Visual Management Placing tools, parts, production activities, plans, schedules, measures and performance indicators in plain view, This assures that the status of the system can be understood at a glance by everyone involved and actions taken locally in support of system objectives.

Waste The opposite of value. There are seven basic types of waste including: defects, waiting, transportation of goods, motion, inventory, overproduction, and unnecessary process steps.

Weekly Work Plan The commitment-level ("will") planning document of LPS—a list of promised task completions agreed upon by the Performers. The WWP is used to determine the success of the planning effort and to determine what factors limit performance. All the activities shown on the 6W LAS for the current week are included on the WWP—in most cases they are expanded to include more detailed assignments that allow coordination between the different performers to occur at a Weekly Work Planning Meeting.

Weekly Work Planning The process by which the Last Planner establishes the plan for the coming period.

Work Flow The movement of information and materials through networks of interdependent specialists.

Work Structuring Designing the production system to determine who does what, when, where and how, usually by breaking work into pieces, where pieces will likely be different from one production unit to the next. The purpose of work structuring is to promote flow and optimize system throughput by focusing on handoffs and opportunities for moving smaller batches of work though the production system.

Workable Backlog An activity or assignment that is ready to be performed, but is not assigned to be performed during the active week in the WWP. If the team agrees that performance of this activity will not hinder other work then it can be placed on the list of Workable Backlog as part of the WWP. Completion or non-completion of these activities are not recorded or counted in calculation of PPC. A reasonable amount of Workable Backlog allows performers who are stopped from doing their assignments on the WWP or finish them early to continue work without causing harm to others—thus maintaining a reliable work flow.

Assignments that have met all quality criteria, except that some must yet satisfy the sequence criterion by prior execution of prerequisite work already scheduled. Other backlog assignments may be performed within a range of time without interfering with other tasks. Example: Those spare parts lists don't have to be completed for 3 months, but it won't harm anything if they are produced earlier, so use them as fallback or fill-in work when needed.

Work In Process The inventory between the start and end points of a production process.

Lean Project Delivery Glossary

A3 A one-page report prepared on a single 11 x 17 sheet of paper that adheres to the discipline of PDCA thinking as applied to problem solving—or A3 Thinking. The A3 includes the background, problem statement, analysis, proposed corrective actions (and the action plan), and the expected results, often with graphics. A3 reports can be used as a standard method for summarizing problem solving efforts (including analysis of Target Value Design options), status reports and planning exercises.

5S A disciplined approach to maintaining order in the workplace, using visual controls, to eliminate waste. Typically the English translations of the 5S words are Sort, Set in Order, Shine/Sweep, Standardize and Self-Discipline/Sustain.

5 Why Analysis The problem solving technique used to dig for the root cause of a condition by asking why successively (at least five times) whenever a problem exists in order to get beyond the apparent symptoms. As each answer to the why question is documented, an additional inquiry is made concerning that response.

Activity An identifiable chunk of work with recognized prerequisite requirements to begin and a recognized state of completion—or conditions of satisfaction. Another way to look at an activity—establish the hand-offs for each chunk of work thus defining the activity. (see also **Task**)

Actual Cost The documented costs of actually performing a portion of work or an entire project based upon an agreed definitions of cost, overhead, and profit.

Allowable Cost The maximum amount the Owner is willing and able to spend for a facility asset.

Assignment A request or offer that has resulted in a Reliable Promise and is ready to be placed on the Weekly Work Plan for performance. An assignment must meet the characteristics for a Quality Assignment prior to inclusion on the WWP.

Batch An accumulation of work produced by a trade, discipline or other specialist that moves as a unit. The goal of lean is to produce a batch size of one to achieve "single piece flow." Leading to the mantra: "Flow where you can, Pull where you can't, Push where you must."

Buffer As a verb: "to isolate one activity from the next." A mechanism for deadening the force of reality unfolding in a manner that is contrary to what was anticipated in the plan. For example, a capacity buffer is created by committing to complete less work than what would be achieved according to the planned capacity of the resource. If production falls behind schedule, there is capacity available for catching up. (Lean production/construction generally prefers capacity buffers to inventory buffers.)

