation points. Plot specific risk reduction strategies included raising houses on platforms in flood prone areas and land build-up/excavation to reduce the risk of landslides.

12.3 | Spatial planning

Participatory planning processes were used extensively to develop a shared understanding of the site constraints,

Participatory planning

Many agencies used participatory planning techniques to enable communities to design their new settlements. Several iterations of the village plan were often required to ensure everyone's needs were met. Once agreement had been reached within the community, multiple permissions were required from village leaders, land owners, religious leaders and local government before the reconstruction could begin. Although time consuming, the process of village planning was an important step in enabling communities to take control of the future of their village and ownership of the reconstruction process. Some DEC Member Agencies set up focus groups involving women, men, community leaders and other interest groups. These provided a forum for making decisions regarding the layout and location of houses, evacuation routes and what was required in terms of public facilities. Such meetings were facilitated either by community members or by Acehnese or Indonesian architects working as part of the shelter team.

Source: Prathiwi Widyatmi / Oxfam GB

negotiate adjustments to land boundaries, and determine zoning for livelihood, commercial or public activities. This included identifying preferred locations for schools and health centres, shops, market places, village roads and locations, and routing for services including drainage and solid waste collection and disposal. In many cases the location of communal buildings and infrastructure required the community to identify suitable land and this was often common land or donated by individuals.

For settlement wide services and infrastructure, the community and the agency were able to work together to identify existing capacities within the community and within additional partners. Potential partners included government agencies and other humanitarian organisations. Where reconstruction focused solely on the provision of houses, and failed to consider services, livelihoods or public facilities, houses often remained unoccupied after completion. Households preferred to remain in other accommodation closer to their place of work, or where water, sanitation and electricity was available.

Participatory processes were also used to identify the most appropriate form of reconstruction whether be it individual/semi-detached houses or clusters of houses. In new settlement sites, whether provided by BRR or the community, plot sizes were generally standardised. However on existing sites plot sizes varied significantly and sometimes were too small to accommodate a standard individual 36m^2 house. This required adaptation of the standard house type and resulted in a number of semi-detached or terraced house designs.

Community agreement on village planning was a time consuming and complicated process, as technical inputs such as site surveys and infrastructure design were integrated with community requirements. Detailed physical planning was needed for each plot to ensure that the footprint of the house itself and the water and sanitation systems would fit. Typically, DEC Member Agencies provided toilets and wells with the plots themselves and the household could then connect to piped water supplies when they became available. ■

Source: BRR (2006) Village Planning Guidelines

A VILLAGE PLAN SIGNED BY RESIDENTS, REPRESENTATIVES AND GOVERNMENT OFFICIALS

Physical Planning

Local physical planning practices are used where possible, enabling safe and secure access to and use of shelters and essential services and facilities, as well as ensuring appropriate privacy and separation between individual household shelters.

Sphere (2004) Shelter and Settlement Standard 2

KEY QUESTIONS

- **How are communities involved in the planning process? Is this sufficient to ensure reconstruction is owner driven?**
- **How long will this process take? What assistance will they require and are appropriate built environment professionals involved?**
- **Are communities directly involved in risk mapping and identifying risk reduction strategies?**
- **How are public buildings, livelihood facilities, infrastructure and risk reduction strategies incorporated into settlement plans?**
- **Who will provide the land and who will provide the buildings/infrastructure? Can partnerships be established?**
- **What is the most appropriate settlement layout? Individual houses, streets or clusters?**
- **Will the pre-disaster settlement be reconstructed as before, or is there an opportunity for improvement?**

13 | Quality

Quality, cost and timescales are the three key elements of a reconstruction programme that need to be carefully managed. Typically pressure to commence reconstruction and limited resources means that budgets and timescales prevail and insufficient consideration is given to establishing a clear definition of quality. It is important that quality is understood from the occupant's perspective which requires extensive consultation. Their primary concern will be factors that contribute to the habitability or functionality (protection from the weather, internal comfort, safety and security, sufficient space, access to services), though longer term there may be additional considerations such as durability and adaptability.

Once the occupant's requirements are captured in a design brief or performance specification they can be used as the basis on which a variety of designs can be developed. This is preferable to a prescriptive specification which makes various parameters mandatory (size, number of rooms, construction type). Reference should also be made to international standards and pre-disaster housing provides a useful benchmark for what might be considered acceptable quality. Coordination is essential to ensure that all stakeholders have a shared understanding of quality so as to avoid inequitable and/or inadequate responses.

13.1 | Definition

There was no accepted definition of quality in Aceh. BRR used house size and type of construction as basic prescriptive indicators of quality stipulating 36m^2 reinforced concrete frame with masonry infill as a common minimum standard. This form of construction reflected Acehnese houses in better off urban areas although 36m^2 was considerably smaller than many families' previous homes, leading to dissatisfaction. In fishing and mountain villages timber frame with half brick walls or timber huts were more common and traditional Acehnese houses are elaborately carved timber frames.

Most agencies jumped to developing design solutions without attempting to comprehensively define quality or develop a brief or building specification. Although various guidelines and standards were developed they related primarily to the quality of construction rather than the building performance. The lack of coordination meant there was no shared understanding amongst communities, BRR and the international community as to what quality comprised. This resulted in a wide variety of responses and competition between organisations which in turn led to concerns about appropriateness and equity of assistance.

Greater consistency in response might have been achieved if quality had been better defined at the outset. This could

Local precedent

Traditional housing in Aceh is typically an elaborately carved timber A-frame elevated on posts to protect against animal attacks and flooding, and to provide a space for working in the shade. The house typically includes a front veranda, a middle section containing bedrooms and a rear veranda. The front veranda provides a space for visitors while the rear is for cooking and family activities. These houses have evolved empirically and are highly crafted. Some agencies tried to replicate or reinterpret this style, but had difficulty identifying suitably skilled carpenters still working in this traditional manner. Key characteristics such as the foundation stones (*umpak*) were replaced by concrete plinths and coconut timber or softwood used instead of hardwoods. These modifications tended to compromise structural integrity and termite attack. Rotting timber also contributed to a loss of confidence in this approach, so reinforced concrete and masonry houses came to be perceived as being more desirable.

Source: Arup

have been developed as a common set of key performance criteria resulting in a performance specification. Key performance criteria should be based on both user and donor concerns including: environmental protection, safety and security, space to carry out household duties, the lifespan of materials, ability to repair maintain and adapt the building to serve future needs, buildability, affordability or value for money in relation to the local housing market.

13.2 | Outcome

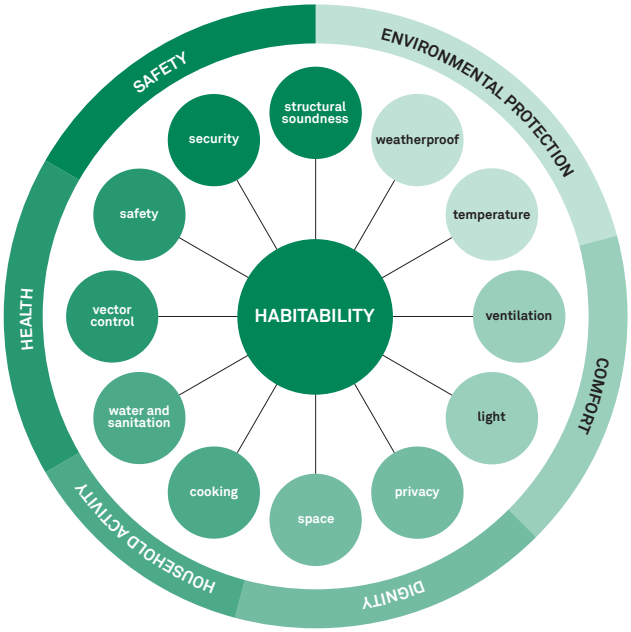
In practice quality was judged qualitatively against the housing provided by BRR and other agencies and the level of beneficiary satisfaction with completed housing related closely to the quality of their pre-tsunami housing and expectation based on government policy. Other benchmarks for assessing quality included the *Building Code for Aceh* and international standards such as the *Sphere Standards*. Some agencies felt that the *Sphere Standards* were not applicable to reconstruction although the six shelter standards provide a valuable framework for considering quality, provided the indicators are interpreted to reflect the local context.

The quality of houses constructed by DEC Member Agencies were as good as and frequently better than those constructed by BRR and other international agencies. This was reflected in high occupancy rates and generally positive responses to post-occupancy surveys. Schools and health centres were also high quality and according to the principals and staff operating these facilities they were of a much higher standard than existed pre-tsunami. Comments from beneficiaries such as "better than others" reflect how quality is judged by comparison, and the benchmark rose over the three years as expectations increased.

Specific challenges were faced in terms of construction quality, which agencies responded to. This response improved as the process continued (see Chapter 20 – 24). However, a key oversight was that, despite the desire to 'build back better' and reduce the risk of future disasters structural performance in earthquakes was overlooked initially by most organisations and was not considered as a mandatory requirement by BRR (see Chapter 16: Disaster risk reduction).

13.3 | Consultation

The high quality of permanent construction by DEC Member Agencies was in part a result of extensive consultation carried out with the affected community, teachers and health professionals. All DEC Member Agencies implemented community participation programmes to varying degrees and had policies to ensure equitable involvement of vulnerable groups. Communities were involved in house design and village planning, and were often able to choose their favoured house design from a number of options. Some agencies



KEY PERFORMANCE CRITERIA FOR HOUSING

Source: da Silva, 2007

implemented prototype house constructions and/or pilot projects to engage communities in the process and enable informed discussions regarding layouts and the nature of reconstruction.

One challenge of engaging communities in the design and construction process was that expectations began to rise as more and more housing projects were completed. What had previously been judged as a "good quality" solution came into question again as beneficiaries became aware of projects and proposals in other areas. This led to further rounds of consultation and resulted in delays but meant that occupancy rates on completion were relatively high. ■

KEY QUESTIONS

- **What were the pre-disaster housing conditions of the affected population? What is the vernacular housing?**
- **Does contemporary housing vary significantly between rural and urban populations?**
- **What are the essential requirements of housing in terms of occupant comfort, environmental protection, safety, health, ability to carry out normal household activities and dignity?**
- **How has quality been defined based on these requirements? Does the definition of quality refer to national and international standards?**
- **Is there a shared understanding of quality amongst key stakeholders? Is it based on community consultation?**
- **How do these requirements translate into a brief for the design of the house, and requirements for water, sanitation and energy?**

14 | Types of construction

The choice of building system must reflect the capabilities of the community and capacity of the local market. Local building practices may be difficult to scale-up due to shortfalls in skilled labour and materials, or may require modifications to achieve an acceptable level of quality and safety. Post-disaster reconstruction presents an opportunity to invest in the introduction of improved building practices or new materials and technologies. However, this must be balanced against cultural acceptability, requirements for skilled labour, future adaptability and the timescale of the response. Technical expertise should be sought when determining what type of building system to adopt so that the relative advantages and disadvantages can be assessed.

14.1 | Concrete frame with masonry infill

The *Building Code for Aceh* (included in UNHIC, 2005) did not specify a building system. However the preferred form of house construction stipulated by BRR was reinforced concrete frames with burnt brick masonry infill and the majority of agencies ultimately defaulted to this whether building houses, schools or health centres. This form of construction is inherently brittle and therefore vulnerable to earthquake damage; masonry walls collapsing are a major cause of death and injury. It is therefore generally not recommended in areas of high seismicity although it was common in Aceh and not prohibited in national building codes.

If this type of construction is used, it is essential that such buildings are correctly engineered following guidance for confined masonry construction and well built in order to prevent collapse. However, this was not understood locally and 'unsafe' construction techniques were endemic. These included the use of plain reinforcement bars, lack of continuity between beam and column reinforcement, open links, untied masonry and lack of ring beams. Unsafe construction techniques were compounded by poor-quality workmanship and most DEC Member Agencies who adopted this form of construction found that high levels of site supervision were required to ensure adequate construction quality. Some had to carry out extensive remedial works and retro-fitting to strengthen structures that were inappropriately designed or constructed in the initial stages of the response.

Some DEC Member Agencies decided to use lightweight blockwork instead of burnt bricks for the infill walls. This was the result of difficulty obtaining good quality brick, and concern over the environmental impact resulting from the amount of timber used to fire the bricks (See Chapter 15: Environment). It was much easier to achieve consistency in the quality of lightweight blocks, particularly if they were machine rather than hand-made, though they generally had to be imported from Medan. Less mortar was required and construction was much quicker as the blocks were larger. It was also easier to lay horizontal reinforcement in the bedding joints tied to the columns and this greatly improved performance in earthquakes. Overall this was a much better solution but cultural preference and pressure from local communities to use locally sourced bricks meant it was not a common approach.

14.2 | Reinforced blockwork

One DEC Member Agency attempted to introduce hollow concrete block construction with both horizontal and

Hybrid systems

In order to cater for individual preferences, one DEC Member Agency adopted a systemised approach to the various building elements. The foundations and floor slab were constructed in reinforced concrete with the option to elevate it on 1.2 m or 2.15 m columns to protect from flood. This provided a durable platform for the superstructure. The occupant could then choose whether they wanted this to be a timber frame, blockwork or timber frame with half-walls in blockwork. This generated nine variations of what was essentially the same house in terms of size and layout. The roof sheets were galvanised iron and fibre board was used for the cladding due to difficulties obtaining weatherboard. Doors and windows were initially specified in timber but replaced by metal frame windows and doors due to problems sourcing timber.

Source: Arup

vertical reinforcement, otherwise known as reinforced masonry units (RMU). This provided a much more robust solution than reinforced concrete frame and masonry infill; it was also less dependent on workmanship and relatively simple and quick to build. It was well-suited to seismic zones since it had a high degree of ductility and redundancy, provided care was taken to ensure the reinforcement was adequately grouted, particularly vertical reinforcement at corners and around openings. Although used extensively elsewhere in Indonesia this form of construction was new to Aceh and encountered considerable resistance from local communities. It was perceived as weaker than concrete frames, because it was 100% masonry, and investment was needed to convince communities otherwise. High quality blocks were not available locally and had to be imported which was unpopular in the face of ongoing pressure to use locally made bricks.

14.3 | Timber frame

Timber is a traditional form of house construction in Aceh where houses are raised above ground on posts to protect against animal attacks and flooding. Timber frames also perform well in earthquakes as they are both lightweight and ductile. Many families affected by the tsunami had previously lived in timber houses or structures with half masonry walls known as 'semi-permanent' houses. However they aspired to a 'permanent' house (typically a reinforced concrete frame with brick infill) as this was felt to have higher status and was prevalent in urban areas. Although some DEC Member Agencies began by building 'semi-permanent' houses, demand quickly fell away when families realised they were entitled to a 'permanent' house.

Some DEC Member Agencies experimented with variations on the traditional Acehenese timber frame house but experienced difficulties obtaining good quality timber, and problems with workmanship due to a shortage of skilled carpenters. BRR discouraged timber construction as there was a shortage of hardwood from responsible sources, and insects and rotting affected softwoods that had been inadequately specified or left untreated. The difficulty in obtaining sustainably sourced high quality timber, changes in government policy and increased beneficiary expectations led most DEC Member Agencies to progressively revert to alternative forms of construction.

