KICEM Journal of Construction Engineering and Project Management
Online ISSN 2233-9582

www.jcepm.org
http://dx.doi.org/10.6106/JCEPM.2015.5.2.011

A Systematic Approach Of Construction Management Based On Last Planner System And Its Implementation In The Construction Industry

S M Abdul Mannan Hussain[1], Dr.T.Seshadri Sekhar[2] and Asra Fatima[3]

Abstract:*The Last PlannerSystem (LPS) has been implemented on construction projects to increase work flow reliability, a precondition for project performance againstproductivity and progress targets. The LPS encompasses four tiers of planning processes:master scheduling, phase scheduling, lookahead planning, and commitment / weeklywork planning. This research highlights deficiencies in the current implementation of LPS including poor lookahead planning which results in poor linkage between weeklywork plans and the master schedule. This poor linkage undetermines the ability of theweekly work planning process to select for execution tasks that are critical to projectsuccess. As a result, percent plan complete (PPC) becomes a weak indicator of project progress. The purpose of this research is to improve lookahead planning (the bridgebetween weekly work planning and master scheduling), improve PPC, and improve theselection of tasks that are critical to project success by increasing the link betweenShould, Can, Will, and Did (components of the LPS), thereby rendering PPC a betterindicator of project progress.*

The research employs the case study research method to describe deficiencies inthe current implementation of the LPS and suggest guidelines for a better application ofLPS in general and lookahead planning in particular. It then introduces an analyticalsimulation model to analyze the lookahead planning process. This is done by examining the impact on PPC of increasing two lookahead planning performance metrics: tasksanticipated (TA) and tasks made ready (TMR). Finally, the research investigates theimportance of the lookahead planning functions: identification and removal ofconstraints, task breakdown, and operations design.The research findings confirm the positive impact of improving lookaheadplanning (i.e., TA and TMR) on PPC. It also recognizes the need to perform lookaheadplanning differently for three types of work involving different levels of uncertainty:stable work, medium uncertainty work, and highly emergent work.The research confirms the LPS rules for practice and specifically the need to planin greater detail as time gets closer to performing the work. It highlights the role of LPSas a production system that incorporates deliberate planning (predetermined andoptimized) and situated planning (flexible and adaptive). Finally, the research presents recommendations for production planningimprovements in three areas: process related, (suggesting guidelines for practice),technical, (highlighting issues with current software programs and advocating theinclusion of collaborative planning capability), and organizational improvements(suggesting transitional steps when applying the LPS).

Keywords—Continous Improvement System, Tasks Made Ready,Construction Management, Last Planner System, Master schedule, Look-ahead schedule,Percent planned complete, Make work ready planning.

I. INTRODUCTION TO THE PROBLEM

Construction management suffers from many problems and the majority are practical which need to be solved or better understood. As a result, the construction industry is overwhelmed by delay and often has suffered cost and time overrun. In their critical evaluation of previous Studies on construction delay, reported that the poor project management was a dominant and common reason for delay in construction projects.

The goal of this research is to close the gap between long-term and short-term planning.The strategy for achieving this goal is to improve lookahead planning and increase the connectedness between weekly work plans and the master schedule, by increasing the selection and execution of tasks critical to project success. This is expected to make PPC not only a measure of reliable release of work from one specialist to the next (and hence a proxy for increased labor productivity), but also a measure of project progress. To achieve this goal an understanding of system design and execution is required.

II. LITERATURE SURVEY

Mossman (2013) proposed that Lean Construction using the Last Planner System influences construction culture by encouraging collaboration, transparency, trust, reliability of scheduling and delivery of value while, consuming the fewest resources. Henceforth, overcoming natural cultural issues of poor quality work and overruns in time and cost.

[1] Research Scholar, GITAM University, Hyd Assistant Professor ,Dept. of Civil Engg Malla Reddy Engineering College (Autonomous), Secundraba
[2] Project Guide, Professor & HOD GITAM University, Hyderabad campus Department of Civil Engineering
[3] Research Scholar, GITAM University Assistant Professor, Civil Eng. Dept Muffakham Jah Engineering College Banjara Hills, Hyderabad

Hamzeh (2011) presented a framework for successful implementation of the Last Planner System on construction projects. However, when the entire Last Planner System (master scheduling, phase scheduling, lookahead planning, and weekly work planning) is executed and updated as designed, PPC should be an indicator of project progress; i.e., PPC and progress should vary with eachother. This claim can be expressed as a complex hypothesis.

