



emergency
architects

Foundation of public interest

Study of habitat typologies and Solutions for their seismic reinforcement
Nepal – Avril 2016

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Preamble

The 25th of April and the 12th of May 2015, two earthquakes of 7.8 and 7.3 magnitudes struck Nepal, killing more than 8 500 people and injuring more than 100 000 people. The half of the country districts were hit and a lot of buildings collapsed.

Emergency Architects arrived just after the first earthquake and began his work assessing a large amount of these buildings.

Emergency Architects Foundation (EA) is a French non-governmental organization (NGO) specialized in Emergency and Permanent Reconstruction after natural, technological or human disasters. Its missions are focusing mainly on the assessments of building damages, the survey of buildings and the emergency reconstruction.

Emergency Architects has already worked for 14 years in more than 25 countries worldwide, including Afghanistan, Haiti, Colombia, Chad, Peru, Indonesia, Pakistan, Philippines... EA is currently working in Nepal, Haïti and Philippines.

EA's expertise is based on years of experiences in the construction of hundreds of public and private buildings all over the world in compliance with earthquake and typhoon resistance regulations.

The aim of this catalogue, developed by EA, is to provide a typological study about specific Nepali housing, but including earthquake-resistant reinforcement solutions. So, all the houses presented hereafter respect local vernacular architecture, ethnic traditions and paraseismic rules.

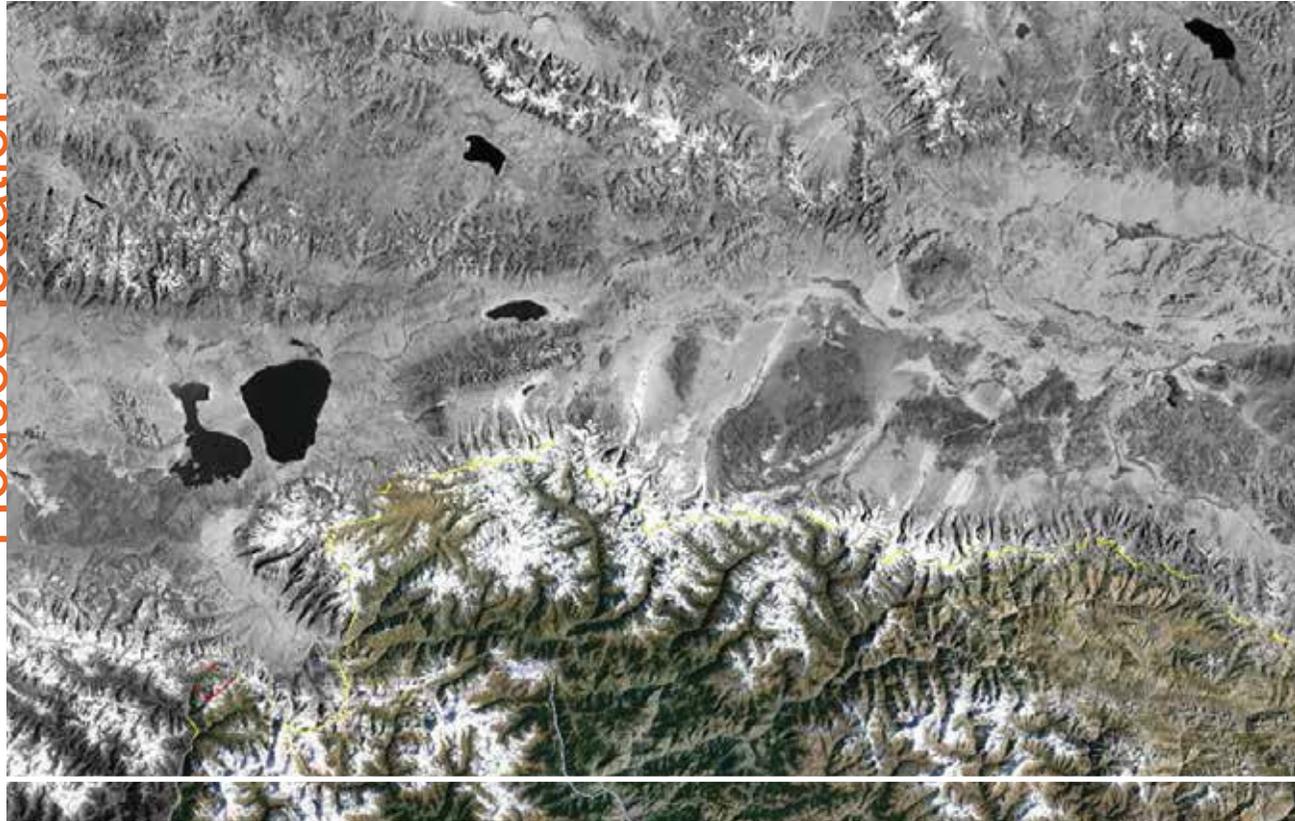
Our catalogue is organized following the different types of local architectures according to ethnics groups: Tamang, Newar and Gurung.

As a result, there have been no less than 9 houses models presented in the following pages located in 4 several districts : Kathmandu Valley, Gorkha District, Nuwakot and Rasuwa Districts.



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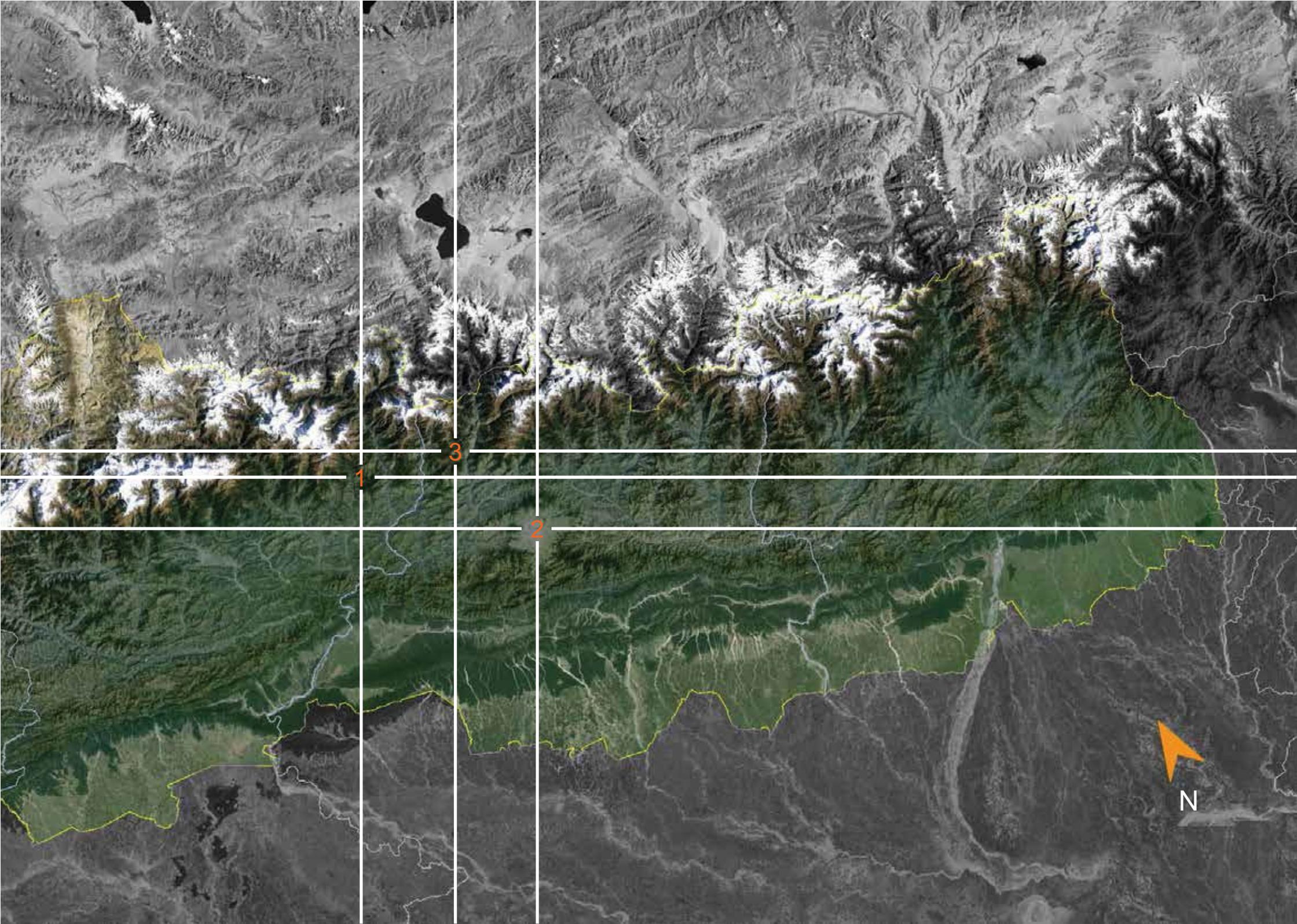
Houses location



Gurung house models 1

Newari house models 2

Tamang house models 3



Gurung house models

The Gurung people, also called Tamu, use to live in the mountains and are the main ethnic group in the Annapurna's region.

The Gurung country covers the high valleys of the southern slope of the chain of Annapurna. It is bounded on the west by the valley of the Kali Gandaki River, to the east by the valley of the river Budhi Gandaki, in the north by the high peaks and the Tibetan plateau, and in the south by a serie of small plains and valleys such as Pokhara.

The houses are welcomed by a porch which they call 'pidi'. The houses have a robust appearance blending with surrounding.

The ground floor is multi-functional with kitchens, bedrooms or stores. The latrines are placed outside the house. A straight flight of timber is placed at a corner of the room connecting to the upper floor, often used for bedrooms and storage purposes.

Stone and bricks are generally used for masonry with mud mortar. Locally available stones are dressed by hammer and used in walls and footings. After completing stone walls, they erect wooden post to support beam.



GURUNG HOUSE MODEL - LAPRAK VILLAGE



Laprak is a Gurung village located in a remote area of Gorkha district.



Laprak is one of the large villages at elevation, altitude of 2330 m in this region with more than 500 houses and 2400 inhabitants who are following Buddhist culture and strong ancestral traditions.

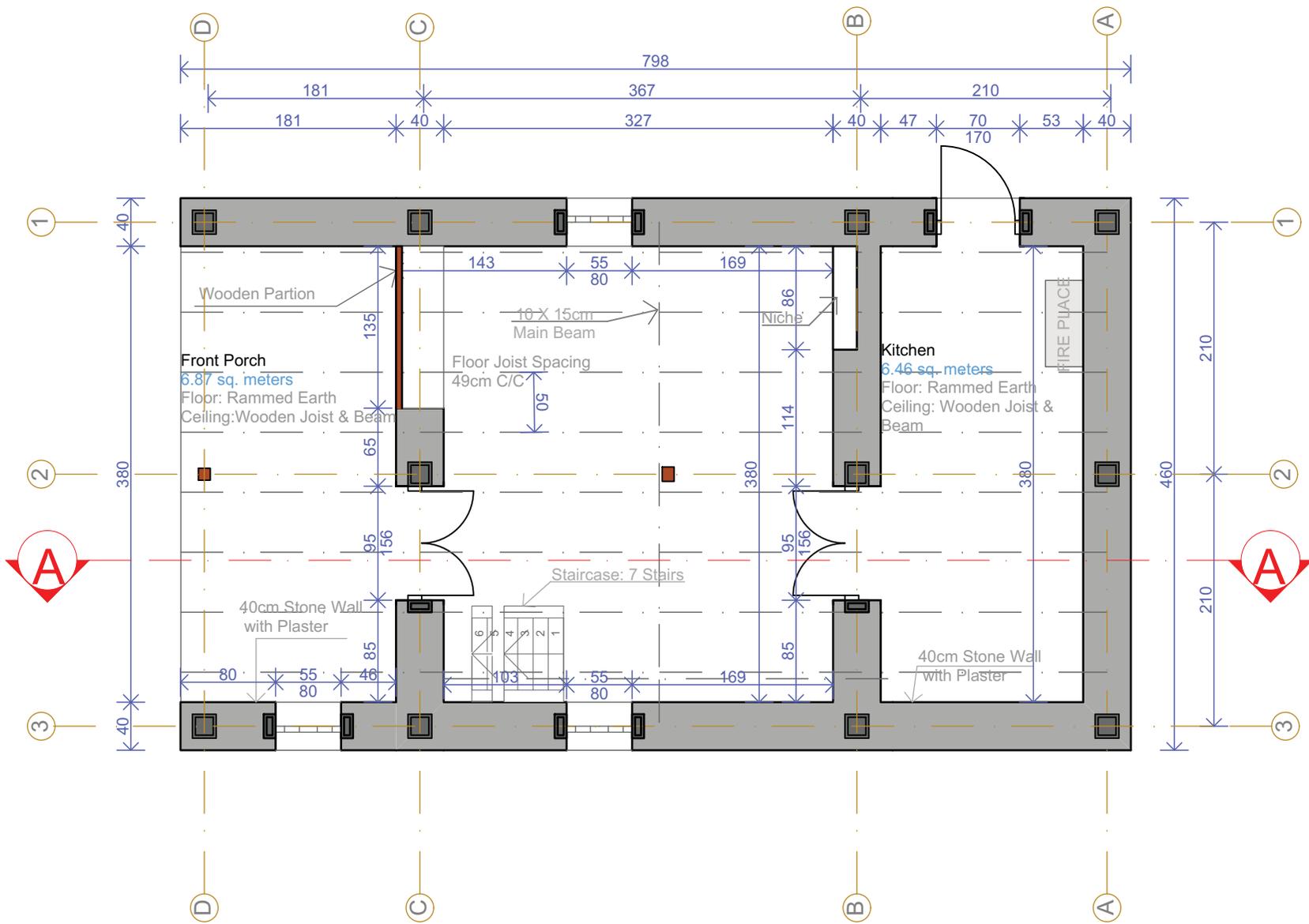


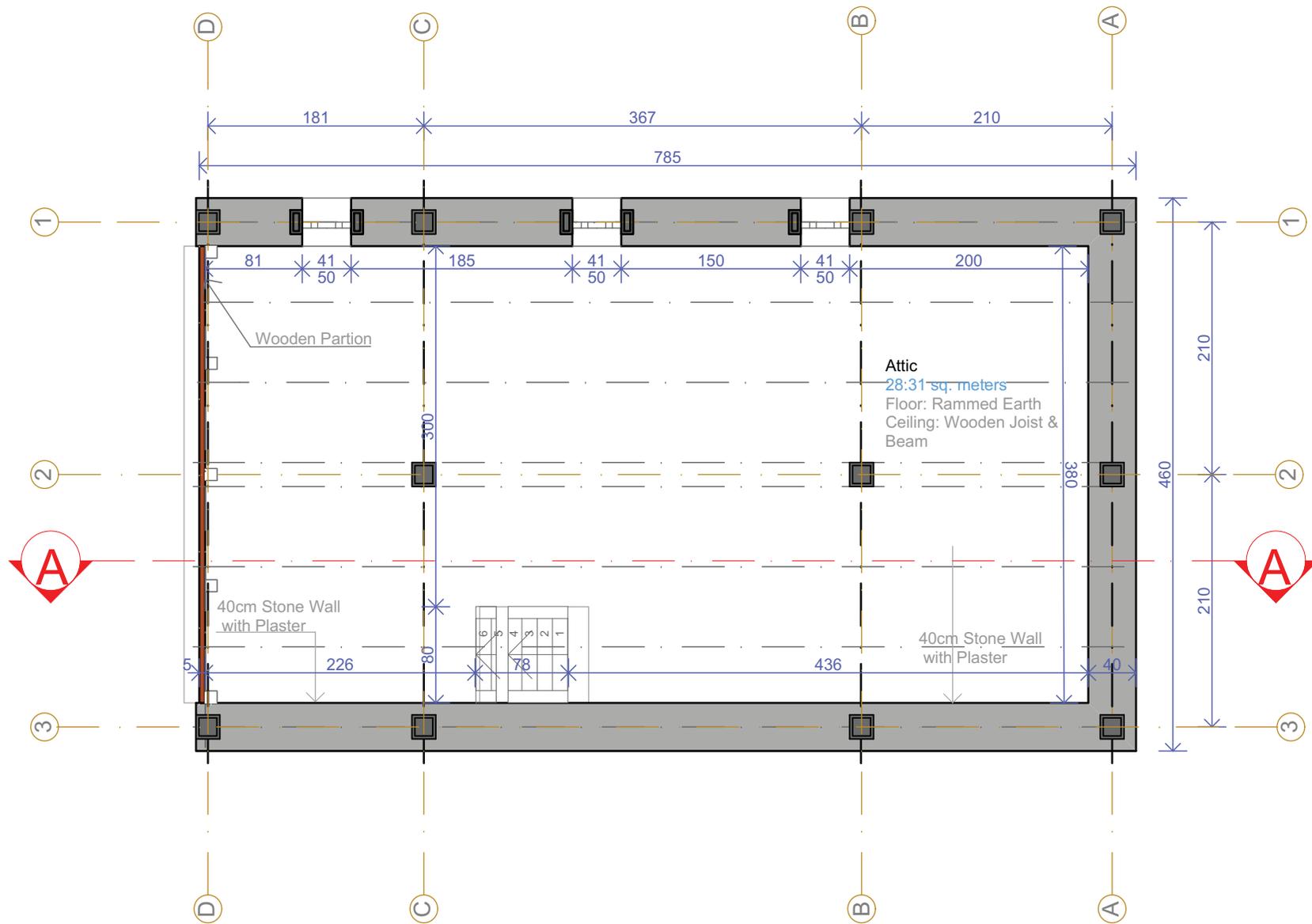
The 7.8 magnitude's earthquake devastated the village, which is around 3 miles in the north of Barpak, the epicenter of the first earthquake.

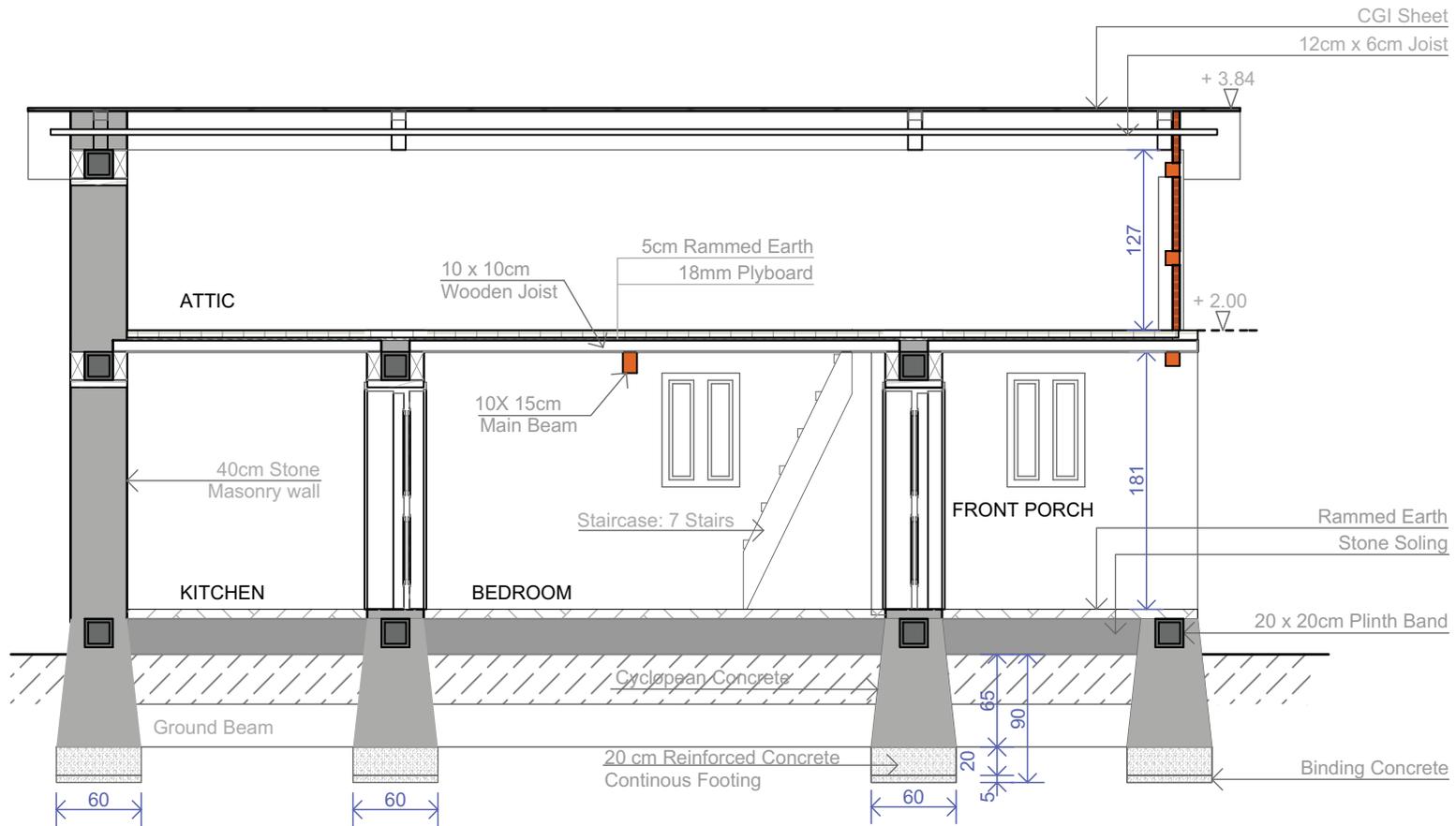


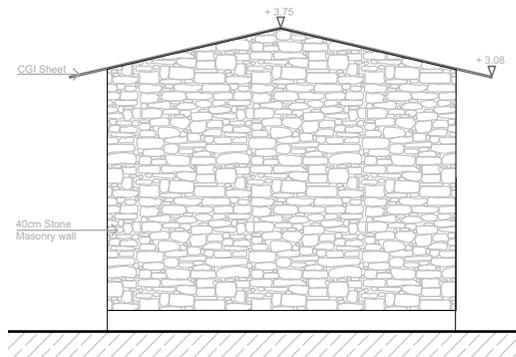
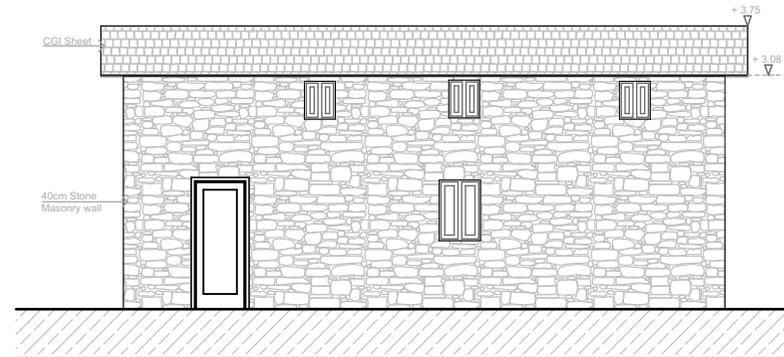
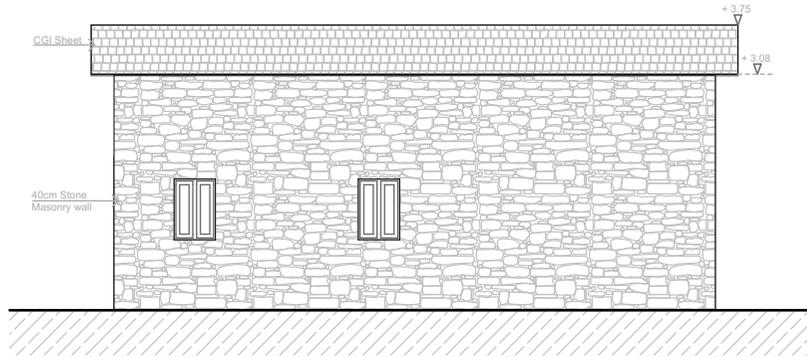
This house is designed for a better resilience to earthquakes considering the human safety. It includes the provision of horizontal bands, vertical and corner reinforcements, T-junctions to bind the house as a frame structure.









