Study of Resource Levelling By Remodified Minimum Moment Method For High Rise Building

Prof. P.M.Attarde[1], Suyog G. Gend[2]
[1, 2] Dept of Civil Engineering
[1, 2] S.S.G.B. College of Engineering and Technology Bhusawal

Abstract- *This study includes the Re modified minimum moment method of resource levelling to construction projects. The method is based upon the critical path method & it was developed with the assumption of no activity splitting and fixed project duration with unlimited availability of resources. The criteria of selecting the activity that has to be shifted from its original position to a better position is judged by the change in the statically moment of the resource histogram before and after such movement as well as by Resource Improvement Coefficient. To achieve the objectives of the study, the data of residential construction projects is taken. Initially the activities are arranged according to their EST then as per the Re modified minimum moment method & as per their LFT. Bar chart & histogram is prepared for each solution. Maximum daily requirement of mason, EFR, SFR, moment of histogram & RIC are calculated for each solution from the respective histograms. These values are then compared for each solution. It has been observed that Maximum daily requirement of mason, SFR, moment of histogram & RIC are reduced & EFR is increased by Re modified minimum moment method.*

I. INTRODUCTION

Though importance of project planning is recognized in many project based industries, but construction companies depend on scheduling skills. As they are operating under continuously changing environmental conditions and being involved in complex and unique projects, which require multidisciplinary collaboration, they have to develop realistic schedules and update them regularly. Increasing competition within industry also forces construction companies to provide products of higher quality, in shorter durations, for lower costs & under safer working environments. Obviously, it is not possible to achieve these objectives simultaneously in the absence of an adequate schedule. Preparation of schedule for construction project required simultaneous consideration of several issues. Scheduling is not a simple matter of determining the sequence and timing of activities within a project, a planner has to cope with a number of constraints and considerations. Precedence relations, lag times, productivity rates, site availability, working calendars & climatic conditions are some of the many issues to be considered during the preparation of schedule. addition to these, resource requirements of activities, availability of resources and shape of the resource requirement curves also need to be considered to ensure economical resource utilization.

II. OBJECTIVES

1. To involve the study of minimum moment method & its modification for resource leveling.
2. To conduct the study about labour requirement by conventional & Minimum moment method
3. Comparison & Analysis of data of the above study. 4. Discussions & suggestions carried out about economical resource leveling for construction Industry.

III. PROBLEM STATEMENT

1. Optimizing resource leveling in order to maximize resource utilization efficiency while maintaining the original project duration.
2. Optimizing resource allocation and leveling in order to minimize the negative impacts of resource availability constraints on project time while maximizing resource utilization efficiency.
3. Optimizing resource fluctuation costs in order to provide the most cost effective and efficient resource utilization for construction projects.

IV. LITERATURE REVIEW

M. Easa "Resource leveling in Construction by Optimization" et.al. (2013) Construction industries needs a Resource leveling to avoid the difficulties associated with the large variations in resource usage. In this paper presents an in-teger-linear optimization model of resource leveling (single resource, continuous activities etc.) which guarantees the optimal leveling. The main objective function of this model minimize the deviation between resource requirements, or between the resource requirement and desirable non-uniform resource level. The model require input the critical path method scheduling result to which the constraints and objective of the model are established automatically by an interface program.

Edem O. P. Akpan "Resource smoothing: A cost minimization approach" et.al. (2000) the aim of the resource smoothing exercise is to achieve optimal resource usage by avoiding high peaks and deep valleys in the project resource profile or histogram. In this study the general approach has always been to move some activities with floats in the high peak regions to be started at a later date, and this is done, the valleys will be filled to smooth the resource profile subject of course to time constraint. If this approach is followed as it is, it would be difficult to determine optimality especially when many resources are involved.

Robert B. Harris, Fellow "Packing Method for Resource Leveling (Pack)" et.al (2013): the study of resources levelling has a new heuristic method is "packing method for resources levelling". This study mainly depends upon the critical path method. The minimum moment of the resource histogram is used to measure the level of resources. The heuristic assigns project activities to specific days so that the final resource histogram approaches a rectangle and its moment approaches a minimum value. In This study all activities are listed in a priority order and all possible assignment for each are determined. The incremental moments contributed by the activity resources rate and penalties that recognize network interaction are calculated. Each activity is positioned in the time span where the sum of these quantities is a minimum. The histogram is built step-by-step until all activities have been positioned within the constraints of a CPM or PERT network.

