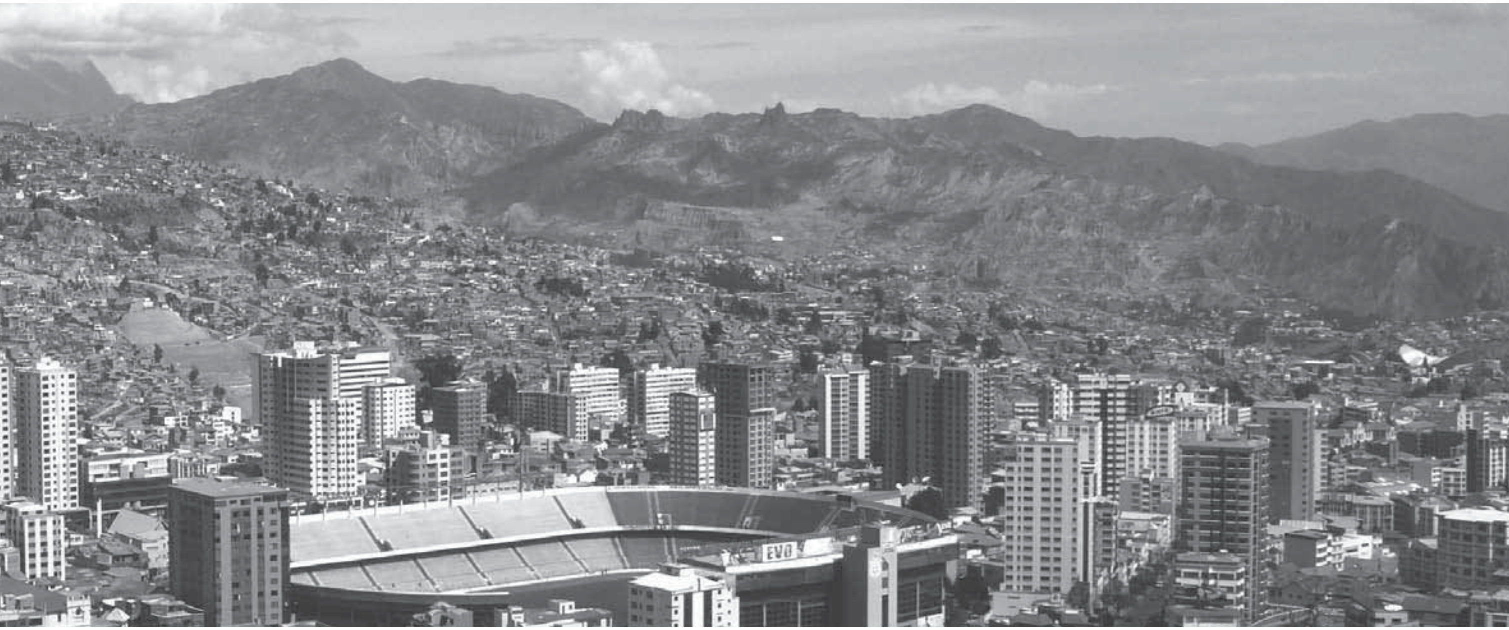

Sustainable Reconstruction in Urban Areas

A Handbook

International Federation
of Red Cross and Red Crescent Societies

skat_ Swiss Resource Centre and
Consultancies for Development

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Preface

The increasing debate on urban reconstruction along with a number of recent publications on urban vulnerability highlights the importance of improving the understanding within humanitarian organisations in responding to urban disasters.

This evolving issue has prompted encouraging developments: the use of more creative approaches to post-disaster housing such as the provision of direct financial aid and host families' support means that international organisations are moving away from the traditional emergency solutions such as tents and tarpaulins, which rarely meet the variety of sheltering needs in urban areas.

However, finding housing solutions in emergencies in big cities remains extremely complex. Humanitarian and development workers are facing unprecedented challenges in cities like Port-au-Prince, in Rio's landslide-vulnerable favelas or in Asian cities like Padang.

What we have recently witnessed is that even the cities of the richest nations cannot consider themselves to be safe: the earthquake and subsequent tsunami in Japan struck an urbanised coast with one of the most advanced levels of disaster preparedness in the world, with norms to regulate construction and structures in place to mitigate the effects of sudden disasters.

Over and above the radically different resources and capacities that these countries possess, the reality is that urban density in multi-risk contexts generates enormous shelter and reconstruction challenges – how can the required range of housing solutions be provided in a very short space of time, across an entire city, when the areas affected are full of debris or have been made inaccessible? How can temporary solutions to house displaced populations in the early period after a disaster be turned into more durable homes? How can housing policies be influenced from the onset to promote equitable reconstruction when the administrative bodies involved are extremely weak or disempowered? How can work be carried out in dense neighbourhoods where there is a mixture of single and multi-storeyed houses both damaged

An urban neighbourhood in Port-au-Prince, Haiti
Daniel Wyss (Skat)

and destroyed, residential and commercial usage often in the same structure, with a variety of forms of tenure, and building codes and regulations geared to incremental construction over time rather than rapid reconstruction at scale?

Recurrent dilemmas such as the loss of lives and expertise, disruption of supply chains, the urgent need to identify provisional locations to relocate displaced people, and political and legal constraints on land and tenure are among the many issues to consider.

There is not one answer, but making the most of urban opportunities, such as access to established construction industries and the private sector, utilising new technologies, harnessing innovation and enterprise, can inform a given response to meeting post-disaster housing and reconstruction needs.

This handbook on 'Sustainable reconstruction in urban areas' seeks to unpack the problems that many organisations are confronted with, while providing step-by-step guidance on how to design and implement housing reconstruction programmes in cities.

As the result of collaboration between the International Federation of the Red Cross and Red Crescent and Skat – Swiss Resource Centre and Consultancies for Development, this handbook describes the specific dimensions of reconstruction and rehousing strategies, providing context-based options that have proven successful in recent disasters. It does not aim to be exhaustive, but rather to inform programme decision-makers and implementers on emerging practices.

Many of the lessons which have been learned – in terms of building partnerships to prepare for disasters and working within the framework of more complex legal and administrative procedures – can help to address these recurring challenges.

This publication sets a milestone in this direction.

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Acronyms and abbreviations

ACF	Action Contre la Faim
ACM	Asbestos-containing materials
ALNAP	Active Learning Network for Accountability and Performance in Humanitarian Action
BRC	British Red Cross
CAP	Community Action Planning
CAP	Common alerting protocol (chapter 2.4.4)
CBO	Community-based organisation
CCR	Competence Centre for Reconstruction
CDR	Community-driven reconstruction
CFS	Cold-formed steel
CFW	Cash for work
CHF	CHF International
CNIGS	Centre National d'Information Géo-Spatial
DAC	Development Assistance Committee
DM	Disaster Management
DRR	Disaster risk reduction
EC	European Commission
EIA	Environmental Impact Assessment
EMMA	Emergency Market Mapping and Analysis Toolkit
ENA	Environmental Needs Assessment
ENAT	Environmental Needs Assessment Team
ENDA	Environmental development action in the Third World (Environnement et développement du tiers monde)
ESR	Environmental Stewardship Review
ETHZ	Eidgenössische Technische Hochschule Zürich
FEAT	Flash Environmental Assessment Tool
FRC	French Red Cross
GCI	Galvanised corrugated iron
GEO-CAN	Global Earth Observation – Catastrophe Assessment Network
GFDRR	Global Facility for Disaster Reduction and Recovery
GIS	Geographic information system
GPS	Global positioning system
HLP	Housing, land and property
IASC	Inter-agency standing committee
ICRC	International Committee of the Red Cross
IDP	Internally displaced person
IFRC	International Federation of Red Cross and Red Crescent Societies
IHRC	Interim Haiti Recovery Commission
ILO	International Labour Organization
ITDG	Intermediate Technology Development Group (now: Practical Action), UK-based NGO
JMP	Joint monitoring programme

JRC	Joint Research Centre
LENSS	Local emergency needs for shelter and settlement
LIDAR	Light detection and ranging
LIS	Land information system
LPG	Liquefied petroleum gas
M&E	Monitoring and evaluation
MTPTC	Ministère des Travaux Publics, Transports et Communications (Haiti)
MoU	Memorandum of understanding
NASA	National Aeronautics and Space Administration
NGO	Non-governmental organisation
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
ODR	Owner-driven reconstruction
OECD	Organisation for Economic Co-operation and Development
OSM	OpenStreetMap
PASSA	Participatory Approach to Safe Shelter Awareness
PHAST	Participatory Hygiene and Sanitation Transformation
PV	Photovoltaic
RCRC	Red Cross and Red Crescent
REA	Rapid Environmental Impact Assessment
RSS	Really Simple Syndication
SIM	Subscriber Identity Module
Skat	Swiss Resource Centre and Consultancies for Development
SMS	Short message service
SWM	Solid waste management
SWOT	Strengths, weaknesses/limitations, opportunities and threats
T Shelter	Temporary/transitional shelter
TWIG	Technical Working Group
UDDT	Urine-diverting dehydration toilet
UN	United Nations
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UN-HABITAT	The United Nations Human Settlements Programme
UNICEF	United Nations International Children's Emergency Fund
UNITAR	United Nations Institute for Training and Research
UNOCHA	United Nations Office for the Coordination of Humanitarian Affairs
UNOSAT	Operational Satellite Applications Programme
US	United States (of America)
USAID	United States Agency for International Development
VCA	Vulnerability and capacity assessment
VIP	Ventilated improved pit
WASH	Water supply, sanitation and hygiene promotion
WATSAN	Water supply and environmental sanitation
WEDC	Water, Engineering and Development Centre
WHO	World Health Organization
WS&S	Water supply and sanitation

Glossary

Apartment owner-occupant	Occupant who owns his/her apartment. Ownership may be formal or informal.
Apartment tenant	Occupant who rents the apartment, formally or informally.
Black water	Heavily contaminated wastewater, e.g., toilet wastewater. Black water is also known as 'brown water'; it 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.
Building code	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.
Capacity	The combination of all the strengths, attributes and resources available within a community, society or organisation that can be used to achieve agreed goals.
Capacity development	Process by which people, organisations and society systematically stimulate and develop their capacities over time to achieve social and economic goals, including through improvement of knowledge, skills, systems and institutions.
Climate change	The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods".
Collective centres	Transitional facilities housed in pre-existing structures (i.e., schools, community centres, etc.).
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 and access to information, as well as providing less tangible forms of support, such as counselling and groups for awareness-building.
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.
Coping capacity	Ability of people, organisations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters.
Disaster	A serious disruption of the functioning of a community or a society, causing widespread human, material, economic or environmental losses and impacts which exceed the ability of the affected community or society to cope using its own resources.
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	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	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.
Disaster risk management	Systematic process of using administrative directives, organisations, and operational skills and capacities to implement strategies, policies and improved coping capacities in order to lessen the adverse impacts of hazards and the possibility of disaster.
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.
Early-warning system	The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organisations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss.
Embodied energy	Quantity of energy required to acquire primary material, manufacture, handle and transport to the point of use, a product, material or service.
Environmental degradation	Reduction of the capacity of the environment to meet social and ecological objectives and needs.
Environmental Impact Assessment (EIA)	Process by which the environmental consequences of a proposed project or programme are evaluated and 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.
Exposure	People, property, systems or other elements present in hazard zones that are thereby subject to potential losses.
GIS	A computer system capable of assembling, storing, manipulating and displaying geographically referenced information, i.e., data identified according to their locations. GIS may refer to hardware and software, or include data.
Grey water	Wastewater that is generated from processes such as washing dishes, laundry and bathing.

Hazard	A dangerous phenomenon, substance, human activity or condition 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. A natural hazard is a 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.
House owner-occupant	Occupant who owns his/her house and land, or is part-owner, such as when repaying a mortgage or a loan. Ownership may be formal or informal.
House tenant	Occupant who rents the house and land, formally or informally.
Informal landholders	People who occupy or use land without formal recognition or protection from the law. They are often recognised by customary law or local practices.
Land-use planning	The process undertaken by public authorities to identify, evaluate and decide on different options for the use of land, including consideration of long-term economic, social and environmental objectives and the implications for different communities and interest groups, and the subsequent formulation and promulgation of plans that describe the permitted or acceptable uses.
Land tenant	Occupant who owns the house and rents the land, formally or informally.
Lease	Agreement between a landowner and a tenant. Usually, a landowner grants a tenant limited possession and use of land for a fixed period of time in exchange for the payment of rent.
Livelihoods rebuilding	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).
Mitigation	The lessening or limitation of the adverse impacts of hazards and related disasters.
National platform for disaster risk reduction	Generic term for national mechanisms for coordination and policy guidance on disaster risk reduction that are multi-sectoral and inter-disciplinary in nature, with public, private and civil society participation involving all concerned entities within a country.
Occupancy with no legal status (squatter)	Occupant occupies land or property without the explicit permission of the owner.
Photovoltaic (PV) cell	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.
Preparedness	The knowledge and capacities developed by governments, professional response and recovery organisations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.
Prevention	The outright avoidance of adverse impacts of hazards and related disasters. For example, disaster prevention expresses the concept and intention to completely avoid potential adverse impacts through action taken in advance.
Quarry	A site from which rocks, gravel, sand or clay is extracted in substantial quantities.

Recovery	The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors.
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 which capture their energy from natural energy sources, such as sunlight, wind, 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 be used only one time).
Resilience	Ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.
Response	Provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected. Disaster response is predominantly focused on immediate and short-term needs and is sometimes called 'disaster relief'.
Retrofitting	Reinforcement or upgrading of existing structures to become more resistant and resilient to the damaging effects of hazards.
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.
Risk	The combination of the probability of an event and its negative consequences.
Risk assessment	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.
Risk management	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.
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.
Urban self-settlement	Settlement in an urban area, occupying available public or private property or land.
Users	The beneficiaries and residents of reconstructed housing.
Vulnerability	The characteristics and circumstances of a community, system or asset that make it subject to the damaging effects of a hazard.
Waste management	Strategies and systems for collecting, transporting, processing (waste treatment), recycling or disposing of waste materials.

Introduction

More frequently, towns and urban agglomerations are affected by natural disasters. Large cities and mega-cities concentrate and magnify risk, but smaller cities also suffer from exposure to multiple risks.[1] A recent example of the catastrophic effect on a city is that of Port-au-Prince in Haiti, where huge areas had been destroyed by a 7.0 magnitude earthquake in January 2010 – resulting in the deaths of at least 150,000 people, and making 1.5 million people homeless.[2] Another example is the complex emergency that affected Japan, in early 2011, showing that even well-prepared nations with densely populated urban and peri-urban areas can be vulnerable to disasters.

Therefore, involvement in reconstruction and rehabilitation efforts in urban and peri-urban areas has become increasingly significant. Field-focused guidance for practitioners and decision-makers on key issues to inform current transitional shelter programming and the initiation of reconstruction and repair programmes in the urban context is crucial to ensure a sustainable recovery. There are various reconstruction manuals available – yet most of them focus only on rural areas. Consequently, Swiss Resource Centre and Consultancies for Development (Skat) and the International Federation of the Red Cross and Red Crescent (IFRC) have compiled these guidelines with a focus on the urban context.

In referring to these guidelines, the user will receive an overview of the issues and steps involved when undertaking sustainable reconstruction programmes following a natural disaster.

Earthquake damage in Bhuj, India (2001)
Denis McClean (IFRC)

Earthquake damage in Haiti (2010)
Eric Quintero (IFRC)

1 The World Bank, 2011, GFDRR – Global Facility for Disaster Reduction and Recovery, and UNISDR – United Nations International Strategy for Disaster Reduction

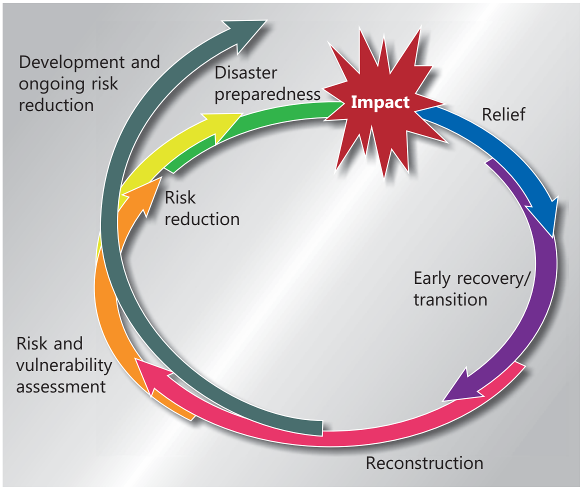
2 OECD, 2010, Promoting Haiti's Reconstruction: Service Delivery Guidance, Partnership for Democratic Governance

What is the scope of the handbook?

The handbook is focused on the **reconstruction phase**, in particular on **permanent housing**, not on transitional shelter. It also incorporates risk-reduction measures within reconstruction methodology in order to prepare for any future disaster. The handbook concentrates, primarily, on the transfer of emergency shelter to more permanent housing solutions following a disaster. It gives specific direction in how to overcome the complexity and challenges of reconstruction by ensuring that safe and sustainable approaches are taken within urban areas.

This handbook does not cover every activity to be performed throughout the programme cycle. It is for use as a reference point only for reconstruction programmes; it enables the user to understand and engage in the main issues that make up a sustainable reconstruction programme.

The handbook is not only relevant to the most recent Haiti emergency, but refers generically to similar post-disaster situations in less-developed countries in Latin America, Southern and Central Asia, and Africa.



The handbook concentrates on the reconstruction phase.[3]

The objectives of the handbook are to:

- provide technical information on the sustainable neighbourhoods and integrated settlement approaches, including construction materials and technologies, energy efficiency and ecological aspects, alternative water supply and sanitation systems, solid waste, and environmentally friendly site management in high-risk and poor-income areas
- offer guidance on the reuse and recycling of temporary shelters, and on the transfer from transitional shelter to permanent housing; it includes orientation on damage assessments, debris reuse and controlled demolition
- provide a selection of successful post-disaster reconstruction examples[4] implemented in cities with recommendations for better disaster preparedness
- present practical checklists and references to assist practitioners, field workers and other stakeholders in making their choices.

Who is the handbook for?

This handbook is mainly for field practitioners who are planning and implementing housing-reconstruction programmes in urban areas. This includes members of reconstruction operations such as programme managers, and housing and construction delegates. The guidelines have

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3 Adapted from: University of Westminster, 2009

4 The listed case studies in this handbook are not intended to be used as fully resolved solutions for direct application. They function rather as experiences to generate ideas and to provide a certain inspiration and, where appropriate, to adapt and to apply to the given context. Socio-economic conditions, cultural norms, gender, etc. together with many other factors may influence the process and success of any intervention in urban reconstruction.

been designed also for use by government institutions as well as local authorities engaged in reconstruction activities.

A building cannot be built without fundamental knowledge of construction materials and technologies. Therefore, reconstruction implementers should, as far as possible, engage qualified personnel such as project supervisors, planners, architects and engineers. They should not only have technical and organisational capacities, but also have experience in managing teams and demonstrate good interpersonal skills. Successful reconstruction projects are typically managed by implementers who are highly committed and motivated team leaders.

Lastly, reconstruction and recovery programme managers, and their technical staff, should consistently encourage participatory methods, which foster social cohesion and build on local knowledge and capacities.

How should it be used?

In line with best practices, every effort should be made so that the host country's government undertakes the rehabilitation and reconstruction of large-scale housing and infrastructure projects. However, if the host country's government does not have the capacity to do so, due to the impact of the disaster, other actors, including Red Cross Red Crescent (RCRC), may decide to intervene to take on the work and/or provide assistance through direct implementation.

This handbook has been designed to be used as a 'hands-on' resource to facilitate National Society staff and IFRC staff through the process and issues that need to be kept in mind while planning and implementing sustainable reconstruction projects. It is not by any means an exhaustive guide, but aims to provide insight into the sequences and processes that will need to be implemented throughout a reconstruction programme. Case studies highlighting good-practice examples are used throughout the document.

What does it include?

This guide does not repeat technical advice available in other sectoral manuals but refers readers to these manuals and other useful reading material as and where appropriate.

The overview provides background on why the urban context is significant relative to trends in urbanisation and how and why these, often unmanaged, processes impact on populations once disaster strikes. The overview includes:

> **Significance of the urban context**: Considers why the focus is on the urban.
>
> **Urban risk**: Highlights the risks associated with urban areas and the challenges as well as opportunities that urban contexts present in times of disaster.
>
> **Sustainable reconstruction**: Defines the principles and elements required to achieve a sustainable recovery.

Needs assessments and analysis (chapter 1) elaborates on processes available for assessment of communities, damage, land, environment and institutions with further reference to other assessment tools from alternative documents.

Methodological approach (chapter 2) highlights various approaches available for interim and permanent solutions as well as outlining the uses for cash programmes and available participatory methods for working with communities.

Who is involved? (chapter 3) outlines specific professionals and their roles within a reconstruction programme as well as the institutions that professionals and implementing organisations will need to work with in delivering the rehabilitation programme.

Preparation (chapter 4) covers an introduction to processes for community engagement, the basics of reconstruction programme planning as well as land surveying and site selection.

Planning and design process (chapter 5) provides insight into settlement planning in terms of technical, social, environmental and regulatory considerations with further advice on housing design and building form under the same subject headings.

Infrastructure (chapter 6) provides information on the basics of provision for water, sanitation and drainage, as well as planning for roads, solid waste management and other infrastructure services.

Implementation (chapter 7) provides an overview of the phases and elements used within construction programmes.

Monitoring and risk reduction (chapter 8) encompasses issues of quality throughout the construction process, maintenance and guidelines on how to incorporate risk-reduction measures at a community level.

Overview

Why focus on the urban context?

The handbook's overall focus is on the urban context, which covers neighbourhoods in peri-urban as well as urban areas. Peri-urban refers to the urban fringe and is located between the suburbs of the city and its surrounding countryside.

The World Disaster Report (2010)[5] stresses the significance of urban risks:

"Far more attention needs to be given to urban risk in a world which is urbanising rapidly and where, for the first time, over half the world's population lives in cities and towns. More than one billion people today live in appalling conditions in urban areas and their numbers are growing."

An urban neighbourhood in La Paz, Bolivia
Daniel Wyss (Skat)

5 IFRC – International Federation of Red Cross and Red Crescent Societies, 2010, World Disasters Report 2010 – Focus on urban risk

Most of these densely populated and poorly developed city areas are exposed to hazards. In particular, these populations are vulnerable to earthquakes, cyclones and floods, among others. Recent examples of cities that have been severely affected by natural disasters are: Port-au-Prince, Haiti (earthquake in 2010); Bam, Iran (earthquake in 2003); and Rio de Janeiro, Brazil (landslides due to heavy rainfalls in 2010).

Cities as a whole, with their high concentration of people, buildings, infrastructure and economies, are places of small and large-scale disasters when situated in risk areas of the world. In particular, urban areas in low-income countries face very high levels of risk due to inadequate infrastructure, the low quality of housing construction and the failures of local government. The poor in urban environments often have the most to lose when disaster strikes.

Low-quality, insecure, hazardous and overcrowded urban housing construction located on dangerous sites such as flood plains, steep slopes and unstable ground is a major challenge. Inadequate provision of urban infrastructure and services such as piped water and sanitation, lack of drainage, poor-quality roads and electricity, etc. present a further difficulty. Lastly, poor urban populations lack influence over local government, especially when formulating their responses in recovery and post-disaster reconstruction.

IFRC's one-year progress report of the Haiti Earthquake Operation (2011) summarises the problem as:

"Take an urban setting in one of the world's poorest countries, add a couple of million people packed tightly together in poorly constructed dwellings built on steep or otherwise hazardous sites, omit enforced building codes, construction quality inspections, adequate urban planning, sewerage systems and municipal solid waste management and shake hard."

Urban risks

Urban areas are often risk-prone places in which to live and work. This is particularly the case in cities where many low-income populations live on hazard-prone sites (i.e., steep slopes) because alternative safer land is not available to them. They often lack financial means to take measures that can reduce the risks they face.

Urban risks are often attributed to[6]:

- cities developing or expanding onto sites at risk from floods, landslides or earthquakes (usually particular population groups, rather than the whole city, are at risk)
- settlement patterns and buildings that increase scales and levels of risk from floods, landslides, earthquakes, fires, transport accidents or industrial accidents (particular groups are at risk)
- the role of 'under-resourced' local governments in causing or exacerbating risks from floods, landslides, earthquakes, fires, transport accidents and industrial accidents through, for instance, non-conformance to national or local building codes (or lack of codes)
- changes in the outlying regions around cities that can cause or exacerbate risks from floods (e.g., poor watershed management – often a problem for municipal governments when the watershed lies outside their jurisdiction).

6 Adapted from: AURAN, 2007

Severe damages after the Haiti earthquake (2010)
Marco Kokic (ICRC)

A further significant issue is that of land and shelter. As highlighted in Haiti, but evident in many disasters, the lack of temporary procedures, mechanisms or recognised best practice to enable the short-term or interim use of land or property for the temporary settling of displaced households is a major impediment to providing adequate housing and settlement solutions. Lack of tenure, inadequate land register (cadastral) systems, and inequity in the recognition of property rights, for example, are systemic issues that require solutions. However, after a disaster, these issues are often not adequately addressed to enable immediate housing and settlement needs to be met.

Conditions that influence the reconstruction process in urban areas present both opportunities as well as challenges[7]:

Opportunities

- Private sector capacity, financial as well as operational, is greater in urban areas, especially in the construction sector.
- There is often capacity in public sector organisations, including those responsible for disaster management, but they often lack experience in coordination between ministries.
- There is the potential for disaster-risk-reduction (DRR) measures to be based in planning and other regulatory frameworks.

7 Adapted from: Abhas, K. J., 2009

- Higher literacy levels in urban areas may translate into greater efficacy of communication initiatives undertaken by the recovery and reconstruction agencies.
- There is potential for private sector investments to support the reconstruction objective.
- There are economic and social interests and political organisations and relationships between them.

Challenges

- Land is scarce and therefore commands higher values.
- Ownership and titling issues may require legal procedures in order to be resolved.
- There is increased incidence of informal housing located in high-risk areas.
- Risks of environmental degradation are higher, and greater planning effort is required to adequately address them.
- Housing reconstruction efforts are often more difficult as well as more costly.
- Social structures are more complex and are likely to give rise to conflicts and to complicate participation in reconstruction planning.
- Rubble removal and adequate disposal is more difficult due to lack of space.

Informal housing in an urban area

- Economic impacts from the urban disaster are more likely to affect the rest of the country.
- Damage to infrastructure and service-delivery networks is greater in urban areas and presents additional financial assistance requirements as well as longer programme-completion time lines.

Principles of sustainable reconstruction in the urban context

"Meeting the needs of the present generation without compromising the ability of future generations to meet their own needs" (Brundtland Commission in 1987) requires balancing the interests of environment, social equity and the economy. Therefore, sustainable reconstruction has to be seen as an integrated approach. Environmental, technical, economic, social and institutional concerns are considered in each stage and for each activity of reconstruction to ensure the best long-term result, not only in terms of house design and construction activities, but also in the provision of related urban infrastructure such as roads, water supply and sanitation systems.

Integrated approaches also should include social structures, and consider livelihoods opportunities and protection/safety issues.

There are at least five key principles behind sustainable urban housing[8]:

- **Technical sustainability**: The requisite skills can be introduced and passed on to others, and the necessary tools are accessible to the affected population.
- **Institutional sustainability**: There is a structure to bring together the different stakeholders without, for example, needing to call on outside expertise on each occasion.
- **Social sustainability**: The overall process and product fits within and satisfies the needs of the society.
- **Environmental sustainability**: The chosen approach avoids depleting natural resources and contaminating the environment.
- **Economic sustainability**: Money or service exchange can be accessed to pay for the work that needs to be done.

8 John Norton in IRP – International Recovery Platform/UNDP – United Nations Development Programme, India, 2010

Further details on the above subheadings are described in the following list:

Technical

- resistance of housing construction to withstand a natural hazard
- practical, technically simple and feasible solutions
- field-tested construction technologies for urban areas (including apartment blocks and multi-storey buildings)
- safety of housing design
- housing design and construction materials that are viable for the local climate (e.g., use of natural lighting and cooling systems)
- compliance with building codes
- awareness about safe building standards and quality of construction

Institutional

- strong planning and executive capacities of local governments
- urban governance
- clear land ownership and secure tenure
- reliable local authorities with capacity to issue building permits and planning permissions
- comprehensive building codes and their enforcement
- effective cooperation between communities, local governments and private sector
- spatial planning – access, density, public services, market places, etc.

Social

- housing design that is adaptable to the users' needs and living conditions
- different members of the community, i.e., women, girls, men, boys, elderly and disabled, providing feedback on the design
- social and cultural relevance of housing design, community planning and capacity-building of urban neighbourhoods
- vocational training

Environmental

- environmental characteristics of construction material: safe, durable and not from sources that are overexploited or threatened (e.g., unsustainably harvested wood)
- low generation of waste during production and construction
- high potential for waste reuse or recycling of material
- sustainable energy supply, if possible, making use of renewable energy sources

Economic

- economic feasibility (building costs and overall affordability)
- low-cost building design
- positive effect on local economy: community involvement in production and construction
- support and strengthening of local skills
- enterprise development
- employment opportunities
- home-based income generation as part of employment (creation) opportunities

A holistic urban reconstruction intervention should follow the principles of sustainable recovery as set out below[9]:

Permanence: The affected population is able to return to, or otherwise secure, permanent housing. Housing support needs to be equitable between the needs of renters and landlords.

Disaster risk reduction: Housing units that are repaired or replaced adequately account for future hazard risk in design, construction and materials. Local know-how and methods of organisation, adaptation and housing protection strategies need to be identified and incorporated into the programmes.

Viability: The housing solution is one that ensures access to appropriate services required by residents to lead a practical and practicable living (e.g., access to livelihoods; availability of food and water; access to markets, utilities, and transportation; access to religion and religious facilities; existence of a community).

Independence: The affected population is able to achieve self-reliance.

Cultural sensitivity: The projects are developed in line with the cultural practices and traditional values of the affected communities.

Community input and acceptance: The wishes of the affected population are heard, understood, respected and incorporated. Affected populations need to be at the centre of the needs assessment and the evaluation of local capacities: adopt community-driven approaches, strengthen social ties that enable a return of individual dignity.

Gender sensitive and socially inclusive: The projects take the needs of women, girls, men and boys, and elderly and disabled people into consideration.

Environmentally friendly housing: If the project can have adverse effects on the environment, a plan is in place to address the negative environmental impact.

Cost-effectiveness: Housing solutions do not put governments, communities or individual residents in crippling financial circumstances. Cost-effectiveness needs are considered not only for eventual maintenance but also when developing the project.

9 Adapted from: IRP – International Recovery Platform/UNDP – United Nations Development Programme India, 2010

Progressive: Ongoing, long-term development progress is maintained and continuing community goals are not sacrificed for short-term individual benefits. The urban fabric needs to be carefully analysed and spatial planning considerations tailored to reinforce strengths and address pre-existing gaps. Density issues of informal/slum areas should be recognised and subsequently higher construction densities (and lower minimum space standards) are accepted.

Further to the above, the following leading principles of urban reconstruction are recommended[10]:

- The housing programme should support the objectives established for the reconstruction programme in its reconstruction policy.
- Each disaster will require its own housing approach. There is no 'one size fits all' recipe.
- Decisions regarding eligibility criteria and housing assistance must be objectively adopted and transparently made.
- Any post-disaster housing policy must consider the situation of the affected populations that fall under all categories of housing tenancy, including squatters and renters, although all members of all categories may not receive assistance.
- Assistance needs to be tailored to different levels of damage and, where possible, actions must be avoided that could lead to beneficiaries having false expectations that assistance will be provided. This could, in turn, lead to negative publicity for the implementing organisation.

10 Adapted from: Abhas, K. J., 2009

Reconstruction and sustainable urban development[11]

Emergency and sustainability

Damages to and the destruction of urban areas caused by natural disasters or civil unrest need immediate reconstruction in order to restore people's livelihoods and provide them with housing. Reconstruction should focus on basic urban services such as housing, traffic infrastructure, technical supply, commercial, social and administrative facilities. These services, however, do not only cover urgent needs of the affected inhabitants, but they also give significant direction for long-term urban developments. Once the foundations for residential, economic and other urban activities are constructed, they trigger long-term and often irreversible urban development. If these long-term effects of emergency reconstruction are not taken into consideration from the very beginning, the resulting construction can result in dysfunctional urban spaces.

11 A contribution by Tim Rieniets, ETHZ, on the importance of the urban neighbourhood's capacity to adapt to changes – Planners and decision makers need to consider issues of flexibility from the beginning right after the disaster.

In the past, many reconstruction programmes have failed because of their short-sightedness or cultural inappropriateness and, as a result, either they are discredited or the inhabitants are accused of misuse. Therefore, sustainable urban reconstruction needs to consider at least two planning horizons: firstly, the immediate assistance for people in need and, secondly, the long-term development of the city.

Local expertise

The needs for short-term urban reconstruction caused by catastrophes or civil unrest are self-evident and can be easily assessed. The needs for long-term sustainable developments, however, can be estimated only on the basis of empirical knowledge, prognoses and scenario techniques.

For this purpose, in-depth knowledge of the local political, social and cultural conditions is needed: What are the long-term needs and requirements of the population? Which stakeholders are involved in urban decision-making processes (e.g., local authorities, clan chiefs, landlords, affected population, etc.)? Which economic and social structures of everyday urban life have to be considered (e.g., gender issues, interrelation of work and life)? Which traditions, norms and values have to be respected?

Urban reconstruction can lead to a sustainable development only if these local conditions are taken into consideration. Therefore, appropriate knowledge should be integrated into the design process from the very beginning. Since the collection of such knowledge is time-consuming, it should be collected in advance and included in a pre-existing contingency plan.

Framework and infill

Long-term developments of cities are hardly predictable. The future of a city cannot be foreseen especially following the far-reaching consequences of disasters. Even if prognoses, scenarios and empirical knowledge are conducted as suggested above, the future cannot be predicted flawlessly. How it is then possible to design urban reconstruction projects in order to allow for sustainable long-term developments? To provide the best conditions for future urban development and to minimise the risk of failure, it is suggested that the design of urban reconstruction projects is divided into two separate yet interrelated categories:

Framework: This includes all projects of primary importance that have to be realised at all events in order to serve common needs (e.g., main traffic infrastructure, commercial, social and administrative infrastructures of major importance, main technical supplies, etc.). These projects have to be built first and in accordance with appropriate standards as well as building codes.

Infill: This includes all other projects of secondary importance (e.g., secondary infrastructure, secondary technical supplies, etc.). These projects can be built time after time and according to local possibilities and needs. They are flexible and can adapt to unforeseen developments. Also, if in accordance with legal and cultural conditions, they may be built by users as self-help projects.

1. Needs assessment and analysis

The needs assessment and analysis phase of an urban reconstruction intervention is crucial and forms the basis of the entire reconstruction programme.

1.1 General

The following assessments are recommended for consideration in urban environments. They are intended to give a detailed overview of the situation on the ground in order to be able to plan and implement a reconstruction programme utilising all sustainable resources and capabilities available to the community. Vital for any programme is the ability to identify the affected population (in particular, the most vulnerable). It is recommended that all assessments are carried out utilising a gender lens, thus ensuring a better understanding of the needs of the affected population. Recognising the physical, social, economic and environmental constraints of the situation will assist in identifying the most appropriate methodological approach for reconstruction[12]:

- **Household survey**: to assess the level of damage to the buildings, the type of buildings that existed before the disaster, land ownership, income, livelihoods, infrastructure preferences, family sizes, gender issues, etc.
- **Baseline survey**: to assess the conditions before any reconstruction activity begins to define the pre-operation situation to develop indicators that will be used to assess achievement of the outcomes and impact expressed in the programme's design
- **Stakeholder analysis**: to, at least, make a list of the relevant stakeholders and their priorities
- **Damage assessment**: assessment of public buildings and facilities (local authorities, churches, schools, clinics, market places); assessment of infrastructure – provision of water, sanitation, electricity, etc.
- **Analysis of available local construction materials**, including their quality, supply chains, advantages, disadvantages, etc.
- **Map of seasonal variations** on availability of materials and labour
- **Analysis of local building practices**, including their quality, advantages, disadvantages, etc.
- **Assessment of locally available skills and capacities** for reconstruction
- **Livelihoods analysis**: to assess major occupation sectors, income generation opportunities, etc.
- **Vulnerability and capacity assessment** (VCA) of the community
- **PASSA** Participatory Approach for Safe Shelter Awareness
- **Assessment of potential constraints** on scheduling of reconstruction measurements during seasons and festivals.

12 Adapted from: RedR in Oxfam, 2008

1.2 Community assessment

Community assessments are essential for the reconstruction and entire development process. The benefits include field verification of satellite mapping, gaining knowledge about the community that has been affected and identifying community resources and skills that can be integrated into the reconstruction process.

Community assessment assumes that communities understand their own exposure to disaster risk.

Everybody has the right to an assessment of his/her house for safety and equality reasons! To meet this requirement, one needs to organise efficient management structures to handle a large workload of assessments.

The following key questions can help in community assessments[13]:

- Why were people vulnerable to the hazard that occurred?
- Did vulnerabilities differ amongst various groups of people (e.g., it is important to think about: girls and boys, especially in contexts where there are child-headed households; women, girls, men and boys; owners/tenants; landowners/landless people; able/disabled)?
- Has the disaster further worsened the pre-disaster vulnerabilities?
- Who are the individuals or groups of people that are particularly at risk and will thus need special attention in reconstruction?
- What is the probability of disasters happening in this area? Does it have particular geographic features that make it vulnerable?
- Are there any other risks besides those directly related to a disaster?
- What are the local capabilities, amongst residents, local authorities, professionals as well as construction workers and contractors, to build in a disaster-resistant manner?
- Are the required resources for reconstruction – human resources with the right skills and materials – available?
- How is power used in the community and how power might be used or abused to create vulnerable groups of people or control resources.

Community gathering
Agostino Pacciani (IFRC)

13 Adapted from: IFRC – International Federation of Red Cross and Red Crescent Societies/Practical Action, 2010, Tool 3

Vulnerable groups should always be included in the community-assessment process. Vulnerable groups consist of displaced people, women, girls, men and boys, the elderly, the disabled, orphans and any group exposed to potential discrimination. Vulnerable groups may require that particular steps be taken in reconstruction. Good practices include[14]:

- actively involving vulnerable group members in assessment and in all stages of decision-making
- obtaining information about the needs of the affected group from both men and women
- collecting data disaggregated by sex, age, health status, economic status, etc., and then using the disaggregated data in both programme planning and monitoring
- paying special attention in assessments to groups that experience social exclusion (such as the handicapped, widows and female heads of household)
- assessing disaster impact on the informal social protection systems on which vulnerable groups depend.

1.3 Damage assessment

A damage assessment is an assessment of the total or partial destruction of physical assets, both physical units and reconstruction costs. One of the objectives of structural damage assessments is to analyse why some buildings were badly damaged and others less so.

A professional team of engineers and architects with experience in urban reconstruction together with representatives/technical personnel from local authorities should carry out the damage assessment to ensure a certain quality of the results of the assessment.

The following are key questions that should be asked during damage assessments:

- What made people's housing vulnerable to the hazard?
- Which construction technologies were used mostly and what were their strengths and weaknesses?
- What aspects influenced disaster resistance with particular technologies?

An inherent aspect of urban areas relates to the complexities of multi-storey buildings. Damage assessments of these constructions, especially if built in reinforced concrete, often require sophisticated expertise and costly testing of load bearing structures. The results of individual building assessments should also consider the adjacent properties which put the assessed property at risk.

Urban housing damages are categorised according to the anticipated level of effort required to return the residents to their home. These categories usually encompass the following descriptions[15]:

- **Affected**: Structure is inhabitable with no additional risk to the resident. Often following earthquakes, it is common to see residents in the affected area whose structures received no damage whatsoever, but who are otherwise too scared to return because they are unable

14 Adapted from: Abhas, K. J., 2009

15 Adapted from: Abhas, K. J., 2009

to assess the safety of their homes. Their homes may even have suffered some cosmetic damage but are nonetheless safe to inhabit. Typically these residents require nothing more than reassurance from a trained architect or structural engineer who can certify the safety of the homes.

- **Minor damage**: Structure has sustained damage that makes it uninhabitable, but minor temporary repairs can be made to enable the resident to return. For example, a resident of a house that may have lost parts of a roof or roof shingles in a cyclone may be able to return home after installing a waterproof tarpaulin. Permanent repairs will be required in the long run but the habitability of the home reduces the burden on temporary shelter services.
- **Major damage**: Structure has sustained damage that will require significant work to repair, and is unsafe for residents in its current state.
- **Destroyed**: Structure is permanently uninhabitable. In these cases, the home cannot be repaired and must be demolished if it is still standing.

