

# DESIGN REPORT: CONSTRUCTION OF RESIDENTIAL BUILDING, PLOT NUMBER: 2874

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3. **PROJECT NAME:** PROPOSED PROJECT OF CONSTRUCTION OF RESIDENTIAL BUILDING

**PURPOSE** : RESIDENTIAL HOUSE

**PROJECT CONSULTANT:** Eng. PHILIPPE DUFATANYE



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## 1) DESIGN CONCEPT

### 1.1 Objectives and nature of the project

The country has experienced a rapid growth over the past decade. This growth has consequently increased the capacity of the general population social economically. The increase of the population leads to an increase of an increase of the demand of houses. And nowadays Rubavu District is experiencing the development of residential houses.

This project will be executed in one of the secondary cities of Rwanda(Rubavu) to develop housing and unplanned settlement, Growth of the city, socio-economic conditions, Economic Development Status.

The City of Rubavu is rapidly growing not only in terms of population size but also in terms of economic activities. This growth requires the development of housing infrastructures to accommodate the people with low and medium income. The sustainable housing of people contributes to the economic development of the City as the city of Rubavu has been struggling with the crisis in informal settlement over the last 2 decades. However it is commonly known that good conditions of life consist only in good residences and good infrastructures.

- ✓ *This project aims to contribute to reducing the gap of modern housing by providing a “Residential building” in a residential area where existing settlements have already developed with modern construction complying with the new District Development plan/Physical Plan. The main objective of this project is to contribute to the construction of an residential building by minimizing the use of surface ground and occupying the upper floors for economic purpose of the scarce land for construction.*

### 1.2 How the project complies with the zoning guideline of this area

For that purpose, the project will include the following:

- Residential building that will accommodate friendly and in an environmental framework about 2 families in two storey building, with 5 people per family. The total population in the building is 10 people.

**Note:** As this area is developed with modern building for people with high/medium income, this project will serve as contributing to the reducing of informal settlement in the city of Rubavu.



*Fig 1: picture of existing structures surrounding the project*

### 1.3 PROJECT SITE LOCATION AND SURROUNDINGS

The project is on the **Plot 2874** located in Rubavu District, Gisenyi sector, Mbugangari cell, Gasutamo Village. This project is surrounded by new development projects as the new infrastructures are being development,



*Fig 2: Landscape of the proposed building*

#### 1.4 PLOT SIZE

The project is on the **Plot No 2874**, the building itself is on the plot area of 487.5sqm, the total areas of all the floors is **565.31 sqm** hence the Floor Area Ratio (F.A.R) of  $0.632 < 1.4$ . ok

## 2. Design Proposal

### 2.1 Design considerations with the site

This building has been designed using manuals of the Rwanda Building Control Regulations. The site has a slope that is not so high ( $< 3\%$ ) and that makes it to be comfortable to the environment. The topography of the site show that there will be no more cuts/fills volumes, the use of manual labour will be advantages as to promote the employment in the area in order to complement with the EDPRS 2 targets about fighting poverty.

The Architectural and structural designs specifications have been considered by the Registered as Civil Engineer, DUFATANYE BIZIMANA PHILIPPE, with Reg No: A194/EC/IER/2013.



2. 2 Accessibility

The project is designed for maximum of 2 families as the building is a two storey building the ground floor is comprised of 2 compartments of 4 bed rooms each. The building is accessible to the roads in both sides of the building.



Fig 3: Accessibility to the building

2.3. Green Space

In accordance to the client’s desire to provide development that gives a feel of openness. For this purpose 30% of plot has been allocated to the landscaped gardens for beautifulness purposes. Due to the high solar reflective index of the pavement materials, the provision of trees and greening in the parking area is necessary during the execution of the project.

2.4. Occupancy

It is projected that the maximum number of users that will be occupying the space during operation is 10 persons in two families, upper and ground floor respectively.

2.5 Implementation Schedule

The project is presumed for completion within an estimated period of 6 months as detailed below.