Wambeke et al. (2011) conducted a nationwide survey that identified the most prevalent causes and magnitudes of variation on the basis of the perceptions of craft workers, Foremen, and project managers. Their research also quantitatively analyzed the underlying structure of the causes of variation using factor analysis. Factor analysis was used to develop various factors that should be focused on the planning process on the basis of the number of trades involved.

Seppänen et al., (2010) stated that Look-ahead planning, as part of the Last Planner system, could be used to set deliverable milestones on the planning timeline. The milestones, acting as deadlines, can then be used as the benchmark from which reverse phase scheduling is performed where activities are distributed accordingly and the production rate of each activity is adjusted within feasible limits to meet the imposed takt time.

Liu and Ballard (2009) demonstrated how the use of the LPS method can increase both the Planned PercentComplete and productivity as well and to create a more reliable weekly work plan.

Hamzeh (2009) highlighted two sets of factors, local and general, impacting the implementation of new methods, in general, and the LPS, in particular. Local factors are potential challenges attributed to project circumstances and the team including: fairly new experience in lean methods, traditional project management methods, novelty of LPS to team members, fragmented leadership, and team chemistry. General factors impacting the implementation of a new process include: human capital, organizational inertia, resistance to change, technological barriers, and climate.

Hopp and Spearman (2008) highlight two types of variability in a manufacturing production setting: (1) process time for a task executed at a workstation and (2) the rate of task arrival at a workstation. The quest to reduce the negative impacts of variability and increase the reliability of workflow has lead to the development of the Last Planner system (LPS) for production planning and control. This system has been successfully implemented on construction projects to increase the reliability of planning, improve production performance, and create a predictable workflow.

Ballard et al. (2007) studied the implementation of LPS on many construction projects and reported various implementation obstacles. Projects in the study experienced strong resistance to change on the part of project team and members within the organization. In some cases, implementation challenges were the result of a lack of leadership during the process. In other cases, there was a lack of commitment by upper management or top down mandates without active support.

Sacks and Goldin (2007) proposed a management model for the construction of high-rise apartment buildings. The model applies lean construction principles to reduce cycle time, improve cash flow, and increase flexibility to provide varied interior designs with short lead times. As part of the development of the lean management model, simulation was used to explore the impacts of the model prior to implementation in practice.

Ballard & Howell, (2004) stated that production planning and control system is the Last Planner system (LPS) which has been successfully implemented on construction projects to increase the reliability of planning, increase production performance, and improve workflow in design and construction operations.

Liker, (2004) implemented that the first requirement for creating a continuous flow is identifying the takt time and producing accordingly. Takt time is the time set for the supply of a certain process and is derived from the customer demand. "It is the heart beat of one piece flow". The benefits that takt time introduces to the project are reducing variability, decreasing the whole project duration and minimizing the cost of the project. This paves the way for creating continuous flow that allows us to see the problems in advance.

III. OBJECTIVE OF THE WORK

IN THIS CONTEXT, THREE OBJECTIVES ARE DEFINED.

Objective1: Understand the reasons behind the poor connection and widegap between long-term planning (master scheduling) and short-term planning(weekly work planning).
Objective2: Understanding the reasons is the first step to formulatingimprovement strategies as one cannot manage what one does not understand. Thisrequires a study of current planning processes and suggesting improvements.
Objective3: Explore and experiment with methods for increasing theconnection between weekly work plans and the master schedule while increasing PPC. This entails improving the lookahead planning process that links weekly workplanning and master scheduling processes. Accordingly, an understanding of the status of current lookaheadplanning processes is required before suggesting processimprovements and applying them on construction projects.

VI. METHODOLOGY

4.1 LAST PLANNER SYSTEM

The Last Planner® (sometimes referred to as the Last Planner® System) is a production planning system designed to produce predictable work flow and rapid learning in programming, design, construction and commissioning of projects. Last Planner® was developed by Glenn Ballard and Greg Howell. LCI licenses the use of these processes and related IP to various organizations, including most recently the Associated General Contractors of America.

