Introduction to Lean Project Delivery

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Immersive Education Program

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Table Introductions & 2 Discussion Questions

1. What do you **want out of this** Introduction to Lean Project Delivery?
2. What are your **dissatisfactions** with the way projects are currently designed and constructed?

10 minute discussion

ELECT A SPOKESPERSON TO TAKE NOTES

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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.

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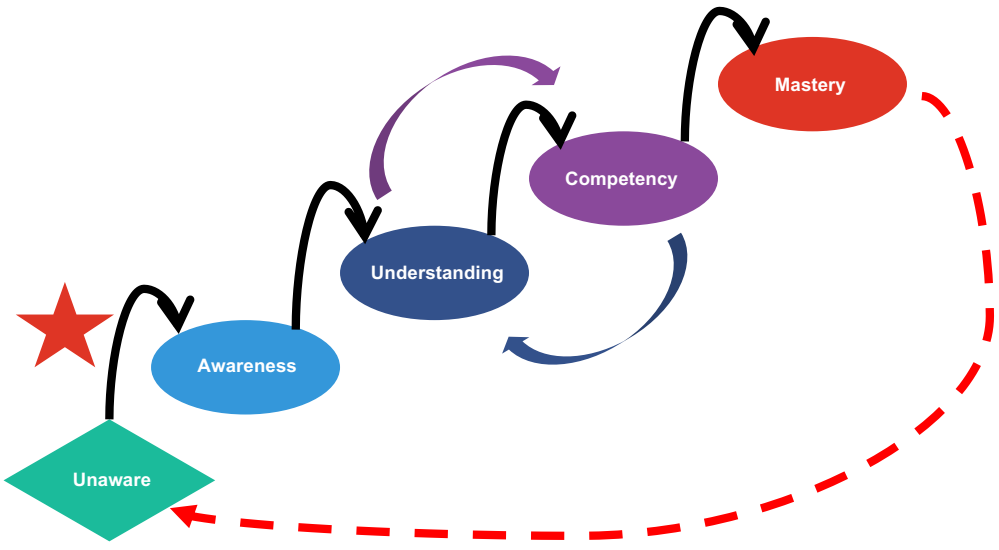
Lean Journey to Mastery



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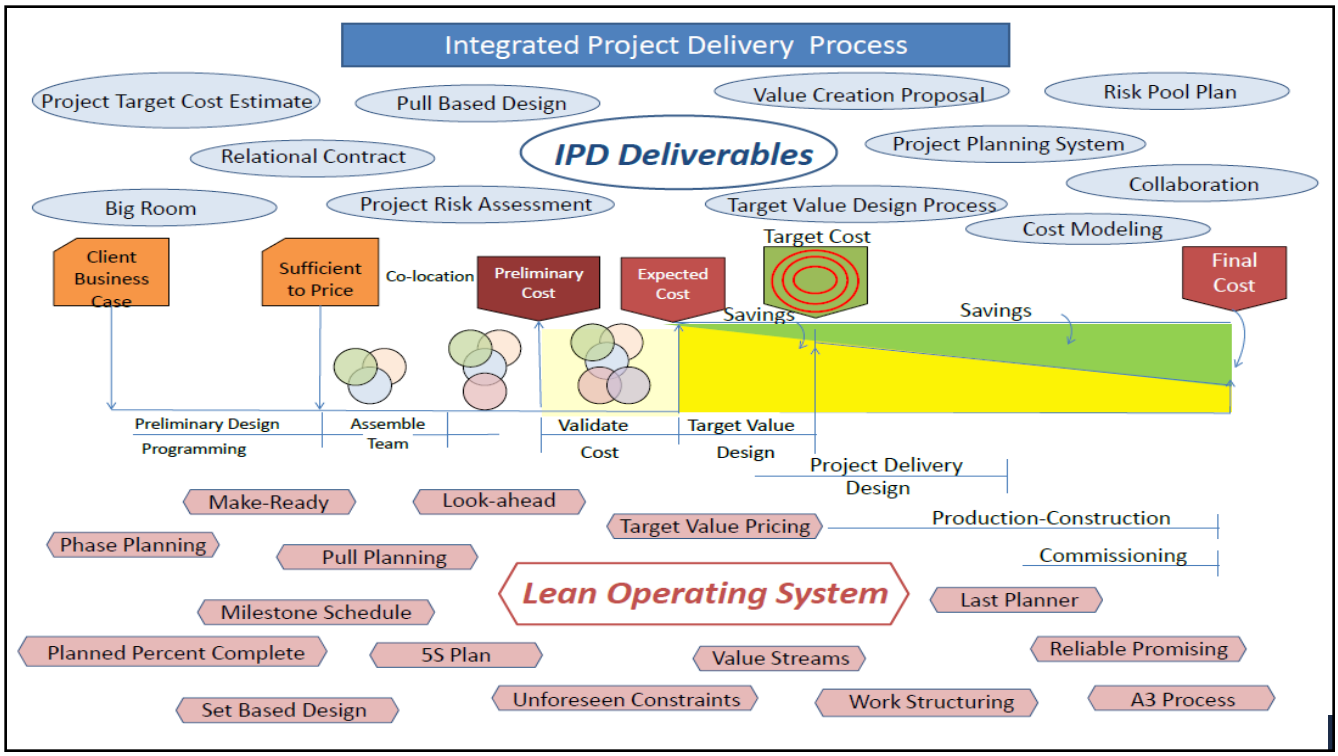
Integrated Project Delivery Process
Project Target Cost Estimate
Pull Based Design
Value Creation Proposal
Risk Pool Plan
Relational Contract
IPD Deliverables
Project Planning System
Collaboration
Big Room
Project Risk Assessment
Target Value Design Process
Cost Modeling
Target Cost
Client Business Case
Sufficient to Price
Co-location
Preliminary Cost
Expected Cost
Final Cost
Savings
Savings
Preliminary Design
Programming
Assemble Team
Validate
Cost
Target Value
Design
Project Delivery
Design
Make-Ready
Look-ahead
Target Value Pricing
Production-Construction
Phase Planning
Pull Planning
Commissioning
Lean Operating System
Last Planner
Milestone Schedule
Planned Percent Complete
5S Plan
Value Streams
Reliable Promising
Set Based Design
Unforeseen Constraints
Work Structuring
A3 Process

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"No! I can't be bothered to see any crazy salesmen... we've got a battle to fight!"
Lean
© LEAN CONSTRUCTION INSTITUTE

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Definitions

Lean:

Culture of **respect** and **continuous improvement** aimed at creating more **value** for the customer while identifying and **eliminating waste.**

Lean Project Delivery:

An organized implementation of **Lean Principles** and **tools** combined to allow a team to operate in **unison** to create **flow**.

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Origins of Lean

- **Scientific Management** 1880-1930
- **Assembly Lines** 1903-1914
- **World War II** 1939-1945
- **Lean Manufacturing** 1945 - present

Toyota Production System (TPS)

TOYOTA

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Meals Per Hour Video

- Super Storm Sandy

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Two Non-Negotiables

- Respect for people
- Continuous improvement

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Traditional Delivery Outcomes…

- Risk is High
- ~70% Late
- ~73% Over Budget
- Rework and Waste
- Teamwork is Unreliable
- Customers Satisfaction
- Profit Margins

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Brief History : Lean in Design & Construction

- Early 1990's: Glenn Ballard & Greg Howell
- Problem: Ability of front-line supervision to plan and execute work

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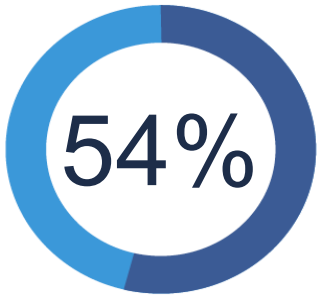
Brief History : Lean in Design & Construction



Planned work that was completed by the end of the week.

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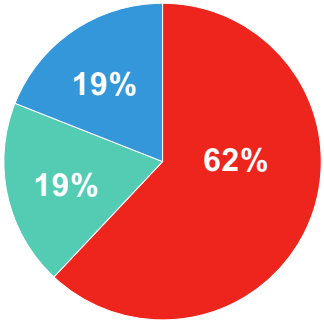
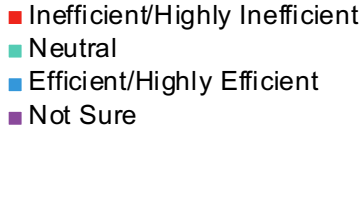
Overcoming Industry Inertia

How Efficient are you?

