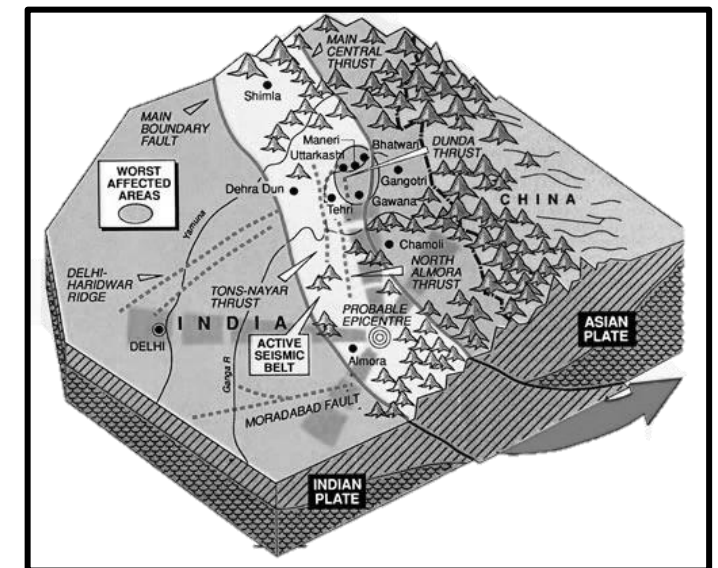
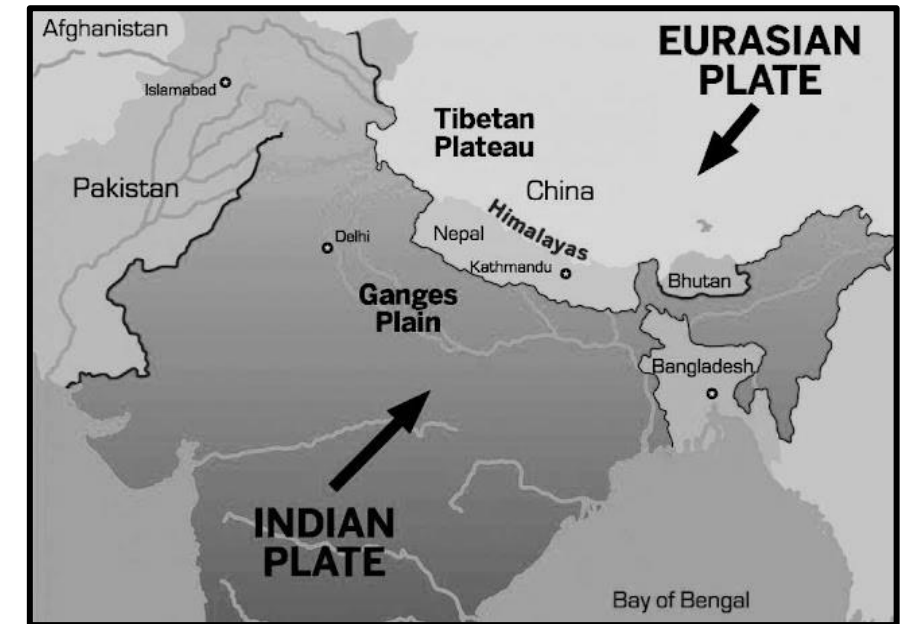
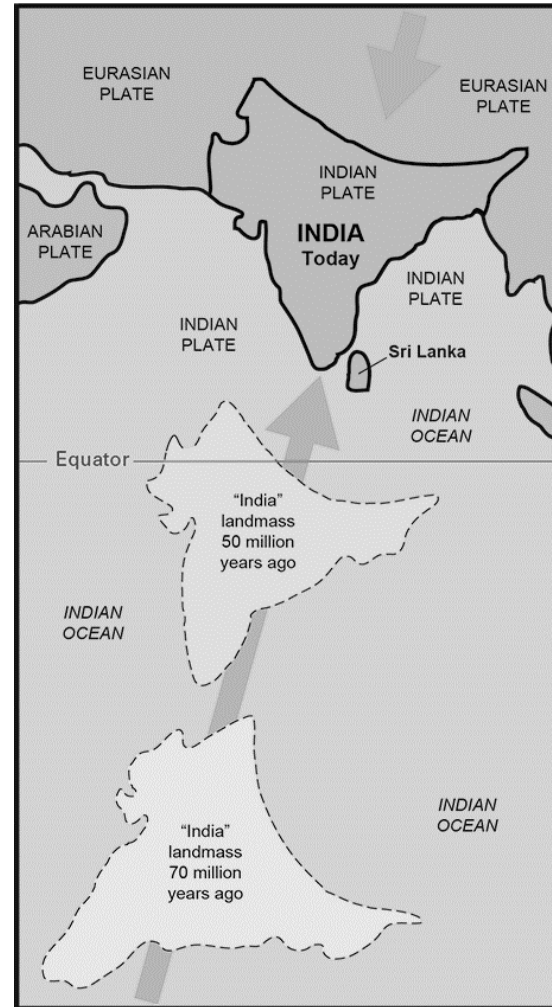


