FINAL YEAR PROJECT PROPOSAL

By

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DESIGN OF AN UNDERGROUND WATER TANK FOR GEGELE COMMUNITY IN KWARA STATE.

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1.0 INTRODUCTION

The growing need for water tanks was impelled by water scarcity and rapid population explosion within the last decade.Underground tanks are liquid containing vessels that accommodate the internal pressure from the containing fluid and the lateral earth pressure from the surrounding soil. Underground water tanks are used to store water, liquid petroleum, petroleum products and similar liquids. The force analysis of the tanks is about the same irrespective of the chemical nature of the product. All tanks are designed as water proof structures to eliminate any leakage to the soil and also to prevent seepage into the tank there by causing contamination.

Water is one of the basic necessities for human beings. Different sectors of the society use water for different purposes, for example drinking, cooking, bathing,sanitation and washing clothes. Water requirements for any society vary upon factors such as number of buildings in the society, number of floors in each building. Swimming and gardening have become additional factors for increased water demand nowadays.

Gegele community is a densely populated residential society in the heart of Ilorin metropolis of Kwara State. The community has a low pressure water supply from the state water Corporation. The low water pressure inhibits proper circulation and distribution of water in the society. The general idea of this project is to collect and store this low pressure water in the proposed underground tank and then pump it to designated overhead tanks for efficient distribution to the community under gravity.

In general, there are three types of water tanks:

(i) Surface tanks
(ii) Elevated tanks, and
(iii) Underground tanks.

Water tanks could also be made from ranges of materials such as(Woolhether, 2012):

- Plastic
- Fiberglass

- Steel
- Concrete: Precast or cast-in-place concrete is an exceptionally strong and durable material used for underground water tanks. Underground concrete tanks work well where space is a challenge. Concrete works especially well in fire-prone areas. If placed underground, there is minimal risk of damage from fire or environmental factors.

From the shape point of view, water tanks may be of several types, such as:

1. Circular tanks
2. Rectangular tanks
3. Spherical tanks
4. Circular tanks with conical bottoms (Intze tanks).
5. Conical tanks

Rectangular tanks are usuallyused when small capacityof water is required. Small-capacity circular tanks are uneconomical becauseshuttering (formwork) for circular tank is very costly. The rectangular tanks should be preferably square in plan so as to economize construction material. It is desirable that the longer side should not be greater than twice the smaller side (Mohammed, 2011). However rectangular tanks are not used for large capacities since they are not economical and also, its exact analysis is difficult. For a given capacity, perimeter is least for a circular tank (Punmia et. al., 2003).

The aim of this project is to efficiently store the low pressure water supply in Gegele community in a designed underground tank.

2.0 STUDY AREA

The case study is Gegelecommunity, it is an Urban Settlement in the heart of Ilorin metropolis, Ilorin West, Kwara State. Gegele has a global coordinate of 8° 29′ 41.89″ N and 4° 32′ 53.24″ E.

3.0 AIM AND OBJECTIVES

The aim of this project is to designfor a durable, reliable, economic and functional underground water tank for Gegele community in Kwara State.

The specific objectives to accomplish the aim are:

- To reliably and approximately estimate the total water demand for Gegele community.
- To structurally analyzean underground water tank.
- To economically designand detail aconcrete underground water tank.

- To reasonably estimate the cost of constructing a functional underground water tank for Gegele community in Kwara State.

4.0 LITERATURE REVIEW

The choice of concrete as the constructionmaterial for underground water tanks has many advantages over other materials, including (Gibson 2010):

- Inherent strength making them naturally rigid and durable.
- Durability without prone to rusting, corroding or being damaged by tree roots.
- Availability in a variety of different sizes.
- Concrete tanks are not liable to 'float' like a plastic tank under high Hydrostatic pressure.
- Concrete is made from natural materials and is therefore easily recycled.
- Concrete tanks save space by being buried underground.
- Keeping water cool.

In the construction of concrete structures for the storage of liquids, the imperviousness of concrete is an important basic requirement. Hence, the design of such construction is based on avoidance of cracking in the concrete. In addition, concrete tanks require low maintenance. Concrete construction makes for a substantial, sturdy tank structure that easily contain the internal liquid pressure while comfortably resisting external forces such as earthquake, wind, and lateral earth pressure. The water tank has to be far away from sanitary structures such as soak-aways and septic tanks.

Mohammed (2011) stated that the design of a tank can be more economical, reliable and simple ifoptimization method is used to calculate the minimum cost of structural design of rectangular and circular sanitary concrete tanks. Gupta (2010) analyzed the theory behind the design of liquid retaining structure such as rectangular underground water tank. Thereport also included design requirements of water tank, survey, excavation methods, reduced levels, average depth of UGWT, soil on which it is constructed, depth of water table, type of mix design and capacity of the tank.

