Lean Construction Institute
Immersive Education Program

Lean in Design-Build

Presenters: Diane Anglin, Ron Migliori, Victor Ortiz

14 October 2019

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Provider Number H561

LCI-DBIA Lean in Design-Build

LCITB.LIDP

Diane Anglin, Victor Ortiz, Ron Migliori

Monday, October 14, 2019

4 LU Credit(s) earned on completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

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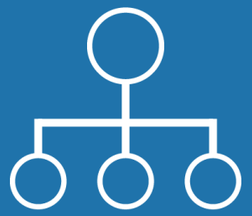
Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Learning Objectives






01.

Participants will understand fundamental concepts of Lean design and construction including identification of waste, definition of value and importance of reliable and predictable flow on project outcomes.

02.

Participants will recognize and understand how Lean is not only for IPD projects, but is particularly well-suited to use in Design-Build which accounts for 40% of non-residential projects.

03.

Participants will understand the fundamentals behind Design-Build done right as recommended by DBIA.

04.

Participants will understand how Lean reinforces Design-Build done right through an understanding of which Lean practices and tools align well with the objectives of Design-Build done right.

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Morning Session Agenda

8:00 AM – Agenda, Introductions, Expectations

8:15 AM – DBDR and Lean – Foundational Concepts

10:00 AM – Break 15 minutes

10:15 AM – DB Best Practices/Lean Approaches

11:45 AM – How to Start, Q&A, Plus/Delta

12:00 PM – Adjourn

Operating Agreements (Ground Rules)

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1. Sit with some new people
2. Participate, stay engaged
3. Questions Encouraged
4. Parking Lot (ok to defer)
5. Cell Phones off
6. Be Comfortable
7. Keep it moving

Introductions

- What brings you here today?
- What is your experience with Lean and/or Design Build?
- What do you want to learn? What are your expectations?

---

20 min discussion
Tables, then report out “expectations”

Foundations of Lean

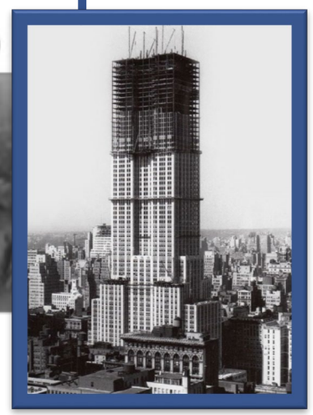
Late 1800's
Frederick Taylor
(standard Work)

Early 1900's
Frank & Lillian Gilbreth
(Time & Motion Study/
Process Mapping)

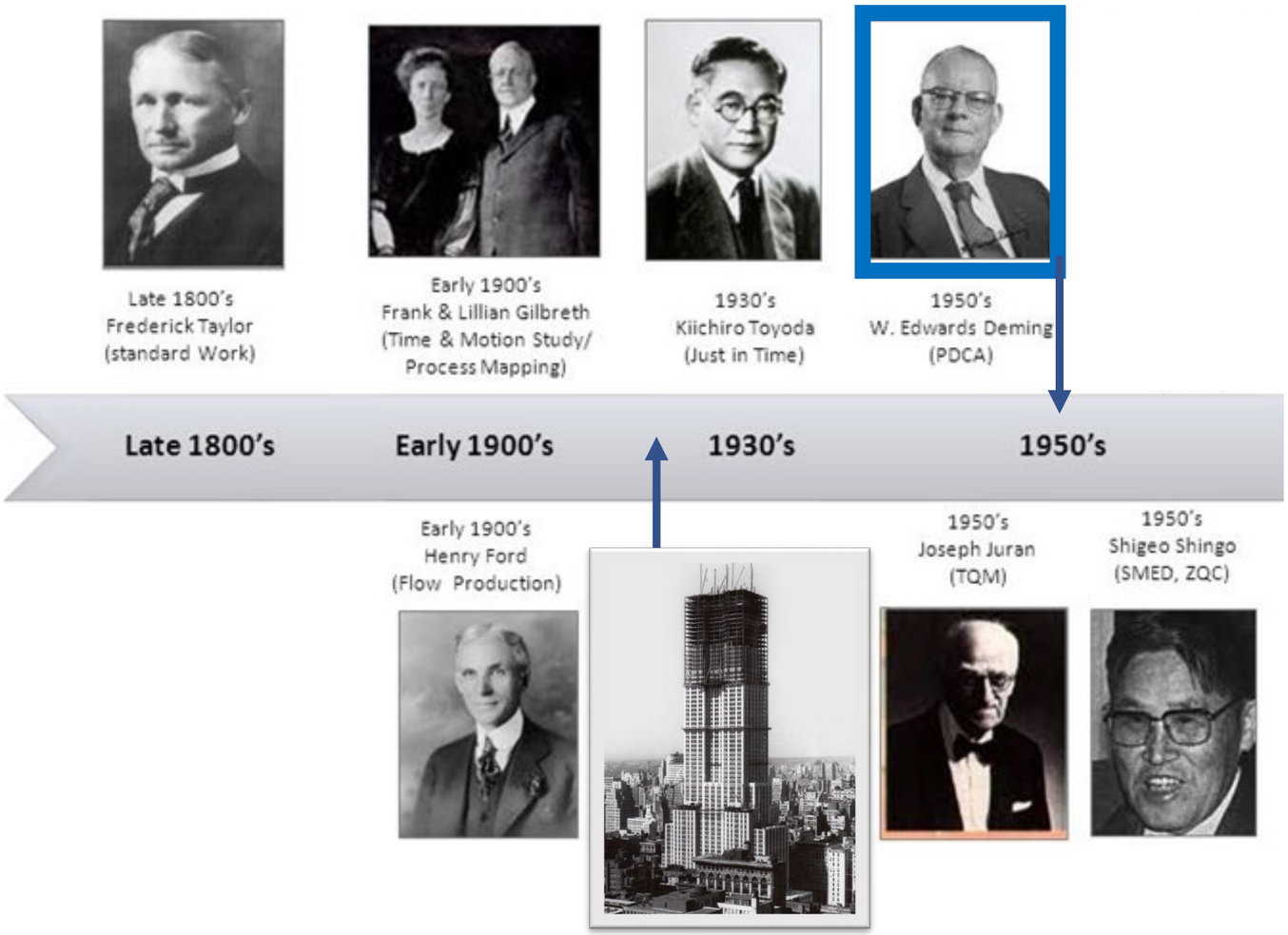
1930's
Kiichiro Toyoda
(Just in Time)

Late 1800's **Early 1900's** **1930's**

Early 1900's
Henry Ford
(Flow Production)

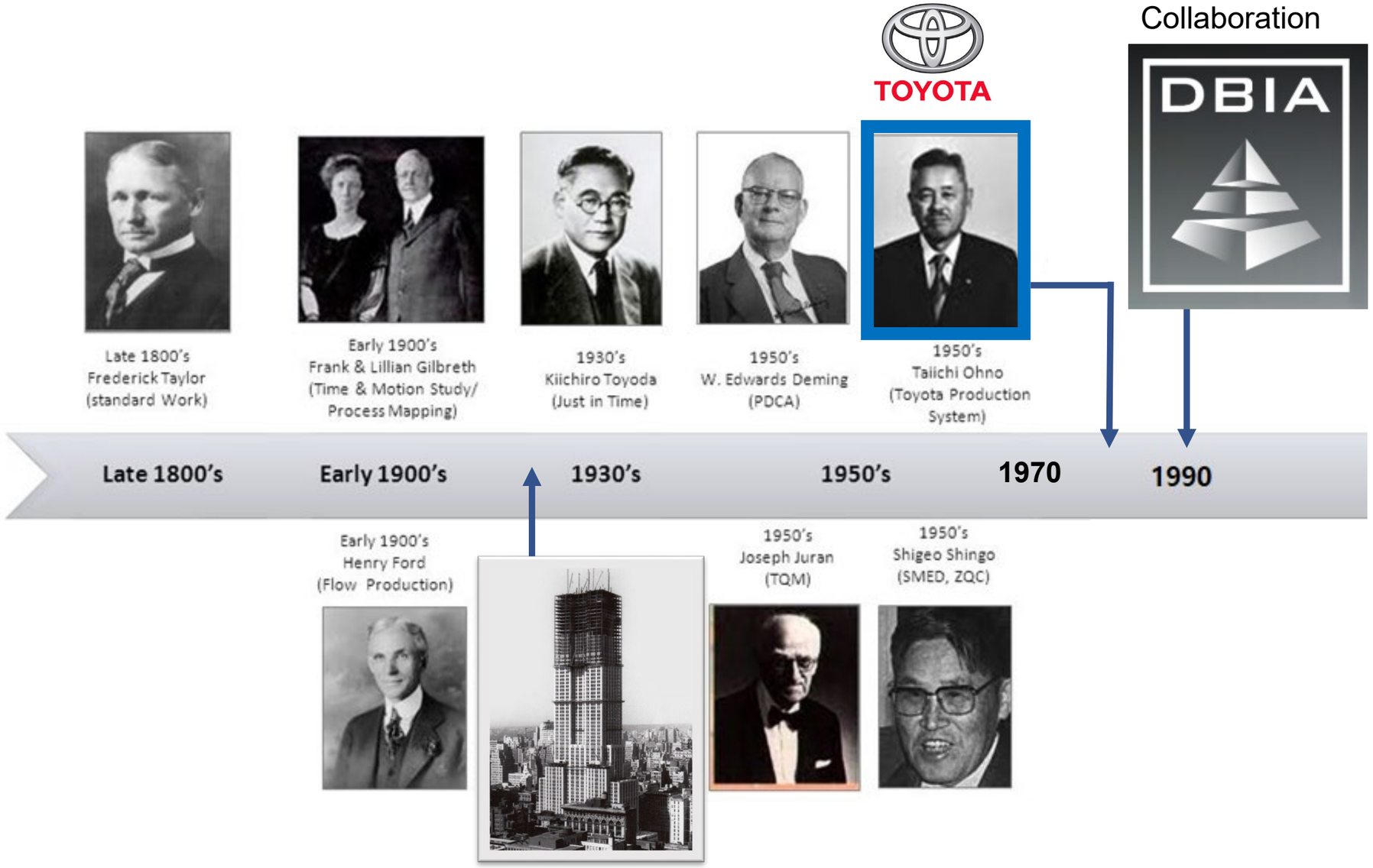


Foundations of Lean



Foundations of Lean

Toyota did not **use** the **term Lean**, instead -- "**it is just what we do**".



Foundations of Lean

Late 1800's
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Process Mapping)

1930's
Kiichiro Toyoda
(Just in Time)

1950's
W. Edwards Deming
(PDCA)

(V)

1950's
Taiichi Ohno
(Toyota Production
System)

TOYOTA

DBIA

1997
Lean Construction Institute
Founded

Late 1800's | Early 1900's | 1930's | 1950's | 1970 | 1990 | 2009

Early 1900's
Henry Ford
(Flow Production)

1950's
Joseph Juran
(TQM)

1950's
Shigeo Shingo
(SMED, ZQC)

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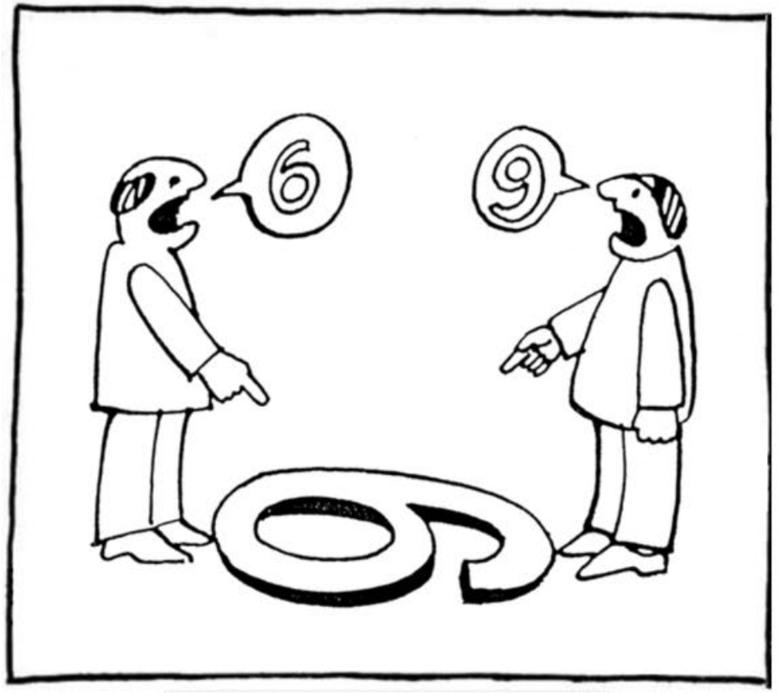
What we see depends on our perspective.
We act based on what we see

LOD Planner



Confusion

&

Blame

PERPETUAL PARADOX

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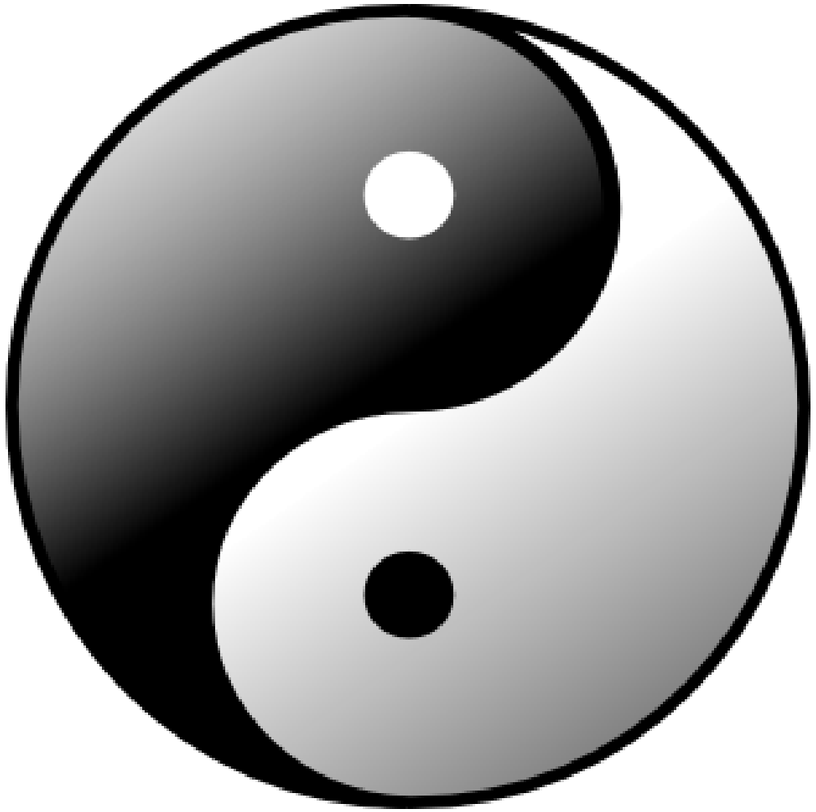
Manage		Lead
Knowing Culture		Learning Culture
Push		Pull
Content Focus		Process Focus
Reduce Variation		Induce Change
Reduce Risk		Innovate
Control Cost		Invest Wisely
Build Your Brand		Be Transparent
Deliver Value		Reduce Waste
Git ‘er Done		Plan to Plan

DYNAMIC BALANCE

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Assertions

- Lean Concepts and Practices are entirely applicable to DBDR
- Most DBDR practices already utilize many Lean Principles
- Lean does not require Integrated Project Delivery (IPD) contracts, but more and more IPD best practices are being used to improve DBDR contracts
- The more you know about and implement Lean Principles and Lean Practices, the more successful your DBDR projects will be.
- It is important to understand Lean Principles and Practices well enough to identify which current or future recommended practices are or are not Lean.

Lean Journey to Mastery

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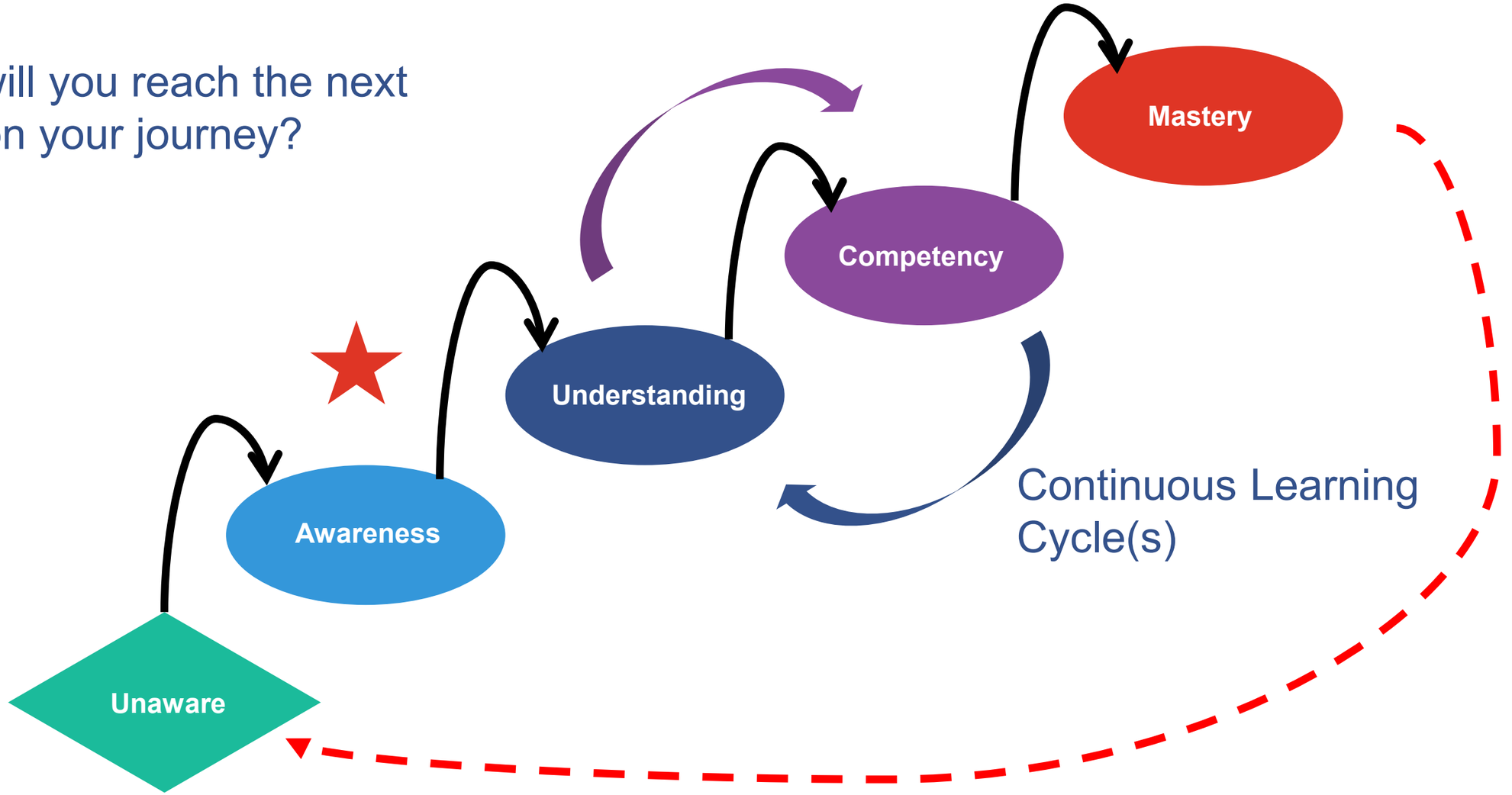
How will you reach the next level on your journey?



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A First Principle

If you don’t agree on the problem,

you probably won’t agree on the solution.

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Discussion Question

What's working in Design-Build?

What's not working in Design-Build?

Small Group Discussion
7 minutes
Report out: 7 minutes

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Discussion Question

What do the problems with DB have in common?

Root Cause Analysis
Process vs. Content

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Discussion Question

Root Cause Analysis (“5 Why’s)
Ultimately derive back to the basis of some choice we made:

Our underlying mental models

(Sometimes it takes 6 Why’s)

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.

Current State Conditions

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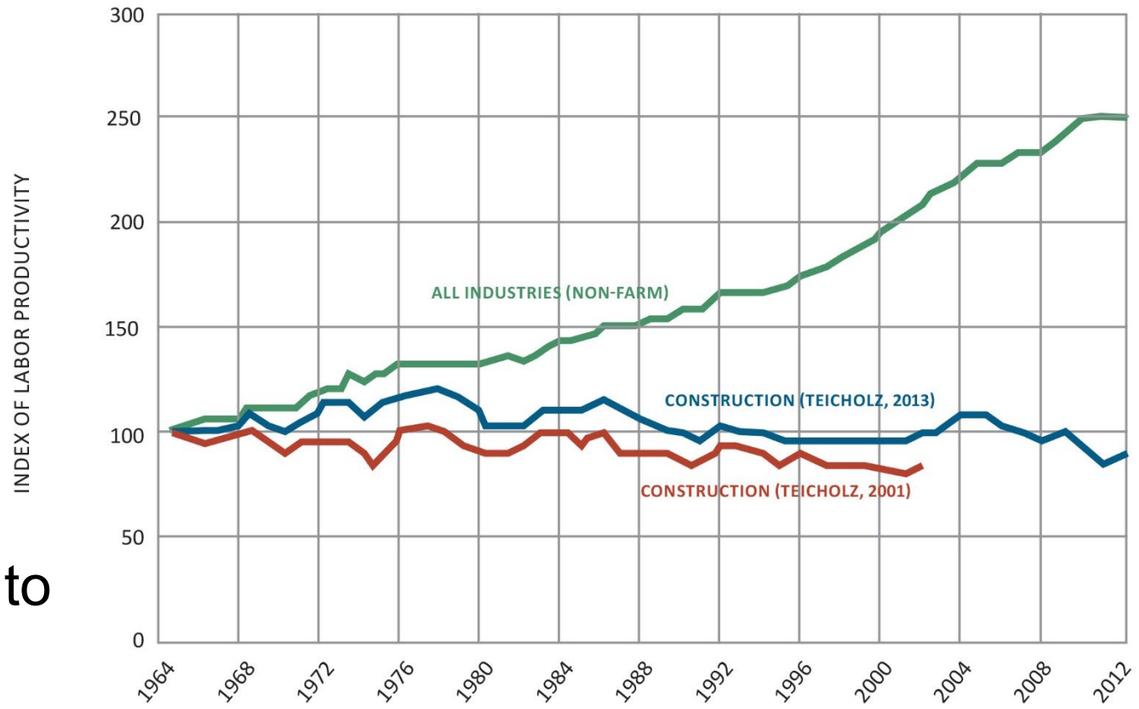
- Construction productivity is declining.
- Construction costs are skyrocketing.
- Injuries are too high.
- Traditional planning systems are unable to produce predictable workflows.
- Workflow reliability directly affects speed and cost of projects.



