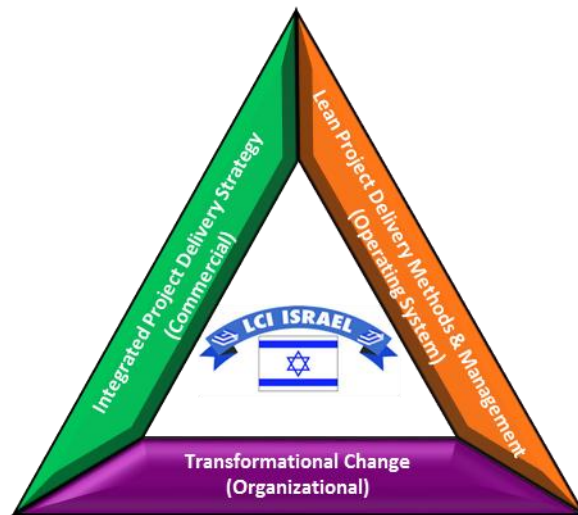


Last Planner[®] System

Business Process Standard and Guidelines

This document is an Organizational Process Asset, which is to be maintained within the Knowledge Management System (KMS) or Project Management Office (PMO).



This document provides a foundation for learning, implementation and disciplined practice of the Last Planner[®] System.



Contents

Section A: Last Planner® System – Introduction; Principles; Scope; Stakeholders; Implementation; Goals, and General Theory; Applicable Definitions	3
1. Introduction	3
2. Principles of LPS	4
3. Scope	5
4. Stakeholders.....	6
5. Implementation.....	7
5.11. Illustration: <i>Should-Can-Will-Did Planning for creating and maintaining reliable work flow.</i>	10
6. Goals, and General Theory	11
7. Applicable Definitions	16
Section B: Top 5 Actions for Getting Off to a Good Start; Finding More LPS Information; Policy and Process Standards	26
9. Find out more about LPS implementation	27
10. Last Planner® System, Policy and Process Standards.....	27



Section A: Last Planner® System – Introduction; Principles; Scope; Stakeholders; Implementation; Goals, and General Theory; Applicable Definitions

1. Introduction

- 1.1. Application: Owner, Corporate Services Construction Projects, Production Control.
- 1.2. The Last Planner® System promotes conversations between trade foremen and project management at appropriate levels of detail, and before issues become critical. These conversations increase the chances that work flows reliably, and recognizes that personal relationships and peer pressure are critical to that process.
- 1.3. Last Planner® System of Production Control was developed to make planning processes and work flow highly reliable, and to build necessary trust within a collaborative team environment. The Last Planner® System makes detailed plans by those whom execute the work. It reviews the plan near its execution specifically for collaborative planning to remove constraints as a team and verify that the promises made are tied to milestones and that these commitments are firm, timely and without ambiguity.
- 1.4. LPS is a planning, monitoring and control system that follows lean construction principles such as Just-In-Time (JIT) delivery, value stream mapping (VSM) and Pull Planning.
 - 1.4.1. Pull planning itself is a procedure of creating a master schedule, a look-ahead, and a commitment-based weekly work plan through front-end planning using¹Lean Construction Planning techniques.
- 1.5. Weekly work planning is referred to as “commitment planning” because, at this stage, specific resource assignments need to be made so that work can actually be performed. Effective weekly work planning is the foundation upon which trust within the team is built.
- 1.6. The primary function of LPS is the collaborative planning process that involves 'Last Planners'² for planning in greater detail as team gets closer to doing the work. The

¹ Glenn Ballard, PhD and Gregory Howell, P.E, 1994

² “Last Planner” refers to the person that creates tasks for direct workers to perform. “Foreman,” “Superintendent,” “Work Group Supervisor,” “System Owner,” “Tool Owner,” “Vendor Lead Tech” are common Intel environment roles for Last Planners in the construction process.

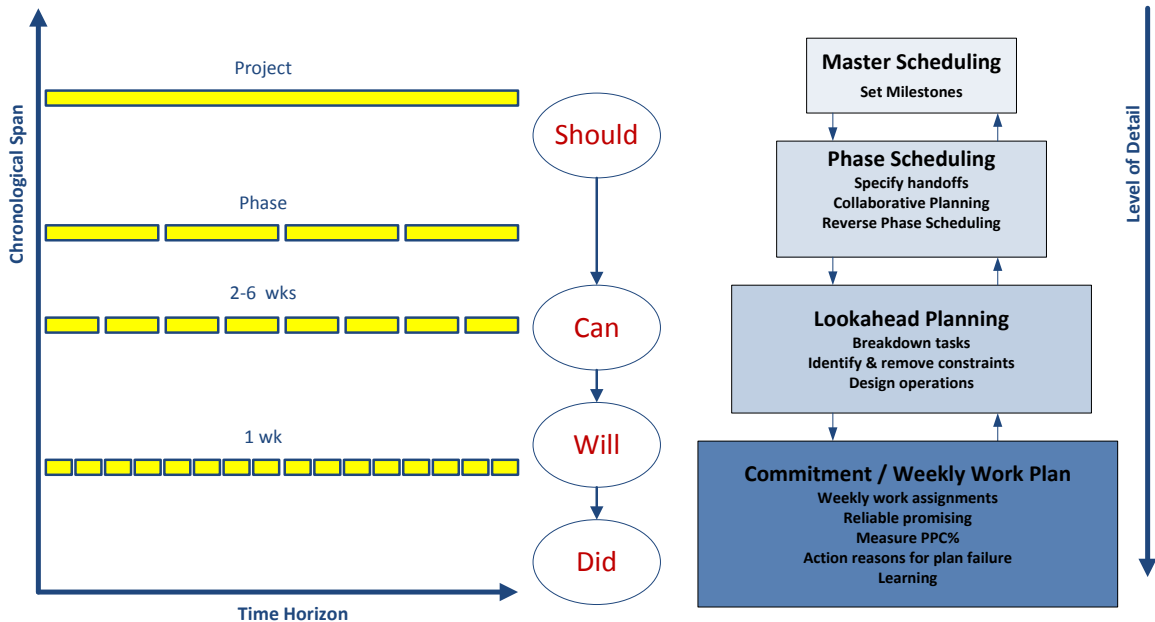


Last Planner® System is an opposite way of thinking when compared to conventional ‘push scheduling’ principles, where the work that SHOULD be done is planned in weekly meetings emphasizing adherence to the master schedule milestones. In contrast, LPS incorporates ‘pull planning’ principles where only the work that CAN and WILL be done is considered and promised by Last Planners themselves.

1.6.1. Because at its core, LPS is a “system view” versus “local optimization,” the Last Planners’3’ active engagement in this systematic process is fundamentally a *requirement*. In other words, the Last Planner® System is a “team sport.”

1.7. Constraint analysis is an integral part of the LPS that is applied as a proactive approach to problem solving as a team, despite the typical challenges faced on construction projects.

