Optimizing Allocation of Resources of Residential Building

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Abstract- *Study includes the Remodified 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 Remodified minimum moment method & histogram is prepared for each solution. Maximum daily requirement of mason, 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, moment of histogram & RIC are reduced .

Keywords- Resource Improvement Coefficient,Earliest Start time etc.

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 the industry also forces construction companies to provide products of higher quality, in shorter durations, for lower costs and under safer working environments. Obviously, it is not possible to achieve these objectives simultaneously in the absence of an adequate schedule. Preparation of a schedule for a construction project requires 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. Many project-based industries are recognizing the importance of project planning, but the Infrastructural industry depend on scheduling skills. As theyare working under changing environmental conditions and being involved in some complex and a unique project accurate planning and frequently modernizing in it. In infrastructure project preparation, its schedule requires immediate changes in various uncertainties. In infrastructure project preparation, its schedule requires immediate changes in various uncertainties. Scheduling is not a simple concept of determining these quinces and the timings of activities within a project.

II. IDENTIFY,RESEARCHANDCOLLECT IDEA

In all above study Various analytical & heuristic methods have been developed to apply resources during the scheduling process. Analytical methods attempt to determine the optimum solution in terms of minimum project resources &/or duration. However, they requires large amount of computational time and therefore impractical for real construction projects. On the other hand, heuristic approaches provide reasonable solution within a practical period of time. Minimum moment method is one of the Heuristic methods used for resource leveling. Latter on modifications & remodifications are suggested to traditional minimum moment method.

For the proposed work we will take only remodified minimum moment method for comparison as it minimizes the number of iterations as well as simpler for calculations as compared to modified & traditional minimum moment method. It is most economical method which will reduce the number of iterations, calculations & to be used for Resource leveling of a construction project which will also help to reduce a) the undesirable resource fluctuation b) the crew idle time c) idle cost d) Short term release & rehire & improve overall resource utilization efficiency in order to improve construction productivity and reduce project duration and cost.

[1] **Step1**.Literature survey will be carried to describe, summarize, evaluate, and to integrate the content of information regarding the resource leveling for construction project. The source of information for review

literature includes journal publications, magazine articles, international agendas & reports.

[2] **Step 2**. Study of high rise building will be undertaken to collect the data about labour requirement for each activity.

[3] **Step 3**.To analyze & compare the results, the same project schedule will be restructured by the Remodified minimum moment method. Labour requirement will be found out & will be compared with the actual labour emloyed on site.

[4] **Step 4.** After analyzing & comparing the results, discussions will be carried out to found out the advantages & limitations of the resource leveling by remodified minimum moment method.

[5] **Step 5**.Applying the RMMM method on data which is collected from site. In backward cycle to calculate the improvement factor, skip the activity having free float (FF) zero from CPM network.

[6] **Step 6.** Select the activity having largest value of resource rate. There is possibility of having same value of R, at that time choose the activity having largest number of FF

[7] **Step 7.** If again there is tie, then activity which having largest duration is to be selected.
If again there is tie, then choose the first activity in the queue.

[8] **Step 8.** After calculating Improvement factor, the activity will be shifted to the new position if the calculated improvement factor of that activity will be larger than zero or equal to zero.

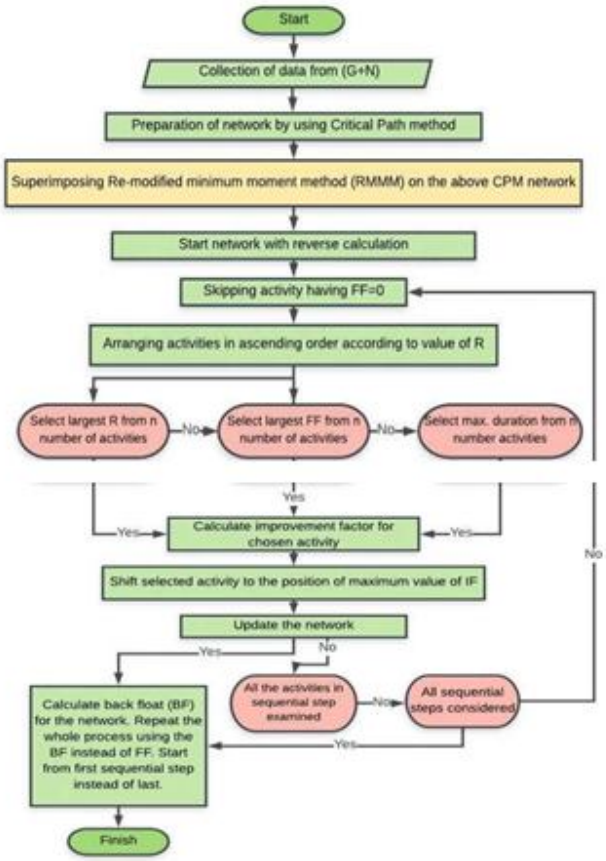
[9] **Step 9**. Still the tie is observed in the value of IF, then the largest value of time unit is selected. No shifting of activity takes place if the value of Improvement factor is negative.

