

**26<sup>TH</sup> ANNUAL**



**26<sup>TH</sup> LCI CONGRESS**  
**OCTOBER 22-25, 2024**

**CC-03:**

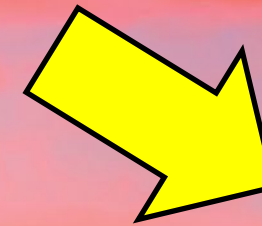
# **A Job Well Begun is Half Done: Pull Planning Essentials**

**David MacNeel, On Point Lean Consulting**  
**Bartug Kanik, Pernix Federal**

**SURFING THE WAVE OF LEAN DESIGN AND CONSTRUCTION**

**October 23, 2024**

**QR Code for  
Congress App**





# Introductions



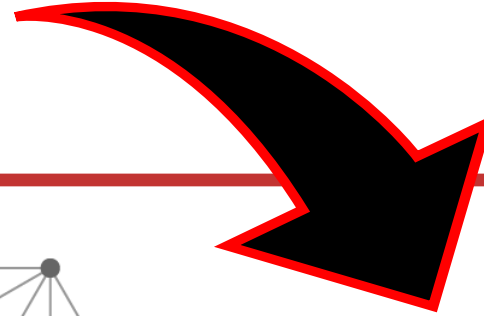
**Dave MacNeel**  
Principal & Founder  
On Point Lean Consulting



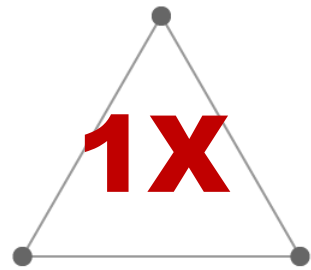
**Bartug Kanik**  
Lean Planning Engineer  
Pernix Federal



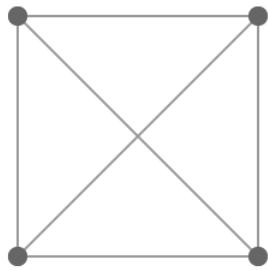
# The Problem



## COMPLEXITY



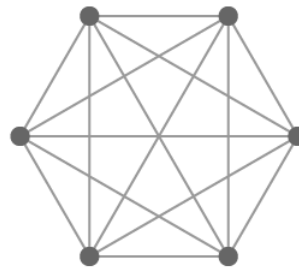
3 people, 3 lines



4 people, 6 lines



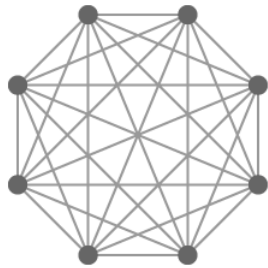
5 people, 10 lines



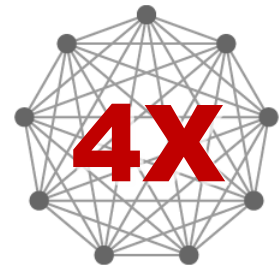
6 people, 15 lines



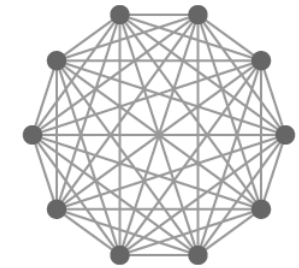
7 people, 21 lines



8 people, 28 lines



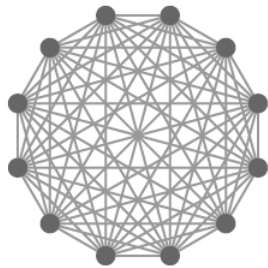
9 people, 36 lines



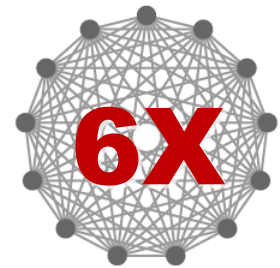
10 people, 45 lines



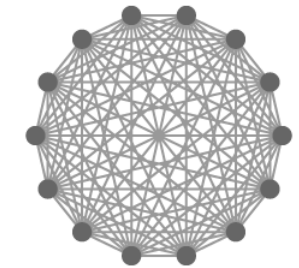
11 people, 55 lines



12 people, 66 lines



13 people, 78 lines



14 people, 91 lines



1974 vs 2024  
Corvette

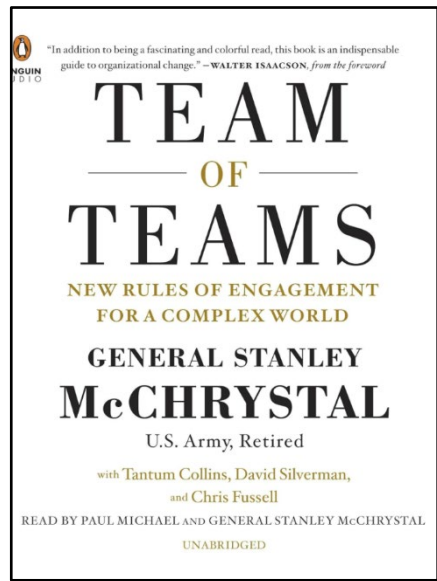




# The Problem

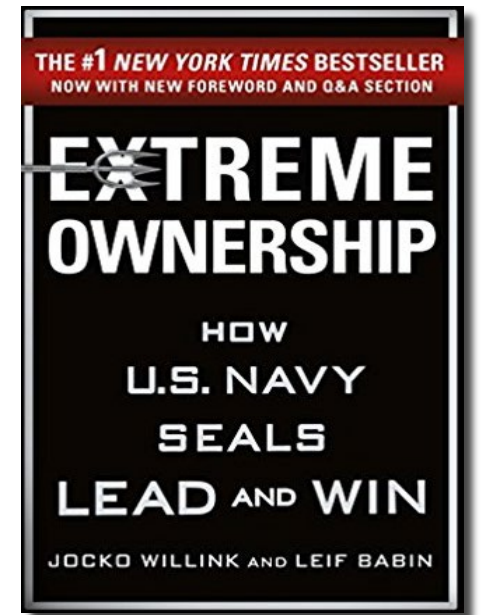
&

# The Countermeasures



Shared  
Knowledge

Deep  
Collaboration



COMPLEXITY

Rapid  
Adaptability

Extreme  
Ownership



# Q: How Can We Counteract Complexity?

Answer: **Last Planner System<sup>®</sup> (LPS)**



Goals:

- ✓ **Flow**
- ✓ **Reliability**
- ✓ **Predictability**

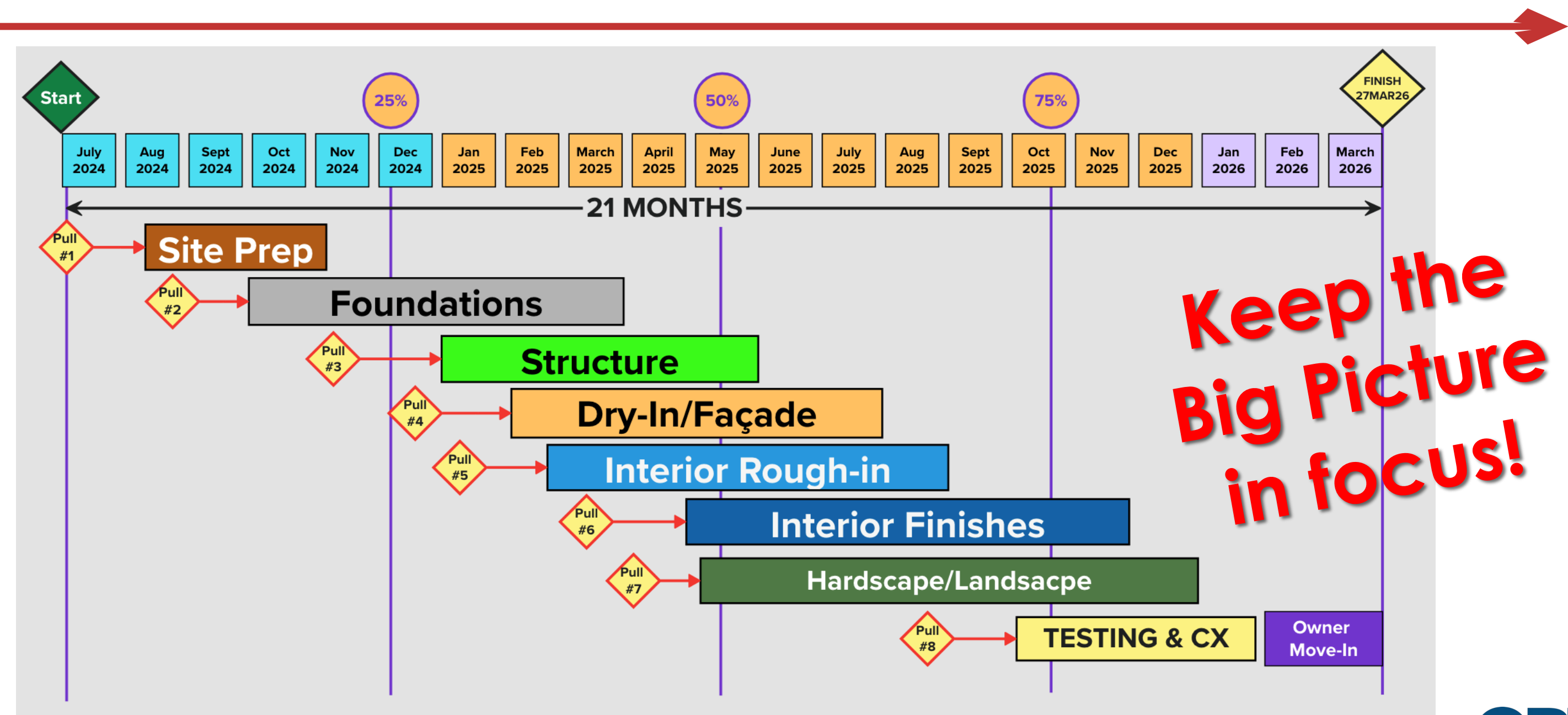
# Last Planner System® (LPS)