To overcome issues with the quality and availability of timber one DEC Member Agency adopted a traditional Acehnese timber frame design, constructed from prefabricated timber beams and posts. The building system was designed in Canada and was essentially a 'kit-of parts' compromising nail-laminated beams and columns that could be rapidly assembled on site with simple bolted connections. This solution overcame many of the problems with local timber and was positively received by the beneficiaries. However it was not particularly efficient (in terms of the amount of timber required) and the prefabricated elements had to be transported from North America.

14.5 | Pre-fabricated systems

The large number of houses required, and pressure to build quickly, led to considerable interest from manufacturers of bespoke modular systems. These included steel or pre-cast concrete frames with a variety of infill walls and pre-cast or in-situ concrete panel systems. The key issue with all of these was cultural acceptability and the limited potential to adapt the basic structure in the future. Many of these systems had been developed for housing markets in non-seismic countries and were not suitable. Others had been load tested on the shake table at the Institute of Technology in Bandung but the test model had assumed lightweight infill walls rather than masonry and was therefore invalid. ■

Construction

The construction approach is in accordance with safe local building practices and maximises local livelihood opportunities.

Sphere (2004) Shelter and Settlement Standard 5

KEY QUESTIONS

- **What is the traditional type of house construction? Is this appropriate for reconstruction or are there alternatives?**
- **Do sufficient material supplies and skilled labourers exist locally in this type of construction? Or will they have to be sourced from elsewhere? How will this impact on lead in times and relationships with the community?**
- **Do national or international standards specify the type of construction which can be used?**
- **Is there potential to use prefabrication of building components to speed up construction? Or to set up manufacturing of building components as a related livelihood programme?**
- **Will beneficiaries have the appropriate skills to maintain, adapt or extend their homes?**

15 | Environment

In addition to loss of life, livelihoods and damage to property disasters may also cause significant environmental damage. Loss of ecosystems and fertile soil, contamination of water sources and damage to coastal mangroves can all leave the population vulnerable in the longer-term. It is essential that further environmental degradation is avoided in the reconstruction phase.

Mitigating the environmental impact of reconstruction must be considered as an integral part of the design process; material sourcing leading to over exploitation of natural resources, the use and disposal of toxic substances, inadequate consideration of water and sanitation and wholesale removal of trees and vegetation are examples of negative impacts. There may also be wider opportunities to enhance local environmental management practices or to introduce 'green' building technologies and approaches.

15.1 | Materials

The scale of reconstruction in Aceh required the production and supply of reconstruction materials to be addressed at a strategic level to minimise depletion of natural resources. However BRR did not recognise the volume of materials required and the shortfalls in sustainable local supply. Few measures were taken to import materials in bulk, manage distribution or build local sustainable production capacity. These measures would have ensured that the ongoing needs of both the affected and unaffected populations were met, and that rights to access natural resources were respected. Minimising environmental impact through material sourcing, design optimisation and construction techniques was not seen as a key consideration by most implementing agencies. Most defaulted to using locally available materials without realising the environmental implications of this decision, particularly when replicated at scale.

Timber was favoured initially by many agencies because it was locally available. It was also perceived as being a renewable resource and therefore a 'greener' option than concrete, steel or masonry. Even though responsible sourcing of timber was a government regulation, it was not adequately enforced, and agencies were put under pressure to accept timber supplied through the communities without knowing where it originated. Many also lacked sufficient understanding of species and timber classification to be able to determine whether it was of suitable quality or even a protected species. International organisations such as the Timber Research and Development Association (TRADA) from the United Kingdom were consulted and there was a progressive shift away from using locally purchased timber. Some larger agencies imported timber but experienced delays due to lengthy international tenders and delivery time. Efforts were made to avoid using timber altogether, for instance by using locally manufactured cement fibre board for walls, and in one case using re-useable plastic formwork for casting concrete columns.

15.2 | Re-use and recycling

The earthquake and tsunami created vast quantities of debris and solid waste; according to some estimates up to

Brick production

Estimates in 2006 suggested that the reconstruction of 120,000 houses would require approximately 1 million tonnes of cement, 3.6 million m^3 of sand, 508,000 m^3 of concrete blocks, 87,000 m^3 of plywood, 370,000 m^3 of sawn timber and 1.1 billion fired clay bricks (UNEP, 2007). Brick production has a significant environmental impact since it takes 8m^3 of timber to produce 1m^3 of bricks. The UN Environment Programme (UNEP) estimated that 945,000 m^3 of fuel wood would be needed for brick kiln firing which equates to logging about 10,000 hectares of forest. As a result, several agencies switched from bricks to hollow cement blocks, but by then numerous brick kilns had been established to meet demand. Had strategic measures to manufacture or import high quality blocks been instigated, this could have provided a viable alternative which would also have generated livelihood opportunities.

Source: Rumana Kabir / Oxfam GB

400,000 m^3 of debris was deposited in Banda Aceh alone (UNEP, 2007). Although there were some instances of recycling tsunami debris for use in construction, this was generally through small-scale private enterprise and this approach was not widespread. Only the UNDP's Tsunami Recovery Waste Management Programme recycled waste on a large scale, with wood recovered for use in furniture production or as fuel for brick kilns and building rubble used for road construction. More encouraging was that transitional shelters supplied through IFRC were re-used rather than abandoned once housing was built. In many cases they were used as a kitchen or an additional bedroom by the original occupants. In other cases they were sold on, to be dismantled and relocated by the new owner.

15.3 | Water and sanitation

The majority of people in Aceh depend on ground or surface water supplies. Water is collected from springs or shallow wells which are highly vulnerable to pollution and saline intrusion. Although the Acehenese have a high water demand for personal use (100 litres/person/day), and it rains throughout the year, rainwater harvesting was not a traditional way of collecting water. Assuming an average roof area of 36 m^2, a mean annual precipitation of 1,600 mm, as is the case in Banda Aceh, and a collection efficiency of 90%, an average of more than 140 litres of rainwater per day could be collected from a single roof. This could have made a significant contribution to water supply, particularly for houses or settlements that are difficult to reach with piped water.

Prior to the tsunami there were no treatment plants for household waste water in the whole of Aceh province (UNEP, 2007). Where household septic tanks did exist, the quality varied considerably, and many polluted the ground and drinking water. Most agencies were aware of this and took considerable care to introduce household latrine systems; employing septic tanks and treatment wetlands designed to minimise the risk of groundwater contamination. This was not straightforward in areas such as Banda Aceh, where the high water table meant that specialist designs were required to ensure that effluent was correctly filtered before entering the shallow aquifer.

15.4 | Energy

The energy demands of households in Aceh was fairly low, with cooking (on small gas stoves) and electric lighting being the main requirements. An electricity connection was promised by the state electricity company (PT PLN) to all houses reconstructed post-tsunami, however alternative forms of renewable energy supply were generally not considered as part of the reconstruction effort.

15.5 | Ecology

BRR recognised the need to reinstate coastal mangroves, palm plantations and natural forest that had been destroyed by the tsunami and extensive re-planting programmes were carried out during the reconstruction phase. However, relocation of settlements required a large area of land to be found and cleared. This was often done with machines so that all existing trees and other vegetation were removed with no compensatory planting planned. This affected drainage patterns and substantially increased risk of landslides. In one instance a DEC Member Agency invested months of negotiation in acquiring land for a fishing community near to their original village. It was a steep hillside which the Public Works department then completely cleared of vegetation; leaving an unstable muddy slope on which houses could not be built without very significant engineering works in the form of drainage systems and retaining walls. Consequently, the site had to be abandoned. ■

Construction

The adverse impact on the environment is minimised by the settling of disaster-affected households, the material sourcing and construction techniques used.

Sphere (2004) Shelter and Settlement Standard 6

KEY QUESTIONS

- **How did the disaster affect the environment? How can reconstruction protect, repair and enhance ecosytems?**
- **Is there potential to re-use or recycle waste materials generated by the disaster? Can transitional shelters be re-used or incorporated into permanent housing?**
- **What materials are available locally and are they sustainably sourced and certified? Is there potential to introduce new materials or manufacturing processes which have less environmental impact?**
- **How are building components manufactured? Do they require energy intensive processes or create toxic waste products?**
- **What is the source of potable water? Has this been affected by the disaster? How can sanitation and solid waste management be designed to protect and enhance water sources?**
- **Is there potential to incorporate rainwater harvesting, renewable energy, composting or biogas toilets? Are these appropriate and would they be maintained?**

16 | Disaster risk reduction

Vulnerability to natural hazards can be very significantly mitigated, and even prevented, through appropriate site location, design and construction. Consequently a step change in disaster risk reduction can be achieved, often without significant cost implications, if disaster risk reduction strategies are considered an integral part of the reconstruction process. Appropriate specialist technical expertise should be sought and relevant national and international standards and best practice guidelines adhered to. As well as 'building back better' there is an opportunity to influence local building practices and planning processes so that they support safer construction in the long term. Availability of funds and political will post-disaster may also provide scope for introducing social or financial mechanisms related to awareness raising, disaster preparedness, or risk transfer.

16.1 | Site selection and planning

In Aceh topographical, geotechnical and hydrological mapping were rarely used to inform the location and design of settlements. Areas subject to hazards such as landslides, with soil or geological instability, high water tables or flooding were not always identified. This would have informed decisions to avoid specific location, or to undertake engineering works to minimise risk. This type of information was particularly important in areas such as Singkil, in the south-west, where the ground level had dropped more than 1 m, leaving land permanently underwater and substantially altering historic flood patterns. (See also Chapter 10: Site selection and surveys)

Urban communities were typically rebuilt repeating the pattern of organic growth and siting public buildings as before. The opportunity to rationalise urban plans to include evacuation routes, strategically address services provision and route critical infrastructure was generally overlooked. At a more localised level, some health centres were rebuilt on higher ground and disaster risk reduction strategies to protect against future tsunami, storm surge or severe flooding were incorporated into village plans. (See also Chapter 12: Physical planning).

Where people wished to rebuild on their own land measures to mitigate the risk of flooding or landslide included landscaping to facilitate drainage and/or elevating houses on stilts; building houses at least 1.5 m away from slope edges and constructing retaining walls. For sloping sites (five to 20 degrees) some agencies varied the height of stilts to accommodate the slope. However, it would have been preferable to cut into the slope and create small level platforms on which to seat individual houses. The extent of engineering works needed at some relocation sites relied on the Public Works Department. The shortage of suitably qualified geotechnical and civil engineers to design and supervise the works resulted in substantial delays in handing over some sites.

16.2 | Design and construction

Prior to the tsunami, houses in Aceh had been typically considered as non-engineered structures, following local building practices which took no account of earthquake risks. However, the whole of Aceh is classified as an area of high seismicity. Therefore, it is essential that building designs are correctly engineered and embrace current legislation, guidance and good practice. Additionally, every effort must be made to ensure that the quality of construction does not compromise the design intent. (See Chapter 22: Materials and logistics and Chapter 23: Workmanship)

Key seismic design principles

- Buildings are symmetrical
- Openings are placed centrally
- Ring beams are provided at ground and roof level and above/below openings
- Deformed or ribbed bars are used for main reinforcement, rather than plain bars
- Beam-column junctions follow good practice reinforcement detailing e.g. L – bars, anchorages
- Stirrups or links have 135° bends and anchorage 6 x bar diameter
- Masonry walls are less than 9m^2 and either tied to concrete columns or reinforced.

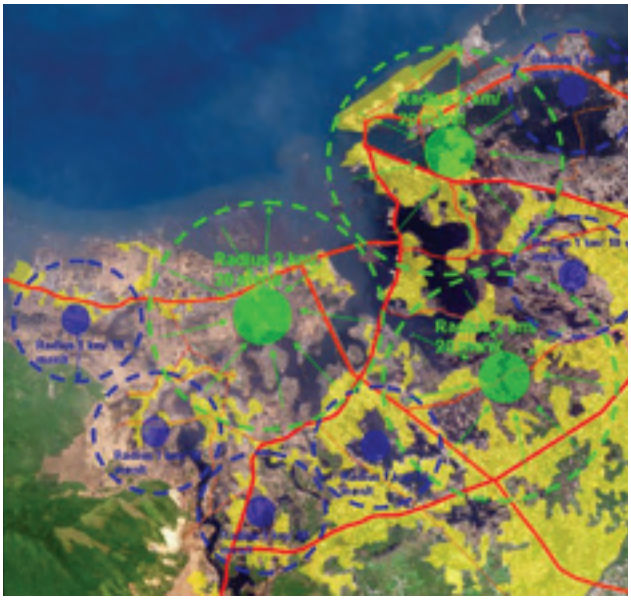
Source: Arup

After the tsunami the need to design for earthquakes was overlooked strategically by BRR and many implementing agencies. BRR justified the fact that most of their own construction was not seismically resilient on the grounds that to make it so was probably cost prohibitive and that reconstruction timescales did not allow for additional design time. DEC's Strategic Framework specifically referred to reducing vulnerability to natural hazards. However, in practice the extent to which DEC Member Agencies appreciated the importance of seismic resilience, and how to achieve it, was largely dependent on the degree to which they employed external expertise, and the timeliness of this advice in shaping their proposals. Many agencies experienced challenges in achieving adequate seismic design. Some had to demolish and rebuild houses and others retrofitted solutions to enhance seismic performance.

A key issue was confusion as to what codes and standards should be followed. The *Building Code for Aceh* (included in UNHIC, 2005) referred to the Indonesian seismic design code (SNI.03-1726-2002) but this was not mandatory for single storey dwellings. Instead it provided a prescriptive specification for various building elements, but failed to include basic good seismic design practice in relation to symmetry, openings, wall panel sizes, ring beams, ductile reinforcement detailing and ties between elements. Several agencies complied with the *Building Code for Aceh* assuming that it was sufficient or that local designers and contractors knew what they were doing without realising that safe construction practices were not common practice.

Local engineering consultants employed by implementing agencies to develop structural designs generally had limited experience of seismic design, which typically requires an additional post-graduate qualification. This resulted in poor design solutions which were not compliant with the Indonesian code. Recognising this, some agencies employed specialist international consultants or firms to develop or check designs, or sought advice from local and national universities. International engineers were also employed as consultants in-house. However, many of these engineers did not previously have seismic design experience and so were ascending a learning curve, trying to follow available guidance and incorporate it into the construction drawings.