BIM The process of generating and managing building data during the life cycle of a building. BIM uses three-dimensional (3D), real-time, dynamic building modeling software. BIM includes building geometry, spatial relationships, geographic information, and quantities and properties of building components. BIM can include four-dimensional (4D) simulations to see how part or all of the facility is intended to be built and 5D capability for model-based estimating. BIM provides the platform for simultaneous conversations related to the design of the "product" and its delivery process.

Capacity The amount of work that can be produced by an individual specialist or work group in a given period of time.

Commitment Based Planning A planning system that is based on making and securing reliable promises in a public setting.

Conditions of Satisfaction An explicit description by a Customer of all the actual requirements that must be satisfied by the Performer in order for the Customer to feel that he or she received exactly what was wanted.

Constraint An item or requirement that will prevent an activity from starting, advancing or completing as planned. Something that stands in the way of a task being executable or sound. It is not a preceding element of work already shown on the look-ahead plan, but something that is not shown such as a new client requirement, a contract that must be issued prior to work beginning, approval from an architect to change a design, etc.

Constraints should be identified by the Screening Process.

Constraint Log A list of Constraints with identification of an individual promising to resolve the item by an agreed date. Typically developed during a review of the Six Week Look-Ahead Plan when it is discovered that activities are not constraint free.

Control To engage in activities designed to cause events to be performed as planned, or to initiate re-planning and learning. Example: Engaging in pull planning to explore the master schedule activities in greater detail, screening the resultant tasks for constraints, and acting to remove those constraints are all control actions intended to cause performance to conform to plan. Forward looking to provide the ability to steer.

Customer The individual engaged in a conversation for action who will receive the results of performance either requested from, or offered by, the Performer.

Cycle Time The time it takes a product or unit of work (e.g., a room, building, quadrant) to go from beginning to completion of a production process; i.e., the time it is work-in-process.

Defined A Quality Task must be "Defined"—it must have a beginning and end. It should be clear to all when it has been completed—"install the lights in room 65," "prepare one-line drawings for MCC 32," "erect columns on ¢ D between ¢'s 12 and 23," "perform OSHPD inspection in west wing of second floor." Typically tasks should take less than a week. If not, the portion to be completed in the specific week should be clear—so many pages, or columns, or yards of concrete—not 30% or 50%. As teams advance, the goal should be no larger than day-sized tasks.

Dependence Where two or more tasks are sufficiently related that one cannot be started (or finished) without a certain measure of progress or completion having been achieved by the other. Waiting on release of work.

Expected Cost An expression of the team's best estimate at the conclusion of the Validation Phase of what current best practice would produce as a price for the facility reflected in the accompanying basis of design documents. Typically, the Expected Cost will also be supported by benchmarking or other market data to calibrate the Expected Cost in light of the market context.

First-run Study Trial execution of a process in order to determine the best means, methods, sequencing, etc. to perform it. First-run studies are done at least a few weeks ahead of the scheduled execution of the process, while there is time to acquire different or additional prerequisites and resources. They may also be performed during design as a basis for evaluating options or designing the portion of the work.

Flow Movement that is smooth and uninterrupted, as in the "flow of work from one crew to the next" or the flow of value at the Pull of the customer.

Shielding Preventing the release work to production units because it does not meet quality criteria; the work is not a quality assignment. It is akin to "stopping the assembly line," rather than advancing a defective product. The purpose of shielding is to reduce uncertainty and variation, thereby providing production units with greater opportunity to be reliable.

Should-Can-Will-Did To be effective, production management systems must tell us what we should do and what we can do, so that we can decide what we will do, then compare with what we did to improve our planning.

Sized Quality criterion for assignments whereby the amount of work included in an assignment is made to match the capacity of the production unit that will do the work. The Performer should have a very reasonable expectation that the assignment can be completed by the number of people available to do the job—in other words—no "stretch" goals. LPS stresses "completion as stated" or reliability first not productivity.

Sound Quality criterion for assignments that tests whether or not assignments have had all constraints removed. The Performer of an assignment should know that the materials, tools, staff and information to complete an assignment are available before accepting it—the Performer must be prepared and able to say "no" to the assignment when that is not the case.

Target Cost The cost goal established by the delivery team as the "target" for its design and delivery efforts. The Target Cost should be set at less than best-in-class past performance. The goal is to create a sense of necessity to drive innovation and waste reduction into the design and construction process.

