

IMPACT OF EQUIPMENT MANAGEMENT ON BUILDING SITE PRODUCTIVITY

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ABSTRACT

Construction equipment is the important factor to run the project in a successful manner. The effectiveness of construction machineries is a major factor that differentiates construction companies in terms of heavy construction and light construction. Time and cost is an important factor in construction. Selection and planning of equipment is essential for its proper utilization. To complete the project within a stipulated time use of equipment becomes a priority. Utilization of machine properly and match their capacities to specific project requirements are important. Main objective of this paper is to manage the equipment and thereby improve the productivity of the construction.

Better project management in construction must vigorously pursue the efficient utilization of labour, material and equipment. Improvement of productivity should be a major concern of those who are responsible for cost control of constructed facilities. Equipment handling requires special attention for cost reduction. To understand effective construction equipment management need to also understand effective construction equipment maintenance. Equipment details and work details were collected from two construction companies. Cost of equipments and maintenance cost required for each equipments were collected from the construction companies. Comparison has been done based on the details collected. Main objective of this paper is to manage the equipment and thereby improve the productivity on building site.

KEYWORDS: Equipment management, proper planning, methods for improving productivity.

I. INTRODUCTION

Equipment management requires a special attention for cost reduction. The use of new equipment and innovative methods has made possible changes in the construction technologies in recent decades. Organizations which do not recognize the impact of various innovations and have not adapted to changing environments have justifiably been forced out of the mainstream of construction activities. The basic operations that involved in the construction of any project are excavation, digging of small or large quantities of earth and moving them to fairly long distances, placement, compacting, leveling, dozing, grading, hauling, etc. All the machines that are usually used to carry out these construction operations are referred to as construction equipment. Construction firms are often faced with problems related to high rate of equipment unavailability, failure or breakdown and accidents that reducing productivity. Poor selection of equipment often claimed as a major cause of equipment related problems. The only way to avoid this huge amount of loss that usually leads to equipment breakdown or failure is to adopt proper equipment maintenance management strategy. This will keep construction equipment fit at all times and allow timely completion of construction project, thereby increasing construction project profitability. Thus, to understand effective construction equipment management, one must also understand effective construction equipment maintenance. There is a need to let construction managers realize that maintenance of construction equipment if properly carryout is a profit Centre, Effective management of equipment is crucial for the success of construction firms. Inadequate manual processes of equipment management and decisions of equipment managers usually result in major losses in construction firms. The equipment management practices vary, to some extent, among different contractor sizes. Equipment manager's

main task is to reduce downtime, achieve optimum equipment utilization and increase production at minimum cost.

Importance of Equipments in Construction:

With the advent of heavy construction equipment and the approach of large construction company of converting the construction sector to a more mechanized and in turn an organized sector has made it mandatory for maintaining the fleet of equipment to perform to its optimum.

Since machinery and equipment which have become an integral part of any construction activity and plants and machinery now constitute a substantial portion of the construction cost in a project has to be maintained to turn the project into a profit making center for any organization. And also because the cost of maintenance of any equipment is in tune of 200 to 250 percent of cost of equipment it has become imperative for going in for maintaining the equipment during its expected life cycle.

Equipment maintenance is a science because it involves scientific and technical knowhow of different machineries involved, and it is an art because for identical problem it may require different treatment or action or process. We need equipment's for technical and speedy construction and at the same time for economical and timely completion of project.

II. SCOPE AND OBJECTIVE OF STUDY

The objective of this paper is:

- To study the various equipment management practices currently being employed by large construction sector.
- To identify the best practices for effective management. This study will help to understand the factors responsible for better efficiency and less operating cost of owning and operating by reducing the downtime of equipment.

