

**Design of a four storey building office in Huye District of Rwanda.**

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**ABSTRACT**

Office administration is a set of day-to-day activities that are related to financial planning, record keeping & billing and confidentiality with those of communicating, is the central dilemma of office design. The architectural design helps the owner of the building to determine the total cost of building by showing the plan view, bill of quantities and cost estimation of the building before the execution. Huye district office is one of the district offices that make up the Southern province and is located in Huye district, Ngoma sector, Butare cell, Karubanda village. It has small and old office building compared to the number of staffs who are known not working in a comfortably setting. From that fact the researcher came up with an idea of making a project of designing and quantify a new building in a way of resolving the identified problem. Architectural design, quantity and cost estimation of four storied for Huye district's office is the purpose of this study. Is supposed to have forty-seven offices rooms, conference hall, video room, restaurant, and thirty-six water closets for whole building, which can serve simultaneously. New Huye district's office building must be esthetically, well designed and be comfortable in order to accommodate the whole users (staff members and visitors). This has done by conducting site survey to collect the plot data by using the GPS and other software related for collecting all information required, concerning with the site. In this project, different activities helped to achieve project objectives like survey, design of floor plans and provision of details using design software (ArchiCAD and Artlantis); bill of quantity and cost estimate, drawing, and photos which will help everyone who is able to implement this project guided by design standards and principles were taken into account, to meet acceptable level of service regarding the offices building, its components are standardized and sized enough. The total cost estimated to accomplish the works of whole project, (combined building and external works) is one billion, ten-million, eight hundred forty-seven thousand and eight hundred eighty-one Rwandan franc. (1,010,847,881Rwf).

**Keywords:** design standards, office building, Storey, quantity estimation

**1.1.BACKGROUND**

Huye district office is one in eight districts offices built up Southern province. It is locate in Huye

district, Ngoma sector, Butare cell, Karubanda village. Huye district is made up by eight

Municipalities, which are: Ngoma, Huye, Mbazi, Gishamvu, Runyinya, Maraba, Ruhashya, a part of Rusatira, and half of Kinyamakara; then it became to be one District of Huye. It is composed by fourteen sectors, seventy seven cells, five hundred and nine villages, and cover area of 581.5km<sup>2</sup>.(Huye District, 2012)

Huye district office has forty rooms which are not fulfill the standard dimension of offices, meeting hall, conference room, and fourteen water closets, one stair case with stairs of 12cm riser. It hasn't any disability person's way (ramp) and none elevator, even space of circulation way (lobby) is not sufficient.

After this enlargement of all districts and to do decentralization to the population, our country remain with only 30 districts. This increased the number of employers for districts level in general, for this reason every district must have an office which are capable to accommodate and receiving their users (personals and Visitors). District's office building must be sizeable (large) enough, locate outside of district city, and must be capable to receive all its offices according to the number of employers (staffs), in order to avoiding high density, and minimizing number of office shared. Because of district organigram structure shows that, district level is supposed to have less than 100 employers. It is better to provide the others offices which fulfill the standard and dimension required for office building, in order to be occupied by the workers who could came from sector level, or other institution supported by Government.(Ministry of local government, 2000)

## **CHAPTER II: LITERATURE REVIEW**

### **2.0. INTRODUCTION**

This chapter includes several reviews of different authors concerned on the design of multi storey building especially four storey building, it also deal with the architectural design and esthetic design notes from different authors. This chapter also presents design conditions, and the main elements to be considered while designing. Multi storey building is used for different purposes, some used as commercial, hotels, residential,

office and many others, this paper focuses mainly on office building.

### **2.1. OFFICE BUILDING**

Office building is the most tangible reflection of a profound change in employment patterns that has occurred over the last one hundred year. To accomplish the requirement, the building must benefit from an integrated design approach that focuses on meeting a list of objectives. Through integrated design, a new generation of high-performance office buildings is beginning to emerge that offers work satisfaction and productivity.

The office building must have flexible and technologically-advanced working environments that are safe, healthy, comfortable, durable, and aesthetically-pleasing. It must be able to accommodate the specific space and equipment needs of the tenant. Special attention should be made to the selection of interior finishes and art installations, particularly in entry spaces, conference rooms, and other areas with public access. (Raymond, 2005).

