Lean Construction Institute
Immersive Education Program

Introduction to the Last Planner System®

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Health precautions to keep everyone as safe as possible at Congress:

- 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. Seating at plenary sessions is structured to help with this.
- If you feel ill at any time, please leave the conference and return to your room/consult a physician as necessary.
- Ultimately, our collective health and safety at Congress is up to all of us. Thanks for your support!

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LCI Course:
Introduction to Last Planner System®
4 CEU

Sign the sign-in sheet for credit

AIA Approved Continuing Education

Learning Objectives

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Recognize the need for predictability on projects and how LPS creates more predictable outcomes.

Gain an overview understanding of each of the five connected planning conversations of LPS and how they interrelate.

Discover the basic mechanics of LPS including the foundational base of reliable commitments.

Understand the need for continuous learning and for measuring reliability to improve predictability.

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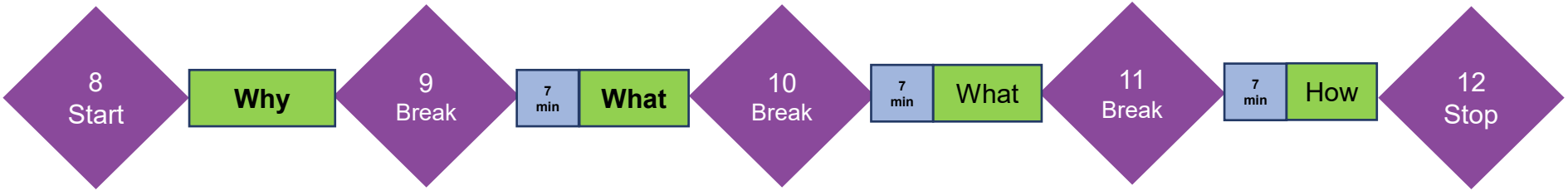
Rules of Engagement

- This is a safe zone
- Everyone has equal status
- Speak up and share your ideas
- Actively listen to others
- One conversation at a time
- Use E.L.M.O.
  Enough, **L**et's **M**ove **O**n
- Silence phones
- Be focused and engaged
- Stay on time
- Have fun!

Work Plan – Guideline Agenda



7 minute breaks – Breaks will have a visual timer measured from the time coach dismisses to break and the time coach restarts topic.

Learning Overview

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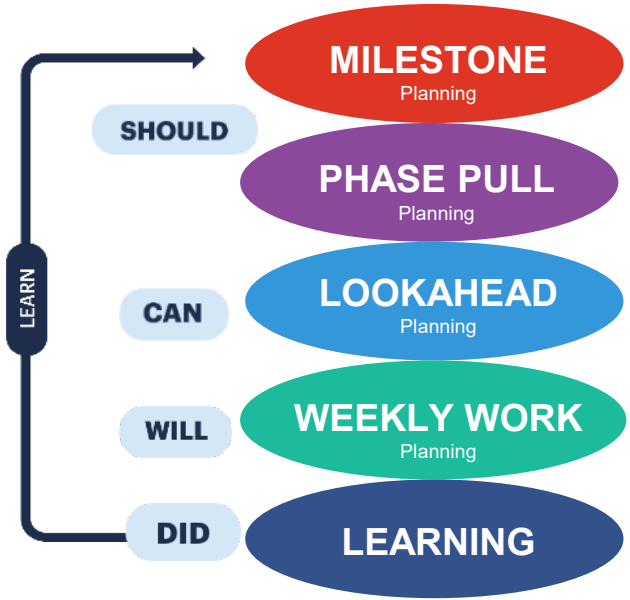
1. Why Last Planner System
2. LPS Overview
3. Milestone Planning
4. Phase Pull Planning
5. Lookahead Planning
6. Weekly Work Planning
7. Learning

5 Connected Conversations



Lean Journey to Mastery

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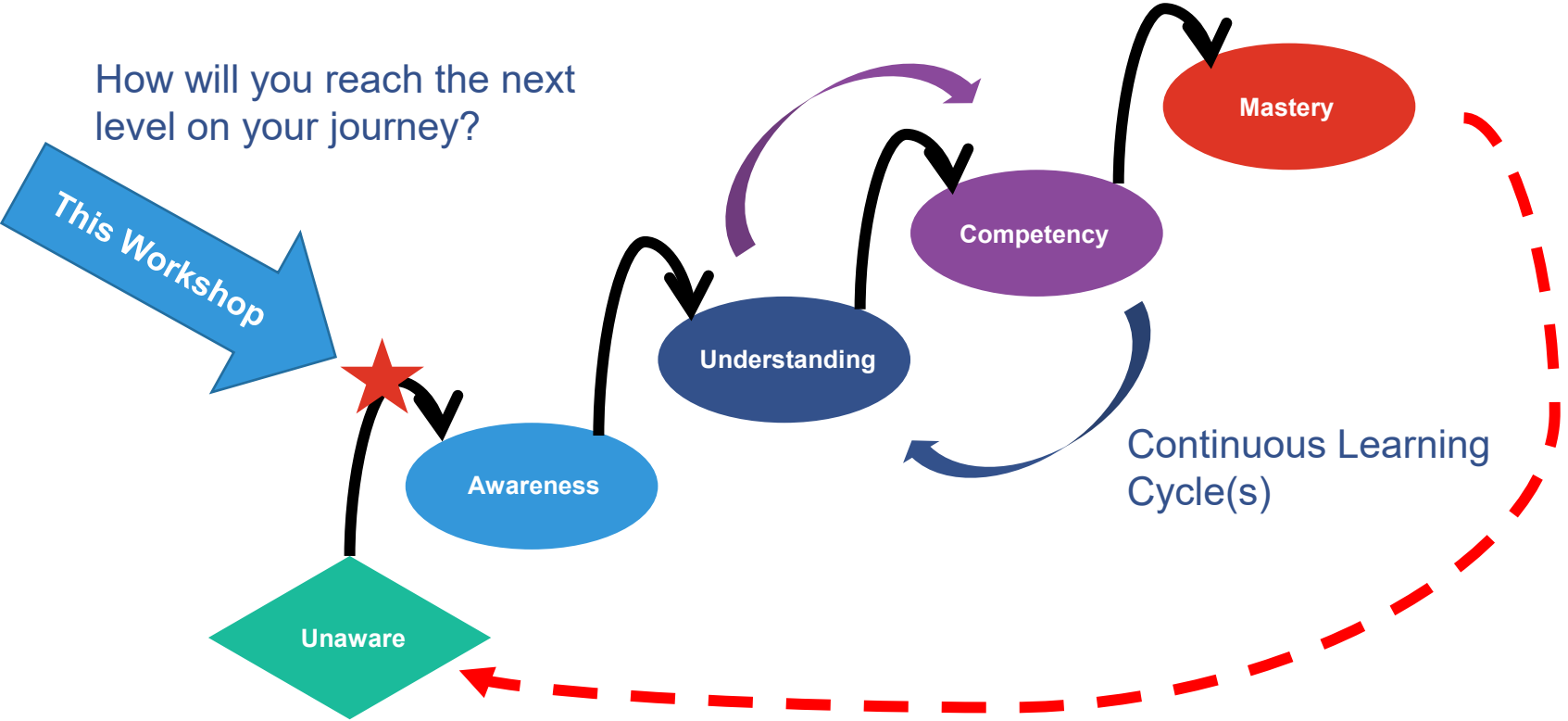

Discussion Question

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What are your dissatisfactions with the way projects are currently scheduled and planned?

Large Group Discussion 5 min

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Parade of Trades

Workflow: The Parade of Trades Exercise

Parade of Trades is a simulation to illustrate what is more important for advancing our work the most efficiently, smoothly, and safely with the highest productivity and highest quality.

What is more important on your project?

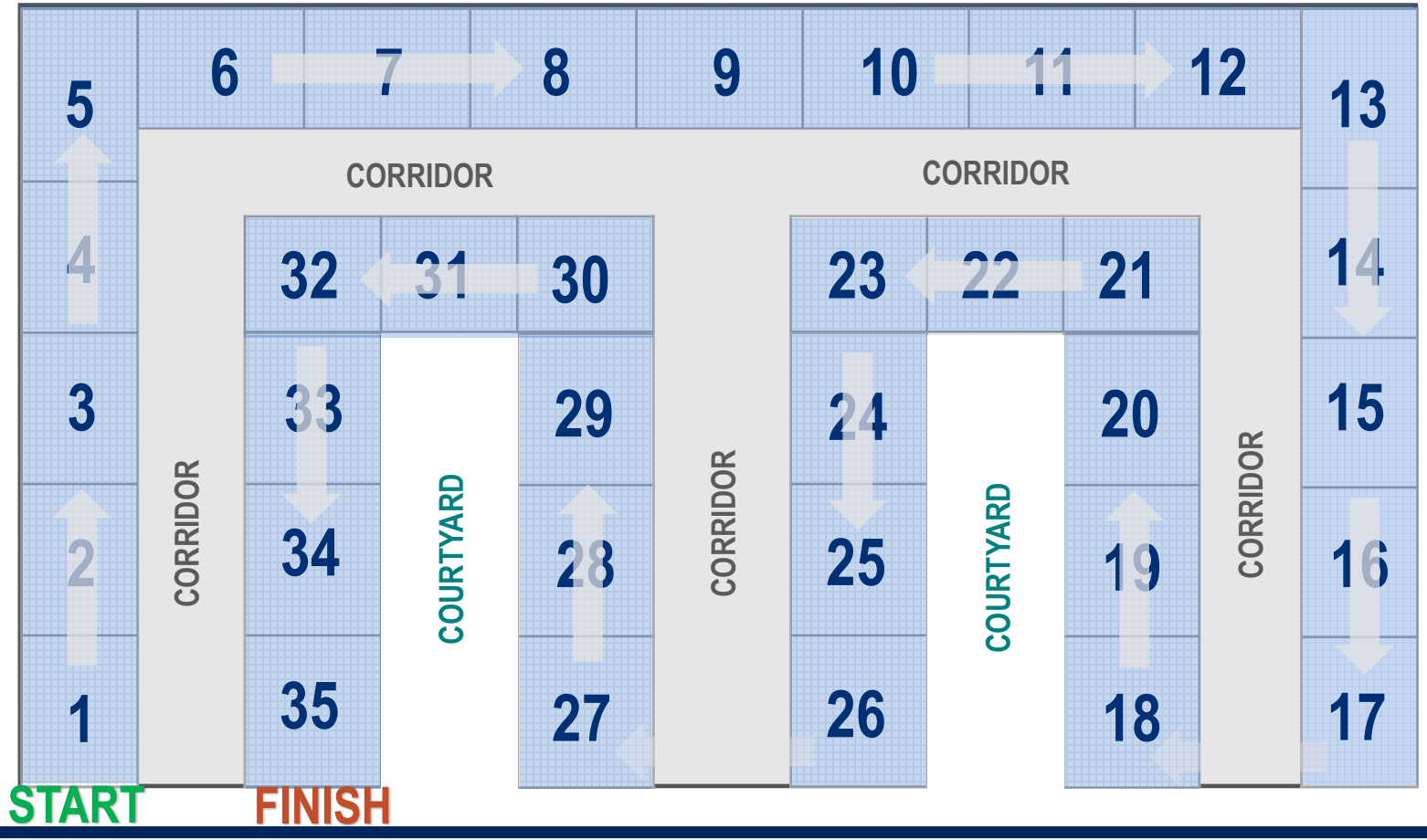
Point speed

Pushing each party on the project to go as fast as they can on each task

System reliability

Planning the work so that every handoff happens as it was promised

Scope of Work: 35 Classroom School Fit Out



Parade of Trades

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01. The building has 35 rooms.

02. There are seven trades.

03. Each trade has work in every room.

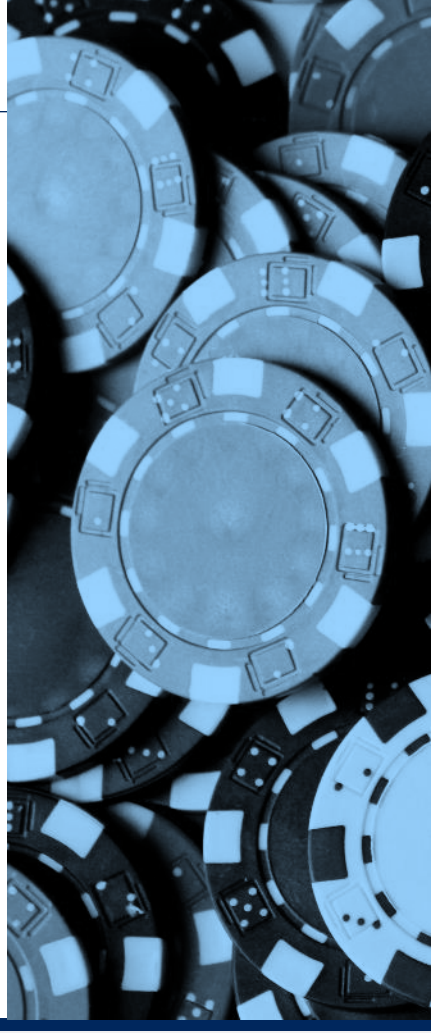
04. The work must be done in sequence, with each trade only able to work on those rooms that have been given to them by the previous trade.

05. The trades mobilize to the site one week apart.

Parade of Trades - Rules

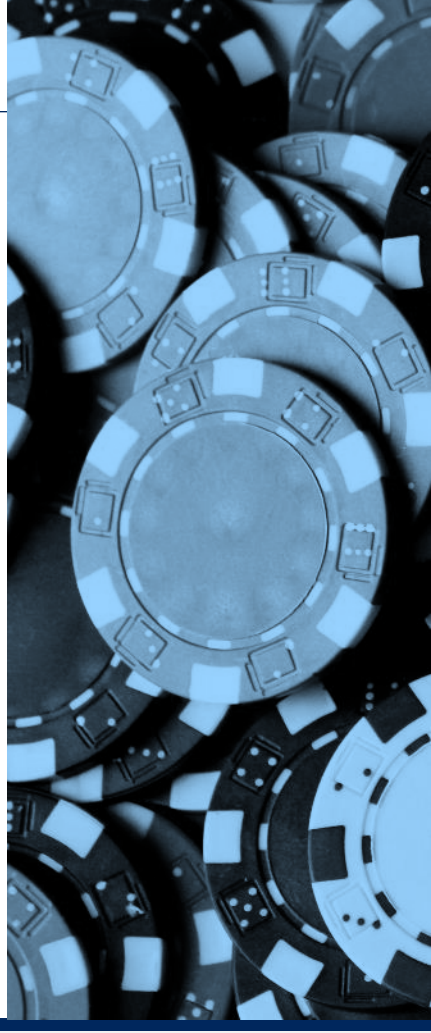
Rules:

1. Each chip represents one classroom. (There are 35 chips at the starting block.)
2. You roll the “die” to advance work to the next trade in line.
3. One roll equals one week’s worth of work.
4. Each dot on the “die” represents one unit (classroom).
5. The cost to complete one unit is $1K.



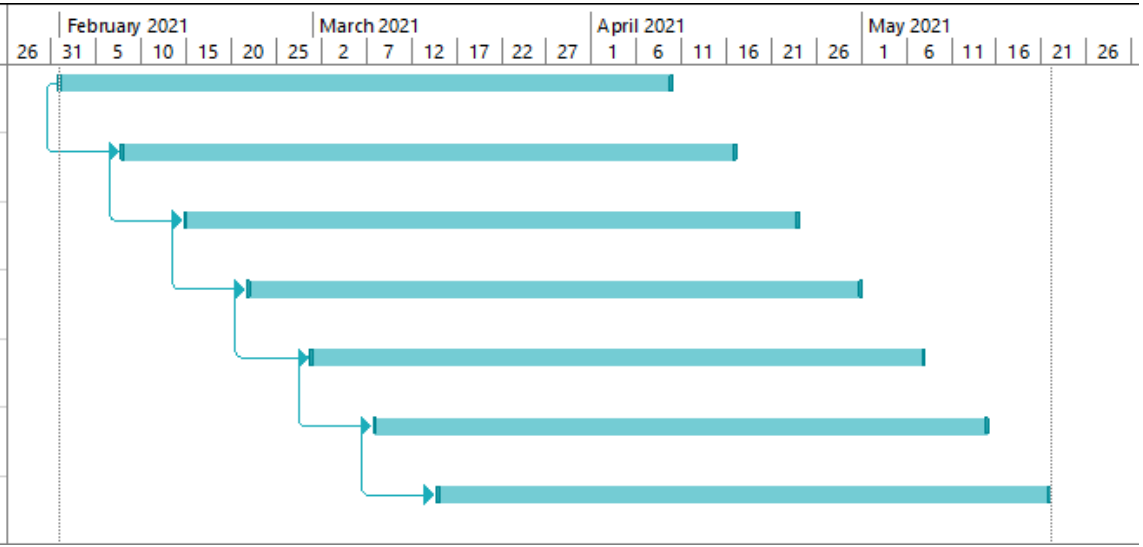
Scope of Work: In a Perfect World

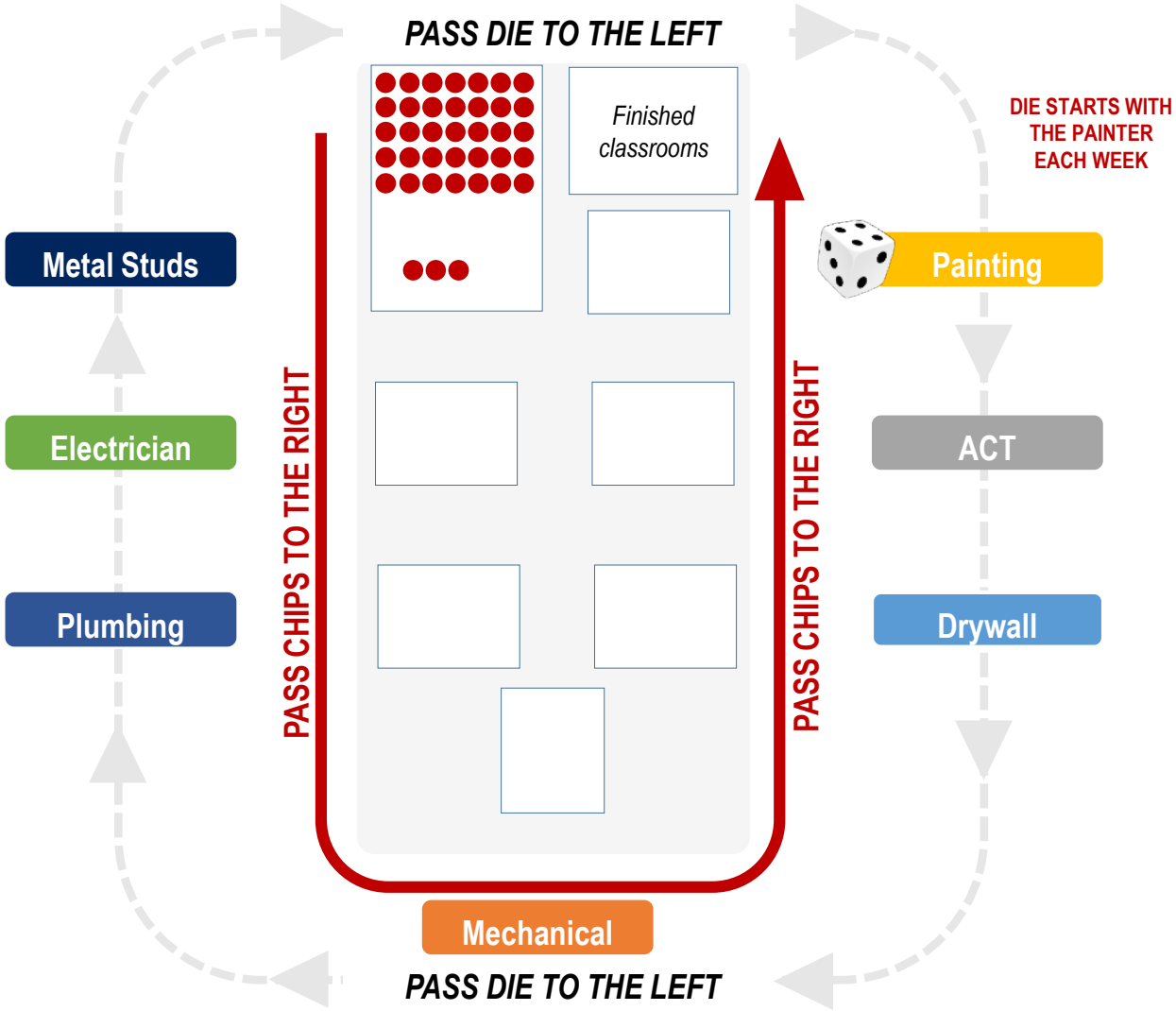
- What is the average roll on a die? (Your average capacity for a given week.)
  - 1+2+3+4+5+6 = 21 / 6 = **3.5 classrooms/week**
- How many weeks will it take each trade to finish their work in 35 classrooms?
  - 35 classrooms / 3.5 average classrooms per week = **10 weeks**
- How many weeks will it take all seven trades to finish 35 classrooms?
  - Trade one takes 10 weeks. The second trade should finish one week later (week 11), etc. **The seventh station finishes on Week 16.**



