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DEPARTMENT OF CIVIL ENGINEERING

OPTION: CONSTRUCTION TECHNOLOGY

FINAL YEAR PROJECT

A project report submitted in partial fulfillment of the requirements for the award of an Advanced Diploma in civil engineering department, construction technology Option

SUBMITTED BY: TERERA Pierre Celestin

Roll number: 202250456

Under the guidance: Eng. RUKUNDO Emmanuel

Academic year: 2023-2024

Kigali, September, 2024

DECLARATION

We do hereby declare that this project entitled “FEASIBILITY STUDY OF AFFORDABLE MODEL VILLAGE AT RILIMA IN BUGESERA district” submitted in partial fulfillment for the advanced diploma in civil engineering at ULK polytechnic institute regional center Gisozi is our original work and it has not previously been submitted elsewhere. We thus declare this work is ours and were completed successfully under the supervision of Eng. RUKUNDO EMMANUEL

TERERA Pierre Celestin roll number:202250456

Date: …/………/………….

BONAFIDE CERTIFICATE

This to certify that this project titled “Feasibility study of affordable model village at Rilima site in Bugesera district” is a work of TERERA Pierre Celestin (Roll No:202250456) who carried out the research under my supervision. Certified further that to the best of my knowledge, the work reported herein does not form a part of my other project report or dissertation on the basis of which the advanced diploma in civil engineering, construction technology was conferred on any earlier occasion on this or any other candidate.

Supervisor:	Head of civil engineering department:
Eng.RUKUNDO Emmanuel	MUKASHEMA Annoncee
Date: …/………/……….	Date: …/………/………....
Signature: ……………………………	Signature: …………………...

DEDICATION

This project is dedicated to Almighty God for the daily support since our birth until now

Our parents for support and advices

Our supervisor for his high advices and guidance

Our classmates for their support in learning.

Our friends for their encouragements.

Civil engineering department lecturers and assistant lecturers

Our sisters

Furthermore, it is dedicated for everyone who struggled and prayed for the progress of final project.

ACKNOWLEDGMENT:

The time we spent in ULK Polytechnic institute as from the past three years was a memorable one for us, as it was rich in experience sharing and helped us discover our potential. we have hand so many rich experience sharing and opportunities that we personally believe will forever shape and influence our professional life while fostering personal growth and development. In this final year report, we hope to high light the enormous opportunities offered by ULK Polytechnic institute to us, wishing to pursue a career in the domain of civil society. These few details lead us to realize that, like all human activities, this final year project report may not be perfect and may contain errors and shortcomings. thus, we remain open to all blames and suggestions which could present me with new sources of inspiration as we develop in our ability to research and learn. This final year project report would not have been possible without the contribution and collaboration of others. Our sincere gratitude:

To Almighty God who granted using the Grace, Opportunity and strength, without which we could not have finished this industrial training report;

To our dear supervisor Eng. RUKUNDO Emmanuel, for endorsing each and every day support and guidelines from day one to the completion of this report preparation and for his assistance during the preparation.

To our parents who did not hesitate to give us any kind of love, motivation, advices and support so that our final year project report will be fulfilled without any obstruction.

I am also grateful to the faculty members of ULK Polytechnic Institute for their encouragement and support. Their knowledge and expertise in the field have been instrumental in shaping my understanding of the subject matter.

ABSTRACT:

This project report entitled “Feasibility study of affordable model village of G+2 at Rilima site in Bugesera district” was designed to provide model village layout which is Rilima site and affordable to be implemented by Bugesera district. This study was done for the purpose of conducting the Geotechnical study, architectural and structural study, topographic study of Rilima site, bills of quantities and environmental impact assessment. To achieve the above objectives, different methods and material have been used. Geotechnical study conducted by site visit and conducting dynamic cone penetration test (DCPT) and the preferable bearing capacity of soil is 3.47Bar at 80cm penetration depth. Architectural drawing provided are three G+2 apartments, health post, bank, 12 classrooms, minor market, Playgrounds and two car parking area by using Arch card 24.

Structural study included are designed of slab, beam, column and footing (here the most critical members are designed and the findings are applied to all related members) This was done by referring to British standards design procedures of structural elements and soft wares (Arcad and prokon) to determine maximum bending moment and shear force. Topographic study was conducted by site investigation and software (arch GIS) and result gives that Rilima site is somehow plane site which means that it is not too sloped. Environmental impact assessment(EIA) was done by documentation referring to be lows of conduct established by the government of Rwanda for the wellbeing of Rwandans. In this phase positive impact of project were observed and negative impact were found with their respective mitigation measures.

The results after analyzing show that the reinforcements for slab have been found to be T10@300mm in long direction and T12@250mm in shorten direction of slab and no links required due to shear resistance is bigger than shear stress, beam reinforcements was found to be 7T12 maximum applied moment=90.38KNm, ultimate shear force(v)=123.69KN and links are T6@248mm. The steel reinforcement of column was 5T12, for turning ramp steel bar of T10@300mm was found while for and foundation reinforcements was found to be T16@75mm in both direction of the footing. The soil bearing capacity is equal to 3.47 Bar.

As Rwanda housing authority(RHA) ordered all 30 Rwanda's districts to house people who live in high risk zone and those who are not owned to land for accommodation. In line with government policy to work on the feasibility study of Rilima affordable model village and show its positive impacts and negative impacts with their mitigation measures t in Bugesera district especially the population of Rilima and their surroundings.

It was concluded that the design of a Model village was a very careful task to accomplish because it includes many services (apartments, classrooms, health post, bank and minor market) which require great attention and enough time to accomplish. Every structural member was designed at their most crictally loaded areas to provide maximum safety and service ability of such dwelling buildings. The result of geotechnical study shows that the capacity of sub soil is capable of resisting the ultimate applied load.

It was recommended to: Bugesera district possibly implement this designed project with any additional design other than that conducted, in this project. To ULK Polytechnic institute to increase the organized field visits for getting tangible knowledge and skills for linking the class trainings and the and reality on the field for the purpose of having qualified graduates with greater practical design skills. Future students of ULK Polytechnic institute to put more effort in studying civil engineering software because they are its base.

LIST OF ABBREVIATION

ULK: Kigali Independent University

Ac: Area of Concrete

As min: Minimum area of steel

As prov: Area of steel provided

As req: Minim area of steel

As: Steel reinforcement

Asc: Minim area of steel in compression

As: Minim area of steel in compression

d: Depth

b: Effective Breath

bw: Web width of flanged beam

Ly: Long span

Lx: Short span

fcu: Design Strength of Concrete

fy: Yield Stress of Steel

Z: Level arm

M: Applied moment

MR: Resisting moment

E: Modulus of elasticity

Gk: Dead load

Qk; Imposed load

Wk: Wind load

L: Span

MF: Modification factor

N: Design axial load

Msy, Msx: Moment in long and short span

Bsx, Bsy: Moment coefficient in short and long span

Vsx, Vsy: shear force in short and long span

Bvx, Bvy: Shear coefficient in short and long span

Lc: effective height of column

Lo: clear distance between column and resistance

V́: Nominal shear,

V: Design shear V́c: Shear capacity

B: coefficient of end connection

BS: British Standard

Eng: Engineer

HOD: Head of Department

ASD: Allowable Stress Design

BS: British Standard

Eng.: Engineer

Kg: Kilogram

KN: Kilo newton

RC: Reinforced concrete

LIST OF SYMBOLS

A: cross section area.

