MAINTENANCE MANAGEMENT OF CONSTRUCTION EQUIPMENT ON CONSTRUCTION PROJECT

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Abstract - *Proper planning, selection, procurement, installation, operation& maintenance of construction equipment plays an important role on construction project. The overall cost of construction is a function of the design of the construction operations and its execution. The cost of construction equipment in civil engineering construction projects can ranges from 25-40% of the total project cost. The efficiency and productivity of construction equipment mainly depends upon the type of maintenance management systems that is adopted by site supervisors. So it is necessary to give proper attention on maintaining equipment in healthy condition Therefore, creating database is necessary for maintaining equipment records. It is also necessary to maintain equipment's maintenance records on construction site. The data given is monthly equipment utilization on site and various reasons for losses in construction due to idle and breakdown of equipment for operation and production*

***Key Words*: Construction Equipment Maintenance, Equipment efficiency Productivity, Maintenance database, Losses due to idle and Breakdown**.

1. INTRODUCTION

If a construction contract is a unit price, lump sum or cost more; Whether the construction project is linear (ie, concept, design, procurement, construction) or fast track (ie, design / construction), the cost of construction is an important factor in all projects. The main factors that affect construction costs are materials, labour, equipment, overhead and profits. The cost of equipment for civil engineering construction projects can range between 25 and 40% of the total cost of the project. It is important for design engineers and construction engineers to know the construction equipment. Construction equipment and integral part of the construction process. The cost of construction is a function of the design of the construction operation. The purpose of this study is to know the traffic flow of construction equipment on site and how it affects the efficiency of construction operations due to its failure and inactivity. A large construction project requires large amounts of construction equipment. It is necessary to evaluate if a project can be completed in a certain time, even if additional construction equipment is brought to the construction site. However, to date, limited research has been conducted to evaluate these effects in planning the use of the equipment. The high failure rate and the extreme competitiveness of the construction company demand that contractors continually seek new ways to reduce costs. Many companies seek competitive advantages by reducing labour and raw material costs or by increasing service and controlling losses. One way in which companies in the industrial sector have found cash to increase profit margins is through Equipment maintenance. Most construction companies tend to concentrate maintenance efforts on unscheduled breakdowns or emergency repairs. These tend to be the most costly in production losses, overtime of the maintenance department and in the streamlining of parts for repairs. Usually, the largest assets of a construction company are in the equipment that it owns. By anticipating and preventing these unplanned events, a Company can protect its assets from equipment against downtime of production, unscheduled losses or costly failures, while improving safety factors.

1.1 General:

1.1.1 Need for equipment maintenance records and workshops:

Construction is the ultimate goal of a design and machines make it possible to achieve that goal. The mechanized construction is indispensable under certain conditions for a fast, efficient and quality-oriented execution of the projects. The ability to win contracts and realize them with a profit is determined for the construction contractor by two vital assets: people and equipment. The optimization in the management of the propagation of a team is fundamental for a contractor to achieve a competitive price position.

Machinery and equipment that has become an integral part of any construction activity, and plants and machinery now constitute a substantial part of the construction cost of a project (in a proportion of 10 to 30 percent of the total cost of the project, depending on the extent of the mechanization), will be maintained to turn the project into a profit center for any

organization. The Plant and Machinery (P & M) workshops on the site are the places where this maintenance is carried out and, therefore, it is Necessary that the project sites have a well-planned and equipped P & M workshop and workspace:

Study the performance of the planned equipment in construction projects, if they are sufficient in the planned production of a project.

To study the effects of equipment hours used in relation to planned production, study delays, inactivity due to failure, equipment failure and the amount of delay due to equipment failure due to improper maintenance.

1.1.2 Equipment Maintenance Plan:

The Equipment Maintenance Plan, or EMP, as it is commonly called, is a document, in a table format, that is used when performing the tasks necessary for the proper maintenance of the facilities, plant or process equipment. The EMP helps direct the person or people who perform the required maintenance tasks by ensuring that the development is done consistently for all teams. Each EMP must include one or more maintenance tasks designed to guarantee the continuous operation and maintenance of an item, process or system of the equipment. Each of these tasks has the following characteristics:

• A descriptive title for each maintenance task to be performed.