The Parade of Trades Workflow: Master Schedule

ID	Task Name	Duration	Start	Finish
1	Metal Studs/Insulation	50 days	2/1	4/9
2	Electrical	50 days	2/8	4/16
3	Plumbing	50 days	2/15	4/23
4	Mechancial	50 days	2/22	4/30
5	Gyp Board/Tape	50 days	3/1	5/7
6	ACT	50 days	3/8	5/14
7	Paint	50 days	3/15	5/21

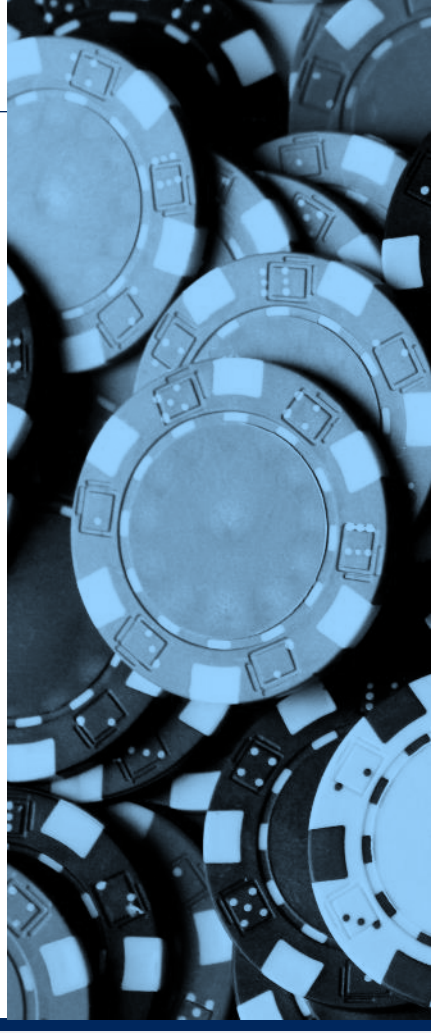



PASS DIE TO THE LEFT
Finished classrooms
DIE STARTS WITH THE PAINTER EACH WEEK
Metal Studs
Painting
Electrician
ACT
Plumbing
Drywall
PASS CHIPS TO THE RIGHT
PASS CHIPS TO THE RIGHT
Mechanical
PASS DIE TO THE LEFT

Scope of Work: In a Perfect World

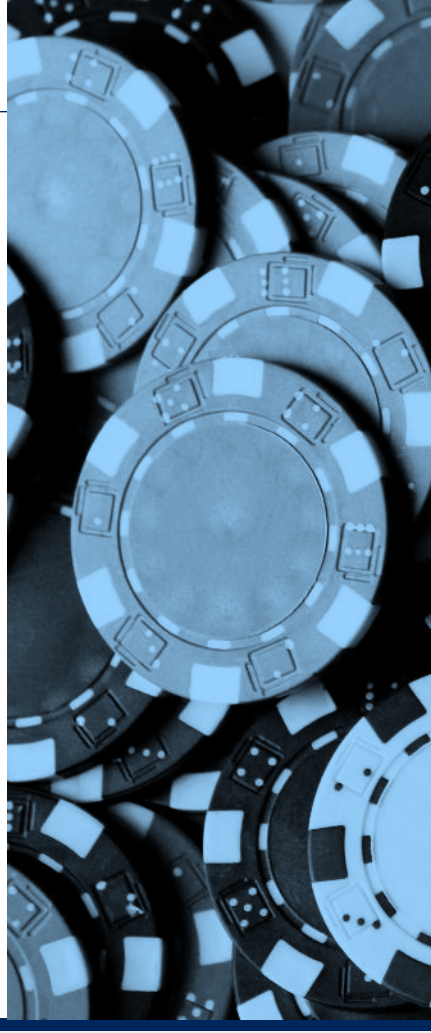
What Would You Bid?

- Ideally, how much capacity, or the sum of every trades' die rolls, is needed to finish?
  - Each trade completes an average of 3.5 rooms per week.
  - Each trade completes their work in 10 weeks.
  - Seven trades will each be working 10 weeks.
  - 3.5 roll x 10 weeks x seven trade = **245**
- If it costs us $1K per unit (classroom) x 245 = $245K, what would you add for profit?
  - Let's just say 15%.
  - Fifteen percent would be $37K + $245K = **$282,000.**



Scorecard

- Look at your scorecard and notice that it starts on the week you first show up to do the work.
  - For example, the “Plumbing” trade starts work on week 3, so plumbing does not have a week 1 or 2 on the scorecard. Therefore, they do not roll on weeks 1 and 2.
- For the first 7 weeks, your station number is the same as the number of the week in which you make your first roll.
  - Station 1: Metal Studs/Insulation starts rolling and rolls first in Week 1.
  - Station 2: Electrical starts rolling and rolls first in Week 2.
  - Station 3: Plumbing starts rolling and rolls first in Week 3.



Each Trade's First Week Onsite

Trade	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Metal Studs	First Roll	Roll	Roll	Roll	Roll	Roll	Roll
Electrical	No Roll	First Roll	Roll	Roll	Roll	Roll	Roll
Plumbing	No Roll	No Roll	First Roll	Roll	Roll	Roll	Roll
Mechanical	No Roll	No Roll	No Roll	First Roll	Roll	Roll	Roll
Drywall	No Roll	No Roll	No Roll	No Roll	First Roll	Roll	Roll
ACT	No Roll	No Roll	No Roll	No Roll	No Roll	First Roll	Roll
Paint	No Roll	No Roll	No Roll	No Roll	No Roll	No Roll	First Roll

PARADE OF TRADES

WEEK:

1

TRADE:

Metal Studs

ROLL:

PASS DIE TO THE LEFT

DIE STARTS WITH THE PAINTER EACH WEEK: Painter says; *"starting week 1"*

Metal Studs

Electrician

Plumbing

Finished classrooms

PASS CHIPS TO THE RIGHT

PASS CHIPS TO THE RIGHT

Painting

ACT

Drywall

Mechanical

PASS DIE TO THE LEFT

Filling Out the Trade Scorecard
Example for Week 1: Metal Studs/Insulation

Metal Studs

35

"Available" Work

Week	A Capacity B	Passed	C Remaining inventory
	Number on die you rolled	*Number of chips you can pass*	*Available chips minus chips passed*
1	3	3	32
2			

35 minus 3 = 32

A. Capacity: the number of classrooms your crew could complete in that week
B. Passed: the number of classrooms you completed in the given week and made ready for the next trade
C. Remaining inventory: the number of classrooms you were not able to complete in that week

PARADE OF TRADES

WEEK:

2

TRADE:

Electrician

ROLL:

PASS DIE TO THE LEFT

DIE STARTS WITH THE PAINTER EACH WEEK

Finished classrooms

Metal Studs

Electrician

Plumbing

Painting

ACT

Drywall

Mechanical

PASS CHIPS TO THE RIGHT

PASS CHIPS TO THE RIGHT

PASS DIE TO THE LEFT

Filling Out the Trade Scorecard
Example for Week 2: Electrical

Electrical

3*

"Available" Work

** 3 came from Metal Studs done week #1*

Week	A Capacity B	Passed	C Remaining inventory
	Number on die you rolled	*Number of chips you can pass*	*Available chips minus chips passed*
1	*No roll*	*pass the*	*die left*
2	2	2	*3 minus 2 = 1* 1

A. Capacity: the number of classrooms your crew could complete in that week
B. Passed: the number of classrooms you completed in the given week and made ready for the next trade
C. Remaining inventory: the number of classrooms you were not able to complete in that week

PARADE OF TRADES

WEEK:

2

TRADE:

Metal Studs

ROLL:

PASS DIE TO THE LEFT

DIE STARTS WITH THE PAINTER EACH WEEK

Finished classrooms

Metal Studs

Painting

Electrician

ACT

PASS CHIPS TO THE RIGHT

PASS CHIPS TO THE RIGHT

Plumbing

Drywall

Mechanical

PASS DIE TO THE LEFT

Filling Out the Trade Scorecard
Example for Week 2: Metal Studs/Insulation

Metal Studs

32

"Available" Work

Week	A Capacity	B Passed	C Remaining inventory
	Number on die you rolled	*Number of chips you can pass*	*Available chips minus chips passed*
1	3	3	32
2	4	4	*32 minus 4 = 28* 28

A. Capacity: the number of classrooms your crew could complete in that week
B. Passed: the number of classrooms you completed in the given week and made ready for the next trade
C. Remaining inventory: the number of classrooms you were not able to complete in that week

PARADE OF TRADES

WEEK:

3

TRADE:

Plumbing

ROLL:

PASS DIE TO THE LEFT

Finished classrooms

PAINTER SAYS: *"Starting week 3"*

Metal Studs

Painting

Electrician

ACT

Plumbing

Drywall

PASS CHIPS TO THE RIGHT

PASS CHIPS TO THE RIGHT

Mechanical

PASS DIE TO THE LEFT

Execute the Work: Filling Out the Trade Scorecard
Example for Week 3: Plumbing

What happens if you roll more than the number of chips you have available?

Plumbing

2*

"Available" Work

*2 came from Electrical week # 2

Week #	A Capacity	B Passed	Remaining Incoming Inventory
	Number on die you rolled	*Number of chips you can pass*	*Available chips minus chips passed*
1	*No roll*	*pass the*	*die left*
2	*No roll*	*pass the*	*die left*
3	5	2	*2 minus 2 = 0* 0

Round One: Go Slow at First!

- Your coach will help you fill in the scorecard correctly.
- Each box and each column must be filled in with a number.
- Follow your coach's directions.

START ROLLING!!

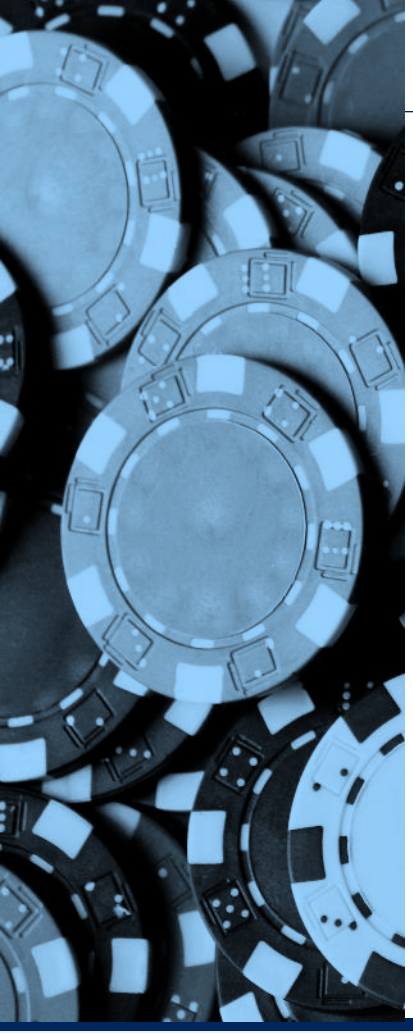
ROLE PLAYING – Biggest Pile of Chips

1. At this point, who has the most chips waiting to pass at your table?
2. How many chips does this person have and which trade are they?
3. Ask for a volunteer to play the role of the superintendent
   - You can see this trade has a big pile of classrooms that need to be worked on and they are not making any progress.
   - As a superintendent, what would you tell this trade that they must do to catch up?
   - *Instructor record the things a Superintendent would say*

Round One: Go Slow at First!

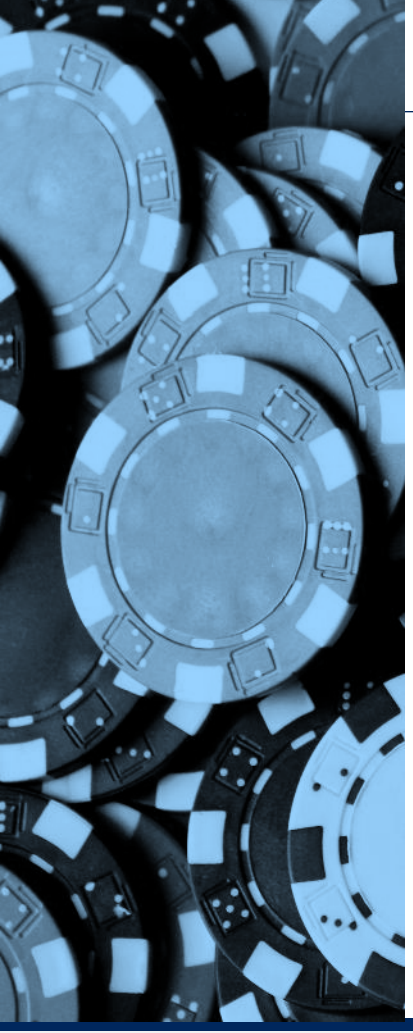
- Roll until all the chips are in the painter's done pile.

CONTINUE ROLLING!!



Final Results: Round One

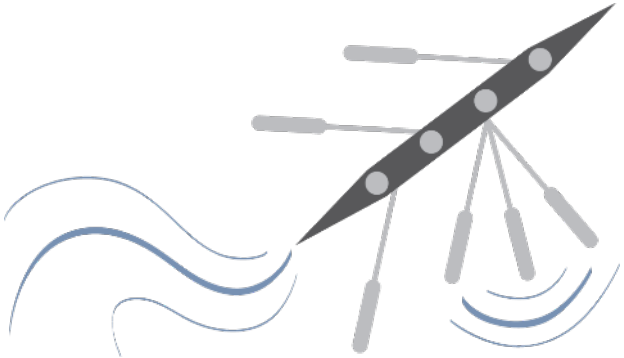
1. Did we finish on time?
   A. Complete all classrooms by week 16 per our baseline schedule.
2. Did we make money?
   A. Our team's ideal capacity was 245. total of 7 trades average roll
   B. We bid $282 K ($1,000 per dot on die + 15% profit).
   C. What was your profit or was there a loss?
3. Did anyone win?
4. What, or who was the problem?



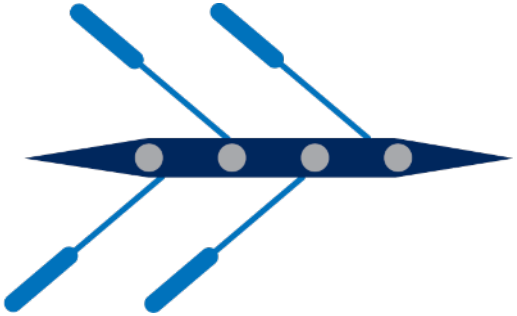
Execute the Work: Final Results: Round One

- Which boat are we in this round - the boat on the left or on the right?

Individual Efficiency
= Sub-optimization



System Efficiency
= Optimal Value Stream Performance



"Slow is Smooth. Smooth is ***Fast***"

BREAK #1 - 7 minutes

Round Two: Experiment to Improve The Results

- Keeping the average of the die the same, how might we modify the die, so we roll to reduce variance?

CURRENT DIE

1 + 2 + 3 + 4 + 5 + 6 = 21 / 6 = 3.5 avg. roll

ROUND 2 DIE

3 + 3 + 3 + 4 + 4 + 4 = 21 / 6 = 3.5 avg. roll

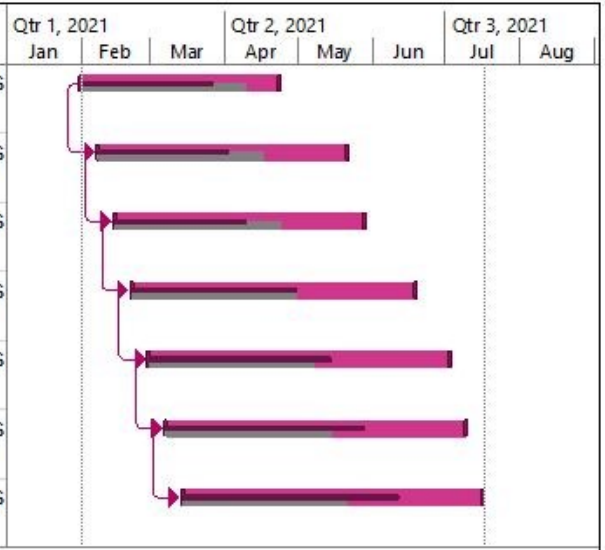
- To continue with ROUND 2, we will only roll 3s and 4s
  - Every time you roll a 1, 2, or 3 it will be logged as a 3.
  - Every time you roll a 4, 5, or 6 it will be logged as a 4.

The roles for Round 2 are changed and are shown on the Miro Board

Final Results: Round Two

- Did we finish on time?

ID	Task Name	Start	Finish	Baseline Start	Baseline Finish	Start Var.	Finish Var.
1	Metal Studs/Insulation	2/1	4/23	2/1	4/9	0 days	10 days
2	Electrical	2/8	5/21	2/8	4/16	0 days	25 days
3	Plumbing	2/15	5/28	2/15	4/23	0 days	25 days
4	Mechancial	2/22	6/18	2/22	4/30	0 days	35 days
5	Gyp Board/Tape	3/1	7/2	3/1	5/7	0 days	40 days
6	ACT	3/8	7/9	3/8	5/14	0 days	40 days
7	Paint	3/15	7/16	3/15	5/21	0 days	40 days

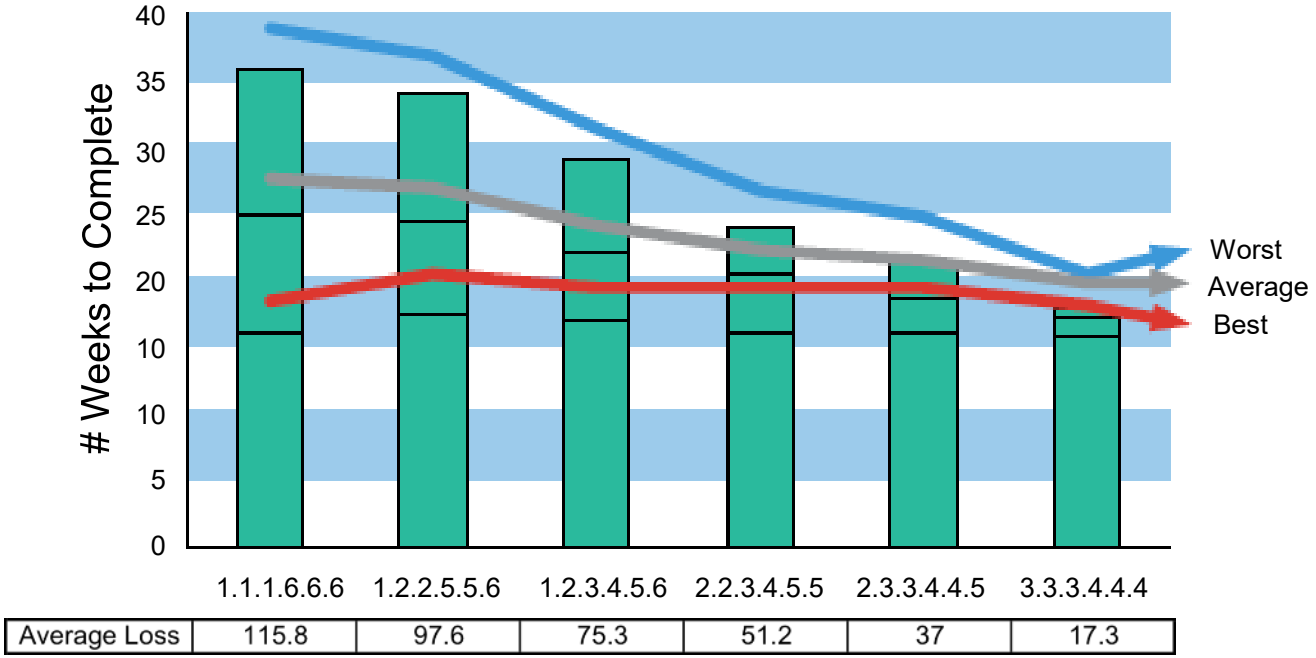


This is the actual results comparing the baseline schedule to actual results of Round 1 during the 9/15/2021 lean workshop

REFLECTION

1. Which die do you think best represents how our jobs are typically run: round 1 or 2?
2. Which die would you rather use: round 1 or 2?
3. Which die is more likely to have a safety issue: round 1 or 2? Why?
4. Which die is more likely to have quality issues: round 1 or 2?
5. Can we have all four business fundamentals?
6. When we had a pile of classrooms available, the superintendent made some suggestions/requests. Which die did the we give to the trade with the biggest pile of backlog: Round 1 die? Or round 2 die?
7. Is GC superintendent the only one that must focus on managing work in a way that the job is rolling 3's & 4's

Results



Average Loss	115.8	97.6	75.3	51.2	37	17.3

Discussion Question

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What would be the specific advantages of improved work flow reliability on your projects?

