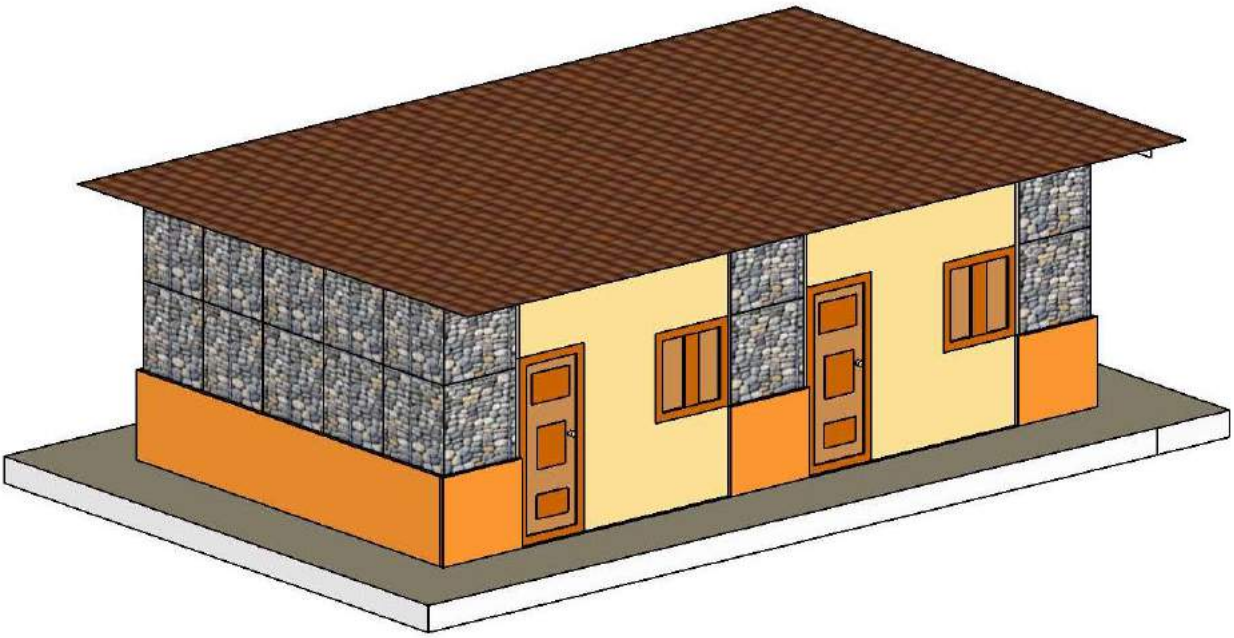
THE STONE HOUSE

Innovative Gabion Housing for temporary and semi-permanent settlement



DESIGN SUBMITTED FOR PARTICIPATION IN

#HackTheQuake

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The Gorkha Earthquake has devastated many villages. Many families have become homeless and there is no quick way to build new houses in short time. To meet the demand of temporary housing in rural area, we propose to use the gabion in innovative way. Gabion has been traditionally used as retaining structure. If we hack this retaining structure, we can get semi-permanent housing for thousands of homeless family.

Gabion houses can be build in short time using the materials from collapsed houses in a cost effective way. Such gabion houses can be expanded rapidly to construct temporary public spaces like hospital and police stations as well.

Here we present the concept by designing a two roomed house. Such two room houses are suitable for small family.

Two room Gabion House

ATTRACTIVE FEATURES OF THE STONE HOUSE

SAFETY

- Seismic capacity of 0.20g

COMFORT AND AESTHETIC

- Thermal insulation
- Damp proof
- Sound insulation
- Good ventilation

COST EFFECTIVE

- Local material utilized
- Reuse of collapsed building's material
- Low cost
- Expandable
- No technical skill required to build

Materials Required

SN	Item	Unit	Quantity
1	Stone	m3	70.15
2	GI wire box 1mX1m	Nos	63.00
3	Chicken mesh wire for plaster	m2	66.00
4	Woodworks	m3	1.31
5	Soil for plaster	m3	4.40
6	CGI sheets	m2	65.00
7	Nails	Kg	2.00
8	J-hooks	Nos	36.00
9	Hinge for door and windows	Nos	8.00

Construction details

The Stone house will require about 7m X 13m parcel of flat land. The location of the house should be chosen in such a way that there is minimum risk of other accident such as landslide and rock fall. The detail of house is shown in concept drawings. The house will be constructed in following sequence.

