Ghyanglekh Rural Municipality
Bagmati Province, Sindhuli, Nepal

Final
Main Report of
Ghyanglekh Rural Municipality
Administrative Building

Volume – I

Submitted by: **May 2023**

Empirical Engineering Consultancy Pvt. Ltd.
Anamnagar, Kathmandu

ACKNOWLEDGEMENTS

The Empirical Engineering Consultancy (Pvt.) Ltd. expresses its sincere gratitude to the Ghyanglekh Rural Municipality, The Office of the Municipal Executive for entrusting the responsibility of preparation of the Building Design Report of the proposed **Administrative Building** in Bagmati Province, Sindhuli District of Nepal.

We are particularly thankful to the Chairperson, Chief Administrative Officer of the Ghyanglekh Rural Municipality, and the Office of the Municipal Executive. We would similarly like to appreciate the co-operation received from the technical personnel of the Municipal executive for giving us all the technical inputs needed for the study.

Last but not the least, all Municipal Officials, Key Informants and beneficiary all enthusiastically cooperated in the participatory study of the project, and provided the necessary information sought by the study team. All of them deserve our heartfelt appreciation.

Empirical Engineering Consultancy (P) Ltd.
Anamnagar, Kathmandu
May, 2023

EXECUTIVE SUMMARY

The Detailed Project Report (DPR) was carried out for the Administrative Building of Ghyanglekh Rural Municipality with appropriate structures and necessary components. Final Report is submitted to the Office of the Municipal Executive, Ghyanglekh Rural Municipality in accordance with the ToR.

The initial design of the administrative building, created in 2021, needed to be revised due to inadequate space within the allocated area. The prepared area fell short of meeting the requirements for constructing the originally designed building. To address this issue, certain modifications were made to optimize the available space effectively.

Firstly, a shared wall was constructed approximately 7-10 meters towards the southern region of the land. After careful assessment of the available space, it has become evident that due to the limitations in the prepared area, providing the necessary setback for the building is not feasible. Setbacks play a crucial role in ensuring safety, functionality, and compliance with building regulations. Without adequate setbacks, the proposed building may not meet the required standards.

Furthermore, it was noted that the eastern part of the land was occupied by the construction of a safe house, which further limited the available area for the administrative building. Consequently, the design was revised to account for this reduction in land space, ensuring that the building could still be constructed within the optimum available area with required functional aspects of the building.

Our team of architects and engineers worked diligently to revise the design, ensuring that the final plan was efficient, safe, and met all the necessary requirements. By utilizing the available area optimally, we were able to create a functional workspace that fulfills the intended purpose of the administrative building. Therefore, as an expert consultant we have prepared the revised design for the Ghyanglekh Rural Municipality after discussion with all related stakeholders.

Summary of the Project Cost

S.N	Particulars	Amount	Remarks
A	**Main Building**		
1	Main Building Civil Works	64,827,646.88	
2	Total Cost of Provisional Costs	952,191.45	
3	Total Cost of Misc Works	1,066,025.14	
4	Sanitary Works	3,241,382.34	5%
5	Electrical Works	5,186,211.75	8%
	Total	**75,273,457.57**	
	Physical Contingency @ 10%	7,527,345.76	
	Total With Contingency	**82,800,803.33**	
	VAT @ 13 %	9,785,549.48	
	Grand Total	**92,586,352.81**	

