

Lean Construction



S&D YOUiversity - WBC Lean Construction Seminar

June 20, 2024

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(AGC Certificate of Management - Lean Construction)

Agenda

- What is Lean Construction
- Lean Principles
 - Value
 - The 8 Wastes
- Lean Practices/ Tools
 - Recognizing waste
 - Reducing Waste
 - Last Planner System - Pull Planning Block Tower Simulation
- Culture of Continuous Improvement



Too busy to improve?

“Everyone appears busy, so we are as productive as we can be”

“Don’t have time to look for the causes”

“Production tracking hurts employee moral”



“My project’s schedule is too aggressive to use lean”

“No time to plan- well figure it out as we go along”

“We’ve been successful doing it this way so why change”



Lean Thinking

- What is Lean?
 - Lean is a mindset, a way of thinking, rather than a technique.
 - Lean requires buy-in from a team that is focused on continuously improving working processes to seek the best possible outcomes.
 - Ultimately, Lean is a shift in how a team works together.



Lean Construction Institute
Transforming Design and Construction



Lean (at its core)

Maximize **value** and eliminating waste

- **Value** is what the customer wants and is actually paying for

*Our customers want the **Highest Quality** at the **Lowest Cost** in the **Shortest Delivery Time***



What activates add value?

VALUE-ADDING

1. Customer is willing to pay for this activity
2. Must be done right the first time
3. Must somehow change the product or service in some manner.

- Hanging Hangers
- Connecting Pipe
- Setting Equipment
- Fixtures
- Start -p Equipment

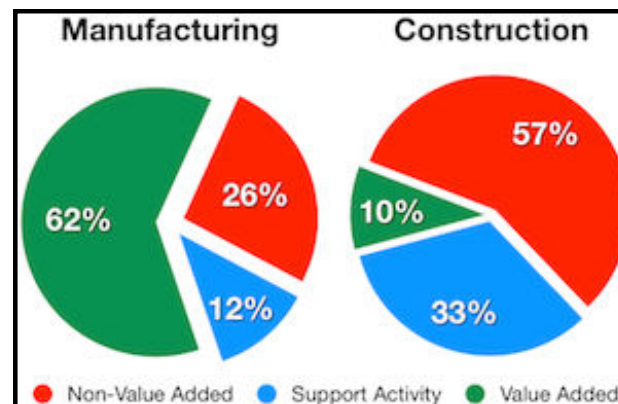
NON-VALUE-ADDING

NECESSARY
but non-value-adding

- Reviewing Drawings
- Laying-out
- Cutting hanger rods
- Preparing Joints
- Testing

WASTE

- Rework
- Waiting for information
- Storing/moving material
- Fetching material from C-Can



The “8 Wastes”!



Defects

Errors

PA forms, AdComp forms,
Incomplete information for
Grants submission



Overproduction

Doing more than needed

Extra reports, Unnecessary info.
sent automatically, printing in
advance



Waiting

Waiting or Delays

Waiting for information,
report, answer, approvals,
signatures, etc.



Not Utilizing Employees

Ideas and skills not used

Not recognizing employees as
best source for fixing issues



Transport

Movement of people or material

Transport between campuses,
Movement of files to different
locations



Inventory

Too much material

Buying in bulk, more servers
than required, supplies,
equipment



Motion

Movement by workers

Searching for supplies, items
needed not close by, always
looking in shared drives



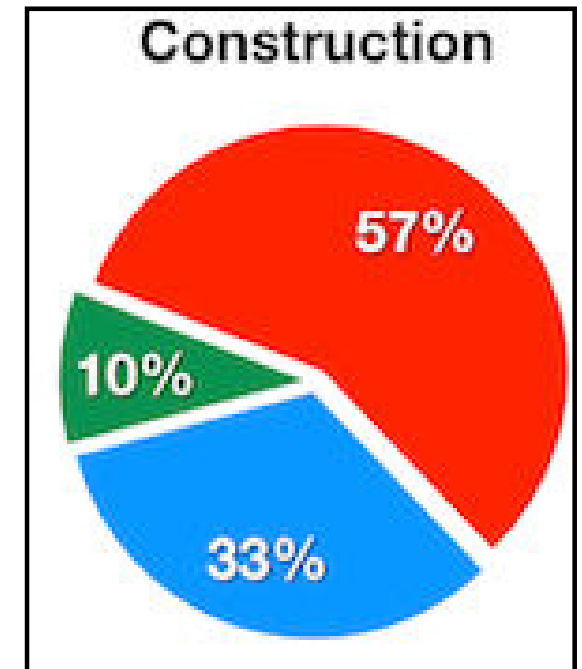
Extra Processing

Re-dos

Unnecessary approvals,
rework, same data required in
multiple places or systems

How do we Reduce Waste?

1. **Develop a culture where everyone is looking for ways to improve** *no more "we always did it that way"*
2. **Lean Training & Education.**
3. **Recognize waste and understand Why that waste occurs** *Gemba Walk, Root Cause Analysis (5 Whys)*
4. **Improve our process to eliminate the waste in the future** *Visual Work Place (5S), Small incremental changes, "Just in Time", Prefab & Modulization*
5. **Look at the process as a whole and reduce variation in the process** *Standarization, Last Planner System*
6. **Continuous Improvement** *Plan, Do, Check, Adjust*



efined



Lean Construction Principles



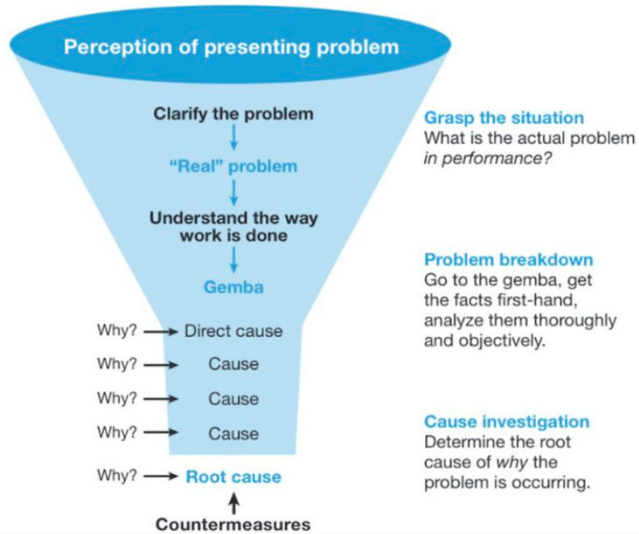
Identify Waste/ Root Cause

Gemba (Go See) Walk Gemba walks focus on observation, gaining an understanding of how work is being performed, engaging with workers to understand the what and why for the methods being employed, the challenges being faced, and potential areas where waste is occurring.

