Proceedings of 4th RIT Post Graduates Conference (RIT PG Con-18)
NOVATEUR PUBLICATIONS
JournalNX- A Multidisciplinary Peer Reviewed Journal (ISSN No:2581-4230)
April, 13th, 2018

FACTORS INFLUENCING PRODUCTIVITY OF CONSTRUCTION EQUIPMENT ON SITE

Mr. Deokar Kishor H.
PG Student, Civil- Construction management
Rajarambapu Institute of Technology,
Rajaramnagar, Islampur, India.
kishordeokarcivil@gmail.com

Dr. Mrs. Kulkarni Sushma S.
Director,
Rajarambapu Institute of Technology.
Rajaramnagar, Islampur, India.
sushma.kulkarni@ritindia.edu

Abstract – Construction equipment productivity is one of the main drivers for completing projects within stipulated time and cost. To improve productivity we must be able to do changes in methods, operation strategies and systems. There is an even greater need to properly plan equipment operations. An equipment is only economical if used in the proper manner and in the environment for which it has the mechanical capabilities to engage. This study is done to find the factors affecting the output of the equipment. The paper here presents the identification of various factors affecting the productivity of construction equipment by observing various excavation sites.

Keywords- **Construction equipment; productivity; Factors affect.**

I. INTRODUCTION

Construction project's cost is directly being affecting by the speed of construction. Modern tools and equipments are widely used for speedy construction. Though the construction equipments are helping in fast construction; there are lot of factors affecting the production of construction equipment.

There are lot of bad practices happening on the site through which mal practices and faulty reports are generated, which shows higher productivity on paper but not on actual sites. There is need of innovating new techniques and methods to improve productivity and search for the reasons of low productivity of construction equipments.

II. RESEARCH DESIGN

Excavator is one of the most important heavy equipment used during construction for digging and loading heavy materials. Here we are focusing on operation activities of hydraulic excavator. In this research some factor will be observed which help us to enhance productivity of construction equipment which play very important role in operation. Construction management on project can be classified in to two levels activity level and operation level [1]. There is an even greater need to properly plan equipment activities and operations.

In the data collection first of all collect data by traditional method which is regularly apply in construction site after that develop new strategy which gives equipment's actual productivity and find the operation strategy or new methods to avoid bad practices which affect the equipment's production. In this research must require data collection about operation method, accessories use, lubricants use, various Attachments and also collect data after applying new method to know about how to increase the productivity. The measured values of productivity will be compared with traditional methods to get results from changes by applying on site.

III. CONSTRUCTION EQUIPMENT

The activities connected with construction projects where the magnitude of the work is on a large scale, speedy work and timely completion of work with quality control are very vital in order to achieve work has to be done, where construction machinery and equipment play a leading role. Following equipments are mostly used in construction activities [2].

A. Earthmoving equipment
B. Road construction equipment
C. Material handling equipment
D. Tunnelling and drilling equipment
E. Concrete Equipment

A. Earthmoving equipment

Earthmoving equipment is mostly used in construction sector in India. These equipment mainly use in mining and digging activity.

As per survey done by "India Brand Equity Foundation" in terms of equipment market size; earthmoving equipments constitute biggest segment, accounting for nearly 57 % of the overall equipment market.

B. Road construction eqipment-

Road construction equipment used in various stages of road building activity. Road construction equipment nearly 7% of the overall equipment market used in construction activity.

C. Material handling equipment- 13 %

In this type of equipment have four categories; storage and handling equipment, engineered system, industrial truck and bulk material handling. Material handling equipment nearly
13% of the overall equipment market used in construction activity.

D. Tunnelling and drilling equipment- 12 %

E. Concrete equipment- 6 %

This type of equipment is used for mixing and transportation of concrete.

IV. OBJECTIVES

1) To analyze the current operation practices related with construction equipment excavator.

2) To identify factors affecting on Productivity of construction equipment on field.

V. METHODOLOGY

Define Problem
↓
Literature Survey
↓
Equipment Selection
↓
Performance Analysis
↓
Result
↓
Conclusion

VI. RESEARCH SURVEY

A. Excavator Usage Survey

Excavators are extensively used in many roles such as digging of trenches and foundation, demolition, landscaping, heavy lifting, and mining. Excavator come in a ranges of capacities and are usually classified on the basis of tonnage. The lower end excavator; referred to as mini excavator find greater usage in urban development. The heavier duty excavator are used in mining and heavy construction. Following research survey is done to find out widely used excavator in urban area. Due to large market size and mostly used in construction industry, earthmoving equipments are selected in this study [2].

