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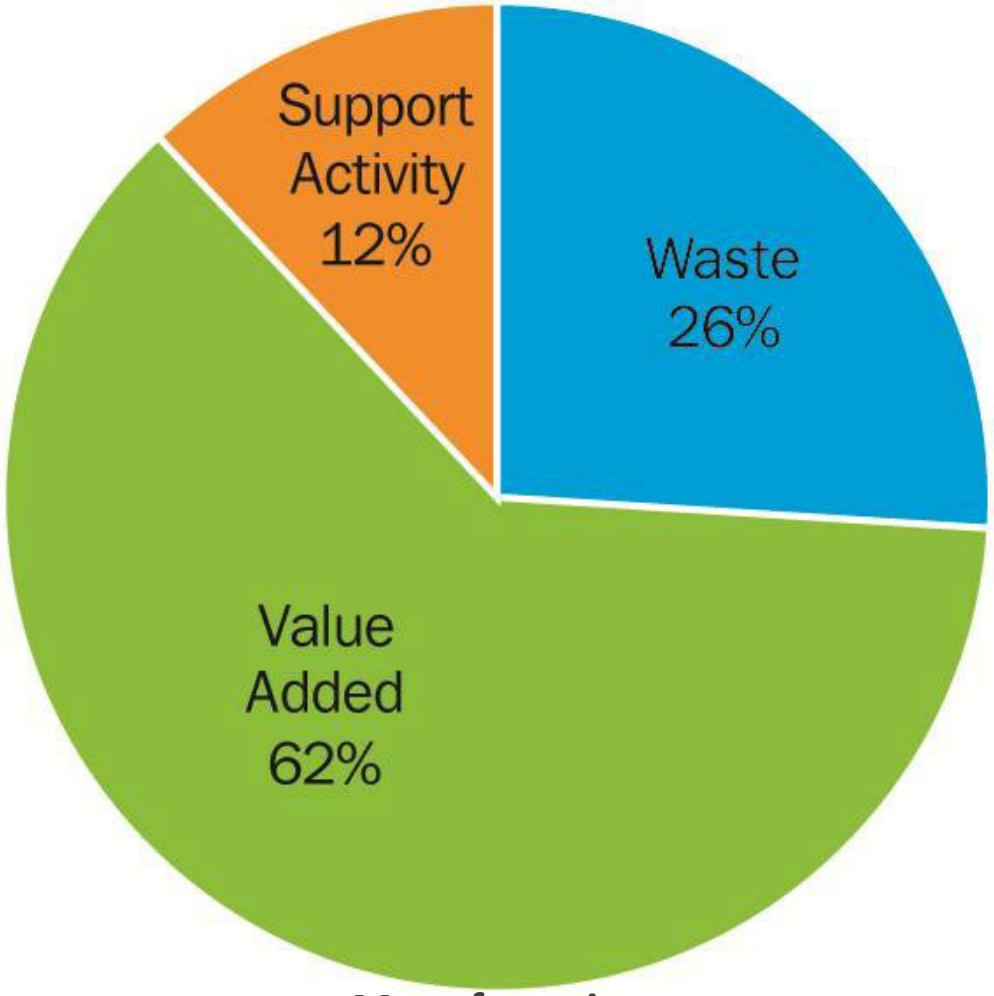
9.25.2024

Utah Contractor
Continuing Education

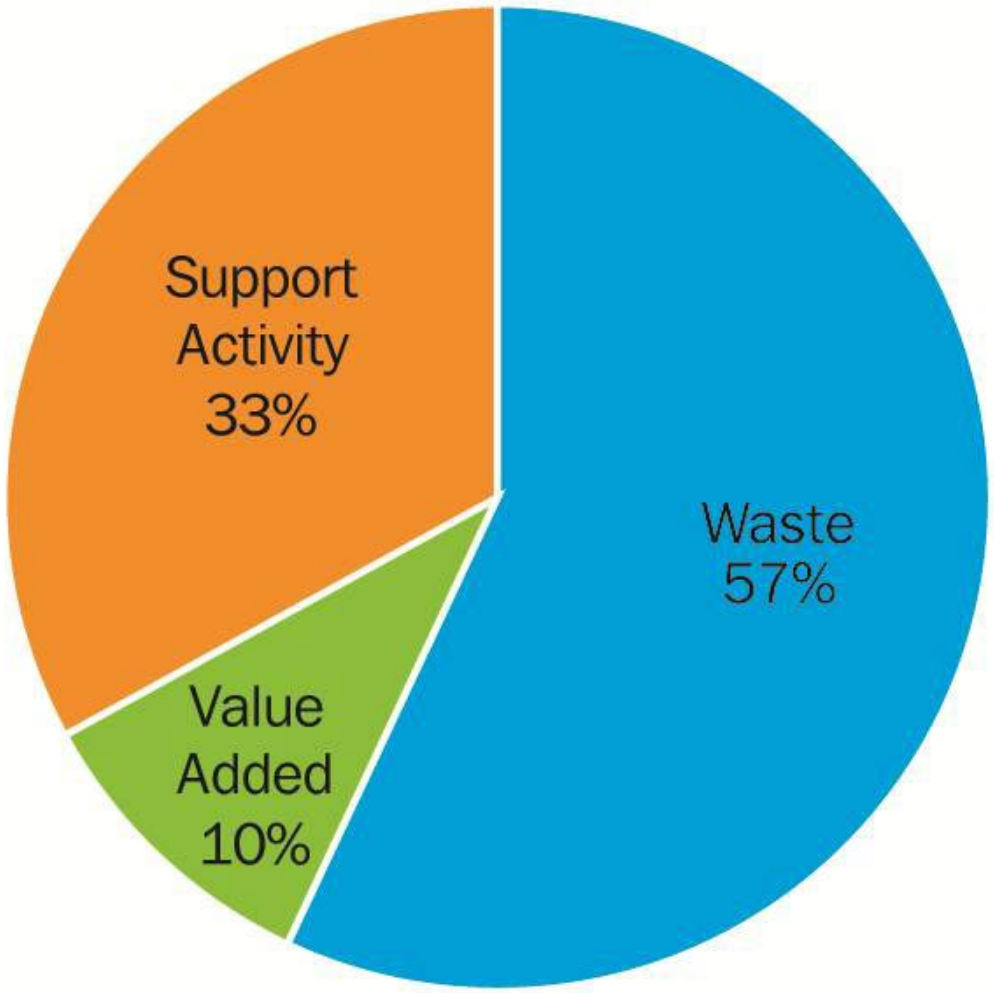
Short Interval Planning (SIPs)

From **One-Piece Flow**
to **Takt Time Planning**

How Much **WASTE** Is There On My Projects?



Manufacturing

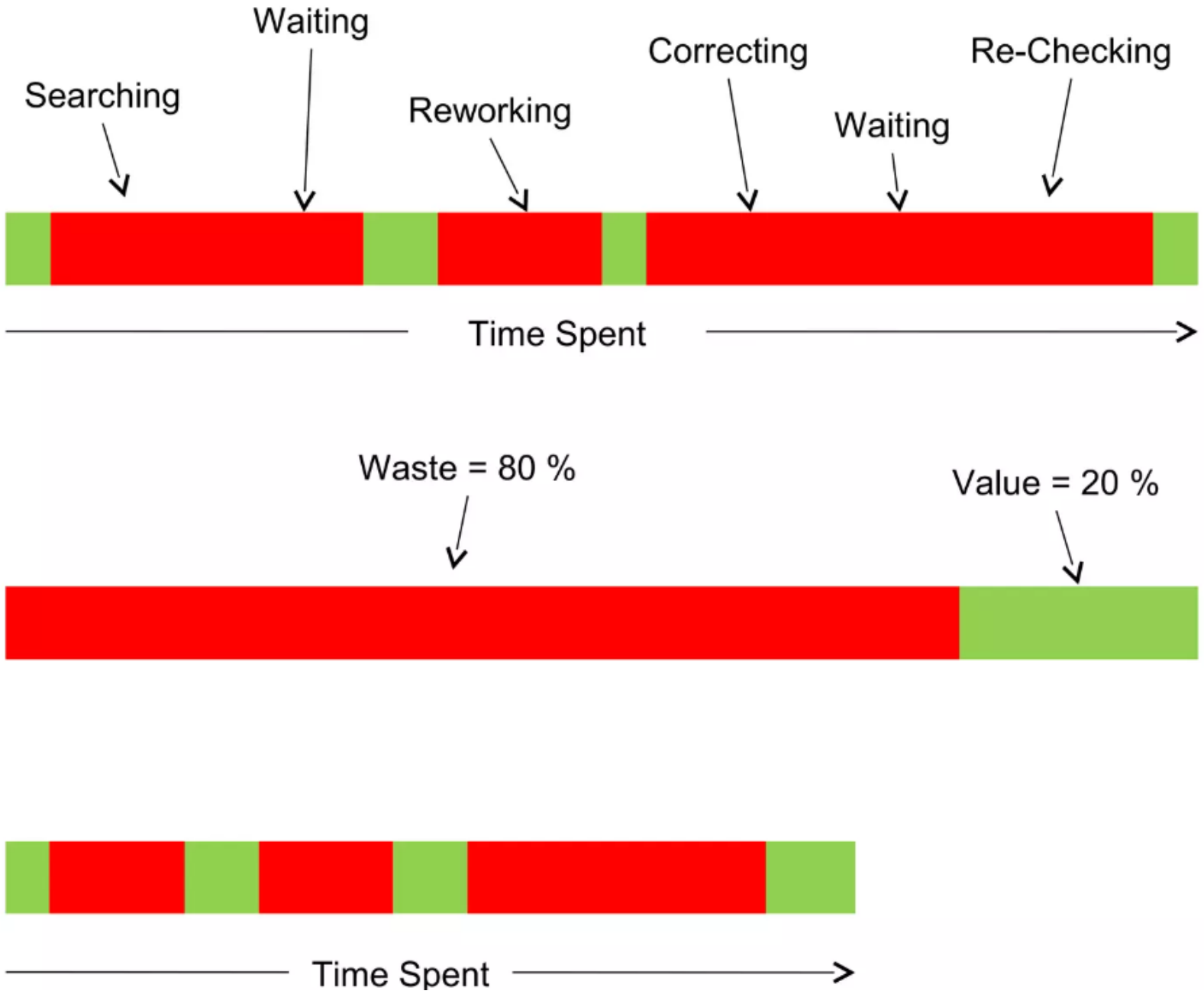


Construction

LEAN Construction

Minimize Waste

Maximize Value



The 8 Wastes

To remember The 8 Wastes, you can use the acronym "DOWNTIME."

D	Defects
O	Overproduction
W	Waiting
N	Non-Utilized Talent
T	Transportation
I	Inventory
M	Motion
E	Extra-Processing

Defects

Efforts caused by rework, scrap, and incorrect information.

Overproduction

Production that is more than needed or before it is needed.

Waiting

Wasted time waiting for the next step in a process.

Non-Utilized Talent

Underutilizing people's talents, skills, & knowledge.

Transportation

Unnecessary movements of products & materials.

Inventory

Excess products and materials not being processed.

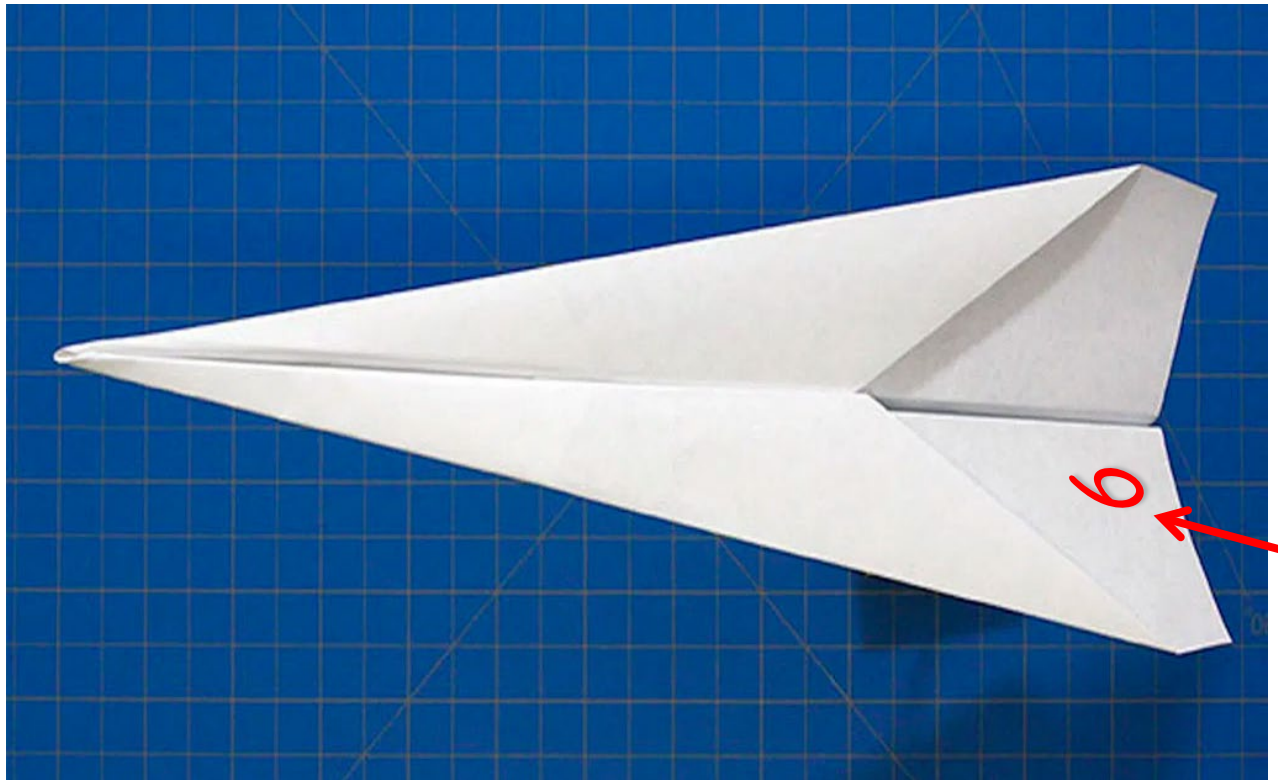
Motion

Unnecessary movements by people (e.g., walking).

