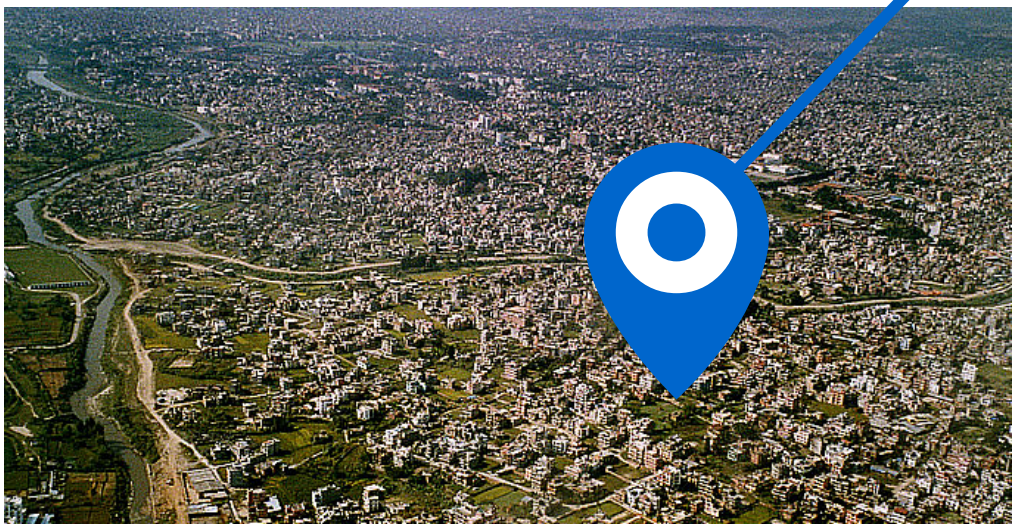
Addressing Poverty, Improving Safety of The Urban Poor: A Shelter Programme in Nepal

Kathmandu Valley, Nepal

Proposed Low Cost, Earthquake Resistant Residential Building



The primary objective of this project is to implement a low cost, earthquake resistant shelter programme for the urban poor in Nepal.The most vulnerable region, Kathmandu Valley, is exposed to seismic hazards and flooding. However, the socio-economic and political systems contribute to the overall vulnerability and substandard housing design. Poor land use planning is rampant, as typified by the Shankhamul squatter settlements.

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Project Overview

Summary

1

CONTEXT

A geographically isolated mountain nation, Nepal is comparatively poor and extremely vulnerable to natural hazards.

2

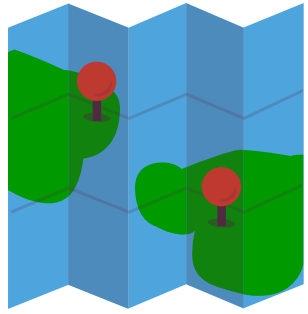
CONCEPT

A seismic-resistant housing programme could improve overall quality of life and provide economic stimulation for slum populations.

3

DESIGN

Earthquake resistant housing, using a simplified base isolator design. Seismic reliability, simplicity of construction, and low-cost materials are key design drivers



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PLAN

- Acquire government and community support.
- Establish local base isolator manufacturing centre.
- Replace new slum housing
- Begin phased replacement of slum housing with E-Proof design.

Context

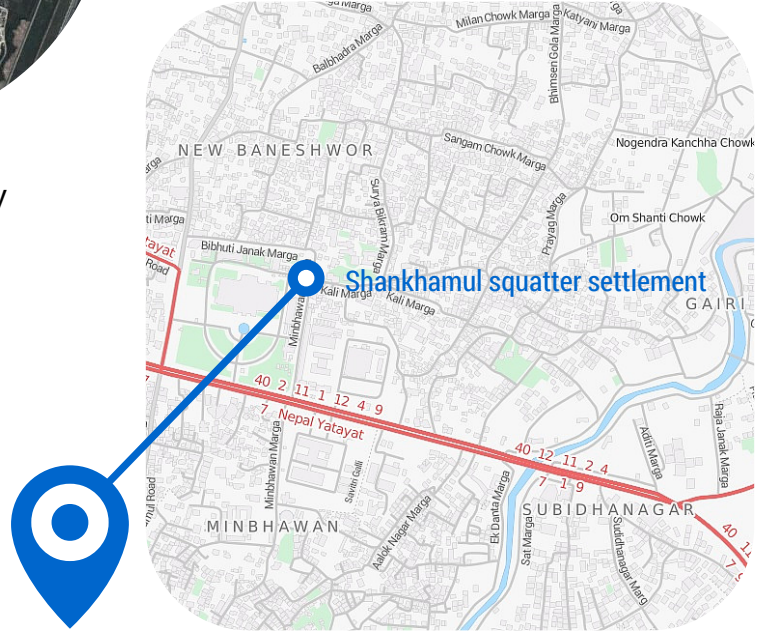
Geography and Location

Kathmandu Valley is geographically isolated by the Himalayas.