1.8. Illustration A: LPS Planning Process Overview



Planning stages / levels in the Last Planner® System (adjusted from Ballard, 2000)

2. Principles of LPS

- 2.1. Plan in greater detail as you get closer to doing the work.
- 2.2. Produce plans collaboratively with those who will do the work.

3 “Last Planner” refers to the person that creates tasks for direct workers to perform. “Foreman,” “Superintendent,” “Work Group Supervisor,” “System Owner,” “Tool Owner,” “Vendor Lead Tech” are common Intel environment roles for Last Planners in the construction process.



- 2.3. Reveal and remove constraints on planned tasks as a team.
- 2.4. Make and secure reliable promises.
- 2.5. Measure promises kept (planning capabilities, PPC) in order to improve by learning from variance (work flow disruptions)
- 2.6. Continuously improve as a team, remove waste and adjust performance based on what has been learned as a means to optimize work flows.

3. Scope

- 3.1. The Last Planner® System applies to all Owner Construction Projects as a fundamental advantage.
 - 3.1.1. It is a baseline expectation that all work in progress have at minimum a Weekly Work Plan, which is collaboratively created by each Production Team. Minimum weekly output requirements are:
 - a. Percent Plan Complete Chart
 - b. Variance Pareto
 - c. Constraint Log w/ Timing ID Gauge
- 3.2. Work assignments as analyzed by the team while Weekly Work Planning must be screened for quality (e.g. constraint-free work, or the work that Will be done) prior to being included in the Weekly Work Plans. More importantly, the overall Weekly Work Plan must be agreed upon by the Last Planners themselves.
- 3.3. More tasks may be added to the plan through each phase of the collaborated plan in order to provide more detail for execution of previously scheduled activities. Progressively elaborated – greater detailed – assignment planning should naturally occur as you get closure to the actual work.
- 3.4. Each team member must agree and commit to reliably delivering each assignment they are responsible for providing to the team. The whole focus and effort is on creating and improving reliable work flows in a collaborative environment. *Trust* is the product of these efforts.



3.5. Proactive constraint identification⁴ and removal is the work of the team. Others may be brought in for certain constraints, but only people in the room, or on the team can be named as owner for removal of an assigned constraint. Yes, the responsible individual may need to work with others, whether on the team or not, to resolve an assigned constraint. The key is to have a commitment from someone on the team directly accountable for resolving the constraint through whatever acceptable means.

4. Stakeholders

- 4.1. Stakeholder defined: (1) anyone that is actively involved in the project; (2) has interests that may be positively or negatively affected by the performance or completion of the project; (3) may exert influence over the project, its deliverables or its team members.
- 4.2. Examples of typical stakeholders in our environment are:
 - 4.2.1. Projection Crew Members (Trade Craftsmen and Discipline-specific Technicians)
 - 4.2.2. Foremen, Work Group Supervisors
 - 4.2.3. General Foremen, Superintendents
 - 4.2.4. Construction Coordination Management Services if applicable (CCMS, often referred to as Project Engineers and/or Construction Coordinators)
 - 4.2.5. Project Manager
 - 4.2.6. Project Implementation Team (PIT Lead)
 - 4.2.7. Third-Party Support (e.g. Analytical Gas Line Testing and Certification; Exhaust Test and Balance; Pump/Abatement System Setup and Commissioning; Life Safety Systems Terminations and Functional Acceptance Testing; Lateral Valve Manipulation Technicians. The 3rd Party contributors may also be considered to be Responsible Individuals when their tasks are made ready within either the six week Look Ahead (Pull Plan) or within the Weekly Work Planning.
 - 4.2.8. Tool Owner (TO)
 - 4.2.9. System Owner (SO)
 - 4.2.10. Area Coordinator (AC)
 - 4.2.11. Tool Supplier (aka “vendor”)

⁴ As a form on continuous improvement, teams should make it a goal to increase the ratio of constraints removed 30 days prior to work start as compared to those discovered +/- 7 days before work start.



4.2.12. Project Management Team, Voting Membership (PMT)

4.2.13. Site Management Team, Voting Membership (SMT)

4.2.14. IPD Transfer Implementation Leadership Team (TILT)

4.2.15. Last Planner® System Site Champion Shared Learning Forum (LPS SLF)

4.2.16. Enterprise Leadership Steering Committee (ELSC)

5. Implementation

5.1. Last Planner® System (LPS) is a simple process that allows your team to create and maintain reliable work flow on construction projects. The eight key elements of LPS are:

5.1.1. Master Planning: team alignment with milestones within the Master Schedule
(*What Should Occur*)

5.1.2. Pull Planning: strategically planning segments of work in order to produce progressively elaborate Weekly Work Plans. (*What Should Occur*)

5.1.3. Make-Ready Planning: look-ahead scheduling and constraint removal (roadblock removal process) in support of the progressively elaborate planning process
(*What Can Occur* is the input into the process and *What Will Occur* is the output).

5.1.4. Weekly Work Planning: tactical team collaboration to plan each day's work, conditions for handoff and acceptance, sequencing and synchronizing next week's work. The point of maximum progressive elaboration to create reliable work plans. (*What Will Occur*)

5.1.5. Daily Huddles: team check-ins, discussions based on the Weekly Work Plan. How are we doing? What do we need to maintain the plan as it is in progress? (*What IS Occurring*)

5.1.6. Percent Plan Complete: number of activities completed divided by the total number of planned activities. (*What Did Occur*)

5.1.7. Reasons for Variance: charted in Pareto to see trends, learning – knowing what needs to be fixed in order to improve next week's PPC. (*What Did we Learn from what Occurred?*)

5.1.8. Team Health, Maturity and Effectiveness: the essence of collaboration, what really matters most!



- 5.2. In order to effectively implement successful LPS, practitioners and early adopters must apply discipline and balanced efforts toward all eight of the key elements listed above. More importantly, learn from variance as the business of the team and always collaborate toward improving behaviors and peoples' interactions within the system.
- 5.3. Customer Expectations and Owner's Promises of the Project must be made clear. Likewise, the conditions of satisfaction for all team members should be actively discussed as a means to develop an environment of mutually-dependant commitments - promises made and promises kept by everyone on the team.
- 5.3.1. The Owner's primary roles are to 1) establish, solidify and maintain the Milestones within the Master Schedule, and 2) support the teams and work flow improvements necessary to produce safe, reliable and factory-interrupt-free project delivery.
- 5.4. Projects are essentially made up of an extensive set of *promises*. As an example, construction sequencing from design, execution of each phase of work through commissioning, SL1/SL2 can be viewed as a set of *promises*. You need to go to the source (e.g. Foremen, Work Group Supervisors) to secure the actual *promises* within the team for the detailed work plans that deliver the *promises* of the project.
- 5.5. To ensure that the promises of the project are aligned with the team's plans to deliver value, the Project Manager should establish meetings with the customer with an agenda that includes:
- 5.5.1. Project update and assessments of the project (risks, opportunities and performance plan)
- 5.5.2. Discussions are to be had regarding Conditions of Satisfaction. This needs to be done up front when the team is formed, documented and kept alive (adjusts as necessary) and visual as a means to navigate decisions and measure deliverables.
- 5.6. Integrate the customer directly into the team's plan development and decision making processes.
- 5.7. The Project Manager needs to overtly and continually build on integration of the Foremen, Work Group Supervisors, Tool Owners, and Vendor Lead Technicians, motivating everyone to work together and to improve work flow reliability.