### **2.2. ARCHITECTURAL DESIGN**

#### **2.2.1. Definitions**

Architecture is a general term used to describe a building and other physical structure. The art and science of designing building structures. Both the overall design of the building and the configuration of each individual element should permit total and efficient control of the ambient conditions (lighting, acoustics, etc.). Buildings should be both functional and economical, while respecting the essential design principles of simplicity, efficiency and the state of the art. In relation with buildings, architecture has to work with the planning, designing and constructing form, that reflect functional, technical, social, environmental, and aesthetic considerations. (Rajesh, 2013).

#### **2.2.2. Aspects of designing**

Is a way in which something can be viewed by the mind. Good graphic design needs to have several elements in perfect balance. Professional designers stress on the fact that a great design does not aim to overwhelm, but is understated and harmonious. All the elements are in smooth accord and there is nothing that mars you visual experience.

Good graphic design aims to be functional and efficient, aesthetic, user-focused and absorbing. But to achieve this, the designer will have to ensure the important elements work together to realize the best result.

### **2.2.3. Functionalism**

In architecture, Functionalism is the principle that architects should design a building based on the purpose of that building. This statement is less self-evident than it first appears, and is a matter of confusion and controversy within the profession, particularly in regard to modern architecture. Functionalism, in architecture, the doctrine that the form of a building should be determined by practical considerations such as use, material, and structure, as distinct from the attitude that plan and structure must conform to a preconceived picture in the designer's mind. (*Rajesh, 2013*).

### **2.2.4. Aesthetic**

Aesthetic deals with the nature of beauty really in the eye of the beholder, while one may prefer ornamentation and oak, the other may like chrome and concrete. Yet despite the diversity of our desires, there is some agreement regarding underlying patterns of development. While designing, Architect must think about necessary point which are aesthetic and standard dimension will help to reach at goal with smart product. To this particular way of expressing values, architecture can stimulate and influence social life, and will promote it to the development. Thus aesthetics will increase good appearance and presentation of the project. (*Rajesh, 2013*).

### **2.2.5 Sustainability**

There are many different views on what it is and how it can be achieved. The idea of sustainability stems from the concept of sustainable development. The original definition of sustainable development is usually considered to be a process of change in which the exploitation of resources, direction of investment, the orientation of technological development and enhance both current and future potential to meet human needs and aspiration.

### **2.2.6 Durability**

Durability is, according to definition, the ability of product to perform its required function over a

lengthy period under normal conditions of use without excessive expenditure on maintenance or repair.

Several units may be used to measure the durability of a product according to its field of application, such as year of life, time of use, and operation cycles. In economics, good with a long usable life are referred to as durable goods. That is reason why during the process of designing and giving specification, it is better to prefer using the materials that will favor the construction and structural stability and long lasting especially in concrete for footings, columns, beams, slab, passageways to support the building, in order to avoiding all failure. (*Arthur, 2007*).

## **2.3 ARCHITECTURAL DRAWING**

An architectural drawing or architect's drawing is a [technical drawing](#) of a building (or building project) that falls within the definition of [architecture](#). Architectural drawings are used by [architects](#) and others for a number of purposes: to develop a design idea into a coherent proposal, to communicate ideas and concepts, to convince clients of the merits of a design, to enable a [building contractor](#) to construct it, as a record of the completed work, and to make a record of a building that already exists. Architectural drawings are made according to a set of [conventions](#), which include particular views (floor plan, section (*Raymond, 2005*)).

### **2.3.1 The size and scale**

The size of drawings reflects the materials available and the size that is convenient to transport rolled up or folded, laid out on a table, or pinned up on wall. The draughting process may impose limitation on the size that is realistically workable. Sizes are determined by a consistent paper size system, according to local usage. Normally the largest paper size used in modern architectural practice is ISO A0 (841mm x 1,189mm), the smallest paper size used is ISO A4 (247mm x 210mm). Architectural drawings are drawn to scale, so that relative size are correctly represented.

#### **2.3.1.1 Floor plan**

A floor plan is the most fundamental architectural diagram, a view from above showing the arrangement of space in building in the same way

as a map, but showing the arrangement at a particular level of a building. Technically it is a horizontal section cut through a building (conventionally one meter and twenty centimeters above floor level), showing walls, windows and doors openings and other features at that level.

