Collaborative Implementation of Last Planner System in Construction Industry

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***ABSTRACT*-Last Planner system has previously been successively applied by firms with direct responsibility for production management. The Last Planner system makes project programs more predictable and increases the chances that work will flow and projects will be completed on time. This extends system application to those coordinating specialists, both in design and construction, through a series of case studies, one of which also explores the limits on unilateral implementation by specialists. We approach problems related to production in construction first in physical and then systems terms believing that issues of organization and contract can only be resolved by assuring they best manage the "physics" of production. This approach is in contrast with efforts that start with issues of motivation and contract and never to come to grips with the work itself. In each case we first want understand the current state of knowledge, and then form our theories. In this stage we must understand how the function is accomplished in current practice and the underlying mental model or theory that supports that practice.**

Keywords—Last Planner System,Continous improvement system,Construction Management,Master schedule, Look-ahead schedule, Weekly workplan,Percent planned complete, Make work ready.

1. INTRODUCTION

The objective of the present study is to analyze the Last Planner System in reducing the construction complexities involved in the project and to analyze the last planner system to complete the project within the stipulated time and cost and to study the concept of lean construction and how it is being implied in the local construction. Controlling time involves planning, scheduling, and monitoring. Planning decides what is to be accomplished and in what sequence. Scheduling determines task duration and timing. Monitoring checks progress of tasks against the schedule and forecasts when work will be completed. The objective of time control is production or progress, not productivity. Decisions made regarding budget and schedule, productivity and production must recognize their interdependence. Productivity and production are formally related in earned value systems, which propose a solution to the problem that progress and expenditure of resources need not coincide. Rates of resource consumption are established for the various kinds of work to be performed on a project. The Last Planner system makes project programs more predictable and increases the chances that work will flow and projects will be completed on time

2. NECESSITY OF THE STUDY

Planning defining criteria for success and producing strategies for achieving objectives. Control causing events to conform to plan and promoting, learning and re-planning. Better planning results from overcoming several obstacles common in the construction industry, including:

- Management focus is on control, which prevents bad changes and neglects breakthrough, which causes good changes.
- Planning is not conceived as a system, but is rather understood in terms of the skills and talents of the individuals who are in charge of planning.
- One of the best known Lean techniques is the Last Planner System which has been demonstrated to be a very useful tool for the management of the construction process, and continuous monitoring of the planning efficiency.
- The Last Planner integrated components are master plan, phase planning, look-ahead and weekly planning.

3. OVERVIEW OF CONSTRUCTION INDUSTRY

Construction industry demands high degree of management of men and materials to complete the project successfully at an optimum cost. Hence, a special branch of building construction has been developed to accommodate the techniques, which are adopted to improve the performance of various aspects of an engineering project. The subject of construction of structures and management of works as such as very wide and it can be understood by practical experience only in the sense that every project poses certain problem which can be solved by common sense and skill of site

engineer only. Decision making powers should be well distributed among the project team. . Last Planner System (LPS) aims to shift the focus of control from the workers to the flow of work that links them together.

3.1 GENERAL FORMULATION

In its most general form, the resource-constrained scheduling problem is defined as follows:

- Set of activities that must be executed
- A set of resources with which to perform the activities
- Set of constraints which must be satisfied, and
- A set of objectives with which to judge a schedule's performance.
- Minimization of project duration
- Minimization of cost
- Maximization of the net present value of the project
- Optimum resource utilization efficiency
- Involvement of designers in joint solutions.
- Direct interactions between designers and customers.
- Explicit and healthy client supplier relations.
- Always working with a set of design alternatives.

4. LAST PLANNER SYSTEM

This tool in simple words can be taken to be an assimilation of the above mentioned tools. It also has a number of other features which are explained below. The main objectives of a production control system like the Last Planner System are as follows

- Manage and mitigate the variability.
- Assignments and schedules should be sound regarding their prerequisites.

- The completed assignments should be monitored. Causes for failure to complete the planned work should be investigated and removed.

- There should be a workable backlog for each crew and production unit.

- The prerequisites of upcoming assignments should be made ready.

- The traditional push based construction process model should be incorporated with pull techniques.