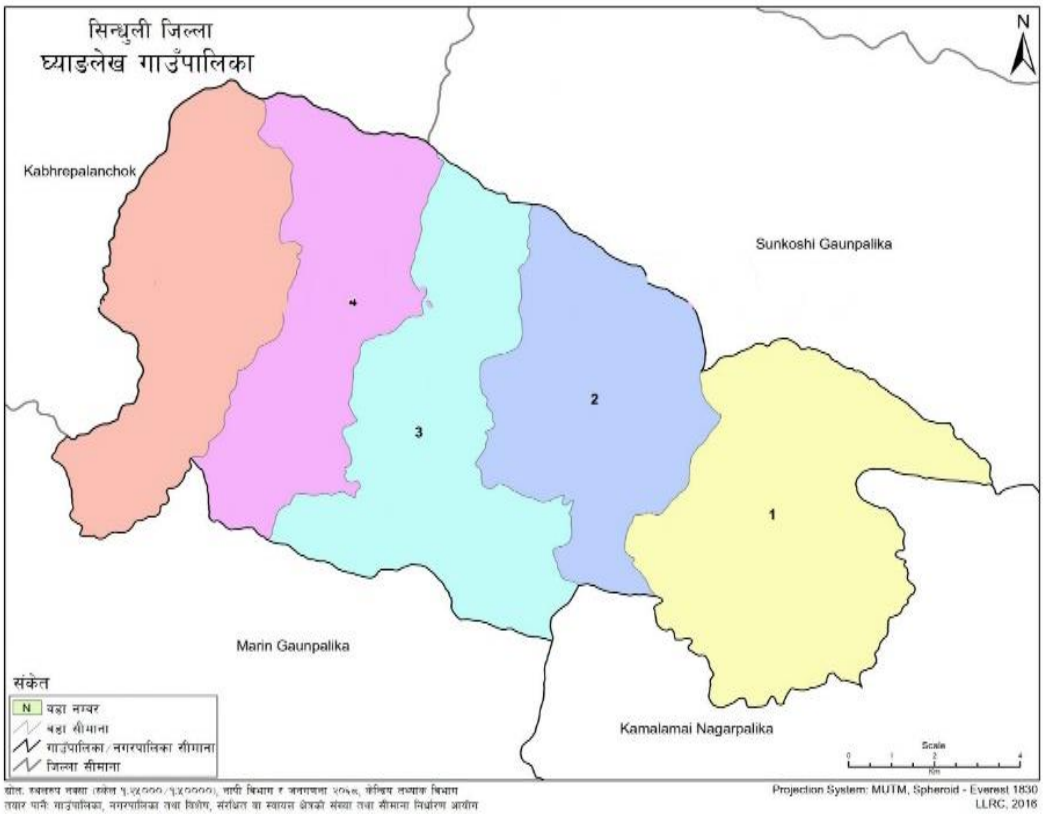
CONTENTS

CHAPTER –I: INTRODUCTION

1. PROJECT BACKGROUND

Ghyanglekh Rural municipality is located within the Sindhuli District of the Bagmati Province of Nepal. The municipality spans 166.77 square kilometres (64.39 sq mi) of area, with a total population of 13,761 according to a 2011 Nepal census.

On March 10, 2017, the Government of Nepal restructured the local level bodies into 753 new local level structures. The previous Amale, Bastipur, Tamajor, Netrakali and Shanteshwari VDCs were merged to form Ghyanglekh Rural Municipality. Ghyanglekh is divided into 5 wards, with Bastipur declared the administrative center of the rural municipality.



Map showing Ghyanglekh Rural Municipality with 5 wards

Google Earth map showing proposed project location of Ghyanglekh administrative building.

Ghyanglekh Rural Municipality don't have its own administrative building and planned for the construction of building to provide smooth service for the beneficiaries. The existing work place is inadequate to provide smooth services for the beneficiaries. In this regard, to establish the administrative building of Ghyanglekh Rural Municipality, the Municipal Chairperson with all Public representative and chief executive has decided to construct administrative building.

2. OBJECTIVES AND SCOPE OF THE CONSULTING SERVICES

The main objective of the consulting services are:

- Conduct detailed engineering survey of the existing land
- Prepare the topographical map of the Area.
- Analyze the existing situation on topographic map as well as on field
- To prepare Architectural design and drawings of administrative building and all required facilities which will be cost effective and energy saving in future.
- To prepare structural design and drawings to build safe, reliable and seismic resistant building.
- To prepare detail cost estimate with rate analysis of Municipality buildings

CHAPTER –II: HYDROLOGY AND METEROLOGY

1. GENERAL

Geographical setting of the country is so extreme that it ranges from a nearly sea level to snow covered Himalayas. This great variety of topography of the country creates diversity of water as well as climate. The proposed Ghyanglekh Administrative building is located at an elevation of about 900 meters above sea level.

2. RAINFALL PATTERN

Sindhulih has a Humid subtropical, dry winter climate (Classification: Cwa). The district's yearly temperature is 30.71ºC (87.28ºF) and it is 8.71% higher than Nepal's averages. Sindhuli typically receives about 147.1 millimeters (5.79 inches) of precipitation and has 141.61 rainy days (38.8% of the time) annually.