**5 Connected  
Conversations**





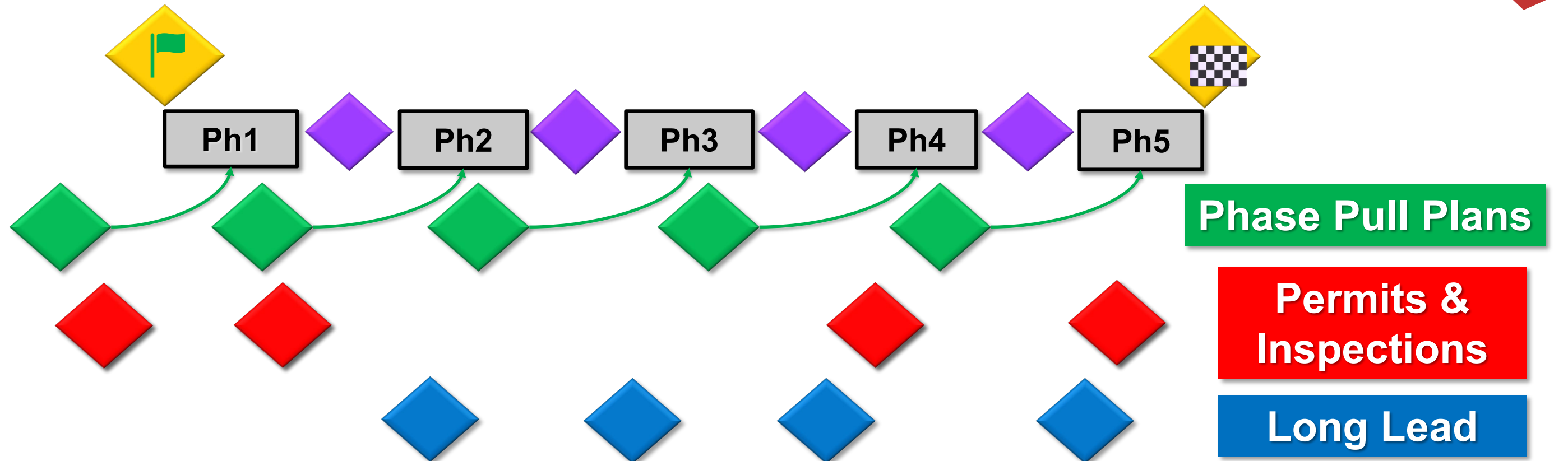
# Starting Point: Milestone Planning



# Major Milestones

## Phase Milestones

**WORK PHASES**  
(~3 months)



**Phase Milestones Represent:**  
**The COMPLETION of One Phase and**  
**the START of the Next phase**



# We All Pull Plan Important Events

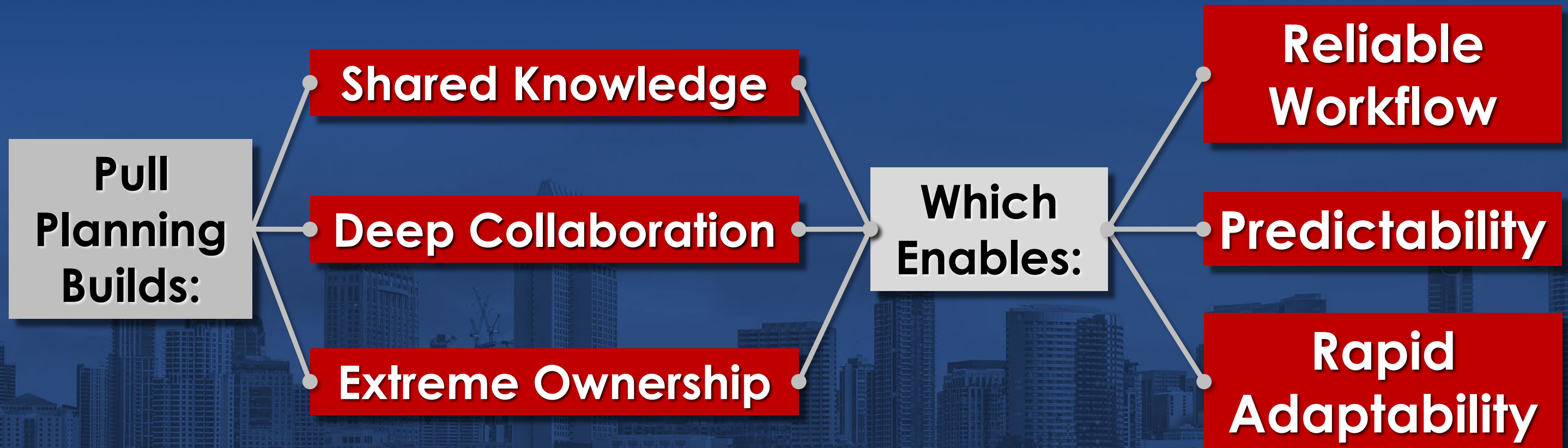




# Phase Pull Planning

A series of collaboration sessions to:

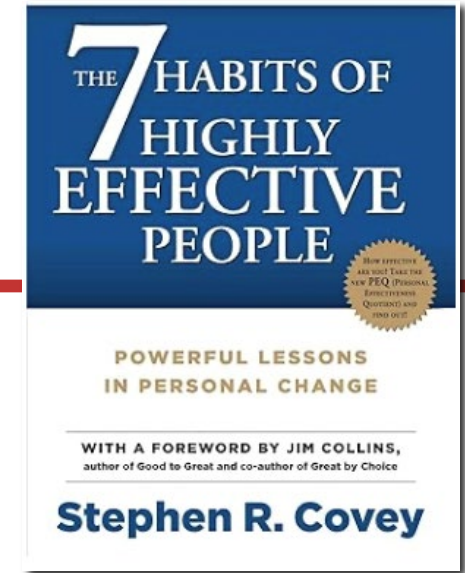
- Verify Interim Phase Milestones
- Establish the Sequence, Pace, & Flow (Handoffs)





# What is Pull?

- History: U.S. Supermarkets
- Opposite of PUSH
- Downstream work “pulls” upstream work.
- *"Start with the End in Mind."*
- Focus on activities individually, then...What ‘triggers’ each to start and run efficiently?



Quote:

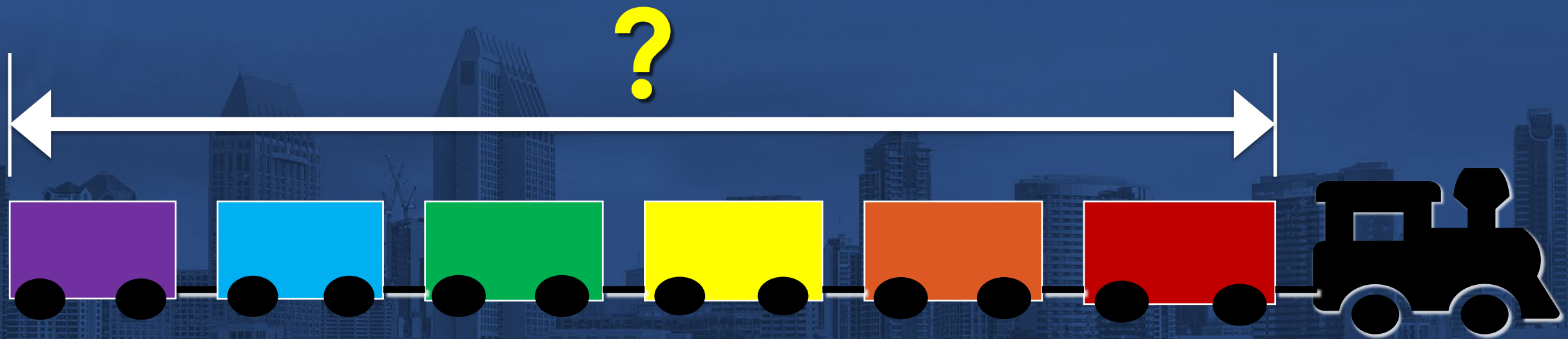
***Flow where you can,  
Pull where you can't,  
Push where you must.***

- John Shook, Toyota/LEI



# Overarching Goals of Pull Planning:

- Establish **FLOW**
- Determine **HANDOFFS** (Needs)
- Uncover **CONSTRAINTS**
- Determine the Overall **DURATION**



# *Do I have to go backward?*

In your head, say the alphabet BACKWARDS...

Now try it...