National good practice guidance on earthquake design existed pre-tsunami. Much of which had been developed at the Institute of Technology in Bandung, and local experts including Teddy Boen (senior adviser to the World Seismic Safety Initiative (WSSI)) also advocated for the incorporation of mitigation measures (Boen, 2005). Further guidance was developed by UN-Habitat, UNDP and others, specifically for the Acehenese post-tsunami context. However, lack of coordination and leadership within the shelter sector meant that these references were not widely distributed and were frequently either not known about, or published too late to make a significant contribution. ►



Source: BRR

BRR EVACUATION PLAN FOR BANDA ACEH

KEY QUESTIONS

- **Is reconstruction in an area where earthquakes, floods or cyclones are prevalent? Have hazards and vulnerabilities been identified through participatory processes?**
- **What national standards and best practice guidance exist? Do they reflect best practice? Is there consensus as to which are applicable?**
- **Are hazard maps available or are additional surveys required?**
- **Do settlement plans mitigate the impacts of hazards? Can hazard mitigation be included in planning and approval processes?**
- **If buildings must be built in vulnerable areas are engineering works required to reduce the risk?**
- **Has advice been sought from local or national universities, institutions or the private sector?**
- **Is designing for natural hazards a specialist skill? Do your technical advisors have appropriate experience and qualifications?**
- **Can existing coordination mechanisms and coping strategies be identified and supported?**
- **Can training be used to raise awareness and improve construction practices?**
- **To what extent do affected communities have access to finance to enable them to recover quickly or contribute to reconstruction?**

▸ 16.3 | Social

In some villages communities identified potential hazards and risks of future disasters through participatory planning processes. They developed scenarios for different types of emergency and identified preferred coping strategies such as evacuation routes and meeting points where first aid and assistance could be provided.

Communities in Aceh are used to living with a high risk of seismic activity and flooding. Therefore it was important to ensure that community preparedness planning supported their existing coordination and coping strategies, while increasing their understanding of risk and mitigation.

Once the completed houses had been handed over many households very quickly began to invest in extensions. In some cases the community had been trained in safe building techniques as part of reconstruction programmes so they appreciated the importance of safe design and construction. But generally such extensions reverted to being non-engineered structures using poor quality materials and workmanship. In some cases they also undermined the structural integrity of the core house by creating asymmetry or cutting through ring beams.

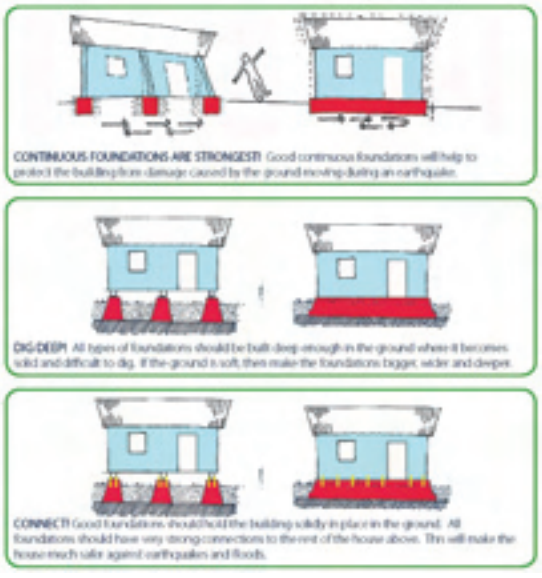
16.4 | Financial

The capacity of a community to recover after a disaster depends to a large extent on their access to savings, insurance and loans. The affected community's access to private finance varied across the region and between rural and urban areas. In more affluent areas, such as Banda Aceh, families had access to savings or private insurance and thus were able to use their own resources to recover their homes and livelihoods. In rural areas the majority of the affected population had no access to private financial assistance.

In rural areas it was common pre-tsunami for people to work in other parts of the country or abroad and provide money to their families through remittance schemes. For many families this continued post-tsunami and in some cases, when their livelihoods had been destroyed, people left rural areas to find work in order to finance the reconstruction of their family's home and livelihood. Even if most of the affected population did not have access to formal methods of financial assistance, the majority used informal methods of assistance such as reusing waste materials from the tsunami or using timber from their local forests. ■

Safe housing programme

One DEC Member Agency included a specific 'Safe House' training programme as part of their livelihoods programme which was well received. It was intended to raise awareness of the risk posed by earthquakes and educate the whole community about the importance of safe building practices. Clear and colourful posters were designed which displayed the 12 key principles of safe construction. Each of these was expanded in the training modules to show how it can be practically achieved with key 'Do's' and 'Don'ts'. The programme included the construction of a community building in each village using local materials which was used to demonstrate safe building techniques and for specific skills training for labourers. During construction participatory workshops were also held for community members to better understand safe construction techniques so that they could play an active role in monitoring the quality of construction. This allowed them to satisfy themselves that their houses were safe.



Source: British Red Cross

17 | Design of houses

House designs must meet relevant national and international standards, be culturally and climatically appropriate, durable and easy to maintain, allow for future adaptation and be developed in partnership with the intended occupants. While architects may be best placed to advise on building form, engineering expertise is required to carry out surveys and to ensure structural integrity, particularly in areas of high seismic activity. Services such as water, sanitation and electricity must be included in housing design to ensure houses are not left unoccupied after completion. Standardisation and optimisation of designs can improve performance, minimise costs and facilitate speed of delivery and scaling-up. However, this must be balanced against the requirements of specific households and the limitations of individual plots.

17.1 | Technical expertise

The interpretation of the standard 36m^2 house proposed by BRR was left to individual implementing agencies. All DEC Member Agencies recognised the need for technical expertise and employed international or local architectural consultants to develop initial concept designs. These were based on consultation with specific communities, consideration of site specific requirements, and the availability of materials.

In addition engineering advice was needed to develop the detail design and construction drawings for the main building elements (foundations, structural frame, roof and walls) particularly due to the high level of earthquake risk. Structural analysis, calculations and/or testing is necessary in order to demonstrate a design is safe and in accordance with local and national building regulations. This was not required as part of BRR's approval process and not appreciated by many agencies. Consequently, many designs were developed without engineering input. Standard good practice such as the incorporation of ring beams, ties and adequate laps between reinforcement was not shown on construction drawings, and specifications did not adequately cover material quality, testing and workmanship.

Where advice was sought it was frequently from locally trained recent graduates who had very limited experience and were not familiar with the building codes. Crucially, unless engineers had a specialist post-graduate qualification they had no knowledge of seismic design. However, this expertise was available in the engineering departments at Siyah Kuala University in Banda Aceh, and at the Institute of Technology in Bandung where Professor Teddy Boen (a globally recognised seismic engineer) is based. There was a reluctance to engage international engineering consultants due to an inability to write appropriate terms of reference, uncertainties over where design responsibility lay and concern over costs.

Specialist input was also needed to design household water and sanitation systems. This was more readily available within the humanitarian community and several housing programmes involved partnerships between agencies. ▶

Key seismic design principles

One DEC Member Agency initially provided pre-fabricated timber houses in the traditional Acehnese style. However, these later had to be upgraded due to design flaws and poor quality materials and workmanship. After receiving technical advice from Syiah Kuala University, a systematic retrofit programme, including recasting the footings and using treated timber and calci-board, was implemented in 2007. While other agencies chose to replace housing, the retro-fitting programme was favoured by this agency as it reduced dependency. Demonstration of the proposals on two prototype houses achieved buy-in from the community, where similar houses had been abandoned in other locations. The agency also provided handover kits, which included plywood for ceilings and mosquito screening, but the households retained responsibility for undertaking the repair work themselves. This developed a sense of ownership and enabled the agency to achieve smooth handover.

Source: Arup

17.2 | Process

The design process in Aceh was generally iterative. Initially, a number of conceptual designs were developed. These demonstrated possible variations to layout, treatment of elevations and key details to reflect local traditions and aesthetics. The preferred option was identified through consultation and then developed to optimise performance and minimise costs, and to provide sufficient information for construction. This process allowed a certain amount of standardisation and helped to avoid issues of inequity within communities. The variety of solutions produced created intense competition between agencies and families shopped around for assistance based on what they deemed to be the best design and promises of speed of delivery.

One DEC Member Agency initially developed and constructed 11 types of houses. However, after recognising that this led to added complexity, they reduced the number of different designs to three. Another DEC Member Agency developed a 'kit-of-parts' approach where families were offered a standard layout with a choice of material options for the walls and frame and the option to raise the houses on a plinth or stilts. This meant that several options could be assembled to suit the requirements of the family and the site. thus providing flexibility while still retaining economies of scale.

The 'kit-of-parts' approach, using repeated components, can improve buildability (which impacts on both quality and speed of construction) and should be a prime consideration in scaling up programmes. However, in Aceh the opposite was often the case. Construction was predominantly in-situ and efforts to reduce material quantities and costs by reducing the size of concrete columns or beams resulted in extremely congested connection details. These were almost impossible to construct. Standardised bespoke construction technologies such as precast panels and steel frames were generally avoided due to issues of cultural acceptability and potential difficulties in future adaptation by the occupants.

17.3 | Size and layout

All agencies provided housing ranging from 36 to 45m^2 in accordance with BRR and/or local government policy. For instance, in Meulaboh the local government stipulated 45m^2 as opposed to BRR standards of 36m^2. Where agencies provided larger 45m^2 houses as a result of consultation, which exceeded both BRR and local government standards, it was welcomed by households. However, the disparity raised issues of equity of assistance and intensified inter-agency competition. Several agencies included options for smaller houses (less than 36m^2), narrow houses, or semi-detached houses to suit smaller plot sizes

The BRR standard is approximately twice the minimum covered floor area per person (at least 3.5m^2) recommended in the *Sphere Standards* for disaster response (Sphere, 2004). It was deemed adequate for an average family size of four to five people although there were instances of families of up to 10 people living in 36m^2 houses. Many families, particularly on the west coast, had previously lived in smaller timber houses. Consequently, a 36m^2 house (particularly if concrete and masonry) was well received. For others, the 36m^2 was considered to be too small, but mostly they planned to use their own funds to modify their houses or to add extensions provided plot sizes were adequate. In some cases extensions were substantial and even included a second storey.

Building footprints were compact and kept fairly symmetric for earthquake resistance and to reduce costs. Typically houses comprised three rooms: one large living area and two smaller rooms, mostly with an attached toilet-bathroom at the rear. Uni-sex sleeping arrangements were more challenging for larger families with older children. Verandas were welcomed as communal spaces and as additional sleeping quarters. The majority of families considered the space available for cooking to be inadequate and many built kitchens at the rear or redeployed their temporary shelters as a kitchen. Some houses were constructed on plinths or raised platforms to prevent flooding. This created difficulties for access by disabled or elderly people but had the advantage that the space underneath could be used as kitchen or storage.

17.4 | Comfort and well-being

All house designs had pitched roofs designed with sufficient overhangs to provide shade and protection from heavy rains. Several allowed for a porch or small veranda. Sufficient openings were provided in the form of windows, louvers or perforated panels to allow natural ventilation. Temperature was regulated by providing ceilings beneath metal roofing, as well as utilising the thermal mass of solid concrete or tiled floors and masonry walls. The resulting levels of thermal comfort and fresh air were acceptable. Internal partitions and lockable doors and windows allowed privacy and security. Most window designs incorporated mosquito screens, but not all. Minor problems with broken locks, leaking roofs and wind blown rain reported within the defects period were generally fixed to the beneficiaries' satisfaction

17.5 | Water and sanitation

House designs generally included a bathroom and plot sizes were determined to accommodate a well and sanitation system. Bathrooms were generally fully tiled up to mid-wall level and included a ceramic squat toilet and an Indonesian style bath (*mundi*). Ceramic toilets and washrooms were welcomed by many families who did not have their own toilet previously. However, where hygiene education was not carried out, or water was not immediately available to flush the toilet, there were problems with odours and blockages. Sometimes toilets were used as storage rooms.

Few agencies succeeded in handing over houses with access to water, sanitation and power in place unless they had taken on direct responsibility for these aspects. (See Chapter 15: Environment). Where the provision of toilets and water had been delayed this was deemed a problem, but houses were often still occupied in preference to living in temporary shelters or barracks.

17.6 | Adaptability and durability

The BRR 36m^2 standard house was intended to act as a 'core shelter' which the household could extend with

their own funds as their family size, status or livelihood required. Most agencies took this idea on board and made allowances for future extensions. However, this was not always the case and in some areas (particularly around Banda Aceh) land scarcity meant that houses were located very close together. This left very little room for extensions although there was positive evidence of ownership by families personalising their houses with verandas and decorative finishes.

In some cases agencies accommodated the desire of households to improve their housing and designs were modified to take into account additional capital invested by individual households. Although this led to high levels of satisfaction it delayed the overall reconstruction programme and led to problems over what appeared to be inequitable solutions.

Concrete frame and masonry houses were generally built by contractors and this left very little knowledge within the affected community of how to safely adapt or extend the structure of their new home. Some DEC Member Agencies provided specific training on safe construction techniques and/or the maintenance and repair of houses. However, extensions were often self-built and poorer quality with limited resistance to earthquakes (see case study: disaster risk reduction).

If correctly constructed, concrete and masonry provided an inherently durable solution requiring minimum maintenance particularly where internal finishes included painted walls and a tiled floor. This was appreciated by householders and preferred to timber frames where there were more maintenance issues and concerns over durability of untreated softwood. ■

Covered living space

People have sufficient covered space to provide dignified accommodation. Essential household activities can be satisfactorily undertaken, and livelihood support activities can be pursued as required.

Sphere (2004) Shelter and settlement standard 3

Design

The design of the shelter is acceptable to the affected population and provides sufficient thermal comfort, fresh air and protection from the climate to ensure their dignity, health, safety and well-being.

Sphere (2004) Shelter and settlement standard 4

KEY QUESTIONS

- **Does the house design meet the requirements of local, national and international standards?**
- **Have architects and engineers been involved in the design and detailing of the houses? Who is responsible for the design? Do they have the appropriate qualifications and experience? Is the design safe and buildable?**
- **How are beneficiaries involved in design?**
- **Is the size and spatial arrangement of the house culturally and climatically appropriate? Does it incorporate appropriate facilities for washing, cooking and livelihood activities?**
- **Are houses easily accessible?**
- **How can the design be developed to optimise performance and minimise costs? What is the potential for standardisation?**
- **How is standardisation balanced against the requirements for adaptation to suit the requirements of individual households or non-standard plot sizes?**
- **Are households allowed to use their own funds to adapt or extend their homes during design and construction? Does individual adaptation have cost or programme implications?**
- **Will the completed houses be durable and easy to maintain? Do they allow for future adaptations and extensions?**

18 | Design of schools and health centres

Schools and health centres are larger and more complicated buildings, with higher occupancy, and play a critical role in the community. It is therefore essential that they are fit for purpose and built soundly. This requires consultation with the relevant government departments and staff and a higher level of technical design expertise and site supervision. Their operation is dependent on provision of specialist services, equipment and trained personnel which need to be integrated into the building design and included in an operation and maintenance plan. Since these building types are deemed to be critical infrastructure they need to be designed and constructed to higher specifications than housing, and to include built-in redundancy to ensure continuity of operation following a future disaster.