#### **2.3.1.2 Site plan**

A site plan is a specific type of plan, showing the whole context of a building or group of buildings. A site plan shows property boundaries already existing and means of access to the site and nearby structures if they are relevant to the design. For a construction project, the site plan also needs to show all the services connection: drainage and sewer line, water supply, electrical and communication cables, etc.

#### **2.3.1.3 Elevation**

An elevation is a view of a building seen from one side, a flat representation of one side (façade). This is the most common view used to describe the external appearance of a building.

#### **2.3.1.4 Cross section**

A cross section, also simply called a section represents a vertical plane cut through the object, in the same way as a floor plan is a horizontal section viewed from the top. Sections are used to describe the relationship between different levels of a building.

#### **2.3.1.5 Architectural in perspective**

Perspective in drawing is an approximate representation on a flat surface of an image as it is perceived by the eye. Cross section, also simply called a section represents a vertical plane cut through the object, in the same way as a floor plan is a horizontal section viewed from the top. Sections are used to describe the relationship between different levels of a building.

Perspective is the view from a particular fixed viewpoint. In architecture, the finished work is expensive and time consuming, so it is important to resolve the design as fully as possible before construction work begins.

## **2.4. DESIGN PRINCIPLES**

### **2.4.1 Environment**

The building should be comfortable, welcoming, with good natural lighting and ventilation; and it should be easy to maintain and keep clean. Additional electricity could be produced by installing a system which can produce power independently.

### **2.4.2. The concept of office space**

The main purpose of an office environment is to support its occupants in performing their job preferably to maximum satisfaction. With different people performing different tasks and activities, however, it is not always easy to select the right office space. To aid decision-making in workplace and office design, one can distinguish three different types of office space: Work spaces, Meeting spaces, and Support spaces. (*Raymond, 2005*).

## **2.4.3. TYPES OF OFFICE SPACES**

### **2.4.3.1. Work spaces**

Work spaces in office are typically used for conventional office activities such as reading, writing and computer work. These are:

- ✓ **Shared office:** A semi-enclosed work spaces for two or three people, suitable for semi-concentrated work and collaborative work in small groups. (*Raymond, 2005*).

### **2.4.3.2. Meeting spaces**

Meeting spaces in office are typically use interactive processes, quick conversations, which are:

- ✓ **Small meeting room:** An enclosed meeting spaces for two to four persons.
- ✓ **Large meeting room:** An enclosed meeting spaces for five to twelve peoples.
- ✓ **Meeting point:** An open meeting point for two to four persons.

### **2.4.3.3. Support spaces**

Support spaces in an office are typically used for secondary activities such as filing documents or taking a break. These are:

- ✓ **Filing space:** An open or enclosed support space for the storage of frequently used files and documents.

- ✓ **Storage space:** An open or enclosed support space for storage of commonly used office supply.
- ✓ **Print and copy area:** An open or enclosed support space with facilities for printing, scanning and copying.
- ✓ **Pantry area:** An open or enclosed support space where people can get coffee and tea as well as soft drinks.
- ✓ **Smoking room:** An enclosed support space where employees can smoke a cigarette.
- ✓ **Stairs and ramps:** A series of steps that connect two consecutive floor levels, and facilitate the passage of mobility peoples (handicap) in ramps and normal peoples using stairs.

#### 2.4.3.4. Offices dimensions

Appropriate size and space is provided for approach, reach, manipulation, and use, regardless of the user's body size, posture, or mobility. Henry Dreyfuss Associates (1993) provides a number of templates for ergonomic analysis of hand and body for design of furniture and environmental settings. To set out the technical performance and characteristics required of a building in which commission departments are to be housed with their programme component.

- 1) Meeting rooms: 2.50 m<sup>2</sup> per person
- 2) (Private office) or Individual office made up of two façade module or 10.00 m<sup>2</sup> minimum
- 3) Shared offices: 8.00 m<sup>2</sup> per person ( partitioning on a case-by-case basis)
- 4) Lobby: 1.50 m<sup>2</sup> per person.
- 5) Corridor: not less than 1.80m width.
- 6) Restaurants: 2 m<sup>2</sup> per person.
- 7) Cinema: 1.5 m<sup>2</sup> per person.
- 8) Old records files: 1.00m<sup>2</sup> per 220 for recorder file.
- 9) Standard meeting area for 8 to 10 persons: 16.70m<sup>2</sup>. (*Zupkó, December 2011*)

## 2.5. OFFICE OPENINGS

### 2.5.1. Doors

A door is a moveable used to cover an opening. In construction door are widely used and found in walls or partitions of buildings.

