



## CHAPTER 1

### BACK GROUND OF INTERNSHIP HOSTING COMPANY

#### 1.1 BRIEF HISTORY

MESCON Construction Company is a 1<sup>st</sup> class building construction company established in 1996E.C. As I have observed from the company profile at the headquarters' it was founded by individuals who have been working in the trading sector for certain years. They joined this sector as it is a growing economic activity in the country and help improve their company's development by securing an increasing profit level. I have also understood that they have an accumulated experience in running business activities successfully.

At the time of establishment; the company was called Mesfin Teferra building contractor named after the founder of the company .It was a building contractor of classBC-3/building contractor of class 3/ at that time. Based on this; they had taken a building contractor license agreement from the Addis Ababa city administration trade and industry office and from the ministry of trade and industry at the federal level. The first project they constructed was a primary school building with four floors and having twenty five class rooms.

Constructing various types of buildings and have been successful in completing these projects based on their respective contract termination periods. Due to its years of experience; the firm has attained a well organized organizational makeup for running the business. They own a wide variety of construction machineries, transport and various facilities .For instance; concrete mixers, dumpers, vibrators, excavators and compactors can be listed out of the construction machineries .on the other hand; dump trucks, fuel trucks, and storage tanks are used for transport and storage purposes. Apart from this; they have experienced professional workers who are found at various sites and offices.



## 1.2 MAJOR ACTIVITIES

### 1.2.1 Construction Activities

MESCON construction company as explained before focuses mainly on conducting construction of building and they have successfully completed the construction of various projects until now

Based on this I have listed some projects which have been constructed by the company together with their location, owners and year of project termination within the following table.

NO	Project	Owner	Location	Year of completion
1	Red cross blood bank	Ethiopian red cross society	Jimma and Harrar	1999
2	Yeka II low cost condominium housing	Yeka sub city	Addis Ababa	1999
3	Southern nations and nationalities region finance office	SNNPR finance bureau	Hawassa	2001
4	Sebeta market center	Sebeta city administration	Sebeta	2002
5	Hawassa office building	Hawassa university	Hawassa main campus and referral hospital	2002
6	Gelan No.2 Primary school	Akaki kality city administration	Addis Ababa	2000

Table1.1 List of some projects constructed by the company



- Some of the photographs of completed projects taken after completion of works are shown below.



*Fig 1.1 Some of completed projects by the company*

Apart from the completed projects listed above; the company is currently constructing various projects in different areas of the country. As they have improved their capacity; they have increased their participation in large construction contracts.

### **Current Projects**

Some of the current projects which are found at various stages of construction are listed below:

- ❖ Hawassa university Lot2 project including dormitory ,library and classrooms at Hawassa town
- ❖ Part of the 10 New university project at Addis Ababa Kilino site owned by the ministry of education
- ❖ Low cost condominium house constructions in different sub cities of Addis Ababa taking contracts from the Addis Ababa city administration etc...



### 1.2.2 Other Activities

The company conducts additional activities other than the construction work. These activities are mainly targeted at improving the supply of building materials in addition to the stock they are purchasing from the market.

On this respect; the company is producing aggregates for concrete work at different sites and distributing to its various projects .Some construction sites/including the site I have been working on/ contain an accumulation of large stones which were used as a source of aggregates .After checking the suitability of the material and ensuring the quality requirements with the project specification; a crushing machine will be transported to the site and production process will go on.

In addition to the aggregate production, they are also producing hollow concrete block (HCB) to be used for masonry works of walls and other structural components of buildings.

### 1.3 OVERALL ORGANIZATIONAL STRUCTURE

The construction company has a well defined organizational structure which comprises various components and sections within a specified organizational hierarchy. The organizational structure consists of different decision making units, control and supervision units and lastly coordinating and administration sections.

Based on the information I have collected from the head office; I have been able to understand the organizational make up comprises two major sections. The first part consists of units starting from the managing director up to different project managers while the second portion includes stakeholders ranging from project managers up to different professional sub sections .Based on this scheme; the organizational chart of the firm is as shown below(charts 1.1& 1.2).