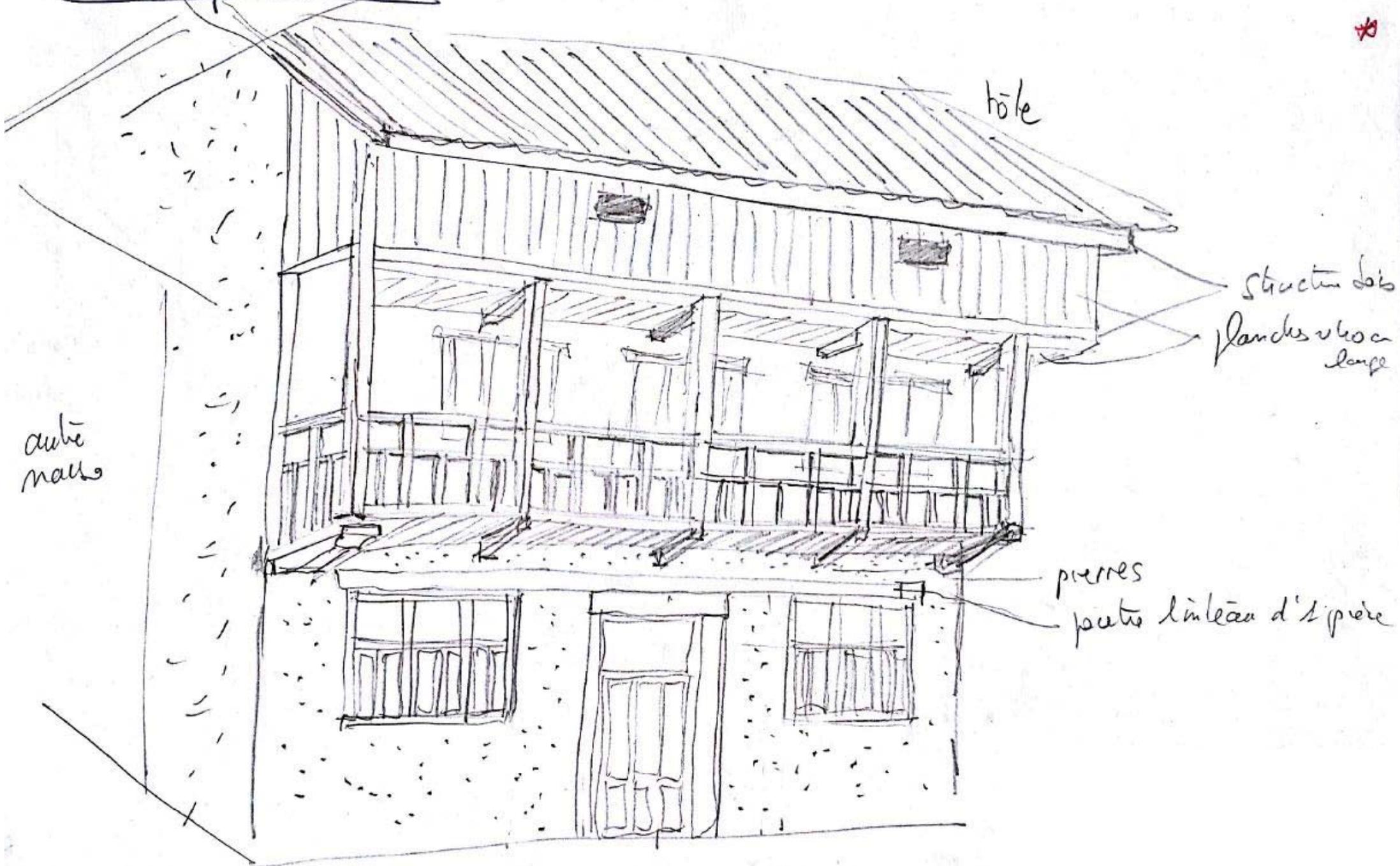


maison type 2 étages

partie non bordée débordé

= maison TAMANG GURUNG

*



tôle

structure bois
planches vloca
longe

autre
maison

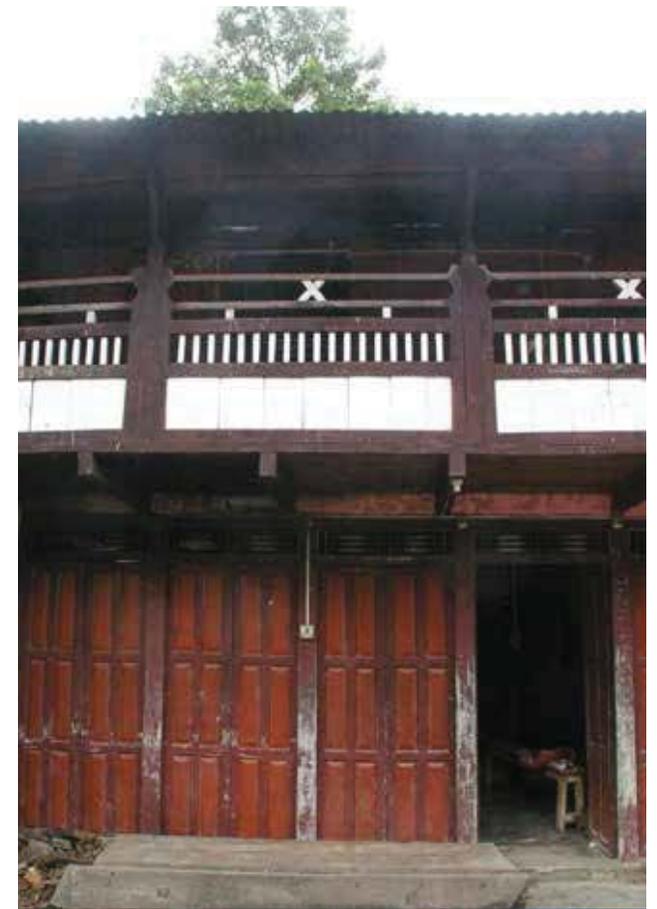
pierres
partie linéaire d'1 pierre

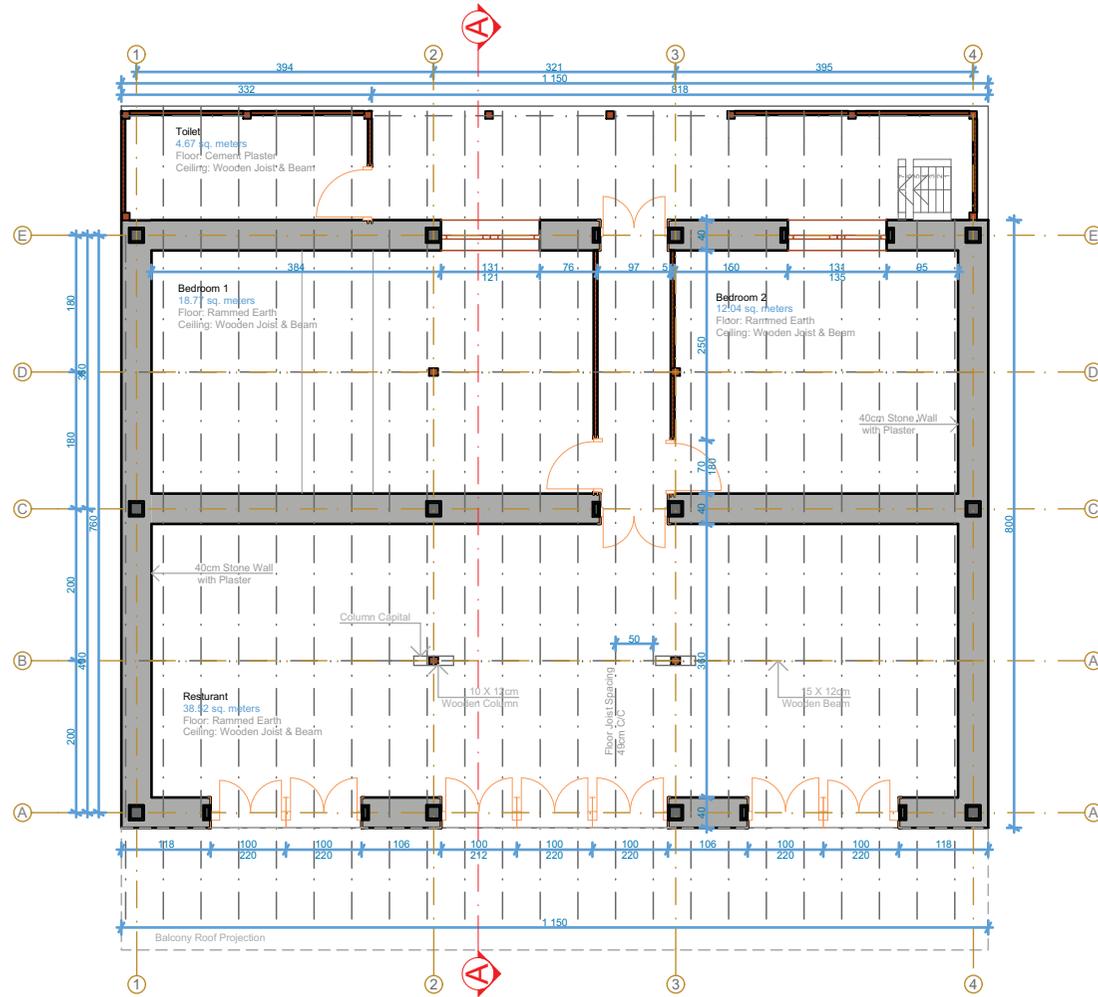
GURUNG HOUSE MODEL - BALUWA COMMUNITY

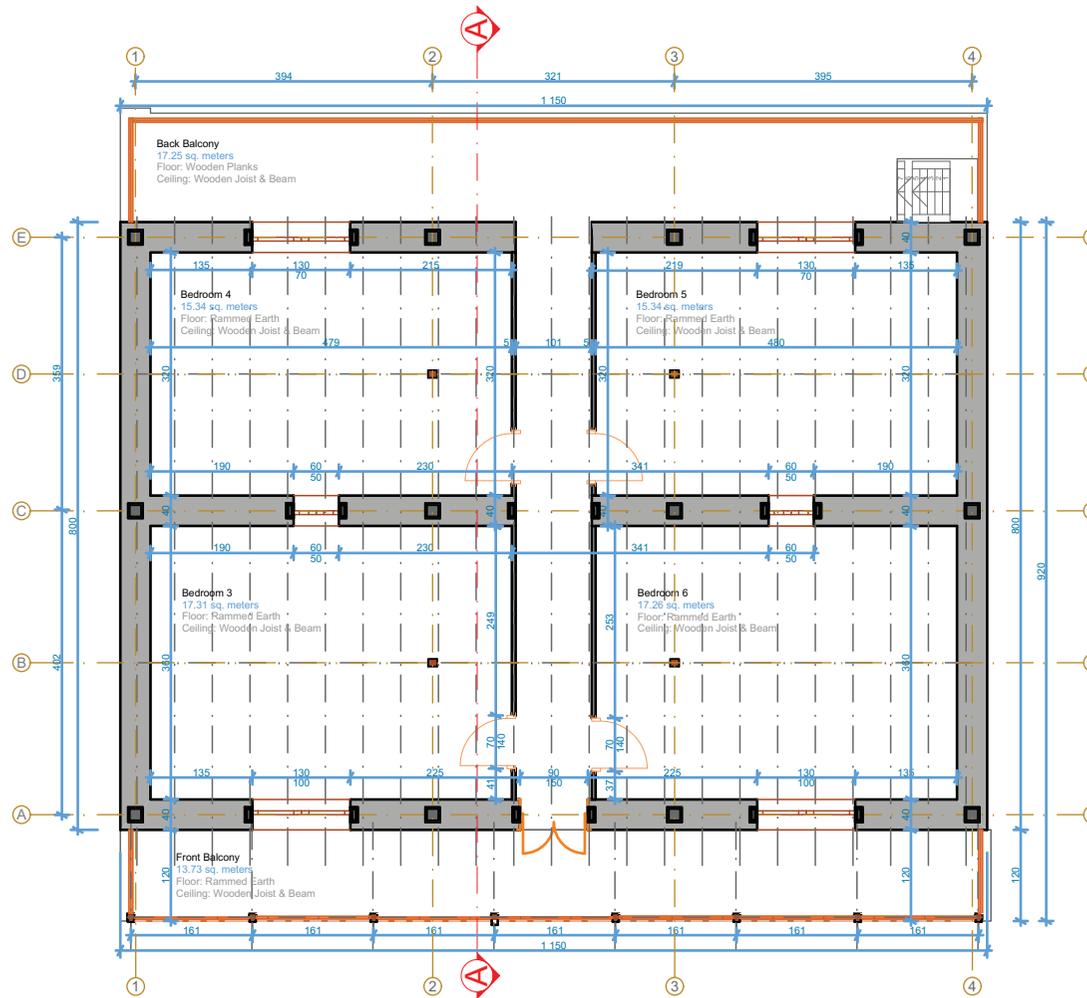


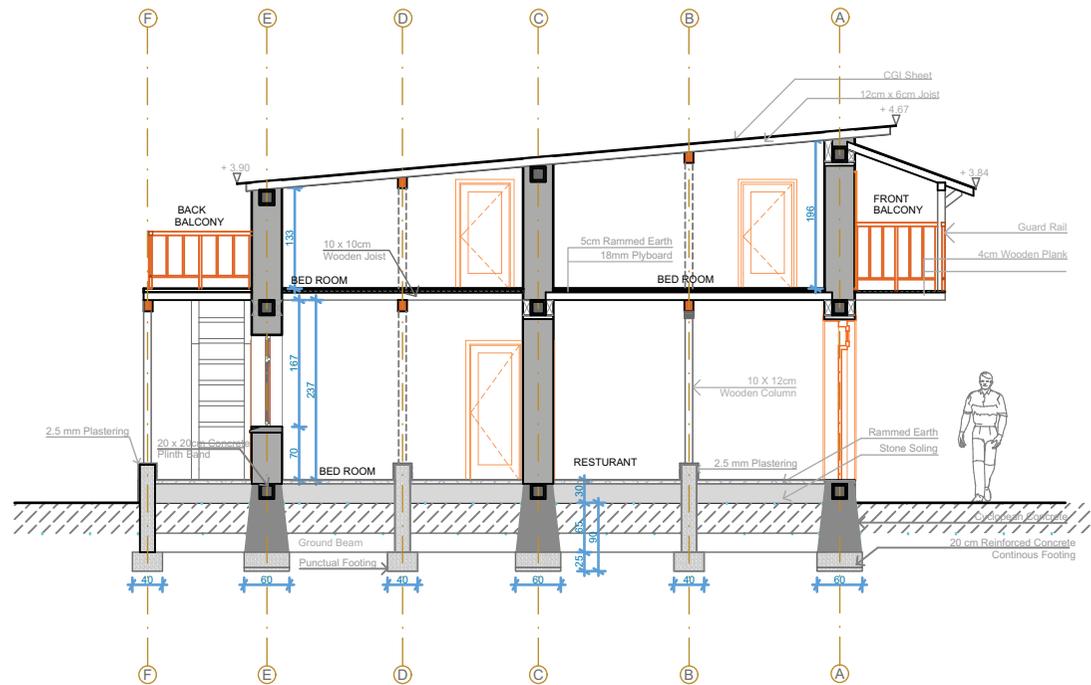
Baluwa is a Gurung vilage located in a rural and remote region, in Gorkha district, at 800 m high above the sea level and 32 km from the Gorkha bazaar. There are more than 200 houses and 1500 inhabitants living in this village.

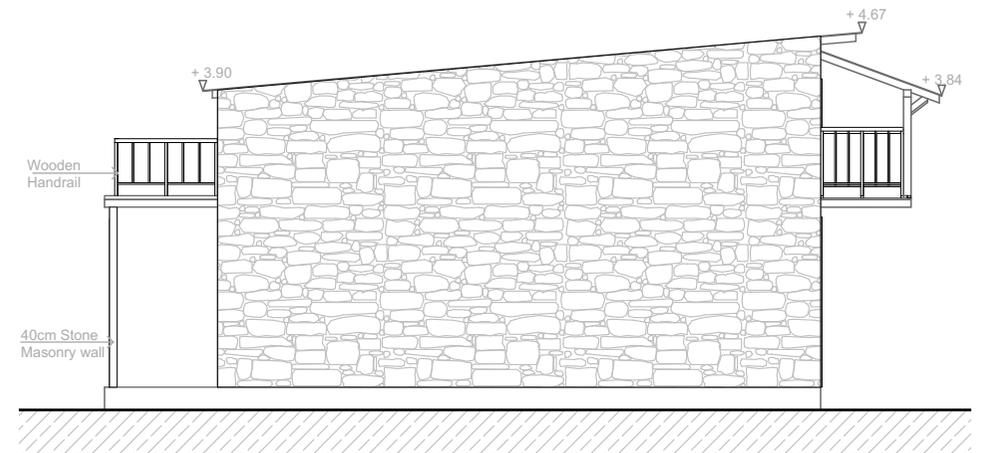
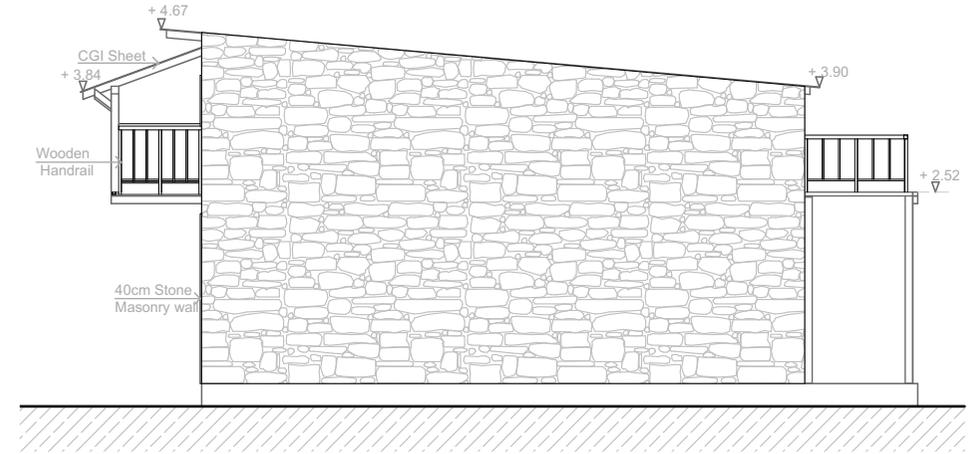
This house is designed for a better resillience to earthquakes considering the human safety. It includes the provision of horizontal bands, vertical and corner reinforcements, T-junctions to bind the house as a frame structure.











Newari house models

The Newars are the historical inhabitants of the Kathmandu Valley. They are known for their contributions to art, sculpture and architecture.

Fine brickwork and woodcarving are the marks of Newar architecture. These elements are inherent to all their constructions: monastic courtyards, temples, stupas, palaces, priest houses, or residential houses.