III. METHODOLOGY

Literature study and comparison are followed for this thesis. Step by step methodology of this thesis contains

- Site visit
- Preparation of data
- Conducting Interview
- Analysis of data
- Comparisons of data
- Result and Conclusion

IV. DATA ANALYSIS

Equipment planning on major construction projects includes besides its selection, the decision about working shifts, number and size of machines, the matching of units working in a team, procurement schedule and the arrangement of necessary technical staff to operate, service and repair of the equipment. Planning of workshop and store facilities is also an important aspect of equipment planning. The number and size of machines selected depend upon the magnitude of work, working days available and number of shifts worked in a day. Size matching of all equipments working in a group is vital. The procurement plan must be in line with the construction schedule. for its operation. Suitable service facilities are vital to realize the planned output rate of equipments. Availability of operation and maintenance staff having adequate quality and number for the operation of equipment is essential to obtain full production.

Equipment planning shall include the following aspects.

- Selection of equipment.
- Number and sizes of units.
- Matching capacities.
- Schedule of procurement.
- Arrangement of skilled staff for operation and maintenance.
- Decision regarding number of shifts per operation.

A systematic approach in respect of planning for equipment is necessary, incorporating all the factors detailed above. In addition an important factor to be considered is the necessary inter-disciplinary acceptance of the planning for equipment. In a majority of the cases a Civil Engineer may head project whereas the construction equipment management will demand close liaison with mechanical and electrical engineers.

Equipment Details of Construction Companies:

List of equipments in Heather Constructions and their capacity and identifications.

SI No	Name of the Equipment	NOS	Capacity	Identification
1.	Dozer	5		BEML (D155)
2.	Dozer	1		BEML (D50)
3.	Motor Graders	27	155 Hp	BEML (GD 605R2)
4.	Motor Graders	10	155Hp	KOMATS
5.	Wheel Loaders	22	1.7 cum	HM 20-21
6.	Wheel Loaders	8	1.7 cum	L&T CASE W20
7.	Excavator	13	900L	L&T Proclaim
8.	Back Hoe (loader)	2	1.00cum	JCB
9.	Back Hoe (loader)	14	1.00cum	L&T Case 580
10.	Vibratory Roller	40	10 Ton	L&T Vibromax
11.	Vibratory Roller	13	2.7 Ton	Bomang
12.	Heavy Crane	3	250 Ton	American
13.	Heavy Crane	1	750 Ton	Link Belt
14.	Crane	56	75 Ton	TATA 955
15.	Crane	10	20Ton	COLES620
16.	Crane	70	8Ton	ESCORTS
17.	Crane	69	18Ton	TATA32
18.	Truck	70	10Ton	Ashok Leyland
19.	Mini Truck	18	6Ton	TATA 407
20.	Tipper	76	6 Cum	TATA

21.	Tipper	119	6cum	Ashok Leyland
22.	Water Tankers	47	10000L	Ashok Leyland
23.	Batching plant	30	30cum	Stetter
24.	Batching plant	24	30cum	Millers
25.	Concrete pump	44	56cum	Stetter
26.	Hot mixer plant	1	120ton	Linhoff
27.	Hot Mix Plant	1	135Ton	Marini
28.	Hot Mix Plant	3	90Ton	Condecup
29.	JCB	2	036Cum	Escort

List of equipments in Prime Builders and their capacity and identifications:

Sl No	Name of the Equipment	Nos	Capacity	Identification
1	Crane	5	20MT	Komatsu
2	Crane	1	30MT	Tfi
3	Crane	2	75MT	TATA
4	Crane	1	20MT	Navin
5	Concrete Pump	1	30cum/Hr	Greaves
6	Mobile Concrete pump	2	52 Cum/Hr	Schwing
7	Wheel Dozers	6	2MT	TATA
8	Wheel Dozers	10	2MT	Hindustan
9	Wheel Dozers	3	3Cum	Volvo
10	Excavater	3	0.9Cum	Caterpillar
11	Excavater	2	200Hp	Caterpillar
12	Excavater	3	200Hp	Samsung
13	Excavater	2	300Hp	Daewoo
14	JCB	5	036Cum	Escort
15	JCB	2	0.6Cum	TATA
16	Motor Graders	3	120Hp	Komatsu
17	Motor Graders	13	120Hp	Caterpillar