• A frequency assigned to perform each task.

• Assignment of a specific trade or work group and the number of each trade or work group required to perform the task

• Condition of the equipment required for the performance of the task (that is, running or shutdown)

• Type of work: preventive maintenance (PM), predictive maintenance (PdM), corrective maintenance (CM), situational maintenance (SIT), etc.

• Procedure number: unique identifier for the task, or name of the file if it is linked to another document that provides instructions for the individual task

• Estimated time to complete the task.

• Special tools, materials and equipment needed to complete the task.

The maintenance plan determines the quality of the maintenance work. A unique aspect of maintenance activities is the difficulty of accessing the quality of work performed. If the maintenance work is performed poorly, it can cause a breakdown due to the delay of the intervention time, and to whom it is difficult to judge if it was due to maintenance errors or defective parts. In other words, the quality of maintenance must ensure the quality of the work itself. To achieve this, each individual member of the maintenance team must have a sense of responsibility and consider methods to prepare, execute and validate their own work.

2. Scope of Work:

Study performance of planned equipment on a construction projects, if they are enough in planned production of a project. To study effects of Equipment hours used linked to planned production studying delays, Idle due to break down, failure of Equipment and Quantum of delay on account of equipment breakdown due to improper maintenance.

3. Type of maintenance:

3.1 Reactive maintenance:

The oldest maintenance approach is reactive, or "execution to failure". The equipment is not repaired or replaced until it breaks. Companies that depend solely on reactive maintenance discover that they have:

-Costly downtime: - The equipment fails with little or no warning, so the process could be delayed until the replacement parts arrive, which would cause a loss of income.

-Higher maintenance costs: - Unexpected failures can increase extra labor costs, as well as accelerated delivery of spare

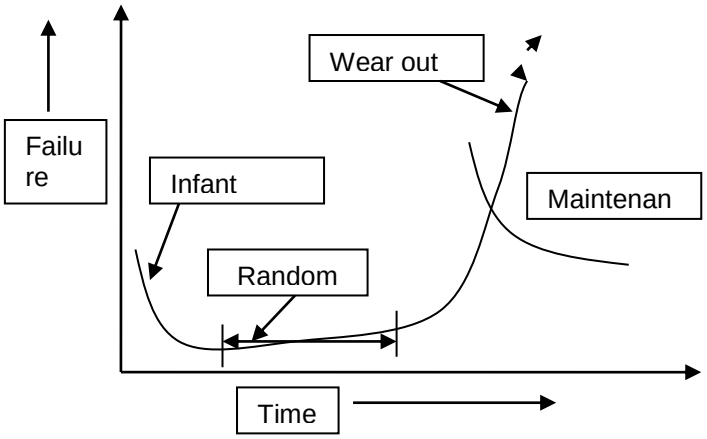
parts.

-Safety hazards: - Failure without warning could create a safety problem with the defective equipment or other units that could be affected.

Reactive maintenance is basically the maintenance mode "run until it breaks". No action or effort is taken to maintain the equipment as the designer originally intended to ensure that the design life is achieved. Keep in mind that more than 55% of the maintenance resources and the activities of an average installation are still reactive. The advantages of reactive maintenance can be seen as a double-edged sword. If we are dealing with a new equipment, we can expect minimal failure incidents. Actually, during the time that we believe we are saving maintenance and capital cost, we are really spending more dollars than we would have under a different maintenance approach. We are spending more money associated with the cost of capital because, while we wait for the equipment to break, we are shortening the life of the equipment, resulting in a more frequent replacement. We can incur costs in case of failure of the primary device associated with its failure that causes the failure of a secondary device. Our labor cost associated with the repair will likely be higher than normal because the failure will likely require more extensive repairs than would have been necessary if the piece of equipment had not been executed until failure. It is likely that the piece of equipment fails during off-hours or near the end of the normal workday. If it is a critical team that needs to get back online quickly, we will have to pay the cost of the extra maintenance hours. Because we expect the equipment to work with failure, we require a large inventory of repair parts materials. This is a cost that we could minimize under a different maintenance strategy.