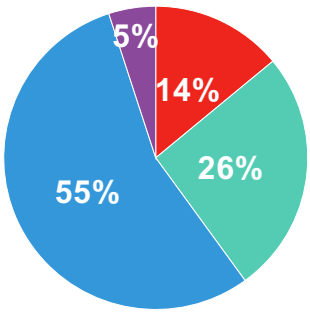
(By Level of Lean Engagement)

Lean Practitioners





Non-Lean Practitioners



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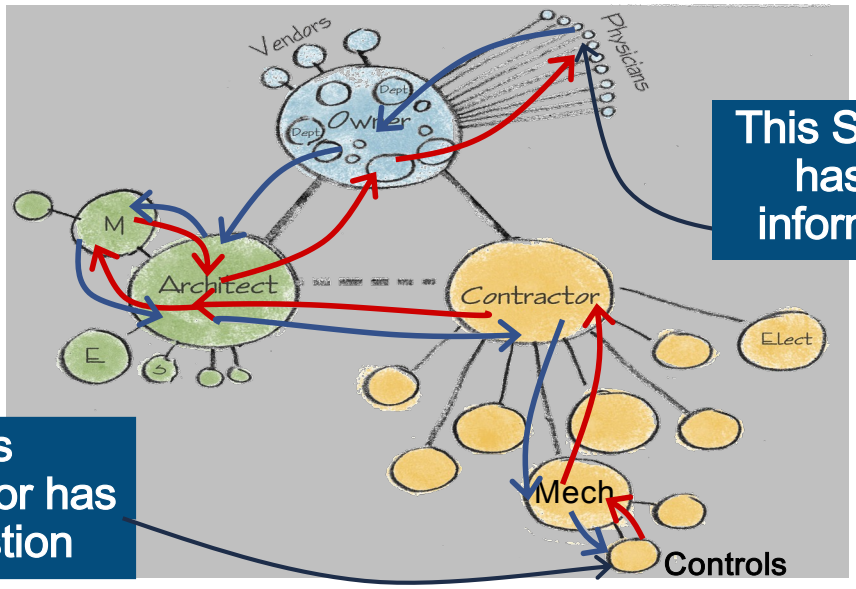
Traditional Structures Create Waste:



This Surgeon has the information

This Contractor has a question

Courtesy of SSM Cardinal Glennon

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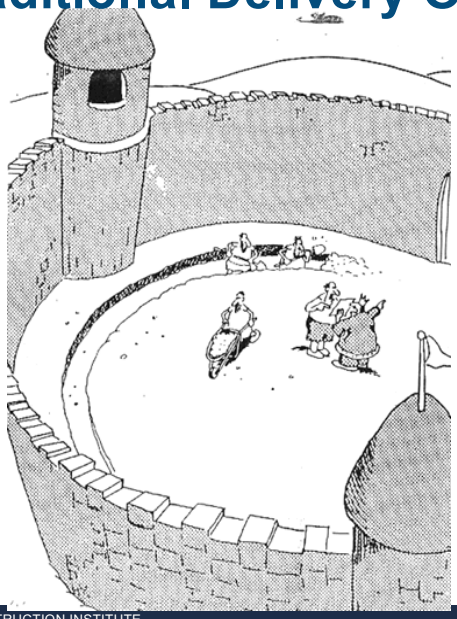
Traditional Delivery Outcomes…



"Suddenly, a heated exchange takes place between the King and the Moat Contractor…"

- *The Far Side* 1990

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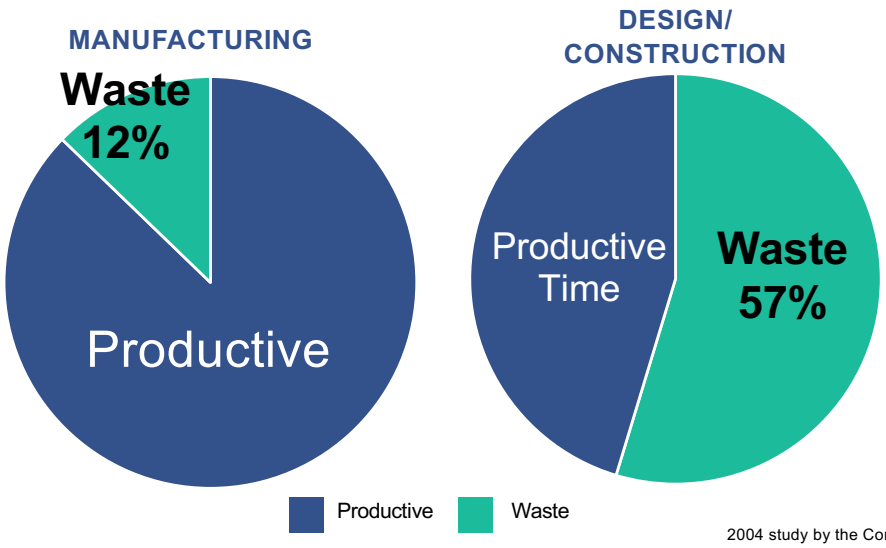
The Opportunity…



2004 study by the Construction Industry Institute

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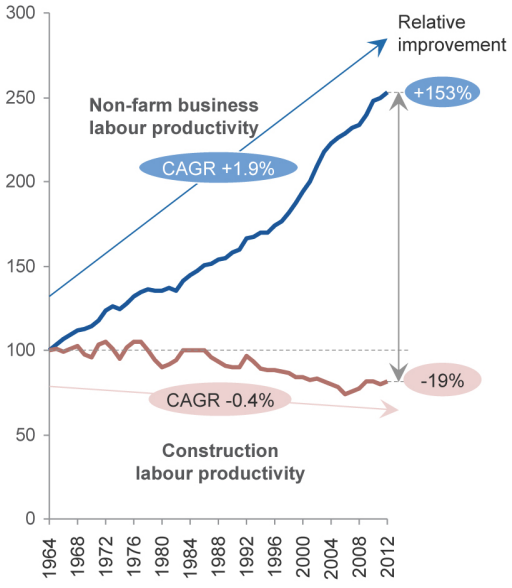
Why Lean?

- Productivity is declining
- Costs are skyrocketing
- Injuries are too high
- Unpredictable workflows
- Workflow reliability directly impacts the speed and cost of projects



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Lean Project Delivery Enables

- Collaborative Risk Management
- On-time or Early Delivery
- At or Below Budget
- Less Waste and Rework
- Team Reliability
- Higher Customer Satisfaction
- Fair Profits

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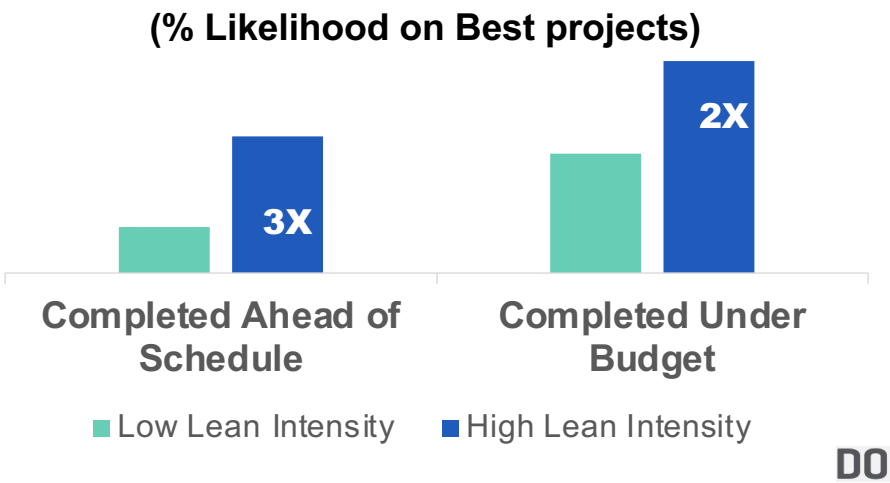
Correlation of Lean Intensity to Outcomes



DODGE DATA & ANALYTICS

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*"Lean processes bring about improvements not only in cost and delivery but also in **quality and safety.**"*

– WORLD ECONOMIC FORUM'S SHAPING THE FUTURE OF CONSTRUCTION: A BREAKTHROUGH IN MINDSET AND TECHNOLOGY (PG. 31).

