PROJECT INFORMATION

Name of the Project	INTEGRATED URBAN DEVELOPMENT PROJECT (IUDP) "Preparation of Detailed Engineering Design and Report for Master Plan of Tharu Museum", Rajapur Municipality of Bardiya District Package No: 05-075/76
Project Executive Agency	Government of Nepal Ministry of Urban Development Department of Urban Development and Building Construction
Implementation Agency	INTEGRATED URBAN DEVELOPMENT PROJECT (IUDP) ENVIRONMENT SECTION Government of Nepal Ministry of Urban Development Rajapur Municipality
Name of the consultant	GOEC-GRID-RAJDEVI JV Kathmandu

SUBMISSION INFORMATION

Name of the Report	Detail Engineering Design for INTEGRATED URBAN DEVELOPMENT PROJECT (IUDP) of " Master Plan of Tharu Museum", Rajapur Municipality of Bardiya District
No. of Volumes	Volume IV :Detail Engineering Design (Master Plan of Tharu Museum)
Version No	1
Date of Submission	2019
Submission Type	Hard Copy
Copies Produced	Two copies of Report (min.1 copy color report) Five copies of the Final report with original photos (min.1 copy colour report)
Prepared By	GOEC-GRID-RAJDEVI JV Kathmandu
Checked By	
Reviewed By	
Official Stamp	

ACKNOWLEDGEMENT

This report has been prepared as per the contract between the Environment Section, Department of Urban Development and Building Construction as the Client and the GOEC-GRID-RAJDEVI JV, Kathmandu, as the Consultant for Detailed Project Report of "Master Plan of Tharu Museum" submitted in accordance with the given Terms of Reference (TOR).

This report is an outcome of a systematic compilation of all relevant data collected during the desk study and data collected during field study as well as from the secondary sources as presented in various formats and drawings.

We would like to express our genuine gratitude towards the Environment Section., Department of Urban Development and Building Construction for awarding this project. Also, we would like to express our deep gratitude and sincere thanks to division chief for providing us necessary guidance, relevant and useful concepts and encouragement, valuable suggestion and comments which were indeed an immense help for the successful completion of this project.

We would like to wish to acknowledge the support provided by Government of Nepal who make this project possible and the contributions of all those who prepared consultant services and participated in that process and also thankful to Municipality's staffs for their sincere co-ordination, support, valuable guidelines and co-operation.

At last, we are grateful to all the local people, leaders of political parties, civil society and all the office colleagues who have rendered their valuable accompany to our team during execution of the works.

GOEC-GRID-RAJDEVI JV

Kathmandu

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Executive Summary

This report has been prepared as per the contract between the Environment Section. Department of Urban Development and Building Construction as the Client and the GOEC-GRID-RAJDEVI JV, Kathmandu, as the Consultant for Detailed Engineering Design (DED) of "Master plan of Tharu Museum". This Report for Museum is submitted in accordance with the given Terms of Reference (TOR).

Rajapur Municipality is located in Bardiya district Province No 5 covers an area of 127.08 square kilometer. Municipality is separated by Karnali River from western boundary (Tikapur Municipality) and by Geruwa River from the eastern Boundary (Madhuwan Rural Municipality). Major ethnic group of Rajapur Municipality is Tharu and celebrates Tharu culture. Religious and cultural festivities form a major part of the lives of people residing in Rajapur. There are very few places, which possess a religious importance to attract local and foreign tourist.

Construction of Tharu Museum will help to conserve and promote Tharu Culture for a long run, which will be helpful for the development of economy of the people. The Tharu Cultural Museum provides a nice collection of Tharu artifacts/information. It houses exhibits on many facets of Tharu culture, including collections of traditional fishing baskets and cookware. Visitors will get great opportunity to learn about a vibrant, historically underserved Nepali cultural group. Museum offers different clothes, daily household objects, house style, tradition and other many more, which reflect the Tharu Culture and their living way.

The Tharu Culture Museum offers visitors a glimpse of Tharu culture and traditions they perform that are fast disappearing in the Tharu community. It offers visitors a unique opportunity to view existent Tharu community along the way to the museum, where the museum displays culture and traditions as a replica. Tharu Cultural Museum will be, one of the popular destinations for domestic and international tourists.

This report consists of two chapters. For this purpose, multi-disciplinary teams of experts were engaged for carrying out desk, field and office studies as well as analysis of all available primary and secondary information and data pertaining to a variety of disciplines.

Chapter 1 of the report highlights the general introduction, location of project, rational of the project as well as survey and investigation.

Chapter 2 of the report highlights the detailed design and cost estimate of the project. It describes about detailed design such as: architecture design, structural design, project cost estimate, rate analysis, quantity estimate, bill of quantities and summary of quantity and project cost.

Annexes of the report consist of the following information and data

Annex I : Drawings (Architecture, Structure, Electrical, Sanitary)

Annex II : Structure Analysis

Annex III : Detailed of cost estimate and quantity

Annex IV : District Rate Analysis

Annex V : Photographs

Annex VI : Checklist/Questionnaire

CHAPTER 1 : PROJECT BACKGROUND

1.1 Introduction

Rajapur Municipality is located in Bardiya district Province No 5 covers an area of 127.08 square kilometer. Municipality is separated by Karnali River from western boundary (Tikapur Municipality) and by Geruwa River from the eastern Boundary (Madhuwan Rural Municipality). Major ethnic group of Rajapur Municipality is Tharu and celebrates Tharu culture. Religious and cultural festivities form a major part of the lives of people residing in Rajapur.

There are very few places, which possess a religious importance to attract local and foreign tourist. One of the most important matter to attract tourist in that area is maghi festival, which is celebrated by tharu community for one week. Construction of Tharu Museum will help to conserve and promote Tharu Culture for a long run, which will be helpful for the development of economy of the people.

The Tharu Cultural Museum provides a nice collection of Tharu artifacts/information. It houses exhibits on many facets of Tharu culture, including collections of traditional fishing baskets and cookware. Visitors will get great opportunity to learn about a vibrant, historically underserved Nepali cultural group. Museum offers different clothes, daily household objects, house style, tradition and other many more, which reflect the Tharu Culture and their living way.

1.1.1 Sources of Information Collection

Given the nature of the project and scope of the assignment, considerable information/data has been collected through primary sources although considerable information on selected key indicators of the study was available from secondary published or unpublished sources.

1.1.2 Data Analysis and Report Writing

The data were edited in the field and the observed errors were corrected. The edited data were brought and coded prior to computer processing. The computer-processed data were categorized and classified in different variables and presented in a tabular form and analyses in the report format. Report writing was done using Excel, MS Word, and other statistical procedures and processes.

1.2 Location

The detail surveys, master plan, design and estimate of Rajapur Museum was done as per the information/data received and requirement.

1.2.1 Site Location of Museum at Rajapur Municipality

- **Description of Project Area**

After visiting different places, a site at Sohariya has been proposed for establishing Museum. The site proposed at Sohariya, ward no 2 covers about **28,967 sq.m** of land alongside the Nangapur- Prayagpur- Rajapur road and Badalpur Nursery Sohoriya road.

Figure 1. Satellite Map of the proposed location at Rajapur Municipality

1.2.2 Site scenario

A. Existing Site Condition

The proposed museum in the Rajapur Municipality lies in Rajapur-ward no 2 along the Nangapur- Prayagpur- Rajapur road and Badalpur Nursery Sohoriya road. In the present scenario, proposes site is an open land. There is the agriculture land on west; east, south side and north side of the site. The site is present in the prime location with easy access to the road. This feature is an advantages further justifies the importance of this site.

Hence, considering all the physical and social aspects regarding the site, the location is found to be highly favorable for the construction of Museum.

