COMPARATIVE ANALYSIS OF TRADITIONAL AND CONTEMPORARY ARCHITECTURE IN CONTEXT TO SUSTAINABLE CHARACTERISTICS AND ITS CONSTRUCTION TECHNIQUES: A CASE OF KUMAON REGION

A DISSERTATION

Submitted in Fulfillment

of the Requirements for the Degree

of

MASTER OF ARCHITECTURE

By:

NITIKA RANJAN RAO

Enrollment no.1200109007

Under the Supervision of

Ar. Saurabh Saxena (Assistant Professor)

BBDU, Lucknow

SCHOOL OF ARCHITECTURE AND PLANNING

BABU BANARASI DAS UNIVERSITY, LUCKNOW

June, 2023

ANNEXURE II

CERTIFICATE

It is certified that the work contained in this dissertation entitled **"Comparative analysis of traditional and contemporary architecture in context to sustainable characteristics and its construction techniques: A case of Kumaon region",** by **Nitika Ranjan Rao** (Enrollment No.-1200109007), for the award of **Master of Architecture** from Babu Banarasi Das University has been carried out under my supervision and that this work has not been submitted elsewhere for a degree.

Nitika Ranjan Rao
(M.Arch Student)

(Ar. Saurabh Saxena)
School Of Architecture & Planning

BBD University, Lucknow,226028
India

Date: 24th June,2023

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4. Degree for which the dissertation is submitted: **Master of Architecture**
5. Faculty of the University to which the dissertation is submitted: **Ar. Saurabh Saxena**
6. Dissertation Preparation Guide was referred to for preparing the dissertation. YES☐ NO☐
7. Specifications regarding dissertation format have been closely followed. YES☐ NO☐
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Ar. Saurabh Saxena

School of Architecture & Planning
BBD University, Lucknow

Nitika Ranjan Rao
Enrollment No.1200109007

ANNEXURE III

TABLE OF CONTENTS

LIST OF FIGURES

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Besides my advisor, I would also like to thank all my fellow classmates for their constant support and the stimulating discussions we had on my topic.

ABSTRACT

This research mainly focuses on the study of traditional architecture of Kumaon, and how it has changed over the period of time. Kumaon region in Uttarakhand shows great examples of traditional architecture which has proven to be the best earth-resistant structures. The concept of science and earthquake-resistant structures were beyond the thought process of the people of that time. These traditional structures were cost effective, energy-efficient, provide thermal comfort for the longer period of day. The buildings of that time were locally constructed by the skilled person of the community using conventional materials like stone, mud, timber slates etc.

With rapid urbanization, the need for rapid development has increased, transportation has improved, and the need for high rise structures has encouraged the use of modern materials such as concrete, making the area unique. Used. However, society continues to demand better services, faster and easier construction to meet the needs of residents, resulting in serious damage to the fragile environment in and around settlements. To minimize the environmental impact of damage caused by modern technology, the use of indigenous practices needs to be revived. Traditional architecture is an indigenous form of structure that uses resources from the area and serves as a reflection of a nation's geography, topography, climate, building materials, etc. Traditional architecture has a positive impact on communities all over the world because it promotes a sense of connection between the built environment, cultural identity, and historical context. A crucial aspect of sustainable design that must evolve through time and establish the optimum connection between people and their environment. However, because of rapid modernization and significant transformations in socio-economic and cultural phenomena, traditional architecture was subjected to significant destruction and deterioration.

Currently contemporary architecture is overtaking all the traditional architectural styles which is why traditional architecture of specific region is depleting and the regional, heritage and cultural identity is lost.

This research not only aims at exploring the central identity of vernacular architecture and how this vernacular architecture has deteriorated due to rapid advancement and modernization but also presents some of the vernacular building styles which create ethics of local architecture. This research comprises of the comparison of traditional architectural

style “Koti banal” which is being used in many northern parts of Uttarakhand and current construction technique which is affecting the natural terrain of Kumaon resulting in natural calamities like landslide, soil erosion etc. The vernacular practices and patterns followed in conventional hill settlements have splendid capability to emerge as the premise for brand new improvement and system of suitable constructing policies for hill settlements.

CHAPTER 1: INRODUCTION

1.1 TOPIC OVERVIEW

Kumaon region in Uttarakhand is positioned on the foothills of the Himalayan Mountain ranges, it is largely a hilly area, surrounded by China in north, Nepal in east, Uttar Pradesh in south and Himachal Pradesh in north-west.

Despite the fact that it is situated in a seismically extremely vulnerable region, Kumaon has an intricate tradition of building multi-story dwellings. Based on readily accessible materials like wood and stone, Kumaon developed its own architectural style.The majority of the vernacularly made dwellings were built locally with traditional construction materials such as mud, wood, and stone.

The sensitive and fragile ecology in and around hill settlements is affected by the current situation, which involves numerous buildings being created in various hill settlements using modern materials and techniques without regard for the context. The loss of ancient knowledge systems, the lack of experienced craftspeople, the introduction of modern building materials, and government policies are only a few of the factors that have an impact on and drive current construction methods in Uttarakhand's hills. This has resulted in the adoption of an architectural style that is not indigenous to hills but is commonly found in flat regions.

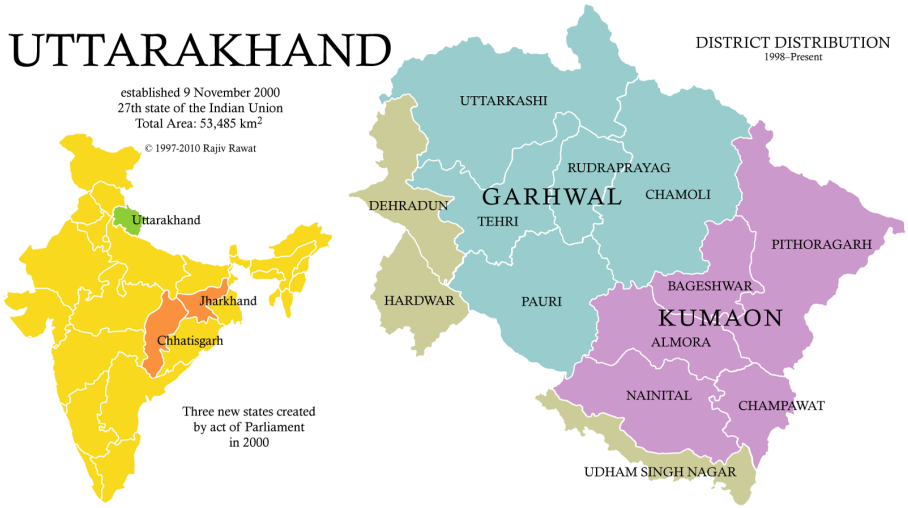


Figure 1:Uttarakhand map

Building in hilly areas requires extensive planning, site selection, and sustainable building practices. In response to these harsh development conditions, numerous vernacular and sustainable practises and styles have evolved using local materials and indigenous techniques to address these needs while causing minimal environmental damage. Despite the fact that these vernacular practises have a number of advantages, they are rarely utilised in new developments because of the growing need for more constructed spaces driven on by fast population expansion, the availability of new building materials and techniques, and people' resistance to adopting vernacular practises.

1.2 CRITERIA OF SELECTION

Kumaon architecture exemplifies the region's richness of art. Kumaon has a distinct sense of style when it comes to art and architecture. Despite being disaster prone region, few traditional buildings have proved to be disaster-resilient.

On the other hand, Uttarakhand has observed many natural calamities in last few decades, in spite of that we can examine that people are nonetheless using construction techniques which are being used in plain areas. This practice has also given birth to loss of traditional architecture and loss of lives and properties.

There is need to study traditional architecture and draw lessons learned from the traditional built environment and combine it with contemporary practices to attain sustainability, a modern approach to life, conservation of cultural heritage preservation and disaster risk reduction.

Figure 2:RCC structure just before the collapse

Figure 3:Excess excavation of land for construction

1.3 AIM OF THE RESEARCH

The purpose of this study is to analyse the prevailing construction technologies and materials in the Kumaon region of Uttarakhand and to address the negligence of traditional building materials and construction methods. Furthermore, this research aims to identify, promote and combine traditional building methods, which are easily adaptable and region specific with the modern approach and techniques, which are more adaptive in the current context that improves the structure both aesthetically and functionally.

1.4 OBJECTIVE OF THE RESEARCH

- Study the traditional and contemporary architecture of Kumaon region.
- To analyze the impact of contemporary materials on the ecologically sensitive hilly region.
- To draw comparative study of conventional building construction to contemporary construction and materials
- Analysis of the outcomes and propose a recreational space that will promote the unique identity and culture of Kumaon.

1.5 RESEARCH QUESTIONS

- What effects modern materials are having on the environment in the hilly region?
- The rationale behind not using traditional materials.
- Are traditional construction practices done were better than contemporary construction practices?

1.6 RESEARCH METHODOLOGY

- Study of Kumaon region on the basis of construction techniques, local material used and sustainable factors.
- Compare modern construction techniques with traditional architecture.
- Draw a final conclusion from the case study and literature study.

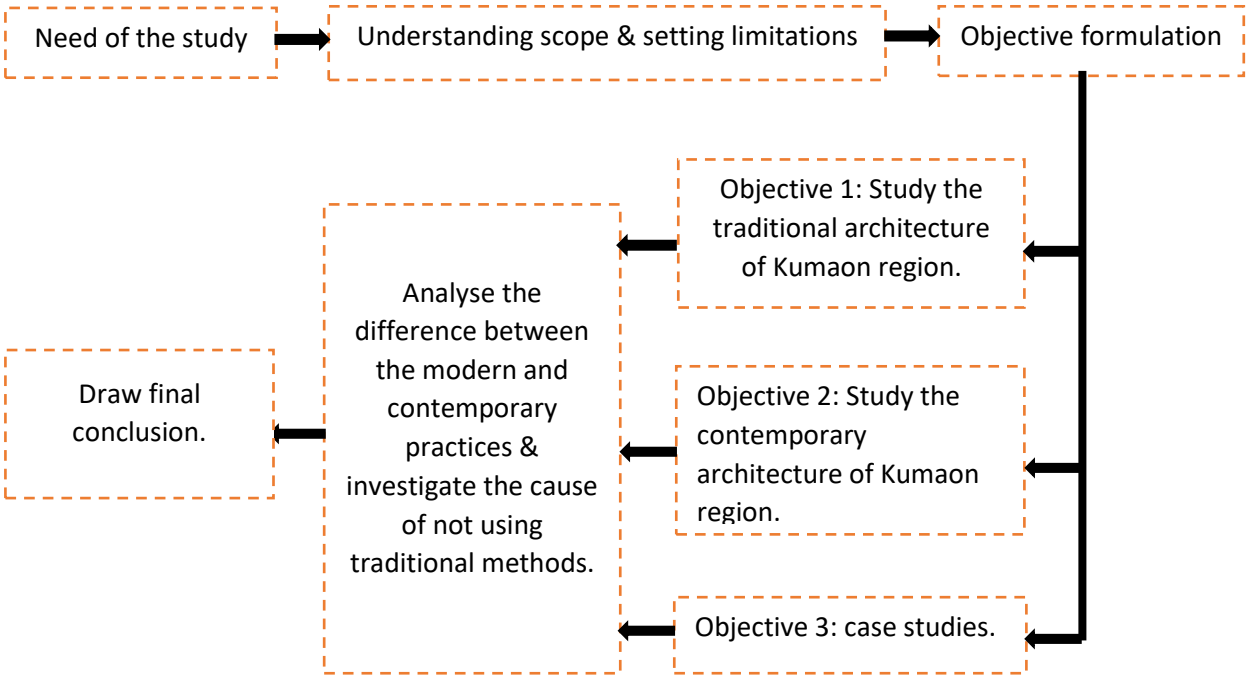


Figure 4: Methodology

1.7 SCOPE AND LIMITATIONS

- This study will only focus on the study of Kumaon region.
- This research will provide an outlet to study the local architecture keeping in mind of climatic factors, behavioural pattern and user attitude.
- The proposed project will be located somewhat outside of the city so that people may take advantage of the natural beauty and pure air there.
- The design aspect will be limited to the activities within the site; the surrounding hill area will not be subject to any sort of development.

CHAPTER 2: KUMAON REGION-GENERAL

2.1 BACKGROUND

Kumaon is located in the foothills of Himalayas. Kumaon is a revenue and administrative division in the Indian State of Uttarakhand. It is known for its cool and fresh mountain breeze and scenic beauty.it is also known for its rolling cultivation of hill crops. This region is blessed with beautiful landscapes, climate and sloped terrain.

Kumaon region consist of six districts namely Almora, Bagheshwar, Champavat, Nainital, Pithoragarh and Udham Nagar.

Kumaoni villages consist of loosely grouped homes surrounded by farmlands. The villages are generally situated near rivers or springs, and the homes are connected by footpaths. Like hill architecture all over, the houses in Kumaon are spread out in clusters. Every house has space for cattle and storage and it's a close -knit lifestyle with nature.

Figure 5: Uttarakhand map

(Source: uttarakhand-tourism.com)

2.2 KUMAON VULNERABILITY MAP

As per a report, submitted in the Parliament in 2016, Uttarakhand has the highest number of unstable zones among north Himalayan state Himachal Pradesh and Union Territory Jammu & Kashmir. Every year, several forms of natural catastrophe strike Uttarakhand due to its geographical nature. Since a significant portion of Uttarakhand is mountainous, calamities such as earthquakes and landslides occur frequently. Also due to the fact that most of the area is forested in Uttarakhand, there is loss of life and property due to the disaster of fire in

the forests and floods in the rivers due to excessive rains**. As per earthquake zonation of India, Uttarakhand can be divided into 2 zones, zone 4 and zone 5.**Landslides, forest fires, cloudbursts and flash-floods are seasonal in nature and these strike at a certain period of the year with high frequency. Earthquake is the most devastating disaster in the mountains and are unpredictable.

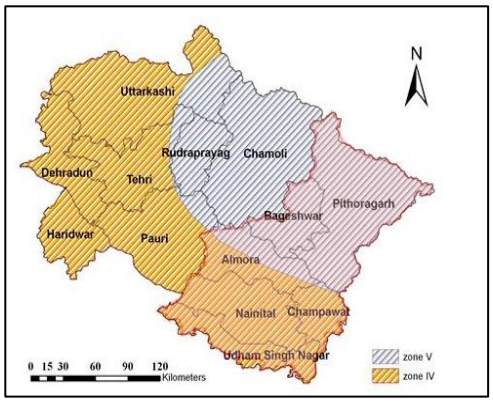


Figure 6:Uttarakhand earthquake hazard zonation

(Source: Uttarakhand State Disaster Management Authority)

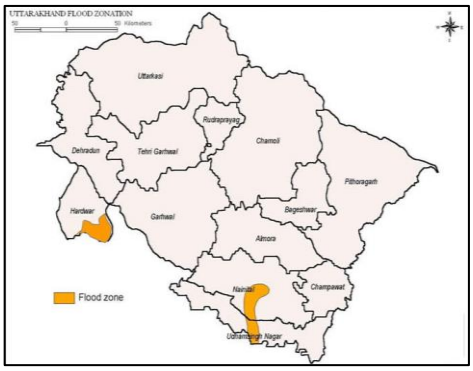


Figure 7:Uttarakhand flood zonation

(Source: Uttarakhand State Disaster Management Authority)

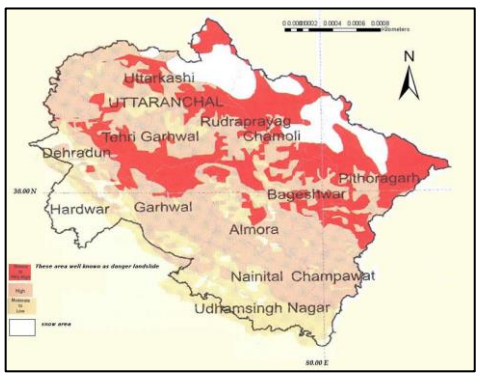


Figure 8: Uttarakhand landslide zonation

(Source: Uttarakhand State Disaster Management Authority)

2.3 DISASTER HISTORY OF UTTARAKHAND

1991 Uttarkashi Earthquake

- An earthquake of 6.8 magnitude hit the undivided state of Uttar Pradesh in October 1991 in which at least 768 people were killed and thousands of homes destroyed.

1998 Malpa Landslide

- The small village of Malpa in Pithoragarh district was wiped in the landslide in which about 255 people.

1999 chamoli earthquake

- The Chamoli district was hit by a 6.5 magnitude earthquake. Several hundred individuals were hurt, and 50,000 homes were destroyed.The earthquake harmed around 2,000 settlements.

2013 North India Floods

- In June 2013, a multi-day cloudburst centered on Uttarakhand .. caused devastating floods and landslides. According to the state government, more than 5,700 people werepresumed dead in the disaster.

2021 Uttarakhand flood

- caused by a large rock and ice avalanche in the Chamoli district. The disaster left over 200 killed or missing.

(Source: https://en.wikipedia.org/wiki/Category:Disasters_in_Uttarakhand)

CHAPTER 3: TRADITIONAL CONSTRUCTION OF KUMAON

3.1 ARCHITECTURAL HISTORY

The architecture of Kumaon defines the artistic richness of the region. Kumaon has a unique sense for art and architecture. On the one hand, it can be seen as a scattered settlement in the high mountains and populated agricultural valleys of the Himalayas, and on the other, as a temple, forts and dharmshalas.

- • All of the ancestral houses in Kumaon have stone walls, mud floors, slate roofs, and patangans (courtyards of grey stone).
- The main entrance, doors and windows have detailed drawings of Lord Ganesh and other holy gods and goddesses.
- • Around a thousand years ago, temples, monuments, and other buildings were built in accordance with a unique indigenous style known as the "Himadri" style of architecture.

