

Implementation of Last Planner System in Indian Construction Sites: A Case Study

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Abstract

One of the most commonly used tools of lean is Last Planner System (LPS) which achieves goals through social process of collaboration. It is a short term project planning system to produce predictable uninterrupted workflow by creating a set of commitments that coordinates the actions of all stakeholders. The work described in this paper presents results of an ongoing construction project in finishing phase. It focuses on contractor's implementation of LPS to analyze how lean construction techniques improve performance and productivity. The examination completed with the four contractors inquiring as to whether the LPS could be actualized in their development project. The results reveal that implementing LPS had significant improvements over traditional management and a notable increase in average Percentage Plan Completed. The results from the Last Planner system implementation show that identifying the constraints of the planned work leads to an improvement in the percentage and quality of completed activities.

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I. INTRODUCTION

1.1casebackground

It entailed the construction of Villas Project by four different contractors. Every contractor had a similar plan and degree for the building.

i. Location-Kompally

ii. Purpose- Luxury Villas

iii.Structural Consultants- TCA Consultants Pvt. Ltd

iv Architect Consultant-M/s Simha Associates

1.1.1 Contractor-1

First Contractor with code name CTR1 with an average of 27 workers and that includes Engineers,

Builder, Foremen, Carpenters, Plumbers, and Bricklayers.

1.1.2 Contractor-2

Second Contractor with Code Name CTR2 with an average of 35 workers and that includes Engineers, Skilled workers, Carpenters, Plumbers, and Masons.

1.1.3 Contractor-3

Contractor three with code name CTR3 with an average of 29 workers and that includes Engineers, Land surveyor, Masons, bar benders, and Skilled labors.

1.1.4 Contractor-4

Contractor four with code name CTR4 with an average of 43 workers and that includes Engineers,

Land surveyors, Planning engineers, masons, carpenters, and bar benders.

II. SUMMARY OF CONTRACTORS PROFILE

Table 1: Summary of Contractors Profile

Code	CTR1	CTR2	CTR3	CTR4
No. of employees	27	35	29	43
Specialization	Building	Building	Building	Building
Years of experience	8	10	6.5	14

2.1 Case Description

The examination completed with the four contractors inquiring as to whether the LPS could be actualized in their development project. In any case, every one of the contractual workers was willing to be a part of the investigation, and all the four Contractors agreed the proposal to implement the LPS.

The information accumulated was in stages included pre-execution stage, execution stage, and post-execution stage. For the pre-execution stage, the information was received utilizing non-member perceptions and meetings. While for the execution stage, information was gathered utilizing member perceptions and documentary investigation. At last, for the third stage, information was gathered utilizing questionnaires, and this was the post-execution stage. Table 2 shows the phases of implementation of the research.

Table 2: Phases of Implementation

Phase 1	Pre-Execution stage	• Non-Members Opinions
Phase 2	Execution stage	• Contributor opinions
Phase 3	Post-Execution stage	• Surveys

III. PHASE 1 –PRE-EXECUTION

3.1 Observations

We have received the approval from the owner and contractor reached to the whole building work place that the Project was going on and embraced and by site perception, recording and seeing how site exercises were planned, organized, controlled and measured, without essentially interacting with the project participants. The subsequent were the things the investigator observed within the non-member perception:

- Current Planning practice regarding contractual workers and material planning's
- Recurrence of site gatherings
- Site coordination
- Correspondence and connections

3.2 Interview

The meeting sessions were attempted to learn the accessible planning, control, and management system among the four contractual workers hence the project manager's/site in charge was examined. The investigation gave a definite record of how every contractor planned and carried out their project. A semi-organized meeting utilizing open-finished inquiries was utilized to find the general planning method of the individual contractor.

3.3 Summary of Phase-1

The information received from the four contractors through the responses and the meeting sessions examined in this segment. We began with the non-member responses; this was followed by the meetings, which filled in as an approval of the conclusion got from the observation's procedure. These discoveries from the specific contractor are deliberated here.

3.3.1 Contractor 1 (CTR1)

As per the non-member opinions, the researcher recognized that labor was not synchronized adequately at the work place and manufacturing

supplies were initiate to be situated in various areas of the work locations with very weak housework. We saw that there were no work place conversations set up and this was affirmed amid the meetings wherever the respondents expressed that there was no formal course of action to grasp normal gatherings relatively gatherings happened. Another test practiced at the work place was the absence of specialized tools and an alternate connection among the task administrator and the work place architect and this influenced how function was completed and this made pressure among the other task members. Thus, the meetings uncovered that there was no specialized instrument (i.e., walkie-talkie) accommodated the work place and that the service provider did not exercise a specific task administration framework. They also demonstrated that they didn't know about Lean Construction or the LPS.