18.1 | Standard designs

More than 2,000 schools were damaged or destroyed as a result of the tsunami along with 8 hospitals and 114 community health facilities (BRR and International Partners, 2006). This was compounded by a loss of medical records, equipment and skilled staff, including midwifes, nurses, doctors and teachers. Construction of schools and health centres were conceived as a strategic part of overall assistance in the rehabilitation and replacement of educational and health services, which included provisions of equipment and staff training. New school buildings and health centres were also needed as part of overall provision for social infrastructure on resettlement sites.

Standard building layouts, accommodation and equipment schedules were provided by the Ministry of Health (MoH) and Ministry of Education (MoE) for primary and secondary schools, and for three types of public health facilities: health centres (*puskesmas*); sub-health centres (*posyandu*); and maternity clinics (*polindes*). These provided a valuable starting point for developing the design brief based on international standards and best practice, and on consultation with the respective ministries as well as health centre and school principals, staff and governors. Additional requirements such as extra offices, storage and disabled access were included in the final designs. As a result, the principals of health centres constructed by DEC Member Agencies considered them to be much higher quality than the ones they replaced.

18.2 | Services

Schools and particularly health centres have specialist requirements for water, sanitation and solid waste disposal. Waste collection and disposal facilities were extremely limited so specialist disposal facilities for incineration, clinical waste, sharp objects, needles and drugs were provided on site. School construction included separate toilets and hand washing facilities for girls and boys though in some instances these were left unused as the water supply had not been connected.

Reconstruction of schools

More than 2,000 schools were reported as damaged or destroyed after the tsunami. However, even before the disaster, the education sector in Aceh and Nias was characterized by poor quality school buildings, a lack of adequately trained teachers, poor performance of students in national examinations, poor management, and low levels of community participation. In the immediate aftermath of the tsunami materials including tents, learning materials and recreation kits were distributed to almost one million children in affected districts. This joint effort enabled schools to reopen on January 26, one month after the tsunami, and for emergency schooling to be provided to almost all students, including IDPs (BRR and International Partners, 2005b). By the end of 2006, 747 permanent schools had been repaired or rebuilt and more than 5,000 teachers had been trained (BRR and International Partners, 2006). However, many children continued to go to school in temporary accommodation.

Source: Arup

18.3 | Accommodation and equipment

The effectiveness of educational and health facilities is dependent on the availability of suitably trained staff as well as the quality of facilities and equipment. In schools, whiteboards and specialised training in active learning processes with younger children were exceptionally well received by teaching staff who deemed these interventions as important as the new school building.

The provision of medical equipment and computers was welcomed by health centre managers. Their main concerns were the need for training to use the new equipment and whether there would be sufficient funding to maintain facilities in the future. Health centres included high quality staff accommodation to attract key staff. This was provided as an annex to consulting rooms in sub-health centres (*posyandu*) and as a separate dwelling for health centres (*puksemas*).

18.4 | Critical infrastructure

Schools and health centres are critical infrastructure and need to remain in operation after an emergency. They need to be designed and constructed to higher specifications and include built-in redundancy to ensure continuity of operation. While the DEC's Strategic Framework specifically refers to reducing vulnerability to natural hazards, this was not a specific requirement of the MoH or MoE. Furthermore, the Indonesian seismic design code (SNI.03-1726-2002) is not mandatory for single storey dwellings, schools or health centres. Nevertheless, the few DEC Member Agencies who built schools and health centres appointed appropriately qualified engineers to carry out the structural design so that it should be seismically resilient and used increased safety factors as specified in national and international standards.

One DEC Member Agency voluntarily carried out remedial works to schools which did not initially incorporate seismic resilience following advice from the engineering department at Syiah Kuala University, Banda Aceh. Another provided comprehensive site-wide infrastructure for all their health centres, including back-up power and water supplies, and comprehensive site drainage with capacity for severe storms, having already ensured the buildings were located on higher ground where possible. ■

Source: Arup

SITE DRAINAGE REDUCED VULNERABILITY TO FLOODING

KEY QUESTIONS

- **Are there standard designs and specifications or accommodation and equipment schedules?**
- **How do standard designs relate or compare to international standards?**
- **Do standard designs need to be modified to meet specific site or functional requirements?**
- **Have partnerships been established with appropriate government ministries?**
- **Have the principals and staff who will use these facilities been involved in the design process?**
- **Who will provide equipment and training?**
- **Who will fund operation and maintenance of the building after completion?**
- **What are the specialist requirements in terms of water, sanitation and solid waste disposal, specialist equipment and staff accommodation?**
- **Are schools and health centres located, designed and constructed to remain operational during and after a future disaster?**
- **Has appropriate technical expertise been obtained?**

19 | Project plan

In order to plan the implementation phase, and mobilise necessary resources, there needs to be a Project Plan which clearly defines the reconstruction project (whether it is permanent housing or transitional shelter) and the means to deliver it. The Project Plan should either be an extension to, or read in conjunction with, the Programme plan. It should comprise a cost plan, resource plan and programme for procurement and construction based on a detailed scope of works or activity schedule for each site or community. In addition it should also highlight key risks that might negatively impact on the delivery process so that they can be proactively managed. The Project Plan should form the basis on which a decision to proceed with construction is made. It can also be used as the baseline for monitoring budget and programme during construction and managing expectations regarding quality and timeliness of delivery.

19.1 | Scope of works

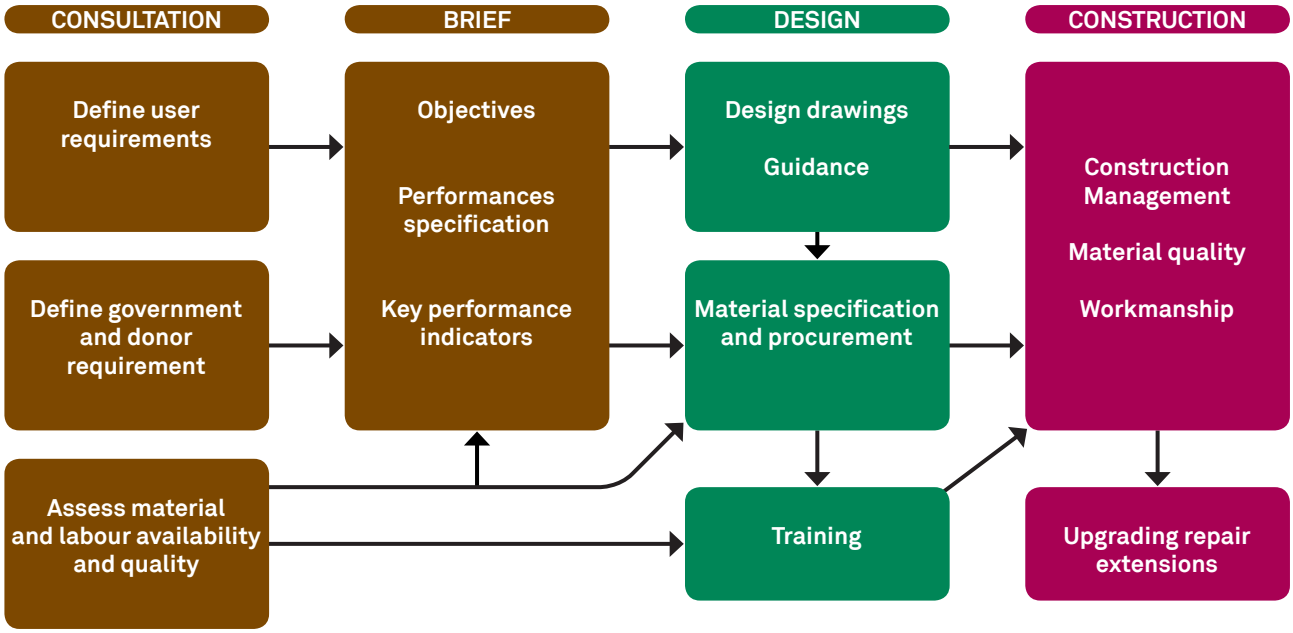
The most successful programmes in Aceh had a well defined scope of works. These comprised of a design package which included drawings at several scales, material and workmanship specifications, and bills of quantities indicating the amount of materials required. Drawings varied in quality, amount of information they contained, and language (English or Indonesian). The most comprehensive included site location drawings showing the buildings, their surroundings and associated infrastructure. Also included were key physical constraints, land ownership and responsibilities of the community, the implementing agency and other partners clearly marked.

All DEC Member Agencies had drawings to describe the buildings which included layout drawings (plans and elevations) and more detailed drawings showing how the building was to be constructed. These were frequently architectural drawings only. While they provided detailed information on doors and windows, they typically only showed main-bar reinforcement but did not include reinforcement details or bar bending schedules, and did not show how different building elements were connected. Some agencies produced models which were more easily understood by the communities and local contractors.

19.2 | Programme

Programmes were frequently overly optimistic and responded to donor timescales and pressure from government rather than the realities on the ground. They varied significantly in terms of the level of detail, and the extent to which they provided, or were used as a tool, to identify resources and subsequently to monitor and manage the delivery process. The most comprehensive programmes clearly identified key activities and project milestones based on a defined scope of works as well as lead in times for major items. They also identified the critical path where one activity is reliant on a chain of preceding activities or contributions from third parties.

Few agencies, or their advisors, were able to draw on previous experience of other construction programmes of this scale as precedent, particularly in post-disaster



INTER-RELATIONSHIPS IN THE IMPLEMENTATION PROCESS

situations. The shortfalls in construction capacity both within affected communities and the local construction industry and within implementing agencies were not necessarily reflected in terms of allowing time for recruitment, mobilisation and training of staff. Other issues which should have been included, but were often overlooked, included:

- lack of availability of labour due to skills shortages;
- demand exceeding supply;
- public holidays or prioritisation of livelihood activities such as fishing, planting or harvesting;
- seasonal variations in weather;
- difficulties with infrastructure and logistics;
- limited supply of construction materials and lead-in periods.

19.3 | Human resources

The level of human resource that each agency could mobilise, and the practicalities of building a team with the necessary breadth and depth of expertise, were significant constraints. Most agencies built an estimate of resources from the bottom up - including design, community liaison, technical oversight, site supervision and construction management - but experienced difficulties in filling both local and international roles and retaining staff. There was also considerable turnover of key staff within agencies, either leaving Aceh or moving between organisations. Roles and responsibilities were not always clear and shelter advisors, particularly if they were external consultants, were not sufficiently empowered to influence decision making at the programme level.

19.4 | Cost plan

Bills of quantities were drawn up for construction costs based on the design package of drawings and specifications. They generally included costs for materials, labour, plant, accommodation, transport and storage. However the rates used did not necessarily accurately reflect how materials were purchased, the distance they had to be transported, or the savings that could be realised by manufacturing materials locally or bulk buying. Contingencies should have also been included for inflation, programme delays, residual risks and unforeseen circumstances.

The scope of works, timescale and human resources are intimately related to the wider cost plan which is not synonymous with the construction cost. For example the programme might be completed more quickly if additional money is spent on human resources or delayed if sufficient resources are not available. The scope of works could be completed at lower cost if it is self-built but this would take longer. It is normally important that these kinds of trade offs are explored, and the cost-benefit calculated qualitatively if not quantitatively. Typically, the aim is to optimise use of resources, although in Aceh this was not an issue due to the extent of funding available.

19.5 | Risks

Risk management is a standard process on construction projects but one that is not mainstreamed within the humanitarian sector. Most reconstruction proceeded without systematically identifying risks that might have negatively impacted the success of the programme. Some DEC Member Agencies did develop risk registers and put in place action plans to monitor and mitigate significant risks. Problems with material quality and availability were key risks that led to significant delays, along with dependency on government or other third parties to deliver particular aspects and difficulty recruiting and retaining personnel.

Adequate and timely monitoring ensures the programme remains relevant to the needs of the affected population. It allows programme managers to identify problems as they arise, and make adjustments so as to minimise delays and avoid incurring additional costs. The Project Plan provides a baseline for monitoring and evaluation which encompasses quality, cost, programme and risk. The timeframe and regularity over which monitoring will occur, who will be responsible and how the results will be shared and actioned will influence the effectiveness of a monitoring and evaluation programme. Many DEC Member Agencies felt that their programmes were being evaluated retrospectively and too late to positively shape the process. ■

KEY QUESTIONS

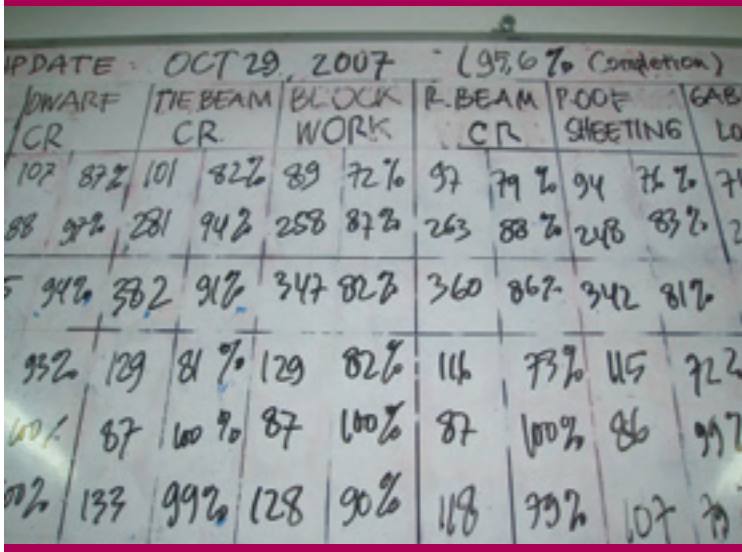
- **Is there a comprehensive set of drawings which describe the building works in sufficient detail for the works to be procured and constructed?**
- **Has a preliminary implementation programme been developed? Does it identify key milestones and inter-relationships between activities?**
- **Has the scope of works and programme been used as the basis for estimating human resources? Is additional recruitment required?**
- **Is there a shared understanding of roles, responsibilities and lines of communication?**
- **Is there a comprehensive bill of quantities based on a defined scope of works? Does this include inflation and contingency allowances?**
- **Has value engineering or cost-benefit analysis verified that funds are being well spent?**
- **Have residual programme risks which might jeopardise the success of the programme been identified so they can be managed?**
- **Has a monitoring and evaluation strategy been agreed upon by all parties? Is there a process for incorporating recommendations?**

Construction

The section covers implementation which includes procurement, construction management, quality assurance and health and safety. There were wide ranging approaches amongst DEC Member Agencies to these issues depending on the size of programme, expertise employed and the extent to which the communities participated in the process ranging from self-build to large scale contracts. However, there are common themes such as material availability, verification of material quality, ensuring sound workmanship, monitoring progress and handover which are applicable to all reconstruction programmes.

Construction

Source: Arup



Source: Arup

Source: Arup

20 | Methods of implementation

The most appropriate method of implementation (self- or community-build, contractor-build or direct implementation) is dependant on the skills and capacity of the affected population, local material availability, the complexity of the housing design and type of construction, the timescale for reconstruction and the availability of funding. A single programme may include different methods of implementation, for example communities may self-build their own housing while contractors may be more appropriate for settlement wide infrastructure.

