

Tibet Earthquake Competition

Entry: 19649-Gars-B



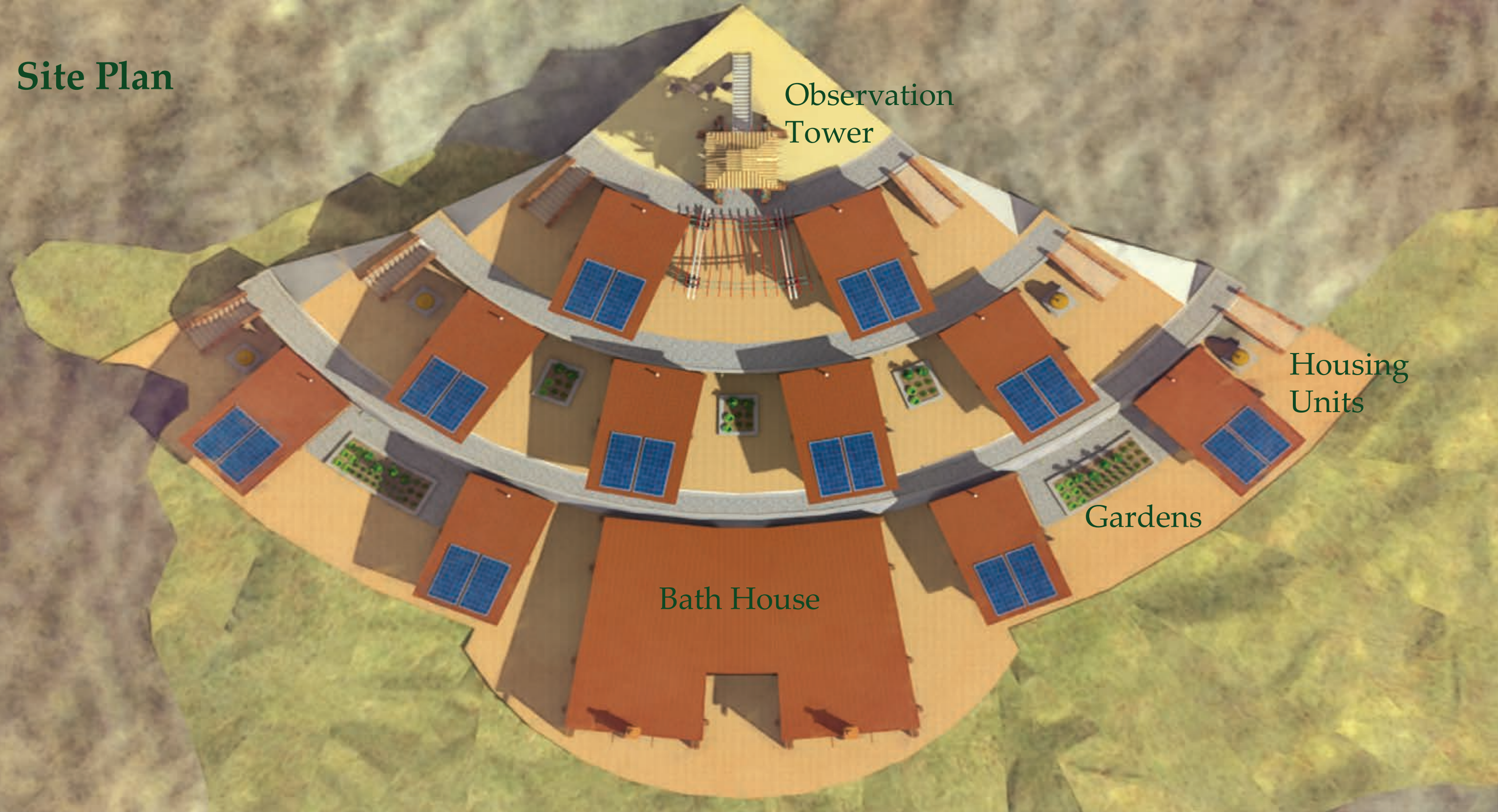
Christopher A. Lobas & Associates, Architects

Christopher Lobas, Principal Kevin Krol, Design Architect
Eric Ramsay, Designer Jason Shui, Translator
David Haggerty, Construction Estimator

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Site Plan



Concept: Mountainside Terraced Village.