3.3.2 Contractor2 (CTR2)

As per the non-member opinions, the analyst saw that the foremen facilitated work at the work place, and no consideration compensated to material stream and access (work place development). The analyst also managed that week after week site meeting were arranged yet could rarely happen due to the phase of work they were managing. It was decided during the meetings through the respondents who expressed that conferences were planned to occur on a week after week premise yet were not routinely happening. They however likewise demonstrated that they didn't know about Lean Construction or the LPS.

3.3.3 Contractor 3 (CTR3)

As per the non-member perceptions, the researcher confirmed that worker and material supplies were satisfactorily planned and managed around the work place. A site administrator oversaw the synchronization of exercises inside site, with different experts helping him on each area of the

undertaking. From the meetings, it came to realize that site meeting was held routinely once a day.

3.3.4 Contractor 4 (CTR4)

From the non-participant observations, the researcher observed that labor, implementation of the schedule and availing the proper availability of materials at a site as per plan are adequately managed. The main hurdle faced during the process of execution was identified as hot weather situations at the site. Senior Manager was appointed as the essential personnel for the management of exercises at the work place, with different experts helping them on each area of the task. From the surveys, it revealed that work place meeting was held regularly after every three days. Table 3 shows the findings from the Non-Participant Observations and Table 4 shows findings from the Interview of the different contractors.

Table 3: Findings from Non-Participant Observations

Themes	Contractor 1 (CTR1)	Contractor 2 (CTR2)	Contractor 3 (CTR3)	Contractor 4 (CTR4)
Present Planning method in terms of labor and material	Week labor coordination	Labor was managed by foremen and less consideration was providing	Labor and supplies were correctly managed	Labor, Implementation schedule were properly coordinated
Regularity of site meetings	No week by week or daily site meetings were	Week by week site meetings but not every day	Daily and consistent site meetings	Twice a week the meeting was held.

Site coordinat ion	Task In charge complete d plans in the head office, while the site engineer executed on work	Push method of managem ent. Wherever work is flowed from upper managem ent stage	Work is appropriat ely organized but not correctly managed	Even though a Sr. Manager is appointed the differences in the lower level staff is identified and it is hindering
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Table 4: Findings from the Interview

Themes	Contractor 1	Contractor 2	Contractor 3	Contractor 4
Present Scheduling and Frequency	Meetings are schedule as they	Meetings are schedule week by	Meetings are schedule everyday	Meetings are schedule twice a
Control Site supervisor	The task in charge and site engineer are supervisor	Foremen oversee site managem ent	Site engineers manages various segments of the site	Sr. Manager oversees the all the activities followed by the Engineers
Communi cation devices	No communi cation devices	No communi cation devices	Communi cation devices are used	Communi cation point was setup.
Project managem ent structures	No special project administr	No special project administr	Critical Path Methods (CPM)	Critical Path Methods (CPM)

Lean knowledge	Unknow n about lean construc tion	Unknow n about lean construct ion	Knowled ge of Lean Construc tion but	Not aware of the LPS practices.
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IV. PHASE 2-IMPLEMENTATION PHASE

We introduced the approach of Lean Construction and the LPS to all the four contractors completing the production. We described the ideas of Lean development and how the LPS functions and their advantages were explained. We attempted to join the LPS in the project. This was conceivable because of the LPS. These highlights comprise: the master strategy; phase schedule; look-ahead arranging; week after week work schedule and the PPC.

As per the Master plan, we reconsidered the undertaking expectations by sketching out the general thought of the task goals. The breakthroughs were found, and distinctive time periods were set to finish the arranged work. Moreover, these points of reference are partitioned into phases which referred to as stage schedule.

For the stage scheduling, distinctive groups were associated with developing diverse parts of the project. They set up the setting of the work, characterized the breakthroughs expectations, built up a finishing procedure and distinguished how every undertaking task should be completed. It was a face to face connection between the project members with each group consenting to perform their relating undertakings in a concurred time frame.