Extra-Processing

More work or higher quality than is required by the customer.

Paper Airplane Game: Batch vs. One-Piece Flow



- Groups of 5
- Three 2 Minute Rounds
  - Batch of 8
  - Batch of 4
  - One-Piece Flow
- Two Folds Maximum per Person
- Batch # Written on Plane
- Record Completion Time
- Post-it note is the queue area

GEMBA ACADEMY

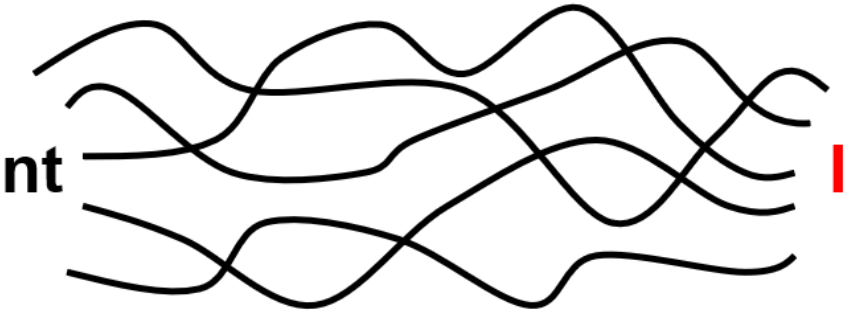
One Piece Flow vs. Mass Production Envelope Stuffing Lean Thinking Simulation

Airplane Game Discussion

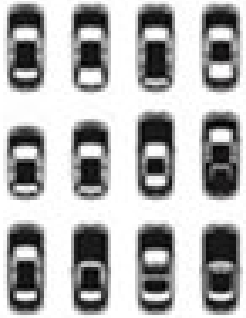
- Which of the eight wastes did you encounter in the game?
  - Defects
  - Overproduction
  - Waiting
  - Non-Utilized Talent
  - Transportation
  - Inventory
  - Motion
  - Extra-Processing
- Why was one-piece flow faster? **It's <u>ALWAYS</u> faster!**
- What is the major problem with defects in batch production?
- What is different in construction?

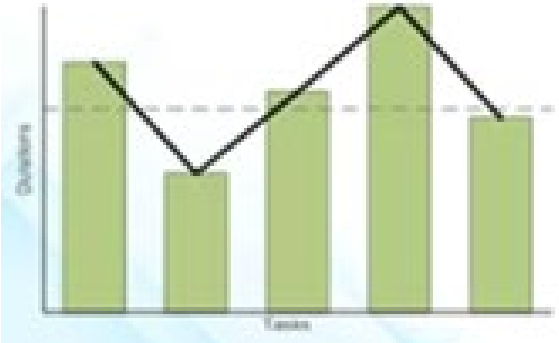
Push vs. Pull

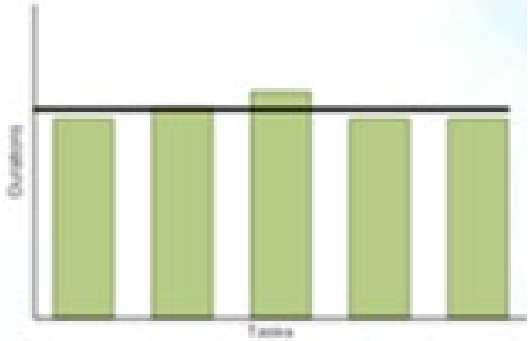
Inconsistent Process



Inconsistent Results







Takt Planning (One-Piece Flow) Brings Order & Predictability to Projects

The Takt System

To illustrate the production strategy in a Takt system, one can think of the following five principles:

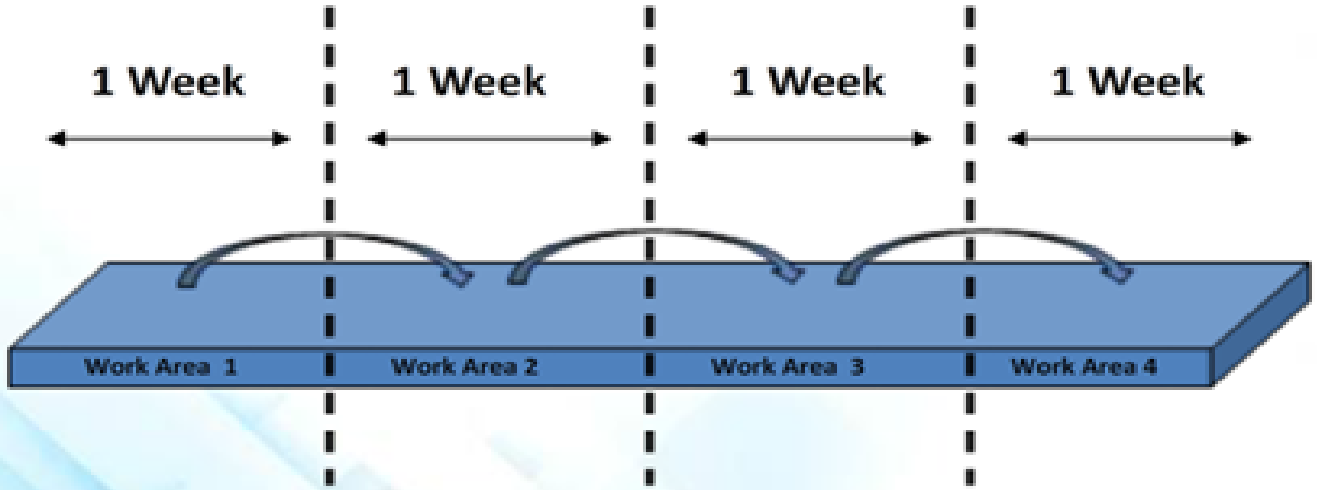
(1) Each floor is broken up into areas with similar amount of scope

(2) Each discipline has set, uniform duration to complete each area

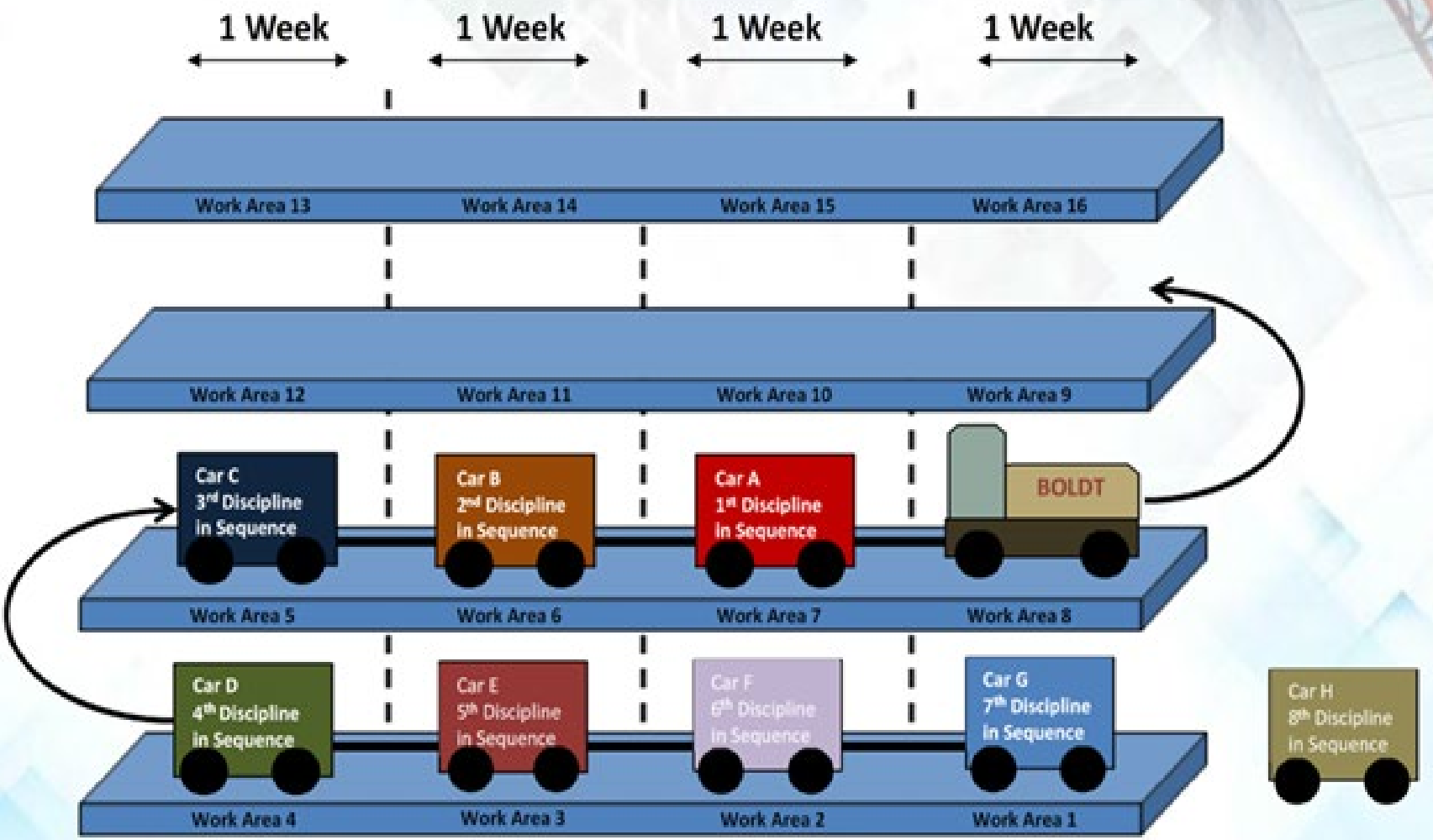
(3) Only one trade is occupying each area at the same time

(4) Each discipline's material is delivered to 'its' work area only

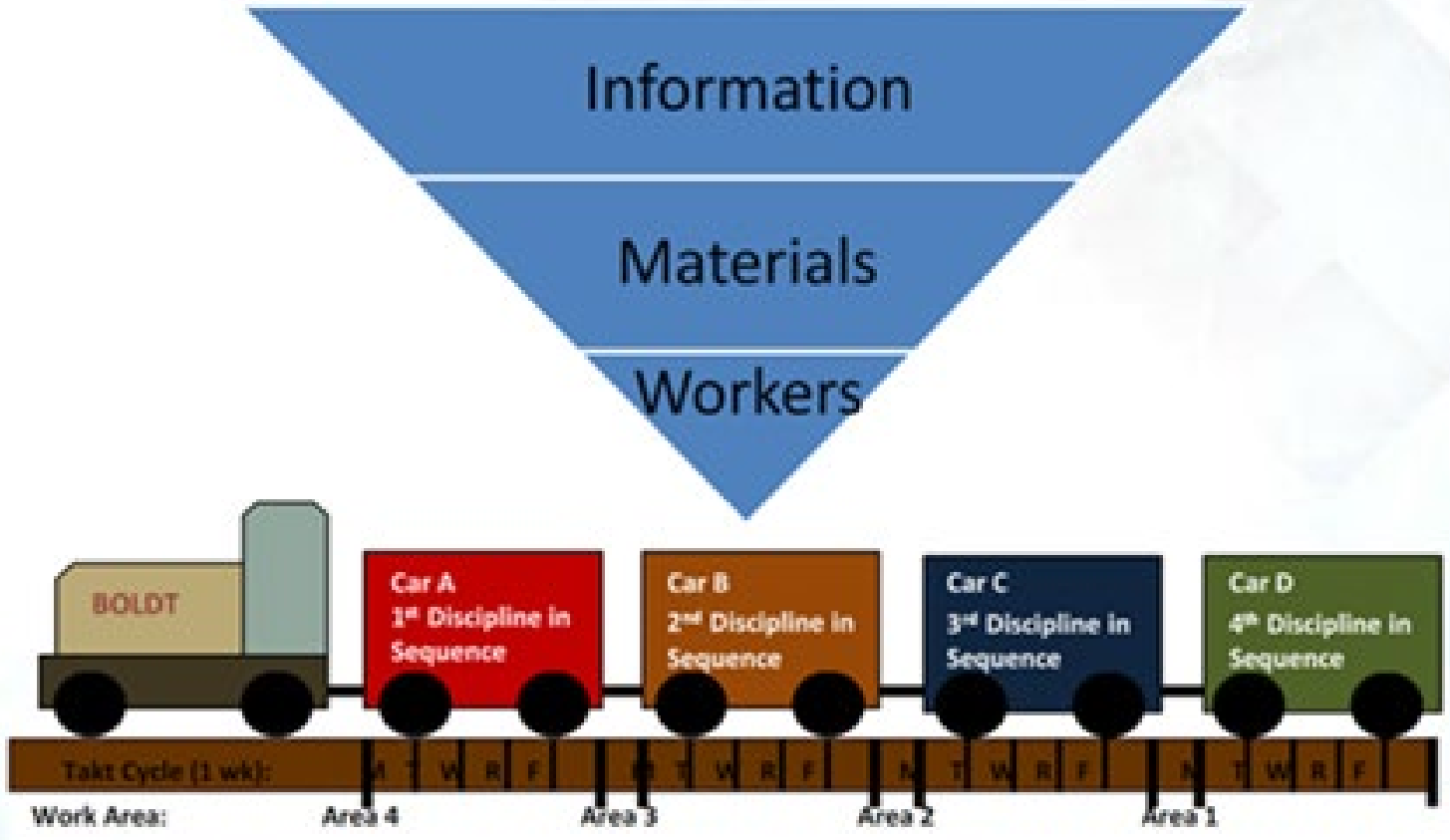
(5) All disciplines complete and move to the next area every Friday



