GUIDANCE ON

Housing

Tsunami Global Lessons Learned Project

DISASTER RECOVERY TOOLKIT

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1) Handbook for Disaster Recovery Practitioners
2) Training Manual – Learning Workshop on Recovery and Reconstruction
3) Guidance on Critical Facilities
4) Guidance on Housing
5) Guidance on Land Use Planning
6) Guidance on Livelihood

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FOREWORD

Ten years have passed since the Indian Ocean Earthquake and Tsunami of December 2004. The consequences of this disaster have continued to unfold in the minds of individuals, the collective lives of affected families and communities, and within the framework of nations and the region as a whole. Indeed, the memory of this great tragedy is imprinted on the global mind. The loved ones of the more than 228, 000 people who perished look back on this disaster every day. For the rest of us, the 10th anniversary provides an opportunity to reflect on the memory of these departed souls, and to think of those who were left behind in devastated families, communities and environments.

The recovery of the affected areas in the months and years since the event itself is an affirmation of human resilience and creativity in building solutions- and finding ways out- of the most challenging situations. It is out of respect to those who perished or suffered that we should take what lessons we can from such experiences, and use them to design better strategies for disaster response and recovery in the future.

With climate change proceeding apace, the notion of environmental vulnerability is becoming increasingly broad and hard to pinpoint: everybody is vulnerable, and because of this, our incentive to learn from what came before should be heightened.

The Tsunami Global Lessons Learned Project (TGLLP) was created with a view to gathering, learning from and sharing experiences relating to the 2004 earthquake and tsunami, and other disasters in the region that occurred between 1993 and 2013. The project sought to deliver three principle outcomes: a global lessons learned study, a

Discovery Channel documentary tracking the recovery, and a disaster recovery toolkit for recovery practitioners.

The first of these outcomes was a report entitled *The Tsunami Legacy: Innovations, Breakthroughs and Challenges* which was officially released on 24 April 2009 at a ceremony at the United Nations Headquarters in New York. A few months later, in December 2009, a documentary on lessons learned, produced independently, was aired on the Discovery Channel.

At the launch of *The Tsunami Legacy* in 2009, an announcement was made regarding the development of a suite of handbook and guidance notes targeted specifically at recovery programme leaders and practitioners. The Disaster Recovery Toolkit forms the third deliverable, and it is this that has been developed by the Tsunami Global Lessons Learned Project Steering Committee (TGLLP-SC) in partnership with the Asian Disaster Preparedness Centre (ADPC). The 'Toolkit' is targeted at practitioners responsible for implementing recovery programmes, its objective to provide a 'how to' guide on development, implementing and managing complex post-disaster recovery programmes.

This document, *Guidance on Housing*, has been framed as a reference document to provide strategic guidance on incorporating Disaster Risk Reduction (DRR) measures in housing during the post-disaster phase. It also aims to accompany and enrich the handbook and the learning workshop module with key considerations on 'why and how' to bring Disaster Risk Reduction (DRR) into housing recovery and reconstruction interventions.

Introducing this guidance, the TGLLP Steering Committee hopes it will enhance the capacities of government agencies, especially central level agencies engaged in policy and strategy formulation for housing recovery and reconstruction and supporting local level agencies in undertaking recovery and reconstruction activities for the sector. The TGLLP-SC also hopes that the guidance will serve as a reference tool for development partners who work alongside the above agencies in housing recovery and reconstruction.

- Steering Committee of The Tsunami Global Lessons Learned Project

CONTENT

ABBREVIATIONS

AADMER	ASEAN Agreement on Disaster Management and Emergency Response
ADRM	Aceh Disaster Risk Map
ARTF	Afghan Reconstruction Trust Fund
ASEAN	Association of Southeast Asian Nations
BMTPC	Building Materials Technology Promotion Council
BRR NAD-Nias	Badan Rehabilitasi dan Rekonstruksi NAD-Nias (Indonesia) *(Agency for the Rehabilitation and Reconstruction of Aceh and Nias)*
CBA	Community Based-Assessment / Communication-based Assessment
CBO	Community-based Organization
CCA	Climate Change Adaptation
CFAN	Coordination Forum for Aceh and Nias
CSO	Civil Society Organization
CZMA	CZM Authority
DAD	Development Assistance Database
DALA	Damage and Loss Assessment
DRMS	Disaster Risk Management Strategy
DRR	Disaster Risk Reduction
DRR-A	"Making Aceh Safer Through Disaster Risk Reduction in Development"
ECHO	European Commission for Humanitarian Aid and Civil Protection
EIA	Environmental Impact Assessment
ERRA	Earthquake Reconstruction & Rehabilitation Authority (Pakistan)
GFDRR	Global Facility for Disaster Reduction and Recovery
GIS	Geographic Information System
GoTN	Government of Tamil Nadu'
GPS	Global Positioning System
GSDMA	Gujarat State Disaster Management Authority (India)
HRNA	Human Recovery Needs Assessment
IASC	Inter-Agency Standing Committee
ICT	Information and Communication Technologies
IRP	International Recovery Platform
KPI	Key Performance Indicator
LIFT	Livelihoods and Food Security Trust Fund
MDF	Multi Donor Fund for Aceh and Nias
MDTF	Multi-Donor Trust Fund

M&E	Monitoring and Evaluation
MHJ	Ministry of Health
MoU	Memorandum of Understanding
MPTF	Multi-Partner Trust Fund
NCRC	NGO Coordination and Resource Centre (Nagapattinam, India)
NDRF	National Disaster Response Force (India)
NDRF	National Disaster Response Framework (USA)
NWFP	North-Western Frontier Province
OCHA	Office for the Coordination of Humanitarian Affairs
ODA	Official Development Assistance
OSD	Officer of Special Duty
OSDMA	Orissa State Disaster Mitigation Authority
PAK	Pakistan-Administered Kashmir
PDNA	Post Disaster Needs Assessments
PHC	Primary Health Centre (India)
PONJA	Post-Nargis Joint Assessment
PONREPP	Post-Nargis Recovery and Emergency Preparedness Plan
PR	Periodic Review
RADA	Reconstruction and Development Agency (Sri Lanka)
RAN	Recovery Aceh-Nias Database (Indonesia)
RIAS	Recovery Information and Accountability System
R&R	Recovery and Reconstruction
SAARC	SAARC South Asian Association of Regional Cooperation
SIFFS	South Indian Federation of Fishermen Societies
SIM	Social Impact Monitoring
SLF	SL framework or SLA framework (according to IFAD)
SNEHA	Social Need Education and Human Awareness
TCCC	The Coca-Cola Company
TCG	Tripartite Core Group
TGLL	Tsunami Global Lessons Learned
TGLLP	TGLL Project (UNDP publications never wrote TGLLP)
TGLLP-SC	TGLL Project Steering Committee
TRIAMS	Tsunami Recovery Impact Assessment and Monitoring System
UN ECHA	United Nations Executive Committee for Humanitarian Affairs
UNF	United Nations Foundation
UNISDR	United Nations International Strategy for Disaster Reduction
UNORC	United Nations Office of the Recovery Coordinator for Aceh and Nias
USD	United States Dollar
VTC	Volunteer Technology Community


SHARP

INTRODUCTION

1 BACKGROUND

The world has witnessed some of history's worst disasters in the recent past, including the 2012 Hurricane 'Sandy' in North America and the Caribbean, the 2011 East Japan earthquake and tsunami, the 2010 Haiti earthquake, the 2008 Sichuan earthquake, the 2008 Nargis cyclone, the 2004 Indian Ocean tsunami and the 2005 Pakistan earthquake. Unplanned urban growth, increased exposure of populations living in vulnerable areas and climate change are reconfiguring risk. Over the past few decades there has been an increasing trend in the rate of disasters. Apart from claiming precious lives, each disaster destroys 'development gains' that have taken years, if not decades or even centuries to achieve. Housing is one of the worst affected sectors in most of disasters. Destruction of housing can threaten the physical, social, emotional and economic fabric of affected households.