Problem

Urbanization and Housing

Kathmandu is the largest urban centre in the country, with 5 major cities, highly vulnerable due to uncontrolled urban growth and poor solid waste management. Management and planning for settlements and housing is fractured among hundreds of government agencies and local NGOs (World Bank,2015).



Risk and Vulnerability

Nepal is ranked as 11th most risk country in world in terms of relative vulnerability to earthquake.The area of Kathmandu Valley with a population of almost 1.5 million people is highly susceptible to social and economic loss if a major earthquake should strike. (World Bank,2015)

Cement Factory

An existing cement factory near the Shankhamul squatter settlement will be re-purposed for manufacturing of base isolators and building materials, plastic tank, gutter and roof sheeting

Development of Concept

Concept

Waste collection site for old tires

"Community members (male and female) employed to the factory", will collect waste tires and plastic material for recycling

2

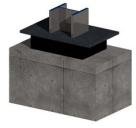
1

Cement factory will be retrofitted to recycle plastic and old tires for the production of base isolator, water tanks,gutter and roof sheeting.

The production of base isolators will involve the support from the Nepalese government ,private sector and the community

3

Earnings collected from the sale of building materials will support the operations of the cement and recycling factory



Building materials for construction of homes

4

Construction of E-proof home with traditional practices, will improve the resilience of the building to seismic hazards

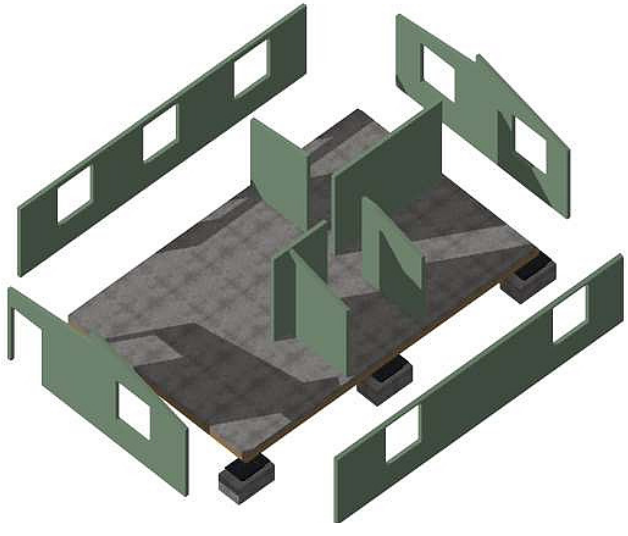
Design

Technology for E-Proof Home

Design Overview

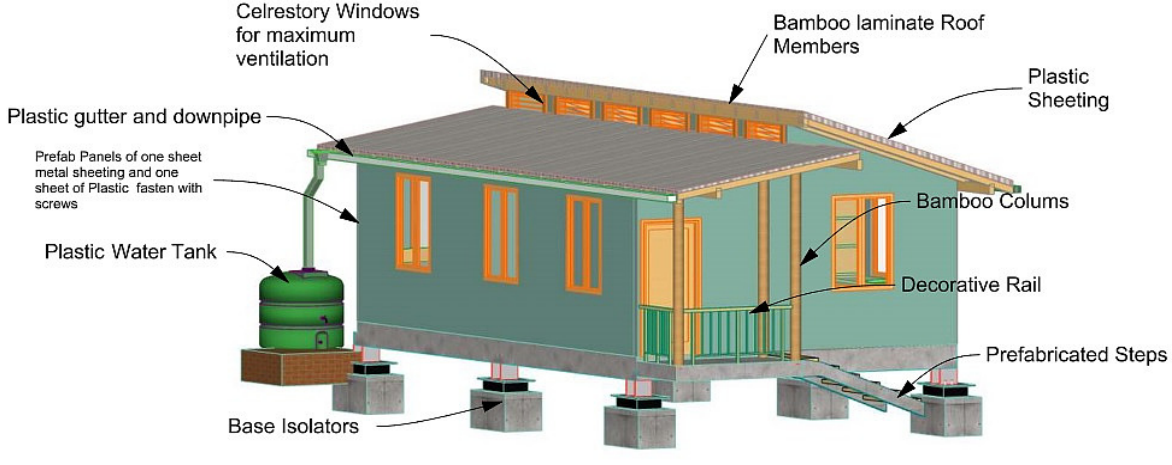
The concept of the design is to build a single storey house approximately 4.0 meters tall, with the area of each floor measuring 50.0 sq. meters. A prefabricated steel frame will be used as the main structure of the building, with a reinforced concrete foundation using a base isolation bearing. Low-damage light materials will be used for the floor, wall, and roof to increase occupant safety during earthquakes

