

2021 Introduction to Lean Project Delivery



Lean Construction Institute
Immersive Education Program



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- Wear masks at all times in indoor events.
- Complete your daily health screening on your phone and bring it with you when you enter the center each day.
- Practice social distancing to the extent possible.
- If you feel ill at any time, please leave the conference and return to your room/consult a physician as necessary.

Instructor Introductions



Lean Construction Institute
Immersive Education Program

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Course Description

This course will **introduce** lean project delivery as an operating system relative to the design and construction industry.

Participants will learn the key principles that are foundational to lean and **be introduced to** collaborative tools and approaches to eliminate/reduce waste from their projects.

This course includes a hands-on learning simulation.

Learning Objectives



01.

At the end of this presentation, participants will know the **definition of Lean** and the **principles associated with a Lean operating system**.



02.

At the end of this presentation, participants will be able to **identify the principles and tools relevant to Lean Design and construction processes**.



03.

At the end of this presentation, participants will be able to **recognize various types of waste in design and construction and identify tools to reduce, minimize and/or eliminate waste**.



04.

At the end of this presentation, participants will **understand ways to increase collaboration and communication on projects through application of structured planning systems and processes**.

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.

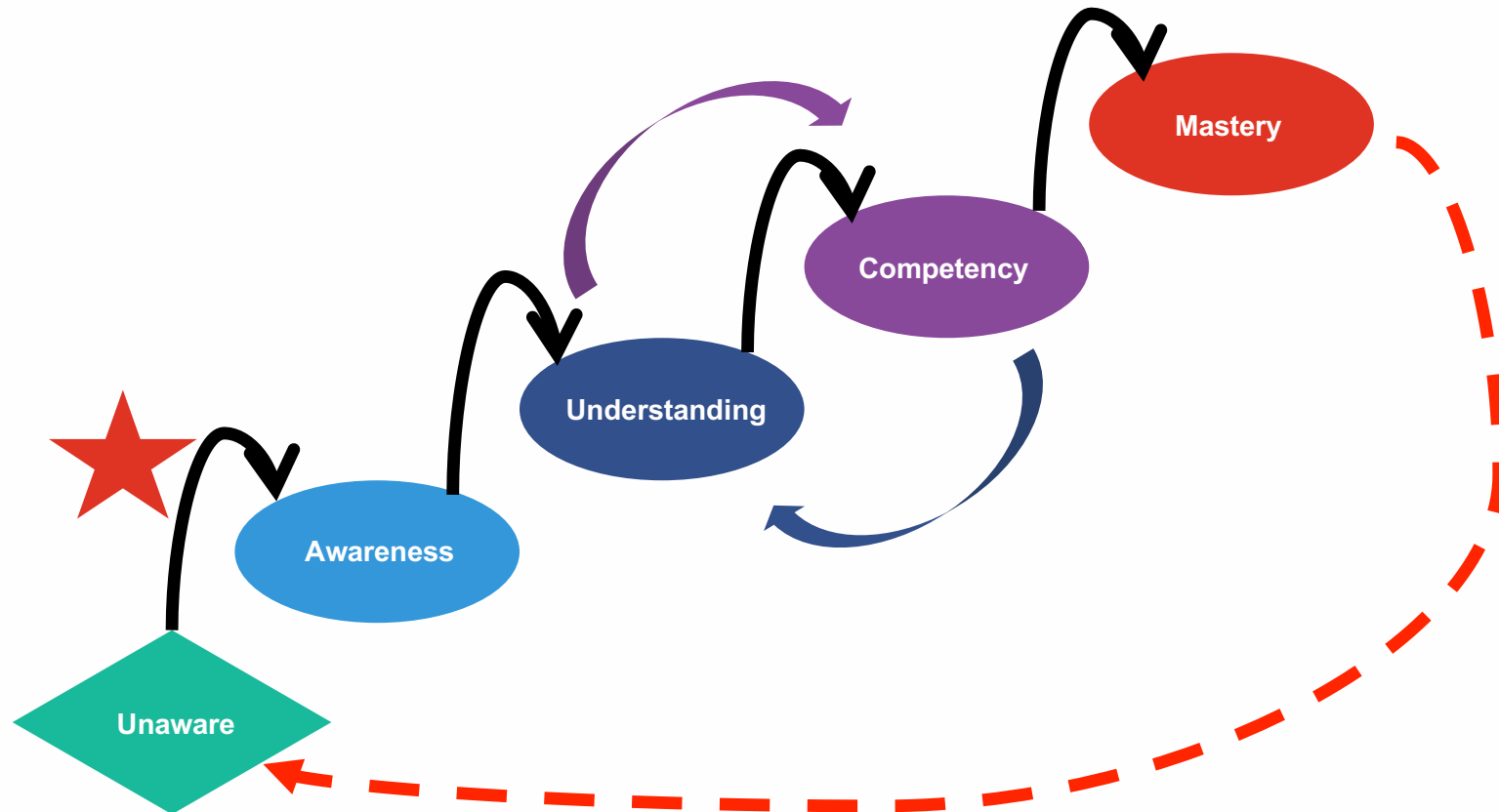


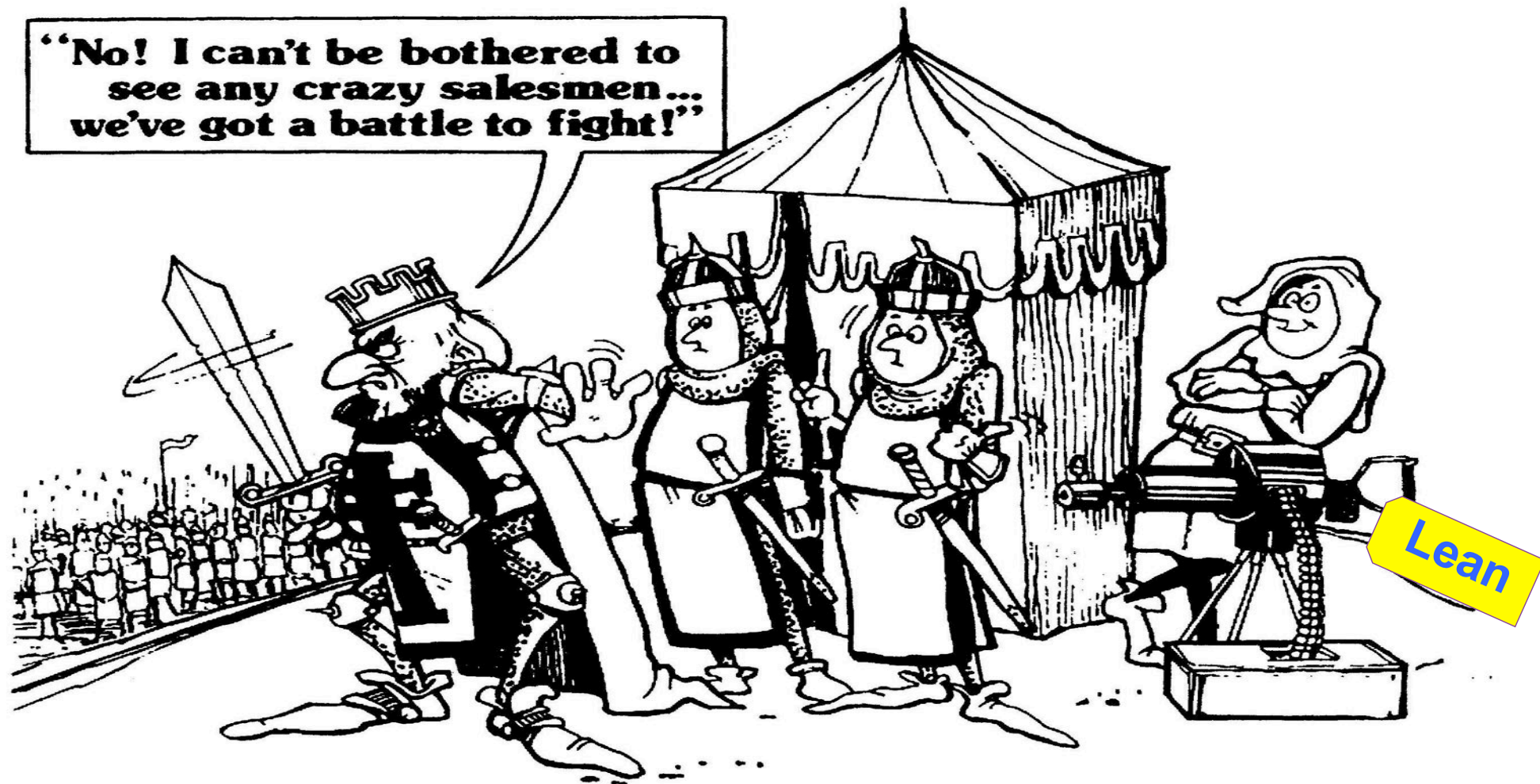
Recognize various types of waste in design and construction and apply tools to reduce, minimize and/or eliminate waste.



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

Lean Journey to Mastery





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.



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



Meals Per Hour Video

- Super Storm Sandy



TOYOTA










Two Non-Negotiables

- Respect for people
- Continuous improvement



Traditional Delivery Outcomes...

-  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

Discussion Question

What are your **dissatisfactions** with the way projects are currently designed and constructed?

Lean Construction Background



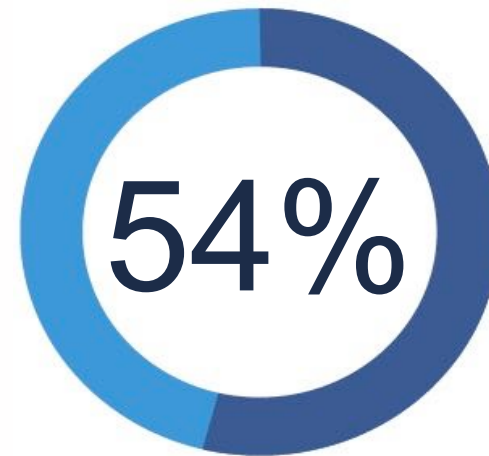
Early 1990's: Glenn Ballard & Greg Howell focused on construction reliability & planning



Surveyed ~475 Superintendents and foremen and asked,
"What do you intend to complete next week?"