Functions of a door are:

- ✓ To allow entrance to the occupants.
- ✓ To admit light into the rooms.
- ✓ To allow natural air ventilation.
- ✓ To provide access movement within interior building.
- ✓ To protect noise especially at the areas where are a lot of movement. (*Neufert, 1999*).

### 2.5.2. Windows

**Window** is a structure made in a form of a frame whereby window sashes will be constructed and fixed or hung in window opening.

## 2.6. VENTILATION

Ventilation is the intentional movement of air from outside of a building to the inside.

The ventilation is the process of "processing" or replacing air in any space to provide high indoor Air quality (i.e. to control temperature, replenish oxygen, or remove moisture, odors, smoke, heat, Dust, airborne bacteria, and carbon dioxide).

Ventilation includes both the exchange of air to the outside as well as circulation of air within the Building; it is one of the most important factors for maintaining acceptable indoor air quality in Buildings. There are two types of ventilation: **natural ventilation** and **mechanical ventilation (Forced)**. (*Zupkó, December 2011*).

### 2.6.1 Natural ventilation

Natural ventilation occurs when the air in a space is changed with outdoor air without the use of mechanical systems, such as a fan. Most often natural ventilation is assured through operable windows but it can also be achieved through temperature and pressure differences between spaces.

Each office room must have naturally ventilation by permanent openings with an opening or open able size not less than 10% of the floor area but 20% is preferred for the room required to be ventilated. Permanent openings are: Doors, window, Skylights. (*Donald & Michael, 1999*)

### 2.6.2 Mechanical ventilation

**"Mechanical"** or **"forced"** ventilation is used to control indoor air quality. Excess humidity, odors, and contaminants can often be controlled via dilution or replacement with outside air. However, in humid climates much energy is

required to remove excess moisture from ventilation air. Mechanical fans drive mechanical ventilation.

## 2.7. STAIRS

A stairway, staircase, stairwell, flight of stairs, or simply stairs is a construction designed to bridge a large vertical distance by dividing it into smaller vertical distances, called steps. Stairs may be straight, round, or may consist of two or more straight pieces connected at angles.

(Rajesh, 2013)

### 2.7.1. Components and terms

A **stair** or **stair step** is one step in a flight of stairs. In buildings, stairs is a term applied to a complete flight of steps between two floors. A **stair flight** is a run of stairs or steps between landings. A **staircase** or **stairway** is one or more flights of stairs leading from one floor to another, and includes landings, handrail, balustrade, and additional parts. A **stairwell** is a compartment extending vertically through a building in which stairs are placed.

Stair may be in a straight run, leading from one floor to another without a turn or change in direction. Step each step is composed of tread and rise.

- a. **Tread** is a part of the stairway that is stepped on. It is constructed to the same specification (thickness) as any other flooring. The tread "depth" is measured from the outer edge of the step to the vertical "riser" between steps. The "width" is measured from one side to the other.
- b. **Riser** is the vertical portion between each tread on the stair.
- c. **Nosing** An edge part of the tread that extend over the riser beneath.
- d. **Trim** are various moldings used to decorate and in some instances support stairway elements.
- e. **Apron** is a wooden fascia board used to cover up trimmers and joists exposed by stairwell openings.
- f. **Landing or platform** is the area of a floor near the top or bottom step of a stair. An intermediate landing is a small platform that is built as part of stair between the main floor levels and is typically used to allow stairs to change direction, or to allow the user a rest.

### 2.7.2. Measurements

The measurement of a stair, in particular the rise height and going of the steps, should remain the same along the stairs. The following stair measurements are important:

- The **rise height** or **rise** of each step is measured from the top of one tread to the next.
- The **tread depth** of step is measured from the edge of the nosing to the vertical riser, if the steps have no nosing, it is the same as the going; otherwise it is the going plus the extent of one nosing.
- The **slope** or **pitch** of the stairs is the ratio between the rise and the going (not the tread depth, due to the nosing). It is sometimes called the **rake** of the stairs. The **pitch line** is the imaginary line along the tip of nosing of the treads.

