MOUNTAIN MUSEUM

"CELEBRATING CULTURE AND ADVENTURES OF MOUNTAINS"

Nagarkot, Bhaktapur

By:

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CERTIFICATE

This is to certify that the thesis entitled **MOUNTAIN MUSEUM - "CELEBRATING CULTURE AND ADVENTURES OF MOUNTAINS"** at *Nagarkot, Bhaktapur,* submitted to the Department of Architecture of Khwopa Engineering College by **Ms. Deepika Lamichhane** of Class Roll No. 13/ B.Arch./076 has been declared successful for the partial fulfillment of the academic requirement towards the completion of the degree of Bachelor of Architecture of Purbanchal University.

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ABSTRACT

A museum is a not-for-profit, permanent institution in the service of society that researches, collects, conserves, interprets and exhibits tangible and intangible heritage. (ICOM 2022). Hence, mountain museum is a dedicated cultural, educational, and experiential institution that preserves, documents, and showcases the history, heritage, and accomplishments of mountaineering. The Himalayas of Nepal, encompassing eight (8) of the world's fourteen (14) highest mountains, have attracted climbers, explorers, and adventurers for decades. A mountaineering museum in Nepal is essential to celebrate this legacy, educate the public, and address pressing environmental concerns.

To execute this idea, studies on various aspects of a museum-its function, the technical aspects like circulations, displays arrangements, standards etc. are carried out through the literature review. Furthermore, to gain-in-depth knowledge, several national and international case studies were done. National case studies on International Mountain Museum (Pokhara), National Museum (Chhauni) helped to analyze the present scenario of museums in context of Nepal. Simultaneously, International case study on Mountain & Sea art Museum (china) and Messner Mountain Museum (Crones) added more insight on topic.

The selection of site was done fulfilling criteria like visitor's accessibility and visual context with the site surrounding ensuring the visitors are provided with the views of mountain range. As a result, Nagarkot was selected for designing the mountain museum. Another reason for the site selection was flow of tourists (national and international) ensuring regular flow of visitors. The main concept in designing the mountain museum embodies the spirit of the Himalayas. The design is carried out following the geography of the site and buildings are placed on site in such a way that maximum views of mountain ranges can be gained by the visitors. The museum is planned as an expedition and its form is inspired by the Himalaya's layered terrains reflecting the sacredness of the Himalayas. Furthermore, enhancement of the project is done by incorporating sustainable design strategies.

Keywords

DECLARATION

I declare that the thesis entitled, **"Mountain Museum: Celebrating Culture and Adventures of Mountains"** at Nagarkot, Bhaktapur is submitted by me in partial fulfillment of the requirement for the degree of Bachelor in architecture to Purbanchal University, Biratnagar, Nepal. I state that this project is the result of my own independent work/ investigation conducted under the guidance and supervision of Ar. Robina Manandhar, my thesis supervisor.

I confirm that this thesis has not been submitted, either in full or in part, for any other degree or diploma at any other institution. All sources and references utilized in the research have been duly acknowledged. I hereby give consent for my project, if accepted to be available for photocopying and understand that any reference to or quotation from my thesis will receive acknowledgement.

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1: PROJECT INTRODUCTION

1.1 INTRODUCTION: MOUNTAIN MUSEUM

A "Mountaineering Museum" is a dedicated cultural, educational, and experiential institution that preserves, documents, and showcases the history, heritage, and accomplishments of mountaineering.

The mountaineering museum serves as a hub for education, inspiration, and conservation, focusing on the relationship between humans and mountains over a period of a time. And it also serves as an accumulation of artifacts, narratives, and exhibits that illustrate the evolution of mountaineering activities, the stories of climbers, ecology and culture of mountains and the technologies and tools that support the journey from the basecamp to summit.

Incorporating interactive technologies, immersive galleries, and experiential exhibits in the museum allow visitors to engage deeply with the world of mountaineering. The museum is not only a showcasing platform but also serves as a bridge between past achievements and future aspirations, encouraging adventure, exploration, and conservation.

Designing "Mountaineering Museum" involves creating spaces that tells the story about the climbers, tools, ecosystem and culture of mountains along with interactive space that provides hands-on experiences.

1.2 PROJECT JUSTIFICATION

Nepal, being a land of major peaks and rich cultural heritage, is internationally recognized as the heart of global mountaineering. As a home for 1310 peaks over 6000m height Nepal is globally recognized as the "Land of the Himalayas," boasting 8 of the 14 highest peaks in the world, including Mount Everest (8,848.86 meters). These peaks have attracted mountaineers and adventure enthusiasts from around the globe, making Nepal one of the most sought-after destinations for mountaineering and trekking as a result 419 peaks are opened for mountaineering and trekking. As per the recent record of 2023, Nepal received 1,014,882 international tourists, of which 15% (approximately 152,232) engaged in trekking and

mountaineering activities *(Source: Rising Nepal Daily).* Similarly, more than 30,000 climbers attempt peaks above 6,000 meters every year in Nepal, including Everest, Annapurna, Manaslu, and Kanchenjunga.

The history of mountaineering in Nepal gained global recognition with the first successful ascent of Mount Everest by Sir Edmund Hillary and Tenzing Norgay Sherpa in 1953. Since then, Nepal has been at the forefront of global mountaineering, hosting expeditions that have shaped the sport's history. Despite this rich legacy, there is a need of institutionalized spaces to preserve and showcase the stories, artifacts, and contributions of Nepal and its people to mountaineering.

The Sherpa and other indigenous communities are integral to mountaineering. Their expertise in navigating treacherous terrains, endurance in extreme conditions, and deep understanding of the mountains has been crucial to the success of many expeditions. However, their stories and contributions often remain underrepresented. A museum dedicated to mountaineering provides an opportunity to honor and document these invaluable contributions.

A mountaineering museum in Nepal is essential to celebrate this legacy, educate the public, and address pressing environmental concerns. While smaller exhibits and museums exist, they fail to capture the broader story of mountaineering—the peaks, the people, the tools, and the journeys. As a result, International Mountain Museum, Pokhara was officially opened on February 5, 2004 which includes all the required spaces showcasing mountain ecology, interactive display, exhibition halls, halls of fame, environmental awareness section, and etc. But it certainly lacks the essence of mountain geography in its design and direct connection to the museum theme.

Given the above data, the need for a Mountaineering Museum in Nepal is strongly justified for the following reasons:

1. Preservation of Mountaineering Heritage:
2. Educational and Research Opportunities:
3. Cultural Preservation and Recognition of Sherpa Contributions:
4. Environmental Advocacy:

5. Economic and Tourism Boost

1.3 PROJECT OBJECTIVE

The objectives focus on creating mountaineering museum that focuses on mountain ecology, culture, mountain expeditions, changing environments and its effects along with ways to minimize the impact. Key objectives include:

1. To design a museum that preserves and displays the history, culture, and achievements of mountaineering in Nepal and the Himalayan region.
2. To design an engaging informative platform for visitors to learn about the challenges and advancements in mountaineering.
3. To employ modern exhibition techniques such as interactive displays, multimedia installations, and virtual reality experiences to make the museum immersive and impactful.
4. To influence and encourage the visitors to get involve in trekking and mountaineering activities in Nepal.

1.4 SCOPE AND LIMITATION

The thesis will begin with in-depth research into the needs of mountain museum and their requirements and needs to make the visitors about the mountain ecology and culture.

1.4.1. Scope of Mountain Museum:

- **Site Analysis:** Study of topography, climate, access, and visual connection to surrounding mountain ranges.
- **Concept Development:** Architecture inspired by mountaineering spirit—exploration, resilience, and harmony with nature.
- **Space Programming:** Defining and allocating spaces including exhibition halls, memorials, interactive digital zones, research/archive areas, educational zones, admin offices, visitor amenities, and service areas.
- **Zoning & Circulation:** Clear separation of public and private zones with intuitive, accessible visitor flow and wayfinding.

- **Architectural Design:** Context-sensitive forms and materials; Designing building forms that dialogue with the landscape.
- **Exhibition Integration:** Spatial storytelling of mountaineering history, gear, notable climbers, mountain ecology, and conservation.

1.4.2. Limitations of the Mountain Museum:

- **Exhibit Content Development:** The project will outline broad thematic directions related to mountaineering and Himalayan culture but will not involve detailed curation, artifact sourcing, or exhibit content scripting.
- **Financial and Operational Planning:** The project excludes cost estimation, budget planning, funding strategies, or long-term operational and maintenance planning.
- **Environmental Impact Studies:** No formal environmental or ecological assessments will be conducted as part of this project.
- **Training Programs:** The project will include basic mountaineering workshops but will not cover advanced training, or provide direct support for actual mountaineering expeditions.
- **Regulatory and Environmental restraints:** Protected areas may limit certain design or construction.

1.5 Methodology

a. General Data and Literature Review

A broad range of data was collected from books, research papers, articles, and other published sources listed in the references. This helped build a foundation for understanding the functional, spatial, and technical aspects relevant to the project.

b. Case Studies

To gain deeper insight into mountain museums, both national and international case studies were conducted.

National Case Studies: Existing museums were visited to study spatial planning, functional zoning, and workflow. The following tools were used:

- Photographic documentation

- On-site building surveys

International Case Studies: Online research methods were used to study international mountain museum, which included:

- Official museum websites
- Documentaries and architectural drawings
- Videos and photographs

c. Site Analysis

Site criteria were first researched to determine suitability for a natural history museum. Based on these criteria, a site located in Nagarkot was selected. The site was analyzed with respect to:

- Land use
- Topography
- Climate
- Site context
- Zoning and Bye-laws

d. Program Formulation

Based on research findings and design needs, the program was developed through:

Figure 1.1: Research Methodology

- Finalization of space requirements
- Concept development
- Exploration of alternative designs
- Preparation of drawings and presentation models

2. LITERATURE REVIEW

2.1. MUSEUM

"A museum is a not-for-profit, permanent institution in the service of society that researches, collects, conserves, interprets and exhibits tangible and intangible heritage. Open to the public, accessible and inclusive, museums foster diversity and sustainability. They operate and communicate ethically, professionally and with the participation of communities, offering varied experiences for education, enjoyment, reflection and knowledge sharing." (ICOM Statutes, adopted by the 22nd general Assembly in Vienna, Austria, on 24 August 2007).

"Museum are living, Breathing, and active records of 'US' in the most universal, global and cosmopolitan sense of world" (Coleen Leth, Why Museum Matter).

A museum is an institution that acquires, conserves, researches, communicates, and exhibits tangible and intangible heritage for education, study, refreshment and enjoyment. Museums play a crucial role in preserving cultural, historical, and scientific artifacts for future generations. They serve as repositories of knowledge, understanding and appreciation of diverse cultures, scientific achievements, and historical events. Museums host a much wider range of objects and they usually focus on a specific theme, such as the arts, science, natural history or local history, and some specialized museums.

2.1.1. HISTORY OF MUSEUMS IN GLOBAL CONTEXT

The concept of museums dates back to ancient civilizations. Museums developed in response to the human need to understand the world by using collections of objects abstractions of real world (Simmons, J.E. 2016).

- Ancient Greece and Rome – Early collections of artifacts were housed in temples and public buildings to honor deities and historical figures.
- First museum of the modern era: Renaissance stable building known as the "Electoral Stable and Stable Courtyard Dresden" in Dresden, was constructed between 1586 and 1588.

- 16th–18th Century – Renaissance-era collectors created private "cabinet of curiosities," showcasing rare and valuable artifacts, evolving into the first public museums. In a 'cabinet of curiosities' natural and art objects were jumbled together on the walls and ceilings, cupboards and drawers of one or two rooms. Their purpose was to surprise and delight; viewers had to find what attracted them and then make their own connections. *(The Architect's Handbook).*

- Public museums emerged as institutions dedicated to education, with renowned institutions like The British Museum (1753) and The Louvre (1793) setting global standards. The British Museum was established to house the private collection of the monarch, perhaps the first art museum supported by public revenues. Similarly, The Louvre referred as an institution dedicated to the glory of the nation. *(The Architect's Handbook).*

- The 19th-century museum was designed as a piece of ceremonial architecture in which the idea of the sacred was translated into secular or national or civic terms.

- 20th–21st Century – Museums incorporated digital technology, interactive exhibits, and immersive experiences, making heritage more accessible to the public.

2.1.2. HISTORY OF MUSEUMS IN CONTEXT OF NEPAL

Nepal has a rich history of museums that reflect its diverse cultural heritage.

- Early Museum– The National Museum (Rashtriya Sangrahalaya), established in 1928, was Nepal's first museum, exhibiting a mix of art, history, and military artifacts. The National Museum of Nepal was originally built in 1824 by Prime Minister General Bhimsen Thapa as an arsenal. It was renamed Silkhana Museum in 1926 by Rana Prime Minister Chandra Shumsher after adding two wings to the north and south of the main building. In 1938, Rana Prime Minister Juddha Shumsher renamed it Nepal Museum and opened it to the public in 1939. In 1967, it was formally named as National Museum (Rastriya Sangrahalaya).

- National Art Gallery – Established in 1960/61 A.D. in Bhaktapur, housing a collection of paintings in the new wing of Bhaktapur Palace.

- Archaeological Site Museum of Kapilvastu – Located in Taulihawa, Western Nepal, established in 1962, featuring antiquities excavated from Buddhist areas in Lumbini Zone.
- Tribhuvan Memorial Museum – Located in Hanuman Dhoka Palace, Kathmandu, established in memory of King Tribhuvan in 2025 B.S.(1968)
- Nepal Natural History Museum – Established in 1975 A.D. at Swayambhu Hill, managed by Tribhuvan University. Notably, it houses the fossilized tooth of Butawal Ramapithecus, one of the oldest human species in Asia.

Nepal's museums serve crucial functions in preserving history, culture, religion, and natural heritage. They contribute to education, tourism, research, and cultural awareness, making them valuable institutions for both national and international visitors. With increasing governmental and private support, the future of museum development in Nepal looks promising as an important educational and cultural sector**.**

2.1.3. FUNCTIONS OF MUSEUMS

Museums serve five primary functions: collecting, storing, conserving, researching, and presenting**.**

1. Collecting: Museums acquire artifacts, artworks, documents, and specimens related to their theme. In Nepal, museums collect historical weapons, paintings, coins, religious sculptures, stamps, and natural history specimens.

2. Storing: Once collected, artifacts are stored under controlled conditions to prevent deterioration. Museums have archives, temperature-controlled storage, and secure facilities to protect delicate items.

3. Conserving: Conservation involves restoring and maintaining artifacts to ensure their longevity. Museums use preservation techniques such as climate control, chemical treatments, and restoration processes to protect objects from damage.

4. Researching: Museums conduct and support research on their collections, helping scholars and the public learn more about history, culture, and science. They document artifacts, study their significance, and publish findings.

5. Presenting: Museums display their collections through exhibitions, guided tours, interactive displays, and educational programs to engage visitors. They use modern techniques like digital exhibits and storytelling to enhance learning.

2.1.4. CATEGORIES OF MUSEUMS

Museums can be classified based on their themes and functions. The main categories include:

- **Art Museums** – These institutions display fine arts, including paintings, sculptures, and visual arts. They provide insight into artistic movements and historical periods (e.g., The Louvre, Paris).
- **History Museums** – Dedicated to showcasing historical artifacts, documents, and exhibits that chronicle significant events (e.g., The British Museum, London).
- **Science Museums** – Focus on scientific advancements, discoveries, and technological innovations. They often include interactive displays (e.g., Smithsonian National Air and Space Museum, USA).
- **Natural History Museums** – Feature exhibits on nature, paleontology, geology, and biodiversity, often including fossils and dioramas (e.g., American Museum of Natural History, New York).
- **Cultural and Ethnographic Museums** – Showcase the traditions, customs, and heritage of specific communities and civilizations.
- **Specialized Museums** – Focus on niche themes such as war, music, aviation, or **mountain** (e.g., Messner Mountain Museum, Italy).

2.2. MOUNTAIN MUSEUM

A "Mountain Museum" is a dedicated cultural, educational, and experiential institution that preserves, documents, and showcases the history, heritage, and accomplishments of mountaineering.

2.2.1. MOUNTAIN MUSEUMS IN CONTEXT OF THE WORLD

- Alpin museum, Munich, Germany (1911): First known mountaineering museum, established by the German Alpine Club.
- Musée Alpin, Chamonix, France: Showcases early alpine climbing history in the European Alps.
- Alpine Museum, Zermatt, Switzerland: Focuses on Matterhorn's climbing history and alpine expeditions.
- American Mountaineering Museum, Colorado, USA: Highlights North American mountaineering history and achievements.

These museums preserve climbing history, display artifacts, and educate visitors on mountaineering evolution.

2.2.2. MOUNTAIN MUSEUMS IN CONTEXT OF NEPAL

- Mt. Everest Documentation Centre, Namche Bazaar (1990): Focuses on Everest expeditions and Sherpa heritage.
- International Mountain Museum (IMM), Pokhara (2004):

  - Established by the Nepal Mountaineering Association (NMA).
  - Showcases Himalayan biodiversity, mountain cultures, and legendary climbers like Tenzing Norgay and Edmund Hillary.

These museums document Nepal's mountaineering legacy, promote tourism, and educate visitors on high-altitude climbing challenges.

2.2.3. INTRODUCTION

The mountain museum serves as a hub for education, inspiration, and conservation, focusing on the relationship between humans and mountains over a period of a time. And it also serves as an accumulation of artifacts, narratives, and exhibits that illustrate the evolution of mountaineering activities, the stories of climbers, ecology and culture of mountains and the technologies and tools that support the journey from the basecamp to summit.

Incorporating interactive technologies, immersive galleries, and experiential exhibits in the museum allow visitors to engage deeply with the world of mountaineering. The museum is not only a showcasing platform but also serves as a bridge between past achievements and future aspirations, encouraging adventure, exploration, and conservation.

2.2.4. Experiential Design Aspects in a Mountaineering Museum

A mountaineering museum should not only display artifacts but also create a memorable experience for visitors by engaging their senses, emotions, and cognition. Thoughtful psychological and experiential design aspects enhance the visitor journey, making the museum immersive and impactful. The elements of experiential design aspects are given below:

1. Way finding & Navigation

- Objective: Ensure visitors can easily navigate the museum without confusion.
- Design Strategies:

- Clear Signage: Use multilingual directional signs, symbols, and digital guides to help visitors move seamlessly.
- Zoning & Circulation: Arrange spaces in a logical flow, such as starting with mountaineering history, moving to exhibits on equipment, expeditions, and ending with tributes to legendary climbers and Sherpa people as an indigenous of mountain region.
- Landmark Elements: Large artifacts, installations, or distinct lighting cues can serve as visual anchors to aid navigation.
- Interactive Maps & Digital Guides: Apps or touchscreens with customized routes for different visitor interests (e.g., general visitors, researchers, and children) enhance way finding.
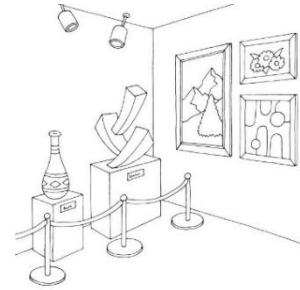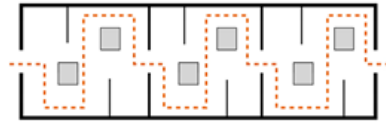
Figure 2.1: Signage in museum   *Figure 2.2: Circulation in museum*   *Figure 2.3: Landmark Element*

2. Immersion & Engagement

- Objective: Make the museum experience interactive and emotionally compelling rather than just informative.
- Design Strategies**:**

o Soundscapes/ 3D artscapes:
- Ambient sounds of wind, snowstorms, or mountaineering expedition radio communications, 3D models, snow experiences create a sense of being in the mountains.
- Sherpa chants or expedition narratives playing in the background can add authenticity.

o Natural Lighting & Dynamic Illumination:
- Simulating sunrise, sunset, or snow-glare effects with controlled lighting enhances realism.
- LED projections or fiber optic displays can mimic the northern lights or starry night skies seen from base camps.

o Interactive Screens & VR Experiences:
- Augmented Reality (AR) & Virtual Reality (VR) exhibits can allow visitors to experience a climb, walk along an ice ridge, or feel the challenges of high-altitude expeditions.
- Digital touchscreens for exploring historical maps, routes, and climber logs.

3. Emotional Connection

- Objective: Establish a deep emotional bond between visitors and the stories of mountaineers.
- Design Strategies:

o Tribute Spaces & Memorials:
- A dedicated area honoring fallen climbers with their biographies, quotes, and personal items (e.g., ice axes, gear).
- Names inscribed on a memorial wall or digital tribute screens.

o Personal Storytelling:
- Life-size displays, recorded testimonials, and video documentaries sharing personal mountaineering experiences.
- Letters, diary entries, and last messages from climbers bring out the human side of mountaineering.

o Symbolic Design Elements:
- Sculptures or installations representing the struggles and triumphs of climbers.
- A climbing wall or scaled-down Himalayan peak model for visitors to engage physically and emotionally with the theme.

