



## Implementing the Last Planner System in a Design Project

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### Abstract

Through the past few years, the last planner system (LPS) as one of the main important methods of lean implementation in the (AECO) industry proved to improve efficiency, performance, reliability, planning and coordination. LPS can be implemented in design projects as well as in construction projects. This research reports the implementation process of the LPS as a basis for continuous improvement in the design stage. The first part is about Lean Concept definition, values and wastes; challenges faced, and Lean implementation. Second part is focusing on the last planner system, its definition and method of implementation. Third part is a case study of how LPS is implemented in managing a design project in a design consultancy firm, how to lead the lean enterprise, and how to deal with change resistance within the team.

**Keywords:** Lean; Last Planner System; Lean Design; Consultants; Collaborative Planning; Project Management

### 1 Introduction

The Architecture, Engineering, Construction and Operation (AECO) industry is always impacted by variations, which affect efficiency, profitability and quality. Lean practice is implemented in design and construction projects to eliminate wastes, add value and improve work processes. Last Planner System as a planning tool is one of the highly recommended collaborative planning processes. This paper aims to define clearly the concept of Last Planner System and how it can be implemented in a design project to achieve best results.

### 2 Lean Thinking

Lean is keeping everything in its most valuable form addressing efficiency, adding value and eliminating wastes while considering continuous improvement (Womack & Jones, 2005).

#### Lean Definition

Lean is adding value to the process and the elimination of waste from the production cycle leading to better quality, higher efficiency, lower costs, shorter time schedule and higher profits. Lean is about delivering the right things (including information) to the right place in the right amount, at the right time and under the right conditions. Value is what the customer needs at the end of the process. While waste can be defined as any step or action which takes place in the process but does not add value. (Badurdeen, 2007; Arleroth & Kristensson, 2011; Elmosalmi, 2014).

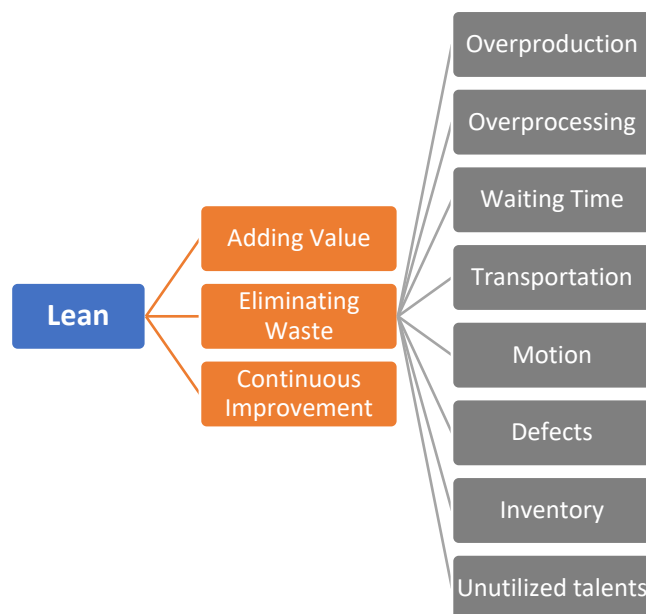
#### 2.1 Lean Thinking Principles

The Lean thinking main principle is about respect for people since the human factor is the most important factor in any process, work or organization. People can make anything succeed or fail. When people feel respected, appreciated, trusted and supported, their performance changes and they

become more efficient. The Lean tenets after Respect for People are: (1) Identify Customer Value, which is understanding the client needs and what he/she is willing to pay for. (2) Generation of Value; adding value to the process considering the end user or client’s main value, (3) Removal of Waste; which is removing any unnecessary activity from the process; (4) Optimize the Whole; which means that Lean is about the big picture not just the small parts or small activities. Success can be achieved when all project elements are working for the sake of success of the one big whole. (5) Focus on Process & Flow of Materials, Information, etc. to achieve smooth workflow without any constraints or obstacles. (6) Continuous Improvement (Kaizen) which is focusing on engaging employees/stakeholders in improving work processes in parallel with their ongoing tasks through a Plan-Do-Check-Act (PDCA) cycle. It also seeks to standardize processes and eliminate waste (Forbes & Ahmed, 2011; Elmosalmi 2014).