Climate Sindhuli Garhi: Weather By Month

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Nov	Oct	Dec	Year
Record high °C (°F)	32.72 (90.9)	36.94 (98.49)	44.33 (111.79)	48.55 (119.39)	48.55 (119.39)	47.49 (117.48)	44.33 (111.79)	43.27 (109.89)	40.11 (104.2)	39.05 (102.29)	36.94 (98.49)	33.77 (92.79)	48.55 (119.39)
Average high °C (°F)	25.4 (77.72)	29.25 (84.65)	35.28 (95.5)	39.98 (103.96)	41.0 (105.8)	40.25 (104.45)	36.49 (97.68)	36.7 (98.06)	35.33 (95.59)	33.72 (92.7)	31.06 (87.91)	27.01 (80.62)	34.29 (93.72)
Daily mean °C (°F)	20.91 (69.64)	24.6 (76.28)	31.1 (87.98)	36.23 (97.21)	37.53 (99.55)	37.21 (98.98)	33.99 (93.18)	34.17 (93.51)	32.59 (90.66)	30.19 (86.34)	27.04 (80.67)	22.9 (73.22)	30.71 (87.28)
Average low °C (°F)	13.59 (56.46)	16.23 (61.21)	21.61 (70.9)	26.76 (80.17)	29.08 (84.34)	30.33 (86.59)	29.15 (84.47)	28.82 (83.88)	27.31 (81.16)	23.77 (74.79)	19.89 (67.8)	15.93 (60.67)	23.54 (74.37)
Record low °C (°F)	6.33 (43.39)	10.55 (50.99)	14.78 (58.6)	21.11 (70.0)	24.27 (75.69)	21.11 (70.0)	20.05 (68.09)	25.33 (77.59)	22.16 (71.89)	17.94 (64.29)	12.66 (54.79)	8.44 (47.19)	6.33 (43.39)
Average precipitation mm (inches)	7.62 (0.3)	16.41 (0.65)	14.83 (0.58)	49.52 (1.95)	121.72 (4.79)	247.78 (9.76)	497.08 (19.57)	379.93 (14.96)	331.6 (13.06)	80.61 (3.17)	10.93 (0.43)	7.12 (0.28)	147.1 (5.79)
Average precipitation days (≥ 1.0 mm)	2.49	2.3	2.59	7.67	16.51	22.26	27.25	24.85	22.84	8.54	2.49	1.83	11.8
Average relative humidity (%)	55.62	49.28	33.51	32.16	44.95	58.17	73.75	73.53	77.07	70.64	60.05	56.77	57.13
Mean monthly sunshine hours	9.01	9.07	11.35	13.47	14.11	14.16	13.15	13.2	11.65	11.95	9.87	9.11	11.67

CHAPTER –III: GEOLOGICAL, GEO-TECHNICAL & ENVIRONMENTAL STUDY

1. REGIONAL GEOLOGY OF THE NEPAL HIMALAYA

The Nepal Himalaya has been divided into the Indo-Gangetic Plain, Sub-Himalaya (Siwalik Group), Lesser Himalaya, Higher Himalaya, and Tibetan-Tethys Himalaya from south to north. The different major geological units are separated by almost east-west running thrust systems that pass through the entire Himalayan region. These thrusts are Indus-Tsangpo Suture, South Tibetan Detachment System, Main Central Thrust, Main Boundary Thrust and Main Frontal Thrust, from north to south. The General subdivision of the Himalaya is as follows:

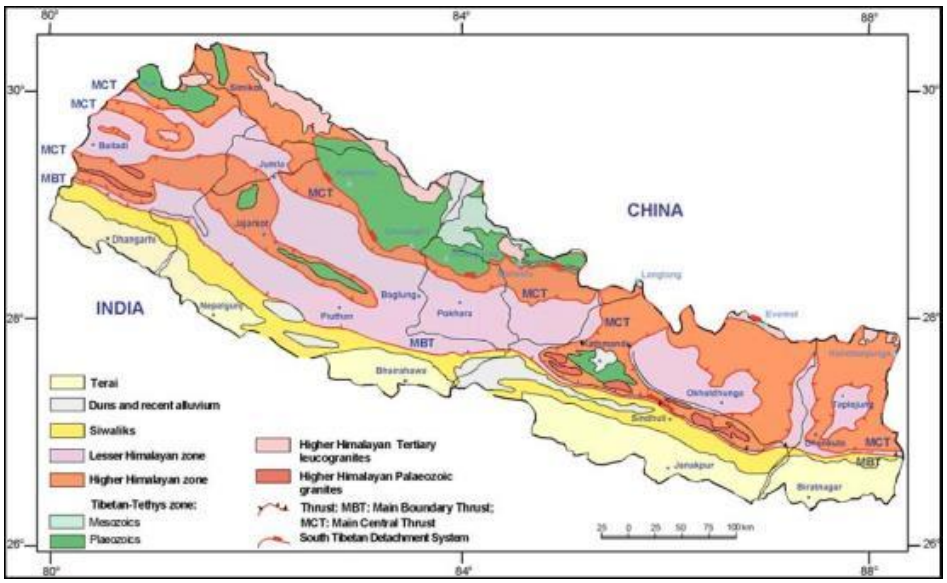


Fig : Geological subdivision of Nepal Himalaya

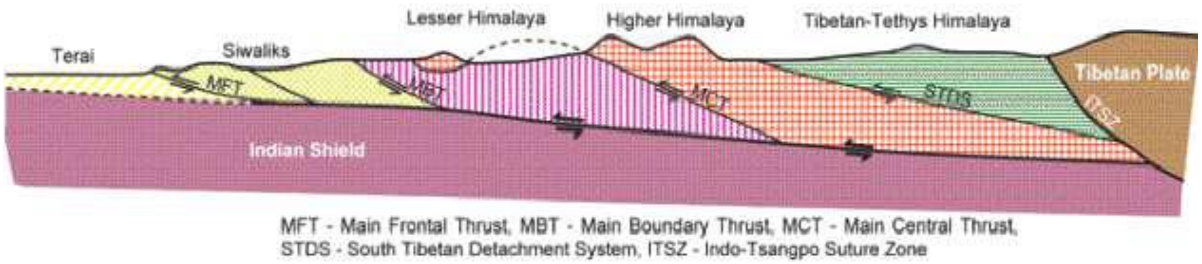


Fig : Generalized cross section of Himalaya (Dahal 2006)

Indo-Gangetic Plain or Terai Plain

The Indo-Gangetic Plain or Terai forms the southernmost tectonic unit of the Nepal Himalaya, having elevation from 100 to 200 m from mean sea level and covering alluvial deposits of Pleistocene to recent in age. The average thickness of the deposits is about 1,500 m.