Tibetans often choose sites with spectacular views. This terraced design preserves the view for all.



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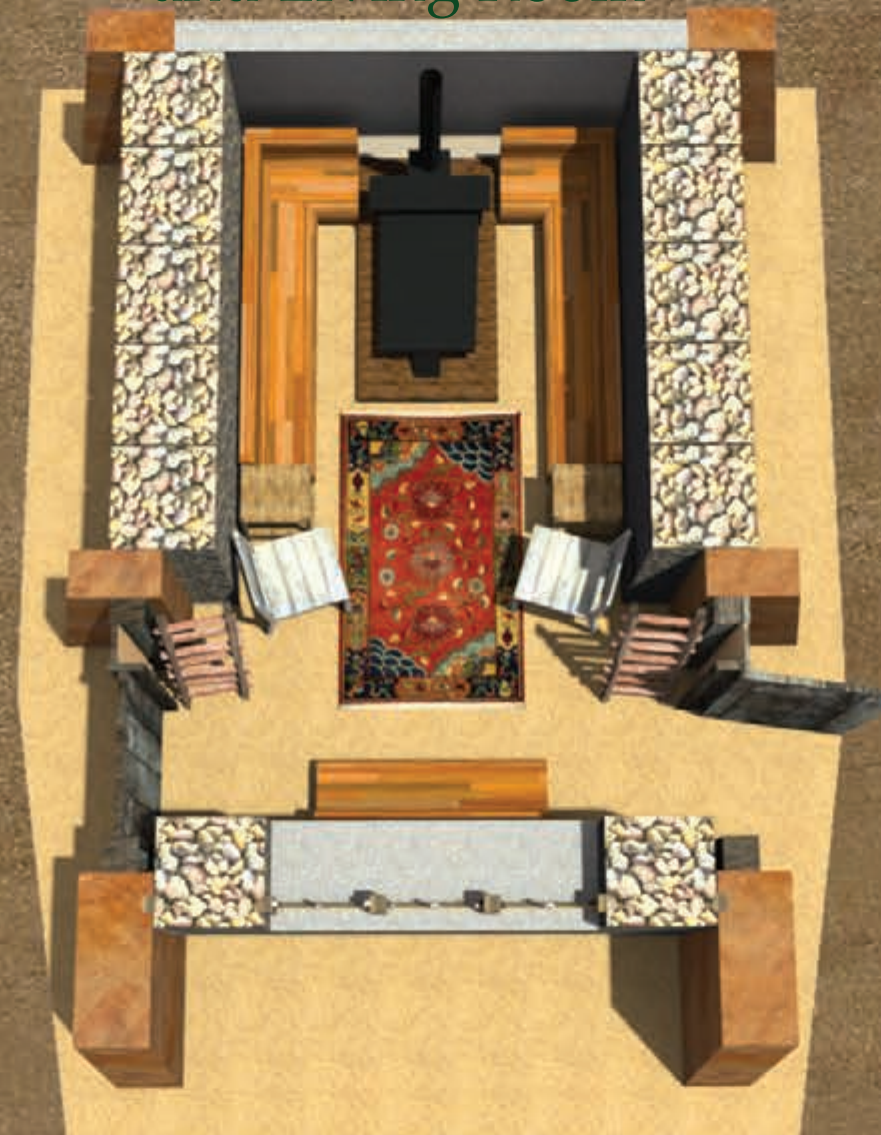