## 2.2 Wastes Classification

Wastes are classified into eight categories; (1) Overproduction waste is producing or delivering more than what is needed resulting in excess stocks and inventory. (2) Waiting time waste is people waiting for work or work waiting for people or equipment waiting for a production process to be completed or resources to arrive. (3) Transport waste is moving equipment or materials unnecessarily without any added value. (4) Motion waste is the movement of people unnecessarily due to poor layout of working area (ergonomic issues). (5) Stocks waste is the material or information stored at office, site or yard, excess work in progress (processing work), unused tools and data (often held as an acceptable buffer but should not be excessive). (6) Defects (errors) waste is the rework or output that does not reach the required quality standard. (7) Over processing waste is the added steps which are not adding value to the process like unnecessary reporting, non-value-added activities, unnecessary reviews. (8) Unused employee creativity waste is the poor utilizing of resources and not working on developing human skills in the fields. One of the most popular methods to eliminate waste is the 6S which are sort, set in order, shine, standardize and sustain. Sort is by separating the items into two groups: using and not using. Set in order is categorizing the items in the group of “using”. Shine is keeping the area clean and everything in its location. Standardize is to apply the standards to the work area. Sustain is maintaining the gain (Bottirov, 2011).



**Fig. 1:** Lean and Wastes Classification

### 3 Last Planner System (LPS)

LPS is the collaborative, commitment-based planning system and production control system that follows lean principles based upon reliable not just predictable plans. It is a collaborative planning process that involves everyone including Last Planners in a pull planning process. LPS follows Just-in-Time (JIT) delivery, Value Stream Mapping (VSM) and Pull Planning.

The Last Planner system involves (1) Lean Workstructuring; which includes the planning schedules and (2) Production Control; which includes the variance analysis and the percent of plan completed (PPC).

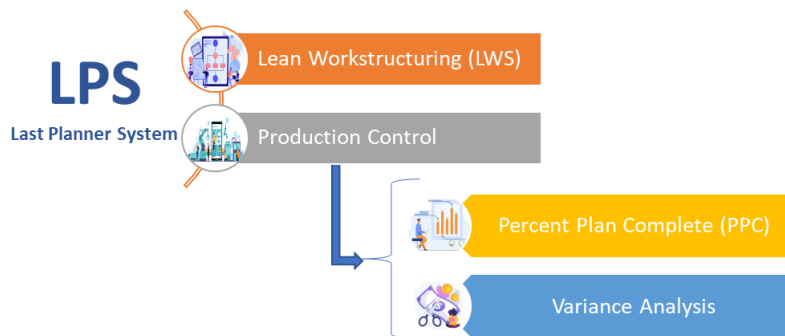


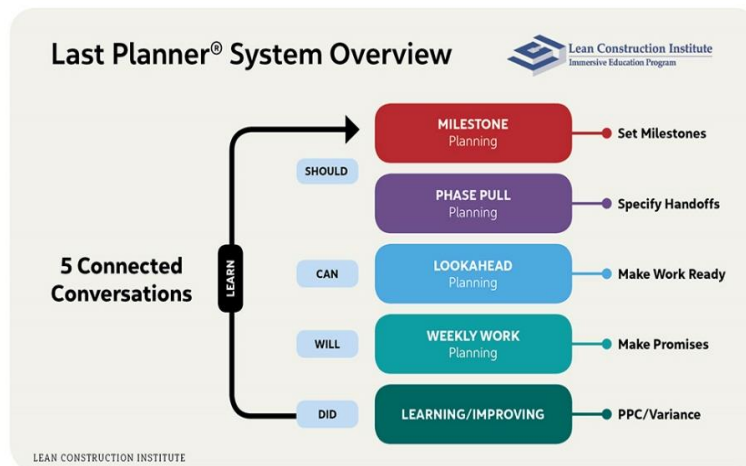
Fig. 2: Last Planner System

#### 3.1 Principles of LPS

LPS is based on the following principles; (1) Plan in greater detail as you get closer to doing the work, (2) Produce plans collaboratively with those who will do the work, (3) Reveal and remove constraints on planned tasks as a team, (4) Make and secure reliable promises, (5) Measure promises kept (planning capabilities, PPC) in order to improve by learning from variance (work flow disruptions), (6) Continuously improve as a team, (7) Remove waste and adjust performance based on what has been learned as a means to optimize work flows. Operations based on Lean thinking and practice also continually strive to achieve flow, in which material and information move through the value stream without stopping. When flow is not possible between process steps, each step in a value stream should “pull” precisely what it currently needs from the previous step in the value stream and that’s how waste is eliminated completely.