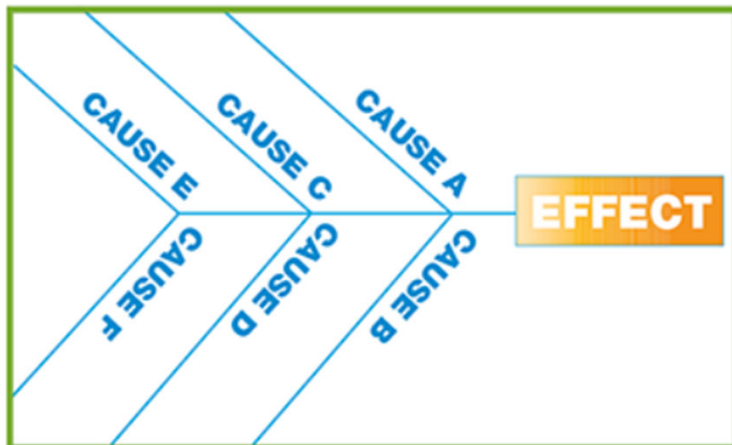
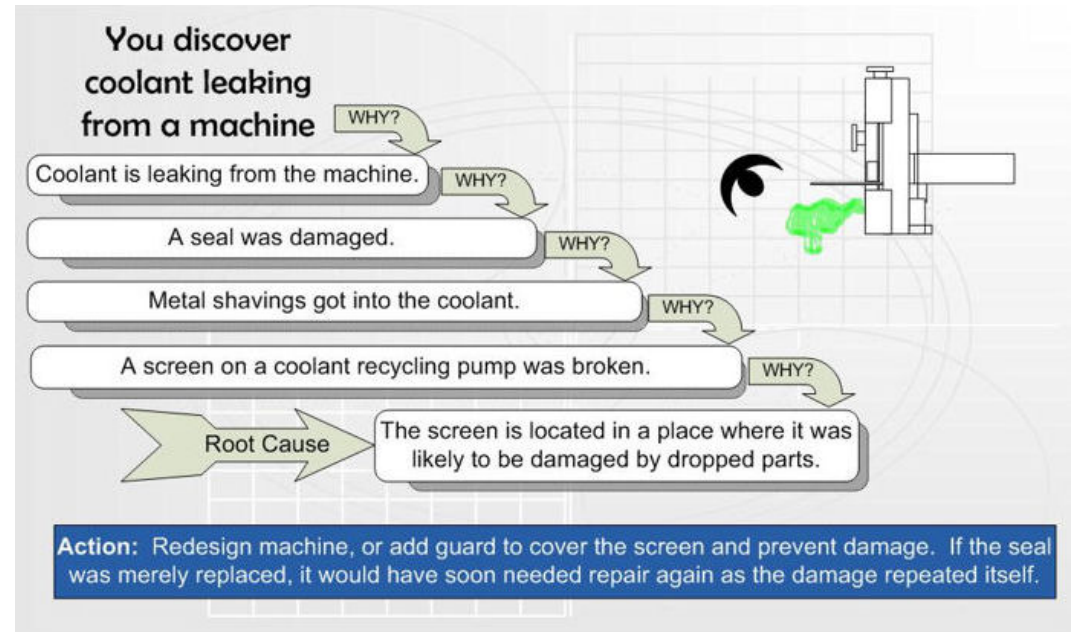
- Don't watch the work - watch for what gets in the way of value! (Flow)
- Focus on Process not people
- Look for Wastes
- Look for Standards/systems/methods (can't improve if no standard way exists)
- Clearly communicate goals and objectives leading to increased employee engagement
- Ask the people doing the work, what the biggest challenges are, and what would make it easier for them to do their job.
- ****Don't try to solve the problem or come up with a solution during the Gemba walk. Simply observe and fully understand.**



Identify Waste/ Root Cause



5 Why Analysis



Fish Bone Diagram



Reducing Waste

5S to a Visual Work Place



Sort

When in doubt, move it out – Red Tag technique



Set in Order

A place for everything and everything in its place



Shine

Clean and inspect or Inspect through cleaning



Standardize

Make up the rules, follow and enforce them



Sustain

Part of daily work and it becomes a habit

Avoid the Treasure Hunt



5S Numbers Game

75 21 30 87 51 33 45 27 72
36 57 24 66 15 54 18 36
29 74 2 68 77 98 80 62
07 47 56 3 41 23 8 4 68
38 47 11 14 2 65 92 17 71
28 54 64 64 9 40 31 26 34 7
73 19 10 22 58 76 16 88 2 25
46 37 82 85 13 49 79 43 70 3



5S Numbers Game Sort

30 27 36 45 33 21 24 15 2 42 23 41 8 4 53 38 47 11 32 14 26 9 17 34 7 28 6 40 31 4 16 34 25 10 22 13 4 19 37 46 61 37 43 5



5S Numbers Game Set In Order

30 21 48 39	24 42	33 15	27 18 45 36
2 20 47 29	3 41 2 23	8 44 26 17	36
28 10 37 19	31 22 40 4	34 16 43	7 25