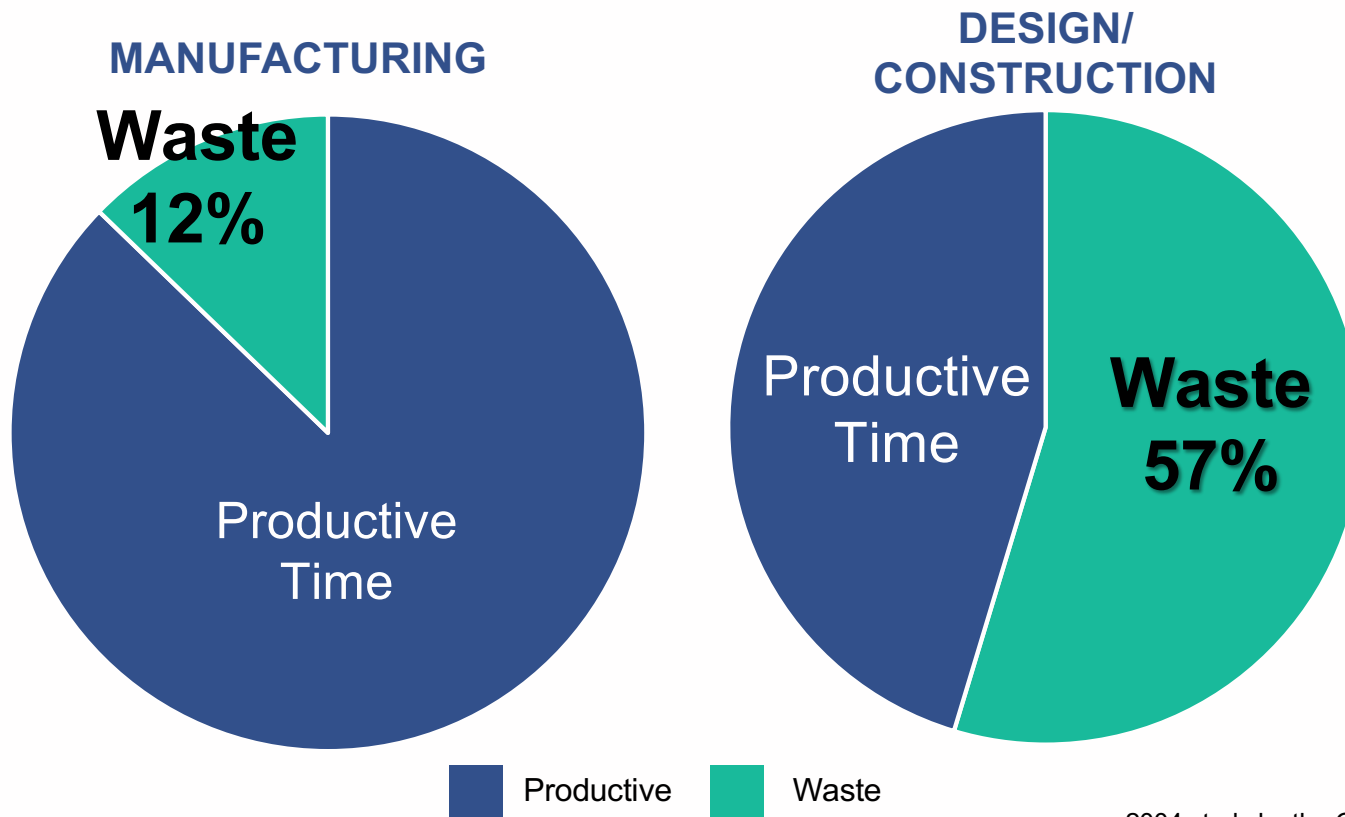


Brief History : Lean in Design & Construction



Discovery: on average, only 54% of planned work was completed by the end of the week.

The Opportunity...



2004 study by the Construction Industry Institute

Why Lean?



Construction productivity is declining



Construction costs are skyrocketing



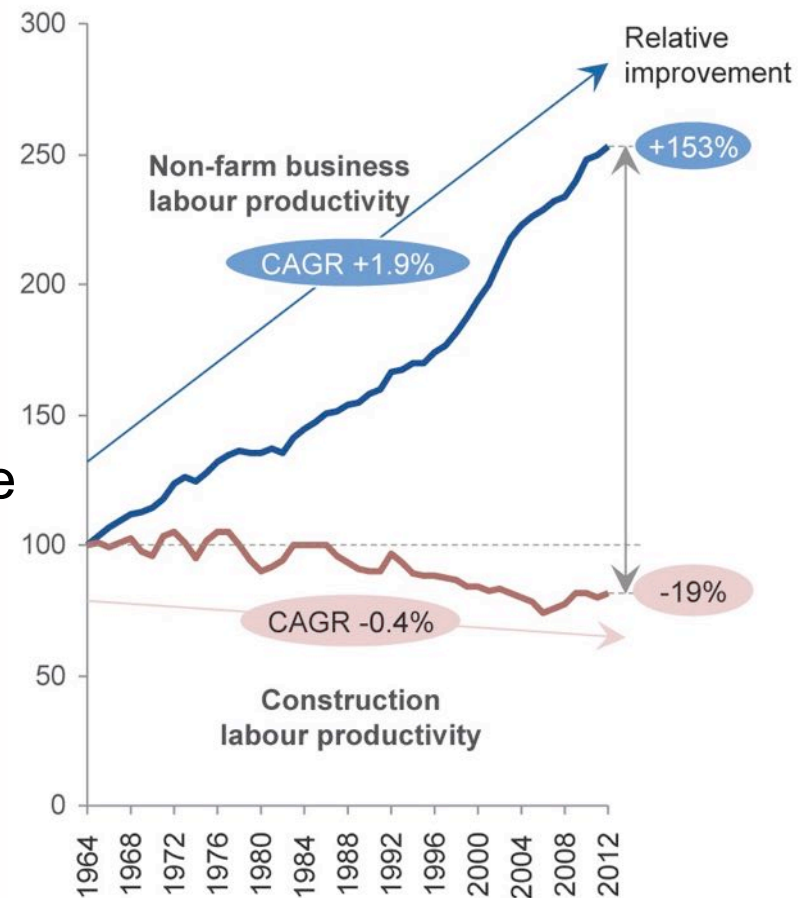
Injuries are too high










Traditional planning systems are unable to produce predictable workflows



Workflow reliability directly affects speed and cost of projects

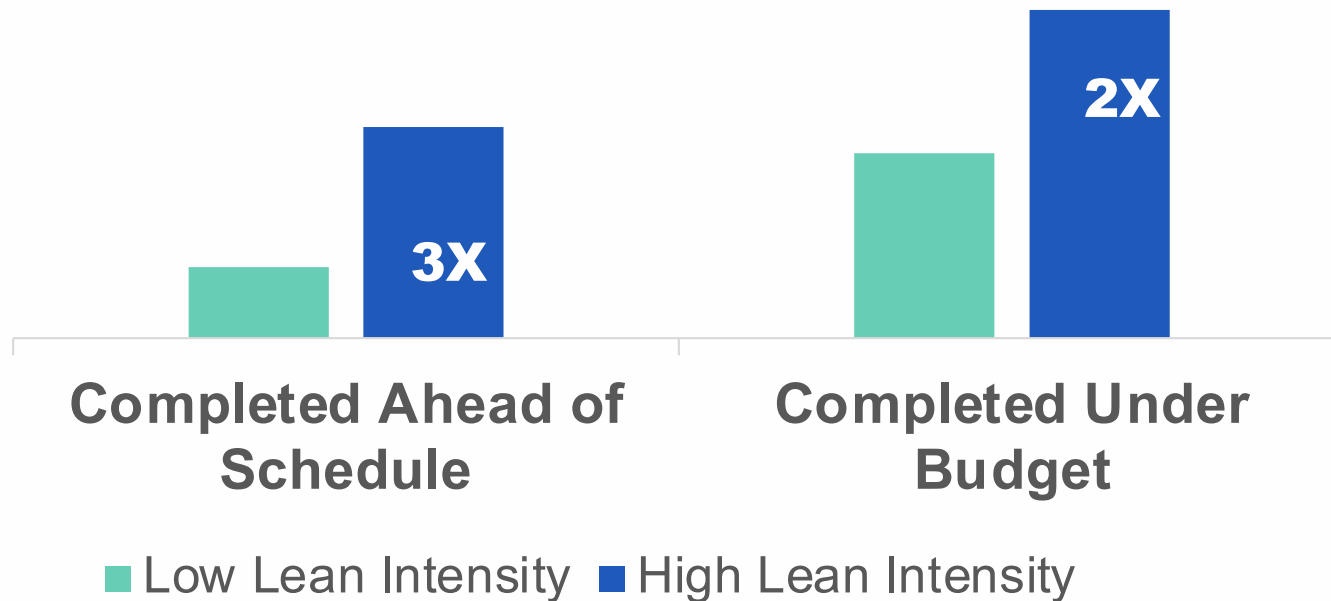


Lean Project Delivery Enables

-  Risk to be collaboratively managed
-  Projects to be delivered on time
-  Projects to be delivered within the budget
-  Less waste and rework
-  Team-wide reliability
-  Higher customer satisfaction
-  Fair profits for providers