#### 3.2 LPS Schedules

The schedules of LPS start at a very high level of information as in the Master Schedule which contains the main milestones. The second LPS level is the Phase schedule at which more details are being put into the master schedule and phases start to appear more clearly. Master and Phase schedules are about the work that should be done and not yet analyzed.



**Fig. 3:** Levels of Last Planner System

The third level of LPS is the Make Ready Planning/Look Ahead Planning; also, named 6 weeks look ahead plan. In this level, work is being planned on a six to eight weeks timeline with gives and gets for each trade to find out what every trade exactly needs to give or submit their part of the work. It is always observed that the first two weeks include more details and tasks than that of later weeks since everyone is planning in greater detail as they get closer to doing the work. The make ready plan is about the work which can be done by the team as per the collaborative planning session at which they are involved. The fourth level is the weekly work plan which is about what exactly will be done during this week with day to day tasks. This is where promises change into actions.

The fifth level is the Learning/Improving or also called daily huddles which is the day to day follow up through a daily 10-15 minutes meeting to hear from the team what has been finished, what will be done today and what are their notes for improvement.

LPS is based on visual management where all communication and data sharing is through visual management using data lists, bar charts, network schedules, graphic schedules, linear schedules, and sticky notes to define the gives and gets.

## 4 Case Study

### 4.1 About the Project

The project is a large-scale mixed-use development located at Doha. The project features 4 (Four) Administration Buildings associated with other additional facilities designed to provide support for both administrative and recreational activities.

### 4.2 Project Challenges

- Fast Track/Crashed Time Schedule.
- Working remotely during the COVID-19 Pandemic.
- Lack of information of existing utilities.
- Modifications to end-user requirements and additional requirements in space program.
- Resources utilization.
- Lack of Lean knowledge on the part of some team members.
- Teams culture (change resistant).

### 4.3 LPS Implementation Plan

ECG implementation plan for LPS internally in design phase was based on: (1) Kick off meeting. (2) The project management team create the master time schedule from the project proposal agreed with the client (main milestones of client submissions, meetings, workshops, etc). (3) The project management team create the phase schedule based on the phases or project stages agreed with client. (4) The project management team send a schedule template for all disciplines to fill their requirements from other trades and dates. (5) The disciplines send their requirements with dates to PM team. (6) PM team prepare the Look Ahead Plan (6-8 weeks Plan) from: The master schedule and phase schedule agreed with the client, PM estimated internal dates for DC Submission, Internal, coordination meetings, data exchange with BOQ and specifications teams, BOQ and specifications submission dates, etc., all disciplines requirements as received with planned dates. (7) On Sunday, PM team send the weekly work plan for Week 1 (Week 1 Plan) to all disciplines to be implemented. (8) Daily follow up should be implemented (daily huddles) by the PM team to ensure that the weekly work plan is running smoothly so that any new issues can be solved as quickly as possible and do not affect the work flow. (9) On Thursday of the same week, the PM team update the status of the weekly work plan and make the below changes: The finished tasks or work activities to be marked in green, the unfinished/delayed tasks to be marked in red, any issues which need response or feedback from the client to be marked with purple, The red tasks to be moved and added to Week 2 plan in red to remain a priority. (10) PM team to send week 2 plan to all disciplines highlighting that the red tasks are the ones delayed from week 1 and should take the highest priority. (11) Daily Follow up (Daily Huddles). (12) As part of continuous improvement, the first created detailed Look Ahead Plan to be standardized for the future same type of projects. (13) Measuring percentage of work completed (PPC) regularly. (14) Variance Analysis Charts checks are carried out every week to ensure compliance with main master schedule and control project budget. (15) A mitigation plan to mitigate the variance is carried out as a part of continuous improvement. (16) LPS implementation process is documented to ensure continuous improvement and lessons learnt to be shared with all other projects teams. (17) Wastes analysis reports were carried out to reduce over processing waste.

### 4.4 LPS Impact on the Project

It was found out that implementing Lean and LPS in the design phase is inherently important for better coordination, collaboration, quality and higher profits. The project was finished with less design cost than the planned budget (77% of the planned budget) achieving extra profit 33% of the project budget in spite of all the challenges that the team faced from the beginning of the project.

