Chapter 6

Crusher Supervisor and Operations

Topics

To hear audio, click on the box. 

Overview

Seabees operate under many different circumstances, and they are sometimes called upon to produce ***aggregate*** for subgrade, concrete, and asphalt. The ability to set up and use rock crusher plants is fundamental in the production of aggregate. The most common method of training for rock crusher operations is achieved through on-the-job-training (OJT).

In the Naval Construction Force (NCF), crusher operations are usually managed by Alfa Company. The Alfa Company operations chief is responsible for crusher operations and should assign a Crusher Supervisor to direct the operations of the crusher.

The Rock Crusher Supervisor's ability to plan cannot be understated. The supervisor must be able to determine crew size based on the amount of aggregate needed to complete the project. The supervisor must also be adept at planning and performing plant maintenance. Safety must always be at the forefront of all aspects of rock crushing, from ***raw material*** delivery to conveyor operations to site selection.

The COMSECONDNCB/COMTHIRDNCB determines which Naval Mobile Construction Battalions (NMCBs) will conduct crusher operations. The NMCBs are then responsible for calculating the proper amount of man-days needed for the project. The Rock Crusher Supervisor is essential in this process.

This chapter will provide a foundation on all aspects of rock crusher plant operation and the proper site planning required to perform the duties of the Crusher Supervisor.

Objectives

When you have completed this chapter, you will be able to do the following:

1. Understand the responsibilities of the Crusher Supervisor.
2. Identify the major components of crushing plants.
3. Understand the purpose, layout, and erection of wash plants.

Prerequisites

None

This course map shows all of the chapters in Equipment Operator (EO) Advanced. The suggested training order begins at the bottom and proceeds up. Skill levels increase as you advance on the course map.

Well Drilling Supervisor and Operations		EO ADVANCED
Asphalt Plant Supervisor and Operations		
Concrete Batch Plant Supervisor and Operations		
Crusher Supervisor and Operations		
Quarry Supervisor and Operations		
Project Supervisor		
Crane Crew Supervisor		
Air Detachment Equipment Supervisor		
Transportation Supervisor		

Features of this Manual

This manual has several features which make it easy to use online.

- Figure and table numbers in the text are italicized. The figure or table is either next to or below the text that refers to it.
- The first time a glossary term appears in the text, it is bold and italicized. When your cursor crosses over that word or phrase, a popup box displays with the appropriate definition.
- Audio and video clips are included in the text, with italicized instructions telling you where to click to activate it.
- Review questions that apply to a section are listed under the Test Your Knowledge banner at the end of the section. Select the answer you choose. If the answer is correct, you will be taken to the next section heading. If the answer is incorrect, you will be taken to the area in the chapter where the information is for review. When you have completed your review, select anywhere in that area to return to the review question. Try to answer the question again.

- Review questions are included at the end of this chapter. Select the answer you choose. If the answer is correct, you will be taken to the next question. If the answer is incorrect, you will be taken to the area in the chapter where the information is for review. When you have completed your review, select anywhere in that area to return to the review question. Try to answer the question again.

1.0.0 CRUSHER SUPERVISOR RESPONSIBILITIES

The Crusher Supervisor must be involved in the planning of the crusher operations from the very beginning. As supervisor, your input will help shape all crusher operations. You need to be able to evaluate the job site and pick the best placement for the plant, one that minimizes haul time for raw materials yet is far enough away from the blasting operations to keep the crew safe. The plant location needs to include the placement of a retaining wall or ramp for use as the discharge platform for the ***hopper***-loading equipment in dual level operations (*Figure 6-1*).