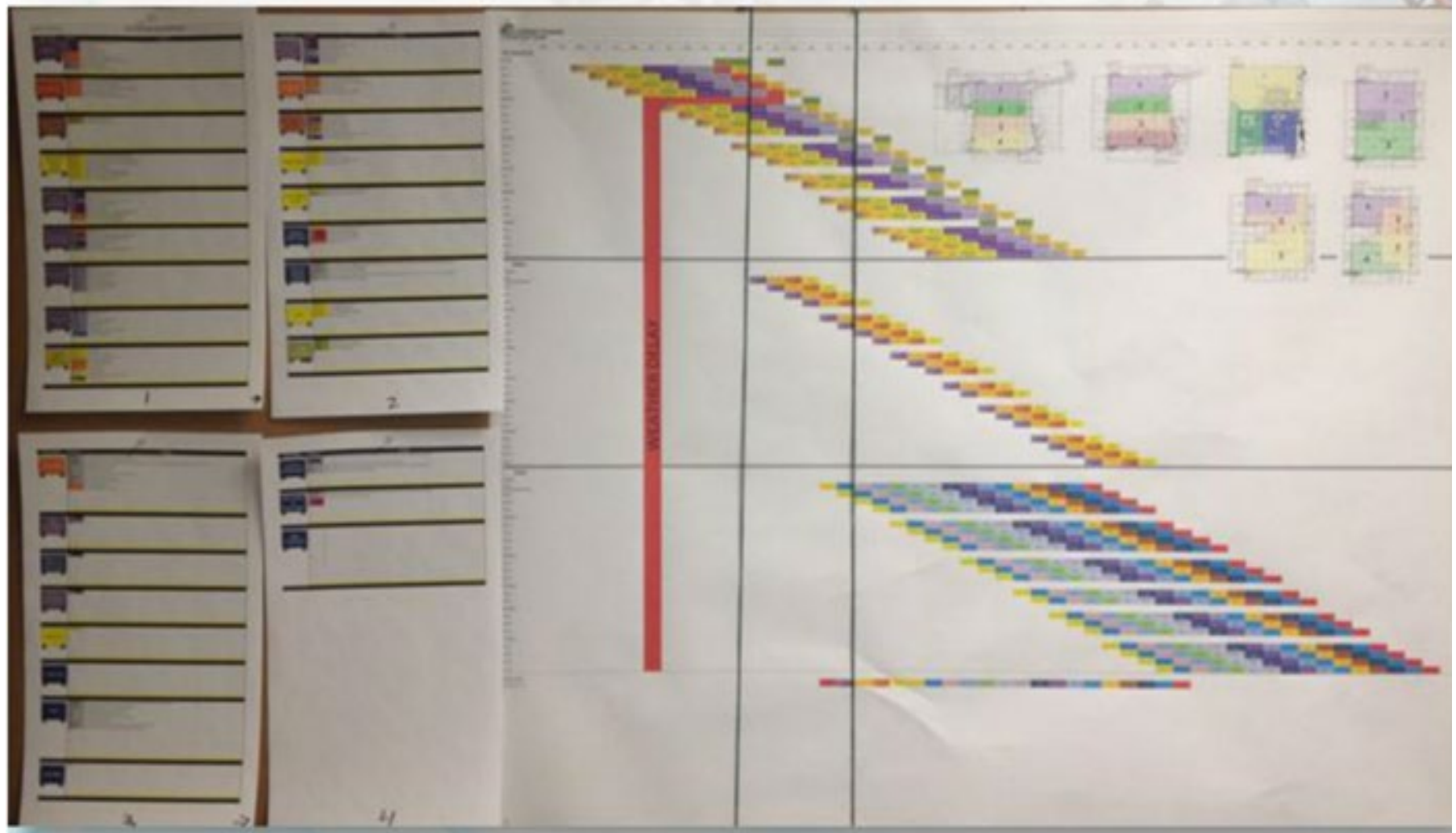
The Takt System



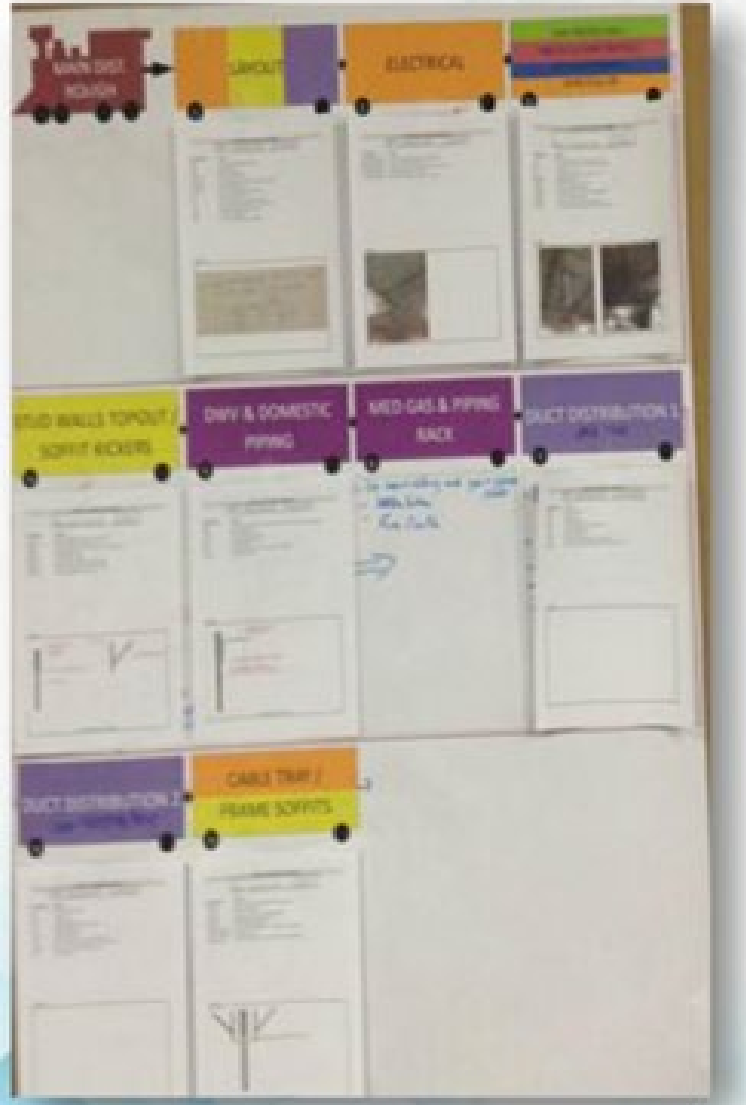
Align All Resources Using Pull



Takt Plan

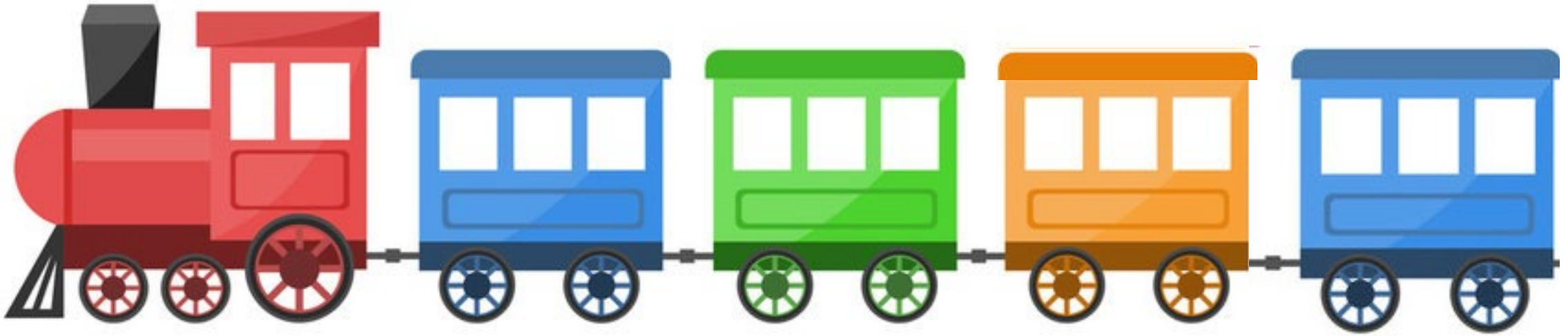


Takt Train Cars with Handoffs



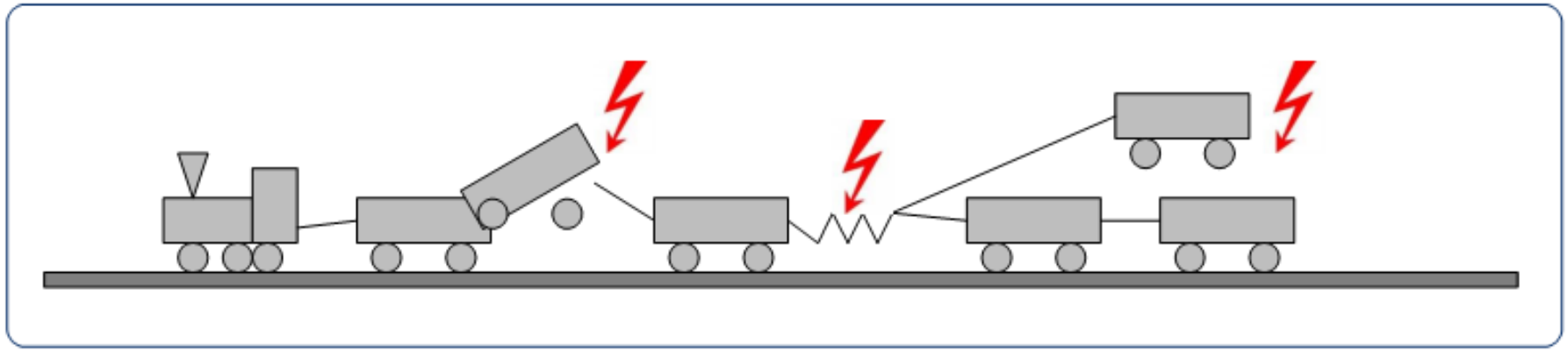
Goal = Flow, like a train of subcontractors

- Each task is a train car with a scope of work to be accomplished in an area
- No trade stacking

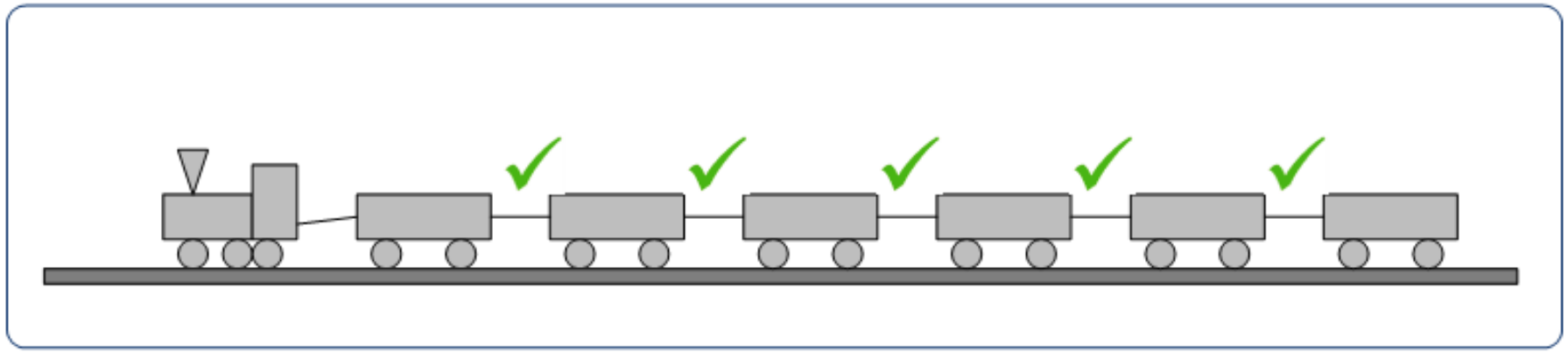


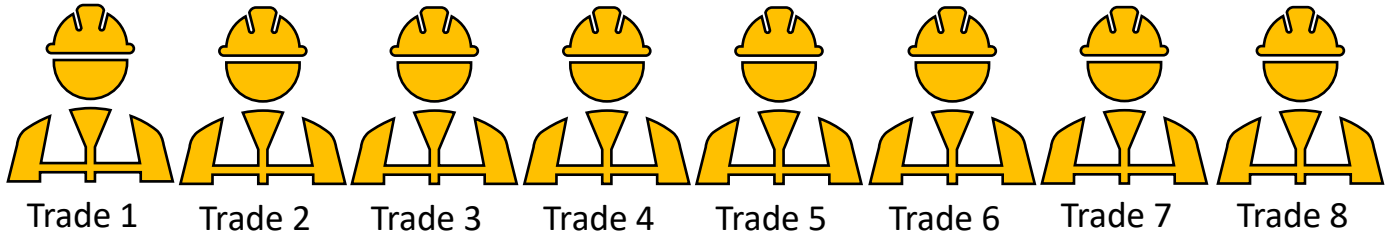
What does the ‘train’ typically look like on construction projects?