**A B C D E F G H I J K L M**  
**N O P Q R S T U V W X Y Z**



# Phase Pull Planning: 4 Meeting Series

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- Over the course of 1 week
- 6 weeks prior to starting work

## 1. Setup Session

- **INTERNAL**
- 1 hour

## 2. Prep Meeting

- **WITH TRADES**
- 1 - 2 hours

## 3. Data Collection + 1st Pass

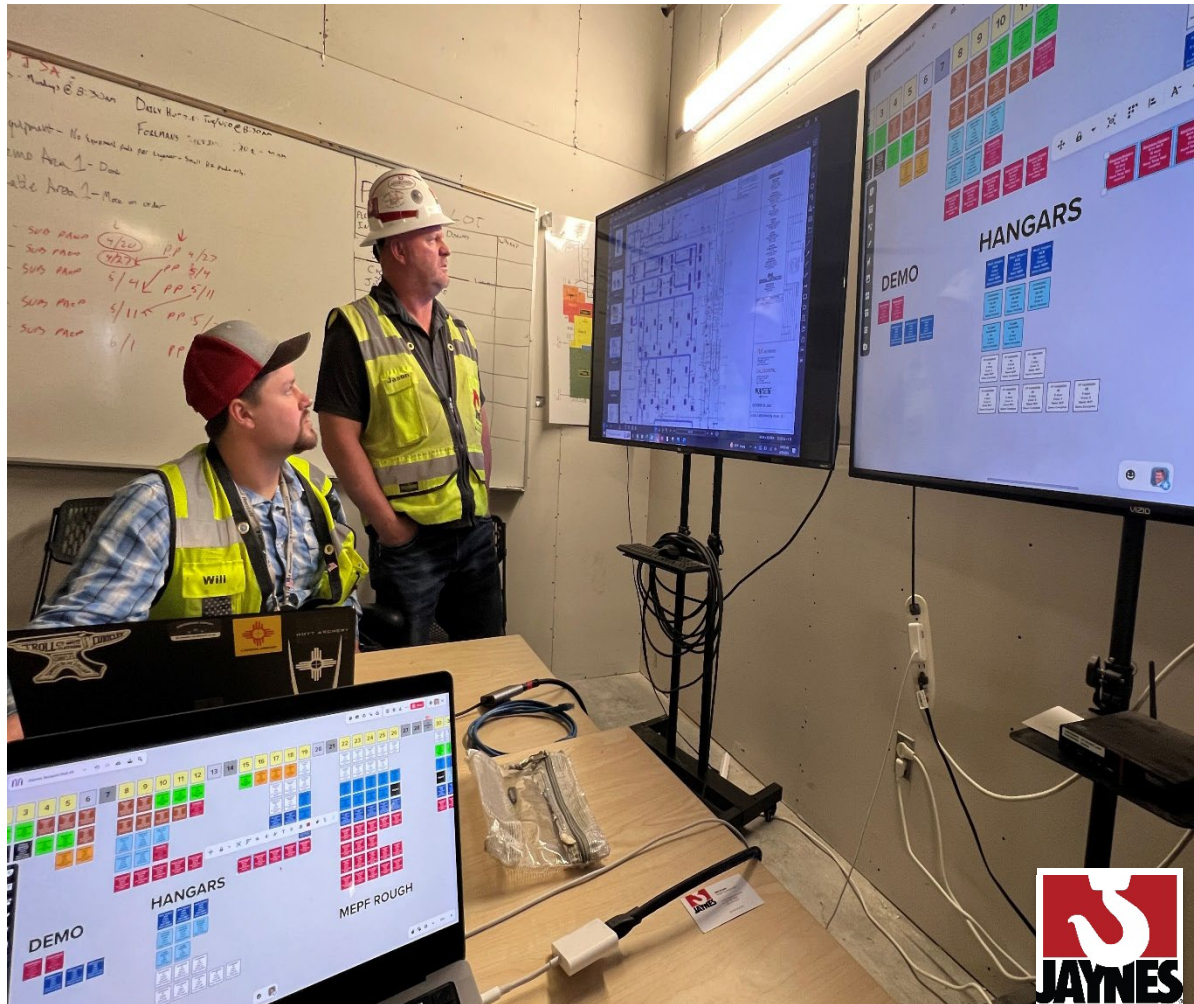
- **INTERNAL**
- 1 - 2 hours

## 4. Phase Pull Plan

- **WITH TRADES**
- 2 - 3 hours



# Phase Pull Planning



## Who Must Attend?

- Be careful with titles
- The individuals who can make commitments: typ **PM & Supt**

*What about VDC/BIM, QC, Safety & Schedulers?*

## How Much Should I Pull?

- New Construction: **12 - 16 Weeks**
- Renovations: **6 - 8 Weeks**
- Design: **12 - 26 Weeks**

## Paper vs Digital?

# Pull Planning 4 Meeting Series



**#1 Setup Session** (Internal)

**#2 Prep Session** (w/Trades)

**#3 Data Collection + 1<sup>st</sup> Pass** (Internal)

**#4 Phase Pull Plan** (w/Trades)

# Phase Pull Planning

## Meeting #1: Set-up Session (Internal)

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1. **Send Invitations and Preparation Instructions**
  - Outline the work in the phase and the goals.
  - Encourage the stakeholders to study their work.
  - Ask for any issues, needs, concerns, or constraints.
2. **Breakdown Work Areas + Identify Flow**
  - Have discussions with “Bus Drivers” in advance.
  - Keep areas small – around 8,000 square feet.
  - Highlight drawings: clearly colored and labeled.



# Little's Law: Smaller Batch Size = FASTER Completion w/SAME Effort

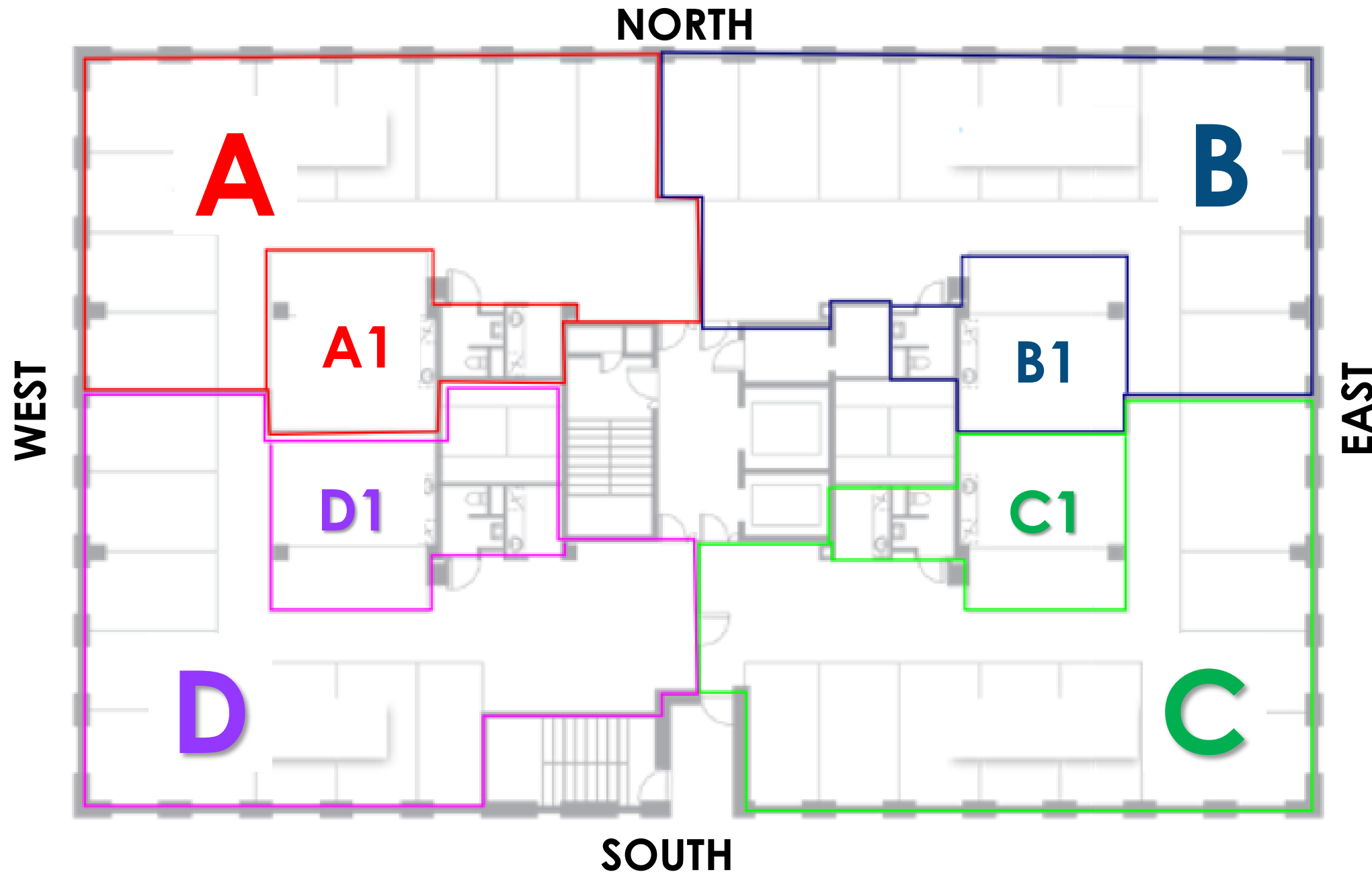
FINISH TO START	Duration	START DAY		Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9
ACTIVITY X	15 days	1		15								
ACTIVITY Y	15 days	16					15					
ACTIVITY Z	15 days	31	baseline							15		
										Total = 45 days		

START TO START, +1 WEEK	Duration	START DAY		Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9
ACTIVITY X	15 days	1		5	5	5						
ACTIVITY Y	15 days	6	% faster		5	5	5					
ACTIVITY Z	15 days	11	44%			5	5	5				
										Total = 25 days		

START TO START, +1 DAY	Duration	START DAY		Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9
ACTIVITY X	15 days	1		days 1-15								
ACTIVITY Y	15 days	2	% faster	days 2-16								
ACTIVITY Z	15 days	3	32%	days 3-17								
										Total = 17 days		

# Work Area Breakdown

## Setup Session



**Size Areas to  
Level the  
Workload**

**Pull is a  
Precursor to Takt**

		W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	W13	W14	W15	W16	W17	W18	V
Area 1	1	C1	C2	C3	C4	C5	C6	C7												
Area 2	2		C1	C2	C3	C4	C5	C6	C7											
Area 3	3			C1	C2	C3	C4	C5	C6	C7										
Area 4	4				C1	C2	C3	C4	C5	C6	C7									
Area 5	5					C1	C2	C3	C4	C5	C6	C7								
Area 6	6						C1	C2	C3	C4	C5	C6	C7							
Area 7	7							C1	C2	C3	C4	C5	C6	C7						
Area 8	8								C1	C2	C3	C4	C5	C6	C7					
Area 9	9									C1	C2	C3	C4	C5	C6	C7				
Area 10	10										C1	C2	C3	C4	C5	C6	C7			
Area 11	11											C1	C2	C3	C4	C5	C6	C7		
Area 12	12												C1	C2	C3	C4	C5	C6	C7	