Target Value Design A disciplined management practice to be used throughout project definition, design, detailing, and construction to assure that the facility meets the operational needs and values of the users, is delivered within the allowable budget, and promotes innovation throughout the process to increase value and eliminate waste (time, money, human effort).

Task An identifiable chunk of work—preparation of design documents, erection of steel, testing of an HVAC system, turnover of a building floor. Type and amount of work assigned to a production unit.

Throughput The output rate of a production process.

Under-loading Making assignments to a production unit, or a resource within a production unit, that absorbs less than 100% of its capacity. Under-loading is necessary to accommodate variation in processing time or production rate, in order to assure plan reliability. Under-loading is also done to release time for workers to take part in training or learning, conducting first-run studies, implementing process improvements, or for equipment to be maintained.

Utilization The percentage of a resource's capacity that is used in production. Example: Because of time lost waiting for materials, our labor utilization last week was only 40%.

Value What the Customer is actually paying for the project to produce and install.

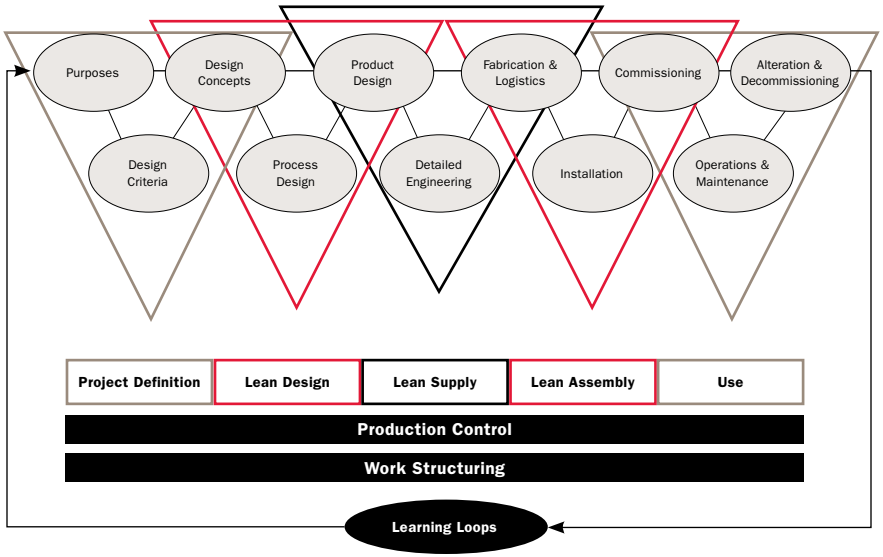
Value Stream Includes all the processes and activities used to design, produce and deliver the product or service to the Customer.

Value Stream Mapping A diagram of every step involved in the material and information flows needed to bring a product from order to delivery.

Variance When an assignment is not completed as stated, it is considered a variance from the weekly work plan.

Variability The range of work completed each day or week.

Lean Project Delivery System



that should be done, can be done, by identifying and removing constraints in advance of need.

Look Ahead Plan A short interval plan, usually based on the pull/phase plan, that identifies all the activities to be performed in the next 6 weeks. The 6W Lookahead Schedule (LAS) is updated each week—always identifying new activities coming 6 weeks out so that the project management team can make appropriate arrangements to assure that the work will be ready to be performed in the week indicated. When an activity cannot be advanced, the reason "why" is identified and listed as a constraint. The 6W LAS typically has been prepared as an Excel spreadsheet, but may also be captured using one of the scheduling software packages.

The output of look-ahead planning is a list of constraints and individual commitments to remove those constraints meeting the follow-on trade's Conditions of Satisfaction.

Look Ahead Window The duration associated with Look Ahead Planning. Typically look-ahead windows extend from 3 to 12 weeks into the future, with 6 weeks preferred on most projects. Reducing the look ahead period will normally increase inventory pushed to site.

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

Master Schedule A schedule that identifies major events in a project (start-up, turn-over to client, order long delivery components, mobilize in field, complete design, government reviews, etc.) and their timing. It is the basis for contractual agreements between the owner and other team members. It is seen as a way to identify long lead items, the feasibility of completing the project as currently required, the basis for defining milestones and phases but not as a way to "control" the project.