Train 1



Train 2



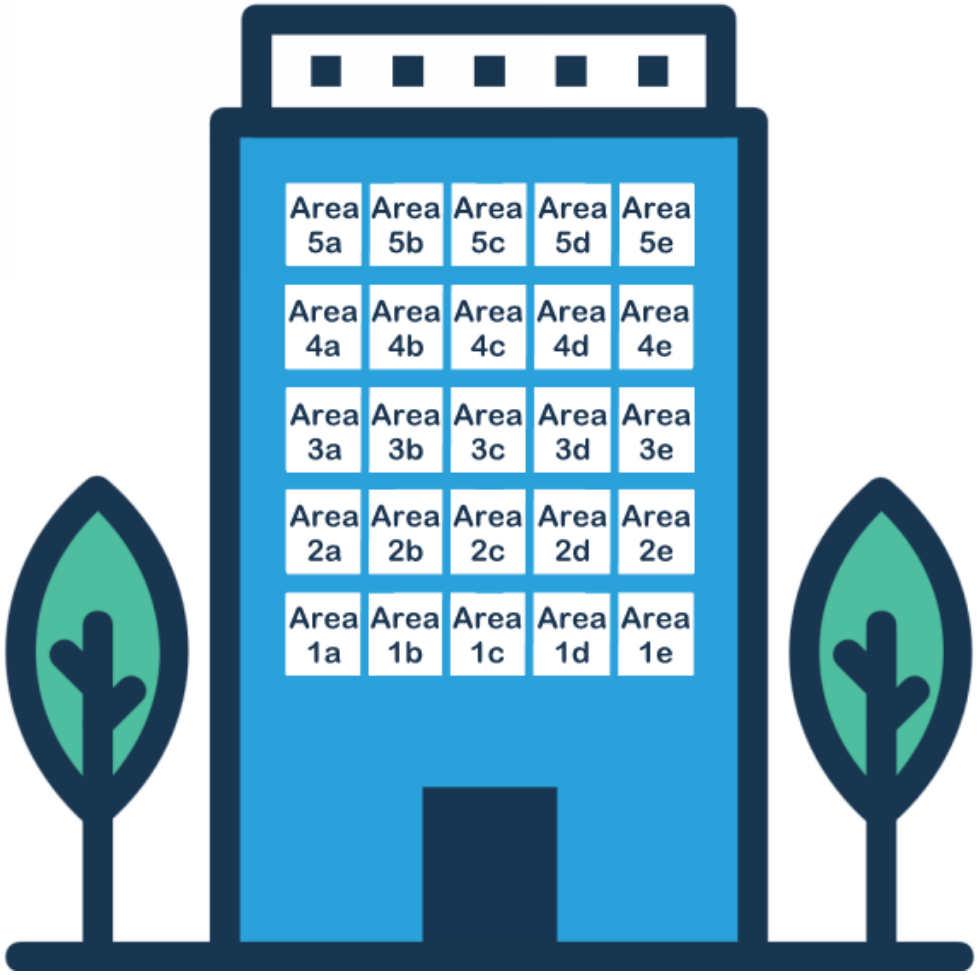


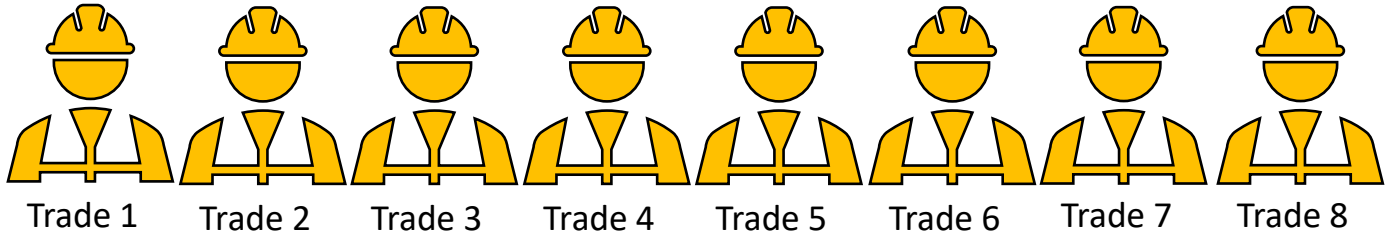
Question 1: If each trade is given **1 week** (5 day work week) to complete an Area and they must go in sequence with no trade stacking, how many days will it take for all 8 trades to complete Area 1?

Question 2: Based on those parameters, how many days will it take all 8 trades to complete all 5 floors?

Question 1: 8 weeks / 40 days
Question 2: 12 weeks / 60 days

Batch Production





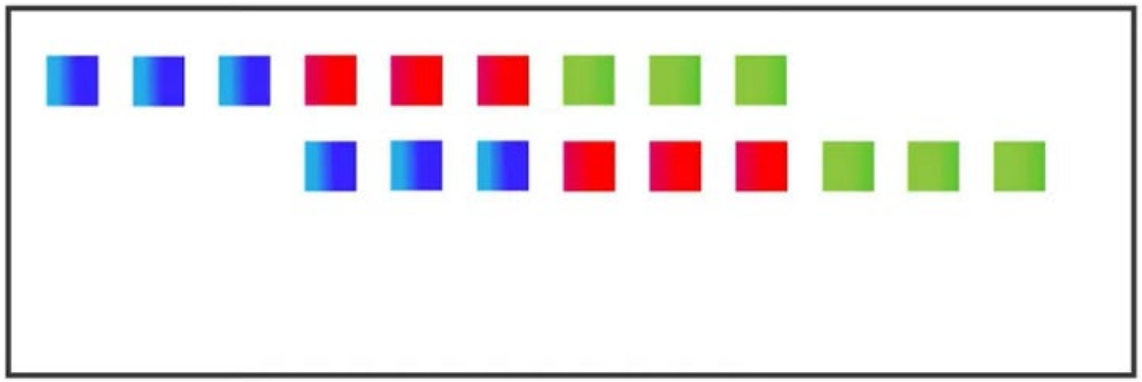
Question 1: If each trade is given **1 week** (5 day work week) to complete an Area (e.g. Area 1a) and they must go in sequence with no trade stacking, how many days will it take for all 8 trades to complete Area 1?

Question 2: Based on those parameters, how many days will it take all 8 trades to complete all 5 floors?