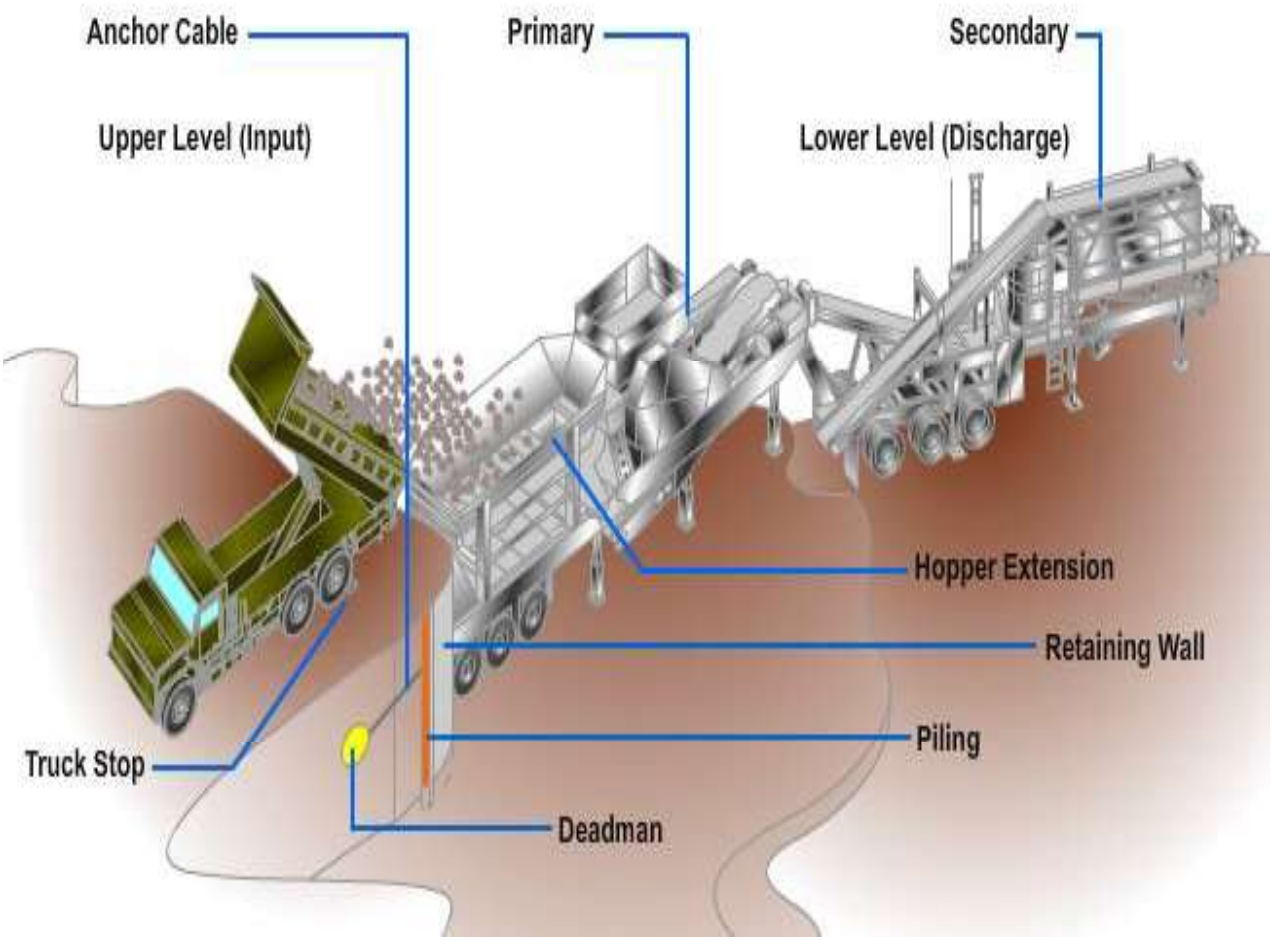

Figure 6-1 — Crusher layout.

The Crusher Supervisor is responsible for the operation, cleanliness, and maintenance of the crusher plant. Maintenance should be on site and convenient for efficient operation and access, but situated far enough away from the plant to facilitate future expansion of quarry operations. As the supervisor, you must be aware of the types of quarry rock available to use in processing in order to choose the appropriate type of crusher to use. You must also know how many crew members are required to produce the proper amount of aggregate needed for job completion.

2.0.0 ROCK CRUSHER

The rock crusher's main purpose is to reduce the size of raw quarry material or shot rock into usable aggregate. The plant also separates the different sizes of the crushed stone, removes vegetation and byproducts, and if needed washes the stone to remove any particles still remaining in the aggregate.

Rock crushers use either compression or impact to break up raw materials. The compression method squeezes rock between two surfaces. The impact method smashes and accelerates the rock inside a chamber, causing the rocks to strike each other and break up.

The Seabees normally use the 75 tons per hour (tph), medium to large capacity rock crusher classified by the amount of crushed stone produced per hour. The hourly rate of production to be obtained from a given size jaw crusher depends upon a number of variable factors. The two primary production factors are the hardness of the material and the gradation or reduction of the raw material to finished product ratio.

This plant is also known as the crushing, screening, and washing plant (CSWP) and is a general purpose crusher that can handle all rock processing situations. The CSWP is made up of two distinct sections, the primary and secondary units. The primary unit reduces the quarry rock or coarse gravel by crushing. The secondary unit further reduces the stone, as well as washes, separates, and transports the crushed stone.

2.1.0 Primary Unit

The primary unit (*Figure 6-2*) is made up of multiple sections. The first section is the vibrating grizzly screen. The vibrating grizzly is a series of bars set on top of the hopper that vibrate, separating the stone into different sizes and then sending it to the hopper; if the stone is too big, it will not be allowed to pass and enter the hopper. The hopper arranges the raw material before feeding it to the crusher. The crusher will then reduce the material and drop it onto conveyors, which take the stone and transport it to the secondary unit.

Figure 6-2 — Primary unit.

The raw mined material is brought to the crusher plant by rear-dump haulers or front-end loaders. Primary crushing reduces this run of mine rock to a more manageable size. The two types of primary crushers are the compression (jaw crushers and rollers) and the impact crushers (Hammer Mill).

The jaw crusher compresses rock between two V-shaped surfaces; one is stationary and the other opens and closes like a jaw (*Figure 6-3*). Rock enters the jaw crusher from the top. Pieces of rock which are larger than the opening at the bottom of the jaw lodge between the two metal plates of the jaw. The opening and closing action of the movable jaw against the fixed jaw continues to reduce the size of the lodged pieces of rock until the pieces are small enough to fall through the opening at the bottom of the jaw. The jaw crusher can be powered by a diesel engine or by electrical power.

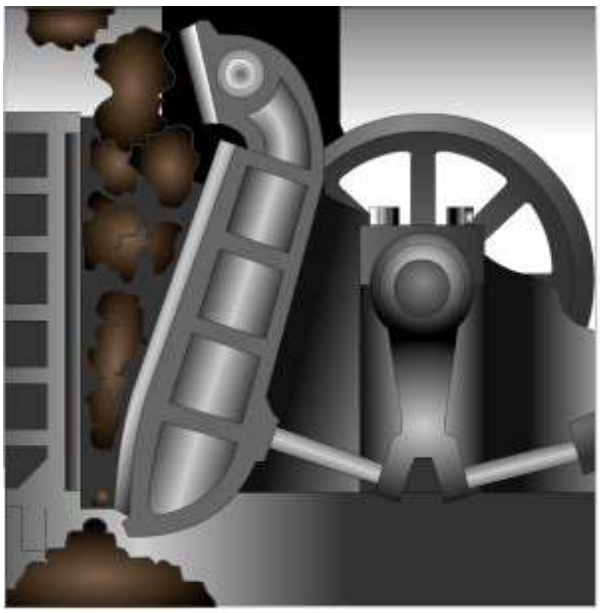

Figure 6-3 — Jaw crusher.