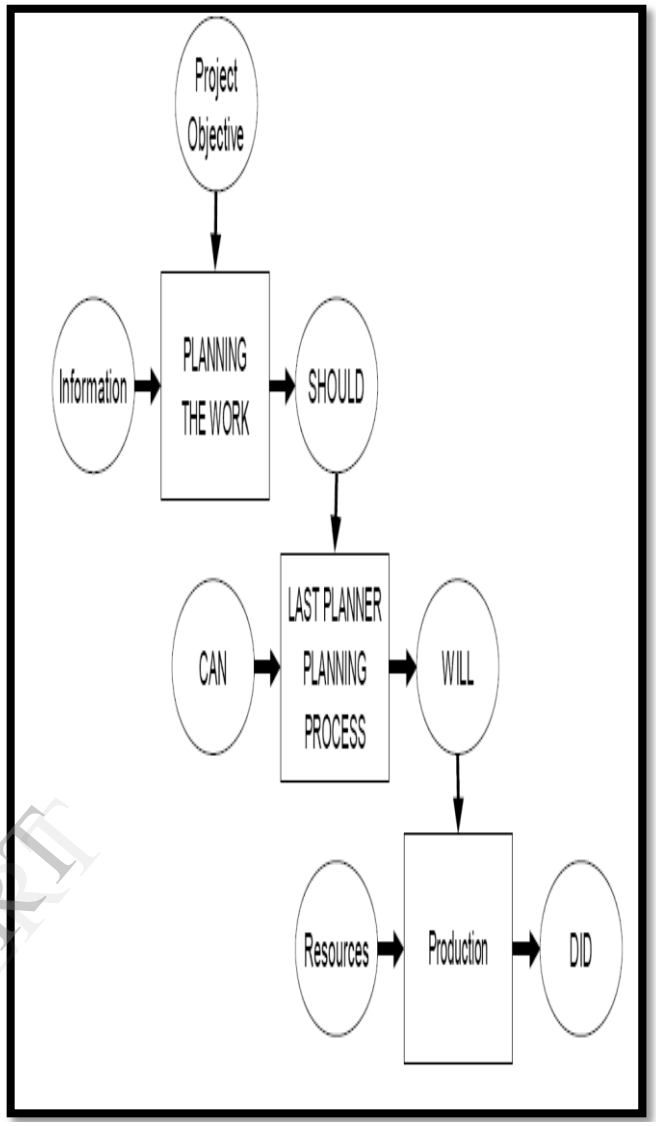

Figure.1 Last Planner system

5. APPLICATION OF LAST PLANNER SYSTEM PRINCIPLES TO THE CONSTRUCTION PROCESS

The construction process is considered as a three phase process:

- Design
- Planning
- Scheduling
- Execution
- Monitoring
- Controlling

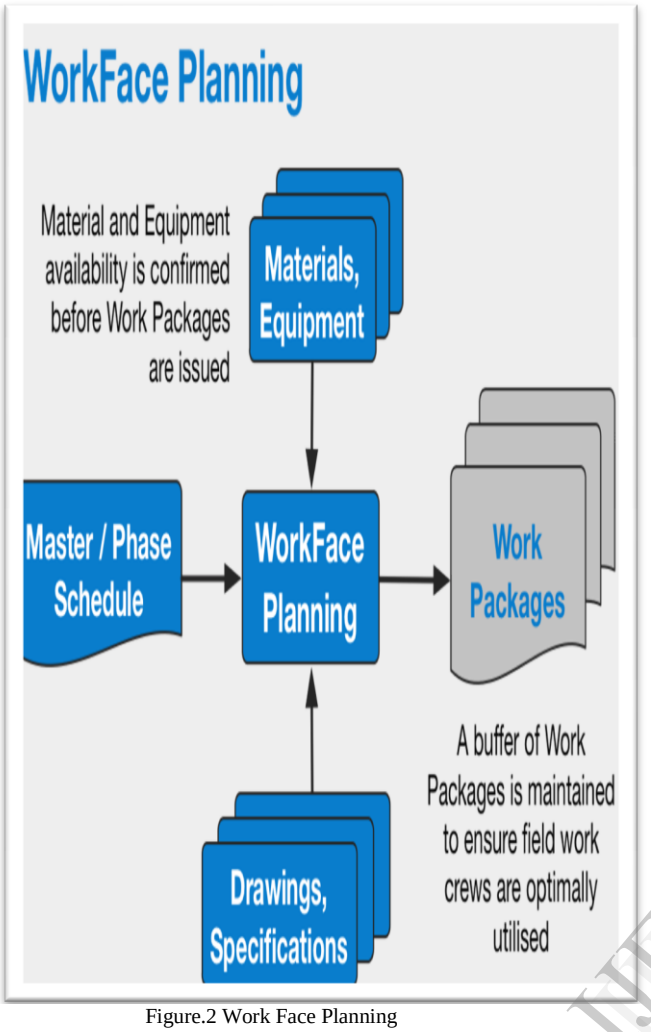

Figure.2 Work Face Planning

5.1 Look ahead process and Last Planner System

The look ahead process involves the following processes: explosion; screening and make ready.