18	Vibratory Rollers	10	10MT	Greaves
19	Vibratory Rollers	4	10MT	Escorts
20	Vibratory Rollers	1	10MT	Kirlosker
21	Water Tankers	41	0000L	TATA
22	Water Tankers	5	12000L	Ashok Leyland
23	Tandem rollers	5	10MT	Escorts
24	Tandem rollers	4	4MT	Escorts
25	Tipper Truck	110	10 MT	TATA
26	Tipper Truck	20	2 MT	Ashok Leyland
27	Concrete Paver	2		Wirtgen

Comparison of Maintenance Cost of Both Companies:

Equipment Name	Equipment No's		Maintenance Cost		Maintenance		Cost For each Equipment	
	Heather	Prime	Heather	Prime	Heather	Prime	Heather	Prime
Tipper	130	195	135200	276900	0.70%	1.07%	1040	1420
Excavator	12	13	37308	54560	1.38%	5.08%	3109	4127
Back Hoe (JCB)	7	16	5810	37280	1.04%	4.70%	830	2330
Motor Graders	16	37	67360	364450	2.23%	10.85%	4210	9850
Concrete Pumps	3	44	3450	154000	0.50%	3.92%	1150	3500
Vibratory Rollers	24	53	25200	106000	1.59%	3.78%	1050	2000
Water Tankers	46	47	56580	66740	3.09%	1.72%	1230	1420
Crane	9	205	7200	282900	4.22%	8.80%	800	1380
Wheel Dozers	19	17	315096	26860	12.56%	1.955%	16585	1580

Failure Mode Effect Analysis (FMEA) as a Tool for Carrying Out Maintenance Cost

Introduction to failure mode effects analysis

A FMEA is a stable and seasoned design tool, Often called a Failure Mode Study, this design and maintenance engineering tool has existed and matured for some time, but is still ignored by many design teams and organizations. Failure Mode and Effects Analysis is an approach that helps identify and prioritize potential equipment and process failures. Often used as a springboard to establishing a Root Cause Failure Analysis program, FMEA is a logical system that objectively ranks potential failures and provides recommendations for

corrective actions. Informal failure analysis happens every day in most plants. As engineers try to figure out why a machine unexpectedly broke down or how a part slowly came out of tolerance.

Once the failure mode has been defined and the potential effects of failure have been determined, the team must assess the severity, occurrence and detection of failures and give those aspects numeric ratings. Severity means how serious the failure will be. Give it a rating from one to ten, where ten is the most severe failure. Likewise, rate the occurrence of failure how frequently you see the failure. Detection indicates how easily that fault or failure can be detected. The detection scale is the reverse of the other 2 scales, with 1 being the easiest or most detected and 10 being the hardest or most difficult to detect. Obviously, for this rating system to work, it's vital that all team members understand what constitutes a failure. Each potential effect of failure is given a severity, occurrence and detection rating. Those numbers are multiplied to produce a Risk Priority Number (RPN).

V. CONCLUSION

Software can be developed to enhance the efficiency of the Failure model analysis (FMEA). For the present study only four parameters are considered for analyzing modes and defects of failure. But software is used for the analysis more parameters can be used in the analysis. There by level of risk of failure can be reduced and more saving in the cost of maintenance can be achieved

- a) On an average it is found that utility of Heather Constructions was 13.76 percent more than Prime Builders.
- b) On an average it is found that total expenditure on maintenance of Heather is 33.14 percent more than that Of Prime.
- c) From the analysis it is found that Heather Construction is in a better position as compared to Prime Builders in optimizing equipment utility, usage and total maintenance cost.

VI. RECOMMENDATIONS

- a) Proper manpower planning and maintenance scheduling synchronized with optimum utilization should be aimed at for improving interdepartmental conflicts.
- b) FEMA can effectively use to find out in advance the failure modes and hence precautionary measures can be taken.
- c) In a tower crane risk priority number is more for improper inspection and improperly trained operator.
- d) In a motor grader risk priority number is more for improperly trained operators, which indicates that the operator must be trained properly.
- e) In a concrete-mixer risk priority number is more for adjustments and repairs not done by a competent designated person. Thus failures vary for each equipment due to RPN value. Thus RPN plays a vital role for each equipment failures.

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