

Cycle-Time Improvement Through Collaborative Planning System



Ashish Kumar Saxena, V. Ramani, Praveen Reddy, and K. Ravichandran

Abstract Construction projects especially the residential projects suffer a huge delay due to miscoordination. As a construction project involves a large number of stakeholders, it demands a closed-loop collaboration and seamless coordination for a successful project completion. With more and more regulations such as RERA coming in, completing the project within the stringent timelines is inevitable. Collaborative planning system (CPS) is one of the most easy to understand yet most difficult to implement lean management concept for any construction project. CPS is a comprehensive lean management concept that encompasses the benefits of lean tools such as last planner system, big rooms, PPC, and root cause analysis. The site under study has shown a considerable savings in time in the overall phase through cycle-time tracking against the day-wise plan for typical floors. A combined result of utilizing the major lean tools enabled the project team to continuously achieve 6–7 days of cycle time. Further extending the micro-monitoring to above terrace works facilitated the completion in average 39 days against the pre-planned duration of 60 days. The implementation has resulted in a saving of approximate 50 days (12% time) for the phase which facilitated over-and-above cost benefits due to early demobilization of resources. This paper captures the comprehensive lean thinking and construction site-based implementations incorporating the lean tools.

Keywords Comprehensive cycle-time improvement · Productivity improvement · Collaborative planning system

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1 Introduction

Any construction project is a network of numerous small and big activities. The interdependency of these activities is of such a scale that any effect on a small activity may have a tremendous impact on a large activity. The project suffers a cascading effect due to change in even a small activity. It is evident from the visuals from a construction project that most of the time is wasted in non-value added (NVA) or non-value-added but necessary (NVAN) activities due to process inefficiencies. These network of inefficiencies have a cascading impacts on the project as a whole.

It is a general practice at construction project sites to revise the schedule frequently. A few of the major causes for the revisions are uncertainty on availability of resources, lack of clarity of instructions, incomplete information, etc. Many a times, this leads to delays or rework in other scenarios. The amount of follow-ups and coordination required in such projects is huge which leads to low productivity and cost overruns. These inefficiencies often lead to underutilization of resources.

2 Literature Review

Lean project management or lean project delivery system is a phased system of reducing wastes in processes and workings. In manufacturing, these phases are project definition, design, supply and assembly [1]. Contemplating the analogy in construction industry, these phases can be broadly divided as—project definition, design, planning (on-site), execution, and hand over. All these phases share a to-and-fro relationship during the project life cycle. As the project progresses, the feedback loop starts to accommodate more stakeholders that increase the chances of creation of more wastes (considering the delay in decision making). Lean principles thus aim for the continuous elimination of all types of wastes. One of the major causes as understood from the industry practitioners is that a lot of waste is generated in process due to lack of coordination and miscommunications at the dynamic construction sites. After reviewing the studies conducted on the fundamental lean principles and how they create wastes in manufacturing industry, similar wastes were observed in the construction industry as well. Simple and specified pathways, supplier–customer relationship, and coordination through rich communication are a few of the major lean principles which need special focus to have a smooth project life cycle [2].

3 Challenges to the Flow of Work

People are the main project drivers. Apart from being the biggest supporters, people are also the biggest resistance to any workflow. Thus, it becomes quite important to involve the people in decision making. It is evident from the current scenarios

at any construction site that faces a huge challenge of lagging in inter-dependent activities. This is mainly due to the fact that most of the departments work in silos. Every function is considered as an independent activity and is planned individually. The feedback at a later stage hampers the flow of work that results in delays, cost overruns, penalties, and negative brand value.

Construction projects have witnessed tremendous changes in terms of complexity and size of projects over a span of few decades. Every construction project is unique in nature and involves large number of interrelated activities. This close-knit network of interdependency involves a large number of stakeholders such as owners, designers, contractors, sub-contractors, and suppliers. Thus, collaboration plays a vital role in success of any project. This involves dealing with large amount of information, and the correct information is made available to the correct stakeholder at the correct time [3].

Collaborative planning system or CPS is one of such tool that breaks the walls of the silos and facilitates a seamless flow of information and ideas across the functional and departmental boundaries.