Ac: total cross-section area of concrete section.

As: area of tensile steel.

As‟: area of compressive reinforcement.

ASV: area of steel in links.

B: width of foundation.

B: width of reinforced concrete section.

Bf: width of flange in a beam.

BW: width of web in a beam.

C: cover.

D: effective depth of tensile reinforcement.

D: depth of foundation.

E: young’s modulus.

Fcu: characteristic yield strength of concrete.

Fv: shear force.

Fs: estimated design service stress in the reinforcement.

Fsv: characteristic yield strength of the links.

FY: characteristic yield strength of steel

G: going

H: overall depth of a concrete section

Hf: thickness of flange in a T-beam

L: span length

Lx: short-span length

Ly: long-span length

Rb: Design concrete compressive strength

Rs: Design steel tensile strength

M: maximum moment that the reinforced concrete element will resist

Mc: Moment capacity

N: ultimate axial load on column

Pa: allowable bearing pressure

.t: thickness

V: shear force

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CHAPTER1: GENERAL INTRODUCTION

1.1 Background

The origin of Model village can be tracked back to 7th century. The first recorded model village in Britain was in Hampstead, north London at the private home of Charles Paget Wade. A Model village is a type of mostly self-contained community built from the late 18th century onwards by landowners and business managers to house their workers. Also government build model villages to house citizens.

Rwanda is a small, densely populated country of 26,338 km2 located in central east Africa. According to the 2022 housing and population census, there was 11 million people in Rwanda, where the country has a density of 416 inhabitants/km2.

Rwanda's vision 2050, aimed that at least 70% of Rwandans in rural areas will be living in planned settlements by the year 2050. The current rate was 55.8% according to the national household living condition survey, which was published in September 2015.

Towards this, the Rwandan government is setting aside planned settlement sites in the different parts of the country and investing in the building of model villages as a part of the latest efforts to modernize rural settlement, officials at the Rwanda housing authority(RHA) have said. Rwanda housing authority(RHA) had asked every district in the country to set aside at least one planned settlement site where the government can build homes for indigent people living in high risk zones.

Doubled model villages, the modern settlement sites will be connected to essential infrastructures like roads, water, electricity, schools, health posts and local markets. The target is that at least 30 sites, one in each of the country' 30 districts will have been aside before the end of the current fiscal year 2016-2017. Several model villages have been constructed and inaugurated other parts of the country, such as Kibangire green village in

Ruzizi district, Gashake green village and Kinigi model village in Musanze district, and Kabyaza model green village in Nyabihu district.

Rilima site is located in Bugesera district, Rilima sector, Nyabagendwa cell. It is at 26.4km from Bugesera district office, 4km from Nyamata hospital, 5.5km from sector office and it is near the () main road Kigali-Bugesera. Many people of Rilima live by agriculture of crops such as maize, banana, beans and they live scarcely.

1.2 Problem statement

The population of Rwanda is highly increasing, in 2022 was 13.78 millions of people and on May 16, 2021 was 13.46 million, which means that 248889 people per year, and remember that the area of Rwanda is still constant to 26338 km2. As the population increases, they need land for accommodation including farming, agriculture and construction, which is difficult to poor people to get their own land for living. Although there is such problem in some areas of the country but there is the problem of very spaced housing which affect the government policy of land consolidation which cause the reduction of agricultural based harvest. Many people of Rilima have not their own land for construction and agriculture, and those who are land owners are separately distributed. The spaced housing has a great impact on access to the infrastructures on public services scale like electricity, water, security, schools, market other infrastructures.

1.3 Objectives of the study

This research study has main objective as well as specific objectives

1.3.1 Main objective

The main objective of this study is to assess the feasibility of developing a model village in Rilima sector, Rwanda, focusing on sustainable development, community engagement, and resource optimization.

1.3.2 Specific objectives

To achieve the main objective of this study, the following specific objectives are proposing:

1. Socio-Economic Assessment: Analyze the socio-economic conditions of the Rilima community to identify needs and opportunities for development.
2. Infrastructure Evaluation: Evaluate existing infrastructure (housing, water supply, sanitation, etc.) to determine necessary improvements for supporting a model village.
3. Environmental Impact Analysis: Assess potential environmental impacts and benefits of establishing a model village, including land use, biodiversity, and resource management.
4. Community Participation: Engage local stakeholders to gather input and ensure community needs are reflected in the development plan.
5. Financial Feasibility: Develop a financial model to estimate costs, funding sources, and economic viability of the project.
6. Sustainability Planning: Create a framework for sustainable practices in housing, agriculture, and energy use within the model village.
7. Cultural Integration: Investigate how cultural elements and traditional practices can be integrated into the design and operation of the model village.
8. Education and Health Services: Assess the need for educational and healthcare facilities and services to support the well-being of residents.

1.4 Significance of the study

Firstly, this study will be interesting to us as researchers through being awarded and will be the way of practicing our skills in order to increase our knowledge. This study will be important to different people and organizations. The government of Rwanda will benefit in this because the standard of living of people who live in Rilima model village and the taxes from this village will increase the economy of the country. Bugesera district will develop due to the increase in infrastructures and this will give good look to Bugesera city. ULK Polytechnic institute will be appreciated through the qualified knowledge of their graduates, and this study will serve as reference to the future students of ULK Polytechnic institute. The execution of this work will be source of employment opportunities to people of Bugesera and their neighbors, it will also help the people who live in Rilima model village to access the government services easily on time.

Additionally, this will support the government policy of land consolidation which will increase the harvest from agriculture.

The study will provide valuable insights into the practicalities of establishing a model village in Rwanda, contributing to:

Community Development: Enhancing the quality of life for residents through improved infrastructure and services.

Sustainable Practices: Promoting sustainable living and environmental stewardship in rural areas.

Policy Guidance: Offering data-driven recommendations for policymakers and stakeholders involved in rural development.

Replication Potential: Serving as a blueprint for similar initiatives in other regions of Rwanda or comparable contexts.

To conduct the environmental impacts assessment of the project to know the impacts or effects of this model village to people and environment of Rilima site,

1.5 Scope

This project contains different buildings and services which are included in model village such as residential buildings, health post, school, play grounds, banks, minor market, electricity, roads and cars parking, resto-bars, offices, gardens and swimming pool. This study focused on feasibility study of residential buildings, health post, school, banks, road, cars parking, offices, design of electricity, plumbing, drainage systems and minor market.

1.6 Methods and materials

1.6.1 Methods

To conduct this study, different methods and materials were used to accomplish the work, which are:

Site investigation: site visit and recording (interview, observation

Testing: laboratory tests and in site soil test.

Documentation: literature reviews of textbooks or internet searches.

1.6.2 Materials, tools and equipment

Tools

Engineering software

Computers

Materials

Soil samples

EQUIPMENT

Testing equipment and machinery

CHAPTER 2: LITERATURE RIVIEW

2.1. Introduction

in this chapter, the main sections are broken down into the four main part namely introduction, conceptual review, theoretical review and empirical reviews

2.2. Theoretical framework

2.2.1. Model village

Model is used in the sense of any ideal to which other developments could be based on. Model village is the type of mostly self-contained community, built from the later 18th century owned by land owners and industrialists to house their workers. Although the villages are located closer to the workplace, there are generally physically separated from them and often consist of relatively high quality housing, with integrated community amenities and attractive physical environments.