Period for Implementation (8 months)

		Months		
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S/N	Main Activities	1	2	3	4	5	6	7	8
1	Earthwork in substructures								
2	foundation works, Setting out and preparation of frameworks								
3	Reinforced concrete works,								
4	Walling (external & internal walls)								
5	Electrical and plumbing works								
6	Wall finishing								
7	Flooring and tiling								
8	Roofing, ceiling, and external works								
9	Final handover and occupation phase	This will be done after 6 months from the provisional handover							

Table 2: Implementation schedule for the construction of apartment building.

The construction phase of the project will be implemented in Eight (8) months after which the project will start entering into an occupation/management phase. The total cost of construction of the building is approximately **Rwf 80,008,640**

## 2.6 Alternatives that have been considered

### 2.6.1 The nature of housing

Different options have been considered at various stages of the project planning, implementation, commissioning and habitation. Designs of **residential** portray a distinct elaboration of modern architectural designs for the **residential building**

Most developing countries are faced with a problem of poor and unplanned urban development which results into slums and a big challenge to provision of basic infrastructures like water and sanitation, electricity. **The residential building** is in line with Rubavu District Development plan or Physical Plan.

The construction materials that are proposed to be used in this project are readily available and will thus result in reduced cost of the residential house.

### 2.6.2 Energy Sources.

The most appropriate energy source considered is the electricity from the Rwanda energy group (REG) the most energy supplying utility in the country.

## 4. ENVIRONMENTAL CONSIDERATIONS

### 1.1. BACKGROUND

The Government of Rwanda takes environmental protection very seriously and has taken significant steps to ensure a balance between economic development and environmental protection, as well as to prevent environmental degradation. Notable among the measure taken is the ban of manufacturing and use of polythene bags. The Government has established a clear legal and institutional framework for environmental protection. Rwanda Environmental Management Authority ([REMA](#)) is the principal agency responsible for the management of the environment in Rwanda and coordinates, monitors and supervises all activities in this field.

In addition, projects that affect the environment are subject to an **Environmental Impact Assessment (EIA)** prior to obtaining authorization for their implementation. Before commencing implementation of business projects, investors are required to cross-check whether their projects are required to undergo an EIA.

The Rubavu City is rapidly growing not only in terms of population but also in terms of economic activities. This growth requires the development of Housing infrastructures to facilitate accomodation of people and goods within the City and beyond.

It is against this situation that the developer intends to build this particular Apartment to promote the residential facility in the area of study.

Rwandan law on environmental protection demands that the implementation of any infrastructure project as complex as the construction of roads must be preceded by an Environmental and social impact Assessment\_ESIA.

The environmental and social impact study intends to make a contribution to share this project to comply with the regulations on the environment during all phases of its execution. On the other hand, it will identify in advance the likely adverse environmental and social impacts and propose mitigation measures for these impacts that will be integrated into the project to maximize the positive and minimize the negative effects of different components of the environment.

### 1.2. THE PURPOSE OF THE ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT

Projects with identified adverse impacts on environment call for a full EIA process for mitigation measures and thus the Ministerial Order N°004/2008 of 15/08/2008 establishing the list of works, activities and projects that have to undertake an environmental impact assessment highlights some projects as follows; construction and repair of international and national roads, large bridges, industries, factories, hydro-dams and electrical lines, public dams for water conservation, rain water harvesting for agricultural activities and



artificial lakes, large hotels, public building which accommodate more than one hundred daily, extraction of mines and public land fills among others.

Carrying out EIA process enables implementation of environmental safeguards to mitigate significant impacts caused by execution of projects which avoids ecological damage and large-scale irreversible loss of natural resources.

However, various projects have different level damage or pollution to the environment depending on their activities, size and products among others.

- The environmental impact assessment is a procedure that examines the consequences, both positive and negative, that a project or program development will cause on the environment and to ensure that these consequences are properly taken into account in the project or program.
- Impact assessment constitutes the essential tool for the environmental assessment of the works and development projects.

The environmental assessment refers to the entire process for:

- Analyzing the environmental effects of a proposed development project, program development, strategic action,
- measuring their environmental acceptability,
- Informing decision makers.