The most famous Newar architect was Arniko, who traveled to China or Tibet and he was the first to build the famous stupas.

Hereafter are presented two examples of Newar residential houses, improved with earthquake-resistant techniques : reinforced concrete columns and beams to maintain the house structure up, mechanical connection between walls and wooden slab / roof. It includes the provision of horizontal bands, vertical and corner reinforcements, T-junctions to bind the house as a frame structure. This houses are designed for a better resillience to earthquakes considering the human safety.



NEWARI HOUSE MODEL - PANGA VILLAGE

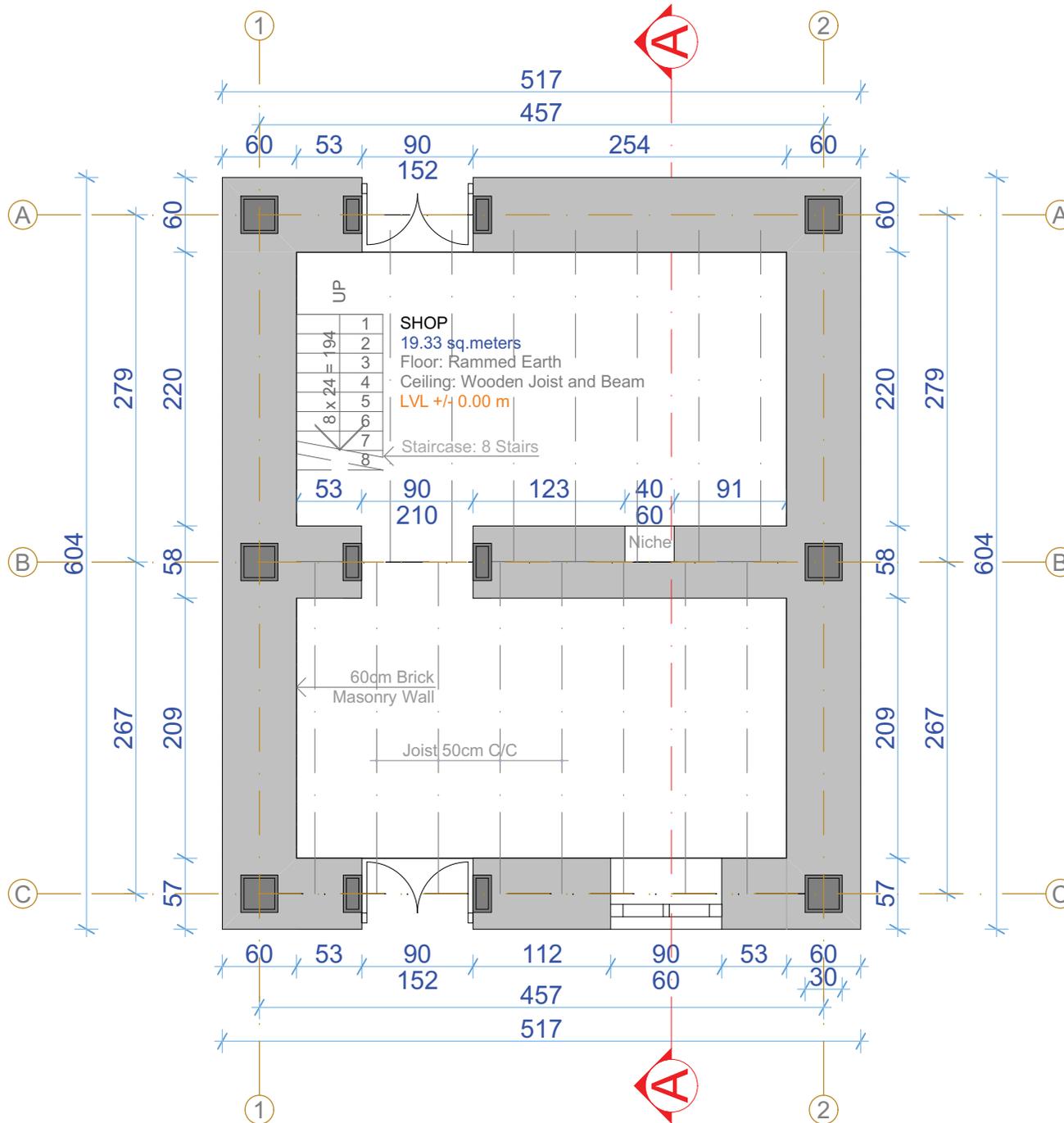


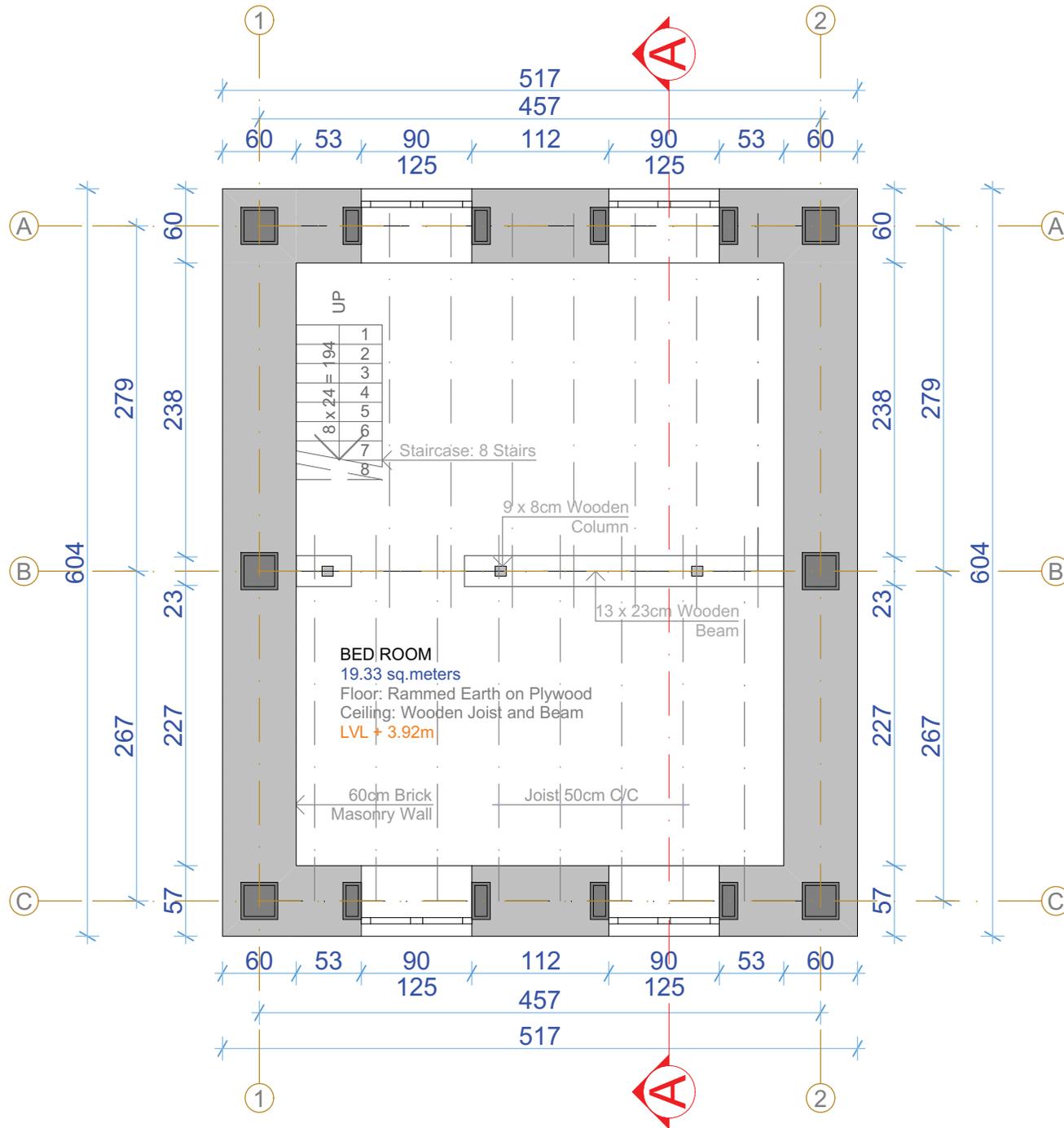
Panga is a typical Newari settlement and a part of Kirtipur Municipality. Originally a Newar foundation, Panga is still a center of Newar culture. It has been merged with surrounding villages to form the municipality of Kirtipur with a population of 65 602.

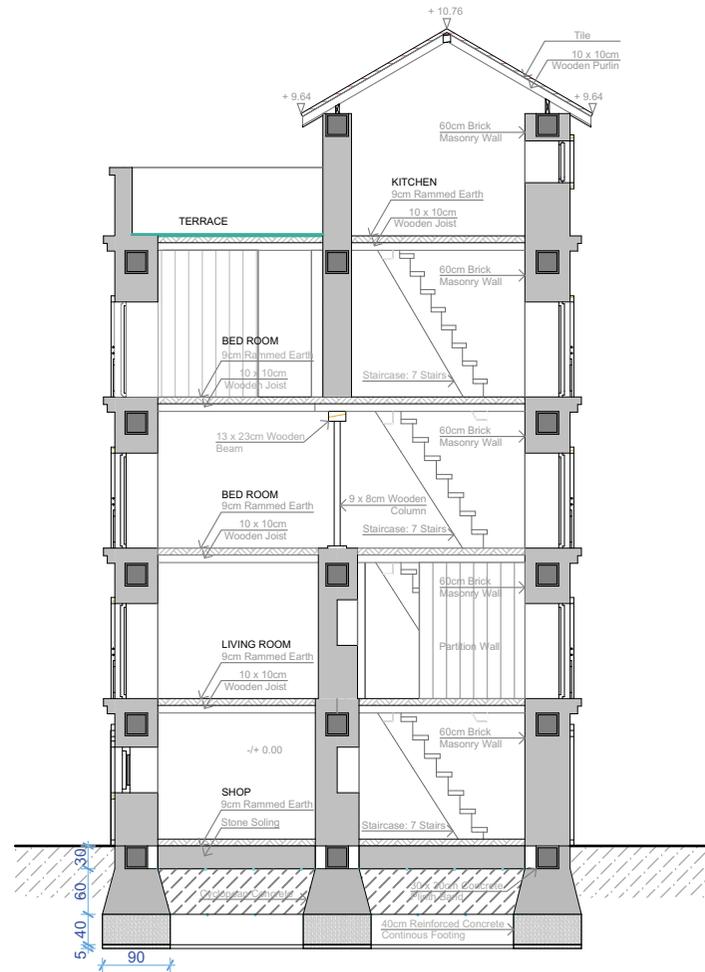
It consists of many temples, Vihara (Buddhist monastery) and churches too.

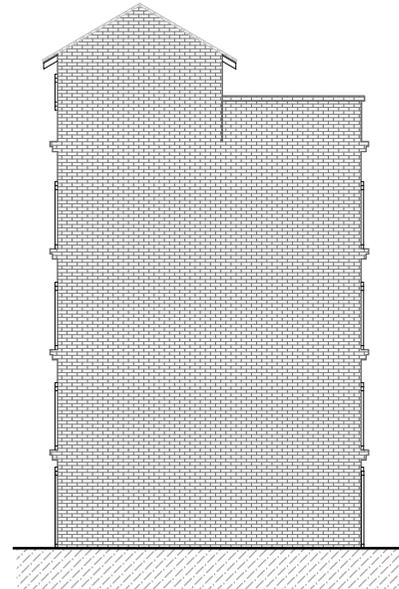
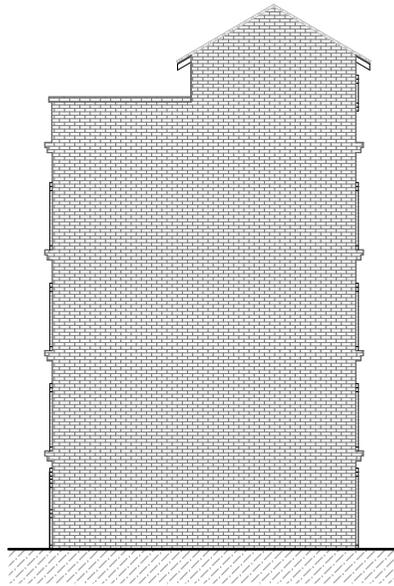
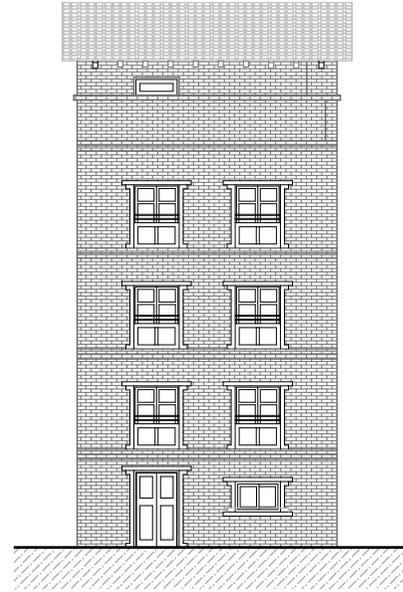
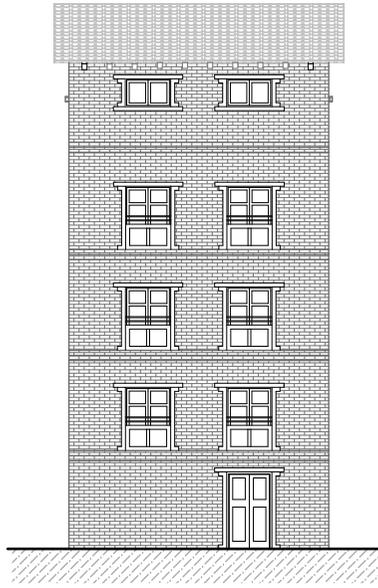
Due to the presence of Tribhuvan University in Kirtipur, Panga is also a popular area for out-of-town students and professors to rent houses and they are major contributors to the local economy.