2.2.2. classification of Model village

2.2.3. Based on structure

Structurally villages in India can be divided into the following types:

The nucleated village

The linear village

Dispersed village

The mixed village

The nucleated village

This is a common pattern of settlement mostly available in paddy growing areas. In this type of village, homes of farmers and artisans are collected to gather. Their land is located outside the village at varying distance. Their livestock ore often housed along with them or nearby them. This type of village is characterized by residential proximity, neighborhood, community felling.

The linear village

In this type of village, houses are built on parallel rows. Each house is surrounded by small gardens. The paddy fields are at a distance from the house. This pattern of settlement unites the social advantage of residential closeness and economic advantage of living on one's land.

Dispersed village

The village in which the dwelling places of the village lay scattered or diffused is called dispersed village. These villages have no definite structure or shape. This type of village is found in hilly areas.

Mixed village

Is the mix of nucleated and dispersed patterns of settlement? In this type of village settlement, there is a large compact settlement of houses which are surrounded by a few small hamlets at a distance. This type of settlement can be seen both in plain as well as hilly areas.

2.2.4. Advantages of model village life

1. The most advantage is to consume balanced diet: everybody cultivates by his/her owner. Therefore, villagers are able to get the balanced diet on the daily meals.
2. they are very friendly and they have unity: this is very rear in cities, even someone don't know the name of neighbor living next to his house in cities, however, in village everyone knows the names of villagers.
3. beauty: you can enjoy the real beauty of nature in village.
4. people in village do not hesitate to help others.
5. pollution free environments: moreover, of course noise free.

2.2.5. Development pillars according to setup of model village

Land productivity

To increase agricultural and livestock productivity.

Post-harvest processing and marketing

To assume food security and promote trade of agriculture product in internal and export sellers.

Cooperative development

To increase economic value and reinforce unity through joined capital and promotion of saving.

Off-farm employment

To diversify and modernize Rwandan economy through creation and enhancement of sustainable off-farm employment.

Promotion of micro-finance and insurance

To increase in puts for economic expansion and protect entrepreneurs against business risks.

Re-settlement

To voluntary settle cities for efficient service delivery and land consolidation.

Rehabilitating eco-system

To ensure optimal utilities and sustainable management of natural resources base.

Social protection

To provide effective and sustainable social protection and release productive capitalities poorest and vulnerable.

2.3. CONCEPTUAL REVIEW

2.3. 1. CIVIL ENGINEERING TERMINOLOGIES

2.3.1,1. Architecture

The choice of architectural elements, how they interact and what are the constraints on these choices. Design is interested in modularity and also the precise interfaces of your design elements, their algorithms along with processes, plus an information types needed to enhance the architecture as well as please particular requirements. Software architecture is a set of structures needed to reason about the software system which can be used across many classes between entities within context, but often layers clustering elements sharing concerns that allows production of work with no more than!

Architectural design… Architectures is necessarily not about the details of implementations (i.e. algorithms and data structures) Architectural stands on a richer collection of abstractions than offered by OOD normally (EDEN, 2003).

The architectural drawing helps architect:

To correspond ideas and models

To convince clients for quality design

To allow a building contractor to construct particular building

To keep the drawings as cord of work

The drawings illustrated are the following:

Plans: these are plans, foundation plan, a roof plan, and a multi-storied building. The aim of these plans is to give details of the floors, arrangement and probable positions of beams, columns, doors, windows, walls, etc.

Elevations: these serve the purpose of describing the nature of cladding; windows and physical out-look of the structure. There are front-views, rear (back) view, right hand side view, and left hand side view.

Sections: these are sections through a structural framework, from roof level to foundation level aimed at showing the internal or hidden structural member like staircases and lift shafts and also columns, beams, slabs.

Perspective: it is aimed at combined at least three different views of the building and represents them in a single drawing.

2.3.1.2. Structure

A structure is the assemblage of two or more basic structural components connected together in such a way that they serve the user functionally and carry the load arising out of the self and superimposed loads safely without causing any problem of serviceability.

Basic structural components in a building are the beams, the columns, the slabs and the footings. These components when connected in a proper in a proper way form a building.

Figure 1 STRUCTURAL MEMBERS

A structure can be defined as a body which can resist the applied loads without appreciable deformations. Civil engineering structures are created to serve some specific functions like human habitation, transportation, bridges, storage etc…... in a safe and economical way.

2.3.1.3. Design

The main design in civil engineering are architectural and structural analysis design. In structural analysis design, the building is subjected to both the vertical loads as well as horizontal loads. The vertical load consists of dead load of structural components such as beams, columns, slabs etc…. and live loads.

The horizontal load consists of the wind forces thus building is designed for dead load, live load and wind load. The building is designed as two dimensional vertical frame and analyzed for the maximum and minimum bending moments and shear forces.

2.3.1.4. Reinforcement

Reinforcement, usually in the form of steel bars, is placed in the concrete member, mainly in the tension zone, to resist the tensile forces resulting from external load on the member. Reinforcement is also used to increase the member's compression resistance.

The concrete is a very variable material, having a wide range of strengths and stress-strain curves. A typical curve for concrete in compression is shown in figure below. The ultimate strain 16 for most structural concretes tends to be a constant value of approximately 0.0035, irrespective of the strength of the concrete.

Shrinkage or dry shrinkage is the contraction that occurs in concrete when it dries and hardens. Drying shrinkage is irreversible but alternative wetting and drying causes expansion and contraction of concrete (Duggal, 2003).

2.4 EMPIRICAL REVIEW

2.4.1. Structure design procedures of structural elements

The first function in design is the planning carried out by the architects to determine the arrangement and layout of the building to meet the client's requirements. The structural engineering determines the best structural system to bring the architect's concept into being. Construction in different materials and with different arrangement and systems may require investigation to determine the most economical answer. That is why the engineering and architect should work together for this conceptual design (R K. B., 2011)

Once the building form and structural arrangement have been finalized the design problem consists of the following:

Idealization of the structure into load bearing frames and elements for analysis and design.

Analysis to determine the maximum moments, thrusts and shears for design

Production of arrangement and detail drawings and schedules

The complete building structure can be broken down into the following elements:

2.4.1.1. Reinforced Concrete Beam

Beam is a concrete structural element that is designed to withstand the loadings from upper structural slab and other loadings from parts above the slab. It consists of two types such as, rectangular beam and flanged beam.: Beams can be described as members that are mainly subjected to flexure and it is essential to focus on the analysis of bending moment, shear, and deflection. When the bending moment acts on the beam, bending strain is produced.

2.4.1.1.1. Rectangular Beam

It is a beam which has rectangular or square shape. The beam is designed as rectangular (singly or doubly reinforced) when is resisting either tensile forced or both compressive and tensile forces itself alone.

The design procedures of rectangular beam are the following:

For singly reinforced beam:

Design Load(q)=1.4Gk+1.6Qk

Design ultimate moment(M)=

K= it becomes singly when k ≤ 0.156

lever arm(z)=d(0.5+ , z≤ 0.95d

Area of steel reinforcement in tension

As’ required =

Doubly reinforced beam

Design Load(q)=1.4Gk+1.6Qk

Design ultimate moment(M)=

K= it becomes doubly reinforced when k found is greater than 0.156 (k ≥ 0.156)

Resisting moment(MRC)=0.156fcubd2

Area of steel reinforcement in compression (As’)

As’ required =

As’ provided is found in the BS table

Tensile force(T)=Cs+ Cs =0.203fcubd+0.95fy As’

Area of steel reinforcement in tension, As required=

The number of steel required in tension found in table.