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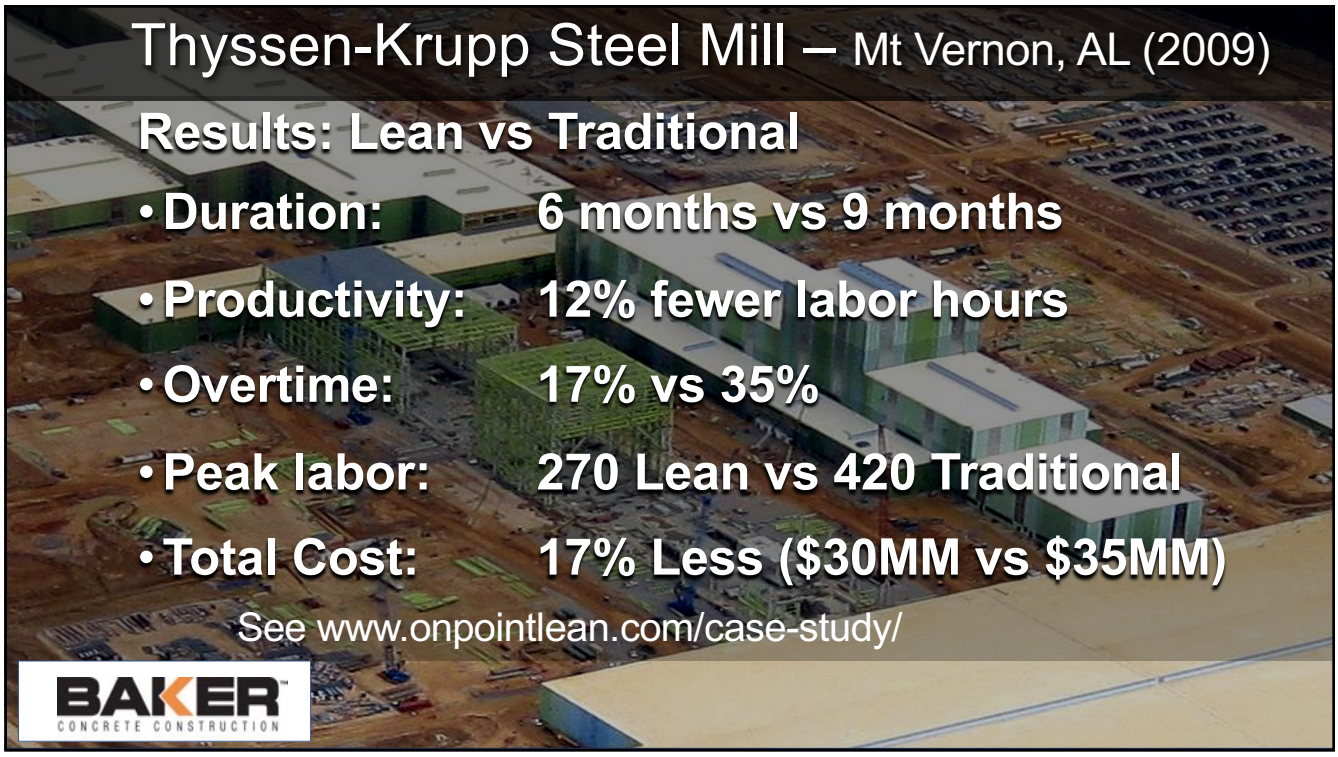

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Goals of Lean Design & Construction

1. Achieve reliable workflow
2. Maximize value to the customer
3. Minimize waste
4. Optimize the whole, not the parts
5. Develop a discipline of learning and continuous improvement.

Photo Courtesy of On Point Lean

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Plan – Do – Check - Act (PDCA)

The Deming Cycle

Improve the System

Predict

Study the Results

Take Action, Try it Out

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Benefits of Lean

1. **Safer work environment**
2. **Cost & Schedule Certainty**
3. **Increased Productivity**
4. **High Stakeholder Satisfaction**
5. **Less Stress on Participants**

Photo Courtesy of WM Jordan

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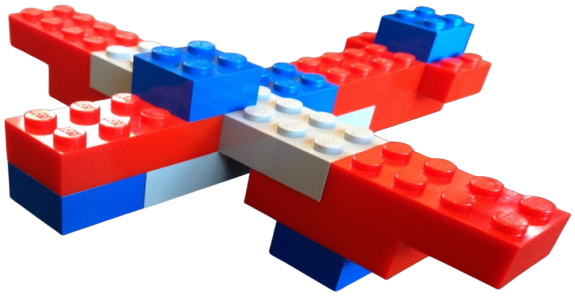
Production System Design Exercise

The Airplane Game



Lean Zone® Production Methodologies is a registered trademark of Visionary Products.

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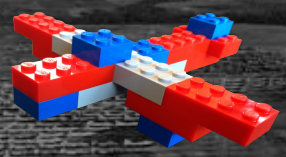
Airplane Simulation Debrief



Discuss and answer the following questions:

1. What are the key points/lessons?
2. What did we do (or change) to get so much better?
3. How might these Key Points and Lessons apply to your work?

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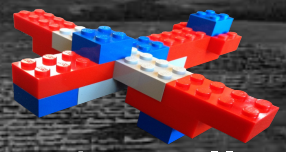
Airplane Game Lessons



- Release work from one party to the next by **pull** instead of push (1 piece flow)
- **Minimize batch sizes** to reduce cycle time
- Make **everyone responsible** for QC
- **Balance the workload** between trades
- Encourage and enable performers to **collaborate** with one another to maintain steady workflow

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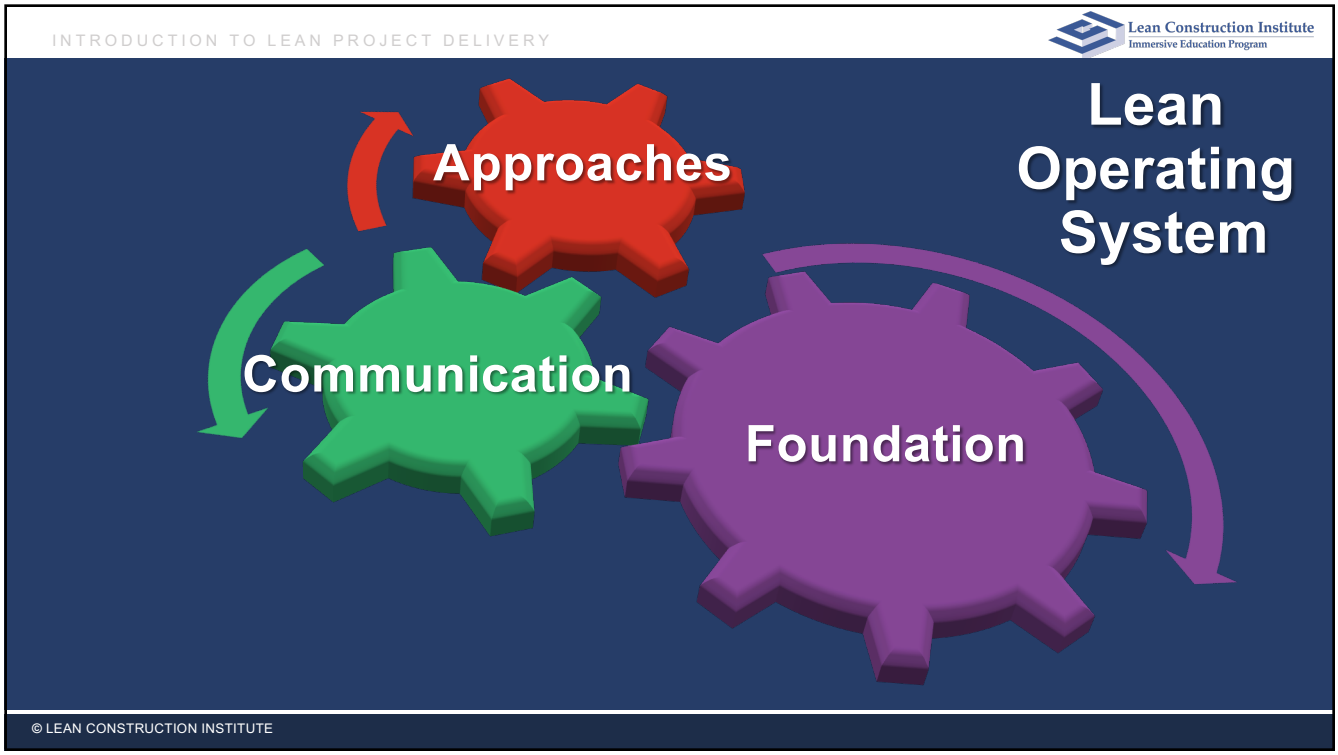