It is well known that earthquakes and other disasters do not kill people, poor buildings do. It is important to reduce the impacts of disasters through safer construction practices, which entail mainstreaming disaster risk reduction (DRR) initiatives into the housing sector. Recovery and reconstruction provides an opportunity to lay the foundation for long-term risk reduction, thus contributing to safer and more sustainable development. Recognising the importance of DRR in post disaster recovery and reconstruction, the Second Session of the Global Platform 2009 called for a target share of 10 per cent of post-disaster reconstruction and recovery projects and national preparedness and response plans for DRR to ensure the mainstreaming of key DRR factors for build back better. DRR in the housing sector is an important pillar of the "build back better" principle during post-disaster recovery and reconstruction. Reconstruction and recovery of houses should address underlying vulnerabilities and avoid unintentionally recreating risk.

2 PURPOSE OF THIS GUIDANCE

The Guidance is framed as a practical reference tool for incorporating DRR measures during post-disaster housing recovery and reconstruction. The guidance also draws on some valuable lessons from housing sector recovery and reconstruction events, in particular the 2004 Indian Ocean tsunami. These technical guidelines emphasise the need to adapt a participatory and flexible approach to support the aspirations of affected people, ensure a smooth recovery process, and support long-term development and resiliency.

3 STRUCTURE OF THE GUIDANCE

This Guideance on mainstreaming DRR considerations into housing recovery and reconstruction planning aims to:

- Identify factors contributing to housing vulnerability and evaluate current practices in post-disaster housing recovery and reconstruction
- Provide a rationale for integrating DRR into housing sector recovery and reconstruction strategies
- Outline key DRR considerations for housing recovery and reconstruction to support the overall build back better objective

4 TARGET AUDIENCE

This Guidance serves as a reference for a wide variety of stakeholders, including government agencies and development partners. However it is primarily targeted at central level government agencies engaged in supporting local level agencies in undertaking housing recovery and reconstruction, and engaging in housing R&R policy and strategy formulation. In addition, the Guidance serves as a reference tool for development partners working alongside the above agencies to support housing recovery and reconstruction.


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HOUSING AND POST-DISASTER R&R

1 IMPACT OF DISASTERS ON HOUSING

Natural hazards of both geophysical and hydro-meteorological origin, and of similar intensity and exposure, have disproportionate impacts on lives, livelihoods and the built environment in developed countries versus low-income/developing countries. There are also disproportionate impacts between urban and rural areas and rich and poor households. The vulnerability of housing and the built environment constitutes the primary risk factor for loss of life and for a significant portion of economic loss during any major disaster event in low-income and developing countries. Likewise, the housing sector constitutes the largest financial item in post-disaster recovery programmes. The box below highlights a few of the recent events in the Asian region.

IMPACT OF RECENT DISASTERS ON HOUSING SECTOR IN THE ASIAN REGION

The 2001 Bhuj earthquake in Gujarat, India destroyed nearly 1,139,300 houses, of which approximately 222,145 were fully destroyed and the rest was partially damaged or repairable. Nearly 79 percent of damaged and destroyed homes were in rural areas.

The 2004 Indian Ocean tsunami affected up to 139,195 homes. In Aceh alone, nearly 88,000 units needed replacement and 71,000 needed to be rehabilitated. In Sri Lanka, more than 100,000 houses were damaged and more than 150,000 people lost their livelihoods.

The 2005 earthquake in Pakistan Administered Kashmir (PAK) and the North Western Frontier Province (NWFP) of Pakistan damaged or destroyed more than 600,000 houses. Ninety percent of the destroyed or damaged houses were in rural areas.

The 2008 Nargis cyclone left close to 800,000 homes damaged or destroyed in 37 townships in the Ayeyarwaddy and Yangon Divisions in Myanmar.

The 2011 Great East Japan Earthquake damaged or destroyed around 125,000 buildings in 18 prefectures.

2 VULNERABILITY OF HOUSING

Human vulnerability to disasters arises from physical, social, environmental and economic factors that are deeply interlinked with a range of underlying risk drivers[1], which may vary over time. In particular, vulnerability of housing stock (physical) constitutes a primary risk factor and is closely associated with other factors. Structural vulnerability[2] to natural hazards determines the impact of natural disasters in addition to exposure and other factors. For example, between 1960 and 2009, earthquake-related deaths were highly concentrated in low-income and developing countries (98.8 percent) as compared to developed countries (1.2 percent), and the main cause of death was structural collapse (about 75 percent). Non-structural and secondary disasters accounted for the other 25 percent (NEHRP, 2009 and Coburn et.al.1992). Table 1 lists the number of people killed and causes of death during major earthquake events since 1970, thus illustrating how housing vulnerability leads to risk. Some of the salient features of high levels of physical vulnerability in many developing countries are:[ii]

1 There is a range of underlying risk drivers such as unplanned settlements, rapid urbanisation, environmental degradation, weak infrastructure, weak governance and poverty, which act individually and in combination, thus exacerbating disaster risks.

2 Structural vulnerability is a straightforward way of assessing disaster impacts as compared to social and environmental consequences, which are more difficult to quantify.

NUMBER OF PEOPLE KILLED, CAUSE OF DEATHS DURING MAJOR EARTHQUAKE EVENTS SINCE 1970[I]

Location (Year)	Deaths (Injuries)	Causes of Death
Ancash, Peru (1970)	66,794 (143,331)	Vulnerable housing, avalanche turning into mud slide
Guatemala (1976)	22,778 (76,504)	Vulnerable housing
Tangshan, China (1976)	242,800 (7,086)	Vulnerable housing
Armenia (1988)	25,000 (20,000)	Vulnerable housing
Manjil, Iran (1990)	45,000 (60,000)	Vulnerable housing
Kocaeli, Turkey (1999)	17,439 (43,953)	66.6 percent structural, 26 percent non-structural
Bhuj, India (2001)	13,805 (166,836)	Vulnerable housing
Bam, Iran (2003)	26,271 (30,000)	Vulnerable housing
Indian Ocean tsunami (2004)	227,898	Drowning, debris
Kashmir, Pakistan and India (2005)	85,351 (75,266)	Vulnerable housing, site effects
Wenchuan, China (2008)	69,195 (374,177)	Vulnerable housing, side effects, slope failures leading to massive landslides
Haiti (2010)	222,570 (300,572)	Vulnerable housing
Tohoku, Japan (2011)	18,940 (6025)	Drowning

- Poor land use planning combined with a poor understanding of hazards and lack of risk-based planning.
- Lack of technical knowledge and incorporation of appropriate disaster-resistant features during planning and construction process.
- Lack of regulatory mechanisms to enforce land use and building regulations.
- Limited or no mechanisms for accountability in case of regulation violations.
- Lack of skilled human resources in planning and execution.
- Poor quality and substandard building materials.
- Poor maintenance of structures.
- Poor governance/corruption.