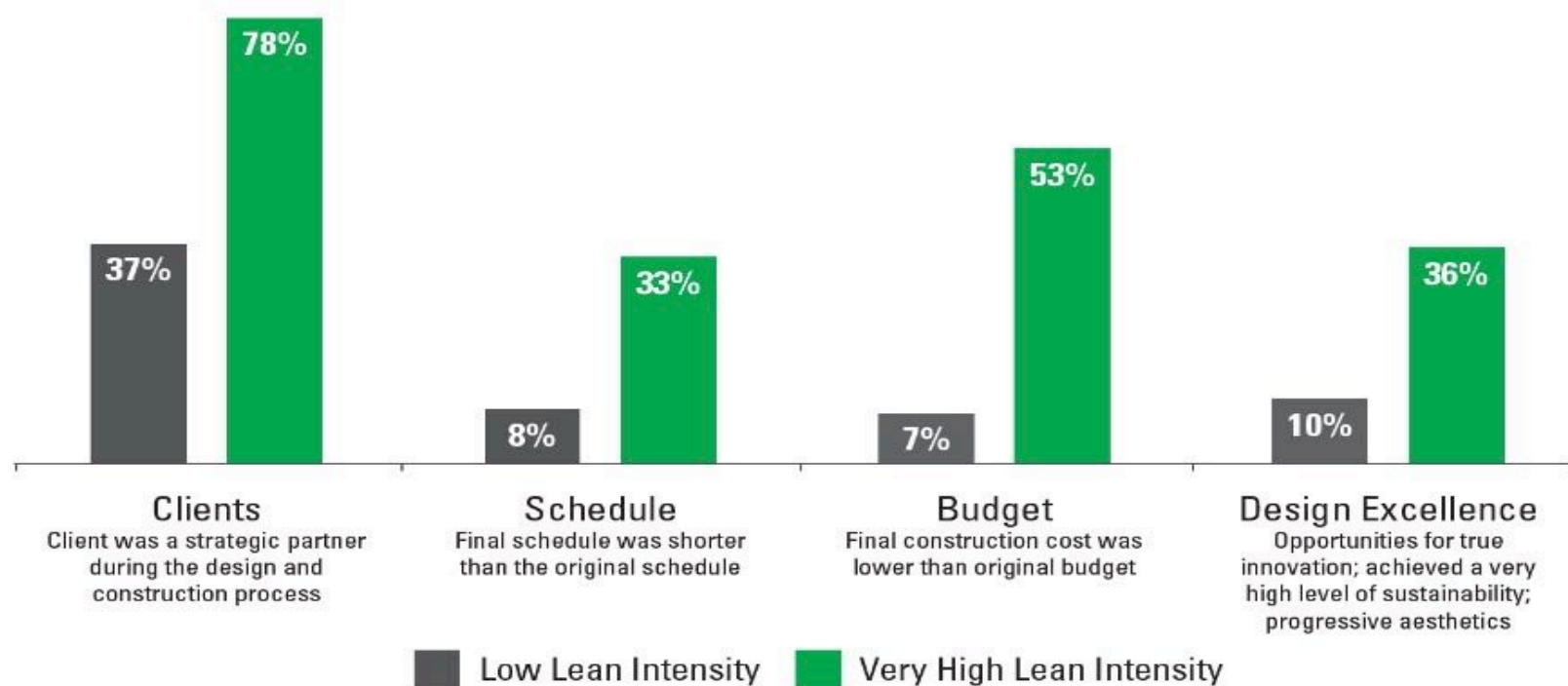
Correlation of Lean

Correlation of lean intensity to outcomes (% likelihood on best projects)



Correlation of Lean

% of Best Projects Achieving Outcome



*“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).

Thyssen-Krupp Steel Mill — Mt Vernon, AL (2009)

Results: Lean vs Traditional

- **Duration:** 6 months vs 9 months
- **Productivity:** 12% fewer labor hours
- **Overtime:** 17% vs 35%
- **Peak labor:** 270 Lean vs 420 Traditional
- **Total Cost:** 17% Less (\$30MM vs \$35MM)

See www.onpointlean.com/case-study/

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.



Plan – Do – Check - Act (PDCA)

The Deming Cycle

Improve the
System

Study the
Results



Predict

Take Action,
Try it Out

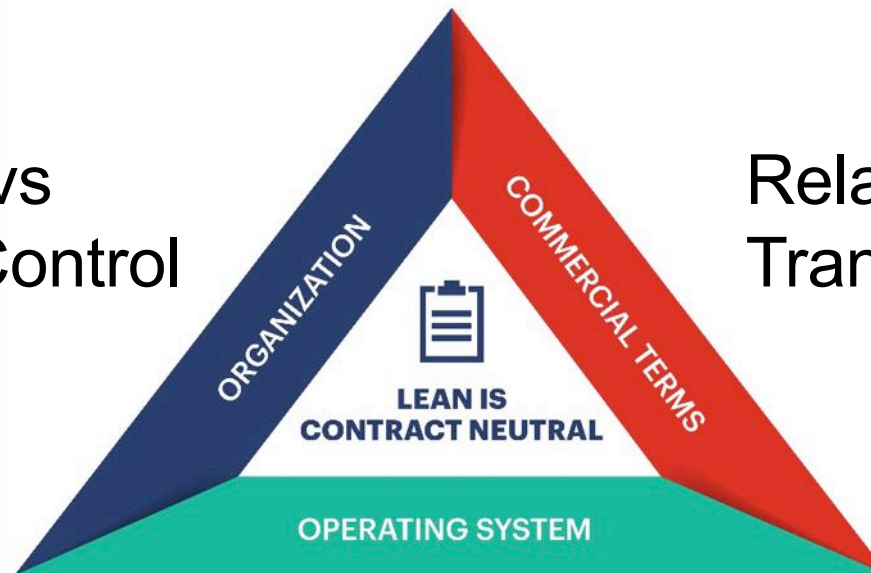
Benefits of Lean

- 1 **Safer work environment:
fewer incidents & injuries**
- 2 **Increased cost & schedule
certainty**
- 3 **Increased productivity**
- 4 **High stakeholder satisfaction**
- 5 **Less stress on participants**



Project Elements: Lean vs Traditional

Collaboration vs
Command & Control



Relational vs
Transactional

Reliability Focus (Flow) vs CPM Scheduling (Push)

Project Elements

Lean teams **organize** in a structure that leads to improved coordination, outcomes and shared leadership.

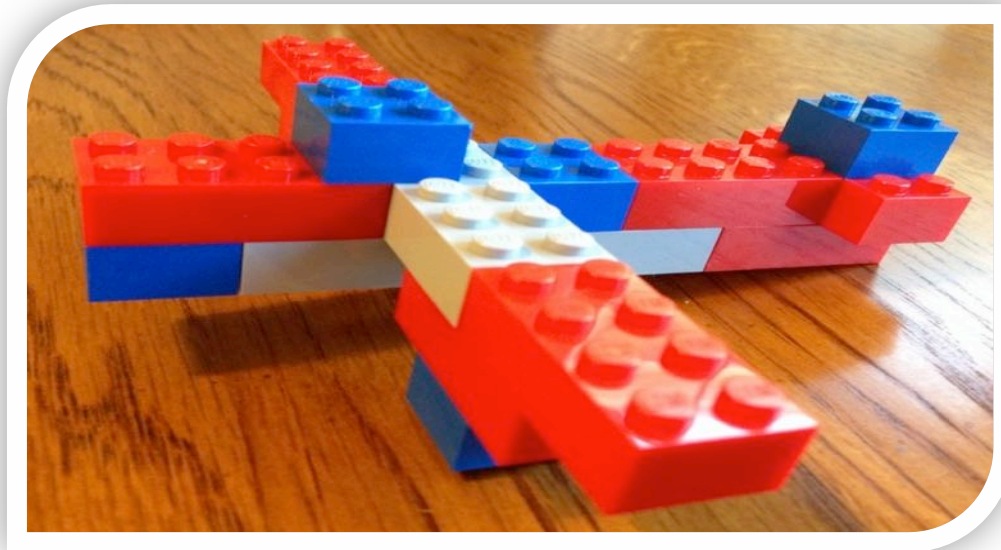


Lean can be implemented regardless of **commercial terms**: Design-Bid-Build, Design-Build or Integrated Project Delivery. The degree of implementation varies with the terms.

A Lean **Operating System** is an organized implementation of Lean Principles and Tools combined to allow a team to operate in unison to create flow.

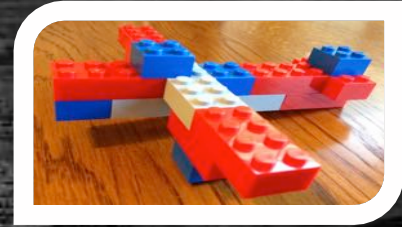
Production System Design Exercise

The Airplane Game



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

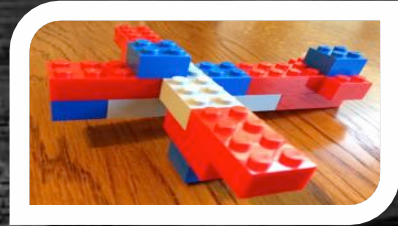
Airplane Simulation Debrief



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?

