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LAST PLANNER IMPLEMENTATION IN BUILDING PROJECTS

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ABSTRACT

Lean Construction method is considered the core principle behind the Identification and Elimination of various wastes in construction. While there are many Conventional Lean Tools like work standardization, doing it right first time, Audits, Just in Time etc., Lean construction identifies and deals with seven forms of waste which is nothing but non-value adding items in construction and also suggests ways and means to eliminate them. As such material wastage can be easily quantified, labour wastage and non-value-added activities by labour was much higher compared to material wastage generated in the construction sites. While, Lean production attempts to integrate the concept of transformation, flow and value, a method such as Last planner when implemented for various finishing activities in building projects, there really exists a sense of deep involvement and a great achievement of the project goal. We discuss in this paper the methodology adopted to implement the Last Planner tool of Lean construction and the improvement thereafter.

KEYWORDS

Lean construction, Lean Principles, Last Planner, Labour activities, target works

INTRODUCTION

As such when we talk of construction, the immediate characteristics that go in our mind are uniqueness, complexity and end result orientation. In order to execute an activity, the first and foremost step is the thought of answering "how", "when" and most importantly "by whom". Though modern constructions have started to improvise the construction methodology by means of mechanization, a large part of any activity is dependent on the construction workers, whom we will hereinafter refer to as "Labours" throughout this paper. Lack of skilled labour and low productivity may seem to be the immediate cause of wastage of labour resource. This is significant mainly in the finishing activities of any building project, since the aesthetics and a feeling of good appearance is mind oriented which can be well organized only with the help of labours. Hence the most important phase of the project, which is the planning stage was taken into account and the Lean

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principle of Last planner was induced into some of the finishing activities of a multistoried building project in the outskirts of Chennai, Tamilnadu state, South India. This Last planner system of Lean principle was adopted in a systematic manner in few of the finishing activities and the improvement in the project performance and decrease in the labour wastage was noted on a day-to-day basis.

LAST PLANNER SYSTEM

Last Planner System is a technique that modulates the system workflow of a project and addresses the variance in the construction. As the name suggests, the Last Planner is the person or the group, which is responsible and accountable for the planning operations at the root level through which the production unit is controlled and individual assignments are clearly specified. In the Last Planner System, the work flow of the planning system moves from the bottom level of constraint and variance analysis to the Master Schedule. The middle stages of planning such as the percent plan complete, weekly work plan, reverse phase schedules are altered in accordance with the root level planning. Hence, this system develops and creates an efficient schedule of planning framework with a pull technique, which regulates the workflow and sequence of activities and the rate of activity completion. Last planner system also correlates the process flow and capacity. It also creates new methods for execution of activities and sustains communication between trades. As stated by Ballard in his works on Lean construction, the Last planner system integrates the key words such as "Should" which indicates works to be executed according to the planned schedule, "Can" indicating activities which can be accomplished in spite of various constraints and "Will" indicating a definite commitment of the last planner.

The main role of the Last Planner tool is to bring about a realistic planning from the optimistic planning approach and this is made by scrutinizing the performance of workers not only based on their productivity but also their ability to achieve their goal in a realistic and a committed manner. The ultimate aim of the Last planner is to pull the activities by reverse phase scheduling method and integrated planning. The procedure of implementing Last planner system is as follows:

- Specifying what tasks should be done when and by whom, from the phases to the mid-phases of the milestones, from the mid-operations of the phases to the end phase, and the process within various operations.
- Developing all the tasks and keeping it in a ready to be performed mode.
- Re-planning to accomplish the overall project objectives.
- Choosing the daily tasks based on weekly work schedules to decide the next immediate work to be performed.
- Making release of work between specialists reliable.
- Making visible the current and future state of the project.
- Measuring planning system performance.
- Learning from plan failures.

Here is where the Pull Planning technique that is used as a part of Last Planner System to develop a plan for doing work at any level of task breakdown is brought in to the phase schedule. Pull planning can be used to plan work in any time horizon, or to sequence activities as a part of a production plan. The most important feature of pull planning is that it should involve all who are responsible for delivering the work and with authority to make decisions, plus others who can provide needed information. Hence, the Last planner refers to the individual (front line supervisor) or the group, which is committed to measurable near-term tasks. The Last planner typically is responsible and accountable for the unit's ability to produce and for the output, they produce. The Last planner may self-perform some of the work.