Kath-Kuni Vernacular Architecture

Seismic Resistant Architecture

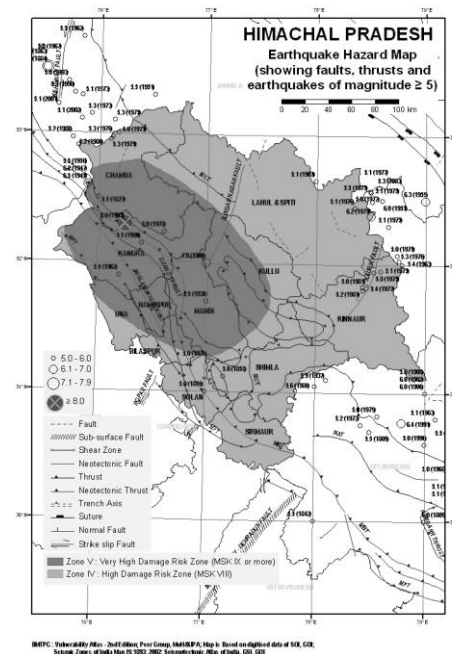
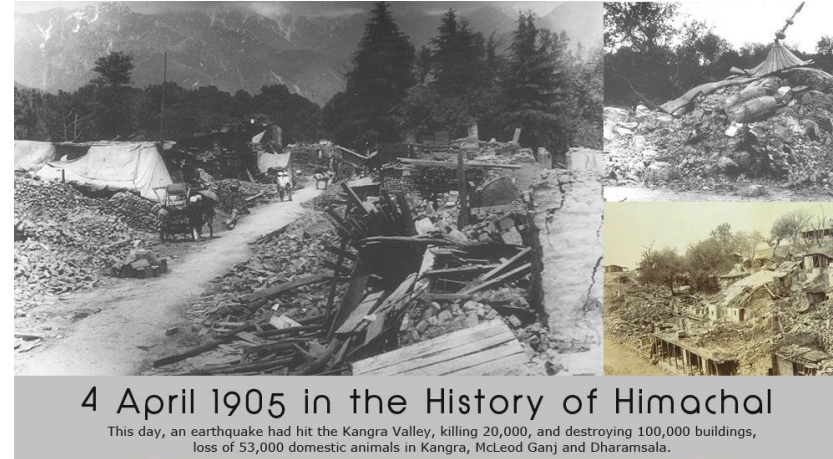
Indian Tectonic Plate and Seismic Activity

- Formation of the Himalaya mountain range – 40 to 50 million years ago
- Formed from the collision of the Indian Plate and the Eurasian Plate
- Pressure and stress built up from the tectonic movement is released as earthquakes
- Moving @ 47mm/year – 54% of the land is prone to earthquakes

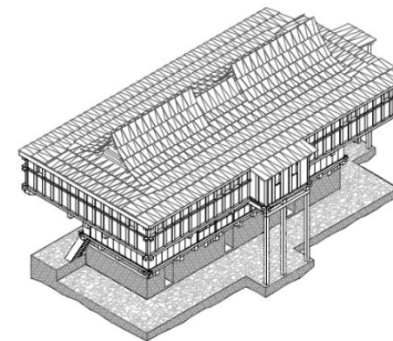


Himalayan Seismic Zone

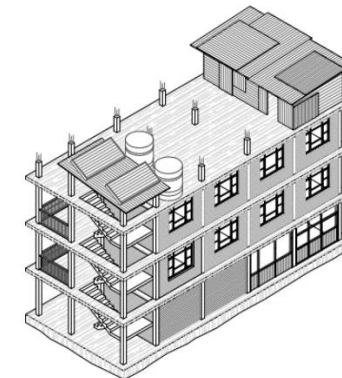
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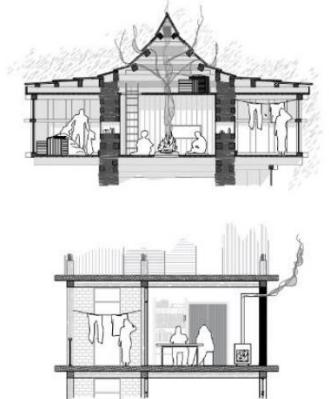
- *Kath-Kuni is an indigenous construction technique in northern India (Himachal Pradesh)*
- *Devised based on:*
 - * *Seismic activity*
 - * *Topography*
 - * *Environment and climate*
 - * *Native materials*
 - * *Cultural landscape*
- *Architecture spread over Himalayas, Karakoram range in India, Pakistan and parts of Afghanistan and China*
- *Building typology – ability to withstand significant seismic activity*
- **Earthquake Resistant Building Style**