The mountain museums are the result of mountaineering and the contributions of those people who are involved in climbing and assisting in acquiring the submit. Hence, the trend of mountaineering, stories of the expedites, contributions of Sherpa, accomplishments of the summiteers are the main reason for the establishment of mountain museums. Thus, we can say that the mountaineering is the main reason to develop the mountain museums all around world to show case the culture, adventures, challenges, lifestyles of the people in high altitudes of mountain.

Following are some spatial ideas thoughtfully designed to serve the purpose of mountain museum:

Core Spaces:

1. **Exhibit Hall**:

   - Permanent or temporary (flexible) exhibit areas.

   - Exhibition halls organized as per themes such as: remarkable mountains, life stories, evolution of tools and gears, etc.

2. **Interactive display Areas**:

   - Virtual Reality Zones offering visitors with a simulated and challenging experience of climbing famous peaks.

   - Interactive maps showcasing mountain ranges, routes, base camps, and elevations.

   - Tactile display of climbing gear like ropes, pitons, carabineers, and boots to understand their materials and usage.

3. **History and Timeline Area**:

   - A section representing the timeline of mountaineering, from early attempts to modern-day expeditions.

   - Showcasing of Key milestones, with highlighted visuals, artifacts, and audio-visual content.

4. **Memorial space or Hall of Fame**:

   - A dedicated space honoring the legendary climbers and explorers who have made remarkable achievements or lost their lives while achieving their passion.

   - Including photographs, names, stories, and quotes by the climbers to inspire visitors and preserve their legacy.

5. **Section of Maps and Routes:**

   - A specialized area displaying detailed maps of famous mountain ranges, climbing routes, and expeditions including annotations on key points, elevations, base camps, challenges, and historical context.

- Dedicated rooms with tools for skill-building relevant to local job markets.

6. **Ecological and Cultural Section:**

- A dedicated space showcasing the mountain ecology and culture of the humans residing in those areas who ensure the success of countless expeditions.
- Specially focusing on the Sherpa community their lifestyles, econmy, food and culture.
- Portraying the journey of human resilience and exploration in their relationship with mountainous landscapes.

7. **Environmental Awareness Section**:

- A dedicated space highlighting the impact of human activities on mountains and glaciers focusing on topics like climate change, pollution, melting glaciers and sustainable mountaineering practices.

Supportive Amenities:

8. **Multipurpose hall**:

A multi-purpose space for:

- Screening documentaries, films, and recorded expeditions.
- Hosting lectures and live talks by mountaineers, historians, and environmentalists.
- Organizing presentations on mountaineering topics like safety, environmental conservation, or inspirational stories of legendary climbers, etc.

9. **Library & research room**:

- A quiet space with access to books, journals, documentaries, and maps related to mountaineering, geography, and environmental studies.
- Useful for researchers, students, and enthusiasts seeking detailed information on mountains, expeditions, and climbers.

10. **Workshop Space**:

A flexible space for hosting educational activities such as:

- Workshops on climbing techniques, survival skills, or mountaineering safety.
- Classes on navigation, weather forecasting, and equipment usage.
- Programs on environmental conservation, emphasizing the protection of mountain ecosystems.

11. **Souvenir Shop**:

- A shop offering mountaineering gear, books, memorabilia, and locally made crafts, giving visitors a chance to take home a souvenir while supporting the museum.

12. **Outdoor Spaces**:

- Gardens or courtyards with water bodies for outdoor relaxation, physical activities, or large events.
- Accessible and secure parking spaces for cars, buses, and bicycles are crucial for visitors who come by different modes of transport.
- Cafeterias offering hearty snacks or meals resonating to mountain base camps or himalayan cuisines creating a cultural and culinary connection.

Safety and Monitoring:

13. **Staff Areas**:

- Ticket counters, information desks, offices for managers, guards and other staff members.
- A monitoring area to ensure the safety and adherence of the visitors.

Integrating these spaces in a museum, make the museum experience more comfortable, engaging, and accessible, ensuring that visitors have a smooth and enjoyable visit while enhancing the educational and immersive experience related to mountaineering.

Moreover, incorporating sustainable features such as green spaces, eco-friendly materials, and energy-efficient designs into the museum's infrastructure reinforces the environmentally conscious ethos of mountaineering culture. These elements not only reduce the museum's ecological footprint but also highlight the significance of preserving natural landscapes for future generations, aligning seamlessly with the values of environmental protection and sustainability.

2.3. MOUNTAINEERING

Mountaineering refers to the outdoor activity or sport and practice of climbing mountains. It involves a combination of hiking, rock or ice climbing, and survival skills to reach high-altitudes. Mountaineering is categorized into different disciplines; including rock climbing, ice climbing, and expedition climbing, all of which requires specific techniques and equipment.

2.3.1. EVOLUTION OF MOUNTAINEERING IN GLOBAL CONTEXT

- Early humans climbed mountains for survival, trade and spiritual reasons.
- Early Expeditions – First recorded ascent Mount Aiguille (2085m, France) in 1492 by Antoine de Ville, marking the start of recreational climbing.
- Golden Age of Alpinism (1850–1900) –
    - Major peaks such as the Matterhorn and Mont Blanc were climbed, marking a period of rapid mountaineering achievements.
    - Mountaineering as a sport in the UK began in 1854 when Sir Alfred Wills climbed the Wetterhorn, making it popular in Britain which marked the start of the Golden Age of Alpinism, leading to the founding of the Alpine Club in 1857, the first mountaineering club.
- Himalayan Exploration (20th Century) – Expeditions in Nepal and Tibet grew in importance, leading to the first ascent of Mount Everest by Sir Edmund Hillary and Tenzing Norgay in 1953.

2.3.2. EVOLUTION OF MOUNTAINEERING IN CONTEXT OF NEPAL

- The British Mount Everest Reconnaissance Expedition has 1st attempted to climb Everest in 1921.

- George Mallory and Andrew Irvine attempted to climb Everest in 1924, but disappeared near the top.

- Nepal opened its boarder to climbers in 1949 and Annapurna-I (8091m) was the first 8000m peak climbed by Maurice Herzog and Louis Lachenal on June 3, 1950.

- In 1953, Sir Edmund Hillary from New Zealand and Tenzing Norgay Sherpa from Nepal successfully reached the top of Everest.

- As a home for 1310 peaks over 6000m height Nepal is globally recognized as the "Land of Himalayas" boasting 8 of 14 highest peaks in the world.

- 419 peaks are opened for mountaineering and trekking in Nepal.

2.3.3. CHALLENGES AND RISKS IN MOUNTAINEERING

Mountaineering is an extreme sport that involves significant risks, including:

- **Altitude Sickness** – Caused by reduced oxygen levels at high altitudes.
- **Avalanches and Rock falls** – Natural hazards that pose threats to climbers.
- **Harsh Weather Conditions** – Unpredictable weather can lead to frostbite, hypothermia, and exhaustion.
- **Technical Challenges** – Navigating steep inclines, ice walls, and crevasses requires specialized skills and equipment.

2.3.4. MOUNTAINEERING TRAINING IN NEPAL

Mountain climbing always bears high risks and without the support of highly skilled and experienced support staff/Sherpa, mountain climbing is almost impossible. So, to promote mountain climbing activities with higher safety, production of skilled human resources was the first condition. Based on this reality, Nepal Mountaineering Association was established on 1 November 1973 which is a non-governmental, non-profit and non-political organization working as a national alpine association of Nepal to promote mountain tourism, climbing sports, protect mountain environments and preserve and promote cultural heritage of mountain people. It is the only national alpine club authorized to issue climbing permits for 27 mountain peaks of Nepal.

In order to minimize the challenges and risks of mountaineering, Nepal Mountaineering Association (NMA) started Basic Mountaineering Training (BMT) in 1979 in cooperation with Yugoslavia Alpine Club. Only after 2000 AD, Nepalese instructors have been conducting the training independently. By now, Nepal stands in second position (preceded by Japan) in producing international standard mountain guides (affiliated with International Federation of Mountain Guide Association (IFMGA)). NMA has produced 60 International Mountain Guides till now. Until 2017, NMA provided BMT for 1,304 individuals and Advance Mountaineering Training (AMT) for 392 individuals. Now, NMA provides BMT in June and AMT in December annually. Basic Mountaineering Training (BMT) produces skilled supporters who are engaged in lower altitude climbing, supporting the climbers and minimizing different kinds of risks. Advanced Mountaineering Training (AMT) produces skilled supporters who engage in high altitude climbing regions thus supporting the climbers, minimizing different types of risks. AMT trained professionals are capable of leading any type of national and international expedition group. BMT trained professionals can be involved as support staff in the expeditions led by the AMT graduates.

2.4. CONSIDERATIONS IN DESIGNING MUSEUM

2.4.1. SPACE ORGANIZATION:

Museum space organization refers to the systematic planning and arrangement of different functional areas within a museum to ensure efficient operations, smooth visitor movement, and optimal display and preservation of artifacts. It involves zoning, circulation planning, and spatial hierarchy to create an engaging and educational experience for visitors while maintaining the integrity of the collections. A good museum includes these basic functions: (1) curatorial, (2) display, (3) display preparation. (4) Education. In order to realize both objectives and functions, certain facilities and spaces are essential. There must be sufficient diversification of spaces to allow each function to be undertaken separately while at the same time combining certain activities in a single area as required for economy. The following table shows the standard considerations to design proper functioning individual spaces:

Table 1: Spatial requirements of a museum (Times Savers Standard)

Functions	Space Required
1. Curatorial Functions	
a. Collection, preservation, identification, documentation, study, restoration.	a. Office-workroom, Workshop.
b. Storage of collections.	b. Reserve Collection Room.
2. Display Function	
Thematic and changing displays of selected objects and documents from the collections arranged to tell a story.	Display Gallery.
3. Display Preparation Function	
The preparation of exhibits.	Workshop, Office-workroom.
4. Educational and Public Functions	
a. Lectures, school tours, society meetings, films, and social functions.	a. Lecture room, Chair storage closet, Kitchenette.
b. Reception, information, sales, supervision of display gallery.	b. Lobby, Sales and Information Counter.
c. Public requirements.	c. Cloakroom, Washrooms.
5. Other Services	
a. Mechanical.	a. Heating-ventilation plant.
b. Janitorial.	b. Janitor's closet.
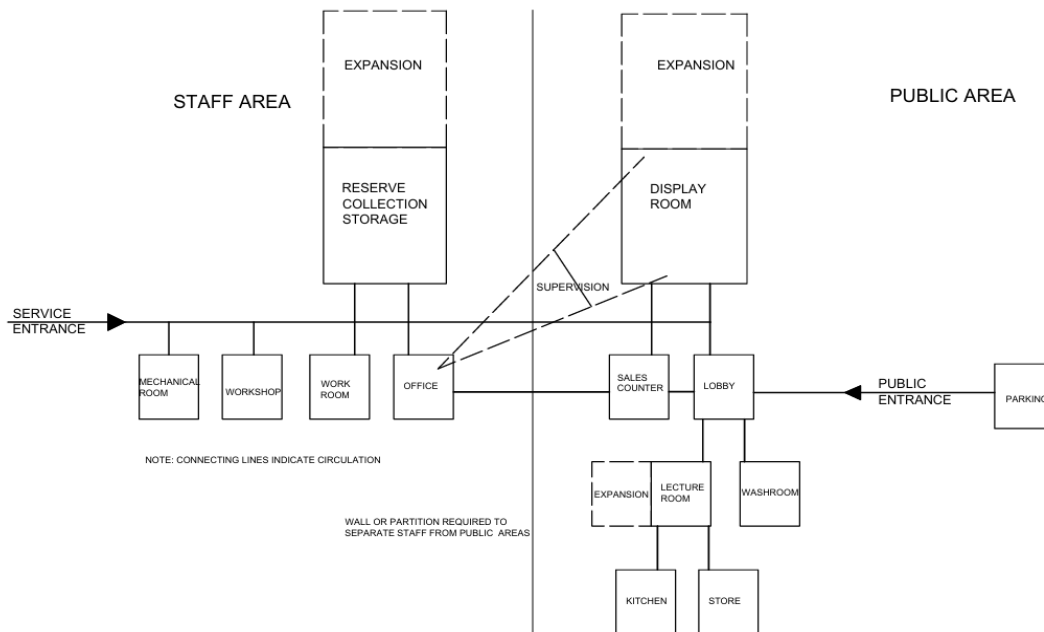
Figure 2.4: Space Organization Diagram (Time Saver Standard)

2.4.2. Zoning Strategy

- **Public Zone** – Entrance, exhibition halls, and interactive spaces.
- **Semi-Public Zone** – Research center, learning areas, and auditorium.
- **Restricted/private Zone** – Administrative offices, staff areas, and storage.
- **Outdoor Zone** – Memorial spaces, interactive experiences, cafeteria, and panoramic viewpoints.

2.4.3. Exhibition Spaces:

Exhibition spaces are the core of a museum, designed to display artifacts, artworks, or educational materials effectively. Their layout, lighting, and environmental control play a crucial role in enhancing visitor experience and preserving exhibits.

2.4.3.1. Types of Exhibition Spaces

1. **Permanent Exhibitions** – Display long-term collections with durable materials and flexible layouts.

2. **Temporary Exhibitions** – Designed for rotating displays, requiring modular and adaptable setups.

3. **Thematic or Interactive Exhibitions** – Include digital, immersive, or hands-on displays for engagement.

2.5. Display techniques:

Display techniques in museums refer to the strategies and methods used to present exhibits in a way that enhances visual appeal, storytelling, visitor engagement, and artifact preservation. These techniques help create a structured and immersive environment, guiding visitors through an educational and sensory experience while ensuring artifacts are showcased effectively and protected. The various ways of display techniques are given below:

1. Freestanding Displays: The items are displayed in table cases or on pedestals, allowing for 360-degree viewing. It is great for highlighting individual objects, artworks, or small collections.

2. Wall-mounted Displays: Exhibits are attached to or hung on walls, such as paintings, photographs, or maps. It is ideal for flat or framed works, maximizing floor space.

3. Display Cases: Display cases are transparent enclosures used for protecting and displaying delicate objects. It is often used for artifacts, fossils, or sculptures to maintain security and preservation.

4. Interactive Displays: Exhibits that engage visitors with touchscreens, VR, or hands-on elements. It encourages visitor participation, making the experience more immersive.

5. Digital Displays: Screens or projectors used to show digital content like videos, animations, or virtual exhibits. It is ideal for multimedia presentations, educational materials, and interactive learning.

6. Thematic Displays: It is grouping of related items together to tell a story or explain a concept. It is organized by theme, era, or culture to provide context for the exhibits.

museums type	display (% ground floor area)	storage
national	35	29
local authority	57	25
independent	58	12
all museums	53	19

Figure 2.5: Display and Storage floor area requirement
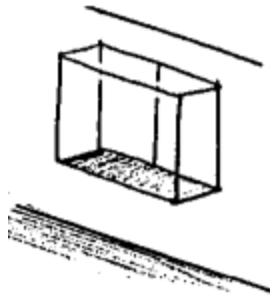
Figure 2.6: Freestanding Display   Figure 2.7: Wall-mounted Display   Figure 2.8: Display Case

2.6. Display gallery:

A gallery in a museum is a curated space where exhibits are displayed for visitors to experience and engage with artifacts, artworks, or thematic collections. The design of a museum gallery depends on factors such as the type of exhibits, visitor experience, circulation, lighting, and spatial organization. A museum in which all the rooms are the same size becomes very monotonous. By varying their dimensions and the relation between height and width and also by using different colors for the walls and different kinds of flooring we provide a spontaneous and unconscious stimulus to attention (Figure).
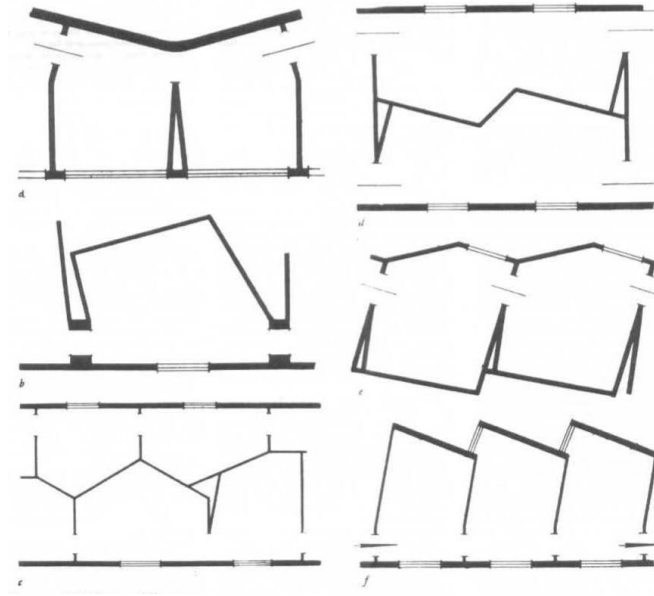
Figure 2.9: Different Ways of Dividing up exhibition space

2.7. Display/Gallery arrangements:

The arrangement of display cases is crucial for optimizing visitor flow, ensuring artifact safety, and creating an engaging exhibition experience. Circular arrangements offer better flexibility and a central focal point compared to straight-line layouts, making them ideal for dynamic and interactive exhibits. Some cases are arranged to narrow down the entrance so, the hall inside opens up and creates some sort of interest. Hence, diverse arrangements of display cases create a sense of interest and mystery among visitors. General considerations in display arrangements are:

- Display areas should have places for viewer to pause, sit down, and rest, after the intensive reflection upon the arts and materials exhibited.
- Seats at appropriate distance from large, important works of arts gives visitors a chance to pause and examine the art without standing for a long time.
- Lighting and color of the gallery should enhance the display without disturbing viewers.
- Unwanted noises should be controlled within galleries.
- Enough space should be in gallery space for easy movements.

- Proper air-conditioning and ventilation should be installed.
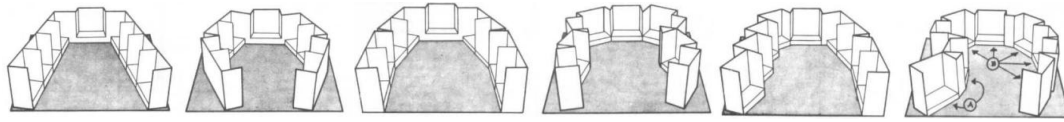
Figure 2.10: Possible Gallery Arrangements

2.8. Layout of exhibition/display spaces:

Museum display layouts are crucial for guiding visitors through exhibits in an engaging and intuitive way. Different layouts serve different purposes based on the type of museum, the theme of the exhibition, and the target audience. Some common museum display layouts:

Tandem Layout features a linear path with exhibits arranged in order, offering structure but limiting flexibility and causing possible congestion.

Radial Layout has a central point with exhibits radiating outward, making navigation easy and encouraging exploration, though it can create congestion at the center.

Channel Layout offers multiple routes through structured paths, providing flexibility and reducing crowding, though some exhibits might be missed.

Hall Layout is an open, free-flowing space that allows maximum freedom and is ideal for large exhibits, but it can feel disorganized without clear way finding.
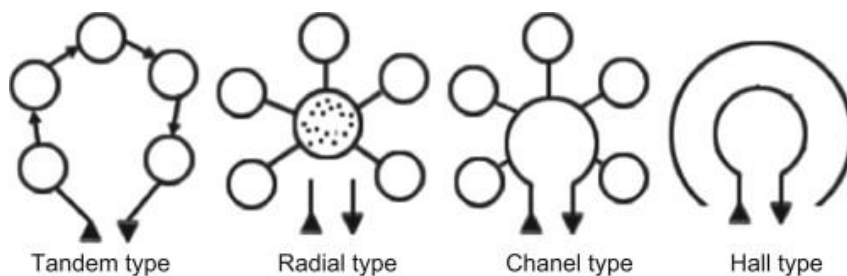
Figure 2.11: Museum Display Layouts

Some other basic layouts are given below:
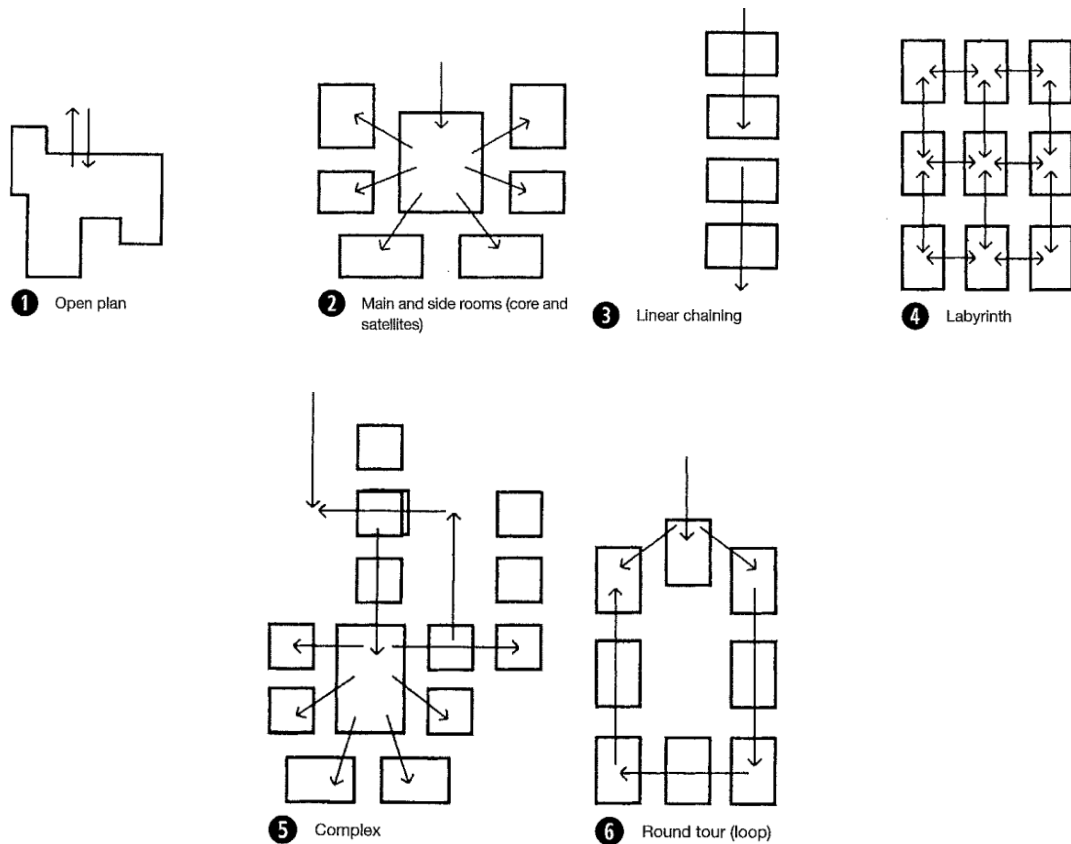
Figure 2.12: Layout in exhibition halls (Neufert's architect's data)

2.9. Circulation:

Circulation refers to the movement of visitors throughout the space. It involves the design and flow of pathways, corridors, and rooms that guide visitors as they move from one exhibit or area to another. Good circulation ensures a smooth, intuitive, and enjoyable experience by facilitating easy access to exhibits, maintaining a logical path, and helping to manage crowd flow. Effective circulation enhances the overall visitor experience, helping people explore exhibits without feeling lost or overwhelmed.