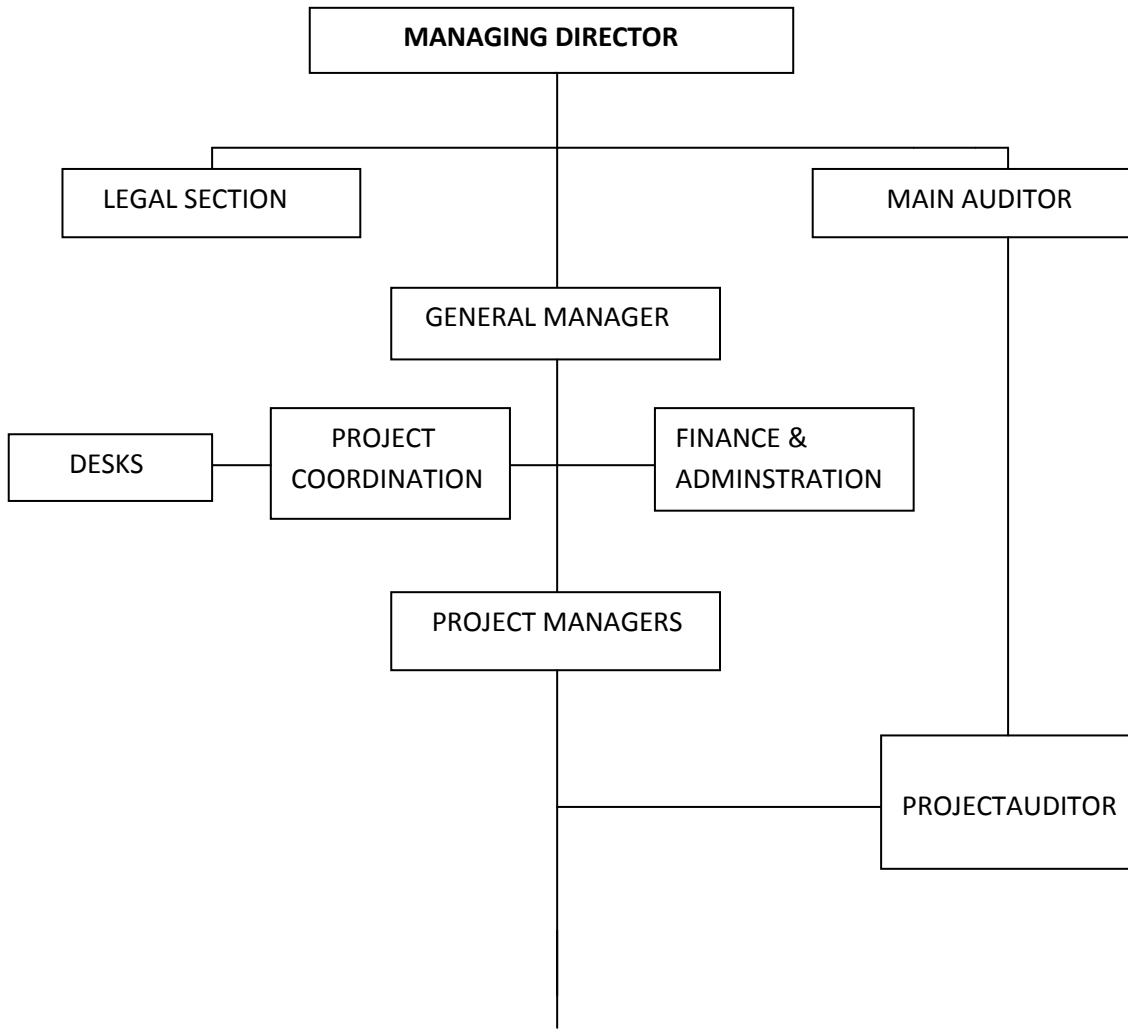


Chart1.1 Major organizational structure





BDU-IOT-SCWRE-CED

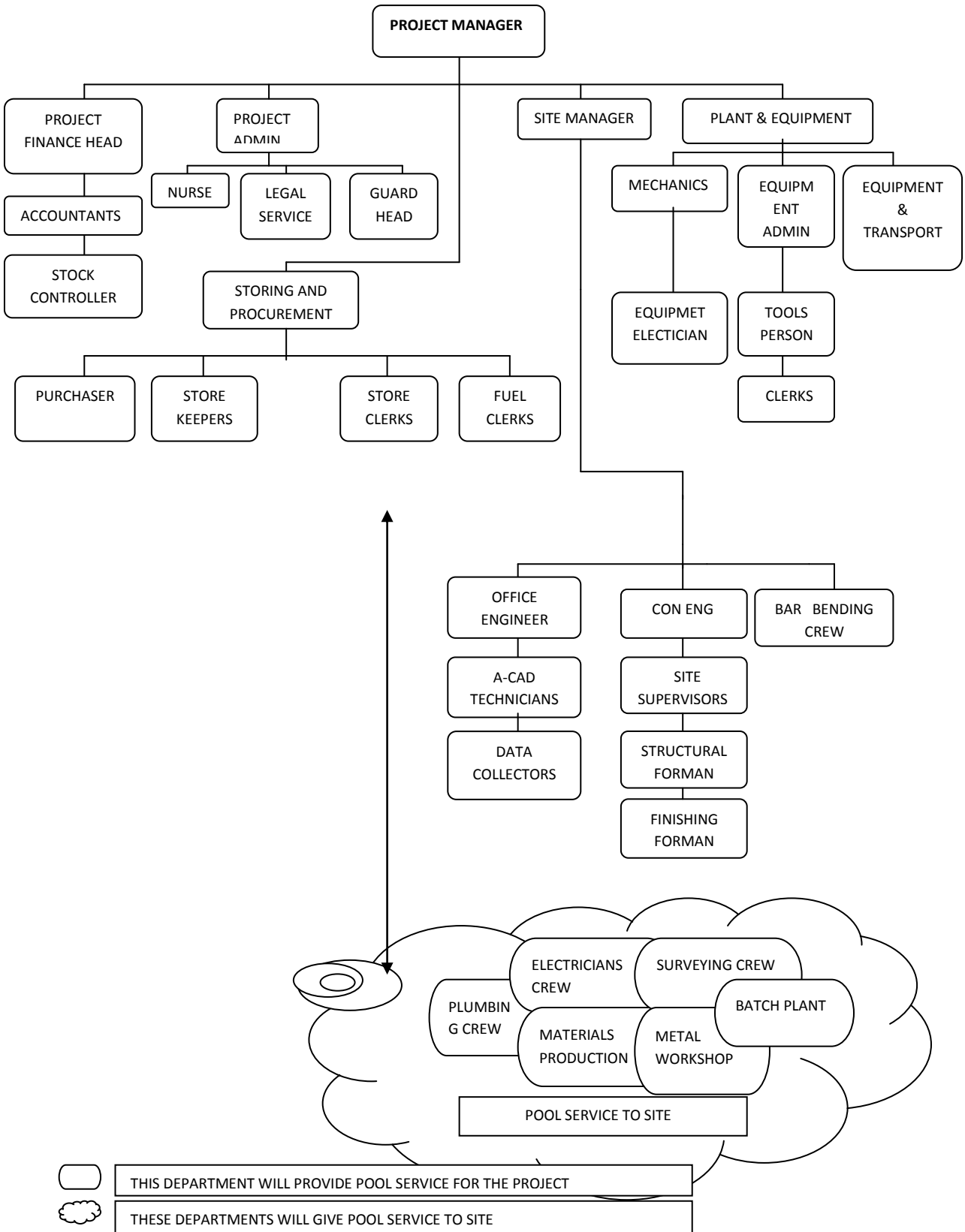


Chart 1.2 Sub organizational structure



## **1.4 WORK FLOW**

AS can be seen from the two charts shown above; the organizational activities will flow through the various components stepwise with the provision of specific tasks for each stake holder and ensuring the work productivity at each level. For ease of description the flow of activities within the firm is presented dividing it into two parts i.e. for the major organizational part at the head office and for the sub section at construction sites.

### **1.4.1 Work Flow at Major Organizational Part**

This section comprises the organizational part from the managing director up to the project managers level. The managing director in this case the owner is the final decision maker .Below the managing director ; there are three major sections mainly the general manager, legal section and the main auditor. The general manager is the person who controls and supervises various projects. Additionally; he leads the projects coordination, finance and administration sections.

The desks at the head office provide frequent and up to date information about current projects acting as a medium of data transfer between sites and the head office by working in collaboration with the project administration unit. The major auditor under the managing director leads project auditors and follows up financial and cash flow activities by providing periodic reports to the managing director. The work flow at this major section terminates at project managers who administer projects at various locations.

### **1.4.2 Work Flow at Sub organizational Part**

The sub organizational part consists of stake holders starting from the project manager until low level professional workers. The project manager leads five sub sections underneath which are: project finance head, project administration head, site manager and plant and equipment section. All these participants continuously contact and report their achievements to the project manager.



## BDU-IOT-SCWRE-CED

Project finance heads supervise finance related matters with accountants and store keepers. They will participate in transferring payment request forms to the main office. The project administration head on its part focuses on site administration by combining and coordinating the medical service, legal sections and working to ensure security of project area being with the guard head.

Storing and procurement unit works to ensure sustainable supply of construction materials. It is the leading participant in material purchasing, transportation, storage and usage of materials. In addition; it will control the consumption of fuel and other materials such as electrical equipments. They follow the operation of machines and will report at times of breakdowns and malfunctions to ensure provision of quick and appropriate maintenance service.

The site manager heads professional workers such as office engineer, construction engineers and the bar bending crew who follow up and coordinate workers under their sub sections by ensuring a developing work performance and accuracy. Plant and equipment section on its part participates in equipment administration and maintenance.

## **VISION**

MESCON Construction Company works to be one of the leading construction companies in the country by maintaining a close teamwork between various stake holders such as engineers, supervisors and management section and working towards successfully attaining its goals.

## **MISSION**

MESCON Construction Company gives great attention at completing project contracts at the specified time by the use of modern and cost effective mechanisms, well organized management schemes and ensuring the superior quality of works at the same time.





## CHAPTER 2

### OVERALL INTERNSHIP EXPERIENCE

#### 2.1 SECURING THE INTERNSHIP PLACE

I have obtained the internship place before the start of the internship program as I have been ordered by the university industry linkage office (UIL) officer to search and secure an internship place. I had observed the G+4 office building being constructed for the Burayou city administration municipality.