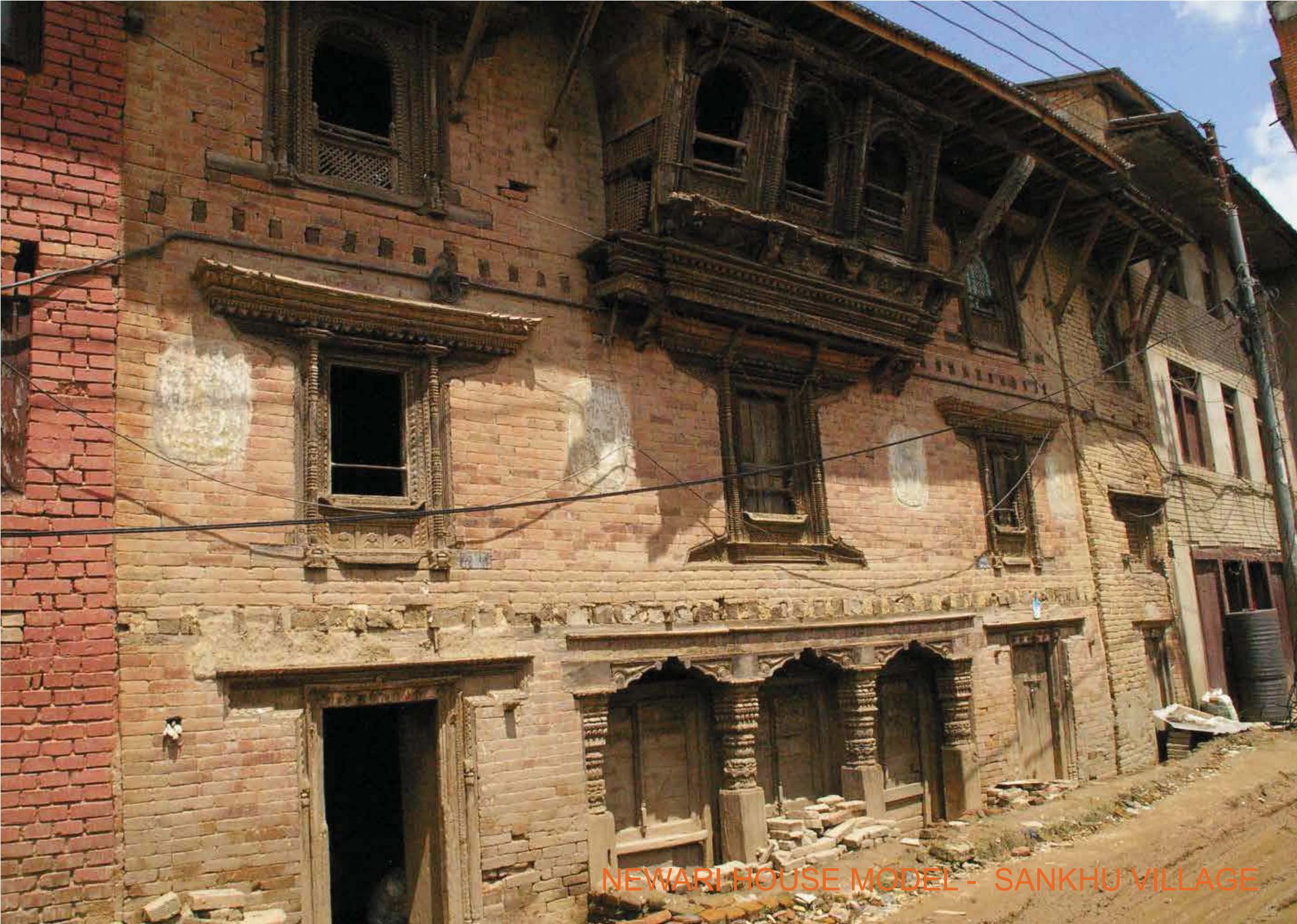












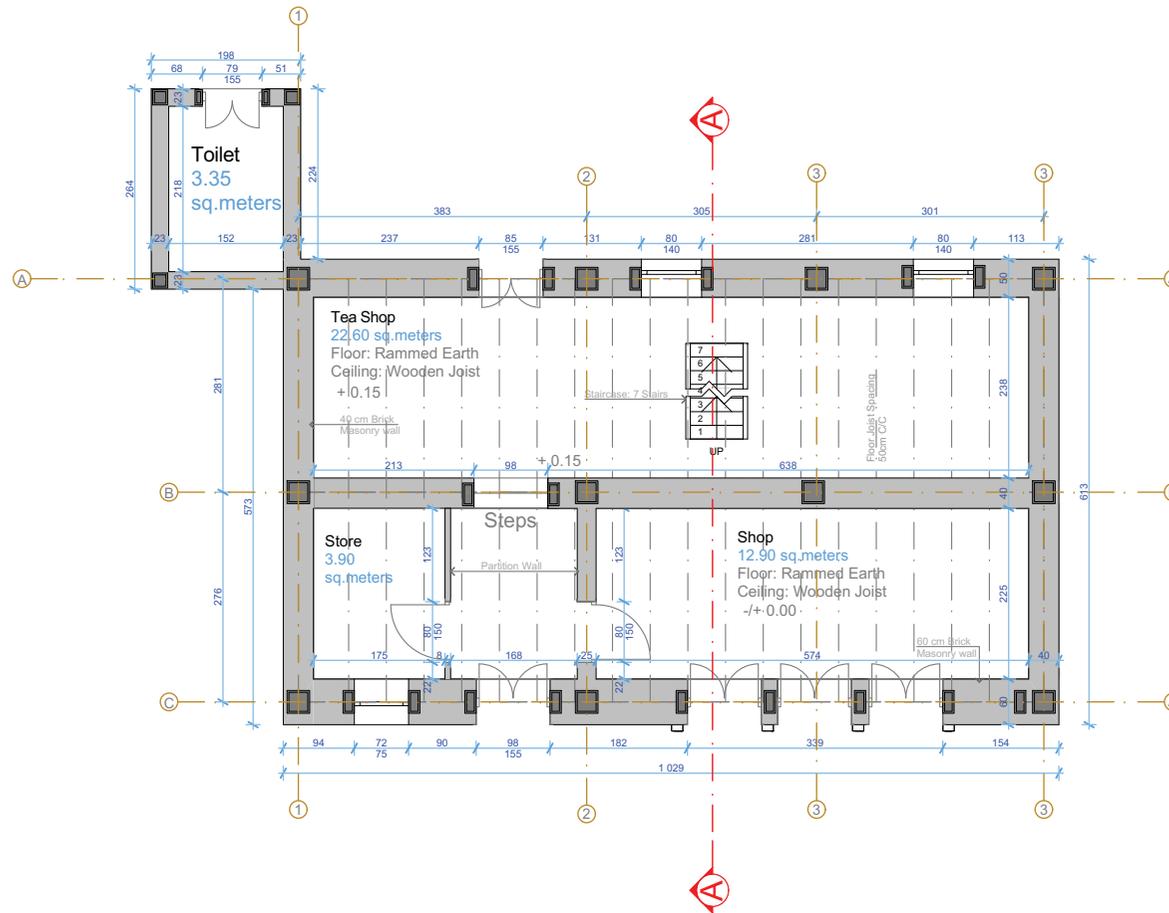
NEWARI HOUSE MODEL - SANKHU VILLAGE

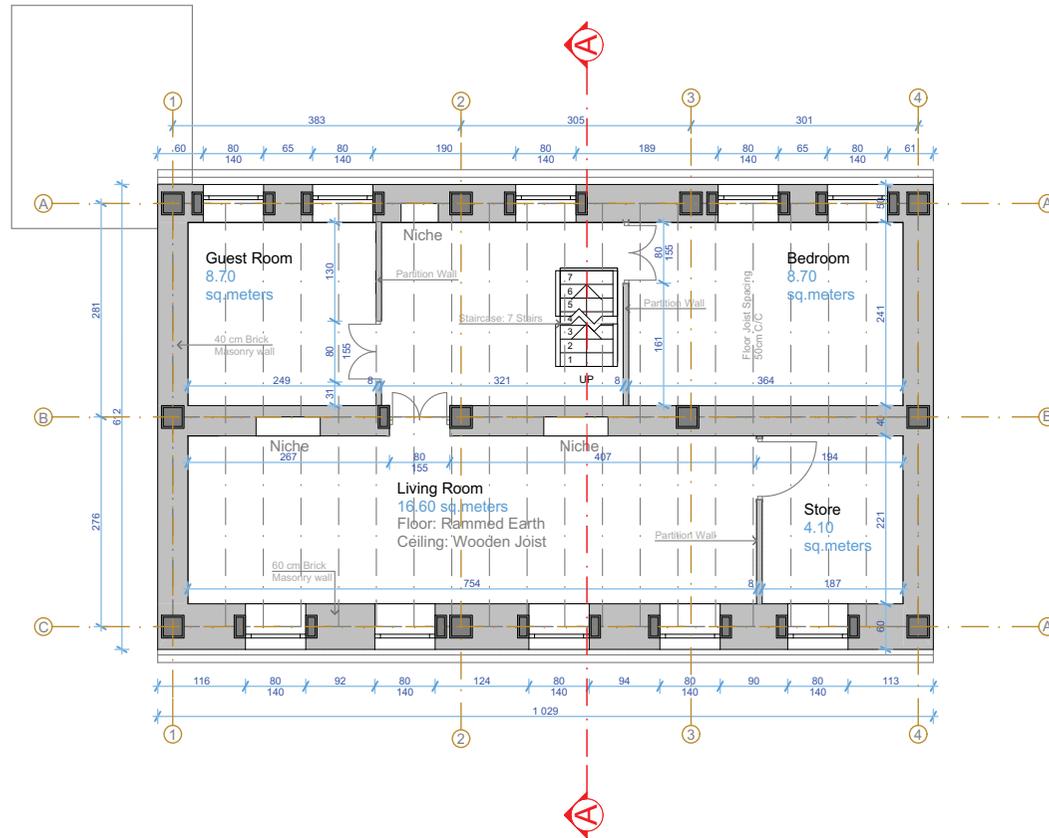


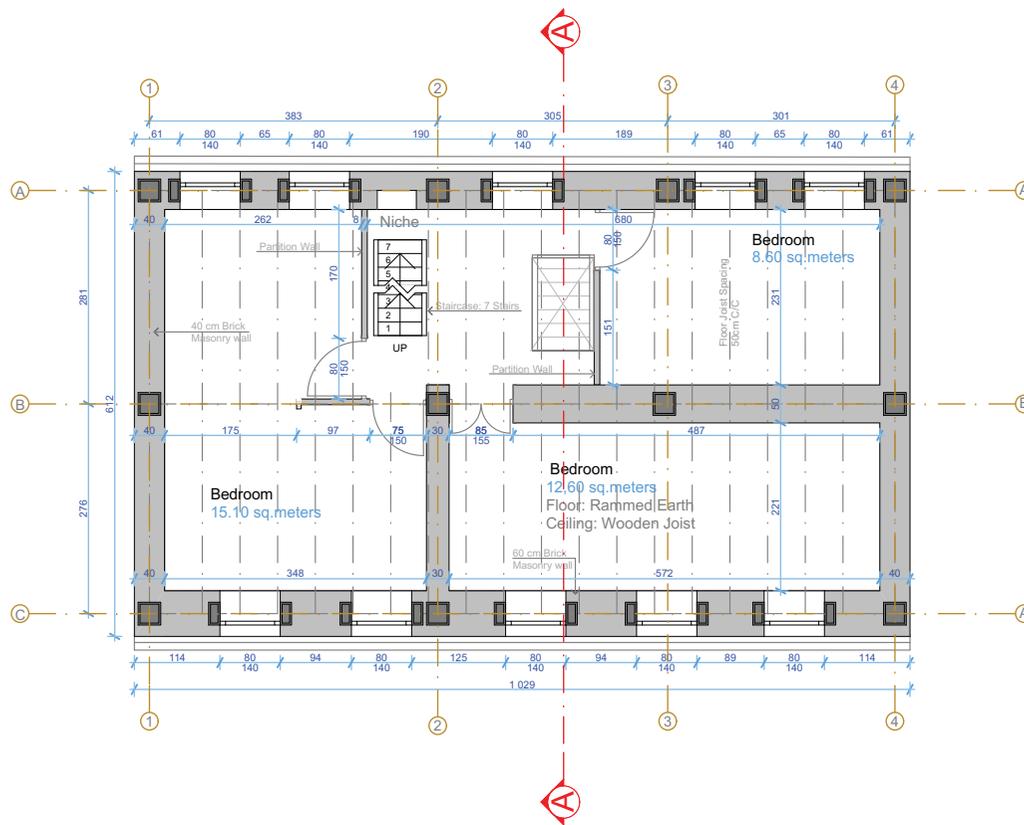
Sankhu is a 100 years old' ancient Newar town located in the north-eastern of Kathmandu Valley, about 17 km from the capital city Kathmandu.

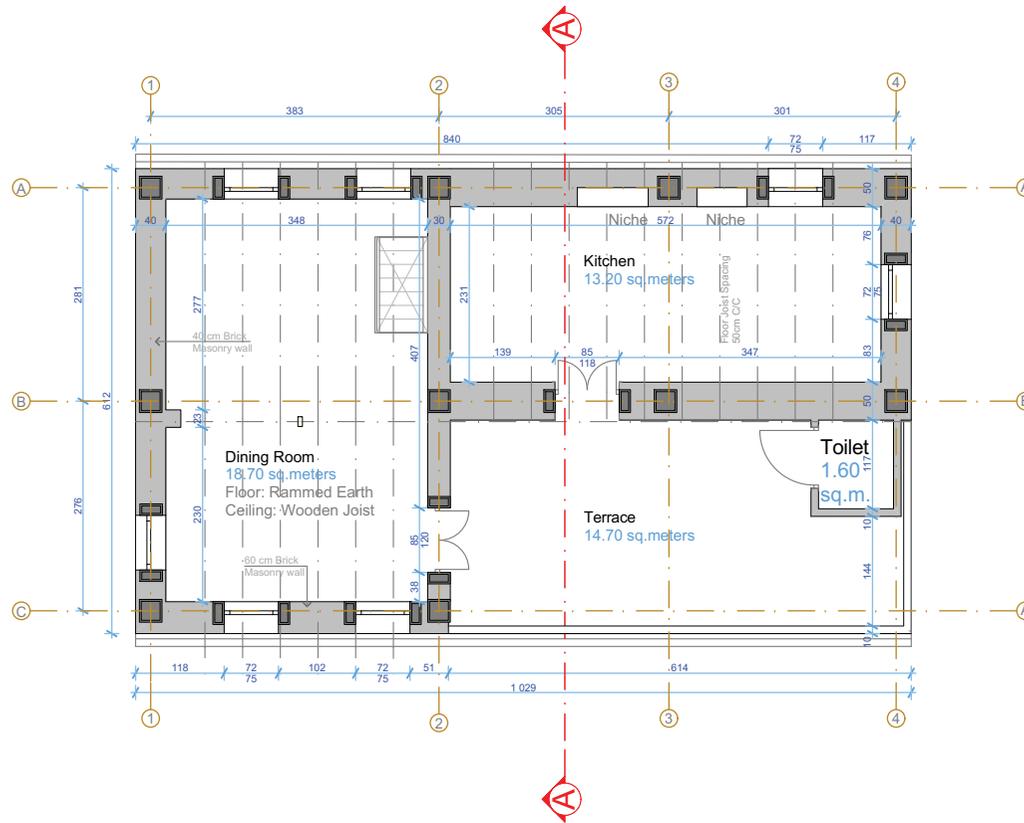
Sankhu is also known as Sankharapur for its famous ancient Sankha-shaped town structure.

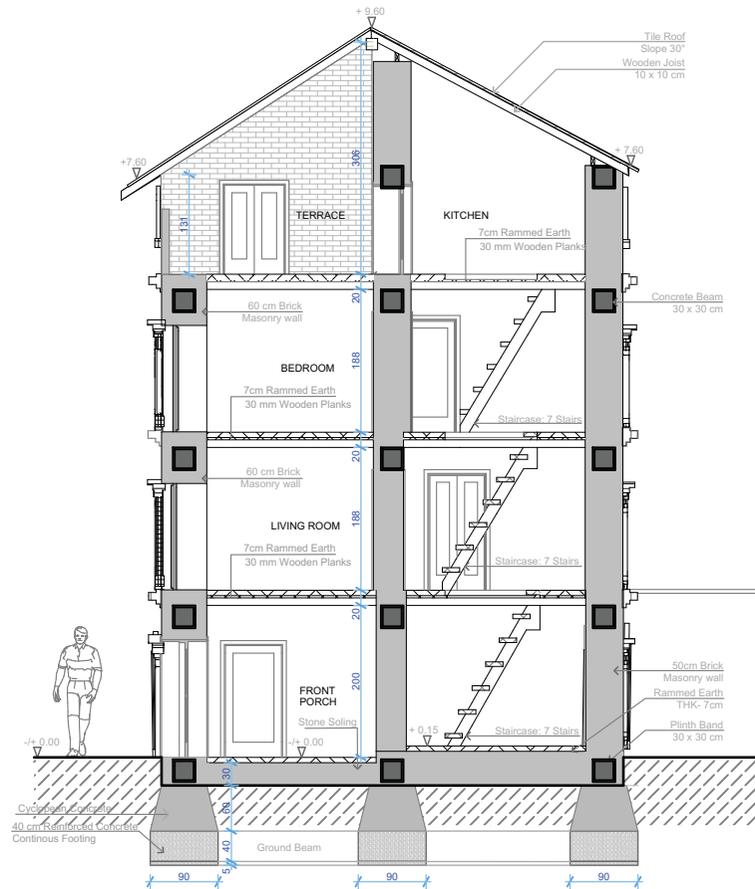
At the time of the 2011 Nepal census, it had a population of 4 333 for 928 individual households.

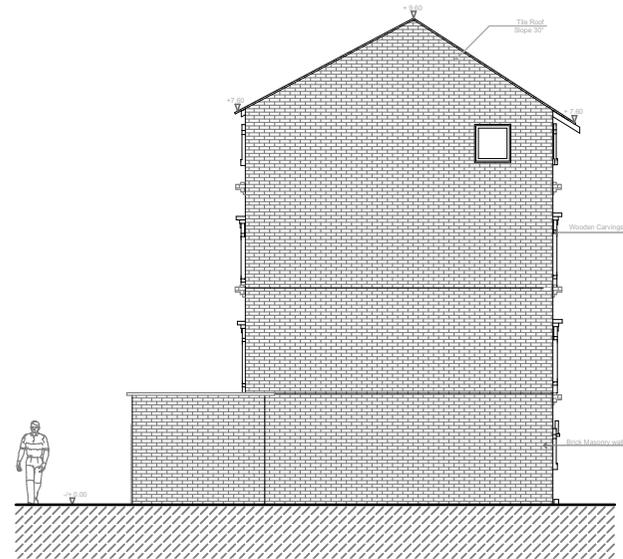
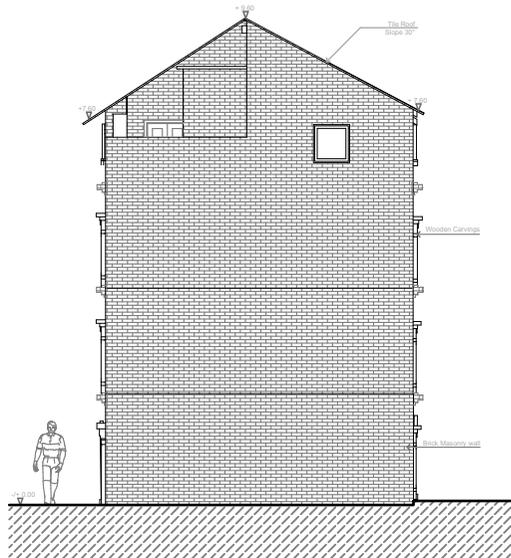
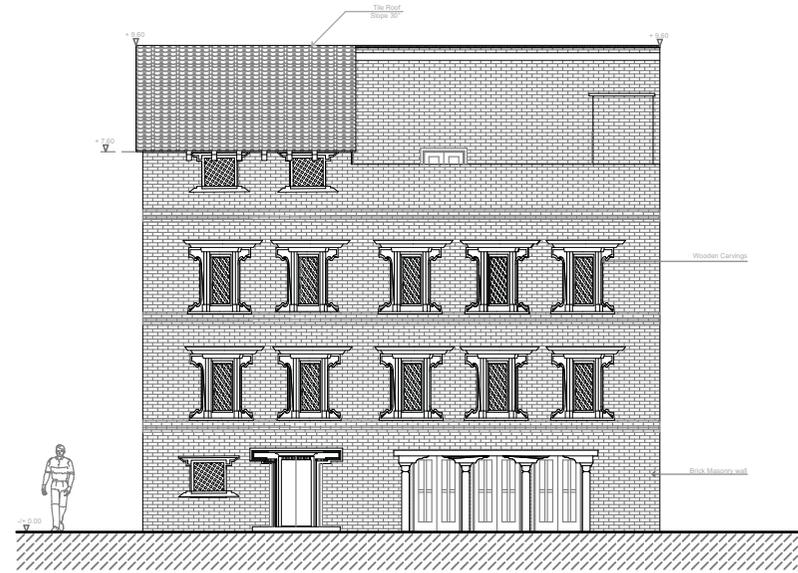
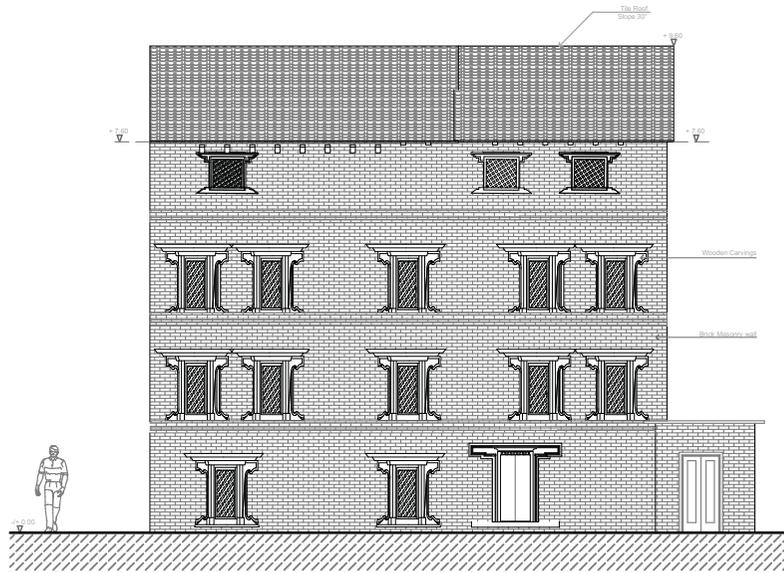












Tamang house models

The name Tamang means 'horse trader'. They are the indigenous inhabitants of the Himalayas regions. Today, they live at the borders of Nepal and Tibet due to marginalization from Kathmandu, and are among the hardest groups hit by the 25th of April 2015 earthquake which destroyed the majority of their houses.

Their architecture mixes stone and wood. The typical houses include two levels: the ground floor for the family, and the first floor for the seeds. All the houses are organized around a central wooden column, and a lot of elements follow very specific set of rules. For example, the staircase has to count 7 steps, and the position of the fire has to be opposite to the location of the door.

Hereafter are presented 5 Tamang residential houses, improved with earthquake-resistant techniques : reinforced concrete columns and beams to maintain the house structure up, mechanical connection between walls and wooden slab / roof. It includes the provision of horizontal bands, vertical and corner reinforcements, T-junctions to bind the house as a frame structure. This houses are designed for a better resilience to earthquakes considering the human safety.



TAMANG HOUSE MODEL - GATLANG COMMUNITY



Gatlang is a village development committee in Rasuwa District in the Bagmati Zone of Northern Nepal.

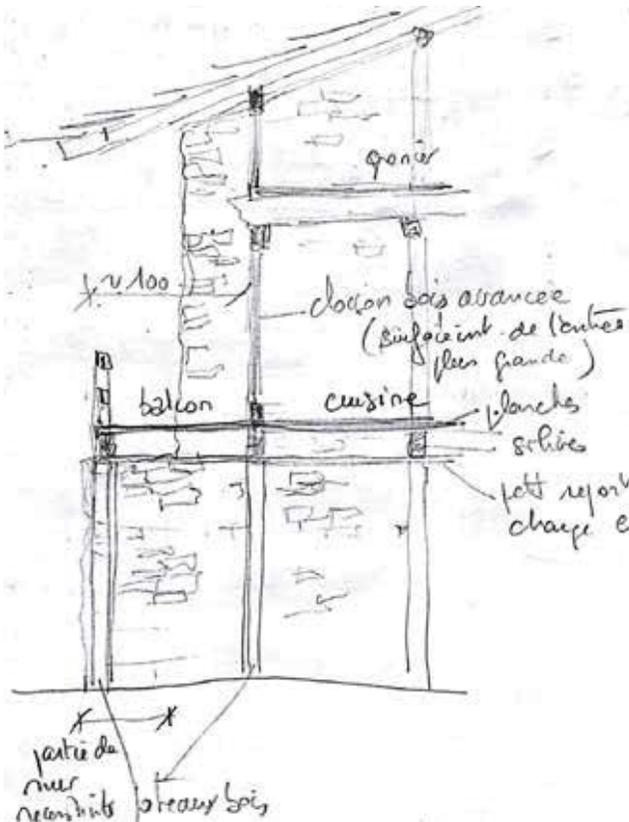
At the time of the 1991 Nepal census, it had a population of 1533 people living in 328 individual households.

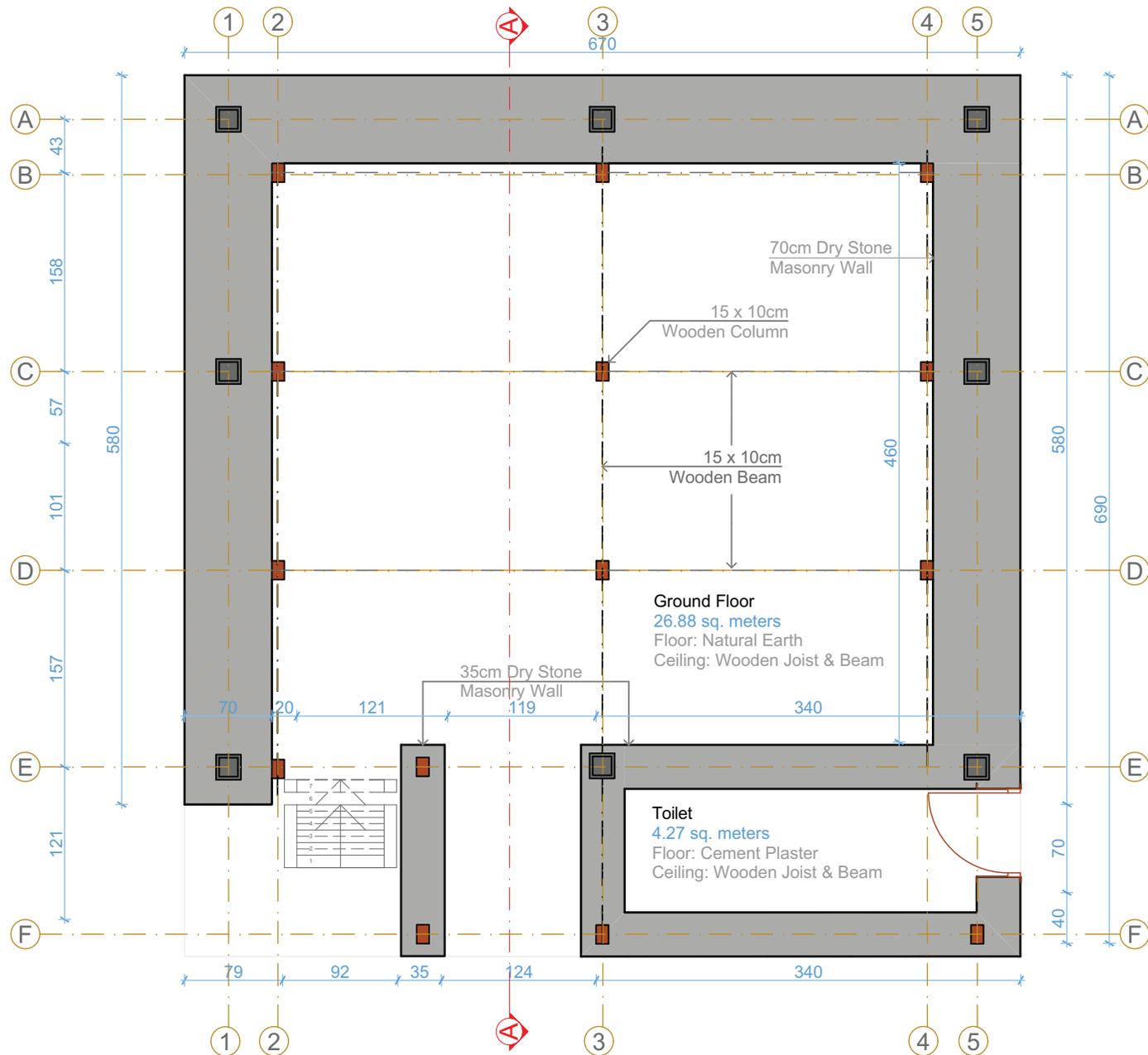
Gatlang houses are famous for their 3 side 70 cm stone masonry with wooden partition walls, their specific roof in wood and their facade made by craftsman carpenter. This village is an ideal stop for trekkers.