Group discussion 10 min

Six Tenets of Lean

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

Last Planner System Trademark

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The Last Planner System® is a registered trademark of the *Lean Construction Institute*:

- Last Planner System®
- LPS®
- Last Planner® (In reference to the person not the system)

The Opportunity…

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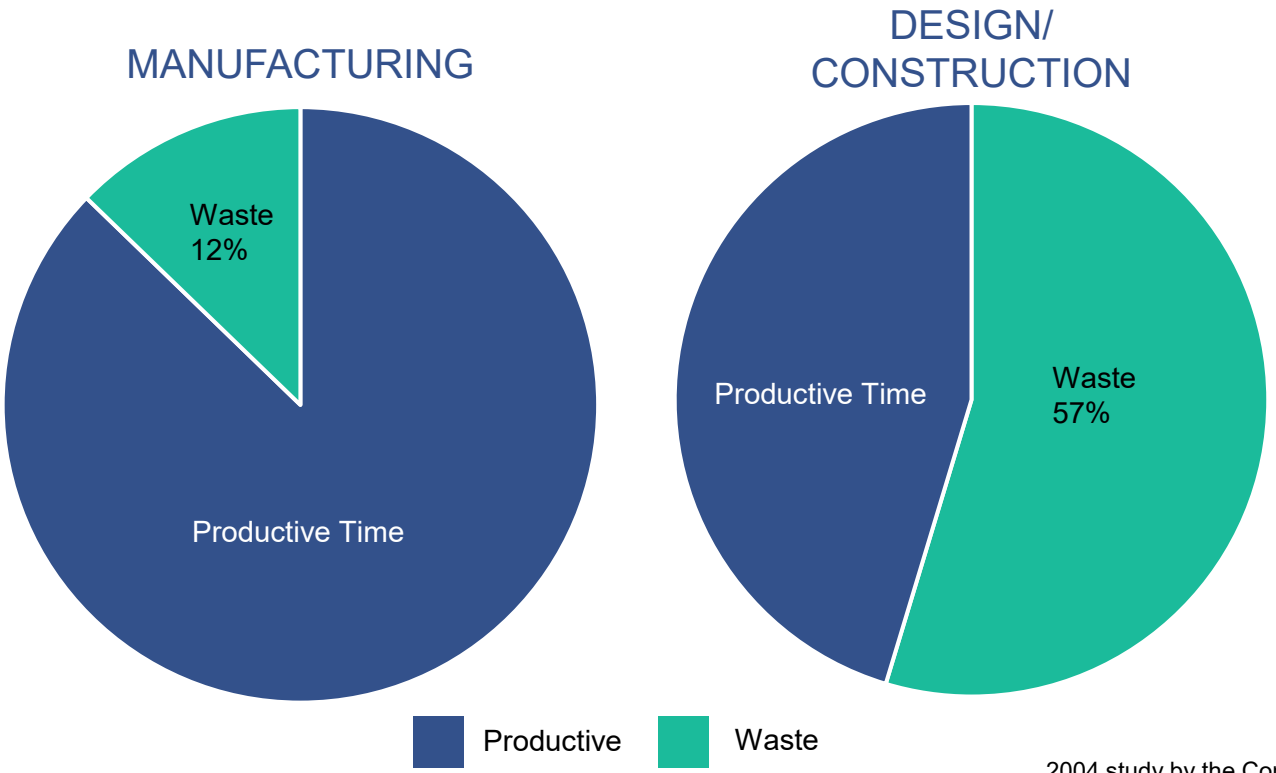

2004 study by the Construction Industry Institute

Why Use Last Planner System?

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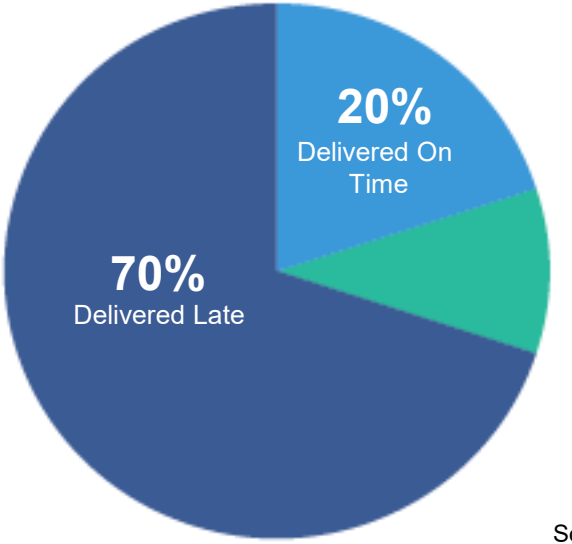
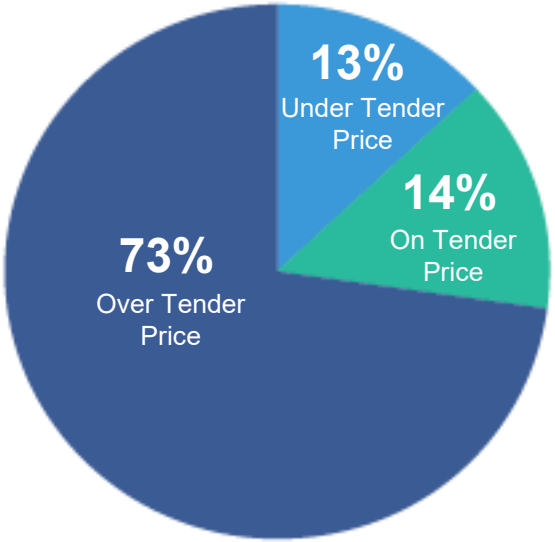
Time —
70% were delivered late



10%
Delivered Early

Cost —
73% were over budget



Source: Benchmarking the Government Client Stage Two Study December 1999

Brief History of LPS – How reliable are we?

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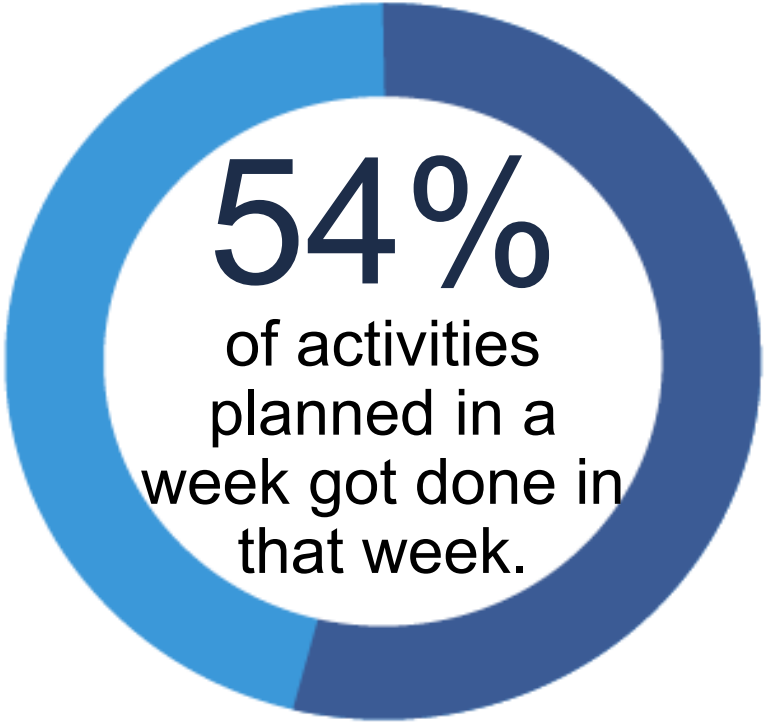

Correlation of Lean

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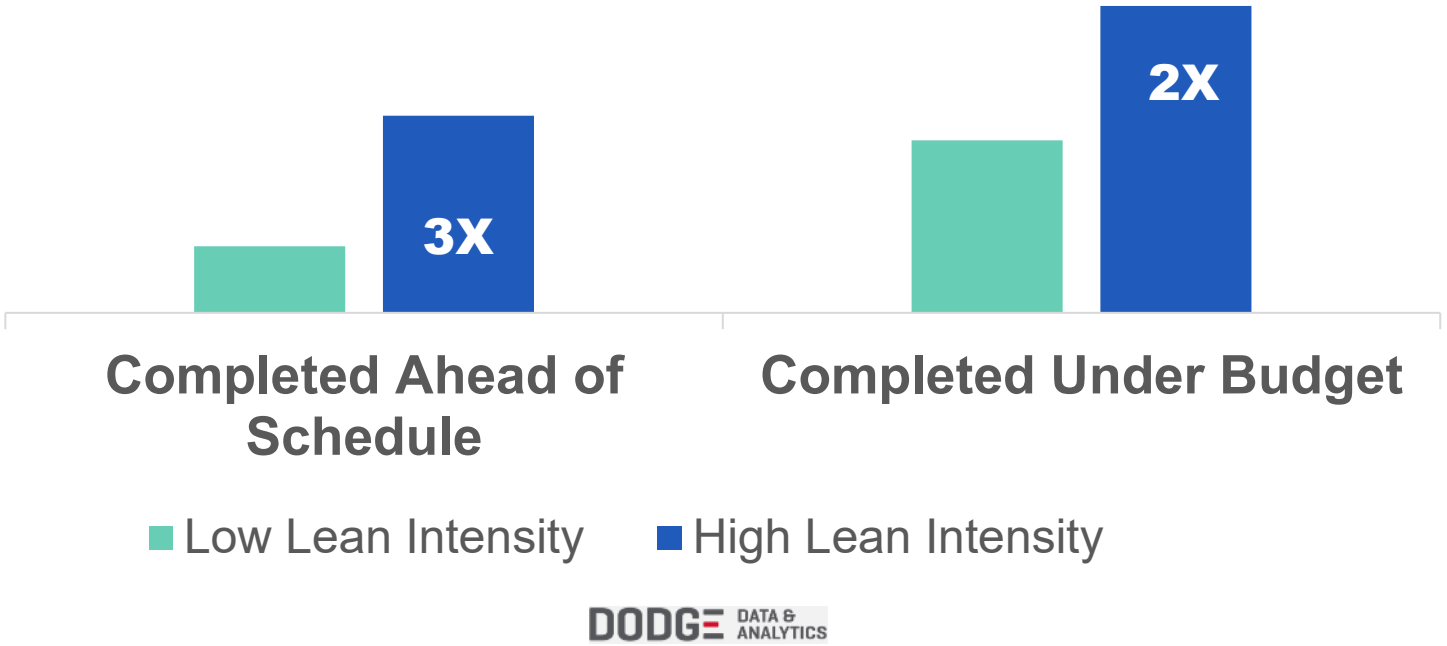
Correlation of Lean intensity to outcomes (% likelihood on best projects)



Workflow and Risk

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1. Workflow losses are real, lead to adversarial relations, and are difficult to quantify, so…
2. Everyone protects themselves by adding contingency and/or holding back labor to keep utilization high.
3. This further reduces workflow predictability and increases project risk
4. By their/our actions, we increase that risk and shift it along.

Last Planner System Defined

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- Production planning system
- Predictable work flow
- Rapid learning in
- Programming, design, construction and commissioning of projects.

Why Status Quo Isn't Working

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

Benefits

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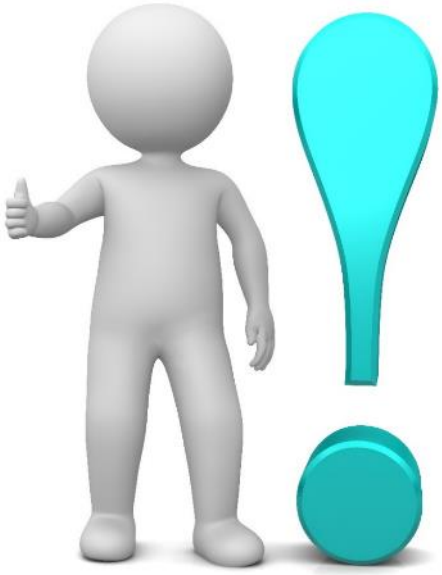
1. Improves communication & reliability.
2. Fosters an enjoyable environment, trust, and collaboration.
3. Promotes early stakeholder engagement.
4. Improves visibility of the project plan (transparency).
5. Creates team alignment.
6. Rapid learning through metrics, revealing areas for improvement.
7.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



Consider the Project As A Promise

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- All groups can be viewed as operating as a *network of promises* or commitments, whether done well or poorly.
- The goal is *improving the quality* of commitments and to *actively take responsibility* for managing them.
- LPS is a planning system based on developing a *network of promises*, then delivering on the commitments.

Elements Of A Promise

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- *The Customer:* The person making the request.
- *The Performer:* The person fulfilling the request.
- *Negotiated Conditions of Satisfaction (CoS):*
  - Are part of the language act of making a promise.
  - Are developed by the people involved in the request and promise.
  - Are mutually agreed to, measurable statements, that help to define the success of the project.
  - Inform the decision-making process.
  - Include a time frame.

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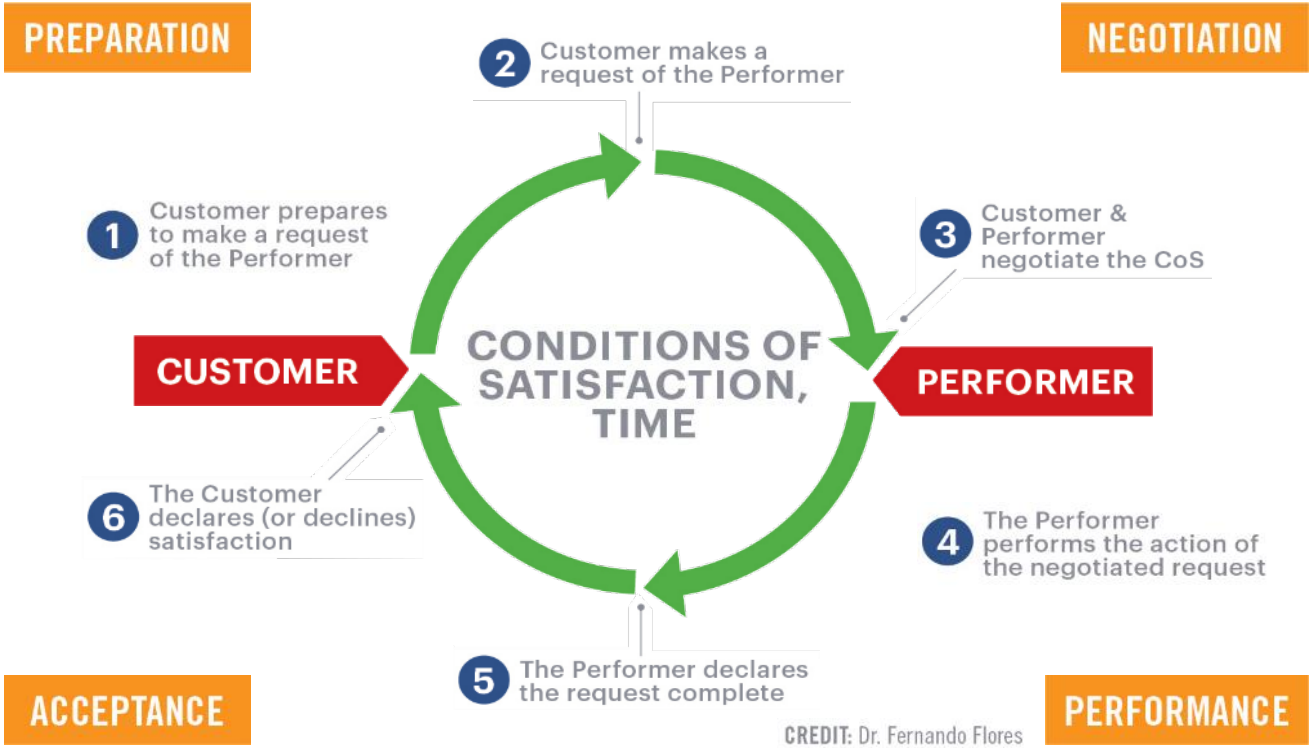
Basic Action Workflow Of A Promise



5 Connected Conversations Of LPS

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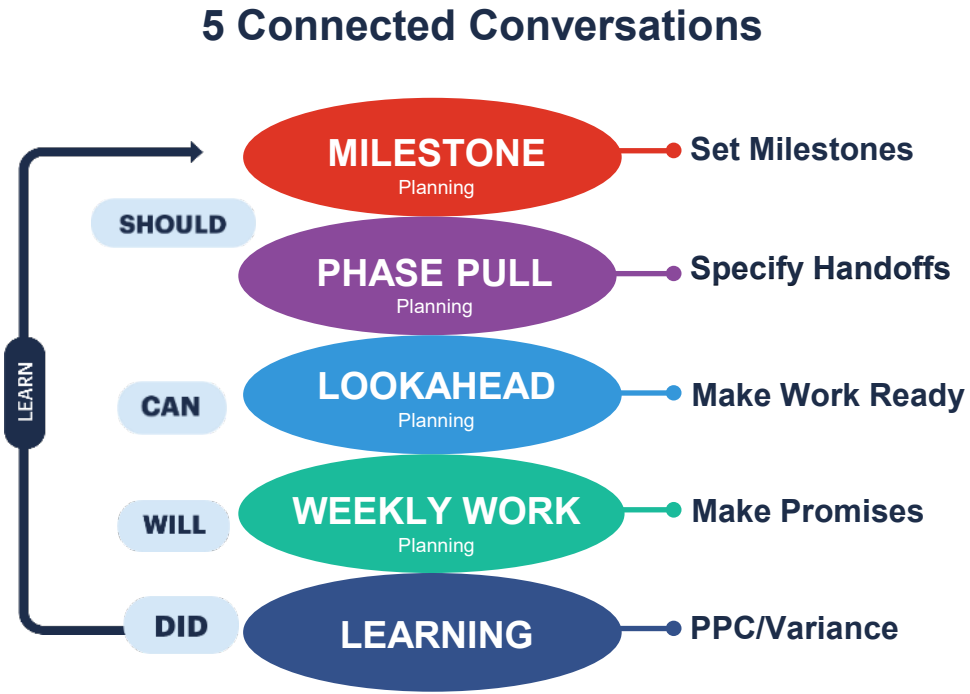
The LPS is a commitment-based system integrating 5 connected planning conversations:

1. Milestone Planning (Should)
2. Phase Pull Planning (Should)
3. Lookahead Planning (Can)
4. Weekly Work Planning (Will)
5. Learning (Did/Learn)



Last Planner System Overview

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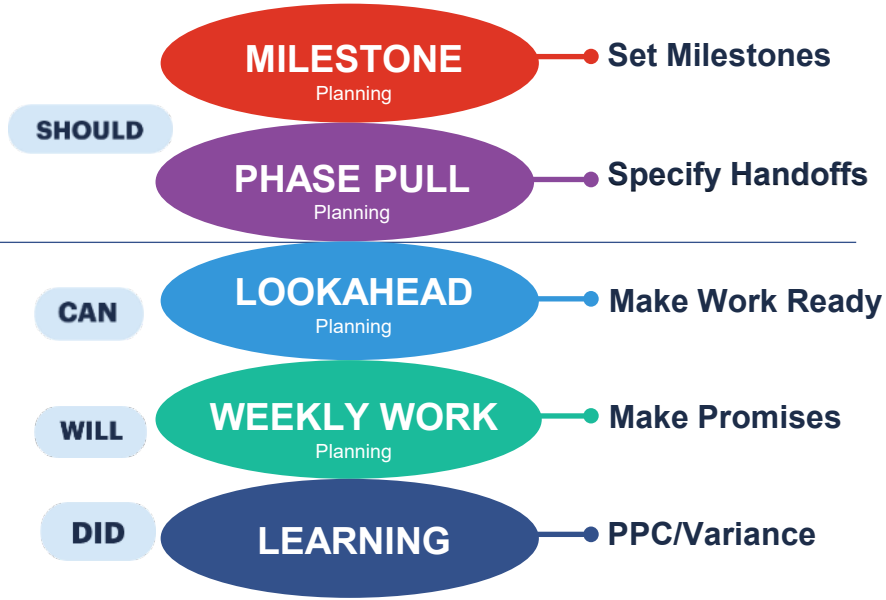
Collaborative Planning

As - Needed

Work Management
Continuous Improvement

Weekly

5 Connected Conversations



System Defined

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A system is a group of interacting or interrelated entities that form a unified whole.