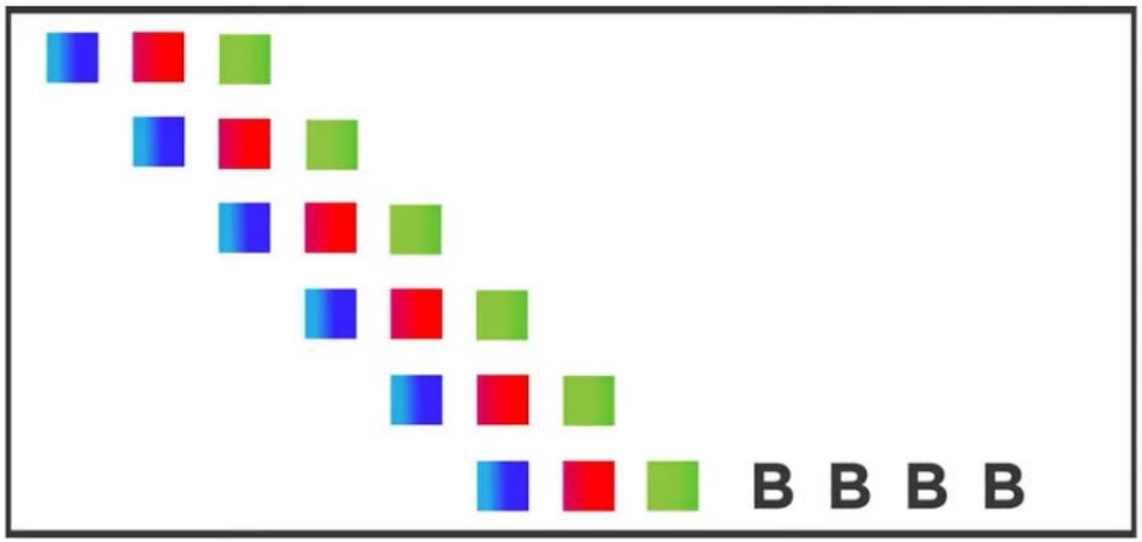
Question 1: 12 days
Question 2: 32 days

One-Piece Flow Production

Takt Planning Helps Complete Projects Sooner

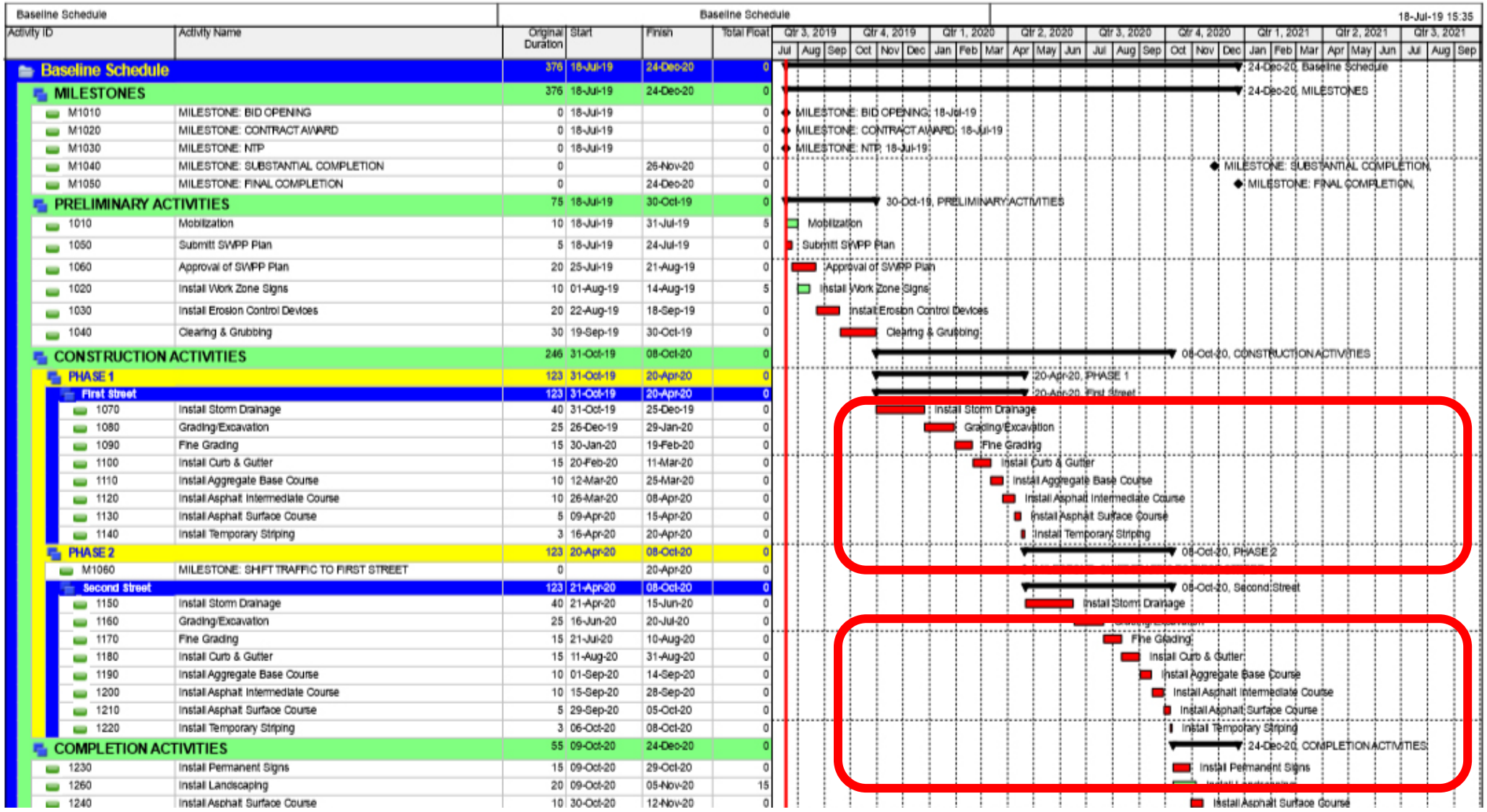


Total Duration = 12



Total Duration = 8

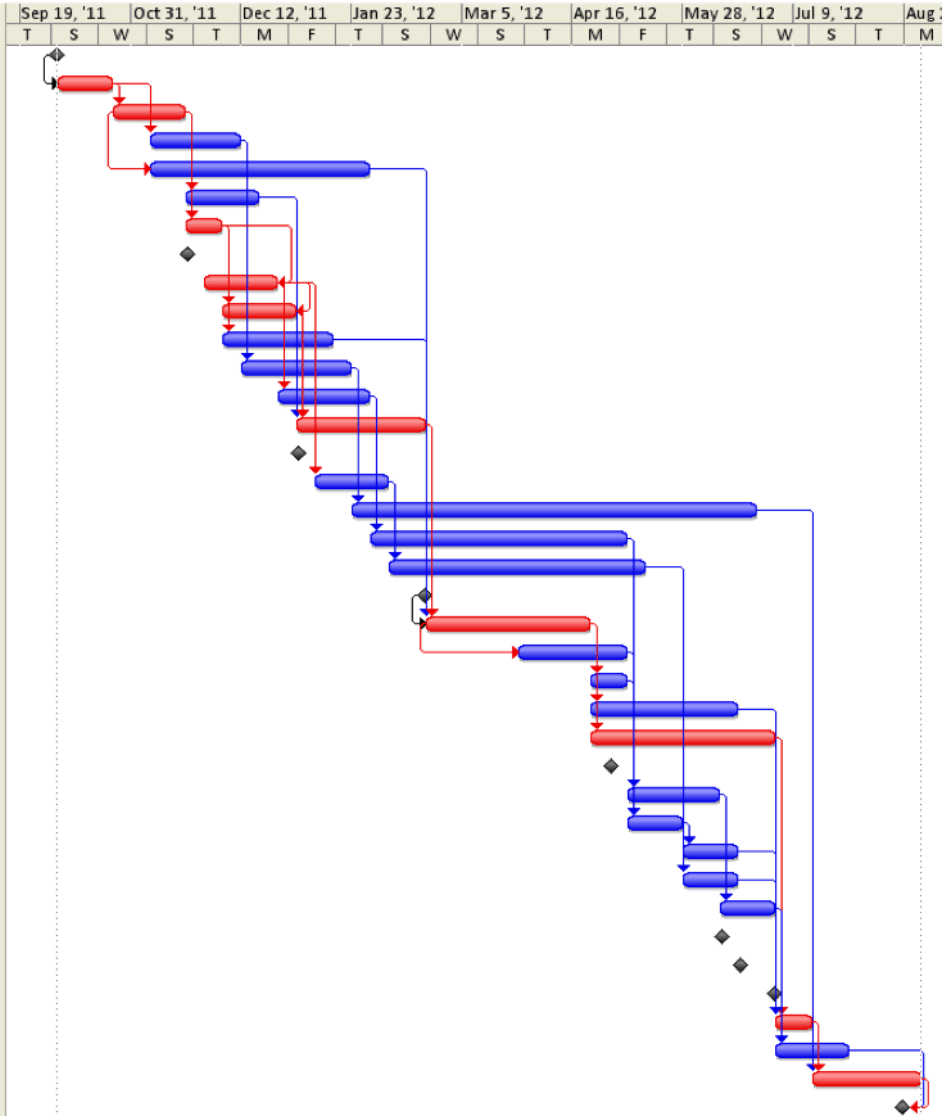
CPM Problems (Batching)



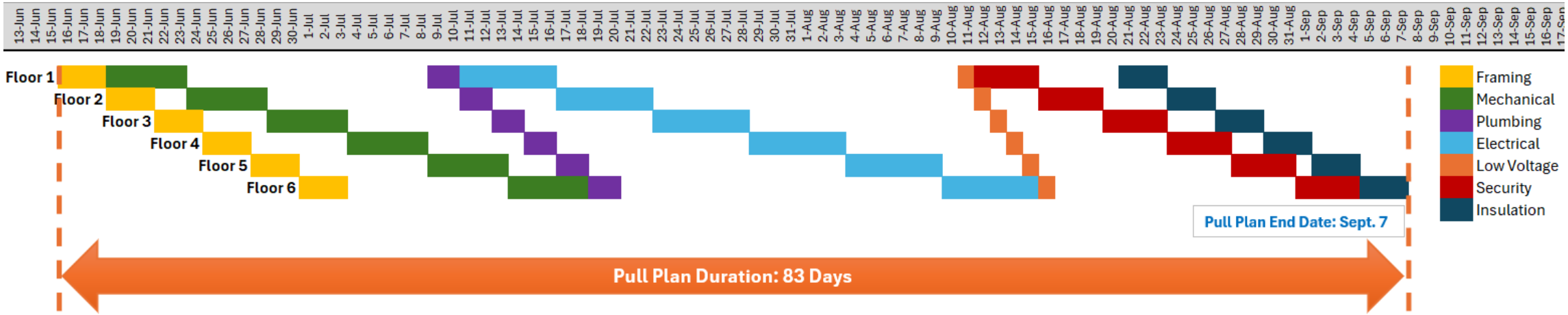
Batching

CPM Problems (Trade Stacking)

Task Name	Duration	Start	Finish	Predecessors	Total Slack
Design NTP	0 days	Mon 10/3/11	Mon 10/3/11		0 days
SD Set	21 days	Mon 10/3/11	Sun 10/23/11	2SS	-7 days
DD Set	28 days	Mon 10/24/11	Sun 11/20/11	10	-7 days
BOD Process Equip	35 days	Mon 11/7/11	Sun 12/11/11	10	14 days
Bid/Award Structural Steel,	84 days	Mon 11/7/11	Sun 1/29/12	11SS+14 days	14 days
FDN Permit	28 days	Mon 11/21/11	Sun 12/18/11	11	7 days
Permit Set	14 days	Mon 11/21/11	Sun 12/4/11	11	-7 days
Design Freeze	0 days	Mon 11/21/11	Mon 11/21/11		279 days
Comp. CD Set	28 days	Mon 11/28/11	Sun 12/25/11	15FF+21 days	-7 days
Buy-Out & Award, GMP, Mob	28 days	Mon 12/5/11	Sun 1/1/12	15,22FF+7 days	-7 days
Building Permit	42 days	Mon 12/5/11	Sun 1/15/12	15	28 days
Gather Equip Quotes	42 days	Mon 12/12/11	Sun 1/22/12	12	14 days
Elevator Shops	35 days	Mon 12/26/11	Sun 1/29/12	22	21 days
Exc, FDN	49 days	Mon 1/2/12	Sun 2/19/12	18,14	-7 days
GPM Lock	0 days	Mon 1/2/12	Mon 1/2/12		237 days
Substation Shops	28 days	Mon 1/9/12	Sun 2/5/12	22	21 days
Equipment Procurement	154 days	Mon 1/23/12	Sun 6/24/12	16	14 days
Elevator Fab/Delivery	98 days	Mon 1/30/12	Sun 5/6/12	23	21 days
Substation Fab/Delivery	98 days	Mon 2/6/12	Sun 5/13/12	32	21 days
MOB Crane	0 days	Mon 2/20/12	Mon 2/20/12		-7 days
Steel Framing SOG, Decks	63 days	Mon 2/20/12	Sun 4/22/12	20,19,13,9SS	-7 days
Walls, Windows, Doors	42 days	Mon 3/26/12	Sun 5/6/12	21SS+35 days	7 days
Roof	14 days	Mon 4/23/12	Sun 5/6/12	21	7 days
Piping/HVAC/FS Rough-In	56 days	Mon 4/23/12	Sun 6/17/12	21	7 days
Power/Lighting/Low Voltage	70 days	Mon 4/23/12	Sun 7/1/12	21	-7 days
DEMOB Crane	0 days	Mon 4/30/12	Mon 4/30/12		118 days
Elevator Install	35 days	Mon 5/7/12	Sun 6/10/12	24	21 days
Int. Walls & Ceiling	21 days	Mon 5/7/12	Sun 5/27/12	27,26	7 days
MEP Controls	21 days	Mon 5/28/12	Sun 6/17/12	28	7 days
Subtation Installation	21 days	Mon 5/28/12	Sun 6/17/12	33	7 days
Finishes	21 days	Mon 6/11/12	Sun 7/1/12	25	21 days
Perm Elevator Available	0 days	Mon 6/11/12	Mon 6/11/12		76 days
Perm Power Available	0 days	Mon 6/18/12	Mon 6/18/12		69 days
Start Process Installation	0 days	Mon 7/2/12	Mon 7/2/12		56 days
MEP Process Equip	14 days	Mon 7/2/12	Sun 7/15/12	29,31,30,34	-7 days
Punchlist Core & Shell	28 days	Mon 7/2/12	Sun 7/29/12	37	21 days
Install/Connect Process Equ	42 days	Mon 7/16/12	Sun 8/26/12	17,35	-7 days
Ready for Commissioning	0 days	Sun 8/19/12	Sun 8/19/12	36FF,38FF	-7 days



