Assessment of Equipment Management In Four Lane Highway: A Case Study of Latur

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Abstract- *Construction equipment is one of the major resources in the construction process for construction companies through the mechanized construction of road projects. Construction equipment planning and management practice lack the necessary policy to meet the standard. As result, many road projects in India experienced time overrun, cost overrun and low quality. Construction equipment is a major resource in the building process for a construction project. When equipment is owned by a contractor, it forms a sizable portion of his assets requiring proper management practices. Selection of construction Equipment plays very crucial role in effective completion of any civil project. Thus selection and planning of equipment is essential for the utilization with minimum cost*

Keywords- Equipment Planning, Equipment Management, Cost Overrun, Utilization

I. INTRODUCTION

Currently in India, the construction sector plays an important role in short term trends, with more frequent development, not only for the sector itself but also for other economic activities as well. As a result, it is firmly believed that the construction industry needs an effective resource management practice to retain profitability and continue its dynamic contribution to the growth of the country. Before starting any project then, the planning should be done with great care, as the efficiency of the whole project largely depends upon its planning. Planning of a construction project involves deciding about the extent of mechanization, equipment planning, equipment management, and execution planning etc.

The cost of equipment in a project varies from 10% to 30% of the total cost of the project, depending upon the extent of mechanization. In modern fully mechanized projects the cost of equipment goes up to 30%. Proper planning, selection, procurement, installation, operation, maintenance and equipment replacement policy plays an important role in equipment management for the successful completion of the project. With the growing use of machinery it has become necessary for construction engineers to be thoroughly familiar with the construction application and upkeep of the wide range of the modern equipment.

Thus, equipment management integrates and continuously interacts with human, technical, financial and production system in order to achieve top efficiency and cost effectiveness. Like the other major resources, committed equipment are expected to be fully utilized to complete the project in due time. Hence, proper planning and management of equipment is crucial for the success of a firm, especially for the road project construction sector where profit margin is very low.

II. PROBLEMSTATEMENT

Construction is the mobilization and utilization of capital and specialized personnel, materials, and equipment and to assemble materials and equipment on a specific site in.

Accordance with drawings, specifications, and contract documents prepared to serve the purposes of a client. Road construction involves a combination of specialized organizations, engineering science, studied guesses, and calculated risks. Since operations must be performed at the site of the project, often affected by planning and management problems, every project is unique. Furthermore, because of exposure to the outdoors, construction is affected by both daily and seasonal weather variations. It is also often influenced significantly by the poor planning, management and utilization of construction equipment. These factors should be addressed and managed in a competent and professional manner to benefit from the industry.

III. OBJECTIVES

- To study the equipment used for four lane highway project,
- To identify the main causes of equipment planning and management problem,
- To determine the effect due to poor equipment planning and management.

IV. MAJOR CONSTRUCTION EQUIPMENT USED IN ROADCONSTRUCTION

PROJECTS

A. Pneumatic tools:

1. Air Compressor
2. Rock Drill/ Jack Hammer/ Steel Drill/ Wood Drill
3. Concrete Breaker
4. Asphalt Cutter
5. Rock Splitter
6. Compactor
7. Impact Wrenches/ Nail Driver
8. Grinder
9. Concrete Vibrator
10. Backfill Tamper
11. Circular Saw/ ChainSaw
12. Road Broom

B. Rock crushers, asphalt And Concrete equipment:

a) Rock crushers:

1. Jaw crushers, double roll crusher, cone crusher, hammer mill
2. Screens
3. Conveyors

b) Asphalt plant:

1. Central mix plant (batch plant/ continuous mixplant)
2. Hot oil heater
3. Asphalt melter
4. Bitumen distributor (trailer mounted/ self- propelled)
5. Asphalt kettle/ bitumen heater
6. Portable mix plant
7. Pavers
8. Rotary sweeper
9. Aggregate spreader

c) Concrete plant:

1. Aggregate batching plant
2. Concrete mixers
3. Concrete pavers
4. Concrete vibrator
5. Concrete saw
6. Portable concrete curing machine

C. Earth moving and compaction equipment:

a) Earth moving:

1. Dozers (track/wheel)
2. Loader / shovel (track /wheel)
3. Excavator/ backhoe (track/wheel)
4. Scrapers
5. Grader
6. Hauler (off-highway haulers, tipper truck, mini dumper)

b) Compaction equipment:

1. Sheep foot roller, tamping roller
2. Steel wheel vibratory roller
3. Steel wheel static roller
4. Pneumatic roller

V. THE MAIN CAUSES OFEQUIPMENT PLANNING ANDMANAGEMENT

PROBLEMS

- Constraints imposed by job and contractual obligation
- Huge capital investment in the acquisition phase
- Poor training of equipment operators
- Poor equipment maintenance practices
- Improper determination of economic life and timing fore placement.