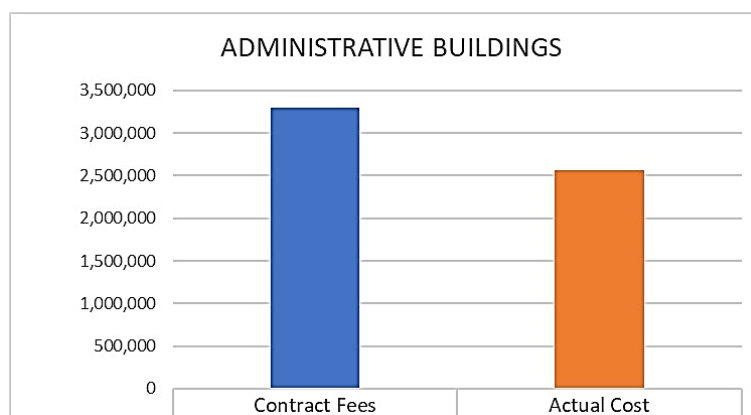
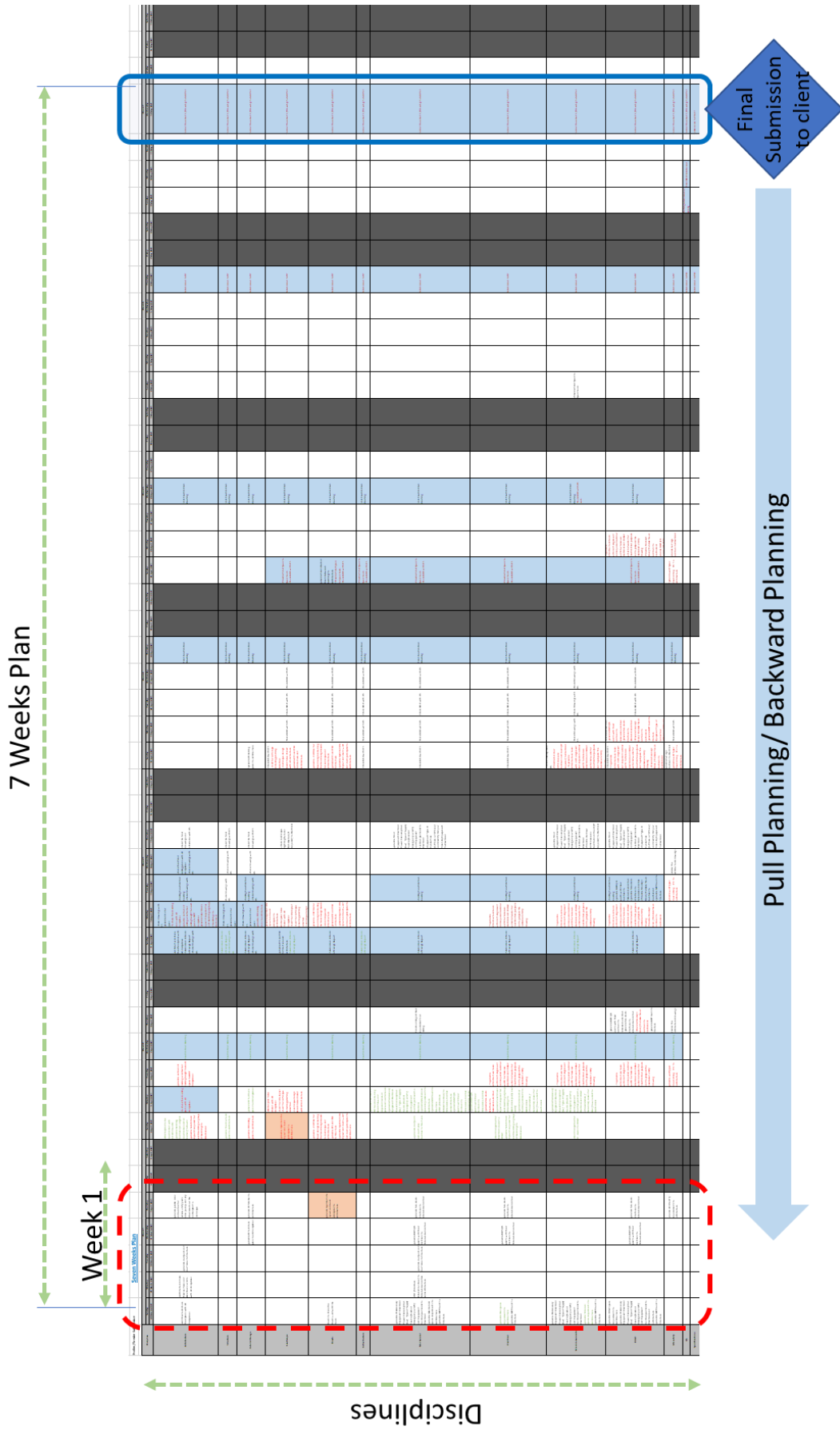
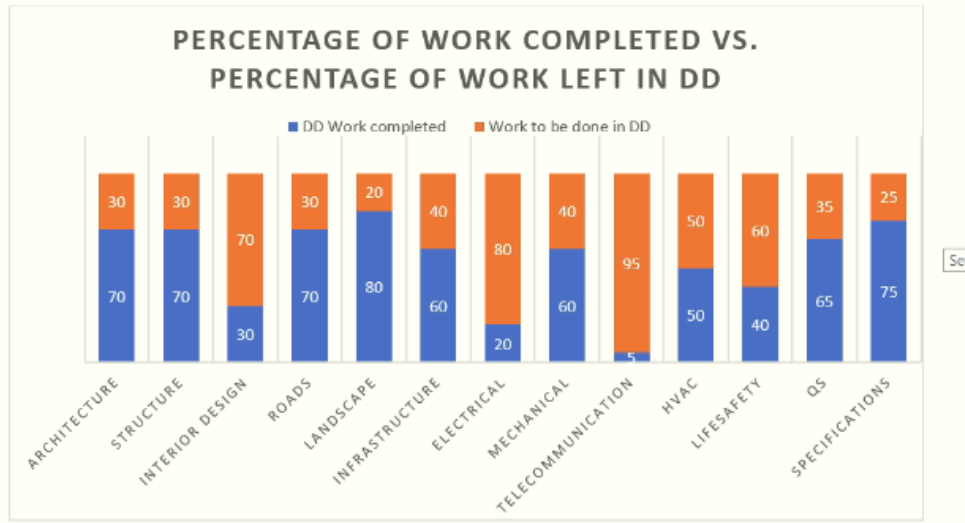