# Phase Pull Planning

## Meeting #1: Setup Session (Continued)

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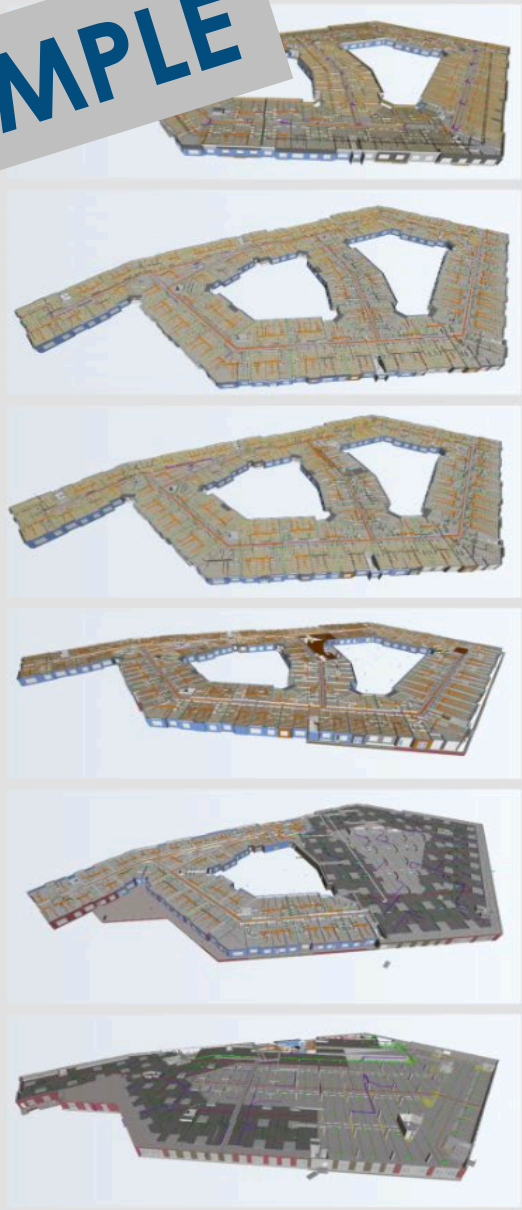
1. Send invitations & Prep Instructions
2. Breakdown Work Areas (~8000 sf)
- 3. Clearly Identify Start & Finish Milestones**
- 4. Have your thoughts on flow, but...**  
**...be willing to change if a better idea arises**
- 5. Determine the Pace and Rhythm:**  
**Week by Week (typ)? Day by Day? Hour by Hour?**
- 6. Assemble the Relevant Information (Next Slides)**



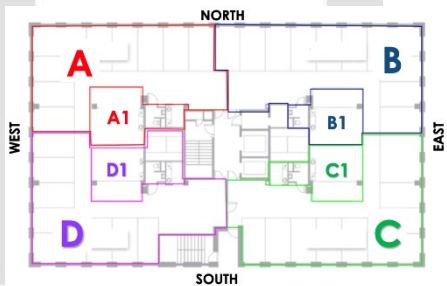
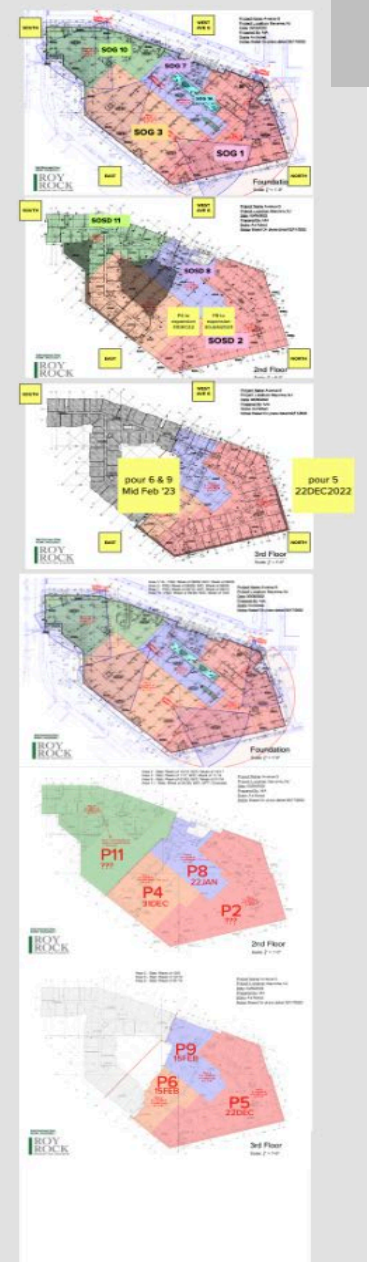
**EXAMPLE**

# Gather Visual Information

- 3D Renderings
- Work Breakdowns
- BIM Model (live or Screenshots)
- Site Logistic Plans
- Drone Photos
- Area Layouts
- Square Footages & Quantities
- Room Counts
- Elevations
- Building Sections
- Floor Plans w/Takt Areas



A - 14 Units, 8k SF  
B – 15 Units, 9k SF  
C – 14 Units, 8k SF  
D – 12 Units, 9k SF  
E – 10 Units, 7k SF





