Key Take-Aways:
1. High value for full day class
2. A lot of material was covered
3. CoP will address Last Planner & Target Value Design by holding workshops in 2017
Austin Community of Practice

2017 Calendar of Events

**January**
Kickoff Happy Hour
Yardhouse at Domain Northside

**February**
Continuous Improvement “KaiNexus”
Tuesday, Feb 21 - Lunch event
Fibercore

**Early April**
Intro to Lean Workshop - Aaron Pitt & Bernita Biekmann
Thursday, April 6th - All day event
Texas Hospital Association

**Late April**
The Business Case for Lean
John Pemberton, LCI
Thursday, April 27th - Lunch event
Galvanize

**May**
Target Value Design, @ Location TBD

**June**
Lean Coffee, @ Location TBD

**July**
Break, Mid-Year check-in with CoP

**August**
Happy Hour, @ Location TBD

**September**
National Speaker - TBD, @ Location TBD

**October**
Lean Coffee - Congress Recap Focus, @ Location TBD

* National Event: Call for Topics for 19th Annual LCI Congress: “Capture and Leverage the Lean Advantage”

* National Event: May 30th – 31st Lean Design Forum (Chicago, IL)

* National Event: Oct 16-20 - 19th Annual Lean Congress (Anaheim, CA)

**November**
Learnings - Success & Failure Panel with CoP Members @ Location TBD

**December**
Break
Introduction to Lean

Bernita Belkman & Aaron Pitt
April 6, 2016

Introduction to Lean

LEARN MORE: lcicongress.org/2017

Introduction to Lean

A must-attend design industry event

LEARN MORE: leanconstruction.org/events/2017-design-forum

Introduction to Lean

Introductions

• Name and Profession

• What do you know/any experience with Lean or Integrated Project Delivery?

• What you hope to learn today?

• First concert you attended?

Introduction to Lean

Learning Objectives

• Define Lean and the principles associated with a Lean operating system.

• Identify the principles and tools relevant to Lean design and construction processes.

• Recognize various types of waste in design and construction and apply tools to reduce, minimize, and/or eliminate waste.

• Increase collaboration and communication on projects through application of structured planning systems and processes.

Introduction to Lean

What is Lean?

“Producing what is needed, when it is needed, with the minimum amount of time, materials, equipment, labor, and space.”

Introduction to Lean

Lean is not about:

• Cost cutting

• Slashing prices

• Workforce reductions

Lean is about:

• Focusing on value

• Eliminating waste

• Continuous improvement

Introduction to Lean

Background

• Based on the Toyota Production System.

• According to a Construction Industry Institute (CII) Study in 2004, 54% of assignments that were scheduled were completed by the end of the week.

• Steven Spear – The High Velocity Edge

Introduction to Lean

The Opportunity….

Manufacturing

Design/Construction

4/7/2017
Discussion Question
What are your dissatisfactions with the way projects are currently designed and constructed?
• Within your control.
• Outside of your control.

Introduction to Lean
Why Lean?
• Construction productivity is declining.
• Construction costs are skyrocketing.
• Injuries are too high.
• Traditional planning systems are unable to produce predictable workflows.
• Workflow reliability directly affects speed and cost of projects.

Source: Davis Langdon OSHPD Report 2006

Introduction to Lean
The Problem With Traditional Construction Culture...
• Risk is high.
• 70% of projects are delivered late.
• 73% of projects are over budget.
• Rework and waste is high.
• Teamwork is unreliable.
• Customers are not satisfied.
• Profit margins are shrinking.

Introduction to Lean
Lean Manufacturing Principles
• Define value.
• Map shortest path to determine value.
• Establish workflow.
• Utilize pull rather than push.
• Pursue perfection, and strive for continuous and incremental improvement.

Introduction to Lean
Goals of Lean Design & Construction
• Achieve reliable workflow.
• Maximize value to the customer.
• Minimize waste.
• Optimize the whole, not the parts.
• Develop a discipline of learning and continuous improvement.

Introduction to Lean
Benefits of Lean
• Safer working environment.
• Fewer incidents and injuries.
• Projects being completed more efficiently.
• Increased productivity.
• Satisfied stakeholders.

Discussion Question
Identify processes that are not Lean and describe how they can be changed to embrace the Lean culture.

A New and Coherent Way to Manage Work in Projects
Three Connected Opportunities
• Interconnected Concepts
• Production System Design
• Collective Enterprise

Discussion Question
Make a Card Game
You are a factory worker with a team of 7. This is how your team is set up:

WS-1
WS-2
WS-3
WS-4
WS-5
WS-6
WS-7

Introduction to Lean

We are here to work. No more talking.

Work Station 1 starts with a Blank Card. Goal is to produce a card that looks like this.