Correlation of Lean

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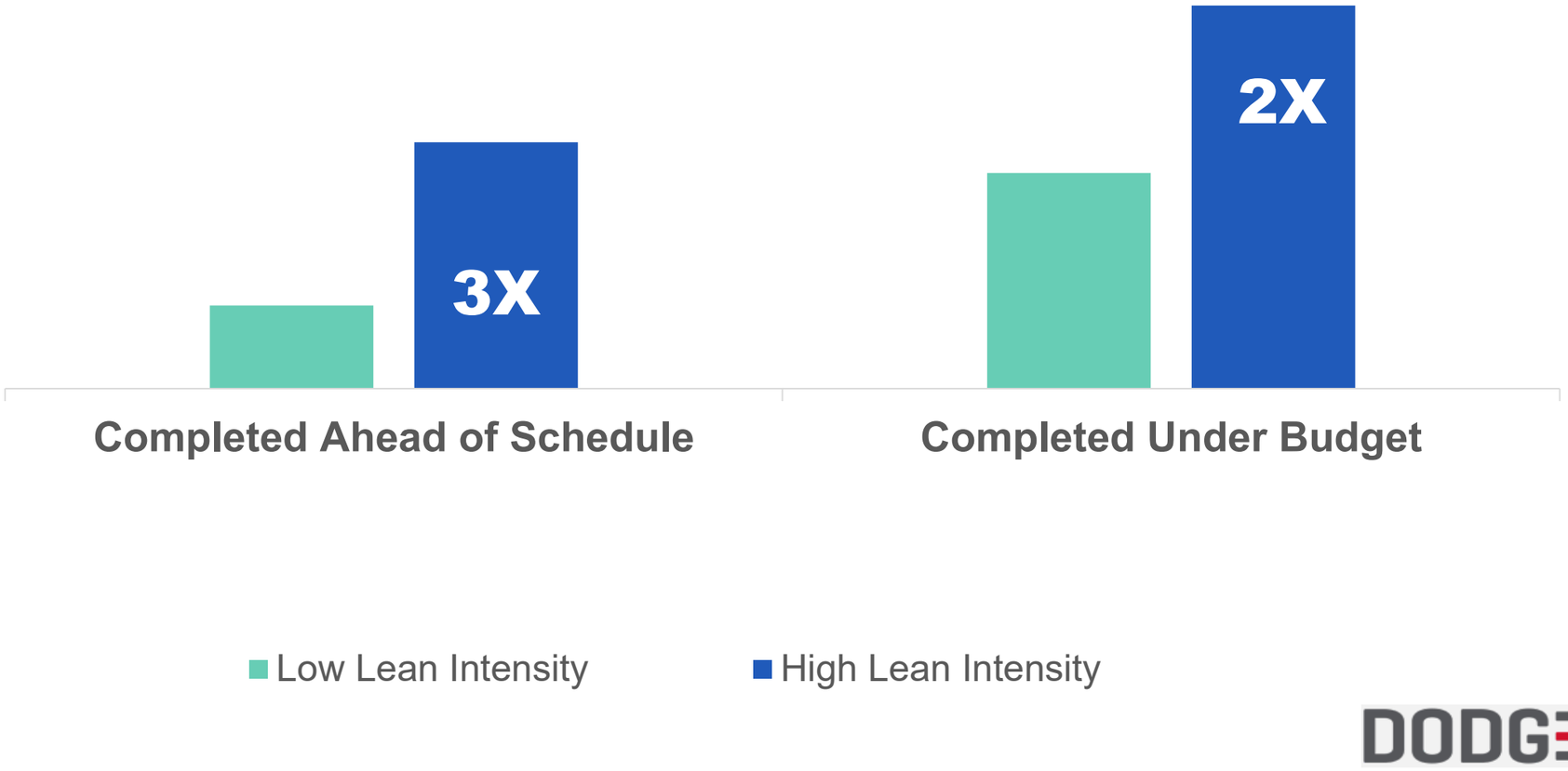
Correlation of lean intensity to outcomes (% likelihood on best projects)



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).

Source: LCI Transforming Design and Construction 2016

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How do Design-Build (DBDR) and Lean Relate?

Design-Build is…

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An **integrated approach** to project delivery

where **design *and* construction** services are provided

in **one contract,**

with a **single point of responsibility** to the owner.

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Lean:

Culture of respect and continuous improvement, and an operations strategy aimed at creating more value for the customer while identifying and eliminating waste

Lean Project Delivery System:

A systematically organized implementation of Lean Principles and Tools combined to allow a team to operate in unison to create effective production through flow.

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DBDR | LEAN

ORGANIZATION

DBDR

- ✓ Collaborative
- ✓ Contract Strategies | Execution

OPERATIONS

LEAN

- ✓ Collaborative
- ✓ Production Management
- ✓ Optimize Strategies | Avoid Problems

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Lean Principles, Lean Construction

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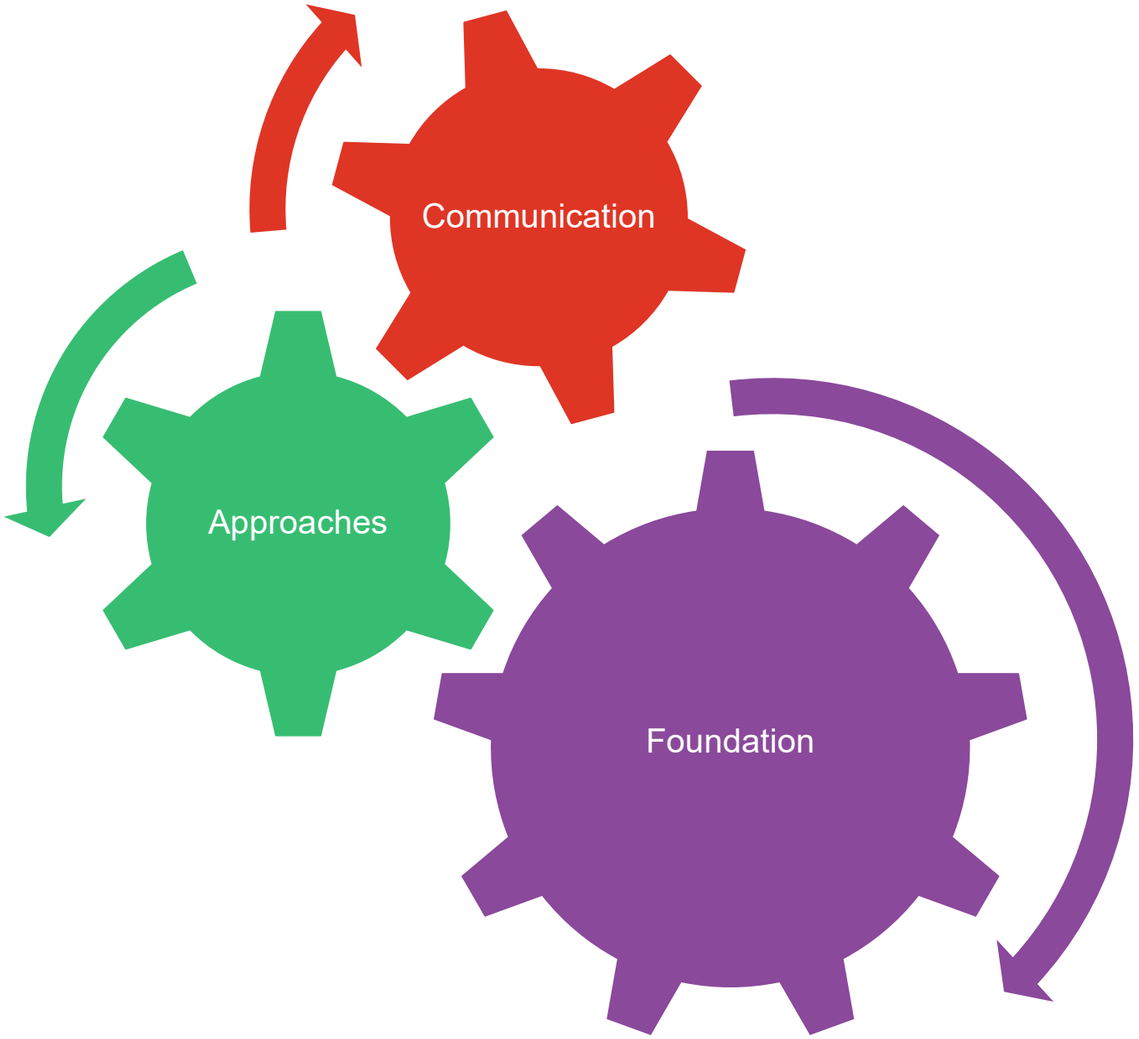
Lean Operating System

Components Include:

- Lean Foundation
- Collaborative Communication
- Approaches



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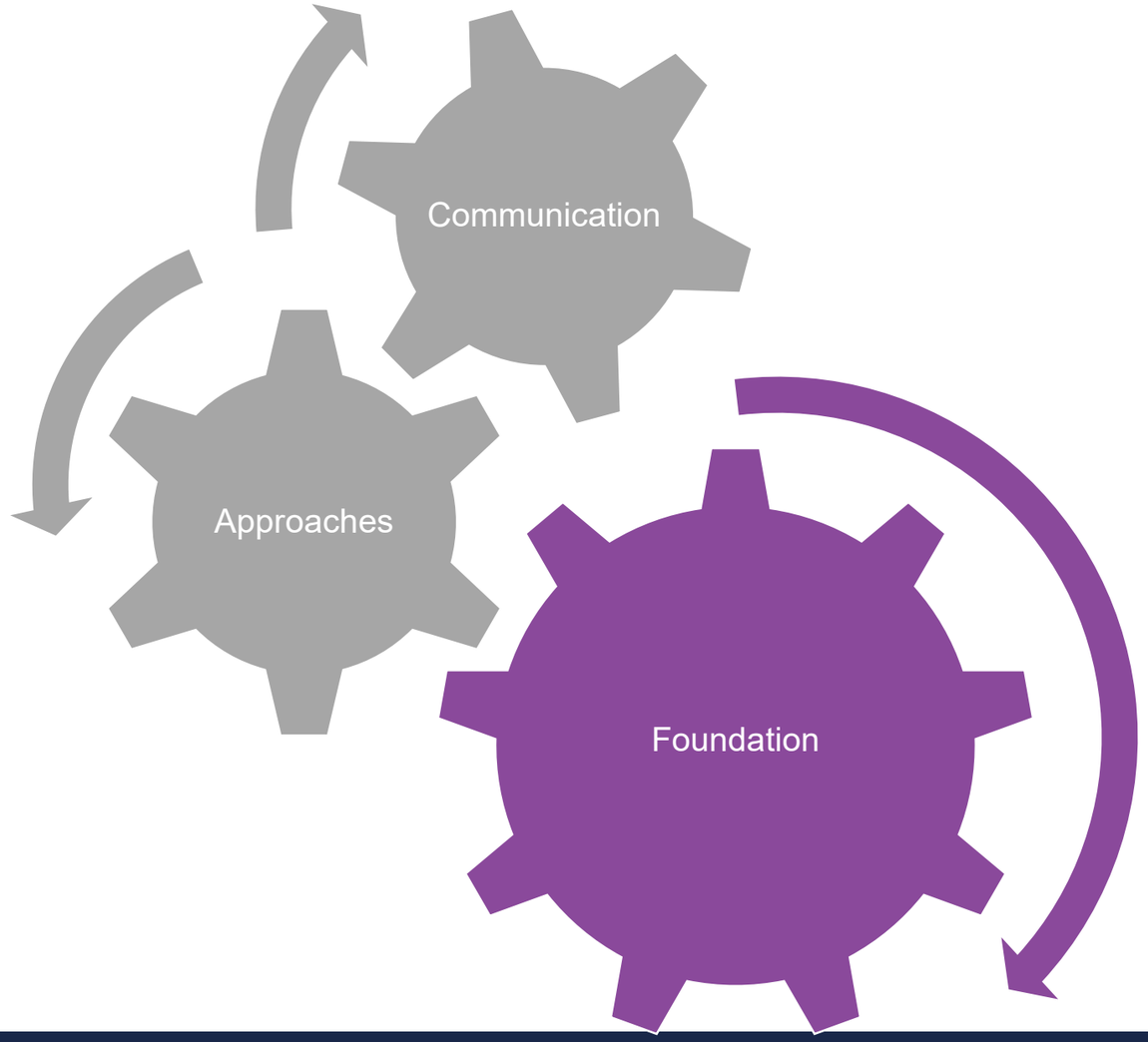
Lean Operating System

Components Include:

- Lean Foundation
  - Basic Concepts
  - Six Tenets of Lean
  - 8 Wastes
- Collaborative Communication
- Approaches



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Lean Philosophy and Guiding Principles

The Lean Fundamentals:

- Value: defined by the customer
- Value Streams: a process approach
- Single-Piece Flow: reduce “WIP”
- Pull: Nothing done until it is needed – “Last Responsible Moment” decisions
- Perfection: The perfect product, delivered instantly, without waste or defect is the ideal pursued through continuous improvement

Goals of Lean Design & Construction

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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.

Eight Types of Waste

Waste is any activity that requires time or resources but does not create value for the customer.

- Over/Under Production
- Waiting
- Unnecessary Transportation
- Over Processing
- Excess Inventory
- Unnecessary Motion
- Defects
- Unused Creativity of Team Members
  (Not listening/Not speaking up)

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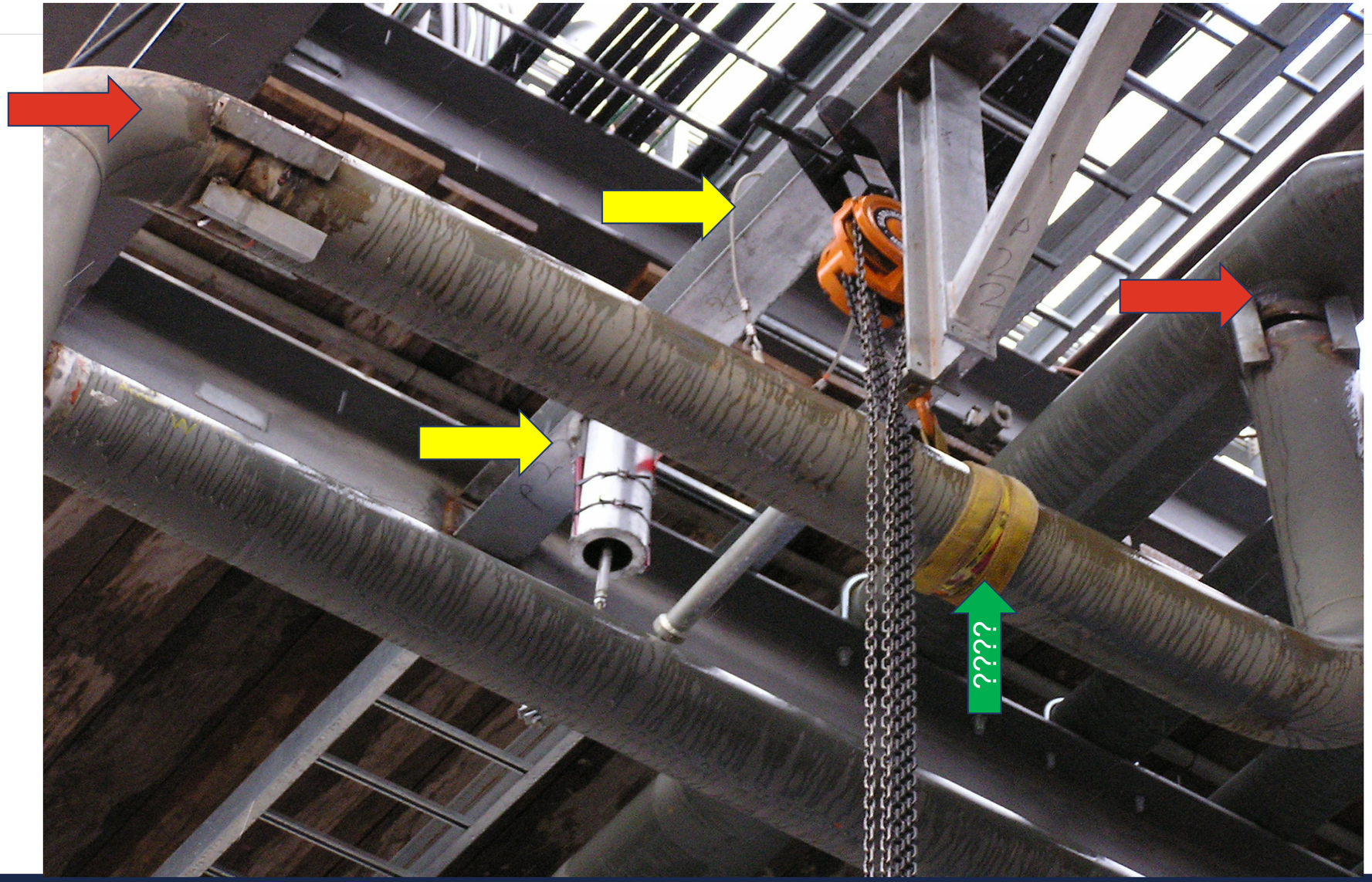
What's Wrong…



With this Picture?

Waste Walk Analysis

Waste Type	Evidence	Cause(s)	Corrections
O/U-Production			
Waiting			
Processing			
Transport			
Inventory			
Movement			
Defects			
Creativity/Ideas			

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What's Wrong…

With this Picture?