WARNING

Keep out of the jaw cavity when you are operating or adjusting the jaws.

Impact crushers are exactly as their name implies; they contain hammers mounted either vertically or horizontally that swing around a powered shaft and impact rocks that have been dropped into a hopper. They are sometimes called Hammer Mills. Impact crushers are used for soft rock such as coal, phosphate, gypsum, weathered shales, and so forth. Impact crushers are limited to smaller sized rocks; however, impact crushers can make a finer sized product.

2.2.0 Secondary Unit

The secondary unit is basically the same as the primary crusher except it reduces the stone to an even smaller size. It consists of a reciprocating feed hopper, an overcrusher conveyor, a two-deck vibrating screen, a compression crusher, an undercrusher return conveyor, a revolving elevator wheel, a diesel power unit, and conveyors (*Figure 6-4*).

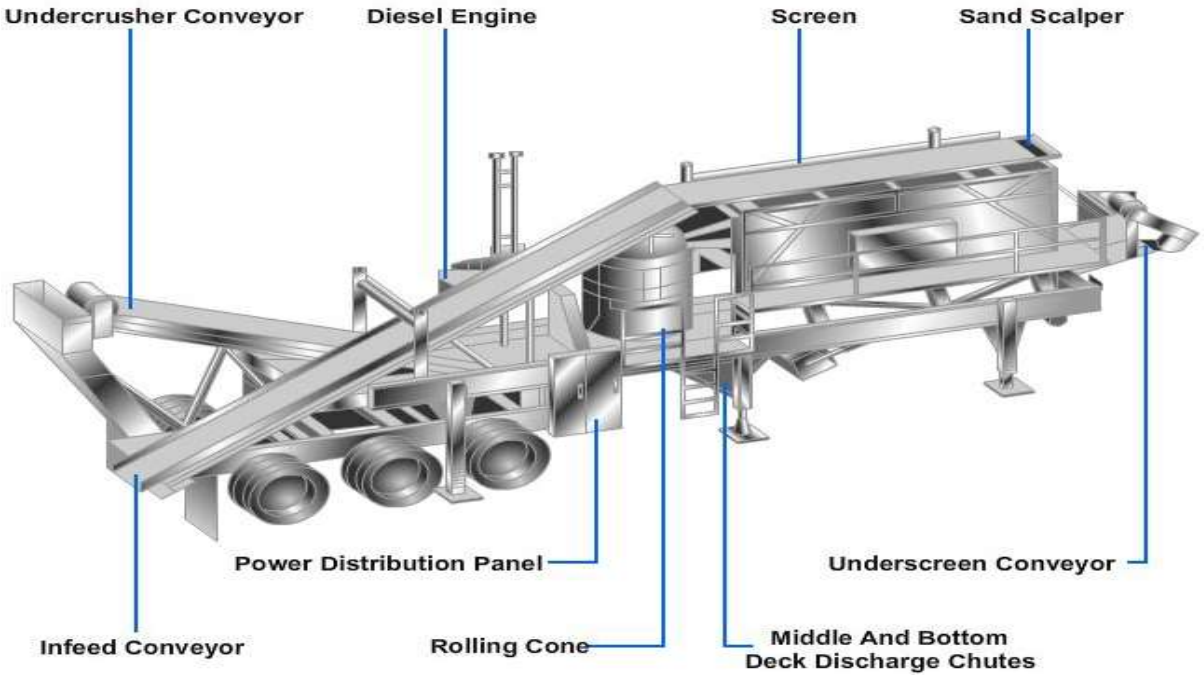

Figure 6-4 — Secondary unit.

The secondary unit includes a bar type of scalping screen (grizzly) that can be inserted into the top rim of the sloping hopper. When inserted, this screen causes any oversized material to be scalped and rolled off of the screen and to the rear of the machine.

Once the material has been has been resized by the secondary crusher, the material travels to the screen at the bottom of the crusher and is routed through a chute to a conveyor and then delivered to the product stockpile. Material too small to meet product specifications is screened out by the bottom screen and delivered to a by-product stockpile.

These units have a wide range of production capability comparable to the primary crusher unit. The actual rate of production in tons per hour is usually determined by how fast a screen can pass the crushed rock onto the next screen or onto a conveyor.

2.3.0 Screens

Screens are essential to the final aggregate product. The right screen selection will allow uninterrupted production of aggregate. Screens separate crushed rock into two or more particle size ranges. Screens are also used to remove oversized rock before they get into the secondary hopper and to separate out very small particles, also known as fines. Screens allow you to direct specific material to be given supplementary processing. Screening also allows you to select out material that does not need processing.

Screening units are arranged from the larger holes on the top screen to smaller holes on the screens at the bottom. Each screen either passes the stone or scalps it off either to be reprocessed or to be stockpiled. The screen surfaces are vibrated to aid sorting. Crushed material is fed at one end and is separated into size ranges as it passes over the screening surface.

Capacity and efficiency depend on how fast a screen can separate the material. The screen's performance can be aided by using the correct inclination, vibration speed, and direction of throw.