2.9.1 Circulation patterns:

Circulation spaces in museums are pathways that guide visitors through exhibitions while ensuring smooth movement and accessibility. These include corridors, lobbies, ramps,

staircases, and open areas that connect different sections of the museum. Well-designed circulation spaces prevent congestion, enhance visitor experience, and maintain a logical flow between exhibits.

General considerations for circulation are:

- Circulation pattern should be continuous from one gallery to another maintaining the continuous flow of people
- Dead ends should be avoided to prevent the visitors for passing same space again and avoid the space from being crowded.
- Enough and exclusive circulation space for the visitors of different nature to move with ease.
- Circulation must start in clockwise direction due to natural turn towards right hand side.
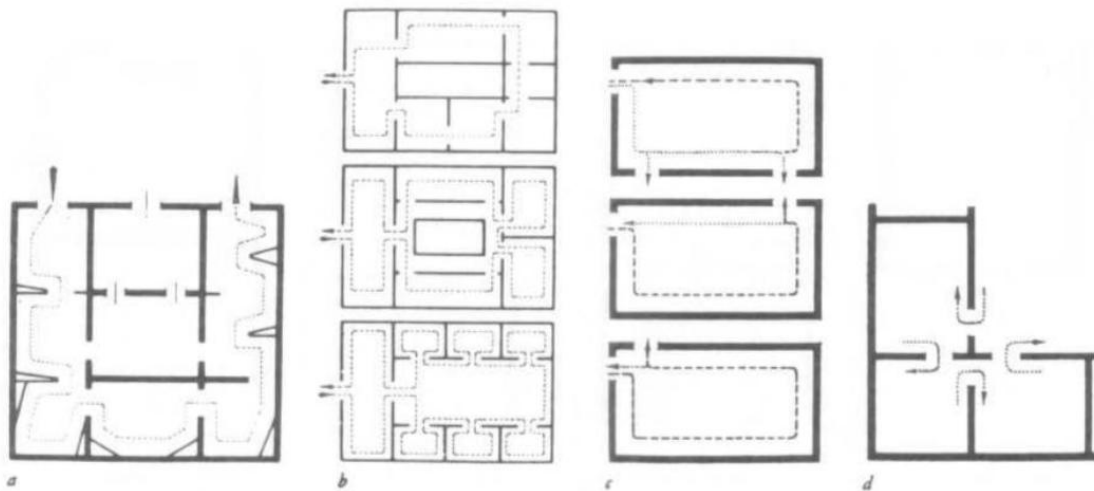
Figure 2.13: Circulation Patterns in Museum (Time Savers Standard)

2.9.2. Circulation Strategy

Circulation in a museum refers to the movement and flow of visitors through the museum space, guiding them from one exhibit to another in an organized and efficient manner. It encompasses the design of pathways, corridors, and areas that allow for easy access to and engagement with the exhibits while ensuring comfort, safety, and accessibility. The goal of effective circulation is to create a seamless and enjoyable visitor experience, maintaining logical routes, clear sight lines, and well-defined zones within the museum. It also includes the consideration of emergency exits, seating areas, and accessibility features. In terms of internal circulation there are two main types: horizontal circulation and vertical circulation.

a. Horizontal Circulation: It refers to the movement of people in spaces on the same floor level. It is simply moving of visitors along walkways, corridors, and paths connecting different galleries or exhibition areas. It ensures easy and uninterrupted access between galleries, allowing for flexible flow across the same floor.

b. Vertical Circulation: It is the movement of visitors between different levels or floors of the museum, typically involving stairs, ramps, or elevators. It is simply connecting different floors or sections of the museum, such as galleries on multiple levels, auditoriums, or special exhibition areas. It helps to maximize the use of space, allowing for multi-story designs and more varied exhibitions. The location of the corridors, staircase and its design, width and slope have to be considered within the overall design steps because they affect the visitors' perception of space and level of visitors' satisfaction. *(Bitgood 2010).*
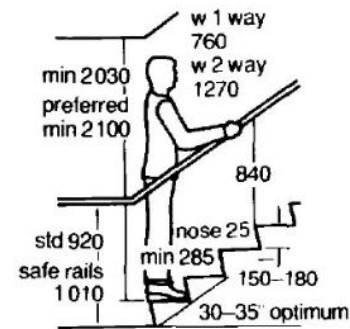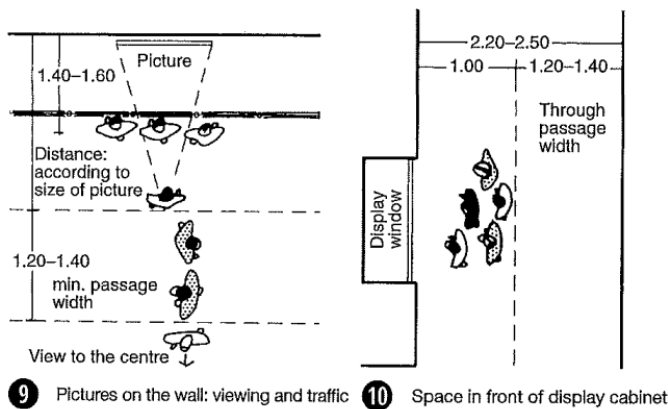
Fig: staircase dimensions
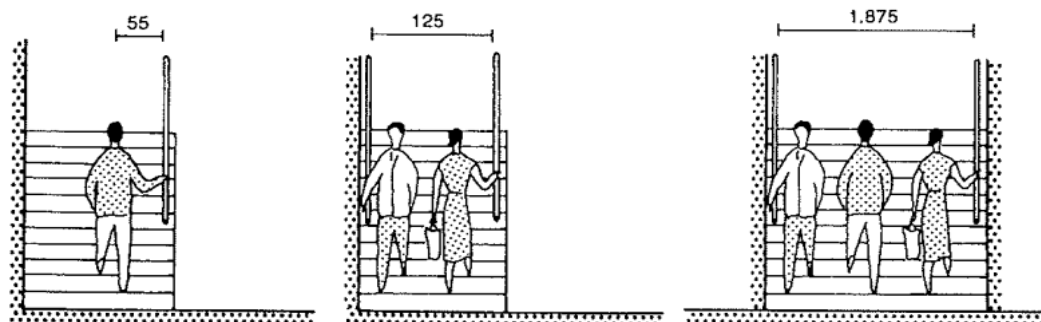
For 1 people　　　　　For 2 people　　　　　For 3 people
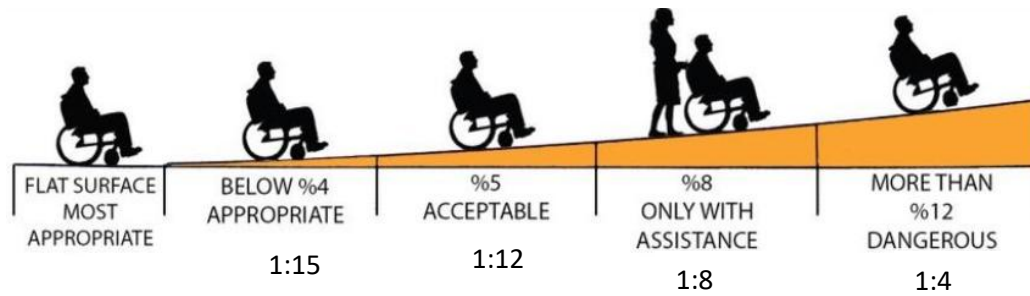
Figure 2.14: Safe ramp ratio for wheelchair users

2.10. Viewing parameters:

When designing an exhibition space, several viewing parameters must be considered to ensure optimal visibility, engagement, and comfort for visitors. While placing exhibits one should not forget that from where and how it can be observed by visitors. Viewing dimensions includes cone of vision, viewing angle, distance of observer from the exhibit, height of the exhibit or size of it, etc. Purpose of considering viewing dimensions is to make vision feel easy while observing objects without causing any difficulties. There should not only be enough space for the installation but also for the visitors to observe them from a favorable distance, while at the same time free circulation space for other visitors.

11 Field of view: height, size and distance
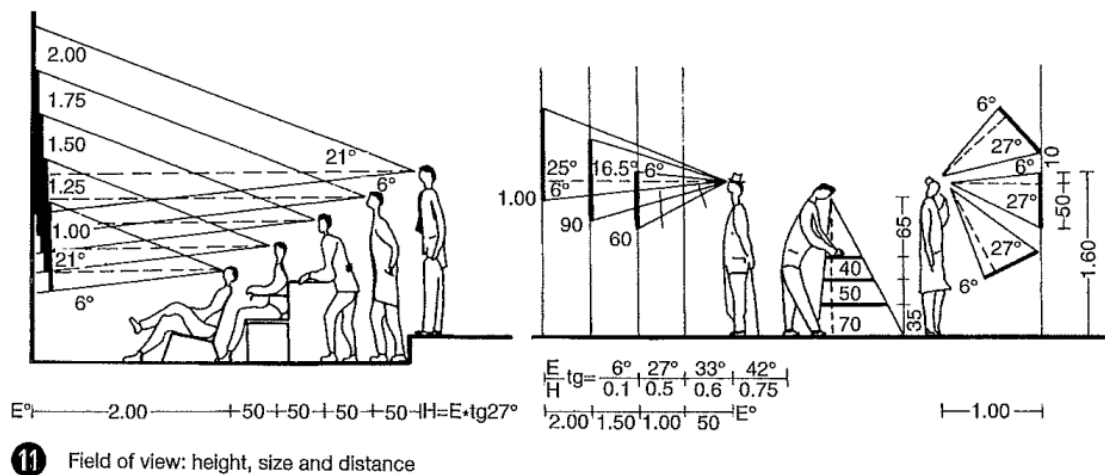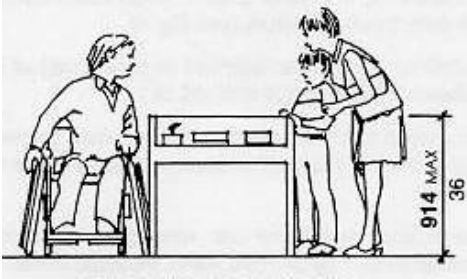
Figure 2.15: Height of table case
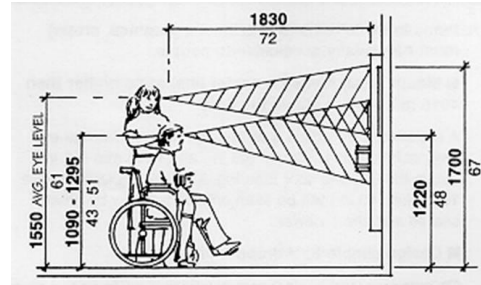
Figure 2.16: Viewing Dimensions
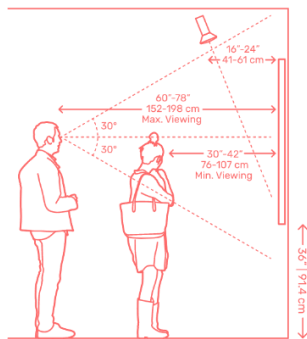
Figure 2.17: Wall Display Dimensions
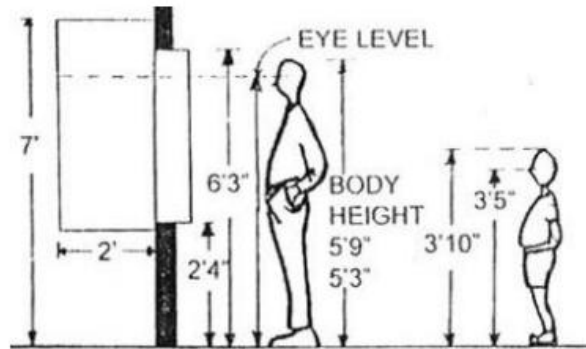
Figure 2.18: Measurement of an adult and six years old visitors

2.11. Lightings:

Lighting in museums is a crucial design element that affects how exhibits are perceived, how visitors experience the space, and how artifacts are preserved. Museum lighting must be adaptable to different types of exhibits, ensuring that artifacts are well-lit without being damaged by excessive light exposure. It is a basic element for the expression of a space. The change in its intensity, color source, distance, etc. can have varying effect on human behavior and psychology. Proper lighting ensures that visitors can clearly view exhibits while enhancing the details, colors, and textures of artworks, sculptures, and historical artifacts. Lighting plays a key role in setting the mood of the museum. Soft, warm lighting can create an inviting ambiance, while dramatic lighting can add depth and focus to specific exhibits. Well-planned lighting helps direct visitors through exhibitions, highlighting pathways, entrances, and key display areas while maintaining a comfortable visual environment. Certain light sources, especially those emitting ultraviolet (UV) and infrared (IR) radiation, can cause fading, discoloration, or deterioration of delicate materials like paintings, textiles, and manuscripts. Museum lighting is carefully designed to minimize these risks while still providing adequate

illumination. Museum lighting must be a balance between functionality, aesthetics, and preservation. A well-designed lighting system enhances the visitor experience while ensuring that valuable artifacts are protected for future generations. It involves a combination of natural and artificial lighting, carefully designed to balance visibility, ambiance, and conservation.

2.11.1. Natural lighting

Natural lighting in museums refers to the use of daylight to illuminate exhibition spaces. It is an essential aspect of museum design, contributing to the overall ambiance, energy efficiency, and visitor experience. However, it must be carefully controlled to prevent damage to sensitive artifacts caused by excessive light exposure, ultraviolet (UV) radiation, and heat. Natural light brings out the true colors and textures of artworks and exhibits, creating a dynamic and engaging viewing experience. Daylight provides a more natural and pleasant atmosphere, reducing eye strain and making museum spaces feel open and inviting. Utilizing natural light reduces reliance on artificial lighting, leading to lower energy consumption and operational costs. Well-designed day lighting improves mood, engagement, and overall visitor satisfaction, making the museum experience more enjoyable. Natural light is typically introduced through skylights, clerestory windows, light wells, and strategically placed openings to provide balanced and diffused illumination. A well-planned natural lighting strategy ensures a balance between aesthetic appeal, sustainability, and conservation, enhancing the museum experience while protecting valuable collections. Natural light can be drawn into the room by following methods:

1. Top lighting: Top lighting is a day lighting strategy where natural light is introduced into an interior space from above, usually through openings in the ceiling, roof, or high-level windows. It is a preferred method in museums as it provides even, diffused illumination that enhances the clarity and depth of exhibits without causing excessive glare. Unlike side windows, which can create uneven lighting and shadows, top lighting allows for a more controlled and uniform distribution of daylight. The primary advantage of top lighting is its ability to create a bright, naturally illuminated space while reducing energy consumption. However, it must be carefully designed with UV filters, louvers, and diffusers to prevent damage to sensitive artifacts from ultraviolet (UV) and infrared (IR) radiation. Proper shading

devices and glazing techniques help regulate daylight intensity and prevent overheating. Top lighting is commonly integrated using skylights, clerestory windows, and light wells.

- Skylights are glass or translucent panels installed in the roof to allow direct or filtered sunlight into museum spaces.
- Clerestory windows are positioned high on walls to introduce natural light while preventing harsh direct exposure on exhibits.
- Light wells are vertical shafts designed to channel daylight from the roof into deeper sections of the museum, ensuring proper illumination in otherwise dark areas.
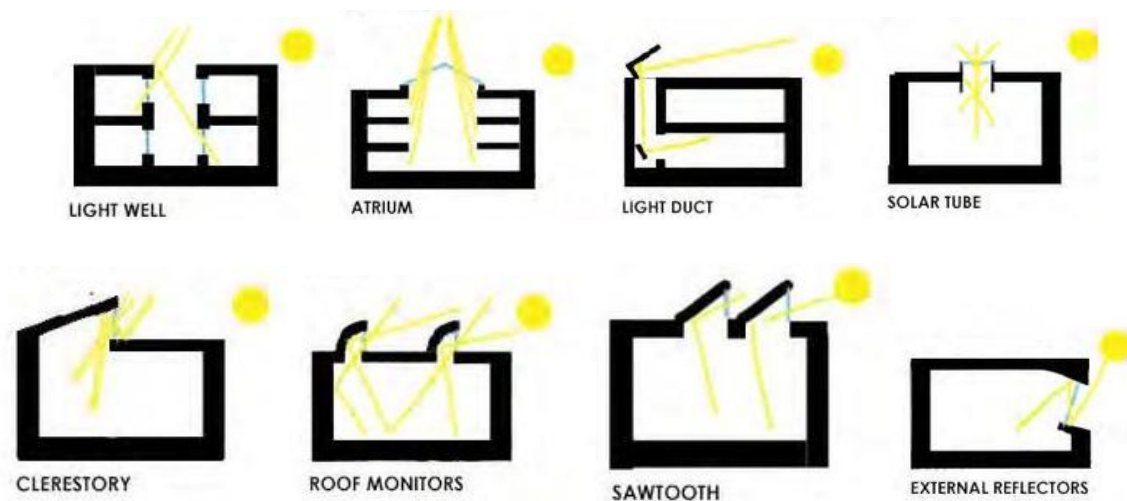
Figure 2.19: Ways of top lightings

2. Side lighting: Side lighting is a natural lighting strategy in which daylight enters a space through windows, glass walls, or openings positioned on the sides of a building. It is one of the oldest and most commonly used lighting techniques in museum design. Unlike top lighting, which illuminates from above, side lighting brings in light from horizontal directions, often creating distinct lighting patterns and depth in exhibition spaces. Properly designed side lighting enhances visual comfort, energy efficiency, and the aesthetic appeal of museum interiors, while also considering the conservation of artifacts by controlling the intensity and quality of light exposure. However, careful design considerations, including shading, filtering, and balancing with artificial lighting, are necessary to protect artifacts and enhance visitor experience. When executed properly, side lighting not only reduces energy costs but also

transforms museum spaces into immersive and engaging environments. The ways of integrating side lights are given below:

• Direct Side Lighting: Natural light enters directly through windows, creating strong contrasts and shadows. It's used for dramatic effects but requires control to avoid glare.

• Diffuse Side lighting: Light is scattered through frosted glass or diffusing panels, providing soft, uniform illumination. Ideal for gallery spaces to avoid glare and shadows.

• Clerestory Windows: High windows let light enter from above, offering diffuse illumination while reducing glare. They are perfect for large spaces like galleries and atriums.

• Window Wall/Glazed Facade: Large glass walls allow daylight into the museum, creating a connection with the outdoors. When filtered, it provides controlled light, often used in modern designs.
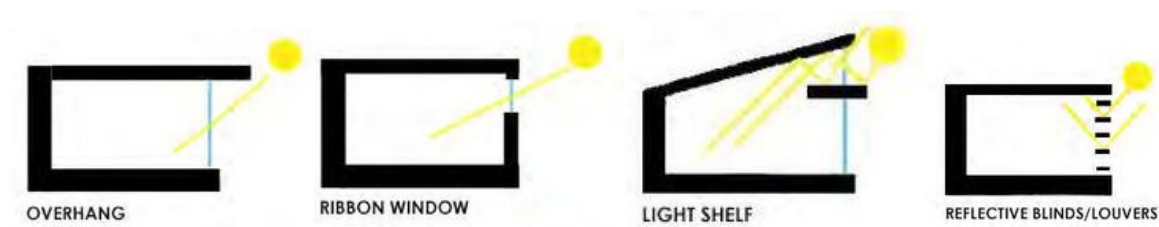
Figure 2.20: Ways of side lighting

2.11.2. Daylight design considerations:

1. Building site: Buildings must be sited properly to maximize the availability of daylight. Nearby buildings or trees may obstruct daylight access. The sky exposure angle can be used to help site the building to ensure adequate access to daylight.