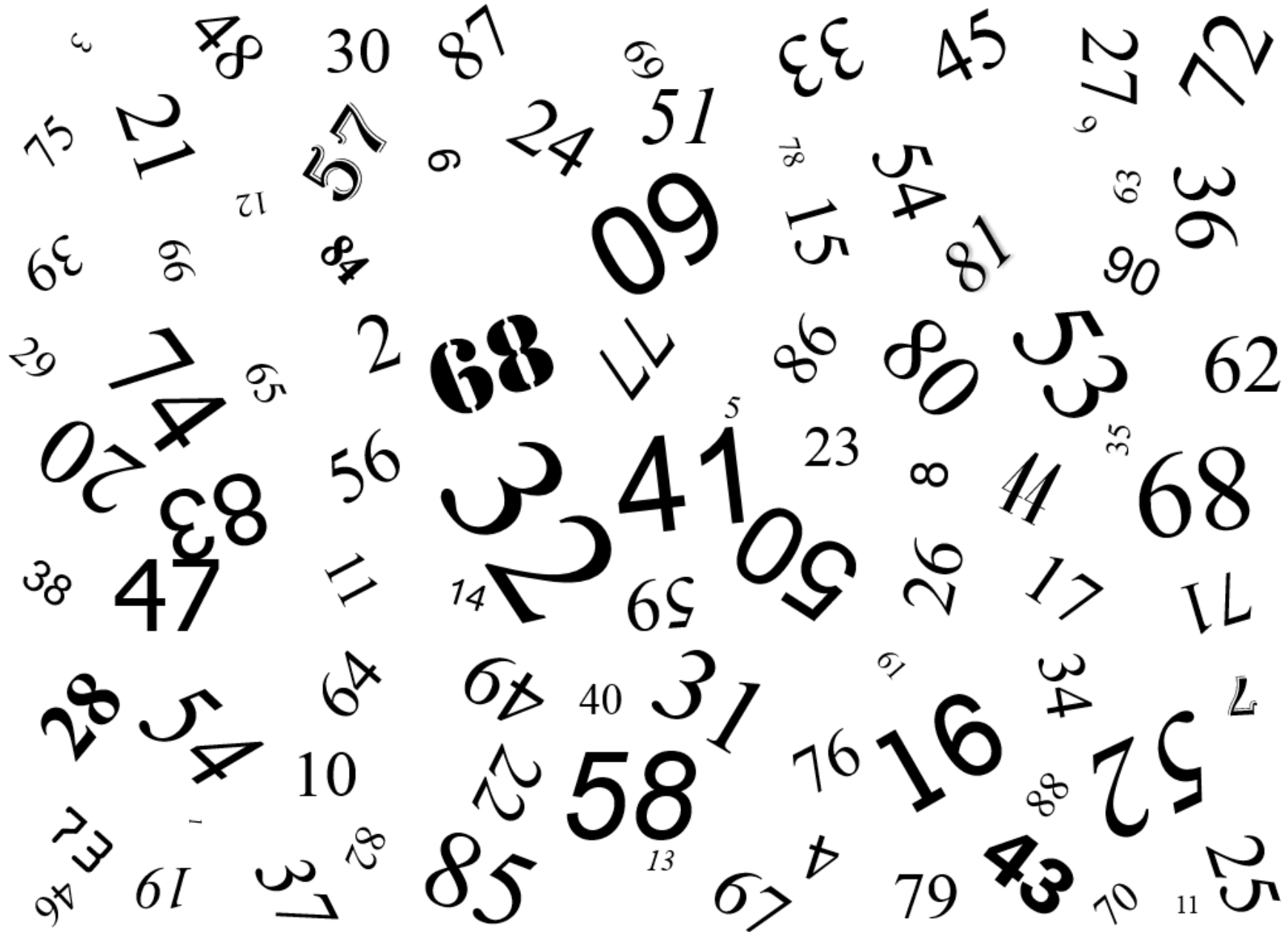
5S Numbers Game Standardize

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	



5S Numbers Game

Find which 2 numbers are missing



5S Numbers Game

Find which 2 numbers are missing

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17		19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41		43	44	45	46	47	48	49	



Reducing Waste – Just in Time (JIT) Delivery

- More materials means its more likely to be damaged or stolen Project team is less flexible to adapt to potential changes
- This adds a lot of **waste** to the construction process
- JIT Eliminates the need for on-site storage and double handling



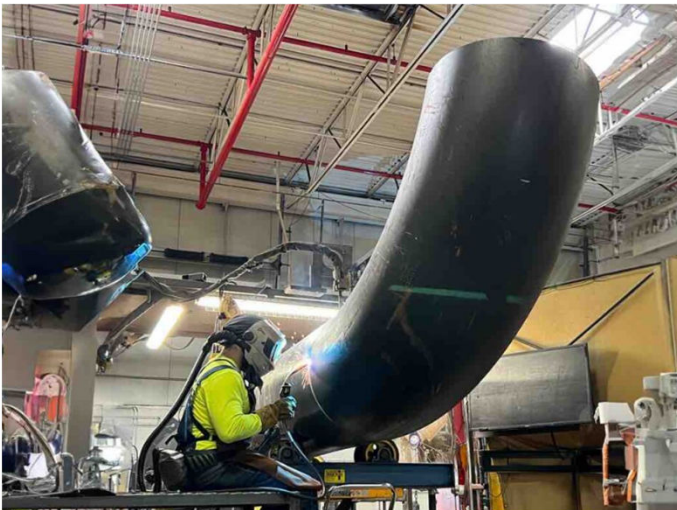
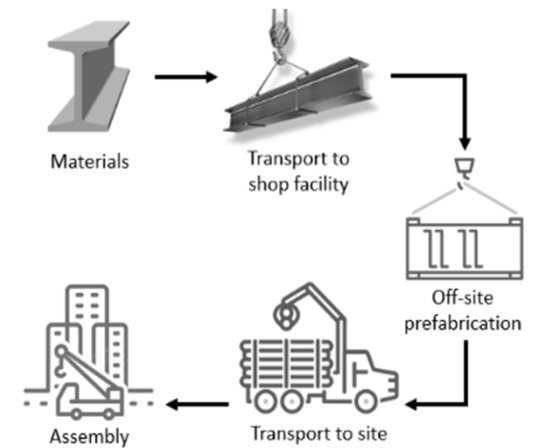
Strategic Buffer for what makes sense for the project

Just in Time - Not Just in case



Reducing Waste - Prefabrication

- Prefab is a lean method that uses components made off-site in a factory, which are then transported and put together on-site to create a building component.
- Prefab supports field workers as internal clients. Reduces the number of pieces a worker needs to handle for each task, grouping parts to reduce worker time, and focusing on the enabling tasks to streamline field installation.



Benefits

- Increase efficiency and work speed due to better working ergonomics.
- Improve quality and safety.
- Generate a lower environmental impact.
- Reduce site disruption.
- Decrease jobsite congestion.
- Reduce waste.

Business Drivers

- Cost-effectiveness.
- Consistency & quality control.
- Reduced lead time and accelerate construction process.
- Reduced effects of uncontrolled factors.
- Optimized work sequences.

Complementary Methods: Modularization, JIT, BIM, Kitting



Reduce Variation in the Process as a whole

- Reducing workflow variability
 - Improves total system performance: cost, schedule, quality, safety
 - Makes project outcomes more predictable
 - Simplifies coordination
 - Reveals new opportunities for improvement
- Point speed and productivity of a single operation doesn't matter - throughput/workflow does.
- Strategy: Reduce variation then, and only then, go for speed to increase throughput : “Go Slow to Go Fast.”



Lean focuses on maximizing value of the whole project not individual performance



Studies show: In construction about **54%** of what we plan to do, actually gets done on a weekly basis

