

## Straws of Steel: Piloting Straw Bale Construction in Kapilbastu, Nepal

**Abstract:** This project will introduce a new, efficient, low cost, and safe building technique using straw bales to Shivagadi village in the Kapilbastu district of Nepal, an area that frequently faces flash floods, droughts, fires and earthquakes. This project will support a first time effort of constructing a straw bale building in the area and help promote low cost, energy efficient and earthquake-safe buildings in highly seismic-prone Nepal.

**Background:** Nepal ranked 23rd in the world in terms of total natural hazard related deaths (above 7,000) in the decades from 1988 to 2007.<sup>1</sup> Low economic development and regular occurrence of different natural hazards make Nepal a disaster hot spot. Nepal's common disasters include earthquakes, floods, landslides, droughts, fires, avalanches, Glacial outburst floods, hailstorms, cold and hot waves, and epidemics. Above all, however, the country is highly vulnerable to earthquakes and is forecasted to experience a major earthquake with a magnitude of over eight on the Richter scale in the near future.

Poorly built houses are one of the major causes of death during an earthquake. In Kathmandu and other parts of Nepal, urbanization is haphazard, and people have inadequate access to services and resources like basic energy and drinking water. Climate change is likely to make many of these stresses worse. Building infrastructure and providing people with secure access to essential services continue to remain the country's most important development challenges.

Specifically Kapilbastu, one of Nepal's southern Terai districts, faces threats from floods, droughts, epidemics, and earthquakes. Eighty percent of the district's population is involved in subsistence rain-fed agriculture, mainly cultivating rice, wheat, maize, pulse, mustard and vegetables. Thick alluvial sediments make the soil suitable for agriculture, but erratic rainfall and threats of floods and droughts make agriculture risky. This project will be piloted in a village, Shivagadi, with an area of 76.34 sq. km, and a population of 5,418 people who live in 955 households. With a multi-ethnic composition and increasing immigration to India and to Gulf countries, the district faces many internal socio-economic challenges. Poverty is pervasive, and large portions of the population live without bare necessities, constantly facing threats from disasters. The main challenge facing Shivagadi is low social and economic development. From 1996 to 2006 Nepal went through a decade long civil war between the government and the Communist Party of Nepal (Maoists). In 2007, after the end of the Maoist insurgency and war, the village experienced a lot of communal riots between hill and plains dwelling people. The Straw Bale initiative, while encouraging people to pursue this alternative house building method as an enterprise, will also help promote harmony in the community that has been much divided and disturbed from the decade long insurgency and the communal troubles that followed. The project will provide an opportunity for the fractioned community to come together to build cheaper and safer community structures.

**Project Introduction:** This *Straws of Steel* project will pilot a special building construction technique using straw bales in the Shivagadi village in Kapilbastu district. The technique involves using straws, packed tightly into rectangular bundles as walls, instead of bricks or concrete. Straw bale houses are light and energy efficient. They are easy to build, structurally sound and have low disaster risks. They are, above all, low cost. An estimate done in UK by University of Bath compares two building materials and shows that the cost of the walls of a 200 square meters, 2-storey 3 bed-roomed house, would approximately be \$16,000 if made of bricks. For the same house, straw bale walls would cost only \$950.<sup>2</sup> In Kapilbastu, where rice and wheat are grown and plentiful and labor costs are low, the costs of construction material and labor will be significantly lower than the University of Bath study that used UK costs to calculate \$950 as cost for walls. Low cost Straw bale houses are, nevertheless, energy efficient, environmentally safe, and have a low carbon footprint. With a strong foundation, they are extremely resilient against earthquakes and significantly reduce the risks of disaster. Straw bales also require less water and produce less waste, and negate the need for materials like bricks and concrete that put tremendous pressures on the environment. The houses are also well insulated, staying warm in the winter and cool in the summer, and tightly packed bales with plastered walls make the houses fire resistant as well.

**Why Kapilbastu?** The reasons for selecting Kapilbastu as the pilot site are as follows:

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<sup>1</sup> See IFRC, 2007: World Disasters Report, International Federation of Red Cross and Red Crescent Societies, Geneva, Switzerland.

