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TME

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Dick Bayer

Executive Director Emeritus,
Lean Construction Institute

TME: Describe the mission of the Lean Construction Institute (LCI).

BAYER: LCI's explicit mission is: We serve as a catalyst for transforming the design and construction industry to deliver value using lean principles and practices.

TME: Please provide the basic principles of lean construction.

BAYER: The fundamental principle underlying lean is that we should attempt to increase value to the customer while we simultaneously eliminate waste.

People often ask how that translates into design and construction where we do not control the environment, the work, the goods and materials, the pace, the contracts or the obligations of all stakeholders? That, as Shakespeare said, is the rub.

We like to think of lean principles being incorporated into the three main opportunities of lean construction and design:

- impeccable coordination;
- production system design; and
- projects as collective enterprises.

Supporting those three opportunities are five big ideas around lean implementation:

- collaborate, really collaborate;
- tightly couple learning with action;
- optimize the whole, not the piece;
- projects are networks of commitments; and
- increase relatedness.

The five big ideas really support the notion that a company has to be a living, breathing laboratory of learning. To support that, we recognize that projects are networks of commitments—people reliably telling others what work they will do and when they will do it. That includes the obligation to request information from others to understand what work actually needs to be done. A core principle of all lean disciplines is to do only the work that the

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customer wants. In construction that means finding out from the many “customers” on the job what work needs to be done, by whom and when.

In order to have reliable commitments that people trust, people need to know the other people on the job (increased relatedness). Once they know each other, they have to be able to work together—not only in passing off work to others but deeply understanding what work needs to be done. That requires real collaboration.

People don't come naturally to collaboration or making reliable commitments or getting to know each other. So we have to teach them how best to start that. But we don't think that classroom training is the most effective so we go into the trailers and design studios and work with the workers. By tightly coupling their learning with their new actions, we find that they are able to collaborate, plan cooperatively and get work to flow across projects. The effect of those combined activities is to optimize the whole project and not just the piece of work contributed by the worker.

Our research has confirmed that projects work best when work flow is unimpeded (when the work of the separate siloed contractors flows across the site). That is what we mean by impeccable coordination: work flowing across a project seamlessly. This rarely happens naturally. So when we plan our work (our production system), we use a pull system to ensure that the work we are doing is only the work that is necessary to accomplish our goal (our deliverable). The pull system starts with the completed deliverable and moves backwards to pull just the work that is actually needed. We are used to doing this in design and construction to meet deadlines. We just institutionalize what is usually an “emergency” procedure into the way we manage projects every day. And we require full participation from the workers and managers.

Construction projects, in order to maximize the project, need to be thought of as collective enterprises. We all fail when one fails.

TME: What acquisition methods are most applicable to the benefits of lean construction? Or is the concept independent of acquisition method?



PHOTO BY KEVIN BROWN

BAYER: The concept is truly independent of the acquisition method. As an old construction litigator, I'm continually amazed by how we have come to define projects as contract delivery models (design, bid, build) rather than as a 200-bed hospital or a 17-story mixed-use project. Our contracts support activities and incentivize behaviors that are contrary to the best interests of the project. In order to optimize the whole, the contract(s) should support collaboration, cooperation, innovation and safety.

We can use lean principles and tools regardless of the contract method. The Last Planner® System of planning can be used on any project, no matter how draconian the contract model. Last Planner is a production planning system designed to produce predictable work flow and rapid learning.

- Begin with a Master or Critical path schedule to identify the strategy of the project, including long-lead items and other important strategic objectives (this should be a limited number of activities to help you get to the Milestones).
- Optionally, validate that schedule with a Milestone schedule developed collaboratively.
- Develop appropriate milestones that take those chunks of work that ought to be done and break them into phases.
- Engage in a highly collaborative system of planning the work in those phases with the people who manage the day-to-day assignment of work for that phase.
- The production plan for each phase should be created using the “pull”

technique, starting from the milestone on the right, and working to the start of the phase toward the left.

- We also have the opportunity to design the production system or align the design of the production system with the BIM model.
- Look ahead planning (usually six weeks) that identifies everything that needs to be in place so that assignments can be made.
- Use of a constraint system (a log or identified stickies) to ensure quality discussions of “making work ready” and to ensure that we document that individuals have made commitments to remove constraints for tasks in future weeks 5 or 6 or beyond.
- Engage the entire team in collaborative weekly work planning that determines the tasks to be done in the next week.
- Tasks that are completed in the assigned week are measured daily, averaged each week and represented publicly in a percent plan complete (PPC) trend chart.
- Tasks not completed are investigated for reasons why so we can analyze whether the failure was one-off, like weather or sickness, or systemic, like continual failures of material to be delivered on time.
- The goal is to have planning reliability substantially ahead of the industry average PPC of 54 percent and that PPC measurement is on an improving trend.
- Regular assessments of the team's use of the Last Planner are to be made to ensure continued improvement of behaviors, process, discipline and tools.