5.1.1 Explosion

This involves exploding the activities mentioned in the master schedule to great details to identify all the pre requisites for the activity before it enters the look a-head window.

5.1.2 Screening

This process is used for determining the status of tasks that are present in the look a-head window based on their pre requisites (constraints). Here we can choose whether to advance or postpone the tasks based on their status.

5.1.3 Make ready

In this process the lead time (time for order to delivery) is estimated, the pre requisites are pulled and the work is executed. This process requires great caution as the ordering times have to be estimated reliably to prevent any inventory from building up at site. The status of the consuming activity should be matched with the ordering times of resources with great detail and caution. The make ready work then enters the workable backlog so that the scheduled work can begin. The work is monitored by using PPC (Percent of Planned Complete) and the inability to achieve a high PPC is investigated for process improvement and to prevent the problems from re occurring.

5.1.4 PPC

PPC or Percent of planned complete is the method used for monitoring of the project. Unlike the techniques of earned value estimate which is traditionally used for monitoring of projects, the PPC measurement has the following advantages:

- Work is selected by the workers themselves and hence there is less chance of time over run.
- The causes for the non completion of work are mentioned explicitly while analyzing PPC.
- PPC helps in continuous improvement of the construction project as efforts are made to prevent the re occurrence of problems.

5.1.5 Look-ahead plan

The Look-ahead plan takes the second place on the hierarchy in planning and is based on the initial plan from which the master plan is derived and embraces time lapses of five to six weeks. It precedes the planning compromise generated by the weekly work plan (WWP). In the WWP, the tasks are explored more in detail, which allows determining the feasibility of the activities to be executed and decide on the preliminary working requirements such as guidelines, resources, and consents needed for task fulfillment. These are known as restrictions. Once restrictions are determined, activities must be submitted to preparation process, where limitations are eliminated, allowing the accomplishment of the activities.

5.1.6 Weekly work plan

The Last Planner system pretends to increment the quality of the weekly work plan (WWP), which generates a general control of working flow when it is combined with the look-ahead planning process. Some of the characteristics that are engaged in the fulfillment of the proper weekly work plan are the following:

• The right selection of the working sequence according to the established master plan, the execution strategies, and the constructability.

• The proper selection of the working quantity, taking into account the work capacity of the crews that are assigned to carry out the tasks.

• The exact definition of the amount of work to be done and that can be done, which means that all the requirements have already been met and that all the resources are available.

5.1.7 Measure of the Planning system performance by the Percentage of planned activities completed.

The last planner system measures the performance of each weekly work plan in order to estimate its quality. This measure, a first step to learn from errors and implement improvement, is expressed by the percentage of planned activities completed (PPC), which can be obtained, each week, by dividing the number of fulfilled activities by the

number of assignments planned and multiplying it by one hundred. In this way, the PPC assesses to what extent the last planner system was able to predict the tasks that were going to be carried out on the following week.

6.0 MODEL DEVELOPMENT OF LAST PLANEER SYETEM

The following are the basic step which is involved in the development of a model. The Flow chart of Last planner system is shown in the figure.

