UNEP

After the Tsunami

Sustainable building guidelines for South-East Asia

UNEP SBCI
Sustainable Buildings & Construction Initiative

skat Swiss Resource Centre and Consultancies for Development

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EXECUTIVE SUMMARY

The Indian Ocean earthquake and tsunami 26 December 2004 (the "Tsunami") severely affected the coastal areas of the Indonesian province of Aceh, Sri Lanka, Thailand, Southern India, the Maldives, Malaysia, and Myanmar, taking over 250,000 lives, leaving millions homeless or displaced and causing enormous destruction and suffering. In the aftermath of the disaster, survivors found shelter in temporary barracks and tents, and one of the most pressing needs remains to provide adequate permanent housing. In Aceh, for example, it has been estimated that 92,000 new houses need to be rebuilt and 151,000 damaged houses rehabilitated[1].

Numerous agencies have taken on the task of reconstructing houses and infrastructure in the aftermath of the tsunami. Project managers, however, are often overwhelmed by the magnitude of the reconstruction challenges they are confronting, the principal one being the need to produce conceptually sound, practical building solutions that minimise environmental impacts.

This manual designed to help project managers meet this challenge by providing them with guidance in the area of 'sustainable reconstruction'. The manual explains how the choice of appropriate design and construction methods and sustainable materials and technologies during the planning, implementation and maintenance phases of reconstruction can protect natural resources and reduce energy consumption and pollution.

Sustainable reconstruction management provides numerous environmental, safety and financial benefits. Construction waste, dust and noise emissions are minimised. Energy-efficient building technologies reduce fuel and power consumption and offer long-term cost savings, while improving health and safety conditions. Initiatives meet user needs and are adjusted to local cultural norms and legal requirements, in particular, government acts, rules and regulations concerning reconstruction and natural disaster mitigation, gaining the support of relevant institutions and local political leaders. And by using locally available and certified source materials or products, sustainable reconstruction provides important knock-on benefits for local livelihoods and resource management. Taken together, sustainable reconstruction management's many benefits offer donors and reconstruction authorities an important opportunity to ensure that their efforts result in net positive environmental or social impacts to local communities – i.e., to truly 'build back better."

[1] See BRR projections in *ADB-ETESP-Spatial Planning and Environmental Management, Draft Guidelines: Environmentally Friendly Construction Material Procurement, Asian Development Bank* (2006).

ACRONYMS

ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
CBO	Community Based Organisation
CFC	Chloroflurorocarbons (an ozone depleting substance)
CEB	Compressed Earth Blocks
DMB	Disaster Management Branch (UNEP)
DTIE	Division of Technology, Industry and Economics (UNEP)
EIA	Environmental Impact Assessment
ITDG	Intermediate Technology Development Group (now: Practical Action), UK-based NGO
M&E	Monitoring and Evaluation
MoU	Memorandum of Understanding
NGO	Non-Governmental Organisation
SWM	Solid Waste Management
WS&S	Water Supply and Sanitation
UN	United Nations
UNEP	United Nations Environment Programme
VSBK	Vertical Shaft Brick Kiln

GLOSSARY

Black water	Heavily contaminated wastewater, e.g., toilet wastewater. Black water is also known as 'brown water', black water is heavily polluted and difficult to treat because of high concentrations of mostly organic pollution.
Buffer zone	A buffer zone is a land area designated for safety purposes that includes the highest sea level previously flooded (e.g., the Tsunami level), together with an additional buffer area.
Community rehabilitation	Community rehabilitation involves mobilising community members and providing them with, or enabling them to provide for themselves, a safe, secure and enabling environment. Community rehabilitation entails restoring infrastructure and basic services, such as energy, water, sanitation, healthcare, education, access to information, as well as providing less tangible forms of support, such as counselling and groups for awareness building.
Disaster management	Disaster management is the body of policy, administrative decisions and operational activities required to prepare for, mitigate, respond to, and repair the effects of natural or man-made disasters. Effective disaster management relies on the development and thorough integration of emergency plans by all levels of government and civil society
Disaster mitigation	Actions taken to eliminate or minimise the effects of disasters, including measures to eliminate or reduce risks or prevent hazards from developing into disasters.
Disaster preparedness	Disaster preparedness minimises the adverse effects of hazards through effective precautionary actions, rehabilitation and recovery measures to ensure the timely, appropriate and effective organisation and delivery of relief and assistance following a disaster. Preparedness measures include plans of action for potential disasters, maintenance and training of emergency services, the development and exercise of emergency population warning methods combined with emergency shelters and evacuation plans, the stockpiling of supplies and equipment and the development and practice of multi-agency coordination.
Disaster prevention	The body of policy and administrative decisions and operational activities related to preventing, managing and mitigating the various stages of disasters at all levels.
Disaster recovery	The restoration of an affected area to its previous state. Disaster recovery involves policies, decisions and activities developed and implemented after immediate needs in disaster areas have been addressed. Recovery activities include rebuilding destroyed property, re-employment, and the repair of other essential infrastructure. Recovery efforts are most effective and most widely accepted by communities when mitigation measures are implemented swiftly.
Ecosystems	Distinct units of the biosphere, including living organisms (plants, animals, micro-organisms) and nonliving components, their interactions and other processes specific to the ecosystem's physical area.
Embodied energy	The quantity of energy required to acquire primary material, manufacture handle and transport to the point of use a product, material or service.
Energy conservation	The practice of reducing the amount of energy used to obtain an outcome or produce an output.
Environmental Impact Assessment (EIA)	An EIA is a formal process used to assess a project's potential impact on human health and the environment. The purpose of the EIA is to enable decision-makers to consider the environmental impacts and options for minimizing them before deciding whether to proceed with the project.