(a) Typical vernacular Kath-Kuni building

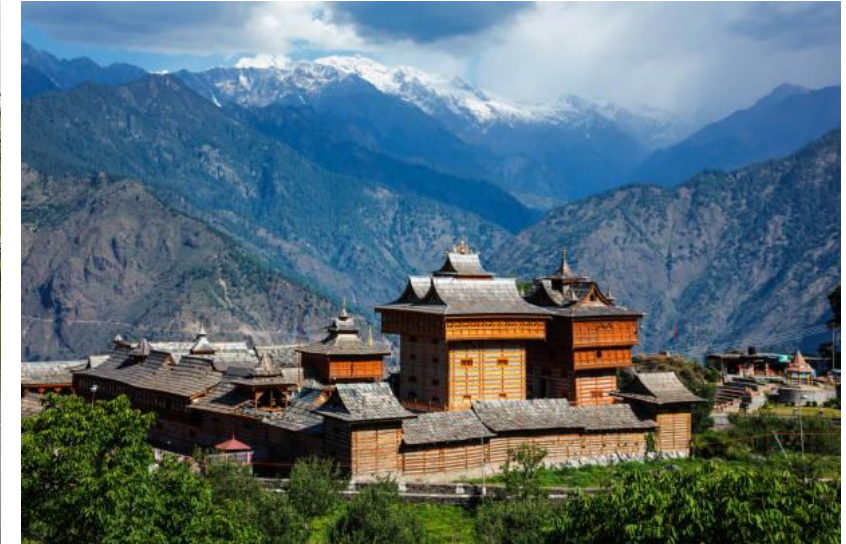


(b) Typical "Modern" concrete building

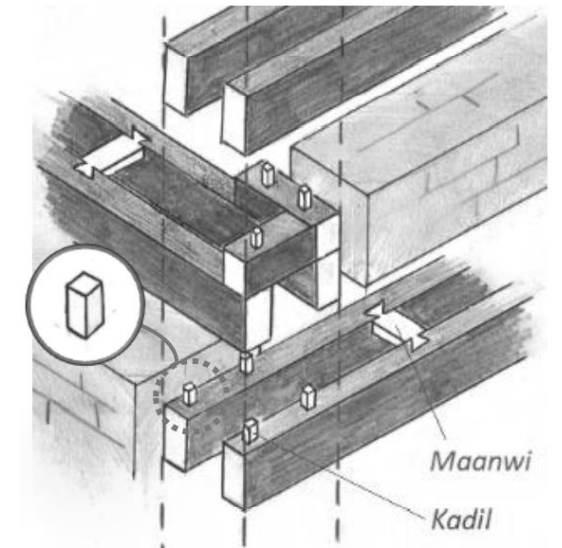
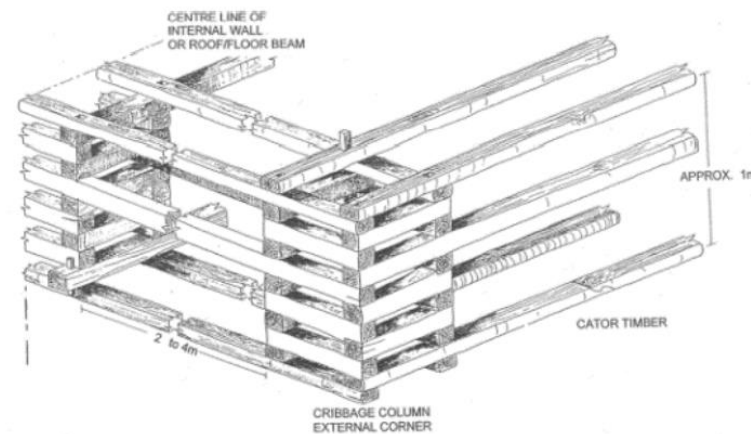
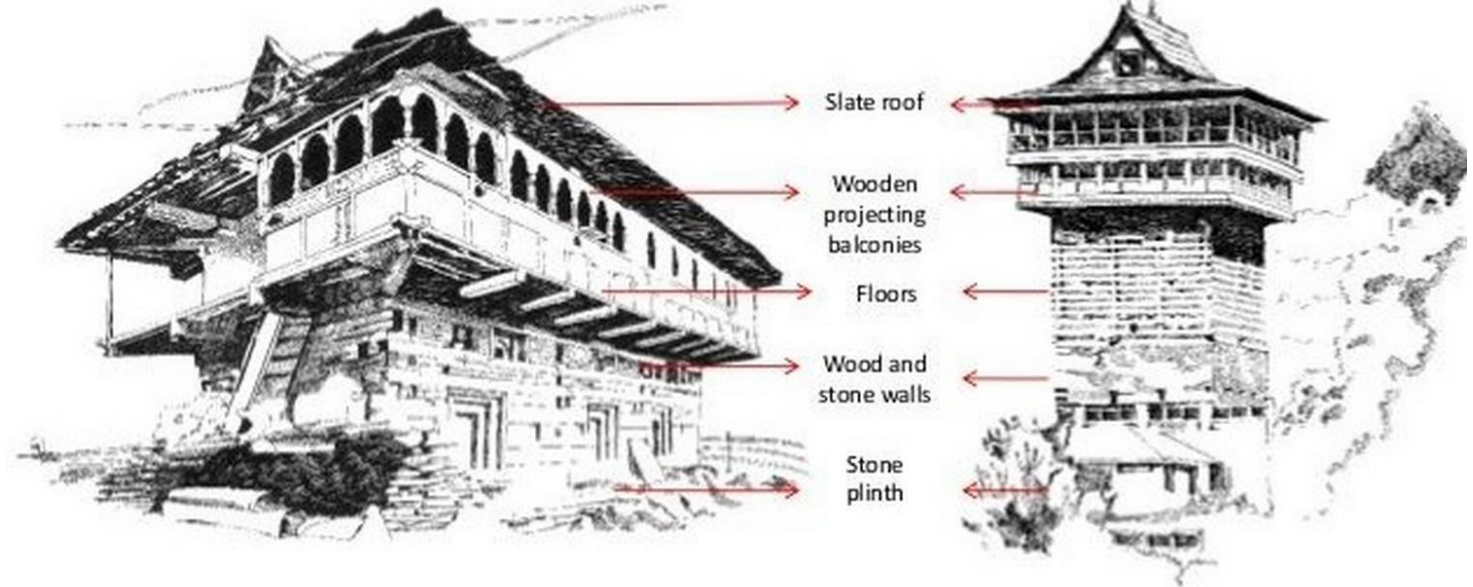