During the preparation of Master plan, following factors has been considered prior to the planning and designing:

a. Physical Condition of the Site
b. Existing land demarcation
c. Existing Access road to the site
d. Water supply
e. Storm Water Drain Outlet

f. Solid Waste Disposal
g. Electricity and Telecommunication Line
h. River training works

a. Physical Condition of the Site

The site lies in the Rajapur area alongside the road, which is on the North East side. There are agriculture lands in the periphery of the site. Being on the prime location, the proposed museum has the higher potential.

b. Existing Land Demarcation

The site is the governmental land without any demarcation by the pillars.

c. Existing access road to the Site

There is the presence of road, which is named as Nangapur- Prayagpur- Rajapur road and Badalpur Nursery Sohoriya road. Furthermore, on the master plan, an entry gate has been proposed with its opening to the existing road.

d. Storm Water Drain Outlet

Though the existing site lies in the plain area, the slope of the site is very good for draining out the storm water from the site and disposing to the nearby outlet.

e. Solid Waste Disposal

There is the provision of Septic tank to collect toilet waste whereas for the collection of organic and other waste, space has been allocated for the disposal of garbage. For the purpose of the collection from the site, even a vehicle has been proposed. The tractor will collect all the waste from the canteen and deposit at the concerned space, which would ultimately be collected and disposed by the municipality waste collection vehicle.

f. Electricity and telecommunication Line

Since the site is alongside the major road, the site will be well facilitated with the electrical and transmission line. Few electric poles are also present in the current situation and hence establishment of electrical and transmission line would not be of a problem.

B. Existing Operation Modality

The construction of museum is to be taken by the Municipality and currently no committee is formed for its construction phase. Since, the project area is within the Rajapur Municipality boundary, current building byelaws will be properly considered to avoid possible complications in obtaining building permit in the future.

C. Major Findings of the Field Visit

Since the museum is the new construction, major focus will be given to meet all the requirements and Municipal building guidelines. Some of the major findings that were visited from the field are listed below:

1. The proposed site has good accessibility of the road network ie. Nangapur- Prayagpur-Rajapur road and Badalpur Nursery Sohoriya road. There are no any other issues regarding land acquisition. Hence, construction activity can easily be carried out without any major issues.
2. There is no any museum in the Rajapur Municipality. However, the proposed museum would be best option for the municipality.

1.3 Broad Project Rationale

Religious and cultural festivities form a major part of the lives of people residing in Rajapur. Major ethnic group of Rajapur Municipality is Tharu and celebrates Tharu culture. There are very few places, which possess a religious importance to attract local and foreign tourist. One of the most important matter to attract tourist in that area is maghi festival, which is celebrated by tharu community for one week.

The Tharu Culture Museum offers visitors a glimpse of Tharu culture and traditions they perform that are fast disappearing in the Tharu community. It offers visitors a unique opportunity to view existent Tharu community along the way to the museum, where the museum displays culture and traditions as a replica.

Construction of Tharu Museum will help to conserve and promote Tharu Culture for a long run, which will be helpful for the development of economy of the people. Museum offers the information about Tharu Culture and Tradition. Tharu Cultural Museum will be, one of the popular destinations for domestic and international tourists.

1.4 Survey and Investigations

The consultant undertook a detailed comprehensive survey of the proposed area using standard and accepted engineering method / tools for the design of various structured and non-structured requirements within the site to arrive at the following:

- Topo Map of the Site
- Specifications of cadastral, geotechnical/soil investigations
- Classification of the site as per agro climatic region to so as to interpret the site in terms of type of soil, moisture retention capacity, drainage pattern, average rainfall and humidity, type of vegetation
- Ground water/ surface water sources and potential of these sources, quality of water.
- Identifying the existing basic infrastructures including roads, major drains, electric lines, water logging, if any, present land use pattern and usage by informal sector, if any.
- Identification of final disposal of effluents.

The existing features at the site like surface height, access road, bridges, electric poles, water bodies, neighboring plots, boundaries were studied and documented.
GPS tracking and detailed survey using total station was carried out at the site to prepare topographic map of the required field. Physical and environmental assessment of the sites was done with the help of questionnaire by interaction with the local people. All recorded survey data were exported to AutoCAD and processed for preparing topographic maps.

The methodology used for the engineering survey was as follows*:*
Topo sheets, Land use maps, and other available literatures and maps were collected to identify the important features of the site. First reconnaissance of the proposed area was done to fix the stations to cover maximum details of the area. The survey was conducted using total station. Stations were fixed after reconnaissance and maximum data were measured from the stations. The inaccessible details were measured by establishing secondary stations inside the boundary. Details such as road, canal, river, riverbank, jungle, tree, house corners, boundary, spot height, etc. were measured. Local labors were used to help with the survey. Permanent benchmarks were established on the concrete floor near the boundary of the site with the help of total station to carry out further survey during construction phase.

1.4.1 Soil Investigation of the Proposed Area

A. Introduction

The soil investigation was conducted on the proposed site.
The soil investigation program consisted of:

- Standard Penetration Test of boreholes in the proposed site.
- Laboratory Test on soil samples including
  Grain Size Analysis (ASTM D422)
  Atterberg Limits (ASTM D4318)
  - Determination of Moisture Content (ASTM D2216)
  - Determination of Unit Weight (ASTM D7263)
  - Determination of Soil Parameters based on Direct Shear Test (D3080/ D3080 M)

The proposed soil investigation is to determine the layering of the soil formation, the soil condition, and particularly the strength and deformation characteristics of soil that will be utilized as soil foundation.

Foundation of proposed units/buildings should be capable of undergoing imposed load without undergoing excessive settlement that may cause structural damage or unwarranted effects to the planned usage of the facility. These considerations require that the soil responsible for supporting the foundation system need not be stressed beyond its permissible strength limit as determined by the standard test procedures.

B. Laboratory Testing

The representative soil samples were collected from the sites as per the suggestion of geotechnical expert, and were collected in air-tight plastic bags and were carefully transported to the lab in Kathmandu for the necessary tests.

- **Standard Penetration Test**

Standard Penetration Test (SPT) consists of driving a Split Spoon Sampler with an outside Diameter of 50mm into the soil at the base of the borehole to determine the allowable bearing capacity of the soil. The allowable bearing capacity is the maximum pressure that can be imposed on the foundation soil taking into consideration of the ultimate bearing capacity, and the pressure corresponding to a specified maximum settlement were performed, and the minimum value from the lot was adopted as the allowable bearing capacity of the soil.

1.4.2 Site Investigation Preparation and Development

A. Site Investigations

The site investigation survey has been considered for the following:

- The depth and appropriate standards be adopted for the compaction of areas of fill based on the soil type and the type of compaction plant to be used (to be confirmed during construction by undertaking field density tests)
- Measures to be taken for disposal of unsuitable fill material
- The types of foundations required for different building types
- The modulus of vertical subgrade reaction, dry density, and coefficient of permeability of foundation soils.
- The maximum dry density and optimum moisture content of sub-grade soils, from modified Proctor compaction tests.
- The minimum 4-days-soaked California Bearing Ratio (CBR) value of the sub-grade soils and the recommended total thickness of the road pavement above the sub-grade, related to the number of commercial vehicles per day.
- Maximum compressive strength of cement-stabilized soils, the proportion of organic matter they contain and whether practical problems and costs could make cement stabilization an attractive option.
- Recommendations on the suitability of natural gravels and mixed soils obtained from the nearby quarry sites for use as imported filling material and as the sub base course for road pavements.
- Comments on pore water pressure inside the void spaces of the soil mass and whether vertical or horizontal sub-soil drains are required for the stabilization of the project site and
- General recommendations on excavating procedures, the depth of cover, surrounds, and bedding required for pipes and standards for backfilling of trenches in graded material.

B. Site preparation and Development

Based on the site investigation survey, a visual inspection of the site and detailed traverse and topographic surveys the overall physical conditions has been accessed. Accordingly, the proposed units are placed considering the main characteristics of the unit and to the site's drainage and topography.

- **Site Drainage Analysis**

The analysis of the drainage has been based as per site location. The site lies alongside the road and proper measures has been taken to provide outlet to the existing drainage.

- **Topographic Analysis**

In the present condition, the proposed site has numerous undulations on the field. Thus, there is need of the proper levelling off the field in order to prevent unnecessary ponding. The levelling will be done by the filling material and have to be compacted as per standard norms.

C. Road Parking

With the exception of areas designated to buildings, landscaping or reserves for future facilities, the entire area within a site will be paved in order to provide the maximum degree of traffic maneuverability and to facilitate site cleaning. The main characteristics of the road system will have been established during the site planning process. A hierarchy of roads will have been defined and the number of parking spaces at peak periods calculated. The purpose of the detail engineering design is to refine the broad assumptions used in the site plan, often necessitating layout assignments.

- **Geometric Design**

The road system of museum need to accommodate a wide range of vehicle types, from the smallest cars and bikes, fire appliances and refuse collection vehicles. Appropriate geometrical design criteria have been adopted for the design of museum. The geometrical design of roads is a specialized activity so application of traffic models to predict flows, the design of a main junction at the site entry/ exit and the detailing of complex loading bay arrangements have been considered.

