

## International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Vol. 5, Issue 2, February 2016

# A Critical Study on Latest Heavy Equipment and Latest Technologies Used In Road Works and Recommending the Types of Equipment and Its Effectiveness for Indian Roads Equipment Recommendation for Indian Roads - A Critical Study

Mithilesh V.V.S, Nagavinothini R

Department of Civil Engineering, SRM University, Chennai, India

**ABSTRACT:** The Indian construction industry, don't have a proper management practice for construction equipments. It's important to have a proper management for maintenance, work schedule, fuel consumption, and idle time. It is essential to know about the utilization of machine properly and match their capacities to specific project requirements. In the Indian construction industry, the time and cost of project is most important constraint for the success of project.

**KEYWORDS:** *construction equipments; maintenance; fuel consumption; capacities*

### I. INTRODUCTION

For the highway construction projects have the attributes of construction equipment in addition to the common characteristics of general commodities, control of cost and management present complexity and different levels to project governors. The construction equipment's will act as backbone for huge construction projects. Proper use of appropriate equipment's will contribute economy, quality,

safety, speed and timely completion of project. Equipment's used in road works are from small to heavy construction equipment's. Almost 15- 30% of total project cost has been accounted towards equipment and machinery. The use of equipment & methods has made possible changes in construction technology in recent decades.

Highway construction projects are the yardstick to measure the development of country. Now the highway construction projects are changing their face. Proper planning, selection, procurement, installation, operation, maintenance and equipment replacement policy plays an important role in equipment management for successful completion of 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 modern equipment. Before starting any project its planning is done with great care, as the efficiency of the whole project largely depends upon its planning. While planning each and every detail should be worked out in anticipation and should be considered carefully. Planning of a construction project involves deciding about the extent of mechanization, equipment planning, and execution planning etc. while planning a highway project equipment manager should be carefully decided the extent of mechanization so as to minimize the cost of project.

The objectives of this study are manifold and they are as follows:

- To identify the latest heavy equipment used in road works.
- To evaluate the equipment and suggest the possible.
- The factors effecting the selection of heavy equipment in the road works.

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Vol. 5, Issue 2, February 2016

- Fuel consumption and productivity.
- An effective maintenance of heavy equipment.
- Safety about the operators during the operations.

## II. SITE DETAILS

The site chosen to carried out for this study is the East Coast Road from Akkarai to Puducherry State border has been improved and strengthened in the Year 2001 to a two lane carriage way with paved/hard shoulders and is being maintained by TNRDC as a Toll Road.

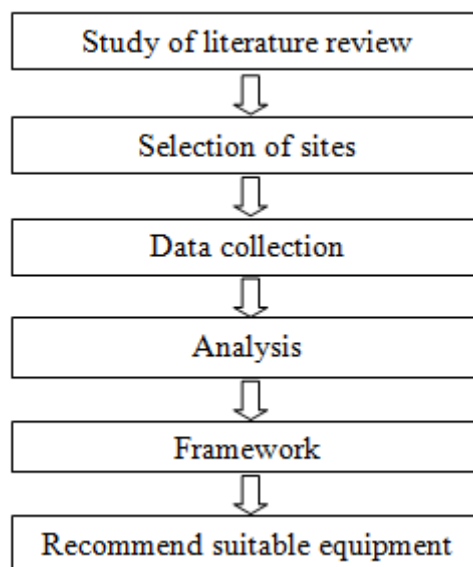
The another site chosen to carried out for this study is Tambaran-Tindivanam expressway road which has in addition to being an engineering feat of sorts, the project includes two major ridges, three railway over-bridges, two toll plazas, four flyovers and one trumpet interchange.

The another site chosen to carried out for the study is Chennai Outer Ring Road phase-II project which is a 62.3km project being built in two phases around the Chennai Metropolitan Area (CMA) in Tamil Nadu, India. The project will connect the GST Road from Vandalur to the Tiruvottiyur Ponneri Pancheti (TPP) Road in Minjur. The key objective of the project is to allow heavy vehicles to travel outside of the city, which will minimize traffic congestion within the central city areas.

## III. METHODOLOGY

The methodology adopted for this study is as follows. A detailed survey is carried out to analyze the equipment and the literatures can be seen in the references of the current paper.

Flow chart



In case of study area when we make a detail study on the latest equipments, its manufacturing companies and model of different equipments along with the different manufacturing companies. So we should have the correct and precise data of the study area on which the study is going to be done. So a detailed study and data's are being collected practically to understand the usage of equipments in different roads according to the particular location from which we

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Vol. 5, Issue 2, February 2016

can find out the ways or method through which the results can be obtained. However, after the collection of data we mainly focus on the main factors of particular equipments in different projects.