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Lean Operating System

- **Lean Foundation**
  - **Three Connected Opportunities**
  - **Six Tenets of Lean**
  - **8 Wastes**
  - **PDCA Cycle**
- Communication
- Approaches

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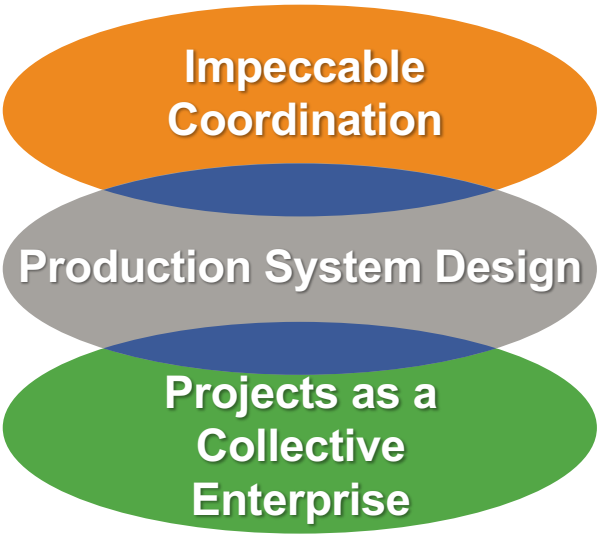
A Coherent Way to Manage Work in Projects

Three Connected Opportunities



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Six Tenets of Lean

1. Respect for people
2. Optimize the Whole
3. Generate Value
4. Eliminate Waste
5. Focus on Flow
6. Continuous Improvement

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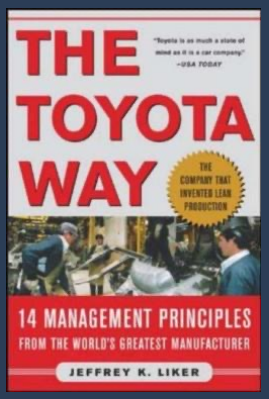
Generating Value

"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



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The 7 Deadly Wastes – Taichi Ohno, Toyota

T ransportation - Unnecessary movement of "things"

I nventory - Excess materials

M otion - Unnecessary movement by people

W aiting - Workers waiting for work OR Work waiting for workers

O ver-production - Producing more than is needed

O ver-processing - Spending more time or expense required

D efects – Rework due to poor quality or out-of-sequence work

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The 8th Waste: Talent

T ransportation - Unnecessary movement of "things"

I nventory – Excess materials

M otion – Unnecessary movement by people

T alent – underutilizing the creativity and skills of the team

W aiting – Workers waiting for work OR Work waiting for workers

O ver-production - Producing more than is needed

O ver-processing – Spending more time or expense required

D efects – Rework due to poor quality or out-of-sequence work

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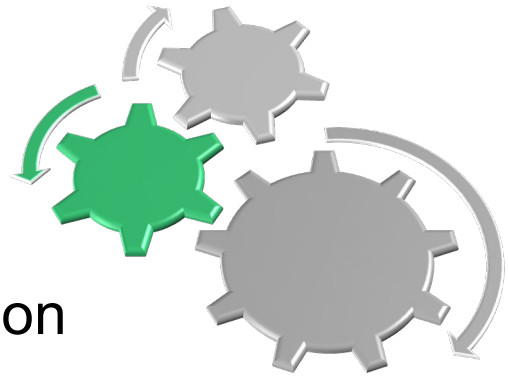
Lean Operating System

- Lean Foundation
- **Collaborative Communication**
  - Project as a promise
  - Conditions of Satisfaction
- Approaches



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Project is a Promise

A project is a very big promise delivered by people in an ever-changing **network of promises.**

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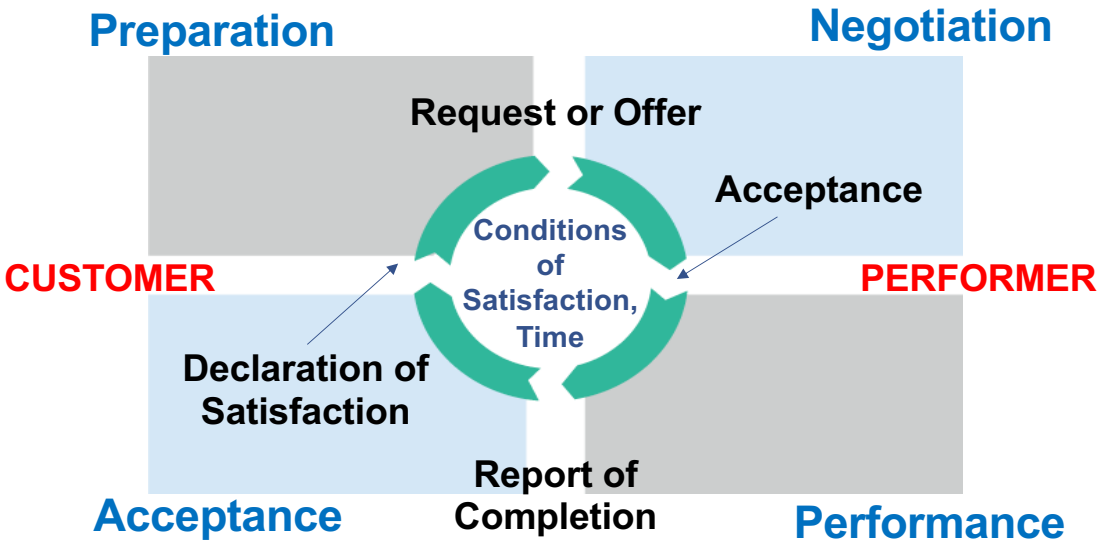
Basic Action Workflow



Credit: Dr. Fernando Flores

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Project Conditions of Satisfaction (PCoS):

- Part of language act of making a promise (Basic Action Workflow)
- Are developed by the team
- Measureable statements that inform a project team about which tests a project must pass to be accepted as a success
- Inform the decision-making process of the team

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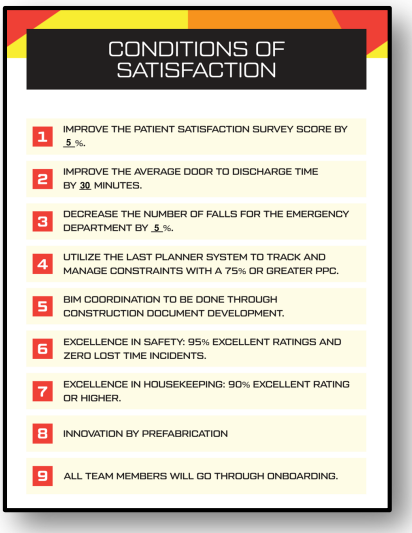
Project Conditions of Satisfaction (CoS):

- Similar to a Project or Team Charter
- *Value Definition Statements* developed by the team
- Determines which *tests a project must pass* to be accepted as a success.
- **Inform the *decision-making process* of the team.**



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Lean Operating System

- Lean Foundation
- Collaborative Communication
- **Approaches:**
  - Integrated Project Delivery (IPD)
  - Team Organization
  - Big Rooms
  - Target Value Delivery (TVD)
  - 5S Implementation
  - Last Planner System® (LPS)
  - Other tools

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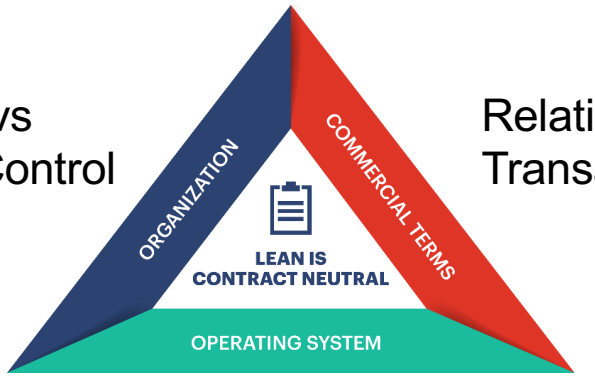
Project Elements: Lean vs Traditional

Collaboration vs
Command & Control



Relational vs
Transactional

Reliability Focus (Flow) vs CPM Scheduling (Push)

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Integrated Project Delivery (IPD)

- Contract form – IFOA / Consensus Docs
  - Think "JV" between O/A/C/Key Trades
- Cost Plus
- Shared Risk/Reward
- Conditions of Satisfaction (CoS)
- Combats the downfalls of traditional D-B-B