It also aims to:

- Improve decision by taking into account explicit and selective environmental considerations ;
- Provide a solid foundation for managing environmental impacts of management actions ;
- Enable citizens to express their views on the likely changes in their living environment ;
- Promote the integration of fundamental objectives of environmental protection and sustainable development ;

The main purpose of this Environmental and Social Impact Study is a contribution to good project design by changing some potential negative impacts or mitigation by applying modifications or additions to certain components of the initial draft. And improving the design project with minimum impact can reduce potential impacts to a minimum cost (ADB, 2003). More specifically, it contributes to :

- Establish the environmental baseline on bio-physical, socio-economic aspects of the project;
- Identify potential negative impacts and propose potential mitigation measures;
- Identify impacts with positive effects on the environment and propose measures to optimize amplification benefits of the project;
- Propose a plan for implementation of the proposed measures or environmental management plan.

Briefly, this impact assessment is a tool for preventive management in the concept that it provides information on the adverse effects on resources and the environment to make good projects by eliminating the negative effects and maximizing positive impacts , prevent costs associated with adverse events, and to meet the requirements of the Rwandan law on Environmental protection.

The works are scheduled as following: The project preparatory work (site installation), general earthworks, substructure/Foundation, superstructure, drainage works, electricity and building Services, slope protection works, air conditioning in the building and fire protection.

These activities may generate significant negative impacts, such as:

- Pollution of soil and water through the discharge of solid and liquid wastes;
  - disturbance to wildlife due to the use of explosives in quarries of hard rock and construction machinery;
  - Impact on landscape related to the installation of base camp, construction equipment and waste on the edge of roads and surroundings;
  - Risk of landslides, soil erosion in the quarries, quarries and around the roads;
  - Air pollution by dust emissions on the quarries, during the excavation and essentially traffic-related transport of essential construction materials;
  - Increased consumption of water for the needs of workers and site works;
  - Increased risk of accident to workers related to the use of explosives on the quarries;
  - Increased risk of infection with STDs (AIDS) and water-borne diseases on the rise construction and at the base camp;
  - Modification of the discharge regime of runoff;
- Hazards of erosion and landslides in the vicinity of roads;
  - Increased risk of accidents due to the increase of velocity flow;
  - Pollution of runoff by washing from vehicular areas
  - Increased risk of infection with STDs due to the increase of international goods traffic.

The study provides mitigation measures to minimize the maximum risk, the most prominent are:

- ✓ Select the period of performance of certain operations of the site;
- ✓ Selection and management of the quarries;
- ✓ Organization of traffic during construction;
- ✓ Selection and management of quarries;
- ✓ Measures for the preservation of human security;
- ✓ Rehabilitation of workplaces;
- ✓ Measures to protect the fauna and flora;
- ✓ Water Conservation Measures;
- ✓ Measures to protect against erosion;
- ✓ *Awareness and information.*

### 3.1. LIKELY ENVIRONMENTAL IMPACT ASSESSMENT DURING CONSTRUCTION AND MITIGATION MEASURES

#### 5.1.3 Negative Impacts

- **Loss of vegetation-** site clearing and installation is expected to destroy the existing vegetation at the plot.

- **Danger of borrow pits-** Borrow pits dug during soil investigations, if not refilled may be hazardous to workers on site. Workers might get injured from falling in such pits, these pits might harbour rodents or venomous reptiles which could endanger lives of site workers.
- **Soil erosion-** Considering a slope difference of about 2m, excavation works during the site clearing and construction shall subject the land to erosion from runoffs and possibly flood, drainage channels that surround the plots blocking them, flood the periphery roads also surrounding the plots commonly used by visitors or workers within the apartment.
- **Traffic congestion-** the frequency and number of truck movements loading and offloading construction material or debris is likely to cause congestion and destruct the normal traffic within the area since the access roads are not capable of traffic flow in situations of double parking.
- **Storm water drainage and disposal-** this is likely to impact the premises and their surrounding considering the slope category of 1-2% and slope difference of about 2m, since during site clearance and construction, huge pieces of land could be opened, vegetation lost resulting in poor runoff infiltration and therefore causing floods. This could block the road drainage channels and the roads too.
- **Air/Dust pollution-** With the excavation works and truck movements, the premises and their surroundings are bound to have lots of dust pollution. Furthermore with exhaust fumes from the vehicles, trucks and machines there is bound to be a formidable level of air pollution with greenhouse gases such as CO, CO<sub>2</sub>.
- **Noise pollution-** Again with truck movements, workers on site, construction works such as; vibrations, compactions, the site area is expected to have noise. This could result in a nuisance for already established offices and industries close by.
- **Solid waste generation-** Stock piles of construction materials and murrum from earth excavations, construction debris, organic waste from food eaten by workers, are likely sources of solid waste generation causing an eye sore to the beauty of the area and in some cases being a source of vector causing diseases.
- **Construction accidents/ injuries-** injuries resulting from sharp objects, workers falling off scaffoldings, electric shocks are bound to happen under such project implementation.
- **Oil spillage-** Activities such as machine re-fueling, oiling or greasing of machines to reduce friction require fuel stock on site. It is emptying and movement of the fuel tanks that cause oil spillage. It is anticipated that oil spillage shall degrade the soil.
- **Fire outbreaks-** Fire outbreaks may be caused by oil spills, electric circuits, and irresponsible use of heating equipment, which might endanger workers and probably affect the neighborhood.
- **Thefts-** With the increase in human activity at the project site, the open space of the site, the huge size of the plots and its surroundings, there is likely to be an increase in theft cases of construction materials and equipment.