5.8. Likewise, the Project Manager needs to be viewed as a trusted leader within the team environment. Often assigned tasks by the team and for the team as a contributor to the actual work, the Project Manager is also by default the team's "Coach" and therefore needs to be continually ready and able to teach and motivate team members. The Project Manager must be *present*.

5.9. It is the Project Manager's responsibility to ensure that disciplined, systematic and collaborative planning and highly reliable work flows occur. This is the essence of the Last Planner® System, and therefore why LPS is the recommended benchmark practice and one of the cornerstone Lean Construction tools.

5.10. Effective LPS implementation can be achieved with these basic materials and/or tools:

5.10.1. Standard conference room Whiteboard (20' horizontal length)

5.10.2. Standard size "sticky notes"

5.10.3. Microsoft Office Suit (for creation of Weekly Work Plans and other necessary LPS-Microsoft Project or Primavera scheduling software (for creation and management of micro schedules, milestone relationships and 6-week Look-Ahead schedules)

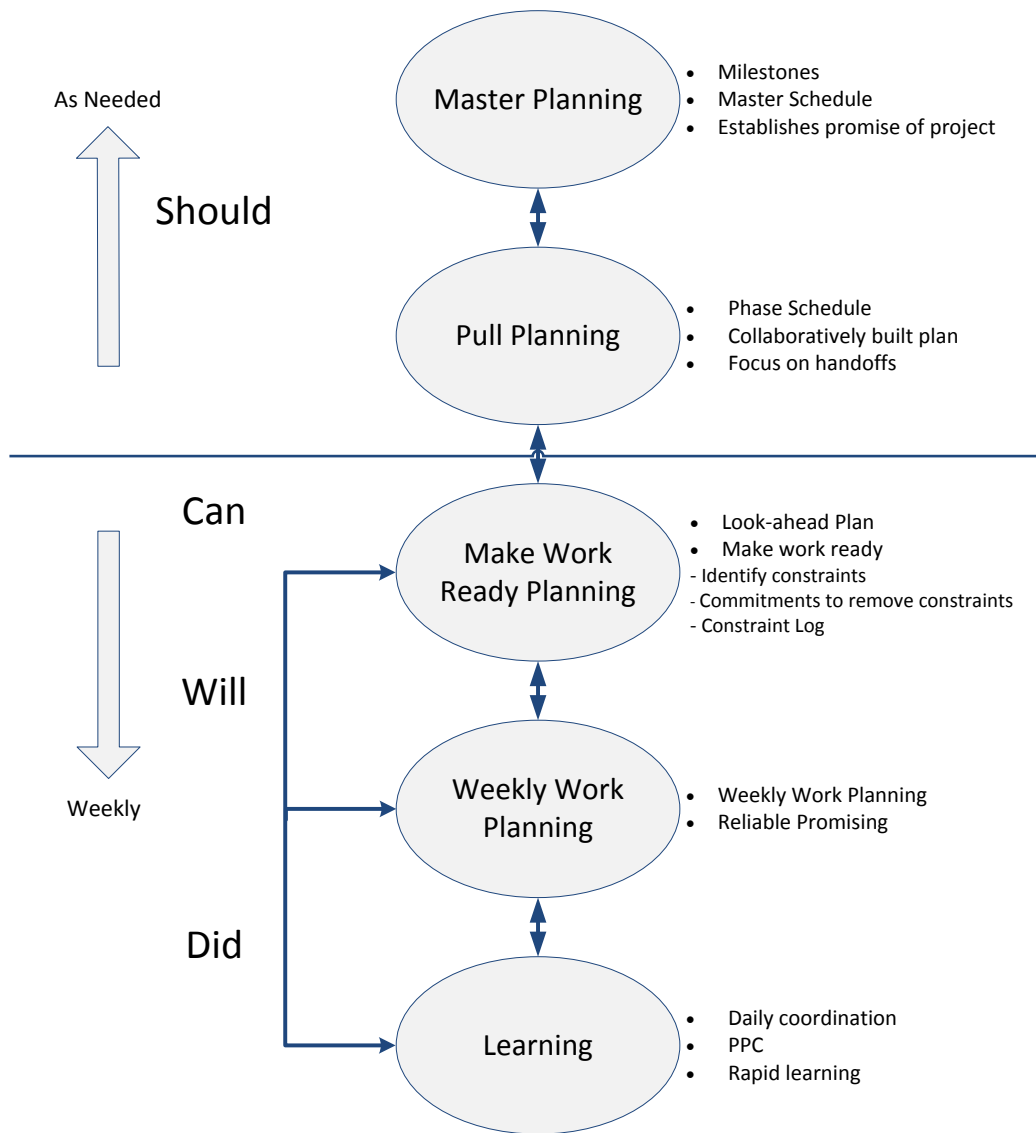
5.10.4. Teams as they mature should also consider LPS management software tools such "OurPlan," "vPlanner," "Oracle," etc.

5.10.4.1. Preferably and ideally – all of the above managed from one single location: The Big Room.

5.10.5. In its most basic form, LPS can be successfully managed with pen and paper.



5.11. Illustration: *Should-Can-Will-Did Planning for creating and maintaining reliable work flow.*



Creating and maintaining reliable workflow



6. Goals, and General Theory

6.1. The goals of effective Last Planner® System implementation are:

6.1.1.5 Produce the best possible plan by involving all direct stakeholders with relevant expertise planning at the point of action.

6.1.2. Create the *right* level of detailed, useful, collaborated plans that produce safe, highly reliable work flow, high quality, on-time-every-time delivery for all construction scope, whether OWNER is operating in a new or existing Owner fabrication facility.