B. Productivity of Excavator

Output of the any equipment per minute, hour or day is called productivity of the equipment. There are four essential element required in the production cycle of excavator. Cycle time under Average condition, for 3 to 5 cy bucket size exactor, are [3]

1. Bucket Loading 7-9 sec
2. Swing with load 4-6 sec
3. Bucket unloading 2-4 sec
4. Return swing 4-5 sec

Ideal production of excavator in lcy/min [3]

$$= \frac{\text{Bucket capacity X Fill Factor X Swing factor X 60 Sec/ Min}}{\text{Cycle time (sec)}}$$

C. Equipment Selection For Analysis

a. Easily Available

There are various type of excavator are available but from survey observed that mostly used excavator is 3DX, PC200, Ex 350 respectively.

b. Output from Excavator

This survey is essential for getting idea about which equipment gives maximum benefit. This information collected from ten different excavator owner.

TABLE NO 02- EQUIPMENT'S OUTPUT SURVEY

Sr no.	Name	3DX	PC 200	Ex 350
1.	Umesh Babaso Lad			✓
2.	Shriram Dinkar Mane	✓		
3.	Hemant Shaklekar		✓	
4.	Annaso Chandankar		✓	
5.	Haridas Deokar			✓
6.	Ramchandra Deokar			✓
7.	Gore D. B.			✓
8.	Aatmaram Deokar	✓		
9.	Hemant Patil		✓	
10.	Pawar A. C			✓

From above result analysis it is observed that most economical equipment is Ex 350 and Pc 200 respectively.

D. Output From Equipment

The data was collected from questionnaire survey. This survey was carried out from seven equipment owners. The final result we got are as follows.

TABLE NO 03- OUTPUT FROM EQUIPMENT

Equipment	3DX	PC200	Ex 350
Daily Usage (Hr)	8Hr	8Hr	5Hr
Rent per hour (Rs)	800	1800	3500
Daily output (Rs)	6400	14400	17500
Daily profit (Rs)	3400	7500	11000

E. Factors affecting the productivity

Following factors are observed from literature about the factors influencing the production of construction equipments on site [3].

1. Class of material
2. Height of cut
3. Angle of swing
4. Operator skill
5. Condition of equipment
6. Haul unit exchange

7. Bucket size
8. Handling of oversize material
9. Clean up of loading area

There are few more factors observed from the questionnaire survey which is selected from the user's manual. From equipment owner highly rated three options are as follows;

a. Equipment's efficiency-

Equipment efficiency change with respect to life of equipment which affect production of equipment.

b. Lack of best quality lubricants-

Low quality lubricant affect the movement of machine which indirectly affect the production of equipment.

c. Less contact between supervisor and operator-

Less contact between operator and supervisor may not get proper use of equipment. Improper guidance results less production.

Sr no	Name	Equipment's efficiency	Lack of best quality lubricants	less contact
1.	Umesh Babaso Lad	✓		
2.	Shriram Dinkar Mane	✓		
3.	Hemant Shaklekar		✓	
4.	Annaso Chandankar	✓		
5.	Haridas Deokar	✓		
6.	Ramchandra Deokar			✓
7.	Gore D. B.		✓	
8.	Aatmaram Deokar		✓	
9.	Hemant Patil			✓
10	Pawar A. C	✓		

From above result analysis it is observed that the main factor affecting the output is the equipment's efficiency.

F. Current Bad Practices In Operation

There are many bad practices happen on construction site while utilizing the equipment. Following observations were identified after analyzing the survey result.

a. Operator training -

Without training or proper knowledge about equipment operation we cannot get maximum utilization of equipment.

b. Fuel Quality-

Quality of fuel affect the equipment's engine efficiency.

c. Equipment improper attachment usage-

Excavator equipment have various type of attachment to handle different type of activities. When attachment is not in proper size, shape, weight it decrease the production of equipment.

Sr no.	Name	Operator training	fuel quality	Proper use of attachment
1.	Umesh Babaso Lad			✓
2.	Shriram Dinkar Mane			
3.	Hemant Shaklekar	✓		
4.	Annaso Chandankar			✓
5.	Haridas Deokar			✓
6.	Ramchandra Deokar		✓	
7.	Gore D. B.			✓
8.	Aatmaram Deokar	✓		
9.	Hemant Patil		✓	
10.	Pawar A. C			✓

From above result analysis mostly observed bad practice is equipment's improper attachment usage.

G. Ways for improveing Equipment's efficiency

After the discussion with operator and several site visits following three major components were found out and surveyed to know which affect most to the productivity of excavator on site.

Sr no	Name	Diesel consumption	Actual usage method	In record
1.	Umesh Babaso Lad		✓	
2.	Shriram Dinkar Mane		✓	
3.	Hemant Shaklekar	✓		
4.	Annaso Chandankar	✓		
5.	Haridas Deokar		✓	
6.	Ramchandra Deokar			✓
7.	Gore D. B.		✓	
8.	Aatmaram Deokar			✓
9.	Hemant Patil	✓		
10	Pawar A. C		✓	

VII. CONCLUSION

As per survey done 3DX and Pc200 excavators is used on large scale. There are lot of problems in the equipment productivity and operation and maintenance cost due to many factors discussed above. The survey results show that the Equipment's efficiency and proper attachment affect the productivity of the equipment on high scale than any other factor taken for the survey. After implementation of new policies construction equipment's productivity may get affected.

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