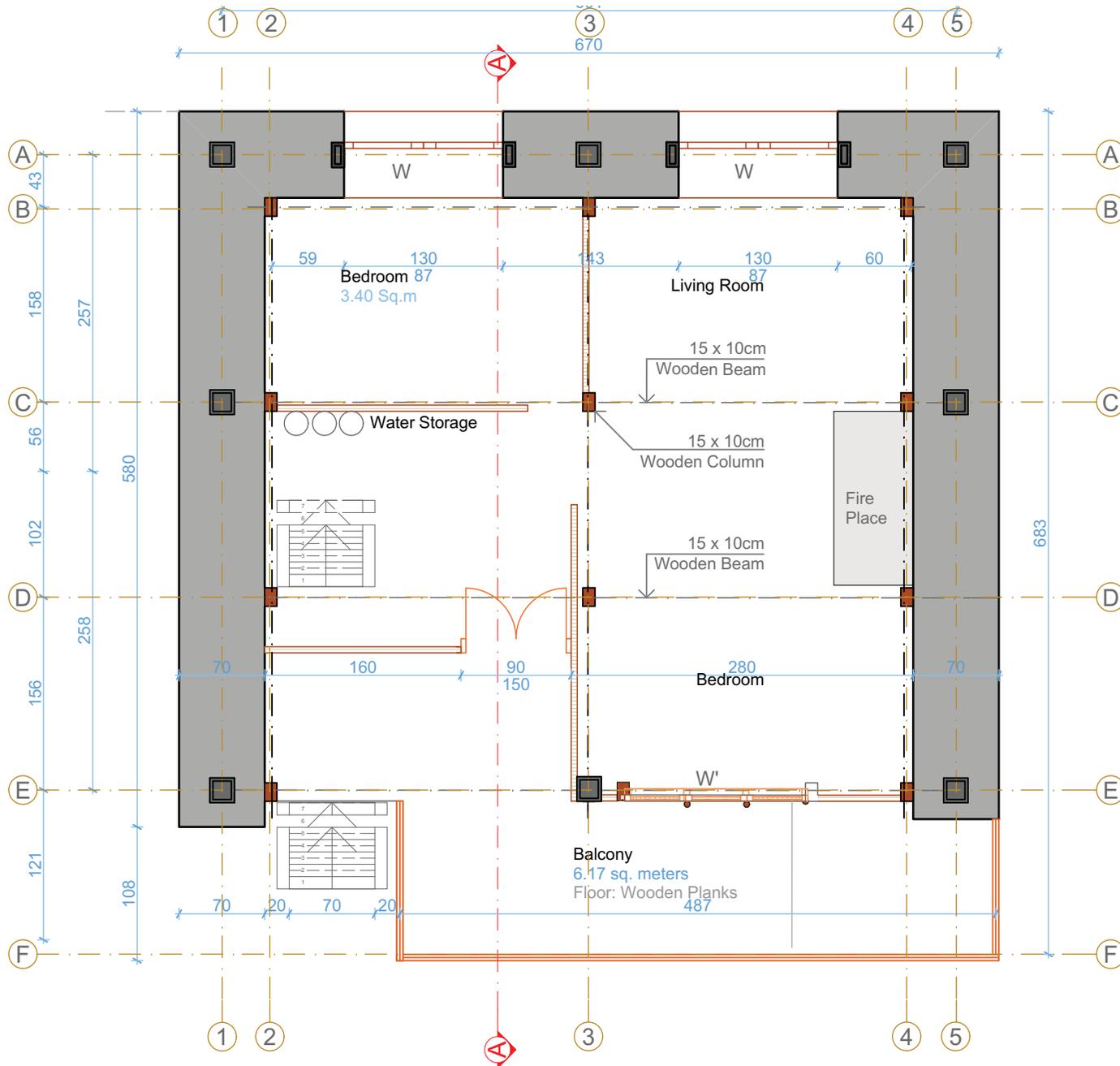
Tamang House Model of Gatlang Community is a double storey house, accomodation for 3 to 5 people. The improved house model preserve the vernacular aspect of the Tamang community of Gatlang with earthquake-resistant standards.

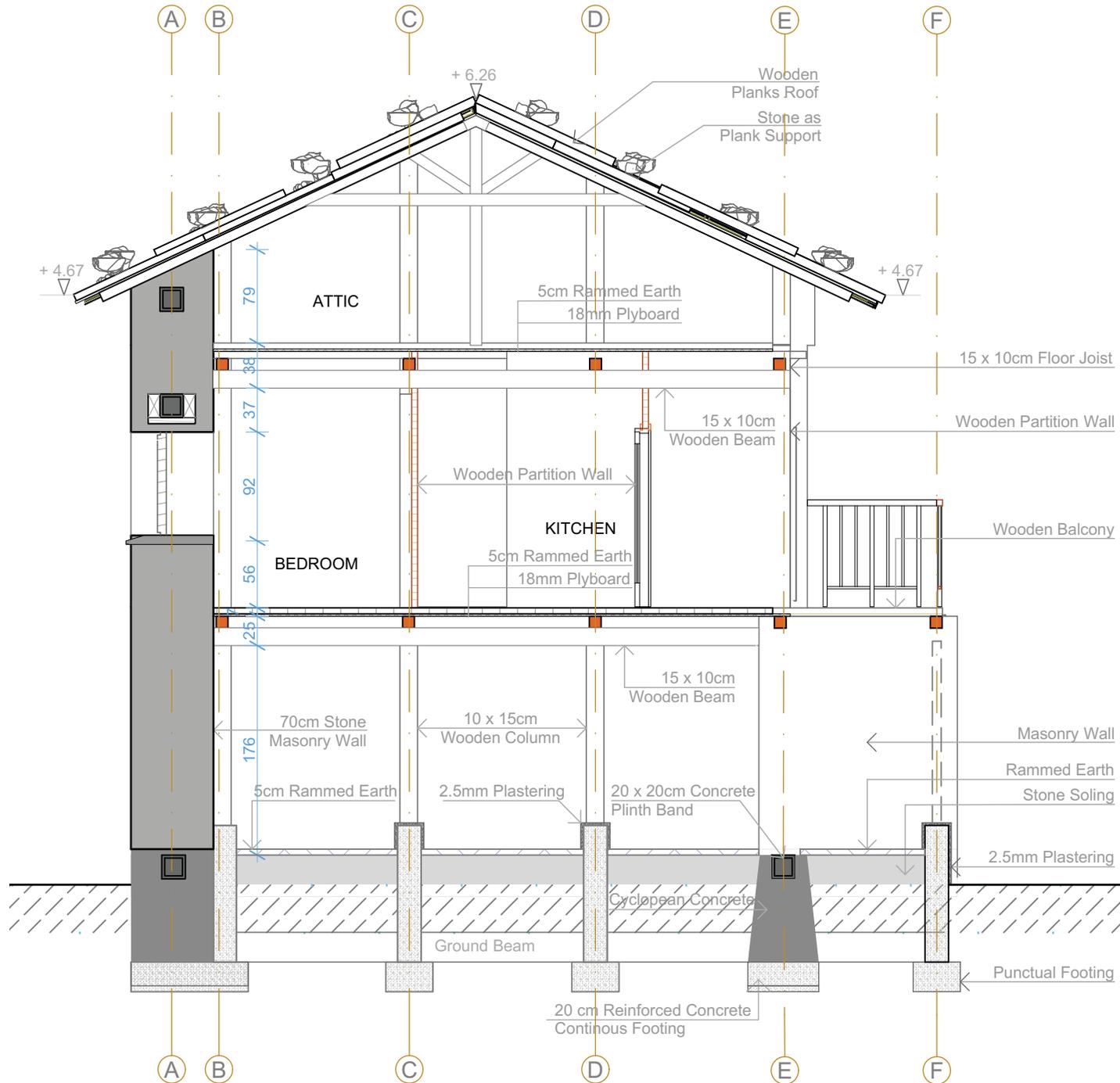
It consists of one balcony and 3 rooms in the first floor : an open kitchen with living room and a bedroom of dimension 314 x 480 cm, a small bedroom of dimension 170 x 211 cm, a room for water storage and a staircase dimension of 120 x 205 cm. The attic is for crops and seeds while the ground floor host the animals.

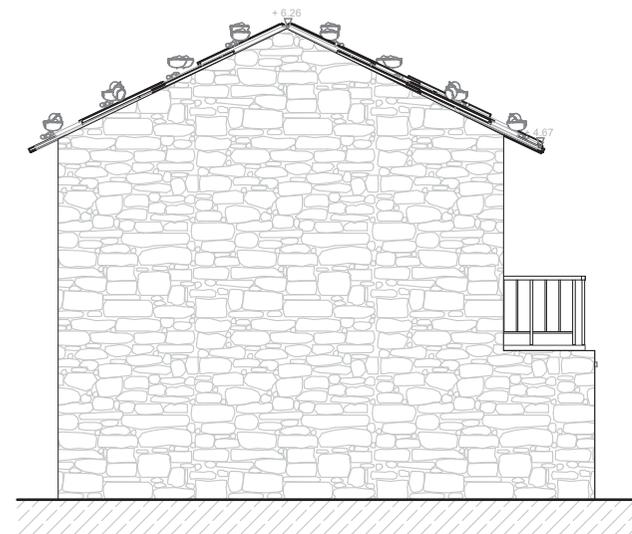
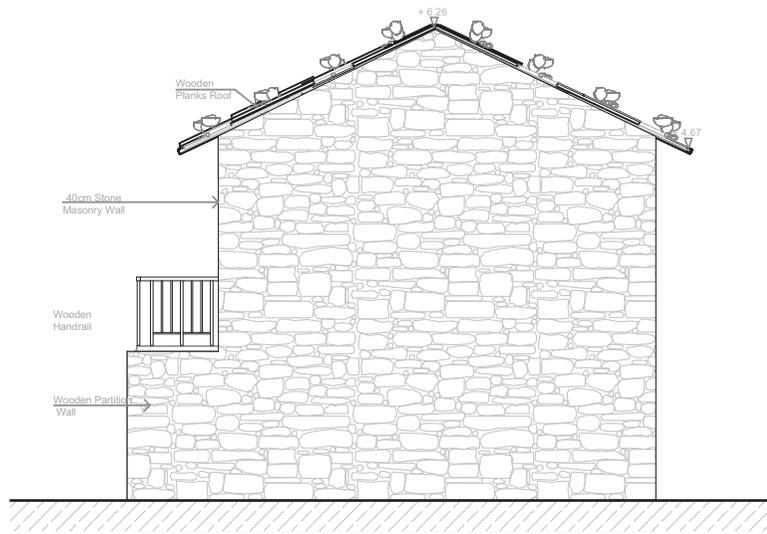
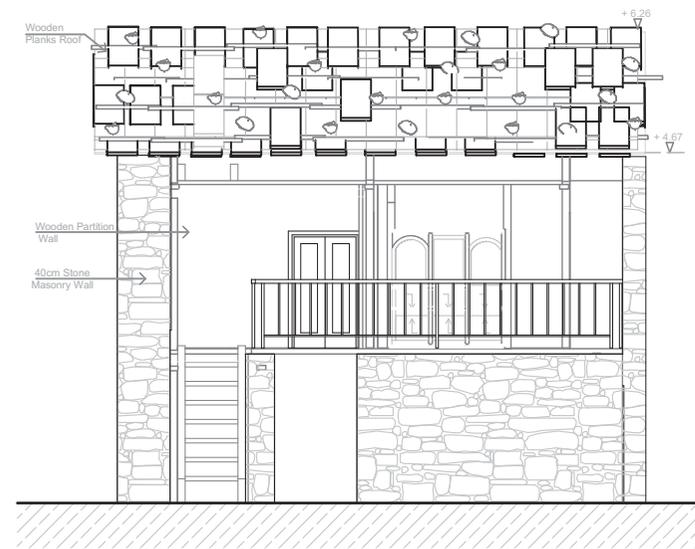
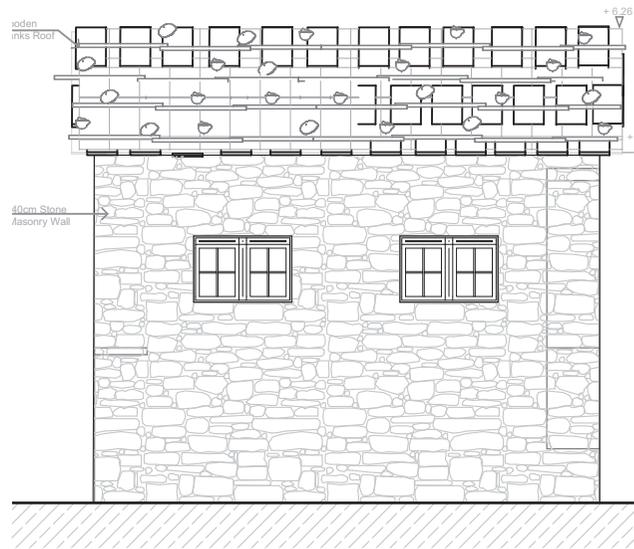
The total ground coverage of the house is 44.42 square meters and the total floor area is 89.02 square meters.











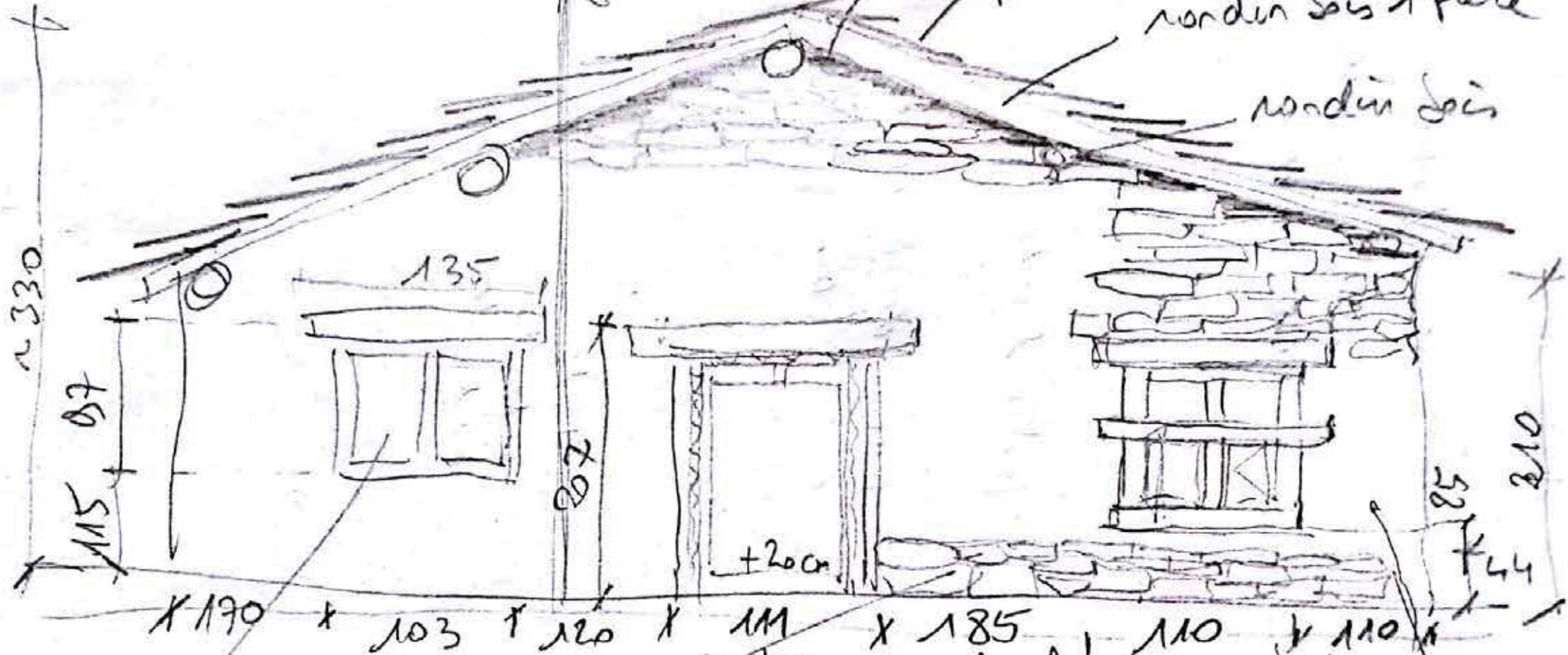
Maison type Kae

mat

vide entre pierres
piers shette plates

rondin bois 1 piece

rondin bois



blets bois

linteaux, seuils, fenêtr en bois
forte sculptée
7x10 cm tasseaux

banca pierre devant la maison

piers shette
sans routes

TAMANG SMALL HOUSE MODEL - GOLJUNG VILLAGE



Goljung is a village development committee in Rasuwa District in the Bagmati Zone of Northern Nepal.



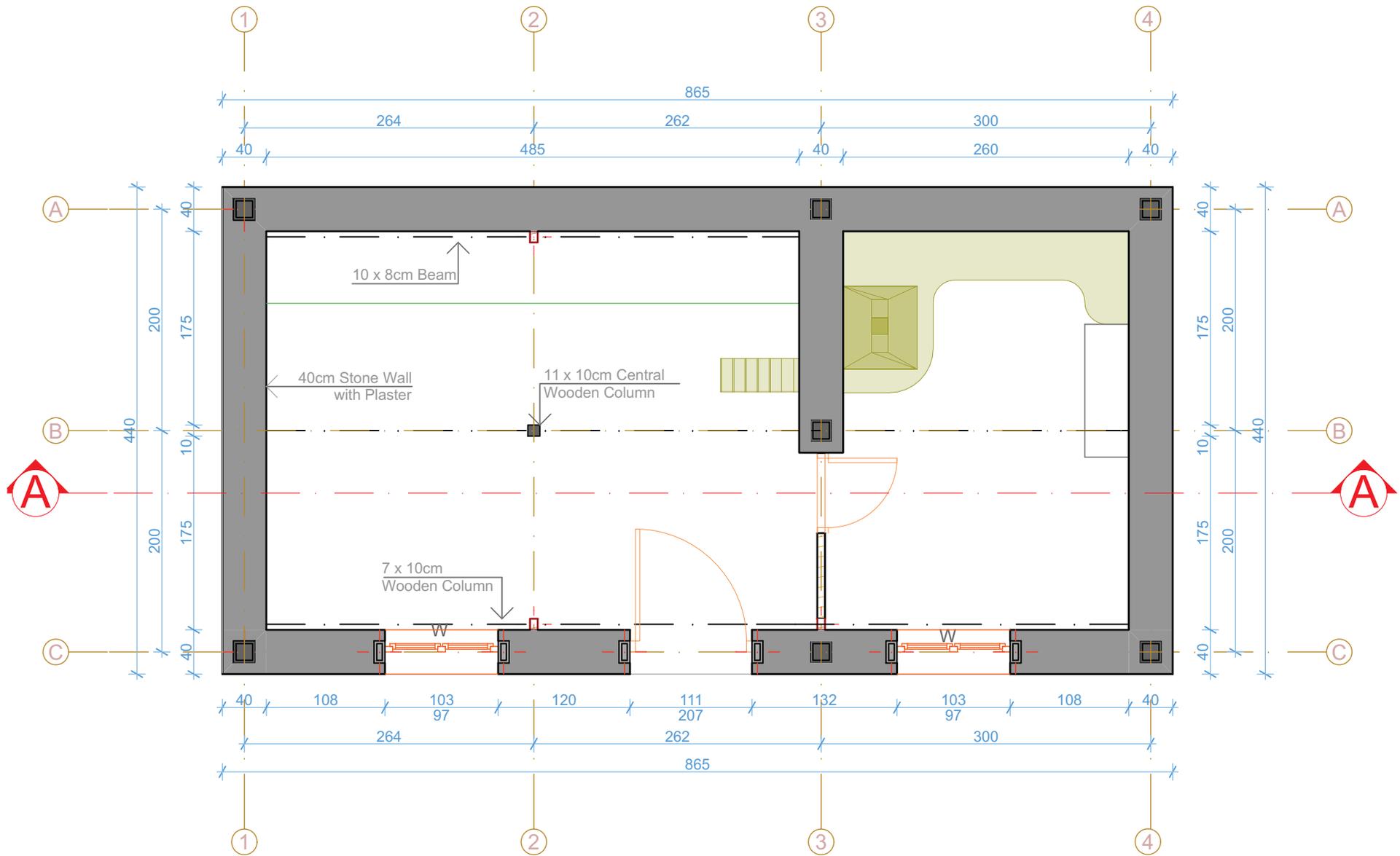
At the time of the 1991 Nepal census, it had a population of 836 people living in 172 individual households.

