A TECHNICAL REPORT

STUDENT INDUSTRIAL WORK EXPERIENCE SCHEME (SIWES)

SEPTEMBER-DECEMBER 2024

Held at

DAVOSACH INVESTMENT AND MINES LIMITED,

OREKE, KWARA STATE

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ND/23/MPE/FT/0029

SUBMITTED TO

DEPARTMENT OF MINERAL AND PETROLEUM RESOURCES ENGINEERING

INSTITUTE OF TECHNOLOGY

KWARA STATE POLYECHNIC, ILORIN.

PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF NATIONAL DIPLOMA IN MINERAL AND PETROLEUM RESOURCES ENGINEERING

SEPTEMBER-DECEMBER 2024

DEDICATION

This report is dedicated to Almighty God the creator of everything, for his love, strength, preservation and for being my source of knowledge at all times, And also to my parents MR. AND MRS ABEJIDE for their effort and support towards me.

ACKNOWLEDGEMENT

This is to express my sincere and utmost gratitude to God Almighty who has always been a pillar for me to lean and also for his unspeakable love, guidance and protection over my life. I would also like to appreciate my supervisor and the entire staff at DAVOSACH INVESMENT LIMITED. My appreciations go to my parents, Mr. and Mrs. ABEJIDE, for their prayer and support, my brothers and sisters, for always giving me the best support in every possible way. God bless you all.

ABSTRACT

This technical report is an analysis of the industrial training carried out at DAVOSACH INVESMENT LIMITED. Where I received an extensive training on drilling and blasting techniques, loading, haulage, crushing and screening (particles sizing) operations and store keeping etc. The area of specialization where I acquired an extensive practical training, ranging from drilling and blasting techniques down to quarry store keeping. Various methods of drilling and drilling equipment used in drilling, were I learnt blasting patterns, explosives calculations, explosives storage and handling as well as blasting agents. More also, I was taught on mode of operation of the crusher, types of crusher and the various aggregates produced. The store keeping of the quarry was not left out and how to arrange the parts of the machines.

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CHAPTER ONE

1.0 INTRODUCTION (BACKGROUND OF SIWES)

The students' industrial work experience scheme (SIWES) was established in 1973 by the industrial training fund (ITF), an institution established by the federal government of Nigeria to carry out training program for students in tertiary institution of the country.

Students' industrial work experience scheme is more or less skills training program which forms part of the approved minimum academic requirements in the various degree program for all universities in Nigeria. It is an effort to bridge the gap existing between theory and practice of engineering and technology, science, agriculture, medicines, management and other professional education programs in Nigeria tertiary education.

It expose student on how to operate machines and equipment, professional work methods and industrial safety of works in industries and other organizations. The scheme is a program that involve students, universities and industries (employers of labour). The scheme exposes students to industry base skilled necessary for a smooth transition from the classroom to the world of the work. It affords students of tertiary institution the opportunity of be familiarize and exposed to the needed experience in handling machineries and equipment which are usually not available in the educational institutions.

Participation in Student Industrial Work Experience Schemes (SIWES) has becomes a necessary precondition for the award of diploma and degree certificates in specific discipline in all institutions of higher learning in the country, in accordance with the education policy of government.

1.1 OBJECTIVES OF SIWES

The Industrial Training Fund`s Policy Document No.1 of 1973 which established SIWES outlined the objectives of the scheme as;

- Provide an avenue for students in institution of higher learning to acquire industrial skills and experience in their respective course of study.
- Prepare students for the industrial work situation they are likely to experience after graduation.
- Expose students to work methods and techniques of handling equipment and machinery that may not be available in their institutions.

- Make the transition from school to the world of work easier; and enhance student`s networks for later job placements.
- Provide students with an opportunity to apply their knowledge to real work situations, thereby bridging the gap between theory and practice.
- Enlist and strengthen Employer`s involvement in the entire educational process; thereby preparing the students for employment in industry and commerce.

1.2 MISSION OF THE ITF

To set and control standards of excellence and effectiveness in and offering direct training of professionals, technicians and entrepreneurs using best of breeds training techniques and modern technology as well highly motivated, competent staff for rapid industrialization.

1.3 VISION OF THE ITF

To be the foremost human resources development organization in providing dynamic, need based and quality driven intervention for industrial skills training and development in Nigeria and the rest of Africa.

CHAPTER TWO

2.1 ABOUT THE COMPANY

Davosach Investment and Mines Limited, was situated at OREKE KWARA STATE. Which was established on 14th of April 2000. Presently, the major operation is the production of dolomite aggregate of various sizes for commercial purposes, mainly for a contrition aggregate for concrete and roads, a flux in steel and iron production.

Lastly, the staff have a union which is fully register in national labor congress (NLC) and which entitled them for any welfare of staff in the company.

The quarry section of (4) four major departments:

Production department: Those in this department are those that are involved in the

i Production process of the dolomite aggreagates. The Mining Engineer, blaster and assistant
   a. Blaster, the driller e.t.c. anyone that engages in the drilling and blasting section, loading, Haulage and crushing operation falls into this department.

ii **Administrative department:** concerns with all the administrative work of the company, sales and income generation, payment of the workers, record keeping e.t.c. The consists of administrative manager, the accountants, clerks and office attendant.

iii **Mechanical department:** Concerns with the maintenance and repair of all equipment used in the company. They also take care of the workshop and store upkeep.

iv **Security department:** Concerns with safeguarding the company including the personnel and equipment.