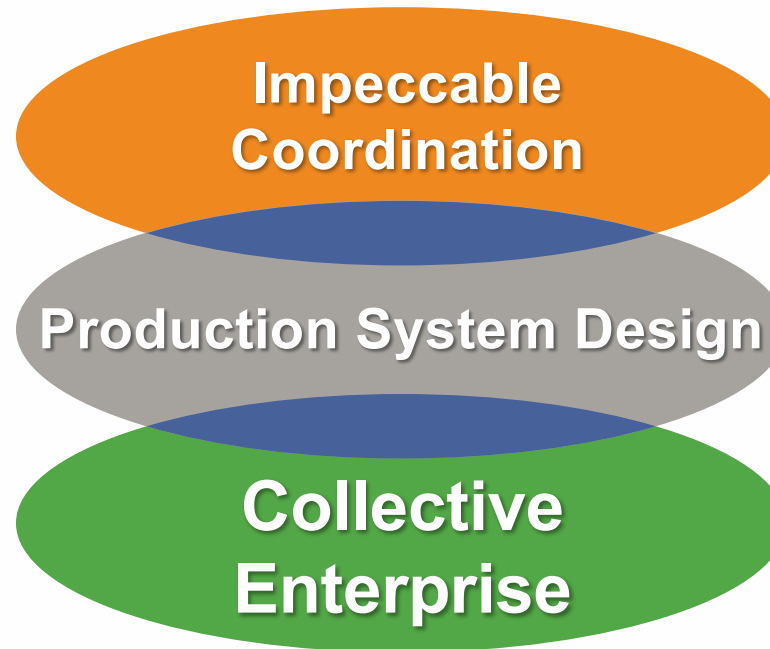
Airplane Game Lessons

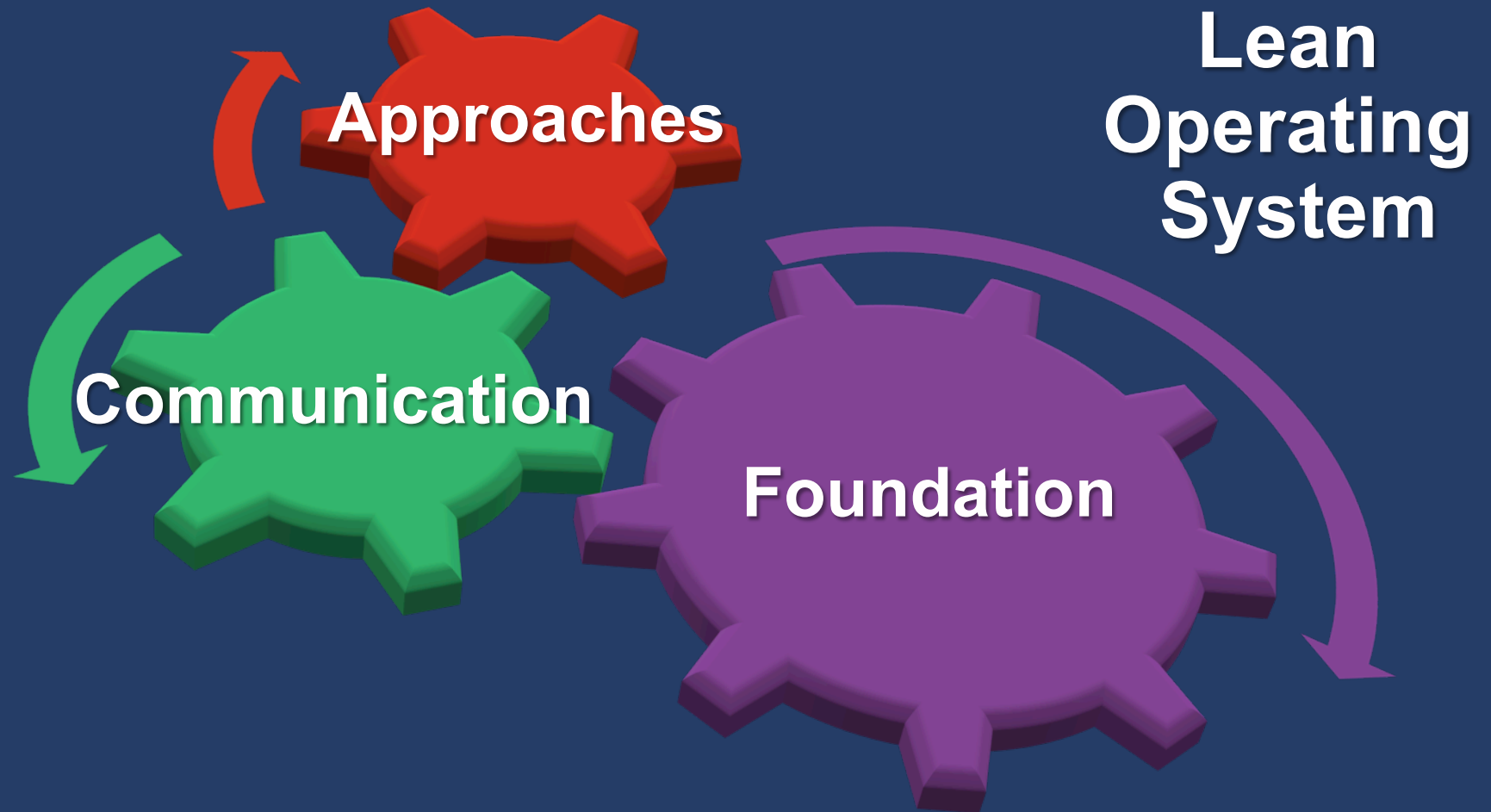


- Release work from one party to the next by **pull** instead of push (1 piece flow)
- **Minimize batch sizes** to reduce cycle time
- Make **everyone responsible** for QC
- **Balance the workload** between trades
- Encourage and enable performers to **collaborate** with one another to maintain steady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

A Coherent Way to Manage Work in Projects

Three Connected Opportunities





Lean Operating System

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



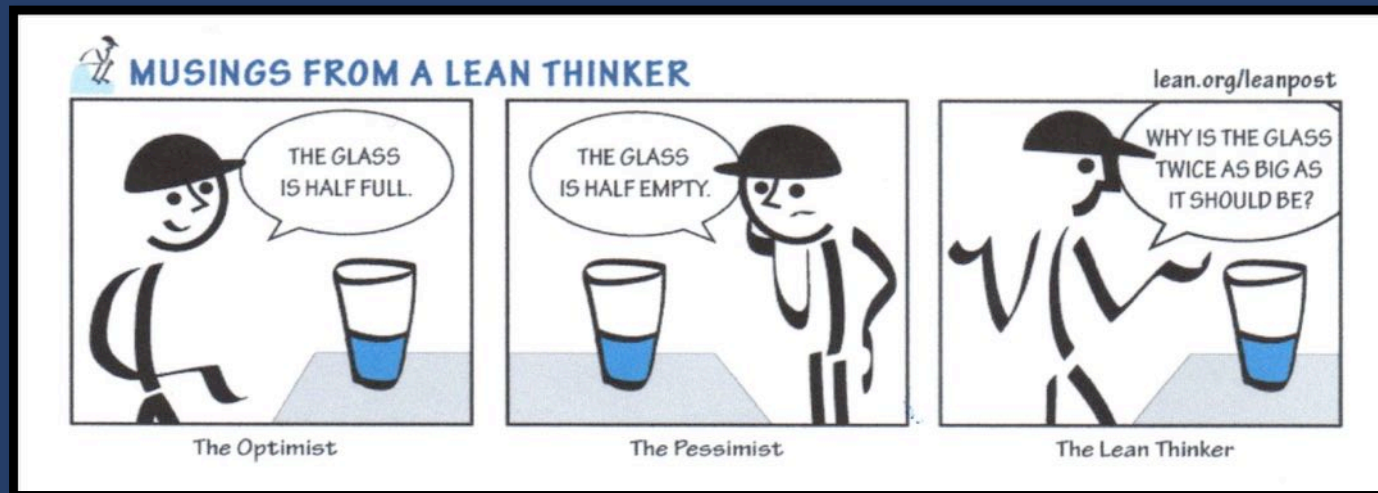
Six Tenets of Lean

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



Optimize the Whole ...*not the parts*

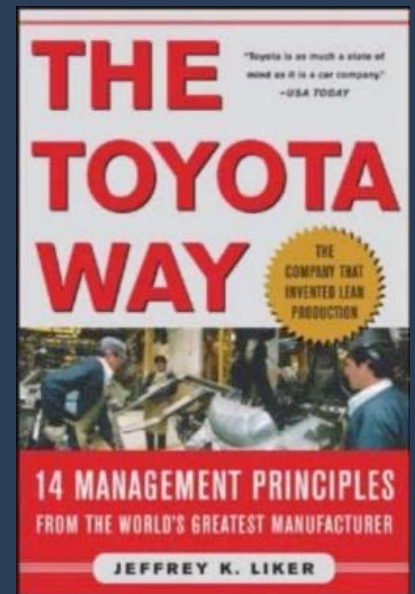
Value optimization encourages looking beyond the local and individual efforts to study the overall outcome to determine where value is added or waste can be eliminated



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



The 7 Deadly Wastes – Taichi Ohno, Toyota

Transportation - Unnecessary movement of “things”

Inventory - Excess materials

Motion - Unnecessary movement by people

Waiting - Workers waiting for work OR Work waiting for workers

Over-production - Producing more than is needed

Over-processing - Spending more time or expense required

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

The 8th Waste: Talent

Transportation - Unnecessary movement of “things”

Inventory - Excess materials

Motion - Unnecessary movement by people

Talent – underutilizing the creativity and skills of the team

Waiting - Workers waiting for work OR Work waiting for workers

Over-production - Producing more than is needed

Over-processing - Spending more time or expense required

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

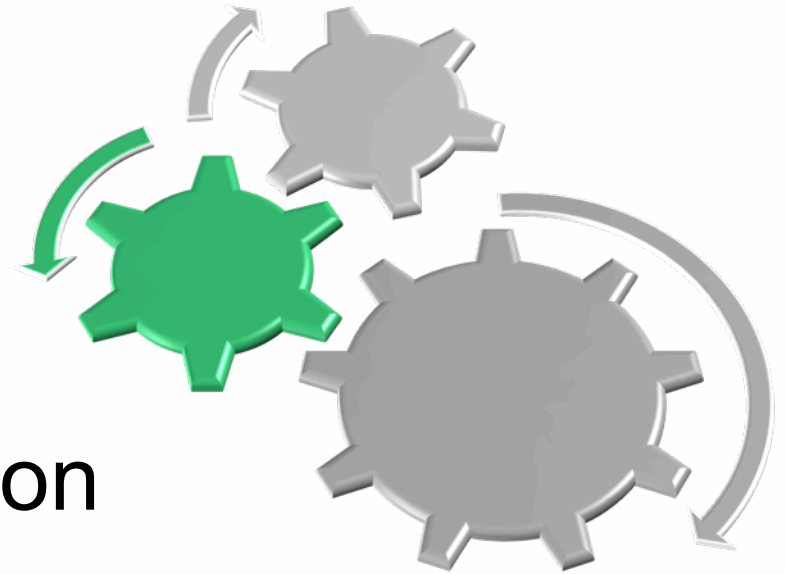
Continuous Improvement (PDCA)

Leaders must create an environment where experimentation is encouraged and small, manageable failure is acceptable if the goal is to improve continuously.