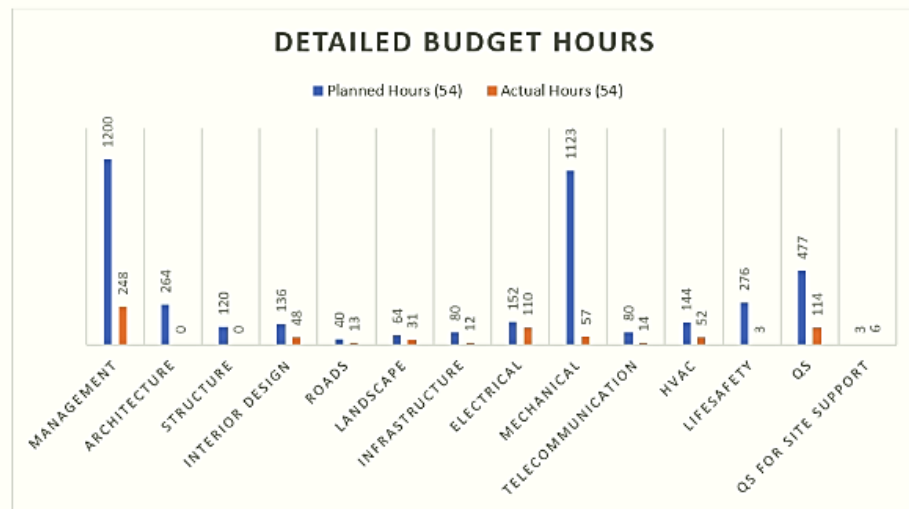
Fig. 5: Project budget vs. Actual Cost



**Fig. 6:** From Make Ready Planning to Weekly Planning on a Spreadsheet



**Variance in manhours at disciplines (54D00)**



**Fig. 7: PPC and Variance Analysis in the Case Study Project**

**5 Conclusion**

Benefits of applying LPS on the project (1) Enhanced workflow reliability and predictability by improving coordination. (2) More detailed and reliable time schedule. (3) Get all team members committed and feel responsible from the first beginning of the project. (4) Get the planning and management team as close as possible to the production team. (5) Better commitment to time schedule. (6) Transparency. (7) More smooth workflow. (8) Less wastes. (9) Identifying and resolving issues and constraints as early as they appear and accordingly avoiding much rework. (10) Focusing on root causes of variance. (11) Standardizing the plans for future projects with the same type and circumstances. (12) Achieving the three project goals of higher quality, less cost and less time; leading to: (13) Client Satisfaction.

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