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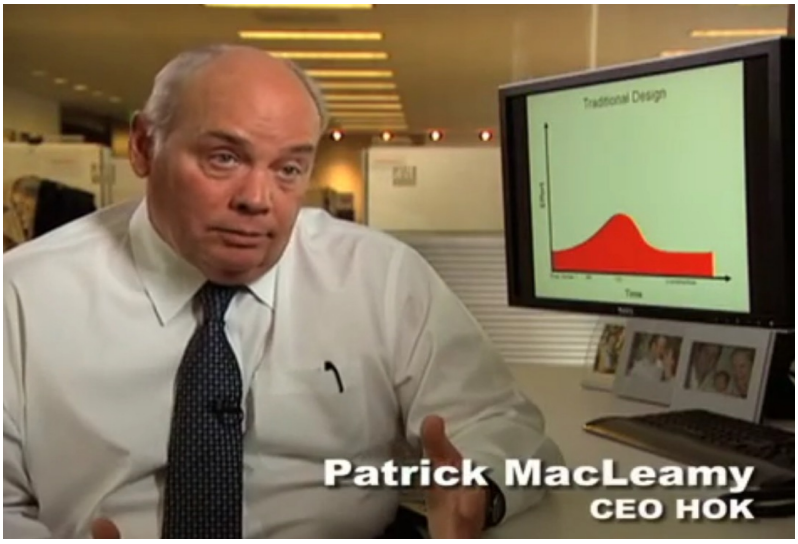
MacLeamy Curve Video



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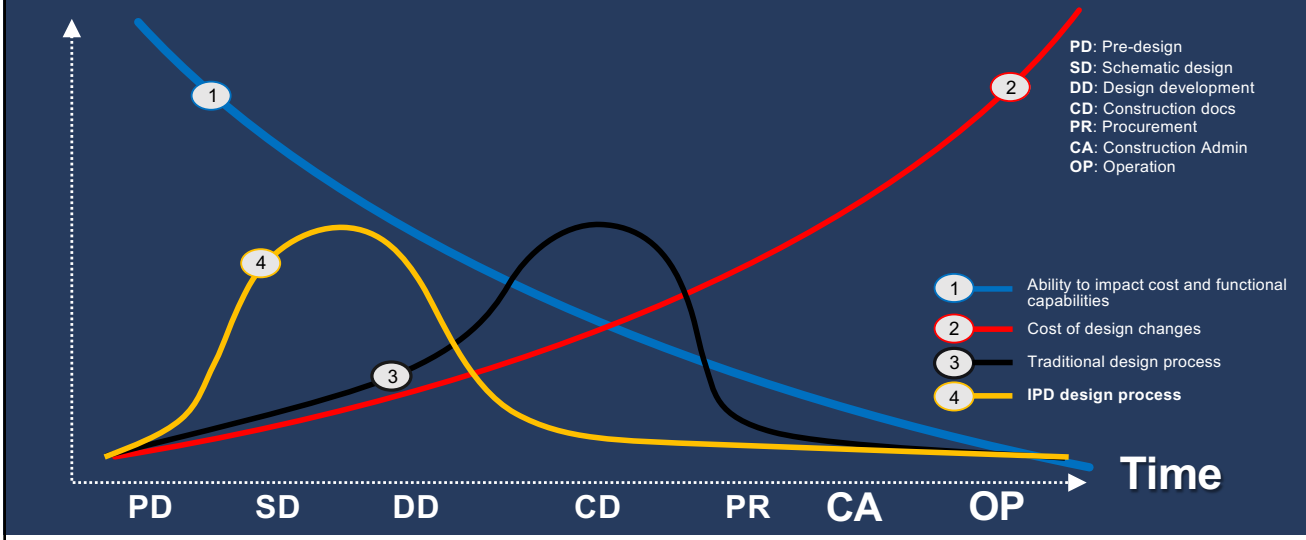
The MacLeamy Curve

Graphic courtesy of Patrick MacLeamy AIA / HOK



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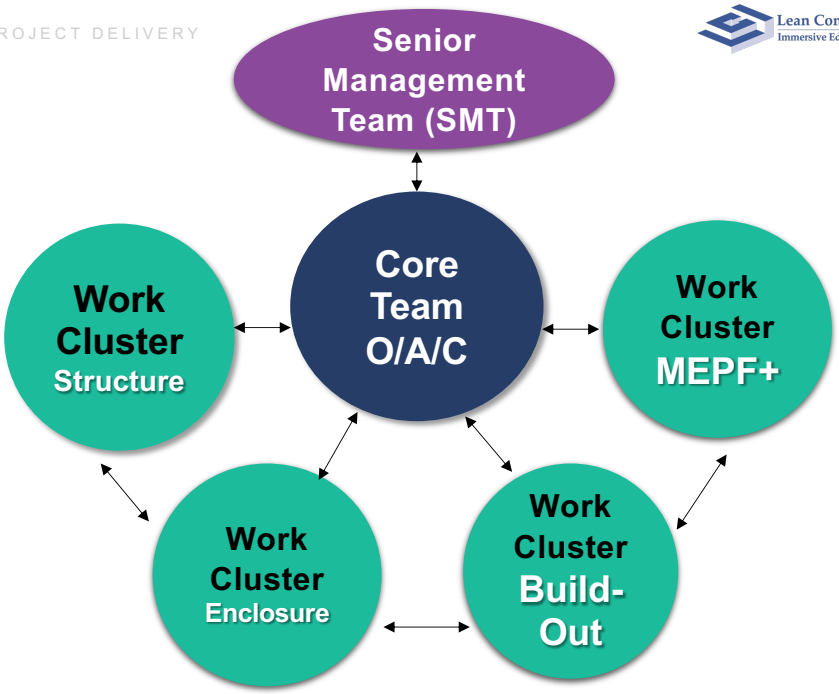
IPD Team Organization



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Big Room

- Speed communication
- Improve decision-making
- Reduce 'siloed' thinking
- **Rapidly Advance work**

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Lean in Design

TOYOTA

Lean Design

Maximize Innovation!

A process to maximize innovation
*…**not** "standardize design"*

Lean Production

Minimize Waste!

Compliments of Stan Chiu, HGA

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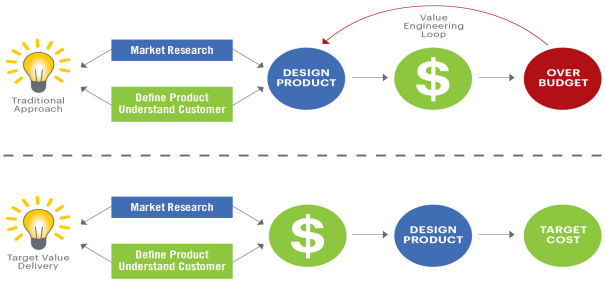
Traditional vs. Target Value Delivery

The goal of TVD:
Minimize the waste inherent in the design-estimate-redesign cycle(s) of the traditional approach.

Traditional: Cost is an *OUTPUT* of design



TVD: Cost is an *INPUT* of design

Graphic Courtesy of HKS Architects

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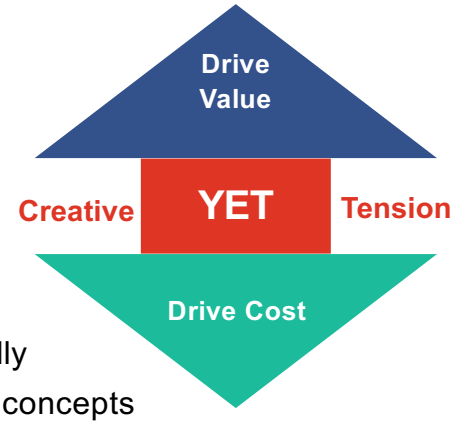
Traditional Delivery vs Target Value Delivery

Traditional Delivery:

- Work performed in silos – low visibility
- Early commitment to design solutions
- "Finish your work before I start mine" mentality



Target Value Delivery:

- Information is shared early and often
- Sets of solutions are carried and optimized holistically
- Continuous estimating and cost modeling based on concepts

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Target Value Delivery Guidelines

1. Develop detailed **Cost Model Estimate**
   - A clear schedule of **values**
   - Measure against **benchmarks**
2. Design to the **Estimate** vs. estimating the design
3. Have collaborative design conversations **before** drawing
4. Make decisions after considering **sets of options**
5. Collaboratively make decisions in context of the **whole**

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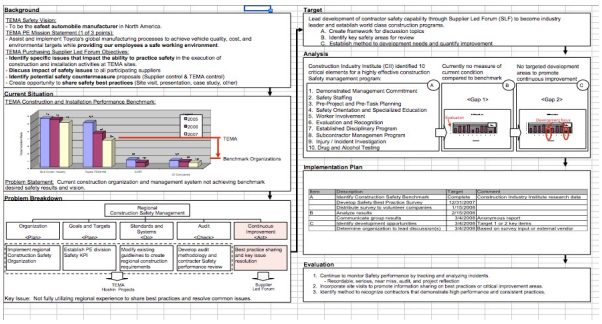
A3 Thinking

(A3 = 11 x 17 paper size)

- Pioneered by Toyota
- Disciplined and highly collaborative approach to Plan-Do-Check-Act
- **A3** Applications:
  - Problem Solving
  - Policy Deployment
  - Reporting
  - Capturing Decisions



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Choosing by Advantages (CBA)

A **sound** decision-making system for determining the **best decision** by looking at the **importance of the advantages** of each alternative.