Foundation

The land should be cleared for any vegetation and other surface features. About 8mX5m of the land will be measured. The ground should then be manually compacted and leveled with local tools. The portion where wooden post will be laid shall be dug and the post must be inserted inside the ground. The post must then be supported by lateral support till other construction is carried out. Then a layer of flat stones shall be laid. Above this stone, 5cm thick soil will be spread and compacted. This soil will act as cushion for a heavy duty plastic sheet that will be laid over it. Finally, 10-15 cm thick cohesive soil will be laid over it as final floor surface.

Surface drain

Gutter of 0.3mX0.5m shall be dug around the house. This will keep the house free from moisture.

Walls

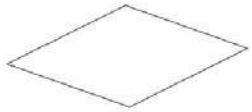
The gabion boxes made with GI wires shall be placed on the correct position and stones with good quality shall be filled in the boxes. If there are low quality stones, they shall be filled in the inner core of the box . Good stones shall be placed on the outer surface. Wood blocks shall be inserted inside the gabion at appropriate positions where door and window frames will be laid later. Similarly, in the top gabion box, wooden poles shall be inserted. These polls will support horizontal beams over which CGI sheets will be laid.

Roofing

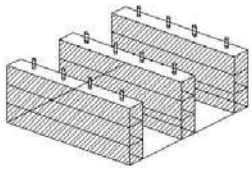
After erecting the wall, the horizontal beams shall be placed over the posts. Then CGI sheets shall be fixed with nails and J-hooks. Measures must be taken to avoid any damage to CGI sheets.

Wall Plaster

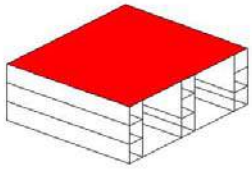
Chicken mesh shall be installed in the wall surface by hooking it with GI wires of gabion. Over this mesh, locally available mud mortar shall be used for plaster. The plaster shall be about 5cm thick, The plaster will help for insulation and also block any insects penetrating from the gabion. The plaster shall be applied in all the inner wall surface. It shall also be used upto 1m in the outer surface. The outer plaster will restrict moisture movement inside the room.