Figure 9: Sun Temple, Katarmal, Almora

3.2 TRADITIONAL ARCHITECTURE OF KUMAON

- Settlement of houses were usually situated near rivers or springs.
- The settlements are generally developed on southern slope for relatively more solar exposure and protection from northern winds.

- To minimize damage to the terrain, buildings are sited along the stepped terraces' contours. having huge openings in the front and waste drains behind the building.
- The dwellings are oriented to the east, south, and west to make maximum use of direct sunlight.
- The abundance of stone and wood in the area defines the distinctive characteristics of the traditional architecture found in this area.
- Stone is often used for walls, while timber is used for structural purposes and slates are used for roofing.
- The height of the buildings and the distances between them are graded so that the rear of the buildings can also get sunlight.
- The sloping slate roof and exquisite woodwork carvings on the doors and windows bring the building's features together. Houses with sloping roofs naturally drain rainwater.
- Buildings are placed in such a way that no building cast its shadow on other building and each of them having a proper opening for ventilation and maximum solar exposure.
- Buildings with simple, regular and symmetry in both plan and elevation configured buildings produce less magnitude of twist during any hazard- landslide, flood, earthquake, wind velocity etc., as considered to be very stable.

• Large projections are susceptible to earthquake damage because they experience substantial deflections and reversible stress. The balcony projection on the upper floor, which is a tiny projection of 1 to 1.2 metres, are constructed of wood, a sturdy, lightweight, and flexible material.

3.3 TRADITIONAL CONSTRUCTION TECHNIQUES: KOTI-BANAL CONSTRUCTION

Koti Banal in Uttarakhand, is one of the oldest architectural styles in the Himalayas. He demonstrates in-depth knowledge of local materials and indigenous sensibilities. Investigations revealed that it was an earthquake-resistant wooden and stone construction that was developed 1000 years ago.

These multi-storeyed houses are found with abundant use of wooden beams and stone bases. The buildings are constructed using the locally available building materials such as long thick wooden logs, stones, and slates (Saraswat and Mayuresh, 2017). This architectural style is one of the most suitable for building in these regions if a suitable substitute for wood can be found as wood is scarce nowadays. This style is proven to have minimal environmental impact and maximum earthquake resistance.

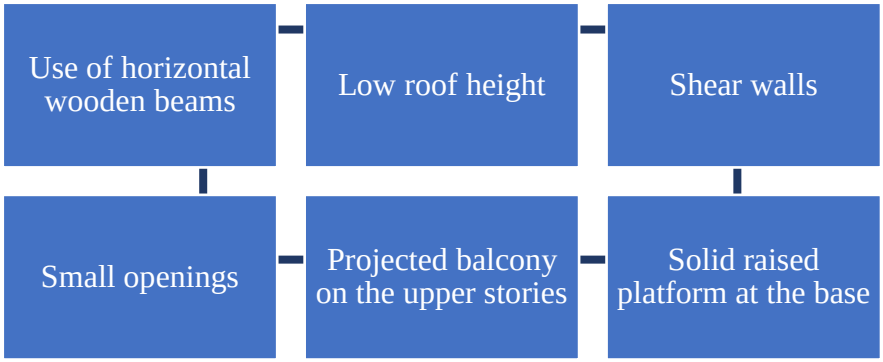
Figure 10: Koti banal house

(Source: https://madhusudanks.wordpress.com/2015/11/07/koti-banal/)

According to the **Housing Report on Timber Reinforced Stone Masonry given by the World Housing Encyclopaedia**, Koti Banal is the name of a village in the Yamuna Valley. This village employs traditional knowledge systems of construction, which are very scientific and earthquake resistant.

The area has already seen several devastating earthquakes. Even though the Kumaon earthquake in 1720 and the Garhwal earthquake in 1803 are regarded as two of the big earthquakes (magnitude >8) that shook the area, this form of architecture has remained

largely unaffected having significant earthquake-resistant characteristics.



The characteristics observed in Koti Banal architecture are:

3.3.1 SITING:

- These buildings are typically found in flat, sloped and hilly terrain. They do not share common walls with adjacent buildings.
- Koti Banal structures were erected separately without any buildings in the immediate vicinity. Especially those located in the villages may also be built close to each other or to other building types.
- When separated from adjacent buildings, the typical distance from a neighboring building is 2.0 - 4.0 meters.
- Stability of slope and selection of firm ground are important criteria from a seismic perspective.

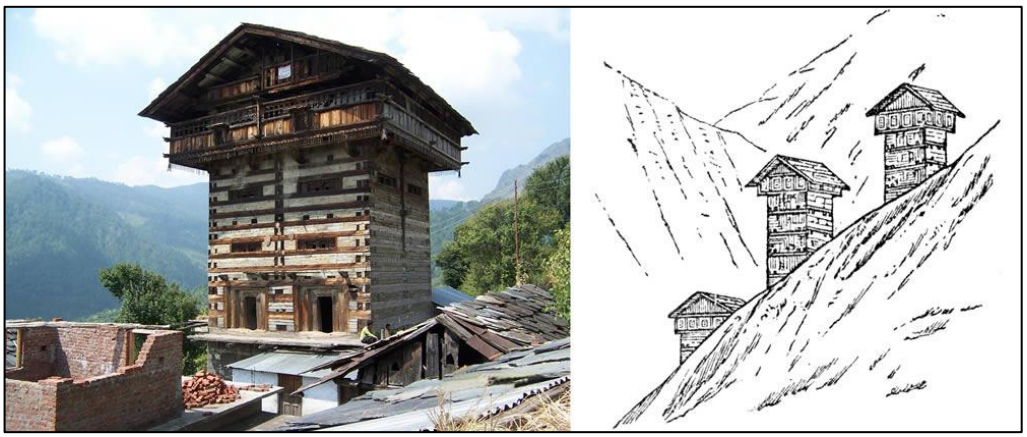


Figure 11: Siting of Koti banal structures

(Source: https://hierleben.net/koti-banal-architecture-49/)

3.3.2 BUILIDING CONFIGURATION:

- Koti Banal buildings are characterized by Very simple rectangular plan configurations while the lengths and widths are varying between 4 and 8 meters.
- The ratio between both dimensions varies between 1.1 and 1.4.
- the buildings rest upon a raised and elaborated stone in the continuation of the foundation trench made of field and rubble stones.
- The platform's height varies between 2 and 4 metres above ground.

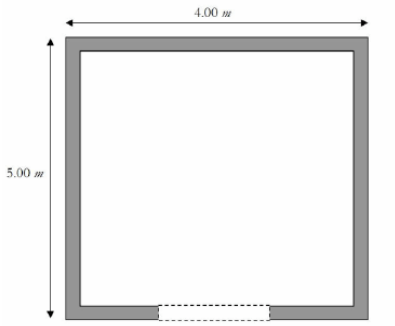


Figure 12: Typical plan of single unit construction

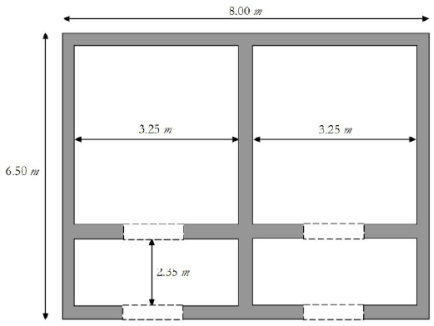


Figure 13: typical plan shape of double unit construction

3.3.3 FUNCTIONAL PLANNING:

- The main function of this building typology is single-family house.
- In a typical building of this type, there are no elevators and no fire-protected exit staircases.

- Buildings of the Koti Banal style have a single main entrance on the ground floor, above the foundation platform.
- Upper floor access is given primarily by wooden ladders built from a single wooden trunk.
- A single small door access on the ground floor and relatively small south facing windows above with window frames and shutters.

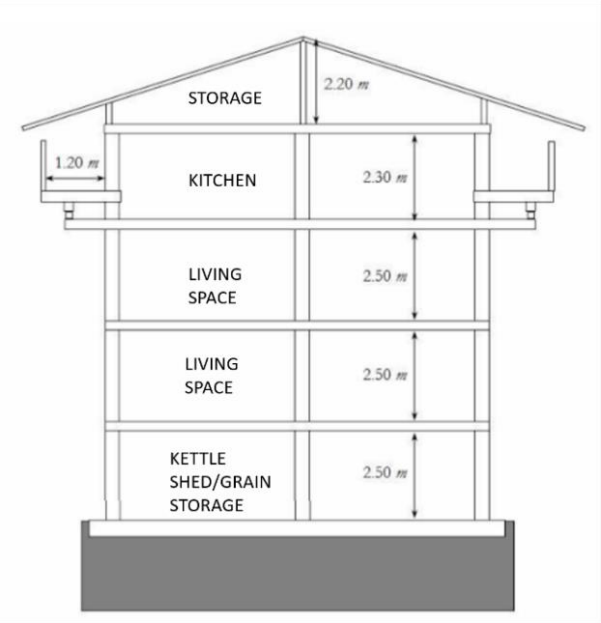


Figure 14: Section of single unit construction of Koti-banal

3.3.4 THERMAL STRATEGY:

- The building envelope's high thermal mass trap heat.
- Small windows that face south help to keep heat inside.
- Low floor heights (2.2–2.5m) limit the amount of interior air that has to be heated; the attic acts as a thermal barrier; regular shapes and simple elevation designs; and the incorporation of wood beams throughout the building's height.
- The Koti Banal structure's floors are built of 20–22 mm thick timber planks that are believed to be quite flexible.

Figure 15:Typical elevation of Koti banal-1

(Source: https://issuu.com/dicrc/docs/kumaon_booklet)

Figure 16: Typical elevation of Koti banal-2

(Source: https://issuu.com/dicrc/docs/kumaon_booklet)

3.3.5 CHOICE OF MATERIALS:

For this form of building construction, wood and stone were the materials of choice. Wood is a ductile material, whereas stone is brittle. The use of wood reinforcement in stone masonry improves the structure's tensile strength.

3.3.6 BUILDIG PLAN AND MASSING:

- Houses were symmetrical about axis.
- Simple rectangular shaper and enclosed areas.
- Simple structures, no or very little ornamentation. (Carving only in wooden members)
- Height of the building were usually 7-12m.

3.3.7 STRUCTURAL SAFETY ASPECTS:

- This type of construction involves a number of distinct features which are good for seismic performance.
- • The platform rises between 2 and 4 metres above the surface. This huge strong base helps maintain the centre of gravity and mass close to the ground, minimising the overturning impact of tall structures during earthquakes.
- The mass of the structure is distributed equally and symmetrically.
- The timber beams are introduced after 20-30cm of rubble dry stone masonry.
- Wood is an elasto-plastic material with a higher strength-to-weight ratio than steel and concrete.

Two type of structural system work upon this type of structures-

A) LATERAL LOAD RESISTING SYSTEM:

- horizontally pairs of wooden logs which are connected to each other by wooden shear pins/tenons act like a wooden frame which is braced by well-dressed flat stones in between the logs increasing the bearing and lateral capacity of the construction.
- The stones between the logs are mostly assembled without any grout or mortar thus enabling a certain level of flexibility and allowing lateral deflections of the building without damage effects.

B) GRAVITY LOAD RESISTING SYSTEM:

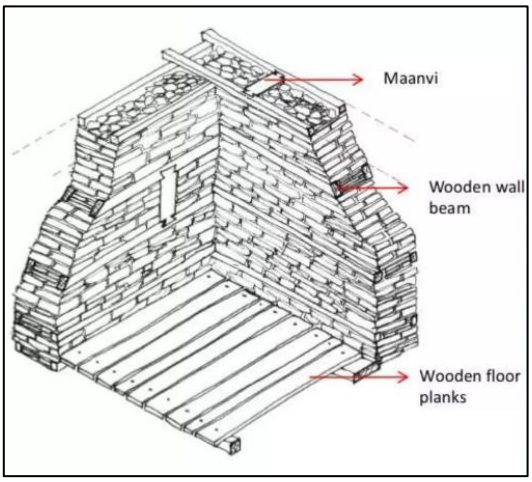


Figure 17: floor beam shear pinned togather by with wall logs

(Source: https://thedesigngesture.com/koti-banal-the-vernacular-architecture/

Figure 18: two parallel cross-beams held a dovetailed timber

(Source: https://issuu.com/dicrc/docs/kumaon_booklet)

- horizontally pairs of wooden logs which are connected to each other by wooden shear pins/tenons act like a wooden frame which is braced by well-dressed flat stones in between the logs increasing the bearing and lateral capacity of the construction.
- The stones between the logs are mostly assembled without any grout or mortar thus enabling a certain level of flexibility and allowing lateral deflections of the building without damage effects.

3.3.8 COST EFFECTIVENESS

- All the materials are locally sourced and the construction by the owners of the house.
- The houses are plastered inside with mud and cow dung which provide thermal insulation for the longer period of time.

3.3.9 KOTI BANAL STRUCTURES AT PRESENT

Most of the houses which belong to this type of construction are disappearing due to challenges of frequent maintenance and concerns for comfort. Many old structures are being put to disuse and are deteriorating because of lack of maintenance. People area demolishing these structures to make new modern dwellings. These structures need to be preserved as heritage buildings to have glimpse of architectural traditions to upcoming generations.

3.4 CASE STUDY: BARAKOT VILLAGE, ALMORA

Almora villages are situated on stepped lands without disturbing natural terrain. The access to houses in Almora is generally through the agricultural lands and much far away from the main road. A typical house of Almora village has a verandah, a gaushala or goth, living area, kitchen store and living area and their farms around the house.

Barakot village is situated on the top of the hill surrounded by higher hills. The entire settlement is planned in a linear manner with street in centre and houses on its side. Exhibitory arched windows, doors and balconies supported on stone columns can be observed in this village.

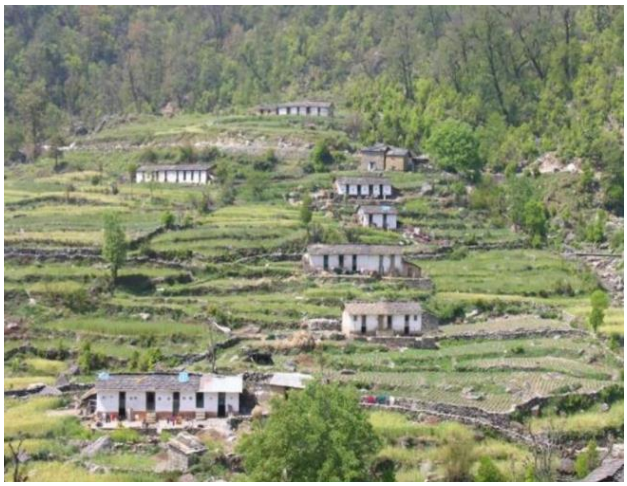


Figure 19:Barakot village in Almora

(Source: okuttarakhand.com)

- It is situated in the foothills of Almora district of Uttarakhand. It is a mix of row houses and single houses. Row houses are planned in a straight manner with houses on both side of the road.
- Houses in this village are mainly placed along the contours and have agricultural field. Terrace farming is adopted in most parts of Kumaon because of sloppy terrain.

Figure 20: Typical Row House of Barakot

(Source: indigenous building of Kumaon)

- Main buildings are placed on the first floor which comprise of a fore-court, kitchen, living room, and bedroom. The kitchen is mostly placed at the end of the unit.
- Windows were placed in the front façade of the building as well as the opposite façade to ensure cross ventilation.

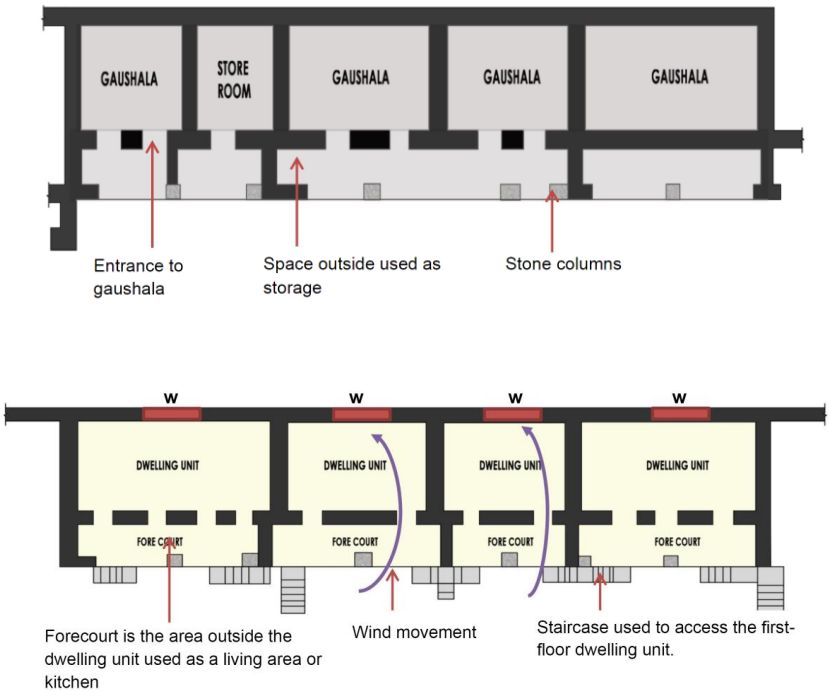


Figure 21: Typical Ground & First Floor Plan of a Row house

(Source: case study on vernacular architecture of Kumaon region)

3.4.1 THERMAL COMFORT

- Thermal comfort is achieved by keeping height of the windows and doors small so that the interior remains warm, and the interior warmth is not transferred to the outside.