I went to the head quarters of the constructing company and submitted the letter from the UIL office to the general manager. I then completed the procedure and started practicing on the project starting from the beginning of the internship period as scheduled by the UIL office.

#### 2.2 GENERAL DESCRIPTION OF THE SITE AND PROJECT

##### 2.2.1 Project Description

The project I have been working on was a G+4 office building owned by the Burayou city municipality and constructed by MESCON Construction Company. The design and supervision work was being conducted by Oromia Water Works Design and supervision enterprise. The site was located at the center of the town near the existing building of the municipality.

The building consists of eight blocks named block A up to G having G+4 floors, a circulation block named block CR at the front consisting of a G+5 block and a meeting hall at the back. It has a semi rectangular open down at the center with the blocks extending out of the central block in a radial orientation. It will be provided with a green area at the bottom. It has a floor level of 3.45m up to first floor and a uniform floor height of 2.7m from second up to fourth floor.

All the blocks except the hall are rectangular in shape while the hall has an oval shape. Blocks A and G consist of two cantilevers verandahs each starting from first



floor up to fourth floor. The meeting hall on the other hand extends up to the first floor having a cantilever portion at the side of the main building.

At the start of the internship program, the construction process was at the third floor level on most blocks and at second floor level for certain blocks. Along the course of the internship program; the construction process has reached a stage where most of the structural components have been completed. The top tie beams of the G+4 blocks were casted and the floor slab of fifth floor on the circulation block was casted.

The meeting hall was the only block located at a low stage of construction. The hall was left behind because they wanted to proceed from the blocks at the front towards those at the back. The hall was located mostly at the earth work level where the footings were constructed prior to the start of the internship program.

### **2.2.2 Project Specifications**

Major construction material specifications for the project are concrete grade C-25, steel S-300 and a concrete mix ratio of 1:2:3. Apart from this a mix ratio of 1:4 was used for plastering work and a 1:5:7 mix ratios were utilized for lean concrete production.

### **2.3 ACTIVITIES PERFORMED**

I have been working with the site engineer at the office and observed various construction activities on the site. The site engineer was always explaining works performed in the office and I have worked with the general Forman while performing activities on the site.

As a new person to join the site; my first task was getting accustomed with the professional workers and other stake holders on the site. After this I have focused on my activities by ensuring proper interaction with my supervisor and other workers.

For better explanation of the activities covered; I have divided this section in to two parts .i.e. activities in the office and on the site.



### **2.3.1 .ACTIVITIES IN THE OFFICE**

Office works at the construction site consist a number of activities which are targeted at administering the site's activities. Some of the activities I have performed in the office consist of preparation of take off sheets, daily data analysis works, bill of quantity of material usage, preparing quantity of completed works for payment purposes and works done in collaboration with project supervisors such as ways of filling approval request forms and solving some inconveniences that occur in relation to design problems & revisions required. Some major activities in the office are discussed in detail below.

#### **Take off sheet works**

Take off sheet formats are prepared to calculate quantity of works and materials. Basically; I have observed certain types of take off sheet forms i.e. one that is used for more than one activity and those which are used for specific kinds of tasks. Quantity of completed works such as area of

Chiseling work , area of plastering works and amount of reinforcement bar works .I have prepared these forms at different times and for various requirements and submitted to my supervisor. In addition to calculating amount of works completed take off sheets formats were used for estimating the cost required for the work and reporting for the payment requirements.(see appendix 1A).

#### **Daily data analysis**

Daily data analysis work is useful to know the amount of daily activities covered per day. It has its own format prepared for collecting and storing data for each kind of activity .Activity types which are analyzed with this format are chiseling work, plastering work ,formwork area and concrete works(by volume). The data collected are then used in the preparation of monthly progress report of the project.(see app1C).



## **Bill of Quantity**

In any construction site; the effective and efficient use of materials is mandatory. Contractors always want to insure cost minimization and decrease wastage. Preparation of quantity of material usage will help to improve proper consumption of materials and sustainable storage and purchasing of materials. This is prepared in excel formats for different materials such as cement, sand and aggregates and reinforcement bars. It will involve the type of work completed, kind and amount of material of each kind used specifically. Additionally it will be used in calculating amount of certain materials required such as HCB, EGA sheet and marble tiles.

### **2.3.2. ACTIVITIES ON THE SITE**

Apart from the office work I have participated on site works being with the general and assistant Formans. Site work consists of many kinds of activities. Some of these are concrete mixing, bar bending and placement, formwork preparation, concrete casting, curing and chiseling and plastering works. The Forman supervises all activities on the site by controlling the activities closely. Some major site activities are presented here.

#### **Follow up and control of formwork preparation**

The formwork preparation involves the participation of carpenters majorly and assistants such as daily laborers. I have been assigned to check the work progress and accuracy of form work preparation for beams, slabs and columns. Making sure the dimension, elevation, material usage and speed of work was required. Checking the alignment, perpendicularity and strength of formwork components was another activity.

Calculating and measuring their productivity in running the work i.e. area of formwork completed per day and per hour by certain combination of workers.

#### **Check up of reinforcement works**

Reinforcement bar work; as a critical part of the structural system; should be given due attention and thoroughly checked prior to the concrete casting process. After



BDU-IOT-SCWRE-CED

they have finished the slab mesh and the beam reinforcement work; the number, diameter and length of bars are checked. The different bar types such as main reinforcements, negative bars and distribution bars should be provided correctly at each point of need.

These components will be checked with respect to the drawings provided in the design. If there are problems with the reinforcement placement. I then reported to the Forman to take corrective measures. Then he commands them to correct mistakes or insert bars if they had been forgotten. Additionally checking the provision of spacer bars was another activity.

### **Follow up and control of concrete work**

Concrete casting work involves certain activities such as concrete mixing, transporting to the place and finally casting into the required shape and dimension. I have been following up the mixing and casting processes at the mixing place. Checking the use of proper batching, material mixing ratio and water content is the critical part. At the casting place the depth and shape of concrete casted is controlled. Instructing masons and other workers to conduct the work properly following the right procedures i.e. dividing the section into a series of strips of slabs and filling the sections correctly in the case of beams.

Another activity that is observed is ensuring the concrete is properly vibrated as it helps to minimize development of cracks by removing entrapped air within the concrete mass. The vibration also decreases segregation problems and allows the concrete enter in all small places between reinforcement bars which helps attain the concrete cover and improve the strength of the overall section.

### **Checking chiseling and plastering works**

The construction process also involves chiseling and plastering works which are conducted step by step after demolishing of the formworks. Chiseling work; as a prerequisite for plastering and surface finishing activities is determinant in ensuring the proper quality of finishing work. Chiseling works were conducted by two groups working in contract.



I have been observing and checking whether the work is done within the appropriate mechanism and have even distribution over the structural part. On the other part the plastering works are conducted by a sub contract company and the material usage of the sub contractor is carefully followed since it results in wastage of materials if not controlled continuously.

## **2.4 FLOW OF ACTIVITIES**

During the internship period; I have been conducting the above mentioned and other activities as they are important. The flow of activities used in the site is multi dimensional. I will focus on how I was practicing activities in the office and site. The flow of activities employed in the office consists of a stepwise arrangement of tasks provided by the site engineer. For easier explanation I have separately presented the flow of activities in to two parts: namely flow of activities in the office and flow of activities on the site.