2.2 MISSION AND VALUES OF THE COMPANY

The company mission is to;

1. Give efficient and effective quality service to customers and to treat them with respect, Courtesy and fairness.
2. Encourage management and member of staff to be creative, innovative and productive.
3. Recognize and encourage constructive teamwork among staff and management.

2.2 ORGANOGRAM CHART OF THE COMPANY

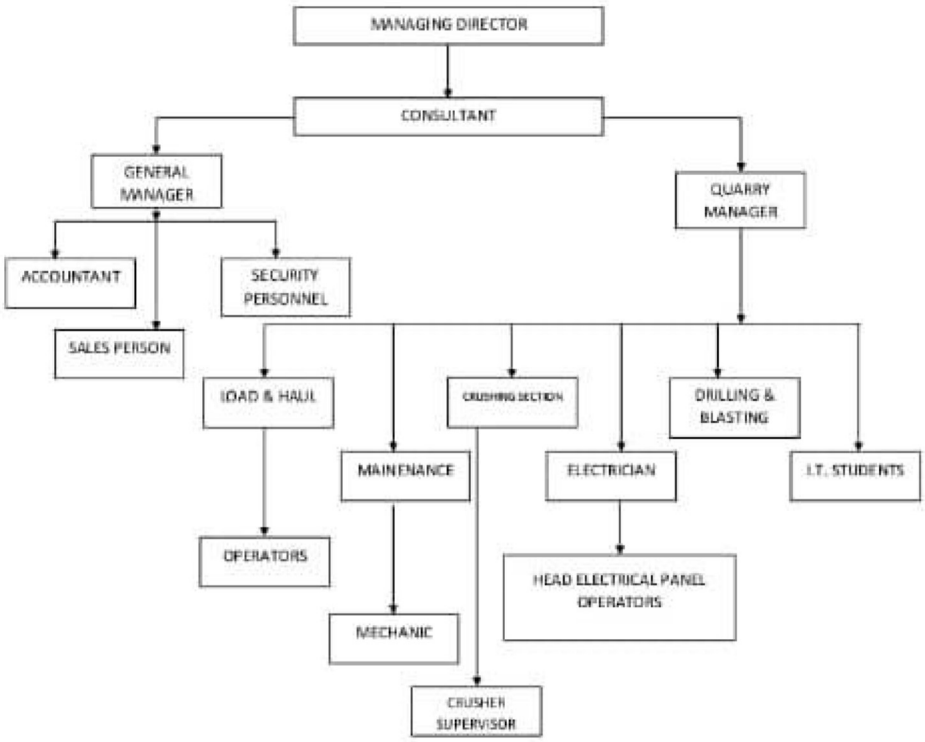

Figure 2.2 Organogram chart of the company

CHAPTER THREE

3.1 GEOLOGY OF THE AREA

The quarry primarily extracts dolomite. Dolomite is a sedimentary rock that contain a higher percentage of mineral dolomite deep beneath the earth's surface. It is primarily composed of calcium and oxygen.

The mineral composition and texture of dolomite can vary depending on the conditions of its formation, such as the amount of calcium magnesium carbonate. Dolomite is a common rock type

found in many parts of the world and is often used as a source of magnesium and calcium, and in construction aggregate.

The hardness of dolomite varies according to its mineral compositions, their types and properties and these can be detect by carrying out necessary test in the laboratory with the core samples obtained during core drilling. Dolomite is usually fine grained and relatively light colored. It has a considerable compressive strength and low porosity

3.2 SURFACE MINING

Surface mining is a type of mining that involves the extraction of minerals or other materials from the earth's surface. It is also known as open-pit mining, strip mining, or quarrying.

This method of mining is used when the desired resource is located close to the surface and the overlying rock (overburden) can be easily removed. DAVOSACH INVESTMENT AND MINES LIMITED, uses open-pit mining to extract aggregates or dimension stones from rock mass. A quarry is a type of open pit mine that extracts construction aggregates, sand, gravel or slate from the ground.

The company focuses on aggregate quarrying which involves a production cycle divided into basic sections including;

. Stripping of overburden
. Drilling
. Blasting
. Loading and haulage

3.3 STRIPPING OF OVERBURDEN

Stripping of overburden is a mining technique that involves the removal of the top layer of soil, rock, or other material that covers a mineral deposit, in order to access and extract the underlying resources. This process is usually done using heavy earth-moving equipment, such as bulldozers, excavators, and trucks. The overburden material that is removed during this process can vary in thickness and composition depending on the type of deposit being mined and the geological conditions of the area. It may consist of loose soil, sand, clay, or rock, and may be contaminated with pollutants or other unwanted materials.

Once the overburden has been removed, the mineral deposit can be accessed and extracted using a variety of mining techniques, such as; open-pit mining, underground mining or placer mining depending on the nature of deposit and the desired end product. The overburden is loaded into the dump truck, which will carry it to another site, where it is dump and later converted into road grading material for the company in creating access roads to the pit.

Figure 3.3a: Stripping of Overburden

Figure 3.3b: Stripped area

3.4 DRILLING OPERATION

Drilling is the process of creating or making holes in a rock mass for the placement of explosives in preparation of blasting operation. Before the commencement of the drilling operation, the spacing and burden is marked out for the entire area to be blast, which will give rise to the drilling pattern.