### 3.2. LIKELY ENVIRONMENTAL IMPACT AFTER COMMISSIONING AND MITIGATION MEASURES

#### 5.1.2 Positive Impacts

- **Employment opportunities-** The project will provide employment to the locals since the construction activities will be recruited from within the country.
- **Government revenues-** revenues shall be collected by Government from the procurement of construction materials and finishes, such as; VAT from sold products among others.
- **Income earnings for truck and machine owners-** Truck and machine owners shall earn from hiring out their vehicles to transport material and do various construction manoeuvres.
- **Affordability of medical insurance and school fees for workers-** Employees from their pay shall afford medical insurance commonly called “mutuelle de sante” or RAMA and even pay school fees for their children.
- **Promotion of locally made construction material-** most of the materials for construction shall be sourced locally.

### 3.3. ALTERNATIVES CONSIDER FOR SITTING, TECHNOLOGY, CONSTRUCTION AND OPERATION PROCEDURES

Sitting, no options were considered as the site is ideal for the stated purpose.

Technology, the developer is exploring the costs involved in supplementing mains electricity with the artificial lighting (openings). If feasible, this will be implementing over the life of the project.

## 4. STRUCTURAL DESIGN

The structural design and calculations of the building structures have been done using British standard (BS8110-1997: The structural use of Concrete 1992) and the consideration was made to the Rwanda Building code. Columns, Slabs, Beams and footings were designed and safety of the structural was considered at a high pace.

## 5. SAFETY AND SECURITY

The safety of the users of the Building will be maintained and the external security like fence; the provision of camera of security will also be available where the security will be maintained. The Security guards will be provided to secure the buildings and the users of the buildings. Electrical cables will be of good quality and protected with the landing compliance to the standard (RBS), the fire extinguishers will be also availed at all the entrances of the buildings for fire protection.

## 6. DRAINAGE, PLUMBING AND WASTE WATER DATA

Due to the topography of the site which is not so highly sloped (2%), we need to Provide some water drains for the runoff water, and the outlet is designed up to the soak way pit for disposal. Part of the storm water will be collected by the gutters and stored into the tanks (LOTO tanks of 10m<sup>3</sup> each) which will be using for washing, cleaning, gardening, etc. another part will be channeled into the outlets through the municipal sewage system. The provision of a septic tank is necessary for final disposal of waste water and black water.