2.4.1.1.2. Flanged Beam

It is designed as flanged beam (T or L-Beam) when the beam is designed in combination with a portion of slab where a lower portion of beam is called web and upper part of slab is called flange. We design flanged beam under two conditions:

When the neutral axis lies in the flange: it means that the design moment is less than the resisting moment (. Where and

When the neutral axis lies in web: it means that the design moment is greater than the resisting moment. Therefore, you will need to find the maximum resisting moment of the whole section. Where with

Design for Shear

An accurate analysis for shear strength is not possible. The problem is solved by establishing first the strength of concrete in shear by test. The shear capacity is represented by the simple formula to calculate the nominal shear stress given in BS8110: Part 1, clause 3.4.5.2:

, the size and spacing of stirrups should be such that : ≥ Where = . (T.J.MACGLEY and B.S.Choo, 1990)

Deflection check

The allowable span-to-effective depth ratio is the basic ratio multiplied by the modification factor for tension reinforcement and multiplied by the modification factor for compression reinforcement. This value should be greater than the actual span/d ratio for the beam to be satisfactory with respect to deflection.

Support conditions

Rectangular beam

Flanged beams, ≤0.3

Cantilever

7

5.6

Simply supported

20

26

Continuous

26.0

20.8

Table 2.1 Table Basic span/effective depth ratio for rectangular or flanged beams. (Table3.9, BS 8110)

Modification factor for tension reinforcement

Deflection is influenced by the amount of tension reinforcement and its stress. The span/effective depth ratio should therefore be modified according to the ultimate design moment and the service stress at the Centre of the span (or at the support in the case of a cantilever). Modification factor for tension reinforcement are given (in BS8110 Part1-1997 table 3.10)

Modification factor = 0.55

The design service stress in the tension reinforcement

B. Modification factors for compression reinforcement

All reinforcement in the compression zone reduces shrinkage and creep and therefore the curvature. This effect decreases the deflection. The modification factors for compression reinforcement are given in BS8110: Part 1, Table 3.12. The modification factor is given by the formula:

End support

First middle span

First interior

Support

Interior middle span

Interior support

Moment

0

0.9FL

-0.11FL

0.07FL

-0.08FL

Shear force

0.45F

0

0.6F

0

0.55F

Table 2.2 Table Coefficient for Moment and Shear Force According To Bs8110-1997

This table is applied on continuous beam only.

Where F: =1.4DL+1.6LL

L: effective span, F: ultimate load, DL: dead load, LL: live load

2.4.1.2. Slabs

are horizontal plate elements carrying lateral loads? They may be simply supported or continuous over one or more supports and are classified according to the method of support as follows: Spanning one way between beams or walls, spanning two ways between the support beams or walls, and Flat slabs carried on columns and edge beams or walls.

Procedure of Design of Slab

Estimation of minimum thickness of slab

The first estimation is done by using the ratio of the short span d. The practice code 8110 gives the following values according to the condition of the support. Design load is found like to the beam.

Determining the design moment

Design moment in each direction is calculated by the following formulas:

For the short span and for long span. Where β_{sx} is coefficients of short span and β_{sy} is coefficient applied for long span from Table 3.14 in the BS

Code 8110-1. Lx is the length of the shorter span; ly is the length of the longer span, N is the total ultimate load per unit area, which is;

End support

End span

penultimate support

interior span

interior support

Moment

0

0.086FL

-0.086FL

0.063FL

-0.063FL

Shear

0.4F

-

0.6F

-

0.5F

F=1.4Gk+1.6Qk and l:effective span

Table 2.3 Table Ultimate moments and shears in one-way spanning slabs

, then Z = ≤ 0.95d

AS=   and As min= , if As < Asmin provide reinforcement corresponding to

Deflection: The deflection is found in the mid span and is done by using bending moment.

Modification factor: M.D= ≤ 2 and

and permissible

C. Design for Shear

Shear is checked along both directions x and y

Shear reinforcements are designed in the following way and using these formulas:

In addition, calculate (This ratio gives the value to be used while calculating of shear force in concrete (vc).

vc= *factor given by

Shear reinforcement are required when shear stress of the steel bars is greater than that of concrete (vc vc).

D. Crack check

Cracking is controlled by specifying the maximum distance between bars in tension. the spacing limits are specified in clause 3.12.11.2. The clause indicates that in normal conditions of internal or external exposure the bar spacing given will limit crack widths to 0.3 mm. calculations of crack widths can be made to justify larger spacing's.

It also states that no further checks are required if:

(a) Grade 250 steel is used and the slab depth does not exceed 250 mm

(b) Grade 460 steel is used and the slab depth does not exceed 200 mm

(c) The reinforcement percentage 100As/bd is less than 0.3% where as is the minimum recommended area, b is the breadth of the slab considered and d is the effective depth

Refer to clauses 3.12.11.7 and 3.12.11.8 for other requirements regarding crack control in slabs.

2.4.1.3. Design of Reinforced Concrete Column

Columns: are vertical structural element that transmits, through compression, the weight of the structure above to the foundation. For the purpose of wind or earthquake, column may be designed to resist lateral forces. Columns support primarily axial load but usually also some bending moments.

Columns are structural members in buildings carrying roof and floor loads to the foundations. Columns primarily carry axial loads, but most columns are subjected to moment as well as axial load. The load at the columns is distributed directly on the column of down story or at the foundation of each type of the column. (T.J.MACGLEY and B.S.Choo, 1990)

Short columns

When the ratios and are both less than 15 for braced columns and less than 10 for unbraced columns.

Slender columns

When the ratios are larger than the values given above.

Where b is the width of the column cross-section, h is the depth of the column Cross section,   is the effective height in respect of the major axis and   is the effective height in respect of the minor axis.

Practical Design Provisions

The minimum number of longitudinal bars in a column section is four (4) for rectangle and six (6) for circle. Percentages of steel ranging from 0.4% to a maximum of 6% for vertically cast Columns. The minimum percentage of reinforcement is given in Table 3.27 of the code for both grades 250 and grade 460 reinforcement as

Where the area of steel in compression and Acc is the area of concrete in compression

A. Requirements for Links

1. The diameter of links should not be less than 6 mm or   of diameter of the largest longitudinal bar.

2. The maximum spacing is to be 12 times the diameter of the smallest longitudinal bar.

Short Braced Axially Loaded Columns

Both longitudinal steel and all the concrete assist in carrying the load. The links prevent the longitudinal bars from buckling. The ultimate load N that a short braced axially loaded column can support is:

. Where Ac is the net cross-sectional area of concrete in the column and sc is the area of vertical reinforcement. Thus in the design equation for short columns the effect of the eccentricity of the load is taken into account by reducing the capacity for axial load by about 10%. The ultimate load is given by the expression.

Biaxial Loaded Column with Bending

When it is necessary to consider biaxial bending and in the absence of more rigorous calculations, symmetrically reinforced rectangular sections may be designed to withstand an increased moment about one axis.

Partial Factor of Safety

Other possible variations such as constructional tolerances are allowed for by partial factors of safety applied to the strength of the materials and to the loadings. In practice these values adopted are based on experience and simplified calculations.

Partial factors of safety for materials

Design strength

With fk =fm -64s, where fk = characteristic strength, f m = mean strength and s =standard deviation.