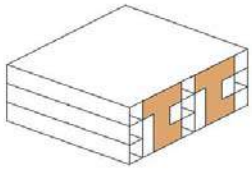
1. Prepare foundation



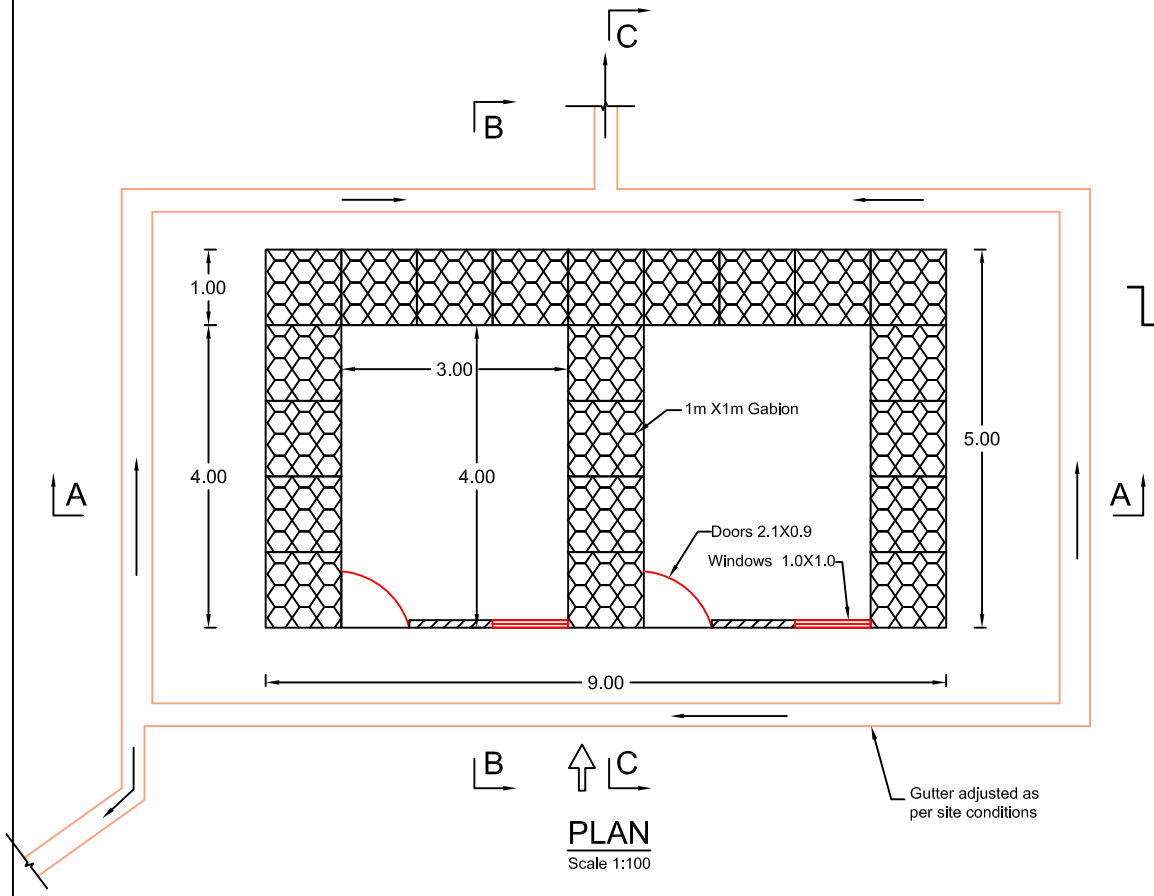
2. Lay gaion walls



3. Install roofing

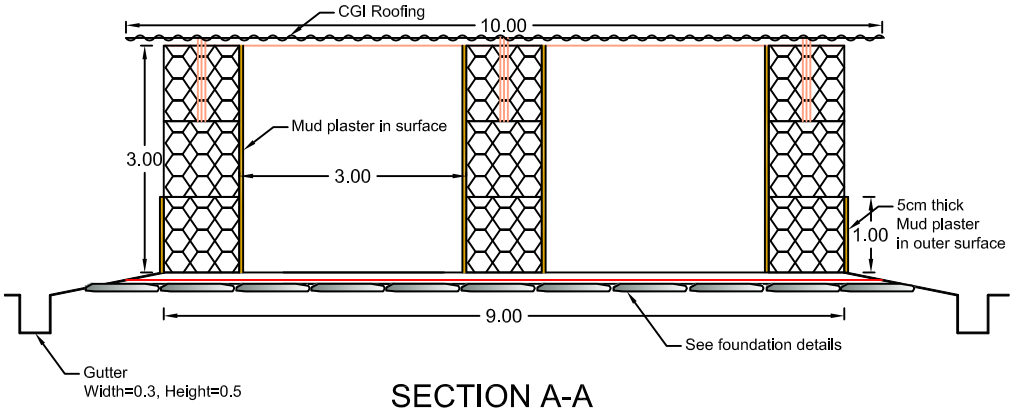


4. Install door and windows



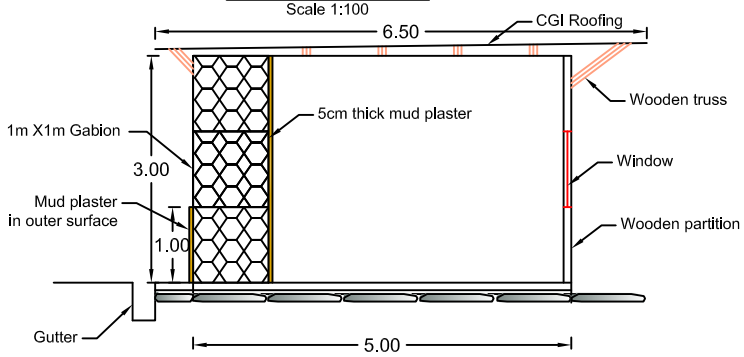
PLAN

Scale 1:100



SECTION A-A

Scale 1:100



SECTION B-B