2.3.1 Screen Selection

After the determination of material size has been made, you must select the proper screen. If the predetermined product size is less than one inch, the screen size should be one sixteenth larger; if the desired product size is between one and two inches, the screen should be one eighth larger; if the product size is between two and three inches, the screen should be a quarter inch larger; and for product size over three inches, the screen should be a half an inch larger. The number of screens to be selected is dependent upon the number of size ranges into which the material must be segregated and the type of equipment available for screening (*Figure 6-5*).

Figure 6-5 — Vibrating screen.

Once the proper screen sizes have been determined, the product will be separated into the appropriate sizes and be passed to conveyor belts.

2.4.0 Conveyors

Conveyors (*Figure 6-6*) increase efficiency when properly used to transport material from one section of the plant to another. They can be used as inputs to hoppers or they can be used to transport finished materials to trucks or stockpiles. The conveyor's efficiency is determined by belt speed, proper loading techniques, and correct incline selection based on the type of material being transported.

Conveyor belts are inherently dangerous and need constant attention to ensure proper operation. Prior to operating the conveyor belt system, take the time to visually inspect the physical condition of the belts; attend to any rips, tears, or fraying prior to operation. Once the initial visual check has been completed, turn on the conveyor system and

check for any stuck rollers or guides. If they are not fixed, they could result in catastrophic belt failure leading to personnel or equipment damage.

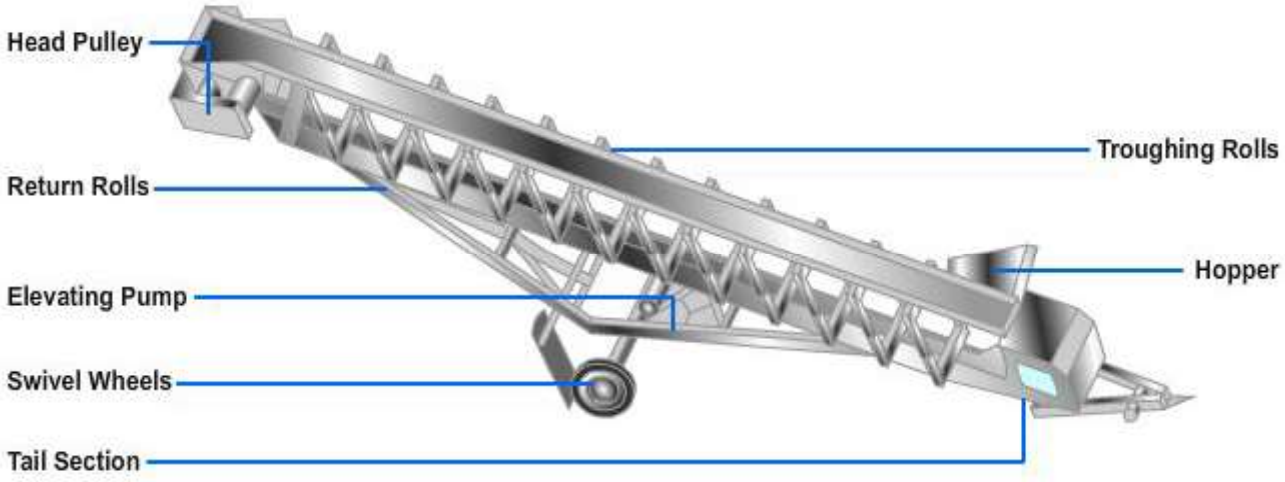

Figure 6-6 — Conveyor.

Follow all manufacturers' recommendations when aligning the troughing idler rollers and tensioners. On newly assembled conveyors, this procedure must be performed quite often during the first few days until the belt is broken in.

Conveyors are provided with wipers located as close to the discharge end of the conveyor as possible on the return side of the belt (*Figure 6-7*). The wiper is usually located under the conveyor out of the way of material flow. Spring tensioners are used to keep the rubber stripping of the wipers adjusted to make light contact with the face of the belt. The wiper removes rocks from the belt, thus preventing rocks from entering between the pulley face and the inside face of the belt.

Figure 6-7 — Conveyor belt wiper.

Test your Knowledge (Select the Correct Response)

1. **(True or False)** The two types of crushers are compression and friction.

   A. True
   B. False

3.0.0 WASH PLANT

A large proportion of aggregate used in the production of concrete and road-wearing materials must be washed to maintain a consistent end product free from impurities. In both instances the cleaner the aggregates and sand, the less ***cement*** and ***bitumen*** are

required in the mix. The cement and bitumen represent the majority of the mix cost, although representing only a fraction by weight. It is therefore of the utmost importance to maintain a high quality, clean aggregate.

To initiate the washing of aggregate, the material is passed over a vibrating screen fitted with water spray jets (*Figure 6-8*). This both washes the stone products and separates the sand from the stone. In most situations it is also normal to split the stone products into finished grades at this stage.

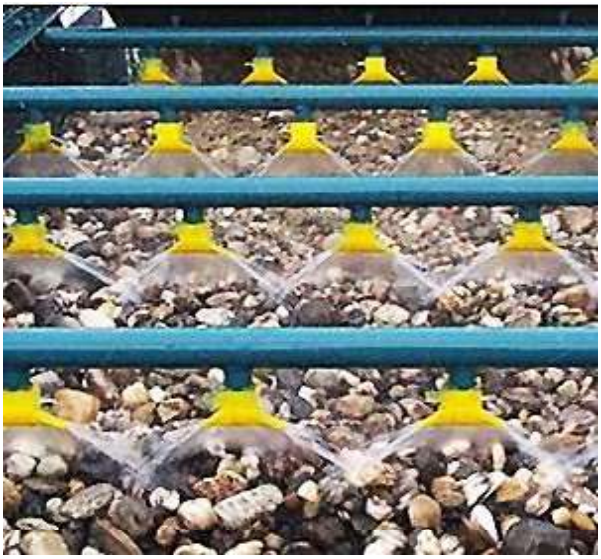

Figure 6-8 — Spray bar.