- **Pavement Design**

A high standard of road construction is always required so the road pavement has been designed based on the California Bearing Ratio (CBR) data for wet conditions, obtained during the site investigations, and the peak projected traffic levels (usually expressed as standard 8,200 kg axle loads). Accordingly, the thickness of the road pavements has been designed.

Adequate supplies of local crushed stone are available at the project site so "Macadam" construction has been adopted, with a compacted sub-grade, sub-base, and base courses, linen finished with a tack coat and surfaced with pre-mixed bitumen based material for the approach road outside of the compound of the museum. Do the rigid pavement within the compound of the museum concrete road pavement has been designed for the road and parking area.

D. Electrical Services

The provision of power is an important infrastructure component as it enables the fullest and safest use to be made of the museums' facilities. A three phase electrical supply will serve with a transformer.

The transformed low voltage supply will run in encased cable ducts to a main switchboard, with distribution cables to sub-switch boards in the individual buildings. For ease of maintenance all external cables will be ducted through cable trenches and internal wirings will be concealed in conduit wherever possible.

External lighting, for security reasons and so that the effective working period of the museum can be extended, all internal roads and paved areas will be adequately lighted by means of high level luminaries, either tungsten halogen, high-pressure mercury or sodium vapor. Building lighting internal lighting levels to buildings will be to a high standard of luminance, with a minimum of 500 lux and preferably 1000 lux to counteract the brighter natural lighting likely to be found outside. To minimize heat gain high efficiency fluorescent fittings will be used for artificial lighting, with the building's ventilation arranged to draw heated air out. For food, displays the color of the tubes should be preferably are warm, but some cultures have a strong preference for the use of cool tubes.

E. Telecommunication System

Telephone is the essential component. It allows rapid communication between people and acts a management and extension tool.

A major building will require the installation of its own switchboard (PABX system) which would be housed in the main management office. It will have sufficient external lines for the installation of computer modems and facsimile equipment. Public telephones will be provided within premises for better communication facility.

F. Foundation Design

The main criteria for structural design of foundations have been established from the site investigation survey. This has been determined from the appropriate bearing pressure that has been adopted in design and the types of foundations required for different building categories, such as strip, raft foundation, or isolated footing supported by long or short piles. The site investigation has also given recommendations for the depth of strip and raft foundation; the minimum length of pile foundations and is the site falls within an active seismic (earthquake) zone, measures which has been taken in the design of column footings and their inter-connection by tie beams.

Depending on soil conditions, the foundations are ideally are conventional isolated pads under the main columns, with connecting strip footings, except for sections of the building where a raft foundation could be required because of higher loadings, such as under a main water tower or tank.

CHAPTER 2 : DETAIL DESIGN AND COST ESTIMATE

2.1 Design Strategies

2.1.1 Design Criteria for proposed building

A. Design Principal and Standards

Following the design principle and standards and other standard of architectural handbook, the Master plan for Rajapur Museum have been worked out.

1. General design Principles

The overriding consideration in the design is that most cost-effective solution should be found. However, there are a number of basic design principles that will need to be considered when preparing proposals for museum infrastructures. These factors include space standards, the choice of materials and structures, and the impact of the climate (rainfall, temperature, and wind) on design.

2. The Use of Space in museum

The use of Space in museum will vary substantially with the type of function it contains. The standard provides a basis for estimating overall space needs. However, at the detailed design stage it will be necessary to develop descriptions that are more precise if the different sections of a museum, distinguishing between following sales:

- General circulation areas (internal and external)
- Other uses, such as storage, administration, public toilets etc

B. Materials and Structure

The choice of materials and construction techniques for museum involves balancing the need for robust and simply maintained structures against the need to minimize expenditure. Additional costs should only be incurred is this can be justified based on the returns obtained from museum fees. Other issues that will have a hearing on the choice of materials and structure will include the span of the structures, consideration of how a project is to be implemented (whether contractor built or by means of self-programs) and the extent to which standardized components can be used (e.g. prefabricated stalls)

In general, the choice of construction technology will depend on a range of factors, including whether indigenous materials are available and what methods of construction might be appropriate.

C. Influence of Climate

In areas with extreme climatic conditions, such as cold weather, high rainfall and intense sunshine, single- story structures are preferable, but where buildings are located in high-density urban areas it may need to be two to three stories high.

In arid climates and to some extent the tropics, it may be appropriate to use internal open courtyards within buildings. This provides a way of improving comfort conditions by allowing cross-ventilations. If the courtyard is too enclosed, there is the probability of it being "dead" and this can be avoided by opening it up to the activities of the building. The spaces can be used as sitting areas, overspill-selling spaces or the courtyard can form part of the entry to the building.

D. Preparation of Conceptual Master Plan and Individual Buildings Floor Plan

Based on the design principle and standards recommended by FAO as well as findings of the primary and secondary data as well as consensus built during meeting with concerned stakeholder, conceptual master plan and Conceptual Building Floor Plan are developed. The orientation of building is planned as per desired wind direction and existing main approach road. Master Plan is developed as per function of individual buildings in one cluster and linkage by different hierarchy of road network and footpath. Functional linkage of different activity is considered. As far as possible, the principle of vaastu is considered. CCTV and Solar backup system (only for administration and other buildings) is provided for emergency light, security and power cut period.

Following points are considered at the time of design.

- The orientation of block
- The orientation of rooms
- Minimum circulation space
- Compact planning
- Simple building form
- Easy for construction
- Security
- Use of local building materials and techniques.
- Low maintenance cost of building
- Follow architects standards for planning and space requirements
- Differently abled friendly design

2.1.2 Structural Design Buildings

The most important element to consider in the structure will be the choice of an appropriate system of roof construction. The selection of cladding materials is important, but equally influential will be the decisions made about how the roof is to be supported. Ideally, the span and width of structural bays has been kept as large as possible to provide an unobstructed operating space. Buildings with depths greater than the maximum practical spans are designed by providing intermediate supports, often coinciding with a break in the roof plane for ventilation.

A. Design Philosophy

Structural design of civil infrastructures is based on following philosophies:

- **Working Stress Method:**

This method is based on the assumption that the load-bearing materials (steel, concrete etc.) are stressed within their elastic limit. This is achieved by dividing the ultimate strength of materials by a factor of safety as stipulated by the codes and prevalent practices.

- **Limit State Philosophy**

This philosophy allows the use of ultimate strength of the materials, but with appropriate partial factors of safety applied to both the loads and the material strength. Since the structural behavior of Reinforced Cement concrete, and steel structures and the associated materials behavior have been sufficiently studied, this method is almost exclusively used nowadays, except for hydraulic structures which are sensitive to cracking.

There are two type of principal limit states:

i. Ultimate Limit State:

This requires that the structure must be able to withstand, with an adequate factor of safety against the maximum load.

ii. Serviceability Limit States:

This limit state requires that despite the structural adequacy of members against ultimate limit state, the members must also full the various serviceable criteria to ensure their functional adequacy. Deflection, cracking, durability, excessive vibration, fatigue, fire resistance etc. are the major serviceable limit states.

B. Design Methodology

The structural design of any structure essentially consists of following parts:

- Analysis
- Design
- Detailing

For the building structures, the analysis is primarily carried out using commercially available structural software. For the analysis, the member sizes are initially assumed based on current practices and some serviceability criteria (for example election), and subsequent analysis is carried out till a safe configuration is finalized. With the results obtained from the analysis, the design is carried out using the design spreadsheets. Once the design is finalized, the detailing of connections and reinforcement is carried out to ensure optimal design.

2.2Detailed Design

2.2.1 Architectural Design

2.2.1.1 Master Plan of Museum at Rajapur Municipality

Requirements and Facilities for Proposed Museum

The requirements and facilities to be provided in proposed museum is governed by the available site area, the number of visitors on pick day as well as year, available surrounding existing facilities and infrastructures and directives issued by line agencies. Based on case study, literature review, the consultant has proposed the requirement of the standard model for proposed Museum at Rajapur are as follows:

1. **Form**
   The form of the building is guided by the function of the structure. Most of the buildings are of rectangular in shape.

2. **Vehicular Movement**
   The function of the building itself calls for big vehicle movement. Ample space has been left in the front of the buildings so that the vehicles can have uninterrupted passage. Proposed roads are of 2- lane and separate walkways of 2 m have been proposed to unobstructed vehicular movement.