Lean Operating System

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

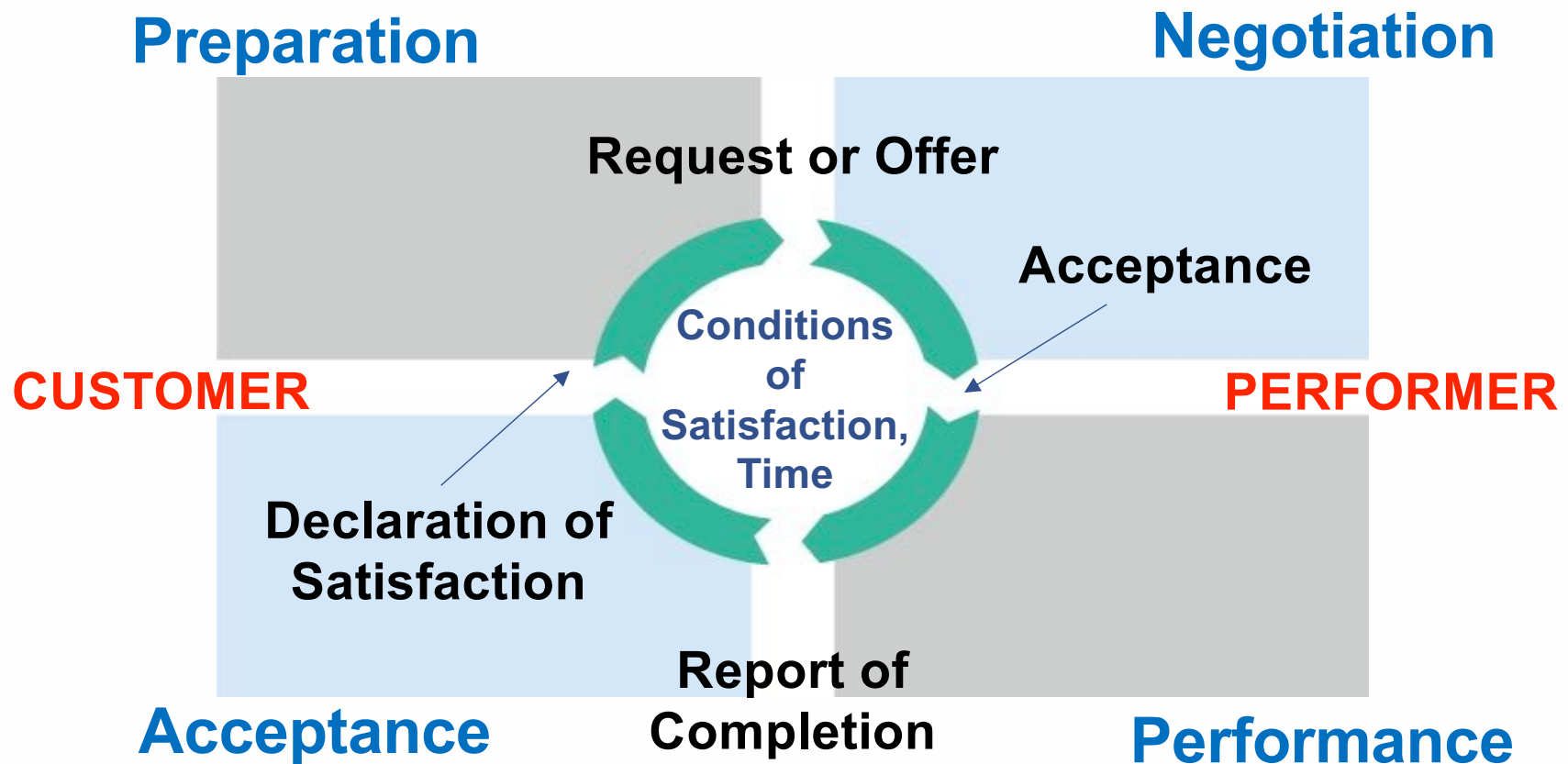


Project is a Promise



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

Basic Action Workflow



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

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



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

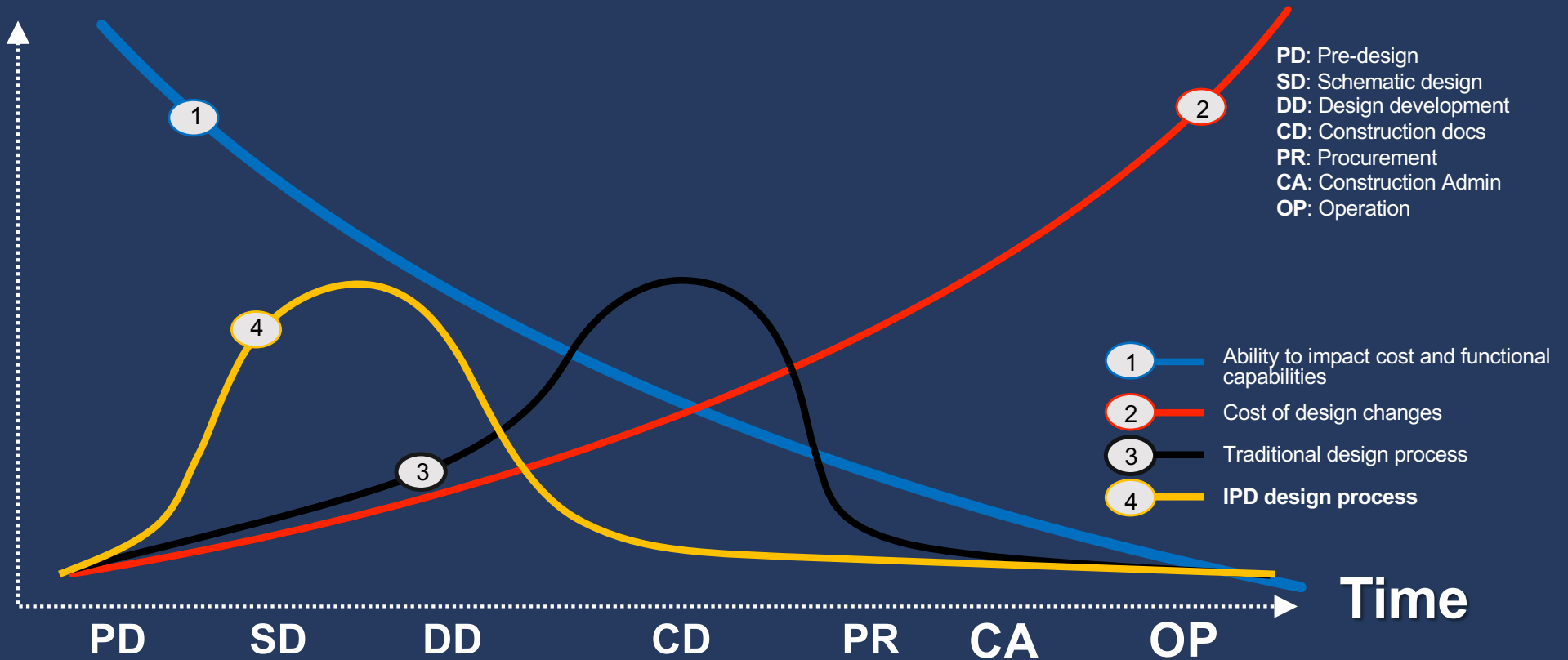
MacLeamy Curve Video



The MacLeamy Curve

Graphic courtesy of Patrick MacLeamy AIA / HOK

Effort/Effect



IPD Work Cluster Organization

Executive/Senior Management:

- Not involved in day-to-day of team
- Resolve conflicts

Core Team:

- Day-to-day leaders of the team

Work Cluster Leader:

- Coordination between work cluster & core team

Work Clusters:

- System oriented
- Cross discipline
- Stakeholder representation
- Form as needed



Big Room

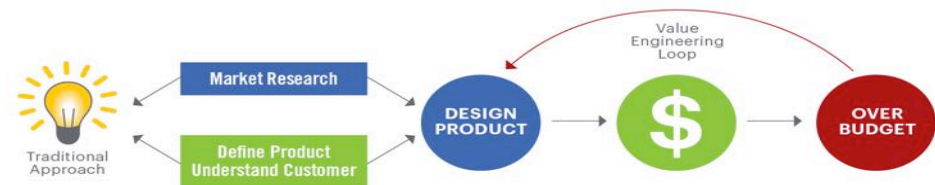
- Speed communication
- Improve decision-making
- Reduce 'siloed' thinking
- **Rapidly Advance work**



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

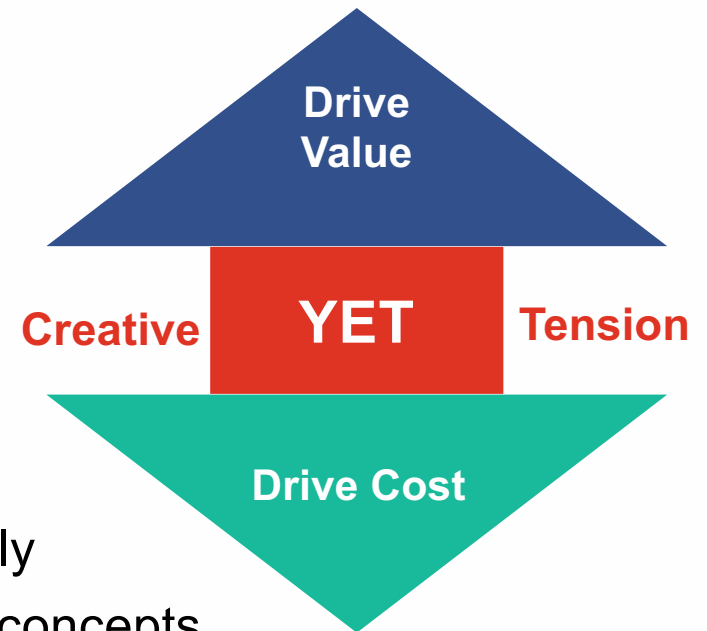
Traditional Delivery vs Target Value Delivery