The factors considered when selecting a suitable value for Partial Factors of Safety for Materials are: the strength of the material in an actual member; and the severity of the limit state being considered. The recommended values for partial factors of safety for materials are given in table below although it should be noted that for precast factory conditions it may be possible to reduce the value for concrete at the ultimate limit state (Neville, 1981)

2.4.1.5. Reinforced concrete footing design

Pad footing

The general procedures to be followed while designing for pad footings are as follows:

Calculate the size of the footing considering allowable bearing pressure and service load

Calculate the bearing pressure for ultimate loads

Check for punching shear

Calculate reinforcement for bending

Check shear at critical section

Calculate the plan area of the footing using serviceability loads.

. Determine the reinforcement areas required for bending using ultimate loads

Check for punching, face and transverse shear.

Where N=1.0GK+1.0QK (serviceability load).

Design for reinforcement

Design moment (m)

Earth pressure where and N=1.4GK++1.6QK

Ultimate design moment

And then

Design for shear

Punching shear

Punching shear perimeter (critical perimeter) =Pcolumn+8 ×1.5d where P is the perimeter of the footing.

Area within perimeter is = (c+3d) 2

Ultimate punching force, V, is V = load on shaded area

Design punching shear stress, = and calculate the design concrete shear stress, c is

× value of design concrete shear stress.

Face shear

Maximum shear stress occurs at face of column. Hence : Vmax< permissible (0.8×√fcu).

Transverse shear

Ultimate shear force (V) = load on shaded area = Ps ×area and design shear stress

v= ≤ c if this condition is verified there will be no transverse shear within the structure.

Cracking check

The crack check is satisfactory if the bar spacing is not to exceed 3d or 750 mm.

Limit state

Materials

Concrete

Steel

Ultimate

Flexure

1.5

1.115

Shear

1.25

1.115

Bond

1.4

Serviceability

1.0

1.0

Table 2.4Table: Partial factors of safety for loads (γf)

Values of partial factors of safety applied to materials   CITATION modeste \l 1033

(Macdonald, 1994)

Errors and inaccuracies may be due to a number of causes such as design assumptions and inaccuracy of calculation; possible unusual load increases; unforeseen stress redistributions and constructional inaccuracy. These cannot be ignored, and are taken into account by applying a partial factor of safety on the loadings, so that

Design load = characteristic load x partial factor of safety (γf)

Where characteristic load = mean load ± 1.64 standard deviations

The value of this factor should also take into account the importance of the limit state under consideration and reflect to some extent the accuracy with which different types of loading can be predicted; and the probability of particular load combinations occurring.

Recommended values are given in table below. It should be noted that design errors and constructional inaccuracies have similar effects and are thus sensibly grouped together.

Load combination

Ultimate

Serviceability all ((

,

Dead(

Imposed(

Earth and Water(

Wind(

Dead and imposed(+Earth and water

1.4(or1.0)

1.6 (or 0.0)

1.4

-

1.0

Dead and wind(+Earth and water

1.4 (or 1.0)

-

1.4

1.4

1.0

Dead , imposed and water (+Earth and water

1.2

1.2

1.2

1.2

1.0

Values of partial factor of safety for loadings

Table 2.5 Values of partial factor of safety for loadings (γf) ((Nelson, 2005)

The lower values in brackets applied to dead loads or imposed load at the ultimate limit state should be used when minimum loading is cri

CHAPTER 3: METHODOLOGY

3.1 Introduction

This chapter explains the This study area data will give an overview of the methodology to be followed and kind is described in this. it narrates the methodology detailing how they conducted their research to get data and variables in study.

3.2 DATA PRESENTATION & COLLECTION TECHNIQUES

3.2.1. Overview of study area

This project takes place in exactly EASTERN province, BUGESERA district, Rilima sector seen in a map (produced from google map data shown below)!

Figure 2 topographic map of Rilima site

3.2.2. Geotechnical data

Geotechnical data have been collected using the Dynamic Cone Penetration test. The Dynamic Cone Penetration Test provides a measure of a material’s in-situ resistance to penetration. Is done by counting the number of blows per 10 cm graduated on rod and record data. The

No

Penetration depth(cm)

Number of blows

Allowable bearing capacity(KN/m2)

1

0

0

0

2

10

3

2.9

3

20

8

11.1

4

30

27

39.6

5

40

31

73.5

6

50

28

105.9

7

60

33

145.2

8

70

50

205.5

9

80

107

334.7

Table 3.1 Record of dynamic cone penetration test

qa= 0.32 * N * RDf2 *   * Sa *100 where B 1.2m

RDf2= depth correction factor (1+0.33)

Df= distance from ground level to hard soil

B= foundation width (1.3m)

Sa= permissible settlement (20 for high raised building)

N= number of blows

3.2.3. Architectural design

Figure 3 Floor Plan

3.2.3. Structural data

Column design

The influence area of a column in structural design refer to the portion of a floor slab or structural element that contributes load to that particular column.

Column(220mm*220mm)

Height of column= 3500mm

Slab design

Slab thickness= 150mm (According to building codes eg: ACI 318, IS 456) Practical guidelines for Minimum slab thickness

Thickness of the slab lies in the range between

$8.78 \leq hf \leq 17.5$ depth of slab =15cm

Msxp = &sxnl2x positive moment in the direction of Lx at the mid span

Msyp = &synl2x positive moment in the direction of Ly at the mid span

&sx=0.099 &sy=0.051 βsx 0.050 βsy=0.032

3. Beam design

Beam(400mm*250mm)

Self-weight of concrete= 24KN/m3

4.Foundation design

Every structure needs a foundation. The function of a foundation is to provide a level and uniformly distributed support for the structure.

Dimensions(section) Df=0.9m

B of footing=1.3m

B of foundation =0.5m

CHAPTER4:DATA ANALYSIS RESULTS AND INTERPRETATION

4.1 Introduction

This chapter deals with interpretation according to the findings in the design of the structure. The main consideration in this design is to ensure against the failure of super-structure and to check if it has the ability to carry the anticipated loading with an adequate margin of safety, so that it does not deform excessively within service.

4.2 Analysis and interpretation

4.2.1. Structural drawing

Drawing of floor plans

Figure 4 Ground floor

4.2.2. Structure elements design

4.2.2.1. Slab design

Slab is designed by considering critical panel from figure of structural plan.

Design parameters

In design, British Standards should be followed. Here are the values from BS: 8110-1997

The self-weight of the concrete: 24KN/m3

Unit weight of the wall: 18KN/m3 (with burnt bricks made in clay

The load due to the finishes: 1.5KN/m2

The live loads for the studio building: 2KN/m2 (BS 8110, 1997).

During design, the ultimate design load is the combination of the live load and dead load.

To get the dead load the following member dimensions are very useful.

