REVIEW OF FORMAL DEVELOPMENT OF LOBST METHOD

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Abstract: This paper reports one aspect of a Repetitive Scheduling Method (RSM) or Line of Balance Scheduling Technique (LOBST) applied for a housing project having project activities repetitive in nature. These scheduling methods are planning and scheduling techniques mostly used in construction and manufacturing industries where repetitive operations are abundant. The Line-Of-Balance Scheduling Technique (LOBST) is a linear scheduling method that allows the balancing of the operations such that each activity is continuously and efficiently performed in each consecutive unit. A preliminary survey of research paper reveals that LOBST is most suitable for the scheduling and planning of repetitive and non repetitive type of project but there are some disadvantages of LOBST method and also find out from the research paper that LOBST method is not developed properly for the computer programming for this drawback when the LOBST method is used with the CPM network most satisfactory result get for the repetitive and non repetitive type of projects.

Index Terms- Repetitive project, Line-of-Balance, Scheduling, LOB Software.

I. INTRODUCTION

Construction projects that engage activities are typically chosen as repetitive or linear projects. Multiple houses and typical floors in a high-rise building (repetitive projects) or highways and pipelines are typical examples. The LOB system is a scheduling route developed by the U.S. Navy in the early 1950s. It was principal functional to industrial manufacturing and production control, where the intent was to attain or calculate the flow rate of complete products in a production streak (Line of Balance 1962).

This review paper reflects formal development and some experimental work done into the field of LOBST. In this review paper select five research paper related to LOB techniques and work done into repetitive type of project. In these review paper pros and cons of LOBST, application of LOBST into field, comparison of LOBST with Network method and details of software used for LOBST method.

II. REVIEW OF PREVIOUS WORK DONE

1] Line-Of-Balance Scheduling in Pavement Construction:

In this research paper, the researchers are taken a case study of Single Layered Highway Surface Treatment project of 100 km stretch of rural highway.

The objective of this research paper is listed below;

1) A programmed rate of completed units is met, 2) A constant rate of repetitive work is maintained, 3) Labor and plant move through the project in a continuous manner such that a balanced labor force is maintained and kept fully employed, and 4) The cost benefits of repetitive working are achieved. The initial procedure of this paper is to dividing the project into four main activities: 10 Aggregate transportation; 2) prime coating; 3) surface coating preliminaries; and 4) surface coating.

The rates of production for these four activities were determined by following factors: 1) The contract duration, 2) Estimated subcontractor performance, 3) Logical limitations and 4) Strategic limitations.

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2] Scheduling Pipeline Project: To Remedy Deficiencies of CPM and LOB:

In this paper researcher addresses the deficiencies of conventional scheduling tools, CPM and LOB, in scheduling pipeline projects.

Like in LOB method researchers identify major two shortcomings; First, LOB has not yet been adapted to numerical computation as readily as network methods and therefore can accommodate only limited degree of complexity. Second, the assumption of having only nice, neat and parallel production lines in LOB impedes its general application in construction.

Another popular scheduling method is CPM. Despite the wide acceptance of this in the construction industry, it possesses various deficiencies in scheduling pipeline projects. Tommelein (1998) indicated that CPM networks do not necessarily show important production information, such as the production rate and work sequence of each crew. The production rate is referred to as the amount of work performed per unit time while the work sequence denotes the locations and orders for crews to perform their job. These sets of information are important because they serve as the foundation for avoiding interferences, identifying bottleneck processes, and balancing production. All of these, unluckily, cannot be done by observing traditional CPM networks. For example, there is no direct indication of production rates of activities in CPM networks. Thus one cannot immediately locate which activity is the “bottleneck” that causes the entire project to slow down and further “balance” the production to achieve shorter project duration and lower overall cost.

The deficiencies of CPM and LOB led to the development of an alternative scheduling system presented in this paper, the Repetitive Scheduling method (RSM) and its computer application, Repetitive Project Planner (RP2).
3] LOB and CPM Integrated Method for Scheduling Repetitive Projects:

Scheduling of repetitive projects represents a challenge for construction planners and managers. Classical CPM investigation does not suit characteristics of cyclic projects, whereas LOB lacks the analytical qualities of CPM scheduling. In this paper, an integrated CPM and LOB repetitive scheduling model has been developed that combines the benefits of both CPM and LOB in an easy analytical no graphical manner.

Overlapping activities of a typical unit is used to specify activities’ relationships. Constant activity duration is assumed along all repetitive units. The model essentially consists of four steps: LOB calculations, calculating activity duration along all repetitive units, specifying logical relationships using overlapping activities, and CPM time analysis. The researchers also identify the procedure for the integration of two method for the construction project; Step 1: LOB Calculation, Step 2: Calculating activity duration, Step 3: Specifying logical relationships using overlapping activities, Step 4: Time scheduling (Forward pass and Backward pass). After this, researchers urbanized modal that demonstrated the steps and features by an example of 10 identical units.