### **2.4.1 WORK FLOW IN THE OFFICE**

In the office; the flow of activities that I have been following is presented as follows .For every new kind of activity that was conducted; my supervisor was providing me the required introduction. After that he was discussing how to perform activities practically and gives previously completed works of the type to make use of them as a reference material .Finally I will practice the activity by myself and it was checked by the supervisor and he gives me his comments and points out mistakes and wrong assumptions which are corrected there.

### **2.4.2 WORK FLOW AT THE SITE**

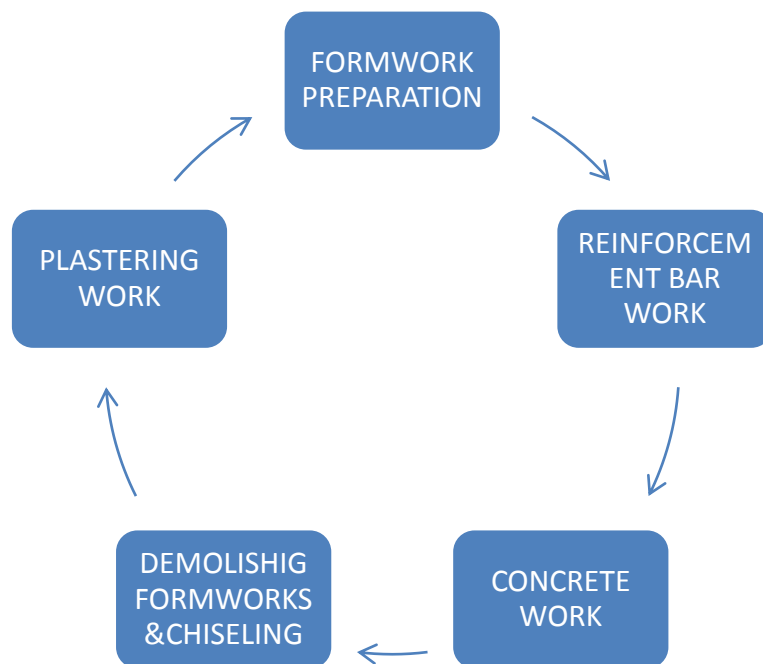
Site works that I have been participating were also conducted in an organized form. As I have explained above; I have been working with the Formans who is responsible in supervising activities. He was giving me various following up and supervising tasks.



## CHAPTER 3

### OVERALL WORKING PROCEDURES ON THE SITE

During the overall internship period; I have observed and participated in major working procedures used in the construction site. Since the foundation work was completed prior to the start of the internship program; I was not able to follow the construction of footings and grade beams .As explained in the previous section the construction process was at a level of third and second floor level. The construction process involves the various working procedures mainly comprising the concrete work , formwork preparation , bar bending work ,conduit work(installation) ,demolishing and removal of formworks, chiseling and plastering works . The major working procedures employed are shown in the chart below.



*Fig3.1 Overall construction procedures*

As it can be seen from the above diagram; the construction process consists of the procedures arranged in step by step orientation. The various procedures mentioned above with some sub components are deeply discussed below.



### 3.1 FORMWORK PREPARATION

#### Fixing Elevation

As I have learned from the general Forman ; the elevation of a floor level will be transferred from bottom floors .During the start of the construction ; the elevation reference was taken from a bench mark from a point by the side of the road. After the elevation was transferred to a point inside the compound which was used as a reference to fix the grade beam level. Then the floor level of the first floor was fixed from the bottom ground level and the same process is repeated continuously up to the final floor level.

- ❖ The steps used in fixing elevation are listed below by identifying the specific tasks in each step
  - A bench mark was specified at the start of the project on a point outside the area near the main road
  - The elevation was transferred from the outside benchmark to a reference point in the compound
  - The level of the grade beam and the ground floor was fixed from the reference point in the compound
  - The first floor elevation was then fixed from the bottom ground floor elevation.

After this the steps involved in fixing the elevation of slab formwork are as follows:

1. A reference line is drawn and a mark is prepared by using a tube water level (gommalik) measurement from the floor beneath. The instrument works based on the principle of hydraulics.
2. Measurement is taken from the mark previously made up to the level where the bottom of the next floor level formwork is placed taking into consideration the dimensions of formwork and depth.
3. Then a rope is stretched to define the dimension and the next task will be continued which is the cristy work.





After these activities are over the formwork preparation is continued. The formwork is determinant as it is used to fix the dimensions of structural components and their specific shapes. Formwork preparation has its own separated procedures and work tasks by the participation of different workers such as carpenters and daily laborers. It also requires the use of materials such as wood, EGA sheets, timber, nails, panels and hand tools. The formwork preparations of various structural components are discussed below.

### 3.1.1 Slab and Beam Formworks

In this building the slabs and beams were constructed together since they were designed having a T-shaped cross section /flanged beams/ which allows the simultaneous construction of both structural components. The slabs were solid slabs having a uniform thickness of 15cm in all the floors while the beams have 250 x 350 dimensions where the 150mm depth is constructed together with the slabs.

- ❖ The following procedures were employed in formwork preparation of slabs and beams:
  - Crispy is erected with a maximum spacing of 60cm along the length of the slab
  - The next step involves the preparation of beam formworks. The bottom portions of the beam formwork are laid over the cristics prepared previously.
  - After finishing the bottom beam formworks; the sides of the formwork are placed and nailed which provide the three dimensions of the final beam structure.
  - Horizontal members which are the main components of the slab formwork called modini are fitted with the sides of the beam formwork. They are laid by considering the spacing provided with respect to the final formwork material to be used i.e. metal sheet or panels.
  - Vertical supporting members are then provided under each horizontal component (modini) which transfers the load of slabs casted from the top horizontal members towards the bottom slabs.



- Horizontal small diameter wooden parts are continuously laid over the horizontal members which support the final formwork materials ;in this case metal sheets



*Figure 3.2 Formwork Preparation*

N.B Step 6 will not exist if the final formwork material is panel.

- Finally the top layer of formwork material will be laid and fixed in position by using nails.

### **3.1.2 Column Formworks**

The columns in this building have mostly similar dimensions. A typical dimension of 300x300mm and 400x400mm were used for rectangular columns while a common 350x350mm dimension was used for circular columns. Metal panels with wooden components are used to prepare these formworks. The step by step activities for this work are the followings:

- The foreman checks whether or not the reinforcements are properly placed and erected with the appropriate dimension, length and spacing. The stirrups will also be checked for proper spacing and orientation.
- The panels of required dimension are tied with the small woods .by using wires followed by the oiling of their surfaces in order to prevent adhesion of the concrete at the time of casting.



- The formworks are erected and close the reinforcement prepared in rectangular or circular shapes needed. The formworks will be strengthened by nailing small pieces of wood (kerebat) along its sides from bottom to top.
- After finishing the above tasks the alignment and perpendicularity of the formwork will be checked and fixed.
- Next comes ensuring the vertical alignment of the formwork by using plumb bob (tumbi) suspended on the sides of the formwork.
- The formwork is then fixed in position by using long wooden members connected with the form work at the top with the horizontal wooden structure (mager) at the bottom.
- Column form work preparation will be finalized by preparing supports and ladder like component for easier and safe upward movement of workers when the concrete is poured in to the formwork.