Work Station 1 -- Performs any necessary layout for installation

Work Station 2 -- Responsible for assuring batch size. Batches of 5 must be punched and secured with a paper clip

Work Station 3 -- Responsible for installing the yellow dot

Work Station 4 -- Responsible for installing the star on the yellow dot

Work Station 5 -- Responsible for installing 3 red dots
Introduction to Lean

Work Station 6 —
Responsible for installing the green dot

Work Station 7 —
Responsible for inspection to assure conformance to the following specifications:
- batches are properly bundled per rules
- no dots touch each other
- star is within yellow dot

Introduction to Lean

Phase 1 Logistics
- Workstations in work flow sequence
- Materials located at workstation
- Workstations 2-7 have an incoming queue space
- Completed Batches of 5 placed in queue space of next station
- Batches remain together until final inspection

Introduction to Lean

Phase 1 Policies
- Workers perform only their assigned tasks - NO THINKING
- Maintain Batch integrity - BUILD IT IF YOU CAN and PASS IT ON IF YOU CAN’t.
- QC Problems only detected by Inspector - NO FEEDBACK - NO TALKING
- All QC problems set aside by inspector as rework - TURN UPSIDE DOWN
- QC Inspector announces first good product.
- Assemblers are paid by the piece, period.

Introduction to Lean

Your Hypotheses
- How long will it take for you to produce the first good card?
- How many good cards will your team produce in Phase I?
- How much rework will you generate (defects)?
- How much WIP will you generate (subassemblies left on the table)?

Introduction to Lean

Performance Metrics
- Production: the number of good cards produced in each 6-minute phase.
- Time: the time it takes the first good card to get through the system.
- Defects: the number of cards set aside to indicate errors in configuration or fit.
- Work in Progress Inventory (WIP): the number of subassemblies on the table at the end of the 6-minute phase.

Introduction to Lean

Results gathering...
How could this system be redesigned for better performance?
Introduction to Lean

Phase 2 Logistics
- Workers may have only one assembly at their workstation
- Only 1 assembly allowed in queue space between stations (Batch size of 1)
- Assembly can only be placed in queue when it is empty (pull mechanism)
- Workstations in Work Flow Sequence
- Materials located at station
- Stations 2-7 have an incoming queue space

Phase 2 Policies
- QC Problems may be verbalized by any worker
  - SOME THINKING and TALKING ALLOWED
- All QC problems set aside as rework at station discovered
  - TURN UPSIDE DOWN
- Everyone is paid hourly wages plus a bonus for team performance
  - Workers perform only their assigned tasks
  - Workers cannot fix QC problems from upstream
  - Inspector announces first good card

Your Hypotheses
- How many good cards will your team produce in Phase II?
- How long will it take for you to produce the first good card?
- How much rework will you generate (cards turned upside down)?
- How much WIP will you generate (subassemblies left on the table)?

Phase 3 Logistics
- Workload may be re-sequenced and/or rebalanced by the team
- Workers may have only one assembly at their workstation
- Only 1 assembly allowed in queue space between stations (Batch size of 1)
- Components can only be placed in queue when it is empty (pull mechanism)
- Workstations in Work Flow Sequence
- Materials located at station
- Stations 2-7 have an incoming queue space

Phase 3 Policies
- Workers perform ANY step in the production process
- QC problems can be fixed by ANY worker – Fix it when you find it.
  - No restrictions on talking.
- Everyone is paid hourly wages plus a bonus for team performance.
  - Inspector announces first good card.

Fundamental Principles
1. Dependence and variation affect system performance
2. Batch size affects system performance
3. Optimizing throughput often requires some part to slow down
4. We can influence performance by how we design the production system

Your Hypotheses
- How does this apply to the design process?
- How does this apply to construction?
Introduction to Lean

Respect for People
Generating Value
Reducing Waste
Process & Flow
Continuous Improvement
Optimizing the Whole

Discussion Question

What is value?

Generating Value

"If it is not something the client is willing to pay for, it is non-value added. Everything else is waste, and therefore should be eliminated, simplified or reduced."
- "The Toyota Way" by J. Liker

What defines waste?

- Activity does not change the information or product
- It is not done right the first time
- Customer does not care about it or is not willing to pay for it

Discussion Question

Eight Types of Waste

- Unnecessary
- Inventory
- Motion
- Waiting

- Transport
- Defects
- Overproduction
- Overprocessing

What is Waste?

List examples of waste you see in design and on construction sites.

Discussion Question

List examples of waste you see in design and on construction sites.
Introduction to Lean

Lean Delivery

• Project Conditions of Satisfaction (CoS)
• The Value of Reliable Workflow
• Tools & Processes that Drive Lean in Design

Vision and Mission

the team. Supports the facilities Vision and Mission.

Integrated Lean Project Delivery (ILPD)

What is the Construction effect?

What's the Design effect?

What is more important?

Speed or Reliability?

Target Value Design (TVD)

"A collaborative team managed design process that is used throughout all stages of design and construction to ensure that projects are delivered within the allowable budget, that projects meet the operational needs and values of the users and that projects promote innovation to increase value and eliminate waste."

Target Value Design (TVD)

- Focuses on value to the end customer through the design process and recognizes the importance of constraints (cost, schedule).
- Design based on detailed estimate, what is constructible, and in a pair or group

Conditions of Satisfaction

Developed by the Team

Could include: Construction, Design, and Operational Goals

Can be Long and/or Short term.

This is a VALUE Proposition for the team. Support the facilities Vision and Mission.