<table>
<thead>
<tr>
<th>Activity</th>
<th>Predecessors</th>
<th>Unit duration (days)</th>
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<tbody>
<tr>
<td>A</td>
<td>—</td>
<td>4</td>
</tr>
<tr>
<td>B</td>
<td>—</td>
<td>6</td>
</tr>
<tr>
<td>C</td>
<td>A</td>
<td>2</td>
</tr>
<tr>
<td>D</td>
<td>B</td>
<td>8</td>
</tr>
<tr>
<td>E</td>
<td>A, B</td>
<td>2</td>
</tr>
<tr>
<td>F</td>
<td>B</td>
<td>10</td>
</tr>
<tr>
<td>G</td>
<td>C</td>
<td>16</td>
</tr>
<tr>
<td>H</td>
<td>C</td>
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<td>I</td>
<td>E, H</td>
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<tr>
<td>K</td>
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<td>6</td>
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</tbody>
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figure 5: alternative 1: decelerating painting activity

figure 6: alternative 2: painting two halves separately

figure 7: alternative 1: two crews for backfill and compaction

figure 8: planning data of a typical uni

In this paper researchers presents a review of the need for the planning and monitoring of construction work, a description of the characteristics of site construction work, particularly the degree of task repetition required for project execution, a review of two planning models comprising the critical path model, which is based on the concept that a project consists of a series of discrete activities, and the linear scheduling-flow line model, which is based on the concept that a project consists of a series of repetitive activities.

The practice of contractors when confront with a construction scheduling problem and the use of the technique derived from the models are examined. Six successful case studies are incorporated, including two renovation projects and four commercial office buildings, two based on the critical path method, two based on the flow line method, and two that use both models in suitable sections.
The cases were selected as typical examples of the purpose of suitable scheduling techniques to the problems of planning and monitoring construction projects.

However, in the writer's experiences, contractors generally limit the use of the techniques to particular aspect of project, such as: (1) The overall direction and control of projects rather than detailed monitoring; (2) The systematic analysis of particular parts of a project, such as the arrangement of approvals and fabrication, sequencing, the assembly order of components, and an indication of the relative importance of these activities to job completion; (3) The provision of the opportunity to strengthen contracts and contractor's performance; and (4) The framework for a sound communication between all the parties involved. Certainly a compelling case can be made to plan and monitor projects to high levels of detail, as well as link the scheduling system with other resources and financial controls, but most evidence suggests that contractors rarely use the techniques to their full potential.

5) Application of Line of Balance Scheduling Technique (LOBST) for a Real estate sector:

This paper reports one aspect of a Repetitive Scheduling Method (RSM) or Line of Balance Scheduling Technique (LOBST) applied for a housing project having project activities repetitive in nature.

LOB technique is extremely appropriate for repetitive projects like residential buildings; however it may be adapted for non-repetitive projects as well. The major advantages of LOB schedule are its graphical donation, effortless understanding of the schedule and the goals of forecast used in it. The research conducted by the author aim to get better the LOB concept on building construction and proves its worth.

A Line of Balance chart should not be submitted as a Tender or an Accepted Program. If it is submitted it is unlikely that it would be accepted anyway; it does not show exact relationships between individual activities in the same way as a Bar Chart does. However, subcontractors should always be expected to produce a Line of Balance Chart for their works as part of their program information. A subcontractor’s program has to be sufficiently detailed to show production rates anyway and should lend itself to being converted into a Line of Balance Chart.

There are hardly any projects where a Line of Balance Chart cannot be used and be of advantage. It is only small subcontracts where the activities are spread across the period of a project that a Line of Balance will not be helpful; for all vital subcontracts it will assist the management of the subcontract and the project. They are typically much easier to interpret than a complete Bar Chart and a subcontractor should forever provide them as part of their progress reports. There is also every reason why the subcontractor’s Line of Balance Charts should be integrated in a growth report, mainly if a subcontract is falling at the back of schedule.

An additional advantage of producing a Line of Balance Chart is the core of such a document is output and productivity. In this respect it is not unusual for claims to be produced by subcontractors when the works are completed citing events for which the employer, in the case of a subcontractor is held responsible. The claims are usually for delay and disruption. By disruption it is meant that an activity or activities achieved lower than planned output and efficiency because of unforeseen circumstances for which others are responsible. Examples of disruption are; where design information was provided in a piecemeal or uncoordinated fashion, or where the resources deployed had to be continually moved from one work area to another or where there are continual variations instructed.

The study shows that there are abundant intrinsic advantages and benefits for applying LOBST in construction projects. The accessibility of supporting software program help recognize these benefits, in addition, LOB could participate a key role in facilitating the accomplishment of Building Information Modeling technologies. The investigate shows that there is immense impending for Line of Balance scheduling in the construction industry, and in the future there is a good opportunity that it would be implemented in more construction projects. With the developing and improvement of Line of Balance software programs and construction related academic programs integrating the LOB scheduling technique in their curriculums, the acceptance and utilization of Line of Balance is expected to increase significantly.

figure 10: example of lob chart
III. CONCLUSION

From this review paper it can be noticed that, LOBST is suitable for the repetitive and non-repetitive type of work but there are some drawbacks of this method, so for the most accurate planning and scheduling of projects the composition of LOBST and CPM method is used.

LOBST method is not been formalized enough to be presented by a body of well-tested algorithms and also find that LOB method is not used in computer because of the not developed the algorithms.

LOBST is more prominent than the CPM network for the planning and scheduling of repetitive type of project, and this method is also easy to plan, tracking, updating and understand the chart of it.

LOBST has not been fully urbanized and implemented by the U.S. construction industry for the reason that of the huge popularity of network techniques including CPM. LOB has been applied to resource scheduling and coordination of subcontractors, to a highway pavement construction project, to modeling production activities for multi-facility projects, and to transportation projects.

In BIM using LOB chart in place of CPM network for the repetitive project gives better satisfactory result.

IV. REFERENCES