Spacing is the distance between two successive rows while burden is the distance between two successive holes. Spacing and burden is mostly required in primary drilling. The depth of the hole to be drill is also determined and handed over to the driller. The spacing and burden used for the drilling is dependent on the strength of rock mass and it also contributed indirectly to the size of boulders obtained after blasting. In DAVOSACH INVESTMENT AND MINES LIMITED The spacing and burden mostly used is 2:2.2m

3.4.1 DRILLING MACHINE

A drilling machine is a power tool used for drilling holes in rocks. It is a tool used in mining to bore holes into the earth crust for exploration. These machines can be either manual or automated and are equipped with drill bits that vary in size and shape depending on the strength of materials being drilled. The drilling process involves rotating the drill bit while applying downward pressure to create a hole (rotary-percussive).

Moreover, there are two types of drilling. They are primary drilling and secondary drilling.

- Primary drilling is drilling done on in-situ rock mass
- Secondary drilling is achieved on boulders or already blasted material that requires further size reduction.

The major objective of drilling at DAVOSACH INVESTMENT AND MINES LIMITED, is to obtain a maximum rate and desired degree of fragmentation after blasting and as well as to minimize the rate at which the drill bit wears out. Spacing and burden can be altered because of variation in the nature of the dolomite to be drill. These are achieved to ensure proper usage of the explosives as well as getting good fragmentation after blasting. Stripping is achieved if the area to drill is cover with overburden but in the absence of overburden, stripping is not required. The drilling patterns in mining are square, rectangular and staggered pattern.

At DAVOSACH INVESTMENT AND MINES LIMITED, rectangular pattern are mostly adopt because it yields more of stone base that is always at high demand. This pattern yields more fragmentation and has high powdered factor.

Areas where drilling operation is used are:

- Surface mining
- Water drainage
- Pipe and cable line
- Underground mining
- Oil and gas production
- Water well

3.4.2 METHODS OF DRILLING

There are various drilling methods, which are list below:

- Mechanical drilling: percussion, rotary and rotary percussion.

- Thermal drilling: flame, plasma, hot fluid, freezing etc.
- Hydraulic drilling: jet, cavitation, erosion etc.
- Chemical drilling: micro-blast and dissolution.
- Electrical drilling: electric arc, magnetic induction etc.
- Nuclear drilling: fusion and fission.

Mechanical drilling is the method that is widely used and that is what is being use at DAVOSACH INVESTMENT AND MINES LIMITED.

Mechanical Drilling: this can be further divide to:

- Percussive
- Rotary
- Rotary-percussive

The Rotary-percussive method is widely used in most quarries and it is also used at DAVOSACH INVESTMENT AND MINES LIMITED. It breaks rocks by a reciprocating hammering and rotating action. It uses both rotary and percussive action in order to chip away rock and produce hole.

The combination of rotation and percussion helps the drill achieve a cutting and grinding (rotary) action at the same time as a chipping (percussive) action. Usually, these motions are hydraulically driven. The rotary-percussive method is subdivided into surface mounting such as hydraulic crawler mounted drill at, DAVOSACH INVESTMENT AND MINES LIMITED, the Down the Hole hydraulic crawler drill is use for primary drilling and at times secondary drilling.

3.4.3 OPERATING COMPONENTS OF THE DRILLING SYSTEM

There are four main functional components of a drilling system, working in the following manner to attack the rock, which is as illustrated below.

- **The drill:** it acts as prime mover converting the origin form of the energy that could be fluid, pneumatic or electric into mechanical energy to activate the system.
- **The rod (drill steel, pipe or stem):** it transmitted the energy from prime mover to the bit.
- **The bit:** it is the applicator of the energy attacking the rock mechanically to achieve penetration.
- **The circulation fluid:** it cleans the holes, cool the bit and at times stabilize the hole. Which also supports the penetration through removal of cutting.

3.4.4 TYPES OF DRILLING

There are (2) two types of drilling operation and both methods are employ at Levant construction limited.

- Primary drilling
- Secondary drilling

PRIMARY DRILLING

As the term connotes this refers to the act of carrying out drilling operations on an in seated rock mass also known as in-situ (that is rock mass that has not been displaced from its original position). This usually brings about the disintegration of the rock body into smaller units and this type of drilling accommodates or allows a drilling depth of greater than one rod (>3.5meters) i.e. two or more rods can be used in the drilling process.

Figure 3.4a: Drilling Machine

SECONDARY DRILLING

Secondary drilling is defined as the method of drilling pop holes for the process of breaking the larger masses of rock thrown down by primary blasting. The secondary blast hole drilling is carried out using a drill wagon. The only difference is that the holes drilled for secondary drilling are

shallower than that of primary drilling. The depth of holes drilled in secondary drilling range from 3m to 1m depending on how big the boulder is. In addition, the diameters of the drilled holes depend on the diameter of the drill bit, which is 3 inches.

3.4.5 DRILLING EQUIPMENTS

- Hydraulic drilling machine
- Drill bit: button bit studded with tungsten carbide and diamond coated 3 inches' size

Figure 3.4b: A drill bit

. Drill rods: they are cylindrical components used in drilling operations to connect the drill bit to the drilling string. They come in various sizes and materials, depending on the specific drilling application. The length of the drill rod used is about 3.7m long.