The method of implementation is critical in determining the social and economic impact of the reconstruction programme. Each option has benefits in terms of skills transfer, economic and livelihood recovery and these may be experienced at a local, regional or national level depending on where cash, skills training or materials are provided. Ownership of the completed programme is also a key issue and mechanisms must be put in place to ensure that communities are adequately engaged in the decision-making process. This helps to ensure beneficiary satisfaction and occupancy of the completed housing.

20.1 | Self- or community-build

In Aceh, many agencies initiated self- or community-build programmes, without considering alternatives, believing this to be the most effective means to generate ownership and re-establish community networks. The intention behind self- or community- build programmes is that the implementing agency acts as a facilitator providing cash transfers, materials, training and technical expertise to enable households to design and construct their new houses and settlements.

Communities with weak social networks or limited building skills do not readily lend themselves to self- or community build approaches. This is particularly true if designs are complex, or quality of construction is a key concern in order to reduce vulnerability to future disasters. Agencies incorrectly assumed the population would have sufficient construction capabilities and under estimated the lack of materials and skills available locally. This meant that agencies struggled with poor quality construction and ever-lengthening build programmes. To overcome this large number of facilitators were required to provide training, site supervision and quality control.

Community expectations and priorities also had to be managed very carefully. Although shelter was their main priority those affected by the tsunami also had to re-establish their lives and livelihoods, balancing participation in the reconstruction process with growing food, fishing, earning cash and looking after their families. This slowed construction, particularly at certain times of the year such as harvest or Ramadam.

Underlying tensions from the conflict also meant that in some areas it was difficult to promote community build, or share resources (warehousing, materials, labour) between communities even in neighbouring villages. As time went

Who benefits?

Self- and community-build approaches included providing cash assistance directly to households or communities who were then responsible for purchasing materials and hiring labour locally. The intention was to provide temporary livelihood opportunity and to support local suppliers, thereby contributing to economic recovery. However, with building materials in short supply locally sourced materials were often of variable quality and dubious origins. In addition, highly inflated prices reduced the effectiveness of cash transfers.

Some DEC Member Agencies overcame these difficulties by purchasing materials on behalf of communities from national or international suppliers. This guaranteed higher quality materials but meant humanitarian funds did not directly benefit the local economy.

Source: Arup

on it also became more difficult to engage people in this type of cooperative build process when other agencies were employing contractors to build houses.

The main advantage of self-build programmes in Aceh was that they catalysed the early recovery process. Reconstruction could be started quickly, avoiding lengthy procurement processes. Families involved in self-build programmes stated that even though it took a long time to complete their finished house they felt a sense of ownership and achievement from the moment they laid the foundations. This helped them overcome the effects of trauma and rebuild their lives sooner than had they lingered in barracks, tents or with host families away from their villages.

20.2 | Contractor-build

As the reconstruction progressed, the lack of building skills within communities, concerns over quality and its impact on seismic resilience and the pressure to build quickly meant that most agencies gradually shifted towards using local or national contractors. In this instance the agency effectively took on the role of developer, acting on behalf of communities to develop a design that satisfied their requirements, and to appoint a contractor who then became responsible for all aspects of construction including labour, materials and workmanship. In these cases, the agency acted as contract administrator overseeing delivery.

DEC Member Agencies generally employed local or national contractors with one contractor initially responsible for 20 to 50 houses. This was increased in subsequent contracts to 100 to 150 based on proven ability to deliver. Contracts were awarded following national tender, usually from a pre-qualified shortlist. The tender process was time consuming and required spot visits to contractor's offices, reviews of their financial standing and verification of previous work. Multiple sub-letting of contracts and corruption was a widespread problem in 2005/06 but over time BRR and implementing agencies developed various lists of black-listed or pre-qualified contractors. These were shared between agencies, which helped to weed out "cowboys". Recognising the role of contracts as a management tool, several DEC Member Agencies obtained expert advice and improved their contracts to reflect local employment law and incorporating payment periods schedules based on no advance payments and retention.

Advantages of contractor-build programmes included speed of construction, greater control over quality, ability to scale up and transparency over disbursement. They also required less construction capacity within the agency, who were responsible for contract administration but not construction management. The risk of contractor-build programmes is that the community can feel excluded, particularly if designs, material and labour are imported, leading to lower occupancy rates through lack of ownership. To overcome this all DEC Member Agencies put in place specific mechanisms to involve communities in physical planning, design or monitoring the quality of construction. This type of participation generated a high degree of ownership whilst ensuring quality and speed of construction and also allowed households to more readily balance their commitment to reconstruction with livelihood recovery.

20.3 | Direct implementation

Several DEC Member Agencies chose direct implementation effectively acting as a main contractor. They provided materials, hired skilled labour and managed the construction process themselves. Often this was because they had difficulties with corruption and contractor performance and were forced to terminate contracts. Many communities preferred this method of implementation over contractor-build as they had greater trust in humanitarian agencies than in contractors. They could directly express their needs and complaints to the implementing agency, and it was easier to maintain engagement throughout the process. The challenge for agencies was recruiting, training and retaining skilled labour in a competitive market, and establishing supply chains.

Few humanitarian organisations have the technical capabilities within their own organisation to manage construction. They were faced either with building up a team of national and international consultants with technical expertise in the built environment, procurement, logistics and finance within their own organisation or partnering with the few specialist NGOs or the private sector. Many agencies faced difficulties recruiting staff due to the lack of local expertise, the time required to identify and recruit international staff and competition between agencies. ■

KEY QUESTIONS

- **Are affected communities willing to engage in a self-build programme? Do they have sufficient skills and capacity?**
- **Are the timescales for reconstruction compatible with self-building? Is the quality of construction required to reduce vulnerability to future disasters achievable?**
- **Are there sufficient capabilities within the agency to manage contractor-build or direct implementation? Has partnering with the private sector or a specialist NGO been considered?**
- **What mechanisms can be put in place to engage the community in contractor-build and direct implementation programmes?**
- **How can the process for selecting and appointing contractors ensure that expectations with respect to quality and costs will be realised?**

21 | Construction management

Effective construction management is critical to the timely delivery of good quality housing while ensuring available funds are spent efficiently and effectively. The challenge is to maintain progress, manage expectations with respect to both programme and quality and remain within budget in an environment where inevitably there are numerous causes for delay and resources are limited. Construction management therefore requires capabilities in financial, programme, personnel and supply-chain management and a sound understanding of quality and risk. These must be informed by previous experience of delivering construction programmes of a similar scale. While some of these capabilities may already exist within an agency, it is likely that national and international consultants will need to be recruited or partnerships formed with the private sector or specialist NGOs.

Various tools and practices can be used to manage construction. The most important of these is the construction programme, which should identify key milestones, the inter-relationships between activities, and critical path items. It can be used to monitor progress and assess the implications of delays. Other common tools include the cost plan, risk register, quality assurance, and health and safety procedures. Construction is a collective effort and the responsibilities, lines of communication and authority for decision making need to be clear and practicable with ultimate responsibility residing in one person – the designated Construction Manager or Country Director.

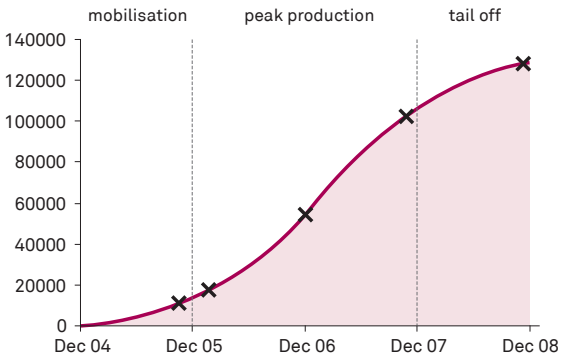
21.1 | Personnel

Over 100 agencies contributed to reconstruction in Aceh. Most were inexperienced in construction, or lacked institutional memory to build on previous experiences such as Gujarat (2001) or Kosovo (1999). In 2005/06 the need for staff with construction management skills was not even recognised by some agencies and this limited their ability to effectively strategically plan, design and implement reconstruction programmes. Many climbed a steep learning curve and as a consequence made costly mistakes, suffered extensive delays or had difficulty managing the expectations of the communities, BRR and donors.

By 2007 all DEC Member Agencies had recognised the need to set up specific construction teams reporting to the Country Director. Most relied heavily on international consultants to fulfil key roles, although it was not easy to find individuals with appropriate construction management skills who were also sympathetic to a post-disaster working environment and prepared to stay for longer than six months. Recruiting Indonesian and Acehnese engineers was equally problematic, particularly for senior roles. Some DEC Member Agency construction teams were led by national staff but they had mostly taken this responsibility once processes and

Scaling up

It took four years to meet BRR's target of 125,000 permanent houses. Many agencies were criticised for being slow to start construction since only 16,200 permanent houses were constructed in the first year. During this period, agencies were beginning mobilisation: recruiting staff, establishing supply chains, working with communities and identifying land for construction. The programmes of the DEC Member Agencies reflect the overall reconstruction programme which followed a typical 'S-curve'. Few completed permanent houses in 2005 but this initial phase enabled agencies to rapidly scale-up their programmes in the following two years with peak production at around 40,000 houses per annum in 2006 and 2007. By the end of 2007 the programmes of many agencies were coming to an end with the completion of houses in relocation sites, remote communities, and locations where problems had been encountered being completed in 2008.



procedures had been established and construction was well underway.

Large numbers of engineers (mostly recent graduates) were employed for more junior roles and as site managers to oversee construction at specific locations. This worked reasonably well as they welcomed the opportunity of employment, were sympathetic to local conditions and able to build good working relationships with communities. However, their lack of experience meant they failed to anticipate or spot problems and needed training and supervision. One DEC Member Agency overcame some of the above issues by hiring an international consultant with extensive experience of construction in Thailand as their Construction Manager. He then established a partnership with a large engineering consultancy from Jakarta to deliver the technical expertise rather than recruiting an in-house team on an individual basis.

In general the DEC Member Agencies established construction teams with two key elements: a technical/management team, responsible for cost, quality and programme, and a community liaison team, responsible for building and maintaining a relationship with the community and local government. The community liaison team played a crucial role in the delivery of the project and ensured that both the product and process responded to the needs, concerns and expectations of the affected community and other local stakeholders. The size of the construction team varied considerably depending on the method of implementation (see chapter 20: Methods of implementation) and number of houses being built. Even contractor-build programmes required between 10 to 50 agency staff and this was considerably greater if the agency was directly responsible for hiring labour or construction quality. Construction teams dwarfed other teams within most the agencies and this was generally most successfully dealt with by recognising it as a separate Construction Unit rather than an element within the Programme Unit.

21.2 | Programme

BRR initially estimated that all house construction would be complete within two years, however, it quickly became apparent that this was totally unrealistic. Although there was no shortage of funding, or organisations willing to contribute to reconstruction, the limiting factors in delivery and scaling up proved to be availability of materials and shortage of construction skills. This should perhaps have been obvious due to the legacy of the conflict combined with the scale of devastation but was not well understood or addressed strategically in terms of bulk-importing of materials, manufacturing building components, artisan training or resource centres (see chapter 6: Methods of assistance). Further constraints were the capacity of local government to identify and certify land and limits to the Public Works Department's ability to undertake the necessary engineering works to develop new sites (see chapter 10: Site selection and surveys). Heavy seasonal rainfall resulting in flooding and religious holidays (Ramadan and Christmas) also caused significant delays. ►

Aid worker competancies and responsibilities

Aid workers possess appropriate qualifications, attitudes and experience to plan and effectively implement appropriate programmes.

Sphere (2004) Common standard 7

Supervision, management and support of personnel

Aid workers receive supervision and support to ensure effective implementation of the humanitarian assistance programme.

Sphere (2004) Common standard 8

KEY QUESTIONS

- **What experience of delivering construction programmes exists within the agency? Do local, national or international staff need to be recruited? Have partnerships with the private sector or specialist agencies been considered?**
- **Who is responsible for building and maintaining a relationship with the community and local authorities? Are they recognised as an integral part of the construction team?**
- **Has a detailed programme been developed which identifies key dependencies and the critical path? Has scenario planning been used and is the overall programme realistic?**
- **Have key milestones been identified? Are key construction stages for individual buildings being monitored against agreed targets?**
- **Who is responsible for managing cost? Are there systems in place for processing payments? How are donor requirements and timescales for release of funds being addressed?**
- **Is there a detailed cost plan which can be used as the baseline for cost management? Does it allow for contingencies and inflation?**
- **Has a risk register been developed? Have mitigation measures been identified that minimise cost and programme implications?**
- **Have health and safety assessments been carried out and steps taken to manage risks?**

- All of the above are risks which should have been identified during the strategic planning phase and this would have led to more realistic expectations from BRR, the media, donors and the affected communities as to when reconstruction might be completed. Instead agencies were heavily criticised for being slow to start and came under pressure throughout the four years to scale up their programmes and speed up delivery.

Those agencies that employed experienced Construction Managers who were able to contribute expertise in construction planning, using standard techniques (such as critical path analysis, scenario planning and monitoring completion of construction stages and percentage of construction complete for each house rather than just number of houses complete) were better placed to predict timescales and manage expectations. Where construction planning and programming was less systematic and/or less detailed it was more difficult to recognise the 'knock-on' implications of delays, or manage resources and timescales. This affected motivation and morale within teams as well as external relationships. One DEC Member Agency undertook very detailed monitoring during construction where a record was kept of each house under construction. Progress was recorded on the site plan by using coloured map pins. These correlated to completion of key stages such as foundations, walls, roofs and finishes. This meant that both the community and the construction team could easily identify which houses were not achieving the construction targets and take appropriate action.

21.3 | Costs

DEC Member Agencies reported difficulties recruiting financial managers with experience of managing construction cash flow and administering contractors' payments. Reconstruction programmes tended to be financed from multiple funding sources with different procedures and timescales for releasing funds. Reporting requirements were always compatible with the drawdown of funds for contractor payments. DEC extended the timescale for the Tsunami Appeal from eighteen months to three years to allow greater flexibility in the pace of delivery, but funds were still allocated on an annual basis with quarterly reporting.

Rigorous financial management was needed to ensure that agreed budgets were not exceeded, and commitments to communities could be met. Most agencies found that the estimates in their initial cost plan increased substantially due to inflation in material and labour costs, programme delays, and the need for more personnel once the complexity was appreciated. Few cost plans included allowances for inflation and contingency, although this is considered normal practice within the construction industry. Additional funds were also required to cover the costs of remedial works.

21.4 | Quality

During 2005/06 difficulties obtaining materials, 'cowboy' contractors, sub-letting of contracts, shortages of skilled labour and corruption were key issues that affected the as-built quality of buildings. By 2007 most agencies had recognised this and introduced quality assurance systems and procedures covering selection of contractors, materials and workmanship.

Agencies involved in community build programmes found that on site training and a continuous site presence by support staff was the most effective way of achieving quality. In spite of supervision instances did occur where poor quality construction was identified and houses needed to be demolished and rebuilt. This caused difficulties between the agency and the household as it was not clear where responsibility lay. The affected households were reluctant to demolish part of their house which they felt was adequate quality and which would delay completion. However, the agency could not accept construction which they felt to be unsafe or lacking seismic resilience.