[10] **Step 10.** If shifting occurs, the resource rate of activity is subtracted from daily resource sum hence the FF, lags, EFD and ESD are updated in the network.

[11] **Step 11**.Repeating the process for all the activities which can be shifted and hence the backward cycle completes.

[12] **Step 12.** Again,the process is staring with forward cycle. At the end, when the process gets finished, we will get final outcome.

The above methodology is descripted into flowchart 2



Despite the wide spread utilization of network scheduling techniques such as the Critical Path Method (CPM) and Precedence Diagram Method (PDM) in the construction industry, they have a number of important limitations including the inability to

1. Minimize the fluctuations in resource utilization levels over the project duration which causes the idle crew time, idle cost, short term release & rehire & increases the releasing & hiring cost.
2. Consider the availability limits of construction resources during various periods of the project because of which resource demand exceeds the available limit.
3. Analyze the impact of utilizing multiple shifts and overtime hours on construction productivity, duration, and cost i.e. Increase in cost, decrease in productivity, increase in risk of injury etc.
4. Consider the uncertainties and risks involved in construction scheduling and cost estimating because of which the project duration may be extended than planned one. In order to overcome the aforementioned limitations of traditional scheduling techniques, a number of resource-driven scheduling models was developed that focused on (1) resource leveling (2) resource allocation (3) the impact of utilizing multiple shifts and overtime

hours on construction productivity, duration, and cost and (4) probabilistic scheduling. Despite the significant contributions of these models, they have many limitations.

In order to address the limitations of existing resource-driven scheduling models, this study will focus on and thoroughly investigate major domain problems: (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. 3.6.1 Uses Of Resource Leveling

Resource leveling prevents resources from being spread too thin while ensuring projects still have what they need to succeed.

To optimize your resources

Resource leveling lets you get the most out of the resources you have on hand. It helps you assess which projects should receive additional resources and which ones are flexible in terms of deadlines.

To minimize deficits

Resource leveling prevents significant project delays, thereby minimizing the losses in costs and labor. This technique allows you to manage the resource demand without exceeding the company's current capacity and financial resources.

To prevent task overloading

Overallocation of resources leads to overwork, which can be overwhelming for team members. Resource leveling prevents this by resolving overallocation issues and adjusting deadlines to ensure team members don't have too much on their plates.

To ensure the quality of a project output

Leveling allows you to manage both resources and client expectations by maintaining the same level of quality for project deliverables. In general, resource leveling can be a useful technique for resolving budget issues, resource overallocation, and project delays.

Histograms

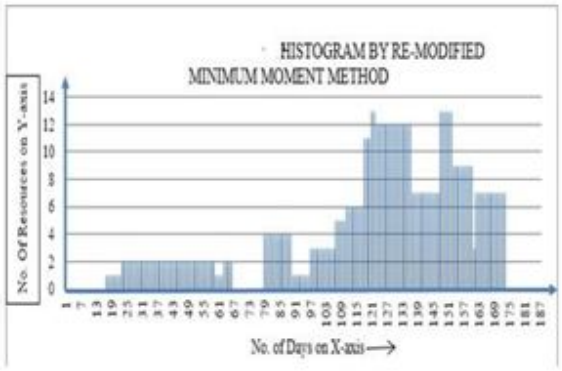
For a given network, the requirements of various resources are determined, using the early start schedule of each activity. In a network various activities are involved, and each activity requires some resources to perform it. There may be activities which are to be performed simultaneously and may require common resources. The requirements of resources to execute these simultaneous activities may exceed the available resources. However, at some other period of execution of the same project, there may be very few activities which may require these resources. Hence the requirement of a particular type of resources may not be uniform during the project duration. This can be best known by plotting the resources usage profile or histograms