# Phase Pull Planning

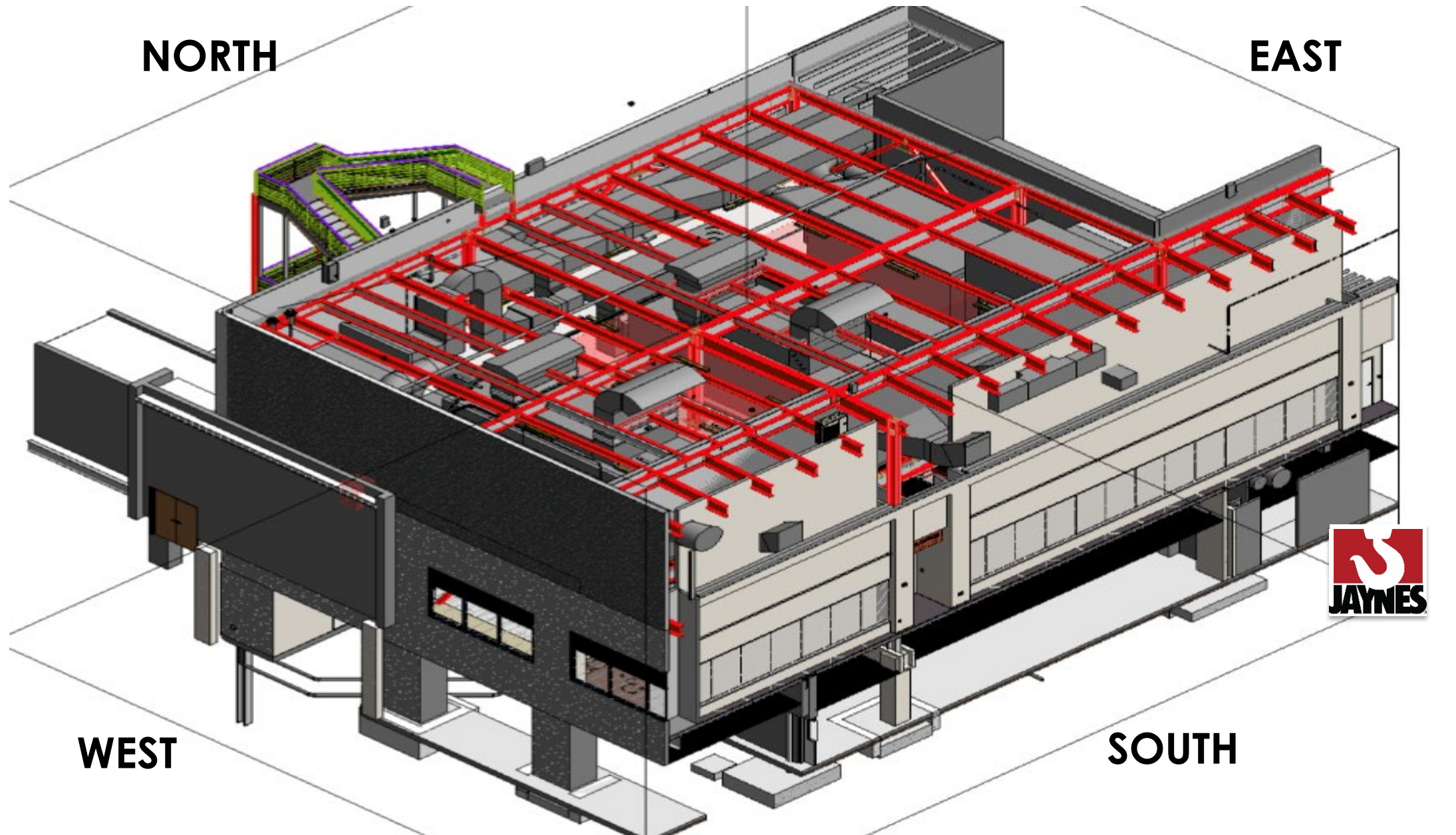
## Meeting #1: **Setup** Examples



NORTH ELEVATION – LOOKING SOUTH

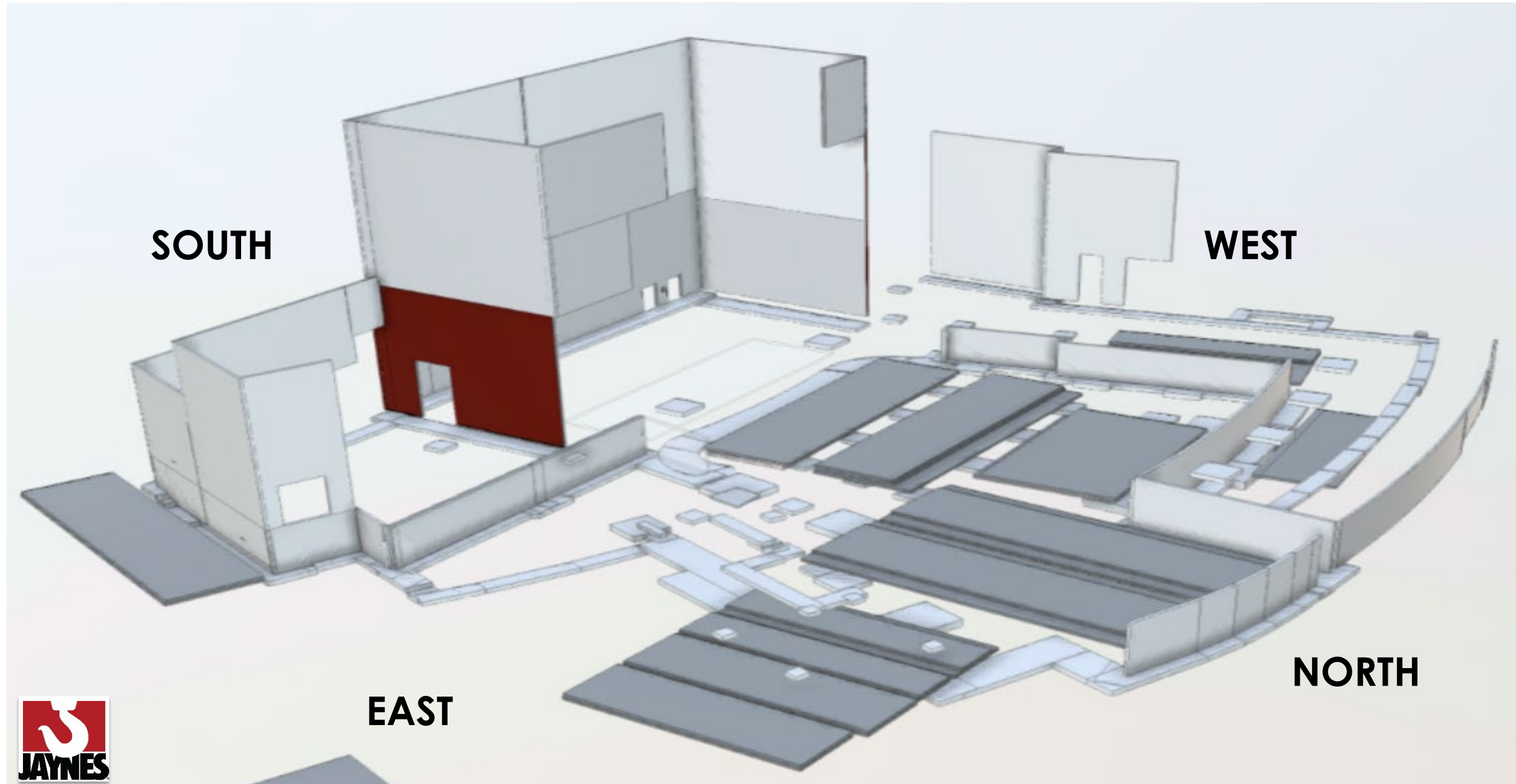


# Phase Pull Planning Meeting #1: Setup Examples



# Phase Pull Planning

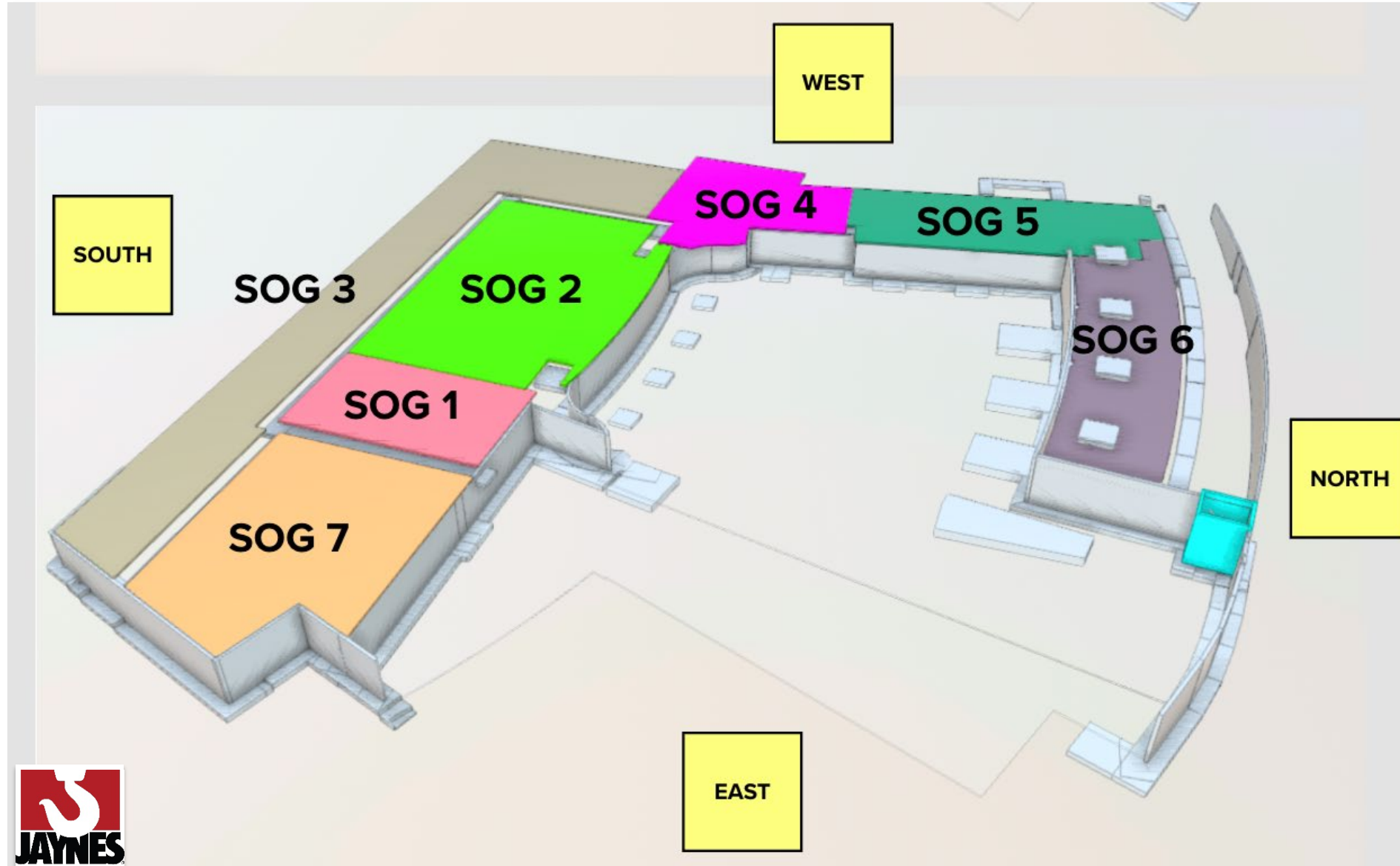
## Meeting #1: Setup Examples



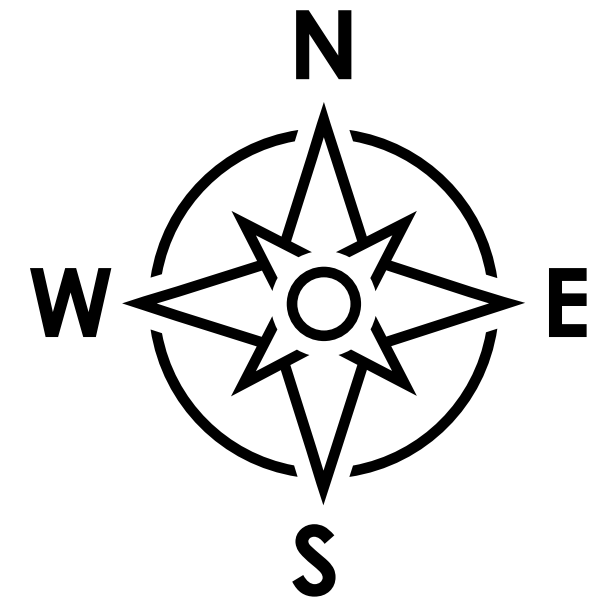


# Phase Pull Planning

## Meeting #1: Setup Examples



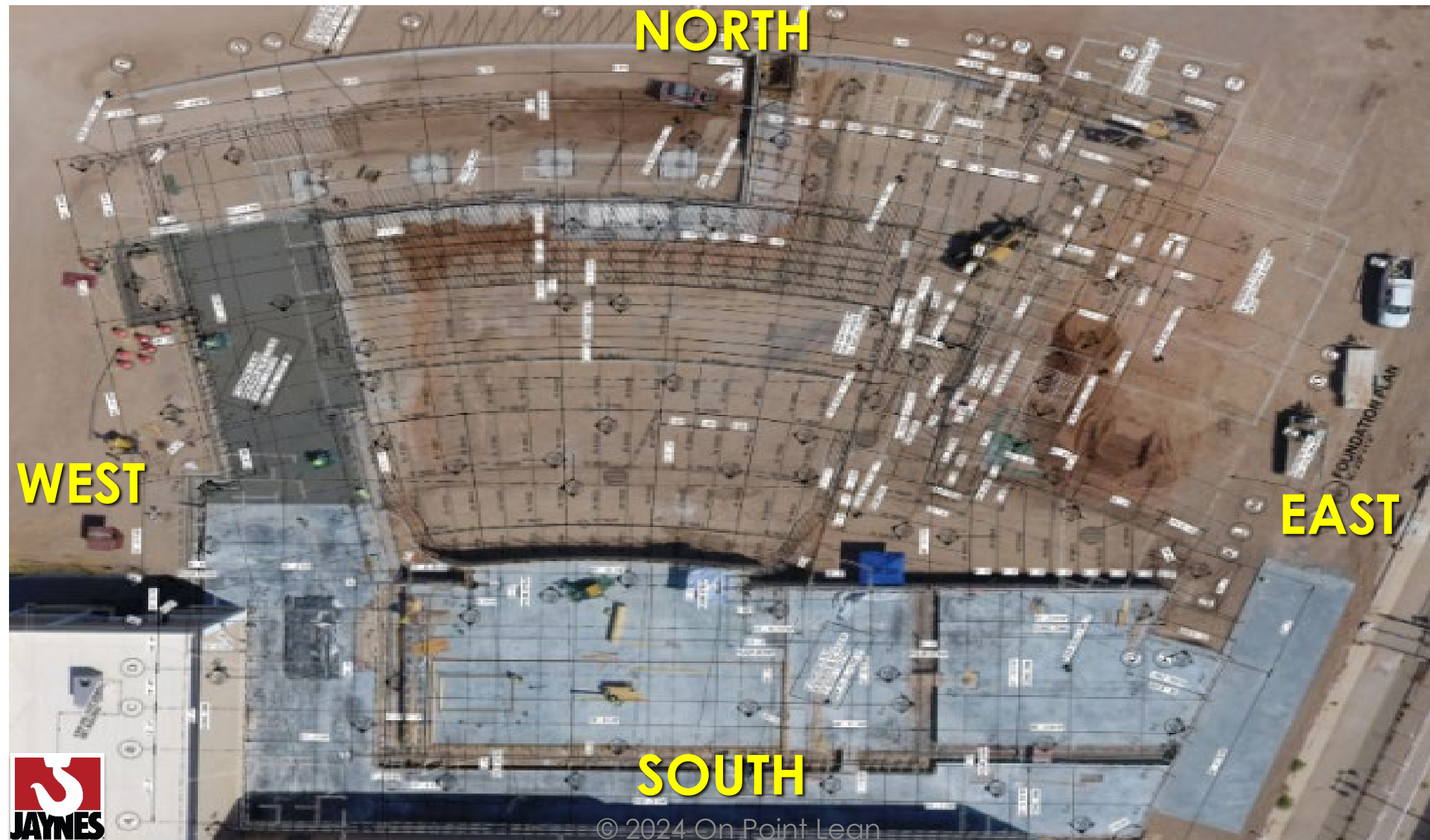
**TIP:**  
**Always**  
**Label**  
**Directions!**





# Phase Pull Planning

## Meeting #1: Setup Examples





# Phase Pull Planning Meeting #1: **Setup** Examples



# Pull Planning 4 Meeting Series



**#1 Setup Session (Internal)**



**#2 Prep Session (w/Trades)**



**#3 Data Collection + 1<sup>st</sup> Pass (Internal)**



**#4 - Phase Pull Plan (w/Trades)**



Created:

04MAY2023

WPI

C&C SERVICES

DEMOLITION CONTRACTOR

B&D Industries, Inc.

Electrical

YEAROUT MECHANICAL

Mechanical Mech Demo/Install

YEAROUT MECHANICAL

Plumbing Plumbing Demo/Install

F&R

Painting & Fireproofing

Western States Fire Protection Co.

Fire Protection

CR

Commercial Roofing LLC

Structural Services Inc

Structural Services

WINTER FINISHES

EIFS/Scaffold

PHASE PULL PLAN SETUP

1

SESSION GOALS

What outcomes are we trying to achieve?

Introduce project stakeholders

Expand/Clarify Bid Schedule

Determine Interim Milestones

Identify constraints/roadblocks

Assign champions & due dates for resolution

Identify long lead items

Gain Full Buy-in to the Plan

Reduce waste, reduce cost, reduce time

Increase safety

ID Quality and Inspection Process

Establish channels of communication

Clarify the sequence and flow of work

Break the work into smaller "chunks" of work

Understand Takt Areas and Takt Time

Get all of the stakeholders on the same page

2

MILESTONE DEFINITION

What kicks-off this phase? What will it look like when it is completed? Done vs Done, Done? Excluded items?

START

PH22 Decking Complete, READY TO ROOF

FINISH

ALL MEPF ROUGH-IN

NO T&B/Commissioning

NO Ceiling finishes (Grid only)

NO Carpet/Tile

TEMP Lighting if permanent not available

NO Flushing

"Ready to close up walls/ceilings"

3

WORK AREA BREAKDOWN

How are we breaking down the areas of this phase of work? Think Takt Areas. Rule of Thumb: 2000m2 or 8000 SF for new construction

4

WORK SEQUENCE

What are the KEY ingredients (activities) for this phase of work? Arrange the lists in the approximate starting order of activities - 1st, 2nd, 3rd, etc.

A

What are the EARLY Activities?

PH22 DECK

ROOF DRAINS

ROOF PENS

SURVEY STAIR

FAB STAIRS

PH22 EXT STAIRS

ROOF PH22

EXTERIOR FRAMING

SET PH22 DOOR FRAMES

DEMO/MOVE TEMP WALL L3

DEMO TEMP TPO L3

FLOOR DEMO/PREP

DEMO FOR BRACING

WELDING BRACES

MECH LAYOUT

PLUMB LAYOUT

B

What are the MIDDLE Activities?

ELECT LAYOUT

FP HANGARS

MECH HANGARS

HYDRONIC HANGARS

PLUMB HANGARS

ELEC HANGARS

WALL LAYOUT

SOFFIT/WALLS TOP TRACK

SPRAY ON FIREPROOFING

FP MAIN ROUGH-IN

FP BRANCH ROUGH-IN

MECH OH ROUGH-IN

HYDRONIC OH ROUGH-IN

PLUMB OH ROUGH-IN

REFRIDGERATION R.I.

MP INSULATION

C

What are the LATE activities?

ELEC OH ROUGH-IN

CONTROLS/LOW OH VOLTAGE

SET AREA 1 DOOR FRAMES

INTERIOR WALL FRAMING

EXTERIOR SHEATHING

CONT/LOW-V IN WALL R.I.

ELECTRICAL IN WALL R.I.

PLUMBING IN WALL R.I.

EXTEND SCAFFOLDING

EXTERIOR INSULATION

EXTERIOR WATERPROOFING

EIFS SYSTEM

PARAPET COPING

INTERIOR SHEETROCK

5

CONSTRAINTS / LONG LEAD ITEMS / NEXT STEPS

