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EXAMINING THE EFFICIENCY OF HEAVY EARTH MOVING MACHINERY (HEMM) IN OPEN CAST MINES

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ABSTRACT

With the current state of affairs, open-pit mining continues to play a significant part in the mining industry and is occasionally brought back into use. The ownership of minerals inside open-pit mining is growing at a steady rate year after year. This is the result of developments in open pit machinery production that have occurred at a rapid pace. An boom in design has occurred in the realm of equipment, which has led to the creation of machines that were previously unimaginable in terms of their scale and output capability. To get the highest possible return on investment per unit, the primary focus of the initial capital expenditure in opencast mining is on equipment for excavation and transportation. This is done with the intention of maximizing the return on investment. Over the course of the past few years, mine management has realized that it is becoming increasingly challenging to recover operating time that has been wasted due to machine faults and idle period. It is possible for HEMMs to lower output, productivity, and expenditures, which ultimately leads to a loss of income when they are not employed correctly. Consequently, in order to achieve cost-effectiveness in transportation and excavation activities, it is required to do frequent evaluations of the performance of the equipment. The Gopinathpur mine in the Mugma area and the Jeenagora mine in the Lodna area are both owned and operated by Eastern Coalfield Limited. The objective of this study was to ascertain the percentage of shovels, dumpers, dozers, and other heavy earth moving machines (HEMMs) that are available and in operation at both mines. Bharat Coking Coalfield Limited, as well as to conduct research into the elements that contribute to the enhancement of the equipment's overall performance.

1. INTRODUCTION

Open-pit mining is becoming increasingly common in India, particularly in its mechanized form. This trend is expected to continue throughout the country. The production of mining machinery is still in its early stages of development, either in terms of the intricacy of the design or the scale of the operation. Both of these aspects are still in the process of being developed. As a consequence of this, open pit mines are compelled to rely largely on devices that are brought in from other countries. There are a number of problems that have been raised in relation to the appropriate utilization of the large earth moving machinery that is now being utilized. This machinery serves as the basis, and it is heavily reliant on open pit mechanization in order to function well. Additionally, it necessitates a substantial amount of financial investments.You are correct in assuming that they are accumulating knowledge from their previous performances. It is general knowledge that in order to extract minerals, mining requires the use of heavy machinery that is not only exceedingly expensive but also highly automated.

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Because of the large rise in size and capacity of these machines over the course of the previous few years, the utilization of the equipment has become less effective, which has resulted in a decline in total productivity. For the purpose of achieving early returns on investments, the management of mining operations is based on the improvement of the efficiency with which equipment is utilized. The area of concern is the neglect in the maintenance of mining equipment, and the management did not pay adequate emphasis on this particular component of the mine. Unfortunately, this is the area of concern. Studies have also revealed that the costs of maintaining opencast mining equipment account for between 30 and 50 percent of the overall operational expenses in mechanized mines. This is a significant amount of money. In order to address the general culture of the organization, which I am responsible for operating and managing, there is a need for a shift in the way that people think. It is the obligation of the organization to identify the maintenance and operational strategy that will be most successful for the various pieces of equipment that are in their possession. Taking this into consideration, it is of the utmost necessity to put into action the needed preventative maintenance processes in order to avoid both unanticipated and predetermined periods of downtime.

EQUIPMENT PERFORMANCE

Depending on the machine or piece of equipment that is being discussed, performance can be defined in a variety of different ways. The production costs and productivity are directly related to the performance and efficiency of the equipment, and there is a direct correlation between the two. The improper utilization of HEMMs and the issues that arise as a consequence of this utilization have a substantial impact on the costs of production, the productivity of the workforce, and the amount of minerals that are produced for the industry. During the course of the working shift, if any heavy earth moving machine (HEMM) is utilized in an insufficient manner, such as a dozer, dumper, or shovel, production will surely come to a halt, which will result in a loss of cash by the company.A benchmark that is widely applied in the process of comparing and evaluating the effectiveness of various pieces of equipment is comprised of the following factors: First paragraph on effectiveness Productivity can be defined as the quantity of work that is accomplished by a piece of machinery in a specific amount of time throughout that period of time. When discussing the productivity of the machinery, it is not uncommon to make reference to production on an hourly, daily, monthly, and annual basis. These are all words that are occasionally employed. In order to compute each of these variables, it is required to make use of the rate of production that is usual during a certain time period. What is it? It is [1]
. This is an estimate of the cost per ton of material that is removed or handled. When determining whether or not a mining company is profitable, production expenses are taken into consideration as a factor. This is as a result of the substantial amount of competition that exists in the market. The operational cost, which includes labor, energy, and maintenance costs, as well as the ownership cost of the equipment, which includes depreciation and interest on capital, among other factors, are both included in the cost per ton of material handled or won. Both of these costs are included in the total cost. In the calculation of the cost per ton of material handled or won, both of these components are included.The period of time that the apparatus can be utilized for the purpose of It has been demonstrated that the great majority of HEMM machines that are capable of being fixed exhibit what is known as a "bathtub curve." It differentiates between three distinct failure rates: a decrease in the