A brief theory behind design of liquid retaining structure (circular water tank with flexible and rigid base and underground water tank) using working stress method was presented by Sahoo (2008). The study also included computer subroutines to analyze and design circular water tank with flexible and rigid base and rectangular underground water tank. The programme was written in Microsoft excel using visual basic programming language.

5.0 METHODOLOGY

The methodological steps involved in executing the project are outlined below:

5.1 Mapping and Geo-information

Google Earth software will be used to show location of the catchment area by aerial photographs and also get important information about the area. Example of such information is the approximate area of the Community.

5.2 Water demand estimation

The water demand of the community has to be calculated by multiplying the population and average water demand per capita per day.An approximate water demand of the community can be calculated using approved standards. The National Population Commission figure for Gegele Community, arithmetic population growthand WHO per capita water demand will be used to estimate the size and geometry of the tank for a 20- year design period. According to World Health Organization (WHO) the average consumption for every human being to have access to sufficient water for personal and domestic use is between 0.05 and 0.1 cubic metre of water per day (United Nations, 2010). In a recent study by Sule et. Al., (2010) it was found out that most Ilorin residents use between 0.046 to 0.115 cubic metre of water per person per day.

5.3 Siting of tank and surveying

The tank must be sited at a place far from sewage and septic tanks so as to prevent water contamination. The site of the tank should also be well drained. Underground tanks conserve space since they are buried under ground, though the cover will have to be designed to accommodate likely imposed loads.

5.4 Laboratory tests

Some soil property parameters of the tank site are needed for design. Examples are: Lateral earth Pressure,Bearing Capacity etc. Parameters like density(γ), Angle of friction (ϕ), cohesiveness (c), are used to determine the active lateral earth pressure force imposed on the tank wall and the bearing capacity of the soil. Example of such experiment to be carried out is Direct Shear test.

5.5 Structural Analysis and Design

The approach of designing this water tank will be manual, using a number of guides, design standards and codes. The tank will be designed and detailed to BS 8007 & 8110 using limit state design approach. This method is based on working loads and permissible stresses in the concrete and steel which is considered to be within the elastic range. Lateral earth pressure, hydrostatic and surcharge pressures will be analyzed in depth. Design will also cater for flotation and cracking. The design is also going to be detailed for more information on the reinforcements.

5.6 Bill of Engineering Measurement and Evaluation(BEME)

The BEME of this project would contain an estimate of the quantity of material and the cost if this project were to be executed.

6.0 EXPECTED RESULTS

The expected result is the design of an economical and durable underground water tank that will ease the poor water supply at Gegele Community.

7.0 TIME FRAME (SCHEDULE)

The project is optimistically estimated to take about seven Months to completion. The Project Work Breakdown Structure and the Gantt chart of the scheduling using Microsoft Project are shown in Table 7.1 and Figure7.1.

Table7.1: Project Work Breakdown Structure (WBS)

S/N	TASK	DURATION (weeks)	START DATE	FINISH DATE
1	Brainstorming of final year project topic	2	16/10/12	29/10/12
2	Writing final year project proposal	9	29/10/12	28/12/12
3	Mapping and Geo-information	2	18/1/13	31/1/13
4	Sourcing for population figure of Gegele community	3	2/1/13	22/1/13
5	Water demand estimation	3	21/2/13	13/3/13
6	Tank siting	9	17/1/13	20/3/13
7	Laboratory tests	6	21/2/13	3/4/13
8	Structural Design, Detailing and Preparation of BEME.	14	7/2/13	15/5/13
9	Project Documentation	2	13/5/13	24/5/13

8.0 BUDGET

The Resources that will be used in carrying out this project is estimated below.

Table8.1: Project budget

S/N	Activity	Estimated cost (Naira)
1	Textbooks	4000.00
2	Internet browsing	5000.00
3	Transportation	1000.00
4	Laboratory Tests	7000.00
5	Project Printing/ Documentation	10000.00
	Total	**27000.00**