Choosing By Advantages Study of: Heating Hot Water System					
		Alternative 1		Alternative 2	
		Central Plant Heating Hot Water System		Distributed Heating Hot Water	
Factor: Square feet of Mechanical Space Required					
Criteria:	Attribute	3200 square feet		5100 sq ft required/17 rooms	
	Advantage	1300 Sq Ft.	2		
Factor: Access for Maintenance					
Criteria:	Attribute	Outside secure perimeter		Inside secure perimeter	
	Advantage	Outside rather than in	4		
Factor: Quantity of Boilers & Standby					
Criteria:	Attribute	3 duty plus 1 standby		20 duty +7 Standby	
	Advantage	Less total boilers	5		
Factor: Ability to do Boiler Stack Heat Recovery					
Criteria:	Attribute	10% increase in boiler efficiency		Not required	
	Advantage	Reduction X therms	8		
Factor: Pumping Energy					
Criteria:	Attribute	More required due to long distribution runs		Less required due to shorter piping runs	
	Advantage			500,000 KwH per year	10
Factor: Construction Schedule					
Criteria:	Attribute	Longer due to site distribution		Shorter - no site distribution required	
	Advantage			2 weeks	1
	Total Importance		19		11
	Capital Cost				

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Choosing by Advantages (CBA) Overview

- Sound outcomes **require** sound decisionmaking methods
- **Methods** → Decisions → Actions → **Outcome**
- Decisionmakers must learn & use sound methods
- Decisions must be anchored to **relevant factual data**
- **Decisions must be based on the importance of advantages**

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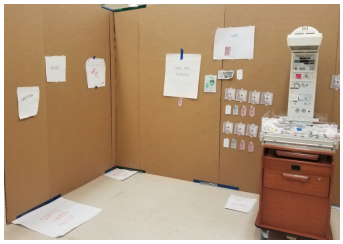
Prototyping - Production Preparation Process (3P)

- **Mock-up**
- **Clarifies requirements**
- **Gains agreement**



Photos Courtesy of Cone Health

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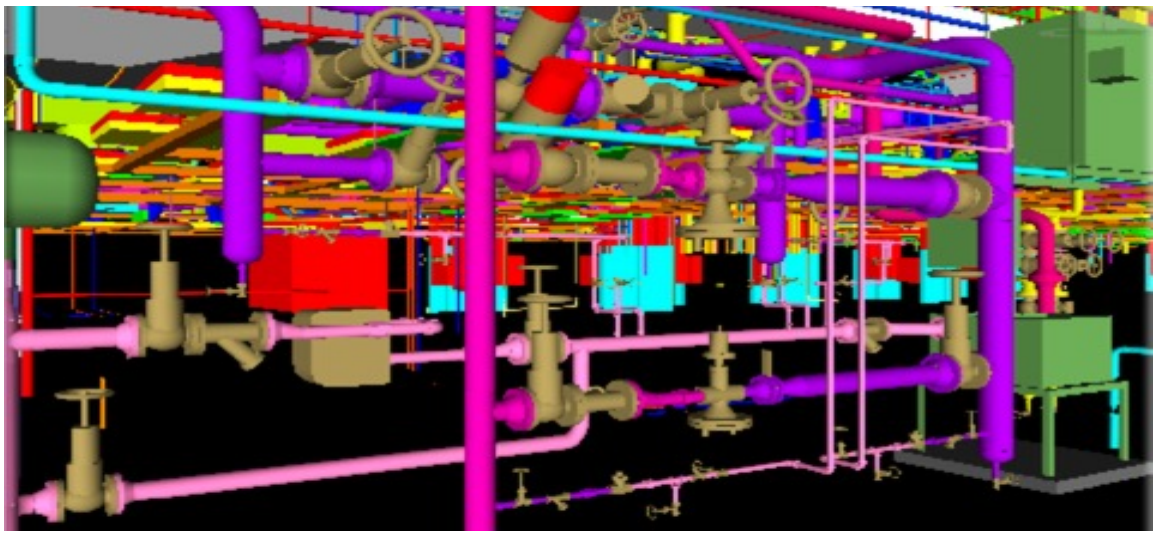
Building Information Modeling (BIM) & Virtual Reality



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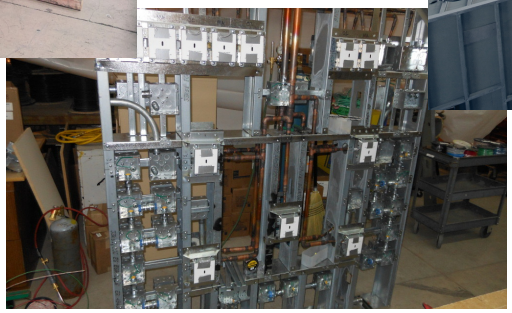
Prefabrication – Headwalls, Plumbing, Bathrooms



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Last Planner System®
Reliability, Flow, Dependency & Variation

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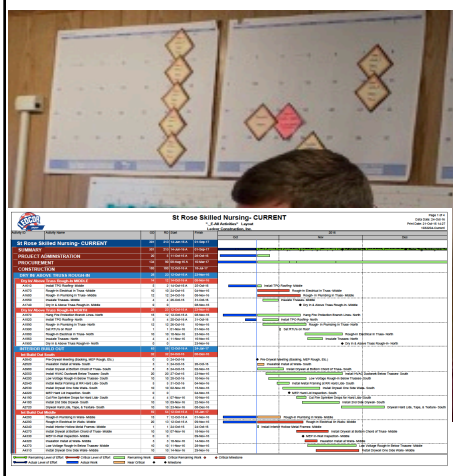
Last Planner System® – 5 Connected Conversations



- **MILESTONE** Planning → **Set Milestones**
- **PHASE PULL** Planning → **Specify Handoffs**
- **LOOKAHEAD** Planning → **Make Work Ready**
- **WEEKLY WORK** Planning
- **LEARNING & IMPROVING**

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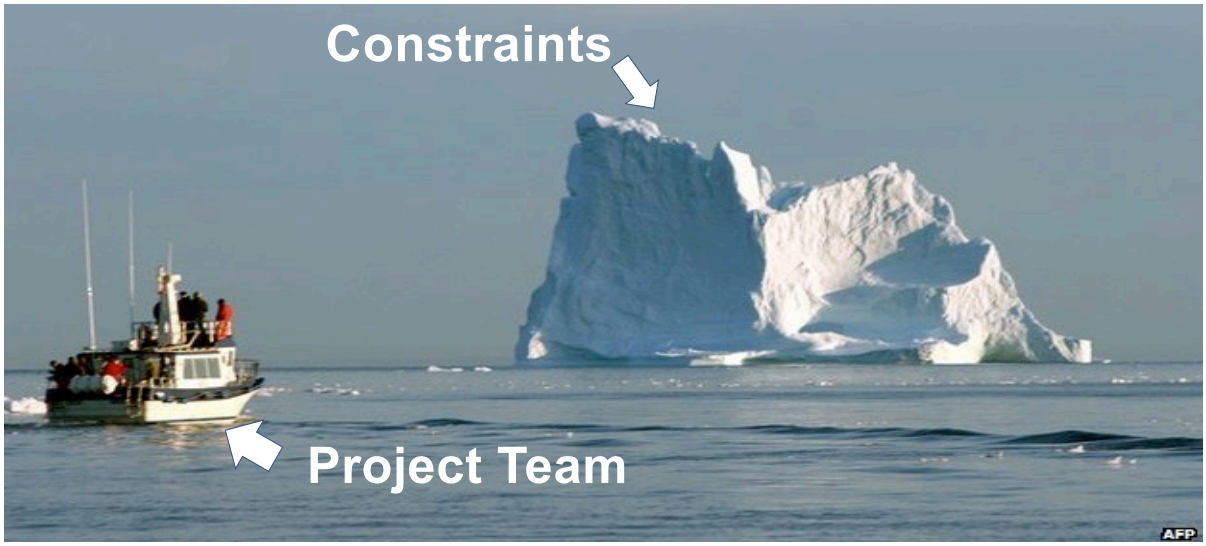
Make-Ready Planning (6 weeks+)