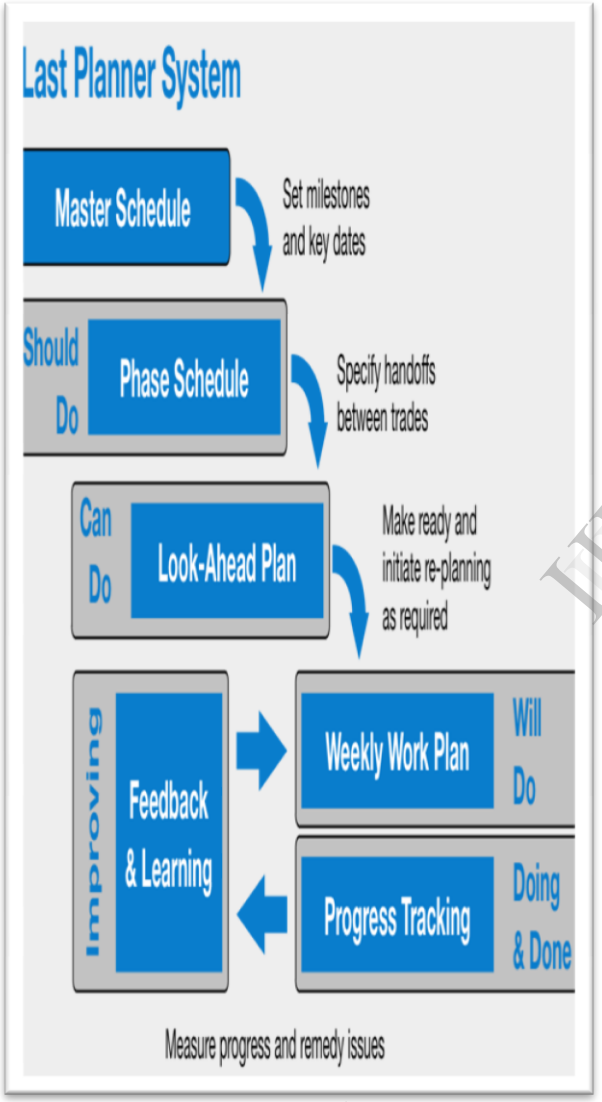

Figure.3 Model Development of Last Planner System

6.1 MASTER SCHEDULE OF THE PROJECT

Master Schedule is the overall project schedule. It contains major milestones only. Milestones dates are determined by using the pull process from successor milestones, beginning with the project starting date and working forward to project completion date.

6.1.1 Look-ahead Schedule

Look-ahead schedule represents an intermediate level of planning. This schedule contains major work items that must be completed in order to meet the milestone dates in the master pull schedule. Major activities and their completion dates are pulled from the master schedule, broken into detail and screened prior to entry in the look-ahead schedule. Screening essentially means that all the constraints preventing the execution of the activity

has been identified.Lookahead schedule comes after the master schedule of project.

6.1.2 Weekly Work Plan

Look ahead schedule is prepared based on the information that is made ready by Screening and pulling which is a workable backlog of selecting, sequencing and sizing the work that can be done through weekly work plan. The Weekly planner is an assignment level schedule, one week in duration. This schedule includes all assignments or work activities that are required to be started that week in order to maintain the completion dates in the look-ahead schedule. Work assignments are pulled from the look-ahead schedule onto the weekly work plan. This process is used for determining the status of tasks that are present in the look a-head window based on their pre requisites (constraints).