<sup>2</sup> University of Bath: [BRE Centre for Innovative Construction Materials](http://www.bath.ac.uk/ace/crop-based-materials) <http://www.bath.ac.uk/ace/crop-based-materials>; Report: "Information to Straw-bale House"

- Nepal's rural areas, including Kapilbastu, face high risks of disasters and lack reliable infrastructure. The low infrastructure in Shivagadi and lack of infrastructure development makes starting the pilot project from here ideal.
- Before attending Grinnell, Rural Self Reliance Development Center (RSDC), a non-governmental organization, offered me the opportunity to visit many villages in Kapilbastu including Shivagadi. I was interested in learning more about poverty and how local organizations conducted poverty alleviation programs. RSDC helps rural individuals and households organize into small groups and cooperatives to implement money making activities. I will work with a RSDC cooperative in Shivagadi village which wants to build an office and has expressed willingness to partner in this piloting initiative.
- The Institute for Social and Environmental Transition-Nepal (ISET-N), a research organization in Kathmandu, is attempting to develop this building technology in Nepal with funding support from the American Red Cross (ARC). In selected villages of Kapilbastu, they are already implementing activities aimed at helping the community adapt to the impacts of climate change. ISET-N has also offered to support me to implement this proposal.
- This pilot will generate lessons to replicate the approach on a wider scale in the district as well the country.

**Project Outline:** The project will be carried out in four stages.

1. In the **planning stage** I will, with RSDC and ISET-N in Kathmandu, work out project logistics, including designing workshops and training sessions for the cooperative members, and schedules. This will be done during the end of May to the start of June.
2. **Stage two** will include a workshop where community members will be introduced to the construction method. This will be done after the first site visit in early June, where I, along with two members from RSDC/ISET-N will travel to the area and discuss the objectives of the workshop and the project with local representatives. The discussion will focus on picking a site for the construction, deciding the number of individuals to be included, and finalizing details of the building. I will work with local partners and the village cooperative to make decisions on the design of the building and plan activities such as identifying sources for the straw, transportation of the baler to make bales, and buying and storing other construction materials. The bales and baler will be donated to the cooperative at the end of the project to allow the cooperative to pursue similar work in the future. The workshops will start within a day of our first meeting with village representatives, and will run for a number of days that is to be determined initially in Kathmandu. Local people from the village will assemble to a designated site and take part in sessions on techniques needed for construction. The duration of the workshop sessions will be decided in Kathmandu, depending on the logistics discussed there. I project the workshops will run for a week. This stage two will last from the middle of June to first week of July.
3. **Stage three** will involve starting construction. The cooperative members will lead the process with technical support from ISET-N, RSDC and myself. The duration of the stage depends upon the logistics of the final building.
4. **Finally**, I will document the construction process using photos and video so that these materials can be used for future training and promotions with the help of RSDC/ISET-N. Upon completion, I will also make a short film to share the experience with a wider city audience and other media outlets in Kathmandu. A further step of the project will entail disseminating lessons from this pilot of constructing straw-bale houses to a larger audience with the support of the cooperative, RSDC and ISET-N.

**Expected Outcome and Sustainability:** The expected outcomes will be as follows:

- The village cooperative will build a low cost, energy efficient, earthquake safe office,
- Members of the cooperative will acquire skills to build straw bale houses and gain knowledge about its costs and benefits,
- The new community structure will demonstrate high efficiency and cost effectiveness, and provide an incentive for using straw bales for private homes and structures
- Straw bale housing method will be introduced in Nepal as an option for future constructions.

The participation of the cooperative will provide the project with community ownership; it will not be an idea imposed from outside. Straw bale construction has a lot of potential in Nepal due to the country's risks and geography. Though new to Nepal, and South Asia, straw bales can be promoted in the Terai belt and other regions where rice and wheat are grown and straw is plentiful. By dovetailing the project with an ongoing effort, I will help develop skill and knowledge of the community. I will also help introduce the concept to a much larger audience in Nepal.