CONSTRAINTS

What constraints / roadblocks can hinder this plan?

Confirm to schedule with client	Steel Complete in Area 1	Steel Complete in Area 2	Steel Complete in Area 3
Confirm to schedule with client	Steel Complete in Area 1	Steel Complete in Area 2	Steel Complete in Area 3
Confirm to schedule with client	Steel Complete in Area 1	Steel Complete in Area 2	Steel Complete in Area 3

What are we missing?

What necessary ingredients do we still need?

Get Items to schedule with client	Get Items to schedule with client
-----------------------------------	-----------------------------------

LONG LEAD ITEMS

What? What? By when?

Get Items to schedule with client	Get Items to schedule with client	Get Items to schedule with client
-----------------------------------	-----------------------------------	-----------------------------------

Next Steps

Think ahead...

Next Pull Plan	Next Pull Plan
Turned On/Off	Turned On/Off

6

STICKY NOTE CREATION AREA

Create activity sticky notes here. When complete, duplicate them, and move the duplicates to the TIMELINE

COLOR KEY

JAYNES	CRLLC	F&R Paint & FP	Winter Finishes	C&C DEMO
WPI FRAMING	YEAROUT MECHANICAL	WSFP	B&D ELECTRICAL	YEAROUT Plumbing

ACTIVITY AREA

DURATION

CREW SIZE

NEED OR PREDECESSOR OR TRIGGER(S)

Conditions of Satisfaction

8

PARKING LOT & ACTION ITEMS

WHAT are our next steps? WHO is responsible? BY WHEN do they need fully resolved?

Do we really need to demo Area 1 now?	Do we really need to demo Area 1 now?	Do we really need to demo Area 1 now?	Do we really need to demo Area 1 now?	Do we really need to demo Area 1 now?	Do we really need to demo Area 1 now?
---------------------------------------	---------------------------------------	---------------------------------------	---------------------------------------	---------------------------------------	---------------------------------------

# PREP SESSION

(with Trades)

Trade Logos & Scope

Color Assignments

Session Goals

Phase Start Milestone

Phase Finish Milestone

Work Area Breakdown

Activity Sequence

Spaces to Capture:

Constraints/Roadblocks

Parking Lot Issues

Commitments

Action Items

Long Lead Items

Next Steps

© 2024 On Point Lean

# Phase Pull Planning

## Meeting #2: **Prep Session** (w/Trades)



### Agenda



1. Session Goals



2. Milestone Definition



3. Work Breakdown



4. Work Sequence



5. Roadblocks / Constraints



6. Sticky Note Creation



7. Project timeline



8. Parking Lot and Action Items



9. Project Information

- ~2 hours, In-Person or Virtual
- Have a SCRIBE
  - Constraints, Commitments, Actions
- Review GOALS of the Session
- Define the START MILESTONE
- Define the FINISH MILESTONE
  - What work is released?
  - Discuss any exclusions
- Review Work Area Breakdown (Takt)
- Walk through and list the ACTIVITY SEQUENCE

# Phase Pull Planning

## Prep Session: **Activity Sequence List**

### **A** What are the **EARLY** Activities?

PH22 DECK  
ROOF DRAINS  
ROOF PENS  
SURVEY STAIR  
FAB STAIRS  
PH22 EXT STAIRS  
ROOF PH22  
EXTERIOR FRAMING  
SET PH22 DOOR FRAMES  
DEMO/MOVE TEMP WALL L3  
DEMO TEMP TPO L3  
FLOOR DEMO/PREP  
DEMO FOR BRACING  
WELDING BRACES  
MECH LAYOUT  
PLUMB LAYOUT

- **List the Activities (Beginning to End)**
- **Do this ‘Live’, and as a Group**
  - **Common Language**
  - **Shared Knowledge**
  - **Deep Collaboration**
- **Get Clarity on what Is or Is Not included – e.g., “Plumbing”**
- ***“Setting the Batting Order”***