System for Planning

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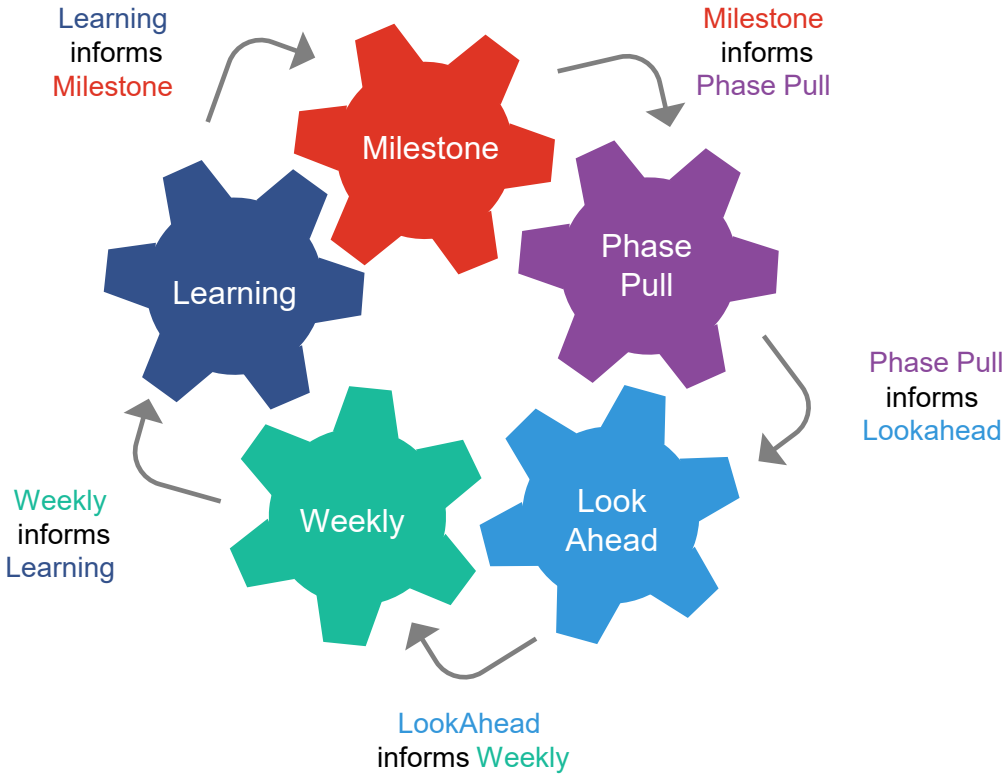

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Continuous Improvement

Lean thinking demands a mindset of continuous improvement.

This requires an environment where we can discuss what's not working well and find fixes.

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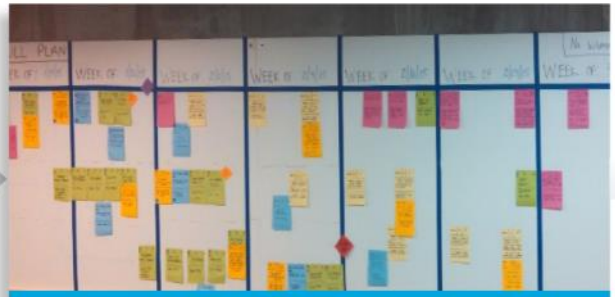
Last Planner System Flow

MILESTONE PLAN

PHASE PULL PLANNING



LOOKAHEAD PLANNING

WEEKLY WORK PLANNING

DAILY HUDDLE

Last Planner System Overview

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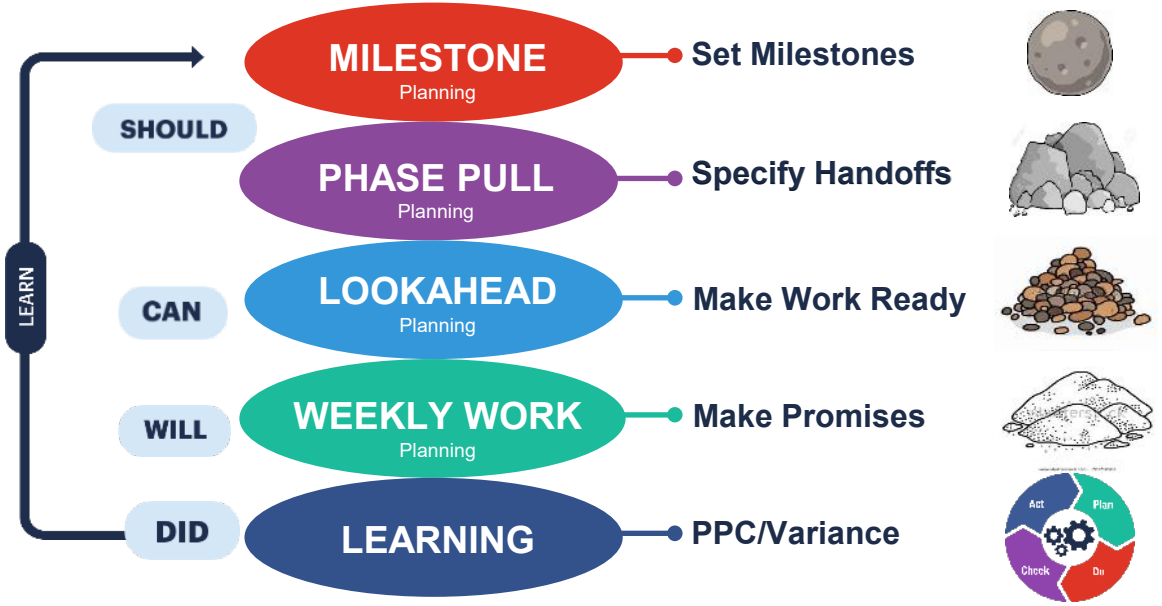
5 Connected Conversations



Who Is The Last Planner

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The *Last Planner* is the person closest to work with authority to make decisions regarding the schedule and to make reliable commitments to complete the work of their discipline.

This may include the lead architect or project manager, the lead engineer, owner's project representative and the constructors as appropriate.

Last Planners

Milestone Planning

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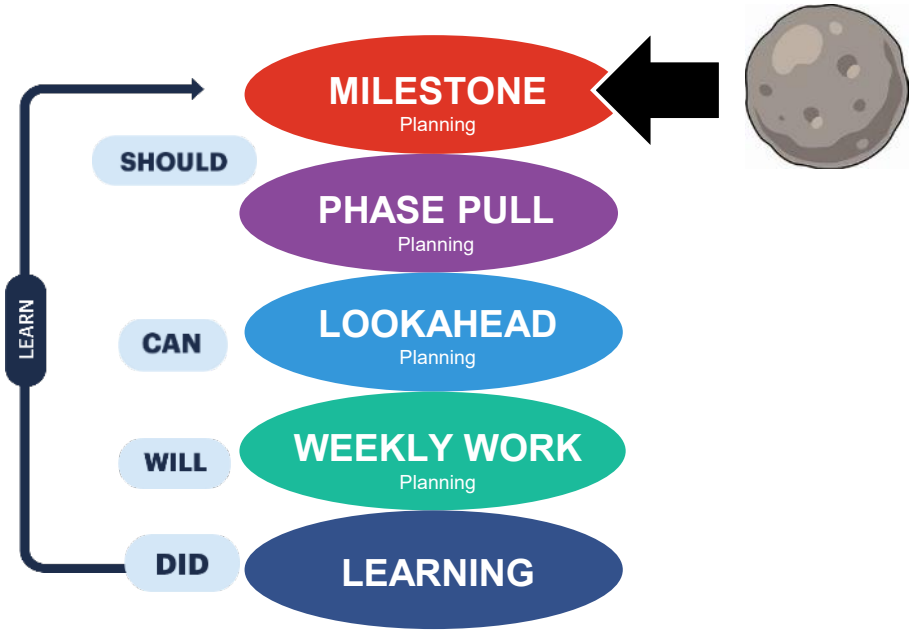
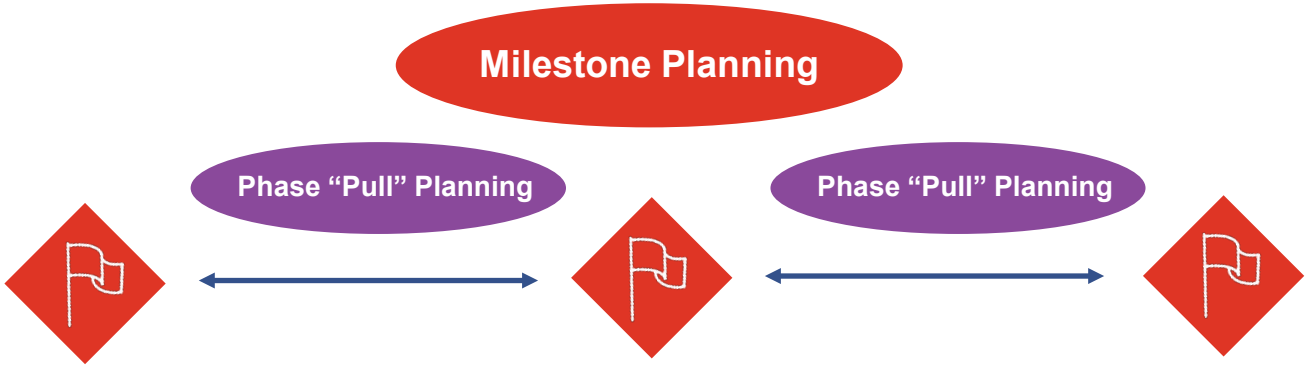
The first conversation of LPS is *Milestone Planning*.

The goal of Milestone Planning is for the team to align on and *set the milestones* for the project.

This starts the we *"should"* be able to do conversation.

5 Connected Conversations





Define the overall road map and gain alignment

Identify milestones important to client and stakeholders – especially immovable dates

Informs the Phase Pull Planning

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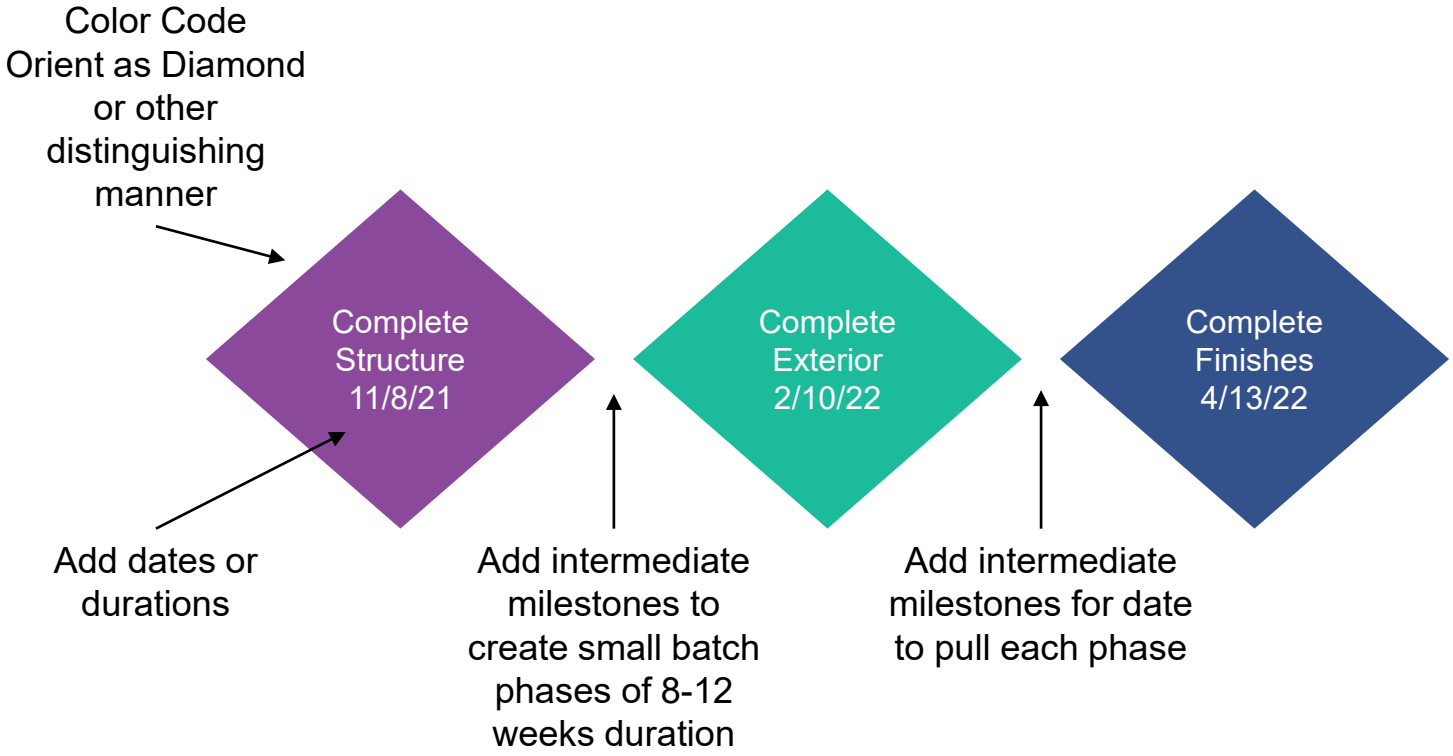
Milestone Planning Example Tag



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Milestone Planning Example Tag

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Milestone Planning Example Tag

Creating The Milestone Plan

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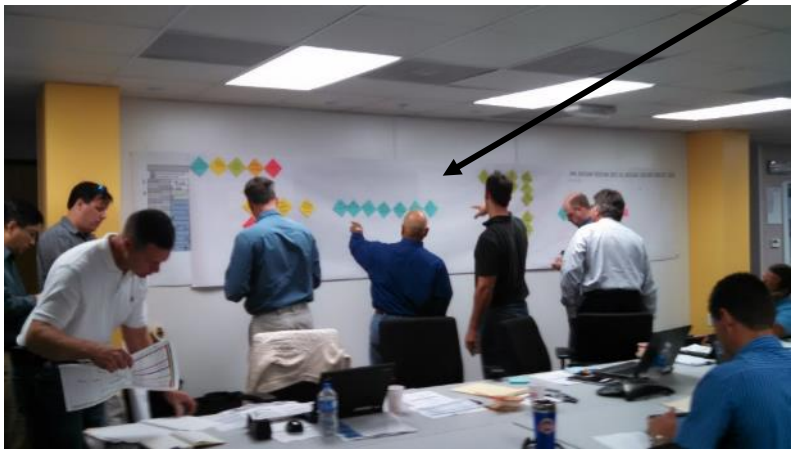
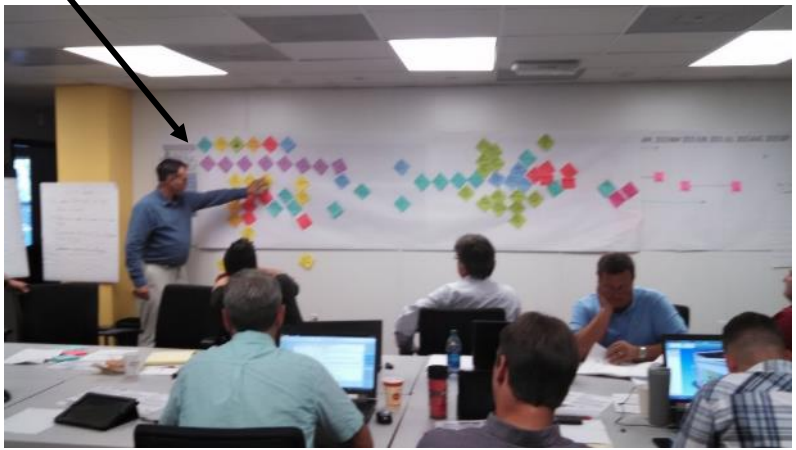
Developing the milestones to structure the flow. The next step will to add estimated durations.



Collaboratively creating the plan

Color coding for different aspects of the plan, i.e. design, approval processes, key decisions, construction, turnover, activation.



Reviewing the plan

Courtesy of: InsideOut Consulting

Creating The Milestone Plan

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Developing the milestones to structure the flow.
The next step is to add estimated durations.

Courtesy of : The ReAlignment Group of California

Phase Pull Planning

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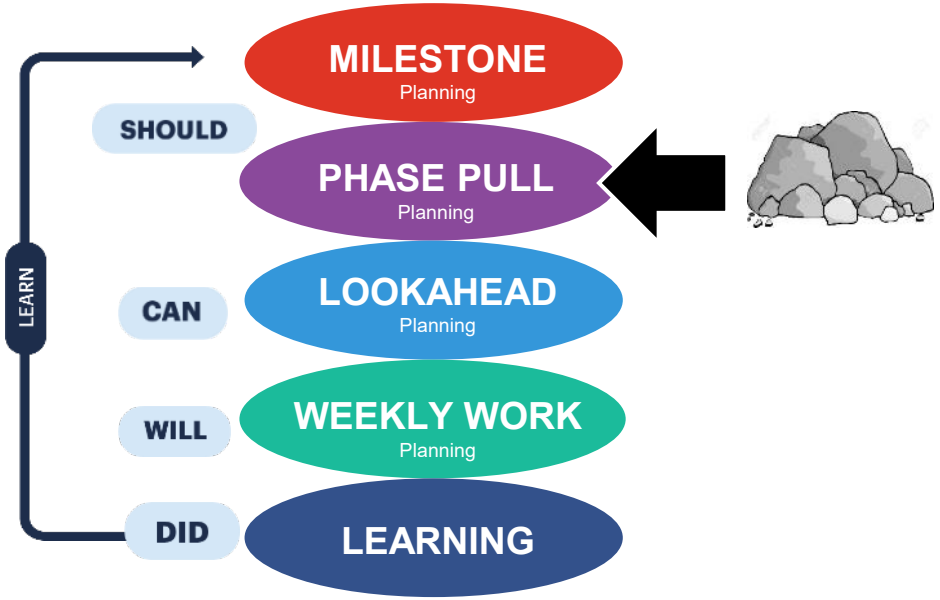
The second conversation of LPS is *Phase Pull Planning.*

The goal of Phase Pull Planning is for the team to determine the key ***handoffs*** of work or information needed to deliver a milestone.

This continues the we *"should"* be able to do conversation.