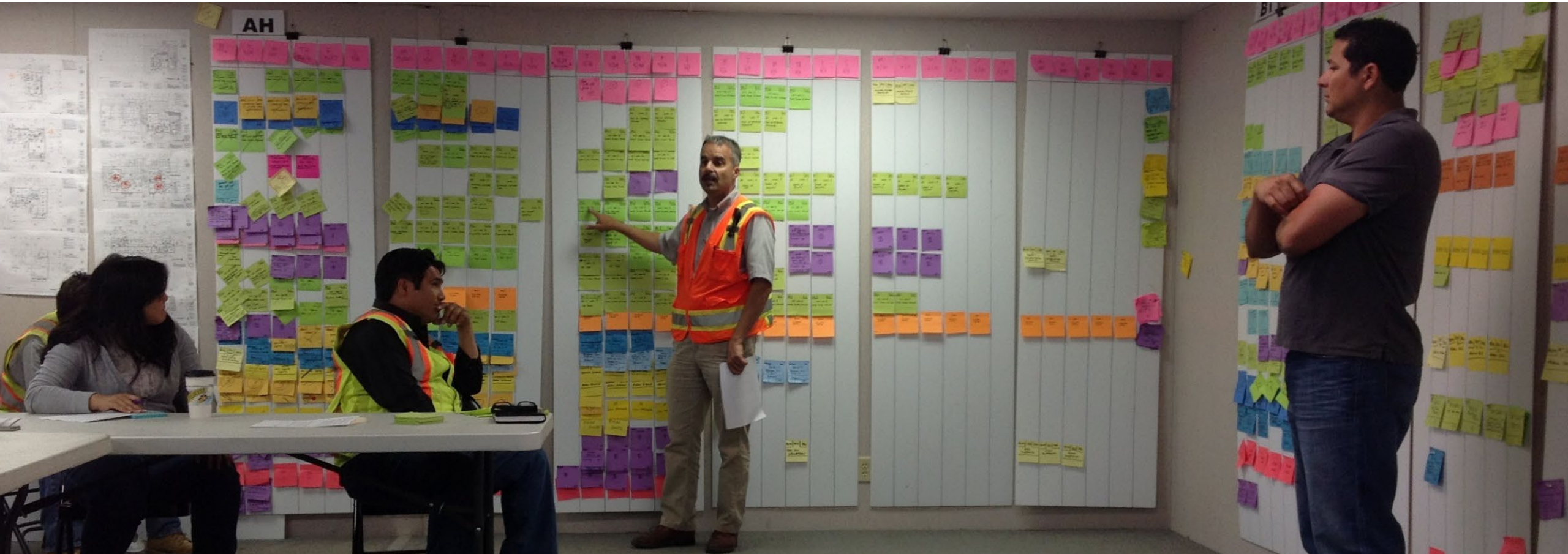
Pull Planning Pros & Cons



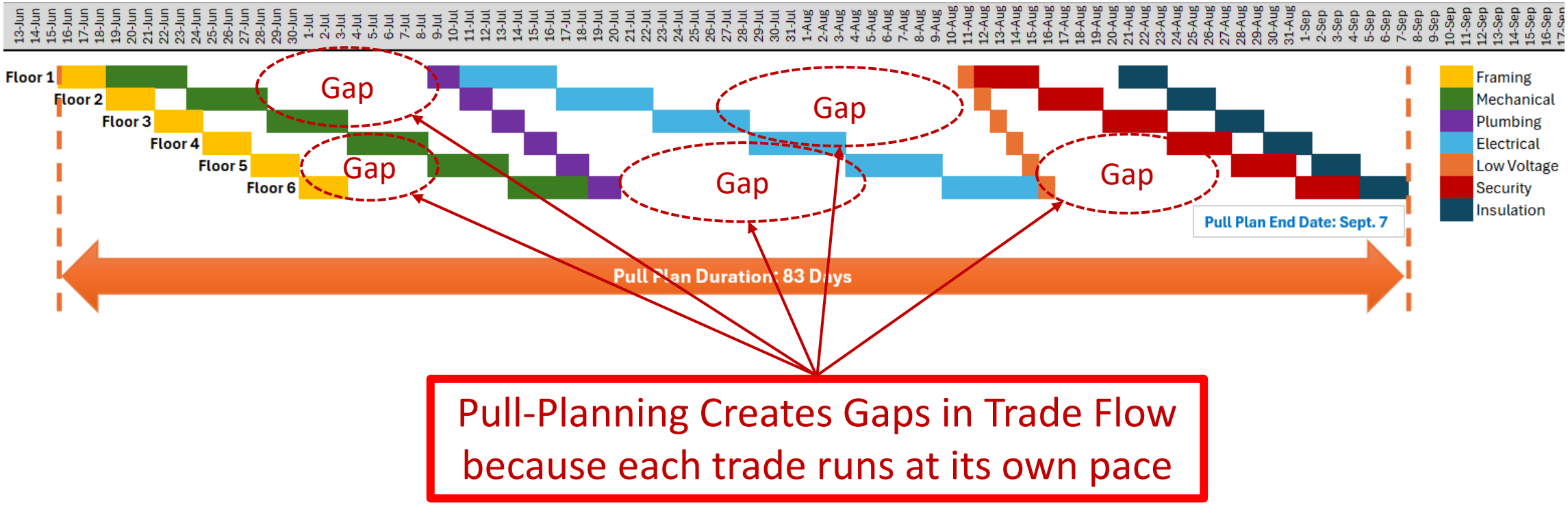
- Trade flows are mostly independent from other trades
- No trade harmonization of trades
- Gaps in schedule
- Work is not visible by area, by trade, etc.

LEAN Pull-Planning

Still contains waste because each contractor works at their own pace



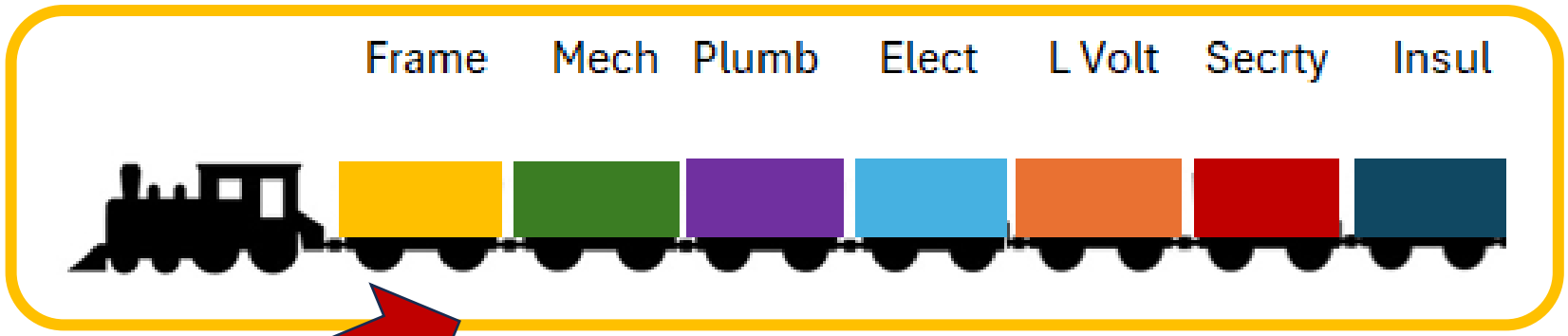
Pull Planning Problems

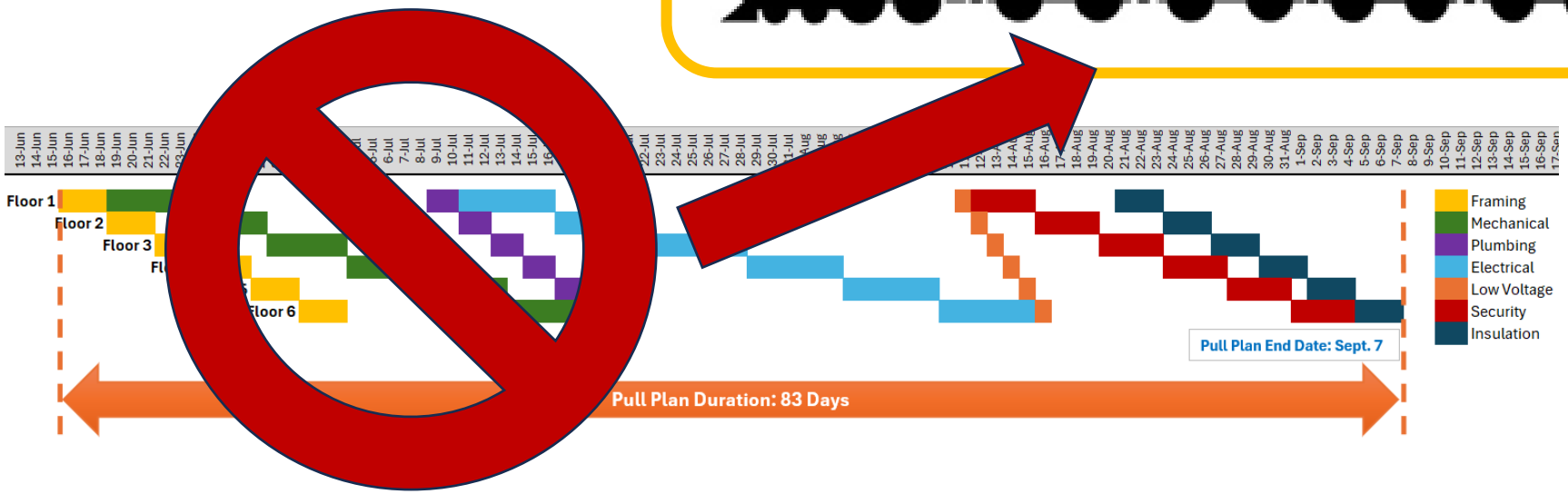


Pull-Planning Creates Gaps in Trade Flow because each trade runs at its own pace

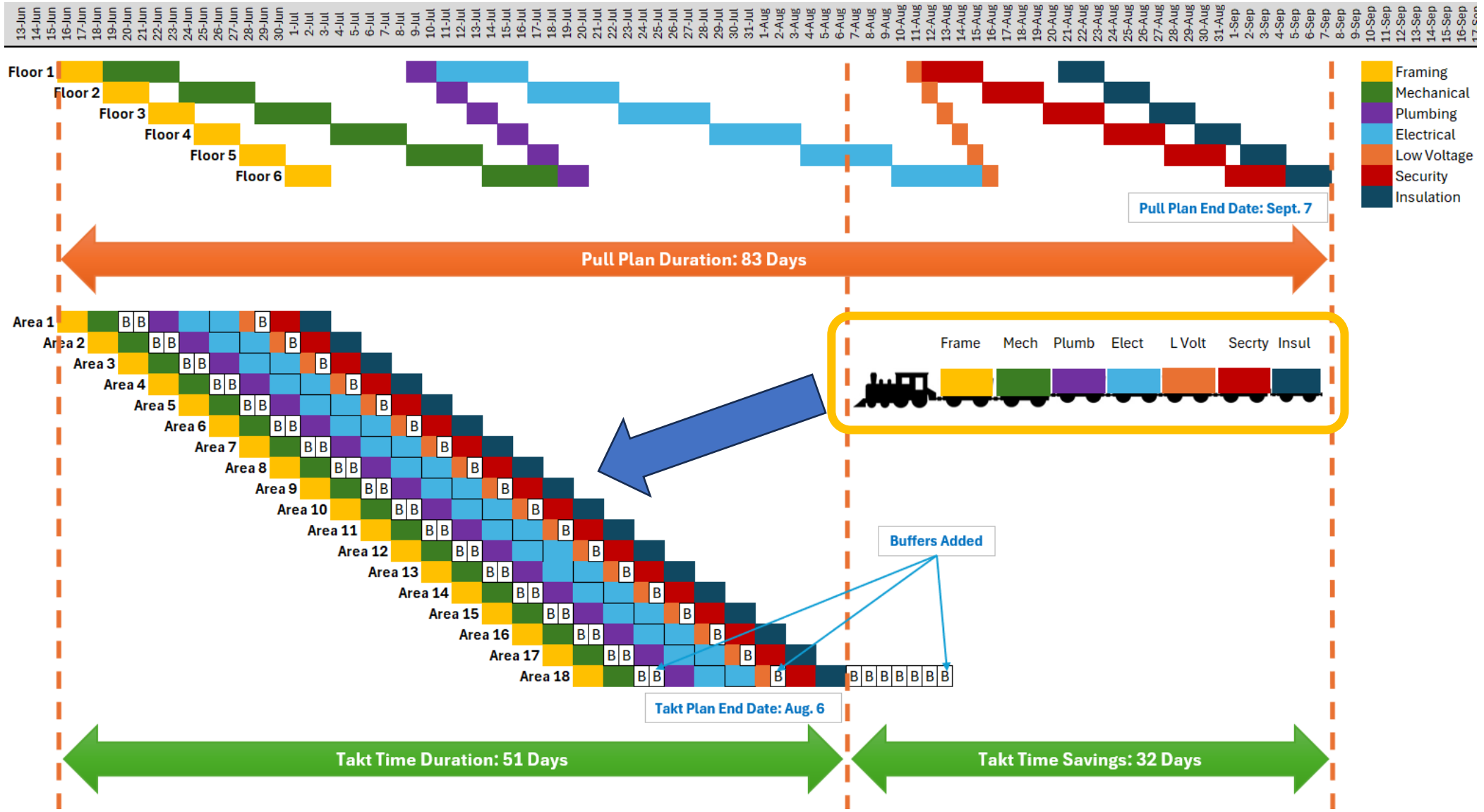
Pull Planning vs. Takt Planning

- More Areas/Zones per Floor
- Leveled (Right-Sized) Crews
- Standardized Work FLOW
- Harmonized Trades
- Consistent Takt Times
- Standardized Work Packages
- Added Buffers