6.1.3. Provide a framework for teams to effectively collaborate with each other.

6.1.4. Increase daily productivity within the production teams through the systematic removal of waste.

6.1.5. Improve OWNER's capabilities to:

6.1.5.1. Measure progress every day

6.1.5.2. Track progress in a standard manner

6.1.5.3. Manage to a daily "*micro schedule*" or *list of promises*

6.1.5.4. See patterns/trends in what is/is not working

6.1.5.5. Be ready and able to respond to changes

6.1.5.6. Make rapid interventions if/when we are off track

6.2. Why LPS?

6.2.1. LPS provides all of the following:

6.2.1.1. Highly reliable work flows.

6.2.1.2. Promotes workplace planning expertise, and reveals opportunities for individual and team growth.

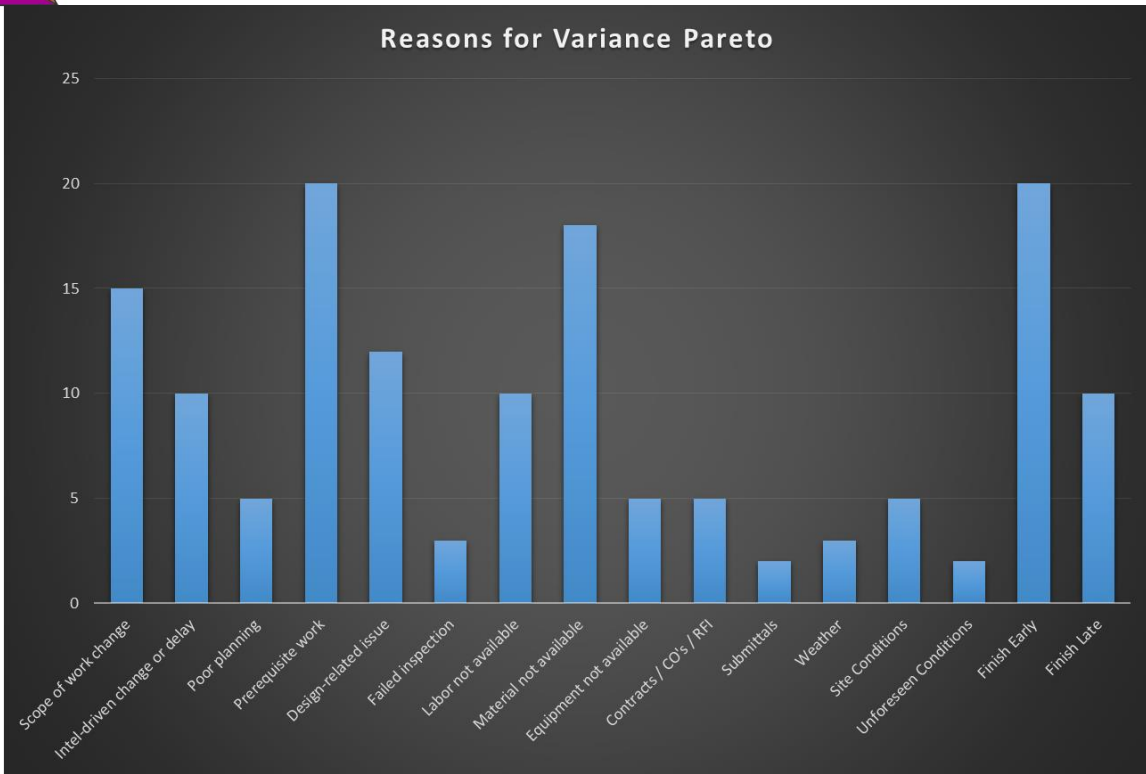
5 Adapted from "Introduction to Lean Construction" by Glenn Ballard, PhD and Gregory Howell, P.E, 2009



- 6.2.1.3. Reliance on people with the accountable individuals⁶ overtly named and empowered to make planning decisions. This level of integration answers the question: who does what?
- 6.2.1.4. It's all about agreements among team members. "Agreement" in this regard means: Clearly defined work sequencing; (1) when to start and when to finish tasks; (2) their relationships to one another, and (3) what are the overtly stated conditions for handoff and acceptance among the collaborators.
- 6.2.1.5. A tool for work flow control and effective decision making through conversations that align interdependent actions necessary to move work forward.
- 6.2.1.6. Necessary transparency enables teams to optimize Milestone delivery, and therefore increases the importance and proper prioritization of the Milestones.
- 6.2.1.6.1. Provides an excellent feedback mechanism for management to see into the project and connect actions to the promises of the project.
- 6.2.1.7. A commitment-based means for measuring and improving the health of the production system.
- 6.2.1.7.1. To be practiced correctly, LPS requires "T-Shaped" behaviors among team members to expand grow and continuously improve. Answers the question: what have we learned and what do we need to fix in order to improve?

⁶ "Last Planner" refers to the person that creates tasks for direct workers to perform. "Foreman," "Superintendent," "Work Group Supervisor," "System Owner," "Tool Owner," "Vendor Lead Tech" are common Intel environment roles for Last Planners in the construction process.

6.3.3.Reasons for Variance Pareto



6.3.4.Constraint Log

<div style="text-align: center;"> CONSTRAINT LOG </div>								
PROJECT: _____								
STAGE: _____								
AREA: _____		WORK WEEK/YEAR: _____						
UPN OR WBS (scope ID)	ASSIGNMENT ID	CONSTRAINT DESCRIPTION	CUSTOMER	RESPONSIBLE INDIVIDUAL	DATE IDENTIFIED	DATE NEEDED RESOLVED	DATE PROMISED	DATE RESOLVED

6.4. The four primary Visual Outputs of LPS are important, and need to be maintained for timeliness and accuracy, but as simply produced as possible within the capabilities of the team.

6.5. The best practice is to display well-maintained outputs for the group to use at Daily Huddles and Weekly Coordination Meetings in the Big Room.



- 6.6. A designee(s) of each team should be assigned the responsibility of managing and maintaining the team's Visual Outputs.
- 6.7. The team should select this person based on skill and interest. Ask for volunteers first before assigning the Visual Output responsible individual. By default, the Project Manager shall either provide the Visual Outputs him/herself, or hold a vote for who from within the team shall perform these necessary tasks.
 - 6.7.1. LPS outputs need to be managed effectively; but more importantly they have to be valuable to the team members themselves.
 - 6.7.2. Where possible, seek ways to pool and/or streamline the maintenance and upkeep of the four Visual Outputs of LPS.
 - 6.7.3. These visual tools drive the team's performance by accurately reflecting it (providing transparency that all can see), so managing this information needs to be an important aspect of how the team works together to produce consistent, useful and accurate Visual Outputs.
 - 6.7.4. Although Excel and other software products are terrific tools that should be predominantly used, on the flip side, don't let them bog down the team. The basics of LPS can be just as effectively practiced with pen and paper.
- 6.8. The main purpose of the LPS is to shield workers from the uncertainties they do not control. (Ballard and Howell, 1997). Ballard and Howell propose that Weekly Work Plans are effective when assignments meet specific quality requirements.
 - 6.8.1. Quality Assignments look like:
 - 6.8.1.1. Defined – what, where, when, who are known
 - 6.8.1.2. Safe – all precautions are taken
 - 6.8.1.3. Sound – the wherewithal is available
 - 6.8.1.4. In Sequence – prerequisite work is done
 - 6.8.1.5. Right-sized – can be done in a week or less

7. Applicable Definitions

7.1. Big Room

7.1.1. The Big Room is essentially the project command center; a place where all team's LPS Visual Outputs are displayed.

Big Room: Israel, Fab 28 Conversion Project



Figure 7.1.1.1: The "Big Room" in operational mode (Israel, 1274 Project)

7.1.2. More importantly, this is the rallying point for each team, or the larger team to make decisions conducive to moving the project forward.

7.1.3. This is where the work of the team is conducted.

7.1.4. Use of the Big Room should be flexible enough to accommodate the needs of multiple teams.

7.1.5. The Big Room is the place for stakeholder to go to exchange project-level information.

7.1.6. It is the room where all project participants and stakeholders can actively see into the project. Complete transparency occurs here.