2. Building orientation:

The southern exposure of the building should be maximized as the south façade allows the most daylight access and the best control of excess solar gain in the summer. This is the most desirable façade for day lighting and is best suited for rooms where variability in light levels

is acceptable. The northern exposure should be optimized to receive diffused lighting with no glares.

3. Building form:

Maximum exposure of building perimeter helps to maximize the day lighting received so large and narrow footprints are better than square ones to access daylight. Single-storey structures have the potential to allow daylight penetration to virtually all interiors than multi-storey. A use of atrium can maximize the daylight in the interior of building.
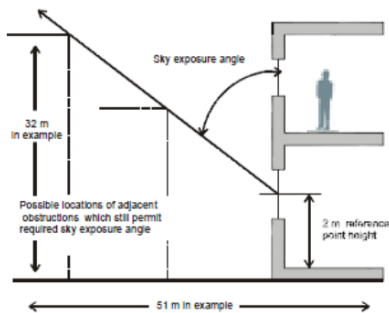
Figure 2.21: Building site   *Figure 2.22: Building Orientation*   *Figure 2.23: Building Form*
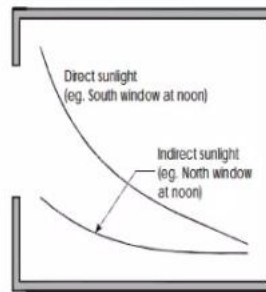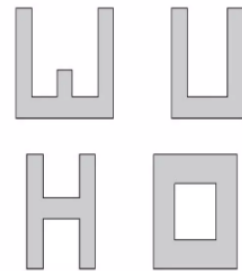
2.11.3. Artificial lightings:

Artificial lighting plays a crucial role in museums by enhancing exhibits, creating ambiance, and ensuring visitor comfort. It serves both functional and aesthetic purposes, helping to highlight artwork, artifacts, and architectural elements while maintaining appropriate illumination levels. Proper lighting design creates an engaging atmosphere while protecting sensitive materials from damage. The various types of artificial lighting used in museum are given below:

a. Direct, Symmetrical Lighting- is ideal for workrooms, meeting rooms, public spaces, and hallways. It provides efficient general lighting while requiring relatively low electrical power. The recommended shading angle for lighting fixtures in these spaces is 30° to 40°, ensuring comfortable illumination. For an effective lighting design, a radiation angle of 70° to 90° should be considered, allowing for even light distribution.

b. Wall washers- are used to create uniform wall illumination and can be installed in different ways. Downlights wall washers and ceiling grid wall washers are placed near walls to achieve even lighting. Wall washers mounted on power supply rails provide both wall and partial room illumination, reaching up to 500 lux with proper spacing. Ceiling-installed wall washers, however, focus solely on lighting the wall without contributing to room brightness, making them useful for highlighting surfaces.

c. Directional spotlights- offer focused lighting and flexibility in positioning. Downlights spotlights are installed in ceilings, arranged systematically to create spatially differentiated lighting. These lights can rotate 40° vertically and 360° horizontally, allowing for precise control. They often use halogen filament lamps, particularly low-voltage types, which are preferred for their bright, targeted light output.

d. Indirect lighting- creates a bright and diffused lighting effect, reducing glare and enhancing the overall ambiance. However, this approach requires high ceilings to work effectively and must be carefully integrated with ceiling architecture. While indirect lighting provides a soft, evenly distributed glow, it is less energy-efficient, consuming up to three times more energy than direct lighting systems.

e. Direct/Indirect lighting- combines 70% direct and 30% indirect light, balancing brightness with energy efficiency. This type of lighting creates a comfortable and well-lit environment while keeping energy consumption reasonable. It works best in rooms with a ceiling height of at least 3 meters and is commonly achieved using fluorescent tubes or a mix of halogen filament and filament lamps.

f. Ceiling and floor lighting- is used to provide general illumination in larger spaces. Ceiling uplighters and floor down lighters help in highlighting ceilings or floors, depending on the design requirements. They can be fitted with different types of lamps, including halogen filaments, fluorescent tubes, or high-pressure discharge lamps, offering varied lighting effects based on the space's needs.

g. Wall lights- are primarily decorative but can also add some functional lighting to a space. They are used to create special effects through color filters, prisms, and limited lighting to the

ceiling and floor. These lights contribute to the ambiance of a space rather than providing strong illumination, making them suitable for aesthetic enhancements in interiors.

h. Museum and exhibition lighting- requires specialized lighting techniques to highlight displays while maintaining visual comfort. Wall washers on power supply rails are used for uniform vertical illumination, ideal for exhibits. Narrow-beam lights can be adjusted to create different effects, such as spotlights (10°), floodlights (30°), or wide washers (90°). Special filters and lenses help modify the light beam, including ultraviolet or infrared filters to protect delicate exhibits and anti-glare flaps to enhance viewer comfort.
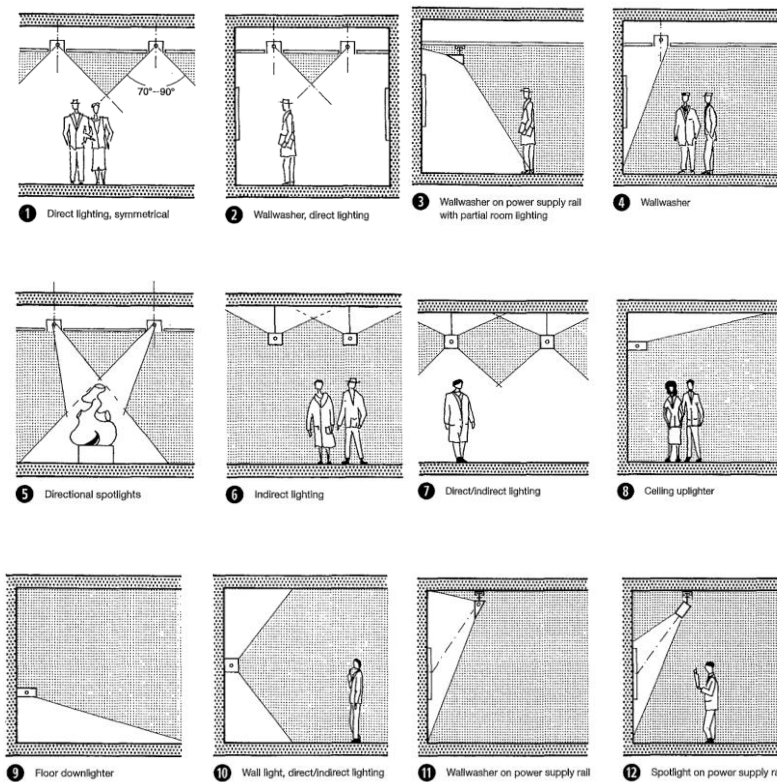
Figure 2.24: Ways of artificial lightings
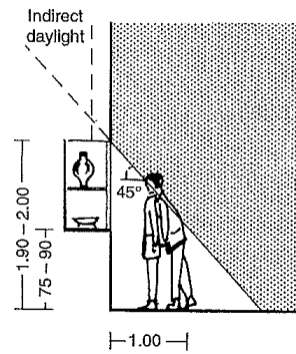
Figure 2.25: Light & Shadow in display cabinet   Figure 2.26: Distance & light
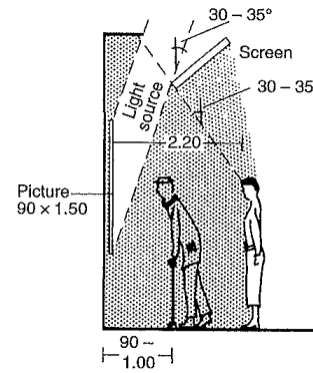
Various types of artificial lighting are given below with their beam angle and application:

Types of lighting	Beam Angle	Application
Spotlights	10°-20°	Accent lighting 3D shapes
Floodlights	25°-35°	Texture lighting
Wide flood lights	>45°	Uniform light across the large surface area
Track Lighting	15°-30°	Artwork Illumination
Wall Washers	20°-60°	Vertical surfaces lighting
Pendant Lights	15°-45°	Suspended art lighting
LED strip lights	120°	Decorative and accent lighting

Figure 2.27: Types of lightings

The required illuminations in the museum are as follows:

Museum Location	Recommended Illuminance (Lux)
Entrance to the Museum	150-300 Lux
Corridors or Hallways	100-200 Lux
Gallery or the Exhibition Area	150-500 Lux
Sculpture Display	200-1000 Lux
Paintings/Artwork Walls	150-750 Lux
Historical Documents	100-300 Lux

Figure 2.28: Required illuminations in museum

2.12. Library area:

A library in a museum serves as a knowledge hub, providing visitors, researchers, and student's access to books, archives, and digital resources related to the museum's theme.

Space Requirements:

- **Reading Areas:** Comfortable seating with natural light. (area: 3 sq.m. per reader)
- **Book Storage:** Open shelving for public access and archive sections for rare collections.
- **Digital Section:** Computers for accessing digital archives and multimedia resources.
- **Study & Research Zone:** Dedicated space for researchers and scholar.
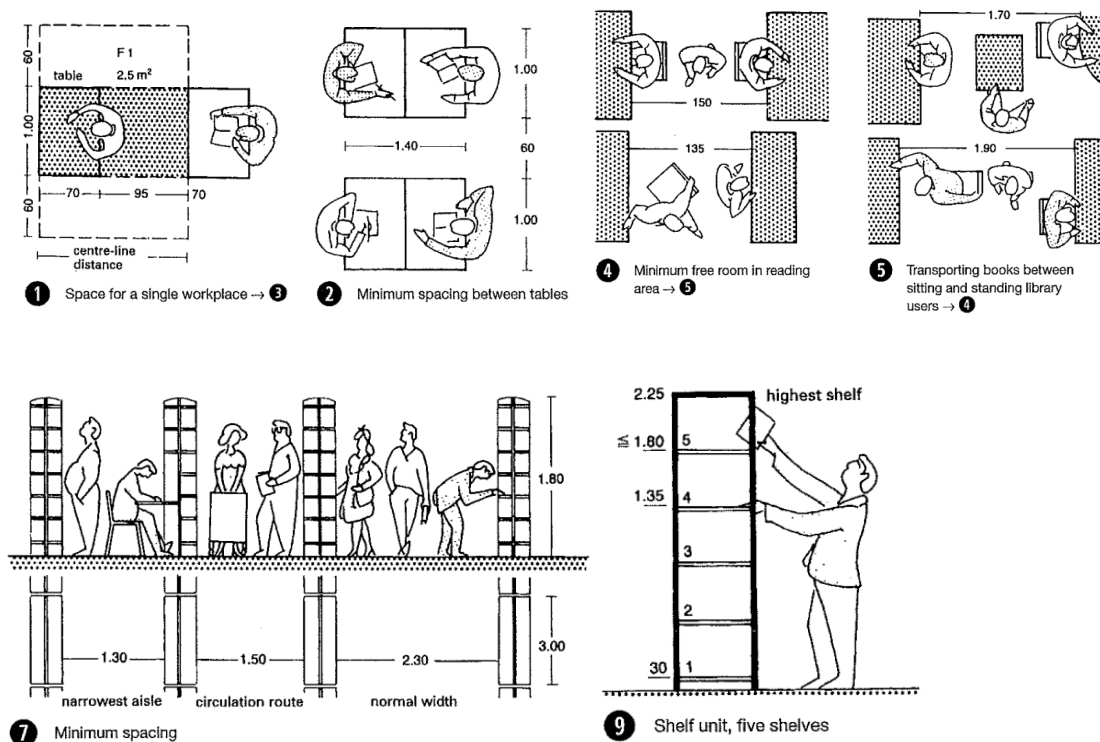
Figure 2.29: Required dimensions in library

2.13. Auditorium:

- Seating capacity: maximum capacity depends upon format selected, aural and visual limitations, seating density, size and shape of platforms.
- Size of auditorium: 0,50 sq.m per spectator

- Length of row: maximum 16 seats per aisle, 25 seats per aisle is permissible if one side exit door of 1m width is provided per 3-4 rows

- Exit, Escape routes: 1m side per 150 people (minimum width 0.78m)
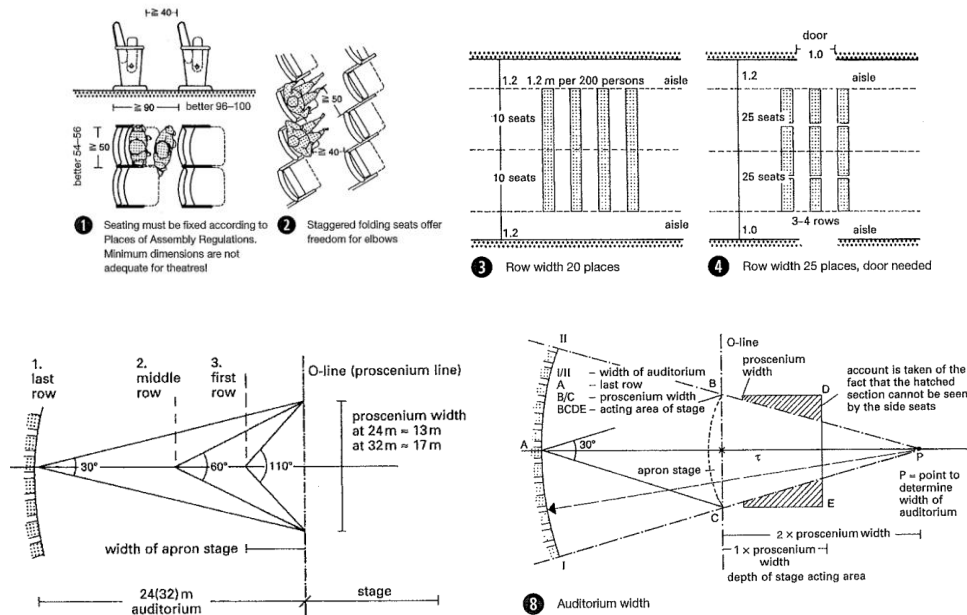
Figure 2.30: Required Dimension In Auditorium

2.14. Parking:

- Dimensions of vehicle parking spaces in parking bays ranges from 1.80 X 4.60m to 2.501 X 6.0m, but slightly longer for parallel parking.

- 90⁰ parking is more economical in space requirements 22-23 sq.m per car

- 45⁰ parking 23-26 sq.m per car can be more convenient.
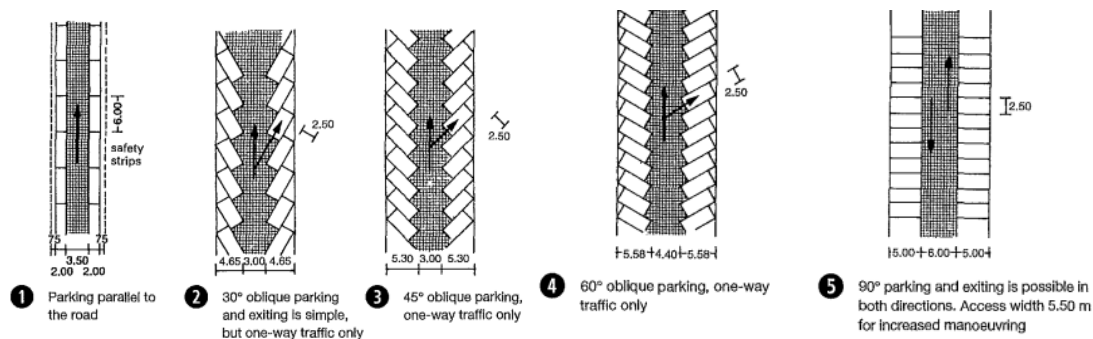
Figure 2.31: Required dimension in Parking

3. CASE STUDIES

A case study is an in-depth analysis of a particular individual, group, event, organization, or phenomenon over a period of time. It is often used in research to explore complex issues in real-world contexts, allowing for detailed examination and insights. The case study includes national, regional and international studies.

    a.   National case study

3.1. International Mountain Museum, Pokhara

3.1.1. General information:

Location: Ratopahiro, Pokhara, Nepal

Site area: 12.5 acres

Total floor area: 4242 square meters

Ownership: Nepal Mountaineering Association
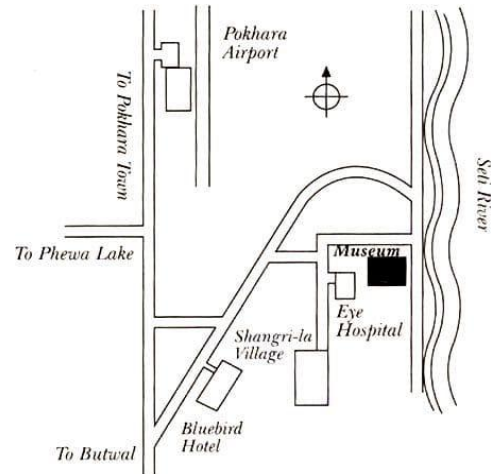
Figure 3.1: Location map

3.1.2. Introduction

The International Mountain Museum (IMM)**,** located in Pokhara, Nepal**,** was established by Nepal Mountaineering Association (NMA) which was officially opened to public on May 5, 2004. It is the first disabled friendly museum of Nepal which has been established with the specific purpose of recording, documenting, and chronicling the various developments and changes that have taken place primarily in three areas namely people residing in the mountains of the world, the historic and scientific information about the origin of the global mountain system and the various activities which have established world records in the field of mountaineering and related activities. The museum exhibits include mountains, their people and culture, the world mountain system, their geological formation,

Figure 3.2: International Mountain Museum, Pokhara

mountain flora and fauna, and those related to mountain exhibits such as mountaineering, skiing, etc. In addition, the museum also displays mountaineering history and the development of mountaineering techniques and equipment over the years.

3.1.3. Architectural Design & Planning

3.1.3.1. Master plan & Zoning:

The international mountain museum has covered a large area of 12.5 acres residing a museum along with Resting places, beautiful natural landscapes with floral, water, and rock garden, and beautiful thatched huts with garden chairs for resting, General and VIP Parking, Outdoor washrooms at suitable places, Sheds for the visitors, Mt. Manaslu Model, Souvenir Shop, Artificial climbing wall, gardens and much more within its periphery.
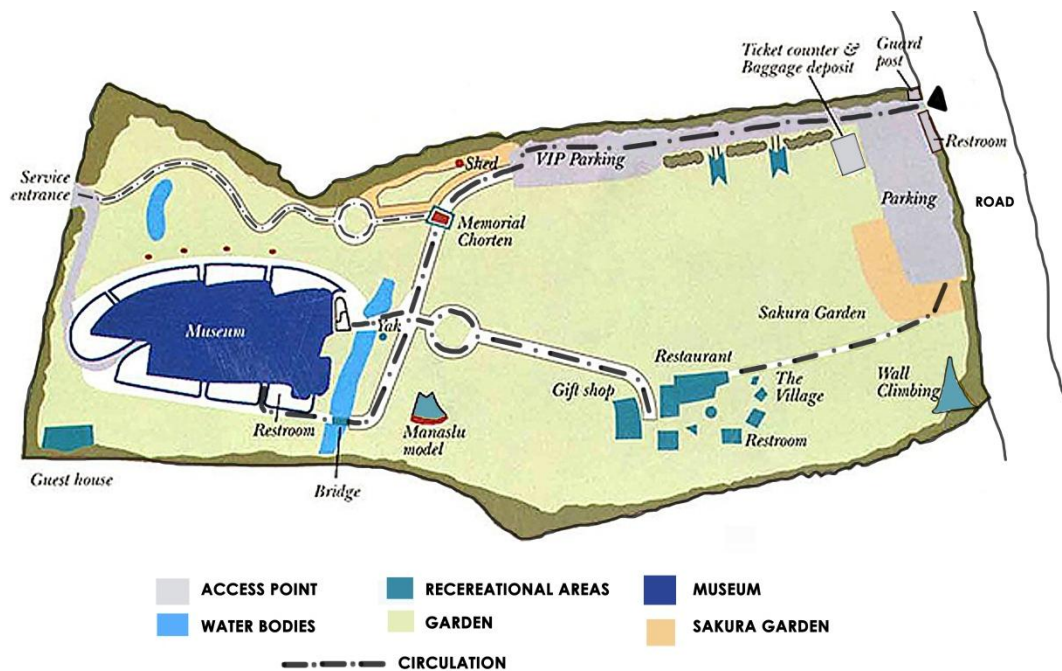
Figure 3.3: Master Plan

The museum consists of two different zones such as museum and outdoor facilities.

3.1.3.2. Outdoor activities:

Access Point: The entrance is provided with guard post, restrooms, ticket counter and parking. The parking has space for more than 100+ two wheelers and 22 four wheelers.

Mt. Manaslu Model: The 31-feet high model of Mt. Manaslu outside the museum is another attraction for the visitors to IMM.