A standard format of a Detailed Evaluation Safety Assessment Form is attached in Annex IV.

1.4 Land assessment

Secure land tenure is a major requirement of any reconstruction and infrastructure programme following a natural disaster. Land assessments, therefore, are necessarily carried out during the early stages of the disaster to identify and collect data on cross-cutting issues such as security of land tenure, land and the landless, land administration procedures, land-use and settlement planning, and land for (potential) relocation and infrastructure.

At the reconstruction stage, much of the information gathered throughout the preceding stages should have been collated into transferable information for handover to government and community actors. Ideally, this information is gathered with the involvement of government and community, and the processes and resultant data are represented in a format that can be aligned within existing national and local administration procedures.

Key activities to be implemented at the reconstruction stage are[16]:

- implementing transfer of land information, tools and functions to government and community actors
- ensuring recognition of tenure security measures by land administration systems
- making sure tenure security for all beneficiaries of housing programmes, including relocated persons

Providing support for community-based land-management systems
Agostino Pacciani (IFRC)

16 UN-HABITAT – United Nations Human Settlements Programme, 2010, Land and Natural Disasters: Guidance for Practitioners

- supporting international standards for legal adjudication of rights to pre-disaster land
- implementing steps to strengthen/upgrade land tenure for informal landholders
- ensuring secure rights and access to agricultural land for vulnerable groups, including tenants and women
- making sure support and recognition for effective community-based land and resource management systems
- developing administrative functions to bring coherence to post-disaster land measures
- facilitating inclusive land policy system for sustainable development and disaster risk reduction and preparedness
- ensuring flexible and participatory planning standards that adapt to changing settlement practices.

Land registration map in Haiti
British Red Cross

1.4.1 Mapping

First and foremost, it is essential to identify whether the original location of housing (pre-disaster) is safe for reconstruction. If assessments prove this is not an option, then suitable land for relocation or resettlement must be identified and agreed between all stakeholders. This process requires close coordination between the affected communities and the relevant local authorities.

Risk mapping is an important part of this assessment process, involving specialist surveys measuring the exposure of sites to natural hazards.

There are several tools which are used in the mapping process:

Remote sensing

Remote sensing is a method of obtaining information on land and geographical patterns from a distance, typically from a satellite or through aerial imaging techniques. Sophisticated technical equipment and special software are required. NASA pictures can be used as a basis for data assessments and further planning.

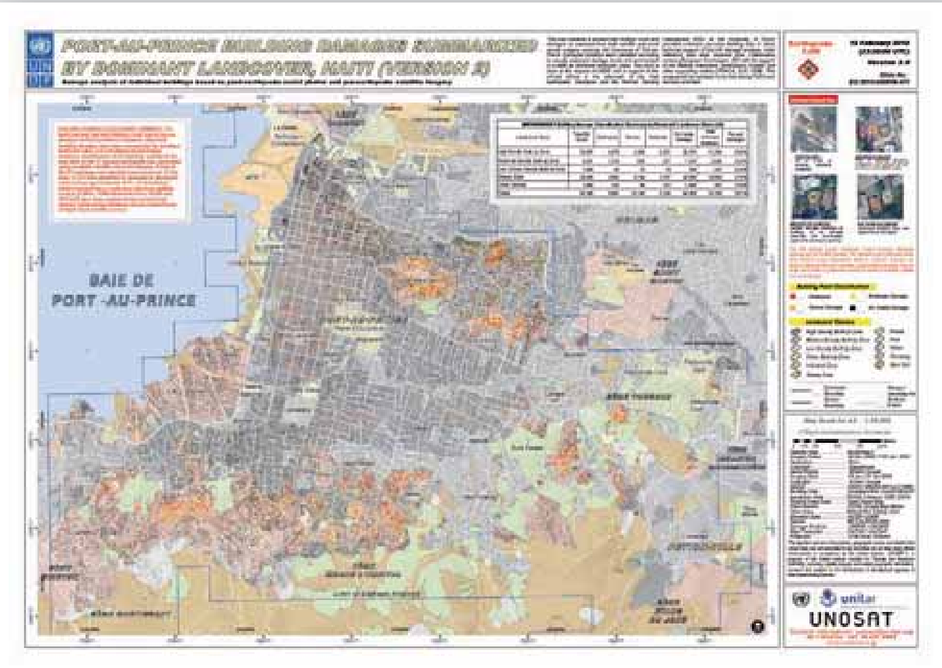
Remote sensing can be utilised to analyse natural disasters, such as floods, fires and volcanoes. Remote sensing can also be used to provide regular updates on flooded land, which can help in calculating the amount of land required for relocation.

When linked with geographic information system (GIS) data, remote sensing can contribute to assessment of ground conditions post-disaster, as well as assist in analysis of the impacts of past or future disasters.

Remote sensing after the earthquake in Haiti 2010[17] — Case study

The United Nations Institute for Training and Research (UNITAR)/Operational Satellite Applications Programme (UNOSAT), the European Commission (EC)/Joint Research Centre (JRC), the Centre National d'Information Géo-Spatial (CNIGS) representing the Government of Haiti and The World Bank/Global Facility for Disaster Reduction and Recovery (GFDRR), supported by its consultant ImageCat, did a detailed assessment of damage to buildings.

The results of this analysis have been significant in identifying the rebuilding needs of Haiti. This damage assessment applied the method of remote sensing technology. Never before had the availability of high-resolution satellite and aerial imagery been so open and accessible. Data from different missions – The World Bank/ImageCat-RIT Remote Sensing Mission (15-centimetre optical and 2pt/m^2 LiDAR), Google (15-centimetre optical), NOAA (25-centimetre optical), Pictometry, as well as satellite imagery from GeoEye and Digitalglobe – allowed damage from the Haiti earthquake to be viewed through multiple sensors and at different times. These multi-dimensional perspectives were very useful in understanding the magnitude and scope of damage.



Port-au-Prince building damages summarized by dominant landcover, Haiti
UNOSAT

17 The World Bank/International Bank of Reconstruction and Development, 2010

In addition to the improvement in access to remote sensing data, improvements in information technology, social networking and communities sharing their knowledge played a crucial role in both data development and damage assessment. Global Earth Observation-Catastrophe Assessment Network (GEO-CAN) emerged from this event as an unexpected resource for damage assessment. Comprised of over 600 engineers and scientists from 23 countries representing over 60 universities, 18 government and non-profit organisations and more than 50 private companies, GEO-CAN identified close to 30,000 severely damaged buildings in less than a week using very-high-resolution aerial imagery.

Utilising the aerial imagery, detailed damage assessments of individual buildings were carried out by comparing pre-earthquake satellite imagery to post-earthquake aerial photos. Using complementary approaches, data sets produced by The World Bank/GEO-CAN team and the UNOSAT/JRC teams were used to: (1) estimate the total number of collapsed and severely damaged buildings in Port-au-Prince and surrounding areas; and (2) establish the overall reliability of the aerial survey damage results. In total, damage estimates were provided for 13 administrative units within Haiti.

In order to validate the aerial survey results and to also extrapolate this information to lower damage states which may not be evident from the aerial photos, the UNOSAT/JRC/The World Bank/ImageCat team performed strategically targeted field ground surveys. In addition, a separate engineering team conducted more detailed damage assessments using very high resolution, oblique imagery provided by Pictometry. This latter dataset was very useful in determining whether major structural damage had been generated that did not result in the complete collapse of a structure. This information, in conjunction with the field survey data, helped to validate that the assessments produced from the aerial surveys were precise in identifying the total number of collapsed structures and that, statistically, the aerial results could be used as an index for estimating damage at all lower levels – below collapsed and very seriously damaged structures.

Geographical information system (GIS)

The geographical information system is a method for geographic data management, including data related to land, water, transport, information on the population and socio-economic indicators. GIS data can be combined with remote sensing to predict, monitor and calculate disaster impacts.

One of the most popular uses of GIS is the global positioning system (GPS) using satellite information. Users can easily know where they are relative to their destination and how to reach it.

Google Earth

The use of Google Earth and also Google Maps can help to map urban neighbourhoods, such as identifying boundaries, streets, density of buildings, rivers, seashores, etc. It is easily accessible via the internet and is free.

Yet, one has to keep in mind that the information obtained from Google Earth and Google Maps might not reflect the current reality. The information is updated only from time to time.

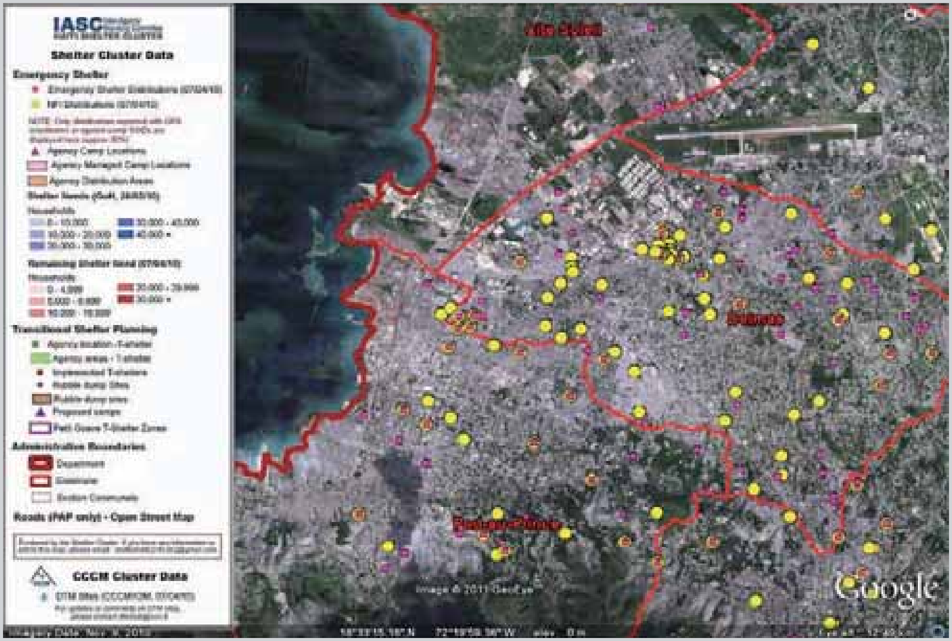
Information management by the Shelter Cluster in Haiti Case study

Information management was one of the most valuable elements of the coordination process in Haiti. The Shelter Coordination Team Information Managers first gathered data on activities undertaken by cluster partner agencies in order to create a consolidated picture of the overall operation. The data enabled the Shelter Cluster to identify gaps and overlaps in the response. The information was fed back to agencies during national, hub and sub-hub meetings in the form of maps, or on Google Earth mapping. The information products allowed agencies to visually identify their implementation activities and adapt accordingly for an improved response.

The Shelter Cluster went through a process of analysing a range of datasets as follows:

- results of a satellite imagery analysis of building damage
- results of a survey conducted across many camps in the affected area which focused on camp residents' original housing
- results of building assessments conducted by the Haitian Ministry of Public Works, Transport and Communications (MTPTC).

Though all data sets came with caveats, triangulating between these analyses allowed the Shelter Cluster to develop an estimate of transitional shelter needs. In turn, the provision of such needs data allowed agencies to decide upon target populations for their programmes, focusing specifically on areas with gaps in provision.



Google Maps

OpenStreetMap (OSM)

Less cost intensive than are the aerial imaging techniques is the OpenStreetMap (OSM) method; it is comparatively cheap and is easy to apply. OSM is a collaborative project to create a free editable map of the world. The maps are created using data from portable GPS devices, aerial photography, other free sources or simply local knowledge. Registered users can upload GPS track logs and edit the data using the given editing tools.

The initial map data is built from scratch by volunteers performing systematic ground surveys, each using a handheld GPS unit and a notebook, digital camera or voice recorder. This data is then entered into the OSM database. More recently, the availability of aerial photography and other data sources from commercial and government sources has greatly increased the speed of this work and has allowed land-use data to be collected more accurately.

Systematic ground surveys are performed by a mapper (volunteer), on foot or on a bicycle, or in a car or boat. Map data are usually collected using a GPS unit, although this is not strictly necessary if an area has already been traced from satellite images. Once the data have been collected, they are entered into the database by uploading them on the project's website. At that point in time, no information about the kind of uploaded track is available; it could be, for example, a motorway, a footpath or a river. Thus, in a second step, editing takes place using one of several purpose-built map editors. This is usually done by the same mapper, sometimes by other users (volunteers) registered at OSM. As the task of collecting and uploading data is separated from editing objects, contribution to the project is possible also without using a GPS unit. In particular, placing and editing objects such as schools, hospitals, taxi ranks, bus stops, etc. is done based on editors' local knowledge. Some committed contributors (similarly the Wikipedia principle) are systematically mapping whole towns and cities over a period of time, or organising mapping parties to intensively map a particular area over an evening or a weekend. In addition to systematic ground surveys, a large number of smaller edits are made by contributors to correct errors or add features.

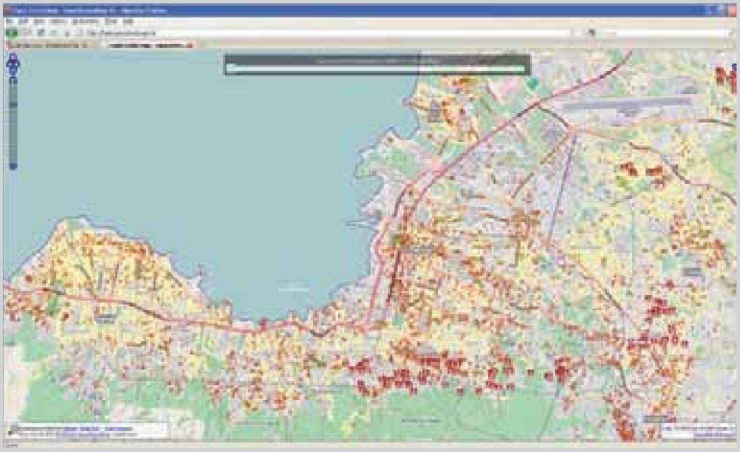
OSM is very useful for accessing an overview of existing streets and buildings, but has not the same accuracy as have land registration (cadastral) maps.

Some government agencies have released official data on appropriate licences. Much of this data has come from the US, where the federal government does not copyright such data. Various authorities have also made more local detailed aerial photography available on suitable licences through OpenAerialMap. Out-of-copyright maps can be good sources of information about features which do not change frequently.

There is now a wide variety of programs that use OSM data to display maps on mobile phones, supporting a large number of different devices. The various programes distinguish themselves according to key features such as whether they use raster maps or vector maps, need an internet connection or can be used offline, support alternate render layers such as cycle paths, support address search or advanced features like routing, thus catering for a large number of different needs for viewing maps.

Use of OpenStreetMap in Haiti, 2010 Case study

Following the 2010 Haiti earthquake, OpenStreetMap and Crisis Commons volunteers used available satellite imagery to map the roads, buildings and refugee camps of Port-au-Prince in just two days, building "the most complete digital map of Haiti's roads". The resulting data and maps have been used by several organisations providing relief aid, such as The World Bank, the European Commission – Joint Research Centre, the Office for the Coordination of Humanitarian Affairs, UNOSAT and others.



(http://haiti.openstreetmap.nl)

1.4.2 Legal status

IFRC's Shelter Technical Brief of the Haiti Earthquake Operation[18] summarises the land-related challenges in this way: "*The overriding challenge is land. Access to land has often been blocked due to a complex and informal system of land tenure making it unclear who actually holds the title to a piece of land. Haiti lacks almost all of the key attributes of a functional civil land system. The earthquake did not create land issues but it has certainly exacerbated them. As a result, plans to build shelters have been seriously impacted. The humanitarian community has no control over land ownership and efforts to secure sufficient amounts of land have taken much longer than expected with only a handful of identified settlements having been established over the past months.*"

Land and property ownership is a critical issue in reconstruction, particularly where land and assets are lost or registers and markers are unavailable. It is therefore crucial to facilitate claims in open consultations with the affected community so that any potential disputes can be identified and resolved quickly before they hinder the entire recovery process. This should involve local leaders and local authorities, together with independent professional advisers, especially surveyors and lawyers.

The following key questions are based on the Local Emergency Needs for Shelter and Settlement (LENSS) Toolkit prepared by the Emergency Shelter Cluster.[19] The answers to these questions will help in understanding the needs of disaster-affected individuals and communities in order to better prepare for the programme planning stage[20]:

18 IFRC – International Federation of Red Cross and Red Crescent Societies, 2010, Haiti earthquake 2010 – One-year progress report

19 UN-HABITAT – United Nations Human Settlements Programme, 2010, Land and Natural Disasters: Guidance for Practitioners

20 Adapted from: UN-HABITAT – United Nations Human Settlements Programme, 2010, Land and Natural Disasters: Guidance for Practitioners

British Red Cross
Delmas 19 Recovery

Enumeration Summary

(Plot, House, Family)

Plot Picture

1- Physical Information

A- House State In Aug 2011

Enumeration No. :	EAL-001
House GPS :	18°33'40.03"N -- 72°18'57.92"
Current Quartier :	Cité Aloulou
House Status :	Safe
Storey No. :	1
MTPTC Tag :	Green

B- House Owner

Family Name :	Louima
First Name :	William
Owner Phone :	(509)3100-1262
Date of House Acquisition :	1998

C- Land Owner

Family Name :	Louima
First Name :	William
Date of Land Acquistion :	
Land Acquistion Type :	Bought
Plot Size (m2):	38.5041
Density (m2):	8

D- Other Household

Renter:	No
Other Occupant:	No
Owner's Family :	No

2-Livelihood Information

LLH Code Match :	N/A
Name attached :	N/A
Household Debt(HTG) :	N/A
Monthly Income(HTG):	N/A
Household Credit(HTG):	N/A

3-HouseHold Information

Each HouseHold Head of Family

No.	HH.Type	Full Name	Sex	School	HH Relation	CIN/NIF	Phone	SingleHeaded	Children
1	Owner	Wiliam Louima	M	N/A	Head of Family	01-13-99-1962-05-00001	(509)3100-1262	No	#Name?
2									
3									
4									
5									
6									
7									
8									
9									

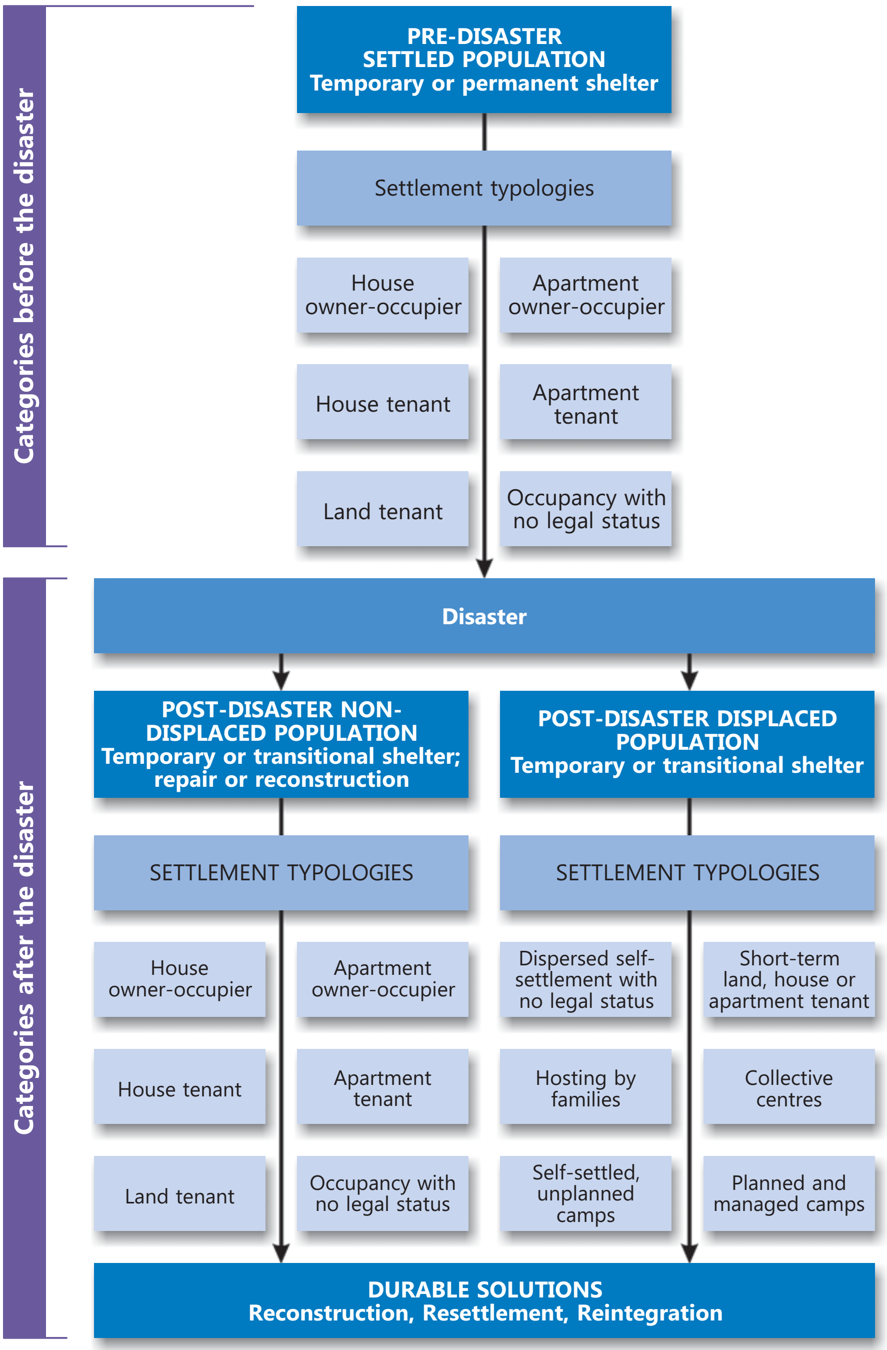
Data sheet containing the information on the property status, obtained through a participatory enumeration process, undertaken by British Red Cross in Delmas 19, Port-au-Prince, Haiti

British Red Cross

- **Ownership**: Who claims to own the land – government, private individual(s) and/or community? What is the legal basis/evidence for this claim? Is the claim contested by another stakeholder?
- **Hazards and risks**: Has there been a risk assessment of the land selected for permanent housing? Is it suitable for housing and livelihoods? Is it sufficiently free from natural hazards? How high is the risk of land and resource conflict with local communities?
- **Legal mechanisms**: Does the constitution or national law include protection against eviction? Do existing land recovery or compensation mechanisms apply to the situation?
- **The land tenure system**: Is land tenure in the locality formal, customary, informal or mixed? Does the system(s) provide sufficient security of tenure for affected landholders? Do people in the host community area consider that the land tenure system provides sufficient security of tenure?
- **Household tenures**: Are affected persons landowners, renters or occupiers with landowner consent? What type of land rights does the host community have? Are there any secondary rights-holders – e.g., tenants, persons with specific-use rights?
- **Land records**: Do land records exist for the locality affected by the disaster? Do these records provide sufficient security of tenure for building reconstruction? Do alternative forms of evidence of land rights exist? Do these enjoy widespread local legitimacy? Do prevailing land dispute resolution mechanisms include steps to restore or provide tenure documentation for building reconstruction?
- **Women and orphans**: Are there obstacles to women and girls owning, using or inheriting land in their own names? Can orphans register rights to land in their own names?
- **Land-use planning**: Is there a land-use planning process for the locality? Is it community-based, participatory and/or consistent with actual settlement practices?

Legal status of renters versus owners and the kind of assistance that can be provided to different 'case-loads'

Renters or tenants need a different kind of assistance from that needed by owners (of land/property), depending on their situation.


Categories before the disaster
PRE-DISASTER
SETTLED POPULATION
Temporary or permanent shelter
Settlement typologies
House owner-occupier
Apartment owner-occupier
House tenant
Apartment tenant
Land tenant
Occupancy with no legal status
Categories after the disaster
Disaster
POST-DISASTER NON-DISPLACED POPULATION
Temporary or transitional shelter; repair or reconstruction
POST-DISASTER DISPLACED POPULATION
Temporary or transitional shelter
SETTLEMENT TYPOLOGIES
House owner-occupier
Apartment owner-occupier
House tenant
Apartment tenant
Land tenant
Occupancy with no legal status
SETTLEMENT TYPOLOGIES
Dispersed self-settlement with no legal status
Short-term land, house or apartment tenant
Hosting by families
Collective centres
Self-settled, unplanned camps
Planned and managed camps
DURABLE SOLUTIONS
Reconstruction, Resettlement, Reintegration

Tenants

After a natural disaster, tenants face a high risk of losing the right to use land and housing as a result of factors such as rapid price increases in the land and housing market and an increase in insurance rates. Providing permanent housing solutions for these tenants will entail restoration of pre-disaster lease agreements and/or support for repair or reconstruction of rental housing. In undertaking such programmes, it is crucial to know that the security of tenure of tenants is linked to that of landowners.

Renters can receive cash grants as a rental subsidy for a limited period of time, depending on the reconstruction programme (e.g. 12 to 18 months). Otherwise, tenants can be provided with direct grants linked to reconstruction of their rental housing, which needs the consent of the landowner. Such agreements should be based on detailed knowledge of local lease conditions so as not to create fewer secure rights for the renter than they had before the disaster.

Landowners

There are advocacy points and strategies for post-disaster land ownership. Direct grants or subsidised loans to landlords for reconstruction of rental housing can be made dependent on: (1) agreement to re-establish prior leases with an extension period for payment of grants; or (2) agreement to make the housing affordable to low-income tenants.

Informal landholders

There are various ways to provide secure access to land for informal landholders after a natural disaster.

Incremental or intermediate steps towards legally approved land rights are necessary in cases where authorities are reluctant to provide registered individual titles to persons who occupied land in an informal or illegal manner prior to a disaster. Intermediate tenure forms provide security without compromising the state's long-term land rights, for example, through providing 'certificates of occupation'. This guarantees the claimant the right to a space within a neighbourhood even though the location of this right is not exactly set. Over time, the certificates of occupation should be upgraded.

Land exchanges allow private investors to obtain land from the government in exchange for constructing housing for informal landholders; investors, however, must ensure that the livelihoods and assets of landholders are not damaged.

1.4.3 Participatory enumeration

Participatory enumeration is a practical tool for a data-gathering process which directly involves the people being surveyed. It entails the recording of individual statements and public knowledge about tenure. The survey is completed and verified by the community itself, professionals and local authorities. All plots should be referenced and plotted on a map. The use of GPS and landmarks supports the community to fill in a database to obtain all relevant information. Thus, a land registration map can be made through community participation and verification.

Participatory enumeration in Delmas 19, Port-au-Prince, Haiti
British Red Cross

Case study

Participatory enumeration, Haiti[21]

The specific Haitian land administration context is characterised by a lack of accurate or existent data on land tenure and tenancy rights, dominating informal forms of tenure in urban areas (informal settlements), several different forms of tenancy, and a lacking functional land-registration system with a low level of formalised titles. Therefore, participatory enumeration is recommended to the Haitian context to address the high degree of informal tenure.

The benefits of participatory enumeration include:

For residents:

- re-establishment of a resident roster approved by the residents and endorsed by the authorities
- ability to keep all data from the roster in a unified database: a simple software program containing the land information system (LIS), securing the rights of both owners and tenants
- community empowerment and mobilisation – enhanced negotiating power.

For the state:

- efficient tool to improve settlement upgrading and land-use planning
- the database/LIS system is a starting point for later systematic land-record improvement
- property data which is useful for the eventual development of a property-tax-collection system
- possible improvement in the relationship between communities, municipalities and national government.

Overview of the process

1. Preparation
   - social mobilisation and trust-building
   - cooperation of local authorities and community leaders; establishment of an ad-hoc committee
   - definition of enumeration area
   - development of an agreed time line
   - drafting of a standardised survey form
   - recruitment and training of enumerators
   - launch of the information campaign (at least ten days before the start of the enumeration)
   - enumeration test survey (at least seven days before the start of the enumeration).
2. Data-gathering/enumeration
   - creating a reference basis through a community map
   - developing the community map from a satellite image subdivided by subsections: manageable sections so that any enumerators/team of enumerators can easily perform their tasks

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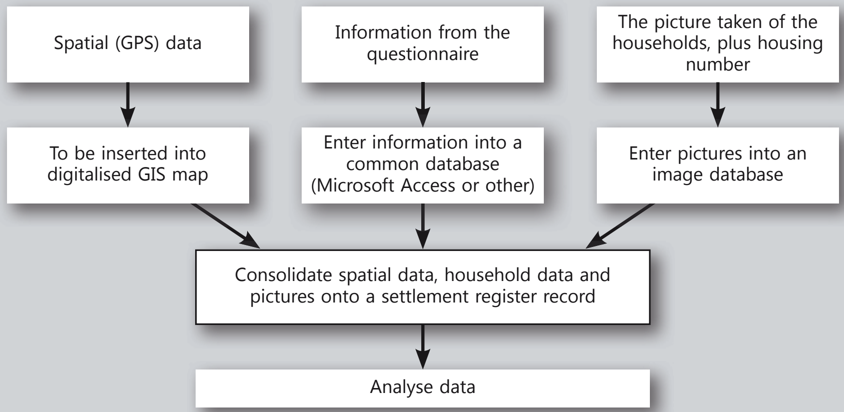
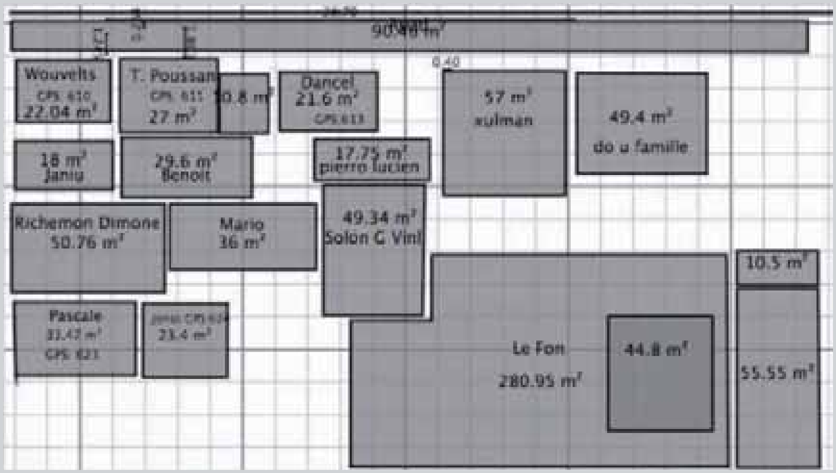
21 Adapted from: CHF International, 2010

- indicating on the community map the timing and the precise date when the enumeration process takes place for each subsection (determinate week/day for any subsection resident members)
- conducting household interviews/fill in household questionnaires: to capture information on household characteristics, housing, land and property rights
- listing the residential units and households (mark with GPS support and/or land marks); using household reference numbers
- gathering photographic data

The data capturing process is illustrated below:



And the findings can be presented as they are in the following diagram:



3. Verification and data updating
   - organising of a residents' mapping meeting
   - creating a digital map
   - establishing a residents' roster
   - creating an overall database (paper-based, simple electronic database, or full GIS system with web interface applications, etc.).

Mapping through GIS systems in Port-au-Prince, Haiti
British Red Cross

4. Post-enumeration process/practical use of data
   - deciding on who is responsible for the data management (short term and long term).

1.5 Environmental impact assessment

Governments often have their own laws/regulations governing the use of environmental impact assessments (EIA) prior to the implementation of reconstruction programmes. Project planners need to be familiar with EIA requirements as well as any other environmental laws that may affect project programming and resourcing.

The EIA process is used to identify high-priority environmental issues rather than to generate lists of all potential environmental issues.

Key elements of an EIA in post-disaster settings are:

- **Screening**: Deciding whether an EIA is required based on information collected
- **Scoping**: Gathering environmental intelligence through consultation with experts and reviewing applicable laws/regulations
- **Impact assessment**: Identifying and evaluating alternatives for achieving objectives, and the impacts of those objectives
- **Mitigation measures**: Reviewing proposals to prevent or minimise potential adverse effects of the project
- **Action**: Incorporating mitigation measures into the project design and implementation.

An EIA intends to foresee environmental impacts at an early stage in reconstruction design, to select measures to minimise unfavourable impacts, to form programmes which aim to avoid harm to the local environment, and to provide important recommendations for a 'Build Back Safer' programme. Using an EIA can have environmental and economic advantages by reducing costs and length of programme implementation, and fulfil obligatory environmental laws and regulations.

Yet, how and when EIA is applied is often a matter of statute and guided by international standards (ISO 14000[22]). Also – there is not one generic form of EIA – the scale and cost can vary significantly.

Generally, an EIA consists of three steps:

1. information collection through site visits, interviews with local residents and experts, and data collection from authorities and expert organisations; the EIA should at a minimum describe:
   - disturbances to sensitive and/or protected flora/fauna
   - release of pollution to air and water, and generation of waste during the houses' construction and use
   - access to water and the capacity of water resources to provide sufficient volumes for the needs of the households
   - noise disturbances
   - potential measures to minimise any negative effects (based on technical and economic evaluations)
2. verification of the EIA findings through public consultations with concerned stakeholders (local populations, future tenants, authorities and concerned NGOs)
3. decision-making on whether the project is environmentally acceptable and, if so, what measures should be taken to minimise negative impacts.

22 The ISO 14000 environmental standards exist to: (a) minimise how operations (processes, etc.) negatively affect the environment (i.e., cause adverse changes to air, water or land); (b) comply with applicable laws, regulations and other environmentally oriented requirements; and (c) continually improve on the above.

There are a number of tools required when undertaking an EIA in a post-disaster situation:

Environmental Stewardship Review for Humanitarian Aid (ESR)

The ESR can be applied in any kind of reconstruction programme and can be carried out in a short time (less than half a day). It entails a field visit to the proposed project site and consultation with project planners and other experts. It was created for recovery programmes in particular.

On the positive side, the ESR can be finalised in a short amount of time by a non-expert with some expert consultation. It includes guidance on how to carry out the analysis.

Yet, the tool is project focused; it is not designed for identifying broad environmental issues at the level of a region associated with a disaster.

Rapid Environmental Impact Assessment in Disasters (REA)

The REA can be utilised in the first 120 days after the disaster. It includes an organisational level assessment that is carried out by the project team which guides the REA. It also entails a community-level assessment to capture the environmental issues from the perspective of the communities and groups which are themselves affected by the disaster.

The tool is designed to be used by a non-expert.

The REA covers a broad range of environmental issues; however, it does not offer answers for the identified challenges.

Flash Environmental Assessment Tool (FEAT)

The FEAT is specially designed to be utilised in the first days directly after a disaster. FEAT is a quick tool to identify environmental impacts and to start first-response activities. The tool concentrates on how to measure and tackle the effects of the release of chemical composites.

FEAT requires a professional level of environmental knowledge. It does not replace thorough environmental assessments, which may be suitable at later stages of the reconstruction programme.

Environmental Needs Assessment (ENA) in Post-Disaster Situation: A Practical Guide for Implementation

Originally, the ENA guide was compiled for a core group of experts who will form an Environmental Needs Assessment Team (ENAT), with particular use by the ENA Team Leader. The tool touches upon environmental aspects of a broader post-disaster needs assessment.

The methodology is flexible and permits classification of the broader environmental issues connected with a disaster. It entails a comprehensive data-gathering.

Certain environmental expertise is required. The assessment takes up to four days on average.

Further information about all four tools can be obtained from: World Wildlife Fund, American Red Cross, 2010, *Toolkit Guide – Green Recovery and Reconstruction: Training Toolkit for Humanitarian Aid*: Module 3: **http://green-recovery.org**

1.6 Institutional assessment

It is important to understand the institutional environment within which one will operate. Such an environment will constitute central and local government, civil society, the private sector and the work of other agencies. According to mandates of the national reconstruction initiative, it is necessary to determine the active institutions and their roles in programme implementation.

A stakeholder analysis is usually very helpful to identify and list all stakeholders (persons, organisations, groups and institutions) who are involved and/or affected by reconstruction actions (please refer also to 'Who is involved?' section – chapter 3).

The following table provides a list of potential stakeholders[23]:

Sample list of potential stakeholders

Institution	Issues to consider
Government administrative hierarchies – from the lowest administrative unit	Local council, provincial authority, district authority, etc. What are their roles in reconstruction?
Reconstruction coordinating agency	Government and non-government coordination mechanisms
Environmental agency	Policy and requirements for construction
Building planning, standards and regulations	Agreed minimum requirements for reconstruction and approval process. Are national standards understood and applied at the local level?
Land-use policy agency	How does current and future land-use policy affect the villages or new settlements?
Land-tenure agency	Include specialised institutions on land rights. Identify types of ownership and formalisation process
Utility providers	Existing infrastructure and planned infrastructure. Provision of water, electricity, gas, communications, etc.
Civil societies, religious and other community organisations	How does the community operate and how can existing channels benefit/harm the programme?
Other active agencies	Expertise and agreed roles. (It is possible that one agency may commit to implement all activities related to a sector, e.g., water and sanitation, construction training, etc.)
Labour unions, local labour, local contractors, local consultants, private sector	General skills, capacity, restrictions, etc.
Research institutions and universities	Quality control, quality testing, design and technology

23 Adapted from: IFRC – International Federation of Red Cross and Red Crescent Societies, 2010, (*Owner-Driven Housing Reconstruction Guidelines*)

As soon as the stakeholders are listed, their particular problems, interests as well as potentials should be identified.

The following table is suggested for this purpose[24]:

	Institutions	Target groups	Others
	Stakeholder 1	Stakeholder 2	Stakeholder 3
Problems			
Interests			
Potential			
Interaction			
Others' actions			

1.7 Further assessments

Further assessments include an analysis of the local construction industry and material suppliers. The future cooperation of the local/regional building industry is essential for the success of any reconstruction programme. Identifying good-quality and reliable companies for implementation is crucial. For this, the following steps are recommended:

- Contact local/regional associations of engineers and architects to receive information and references about local partners.
- Contact relevant local authorities and ministries to obtain references and further information, lists of contractors, material suppliers, etc.
- Conduct interviews with the responsible representatives of the building companies, suppliers, architects, engineers, planners, etc.
- Gather information about prices of construction (cost per m^2/m^3), hiring personnel and technical expertise.
- Identify typical local building practices.
- Find information about sources of construction material.
- Become familiar with usual procedures for warranties/guarantees, tender procedures, legal issues, laws and regulations.
- Assess the logistical challenges: transport and access issues.

24 Adapted from: IFRC Project Planning Process handbook in IFRC – International Federation of Red Cross and Red Crescent Societies, 2010, (*Owner-Driven Housing Reconstruction Guidelines*)

In large-scale emergencies, the Emergency Market Mapping and Analysis Toolkit (EMMA) is often used to assess the existing market to identify disruptions of material supply chain and potential loss of economic assets and to identify key players of the local economy.

EMMA offers a quick analysis with practical recommendations. It does not rely on users having specialist economic or market analysis skills and it is broad in scope: addressing survival needs, livelihoods protection and the transition to economic recovery. The EMMA process is intended to be integrated flexibly into different organisations' response planning.

Further information can be found at www.emma-toolkit.org

1.8 Data quality

In order to ensure data quality, the following is required[25]:

For primary data, it may be advisable that data collection be organised at an inter-agency or cluster level and led by government, with one government department taking the lead in co-ordinating and managing data collection across departments and with agencies to ensure that:

- data are collected on the basis of an agreed-to and mutually consistent analysis plan
- damage classification criteria and categories are consistent across sectors
- damage classification criteria are consistent within a sector and across various administrative/ geographical divisions
- data are validated using empirical tools and plausibility checks
- sex and age-disaggregated data are collected
- baseline asset classification, such as definitions of various types of houses and categories of infrastructure, for instance primary, secondary and tertiary infrastructure, is consistent among assessments and with public accounts.

Guidelines and tools should also be made available to ensure the consistency of the estimates of need, such as use of common rates and uniform reconstruction benchmarks for housing and infrastructure.

25 Adapted from: Abhas, K. J., 2009

2. Methodological approach

2.1 Types of approaches

Reconstruction approaches are often compared according to the degree of household control, the form of assistance, the role of stakeholders and actors, and where the reconstruction takes place. Further issues which must be taken into account when selecting the approach are the disaster situation and its physical effects on households, their tenancy situation pre-disaster as well as likely situation post-disaster and, importantly, the preferences of households themselves.