Sub-Himalaya (Siwalik Group)

The Siwalik Group is delimited by the Main Boundary Thrust (MBT) to the north and the Main Frontal Thrust (MFT) to the south, and lying between the Lesser Himalaya and Indo-Gangetic Plain. About 6,000m thick Neogene molasses type sediments were accumulated into the foreland basin during middle Miocene to lower Pleistocene in age. The sediment comprises

mudstone, sandstone and conglomerate.

Lesser Himalaya

The Lesser Himalaya lies between the Siwalik Group to the south and the Higher Himalaya to the north. Both the southern and the northern limits of the Lesser Himalaya is represented by the thrust fault; the Main Boundary Thrust (MBT) and the Main Central Thrust (MCT), to the south and north, respectively. It is represented by thick piles of the sedimentary rocks and low-grade metamorphic rocks, ranging from the Pre-Cambrian to Tertiary in age. Total thickness of the Lesser Himalayan rocks is exposed more than 14 km. Nappe, Klippe and Schuppen like tectonic structures have made complexity in the Lesser Himalayan geology.

Higher Himalaya

The Higher Himalaya is occupied by the high mountains, and lies between the Lesser Himalaya to south and the Tibetan-Tethys Himalaya to the north, which is separated by the Main Central Thrust (MCT) in the south and north by the South Tibetan Detachment System (STDS). The Higher Himalaya is comprised of high-grade metamorphic rocks of schist with granite bodies, pelitic gneisses and migmatites, and attains 6 to 12 km in thickness.

Tibetan-Tethys Himalaya

The Tibetan-Tethys Himalaya is distributed in the northern part of the territory. The northern border of the Tethys Himalaya is represented by a fault called as the South Tibetan Detachment System (STDS). About 10 km thick shallow marine sedimentary rocks were deposited from Cambrian to Cretaceous in age.

2. PHYSIOGRAPHIC SUBDIVISION OF NEPAL

Physiography of the region governs the geological and engineering geological condition of the terrain and hence is an important factor to be considered during the road construction. The physiographic subdivision of the Nepalese Himalaya is briefly described below:

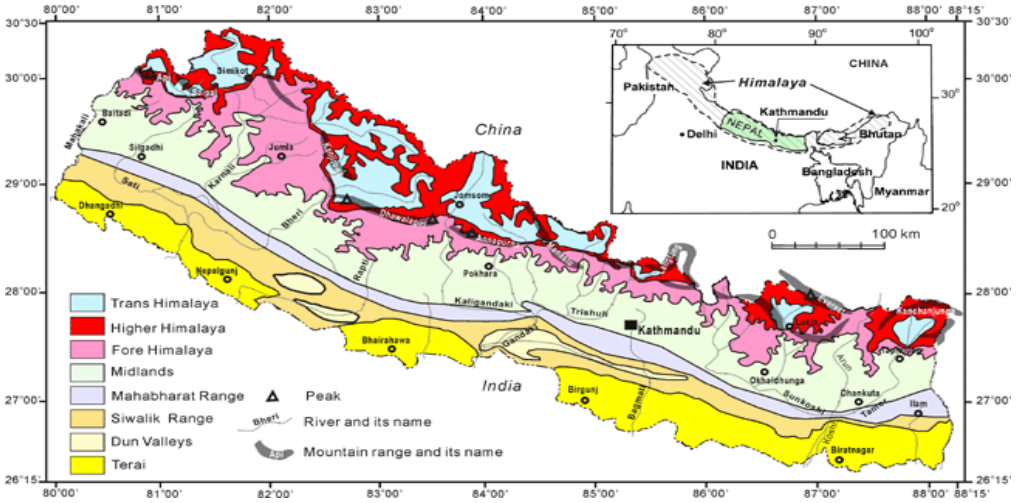


Fig: Physiographic map of Nepal (Upreti, 1999)

Terai Plain and Dun Valleys

The Terai Plain and Dun Valleys comprises of the Quaternary (Recent) sediments deposited from the surrounding mountains through the rivers traversing from the mountainous parts. In addition, there are colluvial deposits at the foothill regions. The Terai Plain (Indo-Gangetic Plain) lies south of the Siwalik while the Dun valleys are more or less plain region surrounded by the Siwalik Range. The elevation of this zone ranges from 100 m - 200 m above sea level.