Discussion Question

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List examples of waste you see in design and construction process

Table Discussion
10 minutes
Report out: 5 minutes

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Break – 15 Minutes

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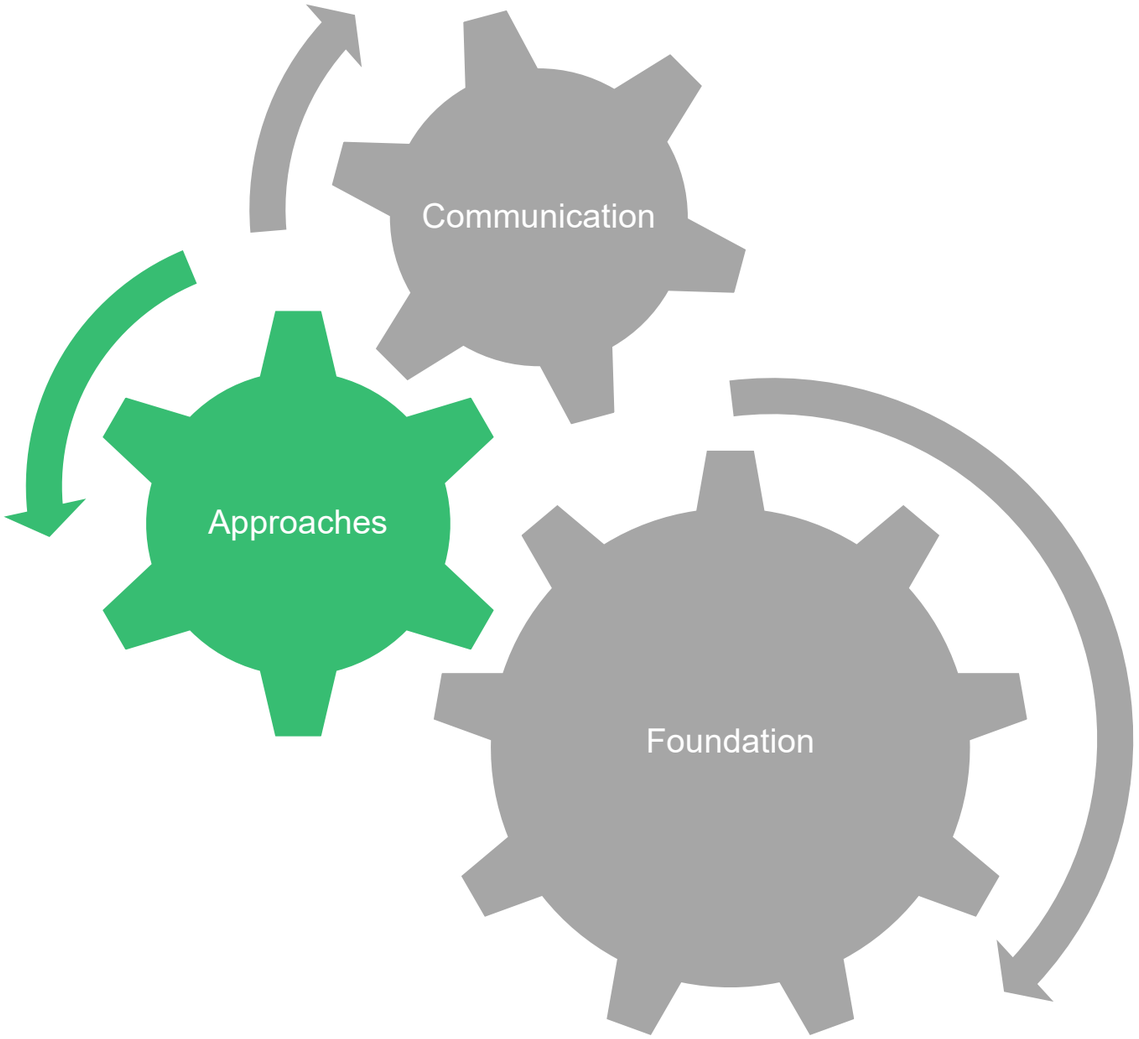
Lean Operating System

Components Include:

- Lean Foundation
- Approaches:
  - Team Organization
  - Big Room Mindset
  - Target Value Delivery
- Collaborative Communication



Coherent way to Manage Projects

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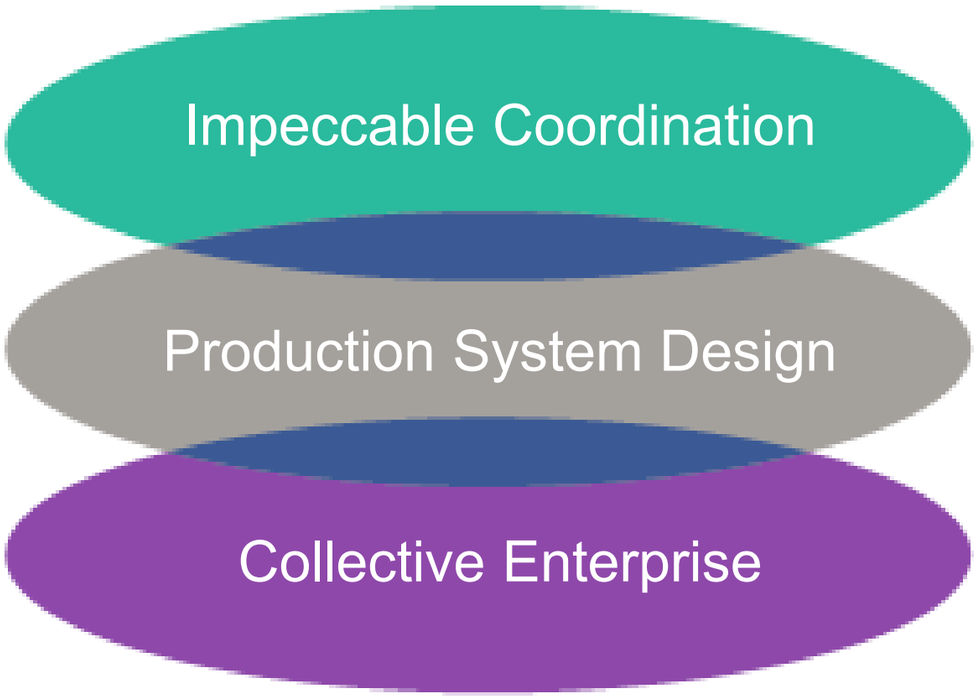
Three Connected Opportunities



Project Elements

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Approaches

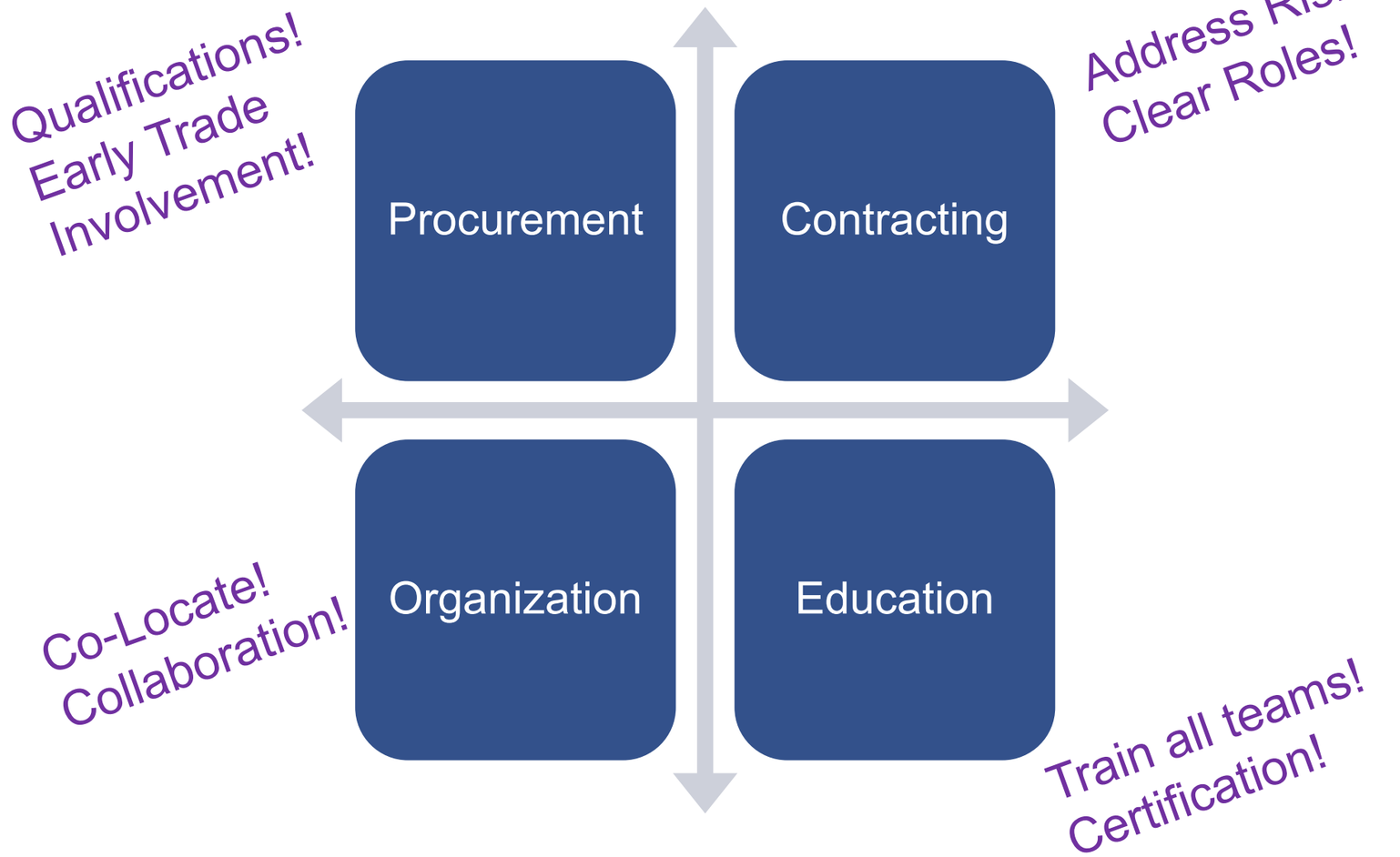
The DBIA Manual of Practice DBDR

LCI 6 Tenets

The authoritative source for current state Best Practices in Design-Build Delivery

Approaches


DESIGN-BUILD
DONE RIGHT
Universally Applicable
» any project type
» any sector
» any size
BEST DESIGN-BUILD PRACTICES
DBIA
DESIGN-BUILD
INSTITUTE OF AMERICA


Qualifications!
Early Trade
Involvement!
Procurement
Contracting
Address Risks!
Clear Roles!
Co-Locate!
Collaboration!
Organization
Education
Train all teams!
Certification!

Approaches

LCI 6 Tenets

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Starts with Respect!

Not just parts!

Customer-defined value!

What to stop doing!
Learning to see waste!

Focus on Flow efficiency!

Learning Mindset!
Small, manageable failure!

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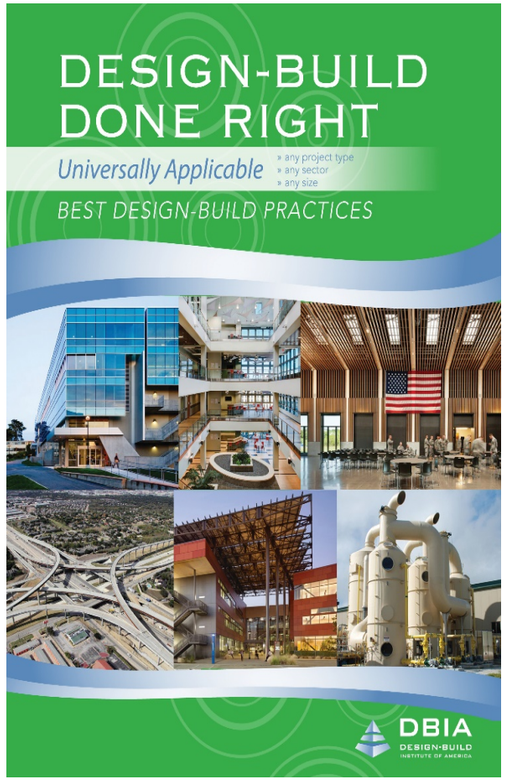
Design-Build Commercial Best Practices



Procurement

- Focus heavily on qualifications rather than price
- Encourage early involvement of key specialty trade contractors

Contracting

- Proactively address project-specific risks
- Evaluate contract incentives
- Agree on roles and procedures
- Encourage communications between parties
- Have a fair process for adjusting contract price and time

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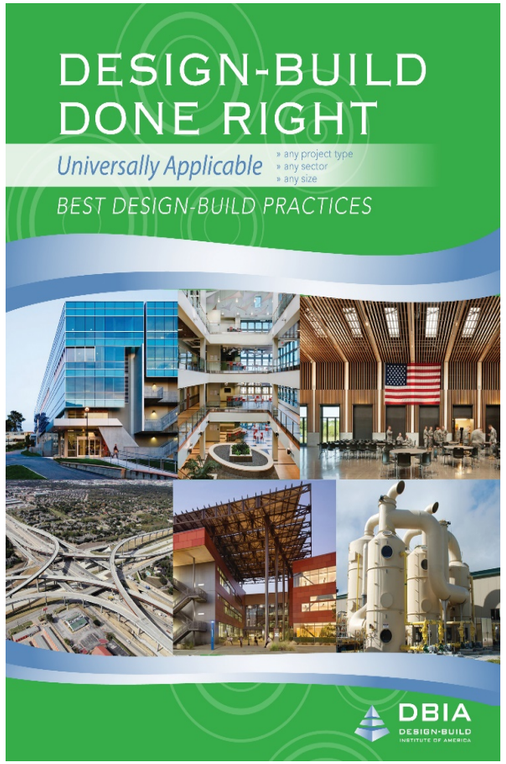
Design-Build Operational Best Practices



Organization

- Co-locate owner and design-builder; design and construction teams work in same place
- Select and train staff with DBDR best practices
- Create an executive leadership group
- Develop collaborative processes to enable key stakeholders to participate
- Document Design and other project changes
- Dedicate sufficient resources to foster collaboration during design development

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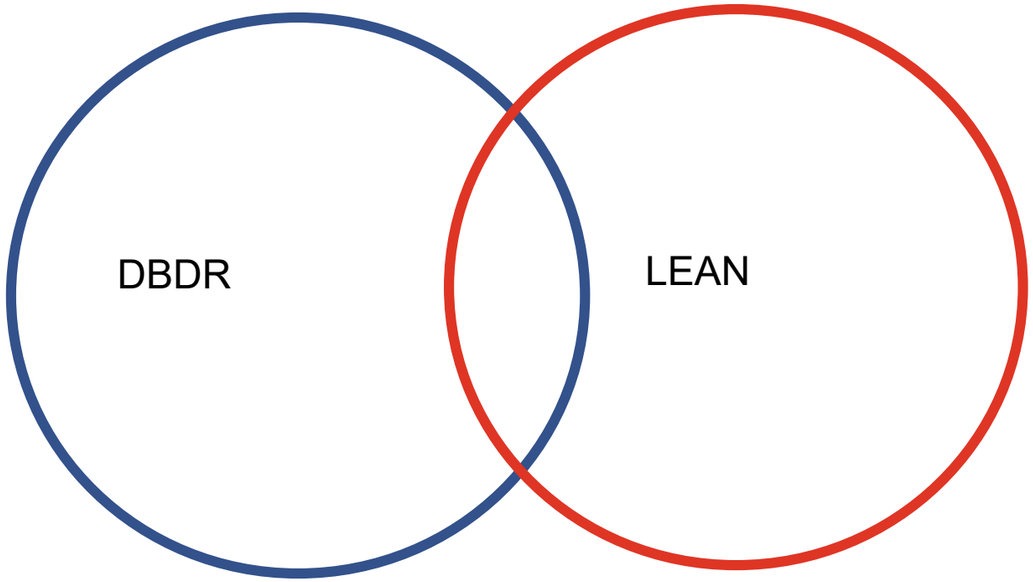
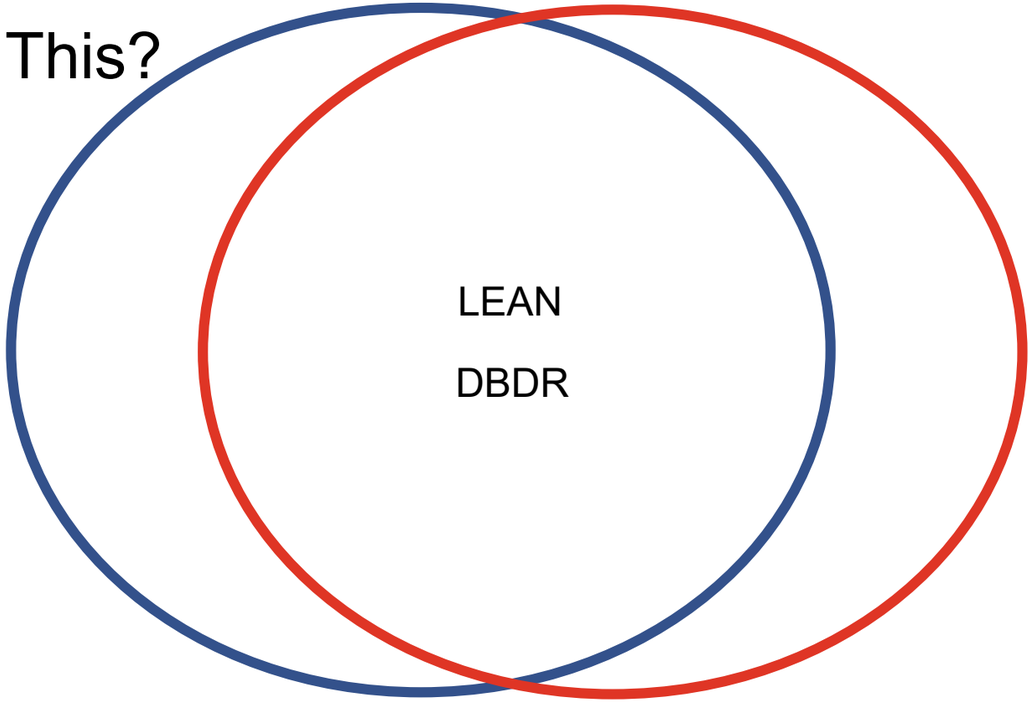
How to we move from…

This…



To This?



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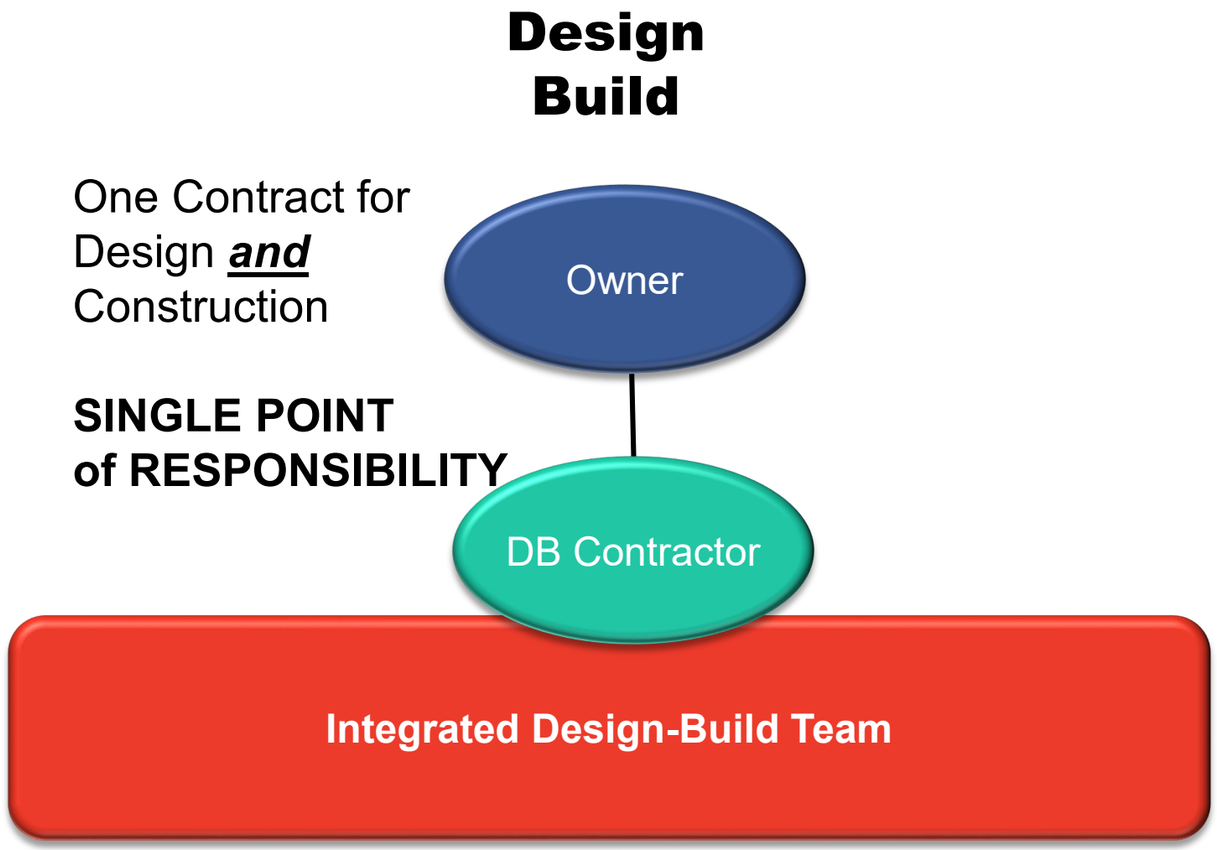
What is the Design-Build Structure?



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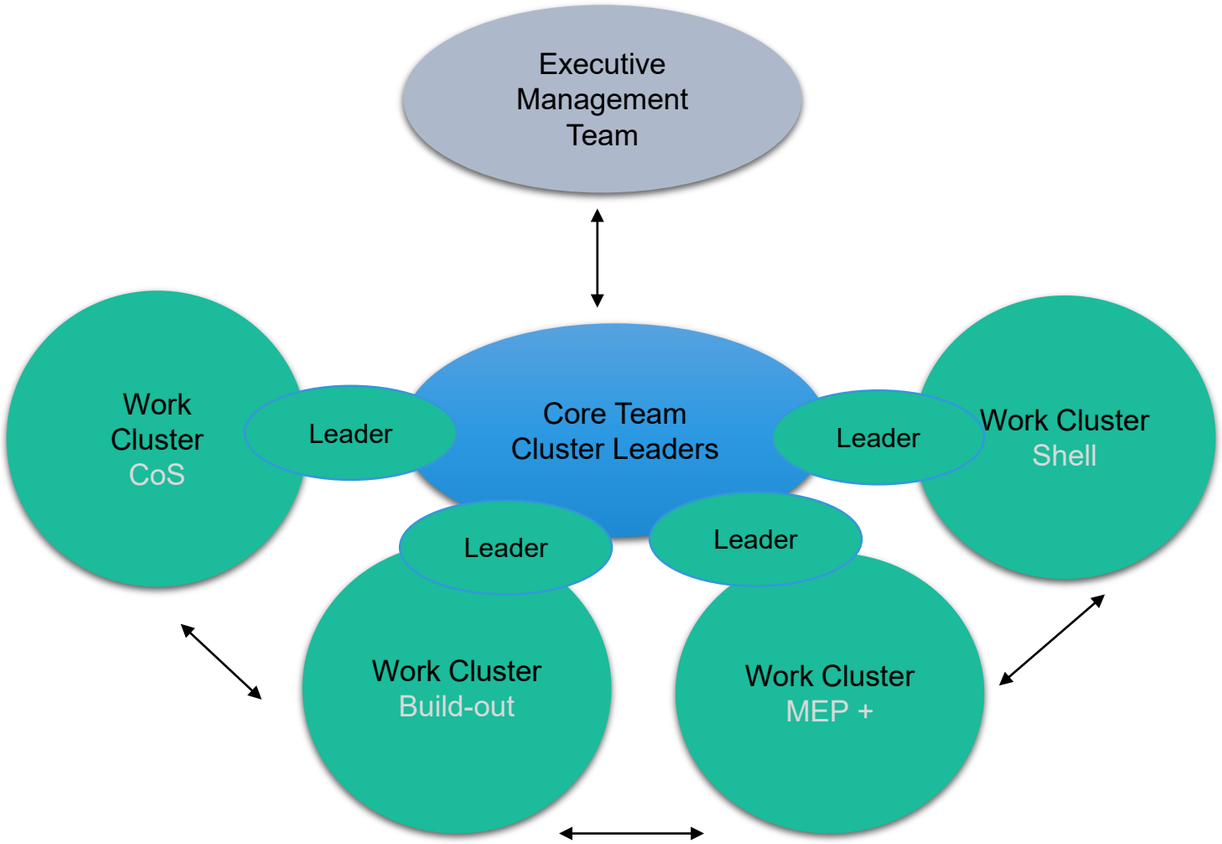
Collaborative Team Organization

Executive/Senior Management:
- Not involved in day-to-day of team
- Resolve conflicts, Champion Change

Core Team:
- Day-to-day leaders of the team

Work Clusters:
- Leader
- System/Area oriented
- Cross discipline
- Stakeholder representation
- Form as need

Work Cluster Leader:
- Coordination between work clusters & core team



Big Room is:

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- Mindset of intense focus on advancing work.
- Enables cross-functional team collaboration.
- Refers to the collaborative behavior of a team and the work they are producing.
- Implemented in design and construction phases.