Consequently, the look-ahead strategies were mutually made with each group. These groups distinguished conceivable requirements to the planned assignments. This was accomplished utilizing requirement examination outlines. They were given to individually group to foresee upcoming requirements like assets or worker, or different requirements that could block the arranged

work. Subsequently, each group guarantees that the distinguished limitations were expelled before the exercises in the look-ahead outlines are arranged as week after week work strategies.

The week after week work designs filled in as a week after week refresh of the look-ahead strategies and the exercises in the week by week work designs were exercises that were prepared to be executed (Actions whose limitations have been expelled). Besides, toward the finish of consistently, the Percentage of PPC were altogether computed and reported together with the purposes behind unfinished task graphs. The look-ahead graphs, imperative investigation graphs, week by week work plan outlines, the level of fruition talks and explanations behind incomplete task charts.

V. SUMMARY OF PHASE 2

At last, the main contractual worker CTR4 in comparison with different contractors had a greater allotment of construction resources, a composed work process and an improved control of the project. Even though, the LPS execution began during the initial phases of the project. This made the way toward relieving the significant obstacle to the implementation.

Not with standing, at last, everybody that took part enjoyed in being a part of the basic managerial procedure. Its advanced shared learning for the purposes behind unfinished assignments. Also, CTR4 got data on task achievement and unsuccessful frequently from the week after week PPC's and the restraint examination were utilized to verify conceivable hitches previously they progress toward becoming issues with the task. For example, every contractor experienced comparable difficulties, a prominent one being a deficiency of materials which was because of the shortage of materials. CTR4 was experienced to manage this task this by steady short-term look-ahead scheduling. The contractor conceived the issue and dwelt quick on time earlier it turned into a main

problem. Below Table 5 shows the comparison of Percentage plan Complete of Contractor-1.

Table 5: Comparison of Four Weeks PPC Contractor-1

Weeks	Number of Finished Tasks	Number of Unfinished Tasks	Total Tasks	PPC
30/01/2016 - 05/02/2016	8	6	14	57.14 %
06/02/2016 - 12/02/2016	3	8	11	27.27 %
13/02/2016 - 19/02/2016	5	7	12	41.67 %
20/02/2016 - 26/02/2016	6	4	10	60.00 %
Total	22	25	47	46.52 %

Figure 1 shows the graphical representation of the Percentage Plan Complete of Contractor -1 and Figure 2 shows the reasons for incomplete work of Contractor-1