The following table provides a comparison between the different reconstruction approaches[26]:

Reconstruction approach	Degree of household control	Form of assistance		Role of actors			Location	
		Financial	Technical	Community	Agency	Contractor	In-situ	New site
Cash approach	Very high	Cash only	None	None	None	Household may hire	Yes	No
Owner-driven reconstruction (ODR)	High	Conditional cash transfer to household	Technical assistance; Training of household	None	Project oversight and training	Household may hire	Yes	No
Community-driven reconstruction (CDR)	Medium to high	Transfer to household or community	Technical assistance; Training of community and household	Project organisation and oversight	Project oversight and training	Community may hire	Yes	No
Agency-driven reconstruction in-situ	Low to medium	Funds handled by agency	Limited or none	Limited	Management of project	Agency hires	Yes	No
Agency-driven reconstruction in relocated site	Low	Funds handled by agency	Limited or none	Limited	Management of project	Agency hires	No	Yes

26 Adapted from: Abhas, K. J., 2009

The following table gives an overview about suitable reconstruction approaches according to the tenancy categories[27]:

Tenancy categories of affected population	Suitable reconstruction approaches
1. House owner-occupant or house landlord	Any approach
2. House tenant	If tenant can become a house owner-occupant during reconstruction, see No. 1. If tenant becomes an apartment owner-occupant, see No. 3. Otherwise, house tenants are dependent on landlords to rebuild.
3. Apartment owner-occupant or apartment building landlord	Cash or ODR. CDR if owners as a group can function as 'community'. Reconstruction of multi-family, engineered buildings will always involve contractors, but owners may not require help of agency.
4. Apartment tenant	If tenant can become a house owner-occupant during reconstruction, see No. 1. If tenant becomes apartment owner-occupant, see No. 3. Otherwise, apartment tenants are dependent on landlords to rebuild.
5. Land tenant (house owner)	With secure tenure, same as No. 1, house owner-occupant. Without secure tenure, same as squatter.
6. Occupant with no legal status (squatter)	If squatter can become a house owner-occupant during reconstruction, see No. 1. If squatter becomes an apartment owner-occupant, see No. 3. Otherwise, squatters are dependent on landlords to rebuild, or they remain without legal status.

2.2 Selection of approach

2.2.1 Interim arrangements

Reconstruction, and the planning process that goes with it, affects whole communities. On the individual level, beneficiaries need to determine what is best for them. But on a community level, each of these personal decisions has a wider impact. Programme managers will face the challenge of finding adequate solutions for the whole community.

Therefore, it is vital to take important decisions together with the community and relevant authorities such as whether to stay at the current location or to move to a new one. One of the key questions is where to accommodate people in the interim period.

27 Adapted from: Abhas, K. J., 2009

If there is neither temporary shelter provided nor a collective shelter solution, affected people locate and secure their own temporary shelter in existing units. There are a number of options available to victims looking for such alternatives, which include:

- In-situ temporary shelter (on the site of the permanent reconstruction)

  In certain instances, it is possible for residents of damaged or destroyed housing to remain on their own property through the provision of temporary shelter solutions. This is most commonly facilitated through the provision of tents; prefabricated or easily assembled robust structures can be also used. If the permanent structure is only moderately damaged, the affected family may return immediately through the provision of minor repairs, such as tarpaulins to cover damaged roofs, with more permanent construction coming later. If the structure is more severely damaged, the family will have to find another location near to their property where their presence does not interfere with the demolition and reconstruction of the structure.

  There are a number of positive implications to long-term housing reconstruction associated with this approach, including:

  - It is easier for victims to maintain their livelihoods and community networks, which are a critical component of long-term housing reconstruction.
  - Affected families are better able to join in the design and reconstruction of their homes given their proximity.
  - There is less disturbance to the community because formal and informal social networks may be sustained.

Temporary shelter in Haiti
Daniel Wyss (Skat)

  - The need to identify and provide additional property for other housing locations is minimised.
  - In-situ temporary shelter helps to ensure affected families are more involved and invested in their own reconstruction efforts.
  - If constructed on site, temporary shelter options can be modified or recycled to improve the quality and function of the permanent structures.
  - Affected families who are actively involved in their reconstruction efforts might be in a better position to lobby for improved access to infrastructure and services.

- Renting houses or apartments
  - Rental assistance allows disaster-affected people to temporarily relocate outside the affected areas, and may increase the likelihood that they return once reconstruction has accomplished given that the rental property is not a viable long-term option.
  - Rental assistance can allow for more immediate yet dignified shelter.
  - The primary challenges associated with rental assistance include rapidly escalating costs that occur when long-term housing options are not available.
  - Rental assistance that allows affected people to relocate into hotels, motels and other available housing can be an effective solution in the short term, but rather costly. The question of who pays for it needs to be clarified.

Further reading:

United Nations, 2008, Executive editors: Tom Corsellis and Antonella Vitale, Shelter Centre, Transitional settlement and reconstruction after natural disasters, United Nations, Geneva, Switzerland

IFRC – International Federation of Red Cross and Red Crescent Societies, 2011, Transitional Shelters – Eight designs, IFRC, Geneva, Switzerland

Shelter Projects 2008/2009/2010, IFRC/UNHCR/UN-Habitat: www.sheltercasestudies.org

Resettlement packages

One of the main challenges in resettlement is that people cannot afford rents to return to original or other undamaged homes.

Case study

IFRC – The (re)settlement approach, case study in Caradeux, Haiti[28]

In July 2010, the IFRC shelter team began the process of registering internally displaced households living in four of the camps that make up Caradeux. A project proposal was developed identifying a variety of solutions for households to support them in returning to their places of origin or finding a housing solution outside of the camp. As many households had lost their livelihoods opportunities at the time of the earthquake, a cash grant was also proposed for people to develop a livelihoods opportunity.

The interventions planned were based on assessments and discussions with families where they identified three areas that would help them to move forward: an improved housing solution; support for livelihoods and plan for the future; and an option to help their children to return to school. Towards this end the planned intervention is described below:

1. **Families who own houses or land where they can build transitional shelters**: Although the number of persons who state that they were property owners is limited, those who were owners are offered options to move back to where their house was, or to a piece of land for which they can prove ownership. In this case, cash for work (CFW) involving people residing in the camp could be undertaken to either clear the land of debris or organic matter if it was an empty block of land. These people would then have access to transitional shelters and a small unconditional grant to help them to re-enter the employment market.
2. **Families who have the opportunity to move to a plot of land**: There are people who are living in the camps who know someone that has a plot of land and have gained their agreement to reside on the plot for two years. In this case, they would need to produce a document signed by their neighbour/friend that states that they can live on the land for two years and a copy of the ownership and identification documents of the owner, in order to confirm the agreement. After clearing the land as per option 1, a transitional shelter is offered to the family on this plot and an unconditional grant is provided to them.
3. **Families who have 'green' houses that require simple work to make them habitable**: There are persons who have houses that have been classified 'green' (safe to return to) and would like to return, if they could repair minor problems with their dwelling. These persons would be offered a cash or voucher system whereby they could access the materials they needed to improve their homes as well as an unconditional grant that would allow them to either buy tools and set up a business or use the grant towards related activities. Training on earthquake-resistant construction will be provided and compulsory for all those that are involved in the voucher option.
4. **Families who were renting and would like to resettle in Port-au-Prince**: Most families who were renting cannot afford rents to return to original or other undamaged homes. They are offered a conditional grant for rents and an unconditional grant to restart their livelihoods.
5. **Families who can move to a host family in the province**: Some families have stated that they would like to return to the provinces where they originated if they were able to receive shelters and some support to enable them to re-enter the employment market. This group is supported with transitional shelters and economic packages. The families who know of alternative accommodation that they could utilise will receive conditional grants that would allow them to move to the alternative accommodation.

Aerial view of La Piste camp, Port-au-Prince, Haiti
IFRC

28 Red Cross Red Crescent Societies, 2011

Host families

There are situations where displaced families prefer to move in provisionally with neighbours, friends or relatives. When available and feasible, this option can be the easiest for disaster-affected people to secure, though it can be a burden on the host family and typically leads to overcrowding within the host family's household. Support for this opportunity is through the provision of food, cash, loans, employment and other essential goods.

Families who cannot find alternatives are sheltered with host families, whilst their permanent homes are being constructed. This is an interesting alternative to the provision of a temporary shelter in a camp-like situation. A cash grant is given to both the host family and the family to be resettled in order to compensate for an increased use of water, electricity, etc., and/or to build an annex. Cash grants also help the families to access the labour market or start their own businesses.

Host family support programme in Haiti[29] — Case study

The American Red Cross, in accordance with the Interim Haiti Recovery Commission (IHRC) Action Plan for National Recovery and Development, provides support to host families through two partners in several areas characterised by receiving a very high number of internally displaced persons (IDPs) in the aftermath of the earthquake on 12 January 2010. The partners provide support to IDPs and host families in a variety of ways, all aimed at reducing overcrowding and reducing the burden on host communities.

In the Central Plateau and Artibonite, one of the partners works with the local vendors to implement market fairs to deliver much-needed items to families that generously took in victims of the January earthquake. Three market fairs have been held, supporting over 700 families, and more than 20 additional fairs will be held over the next six months to support a total of 10,000 families.

At the market fairs, beneficiary families – each of which has hosted at least two or three people displaced by the earthquake – each received vouchers worth about 225 US dollars, to spend as they wished at stalls featuring the wares of local vendors. Construction materials, such as metal sheeting for roofs, have been very popular items. Many other families chose household goods. Schools are also represented at the fairs and parents have an opportunity to use their vouchers to buy school supplies or help pay school tuition.

Assessment of host families in Les Cayes, Haiti
IFRC

In Artibonite, North and South departments, one partner works to address vulnerabilities in the communities and among displaced persons through projects that will directly improve the quality of life for their families and their communities. The programme involves the implementation of small projects addressing needs identified by host communities, in collaboration with local authorities. Over 1,467 IDPs have been employed already in cash-for-work programmes in projects such as drainage improvement, school renovations and irrigation canals. The project will benefit some 14,000 persons through cash for work and approximately 12,000 households will benefit from the improved infrastructure.

29 Red Cross Red Crescent Societies, 2011

Further reading:

Haiti Shelter Cluster, Shelter Cluster Technical Working Group (TWIG), 2010, Host Families' Shelter Response Guidelines for Haiti

Virdee, J., 2010, Host Community Guidelines – Supporting Host Families in Haiti by Tracking Movement, Understanding Needs and Directing Responses, Inter-Agency Standing Committee – Haiti Shelter Cluster/Caritas/Cordaid, 2010

IFRC – International Federation of Red Cross and Red Crescent Societies, 2012, Supporting Host families and communities after crises and natural disasters, IFRC, Geneva, Switzerland

2.2.2 Permanent solutions

Very often, beneficiaries move from relief camps to transitional shelters, before they obtain permanent housing. The permanent housing reconstruction efforts should be linked to the situation of beneficiaries and not be seen as a stand-alone programme. Efforts should be made to integrate the different needs of communities (women, girls, men and boys, and elderly and disabled people, among others) as a means of fulfilling their rights to adequate housing. This would help to maintain the living standards of the beneficiaries and to monitor the reconstruction programme in line with the standards (e.g., SPHERE[30]), agreed principles and codes of conduct. The purpose of standards in permanent housing should be to ensure quality of life and dignity of beneficiaries and communities.

Provision of appropriate and safe housing ensures protection and basic survival needs of women, girls, men and boys. In order to guarantee this, it is important that there is tight coordination among implementing organisations as well as active involvement of communities to make sure that the housing arrangements both in the short and the long term are gender sensitive.

Often, transitional shelters can be an appropriate solution for providing temporary homes to the affected population. However, if these are in use for a longer period than initially foreseen and fail to meet basic humanitarian standards, they could undermine durable reconstruction efforts and self-recovery of the affected population.

There is a growing tendency with supporting agencies to move away from standard emergency relief actions, such as providing tents and tarpaulins to the people in need, as these standard actions may not address the real needs of the people affected by a disaster. Therefore, a better-integrated process by involved agencies is very much needed; for example, the 'settlement approach' to enhance efforts towards permanent housing.

The 'settlement approach' offers a framework of support to communities – providing housing and essential infrastructure, integrating not only sectors such as water, sanitation and education, but also livelihoods responses in order to quickly re-establish better economic conditions for communities. In planning livelihoods activities, it is imperative to ensure that women, girls, men and boys have equal access to and benefit equally from livelihoods programmes. This broadens the understanding of housing to include support to all the settlement options available to

30 The Sphere Project, 2011

the people in need, including host families, rental accommodation and, if necessary, camps. Selection from a variety of alternatives means the affected population can make the best use of their coping strategies for improving their lives after a disaster.

With these approaches, the overall aim is to enhance permanent housing solutions. Permanent housing is the preferred option, when possible, to provide disaster-affected people with adequate long-term homes affording secure and healthy living conditions.

Permanent housing should follow the processes outlined below (please refer also to chapter 5 – planning and design process):

- If possible, use the financial assistance to support the local market for production and supply of construction materials, rather than to support the importation of construction elements or materials.
- Use local materials and building technologies, through the use of agreed and existing building codes and standards.
- Use hazard-resistant construction materials and technologies, supported by regular and professional supervision and inspection.
- Support the enhancement of hazard-resistant building methods, capacities and skills of all involved actors.
- Use an appropriate housing design and durable materials that will last at least 30 years.
- Apply the relevant building codes and standards according to the (future) family size, location, culture and available construction materials and techniques.
- Provide the opportunity to either upgrade the existing housing or reuse the majority of parts of the emergency shelter.
- Involve communities in decision-making processes when it comes to site selection and housing design. Ensure community housing committees are established with balanced participation of women and men to enable them to define their housing needs.
- Offer support on the site where the affected family has secured land rights or tenure, enhancing participation, and prioritise options for the affected family to stay near their place of origin.
- Always provide integrated and timely infrastructure, such as water supply, sanitation, electricity, roads and solid waste solutions, which should be integrated into the housing provision implementation.
- Integrate disaster-preparedness measures, such as contingency plans, technical solutions for earthquakes, flooding and other risk resistance at the household, neighbourhood and city level.
- Pay special consideration to re-establishing community infrastructures such as healthcare, cultural and religious building – recognising their social importance within the neighbourhood.

Case study

Urban Community-Driven Development Project (PRODEPUR)

Haiti – a comprehensive neighbourhood approach

PRODEPUR seeks to improve access to basic infrastructure and services, including removal of earthquake debris, repair and reconstruction of houses, and repair and improvement of community infrastructure. The project will work directly with the municipalities of Port-au-Prince (Carrefour-Feuille) and Delmas (Delmas 32).

The World Bank's support for housing reconstruction in Haiti is closely aligned with the Interim Haiti Reconstruction Commission's (IHRC) Draft Framework for Neighbourhood Reconstruction and Upgrading, currently being reviewed by the Government of Haiti. The Framework aims to facilitate the return of displaced persons to their neighbourhoods in order to rebuild their homes, communities and livelihoods.

Specifically, this 30-million-US-dollar grant will support the following activities:

- Removal of about 60,000 cubic metres of building debris from public spaces and private plots
- Cash grants for housing repair and reconstruction to finance about 5,000 cash grants for owner/resident-driven repair of houses assessed as structurally solid or on-site reconstruction of houses either destroyed or damaged beyond repair
- Repair and improvement of community service infrastructure, including roads, walkways, drainage ditches and channels, solid waste management, water-supply systems, sanitation facilities and related equipment, as well as the creation of community reconstruction centres
- Advisory services to assist communities and local authorities in managing the debris removal and housing repair and reconstruction process efficiently and in compliance with seismic and other natural hazard safety standards. In addition, this component will help prepare medium and long-term urban development and housing strategies.

Relocation

First and foremost, relocation must be a voluntary process which is free from pressure, threats or intimidation. The main alternatives for receiving land for resettlement and/or infrastructure after a disaster entail:

- approval of temporary occupancy permits or other short-term-use rights by responsible authorities
- grant of land by friends, relatives or a local community
- purchase or lease of land on the private land market
- land reallocation
- compulsory purchase of land by the responsible authorities.

Purchase of land for relocation needs to be voluntary, transparent and participatory and made by payment of market prices. Where voluntary purchase is not possible, compulsory land purchase should be: (1) carried out according to law; (2) restricted to certain public purposes; (3) made by payment of fair compensation; and (4) open to court appeal and civil society supervision.

Beneficiary-driven land purchase has proved to be a practical alternative. Often, beneficiaries are typically best placed to negotiate a realistic price and evaluate the appropriateness of a plot with regard to their housing and livelihoods needs.

Land reallocation is a land-management method that can facilitate relocation when public funds for compulsory purchase and infrastructure provision are restricted. This method functions on the basis of bringing together land rights, re-parcelling of land for better planning and the set-up of financial mechanisms to cover infrastructure costs.

Consultation and the participation of all affected communities in the relocation programme planning is essential in avoiding any harmful outcomes, such as distrust of neighbouring communities.

Further reading:

GTZ, 1999, Land Use Planning – Methods, strategies and tools, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, Germany

UN-HABITAT, 2008, Secure Land Rights for All, UN-HABITAT, Nairobi, Kenya

UN-HABITAT – United Nations Human Settlements Programme, 2010, Land and Natural Disasters: Guidance for Practitioners, Nairobi, Kenya

Cash-based solutions

Frequently, approaches to deliver housing assistance include cash grants, prepaid credit cards to buy materials from suppliers and material banks at urban neighbourhood/community level.

Cash for work (CFW): CFW is an interesting option for households that already possess their own land. CFW is provided to disaster-affected people who are still in a camp in order to pay them to clear the land of either debris or organic material.

For further information, go to:

www.oxfam.org.uk/resources/learning/humanitarian/downloads/guides/efsl_cash_for_work.pdf
www.odi.org.uk/hpg
www.sphereproject.org

Cash grants: these are a remarkable means of support to beneficiaries to kick-start the re-establishment of their lives. A cash grant gives the opportunity to access and buy materials to repair or reconstruct their homes. When handing out cash grants, ensure that households headed by either women or men, single-parent households and child-headed households all qualify for such grants. In addition, beneficiaries receive training on disaster-resistant construction to enable them to build safer homes.

Signing a cash voucher
Chile Red Cross/IFRC

With regard to resettlement activities, a lump sum of money is paid to each family which has identified a new place to live. A cash grant for building up or securing livelihoods is provided as well. Monthly meetings or training would give guidance to the families in restarting their lives.

Cash grants are an interesting option of support for people, who own land or have identified a new place to move, to restart their lives. Cash grants, which can be cash vouchers or other forms of conditional or unconditional funds, can be used towards the costs of repairing or reconstructing people's homes and/or for livelihoods support activities.

For further information, go to:

Cash Transfer Programming in Urban Emergencies: A toolkit for practitioners, CaLP, 2012
www.cashlearning.org/downloads/resources/calp/CaLP_Urban_Toolkit_web.pdf

www.odi.org.uk/hpg

www.odi.org.uk/resources/download/256.pdf

Cash vouchers: Cash vouchers are often used as an alternative to 'cash grants', with one of the key differences being the degree of control that the donor organisation has over their use.

For further information, go to:
IFRC, 2007, Guidelines for Cash Transfer Programming:
www.ifrc.org/Global/Publications/disasters/guidelines/guidelines-cash-en.pdf

Case study

Tarjeta Red – Chile earthquake, 2010[31]

Three months after a massive earthquake struck central Chile on 27 February 2010, making sure that thousands of vulnerable families were sheltered from the rain and cold of the approaching winter remained a priority for the Chilean Red Cross.

The 8.8-magnitude earthquake was followed by a tsunami. This double disaster left 521 people dead, 56 missing, more than two million people affected, 370,000 homes destroyed and some 30 billion US dollars in damages. Heavy aftershocks were being recorded for some weeks.

On 27 May, the Chilean Red Cross launched its 'Tarjeta Red' (reparation and development card) programme which helped approximately 8,000 families whose homes had been destroyed or severely damaged to rebuild or repair their homes through a cash transfer system.

The debit cards have a value of 180,000 CLP (approximately 376 US dollars) and a limited validity period, and purchases can be made only at a network of 40 pre-designated hardware stores located in the affected regions and throughout the country. In addition, an instruction manual on building techniques and security rules was provided with each card.

The Tarjeta Red programme helped the recovery on a psychosocial level and contributed to a more-rapid recovery of the entire community because it provided the families with the opportunity to choose the materials and/or tools that they needed as well as being involved in the self-repair of their original homes or improvement of their transitional shelters.

Tarjeta Red
American Red Cross and
Chile Red Cross

31 DiPretoro, S., 2011

Prepaid credit card: A prepaid credit card system is an interesting approach to provide flexible and needs-based assistance in urban reconstruction.

For further information, go to:
www.cashlearning.org/casestudies.html

Material-based solutions

One of the challenges in reconstruction is the immense and sudden need for construction materials and services at a fast pace.

Construction material banks

A construction material bank should be established to facilitate supply and increase availability, for example, of high-quality prefabricated building elements. Prefabricated elements must be of standard quality and accelerate the process of reconstruction, while providing jobs to local people. Moreover, construction material banks can help in guiding house owners and contractors in constructing appropriate homes.

Due to its large scale of operations, a construction material bank can also become an economical supply chain for providing bulk building materials, e.g., cement and steel, and trained masons for speedy reconstruction. Community contracts for bulk purchase of materials can be signed and effected.

Supported by mobile units and urban neighbourhood construction teams, the construction material bank ensures that building elements manufactured within controlled conditions (including qualified supervision) are delivered at the doorsteps of affected families and their construction needs are responded to.

The functions of a construction material bank can entail:

- production and supply of building material and elements
- training in production of building elements for producers and craftspeople
- training for masons, welders, carpenters, etc.
- demonstration of building technologies – equipment, products, production process and applications through demonstration construction
- provision of building elements on demand to the community or urban neighbourhood
- keeping a record of skilled masons and craftspeople trained in construction and construction material production
- providing expert advice.

2.3 Participatory approaches

The active participation of local stakeholders in crucial decisions throughout the project process fosters a strong sense of ownership and acceptance for the reconstruction programme, and helps to facilitate care and maintenance of buildings following construction. This is especially true if the users are also the owners of the housing. Rented-out dwellings tend to deteriorate more quickly than do owner-occupied homes.

Relevant stakeholders – future housing users, community leaders, responsible public authorities, service providers, etc. – can deliver important information and provide support that may be crucial to the programme's success and sustainability. Ensure that women and men are given equal opportunities to be involved in providing feedback as well as making decisions.

Ideally, stakeholders should be consulted during the early programme preparation phase, as well as during planning and implementation phases, in order to establish strong ownership from the beginning. This can be done through a stakeholders' workshop where invited stakeholders set criteria and develop ideas. At this stage, the responsible local reconstruction agencies can also be consulted; this ensures their support.

Different types of participation include:

Donor driven

Donor-driven projects are often the weakest in terms of stakeholder participation. Beneficiaries typically have no or only little access to reconstruction decision-making processes. As a result, there is often a high risk that donors will plan and implement projects without understanding or taking into account the needs of the end users or that the new houses will not be sufficiently appreciated by the beneficiaries. Stakeholder inputs to donor-driven reconstruction programmes are rather restricted to consultation on the use of certain construction materials or methods, but can extend to the entire house design.

Stakeholder driven

In stakeholder-driven programmes, users, local authorities, private contractors and project teams decide together on key issues: site selection, house design, materials, etc. A maximised involvement of the users creates a strong sense of ownership and increased sustainability.

Owner driven

In owner-driven projects, also called 'cash for shelter', donors provide mainly financial support and users have the freedom to decide how they would like to use the money for the reconstruction of their homes. Donors may have less control over the quality of implementation.

Further reading:

IFRC – International Federation of Red Cross and Red Crescent Societies/Practical Action, 2010
PCR Tool 8 – Participatory Design, Switzerland/UK

IFRC – International Federation of Red Cross and Red Crescent Societies, 2010
Owner-Driven Housing Reconstruction Guidelines, Switzerland

IFRC – International Federation of Red Cross and Red Crescent Societies/Practical Action, 2010
PCR Tool 7 – Planning with the people, Switzerland/UK

IFRC – International Federation of Red Cross and Red Crescent Societies, 2012, Post-disaster community infrastructure rehabilitation and (re)construction guidelines, IFRC, Geneva, Switzerland

IFRC – International Federation of Red Cross and Red Crescent Societies, 2012, Post-disaster Settlement Planning Guidelines, IFRC, Geneva, Switzerland

2.4 Cross-cutting principles

2.4.1 Gender-sensitive programming

It is essential that all programmes allow equal participation by women and men in assessments and decision-making processes and that both have representation in community committees. Programmes need to recognise and understand the cultural and traditional differences to be able to address the different needs of each group.

The aim is to work in a gender-sensitive manner; in many communities, women take an active part in disaster relief and ongoing reconstruction initiatives and are often the main users of houses, working from home and taking care of children and the elderly in the house. Women's local knowledge and expertise is therefore an extremely rich but largely untapped resource.

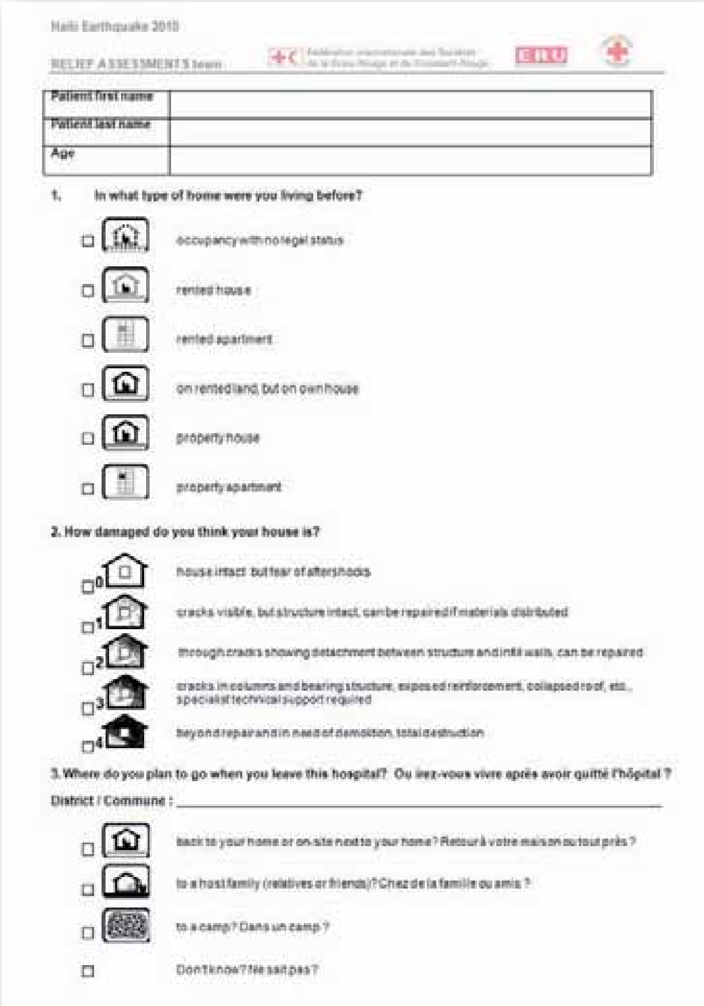
Women are scarcely represented and often excluded from planning and decision-making processes. Interventions often target men only. Integrating women into programme decision-making would greatly enhance post-disaster reconstruction efforts. Women can be effectively incorporated into housing design and construction activities through events, meetings and ongoing consultation processes.

Care should be taken to ensure that opportunities for women to provide input are arranged in a manner that is sensitive to the daily routines and time constraints of women in the target communities.

2.4.2 Elderly, disabled or chronically ill

Urban disasters, such as earthquakes that occur in densely populated neighbourhoods, leave many people wounded or disabled. These groups may not only need special assistance over a period, but may miss 'safety nets' to support them once they leave the hospital or services that have attended them. In the absence of these supports, it is crucial to identify, together with them, which housing options are preferable and to ensure their entitlement for such support.

IFRC's shelter and health teams prepared the following questionnaires for hospital patients in Haiti[32]:



Haiti Earthquake 2010

RELIEF ASSESSMENTS team

Patient first name	
Patient last name	
Age	

1. In what type of home were you living before?

- ☐ occupancy with no legal status
- ☐ rented house
- ☐ rented apartment
- ☐ on rented land, but on own house
- ☐ property house
- ☐ property apartment

2. How damaged do you think your house is?

- ☐ 0 house intact but fear of aftershocks
- ☐ 1 cracks visible, but structure intact, can be repaired if materials distributed
- ☐ 2 through cracks showing detachment between structure and infill walls, can be repaired
- ☐ 3 cracks in columns and bearing structure, exposed reinforcement, collapsed roof, etc., specialist technical support required
- ☐ 4 beyond repair and in need of demolition, total destruction

3. Where do you plan to go when you leave this hospital? Ou irez-vous vivre après avoir quitté l'hôpital ?

District / Commune : ____________

- ☐ back to your home or on-site next to your home? Retour à votre maison ou tout près ?
- ☐ to a host family (relatives or friends)? Chez de la famille ou amis ?
- ☐ to a camp? Dans un camp ?
- ☐ Don't know? Ne sait pas ?

Further reading:

IFRC – International Federation of Red Cross and Red Crescent Societies/Help Age International, 2011, Guidance on including older people in emergency shelter programmes, IFRC/Help Age International

32 CHF International, 2010, Assessing needs in different neighbourhoods of Port-au-Prince, contribution by CHF to the Shelter Cluster TWIG – Technical Working Group

2.4.3 Livelihoods

Integrating livelihoods issues is important in urban reconstruction programmes. The sooner people can start to earn an income, the more their living conditions improve after disasters. It helps to decrease dependence on reconstruction assistance and helps to re-establish people's lives. 'Building Back Better' programmes not only aim at restoring livelihoods to their earlier levels, but use the disasters as opportunities to reduce poverty. Women, girls, men and boys should benefit equally from livelihoods programmes.

Urban reconstruction programmes should be orientated towards making the best use of opportunities for restoring livelihoods. Once rebuilding and/or repair of buildings starts, local people can be involved and earn incomes simultaneously. Local people can be involved in the following ways:

- providing skills and labour to assist in the construction or repair of buildings
- producing and supplying construction materials and elements.

'Cash for work' (CFW) is an approach to pay local people for providing labour in reconstruction programmes. Local people can be paid for clearing debris, demolition work, and constructing and rebuilding infrastructure, such as sewerage pipes, roads, drainages, etc.

Production of infill panels for T Shelters in Haiti
Handicap International

2.4.4 Use of information technology

The timely use of technology, information and communication can be very efficient in urban reconstruction. Using radio broadcasts, TV, newspapers, mobile phones, internet, Facebook, etc. is a direct and fast means of communicating important information concerning not only the planning and implementation of rehabilitation activities, but also disaster-preparedness initiatives.

Mobile telephones/smart phones are fast means to communicate with and coordinate large populations. Mobile technology is becoming broadly used in areas including banking, community organisation, health and education. It can be used for transferring funds using mobile banking services, for the short message service (SMS) to warn populations about risks, for common alerting protocol (CAP), for Really Simple Syndication (RSS) feeds or for Twitter, and for many other functions.

The use of SMSs through pre-agreements with operators has great potential. The RCRC movement alone sent 10 million SMSs in Haiti on different topics (cholera prevention, hurricane preparedness, health, etc.). IFRC is pursuing the idea of using SMS with multiple response options to assess proximity camps and understand what people's preferred housing solutions are.

Using mobile phones in an innovative manner can also help to track the movements of displaced people. In order to plan better for urban reconstruction activities, it is essential to know which locations the affected people moved to or were displaced from. The following case study from Haiti shows how people's movements can be traced via their mobile phones.

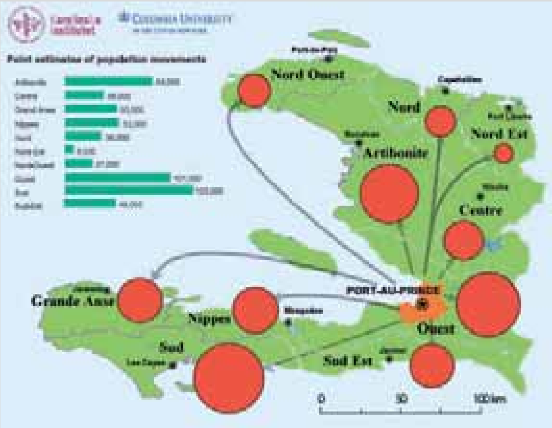
Use of mobile phones
IFRC library

Use of mobile phones in Haiti to trace people's movements[33]

The scientific team of Karolinska Institute, Sweden, with support from Columbia University, New York, analysed the movements of people affected by the earthquake in Haiti, 2010. The method the team used has been very promising in general for tracking population displacement after disasters, especially in areas with high mobile phone coverage.

The team analysed data from the locations of all Digicel mobile phones in Haiti before and after the earthquake. The analyses cover the period from 1 January to 11 March 2010 and include the movements of two million mobile phone SIM cards. The experts matched this data with census data and extrapolated the movement patterns to Haiti's population of 9.9 million persons.

The team was able to track all the people's movements from the metropolitan areas to other towns or to the countryside, after the earthquake happened.



Estimated number of persons who on 31 January 2010 had relocated from the Port-au-Prince metropolitan area

Bengtsson, L., Lu X., Garfield, R., Thorson, A., von Schreeb, J., 2010

33 Adapted from: Bengtsson, L., Lu X., Garfield, R., Thorson, A., von Schreeb, J., 2010

3. Who is involved?

Who is doing what is a major question to address before and during reconstruction initiatives. The following paragraphs explain the various roles and responsibilities of the key actors.

3.1 Roles and responsibilities

In any urban reconstruction activity, it is crucial to determine the roles and responsibilities of the key actors. In cases of natural disasters, governments and local administrations in the affected urban areas are overwhelmed by many tasks and challenges. A huge overload, a lack of knowledge and management, which is often difficult, create a great deal of stress for the key actors. Therefore, it is essential to be familiar with local governmental structures, power relations and procedures and also with the potential options for problem-solving. In order to better coordinate reconstruction, the responsible local authorities need to sign official written agreements with the implementing organisations to ensure legality, protection of staff members and endorsement of programme activities.

3.1.1 Authorities

Central and local governments have key roles to play in mobilising the relevant authorities to undertake, commission and supervise the planning. They should provide the legal mandate for the reconstruction plan and technical expertise if needed. In addition, they are responsible for developing the overall reconstruction policy or strategy.

In particular, local governments create mechanisms to encourage community participation and commitment to executing plans developed through community participation. They approve plans and prepare the regulatory framework for reconstruction activities, and undertake communication campaigns/training to ensure the reconstruction’s conformity with codes and laws. Local governments approve construction plans, enforce building codes and land-use regulations, undertake inspections on site, and execute any sanctions if needed.

A challenging example – Port-au-Prince[34]

The responsibility for spatial planning of metropolitan Port-au-Prince rests with the central government, which also takes care of most management, maintenance and provision of infrastructure and basic services. The municipalities are marginalised.

There is no legally approved master plan for metropolitan Port-au-Prince. Several plans with different geographic and thematic scopes have been developed, most with assistance from donors, but they have neither been endorsed nor institutionalised. In practice, they have not served as a proper framework for spatial and social development but only as inspiration for a few random interventions.

Aside from the absence of an adequate master plan, the statistics and basic information of metropolitan Port-au-Prince are scattered and only randomly updated. Neither the central government nor the municipalities have databases or registers with reliable information on numbers of inhabitants, infrastructure, the legal status of land or access to services.

According to the Ministry of Planning, there are more than 50 institutions that share the responsibility for managing metropolitan Port-au-Prince. The responsibilities for metropolitan development and management are dispersed in a maze of government institutions, agencies, departments and divisions without any coordinating agency. Duplication and gaps are common.

3.1.2 Technical experts

The roles of professionals should be clearly apportioned. Technical experts undertake technical assessments, analysis and data collection to support planning and implementation. They provide technical options and recommendations based on the findings in assessments, and give assistance and quality control in the implementation of plans and compliance with laws and codes. Furthermore, planners and technical experts develop and carry out reconstruction activities which are in accordance with plans and building codes. They make sure that programme actions are conform with governmental policies and technical information and offer feasible and sustainable options to the community and local authorities to facilitate informed decision-making. In addition, they train communities, based on their needs, on issues of planning, reconstruction features and the policy framework.

The tasks of selected professionals are summarised in the following paragraphs[35].

Architects

The architect’s role is to understand the complex needs of clients and users of building projects in collaboration with multidisciplinary teams, to develop and realise designs based on associated outcomes. Architects’ services can cover new buildings, conversions and refurbishment through a series of ‘work stages’ including: inspecting and surveying sites and

34 Adapted from: Forsman, 2010

35 Adapted from: University of Westminster, 2009

existing buildings; consulting with clients and users on their requirements; coordinating the work of other professionals; testing design ideas to establish feasibility; developing selected options; preparing reports and design information ranging from site layouts to the technical details of construction and specification for estimating costs; meeting regulatory requirements; ensuring good performance; guiding construction; and aiding future maintenance. Architects can also manage the procurement process for building-related projects as well as oversee health and safety protocols.

Engineers

Civil engineering is about creating, improving and protecting our environment in a sustainable manner for both present and future generations of society. Along with structural engineering, it involves the safe design, construction and maintenance of infrastructure – roads, harbours, buildings, airports, tunnels, dams, bridges, power generation, safe water supply, drainage, wastewater treatment, railways and telecommunications – with a good understanding of the specific physical and environmental risks. Engineers play a leading role in structural damage assessment on buildings and infrastructure, delivering transport, energy and waste solutions for complex projects. In addition to managing the project procurement process, engineers also oversee the implementation of health and safety measures.

Planners

Planners advise donors, politicians and other decision-makers dealing with urban and regional development processes. The role of the planner is to help manage the development of cities and regions, towns, villages and the countryside by producing and implementing plans and policies based on data. Planners analyse social, economic, demographic and environmental issues to inform the physical and economic development of an area. They are involved in establishing housing, transport and infrastructure and in meeting social, economic and other needs; they play an important role in regenerating socially and economically deprived areas as well as in the creation of livelihoods. To be effective, they must engage with the communities whose lives and livelihoods are being affected.

Surveyors

Chartered surveyors around the world understand the whole life cycle of property: from land management and measurement, land tenure and boundary issues, through planning, environmental impact assessment and investment appraisal, to managing the whole construction process to ensure best use of resources and building quality, and the planned maintenance of buildings. They should work collaboratively with teams of other professionals, funders and contractors, and local community partners – helping to develop capacity and partnerships for the future.

A thorough list about the roles of professionals during the assessment, disaster-preparedness and reconstruction phases is provided in Annex IV.

3.1.3 Civil society

In the ideal case, the affected population as well as the wider urban community develops a joint vision for the future of the community, detailing how the upcoming reconstruction could contribute to this vision. The community should develop a consensus on policy and strategic issues that concern its members at large. It participates in the land-use, physical and strategic planning processes. If possible, it contributes to the planning of details, such as zoning, settlement and housing design.

Community gathering

From an early stage, house owners and renters can be engaged in debris clearance work before and during the reconstruction/repair works (see also under 'cash for work').

Challenges in working with local communities:

Working with local communities can also have limitations. It may be complex, for example, if a group of disaster-affected people is not really a community. If there are households prioritised from an official waiting list, it could be very time-consuming for them to build relationships and generate sufficient trust in, for instance, a communal design process.

Similarly, it can be difficult in urban contexts, particularly as these contain many more mixed groupings of people. There can be problems if there is a mixture of tenants and owners as tenure issues cannot be easily resolved and landlords can hold back tenants' rights to involvement. These issues may be determined by splitting such groups into smaller homogeneous groups for which individual plans can be designed.

Post-earthquake reconstruction in the city of Bhuj, Gujarat, India[36]

In 2001, an earthquake in Gujarat caused widespread devastation. The city of Bhuj was badly damaged, with its historic walled centre being particularly hard hit. Housing, commercial and public buildings were all damaged or destroyed, and infrastructure was disrupted or broken. After the earthquake, an estimated 100,000 people continued to live in the city.

Government and institutional stakeholders decided that a comprehensive development plan was needed in order to guide the city's reconstruction, to relocate some people and to make provision for future expansion. It was decided that this plan should be developed and implemented through a participatory process. This presented a great challenge given the huge numbers of people affected. The walled city presented even greater problems because it served as the commercial and cultural heart of the whole city, was densely populated and had suffered the worst damage. The details of the plan were to be produced by a planning consultancy company; and the Gujarat Urban Development Company Limited was appointed to manage the plan's implementation.