### 3.1.3 STAIRCASE FORMWORK

Stair cases as a major circulation and transport facilities in a building; are constructed for every floor level in a building. The formworks of staircases are prepared in a different methodology from those for beams and slabs. The formworks used were having a width of 1.40m, risers of 17cm and threads having 30cm length.

- ❖ The steps involved are as follows:
  - Vertical supporting wooden parts are erected by ensuring their length increment from small to large in a way its slope is kept correctly.
  - Horizontal members are then laid over these verticals which will carry the formwork materials (panels) above them.
  - The panels are placed and fixed into position along the slope of the staircase.
  - The sides of the formwork are prepared from timber material by maintaining the stair case slab thickness.
  - After this the risers of the staircase formwork are fitted between the sides by keeping their interval and spacing.



### 3.2 REINFORCEMENT BAR WORKS

Reinforced concrete structures by their nature are known to comprise two major components; concrete and reinforcement bars. The strength of RC structures depend to a great extent on the proper design provision of reinforcement since this component is responsible for the tensile loads exerted on the structure.

The reinforcement bars used for the project were locally fabricated bars from Akaki Steel Mines Company. The reinforcement works were conducted by a contract worker who hires different workers under him.

- ❖ The major procedural steps used in this item of work are explained below:
  - The bar benders identify the length, diameter and shape of steel bars required for the specific work item they are performing. They have a previously prepared document which contains the various requirements in terms of length, number and diameter of bars.
  - The bars are then cut into the required lengths with the needed amount with a cutting instrument.
  - Then they are shaped with the required shape and bending dimensions with a shaping instrument.
  - Stirrups are also prepared with a similar methodology.
  - For columns they prepare the whole component at the bending place and transport it to the building and erected by tying with wire.



*Fig3.3 reinforcement work*



- For slabs and beams the prepared bars are transported to the place and are fitted into the required shape and dimension giving attention to the following points.
  - a. Spacing of stirrups: stirrups are spaced based on the detail drawing provided to the bar benders.
  - b. Place of overlap: The reinforcement bars are overlapped following the basic scientific principle which specifies the place of overlap for various bar types. Main bars are overlapped at the column joints while Negative bars are provided with overlap at the mid span.
  - c. Proper orientation: main reinforcements and stirrups should be placed with the right direction and alignment.
- Finally the foreman will check the completed work against the drawing and quantity of reinforcement prepared.

### **3.3 CONCRETE WORK**

The concrete work comprises one of the major structural components of RC structures. As it is known; the concrete is responsible for carrying compressive loads. The overall structural strength of the building is dependent on the concrete work and the quality of materials used in the mix design. The concrete property depends on various climatic, material type and water content factors. The following lines describe the procedures employed in the concrete work.

- Materials are transported to the mixing place. Cement is transported from the store to the mixer while other materials are taken to the mixer being measured by a box having a volume of 0.036m<sup>3</sup>
- At the mixer the materials are proportioned and batched based on the specified mix ratio.
- After this the materials are poured into the drum of the mixer from the inlet box. The materials are then mixed by pouring water into the mixer.
- The mixed concrete is then poured into the dumper from the mixer and transported to the point where the carrying container suspended on the





## BDU-IOT-SCWRE-CED

- pulley is moved up and down. Then the concrete is dumped into the container.
- The concrete will then be taken up to the required floor level where it will be casted.
  - It will be poured on the required place by daily laborers who are supervised by the foreman.
  - Masons being with their assistants cast the concrete by providing he necessary compaction with a vibrator.
  - Then the concrete is shaped in to the required depth by tying a rope to specify the thickness of the cross section.



*Fig3.4 Concrete work*

### **NOTE**

- a. If the concrete casting process was stopped for more than three days ; a cement-water mixture called' buaka' will be splashed along the surface edge of the previously casted concrete in order to ensure proper bondage and adhesion between the previous and the new concrete.
- b. When pouring and casting the concrete it is filled up to  $\frac{1}{3}$  of the span of the specific slab area. After that the next portion of the slab is filled .There are various reasons to fill the slabs in three strips separately. The followings are the major reasons which make filling by parts so important;



- **To decrease structural shrinkage cracks**

The shear force diagram of a typical rigid jointed beam structure shows that the bending moment is maximum at the middle and decreases towards the supports being converted from positive to negative at a small distance from the face of the column. This is the point where the bending moment becomes zero.

On the other hand; the shear force is maximum at the supports and it decreases when going to mid span and becomes zero at approximately the mid span.

Based on this concept; the concrete will be subjected to structural cracks if it is filled at once due to the maximum bending moment at the middle of the span. Hence filling up to  $1/3$  of the span will reduce the effect of the bending moment since the moment is approximately zero at this span length. With respect to the shear force the concrete will be subjected to shear crack if casting is stopped at column joints. Because of these structural effects  $1/3^{\text{rd}}$  of the span length is an ideal place to divide the slab into strips.

- **To Minimize Volumetric Shrinkage**

Casting a complete slab at once has a problem of volumetric shrinkage. When concrete is filled in all the available space; it will not attain the required level of compaction since it can hold void spaces between particles. The reinforcements will also lead to development of cracks when they are stepped on by the workers performing the casting activity.

- **To improve Speed of work**

Filling the whole volume at once will reduce the speed of construction since it will not be suitable to fill the concrete in the required dimension since it gets out of the specified area of casting. In addition to this the existence of void spaces will decrease the structural strength since compressive strength depends on the depth of a section. Another importance of the part by part filling in the casting of slabs is the improvement of workability and increase quality of construction.



### **3.4 DMOLISHING FORMWORKS AND CHISELING WORKS**

After the concrete has attained the required strength; the reinforcements are removed from the hardened concrete for the next items of work to be conducted such as chiseling and plastering works. Slab and beam formworks are removed after the 21<sup>st</sup> day while column formworks are removed after twenty four hours. When removing formworks great attention is given for safe removal of formwork components as they are reused again. Most of the time; formwork components are disconnected when preparing formwork for the next floor above the existing one since the members have similar dimensions and hence are easy to use.

Another activity conducted following the demolishing of formworks is chiseling work which is pre requisite for the plastering work. Chiseling works are conducted by contract workers who perform these activities after form work removal. They use hand tools to chisel the surfaces of structural members such as slab ceilings, beams and columns. The following steps were used in formwork removal (demolishing) and chiseling work.

- First; the vertically supporting formwork members are removed
- The horizontal members together with the beam formworks are removed giving attention to minimize occurrence of accidents.
- The top formwork material is then taken down by ensuring they are removed safely without deformation and breaks.
- After the formwork is taken away; chiselers will start their activity by separating their specific tasks and identifying structural components to be chiseled.

### **3.5 PLASTERING WORK**

Plastering work is one of the major finishing activities which is determinant in keeping the quality of the final surface finish. Plastering helps to maintain a smooth surface on the walls, ceilings, columns and beams by removing some ups and downs occurring during construction. It also functions as a platform for the continuing finishing works such as gypsum and lime plastering and finally the painting.