5 Connected Conversations



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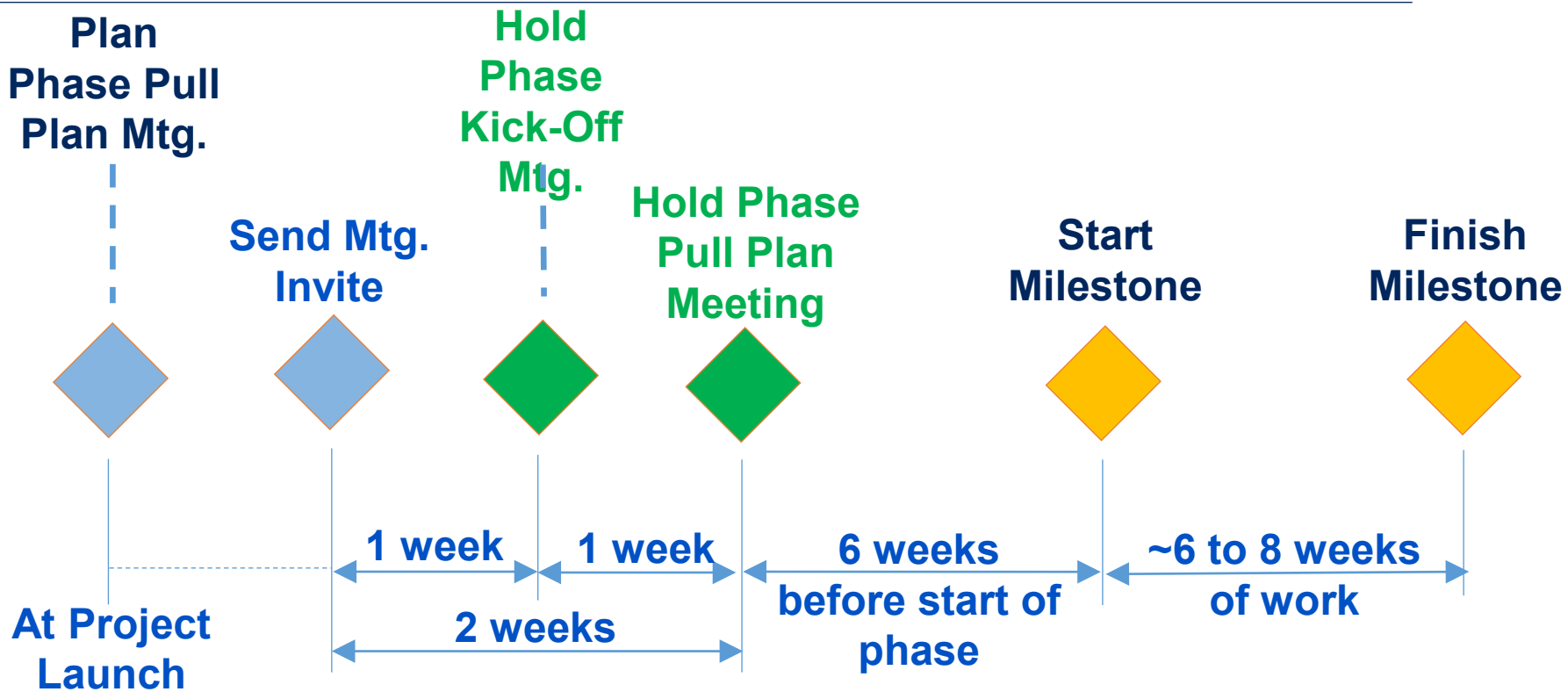
Courtesy of : PCL

- Phase of the work (~6 - 8 weeks)
- Informed by the Milestone Plan
- Work out the structure and durations
- After – add dates and transfer to the Look Ahead Plan

Guideline: When to Hold a Pull Plan Session



* *Adjust these durations based on award from customer & buy-out timeline*

BREAK #2 - 7 minutes

Define Milestones – Included and Excluded Table

START: Begin Building Foundations
FINISH: Ready for Slab-on-Grade

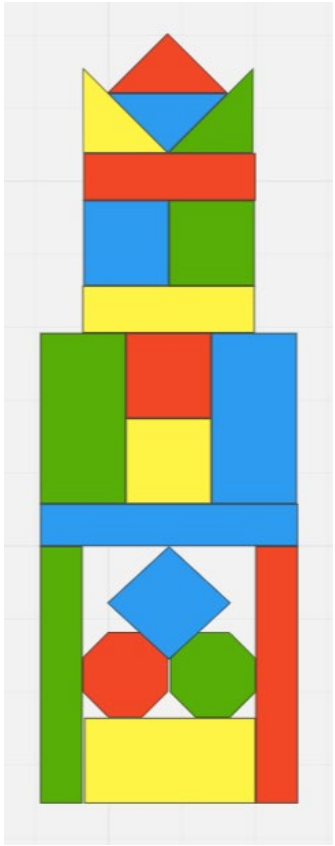
Included in this phase:	
1	Building Pad Certification and Survey Control/Building Corners
2	Excavation and Backfill of Site Utilities and Under Slab MEPF utilities
3	Off-Haul of Excavation Spoils
4	Waterproofing at Elevator Pit
5	Electrical and Plumbing sleeves through grade beams

Excluded from this phase:	
1	Utility Trench: West Road (completed)
2	Curtain wall imbeds: A-line (between 3-line and 12-line) (future phase)
3	Central Utility Plant Foundations (future)
4	Transformer Pad and Trash Enclosure (future)
5	Sector ‘C’ tie-in to existing building(future)

Make a Plan to Build This Tower

Collaborate to make a plan to build this tower using “pull.”

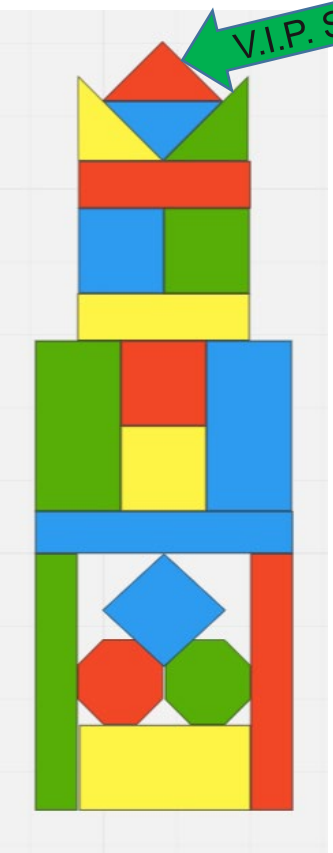
1. Make a plan to build this tower using PULL.
2. Check for quality.



Block Color Legend:

R = Red
B = Blue
G = Green
Y = Yellow

Follow This Example (First Two Tags)



TASK

Red triangle install

1

Blue triangle install

FINISH MILESTONE

Owner ready to move into the VIP suite at top of tower

Red triangle install (The V.I.P. Suite)

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Push vs. Pull

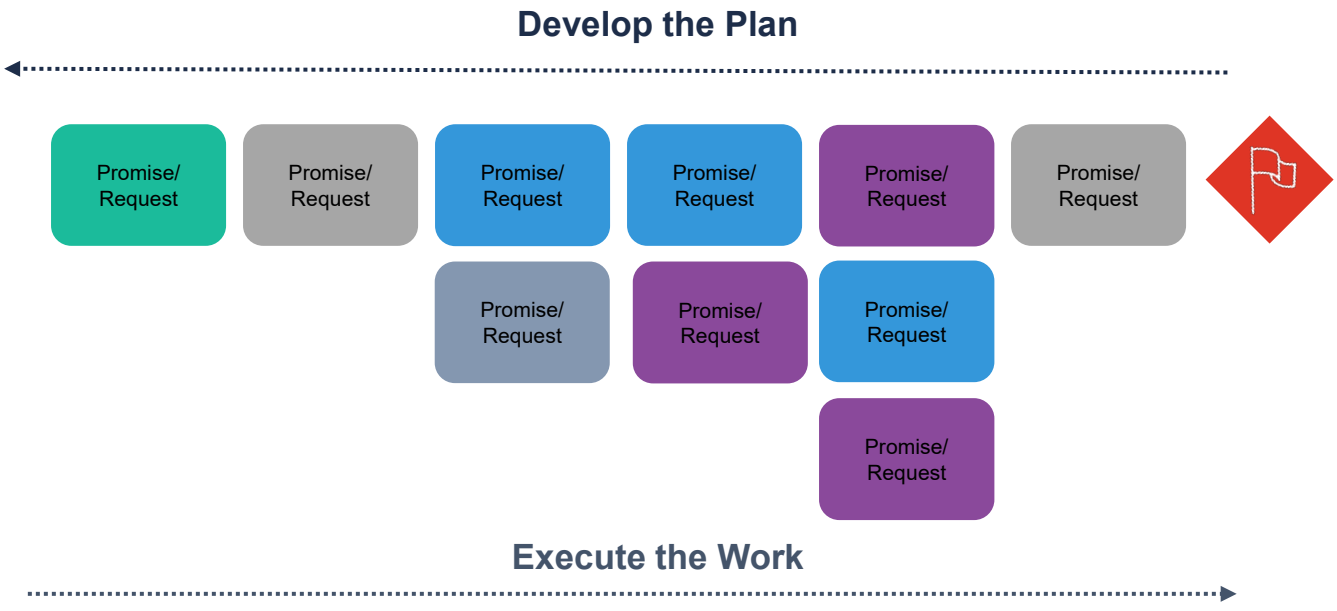
Push:

- Advancing work based on central schedule.
- Releasing materials, information, or directives possibly according to a plan, but irrespective of whether or not the downstream process is ready to process them.

Pull:

- Advancing work when the next in line customer is ready.
- A “Request” from the customer signals that the work is needed and is “pulled” from the performer.

Pull: Creating Flow



Phase Pull Planning: Example Tag

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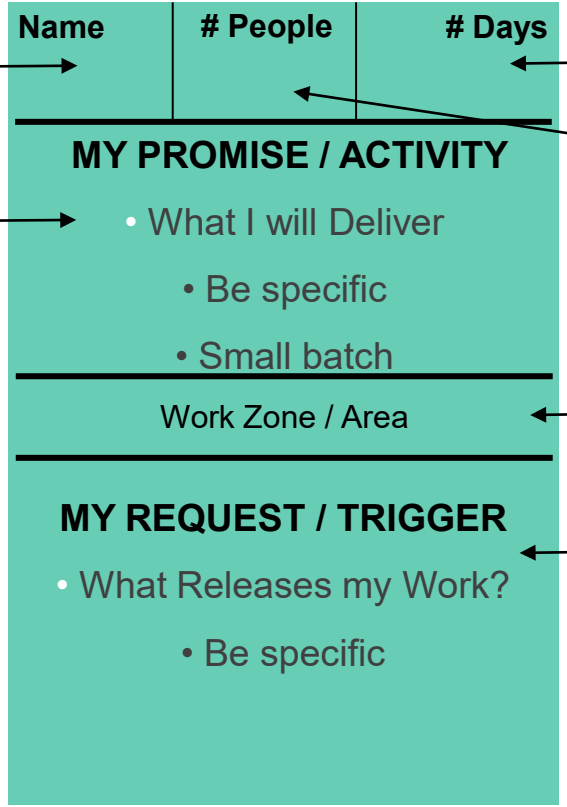
Name of person making the commitment

Description of the activity



Duration of the work in days

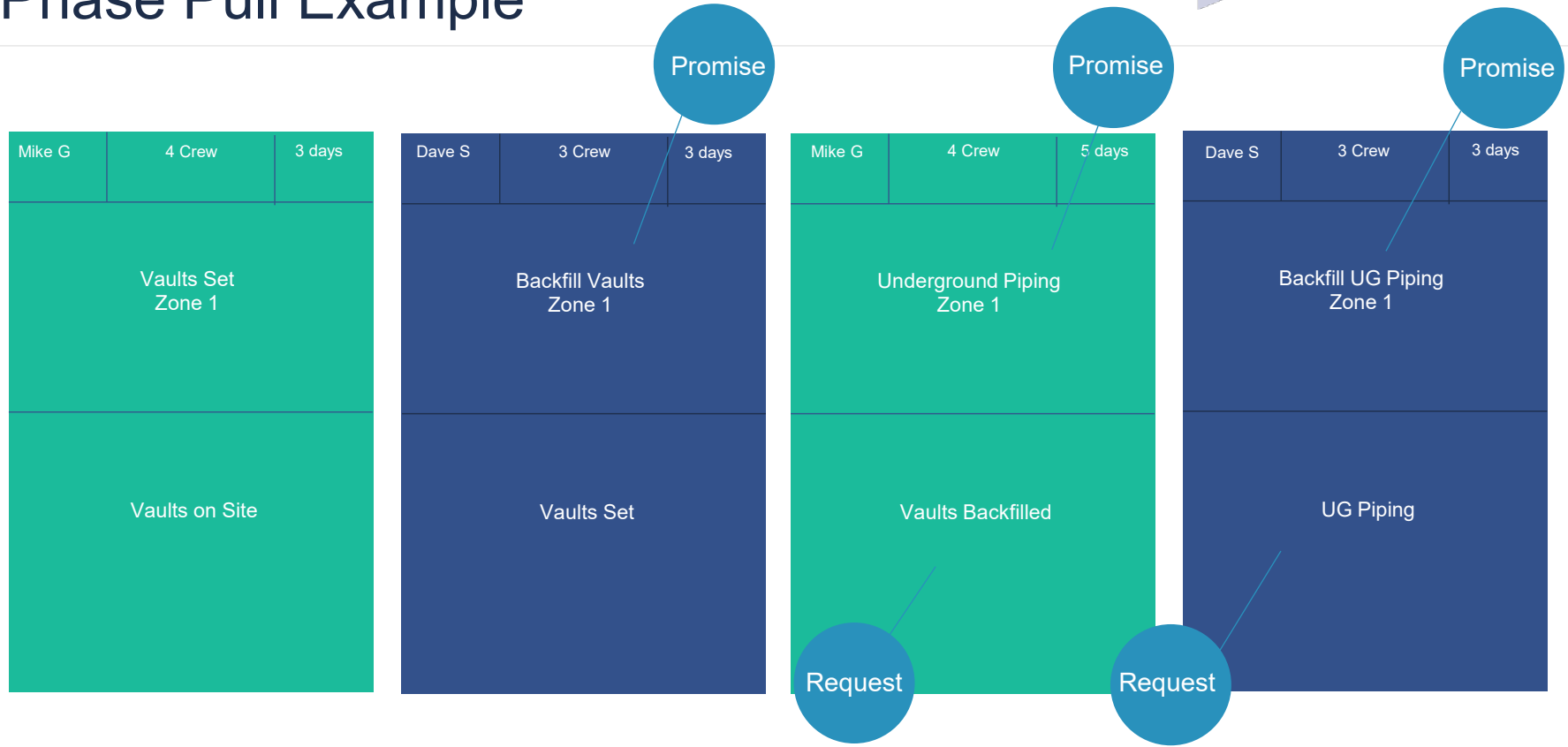
# of People for the work

Work zone or area

Description of the predecessor activity or work that releases the start of your activity

- Format tag to best fit your team needs
- Add more information as valued
- Color code by trade or discipline

Phase Pull Example



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Phase Pull Plan: Start at End

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Phase Pull Plan: Pull The Work

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Phase Pull Plan: Review From The Start

Innovative Pull Planning

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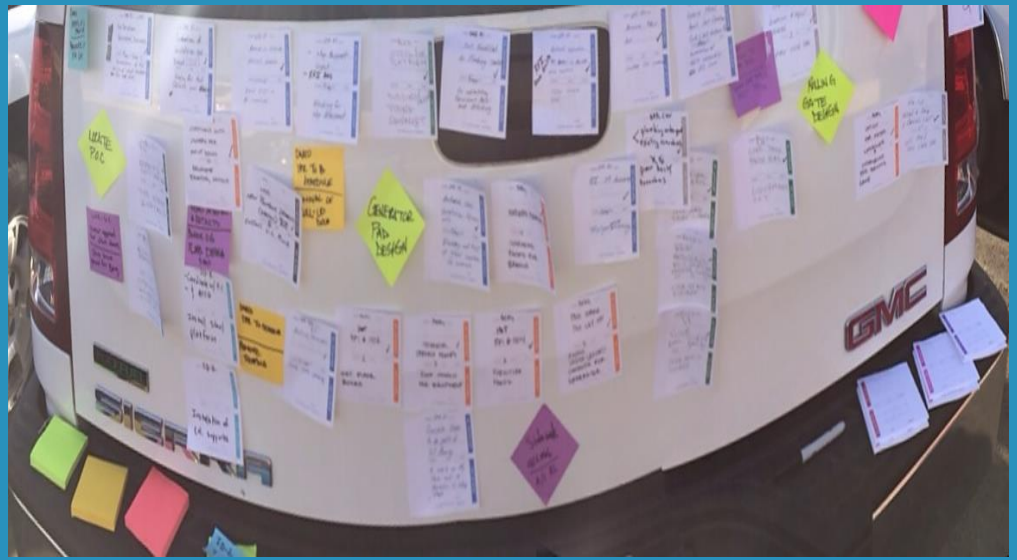

Lookahead Planning

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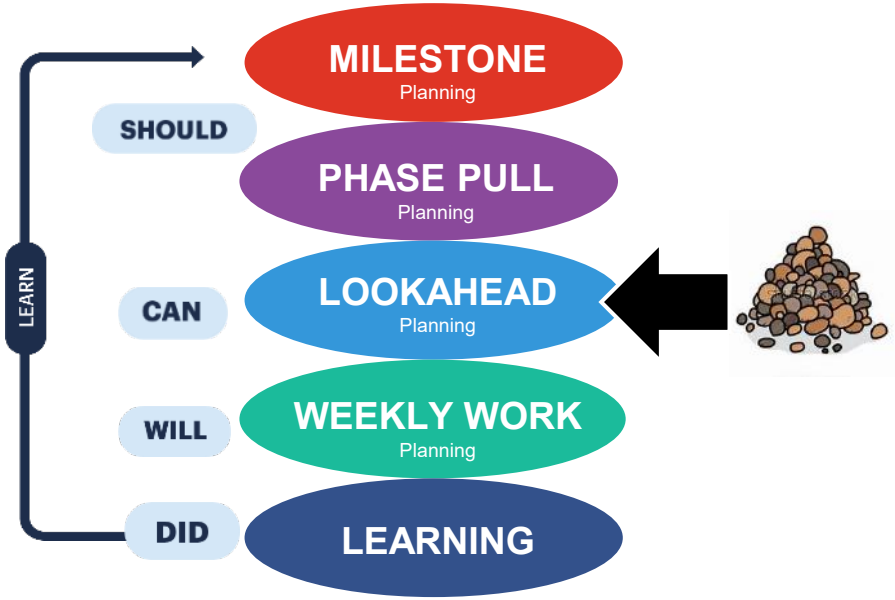
The third conversation of LPS is *Lookahead Planning.*

This level focuses on making work ready or assuring that the work that *should* be done, *can* be done by identifying and *removing constraints* in advance of need.

The conversation is we *"can"* do this.