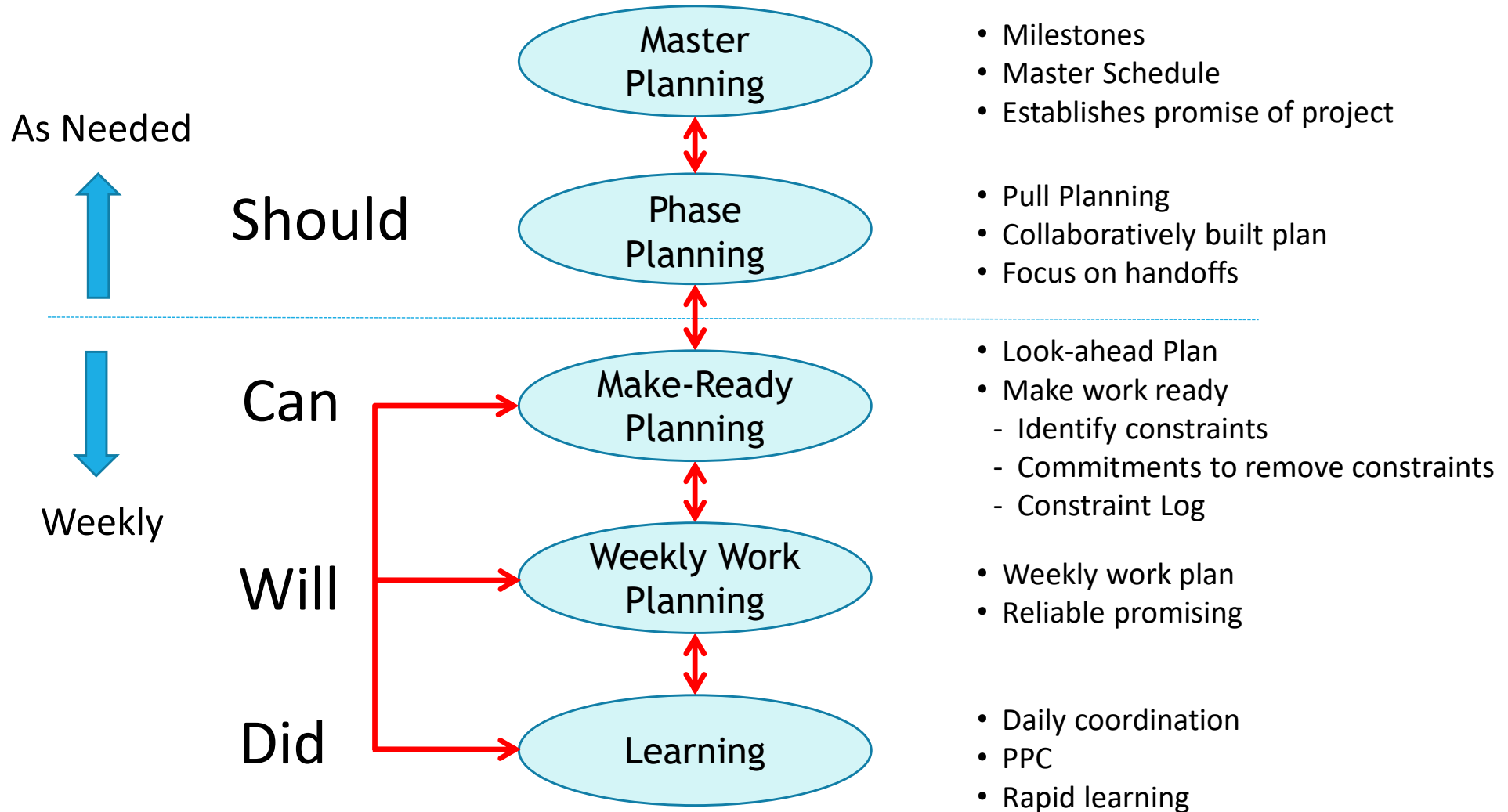
How do we create Reliable Workflow?

The Last Planner System

The Last Planner System (LPS) is a collaborative planning process that involves trade foremen or design team leaders (the last planners) in planning in greater and greater detail as the time for the work to be done gets closer



Last Planner[®] System



Creating and maintaining reliable workflow



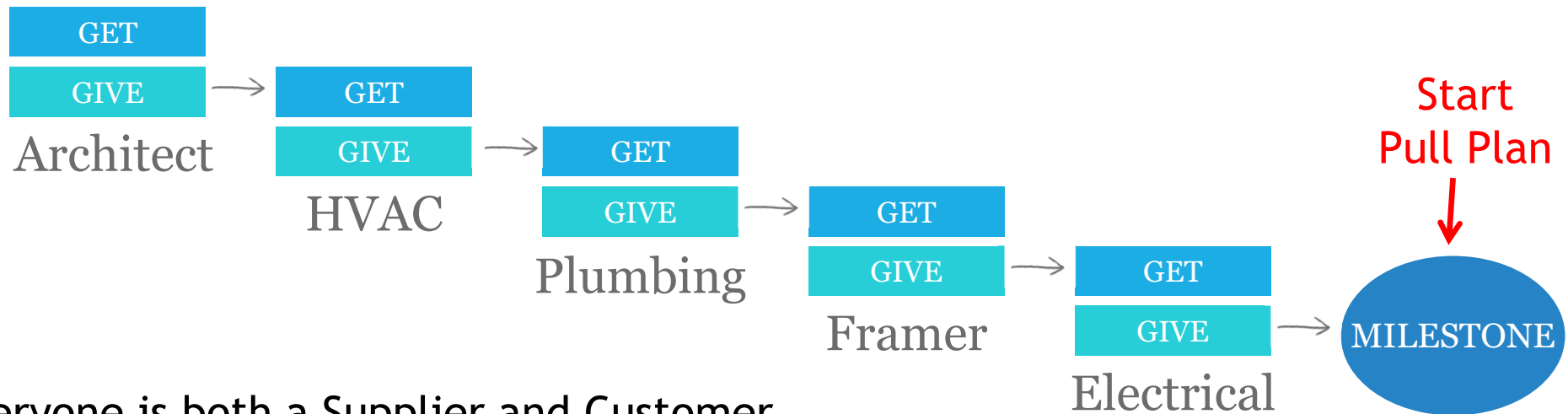
Pull Planning

Push vs. Pull System

Push: Materials and info pushed through the production process based on a predetermined schedule and upstream production