The Last Planner® workshops and seminars are designed to introduce participants to the five elements of the Last Planner® :

- Master Scheduling (setting milestones and strategy; identification of long lead items);
- Phase "Pull" planning (specify handoffs; identify operational conflicts);
- Make Work Ready Planning (look ahead planning to ensure that work is made ready for installation; re-planning as necessary);
- Weekly Work Planning (commitments to perform work in a certain manner and a certain sequence); and
- Learning (measuring percent of plan complete (PPC), deep dive into reasons for failure, developing and implementing lessons learned).

In recent years, use of Last Planner® on projects and within both design and construction firms has increased geometrically. As a consequence, demand for coaching and teaching consultants has also substantially increased. We are committed to being a resource to those who wish to undertake this robust planning system.

FIGURE I
Last Planner system

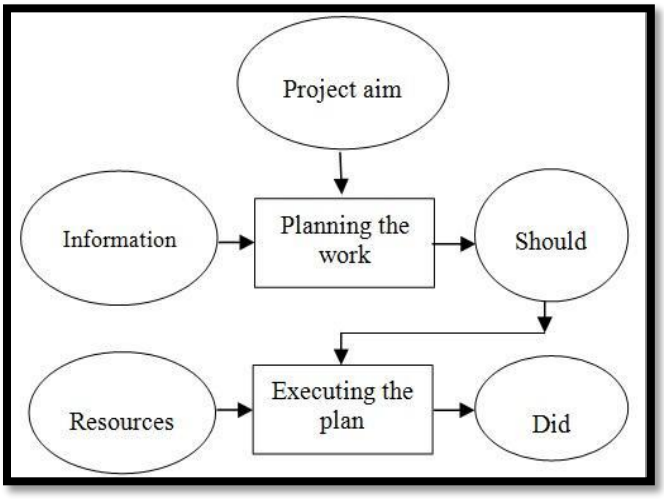

FIGURE II
Traditional planning process

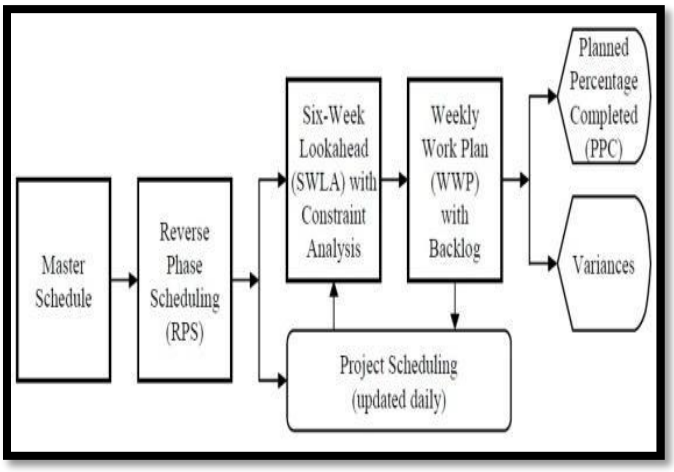

FIGURE III.
The Sequence of Last Planner Process

The most of researcher indicates that Last Planner System (LPS) is a technique of lean construction, which gives sequence of work and project variability in construction. The Last Planner is the person/team assign for operational planning, which facilitate to improved sequence of work, completion of individual assigned task at the operational level. In the last planner system, the sequences of work including (master schedule, reverse phase schedules , six-week look ahead, weekly work plan, percent plan complete, Constraint analysis and Variances analysis) provides optimized schedule planning through a pull technique, sequence which matches work flow and capacity for executing work. It will achieve Should Can Will which is the key words weekly work plan “Should” indicates the work required to be done according to planned schedule requirement. “Can” indicates the work with can actually be accomplished on account of various constraints on the field. “Will” reflects the work commitment. Which will be made

after all the constraints are taken into account. Various way to improve the work flow are included two-way communication, constraints analysis process for six- week look ahead before activity are executed, the analysis of reasons for variance after activity are completed, the efforts of each planner, and the guidance of the project team. Traditional practices do not consider a difference between what should, can, and will be done, the assumption being that pushing more tasks will result in better results. The important function of the Last Planner technique is to change optimistic planning by evaluating workers performance of based on their skill to consistently achieve their commitments. The basic aim of Last Planner is to pull activities by reverse phase scheduling through team planning and minimize resources in the long-term.