4 Objective

The major focus of the study can be summarized in the below mentioned points:

1. To identify the bottlenecks in the process through brainstorming sessions and root cause analysis.
2. To establish a system of collaborative planning system that facilitates seamless exchange of information and ideas across the departmental boundaries.
3. To appreciate the benefits realized in improving the cycle time in a residential project due to implementation of comprehensive lean management principles.

5 Collaborative Planning System (CPS)

Collaborative planning system (CPS) is one the interesting and advanced collaboration system which has started finding its utilization in the Indian construction industry [4, 5]. Collaborative planning approach refers to establishing a practical framework incorporating the best practices from various management concepts such as project management and lean construction to have an improved communication, better coordination, and effective collaboration among project professionals from across the departments and organizations. CPS is basically application of practices followed in systematic and structured way which can significantly improve the project performance and workmen productivity. CPS has four levels of planning which includes reducing the monthly plan from the master plan, look-ahead plan from the monthly plan, and daily plan from the weekly plan. There are chances of weekly and monthly plan to get revised more frequently than the master plan.

In a construction project, the interdependency of people is much higher than any other industry. Project has to face a multiple issues like unavailability of workforce, delay in finalizing vendor, error in drawings, waiting for approvals, etc., which will lead to crisis and require firefighting unless these problems are identified at early stage, channelized to the right people and resolved jointly.

6 Implementation

A comprehensive planning system’s implementation demands a thorough study of the processes and clarity on the activities and their correlations with the subsequent activities. CPS works on the feedback mechanism where the weekly plan is revised based on the percent plan complete (PPC). Figure 1 clearly depicts the schematic diagram of collaborative planning system implemented at a construction project.

In CPS, the main schedule is broken down into phased schedules with sub-milestones. The week in which the work is planned also addresses the backlogs of the previous weeks which is reviewed along with the look-ahead window of say typically 2 to 3 months.

Master construction plan is used to prepare the look-ahead plan which is actually the plan for next 60 or 90 days. Based on this look-ahead, a weekly (or monthly) plan is prepared that is tracked and updated on a regular intervals. With all the major stakeholders, micro or daily plan is prepared in consultation with the last planner [6]. Along with the plan, constraints are discussed, and the root causes for the past failures are deduced and discussed. Due responsibility is allocated for all the root causes and constraints. The progress is regularly updated on a kanban board. At the end of the week (or any pre-defined interval), the percent plan complete (PPC) is calculated which serves as the input for the weekly plan for future. PPC is used for checking the efficiency of the system and is kept improving all the time. It also enables the major factors for the failure through use of lean tools such as cause and effect