In some cases households were willing to demolish and rebuild the problem section if additional funds were provided by the agency. This is the opposite of dealing with contractors who are contractually responsible for quality and required to demolish and rebuild sub-standard construction at their own cost. Despite this site supervision still played a key role in managing quality on contractor build programmes and was labour intensive particularly for larger programmes. One solution to this adopted by a DEC Member Agency on an extensive resettlement site for renters and squatters was to make the beneficiaries responsible for monitoring quality once the structural frame was complete.

21.5 | Risk

Typically risks to reconstruction programmes were not systematically identified at the outset, nor were they proactively managed using tools and techniques such as risk registers, or worst case and best case scenario planning. This approach is recognised as best practice in the construction industry but has not yet become common place in the humanitarian and development community. Health and Safety issues were considered on the sites of most DEC Member Agencies and procedures such as regular health and safety briefings and the provision of appropriate equipment were put in place. This included use of safety helmets, providing gloves for handling roof sheets and specific measures for use and disposal of toxic chemicals.

Environmental risks identified in the design stage must be carefully managed during the construction phase. One DEC Member Agency paid particular attention to avoid contamination of the groundwater when addressing the risk of termite attack. They isolated foundations for timber houses from the ground with a plastic sheet and sprayed this with anti-termite chemicals rather than spraying the ground directly. ■

22 | Materials and logistics

The availability of good quality construction materials in sufficient quantities is critical to the timely delivery of high quality reconstruction programmes. In post disaster situations, construction materials are typically subject to high inflation, and the quality deteriorates as production processes become overstretched in order to meet the large scale demand. Implementing agencies may also face pressure to purchase sub-standard materials from local suppliers. Care is needed to ensure that materials used in construction are consistent with the design specification. This requires verification on delivery, appropriate storage and testing.

A strategic assessment of local resources should be undertaken when planning a reconstruction programme to assess limitations in supply, identify alternative sources and prevent delays during implementation. Working with local suppliers and manufacturers provides opportunities for enhancing small scale building product manufacturing as a livelihoods approach to reconstruction. Alternatively materials may need to be transported considerable distances requiring warehouses to store materials or to assemble building components.

22.1 | Specification

Concrete comprises aggregate, sand, cement and water. All of these elements need to be of a suitable quality, mixed in specific quantities and properly compacted to achieve the desired strength. In Aceh, designs were based on a fairly low concrete strength of C25 (fcu = 25N/mm^2) and specified a 1:2:4 or 1:3:6 mix. Most agencies recognised the benefits of using concrete mixers to improve quality and speed of construction. They also closely supervised the quantities of materials being used so as to achieve the correct mix. Slump tests, cube tests and Schmidt hammer tests were used to varying degrees to verify the mix or as-built strength.

Where concrete was mixed manually the quality was more variable largely due to adding water to improve workability. One DEC Member Agency used pre-mixed sand and aggregate (referred to locally as concrete-sand) but the actual mix - and hence concrete strength - varied considerably between batches. Another DEC Member Agency redesigned their concrete mix to accommodate locally available river aggregate although this required more cement and had cost implications. A common problem was the use of saline water which impairs the long term durability of concrete and clean water was not always clearly specified.

Reinforcement was specified as grade U32 or U24 and suppliers provided mill or test certificates to verify quality. Rusty reinforcement was a problem which caused some deliveries to be rejected. Initially plain reinforcement bars were specified throughout as they were available locally and were cheaper than deformed bars, even though plain bars are inappropriate in areas of medium or high seismicity. This is indicative of the lack of technical engineering expertise that informed early decision making but was later corrected. In the later stages of the response deformed bars were correctly specified for the main steelwork with plain bars used only for links.

Few agencies or their consultants knew how to specify timber or even understood the difference between hardwoods and softwoods and the need to treat softwoods. Timber used in 2005/06 was often purchased locally and was poor quality softwood vulnerable to insect attack ▶

Concrete quality - watch its!

Poor quality concrete resulted from a number of different factors:

- Use of saline water and/or beach sand
- Use of concrete-sand rather than sourcing separate supplies of aggregate and sand
- Hand mixing rather than machine mixing
- Adding water to improve workability
- Poorly graded aggregate due to river extraction
- Alien materials, lack of vibration, cold joints
- Inadequate reinforcement; plain or rusty bars, inadequate links, congested reinforcement detailing

Source: Arup

or to rotting if used externally. One DEC Member Agency undertook extensive remedial works to its timber houses constructed in 2005/6 and another either replaced or upgraded all of its timber houses. Timber is specified by species and grade and definitions vary globally so specifying timber requires an understanding of where it is likely to be sourced as well as what it is to be used for. Various DEC Member Agencies sought advice on timber specification from specialist organisations such as The Timber Research and Development Association (TRADA) in the United Kingdom and Forest Research Institute Malaysia (FRIM). Subsequently *Timber as a Construction material in Humanitarian Emergencies* (UN/OCHA, IFRC, Care International, 2009) has been published which provides a valuable reference.

All agencies were under pressure to build quickly to meet donor timescales and beneficiary expectations. This sometimes resulted in the use of sub-standard materials, especially poor-quality bricks. Brick quality was typically left un-specified and the strength of bricks was qualitatively tested on delivery. Frequently bricks were rejected as sub-standard and in some instances bricks were so weak that they could be easily snapped in half or crushed underfoot. Some agencies specified lightweight concrete or hollow concrete blocks instead of bricks but still had difficulty sourcing blocks with adequate strength, particularly if used structurally rather than as infill walls.

22.2 | Supply

Availability and continuity of supply of materials was a critical issue for almost all implementing agencies. BRR overlooked the need to undertake a strategic assessment of materials available locally and nationally. This would have identified the limitations in supply and highlighted opportunity for strategic interventions such as mass importing of key materials or increasing local manufacturing capacity. Instead it was left to individual agencies to resolve their own supply issues and shortages of materials remained a concern throughout. As agencies resorted to sourcing materials from further away, lead-in times and logistics requirements increased, leading to repeated delays during implementation and cost over-runs.

Many agencies chose to establish their own supply chains and purchase materials directly, either on behalf of the community or for contractors, outside the local market. This was primarily to overcome the shortage of building materials and the vagaries of the local market, which experienced significant price fluctuations and inconsistency quality. Cost savings were also realised through bulk buying and tax exemption on imported construction materials. However this approach placed the onus for logistics and timely delivery on the agency and thus required additional capacity.

There was considerable pressure by local communities and The Free Aceh Movement (GAM) to use local brick suppliers and numerous new brick making facilities were established. The quality of brick was very variable and the cost of bricks subject to high inflation. One DEC Member Agency stopped construction in 2006 until the market was stabilised by BRR importing bricks from Medan and Jakarta. Other strategies to overcome problems with brick supplies included: rejecting poor quality bricks on delivery; memorandums of understanding with communities establishing that materials will be imported if the locally available materials are inadequate quality; and supporting the rehabilitation of existing brick factories. Others switched to importing lightweight concrete or hollow concrete blocks instead of bricks from Medan or Jakarta.

Timber supply remained a major problem throughout. Locally available hardwoods were frequently the product of illegal logging and sustainably forested timber was not readily available. Larger agencies resorted to international tenders and imported timber from Scandinavia, Canada and New Zealand. However the long lead-in time had a negative effect on both transitional shelter and housing reconstruction. Some communities resisted the use of imported treated softwoods due to concerns over its durability as compared to local hardwoods.

Problems with timber quality and supply meant that most agencies chose to reduce timber usage in house

Material storage

Limited availability of materials locally combined with erratic supply chains due to difficulties sourcing and transporting materials from further afield meant that 'just in time' delivery of construction materials was not a viable option. Instead materials had to be stockpiled in advance of construction and care taken to ensure that they did not deteriorate. This generally meant competing with other agencies to find and secure dry warehouse space or identify sites to build their own facilities. Many agencies favoured using pre-fabricated aluminium frame warehouses as these could be erected close to reconstruction sites and could be re-used; others built temporary timber frame structures. Some agencies experienced problems with theft and security guards were employed 24/7 to watch stockpiled materials. Storage was problematic as many locations were vulnerable to flooding or extremely constricted.

Source: Arup

construction by replacing timber roof trusses with lightweight steel trusses, replacing timber boards with calci-board or using metal window and door frames. A considerable number of small businesses were established during the reconstruction to supply the demand for timber doors and windows. Roofing materials were in general corrugated iron sheets or clay tiles, both of which are readily available throughout Indonesia.

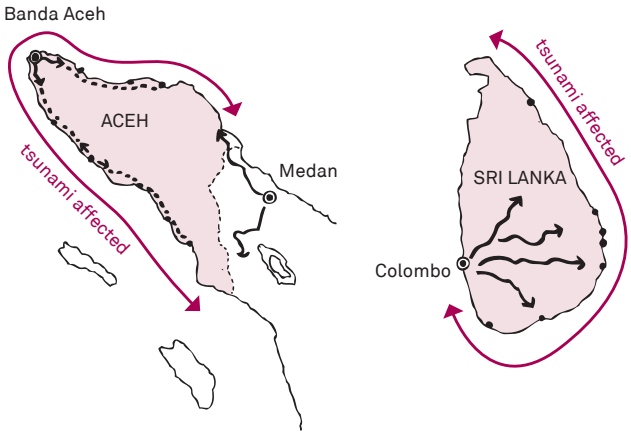
22.3 | Logistics

Shelter and permanent reconstruction requires significantly greater logistical capacity than other sectors of humanitarian operations as the supply of multiple materials from multiple sources needs to be coordinated. For the majority of agencies, many of whom were new to the country or undertaking shelter construction for the first time, this was a key constraint.

Supply chains were also severely compromised by the loss of critical transport infrastructure and the length of time taken for it to be re-established. The tsunami destroyed or damaged 3000 km of roads, 120 bridges, 11 airports and 14 ports. Although infrastructure reconstruction was a vital component of recovery, the scale of projects and number of partnerships required between donors and implementers meant that progress was slow.

By the end of October 2006 only two airports had been reconstructed and five ports were under construction although none had been finished. This situation had improved significantly by October 2007 when 10 airports had been reconstructed, 17 ports completed and 2000 km of road rebuilt but by then most housing programmes were well underway or complete. Limited infrastructure meant that reconstruction initially focused on easily accessible areas and could only spread to more remote areas as infrastructure was rehabilitated.

Although some materials were available locally the majority of materials were purchased in bulk from Medan or Jakarta and transported by road to Banda Aceh or over the mountains to the west coast. One DEC Member Agency's attempts to transport materials by barge met with disaster when the barge sank. Another invested in building a jetty, coconut warehouses and a gang-nail roof truss production line at Calang. This was viable due to the scale and geographic focus of their programme and meant that house construction could take place without waiting for infrastructure projects to be completed by others. ■



ARTERIAL TRANSPORT ROUTES IN ACEH LARGELY FOLLOWED THE COAST AND THUS WERE SEVERELY DAMAGED BY THE TSUNAMI.

KEY QUESTIONS

- **Have materials been properly specified?**
- **Are materials of the appropriate quality and sufficient quantity available locally or do they need to be imported?**
- **Is investment in enhancing local manufacturing capacity required?**
- **Is demand for materials likely to affect the supply chain or cause inflation?**
- **Is warehousing needed to store materials? Are materials being stored appropriately to ensure they do not deteriorate?**
- **Have mechanisms been put in place to ensure the quality of materials delivered to site and used in construction is as specified by the designers?**
- **Are supply routes compromised by loss of infrastructure?**

23 | Workmanship

Good quality workmanship plays a key role in ensuring the structural integrity of buildings, and providing the ability to withstand extreme events including earthquakes, floods, and cyclones. It also directly affects the visual appearance of the building and therefore perception of quality and durability. Workmanship depends on the availability of suitably skilled labour, which may be limited due to a combination of small local capacities and high demand. This can lead to competition between agencies and contractors hiring labour resulting in high staff turnover. It is therefore essential to assess the construction skills of the local population and capacity of the construction industry at the outset so that sufficient resources can be dedicated to recruitment and training.

Equally important is understanding who is responsible for ensuring the quality of workmanship. Quality assurance procedures must be implemented, to identify sub-standard workmanship at key stages during the construction process so that immediate corrective action can be taken. This avoids having to demolish sub standard buildings or carry out extensive remedial works but requires significant numbers of field staff to carry out on-site supervision and monitoring.

23.1 | Skilled labour

Very little skilled labour existed in Aceh prior to the tsunami and the local construction industry was extremely limited as a result of the conflict. Reconstruction programmes (particularly self- or community-build) suffered from a mismatch between the chosen type of construction (reinforced concrete and masonry) and local capabilities. Traditional timber housing had been constructed by an older generation of skilled carpenters whose skills had become redundant as concrete and masonry construction took hold and therefore had not been passed on to the younger generation. Skills in brick-laying, fixing reinforcement and pouring concrete were not yet widespread, particularly in communities whose main livelihoods were fishing and agriculture.

One DEC Member Agency had a very successful small scale community-build programme focused on retraining fisherman from within the community to become builders so that they were able to reconstruct houses and have an alternative source of income. But this approach which recognised the livelihood opportunity of reconstruction was not widespread.

Finding skilled local labour was a constant challenge and increasingly skilled labour was imported from Medan, Jakarta or Java. However the remoteness of many sites, lack of infrastructure and poor living conditions (some imported labourers lived in emergency barracks vacated by tsunami-affected households) meant labourers were only prepared to work a few weeks or months at a time.

Seismic Performance

Most houses were designed to achieve 'life-safety' performance in a major earthquake with minimal damage in smaller events. However, in many cases seismic performance was compromised by poor workmanship, common problems including:

- Small column sizes (15 x 15 cm) and congested reinforcement at beam-column connections
- Links too far apart or without 135° returns
- Practical columns introduced on site to sub-divide large masonry panels but not shown on drawings
- Poor quality concrete mix and inadequate compaction of concrete
- Poor quality masonry and oversized bed joints
- Masonry panels not adequately anchored to concrete columns or lacking ties completely
- Not carrying out soil tests
- Rubble foundations without keystones

Source: Arup

23.2 | Training

The opportunity to strategically invest in developing building skills, for instance by establishing a training college centrally or setting up resource centres, was largely overlooked. Individually most DEC Member Agencies developed training programmes specifically to support the delivery of their own construction programmes. These were targeted at a variety of audiences including homeowners, contractors, labourers and site supervisors. The effectiveness of briefing meetings and training for contractors and skilled labour was severely compromised by high staff turnover and frequent sub-letting of contracts. Close site supervision and on the job training therefore proved to be a more effective - although very resource intensive - means to ensuring high quality workmanship.