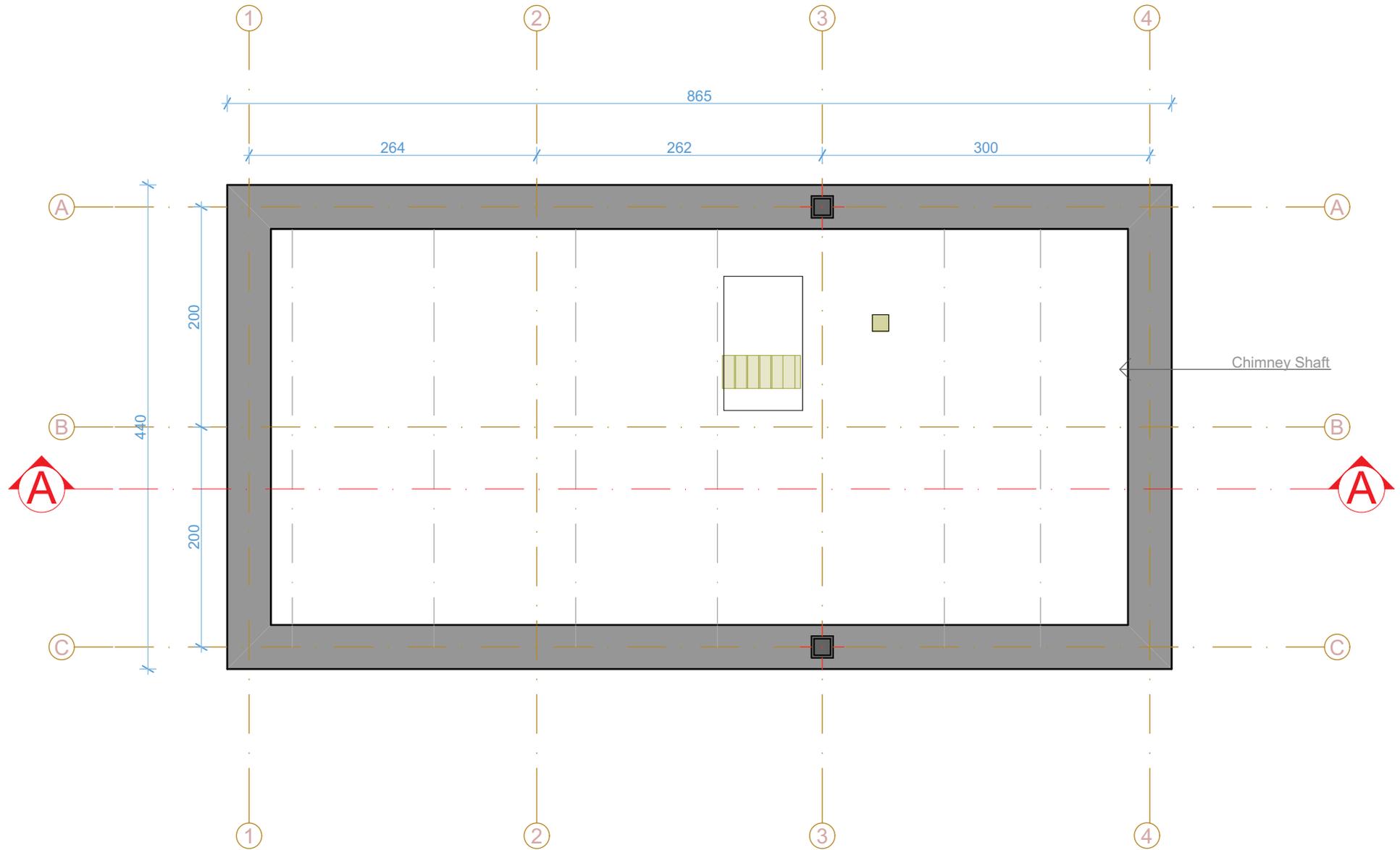
Goljung Small House Model is a single storey house, accommodation for 3 to 5 people. The improved house model preserve the vernacular aspect of architecture with earthquake-resistant standards.

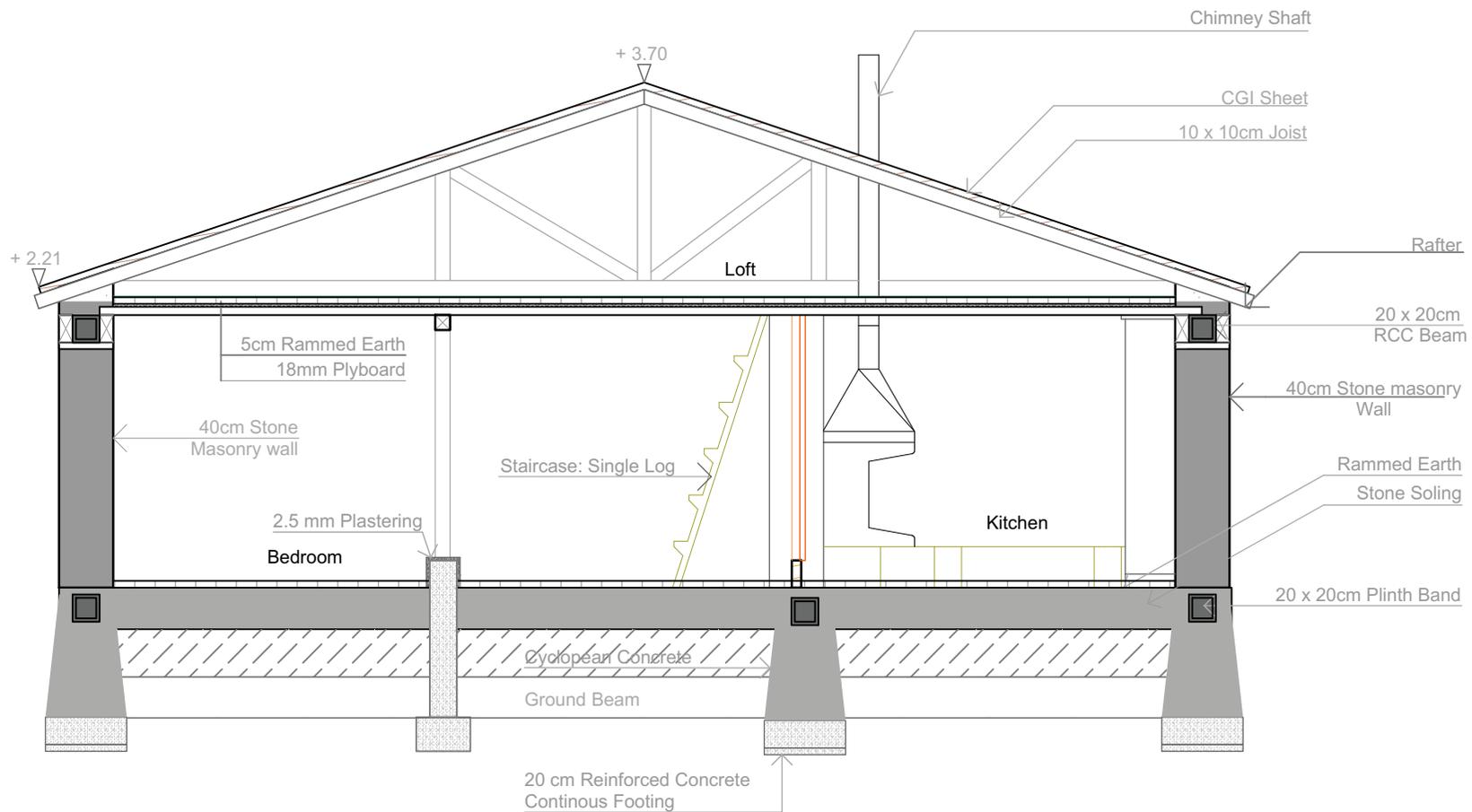
It consists of 2 rooms, a kitchen of dimension 360 x 487 cm and a bedroom of dimension 350 x 258 cm which can be used as a living room too for guests. The attic is for crops and seeds.

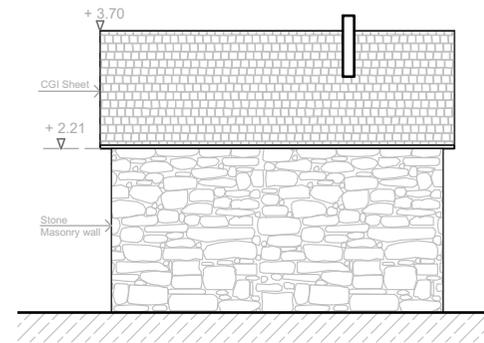
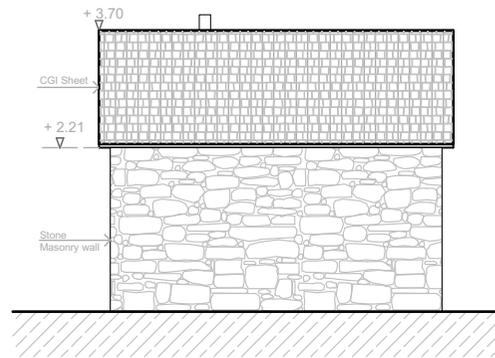
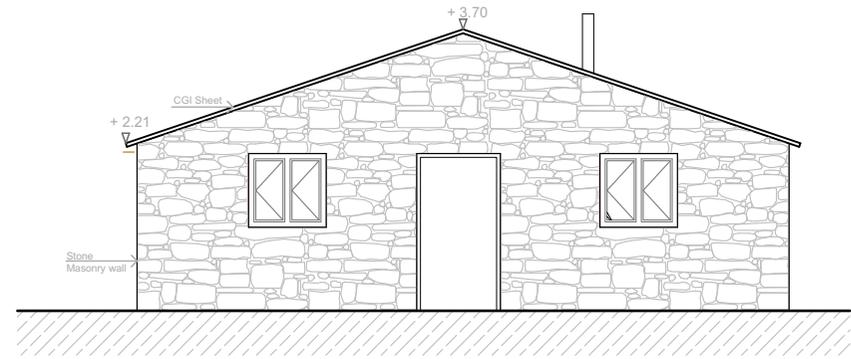
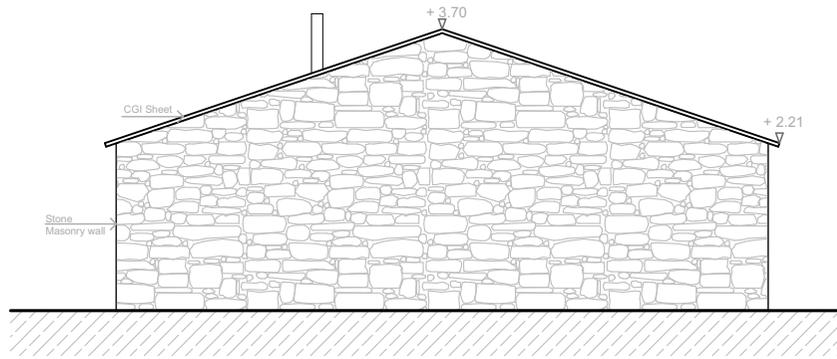
The total ground coverage of the house is 38.06 square meters and the total floor area is 27.67 square meters.













TAMANG LARGE HOUSE MODEL - GOLJUNG VILLAGE



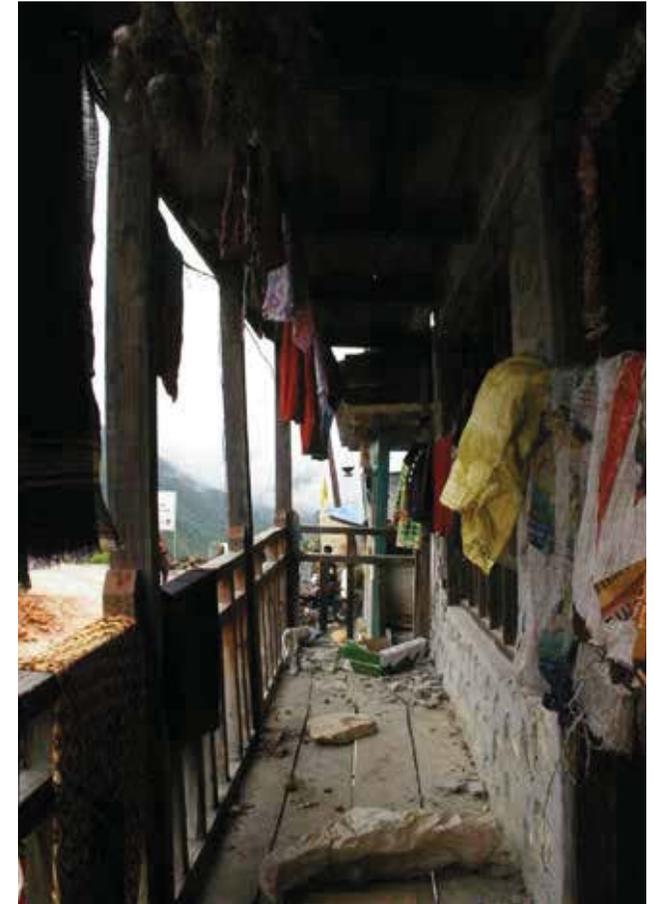
Goljung is a village development committee in Rasuwa District in the Bagmati Zone of Northern Nepal.

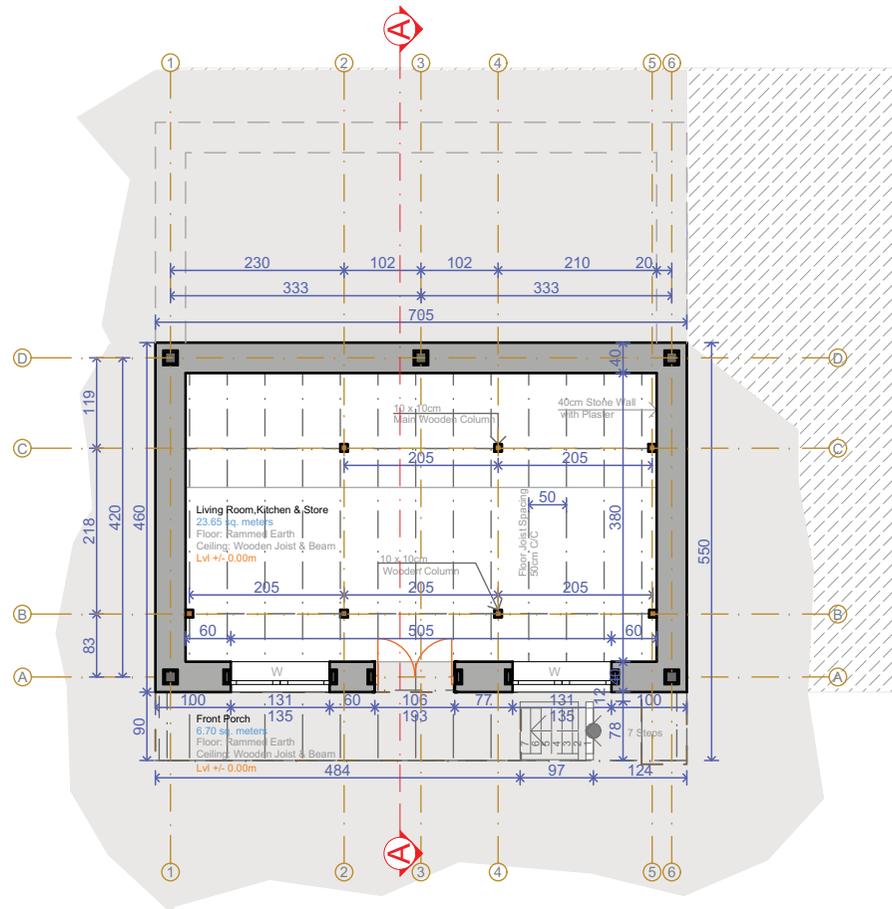
At the time of the 1991 Nepal census, it had a population of 836 people living in 172 individual households.

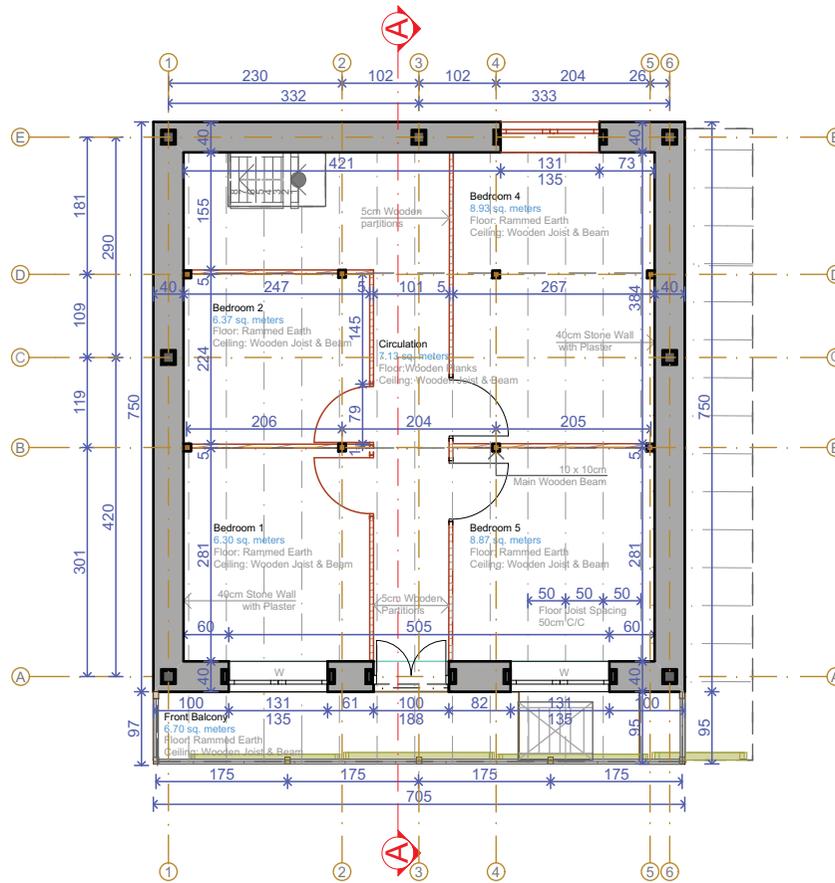
Goljung Tamang Large House Model is a three storey house, accomodation for 3 to 5 family members and lodge for tourists at the first floor. The improved house model preserve the vernacular aspect of architecture with earthquake-resistant standards.

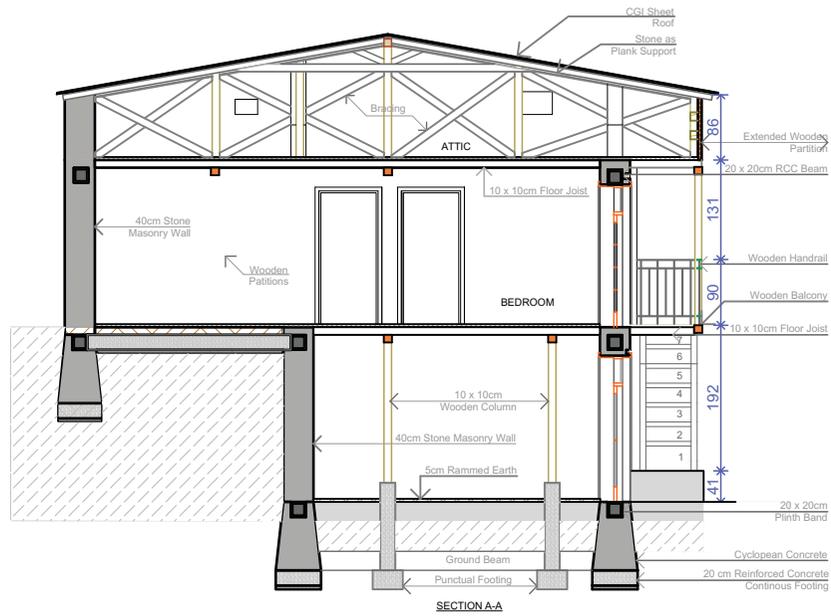
It consists of five rooms : the ground floor is for the family with an open kitchen, living room and bedroom while the first floor is for the tourists in visit with 4 bedrooms separated by wooden partitions. The top floor as an attic space is for crops and seeds.