36 IFRC/Practical Action, 2010, PCR Tool 7 – Planning with the People, Switzerland/UK

Steps in development of the plan included:

- An analysis of stakeholders to identify the main community leaders, public sector officials and other key resource persons in the city.
- These people were invited to discuss how the participative process should be undertaken. They also helped to provide a situation analysis and a SWOT analysis[37] of the planning process. A Vision Statement for Bhuj was drawn up and the leaders formulated objectives, strategies and proposals. These were brought together as a draft 'Conceptual Development Plan'.
- The draft plan was taken to a series of ward meetings and focus-group meetings for consultation and comment. The meetings were widely advertised. As part of the meetings, a series of maps showing the proposed reconstruction was exhibited for public comment.
- Based on the public consultation, the Plan was modified and more detail was added to the proposals. A draft Development Plan was put together.
- The draft Development Plan was again widely advertised for comment. A final version of the plan was then produced including maps of how the city would be reconstructed and developed.
- A special plan was produced for the walled city. As well as the input of local people, the Bhuj Development Council and various NGOs contributed to this plan.

To support the process, a Study and Action Group was formed consisting of key local resource persons identified earlier. The group helped to inform the process, provide information on the local context, assist in resolving disputes, and produce proposals and policies.

In the walled city, an even more intensive process was used. A Core Committee was formed with similar objectives, to those of the Study and Action Group, which interacted very actively with residents. Rehabilitation committees were formed at the 'falia' (neighbourhood) level. Decentralised offices were set up, where the latest drafts of the plans were available and staff could provide information to residents on the plans and help them to comment or contribute ideas.

The commitment of the government and institutional stakeholders to the idea of participation in planning for reconstruction and development was followed through in establishing the structures for participation. That enabled many local people to contribute their ideas to the final plans.

37 SWOT analysis is a strategic planning method used to evaluate the strengths, weaknesses/limitations, opportunities and threats involved in a project or programme.

3.2 Organisational set-up

It is important to establish and maintain well-functioning programme management; a well-functioning management process is the backbone for the success of any reconstruction project. Below are key reconstruction programme management practices that should normally be considered.

Contracts and roles and responsibilities of partners should be clarified as early as possible. A clear programme set-up includes the following activities:

- deciding on the programme's most important objectives
- selecting reliable and skilled local partners
- clarifying expectations of partners and stakeholders (donor, national and local partners, implementers, etc.)
- identifying and agreeing on responsibilities and tasks; entering a formal written agreement with partners (e.g., a Memorandum of Understanding or contract)
- setting a time-frame according to the major milestones formulated in the objectives
- confirming available budget
- selecting the location and target group (community).

Other preparation activities include the establishment of an office and management structure:

- preparing office facilities and infrastructure
- establishing the programme team's professional staff; ensuring that they have adequate skills
- selecting a multidisciplinary team, according to the programme's objectives, including engineers (with technical background and substantial experience in housing construction), social workers (with experience in community mobilisation and participatory decision-making processes), economic specialists, etc.
- formulating team members' job descriptions
- agreeing on decision-making procedures
- establishing office management budget
- opening a bank account.

4. Preparation

4.1 How to identify and select beneficiaries

When a reconstruction programme starts, the responsible project manager together with the key stakeholders should tackle the following questions:

- Who is entitled to housing?
- What type of housing solution are beneficiaries entitled to receive?
- How much housing assistance will they be given?

The following table provides an orientation about the various categories of potential beneficiaries and related responsibilities[38]:

Categories	Responsible stakeholder for reconstruction (in the normal case)
Squatter (no legal status)	Squatter, if status remains informal; otherwise, moves to another category
House tenant	Landlord
House owner-occupant or house landlord	Owner-occupant or landlord
Apartment tenant	Landlord (public or private)
Apartment owner-occupant or apartment landlord	Owners as a group or landlord
Land tenant	Tenant, unless tenure is not secure

38 Adapted from: Abhas, K. J., 2009

How do you identify beneficiaries
Manuel José Jimenez (IFRC)

One of the challenges is how to identify the most vulnerable and integrate them equally in the project. The following table[39] gives an overview about guiding questions, which help to identify and select the beneficiaries:

Criteria	Guiding questions	Issues	Recommendations
Critical points	Should all people who suffered housing losses be entitled to aid or should assistance be targeted only to specific categories of people? Is having legal status in the country a requirement? Should households not affected by the disaster be assisted if they have housing problems similar to those of the households who were affected? How will those with a need for housing who have migrated into the disaster region after the disaster be treated?	Categories may be economic, geographic or related to some aspect of pre-disaster housing condition, but any choice can create inequitable outcomes in certain situations.	The reconstruction programme must have enough resources and administrative capacity to carry out the selection process of beneficiaries.
Assistance	Is the unit of entitlement the house, the family or the household? Is a single-person household treated differently? How is assistance calculated for a household with multiple families?	If pre-disaster housing provision was inadequate, multiple households or extended families may be sharing a single house unwillingly. On the contrary, a single family may own or live in more than one house.	Make an early decision on the unit of assistance and the extent to which the goal is to address pre-disaster housing deficits.
Economic status	Is income below a certain level a qualification for receiving help or do all income levels qualify?	Income records may be inaccurate, destroyed in the disaster or non-existent.	Ensure there is a feasible process for qualifying according to income.

39 Adapted from: Abhas, K. J., 2009

Social issues	Do social characteristics, such as gender, class or incapacity, override income as factors in those cases where there is an income interruption?	Women and members of other vulnerable groups may need housing assistance even when their income exceeds the interruption.	Consider using community members to help identify those who truly need assistance.
Renters versus owners	Who receives the assistance? Renters? Owners? Both?	It is important for rental housing to be rebuilt; yet, during reconstruction, renters may need assistance for temporary shelter.	Consider requiring owners to allow renters return for similar rents to those charged before the disaster as a condition of owners receiving assistance.
Informal tenure-holders	Is a squatter or informal settler entitled to the same housing assistance as is a property owner?	Squatters may need assistance in addition to housing. This assistance will require planning for a more comprehensive set of services. Squatters often move to a disaster area after a disaster to obtain housing assistance.	Ensure sufficient resources are available to carry out a full-service resettlement programme. Carefully examine whether it may be necessary to exclude families that have migrated after the disaster to the disaster-affected area.
Absentee owners versus owner-occupants	Should owners living elsewhere be entitled to housing assistance or only residents of the disaster area? Are owners of houses under construction entitled to assistance?	This issue is related to the question of the unit of assistance. If the primary motivation is to resettle residents, absentee owners may not qualify. If the neighbourhood is a concern, broader eligibility will help prevent the negative effect of abandoned properties. If the owners are migrants, their money transfers may be supporting other households in the affected area.	Try to use housing assistance as an incentive for owners to sell or rent.

After the selection process is finished, a contract should be signed between the implementing agency and the renter and/or owner (of the land/house). The contract should at least include the time-frame, conditions, contributions (financial, labour, in-kind), issues of later maintenance, etc.

4.2 Social mobilisation

As per definition, social mobilisation is a dynamic process to harness the potential of the people to help themselves. Social mobilisation is an approach for mobilising communities for active participation in development processes. Consequently, the premises for effective development through social mobilisation are that those processes are:

- **people centred**: putting people first and providing them an opportunity to meet their basic needs
- **service oriented**: taking services to the people rather than asking them to come to the centre
- **participatory**: ensuring that each person has an equal share in the decisions that shape their livelihoods.

4.2.1 Community action plan (CAP)

CAP is the tangible result of a participatory process. It is a useful tool to formulate not only short-term activities but also interventions for the longer term. CAP empowers the community to be involved in developing their own neighbourhood and environment. CAP results can feed into small-scale spatial neighbourhood plans as well as into broader infrastructural planning. However, this should be supported by a cadastral survey. The CAP provides the community with a platform from which to appeal to local government for positive changes in the neighbourhood.

Defining key steps of CAP:

- Define the boundaries of the urban community; how many households should participate?
- Identify/select the community representatives to participate in the CAP. There should be at least five representatives.
- Organise a CAP workshop and collect the findings.
- Carry out the agreed follow-ups.
- Communicate the results of the CAP workshop to the relevant stakeholders.
- Ensure that community representatives exchange information between the community and partners.
- Maintain the momentum and initiatives for reconstruction activities and changes.
- Organise further meetings with the community about the reconstruction process, future actions, cash-for-work procedures, etc.

4.3 Programme planning

The programme planning phase for reconstruction is essential to avoid major failures during implementation.

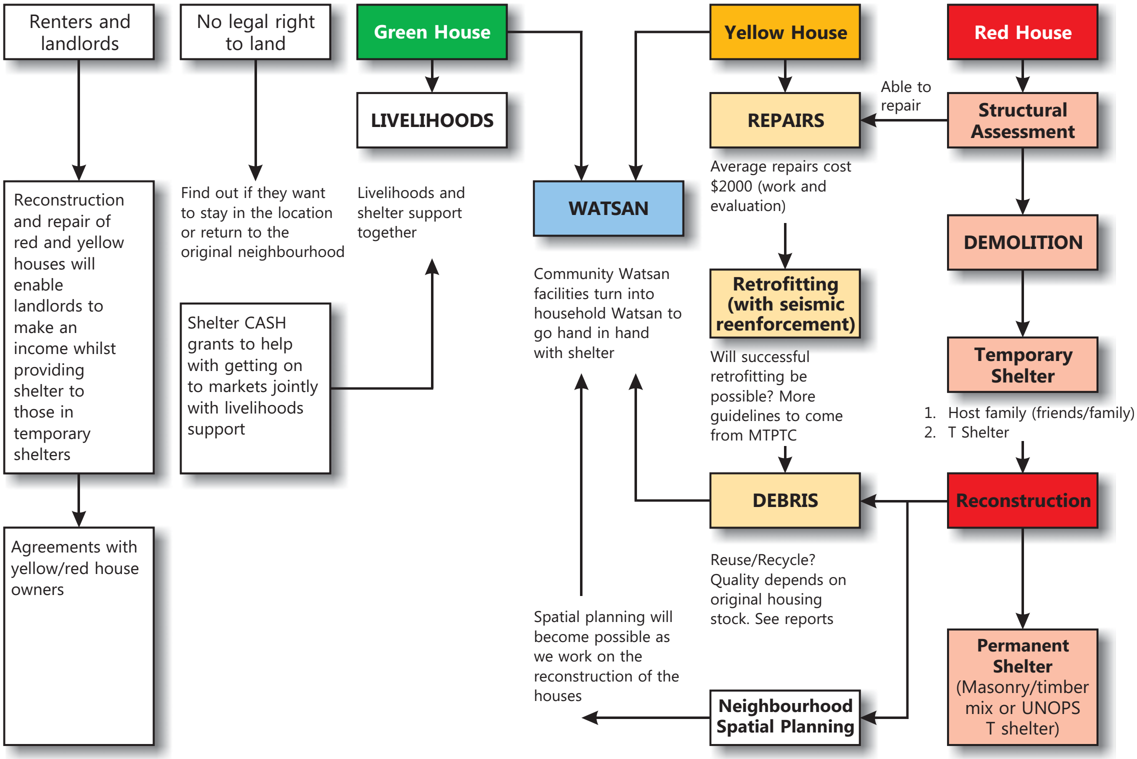
It is recommended that the following steps are considered[40]:

- Plan for human resources and competencies required for programme management.
- Prepare an estimate of costs for human resources.
- Agree on the criteria for beneficiary selection with the relevant stakeholders.
- Prepare a beneficiary list. The list is developed further with time and through rounds of discussion with the relevant stakeholders.
- Obtain, check and verify beneficiary lists, approved by the community and government.
- Analyse existing policy frameworks.
- Identify options for gender-responsive actions within the reconstruction programme.
- Conduct analysis of environmental impacts of the options within a reconstruction programme, in particular of the selection of construction materials.
- Undertake a comparative analysis of material options with regard to quality, costs and environmental impact.
- Analyse and take a decision in the setting of standards and technical norms.
- Share all important analyses with the community, government and other relevant stakeholders.
- Prepare an overall strategy for the reconstruction programme which considers also the handing-over and maintenance of the new buildings.
- Set up a project-implementation committee and agree on the terms of reference for it.
- Assist, where needed, in maintaining minutes of meetings of any committees, such as the project-implementation committee, beneficiary committee, etc.
- Facilitate appropriate site selection.
- Support the identification of safe land.
- Facilitate a feasibility study in case of resettlement.
- Assist in comprehensive participatory site planning.
- Prepare a programme budget.
- Facilitate agreements with partners and participating communities (tripartite agreements), clearly emphasising accountability norms. Each agreement should include a list of information/documents which should be shared.
- Make contracts between the beneficiaries and the implementing partner.
- Obtain an agreement with the government.

40 Adapted from: RedR in Oxfam, 2008

Below is an example of a planning diagram:

British Red Cross, Haiti Recovery Programme



British Red Cross Recovery Programme: Shelter Strategy for Delmas, Haiti

4.4 Land survey and acquisition

Whilst damaged or destroyed structures are being reconstructed, an area of land may need to be identified and developed for permanent housing needs. This requires a survey of suitable areas and should be undertaken in consultation with the community as well as landowners and the local authorities. Surveys need to locate valuable agricultural zones, or land of high ecological importance that should be avoided for construction.

Further reading:

GTZ, 1999, Land Use Planning – Methods, strategies and tools, Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, Germany

UN-HABITAT, 2008, Secure Land Rights for All, UN-HABITAT, Nairobi, Kenya

4.5 Site selection

Careful site selection is a key step that can determine the success or failure of a reconstruction programme. Reconstruction settlements in hazardous areas are vulnerable to earthquakes, floods, landslides, cyclones, etc. An assessment of potential risks at reconstruction sites is, therefore, crucial to avoid repeated destruction.

Site selection should be made based on a careful determination of principal or pre-existing land rights, including customary rights, and, in the case of resettlement, the rights of neighbouring communities. Where such rights exist, local consent or a lease contract should be agreed upon to avoid host community tensions.

Another challenge is that beneficiaries may not accept particular site locations for various reasons, including the site's history or other socio-cultural issues. Site selection should be based on the informed approval of persons displaced by the disaster.

Reconstruction actors should provide information on site risks to allow displaced persons to make informed decisions. Even in cases where the government provides plots for reconstruction or resettlements, programme managers need to collect the same information to be aware of existing disputes and claims.

In order to select a suitable construction site, project managers should consider a number of issues and should verify facts and recommendations with intended users and local stakeholders. The key factors to consider when choosing a site include:

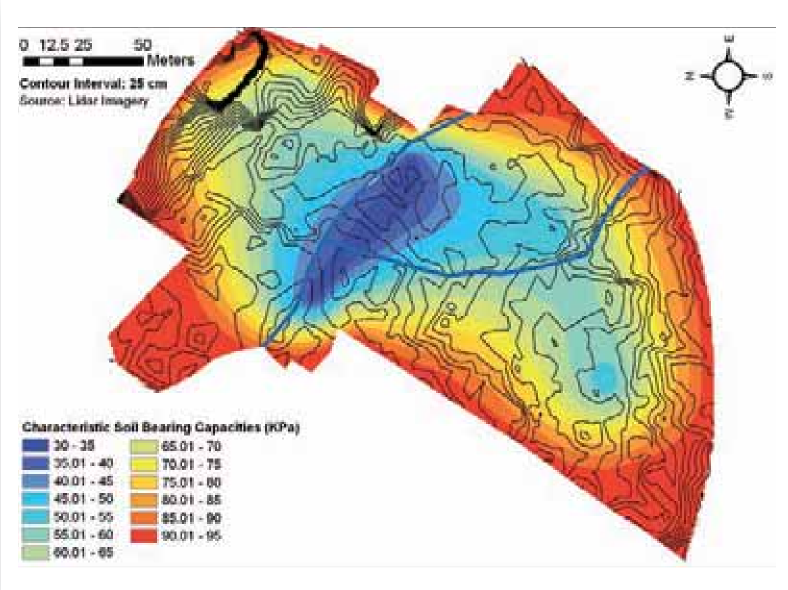
Field assessment of site quality

- Favour sites on open and even topography rather than on hills and steep slopes.
- Avoid sites that are likely to liquefy during an earthquake.
- Avoid building on unstable slopes that could fail or slide during an earthquake.
- Buildings of up to two floors can be built on solid rocks. Buildings on solid rocks and firm soils endure better than do buildings on soft, sandy, clay or silty grounds.

4.5.1 Technical aspects

- Assess risks from natural hazards (e.g., tidal waves, storm surges, landslides, heavy rainfall, earthquakes and cyclones) and avoid rebuilding in unsafe zones. As part of the assessment, check municipal flood records.
- Select a site that is out of reach from storm surge and tidal waves. Check with the responsible local authority whether there are any buffer zones, i.e., a safety zone that extends beyond the highest previous level of flooding.
- Assess site topography. When possible, favour elevated (but flat) sites in order to avoid flooding and use shallow bedrock conditions for seismic protection.

- Check the slope stability (angle, soil type, drainage, etc.).
- Assess soil characteristics. This provides important information for determining a suitable foundation type (strip or slab) and depth for drilling water wells and for digging holes for septic tanks (rocky ground is not very suitable).
- Vegetation can help mitigate the effect of hazards to settlements. In areas vulnerable to natural hazards, use trees with long root structures (in cyclone areas, put them together with bushy shrubs as wind-breaks).
- Assess the site's existing vegetation. Check whether it is necessary to clear trees or bushes from the site or, alternatively, to re-forest the site to create a cooler microclimate or stabilise soils.
- In tsunami-prone areas, try to create a 'bio-shield' (e.g., trees, bushes) to slow the tsunami wave.



Plan of characteristic soil bearing capacities
British Red Cross

- Consider whether land filling is needed to elevate new buildings above likely flooding levels. Fill material should come from controlled sources to avoid causing landslides.
- Assess impacts from nearby industries and airports (e.g., noise, pollution, etc.) and determine how to minimise disturbances.
- Analyse access to clean water, roads, shops and markets, schools and health facilities, and employment.
- Analyse conditions and technical requirements for water supply, sanitation, waste management and power supply.
- Check for existing connections to municipal water mains. Assess their conditions and the measures needed to connect the site to the municipal mains.
- Check water quality through chemical/physical testing. Determine whether groundwater is contaminated and, if so, arrange the delivery of supplies from safe sources.
- Identify the depth of the groundwater table. This will be important information for the purposes of establishing foundation depth and size as well as determining the depth and distance between latrine systems/septic tanks and water tanks.
- Check whether local reconstruction materials are available at the site or nearby in order to minimise transport costs.

4.5.2 Social aspects

- Ensure users' acceptance of site locations.
- Use an appropriate, participatory decision-making process to select an appropriate site.
- Ensure the locations' accessibility to jobs, shops, health facilities and other infrastructure.
- Consider whether neighbouring settlements of different ethnic groups are an issue.
- Assess the issue of resettlement. Relocating residents without their definite acceptance of the new site may cause resistance, users' moving back to their former locations and other problems.
- Check whether the new area meets the population's need in terms of social infrastructure and economic activities.
- Inform and prepare affected people. It is important to achieve full participation of the target group.
- Ensure sites are safe and secure and easily accessible for the elderly, the disabled, women, girls, men and boys.
- Ensure that places of worship are accessible to all.
- Consider the risk of urban violence or violent dynamics in the selected location and its surrounding, particularly if these helped create patterns of vulnerability, isolation or power consolidation.

4.5.3 Legal aspects

- Make sure that formal land titles are available.
- If needed, support the restoration of pre-disaster lease agreements.
- If formal land titles are unavailable, the following documents may help:
  - signed statements of ownership verified by neighbours and/or community leaders
  - maps showing placement of property or boundary markers by survivors in consultation with neighbours
  - informal maps of land plots, existing trees, burial locations, ritual locations and public areas agreed through community mechanisms
  - signed statements of inheritance verified by family members
  - signed statements of guardianship of orphans verified by community members.
- Clarify who will be the landowner in order to avoid future conflicts and even the eviction of residents.
- Use gender-sensitive databases: post-disaster tenure documentation databases should include fields to record: (1) details of women's rights to land, including rights other than ownership; and (2) marital land co-owned by a husband or wife.
- Support the collection of validating evidence documents. Where formalisation of land rights will enhance tenure security for landholders, reconstruction programme beneficiaries should be assisted to collect evidence for requests to record or register formal legal rights to their land, wherever possible in the names of women and men.
- Consider what kind of rights the owners should have (e.g., to sell, rent, assign to heirs, etc.).
- Use simple boundary identification. Often, community members and programmes need only identify basic parcel layouts and sites for utilities and public facilities.[41]
- Aim to resolve disputes. Interim tenure documentation should not be issued where rights to land remain uncertain but, rather, the parties should be referred to mediation and arbitration mechanisms.
- Clarify with local authorities the building permits that are required at the site.

41 Formal surveying of boundaries is expensive, time-consuming and may be difficult or impossible to achieve at the required national standard.

5. Planning and design process

The planning and design process is one of the key steps in an urban reconstruction programme. Intelligent planning takes into account requirements for a site and buildings which provides safe and user-friendly buildings that can be maintained easily. A planning and design process contains careful settlement planning and house design.

5.1 Settlement planning

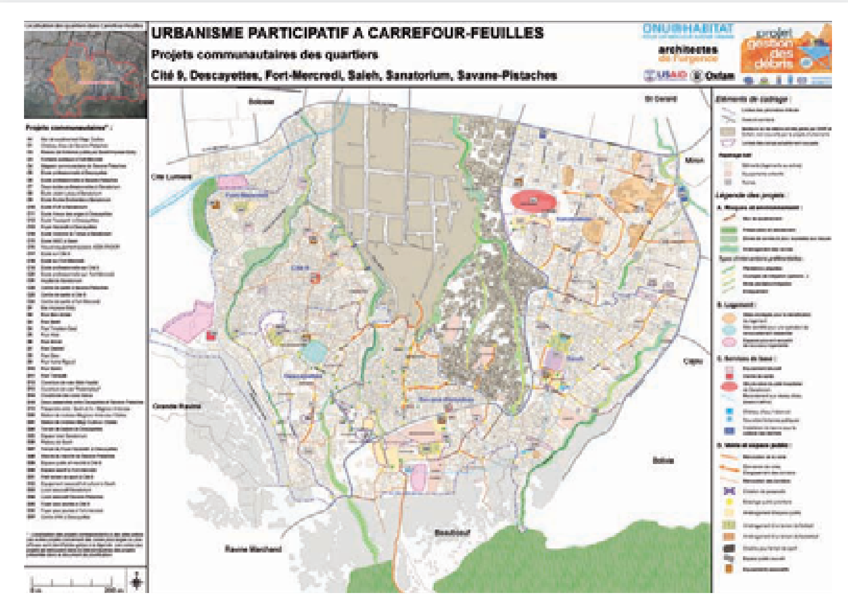
As the number of people increases, the number of vulnerable persons rises. Higher population density can simply mean an increase in the number of people who are exposed to hazards. With urbanisation comes marginalisation of the poor, who are compelled to the rather hazardous, unsafe areas of cities and, possibly, to locations where construction may have been forbidden formerly. As it is mainly the poor who settle in these locations, risk-mitigation measures are often not observed.

In many cases, the most favoured land can also be the most at risk. For example, housing that emerges along the peri-urban interface can be a factor of urban sprawl and a lack of safe buildable land. Construction on unstable urban hillsides, usually in slums, can be initiated by individuals who do not have any other option. Regardless of why construction occurs in these high-risk zones, there may be few mitigation options for the people who reside there.

In post-disaster scenarios, the challenge of urban reconstruction remains with the problem of poor urban planning. City boundaries seldom match with actual settlement locations. Often, building codes and zoning by-laws are unaffordable and unrealistic from the point of view of disaster-affected people. Informal settlements tend to grow on hazardous land without access to basic services and infrastructure or the benefit of disaster-risk-reduction planning. Land-use plans are in many cases unfinished, out of date and uncoordinated with land administration systems across different authorities and levels of government.

After a suitable location has been selected, a settlement plan needs to be developed at neighbourhood level. Settlement plans are usually prepared by a planner or architect and should be based on the site analysis.

Before developing the settlement plan for the neighbourhood, check the overall master plan of the area or city, if any, to ensure compliance with its requirements. Master plans usually cover larger areas than do settlement plans, which normally apply to only one neighbourhood.



Participatory Planning map, elaborated with the community of Carrefour Feuille (Port-au-Prince, Haiti).

Project supported by MTPTC, UN-HABITAT, US-Aid, Oxfam, Architectes de l'Urgence.

Shelter Cluster, Haiti

The settlement plan for the neighbourhood should address prevailing natural hazards and local climate conditions. It contains all necessary information about further potential risks, density of buildings, roads, vegetation and access to infrastructure. Buildings should be set in such a way that they have the least impact on the surrounding environment or nearby ecosystems.

Careful planning is required to establish the buildings' orientation on the plots, where infrastructure (piping and other services) is laid, the integration of suitable vegetation, the arrangements of external and internal spaces and urban socio-cultural requirements.

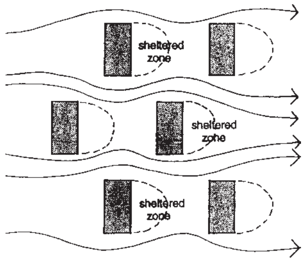
The following factors need to be considered:

5.1.1 Technical aspects

- Check whether you need to develop a new settlement plan or if a former plan is still usable or valid.
- Make the settlement plans flexible for future extensions, new accesses and necessary adjustments due to changes in the users' needs and habits.
- Ensure access through adequate streets including pathways and the public transport system.

5.1.2 Environmental aspects

- Carry out an Environmental Impact Assessment (EIA) to identify potential negative impacts on the environment and opportunities to avoid or mitigate such impacts. Integrate key requirements out of the EIA into the settlement plan (refer also to chapter 1.5).
- Protect existing vegetation, such as trees, bushes, etc. Plan to plant additional trees. Vegetation is important to improve air quality in a city.[42] Green vegetation has also aesthetic and recreational value, enhancing a city's overall quality.
- Cluster buildings in a staggered pattern to allow proper ventilation. Zigzag patterns avoid wind-tunnel effects.
- Position buildings to optimise the use of sun and wind. In a hot climate, the east and west façades should be shaded in order to minimise solar heating, especially during morning and afternoon hours, and heat gain of external walls, thus minimising indoor temperatures and improving users' comfort.
- Arrange streets and paths to economise on land use, while providing good access to buildings and facilities.



Building layout can limit wind-tunnel effects

Gut, Ackerknecht, 1993

42 Vegetation has an absorptive capacity for many pollutants, including some greenhouse gases.

5.1.3 Socio-economic aspects

- As far as possible, maintain existing social relationships within the community when resettling. The social network among families and within neighbourhoods is usually very important for the sustainable development of communities, including poverty reduction.
- Use land efficiently to preserve or enhance its economic potential.

5.1.4 Regulatory aspects

Comply with buffer zones. Local and national land-planning authorities should provide such information.

Comply with building codes, laws and regulations, such as maintaining:

- minimum distance to neighbouring industrial areas and the airport
- minimum sizes of the plots and their subdivisions
- minimum distances between buildings
- minimum plot density (normally, the building should not cover more than 55% of the plot)
- heights of buildings, numbers of floors
- purpose and usage of houses
- street width (six to nine metres, depending on how many plots are to be accessed).

5.2 Principles of housing design

Housing design is the core issue of every reconstruction programme. The design aspect is one of the most crucial factors in determining the level of ownership and acceptance by beneficiaries and communities. Therefore, it is essential that partners and beneficiaries decide jointly on appropriate and well-structured design. This may require a longer time-frame, additional work and lobbying efforts.

As a whole, an important aspect of urban housing design is the extent to which the housing can accommodate user needs, climatic conditions and local natural hazards, such as earthquakes, floods and storms. Well-designed housing minimises environmental impacts and risks, while meeting user needs. Also the choice of cooling, solar and ventilation systems, for example, has a direct impact on a building’s energy efficiency and conservation potential.

A housing design should increase resilience or vulnerability according to the hazard to which it is exposed. For example, in earthquake-prone areas, buildings with open floors (e.g., first-floor parking garages) or irregular shapes are typically more likely to fail with the incidence of an earthquake. In high-wind zones, having no roof ties usually leads to roof loss or structural failure. Areas of high snow probability must have adequate snow-load capacity integrated into frames and roof structures.

Key recommendations are:

- Favour solutions that are environmentally sustainable and energy efficient.
- Use housing designs that are resistant to natural hazards, such as earthquakes, floods and storms.
- Favour simple, low-cost, robust and practical solutions.
- Consider flexible designs that are easy to upgrade and expand.
- Assess the whole life cycle when designing a building: construction, maintenance, reuse, demolition and recycling phases.
- Ensure easy maintenance through the use of plain housing styles. In many cases, maintenance and later renovation turn out to be technically complicated and, therefore, more expensive.
- Make sure that materials, and tools needed to work the materials, are available locally.
- Ensure cost-effectiveness in all construction activities.
- Incorporate the users' needs and cultural requirements.

The house design phase of an intervention is very crucial and is the foundation of acceptance and ownership by communities.

It is recommended that the following steps are considered[43]**:**

- preparation of a site layout/plot/zoning plan
- planning for the provision of infrastructure and services at settlement level
- preparation of technical drawings for the construction of a building
- preparation of structural drawings
- preparation of drawings for infrastructure and services, such as water and sanitation, drainage, etc.
- preparation of detailed drawings of various building elements, such as parapet, doors, windows, foundation, sanitary facilities, kitchen, etc.
- approval of design by the relevant governmental authorities
- regular coordination with the various stakeholders to share good practice and knowledge
- frequent briefings with the project committees and relevant stakeholders
- undertaking regular consultations and sharing of information with various decision- and opinion-makers.

43 Adapted from: RedR in Oxfam, 2008

5.3 Building form

The form of a building is crucial to ensuring that it is built sustainably. Certain building forms can better minimise or withstand the impact of earthquakes, floods, tidal waves, storm surges, cyclones and climate conditions.

The checklist below contains the most important points to consider when thinking about sustainable building form.

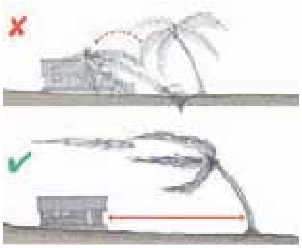
5.3.1 Technical aspects

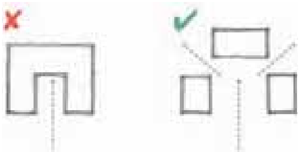
The shape of the building has an important effect on its stability. The following rules should be taken into account:

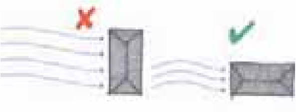
- The more compact the building's shape, the better its stability.
- L-shaped plans are less stable. An alternative is to separate house parts from each other.
- For better resistance to floods, consider elevating the ground floor and building an extra floor or using a flat roof that residents could flee to, if necessary.
- To accommodate the local climate, research the climate zone in which the reconstruction programme is located.
- If the programme is sited in a warm-humid zone, use the natural airflow to lower internal temperatures and reduce the impacts of heat and humidity on the building and its users.

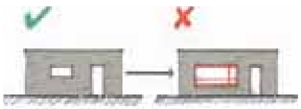
A number of steps can be taken to increase the natural airflow (in tropical climates):

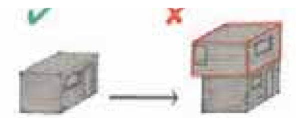
- The building's shape should be of 'open' character, allowing airflow through openings, such as windows, louvres and doors. Openings should be placed on opposite sides of the building to improve cross-ventilation. However, distribute openings well to ensure earthquake resistance (see also in Annex IV).
- Consider creating openings in the roof to enable warm and humid air to exit.
- Elevate the housing construction from the ground to allow airflow underneath the building.
- Use detached or double roofing, which allows better air circulation and provides protection from the sun.
- When possible, place the buildings with their longer axes to the prevailing wind direction in order to maximise airflow.











Sketches from 'Shelter Safety Handbook – some important information on how to build safer'
IFRC, 2011

Ten key principles of storm-resistant construction

- Tie the structure together firmly and use diagonal bracing.
- Attach the roof covering securely.
- Pitch the roof between 30 and 45 degrees to lower wind suction.
- Simplify the building's form to minimise obstruction to the wind.
- Separate verandas from the house's main structure.
- Pay attention to the size and positioning of openings.
- Ensure that openings can be closed with outside shutters.
- Use landscape and topography to protect the housing.
- Plant wind-breaks in the form of hedges, dense trees or other vegetation.

5.3.2 Economic aspects

- Construction costs can be minimised by using simple shapes without numerous and complicated angles. Sophisticated housing shapes are normally more labour and material intensive than are plain shapes, so should be carefully considered.
- Economic incentives to salvage and reuse testified materials from damaged buildings (roof tiles, poles, etc.) should be encouraged.

5.3.3 Socio-cultural aspect

- To ensure a socially, aesthetically and culturally appropriate housing design, always consult with the future users/owners regarding which building form and layout will best suit their needs and fit with their customs.

Sample questions for future residents include:

- Where should the toilet be located?
- What direction should the entrance or important rooms face?
- How many sleeping rooms are required?
- Is there need for a religious space in the house?
- What other cultural requirements do the residents have concerning privacy or religious practices (blinds, division walls, prayer corners, etc.)?
- How is accessibility for disabled people dealt with?
- Where should the kitchen be located?

5.3.4 Regulatory aspects

- It is essential to ensure that the shape, form and size of the housing complies with national building codes and other laws and regulations, particularly with respect to anti-seismic, storm and flood specifications.
- Building codes should be based upon identified hazard risk, and are normally established upon a minimum standard of safety. Building codes that do not appropriately address hazard risk induce higher risks into the housing design. Codes must be regularly updated to follow up industrial innovations, new risk expertise, and new practice and knowledge of the construction business.

Building codes are ineffective if they are not appropriately enforced. Increased construction costs related to rigid building codes are often neglected both by contractors and by the beneficiaries themselves. Building codes are effective only when there is a mechanism in place to inspect constructions as they are built and upon completion. Penalties should be imposed on those who do not construct correctly or build according to the codes.

There have been cases where building codes were adequate but there was a lack of competent inspectors to handle the case-load at the time. Likewise, there are cases where sufficient staff members are available but a culture of corruption exists allowing buildings to obtain proper approvals despite code violations by using bribery or other means.

6. Infrastructure

Urban housing that depends on weak infrastructure is likely to become unusable in the event of a disaster, even if the structure of the housing itself is solid and/or unaffected by the disaster. Urban households need various essential infrastructure and services. For example, residents and businesses need access to services, such as water supply, sanitation, electricity, roads, transport and communication. People need access to their livelihoods and children need access to education. Infrastructure programmes must give due consideration to the use of appropriate local technologies and cultural preferences for the sustainability of the work. Imported solutions from developed countries are often destined to fail. When planning for urban housing, budget and human resource considerations for infrastructure are a crucial element.

6.1 Water supply

Safe water supply, together with safe sanitation, is extremely important for public health and for economic development in urban areas. Water supply and sanitation planning must therefore be an integral part of planning for urban reconstruction. It must be noted that including water and sanitation activities requires significant budget and time allocations.

Undertaking water supply and sanitation interventions requires the involvement of qualified water and sanitation technicians for both hardware (e.g., pumps and pipes) and software (hygiene education, community participation and management, etc.). The hardware aspects of water and sanitation interventions are easier to implement compared to the software requirements.

The software component should be strongly linked to the hardware planning process, bringing together the community and engineering aspects of the project. The selection of appropriate technical options and management system should involve the community through a participatory process in which the community is an active partner and not simply a passive recipient. Partnership helps to sustain a project because it sets in place dignity and a sense of value and dignity for those who are vulnerable. This will require well-designed water supply projects that build community capacities, recognising local leadership in operation and maintenance skills. When the community is committed, government is informed and relationships with other stakeholders and local structures are established, the engineering work may commence.

An important 'software' component of water and sanitation is hygiene promotion which goes hand in hand with sanitation hardware, and can progressively lead to behavioural change.

6.1.1 Water supply system options

Options for water supply in urban areas include:

- centralised piped-water supply systems
- decentralised piped-water supply systems
- individual water supply systems at household level
- water distribution by trucks, carts or in bottles.

All systems can be applied in a combined way within the same urban setting.

Centralised piped-water supply systems consist of the following components:

- Extraction of groundwater or surface water resources in the immediate proximity of the city and from great distances, depending on the availability of resources. Groundwater is extracted by using several wells equipped with pumps, whereas extraction of surface water requires specific intake facilities. In larger cities, the use of several water sources is frequently required.
- Water treatment for removing harmful chemical substances and disease-causing bacteria as well as undesirable particles, colour, etc. from raw water. The type of treatment technology depends very much on the specific quality of raw water. A typical basic treatment for surface water is sand filtration and disinfection with chlorine. Chlorine is also frequently added to treated water for preventing recontamination of water in the distribution system.
- Transmission pipework and, if required by topography, pumping stations for transportation of water from the location of water abstraction to the entry points of the distribution system.
- Reservoirs for water storage before the water enters the distribution systems. Reservoirs are needed to satisfy peak demands during times of maximum water consumption.
- A distribution network for the supply of water to the user. The network is generally composed of primary and secondary main pipes and distribution branches. Distribution networks in larger cities are generally divided into a range of supply zones, especially if topography requires different pressure zones. Distribution networks contain valves for isolating zones or shutting down certain areas for maintenance.
- Supply points can be either public standpipes or household connections.

Centralised systems for larger cities are often complex systems and use several water sources sometimes located at considerable distance from the city, different supply zones in the distribution network, and sophisticated treatment technology. Operation and management of centralised systems require considerable technical and organisational capacities and are generally assured by municipal or corporate-owned utilities.

Decentralised piped-water supply systems are based on the same components as are larger centralised systems but use water resources available in closer proximity, supply smaller areas and often use only basic treatment technologies. Safe water resources in close proximity to the supply zone are rare in the case of densely populated urban centres but may be possible in peri-urban areas. Decentralised systems can be managed by utilities but also by community-based schemes, which make them potential alternative solutions for self-supply of communities in situations with deficient public water supplies.

Individual water supply systems at a household level are based on shallow wells or rainwater harvesting and are typical rural water supply options, though in some situations they may also be appropriate in peri-urban settings.

Water supply by trucks or carts or in bottles is common when no other systems of water supply are available and are therefore frequently encountered in post-disaster situations where existing infrastructure or organisational structures have collapsed. Such water supply cannot be considered as acceptable in the long term as it is very costly and insufficient quantities of water per person are being supplied.

Centralised water supply systems are the best option for efficient and safe water supply and should always be the preferred option whenever the required institutional capacities are available or can realistically be developed, and when there is necessary capital for investment. Decentralised piped systems or individual systems in urban areas may be the only option in some urban neighbourhoods if public institutions are too weak for reliable service provision or if not enough capital is accessible to cover the entire urban area. Vender-based informal services should be considered only as a temporary or transitional solution and be replaced as soon as possible by a formal water supply.

The WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply and Sanitation is responsible for monitoring the progress towards the UN Millennium Development Goals for water supply and sanitation. The following figure lists the definitions used by JMP to qualify which water supply options are accepted as 'improved' options and which are unacceptable or 'unimproved'.

IMPROVED DRINKING WATER	**Use of the following sources:** ■ Piped water into dwelling, yard or plot ■ Public tap or standpipe ■ Tubewell or borehole ■ Protected dug well ■ Protected spring ■ Rainwater collection
UNIMPROVED DRINKING WATER	**Use of the following sources:** ■ Unprotected dug well ■ Unprotected spring ■ Cart with small tank or drum ■ Tanker truck ■ Surface water (river, dam, lake, pond, stream, canal, irrigation channel) ■ Bottled water

Definition of improved and unimproved water supply systems[44]

44 Adapted from: WHO – World Health Organization/UNICEF – United Nations Children's Fund, 2010

Urban water supply systems	Suitability according to WHO/UNICEF/JMP criteria	Required capacities	Investment needs
Centralised piped-water supply systems	Improved water supply, if properly managed	High operation and maintenance capacities of utilities required	High public investment
Decentralised piped-water supply systems	Improved water supply, if properly managed and favourable local conditions	Good community organisation and technical skills required	Low/no public investment, in-kind community contribution possible
Individual water supply	Improved water supply, if properly managed and favourable local conditions	Good awareness and information of households required	Low/no public investment, medium investments by individuals
Tanker/bottled water supply	Unimproved water supply	Basic awareness and information of households required; high running costs for households	Medium public/private sector investments

Comparison of suitability and requirements for different types of water supply system

6.1.2 Assessment of water supply infrastructure

A thorough assessment of the state of water supply infrastructure is the first important step for post-disaster reconstruction to allow decision-making on which parts of the infrastructure are still functional and which can potentially be rehabilitated or whether complete reconstruction would be more effective.

For centralised piped-water supply systems, assessment should start with interviews of management staff and users of the system to determine the pre-disaster state of infrastructure and level of service, as well as the extent of damage to infrastructure and deterioration of service caused by the disaster. This will help to focus assessment on the main elements of infrastructure damaged by the disaster.