#### The requirement of good stair

- A landing should be provided at the top and bottom of each flight.
- No doors should swing across landings.
- All nosing should have a permanently contrasting material 55mm wide on both the tread and the riser. This is to facilitate easy recognition of the tread and where to place feet.
- Projecting nosing should be avoided.
- The rise and going of each step should be consistent throughout a flight.
- The rise of each step should be between 150mm and 170mm. excessively high risers may result in strain being placed on knee and/or hip joints when descending and should thus be avoided.
  - The going of each step should be between 280mm and 425mm, 300mm is preferable.

## 2.8. RAMPS

Ramp is a sloping surface joining two different levels, as at the entrance or between floors of building. Ramps are useful in their own right as they allow access for wheeled items such as wheel chairs and trolleys but they take up a great deal of room. They have certain angle or gradients (usually 1:12) that make them possible to be used those who are wheelchair bound or if pushing object such as trolleys without struggling to do so.

## 2.9. PLUMBING AND SANITATION

Is the hygienic means of promoting health through prevention of human contact with the hazards of wastes as well as the treatment and proper disposal of sewage or wastewater. Hazards can be physical, microbiological, biological or chemical agents of disease. Sanitary appliances play a vital role in all our lives. Its means we can keep ourselves and our eating utensils clean, and we can use the toilet in private and in comfort.

Wastes that can cause health problems include human and animal excreta, solid wastes, domestic wastewater (sewage or grey-water) industrial wastes and agricultural wastes. Hygienic means of prevention can be by using engineering solutions.

### 2.10. WATER TANKS AND WATER PUMP.

The water tanks will be installing at a top of building, for important purpose of supplying easily into a building with a sufficient speed. Water will be stored before to supply it in order to provide a best solution when water is decreased. Those water tanks will be in plastics.

Pumps are used to move or raise fluids from one point to another continuously. Pumps are of two general types which are: centrifugal pumps and positive displacement design type (hydrostatic). A hydrostatic or positive displacement pump is depending on dynamic forces.

Here we will only consider positive displacement pumps, which can be understood purely by hydrostatic considerations. They have a piston (or equivalent) moving in a closely-fitting cylinder and forces are exerted on the fluid by motion of the piston.

Both types follow the same purpose, which is to move water from one point to another continuously. These two major components have a wide variety of options that might be used depending on project specific needs.

### 2.11. DRAINAGE.

Drainage is the technique used to collect and drain water which used in building and water following from a roof through the pipes, channels toward where it can be take a rest (in septic tanks, and soak pit, etc). Water from the building is

collected according to where it is used. Example water from W.C (Water Closet) is evacuated to the S.T (Septic Tank).

Above ground discharge systems (AGDS) are essential to ensure that we are able to keep ourselves and our household environment clean and hygienic. This unit of AGDS is looking for:

- Sanitary systems and final disposal units
- Rain water drainage – that is guttering and fall pipe systems.

## 2.12. COST ESTIMATION

Cost estimation is the predictive process used to quantify, cost, and price the resources required by the scope of an investment option, activity, or project. The output of the estimating process, the cost estimate, is typically used to establish a project budget, but may also be used for other purposes, such as: determining the economic feasibility of a project; evaluating between project alternative; and proving a basis for project cost and schedule control. Several cost estimation and calculation models can be used during construction process; beginning with the conception phase of the construction project and the schematic design, design development, construction documents phases respectively. (*Cost Engineering Terminology, April 2004*)

### 2.12.1. Bill of quantities

A bill of quantity is document used in tendering in construction activities (supplies) in which materials, parts, and labor (with their costs) are itemized. The prime purpose of the bill of quantities is to enable all contractors tendering for a contract to price on exactly the same information.

### 2.12.2. Factors consider during preparation of bill of quantity

- Choice of work method.
- Output of crew (given the firm's unique efficiency).
- Cost of labor.
- Cost of material and its transportation.
- Addition of overheads and profit.
- Location of site.

### 2.12.3. Accuracy

Estimating is one of the most important functions of a successful project. Accurate estimates

optimize good contacting as well as the process of calculating and analyzing all the costs that will enter into a particular job to arrive at a set total. The estimator is responsible for these estimates which serve to ensure the project will have a successful financial outcome and this estimate also influence the decisions made for budgeting and assist in client's decisions for contractor selection.