Pull: Work releases based on downstream demand, creating reliable workflow

You probably used **Pull Planning** when planning to catch a scheduled flight



Everyone is both a Supplier and Customer

Supplier: Provides what is wanted

Customer: must receive something in order to provide something wanted

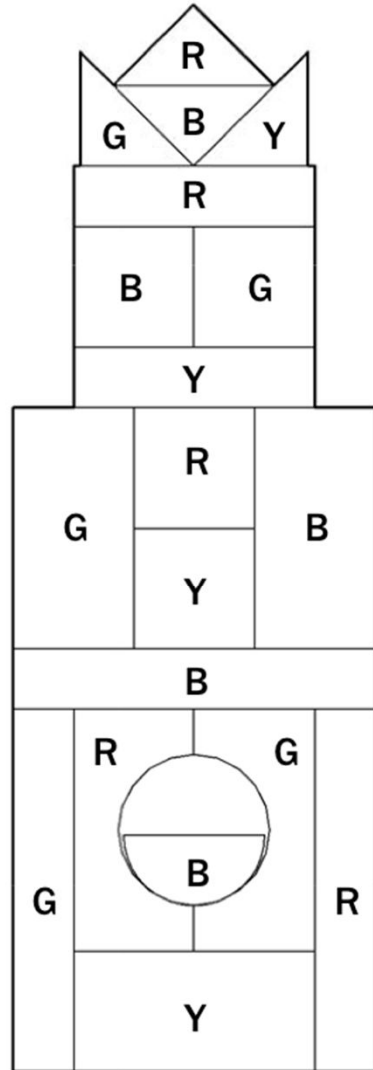


Pull Planning Block Game

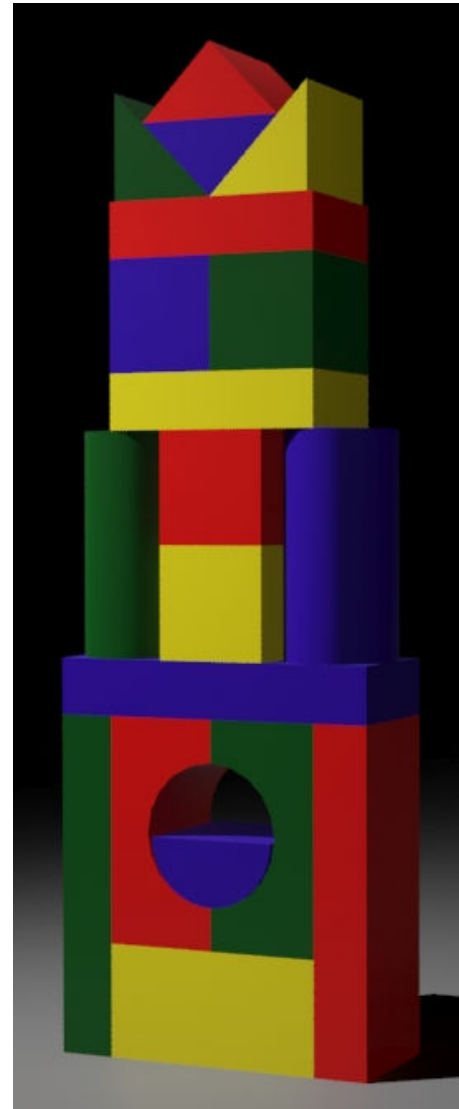
We Will Create a Pull Plan for Building This



② SIDE ELEVATION
1:1



① FRONT ELEVATION
1:1



Pull Planning Block Game

COMPANY:	Card #:	WHAT I NEED FROM OTHERS	
I GET			
DURATION:	START:	FINISH:	WHAT I WILL DELIVER
I GIVE			
For #:			
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The Rules

- A supplier can't walk up and put their activity on the board; Each supplier must be invited by their customer
- Always place the supplier card to the left of the customer card
- To satisfy the customer, the supplier's scope of work (the "I Give") should be the same as the "I Get" of a card that has already been put on the board by their customer
- Write one card for each Give, a Give may require more than one Get so multiple Gets may be listed on a single card

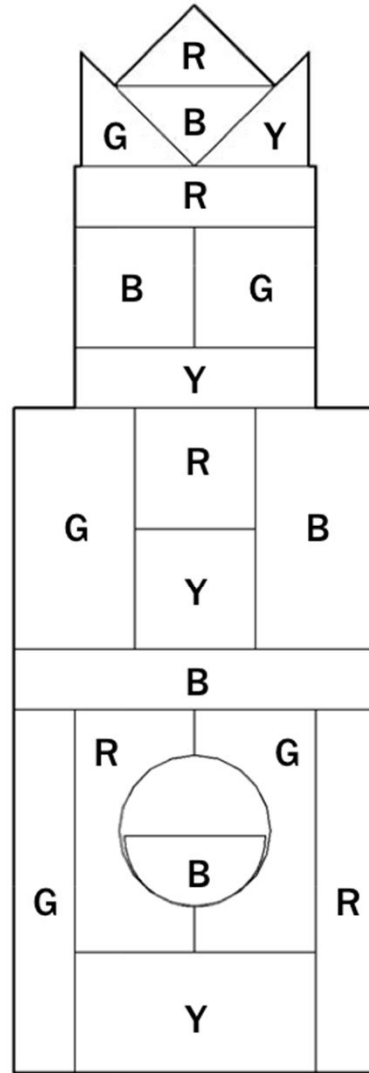


Pull Planning Block Game

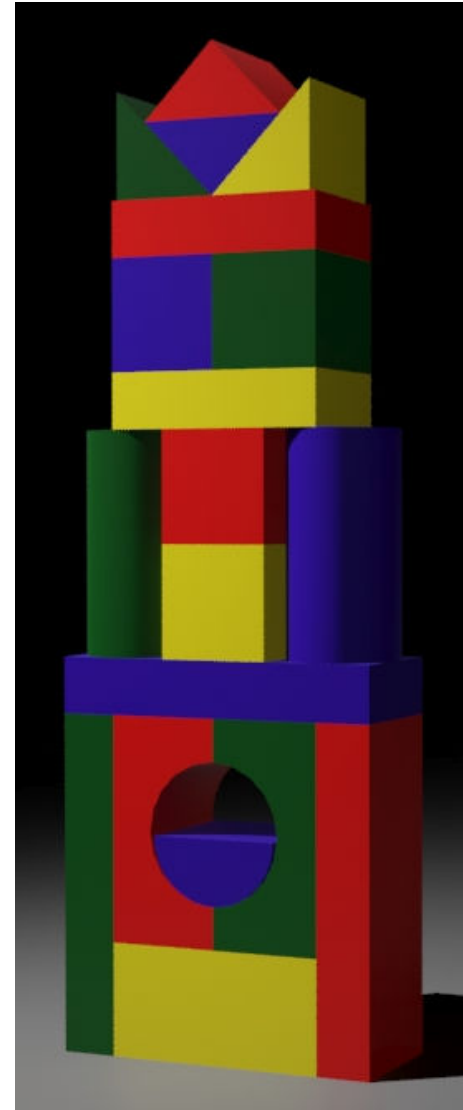
Lets Plan!



② SIDE ELEVATION
1:1

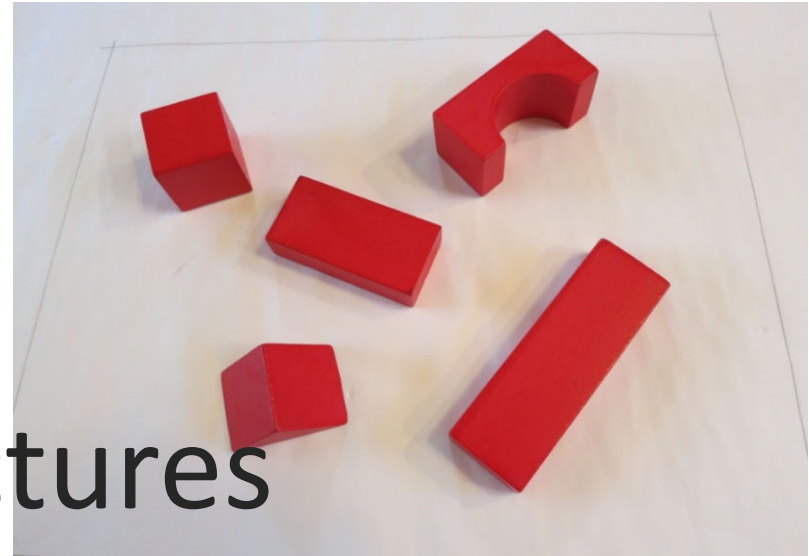
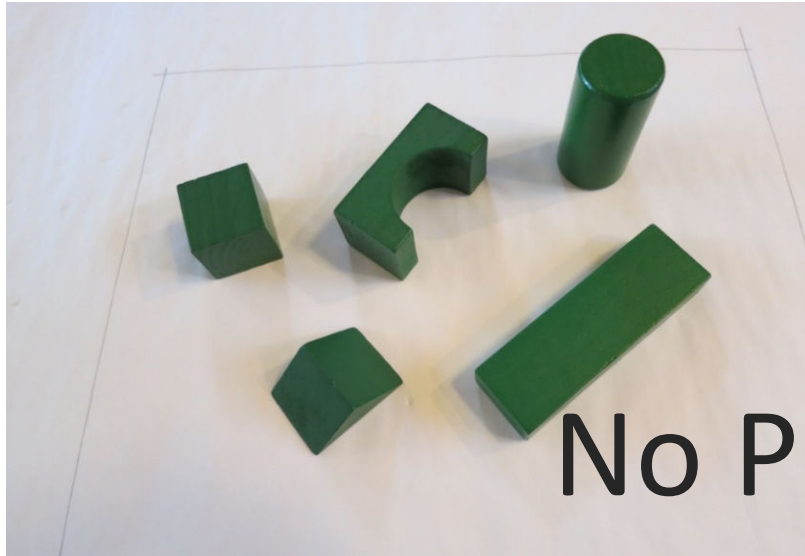