7.2. Constraint

7.2.1. A constraint is a factor that limits the system from getting more of whatever it strives.

7.2.2. Anything that limits the team's performance of work; or anything that restricts workflow.



7.3. Daily Huddle Meetings

Figure 7.2.1: The Daily Huddles should take place as close to the workplace as possible.

7.3.1. Daily Huddle Meetings are where team members quickly give the status of the previous shift's accomplishments and failures, plus the current shift's plan of work for that day.

7.3.1.1. This tool is similar to the lean manufacturing concept of employee involvement, which ensures rapid response to problems through empowerment of workers, and continuous, open communication through talking about planned work on a daily basis.

7.3.2. Daily Huddle discussions must be directly connected to the team's Weekly Work Plan.

7.3.3. This is where transparency and reliable commitments are measured first and foremost for the Last Planners themselves to see and interact with directly. More



importantly, it is the rallying point for “our plan,” which has “my input” accurately reflected. This is the heart of LPS, so of utmost importance for the project manager and the team itself to establish and drive healthy Daily Huddle discipline. Everyone needs to realize that the Daily Huddle is the quickest means to influence improved work flow reliability and productivity.

7.4. Last Planner®

7.4.1. The person that creates tasks for direct workers to perform. “Foreman,” “Superintendent,” “Work Group Supervisor,” “Tool Owner,” “Vendor Lead Tech,” “System Owner” are common Owner environment roles for Last Planners in the construction process.

7.5. Last Planner® System (LPS)

7.5.1. The Last Planner® System improves both design and construction project work flow reliability. Work completed as and when promised is the key goal of LPS. It is a system of inter-related elements. Full benefits come when all aspects and principles are implemented and practiced in a disciplined approach and within all functional areas across the whole project.

7.6. Look-ahead Plan

7.6.1. The middle level in the planning system hierarchy, below front end planning and above detailed execution planning, dedicated to controlling the flow of work through the production system.

7.6.2. This is the fertile ground for proactively removing constraints as early as possible before the actual work gets closer.

7.6.3. The Owner's focus should be on identifying the right Milestones in the Look-ahead Plan, in the correct prioritization and actively “freezing” those Milestones as the main promise to the team.

7.7. Look-ahead Schedule

7.7.1. The Look-ahead Plan is the input to the Look-ahead Schedule. Scheduled milestones align with Master Schedule; the resultant tasks are screened before allowing entry into the look-ahead schedule. Look-ahead schedules may be presented in list form or bar charts.



7.7.1.1. Milestones within the Look-ahead Schedule must reflect the agreed Master Schedule milestones related construction deliverables (all milestones from Design Start through Commissioning or Owner SL2 Finish). The Project Management Team must work toward freezing all Construction Milestones that are within the Look-ahead Schedule. In an IPD environment, this is one of the primary PMT deliverables to the Production Teams.

7.7.2. The purpose of the look-ahead schedule is to:

- 7.7.2.1. Shape work flow in the best achievable sequence and rate for achieving project objectives that are within the power of the organization at each point in time.
- 7.7.2.2. Match labor and related resources to work flow.
- 7.7.2.3. Group together work that is highly interdependent, so the work method can be planned for the whole operation, and Identify operations to be planned jointly by multiple trades.

7.8. Make Ready

7.8.1. "To make ready" is to take actions needed to remove constraints from assignments to make them sound.

7.8.1.1. Also referred to as "screening assignments for quality."

7.8.1.1.1. Quality Assignments (screening process for making work ready) are:

7.8.1.1.1.1. Defined – what, where, when, who are known

7.8.1.1.1.2. Safe – all precautions are taken

7.8.1.1.1.3. Sound – the wherewithal is available – no constraints

7.8.1.1.1.4. In Sequence – prerequisite work is done, matches the overall plan

7.8.1.1.1.5. Right-sized – can be done in a week or less

7.8.2. Only work that has been made ready can be entered into the weekly work plans.

7.8.2.1. Work *Made Ready* Is the Work that Will be done (e.g. constraint-free work assignments ready for incorporation into Weekly Work Plan)

7.9. Master Schedule



7.9.1. Master schedule refers to the Owner produced P3 or P6 schedule.

7.9.1.1. This schedule will set the major construction-related milestones.

7.10. Percent Plan Complete (PPC)

7.10.1. PPC (Percent Plan Complete) gauges the reliability of the planning system. PPC is the number of planned activities completed divided by the total number of planned activities, expressed as a percentage. PPC measures the extent to which the front line supervisor's commitment (WILL) was realized (Ballard 2000). Unlike other project performance criteria or variance analysis (e.g., earned value method) that measure whether the project is on schedule (e.g., schedule index or schedule variance) or on budget (e.g., cost index or cost variance), PPC measures whether the planning system is able to reliably anticipate what will actually be done. Determining whether the planning system is able to reliably anticipate what will actually be done.

7.10.1.1. Example:

TOTAL ACTIVITIES	12
ACTIVITIES COMPLETED	9
PERCENT PLANNED COMPLETE	75%

7.11. Phase Scheduling

7.11.1. Purpose: To produce a plan for completing a phase of work that maximizes value generation and one that everyone involved understands and supports; to produce a plan from which scheduled activities are drawn into the Lookahead process to be exploded into operational detail and made ready for assignment in weekly work plans.

7.11.1.1. To do this in construction at Owner, it is important that team members understand they'll play two roles; (1) provider and (2) customer. To have effective conversations in the team, promoting both behaviors is key to creating reliable workflows. Understanding and agreeing to hand-off criterion, conditions of acceptance, proper sequencing, access to the work and early identification of optimization opportunities are the necessary fundamentals.



7.11.2. Another term for Phase Scheduling is a “network of commitments.” Everything is tied to the milestones, but phase scheduling breaks down the work in manageable chunks, and provides the initial fertile ground for proactive constraint identification and removal.

7.12. Pull Planning

7.12.1. Pull is a technique in phase scheduling in which the team starts with the end in mind and only completes work when it releases work to others (e.g. Lateral w/ POC in place to enable a properly mated connection; Pedestal installation finish as a predecessor to popouts being opened; or pump package in place prior to EV line vertical spool section installation).

7.12.1.1. Optimization of interdependent handoffs and conditions for acceptance becomes possible when effective Pull techniques are applied and people work together to produce useful plans.

7.12.2. Effective Pull Planning brings relevant experts together to rehearse the actual project execution.



7.12.2.1. Effective pull planning aligns understanding and reveals unexpected interactions, problems and value adding opportunities: Builds relationship and trust that can be sustained.

7.12.2.2. Assures that everyone in a phase understands and supports the plan by the working as a team.

7.12.2.3. Assures the selection of value adding tasks by working backwards from the target completion date and only scheduling work that releases other work.



7.12.2.4. Establishes the amount of time available for 'contingency' and team agreement on how it should be allocated, as an example in a Workable Backlog.