- Ceiling height is also kept low so that the interior remains warm and insulated.
- Gaushala on the ground floor helps to keep upper floor warm. The windows are generally smaller so that the warmth from gaushala is transferred to first floor.

3.4.2 WALLS

The stone masonry wall of 1.5ft. thickness running in all four directions keeps the structure intact during calamities and seasonal changes.

3.4.3 DOOR/WINDOW OPENINGS

Rear side of the house, which does not face sun usually have no windows or other openings.

3.4.4 SHAPE OF THE PLAN

Shape of the plan is rectangular and the ratio of the width is 1.2 times of its depth. *(Source: Y. Neelam, C. Navanil, Traditional Vernacular Architecture of Kumaon,2021)*

3.4.5 SITING OFF THE HOUSE

Entire settlement is placed in linear manner without disturbing terrain. The houses were planned with streets in centre and houses on its side.

3.4.6 CEILING HEIGHT

Height of the first-floor unit is usually kept low.

3.4.7 COST EFFECTIVENESS

The materials used were locally sourced from around the site which makes it more Sustainable.

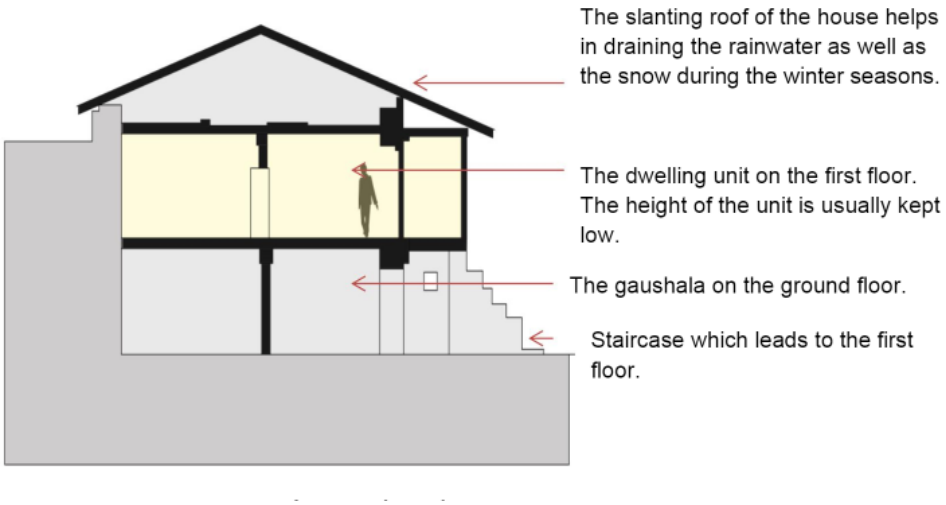


Figure 22: Typical Section of a Row House of Barakot village

3.4.8 ROOFING

- The slabs of the stone are cut into tiles and then used as a roofing material in most Kumaon region.
- The major disadvantage of this roofing type is the load of the stone on the foundation therefore it is not considered in the construction.
- stone roof provides excellent insulation.
- Stone roof is supported by battens and wood logs area used as beam.

Figure 23: Stone Roofing

(Source: https://www.slideshare.net/mansiarch/kath-khuni-of-himachal-pradesh-autosavedpdf-low)

Figure 24:Roof supported on wooden beam and batten

(Source: https://www.slideshare.net/mansiarch/kath-khuni-of-himachal-pradesh-autosavedpdf-low)

- Most common building material used in these houses are wood and stone. Walls are built up of stone and timer is used as structural member in roofing. slates are used for roofing. both materials are abundantly available in Kumaon region.

3.4.9 FOUNDATION

- The foundation of these individual dwellings are mostly 3-4 feet deep and large stones are used in masonry work.

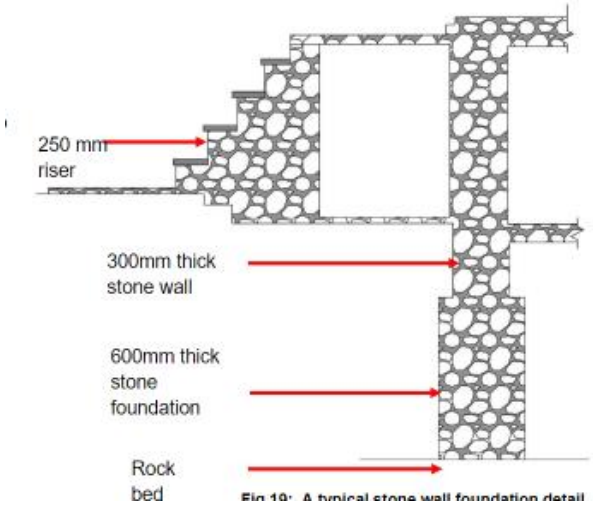


Figure 25: A typical stone wall foundation detail

(Source: report on vernacular architecture of Kumaon)

3.5 CASE STUDY-2: HARKOT VILLAGE, MUNSIYARI

Munsiyari is located in the upper Himalayan area, where the climate is moderate and the rainfall is frequent. It is densely forested with scenic parts of irrigated terraces.

The settlement of Harkot village is located on relatively flat terrain at the base of the mountains. The surrounding area has been transformed into a stepped terrace.

These settlements also have distinctive architecture that reflects their culture and way of life.

In Munsiyari, Religion, climate, sociocultural practises, and the availability of raw materials all have a significant impact on traditional vernacular architecture. Settlement and individual living habits have been influenced by culture and social practises. The settlement is made up of hamlets of 10 to fifteen dwellings that have been strategically placed along small patches of flat land in the mountainous terrain.

3.5.1 SETTLEMENT PATTERN OF HARKOT VILLAGE

Figure 26: conceptual sketch of Harkot village and its setting

(Source: https://villageinfo.in/uttarakhand/pithoragarh/munsiari/harkot.html)

- The village is situated in a way that makes the best use of the available flat terrain, direct sunlight, and protection from wind. By analysing various types of physical elements, the location of these settlements may be understood.
- Villages are always sited on the sunniest slopes.
- Stepped terraces are usually cut into the mountain slopes and then carefully dammed with stone walls and vegetation as reinforcement to prevent erosion.

3.5.2 ARCHITECTURE

- The verandah and front court are designed to capture the sun's warmth
- the presence of livestock on the lower floor contributes to maintaining warmth in the home
- openings are small and few in number to reduce the flow of cold wind; and the cold, dry climate and the extreme winters.

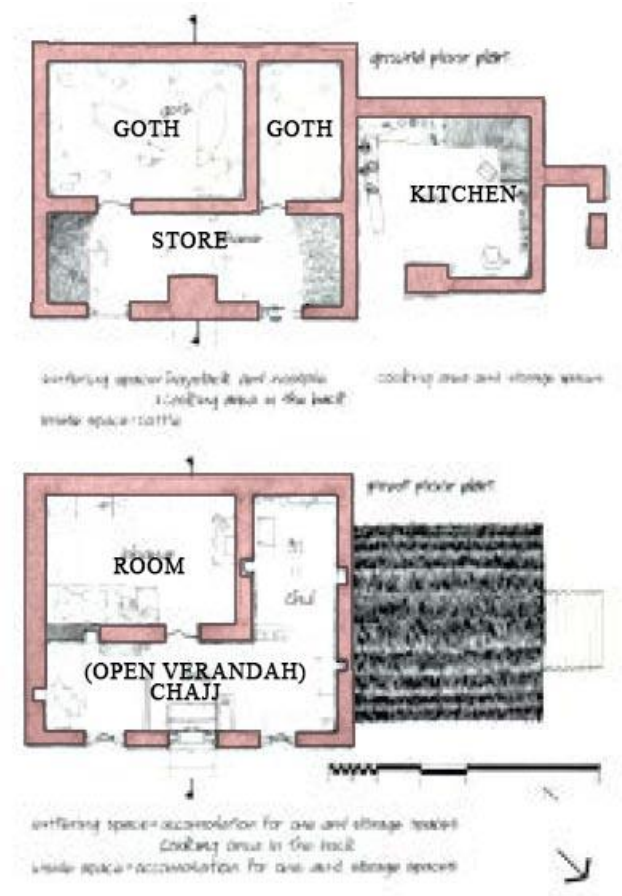


Figure 27: ground and first floor plan of Harkot village showing living space

(Source: Report on traditional vernacular architecture of Kumaon)

• The sloping roofs aid in removing snow in the winter and keep water from accumulating during the monsoon. To control the temperature inside the home, the locals additionally cover the sloped roof with a natural grass called selum to aid in the melting of snow in the winter.

• Typically, there are no windows or other openings at the rear of a house that do not face the sun.

3.5.3 FOUNDATION

Individual homes have a one- to three-foot-deep, shallow stone foundation made of huge stones extracted locally.

3.5.4 FLOORING

The flooring is built of wooden planks that are supported by wooden trunks acting as beams and are covered every second or third day with cow dung paste and clay.

3.5.5 CONSTRUCTION

Traditionally, these buildings were built by a family and community effort. Members of the extended family and community members typically assisted in the construction.

3.5.6 WALLS

Walls are made of local stone and wood and daubed with mud. dry stone walls were built Without any mortar.

3.5.7 ROOFING

Sloping roof of stone slates were used. People used native grass called selum to cover sloping roof to help regulate warmth inside house.

3.5.8 THERMAL INSULATION

Low floor height and small door and window openings allows heat to trap for longer period of time.

3.5.9 COST-EFFECTIVENESS

All the materials are locally sourced and the construction done by the owners of the house.

3.6 INFERENCES OF CASE STUDY (TRADITIONAL CONSTRUCTION)

- The buildings are oriented in such a way that the sun penetrates maximum into the building. Mostly the buildings are designed in a linear settlement so that the sunlight doesn't get blocked due to other buildings.
- The buildings are mostly placed along the contours without disturbing the natural terrain which helps in maintaining the soil strength which is turn prevents soil erosion as well as landslides.

- The windows are provided with sunshades for prevention against direct sunlight as well as rainwater.
- Sloped roofs are used to naturally drain rainwater.
- Cow dung and mud are used to plaster the interior of the building which include the floor as well as the walls.
- The height of the openings i.e., doors and windows are kept low to prevent loss of interior warmth, similarly the floor to roof height is also kept low to keep interiors warm and maintain thermal comfort.
- The goth on ground floor has low ceiling height and small window openings which help in keeping the upper floor warmth.
- The use of locally available materials like stone and wood can be seen in the constructions of the buildings which not only is economical but maintains the regional language of the area.
- Culture also played an important role while designing these houses as the kitchen mostly placed at the end of the dwelling unit as they didn't want outsides to enter the innermost part of the house.

CHAPTER 4: CONTEMPORARY CONSTRUCTION OF KUMAON

4.1 EXISTING SCENERIO

With rapid urbanization and need for fast development, started the use of contemporary materials and techniques. The materials like concrete became one of the most readily available materials which have reduced the use of these traditional practices in India. The industrialization of cement production in the last 30 years has eroded traditional methods of building, local skills and local markets (Fazil and Agarwal, 2011). The use of such

contemporary materials and techniques resulted in significant changes to the environment and surrounding, creating a risk and vulnerability for the local communities. The life span of these structures is estimated to be 50 to 80 years by its developer while the built environment created using the vernacular practices have withstood a much longer lifespan with minimum maintenance, and are much environmentally friendly than these modern practices.

4.2 CURRENT CONSTRUCTION TECHNIQUE USED

The influence of modern construction can be seen in the Uttarakhand region.

- **Cut & Fill Construction Technique-** This excavation technique is mainly used for construction of embankments and other flat surface works on hilly terrains. The site is converted to a flat before construction to make the construction process easy. Nearby lands are also excavated for soil which decreases soil strength.

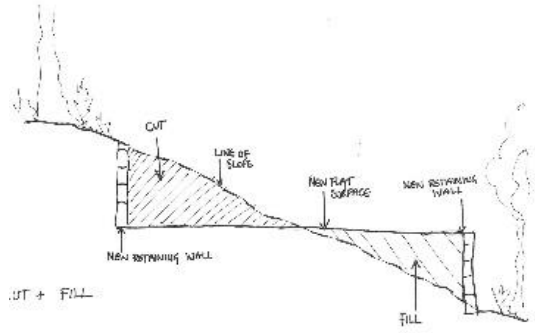


Figure 28:Cut and fill construction techniques

- **Stepped foundation-** The excavation trenches are made in the form of steps. All the steps should be preferable of equal length and depth. The function of providing steps is. to avoid unnecessary cutting and filling.

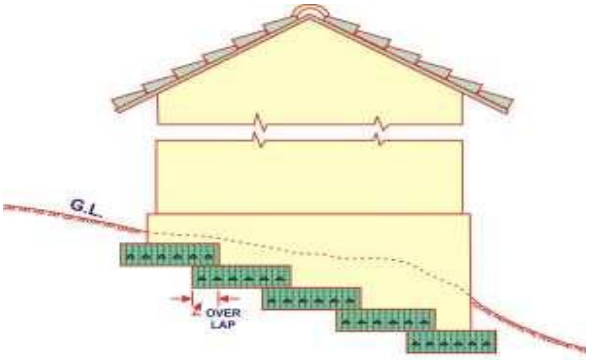


Figure 29: stepped foundation

- **Pile foundation-** Piles are vertical columns driven into the ground on which wooden or concrete platforms are supported. The piles are driven at regular distances. The size and distance apart, of the piles depends upon the bearing capacity and type of soil and the load of the structure.

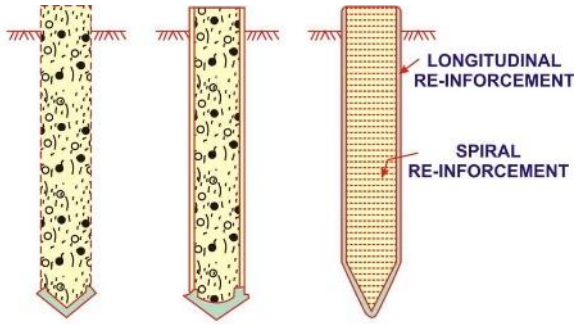


Figure 30: Pile foundation

4.3 CONSEQUENCES OF CONTEMPORARY CONSTRUCTION

- Despite being unsuited to the local climate, cement-based building is becoming more and more popular as modernity spreads throughout Uttarakhand. The major consequences of these construction techniques are landslides which causes loss of life and property.
- Another consequence of these construction techniques is the depletion of the regional architectural style and construction techniques.
- The loss of traditional knowledge and cultural heritage of that region.

4.4 CONTRIBUTION OF ARCHITECTS TOWARDS SAVING KOTI-BANAL STRUCTURES

Koti-Banal is a popular type of natural building which uses locally available wood and stone as prime materials for construction. These humble looking abodes made of stone, mud and wood were popular in traditional time. There were several reasons for its popularity: It is environmentally friendly, kept the cold out, and can survive earthquakes due to its high tensile strength.

Unavailability of materials, high cost and lack experienced mistiris are the main reasons for its decline. But according to NORTH, the cost and time required for constructing Koti Banal houses can be reduced by replacing wood with other sustainable and cheap materials like bamboo and hempcrete.

Rahul Bhushan, a 29-year-old Himachali local and alumnus of CEPT is trying to bring back the glory of Kath Kuni structures which is very similar to Koti-Banal. He runs an organisation called NORTH in Naggar, A small town in the Kullu Valley of Himachal Pradesh.

Koti-Banal architecture should be preserved and revived for an environmentally sustainable Himachal. If Koti-Banal architecture and its artisans fade away into history, a deep knowledge of the mountains and how to live in them also disappear.

4.5 CASE STUDY-1 WOOD HOUSE, NAINITAL

Design: Matra Architects

Location: India

Principal Architect: Verendra Wakhloo (Design Detailing)

Project Architect: Mrinalini Ghadiok (Design development)

Location: Sohna Pani, Almora District; Uttarakhand, India.

Completion Year: jun-13

Plot / Site: 3 acres (130700 sqft)

Built-up: 2550 sqft

Category: Residential Architecture Single family house

MATERIALS

Foundation and Plinth: Yellow stone

Structure: Glued timber made of saal wood

External Cladding: Red Cedar

Insulation: Extended polystyrene

Internal Cladding: Pine wood

Roof: GI Sheet and red cedar slats

Flashing and Gutter: GI sheet

Flooring- Bathroom: Vitrified clay tiles (VM.L. Sharma)

Flooring- General: Pine wood planks

Windows and Doors: Red Cedar frames and shutters) (Saint Gobain)

Skylight: Aluminum + DGU (insulated glass)

The house is situated in the village of Satkol (Nanital district) at a height of 2000 metres, and there are no other typical village homes nearby that reflect the direct way of life of the local farmers. It was built as a vacation house for private usage.

Figure 31:Woodhouse,Satkol

(Source: https://www.woodhousesatoli.com/)

Figure 32:the building placement at the lowest terrace level-woodhouse

(Source: https://www.woodhousesatoli.com/)

4.5.1 DESIGN OF THE WOOD HOUSE

The architecture of this home draws inspiration from the nearby view of the northern Himalayan range covered in snow, but it also has a deep connection to the terraces it occupies, which are still intact and undamaged. The position of the structure at the lowest terrace level of the property and its interaction with the surrounding environment were established by these two landscape features.

4.5.2 SPACES

The spaces are divided into three distinct levels, with each level occupying roughly 14.50 m by 3.60 m of the surrounding natural terrain. The uninterrupted, spectacular views of Almora town and the nearby orchards are experienced and expressed architecturally through continuous glazing all the way around the external floating envelope. This rift deals with the transition between the site's exposed, dressed dry stonewall base and the locally-sourced, oiled "thin" wood cladding.