① FRONT ELEVATION
1:1



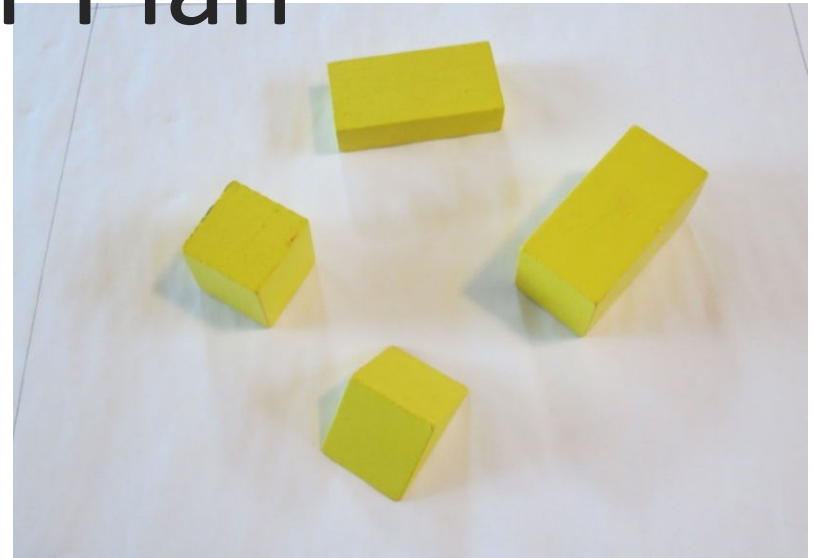
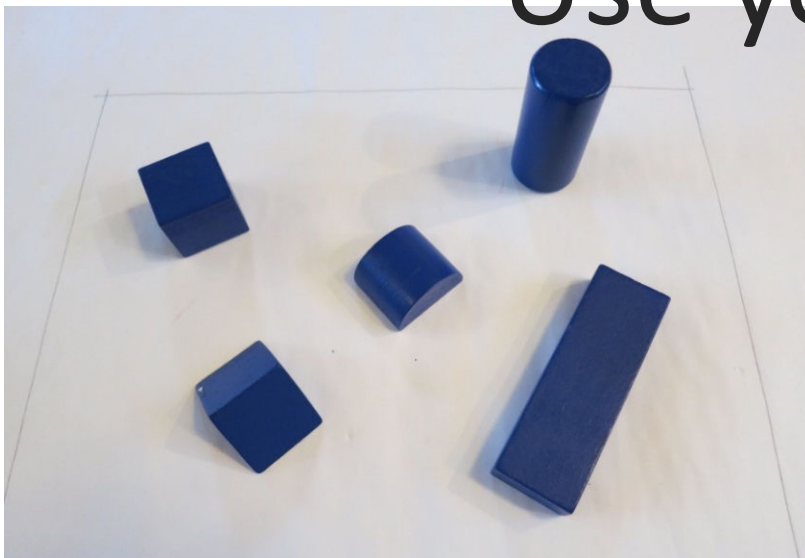
Pull Planning Block Game

Lets Build!