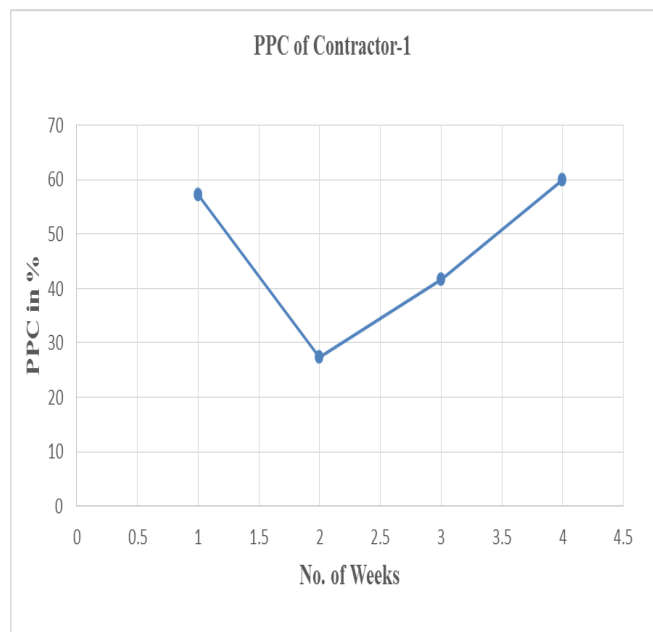


Figure 1: PPC of Contractor-1

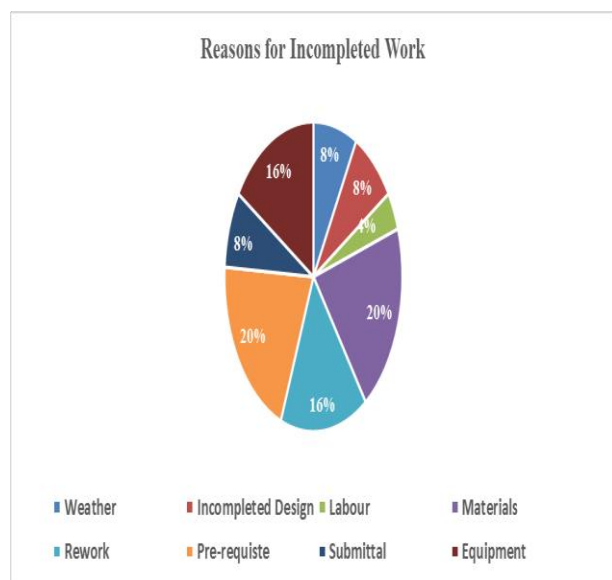


Figure 2: Reasons for Incomplete Work of Contractor-1

It is noticed that personal reasons had the most elevated level of 20% contrasted with the other seven explanations behind Materials accessibility. Other real reasons incorporate rework (16%), equipment breakdown/inaccessibility (16%) and Pre-requisite necessities (20%), submittals (8%), availability of labor (4%). On the contrary, include Designs/Drawings availability (8%) and poor weather (8%).

Table 6 shows the comparison of Planned Percent Complete of Contractor-2, Figure 3 shows the graphical representation of the Percentage plan complete of Contractor -2 and Figure 4 briefs about the reasons for incomplete assignment of Contractor-2.

Table 6: Comparison of Four Weeks PPC of Contractor-2

Weeks	No. of Finis hed Tasks	No. of Unfinis hed Tasks	Total Tasks	PP C
27/02/2016-04/03/2016	8	4	12	66.7
05/03/2016 - 11/03/2016	7	7	14	50.0
12/03/2016 - 18/03/2016	6	7	13	46.2
19/03/2016 - 25/03/2016	7	5	12	58.3
Total	28	23	51	54.9

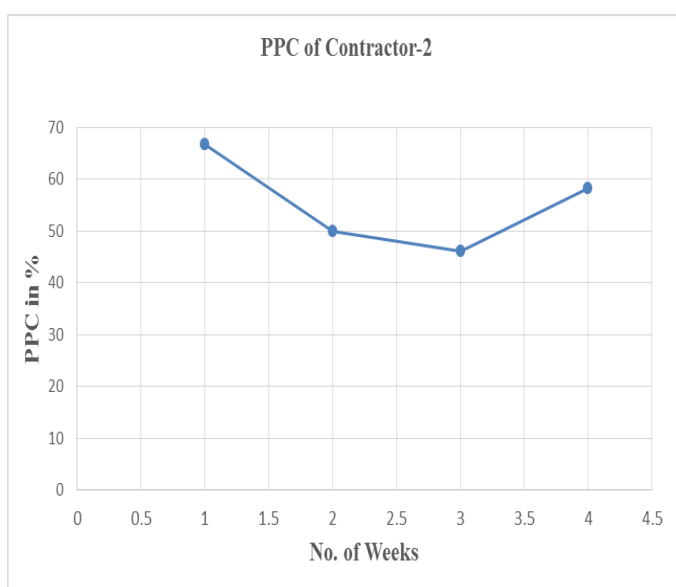


Figure 3: PPC of Contractor-2

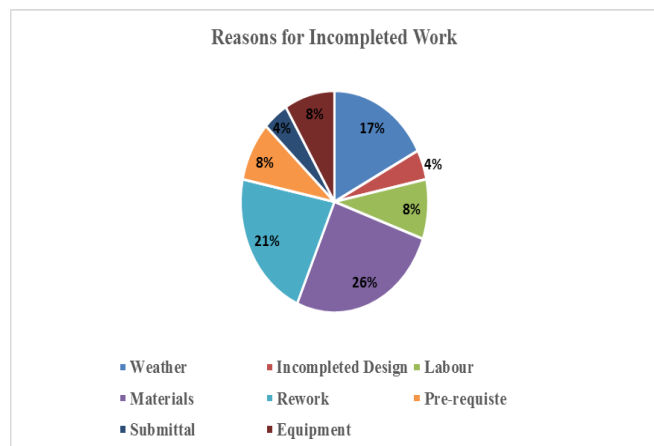


Figure 4: Reasons for Incomplete Work of Contractor-2

It is demonstrated that materials had the highest level of 26% contrasted with the other six purposes behind materials accessibility. Other real reasons incorporate rework (21%), equipment breakdown/inaccessibility (8%) and Weather (4%), Incomplete Design (4%). The other reasons were availability of Labor (8%), Pre-requisite (8%) and Submittal (4%).