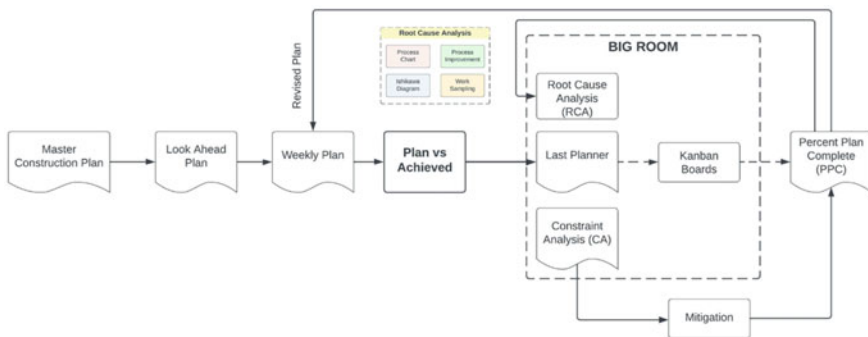


Fig. 1 Schematic diagram of collaborative system

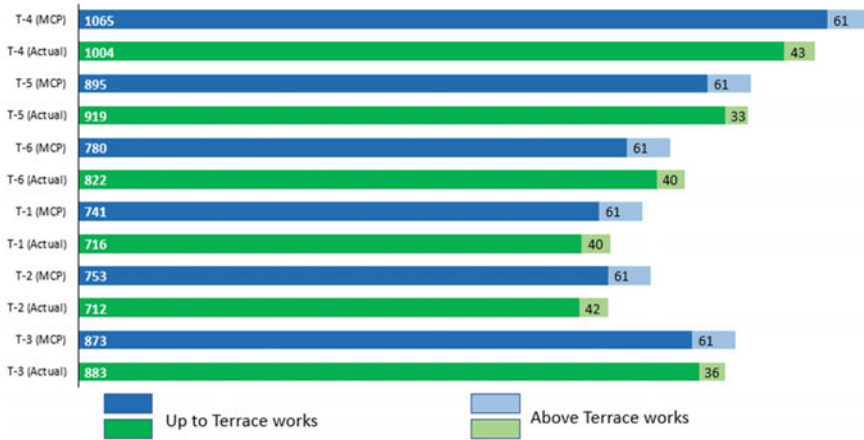


Fig. 2 Tower-wise tracking against the MCP

diagram, process charts, and work sampling. Finally, the big room meetings bring all the stakeholders in the same space along with the front-line supervisors. The essential planning involves the supervisors based on the inputs from other stakeholders such as resource managers, design team, project managers, and project controller. Furthermore, the progress is also tracked against the 10-days standard cycle-time template which is updated every day, the backlog is discussed in the morning (daily) huddles, and the issues are resolved.

The same tracking mechanism is followed throughout the project life. The impact of the micro-level monitoring can be deduced from the saving of 53 days for the phase. Figure 2 shows the actual duration taken to complete the various towers against the duration considered in the master construction program (MCP).

Various lean tools such as big rooms, last planner system, constraint analysis, and variation analysis were deployed, and the synergic impact of the tools were compared against the performance in similar projects and against the master construction plan. Figure 3 shows the various lean tools implemented at the project site for better management.

7 Results and Conclusions

Lean tools such as root cause analysis, constraint analysis, big room meetings, and last planner system enabled the project team to narrow down the major factors for the in-efficient process system. One of the major factors in the seamless flow of work is the lack of an efficient system communication and coordination. This also captures the fact that most of the information lies in silos that hinders the holistic decision making at the project level.