5 Connected Conversations



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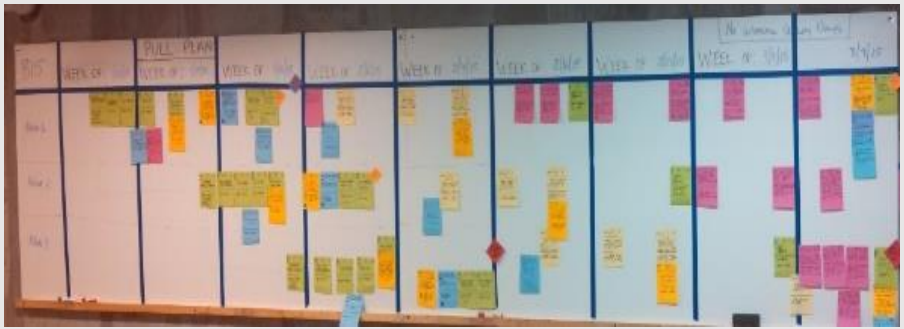


Project:
Project No.:
Responsible Person:

Constraint Number	Activity Number	Constraint Description	RFI No.	Responsible Person	Responsible Company	Date Identified	Date Need Resolution	Date Resolution Promised	Actual Date Resolved

Constraint Log

87

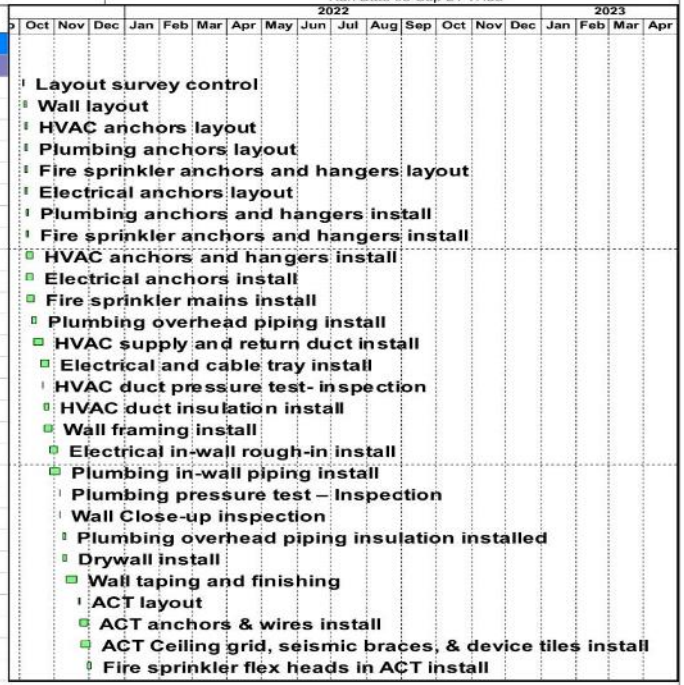
Lookahead Planning

- Transferred from the **Phase Pull Plan** to a plan with dates/weeks
- Boards, P6 or other software documentation
- Rolling (6-10 weeks) Look ahead to "make work ready"
- Supports Team Meeting Discussion/Action for:
- Identify Risk – **Risk Log**
- Identify Constraints – **Constraint Log**
- Informs the **Weekly Work Plan**

Production Plan for the Henry C. Turner Elementary School – Batch 1

HCT Elem. School - B1-1 | Page 1 of 2 | Run Date 08-Sep-21 17:38

Activity ID	Activity Name	Orig Dur	Start	Finish
Henry C. Turner Elem School - B1.2 - Optimized Production Plan		45	04-Oct-21	07-Dec-21
Pull Plan Batch 1 Interiors		45	04-Oct-21	07-Dec-21
PP-B1 271	Layout survey control	1	04-Oct-21*	04-Oct-21
PP-B1 01	Wall layout	2	05-Oct-21	06-Oct-21
PP-B1 81	HVAC anchors layout	2	06-Oct-21	07-Oct-21
PP-B1 131	Plumbing anchors layout	2	06-Oct-21	07-Oct-21
PP-B1 181	Fire sprinkler anchors and hangers layout	2	06-Oct-21	07-Oct-21
PP-B1 221	Electrical anchors layout	2	06-Oct-21	07-Oct-21
PP-B1 141	Plumbing anchors and hangers install	2	07-Oct-21	08-Oct-21
PP-B1 191	Fire sprinkler anchors and hangers install	2	07-Oct-21	08-Oct-21
PP-B1 91	HVAC anchors and hangers install	4	07-Oct-21	12-Oct-21
PP-B1 231	Electrical anchors install	4	07-Oct-21	12-Oct-21
PP-B1 201	Fire sprinkler mains install	4	08-Oct-21	13-Oct-21
PP-B1 151	Plumbing overhead piping install	4	12-Oct-21	15-Oct-21
PP-B1 101	HVAC supply and return duct install	6	14-Oct-21	21-Oct-21
PP-B1 241	Electrical and cable tray install	6	19-Oct-21	26-Oct-21
PP-B1 281	HVAC duct pressure test- inspection	1	21-Oct-21	21-Oct-21
PP-B1 111	HVAC duct insulation install	3	22-Oct-21	26-Oct-21
PP-B1 11	Wall framing install	6	22-Oct-21	29-Oct-21
PP-B1 251	Electrical in-wall rough-in install	6	27-Oct-21	03-Nov-21
PP-B1 161	Plumbing in-wall piping install	8	27-Oct-21	05-Nov-21
PP-B1 291	Plumbing pressure test – Inspection	1	05-Nov-21	05-Nov-21
PP-B1 301	Wall Close-up inspection	1	05-Nov-21	05-Nov-21
PP-B1 171	Plumbing overhead piping insulation installed	3	08-Nov-21	10-Nov-21
PP-B1 21	Drywall install	4	08-Nov-21	11-Nov-21
PP-B1 31	Wall taping and finishing	7	11-Nov-21	19-Nov-21
PP-B1 41	ACT layout	1	22-Nov-21	22-Nov-21
PP-B1 51	ACT anchors & wires install	3	23-Nov-21	29-Nov-21
PP-B1 61	ACT Ceiling grid, seismic braces, & device tiles install	4	24-Nov-21	01-Dec-21
PP-B1 211	Fire sprinkler flex heads in ACT install	3	30-Nov-21	02-Dec-21



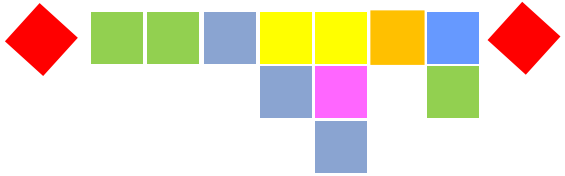
Actual Work
Remaining Work
Critical Remaining Work
Milestone

Henry C Turner Elem School - Batch 1
Production Plan

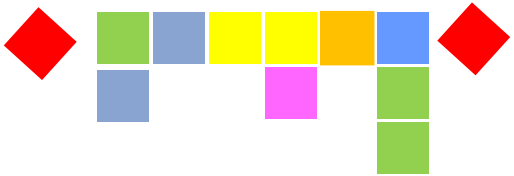
Start Date 04-Oct-21
Finish Date 30-Dec-21
Data Date 19-Jul-21

Creating the Production Plan from a Phase Pull Plan

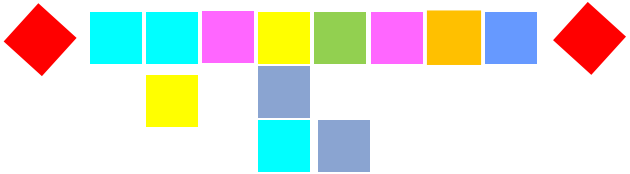
PULL PLAN 1

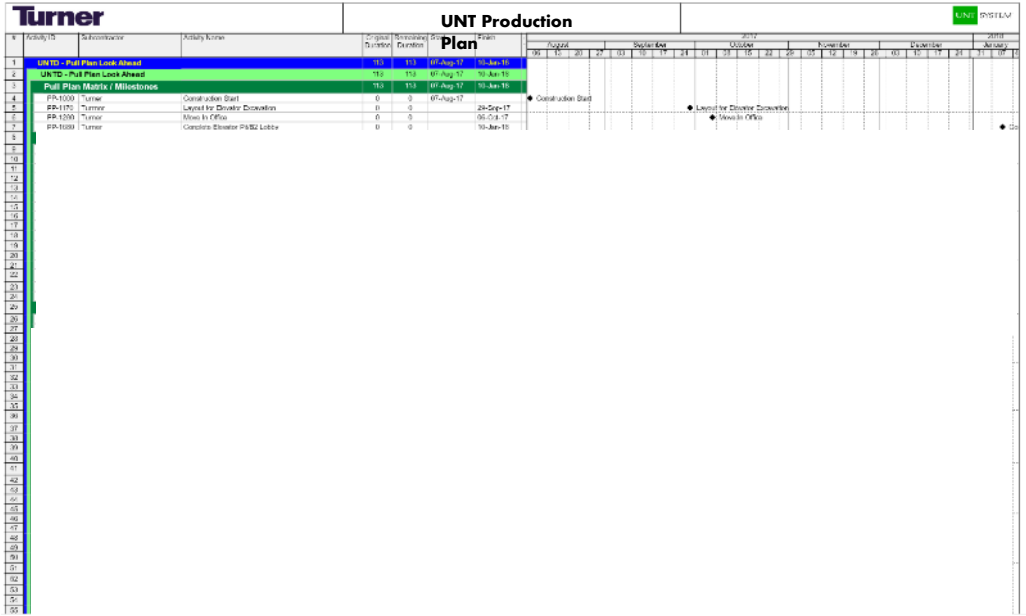


PULL PLAN 2



PULL PLAN 3

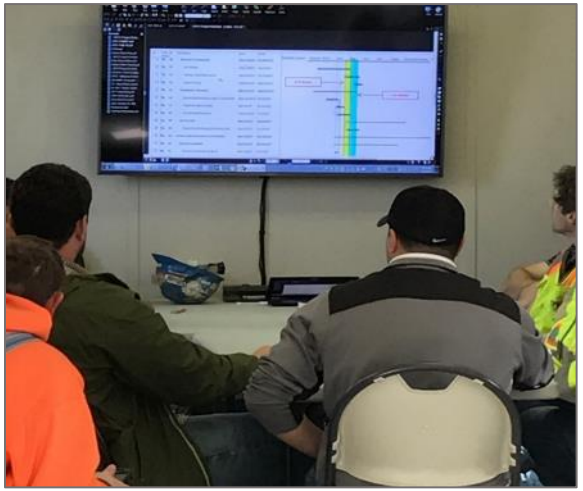




NOTE: Use Work Breakdown Structure numbering system to place Phase Pull Plans at the bottom of P6 CPM Contract Schedule WBS

What does Make Ready Mean? Use The Make Ready Checklist

1. ☐ The trade crew leader, trade PM, and trade detailer have built all the details for that task/work in their BIM model/shop drawings and/or in a mock-up.
2. ☐ The Turner engineer has personal knowledge that all the details for the work shown on the trade's tag can be assembled/built without changes or RFIs.
3. ☐ There are zero open RFIs for this work.
4. ☐ Change orders or other authorizations need approved officially according to the job's financial change management process.



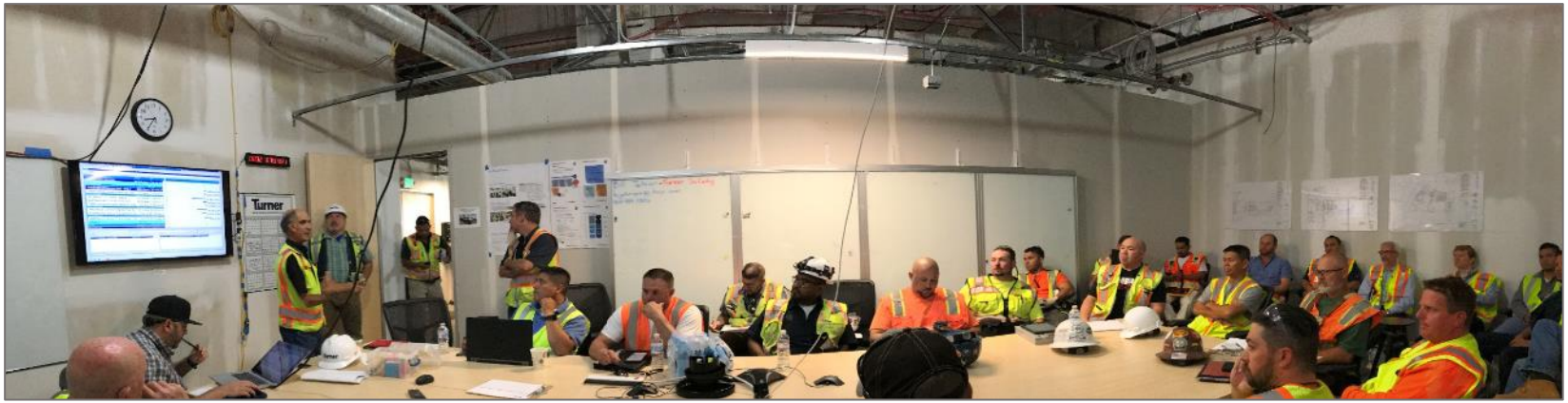
What does Make Ready Mean? Use The Make Ready Checklist (Continued)

5. ☐ The work for this task has received all the necessary building permit approvals needed.
6. ☐ The trade has ordered the materials and material delivery will be made by this date.
7. ☐ Special training, inspection requirements, quality pre-install meeting, and tools have been arranged on the production plan and confirmed for that date or earlier.

What does Make Ready Mean? Use The Make Ready Checklist (Continued)

8. ☐ Work can start and be completed without interruption.
   The trade needs their craft labor to show up and start this installation.

9. ☐ All safety planning including Job Hazard Analysis (JHAs) and Pre-Task Planning (PTP) , mitigation for High Risk Activities (HRA's) must be in place for the work.



Lookahead Planning Example

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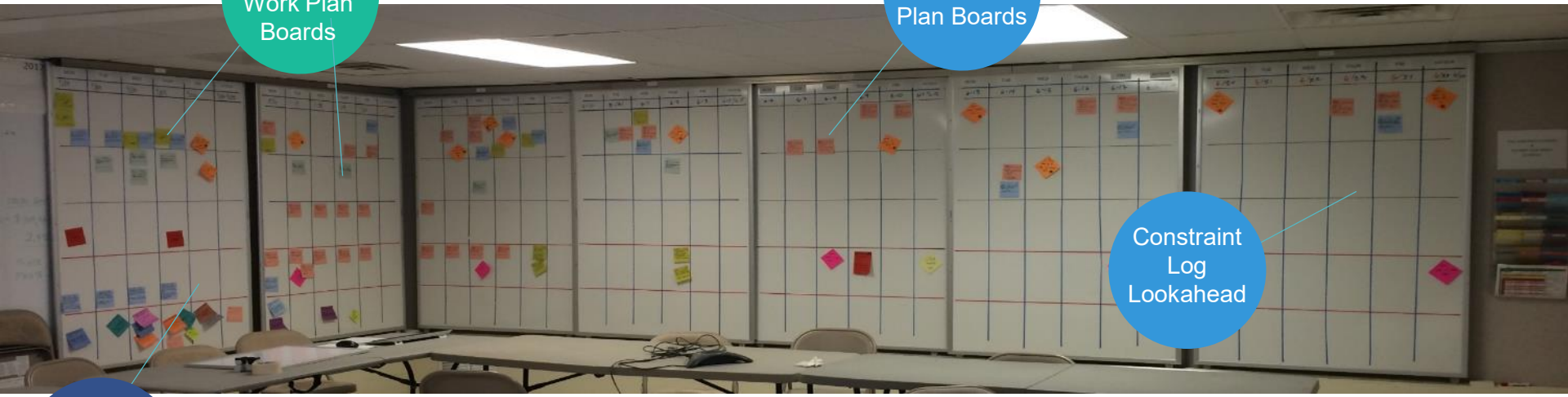
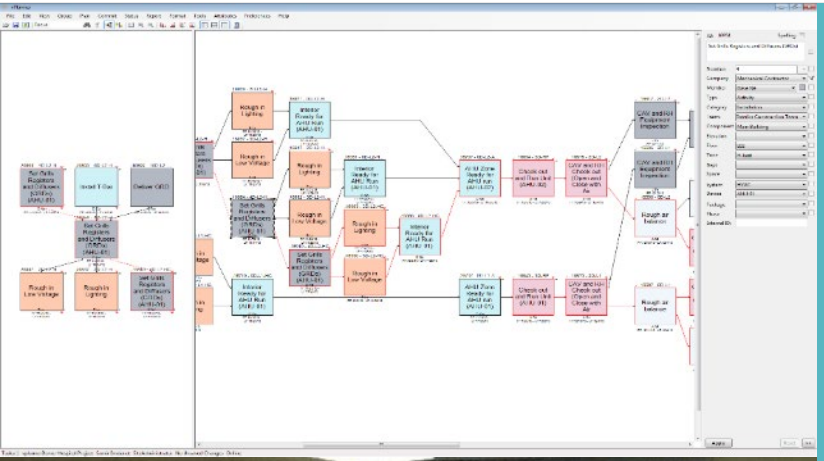


Courtesy of: Turner Construction

Lookahead Planning Options



Electronic

- P6
- Microsoft Project
- TouchPlan
- PlanGrid
- vPlanner
- Others

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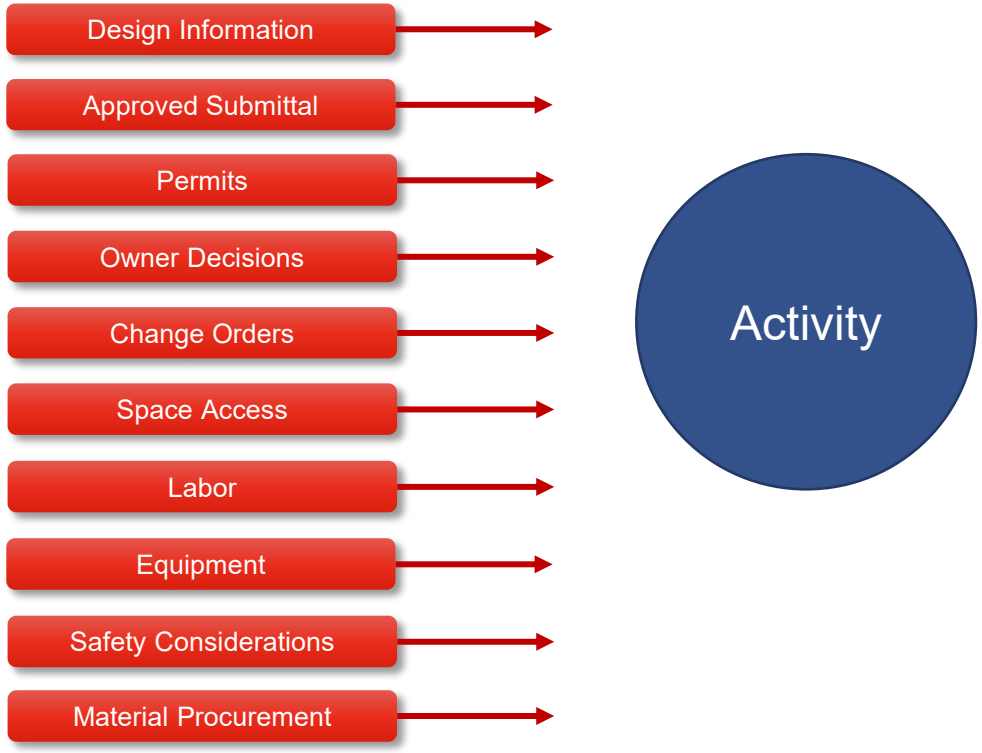
Constraint Defined

Constraint:
An item or requirement that **will prevent an activity** from starting, advancing or completing as planned.



Constraint Log Example

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Project:
Project No.:
Responsible Person:

Constraint Number	Activity Number	Constraint Description	RFI No.	Responsible Person	Responsible Company	Date Identified	Date Need Resolution	Date Resolution Promised	Actual Date Resolved