No Pictures

Use your Plan



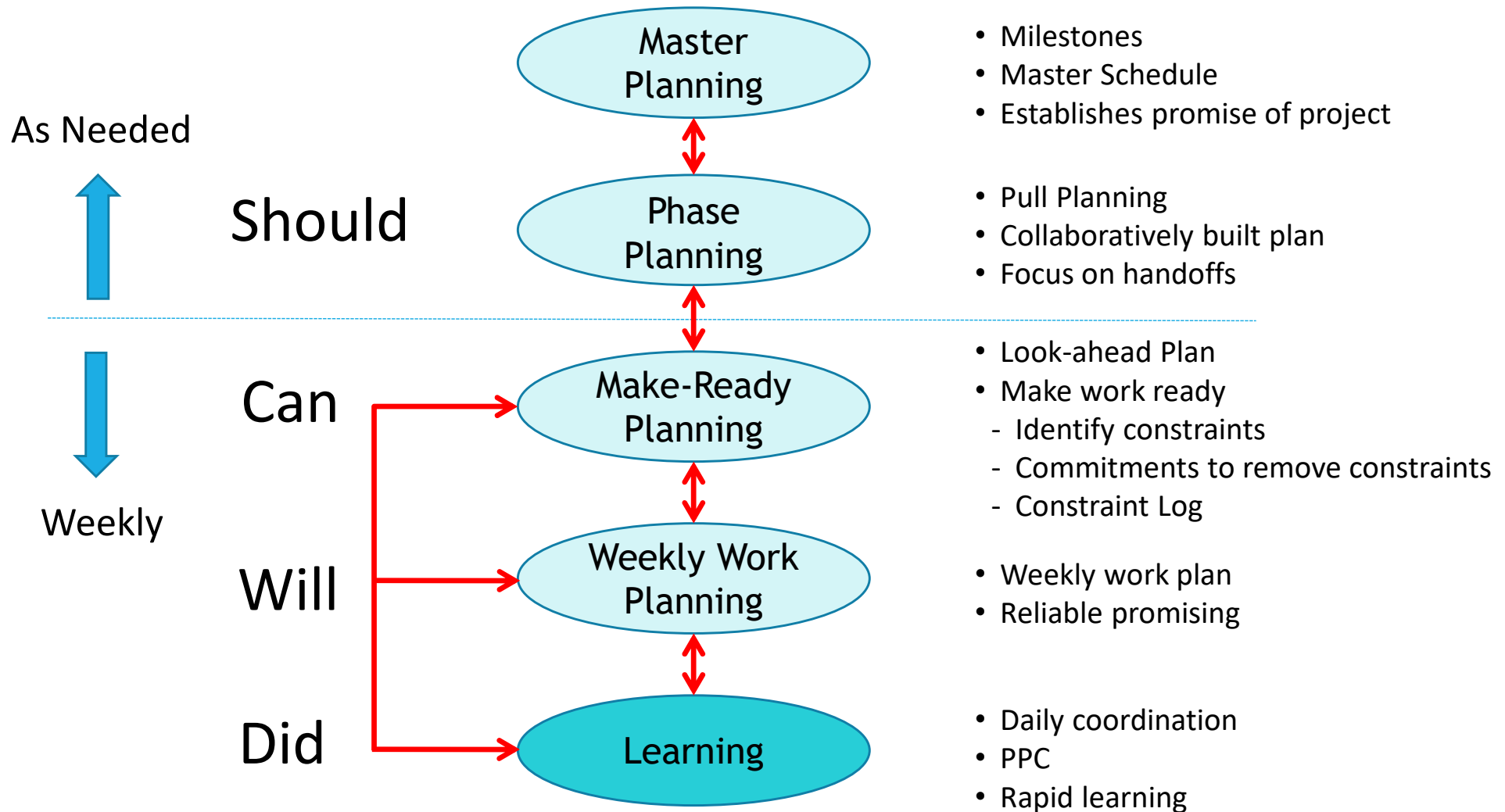
Pull Planning Block Game



So what did you experience



Last Planner[®] System



Creating and maintaining reliable workflow

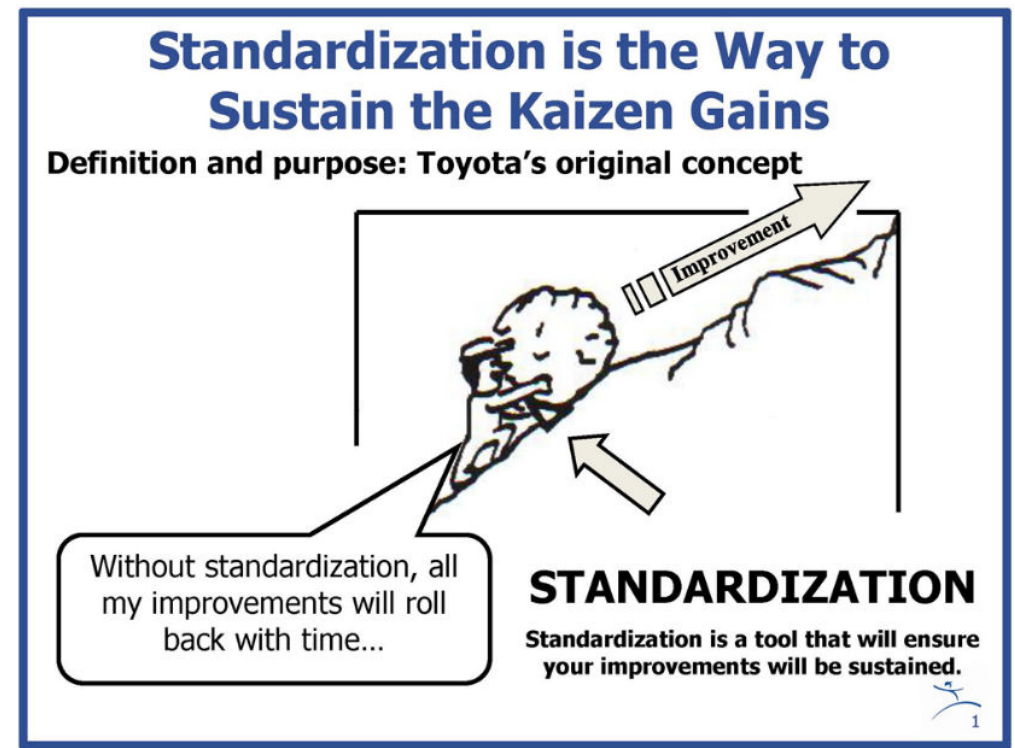


Continuous Improvement

Everyone has 2 jobs:

1. Do the Work

2. Improve the Work

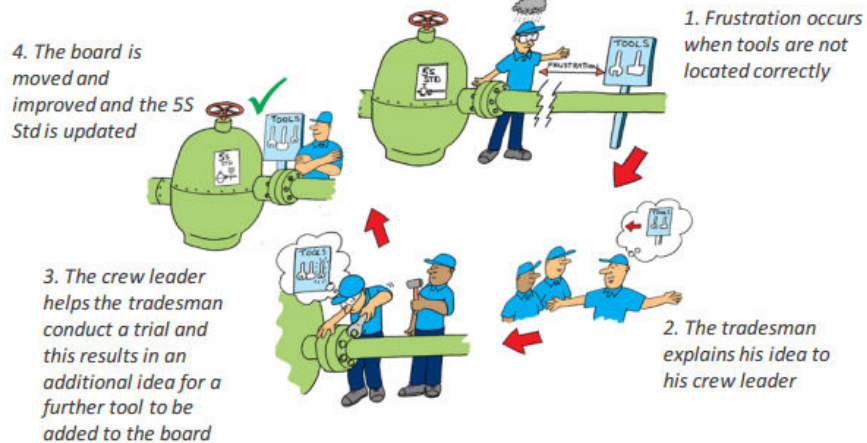


The Worst Waste:
Not using people as a resource



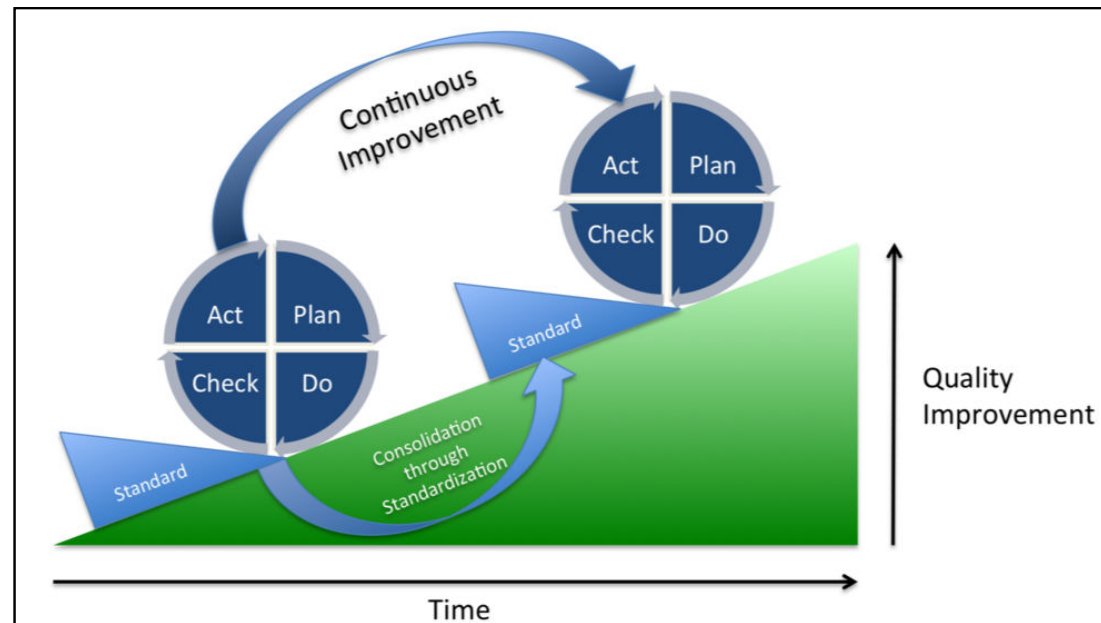
Culture of Continuous Improvement

Many Continuous Improvement examples are born out of frustration:



We look for fixes which can be done by the crews themselves:

- Not just fixing things and moving on.
- Solving problems at the level they occur.
- Working together to identify root causes and make improvements.