3.2 Preventive maintenance:

The preventive maintenance philosophy is also known as time-based or planned maintenance. The goal of this approach is to maintain equipment in a healthy condition. Selected service and part replacements are scheduled based on a time interval for each device — whether it needs it or not.



The cycle starts with a high probability of premature (infant) failures that result from manufacturing or installation errors. The curves shown failure probability verses time required. In this failure cycle shows the various type of failure and time required for repair it. The probability of failures is then relatively level until the equipment begins to wear out. Preventive maintenance is scheduled to take place before this probability increases significantly.

3.3 Predictive maintenance:

In predictive maintenance, the condition of the equipment instead of the time intervals determines the need for service. On-line condition monitoring helps identify when the risk of attrition begins to increase and predicts when a failure is likely to occur.

This approach can save time and money because it allows you to correct the problem before the equipment really fails. It avoids downtime and repair costs caused by unexpected failures, as well as costs and loss of production caused by unnecessary preventive maintenance. An advanced predictive maintenance program modifies the definition of a failure. Traditionally, a failure is defined as the point where the equipment breaks down and is no longer available for production. A more appropriate definition is that the equipment is no longer able to produce the right quality at the right production rate and the right cost.

3.4 Proactive maintenance:

While predictive maintenance uses online condition monitoring to help predict when a fault will occur, it does not always identify the root cause of the failure. That's where proactive maintenance comes into play. Proactive maintenance is based on information provided by predictive methods to identify problems and isolate the source of the error.

4. Economics of Construction Equipment

The economy of construction equipment is a study of the cost accounting process related to the operation of the machinery and includes the calculation of the rates of use of the plant and the unit cost of production. Investment criteria with a view to acquiring a piece of equipment or withdrawing based on the economic evaluation can also be included in the equipment economy. Another aspect of the cost accounting process is the maintenance of records related to the equipment. Without these records, it would be impossible to control equipment costs and the valuable information needed in the future selection of equipment would be lost. The costs of possession and operation per hour of a given machine can vary widely because they are influenced by many factors

1. Cost of equipment delivered to owner
2. Conditions under which it is used
3. Number of hours it is used per year
4. Number of years it is used
5. Maintenance and repair for the equipment

Demand for the used equipment when it is sold, which will affect the salvage value. In order to optimize the procurement and utilization of the construction equipment, it is necessary to understand the various factors of cost of using the equipment. It is customary to group those cost elements in two groups and various subgroups as given below.

4.1 Economic replacement theory-

Decisions about heavy equipment should be made based on sound economic principles, note motions or intuition (Douglas, 1975). Economic replacement theory models attempt to answer the question: "What is the optimum economic life of this piece of equipment?" The goal is to find an optimum length of service for a given machine. After this time has expired, there is at least one other alternative (replace, retire, rebuild, etc.) which is more economical than keeping the machine in its present state. The models attempt to find the optimum length of service by using a variety of techniques based on the science of economics.

4.2 Equipment Age

The factor of equipment age is considered as a dependency factor to the maintenance Costs. As the equipment ages, the ownership costs decrease. Simultaneously, the operating costs increase due mostly to the additional costs related to maintenance and repairs with a smaller cause by reduced productivity to wear and tear.

There are three basic theories in the field of economic replacement that are relevant to an understanding of this dissertation. They are: The Cost Minimization Model, the Profit Maximization Model, And the Repair Limit Model**.** There are many other names for equipment replacement models but most of them can be categorized as an offshoot of either cost minimization or profit maximization. Cost minimization and profit maximization theories developed on parallel paths beginning in the 1920's. Repair limit theory is relatively new—it was first published in the 1960's.Throughout this section, the terms "Defender" and "Challenger" will be used (Terborch, 1949).The Defender is the machine that is currently under study by the company. The Challenger is a new machine that could serve the same purpose as the Defender.

5. Conclusion:

Equipment plays an important role in today's construction projects which is more demanding need to be completed in stipulated time with best Quality. The cost of equipment in a project varies from 10-30 % of the total cost of project, depending upon extent of mechanization. Proper planning, selection, procurement, installation, operation, maintenance and equipment replacement policy plays important role in equipment management for successful completion of project.

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