While the earthquake events mentioned in Table 1 reveal that weak structures are the primary factor for loss of life, it is important to understand the following key underlying issues:

- Vulnerability is also associated with other factors, such as socio-economic and environmental factors.
- Poverty is not synonymous with vulnerability; however poverty is one of vulnerability's principal driving forces.

Addressing vulnerabilities to natural hazards should not be limited to physical vulnerability but should also include other factors, as highlighted above.

3 POST-DISASTER HOUSING R&R

Each recovery and reconstruction programme, including housing recovery and reconstruction, is considered to be unique. However there are some commonalities. In an event of major disaster and damage, transitional housing is provided to displaced people and in many cases, temporary housing remains their only housing option. These guidelines, given their limited scope, focus on permanent housing recovery and reconstruction. The key activities in housing recovery and reconstruction[iii] are as follows:

- Assessment of damage and development of a reconstruction policy
  · Housing sector assessment.
  · Social dimension of housing reconstruction.
  · Development of recovery plan, including housing.
  · Articulating housing reconstruction approaches.

- Planning housing recovery and reconstruction
  · Land use and physical planning.
  · Infrastructure and service delivery.
  · Environmental planning.
  · Housing design and construction technology.

- Implementation of housing recovery programme
  · Community participation in housing recovery.
  · Institutional options for management of programme.
  · Engagement of development partners in housing recovery.
  · Mobilisation of resources.

- Monitoring and evaluation of the housing reconstruction programme.

It is important for the recovery policy/strategy for housing needs to be based on available information on housing damage, as well as on damage categories. Currently, many countries in the region do not have standards to classify damage, which often leads to over- or underestimating on damages and housing requirements.
(see box A on the next page)

A DAMAGE ASSESSMENT EXPERIENCE, GUJARAT, INDIA

An important lesson from the Gujarat recovery is that the classification of housing damage should be simplified in order to align physical damage with appropriate financial assistance. It is important to communicate and share information related to damage assessment criteria and classification so community expectations are managed. The housing damage assessment and financial assistance policies should be aligned as closely as possible. Project efficiency can be enhanced if the classifications are based on technical and financial considerations. For example, the Gujarat earthquake housing recovery programme implemented a complex, five-category housing damage scale and five financial assistance packages, ranging from INR 2,000 for ½-inch cracks to INR 175,000 for 40 percent housing reconstruction. The damage assessment of affected houses was undertaken by a team of three members which included an engineer, an administrator (revenue department staff) and one member from the community. The Gujarat programme tried to be cost efficient in terms of aligning damage with the cost of reconstruction.

B KEY STRATEGIES FROM HOUSING RECONSTRUCTION IN ACEH, INDONESIA

- A participatory decision-making process.
- A participatory spatial planning process (for relocation, debris cleaning, rebuilding of public infrastructure).
- A participatory determination of the status of land ownership.
- Joint environmental and spatial planning to improve the quality of housing.
- Capacity building of affected communities in home repairs and constructions through technical expertise, materials support and training of local builders (carpenters, masons, etc.) and establishment of building codes.
- Improving multi-sector coordination (for linkages between livelihoods and infrastructure provision).
- Improving the capacity, comprehensiveness and decentralisation of programme management at the ground level by strengthening the ability and knowledge of implementing agencies (both government and non-government).
- Strengthening the monitoring and evaluation mechanisms at each level of government and developing an independent M&E system to ensure the success of the programme.[iv]

Housing sector recovery policies should be clear about the reconstruction strategy, such as determining damage criteria for in-situ reconstruction/repair and relocation; criteria for identifying beneficiaries and vulnerable groups; types of compensation and reconstruction arrangements. *Box B* on the previous page shows the key elements of the housing reconstruction strategy used in Aceh, Indonesia.

In many cases, ambiguities in the housing recovery policy (often tied to financial commitments) and in the structure of the post disaster management mechanisms not only slow down fund disbursement, but also impede coordination between agencies implementing various components of the housing programme.

Based on experiences from past interventions, housing recovery strategies have evolved and adapted to local contexts. Broadly, housing reconstruction strategies have used a combination of approaches to rebuild damaged houses: contractor-built housing, government public housing and homeowner-driven housing reconstruction both at in-situ and relocation sites. The table on the right provides a brief description of various housing reconstruction strategies.

In consultation with affected communities, relocation should be based on risk assessments and an analysis of cost-effective mitigation measures in order to reduce recurrent and future hazards based on location, site settlement plannings and building materials.

GENERIC HOUSING RECONSTRUCTION STRATEGIES

Housing Reconstruction Strategies	Operating Guidelines
Homeowner-Driven/ In-situ Reconstruction Model	Cash grants are given directly to the homeowners. Homeowners are free to construct, using contractors or traditional construction workers/masons based on technical specifications laid out in the project. Homeowners are free to access supplementary assistance from other organisations based on co-financing guidelines, if available. Financial assistance is paid based on a progress-linked technical certification or construction audit. Reconstructed houses are to be registered in the name of both spouses. Construction should comply with the project technical guidelines, including minimum floor area/per house.
Public-Private Partnership/ In-situ Reconstruction Model	Reconstruction is undertaken based on the MOU signed between the disaster management authority and partner organisations/NGOs. Housing reconstruction cost is shared between government and partner organisations based on predetermined partnership guidelines. Houses are reconstructed in-situ by NGOs through contractors. NGOs provide basic community facilities as per the MOU. NGOs are free to procure contractors using own procurement methods. Government cash grants provided to beneficiaries are either passed over to NGOs by the government as per the MOU or used by homeowner for home improvements. NGOs manage the project expenditure through separate accounts which can be audited by the government if required. Reconstructed houses are to be registered in the name of both spouses All houses have minimum built up area.
Public-Private Partnership/ NGO-Based Relocation Model	NGOs are free to adopt villages and meet the full cost of reconstruction based on the resettlement/relocation policy laid down by the government. NGOs are free to implement housing relocation using either financial contributions from the government based on the relocation MOU, or by meeting the full cost of construction, including the cost of relocation. Relocation is planned after obtaining the full consent of the beneficiaries/village rehabilitation committees. Construction is done by contractors, using standard design and construction methods as per the DRR principles laid out by the government. Plot and house sizes are provided by government housing assistance package guidelines. House allotment is made in consultation with beneficiaries based on transparent house allocation guidelines. NGOs provide basic facilities/community infrastructure as per the PPP agreement. NGOs hand over land and house ownership titles registered in the name of both spouses upon project completion. All houses have the minimum built up area.

Retrofitting of damaged structures needs highly skilled professionals, and updated techniques are constantly being developed to retrofit existing houses in order to meet new building requirements. In addition, a few countries have promoted incentives for retrofitting existing structures to meet new design criteria based on stricter requirements.