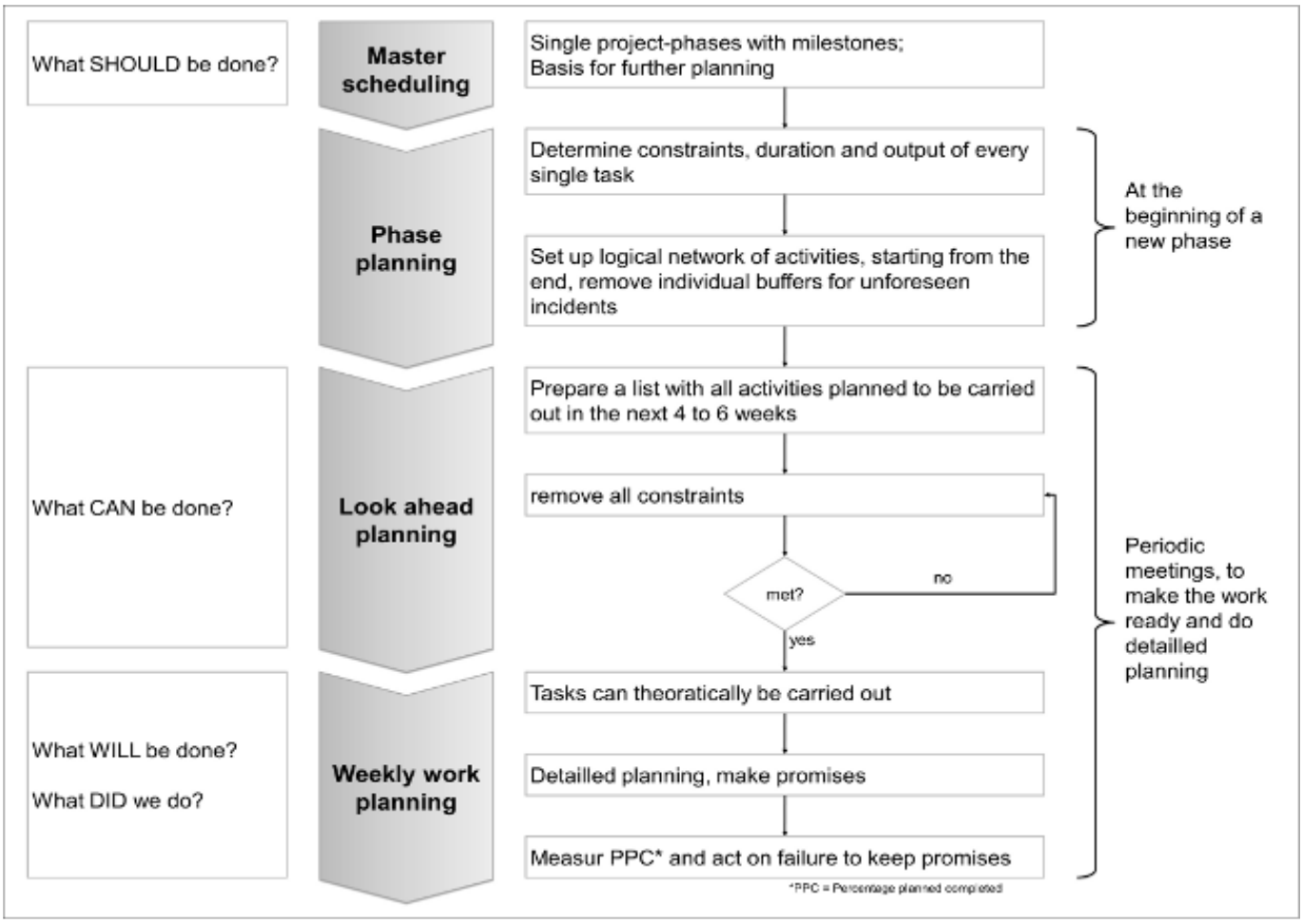

FIGURE IV
PROCESS OF LAST PLANNER SYSTEM

4.2. SEQUENCE OF LAST PLANNER SYSTEM

4.2.1. MASTER PLAN

This is to obtain a general plan and identify all the work packages for the whole project showing the main activities, their duration, and sequence.