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



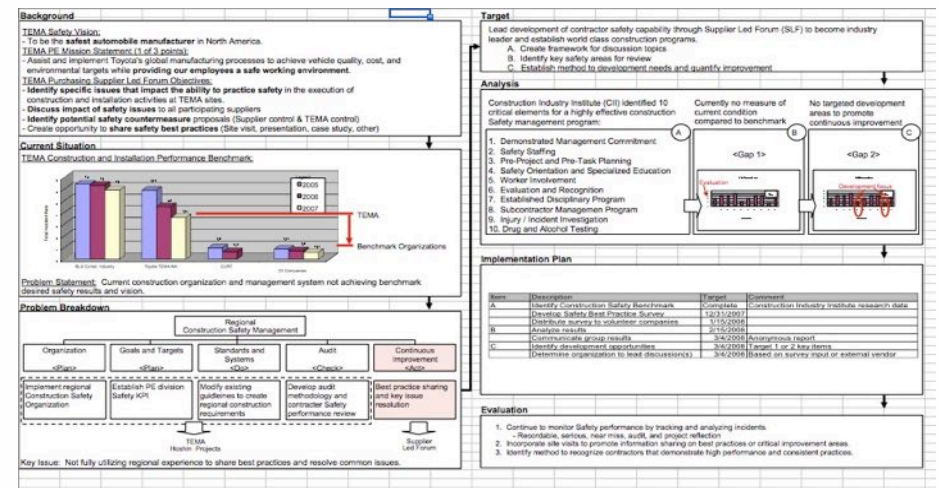
A3 Thinking

(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

WELLINGTON REGIONAL MEDICAL CENTER MONTHLY PROJECT UPDATE

November 2012



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.

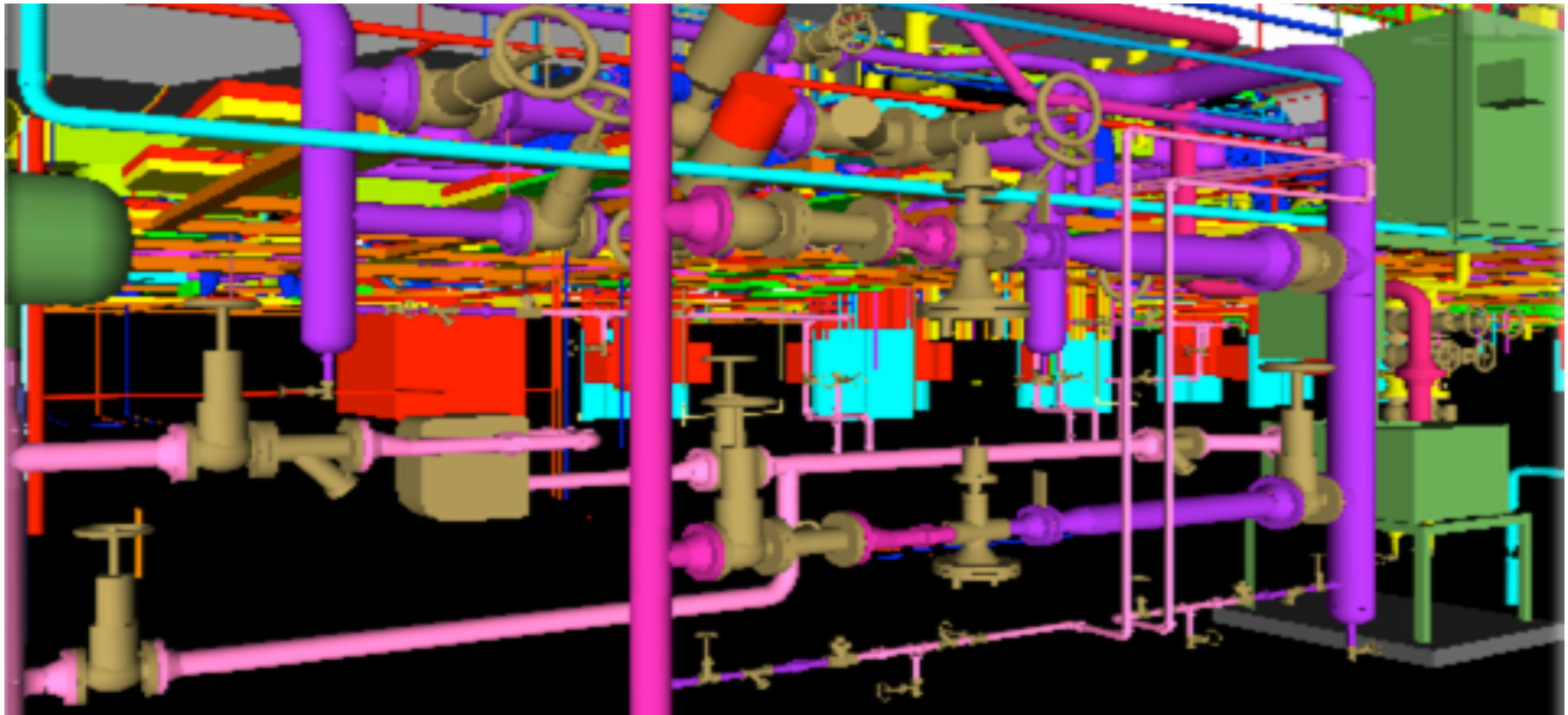
Choosing By Advantages Study of: Heating Hot Water System				
		Alternative 1		Alternative 2
		Central Plant Heating Hot Water System		Distributed Heating Hot Water
Factor: Square feet of Mechanical Space Required				
Criteria:	Attribute	3200 square feet		5100 sq ft required/17 rooms
	Advantage	1300 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 terms	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
Factor: Construction Schedule				
Criteria:	Attribute	Longer due to site distribution		Shorter - no site distribution required
	Advantage			2 weeks
Total Importance			19	11
Capital Cost				

Prototyping - Production Preparation Process (3P)

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



Building Information Modeling (BIM) & Virtual Reality



Prefabrication — Headwalls, Plumbing, Bathrooms



Last Planner System®

Reliability, Flow, Dependency & Variation





*“In preparing for battle, I have always found that plans are **useless**, but planning is **indispensable**.”*

- Dwight Eisenhower

Set Milestones

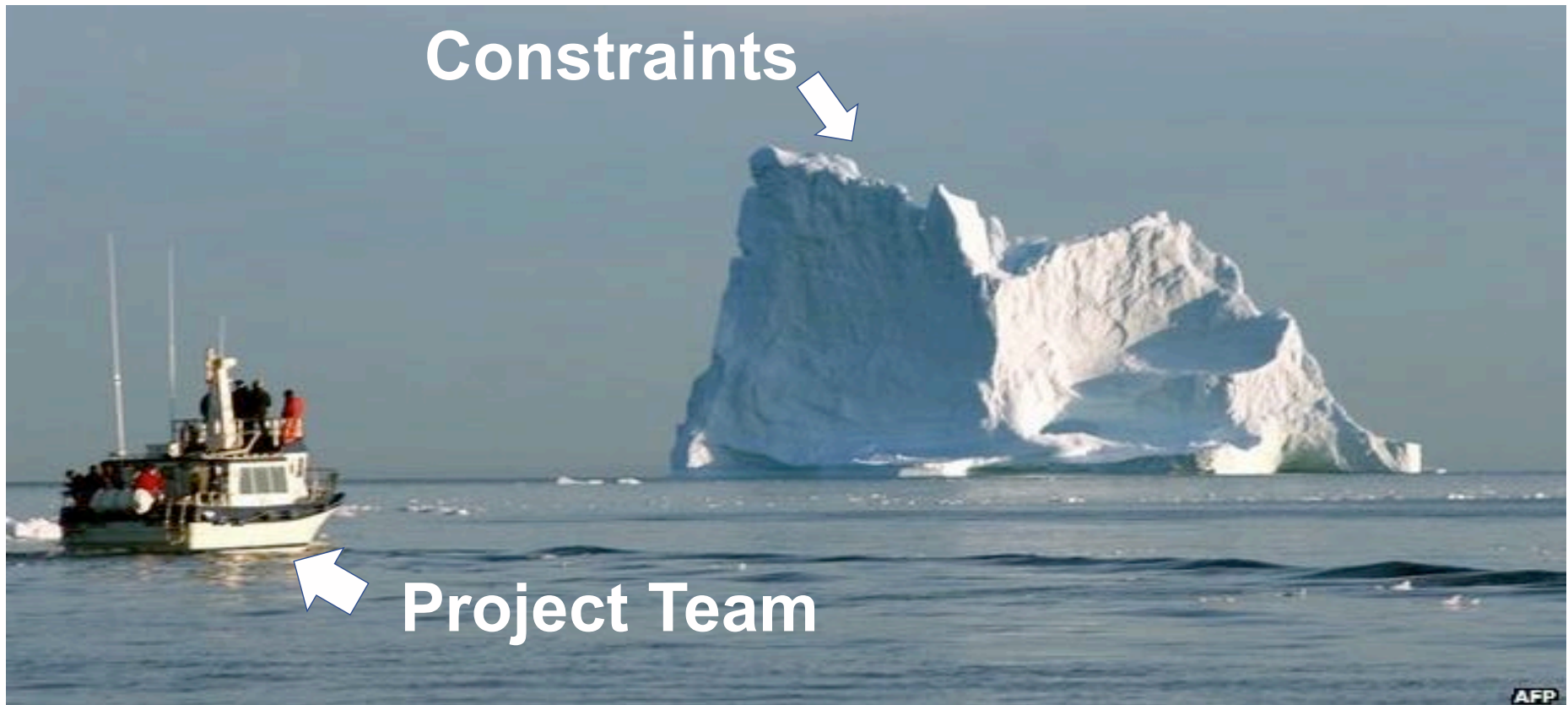
Specify Handoffs

Make Work Ready

LEARNING & IMPROVING

Make-Ready Planning (6 weeks+)

