

Impact of Construction Equipment on Building Site

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Abstract— The equipment management system and equipment policy have a great impact on the profitability of the contractors with large investment in equipment's. In civil engineering construction projects, the cost of equipment can vary from 25-40% of the total project cost. The objective of this project is that how the planned and proper maintenance is important for construction equipment for better production. The data given is monthly equipment utilization on site & various reason for losses in construction equipment production. It is necessary to evaluate whether a project can be completed in a given time even if additional construction equipment is brought to the construction site. The purpose of this study is to evaluate that how much there will be effect of equipment on building site productivity.

Keywords: Construction Equipment, Building Site, Equipment Maintenance

I. INTRODUCTION

A. General

The cost of construction is a major factor in all projects whether the construction projects is to be linear (i.e., concept, design, procurement, construction) or fast-track (i.e., design/build); whether a construction contract is unit price, lump sum, or cost-plus. The labour, materials, overhead, equipment and profit are major factors that impact construction costs. The front end of the project has the greatest influence to construction cost. During the conceptual and design phases of a project an assumptions made by design engineers to dictate the choice of equipment and the choice of materials that will be used for the particular project. Sometimes, the best and most cost-effective solution may restrict from being utilized by design. It is important for design engineers and construction engineers to be knowledgeable about construction equipment. Integral parts of the construction process are construction equipment. The cost of the construction is the function of the design of the construction operation.

The purpose of this study is to find out how construction equipment affects the efficiency of construction operation and to evaluate the traffic flow. However, till date, limited work has been published related to these especially in planning for equipment utilization many construction firms seek to gain competitive advantages by increasing controlling and service losses by reducing raw material and labour costs. By effective maintenance, companies have found effective way to increase profit margins. Most construction firms are tends to concentrate on maintenance efforts of unscheduled breakdowns and emergency repairs. This eventually tends to concentrate on maintenance department overtime, the production losses and in expediting parts of repairs. Thus, the equipments are largest assets of construction companies.

II. PROPOSED METHODOLOGY

The main part of the project is to find out that how much there will be effect of skill shortages on a building construction project. For that project site, the Garden city Township is selected. Then data collection regarding actual utilization of effect of shortages is done. Next step of this project is data which is allocated will be analysis and total loss in building construction in terms of loss due to unskilled labor and delay of supply will be find out .To reduce this loss, last stage of this project is done by providing different education, training and planning. Figure 1 shows the flow chart indicating the work.

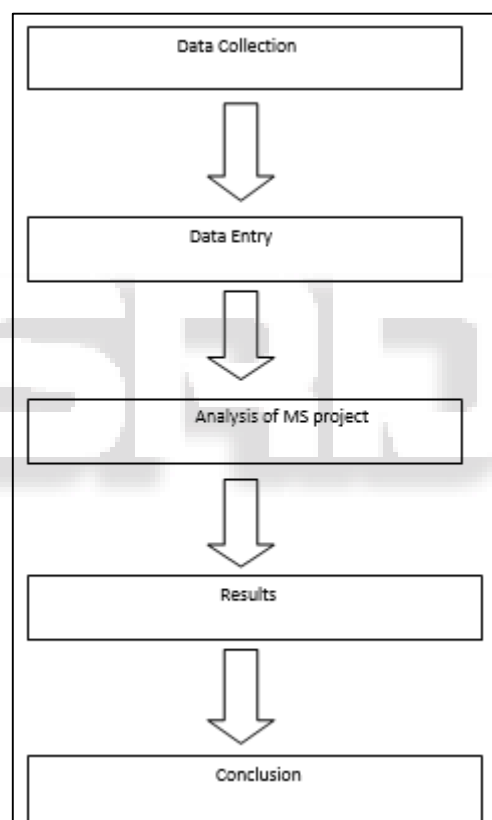


Fig. 1: Research Methodology Chart

III. LITERATURE REVIEW

Michael C. Vorster, (International journal of management and economics invention Volume 2, Nov-2010), has presented a model that has the capability to quantify the consequential costs of downtime and lack of availability. An understanding of the philosophy, as well as the methodology used for quantification, should make it possible to model most situation, given a little thought and creativity in applying the model.