#### **2.12.4. Factors affecting the accuracy of estimating**

However, many factors might affect the accuracy of a cost estimate. This study aims at identifying the factors affecting the accuracy of cost estimating construction projects. The affecting factors due to the surveyed contractors are: fluctuation in currency exchange rate; contract management; number of competitors; financial status of owners; and fluctuation of prices of materials.

The affecting factors due to the surveyed consultants are: political situation; fluctuation of prices of materials; economic stability; poor planning; and previous experience of contractor.

#### **2.12.5. Purpose of cost estimating**

The purpose of estimating is to indicate probable construction costs. This is an important factor that clients consider when deciding to build; it determines the feasibility of a project, or even provides the basis for budget control during tendering and construction.

#### **2.12.6. Data required in the preparation of estimating**

Estimating requires the following data:

1. **Drawings** (plans, elevations, sections, etc.): if the drawings are not clear and without complete dimensions the preparation of estimation becomes very difficult. So, it is very essential before preparing an estimate.
2. **Specification**
  - a) **General specifications** these give the detailed description of the various items of work and materials in general terms to be used in various parts of work. It helps no form a general idea of building.
  - b) **Detailed specification** these gives the detailed description of the various items of

the work laying down the quantities and qualities of materials, their proportions, the method of preparation workmanship and execution of the work

3. **Rates:** for preparing the estimate the unit rates of each item of work are required
  - For arriving at the unit of each item
  - The rates of various materials to be used in the construction
  - The cost of transport of materials. (Dutta, 2005)

### **3. RESEARCH METHODS**

#### **3.0. INTRODUCTION**

This chapter presents the detailed procedures of this project titled "Design of four storey building office in Huye district of Rwanda" followed, the data needed for well performed project included the field survey data like topography, location and so on. The topographic surveys of the site was conducted on the site, the conception and design of all detailed drawings of Huye district office, were performed by using the software, such as: ArchiCAD15, AutoCAD, Artlantis studio, and the engineering books showing the principles of designing.

#### **3.1 STUDY DESIGN**

The purpose of this study was to design suitable, safe and durable four storey office building to accommodate different Huye district headers and workers. The study area was performed in different days, where the field data collection was conducted and recorded to be used in drawing and detail designing of the building, the methods used to collect data were direct observation, field survey and experimentation on the soil conditions.

#### **3.2 BRIEF DESCRIPTION OF THE STUDY AREA**

This project of architectural design, quantity and cost estimation of four storied office building for Huye district will be implemented in Bigangara village, Gatobotobo cell, Mbazi sector, Huye district.



Figure 1: Existing condition of plot. (Source: Google earth in March 2017)

Table 1: Plot coordinates, elevation, and slope.

	<b>P1</b>	<b>P2</b>	<b>P3</b>	<b>P4</b>
Latitude	2°34'20.09"S	2°34'20.27"S	2°34'20.65"S	2°34'18.67"S
Longitude	29°45'12.61"E	29°45'13.23"E	29°45'13.30"E	29°45'12.46"E
Elevation profile (Altitude)	5692ft = 1737m	5682ft= 1733m	5693ft= 1734m	5693ft= 1738m
<b>Measurement</b>	<b>P1 to P2</b>	<b>P2 to P3</b>	<b>P3 to P4</b>	<b>P4 to P1</b>
Length	106.000m	138.000m	120.000m	160.000m
<b>Tilt or Slope</b>	<b>P1 to P2</b>	<b>P2 to P3</b>	<b>P3 to P4</b>	<b>P4 to P1</b>
	4% = 2.3°	1 % = 0.6°	3% = 1.7°	1 % = 0.6°

### 3.3 CURRENT SITUATION OF THE SITE

MBAZI is a sector of HUYE district, which is chosen to receive a construction of Huye district's office, in order to do a decentralization of governance to the population, and extending the infrastructure in Huye district. Plot is located in that sector which is called Mbazi, Gatobotobo cell, Bigangara village; it is an area which fulfills the basic needs of infrastructure; such as power, water and road. A plot has best view.



Figure 2: Existing situation of the site.

### **3.4 ARCHITECTURAL DRAWING**

The architecture drawing was performed by using ArchiCAD15 software with combination of engineering books guidance to design an adequate space, and dimension of the building components: the views of a building, elevations, sections, roof plan, foundation plan, and perspective.