Churia Range

The Churia Range (Siwaliks) comprises the mountains lying north of the Terai Plain and the elevation ranges from 200 m -700 m above sea level. This range is consisting of sedimentary rocks, mainly mudstone, sandstone and conglomerates.

Mahabharata Range

North of the Siwalik range, the abruptly rising hills belong to the Mahabharat Range. The altitude of this region ranges from 1000 m - 2500 m above sea level.

Midlands

The Midland zone lie north of the Mahabharata Range, the altitude ranges from 300 m – 2000 m above sea level. This is the most inhibited region in the Nepalese mountains due to the presence of fertile valleys and slope cultivation is dominant.

Fore-Himalaya

This region lies at the higher elevation range (2000 m - 4500 m) than the Midland zone. It is the transition between the lesser Himalaya and Higher Himalayan region.

Higher Himalaya

The higher Himalayan region lies above 4000 m elevation and is relatively inaccessible region, consisting of snowy mountain peaks.

Inner Valleys

The inner valleys are the regions surrounded by the higher Himalayas. The elevation ranges between 2500 m and 4000 m above sea level. These valleys are situated mostly along the major river traversing the higher Himalayan range.

Geology of Project Area

The geology of Garuda Municiplity lies in **Sub-Himalaya (Siwalik Group)** and the physiography of the project area lies in **Churia Range**.

3. ENVIRONMENTAL STUDY

Impact on Land Use

The Construction works for the administrative building are proposed in bare land area and new land acquisition is not required.

Impact on the Environment, Impact on Human Life, and Population Pressure

The commissioning of the proposal shall have both the beneficial and adverse impacts on the Environment, human life and population, which are discussed below:

Positive Environmental Impacts

The primary benefit of Construction of administrative building is to provide the essential facility to the local residing in the Ghyanglekh Rural Municipality. It will result in improved many facilities, including economic stimulation and employment generation. Local people currently experience lack of availability of proper administrative building. Another benefit that will be derived from the project is the income generation for the Ghyanglekh Rural Municipality which will be allocated in the budget for the development of the overall development of the Ghyanglekh Rural Municipality.

Adverse Environmental Impacts

Some adverse environmental impacts are likely to result from the proposed project however; there will be no population displacement. With proper mitigate plans; the adverse impacts can be made to a minimum. The disposal of excess material from construction can potentially create a significant environmental impact unless it is correctly managed. Detail design team have included quantity of disposal material in Bill of Quantities to suitable disposal locations to ensure that uncontrolled tipping does not damage private and public land and vegetation. Minor adverse impacts (e.g., noise, vibration and air quality) will occur, either during construction. The mitigation measures to be incorporated into design stages include provision of safe location of quarry sites; borrow pits and safe disposal of spoil and construction waste. Likewise, during the construction stage, important considerations include work camp and labor camp location and operation, stockpiling of materials, combustible, and toxic materials, and management of stone crushing plant. Similarly, during post-construction stage, things to consider are installation of safety measures. Social development benefits will result from improved access, including economic stimulation and construction employment.

CHAPTER –IV: PLANNING AND DESIGN

1. ENGINEERING DESIGN

Desk Study

Desk study had been conducted in two parts; firstly, to study the status of the project about proposed site, design level, various criteria and other relevant terms and conditions. This phase included the initial pre-meeting with the Ghyanglekh Rural Municipality Officials and technical bodies.

Secondly, as precise and high accuracy work is the main responsibility of engineering consulting firm in detail study, planning and design of the area, methodology for the work is discussed in detail.

This desk study carried out through the collection of available reading material and publications about the study area, topographical maps and other data available in respect of geology, geomorphology and hydrology and others related to the required design conditions. The concerned institutions/sources for collecting these data will be Office of the Municipal Executive, Ghyanglekh Rural Municipality, Department of Survey, Maps & Publication regarding the Project area.

Field Study and Investigation

Reconnaissance

This step includes the field visit and gathering the relevant information and data if any necessary for the detail survey and design works. This field visit was done along with the technical team and the elected representatives of Office of the Municipal Executive, Ghyanglekh Rural Municipality.

Topographical/Detail Survey

After the reconnaissance of the project sites the detail topographic/Detail survey of the total project area are carried out. The topographical/Detail Survey as well as map production covered all the proposed area. Bench Mark BM are placed at 4 different places are attached in the Annex.

The survey was done in digital format with x, y, z coordinates of all survey points.