For the slab:

Thickness of the slab lies in the range between

For all the reinforced concrete members, the cover to be consider is 25mm slab design

Data to be used

Imposed loads (QK) = 2.0 KN/m2 fy= 460N/mm2

Depth of slab = 150mm = 15cm Concrete cover = 25 mm

Finishes = 1.5KN/m2

fcu= 30 N/mm2

Calculation of Loadings

Self-weight of the slab= 24*1*1*0.15=3.6KNm2

The total dead loads on the slab are the ∑of the self-weight of the slab and the finishes,

Total dead load (GK) =3.6+1.5=5.1KN/m2

The ultimate design load due to the self-weight of the slab and the finishes,

N=1.4Gk+1.6QK, N= (1.6*2) +(1.4*5.1) =10.34KNm

The total ultimate design load per 1m of width for the slab

N= 10.34KN/m2 × 1m = 10.34KNm

N= 10.34KN/m2 × 1m = 10.34KNm IS TWO WAY SPANNING SLAB

Figure 5 critical slab panel

Figure 6 critical panel & Influence area of critical column

Thickness of the slab lies in the range between

$8.78 \le hf \le 17.5$, let take depth of slab =15cm

N= 10.34KN/m2 × 1m = 10.34KNm

Msxp = &sxnl2x positive moment in the direction of Lx at the mid span

Msyp = &synl2x positive moment in the direction of Ly at the mid span

&sx=0.099 &sy=0.051 βsx 0.050 βsy=0.032

Among all these moments exerting on the slabs, the moments to be used is that exerting on this Panel because it is the greatest and its details will be apply to all slab:

Then, for the support

Msxn=0.050*10.34*3.512*3.512=6.34KNm

Msyn=0.032*10.34*3.512*3.512=4.08KNm

For the mid span

Msxp=0.099*10.34*3,512*3.512=12.62KNm

Msyp=0.051*10.34*3.512*3.512=6.5KNm

For the support

The moments near the support is the hogging moments which means that the tensile stresses are acting at the top of the slab, thus the tensile reinforcements should be at the upper.

Reinforcement in the small span (Lx direction)

Mx =6.1KNm

The effective depth d=h-cover- Φ/2 =150-25-12/2=119mm

Where Φ is assumed reinforcement to be at the bottom=12mm.

The effective width b=1m=1000m, let calculate the lever arm Z,

Mu =0.156 fcubd2 = [0.156x30x1000*(1502)x

Mu =105.3KNm

= =0.009

If (M=6.1KNm) <(Mu=105.3KNm) and K=0.009<0.156, thus no compression reinforcement required

The tensile reinforcement

0.98d>0.95d,

then z=0.95d=0.95*119=113.05mm

The lever arm=113.05mm

=106.27mm2

The minimum area of reinforcement for high yield steel, =0.13%BH.

=

As min >As 195mm2<106.27mm2, thus we provide the reinforcement from As.

The tensile bars provided are T10@300mm with =261mm2(at the top) 13bars

Here steel of 10mm diameter are used at 300mm spacing

Reinforcement in long span (Ly direction)

For the mid span in ly direction

Mx =12.08KNm

The effective depth d=h-cover- Φ/2 =150-25-12/2=119mm

let calculate the lever arm Z, d 150mm

= =0.0178

As K=0.0178< 0.156, thus no compression reinforcement required in Ly direction.

The tensile reinforcement:

The lever arm

0.98d>0.95d, then z=0.95d=0.95*119=113.05mm

If (M=12.08KNm) <(Mu=105.3KNm) and K=0.009<0.156, thus no compression reinforcement required

=368.33mm2/m

The minimum area of reinforcement for high yield steel,

=0.13%bh =

thus, we provide the reinforcement from . The

Tensile bars provided are T12@250mm with =452mm2. 21bars of short span

Here steel of 12mm diameter are used at 250mm spacing

Design for Shear

From table. Bvx= 0.43 and βvy =0.33

Vsx = βvx×n×lx= 0.43×8.996×3.512= 13.58KN (most critical) and Vsy= βvy×n×lx=0.33*8.996*3.512=10.42KN

The corresponding value is 0.67

=1.06

Therefore, the beam is satisfactory to shear, no shear reinforcements required.

Deflection check

Basic span/d=26 from (Table 3.9 of BS 8110 part)

and

So MF=2

; Thus 54 , therefore the floor is safe about deflection

Crack control

Within BS 8810 Part 1 clause 3.12.11.2.7, this clause; slab states that the clear distance bars should not exceed 3d or 360 mm. Our spacing =250 mm 360 mm ok. So our slab is safe for cracks.

4.2.2.2 Beam design

The most loaded beam is that has a large influence area on it.

Figure 6 Critical beam A-B

For the first span

The length of the span L=3.551m

The self-weight of the beam=0.25 0.55 24=3.3KN/m

The self-weight of the slab= (0.11 24 6.35)/3.551=4.72KN/m

The self-weight of the wall= 0.2 2.4*2 18=17.28KN/m

The total finishes=1 6.35/3.551=1.788 KN/m

The total dead load per unit length =3.3+4.72+17.28+1.788=27.08 KN/m

The live load per unit length is =

Thus, the ultimate load exerting on the first span and fifth span is given by n=1.4gk+1.6qk

For the second span

Influence area (A) is 9.94m2

The length of the span L=4.566m

The self-weight of the beam=0.2 0.55 24=3.3KN/m

The self-weight of the slab= (0.11 24 9.94)/4.566=5.74 KN/m

The self-weight of the wall= 0.2 2.4*2 18=17.28KN/m

The total finishes=1 9.94/4.566=2.17KN/m

The total dead load per unit length = 3.3+5.74+17.28+2.17=28.49KN/m

The live load per unit length is =

Thus, the ultimate load exerting on the second span is given by n=1.4gk+1.6qk

For the third span

Influence area (A) is 11.09m2

The length of the span L=4.883 m

The self-weight of the beam=0.2 0.55 24=3.3KN/m

The self-weight of the slab= (0.11 24 11.09m2)/4.883m= 6.41KN/m

The self-weight of the wall= 0.2 2.4*2 18=17.28KN/m

The total finishes=1 /4.883=2.27KN/m

The total dead load per unit length = 3.3+6.41+17.38+2.27=29.26KN/m

The live load per unit length is =

Thus, the ultimate load exerting span is given by n=1.4gk+1.6qk

For the fourth span

Influence area (A) is 5.16m2

The length of the span L=3.2m

The self-weight of the beam=0.25 0.55 24=3.3KN/m

The self-weight of the slab= (0.11 24)/3.2 =4.257 KN/m

The self-weight of the wall= 0.2 24*2 18=17.28KN/m

The total finishes=1 5.16/3.2=1.61 KN/m

The total dead load per unit length = 3.3+4.257 +17.28+1.61=26.447KN/m

The live load per unit length is =

Thus, the ultimate load exerting on the second span and fourth span is given by

n=1.4gk+1.6qk

Design of the flanged beam

,

h , let take h=400mm

D=h+cover+mainbar/2=links

D=400-25-16/2+8=375mm

 For the section of T bean

1/3 of the beam span =1/3 (517) = 172.3mm

Bf= 1/2 of the distance between beams =1/2(4.57) =2290mm

12. $hf + bw$ (for T $section$) =(12*15)+25=2050mm

Mmax = =

MRC=0.156fcubd2

MRC=0.156*30*106*172.3*3752

MRC=1.133KNm

MK= =51.7*106/30*172.3*3752=0.071KNm

=376mm

Figure 7 Bending moment diagram of critical beam (from prokon)

Hf=150mm span=4.883m

D=550mm

d=400mm bw=250mm

fcu=30N/mm2 fy=460N/mm2

Moment Applied(M)=90.38KNm (at the mid span

Breadth of flange=bw+ = 250+ =1226.6mm

Resisting Moment(MRC flange)=)

MRC=)

MRC =628417845Nmm

MRC =807.23KNm

MBeam is designed as rectangular

K= = =0.009

K<0,156, hence the beam is designed as singly reinforced rectangular beam

=269.44mm

level arm(Z)≥0.95d=380mm

Area of steel required= = =767.58mm2

Area of steel provided=791mm2

the steel provided are 7T12

Here 7 steel of 12mm diameter are used.