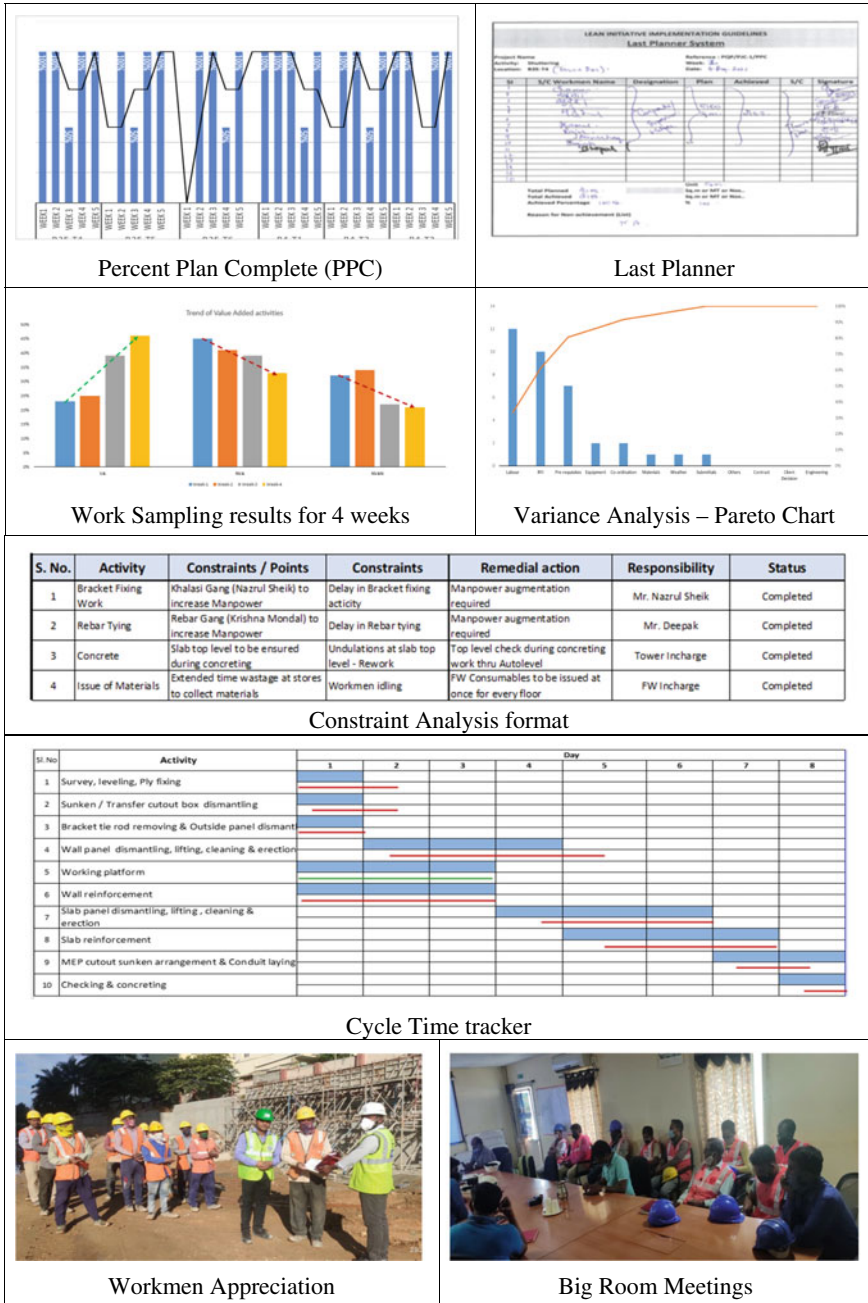


Fig. 3 Various lean tools implemented as a part of collaborative planning system

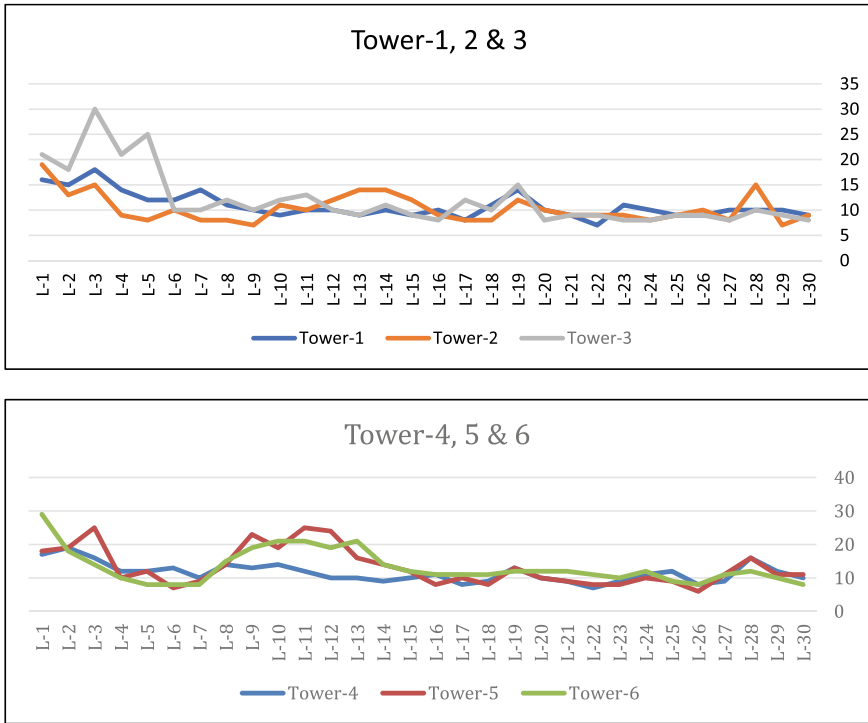


Fig. 4 Cycle-time trend

And the collaborative planning system is a team-based system where everyone becomes responsible to achieve the milestone by reducing process constraint. Overall the phase was completed 53 days ahead of the schedule.

Tower-wise cycle-time details are shown in Fig. 4.

The early completion had many benefits, and a few of the major ones are listed below:

- Early handing over to customer;
- Early demobilization of resources that enabled savings on indirect cost;
- Created a benchmark for the upcoming projects;
- Cultural change due to improved coordination and communication by breaking the silos;
- Reliability on resource planning was improved;
- Improved productivity through innovation as the external stakeholders are also involved and they bring diverse perspective into the process;
- Indirectly enhanced performance on ESG parameters such as controlling material waste and reduction in carbon emissions.

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