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Implementation of Last Planner System in Medium Scale Construction: Adoption & Problem Analysis

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Abstract: Indian construction industry is lagging behind as compared to other countries. The main reason for this failure is lack of planning and management which causes cost and time overruns. Last Planner System (LPS) which is the part of Lean Construction (LC) techniques is the suggested solution for avoiding delays. This study focuses on implementation of Last Planner System on medium scale construction. Mainly focusing on Phase scheduling, Look Ahead Plan, Weekly Work Plan (WWP), Percentage Plan Complete (PPC), and Constraint Analysis. By this attempt comparison of the results of LPS with traditional planning methods can be done.

Keywords: Lean Construction Techniques, Last Planner System (LPS), Phase Scheduling, Look Ahead Plan, Weekly Work Plan, Percentage Plan Complete, Constraint Analysis

1. INTRODUCTION

As per the results of surveys carried out on construction sector, up to 30% of construction costs is increased by inefficiencies of equipments & workers, mistakes in construction work, delays, and poor communications. Researchers have found the tendency of industries to measure performance in following terms: completion within time & budget, and meeting construction codes (Koskela 1992). Traditional construction process generally leads to poor site management of resources and materials, waste management, time and cost overruns. The last planner system is the most effective technique of lean construction can be the solution of this problem, which provides operational planning to decrease the cost and time. The Last Planner system was developed, in a design science research manner, to solve the practical problems during the construction (Ballard1994). In short we can say that, Last Planner is the person/team assigned for operational planning, which results into improved sequence of work, completion of individual assigned task at the operational level. In LPS, the company brings their subcontractors and foremen (who are directly responsible for executing & supervising work at the site) all together to "pull" a schedule backwards and identify the constraints. The part of LPS commonly known as "look-ahead planning" exists to make sure that critical activities can start on time. Various ways in LPS to improve the work includes two-way communication, constraints analysis process for six- week look ahead before activities are executed, the analysis of reasons for variance after activities are completed. (Howell 999). The main function of the Last Planner technique is to change optimistic planning by evaluating workers performance from their skill to achieve their commitments.

AIM AND OBJECTIVES

To implement Last Planner System in medium scale construction project and compare it with traditional planning method.

Objectives of the study are to study LPS in detail, to study areas of applications of LPS, to study limitations, scope, advantages and functions of LPS, to implement LPS on medium scale construction, to study problems while implementing LPS, to compare traditional planning with LPS.

2. LITERATURE REVIEW

Lean construction (LC) is similar to the current practices in the construction industry; both practices pursue better meeting customer needs while reducing waste of every resource. However, the difference between the current practices and lean construction is that lean construction is based on production management principles, and it has better results in complex, uncertain, and quick projects. One limitation to implementation of lean construction tools in the United States is the lack of investment in research from the construction industry (Howel 1999). Last Planner System is one of the techniques of lean construction. Last Planner System planning process is a procedure of creating a master schedule, a look-ahead, and a commitment/weekly work

plan through front-end planning using Lean Construction Planning techniques (Howell and Ballard 1994). Weekly work planning is referred as "commitment planning" because, at this stage, specific resource assignments need to be made so that work can actually be performed. Constraint analysis is an integral part of LPS that is applied to take a proactive approach to problem solving as faced during the day-to-day life on construction projects (Ballard 2000). The primary function of LPS is the collaborative planning process that involves 'last planners' for planning -in greater detail as team gets closer to doing the work. The other major functions of the LPS include: productive unit and work flow control, and completing quality assignments. It also makes it easier to get to the root cause of the problems, and to make timely decisions for solving the problems in order to execute actions, thereby increasing productivity (Fiallo and Revelo 2002). In one of the case study of LPS which has been referred for this study. The research was carried out in a University construction site, where four prototype hostel buildings were being constructed simultaneously by four different contractors. LC technique via the Last Planner Systems (LPS) was adopted by one of the contractors in the construction of one of the hostel building. The results reveal that the LC project made significant improvements in terms of; the timely completion of the project, 30% cost savings as against the others and an average Percentage Plan Completed (PPC) of 80%. These improvements were facilitated by the way the site was planned, managed and controlled using LPS. Last Planner System (LPS) is the most developed LC tool used in improving work plans and control of projects. (Ograbe Ahiakwo1 , David Oloke2 , Subashini Suresh3 and Jamal Khatib4)

3. METHODOLOGY

	Task Name	Duration	Start	Finish	Predecessor
0	**Avasara - Phase Scheduling**	**179 d**	**Mon Nov 2, '15**	**Wed May 25, '16**	
1	**Part A- Building , UGWT, OHWT & Water-proofing**	**179 d**	**Mon Nov 2, '15**	**Wed May 25, '16**	
2	**Mobilization Of Site**	**9 d**	**Mon Nov 2, '15**	**Wed Nov 11, '15**	
3	Conformation or Handover of LOI	1 d	Mon Nov 2, '15	Mon Nov 2, '15	
4	Labour Camp	8 d	Tue Nov 3, '15	Wed Nov 11, '15	3
5	Fixing of toilets for Staff & Labours	5 d	Tue Nov 3, '15	Sat Nov 7, '15	3
6	Site office	1 d	Mon Nov 2, '15	Mon Nov 2, '15	
7	Cement Store	1 d	Mon Nov 2, '15	Mon Nov 2, '15	
8	Store & Quality Lab	2 d	Mon Nov 2, '15	Tue Nov 3, '15	
9	Bhumi Pujan	1 d	Tue Nov 3, '15	Tue Nov 3, '15	3
10	**Finalizing of Contractors**	**1 d**	**Mon Nov 2, '15**	**Mon Nov 2, '15**	

Fig.1 View of phase Scheduling

3.1 Visit and Selection of site

This study aims at implementation of last planner system to complete the construction of selected site within or before schedule. The selected site is located near Flame University, Oxford Golf Club Road, Pune. Details are shown in Table-1

Table-1

PMC	AMs Project Consultants Pvt. Ltd.
Client	Avasara Leadership Academy
Contractor	Vaichal Construction Pvt. Ltd.
Type of building	G+3 School Building
Plot Area	4Acre
Built up area	6000 sq.fts.