23.3 | Supervision and quality control

As the reconstruction programme progressed all DEC Member Agencies recognised the need for extensive site supervision and several developed comprehensive quality assurance procedures following lessons learned in the earlier stages. These included a number of tools including soil tests, material verification certificates, checklists for site supervisors, formal requests for information / site instructions and random spot checks. Quality assurance was not identified as a key issue for inter-agency coordination. Consequently investment by individual agencies in developing tools and procedures was duplicated. Efforts by individual agencies did not benefit others who were struggling to understand what measures they might put in place to counteract the difficulties they were experiencing in achieving good quality workmanship.

Although the appearance of complete buildings was generally acceptable with reasonably good quality finishes, in some instances this disguised deficiencies in workmanship evident in buildings still under construction, which might potentially compromise the lifespan of the building or seismic performance. Ensuring a positive long term outcome relied on there being a continuous site presence, and on ensuring that site supervisors had relevant experience or received training in order to be able to identify inadequate workmanship as construction proceeded. Typically two Indonesian or Acehnese young graduate engineers would be employed as site managers to oversee 20 houses even where responsibility for quality for workmanship ultimately rested with the contractor.

Several agencies experienced major difficulties with quality of construction resulting from inappropriate design compounded by sub-standard materials and poor workmanship. Rejection of poor quality materials and demolition of sub-standard construction became normal practice and in some cases entire houses were demolished and rebuilt while in others substantial remedial works programmes were required. The quality of construction was noticeably improved where it was broken down into discrete tasks, undertaken by specific teams in accordance with agreed method statements and closely supervised. Prefabrication, where standardised elements, such as roof trusses, could be manufactured at scale in a central location also helped in ensuring high quality of individual elements. ■

KEY QUESTIONS

- **What capacity exists locally in terms of both skilled and unskilled labour?**
- **Do skilled labourers need to be recruited nationally? Or could training programmes increase the availability and quality of skilled labour?**
- **What procedures have been put in place to monitor or evaluate the quality of construction at key stages? Do they include checklists or guidance?**
- **Has overall construction been sub-divided into key stages and method statements developed for each stage identifying the sequence of activity, materials, labour and equipment required?**
- **Is there potential for off-site pre-fabrication of standard building components to reduce the need for skilled labour and site supervision?**
- **Who is supervising construction and who is ultimately responsible for ensuring quality of workmanship?**
- **Who has authority to condemn poor quality construction and require it to be demolished?**
- **How will the quality of construction be monitored? Have quality assurance systems been put in place?**

24 | Handover

The end of a reconstruction programme is marked by handover of the houses or facilities to their future owners and end-users. At this point in time they take ownership and accept responsibility for the building. It is important to facilitate this transition by agreeing a finite period during which the agency will remain responsible for addressing defects. There needs to be a shared understanding between the agency and community as to the point at which handover will occur. This may be before the building is fully complete, for instance if the priority is to provide a safe 'core' house, or where families are able to carry out finishing works themselves. For schools and hospitals a longer handover period may be needed to allow for equipment to be installed and the facility to become functional. Occupancy provides a good initial indication of acceptance and satisfaction but an evaluation should also be carried out to ensure that the programme realised its objectives and to identify any shortcomings. The evaluation should indicate whether the reconstruction has succeeded in acting as a catalyst for recovery, or where there are further requirements for assistance.

24.1 | Handover

In Aceh, many agencies held completion ceremonies to celebrate handover and issued completion certificates to mark this significant milestone for the affected communities. However, there were some instances where handover was less straightforward. Problems with materials supply and quality of workmanship delayed construction and in some cases houses were started but never reached a stage where they could be handed over. On self-build programmes some communities became reluctant to complete their houses to the required standard; in part due to an increasing expectation that agencies would provide housing rather than facilitate reconstruction. Elsewhere problems arose with affected households occupying their houses before completion in preference to their alternative shelter options, either living on-site in a tent or self-built transitional shelter or in remote barracks buildings. It was then not clear where responsibility lay for completing the final stages of the construction or whether the responsibility for repair and maintenance had been handed over from the implementing agency to the household. Some households also became unwilling to complete their houses to the standards expected by donors raising issues of donor versus beneficiary accountability.

Most agencies retained a duty of care for a certain period of time after the completed houses were handed over to the community during which they rectified defects and completed basic maintenance. This was sometimes formalised as a defects period agreement with the community. It was important that this was finite so as not to promote a culture of dependency. However in some cases short-comings in the buildings did not materialise until later on when timber began to deteriorate or evaluations

Replace or upgrade

One DEC Member Agency opted to construct timber frame houses of a similar style to traditional Acehnese houses (see chapter 13: Quality). This was welcomed by the communities they were assisting and on completion occupancy rates were high. However soon after the houses began to deteriorate due to deficiencies with the quality of workmanship and durability of the timber used. This resulted in dissatisfaction and requests to replace the houses with 'permanent' houses. Instead they completed repair and retro-fitting works on two houses to demonstrate the shortcomings could be very quickly resolved. This approach achieved buy-in from the community and avoided the alternative of houses being demolished unnecessarily. The agency retained the timber frame style house for future projects but used imported Canadian timber in the form of pre-fabricated frames. In order to allow households to personalise their homes they included plywood for ceilings and mosquito screening as part of handover kits.

Source: Arup

identified serious defects in seismic resilience. In these cases DEC Member Agencies accepted the responsibility to rectify the defects and either demolished and replaced the sub-standard houses or completed extensive renovation programmes.

For health centres and schools responsibility for the future of the facility is shared between the end-users and the government as owners. The principal of a health centre (*puskesmas*) constructed by one DEC Member Agency warmly welcomed her new facility but expressed concerns at handover as to whether the government would provide adequate funding for staff, training and maintenance of the buildings. She was not clear where responsibility for maintenance rested. They had received new equipment and computers as part of the programme but the staff needed training on how to use it. For these more complex buildings it is important to clarify on-going responsibilities, and ensure appropriate budgets are available so that the value of the asset is realised and does not deteriorate over time. Also it is good practice to provide an Operations and Maintenance Manual as part of the handover process.

24.2 | Occupancy

BRR measured numbers of houses completed and occupancy to measure progress and household satisfaction. At the end of 2007 BRR estimated that occupancy rates of completed houses were only around 60-70%. The level of occupancy rates in DEC members' houses was higher at between 85-100% reflecting the quality of construction and extent to which the community participated in the process so that the end product met their needs. Lower levels of occupancy occurred as a result of poor quality construction or delays in the provision of services (water, sanitation, power) by third parties.

In some cases, although initially houses were thought to be unoccupied further investigation established 'technical occupancy'; there was satisfaction with the house and it was welcomed as an asset but the owner was choosing to live elsewhere. Some families preferred to live together in one house leaving the other vacant as having lost family members and got used to living in multiple-occupancy accommodation in the barracks they were unwilling to live alone. In some cases the owners were children who had lost their parents and were living with friends or relatives. Others did not want to move back as they had still to come to terms with the 'ghosts' and memories of family who died.

24.3 | Evaluation

Most agencies conducted post-occupancy surveys. The consensus amongst DEC Member Agencies was that these were best carried out some months after handover to give time for families to settle in and establish themselves. This also helped break the culture of dependency on agency support which in some cases was a consequence of the reconstruction process. Further support was generally requested with re-establishing livelihoods highlighting the need for an integrated cross-sectoral approach to reconstruction programmes if they are to be effective in promoting early recovery.

In general households expressed a high level of satisfaction with their completed houses as a result of having high levels of involvement in the project with clear expectations. For many the housing was larger and more substantial (concrete and masonry) than their pre-tsunami accommodation, and included a bathroom with a toilet. Other factors included satisfaction with the quality of bathroom fittings and finishes and feeling safe in subsequent earthquakes. Lower levels of household satisfaction were expressed by households who felt they had inadequate or dwindling involvement in the project and who had received houses which they felt were poor quality, or remote from their places of employment / education, or lacked sufficient space for their family.

Very high levels of satisfaction were expressed by the staff and governors of health centres and schools provided by DEC Member Agencies. The staff at one school took great pride in their new facility, though they expressed concern that the toilets were still inadequate. They were particularly enthusiastic about the whiteboards and teacher training they had received as part of the programme which they felt helped them do their jobs better. These comments illustrate that reconstructing a school is much more than reconstructing a building, and likewise a home is not just a house.

These type of surveys illustrated the success of DEC Member Agency programmes in reconstructing houses, schools and health centres. But the most important outcome will be the extent to which these programmes have acted as a catalyst to recovery, contributed to long term development and reduced vulnerability to future disasters. This will only become apparent over the next few years and decades. Meanwhile there are many valuable lessons learned for future responses. ■

KEY QUESTIONS

- **Has the point of handover been agreed with the occupants or end-users?**
- **Has a transition period been agreed during which time the agency will remain responsible for addressing defects?**
- **Are occupancy rates higher or lower than anticipated? What are the reasons for less than 100% occupancy? Can these be addressed?**
- **When will a post-occupancy evaluation be carried out? How will the outcome and key learnings be shared?**
- **Has reconstruction acted as a catalyst for recovery? Is further assistance required?**

Resources

Source: Arup

Source: Arup

Source: Arup

Glossary

List of acronyms

ADB	Asian Development Bank
AMDAL	Environmental Impact Assessment (*Analisa Mengenai Dampak Lingkungan*)
AMM	Aceh Monitoring Mission
BAKORNAS PBP	National Coordinating Board for Disaster Management (*Badan Koordinasi Nasional Penanggulangan Bencana dan Penanganan Pengungsi*)
BAPPENAS	National Development Planning Board Badan Perencanaan Pembangunan Nasional
BPN	National Land Agency (*Badan Pertanahan Nasional*)
BRR	Agency for the Rehabilitation and Reconstruction of Aceh-Nias (*Badan Rehabilitasi dan Rekonstruksi NAD-Nias*)
DRR	Disaster Risk Reduction
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization
GAM	Free Aceh Movement (*Gerakan Aceh Merdeka*)
GIS	Geographic Information System
GoI	Government of Indonesia (*Pemerintah Republik Indonesia*)
IDP	Internally Displaced Person
IDR	Indonesian Rupiah
IFRC	International Federation of Red Cross and Red Crescent Societies
IOM	International Organization for Migration
KDP	*Kecamatan* (Sub-District) Development Program
MPW	Ministry of Public Works
MDTF	Multi-Donor Trust Fund
NAD	Nanggröe Aceh Darussalam
NGO	Non-governmental organization
PLN	The National Electricity Company (*Perusahaan Listrik Negara*)
RAND	Recovery Aceh-Nias Database
RALAS	Restoration of Aceh Land Administration System
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UN-HABITAT	United Nations Human Settlements Programme
UNHCR	United Nations High Commissioner for Refugees
UPP	Community-driven development project
WFP	World Food Program
WHO	World Health Organization

Indonesian/Acehnese Terms

Kabupaten	District
Bupati	Head of district
Kecamatan	Sub-district
Camat	Head of sub-district
Kota/Kotamadya	Distict (urban)
Walikota	Head of kota
Desa	Village (Indonesian)
Kepala Desa	Head of village (Indonesian)
Geucik	Head of village (Acehnese)
Gampong	Village (Acehnese)
Kampung	Village (Indonesian)
Kelurahan	Urban equivalent of desa
Puskesmas	Health centre
Pustu	Sub-health centres
Polindes	Village maternity clinic
Adat	Local or customary law or institutions
Tukang	Skilled labourer

Technical terms

Assistance methods (or methods of assistance)
The variety of material or service contributions that are combined and offered to beneficiaries in implementing a transitional settlement or reconstruction project (UN, 2008).

Building code
A set of ordinances or regulations and associated standards intended to control aspects of the design, construction, materials, alteration and occupancy of structures that are necessary to ensure human safety and welfare, including resistance to collapse and damage (UN/ISDR, 2009).

Capacity
The combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals (UN/ISDR, 2009).

Collective centres
Collective centres, also referred to as mass shelters, are usually transit facilities located in pre-existing structures, such as community centres, town halls, gymnasiums, hotels, warehouses, disused factories and unfinished buildings. They are often used when displacement occurs inside a city, or when there are significant flows of displaced people into a city or town (UN, 2008).

Contingency planning
A management process that analyses specific potential events or emerging situations that might threaten society or the environment and establishes arrangements in advance to enable timely, effective and appropriate responses to such events and situations (UN/ISDR, 2009).

Critical facilities
The primary physical structures, technical facilities and systems which are socially, economically or operationally essential to the functioning of a society or community, both in routine circumstances and in the extreme circumstances of an emergency (UN/ISDR, 2009).

Disaster
A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources (UN/ISDR, 2009).

Disaster risk reduction
The concept and practice of reducing disaster risks through systematic efforts to analyse and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events (UN/ISDR, 2009).

Durable solutions
The point at which permanent settlement and shelter for both displaced and non-displaced populations have been rebuilt and established, sufficient for communities to support their own livelihoods (UN, 2008).

Early warning system
The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss (UN/ISDR, 2009).

Environmental impact assessment
Process by which the environmental consequences of a proposed project or programme are evaluated, undertaken as an integral part of planning and decision-making processes with a view to limiting or reducing the adverse impacts of the project or programme (UN/ISDR, 2009).

Geological hazard
Geological process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage (UN/ISDR, 2009).

Host families
A transitional settlement option, consistent with the following definition, 'sheltering the displaced population within the households of local families, or on land or in properties owned by them' (UN, 2008).

Housing
Lodging or shelter for human habitation. The immediate physical environment, both within and outside of buildings, in which families and households live and which serves as shelter. Also, a government project to provide shelter to low-income groups (UN, 2008).

Hydrometeorological hazard
Process or phenomenon of atmospheric, hydrological or oceanographic nature that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage (UN/ISDR, 2009).

Internally displaced persons (IDPs)
Persons displaced from their habitual place of residence by disaster, fear of persecution or fear of physical harm, but remaining within the territorial limits of their country of origin. Like refugees, IDPs have no internationally defined legal status (UN, 2008).

Liquefaction
Process by which water-saturated sediment temporarily loses strength and acts as a fluid. This effect can be caused by earthquake shaking (USGS, http://earthquake.usgs.gov).

Mitigation
The lessening or limitation of the adverse impacts of hazards and related disasters (UN/ISDR, 2009).

Natural hazard
Natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage (UN/ISDR, 2009).

Non-food item
The basic goods and supplies required to enable families to meet personal hygiene needs, prepare and eat food, provide thermal comfort and build, maintain or repair shelters (UN, 2008).

Preparedness
The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions (UN/ISDR, 2009).

Recovery
The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors (UN/ISDR, 2009).

Resettlement
Actions necessary for the permanent settlement of persons dislocated or otherwise affected by a disaster to an area different from their last place of habitation (UN, 2008).

Risk
The combination of the probability of an event and its negative consequences (UN/ISDR, 2009).

Risk assessment
A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend (UN/ISDR, 2009).

Shelter
Shelter is a critical determinant of survival in the initial stage of an emergency. Beyond survival, shelter is necessary to provide security and personal safety, protection from the climate and enhanced resistance to ill health and disease. It is also important for human dignity and to sustain family and community life as far as possible in difficult circumstances. Shelter and associated settlement and non-food item responses should support communal coping strategies, incorporating as much self-sufficiency and self-management into the process as possible (The Sphere Project, 2004).