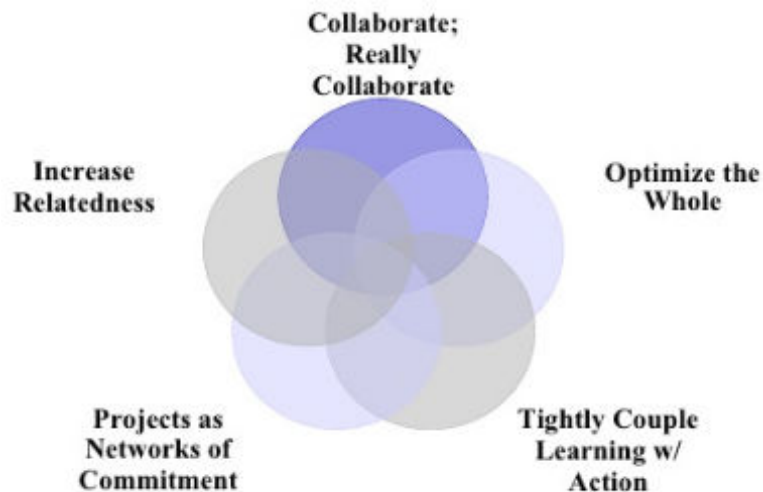


- Measuring our performance
- Its better to have 400 people looking for waste than just a few leaders or engineers

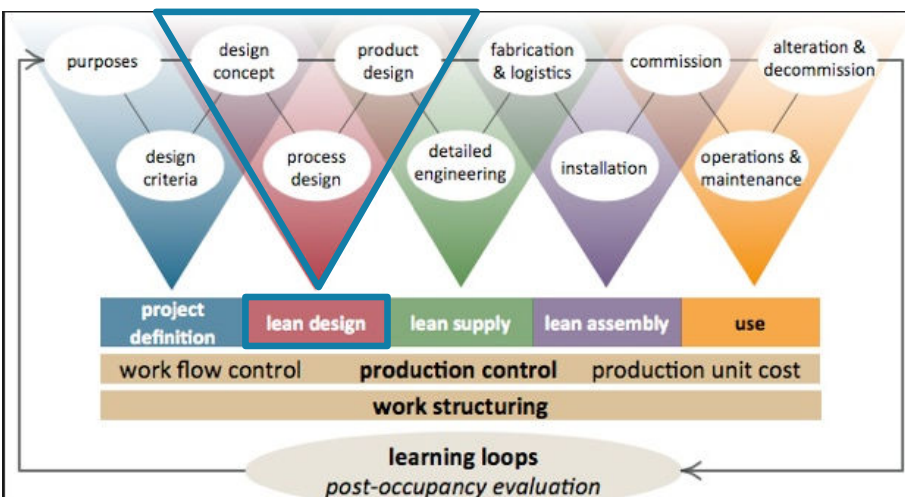


Lean Design and Pre Construction

Lean Design - to improve manufacturability through attention to information coordination and flows at the outset of the project



- Value is defined not only by the owner but also the next person/ organization in the process
- 1/10/100 Rule: changes made during the pre-design has an impact of \$1 to the project, \$10 during design and \$100 after beginning of construction
- Early involvement of downstream participants
- Deferring of design decisions to the last responsible moment to allow more time for developing and exploring alternatives

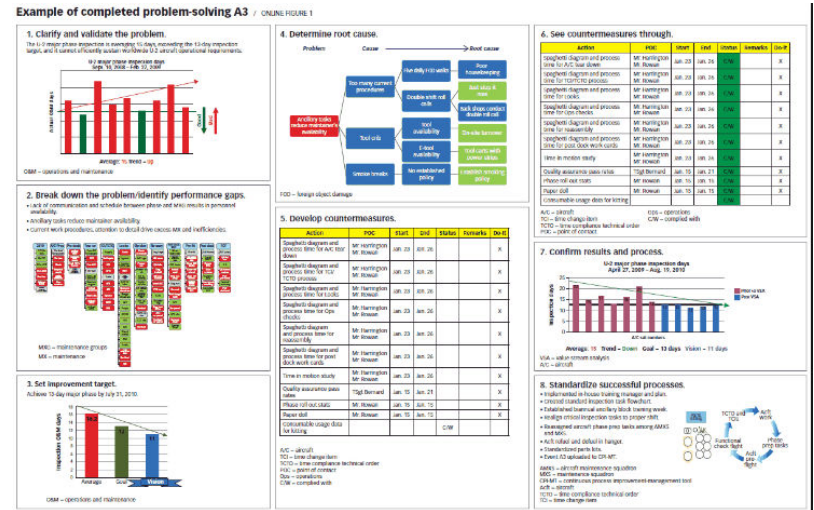


Lean Design Tools

- Choosing by Advantages - more effective than Pros and cons
- A3 - Displaying data into a single page that can be presented to leadership for a decision

Choosing by Advantages

	Flat	Butterfly	Bow String	Pavilion			
Expense	Very Good	9	Moderate	5	Moderate	5	0
Integrated Solar Panels	0	Very Good	2	Good	1	Good	1
Interior Aesthetics	0	Good	8	Good	8	0	0
Exterior Ground	0	Good	6	Very Good	10	Very Good	10
Exterior Above	0	Moderate	3	Very Good	8	Moderate	3
Context	Very Good	7	0	Good	5	0	0
Total		16	24	37	14		



- Set based design - A set of possible options is developed in parallel with the best one (or features form multiple options is decided at the last responsible moment
- Target Vale Design - focuses on producing a design what can be constructed within a defined budget



Lean Construction Summary

- Lean is about decreasing waste and adding Value to the customer.
- Goal of lean construction is to create Flow. Increase Flow Efficiency over recourse efficiency
- Getting work to flow reliably and predictably requires planning among the entire supply chain
- Measure and analyze results to learn what is working and what is not
- Understand the Root Cause of an issue before determining the best solution
- Standardization is key to maintain improvements.
- Every single person know ways to improve the process and their own tasks. Create an environment where people feel open to share their ideas.





QUESTIONS

Thank you for attending!



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