- ❖ Major steps in the plastering work are as follows:
  - The mortar is prepared by using the appropriate mix ratio.
  - The material is transported to the plastering place
  - A rope is extended to help in attaining the required thickness.
  - The first coat of plastering is conducted by providing the appropriate depth .Together with the first coat ;a layout of line is prepared along the longer dimension of slabs for ensuring accurate depth for the second coat.
  - The second coat of plastering is conducted over the first coat by providing a smooth surface.
  - The edges of the building components such as beams and columns are shaped and provided with a sharp edge to give a better look.

### 3.6 SITE VISIT OF FOUNDATION WORK

Apart from the major construction site, I have made a visit on another construction site located in Kotebe where a G+4 condominium building was constructed. The construction process was located at the foundation level where pits were excavated and footings were constructed.I have observed how the excavation was conducted by giving the required working space for the workers, ways of placing the reinforcement appropriately by providing the required concrete cover for the footing, and the formwork preparation for the concrete work of the footing. Some of these findings are shown in the figure below.



*Fig 3.5 Foundation work*



## CHAPTER 4

### CHALLENGES I FACED DURIG THE INTERNSHIP

Working on a construction site has its own challenges that occur frequently which originate from various sources. The major sources of challenges may be natural occurrences, challenges originating from the construction company and those which arise from indirect sources such as problems with electricity, water supply, communication and transport facilities. Some major challenges that I faced during the internship period are presented as follows.

#### ❖ **Problems on working drawings**

The drawing problems were the major challenges I have been facing when I was conducting my office and site activities. These problems originate from the designing company. The drawing problems that I met frequently were related to provision of reinforcement bars. The problem was most noticeable on beam detail drawings where they have placed inappropriate number of bars which could result in reducing the strength of the cross section.

When facing these problems; I have been reporting directly to my supervisor and the foreman on the site. The foreman has given me explanation about the ways they followed in solving these inconvenient situations. According to the extent of the error encountered; they try to modify the inconveniences at the site and solve the problem over there. If the problems are large scale, which require deeper analysis and revision; they ask for design revisions from the designing company.

#### ❖ **Lack of Safety Utilities**

When working on a construction site; ensuring the safety of oneself is of primary importance both for the worker and the company. Since the company is subjected to medical expenses; In case of harsh accidents on the site. With respect to this concept; there was a lack of safety utilities such as helmets. The company is working to fulfill every needed materials and instruments but these utilities were not found in enough amounts.



I had asked with my fellow interns in order to get these helmets as they are necessary to ensure our safety and move on the construction site with full confidence .They had forwarded our request for the head office and were trying to make them available.

#### ❖ **Lack of Computer Service**

AS a civil engineering trainee; Apart from conducting activities on the site: I have also performed office activities which need to be supported with computer applications. In addition Practicing AutoCAD was another activity to be performed. But I was not able to get computer service as there was no free computer to use and the existing computers were always busy since they were used every day.

To minimize the problem ; I have been using computer for practicing AutoCAD and other works out of the normal working hours in the morning and after working hours in the afternoon .

### **PROBLEMS ON THE CONSTRUCTION SITE**

There were problems occurring on the site that were of different kinds and sources. These problems have more or less effect on the construction process. Some of these problems were out of the control of the constructing company while others can be solved with certain corrective measures. Out of the major problems I had observed; some are presented as follows.

#### **1. Lack of Construction Materials**

There was a problem of timely deposition of construction materials which was slowing the speed of construction and minimizing the overall productivity. With respect to this the lack of cement and aggregates can be mentioned. Sometimes cement was not transported on time and workers were not able to continue their activity.

#### **2. Lack of certain construction machineries**

The site requires the use of many kinds of construction machines. Starting from the mixer & dumper; they play an irreplaceable role in fastening the construction



activity. The site is equipped with most of the important construction machines. The major construction machinery that was causing problem was a pulley. They were using a pulley by rental service with a certain value per day which is resulting in the loss of large amount of money.

### **3 .Machinery problems**

Apart from the above mentioned problems; the breakdown of certain machineries is posing a problem to the construction process. The frequently affected machine was the dumper that was used to transport mixed concrete from the mixer to the bottom of building where the pulley takes up the concrete with a carrying container.

### **4. Problem of electricity**

The frequent stopping of electricity is the major problem which greatly slows down the construction process. The power problem is frequently occurring and stopping overall activities which need electricity. Some of these are mixing place, concrete work and office works. The breakdown of electricity therefore was a significant problem.

### **5 .Shortage of Labor force**

Another problem that was occurring frequently was the lack of workers such as carpenters and masons. Since they were leaving out when getting a better work place and salary. Replacing the open working places consecutively was becoming another activity of the site. At times they get workers they may not have the required skill and experience which makes it difficult to hire workers on time and results in retarding the speed of construction.



## CHAPTER 5

### BENEFITS OF THE INTERNSHIP PROGRAM

The internship program as it is known was started with a major plan of enabling students acquire enough technical and practical knowledge concerning how the works are performed in the practical world in relation to their field of study. Therefore it was a very interesting period where I was able to grasp technical knowledge, participate in real construction activity, enjoyed working with experienced professionals and have been successful in performing activities. Below this I have presented what I have gained in various types of technical and practical skills.

#### 5.1 Practical Skills

I have been able to accumulate certain practical skills which are important in running a construction project. As I have noticed this sector requires the availability of enough practical knowledge and very educated professionals. In the time elapsed I have worked with professionals that helped me acquire practical skills both on the site and in the office.

As I have explained before performing works in the office was my activity where I was able to thoroughly understand and practice work tasks conducted in the office. Based on this I have practiced preparing take off sheets for different work items.

On the site I have practiced the works of various structural parts by following the procedures utilized for each specific categories of work. In this respect the concrete works, bar bending, formwork preparation, demolishing, chiseling and plastering works were included. Another practical activity I have obtained was the skill of supervision which includes controlling, commanding and leading a group of workers in performing a task.

- Some of the technical skills I have obtained are listed below:
  - ◆ Preparation of take off sheets including take off sheets of chiseling, plastering and reinforcement works.



- ◆ Preparation of breakdown of certain materials such as HCB, marble tiles and EGA sheet.
- ◆ Bill of quantity of chiseling and plastering works.
- ◆ Calculation of the work efficiency (productivity) of workers as a way of controlling their performance.
- ◆ Reading, understanding and implementing working drawings.
- ◆ Ways of taking measurements on the construction site.
- ◆ Supervision and checking of reinforcement, formwork, concrete and plastering works.
- ◆ Ways of keeping the alignment and perpendicularity of column formworks.
- ◆ Methods of solving some construction errors on the site.
- ◆ Techniques of assigning , coordinating and supervising workers

## 5.2 THEORETICAL KNOWLEDGE

The internship program has given me a chance to enhance my theoretical knowledge to a great extent. When observing the activities performed on the site ; there were various points which attract and require the closer analysis and assistance from professionals working there. Since I have been working on an RC structure; I have utilized the knowledge I have got from the previous courses.

I have tried to focus on relating the concepts from the courses taken with working principles and mechanisms followed on the site. Reinforcement works were mainly related with the course that I had taken enabling me understand the application of design concepts covered in the course.

- List of some theoretical concepts obtained:
  - ◆ Concrete works including ways of material proportioning ,mixing, transporting(conveying), casting and curing
    - ✓ Use of cement water mixture (buaka) in concrete casting.
    - ✓ Use of *Nitobond* as a binding material.