early stages of life or during the era of infant mortality; a stable failure rate throughout the majority of the equipment's functional life; and an increase in failure rate throughout the aging or wear-out phase of the equipment. All of these failure rates are unique to the equipment.Because it would be financially unfeasible to continue using a machine after it has reached the end of its useful life, it is imperative that the machine be disposed of once it has reached this point. Because it will have an effect on the return on investment [1,] this number is significant because it will have an effect on the return on investment.

METHODOLOGY

Both the Gopinathpur mine, which is situated in the Mugma Area of Eastern Coalfield Limited (ECL), and the Jeenagora mine, which is situated in the Lodna Area of Bharat Coking Coal Limited (BCCL), have made contributions to the collection of data. Both of these mines are operated by Eastern Coalfield Limited. In order to achieve the objectives that were outlined before, this action was made in order to be effective in achieving those objectives.

During the mining season that took place in 2014-2015, the mine that was mentioned before served as the source of data on working hours (WH), maintenance hours (MH), breakdown hours (BH), and idle hours (IH). These hours were taken into consideration when calculating the total number of hours worked.

This information was utilized in order to compute the percentage availability and percentage utilization for all of the heavy earth moving machines (HEMMs) that were present at that area. The data that was acquired above was utilized. A variety of HEMMs, such as shovels, dumpers, dozers, and drills, were provided.

A computation was carried out in order to ascertain the Overall Equipment Effectiveness (OEE) of the shovel that was utilized in the two mines that were discussed earlier. This was done in order to determine the overall effectiveness of the shovel.

A comparison and contrast was made between the two mines with regard to the overall equipment effectiveness (OEE), percentage of availability, and percentage of utilization of their respective technologies.

1. HEMMS IN MINES

Listed below is a general summary of the HEMMs that are utilized in the two mines that were under inspection:

Dozers:-

The term "dozer" refers to a continuous tracked tractor (crawler) that is utilized for projects involving building or conversion. It is equipped with a blade, which is a substantial metal plate, that is utilized for the purpose of pushing massive quantities of soil, sand, rubble, or any other material that is related. An additional feature that is frequently installed on the rear of a dozer is a device that is known as a ripper. This device is designed to look like a claw. This apparatus is utilized for the purpose of releasing materials that have been strongly compressed. Dozers are supplied with tracks that not only equip them with the capacity to retain a strong ground holding capability but also allow them the ability to maneuver on highly uneven terrain. It is feasible for the dozer to avoid sinking on muddy or sandy ground due of its wide tracks, which serve to spread its weight over a big region. This allows the dozer

to travel across a considerable distance. As a result, the ground pressure is reduced, which in turn stops the dozer from sinking underneath the earth. Additionally, this type of track is sometimes referred to as low ground pressure tracks, which are also commonly referred to as swamp tracks. LGP tracks are another name that is occasionally used to refer to swamp tracks. More specifically, the transmission systems that are installed on bulldozers are designed to generate an incredible amount of tractive force and to make the most efficient use of the track system [3]. The blade, which is a hefty metal plate that is located on the front side of the tractor, is considered to be one of the most significant components when it comes to a dozer. The blade is often located on the front side of the tractor. In addition to moving things, it is also capable of pushing sand, mud, and debris over obstructions. The majority of dozer blades can be categorized into one of three categories [7]: a blade that is straight (often referred to as a "S blade"), short, and does not have any lateral curves or side wings; it is also capable of being used for fine grading; and a blade that is capable of being used for fine grading.

A blade is said to be a "universal blade" if it is tall, has a significant amount of curvature, and has large side wings that enable it to retain a greater amount of material. When referring to this particular kind of blade, the term "universal blade" is typically used.

The length of a "S-U" combination blade is shorter than that of its counterpart, which results in less curvature and smaller side wings. This is because the shape of the blade is shorter. When working in typical situations, such as those that are present in a quarry, this particular blade is utilized for the goal of pushing stacks of gigantic boulders. You have the option of installing the blades in a straight line across the frame or at an inclination toward the frame. 'Tilt cylinders' are deployed in specific situations in order to make adjustments to the angle while the blade is in motion. It's possible that either of these two setups could work. It is possible, for example, to sharpen the bottom edge of the blade in order to make it simpler to cut down tree stumps [seven].