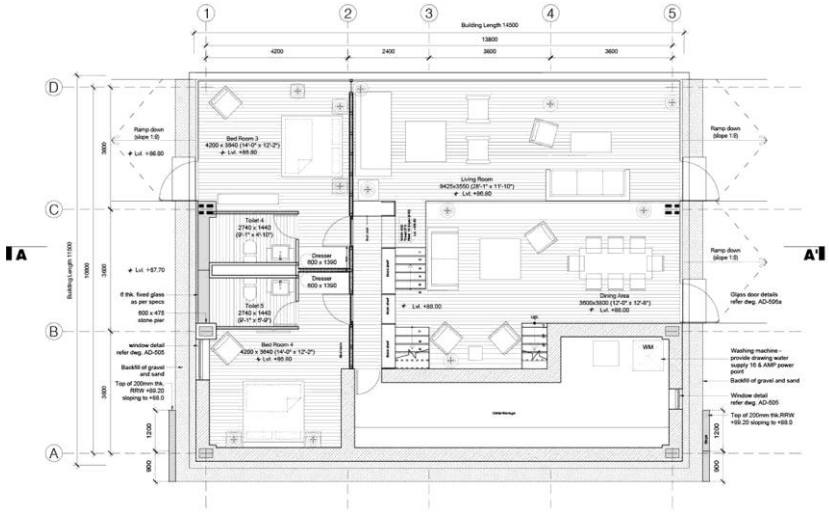


Figure 33:Lower ground floor plan (Source: https://arqa.com/en/architecture/wood-house.html)

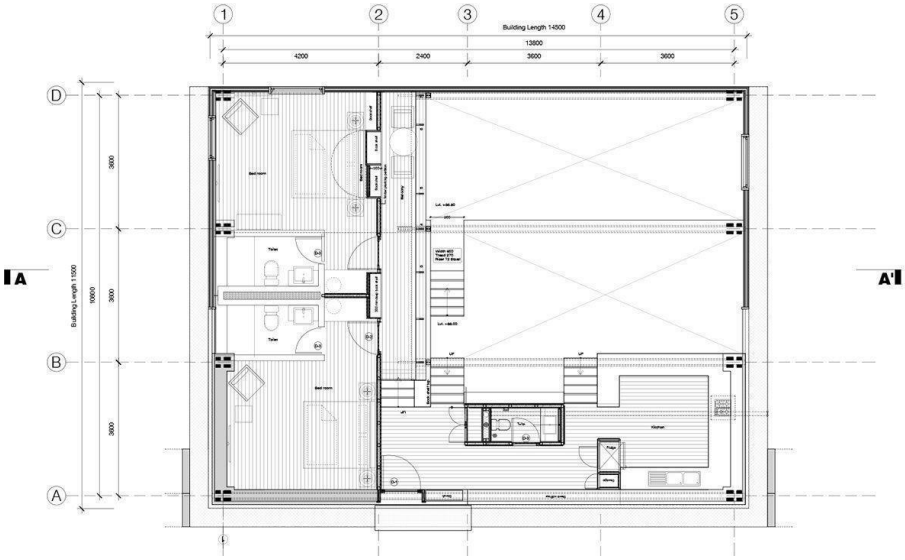


Figure 34: Upper ground floor plan

(Source: https://arqa.com/en/architecture/wood-house.html)

- the continuous windows allow for undisturbed spectacular views of the neighbouring orchards and the town of Almora. (Fig 35)
- The skylight introduces sunlight into the bedroom (Fig 36)

Figure 35:interior space of main building

Figure 36:skylight for indirect lighting

4.5.3 STRUCTURE

Four 14.5m span ‘Sal wood frames made of multiple glued planks and thin steel tie rods, support the entire timber covered roof, the insulated building envelope, the entire wooden mezzanine floor and shape the iconic double-glazed skylight.

The entire house suspended from these robust truss frames without the support of any intermediate columns allows an undisturbed flow of contours into the silent pinewood ‘paneled interior spaces. Carefully crafted collage of square windows towards all directions ensures ‘zen’ views of various mountain peaks and ever- changing clouds.

The timber-clad roof structure of this house in the foothills of the Himalayas features a pointed peak incorporating skylights that allow daylight to flood an open-plan interior arranged over stepped levels.

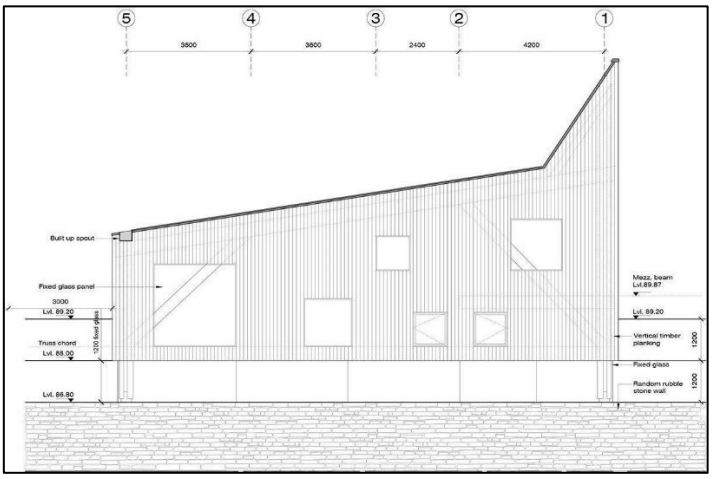


Figure 37:North elevation

(Source: https://arqa.com/en/architecture/wood-house.html)

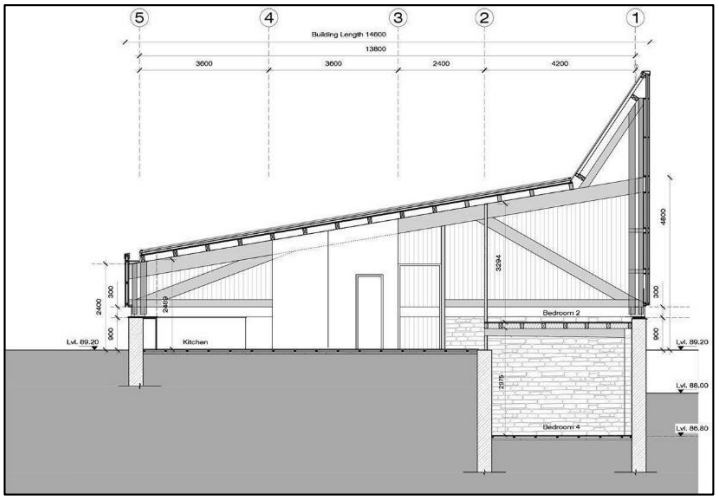


Figure 38: Section A-A'

(Source: https://arqa.com/en/architecture/wood-house.html)

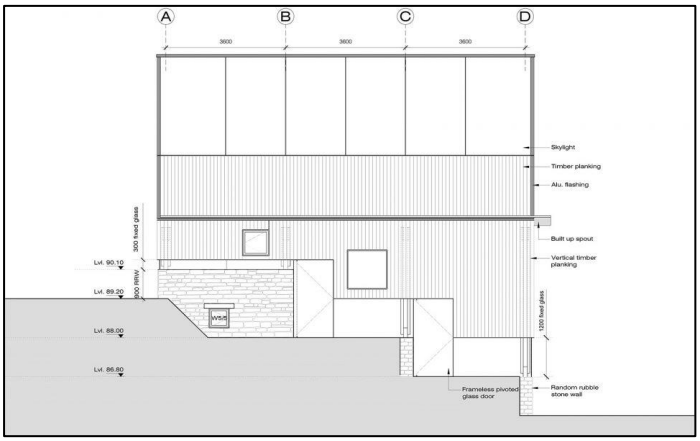


Figure 39:East elevation

(Source: https://arqa.com/en/architecture/wood-house.html)

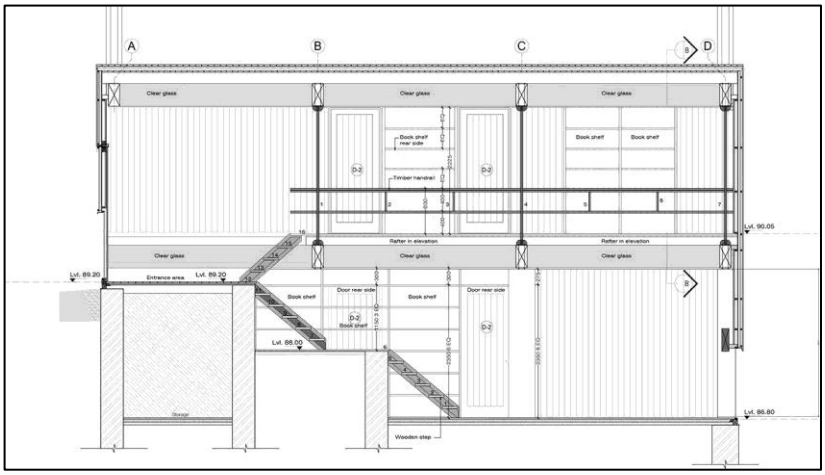


Figure 40:Partition elevational section

(Source: https://arqa.com/en/architecture/wood-house.html)

4.6 CASE STUDY-2 THE KUMAON, ALMORA

In Uttarakhand, India, this small hotel is in the village of Kasar Devi, close to the town of Almora, at a height of 1600 metres above sea level. The Kumaon is a mountain retreat situated in the heart of Himalayas in Almora. The Kumaon is all about a Walk-through hamlet practising traditional agriculture; descend through forests of Oak, Cedar and Rhododendron to ancient stone temples, or relax in the mountain sunshine and cool breeze, surrounded by birdsong and the fragrant smell of pine. It was conceptualized by Vikrom Mathur and Raghav Priyadarshi in 2013.

Figure 41:The Kumaon, Almora

(Source: https://thekumaon.com/)

The location can be accessed via a relatively steep route down from the main road. This village road ends around 250 metres from the site, and the remainder of the route to the site is through a village walking track.

Architectural firm: Zowa Architects

Site area: 2.5 Acres

Total floor area: 1,160 sqm

Design phase: Nov 2013 – June 2014

Construction phase: Aug 2014 – May 2017

Year of completion: 2017

A small gate marks the entrance of the hotel, and a walkway leads to the main lounge, which serves as the visitor's point of entry. a row of bamboo trees that have been planted to block the view of the chalets beyond and to obstruct the mountain vistas. The purpose was to blend the mountains with a tropical sensibility.

4.6.1 THE DESIGN STRUCTURE OF THE KUMAON

The sloping site is terraced. It is divided into two parts: a half-acre plot at the top is used to facilitate the service facility, and a 2-acre plot is separated by a small section of common land. The land has uninterrupted views of the valley below and magnificent views of the Indian Himalayas, which are located 300 kilometres away.

There are seven structures built at the site. The main unit comprises the lounge and a double-sided fire unit which differentiates the lounge from the library. The terrace of this unit opens into an open yoga and breakfast area. Adjoining this, sitting perpendicular above the lounge and library is a cantilever structure which makes for the kitchen and dining area.

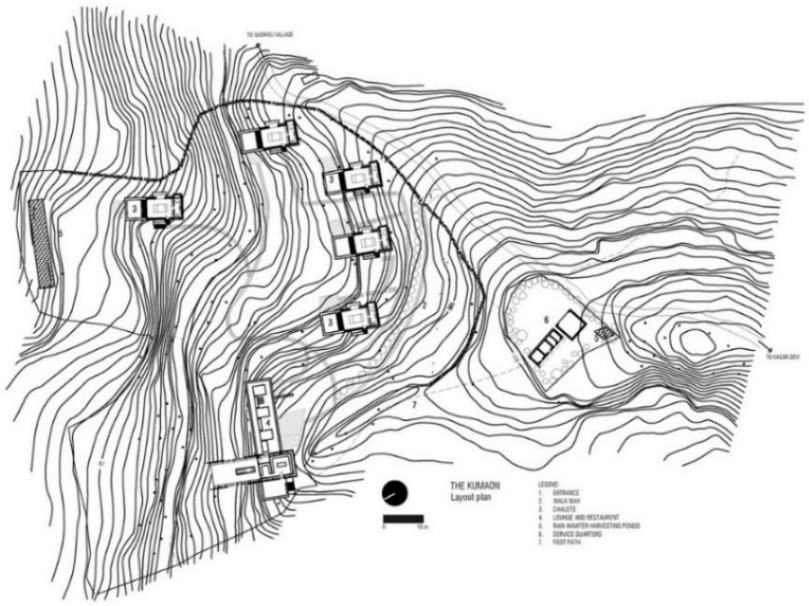


Figure 42:Site plan, The Kumaon

(Source: https://thekumaon.com/)

The lower structure is made of stone and cantilever of steel. The restaurant surrounded by floor-to-ceiling glass on three sides, facilitates a view of the Himalayan Mountain range.

Utilizing the contours of the landscape, the five chalets are built across terraces. Further the three sides of the dining room were also cladded with bamboo sticks to reduce the visual impact of the bulky steel structure. Overall attempt was to highlight the stunning natural landscape and focus on the mountain views. While paying homage to local materials, tradition and culture.

The ten rooms of the resort are nestled in pairs, across the five chalets, which splits into two units with one room each. Every room includes a sit-out space and separate entry points. The footprint of the rooms remains while the materials change. The foundational level of the chalet is built out of stone quarried from the vicinity with walls of fly ash brick. The upper level is finished in cement render.

4.6.2 SUSTAINABILITY: REDUCING THE ECO-FOOTPRINT OF THE KUMAON'S ACTIVITIES

By dispersing the structures clad with bamboo around the site, architects were able to dissolve the visual impact a steel building can have in a forest environment. Situated in a water starved region, The Kumaon is equipped for rainwater harvesting with a drainage system that brings collected water from the roofs to a holding tank at the bottom of the site. Flora was planted to ensure that the site merges with the forest. Material cost leads to greenhouse gas emissions and contributes to pollution, to avoid that it was ensured that local materials were used. Local pinewood is used extensively, from floor finish to doors and windows. Even the furniture was designed and made on site.

Every building was constructed with an aim of collecting rainwater harvesting, and a drainage system supplying the water to a large storage tank at the bottom of the site.

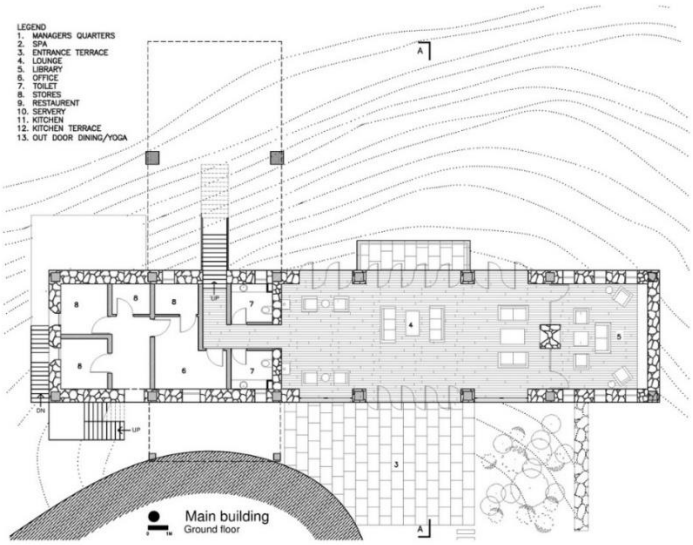


Figure 43: main building- ground floor

(Source: https://thekumaon.com/)

The main building was situated on the highest point in the site, the ground level is the main entry point which houses a lounge, library, and toilet and administrative facilities, while the first floor houses a dramatic steel cantilevered dining room.

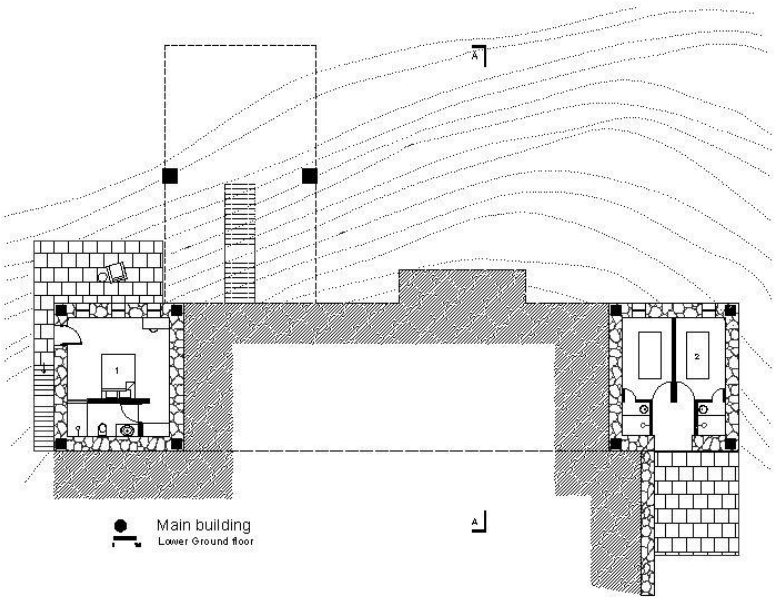


Figure 44: 39 main building- lower ground floor

(Source: thekumaon.com)

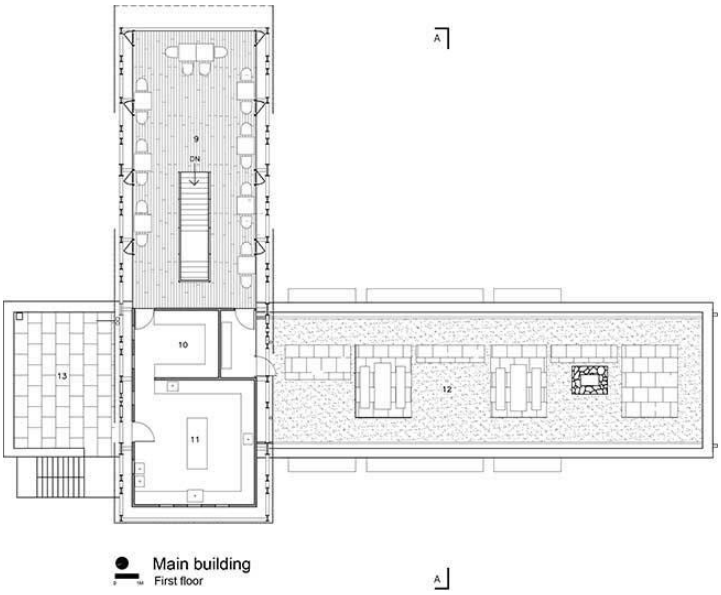


Figure 45: main building- first floor

(Source: thekumaon.com)

- Access to the site is via a slightly steep track down, off the main road.
- The sloping site is terraced which is typical of agricultural plots in this area and is in two parts a small half-acre plot at the top of the site which we used to **situate the service facilities** and a two-acre plot, separated by small strip of common land.
- Rooms were designed in pairs, one atop the other This was partly to reduce the bulk of the building and also to reduce the overall footprint of the development.