Figure 3.4c: A drill rod

- Measuring tape: for marking out spacing and burden.
- Grease and lubricating oil: for lubricating and cooling off the metallic part of the machine.

3.5 BLASTING

Blasting is the process of breaking mass in-situ rock into smaller pieces by use of explosives. It is a technique employed widely in mining and structural engineering.

Blasting operation follows drilling operation during which holes are drill in uniform spacing for the placement of explosives and proceeds loading, haulage and crushing.

The major objectives of blasting are:

- Displacement of rock from its in-situ position.
- Fragmentation.

The variables that affect blasting performance include; rock properties, explosive properties, the blasting geometry and initiation while the geological factors are uncontrollable. However, with good engineering judgment values can be place on them to achieve a good fragmentation.

Side effect of Blasting

Some adverse effects that occur because of blasting include:

Noise: cause a lot of disturbance to hearing.

Ground vibration: vibration occurs because of excess energy from blasting. The more the number of drilled holes, the more increase in the ground vibration.

Fly rocks: they are rocks that fly out because of defects in the blasting design.

Blasting accessories

- Explosives (high and low)
- Detonating cord or non-electric detonator
- Exploder
- Electric detonator
- Electric wire
- Ohm meter for testing the wire connection
- Stone dust for stemming

EXPLOSIVES

These are chemical compounds or mechanical mixture of solid and liquid capable of rapid and violent decomposition under the effect of external impulse (heat, percussion, fire and spark) producing large volume of gases with great release of energy (high temperature and pressure).

The most commonly used explosive are; Dynamite and ANFO (ammonium nitrate mixed fuel oil).

Explosive materials are categorized by the speed at which they expand. Materials that detonate (explode faster than the speed of sound) are said to be "high explosives" and materials that deflagrate are said to be "low explosives". They can also be categorized by their sensitivity. Sensitive materials that can be initiate by a relatively small amount of heat or pressure are "primary explosive" and insensitive material are “secondary or tertiary explosive’’

Areas of use of explosive

1. for war purposes
2. for demolition purposes
3. Construction of dams and power station
4. in mining industries
5. for exploration of deposits of oil & gas

Figure 3.5a: Image of Explosives

DYNAMITE

Dynamite is a commercial explosive used for mainly demolition and mining. It is more accurately describe as the packaging of nitroglycerin, a highly poisonous explosive liquid, or other volatile compound such as sensitized ammonium nitrate. Dynamite can be pack in measured charges, and, with the proper detonator, exploded safely. Because dynamite explosion creates a cool flame, which is less likely to ignite methane and coal dust mixtures present in mines, dynamite are frequently use in several mining operation.

The name of the packed dynamite used for blasting is superpower90; superpower90 is a non NG and high strength cap sensitive explosive, which comes in either water gel or packed Emulsion form, good for all diameters of blast holes. It is highly water resistant and offers considerable reduction in noxious fumes.

ANFO (Ammonium nitrate fuel oil)

ANFO is achieved by the mixture ammonium nitrate and fuel oil in the ratio of 96:4. The ammonium nitrate, which is regarded as a fertilizer after been thoroughly mixed with diesel can turn into a lower explosive.

Figure 3.5b: packed ANFO

INITIATING DEVICES

They are the devices used to initiate the detonator of explosives. They include detonating cord and blasting caps such as electric wires, non-electric and struck line

DETONATING CORD: This is a flexible tube containing a core of a high velocity, cap – sensitive explosive use, is dispenta-erythritolteranitrate (PETN). The amount of high explosive in detonating cord varies from 1 to 1300gains of PETN. Detonating cord detonates at about 8000m/sec and has the effect of a blasting cap along its length. The applications of detonating cord include:

- Under water operation
- Reduction of ground vibration during blasting

BLASTING CAP: A blasting cap is a small explosive device generated used to detonate more powerful explosives such as dynamite. Blasting cap come in a variety of types, some of which are: electric cap and non-electric cap and fuse caps. They are used in commercial mining and are set off by a dynamo device which generate a short burst of current in a line long enough to ensure safety. All explosive compounds have a certain amount of energy require creating detonation.

NON-ELECTRIC DETONATOR: This is essentially a plastic tube, which is thinly coat with a reactive substance. It is 3mm in diameter and weighs only 5.5g/m with the explosive because it is nonelectric and hence does not require very high electricity for initiation.

Figure 3.5c: Non-electric detonator

3.5.1 PRIMARY BLASTING

Primary blasting is a method of rock blasting where explosives are used to break large rocks into smaller pieces for excavation or construction purposes. It involves drilling a series of holes in the rock through the drilling machine and charging the drilled holes with high explosives and then detonating them to break the rock apart. The stages involved in primary blasting includes;

- Drill holes flushing
- Charging of holes with explosives
- Stemming with dry stone dust
- Surface connection
- Initiation

CHARGING OF HOLES WITH EXPLOSIVES: Charging is the process of filling a borehole or shot hole with an explosive, which can be ANFO or dynamite. In DAVOSACH INVESTMENT AND MINES LIMITED, the drilled holes are either charge with dynamite or Ammonium nitrate. Ammonium Nitrate is mix with diesel oil to generate ANFO.