(c) Living spaces in both construction typologies

- *Himalayan Heritage*
- *Kath-Kuni means “wooden corner” in local Himachal language*
- *Building technique was never conventionally engineered but a consequence of progressive design optimization*
- *Built with knowledge of local people and improved over time*
- *Indian Himalayas are often prone to earthquakes and the inhabitants learned to deal with this hazard by improving their local architecture*
- *Koti-Banal is a similar architectural style as the Kath-Kuni*
- *During the 1991 Uttarkashi Earthquake the traditional architecture remained unharmed*

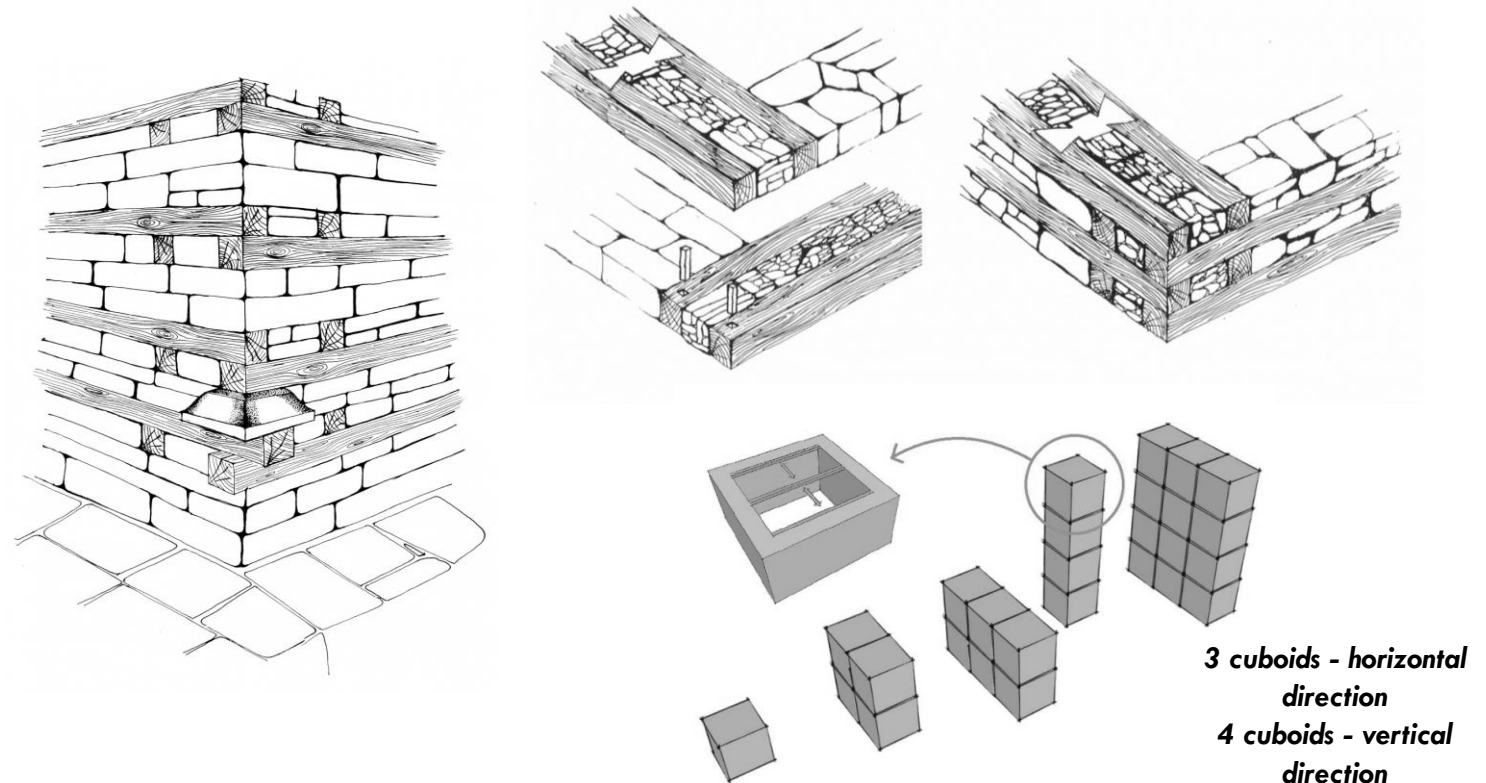


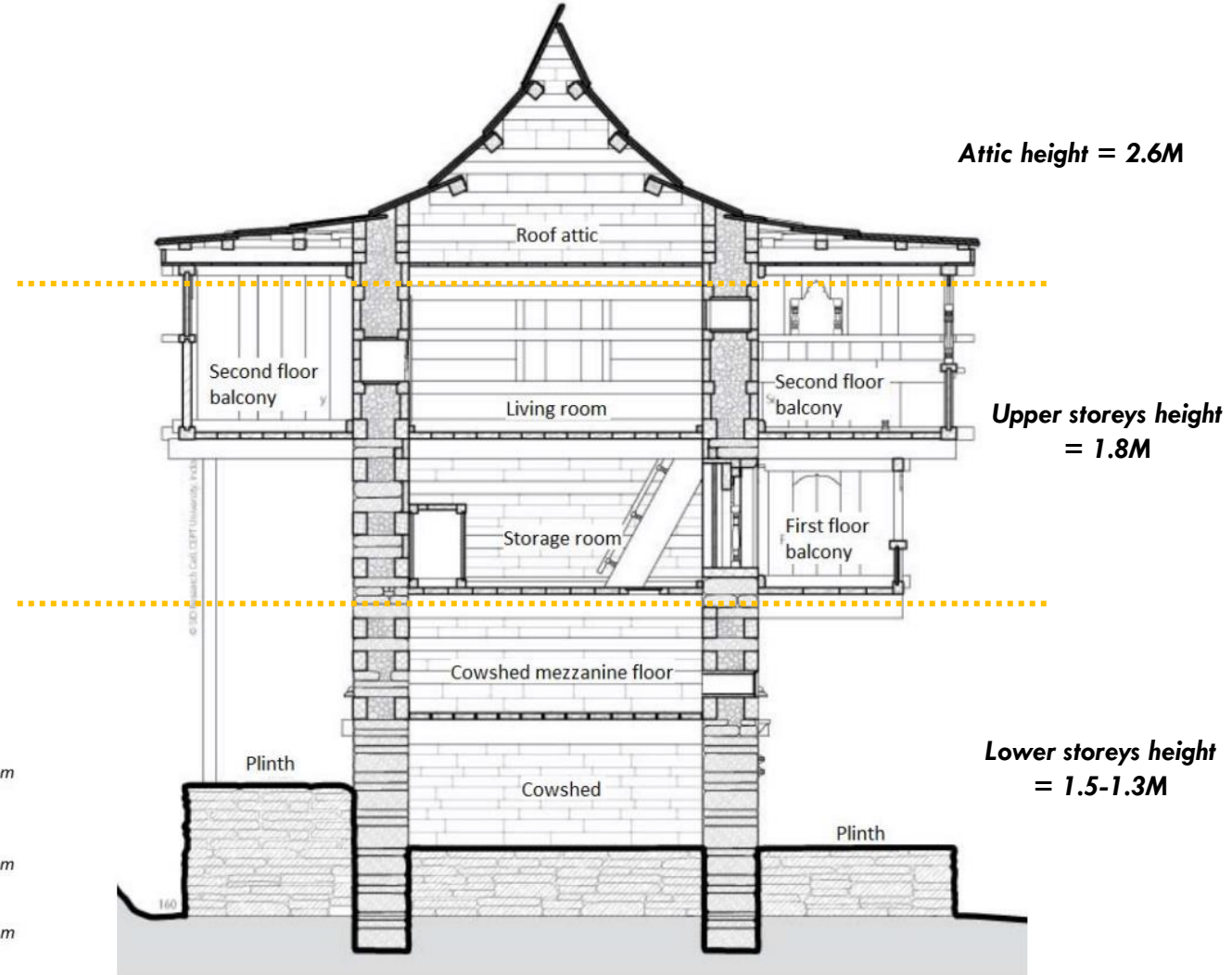
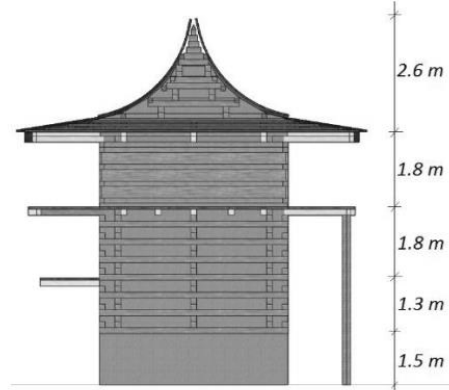
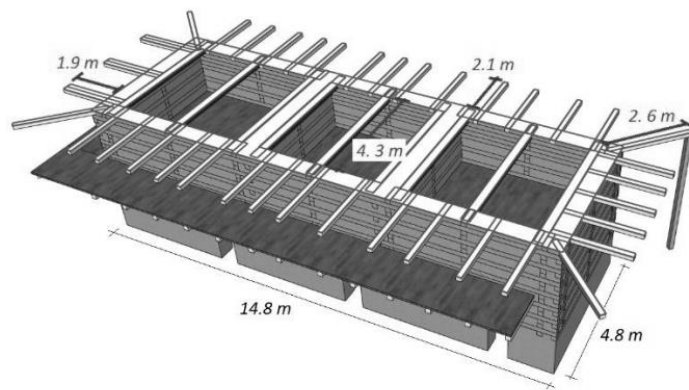
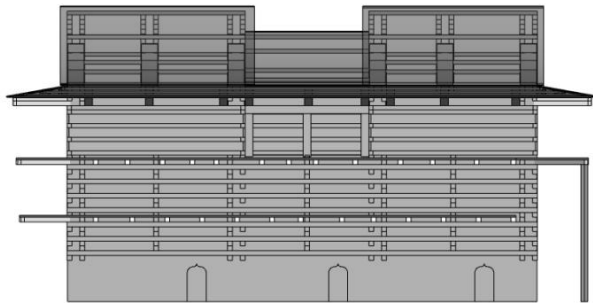
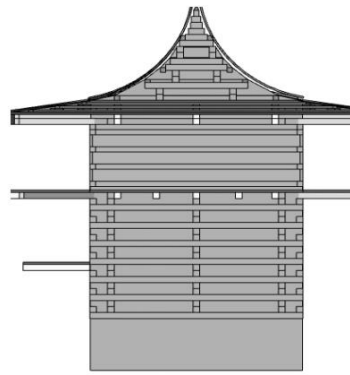
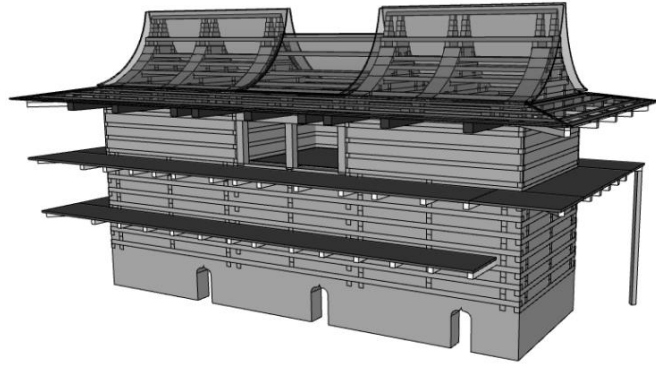
- “Cator-and cribbage” (or) “timber laced masonry”
- Characterized by double horizontal timber beams – part of the thick load bearing walls
- Timber dovetail connection used is called ‘Maanwi’