METHODOLOGY OF IMPLEMENTING LAST PLANNER SYSTEM

To start with, initially the Engineers had started observing and noting down the time taken only on the execution of the various activities and the consumption of labours on a day-to-day basis for that particular activity. This was more of a supervisory work. The next stage was the initiation of the last planner system wherein the gypsum plaster works was monitored on an hourly basis, starting the day with noting down the number of labours (Masons plus Helpers) involved and the materials organized to execute a particular stretch of gypsum plastering. This data collected on an hourly basis was then summarized on a daily basis. While implementing the last planner system, the main components of the lean construction techniques analyzed and noted down were the actual timings of works being executed by individual labour, the time spent on unproductive works by these labours. As such, the time wasted for various factors, which were analyzed, were listed down in minutes and tabulated as given in the table 1 below. The activities bore the effect of timings wasted which were recorded on hourly basis by each of the labour executing a particular common activity in a common place, for example, a floor of a multi-storied building.

During the initial stages of works, only the observation was made on the activities being executed by the labours. The next stage was the noting down of the wastages being incurred by the labour resources on an hourly basis such as usage of mobile phone, taking rest in between for no reason, arriving late after a bio-break or lunch, waiting for enabling resources such as water for mixing the mortar, builder's hoist for shifting the materials etc., The datas were tabulated in a excel sheet as given below in Table 1 and Table 2 for the various non-compliances and non-value adding activities. As such these activities may not be completely overcome and a proper planning done to match with the hourly productivity, but to a greater extent a realization and a proper correction of these non-value added activities will definitely enhance the quality of time spent by the labours and improve upon the work involvement and provide a sense of satisfaction of achieved what is being planned by the Last Planner.

HOUSING PROJECT

Table 1: Wastage of time of the Labours – Pre-Lunch (time in minutes)

No.	Category	In Time	8 am-9 am	9 am - 10 am	10 am -11 am	11am-12pm	12 pm - 1 pm	1 pm - 2 pm	Total time wasted
1	Mason1	8 am	5	14	0	7	5	lunch	31
2	Helper 1	8 am	10	5	7	5	0	lunch	27
3	Mason 2	8 am	10	0	10	5	10	lunch	35
4	Helper 2	8 am	20	10	5	0	7	lunch	42

Table 2: Wastage of time of the Labours – Post-Lunch (time in minutes)

No.	Category	2 pm-3 pm	3 pm-4 pm	4 pm-5 pm	5 pm-6 pm	Total time wasted
1	Mason1	10	5	15	5	35
2	Helper 1	20	5	10	7	42
3	Mason 2	15	10	5	5	35
4	Helper 2	25	5	5	10	45

Item of work done:Gypsum Plastering
Total No. of gypsum bags issued: 25
Total No. of gypsum bags used: 24
Area to have been completed: 44.5 sqm
Actual area completed: 35.67 sqm

ANALYSIS OF THE LAST PLANNER SYSTEM

While studying this non-value added activities, many of the systems were found to add value and achieve what has been planned by implementing the Lean system through the Last planner.

Before Lean implementation, though a proper provision of temporary mobile toilet was kept for the labours in every fourth floor of the multi-storey building, there was no provision of drinking water. Hence, labours had to walk down for more than twenty floors to have drinking water. After the implementation of Lean system, the workers were advised to carry water bottles while coming for the day's work and were taught of how this could help them to avoid wasting time by not accomplishing their day-to-day task by theoretically counting the minutes they spent on transit for drinking water.

Before Lean implementation, the main contractor who had engaged masons and helpers had no idea of how to allocate and level his resources of labours containing masons and helpers. Hence for a smaller area of gypsum plastering work to be done in a day, four masons and one helper were engaged, but for a larger area, 2 masons and one helper was engaged. The contractor who was paid on measurement basis had not been

able to get his payment. After Lean implementation, the resource leveling was done according to the area of work to be accomplished for the day and hence the contractor was able to achieve more with the same number of labours.