3. **Boundary Wall/ Fences**
   Boundary Wall is a beauty as well as security of the museum. Compound wall should be cemented and wall compound's height should be minimum 5 feet within the museum area. Wall compound prevents the trespassing the local and ordinary people within the premises. In case of proposed museum in Rajapur, the proposed site is open land.

4. **Administration Block**
   This block includes the management team of the organization. The building is lined with R.C.C. structures. It is of 4 storied building with canteen at the ground floor.

5. **Guard room**
   Security is one of the most important requisite in the museum. Duty guards should be working 24 hours a day and there should be at least 4-6 guards. When a guard changes his duty, they have to take a rest for their good health. The Market Management Committee will manage security. Guardroom has been kept in the strategic location of the proposed complex.

6. **Toilet and Bathroom**
   Toilet and bathroom are one of the basic needs of museum. Urinal and toilet should be separate for male and female. When visitors use the toilet, there should be the good availability of eater. If anyone use the toilet, it must be compulsory to pay minor taxes.

This facility will provide as per standards in proposed building. Irrespective of separate Male and Female toilets, provision of toilet for differently abled people has also been taken into consideration while preparing plan.

7. **Garbage Management Facility**
   A large number of visitors are frequently visiting the museum. The garbage management facility is highly required for sanitation and hygiene view. Separate garbage dumping space with fencing and gate will be kept in the complex. Regular cleaning of the proposed area, collection of waste and transport to collection yard will be responsible of Management Committee. Transportation of garbage waste from garbage collection yard to dumping site or compost manual plant will be responsible of Municipality with a vehicle also being proposed to collect the garbage within the complex.

8. **Canteen**
   Neat and clean is one of the basic requirements. Canteen should open days from 7:00 A.M. to 9.0 P.M. The food items should be hygienic and fresh. The price of food should be reasonable. Visitors and other staffs can be refreshed in the canteen and take rest for some time.

9. **Sewerage and Drainage**
   Sewerage and drainage system are very necessary as well as basic infrastructure. Drainage should be well-managed time to time to prove the environmental situation because visitors prefer to come in clean areas. This infrastructure will be provided as per engineering point of view in proposed building.

10. **Water facility**
    Water facility is one of the most important factors. Water helps in the sanitation. Water facility should be available for 24 hrs a day. It can be used as drinking water, in cleaning toilet, hand washing, and bathing purpose.

11. **CCTV with street lighting**
    CCTV is essential for the security of the museum. For security of the museum during night as well as daytime, CCTV facility with street lighting will be provided in the proposed complex. This provision enables the sense of security in every aspect.

12. **Cross-ventilation in building**
    Cross ventilation in building is one of the important aspect of building. The orientation of building, height of room and other ventilation friendly architectural details will consider for cross ventilation while planning and designing of building in proposed complex.

2.2.1.2 Requirements and Facilities Proposed for Museum at Rajapur Municipality

As shown in requirements of standard Model of museum and based on opinion survey with mayor and other municipal officials of Municipality and experts, the following requirements and facilities are proposed for museum building to develop as an ideal Museum.

TABLE 1. PROPOSED FACILITIES FOR THE MUSEUM

SN	Facilities	Quantity	Remarks
1	Boundary Wall	Throughout Perimeter	
2	Entrance gate	1 Nos.	
3	Guard Post	1	
4	Guard House	1	
5	Parking area for Four wheeler and two wheeler	Sufficient area	
6	Purposed Museum Block	1	
7	Administration Building	1	
8	Public Toilet	1	
9	Canteen Block	1	
	Electrical / Generation Room	1	
10	Manager Quarter	1	
11	Water Tank Area	1	
12	Provision of fire hydrant	As appropriate	
13	Provision of CCTV	Covering all area	
14	Landscaping	Throughout area as applicable	
15	LED information Board	1	
16	Septic Tank Area	1	

2.2.1.3 Design Concept and Features

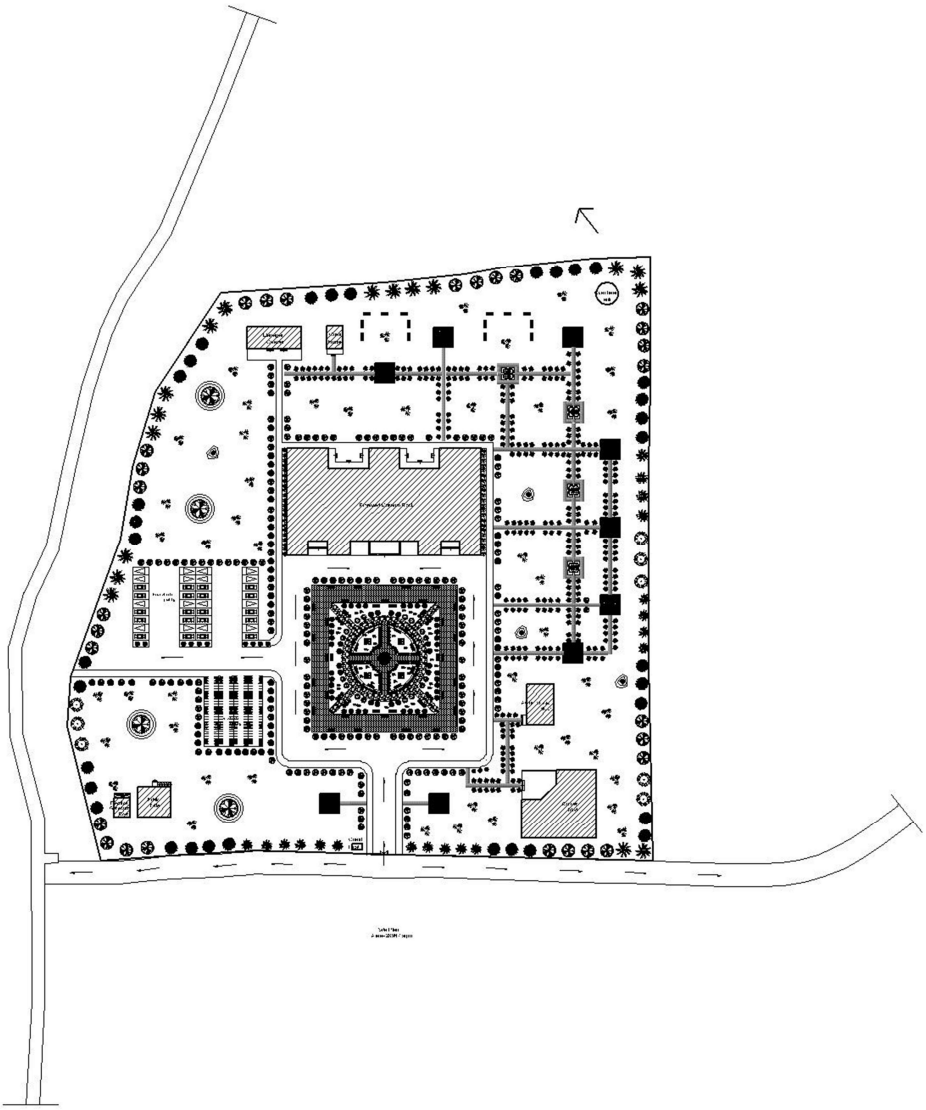

Figure 2. Site plan of Rajapur Municipality

- During the preparation of Master plan of Museum, maximum care has been taken to incorporate the detail of structures within the area provided by the Municipality.

- Detailed Master Plan and Building Plan are prepared as per Vaastu Principal as far as possible

- Master Plan of site is prepared in harmony of greenery, lawn, water bodies, paved walkways, and vehicle driveway, surface parking spaces with shed, other supporting building and administration office building.

- The master plan is prepared incorporating surface drainage and sewerage system, water supply system, external lighting system, and security system and other necessary infrastructures.

- Design of building is prepared in concept of low-rise and earthquake resistance.

- Number of stories of administrative building is proposed for four storied with basement.

- Road and Pedestrian footpath are arranged as linkage between different zone so that movement of vehicle and people is very smooth, resulting in low conflict between them.

- A sufficient landscaping with Park has been proposed in the core area. This space will help the visitors for recreation. Since a park has also been proposed, it would further help in the promotion of museum.

- All modern facilities such as canteen, bank counter, public toilets, Standby generator, CCTV, Guardhouse for security and a landscape garden has been provided in the proposed site.