In recent years, recovery strategies have used the Build Back Better approach to recovery and reconstruction as a process of rebuilding damaged structures to pre-disaster levels, as well as to implement DRR measures to reduce the impacts of future disasters. However experience shows that in face of pressure to complete reconstruction work, and often with limited knowledge and understanding, many basic practices are overlooked, leading to poor quality control and workmanship. DRR measures, even basic construction detailing, are often ignored during reconstruction.

During the past decades, several organizations have been involved in housing reconstruction and there is a widespread belief that using new types of building materials and practices can be an effective way of making structures resilient (for example reinforced cement or tin sheet roofing). Experience from past recovery and reconstruction projects shows there is a need to take into account local climate conditions, culture and other traditional practices, given that inappropriate building adaptations that have not done so were largely abandoned following construction.

Involving the local community and authorities in the planning exercise is equally as important, but not actually practiced by many organizations. In many cases, the long and time-consuming consultative process is skipped due to time and resource constraints. But housing sector recovery agencies need to realise that local involvement creates a favourable environment on the ground. This is needed to drive and sustain the task of reconstruction. Moreover, housing recovery is a work in progress and as more data emerges or the situation on the ground changes, adjustments need to be made. This can be best achieved only if local stakeholders are already on board.

Furthermore, a post disaster housing recovery programme study highlights the need to pay close attention to sustainable goals for well-being, and also to address a range of social problems in order to ensure that long-term physical, social and economic recoveries are achievable and equitable for to broad range of stakeholders[v].

RATIONALE TO INTEGRATE DRR INTO THE R&R OF HOUSING

The previous chapter highlights the factors contributing to the vulnerability of buildings and underlying factors which shape disaster risk, as well as the current trends in recovery and reconstruction related to housing. It is important to address the vulnerability and underlying risk factors during the development process, as well as the window of opportunity for build back better provided during the recovery and reconstruction period. If these issues are unaddressed during the recovery and reconstruction process, it is certain that any interventions will recreate or rebuild risk and may even lead to pre-disaster conditions. For example the box below highlights the lessons learned from Cyclone Nargis recovery and reconstruction in Myanmar.

Among other needs, integration of DRR measures into post housing reconstruction, along with other complementary DRR measures (such as land use planning, early warning systems, adequate infrastructure, risk transfer mechanism, awareness and training) can result in:

- Proactive reduction of vulnerability to hazards.
- Enhanced safety and standard of living.
- Minimised costs associated with future relief and reconstruction.

CYCLONE NARGIS HOUSING RECOVERY AND RECONSTRUCTION

Cyclone Nargis, which affected the Myanmar Ayeyarwaddy Delta region in 2008, left close to 800,000 homes damaged or destroyed in the 37 townships of Ayeyarwaddy and Yangon Divisions in Myanmar. An estimated 450,000 homes were totally destroyed and 350,000 were partially destroyed, with close to 2.4 million people affected. Total economic loss in the housing sector was calculated at 686,000 million kyats (approximately USD 690 million). A study by UN-Habitat and UNISDR called "Lessons Learned & Way Forward For Resilient Shelter Interventions in Rural Myanmar – 2011" found that 62 percent or more of surveyed households lived in shelters that are not disaster resilient (based on six essential features for hazard resilient structures: anchor, bracing, fixing purlin/rafter, fixed roof cover, roof projection and roof pitch) and needed retrofitting[vi].

1 PROACTIVE REDUCTION OF VULNERABILITY

Structural vulnerability is one of the primary factors behind the loss of lives, damage to structures and associated economic losses from natural hazards. In recent years, particularly after the 2004 Indian Ocean tsunami, the concept of Build Back Better has been an over-arching goal for post-disaster recovery and reconstruction programmes. Build Back Better is not about reconstructing to pre-disaster conditions, but incorporating DRR measures into recovery and addressing other relevant issues to reduce the impact of future disasters. Any interventions supporting recovery should address preexisting disaster risk and not exacerbate or create new risks. For example in Ghaen, Iran, building models promoted after the 1980 earthquake as earthquake-resistant were deficient in both design and construction quality, and consequentially collapsed during the 1998 earthquake.[vii]

Particularly in housing, it is important to address risk reduction both in terms of vulnerability reduction and reduction of exposure to naturally recurring hazards. Addressing risk reduction only through structural mitigation measures, such as earthquake-resistant structures merely reduces vulnerability to a limited extent[3] and might provide a false sense of safety. There is a need for a balanced approach to identifying acceptable levels of risk and addressing them through other measures such as land use planning, livelihood diversification and insurance. *(see Guidance on Land Use Planning and Guidance on Livelihoods)*

3 If building design follows certain building codes and standards, it may be adequately designed for hazards of a certain return period or design criteria only

Addressing issues related to structural vulnerability is as challenging as the overall recovery and reconstruction process because there is only a limited window to identify vulnerability factors and identify appropriate options and strategies. Vulnerability factors also depend on the housing reconstruction strategy or model. Depending on the scope, the majority of housing recovery programmes are supported by the government, NGOs, and development and humanitarian agencies through different delivery models. Most agencies have specific plans and strategies based on the housing recovery and reconstruction strategy and guidelines issued by the government. However, assessment studies highlight that compliance to government policy varies considerably due to myriad factors.[viii] In the case of home owner driven construction, there is a need for a range of activities to promote DRR incorporation such as awareness, training, oversight and fund disbursement. In the case of other models, there is a need for design standards, training and capacity building, quality control, and monitoring and coordination mechanisms.

Irrespective of whether houses are repaired or rebuilt, DRR elements need to be addressed. The housing recovery strategy should be explicit in addressing vulnerability issues and should link with sectoral strategies through concerted efforts at all levels in legal, policy and institutional frameworks. Addressing risk reduction during recovery also ensures that future development adequately considers risk reduction.

2 ENHANCING SAFETY AND STANDARD OF LIVING

Addressing structural vulnerability not only enhances the safety, but also contributes to the physical and psychological well being of households and communities. Housing reconstruction should consider the community as a whole and provide for adequate basic infrastructure such as water, energy, waste disposal, drainage, roads and community facilities.

If infrastructure is not structurally sound (including choice of locations) it will create a sense of insecurity and fear and other psychological stress. This is particularly important in the context of vulnerable groups who live in substandard conditions in hazard-prone areas. Lessons learned from post-disaster reconstruction projects highlight the importance of community participation in all stages of housing recovery and reconstruction, as well as in settlement planning. Failure to have adequate participation and ownership at the initial stages can slow down the overall recovery and in the worst case lead to non-usage of those settlements.

In addition, providing adequate infrastructure also minimises the losses and costs associated with future disruption of basic services, community function, and businesses (particularly those associated with micro-, small- and medium-sized business). Furthermore, housing recovery strategies should also address land tenure issues and other risk-transfer mechanisms.