Big Room is a commitment to a project, the team, and to working together!

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Benefits

- Aims to improve collaboration through greater team interaction.
- Deliver a ‘higher performing building’ on time and on budget.
- Allows team members to support each other and align themselves with the goals of the project.
- Co-location makes it easier to ask team members for information.
- Breaks down the ‘silo’ mentality within the project.

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Venue Types

Co-located:

- Continuously located with continuous collaboration.

Recurring:

- Meet in person on regular scheduled recurring basis.

Hybrid:

- Combination of in-person and virtual.

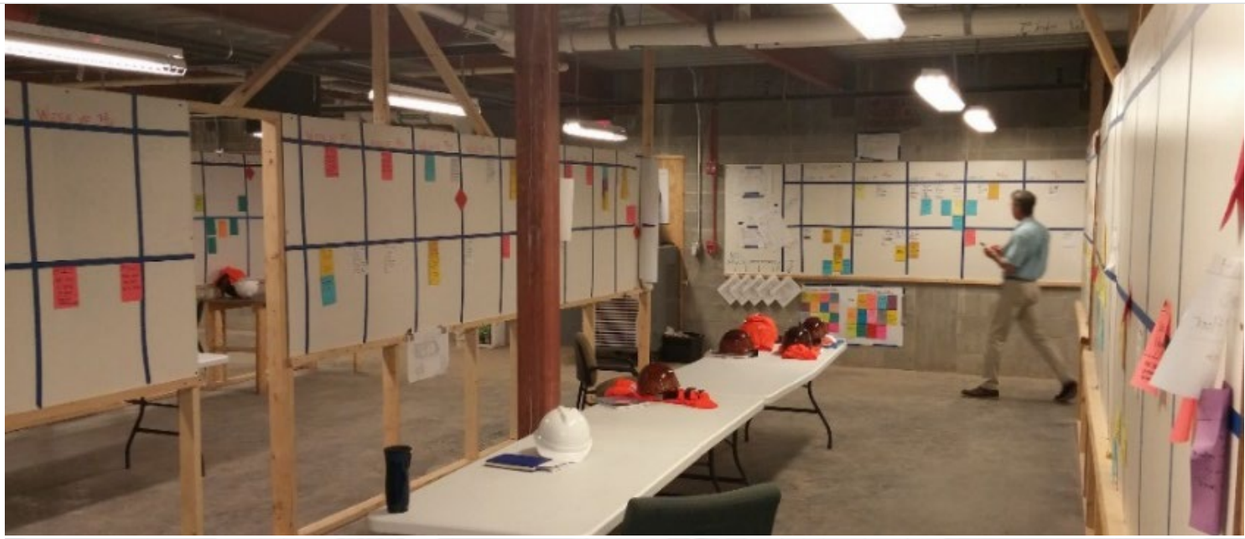

Photo Credits: InsideOut Consulting, Inc.

Big Room Implementation

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Courtesy of: KHS&S

Discussion Question

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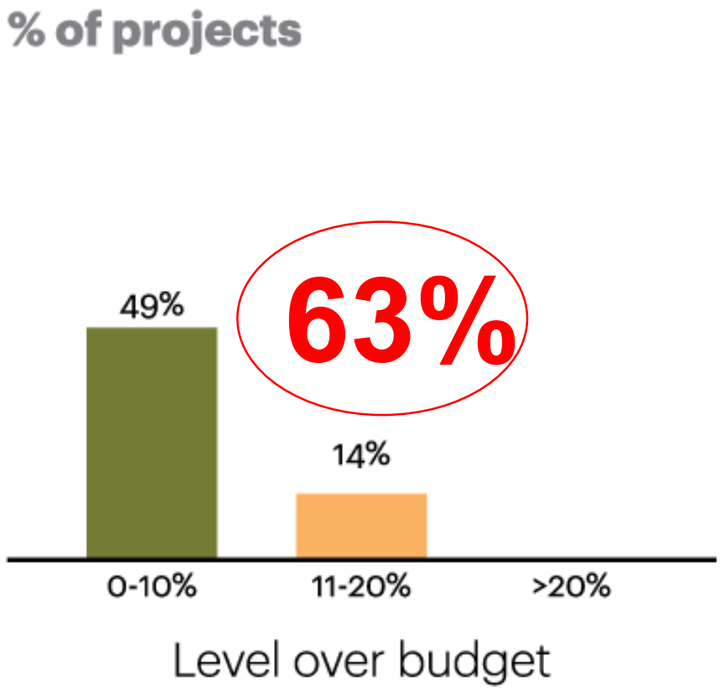
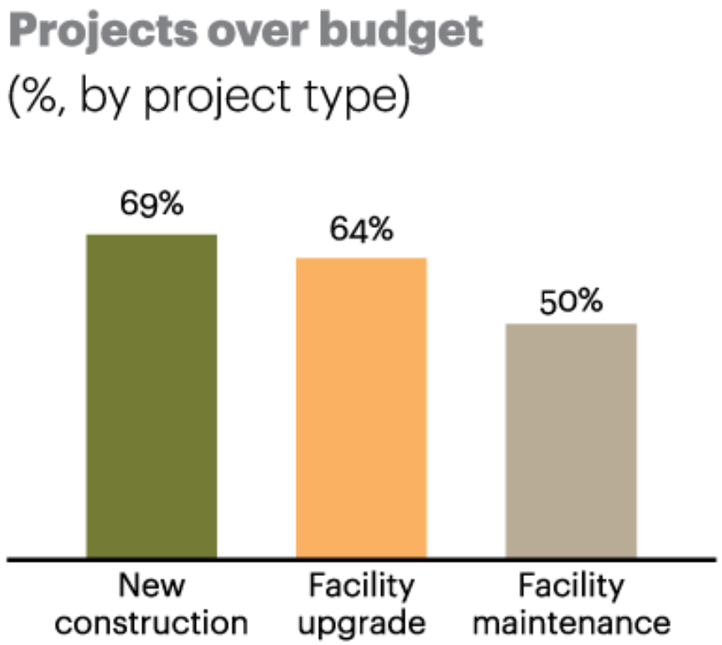
How do the Big Room Mindset and the Lean Team Organization align Design–Build?

Discuss as a whole group.
(5 minutes)

Capital Projects' Budget Performance





Source: A.T. Kearney Excellence in Capital Projects II study, 2012

Target Value Delivery Culture

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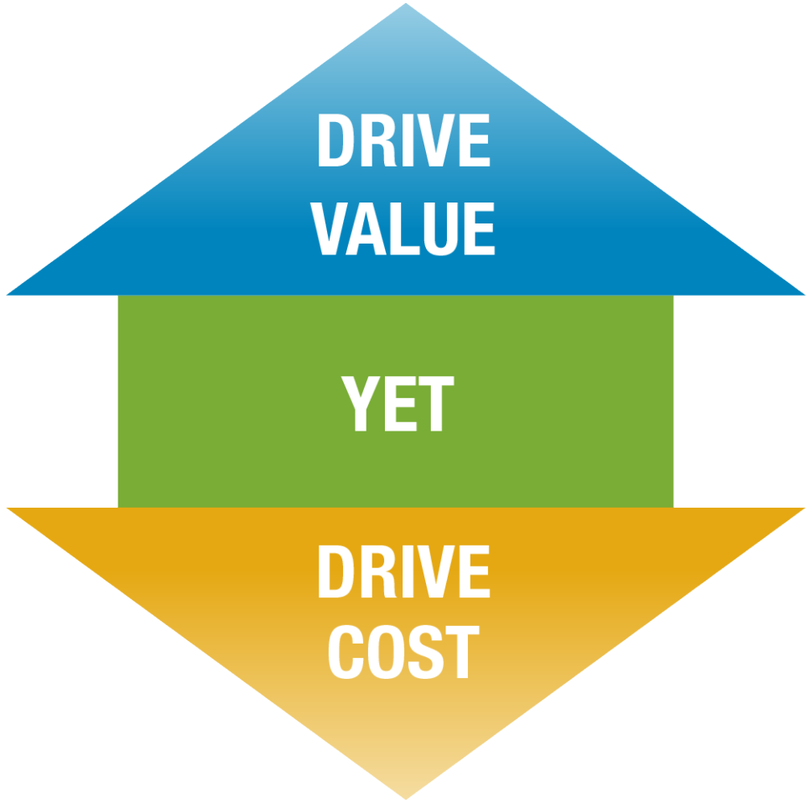
A disciplined management practice to be used throughout the project to assure that the facility meets the operational needs and values of the users, is delivered with in the allowable budget and promotes innovation through the process to increase value and eliminate waste.

Keys to implementation:

- Innovation
- Drive out waste
- Sound Decision Making



Target Value Delivery Approach

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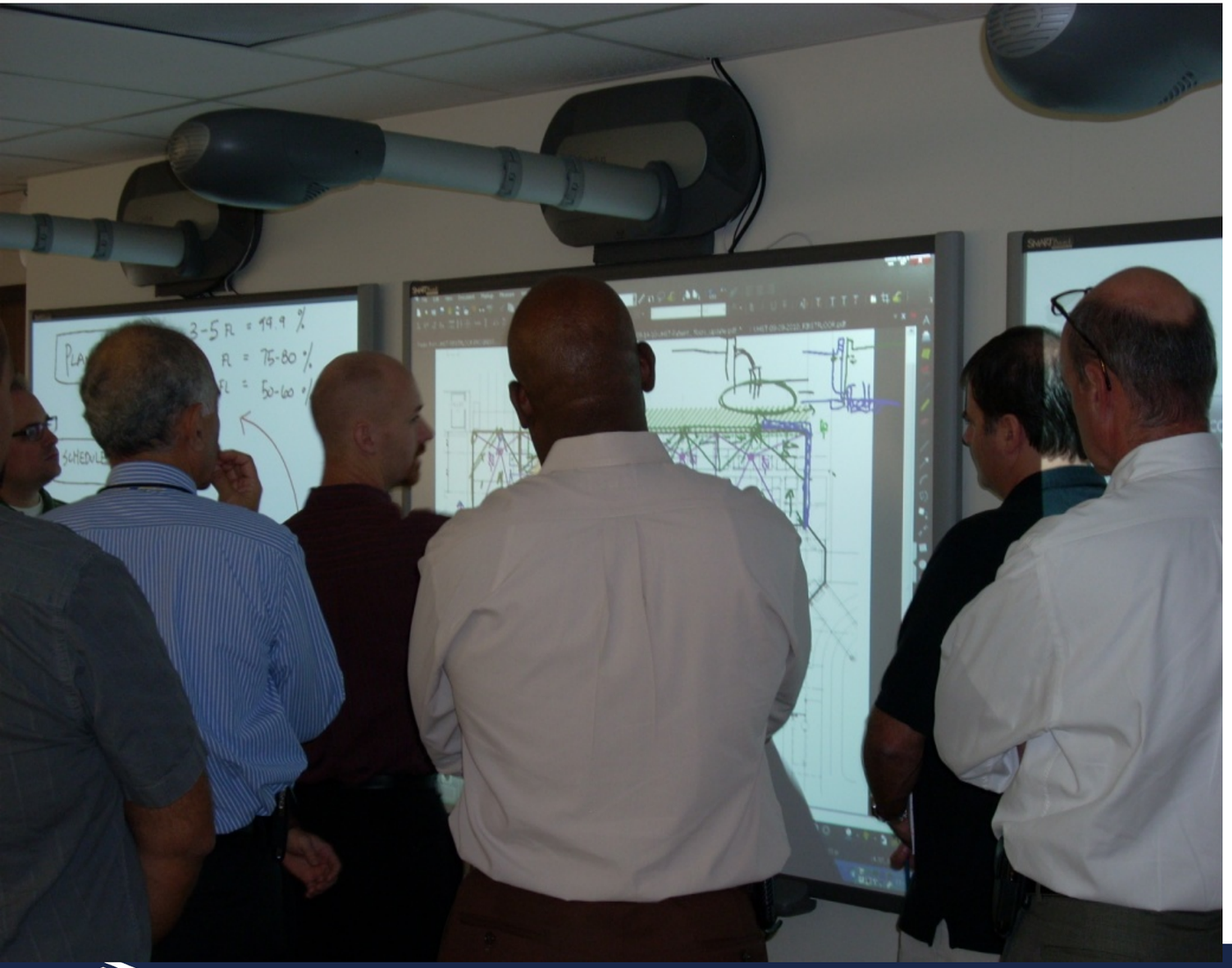

Traditionally:

- Cost is an output of design
- Finish your work before I start mine mentality
- Early commitment to design solutions in silos
- Design then determine cost, then rework

Target Value Delivery:

- Cost is an input to design
- Information is shared early and often
- Sets of solutions are carried and optimized based on the whole
- Continuous estimating and cost modeling based on concepts

TVD Continuous Estimating Model

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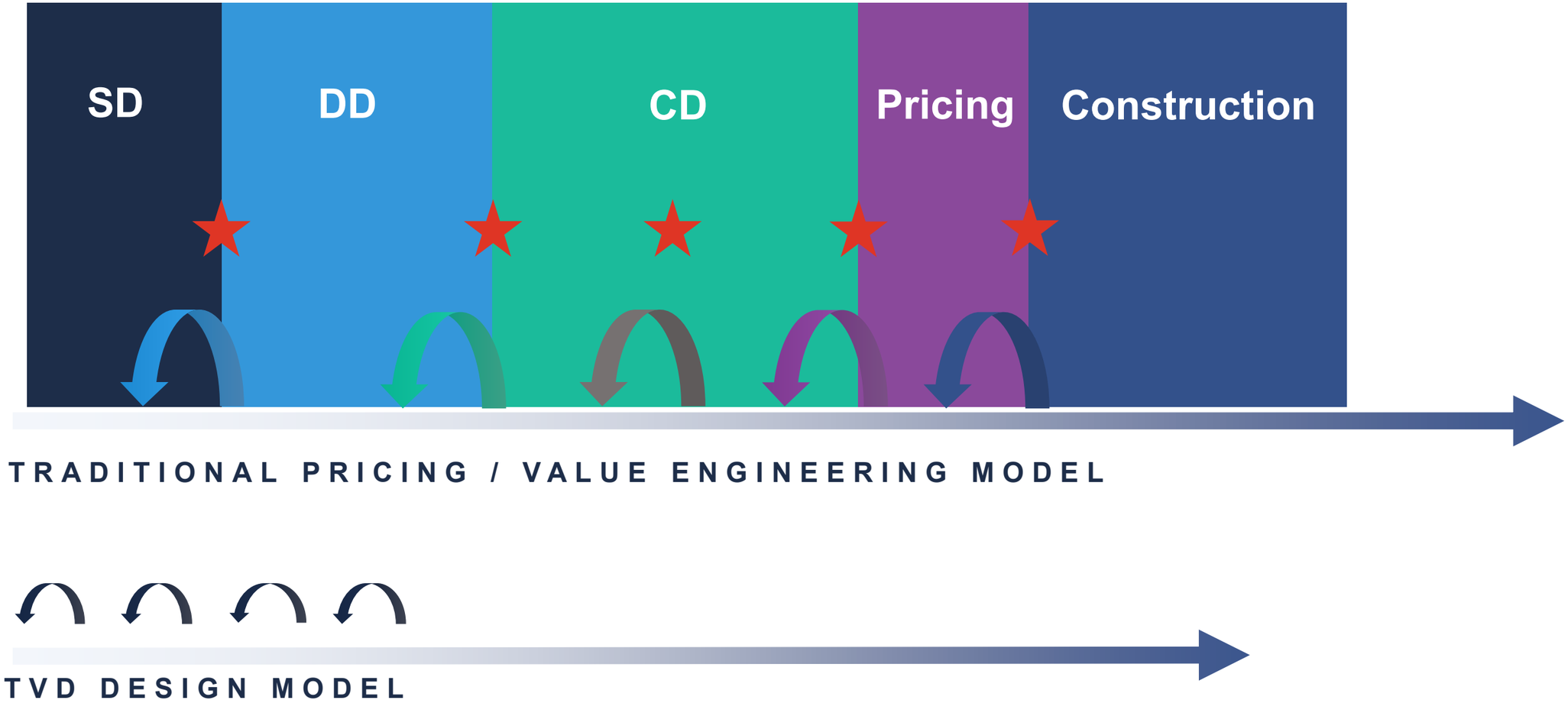

Types of Estimating

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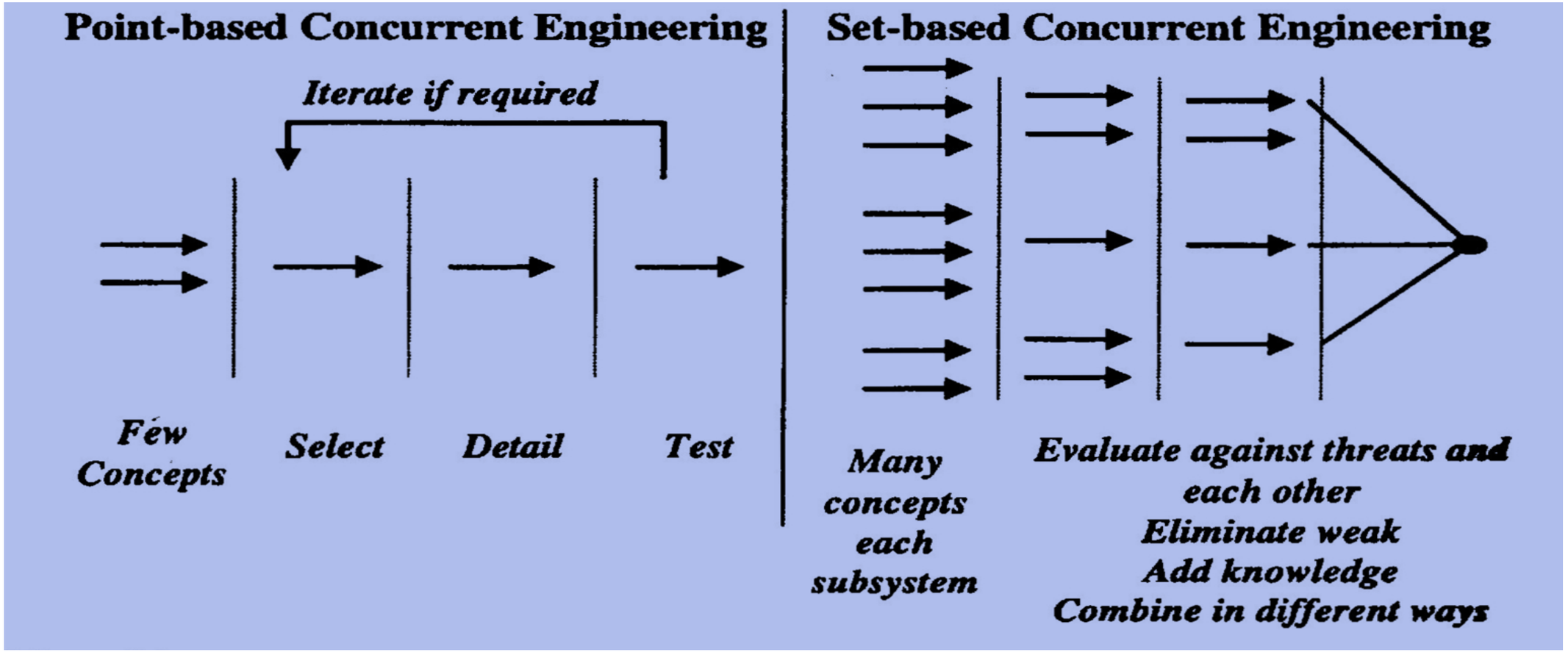
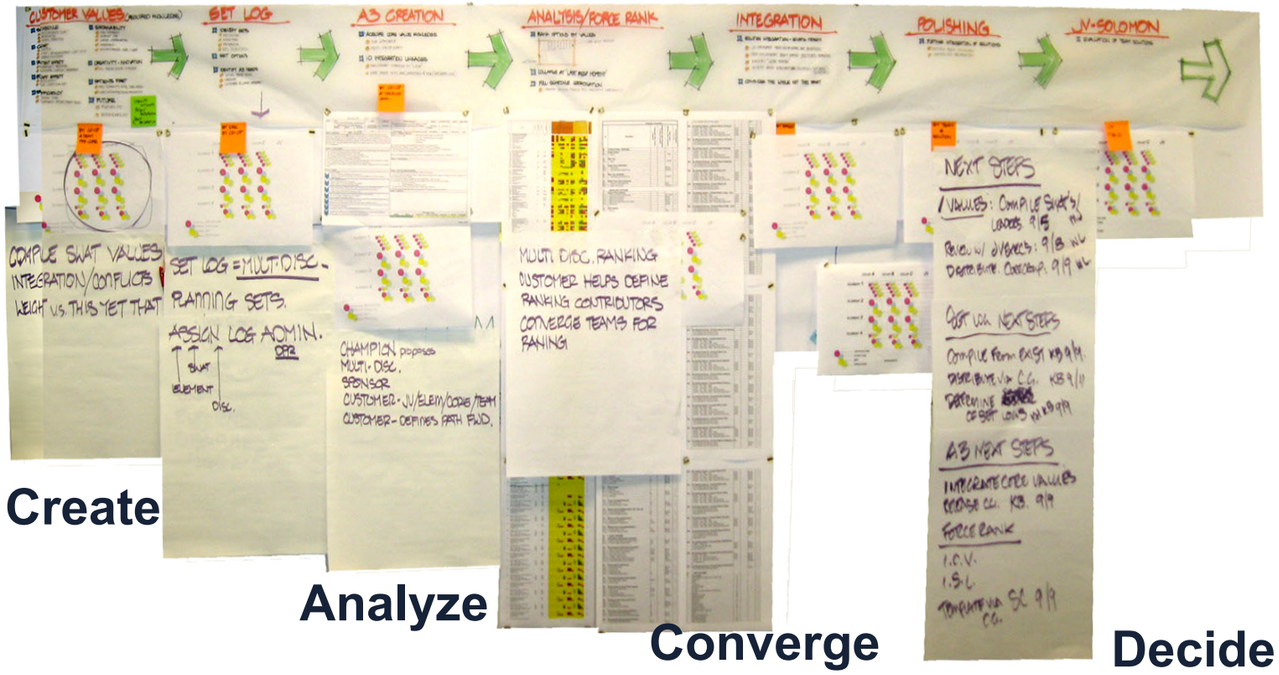
1. Cost Benchmarking
2. Conceptual
3. Production