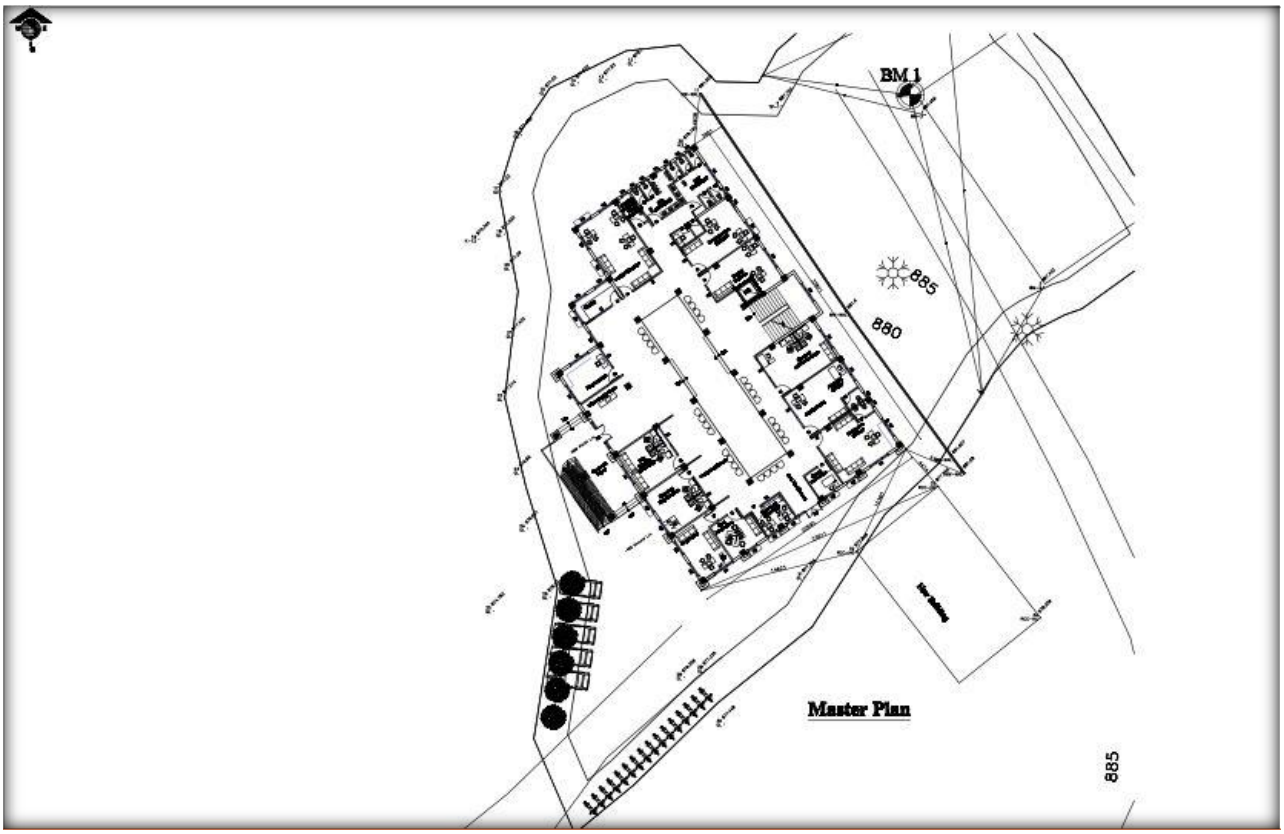
The jobs done during topographical survey can be listed as:

- The contour of 1m interval and of 0.5 m interval wherever necessary with spot levels at all important points will be drawn.
- The details of all the existing structures with close polygon format will be shown.

- All the electrical, telephone, sewer line etc. passing through the surveyed area will be shown.
- All the bench marks, traverse lines, reference line and reference points with respect to which the present topographical map is to be prepared will be shown.
- Other information needed for design, planning and construction purpose will be also collected.
- Topological map hard copy will be prepared in 1:500 scales. All the benchmarks established will be shown in map.
- The reduced level and coordinates will be transferred from the nearest permanent survey station i.e. Central Grid.
- About 50 numbers of 150*150*600 mm concrete column will be established which should be visible from at least two points.
- Sufficient still photographs will be taken.

2. ARCHITECTURAL PLANNING AND DESIGN

The design of the Building has been prepared on the basis of functional requirements, level of proposed services, safety and security measures, the architectural and aesthetic character, structural system and construction method/technology.



Master Plan of Ghyanglekh Administrative Building

Architectural Design and Planning Criteria was made based on the standard norms, standards, bye -laws and municipal bye – laws and the design criteria had been established based on those standards.

General Specification of administrative Building

Description	**Administrative Building**
Plinth Area	737 sq. m. (With courtyard)
Building Structure	Framed Structure
No of stories	3
Store Height	3.32m
External Wall	Fair faced Full Brick
Internal Wall	Full Brick
Door and Windows	Aluminum
Wall Finishing	Cement – Sand Plaster

3. STRUCTURAL ANALYSIS AND DESIGN

Fundamentally the structural analysis and design of the Building was carried out based on its architectural design, the recommended design, safety requirements of National Building Codes including Earthquake Resistance and sub- surface exploration. Basically the structural system is selected based on functional and safety requirements and construction technology available.