"Pinging the water" for Icebergs



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Make Ready Example

1950 vs 2013 Pit Stops

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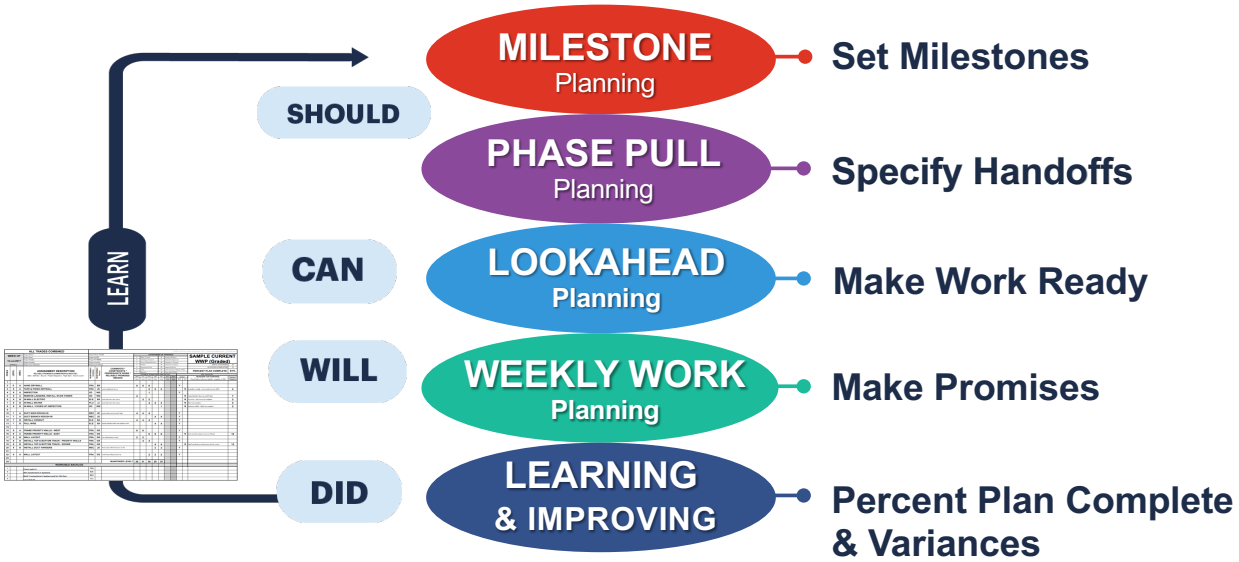
Last Planner® System – 5 Connected Conversations



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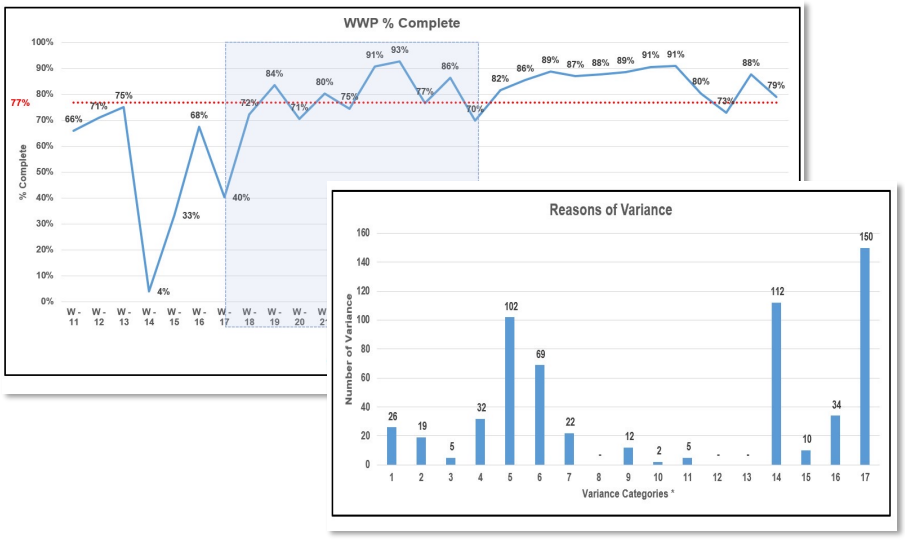
Percent Plan Complete (PPC) & Variances



(*) Variance Categories	
1	Coordination
2	Engineering / Design
3	Owner's Decision
4	Weather
5	Prerequisite Work
6	Labor
7	Materials
8	Contracts/Change Orders
9	Submittals
10	Approvals
11	Equipment
12	RFIs
13	Overtime (OT) Approval
14	Site Conditions
15	Inspections
16	Other
17	Covid-19

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5S: A Starting Point with Lean

- **S**ORT
- **S**TRAIGHTEN
- **S**HINE
- **S**TANDARDIZE
- **S**USTAIN

A disciplined approach to **maintaining order** in the workplace, using **visual controls** to eliminate waste.

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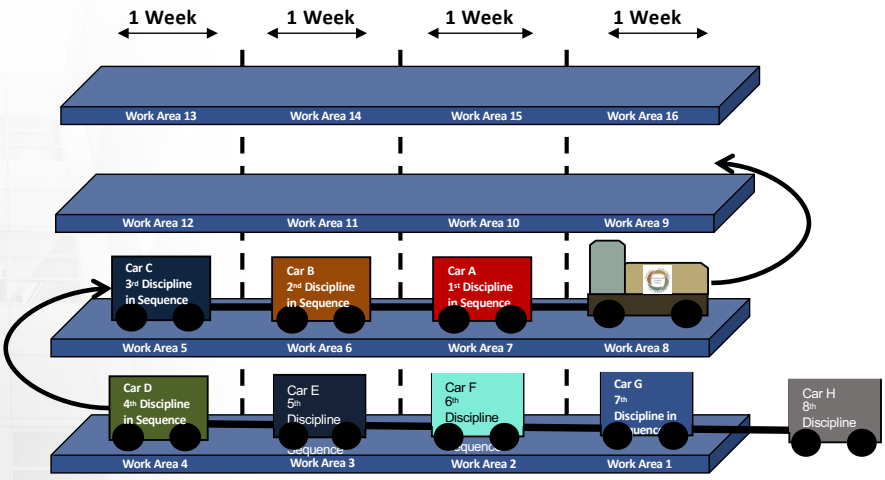
Takt Planning / Short Interval Production Planning