DISASTER IMPACT ON HOUSING SECTOR

Year/ Country	Type/ Name	Number of houses fully damaged (partially damaged)	Housing sector damage (total damage and loss) in millions of USD	Percent of housing sector damaged	Housing sector reconstruction needs (overall reconstruction needs)
2005/ Pakistan	Earthquake	203,579 (196,574)	1152.1 (2876.0)	40.06	1550 (3503)
2007/ Bangladesh	Cyclone Sidr	564,967 (957,110)	839.0 (1674.9)	50.09	65 (1313)
2008/ Myanmar	Cyclone Nargis	450,000 (350,000)	647.2 (4022-4134)	15.65-16.09	362 (1002)
2009/ Philippines	Typhoons Ondoy and Pepeng	220,000 (-)	730.3 (4383)	16.66	1611.4 (4423)
2010/ Pakistan	Floods	913,307 (694,878)	1,588.0 (10,056)	15.79	2206 (8915)

3 MINIMISING FUTURE R&R EXPENDITURE

Investing in DRR has both tangible and intangible benefits, which numerous studies have tried to quantify. The table on the left attempts to highlight the impact of selected disasters, including the financial implications to the housing sector.

In the past, investing in DRR during recovery and reconstruction has not been a priority.[ix] However, in recent years it has been gaining significant attention not just as a standalone component of recovery programmes, but as an integral component of recovery strategies across all sectors.

While it may not be appropriate to make fail-safe structures due to cost factors, it is important to consider safety aspects during housing sector recovery, including non-structural mitigation measures. Additional costs associated with making structures resilient depend on acceptable levels of risk and design parameters. Hence, acceptable levels of risk need to be determined in consultation with communities and stakeholders. Experience from the Gujarat earthquake reconstruction programme suggests that earthquake resilient construction of single houses costs no more than 15 percent.[x] Similarly, simple modifications to improve the cyclone-resistance of kutcha (non-masonry) or temporary houses in Bangladesh amounted to only 5 per cent of construction costs.[xi]

From a sustainable development perspective, these additional costs could be viewed as long-term investments and supported as part of post-disaster management assistance. As noted in the previous section, there is a renewed call for allocating 10% of a recovery and reconstruction budget in DRR to support Building Back Better. By ensuring DRR measures are adequately addressed during recovery and reconstruction, Building Back Better serves as an enabling factor for long-term sustainable development as well as resiliency.

KEY CONSIDERATIONS

DRR is an integral element of the 'Build Back Better' approach to post-disaster recovery and reconstruction, and housing recovery and reconstruction should mitigate current as well as future risks. Addressing risk reduction in the housing sector needs to be done in a holistic manner, not limited to structures alone. The process must also address basic services and infrastructure, legal provisions, policy and institutional frameworks, and building materials and capacity in order to improve the overall quality of the built and social environment. Appropriate legal, policy and institutional frameworks need to be in place to provide an enabling environment for housing sector recovery. Community participation and ownership is fundamental for successful recovery and reconstruction, hence it is important to engage the community from the start.

The first chapter provided an overview of housing recovery and reconstruction. DRR inclusion in every step of housing recovery and reconstruction is crucial, as highlighted previously. The following seven key considerations related to DRR inclusion in housing recovery and reconstruction have been identified. All contribute towards the goal of resilient development.

1 EMPHASISING RISK REDUCTION IN POLICY AND PLANNING

The early recovery phase provides a window of opportunity to assess, identify and integrate DRR measures into the overall recovery and reconstruction programme, including the housing sector reconstruction policy, strategy or plan. However, the window for such measures is short when compared to normal planning and decision-making processes.

In order to ensure risk reduction concerns are addressed in housing recovery, it is essential that DRR considerations and options are discussed during the early recovery stage. The considerations need to encompass structural and non-structural aspects of both the repair and retrofitting of existing houses by creating a conducive environment for such endeavours. This can include the review of existing legal and policy frameworks, building codes, land use plans and enforcement mechanisms, as well as the strengthening or establishment of a coordination mechanisms for recovery and reconstruction at all levels. Lessons learned from the post-tsunami intervention highlight that strong institutions and leadership with a flexible approach are required in recovery and reconstruction (*see Handbook for Disaster Recovery Practitioners).*

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Furthermore, the housing recovery and reconstruction plan should adequately consider compensation, beneficiaries, vulnerable groups (widows, disabled persons and landless tenants), land tenure, land use planning, debris disposal and environmental protection and conservation with a view to vulnerability reduction in a multi-hazard framework. Effective participation of households and local communities is central to a sustainable housing recovery programme.
Some of the recognised principles for integrating DRR considerations into tsunami housing rehabilitation and reconstruction programmes are:[xii]

- Promoting design that is cost effective, locally appropriate, culturally sensitive and consistent with needs.
- Placement of infrastructure away from hazard and resource areas, favouring innovative and soft engineering solutions to coastal erosion.
- Reducing the vulnerability of coastal communities to natural hazards by establishing a regional early warning system and by applying construction setbacks, greenbelts and other no-build areas in disaster prone areas, founded on a scientifically mapped "reference line".
- Widely disseminating good housing reconstruction practices and lessons learned as they emerge.
- Adopting ecosystem-based management measures.
- Ensuring public participation through capacity building and the effective utilisation of all means of communication.
- Promoting early resettlement with provisions for safe housing, debris clearance, potable water, sanitation and drainage services and access to sustainable livelihood options.

2 UTILISING DAMAGE ASSESSMENTS

Findings from damage assessments are an important source of information for identifing vulnerability factors (such as inadequate building design, poor quality building materials, workmanship, enforcement) that shape disaster risk. Damage assessment results, combined with the existing land use plan/available hazard and risk maps and satellite imagery, can be used to validate whether the area is safe or not. Further, assessment findings can provide specific inputs for the recovery and housing sector strategies particularly on repair, retrofitting, moratoriums on reconstruction, and relocation requirements. Damage assessment findings can also provide the scope and requirements for debris clearance and guide authorities on the safe disposal of debris.

In general, specialists, such as structural or civil engineers, need to examine the damage to housing and associated utilities using categories to classify the varying degree of damages, e.g. completely destroyed/ beyond repair, partially damaged/repairable, minor damage, no damage and safe. Further categories can include: repaired, retrofitted, needs to be demolished for reconstruction or relocation. Housing damage assessments should also provide feedback to the land use planning process during recovery and reconstruction *(see Guidance on Land Use Planning*). Currently, most countries lack a standard tool for classification, and have developed complicated procedures that make the assessment process longer and unnecessarily complex *(see box A on page 15).*

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A transparent and technical assessment of the damage should form the basis of a financial assistance policy and beneficiary selection process during housing recovery. It is important that a surveyor/assessor consult with each affected family during this assessment to develop a reasonable consensus on the method and basis for classifying the affected housing unit. It is also advisable to engage the local community, NGO or civil society organizations in the damage assessment process to ensure transparency and community ownership.

3 INTEGRATING HAZARD-RESISTANT ELEMENTS IN RECONSTRUCTION

Over the years, scientific and engineering communities have developed guidelines and building codes on hazard-resistant design. However due to lack of knowledge, expertise, and enforcement in many developing countries, these simple practices are often overlooked during construction. Post-disaster reconstruction can be an opportunity to upgrade housing conditions. Based on the damage assessment findings and reviews of land use and existing practices (e.g. building materials and construction techniques), vulnerability factors can be identified and addressed. In doing so, the housing sector can contribute to tangible risk reduction. Vulnerability reduction through housing recovery and reconstruction should be supported through legal, policy, and institutional frameworks with capacity building and financial incentives.