Table 7 shows the comparison of Planned Percent Complete of Contractor-3, Figure 5 shows the graphical representation of the Percentage plan complete of Contractor-3 and Figure 6 briefs about the reasons for incomplete assignment of Contractor-3.

Table 7: Comparison of Four Weeks PPC of Contractor-3

Weeks	No. of Finis hed Tasks	No. of Unfinis hed Tasks	Total Tasks	PP C
26/03/2016-01/04/2016	10	2	12	83.3
02/04/2016-08/04/2016	11	7	18	61.1
09/04/2016-15/04/2016	9	2	11	81.8
16/04/2016-22/04/2016	8	4	12	66.7

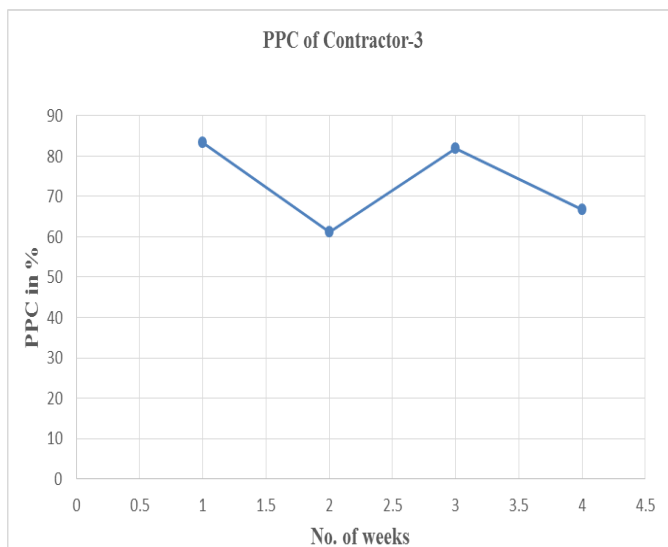


Figure 5: PPC of Contractor-3

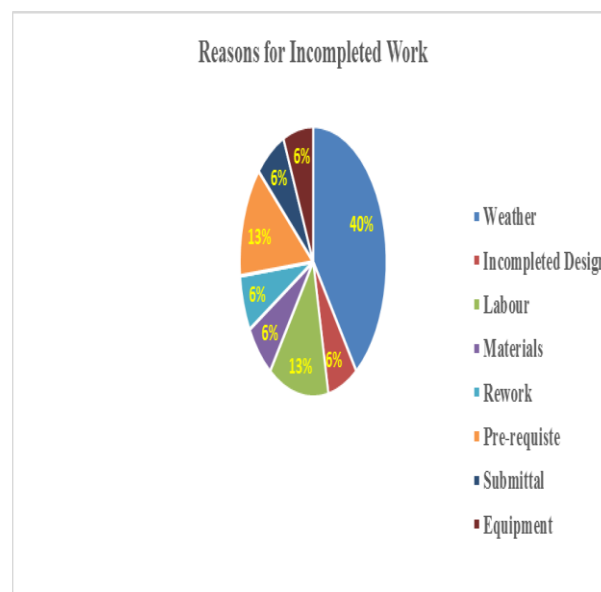


Figure 6: Reasons for Incomplete work of Contractor-3

It is demonstrated that materials had the highest level of 40% compared with the other seven purposes. Other significant reasons consist the availability of worker and prerequisite (13%), incomplete design, submittal, availability of equipment, availability of materials, and rework contributes about 6% for the incomplete assignment.

Table 8 shows the comparison of Planned Percent Complete of Contractor-4, Figure 8.7 shows the graphical representation of the Percentage plan completes of Contractor-4 and Figure 8.8 briefs

about the reasons for incomplete assignment of Contractor-4.

VI. CONCLUSIONS

To achieve the objective, Investigation was carried out by Pre-Implementation process through Non-participant observation and interviews. During this process four real case studies were considered for accurate results. Pre- Implementation is the initial phase of investigation and analyzation of all stages of construction project at site. It was observed and recorded that there was improper planning, scheduling and controlling of work at the site by engineers. In Non- participant observation the researcher observes the construction activities without interacting with the project participants over a period. Findings from the non-participant observations were current planning practice, the occurrence of site assemblies, site organization & communication

The barriers identified are weather conditions, incomplete design, labor, equipment, material, rework, prerequisite works, submittals, and sub-contractor's involvement, resistance from change, extensive endorsement, subcontractor's inclusion, insufficient supervision, quality control and vacillations.

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