- Corners – beams are connected in the horizontal direction by timber dowels called ‘Kadils’



Old-Jubbal House

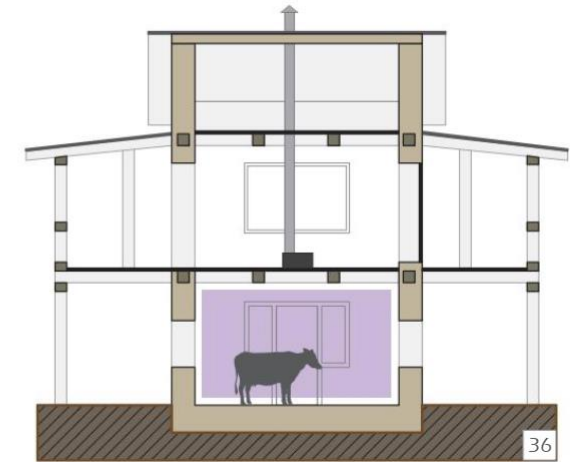
- 200 years old structure built by upper class family
- **No nails** are used in the construction
- Typical arrangement of several cuboids
- Smallest house is a single cuboid
- **Thickness of Kath-Kuni wall = 0.5M**
- Two cuboids are separated by one thick Kath-Kuni Wall
- Two timber beams are placed parallel on the stone layers – filled with stone rubble
- Higher storeys are made completely with timber