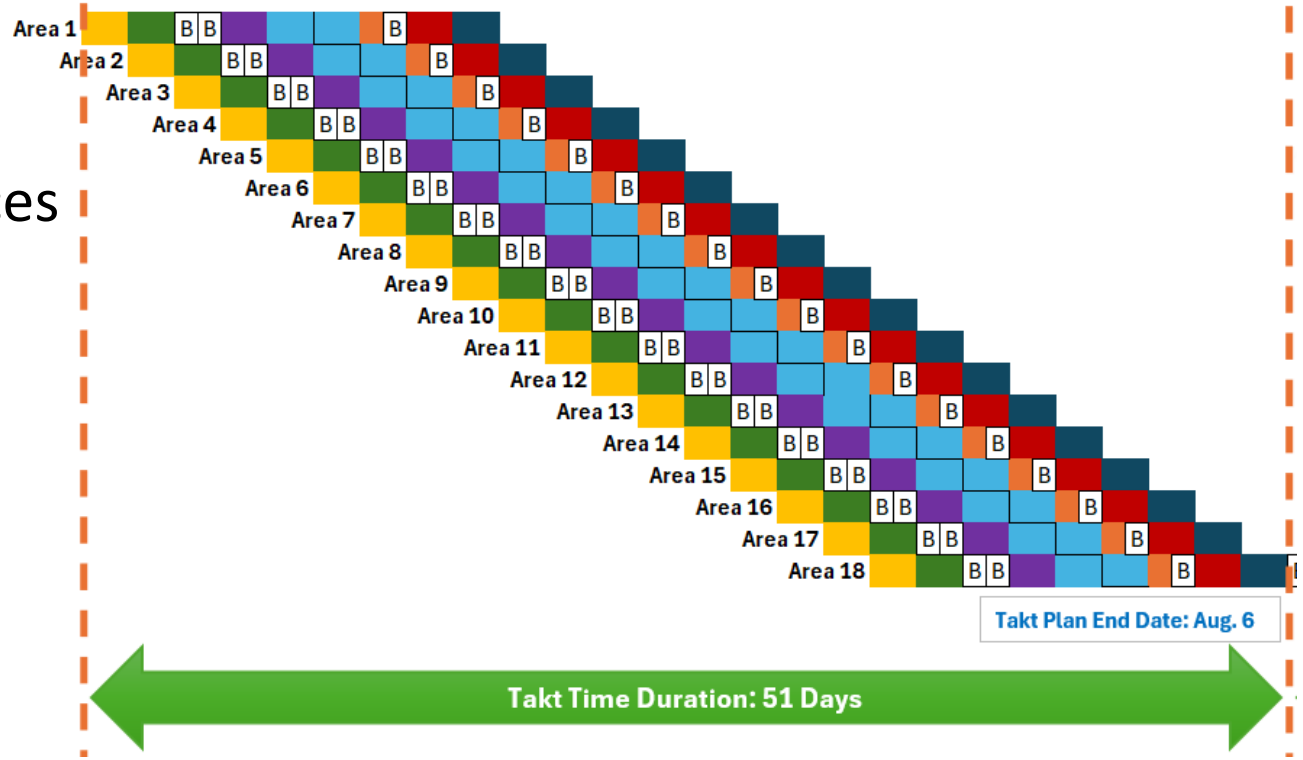


Pull Planning vs. Takt Planning

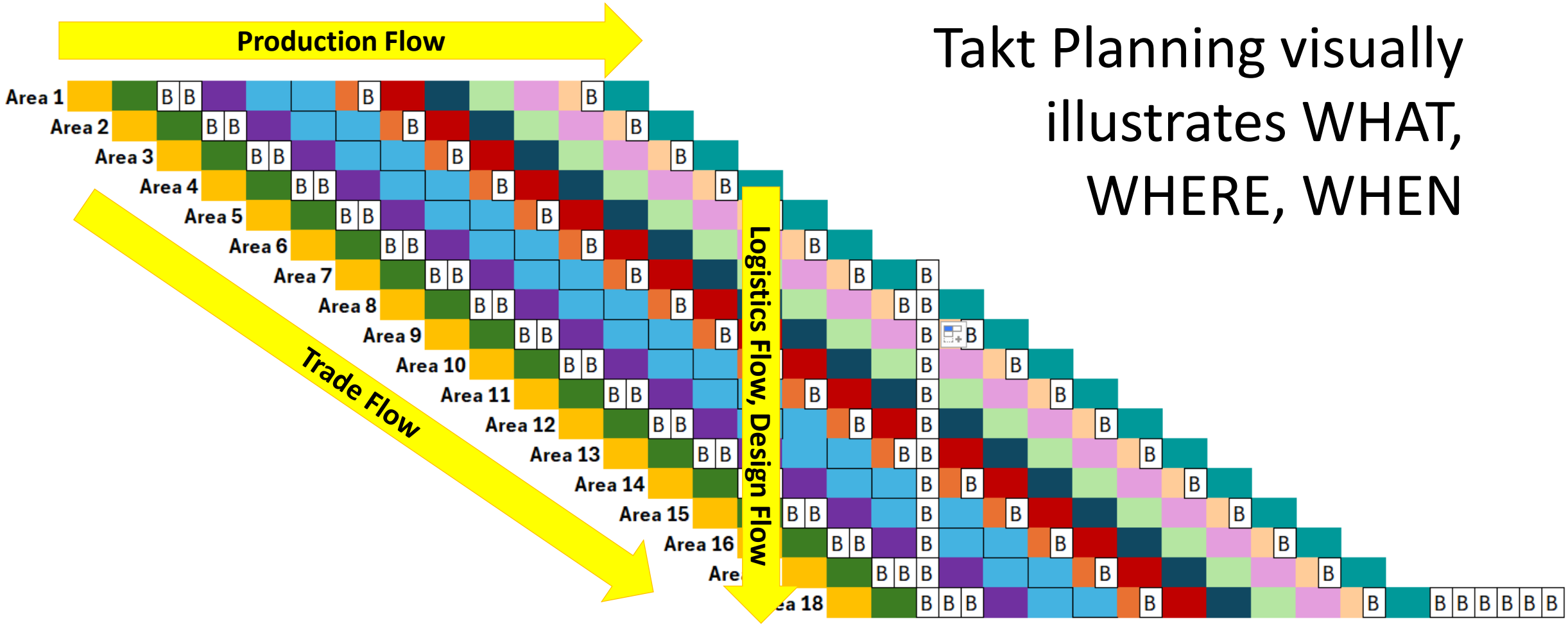


Pull Planning vs. Takt Planning

- Predictable, Visual, Leveled
  - Enhanced GC Planning
  - Influences/Persuades Owners
  - Balances Trade Manpower Resources
  - Coordinated Supplier Deliveries
- Promotes **Teamwork**
- Minimizes Sub Self-Optimization
- Capitalizes Lean Flow & Pull
- Assists Just-In-Time Delivery

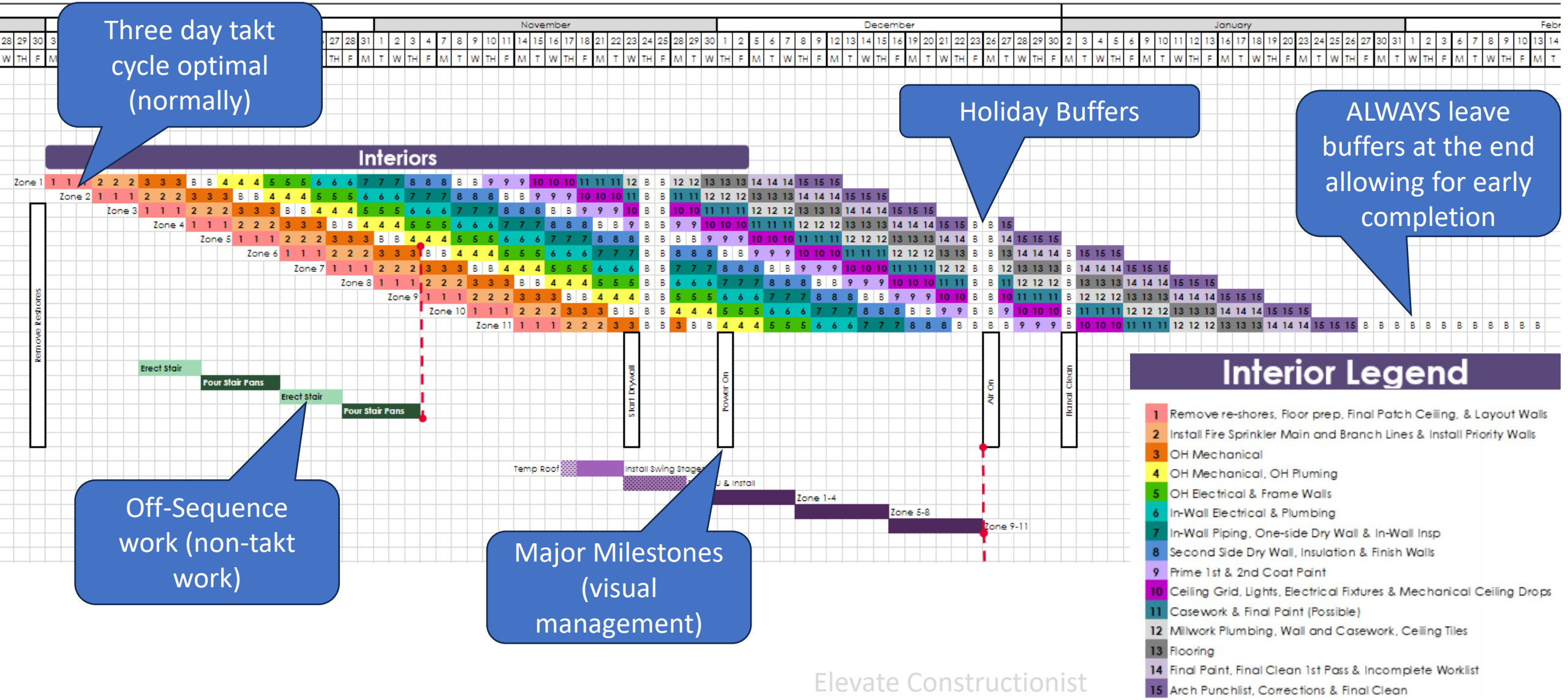


FLOW Visibility



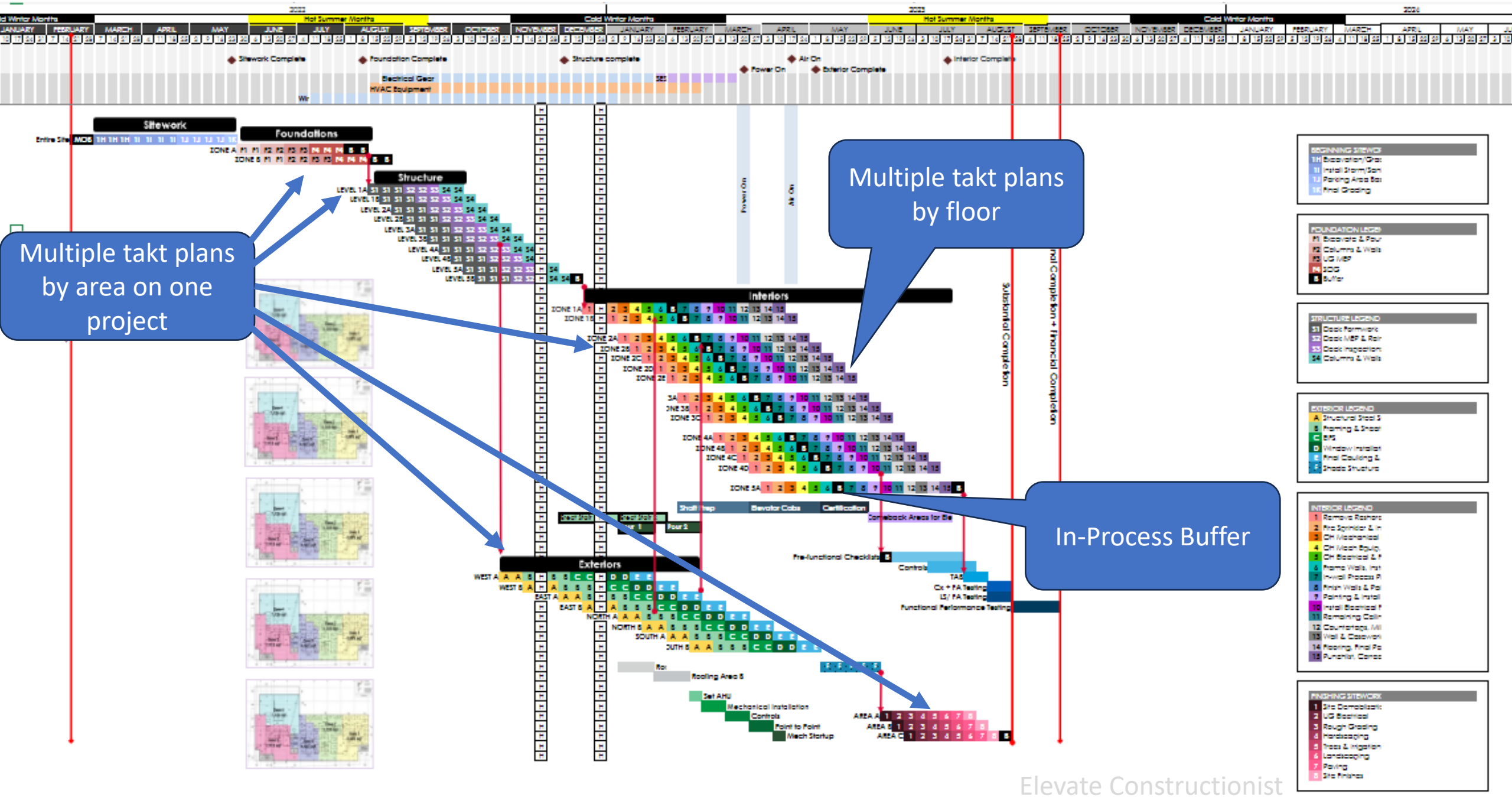
Takt Planning visually illustrates WHAT, WHERE, WHEN

Visually Display Flow on Project



Interior Legend

1	Remove re-shores, Floor prep, Final Patch Ceiling, & Layout Walls
2	Install Fire Sprinkler Main and Branch Lines & Install Priority Walls
3	OH Mechanical
4	OH Mechanical, OH Pluming
5	OH Electrical & Frame Walls
6	In-Wall Electrical & Plumbing
7	In-Wall Piping, One-side Dry Wall & In-Wall Insp
8	Second Side Dry Wall, Insulation & Finish Walls
9	Prime 1st & 2nd Coat Paint
10	Ceiling Grid, Lights, Electrical Fixtures & Mechanical Ceiling Drops
11	Casework & Final Paint (Possible)
12	Millwork Plumbing, Wall and Casework, Ceiling Tiles
13	Flooring
14	Final Paint, Final Clean 1st Pass & Incomplete Worklist
15	Arch Punchlist, Corrections & Final Clean


Multiple takt plans by area on one project
Multiple takt plans by floor
In-Process Buffer
Sitework
Foundations
Structure
Interiors
Exteriors
Substantial Completion
Elevate Constructionist

Takt Improvements over CPM

- **Structured Flexibility**: Takt planning divides work into balanced zones and activities, adding Flexibility to CPM's structure.
- **Clear and Simple**: It simplifies complex plans (schedules) into a single-page format that's easy to understand.
- **Big-Picture Efficiency**: Focuses on overall project throughput, avoiding narrow focus on individual task efficiencies.
- **Work-in-Process ("WIP") Control**: Encourages completing tasks in sequence, preventing incomplete work from piling up.
- **Prevents Overproduction**: Aligns trade work to ensure that finishing one task early doesn't disrupt the overall project flow.
- **Resource Balancing**: Levels resources, improves efficiency, and addresses CPM's resource allocation issues.
- **Easier Plan Verification**: Simplifies the process of verifying plan accuracy and logic.
- **Consistent Work Rhythm**: Establishes a steady workflow, improving trade coordination and efficiency.
- **Improves Problem Detection**: Its uniform structure makes it easier to spot and solve issues, unlike CPM's more complex format.