Grey water	Wastewater that is generated from processes such as washing dishes, laundry and bathing.
Irrigation	Water artificially supplied (by, e.g., pipes, ditches or streams) for the purpose of watering grass, trees, and other plants.
Livelihood rebuilding	The provision of support to major occupation sectors (fishery, agriculture, tourism) as well as families with specific needs (e.g., home-based work for single-person households).
Photovoltaic (PV) cell	A device that converts sunlight directly into electricity using cells made of silicon or other conductive materials.
Pollution	Harmful substances (gases, liquids and solids) that have been released into the environment.
Quarry	A site from which rocks, gravel, sand or clay is extracted in substantial quantities.
Recycling	Systems and processes for collecting, sorting, and reprocessing used products, substances and materials into raw material suitable for reuse.
Renewable energy	Renewable energy resources capture their energy from natural energy sources, such as sunlight, wind, and hydropower, biogas, and geothermal heat that are self-replenishing (as opposed to non-renewable energy sources, e.g., oil, gas and coal, that are can only be used one time).
Reuse	The employment of a product, substance or material, once again for its original purpose, or for a different purpose, without prior processing to change its physical or chemical characteristics.
Reverse Osmosis (RO)	A membrane separation process designed to treat wastewater or seawater containing a variety of contaminants including organic compounds.
Risk management	The process of measuring or assessing risk and developing strategies to manage it. Strategies include avoiding the risk, reducing the negative effect of the risk, and accepting some or all of the consequences of a particular risk.
Sulphur dioxide (SO2)	A gas that causes acid rain. Burning fossil fuels, such as coal, releases SO2 into the atmosphere.
Sustainability	The notion that societies can plan and organise their economic, political and social activities in a manner that will meet their needs and express their greatest potential in the present, while preserving ecosystems, biodiversity and natural resources for future generations.
Sustainable reconstruction	Reconstruction activities that are guided in their planning, design and implementation by the goal of sustainability.
Users	The beneficiaries and residents of reconstructed housing.
Waste management	Strategies and systems for collecting, transporting, processing (waste treatment), recycling or disposing of waste materials.

1 INTRODUCTION

1.1 About this manual

In post-disaster settings such as those found in the aftermath of the Tsunami, the urgency and scale of the need for shelter poses a tremendous challenge. This manual provides guidance regarding key aspects of sustainable reconstruction.

The manual's main objective is to help improve the design and reconstruction of houses after the Tsunami and, in so doing, to minimise the negative impacts of poorly constructed houses on the environment. The aim is to raise awareness of sustainable reconstruction and to encourage project managers as well as planners to adapt this approach wherever possible in their projects. The manual serves as a reference. While the manual is intended to be as comprehensive as possible, it cannot be considered complete and does not represent a scientific study of sustainable reconstruction practices. Nor, on the other hand, does it provide ready-made solutions for construction projects, each of which differ according to locations, budgets and other conditions.

Although the focus of this manual is on housing, the reader will likely find some of the information applicable to other types of buildings (schools, health facilities, etc.).

The manual concentrates on the *physical* aspects of reconstruction, which provide the basis for, and go hand in hand with, community rehabilitation and the rebuilding of livelihoods. The manual will not go into the details of community rehabilitation and livelihood rebuilding.

1.2 Target group

The manual has been designed for the benefit of international

This manual was designed to assist such on-site personnel in their efforts to meet the many challenges that arise in reconstruction projects.

1.3 How to use the manual

Key challenges that face those reconstructing houses include choosing and obtaining building materials and technologies, achieving cost-effectiveness and affordability, gaining access to information, using environmentally sound and energy efficient building practices, and winning institutional and community acceptance. The manual, therefore, addresses the following aspects of sustainable reconstruction:

Technical:
Practical, robust and technically feasible solutions.

Economic:
Cost-effective solutions.

Environmental:
Environmental impacts (positive as well as negative), disaster risks and vulnerability, etc.

Institutional:
Laws and regulations and their enforcement, relevant institutions.

Social:
Health and safety issues, user-friendliness, adaptability to the users' needs and living conditions, acceptance by users, etc.

The manual should be used as a flexible tool. Regardless of the stage of a project, a project manager can consult the