## IV. DATA COLLECTION AND ANALYSIS

A well designed questionnaire including 51 factors influencing the performance of individual equipment in road construction industry has prepared using the previous studies and they were distributed among the engineers of different road projects in Chennai. Twelve engineers have responded and returned the questionnaire along with comments. The participants were requested to fill the space with allocated scores 1-10. ( 1,2- very poor influence ; 3,4- poor influence; 5,6- average influence; 7,8- high influence; 9,10- very high influence ) to each factor influences according to their knowledge. Among those factors, ten factors obtained any average score of 3.00 and above are listed in Table.....

Average score of the varying responses are varying from 4.57 to 2.77. Factors are obtained average score of 3.00 and these are selected for the factor analysis initially. IDM SPSS (Statistical Package for Social Studies ) Software version 22 was used for factor analysis and initial run was conducted for 51 factors . Factor analysis result of this run indicated that the matrix is not positive definite. In order to make the matrix positive definite the number of factors selected should be less than the number of responses. Therefore 27 factors up to the average score of 4.07 were selected and the second factor analysis run was conducted and the result indicated that this run was satisfactory.

Table 1 Financial factors of the equipment

Description of factors	Number after ranking	Original no allocated
Oil	1	13
Fuel	2	12
Maintenance	3	10
Insurance	4	6
Inspection	5	19
External revenue	6	27
Labor	7	14
Break down	8	16
Selection of equipment	9	25

Table 2 Non financial factors of the equipment

Description of factors	Number after ranking	Original no allocated
Company goals	1	4
Planning, budgeting	2	5
Lag time during procurement	3	10
Prestige of company	4	2
Compatibility of staff for proper operation	5	19
Employee morale	6	22
Other investments	7	16

In the below the equipments are compared individually from different projects with their equipment rate, operator

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Vol. 5, Issue 2, February 2016

cost and the maintenance cost. In the below bar chart the rate of equipment, maintenance and the operator cost of JCB for different projects in shown below.

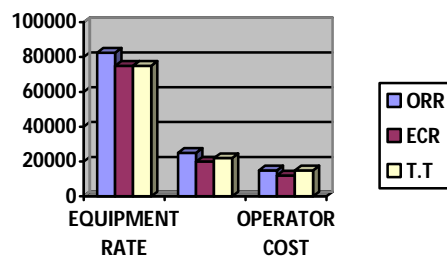


Fig 1 shows the details about JCB equipment in three different projects

In the below the equipments are compared individually from different projects with their equipment rate, operator cost and the maintenance cost. In the below bar chart the rate of equipment, maintenance and the operator cost of Lifting crane for different projects in shown below.

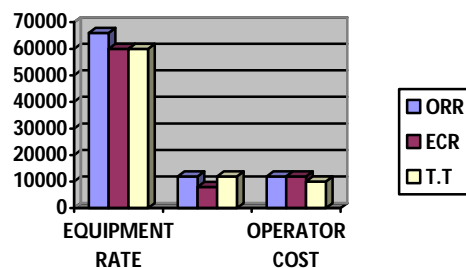


Fig 2 shows the details about lifting crane equipment in three different projects

In the below the equipments are compared individually from different projects with their equipment rate, operator cost and the maintenance cost. In the below bar chart the rate of equipment, maintenance and the operator cost of excavator for different projects in shown below.

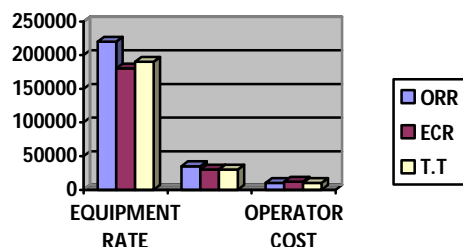


Fig 3 shows the details about excavator equipment in three different projects

## V. CONCLUSION

The study reveals the types of equipment used in construction industry has a great significant influence of construction industry. As the cost of the equipment plays a major role, the construction industry based on size of the

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

Vol. 5, Issue 2, February 2016

project i.e; small, medium, and large projects utilize the types of equipment based on its need.

[1] Equipment selection is a much more critical in heavy construction projects where the equipment fleet plays a vital role in performing the work. In this type of projects, the equipment fleet may represent the largest portion of the bidding price.