Set-Based Design



"Product Development for the Lean Enterprise", Michael Kennedy

Set-Based Example



From CPR Program

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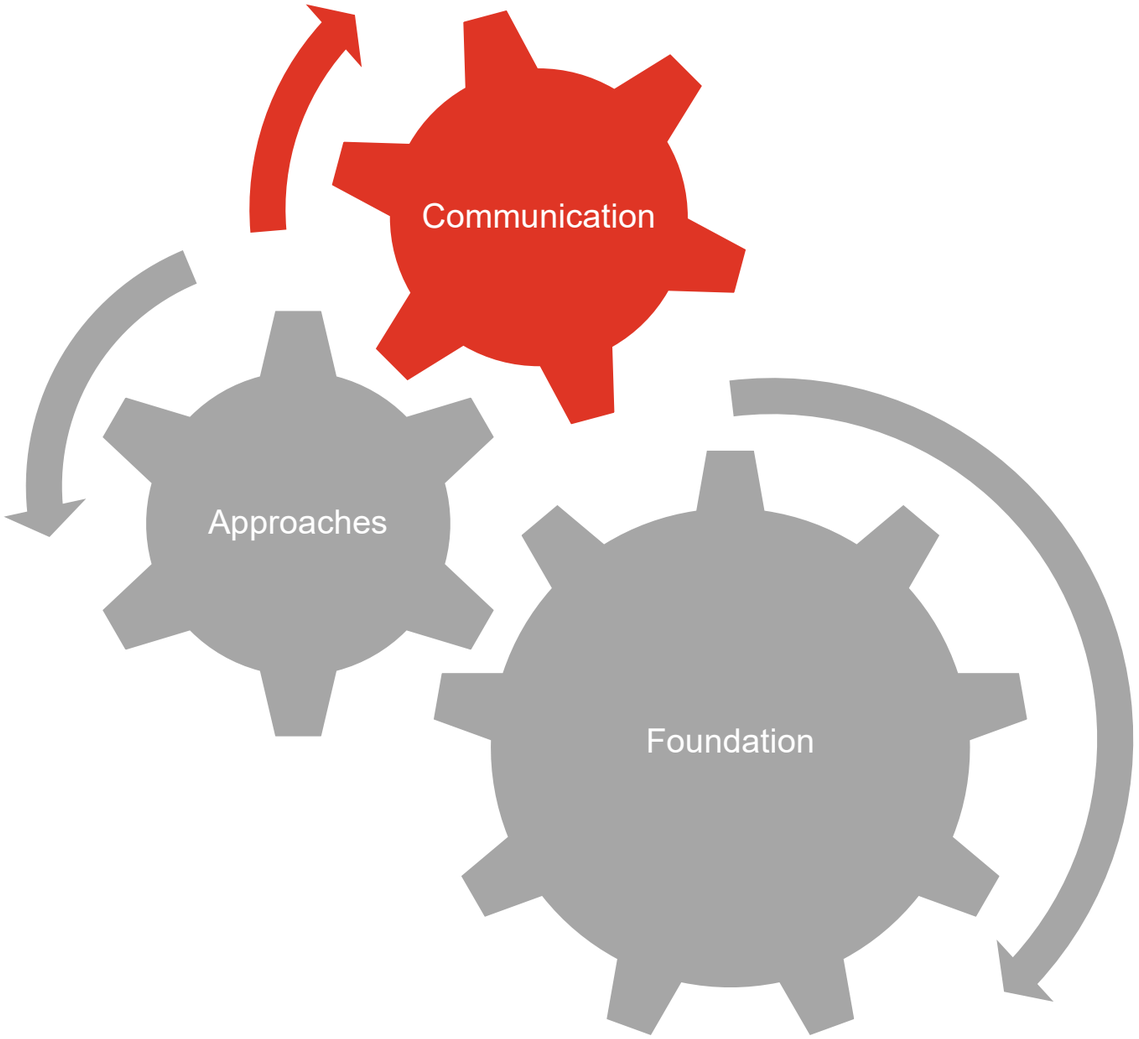
Lean Operating System

Components Include:

- Lean Foundation
- Approaches
- Collaborative Communication
  - Project as a Promise
  - Collaborative Planning
  - Value Definition / Strategy



Teams Interact to Problem Solve!

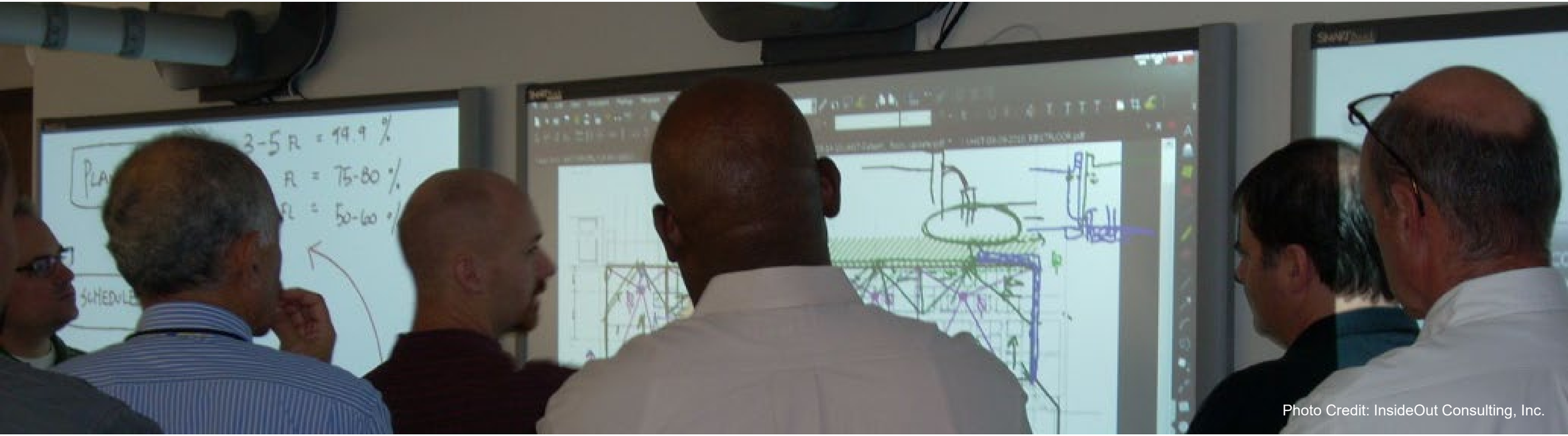


Photo Credit: InsideOut Consulting, Inc.

- Cross functional
- Visual manifestation
- All perspectives
- Explore options
- Gain alignment

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A3 Thinking Structure

Title: Describes the problem

Background:

Provides the context

Current Condition

Describes what is currently known

Goal/Target Condition:

Identifies the desired outcome

Analysis:

Analyze the situation for root cause creating the gap between current condition and target condition

5 Why Root Cause Analysis

Collaborators: List

Proposal/Recommendation

Propose countermeasure(s)

Implementation Plan:

Indicates the actions/outcomes, time table and responsibilities

Follow-up

Creates a follow-up / review process

A3 Example

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1 PROBLEM STATEMENT	2 INTENDED GOAL	Health Care Bed Tower Expansion	A3 001
This A3 presents a study of the various structural building systems practical for this project with the intent of understanding the relative advantages of various systems and their importance for this project and the relative costs of implementing the different systems. The study will conclude with recommendations as to the structural system that delivers the best value for the project. The study will include a preliminary structural analysis and drawing package for all the proposed alternates. These packages will serve as the basis for evaluating the advantages of the various alternatives using specific - evidence based criteria including impacts to clinical functions, impacts to other building systems, construction cost and construction schedule. A full Choosing by Advantages (CBA) analysis is performed separately with the significant advantages and other data summarized here.	Select a structural system that provides the best value for the project. That is, the system with the least cost for which the additional advantages of other systems are not worth the additional cost.	Location: California Campus: Health Care Regional Hospital Date: 10/07/2020 Author: Structural Engineer Contributors: General Contractor Architect	

3 Project Parameters

Location: California Building use: Acute Care Hospital (OSHPD 1)
Number of stories: 3 Floor Area per Floor: 18,000 SF
Floor Area per building: 53,800 SF
Typical story height – 16'-0" (to match existing hospital)
Directly abuts the existing hospital with a seismic joint

Typical use:
Upper floors – Patient rooms and support spaces
Ground floor – diagnostic and treatment, including new operating room, procedure/treatment rooms and support spaces
Typical bays: 16 ft. to 30 ft.

Floor Plan:

4 Analysis Summary

CBA Metric Parameters

Factors	Alternate 1	Alternate 2	Alternate 3	Alternate 4	Alternate 5
	Structural Steel Frame - BRB: metal deck and concrete. Buckling Restrained Braced Frame lateral system, non-structural metal stud skin	Structural Steel Frame - SMF: metal deck and concrete. Special steel moment frame (Non-Proto) lateral system, non-structural metal stud skin	Structural Steel Frame - SCBF: metal deck and concrete. Special concentric braced frame lateral system, non-structural metal stud skin	Structural Steel Frame - EBF/BRB: metal deck and concrete. Hybrid EBF/BRB braced frame lateral system, non-structural metal stud skin	Structural Steel Frame – CoreXTech: metal deck and concrete. CoreXTech special steel eccentric frame lateral system, non-structural metal stud skin
	Attributes				
Factor: Schedule (design, detail, procure, fabricate, erect)	31 weeks (22+9 to erect)	28 weeks (22 + 7 to erect) - (possible extension to other schedules)	31 weeks (22+9 to erect)	31 weeks (22+9 to erect)	19.5 weeks (18+1.5 to erect)
Factor: Flexibility - MEP construction	Braced frames impede utility runs, shallow beams (W24 at corridors), fewer beam braces. Fewer protected zones	all bays open for utility runs, more beam braces, deeper beams (W33 at corridors)	Braced frames impede utility runs, shallow beams (W24 at corridors), fewer beam braces. Fewer protected zones	Shallow beams (W24 at corridors) EBF's allow more passage for ducts. Fewer protected zones	all bays open for utility runs, more beam braces, deeper beams (W33 at corridors)
Factor: Flexibility - Floor Plan	Braced frames require permanent walls. Require special doors or geometry to patient rooms. W14 columns free up room for patient room windows	all bays free of braces. Very large moment columns (24inch deep) will conceal patient room windows	Braced frames require permanent walls. Require special doors or geometry to patient rooms. W14 columns free up room for patient room windows	Braced frames require permanent walls. EBF frames allow doors at patient rooms. W14 columns free up room for patient room windows	all bays free of braces. smaller moment columns (16inch deep)
Factor: Flexibility - Future program chgs	Braced frames require permanent walls.	all bays free of braces. Very large moment columns (36inch deep)	Braced frames require permanent walls.	Braced frames require permanent walls. EBF frames allow doors at patient rooms.	all bays free of braces. Very large moment columns (17inch deep)
Factor: Building Seismic Drift	1.45 in max	2.88 in max	1.80 in max	1.50 in max	2.88 in max
Factor: Proprietary technology	non proprietary	Slot/Plate connections are proprietary	non proprietary	non proprietary	Rain source fabricator
Factor: Risk of Field Inspection Delay	Higher due to complex connections & components	Some Risk due to only minor Field welding	Higher due to complex connections & components	Higher due to complex connections & components	Low Risk due to bolted connections
Factor: Familiarity with System	BRB's are new to some	Moderate to new to some	Very traditional and familiar	BRB's & EBF's are new to some	CoreXTech are new to most
Total Advantage Value	70	185	80	215	225
Structure Cost Estimate (steel, precast, fabrication & erect)	$1,046,751	$2,049,681	$1,413,649	$1,863,099	$2,405,099
Total Project Costs	$276,750	$858,190	$294,750	$304,750	$1,405,099
Total Alternative Cost	$1,323,841	$2,907,871	$1,624,398	$1,886,359	$3,880,599
Extra cost over least cost	$308,843	$1,292,873	$0	$261,961	$2,256,170

5 RECOMMENDATION

Alternative 4 - Structural Steel Frame with Hybrid EBF and BRB Lateral System

Discussion:
The additional cost of Alternate 4 over Alt 3 is justified because the plan adjustments necessary to accommodate the traditional braces (all 1 & 3) at the patient room doors would drive us to wider patient room sizes and uneven bays.
The value of a completely braced free floor plan in Alternate 2 is not worth the additional cost of alternates 2 over alternate 4, especially when the impacts of the deeper columns of Alt 2 & 4 is taken into account at the patient room windows.

Alternate 5 offers additional advantages over Alternative 4, namely a considerable schedule savings in schedule. However, the additional cost is substantial. Since schedule and cost were derived by different sources, suggest additional validation of schedule for all alternatives.

6 IMPLEMENTATION

Action Item	Champion	Completion Date
Validate CoreXTech schedule impact	DE	
Team workshop braced frame location	DE	

7 APPROVALS

A3 Example

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1 PROBLEM STATEMENT	2 INTENDED GOAL	Health Care Bed Tower Expansion	A3-S01
This A3 presents a study of the various structural building systems practical for this project with the intent of understanding the relative advantages of various systems and their importance to this project and the relative costs of implementing the different systems. The study will conclude with recomendations as to the structural system that delivers the best value for the project. The study will include a preliminary structural analysis and drawing package for all the proposed alternates. These packages will serve as the basis for evaluating the advantages of the various alternatives using specific , evidence based criteria including impacts to clinical functions, impacts to other building systems, construction cost and construction schedule. A full Choosing by Advantages (CBA) analysis is performed seperately with the significant advantages and other data summarized here.	Select a structural system that provides the best value for the project. That is, the system with the least cost for which the additional advantages of other systems are not worth the additional cost.	Location: California Campus: Health Care Regional Hospital Date: 1/20/2020 Author: Structural Engineer Contributors: General Contractor Architect	

3 Problem Parameters	4 Analysis Summary
Location: California Building use: Acute Care Hospital (OSHPD I) Number of stories: 3 Floor Area per floor: 18,600 SF Floor Area per building: 57,000 SF Typical story height – 16'-0" (to match existing hospital) Directly abuts the existing hospital with a seismic joint Typical use: Upper floors – Patient rooms and support spaces	CBA Notes/ Parameters

Factors	Alternate 1 Structural Steel Frame - BRB metal deck and concrete, Buckling	Alternate 2 Structural Steel Frame - SMF metal deck and concrete, Special steel	Alternate 3 Structural Steel Frame - SCBF metal deck and concrete, Special	Alternate 4 Structural Steel Frame - EBF/BRB metal deck and concrete, Hybrid	Alternate 5 Structural Steel Frame - ConXTech metal deck and concrete, ConXTech
Total Advantage Value	**70**	**185**	**80**	**215**	**235**
Structure Cost Estimate: (detail, procure, fabicate & erect)	$1,696,791	$2,048,881	$1,419,648	$1,683,509	$2,430,000
Total Related Costs	$236,250	$858,190	$204,750	$204,750	$1,450,568
Total Alternative Cost	**$1,933,041**	**$2,907,071**	**$1,624,398**	**$1,888,259**	**$3,880,568**
Extra cost over least cost	**$308,643**	**$1,282,673**	**$0**	**$263,861**	**$2,256,170**

program chgs	walls.	moment columns (36inch deep)	walls.	walls. EBF frames allow doors at patient rooms.	moment columns (??inch deep)
Factor: Building Seismic Drift	1.45 in max	2.88 in max	1.60 in max	1.50 in max	2.88 in max
Factor: Proprietary technology	non proprietary	SidePlate connections are proprietary	non proprietary	non proprietary	Sole source fabricator
Factor: Risk of Field Inspection Delay	Higher due to complex connections & components	Some Risk due to only minor fillet welding	Higher due to complex connections & components	Higher due to complex connections & components	Low Risk due to bolted connections
Factor: Familiarity with System	BRB's are new to some	Sideplate is new to some	Very traditional and familiar	BRB's & EBF's are new to some	ConXTech are new to most
Total Advantage Value	**70**	**185**	**80**	**215**	**235**
Structure Cost Estimate: (detail, procure, fabicate & erect)	$1,696,791	$2,048,881	$1,419,648	$1,683,509	$2,430,000
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Alternate 5 offers additonal advantages over Alternative 4, namely a considerable schedule savings in schedule. However, the additional cost is substantial. Since schedule and cost were derived by differennt sources, suggest additional validation of schedule for all alternatives.

6 IMPLEMENTATION

Action Item	Champion	Completion Date
Validate related costs with HB	SE	
Validate ConXTech data team	SE	
Team to make final selection	SE	

7 APPROVALS

Collaborative Decision-Making CBA

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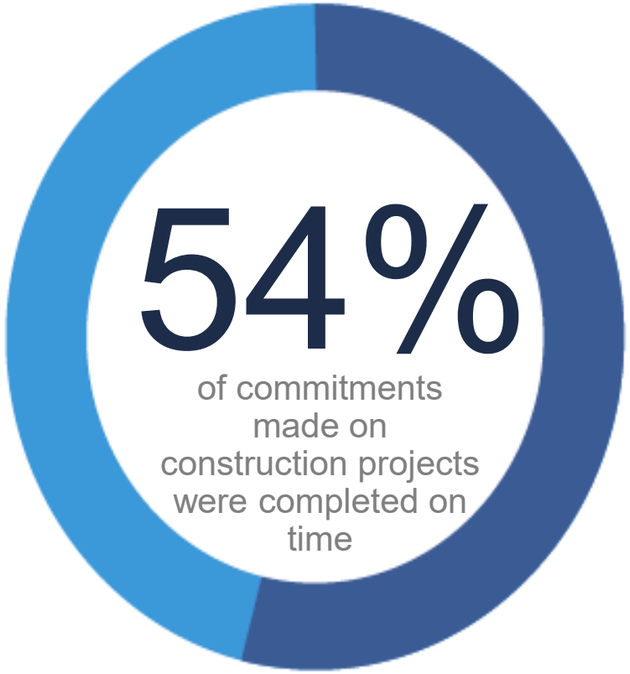
Choosing by Advantages:

A decision-making system developed by Jim Suhr based on the importance of each alternative's advantages

LEGEND Underline Least Preferred Attribute per Factor Yellow cell = most important Advantage in Factor Blank = no advantage Circle = paramount advantage	**Alternative 1** **Structural Steel Frame - BRB** metal deck and concrete, Buckling Restrained Braced Frame lateral system, non-structural metal stud skin		**Alternative 2** **Structural Steel Frame - SMF** metal deck and concrete, Special steel moment frame (SidePlate) lateral system, non-structural metal stud skin		**Alternative 3** **Structural Steel Frame - SCBF** metal deck and concrete, Special concentric braced frame lateral system, non-structural metal stud skin	
Factor:* Schedule** ***(design, detail, procure, fabricate, erect) *Criteria:* Want faster (least # weeks)	31 weeks (22+9 to erect)		29 weeks (22 + 7 to erect) -(possible extension to other schedules)		31 weeks (22+9 to erect)	
Attribute:						
Advantage:	None	0	two weeks faster to erect	25	None	0
***Factor:* Proprietary technology** *Criteria:* Want non-proprietary	non proprietary		SidePlate connections are proprietary		non proprietary	
Attribute:						
Advantage:	non-proprietary	10	Partly Proprietary	5	non-proprietary	10
***Factor:* Risk of Field Inspection Delay** *Criteria:* Want lower risk	Higher due to complex connections & components		Some Risk due to only minor fillet welding		Higher due to complex connections & components	
Attribute:						
Advantage:	none	0	somewhat lower risk	5	none	0
Factor: **Flexibility - Future program chgs** *Criteria: Want flexibility for future space use changes, more is better.*	Braced frames require permanent walls.		all bays free of braces. Very large moment columns (36inch deep)		Braced frames require permanent walls.	
Attribute:						
Advantage:	none	0	Most Flexible	35	none	0
***Factor:* Building Seismic Drift** *Criteria: Less drift is better. Drift increases complexity for non-structural connection like skin, partitions, MEP*	1.45 in max		2.88 in max		1.60 in max	
Attribute:						
Advantage:	1.43 in less drift	60	none	0	1.28 in less drift	55
Advantage Importance Score		**70**		**185**		**80**
Structure Cost Estimate: **(detail, procure, fabicate & erect)**	$1,696,791		$2,048,881		$1,419,648	
Total Alternative Cost	**$1,933,041**		**$2,907,071**		**$1,624,398**	
Extra cost over least cost	$308,643		$1,282,673		$0	

Brief History



Key Concepts

1. Traditional planning systems are unable to produce predictable workflow.
2. Workflow reliability directly affects system speed and cost.
3. All plans are forecasts, all forecasts are wrong, further in advance – more wrong, more detail – more wrong.