DATE PROMISED

CONSTRAINT DESCRIPTION

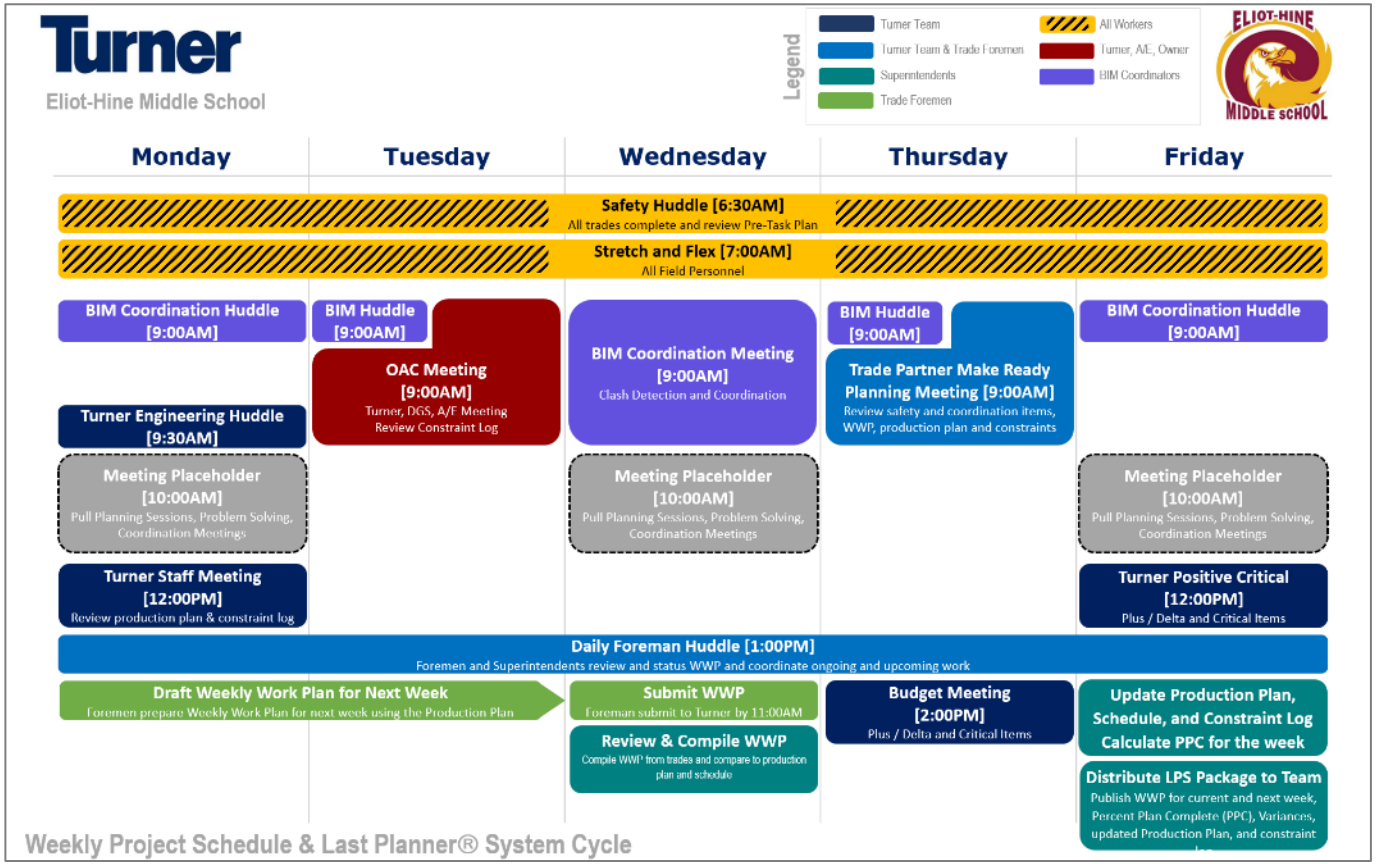
RESPONSIBLE PERSON & CO

DATE IDENTIFIED

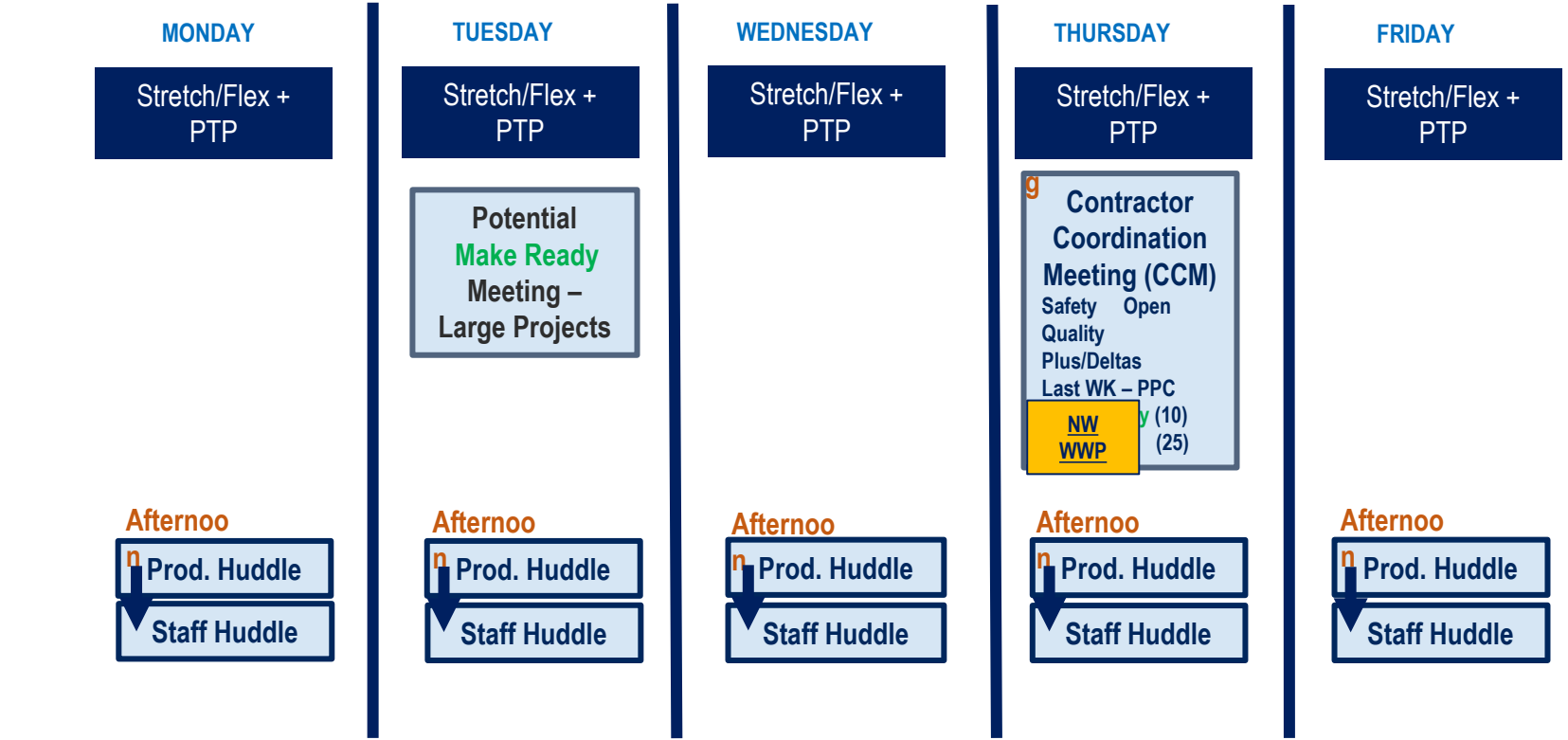
DATE NEEDED

DATE RESOLVED

Weekly Routine of the Last Planner System® (Small to Medium Projects)



Weekly Routine of the Last Planner System® (Large Projects)



CCM: Contractor Coordination Meeting **PPC:** Percent Plan Complete **NW:** Next Weeks **WWP:** Weekly Work Plan

Constraint Management Maturity – Reduce Firefighting

Date Identified:

Requestor Date Needed:

09/30/21 ⟷ 11/12/21

30 days

09/30/21 ⟷ 10/06/21

4 days

Discussion Question

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How will looking ahead to remove constraints help your projects? Discuss amongst selves in small groups

---

Table discussion 10 min with 5 min report out

BREAK #3- 7 minutes

Weekly Work Planning

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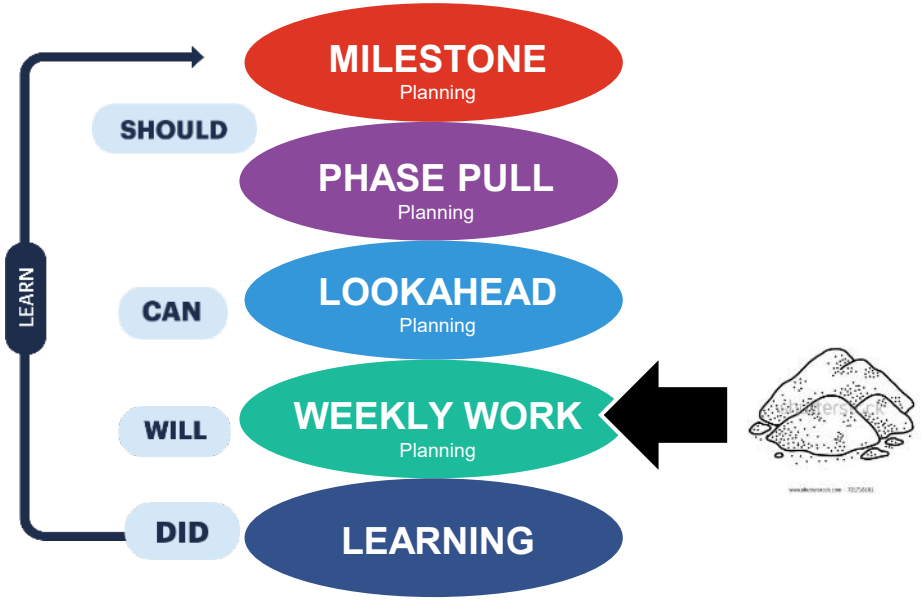
The fourth conversation of LPS is *Weekly Work Planning.*

The goal of this level is for the Last Planners to ***establish the plan*** for the upcoming week at the daily level.

The conversation is I *"will"* do this.

5 Connected Conversations



Weekly Work Planning

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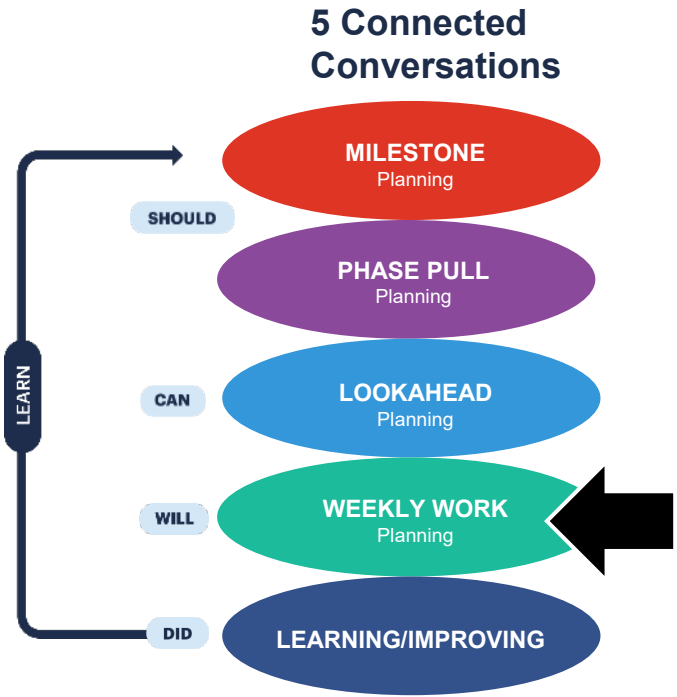
This is the level that the team identifies the *promised task completions* agreed upon by the *Performers* for the upcoming week.

The WWP is used to determine the *success* of the planning effort and to determine what *factors limit performance*. And is the basis of measuring PPC (Percent Plan Complete).

This is done during a *Check-in Session or Huddle.*



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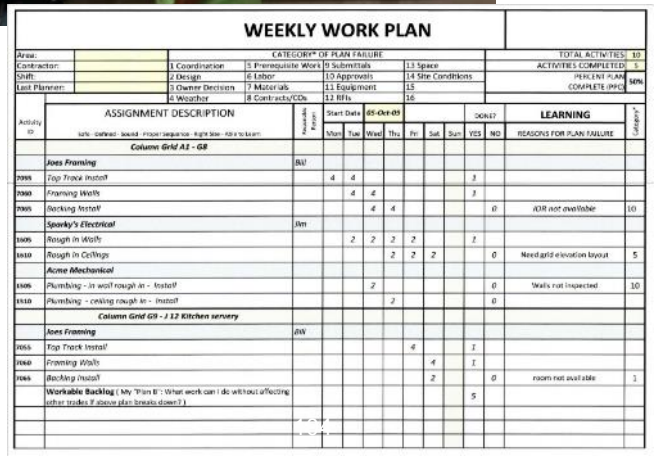

WEEKLY WORK PLAN

Area:		CATEGORY* OF PLAN FAILURE				TOTAL ACTIVITIES	10
Contractor:		1 Coordination	5 Prerequisite Work	9 Submittals	13 Space	ACTIVITIES COMPLETED	5
Shift:		2 Design	6 Labor	10 Approvals	14 Site Conditions	PERCENT PLAN COMPLETE (PPC)	50%
Last Planner:		3 Owner Decision	7 Materials	11 Equipment	15		
		4 Weather	8 Contracts/COs	12 RFIs	16		

Activity ID	ASSIGNMENT DESCRIPTION Safe - Defined - Sound - Proper Sequence - Right Size - Able to learn	Responsible Person	Start Date		05-Oct-03					DONE?		LEARNING	Category*
			Mon	Tue	Wed	Thu	Fri	Sat	Sun	YES	NO	REASONS FOR PLAN FAILURE	
	Column Grid A1 - G8												
	Joes Framing	Bill											
2095	*Top Track Install*		4	4						3			
2080	*Framing Walls*			4	4					1			
2085	*Backing Install*				4	4					0	*IOR not available*	10
	Sparky's Electrical	Jim											
1505	*Rough In Walls*			2	2	2	2			1			
1610	*Rough In Ceilings*					2	2	2			0	*Need grid elevation layout*	5
	Acme Mechanical												
1505	*Plumbing - In wall rough in - Install*				2						0	*Walls not inspected*	10
1510	*Plumbing - ceiling rough in - Install*					2					0		
	Column Grid G9 - J 12 Kitchen servery												
	Joes Framing	Bill											
2055	*Top Track Install*						4			1			
2060	*Framing Walls*							4		1			
2065	*Backing Install*							2			0	*room not available*	1
	Workable Backlog (My "Plan B" : What work can I do without affecting other trades if above plan breaks down?)									5			

Weekly Work Planning

- Informed by the Look Ahead Plan
- Detail work by trade at the Daily Level
- Detailing of the next week
- Informs the Daily Huddle
- Take to the field

Weekly Work Planning

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Weekly Work Plan Informs the Daily Huddle

Courtesy of : PCL

Courtesy of : Turner/DPR JV

Weekly Work Planning Example

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"What, Where, Who & When"

WEEKLY WORK PLAN

Work Beginning:

Area:		CATEGORIES OF PLAN FAILURE				TOTAL ACTIVITIES	31
Contractor:		1 Coordination	5 Prerequisite Work	9 Submittals	13 Space	ACTIVITIES COMPLETED	
Shift:		2 Eng/Design	6 Labor	10 Approvals	14 Site Conditions	PERCENT PLANNED COMPLETE	0%
Last Planner:		3 Owner Decision	7 Materials	11 Equipment	15		
		4 Weather	8 Contracts/COs	12 RFIs	16		

Activity ID	Commitment Description Safe - Defined - Sound - Proper Sequence - Right Size - Able to Learn	Responsible Person	Start Date		1\28					DONE?		LEARNING	Category
			Mon	Tue	Wed	Thu	Fri	Sat	Sun	YES	NO	REASONS FOR PLAN FAILURE	
1	Pour new moat floor on the south side of the building	B.A.M	4	4									
2	Adjust (4) down spouts on the south side of the building	B.A.M	2	2	2								
3	Patch masonry around 6 conducter boxes on the roof	B.A.M	1	1	1	1	1						
4	Install base on 2nd floor in the south side class rooms	B.A.M		3	3	3	3						
5	Install wainscoting on the first floor north side	B.A.M		4	3	4							
6													
7													
8	Pull wire for Chiller	Ryan	5										
9	Security rough-in on all floors	Ryan	3	3	3	3	3						
10	Basement rough-in complete	Ryan	4	4	4	4	4						
11													
12	Hang and finish all rated chases	Fred			3	3							
13	Reframe and hang dry wall in hallway 121	Fred	4	4	4	3	5						
14	Sand dry wall in hallway 139	Fred	2	2									
15	Finish dry wall in west class room 107,144	Fred	3	3	3	3							
16													
17													
18	Rough-in media center ceiling	Troy	5										
19	Get fresh air duct inspected in attic	Troy				6							
20	Get north west chase duct inspected	Troy				6							
21	Insulate north west chase duct	Troy			4								
22	Tie in vav boxes in the attic	Troy	3	3	3								
23	Start tying in vav boxes in the east wing 1st and 2nd floors	Troy	4	4	4	4							

What & Where?

Crew Size?

Who?

When will it be done?

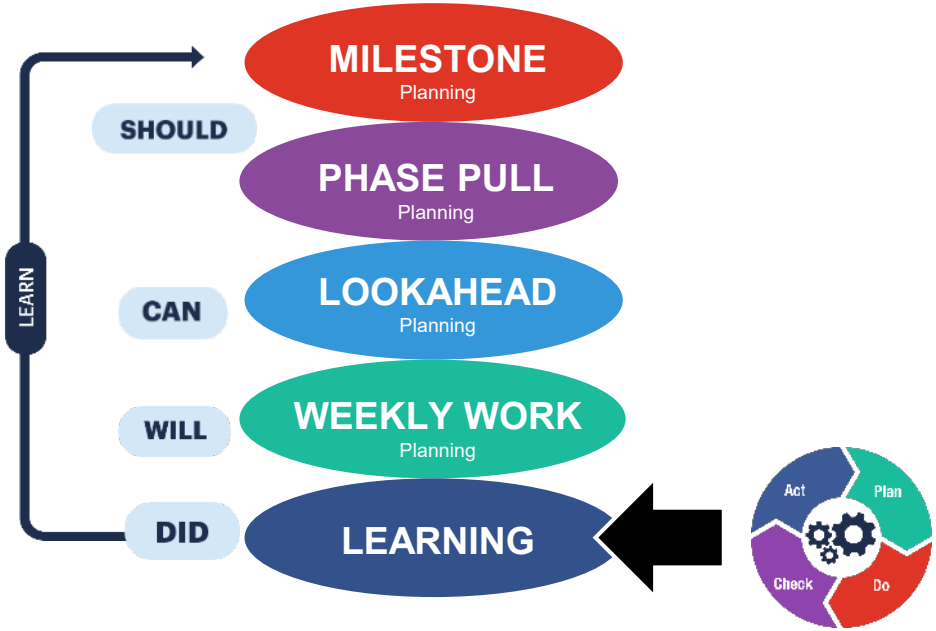
Learning/Improving

The fifth conversation is *Learning/Improving*.

The goal is for the team to *learn* from the cycle and take *actions for improving* going forward fulfilling PDCA.

The conversation is what we *"Did"* and *"Learned"*.

5 Connected Conversations



Daily Huddle

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1. What did I complete?
2. What will I complete?
3. What needs to be re-planned?
4. How can we prevent this from happening again?

Learning From Daily Huddles

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The *Percent Plan Complete* (PPC) is calculated for the period or week.

PPC is the basic measure of how well the *planning system is working.*

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Calculating PPC

$$\text{WEEKLY PPC} = \frac{\text{\# Completed Activities}}{\text{\# Planned Activities}} = \frac{16}{20} = 80\%$$

Percent Plan Complete (Plan Percent Complete)

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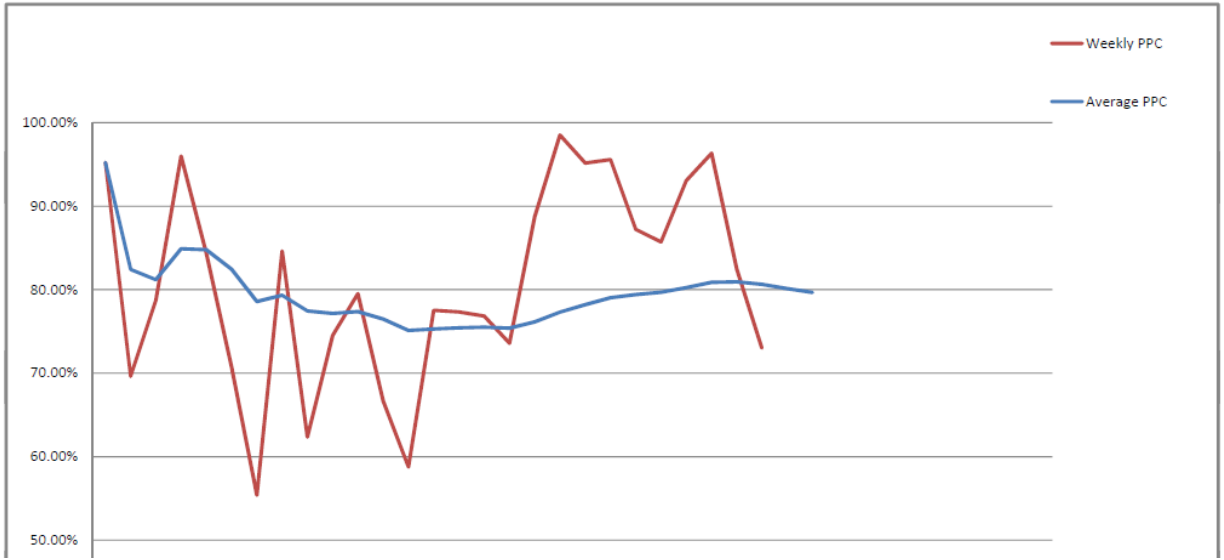
OVERALL PLAN PERCENT COMPLETE

PROJECT AREA
THEATERS

Current Overall PPC = 79.67%
As of: 6/1/2014

Week #	Week Ending	Number of Tasks	Number Completed	PPC	Average	Tasks Not Done
1	11/17/2013	21	20	95.24%	95.24%	1
2	11/24/2013	79	55	69.62%	82.43%	24
3	12/1/2013	47	37	78.72%	81.19%	10
4	12/8/2013	50	48	96.00%	84.90%	2
5	12/15/2013	83	70	84.34%	84.78%	13
6	12/22/2013	99	70	70.71%	82.44%	29
7	12/29/2013	65	36	55.38%	78.57%	29
8	1/5/2014	52	44	84.62%	79.33%	8
9	1/12/2014	85	53	62.35%	77.44%	32
10	1/19/2014	98	73	74.49%	77.15%	25
11	1/26/2014	83	66	79.52%	77.36%	17
12	2/2/2014	66	44	66.67%	76.47%	22
13	2/9/2014	97	57	58.76%	75.11%	40
14	2/16/2014	89	69	77.53%	75.28%	20
15	2/23/2014	97	75	77.32%	75.42%	22
16	3/2/2014	82	63	76.83%	75.51%	19
17	3/9/2014	106	78	73.58%	75.39%	28
18	3/16/2014	80	71	88.75%	76.13%	9
19	3/23/2014	67	66	98.51%	77.31%	1



Reasons For Variance

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Reason for Variance:

- Factors that prevented a task from being completed as promised.
- Used by the team to promote learning concerning the failure of the planning system to produce predictable workflow.
- Assigned a category of variance.
- Enable a team to identify those areas of recurring failure that require additional reflection and analysis.