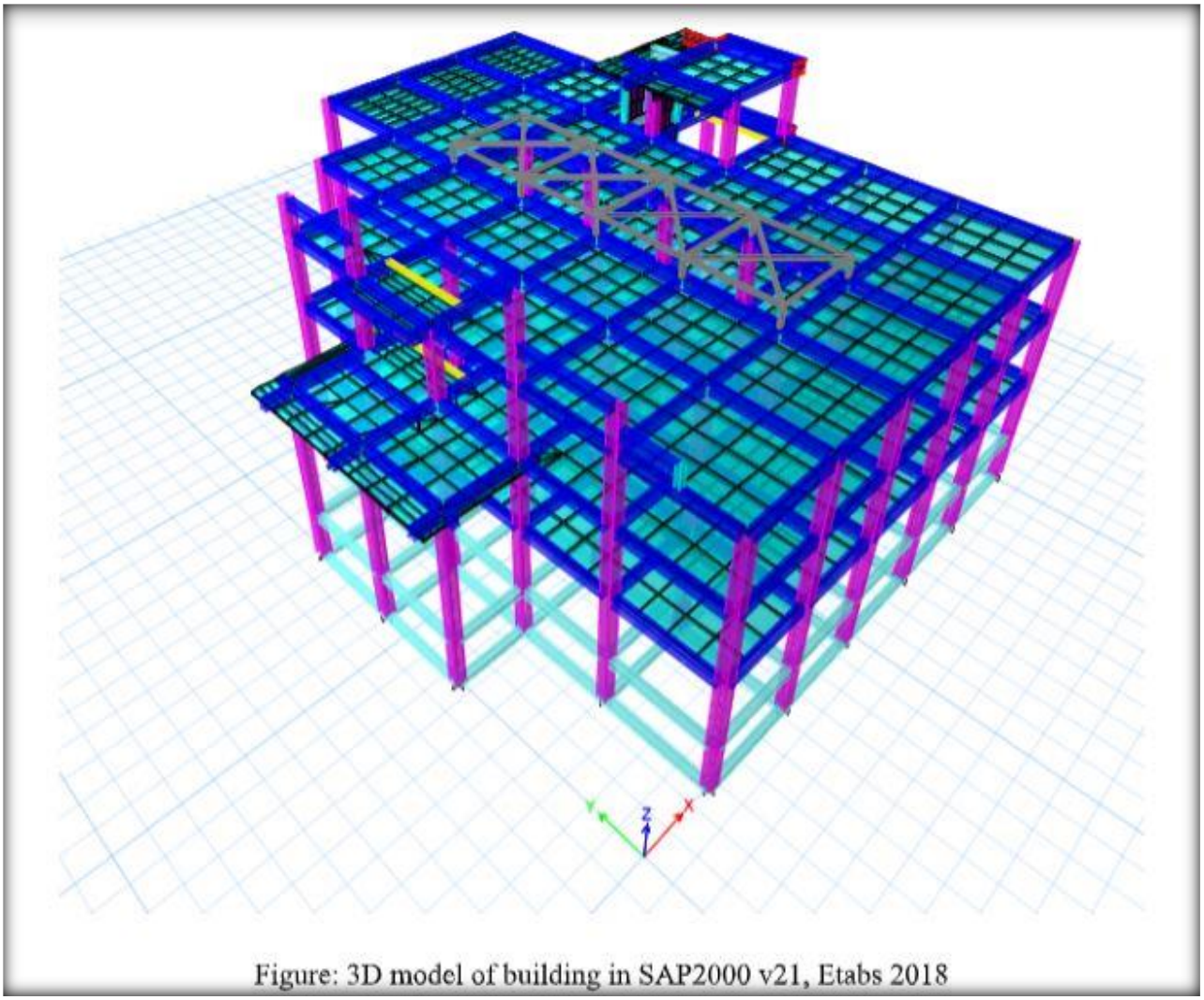


Figure: 3D model of building in SAP2000 v21, Etabs 2018

During detail design stage, structural drawings and details were prepared in a suitable scale (1:100, 1:50 and 1:20) The drawings is successfully detailed to provide materials and testing requirements, maintaining line and levels, workmanship requirement for finishing and suitable for construction without any ambiguities. Suitable arrangement was made as far as possible to avoid dismantling or chiseling of any portion of RCC components. All reinforcement bars position with their lapping, bending, chairs and schedules is prepared in such a way so that the bars will not be displaced, deformed during concreting.

DESIGN CONSIDERATIONS

The aim of structural design is to design a structure so that it full fills its intended purpose during its intended life time with adequate safety (in terms of strength, Stability and structural integrity), adequate serviceability (in terms of stiffness, durability etc.) and economy.