Identification of appropriate designs and incorporating DRR elements, both architectural and structural should be undertaken during the early recovery phase in consultation with the community. Regardless of whether the houses are to be repaired, retrofitted or completely rebuilt, the options for appropriate risk reduction measures are influenced by the same factors: type, design, acceptable level of risk, availability of construction materials and ability of construction workforce. Identifying acceptable levels of risk will be critical for overall DRR, since vulnerability reduction through structural means will not be cost effective for all cases and may require complementary DRR activities. This decision should be guided by the outcomes of damage and risk assessments.

The box on the next page lists a few housing guidelines developed with DRR elements.

TECHNICAL GUIDELINES FOR HOUSING RECONSTRUCTION[XIV]

One of the significant improvements in recent years on housing reconstruction is adoption of flexible reconstruction approaches with guidelines on housing requirements to ensure uniformity and equity. Technical guidelines can include types of houses, area, designs and retrofitting techniques. Some examples are: Guidelines for Construction of Compressed Stabilised Earthen Wall Buildings (Gujarat State Disaster Management Authority), Hunnarshala Foundation for Building Technology and Innovations, Bhuj, India, http://hunnar.org; Manual on Hazard Resistance Construction in India, UNDP India and Government of India, Ahmedabad, http://www.ncpdpindia.org; Guidelines for reconstruction of houses affected by tsunami, http://www.tn.gov.in; Guidelines for housing development in coastal Sri Lanka, http://www.humanitarian-srilanka.org; Guidelines for earthquake-resistant construction of non-engineered rural and suburban masonry houses in cement sand mortar in earthquake-affected areas, ERRA, Government of Pakistan, http://www.erra.gov.pk; and, Post Cyclone Nargis Shelter Guidelines, UN-Habitat-Myanmar, http://www.dias.unhabitat-mya.org/documents/iec.php.

Housing design should incorporate the social, cultural and economic behaviours of the affected population. Traditional methods may be the best solution if local materials and local workforces are used in the reconstruction process. However, there is a need to review local practices and enhance workers' skills to ensure they can comply with guidelines. For example, in Gujarat, India, Aceh, Indonesia, Padang, Indonesia, and the Ayeyarwady Delta, Myanmar many agencies promoted reconstruction and retrofitting of houses using traditional methods and materials while incorporating disaster risk reduction elements. A review of recent housing reconstruction programmes reveals that compliance to guidelines vary considerably with the capacity to coordinate, deliver and monitor housing reconstruction in the post-disaster context.[xiii] Availability of materials and skilled human resources are major challenges. Retrofitting options for structures should be practical, have strong incentives and use skilled professionals with adequate oversight on quality control.

4 PROMOTING ENVIRONMENTALLY FRIENDLY MATERIALS

The availability of local construction materials has to be assessed thoroughly to make sure there is adequate supply and that materials are affordable and acceptable to the local community and environment. It is always preferable to use locally available expertise, labour and materials, but if these do not meet the required standards, materials can be sourced from other areas. The decision to source from outside the affected area needs to be carefully evaluated, not just for availability but also for import restrictions and delivery time. For example in Aceh, wood has been used as the predominant building material as it is appropriate to local climate conditions and is relatively easy to build with. However, post-tsunami, the demand for wood surged, which led to sourcing from unlicensed and illegal vendors. It also led to sourcing from Canada and New Zealand, which created bottlenecks due to import procedures. It is, likewise, important to consider maintenance aspects when new building materials are being introduced as communities may find them difficult to maintain and repair.[xv]

In addition, the housing reconstruction strategy needs to be explicit about restoring the environment. Simultaneously, the process should minimise any negative impacts of the reconstruction process and the use of building materials on the environment. The former is associated with revitalisation of the environment from disaster damage, whereas the latter focuses mainly on the application of eco-friendly construction practices, materials and building designs, along with minimising the negative impact on environment. The table on the next page lists criteria for assessing the environmental impact of construction materials.[xvi]

Introduction of eco-conscious construction practices, with proper legislative support, can enhance the balance between the built and natural environment. Equally important is the change of attitude by the community in its practices, and the identifying ways people can live in harmony with the environment while also depending on it for livelihoods and consumption. This requires continuous consultation and awareness raising in communities, as well as capacity building of artisans.

CRITERIA FOR ASSESSING THE ENVIRONMENTAL IMPACT OF CONSTRUCTION MATERIALS

Criteria	Rationale	Recommendations
Local availability of raw materials	The use of local and abundant material is more eco-friendly than the use of imported or scarce materials (though consumption of even abundant raw materials has to be managed).	Maximise the use of locally available, abundant materials.
Environmental impact of the materials	The environmental impact of materials should be assessed in terms of grey energy consumed for their production. The energy needed for transporting the materials to the site has to be taken into consideration as well.	Take into account grey energy consumption and CO^2 emissions in selection of construction materials.
Pollutants in construction materials	Refers to the emission of pollutants indoors as well as outdoor. Air change is essential for the elimination of indoor pollutants. Although a complete elimination of pollution is unachievable, significant reduction can be achieved through careful selection of construction materials.	Take into account emission of pollutants in selection of construction materials.
Impact of materials in case of demolition	Reuse and recycling of construction materials allows for conservation of raw materials and energy. For recycling purposes the original components need to be separable.	Use replaceable, separable, and recyclable materials.

5 ENHANCING SKILLS FOR HAZARD-RESISTANT CONSTRUCTION

A key factor influencing the quality of housing reconstruction interventions is the capacity of institutions and individuals involved in the process. For example, after the tsunami in Tamil Nadu, India had adequate expertise, institutional arrangements and public sector capacity to undertake post-disaster housing reconstruction with little external support other than financial assistance. However, in the case of Sri Lanka, international assistance was not only required for funding, but also for implementing the housing programme.[xvii]

Another frequent challenge in reconstruction programmes is the mismatch between the chosen type of construction (e.g. reinforced concrete, masonry, etc) and local capabilities.[xviii] For example, a local construction workforce may be well versed in traditional house building, but may have very limited experience with new building materials or hazard-resistant techniques. In areas where the local artisans do not have formal trainings on new construction materials and techniques, the quality of construction will be negatively affected. In Aceh, several agencies working on reconstruction experienced serious problems with untrained local labourers. Similar cases were observed in post-Nargis recovery in Myanmar. In Aceh, sub-standard housing posed such a risk that in some cases entire houses were demolished and rebuilt, while in others, substantial remedial work was required.[xix]

Housing recovery strategies should also adequately address the capacity building needs of relevant institutions to provide services such as land management, spatial planning and community infrastructure with adequate human resources to oversee the recovery process. Strategies should also build the capacity of those involved in reconstruction delivery such as engineers, planners, architects, carpenters and masons.

6 INTEGRATING DRR INDICATORS INTO HOUSING M&E FRAMEWORKS

In most externally funded development projects and programmes, monitoring and evaluation (M&E) frameworks are well established to support programme implementation. However, in post disaster recovery and reconstruction, M&E frameworks might not be flexible enough as the post disaster context is more complex than normal development programmes, particularly in the housing sector. *Chapter 5 of the Handbook for Disaster Practicioners* highlights the importance of an M&E framework in the post-disaster context and provides recommendations on adopting a flexible approach.