7.12.3. Pull Planning answers these essential planning questions:

7.12.3.1. Do we understand how we are going to do the work?

7.12.3.2. Have we collaborated with the right people to make the work happen?

7.12.3.3. Are we confident we can deliver the milestone?

7.12.4. This type of analysis promotes effective labor utilization and material delivered as needed, or "Just in Time."

7.12.5. Requires deeper levels of collaboration and commitment than the traditional approach.

7.12.6. Enables continuous flow of work from one activity to the next once all constraints are relieved.

7.12.7. Creates an environment of schedule ownership by all stakeholders, therefore increasing overall performance by reducing work flow variability.

7.12.7.1. Makes project outcomes more predictable

7.12.7.2. Simplifies coordination

7.12.7.3. Reveals new opportunities for improvement

7.13. Reliable Promises

7.13.1. A promise is considered reliable at the time it is made when one can assess that the performer has the wherewithal (materials, tools, skill, etc.) for performing the task, has assessed the time to perform, has allocated sufficient capacity for performing, is sincere in making the promise, and is ready to be responsible for the consequences in the likelihood that the promise cannot be fulfilled for whatever reason.

7.14. Reason for variance

7.14.1. Faulty directives or information provided to the Last Planner; e.g., the information system incorrectly indicated that material was available or that prerequisite work was complete.

7.14.2. Failure in Last Planner planning; e.g., too much work was planned.

7.14.3. Failure in coordination of shared resources; e.g., lack of a crane or scaffolding.



7.14.4. Change in priority; e.g., crew (part or whole) reassigned temporarily to a "hot" area.

7.14.5. Design error or vendor error discovered in the attempt to carry out a planned activity, etc.

7.14.5.1. Variance management provides the data needed for analysis and improvement of PPC, and consequently for improving project performance.

7.15. Responsible Individual / Last Planner®

7.15.1. A person who makes promises on the project. These promises usually encompass a domain of action or responsibility (e.g., foreman, superintendent, tool owner, vendor, construction coordinator)

7.16. Value add

7.16.1. An activity is value added if the customer is willing to pay for it, the activity changes the form, fit or function of the final product, and the activity is done right the first time. Only if all three of these requirements are met is the activity then considered value add.

7.17. Waste

7.17.1. Waste refers to non value add activity, i.e. activities that do not meet the three requirements of a value add activity as stated above. Seven common wastes are defined by the acronym TIMWOOD.

7.17.1.1. Transportation – movement of material/work in progress from place to place without changing the form, fit or function of the final product.
Example: Carrying material from point (A) to point (B), then to point (C).

7.17.1.2. Inventory – producing something that will not be used right away in the next step of the production. Example: Aging spool sections staged on racks in the subfab.

7.17.1.3. Motion – excessive movement by people or machines. Walking is one of the most common types of this waste. Example: Traveling back and forth from the canteen to the workforce.

7.17.1.4. Waiting – when work is stopped and no progress is being made to complete the final product. Example: Gown room entry back-ups during peak work periods.



7.17.1.5. Over processing – completing more work than the customer requires.

Examples: Excessive labeling; un-used unistrut frames; back-welding compression fittings.

7.17.1.6. Overproduction – completing more work before it is needed. Example:

Duct work assemblies staged to compensate for undetected clashes as they emerge.

7.17.1.7. Defects – part or parts produced that do not meet customer

requirement/specifications. Defects cause rework, which leads to added cost and/or time loss. Example: Poor craftsmanship; missing scope; valid punchlist items

7.18. Weekly Work Plan

7.18.1. Specify tasks planned to be done next week and on which days.

7.18.1.1. Why: Work flow becomes more predictable when team can reliably plan and execute work.

7.18.2. Quality of input into a collaboratively built Weekly Work Plan must be controlled. Here are the five minimum WWP requirements:

7.18.2.1. What is the Task

7.18.2.2. What will be done, e.g. install wire way sections 1, 2, 3

7.18.2.3. Where it will be done, e.g. Column A/1, above AC Box

7.18.2.4. When it will be done, e.g. Tuesday and Wednesday

7.18.2.5. Who will do it, e.g. Joe Foreman

7.18.3. The purpose of the Weekly Work Plan is to:

7.18.3.1. Identify make ready actions by assessing their feasibility prior to making assignments in the WWP so as to shield production workers from uncertainty.

7.18.3.2. Synchronize actions made ready (tasks) relative to the promises of the team members; the conditions for hand off and acceptance clearly communicated, all constraints removed. Optimization of the team capabilities to plan, synchronize, execute, learn and improve Weekly Work Planning should be the primary focus of the team.

7.18.4. Analysis of the Weekly Work Plan:



7.18.4.1. Task duration 5 days or less – Will it be clear when the task is 100% complete? What will be done in this segment of work?

7.18.4.2. Watch for these imprecise words:

7.18.4.2.1. ongoing

7.18.4.2.2. begin

7.18.4.2.3. continue

7.18.4.3. Can all tasks be finished - no unresolved constraints?

7.19. Weekly Coordination Meeting (recommend holding this meeting on Thursday's)

7.19.1. The meeting in which the team conducts the business of the team:

7.19.1.1. General and operational concerns (5 min.)

7.19.1.2. Review 6-week look-ahead plan (15 min.)

7.19.1.2.1. Review the new week (#6) – Note activities that are starting up in week 6.

7.19.1.2.2. Review weeks 2-5 only by new exceptions that pop up. (Team should have been looking at weeks 2-5 for the last 5 weeks.)