- The other features of the museum include a souvenir shop that sells handicrafts made by Tharu women, who are particularly known for their distinctive weaved baskets and woodwork.
- The museum harbors a mosaic of cultural traditions of the Tharu people during the three periods of their lifecycle – pre-marital, marital and post marital.

Museum wall painting

The Museums wall paintings demonstrating the general life style, and the birth, wedding and death ceremonies of the indigenous Tharu of Rajapur. The Paintings are historically and archeologically very significant. The paintings not only tell the life cycle, life style of indigenous life style of indigenous Tharu people but also tell how the life of Tharu people has changed over time.

Figure 3. Museum wall painting

Tharu Sculptures

The Museum endeavors to demonstrate Tharu Culture via several sculptures. The museum has three sculptures:

- Tharu woman in traditional dress,
- A woman with grinding toll,
- A man in a traditional dress.

Figure 4. Tharu Sculptures

Tharu Traditional Cookwares

The Museum endeavors to demonstrate Tharu traditional cookewares that were used for daily cooking

Figure 5. Tharu Traditional Cookwares

TABLE 2. AREA COVERAGE OF PROPOSED BUILDINGS

S.N.	Descriptions		Area (Sq. m)
1	Purposed Museum		1664.53
2	Manager Quarter		112.32
3	Canteen Block		394.12
4	Administration Block		102.02
5	Guard House		34.01
6	Electrical / Generation Room		30
7	Public Toilet (1 nos)		94.56
8	**Total Built up area**		**2,431.56**
9	**Open Spaces (Landscaping, Road Network, Foot**		**26,535.44**
10	**Total**		**28,967**

2.2.1.4 Operation and Maintenance

The municipality has enough institutional setup to operate operation and maintenance. They have planning and design section to look after the buildings and infrastructure. Operation and maintenance of the building and the proposed project would not be a problem at municipality. The available engineers and their assistants are well committed to perform such responsibility. The budgetary provision will not be a problem as municipality has that culture to dedicate some of the budget for building maintenance and for building operation.

2.2 Structural Design

The basic aim of the structural design is to build a structure, which is safe, fulfilling the intended purpose during its estimated life span, economical in terms of initial and maintenance cost, durable and also maintaining a good aesthetic appearance.

A building is considered to be structurally sound, if the individual elements and the building as a whole satisfy the criteria for strength, stability and serviceability and in seismic areas additional criteria for ductility and energy absorption capabilities. The overall building must be strong enough to transfer all loads through the structure to the ground without collapsing or losing structural integrity by rupture of the material at the critical sections, by transformation of the whole or parts into mechanisms or by instability.

Failure of one structural element (e.g., due of explosions or collisions) should not cause progressive collapse of the entire structure. Such a building will normally have alternate load paths or mechanisms to transfer loads safely to the foundation.

2.2.1 Nepal lies in a Seismic Zone

Nepal is located in the boundary of two colliding tectonic plates, namely, the Indian Plate (Indo-Australian Plate) and the Tibetan Plate (Eurasian Plate). The Indian Plate is constantly moving under the Tibetan Plate causing many minor and major earthquakes in this region. As a result, Nepal has witnessed many major as well as minor earthquakes during the past. Records show that around 18 major earthquakes have shaken Nepal since then. The 1833 A.D.

earthquake and 1934 A.D Bihar-Nepal earthquakes were the most destructive ones in the history of Nepal.

Thus structures to be built in Nepal need to be suitably designed and detailed, so as to counteract the forces due to earthquakes.

2.2.2 Salient Features

2.2.2.1 Building Features

Table 1: Building Features

SN	Building Name	Type of Structure	Frame system	Foundation
1.	Purposed Museum	RCC framed structure	Special moment resisting frame	Isolated Footing
2.	Manager Quarter	RCC framed structure	Special moment resisting frame	Isolated Footing
3.	Administration Block	RCC framed structure	Special moment resisting frame	Raft Footing
4.	Canteen Block	RCC framed structure	Special moment resisting frame	Isolated Footing
5.	Public toilet	RCC framed structure	Special moment resisting frame	Isolated Footing
6.	Guard House	RCC framed structure	Special moment resisting frame	Isolated Footing

2.2.2.2 Site Condition

Soil Type : v (for seismic consideration as per IS1893 part1)

Seismic Zone Factor : 0.36

Soil bearing capacity : 150 KN/m^2 (assumed)

2.2.2.3 Geometry of the Building

Geometry of the building is given in the table below.

Table 2: Geometry of the Building

SN	Building Name	Storey	Story Height (m)	Total length (m)	Total width (m)	Overall Height (m)	Area (m^2)
1.	Purposed Museum	GF+1 Storey +Stair Cover	3.6	59.448	33	11.25	1777.33

2.	Manager Quarter	GF+ Stair Cover	3.6	16.661	6.751	3.6	112.32
3.	Administration Block	Basement+ GF + 4 storey	3.6	12.290	8.302	21.00	102.02
4.	Canteen	GF+ Stair Cover	3.6	22.73	21	7.2	394.12
5.	Public Toilet	GF	4.05	10.18	9.29	4.05	94.56
6.	Guard House	GF	3.6	7.012	4.850	3.6	34.01

2.3 Design Approach and Methodology

2.3.1 General

The structure is analyzed with Finite Element Method (FEM). Beams and columns are modeled as frame (line) elements with sufficient and appropriate meshing. Modulus of elasticity and possion's ratio for the materials used are taken accordingly. The section properties used are based on preliminary section sizing with consideration for deflection, minimum sizing specified and serviceability. Computation for stiffness as a whole is carried out using FEM based on this software.

Modal Analysis is carried out up to twelve modes confirming more than 95% seismic mass participation and it is applied for lateral seismic force distribution generated with NBC 105 based spectral Function for soil type-III.

For section design and check, suitable load combinations as suggested in NBC 105:1994 and if not covered in that, IS 1893-2002 is referred with consideration of envelopes of internal forces developed.

Foundation design is carried out to satisfy strength and stability requirements.

2.3.1.1 Software used: (Introduction to Analysis software)

- **ETABS**: The analysis has been carried out using a standard software package ETABS Version 16.2 based on finite element method. The software is capable of carrying out a Three Dimensional analysis. It is windows based software. It has a user friendly graphical input and output interface. It can account for the rigid zones at the beam - column junction. It has a capability to create a special joint at any grid intersection. The program has a facility to create shell elements also. Shell elements can be used for the analysis of Slabs and Shear walls. A full 3D finite element model using frame and shell elements can also be created using ETABS.

  A Three Dimensional Linear elastic analysis has been carried out. A model based on Rigid Diaphragm Concept has been considered. This is done by creating a special joint at the centre of mass of each floor level and constraining all the joints at this level by a

diaphragm constraint. The stiffness contribution of brick walls on the structure has been ignored and the building has been modeled as a "Bare Frame" with no infill wall panels.

- **STAAD pro V8i**: The analysis of some building has been carried out using a structure analysis and design software STAAD pro V8i.The analysis of 3D building and truss structure is easily done. This software is used to for analysis, designing and detailing of different structural element like beam, column, slab, and truss.

  The software will give you the forces required to design the structure. It can also perform the member design using a range of design codes. This software is give BMD, SFD, and Stress. The result are summarized which helps to know where the maximum forces are acting in structure.

2.3.2 Structural Performance

Structural response under limit state of serviceability is thoroughly checked. The force and stiffness relationship resulting the deflection under various load cases and combined action of forces are duly evaluated. Basically short- term elastic deflection due to vertical loads and lateral deflection due to seismic forces are of major importance along with the long-term defection of beam elements under sustained loading condition due to shrinkage and creep are also taken into account.

2.3.3 Deformation under Vertical Loads.

Maximum vertical deflection in all beam and slab elements that resulted under vertical load of combined effect of self, imposed dead and live load are checked for critical elements and maintained to be within permissible limit. Short-term elastic deflection and long-term deflection due to shrinkage and creep due to sustained loads are also maintained within permissible limits for all the elements. In order to control deflection of structural elements, the criteria given in clause 23.2 of IS 456-2000 is proposed to be used.