3.2 Collection of the technical data

All the technical details required for the planning are collected. It includes working drawings, resource details (labor, machines, material, funds) etc.

3.3 Applying Last Planner System (LPS) to the project

3.3.1. Phase Scheduling

At the starting phase of the project, work was going on with the traditional method. Appx. after 1month LPS was implemented on the site Phase scheduling of the entire project is done in more details so that each activity can be concentrated. Total project is divided into 5 milestones and 171 activities. Project duration is 179 days with starting date
2nd November 2015 and finishing date 25th May 2016. From total project duration milestone dates were found out. Reverse scheduling was done from each milestone which is known as 'pull technique'.

3.3.2 Look Ahead Plan

It is the schedule of the work to be done in near future generally for six weeks. Only those activities are allowed to keep in look ahead plan about which the planner is confident that the activity can be executed at the scheduled date. If there is any problem for the execution then that activity can't be included in look ahead plan. From the date of LPS implementation look ahead plan was prepared for each six weeks.

3.3.3 Weekly Work Plan

It includes the activities to be executed in coming week. Weekly plans are developed in weekly meetings. Only those activities are included in weekly work plan whose constraints are removed and can be actually executed in that week. By taking the reference of look ahead plan weekly work plan is made. WWP was made in weekly meetings conducted on each Saturday. Fig 2 displays the view of weekly activities to be executed from 1st May to 7th May.

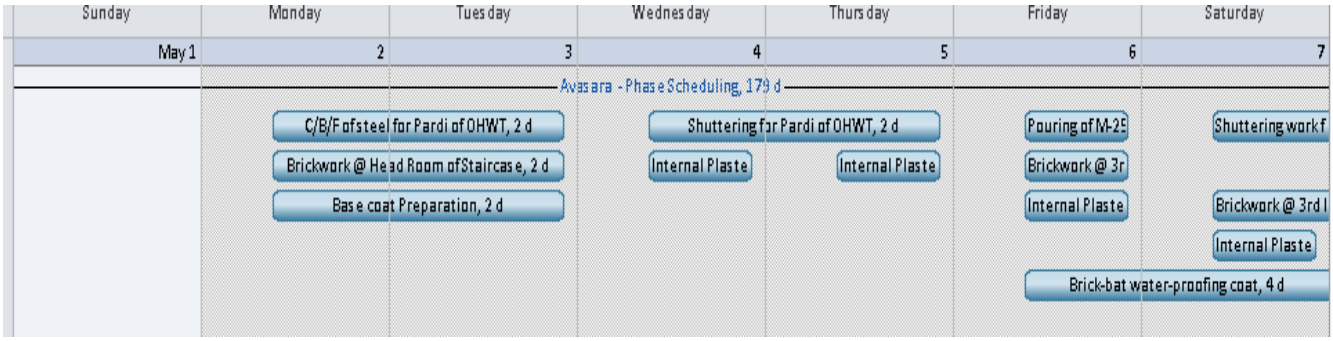

Fig.2 View of Weekly Work Plan

3.3.5 Constraint Analysis

After the assignment is done, constraint analysis is required. Constraint analysis means identification and removal of the constraints. Mainly the constraints are designs, labors, materials, weather, resistance to change, lack of skill. By observation and discussion, it is found that main constraints are materials and labors. By offering around 5% more wages as compared to normal, workers unavailability is reduced. By maintaining good relationship with materials suppliers, material constraint is also removed i.e. main reasons for delays are identified and removed partially. Another constraint for implementation of LPS is resistance of workers to change. Many of the workers as well as technical persons don't support to change the traditional methods, but after convincing them they have accepted LPS.

3.3.4 Percentage Plan Complete (PPC)

PPC is calculated as number of planned activities completed divided by the total number of planned activities, expressed as a percentage. Percentage Plan Complete (PPC) was calculated at every weekly meeting and displayed to the workers and engineers so that all will be aware of difference between planned and actual schedule. At different levels the PPC is calculated. PPC values are calculated per week at starting phase and per month later on. It is observed that the value of PPC goes on increasing day by day with LPS.

4. OBSERVATIONS

The rate of doing work of labors was about 8-10$m^{3/}$day, but after the implementation of LPS it is increased to about 12-13m^3/day. Out of 5 milestones, first 4 are completed as per scheduled resulting into huge cost saving. Because the total cost of the project is 1.8Cr, and for 1 day delay of each milestone they have to pay 0.15% of

the total project cost. Because of the weekly meetings, all the workers are motivated by the engineers, resulting into around 5%-7% increased efficiency of workers. By maintaining good relations with suppliers and offering about 5% more wages to the workers, labor and material constraints are removed, resulting into timely completion and cost saving. But, while offering extra wages, promise has been taken from the workers that they will finish the work in scheduled time, so the chances of loss were removed.

5. CONCLUSIONS

In this work Last Planner System which is the technique of lean construction is used. As the cost of delay for 1 day in medium scale construction is neither a small amount nor a large amount, generally planners get confused whether to invest fort timely completion or not. But from this study it can be concluded that by investing small amount for planning very large amount can be saved. At the starting phase huge resistance from workers was experienced, but after convincing them they have contributed very well. For implementation of LPS no extra investment is required other than a good planning person. And by simply spreading awareness amongst workers and maintaining good customer supplier relations we can easily achieve the desired goal.

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