Craig A. Clutts, (Journal of the Malaysian Institute of Planners, Issue v 2016) has defines about how construction equipment maintenance is profitable for construction industry. This project recommends a decision support model

that can be used by private and public entities alike to determine the best fit acquisition method between rent-lease-buy and guidance for profitability optimization. Methods of life cycle cost estimating and decision method were researched and compared.

Tom Iseley Blackhawk.(2014) has stated that equipment spread selected for a specific construction operation is critical to success the project. While there will be some overlap in equipment utilization each activity must be evaluated carefully to ensure that the equipment selected for each operation is compatible with task to be completed. The intent is not to provide a detailed description of each activity but to illustrate how equipment selection & utilization are function of the associated variables.

Cynthia S. Collyard (2012) has described as the contractor's equipment policy and equipment management system have a great impact on the profitability of the firms, especially for contractors with large investment in equipment. Database management system (DBMS) provide numerous command and function to design and create database files; update, sorts, and organize those files; and retrieve those files. Development, acceptance, and continued use of such system should contribute to the efficiency and profitability of contractors.

Faizul Azli Mohd-Rahim¹, Nurul Safwah Mohd , (Journal of the Malaysian Institute of Planners , Issue v 2016), "The challenge of labour shortage for Sustainable construction." The construction industry is one of the sectors that play a significant role in the socio-economic growth of a country. Apart from being a major contributor to the overall GDP of a country, it is also responsible for providing the necessary infrastructure to improve the quality of life of a nation.

K.Ponnaian¹, Dr. T. Iyappan, (International journal of management and economics invention Volume 2, Nov-2016), "Problems of Building Construction Workers in Kanyakumari." The problems of construction workers differ from place to place and work to work depending on the noise, chemicals, tools or equipments, availability of safety measures, height and environment.

Govindan Kannan, (International journal of management and economics invention Volume 2, Nov-2017), has relates some of the recent academic research to industry practices. The purpose of this paper is twofold: (a) to evaluate the performance of the tools from the body of knowledge, and (b) to record observations and knowledge with a hope that they can serve as seeds for new research. Almost all of the concept and tools developed around this research were found to be well accepted in the construction industry

IV. CASE STUDY

A case study is nothing but a process of research into development of project over a period of time to fulfill the objective of this research, a site has to be selected. For the same, The Garden City Township, mogara Building Amravati is the ideal one. Table 1 shows the detail site information which is taken as case study of the project .It is a residential project site which is located at Akola Nagpur bypass, near maharshi school Amravati.

Project Name	Mogara Building, Garden City Township
Address	Akola Nagpur Bypass, near maharshi school, Amravati
Building Type	Residential
Name of Client	Nilesh Thakare
Name of Contractor	Raju Thakare
Site Engineer	Aditya Lohiya
Construction Started	June-2014
Date of Completion	Aug-2016
Total cost of Project in Rs.	60 crore
No of floor	G+7 2 BHK
Area of project	4 acres

Table 1: Site Information (Source: Mogara Building, Garden City)

A. Equipment List

Construction equipment used on the site are shown in table 2. It contain type of equipments, number of equipment used on site and manufactures of equipment.

No	Equipment name	Company	No
1	Air compressor	ELGI	5
2	Auto level	EIE	7
3	Bar bending machine	Global	12
4	Bar cutting machine	Hitachi	15
5	Batching plant 30cum/hr	Aquarius	1
6	Breaker machine	EIE	10
7	Concrete pump	Potain	3
8	Cube testing machine	ITCO	1
9	Crane	Tata	4
10	Drill machine	Saluja	20
11	Dumper	Cosmos	2
12	Earth compactor	Kirloskar	2
13	Electrical vibrator	Hitachi	20
14	Generator	L&T	1
15	Grinder machine	Hitachi	19
16	JCB	L&T	2
17	Lift	Universal	2
18	Mini roller	L&T	2
19	Needle	Saluja	30
20	Plywood cutter	Global	4
21	Passenger lift	Universal	2
22	Slump cone test	Accro- tech	1
23	Transit mixer	ACC	8
24	Total station	ELE	1
25	Welding machine	WrapEngg.	1
26	Weigh batcher	ACC	1