Cattle Shed

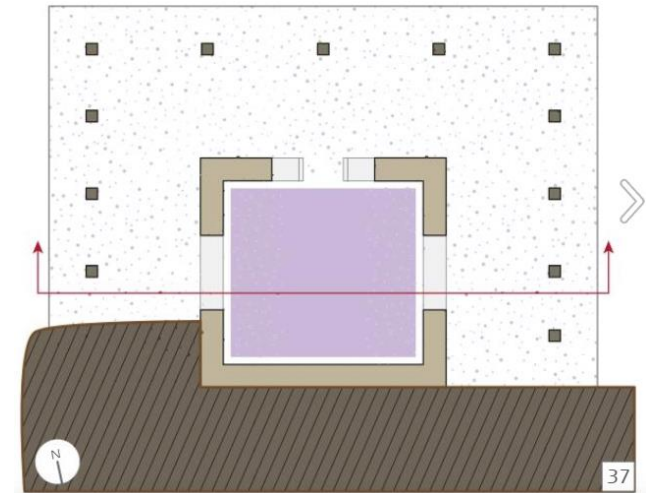
- Above the stone plinth
- Door faces the south
- Balcony for ventilation
- Wooden frames form the walls of the shed
- Openings are covered with cloth bags during winters
- Often used as a storage space



Section - View of the Cattle shed door, two openings for ventilation



Uncovered opening for cattle during summer season



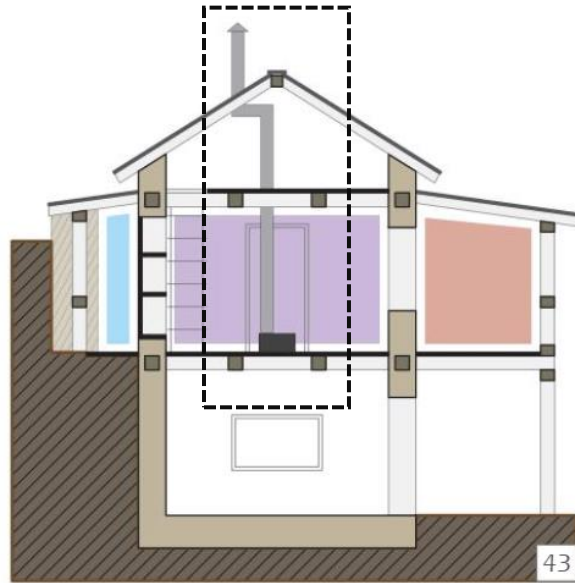
Ground Floor Plan – stone base is wider than the balcony

First floor

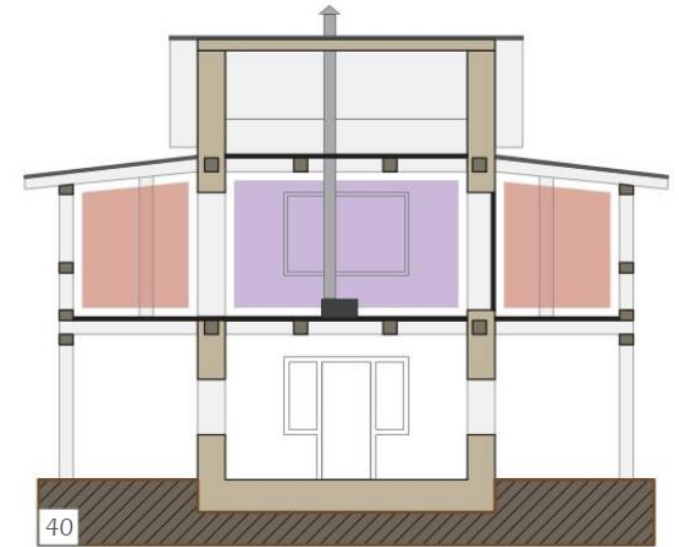
- Three openings for circulation
- Vertical circulation only through a ladder
- Most important part of the house is the hearth in the center – Tandoori