The AutoCAD Covadis is used for receiving the data from GPS, and special element details. Artlantis software used to provide clearness of the drawings.

### **3.5 DATA COLLECTION METHOD**

#### **3.5.1. Primary data**

Primary data are the data observed or collected directly from first-hand experience. I have visited the site before, where the required information is obtained directly from first-hand sources by means of surveys, Observation or experimentation.

During data collection, the following types of collecting data; site survey, and documentation are used.

#### **3.5.1.1 Site survey or field survey**

According to (Dr. Tim Cooper, 2005) ; Surveying is the technique, profession, and science of determining the terrestrial or three- dimensional position of points and the distances and angles between them.

For this surveying method (site survey), we have observed the site by visit, during site visit we have got all basic information needed, then after, Google earth is used to collect the data following Plot coordinates, elevation, slope (tilt) and its orientation.

To get and collect this information by primary surveys is called field surveys.

They are an essential component of geographic enquiry. Site survey is a basic procedure to understand the earth as a home of humankind, where surveyors have visited the site with purpose of knowing more, in deep the behavior of that site (soil characteristics); such as slope, altitude, area covered by observation and using the materials of measurements and positioning, photographic camera.

#### **The purpose of site survey:**

- ❖ To determine the dimensions and contours of any part of the earth's surface,
- ❖ To prepare a plan or map,
- ❖ To establish boundaries of the land (plot),
- ❖ To calculate Area and volume
- ❖ To select a suitable site for engineering project.

### **3.5.2 DOCUMENTATION METHOD**

It is a method of systematic and concise capture of critical project related plans and concepts, so that the information can be shared with concerned individuals in future for smooth running of the project. That is why the written books, lecture notes and electronic (internet) resources are to be used for obtaining the necessary information concerning the architectural design, quantity and cost estimation of four storied of Huye district's office building.

## **4. PRESENTATION AND ANALYSIS OF RESULTS**

### **4.1. INTRODUCTION**

This chapter deals with how the data should be presented, analyzed, and interpretation of results.

#### **4.1.2 Architectural design**

##### **4.1.2.1. Current situation**

Currently, Huye district is located in southern province, Ngoma Sector but it has been constructed in the years ago before genocide of Tutsi, for serving the municipality's staff. This building now is used as district's office, where the offices are insufficient for the users, and not fulfill the requirements of decentralization facilities, is reason by which it is better to think about how can be resolved. Huye district's office currently is located between Bank national of Rwanda (BNR) and Huye stadium, to the main road Kigali-Huye- Burundi.

##### **4.1.2.2. Site plan**

The new Huye district's office shall be implemented in Southern province, Mbazi sector, Gatobotobo cell, Bigangara village, in a plot cover area of 12001 square meters (m<sup>2</sup>), with different elevations (altitude) and tilt (slope) which are described previous chapter. The site is located nearest feeder road from Rwabuye to Mbazi health center.

The drawings which are performed are following:

- Ground floor plan.
- Plan of 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup>Floors.
- Roof plan
- Front elevation, Back elevation, right side elevation and left side elevation.
- Sections :( longitudinal)
- Site plan and waste water location
- Perspectives of office building.

#### **4.2. GROUND FLOOR**

Ground floor is composed by twelve rooms; district executive secretary's office, vice mayor in charge of social affairs(ASOC)'s office, two administrative assistances, immigration officer, in charge of agriculture & in charge of animal resource officer, in charge of infrastructure and in charge of one stop center officer, in charge of statistic officer, in charge of planning & imihigo officer, director in charge of strategic & planning officer, and in charge of cooperative & entrepreneurship officer, with reception and ten water closets, corridor, two staircases and ramps reserved for disabilities persons to access other upper levels of the building. This ground floor is estimated to have total cost of **three hundred thirty-millions, two hundred thirty-nine thousand and eight hundred sixty-nine Rwandan francs (330,239,869 Rwf).**

#### **4.3. FIRST FLOOR**

First floor is composed by eleven rooms; mayor's office, vice mayor charge of social affairs, two administrative assistances, advice to the mayor's office, vice mayor in charge of economics and development (FED)'s office, video room, old file record's room, labor inspection officer, central secretariat, education officer, internal audit's officer, ten water closets, corridor, two staircases and ramps reserved for disabilities persons to access other upper levels of the building.