Last Planner® System Benefits

1. Improves communication & reliability.
2. Fosters an enjoyable environment, trust, and collaboration.
3. Promotes early stakeholder engagement.
4. Improves visibility of the project plan (transparency).
5. Creates team buy in.
6. Rapid learning through metrics, revealing areas for improvement.
7. Improves planning in both design & construction phases.

Last Planner® System

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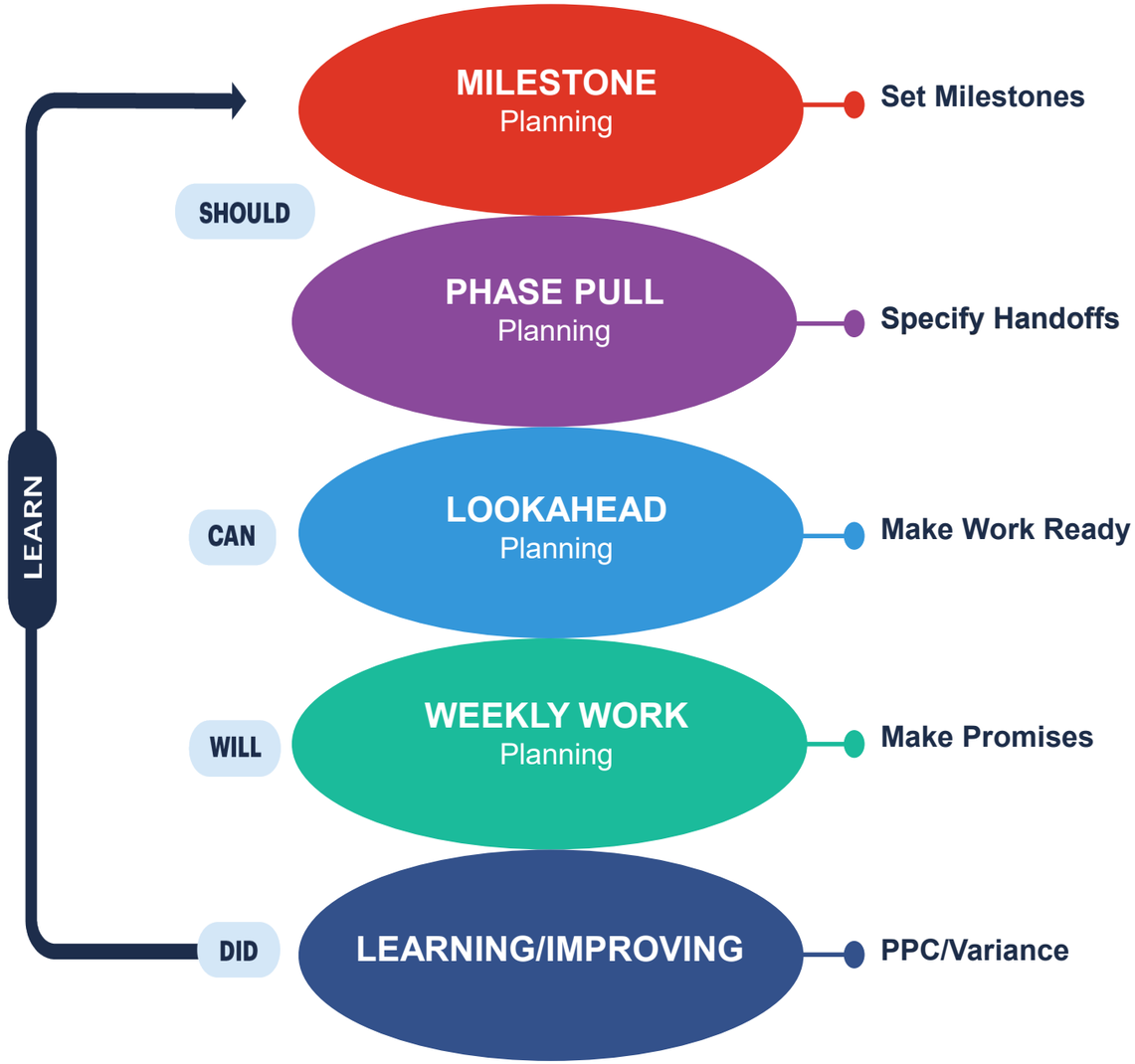
5 Connected Conversations



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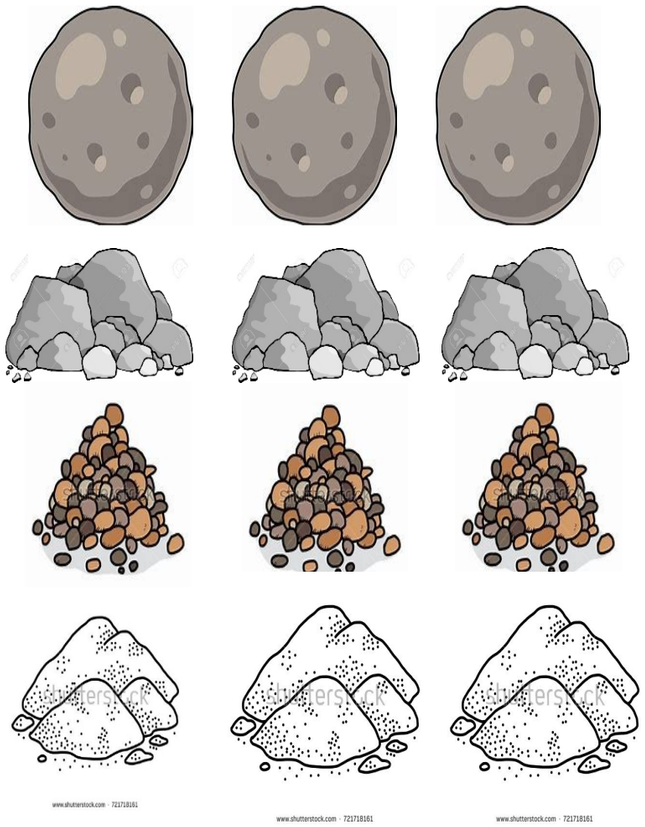
Levels of Granularity

Milestone Planning

Phase Pull Planning

Lookahead Planning

Weekly Work Planning



Boulder

Rock

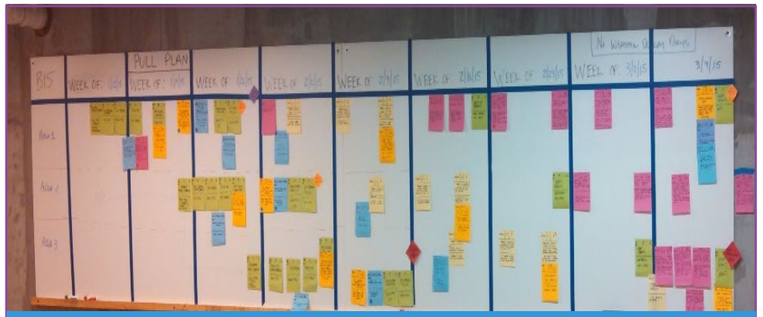
Pebble

Sand

Collaborative Planning

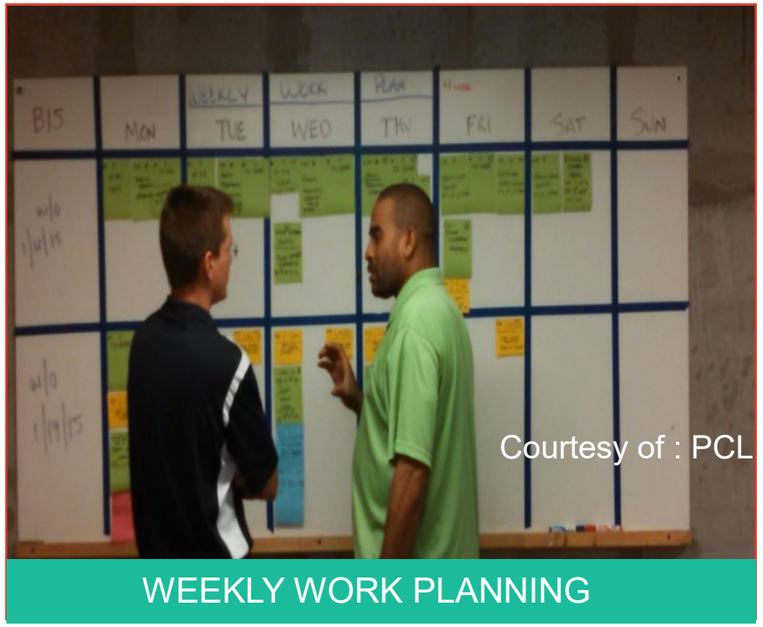
Last Planner® System

PHASE PULL PLANNING



LOOKAHEAD PLANNING

DAILY HUDDLE



WEEKLY WORK PLANNING

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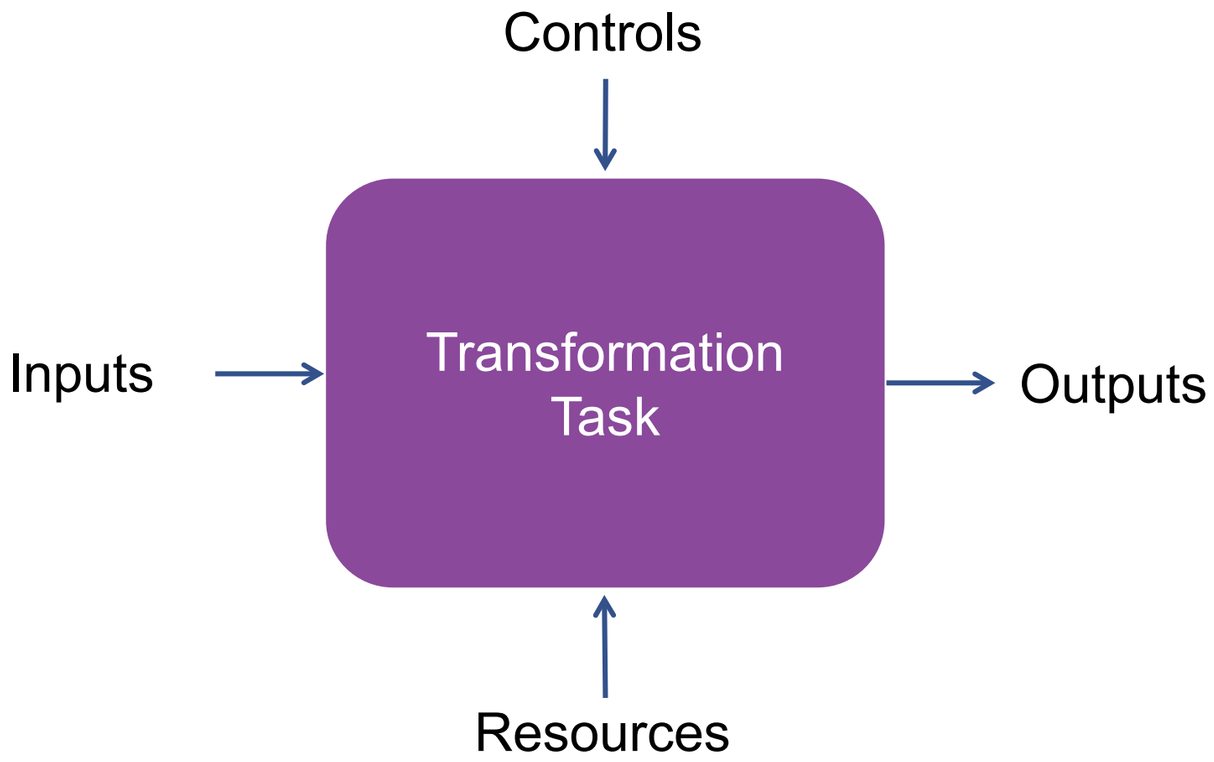
Activity Definition Diagram



Process and Flow

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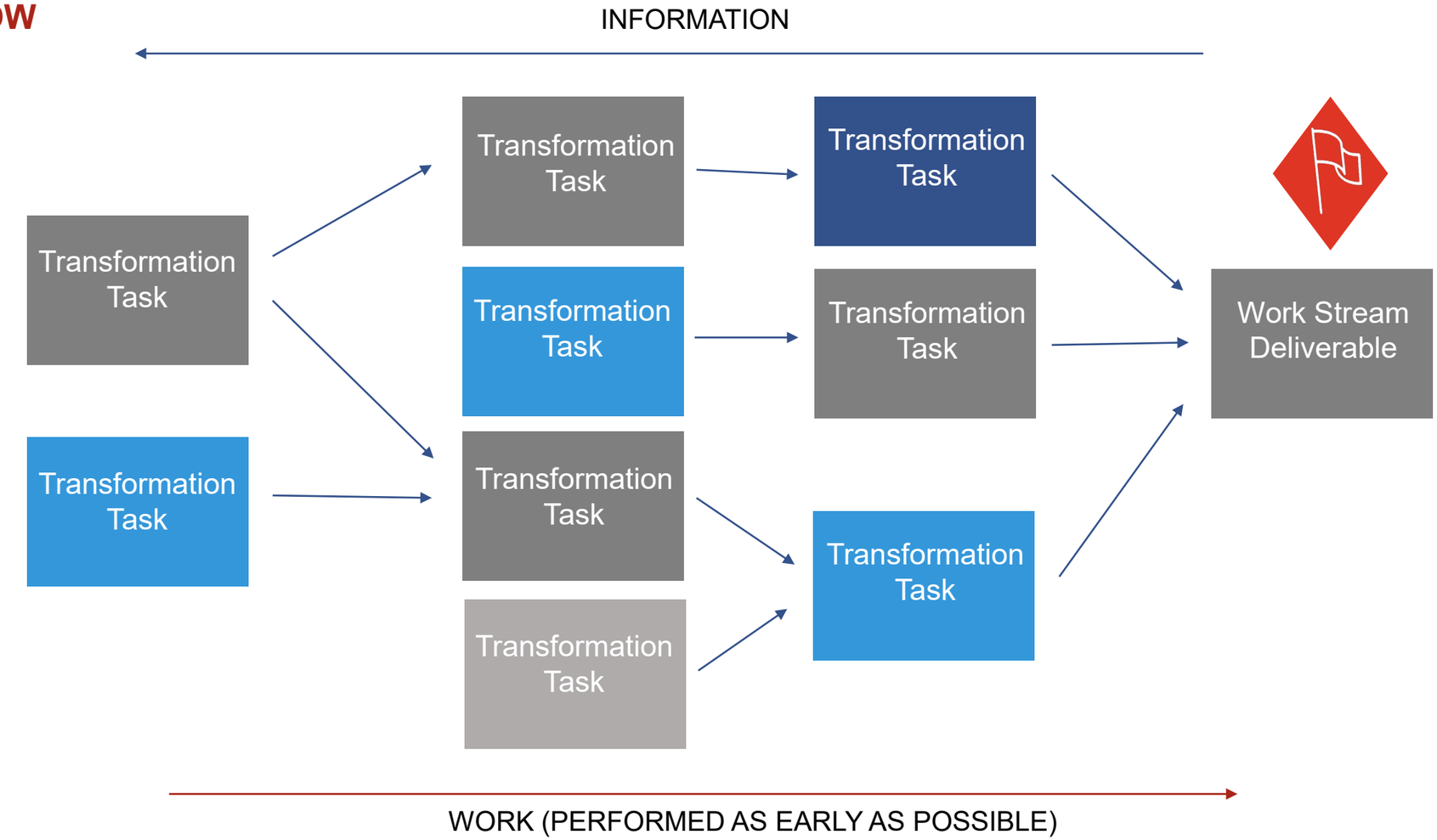
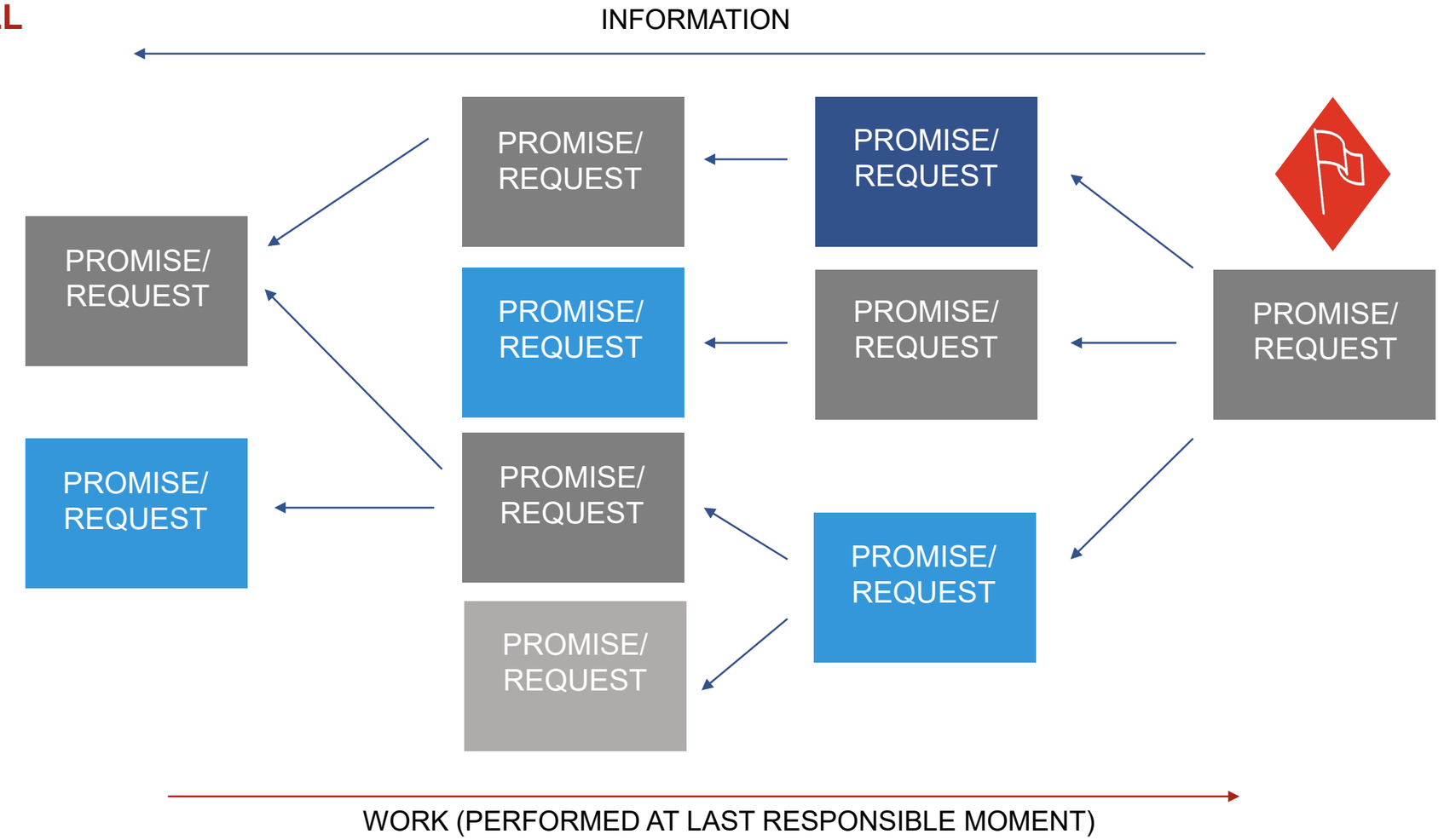
CREATING FLOW

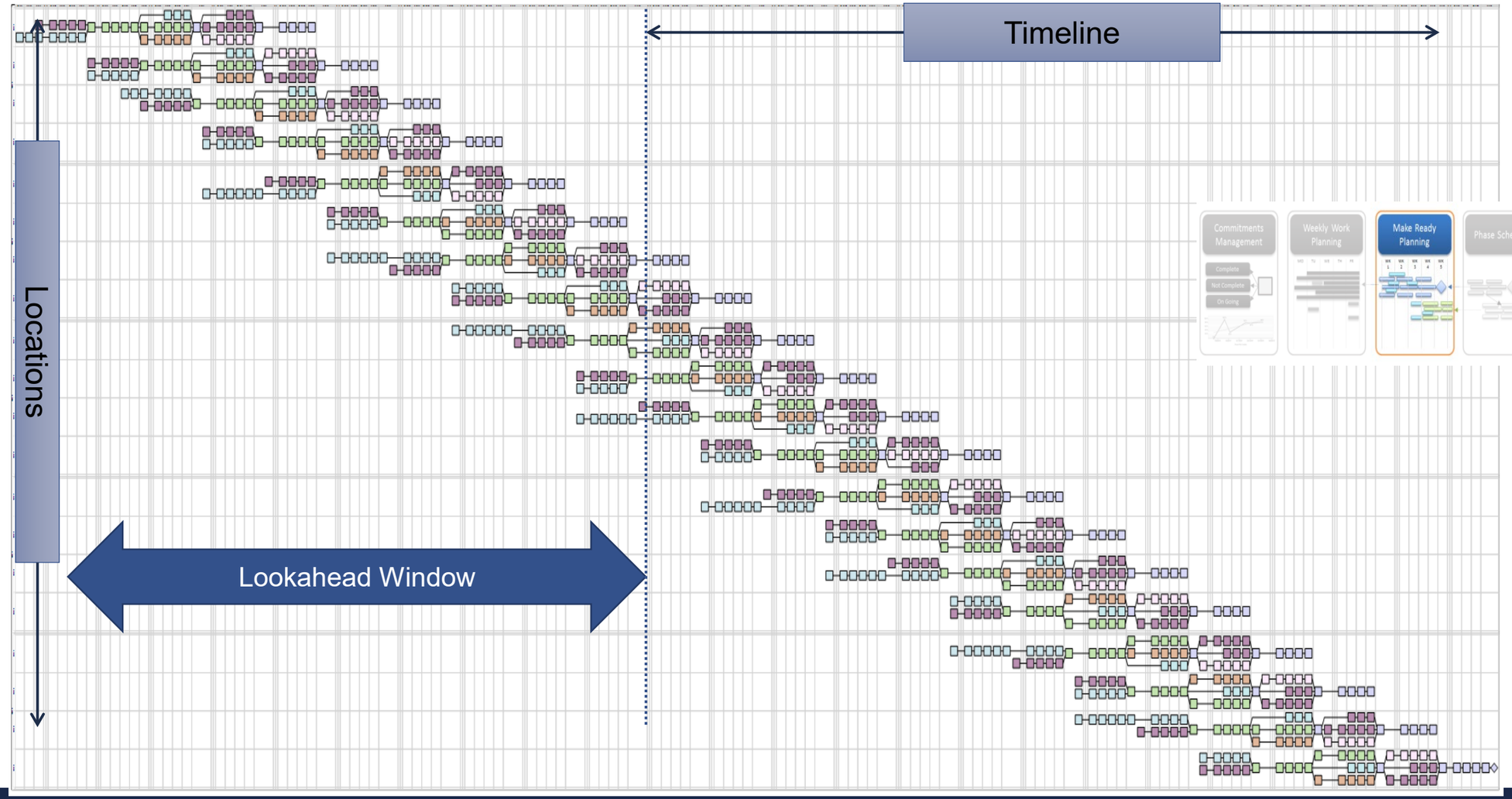


Process and Flow

CREATING PULL



Main Features: Lookahead Planning



- Activities are automatically split into single tasks and arranged on “Electronic Planning Boards”.