Where aggregates are heavily contaminated by clays, a rotating scrubber barrel or screws can be incorporated into the system to ensure adequate cleaning. The sand product flows with the wash water to a sand dewatering system where the silt and clay are removed and the sand is dewatered. The silt-laden wastewater from the sand dewaterer is normally gravity fed to either settling ponds or a water cleaning system. The clean sand is carried up and into a stockpiling conveyor.

The capacity of the washing and screening plant is based on the percent of sand in the deposit; each washer can handle a certain amount of material. The screen is also a factor to consider when figuring the capacity of this plant. It is necessary to have enough screening area to handle each gradation of material desired.

Test your Knowledge (Select the Correct Response)

2. What is the capacity of the washing and screening plant based on?

   A. Temperature of the water
   B. Pressure of the water
   C. Percent of sand in the deposit
   D. Speed of the quarry crew

4.0.0 Plant Layout

The most important goals when planning the layout of a crushing plant are that it meets production requirements, operates efficiently, and complies with all environmental regulations. Proper preparation and planning will ensure smooth plant operations. It is essential to take the time to properly plan out the setup and routing of the plant with the quarry/pit. Once the plant is in operation, there is rarely time to stop operations to reposition the equipment.

4.1.0 Equipment Configuration

When configuring the plant, you should ensure there is a logical flow to each section of the plant. All aspects of equipment positioning should take into account the movement of the material, from the receiving of the inbound raw material to the transporting of the finished aggregate. Assess the requirements for each piece of equipment, such as the

requirements for the foundation, water, and power, to ensure they are accounted for during the construction stage.

4.2.0 Drainage

Drainage is an important consideration throughout a quarry operation. The quarry working floor should slope away from the face (a 3 percent slope is sufficient) to prevent water accumulation in the working area. In cases where water may not drain off naturally, provide a collection point or sump. Locate sumps away from traffic areas or any area interfering with efficient operation. Consider erosion control as part of the drainage plan. Excess erosion causes a high amount of suspended solids to wash into existing streams and lakes, which dramatically changes the water quality and potentially affects the organisms living there. Coordinate with local environmental offices to ensure that environmental regulations are followed.

4.3.0 Prevailing Winds

Equipment should be oriented in such a manner that prevailing winds carry the rock dust generated by the crusher away from the facility. Support equipment, such as generators and water pumps, and permanent facilities, such as latrines, offices, and maintenance shops, should be located out of the path of winds carrying the rock dust.

The ***Department of Environmental Quality*** (DEQ) is responsible for enforcing federal regulations. The U.S. EPA regulates the emissions of particulate matter from nonmetallic mineral crushing facilities through the ***New Source Performance Standards*** (NSPS). Subpart OOO, 40 CFR 60.670(a) defines, in part, an affected facility in fixed or portable nonmetallic mineral processing plants as each crusher, grinding mill, screening operation, bucket elevator, belt conveyor, bagging operation, storage bin, enclosed truck or railcar loading station which commences construction, reconstruction or modification after August 31, 1983. Based on this definition, the requirements of Subpart OOO apply to individual pieces of equipment and include, but are not limited to, equipment specific opacity limits, notification of equipment startup, and reporting and recordkeeping provisions. Subpart OOO also requires an initial performance test for most subject equipment.

Fixed sand and gravel plants and crushed stone plants with capacities of 25 tph or less, and portable sand and gravel plants and crushed stone plants with capacities of 150 tph or less are not subject to Subpart OOO.

The COMSECOND/COMTHIRDNCB Equipment Offices work closely with the DEQ to ensure the plants in the NCF abide by the rules of the DEQ. To meet federal regulations, sprinkler systems have been installed on rock crushers in the NCF to control the rock dust produced from crushing operations. As the Crusher Supervisor, you are responsible to make sure these systems remain operational.

4.4.0 Organization Space

Organizing a plant should take into account not only normal operations but also scheduled and unscheduled maintenance and cleanup. If a major unit of the plant needs to be replaced, a crane will need to be brought in to change the part. Clearance for ***ancillary machinery*** should be designed into the plans. The use of conveyor belts also means there will be spillage as well as normal wear; access to the areas both on the side and underneath the conveyors should be kept clear to facilitate these procedures.

The plant design should include adequate space around the equipment to include space for the fuel truck to refuel the equipment, and space to remove and replace components of the crusher unit. If the material needs to be washed, then you should place a drainage system in an area that will not impede normal operations of the plant or access roads.

4.5.0 Material Handling

The handling of raw and processed material should be done very judiciously. The more the material is handled, the greater the chances are that the material will change its shape, changing the quality of the aggregate. With this in mind, you should set up the plant layout to minimize material handling.

A headwall ramp should be constructed to allow haul units or loaders to back up to or approach the apron feeder of the primary unit and discharge their loads. If a problem with oversized rock is anticipated, you should have a prescreening grizzly built in the quarry or over the apron feeder to remove the oversized rock.

Quality product-size aggregate should be stored in bins rather than in open stockpiles when possible. This is most important when the aggregate is crushed to specifications sizes or has been washed. Open stockpiled aggregate can be contaminated by windblown sand, fines, and trash.

When bins are not available for aggregate storage, locate ground-level stockpiles on a hard base with good drainage, preferably on slabs or planking. Keep them far enough apart or separate them with dividing walls of sufficient height to prevent cross-contamination. The area separating the headwalls should be large enough to stockpile a large supply of aggregate and have adequate space on the front side for loading vehicles without causing congested traffic areas.