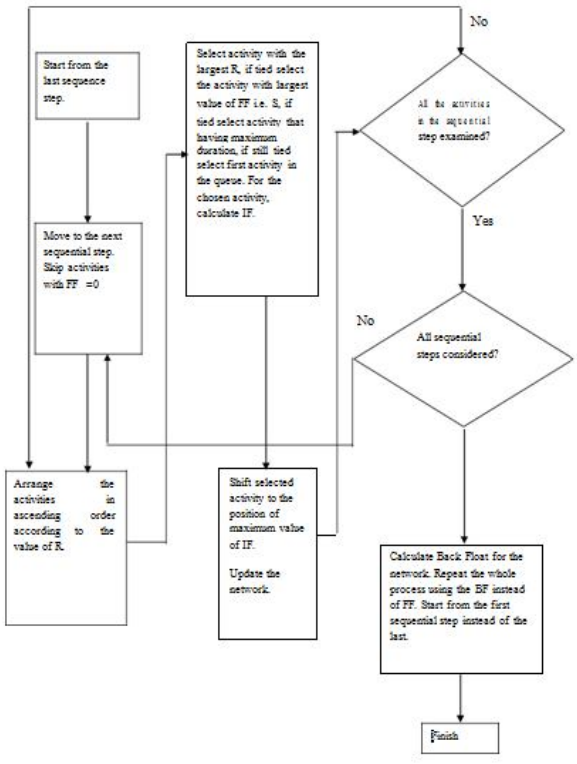
Jorge E. Gomer "Assignment & Allocation Optimization Partially Multi skilled Workforce" et.al.(2002) The multiskilling is a workforce strategy that has been shown to reduce indirect labor costs, improve productivity, and reduce turnover and increase the quality of work. A multi-skilled workforce is one in which the workers possess a range of skills that allow them to participate in more than one work process. The success of multiskilling greatly relies on the foreman's ability to assign workers to appropriate tasks and to compose crews effectively. The foreman assigns tasks to workers according to their knowledge, capabilities, and experience on former projects.

V. MODIFIED MINIMUM MOMENT METHOD

This method is suggested by Mohammad Hiyassat. This is the modification over traditional minimum moment approach in terms of the criteria of selecting the activity that has to be shifted from its original position to a better position. According to this method, the activities that lie at the same sequence step, the activity that is to be shifted first is selected based upon both the value of its free float(S) and the value of its resource rate (R). The criteria used for selecting an activity for possible shifting is the value in terms of multiplication of activity resource rate (R) and the free float(S) of that corresponding activity. In a sequence step of network, the values of (RxS) are calculated for all the activities and the activity having maximum value of (R x S) is considered for first possible shifting. At this stage the same improvement factor introduced by the traditional method is calculated. If the improvement factor for a given activity is either positive or zero, then only activity can be shifted; otherwise, activity cannot be shifted. To calculate the improvement factor (IF) the value of R is dropped and its value is constant for the same activity. Thus, the mathematical form of the Improvement factor is as follows, IF(activity J,S) = $\sum x - \sum w - mR$ The chosen activity is shifted to get maximum moment improvement within its limit of free float. The network and resource histogram is updated for selection of the next activity with the largest value of the term (R x S). The process continues up to first sequence step of the same network where forward cycle ends.

VI. PROPOSED METHOD

The methodology adopted to achieve the above objectives comprises of the following steps:-



Flowchart of Remodified Minimum Moment Method

VII. DISCUSSION & CONCLUSIONS

Various methods of Resource leveling are studied in literature review & based on this, Heuristic methods are found to be easier than the others. Traditional Minimum Moment Method, its modification & remodification are studied in details and compared. Base on this comparison, it is found that Re modified Minimum Moment Method is easier & involves less calculations than the other two. Hence Remodified Minimum Moment method is selected for resource leveling of Construction projects. Though all these methods are used for resource leveling in Project Management, it is very much important to check whether they can be applied to Construction Management. The minimum moment by traditional method and re-modified method is identical. The resource improvement coefficient (RIC) is1.2079 for both the methods and 1.19 by modified method.

REFERENCES

[1] Hiyassat, M. A. S. (2000), "Modification of minimum moment approach in resource leveling." J. Construction Engineering and Management, ASCE. 126(4), 278–284.
[2] Harris, R. I. (1978). Precedence and arrow networking techniques for construction, Wiley, New York
[3] Ahuja, H. N. (1976). Construction Performance Control by Networks. John Wiley & Sons, Inc, New York, N. Y.
[4] Akpan, E. O. P. (2000). "Resource smoothing: a cost minimization approach." Journal of Production Planning & Control, 11(8), 775-780.
[5] AbhayTawalare, Rajesh Lalwani (2013), "Resource Leveling in Construction Projects using Re- Modified Minimum Moment Approach", World Academy of Science, Engineering and Technology 62 2012.
[6] Gomar, J. E., Haas, C. T., and Morton, D. P. (2002). "Assignment and Allocation Optimization of Partially Multiskilled Workforce." Journal of Construction Engineering and Management, 128(2), 103-109