The E-Proof home is a creative adaptation of locally sources materials and the use of recycled by products utilizing plastic and old tires.



Walls

The walls of the house are made of prefabricated panels, including one metal panel outside and one plastic panel inside with an insulation (glasswool) layer between. The roof and the walls are supported by metal stubs. All panels are joint together by screws. All panels are joined together by screws. The windows are designed to enhance ventilation and natural lighting in the houses.



Floor

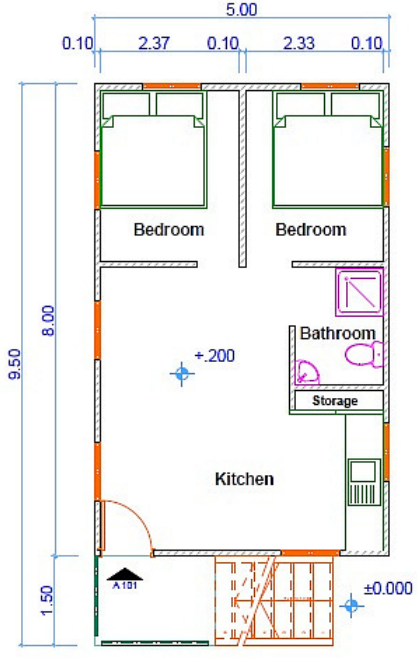
The basement is made of prefabricated slabs, which form the surface of the floor. One layer of mortar is used to join panels with the basement. The floor level of the house is above street level, in order to prevent flooding during the rainy season.

Design

Technology for E-Proof Home

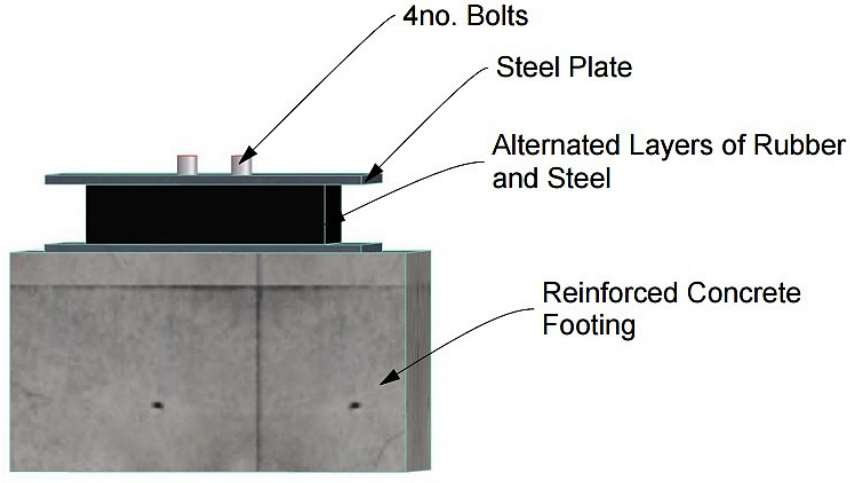
Roof ,Water and Gutter

The E-Proof house utilizes a simple gable roof. The roof is constructed with a double pitch with a clerestory window to allow maximum ventilation and lighting. The plastic sheeting covering is fastened to bamboo laminate purlins and main rafters. Gutters, made from recycled materials, are used to collect water from the roof and transported from the roof and transport it to the water tank