Aggregate stockpiles are loaded by conveyors, loaders or clamshells. These machines are most efficient for loading vehicles with clean aggregate off the top of stockpiles. The aggregates at the bottom of stockpiles become embedded in the ground and tend to become contaminated. This layer is lost for use.

4.6.0 Stockpiling

A stockpiling plan will help to ensure quality control by keeping the finished product from becoming unintentionally blended, segregated, or contaminated. When stockpiles are well placed between the extraction, processing, and loading facilities, hauling distances are minimized, saving time, fuel, and machinery maintenance. Stockpile planning will also organize placement of ***overburden***, topsoil, and by-products, helping to avoid double handling of low-value materials.

Stockpiles can be constructed using front-end loaders, trucks, or conveyor systems. The types of stockpiles and stockpiling procedures will depend upon the available land and equipment, flow characteristics of the material, climate and length of the processing season, quantity of material, and range of products.

Trucks should be kept off a stockpile, both for safety measures and to avoid packing, by dumping on level ground and piling by dozer or loader. The loader is more efficient than a dozer because it can combine lift with push for higher, steeper piles with shorter moves and less power consumption heaping stockpiles rapidly (*Figure 6-9*). The dozer is entirely flexible in placing or varying the size and shape of a stockpile and can be used for a variety of other work; however, it must move its entire weight up the pile with each load, and the constantly working tracks on the dozer may be subjected to severe wear in sand or other abrasive materials. Also, the tracks may pack or crush soft materials that drastically reduce their value.

Figure 6-9 — Stockpiling fine crushed stone.

Choice of tracks or wheels depends on the availability of equipment and the type of material. Wheels provide more compaction and cause less breakage into fines. They wear less in sand or gravel as long as the operators avoid spinning the tires during loading operations; however, wheels become ineffective under slippery conditions.

Loaders of either type can be used to reclaim the pile, loading the material into trucks or carrying it to hoppers or to the area of use. Tires have an advantage in both speed and economy for carries greater than 50 feet.

Some general stockpiling guidelines should be followed; for example, sites for stockpiles should be clean and level prior to storing materials, and aggregates should not be removed from stockpiles within 0.3 meter (1 foot) of the ground until final cleanup/removal of the stockpile. Layering can help to minimize moisture absorption in stockpiles, tarps can also be used for products that need to be kept dry, and stockpiles can be located to function as sight and sound barriers.

4.7.0 Road Networks

The road network in a plant should be part of the initial planning of any quarry/pit. Well planned roads are needed to prevent congestion, decrease the time haul units are in the plant, and to promote safety. Road networks are needed to transport material from the quarry face to the primary crusher, to transport the processed aggregate to construction sites, and to provide access for service vehicles such as crew, fuel, and maintenance trucks.

If possible, plant roads should be one way and be wide enough for the largest haul unit expected. They should be designed to support heavy loads. If there is a grade, proper drainage should be planned. The road surface should be stone to decrease the amount of dust kicked up by the movement of the trucks and to reduce slipping of the haul vehicles' tires in wet conditions.

Plant roads need a maintenance plan. Plant roads must be maintained constantly. In dry areas where there is little rainfall, a water truck is required to wet down the roads to control the dust. In wet areas crushed rock should be used on the roads to keep haul

units from sliding off into ditches. Berms need to be constructed on the edges of all turns. A maximum speed limit should be posted for vehicular traffic within the crusher area and on the haul roads.

4.8.0 Plant Setup

The importance of proper site preparation and proper stationing of the plant cannot be overemphasized. Your site for stationing the plant should be flat, level, and well compacted. Crushing and screening plants may be operated for short periods of time from the wheelbase. However, from a maintenance standpoint it is advantageous on longer and more deliberate jobs not to operate the plant until it has been blocked and leveled with the tires clear of the ground.

The plant should be leveled before initial operation and should be frequently checked while in operation. Leveling should be done on the frame for longitudinal leveling (*Figure 6-10*). Use a rigid, straight plank across the unit frame rails for transverse leveling. Check the leveling at several points throughout the unit. Inaccurate leveling may cause the drive belts and conveyor belts to run off, material to ravel to one side of screens,

Figure 6-10 Leveling jacks.

and rubber mountings of the vibrating screen to twist, resulting in damage to equipment.

Install blocks under each side of the tandem axles and under the dolly axle or the fifth wheel plate to raise the tires or landing gear clear of the ground. Place blocking or cribbing parallel to the longitudinal center line of the unit.

Place hydraulic jacks on each side of the unit opposite each other and under the unit frame members. Raise and lower the jacks in equal increments to prevent bending of the frame.

Tighten the screw type of stabilizing jacks to maximum torque after the crusher has been blocked and leveled.

Ensure all bolts are tight by torquing the nuts, not the bolt heads. Additionally, retorquing should be continued throughout the operation of the plant. This should be performed at critical locations and during the initial operation to assure proper seating and prevent parts from loosening and getting out of adjustment. Any adjustments

required, such as movement of trunnion wheels on the trunnion shaft, should be made during the first hours of operation.

Jaw plates and roll shells are held in place by wedges which are secured by keeper bolts. The wedges must be driven home with a sledge hammer while constantly applying torque with the wrench to achieve proper tightening.

To prevent damage and eventual breakage, you should visually inspect the plant constantly to detect any misadjustment or loss of adjustment. Visual inspections should be made from ground level, from the platform, and from walkways. All adjustments should be checked with the components operating while empty and rechecked while loaded with aggregate.