Second Floor Plan



First Floor Plan

Kitchen with Stove
and Living Room

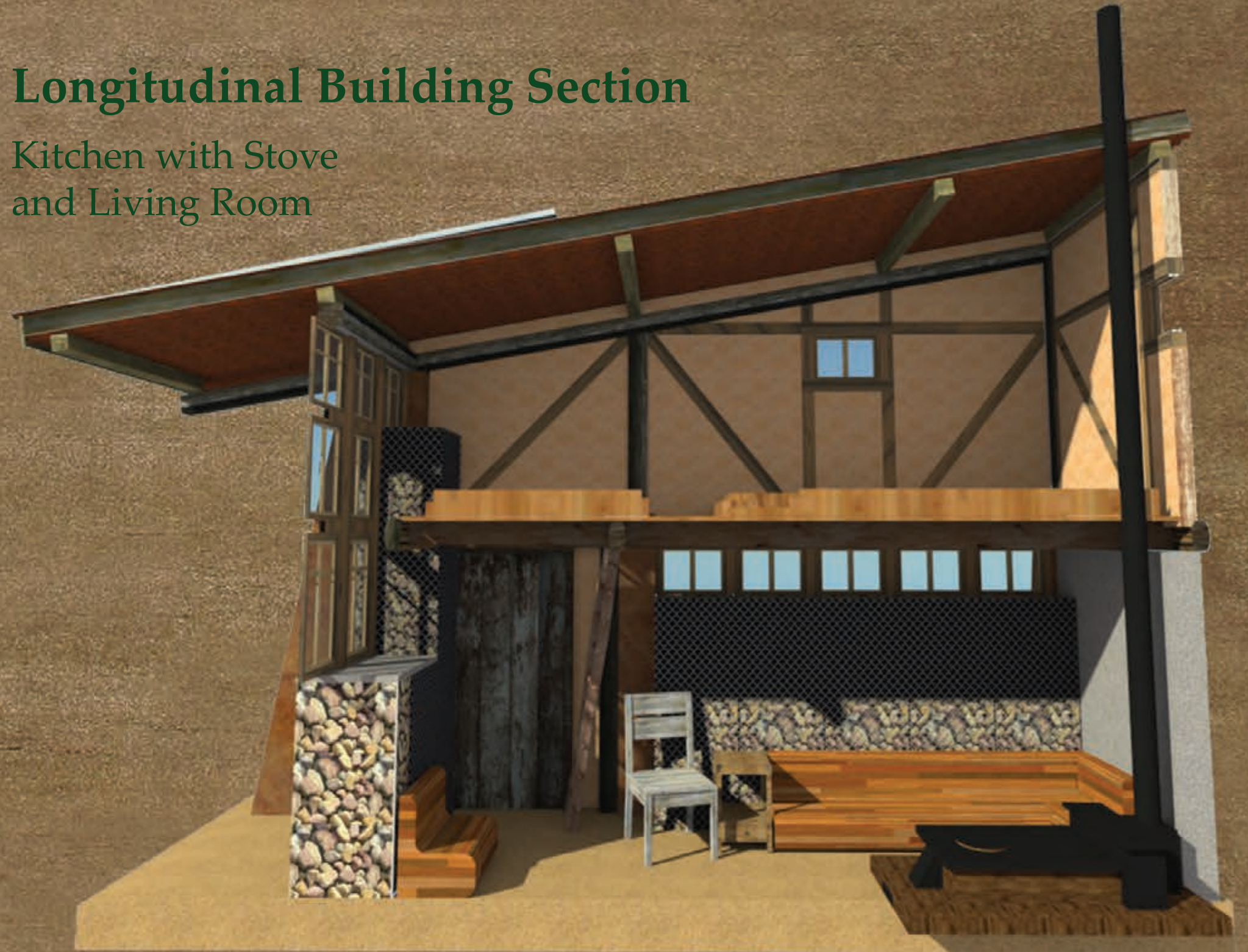


Each dwelling unit can provide living quarters for 6-8 individuals. Water is shared in a “well-wall” typical in Tibetan mountain construction.