Milestone An item on the Master Schedule that defines the end or beginning of a phase or a contractually required event.

Muda Japanese word for "Non-value-added" or Ohno's 7 Wastes.

Mura Japanese word for "Unevenness"—fluctuation in demand that causes the workflow to be uneven.

Muri Japanese word for "Overburdening"—excessive demand on a system that causes the system to produce beyond its reasonable capacity. Pushing a machine or person beyond natural limits. Overburdening people results in safety and quality problems. Overburdening equipment causes breakdowns and defects.

Network of Commitments The web of promises necessary to deliver any project. The role of management is to articulate and activate the unique network of commitments required to deliver each project.

PDCA Stands for Plan–Do–Check–Act. The cycle introduced by Walter A. Shewhart and popularized by Dr. W. E. Deming as a method of continuous improvement.

Phase A period of the project where a specific group of activities is scheduled to be accomplished such as building design, completion of foundations, erection of exterior walls, building dry-in, etc. A phase can be either a time period or a group of activities leading to the accomplishment of a defined goal/milestone.

Phase Plan or Pull Plan A plan for executing a specific phase of a project using a pull technique to determine handoffs. Typically it is prepared by the team actually responsible for doing the work—engineers, architects, owners, designers for a "design phase", designers, specialty contractors, GC for a "construction phase." The team members start at the conclusion of the phase and work backwards, at each step identifying the requirements to declare a chunk of work complete and their needs to start that chunk. Many times it is performed by pasting descriptions of the chunks of work on a wall, establishing durations and efficient work flow pattern and then capturing the final solution in Visio or project management software.

Performer The individual engaged in a conversation for action who agrees to undertake performance either requested from or offered to a Customer.

Plan Reliability The extent to which a plan is an accurate forecast of future events, measured by PPC. Example: If your weekly work plans have a 60% PPC, they accurately predict completion/release of 60% of the tasks represented as weekly assignments.

Planning The collective act of discussing and developing a strategy for future performance. Lean planning is undertaken with the understanding that all plans are forecasts of the future, that all forecasts are wrong, that the further in advance the plan is developed, the more wrong it will be; and the greater the detail of the plan, the more wrong it will be. Planning can also be thought of as "practicing" or "rehearsing" for future performance.

Plus/Delta Review A discussion done at the end of a meeting, project or event used to evaluate the session or activity. Two questions are asked and discussed: What worked or produced value during the session? What could we do different/better next time to improve the process or outcome?

Point Speed How fast each assignment or activity is completed.

Poke Yoke A mistake-proofing method or device developed by Shigeo Shingo that is used to prevent an error or defect from happening or being passed on to the next operation.

PPC (Plan Percent Complete) A basic measure of how well the planning system is working—calculated as the "number of assignments completed on the day stated"

divided by the "total number of assignments made for the week." In many cases the PPC will be less than 50% when a project starts to monitor the PPC and will rise to 80% or 90% as the team becomes conscious of the need to actually perform work as planned. PPC is not a form of Earned Value that measures the percentage of completion achieved for an activity; rather it measures the percentage of assignments that are 100% complete.

Prerequisite Work Work done by others on materials or information that serves as an input or substrate for your work. Example: You need to know the surface area of glass designed by the architect in order to size cooling equipment.

Process Mapping A flowchart identifying all the activities, operations, steps and work times for a process.

Promise The action taken by a speaker ("Performer") to commit to a listener ("Customer") to take some action to produce a mutually understood result ("Conditions of Satisfaction") by a definite time in the future. (see **Reliable Promise**)

"Pull" A method of advancing the wherewithal necessary for work when the next in line customer is ready to use it. A "Request" from the customer signals that the work is needed and is "pulled" from the performer. Pull releases work when the system is ready to use it.

"Push" An "Order" from a central authority based on a schedule; advancing work based on central schedule. Releasing materials, information, or directives possibly according to a plan but irrespective of whether or not the downstream process is ready to process them.

Quality Conformance to a Customer's valid and agreed upon Conditions of Satisfaction.