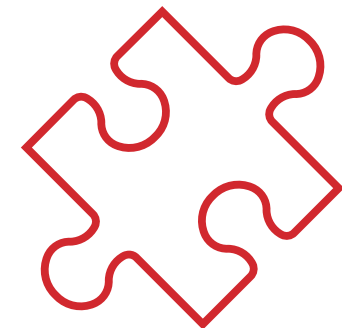


# Phase Pull Planning

## Post-Meeting #2: **Key Information to Collect**

1. **Activity:** From the **ACTIVITY SEQUENCE LIST**
2. **Area:** Work Area Breakdown (Takt Areas)
3. **Duration:** Install time per **AREA**, in **WORKING DAYS**
4. **Crew Size:** Approx. # of workers
5. **Trigger(s):** What prior activity 'triggers' you to start?
6. **Conditions of Satisfaction (CoS)** (Optional):  
Specific things you need or expect from OTHERS  
(which are NOT part of your scope)

ACTIVITY  
AREA  
DURATION  
CREW SIZE  
TRIGGER(S)  
Conditions of  
Satisfaction



# Pull Planning 4 Meeting Series



**#1 Setup Session (Internal)**

**#2 Prep Session (w/Trades)**

**#3 Data Collection + 1<sup>st</sup> Pass (internal)**

**#4 Phase Pull Plan (w/Trades)**

# Phase Pull Planning

## Meeting #3: **Data Collection & 1<sup>st</sup> Pass**



**ACTIVITY**

**AREA**

**DURATION**

**CREW SIZE**

**TRIGGERS(S)**

**Cond of Satisfaction**

- **Collect the Trade Info**
  - 2 days prior to pull session
- **Review for completeness**
  - Missing crews, triggers?
- **Get corrections if needed**



# Phase Pull Planning

## Meeting #3 : Data Clean-Up & Sticky Creation



### Raw Information:

**MECHANICAL PENETRATIONS ON THE ROOF for about 3 DAYS with 3-5 sheet metal workers at Concourse Penthouse #22, I need Concourse Penthouse #22 fully decked & with safety rails installed by the steel contractor and signed-off.**

**I also need the clash with the steel beams resolved by 14NOV**

**Add to Constraint Log**



**ROOF PENS  
PH #22  
3 days  
Crew: 4  
Need: PH22  
Decking Signed Off**

**Edited Info**



# Phase Pull Planning

## Meeting #3: **First Pass**

---

- Prior to in-person Pull Session
- Log Constraints, Issues, Needs, or Concerns
- Note any questions or comments
  - From the Data Received
- **Create Sticky Notes** (data points)
- **Make a 1st Pass at the Sequence**
  - Prior to the in-person pull session (saves time)
  - Use the info as it was submitted

# Pull Planning 4 Meeting Series



**#1 Setup Session (Internal)**

**#2 Prep Session (w/Trades)**

**#3 Data Collection + 1<sup>st</sup> Pass (Internal)**

**#4 - Phase Pull Plan (w/Trades)**



# Phase Pull Planning

## Meeting #4: **Phase Pull Plan** (w/trades)



- 2 to 3 hours, in-person (if possible)
- Make time for **Introductions**
  - Use Name Tags if new team
- Seat key players together
- Review any questions
- **SET DRIVING ACTIVITIES 1st**
  - Put these at the top of the plan
  - Then add non-driving work
- Focus: **CLEAN HANDOFFS**

Bob Smith  
ABC Electric

# Key Info for Pull Planning



Task	Area or Level
Duration	Crew Size
Trigger(s) + Cond. of Satisfaction	

Install Duct Mains & VAVs	L3Z4
5 days	4
Wall Framing + Leaveouts @ mains	

**Beginning of Phase**

**SOG  
Area A  
11OCT**

Rebar	A
3 days	6
Vapor Barrier	

Embeds	A
2 days	3
Rebar at Perimeter	

Inspect	A
1 day	1
Rebar & Embeds Installed	

Pour	A
1 day	8
Rebar Inspection	

**Downstream Work “PULLS” Upstream Work**

**Milestone completion**



**Beginning of Phase**

**SOG  
Area A  
11OCT**

Rebar	A
3 days	6
Vapor Barrier	

Embeds	A
2 days	3
Rebar at Perimeter	

Inspect	A
1 day	1
Rebar & Embeds Installed	

Pour	A
1 day	8
Rebar Inspection	

*Conversation*

**Milestone completion**

COLOR KEY

B&S ISD

PCI

MARRS ELECTRIC

NWASM

FREEDOM FIRE PRO

MOUNTAIN MECHANICAL

TRIM TECH

UDI WOOD CEILINGS

GEELS PAINTING

MILLER FLOORING

GDA/OK WP SEALANTS

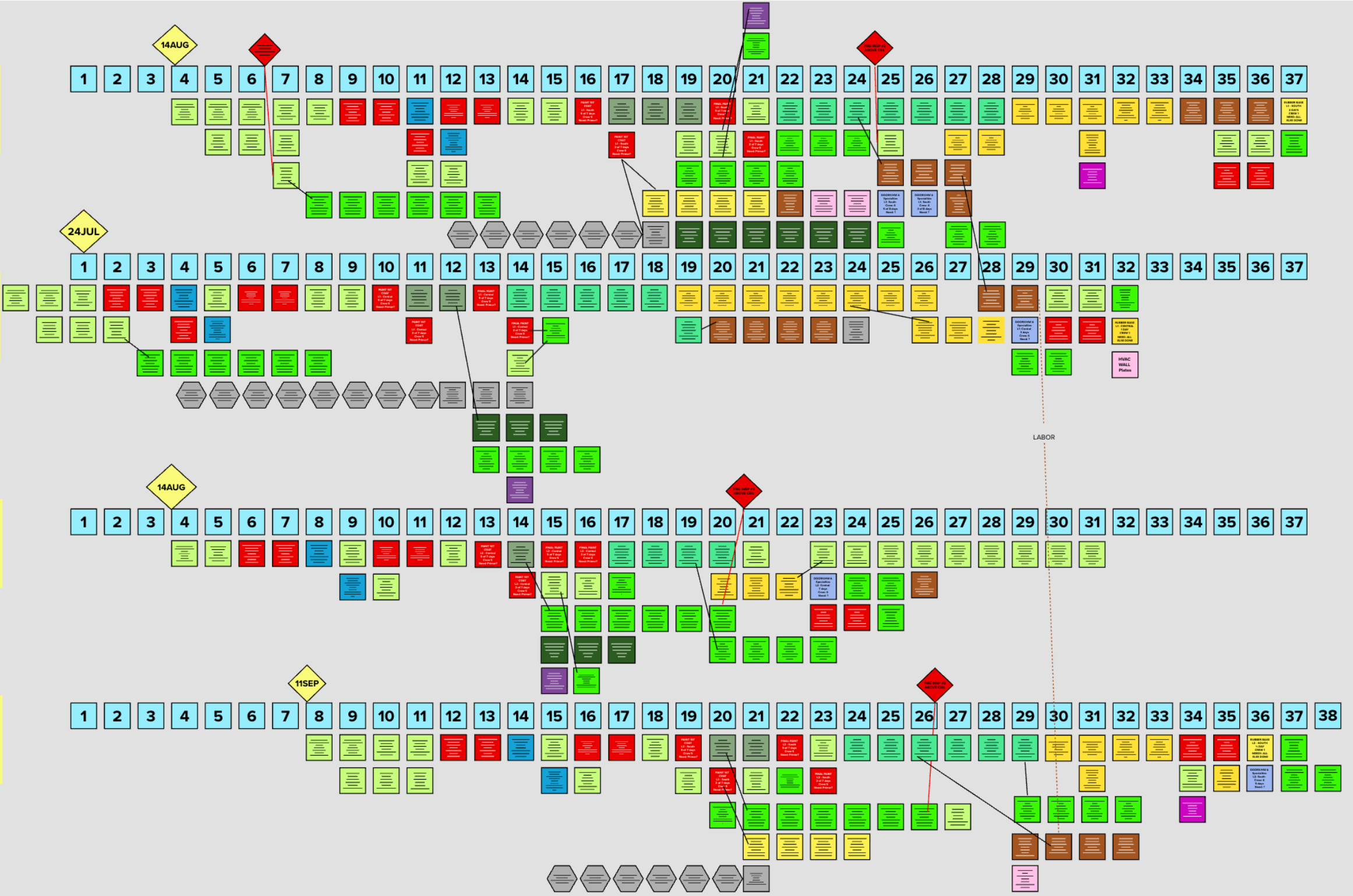
ACE Glass

L1 SOUTH

L1 CENTRAL

L2 CENTRAL

L2 SOUTH



# Phase Pull Planning Tips

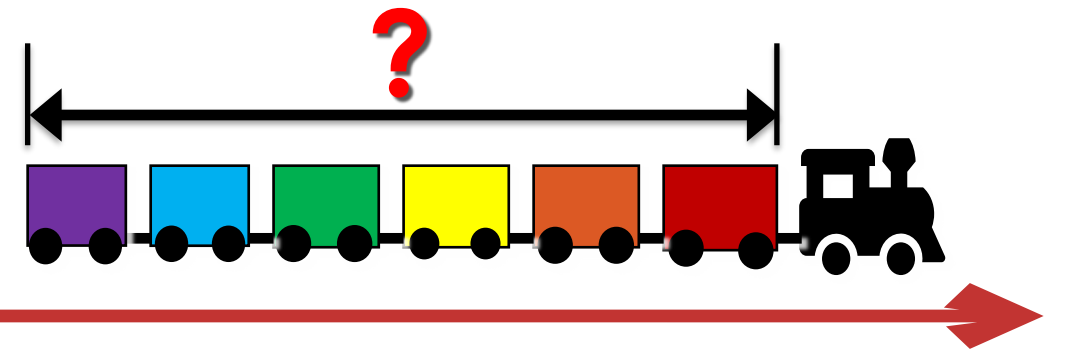
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- **Determine the Right Level of Detail**
- **Task Durations:**
  - **New Construction: 1 week or LESS**
  - **Renovations or complicated work: 1 day**
  - **Design: 2 weeks or less**
- **Follow the requests from downstream**
  - *What do they say they need?*
- **Copy & Paste repetitive areas to save time**
- **If something doesn't look or sound right: **ASK!****