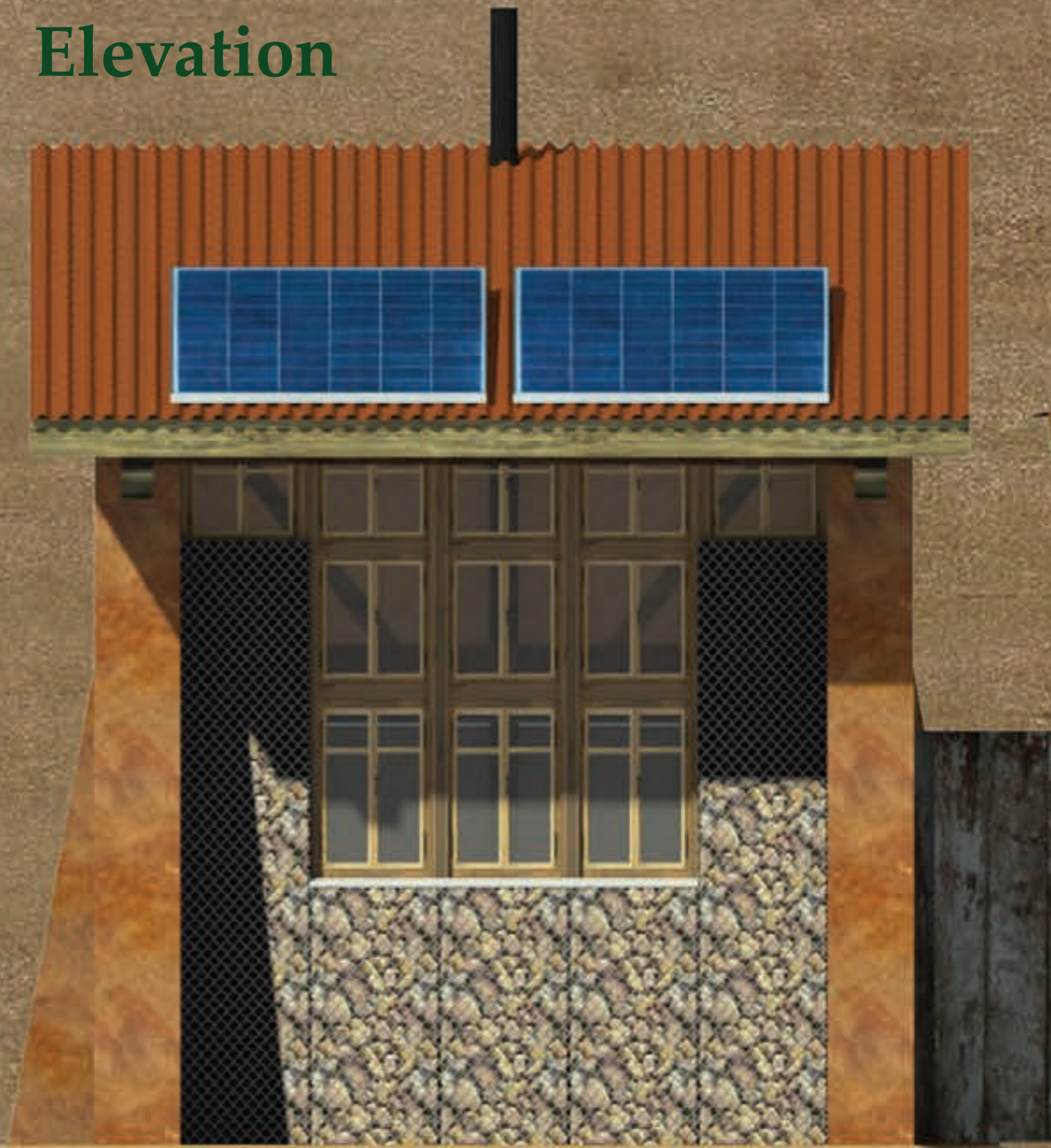
Longitudinal Building Section

Kitchen with Stove
and Living Room

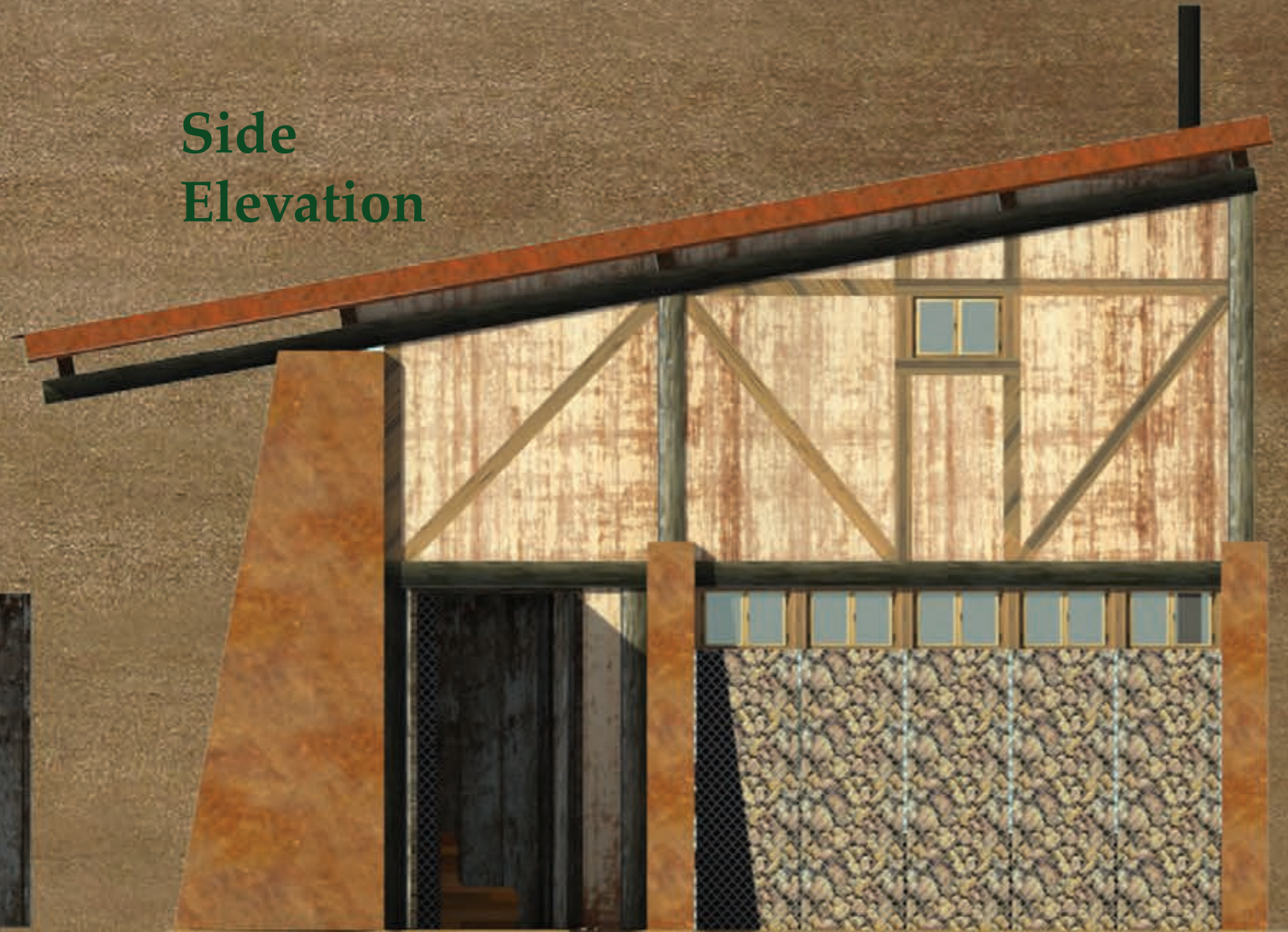


Dwelling Units are of Hybrid Construction:
Gabions (cages with rubble and infill) and
confined masonry (concrete-bound construction)