Quality Assignment Assignment that meets quality criteria for release to the customer process. The quality criteria are: (1) definition, (2) soundness, (3) sequence, (4) size, and (5) learning.

Reason for Variance Factors that prevented an assignment from being completed as promised, used by the team to promote learning concerning the failure of the planning system to produce predictable workflow. By assigning a category of variance to each uncompleted task, a team is able to identify those areas of recurring failure that require additional reflection and analysis, using 5 Why or other suitable problem solving techniques.

Request The action taken by a speaker ("Customer") to ask a listener ("Performer") to take some action to produce a mutually understood result ("Conditions of Satisfaction") by a definite time in the future.

Reliable Promise A promise made by a performer only after self-assuring that the promisor (1) is competent or has access to the competence (both skill and wherewithal), (2) has estimated the amount of time the task will take, (3) has blocked all time needed to perform, (4) is freely committing and is not privately doubting ability to achieve the outcome, and (5) is prepared to accept any upset that may result from failure to deliver as promised.

Root Cause Analysis A systematic method of analyzing possible causes to determine the root cause of a problem. (see also **5 Why Analysis**)

Sequenced A "sequenced" assignment should release work to another Performer and in no case should it hinder another assignment or cause other crews to do additional work. Quality criterion for selecting assignments among those that are sound in priority order and in constructability order.

Screening Determining the status of tasks in the look-ahead window relative to their constraints, and choosing to advance or retard tasks based on their constraint status and the probability of removing constraints.

Five Big Ideas A set of organizing concepts that support Lean Project Delivery. They were developed to explain and organize the Sutter Health Lean Construction Initiative: Optimize the project not the piece, Collaborate, Really Collaborate (originally implied "specialty contractors involved at schematic design"), Projects as Networks of Commitment, Increase Relatedness, and Tightly Couple Action and Learning.

Gemba The Japanese term for where value is added or the "work face." Typically this is the shop or installation area.

Hand-off The act of releasing an item or activity to the person or group performing the next step or operation on that item or activity e.g., a structural steel design is "handed off" to the steel detailer to complete shop drawings, a room (or portion) that has been framed is "handed off" to the drywall installer, or all construction on a floor of a hospital is completed and it is "handed off" to the hospital personnel to begin "staff and stock" activities.

Hand-off Criteria The Conditions of Satisfaction discussed and explicitly agreed upon between the parties to a hand-off.

Integrated Project Delivery (IPD) A delivery system that seeks to align interests, objectives and practices, by reconceiving the Organization, Operating System and Commercial Terms governing the project. The primary Team Members would include the Architect, key technical consultants as well as a general contractor and key specialty contractors. It creates an organization able to apply the principles and practices of the Lean Project Delivery System.

Inventory Stock on hand; often divided between raw materials inventory, work-in-process, and finished goods inventory.

Just-in-Time (JIT) A system for producing or delivering the right amount of parts or product at the time it is needed for production.

Kaizen The Japanese word for continuous improvement. Kaizen has come to mean the philosophy of continuous improvement

Kanban Japanese term meaning "a signboard." A communication tool used in JIT production systems. The signal tells workers to pull parts or refill material to a certain quantity used in production.

Last Planner® The person or group that makes assignments to direct workers. "Squad boss" and "discipline lead" are common names for last planners in design processes. "Superintendent" (if a job is small) or "foreman" are common names for last planners in construction processes.

Last Planner System (LPS) The collaborative, commitment-based planning system that integrates should-can-will-did planning, pull planning, make-ready look-ahead planning with constraint analysis, weekly work planning based upon reliable promises, and learning based upon analysis of PPC and Reasons for Variance.

Lean Project Delivery System (LPDS) LPDS represents the development and delivery of a project from determining that which helps clients better achieve their business purposes through final use. Positive iterations are encouraged within each phase so as to prevent negative iteration between the phases. Production control, work structuring and learning are continuing functions. (Refer to diagram on next page.)

Load The utilization of a resource. The amount of output expected from a production unit or individual worker within a given time. Within a weekly work plan, what is to be accomplished by a design squad or individual designer, engineer, draftsperson, construction craft worker, crew, etc. A quality assignment "loads" a resource within its capacity.

Look Ahead Planning The portion of the Last Planner System that focuses on making work ready—assuring that work