WARNING

Do not connect electrical power or operate the equipment if the ground connection is not properly installed. Death by electrocution could result from improperly grounded equipment.

4.8.1 75-tph Plant

The 75-ton-per-hour plant is used in any of four basic setups, depending upon the raw material available and the nature of the end products required for construction projects. The four basic setups are as follows:

1. The jaw crusher is used alone to work with quarry rock. Large quantities of material are ordinarily needed for base course, roads, and airfields; the fine particles are desired for binder. This means all of the crushed material is used together with no screening necessary.
2. The primary and secondary units are used in conjunction with each other to produce graded aggregate from quarry rock. The material is reduced in successive stages and screened to separate material into size ranges required to meet specifications.
3. The primary and secondary units are used together to produce graded aggregate from gravel deposits which are too large to be handled by the secondary unit alone.
4. The secondary unit is used alone when the bulk of the material in a gravel deposit does not exceed 3 inches in diameter. In this case, a positive means is provided to limit the size of the material fed to the unit.

Rarely are two aggregate production operations exactly the same. Each project must be analyzed on the basis of its own particular conditions and requirements. The 75-tph plant equipment is sufficiently flexible to meet all aggregate requirements of construction battalions.

4.9.0 Maintaining Quarry Equipment

Quarry equipment is subject to exceptionally hard wear due to the abrasive action of rock and rock dust; therefore, the operator's maintenance procedures contained in the manufacturer's maintenance and service manuals must be strictly followed. Safety is always the number one factor when planning maintenance, so you must ensure that everyone involved in the maintenance evolution is properly trained.

As the supervisor in charge of quarry operations, you must ensure that a schedule is posted and understood by all crew members. Make sure that prior to daily operations all

equipment is given a preoperational check. You must also ensure that the operator's maintenance is performed by the book and that all cutting edges, end bits, teeth and shanks, dozer tracks, tires, blades, and conveyors are checked daily for wear.

Equipment used in quarry operations should be wearfaced—a process also known as hardfacing. Hardfacing greatly extends the usable life of construction equipment, ensures efficient operation with less downtime, and greatly reduces the need for spare parts. Guidelines for wearfacing equipment parts and accessories are outlined in the *NCF Welding Materials Handbook*, NAVFAC P-433.

Because of the working conditions around a crushing operation, the entire crew must be totally familiar with the manufacturer's requirements and any special conditions that may exist. This ensures proper maintenance and the safe and productive operation of the crusher equipment.

The entire quarry and rock production operation depends on proper and adequate maintenance of equipment. A regulated program of maintenance, including step-by-step procedures, is recommended for each piece of equipment.

In contrast to other types of construction equipment, procurement of repair parts and new units for crushing and screening equipment requires a much greater lead time. Without proper parts and units, production either slows down or stops altogether.

Unfortunately, maintenance is often put off to a later date because of production. This may satisfy the immediate production demands of the unit, but it is not good for the equipment and creates a lax attitude toward scheduled maintenance. As the supervisor in charge of crushing and screening operations, you must ensure operator maintenance procedures are performed by the operators and maintenance mechanics to ensure continuous operation of the equipment.

WARNING

Be sure the main power sources remain "OFF" and are properly "red-tagged" while personnel are working on electrical equipment.

You should make frequent inspections during operations to ensure that the equipment is not being abused, that the units are level and cribbed, that calibrations are correct, and that proper shutdown procedures are being followed.

Test your Knowledge (Select the Correct Response)

3. **(True or False)** The most important goals when planning the layout of a crushing plant are that it meets production requirements, operates efficiently, and complies with all environmental regulations.

   A. True
   B. False

4. When possible where should sized aggregates be stockpiled to keep it from being contaminated?

   A. Near the jobsite
   B. As close to the crusher as possible
   C. In storage bins
   D. Away from access points to the quarry

Summary

This chapter discussed the responsibilities of a Rock Crusher Supervisor. It discussed the role the Rock Crusher Supervisor plays when planning a quarry, including always keeping the flow of the quarry at the forefront of the planning stages. This chapter also emphasized the importance of the placement and the requirements of the rock crushing plant. It discussed how to determine the crew size needed to produce enough aggregate for project completion and how to erect a rock crusher plant.

Additionally, this chapter touched on the different types of crushers and identified individual components of the plants with a brief explanation of each.

Because of the importance of safety at the job site, this chapter listed the responsibilities of the Project Supervisor concerning safety, such as developing and posting project safety plans.

Review Questions (Select the Correct Response)

1. What must the Crusher Supervisor be able to calculate using the crusher's output capacity and amount of material needed for job completion?

   A. Maintenance
   B. Crew size
   C. Material quality
   D. Fuel usage

2. Which command directs the tasking of crusher operations for an NMCB?

   A. NAVFACENGCOM
   B. NAVCHAPGRU
   C. COMSECOND/COMTHIRDNCB
   D. COMNCFNCB

3. Crusher plants are classified by what factor?

   A. Capacity output
   B. Weight of crusher unit
   C. Size of the jaws
   D. Area displacement

4. What is the main purpose of a crusher plant?

   A. To feed material to the secondary unit
   B. To reduce the size of the raw material
   C. To mine the raw material
   D. To sort the material before feeding the secondary unit