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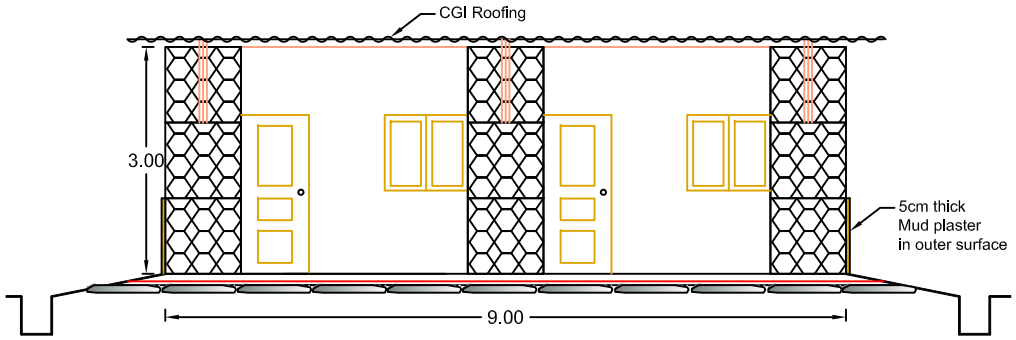
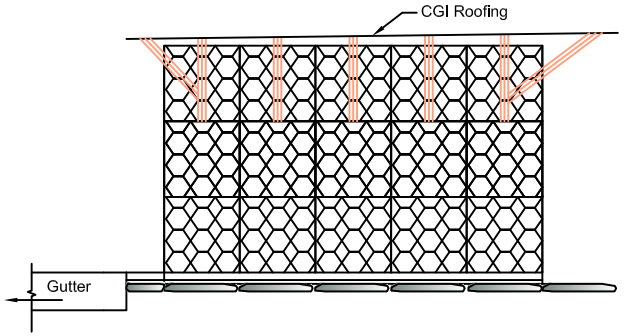


FRONT ELEVATION

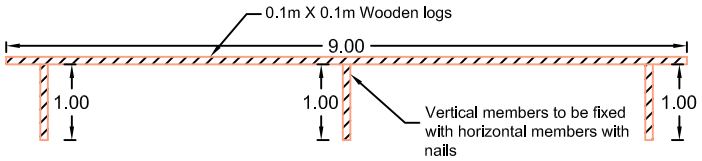
Scale 1:100



SECTION C-C

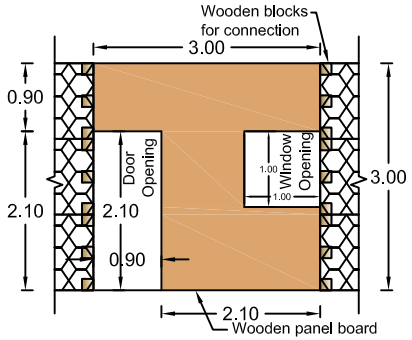
Scale 1:100

CONCEPT DRAWINGS	THE STONE HOUSE	#HackTheQuake	2015 AD	© Nirmal Raj Joshi | Narayan Nyaupane