Bouldering: IMM has a bouldering wall of 5-meter-tall and interested climber can enjoy up to 20 different routes. NMA is the first institution to promote sport climbing activities in Pokhara through Maurice Herzog Climbing Wall, which was later displaced by this bouldering wall, hence; it is probably the first bouldering wall of Pokhara.

Living Museum: The thatched huts, on the southeastern side outside the museum, offer a glimpse of the typical Nepali mountain people's village. It is a live museum where one can see people at work. In this village, local or foreign visitors would find an equally interesting and homely village atmosphere with all the originality and tradition. It has all the indigenous crafts, culture, works, and activities both social and ceremonial. The restaurant there serves various kinds of dishes including Nepali delicacies.

Figure 3.4: Mt. Manaslu   *Figure 3.5: Bouldering*   *Figure 3.6: Living Museum*

3.1.3.3. Museum

The museum consists of basically two levels i.e. basement floor and ground floor. The basement floor consists of three different galleries which are as follows:

1. **Hall of mountain people**
2. **Hall of world mountains**

3. Hall of mountain activities
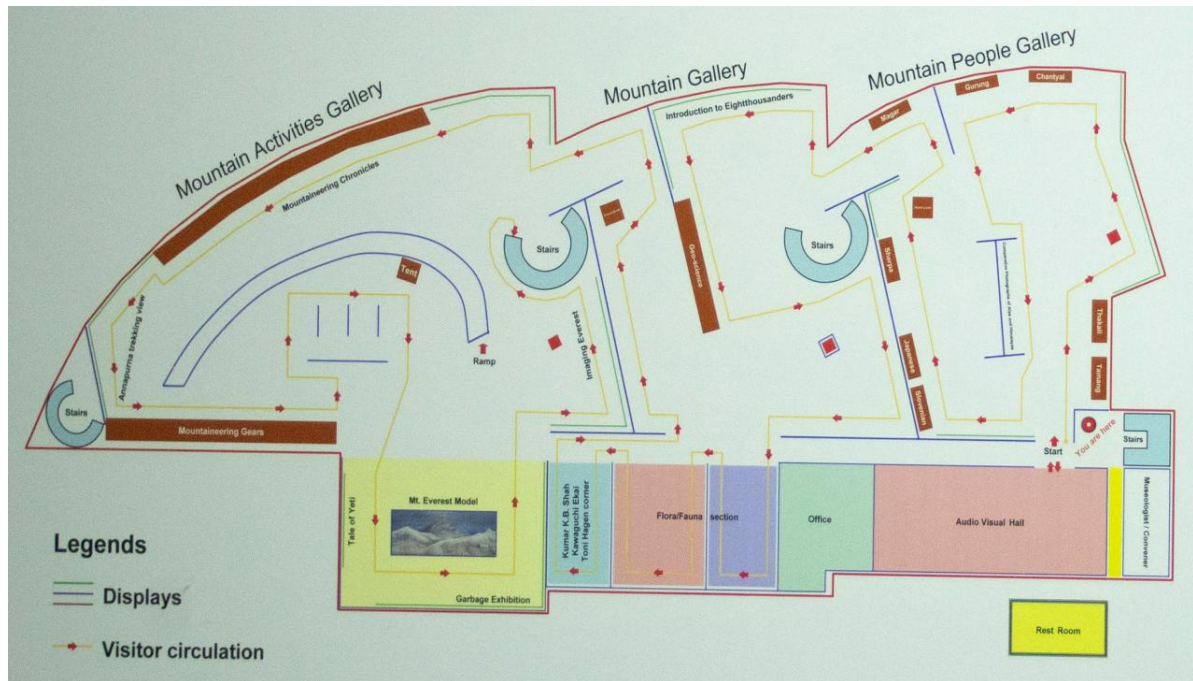
Figure 3.7: Basement Plan
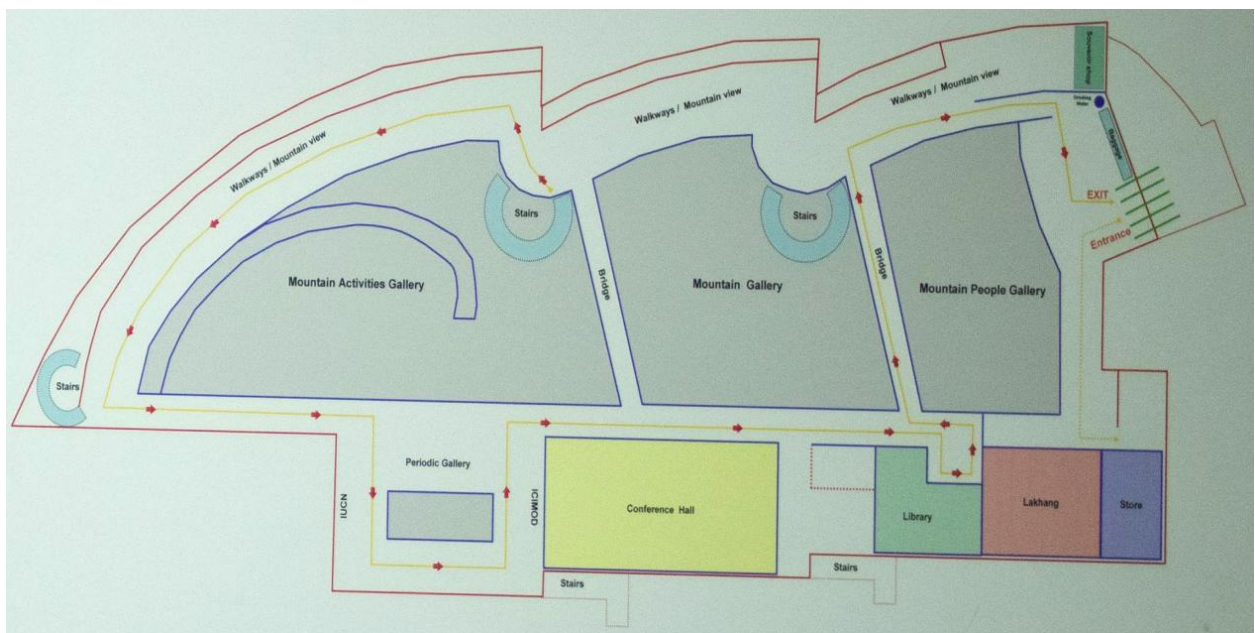
Figure 3.8: Ground Floor plan

1. HALL OF MOUNTAIN PEOPLE:

It has two sections and the museum starts from here.

Mountain People of Nepal: It familiarize the visitors with the customs, traditions, and culture of the mountain people of Nepal, the dresses, ornaments, musical instruments, household utensils and cultural activities of the Sherpas, Gurungs, Tamangs, Thakalis, Chhntyals, Pun Magars, Yakkhas, Rais, Limbus, and Sunuwars have been displaced in this section.

Mountain People of the World: This section introduces the visitors to mountain people of other countries e.g. Taiwan, Slovenia, and Japan, and compares images of the alpine mountain people of Europe from more than fifty years back and present-day Nepal.

Figure 3.9: Hall of Mountain people

2. HALL OF WORLD MOUNTAINS:

This Hall introduces the name and height of national and international mountains, their historical background, highest summits, geological information, the origin of the Himalayas flora and fauna of the Himalayan region, research on mountains, and changes in the features of the earth over the time. There are four sections in this Hall.

Mountain Section: This presents an introduction of all the fourteen peaks over 8000m and their images on display.

Geological Section: This section exhibits the geological formation of the mountains.

Flora and Fauna Section: This section displays the natural vegetation, animals, and birds of the mountain regions of Nepal.

Corner of Dedications: In memory of their invaluable contributions, this section displays the clothes, equipment, photographs, etc. of renowned personalities in mountaineering adventures and achievements.

Figure 3.10: Hall of world mountains

3. HALL OF MOUNTAIN ACTIVITIES:

It includes six sections.

Mountaineering Section: This section displays the equipment, clothes, and photographs of the successful French Expedition team member Mr. Maurice Herzog who had scaled an 8000m peak (Mt. Annapurna I) for the first time on 3 June1950. Moreover, it exhibits other first summiteers like of Ms. Junko Tabei, the first woman Everest summiteer, Mr. Toshiu Imanishi, the first Mt. Manaslu summiteer, Lionel Terrey, the first Makalu summiteer and team leader Jean Franco and other mountaineers' are also on display. The dress, equipment, and photographs of famous South Korean mountaineer Par Young Seok, the first Asian to summit all the fourteen 8000m peaks in the world, are displayed in this area. This section also displays the photographs of the first successful ascents of all the 14 peaks over 8000m in chronological order according to the year.

Mountaineering Equipment Section: The necessary equipment and their uses while climbing mountains are exhibited in the showcases.

Mountain Ecology/Environment Section: This section presents environmental information about the mountain region. This section also exhibits the garbage collected from Mt. Everest and Mt. Lhotse between 2000 and 2003 by the famous mountaineer and environmentalist Mr. Ken Neguchi.

Imaging Everest Section: This section displays the photographs of the British expeditions to Mt. Everest from 1921 until the successful expedition of 1953 presented to the IMM by the British Council and the Royal Geography Society.

Climate Change Section: In this section, information is provided to the public with regard to the effects of climate change through the means of photos and equipment. This section is further divided into three parts: i) Air Section ii) Water Section iii) Ice Section

Touch- Screen section: This touch-screen section is the center of attraction for visitors. The visitors can touch the screen which displays satellite images of settlements, glacial lakes, mountains, and surroundings of the Himalayan region. The visitors can observe the images of Mt. Makalu, Mt. Everest, Upper Khumbu, and Lower Khumbu on the touch-screen.

Figure 3.11: Hall of Mountain Activities

4. Other facilities:

Lakhang: A replica of Lakhang, a prayer room, has also been built. The Lakhang helps those interested in internalizing the true sensitivity of the Buddhist prayer room. It is always open to offering prayers and reflects the culture of the people living in the Himalayan region.

Library: The IMM library has a large collection of books on mountains, flora and fauna, mountain people, and mountaineering for the benefit of scholars, researchers, and students.

Conference hall and audio visual hall: the museum is provided with a conference hall on its ground floor with a capacity of 150 people which also has a separate access through the exterior of museum building. The museum also has an audio visual hall on its basement where interactive displays and VR stimulations are provided.

Figure 3.12: Lakhang

Figure 3.13: Library

3.1.4. Circulation:

The circulation within the museum building is through horizontal and vertical movements.

3.1.4.1. Horizontal circulation
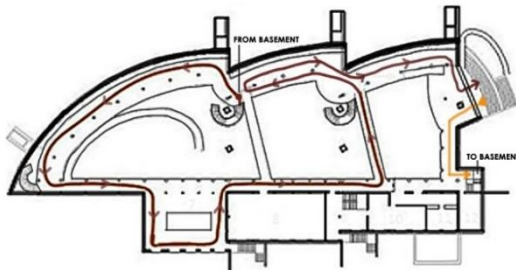
Figure 3.14: Ground floor plan circulation
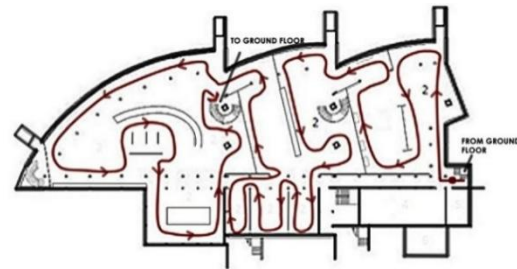
Figure 3.15: Basement plan circulation

The museum has the entrance on the ground floor but the exhibition display starts from basement which is accessed through staircase on ground floor. The basement of the museum has open floor plan which is divided by the display panels and cases creating separate zones and directions for the flow and movements of the visitors in the museum. The internal circulation of the museum building is guided in a clockwise direction. The visitors are guided by the allocated staffs regarding the directions. The arrangements of the display in an open floor plan guide the movements of the visitors. The circulation pattern is created in such a way that the visitors can get confused and some spaces in museum also tend to remain unexplored. There are certain chances of collision among the viewer creating unpleasant experiences in some spaces. The average circulation is 1.5m across the galleries and 2m in hallways, bridge width 1m.

The ground floor is connected through the bridges and walkways and hallways are provided to reach the display areas, conference hall, Lakhang, library. The circulation in ground floor is also confusing as there are many circulation routes.

3.1.4.2. Vertical circulation

The means for vertical circulation in the museum are open well staircase, 3 spiral staircase and ramp for differently abled visitors.
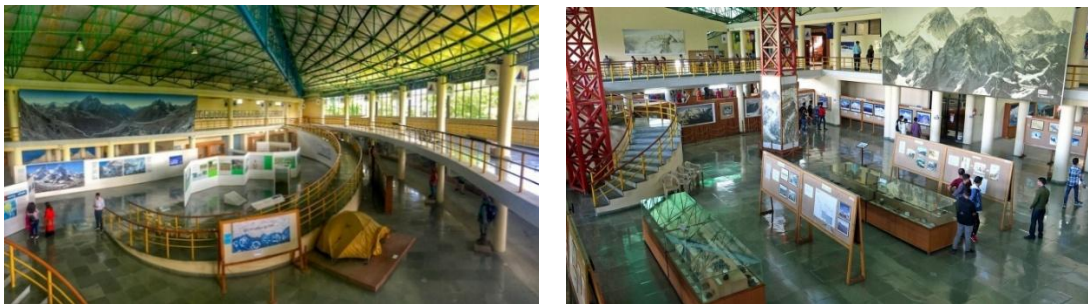
Figure 3.16: means of vertical circulations

Universal Design: - Ramp: width 4'-6", **Stairs:** width 1.5m **(**Require assistance to access the ramp*)*

3.1.5. Lighting

Since the building has high ceiling with the variation in height ranging from 3m to 6m and more in the exhibition spaces there is interplay of both natural and artificial lights. The natural light is integrated in the building through ribbon windows, clere story windows, skylights, casement windows and full length windows. As the central exhibition space has voids in between the bridges in ground floor the basement also receives the adequate lightings. Similarly, those spaces which are not provided with sufficient natural lighting are provided with artificial lightings which include: track lights, focus lights, tube lights, LED lights, and fluorescent lights.
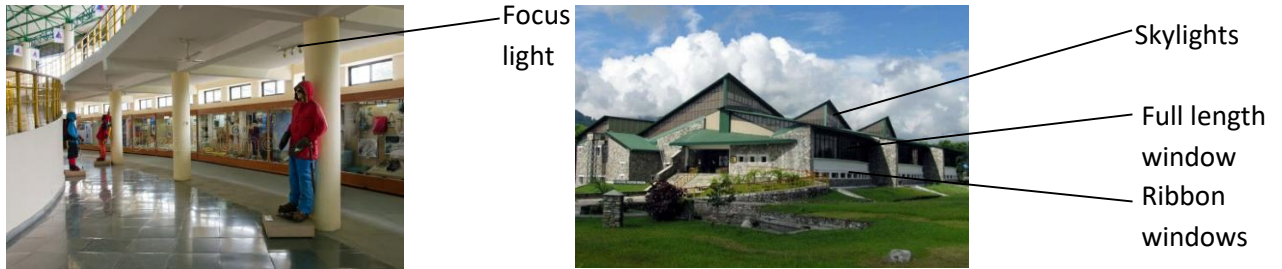
Figure 3.17: lightings in museums

3.1.6. Architectural style

The museum is a low-rise, horizontally spread structure with Stone cladding & exposed brickwork to reflect local materials. Large glass panels are used for transparency and natural lighting. The roof of the structure is inspired by traditional sloping roofs, resembling Himalayan terrain. Local stone, wood, concrete, and steel are used for the construction of museum whereas sustainable insulation materials are used for thermal comfort. The museum has reinforced concrete frame with seismic resilience and truss roof. It is the hybrid of vernacular and modern techniques.

3.1.7. Building Services

- **Fire Safety:** Sprinklers, fire exits, and smoke detection systems are provided.
- **Sanitation & Water Management:** Eco-friendly toilets, rainwater harvesting, and wastewater treatment is one of the major sustainable considerations.
- **Security Systems:** CCTV surveillance, alarm systems are installed for safety.

3.1.8. Inferences:

- Zoning strategies for different functional spaces.
- Effective use of natural light for exhibition spaces.
- Incorporating local materials while maintaining a modern museum structure.
- Interactive and engaging exhibits to improve visitor experiences.
- Incorporation of universal design.

3.2. National museum, Chhauni

3.2.1. General information:

Location: Chhauni, Kathmandu, Nepal

Site area: 20,000 sq.m

Architectural style: Neo-classical, Malla residence

Ownership: Nepal government

Building type: Adaptive reuse and new blocks
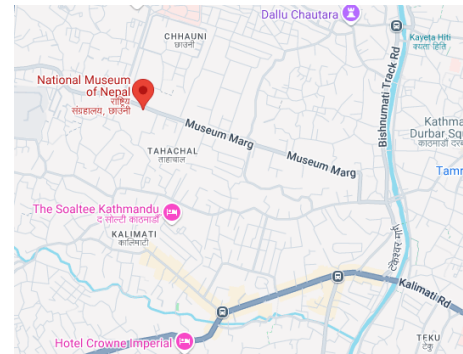
Figure 3.18: location map

3.2.2. Introduction

It is the largest museum in Nepal, preserving and exhibiting the country's rich historical, cultural, artistic, and military heritage. It plays a crucial role in educating visitors about Nepal's history, traditions, and artistic evolution. The museum is divided into three major buildings, each with a unique focus: Juddha Jatiya Kalashala, The Buddhist Gallery and the Main Historic Building. It is Nepal's first museum, exhibiting a mix of art, history, and military artifacts. The National Museum of Nepal was originally built in 1824 by Prime Minister General Bhimsen Thapa as an arsenal for the display and protection of the military equipments. It was renamed Silkhana Museum in 1926 by Rana Prime Minister Chandra Shumsher after adding two wings to the north and south of the main building. In 1938, Rana Prime Minister Juddha Shumsher renamed it Nepal Museum and opened it to the public in 1939. In 1967, it was formally named as National Museum (Rastriya Sangrahalaya). The Juddha Jatiya Kalashala is named after Juddha Shumsher Rana, this gallery focuses on traditional and contemporary Nepalese art. The displays include: Paubha paintings (traditional religious paintings similar to Tibetan Thangka), Ancient sculptures made from metal, wood and stone, Contemporary artworks from various Nepalese artists. Buddhist Art Gallery is the second building, which was formerly the shah king Mahendra's Mahendra Smriti Sangrahalaya. This building initially housed the private collection of the Rana and Shah Family but after democracy of 2048 B.S. It was turned to Buddhist Gallery showcasing various Buddhist paintings, relief, rituals from Terai, Hill and Mountain regions of Nepal. The Natural Science Gallery, Historic Gallery, Philatelic Gallery

and Numismatic Museum are the final four galleries of the Historical Museums main palace. The museum receives on an average 63750 visitors yearly including the foreign tourists, SAARC tourists, Nepali visitors and students.