Table Exercise (Step 1)

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How do you align your project Lean Approach to address different value propositions and COS?

What Lean approaches will be essential? Why?

Review 3 Value Scenarios, assign to tables.
(5 minutes)

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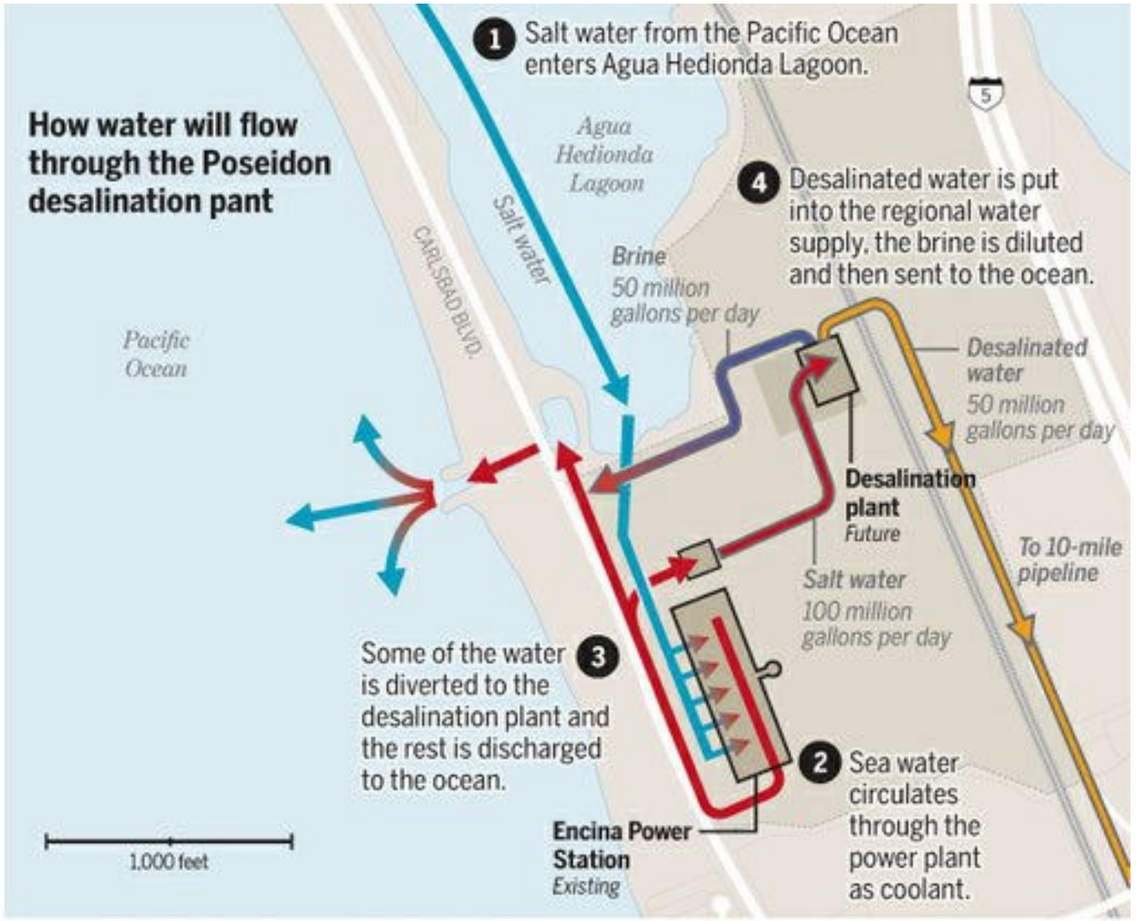
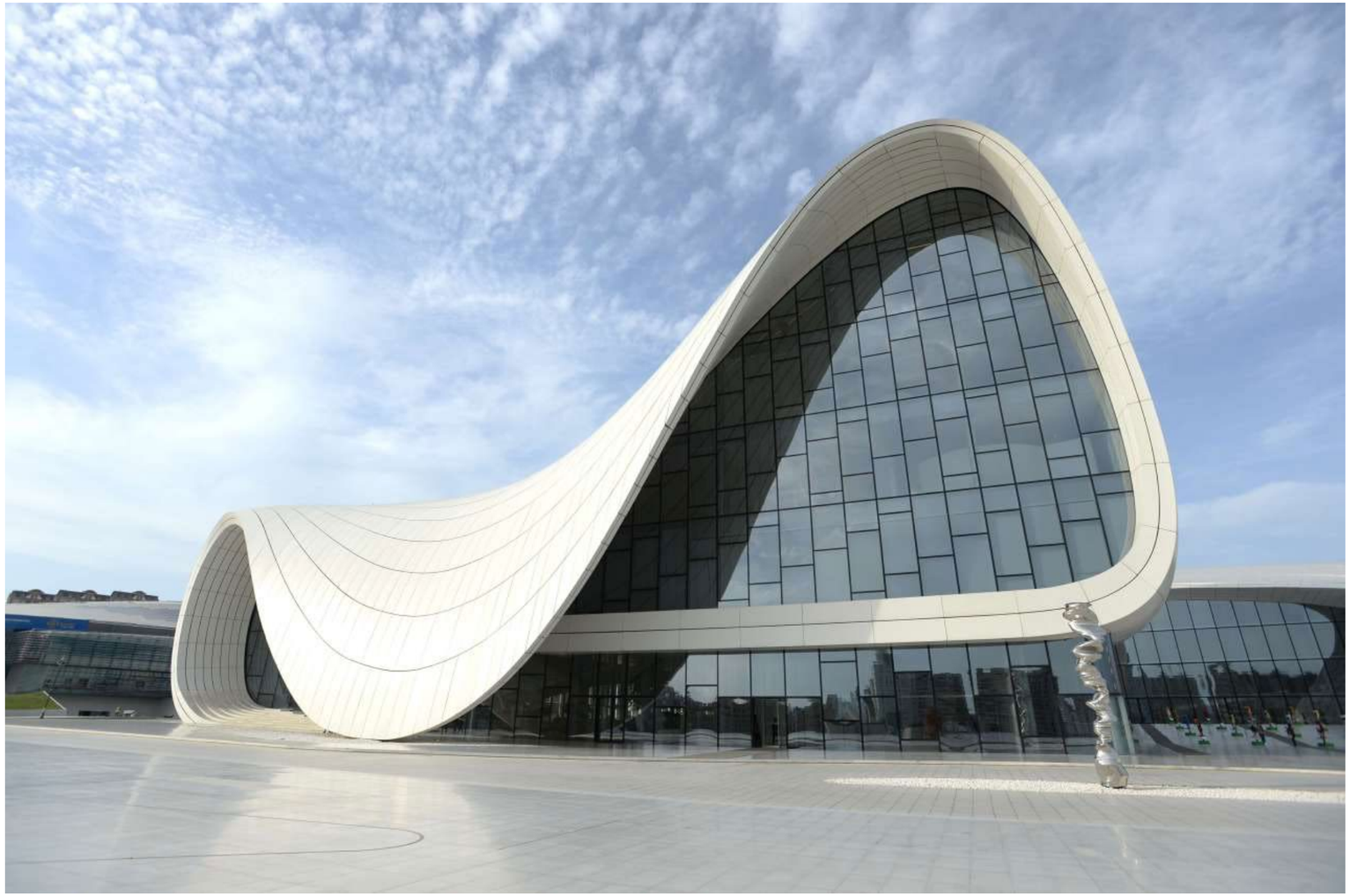
Value = Speed to Production



Value = Getting the most for the money / Brand enhancement



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Value = Lowest Possible Cost for required CoS

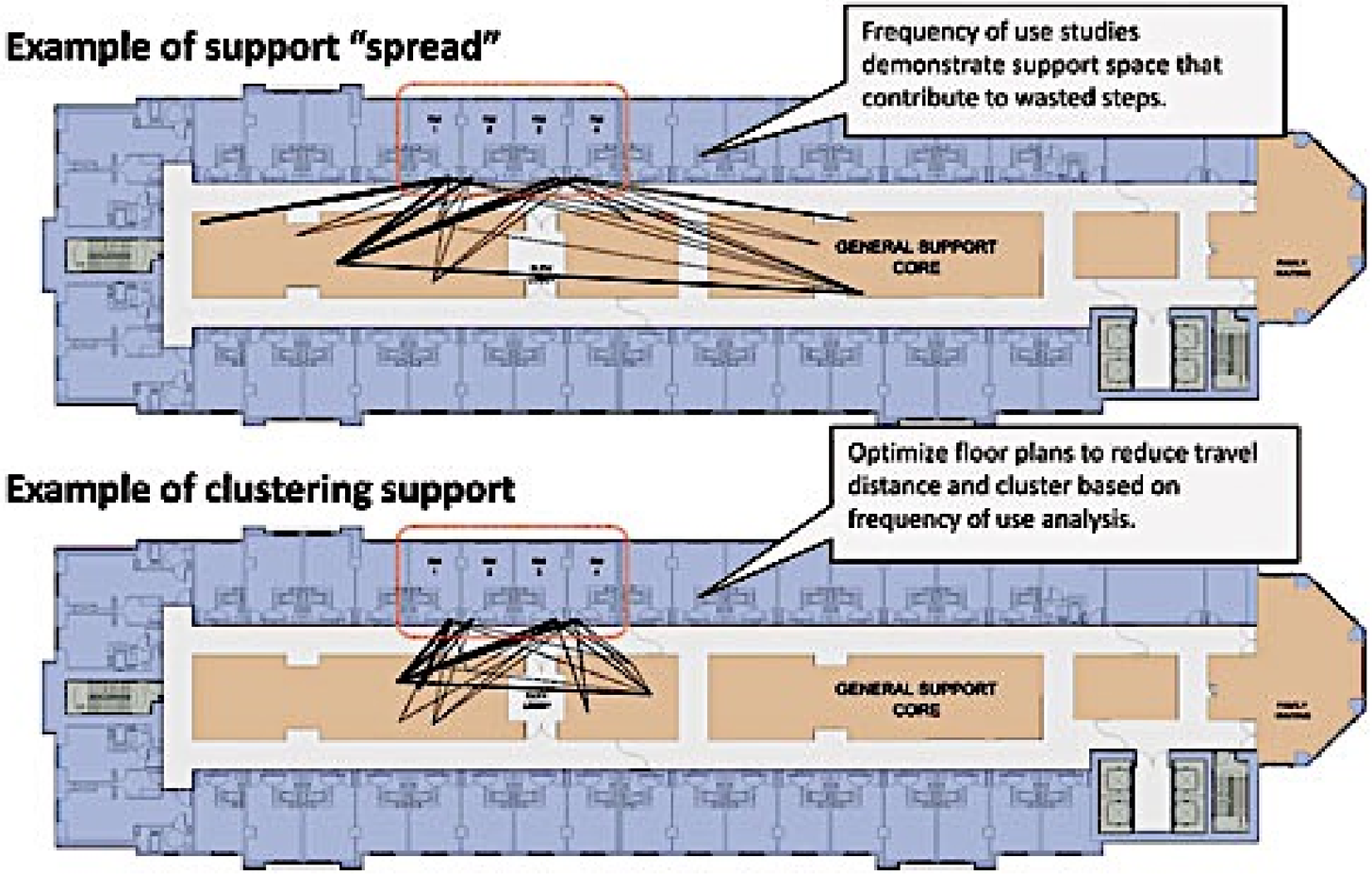

DIAGRAM COURTESY OF HEALTH STRATEGIES & SOLUTIONS, INC.

Table Exercise (Step 2)

For your assigned Value Scenario / Challenge

1. Come up with 3 different examples of projects that exemplify this value challenge (5 minutes)
2. Discuss and flipchart at least 3 Lean Approaches that would help meet the value challenge – why? (15 minutes)
3. Prepare a brief report out (5 min. max)
4. Reports and discussion (20 Minutes, max.)

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Where do we go from here?

Some suggestions

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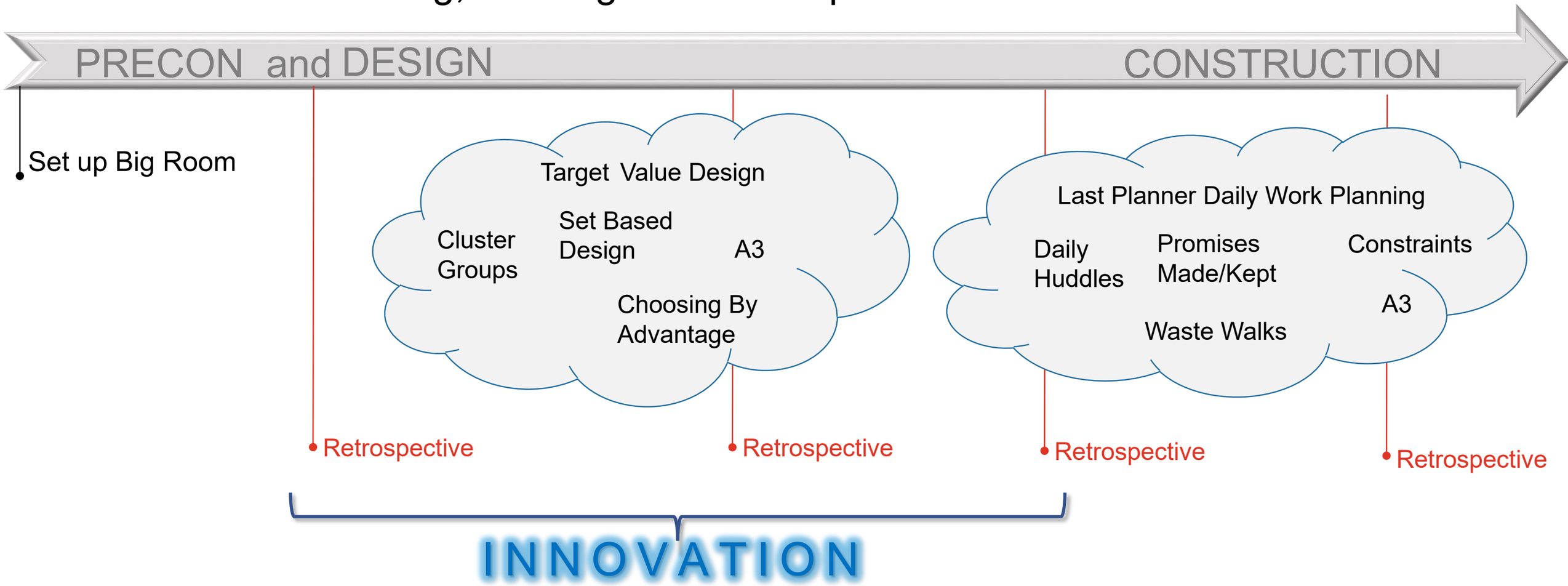
IMPLEMENTATION – What and When

Continuous Onboarding, Training and Development



Avoid Not-Lean Practices

1. Deriving cost from the design, without construction input
2. Ordering large batches of materials early
3. Trying to save time by doing everything as early as possible
4. Typical construction schedules with great detail, no LPS®
5. Top-down direction and accountability without real commitment
6. RFIs and Change Orders
7. No supply chain participation in LPS® (Use of “Constraint Logs”)
8. Redundant documentation

Continuous Improvement (PDCA)

Lean thinking demands a mindset of continuous improvement.

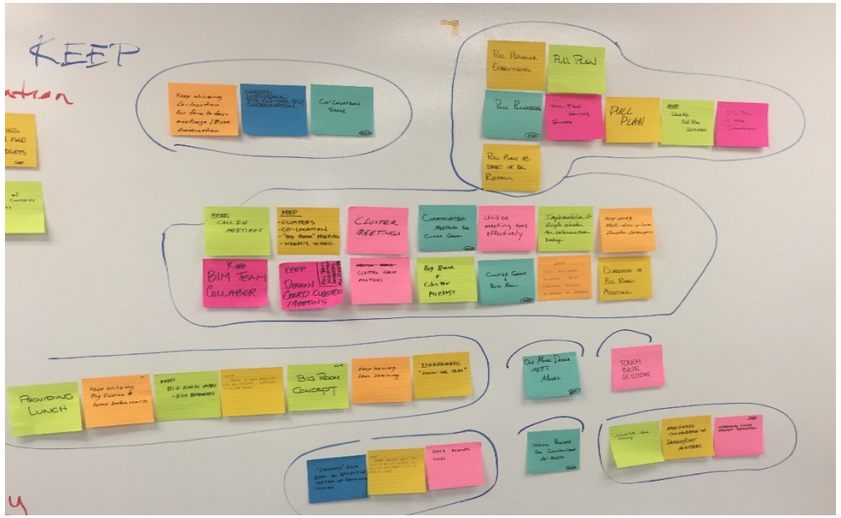
Leaders must create an environment where experimentation is encouraged and small manageable failure is acceptable if the goal is to improve continuously.

Lean – What/When/Why

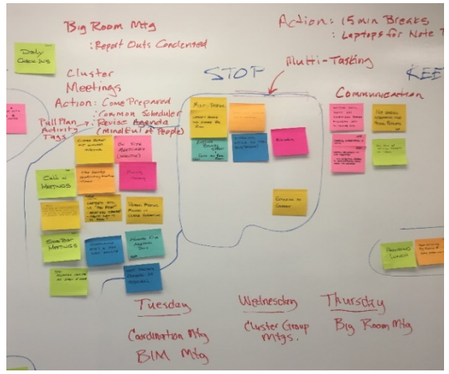
Retrospectives

- Continuous Improvement
  - What should we ***keep*** doing?
  - What should we ***stop*** doing?
  - What should we ***start*** doing?
- Immediate team improvements
- Document lessons learned

Keep



Stop



Start

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Get Curious!! (Climb the +/△ Ladder)

The Industry

- How does our productivity compare?
- Are we delivering all the value we can?
- How can we contribute to the common good?

Our Company

- What is our company culture?
- How do our current practices limit us?
- What do we do to continuously improve?

This Project

- What's working / What's not working?
- What is value-added / What is waste?
- Are we working together productively?

My Work

- My mental Model: Does it help or hinder?
- My skills and Knowledge: Am I growing? Am I stuck?
- My quality of life: Do I make a meaningful contribution?

