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Terms of Reference

Research on Sustainable Alternative Building Construction Materials

Title	**:**	**National Consultant- Researcher**
Host Agency	**:**	**UN-Habitat**
Duty Station	**:**	**Kathmandu**
Supervisor	**:**	**DUDBC & UN-Habitat team**
Contract Type	**:**	**Individual Contract with Principal Researcher**
Duration	**:**	**Three months within five months**
Starting Date	**:**	**September 2014**
Location	**:**	**Kathmandu, Nepal**

1. Background

Housing sector contributes significantly to the local economy but also causes pollution and promotes unsustainable living. 18% of total urban employment in Nepal is contributed by construction industries and there will be an additional need of 1 million urban houses from 2011-21. To meet this demand, the increasing conventional building practices that depends upon depletable natural resources, will disgracefully contribute to the urban pollution along with increasing other climate change factors.The sector also imports most of its construction materials from India, China and other part of the world, thus it's a costly business as well as creating large carbon footprints. In addition, it needs high cost for heating and cooling as well as retrofitting because of its poor performance in serve temperature.

On the other hand, housing itself is exposed to a variety of environmental impacts and hazards, including those associated with natural disasters and climate change. The way buildings are designed, constructed and operated todays is likely to compound these stress and has a direct implication on inhabitants' economy, safety, comfort as well as health. To enhance sustainability and address these stresses, it is imperative to include eco-friendly practices and to curb the energy consumption in the housing sector - both embodied in construction materials as well as operational.

To respond to such a situation, UN-Habitat is addressing urban climate change agenda through its Cities and Climate Change Initiatives (CCCI). Under SWITCH Asia call for Sustainable Consumption and Production, UN-Habitat and its partners have initiated a three year 'Green Homes Project' in association with both the Government of Nepal and the European Union for the promotion of sustainable housing in the cities of Nepal. This project will be implemented primarily in three cities of Nepal viz Lalitpur, Lalitpur and Dharan with wider impact to other municipalities

SWITCH Asia is the initiative of European Union (EU) promoting sustainable consumption and production in Asia. Under this call non-state actors are encouraged to participate in supporting the developing countries in Asia to promote sustainable economic growth. The global objective is to contribute to both economic prosperity and poverty reduction in Asia, as well as to the mitigation of climate change, through promoting sustainable growth. The specific objective is to promote sustainable production (i.e. development of less polluting and more resource efficient products, processes and/or services) and sustainable consumption patterns and behaviour in Asia, through an improved understanding and strengthened cooperation between Europe and Asia, and within Asia, notably by mobilizing the private sector, i.e. SMEs, retailers, intermediary producer and consumer organizations, and financial sector organizations, along with relevant public sector authorities. UN-Habitat along with its partners has joined EU call to promote sustainable housing under this call in 2012.

Green Homes or Sustainable Housing is an approach that includes household systems that reduce pressure on natural resources and carbon emissions, thus resulting in human wellbeing, social equity, and green economy. Besides energy efficient buildings, it also includes eco-friendly practices for water and waste management systems such as rainwater harvesting, and waste/wastewater recycling. Green homes are more than just green buildings - they reflect a sustainable lifestyle based on eco-friendly systems and behaviour.

To achieve the overall objective of promoting sustainable housing technologies and services to contribute towards mitigating climate change and reducing poverty through creation of green jobs and moving towards a green economy, UN-Habitat and its partners will work on a three-pronged approach as indicated by the specific objectives as follows:

- Create an enabling policy environment to promote sustainable housing;
- Strengthen supply chains for sustainable housing and building capacity of SMEs to deliver household level green technologies and services
- Stimulate demand for sustainable housing

The project will work with Ministry of Urban Development, Department of Urban Development and Building Construction of Government of Nepal and three selected municipalities to build the capacity of the agencies and promote SMEs and consumers towards sustainable housing.

2. Purpose of the Assignment

Currently fire brick is a major construction material. It has a serious environmental and health issues especially because the industries use poor-quality fuel and inefficient technology and is a major source of pollution as well as land-use problems. Since brick kilns utilize top fertile soil from agricultural fields, it has detrimental impacts on soil and causes a serious loss in agricultural productivity. On the other hand to meet the need for housing, 20 billion bricks i.e. 85,000 tera-joule energy will be needed. In this context, it is necessary to search greener and sustainable alternative construction materials and technologies.

In the market, there are various alternative green construction materials available such as hollow concrete block, soil cement block etc. However, there are limited uses of these construction materials. The major problem is quality standardization of the products and lack of information on it to provide sufficient design parameter for the construction. Even in National Building Code, there

are not much addressed. To response of this context, UN-Habitat with the association of Department of Urban Development and Building Construction (DUDBC), is going to conduct research on some available sustainable construction materials, especially on HCB and soil cement block. These research finding will expect to provide evidence on necessary design parameters for production of green construction materials. Similarly, it will help to standardization HCB production quality which will support to address green homes component in National policy level guideline and ultimately to promote those services and products at household level in Nepal.

3. Objectives

The objective of the research on sustainable alternative construction materials is to standardize the quality and construction techniques of sustainable construction materials especially HCB and soil cement block which include;

- Develop quality standards of HCB for safe building construction
- Develop earthquake resistance building construction technique for HCB and soil cement block building structures with diagonal shear testing and computer modeling of these materials

4. Methodology /Scope of Works

The research team of green construction materials should include

- Developing research topics and its methodology as per research objectives consulting with UN-Habitat and DUDBC.
- Conducting necessary literature review on sustainable alternative construction materials available in the market;
- Managing necessary testing facilities, equipment and materials for the research
- Coordinating, managing and conducting overall laboratory and field testing in coordination with UN-Habitat and DUDBC
- Documenting all the data and share with UN-Habitat and DUDBC
- Ensuring that research findings are disseminated appropriately;
- Reporting any incidence of adverse events or suspected misconduct

5. Deliverables/ Output

The principal researcher will be responsible on this research works. In consultation with UN-Habitat's HPM and Sustainable Housing Analyst, the principal researcher (consultant) will produce following deliverables:

1. A complete report on sustainable alternative construction materials
2. Three Masters level thesis on sustainable alternative materials – HCB and Soil-cement block.

6. Required Qualification and Competence

Team composition and minimum qualification and experience of team should be as mentioned below table.

S.No.	Experts/Assistants	Qualification
1	Principal Researcher / Team Leader (1)	Advanced university degree in Structural Engineering, Earthquake Engineering and other related field with more than

		10 year research and academy experiences in structural engineering, earthquake resistance buildings design and construction material. Must be a senior faculty member of the university.
2	Researchers (2)	Master degree in Structural Engineering, Earthquake Engineering, building construction and other related field with more than 5 year research and academy experiences in structural engineering, earthquake resistance buildings design especially in sustainable construction material
3	Students (3)	Bachelor of Civil Engineering and Architect. Must be a master level student of the university

7. Payment Schedule:

, Payment will be made to Principal Researcher (Individual Contractor) as below mentioned installment basis. Principle Researchers will be responsible to pay to the other team members:

- 20% upon signing of contract
- 30% upon submission of Inception Report with detailed work plan.
- 40% after submission of the first draft report and three master thesis on the research topics
- 10% after completion of the final report and three master thesis

8. Time Schedule

The overall research assignment will be for 90 working days within 5 months.

9. Required Documents to be submitted

1. Sign CV of each team
2. Proposal of Programme and Finance with methodology
3. Activity Plan schedule