Table 2: Equipment used on site

From above equipments, we are considering only excavation & concreting activity. In that, only three equipment JCB, concrete pump & transit mixer are considered because thus machinery majorly used for excavation & concreting work. Balance equipments are not taken in consideration for data collection and data analysis, because percentage (%) losses incurred by them are much less as compare with the major machinery.

There are so many reasons for delay in construction work, but the main focus on delays due to breakdown of equipment and losses occurred in time and cost due to it.

B. Data Analysis

Data analysis focused on delay in time and loss in cost due to breakdown. On an average in a single day, 8 hours considered as a working hours.

Equipment	Required labor	Payment of labor per month	Payment of labor per day	Payment of labor per hr	Idle due to breakdown & failures in hr	Loss in rs due to breakdown	Maintenance required	Total loss in rs
JCB 235	Driver	13000	430	54	127	6858	21090	31885
	Helper	7500	250	31		3937		
JCB 9859	Driver	13000	430	54	174	9396	21952	36742
	helper	7500	250	31		5394		
Concrete pump 09	Operator	12000	400	50	128	6400	16314	31418
	Labor	8000	270	34		4352		
	Helper	8000	270	34		4352		
Transit mixer7463	Driver	9000	300	38	159	6042	27340	33382
Transit mixer 7466	Driver	9000	300	38	156	5928	21360	27288
Transit mixer 7467	Driver	9000	300	38	176	6688	190880	197568

Table 3: Overall losses due to breakdown and maintenance

C. Delays Due to Breakdown

Table 4 shows summarized data for total expenditure, delays in hours and delays in days, for each equipment for periods of six months.

In this total expenditure shows loss occurred by each equipment due to breakdown and maintenance. By considering, 8 hours of work per day, total delays in hours can be converted into delays in day. This gives idea about delays of project in this six month.

No	Equipment	Delays in days	Delays in hours	Total expenditure in Rs.
1	Concrete pump 09	16	128	31418
2	JCB 235	15-16	127	31885
3	JCB 9859	21-22	174	36742
4	Transit mixer 7463	19-20	159	33382
5	Transit mixer 7466	19-20	156	27288
6	Transit mixer 7467	22	176	197568

Table 4: shows summarized data for total expenditure, delays in hours and delays in days, for each equipment for periods of six months.

On the mogara building garden city, there was no proper maintenance schedule followed. Only reactive maintenance was applied on equipments. Instead of this, if they would follow preventive maintenance for equipments, there was np wastage of money and time as well as project will be completed much earlier with less cost.

In table 3 shows that total loss of equipment for six months. The total loss is the addition of loss due to breakdown & loss due to maintenance.

D. Analytical Summary

From the analytical Table 5 resent individual reasons for failure of equipments due to breakdown result in substantial over repairs. They can be analyses as follows.

1) Loss in production

Due to different reason of failure of equipment loss incurred in production

- 1) Concrete pump 09 – 4533 cum over 6 month.
- 2) JCB (235, 9859) – 3111 cum over 6 month.
- 3) Transit mixer (4766 ,4767, 277) – 1764 cum over 6 month.

2) Reason wise analysis

In the 62 times events of failure occur for total 13 equipments over a period of 6 months.(Oct – March)

Sr. No	Reason	% of failure	Out of 100%
1	Equipment life was over	35%	17%
2	Spare parts are not available on site	31%	15%
3	Not providing daily/ weekly maintenance to equipment	58%	28%
4	No proper maintenance schedule was prepared for equipment maintenance	37%	18%
5	Servicing workshop is far away from site	13%	7%
6	Only reactive maintenance was done they didn't go for any preventive maintenance for any equipments	32%	15%
7	Total	206	100%

Table 5: Reason for percentage of failures for considered equipment (source: Mogara building garden city near maharshi school navsari, Amravati)

1) As per table 5 first reason equipment life was over. This reason was applicable 22 times event in out of 62 events.