Figure 3.19: National museum

3.2.3. Architectural Design & Planning

3.2.3.1. Master plan & Zoning:

The museum complex has site area of 20,000 sq.m and resides three main buildings: Juddha Jatiya Kalashala, The Buddhist Gallery and the Main Historic Building. As for the planning of the buildings, they are arranged in two mutually perpendicular directions with respect to the main entry. This eases in the orientation of the visitors as all three block are clearly perceivable from the central court, which also directs towards the museum shop, parking and the canteen. The placement of these public zones around the court creates a clear circulation pattern and provides the visitors with choices. The restroom is placed at the rear end of site, which is not easily approachable. In addition, the museum often fails to provide enough parking spaces for large number of visitors.
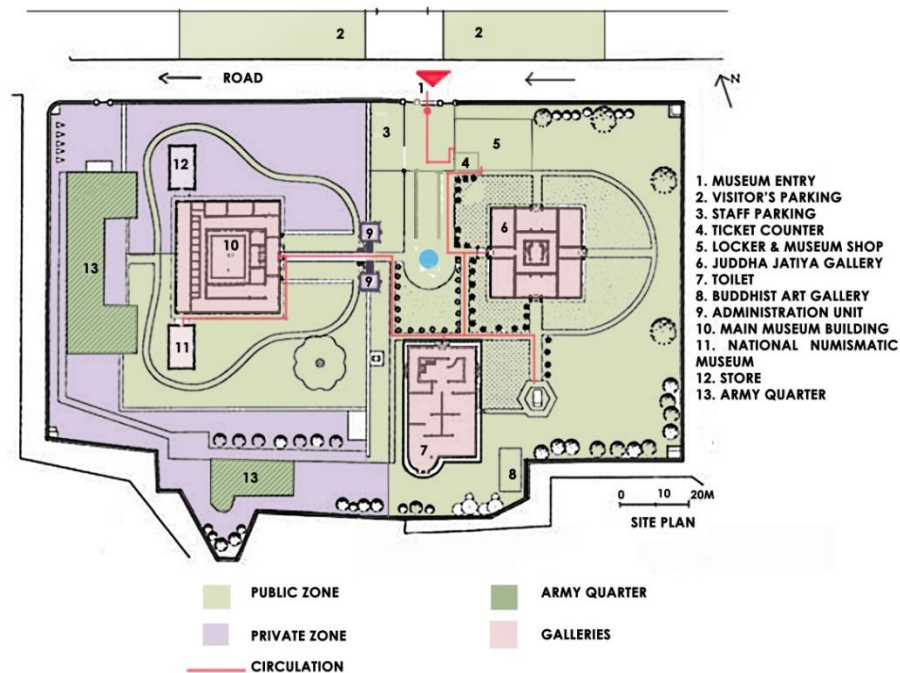
Figure 3.20: site plan of National museum

Galleries

1. Juddha Jatiya Kalashala:

It was first museum building to be established during 1999-2000 B.C. by then prime minister Juddha Shumser. The outlook of the building is combination of traditional Nepalese architecture, Post Victorian architecture and a touch of Indian architecture. It has rectilinear plan with its entry resembling the Sanchi Stupa. It resides stone sculptures, terracotta creations, old paintings, wood creations, and bronze antiquities. This building is planned in a symmetric order, the entrance is located at western side and the galleries are located all around the edge with central circulation and stair hall section.
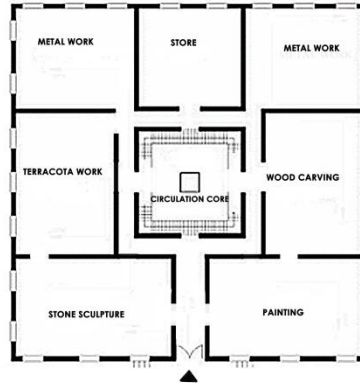
Figure 3.21: 3D view   *Figure 3.22: Ground floor Plan*   *Figure 3.23: Terrace floor plan*
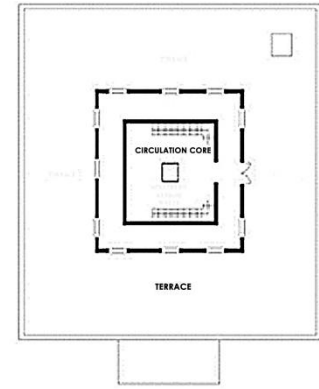
1.1 Circulation

The circulation within the museum is studied on the basis of horizontal and vertical movements.

a. Horizontal circulation

The museum's circulation follows a structured room-to-room flow in a clockwise direction. Upon entering, visitors encounter the stone gallery on the left and an old painting collection on the right. They naturally move left, guided by both instinct and staff assistance. Displays are positioned on the left-hand side, directing movement and ensuring a structured viewing experience. However, this layout may cause congestion

Figure 3.24: circulation in ground floor

when large groups, such as students, visit the museum, leading to possible collisions and discomfort. A winding circulation path around a central hall, along with a stone staircase, connects all exhibits within the Juddha Jatiya KalaShala. The central corridor also serves as an alternative route, allowing for smoother transitions between entry and exit points while maintaining an efficient flow. The average circulation width is 1.7 meters in galleries and 2.7 meters in hallways, ensuring comfortable movement.

On the upper floor, displays are arranged within the central hall and circumambulatory spaces. The central hall features a prominent centerpiece visible from all directions, along with additional exhibits mounted on the walls. Visitors continue to move in a clockwise direction, maintaining a seamless and organized circulation throughout the space.

b. Vertical circulation

The vertical means of circulation in this building is a set of staircase at the center where one is used for ascend and other is used for descend. There are 27 number of risers each around 190cm high, creating to the double story hall of height 4m creating grandness.
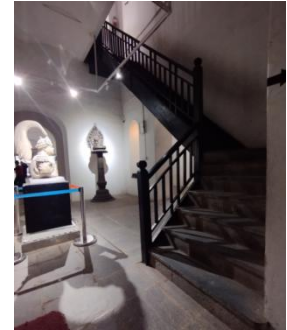
Figure 3.25: Vertical circulation in ground floor

1.2 Lighting

As the buildings have high ceilings there is interplay of both natural and artificial lights. The display section utilizes both natural and artificial lights. The natural light is integrated in the building through high perforated windows. Whereas cool artificial lights are used in the display areas and warm lights in central circulation spaces. The entire corridor has dim ambience. The display objects are illuminated through focus lights installed on the suspended metal supports. The display case has inbuilt diffused lights.
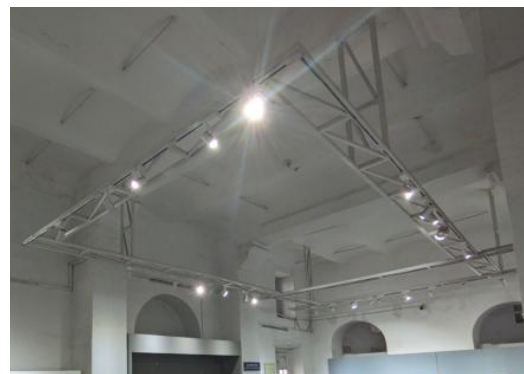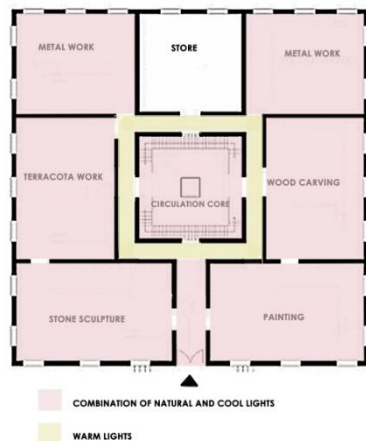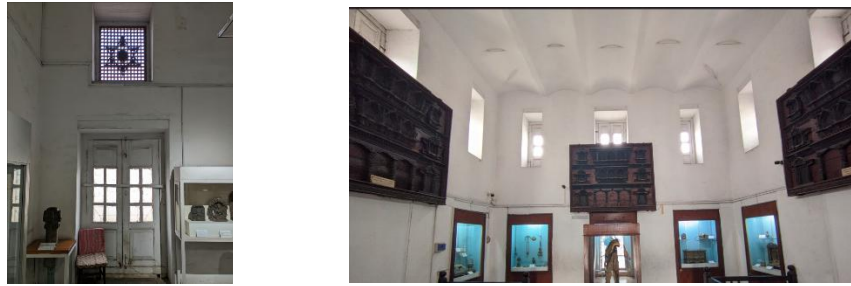
Figure 3.26: Lighting in museum

1.3 Ventilation

The high perforated windows are used for ventilation in the museum as it lacks mechanical ventilation. These windows are used for cross ventilation across the building.

2. The Buddhist Gallery

The Buddhist Art Gallery, funded by Japan in 1997, was established to meet museum functional standards. Initially, it housed the private collections of the Rana and Shah families. However, following the democratic transition in 2048 B.S., it was converted into a Buddhist gallery. The museum now showcases Buddhist reliefs, paintings, and ritual artifacts from the Terai, Hills, and Mountain regions of Nepal. The upper floor is currently used for temporary exhibitions featuring historical Nepalese artifacts acquired from different foreign nations. Designed as an exhibition space, this building features some of the best gallery layouts and modern facilities. It includes a small audio-visual area and a lecture hall. The gallery follows a simple linear circulation pattern, with spacious exhibition areas. Partitions and exhibits effectively structure the space, guiding visitors along a defined path while allowing unobstructed views.

Figure 3.27: 3D view
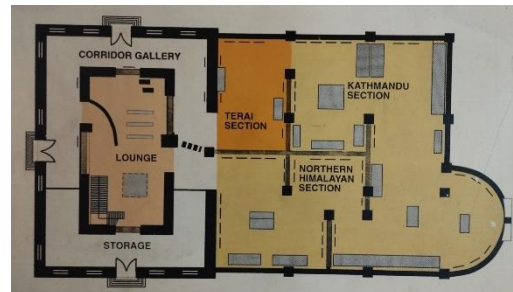
Figure 3.28: Ground floor plan

2.1 Circulation

The circulation follows a unidirectional flow, guiding visitors from the left of the entrance through a continuous path along the exhibits. Partitions create an interactive experience within the enclosed space, while brick and wooden carvings enhance the traditional Nepali aesthetic. At the end of the gallery, an audio-visual room features a projector and seating. A staircase nearby leads to the

Figure 3.29: circulation plan

upper floor, which hosts temporary exhibitions displaying recovered stolen artifacts.

2.2 Lighting

The gallery attains the maximum lightings from the artificial lights. The natural lights entering from the windows are covered with screens to avoid sharp lights. For artificial light CFL lights and focus lights are used in case of display lights. The incased diffused light is properly installed with a screen to defuse and eliminate sharp shadows while focus lights have no screen so glare is experienced.

Figure 3.30: lighting in museum

3. Main Museum Building

The main building was curated by Bhimsen Thapa Nepals first prime minister. It showcases the military arsenal; the Natural Science Gallery, Historic Gallery, Philatelic Gallery and Numismatic Museum are the final four galleries of the Historical Museums main palace. It features a variety of
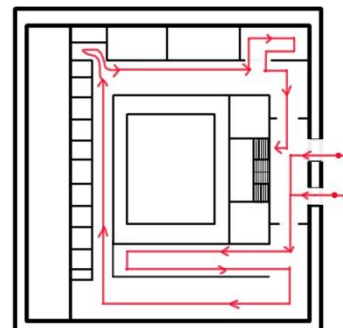
Figure 3.31: Circulation in museum

collections of artworks and ethnographic artifacts of people around the world.

3.1 Lighting

Being the oldest building, the lighting in this building is quiet poor compared to other two buildings. Fluorescent tubes, CFL, spotlights have been used in the building. The lights of this buildings are quiet faulty.

Figure 3.32: lighting in museum

4. Inferences

- Segregation of museum buildings.
- Symmetrical planning and circulation.
- Display techniques and use of traditional Nepalese architecture in design.

b. Regional case study:

3.3. Mountain & Sea art museum, China

3.3.1. General information:

Location: Cuifeng Ecological Park, Kunming, China

Area: 2998 sq.m

Architects: gad

Type: Cultural Museum

Figure 3.33: Mountain & Sea art museum

3.3.2. Introduction

The Mountain & Sea Art Museum, designed by the architectural firm gad, is a contemporary cultural landmark situated in Kunming, China. Situated on a mountain slope overlooking Dianchi Lake, the museum derives its name from its unique location standing amid the mountains while visually connecting to the expansive waterscape. It serves as an important public building, offering an immersive artistic and spatial experience that harmonizes with nature. Unlike conventional museums built on stable platforms, this museum follows the natural contours of the terrain, making it an architectural response to the site's ecological and topographical characteristics. The museum's design philosophy is rooted in low intervention, with spaces scattered along the hillside, creating an organic and fluid composition rather than a rigid built form. The museum provides visitors with a multi-sensory journey that merges architecture, art, and landscape, creating a tranquil retreat away from the urban hustle.

3.3.3. Architectural Design & Planning

3.3.3.1. Master Plan and Zoning

The master plan of the museum is developed in response to the site's dramatic topography, with the structure divided into different levels and platforms that follow the mountain's natural slope. The site features a height difference of more than ten meters, which significantly

influences the spatial arrangement. Instead of constructing a singular mass, the museum is broken down into multiple interconnected spaces that adapt to the terrain. The zoning of the museum is fluid, integrating exhibition spaces, viewing platforms, and leisure areas such as tea houses, verandas, and pavilions that provide spaces for relaxation and contemplation. The museum does not follow a conventional centralized layout but rather unfolds organically along the hillside. The positioning of spaces is inspired by historical site elements, such as stone pathways and gathering areas previously used by scholars. These fragmented zones, connected by a continuous circulation path, create an experiential journey where visitors transition between enclosed, semi-open, and open spaces, blurring the boundaries between the museum and its natural setting.

1. LOBBY
2. EXHIBITION HALL
3. OFFICE
4. WASHROOMS
5. CULTURAL EXHIBITION HALL
6. WATER FEATURES
7. STONE FORESTS
8. COURTYARD

Figure 3.34: Master Plan

3.3.4. Circulation

Circulation in the Mountain & Sea Art Museum is designed to provide visitors with a dynamic, exploratory experience rather than a linear, predefined route. The primary circulation is based on an infinity-loop (∞) pathway, which interconnects different museum spaces while allowing visitors to engage with the surrounding landscape. This fluid movement pattern enables a non-hierarchical experience, where visitors can navigate through the museum in multiple ways rather than following a rigid path. The circulation plan incorporates a combination of ramps, staircases, and terraces, which guide visitors through varying levels while maintaining visual continuity with the surrounding mountains and lake. Open-air pathways and transitional spaces between galleries provide moments of pause, offering framed views of the natural environment. Additionally, circulation is enhanced through the interplay of elevation changes, where visitors ascend and descend through different platforms, creating a rhythmic spatial journey. The integration of exterior and interior movement pathways makes circulation feel organic, inviting visitors to engage with both the museum and its context as they explore.
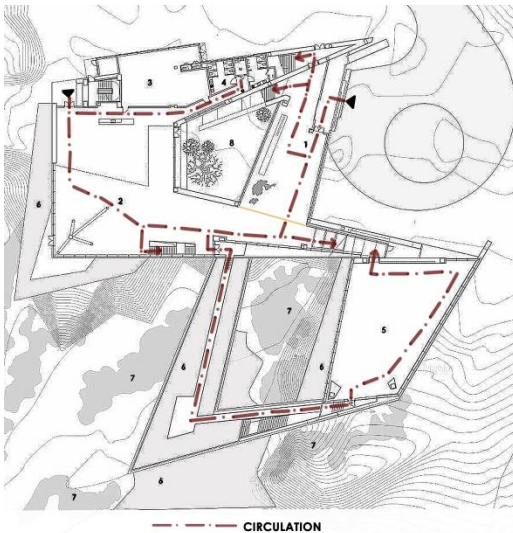
Figure 3.35: Infinity loop circulation

Figure 3.36: Staircase for circulation

3.3.5. Lighting

Lighting in the museum plays a crucial role in shaping the spatial experience and reinforcing the architectural concept of merging with nature. Natural day lighting is maximized through

strategically placed openings, skylights, and large south-facing facades, ensuring that exhibition spaces receive controlled yet sufficient illumination. The museum's fragmented layout allows daylight to filter through different levels, creating interplay of light and shadow that change throughout the day. The discrete wall system, inspired by the stone forest, further enhances this effect, casting intricate patterns of light that interact with the interior spaces. Overhanging roofs and recessed walls help control direct sunlight, preventing excessive glare while maintaining a soft, ambient lighting condition. Artificial lighting is carefully integrated to complement the natural illumination and enhance the museum's nighttime presence. Warm ambient lighting is used throughout the interiors, creating a sense of intimacy and calmness. Adjustable spotlights and recessed ceiling lights highlight exhibits without overpowering them, ensuring that artworks remain the focal point. The infinity-loop circulation path is subtly illuminated with embedded floor and wall lighting, guiding visitors through the space in a seamless manner. At night, exterior lighting embedded within the terrain enhances the museum's floating effect, making it appear as a glowing entity that blends harmoniously with the surrounding landscape. The thoughtful use of both natural and artificial lighting reinforces the museum's philosophy of integrating architecture with its environment while providing an immersive visitor experience.

Figure 3.37: lighting in museum

3.3.6. Architectural Expression

The architectural expression of the Mountain & Sea Art Museum is deeply rooted in the natural characteristics of its site. The museum does not conform to conventional box-like forms but instead adopts a fragmented and organic composition, responding to the terrain's undulating topography. The structure's design is inspired by the surrounding stone forest, with walls and spaces arranged in a seemingly irregular yet harmonious manner. The building is enclosed in the north while opening towards the south, embracing views of the mountains and lake in a

sequential manner. Its form gives the impression of being lightly placed on the landscape, following the logic of "low intervention" construction, where the design adapts to the environment rather than imposing itself upon it. Materiality plays a key role in the museum's architectural language. The use of local Yunnan rammed earth and red clay integrates the building seamlessly with its natural surroundings, reinforcing a sense of place and cultural identity. The structural system is carefully designed to minimize disruption to the site, with indoor tree-shaped columns that provide support while maintaining openness and transparency. This design choice allows for unobstructed views of the exhibits and landscape, creating a floating effect within the interior spaces. The building's surfaces interact with light and shadow, further enhancing its visual and experiential qualities. Overall, the architectural expression of the museum is one of balance—between built form and nature, between solidity and openness, and between history and contemporary design.

3.3.7. Inferences

- Site Integration and Terrain-Based Design
- Master Plan and Zoning Inspired by Adventure and Exploration
- Circulation as an Engaging and Dynamic Journey
- Lighting Strategy: Emphasizing Natural & Thematic Ambience
- Architectural Expression: Symbolizing the Spirit of Mountaineering
- Sensory Experience and Interaction with Nature

c.   International case study:

3.4. Messner Mountain Museum Corones, Italy

3.4.1. General information:

Location: South Tyrol, Italy

Area: 1000 sq.m

Architects: Zaha Hadid Architects

Figure 3.38: Messner Mountain museum

3.4.2. Introduction

The Messner Mountain Museum Corones, designed by Zaha Hadid Architects, is a remarkable museum dedicated to mountaineering, located at the summit of Kronplatz (Plan de Corones) in South Tyrol, Italy. It is part of a network of six museums founded by Reinhold Messner, one of the world's most legendary mountaineers. The museum is situated at an altitude of 2,275 meters, offering a 360-degree panoramic view of the Dolomite mountain range. The museum serves as a tribute to the history, culture, and technical advancements of alpinism, providing visitors with an immersive experience of mountain exploration. Designed to blend seamlessly with the rugged landscape, the museum is largely embedded into the mountain itself, with only its entrance, viewing terraces, and large panoramic windows visible from the outside. This organic integration with the terrain ensures minimal visual impact on the surrounding natural environment while enhancing the dramatic effect of emerging from the mountain.

3.4.3. Master Plan and Zoning

The museum is carefully embedded within the rocky summit, minimizing environmental disturbance while creating an immersive, cave-like experience. The layout is subterranean, with exhibition spaces, galleries, and viewing platforms carved into the mountain. The master plan consists of:

- **Entrance Zone:** A subtly designed access point that leads visitors into the underground museum.

- **Exhibition Spaces:** Spread across multiple levels, displaying mountaineering artifacts, multimedia installations, and historical narratives.

- **Panoramic Viewing Terraces:** Three strategically placed terraces offering breathtaking views of the Dolomites, Zillertal Alps, and Marmolada Glacier**.**

- **Auditorium & Lounge Areas:** Spaces designed for storytelling, film screenings, and lectures on mountaineering culture and history.

The museum's fluid and organic form allows visitors to experience both enclosed, introspective spaces and expansive, outward-facing platforms that connect them with the surrounding landscape.
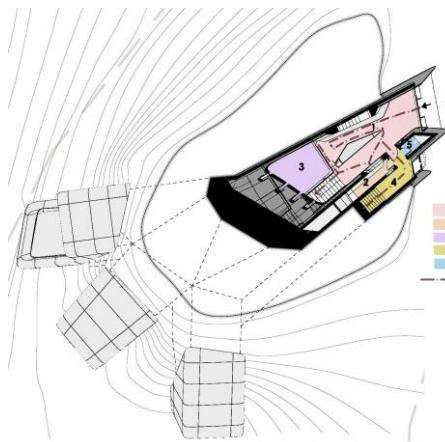
Figure 3.39: level GF
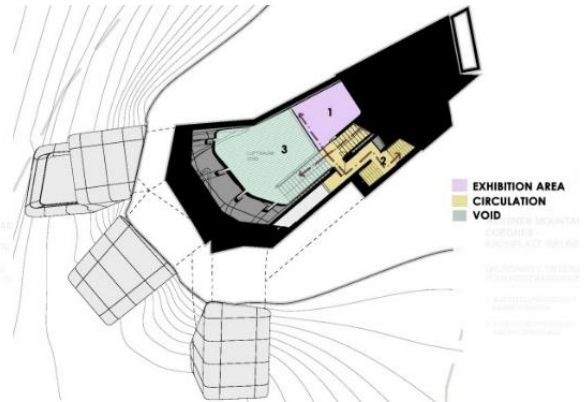
Figure 3.40: Level B1
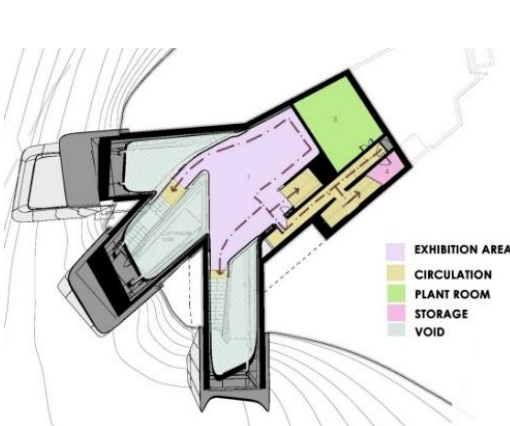
Figure 3.41: Level
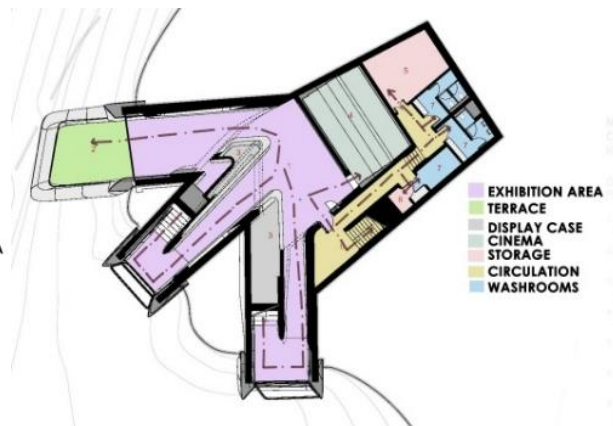
Figure 3.42: level B3

Figure 3.43: Section

3.4.4. Circulation

The circulation within the Messner Mountain Museum Corones follows a journey-like experience, inspired by the concept of exploration and discovery. Unlike conventional museums with clear, linear pathways, the undulating and interconnected corridors mimic the unpredictability of navigating through a mountain landscape. Visitors descend into the museum through a series of curved passageways that lead to different exhibition halls. The progression is gradual, allowing visitors to absorb information at their own pace while experiencing changing spatial dimensions. The journey culminates at three dramatic viewing terraces, which act as "summit points," symbolizing the reward of reaching the peak after a climb. The museum's organic circulation flow ensures that the movement through the space is seamless, immersive, and reflective of a mountaineering expedition.