5. The hourly production rate of the 75-tph crusher plant is determined by what primary factor?

   A. Power output
   B. Operator skills
   C. Size of the hopper
   D. Hardness of the rock

6. What is NOT one of the primary functions of the secondary unit in the CSWP?

   A. To further reduce the stone
   B. To screen the sizes of stone
   C. To wash the stone
   D. To scalp the overburden

7. What component of the primary unit prescreens material that is already reduced to the desired size?

   A. Vibrating screens
   B. Apron feeder
   C. Under-crusher delivery conveyor
   D. Vibrating grizzly

8. Which piece of equipment is a type of compression rock crusher?

   A. Hammer Mill
   B. Vertically mounted impact
   C. Jaw crusher
   D. Packing

9. What is the primary factor that determines using either a compression or an impact crusher?

   A. Softness of the material
   B. Speed setting
   C. Size of the processed aggregate
   D. Availability of electrical power

10. How is the actual production rate of the secondary crusher determined?

    A. By raising or lowering the mantle
    B. By adjusting the feed spout
    C. By the capacity of the screening unit
    D. By adjusting the concave ring

11. What term refers to material from the screening process that is too small for the required aggregate?

    A. By-product
    B. Fines
    C. Overburden
    D. Waste

12. The desired performance of a specific screen is obtained by taking which action?

    A. Varying the degree of inclination
    B. Varying the frequency and amplitude of stroke
    C. Varying the direction of throw
    D. All of the above

13. Which factor does NOT affect the operational efficiency of a conveyor?

    A. Speed
    B. Length of travel
    C. Load
    D. Incline

14. What factor determines the capacity of a washing and screening plant?

A. Water pressure
B. Speed of the dehydrator
C. Percent of sand in the deposit
D. Capacity of the scrubber

15. **(True or False)** When you are developing a layout of a plant, you should give special attention to creating a logical flow of material.

A. True
B. False

16. For proper drainage, the slope of an effective quarry working floor should be at least how many degrees?

A. 2
B. 3
C. 4
D. 5

17. What factor must be considered as part of the drainage maintenance plan for the quarry?

A. Erosion control
B. Types of blasting equipment
C. Prevailing winds
D. Quality of stone being mined

18. Which department is responsible for enforcing federal regulations regarding dust particles?

A. Environmental Protection Agency
B. Environmental Quality
C. OSHA
D. MSHA

19. What capacity classification of fixed sand and gravel pits are subject to Subpart 000, 40 CFR 60.670?

A. 10 tph
B. 15 tph
C. 25 tph
D. 50 tph

20. Which type of machinery should be planned for when initially setting up a crusher plant for clearance?

A. Ancillary
B. Leased
C. Pneumatic
D. Diesel

21. Which material can contaminate open stockpiles of aggregate?

A. Windblown sand
B. Fines
C. Trash
D. All of the above

22. If a problem with oversized rock is anticipated at the primary crusher, you should take what action at the apron feeder?

A. Pre-crush the rock
B. Deploy a wet-down system
C. Place a vibrating grizzly over the apron feeder
D. Set up a small blasting unit at the headwall ramp

23. Why are bins preferable to stockpiling when storing aggregate?

A. They are cheaper.
B. They can handle larger quantities.
C. They prevent cross-contamination.
D. They are easier to set up.

24. Which piece of equipment is more efficient when building stockpiles?

A. Dozer
B. Loader
C. Clamshell
D. Excavator

25. The site for crusher plant setup should have which characteristic?

A. Flat
B. Level
C. Well compacted
D. All of the above

26. **(True or False)** When torquing bolts and nuts on the plant, you do so by torquing the bolt head.

A. True
B. False

27. Of the following basic setups for a 75-tph crushing plant, which should be used when the bulk of the material from a gravel deposit is 3 inches in diameter or less?

A. Jaw crusher
B. Primary unit only
C. Secondary unit only
D. Primary and secondary units together

28. **(True or False)** The entire quarry and rock production operation is affected very little by improper and inadequate maintenance of equipment.

A. True
B. False

Terms Introduced in this Chapter

Aggregate	Granular material such as sand, gravel, crushed gravel, crushed stone, slag, and cinders. Aggregate is used in construction for the manufacturing of concrete, mortar, grout, asphaltic concrete, and roofing shingles.
Ancillary Equipment	Equipment that is not directly involved in a stone-making process. Cranes to change worn parts and fuel trucks are considered ancillary equipment.
Bitumen	Any of various flammable mixtures of hydrocarbons and other substances, occurring naturally or obtained by distillation from coal or petroleum, that are a component of asphalt and tar and are used for surfacing roads and for waterproofing.
Cement	A fine grey powder made of a mixture of calcined limestone and clay, used with water and sand to make mortar, or with water, sand, and aggregate, to make concrete.
Department of Environmental Quality	The agency's mission is to protect, sustain, and improve a clean and healthful environment to benefit present and future generations. This is accomplished through managing, planning, and enforcing air and water quality laws and administrative rules. Remediation responsibilities include overseeing investigation and cleanup activities at state and federal Superfund sites to ensure compliance with applicable state and federal regulations, and to prevent exposure of potential human and ecological receptors to hazardous or toxic materials that have been released to soil, sediment, surface water, or groundwater.
Hopper	A general term for a chute with additional width and depth to provide a volume for temporary storage of material(s). The bottom of the hopper chute typically has a mechanism to control the flow of materials, thus allowing them to be metered out at the desired rate.
New Source Performance Standards	New Source Performance Standards (NSPS) are pollution control standards issued by the United States Environmental Protection Agency (EPA).

Overburden	All plant and mineral materials that must be removed to uncover the rock that is to be mined.
Raw material	The rock from the quarry/pit that has not been processed by the crushing plant.

Additional Resources and References

This chapter is intended to present thorough resources for task training. The following reference works are suggested for further study. This is optional material for continued education rather than for task training.

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