Ripper

There is a long tool that looks like a claw that is attached to the back of the bulldozer. The term for this feature is the ripper. When it comes to rippers, there are two distinct categories: single shank rippers, which are also referred to as gigantic rippers, and multi shank rippers, which are collections of two or more rippers. When it comes to heavy ripping, the most common inclination is to use a single shank. In addition, the ripper shank is fitted with a tip made of tungsten steel alloy that may be replaced if necessary. The process of ripping rock involves breaking down the rock or pavement that is currently on the ground surface into smaller pieces that are more manageable and easier to transport. After that, these components can be taken out so that the grading process can proceed. The term "agricultural ripping" refers to the procedure by which a farmer tears up stony or exceptionally hard soil (like podzol hardpan), which would otherwise be impossible to plough, in order to cultivate it. This happens in order to accomplish the cultivation of the soil. For example, most of the most valuable land in the wine region of California is made up of ancient lava flows [7]. This is a large amount of the land at that location.

Dumper :-

A specific type of truck known as a dumper, which is also commonly referred to as a dump truck, is primarily used for the purpose of transporting loose materials. This is the major function of the dumper. Coal, ore, overburden, top soil, and sand, gravels, or soil are the components that make up these aforementioned resources for mining operations. These materials include those that are used for construction projects. A dump truck typically has an open-box bed that is hinged at the back and equipped with a hydraulic piston that lifts the front of the bed. This configuration is typically used in dump trucks. The configuration that is being presented here is highly usual. It is possible for the material that is contained within the bed to be deposited (also known as "dumped") on the ground behind the truck at the spot where the delivery is being made [9]. This is a possibility. As a result of the arrangement that is currently being utilized, this is now feasible.

Specifically with regard to the Cab:Among the components of the hydraulic excavator is the top structure, which is the third component of the machine. This structure is one of the components. Not only does this area of the machine hold the seat that the driver will be sitting in, but it is also where the controls are located. By operating both levers simultaneously with the assistance of two levers on both sides and two levers in the front of the vehicle, the driver is able to control the height of the vehicle as well as the direction in which it is traveling at the same time [10]. This is made possible by the fact that the vehicle is able to travel in both directions simultaneously.

CONCLUSION

The percentage of shovels, dumpers, dozers, and drills that were available and utilized was established by analyzing the working hours, breakdown hours, maintenance hours, and idle hours that were acquired from the Gopinathpur Mine in the Mugma Area of ECL and the Jeenagora Mine in the Lodna Area of BCCL. Both mines are located in the Lodna Area. It was necessary to carry out this activity in order to ascertain the proportion of shovels, dumpers, and dozers that were simultaneously accessible. The results of this computation showed that the HEMMs (shovel, dumper, dozer, and drill) that are used at the Jeenagora Mine are more readily available and utilized than those that are used at the Gopinathpur Mine. This was determined after the computation was completed. The conclusion that was arrived at was found to be this. This is because the machinery that was intended to be used at the Jeenagora Mine was not functioning in the appropriate manner the majority of the time. This is the reason why this is the case. Another thing that was found out was that the shovel had an OEE, which is an acronym that stands for overall equipment effectiveness. During the course of the research, this was yet another interesting finding that was made.

At the Gopinathpur Mine, the overall equipment effectiveness (OEE) of the four shovels with models EX 350, H55N, EX 300, and CK 300 was determined to be 0.18, 0.01, 0.12, and 0.33 respectively. These figures were determined by analyzing the data collected from the shovels. A thorough examination of the information obtained from the shovels led to the determination of these figures. The process of analyzing the data led to the determination of these numerical values. On the other hand, it was discovered that the overall equipment effectiveness (OEE) of the three shovels that were used at the Jeenagora Mine was equivalent to 0.50, 0.44, and 0.58 correspondingly. This was the case. It was determined that the shovels in question were examples of the EKG 5.0, EX 300- LC, and 90 CK varieties. According to the data presented here, it would appear that the machinery at Jeenagora Mine was more efficient than the machinery at Gopinathpur Mine during the production year of 2014-2015. This is the conclusion that can be drawn from the information presented here. A poor overall equipment effectiveness (OEE) not only suggests that the equipment is not being utilized effectively, but it also indicates that the equipment is not producing as much as it should be producing. This is because the OEE is expressed as a percentage.Not only does the provision of routine maintenance have the capacity to bring about an increase or improvement in the productivity of the machinery that is being utilized within the company, but it also has the potential to bring about a decrease in the number of hours spent in idleness and breakdowns. When it comes to conducting an investigation into the operation of mining equipment, the usage component is of the utmost significance during the investigation. Because it takes into account not only the downtime that occurs as a result of equipment failure, but also the time that is spent idle, this is the reason why it is effective. This is the reason why situations are the way they are.Not only does this component contribute to the improvement of the low production, but it also contributes to the enhancement of the system's overall efficiency, which is why this component is of such critical importance.

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