4.2.2 PHASE PLANNING

It is about dividing the master plan into various phases detailed work plan and provide aims that can be considered targets by the project team. Phase planning is a gap between the master plan and look ahead planning.

4.3.3. LOOK AHEAD PLANNING

In the look ahead planning management focusing and give attention on what is supposed to happen at some time in the future, and to take actions in the present that cause that future work.

4.4.4. WEEKLY WORK PLAN

This is the plan taken from the contractor tasks for the next day or week via weekly meetings. Weekly meeting help to plan the work that will be done in the next week. The weekly work plan meeting covers the weekly plans, safety issue, quality issue, resources, construction methods, and any problems that occur in the field.

4.5.5. PERCENT PLAN COMPLETED (PPC)

In this improving the project planning by continual evaluation and learning from stoppage. PPC is determining of the percentage of promises made that are delivered on time. PPC can be calculated as the number of activities that are completed as planned divided by the total number of planned activities. 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.

4.3. BENEFITS OF LAST PLANNER SYSTEM (LPS)

- Smooth work flow.
- Expected work plans.
- Reduced cost.
- Reduced time of project.
- Improved productivity.
- Greater collaboration with field personnel and sub contractors.

V. ONCLUSION

In conclusion, the developed model is more accurate and simple to use, with much time saving compared to other method. 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. 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.

REFERENCES

[1]. Mossman, Alan (2013) Last Planner® : 5 + 1 crucial & collaborative conversations for predictable design & construction delivery. http://bit.ly/LPS-5cc (22-Apr-13)

[2]. Hamzeh, F.R. (2011). "The Lean Journey: Implementing the Last Planner System in Construction", Proceedings of the 19th Annual Conference of the International Group for Lean Construction, IGLC 19, 13-15 July, Lima, Peru, pp. 379- 390

[3]. Wambeke, B. W., Hsiang, S. M., and Liu, M. (2011). "Causes of variation in construction project task starting times and duration." *J. Constr.Eng. Manage*, pp.137(9), 663–677.

[4].Seppänen, G. Ballard, and S. Pesonen, The Combination of Last Planner System and Location-Based Management System, Lean Construction Journal, (2010) 6 (1), pp.43-54.

[5]. Liu, M., and Ballard, G. (2009). "Factors affecting work flow reliability—A case study." Proc. of the 17th Annual Conference of the International Group for Lean Construction, National Pingtung Univ. of Science & Technology, Taiwan, , pp.657–666.

[6]. Hopp, W.J., and Spearman, M.L. (2008). Factory Physics, 3rd Ed., Irwin/ McGraw-Hill, Boston,720 pp.

[7]. Hamzeh, F.R. (2009). Improving Construction Workflow – The Role of Production Planning and Control, PhD Dissertation, University of California at Berkeley, Berkeley, CA, 273.

[8] .Ballard, G., Kim, Y.W., Jang, J.W., and Liu, M. (2007). Road Map for Lean Implementation at the Project Level, Research Report 234-11, Construction Industry Institute, The University of Texas at Austin, Texas, USA, 426.

[9] .Sacks, R., and Goldin, M. (2007). "Lean management model for construction of high-rise apartment buildings." J. Constr. Eng. Manage., 133(5), pp.374–384.

[10]. Ballard, G., & Howell, G. (2004). An Update on Last Planner, Proc. 11th Annual Conf. Intl. Group for Lean Construction, Blacksburg, Virginia, USA, 13.

[11]. Liker, J. (2004). The Toyota Way, McGraw-Hill, New York.

ABOUT AUTHORS

S M Abdul Mannan Hussain, B.E,M.E,(Ph.D)
Research Scholar, Gitam University,Hyderabad
Assistant Professor, Civil Engg Dept.
Malla Reddy Engineering College (Autonomous)

Dr.T.Seshadri Sekhar Tirumala
Ph.D,M.Tech,M.s (Software Systems) Head of the Department, GITAM UNIVERSITY,Hyderabad. CIVIL ENGINEERING DEPARTMENT

Asra Fatima B.E,M.E,(Ph.D)
Research Scholar, Gitam University,Hyderabad
Assistant Professor, Civil Engg Dept.
Muffakham Jah College Of Engg & Tech.