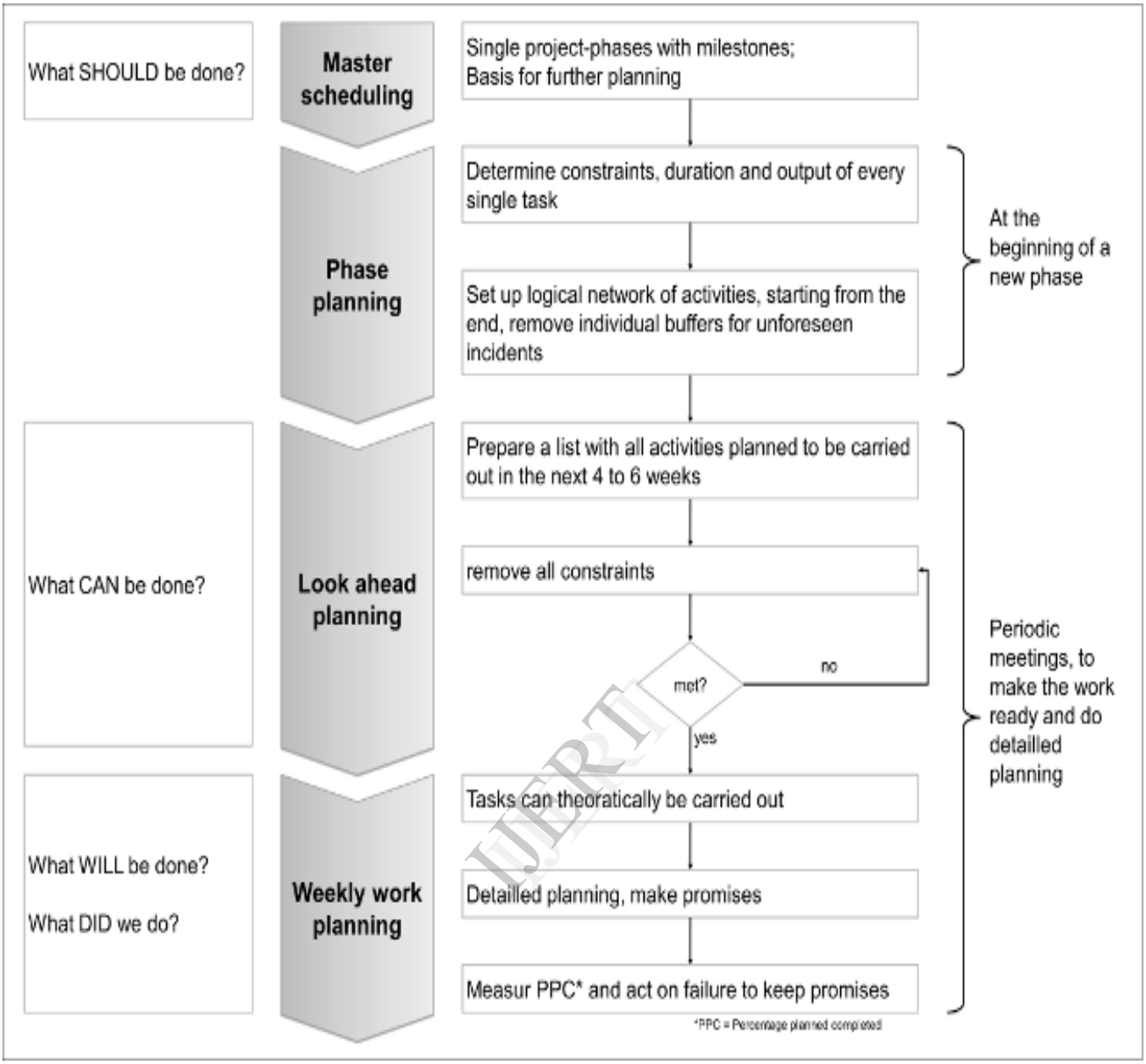

Figure.4 Process of Last Planner System

7.0 DISCUSSIONS OF RESULTS

Based on the present case study the following results are determined. The various factors are tabulated as follows which indicate the data representation to achieve the following results.

Table 1. Master schedule of the project

S.no	Name of the Blocks	Planned		Actual	
		Cost in Lakhs	Duration in months	Cost in Lakhs	Duration in months
1	Block-1	699	27.86	526.4	26
2	Block-2	696	27.86	499	25.86
3	Block-3	825	26.87	658	25
4	Block-4	896.73	28.87	825	30
5	Block-5	1427.54	28.03	1427	30

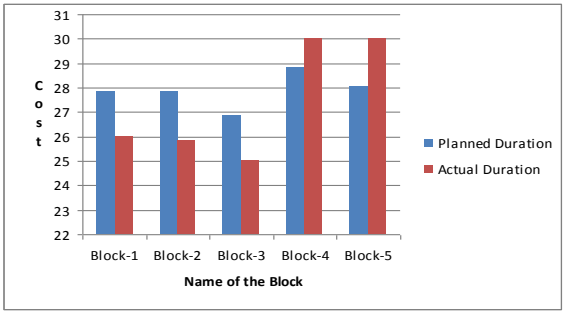

Fig.5 Planned duration Vs Actual duration for all the blocks

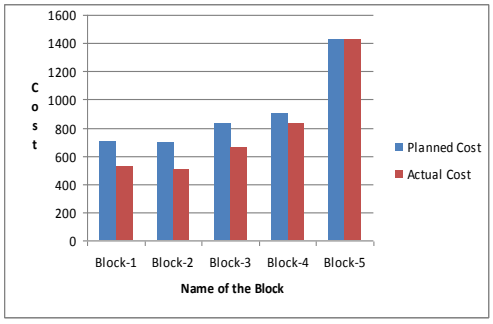

Fig.6 Planned cost Vs Actual cost for all the blocks

8.0 CONCLUSIONS

The last planners system could be an appropriate tool to help solve problems which arise at site during execution, minimizes delays, optimize the resources, and reduced the project cost. Present study describes how a Last planner system is prepared and the case study demonstrates an application in which the Last planner system enabled the user to validate proposed construction estimation.

The purpose of using Last planner system for construction simulation is to assist project planners to better understand the construction process and predict the accurate future costs.. This shows that the Last planner system can be used for this purpose and site is a key to implement the Last planner method. The specific conclusions derived from the following study are as follows:

- It has been seen that the Last planner system was successful in reducing the construction complexities during execution of the project.
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- In conclusion, the developed Last planner system is more accurate and simple to use most with significant time and cost saving.
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