- The walls of the top chalet were constructed from fly ash bricks and covered with bamboo sticks to create a sense of lightness, while the lower chalet was constructed from stone mined locally.

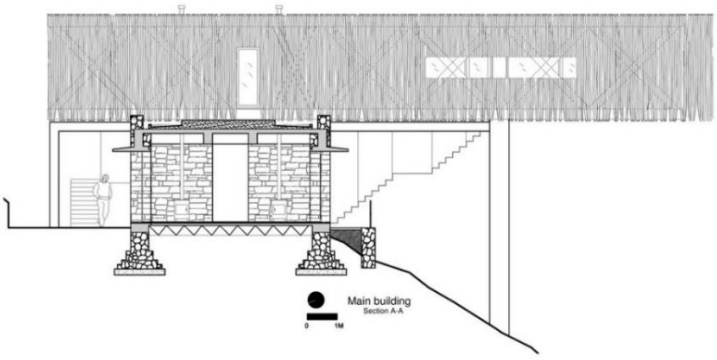


Figure 46: Section of the main building

(Source: thekumaon.com)

4.7 INFERENCES OF THE CASE STUDY (MODERN CONSTRUCTION)

- Modern buildings are designed considering the need of the today's life-style.
- Traditional buildings lack sense of living if we compare it to the today's living lifestyle.
- The traditional buildings were no doubt stable, having life-span of 1000 years and above.
- Current practices done by architects are no doubt sustainable and following standard design consideration of hilly region, but they somehow lack the traditional methods which are much stable in the hilly terrain.
- Current generations do not know about the traditional Koti-banal, if we incorporate old structures with modern materials, we can revive the old methods.

CHAPTER 5: ANALYSIS OF CASE STUDY

Parameter of analysis	**Case study-1** **Barakot village,** **Almora**	**Case study-2** **Harkot village,** **Munshiyari**	**Case study-3** **The Kumaon,** **Almora**	**Case study-4** **Wood house,** **Nainital**	**Inferences**
Siting	situated on stepped lands without disturbing natural terrain.	Entire settlement is placed in linear manner without disturbing terrain. The houses were planned with streets in centre and houses on its side.	terraced which is typical of agricultural plots	rooted strongly to existing and unharmed terraces.	All case studies taken has followed the siting along the contour without disturbing the natural contour.
Orientation	Oriented along east and south	sited on the sunniest slopes	Located along south-east	Oriented along east-west	Orientation of both approaches were kept along the sunniest slope to get maximum benefit.
Foundation design	3-4 feet deep stone foundation	shallow stone foundation, one to three feet deep	Load bearing stone foundation	Stepped foundation with retaining wall	Stone and mortar were used in traditional, stepped foundation used in contemporary to avoid unnecessary cutting and filling

Shape of the plan	Shape of the plan is rectangular and the ratio of the width is 1.2 times of its depth.	Rectangular in shape	Rectangular units	rectangle	Building plan of both traditional and modern is rectangular which is safe.
Thermal insulation	Ground floor was made with small windows to make it warm; people live on first floor, livestock on ground	Low floor height and small door and window openings allows heat to trap for longer period of time.	Bamboo and Stone walls acts as barrier for thermal conductivity.	2 wood panels with void in b/w them to create insulation the interior space	Wooden walls provide more insulation and are easily built
Roofing	The slabs of the stone are cut into tiles and then used as a roofing material	Stone slate slab, native grass called *selum used to* cover the sloping roof to help regulate the warmth	Kota stone terrace supported on wooden beams	Timber roof with iron tie rods	Slanted roofs with slates provide better flow of rain and snow
Walls	Stone masonry with wooden beam introduced at 30cm gap alternatively	1.5 ft. thick Stone masonry walls	Fly-ash walls and stone	Bamboo and stone walls fixed with mortar	Stone walls with wooden beams provide flexibility and strength in earthquakes
Door /window opening	Rear side of the house, which does not face sun usually have no windows or other openings.	Ground floor was made with small windows to make it warm; people live on first floor; livestock	Window opening were much bigger, Mechanical means were used to warm the interior space	Windows opening in all direction to ensure mountain views	Small windows with wooden lintel beam provide better insulation as cool air is managed through ventilation

		were on ground			
Ceiling height	Ceiling ht kept low ,2.4-2.5	Ceiling ht. was kept low.	ceiling ht of units were kept low	Double ht. ceiling	Low ceiling height create warm environment
Cost -effective-ness	All the materials were locally excavated and construction were done by the owner family	All the materials are locally sourced and the construction done by the owners of the house.	Some materials are exported like fly ash bricks and bamboo cladding. Major construction was done from stone	Sal wood of Multiple plans are used which makes it expensive.	Traditional materials were much cost effective compared to modern construction.
Environmental impact	Local materials were used which were available in abundance.	Stone and wood are available in abundance.	Units are placed partly to reduce the bulk of the building and also to reduce the overall footprint of the development. rainwater harvesting, with a drain system	bio-engineering method, to stabilise the slopes, while stone-built gully plugs were employed to allow rainwater to percolate into the ground.	Stones and woods were quarried from nearby. rainwater harvesting with a drainage system

CHAPTER 6: CONCLUSION

The changes that have taken place in the Koti Banal style of architecture are reflections of social and environmental changes that have taken place in the society. They indicate that it is not easy to hold on to the construction techniques and the historic vernacular forms, due to the contemporary aspirations.

The macro level components—materials for building, methods of construction, and the form of house—are particularly vulnerable to the mentioned changes. They are strongly impacted by resource availability and market dynamics (current trends; supply-demand), aspects that are beyond the control of the community. The macro level changes in interior-architecture have brought long lasting changes in the life of the community. Also, the continuity of vernacular traditions is threatened. Changes at this level have large-scale impacts on its appearance (for example, the disappearing goth, which has been so integral to the house form and the lifestyle). Cumulative changes like this multiply, and alter drastically the innate character of the cultural landscape of the settlement. However, having expressed the above, there is still a presence of the "Koti Banal" style. It is at least clear that the style has not been completely abandoned; few selected aspects have been modified to address changes in building materials and lifestyle.

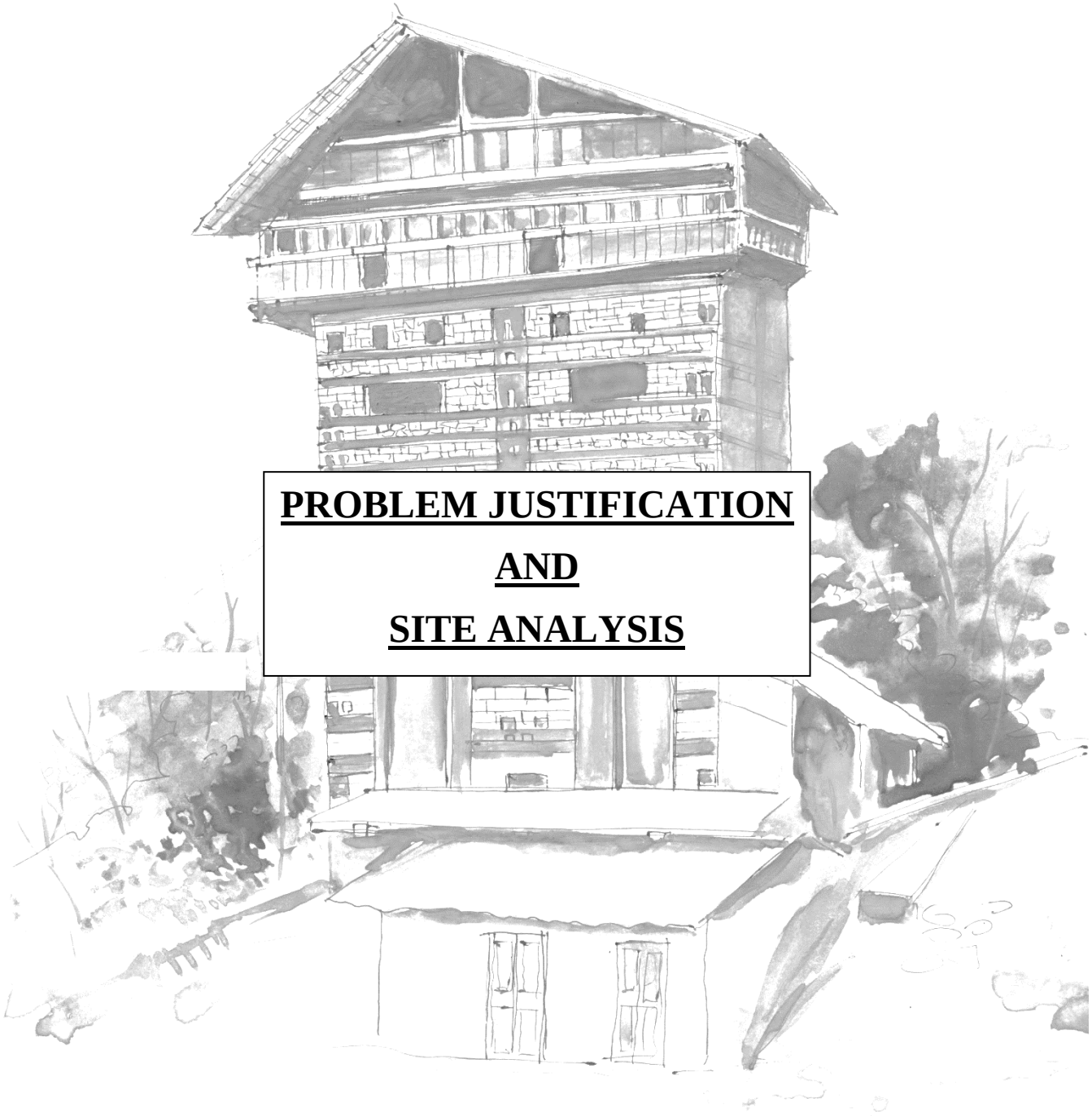
There is a need to delve into new materials with the old principles of structural design and community involvement, which Koti Banal style embraced. It will ensure a landscape that continues to reflect the identity of the community and also takes care of new aspirations. Since, the local skills will get employed; it will also lead to opportunities for culturally sustainable livelihoods and enterprises resulting in additional benefits to the local economy. It is also suggested that the Government should ensure that the new constructions proposed, should respect the existing built forms and maintain the unique identity of the state.

The vernacular practices of a place are sustainable and better for environmental protection can be proven by the fact that they have lived in the context for centuries, they have developed and evolved according to the needs of people.

The changes and moderation in the practices have taken place according to the climate, the culture and the social requirements of the community. These practices can form the basis for the development of modern buildings and in order to achieve sustainability in modern

construction in hill settlements of Uttarakhand, these techniques need to be revived to help us in maintaining the ecological balance of the region and minimize the climatic change caused due to contemporary construction. Reviving these practices will also help the local culture to develop and will increase the employment opportunity in the region resulting in economic growth of the region. Moreover, this will ensure that these practices maintain to be unique in character and to specific region. It is also true that these practices can't be adopted in their earlier form but with some modification in materials and techniques they still prove to be better solution and can be integrated with modern construction techniques.

The government need to take the lead in bringing this architectural style back. Why not use the Koti Banal approach, for instance, if the government intends to build an institution someplace in the hills instead of constructing a typical cemented structure? Not only will it preserve a technology that is on the verge of extinction, but it will also provide contractors with expertise in Koti Banal constructions work and assistance. The same method might be applied to government structures and monuments.



PROBLEM JUSTIFICATION AND SITE ANALYSIS

CHAPTER 7: PROBLEM JUSTIFICATION

7.1 BACKGROUND

Tourism is a very important tool for economic advancement of India. In present situation the tourism industry is growing every day. If we analyse resort tourism and need of leisure places, it not only focuses on overnight stays but also concerns in day services too. Uttarakhand is one of the tourist destinations Uttarakhand is one of the tourist destinations. Kumaon architecture exemplifies the region's richness of art. Kumaon has a distinct sense of style when it comes to art and architecture.

In my dissertation part -1, I have done research on "*Comparative analysis of traditional and contemporary architecture in context to sustainable characteristics and its construction techniques*" of Kumaon region. We concluded that how Koti- banal architecture of Uttarakhand has sustained over 1000 years. It is one of the oldest architectural styles in the Himalayas. Kumaon region in Uttarakhand shows great examples of traditional architecture which has proven to be the best earthquake -resistant structures.

My aim is to create a visual and cultural identity of the region that is in sync with nature by developing tourist destination for recreation, and appreciation of nature incorporating vernacular practice of Koti banal style of architecture which is disappearing gradually.

7.2 OBJECTIVE OF THE PROJECT

This dissertation explores on the designing and planning of resort considering the three dimensions of sustainability i.e., environmental, economic and social dimensions. To achieve this the thesis has been carried out in four stages. First to understand the concepts of resorts. Second to understand the typologies and planning aspects. Third to explore material and construction techniques. Fourth deriving consideration and designing according to the user group.

7.3 NEED

Despite being located in a seismically highly vulnerable region, Kumaon shows an elaborate tradition of constructing multistoried houses. Kumaon had developed its own style of

architecture based on abundantly available material. Proposal of design of resort in blend with Koti-banal style combine it with contemporary practices to attain sustainability, a modern approach to life, conservation of cultural heritage preservation and disaster risk reduction.it will not only preserve the cultural heritage but also will attract the tourists to get to know about the history of1000 years old construction techniques which is near extinction. Foothill tourism in developing countries is becoming a growing environmental concern due to extreme seasonality, lack of suitable infrastructures and planning, and interference with fragile ecosystems and protected areas. In the Indian Himalayan Region (IHR) tourism has experienced continued growth and increasing diversification over the last few decades. It is expected to grow at an average annual rate of 7.9% from 2013 to 2023. (Ref: Niti Ayog: Sustainable Tourism in the Indian Himalayan Region).

The need of the project is to preserve the cultural environment with sustainable development and to enhance and develop tourism in Kumaon region. In present context, tourism holds a great potential to establish itself as a significant means of economy. it has a great potentiality to generate foreign revenue.

SITE ANALYSIS

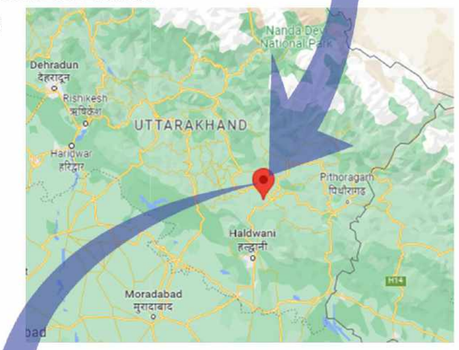
ABOUT SITE:

The site is located on the Shitlakhet road, Dhamas, Almora city in the state Uttarakhand . The project site of approx. 5.62 Acers land area sits in the beautiful hilly terrain and oversee the specular valley view. surrounding of the site includes step farms and villages.

Latitude 79°35'23.5"E **Longitude** 29°36'20.4"N

APPROACH TO THE SITE:

The approach road accessing the site is on Kosi-Shitlakhet Road. The site is located 17km away from SH-37 .There is only one major approach road which serves the transport to the site. Width of the approach road is aprox 6 meters.

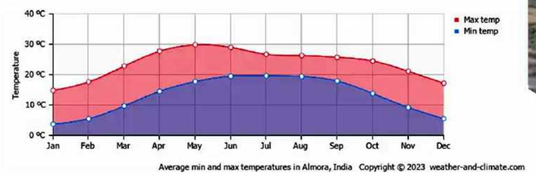


Area: 5.62 acres(22745 sq.m.)

CLIMATIC CONDITION:

Temperature:

- Almora has an average annual maximum temperature of around 23°C and average minimum temperature of approximately 10°C.
- Summer months are from April to July, which sees a moderate climate with the mercury remaining mostly below 30°C.
- December to February months are usually freezing and the temperature may go below 0°C.



EXISTING STRUCTURE ON SITE:

Cut and fill work has started on the site.

EARTHQUAKE FACTOR:

Uttarakhand falls under seismic zones IV and V of the earthquake risk map of India.

ELECTRICITY SUPPLY:

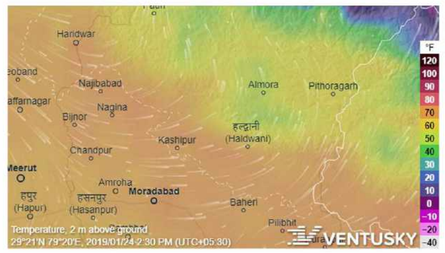
Underground electrical cable systems are present.

