

## Key messages

- Use participatory approaches and ensure all stakeholders, including women, are involved in project planning and implementation.
- Develop indicators for monitoring and evaluating progress and environmental / social impacts.
- Perform environmental assessments of sites to identify potential natural resources and limitations, e.g. water access.
- Be familiar with traditional architectural styles and incorporate these into project plans.
- Understand local laws, standards and best construction and management practices.
- Understand the accessibility of the site to needed facilities, e.g. hospitals, schools.
- Provide adequate, sustainable drainage, solid waste, sanitation and wastewater systems.
- Incorporate technologies that support energy and water needs for households.
- Protect and add native vegetation as appropriate to the project site and building designs.
- Prefer local, sustainable materials and the development of local livelihoods, e.g. community soil stabilised block making projects.
- Implement measures to reduce construction waste and material toxicity.
- Design shelters that minimise the rate of heat transfer.
- Construct shelters that promote healthy indoor environments.

## SUSTAINABLE CONSTRUCTION IN NORTH DARFUR

### INTRODUCTION

Although attention is often given to sustainability criteria, such as choice of materials and building technologies, it is also important to include sustainability criteria in the pre-design and planning phases.

**Pre-design phase:** It is important that all stakeholders become involved, including women. Using participatory approaches, stakeholder involvement should then be continued throughout the entire project, including the development of monitoring and evaluation indicators to identify progress and environmental / social impacts.

**Planning phase:** Start the planning phase by conducting environmental assessments of sites to identify how current vegetation can be protected and what other natural resource assets and constraints are present. In North Darfur, it is especially important to assess water availability and energy options that do not contribute to unsustainable use of wood products. In many cases, it may be useful to include rainwater harvesting systems or fuel-efficient stoves. Also make sure to identify and incorporate traditional architectural styles, local laws and best construction and management practices for the area. Proper spatial planning should identify site accessibility to nearby medical, educational and livelihood options and address system needs for drainage, solid waste, sanitation and wastewater. For example, greywater separation systems may be appropriate.

### KEY SUSTAINABILITY CONSIDERATIONS

Other important sustainability considerations for construction in a hot-dry climate and fragile ecosystem, such as North Darfur, are:

#### Materials

- Favour local, sustainable, non-forest materials (see over for information on stabilised soil block-making).
- Re-use or recycle existing products.
- Limit the amount of materials needed.

#### Waste

- Re-use and recycle construction debris.
- Use products with limited packaging.
- Avoid toxic materials, e.g. asbestos, and find appropriate disposal methods for all unusable materials.
- Avoid water loss during construction, e.g. find ways to collect water spilled from taps for use elsewhere.

#### Heat Transfer

- Reduce the surface area to volume ratio of the building.
- Increase the roof angle to decrease exposure to direct radiation.
- Provide roof overhangs and strategically place native vegetation for shade and ventilation.
- Use lighter colours and rough textures for shelter exteriors.

#### Indoor Environments

- Include large openings, e.g. windows, for air flow but make sure they are protected from radiation, rain and insect intrusions.
- Separate kitchen areas from animal pens and toilets.

## QUICK GUIDE TO STABILIZED SOIL BLOCKS (UNESCO 2001, UN-HABITAT 2009)

Soil-based construction techniques are used in 80 per cent of urban buildings and 90 per cent of rural buildings in Sudan.

### Advantages of Soil

- ✓ Affordable.
- ✓ Easy to use.
- ✓ Suitable for making most parts of a building.
- ✓ Block manufacturing can be done locally, which promotes livelihoods.
- ✓ Fire resistant.
- ✓ Helps balance internal temperatures.
- ✓ Low energy input for manufacturing.
- ✓ Environmentally appropriate and available material, which can reduce construction impact on wood resources.

### Basic Process for Block-Making

- ✓ Test soil for appropriateness for use: evaluate sedimentation and shrinkage properties, and identify quantities of soil available.
- ✓ Choose a stabiliser and other additives: cement, lime, straw and dung are normally locally available.
- ✓ Train community on block-making procedures and how to use machine: there are many types ranging from manual and motorised presses, and it is important for the community to be involved in deciding which machine suits their needs most.
- ✓ Remove top soil and then begin accumulating soil for block-making: for small-scale projects, approximately 500m<sup>3</sup> of soil will be needed each year for most types of block-making machines assuming a single level home of 50m<sup>2</sup> requires 3,000 blocks.
- ✓ Sieve the soil and let it dry fully.
- ✓ Mix stabiliser using appropriate stabiliser-to-soil ratio: 5-8 per cent hydrated lime or cement is normally standard.
- ✓ Mix in water as determined appropriate.
- ✓ Place mixture into machine and compress the mix.
- ✓ Remove the block and stack blocks for drying: curing may take around four weeks.
- ✓ Always check quality of manufactured blocks and modify process as required.

## Further reading and resources

**Compressed Stabilised Earth Block Manufacture in Sudan** (UNESCO, 2001).  
<http://unesdoc.unesco.org/images/0012/001282/128236e.pdf>

**Interlocking Stabilised Soil Blocks: Appropriate Earth Technologies in Uganda** (UN-HABITAT, 2009).  
[http://www.sheltercentre.org/sites/default/files/2736\\_alt.pdf](http://www.sheltercentre.org/sites/default/files/2736_alt.pdf)

**Environmental Guidelines for Small-Scale Activities in Africa: Environmentally Sound Design for Planning and Implementing Humanitarian and Development Activities** (USAID, 1996).  
<http://www.afr-sd.org/publications/18ngo.pdf>

**Housing Reconstruction After Conflict and Disaster** (ODI, 2003).  
<http://www.odihpn.org/documents/networkpaper043.pdf>

**Technology, Post-Disaster Housing Reconstruction and Livelihood Security** (Practical Action, 2006).  
<http://www.abuhrc.org/Publications/Working%20paper%2015.pdf>

**Eco-Housing Guidelines for Tropical Regions** (UNEP, 2006). [http://www.rrcap.unep.org/ecohouse/2005-08/ecohouse%20guidelines\\_261106\\_for%20review.pdf](http://www.rrcap.unep.org/ecohouse/2005-08/ecohouse%20guidelines_261106_for%20review.pdf)

**The Construction of the Timberless House Model** (Practical Action, 2009).  
[http://practicalaction.org/practicalanswers/product\\_info.php?cPath=27\\_67&products\\_id=403&attrib=1](http://practicalaction.org/practicalanswers/product_info.php?cPath=27_67&products_id=403&attrib=1)

*ProAct Network is a Swiss-based non-governmental environmental organisation. Our work aims to help vulnerable communities improve their resilience to disasters, climate change and humanitarian crises, through sustainable environmental management. This briefing note was compiled under the project "Strengthening Environmental Awareness and Building Management Capacity of the Sustainable Action Group's Operations in Sudan", funded by Christian Aid.*

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