Attic

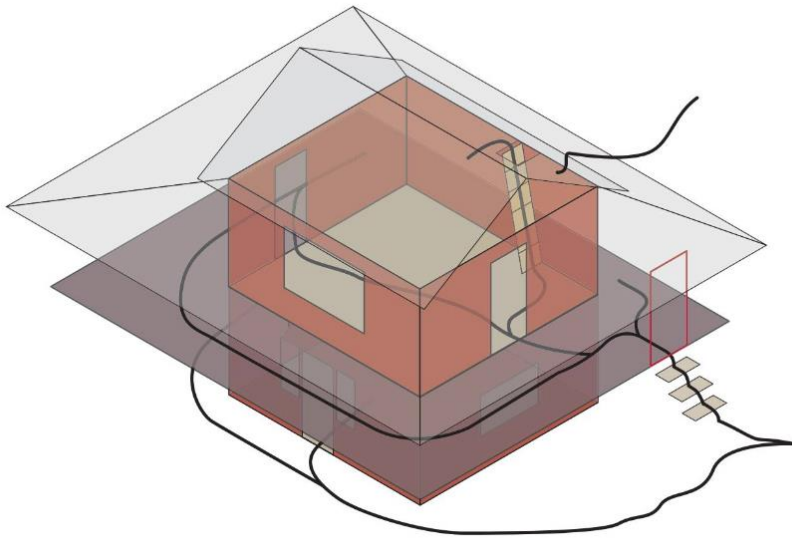
- Used as a storage or kitchen in some houses



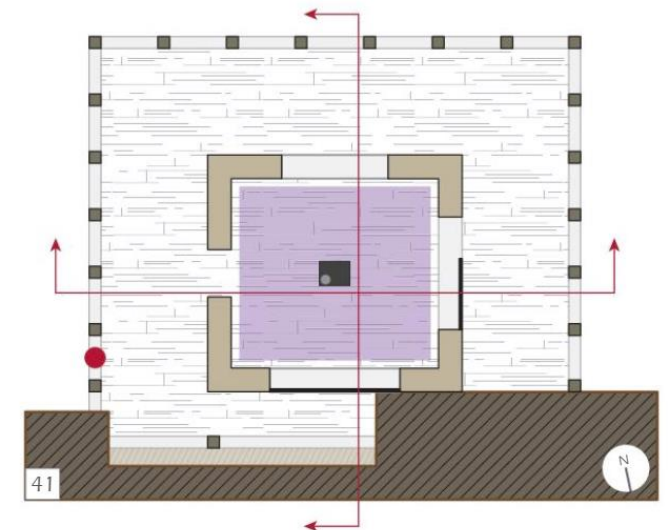
Hearth - Tandoori



Three openings and window



42 - View of window, service door and relation with balcony



Two local materials:

Himalayan slate – dark layered stone

- *absorbs heat*
- *Impermeable to moisture*
- *Used for foundation, infill for insulation*
- *Roof tiles*

Deodar timber

- *Mountain cedar*
- *Moisture resistant*
- *Adjustable to climatic and seismic changes*
- *Functions as a floating frame of the building*
- *Used for structural frame – beams and support walls*
- *Also used for ornamentation*



Step 1:
Building the Stone Plinth – Base of the House



Step 2:
Wood-Stone Structural Walls – forming the core of the house



Step 3: Second Skin Construction

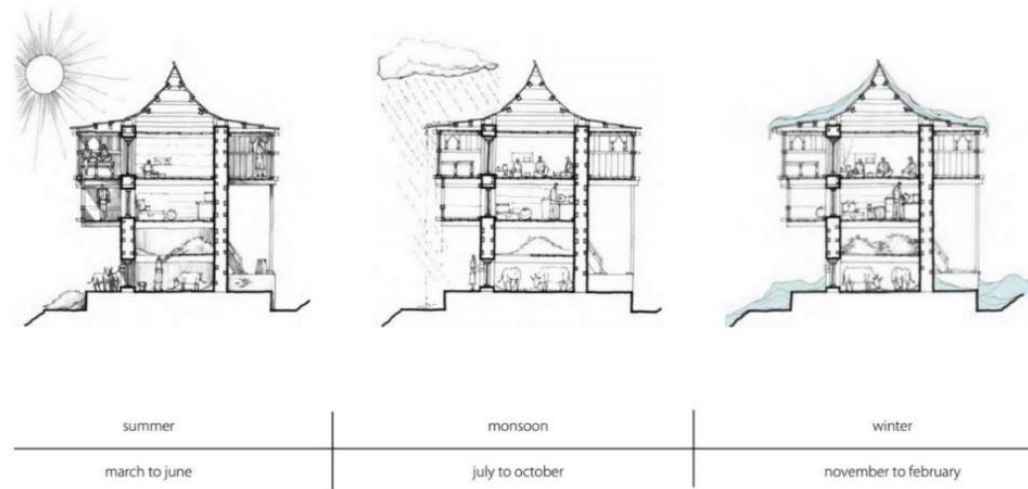


Step 4: Overhanging Slate Roof





Orientation maximizes heat in the winter and avoids storms



Location of the house based on the Caste System



Religious Places – Public Spaces where people socialize everyday



Thank you