H

As discussed in the previous section, housing sector recovery is a complex undertaking done in a short period of time through a range of activities. "Debris cleared, land mapped, village mapping done and infrastructure and amenities developed. These activities are like a long pipeline of things to be done. Settlement rebuilding both precedes and follows upon the reconstruction of houses proper. No monitoring programme could track intertwined actions and events truly separately, but had to consider their progress together in an intelligent way".[xx] If existing institutions are weak, it is likely that the housing recovery process will be prolonged. Post tsunami in Aceh, UN-Habitat provided policy support to the Housing and Settlements Department of BRR, including through a complementary monitoring programme for housing recovery in line with the Master Plan and in collaboration with UNSIYAH University. The M&E system not only tracked progress but also the quality of progress and compliance with building regulations. *(see next page)*

It is important to establish an M&E framework for housing recovery and reconstruction. This should also include indicators capturing DRR issues.

SETTLEMENT RECOVERY MONITORING – ACEH[XXI]

UN-Habitat, as part of its policy support to BRR, established a settlement recovery monitoring system with complementary objectives of compliance: compliance-against-standards and the stimulation of a compliance culture. Initially, the system measured construction quality against the building code as an indication of compliance-against-standard indicators on beneficiary satisfaction and the transparency of the process. It reported relative performance during implementation against other implementing organizations and later shifted reporting from performance to overall sustainable recovery. Indicators were designed to give a measure of early success or failure of individual programmes and, thus, of the risks faced by them. Aggregate information also informed the prospects and the risks for the housing recovery programming as a whole. Figure 1 illustrates the details of the participatory M&E tool and the construction quality indicator, which measured compliance in relation to building code incorporation of DRR measures.

Participatory M&E tool and the construction quality indicator

Questionnaire Sections	Respondents	Scope
1. Identification of 5 sample respondents (24 questions)	Focus group and Village Leader	Within the Housing Programme Area
2. Identification of the housing programme (9 questions)	Focus group	Housing Programme
3. Needs in the village for settlement & housing recovery, including for short-term humanitarian assistance (58 questions)	Focus group and Village Leader	Village
4. Preparatory works for land mapping, village planning and relocation (34 questions)	Focus group and Village Leader	Housing Programme Area
5. Infrastructure & amenities issues (94 questions)	Focus group and Village Leader	Village
6. Details about the housing programme (34 questions)	Focus group and Village Leader	Housing Programme Area
7. Construction quality (71 questions)	Visual Observation	Housing Programme

Scoring Matrix for Construction Quality

	Building Type	
Score	**Brick, concrete, metal**	**Half-brick, soft-infill, timber**
4	Better than building code	Building code, and very durable
better than required		
3	Building code threshold	Building code, and more durable
>2.5	Broadly acceptable	
>2.5	maybe acceptable, may require inspection for retrofitting	
2	Below building code	Building code threshold
poor, to be replaced a retrofitted		
1	Critically below building code	Below building code
Dangerous, to be replaced immediately		
0	Unacceptable	Critically below building code

7 PROMOTING RISK TRANSFER MECHANISMS

Holistic DRR measures should not only address vulnerability reduction but should also identify appropriate mechanisms for risk sharing and transfer. Insurance is a primary tool used for risk sharing and transfer. Although the practice is well established in developed countries, the high premiums charged for disaster insurance are not affordable for most people in developing countries, especially vulnerable groups and those living in high-risk areas. In recent years, insurance in post-disaster recovery and reconstruction has been gaining recognition, particularly in the housing sector. The box below presents the Disaster Risk Transfer mechanism from Gujarat, India.

DISASTER RISK TRANSFER MECHANISM (EARTHQUAKE HOME INSURANCE)

To transfer future earthquake risk to the private sector, the Government of Gujarat formulated a multi-hazard insurance scheme in partnership with national insurance companies under the housing recovery programme. The package insured multi-hazard damages of a newly reconstructed house for USD 2,000 for ten years for a one-time premium payment of USD 7. The housing assistance policy made the insurance compulsory for all newly reconstructed houses. Likewise in Tamil Nadu, the government financed tsunami reconstruction houses that were covered for 14 hazards, including: Fire, explosion/implosion, impact by any rail, aircraft or other aerial and/or space devices and/or articles dropped from it, bursting and/or overflowing of water tanks, apparatus and pipes, missile testing operations, leakage from automatic sprinklers, bush fire, riots, strikes, malicious acts, lightning, storm, cyclone, typhoon, tempest, hurricane, tornadoes, flood and inundation, tsunami, subsidence and landslides including rock slides, earthquake fire and shock cover, and terrorism. The coverage period was 10 years.