Design for shear

Ultimate shear force(v) =123.69KN

Shear stress(vu)= <4.8N/mm2

=0.85 =1

Sv (minimum spacing between links=

The spacing of links Sv should exceed 0.75d

Using links of 8mm diameter

The area of two legs=

Figure 8 Shear force diagram of critical beam (From Prokon)

Check for deflection

Basic span/d=26 from (Table 3.9 of BS 8110 part)

and

26*1.28=33.28; Thus 33.28 , therefore the floor is safe about deflection

Crack control

1.

2.for fy = 460N/mm2, d slab depth =150mm

Then our beam is satisfactory for cracks

4.2.2.3 COLUMN DESIGN

Effective column height

Design code: BS8110 - 1997

General design parameters:

Given: Column height= 3.5m Column section= (200*200) mm

Lx = Lex/h Ly=ley/b lex=βx.lo=0.7×3.5=2.45m

A column may be considered braced in a given plane if lateral stability to the structure as a whole is Provided by walls or bracing or buttressing designed to resist all lateral forces in that plane. It should otherwise be considered as unbraced

Check the slenderness of the column

For the braced if the ratios , are less than 15 the column is said to be short if not they are slender. For the unbraced if the ratios , are less than 10 the column is said to be short if not it is slender.

And b=200mm

And h=220m

Clear height between end restraints

Are equal to 11.13 (lx = 11.25 < 15, ly = 12.25 < 15 and respectively both are less than 15 so they are short as the designed column is braced

Figure 9 Influence area of critical column

Column is short braced

Determination of loads on column

loading area of column=

slab (permanent loads) = 1.4*0.15m*24KN/m3*8.311m2=41.88KN

live loads from the slab = 2KN/m2*1.6*8.311m2=26.59KN

load from beam=1.4*0.25*0.51*4.566m*24=20.08KN

load from the wall masonry=1.4*0.2*2.4*1*3.6*18=43.54KN

on floor of column=1.4*0.2*0.2*3.5*2.4=0.47KN

Load from slab roof=1.4*0.15m*24KN/m3*8.311m2=41.88KN

Ultimate loads(N)= (41.88 +26.59+20.08+43.54)2+(0.47*3) +41.88=307.47KN

Required steel reinforcement

N=

Acc=b*h=200*200mm=40000mm2

5T12 are provided

Here 5 steel of 12mm diameter are used.

4.2.2.4. Foundation design

Clause 3.3.1.4 of the B.S code states that the minimum cover should be 75 mm if the concrete is cast directly against the earth and the minimum grade of concrete to be used in foundations is grade 35.The soil bearing capacity used has been related to who stated that the soil of But are region is hard clay (MININFRA, 2012) And it has the soil bearing capacity which varies between 300-600Kpa/mm2

The compressive strength is 35N/mm2

Bearing pressure of the soil is 145.2KN/m2

Total dead load from the 3 floors up to the foundation = 321.02KN

The total live load from the 3 floors up to the foundation =77.98KN

The ultimate axial load on the footing =423.933KN

Calculations

The assumed the overall depth of footing (h) =800mm

Footing self-weight =one tenth of the total ultimate axial load on footing=

423.933/9=47.103KN

The total dead load including the self-weight of the footing = (229.3KN +47.103kN)

=276.403KN exerting on the soil.

The total serviceability load=272.2KN +48.73KN =320.93KN

The required area of the footing is calculated by serviceability limit state,

The side of the footing is

Side A=0.97

Side B=1.3

let us take 1.3m as area of 1.69m2

For the ultimate axial loads = 423.933KN

The earth pressure = (423.933KN /1.69) = 256.17KN/m2

Punching shear perimeter (critical perimeter)=Pcolumn+(8*1.5d) where p is the perimeter of the footing=

Area within perimeter =(C is breadth of column and d is the effective depth of footing

=

Punching shear= earth pressure (l2-area within perimeter)

=

Check the shear stress at face of the column.

Face shear

Shear stress vc

As the maximum shear stress at face of the support is less than 5N/mm2, no shear reinforcement required.

Let check if the assumed thickness of the footing is adequate.

As the axial load from the column is acting as concentrated, it may cause the excessive punching shear force. To ensure if those punching shear stresses are within the allowable limit the thickness of the footing is sufficient.

Bending reinforcements

By considering the thickness of the footing to be 400mm and the assumed reinforcement to be T16, the effective depth d ,

Design moment(M)=

Where PS= punching shear

L= length of footing

Let check if the compression reinforcements if are needed,

No compression reinforcement required because K<0.156

The tensile reinforcement in the footing,

= 309.68 mm 0.95d

for As provided=2680mm2

Number of steel=

4.2.2.5 Design of Ramp

Figure 20: ramp plan

Calculation of ramp loading

Live loads on Ramp = 2KN/m2 (from BS6399-weight of building materials)

Loads of finishes =1.5KN/m2

Unit weight of concrete=25KN/m3 C=25mm

And the overall depth (h) =150mm

d=h- C - =150-25-   =120mm

Design load = 1.4Gk + 1.6Qk

Self-weight of ramp + finishes = (0.15m x 25KN/m3) +1.5KN/m2= 5.25 KN/m2

Design load (N) = (1.4 x 5.25) + (1.6 x2) = 10.55KN/m2

Ultimate design load (F) =10.55KN/m2 x 1m = 10.55KN/ m

Design moment

W=F*L= 10.55KN/m × 1.2 m = 12.66KN

Design moment,

Ultimate moment= Mu =0.156 fcuxbxd2 = [0.156x30x] x =67.392 KNm

For M < Mu, as   KN/m < 67.392 KNm, no compression reinforcement required.

Main steel

no compression reinforcement required.

The lever arm Z,

The lever arm   (Critical)

/m

/m

For AsSo let provide T10@300mm for ASP = 262 mm2

Secondary steel

While no compression reinforcement required, the secondary reinforcement is provided

Based on minimum steel area which is /m,

So provide T10@300mm for ASP =262 mm2

Shear reinforcement

V=WL/2=   KN

, By interpolation value of /mm2 is 0.56 /mm2)

/mm2

/mm2, therefore no shear reinforcement required.

 Check for deflection

Basic span/d=26 from (Table 3.9 of BS 8110 part 1)

and

Hence M.F is taken as 2.0

(Ok) Therefore the ramp is safe about deflection

 check crack on ramp

Maximum spacing between bars should not exceed the lesser of 3d (3*120 mm) or 360 mm. Actual spacing= 300 mm main steel and secondary steel (300<360). Ok (no crack on ramp)

Figure 20: Details of Ramp

4.2.4 Environmental Impact Assessment

This proposed model village is to be constructed on the whole coverage of the reserved soil at Rilima cell.

The objective of this proposed project is to construct the new model village for facilitate population of the area for accommodation and services. The project will bring significant environmental, social and economic benefits through communication also have substantial negative impacts on communities and the natural environment.

To comply with the environmental protection law, in this project we have included in the study, to carry out an environmental and social management study.

Environment impact assessment is an assessment of the possible positive and negative impact that a proposed project may have on the environment.

During the project operation, some preventive and security measures should be put in place on one hand and need to be set and respected on the other hand.