2.3.4 Deformation under Lateral Loads

An effect of lateral load due to seismic force is analyzed using response spectrum input compatible with codal provision. Using Compatible Quadratic combination (CQC) method of modal combinations combines the deformations and related forced reported. To control overall deflection due to earthquake load, the criteria given in clause 7.11 of is 1893-2002: the storey drift in any storey due to the minimum specified design lateral force, with partial load factor of 1 does not exceed *0.004 times the storey height*. The maximum top displacement under extreme load condition (EQx and EQy) are shown in table below which is in the permissible value prescribed by the code.

Table 3 : Deformation under Lateral loads

SN	Building Name		Max. allowable displacement (mm)	EQx (mm)	EQy (mm)
1.	Purposed Museum	Left block	45	16.60	14.94
		Right block	45	16.35	17.84
2.	Manager Quarter		28.8	-	-
3.	Administration Block		84	33.88	34.21
4.	Canteen		28.8	0.65	0.65

2.4 Analysis

2.4.1 Loading details/ Types of Loads

a. Dead Load: The Dead load comprises the loads due to the materials used in the construction and parts or components in a building. It consists of the loads due to structural elements like beam, column, wall slab, staircase, etc.; finishes applied in the building and some permanent structures line water tanks etc.

b. Imposed Load: The imposed load comprises the loads due to the physical contribution to people and the loads due to the nature of occupancy, the furniture and other equipment's which are a part of the character of the occupancy. The imposed loads on the structural system are based on the codal provisions as specified in IS 875(part2)-1987.

c. Earthquake load: The Earthquake load is the horizontal/ lateral load induced by the ground motion due to earthquakes. The design lateral load / force is considered in two orthogonal horizontal directions of the structures. The earthquake induced lateral loads on the structural system are based on the codal provisions as specified in NBC 105:1994.

d. Wind Load: The wind load is the force or pressure exerted by the wind on and object and can be measured. The wind loads on the structural system are based on the codal provisions as specified by NBC 101:1994.

2.4.2 Material Specification

Considering Architectural, Economic and strength demands, reinforced cement concrete (RCC) is used as the major structural material, the selected material also confirms the availability and ease in construction. The concrete grade used is M20 and M25 in general. Fe 500 is provided as longitudinal and shear reinforcement is structural elements wherever RCC is used.

Considerations of material for loading and strength parameter are as detailed below:

Concrete

Grade: M20, M25

Characteristic Compressive strength: 20 N/mm^2 and 25 N/mm^2

Unit weight: 25 KN/m^3

Young's modulus of elasticity (E) = 5000*sqrt (fck) = 22360679.8 KN/m^2

Poisson's Ratio = 0.2

Steel Reinforcement (for both longitudinal and shear reinforcement)

Grade: Fe 500

Yield stress: 500 N/mm^2

Brick

Unit weight: 19 KN/m^3

NOTE: During this design, brick is not considered as structural component and hence its strength is not considered.

Finishing

Cement Plaster (20mm thick): 20.4 KN/m^3

Screed (25mm thick):19.2 KN/m^3

Marble Dressed: 26.5 KN/m^3

Live load: Lobby & Staircase: 3KN/m^2; Rooms: 2KN/m^2

2.4.3 Loading on Structural Model

The following considerations are made during the loading on the structural model;

- The loads distributed over the area are imposed on area element and that distributed over length are imposed on line element whenever possible.
- Where such loading is not applicable, equivalent conversion to different loading distribution is carried to load the model near the real case as far as possible.
- For lateral load, necessary calculations are performed to comply with the requirements of NBC 105:1994.

The earthquake induced lateral loads are determined and used from the spectral load cases based on NBC 105:1994 Spectrum for Soil Type III. Lateral load thus developed is the product of structural seismic mass, modal response and respective spectral ordinates.

2.4.4 Load Cases

The following load cases were used for loading during the analysis;

Dead : Self Weight of the building structural components, Wall load, Finish load on slab

Live : Live load in the building area elements

Wind : Load due to wind in structure.

Eqx : Spectral seismic load in X-Direction

Eqy : Spectral seismic load in Y-Direction

2.4.5 Load Combination

The load combinations are based on IS1893:2000 part 1. The following load combinations for Limit State Method of design are specified by IS1893:2000 part 1.In some case we have to

consider wind load, then the combination may change. Staad pro software auto generates the load combination which is included in Annex.

1. 1.5DL + 1.5LL
2. 1.2(DL + LL + EQPX)
3. 1.2(DL + LL + EQNX)
4. 1.2(DL + LL + EQPY)
5. 1.2(DL + LL + EQNY)
6. 1.5DL + 1.5EQPX
7. 1.5DL + 1.5EQNX
8. 1.5DL + 1.5EQPY
9. 1.5DL + 1.5EQNY
10. 0.9DL + 1.5EQPX
11. 0.9DL + 1.5EQNX
12. 0.9DL + 1.5EQPY
13. 0.9DL + 1.5EQNY
14. 1.5DL

Where, DL: Dead load
LL: Live load
EQ: Earthquake load

2.4.6 Assumptions

The following assumptions are taken into consideration in the seismic resistant analysis and design of structures:

- Adequate supervision and quality systems are provided during execution of the works.
- Construction is carried out by personnel having the appropriate skill and experience.
- Construction materials and products confirm to the pertinent codes and specifications.
- The structure is adequately maintained.
- The structure is used in accordance with the design brief.
- An earthquake is not likely to occur simultaneously with maximum flood, wind, waves of tides.
- Resonance as visualized under steady state sinusoidal excitation will not occur, as the small duration of earthquake is not enough to build up resonance amplitudes.
- Subsoil does not considerably settle or slide due to earthquake at the site of structure.

2.4.7 Analysis and Design

The analysis has been carried out using a standard software package ETABS and Staad pro based on finite element method. The software is capable of carrying out a Three Dimensional analysis. It is windows based software. It has a user friendly graphical input and output interface. It can account for the rigid zones at the beam - column junction. It has a capability to create a special joint at any grid intersection. The program has a facility to create shell elements also. Shell elements can be used for the analysis of Slabs and Shear walls. A full 3D finite element model using frame and shell elements can also be created using ETABS and Staad pro.

A Three Dimensional Linear elastic analysis has been carried out. A model based on Rigid Diaphragm Concept has been considered. This is done by creating a special joint at the centre of mass of each floor level and constraining all the joints at this level by a diaphragm constraint.

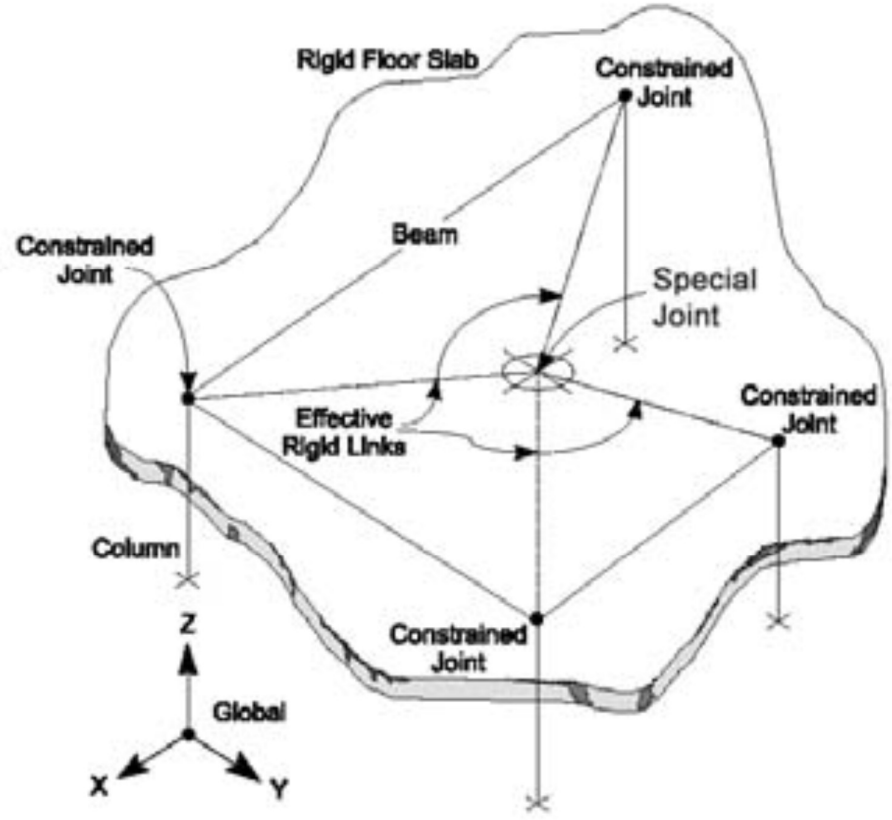

Figure 1: Use of Diaphragm Constraint to model a Rigid Floor Slab

The structure is assumed to be fixed at the plinth level. The compartments between the plinth beams are filled with compacted earth.
The stiffness contribution of brick walls on the structure has been ignored and the building has been modeled as a "Bare Frame" with no infill wall panels.
The flange effect of the slab has been neglected. The beams have been modeled as rectangular beams.