First story is estimated to have total cost of **two hundred twenty-four million, seven hundred seventy-three thousand and three hundred seventy-one Rwandan francs (224,773,371 Rwf).**

#### **4.4. SECOND FLOOR**

The second floor is composed by fifteen rooms, which are: Coffee preparation room, Canteen VIP for district's executive committee, in charge of sport & culture officer, in charge of legal service

officer, in charge of legal notary service officer, in charge of disaster prevention officer, accounting officer, direct of finance officer, human resource officer, local revenue inspection officer, local revenue collection officer, budgeting officer, in charge of good governance officer, with eight water closets.

It is estimated to have a total cost of **two hundred twenty-three millions, nine hundred seventy-eight thousand and one hundred seventy one Rwandan francs. (223,978,171 Rwf)**

#### **4.5. THIRD FLOOR**

The third floor is composed by eight rooms, which are: Control room, Procurement officer, Restaurant, Meeting hall, director in charge of health service officer, in charge of pharmacy officer, in charge of MUSA officer, Logistic officer, with eight water closets.

It is covered a total cost of **one hundred sixty-two million, six hundred forty seven thousand two hundred and five Rwandan francs. (162,647,205Rwf)**

#### **4.6 EXTERNAL WORKS**

The external works are combined with septic tank, soak pits, manholes, paving area, gardens, fence, and security house.

External works are estimated to have total cost of **sixty-nine million, two hundred nine thousand and two hundred sixty-six Rwandan francs (69,209,266 Rwf).**

The total cost estimated to accomplish the works of whole project, (combined building and external works) is **one billion, ten-millions, eight hundred forty-seven thousand and eight hundred eighty-one Rwandan franc. (1,010,847,881Rwf).**

### **5. CONCLUSION AND RECOMMENDATIONS**

#### **5.0. INTRODUCTION**

This chapter presents the purpose of this thesis and the conclusion as well as the importance from well design and quantity estimation of the Huye district office building so that to serve a number of population seeking services and also to hold well district leaders. Lastly, it will the

recommendation to the University of IST and to the government of Rwanda as well.

### 5.1. CONCLUSION

This project titled " Design of four storey building office in Huye district of Rwanda" was provided to use as offices building, in order to serve different categories of population living in Huye district and others seeking services from Huye District office, with the purpose (objective) of designing modern office building, decentralization governance to the population and developing our country, and southern province.

This project when considered, is coming to solve those problem of office building which is not fulfill the requirement standard of modern office building such as density of employees, office shared and insufficient working place.

For reaching at the end of purpose of this project, different methodology such as: documentation, refer to the different books of authors, Site visit and using engineer's drawings software.

This overall project "architectural design, quantity and cost estimation of four stored building for Huye district's office" helped us to get and increase more knowledge and skills as students performed well this project regarding how architectural design, to quantify and cost estimation of any building is done and perform, then after this project should be useful because it is well accomplished.

The total cost of this project "architectural design, quantity and cost estimation of four stored building for Huye district's office" is **one billion, ten millions, eight hundred forty seven thousand and eight hundred eighty-one Rwandan franc. (1,010,847,881Rwf)**. It will be implemented on the plot cover 12001m<sup>2</sup> (sqm).

### 5.2. RECOMMENDATION

I would recommend to Institut Supérieur de Technologies as institution where project is designed from, should collaborate with institution (District) where project is designed for, to take consideration of this project because it was designed carefully with good supervision. It should be a way of avoiding to publishing

expensive tender of project study and saving financial interest.

### 6. LIST OF ABBREVIATIONS

**CAD:** Computer Aided Design

**AGDS:** Above Ground Discharge Systems

**P:** Point

**GPS:** Global Positioning System

**R.C.C:** Reinforcement Concrete Cement

**B:** Breadth

**L:** Length

**H or W:** Height

**BNR:** National Bank of Rwanda

**ASOC:** Social Affairs

**FED:** Economics Development

**MUSA:** Mutuelle de Santé

**MINALOC:** Ministry of Local Government

**Ms:** Microsoft

**IST:** Institut Supérieur de Technologies

**DPC:** Dump Proof Course

**DPM:** Dump Proof Membrane

**W.C:** Water Closet

**S.T:** Septic Tank

**S.P:** Soak Pit

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