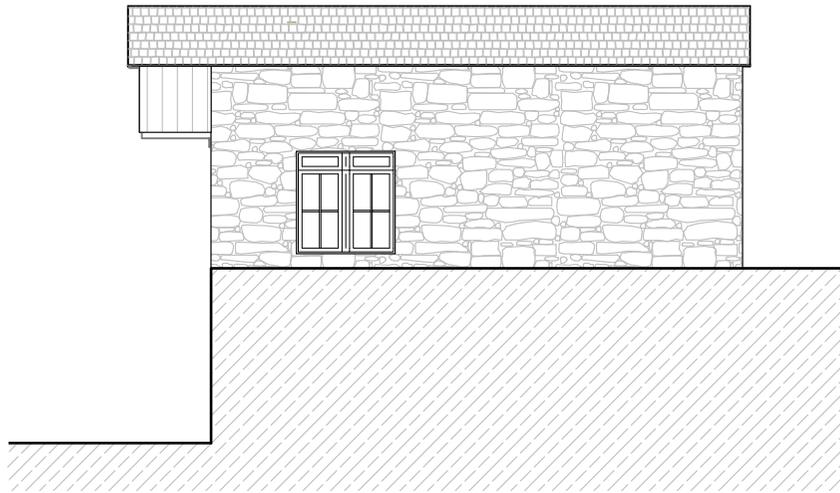
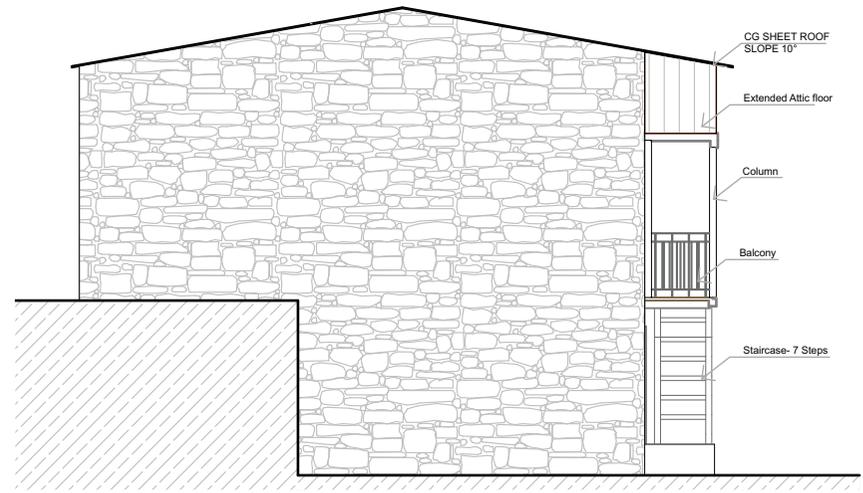
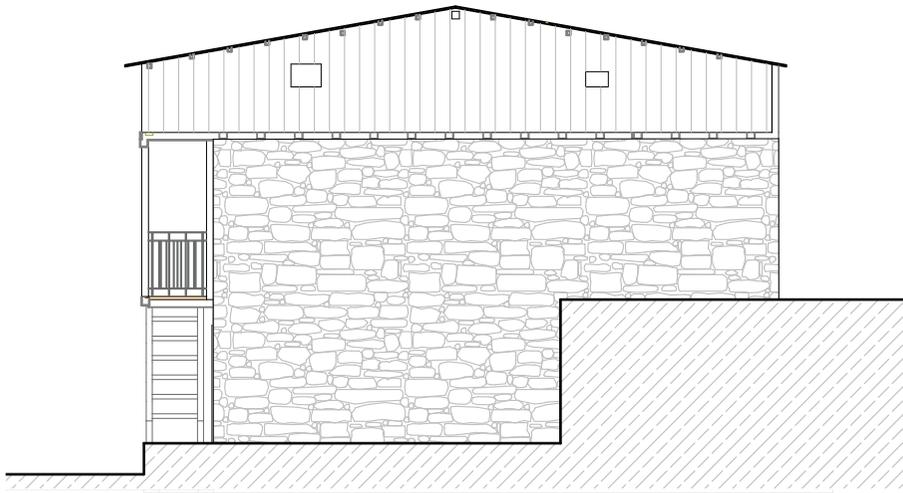
The total ground coverage of the house is 52.87 square meters and the total floor area is 159.54 square meters.













TAMANG HOUSE MODEL- CHARGHARE VILLAGE

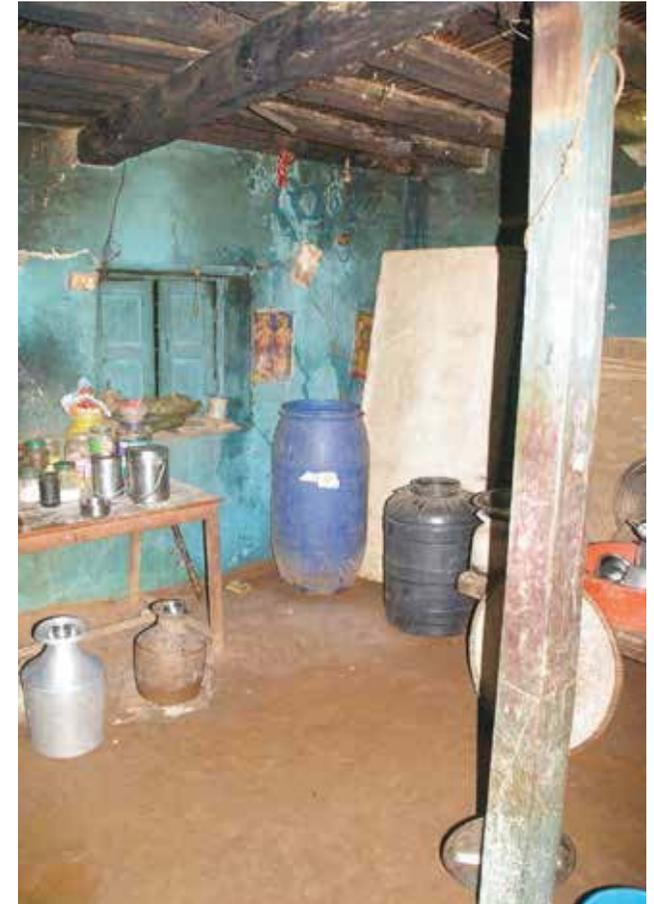


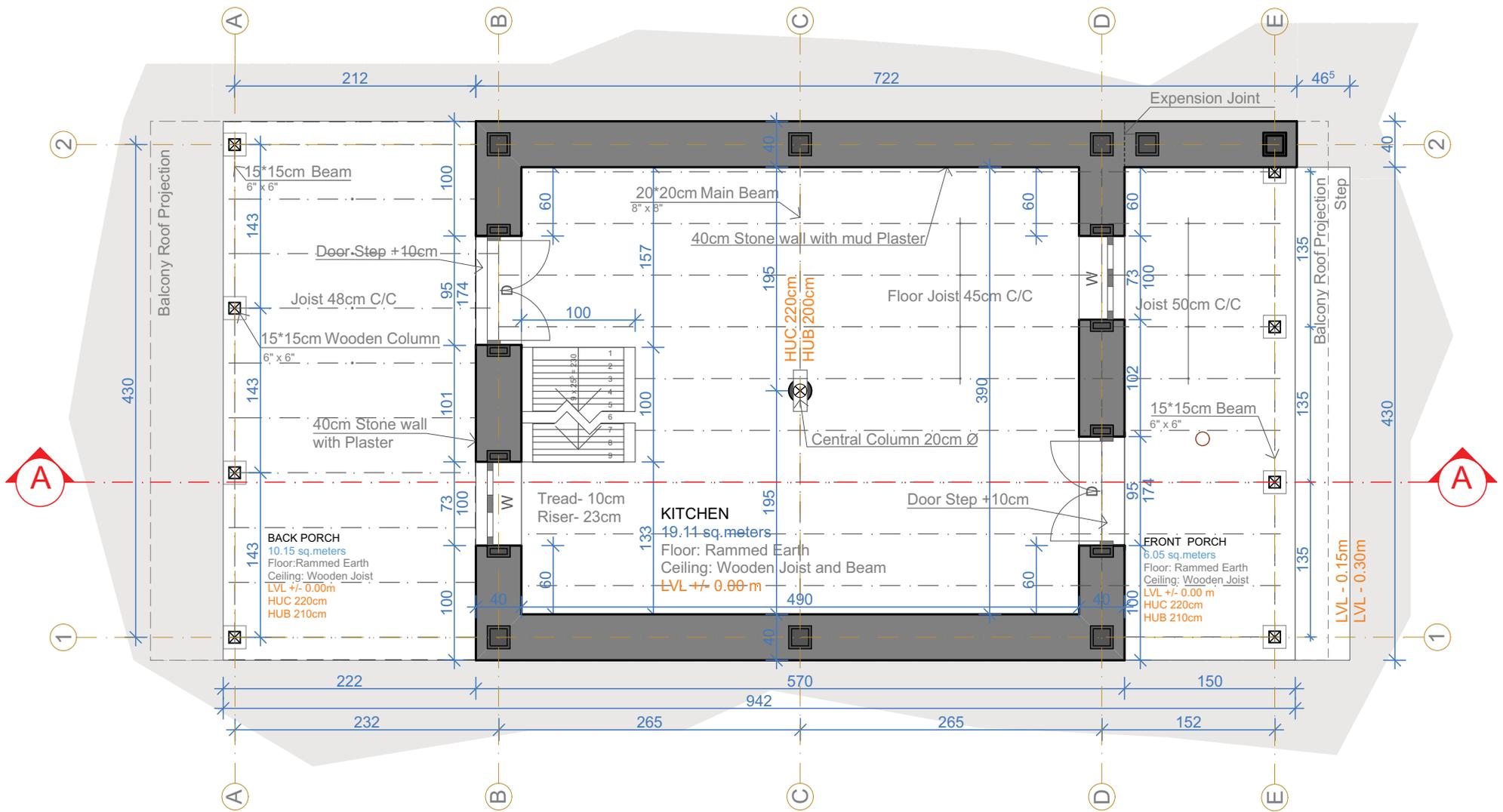
Charghare is a village development committee in Nuwakot District.

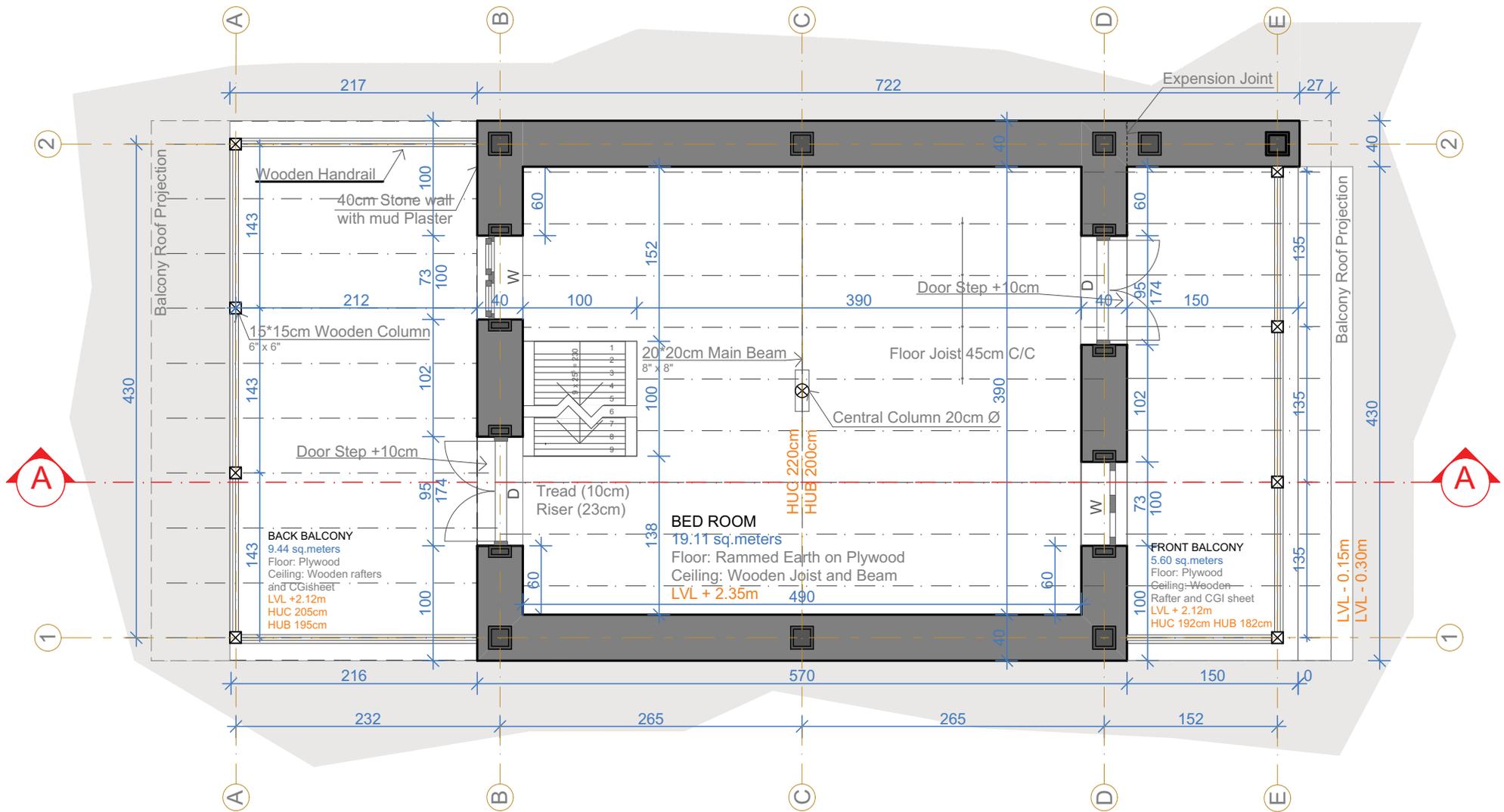
At the time of the 2011 Nepal census, it had a population of 5 419 people.

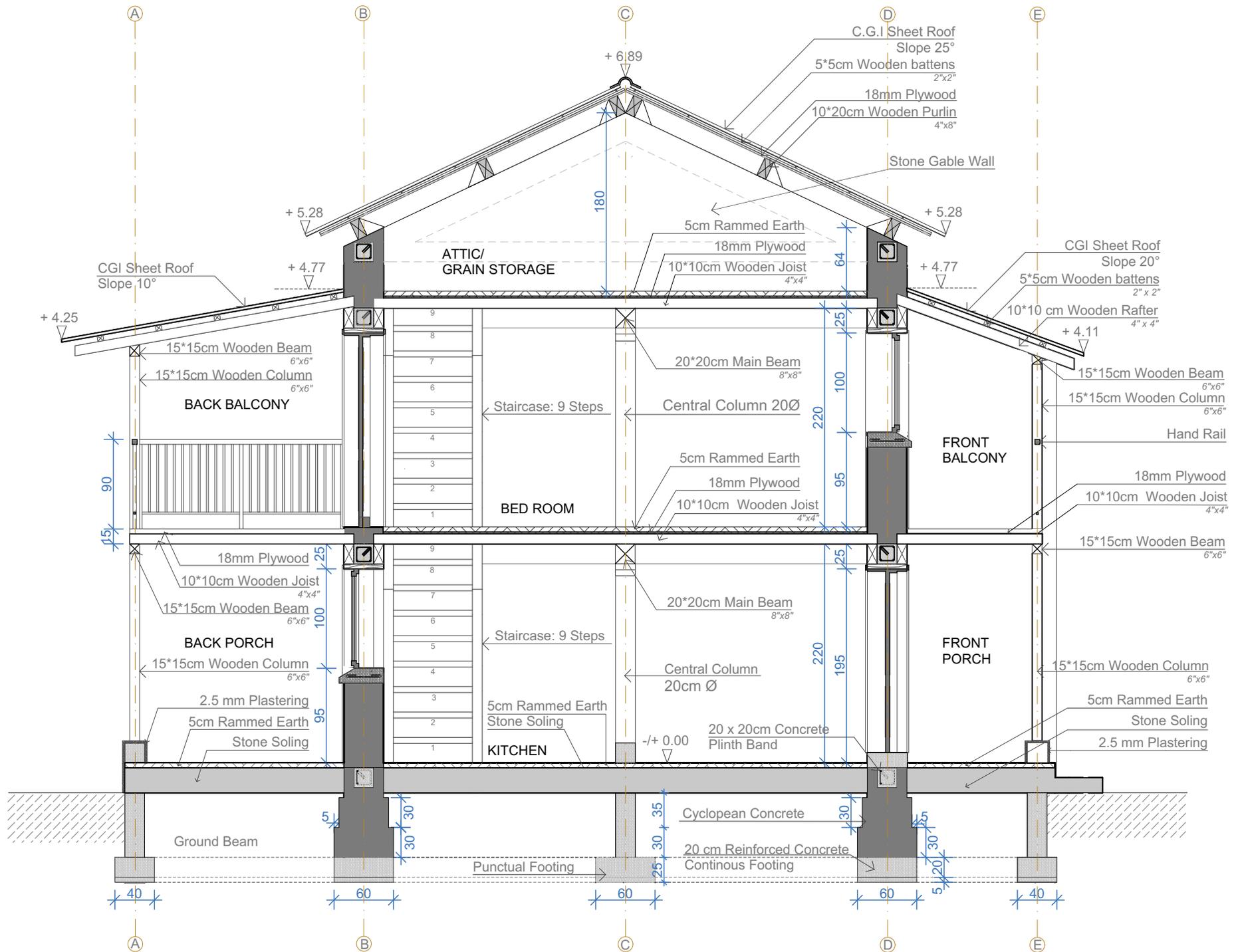
Tamang are one of the indigenous inhabitants of Nepal. They have specific beliefs visible in each house like a central wooden column in the middle of the main room which they consider as a prime element for the stability of the family.

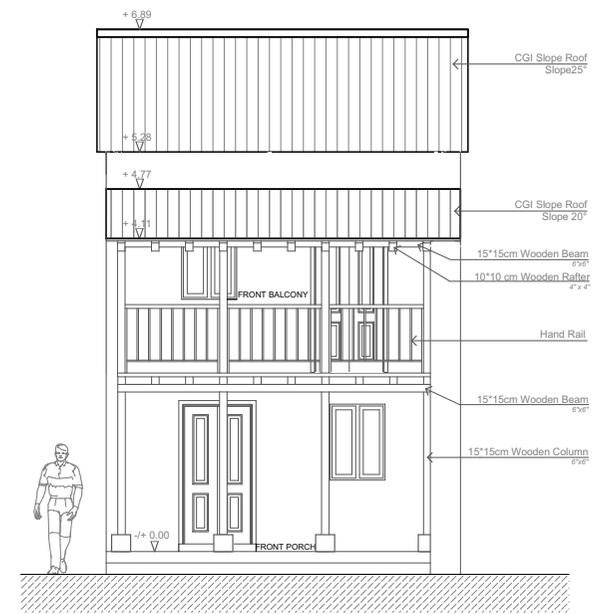
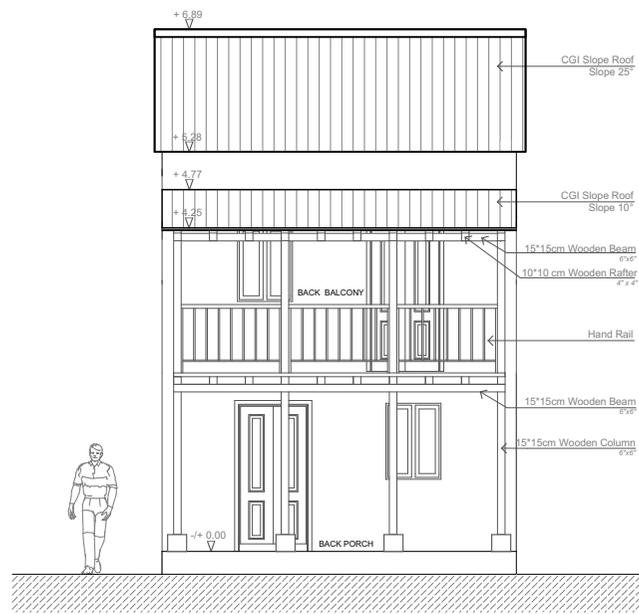
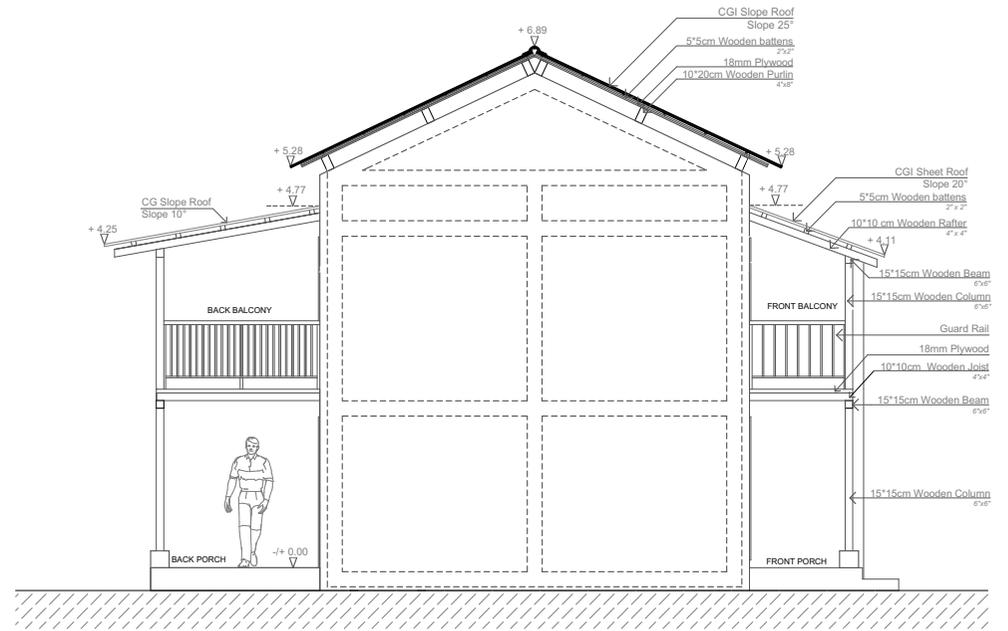
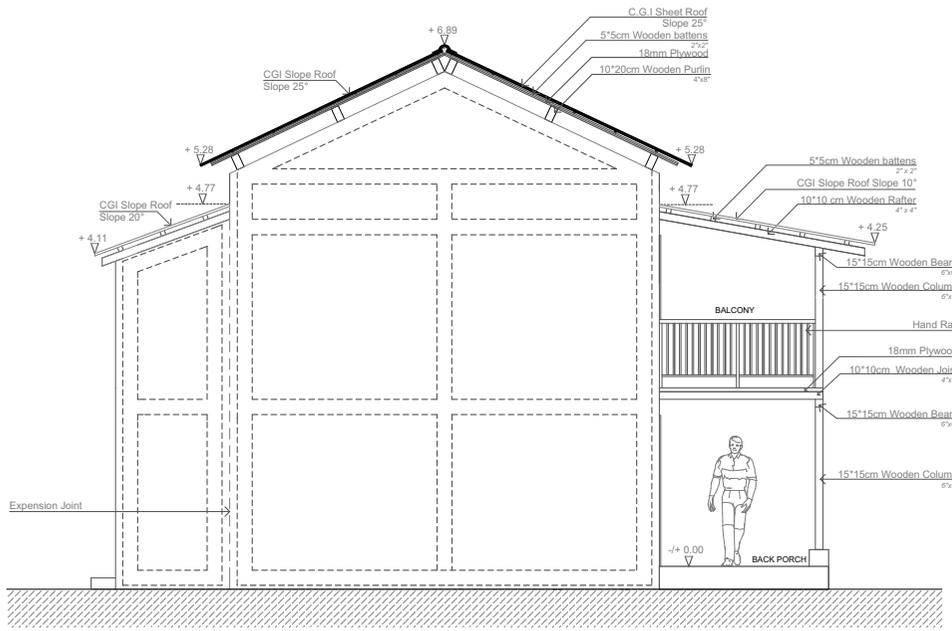
Similarly, their construction method is composed of stone masonry with dry mortar to trap air inside for better insulation.