4.2.4.1 Identification of Positive &Negative impacts of the project on the environment

Positives Impacts

Local employment opportunities both for men and women;

The demand for laborers will increase as the contractor is expected to employ Hundreds of local labor as workers, teachers, nurses, accountants, engineers, etc.

Increase in the income of the population working for the project;

The local markets will provide food, clothing, and other consumables for the Workforce of the project;

Population living in the vicinity of the project site can benefit by starting small rural enterprises, such as selling food or providing other services;

The project will enhance geographic and social mobility;

Health and living standards will be improved, etc.

Below is detailed Negative impacts & its respective mitigation measure:

S/N

Impacts

Assessment

Mitigation measures

1

Risk of increase of COVID 19, and HIV/AIDS and other

Sexually

Transmitted Diseases

Increase in activities and interaction of workers and communities may lead to the increase of Covid-19 & HIV/AIDS and other Sexually Transmitted Diseases in the project area

The client will collaborate with the Local Health Centers to provide awareness and education on Covid-19, STDs and HIV/AIDs and will ensure the provision of Hand sanitizer, masks, Hand Washbasin, soap and water, condoms

to project workers at all

time

2

Risk of Destruction of fauna and flora and Impacts on landscape aesthetics during operation phase.

The vegetation coverage will be removed and destroyed, where operation will take place

During construction works, the developer will take care of vegetation and will be rehabilitated after the project is ended by Landscape the site by planting grass and trees at all disturbed areas

3

Risk of conflicts with communities during land acquisition

Risk of conflicts with communities during land acquisition will be

revealed and foreseen

Avoiding conflicts by involving all stakeholders in land acquisition.

The expropriation of other properties and lands should be based on the applied new law and should take into account the leap in property market prices and the payment of the afore said before starting the works

4

Safety issues during construction works including accidents and injuries to workers

Some of the workforce on this project or other involve in project may face accident due to tracks and other vehicles movement and also by using hand tools and equipment's.

The workers will be fitted with appropriate person protecting Equipment (PPE) which are: Ear muffs, Gloves, Helmets, Dust masks, safety boots, Eye goggles;

And Engage workers to be self-control.

5

Air pollution by dust and gases

Workers & population in villages may be affected by dust during construction works. also Machinery & vehicles will cause air pollution by the emission of carbon dioxide and other greenhouse gases.

Reduce gas emission from generators used for combustion.

Monitoring of the dust level by spray water when necessary throughout working hours;

Aggregate plant and equipment are fitted with catalytic converters to reduce air pollution;

Provide dust masks for the person in dust generation areas.

Engage workers to be self-control.

6

Noise and vibration impact

The increase of noise and vibration level would be site specific and will impact the population living and working close to the project

Works especially those that produce noise and excessive vibrations like compaction and crushing works should be executed

7

Public Health and occupational Safety

Risk of waste to affect the worker & surround area.

Ensure proper solid waste disposal and collection facilities.

Ensure dustbin cubicles are protected from animals. Rains and well covered.

Provide suitable (PPE) for all person.

8

Site cleanness, hygiene and sanitation facilities; effects of generated sewage

Waste water from temporary toilets and other sanitation facilities of workers will be Generated.

Risk of healthy & hygiene related disease.

The client should provide proper sanitation for the staff, and make sure that the hygiene & sanitation rules and regulations are well followed to avoid waterborne diseases due to poor hygiene

Ensure proper solid waste disposal and collection facilities;

CHAPTER 5: CONCLUTION AND RECOMMENDATION

5.1 CONCLUTION

Different projects were conducted for Model Village such as, Health Post, Minor Market, School, and Accommodation Houses; this project focused on designing accommodation houses because execution is not a simple work activity in this project. By the beginning of this project, he had come up with the objective of a feasibility study of an affordable model village at the RILIMA site in BUGESERA district, and that objective has been reached because all the structural members had been well designed and have been satisfactorily designed to overcome the loads that will be applied to each and every structural member since it has the specific ultimate load to carry out. Designing members such as a roof, slab, beam, column, stairs, lamp, and the foundation itself were designed-all made of reinforced cement concrete, R.C.C.

Briefly, the structural design involves computation of the loads and providing reinforcements required to resist against the loadings by considering the dead and the imposed loads in each member. The loadings have been calculated referring to the architectural drawings and code of practice; British standard has been used. Details of reinforcement for each structural member have been provided, such as the number of bars, their size, and spacing, so that these can be made use of during the implementation of this project, with the guarantee that once this project is executed with the use of all specifications written in this project report, the stability of every member making up the entire building will be guaranteed. This project gives the ultimate gross pressure or load-bearing capacity of the soil after designing the different elements of the building. Then, after verification, we find that the load-bearing pressure is less than the bearing capacity of the soil, which means our building is safe. Unfortunately, some of the works have not been fully finished due to a shortage of time; hence we excuse such a case. Given adequate time, this would have been accomplished by now but are not finished now so that whoever may want to continue and put the road design installation of electricity and water supply.

5.2 RECOMMENDATION

We would like, based on the outcomes of this project, to recommend the following:

The enhancement of the way of learning the engineering software since most are used in final year project and in daily life of the engineer.

soil test of the topics related to structural design as a primary work of the final year project.

• To ULK_Poltechnic Institute to increase the organized field visits for getting tangible knowledge and skills for linking the class trainings and the reality on the field.

• For better researching ULK_Poltechnic Institute would bring the laboratory test of civil engineering, And improve the manner of teaching engineering soft wares.

• Possibly BUGESERA district to implement this designed project with any additional design other than that we conducted.

• Students in the future at ULK should put more effort into studying civil engineering software; after all, it is their foundation.

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Appendix 1: Table Used

Table 6 section area per meter width for various bar spacing (mm2)

Table 7 Tension reinforcement's modification factor

Table 8Cross-sectional areas of groups of bars (mm2)

0

0.1

0.2

0.3

0.4

0.5

1

0.88

0.77

0.65

0.53

0.42

0.50

Table 9 Values of beta (β) due to N/bh fcu

Table 10 Values of beta due to the end condition of the column

Other National Concrete Cover Requirements

Country

Concrete Code

Range of Concrete Cover

(mm)

UK

BS:8110

25-50

Load combination

Ultimate

Dead

Imposed

Earth Water

Wind

Serviceability All

Dead &Imposed (+Earth Water)

1.4

(or1.0)

1.6or 0.0

1.4

-

1.0

Dead&Wind(+Earth Water)

1.4(or1.0)

-

1.4

1.4

1.0

Dead&Imposed&Wind

1.2

1.2

1.2

1.2

1.0

Table 11 National codes also specify minimum

Table 12 : Bending moment

v

Table 13 Shear force coefficient for uniformly loaded rectangular panel

APPENDIX2 ARCHITECTURAL DRAWINGS

Figure 10 GROUND FLOOR

Figure 11 FIRST STORY

Figure 12 SECOND STORY

Figure 13 FRONT ELEVATION

Figure 14 BACK VIEW

Figure 15 RIGHT VIEW

Figure 16 LEFT VIEW

Figure 17 CROSS-SECTION

Figure 18 LONGITUDINAL SECTION

Figure 19 PERSPECTIVE 1

Figure 20 PERSPECTIVE2

EXCLUDE CUSTOM MATCHES	ON
EXCLUDE QUOTES	OFF
EXCLUDE BIBLIOGRAPHY	OFF