- Safety implies that the like hood of (partial or total) collapse of the structure is acceptably low not only under the normal expected loads (service loads) but also under some abnormal but probable over loads (such as due to earthquake or extreme wind).
- Serviceability implies satisfactory performance of the structure under service loads, without discomfort to the excessive deflection, cracking, and vibration etc.

DESIGN PHILOSOPHY

For the design of building we have used the modern "Limit State Method of Design". Which is reliability based concept.

- Lateral Load Resisting Systems: Frame Structure System.
- Ductility Consideration: The design consideration in present building for ductility is
- Using a low tensile steel ratio (so Fe 415 is used) and use of compression steel
- Providing adequate stirrups to ensure that shear failure does not precede flexural failure.
- Confining concrete and compression steel by closely spaced hoops.
- Proper detailing with regard to connections, anchorage, splicing, minimum reinforcement, etc
- Requirement of stability and stiffness

Under the sever earthquakes, it is expected that the structure will resist seismic forces in a ductile manner, large lateral deformation and oscillation resulting in the development of reversible plastic hinges at a various location in the ductile frames.

METHODS OF ANALYSIS

- The structure is analyzed using Structural analysis Program (ETABS 2018 Non Linear Analysis).
- Seismic design considerations are according to 1893:2002

4. SANITARY AND PLUMBING SYSTEM & FIXTURE DETAILS &DESIGN

In this designing phase some utmost spaces has been provided such as toilets. During detail design the consultant has prepared the sanitary and plumbing system layout plan distinctly showing the supply lines water, waste and soil pipes and supported by necessary fixture details in a suitable scale. The effectiveness of the layout plan can be reflected (I) ease of maintenance, (ii) less turning, bending and shortest distance connection with main lines and (iii) properly located regulators, check valves, gate valves, heat measuring devices etc.

5. ELECTRICAL DESIGN

This task had carried out simultaneously after the preparation of the final architectural design and would cover the following:

- Single line diagram
- Floor plans showing the arrangement for all types of fixtures
- Floor plans for layout/arrangement of lights and exhaust
- connection with fire alarm system
- Electric switch room
- Power supply system including external illumination and street lighting

6. SEWERAGE SYSTEM

General Layout

The general layout of the sewerage system is in two parts, the external and the internal. Both of these are being shown in the general layout plan.

Demand Analysis

A demand analysis for the entire building had be made followed by necessary calculations, which could be reflected in deciding the appropriate and efficient section of

pipes, quantity of daily water consumption etc.

Cross sections and Details

Required cross sections and details are prepared in scale 1: 100

7. WATER SUPPLY

During detailed design Phase these tasks are done:

Demand Analysis and calculations

The demand analysis covers both the sanitary demand and potable water demand. The demand calculations are carried out based on the total number of inhabitant and daily water consumption rate. The floating population/ visitors shall be taken into consideration.

General Layout

The general layout plan are shown the location, supply line networking which cover supply connection from the source, collection line to underground water tank/ reservoir, transmission line from underground reservoir to main overhead service tank, reticulation system, fire hydrant system and supply for landscaping/ beautification.

Design of Structures / Installations

Required details for the construction of the structure viz. underground and overhead water reservoirs, pump room are worked out in appropriate scales. The details of installations and their specifications has worked out including pumps, fire hydrants, stand - pits for gardening/ landscaping etc. As per approved standards and parameters.

CHAPTER –V: QUANTITY SURVEY AND ESTIMATE

1. GENERAL

The construction cost was estimated on the basis of quantities of Earthwork, Structure, desired materials quality and other required facilities. From the detailed design, drawings and investigation/ reports, various items of works forming Bill of Quantities has developed to cover the requirements of the entire works.

Estimate of quantities for each items of work forming the Bill of Quantities was prepared keeping in mind the desired degree of accuracy and this will form a part of tender document preparation. A summary of quantities of various items will be grouped under major sections as site development works, building construction, equipment and accessories and infrastructures.

Please refer volume-2 for Rate analysis & Detail Quantity and cost Estimates

2. PREPARATION OF ITEM OF WORKS

Designs have been developed for various items of works; the unit price for each item of works of Bill of Quantities will be prepared on the basis of appropriate construction method and specification as well as accessories. In finalizing these unit price due consideration will be given to available schedule of rates, wages of labor fixed by the Government, prevailing wage rate for different categories as labor and market prices of materials. The contractor is expected to mobilize all equipment and the cost of equipment usage will be taken into account.

3. RATE ANALYSIS & QUANTITY ESTIMATES

The detail rate analysis for the construction of Building has been prepared based on the district rate and norms of fiscal year 2077-78. The extent of works required for construction of the Building complex has been assessed on the basis of information collected during study. The construction quantities of various item of work are calculated on the basis of their design.

The estimated quantity Includes: Earthworks, Brick Masonry, Concreting works, Reinforcement Work, Wood Works, Electrical, Sanitary and Plumbing work, Landscaping.

Annex