Blasting agent is use to charge the holes. To charge, an explosive is primed. Priming is achieved by inserting the primer end of the detonator into the explosive cartridge approximately 10 inches from the detonator is then wrap along the length of the cartridge. This is to ensure that the initiation spreads through the entire cartridge. The explosive is gently drop in the hole while the cap end of the detonator is expose to the surface. More explosive are add depending on the depth of the hole to form the bottom charge.

After this, ANFO is poured into the hole to fill about three quarter of it, after which the hole is stemmed mostly with sand and the cap of the detonator is left above the surface for connection purposes**.** During charging, if ammonium is too much, there will be more powdered factor and more dust there will be excess fly rocks. In addition, if the bottom charge explosive is more than ammonium, there will be boulders. The last line of the drilled holes must be charge with high explosive (gelatin) more than low explosive (ammonium) to have a smooth and perfect wall, and to avoid hanging walls.

SURFACE CONNECTION: surface connection is the connection of non-electric detonator and struck line delay together.

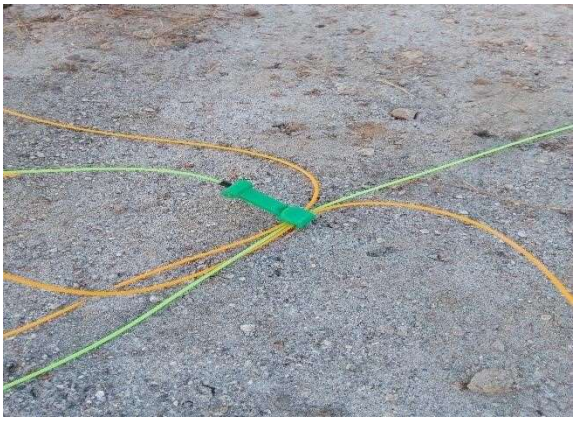

Figure 3.5d: surface connection

CALCULATED TONNAGE OF BLASTED ROCK

Number of drilled hole (N) =130 depth = 20m

Spacing and burden = 2.2m: 2.2m. S.G =2.6

Solution

Volume = N×B×S×D

Volume =130m×2.2m×2.2m×20m =12,584m^3

Tonnage = density ×volume

Density = S.G×1000kg/m^3

Density = 2.6×1000kg/m^3 = 2600kg/m^3

Therefore, since tonnage is density × volume

Then, tonnage = 2600kg/m^3× 12,584m^3 =32,718,400kg Recall that, 1ton = 1000kg.

Therefore, tonnage is 32718.4 tonnes

3.5.2 SECONDARY BLASTING

Secondary blasting is the process of breaking the oversized boulders, which results during primary blasting operations. Handling of oversize boulders give undue strain to the loading and hauling equipment is, reducing their overall working life and efficiency.

SECONDARY BLASTING METHODS

At DAVOSACH INVESTMENT AND MINES LIMITED, there are two methods used to break or blast the boulders to achieve a desirable product. The method used are outline below;

with the aid of explosive: In secondary blasting, explosive such as ANFO and other blasting accessories like detonating cord, electric cord, ohm meter etc. are used. The boulders are drilled to certain depth with undetermined spacing and burden. The boulders is shot by putting ANFO over it and stem with stone dust afterwards, connect and blast.

Figure 3.5e: connected boulders with aid of explosive for secondary blasting

. **Without the aid of explosive:** rock breaker is another method used for breaking oversize boulder into smaller particles for crusher. This is widely used, rock breaker is suitable for hard rocks and it is safe, efficient and economical.

Plate 3.5f: rock breaker performing secondary blasting

3.5.3 BLASTING PARAMETERS

In choosing the blasting parameters, the following has been strictly considered:

- The desired direction of rock fragments
- The delay times in adjacent blast holes
- The physical dimension of burden and spacing

It is expedient to note that the knowledge of local geology will determine the dimension of the burden and spacing. These would ensure efficiency in blasting operation.

i. **Burden:** this is the horizontal distance from center of hole to free phase or distance between two rows. During blasting, the burden can cause severe back break or hanging walls if it is more than boulder, if not properly chose

ii. **Spacing:** this is the distance between two successive drill holes measure at right angles to the vertical plane. It is measure from the center of one drill hole to another. Calculation of spacing is achieve by multiplying specific gravity of rock with the diameter of drill bit.

3.5.4 RECTANGULAR PATTERN

This pattern is usually employed at DAVOSACH INVESTMENT AND MINES LIMITED. The system produces large size of fragmentation sometime large amount of boulder. The degree of fragmentation depends on spacing and burden and on properties of the explosive used.

Figure 3.5g: drilling pattern

3.5.5 FLOOR CORRECTION

Floor correction is carried out after secondary blasting in order to level the mine access road or smooth the floor of mine for equipment and machinery in order to improve loading capacity and hauling, reduce costs of maintenance of equipment.