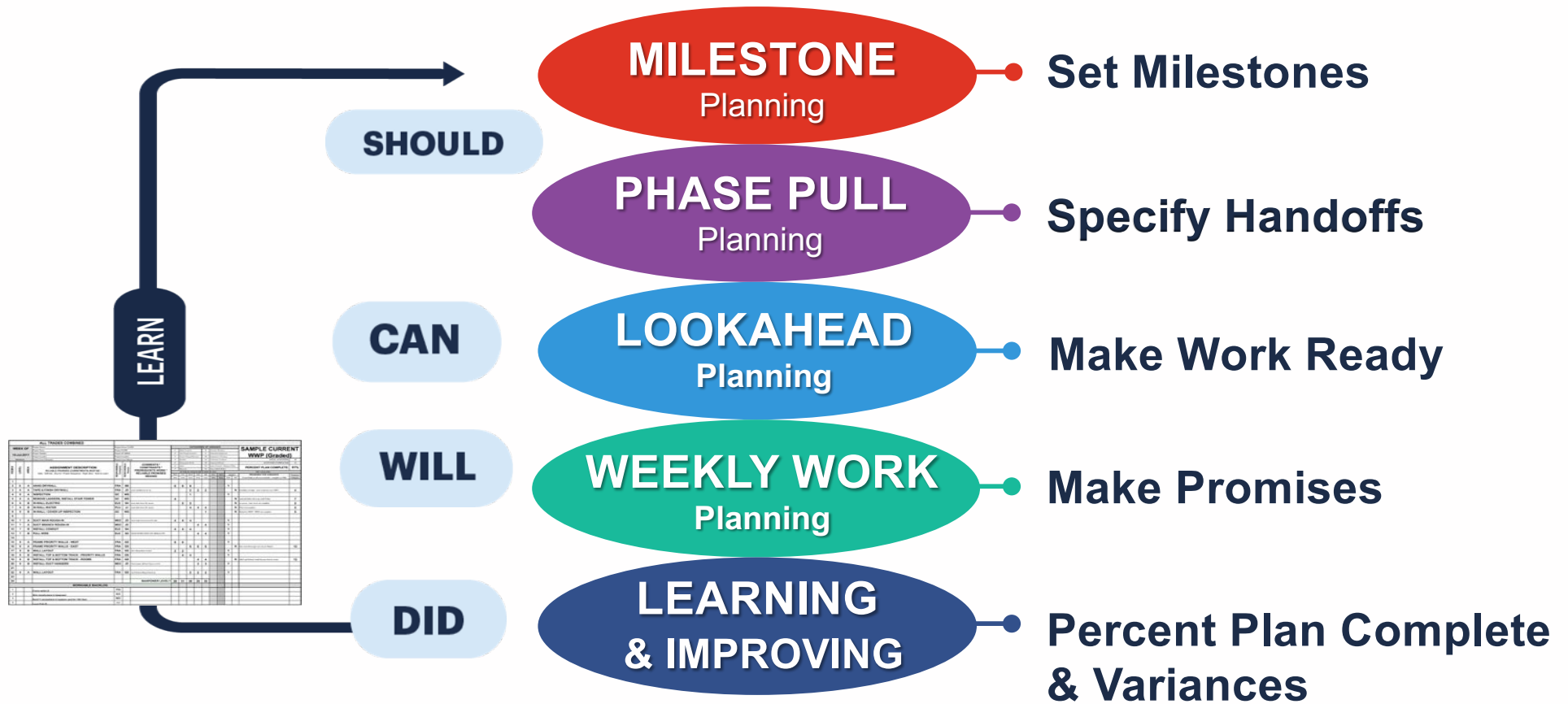
“Pinging the water” for Icebergs



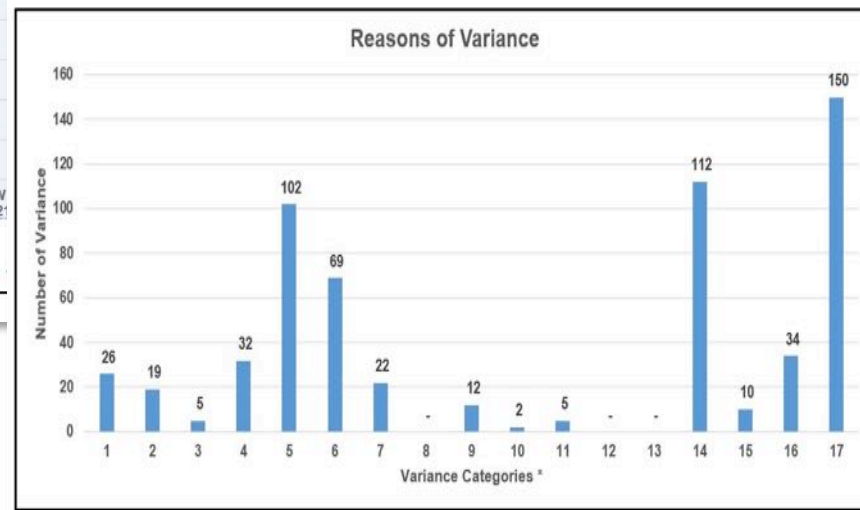
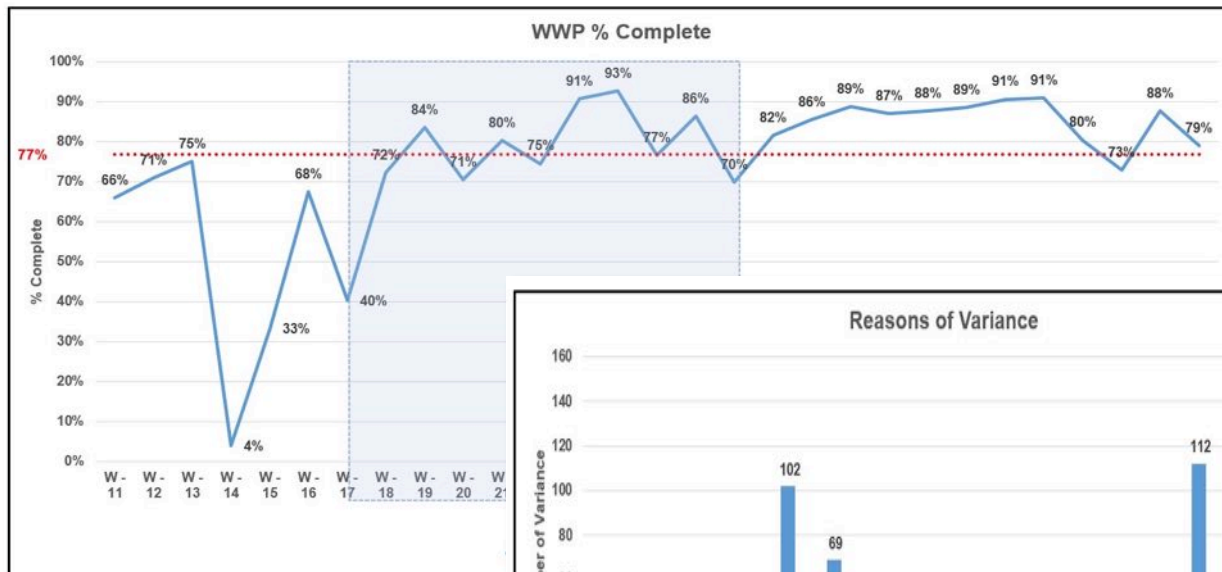
Make Ready Example 1950 vs 2013 Pit Stops