TAMANG HOUSE MODEL - SALME COMMUNITY



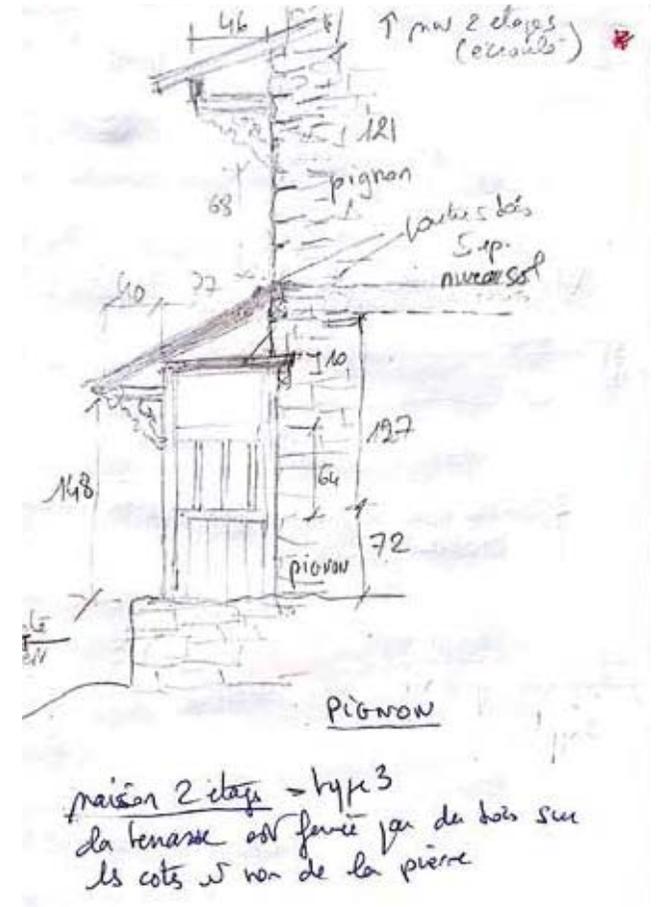
Salme is a village development committee in Nuwakot District in the Bagmati Zone of Central Nepal.

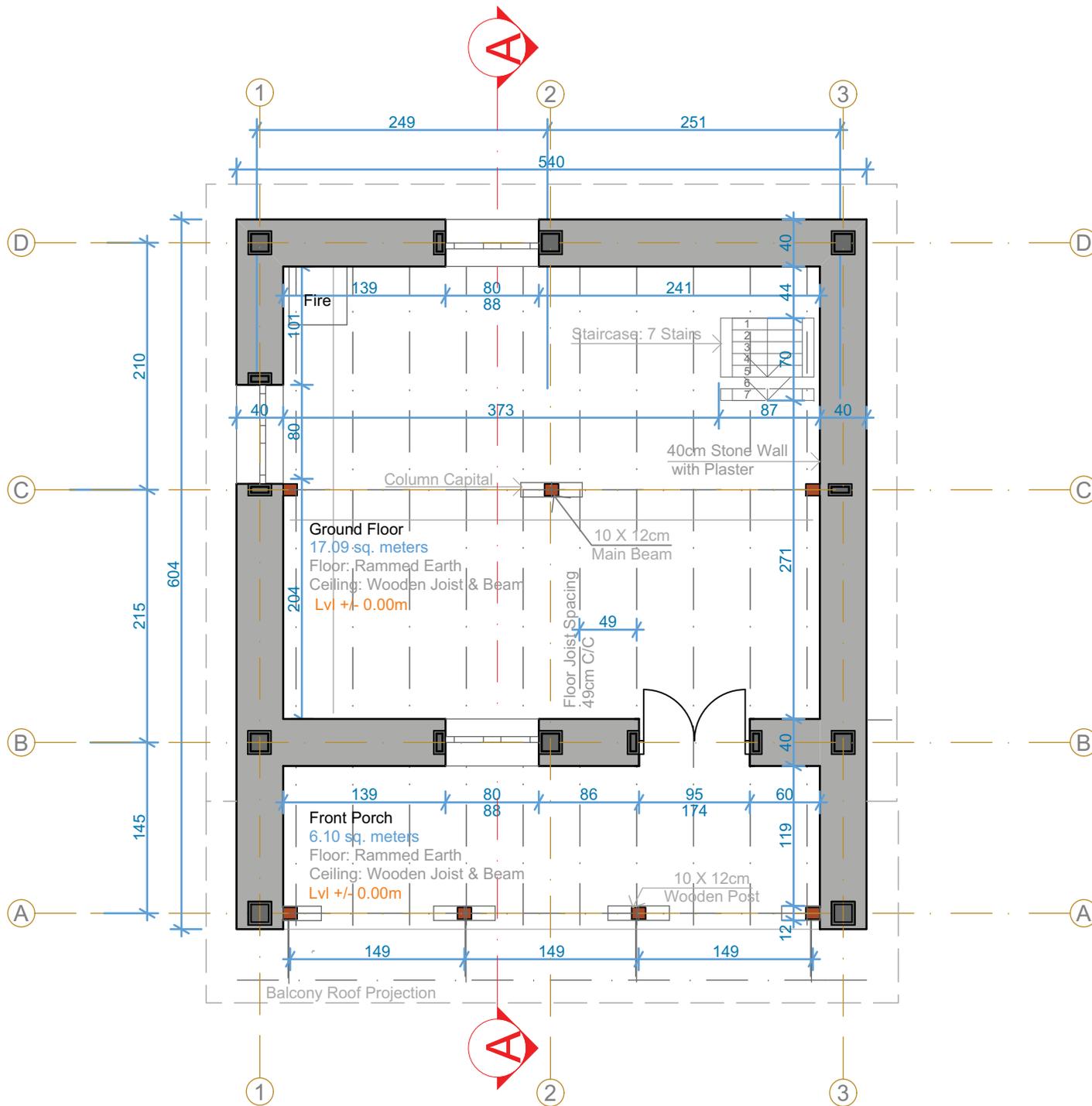
At the time of the 1991 Nepal census, it had a population of 1678 people living in 355 individual households.

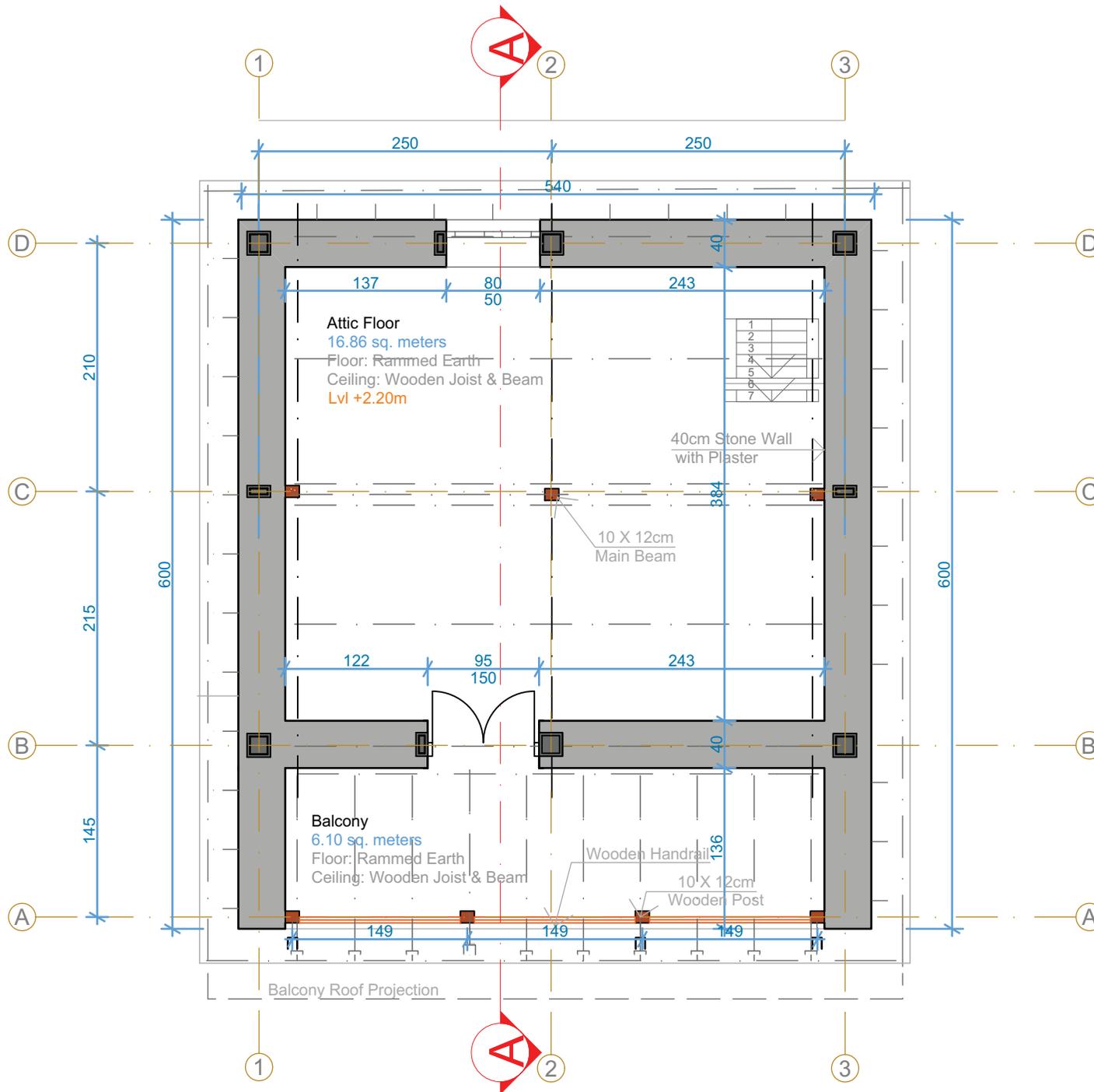
Tamang House Model of Salme Community is a two storey house, accomodation for 5 to 7 family members. The improved house model preserve the vernacular aspect of architecture with earthquake-resistant standards.

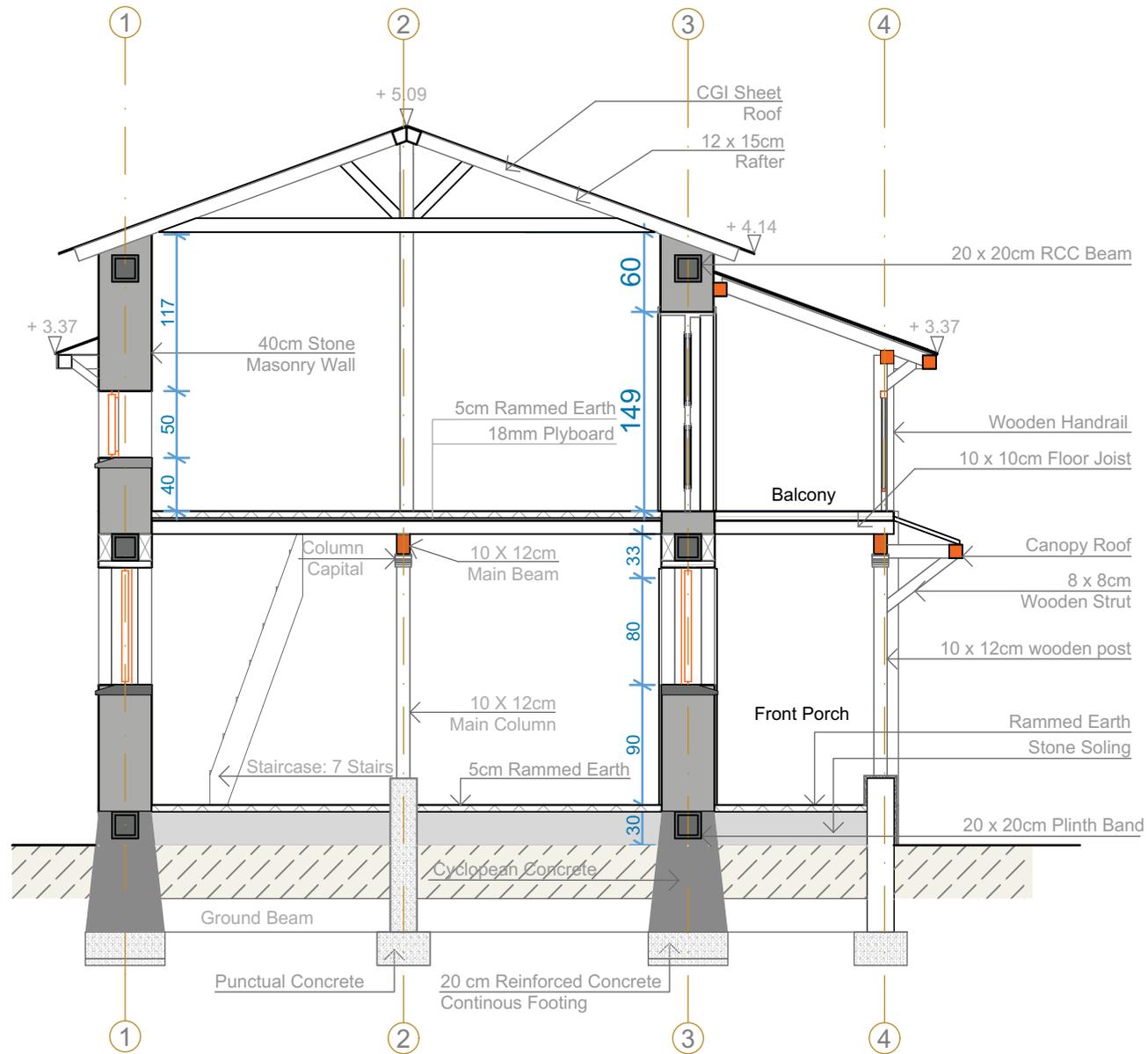
It consists of two rooms : a bedroom and an open kitchen in the ground floor for the family and an extra room for tourists in treks or an attic space in the first floor. The house can be up to three storey depending on the size of the family.

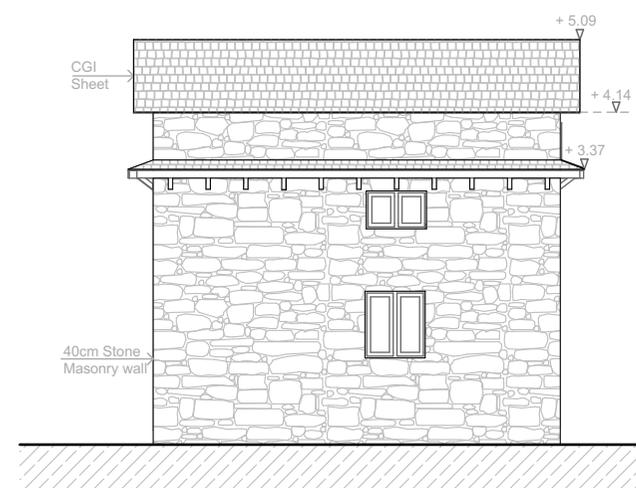
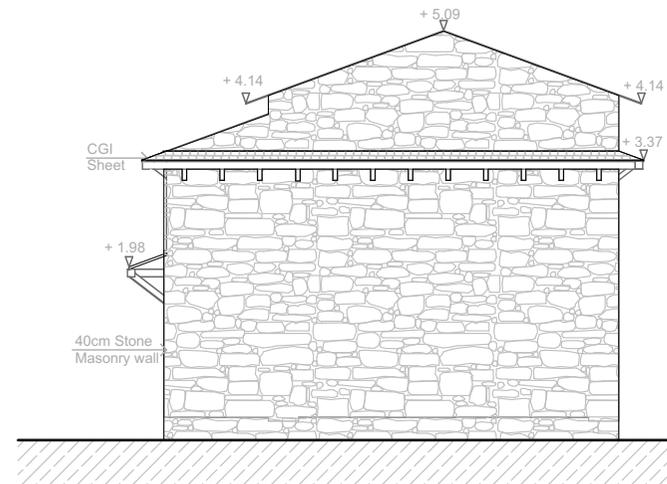
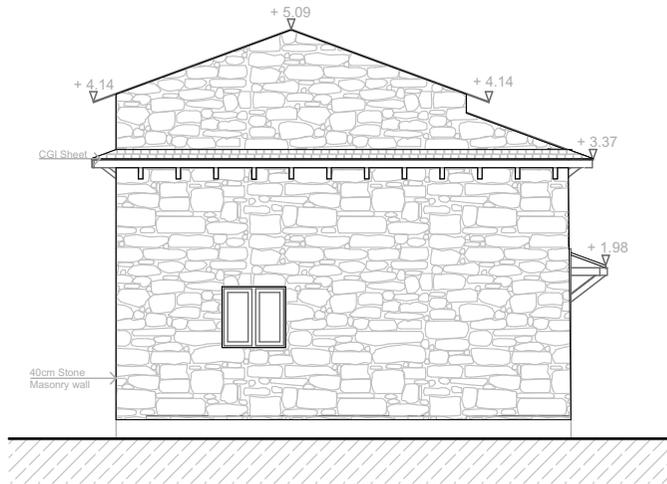
The total ground coverage of the house is 32.40 square meters and the total floor area is 64.80 square meters.













Afterword

During its intervention in Nepal, Emergency Architects Foundation observed and analyzed damages on houses after the 25th of April's and 12th of May's earthquakes. This damages suggest that the traditional constructions would need some adjustments in order to resist to any upcoming earthquake. Also, the people living in affected areas are under temporary shelters and need to endure the potential risks of landslides or additional earthquake(s), the monsoon and associated flooding and illnesses leading them to a precarious state.

Whereas it is important to save and preserve the vernacular architectural heritage in order to perpetuate Nepali culture and knowhow of the entire villages. The results of our assessment showed the necessity to adapt the buildings in compliance with the earthquake-resistant standards.

Thus, our foundation produced a well-explained design catalogue of 9 typical and traditional Nepali houses reinforced seismically, for a better resilience considering the human safety, representative of 3 ethnic groups: Tamang, Newar, and Gurung.

These 3 ethnic groups are located in several places in Nepal: Kathmandu Valley, Gorkha District, Nuwakot and Rasuwa Districts, which are some of the areas severely affected by the two earthquakes of April and May 2015.

Our catalogue shows the Nepali diversity in rural remote regions and provide to everyone, who is willing to rebuild and reinforce houses in Nepal, a typological study regarding to the habitat, the local various vernacular architecture, the high level of quality, the tradition of ethnic groups, and also solutions to make earthquake-resistant each of these houses respecting the uses and customs of the Nepali population.

The work of Emergency Architects Foundation will help you to understand the design and the sustainable constructive implementation with the strong desire to respect the traditional construction's typology, specific to each area, using the local materials combined with technical construction improvements (reinforced concrete columns and beams to maintain the house structure up, mechanical connection between walls and wooden slab / roof, the provision of horizontal bands, vertical and corner reinforcements, T-junctions to bind the house as a frame structure), following the strict rules of the earthquake-resistant standards.

Therefore, buildings and lives will be safer in case of a new natural disaster. Tradition and earthquake-resistance are possible.



Support us



Since 2001, Emergency Architects Foundation has been developing projects around the world to help people in needs to rebuild their lives. Numerous donors have already supported us. This support allows us to maintain our financial independence but also to act as quickly as possible and without any constraint for those who have been affected by natural disasters or conflicts and have lost everything.

Now, we need your help to continue our actions. This is why, to continue the action engaged and begin without delay permanent and sustainable reconstruction projects, the foundation is calling for donations and for public, individuals and companies generosity to support its actions in Nepal and to implement as soon as possible efficient and adapted rehousing solutions for Nepalese victims of these terrible earthquakes. To follow our actions, simply go to our website: www.archi-urgent.com.

Donations can be sent online via the website of the foundation www.archi-urgent.com or by mail to Emergency Architects Foundation - Solidarity Nepal, 73 boulevard du Cange, BP 10421, 80004 Amiens cedex 1 - Tel. + 33 (0) 3 22 80 00 60.

We would like to thank all of you, individuals, associations, organizations or companies who are willing to support the actions of Emergency Architects Foundation in any way possible.

Help us **to restore lives by building back walls**, we are all **constructor of hope** !

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