- ◆ Reinforcement works including bar cutting, bending and placement, preparation of mesh for slabs, staircases, use of distribution bars and use of submerged beams.
- ◆ Chiseling and plastering works procedures.
- ◆ Method of solving problems on between contractor and consultant.
- ◆ Ways of reporting design and drawing problems and asking for design revision.
- ◆ Techniques of site management and labor administration.
- ◆ Payment and cost related ideas in connection with the Contract agreement.

### 5.3 INTERPERSONAL COMMUNICATION SKILLS

Construction projects involve the participation of different parties. A fast flowing internal communication and interaction between the sections of a certain unit and between different parts of the working units within the construction site.

Based on this concept; the interpersonal communication activities as guided by the work flow provided in the organizational structure on the site. When working in the office I have been followed up and helped by the site engineer who was my company supervisor. I had an interactive relationship with the supervisor during all the internship period when receiving explanations, commands and submitting our work results and reports.

I have also developed communication skills on site works when working with the foreman and other workers on the site. During the execution of assigned activities on the site such as checking the appropriateness of certain works, follow up and supervision activities; I have been interacting with various workers like carpenters, masons etc. which helped me understand the ways of discussing and analyzing problems in a constructive way by giving enough chances to hear and respect the ideas of the workmen.





## **5.4 TEAM PLAYING SKILLS**

The activities I have conducted in the site were undertaken by contributing parts to the group of workers where certain activities were taken into account by making discussions and executing a task through bringing the individual effects together into a specific item of work.

The procedures employed in these team based activities were the analysis and discussion of the activity to be performed where the basic principles and working procedures are carefully identified and stated. These proven techniques and procedural steps were then related with the scientific principles by conducting thorough discussions on the concepts covered on theoretical courses and the incidents they were applied to.

## **5.5 LEADERSHIP SKILLS**

Leadership skills; as another important type of practical skill has also been given attention while conducting activities and participating in assigned tasks which are important in deciding the perfection and accuracy of some work types. Sometimes the appropriate and well analyzed decisions are absolutely essential in undertaking activities since problems arise which makes things difficult and require certain specific actions to fix problems and complete that piece of work successfully.

Decision making skills are also important by giving a chance to enhance self confidence in handling work tasks and leading group of workers to perform a certain activity with the required quality and speed of work.

## **5.6 ENTREPRENEURSHIP SKILLS**

Developing the skills and ideologies of entrepreneurship is another important achievement that I have got from the internship experience. I have tried to analyse the step by step development of the hosting company by identifying the development cycle and its core elements functioning as basic components in the makeup of the company. As the company is founded and owned by an entrepreneur; it has given me





a chance to observe the organizational structure, back ground and basic achievements which was important in understanding its entrepreneurial activities.

Understanding the basic principles of entrepreneurship including the existence of vision and passion and commitment to organize and lead an organization and other entrepreneurial characteristics such as need for achievement, willingness to take risks, self confidence and innovative skills.

## **5.7 WORK ETHICS**

In every profession, there are ethics to be followed. These rules help workers maintain appropriate professional discipline. Without these ethics, it would be difficult to conduct ones work effectively. There is labor discipline that each worker should observe and respect. These could relate to norms, mode of carrying out a work, protection of the property and means of working and managing activities. Failure to observe such ethical rules would result in penalty which ranges from suspension to dismissal. Thus workers are expected to observe professional rules so as to be more productive and to establish good rapport with other workers. Some important ethical values that should be followed are discussed below.

### **5.7.1 Punctuality**

One of the major work ethics component that is so important in ensuring proper progress of the project and effectively use the project period to complete the work on the project termination time. The working periods were 8:00am up to 12:0pm in the morning and 1:00pm up to 5:00pm in the afternoon. The entrance and exit times of the workers were are checked by a time keeper who controls and reports the working periods, absentees, overtimes etc. of each worker.

I have been working on my activities based on the working period and giving the required attention on the use of working periods effectively. This has helped me understand the importance of respecting time and work towards maximum utilization of the available time when performing the activities.



### **5.7.2 Accountability**

Working on construction activities has its own working principles which require the specified personnel to take responsibility of his activities in their positive and negative outcomes. When running activities provided; taking the accountability of these activities will help to carefully undertake the specific task by giving enough attention for the working procedures and principles in conducting these items of work.

Since construction companies have accountability of their construction activities which continues even for a certain period after the completion of the project. Developing this skill is thus of prime importance in the future professional working period where taking the accountability of performed activities is required and is one of the capacity measures utilized in estimating the capacity of professionals.

### **5.7.3 Honesty and Truthfulness**

Having a honest and truthful behavior is also important when working in the construction sector .Being able to take the risks of one's action and cooperating an finding the solutions of some inconveniences related to the mistakes committed is so useful to maintain a good working environment and proper interaction between various workers. Thus; being honest in every action conducted is one of the fundamental requirements of workers on the construction site.

### **5.7.4 Transparency**

This work ethics value is mainly concerned with following clearly pointed out procedures and using relative scientific principles in conducting activities. This allows the concerned body to closely follow up and control the progress and quality of specific tasks under action. The existence of such working condition is also important in realizing the usage of appropriate materials and equipments and other inputs for the task under action.

Advantages of following transparent working methodology is the ease of handling important data, increased speed of task execution and existence of workable environment in which activities are performed with a better quality and speed.



BDU-IOT-SCWRE-CED

### 5.7.5 Appropriate Handling and use of Instruments

All workers are expected to handle and appropriately use the instruments given to that specific profession. When working in office and site various materials equipments are used thus using the materials effectively and carefully is important both for the company and the worker himself.

Another equally important idea is the appropriate and efficient use of construction materials such as cement, sand and aggregates which are determinant in ensuring the proper material consumption based on the project's specifications. Minimizing wastage is of predominant importance in realizing the effective material usage and increase the profit level to be gained by the company.



## CHAPTER 6

### CONCLUSION AND RECOMMENDATIONS

#### 6.1 CONCLUSION

My internship hosting company has been eager to give a chance for me to take my internship career there and providing me with a supervisor who had a major part in helping and learning me in all my activities. This shows that MESCON Construction Company has been cooperative and helpful in giving chances for conducting the internship activities by maintaining good working conditions.

During the internship period I have been conducting activities In the office and on the site. The site engineer who was my supervisor was providing me with the required explanations and support, giving commands to execute certain activities and control and supervise my activities.

When conducting these activities well defined procedures were being followed to conduct activities in the office and on the site. The existence of work division and specified procedures has made it suitable for easier execution.

Apart from the working conditions and environments; there had been some challenges which I faced during the program. Some of them were related to the office work while others are stringed to site activities. Lack of computer service, lack of safety utilities and drawing problems on the design were predominant. Other problems related to the company such as lack of construction materials, breakdown of machines and problems beyond company's control like electricity problems were common. I have tried to minimize the effects of these inconvenient situations by taking and applying measures and working closely with people around me.

In terms of getting benefits from the internship; I have been able to acquire basic theoretical and practical skills which are important in my future working period giving an understanding on the working methods used on the site and serving as a well prepared place to practice what I have observed in collaboration with other stake holders.