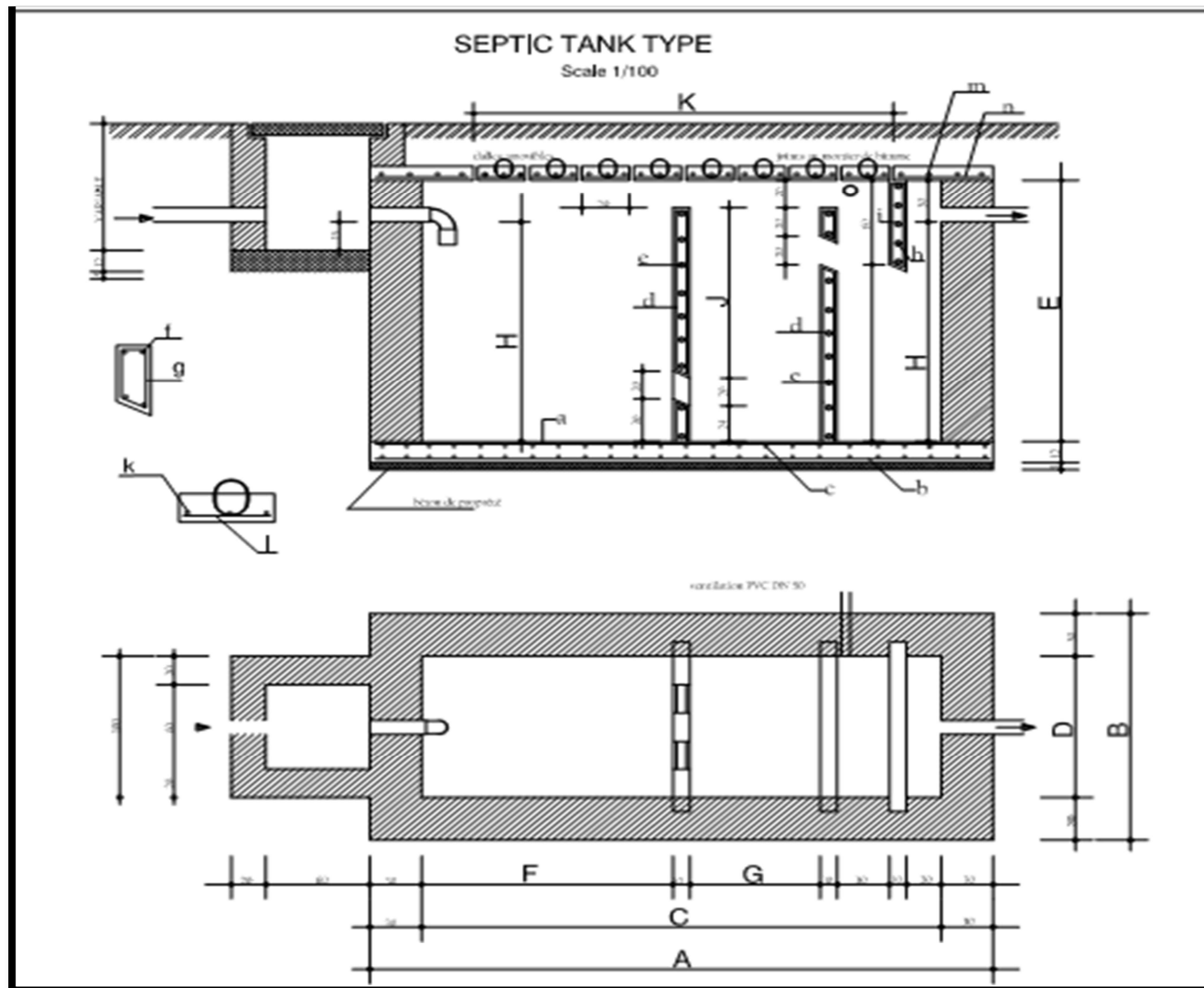


Fig 4: typical plant flow layout



## 5. Fire protection

**Fire protection** is the study and practice of mitigating the unwanted effects of potentially destructive fires. It involves the study of the behavior, compartmentalization, suppression and investigation of fire and its related emergencies, as well as the research and development, production, testing and application of mitigating systems. In structures, be they land-based, offshore or even ships, the owners and operators are responsible to maintain their facilities in accordance with a design-basis that is rooted in laws, including the local building code and fire code, which are enforced by the Authority Having Jurisdiction. Buildings must be constructed in accordance with the version of the building code that is in effect when an application for a building permit is made. Building inspectors check on compliance of a building under construction with the building code.

Once construction is complete, this building will be maintained in accordance with the current fire code, which is enforced by the fire prevention officers of a local fire department. In the event of fire emergencies, Firefighters, fire investigators, and other fire prevention personnel called to mitigate, investigate and learn from the damage of a fire.

The provision of fire hydrants at every corner of the project boundary for fire fighting. In the building also will be provided the fire alarms on each exits and entrances of the building.



Fig 6: Fire fighting equipments

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