The following points of assessment of infrastructure for large piped-water supply systems affected by disasters need to be considered:

Water source

Natural disasters may affect the quality of water resources used for the water supply system, e.g., through salinity intrusion in coastal groundwater or surface water bodies or chemical and microbial contamination of water resources. Alternative water sources may need to be developed if long-term contamination is likely.

Facilities for water production

Facilities for water production are frequently among the most affected by natural disasters and, as key elements of water supply infrastructure, often need the most urgent attention for rehabilitation. Damage from natural disasters to facilities for water production may include the following:

- Wells are often located in flood-prone areas and may be contaminated or damaged by flooding.
- Water intake facilities located on river shores may be damaged from flooding.
- Reservoirs and water treatment facilities are prone to damage from earthquakes.
- Transmission main pipes are vulnerable to flooding when located close to watercourses and are at risk of damage from earthquakes.

Distribution network

The status of the distribution network will generally be closely linked to the condition of the housing infrastructure. Earthquakes and flooding may severely damage distribution networks.

Areas with individual water supply may also be severely impacted by disasters; shallow wells, especially, are very prone to contamination from flooding.

6.1.3 Planning reconstruction of water supply infrastructure

Based on the assessment of the state of the water supply infrastructure, objectives for reconstruction need to be defined. In general, the minimum objective will be to restore the pre-disaster level of service. However, if the pre-disaster level of water supply was already unsatisfactory, the objective of reconstruction should be to improve water supply beyond repairing damage from disaster. The objectives for determining a suitable level of service will depend on the following factors:

- urban planning context: reconstruction to existing perimeter or relocation to other areas
- level of damage to infrastructure and rehabilitation needs
- institutional capacities for managing centralised piped-water supply systems
- investment budget available for reconstruction.

For urban areas, centralised piped-water systems with metered household connections should always be the preferred option. If the required investment budget is not available or necessary institutional capacities cannot be increased, a lower level of service should be chosen for parts of the city as a medium-term solution and conceived in a way to allow for future upgrading.

In the following paragraph some further important design considerations for piped-water supply systems are discussed.

Quantity of water supplied

When designing water supply systems, one main criterion is the quantity of water to be supplied. In general, a use of 20 litres per day (l/day) per person will ensure consumption needs such as hand-washing and basic food hygiene, but not the needs for bathing and laundry. Fifty l/day is considered the minimum water-use rate to satisfy all needs for consumption and hygiene, whereas 100 l/day is considered the optimum for urban household connections (WHO, 2003). Improving water supply beyond the level of basic needs also allows productive use of water (e.g., in small-scale food production) and supports income generation in poor households.

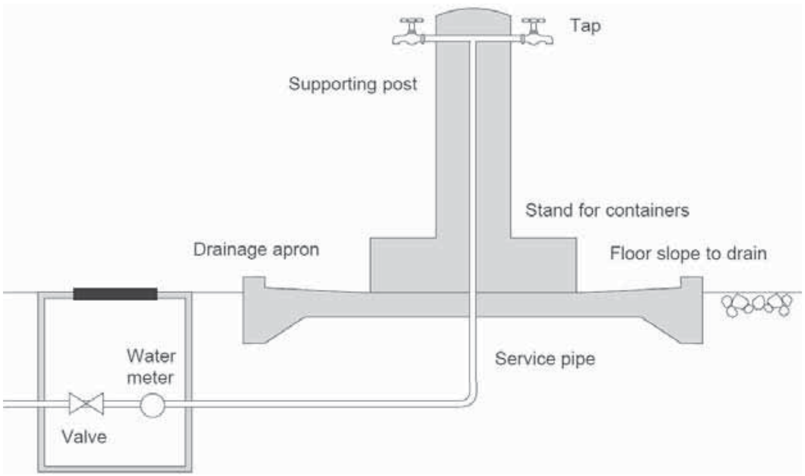
The quantity of water is closely related to the type of supply point: public standpipes are unlikely to supply more than 20 l/day when the distance to the household exceeds 100 metres. Taps on the house plot supply 50 l/day on average, whereas connections with pumps and several taps inside the house are able to supply 100 l/day or more.

System design should be based on targeted water consumption rates and on locally measured consumption rates in areas with existing good water supply.

Type of supply points

The different options for supply points in piped-water systems are as follows:

- **Public standpipes** located in streets where people collect water with containers. Water use can be free of charge or with fee collection (water kiosk). Household connections serve individual households; in general, water fees are collected based on metered consumption or on a lump-sum fee.



Public standpipe[45]

45 WEDC – Water Engineering and Development Centre, 2000

- **Household connections**, including connections with a single tap in the yard or plumbing and several taps inside the house.

Household connections offer the best level of service and generally are the preferred option. However, public standpipes may result in service to poor populations that cannot afford fees for household connections. Also, standpipes may be used as initial supply points while individual households are being connected progressively.

Continuity of supply

Supply in piped systems can be continuous or intermittent. For continuous supply, distribution pipes are maintained under pressure at all times and consumption through supply points is possible at any time. For intermittent supply, water is supplied to different supply zones on a rotational basis and only for limited periods. Intermittent supply is usually used for rationing water when capacity of water production is not sufficient to satisfy the total demand. However, often the reason for intermittent supply is poor management of the system which does not allow maintenance of pressure within the distribution network.

Water quality from networks operated with intermittent supply cannot be considered as safe, because low or negative pressure in pipes during irregular supply allows contamination to enter the pipes. Continuous supply should therefore be the objective whenever sufficient water resources are available.

Further reading:

WEDC – Water Engineering and Development Centre, 2000, Services for the urban poor – sections 1–6: Guidance for policymakers, planners and engineers; Andrew Cotton; WEDC, Loughborough, Leicestershire, UK

6.2 Sanitation

6.2.1 Sanitation options

Good environmental sanitation is as important for public health in urban areas as is water supply. Sanitation systems provide the collection of used water in households and human waste, including its conveyance, treatment and disposal or reuse. In urban areas, sanitation systems often require a complex arrangement of different technologies and organisational set-ups. Sanitation systems for urban areas can be any of the following:

- centralised systems with large gravity sewer systems and central wastewater treatment plants
- decentralised wastewater collection and treatment systems
- on-site sanitation systems.

Many technological options are available for sanitation and can be applied in a combination of ways for different situations within the same urban area. Some of the most important options for urban settings are listed below. These are **selected options only**; for a complete overview of options, the Compendium of Sanitation Systems and Technologies[46] is recommended.

46 EAWAG – Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz, 2008

The following figure summarises the JMP definitions for improved and unimproved sanitation options:

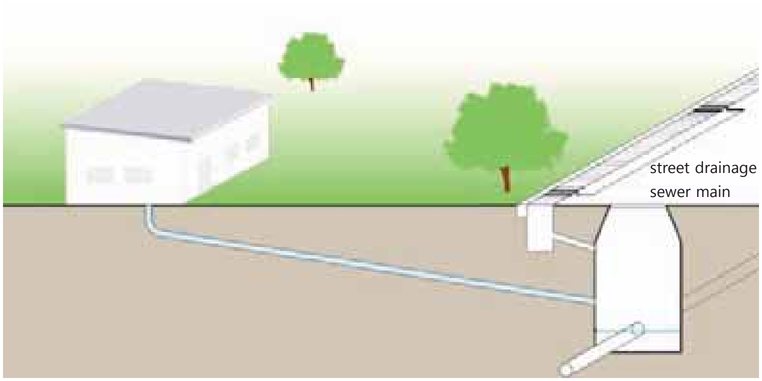
IMPROVED SANITATION	**Use of the following facilities:** ■ Flush or pour-flush to: – piped sewer system – septic tank – pit latrine ■ Ventilated improved pit (VIP) latrine ■ Pit latrine with slab ■ Composting toilet
UNIMPROVED SANITATION	**Use of the following facilities:** ■ Flush or pour-flush to elsewhere (i.e., not to piped sewer system, septic tank or pit latrine) ■ Pit latrine without slab / open pit ■ Bucket ■ Hanging toilet or hanging latrine **Shared facilities of any type** **No facilities, bush or field**

Definition of improved and unimproved sanitation systems[47]

Centralised gravity sewerage and wastewater treatment

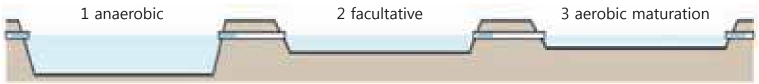
Gravity sewers are large networks of underground pipes that convey household wastewater, including from flush toilets, as well as storm-water (see also chapter 6.3) to a centralised treatment facility using gravity. Such systems typically serve urban centres and densely populated sites, sometimes entire urban areas. The gravity sewer system is designed with many branches, typically subdivided into main sewer lines along main roads and a network at the neighbourhood and household level. Because the waste is not treated before it is discharged, a constant downhill gradient must be guaranteed to avoid accumulation of solids. When a downhill grade cannot be maintained, a pump station must be installed. Access manholes are placed at set intervals along the sewer, at pipe intersections and at changes in the pipeline's route. This technology provides a high level of hygiene and comfort for the user at the point of use. However, because the waste is conveyed to an off-site location for treatment, the ultimate health and environmental impacts are determined by the treatment provided by the downstream facility.

47 WHO – World Health Organization/UNICEF – United Nations Children's Fund, 2010



Gravity sewerage, manhole and household connection[48]

Various technologies are available for **central wastewater treatment**, ranging from technically sophisticated systems like activated sludge treatment to efficient low-tech systems such as waste stabilisation ponds. Important criteria for choosing the appropriate treatment technologies are required effluent standards, access to investment capital, existing management capacities and available land.



Waste stabilisation ponds: a very efficient wastewater treatment technology with low maintenance needs but high land requirements[49]

Planning, construction, operation and maintenance require expert knowledge. Gravity sewers are expensive to build and, because the installation of a sewer line is disruptive and requires extensive coordination between the authorities, construction companies and the property owners, a professional management system must be in place.

Decentralised or community-based systems

Decentralised wastewater collection and treatment systems are based on simplified sewer systems for collection of wastewater that has been partly treated. Those systems typically serve limited areas such as smaller neighbourhoods in peri-urban areas.

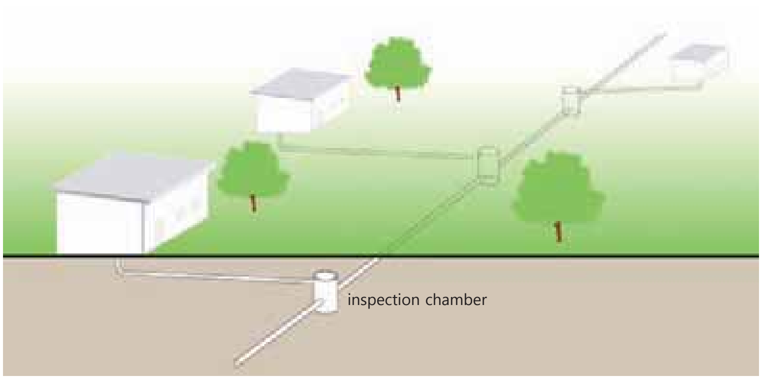
48 EAWAG – Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz, 2008

49 EAWAG – Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz, 2008

Simplified sewers comprise a sewerage network that is constructed using smaller-diameter pipes laid at a shallower depth and at a flatter gradient than those used in conventional sewers. This allows for a more flexible design with lower costs and a higher number of connected households. Expensive manholes are replaced with simple inspection chambers. Each discharge point is connected to an interceptor tank to prevent 'settleable' solids and rubbish from entering the sewer. In addition, each household should have a grease trap at the sewer connection. Another key design feature is that the sewers are laid within the property boundaries, rather than beneath the central road.

Because simplified sewers are laid on or around the property of the users, higher connection rates can be achieved, fewer and shorter pipes can be used and less excavation is required as the pipes will not be subjected to heavy traffic loads. However, this type of conveyance technology requires careful negotiation between stakeholders since design and maintenance must be jointly coordinated.

Simplified sewers can be installed in almost all types of settlements and are especially appropriate for dense, urban communities. Operation and maintenance of simplified sewers can be carried out by municipal utilities or community groups.

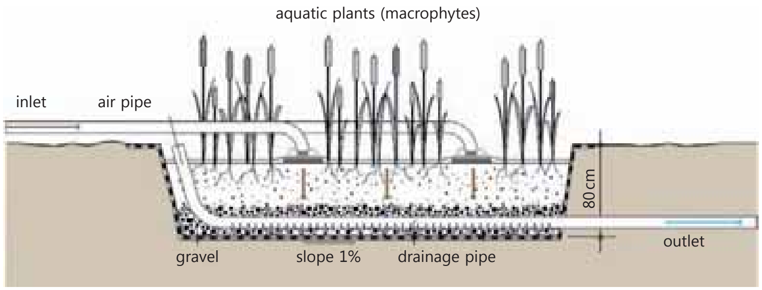


Simplified sewer system with collection pipes on plot and inspection chambers functioning as settling tanks[50]

Wastewater collected in simplified sewers can be treated in small-scale wastewater treatment plants or discharged into a branch of a conventional sewer system.

Various technologies are available for decentralised wastewater treatment to suit local conditions and requirements regarding effluent standards, access to investment capital, existing management capacities and available land. In general, decentralised systems need to be easier to operate and maintain than are central wastewater treatment plants because of lower capacities at the local level. Natural treatment systems such as constructed wetland are especially suitable for these small-scale treatment plants.

50 EAWAG – Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz, 2008

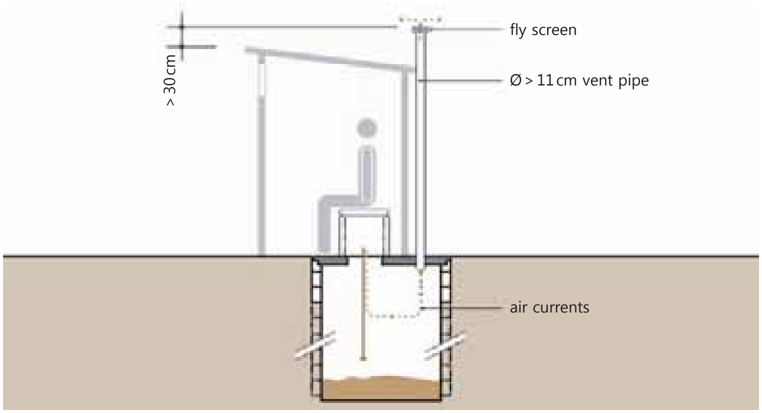


Example of a small-scale wastewater treatment plant: vertical flow constructed wetland[51]

On-site systems

On-site systems provide most functions of a sanitation system at the housing location and generally serve one individual household. Waste and wastewater are collected, treated and stored on site. Disposal or reuse may also happen on site. On-site sanitation frequently involves separate systems for different household wastes, e.g., separate facilities for collection of faeces and urine and of grey water (wastewater from kitchen and bathing). Many on-site sanitation systems and technologies exist; some of the most common ones are described below:

Ventilated improved pit (VIP) latrines are waterless toilets that collect faeces and urine in a simple earth pit. A superstructure and venting system makes the latrine safe and hygienic to the user. Liquids are drained in the underground, in order to avoid microbial contamination of drinking water; latrines have to be placed at a certain minimum distance (>30 metres) from water sources such as shallow wells. Solids accumulate in the pit; when the pit is full, either it needs to be emptied or a new latrine needs to be built nearby.

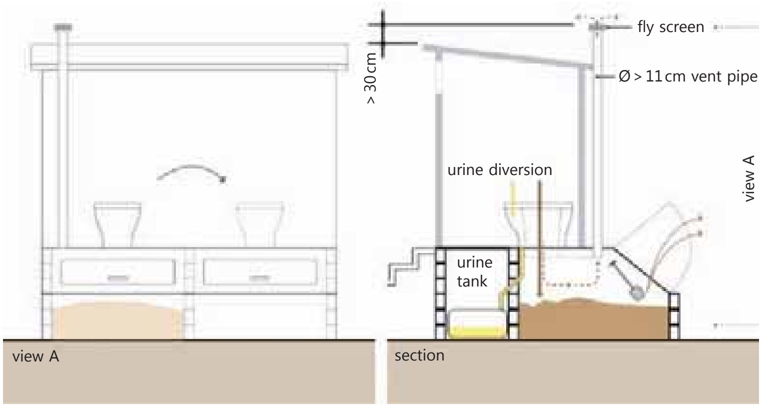


Ventilated improved pit (VIP) latrine[52]

51 EAWAG – Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz, 2008

52 EAWAG – Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz, 2008

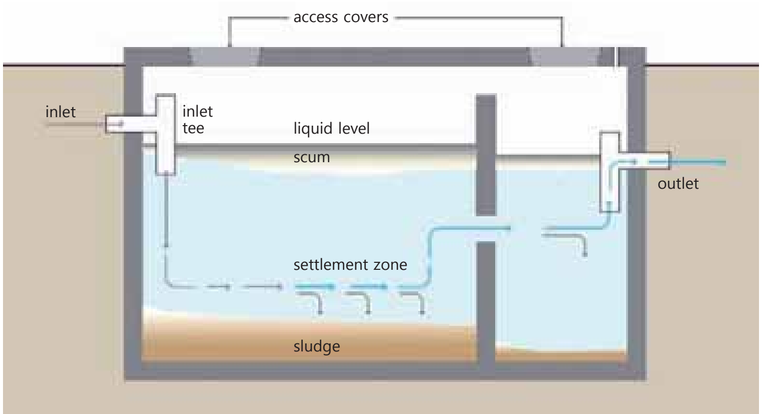
Urine-diverting dehydration toilets (UDDT) are a different type of waterless toilet, where urine is collected separately in containers and faeces are collected in sealed chambers. The separation of urine allows complete drying of faeces. A double-vault system for faeces collection, where one vault receives faeces and the other stores previously collected faeces for about six months, ensures that no fresh faeces need to be handled when emptying the chamber. UDDTs do not need replacement as do VIP latrines and do not contaminate groundwater; additionally, dried faeces and collected urine can be used as fertilisers, e.g., on site in gardens. If no space for on-site reuse is available, collection systems are required.



Double-vault urine-diverting dehydration toilet[53]

Flush toilets (or pour-flush toilets) connected to septic tanks collect and pre-treat urine, faeces, flushing water and optionally also grey water. Treatment in a septic tank is based on settling and anaerobic digestion of solids; the solid-free effluent is then either infiltrated on site or needs to be collected in a simplified sewer system. Digestion of solids greatly reduces the accumulation of sludge; nonetheless, the septic tanks require de-sludging every few years.

53 EAWAG – Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz, 2008



Septic tank[54]

On-site systems generally require some space on the plot for the facilities and are therefore rarely appropriate for densely populated urban centres. In urban areas, on-site sanitation is often a very viable solution, especially if public sanitation service provision is weak. On-site sanitation is user based; investment, maintenance and operation are, to a large extent, provided by the households. However, the quality of on-site sanitation greatly depends on the awareness, know-how and resources of households. Efforts towards awareness-raising and information-giving, as well as financial support, are often required to ensure sustainability and safety of on-site sanitation. Further, most urban on-site sanitation requires some collection services, e.g., sludge from septic tanks or latrines needs to be collected, treated or disposed of safely. These services need to be organised by community groups, public utilities or private service providers.

Shared facilities

Shared sanitation facilities such as public toilet blocks are sometimes used in densely populated, poor neighbourhoods. Technologies for public toilet facilities are similar to on-site sanitation or sometimes use small-scale wastewater treatment. Public toilets are particular common as temporary solutions in post-disaster situations, as they can be installed quickly and serve large numbers of users. However, according to JMP criteria, shared facilities cannot be considered as a sustainable and safe sanitation solution in the long term and in post-disaster reconstruction should be replaced by an improved solution as promptly as possible.

54 EAWAG – Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz, 2008

Public toilet in India
GTZ – Deutsche Gesellschaft für Technische Zusammenarbeit, 2007

6.2.2 Situation assessment and definition of objectives

A thorough assessment of the state of sanitation infrastructure is the first important step for post-disaster reconstruction. Interviews with management staff and users in the different areas of the urban setting may be the best starting point to determine the pre-disaster state of infrastructure and level of service as well as the main damage to infrastructure and deterioration of service caused by the disaster. This will enable identification of the main damage caused by the disaster and elements of infrastructure needing detailed assessment. Damage from natural disasters to sanitation facilities often includes the following:

- Sewers may be clogged with silt and debris after flooding or may be ruptured by earthquakes.
- Wastewater treatment plants may be damaged from earthquakes or flooding, particularly when located close to watercourses.
- Damage to on-site sanitation facilities will be closely linked to the condition of building infrastructure.

6.2.3 Planning reconstruction of sanitation infrastructure

Based on the assessment of the state of the sanitation infrastructure, objectives for urban reconstruction of sanitation systems need to be defined. In general, the minimum goal will be to restore the pre-disaster level of service. However, if the pre-disaster level of sanitation was already unsatisfactory, the objective of reconstruction should be to improve the situation beyond repairing damage from the disaster. The objectives for determining a suitable level of service will depend on the following factors:

- urban planning context: reconstruction on existing perimeter or relocation to other areas
- level of damage to infrastructure and rehabilitation needs
- institutional capacities for managing centralised sewer systems
- investment budget available for reconstruction.

For sanitation, there is no 'one size fits all' solution; reconstruction should always be tailored to the specific situation, which can vary from one neighbourhood to the other.

Many sanitation systems have components integrated into the building infrastructure, e.g., flush toilets, septic tanks, etc. When entire neighbourhoods need to be completely rebuilt or relocated, there is the chance to rethink the sanitation systems and apply solutions which are better than was the infrastructure prior to the disaster.

Investment and management of a decentralised and on-site sanitation system is highly dependent on involvement of individual households. It is therefore very important to focus on awareness-raising and information-giving, as well as on ensuring participation of users in sanitation planning.

Further reading:

WEDC – Water Engineering and Development Centre, 2000, Services for the urban poor – sections 1–6: Guidance for policymakers, planners and engineers; Andrew Cotton; WEDC, Loughborough, Leicestershire, UK

EAWAG – Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz, 2008, Compendium of Sanitation Systems and Technologies; Elizabeth Tilley, Christoph Lüthi, Antoine Morel, Chris Zurbrügg and Roland Schertenleib; Eawag/Sandec, Dübendorf, Switzerland: www.eawag.ch/forschung/sandec/publikationen/sesp/dl/compendium_high.pdf

IFRC – Post-disaster community infrastructure rehabilitation and (re)construction guidelines, 2012

6.3 Drainage

6.3.1 Basic considerations

Drainage systems remove storm-water and wastewater from neighbourhoods to minimise public health risks, inconvenience to inhabitants and damage to other infrastructure. The objectives of drainage are:

- minimising flooding of houses
- preventing erosion and damage to buildings
- eliminating standing water and the resultant risks from mosquito-transmitted diseases
- reducing the extent and duration of flooding of streets to acceptable levels.

Drainage must handle two very different types of water:

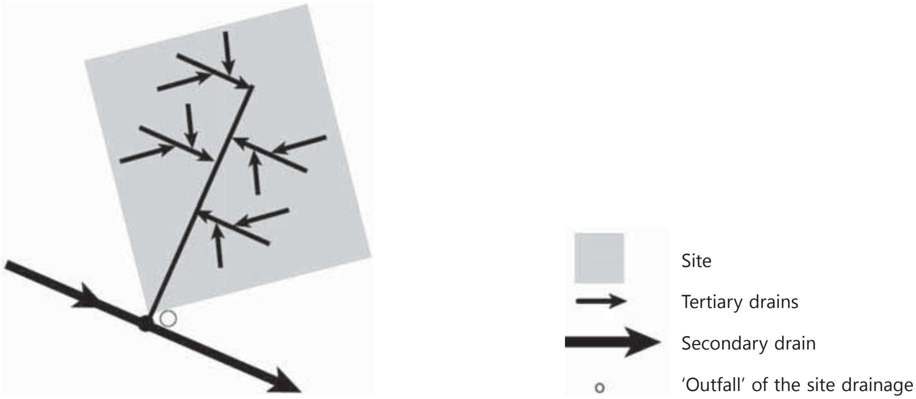
- Storm-water is water from rain events which occur infrequently but can generate large flows of water requiring evacuation. The flow depends on climatic conditions; in tropical climates, the intensity of rainfall can be extremely high. There are two main causes of flooding by storm-water:
  - inundation from a surrounding area, e.g., from a river or canal which is flowing at an abnormally high level
  - inability of the drainage system to remove the required quantity of storm-water resulting from intense rainfall.
- Wastewater occurs in comparatively small but permanent flows. The volume of wastewater is closely linked to the consumption of drinking water.

Drainage
Claudia Schneider (Skat)

As with sewerage, there is a hierarchy in drainage systems:

- Tertiary drains are those drains at the neighbourhood level which collect and deliver drained water to the outfall point at the site boundary.
- Secondary drains run past the site and collect water from the tertiary drains.
- Primary drains, such as large drainage canals, streams or rivers, collect water from the secondary drains.

It is important to realise that the drainage problem does not end once a drainage network has been designed for the site in question. The drainage water which has been collected from the site discharges into a nearby secondary drain; if this has insufficient capacity to cope with the additional flows, its water level rises and water cannot escape from the site drains. Flooding then occurs on the site, and the fundamental problem has not been solved. Consideration must always be given to the downstream part of the drainage system.



Basic layout of a drainage system[55]

The principal problems in the design and implementation of drainage relate to the slope of the ground. Difficulties are encountered on ground which is either flat or excessively steep:

Flat ground: Drainage by gravity implies that all drains must slope downhill. This is achieved by following the land's natural contours. On low-lying or flat sites which are being reconstructed, it is difficult to create the required slope and ground preparation must ensure adequate contouring of the ground to permit drainage. The available options include:

- filling and contouring
- moving the outfall closer to the site by means of a canal
- constructing the outfall drain as a buried pipeline.

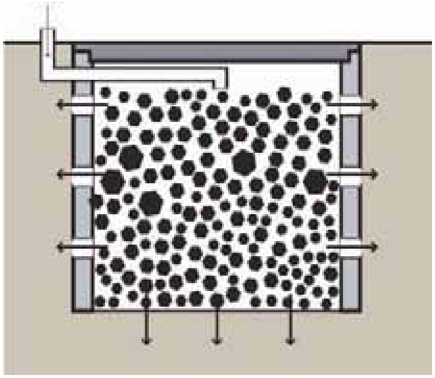
Steep ground: Strong erosion and risk of landslides may result from insufficient drainage of sites with steep slopes. Drains should follow a path parallel to the contours for short distances to help reduce the speed of the flow. Where the drains run steeply downhill, they need to be lined and include structures to reduce the velocity of this flow, such as a series of downward steps.

6.3.2 Technological options

On-site disposal of wastewater

Wastewater can be disposed of on site by infiltration pits after pre-treatment in septic tanks or directly (see chapter 6.2). Key factors are the quantity of wastewater, the plot size and the permeability of the ground. If the ground is only slightly permeable, or is waterlogged during the wet season, infiltration pits will not work. On-site disposal may be feasible where water is being fetched from a public water supply point. However, where the houses have individual water connections it is unlikely to be appropriate unless the ground is very permeable or the plots are very large.

55 WEDC – Water Engineering and Development Centre, 2000



Example of a soak-pit for the infiltration of pre-treated wastewater[56]

Sewerage for wastewater

Wastewater can be evacuated by gravity or simplified sewer systems (see chapter 6.2). Gravity sewers for exclusive wastewater collection are very expensive; usually, gravity sewers receive both wastewater and storm-water. Simplified sewers are appropriate only for wastewater collection, not for storm-water. Their lower costs, however, make them an interesting option for separate wastewater and storm-water systems.

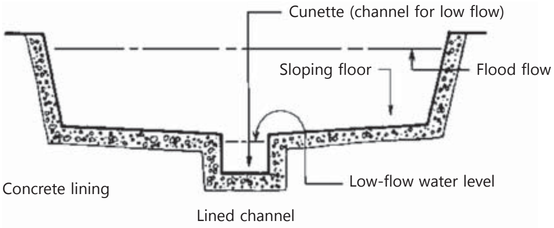
Combined wastewater and storm-water sewers

Combined sewer systems for wastewater and storm-water are a common solution. They must satisfactorily carry high flows resulting from intense rainfall and very low flows of wastewater at a velocity sufficiently high to prevent deposition of solids. Sewers can act as tertiary and secondary storm-water drains, but usually not as primary drains. Storm-water overflow facilities will then be needed to discharge high flows into large primary drains during rain events. Sewer pipes are particularly sensitive to clogging; therefore, a good maintenance of sewers as well as efficient solid waste collection and street cleaning are crucial for the functioning of sewers during high-intensity rainfalls.

Open channels

Open channels are relatively simple to construct and maintain. They are used for primary drains but can also act as tertiary and secondary drains. When availability of space is limited, or when open drains also receive wastewater, they are often covered with concrete slabs. Open channels can be lined or unlined; although unlined channels are cheaper to construct, they have much higher maintenance requirements.

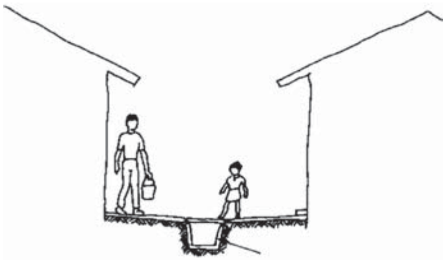
56 EAWAG – Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz, 2008

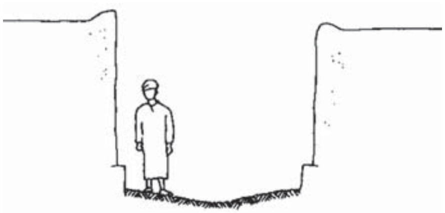


Open-channel drain for wastewater and storm-water[57]

Roads as surface water drains

Paved roadways and alleys can be used to carry storm-water short distances to drainage channels, which means that water is deliberately allowed to flow along the paved surface and there are no channels alongside. This works where the surfaces are fully paved and well maintained and is only applicable if separate wastewater disposal facilities exist. It is cost effective and is recommended wherever possible.





Drainage examples: covered open-channel drain; road acting as drain[58]

Storm-water retention

Storm-water can be stored temporarily in basins, on roofs or other areas to allow water to drain away in a controlled manner, to reduce the volume of the peak flows and lessen the required capacity of the off-site drainage system. The main drawback of this is that land is required for the storage and is rarely available in dense urban settings. However, the possibility of temporary retention in conjunction with removal by surface-water drains is attractive and should be investigated.

57 WHO – World Health Organization, 1991

58 WHO – World Health Organization, 1991

6.3.3 Reconstruction planning

A functioning drainage system in urban areas is a very important measure for prevention of flood damage. Severe damage from flooding in urban areas is often a clear indicator of ineffective drainage systems and reconstruction efforts must include improvement of the drainage to mitigate risks from future events. Therefore, it is very important to assess the weaknesses of the infrastructure as well as the operation and maintenance systems.

Special attention should be paid to the drainage situation in areas located on steep slopes. These are often poor or informal settlements with very limited infrastructure which are extremely vulnerable to landslides during prolonged rain events. Improving drainage is vital for reducing the risk of landslides in such areas.

However, flooding may also be influenced by factors beyond urban drainage. Other aspects of flood protection to be considered for reconstruction of flood-affected urban areas include:

- infrastructure for flood protection such as river or sea dykes
- watershed management such as control of deforestation
- relocation of settlements to areas not vulnerable to flooding or landslides.

As with water supply and sanitation, operation and maintenance of drainage infrastructure is crucial to ensure its effectiveness. Therefore, reconstruction of drainage infrastructure needs to include the development of required capacities for operation and maintenance.

Further reading:

WEDC – Water Engineering and Development Centre, 2000, Services for the urban poor – sections 1–6: Guidance for policymakers, planners and engineers; Andrew Cotton; WEDC, Loughborough, Leicestershire, UK

WHO – World Health Organization, 1991, Surface-Water Drainage for Low-Income Communities, Geneva

6.4 Roads

6.4.1 Basic considerations

Access: Access provision takes account of the needs of people, vehicles and services. Access routes enable the inhabitants of a site to move freely from their homes to other areas of the site and to major adjoining areas.

People: People require access to their houses. Whilst walking distances to main trunk routes should be minimised, some access restrictions to other parts of the housing area may be effective in enhancing security and community awareness within subsections or clusters of the housing site.

Access can be difficult in urban areas...
Julien Goldstein (IFRC)

Vehicles: Vehicles do not necessarily need to be able to reach every house. In low-income areas which are predominantly residential, pedestrian and small-vehicle (rickshaws, bicycles, carts) movements tend to dominate. Design of all roads for substantial movements of conventional vehicles is unnecessary; however, it is desirable to allow small-vehicle access to all houses for occasional personal transportation and to permit delivery of building materials. Small buses and para-transit vehicles should be able to travel freely on distributor roads, but do not need access to each house.

Services: It is common practice for service lines to follow the street alignment. Many services require space and full account must be taken of the needs of water supply and sewerage pipes, open-channel drains, and power lines. Large vehicles for services (solid waste and septic sludge collection) do not require access to every house, but at least smaller vehicles or carts needed for the service provision should be able to reach every house and those needs must be considered.

Consideration of these requirements leads to designs for a hierarchy of access. There may be one or more site access roads leading off a trunk route; a site distributor then connects all the housing clusters to the site access road. A cluster road gives access to individual households and, finally, pathways may be used to interconnect clusters.

Paving

Paving has three basic functions:

- to provide a hard, dry access to residential, commercial and industrial areas
- to improve the drainage
- to provide a smooth-running surface with adequate skid resistance for vehicles.

Any access route for pedestrians or vehicles requires a smooth surface, free of obstructions or holes, which is passable in wet weather. The consequent improvements to drainage are usually a high priority, whilst skid resistance is of importance mainly on primary routes.

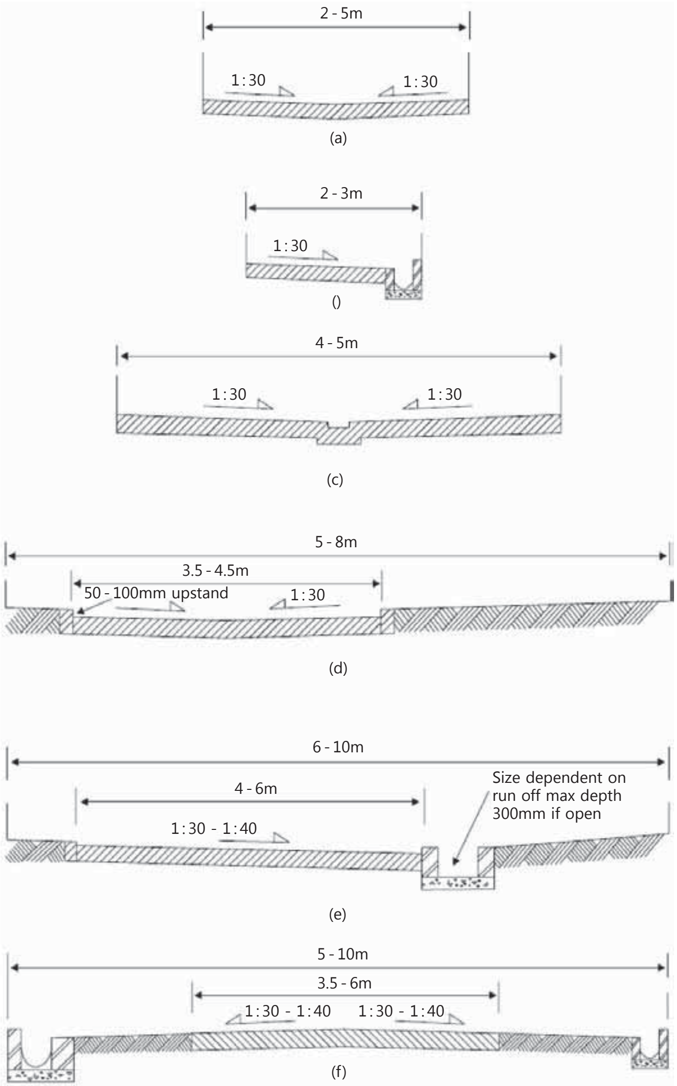
Paving must have sufficient strength to resist the loads which are imposed on it and transmit them to the underlying ground. Therefore, an important feature of paving is structural strength, which depends upon the materials used and the pavement thickness. Failure to consider the drainage implications of street paving work may lead to rapid deterioration of the surface.

Options for pedestrian and lightly trafficked areas (i.e., those carrying some cars but few, if any, commercial vehicles) include:

- hard core or granular fill
- bricks or concrete blocks laid in sand or cement
- in-situ unreinforced concrete
- hand-laid asphalt.

Options for through routes carrying commercial traffic include:

- surface treatment
- bituminous carpet
- concrete.



Typical cross-sections of various types of access roads[59]

59 WEDC – Water Engineering and Development Centre, 2000

6.4.2 Planning

In many situations, paving is carried out in an uncoordinated manner with no overall planning; the full benefits of improved overall access and drainage are not realised. At the planning stage, decisions have to be made about the type and width of paving, the methods and materials to be used and the role that the paving is to play as part of the drainage system. To some extent, these decisions are interrelated. In particular, the materials to be used and the pavement levels adopted will be influenced by the way in which the paving is to be incorporated into the drainage system.

The first task is to decide the hierarchy of access. Through streets must be distinguished from those that will be used for purely local access.

The pavement width required depends on the width of the street and the traffic to be carried by the street. For streets up to about five metres in width, it will usually be advisable to pave the whole width, other than that required for any drains. For wider streets, paving should usually be provided only to accommodate access needs.

In reconstruction situations, where entire neighbourhoods are being rebuilt, it is particularly important to coordinate planning and construction of the different infrastructure components for water supply, sanitation, drainage and roads.

Further reading:

WEDC – Water Engineering and Development Centre, 2000, Services for the urban poor – sections 1–6: Guidance for policymakers, planners and engineers; Andrew Cotton; WEDC, Loughborough, Leicestershire, UK

6.5 Solid waste management

6.5.1 Basic considerations

Solid waste management in urban areas is one of the most challenging environmental issues in disaster-affected regions. Waste disposal practices vary among areas, depending on access to disposal facilities, local tradition and the degree of governmental or municipal intervention.

Quite often, there is no regular and controlled waste collection at all. Existing laws, regulations and administrative arrangements concerning waste collection and treatment are often not put into practice. It is also common to find that lack of proper waste management is not perceived as a major problem. It is essential that all stakeholders gain awareness of the need for more sustainable approaches to waste management.

It is usual to find that planners overemphasise the provision of waste management infrastructure, such as truck fleets and dumpsites, but neglect to plan how and by whom waste should be segregated, collected, treated and disposed of. A long-term support programme for waste management should be included in any reconstruction action.

A major challenge of waste management in cities and surroundings is the disposal sites themselves, which are often uncontrolled, unmanaged and typically located along vegetation lines or shores, causing a pollution threat to rivers, natural water systems and the groundwater.

Uncontrolled waste disposal
Manuel José Jimenez (IFRC)

Impacts on groundwater supplies, the coastal zones and reefs are quite evident. In the absence of alternatives, residents often burn their waste in their backyards or in uncontrolled locations in the city, resulting in local air pollution, smell and health hazards from the production of dioxins and other toxins.

Waste materials are generally not segregated at the source. Where markets for recyclables exist, it is more likely that segregation is undertaken at household level.

To meet waste management challenges, the following steps are recommended:

- Solid waste management should be approached in a holistic way. Urban and settlement planning, community organisation, administrative framework, water resources management, environmental protection and resource recovery aspects should all be fully considered.
- A good starting point is to assess the strengths and weaknesses of the former waste-management system and identify how it can be further improved.
- Recyclables such as metals, paper and plastics should be collected systematically and marketed. Sometimes, this is economically unattractive for a single household, but may become acceptable if organised on a neighbourhood or city scale.
- Separate collection and treatment of the organic or 'wet fraction' will allow the production of compost and reduce the amounts of residual waste that have to be hauled to the disposal facility and the associated costs.
- Consider low-cost, affordable waste-management technologies and systems.

Waste collection and sorting
British Red Cross

- If properly organised, waste management can become a source of income for small transport entrepreneurs or community-based enterprises.
- As an incentive to reduce waste, to raise awareness and to ensure regularity and quality of collection and disposal services, at least a part of the costs of solid waste management should be charged to the residents.

As a whole, there is no ready-made solution for solid waste management that fits every situation. Each set of urban conditions may well have different requirements, and the right solution for a given place and time will have to be found. As many desired improvements are related to people's awareness, habits and customs, a practical and realistic step-by-step approach involving as many stakeholders as possible is more likely to bear more cost-effective and appropriate results than centrally planned proposals based on technology inputs and huge investments.

The location of disposal sites should be determined through consultation with key stakeholders including local authority officials, families' representatives and relevant organisations. Appropriate locations should avoid negative impacts on the neighbourhoods including from smell, smoke, water pollution, insects and animals.