Shelter non-food item (NFI)
An item that meets a need related to transitional settlement or shelter but is not structural, such as blankets, mattresses, mosquito nets, stoves and fuels (UN, 2008).

Squatter
A person occupying an otherwise abandoned housing unit or land without legal title to that unit or land. For example, persons who take up residence in unused or abandoned dwellings or buildings are squatters (UN, 2008).

Strategic plan
A single coordinated approach to developing and implementing the contribution of the sector, agreed by all stakeholders and usually maintained at national level by or in partnership with the government. The strategic plan integrates programme and project plans in order to describe the entire response to sector needs (UN, 2008).

Subsidence
Lowering of the ground's surface in a particular area due to the removal of subsurface support. In earthquakes this is typically caused by shifting of the subsurface near fault lines (UN, 2008).

Transitional reconstruction
The processes by which populations affected but not displaced by conflict or natural disasters achieve durable solutions to their settlement and shelter needs (UN, 2008).

Transitional settlement
Settlement and shelter resulting from conflict and natural disasters, ranging from emergency response to durable solutions (UN, 2008).

Transitional shelter
Shelter which provides a habitable covered living space and a secure, healthy living environment, with privacy and dignity, for those within it, during the period between a conflict or natural disaster and the achievement of a durable shelter solution (UN, 2008).

Vulnerability
The characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural or man-made hazard (UN, 2008).

References

Key references

Arup (2007) *Tsunami Appeal Assurance Mission: Mission Report*

Arup (2008) *Post Disaster Reconstruction: Lessons from Aceh – Scoping Study*

Arup (2006) *The People of Aceh: Aceh & Nias Post Tsunami Reconstruction - Review of Aceh Housing Program*
www.arup.com/_assets/_download/download512.pdf

COHRE (2005) *The Pinheiro Principles: United Nations Principles on Housing and Property Restitution for Refugees and Displaced Persons*, COHRE, Geneva.
http://www.sheltercentre.org/library/The+Pinheiro+Principles

da Silva, J. (2007) *Quality and Standards in Post-Disaster Shelter*, The Structural Engineer, June 2007
http://www.istructe.org/thestructuralengineer/abstract.asp?pid=7360

Sphere Project (2004) *Humanitarian Charter and Minimum Standards in Disaster Response*, Oxfam GB.
http://www.sphereproject.org/component/option,com_docman/task,cat_view/gid,17/Itemid,203/lang,English/

UN (2008) *Transitional Settlement and Reconstruction after Natural Disasters*, United Nations, Geneva, 2008.
http://www.sheltercentre.org/library/Transitional+settlement+and+reconstruction+after+natural+disasters

UN (forthcoming) *Shelter After Disaster: Transitional Settlement and Reconstruction*, United Nations, Geneva, expected February 2010

UK Shelter Forum (2006) *Rising to the Challenge in Aceh: NG0- Led Shelter Construction*
http://www.shelterforum.org.uk/ref/Rising-to-the-Challenge_Aceh_ShelterForum_11DEC2006.pdf

Government publications

BAPPENAS (2005) *Master plan for the rehabilitation and reconstruction of the regions and communities of the province of Nanggroe Aceh Darussalam and the islands of Nias, North Sumatera*.
www.undp.org/cpr/disred/documents/tsunami/indonesia/reports/masterplan_0405_eng.pdf

BAPPENAS and International Partners (2005) *Indonesia: Preliminary Damage and Loss Assessment*
http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/INDONESIAEXTN/0,,contentMDK:21149942%7EpagePK:141137%7EpiPK:141127%7EtheSitePK:226309,00.html

BAPPENAS and International Partners (2005) *Indonesia: Notes on Reconstruction*
http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/EASTASIAPACIFICEXT/INDONESIAEXTN/0,,contentMDK:21149942%7EpagePK:141137%7EpiPK:141127%7EtheSitePK:226309,00.html

BRR and International Partners (2005a) *Rebuilding a Better Aceh and Nias*
http://www.reliefweb.int/rw/rwb.nsf/db900SID/KHII-6DU466?OpenDocument

BRR and International Partners (2005b) *Aceh and Nias One Year after the Tsunami: The Recovery Effort and Way Forward.*
http://www.reliefweb.int/rw/rwb.nsf/db900sid/KHII-6K54EE?OpenDocument&query=BRR%20Aceh%20and%20Nias

BRR and International Partners (2006) *Aceh and Nias Two Years after the Tsunami, Government of Indonesia.*
http://www.reliefweb.int/rw/rwb.nsf/db900sid/EKOI-6WW8DZ?OpenDocument&query=BRR%20Aceh%20and%20Nias

Assessments and evaluations

Clinton, W. J. (2006) *Key propositions for building back better: Lessons Learned from the Tsunami recovery* Office of the UN Secretary General's Special Envoy for Tsunami Recovery
http://ochaonline.un.org/OchaLinkClick.aspx?link=ocha&docid=1005912

Directorate General of Human Settlement/Ministry of Public Works (2005) *Post Disaster Damage Assessment in Nanggroe Aceh Darussalam*, IOM 2005. http://www.iom.or.id/reports.jsp?lang=eng

UN-Habitat (2007) *Two Years of Settlement and Recovery in Aceh and Nias: What Should the Planners Have Learned?* Dercon, B and Kusumawijaya, M. UN-HABITAT, 2007
http://www.unhabitat-indonesia.org/publication/index.htm

GoI/UN (2005) *Post-Tsunami Lessons Learned and Best Practices Workshop*, 16-17 May 2005
www.tsunami-evaluation.org/NR/rdonlyres/452D81BC-79EF-4D71-A7E7-7E22578EB513/0/lessons_indonesia.pdf

IOM (2005) *Settlement and Livelihood Needs and Aspirations Assessment of Disaster-Affected and Host Communities in Nanggroe Aceh Darussalam*
http://www.iom.or.id/reports.jsp?lang=eng

Kennedy, J. et al. (2007) *Post-Tsunami Transitional Settlement and Shelter: Field Experience from Aceh and Sri Lanka*, Humanitarian Exchange Magazine, Issue 37, March 2007
http://www.odihpn.org/report.asp?id=2879

Telford, J, Cosgrave, J and Houghton, R (2006) *Joint Evaluation of the international response to the Indian Ocean tsunami: Synthesis Report*. Tsunami Evaluation Coalition, London.
http://www.tsunami-evaluation.org/The+TEC+Synthesis+Report/Full+Report.htm

UNEP (2006) *After the Tsunami: Rapid Environmental Assessment*, UNEP
http://www.unep.org/tsunami/tsunami_rpt.asp

UNEP (2007) *Environment and Reconstruction in Aceh: Two years after the tsunami*, UNEP
http://postconflict.unep.ch/publications/dmb_aceh.pdf

WWF/Greenomics Indonesia (2005) *The Implementation Design: Timber for Aceh*
http://www.panda.org/about_wwf/where_we_work/oceania/publications/?20151

DEC Member Agencies

HelpAge International (2006) *Older People in Aceh, Indonesia, 18 Months after the Tsunami*
http://www.helpage.org/Resources/Researchreports/main_content/EhHE/op-18mth-tsunami.pdf

HelpAge International (2007) *Mainstreaming Age-Friendliness*
http://www.globalaging.org/armedconflict/Mainstreamingage-friendliness_revisedaddress%5B1%5D.pdf

HelpAge International (n.d.) *Key Lessons Learned by Help-Age International during its Tsunami DRP Program Implemented in Indonesia* (unpublished internal document)

Merlin (2007) *Minimum Building Standards*, Annex n.1.2.d.

Oxfam International (2005a) *The Asian Tsunami: The challenge after the Jakarta summit*. Oxfam Briefing Note, 07.01.2005 www.oxfam.org.uk/resources/policy/conflict_disasters/downloads/bn_tsunami.pdf

Oxfam International (2005b) *The Asian Tsunami: Three weeks on*. Oxfam Briefing Note, 14.01.2005 www.oxfam.org.uk/resources/policy/conflict_disasters/downloads/bn_tsunami2.pdf

Oxfam International (2005c) *Targeting Poor People: Rebuilding Lives after the Tsunami*, Oxfam Briefing Note, 25.06.2005
www.oxfam.org.uk/resources/policy/conflict_disasters/downloads/bn_tsunami_6months.pdf

Oxfam International (2005d) *A Place to Stay, A Place to Live: Challenges in Providing Shelter in India, Indonesia and Sri Lanka after the Tsunami*. Oxfam Briefing Note, 14.12.05
http://www.oxfam.org.uk/resources/policy/conflict_disasters/bn_tsunami_shelter.html

Oxfam International (2006) *The Tsunami Two Years On: Land Rights in Aceh*. Oxfam Briefing Note, 30.11.2006
http://www.oxfam.org.uk/resources/policy/conflict_disasters/bn_tsunami2years.html

World Vision (2007) *World Vision Shelter Programming: Learning from the Asia Tsunami Response*

World Vision (2007) *Shelter: Lessons and recommendations from the 2004 Asian Tsunami Shelter Programme - Working Final Draft Report*, World Vision Organisational Learning Paper (unpublished internal document).

Further reading

Guidelines published subsequently

ALNAP/ProVention (2008) *Responding to Earthquakes 2008: Learning from earthquake relief and recovery operations*
http://www.proventionconsortium.org/themes/default/pdfs/ALNAP-ProVention_earthquake08.pdf

Benson, C. and Twigg, J. (2007) *Tools for Mainstreaming Disaster Risk Reduction*, Provention Consortium.
http://www.proventionconsortium.org/themes/default/pdfs/tools_for_mainstreaming_DRR.pdf

IASC ESC (2009) *Selecting NFIs for Shelter*, Emergency Shelter Cluster, Geneva, 2009.
http://www.sheltercentre.org/snfis/shelter+sector+items

NZAID/AC Consulting Group Ltd. (2006) *Improving the earthquake resistance of small buildings, houses and community infrastructure*
http://www.preventionweb.net/files/1390_Earthquake.pdf
Indonesian version: http://www.ppk.or.id/downloads/Buku%20Meningkatkan%20Daya%20Tahan%20Terhadap%20Gempa.pdf.

UNDP/UNISDR (2007) *Handbook on Good Building Design and Construction: Aceh and Nias Islands*
http://www.unisdr.org/eng/ about_isdr/isdr-publications/ joint-pub/Handbook26-03-07.pdf

UNEP/SKAT (2007) *After the Tsunami, Sustainable Building Guidelines for South-East Asia*
http://www.skat.ch/activities/prarticle.2005-09-20.1264594682/skatactivity.2006-10-09.2300065102/prarticleblockfile.2008-02-25.2351566031/file

UNISDR (2009) UNISDR Terminology on Disaster Risk Reduction.
www.unisdr.org/eng/library/UNISDR-terminology-2009-eng.pdf

UN/OCHA, IFRC, Care International (2009) *Timber as a construction material in humanitarian operations*
www.humanitariantimber.org

Aceh specific

ACARP (2007) *The Acehnese Gampong Three Years On: Assessing Local Capacity and reconstruction Assistance in Post-tsunami Aceh*, Report of the Aceh Community Assistance Research Project (ACARP), December 2007.
http://www.indo.ausaid.gov.au/featurestories/acarpreport.pdf

Boen, T (2005) *Building a Safer Aceh, Reconstruction of Houses, One Year after the Dec.* 26, 2004, Tsunami, World Seismic Safety Initiative (WSSI) Jakarta.
http://www.unhabitat-indonesia.org/newsletter/02/files/02NL-08.pdf.

Burke, A. and Afnan (2005) *Aceh: Reconstruction in a Conflict Environment*, Indonesian Social Development Paper No. 8.
http://www.reliefweb.int/rw/RWB.NSF/db900SID/KHII-6KF7L4?OpenDocument

Couldrey, M. and Morris, T. (2005) *Tsunami: learning from the humanitarian response*, Forced Migration Review-Special Issue, July 2005.
http://www.fmreview.org/FMRpdfs/Tsunami/full.pdf

Guardian (2005) *Rebuilding Nusa: A Year of Recovery*.
http://www.guardian.co.uk/world/series/rebuildingnusa

Renner, M. (2006) *Conflict and Peacemaking in Aceh: A Chronology*, World Watch Institute.
http://www.worldwatch.org

Steinberg, F. (2007) *Housing reconstruction and rehabilitation in Aceh and Nias, Indonesia—Rebuilding lives*, Habitat International
http://www.adb.org/Documents/Reports/Housing-Reconstruction-Aceh/Housing-Reconstruction-Aceh.pdf

UN-HABITAT (2007) *Anchoring Homes: UN-HABITAT's People's Process in Aceh and Nias after the Tsunami*.
http://www.unhabitat-indonesia.org/publication/index.htm

UNHIC (2005) *Shelter Data Pack*, Banda Aceh, Indonesia.

Post-disaster reconstruction

Barakat, S. *Housing reconstruction after conflict and disaster* (HPN Network Paper 43), December (2003)
http://www.odihpn.org/documents%5Cnetworkpaper043.pdf

CHF International (2005) *The Economic Impact of Shelter Assistance in Post-Disaster Settings*
http://www.sheltercentre.org/library/Economic+Impact+Shelter+Assistance+PostDisaster+Settings

Davis, J. Lambert, R. (2002) *Engineering in Emergencies: A Practical Guide for Relief Workers*, ITDG Publishing

IAEE (1986) *Guidelines for Earthquake Resistant Non-Engineered Construction*
http://www.nicee.org/IAEE_English.php

IASC ESC (2009) *Shelter Projects 2008*
www.disasterassessment.org/documents/IASC_shelter_projects_2008.pdf

Corsellis & Vitale (2005) *Transitional Settlement: Displaced Populations*, The University of Cambridge Shelterproject
http://www.sheltercentre.org/library/transitional+settlement+displaced+populations

UNDRO (1982) *Shelter after Disaster: Guidelines for Assistance*, United Nations, New York, 1982.
http://www.reliefweb.int/library/documents/2003/undro-shelter-jul82.htm

UN/OCHA (2006) *Exploring key changes and developments in post-disaster settlement, shelter and housing, 1982-2006: Scoping study to inform the revision of "Shelter after Disaster: Guidelines for Assistance."*
http://www.sheltercentre.org/library/Exploring+key+changes+and+developments+postdisaster+settlement+shelter+and+housing+19822006

UNHCR (2007) *Handbook for Emergencies*, UNHCR, Geneva.

Websites

Arup
www.arup.com/internationaldevelopment

The Disasters Emergency Committee
www.dec.org.uk

Emergency Shelter Cluster
www.humanitarianreform.org/humanitarianreform/Default.aspx?tabid=77

Shelter Centre
www.sheltercentre.org

Relief Web
www.reliefweb.int

Tsunami Evaluation Coalition
www.tsunami-evaluation.org

UK Shelter Forum
www.shelterforum.org.uk