3.4.5. Lighting

Lighting plays a crucial role in enhancing the museum's spatial experience, both internally and externally. Natural Light is integrated through large panoramic openings frame spectacular views of the Alps and Dolomites, allowing daylight to flood the exhibition spaces. These openings are carefully positioned to create interplay of light and shadow, resembling the way sunlight penetrates mountain crevices. Artificial Light such as Recessed LED lighting

highlights exhibition displays, maintaining a soft and ambient glow without overpowering the space. Indirect lighting is used in corridors and transition areas, emphasizing the smooth, fluid curves of the interior. Spotlights focus on mountaineering artifacts and storytelling exhibits, drawing visitors' attention to key elements. The contrast between enclosed, dimly lit spaces and bright, panoramic openings creates a dramatic effect, reinforcing the museum's cave-like atmosphere while symbolizing the transition from darkness to enlightenment akin to the mountaineering experience itself.

Figure 3.44: Lighting in museum

3.4.6. Architectural Expression

The Messner Mountain Museum Corones is a striking example of Zaha Hadid's signature fluid, organic architecture, inspired by the dynamics of nature and topography. The structure appears as if it is emerging from the mountain itself, reflecting the raw and powerful essence of alpine landscapes. The curved, sculptural concrete walls resemble the natural erosion of rocks, while the smooth, flowing forms contrast with the rugged surroundings. The museum's materiality is carefully chosen to blend with the environment reinforced concrete gives it a monolithic, stone-like appearance, ensuring longevity and resilience against extreme mountain weather conditions. The use of glass for panoramic openings creates a seamless visual connection between the interior and exterior, reinforcing the idea of nature as a living exhibition.

3.4.7. Inferences

- Site Integration and Respect for Topography
- Progressive non-linear Circulation
- Lighting as a Tool for Immersion

- Organic Architecture and Materiality
- Connection to Nature and Immersive Experience
- Thematic Exhibition Spaces

Comparison

Table 2: Comparison between case studies

Feature	International Mountain Museum, Pokhara	National Museum, Chhauni	Mountain & Sea Art Museum, China	Messner Mountain Museum, Italy
Location	Ratopahiro, Pokhara	Chhauni, Kathmandu	Kunming, China	South Tyrol, Italy
Topography	Flat Terrain near Seti river, scenic views of Annapurna Range	Flat Terrain, Urban setting	Mountainous, integrated with natural rocky formations	Steep, mountainous terrain at 2,275m altitude
Site Area	4242 Sq.m.	20,000 Sq.m.	2998 Sq.m.	1000 Sq.m.
Zoning Strategy	Two zones: museum, outdoor facilities	Three Main Galleries: A. Juddha Jatiya Kalashala B. Buddhist Art Gallery C. Main Museum Building	Discrete gallery spaces embedded along an infinity-shaped path	Integrated zoning with radial underground galleries
Circulation	Central Spine With Radial branches, guiding visitors through exhibits	Linear movement, interconnected halls and courtyards	Infinity-shaped Pathway connecting fragmented volumes,	Radial underground tunnels, creating a seamless flow between spaces

		integrating with natural terrain	
Display Strategy	Interactive and Physical exhibits, large-scale models, mountaineering archives	Traditional static exhibits, artifacts in glass cases, framed paintings	Traditional static exhibits, artifacts in glass cases, framed paintings	Traditional static exhibits, artifacts in glass cases, framed paintings
Architectural Expression	Modern functionalist, local materials, clean geometric form	Traditional Nepali and colonial influences, brick masonry, sloped roofs	Fragmented infinity volume, integrating with the mountain's stone formations	Organic Form, blending into the mountain with underground spaces
Materials used	Concrete, steel, glass, local wood	Brick, timber, stone, mud mortar	Local Rammed earth, red clay, concrete, glass	Reinforced Concrete, corten steel, glass
Parking	Large parking area (100+ two-wheelers) 22 four-wheelers	Small parking area (30-40 vehicles) mainly for staff	No Data available	Limited parking at base station (20-30 vehicles)
Universal / Inclusive Design	Wheelchair ramps, accessible exhibition spaces, braille signage	Limited accessibility due to historical layout	Continuous path of open flow between indoor and outdoor spaces	Limited due to steep terrain, minimal accessibility

4. SITE ANALYSIS

4.1. INTRODUCTION

Location: Nagarkot Sunrise Panoramic Viewpoint, Nagarkot

Area: 10500 sq.m. (20-10-0-3)

Topography: Hilly terrain with gentle slopes

Present Use: Tourist attraction and viewpoint

Figure 4.1: Location map

4.2. SITE JUSTIFICATION

- **Scenic Beauty:** The site offers panoramic views of the Himalayan range, including peaks such as Manaslu, Ganesh Himal, Langtang, Rolwaling Range, Jugal, Annapurna, Numbur and Mahalangur range (Mount Everest).

- **Accessibility:** Located approximately 18 km east of Bhaktapur, Nagarkot is accessible via **Nagarkot Road (9m)**, making it a convenient destination for tourists seeking natural beauty and tranquility.

- **Utilities:** Essential services such as electricity, water, and communication networks are available, supporting tourism infrastructure.

- **Topography:** The gentle slopes and elevated position make it ideal for constructing viewing platforms, mountain museums supporting the project mountain museum offering breathtaking views of 7 mountain ranges.

- **Environment:** Situated away from traffic areas, Nagarkot provides a peaceful and pollution-free environment, enhancing the visitor experience.

4.3. APPROACH/ACCESS

- **Distance from Bhaktapur:** Approximately 18.2 km,

- **Road Access:** Connected to Nagarkot road, which is suitable for all vehicle types.

- **Public Transportation:** Regular bus services operate

Figure 4.2: Accessibility Map

between Bhaktapur (Kamalbinyak) and Nagarkot, with the nearest bus stop located within walking distance of 30-35 minutes (2.6 km) from the viewpoint.

- **Local Access:** The site is accessible via a 6-meter-wide road.

4.4. SITE TOPOGRAPHY

The site is characterized by gentle slopes, providing an excellent vantage point for panoramic views. The exact location according to Google Earth:

- **Latitude:** 27.42° N
- **Longitude:** 85.31° E
- **Altitude:** 2,025 meters above sea level
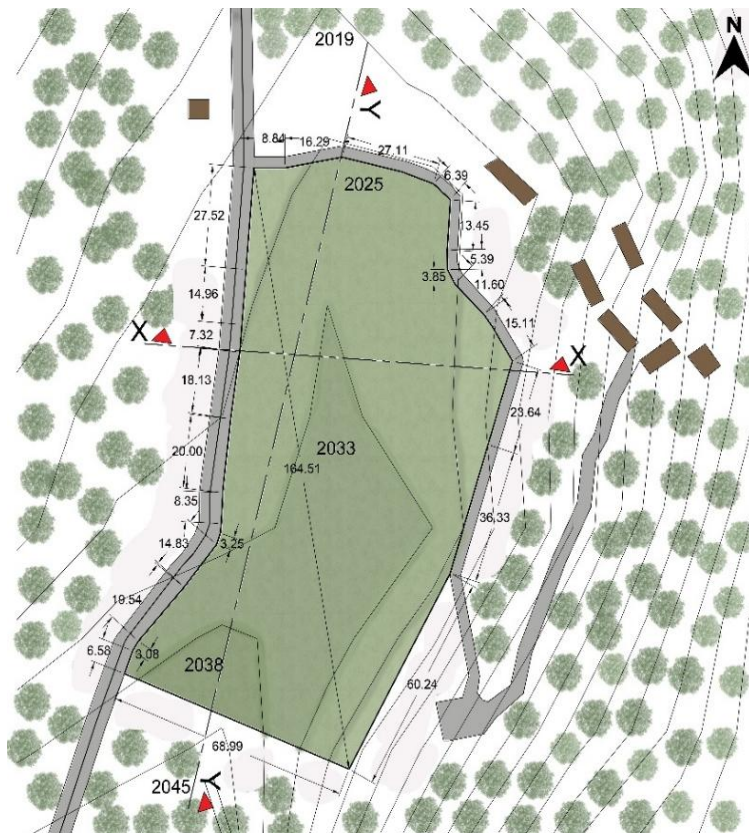
Figure 4.3: Site with dimensions

Figure 4.4: Section at X-X
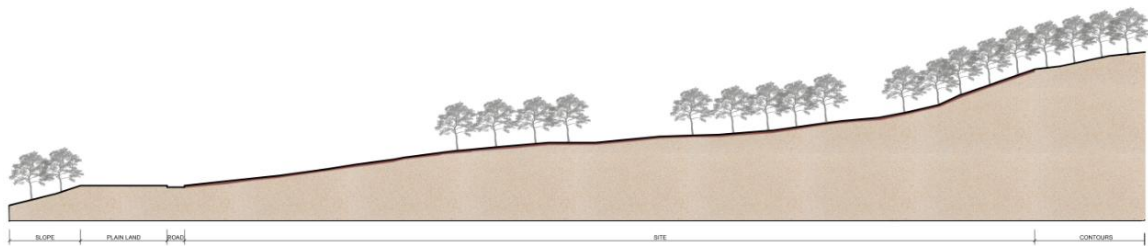
Figure 4.5: Section at Y-Y

Site Views

4.5. CLIMATIC CONDITION

Nagarkot experiences a cool and temperate climate due to its elevation.

- **Hottest Month:** June, with average temperatures around 25°C
- **Coldest Month:** January, with temperatures dropping to approximately 2°C
- **Sun Angle:** Summer 82° / Winter 37°
- **Humidity:** Moderate, with higher levels during the monsoon season (June to September)
- **Wind:** Prevailing winds from the southwest, averaging 7 km/h.
- **Snow fall:** Occasionally during end of December to February.
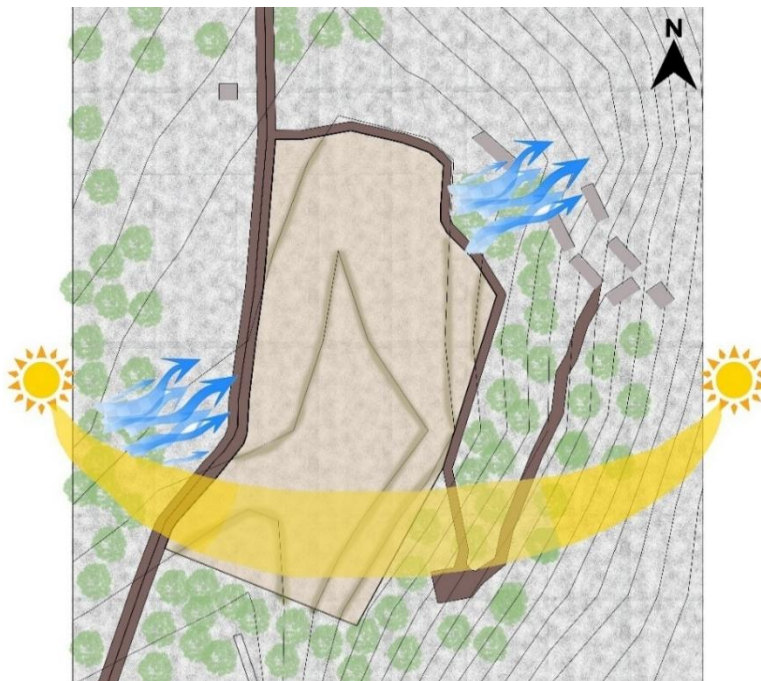
Figure 4.6: Sun path diagram with wind directions

4.6. LAND USE

- **Current Use:** Designated as a viewing platforms (Government Land).
- **Surrounding Areas:** Primarily forested land, interspersed with agricultural fields and small settlements.
- **Development Potential:** The area is suitable for eco-tourism projects, including hiking trails, nature related museums and natural parks.
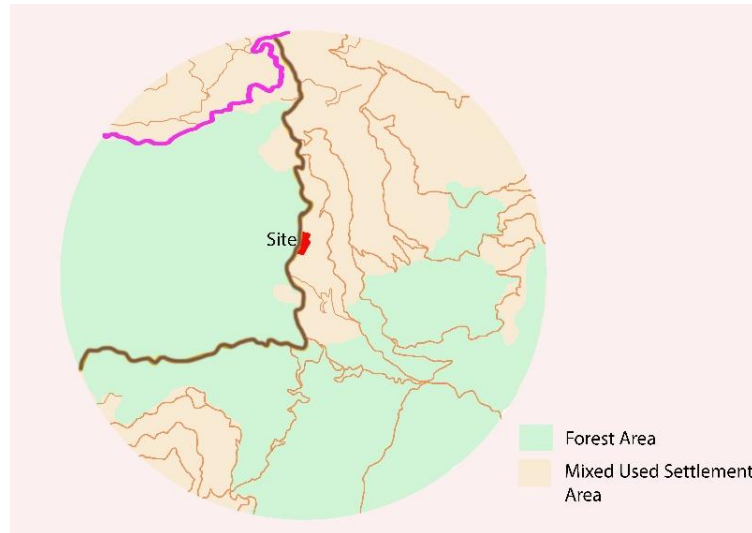
Figure 4.7: Land use Plan

4.7. UTILITIES

- **Drinking Water Services:** Available through local supply systems; however, during dry seasons, water scarcity can occur, necessitating water conservation measures.
- **Electricity Services:** Connected to the national grid, with occasional power outages; backup generators are commonly used in hotels and resorts.
- **Communication Services:** Mobile network coverage is reliable, and internet services are available in most tourist establishments.
- **Transportation Facilities:** Well-connected by road; tourist jeeps and local taxis operate regularly.

Figure 4.8: Utilities Plan

4.8. SITE FEATURES AND SURROUNDINGS

- **Natural Attractions:** The site offers stunning sunrise and sunset views over the Himalayas, making it a popular destination for photographers and nature enthusiasts.
- **Hiking Trails:** Several trails connect Nagarkot to nearby villages and viewpoints, providing opportunities for trekking and cultural exploration.
- **Flora and Fauna:** The surrounding forests are rich in biodiversity, featuring pine, rhododendron, and oak trees, as well as various bird species.
- **Nearby Attractions;** View towers, Viewpoints, parks, Picnic spots, hotels and resorts.
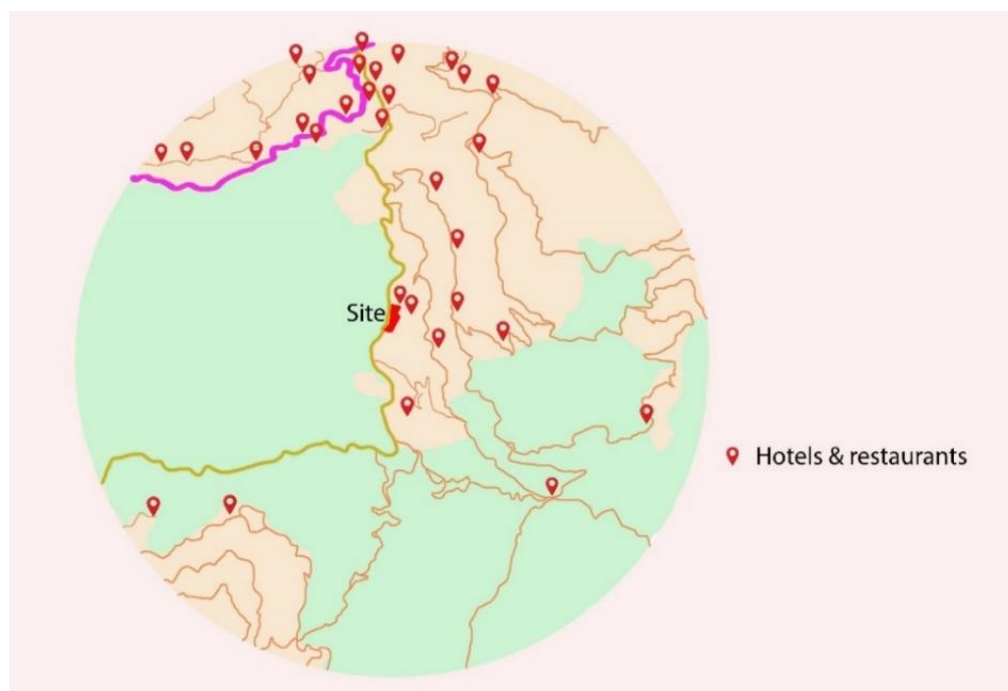
Figure 4.9: Tourist attraction around site
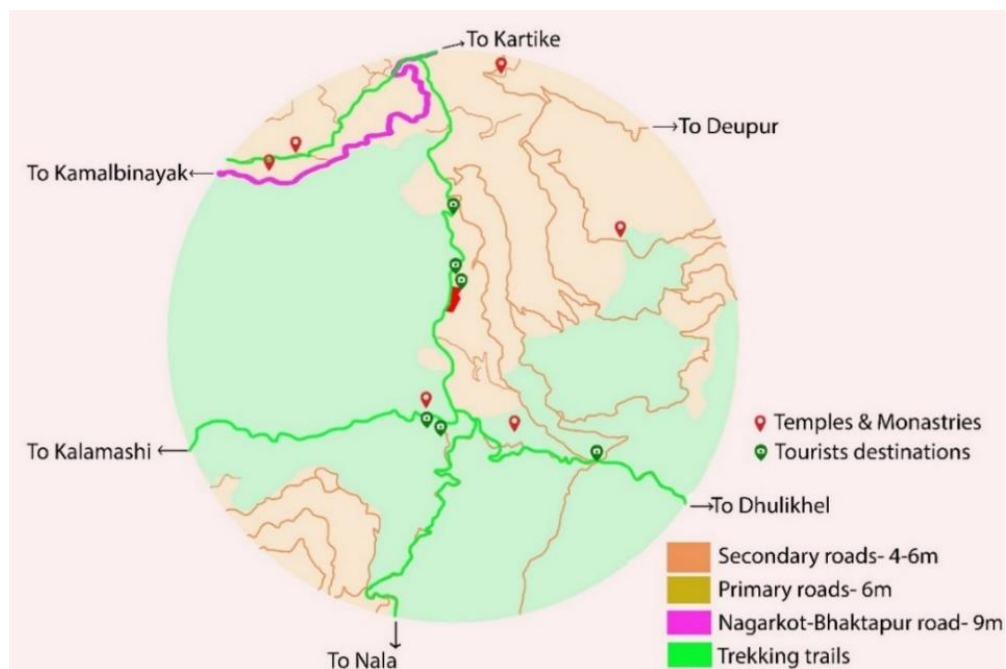
Figure 4.10: Plan showing hotels & restaurants

4.9. SOCIO-CULTURAL ASPECTS

- **Local Communities:** Inhabited predominantly by Tamang and few other ethnic groups like (Brahmin, Chhetri, Newars, etc), who maintain rich cultural traditions and practices.
- **Cultural Festivals:** Local festivals such as Lhosar (Tamang New Year) and various Hindu and Buddhist festivals are celebrated with traditional music, dance, and rituals.
- **Handicrafts and Cuisine:** Visitors can experience local handicrafts, including weaving and woodcarving, and enjoy traditional Nepali cuisine in local eateries.

4.10. BYLAWS

- **Setback:** Minimum 1.5 meters from the edge of the road for new constructions, 3m for public buildings.
- **Ground Coverage:** Maximum of 40% to preserve natural landscapes and prevent soil erosion.
- **Right of Way (ROW):** 4 meters from the centerline of the main access road + 3m setback = 7m from center.
- **Maximum Height:** 15 meters (approximately 5 stories) to ensure safety in the hilly terrain.
- **FAR:** 2.5

4.11. SWOT ANALYSIS

Strengths

- Stunning **views** of the Himalayan range as a supporting aspect for the project.
- **Major tourist attraction** with high footfall.
- **Pleasant climate** throughout the year with occasional snowfall as a supporting element for the project.

Weaknesses

- **Steep terrain** makes construction challenging.
- **Seasonal tourist fluctuations**, affecting business sustainability.