6.5.2 Technical aspects

Selected waste-management solutions must be practical and easily manageable under urban conditions. Technologies used should be gradually upgraded. For example, it is often better to organise primary collection through locally available means of transport, such as handcarts, horse-drawn carriages or tractors with trailers, instead of relying on costly and maintenance-intensive specialised equipment like compactor trucks.

Likewise, building a fully engineered and controlled sanitary landfill with leachate control and landfill gas recovery may be the optimum solution but, to eliminate uncontrolled burning and dumping, the designation of smaller dumpsites on carefully chosen, easily accessible locations may be a better approach to improving conditions until a more comprehensive long-term solution can be implemented. Two possible solutions could be to:

- provide drainage trenches downhill of landfill sites on sloping areas
- secure and fence off disposal sites.

Rough estimate of solid waste generation per person:

Each person is likely to produce 0.5 to 1.0 litres of waste per day with an organic content of 25 to 35 per cent.

These figures are likely to vary greatly, however, and estimates should be made locally.

6.5.3 Environmental aspects

- Consider activities that will raise environmental awareness among families and facilitate the introduction of environmentally friendly, healthy, effective, efficient and sustainable waste-management systems.
- Ensure that waste is deposited only on designated sites, which are chosen to minimise the risk of water pollution, uncontrolled burning, access of animals, spread of disease-carrying organisms, and the scattering of waste by the wind.
- Locate disposal sites downhill from groundwater sources.
- Position sites at least 50 metres from surface-water sources.

6.5.4 Institutional aspects

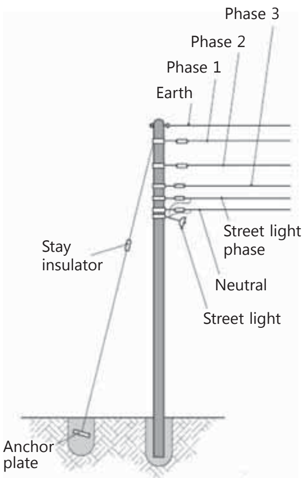
- Assess all stakeholders and their real and potential responsibilities regarding waste management.
- Consider the local administrative and political situation.
- Review local legislation and regulations on waste management.
- Assess who owns the proposed waste-disposal site.

6.5.5 Social aspects

- Assess which solid waste management system the residents and the responsible institutions are accustomed to; i.e., collection at household level or at centrally located collection sites within a neighbourhood.
- The best results in waste management are achieved if the community recognises that it is in their own interest to use the system. Explore, support and promote community participation in all aspects of the planning, organisation, implementation, supervision and financing of waste-management activities.
- Effective solid waste management in a city can be achieved only if all citizens at all income levels are served by the system.
- If restricted municipal budgets, accessibility limitations or incapacity to pay service fees exclude part of the households from proper waste management, environmental and health improvements in other neighbourhoods will remain at risk. Therefore, ways of achieving full coverage for all social groups must be sought.

6.6 Other urban infrastructure

6.6.1 Electricity/Energy



Local electricity distribution system[60]

Urban households use energy for cooking, lighting, heating/cooling of air and water, for powering refrigerators and other household equipment, and often also for other electric equipment such as TVs, radios and computers.

Power supply is necessary to provide increased levels of street and security lighting and to run simple household appliances. The principal benefits of domestic connections are largely related to convenience and communication (e.g., charging mobile-phone batteries), and possibly to status and productive uses.

During planning of housing reconstruction, it is very important to consider the energy needs of the inhabitants, including objectives regarding sustainable energy supply as well as exploring ways of improving energy efficiency in housing.

The cost of conventional power supply is influenced by the proximity of the reconstruction area to existing three-phase power supply lines. Where extensions to the primary distributor system are required along with new transformers and ancillary equipment, the costs become very high. Conventional power supply requires distribution through systems of conductors and transformers; the options include either overhead lines or underground cables, the latter being expensive and uncommon. Overhead lines may be bare or insulated and either suspended between poles or attached to the face of buildings; in this latter case, the lines must be insulated.

The structure of connection and consumption fees needs to be carefully considered to make a power supply affordable to the poorest households. Full-cost connection fees where the entire costs of connection and the meter have to be paid first are often prohibitive to these households. Fee schemes where connection fees are paid in instalments and collected with consumption fees

60 WEDC – Water Engineering and Development Centre, 2000

are preferable. Due to high-density settlement, power supply to poor neighbourhoods can often be realised at a very low cost per capita. Billing and collection costs can be significantly reduced by efficient management or modern technologies. For example, prepaid card systems eliminate the need for meter-reading, billing, collection and enforcement. Full advantage has to be made of such options to bring down costs of power connections within poor residential areas.

Renewable energy solutions are often more expensive to purchase and install than are conventional sources. Because renewable energy is virtually free, however, the economy of renewable energy sources over the lifespan of the building is normally much better than are conventional systems.

Solar energy

Few options exist for independent power supply in urban areas. Photovoltaic (PV) panels are generally too expensive for poor residents to purchase. However, solar panes for production of hot water are affordable and help reduce costs of electricity consumption.

Solar energy can be used to provide lighting, mechanical power and electricity. Sunlight is converted to electricity using PV cells, also known as 'solar cells' or 'solar panels'. PV cells produce electricity as long as light shines on them; they require little maintenance, do not pollute and they operate silently. A reliable supplier of solar panels and appropriate installation is required. Prices for solar panels can vary from region to region. Solar panels can be easily installed on roofs or placed beside houses.

Solar panels for hot-water production in Bruce Sutherland, City of Cape Town[61]

Photovoltaic panels, used to produce electricity

61 UN-HABITAT, 2009

Another challenging issue is that of clean cooking fuels in poor settlements. Energy in the form of cooking fuel is generally the dominant energy need of the urban poor. The cost of charcoal is often only marginally lower than the cost of domestic cooking gas (LPG). Subsidising initial costs of LPG stoves and cylinders may allow substitution of charcoal or firewood with LPG, which would have many positive health and environment benefits.

As far as possible, energy consumption should be reduced through good planning and building design, and by making use of renewable energy sources such as solar, wind and hydro power, and geothermal and bio-power mass-energy systems. The benefits of using renewable energy include long-term competitive price stability, reduced vulnerability to fuel supply disruptions, and minimised emissions of greenhouse gases.

Technical aspects

- Reconstruction offers a good opportunity to install renewable energy systems, especially when the systems can be installed in a large number of buildings at the same time.
- Select the renewable energy system most suitable for the area of reconstruction. National meteorological organisations usually have maps and data available to estimate how many windy days or sunny days the area has in a year.
- Some renewable energy sources (wind, solar) should have a conventional back-up system for days with unsuitable weather conditions.

Social aspects

- Sustainable power and renewable energy systems must be well adapted and sensitive to the users' culture.
- Cooking and heating with fuel wood or coal can cause serious indoor pollution with associated health problems. As far as possible, avoid these kinds of energy sources for indoor use.
- Training is necessary for the construction and maintenance of alternative energy solutions.

Institutional aspect

- Some governments are actively promoting renewable energy sources and providing incentives, such as loans and tax reductions, for users to install such systems.

6.6.2 Social infrastructure

Urban neighbourhoods of a certain size require social infrastructure, either within the community or outside. Social infrastructure includes:

- schools
- kindergartens
- administration centres
- shops
- health centres

- sport facilities
- community halls
- places of worship.

The provision of social infrastructure is an essential part of developing a functioning urban neighbourhood and should be integrated in any reconstruction programme. Social infrastructure buildings can be simple structures, yet their intense usage by many people should be taken into account.

Social infrastructure buildings can be constructed with the same materials and technologies as those used for the housing structures, or with those in another suitable form. The location should be well selected and easily reachable by the community members.

Rebuilding a shop
Julien Goldstein (IFRC)

7. Implementation

The construction phase of a reconstruction programme is crucial and, through careful implementation and management, will deliver a quality building product and infrastructure.

It is recommended that the following steps are considered[62]:

- Establish a team for the management of the implementation (if appropriate, continue with the team that was formed during the planning phase).
- Follow up on initial assessments, keep to the plan, and follow jointly agreed decisions with the key stakeholders.
- Establish an agenda for the construction phase.
- Facilitate locally accepted and practical construction technologies for the buildings.
- Provide support for the selection of sustainable technologies/systems for sanitation, drainage, solid waste, etc.
- Prepare a bill of quantities with technical specifications.
- Prepare a detailed cost estimate of the building.
- Draft a cost estimate for site preparation.
- Undertake a tender process for procurement of labour, construction materials, contractors, etc.
- Produce tender documents.
- Set 'green procurement' priorities in selecting materials and services that minimise any environmental impact.
- Prepare a comparative short analysis based on the tenders received.
- Meet and negotiate with potential suppliers and contractors.
- Agree terms with the selected contractor and provide the necessary contract documentation.
- Write a works order.
- Select reliable suppliers for procuring quality materials on a regular basis.
- Analyse the social, financial, technical and human resource inputs provided by all the partners and community members.
- Provide skills training for construction workers and the community, based on identified knowledge gaps.
- Set safety procedures for all areas of the construction site.
- Establish performance standards.
- Conduct soil testing.
- Establish systems for record-keeping and documentation.
- As a routine, ensure regular monitoring of construction activity, use of materials, quality, etc.

62 Adapted from: RedR in Oxfam, 2008

- If appropriate, use mechanisms for the monitoring of all those involved.
- If necessary, facilitate a real-time evaluation with feedback.
- Measure construction work already completed on the construction site.
- Conduct testing of construction materials, such as a cube test for concrete, checking the quality of the water used for construction, etc.
- Regularly check and certify all bills.
- Arrange a release order for payments.
- Establish a construction yard, if appropriate.
- Construct a model building, if appropriate.
- Facilitate community meetings at all stages of the programme to engage members in all the processes, wherever possible.

7.1 Demolition and debris

7.1.1 Controlled demolition

IFRC's Shelter Technical Brief of the Haiti Earthquake Operation[63] summarises the land-related challenges as *"A challenge is that of rubble removal from potential building sites. While a more straightforward task than the one above, there is an estimated 20 million cubic metres of debris in the earthquake-affected areas and clearing it requires equipment, manpower and a place to dump the debris. Clearing available land of debris is one solution."*

63 Red Cross and Red Crescent Societies, 2011

Debris removal
Daniel Wyss (Skat)

Demolishing unsafe structures, reuse of rubble and removal of debris are essential parts of urban reconstruction. Debris and badly damaged buildings located on private property need cautious consideration, suitable equipment and a right of access made available.

The following principles are recommended[64]:

- Actors must consult with the local authority prior to undertaking any activities and, wherever possible, sign an agreement clearly stating the scope of the project and each party's responsibilities.
- Property owners must be informed prior to the start of demolition or removal activities, and must understand and agree with the activities to be undertaken.
- Actors must consult with the relevant authorities prior to considering the demolition or removal of buildings marked as 'National Heritage' sites.
- If the owner or its representative is not present, actors may demolish structures or remove rubble only when written authorisation has been given by the local authorities, after the local authorities have made demonstrable attempts to contact the owner.
- In the event that an owner refuses to demolish/clear the plot, the local authority may grant written authorisation to clear the site. Actors must not enter a plot for the purpose of demolition or removal unless the owner or the relevant local authority has granted access.

64 Adapted from: Blanco, U., Cordero, C., Gestion de Débris

The following steps may apply:

1. Identify plots for demolition or removal: This can be carried out in a number of ways and may include a neighbourhood or street survey, participatory enumeration, individual plot identification from camp residents and/or official assessment lists from national authorities/ local governments. Owners may contact debris managers directly and request their services, or programme planning information may be posted in kiosks or public locations with the consent of the responsible authority.
2. Identify owner or owner's representative.
3. Inform the owner or owner's representative of the process. These elements should be included:
   - a range of dates when activities may start
   - a set date for the owner to remove any usable material
   - a range of dates for the removal of rubble (after demolition)
   - confirmation about whether or not housing construction will follow once debris has been removed.
4. As much as is possible, verify ownership or proof of authority over the plot. In order of preference:
   - Request copies of proof of ownership and verify with the local authority or notary records. If this is not feasible,
   - request copies of proof of ownership. If not available,
   - secure the signatures of three witnesses from the neighbourhood and of a local authority. If not available,

- secure the signatures of three witnesses from the neighbourhood and of a community leader. If not available,
- secure signatures of three witnesses from the neighbourhood – minimum recommended for demolition,
- a written statement of authority, or
- a verbal statement of authority, – not recommended for demolition.

5. Document the right of access: The owner or its representative should sign a written statement of authorisation to avoid future disputes. The authorisation may state that, once the debris is removed, the grantor has full responsibility for securing the site. The authorisation may be countersigned by a witness and/or a community leader.

French Red Cross – Rubble removal and implementation of transitional shelters strategy, Haiti[65]

The French Red Cross has committed to supporting 2,500 families in the metropolitan area of Port-au-Prince, firstly through provision of transitional shelters (T Shelters), specifically in Delmas, which is a very densely populated area with no public land available. As a result of the earthquake, around 50 per cent of the houses have been affected and 25 per cent have collapsed (or should be destroyed as they are too dangerous for habitation).

Due to lack of free space, rubble removal through cash-for-work (CFW) activity was a necessity on private plots before transitional shelter implementation. The “high-intensity labour works implementation” guidelines published by the Haitian Government specifies that one CFW activity should employ 100 workers from the community.

Agreements for rubble removal and shelter implementation will then be signed by the owners of the land, by people from the community and by the Delmas Mayor’s office.

The operational area is consecutively mapped with a consequent list of beneficiaries (owners of the destroyed houses and their former renters) and the Mayor’s office delivers work authorisation to the French Red Cross.

Each CFW’s rotation is composed of 100 workers and five team leaders during a period of 15 calendar days in three weeks. The French Red Cross might launch several rotations at the same time in different locations or in the same place (with not more than two rotations per working area). 15 rotations have been launched by the French Red Cross; 196 landowners have signed for the completion of 379 T Shelters and 159 properties have been cleared of rubble.

In total, 8,376 cubic metres of rubble has been removed (1,126 in Delmas 9 in 15 weeks, 3,345 in Delmas 17 in 12 weeks, and 3,905 in Delmas 33 in 18 weeks). Delmas 9 was the first block to be engaged and was the most difficult to clear.

The operational cost for a CFW activity per week is 7,700 US dollars (equipment and salaries for workers). The average cost for clearing the 196 properties is 2,060 US dollars per plot which means 1,064 US dollars per shelter. For the implementation of T Shelters, the team is composed of one mason, two carpenters and four workers, under the supervision of a French Red Cross programme officer.

Delmas 9: individual plot before clearing
French Red Cross

Delmas 9: cleared plot with T Shelter
French Red Cross

65 Red Cross Red Crescent Societies, 2011

7.1.2 Debris reuse

Reusing or recycling of materials found from damaged or destroyed buildings has various benefits. Such materials help to minimise the environmental impact of reconstruction, are immediately available, reduce the amount of debris to be cleared and help to reduce reconstruction costs.

Pure materials like bricks, wood, concrete, stone and metal sheets are best for reuse or recycling:

- Concrete, old bricks and stones can be used as fill material to construct roads.
- Metal sheets and bricks can be ideal for fencing.

Brick masonry rubble provides a good source of material for use as aggregate in concrete-making.

Recycled Material – Earthquake, Yogyakarta, Indonesia, 2006[66]

In the housing recovery effort in Yogyakarta, following the earthquake, brick masonry from damaged and destroyed structures was used extensively to make cast-in-place concrete for the permanent structures. In doing this, construction costs were significantly reduced. Crushing of the brick masonry wall rubble was performed using both manual and mechanical means. Through the process, brick rubble was crushed into fine aggregate required in the mixing of mortar and concrete. The manual process was performed through the use of a simple hammer, while the mechanical process required the use of a mobile stone crusher. Using the mechanical device, one stone-crusher operator and six support workers could create 15 cubic metres of aggregate each day, relying on only 0.6 litres of oil per cubic metre. Several stone crushers were deployed throughout the affected area, and rubble-crushing was conducted extensively.

66 Satyarno, I., in IRP – International Recovery Platform/UNDP – United Nations Development Programme, India, 2010

Earthquake Yogyakarta 2006: collection of reusable debris material
Olav A. Saltbones (IFRC)

Rubble can be processed and transformed into construction material, ready to use on site. Rubble-crushers are used for this purpose. One innovative prototype is the gabion house, which uses caged rubble as building blocks and is currently being assessed for earthquake and hurricane resistance, for example in Haiti.

Red Cross Red Crescent Societies – Rubble recycling and permanent housing, a pilot project, the Gabion Core House, Haiti[67]

This pilot project was driven by the efforts of the IASC Shelter Cluster team in Haiti. The project was implemented by the non-governmental organisation 'Haven', with financial support from the American Red Cross and Australian Red Cross.

A gabion house consists basically of gabions. A gabion is a wire cage that can be stacked vertically in a wall and then packed with various materials. Normally gabions are used as retaining walls but, in the case of the gabion house, their design has been modified to allow them to be stacked to form a load-bearing, masonry wall.

To enable the gabions to effectively perform as a load-bearing wall, they must:

- be laid in stretcher bond
- be wired together, both vertically and horizontally
- have a roof structure tied very strongly to the gabion-type walls
- comprise masonry material that is packed tightly to avoid subsidence.
- be protected from the weather, in this case by plaster, made from crushed rubble
- be restrained at the top. This is achieved by spacing 12-millimetre threaded rods at intervals of approximately two metres around the perimeter wall
- connect the walls in the corners very well
- be used only as external walls; use light wooden dividers as internal walls.

The gabion cages provide a matrix of wire mesh throughout the body of the wall. It is this confinement of the masonry, both horizontally and vertically, as well as the tension provided by the tie-down rods, which provides the restrained flexibility responsible for earthquake resistance. It is the mass of the walls, together with the foundation-to-top-plate tie-down provided by threaded rods, which gives these buildings good resistance to hurricanes.

In addition, it is the mass of the walls and the concrete floor that provide a thermal buffer to external temperature variations, by providing a tempering heat/cool bank. Also, the internal temperature is controlled by venting the gable ends.

Many of the construction processes require only semi-skilled labour so this will enable the employment of the most vulnerable in the community. There is also the possibility of setting up small enterprises to produce the gabions and crush the rubble.

Forming gabion walls
IFRC

67 Red Cross Red Crescent Societies, 2011

Preparing gabion cages
IFRC

The costs of construction are low. They do, however, depend on a number of factors, such as labour costs, proximity of the rubble as well as the size of and amenities included in the house. In the context of the Haiti earthquake in 2010, it was planned to produce a 24-square-metre house for between 4,000 and 5,000 US dollars. If the saved cost of trucking and dumping rubble is deducted, the cost would be between 3,000 and 4,000 US dollars.

The original pilot design was developed to include elements that are appropriate to Haitian architecture. The new building typology allows for a shaded veranda at the back. This area of transition between exterior and interior, typical in tropical climate architecture, ensures cooler spaces; this is the area where inhabitants usually spend most of their time at home. The gabion structure is conceived as a core house; two side windows will enable new doors and passages. Housing elements such as louvre windows, railings, gables and others, built and personalised by each family, will enhance the sense of ownership and also provide character to the neighbourhood.

Gabions are, by nature, monolithic blocks. The wire cages provide a tensile capacity that holds the rock material as one block and, when these blocks are stacked to form walls, they achieve stability essentially by their relatively squat structural systems.

Lateral loads (hurricane and seismic) produce in-plane and out-of-plane forces and buildings require systems that resist the first and transfer the second. This house design uses gabion walls to resist in-plane forces and diagonal ties (timber or steel depending on costs) at ceiling level to transfer out-of-plane forces to these walls. Consequently, the plaster finishing is not used structurally but instead relies on good packing of gabions.

7.2 Technical reference centres

Technical reference centres can be a useful means to support and back up agencies that implement urban reconstruction housing projects.

Competence Centre for Reconstruction (CCR) in Haiti

Swiss Humanitarian Aid created a CCR to assist the Cooperation Office based in Port-au-Prince, in 2010. The CCR tries to operate within the various existing processes and networks in an effort to ensure better coordination of the activities of the many players active in reconstruction works. The general aim is to improve the quality of projects and to help strengthen local capacities by providing specific technical and methodological support.

In particular, the Centre provides solutions to specific technical questions, such as para-seismic calculations. Further, the Centre has the intention of raising public awareness of reconstruction issues and it is actively involved in training in an effort to develop technical capacities at the private as well as the governmental level. For example, the training is targeted at building-site staff – including entrepreneurs, masons, carpenters, etc. – and covers the techniques that make buildings earthquake and cyclone resistant.

7.3 Reuse of temporary shelters

The Active Learning Network for Accountability and Performance in Humanitarian Action (ALNAP) lists four categories of temporary housing. These differ in terms of the post-disaster utilisation of the structure or of its basic construction materials and include[68]:

- **Upgradeable housing**: While being inhabited, the temporary shelter is improved to become a permanent housing. This is achieved through maintenance, extension or by replacing original materials with more durable alternatives.
- **Reusable**: Following the construction of a permanent housing solution, the temporary shelter is used for a purpose other than housing, such as a shelter for animals, a kitchen or for storage (applicable in less-dense urban areas).
- **Resellable**: The temporary shelter is inhabited while parallel reconstruction activities are taking place. Once reconstruction is complete, the temporary shelter is dismantled and its materials are used as a resource to sell. Therefore, materials need to be selected for their suitability for resale after the shelter is dismantled.
- **Recyclable**: The temporary shelter is inhabited while parallel reconstruction activities are taking place. The temporary shelter is gradually dismantled during the reconstruction process and the materials from the transitional shelter are used in the construction of a durable home.

Metal-framed shelter

Temporary shelters can be reused when they are still in good condition. These shelters, therefore, should be planned and constructed to enable them to be either integrated into, or dismantled and recycled for use in, the permanent housing buildings.

The following summarises the options for reusing temporary shelters to form one to two-levelled housing in less-densely populated urban areas:

- A well-developed site plan can be developed once the permanent plots have been identified and approved. Plots should be large enough to accommodate one family on a long-term basis. One option is to install the temporary shelter at the back of the plot, so that construction of the permanent housing can be carried out. The temporary shelter could be reused as an annex, for storage or as a bathroom. A robust temporary structure and already-prepared infrastructure (sanitation, pipes, latrine, etc.) is essential if this approach is to be adopted.
- Another option is to provide a solid foundation with a ground-floor slab on which the temporary shelter is built so that the foundation can be reused later to form the base of the permanent house.

Temporary shelters
Daniel Wyss (Skat)

68 Adapted from: Shelter Centre, 2010

Pre-cycling shelter designs for permanent housing

Transitional shelters (T Shelters) are designed for offering the disaster-affected population housing for a period of about five years. In the years after the disaster, beneficiaries may require more space and upgrade or extend the T Shelter, or recycle elements for integrating them into permanent housing.

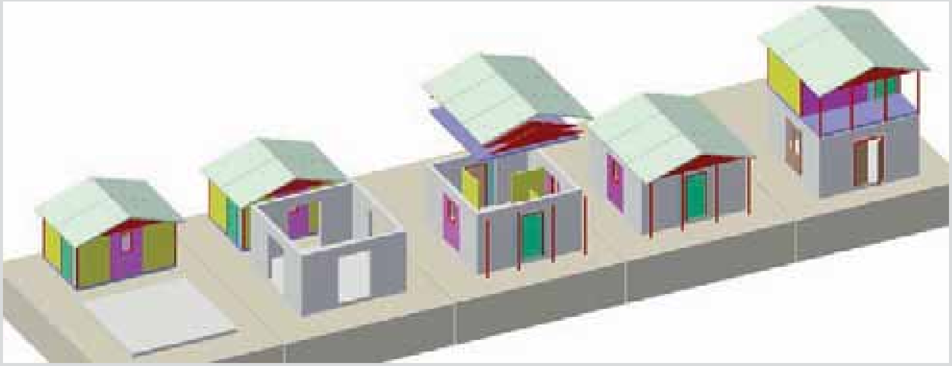
However, the shelter design and the various structural elements would only have been resistant to hurricanes, floods and earthquakes in their original form. Therefore, the self-made modifications or recycling of shelter elements represent a potential hazard for shelter residents, particularly if these people are not familiar with the building materials.

T-Shelter elements can be integrated into the permanent housing structure in a safe and most effective way. This is achieved by means of designing the shelter in line with the principles of 'pre-cycling', such as those applied in the construction of exhibition pavilions, etc. Pre-cycled structures (shelter and other) are designed for transitional as well as for permanent uses.

Designs of existing shelters (e.g., from IFRC's Eight Transitional Shelter Designs) can be transformed into Pre-cycled Shelters, by small adaptations, applying their reuse in a pre-engineered manner. The safe recycling options must fit to local construction methods and building materials and be described in a recycling manual for shelter residents.

For disaster-prone urban areas, shelter project designs may describe how the transitional structure can be transformed into a permanent house, and which permanent house designs may best utilise the shelter's structural, walling and roofing elements. Consequently Pre-cycled Shelter kits contain structural connections for not only the temporary shelter stage, but also transformation of construction elements for permanent housing e.g., as roof, veranda, upper-floor structure, indoor separation walls, etc. A plan set and transformation manual provides the residents with details of recycling options and a list of specific do's and don'ts.

For safe integration of T Shelter elements into permanent housing structures, Skat (Swiss Resource Centre and Consultancies for Development) has developed a modular low-cost core-house design for peri-urban neighbourhoods in Haiti, which could serve as one basis for transforming a standard T Shelter into a Pre-cycled Shelter.



1. T Shelter stage   2. Building core-house structure   3. Integrating shelter elements (various options)
Daniel Wyss (Skat)

7.4 Building conversions

Conversion – the future value of built substance[69]

When one speaks of conversion, one assumes the change of the use of a building. The strategies used in dealing with existing buildings range from protection and conservation to revitalisation all the way to temporary uses or demolition. Any kind of building can lose its original function. This process is by no means new to the history of the city. Buildings bind resources and workers and therefore were oriented towards long-lasting permanence. As a result, they provided a shell that could be filled with different functions. If they were no longer acceptable because of practical or ideological reasons, one demolished them or left them to decay. Often, however, they were also reused in these cases: the material mostly found a new function. The buildings have not been conserved in the sense of 'musealisation', but rather converted, transformed and built upon. They continue to be a part of daily life, only now in a new role. However, the rigid assignment of function in the modern era and the rise of historic conservation have changed the way in which we deal with existing building substance and limited this openness to reuse.

The value of a building

Existing buildings represent a resource. The value of a building is measured not on its economic but rather also on its social potential. If one looks at the economic components, buildings have an intrinsic value. The built substance, technical infrastructure and site development are present. In comparison with demolition and new construction, a simple renovation often represents significant cost savings. In addition, often the building and capital costs have already been amortised. As a result, new value creation can be initiated through a conversion.

In their architecture and appearance, the still-existing buildings show their original use and meaning. They are witnesses of the past and part of the identity of a place. This is determined not only by prominent buildings, but rather by the ordinary buildings of living, commerce and production. In this sense, buildings can have important social significance: people identify and orient themselves with them. If existing buildings are reused, they remain an active part of the city's built fabric. A conversion is reasonable in terms of ecological considerations as well. In the sense of sustainable economic activity, resources could be saved (material, workforce, money) and no additional land will be developed (land consumption).

When do conversions make sense?

The question of how to deal with existing built substance often poses itself in crisis situations. The factors of time and availability thereby play a significant role: the building exists, is often quickly obtainable and is equipped with the most necessary infrastructure. However, there are still different aspects that need to be accounted for and considered. The following questions can help to evaluate each particular situation and structure the consideration process:

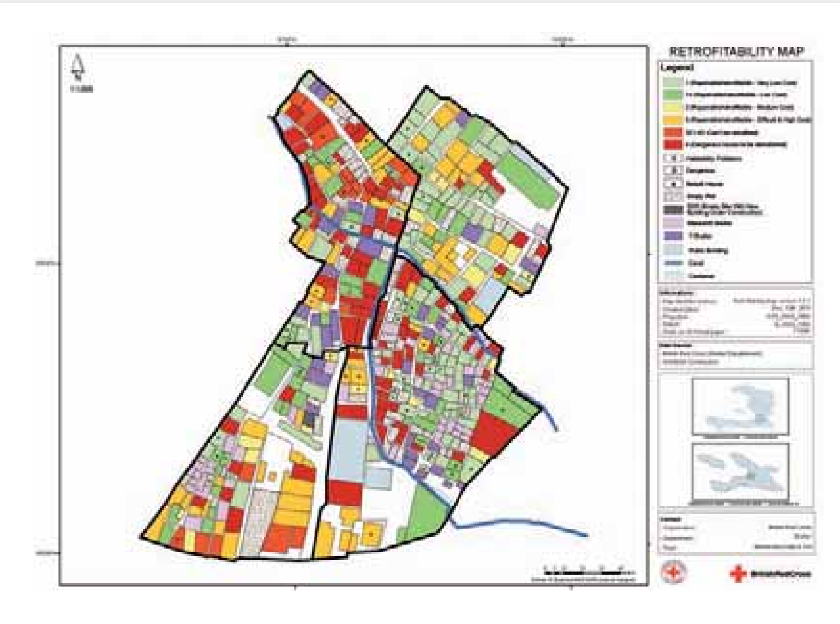
Availability:	Which buildings are available?
Condition:	What is the condition of these buildings?
Reuse potential:	To what extent are these buildings adaptable and alterable?

69 A contribution by Dr Martina Baum, ETH Zurich, on the possibility of converting existing buildings.

Constraints:	Are there adverse effects and/or obligations?
Value:	What is the social value of these buildings? What role do they play in the city's built fabric?
Profitability:	Is a reuse financially profitable?
Demand:	Is there a demand for this building?

An assessment of the economic and social context, as well as of the market (demand, needs), but also the analysis and appraisal of the building itself (building structure, value, potential for change) and its context (location, accessibility, programme), are decision-making components. One must be able to assess what space requirements are needed for which programme and if the building can accommodate these. In doing so, one should not only develop a position in relation to the preservation of built substance but also determine the buildings that may disappear.

Despite any rush arising in a crisis situation, decision-making should take future developments into consideration. A demolition in the current situation could represent a large loss in relation to the identity and history of a place in the future. In general, a demolition is not reversible and can only be reversed through laborious reconstruction, which would only represent a copy of the original. As a result, a certain amount of foresight as well as a sense for the significance of the past should flow into the decision-making. The new use of a space requires an examination of the place, programme and context, and requires creativity as well.



Retrofitability map – elaborated by British Red Cross in Delmas 19 (Port-au-Prince, Haiti)

British Red Cross

7.5 Retrofitting and repairs

Retrofitting

Retrofitting aims at strengthening old or existing buildings to make them earthquake and hurricane resistant, in order to reduce their vulnerability.

The current challenge is that retrofitting remains limited in reconstruction. A large number of buildings that can easily be retrofitted are still being demolished and replaced, or continue to be in use in very vulnerable conditions.

Retrofitting should be carefully planned, noting the following key points:

- Always involve a well-qualified engineer/architect and skilled contractors as retrofitting can be tricky and dangerous.
- If the house is damaged, restore it to its undamaged pre-earthquake/hurricane condition.

- Assess the vulnerability of the structure by means of a vulnerability assessment.
- Assess one room or part of a building at a time to decide what needs to be done.
- Prepare a retrofitting scheme for the whole building in order to ensure proper synchronisation of all retrofitting activities.
- Prepare drawings necessary for implementation of retrofitting and prepare quantity and cost estimates for materials.

Retrofitting may include the following measures:

- reinforcing walls
- installing cross-walls
- connecting walls to each other
- strengthening foundations
- minimising the number of openings
- installing reinforcements around openings
- installing connection ties
- strengthening retaining walls.

Further reading:

Desai, R., Desai, R., National Centre for Peoples – Action in Disaster Preparedness (NCPDP), 2007, Manual for Restoration and Retrofitting of Rural Structures in Kashmir, UNESCO/UNDP, Gujarat, India

Patel D., Patel, D., Pindoria, K., 2001, Repair and strengthening guide for earthquake-damaged low-rise domestic buildings in Gujarat, India, Gujarat Relief Engineering Advice Team (GREAT) Publications, Gujarat, India

Schacher, T., 2009, Retrofitting – Some basics, PowerPoint presentation, SAH construction course, Walkringen: www.constructiongroup.ch/system/files/retrofitting+some+basics.pdf

Housing repair

"In some instances, the cheapest and quickest method of providing adequate housing is to repair the damaged stock." [70]

In particular, this could be a good solution when the local population has not been significantly displaced. The scale of damage will vary; therefore, assessments will be necessary to determine the materials and levels of skill required for repairing the houses. Repair can be far less traumatic, for survivors of disasters, than is moving into emergency shelters or communal centres and undertaking comprehensive reconstruction, as residents are often able to remain in their homes.

Subject to the scale of damage and availability of local skills, people can undertake their own repairs. This can help the community to return, as quickly as possible, to some form of normality.

70 Barakat, S., 2003

If damage to an area is minimal, and the local community can provide materials and resources, agencies can support efforts through the provision of advice and by subsidising materials. Alternatively, agencies may choose to support the repair efforts by means of housing repair toolkits, which can be tailored to the needs or target specific areas such as roofs and windows.

Repairs are often limited to essential works necessary to ensure houses are habitable: repairs to roofing, load-bearing walls and structural frames; bathrooms or latrines; and cooking spaces or kitchens. Depending on the region's climate, works to windows, doors and internal plastering may also be considered essential.

Reconstruction programmes will need to assess the viability of such work by addressing technical issues, costs, training requirements and the production of guidelines relevant to the local context.

Below are some of the issues that should be considered in a repair or retrofit programme[71]:

Issue	Relevance
Relocation	The repair or retrofit option is unlikely if a house has to be relocated.
Damage level	The level of damage to the house must be fully considered prior to a decision about whether repair or retrofit is the appropriate option.
Cost of the repair or retrofit option versus reconstruction	To be justifiable, the total cost of the repair or retrofit option should generally be lower than that of demolition and reconstruction.
Willingness and capacity of community to repair or retrofit their houses	Participation of the community and families in the discussion on repair or retrofitting work is essential. It is often not viewed as a viable or desirable option. Without local support, this option could meet with passionate objection. Communication, training and public outreach are all necessary elements of a successful repair or retrofit programme.
Architectural, historical, cultural and socio-economic value of damaged houses	If particular houses or buildings have high architectural, historical, cultural or socio-economic value, considerable effort in overcoming technical and cost difficulties to prevent demolition may be justified. The owner may be offered extra financial or technical assistance, if the house is considered part of the community's heritage, to encourage preservation of the property.

Training of home-owners

Training of home-owners and unskilled people is an essential tool for quality control. However, this does not mean delegating quality assurance to the families: it means making them aware of quality parameters and empowering them to be fully part of the process. Responsibility for quality control, technical monitoring and supervision of the site should stay with professionally trained staff.

71 Adapted from: Abhas, K. J., 2009

British Red Cross, Haiti Recovery Programme[72]

The British Red Cross provided a one-day training programme for home-owners on the issue of 'Safe, Satisfactory and Sustainable Housing Reconstruction after Earthquakes'. Further, a three-day training programme was delivered for local builders and masons on the same subject. This was complemented by a one-day training programme for local builders and masons on the repair guidelines of the Ministère des Travaux Publics, Transport et Communications (MTPTC) of Haiti.

It has been observed that although these training programmes were very useful in introducing the various issues of quality control in reconstruction to the home-owners and local builders, it remains crucial that the practical building skills will have to be developed on site under the supervision of the construction team.

Training provided through theory and practice, British Red Cross in Delmas 19, (Port-au-Prince, Haiti)

British Red Cross

7.6 Construction materials

Permanent urban housing must be constructed of materials that are able to withstand natural hazards. Informal housing is typically built with cheap materials that either are of poor quality or are improperly made; for instance, concrete blocks with high quantities of sand or un-reinforced concrete and materials that are not appropriate for the risk profile of the area, e.g., earth brick. These materials may offer little protection from external forces such as shaking (earthquakes), wind, fire, loading (snow loads), amongst others.

Building materials are made either from naturally available sources like inorganic materials (e.g., clay, stone, steel) or from organic raw materials (wood). Supporting the use of environmentally sustainable building materials is essential in reconstruction activities.

Paving blocks made out of crushed cement bricks, produced after the Haiti earthquake by IFRC's Integrated Neighbourhood Programme

Britt Christiaens (IFRC)

72 British Red Cross, 2010-2011

The appropriateness of a particular building material can never be generalised. Whether a specific building material is sustainable or not, depends on the local context. The quarrying of soil must also not jeopardise ecologically sensitive areas, agricultural land or other sources of livelihoods.

It is essential, therefore, to:

- investigate the purchasing policy or 'green procurement' guidelines of your organisation, if they exist. For example, the use of hazardous materials, such as asbestos, is not acceptable, nor is using unsustainably manufactured products, such as illegally logged rainforest timber.

Reuse and recycling of materials:

The reuse and recycling of construction materials has to be considered carefully during the planning phase.

- Use pure materials, like bricks, wood, concrete, stone and metal sheets. These are best able to be reused or recycled.
- Avoid (if possible) all types of composite materials (e.g., prefabricated solid foam-metal or foam-plaster elements). They are difficult to separate and recycle.

There is a risk that soil for land filling may be taken from foothills in secondary and tertiary forest areas. This needs to be monitored and managed to minimise soil erosion and impacts on vegetation and the landscape. To ensure more sustainable landfill, check the origin of soil that is to be used for land filling.

For easier reuse and recycling of materials:

- Select building materials that are easy to disconnect and detach.
- Avoid sophisticated compounds and composites in building materials.
- Avoid complicated bonding agents and adhesives when not necessary.

To save natural resources and energy:

- Check whether you can use recycled material.
- Find out whether there are materials available from demolished buildings nearby.
- Reuse debris, if it is suitable; e.g., timber and roofing components are robust and cost-effective materials that can sometimes be easily reused.
- Recycle debris material; e.g., rocks, sand and concrete slabs can provide excellent fill for concrete if they are first washed, sorted and (sometimes) crushed or ground into smaller particles.

Further reading:

World Wildlife Fund, American Red Cross, 2010, Toolkit Guide – Green Recovery and Reconstruction: Training Toolkit for Humanitarian Aid, Creative Commons, San Francisco, USA: http://green-recovery.org/

The following summarises the key issues regarding sustainable building materials:

7.6.1 Environmental aspects

Wood: An often-reported challenge is that suppliers sometimes deliver unspecified or illegally sourced timber to construction sites.

It is important, therefore, to:

- favour wood from plantations (managed by certified companies)
- avoid illegally logged timber and choose certified timber. Because timber certificates can be falsified, be careful to investigate the certificating authority's reliability and the authenticity of the certificate.

Concrete/brick: Concrete and brick production requires amongst others large supplies of sand, gravel (for concrete) and appropriate clay (for bricks). In the reconstruction process, when demand is high, many people remove raw material from the closest riverbeds or mountains. Such practices are highly destructive and can have devastating effects, e.g., on wetlands, coral reefs or forest ecosystems.

To follow a more environmentally sustainable approach:

- Use only raw materials that are produced in an environmentally acceptable manner, and avoid using materials extracted from sensitive areas.
- Check the origin of sand. Avoid the use of coral sand and inappropriately quarried supplies.
- Find out whether quarry sites are rehabilitated afterwards.

The careful use of building materials can lead to a significant reduction in a project's environmental impact. Using local materials, for example, can minimise transport-related emissions. The use of local materials also helps to preserve local cultural identity and knowledge in project areas. In summary:

- Favour locally produced building materials.
- Identify and verify that supplies and raw materials come from environmentally friendly practices and suppliers.

To safeguard the health of the residents:

- Do not use asbestos.
- Do not use toxic materials.
- Do not use materials containing chlorofluorocarbons (CFC), e.g., in refrigerators or air-conditioners.

Asbestos risks and how to avoid them

Asbestos is a mineral that occurs in nature. It has been used in over 3,000 products, including a variety of building products, such as cement roofing sheets, insulation and pipe lagging, because of its high tensile strength, relative resistance to acid and temperature, varying texture and flexibility. It does not evaporate or dissolve, burn or undergo significant reactions with other chemicals; these attributes make asbestos very useful but also non-biodegradable and environmentally hazardous.

Exposure to asbestos can cause lung disease and cancer, depending on the concentration in the air and the length of exposure time. All forms of asbestos are carcinogenic and no safe level of exposure is known. Fibrosis of the lungs due to asbestos is called asbestosis. When asbestos fibres penetrate the lungs and become lodged within the lung linings or pleurae, cancer of the pleura, known as mesothelioma, may develop. Some intestinal cancer (stomach, pharyngeal, colorectal) has also been identified as having been caused by ingestion of asbestos.