Last Planner® System – 5 Connected Conversations



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

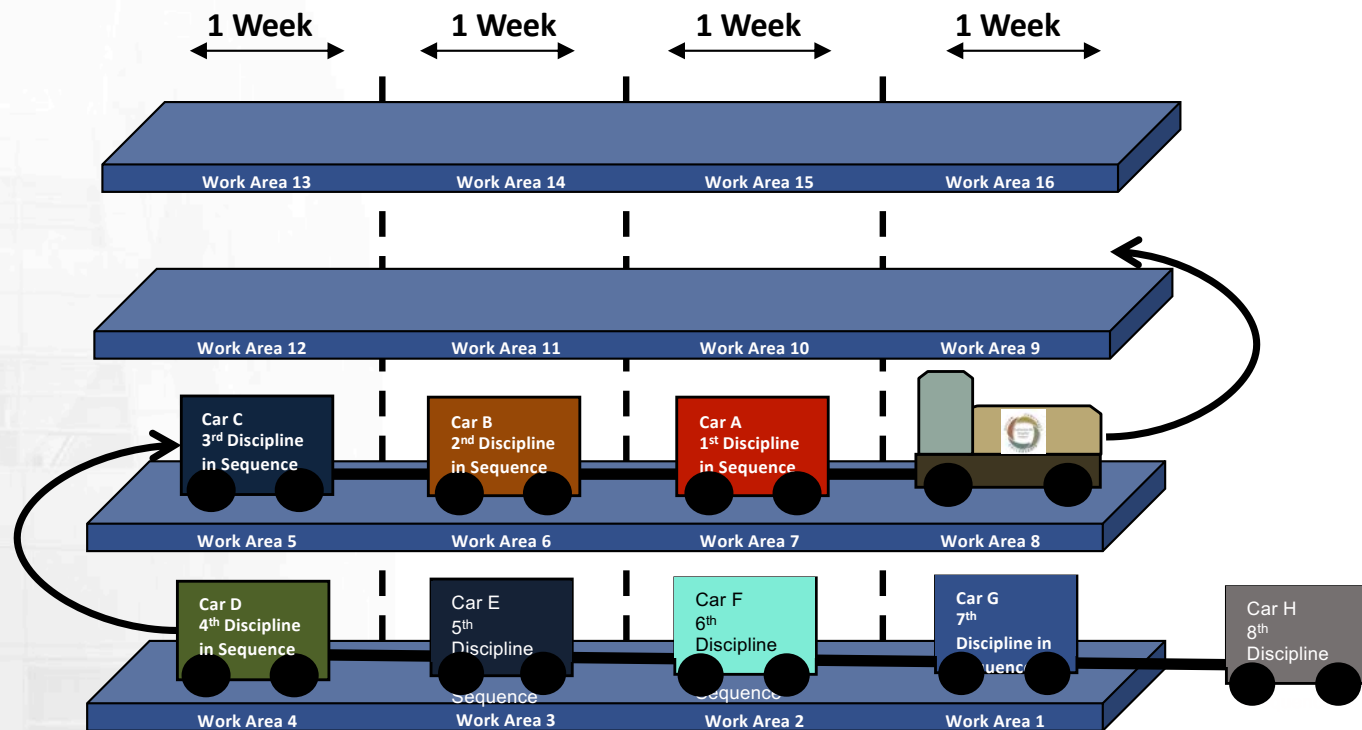
5S: A Starting Point with Lean

- **S**_{ORT}
- **S**_{TRAIGHTEN}
- **S**_{HINE}
- **S**_{TANDARDIZE}
- **S**_{USTAIN}



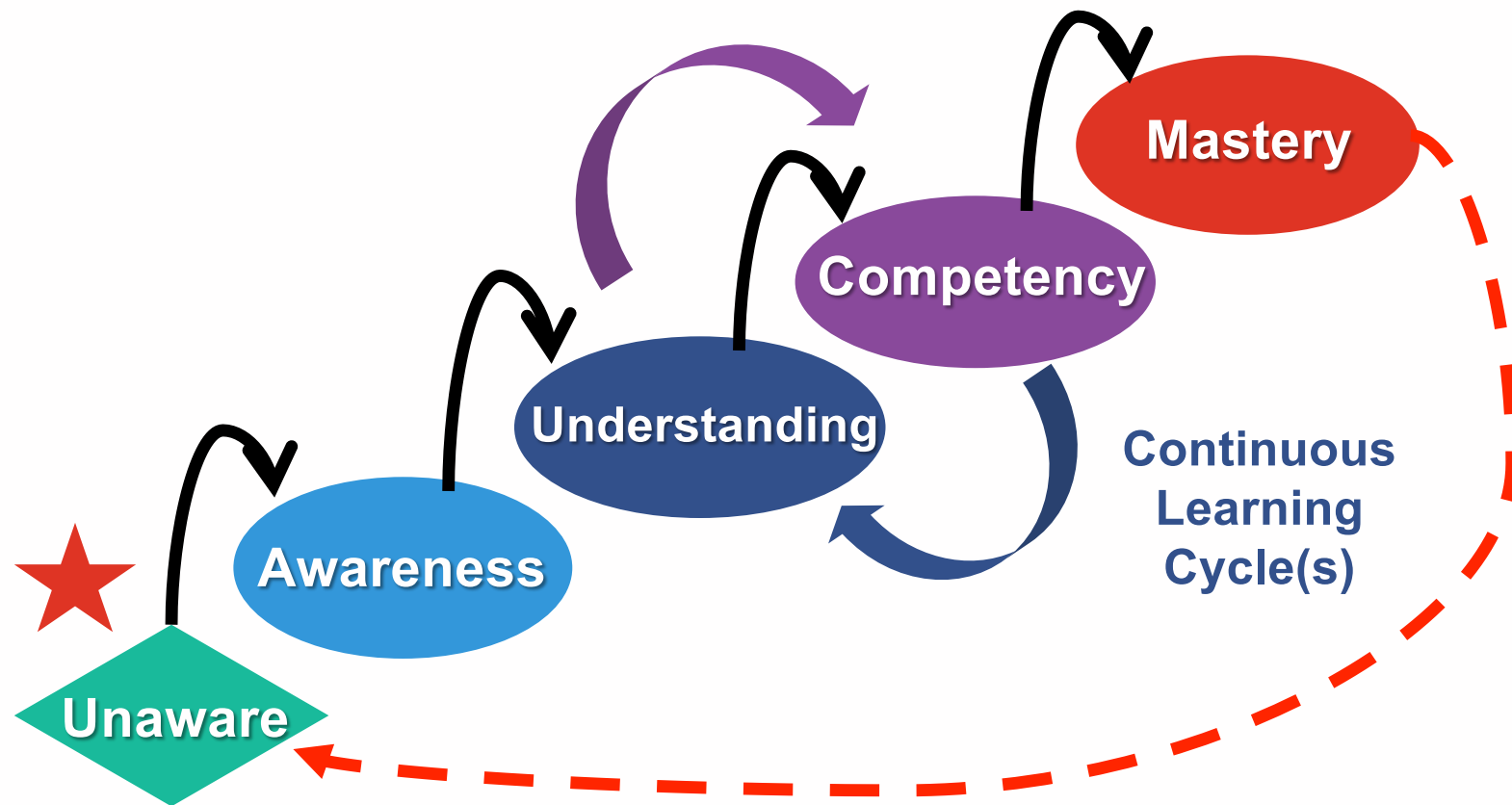
A disciplined approach to **maintaining order** in the workplace, using **visual controls** to eliminate waste.

Takt Planning

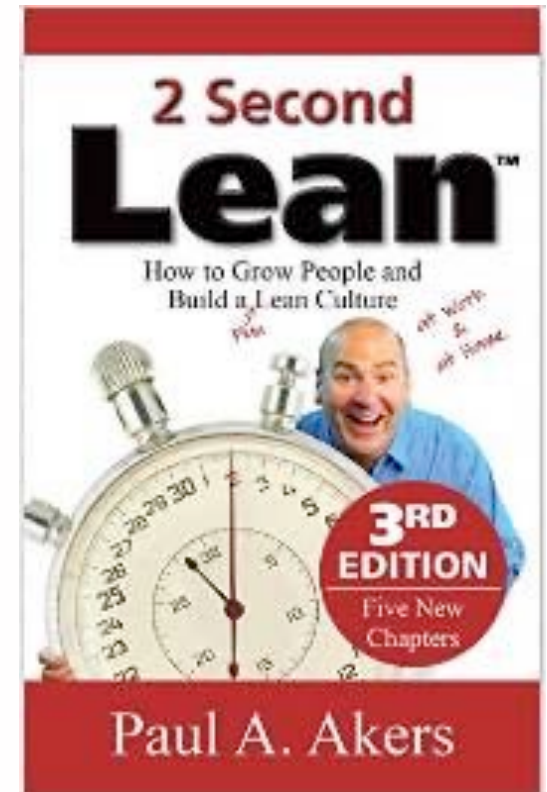


BOLD THINKING.

Lean Journey to Mastery



Paul Akers: 3 Keys to Lean Video



Conduct Plus/Delta

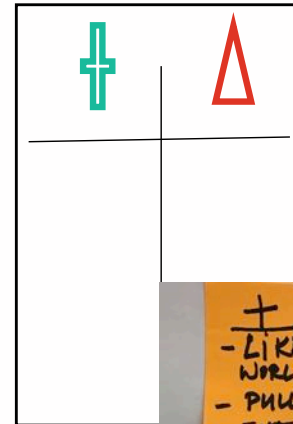
Capture on a flip chart or white board, or use **Sticky Notes**

Plus: What produced value during the session?

“I LIKED...”

Delta: What could we change to improve the process or outcome?

“I WISH...”



+

- LIKED THE REAL WORLD EXAMPLES.
- PULL PLANNING
- INTERACTIVE
- BREAKOUT GROUP EXERCISES
- GOOD PRESENTATION!

+

- Good explanation of Lean tools
- Good practices
- Good speaker
- Good teamwork and participation

Δ

Additional exercises with real project examples

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• TOO MANY SIDE CONVERSATIONS

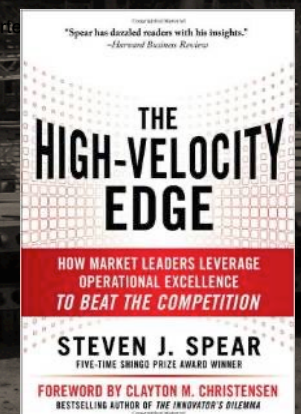
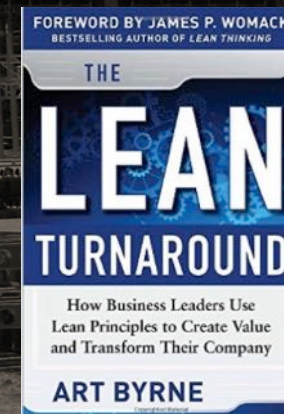
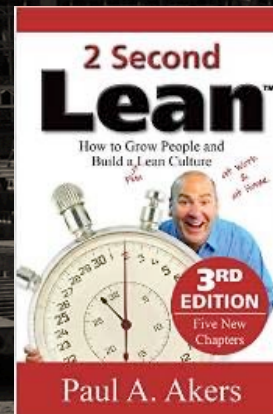
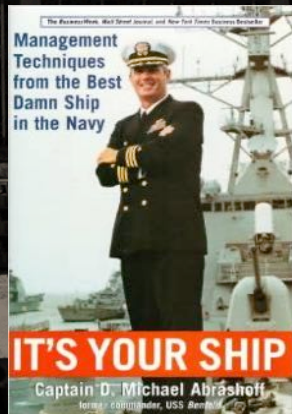
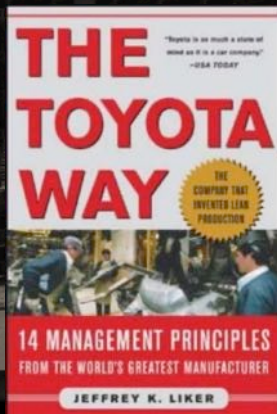
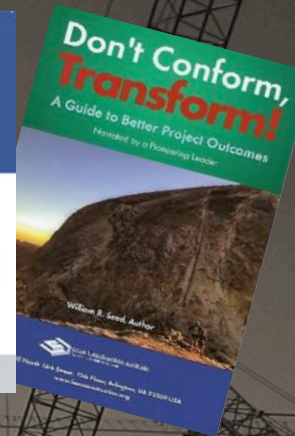
• MORE PROJECTS IN THE WORLD THAT USE THIS

Questions?



Additional Resources

www.LeanConstruction.org



This concludes The American Institute of Architects
Continuing Education Systems Course



Lean Construction Institute



info@leanconstruction.org