The 5 Why Process, designed to get to the root cause of a problem, can be applied to any issue, regardless of contract model. Maintaining and tracking projects through the A3 process can be used on any project. Lessons learned can be garnered on any project. In fact, project partnering (as opposed to relationship partnering) often looks back every quarter on lessons learned to figure out what we should keep doing, stop doing and start doing. The concept of increasing value and driving out waste can support process analysis anywhere.

TME: Who benefits from lean? Owners, prime contractors, subcontractors?

BAYER:

- **Owner**—The owner benefits from reduced cost, faster completion, better quality and increased safety. The owner gets what the owner wanted without having to sacrifice one of the three legs of the project delivery stool—time, money or quality. On well-managed lean projects, owners usually use fewer resources to supervise and manage the project, lowering their overall soft costs.
- **Prime Contractor**—The general contractor (GC) or prime contractor benefits from increased collaboration on the job, reduced punch lists, faster completion and greater safety records. Customer satisfaction is higher on lean jobs leading to a greater trust and improved relationship between owner and GCs. Often GCs receive general conditions payments on the project after completion because the job finishes ahead of the requirement.
- **Subcontractor or Trade Partner**—For the first time on projects, trades can rely on commitments for when their work will be required. If I am a drywall contractor, my greatest hope is that I can show up on Tuesday with the right-sized crew to do the work I anticipated. That usually means jobs are completed by trades with up to 20 percent fewer resources—meaning their bottom line also increases 20 percent (all else being equal). We find trades who have worked on lean projects usually reduce their bids for those GCs going forward, knowing that they will continue to experience reliable project delivery.

TME: How do you measure the results of implementing lean? Give some examples of savings from lean construction.

BAYER: The most prominent and well-known measure of performance on lean projects is the PPC each week. LCI research indicated in the early 1990s that only 54 percent of the work contractors thought they would accomplish in any week was actually completed. Other studies have shown that up to 50 percent of the work done on projects is waste. The goal of Last Planner and other production systems is to increase PPC to 85 percent or 90 percent every week. We routinely reach that objective on lean projects.

Other metrics include:

- **Increased Efficiency:** Parkland Hospital in Dallas, Texas (2.1-million-ft²), has reported they are using 20 percent fewer resources on the project than predicted. This equates to roughly 400 fewer workers (400 fewer trips to and from the site every day and 400 fewer folks to get in the way of work or impact safety).
- **Project Savings:** Projects delivered through integrated project delivery (IPD) methods (meaning the whole team is assembled on the job early; design is both to budget and constructability; and construction is managed from design through commissioning) have routinely achieved schedule and budget advantages. Universal Health Services (UHS) has been using IPD for roughly five years and reports that only 1 of 40 projects has been over budget and that one was at 103 percent of budget. Here are some of their statistics:

Fairmont, 54-Bed Facility Traditional	Horsham, 60-Bed Facility IPD
Bid Day: \$8,828,677	Target Cost: \$8,206,072
Change Requests: 30	Change Requests: 3
Increased Costs through Changes: \$677,758	Increased Costs through Changes: (\$36,181)
Final Cost: 9,500,000	Final Cost: 8,169,891

- **Schedule Efficiencies:**
 - **Seattle Children’s Clinic**—schedule: 18 months; finish: 14 months
 - **Wisconsin Hospital**—schedule: 38 months; finish: 36 months
 - **St. Louis Hospital**—schedule: 26 months; finish: 24 months
 - **Toronto Tenant Finish**—schedule: 14 months; finish: eight months
 - **University Stadium East Stands**—schedule: 10 months; finish: eight months
- **Decreased Request-for-Information (RFI) and Changes:** Industry figures indicate that RFIs cost between \$600 and \$1,000 to generate and answer. Lean projects see a significant decrease in RFIs and changes. The Seattle Children’s Clinic, for instance, compared RFIs on its lean job with those on its next best project (managed by the same general superintendent). They saw a decrease from 608 to 78.
- **Increased Satisfaction:** In interviews with owners, I repeatedly hear that their lean projects have been the “most fun” projects they’ve been associated with for years. In addition, the LCI Board now includes a number of owner’s representatives (Bill Seed from UHS, Craig Russell from Disney, and Michael Bade from the University of California-San Francisco) who use IPD models on every project. This includes Michael who has to work with California public procurement laws to allow as much lean as possible.

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Dick Bayer is President of the ReAlignment Group Ltd. Between July 2010 and March 2013, he served as Interim Executive Director of the Lean Construction Institute where he previously was a Board Member. During his career he has consulted on more than 200 lean or IPD projects throughout North America and Europe. Bayer also is a licensed attorney, having practiced construction law in Colorado, California and Idaho for the past 37 years. He graduated with high honors from Middlebury College in 1973 with a degree in American History and earned his Juris Doctor from the University of Colorado-Boulder in 1976.