WATER SUPPLY:

Water is supplied from hill top underground tanks.

WIND DIRECTION:

- Principle wind direction is SW to NE in summers.
- Normal wind speed is 9-12 kmph.
- The average wind direction throughout the winter is predominantly from the SW to North.



TOPOGRAPHY/;

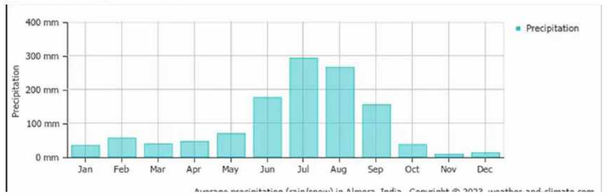
- The site has contoured terrain. The topography of the site is such that it allows a play of levels and provides great thermal mass for insulation against heat.
- The lowest contour level of the site is 1430 m and the highest contour level is 1556 m.

Section A-A'

Section B-B'

RAINFALL:

- The average annual rainfall in Almora is between 1000 and 2000 mm.
- Rainy season falls in the months: June, July, August and September

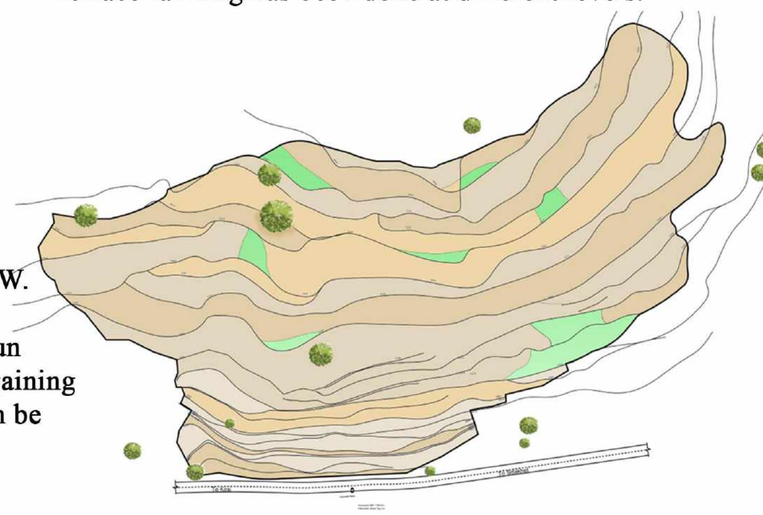


ORIENTATION:

- The site is irregular polygonal in nature facing N-W.
- Its longer axis oriented in NE-SW direction.
- The building should be oriented correctly to the sun path of the site which to avoid the building from gaining heat. With presence of stone walls the sun rays can be minimized going towards the building.

VEGETATION:

- The existing vegetation consists of deciduous trees-deodar, Sal, oak.
- Small shrubs and bushes are present in small patches with the groundcover.
- Terrace farming has been done at different levels.

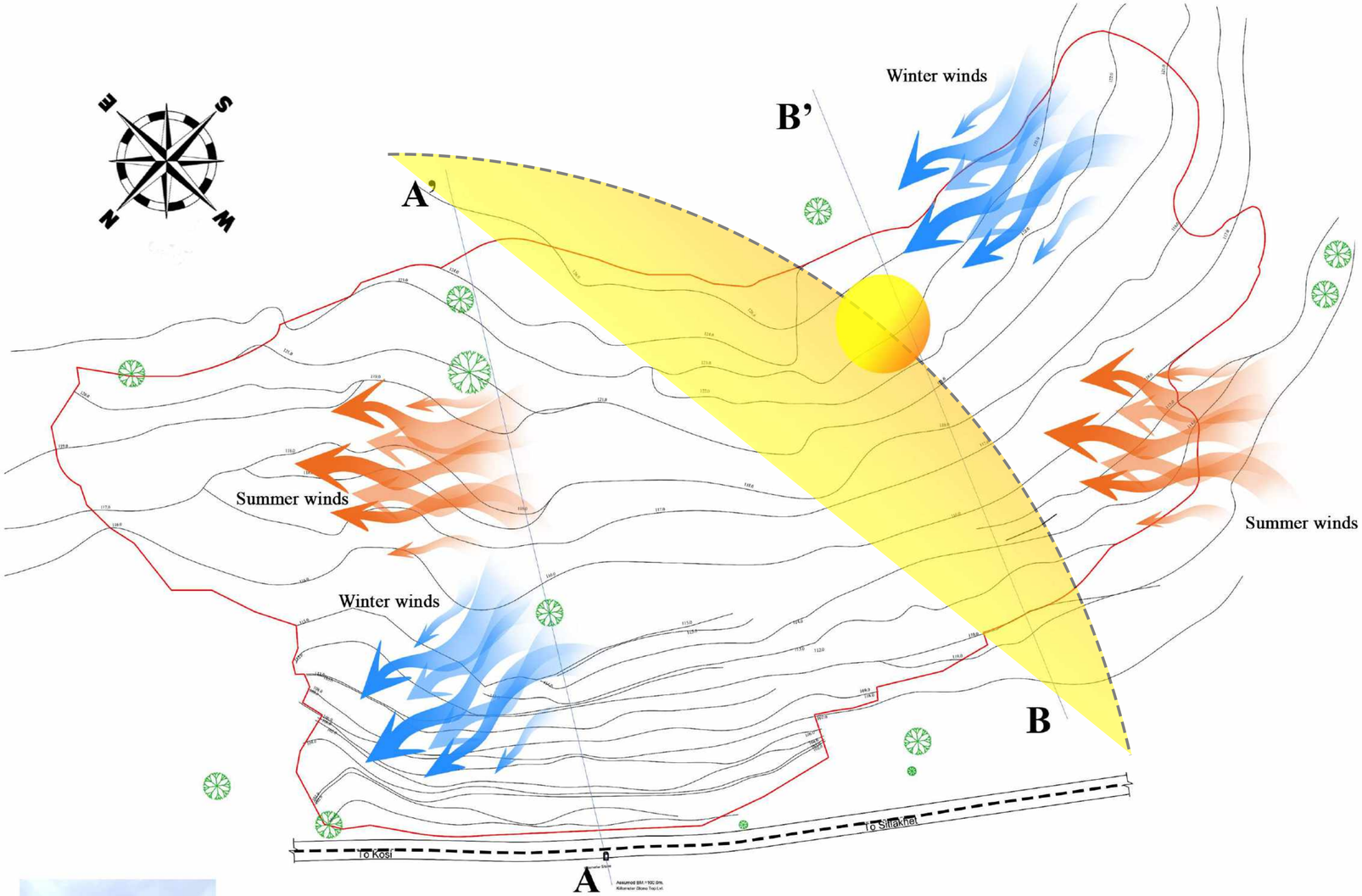


PROPOSED ECO-TOURISM RESORT AT ALMORA, UTTARAKHAND

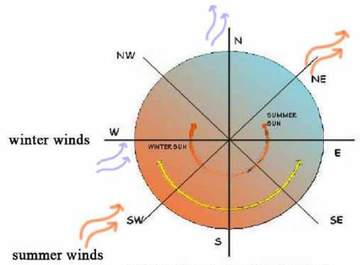
GUIDE: AR. SAURABH SAXENA

NITIKA RANJAN RAO
M.ARCH. (P.T.), 2020-23
ENROLLMENT NO. 1200109007

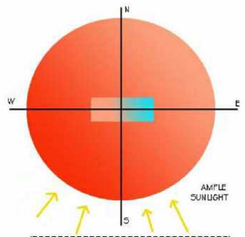
SITE ANALYSIS



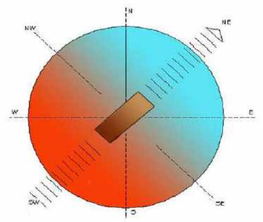
BUILDING ORIENTATION CONSIDERATION:



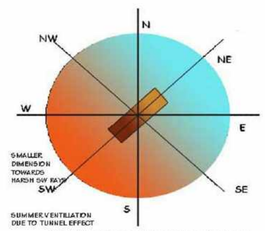
solar and wind diagram



sun orientation



wind orientation



favourable orientation

POTENTIALS AND CONSTRAINTS OF THE SITE:

- It is surrounded by agricultural land all around with no development in close proximity thus no hazard of the calmness being disturbed.
- Uttarakhand lies under earthquake prone area.
- Since the site is located in Uttarakhand,it can be developed as a tourism centre that can provide a glimpse of rich culture of kumaon and encourage tourits to get a first hand experience by viiting those less explored areas.

POTENTIALS AND CONSTRAINTS OF THE SITE:

Building bye-laws:
Minimum plot area for eco-resort(hilly region) - 7500sqm
Maximum height of the building in hilly region-
F.A.R. & Ground coverage(hilly region) – 0.25 , 20%
Setback-

Front- 12.0m	Back- 6.0m
Side 1- 6.0m	Side 2- 6.0m

E.C.S. - 1.5

Distance from existing trees:
Construction shall not be permissible within 3m area from the trees.

apporch road leading to the site.

ongoing site-work isolated footing

shallow sloped contoured terrain facing valley proving a scenic perspective of mountains.

cut and fill has done on the site.MS square pipe frame has been developed at site for making plinth of wooden structure resting on it.

terrace farming done by nearby villagers.

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CONCEPT DEVELOPMENT

BACKGROUND:

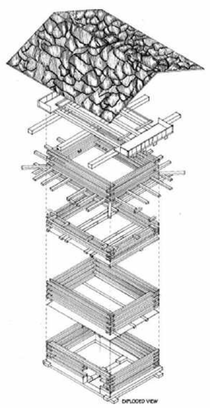
Tourism is a very important tool for economic advancement of India. In present situation the tourism industry is growing everyday. If we analyse resort tourism and need of leisure places, it not only focuses on overnight stays but also concerns in day services too.
Uttarakhand is one of the tourist destinations Kumaon architecture exemplifies the region's richness of art. Kumaon has a distinct sense of style when it comes to art and architecture.

AIM:

The aim is to create a visual and cultural identity of the region that is in sync with nature by developing tourist destination for recreation, and appreciation of nature incorporating vernacular practice of Koti banal style of architecture which is disappearing gradually.

JUSTIFICATION:

Despite being located in a seismically highly vulnerable region, Kumaon shows an elaborate tradition of constructing multi-storeyed houses. Kumaon had developed its own style of architecture based on abundantly available material,called Koti-banal.
Proposal of design of resort in blend with Koti-banal style combine it with contemporary practices to attain sustainability, a modern approach to life, conservation of cultural heritage preservation and disaster risk reduction it will not only preserve the cultual heritage but also will attract the tourists to get to know about the history of1000 years old construction techniques which is near extinction.



Exploded view of typical Koti-banal house

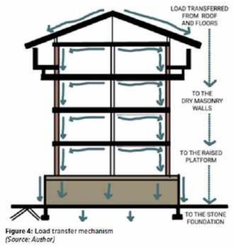
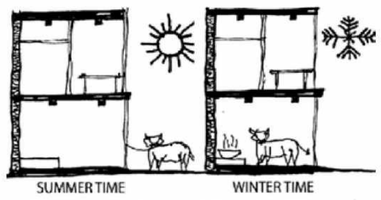


Figure 4: Load transfer mechanism (Source: Author)

Load transfer mechanism

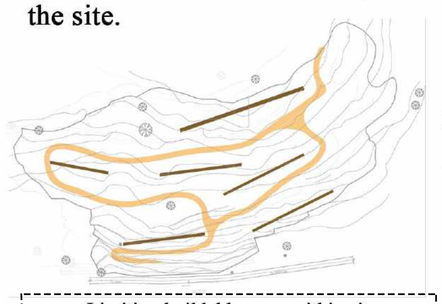


Different use of ground floor in different season

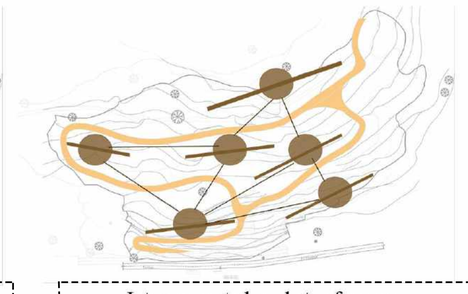
Local aipan artform has been taken as an inspiration to create landscape in the site

CONCEPT AND DESIGN DEVELOPMENT:

The idea behind developing the whole site was to preserve the existing site condition while creating inter connected pockets of spaces throughout the site.

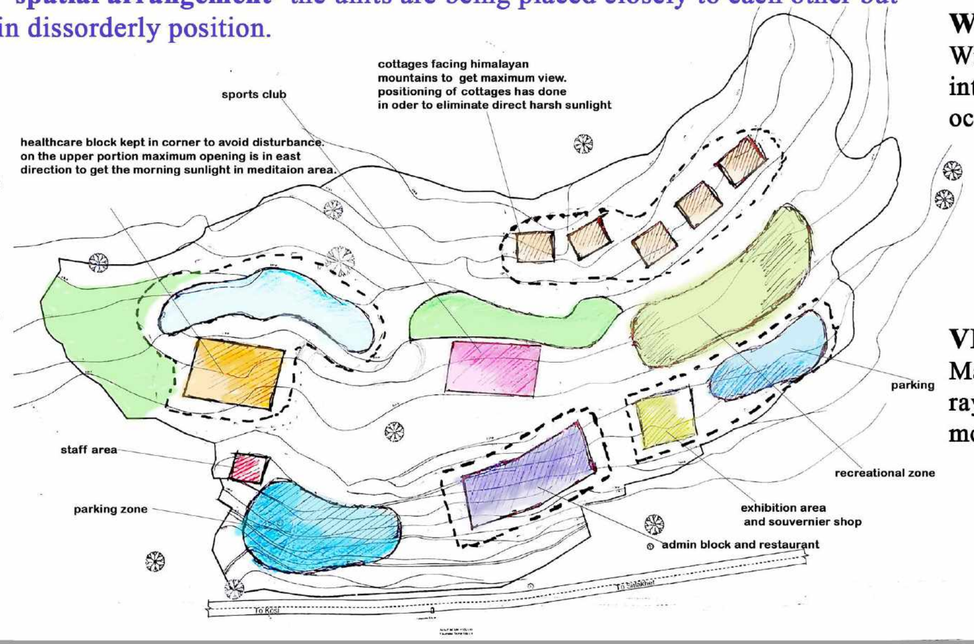


Limiting buildable zone within site

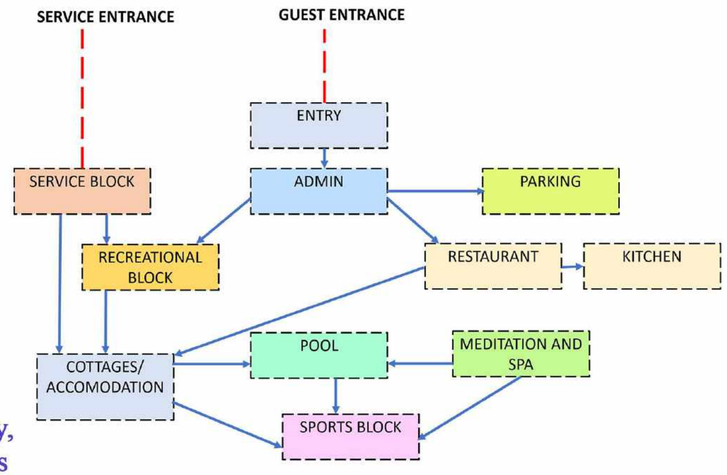


Interconnected pockets of spaces

- Land parcels were demarcated according to gradient, sun exposure, scenery, and tree locations. The construction methodology adopted lends the pockets to orient on site according to the site contours.
- Organic pathway winding through open spaces connect all the built areas while giving an interesting experience to different types of users throughout the site.
- Intervention of sustainable material- by replacing wooden beams with bamboo or hempcrete
- **spatial arrangement**- the units are being placed closely to each other but in dissorderly position.

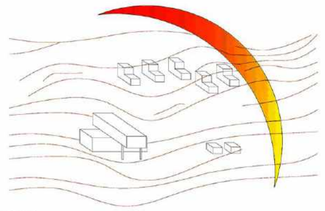


BASIC RELATIONSHIP & ZONING OF RESORT:



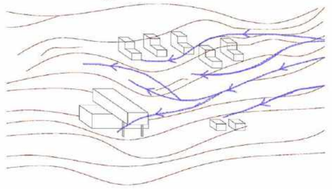
SUNPATH

refering to the concept of the building,it is oriented correctly to the sunpath of site to avoid building from gaining heat.



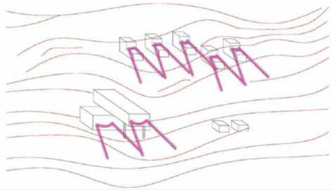
WIND PATH

With the strong winds coming up toward terrain,the buildings intended to do openings so that more coross-ventilation occurs in the building.



VIEWS

Maximum openings have been made facing away from sun rays,positive view is mostly facing towards himalayan mountains.