Front
Elevation



Side
Elevation



The upper level is built with timber-frame, of much lighter construction. Roof is corrugated metal. Photovoltaic panels power each dwelling unit.

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Construction Instructions

- 1) Construction begins with the selection and surveying of the site
- 2) The tiers are placed, with correct retaining walls to hold back the soil bearing pressure
- 3) For residences, gabions are placed first, filled with stone, rubble, and even debris.
- 4) Concrete piers are placed at edges, using reusable formwork.
- 5) Wood framing is installed, using traditional methods commonly known to the villagers.
- 6) Roofing is installed with cor-ten steel surrounding a matrix of insulation
- 7) Finishes, both external and internal, are plaster and are installed with trowel
- 8) Units are modular, and similar from site to site, whether sloped or flat
- 9) Bathhouse and observation tower are shared facilities.
- 10) Trellis and gardens are installed

Construction Estimate by David Haggerty

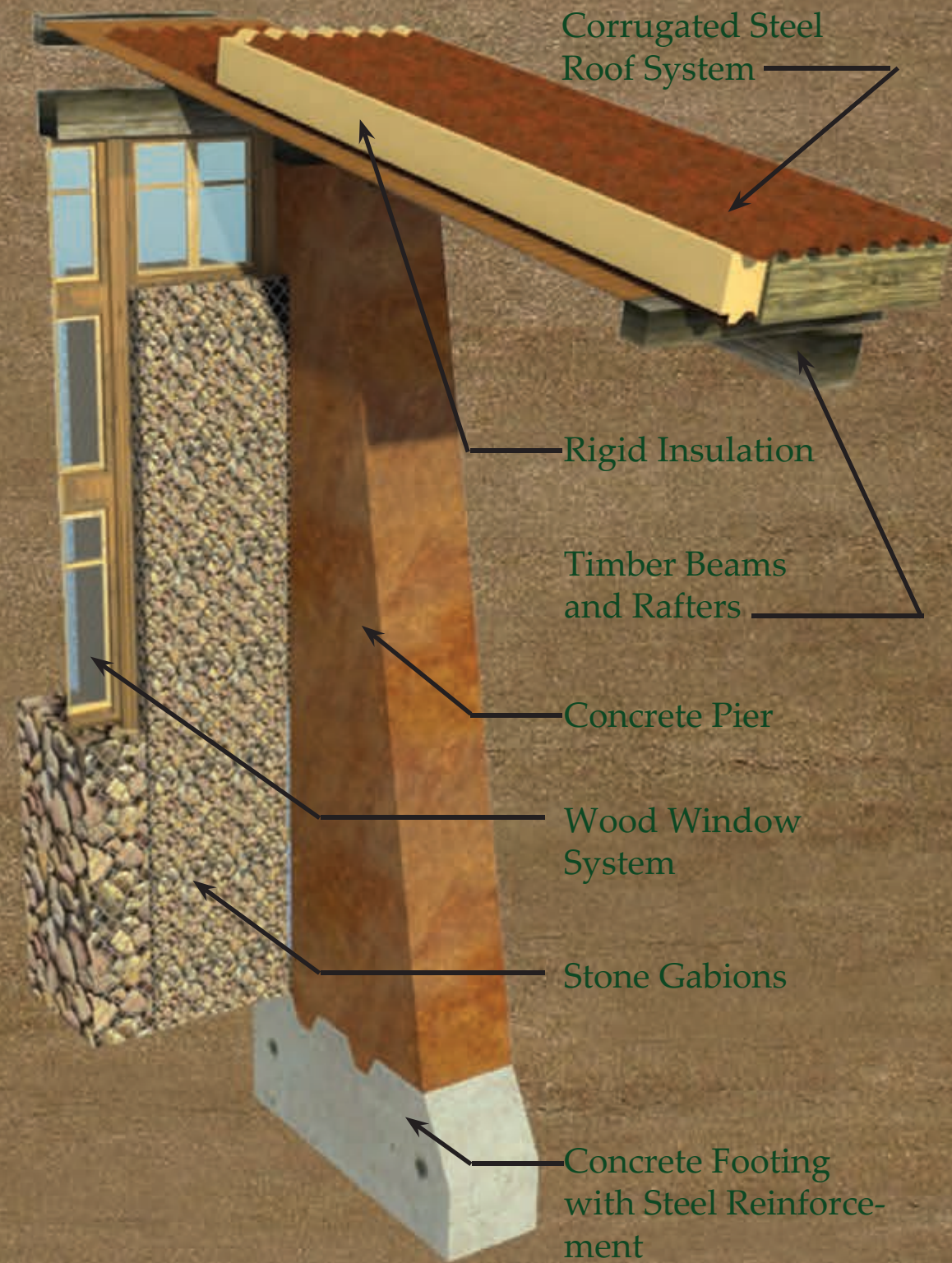
Costs in U.S. Dollars per similar scale U.S. project: \$365,037 or 36,503 per unit.