[2] Equipment selection is a critical factor when trying to complete a project within budget and on schedule. Without the proper working equipment, productivity decreases, delays increase, possible injuries occur, and unnecessary costs are incurred.

[3] Two factors that can be considered when selecting proper equipment: (i) type and condition of the site work; which includes the distance to be travelled; and (ii) desired productivity; which is a critical factor that affects equipment selection.

[4] Proper use of appropriate equipment contributes to the economy, quality, safety, speed and timely completion of the project.

[5] Cost and time that exceed the designated budget or schedule on projects have often resulted from poor equipment maintenance practice.

## ACKNOWLEDGMENT

The authors would like to acknowledge the engineers and the technical employees for helping us out to perform the entire study and gather data regarding the equipments.

## REFERENCES

- [1] Tavakoli, A., & Taye, E., Equipment policy of top 400 contractors: a survey. *Journal of Construction Engineering and Management* , 115 (2), (1989). 317-329.
- [2] Amirhanian, S., & Baker, N., Expert system for equipment selection for earthmoving operations. *Journal of Construction Engineering and Management* , 118 (2). (1992). 318-331.
- [3] O'Brien, J. J., Havers, J. A., and Stubbs, F. W. (1996). *Standard book of heavy construction*, 3rd Ed., McGraw-Hill, New York.
- [4] Schaufelberger, J. E., (1999). *Construction equipment management*, Prentice-Hall, Upper Saddle River, N.J.
- [5] Harris, F., and McCaffer, R., (2001). *Modern construction management*, 5th Ed., Blackwell Science, Oxford, U.K.
- [6] Peurifoy, R. L., Schexnayder, C. J., and Shapira, A., (2006). *Construction planning, equipment, and methods*, 7th Ed., McGraw-Hill, Boston.
- [7] Gransberg, D., Popescu, C., & Ryan, R., (2006). *Construction equipment management for engineers, estimators, and owners*. Boca Raton, FL: Taylor & Francis Group.
- [8] Tatum, C.B., Gren, G. H., Fett, H. (2006). *Construction Equipment and their Uses*, *Journal of Construction and Engineering Management*, pp.132-137.
- [9] Yeo, K.T., Ning, J.H., Managing uncertainty in major equipment procurement in engineering projects. *Eur. J. Oper. Res.* 17 (1), (2006). 123-134.
- [10] Avetisyan, H., Miller-Hooks, E., Melanta, S., Decision models to support greenhouse gas emissions reduction from transportation construction projects. *Construction Engineering and Management* 138 (5), (2012). 631-641.
- [11] Alkass, S.; Aronian, A. and Moselhi, O. (1993) Computer aided equipment selection for transporting and placing concrete. *ASCE Journal of Construction Engineering and Management*, 119(3), p. 445-465.
- [12] SAP (2003) *Engineering, Construction & Operations – Edition 2004*, <http://www.sap.com/businessmaps/> (as viewed on 5/3/2004).
- [13] Anderson, M. L. (1994) Predictive maintenance: its present state and future potential for the mobile equipment industries. In: *Proc of the Conference Equipment resource management into the 21st century, Nashville, Tennessee*, ASCE, New York. 210 p
- [14] Chitkara, K.K. (2009). *Construction Project Management. Planning, Scheduling and Controlling*. Seventh Edition, Tata McGraw-Hill, New Delhi, India.
- [15] Murdock, I.J. (2000). *Maintenance Engineering Handbook*, McGraw Hill, New York, pp 23-25
- [16] Sanvido V.E. (1988). "Conceptual Construction Process Model." *Journal of Construction Engineering and Management* 114: 294 - 310.
- [17] Kaming P.F., (1998). "Severity Diagnosis of Productivity Problems a Reliability Analysis." *International Journal of Project Management*.
- [18] Tavakoli, A., Productivity analysis of construction operations. *Journal of Construction Engineering and Management* , 111 (1), (1985). 31-39.
- [19] Alwood, R.J., (1989). *Techniques and Applications of Expert System in the Construction Industry*. Horwood, England.
- [20] Dolage D.A.R., (2010). "Analysis of user Problems in Construction Machinery Hiring, "Engineer" *Journal of The Institution of Engineers*, Sri Lanka.
- [21] Halligan D.W., (1994). "Action Response Model and Loss of Productivity in Construction. *Journal of Construction Engineering & Management*.
- [22] Wijekoon S.B, (2011), "Study on the Factors Influencing Performance of Road Construction Industry" *International Conference on Structural Engineering, Construction and Management*.