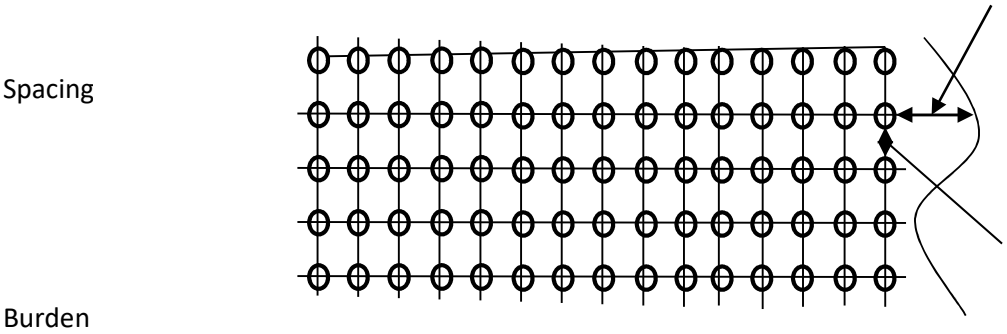

Plate 3.5h: floor correction

3.6 LOADING AND HAULING

In this section the blasted materials are been transported from the pit to the crushing section using haulage materials during quarrying. This is ordinarily performed in two steps, loading and hauling. Loading is termed as carrying and elevating blasted rock materials from inside the pits into haulage equipment and then taken to the crushing section. Loading equipment used include: Excavators, payloader. While hauling refers to the transportation of extracted rock from the quarry face to the processing plant, stockpile, or transportation hub. Such as dump truck, conveyor systems.

Plate 3.6a: An excavator loading a dump truck at the pit

3.6.1 HYDRAULIC EXCAVATOR: This is a heavy mine equipment consisting of a boom, stick, and the cab on a rotating platform known as the "house". The house sits on top of the undercarriage with tracks. All movements and functions of a hydraulic excavator are accomplished using hydraulic fluid, with hydraulic cylinders and hydraulic motors. It is the most commonly used type of excavator in mining. It is diesel powered and excavates on and below the natural surface on which it rests. The model of the hydraulic excavator are CAT 330D, which has bucket capacity of 3tons, CAT 345B has bucket capacity of 5tons and 350D has bucket capacity of 7tons.

3.6.2 PAY LOADER: The principal of the pay loader involves advancing into the pile of rock fragments, scrapping the rock fragment with the bucket and pouring the fragments into a waiting tipper.

Figure 3.6b payloader

3.6.2 HAULING EQUIPMENT

Hauling equipment refers to vehicles, machines, and system used to transport materials, goods, or products from one location to another. Such as dump trucks, off highway trucks e.t.c.

Figure 3.6c: dump truck

CONVEYOR SYSTEMS: It plays a vital role in quarry operations, efficiently transporting materials from extraction points to processing plants, stockpiles

Figure 3.6d Conveyor belt

3.6.3 HAUL ROADS

Haul roads are specially designed and constructed roads within mines that enable the efficient and safe transportation of ores, waste rock, and other materials. This roads are critical to the mining operation, as they facilitate the movement of heavy equipment, trucks, and personnel. These roads are typically built with a stable base course, drainage system, and wearing course to withstand heavy traffic and harsh environmental conditions. Haul roads are designed with gentle gradients and curves to ensure safe and efficient transportation, and are often surfaced with materials like asphalt, concrete, or compacted gravel. Proper maintenance of haul roads is crucial to prevent road deterioration, reduce equipment wear and tear, and minimize environmental impacts. Effective haul road design and maintenance are critical to optimizing mine and quarry operations, reducing costs, and improving safety.

3.6.4 ROAD MAINTENANCE EQUIPMENT

Road maintenance equipment refers to the machines and tools used to preserve and repair roads, highways, and other transportation infrastructure. These equipment help to maintain road safety, extend pavement life and ensure smooth traffic flow.

3.7.1 POWER SOURCE

The crushing unit uses electricity and is power by an electric motor of 150kw and 120kw capacity for primary and secondary crusher respectively. This is supplied major by two stand-by two generators with capacities of 500kva and 750kva respectively.

3.7.2 SIZE REDUCTION EQUIPMENT

These are usually group with consideration to particle size, as the primary criteria through other methods are also available. Mechanical means of size reduction comes in the form of crushing (size reduction to about 25mm) and grinding (finer reductions.) both of these stages can be subdivided into primary, secondary and tertiary which depend on the machinery used. The crushing plant is as follows:

1. Hopper
2. Feeder
3. Crusher (primary, secondary, tertiary)

4. Conveyor belts

1. HOPPER: The hopper is built at an incline of about 120 degrees to the vibrating feeder to enable easy flow of the rock material; the stone is drop from the dump truck to the hopper before it moves it to the feeder.

Figure 3.7a Hopper

2. FEEDER: This contain the stone from the dump truck, which is dumped on the feeder, under it is an electric motor which vibrates and move the stone with force into the jaw, it can also be called a vibrator.

3. CRUSHER: The crusher used are primary crusher (jaw crusher), secondary and tertiary crusher (cone crusher). In jaw crusher (primary) there are two actions working together to form the jaw, which are moveable jaw and the fixed jaw. The moveable jaw is control by motor with wheel, its help in hitting the stone on the unmovable jaw (fixed jaw) to breaks, this process is called crushing. In cone crusher, the cone, which is called the secondary and tertiary crusher, which helps in crushing the stone into semifinal particles. Immediately the longest conveyor belt into the screen mesh takes it.

4. CONVEYOR BELT: The primary belt conveyor helps in transporting the already crushed materials from the jaw crusher and moved it into the cone crusher. The return conveyor plays an important role to the cone; this determine how fast or slow is the operation, i.e. if there is too much of stone particles it will not penetrate into the other inch sift, and when this happens the operation will be slow.