Multipliers for Tibet by Jason Shui

Material: 1.5 x similar U.S. project

Unskilled Labor: 0.2

Skilled Labor: 0.3



Construction Instructions

- 1) 施工从选址和地形勘探开始
- 2) 每一层住房由相应的挡土墙支撑土层承载能力
- 3) 对各个住房施工，先填充钢筋石笼墙，内部可使用石块，碎石，甚至建筑残骸
- 4) 使用可重复利用的模板将混凝土立柱置于钢筋石笼墙两侧
- 5) 使用村民熟悉的方式将房屋内部木制框架搭建起来
- 6) 房顶由耐候钢（cor-ten steel）及隔热层矩阵搭建
- 7) 最后用泥刀配合灰泥和石膏粉刷外墙和内墙
- 8) 每栋单元是独立的，不管是平顶还是斜顶，在每处施工都是相似的
- 9) 澡堂和瞭望塔是公用设施
- 10) 搭建植物棚架和花园



Construction: Step-by-step Instructions Mountainside Terraced Village

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Design Concept: Mountainside Terraced Village

Tibetan housing inhabits both the plateau and elevated land. The variety of sites, and slopes provides great diversity in housing. The most desirable sites are usually elevated, and face south. This instinctual tendency towards the availability of light and heat creates a marvelous aesthetic of tiered homes in the landscape, each overlooking the ones below and allowing views for those above. We chose this tiered site condition as our primary design case due to the clear geometric plan and site organization, and as a response to the sublime Tibetan mountain landscape. The homes are readily adaptable to flatter land as well, where they can also be arranged harmoniously and in interesting patterns.

Heavy walls are not atypical in Tibetan homes, and their structural bearing capacity should be noted as a benefit during seismic events. For our design, we integrated heavy gabion walls with concrete piers, creating an effect similar to that of confined masonry, a design with proven seismic effectiveness, and recommended in many nations. The gabions are squeezed between the piers, preventing movement of the stonework within. Our pier design is battered, not unlike that of many traditional Tibetan dwellings. The gabions, truly cages of metal with heavy ballast within, can really contain anything. With the current predicament of widespread rubble and debris from collapsed construction, this ballast can range from stone to broke blocks to bricks and clay tile, really, any found heavy objects. An alternate to the gabion would be the common Tibetan material of rammed earth, also requiring considerable thickness, and structurally benefitting from the concrete pier bookends.