REFERENCES

ADPC, *Mainstreaming DRR in Housing Sector,* 2011.
ACHR, *Housing by People in Asia; Special Issue on How Asia's Precarious Coastal Communities are Coping after the Tsunami, Newsletter of the ACHR,* August 2005.
ADB, *Indonesia: Aceh-Nias Rehabilitation and Reconstruction*, 2009.
ADRC, *Disaster Reconstruction in Japan: Lessons Learned from the Kobe Earthquake,* a powerpoint presentation at SAR Regional Conference on Hazard Risk Management, December 2006, India.
Barakat Sultan, *Humanitarian Practice Network, Housing Reconstruction after Conflict and Disaster*, Network Paper Number 43, 2003
Barenstein Jennifer Duyne, *Challenges and risks in post-tsunami housing reconstruction in Tamil Nadu,* Humanitarian Exchange Magazine, 2006.
Barenstein Jennifer Duyne and Pittet Daniel, *Post-disaster housing reconstruction Current trends and sustainable alternatives for tsunami-affected communities in coastal Tamil Nadu.*
Batha E., *Post Tsunami Chaos Wastes Aids: an article on AlertNet,* October 2005 http://reliefweb.int/node/186754.
Bendimerad F., *DRR and Sustainable Development,* 2003.
Benson C. and Twigg J., *Tools for mainstreaming DRR: Guidance note for development organizations,* ProVention Consortium, 2007.
Da Silva J., *Lessons from Aceh: Key Considerations in Post-Disaster Reconstruction,* 2010.
ERRA, Rural Housing Reconstruction Strategy of Earthquake Hit Districts in NWFP and AJK, Pakistan, 2006.
ERRA, *A Strategy for Reconstruction, Rehabilitation and Development of Earthquake Affected Urban Areas,* 2007.
EMA, *Economic and Financial Aspects of Disaster Recovery*, Australian Emergency Manual Series, 2002.
EPC, *Participatory Planning Guide for Post-Disaster Reconstruction,* Environmental Planning Collaborative, Ahmedabad, India and TCG International, USA, 2004.
GFDRR, *Safer Homes, Stronger Communities: A Handbook for Reconstruction after Natural Disasters,* The World Bank, 2009.
Government of Tamil Nadu, India and UNDP, *Guidelines for Reconstruction of Houses Affected by Tsunami: General and Public Buildings (Masonry).*
Government of Tamil Nadu. *Guidelines for Reconstruction of Houses Affected by Tsunami in Tamil Nadu.*
Government of Tamil Nadu and UNDP, *Disaster Resistant Construction Practices: A Reference Manual.*
IRP, *Learning from Disaster Recovery: Guidance for Decision Makers,* 2007.
IRP, *Gender-Sensitive Post-Disaster Rehabilitation Guidance: Shelter/Housing,* 2008. Knowledge for Recovery Series, Info Kit 3.
Jayaraj A., *Post Disaster Reconstruction Experiences in Andhra Pradesh, India,* 2003.
Lloyd-Jones T., *Mind the Gap! Post-disaster Reconstruction and the Transition from Humanitarian Relief,* University of Westminster, 2006.
Mechler R., Linnerooth-Bayer, J., Peppiatt D., *Disaster Insurance for the Poor? A Review of Microinsurance for Natural Disaster Risks in Developing Countries,* Provention Consortium/ IIASA Study, 2006.
Mumtaz, H; Habib Mughal S., Stephenson M., Bothara Jitendra K., *The Challenges of Reconstruction after the October 2005 Kashmir Earthquake,* 2008.
Narayanan Edadan, *Gujarat Earthquake Housing Reconstruction Programme-Lessons Learnt,* The World Bank, 2008.
OXFAM, *A Place to Stay, A Place to Live: Challenges in Providing Shelter in India, Indonesia and Sri Lanka After the Tsunami: OXFAM Briefing Note,* 2005.
Prevention Consortium, *Construction Design, Building Standards and Site Selection: Tools for Mainstreaming DRR, Guidance Note 12,* 2008.
Ramal Vivek, Desai, Rajendra; Jadeja, Dharmesh, *Assessing Post-Tsunami Housing Reconstruction in Andaman and Nicobar Islands: A People's Perspective,* 2006.
Robin Spence and Emily So, *Estimating Shaking-Induced Casualties And Building Damage for Global Earthquake Events,* NEHRP Grant Number 08HQGR0102, 2009.
Royal Thai Ministry of Foreign Affairs, *Thailand UNDP Report and Summary of Main Conclusions: National Workshop on Tsunami Lessons Learned and Best Practices in Thailand,* 2005.
Shelter Centre, *Transitional Shelter: Understanding Shelter from the Emergency through Reconstruction and Beyond, Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP) Case Study No.5,* 2010.
Steinberg F., *Housing Reconstruction and Rehabilitation in Aceh and Nias, Indonesia,* Rebuilding Lives, Habitat International Volume 31 Issue1 March 2007.
BRR NAD-Nias, *Housing: Roofing the Pillars of Hope,* The Executing Agency of Rehabilitation and Reconstruction for Aceh and Nias, 2009.
IPS of Sri Lanka, ADBI, Tokyo, Japan and The Asian Economics Centre, University of Melbourne, Australia, *Post-Tsunami Recovery: Issues and Challenges in Sri Lanka,* 2005.
UNDP and UNISDR, *Handbook on Good Building Design and Construction: Aceh and Nias Islands,* 2007.
UNDP-Indonesia, *Building Blocks for Sustainable Recovery: Second Annual Report of the Aceh-Nias Emergency Response and Transitional Recovery (ERTR) Programme,* 2005-2006.
UNESCAP, *Guidelines and Manual on Land-use Planning and Practices in Watershed Management and Disaster Reduction,* 1997.
UNEP/GPA in cooperation with Stephen Bloye Olsen, et al., *Cairo Guiding Principles: An annotated guiding principles for post tsunami housing rehabilitation and reconstruction;* University of Rhode Island, USA.
http://www.cobsea.org/Cairo percent20Guiding percent20Principles.pdf

UNEP/GPA, *Annotated Guiding Principles for Post-Tsunami Rehabilitation and Reconstruction,* United Nations Environment Programme Coordination Office of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (2006)
UN-HABITAT, *Innovative Approaches for Involuntary Resettlement, Lunawa Environmental Improvement & Community Development Project,* Sri Lanka, 2009.
UN-HABITAT, *Post Tsunami Aceh-Nias Settlement and Housing Recovery Review,* 2009.
UN-HABITAT, *Land and Natural Disasters: Guidance for Practitioners,* 2010.
UN-HABITAT, *Lessons Learned & Way Forward for Resilient Shelter Interventions in Rural Myanmar,* 2011.
World Bank-UN, *Natural Hazards, Un Natural Disasters: The Economics of Effective Prevention,* 2010.

ENDNOTES

i NEHRP, 2009 with additional data from *UNOCHA and **National Police Agency, GoJ.
ii ADPC (2011)
iii GFDRR, Safer Homes, Stronger Communities
iv Da Silva, Jo (2010) Lessons from Aceh: Key Considerations in Post-Disaster Reconstruction, The Executing Agency of Rehabilitation and Reconstruction for Aceh and Nias (BRR NAD-Nias) (2009) Housing: Roofing the Pillars of Hope, Steinberg, Florian (2007), Housing Reconstruction and Rehabilitation in Aceh and Nias, Indonesia – Rebuilding Lives, Habitat International Volume 31 Issue1.
v Arlikatti, S. and Andrew, S. (2012). Housing Design and Long-Term Recovery Processes in the Aftermath of the 2004 Indian Ocean Tsunami. Nat. Hazards Rev., 13(1), 34–44.
vi http://www.dias.unhabitat-mya.org/documents/Report/llwf.php
vii ALNAP, 2008
viii Shaw Judith, Mulligan Martin, Nadarajah Yaso, Mercer Dave and Ahmed Iftekhar, Lessons from Tsunami Recovery in Sri Lanka and India Community, Livelihoods, Tourism And Housing, 2011.
ix According to joint World Bank/UN report: Natural Hazards, Un Natural Disasters: The Economics of Effective Prevention (2010), 99 percent of the donor funded disaster management activities are for relief and reconstruction and only a small 1 percent is spent on DRR measures.
x Narayanan Edadan (2008), Gujarat Earthquake Housing Reconstruction Programme-Lessons Learnt, The World Bank
xi Charlotte Benson and John Twigg (2007), Tools for mainstreaming DRR: Guidance note for development organizations, ProVention Consortium.
xii Cairo Guiding Principles: An annotated guiding principles for post tsunami housing rehabilitation and reconstruction
xiii Post Tsunami Aceh-Nias Settlement and Housing Recovery Review UN-Habitat, 2009; Lessons from Tsunami Recovery in Sri Lanka and India Community, Livelihoods, Tourism and Housing Shaw et.al 2011; Lessons Learned & Way Forward for Resilient Shelter Interventions in Rural Myanmar, UN-Habitat, UN-ISDR, 2011.
xiv Adapted from GFDRR,2009
xv Barenstein, Jennifer Duyne (2006) Housing Reconstruction in Post-earthquake Gujarat: A Comparative Analysis, Humanitarian Practice Network Paper No. 54.
xvi Barenstein et.al 2007, http://www.chs.ubc.ca/archives/files/Post-disaster percent20housing percent20recounstruction percent20current percent20trends percent20and percent20sustianable percent20alternatives.pdf
xvii Shaw, 2011
xviii da Silva; Joe (2010) Lessons from Aceh: Key Considerations in Post-Disaster Reconstruction.
xix Ibid.
xx UN-Habitat, 2009
xxi UN-Habitat, 2009, Post Tsunami Aceh- Nias Settlement and Housing Recovery Review.

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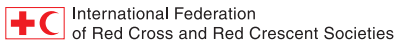

Tsunami Global Lessons Learned Project