While the targets were set with the weekly plan on an area basis for the gypsum plastering works, the uneducated labours were not able to realize their target for the day before implementation of Lean. This resulted in a high level of mismatch of the quantum of work done with the rates fixed for carrying out the activities and hence the labours were not able to get their payment due in relation with the quantity of work done. However, these labours were educated by correlating their quantum of work target with the easily identifiable count of the target they have to achieve as a part of Lean implementation. At times, when the payment was made on measurement basis to the main labour contractors, who had arranged for the labours, the rate system of payment based on the quantity of work done was falling short heavily when correlated with the lump sum payment on daily basis made to the labours by the contractors. Hence, the daily targets were clearly understood and achieved by the labours which helped not only in realizing the payment by the contractors, with respect to the quantum of work done by the labours, but also a sufficient amount of profit was also earned by the labour contractors. In addition, there was a sense of commitment and a balance between the works done and the payment realized by the quantum of the works done.

Preparatory works plays a major role in the completion of the main activities. As such, these preparatory works do not find a place in any of the schedule. For example, of the button marks to achieve even thickness of the gypsum plaster is definitely a time consuming preparatory work, but when it is not given prior importance and is done just before the start of the plastering work, the daily planned target could not be achieved. Here is where the Lean system of the last planner came as a solution that the mason executing the main activity stayed back the previous day and completed the button marks to make sure that the main activities started on time the following day to achieve the day's target as planned by the last planner.

The related works for the activity taken for the last planner i.e., the coordination of MEP works was a hindrance for the smooth flow of the activities planned. For example in the multi storeyed building, while the gypsum plastering works were getting completed in the 21st floor, the wall concealed electrical works were incomplete in the next floor i.e., 22nd floor wherein the gypsum works were to be taken off. This resulted in the stoppage of civil works by the mason, sometimes even for days together. This would be resulting in a major overall delay in not only in a particular building, but also in the delay in the project. Hence, last planning system was jointly made by both the labours of the civil and electrical discipline. The integrated system of planning was also made possible in this system. The integrated system brings about a direct and a straight relation and a good flow of activities with respect to the various disciplines such as civil, electrical, mechanical and plumbing works. When this particular activity of gypsum works connected with the masons of the civil discipline had to be planned by the last planner who is the mason in this case, the involvement of the electrical conduiting works which had to be concealed, the plumbing lines which had to be concealed in the walls before the application of the gypsum plaster by the mason of the civil discipline, and also the

overhead piping works for the fire fighting system and the air conditioning system which has to be carried out by the mechanical discipline labours. Hence, there had to be coordinated meeting which had to be conducted by the engineer in charge who is implementing the last planner system through the mason who is carrying out the gypsum plaster works and the engineers of the electrical, mechanical and plumbing disciplines. This meeting not only brought out the particular activity completion of a particular building, but also the overall completion of the activities connected with the various disciplines and the overall completion of the project.

In the system of arranging the materials for the labour who was directly involved in the last planning system, a proper understanding was not held between the labour who did the activity and the lift operator who had to lift and shift the material for the labour to the higher floors. This was mainly due to the fact that the lift operator was working only to the assigned official timings but in order to get the next day's work started on time by the mason, the helper had to work overtime after the end of the day's work and shift the materials. The same was the work hindrance during the resumption of the work after the lunch timings. A coordinated meeting as a part of the lean system implementation helped to successfully gain the benefits of the last planner system since the materials required for the shift of a particular day was supplied to the labour without any stoppage and wastage of waiting or idle time.

A compulsion and a better sense of understanding to achieve the day's target was unable to maintain by the last planner, the labour who had to waste time of climbing down and up the 22nd floor for his lunch. While the labourwho was being paid on the measurement of works done was induced with the quantum of time being wasted for his lunch, the last planner was able to get packed lunch to the work spot, thereby reducing the time taken by him for having his lunch.

There were unnecessary gap of time being wasted while shifting the activity from one work spot to other, though sometimes when both the work spots that is two walls in the same room were nearer for carrying out the gypsum plaster activity. This was due to the time taken for shifting the materials and consumables to the next work spot. As a part of lean system implementation, the helpers who were idle during the time when the masons were carrying out the plastering works arranged for the materials and consumables for the succeeding work spot and hence the idle time was considerably reduced which was caused due to shifting from one work spot to another.