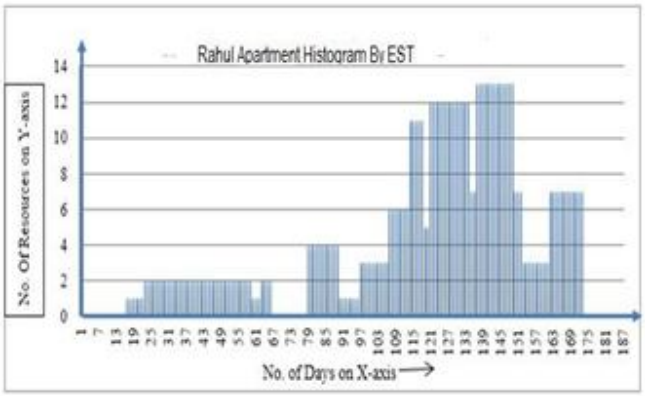
REMODIFIED MINIMUM MOMENT METHOD

The method is also based upon minimum moment approach theory but it is re modification over modified minimum moment method in terms of selecting criteria of the Activity in sequence step of network. Therefore the assumptions for proposed method are same as that of Minimum moment method and modified minimum moment method. The aim of the theory is to reduce, as much as possible, the differences between peaks and valleys in the resource histogram, by means of shifting noncritical activities from their original position to some other position. It should be noted that the new position should have a lower value of the statically moment of a resource histogram than the original one.

The assumptions are as follows:

1. No interruption is expected once the activity started up to its completion.
2. Resources applied to each activity remains constant throughout their completion.
3. The duration of each activity remains constant.
4. The network logic is fixed.
5. The project's completion date is fixed





III. STUDIESAND RESULTS

- Despite the wide spread utilization of network scheduling techniques such as the Critical Path Method (CPM) and Precedence Diagram Method (PDM) in the construction industry
- Minimize the fluctuations in resource utilization levels over the project duration which causes the idle crew time, idle cost, short term release & rehire & increases the releasing & hiring cost.
- Consider the availability limits of construction resources during various periods of the project because of which resource demand exceeds the available limit.
- Analyze the impact of utilizing multiple shifts and overtime hours on construction productivity, duration, and cost i.e. Increase in cost, decrease in productivity, increase in risk of injury etc.
- Planning and steering of projects under these conditions turns out to be a really tough job even for the most experienced project managers.
- To deal responsibly with project sponsors or customers, they must consider carefully the resources that are required to complete a project on time and within the estimated budget.
- As a consequence, the leveling of resources has faded into the focus of attention.
- Various methods of Resource leveling are studied in literature review & based on this, Heuristic methods are found to be easier than the others.
- 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.
- Hence Re modified Minimum Moment Method is applied for resource leveling of the Construction Projects.

IV.CONCLUSION

This study aimed to determine whether Re modified Minimum Moment method is applicable for resource leveling of Construction project. Data was collected from residential construction projects. Data was analyzed by arranging the activities according to their EST, Re modified Minimum Moment method . On the basis of this study the conclusion was elaborated as below:-

1. Moment & RIC of histogram drawn by Re modified Minimum Moment method is reduced & hence Re modified Minimum Moment method used for resource leveling is applicable to construction project.
2. It reduces the number of iterations & makes the calculations simpler than the other. The calculations required for this method can be easily programmed in excel which again reduces the time required for calculation.
3. It is used for Resource leveling of a construction project which will help to reduce
   a) The undesirable resource fluctuation
   b) The crew idle time
   c) Idle cost
   d) Short term release & rehire
4. This method will improve the overall resource utilization efficiency in order to improve construction productivity and reduce project duration and cost.
5. Profiling Resources to meet project requirements is an important part of schedule development.

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