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M.ARCH. (P.T.), 2020-23
ENROLLMENT NO. 1200109007

FLOOR PLANS

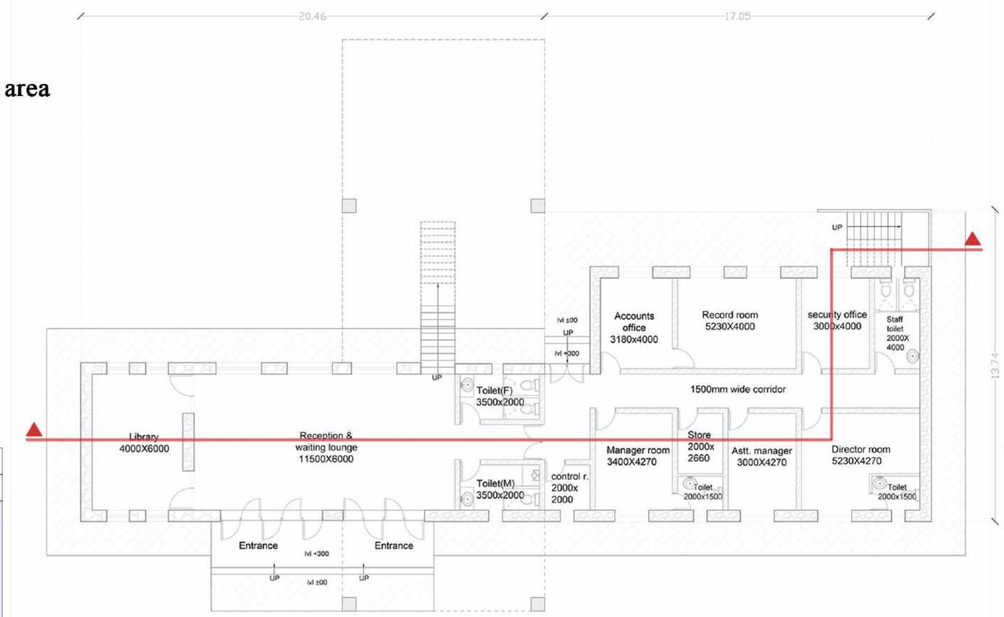
AREA CALCULATION:

Plot area-5.62 acres(22743.33 sq.m.)
Permissible Ground coverage = 20%
= 4548.6 sq.m.
F.A.R. = total covered area on all the floor/plot area
0.25 =total cov. Area on all floor/22745
Total covered area = 0.25x22743.33
= 5685.8 sq.m.
Achieved covered area=5384.5 sq.m.
parking calculation
E.C.S.= 1.5/100 sqm of covered area
=5384.5 X 1.5 /100
=80.7=81 no. of cars

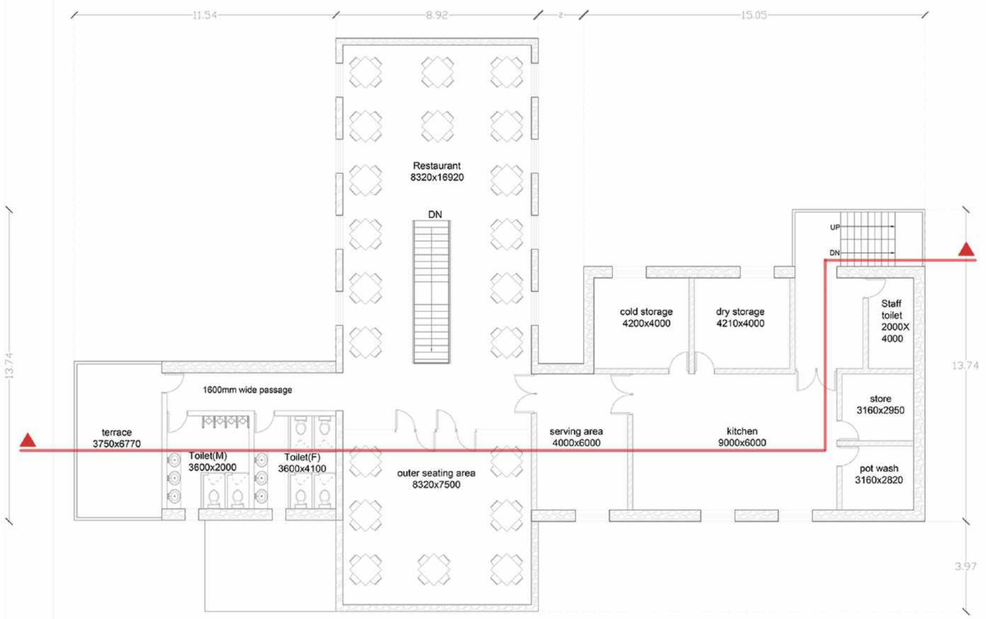
AREA STATEMENT:

FUNCTION	NOS.	TOTAL AREA (Sq,m)
ADMIN BLOCK(GROUND FLOOR)		
▪ Reception & waiting	1	70
▪ Library	1	24
▪ Manager room+toilet	1	18
▪ Assistant manager	1	13
▪ Accounts office	1	21
▪ Record room	1	5
▪ Store	1	12
▪ Security office	1	12
▪ Staff toilet	1	8
▪ Director room+toilet	1	22
▪ Toilet (M+F)	2	14
TOTAL AREA		219

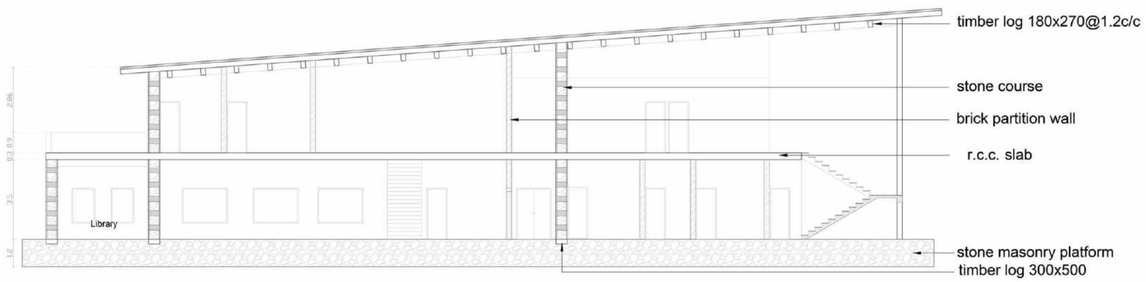
FUNCTION	NOS.	TOTAL AREA (Sq,m)
ADMIN BLOCK(FIRST FLOOR)		
▪ Restaurant	1	140
▪ Outer seating	1	62
▪ Kitchen	1	54
➢ Serving area	1	24
➢ Cold storage	1	16.8
➢ Dry storage	1	16.8
➢ Pot wash	1	9
▪ Store	1	9
▪ Toilet (M+F)	2	14.4
TOTAL AREA		346



Admin block-Ground floor



Admin block-First floor



Admin block-section A-A'

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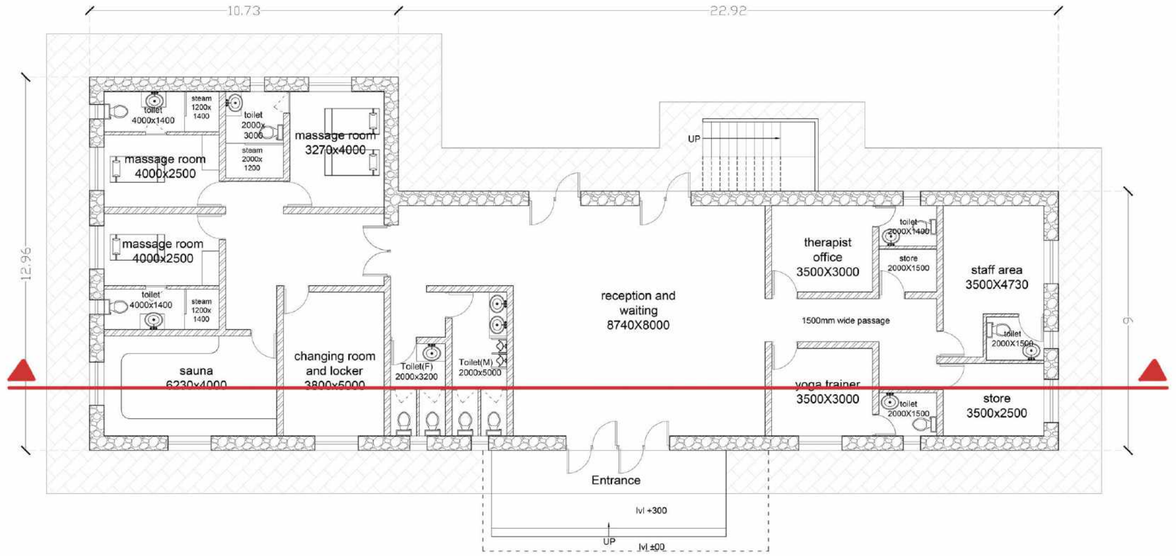
FLOOR PLANS

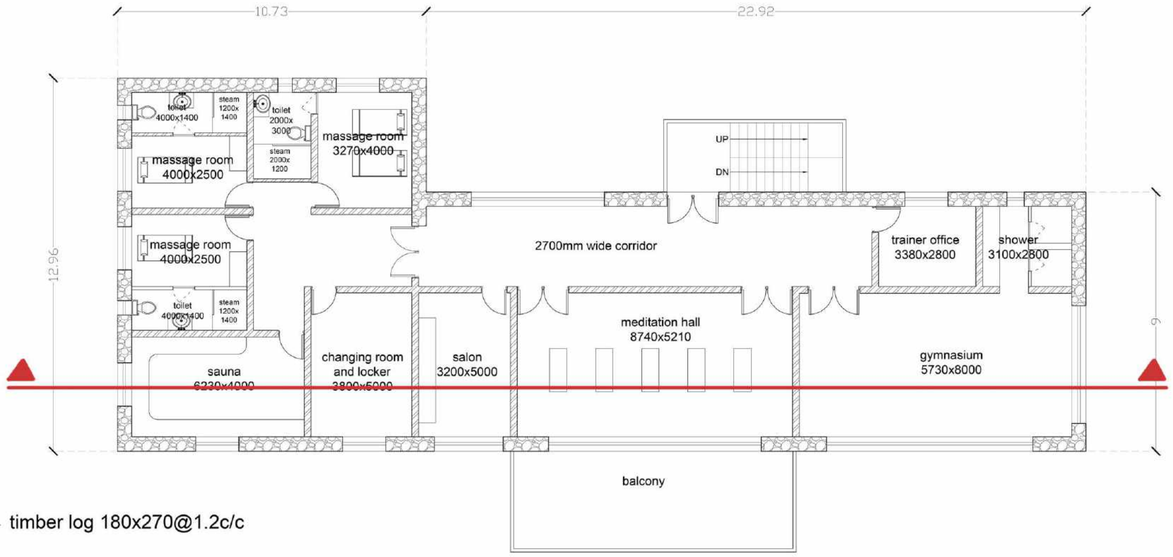
AREA STATEMENT:

FUNCTION	NOS.	TOTAL AREA (Sq,m)
Meditation & SPA BLOCK(GROUND FLOOR)		
▪ Reception & waiting	1	70
▪ Therapist office+toilet	1	10
▪ Yoga trainer+toilet	1	10
▪ Staff area	1	16.5
▪ Store	1	9.5
▪ Changing room+locker	1	20
▪ Sauna	1	24.8
▪ Massage room+toilet	3	40
▪ Toilet (M+F)	2	16.4
TOTAL AREA		217.2

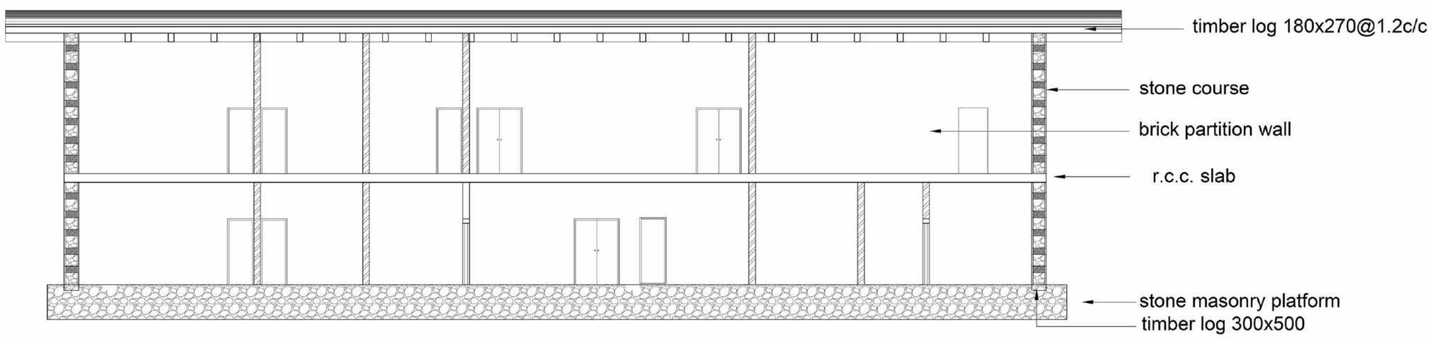
FUNCTION	NOS.	TOTAL AREA (Sq,m)
Meditation & SPA BLOCK(FIRST FLOOR)		
▪ Meditation hall	1	45.4
▪ Gymnasium+shower	1	54.2
▪ Trainer office	1	10
▪ salon	1	16
▪ Changing room+locker	1	20
▪ Sauna	1	24.8
▪ Massage room+toilet	3	40
TOTAL AREA		210.4



SPA block-Ground floor



SPA block-First floor



Spa block-section A-A'

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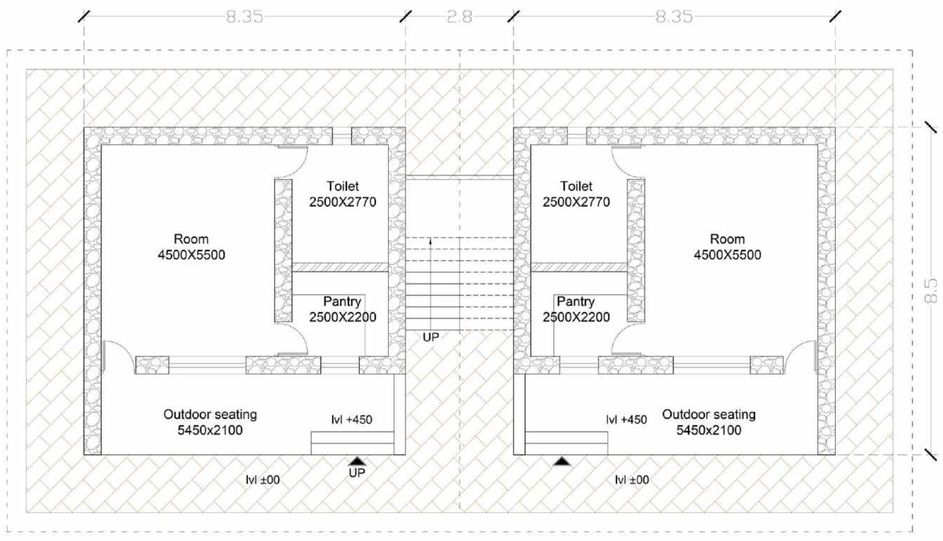
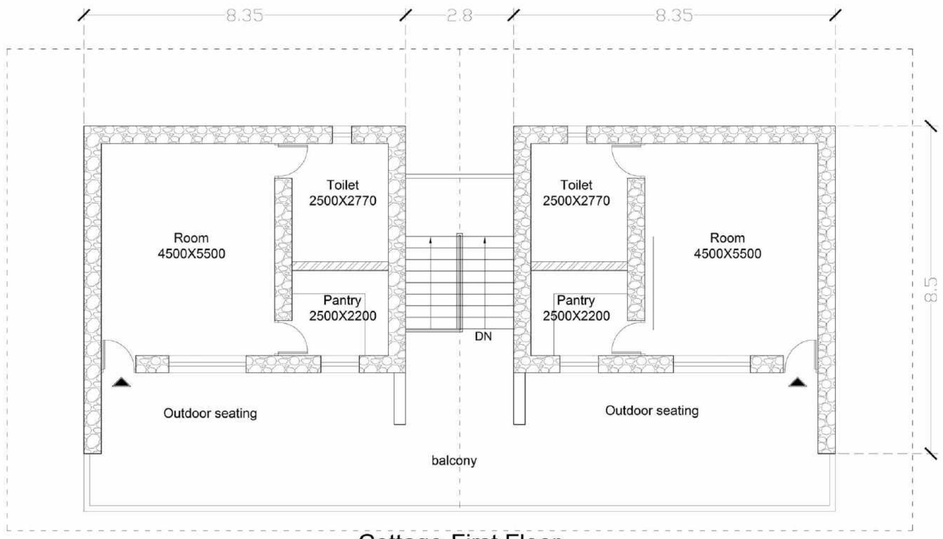
FLOOR PLANS

AREA STATEMENT:

FUNCTION	NOS.	TOTAL AREA (Sq,m)
Cottages		
Cottage with- ▪ Covered verandah ▪ Bedroom ▪ Toilet ▪ Kitchen	36	71x36
TOTAL AREA		2556