Poster produced by IFRC to raise the awareness of the asbestos risk in post-disaster debris treatment

Emeline Decoray (FRC/IFRC)

The International Labour Organization and the WHO have called for a ban on the production of all types of asbestos, which kills over 100,000 people annually. Asbestos products are already banned in 40 countries, including all European Union states. Some donor countries, such as the United Kingdom and Australia, have prohibited the use of asbestos in their tsunami-related reconstruction projects. Countries in which asbestos-containing materials (ACM) are being used should:

- develop certification and specifications for all ACM products
- establish standards for the work environment
- regulate asbestos handling, disposal and toxicity testing, and the use of personal protective equipment.

The best and recommended way to avoid the risks and unnecessary deaths associated with exposure to asbestos is to avoid using building products with ACM.

In cases where existing ACM products are being removed, workers should be provided with personal protective equipment, including well-tested respirators, to ensure that no asbestos fibres can enter their lungs. The proper use of respirators requires training, maintenance and good storage. After work, washrooms should be made available, and workers should take showers. Work clothing should not be brought home, but cleaned at the premises.

7.6.2 Technical aspects

Buildings constructed using poor-quality materials, low-quality concrete or inadequate steel reinforcement are usually badly damaged by disasters. Project managers should therefore always give special attention to using high-quality building materials. Try to ensure that the delivered material is of good quality by regularly testing the aggregates (sand and stone), water and cement used.

- Aggregates must be free from clay, loam, leaves or any other organic material. Clay or soil coating on aggregates prevents adhesion of the cement to the aggregate, slows down the setting and hardening processes, and reduces the strength of the mortar.
- Water should be of drinking quality without pronounced taste. Water containing salt (e.g., sea water) should never be used for mixing concrete as the salt reduces the strength of the concrete and also corrodes steel reinforcement in the concrete.
- The most common type of cement is ordinary Portland cement. Although freshly produced cement is normally of sufficient quality, it can lose quality through poor storage and transport.

7.6.3 Economic aspects

The cost of building materials often determines what types of products are used. The cheapest materials, however, are not always the most suitable ones. Factors such as quality, durability, maintenance cost and reliability of supply must also be considered. It is particularly important to assess the maintenance and potential repair cost of materials over the entire life cycle of the building to optimise overall long-term cost savings. Other important economic considerations that may affect the appropriateness of materials include:

- Prices of building materials can increase suddenly, especially in post-disaster situations where urgent demand often exceeds supply significantly. It is wise to plan for some financial reserves to avoid overstretching the project budget.
- Using locally produced materials can save transport costs, strengthen the local material production industry, stimulate local job creation and avoid taxes on imported material.
- Production of building materials at the construction site is often cheaper than using prefabricated materials or elements and may also enable better quality control.

7.6.4 Socio-cultural aspects

In some cases, residents have abandoned their homes because they did not feel comfortable with the materials used. Therefore, make sure

Consult with house users/owners

Agostino Pacciani (IFRC)

that users accept and feel comfortable with the construction materials chosen. To help ensure users' satisfaction and the cultural appropriateness of materials, note the following advice:

- Consult with the users/owners regarding whether certain materials are considered to be of a low standard or otherwise inappropriate.
- Assess whether local raw materials are being extracted or collected under safe and healthy working conditions.

7.6.5 Regulatory and institutional aspects

It is crucial that the selected materials comply with relevant legal standards, national building codes and local regulations regarding safety, environmental sustainability, technical feasibility, etc. To help ensure compliance:

- Regularly check the specifications and sources of delivered material.
- Reject materials, if necessary.
- Maintain transparent dealings with suppliers at all times.
- Support awareness campaigns which focus on the importance of using legal building materials.

7.7 Construction technologies

The selected construction technologies should be low cost, practical and environmentally appropriate. When selecting the most suitable construction methods for urban areas, project managers should choose those that best suit local conditions, such as the availability of building techniques, material and skilled workers.

Depending on local urban conditions, project managers may want to choose from among the following methods:

7.7.1 On-site construction

All raw materials and construction products are transported to the construction site for assembly. Some elements, such as windows or doors, may be prefabricated. Concrete elements used for the foundation, columns and beams can be produced on site, if there is enough space there.

Key factors to consider:

- Individual elements should not weigh more than 150 kilograms so that three workers can move them safely. Avoid bulky elements.
- Concrete elements should be cast in wooden or steel moulds.
- The on-site construction option is more labour intensive and it requires regular quality control on site.
- Raw materials should be available locally.

7.7.2 Prefabrication

Entire walls, floors and roofs are ready-made, produced in the factory and shipped to the building site. It is essential that access roads are sufficiently wide and can bear heavy load trucks to transport the prefabricated elements to the site. Prefabrication allows for quicker and easier construction than do on-site methods and can help to reduce labour costs and ensure quality control. Because construction with wall modules is rather complicated, good planning and organisation is essential. In too many instances prefabricated houses that fail to meet this basic requirement have been exported to developing countries.

Key points to consider:

- Skilled staff and special equipment are often needed.
- Ensure that prefabricated buildings are designed to suit local conditions (climate, subsoil, culture, etc.). For example, the routine for cleaning houses differs among cultures. It can be common to wash floors with a lot of water, in which case floors and the lower parts of walls must be designed to withstand water.

7.8 Construction elements

The main construction elements of a building are the foundations, supporting frames, floors, walls (with door and windows), ceiling and roof. Simple construction techniques should be chosen to accomplish an appropriate reconstruction. Local workers and contractors need to have sufficient capacities to ensure that the houses are built safely and with good quality. If needed, additional training may be recommended.

Metal frame
Daniel Wyss (Skat)

The following steps are advised:

- Check whether the material and technology can be used and clearly understood by the local workers and contractors.
- Check whether special skills, experience or equipment are required.
- Assess whether repairs and replacements will be possible using local resources.
- When possible, select construction elements that are easy to dismantle to enable future recycling and reuse.

7.8.1 Foundation

The quality and lifespan of a house depend to a great extent on how the foundations are made. Poor foundations can ultimately lead to damage and deterioration that is difficult to repair.

The ground under the house needs to be strong enough to support the building, even if it is flooded or exposed to earthquakes. A proper assessment of the underground area and removal of overlying earth of poor quality are essential in all cases.

The type of foundation to be used should be selected early in the planning process, because it will influence the building’s overall design.

Key criteria for consideration when selecting a foundation include:

- ground quality, which is determined through a soil investigation
- the anticipated load of the building, i.e., its weight when fully occupied
- availability of equipment and skilled workers.

Design tips for earthquake-safe foundations

- Check soil type and water level.
- Assess soil strength for seismic design of foundations in accordance with building codes.
- Avoid using isolated footings with no ties.
- Use reinforced concrete-strip footings under load-bearing walls.
- Soft clays and sand of loose-to-medium density which are waterlogged may liquefy during an earthquake. Avoid building in such areas or seek expert advice on piled foundations and structural design.

7.8.2 Supporting frames

The supporting frame ('skeleton') of a building is often subject to local traditions and preferences. In situations where access to materials may be restricted, alternative frame systems may need to be considered. There are at least three basic frame systems:

Concrete frames

Concrete frames are widely used in reconstruction. Columns and beams are cast together into a frame. Gaps are filled with bricks or blocks. Bricks of lower quality can be used as fill material for external and internal walls. Good masonry skills are required for this approach.

To withstand earthquakes and other natural hazards, strong connections are required between vertical steel-reinforced concrete columns and ring beams. A ring beam is a horizontal beam that follows the form of the house, so named because it would look like a ring if it were round. The roof often rests directly on a ring beam.

Also crucially important for earthquake resistance are robust connections between supporting walls and non-supporting walls. Unsecured walls may fall outwards.

Steel frames

Steel frames are primarily used for constructing larger houses and buildings. The material is very strong but is difficult to work with without specialised tools and expert knowledge. Because steel frames are typically quite expensive, they are not often used for single-family houses.

An interesting option could be the use of cold-formed steel (CFS). The advantages of using this type of framing are: lightness in weight; high strength and stiffness; prefabrication and mass production; fast and easy installation on site; and resistance to termites. CFS can be used in roof and wall systems, as structural components in structures and frameworks, or as corrugated sheets and profiles.

Timber frames

Timber frames are mostly used in one-to-two-levelled houses. They are often more resistant to earthquakes and other natural disasters than are concrete frames, especially if these are built with insufficient or poor reinforcement, and are easier to work with. Adequate carpentry skills, however, are required.

In a situation where timber is scarce or likely to come from illegal logging, timber framing is not recommended.

7.8.3 Floors

The choice of floor depends on its intended use. Consider the expected load, wear and tear, cleaning method, slip-resistance and the ability to resist moisture and insects.

In hot and humid climates, direct contact of the floor with the ground does not provide good cooling. To improve floor cooling, consider the following:

- Raise the floor and ventilate the space underneath; allow for a minimum of 30 centimetres above the surrounding ground level (single-family houses).
- Elevated floors also help avoid moisture problems.
- Use a light material that does not absorb heat, such as wood.
- Buildings elevated on pillars offer protection from floods but may be more susceptible to damage from earthquakes.

To improve earthquake resistance, consider the following measures:

Concrete floors

- Anchor concrete ground floors and wall columns into the foundations.
- Suspended concrete floors should be fixed securely on their upper and lower sides to the concrete wall columns.

Timber floors

- Each floor beam should be secured and fastened to the ground beam with metal straps.

7.8.4 Walls

The construction technique used for walls depends on the number of floors, the anticipated loads and the risk of cyclones or earthquakes. The choice is influenced, also, by the building material to be used and the availability of skilled workers. Walls should be adapted to the local climate and require as little maintenance as possible.

Walls play a crucial role in a house's resistance to earthquakes. Earthquakes mostly affect buildings by way of horizontal forces. The main danger of horizontal earth movements is that the building's walls and, consequently, roof may collapse. Therefore, the main aim of constructing

'Rat-trap bond' masonry
Skat

earthquake-resistant houses is to avoid walls being able to collapse easily and to ensure that the roof is well secured to the walls. To make houses as resistant to earthquakes, storms and floods as possible, the following measures are recommended:

- Ensure that walls are reinforced sufficiently. If possible, arrange for a qualified engineer to calculate the necessary reinforcement requirements and regularly control the quality of installation on site.
- Make sure that ring beams are adequately connected in each corner and to the reinforcement within the walls and columns.

7.8.5 Windows, doors and other openings

Windows and doors provide natural light, communication with the outside and ventilation. For climatic control reasons, generally, all kinds of wall openings are important to ensure good ventilation and cooling of the building.

The following steps are recommended with regard to window orientation (in tropical climates):

- Minimise direct exposure to sunlight.
- If possible, use trees to create additional shade.
- Locate windows toward prevailing winds and sea breezes for good cross-ventilation and circulation.

In earthquake-prone areas, openings in walls must be considered carefully as they destabilise the wall system, particularly in solid buildings made of bricks or concrete blocks.

The following steps are recommended:

- Ensure that lintels penetrate the wall in order to achieve sufficient bondage (a lintel is a horizontal beam that usually supports the masonry above a window or door opening); or, better, use the ring beam itself as a lintel.
- The window's width should not exceed 1.20 metres and should not cover more than one-third of the wall's width.
- The length of walls between openings must be at least one-third of their height and must not be less than one metre.
- Generally, doors must open towards the outside so that residents can escape more easily if an earthquake occurs.
- A second door at the back of the building is recommended in case the main door is blocked.

7.8.6 Roofs

The quality and state of the roof is extremely important. It protects against weather, wind, heat and cold. To some extent, roofs also protect external walls from sun and rain.

Traditional roofs (made of burnt clay, thatch or earth) require a great deal of maintenance and are often not suitable in urban areas. In addition, thatched roofs are a fire hazard.

Flat roofs should not be used in areas with heavy rains. Highly skilled workers, excellent-quality building materials and regular maintenance are required to keep flat roofs watertight.

For climatic reasons, consider insulating the roof. Insulation reduces heat gain through the roof, keeping temperatures inside to a minimum.

Rain gutter
Claudia Schneider (Skat)

For earthquake-prone areas:

- Roofs should be as light as possible.
- To achieve the best earthquake resistance, roofs should be well connected to all walls and columns.
- The supporting frame and columns should always be able to support the roof without the walls, so that even if a wall collapses, the roof does not fall down.

For cyclone-prone areas:

- Roof slopes at angles of at least 30 degrees reduce wind-suction forces.
- Strong connections of all roof components to the roof structure are required.
- Avoid wide roof overhangs; separate the veranda structure from the building.
- Ensure the roof covering is attached to the roof structure to prevent it from lifting.

Further reading:

Müller, H., 2009, Tsunami House User Manual, KSSS – Kotar Social Service Society, Swiss Caritas: Practical handbook on technical issues of house construction for building up to two floors: www.youngcaritas.ch/media_features/gf/090526_Tsunami_House_User_Manual_final.pdf

7.9 Site management

During the implementation, an environmentally friendly site management and a careful handling of construction waste are essential.

In many ways, the construction phase is an important stage in the implementation process of urban reconstruction activities. Not only can many disturbances be generated from the construction itself, but also the housing's long-term durability depends on whether the sustainable features of the housing design are implemented effectively during the construction process. A badly planned construction phase can result: e.g., in malfunctioning ventilation, energy or water systems; in buildings with substandard foundations, making them vulnerable to flooding and earthquakes; or in buildings that are difficult and expensive to maintain, and more costly to build.

A monitoring and evaluation process should therefore be strictly implemented. Any deviations from the plans or standards should be corrected without delay. In a post-disaster urban housing rehabilitation, the availability of good-quality materials, skilled workers and trained supervision staff with adequate technical and social skills might be missing. Organisations with little or no experience in housing construction and appropriate knowledge of development principles and standards may be engaged because of an overwhelming scale of reconstruction demand. Therefore, a regular quality control of construction standards and, at the same time, adherence to humanitarian and development principles of disaster response are crucial.

Adequate quality control in an urban reconstruction programme is essential to maintain minimum standards and codes of conduct.

Site planning and construction management in the post-tsunami reconstruction in the Maldives

IFRC

The following steps are recommended[73]:

- Regularly supervise the reconstruction work to oversee the diverse activities in order to ensure that technical and humanitarian standards are met.
- Engage a project manager with good construction, management and technical skills. This is an important requirement.
- Support training and capacity-building of the construction workers together with feedback and supervision support, to make sure that technical and humanitarian standards are followed.
- Communicate the technical and humanitarian standards to the communities and other stakeholders.
- Train the community members to monitor the realisation of those standards.
- Monitor safety standards, which are jointly agreed with the partners. This is to enhance the personal safety of the construction workers.
- Share communication of standards, feedback by the monitoring team and recommendations for improvement with the field staff and implementation team, to make sure that these findings are put into action.
- Only use construction materials with approved quality standards or tested products, wherever possible.
- Utilise construction materials that suit the climatic environment of the area.
- As far as possible, employ only skilled personnel with adequate technical and social qualifications.
- Facilitate payments on time to ensure prompt delivery of materials of the necessary quality.
- Ensure quality checks through different methods such as regular technical supervision, reporting, community monitoring committees and material testing.
- Set up coordination methods to share experiences amongst organisations and partners to maintain technical and humanitarian standards of the reconstruction programme.

73 Adapted from: RedR in Oxfam, 2008

7.10 Construction waste management

An important aspect of the construction phase is management and minimisation of construction waste. A certain amount of construction waste will unavoidably be generated. It is important to have a system in place for handling this waste. A 'site waste-management plan', which should be adjusted to the urban area, assists in identifying the volume and type of construction and demolition waste, and sets out how waste disposal will be minimised and managed. Because construction waste can often be recycled or reused, the separation of different kinds of waste is recommended.

Likewise, waste remaining on the building site from buildings and infrastructure destroyed in the disaster should be handled carefully, removed and transported to an interim storage area at a location identified and agreed with community leaders and the local governmental authority.

Donor organisations and reconstruction contractors need to coordinate debris removal time-frames to maximise efficiency and achieve adequate disposal.

Soil contamination during construction can be avoided through the appropriate storage of fuel and chemicals, e.g., in a secondary containment of fuel tanks and chemical containers.

Additional recommendations include:

- Minimise dust and noise emissions during the construction phase as far as possible through cleaning and covering the site and minimising wind exposure.
- Maintain good working conditions with effective health and on-site safety procedures. Provide workers with safe transport to and from the site if needed.
- Careful organisation of the transport of materials, workers, etc., to and from the site will lower emission levels and save costs. Streets might be impassable. Some streets and bridges will not support heavy trucks. A good practice, therefore, is to ask for local advice when making transport plans.

8. Monitoring and risk reduction

8.1 Quality control

An independent external quality control, provided by inspectors, for example, helps to ensure the quality of any reconstruction programme. Those inspectors may be useful also to issue the certificates of completion that approve the acceptable completion of homes before beneficiaries are allowed to move into them.

The most critical elements of a reconstruction that should be checked regularly are the following[74]:

- **Foundations** need to be sufficiently deep, massive and strong enough to resist damage by floods and earthquakes. Building on unstable ground or steep slopes should be avoided, as it would require expensive foundations to make a building safe. Building on slopes above 10 degrees is not recommended. Care needs to be taken when starting to build walls above the plinth layer, as this may become a point of weakness.
- **Structural frames** should be avoided unless local builders have good knowledge of frame construction. Poorly constructed and inadequately jointed frames of reinforced concrete, steel or timber can put inhabitants at high risk. On the other hand, if frames are well built and compatible infill or cladding materials are used, these can give a high level of safety.
- **Masonry walls** need to be built with a proper bond in all directions. Walls must be straight (horizontally) and plumb (vertically). Check for this using a spirit level and plumb-line. If walls are built with distortion, even if it is not visible to the naked eye, this may be a source of weakness.
- **Doors and windows** need to be evenly distributed and not placed too closely to corners or intersections of walls, as this weakens the walls' resistance to earthquakes. Lintels above those openings need to be of sufficient strength and length.
- **Roof structures** need to be anchored well to a wall plate or structural frame; they also need to be interlinked well. During earthquakes and (strong) storms, the building needs to maintain structural strength, with the roof moving together with the walls and keeping them together. If the roof becomes detached and starts to move independently, this can speed up the collapse of a building. The structure needs to be completed to a high standard. Roof rafters and purlins need to be cut or cast to the correct length, with little margin for error. Joints between members need to be well made and fit closely together. Sufficient nails and screws of the correct specification need to be used to tie joints together so that they do not become points of weakness.
- **Roof coverings** of pitched roofs, whether sheets or tiles, need to be tied securely to the frame. Where walls are at risk of being damaged by rain or humidity, roofs need to provide sufficient overhang.

74 Adapted from: IFRC – International Federation of Red Cross and Red Crescent Societies/Practical Action, 2010, PCR Tool 10 – Quality Control

8.2 Regular monitoring and evaluation (M&E)

Monitoring visit, Sri Lanka, 2009
Skat

Regular self-monitoring and evaluation is critical for measuring the progress of urban reconstruction programmes. M&E can be carried out in a rather simple way by selecting key indicators (e.g., amounts of money spent on different activities, volumes of materials used, and timeliness of completion of activities) and then collecting and summarising them on a regular basis (e.g., weekly or fortnightly).

If any indicator shows a deviation from the budget or construction plans, then the cause for the deviation should be identified so that remedial measures can be taken. In addition, an external evaluation can assist by providing a second and independent view on crucial issues. Monitoring is also very useful for building the programme partners' credibility with the local community, national authorities and international donors.

In some recent large humanitarian responses, corruption, particularly in the construction industry has been a real issue. It is important to be familiar with your organisation's procedures for monitoring and whistle-blowing in case of any information about misconduct.

Further reading:

IFRC – International Federation of Red Cross and Red Crescent Societies/Practical Action, 2010, PCR Tool 10 – Quality Control, Switzerland/UK

Cosgrave, J., Ramalingam, B., Beck, T., 2009, Real-time evaluations of humanitarian action, An ALNAP Guide, Pilot Version, Overseas Development Institute

OECD – Organisation for Economic Co-operation and Development, 2010, Quality Standards for Development Evaluation, DAC Guidelines and Reference Series, OECD publishing

Transparency International, Preventing Corruption in Humanitarian Operations, Handbook of Good Practices: www.transparency.org/global_priorities/other_thematic_issues/humanitarian_assistance/ti_projects_activities

8.3 Maintenance

Newly built housing and buildings, as well as infrastructure (water supply, sanitation, electricity, etc.), require regular repairs to maintain their capacity and function. At the outset and during the planning and implementation phase, maintenance issues should be discussed with the beneficiaries and the partners.

As soon as the beneficiaries move into their new housing or newly renovated buildings, they should be familiarised with the technical installations, such as water supply, sanitation, electricity, waste disposal (sorting), and how to best maintain their new homes, e.g., undertaking small repairs and keeping the housing neat and clean.

The main questions concerning the maintenance of housing are: who is responsible for the maintenance, who does it and who finances it?

Urban housing requires regular maintenance, regardless of where it is built or for how long it is intended to function. Maintenance requires regular inspection, economic resources and knowledge. It is a good investment to include a training component for maintenance in reconstruction projects. Maintenance relies on available resources, and new material that is not locally available may prove impossible to maintain.

Buildings in an urban environment are exposed to weather and user wear and tear. Materials are subject to erosion and weathering immediately after construction. Individual components can stop functioning and cause damage to other components. A roof leak, for example, may result in water damage inside the building. Faulty components also need to be repaired or replaced to avoid further damage to the building and, potentially, to its users.

The most cost-effective strategy for keeping buildings operational is to provide regular maintenance and always repair defects while they are still manageable. Buildings that receive no maintenance have only a limited lifespan. Good maintenance, on the other hand, can lengthen a building's lifespan substantially, thus saving resources and prolonging the time before the building will need to be partially or completely rebuilt.

Shortage of funding is often given as a reason for poor maintenance. Remarkable results, however, can be achieved with very limited financial means, if maintenance is regular and systematic. Very often, poor maintenance results from a lack of awareness amongst practitioners and the building's users.

To ensure proper maintenance, the following steps are recommended:

- Indicate to users that maintenance is needed continuously and without interruption in order to guarantee the good functioning of the buildings.
- Analyse attitudes towards maintenance. Possibly the greatest challenge to establishing good maintenance is making involved stakeholders aware of its benefits. Find out the attitudes toward maintenance and habits of concerned stakeholders (users, owners, local craftsmen, contractors and local authorities).
- Clarify who is responsible for maintenance and who controls its quality. How will it work in practice? What would hinder good maintenance?
- When handing over completed buildings to users, provide basic training in maintaining the buildings. According to the users' level of knowledge, this may include information about general cleaning, small repairs, clearing gutters and storm-water drains, and how to use the sanitary facilities.
- Do not hand over buildings unless all systems have been tested and confirmed to be functioning.

- Complete the legal requirements for registration of buildings and land with local authorities.
- Formulate minimum maintenance standards according to the building design and materials used. Technical specifications, drawings and other references to completed construction works can help in the creation of standards. A good question to ask when developing minimum acceptable house standards is: will it be sufficient to preserve the building shell against weather and theft or must comfort and a nice, clean appearance also be assured? The answer to this question will help determine the scope and efforts of maintenance and related costs.
- Maintenance will be easier in buildings with simple designs, good-quality materials and sufficient standards of workmanship.
- Clarify who will pay for any needed repairs and maintenance costs. Users should assume responsibility if reasonably possible.
- Provide tools for maintenance of buildings with community contribution where possible.
- If necessary, local craftsmen can be trained to seal leaking roofs, adjust locks and hinges, and replace water tap seals, broken window panes, etc.
- Avoid complicated technical installations (plumbing, electrical systems, etc.) so any future repairs are easier.
- Promote and facilitate insurance for the buildings.

Example of a priority list

Cleaning:

- cleaning of inside and outside parts of the building
- removal of debris from gutters and storm-water drains
- cutting of grass, if needed
- cutting of trees and bushes when growing too closely to the building, damaging surfaces or dropping leaves into gutters and onto the roof.

Preventing water damage:

- keeping roofs waterproof
- ensuring quick and free drainage of rainwater from the building and the site
- keeping installations waterproof
- checking regularly foundations, floors, walls, ceilings for cracks
- securing foundations against erosion
- investigating cracks to identify the causes; the causes of the cracks should be addressed and the more serious cracks repaired by skilled masons
- undertaking regular rat, bat, insect and micro-organism (fungus) control.

8.4 Disaster risk reduction

8.4.1 Basic considerations

There is a range of methods available for disaster risk reduction (DRR). This permits a flexible use of different tools to adapt to particular contexts. Generally, a mix of tools and methods is used, such as focus-group discussions, semi-structured interviews, observations, random walks, seasonal calendars, historical profiles, household vulnerability assessments, livelihoods analysis, institutional and social network analysis, diagrams, and collection and review of secondary data.

These participatory approaches also provide opportunities to share technical information with communities, although this often requires a non-technical language which enables communities to feel that their exposure to risk is significant in their daily lives.

As a mix of qualitative and quantitative approaches, community-based risk assessment often concentrates on the vulnerability and capacity aspects of risk. The Red Cross Red Crescent approach uses the vulnerability and capacity assessment (VCA). Whilst hazard assessments are often integrated within the VCA, they currently tend not to utilise much scientific or technical information. However, as data availability and resolution increasingly improve, technical hazard analyses are becoming more available at the local urban level. Still, local use of technical data continues to be challenged by information delivery, sometimes due to a lack of local capacity for understanding or processing scientific/technical information.

Further reading:

IFRC – International Federation of Red Cross and Red Crescent Societies, 2006, What is VCA? An introduction to vulnerability and capacity assessment, Geneva, Switzerland

IFRC – International Federation of Red Cross and Red Crescent Societies, 2007, How to do a VCA – A practical step-by-step guide for Red Cross Red Crescent staff and volunteers, Geneva, Switzerland

IFRC – International Federation of Red Cross and Red Crescent Societies, 2007, VCA toolbox with reference sheets, Geneva, Switzerland

The following checklist[75] of disaster risk issues shows what to consider in an urban reconstruction programme:

Assessments

- Map the history of hazards: in particular, the location, frequency, magnitude and severity, resulting impact and vulnerabilities.
- Assess local construction practices and their effectiveness in addressing disaster risks in the past.

Planning and design

- Always seek specialists’ advice on design and technical standards to address hazard risks.
- Assess the suitability of the reconstruction site and detail a plan for site-preparation works.

75 Adapted from: Oxfam, 2008

- Coordinate with the key stakeholders involved in reconstruction to exchange good practices and knowledge.
- Ensure that the programme team has appropriate knowledge and expertise in DRR and disaster preparedness integration in the reconstruction programme.
- Indicate the essential design considerations which are necessary to address specific hazard risks.
- Review existing codes of practice for hazard resistance to assess whether they are adequate or whether they need to be adapted to the given context.
- Study good practices and challenges of other reconstruction programmes to assess the suitability of codes of practice and norms.

Rules of thumb – how to select the best flooding response strategy:

- Buildings should be elevated (but avoid complicated stilt constructions).
- Access ways to buildings have to be safe and dry.
- Any land fillings or new dams should allow run-off of water from heavy rains or tidal waves.
- Flooding response strategy should not create any unwanted water ponds.

Materials and technologies

- Review existing guidelines for what are the kinds of materials and technologies to be used to reduce disaster risks.
- Use only new construction technologies which are properly tested for addressing hazard risks.
- Establish a reconstruction management system which is competent to give the technical inputs and supervision required for dealing with hazard risk conditions, to monitor construction material quality and to build on local capacities.

Community aspects

- Provide the necessary resources for adequate maintenance of housing to ensure that the constructed building withstands hazard risks.
- Support communities to develop contingency plans and rescue plans, and to understand the various hazard threats.
- Facilitate the integration of DRR aspects into other sector interventions to develop a one-programme approach.

8.4.2 Roles and responsibilities in disaster preparedness

The communities are the first responders in any emergency situation and are also the ones that have to deal with a whole range of disaster issues. With regard to enhancing communities' disaster preparedness, awareness-raising of school children is essential. Children should be educated in what they can contribute to prepare their families for emergencies of all kinds. The children's interest could stimulate parents to take action in preparing for emergency situations due to disasters. This may create a generation which is conscious of how they can protect and help themselves in a range of incidents.

There is an acceptance that communities know their own risks better than does any external organisation or individual, and community priorities can be very different from what supporting organisations may anticipate.

Due to the participatory nature of the community assessment, local authorities are usually involved to assure their consent with planned risk-reduction measures and, to a certain degree, strengthening sustainability. In general, the process should bring communities and local authorities into closer contact and encourage partnerships with other stakeholders with the aim of reducing potential disaster risk.

Partnerships, but also the need for communities to be self-supporting and sustaining, are essential. Disaster preparedness requires that the concerned parties around and within a community take over the necessary roles and responsibilities. There is a great need for better coordination and stronger partnerships between communities, local urban authorities and national governments, with the aim to recognise and accept each other's responsibilities and tasks within disaster prevention.

On one hand, national governments need to do more such as to clarify financial needs of communities; on the other hand, communities and families have a certain responsibility for making their homes safer.

Governments need not only to provide financial support for disaster-preparedness actions in communities, but also to encourage families and individuals to invest in reducing their own assets' exposure to natural hazards. Financial support could be mobilised through credit/microfinance schemes which are set up specifically as risk-reduction measures.

Urban governments should have key roles as 'risk reducers'[76]:

- They provide infrastructure and services (some perhaps are contracted to private enterprises or NGOs).
- They guide where development takes place – for instance, influencing where urban settlements develop and where they do not, and what provision they have to avoid floods or fires.
- They regulate hazardous activities that can cause disasters (industries, transport accidents).
- They have an influence on land availability (land-use regulations, zoning, bureaucratic procedures for buying or obtaining land, and what can be built on it); the quality of land-use management influences the proportion of poorer groups having to live on hazardous/disaster-prone sites.
- They encourage/support household/community action that reduces risk (for instance, better-quality housing, safer sites and good infrastructure).
- They provide 'law and order', which should also act to protect the poor from risk.

76 Adapted from: African Urban Risk Analysis Network (AURAN), 2007

Governance surrounding the Saint Louis flooding problem[77]

Background

In this project, ENDA-Tiers Monde, a Senegalese environmental NGO, used a range of action-research methods to explore the levels of risk people were exposed to and to understand the governance challenges that underpinned this risk. A management committee was set up which brought together all possible actors interested in tackling flood risks. This committee defined the key programme components and supervised their implementation.

Saint Louis, Senegal, is rapidly expanding. It grew from 115,000 in 1998 to 200,000 in 2002. The majority of those affected by floods are very poor. Many are rural-urban migrants who left the countryside during the droughts of the early 1970s. During this period, they came to inhabit the lower lying areas of the city. When the rains have returned during the last ten years, these areas have flooded. As a means of flood prevention, the population of low-lying areas uses household waste to make barriers against floodwaters, but this generates additional health hazards. At its heart, flood risk in Saint Louis is a problem of governance; basic data is not available and policy or projects to reduce risk or undertake urban development are often uncoordinated and not inclusive.

Activities

Photographic reports showed how local conditions shape flood risk. For example, household waste contributed heavily to the contamination of flood waters. Interviews with local residents confirmed that people were in constant fear of natural disasters and the threat of disease.

Public meetings allowed residents to think through ways in which changes in behaviour might reduce risk. In particular, practices of disposing of household waste in public areas were challenged. This can disrupt the flow of water increasing risk from flooding and malaria. Public meetings were also held in conjunction with the Office for Public Health and the mayor.

There was much discussion of the ways in which urban development and risk-management strategies currently in use can serve to shift risk between places rather than necessarily reduce it. The area most at risk from flooding was identified – a neighbourhood called Pikine – and, as a result, residents formed a **Commission of Prevention and Fight Against Floods**. This project also provided a mechanism for sharing experiences between communities at risk. For example, Sanankorba village in Mali has undertaken the digging of flood channels. In this case, local residents initiated the project, made bricks and provided labour in partnership with the Canadian Embassy.

The lesson learned is that community solidarity plays a key role in overcoming flood risk. Meetings were also held to assess the role of Civil Defence in disaster management. These activities have brought different interest groups and communities together to reflect on flood risk and its possible improvement. The result has been that through this process new information has been generated and shared and new institutional ties made that can contribute towards the building of a governance system to support risk reduction in the city.

Floods in urban areas of Saint Luis in Senegal
Marta Pena (IFRC)

77 African Urban Risk Analysis Network (AURAN), 2007

Future priorities

The project built on ENDA's past work and will feed into future work on urban environmental conditions, public health and risk, and its focus on education and empowerment through governance reform, not least through the work of a multi-stakeholder management committee. ENDA-Tiers Monde aims to further develop this initiative as an action-research project, combining research with measures aimed at behavioural change of both communities and local authorities. It has a strong interest in expanding this experience in Saint Louis to other countries in West Africa.

8.4.3 Community-based risk assessment

Community-based risk assessment should not be carried out to gather information only, but rather to form a core component of community-based disaster risk management. By being engaged throughout participatory assessment processes, the community's awareness and understanding of risks are enhanced.

Equally important, through 'learning by doing', communities become aware of their own resources, capacities and ways of managing risk. This helps create a sense of ownership and empowerment, generating a culture of prevention within vulnerable communities.

During and after a community-based risk assessment, local disaster-risk-management plans should be developed. These should include contingency plans, defining not only what to do in case of a disaster but also who will be responsible for distinct activities.

In order to enhance communities' resilience, it is necessary to develop action plans, for example a **Community Flood Action Plan**. These plans are targeted to those at risk of flooding where they themselves have a role to play in managing the risk.

Further, a **Community Risk Register** is recommended. Such a register maps all hazards and threats for the concerned district. This helps the community and the responsible local authority to prioritise the main risks. The authorities, together with the communities, identify how to treat these risks either through reduction of impact or probability. This includes everything from a small correction to long-term measurements.

8.4.4 PASSA – Participatory Approach to Safe Shelter Awareness

Urban reconstruction efforts in hazard-prone areas can be enhanced through the integration of disaster preparedness and risk-reduction elements. Any urban reconstruction programme should go beyond mere housing provision. What does it mean – preparing for disasters? What are the 'ingredients' of good urban governance to enhance community contracts? What are participatory budgets? What is PASSA – Participatory Approach to Safe Shelter Awareness? And what is contingency planning and urban simulations?

The purpose of the PASSA methodology is to provide urban communities with tools to improve their living conditions, build safer housing and design more sustainable settlements by utilising a step-by-step method. PASSA tools offer communities knowledge and training to solve their own housing problems and aim at encouraging changes in their behaviour and attitudes.

The method includes the following activities[78]:

- Developing a **historical profile**: to allow the community to identify hazards and vulnerabilities that exist in the community using local historical knowledge.
- Identifying **frequency and impact of hazards**: to enable the community to classify the most important shelter hazards using pictures, photos, etc.
- Undertaking **community mapping and visits**: to map the community's housing conditions and identify potential hazards.
- Classifying **safe shelter and unsafe shelter**: using three-pile sorting drawings and sets of cards to facilitate the categorisation of safe, unsafe and in-between housing and settlement components in the community.
- Identifying **options for solutions**: using the safe and unsafe piles from the previous activity to enable participants to identify options for safe housing and understand how effective each solution is at improving housing safety.
- **Planning for change**: to facilitate development of a community action plan (CAP) to improve housing safety.
- Establishing a **problem box**: to allow the community to review previous decisions and validate all steps and decisions taken.
- Installing a **monitoring plan**: to enable the community to monitor and evaluate progress and outcomes against the agreed community safe-housing plan.
- **Measuring achievement**: using various tools, this activity will facilitate the identification of key results.

78 Adapted from: IFRC, 2010, PASSA – Participatory Approach to Safe Shelter Awareness

PASSA group meeting
British Red Cross

PASSA: Haiti Recovery Programme, British Red Cross, 2010–2011

British Red Cross, supported by IFRC, decided to use the PASSA tool in the community where other reconstruction projects were being implemented, in order to raise the awareness of risks within the built environment.

The British Red Cross chose to use and develop only specific key activities from the PASSA tool in order to continue the existing vital participatory approach. The PASSA activities have also become part of the monitoring process, to check that the selected approach is fully participatory (i.e., including the community at all steps of the project). The selected PASSA activities included:

- historical profiling
- hazard mapping
- community mapping
- issues of safe and unsafe shelter
- options for safe-shelter solutions
- planning for change
- identification of any problems
- monitoring
- measuring achievements.

8.4.5 Vulnerability analysis

Communities often lack a good understanding of hazards and their associated risks. If they want to become more resilient, they need to develop skills to analyse and understand the hazards that affect their lives. In order to achieve this, organisations can work directly with communities to carry out a systematic vulnerability analysis, and/or train community leaders to facilitate community analysis. An analysis of vulnerabilities can be completed in a participatory way, and can help to identify households within a community and those most in need of support.

An analysis of hazards can include the following key issues[79]:

- Identify what different hazards have affected the community or particular groups, both on a regular and a one-off basis.
- Prioritise the different hazards, e.g., according to severity, numbers affected or frequency.
- Further explore the prioritised hazards with the following questions and tools:
  - What is the typical frequency and duration of this hazard; has it changed over time?
  - Are there any warning signs that a hazard event is likely to occur; are there any early-warning systems?

79 Adapted from: IFRC – International Federation of Red Cross and Red Crescent Societies/Practical Action, 2010, PCR Tool 3

- Are there any underlying causes of the hazards and does the community understand them, or how to address them?
- Which groups within the community are most affected and how?
- Which communal or individual assets are affected and how?
- How do different groups typically respond immediately after the hazard occurs (are there contingency plans, safe areas, emergency resources, response organisations, etc.)?
- What particular long-term coping strategies do these people (and particularly vulnerable groups) use to recover from the hazard impact?
- Based on the issues raised, what opportunities and capacities are available, or could be strengthened, to help people cope and recover when hazards and stresses occur?

Suggested tools to use are focus groups, hazard mapping, storytelling, the EMMA – Emergency Market Mapping and Analysis toolkit (to analyse changes to market systems), etc.

Further reading:

Focus groups

OMNI Institute, Toolkit for Conducting Focus Groups, OMNI, Denver, USA: www.omni.org/docs/focusgrouptoolkit.pdf

Hazard mapping

ACF – Action Contre la Faim, Multi-Hazard Mapping using Geographic Information System (GIS), ACF, Community-based Disaster Risk Reduction Project Bicol Region, Philippines: www.preventionweb.net/files/13932_ACF1.pdf

Noson, L., Hazard Mapping and Risk Assessment, Regional Workshop on Best Practices in Disaster Mitigation: www.adpc.net/audmp/rllw/PDF/hazard%20mapping.pdf

EMMA

Emergency Market Mapping and Analysis Toolkit: http://emma-toolkit.org/get/download/

Storytelling

SDC – Swiss Agency for Development and Cooperation, 2006, Story Guide – Building bridges using narrative techniques, SDC, Berne, Switzerland

Knowledge Sharing Toolkit, Storytelling: www.kstoolkit.org/Storytelling

IFRC – Participatory Approach for Safe Shelter Awareness (PASSA), 2011

IFRC – 'No time for doubt' – Tackling Urban Risk: a glance at urban interventions by Red Cross Societies in Latin America and the Caribbean, 2011

Shelter Report 2012 – Build hope: housing cities after a disaster – Habitat for Humanity, 2012

8.4.6 Contingency plans

Contingency planning is an important component within the broader framework of disaster preparedness, which includes early-warning mechanisms, capacity-building, creation and maintenance of stand-by capacities, and stockpiling, among others.

Contingency planning is a process that includes four broad components. Local governments and organisations may follow these steps[80]:

- **Preparation**: Prepare for and organise the contingency-planning process.
- **Analysis**: Analyse hazards and risks, build scenarios and develop planning assumptions.
- **Response planning**: Define response objectives and strategies; define management and coordination mechanisms; develop and approve a response plan.
- **Follow-up and continuation of the process**: Enhance preparedness and continue the planning process.

A good disaster contingency plan consists of organising resources, assessing risks, developing a plan, implementing the plan and monitoring it. The plan is a constantly changing document and needs regular updates. The plan needs to be flexible because communities and resources change over time. The goal of a contingency plan is to decrease or prevent the loss of life. The plan aims at reducing property damage resulting from natural hazards. Urban communities need to understand that contingency plans might be different for different types of emergencies, depending on the type of hazard (flooding, earthquake, cyclone, etc.).