BOLD THINKING

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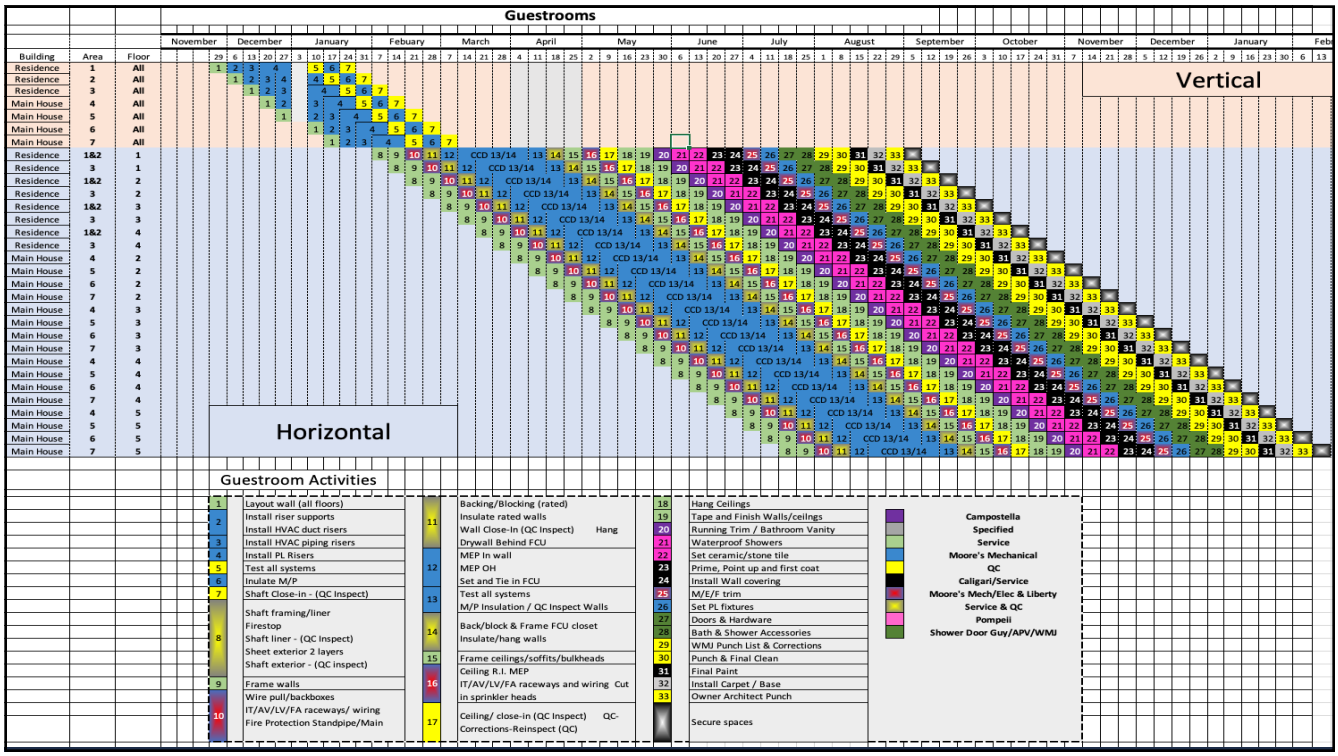
Guestrooms
Vertical
Horizontal
Guestroom Activities
Layout wall (all floors)
Install riser supports
Install HVAC duct risers
Install HVAC piping risers
Install PL Risers
Test all systems
Inulate M/P
Shaft Close-in - (QC Inspect)
Shaft framing/liner
Firestop
Shaft liner - (QC Inspect)
Sheet exterior 2 layers
Shaft exterior - (QC inspect)
Frame walls
Wire pull/backboxes
IT/AV/LV/FA raceways/ wiring
Fire Protection Standpipe/Main
Backing/Blocking (rated)
Insulate rated walls
Wall Close-In (QC Inspect) Hang
Drywall Behind FCU
MEP In wall
MEP OH
Set and Tie in FCU
Test all systems
M/P Insulation / QC Inspect Walls
Back/block & Frame FCU closet
Insulate/hang walls
Frame ceilings/soffits/bulkheads
Ceiling R.I. MEP
IT/AV/LV/FA raceways and wiring Cut in sprinkler heads
Ceiling/ close-in (QC Inspect) QC-Corrections-Reinspect (QC)
Hang Ceilings
Tape and Finish Walls/ceilngs
Running Trim / Bathroom Vanity
Waterproof Showers
Set ceramic/stone tile
Prime, Point up and first coat
Install Wall covering
M/E/F trim
Set PL fixtures
Doors & Hardware
Bath & Shower Accessories
WMJ Punch List & Corrections
Punch & Final Clean
Final Paint
Install Carpet / Base
Owner Architect Punch
Secure spaces
Campostella
Specified
Service
Moore's Mechanical
QC
Caligari/Service
Moore's Mech/Elec & Liberty
Service & QC
Pompeii
Shower Door Guy/APV/WMJ

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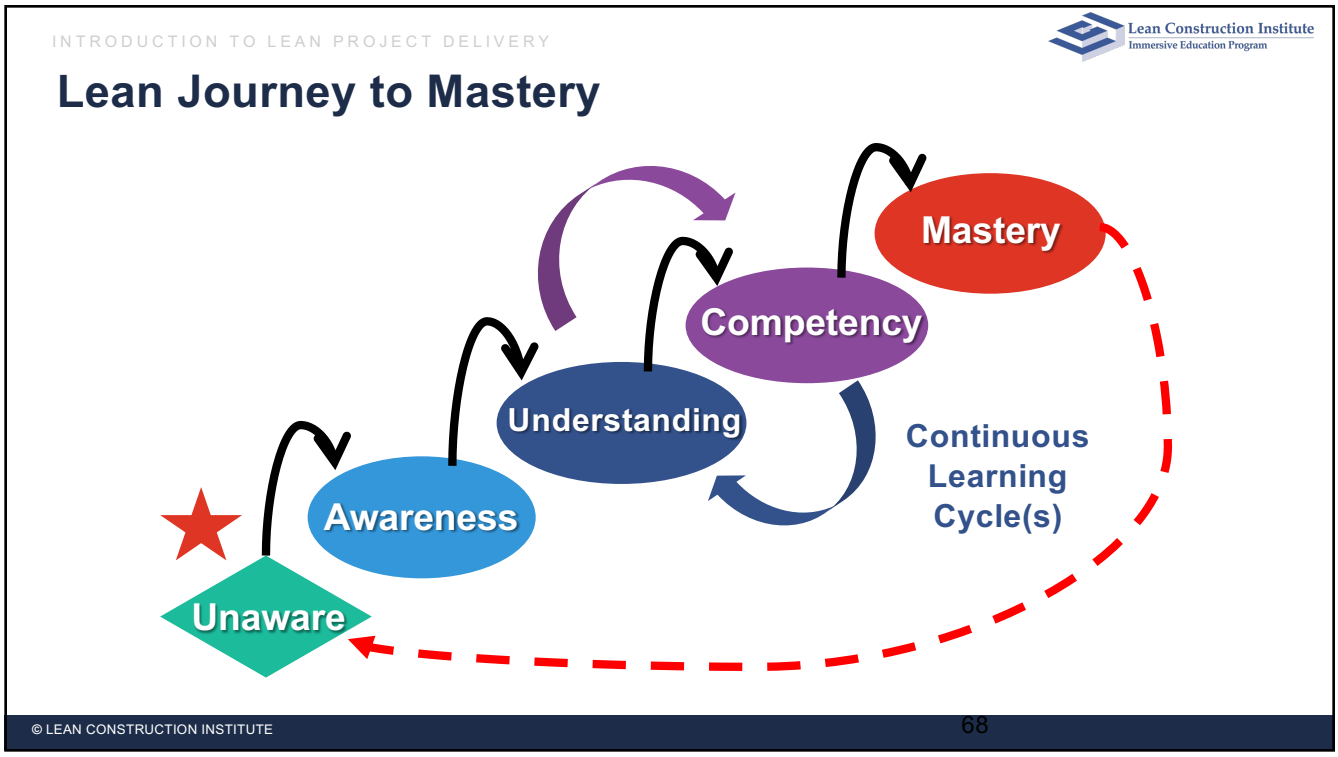
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Lean Journey to Mastery
Mastery
Competency
Understanding
Awareness
Unaware
Continuous Learning Cycle(s)
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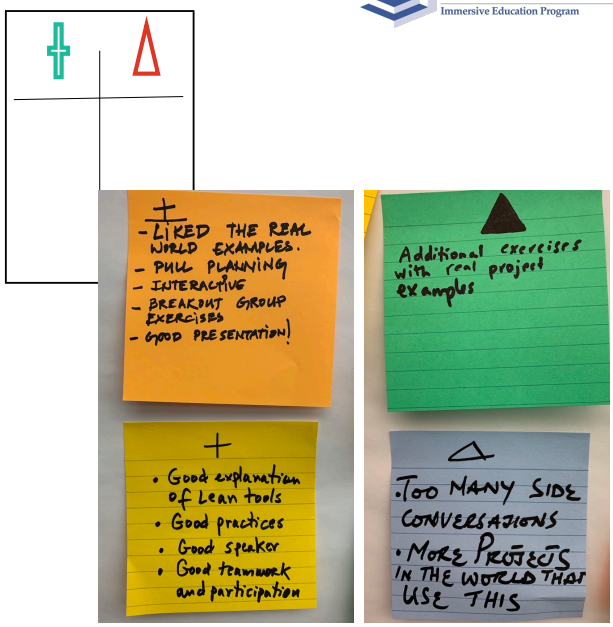
Conduct Plus/Delta

Capture on a flip chart or white board, or use **Sticky Notes**

Plus: What produced <u>value</u> during the session?
"I LIKED…"

Delta: What could we <u>change to improve</u> the process or outcome?
"I WISH…"



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Questions?

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Closing: Miracle on Ice Video

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