In case of this reason, its occurrence in compared to total failure of equipment over a period of 6 month will come to,

$$(22/62) \times 100 = 35\%$$

Total of percentage wise failure for all reason comes to 206.

Hence against the above total of percentage over the various reasons indicated in Table 5.10 occurrence of reasons, equipment life was over comes to,

$$(35/206) \times 100 = 17\%$$

2) As per table 5, second reason spare part are not available on site. This reason was applicable 19 times event in out of 62 events.

In case of this reason, its occurrence in compared to total failure of equipment over a period of 6 month will come to,

$$(19/62) \times 100 = 31\%$$

Total of percentage wise failure for all reason comes to 206.

Hence against the above total of percentage over the various reasons indicated in Table 5.10 occurrence of reasons, spare parts are not available on site comes to,

$$(31/206) \times 100 = 15\%$$

3) As per table 5, third reason not providing daily/ weekly maintenance to equipments. This reason was applicable 36 times event in out of 62 events.

In case of this reason, its occurrence in compared to total failure of equipment over a period of 6 month will come to,

$$(36/62) \times 100 = 58\%$$

Total of percentage wise failure for all reason comes to 206.

Hence against the above total of percentage over the various reasons indicated in Table 5.10 occurrence of reasons, not providing daily/ weekly maintenance to equipments comes to,

$$(58/206) \times 100 = 28\%$$

4) As per table 5, fourth reason no proper maintenance schedule was prepared for equipment maintenance. This reason was applicable 25 times event in out of 62 events.

In case of this reason, its occurrence in compared to total failure of equipment over a period of 6 month will come to,

$$(25/62) \times 100 = 37\%$$

Total of percentage wise failure for all reason comes to 206.

Hence against the above total of percentage over the various reasons indicated in Table 5.10 occurrence of reasons, no proper maintenance schedule prepared comes to,

$$(37/206) \times 100 = 18\%$$

5) As per table 5, fifth reason servicing workshop is far away from site. This reason was applicable 8 times event in out of 62 events.

In case of this reason, its occurrence in compared to total failure of equipment over a period of 6 month will come to,

$$(8/62) \times 100 = 13\%$$

Total of percentage wise failure for all reason comes to 206.

Hence against the above total of percentage over the various reasons indicated in Table 5 occurrence of reasons, servicing workshop is far away from site comes to,

$$(13/206) \times 100 = 7\%$$

6) As per table 5, sixth reason only reactive maintenance was done they didn't go for any preventive maintenance for any equipments. This reason was applicable 20 times event in out of 62 events.

In case of this reason, its occurrence in compared to total failure of equipment over a period of 6 month will come to,

$$(20/62) \times 100 = 32\%$$

Hence against the above total of percentage over the various reasons indicated in Table 5.10 occurrence of reasons, reactive maintenance done instead for preventive maintenance comes to,

$$(13/206) \times 100 = 7\%$$

Total of percentage wise failure for all reason comes to 206.

V. CONCLUSION

Equipment plays an important role in today's construction project 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 the 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. From data collected it is seen that labor technical skill their work and equipment ultimately affect the overall productivity in construction activity on the project. Due to a breakdown and rework more loss in time and cost is occurred. To minimize losses, proper maintenance and schedule should be used for each equipment and also introducing new technologies and construction technique to labor. Because of only reactive maintenance used on site, contractor faces losses in production, time and cost. Instead of that if he go for preventive maintenance then it will give better result for contractor. And also Ineffective vocational training programmers for skilled workers, contractor faces loss in cost and time. Therefore introducing formal training system and development system at organizational level then it will give better result for contractor. Other type of maintenance also required for some equipment. In which some equipment are old enough so that replacing old equipment with new one is the best option. Proactive and predictive maintenance are also helpful for minimizing failure of equipment.

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