7.19.1.2.3. Review constraint log and note any overdue constraints and impact

7.19.1.3. Review last week's performance (5 min.)

7.19.1.3.1. Last week's PPC

7.19.1.3.2. Current week's PPC

7.19.1.3.3. Trend chart

7.19.1.3.4. Variance chart

7.19.1.4. Finalize next week's WWP (35 min.)

7.19.1.5. Coordinate individual plans for off line conversations

7.19.1.6. General/round robin to raise new issues (5 min.)

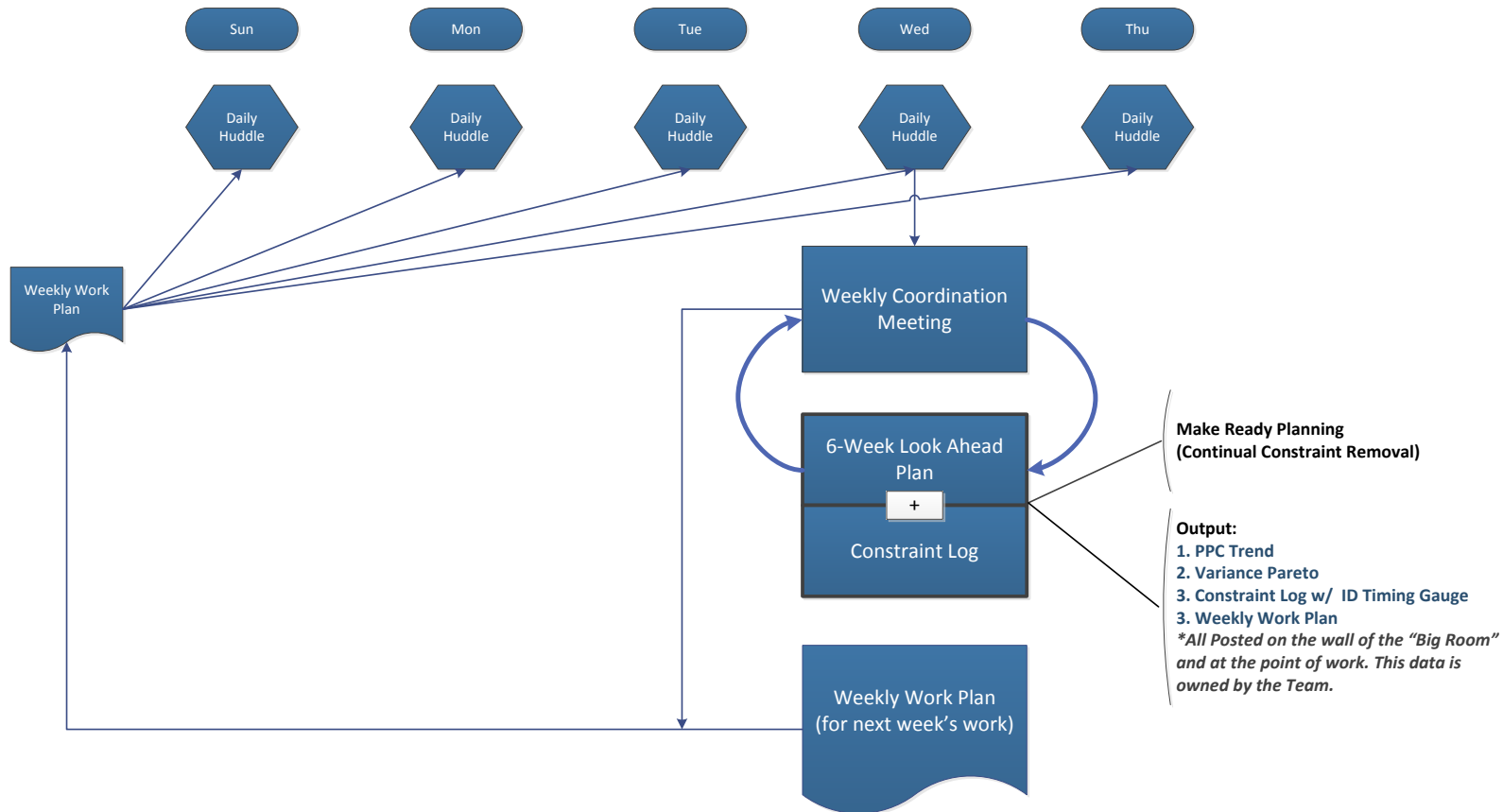
7.19.1.7. Plus/Delta (5 min.)

7.19.2. Illustration: Weekly Work Plan Cycle



The Last Planner® System

Weekly Work Planning Cycle



Section B: Top 5 Actions for Getting Off to a Good Start; Finding More LPS Information; Policy and Process Standards

8. Top Five Actions for Getting Off to a Good Start

- 8.1. Give yourself and your team the opportunity to behave as beginners. You may find the practices to be awkward; they may take you more time than you want to take; and you may find you must revisit work that you thought was complete. You may also need to seek out help from people experienced with the LPS.
- 8.2. Don't pretend that you already do the LPS practices. You'll only short change the project, your team, and yourself. You may already do some of the practices, but it is the set of practices that makes the difference.



- 8.3. Don't be concerned with complete comprehension of the entire program. Deeper understanding will come with practice. Taking time now to learn every detail of the program before you act only delays being in action and there are some things that are just not possible to see or understand until they are experienced.
- 8.4. Make it your goal to make your make mistakes early and often. Create a safe environment for team members to openly discuss failures in the collaborative planning process. Everything should be open for debate as long as it is focused on improving work flow reliability and team maturity.
- 8.5. Take care of mood of the team and your mood. We learn best when we are in moods of openness, wonder, playfulness, and appreciation. Beware of the moods of resignation, panic, arrogance, and complacency. Check in frequently. Speak about your own mood and invite team members to do the same.

Getting Started on Your LPS Journey

Key First Steps

1	Start off by planning and executing next week's work (get <u>really</u> good at this first).
2	Look forward to identify and resolve constraints as a team.
3	Collaboratively plan the work using Pull Planning.
4	Focus on identifying and solving root causes of variance.
5	Make sure that everything is connected to the Milestones.



Driving Principles

Focus on the promises (commitments) made within the production teams
Listen to the Last Planners themselves; involve them; empower them (the homerun). The mood of the team is more important than the tools used.
Set the expectation that there will be failures along the way, and prepare to think about what's after that, and resist the urge to regress (don't give up).
Get planning and management as close to the work as possible.
Build "PDCA" into everything your team does.

9. Find out more about LPS implementation

- 9.1. [Lean Project Delivery Knowledge Center](#)

10. Last Planner® System, Policy and Process Standards

10.1. Policy and Process Standards (PS)

- PS-1: Master Planning
- PS-2: Pull Planning
- PS-3: Make-Ready Planning
- PS-4: Weekly Work Planning



PS-5: Daily Huddle Meetings
 PS-6: Percent Plan Complete (PPC)
 PS-7: Reasons for Variance (learning)
 PS-8: Team Hearth, Maturity and Effectiveness

10.1.2. Policy and Process Standards

P2.0 LAST PLANNER® SYSTEM IMPLEMENTATION

Standard	Input Expectations	Output Expectations	Min. Collaboration
PS-1 Master Planning (What Should Occur)	<ul style="list-style-type: none"> • Previous week's schedule updates • 100% Accurate Set Start Dates • Tool-specific agreed-to durations • Effective change control • Accurate weekly updates - aligned with schedule update process 	<ul style="list-style-type: none"> • Secure Look-Ahead Milestone Planning (4-6 weeks out) • Milestones aligned with program expectations and prioritization. • Ability to predictably see into the future what work needs to be done. • Set the stage for effective pull planning 	Owner, Designer, General Contractor, CM (CCMS), Builder
PS-2 Pull Planning (What Should Occur)	<p>Logistics / Preparations:</p> <ul style="list-style-type: none"> • Big Room adequately sized to facilitate sessions • Adequate consumables to facilitate the session (e.g. sticky notes, markers, pens) • Last Planner® s' proactive field observations and thorough understanding of their scope, production system dynamics, the required work sequences related to the available design information & field conditions. • BIM Model and/or IFC Design drawings made available for team to reference during the session • Layout of work area(s) made available for team members to reference during session 	<ul style="list-style-type: none"> • Collaboratively built plan that all team members have agreed to • Milestones broken down into constituent activities • Clearly defined critical path - activities that are required to achieve each milestone • Optimized schedule of look ahead activities that have been thoroughly assessed for entry into the more detailed WWP. • Micro schedule in MSP, P6 or Excel that can effectively be used to assign work and monitor daily/weekly progress 	Owner, Designer, General Contractor, CM (CCMS), Builder