The master plan had the exact sequencing of activities. Hence, in the implementation of the last planner system, proper care was taken to ensure good quality of preceding works were carried out so that there exists a smooth transition and flow of activities as existed in the master plan.

The work methodology also plays a major role in achieving the target of the last planner system. Initial setbacks were seen while doing the plastering since the sequencing was done both from top to bottom and vice versa. A large amount of wastage of materials was created because of this system. Hence, while implementing the last planner system itself, the labour was educated about the time and the material wastage and then a proper work methodology of doing the gypsum plaster from top to bottom was followed.

There were also many hurdles, which were faced during the implementation of the last planner system. It was found that plastering was done from bottom to top of any wall and during this process, a lot of spillover of the plaster occurred while doing the top portion of the wall. Hence the time consumed to finish a wall was more since the spilled over plaster had to be cleaned and the finishing of the bottom portion of the wall was a rework. As a part of the lean construction principle implementation, the masons were instructed to correct their work methodology and then start their gypsum plastering works from top portion of the wall and then go down to the bottom portion of the wall.

Next, the technology plays a vital role in the last planner system in the sense that it helps to speed up the review process and the planning process of the last planner system implementation for the monitoring of the system. But when last planner principles were adopted in the activities of the building project, it was found that these labours were often using the mobile phones in between their activities and then the works got disrupted in between and the productivity of these labours were decreasing. The helpers when they were idle during the process of the activities being done by their masons were also using the mobile phones and this was even sometimes becoming a safety issue apart from the work interruption. These mobile phones could not be totally made to be avoided since for personal use this was the only way of communication since these labours had travelled from far places in order to earn for their living.

Next, in any construction project, among the four factors of Quality, Safety, Economy and Time, Safety is the most primary factor to be considered and given more weightage since the other three factors could be achieved only if the safety of the workers were taken care of. While the labours were working in the higher floors, particularly in the outer portion of the building, the safety tools and appliances, which have to be adopted, has to be very much on the higher side. The safety equipments, the safety tools and the safety tackles, starting from the helmet, to the safety belt and hooking the belt on to the firm support were taking more time in starting of the activity itself. More over since, these labours are mostly uneducated, the adoption of these safety measures was minimal since they were more concentrating on the target achievement for the day. Hence as a part of the last planner system principle implementation, the safety personal protective equipments were given at the ground level itself, which consumed a lot of time before the start of the day's work.

Next, in the gypsum plastering works, it was observed that there was a mismatch in the number of helpers being allocated for the number of masons. While at the start of the activity, one mason would require one helper, but during the course of the execution of the activity these helpers become idle and again the number of helpers would be fluctuating between one for one mason and two for one mason in order to feed continuously the materials for the masons to do the gypsum plastering without any interruption and also to achieve the target planned as a part of the last planner system. But inspite of this, there were more masons than helpers of the ratio of 3:1 in some places, and hence as a part of the lean implementation, the resource levelling had to be done continuously throughout the day for the number of helpers allocated to the number of masons.

CONCLUSION

The modern construction projects are complex in nature and demand to produce the structure in a very short duration is the need of the hour by the client. Though the conventional projects deal with individual activities and control their schedule and cost through various techniques, the overall project delivery is to be achieved keeping the process flow smooth and without any hindrance and this is achieved by adopting one of the Lean Construction methods as explained in this paper. The category of time wasted by the labours were identified, noted and then shown to the Labours who were then able to get a clear understanding of controlling the time wasted which were in their preview and were able to achieve a better nearby target of the work plan. Lean construction tools such as the Last planner systems, though seem to be complex tools theoretically, application of such tools has definitely improved the overall performance of the project by means of work involvement by the last planner, creating a sense of satisfaction of achieving the target by the labour, promises adhered to etc.,, This was possible only by way of measuring the end result on a daily basis. Lean principle suggests that "overall potential" will never be achieved, as pursuit of the ideal performance overtakes all previous performance benchmarks.

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