2.4.8 Seismic Analysis Detail

2.4.8.1 Method of Seismic Analysis

The building can be classified as a regular one. It satisfies the criteria listed in the clause 5.2 and 5.3 of NBC 105 (H<40 m) and also of IS Code 1893 part 1. Hence, an equivalent Static Analysis (Seismic Coefficient Method) has been performed according to IS Code 1893 part 1. The seismic forces determined by seismic analysis are directly applied at the "special joint" created at the centre of mass of each floor level. The program automatically calculates the centre of stiffness of the structure. Therefore, Torsion is automatically accounted by the program itself. So, no extra calculation is needed to find out extra forces due to torsion.

2.4.8.2 Calculation of Base Shear

Importance Factor
On the lines described in Clause 6.4.2, Table 6 of IS1893 part 1, an importance factor of 1.0 has been chosen for this building.
Zoning Factor
Seismic Zoning factor of 0.36 has been chosen as per Clause 6.4.2, Table 2 of IS1893 part 1.
Response Reduction factor
Being a Special moment resisting frame, Response Reduction factor of 5 has been chosen as per Clause 6.4.2, Table 7 of IS1893 part 1.
Soil profile type
The Site is classified as sub soil category of Type II (Medium Soil Site) as per IS1893_1.

2.4.8.3 Design Seismic Forces

The computation of horizontal forces and their distribution has been carried out as per 7.5 of IS1893 part 1.
The horizontal seismic shear force at the base of the structure is given by:
Vb = Ah*Wt
The horizontal seismic force coefficient Ah is given by:
Ah = (Z*I*Sa/g)/2*R
The horizontal seismic force is distributed at each level is according to the following Equation:
Qi = V Wi hi^2 / Σ Wi hi^2

2.4.9 Design and Detailing

The design of reinforced concrete structural members includes selection of material properties (grade of steel and concrete), shape and size of cross section, factor of safety and amount of steel required. The design of reinforced concrete members are carried out using limit state method as per IS 456: 2000. The limit state method is the modern and latest design methodology. This method evolved around 1970's.
Prior to this working stress method and ultimate load methods were in use. Limit state method is based on the concept of multiple safety factors and attempts to provide adequate safety at the ultimate loads and adequate serviceability at service loads. Limit state method can be termed as an extension of Working state method and ultimate load method.

Earthquake Resistant Design
Engineers do not design earthquake proof buildings. Instead engineers make earthquake resistant buildings. Such buildings may get severely damaged but will not collapse even in the event of severe earthquake. In seismic resistant design, actual forces experienced by the structure are reduced and reliance is placed on the ductility of the structure.

Detailing of Reinforcement as per IS 13920: 1993

IS 13920: 1993 is used for special design and detailing, related to earthquake resistant design. Special design provisions are meant for achieving ductility in the structure. Ductility is achieved by avoiding brittle modes of failure, namely, shear failure, bond failure. Detailing of steel reinforcement is an important aspect of structural design. Poor reinforcement detailing can lead to structural failures.

2.5 Project Cost Estimate

2.5.1 Rate Analysis

One of the primary tasks of the design and supervision consultant (DSC) to proceed engineering cost estimate is collection of approved district rate of respective district for fiscal year. Unit price of construction work is then prepared incorporating comments provided by the clients and project executive agency according to the norms developed by ministry of Works for Civil engineering construction works. Most of the construction materials such as Cement, brick, stones, sands, and wires required for the project is locally available within the market area of the Municipality. Besides from those materials, some of the other construction material such as reinforcement bar, boulders will have to be transported from outside quarry site and appropriate transportation cost component is added for those materials. Sample summary sheet of the unit rate are attached in following table. Details of rate analysis have been provided in Annex III of this Report.

TABLE 3. SUMMARY OF UNIT RATE OF BARDIYA DISTRICT FOR FISCAL YEAR 2076/77

General Items	Units	Rate
Site clearance including removal of bushes, debris, rubissh, garbages's in and out side of drain & road etc and removal at disposal material as per specification and instruction of Engineer	m^2	14.43
Excavation in roadway, drain & retaining structures foundation in all type soil including removal and satisfactory disposal and stacking or hauling (to sites of embankment construction) of suitable cut materials as required and excavation for existing all type of pavement as per specification and instruction of Engineer	m^3	60.19
Construction of roadway and drain in embankment and miscellaneous backfilling areas for road, drain and structures with approved material obtained from roadway excavation and from outside location including transport, spreading in layers, watering and compaction by mechine equipment / manually as per specification and instruction of Engineer	m^3	156.94
Filling by sand and hand compaction (haulage distance 10m) with sprinkling water	m^3	2679.93
Flat brick soling	m^2	677.33

General Items	Units	Rate
Providing and placing different grades of Concrete for foundations, base, benching, wall, cover slab and slab of culvert including mixing, laying, compacting and curing all complete as mentioned in Drawing, specification and directed by the Engineer		
M15	m^3	14,130.13
M20	m^3	17,338.01
1.5" thick 1:2:4 cement concrete floor carting including finishing by rubbing	m^2	651.27
Brick masonry: Providing and laying brick masonry in machine mixed cement mortar including preparation of mortar as per specification, lead 30 m.	m^3	13247.89
12.5mm thick Plaster: Providing and applying 12.5mm thick cement plaster including mortar mixing, scaffolding, curing etc. complete as per specification lead 30 m (Using mixer machine)	m^2	304.71
2 coats distemper painting in addition to one base or lining coat (primer) '	m^2	134.37
Reinforcement for RCC work. It includes procuring steel, its bending, placing, binding and fixing in position as shown on the drawings and as directed by the Engineer.	MT	100,982.38
Formwork where it is provided as separate item with timber as material.	m^2	752.70
Footpath: Providing and laying concrete or natural stone footpath on 12mm thick 1:3 cement sand mortar over the prepared base	m^2	1,634.81
Kerb Stone: Providing and laying M 20/20 Precast or Cast in situ concrete in kerbs with 12mm thick 1:3 cement sand mortar bedding and joints including foundation excavation levelling etc. but excluding foundation concrete or sand gravel materials.	rm	2,558.80
Sub-Grade: Preparation of sub-grade for rehabilitation or other similar works (filling or cutting depth of 10 to 20 cm) in gravel & boulder mixed soil.	m^2	118.51
Sub-Base: Providing, laying, spreading, watering, levelling and compaction of crusher run materials for subbase course grading SB2*lead upto 10m.	m^3	3,648.49
Base: Providing, laying, spreading, watering, levelling and compaction of crusher run material for basecourse grading as per table 12.1 of standard specification lead upto 10m.	m^3	5,148.96
Prime Coat: Providing and Spraying Bituminous Prime Coat MC30/MC70 including cleaning the road surface using wire brushes, brooms etc before applying the prime coat	lit	238.01

General Items	Units	Rate
Asphalt: Providing mixing and laying asphalt concrete with compaction	m^3	19,736.04
Supplying and applying more than two coats paints over new bitumin surface for Road marking including cleaning, watering, brooming etc. all complete (10cm. wide strip).	rm	49.68
Grass sodding works including sod cutting , transporting , placing in position and water sprinkling (Lead upto 10m).	m^2	82.23
Planting shrub and tree seedling 'and cutting on site: Planting containerised tree and shrub seedlings, including pitting, transplanting, composting and placing tree guards, on toe of embankment slopes in plain areas, not 'less than 8m from the road centre line.Pit size '30 cm diameter x 30cm depth.Compost volume 1/4 of the volume of the pit, mixed with original soil.	No.	531.08
Providing and laying concrete or natural stone footpath	m^2	2,445.31
Porcelain Glazed Tile in 1:4 cement sand mortar including border	m^2	2,400.08
Black Pipe : Construction of Truss including prime paint and installation including all complete	Kg	183.60
CGI Sheet	m^2	1,151.23
Supplying and fitting Aluminium Sliding window without Ventilator from section (101mmx45mmx1.5mm) and 5mm glass.	m^2	6,325.00
Supplying and fitting Aluminium casement door section (101mmx45mmx1.5mm) sash 40mmx45mmx1.5mm and 5mm glass.	m^2	7,475.00
4.5x20mm iron plain sheet including 12mmx12mm solid core sqwire iron grill construct and installation and all complete	m^2	1,354.10
I.P W C. COMMODE with cistern and seat cover complete set.	Set	20,240.00
Wash Basin	Set	3,898.50
Urinals	Set	4,519.50
Rubble masonry work including supply of hard stone blocks preparing cement sand mortar and construction of the wall upto 5m high haulage distance upto 10m	m^3	10,933.63
Dry stone laying (soling) in sand	m^3	6,279.00

2.5.2 Quantity Estimate

The quantity estimate of the project site and its components has been carried out using norms provided by DUDBC, DoLiDAR and DoR. Master Plan along with different roads and land development has been provided.Calculation of earth work quantity has been carried out.