9.0 REFERENCES

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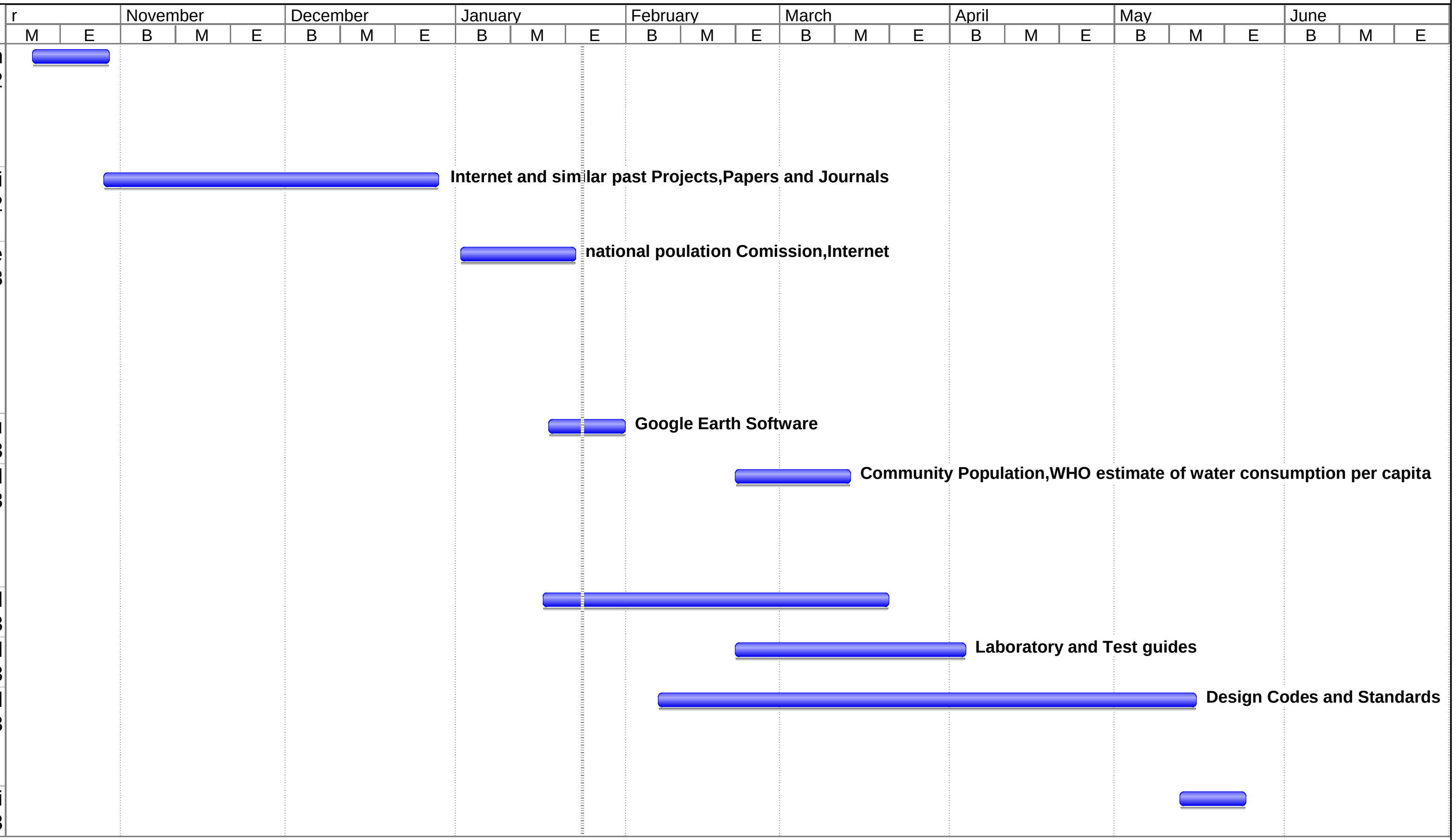
PROJECT TIME FRAME (SCHEDULE)

ID	Task Name	Duration	Start	Finish
1	Brainstorming of Final Year Project Topic: searching for a societal problem	2 wks	Tue 10/16/12	Mon 10/29/12
2	Writing Final Year Project Proposal	9 wks	Mon 10/29/12	Fri 12/28/12
3	Sourcing for Population figure of the area both on the Internet and the Nigerian Population Commission	3 wks	Wed 1/2/13	Tue 1/22/13
4	Mapping and Geo-Information	2 wks	Fri 1/18/13	Thu 1/31/13
5	Estimating Water Demand	3 wks	Thu 2/21/13	Wed 3/13/13
6	Tank Siting	9 wks	Thu 1/17/13	Wed 3/20/13
7	Laboratory Tests	6 wks	Thu 2/21/13	Wed 4/3/13
8	Structural Design, Detailing and preparation of the BEME.	14 wks	Thu 2/7/13	Wed 5/15/13
9	Project Documentation	2 wks	Mon 5/13/13	Fri 5/24/13



Project: timeframe project 4
Date: Thu 1/24/13

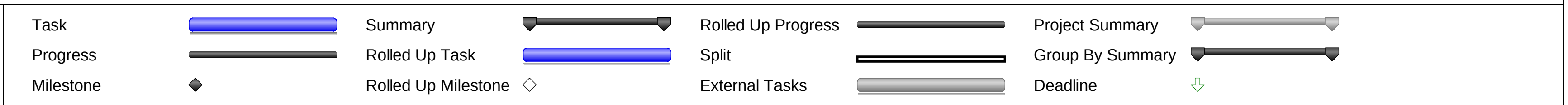


Figure 7.1: Project Gantt Chart.