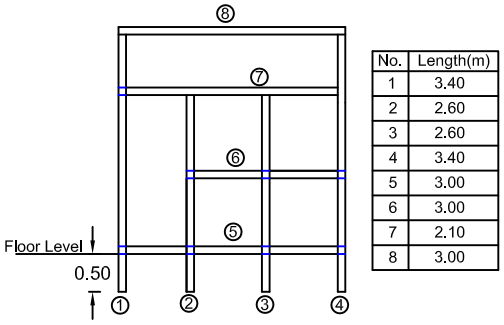
WOODEN FRAME FOR ROOFING

Scale 1:100



FRONT WOODEN PANEL

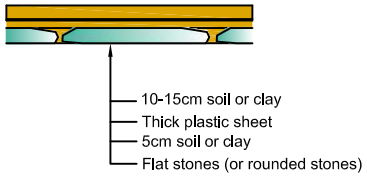
Scale 1:100



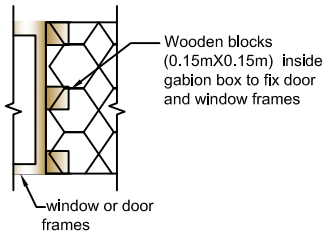
No.	Length(m)
1	3.40
2	2.60
3	2.60
4	3.40
5	3.00
6	3.00
7	2.10
8	3.00

FRAME FOR FRONT PANEL

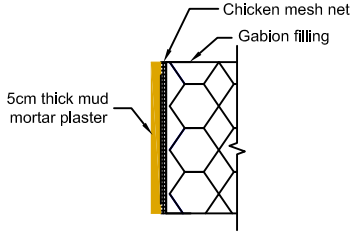
Scale 1:100



FLOORING DETAILS



FIXING DOORS AND WINDOWS



WALL PLASTER DETAILS

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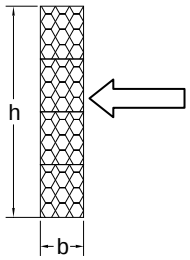
Stability Analysis

Input parameters				
Height	h		2.5	m
Width	b		1	m
Density of stone	d		2400	kN/m3
Packing factor	p		0.7	
Friction coefficient with soil	m		0.45	
Horizontal seismic coefficient	f		0.2	g



Calculations			
Vertical weight of gabion	w=l*b*h*d*p	4200	kN/m
Horizontal seismic force	H=f*w	840	kN/m

Moment calculations

	Force	Moment arm	CCW moment	CW moment
	kN	m	kNm	kNm
Self weight	4200	0.5		2100
Horizontal seismic force	840	1.25	1050	

Safety factor for overturning **2.00**

Safety factor for sliding **2.25**

Quantity estimate

SN	Description	Unit	Nos.	L	B	H	Area	Quantity
1	**Stone**	**m3**						
	Flat stone for foundation		1	11	6.5	0.1		7.15
	Stones for gabion filling		63	1	1	1		63
					subtotal			70.15
2	**GI wire box 1mX1m**	**Nos**	**63**	**1**	**1**	**1**		**63**
3	**Chicken mesh wire for plaster**	**m2**	**2**	**11**		**3**		**66**
4	**Woodworks**	**m3**						
	Wooden frames for front face		1	23.1	0.1	0.1		0.231
	Wooden panels for front face		1			0.03	6.1	0.183
	Wood frames for doors		1	6	0.1	0.1		0.06
	Wood frames for windows		1	4	0.1	0.1		0.04
	Wood panels for doors		1	0.9	0.03	0.9		0.024
	Wood panels for windows		1	1	0.03	1		0.03
	Wood frames for truss		5	12	0.1	0.1		0.6
	Wood blocks to be inserted in the gabion box		42	0.15	0.15	0.15		0.14
					subtotal			1.31
5	**Soil for plaster**	**m3**						
	Inner face of room		2	11	0.05	3		3.3
	outer face		1	22	0.05	1		1.1
					Subtotal			4.4
6	**CGI sheets**	**m2**	**1**	**10**	**6.5**			**65**
7	**Nails**	**Kg**						**2**
8	**J-hooks**	**Nos**	**36**					**36**
9	**Hinge for door and windows**	**Nos**	**8**					**8**