Introduction to Lean

Tools

Integrated Project Delivery (IPD)
Integrated Lean Project Delivery (ILPD)
IPD Contracts (IPkA)
Reliable Promises
Target Value Design
Choosing by Advantages
Prototyping (2P/3P)
Value Stream Mapping
Process Mapping
A3 Thinking
Standard Work
5S
Last Planner System

What is more important?

Speed or Reliability?

What’s the Design effect?

What is the Construction effect?

Introduction to Lean

Plan-Do-Check-Adjust (PDCA)

Make improvements based on the results.

Predict the outcome.

Grasp the Situation

Perform the work

Really Reflect & Study

Introduction to Lean

DESIGN THEN ESTIMATE VS. TVD

Traditional

Cost as an output of design
Well after the front end, don’t bother one remodel
Time consuming manual quality take-off
Early commitment to design solutions
Double cost estimates and reports for owners

Integrated

Cost as an input to design
Share information early and often
Rapid model based estimating
Carry multiple solutions sets forward as long as possible
Provide cost feedback to concepts rather than drawings
Graphical display posted for all to see

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Choosing By Advantage (CBA)
A decision-making system developed by Jim Suhr for determining the best decision by looking at the advantages of each option.

Prototyping
Prototyping is creating a demo of what is being designed or built. It is essential for clarifying required information. A prototype is generally a small-scale model of what you intend to build.

What does it look like?
- Rapid Prototyping
- Staff Ownership of Decisions
- Staff Engagement

like this...

Process Maps
- Steps within a single process
- Shows where decisions are made
- Shows how many steps are involved
- No concept of timing or steps/quality/proportions (no data)

CURRENT STATE   FUTURE STATE

What does it look like?
...and this.

...and this.

Value Stream Maps
The steps needed to provide a service, make a product, facilitate contracting process from beginning to end. Usually contains data and information about each step. Helps focus team on what to improve.

A3s
- Decision making tool with all of the information at hand
- A3s in design allow the team to investigate design options, materials, capture mock-up iterations in a way that tells the story of the project and how the team solved the problem. Shows not just the "what," but the "why" as well.
- Requires Collaboration

Standard Work Instructions
- Allow us to capture the best methods and coach and mentor people on those methods.
- Benefits include easier new employee training and reductions in variability from team to team.
Parade of Trades
1. The building has 35 floors.
2. There are seven trades.
3. Each trade has work on every floor.
4. The work must be done in sequence, with each trade only able to work on those floors that have been given to them by the previous trade.
5. The trades mobilize to site one week apart.

Move 35 pieces of work through 7 tasks. Work is completed at the end of the week and passed to next trade. Place materials as shown.

Week 1
Pass the Die to the LEFT, Pass Chips to the RIGHT!
Plumbing Layout

Framing Rough Electrical

Rough Plumbing

Paint

Casework

Drywall Chips Dice

Casework – It’s your job to keep everyone at the table on the same week.

Announce the week as you get the dice (and to start the game)

Layout – You will finish first.

Please tally the results on the reverse of this page and report results.

EVERYONE

1. Distribute score sheets as directed
2. 35 Chips to the left of Layout
3. Establish queue space to hold available work
4. Give die to Casework

Introduction to Lean

Table of Contents

Introduction to Lean

When Work is Complete

Record the week each Trade finishes. Sum and record the Available Capacity for all Trades. Sum and record the total Remaining Inventory for all Trades except Layout. Note the highest amount of Inventory in any week for each trade. Bring die and score sheet to the front.

<table>
<thead>
<tr>
<th>Trade</th>
<th>Work Complete</th>
<th>Available Capacity</th>
<th>Remaining Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Layout</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Framing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rough Electrical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rough Plumbing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paint</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Casework</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Drywall</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Introduction to Lean

Discussion

• How do we cope with unpredictable workflow now?
• Who manages the coping?
• How would more predictable workflow benefit your company?
• How would more predictable workflow benefit Projects?
• What obstacles do you see to making the workflow more predictable?

Introduction to Lean

Key Points

• Reducing variability
• Improves overall system performance
• Makes project outcomes more predictable
• Simplifies coordination
• Reveals new opportunities for improvement
• Point speed and productivity don’t matter – throughput does
• Reduce variation THEN go for speed to increase throughput
High Variability and High Capacity Utilization Decrease System Throughput

Introduction to Lean

High Variability and High Capacity Utilization Decrease System Throughput

Last Planner® System (Should-Can-Will-Did Planning)

As Needed

Should

Proposal Planning

Can

Weekly

Will

Work Planning

Did

Learning

Applying Lean Thinking

Lean Project Delivery System

- Lean Definition
- Lean Design
- Lean Supply
- Lean Assembly
- Lean

Introduction to Lean

How to Implement Lean

Discussion Question

How can using Lean design and construction practices improve the way projects are managed?

Plus/Delta

- CI: Continuous Improvement
- GV: Growth
- RW: Respect for People
- PF: People First

Summary

- What is Lean?
- Lean Opportunities
- Principles of Lean Thinking
- Lean Delivery
- Last Planner® System
- Target Value Design (TVD)
- Implementing Lean