Ground Floor 1:50

Floor Plan

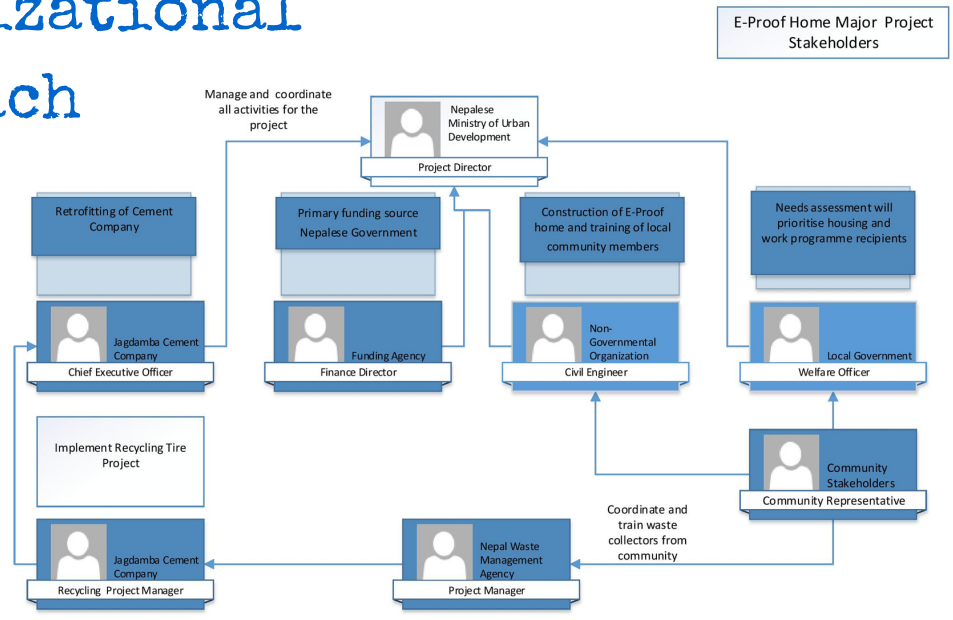


Foundation - Base Isolators

Large rubber elastrometric bearings will be made from recycled tires at the factory. Because the bearings are stiff in the vertical axis and flexible in the horizontal axis, under seismic loading the bearing layer isolates the building from horizontal components of ground movement, while the vertical components are transmitted to the structure relatively unchanged (Construction Rubber ,2012).

PLAN

Organizational Approach



Leadership of the project will be undertaken by the civil government of Nepal. The Ministry of Urban Development will provide policy oversight, in conjunction with a steering committee to include community representatives and implementation partners.

Workforce will be hired from local residents, with available positions prioritised by economic need. Work will include collection of recyclable materials,construction, isolator production in the factory, and material transport.

Support in the form of skilled labour and expertise will be provided by NGO partners with previous experience in urban development, as well as the local construction sector. Special job training will be given to female based groups.

Community engagement in the planning, monitoring & evaluation processes will be a priority.

The conservatively estimated net present value of the programme is USD $18.8 million, based on our plan to replace 4,000 homes. This estimate does not account for intangible benefits such as increased social resilience, reduced inequality, and other unquantifiable increases in quality of life

Benefits	Estimated PV ($)
Reduced Welfare (Economic Stimulation)	15,000,000
Increased Tax Revenue	5,000,000
Reduced Healthcare (Improved Living Cond.)	10,500,000
Reduced Structural Damage from EQs	12,800,000
Reduced Waste/Environmental Costs	2,500,000
Total Benefits	**45,800,000**

Costs	
Factory Retrofit	(1,000,000)
Decommission Old Structures	(500,000)
Factory Materials and Labour	(1,000,000)
Construction (4000 homes at $6000 per home)	(24,000,000)
Less: Avoided construction costs of old designs	(500,000)
Total Costs	**(27,000,000)**

Expected Net Benefit	**$18,800,000**

Amounts indicated as present value (PV) in USD of 30-year benefit

Funding

Primary funding will be from the Nepalese Ministry of Urban Development,supplemented by cash from aid agencies such as the UN Development Programme, and in kind support from directly involved NGOs.Funding will be justified by the key outcomes of the project:

- Reducing earthquake vulnerability
- Alleviating poverty through economic stimulation
- Eliminating sources of environmental waste
- Improving psychosocial health for slum residents by improving the physical environment

PLAN

Implementation Plan

Logistics & Materials

Local sources will be used to minimize environmental impact and moderate transportation and procurement costs. Concrete floor panels will be produced at the factory on isolator footing in 10”x10” sections for easy transport and installation. Other materials, including interior wall dividers, timber rafters, and plastic roof sheeting will also be sourced locally from recycled materials. Steel columns may need to imported and will be sought from in-kind donations.

Schedule

The construction of the first batch of homes in the programme will take place over 15 months, prioritizing summer construction. The key phases of the project are:

1. Needs assessments to prioritize housing and work programme recipients
2. Retrofitting the future isolator factory and sourcing materials
3. Training workers and community leaders
4. Construction of E-Proof homes