Opportunities

- **Sustainable design opportunities** using local materials.

Threats

- **Risk of landslides** during monsoon season.

5. PROGRAM FORMULATION

The Mountain Museum is envisioned as a landmark institution that preserves and showcases Nepal's rich mountaineering history, culture, and ecology of mountains. Given the dynamic evolution of Nepal's socio-cultural landscape, the design must reflect both traditional values and contemporary aspirations. The museum complex will integrate essential spaces such as galleries, research facilities, and recreational areas while fulfilling its role as a cultural and adventurous hub.

5.1 Estimated Daily Visitors

The calculation of the area and number of visitors are in accordance to different case studies made on museums of Nepal. Average number of visitors in the two museums of Nepal are as follows:

Table 3: Number of visitors for various museums of Nepal

Museum	Year	Total Visitors	Visitors/Day	Max.no./ day
International Mountain Museum	2024	95,862	265	475
National Museum, Chhauni	2079/80	63726	175	320

In the proposed Mountain Museum, it is expected that the maximum daily visitors will be 400 per day.

According **Nagarkot Naldum Tourism Development Committee,** the flow of international tourists in nagarkot are as follows:

Off seasons: Minimum – 200/day, Maximum – 300/day

Seasons: Minimum – 500/day, Maximum – 800/day

Note: Record can't be kept for national tourists as there is abundant flow of national tourists every day mainly on weekends (Friday & Saturday).

So, the average annual flow of tourist will be 400 per day approximately.

5.1.1 Museum Operation

Museum Opening Hours: 7 hours/day **(for example, 10 AM to 5 PM)**

Total visitors per day: **400 visitors**

5.1.2 Hourly Catering Capacity of the Museum

Table 4: Day-part breaks down of the museum catering requirement

Day Part	Hours	% of Visitors (approx.)	Visitors in that period	Visitors per hour (avg.)
Morning	10 AM - 12 PM (2 hours)	20%	80 visitors	40 per hour
Midday / Afternoon	12 PM - 3 PM (3 hours)	40%	160 visitors	53 per hour
Late afternoon	3 PM - 6 PM (3 hours)	40%	160 visitors	53 per hour

5.2 Parking

The museum provides a dedicated parking area to accommodate visitors, staff, and service vehicles. Designed for efficient access and circulation.

Table 5: Parking Calculations

S.N.	Description	Area	Units	Quantity	Occupancy	Total Area
1.	Car	12.5	Sq.m	40	-	500
2.	Bike	2.5	Sq.m	60	-	150
3.	Bus	50	Sq.m	3	-	150
4.	Mini truck	36	Sq.m	2	-	72
	Total			**128**		**872**

Total Area for Parking Vehicles: 872 Sq.m

Vehicular circulation (Inside Site): 1188 Sq.m

Total Parking Area: 2060 Sq.m, which is 20%

(20% parking required by Byelaws)

After the various researches, literature review and the case studied considering Bye laws, program formulation for this project has been developed as follows:

5.3 Core Exhibition Gallery

The Exhibition Gallery serves as the core public space of the Mountain Museum, designed to showcase history of mountaineering, mountain flora, fauna and geology, mountain people, mountain activities, contribution of Sherpa's, etc. It provides visitors with an engaging and educational experience through thoughtfully curated displays and exhibits, and immersive environments.

The gallery is organized to facilitate intuitive visitor flow, ensuring easy navigation between thematic zones while maintaining a balanced circulation pattern. Natural and artificial

lighting strategies are employed to highlight exhibits while preserving sensitive materials. The design also prioritizes flexibility, allowing for periodic updates and special exhibitions.

To accommodate 50% of the total maximum daily visitors i.e. 50% of 400= 200 people at once. With,

1.5 m2 per person

3-5 m2 wall surfaces for 2D display

6-10 m2 floor area for 3D display

Table 6: Core Exhibition Gallery Calculations

PROGRAM	AREA m^2
1. Introductory Lobby	75
2. Mountaineering Timeline Gallery	150
3. Mountain Activities Gallery	250
4. Mountain Gallery	370
5. Sherpa Contribution Gallery	160
6. Impacts on Mountain Gallery	100
7. Mountain People Gallery	350
8. Lakhang	75
9. Mountain Flora & Fauna Gallery	270
10. Legendary Climbers Gallery	145
Total	**1800**

5.4 Experiential Gallery

This exhibition Gallery serves as the interactive and immersive public space of the Mountain Museum where people are able to feel and engage in activities that evokes sense of climbing mountains or sense of virtually being present in the Himalayan landscape.

Table 7: Experiential Exhibition Gallery Calculations

PROGRAM	AREA m^2
1. VR Stimulating Zone	180
2. Audio-Visual Room	150
3. Souvenior Shop	90
4. Snow Room	290
Total	**710**

5.5 Entrance & Reception Area

The entrance of the museum serves as the primary threshold between the external world and the immersive experience within. Designed to be welcoming and intuitive, it guides visitors into the central plaza while offering a glimpse of the museum's thematic essence through architectural expression and signage.

Table 8: Entrance & Reception Area calculation

PROGRAM	AREA/PERSON	OCCUPANTS	AREA
Guard Room	10 m^2/person	3	30 m^2
Reception	8 m^2/person	2	16 m^2
Ticket Counter	6 m^2/person	4	24 m^2
Locker Room	1.5 m^2/person	30	45 m^2
Waiting Area	2.5 m^2/person	40	100 m^2
Public Toilet	3.5 m^2/person	-	36 m^2

Total			251m^2

5.6 Administration

The administration area is the core of the museum's management and coordination. It includes offices for directors, curators, and support staff, along with meeting rooms and basic amenities. This space ensures the smooth planning, communication, and day-to-day running of the museum, helping all departments stay organized and efficient.

Table 9: Administration Area Calculation

PROGRAM	AREA/PERSON	OCCUPANTS	AREA
Regestration Room	-	2	100m^2
Store Room	-	1	100 m^2
Classification & Documentation Room	-	4	150m^2
Account Room	3 m^2/person	3	36 m^2
Curator's Room	3 m^2/person	1	36 m^2
Staff Room	2.5 m^2/person	6	48m^2
Meeting Room	2.5 m^2/person	10	75 m^2
Toilet	2.5 m^2/person	-	40 m^2
Chief's Office	3 m^2/person	1	40 m^2
Secretary Office	3 m^2/person	1	40 m^2
Manager's Office	3 m^2/person	1	36 m^2
Total			**701 m^2**

5.7 Educational Spaces

As part of the museum's broader mission to inform and inspire, educational spaces are a vital component of the design. These areas are intended to facilitate learning, research, and deeper engagement with the subjects presented in the galleries.

Table 10: Educational Area Calculation

PROGRAM	AREA/PERSON	OCCUPANTS	AREA
Adult Reading Area	2.5 m^2/person	60	150 m^2
Locker Rooms	1.5 m^2/person	60	90 m^2
Computer Station	3 m^2/person	7	21 m^2
Book Issue Area	6 m^2/person	2	12 m^2
Book Shelf Area	1.5 m^2/person	60	90 m^2
Total			**363 m^2**

5.8 Recreational Zone

The Recreational Zone of the museum serves as a relaxed, welcoming space where visitors can unwind after their journey through the exhibits. Located near the exit, it includes a cozy café offering light refreshments and a souvenir store. This area enhances the visitor experience by providing a moment of leisure and reflection before departure.

Table 11: Recreational Area Circulation

PROGRAM	AREA/PERSON	OCCUPANTS	AREA
Seating Area	1.5 m^2/person	100	150 m^2
Food Serving Area	2 m^2/person	3	12 m^2
Kitchen	10 m^2/person	6	60 m^2
Storage/Prep Area	5 m^2/person	2	10m^2

Toilets	3 m²/person	-	36 m²
Total			**268 m²**

5.9 Multipurpose Hall

The multipurpose hall of the museum serves as an area for hosting various events including conference, experience sharing program, basic training providing area.

Table 12: Multipurpose Area Calculation

PROGRAM	AREA/PERSON	OCCUPANTS	AREA
Foyer	0.25 m²/person	200	100 m²
Seating area	1.5 m²/person	300	450 m²
Technical Room	3 m²/person	-	36 m²
Store	-	2	36 m²
Total			**622 m²**

Total Site Area: 10500 Sq.m (20 Ropani)

Ground Coverage: 3955 Sq.m (37.67%)

Total Built-Up Area: 6,579 Sq.m

6. Concept & Zoning

6.1. CONCEPT

"A Journey Through the Himalayas"

Philosophical Essence: Embodying the Spirit of the Himalayas

The Mountaineering Museum should not be just a place of knowledge but an experiential one that immerses visitors in the physical, emotional, and spiritual journey of mountaineering. Inspired by the Mountain ranges**,** the design will transform the museum into a metaphorical ascent**,** where movement through space reflects the challenges, discoveries, and ascendancy of mountain exploration.

The concept integrates three core ideas:

Spatial Expedition Experiences – The spatial experience will mirror a mountaineering expedition, creating a sense of challenge, and progression.

The Himalayan Landscape – The architectural form will take cues from the terraced topography, glacial ridges, and jagged peaks of the Himalayas.

Spiritual & Climatic Context – The design will capture the sacred aura of the mountains.

6.2. ZONING

In museum design, spaces are divided into public and private areas to serve different needs.

Public spaces are where visitors spend most of their time. These include exhibition halls, visitor lounges, courtyards, recreational areas and educational areas. These spaces are open, welcoming, and easy to navigate. They encourage learning, exploration, and social interaction.

Private spaces are meant for staff and operations. These include offices, storage rooms, workshops, and service areas.

By clearly separating public and private spaces, the design supports both an engaging visitor experience and efficient management of the museum.
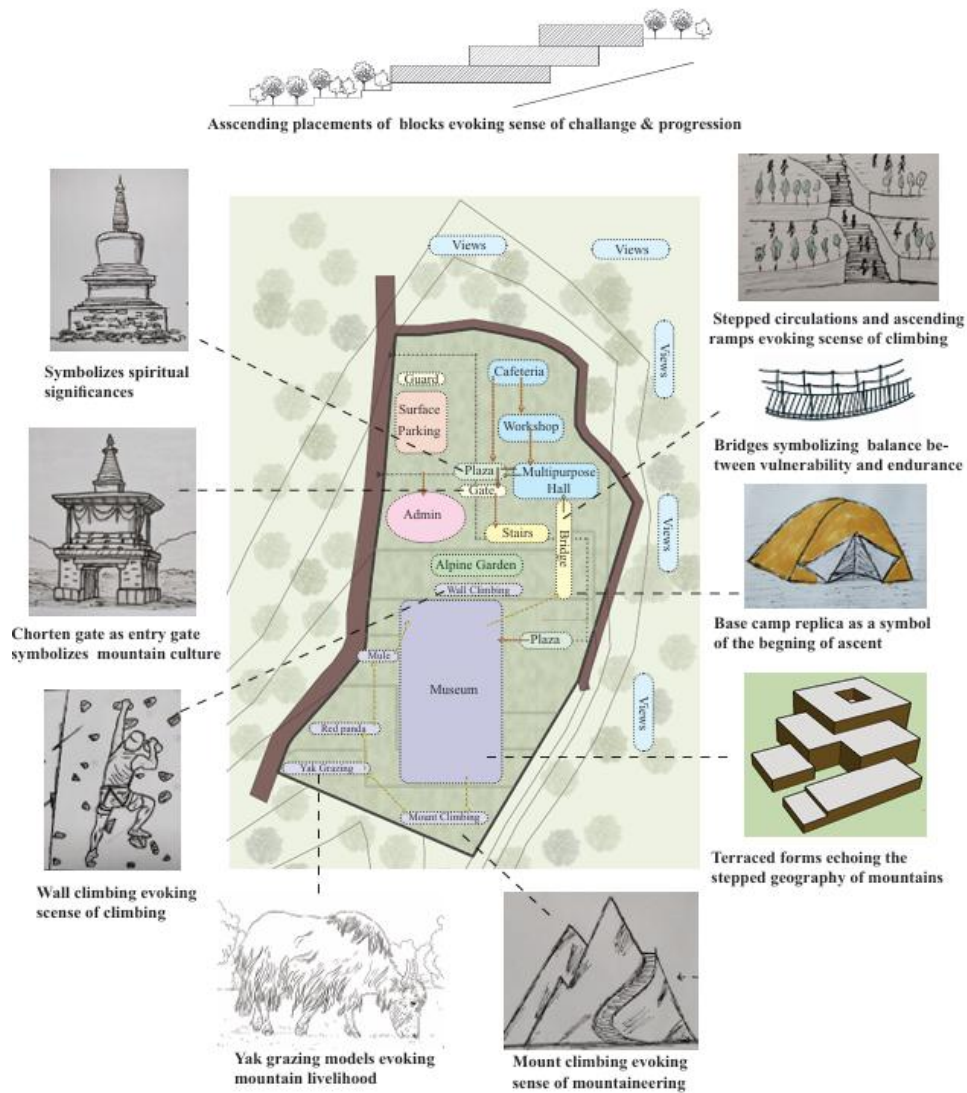

Figure 6.1: Zoning of major areas of museum

6.3. VISITORS FLOW

The movement of visitors through the museum is carefully planned to create a smooth and enjoyable experience. The layout guides visitors naturally from one exhibition space to another without confusion or backtracking. Clear paths and signage help people easily find their way.

The circulation design separates incoming and outgoing flows where possible to avoid crowding. Wide corridors and open courtyards allow visitors to move comfortably, even during busy times. Rest areas and viewing points are placed strategically to give visitors moments to relax and appreciate the exhibits.
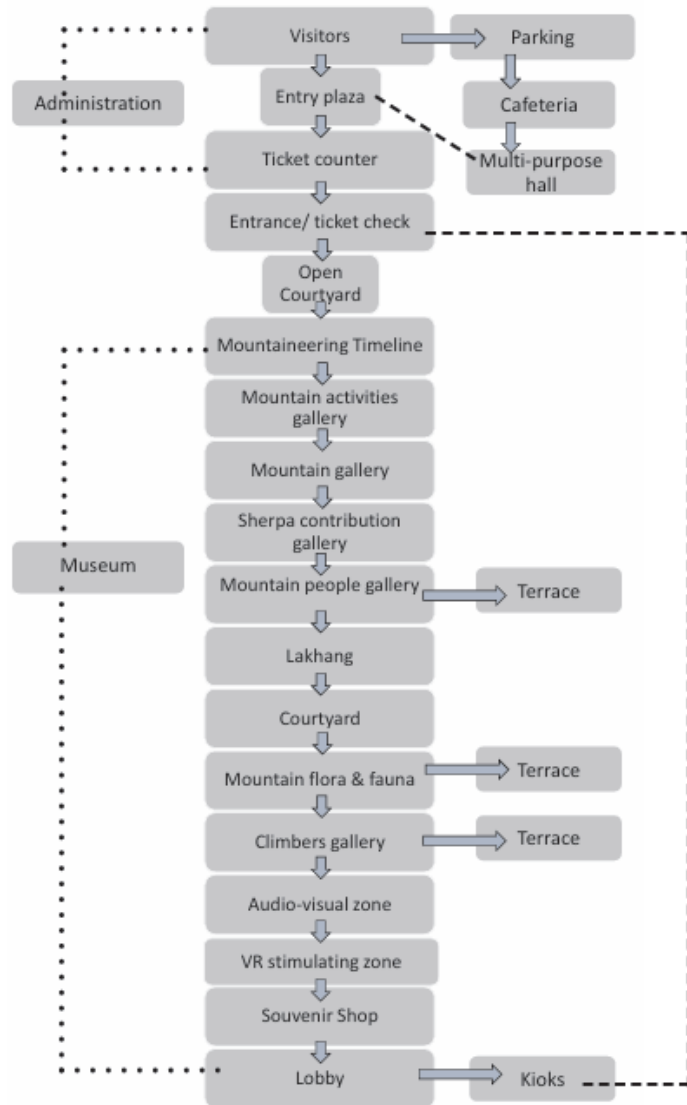

Figure 6.2: Visitors Flow diagram

By organizing visitor movement thoughtfully, the museum encourages learning and exploration while maintaining safety and comfort for everyone.

7. Design Development

The design is proceeded according to zoning and the conceptual design. The site is connected at the road from west and north direction. The site is gradually contoured from north to south as a result the buildings are gradually ascending along with the contours evoking sense of progression. Public facilities like ticket counters, locker area, and waiting are provided near

the entrance for the convenience of visitors. The facilities like multipurpose, library, cafeteria, area easily accessed for other visitors except from the ones entering the museum. The museum units' area only accessible after the ticketing procedure and is developed in the terraced form. The main museum building and recreational block follows similar design pattern evoking the Himalayan terrain landscape.
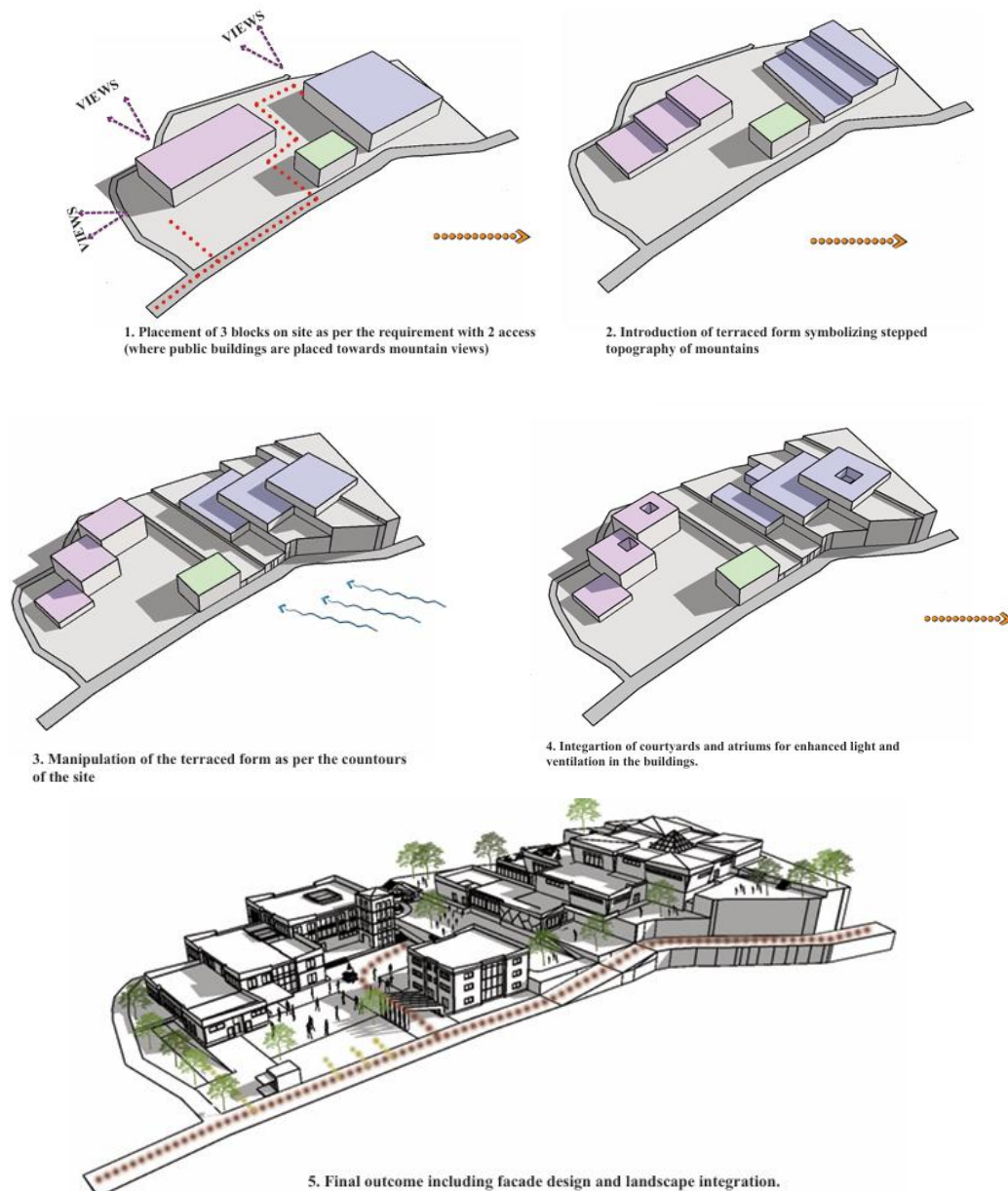

Figure 6.3: Design Developments

8. Conclusion

This project aims to conceptualize and design a Mountaineering Museum that not only embodies the spirit of Nepal's mountaineering heritage but also provides an engaging and immersive experience through the architectural design. By combining education, and innovative design, the museum will become a significant cultural landmark and a source of inspiration for adventurers and conservationists alike.

The integration of public and private spaces, along with well-planned visitor movement, ensures the museum is both functional and welcoming. The design which seems to emerge from the landscape itself gives the unique characteristic to the museum building creating less impact on the existing landscape.

In conclusion, this museum will serve as a valuable space for education, research, and conservation, inspiring visitors to know the lifestyle, culture, history, geography of the Himalayan region and get inspired to involve in mountaineering activities.

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ANNEX