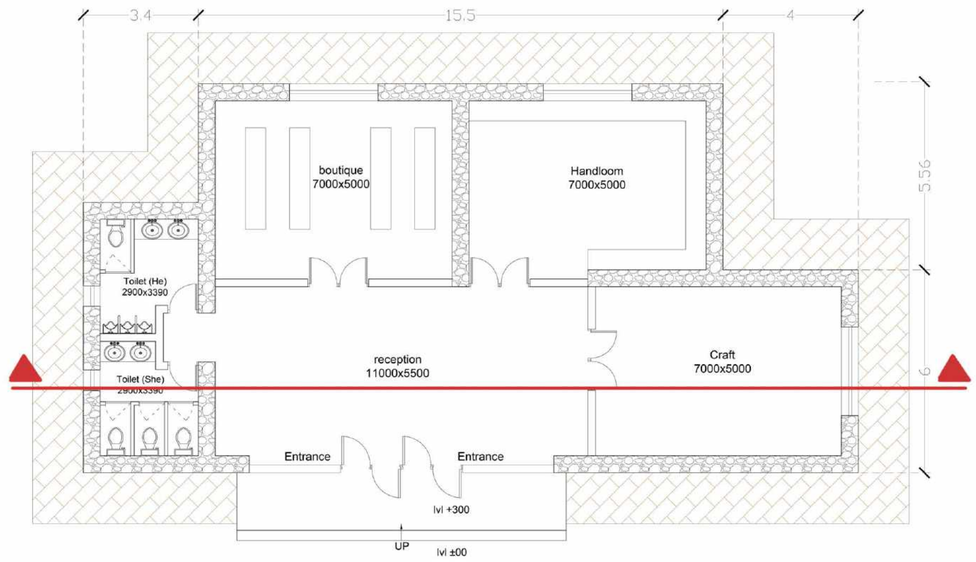
Cottage-Ground Floor



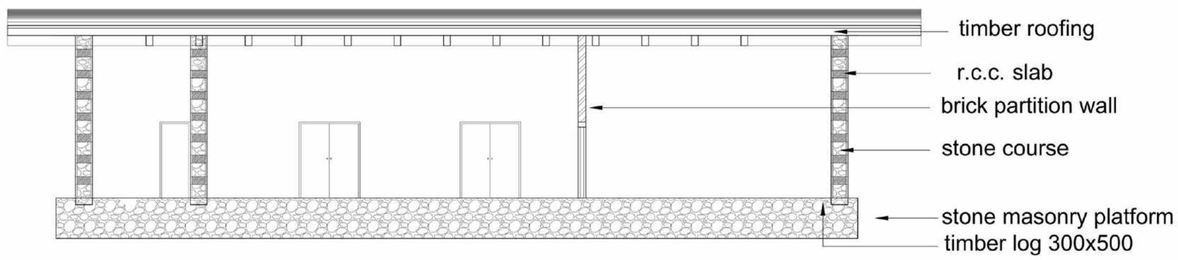
Cottage-First Floor

AREA STATEMENT:

FUNCTION	NOS.	TOTAL AREA (Sq,m)
SOUVENIR SHOP(GROUND FLOOR)		
▪ Reception foyer	1	60.5
▪ Craft store	1	35
▪ Handloom store	1	35
▪ Boutique store	1	35
▪ Toilet (M+F)	2	19.5
TOTAL AREA		185.3



Souvenir Shop-Ground Floor



Souvenir Shop block-section A-A'

PROPOSED ECO-TOURISM RESORT AT ALMORA, UTTARAKHAND

GUIDE: AR. SAURABH SAXENA

NITIKA RANJAN RAO
M.ARCH. (P.T.), 2020-23
ENROLLMENT NO. 1200109007

FLOOR PLANS

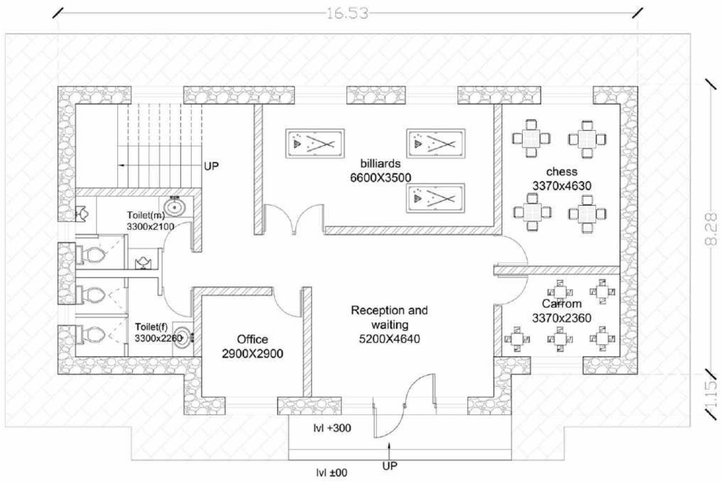
AREA STATEMENT:

FUNCTION	NOS.	TOTAL AREA (Sq,m)
SPORTS CLUB (GROUND FLOOR)		
▪ Reception & waiting	1	24
▪ Office	1	9
▪ Billiards room	1	23
▪ Carrom	1	8
▪ Chess	1	15.6
▪ Toilet (M+F)	2	14
TOTAL AREA		93.6

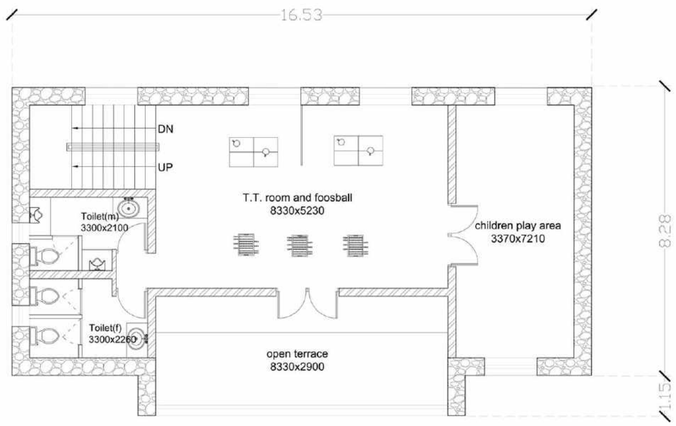
FUNCTION	NOS.	TOTAL AREA (Sq,m)
SPORTS CLUB (FIRST FLOOR)		
▪ T.T. Room and foosball	1	43.5
▪ Children's play area	1	24.2
▪ Toilet (M+F)	2	14
TOTAL AREA		81.7

FUNCTION	NOS.	TOTAL AREA (Sq,m)
RESTAURANT BLOCK(GROUND FLOOR)		
▪ Reception & waiting	1	26.5
▪ Restaurant area	1	95
▪ Serving area	1	24
▪ Pot wash	1	9
▪ Kitchen	1	54
▪ Cold storage	1	8.8
▪ Dry storage	1	6.3
▪ Toilet (M+F)	2	16
TOTAL AREA		239.6

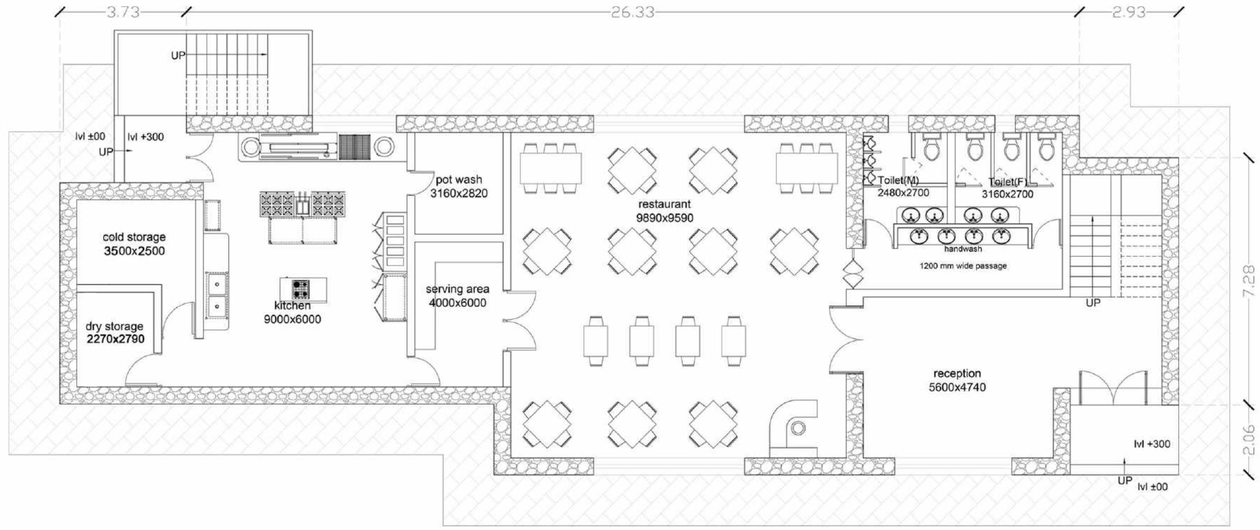
FUNCTION	NOS.	TOTAL AREA (Sq,m)
RESTAURANT BLOCK(GROUND FLOOR)		
▪ Reception & waiting	1	26.5
▪ Restaurant area	1	95
▪ Serving area	1	24
▪ Pot wash	1	9
▪ Kitchen	1	54
▪ Cold storage	1	8.8
▪ Dry storage	1	6.3
▪ Toilet (M+F)	2	16
TOTAL AREA		239.6



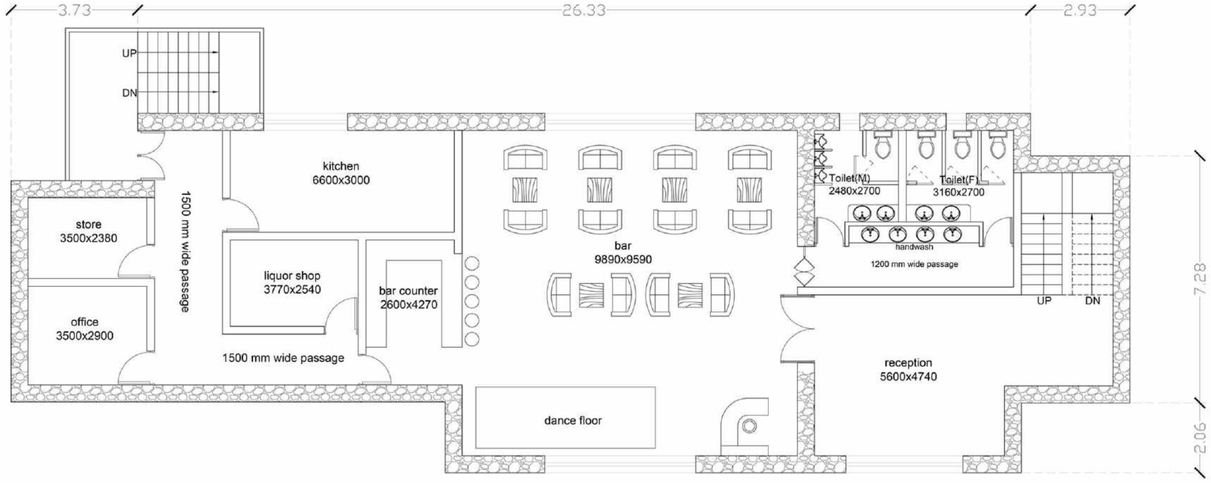
Sports Club-Ground Floor



Sports Club-First Floor



Restaurant block-Ground Floor



Restaurant block-First floor

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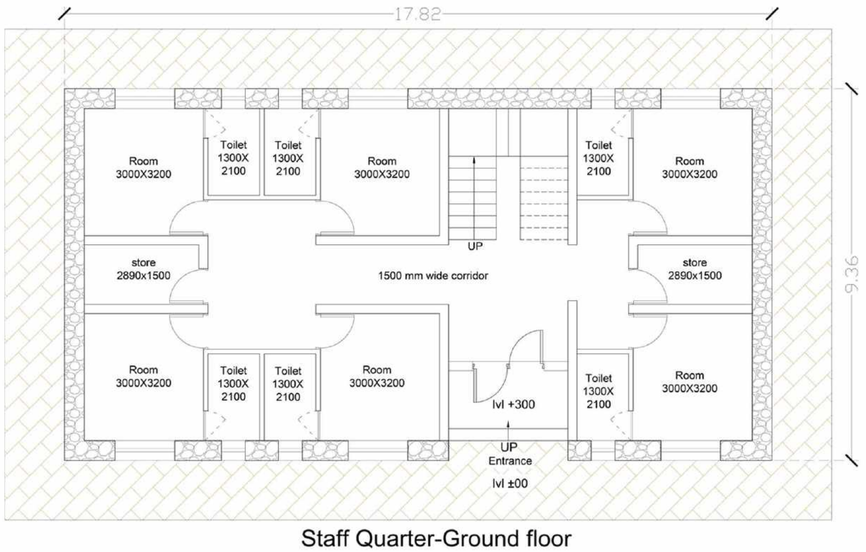
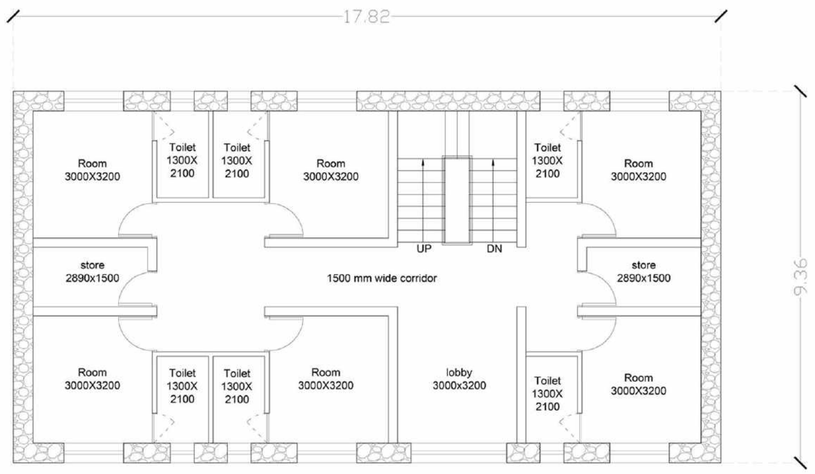
AREA STATEMENT:

FUNCTION	NOS.	TOTAL AREA (Sq,m)
STAFF QUARTER (GROUND FLOOR)		
▪ Entrance lobby	1	9
▪ Room+toilet	6	12.4x6
▪ store	3	4.5x2
TOTAL AREA		92.5

FUNCTION	NOS.	TOTAL AREA (Sq,m)
STAFF QUARTER (GROUND FLOOR)		
▪ Entrance lobby	1	9
▪ Room+toilet	6	12.4x6
▪ store	3	4.5x2
TOTAL AREA		92.5



Staff Quarter-Ground floor

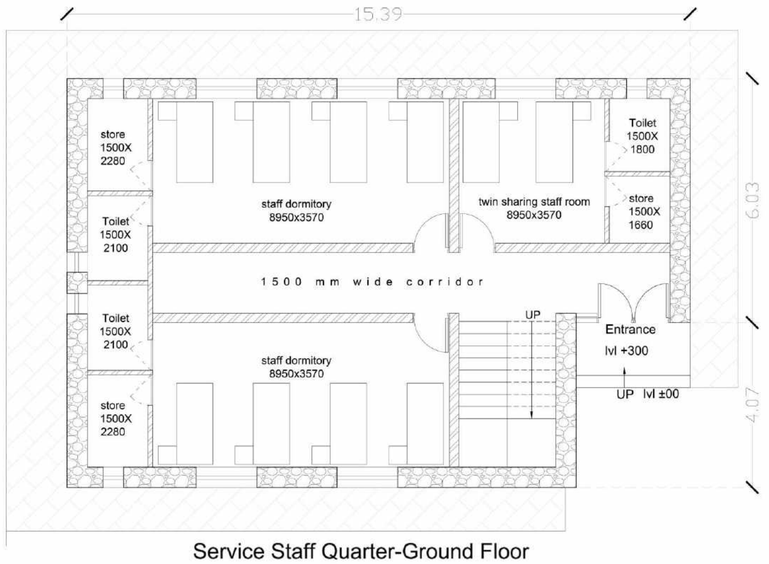


Staff Quarter-First floor

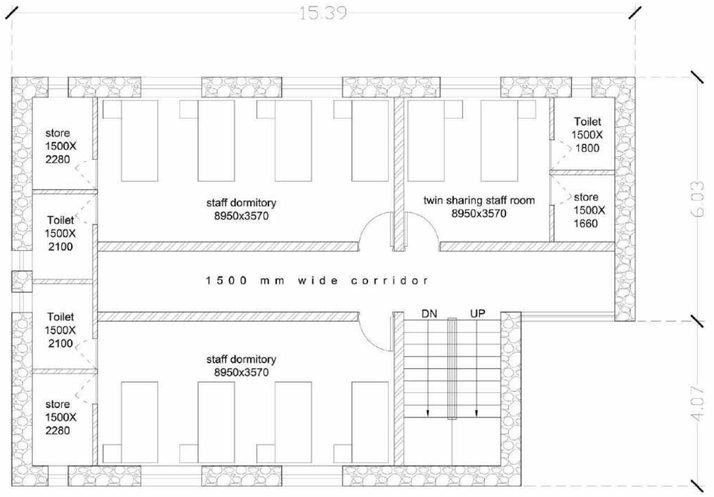
AREA STATEMENT:

FUNCTION	NOS.	TOTAL AREA (Sq,m)
SERVICE STAFF QUARTER (GROUND FLOOR)		
▪ Staff dormitory+toilet	2	70
▪ Room+toilet	1	15.5
▪ store	3	9.5
TOTAL AREA		95

FUNCTION	NOS.	TOTAL AREA (Sq,m)
SERVICE STAFF QUARTER (FIRST FLOOR)		
▪ Staff dormitory+toilet	2	70
▪ Room+toilet	1	15.5
▪ store	3	9.5
TOTAL AREA		95



Service Staff Quarter-Ground Floor



Service Staff Quarter-First Floor

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SITE PLAN

1 Entrance
2 Parking
3 Staff parking
4 Admin block
5 Souvenir shop
6 Restaurant
7 Spa and meditation block
8 Sports club
9 Outdoor seating
10 Staff quarter
11 Service staff quarter
12 Staff canteen
13 swimming pool
14 Pool block
15 Cottage
16 concrete pavers

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