VI. OVERALL EQUIPMENT EFFECTIVENESS(OEE)

By definition, OEE is a measure of value added to the production by a certain machine in a production time. The demand for increasing productivity in the current competitive construction industry led to a need for performance measurement system for the production process. One of such a performance measurement tool which measures different production losses and which indicate area of process improvement is an Overall Equipment Effectiveness (OEE) index. It is a tool designed to distinguish factors contributing for productivity losses. Knowing the three fundamental performance rate Availability Rate (AR), the Performance Rate (PR) and the Quality Rate (QR) will help to compute overall equipment effectiveness index. These rates indicate the degree to which the required output is achieved.

1) Availability Rate as a function to determine OEE:

$$\text{Activity rate} = \frac{\text{Available time} - \text{Planned down time}}{\text{Loading time}} * 100$$

2) Performance rates as a function to determine OEE:

Performing rate = Net operating rate * operating speed coefficient * 100

3) Quality rate as a function to determine OEE:

$$\text{Quality Rate} = \frac{\text{Total executed amount (unit)} - \text{Reworked amount (unit)}}{\text{Total executed amount}} * 100$$

VII. DATA ANALYSIS

The result analysis and the results in this case provide the rank of factors affecting the performance of the construction equipment and the extent of equipment productivity. Table 1 shows the computation of grader productivity rate.

Table 1 Calculation of Three Primary Productivity rate of Grader

Data Collection Template				
Machinery Type: Grader				
Average of Twenty Six Days with 10 Working hour per day				
Productivity Rate(Dependent variables)	**Symbol**	**Independent variables**	**Values**	**Unit**
AR= (E/C) 0.93	A	Available time (___hrs. * 60')	600	min
	B	Scheduled maintenance + scheduled production break	60	min
	C	Loading time = A – B	540	min
	D1	Recorded break down time	10	min
	D2	Time spent for change in operation condition	30	min
	D	Major stoppage losses = (D1 + D2)	40	min
	E	Operating time = C – D	500	min
	G	Ideal production (from manufacturer specification)	200	m3/hr
	H	Actual production	140	m3/hr
PR =P*R 0.70	O	Actual cycle time	38	sec
	I	Production capacity losses downtime = [1-H/G] x L	96.00	min
	K1	Idle time	180	min
QR(%) = (S-T)/S 0.95	K	Minor stoppage/Idle losses = (K1)	180	min
	L	Net Operating Time = [E-K]	320	min
	M	Performing Time = [L-I]	224.00	min
	N	Valuable operating time = [M-J]	189.00	min
	P	Net operating rate = [H*O)/E	1.77	.....
	Q	Ideal/theoretical/design cycle time	15	sec
	R	Operating speed coefficient = [Q/O]	0.39	.....
	J	Time spent for rework and start up yield losses	35	min
	S	Total executed amount(Unit)	1400	m3
	T	Reworked amount (unit)	70	m3
Overall Equipment Effectiveness (OEE) : AR*PR*QR =			0.62	

Table 2 shows the computation of grader productivity rate

Enter # of Hours	10
Availability Rate %	93%
Performance Rate %	70%
Quality Rate %	95%
OEE Rate %	62%

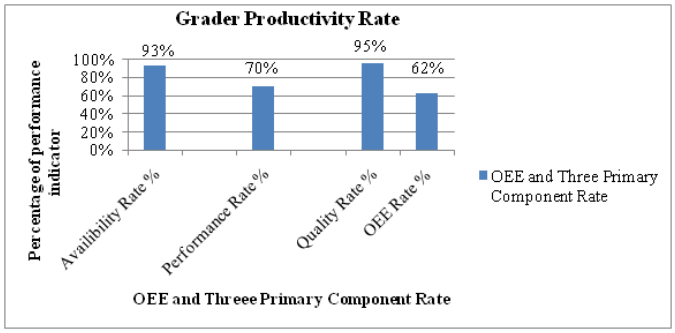

Figure 1. Distribution of primary components and OEE index of Grader

VIII. RESULTS

As indicated in Table 2 and Figure 1, performance rate ranked first on impacting the productivity of equipment, Availability rate ranked second; and Quality rate has lesser effect on productivity of equipment. Table 2 shows that the extent of overall productivity of Grader is poor with OEE of 62%. This is due to improper work management during the utilization of the machine. As noted, insufficient maintenance, shortage of materials, more cycle time were the main contributing factor for loss in productivity. Moreover, the result of the analysis showed that, the performance rate of the machine on road project was most important that needs more attention by the management. In addition, it is the one significantly affecting the overall performance of all the machines.

IX. CONCLUSION

1. Equipment plays an important role in today's infrastructure projects as they are more demanding and highway projects are need to be completed in stipulated time with best quality.
2. Equipment utilization on site is required study in details.
3. As indicated in Table 2 overall productivity of excavator is very poor with OEE of 62%. This is due to improper work management during the utilization of the machine therefore needs more attention by the management.

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