From all the above points I conclude that the internship period has been successfully utilized by conducting expected activities, participating in all important tasks on the site, observing and noticing working procedures. The program has enabled me to get the theoretical, and practical knowledge that are common in my field of study.

## **6.2 RECOMMENDATIONS**

Apart from the positive sides; I have observed certain problems and inconveniences occurring on the site. Some of them have been discussed previously. Some of the problems originate from the company itself while others are the results of different sources such as electricity problems. Other problems are related to the lack of construction materials in the country .Cement is the most common material problem. I have presented some major recommendations which I thought are useful in improving the existing working procedures and speed up the construction process by ensuring better quality of work at the same time.

### **I. Use of Modern Formworks and Scaffolding**

On the construction site; wooden formwork members and scaffolding were used. These types of materials are not suitable for easy and speedy construction activity since they require a lot of time to be prepared in the required shape and dimension.

The use of modern formworks on the other hand are useful in maintaining a fast flowing construction process because of the fact that these formwork members are constructed using a bolt joint which makes them so handy and workable resulting in a fast construction activity. Thus I want to recommend the use of these modern technologies in the construction process as they are useful in improving the work performance and minimizing the contract period of projects.

### **II. Ensure Continuous Supply Of Construction Materials**

Sometimes there were gaps created in the import of construction materials to the site. This was resulting in the stoppage of construction activities and thus slowing down the whole construction activity which will subject the company to extra cost and loss of money in relation to the delays encountered.



The continuous and frequent supply of materials is thus important in running the construction process with the required pace and work quality. Moreover the improved material supply will make workers focus on their respective work task and continue the construction procedure according to the forecasted schedule.

### **III. Improve capacity of Machineries**

As I have tried to explain in the challenges section of this report; some machines were being out of use frequently greatly affecting the construction process. As it is known construction machines play a vital role by substituting a large number of human labor requirements at one point and speeding up the activities to a greater extent.

Maintenance and renewal of some machines is so important to get the maximum output of the machines and run the activities with full capacity of labor force. Thus certain machines like dumpers should get proper maintenance and service to enhance their proper use and work towards attaining the required level of project progress at the specified time.

### **IV. Ensure The Safety of workers**

The safety of workers on the construction site is one of the major issues in the sector. Construction activities by their nature subject workers to different accidents on the site.

To minimize the occurrence of these accidents; different safety mechanisms are applied according to the specific type of accident. With this regard, supplying safety utilities is so important to protect workers from serious injuries and help them be an active participant in their respective work positions.

### **V. Improve site Management**

The proper management of materials, instruments and timely removal of waste materials is important in maintaining a better working environment which results in improved performance of workers. This in turn will facilitate the general construction process by enhancing the execution of tasks at the required time.



Hence creating an interactive and suitable working environment will be important in facilitating the execution of tasks since it is free of obstacles that undermine the working behavior and result in reduced performance.

## **VI. Increase the number of skilled labor**

Apart from the critical positions most of the labor force utilized doesn't have the required educational background which has a negative effect on the quality of works conducted by undermining the timely execution of tasks.

Thus improving the number of well educated professionals has a predominant effect in realizing improved performance of workers and finally being a major source of driving force to finish the construction activity at the required time.



## ***REFERENCES***

- Ministry of works and urban development, (1995). EBCS-2, Design of concrete structures. Addis Ababa, Ethiopia.
- Design of concrete structures by Nilson.
- Design of reinforced concrete structures, S.Ramamrutham, R.Narayan.
- Building construction, Abebe Dinku ; Addis ababa university press.
- Statically Indeterminate structural analyais , Nigussie Tebedge.





**APPENDIX 1**

**VARIOUS FORMATS USED IN THE OFFICE**

**APPENDIX 1A - TAKE OFF SHEET FORMAT**

**Project:**Burayou G+4 office building

**Contractor:**MESCON CONSTRUCTION

**Payment No:**

**Consultant:** OWWDSE

**Client:**B.municipality

NO	Qty	Size	Description	NO	Qty	Size	Description

Contractor

Site Supervisor

-----

-----



**APPENDIX 1B - REINFORCEMENT BAR TAKEOFF SHEET**

**MESCON CONSTRUCTION**

**REINFORCEMENT BAR TAKE OFF**

Project: BURAYOU OFFICE BUILDING

TAKE OFF NO:

BLOCK: F, G &CR

ITEM OF WORK:

NO	LOCA TION	SHAPE	DIA Ø	LENGTH	NO OF BAR	TOTA L	LENGTH OF BAR FOR EACH DIAMETER													
							Ø6 mm	Ø8 mm	Ø10 mm	Ø12 mm	Ø14 mm	Ø16 mm	Ø20 mm	Ø24 mm	Ø32 mm					
		TOTAL LENGTH(M)						-	-	-	-	-	-	-	-	-	-	-	-	-
		WEIGHT(KG/M)						0.22	0.39	0.62	0.89	1.21	1.58	2.47	3.55	6.31				
		TOTAL WEIGHT(KGS)						-	-	-	-	-	-	-	-	-	-	-	-	-

CONTRACTOR-----

SUPERVISOR-----



### APPENDIX 1C - DAILY DATA ANALYSIS SHEET

**MESCON CONSTRUCTION**

**DAILY DATA ANALYSIS SHEET**

**PROJECT:** Burayou office building

DATE	ITEM OF WORK	BLOCK TYPE	MATERIAL USAGE	MAN POWER UTILIZED	MACHINERY OR EQUIPMENT USAGE	UNIT	NO	SIZE OF WORK			AMOUNT OF WORK EXECUTED	WORKING PERIOD
			CEMENT	G.FORMAN	LOADER							
			SAND	MASON	EXCAVATOR							
			AGG.	CARPENTER	MIXER							
			EGA SHEET	DL	VIBRATOR							

Prepared by \_\_\_\_\_ Checked by \_\_\_\_\_ Approved by \_\_\_\_\_



## APPENDIX 2

### Definitions of some common site names

Pensi.....a small opening that occurs between parts of wooden formwork.

Senkelo.....a container used to transport concrete

Kebeleto.....small portion of reinforcement prepared to support negative bars  
During concrete casting.

Kerebat.....wooden formwork member used to fix panels of column formwork

Stanga.....wooden component that keeps column formworks vertical by  
providing support.

Cristy.....a wooden structure used to carry the formworks of slabs and  
beams

Mefaas.....a mason's tool used to make a flat surface.

Rigga.....a metal bar with a small width used to keep the grade level of  
concrete.

Berga.....the name of one full length reinforcement bar.

Begga.....an instrument used to bend bars.

Belenkino.....a carpenter's tool used to remove nails.

Modini.....formwork parts that carry the top layer of formwork and the  
underlying wooden pieces.

Sponda.....the sides of a beam formwork.

Fondo.....the bottom part of a beam formwork.

Krancha.....an instrument used to cut reinforcement bars.

Berrera.....the 1<sup>st</sup> coat of plastering work.

Girff.....the 2<sup>nd</sup> coat of plastering work.

Tumbi.....a line made with 1<sup>st</sup> coat used to determine the 2<sup>nd</sup> coat thickness.



## BDU-IOT-SCWRE-CED



## BDU-IOT-SCWRE-CED

---



## BDU-IOT-SCWRE-CED

.....







## BDU-IOT-SCWRE-CED

.....