Lean Journey to Mastery

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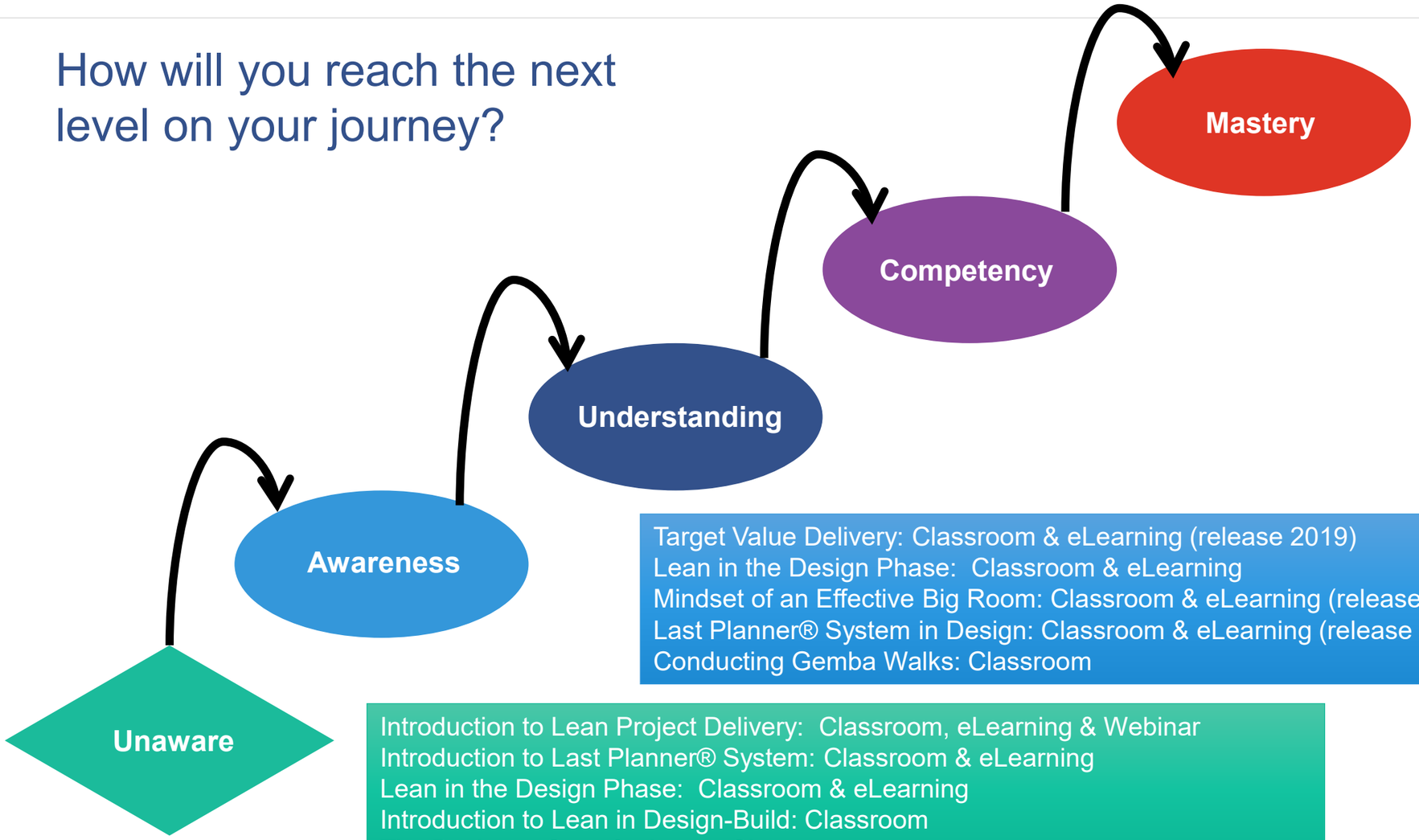
How will you reach the next level on your journey?



Target Value Delivery: Classroom & eLearning (release 2019)
Lean in the Design Phase: Classroom & eLearning
Mindset of an Effective Big Room: Classroom & eLearning (release May 2019)
Last Planner® System in Design: Classroom & eLearning (release 2019)
Conducting Gemba Walks: Classroom

Introduction to Lean Project Delivery: Classroom, eLearning & Webinar
Introduction to Last Planner® System: Classroom & eLearning
Lean in the Design Phase: Classroom & eLearning
Introduction to Lean in Design-Build: Classroom
The Business Case for Learn: Classroom

More on Learning

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Books:

Events:

- Local Community of Practice
- Congress (October)
- Design Forum (May)

Start learning now:
www.LeanConstruction.org

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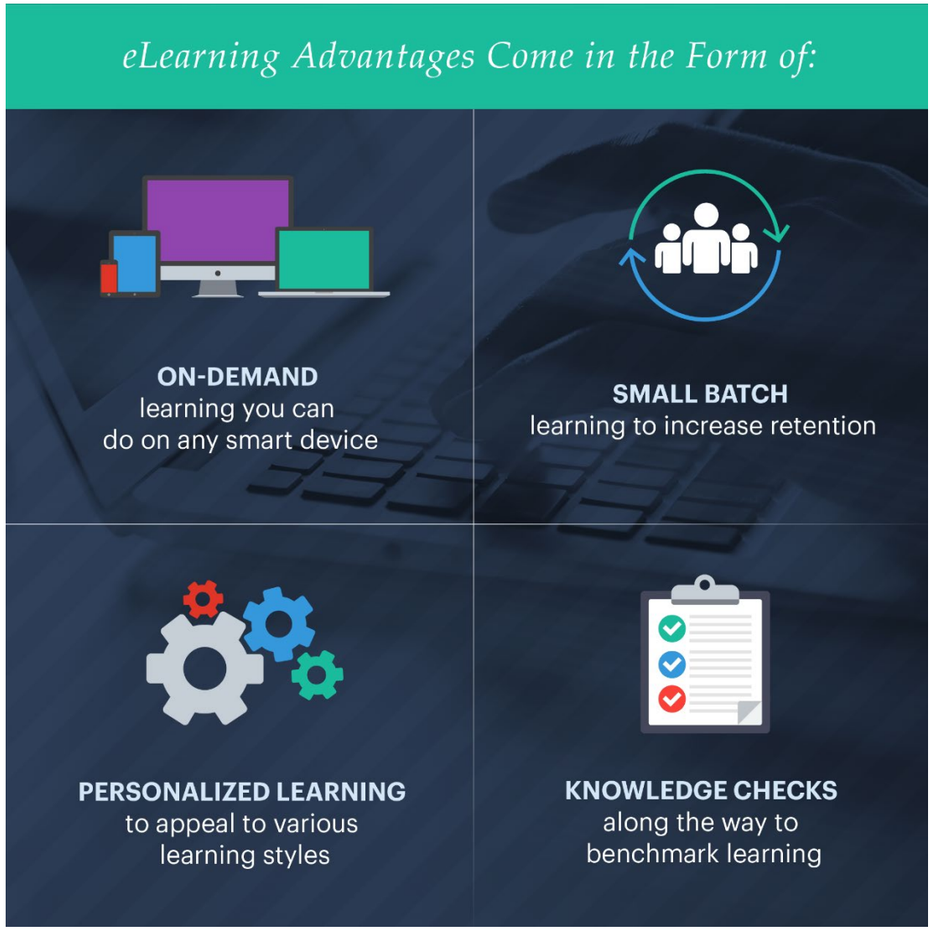
eLearning

- **Learn on your own time** without taking time off project work
- **Increase knowledge retention by up to 60%** with interactive, small-batch learning
- **Access field resources** to use with teams
- **Earn 1.5 CEUs** (self report to AGC CM-Lean and/or AIA)
- **Incentivize with LCI badging credentials** for email signatures and a certificate of completion
- **Save money** by eliminating instructor and travel expenses
  - *LCI corporate member volume discounts of up to **75% off***
  - *Reduced member pricing is available in addition to standard non-member pricing*



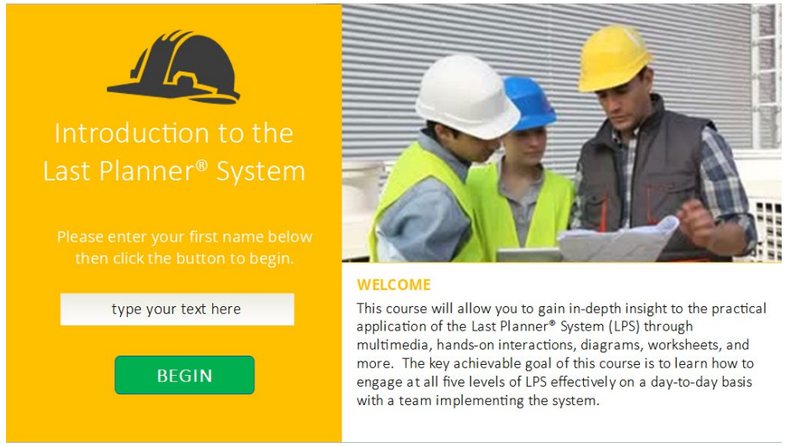
eLearning Courses

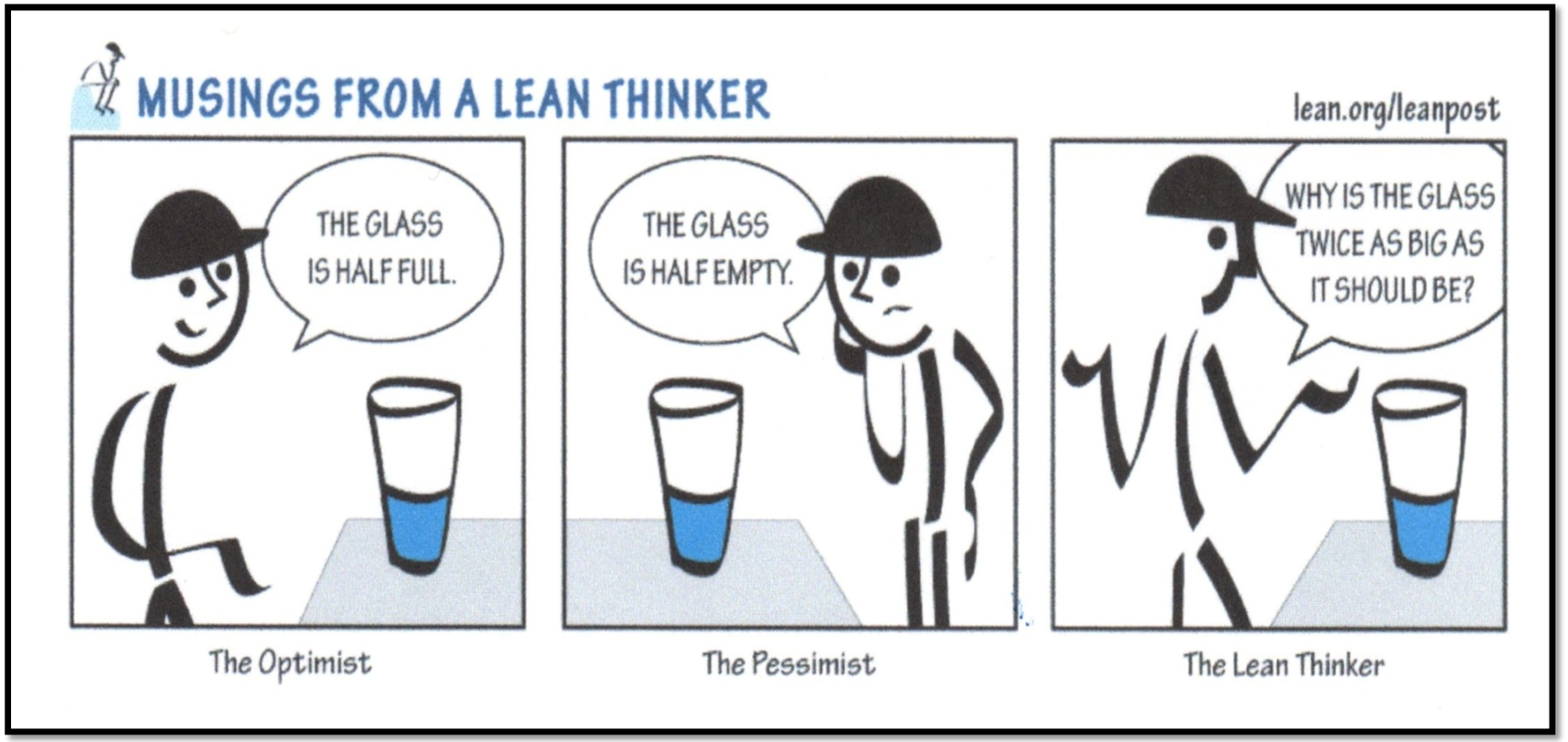
Available now:

- Introduction to the Last Planner® System
- Introduction to Lean Project Delivery
- Lean in the Design Phase
- Effective Big Room

Coming soon:

- Target Value Delivery (Fall 2019)





Learning Objectives

01.

At the end of this presentation, participants will understand fundamental concepts of Lean design and construction including identification of waste, definition of value and importance of reliable and predictable flow on project outcomes.

02.

At the end of this presentation, participants will understand how Lean is particularly well-suited to use in Design-Build which accounts for 44% of non-residential, highway and waste water projects.

03.

At the end of this presentation, participants will understand the fundamentals behind Design-Build Done Right as recommended by DBIA.

04.

At the end of this presentation, participants will understand how several examples of Lean Practices reinforce Design-Build Done Right .

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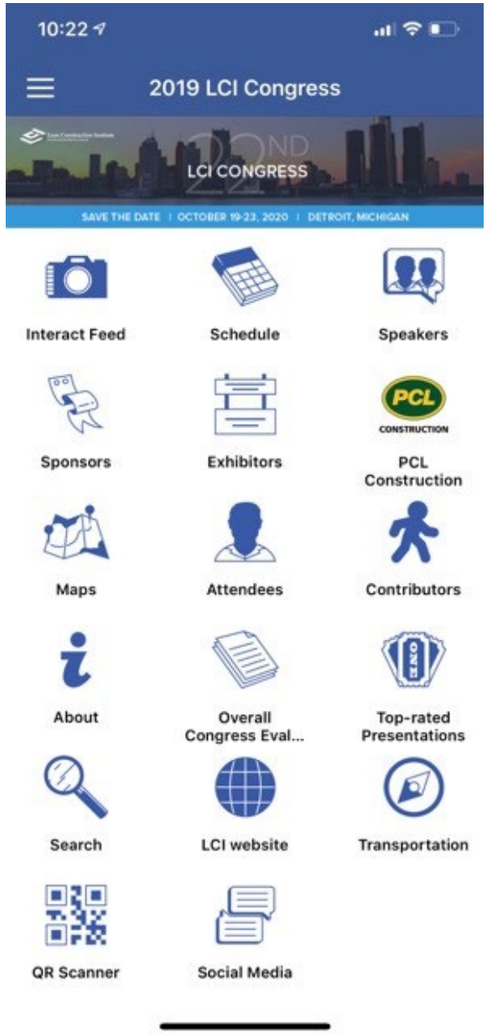
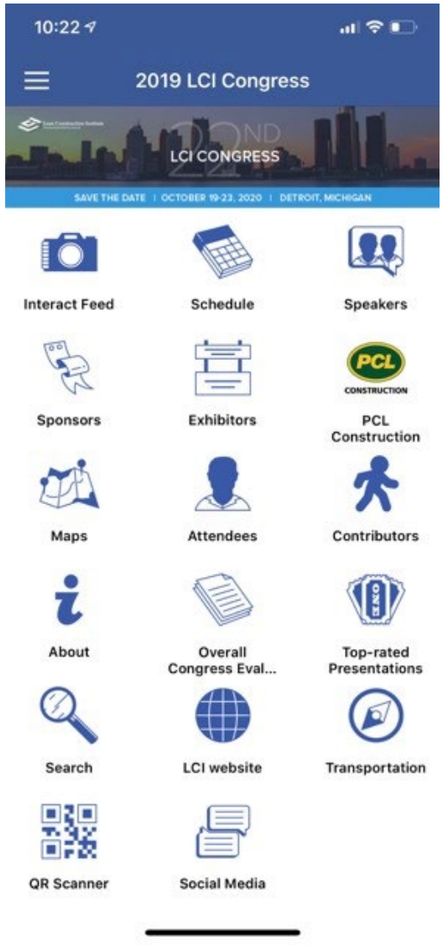
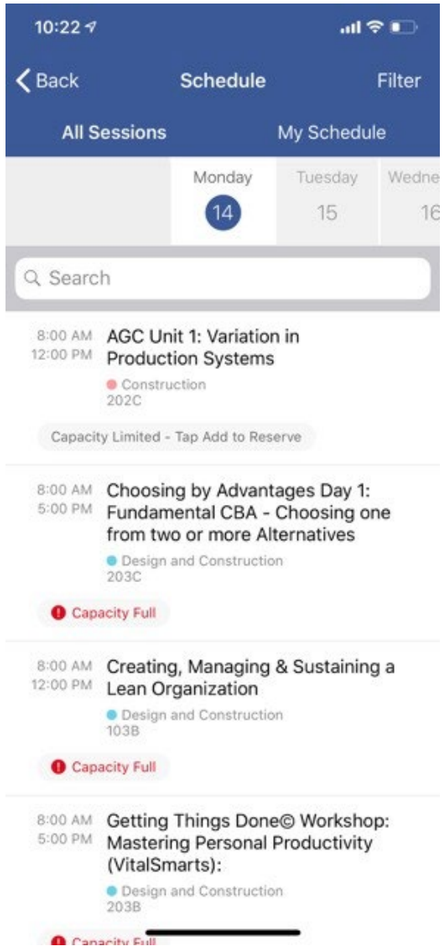
- Tap Verify Account from the same invitation email.
- Tap Open App, and edit your profile!
- Login by entering your first and last name as it appears on your registration.
- A verification code will be sent to your email used to register. Enter the verification code and tap Verify.

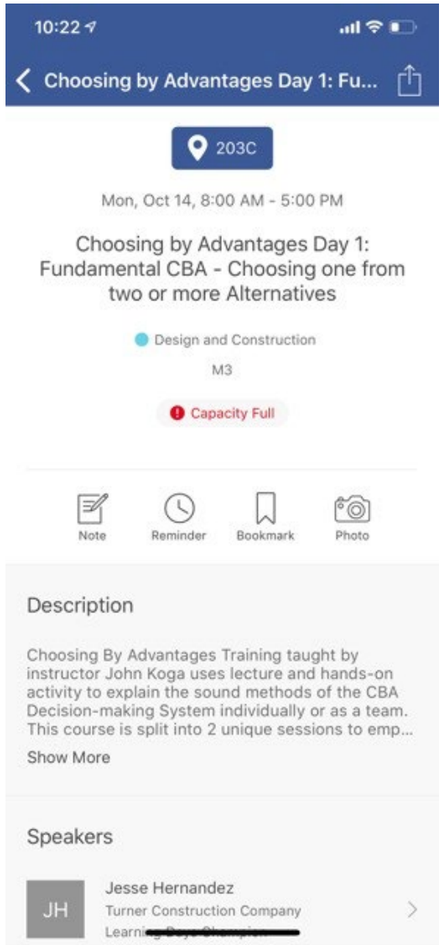
Any trouble shooting, stop by and visit our app resource in the registration area!



Find each learning day session on the app!

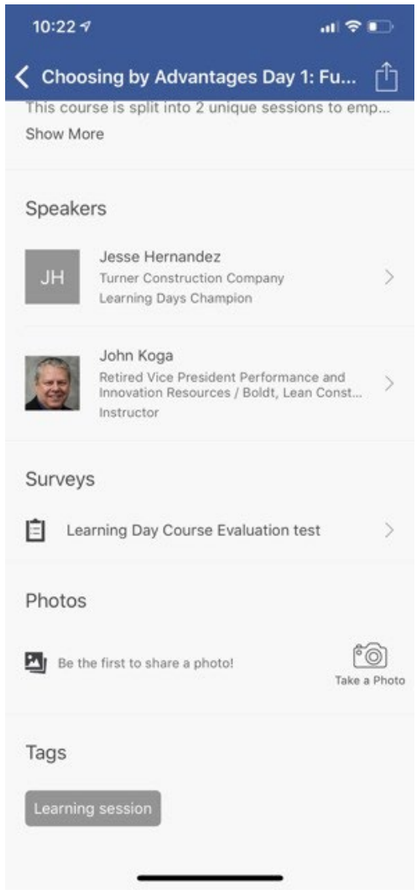


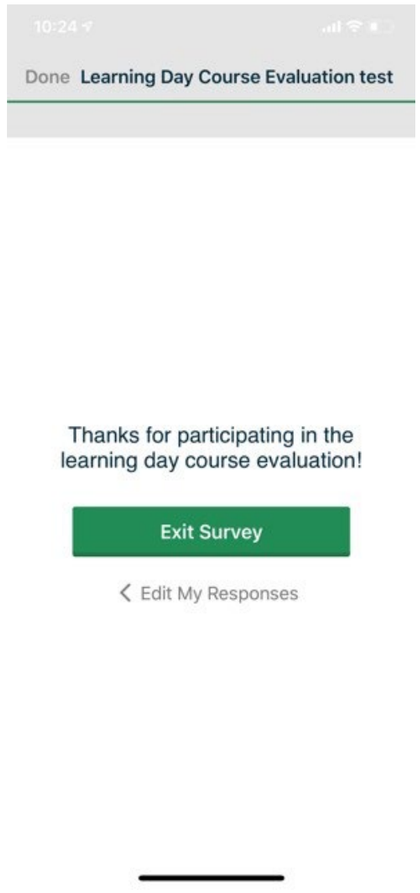




1. Click on the navigation icon “schedule”
2. Click on Monday or Tuesday to locate each learning day session.
3. You will see course description, room number and speaker/champion bios.

Rate each learning day session on the app!





4. Scroll to bottom of page to click on “learning day course evaluation”.
5. First 11 questions require a response.
6. Last two questions are open-ended “what did you find most and least useful”, open ended.
7. Select “exit survey”.

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Questions?

Some answers too

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This concludes The American Institute of Architects Continuing Education Systems Course

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In the spirit of continuous improvement, we would like to remind you to complete this session's survey in the Congress app! We look forward to receiving your feedback.