	<ul style="list-style-type: none"> • Ensure that ALL key players are invited in advance, prepared with their specific inputs and that everyone participates in the actual pull planning session itself. Provide effective coaching upfront, during and post effective pull planning sessions. TIPM is the role model for effectiveness. <p>Implementation:</p> <ul style="list-style-type: none"> • Accurate Milestone Schedule (from 4-6 week look-ahead schedule) - team review and alignment • Segmentation of work coming in the next 6 weeks • Collaboratively plan the 6 week window of work in a way that aligns to the trades' production systems and the Milestones. • Constraint analysis • Make Work Ready quality check • Team conducted backwards-pass planning off each milestone • Input from different project partners and identification of hand-offs and sequential relationships between team members. 	<ul style="list-style-type: none"> • The team confident the plan and Milestones can be achieved • Promises made that can be reliably kept by all participants. 	
--	--	--	--



PS-3 Make-Ready Planning (What Can Occur)	<ul style="list-style-type: none"> • 6 week-ahead schedule of what work is supposed to be done in the near future • (Constraint Log) Constraint analysis of all activates in the look-ahead schedule (e.g. funding, design, materials, prerequisite work such as pedestals and pump packages, direct and indirect labor resource availability, all other potential constraints considered) • Six week slice of your overall planning; now focusing progressively more on the week directly in front of the team. 	<ul style="list-style-type: none"> • Constraint log is the key output of the Make Ready Plan. • Any necessary schedule revisions (last resort) • Confirmation that your pull plan intact. • Enables activates to be released into the Weekly Work Plans, only if the activity has in fact been made ready. 	Production Team: Superintendent, Foremen, Project Manager, Direct Project Support Personnel
PS-4 Weekly Work Planning (What Will Occur)	<ul style="list-style-type: none"> • Last Planner® s and Team Leaders collaborating in the Weekly Coordination Meeting • Input from each Last Planner and Team Leader regarding work that has been made ready for entry into the WWP as each contributor's commitment to the team. • WWP Tasks must be approved for entry by the Last Planners as a team. • Source of tasks comes from the Pull Plan (related to the milestones); greater task detail goes into Weekly Work Planning. • It's not a weekly work plan until everyone on the team has accepted it as their plan for next week, considering all potential overlaps, trades stacking, etc. • The purpose of the weekly work plan meeting is to finalize the weekly work plan for the segment of the plan the meeting is covering. • Focus efforts on how to best maximize work flow for next week's work • The Inputs must come from the Last Planners themselves (proxies should 	<ul style="list-style-type: none"> • Promises and commitments made to each other in terms of what work will be done next week, and in what sequence. • Collaborative input for the short interval of work, and tied to the Milestones (the promises of the project) • Increased plan reliability • Contains only those tasks that team members have agreed will be executed as planned <p>Quality assignments:</p> <ol style="list-style-type: none"> a. Defined – What, Where, When, Who are known b. Safe – All precautions are taken c. Sound – The wherewithal is available d. In Sequence – Prerequisite work is done e. Right-sized – can be done in a week or less 	Production Team: Superintendent, Foremen, Project Manager, Direct Project Support Personnel



	always be viewed with a degree of skepticism until trust within the team is earned)		
PS-5 Daily Huddle Meetings (What is Occurring)	<ul style="list-style-type: none"> • Quick status of what each work supervisor, Last Planner® and Team Leader has worked on since the previous day's meeting. • Raise any issues that might prevent completion of a task assignment. • Compare daily progress to what was in the WWP for that particular day. • Best if held at or as close to the actual work as possible without interrupting the production workers. 	<ul style="list-style-type: none"> • Making sure the work that has been planned is getting done on a daily basis. • Team member involvement • Rapid response to problems • Empowered decision making • Continuous improvement • Open communication 	Production Team: Superintendent, Foremen, Project Manager, Direct Project Support Personnel
PS-6 Percent Plan Complete (PPC – What Did Occur)	<ul style="list-style-type: none"> • Number of planned activities completed divided by the total number of planned activities, expressed in a percentage. • Reliably anticipate what will work will actually be done • Determine what assignments were completed or not based on the plan. • Reasons for failure to complete planned work (the most important input) • Focus is on process improvement 	<ul style="list-style-type: none"> • Ability to gauge the reliability of the planning system. • Measures the extent to which the supervisors, Last Planner®s, Team Leaders commitments were realized. • Measure of the planning system itself and how to understand what work actually got done as compared to the plan • Weekly analysis of PPC results in identifying reasons for the disruption or work. • Systematic learning shared at the point of work • Generates a mindset geared to improving competitiveness among the trades and team members. 	Production Team: Superintendent, Foremen, Project Manager, Direct Project Support Personnel



PS-7 Reason for Variance (Why Did it Occur)	<ul style="list-style-type: none"> • Identification of reasons why planned work was not done • Focus is on identifying what needs to be fixed in order to increase overall production and upcoming PPC. • Problem solving tools applied depending on the problem (e.g. five-whys, root cause analysis, model based problem solving) 	<ul style="list-style-type: none"> • Provides the data needed for analysis and improvement of PPC and for consistently improving project performance. • Reasons for Variance illustrated in Pareto graph format in order to see statistical trends and determine what most needs to be fixed. • Focuses the teams' efforts on what most urgently needs to be fixed in order to maintain project delivery per the plan. • Problem reoccurrence minimized through targeted corrective measures 	Production Team: Superintendent, Foremen, Project Manager, Direct Project Support Personnel
PS-8 Team Health, Maturity and Effectiveness	<ul style="list-style-type: none"> • LPS relevant training, peer support throughout implementation and sustaining • Conduct frequent system health/maturity assessments • Determine what is going well, what has the team learned, what needs more attention, what are the remaining challenges, what help do you or the team need to succeed? • Communicate the bright spots, and things not going well equally - so that the entire production team is aware • Team members talk openly about strengths and weaknesses without fear of reprisal • Build Plan-Do-Check-Act into how the team functions as a group. 	<ul style="list-style-type: none"> • Improved implementation • A culture of collaboration and learning • Team work • Highly functioning teams • Team success • Project success • Project predictability • Individual success 	Production Team: Superintendent, Foremen, Project Manager, Direct Project Support Personnel + Senior Management (Owner, Designer, GC, CM (CCMS), Builder)

Attachments: LPS standard forms and templates:



For Standard Forms & Templates Click Here → [LPD Transfer Deliverables](#)

Open Items: None at this time

Document History

Original Version –4 June, 2013	Revision 4 – 12 May, 2014
Revision 1 – 13 June, 2013	Revision 5 – 14 July, 2014
Revision 2 – 30 October, 2013	Revision 6 – 23 February, 2015
Revision 3 – 14 January, 2014	Revision 6 – 22 June, 2015

*all previous revisions should be disposed of properly – use of the most recent revision is preferred.

For questions, feedback and suggestions, please contact:

Ronald Davidson, PMP

OWNER Enterprise
Central Program Office

✉ <mailto:ronald.m.davidson@Owner.com>

☎ INT: (IDD) 1-602-317-2583