Figure 3.7b CONVEYOR BELT

3.7.3 VIBRATING SCREEN

This was where the classification of the crushed materials into various sizes took place. The vibrations were generated by an eccentric shaft carrying counterweights, which was drive by an electric motor. These oscillations were further amplified by the spring supports to generate an upward – forward – downward – backward throw kind of movement. The equipment had a screen box fitted with three decks of screen (square) mesh of different sizes.

1. The topmost, 30mm mesh, received the materials directly from the secondary crusher. The oversize, +30mm were sent to the tertiary crusher, while the undersize, 0 – 29mm when through to the deck below.
2. The second, 15mm mesh, produced ¾ inch (15 – 27mm) as the oversize, while0 – 18mm when through as the undersize to the lower deck.
3. The bottommost deck had a 10mm screen mesh at the discharge end and a 12mm mesh towards the feed end. The 15 mm mesh produced ½ inch (10 – 15mm) as the oversize and 3/8 inch (5 – 10mm) as the undersize; while the 10mm mesh produced ½ inch (10 -15mm) as the oversize and stone dust (0 – 5mm) as the undersize and the screen mesh sizes were adjusted to optimize production.

3.7.4 PRIMARY CRUSHING

This is the reduction of blasted rock to about 25mm in size. The crushing machine used is called a primary crusher and it comes in various types and designs. At FCC, a jaw crusher is used as the primary crusher. It has a capacity of about 180 - 250 tons per hour and a huge jaw that breaks the stone. It is located next to the hopper. It reduces the size of the blasted rock to blow 25mm by crusher. It wide 42 by 32, open jaw of 32, the jaw helps to crush the smaller boulders into 5inches particles loaded into the cone crusher.

Figure 3.7c: Jaw crusher (primary crusher)

3.7.5 SECONDARY CRUSHING

This follows primary crushing and its aim is to further reduce the 25mm achieved size reduction from the primary crushing to a smaller size. The secondary crusher comes in various designs or types. At FCC, a cone crusher is used. It has a capacity of about 416 tons and a mantle, which bring size reduction.

Figure 3.7d: Cone crusher

3.7.6 TERTIARY CRUSHING

Tertiary crushing is the final stage of crushing in the comminution process, which further reduce the size of dolomite obtained from the secondary crusher. Cone crusher is also used tertiary crusher.

3.8 CRUSHING PROCEDURE

Blasted rock fragments are transport from the blasting site by dump trucks and poured into a hopper of about 1000 units or 250tons. These fragments, which include small boulders. Pebbles, stones and dust move gradually into the feeder where they are fed into the jaw crusher (primary) through a vibrating screen, which pushes them into inner space between the swing and the fixed jaws. The speed of the feeder can be regulated via a bottom located in the control unit headed by the operators who control the rate of crushing of stone between the jaws.

The continuous clockwise rolling of two big rollers on either side of the jaw brings about the swinging action. The roller is power by an electric motor attached to it. The swinging jaw is pivot at the top and possesses potential energy (PE) while in operation it moves sideway, at this stage, it possess kinetic energy (KE). The impact of the forces (compressive and tensile) on the rock fragment brings about the crushing on of the stone into smaller sizes (aggregate). The aggregate from the jaw crusher are passing through the conveyor belt to the cone crusher (secondary and tertiary) which further reduces the rock fragment with the aid of mantle that break down the rocks in a similar fashion as the jaw crusher. The crush rock fragments are passing via a conveyor belt to a vibrator screen (screen mesh) which sorts the fragment as undersize and oversize. The undersize, which are, mainly rock fragments less than 10mm and thus is pass via a conveyor belt to a set of vibrating horizontal screens. The oversize is return via another conveyor belt to cone crusher (secondary) for re-crusher. This process is known as open circuit operation. The set of vibrating horizontal screens comprises four screen with sizes: 35mm, 25mm, 10mm and 5mm. these separate the feed (the fragments from the cone crusher into fives size ranges namely: ¾ inch, ½ inch, 1 inch, 3/8inchand stone dust, which are transport via different conveyor belt and dump as stock as stock pile on the ground ready for shipping The following are the used of dolomite stone products:

1. ¾ inch: construction of bridges, roads and concrete making, decking and pillars
2. ½ inch: Used in the production of asphalt

3. 1 inch: Used for construction purposes
4. Stone dust: Used as substitute for white sand in concrete and block making 5. 3/8 inch: used for production of asphalt

3.9 SIZES OF AGGREGATE

The sizes of aggregates from the screen are listed below

Stone dust (0-5mm) dolomite

½ inch (10-15mm) dolomite

3/4 inch (15-27mm) dolomite

1-inch (27-35mm) dolomite

3/8 inch (5-10mm) dolomite

Stone base ((0-50mm) dolomite

CHAPTER FOUR

SKILLS ACQUIRED AND CHALLENGES ENCOUNTERED

Skills acquired include;

i. Technical skills

ii. Soft skills

iii. Practical skills

iv. Personal development

4.1.1 TECHNICAL SKILLS

- **Drilling and blasting operations:** Understanding drilling and blasting techniques, explosive handling, and safety protocols.
- **Crushing and screening:** Familiarity with crushing and screening equipment, including maintenance and troubleshooting
- **Quarry planning and design:** Knowledge of quarry planning software and design principles.
- **Geological mapping:** Understanding geological mapping techniques and rock identification.
- **Surveying:** Familiarity with surveying equipment and techniques