Design Concept: Mountainside Terraced Village

设计理念： 山坡梯田村庄

藏族民居位于高原和高地上，不同的地形和山坡造就了住房的多样性。最理想的居住地通常位于高地并且面朝南。随着对充足光和热的本能驱使让我们设计出建造在山坡上的呈奇异美感的分层房屋结构，上一层俯看着下一层，还可以为上层建筑提供宽阔的视野。我们选择这种分层建筑作为设计主体是出于对当地几何平面和现场施工组织便利的考虑，以及对西藏山地自然景观的崇敬。这些分层房屋也可以很方便的改造成适合平地居住的住宅，并营造出一种和谐有趣的美感。

重型墙壁在西藏住房中非常典型，这种结构的承重能力在地震中显得格外有用。在设计中，我们把重型钢筋石笼墙和混凝土基墩相结合，创造出类似于约束砌体的稳定结构，这种设计被证明具有抗震效果并被多个国家所推荐。通过把钢筋石笼墙挤压在混凝土基墩间可以有效防止砌石内部滑动。我们的基墩设计是向上倾斜的，像许多传统的西藏民居那样。这种由金属笼框架组成的钢筋石笼墙内部可以用来填充任何压载物，从完整的石块到碎石到砖瓦，几乎任何重物都可以拿来填充。这样做还可以有效利用倒塌建筑的废墟，做到废物回收。替代钢筋石笼墙的另一种建筑方式是采用西藏普遍的建筑材料——夯土，但也需要相当的厚度，并在两端利用混凝土基墩立柱承重。



Design Brief Mountainside Terraced Village



Design Concept: Mountainside Terraced Village

Roofs are usually flat in the central and western Tibet, but sloped in the east and on higher ground. We chose to slope our roofs in all cases for three reasons. First, this slope allows ready reclamation of rainwater. Second, it creates a surface for our photovoltaic and solar thermal panels. Third, it is aesthetically pleasing, as it emulates a hillside or mountainside slope.

Within the individual homes, we include a main floor level with a central oven, utilized for both cooking and heating. This is a common feature in Chinese rural housing, and found throughout Tibet also. Seating is placed around the oven for family dining and gathering. The second floor is accessible either through interior ladders or the walkway from the tier above. There is room for six people on the upper sleeping level.

On each tier, between the homes, there are water walls, each with faucets tied to a central well. This type was observed as a common way for wells to be shared in Tibetan villages. A bathhouse with showers, lavatories, and toilets is centrally located in the lowest position, with ready access from all units, and constructed for best ventilation away from the village. No water is wasted, as rainwater is harnessed and gray water is recycled to best efficiency. Because of its availability at the water walls, and the orientation to the Southern sun, it was sensible to provide a vegetable garden in front of each.

Design Concept: Mountainside Terraced Village

设计理念： 山坡梯田村庄

西藏中西部的房顶大多比较平坦，但在东部高原上则是倾斜的。我们的住房采用斜顶的原因有三个。首先斜顶可以用于雨水回收再利用；其次可以利用斜坡表面安装光电和太阳能面板；最后这种设计与当地山坡倾斜角度一致，视觉效果较好。

在各个住房中，我们在一楼大厅设计了中央火炉，可以用来做饭和取暖。这是中国农村房屋的普遍布置，在大部分西藏民居中也都能看到。家人可以围坐在火炉边一起吃饭聊天。沿着一层木梯或上层走道可以到达二楼，二楼可容纳6个人的床铺。

沿山而上的每一层住宅之间均配有单独的水龙头，这也是西藏村落里普遍的取水方式。澡堂和厕所均位于最底层的中间位置，方便各户人家，同时兼顾了通风换气。所有雨水都能得到回收再利用，中水也能最大程度的回收。考虑到取水及采光便利，在每一层住宅之间的取水附近建小型绿化地是合乎情理的。



Design Brief (Continued) Mountainside Terraced Village