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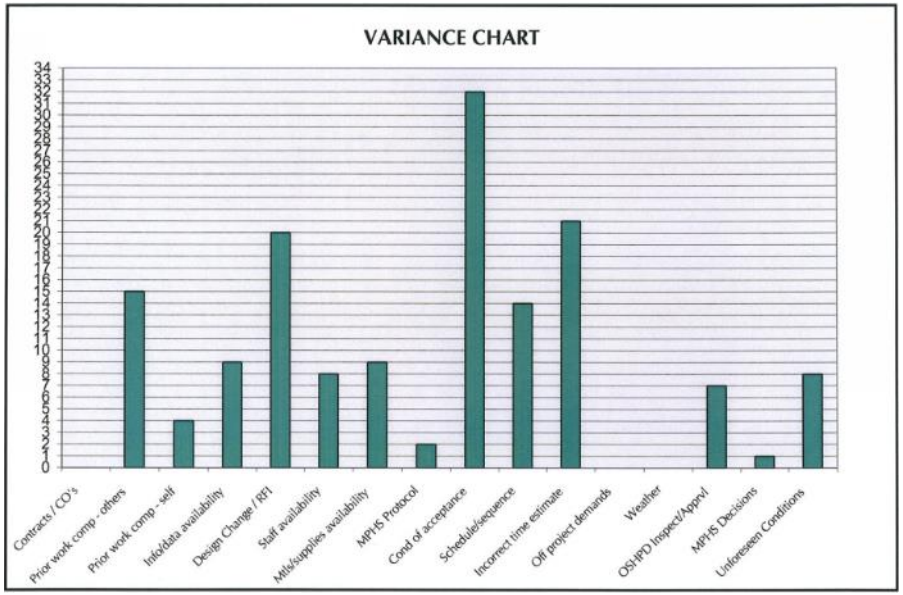
Taking Action For Variance

When a variance or failure occurs, the team must discuss the likelihood of it occurring again and determine actions to mitigate such.



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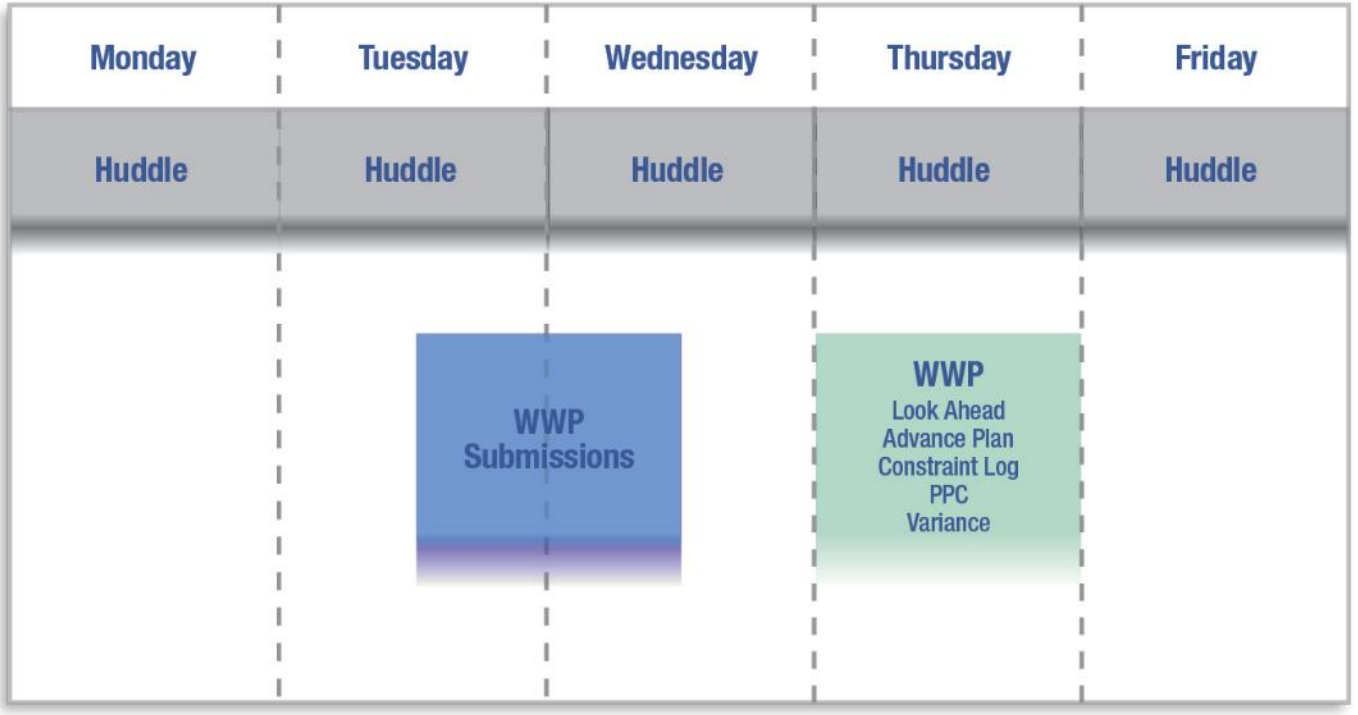
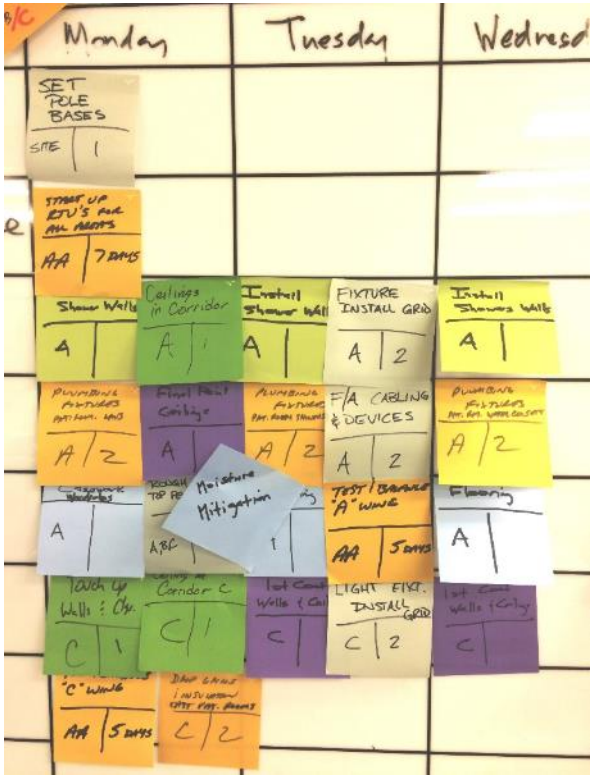
LPS Weekly Routine Example



WWP Meeting Agenda



1. [15 Min] Review Weekly Work Plan
   a. Review last week plan completion, reliability
   b. Compute PPC
   c. Check & track variances - discuss countermeasures
   d. Review tasks moving forward and figure out how to complete that work without affecting a milestone
2. [15 Min] Update Six Week Look Ahead, Make-Ready & Constraints
   a. Update Plan week 5 or 6 Review Constraint Log
   b. Identify/Review constraints
   c. Determine solution or path forward
   d. Check in on previous path forwards to ensure completion by the committed date
3. [15 Min] Finalize Weekly Work Plan for Next Week & Make Commitments
4. [5 Min] Plus/Delta & Improvement Ideas

Productivity & Planning

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Production Goals as informed by Estimates

- Informs phase planning duration
- Breaks weekly targets into daily goals on WWP
- E.G. 4 day activity, how far should be be end of day 1

SHEETMETAL				
RECTANGULAR DUCT	10014	LF	180	642
		MH	241	795
		LF/MD	6.0	6.5
ROUND DUCT	10016	LF	1060	5487
		MH	274	1175
		LF/MD	30.9	37.4
FINISH	10028	EA	0	0
		MH	0	0
		EA/MD	#DIV/0!	#DIV/0!
EQUIPMENT SET	10038	EA	0	0
		MH	0	0

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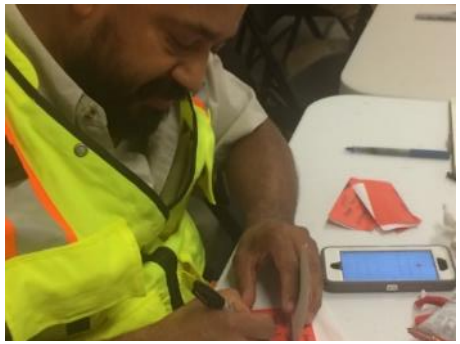
Standard Work Available @ LeanConstruction.org

https://www.leanconstruction.org/membership/corporate-members-center/last-planner-system/

Last Planner System®
Standard Work
3_Planning Session Preparation

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Outcome:
The Last Planner System® organizer will be able to prepare for a planning session by arranging to have the spatial and material requirements for a successful session.

Process:
Prior to the pull planning session, arrange for appropriate space, room set-up and materials to be in place. The session outcome is dependent on this.

LPS Modified For Design

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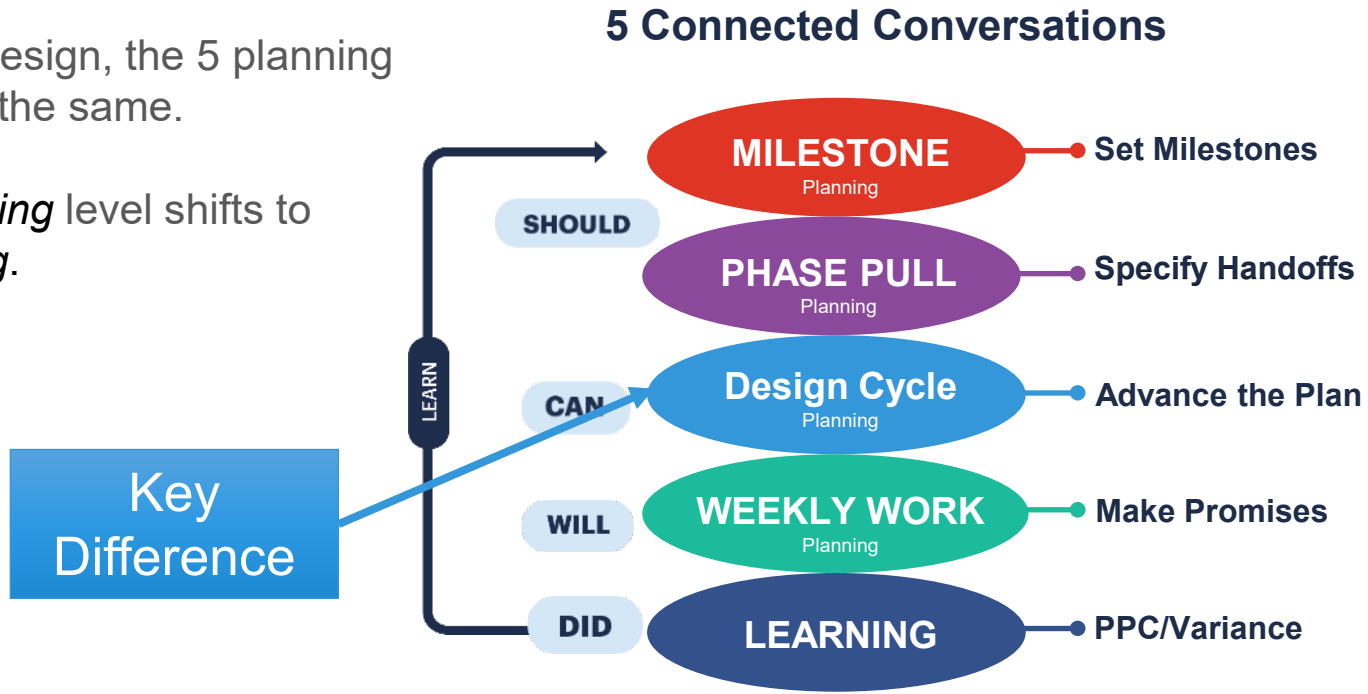
In modifying LPS for design, the 5 planning conversations remain the same.

The *Lookahead Planning* level shifts to *Design Cycle Planning*.



Design Considerations

While the Last Planner System is used in construction, it is highly applicable and useful in design. Some key differences to keep in mind include:

Design:

- Is emerging based on new information and the flow is “information”.
- Milestones are clearly defined by expected outcome which should describe what needs to be known.
- Milestones are often “decision points”.

Construction:

- Is linear in nature and the flow is “tangible materials”.
- Milestones are clearly defined by expected outcome which will be observable in the field.

Creating The Phase Pull Plan

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Color-coded milestones on the Phase Pull Plan

Pull to date of handoff needed

Involve key discipline leads

Future milestone remain on the Milestone Plan

UHS Temecula Valley Hospital Team

Discussion Question

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What new actions or ideas that you learned today can you take back to your project?

Write down on Take Away Sheet (5 minutes)
Share with your neighbor (5 minutes)

Lean Journey to Mastery

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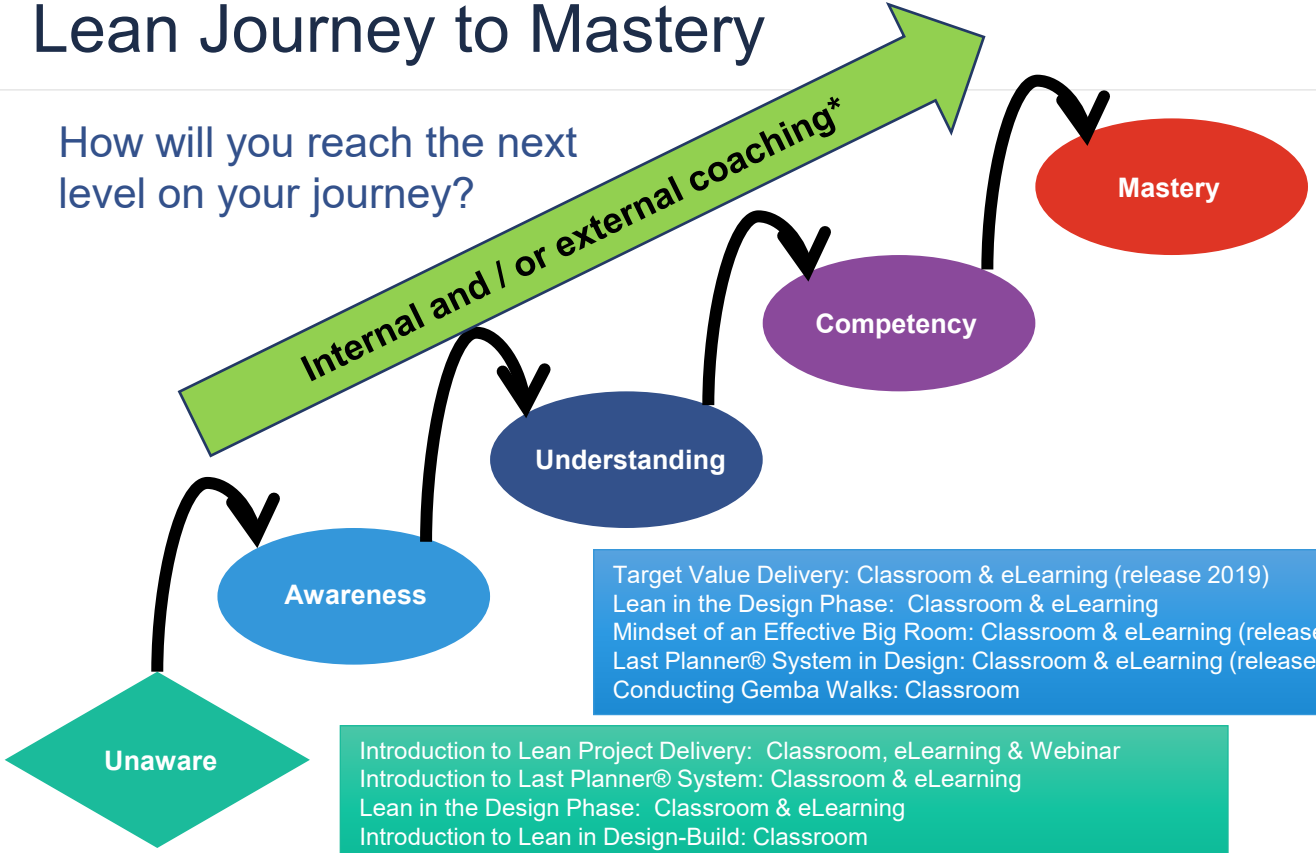
How will you reach the next level on your journey?



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

See LCI web page for coaching directory

More on Learning

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Books:

Events:

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

eLearning:

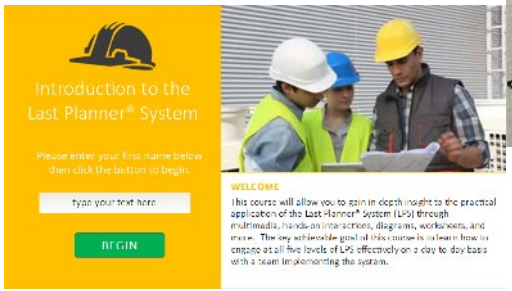
Learn on your own time without taking time off project work.

Start learning now:

www.LeanConstruction.org

eLearning Courses

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



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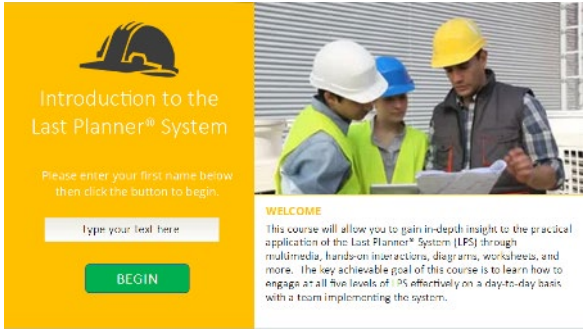

Questions?

Learning Objectives Review

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Recognize the need for predictability on projects and how LPS creates more predictable outcomes.

Gain an overview understanding of each of the five connected planning conversations of LPS and how they interrelate.

Discover the basic mechanics of LPS including the foundational base of reliable commitments.

Understand the need for continuous learning and for measuring reliability to improve predictability.

Conduct Plus/Delta

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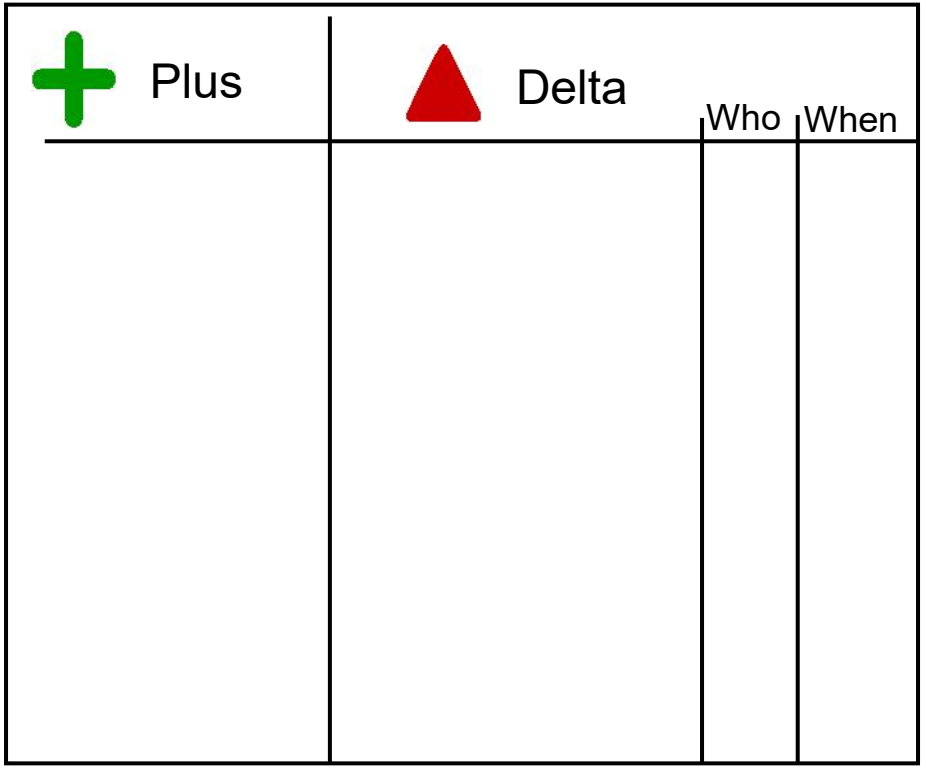
Plus: What helped you? What produced *value* during the session?

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



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