4.1.2 SOFT SKILLS

- **Communication:** Effective communication with quarry personnel, supervisors, and stakeholders.
- **Team work:** Collaboration with quarry team, including drillers, blasters, and maintenance personnel.
- **Problem solving:** Analyzing and resolving technical problems in a fast paced quarry environment.
- **Adaptability:** Flexibility in adapting to changing quarry conditions, schedules, and priorities.
- **Safety awareness:** Understanding and promoting quarry safety protocols and best practices.
- **Leadership:** Developing leadership skills through mentoring, training, and supervising junior staff

- **Data analysis:** Collecting, analyzing, and interpreting quarry data to inform operational decision

4.1.3 PRACTICAL SKILLS

- **Equipment operation:** Familiarity with quarry equipment, including drill rigs, loaders, and haul trucks.
- **Maintenance and repair:** Basic maintenance and repair skills for quarry equipment **.** **Sampling and testing:** Understanding sampling and testing procedures for quarry materials.
- **Quality control:** Familiarity with quality control procedures and standard.
- **Environmental management:** Understanding environmental management principles and quarry regulations.

4.1.4 PERSONAL DEVELOPMENT

- **Confidence:** Developing confidence in a fast paced, dynamic quarry environment.
- **Resilience:** Building resilience through exposure to challenging situations and unexpected events.
- **Networking:** Establishing professional relationships with quarry personnel and industry experts.
- **Self-directed learning:** Developing self- directed learning skills through research, reading, and training.
- **Career development:** Gaining insight into quarry operations and identifying career paths.

4.2 CHALLENGES ENCOUNTERED

Drilling and blasting are critical components of quarry operations, but they pose several challenges that can impact safety, efficiency, and productivity. They are;

i.Safety challenges ii. Technical challenges iii. Environmental challenges

iv. Operational challenges v. Regulatory challenges

SAFETY CHALLENGES

1. Risk of accidents: Drilling and blasting operations can be hazardous, with risks of explosions, fly rock, and toxic gases.

2. Equipment maintenance: poorly maintained equipment can lead to accidents and injuries.
3. Operator error: Human error can cause misfires, incorrect hole depths, or inadequate stemming.

TECHNICAL CHALLENGES

1. Geological variability: Quarries often have diverse geological formations, making it difficult to predict rock behavior.
2. Drill hole accuracy: Ensuring precise drill hole placement and depth can be challenging.
3. Blast design and execution: Designing and executing effective blasts requires expertise and careful planning.
4. Vibration and noise control: Minimizing vibration and noise is essential to prevent damage to surrounding structures and minimize disturbance.

ENVIRONMENTAL CHALLENGES

1. Dust and noise pollution: Drilling and blasting generate dust and noise, impacting nearby communities and wildlife.
2. Groundwater protection: Preventing groundwater contamination is crucial, especially in quarries near water sources.
3. Waste management: Managing drilling and blasting waste, such as drill cuttings and explosive residues is essential

OPERATIONAL CHALLENGES

1. Productivity and efficiency: Optimizing drilling and blasting operations to maximize quarry productivity and efficiency
2. Cost control: Managing costs associated with drilling and blasting, including equipment, explosives, and hauling.
3. Scheduling and planning: Coordinating drilling and blasting with other quarry operations, such as crushing and hauling.

REGULATORY CHALLENGES

1. Compliance with regulations: Adhering to local, state, and federal regulations governing drilling and blasting.
2. Permitting and licensing: Obtaining necessary permits and licenses to operate drilling and blasting equipment.
3. Environmental impact assessments: Conducting thorough environmental impact assessments to minimize quarry footprint.

4.3 SOLUTION TO THE PROBLEM ENCOUNTERED

. Invest in training and education: Provide operators with comprehensive training on drilling and blasting techniques.

. implement safety protocols: Establish strict safety procedures and regular equipment maintenance.

. Conduct regular inspections: Monitor drilling and blasting operations to ensure compliance with regulations and safety standards.

. Invest in technology: Leverage innovative technologies, such automated drilling and blasting systems, to improve efficiency and safety.

. Collaborate with experts: Consult with experienced professionals to address technical and environmental challenges.

. Develop comprehensive plans: Create detailed plans for drilling and blasting operations, including emergency response procedure.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATION

5.1 Conclusion

At the end of my industrial training program, I was able to achieve the ultimate objective of SIWES, which is to provide student the opportunity to apply their theoretical knowledge in real work situation thereby bridging the gap between theory and practice.

I also seized the opportunity to acquire skills and experience that will prepare me for likely work situations after graduation. I was expose to work methods and techniques in handling equipment and machineries while making judicious use of the time in building strong interpersonal relationship and a network of purpose-driven colleagues.

5.2 Recommendation

I therefore recommend that the Industrial Training Fund (ITF) should further improve the process of enlisting and strengthening employers' involvement in the entire education process by creating platforms that would bring students into a more intimate fellowship with various organizations across the nation.

I also recommend the SIWES program should be properly monitor to avoid truancy on the part of the students and to ensure they make the most of the scheme.