## Meeting #4: The Pull Plan

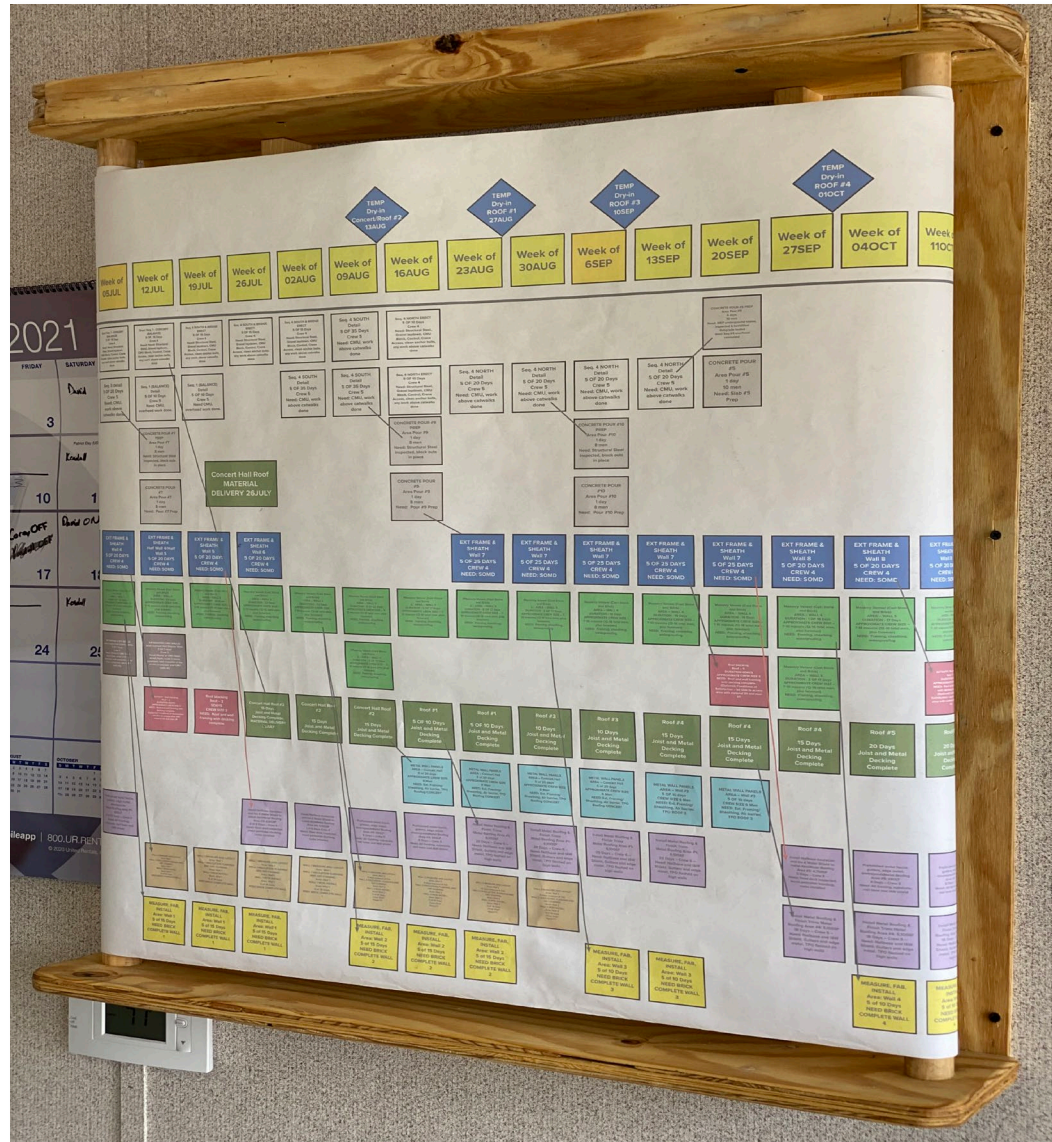
After the Stickies are Up:



**Check the Phase Duration:** *Does our pull plan meet or beat the milestone date?*

- **IF YES:** Maybe we are done, OR maybe we try to take more time out (build float)
- **IF NO:** How can we take time out? Can we reduce batch sizes? Add crews? Stack Activities, Add Shifts, etc.?

# Immediately After the Pull Plan:



- Distribute a PDF of the plan
- Print & Display the plan
- Log & Track ALL Constraints, Commitments, & Actions
- Enter the Plan into software
- Update the Phase Plan WEEKLY
- **Start the Weekly LPS Cadence**  
**Make-Ready Planning, Weekly Work Planning, Daily Huddles, Percent Plan Complete, & Learning**

## Phase Pull Planning:

**If done well, you'll get:**

- **Robust Innovation & Creativity**
- **Early Identification of Constraints**
- **Flow, Predictability, & Reliability**
- **Higher Productivity, with Less Waste & Rework**

**The Pace, Flow, and Handoffs are KNOWN and OWNED by all**

**Countermeasures  
to COMPLEXITY**

**Shared  
Knowledge**

**Deep  
Collaboration**

**Extreme  
Ownership**

**Rapid  
Adaptability**



**What do you do  
when a problem arises?**



## Phase Pull Planning

# GOOD!

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- Pull Planning can be Messy – **Good!**
  - “The Devil is in the Details”
- Expect A LOT Problems to Surface - **Good!**
- Every Pull Plan is Different
  - Construction – Linear
  - Design – Iterative
- **Know that Pull Planning is Just the Start!**
  - You need the rest of Last Planner System



# A Job Well Begun is Half Done: Pull Planning Essentials

## Questions?



**Dave MacNeel**

**On Point Lean Consulting**

Cell: +1 513 500 4511

[dmacneel@onpointlean.com](mailto:dmacneel@onpointlean.com)



**Bartug Kanik**

**Pernix Federal**

Cell: +90 530 117 6030

[bkanik@pernixfederal.com](mailto:bkanik@pernixfederal.com)



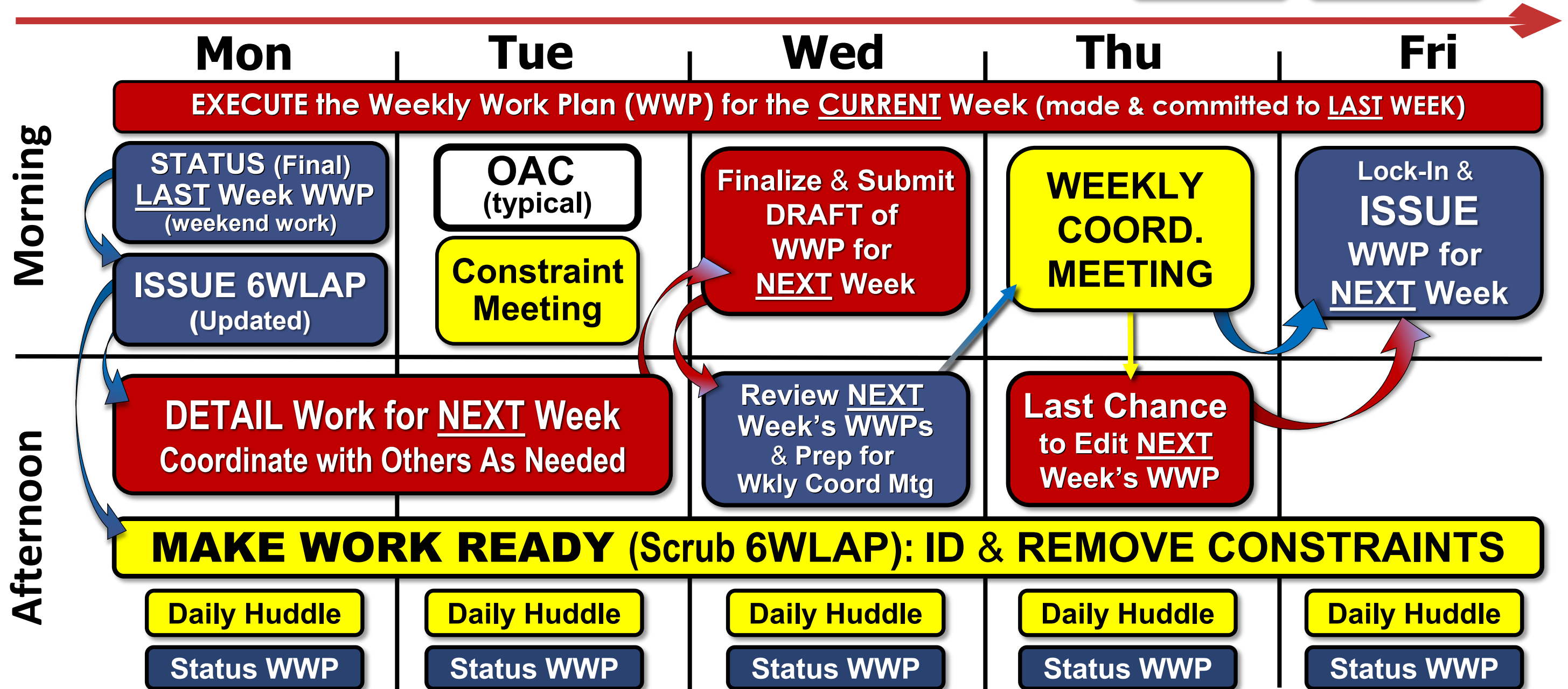
# LPS: Daily Cadence

KEY:

ALL

GC

Trades



5-Day Work Week