In this stage of final design, detailed surveys of all the site have been already completed. Most of the civil components used in building such as guard post, admin building, public toilet, fountain, land management etc, are illustrated in particular drawings. Some of the sample quantity estimate sheets are presented below;

TABLE 4. QUANTITY ESTIMATE OF RAJAPUR MUNICIPALITY

Guard House

S.N.	Particulars	Quantity	Unit
1	Earthwork	38.55	m^3
2	Back fill	24.49	m^3
3	Brick Soling	21.46	m^2
4	PCC (M15)	1.60	m^3
5	PCC for RCC (M20)	12.88	m^3
6	Floor Finishing Work		
	Cora	35.30	m^2
7	Brick Masonry in 1:4	12.07	m^3
8	12.5mm plaster in 1:4	154.58	m^2
9	Form Work	141.68	m^2
10	Reinforcement	1476.15	Kg
11	Painting Work	154.58	m^2
12	Door	1.89	m^2
13	Window	6.07	m^2
14	Electricity, Sanitary, Kitchen etc	1.00	LS

Administration Museum

S.N.	Particulars	Quantity	Unit
1	Earthwork	730.93	m^3
2	Back fill	466.15	m^3
3	Brick Soling	426.77	m^2
4	PCC (M15)	42.68	m^3
5	PCC for RCC (M20)	912.59	m^3
6	Floor Finishing Work		
	Cora	3390.71	m^2

7	Brick Masonry in 1:4	542.10	m^3
8	12.5mm plaster in 1:4	9689.88	m^2
9	Form Work	13445.24	m^2
10	Reinforcement	125591.01	Kg
11	Painting Work	9689.88	m^2
12	Door	222.29	m^2
13	Window	227.35	m^2
14	Doorwindow	59.16	m^2
15	Electricity, Sanitary, Kitchen etc	1.00	LS

Administration Building

S.N.	Particulars	Quantity	Unit
1	Earthwork	457.10	m^3
2	Brick Soling	102.03	m^2
3	PCC (M15)	10.20	m^3
4	PCC for RCC (M20)	313.65	m^3
5	Floor Finishing Work		
6	Cora	606.16	m^2
	Tile	677.36	m^2
7	Brick Masonry in 1:4	185.02	m^3
8	12.5mm plaster in 1:4	2748.27	m^2
9	Form Work	2107.49	m^2
10	Reinforcement	47312.53	Kg
11	Painting Work	2748.27	m^2
12	Door	65.00	m^2
13	Window	143.92	m^2
14	Electricity, Sanitary, Kitchen etc	1.00	LS

Public Toilet

S.N.	Particulars	Quantity	Unit
1	Earthwork	88.12	m^3
2	Back fill	43.20	m^3
3	Brick Soling	49.43	m^2

4	PCC (M15)	3.60	m^3
5	PCC for RCC (M20)	33.20	m^3
6	Floor Finishing Work		
	Cora	100.57	m^2
7	Brick Masonry in 1:4	15.26	m^3
8	12.5mm plaster in 1:4	228.40	m^2
9	Form Work	340.95	m^2
10	Reinforcement	3247.16	Kg
11	Painting Work	228.40	m^2
12	Door	6.88	m^2
13	Window	3.59	m^2
14	Commode	12.00	no.
15	Wash Basin	8.00	no.
16	Urinals	5.00	no.
17	Electricity	1.00	no.

Canteen Block

S.N.	Particulars	Quantity	Unit
1	Earthwork	274.30	m^3
2	Back Fill	171.76	m^3
3	Brick Soling	168.46	m^2
4	PCC (M15)	74.86	m^3
5	PCC for RCC (M20)	104.20	m^3
6	Floor Finishing Work		
	Cora	470.58	m^2
7	Brick Masonry in 1:4	45.03	m^3
8	12.5mm plaster in 1:4	719.79	m^2
9	Form Work	1187.63	m^2
10	Reinforcement	14943.70	Kg
11	Painting Work	719.79	m^2
12	Door	6.09	m^2
13	Window	1.07	m^2
14	Electricity, Sanitary, Kitchen etc	1.00	LS

Electrical and generator block

S.N.	Particulars	Quantity	Unit
1	Earthwork	38.07	m^3
2	Back Filling	24.11	m^3
3	Brick Soling	21.06	m^2
4	PCC (M15)	21.06	m^3
5	PCC for RCC (M20)	9.96	m^3
6	Floor Finishing Work		
	Cora	31.27	m^2
7	Brick Masonry in 1:4	10.66	m^3
8	12.5mm plaster in 1:4	122.89	m^2
9	Form Work	136.51	m^2
10	Reinforcement	1783.97	Kg
11	Painting Work	122.89	m^2
12	Door	2.52	m^2
13	Window	12.15	m^2
14	Computer and all assoceries for process of Weight for weight Mechine and quality test types equipment + Electricity and Sanitary	1.00	LS

Manager Quarter

S.N.	Particulars	Quantity	Unit
1	Earthwork	140.22	m^3
2	Back Fill	87.16	m^3
3	Brick Soling	75.74	m^2
4	PCC (M15)	6.00	m^3
5	PCC for RCC (M20)	34.68	m^3
6	Floor Finishing Work		
	Cora	87.80	m^2
7	Brick Masonry in 1:4	32.89	m^3
8	12.5mm plaster in 1:4	503.84	m^2
9	Form Work	401.65	m^2
10	Reinforcement	4184.34	Kg
11	Painting Work	503.84	m^2

12	Door	3.62	m^2
13	Window	5.05	m^2
14	Electricity, Sanitary, Kitchen etc	1.00	LS

2.5.3 Cost Estimate

Cost estimation work has been carried out based on the unit rates derived in the rate analysis and the detailed quantity estimate. Total cost of the project has been estimated as NRs. **320,287,922.32** including price contingencies 10%, physical contingencies 10%, supervision consulting fee charge 4% and VAT 13%. Detail of cost estimation has been attached in Annex III of this report.

CONCLUSION

The building is dedicated for museum functions at first and for multipurpose function with a unique design to be in the built and natural environment. The building is designed with latest architectural concepts using Nepal National Building Code and established design parameters. With all of the concepts, the building has achieved an optimum level efficiency, effectiveness using modern method and technologies. In all respect, the building is attractive and influential reflecting its time and architecture. The architectural feature dedicated in this building has a great level of paradign shift in building practice in terms of its space quality and the quality of the built environment.

The Tharu Culture Museum offers visitors a glimpse of Tharu culture and traditions they perform that are fast disappearing in the Tharu community. It offers visitors a unique opportunity to view existent Tharu community along the way to the museum, where the museum displays culture and traditions as a replica. It provides a nice collection of Tharu artifacts/information. It houses exhibits on many facets of Tharu culture, including collections of traditional fishing baskets and cookware. Visitors will get great opportunity to learn about a vibrant, historically underserved Nepali cultural group.

Therefore, Tharu Cultural Museum will be, one of the popular destinations for domestic and international tourists. Construction of Tharu Museum will help to conserve and promote Tharu Culture for a long run, which will be helpful for the development of economy of the people. The building will be a pride for municipality in its social and environmental context.

Likewise, detail Architectural and Engineering Design have been carried out with detail survey and analysis of site. Planning and Design Concept started with topography of site and design requirement. All the design works has been carried out within the framework of design criteria like safety factor, illumination, economical factor, reliability of the system, Flexibility of the system and other technical factors.