The following steps are recommended at household level:

- **Assess your risks**: Determine the potential problems in your household and in your community. Include cyclones or wind storms in your plan if you live in an area prone to these meteorological events.
- **Develop a plan and set priorities**: Make an evacuation map of your home. Include each room and possible escape routes from each room. Consider where your family would meet if a disaster happened while your children were at school and you were at work. Learn how to turn off your utilities.
- **Implement the plan and monitor its progress**: Hold regular trainings at home. Make sure everyone knows where to go and what to do in an emergency.
- **Organise your resources**: Take an inventory of resources that would be needed and available in the event of various emergencies. Resources can be other people as well as organisations. Create an emergency list of contacts. Create an inventory of household items and family assets. Keep it in a waterproof and fireproof safe.
- **Make an emergency kit**: Include blankets, food, water, a flashlight and batteries. If possible, add a first-aid kit, extra clothes, a toolkit, tape, a rope, a utility knife and extra medication, if applicable.

80 Adapted from: OCHA – United Nations Office for the Coordination of Humanitarian Affairs, Disaster Response Preparedness Toolkit: **www.ocha.unog.ch/drptoolkit/PContingencyPlanning.html**

8.4.7 Communication and disaster preparedness

Good communication is often a challenge in dealing with disasters. In order to ensure proper disaster preparedness, it is essential to address the following questions:

- How do people behave when they obtain risk information?
- What is the role of social networking in sharing information about disaster risk?
- How do new communication networks support the exchange of risk information that could enhance the resilience of communities?

Experience from Mexico City[81]

In the pre-disaster phase, it is important to put into place early-warning systems. One of the early-warning systems that Mexico City employs is a message (SMS) to phones with a distinct sound in the message. The sound that is played in the message alerts local people that the message is important and that it should be read immediately. Yet, during a disaster, it is important to make sure that there is a plan in place so disasters are handled appropriately, and emergency situations are eliminated, even if 21st-century technology is not working.

Further information can be found at:

INFOASAID: www.infoasaid.org

Communicating with disaster affected communities Haiti: http://cdac-haiti.org/en/content/what-cdac

81 The World Bank/International Bank of Reconstruction and Development, 2010

Annex I: References

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Annex II: Further reading

Assessment

EIA tools that can be used in post-disaster settings include:

> Environmental Stewardship Review for Humanitarian Aid (ESR) **www.worldwildlife.org**
>
> Guidelines for Rapid Environmental Impact Assessment in Disasters (REA) **www.proventionconsortium.org**
>
> Flash Environmental Assessment Tool (FEAT) **www.ochaonline.un.org**
>
> Environmental Needs Assessment in Post-Disaster Situation: A Practical Guide for Implementation (ENA) **www.oneresponse.info**

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Simpson/Strong-Tie, *High Wind-Resistant Construction*: **www.strongtie.com/ftp/catalogs/c-hw09/C-HW09.pdf**

Simpson/Strong-Tie, *Seismic Retrofit Guide*: **www.strongtie.com/ftp/fliers/F-PLANS07.pdf**

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World Wildlife Fund/American Red Cross, 2010, *Toolkit Guide – Green Recovery and Reconstruction: Training Toolkit for Humanitarian Aid, Module 3*, Creative Commons, San Francisco, USA: **http://green-recovery.org**

Contingency planning

OCHA – United Nations Office for the Coordination of Humanitarian Affairs, Disaster Response Preparedness Toolkit: **www.ocha.unog.ch/drptoolkit/PContingencyPlanning.html**

Disaster preparedness

Asian Disaster Management News, Vol. 16, No. 1, January – April 2010, *Earthquake Risk Management*, Bangkok, Thailand

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Focus groups

OMNI Institute, *Toolkit for Conducting Focus Groups*, OMNI, Denver, USA: **www.omni.org/docs/focusgrouptoolkit.pdf**

General

ALNAP, *Flood disasters – Learning from previous relief and recovery operations*, ProVention Consortium: **www.proventionconsortium.org/themes/default/pdfs/ALNAP-ProVention_flood_lessons.pdf**

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IFRC – International Federation of Red Cross and Red Crescent Societies/Help Age International, 2011, *Guidance on including older people in emergency shelter programmes*, IFRC/Help Age International

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UN-OCHA, 1982, *Shelter After Disasters*, Ian Davis et all

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Hazard mapping

ACF – Action Contre la Faim, *Multi-Hazard Mapping using Geographic Information System (GIS)*, ACF, Community-based Disaster Risk Reduction Project, Bicol Region, Philippines: **www.preventionweb.net/files/13932_ACF1.pdf**

Noson, L., *Hazard Mapping and Risk Assessment*, Regional Workshop on Best Practices in Disaster Mitigation: **www.adpc.net/audmp/rllw/PDF/hazard%20mapping.pdf**

Host families

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Virdee, J., 2010, Host Community Guidelines – *Supporting Host Families in Haiti by Tracking Movement, Understanding Needs and Directing Responses*, Inter-Agency Standing Committee – Haiti Shelter Cluster/Caritas/Cordaid

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Mapping

Altan, O., Backhaus, R., Boccardo, P., Zlatanova, S., 2010, *Geoinformation for Disaster and Risk Management – Examples and Best Practices*, Joint Board of Geospatial Information Societies, Copenhagen, Denmark

Cambridge University Centre for Risk in the Built Environment (CURBE), 2010, *Disaster Recovery Indicators*, University of Cambridge, UK

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Cosgrave, J., Ramalingam, B., Beck, T., 2009, *Real-time evaluations of humanitarian action*, An ALNAP Guide, Pilot Version, Overseas Development Institute

IFRC – International Federation of Red Cross and Red Crescent Societies/Practical Action, 2010, *PCR Tool 10 – Quality Control*, Switzerland/UK

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IFRC – International Federation of Red Cross and Red Crescent Societies/Practical Action, 2010, *PCR Tool 8 – Participatory Design*, Switzerland/UK

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IFRC – International Federation of Red Cross and Red Crescent Societies, 2012, *Post-disaster Settlement Planning Guidelines*, IFRC, Geneva, Switzerland

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Schacher, T., 2009, *Retrofitting – Some basics*, PowerPoint presentation, SAH construction course, Walkringen, Switzerland: **www.constructiongroup.ch/system/files/retrofitting+some+basics.pdf**

Standards

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The Sphere Project, 2011, *Humanitarian Charter and Minimum Standards in Humanitarian Response*, Geneva, Switzerland: **www.sphereproject.org**

Storytelling

Knowledge Sharing Toolkit, Storytelling: **www.kstoolkit.org/Storytelling**

SDC – Swiss Agency for Development and Cooperation, 2006, *Story Guide – Building bridges using narrative techniques*, SDC, Berne, Switzerland

Transitional shelter

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Trohanis, Z., Shah, F., Ranghieri, F., 2009, *Building Climate and Disaster Resilience into City Planning and Management Processes*, Fifth Urban Research Symposium 2009, Sustainable Development Department East Asia and the Pacific Region, The World Bank

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WHO – World Health Organization, 1991, *Surface Water drainage for Low-Income Communities*, Geneva, Switzerland

Annex III: Links

General

www.sheltercentre.org

www.recoveryplatform.org

www.alnap.org

Community action planning

www.communityplanning.net

Earthquake-resistant construction

www.confinedmasonry.org

www.structureparasismic.com/MaMaisonParasismique.html

www.safestronghome.com

www.strongtie.com

Intergovernmental coordination in Latin America/Caribbean:

www.minurvi.org

Land issues

www.gltn.net

Mapping

www.openstreetmap.org

www.esri.com

www.hazards.fema.gov/femaportal/wps/portal

Water supply, sanitation, solid waste management

www.sandec.ch

www.cwgnet.net

www.waste.nl

ATC-20 Detailed evaluation safety assessment form[82]:

Page 1

Inspection

Inspecteur ID: ______________________________

Affiliation: ______________________________

Inspection date and time: ____________________ ❑ AM ❑ PM

Final Posting from page 2

- ❑ Inspected
- ❑ Restricted use
- ❑ Unsafe

Building Description

Building name: ______________________________

Address: ______________________________

____

Building contact/phone: ______________________________

Number of stories above ground: _____ below ground: ____________

Approx. "Footprint area" (square feet): ______________________________

Number of residential units: ______________________________

Number of residential units not habitable: ______________________

Type of Construction

- ❑ Wooden frame
- ❑ Steel frame
- ❑ Tilt-up concrete
- ❑ Concrete frame
- ❑ Concrete sheer wall
- ❑ Unreinforced masonry
- ❑ Reinforced masonry
- ❑ Other: ______________________

Primary Occupancy

- ❑ Dwelling
- ❑ Other residential
- ❑ Public assembly
- ❑ Emergency services
- ❑ Commercial
- ❑ Offices
- ❑ Industrial
- ❑ Other: ______________________
- ❑ Government
- ❑ Historic
- ❑ School

Evaluation

Investigate the building for the conditions below and tick the appropriate column. There is room on the second page for a sketch.

Overall hazards:	**Minor/None**	**Moderate**	**Severe**	**Comments**
Collapse or partial collapse	❑	❑	❑	______________
Building or storey leaning	❑	❑	❑	______________
Other ______________	❑	❑	❑	______________
Structural hazards:				
Foundations	❑	❑	❑	______________
Roofs, floors (vertical loads)	❑	❑	❑	______________
Columns, pilasters, corbels	❑	❑	❑	______________
Diaphragms, horizontal bracing	❑	❑	❑	______________
Walls, vertical bracing	❑	❑	❑	______________
Precast connections	❑	❑	❑	______________
Other ______________	❑	❑	❑	______________
Non-structural hazards:				
Parapets, ornamentation	❑	❑	❑	______________
Cladding, glazing	❑	❑	❑	______________
Ceilings, light fixtures	❑	❑	❑	______________
Interior walls, partitions	❑	❑	❑	______________
Elevators	❑	❑	❑	______________
Stairs, exits	❑	❑	❑	______________
Electric, gas	❑	❑	❑	______________
Other ______________	❑	❑	❑	______________
Geotechnical hazards:				
Slope failure, debris	❑	❑	❑	______________
Ground movement, fissures	❑	❑	❑	______________
Other ______________	❑	❑	❑	______________

General Comments: ____

____

82 Adapted from: Applied Technology Council, 1995-2007: **www.atcouncil.org/pdfs/rapid.pdf**

Building name: ______________________ Inspector ID: ______________________

Sketch (optional)

Provide a sketch of the building or damaged portions. Indicate damage points.

Estimated Building Damage

If requested by the jurisdiction, estimate building damage (repair cost/replacement cost, excluding contents).

❑ None
❑ 0–1%
❑ 1–10%
❑ 10–30%
❑ 30–60%
❑ 60–100%
❑ 100%

Posting

If there is an existing posting from a previous evaluation, tick the appropriate box.

Previous posting: ❑ **INSPECTED** ❑ **RESTRICTED USE** ❑ **UNSAFE** Inspector ID: __________ Date: __________

If necessary, revise the posting based on new evaluation and team judgment. *Severe* conditions endangering the overall building are grounds for an Unsafe posting. Local *Severe* and overall *Moderate* conditions may allow a Restricted Use posting. Indicate the current posting below and at the top of page 1.

❑ **INSPECTED** (Green placard) ❑ **RESTRICTED USE** (Yellow placard) ❑ **UNSAFE** (Red placard)

Record any use and entry restrictions exactly as written on placard: ______________________

____

____

Further Actions

Tick the boxes below only if further actions are needed.

❑ Barricades needed in the following areas: ______________________

____

❑ Engineering Evaluation recommended: ❑ **Structural** ❑ **Geotechnical** ❑ **Other:** ______________________

❑ Other recommendations: ______________________

____

____

Comments: ______________________

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Neighbourhood enumeration questionnaire[83]

(Provided by Habitat for Humanity International, 5 December 2010)

Surveyor's Initials: .... # Survey No.: ....

Date and Time: ....

GPS Coordinates: .... Picture:

Respondent's name:...

Contact Phone: ....

1. Household composition: who stays regularly at the home (spends the night)

	Name	Sex (F/M)	Age	Relation to the head of household (1)	Occupation (2)	Vulnerability (3)	Level of education completed (4)
a	(Head of Household)			-----N/A----			
b							
c							
d							
e							
f							
g							
h							

1. Relation to head of household: a) spouse, b) sibling, c) child, d) parent, e) grandparent, f) grandchild, g) niece/nephew, h) aunt/uncle, i) cousin, j) extended family, k) friend of family, l) another relation (explain)
2. Occupation: a) currently working, b) currently not working, c) regular day worker, d) irregular day worker, e) small merchant, f) student, g) transporter, h) contractor/repairs, i) artisan, j) public servant, k) seeking employment, l) religious worker, m) farmer, n) metal worker, o) cash for work, p) other (explain)
3. Vulnerability: a) female head of household, b) handicapped, c) single-parent household, d) pregnant woman, e) child head of household, f) widow(er), g) chronically ill, h) landless, i) internally displaced person, j) elderly >65 years
4. Level of education completed: a) never attended school, b) kindergarten, c) primary school, d) secondary school, e) university, f) professional school, g) vocational school, h) literacy school, i) other (explain)

83 IHC – International Housing Coalition/United States Agency for International Development (USAID), 2011: **http://intlhc.org/wp-content/uploads/2011/05/IHC-Haiti-Shelter-Sector-Assessment.pdf**

2. House conditions (original home, not camp)

a) Was your house damaged by the earthquake? ❑ Yes ❑ No	
b) ATC-20 rapid assessment result: ❑ Red ❑ Yellow ❑ Green ❑ Not evaluated	
c) Material of the house: ❑ Tarp ❑ Corrugated iron sheets ❑ Concrete block ❑ Wood ❑ Other:	
d) How big is your home? ....m x ....m = ...m^2	
d) House location (before the earthquake):	Simon: 0 1 2 3 4 5 6 7 8 Other area: Pele, Cite Dieu Seul, PCS, Other (name): ....
e) Do you sleep in this same house? ❑ Yes ❑ No	
f) If not, where do you sleep?	
g) How many families share the building? ❑ 0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5+	
i) What year did you move to Simon Pele? Where did you move from?	
j) Do you feel safe where you live? ❑ Yes ❑ No	
k) How many rooms are in your house? ❑ 0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5+	
l) Does your house leak? ❑ Yes ❑ No	

3. For home before the earthquake (not camp): Information regarding the house structure

Do you own, rent or just occupy your house (not owner, but not paying)?

If owner:	Since what year?	
	Did you buy it or inherit it or build it yourself?	
	Who did you buy/inherit from?	
If renter:	Since what year?	
	Who is the owner?	
If just occupying:	Since what year?	
	Do you have an agreement with the owner?	
	Who is the owner?	

4. For land before the earthquake (not camp): information regarding the land

Do you own, rent or just occupy the land (not owner, but not paying)?

Owner:	Since what year?	
	Did you buy it or inherit the land? Or other (explanation)?	
	Who did you buy/inherit from?	
Renter:	Since what year?	
	What kind of rent – normal or rent to buy?	
	Who is the owner of the land?	
If just occupying?	Since what year?	
	Do you have an agreement with the owner?	
	Who is the owner of the land?	

5. People living in the house

a)	Do you have regularly staying guests? ❑ Yes ❑ No
b)	If yes, how many on average? ❑ 0 ❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5 ❑ 6+
	How much are the main expenses per month? (in Haitian dollars)
c)	Where do the children spend the daytime?

6. Health

a)	Was anybody in your family sick last week? ❑ Yes ❑ No
b)	How many times did you eat yesterday? ❑ 0 ❑ 1 ❑ 2 ❑ 3 ❑ 4+
c)	If 0 times, did you snack? ❑ Yes ❑ No

7. Transportation

a)	What kind of transport do you use to get to work? (or whoever the main income earner is) ❑ Walk ❑ Tap tap ❑ Taxi ❑ Bicycle ❑ Personal car/motorbike
b)	How much does it cost per day for this trip? (in Haitian dollars) enter number:
c)	Where does your family do its shopping? ❑ In Simon Pele ❑ Port-au-Prince downtown ❑ Cite Soleil ❑ Croix de Bouquets ❑ Delmas ❑ Tabarre

8. Economic activity

a) Do you have work? ❑ Yes ❑ No	
b) If yes, are you paid on a regular basis? ❑ Yes ❑ No ❑ Self-employed	
c) Do you pay income tax? ❑ Yes ❑ No	
d) Do you take out loans? ❑ Yes ❑ No	e) If yes, during what times of the year? ❑ January ❑ February ❑ March ❑ April ❑ May ❑ June ❑ July ❑ August ❑ September ❑ October ❑ November ❑ December ❑ All year ❑ Other (explain): ....
Electricity	Clothing
Transport	Medical costs
Rent and home maintenance	School fees
Food and drinking water	

9. Water and sanitation

a) Where do you get water for cleaning? ❑ Well ❑ Communal tap (paid) ❑ Communal tap (free) ❑ Rainwater catchment ❑ Truck ❑ Buy in the market/stall ❑ Other (explain): ....
b) Where do you get water for drinking? ❑ Well ❑ Communal tap (paid) ❑ Communal tap (free) ❑ Rainwater catchment ❑ Truck ❑ Buy in the market/stall (plastic sacks or 5-gallon bottles) ❑ Other (explain): ....
c) Who retrieves the water? ❑ Woman ❑ Man ❑ Girl ❑ Boy ❑ Elder d) How long does it take? ❑ 0 - 5 minutes ❑ 5 - 10 minutes ❑ 10 - 30 minutes ❑ 30 - 60 minutes ❑ 60+ minutes
e) Is there a toilet in the area? ❑ Yes ❑ No f) ❑ Temporary ❑ Permanent g) How long does it take to get there? ❑ Less than 1 minute ❑ 2 - 5 minutes ❑ 6+ minutes h) ❑ private ❑ communal i) How many families do you share the toilet with? ❑ 1 family ❑ 2 - 3 families ❑ 4 - 5 families ❑ 6+ families
How many times per month is garbage collected in your neighbourhood? .... Who collects garbage in your neighbourhood? ....

10. Disaster risk reduction

Have you ever experienced...? ❑ Flooding ❑ Fire disaster ❑ Eviction ❑ None
If so, how many times?
a) Where did you go during hurricanes before the earthquake?
b) Where do you go during bad weather now?

Roles of professionals in urban reconstruction[84]

Assessments / Risk mitigation

Architects	Surveyors	Planners	Engineers
Provide an assessment of the way people build in the area, their use of dwellings, community facilities and other buildings; can help pinpoint historic and culturally important buildings at risk.	Assess the general stock of buildings and provide costs of mitigating potential disaster impacts by strengthening structures and planning alternative procedures and improving regulations.	Estimate vulnerability relating to the way land is used and settlements, buildings and infrastructure are located, taking into account climate change impacts; assess potential access issues during a disaster; analyse the effectiveness of regulations and policies.	Assess the stability and vulnerability of existing structures particularly vital facilities; identify failure modes and consequences.
Facilitate community surveys and advise on the planning of community shelters and dwellings.	Advise on the cost and delivery of 'risk mitigation' particularly roles and responsibilities of owners and tenants of buildings and assets; marine surveyors can inform on environmental resources to reduce risk in coastal areas.	Identify the risks associated with areas; advise on risk-reduction; plan for quality development in the right locations; develop regulations that are practical and cost effective to implement; facilitate development of stakeholder partnerships and community consultation.	Specify structural requirements and retrofitting measures to mitigate disaster impacts; identify post-disaster response mechanisms; design and implement risk-reduction training for communities in collaboration with social-development professionals.

Disaster preparedness

Architects	Surveyors	Planners	Engineers
Provide advice on building use in the event of hazard.	Advise on the cost and delivery of disaster-preparedness measures.	Locate settlements and define those most at risk; advise of relocation measures before, during and after a disaster; transport planning for access in disaster situations.	Specify measures for providing temporary strengthening of existing structures in the face of hazards; identify vulnerable structures and measures to be taken in the event of damage to the buildings; develop emergency response plans to provide vital services (water, waste water, transport, logistics, communications, power).

84 Adapted from: University of Westminster, 2009

Reconstruction

Architects	Surveyors	Planners	Engineers
Provide an assessment of traditional patterns of use of space, building materials and technology; work as part of social survey teams.	Carry out building-condition surveys, including assessment of key buildings and overall damage assessment; capture detailed information related to land ownership, tenure and registration.	Assess potential locations for interim settlements, transitional dwellings and vital facilities in consultation with key stakeholders.	Structural surveys of buildings and infrastructure; identify safe sites for setting up facilities; establish safe and cost-effective procedures for removal of rubble and clearing sites; assess further environmental risk in the near term.
	Procure and analyse satellite imagery to establish boundaries for planning and property-recovery purposes.	Work with surveyors to review mapping and establish boundaries and provide estimates (if not already available) of land use, transport and access lines, and water bodies and the impact on them after the disaster.	Relate mapping results to sources of key vital services.
Work with social-development agencies to carry out surveys with community groups and households for which shelter needs to be provided.	Carry out surveys of land and property ownership at the ground level; review construction skills in the local community.	Access and provide information on population, households, social and economic activity and carry out additional participatory surveys, as necessary; consultation with communities about their aims and objectives.	Provide information on access and provision of key vital services.
	Interpret housing needs assessment, in particular with regard to issues related to land, title, tenure and cost.	Evaluate overall housing needs, establishing the scale and type of infrastructure, and housing and land required for permanent housing; consider layout design at the settlement level.	
	Carry out land surveys in consultation with planners and other specialists such as hydrologists and geotechnical scientists; identify, in consultation with local communities and local authorities, the exchange, purchase and transfer of land.	Advise on optimum locations for housing based on economic, social and environmental considerations (e.g., flood risk and access to income-generating activities); identify, in consultation with local communities and local authorities, the exchange, purchase and transfer of land.	Provide engineering assessment on suitability of areas of permanent new development.

Reconstruction (continued)

Architects	Surveyors	Planners	Engineers
Establish footprints of dwellings and other typical and key buildings; draw up local area layouts and site planning in consultation with communities and local authorities; ensure overall appropriateness to local culture.	Provide detailed contour surveys for planning purposes; planning surveyors may be engaged to carry out site planning.	Strategic-level physical planning and local area planning: location of buildings, key facilities, transport routes and access (existing and new).	Advise on civil works required to implement the physical plan.
	Estimate quantities and cost of rubble removal.	Identify key infrastructural issues and priorities for action.	Supervise the removal and clearing of sites; reclaim building material (householders may want to claim material from their individual homes).
	Fine-tune property boundaries and ownership; provide input into resolving conflicting land-ownership claims and the protection of community land rights from commercial land grabs.	Establish, with legal assistance, a registry where one does not exist; resolve ownership issues in consultation with authorities and communities.	
	Implement boundary/cadastral survey.	Advise on physical planning and 'intense' areas of particular importance to communities and local authorities.	
	Carry out case-by-case resolution depending on the nature of the dispute.		
Design and plan landscape elements.	Provide baseline survey information for planners and architects.	Plan overall siting of settlements and access routes and infrastructure; be involved in regulatory guidance and enforcement.	Design and plan drainage and further civil works related to the physical plan.
Work with households and communities to ensure that housing is allocated appropriately according to needs and preferences.	Allocate housing in consultation with community groups with reference to the structure of the compensation plan and procedure.	Allocate dwellings in the overall plan for each settlement according to needs assessments.	

Reconstruction (continued)

Architects	Surveyors	Planners	Engineers
Advise on building-related regulations.	Implement codes and regulations within the conditions of leases and ownerships.	Propose ways to monitor and enforce regulations; advise on longer-term policy and plan development to support future risk reduction and efficient reaction to risks.	Advise on building and infrastructure regulations.
Design and plan building technology for dwellings including covered, open and semi-open spaces and vegetation; avoid design faults that will require costly and frequent maintenance and repair.	Assess capital costs as well as lifetime costs of dwellings.	Manage overall impact on use of services and transport, etc.; draw up and amend local planning policies and guidelines to take account of new housing and site-planning requirements.	Design typical safety features in traditional buildings, new buildings and buildings to be retrofitted.
Supervise and advise as the buildings are constructed.	Supervise the buildings as they are constructed such that costs and quality are maintained.	Provide background information on by-laws, construction practices and compliance.	Train any volunteers and professionals to ensure safety standards are maintained.
Develop interface between infrastructure and buildings/ boundaries.	Publish design guidance on ownership and infrastructure, and quality control.	Publish information on land-take for near-site and on-site facilities; confirm that infrastructure meets demand as well as regulation requirements; develop integrated spatial strategies/action plans.	Design to meet demand and other performance criteria set out by the reconstruction authority; supervise and train professionals to ensure safety standards are maintained.
Provide training in construction, retrofitting and maintenance of dwellings and non-dwellings.	Provide training in condition surveys, land surveys, costing and planning of projects.	Provide training in research and risk assessment when designing transitional and permanent settlements; monitor compliance with regulations/policies.	Provide training in safe installation, maintenance and upgrade of basic infrastructure: energy, water, electrical, waste and transport.
Oversee the delivery of dwellings and community facilities with the assistance of community groups and the delivery of facilities such as hospitals with specific clients.	Monitor quality and cost control of the delivery of dwellings/community facilities with the assistance of community groups and for facilities such as hospitals with specific clients.	Provide strategic input into establishing aims and objectives of projects, priorities for action, community consultation and planning at the settlement level.	Provide technical input into project planning and identify items that may delay or risk the project.
Identify the contribution communities are making to dwellings and non-dwellings and feed that into cost model.	Identify complete capital cost as well as life-cycle analysis of costs; identify other sources of finance.	Provide background estimates of demand for funding required; highlight changes in programme and projects; advise on locally generated revenue.	Monitor costs for retrofitting, safety features in new buildings and civil works associated with reconstruction.

Operation/Maintenance

Architects	Surveyors	Planners	Engineers
Review and revisit dwellings and non-dwellings, observing the way people are changing their lifestyles and habits in relation to the use of buildings; ensure safe and sustainable adaptations.	Review and revisit reconstruction sites periodically and carry out condition surveys of key buildings, dwellings, understanding operational costs and labour use.	Periodically review the demand for infrastructure and its capacity; review disaster preparedness plans in consultation with local communities; monitor regulations and compliance to them and revise if necessary.	Periodically review the strength and stability of key buildings as well as dwellings and infrastructure services; carry out further training, if required, to build a skills base.
Undertake life-cycle studies of reconstruction projects and plan for their eventual replacement; work with existing communities to design new developments that reduce their vulnerability to hazards.	Explore the cost-planning implications in life-cycle studies of reconstruction projects, and of new developments that reduce vulnerability to hazards of existing communities.	Work with resident communities in reviewing and renewing plans for the long-term sustainable development of disaster-affected or hazard-prone settlements; develop renewal and regeneration strategy for the settlement as a whole.	Undertake life-cycle studies of infrastructure projects and plan for their eventual replacement; work with existing communities to design new infrastructure developments that reduce their vulnerability to hazards; carry out regular checks on safety of infrastructure, development and maintenance of management plans.
Advise on reducing operational and management costs.	Advise on reducing and servicing debt by utilising the value of land and buildings to the fullest.	Advise on making safety regulations cost less to implement.	Advise on cost-effective retrofitting, extensions and safe new construction.
Identify regular housekeeping and maintenance procedures to avoid major repair.	Ensure repair and maintenance are obligatory and cost-effective.		Monitor any issues that are leading towards major repair of buildings or require addressing to stop unsafe construction.
	Estimate operational costs and ownership of repair and maintenance.	Raise awareness and encourage education among the general public; enforce compliance where necessary.	Carry out regular checks, monitoring and training of specialist workers; provide guidance on infrastructure maintenance provision.
Provide training in building design, construction and extensions for professionals as well as communities.	Provide training in cost-effectiveness and responsibility for maintenance and management.	Provide training in planning for professionals in local authorities, covering future risk assessment and risk reduction when planning developments and settlements.	Provide training in safety and stability of the structures as well as in understanding environmental risks and risks from construction practices.

A programme approach to urban neighbourhood recovery and permanent housing reconstruction (American Red Cross)[85]

Situation

In Port-au-Prince, the pre-earthquake, physical condition of many of the neighbourhoods was weak, hazardous and/or inadequate. The earthquake exacerbated an already vulnerable situation and created neighbourhoods with considerable and extensive damage. Former residents now live in dense, spontaneous camps under plastic sheeting tents, relatively close to their damaged homes, so reuniting residents with their houses is generally possible. The buildings in these neighbourhoods are usually of one-storeyed concrete-block construction. Each damaged building has been structurally examined and marked either green (no significant damage), yellow (structurally sound but needs repair) or red (needs extensive reconstruction or should be demolished). Based on this structural examination, programmes are targeting the clean-up of green houses and repair of yellow houses.

Programme task outline

Task 1 – Define the neighbourhood: The neighbourhood is defined both by physical boundaries and affinity relationships; these also set the boundaries for each project. The neighbourhood should be largely residential. Initial beneficiary consideration should be given to former residents but beneficiary identification can be problematic. The 'affinity' requirement is necessary for community cohesion, neighbourhood involvement and participation in the neighbourhood design function.

Task 2 – Survey and parcel map the neighbourhood: Mapping is critical to the process. It is necessary to accurately establish land rights for the project, agree the parcel boundaries before demolition and provide a basis for the settlement design, particularly for improving road access to land and drainage. In addition, the mapping process must not create a parallel civil land system but aim to fill in the gaps of the existing system. The process will be participatory by involving members of the community. This mapping activity must be undertaken in partnership with local government and the national government's land registration office in order to merge new plot information into the Haitian civil land system when such a system is established.

Task 3 – Assess the road and drainage needs: Roads are important as they often form the storm-water sewer and sanitation sewer systems of the settlement. Roads are also necessary for construction logistics as well as providing a useful livelihoods vehicle. Crushed rubble is used as the road base as well as the curbs, gutters and drainage channels. The final road surface, if any, could be constructed from crushed rubble to create paving bricks, a common road surface in Haiti. This approach has good livelihoods potential.

Task 4 – Identify the houses (red) to be demolished and finalise designs for the replacement of buildings: Red houses, generally, will be replaced with similar houses. Design changes may be necessary through consultation with the neighbourhood design process. All design work would be done in participation with the community and home-owners.

85 Red Cross Red Crescent Societies, 2011

Task 5 – Start rubble removal, demolition and clean-up: There needs to be a rubble plan that integrates with other tasks in the overall programme and with the phases and sequencing of these activities. Large rubble deposits need to be removed immediately. Smaller rubble piles that do not interfere with the overall programme need to be cleared through a cash-for-work programme, if possible.

Task 6 – Establish the neighbourhood design plan: Create the 'master' plan for the neighbourhood. This process may involve re-parcelling, land swaps and reconfigurations. Roads and drainage are important factors. Community participation is critical and the initial parcel map is mandatory. The objective is to develop the best neighbourhood design realistically possible within the context. This activity will set the tone for the community for the next 30 to 50 years.

Task 7 – Assess and specify the completion work needed on the green houses and the repair work on the yellow houses and conduct repair work: Whatever work is needed to bring the green and yellow houses to the 'final' permanent home status as established by the programme would be specified, scheduled and done. The programme envisions 'core' repair. That is, buildings would be completed to a structurally sound, safe and habitable condition. Finishing work such as plastering walls, adding interior doors, painting and other amenities would be the responsibility of the home-owner as their resources allow. For this finishing programme, 'owner driven' assistance would be provided for up to 18 months after the construction programme ends. Repairs would be in accordance with the Ministry of Public Works repair guidelines. The housing status of the home-owner would be equivalent to their housing status before the earthquake, plus qualified improvements.

Task 8 – Assess water and sanitation needs: In a settlement situation one has to look at the cumulative effect of all the latrines and waste water. Since one cannot have sanitation without water, water and sanitation are a mandatory intervention in settlement development.

Task 9 – Determine the extent to which the programme will need: Training programmes for tradesmen; home maintenance programmes for home-owners; disaster risk-reduction programmes and community health programmes; and implementation programmes. Local labour, contractors and tradesmen will be used whenever possible. Where necessary, targeted training programmes will be provided. The other listed programmes are standard American Red Cross community interventions.

Task 10 – Establish a rubble-processing site within the community: Rubble will be crushed on site and can be used for road substrates, aggregate wall footers (where walls are not load-bearing), paving bricks and aggregate for plaster finishes. Rubble not used would be handled in accordance with the rubble-removal programme of the Interim Haiti Reconstruction Commission.

Task 11 – Decide on material manufacture, if any, and how to maintain building material quality control: This task is formulated depending on the characteristics of the project and the extent to which livelihoods components are included. There are a number of potential options, including local factory quality-assistance programmes, which could be part of an economic recovery programme.

Task 12 – Start housing rehabilitation: Many of the approaches and methodologies that are currently being used on the green-yellow shelter-repair programmes would be included into the standard community-assistance programme approach.

Summary of design principles for safety (for small buildings only)[86]

Designing for earthquake resistance	Designing for wind resistance
■ Select a solid site. Avoid landfills, flood plains and steep slopes. ■ Make buildings light to reduce the horizontal forces caused by earthquakes. ■ Make roofs light to avoid them pushing walls sideways and falling in on people. ■ Design compact buildings with a symmetrical shape and closely spaced walls in both directions. If that cannot be done, design them in separate blocks. ■ Separate adjacent small buildings by at least 7.5 centimetres. ■ Avoid gables as they may fall inwards. ■ If buildings have more than one floor, opt for similar floor shapes and designs. ■ Position the foundations on rock or firm soil. Avoid stepped foundations. ■ Provide strong joints between structural components. Use a ring beam and a plinth beam where possible; use bracing at corners. ■ If masonry walls are used, create good bond especially at corners and intersections. ■ If concrete pillars are used, lap vertical reinforcements mid-way between floors and not just above floors. ■ Keep openings to a minimum, well distributed over the building and within walls. Keep them centrally positioned, at least 60 centimetres away from the inside of corners and intersections and from the nearest other opening.	■ Select a sheltered site. ■ Avoid long and narrow (<6 metres) streets. ■ Position houses in a staggered way rather than in rows. Create wind-breaks by planting trees, hedges, etc. ■ Make buildings heavy (so it is more difficult for the wind to blow them away). ■ Use a compact shape, with low walls, to present minimum obstruction to winds. ■ Use a hipped roof, pitched at 30 to 45 degrees, with small eaves to prevent uplift. Avoid gables, as they may be pushed inwards. ■ If a veranda is required, separate veranda frame and covering from the main roof. ■ Tie roofing sheets well to the roof frame; flying sheets can be lethal. In the case of galvanised corrugated iron (GCI) sheet roofing, provide overlaps of 2.5 corrugations, and more-closely spaced 'U' bolts along ridges and external walls. ■ Reinforce structural connections with 'hurricane straps'. ■ Make solid foundations, well anchored to the ground. ■ Provide strong structural joints and fixings, especially between walls and foundations, and walls and roof. Use diagonal bracing. ■ Give walls a rough finish to reduce wind suction. ■ Position openings centrally and away from corners and intersections. Provide openings on both sides of rooms, so that the wind can eventually pass through, rather than lift the roof. ■ Ensure all windows can be closed. Avoid louvres – if they are essential, provide storm shutters or board them up before storms.

86 Adapted from: IFRC – International Federation of Red Cross and Red Crescent Societies/Practical Action, 2010, PCR Tool 8 – Participatory Design

Designing to cope with landslides	Designing to cope with floods
■ Avoid building on steep slopes and do not make steep cuts in slopes to make space for infrastructure or housing; keep any cuts shallow, as steep cuts may become unstable. ■ Drain slopes well, as they can become unstable and lose bearing capacity when soaked. For the same reason, avoid the use of 'soakaways', e.g., for sanitary systems or used household water, on slopes. Use stepped drains to reduce the speed of downward flow of water. ■ Avoid blocking natural drainage ways with buildings or infrastructure. ■ Avoid stepped buildings where possible. Create terraces for small buildings, but avoid deep cuts and fills. Keep any infill at the lower end to a minimum, and stabilise this well. ■ Plan for construction of retaining walls to retain the slope above terraces, and any infill at the lower end. ■ Reduce erosion by planting appropriate vegetation on slopes.	■ Avoid sites close to rivers and other waterways that are known to flood. ■ Provide for good site drainage and good waste management, as waste may block waterways. ■ Plan for measures, such as small dams or gabions, that can reduce the speed of water. ■ Plan any new infrastructure very carefully. Some, such as road or railway embankments, may have devastating effects by redirecting flood waters. ■ Lift buildings onto stilts or raised platforms – where the latter is used, a larger platform for a cluster of houses is preferable over single platforms, to reduce the effect of erosion. ■ Provide deep foundations that keep buildings in place even in strong currents, eventually include a ring beam at plinth level. The minimum depth should be 600 millimetres in solid soils – if stones are used, select angular, not round ones. ■ Avoid the use of soil in foundations or walls that may be reached by flood waters. These lower sections of walls should be made of more durable materials that can resist the shocks of debris floating in water. ■ Protect organic materials such as timber and bamboo from the effects of humidity.

Assessment of strength of natural soils (not fills or organic clays/silts)[87]

The tables below provide guidance regarding how to assess the strength of natural clay or sand soils. Also included is an assessment of the allowable bearing pressures for shallow foundations on natural clay or sand.

These are approximate values and will need to be determined by a site survey in order to design the foundation. A site engineer should always provide advice on allowable foundation pressures.

Rock soil is generally acceptable for foundations of buildings that are only up to two floors high.

Cohesive soils (clay)		
Consistency	**Field assessment of soil strength**	**Typical values of allowable bearing pressure (kN/m^2)**
Very stiff	Indented by thumbnail; brittle or very tough	> 300
Stiff	Indented by thumb pressure; cannot be moulded in fingers	150 – 300
Firm	Moulded by strong finger pressure	75 – 150
Soft	Moulded by light finger pressure	35 – 75

Soils that are not cohesive (sand and/or gravel)		
Consistency	**Field assessment of soil strength**	**Typical values of allowable bearing pressure (kN/m^2)**
Dense	High resistance to penetration by handlebar or pick axe	> 350
Medium dense	Difficult to excavate by shovel	100 – 350
Loose	Easily excavated by shovel; only small resistance to penetration by handlebar	40 – 100

87 Adapted from: Patel D., Patel, D., Pindoria, K., 2001

Basics on material testing methods

Most countries have established quality standards for building materials and, in some cases, producers of materials are required to provide certificates which prove that the standards are met.

Unfortunately it is quite common for such certificates to lack verification or even to be falsified (as is often the case of, e.g., certified timber). It is recommended that the quality of construction materials be assessed whenever their origin and quality are in doubt. Below are a few tips about how to assess materials when testing facilities are not available.

The recycling of materials can be a cheap and easy way of finding construction materials, and is generally a good environmental practice. The quality of recycled materials, however, should always be verified, as even high-quality construction materials may be damaged in disaster situations.

Cement

- When cement is rubbed between fingers and thumb it should feel like a smooth powder such as flour.
- Check the cement for any lumps and remove them.
- Never use cement that has been stored for more than six months.

Concrete blocks

- Good-quality concrete blocks are produced and stored under a sunshade and have a cement-to-aggregate mix ratio of 1:6–8, with clean raw materials (sand, gravel, drinking-quality water) and fresh cement.
- Blocks should be properly cured for 21 days and handled with care until used for masonry work.

Fired bricks

- The quality of a brick is good if there is a clear ringing sound when two bricks are struck together.
- A brick should not break when dropped flat on hard ground from a height of one metre.
- A good fired brick has a surface so hard that a fingernail cannot scratch it.

Sand and aggregates

Dirty sand should never be used in masonry work because it will reduce the mortar's adhesive quality considerably.

To check whether sand is suitably clean, use the hand test:

- Rub a sand sample between damp hands. Clean sand will leave the hands only slightly stained.

Or use the bottle test:

- Fill a bottle halfway up with sand. Add clean water until the bottle is three-quarters full. Shake the bottle thoroughly and leave it for one hour. Clean sand will settle immediately. Silt and clay will settle slowly on top of the sand. The thickness of the clay and silt layers should not equal more than ten per cent of the sand layer's thickness.
- Sand from the sea is unsuitable for mortar as it contains salts, which negatively influence the mortar's moisture and overall quality.

Water

- Water should be of drinking-water quality and have no pronounced taste or smell.
- Seawater should not be used.
- Rainwater collected from roofs can be used for mixing mortar or concrete.
- Water mixed with any kind of oil should not be used for mixing mortar or concrete.
- Water should be stored carefully to prevent it from becoming contaminated.

Annex V: Contacts

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More frequently, towns and urban agglomerations are affected by natural disasters. Large cities and mega-cities concentrate and magnify risk, but smaller cities also suffer from exposure to multiple risks. Therefore, involvement in reconstruction and rehabilitation efforts in urban and peri-urban areas has become increasingly significant. Field-focused guidance for practitioners and decision-makers on key issues to inform current transitional shelter programming and the initiation of reconstruction and repair programmes in the urban context is crucial to ensure a sustainable recovery. There are various reconstruction manuals available – yet most of them focus only on rural areas. Consequently, Swiss Resource Centre and Consultancies for Development (Skat) and the International Federation of the Red Cross and Red Crescent (IFRC) have compiled these guidelines with a focus on the urban context.

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