Benefits of Takt Time Planning

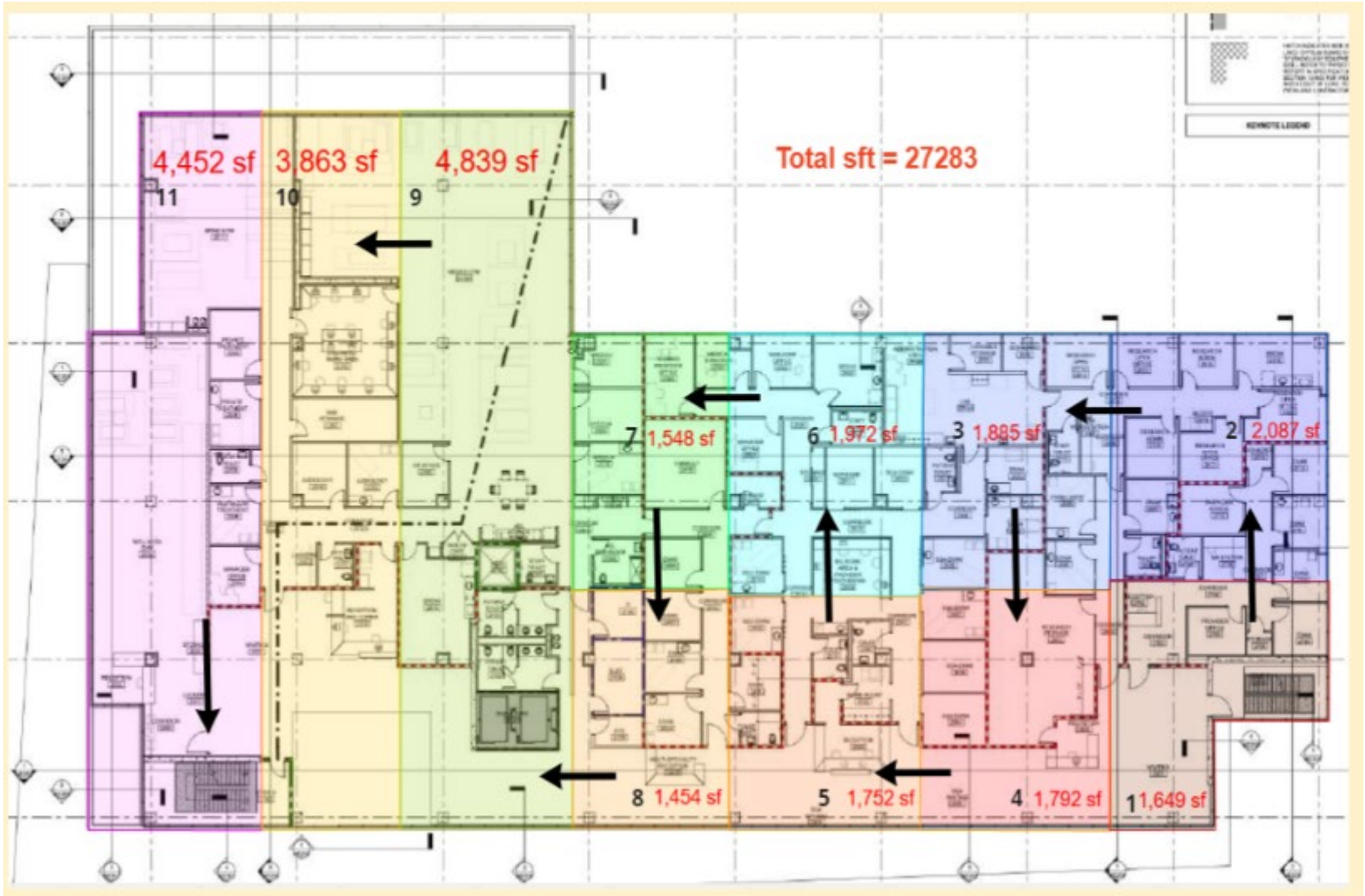
- Clear, structured, predictable, balanced workflow
- (Visual) Location specific expectations
- Subcontractor has clear expectations to manage production
- Subcontractor handoffs should be pre-established between trades
- Structured deliveries
- Consistent deliverables
- Project stake-holders must act as a true TEAM

Marching to the project cadence

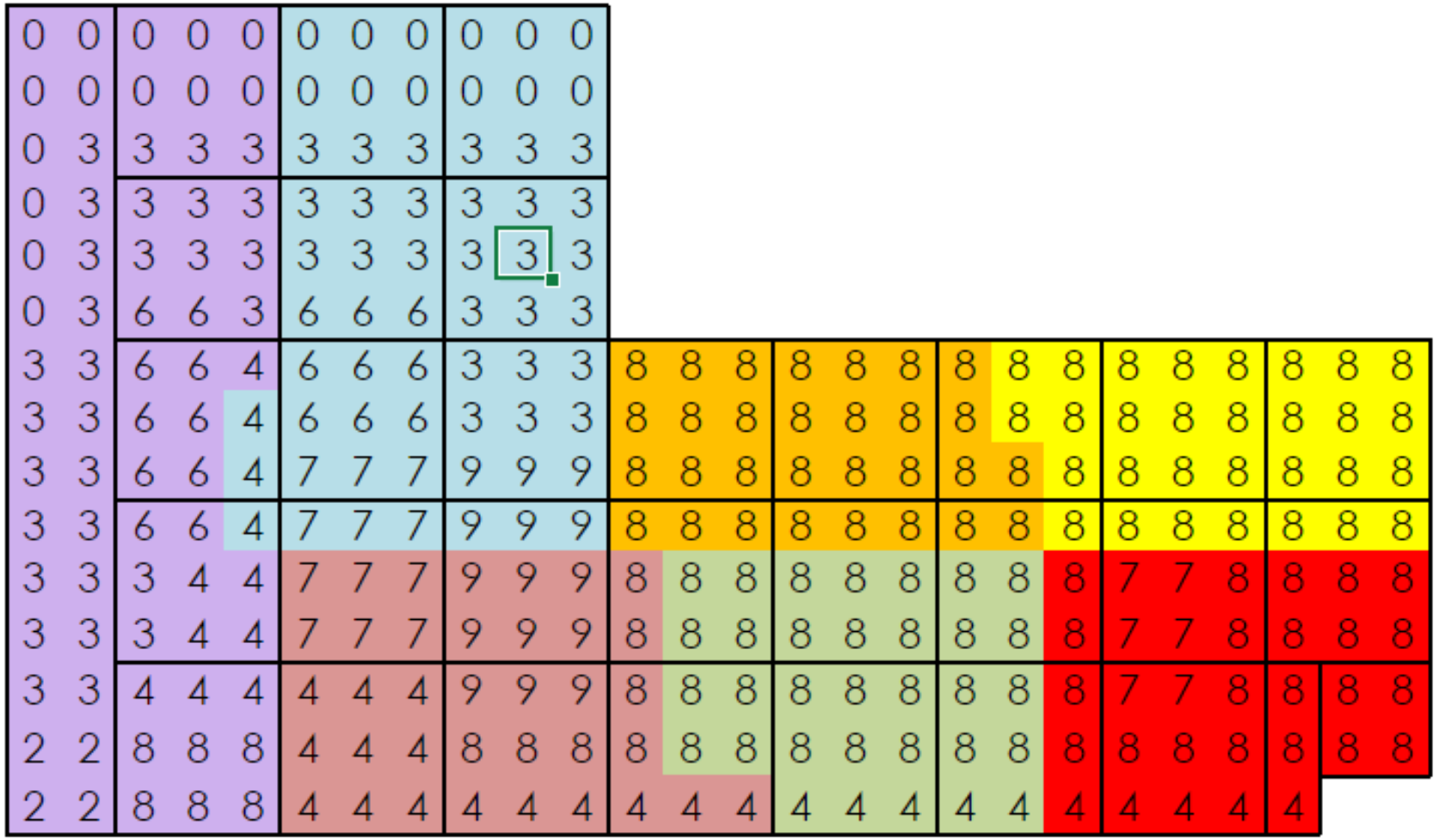
The Takt Planning Process

2. In Construction, *various installation speeds create complexity but brings order & visual clarity to often complex sequences of work.*

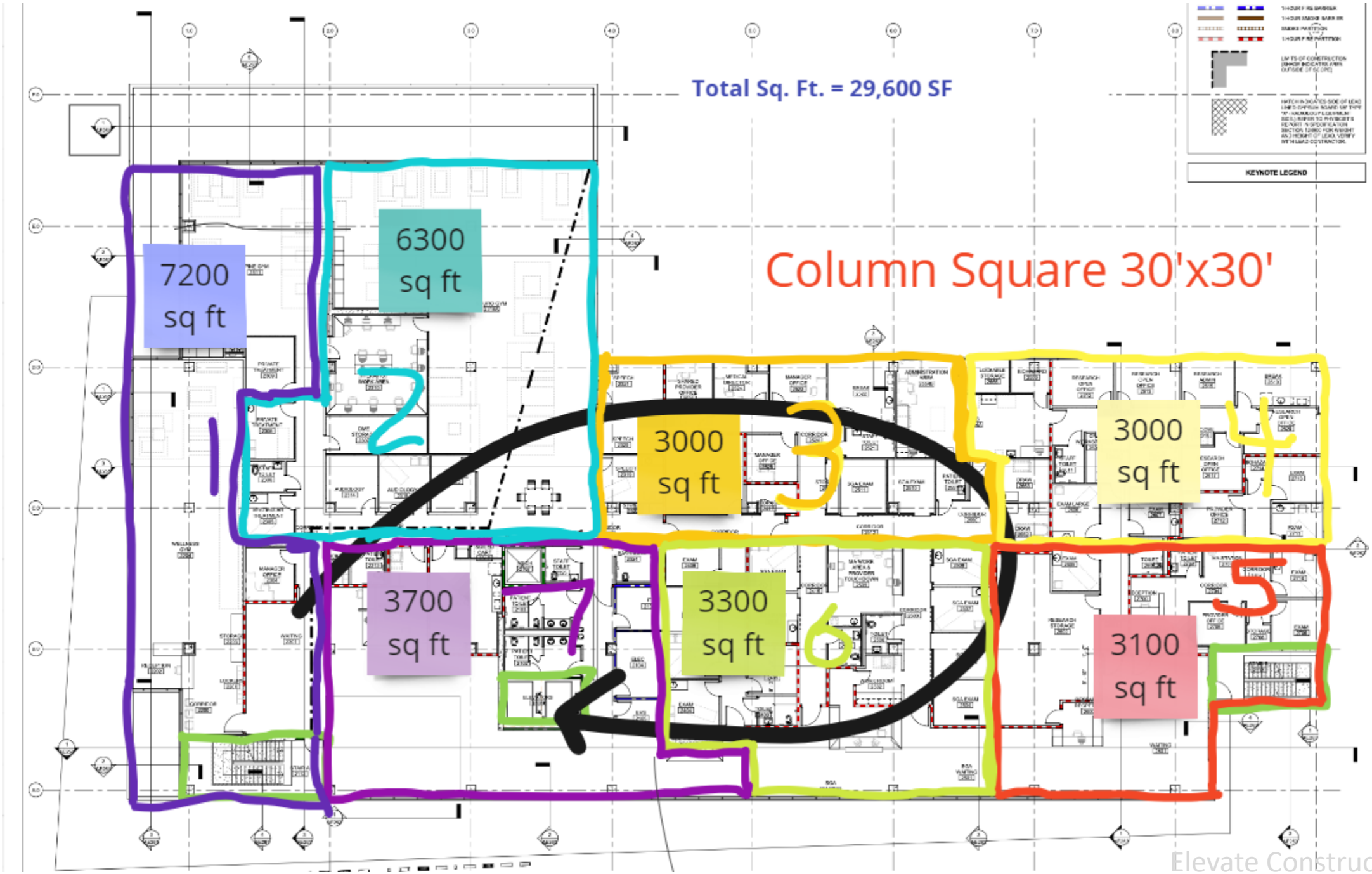
Work Density Mapping (Define Initial Areas)

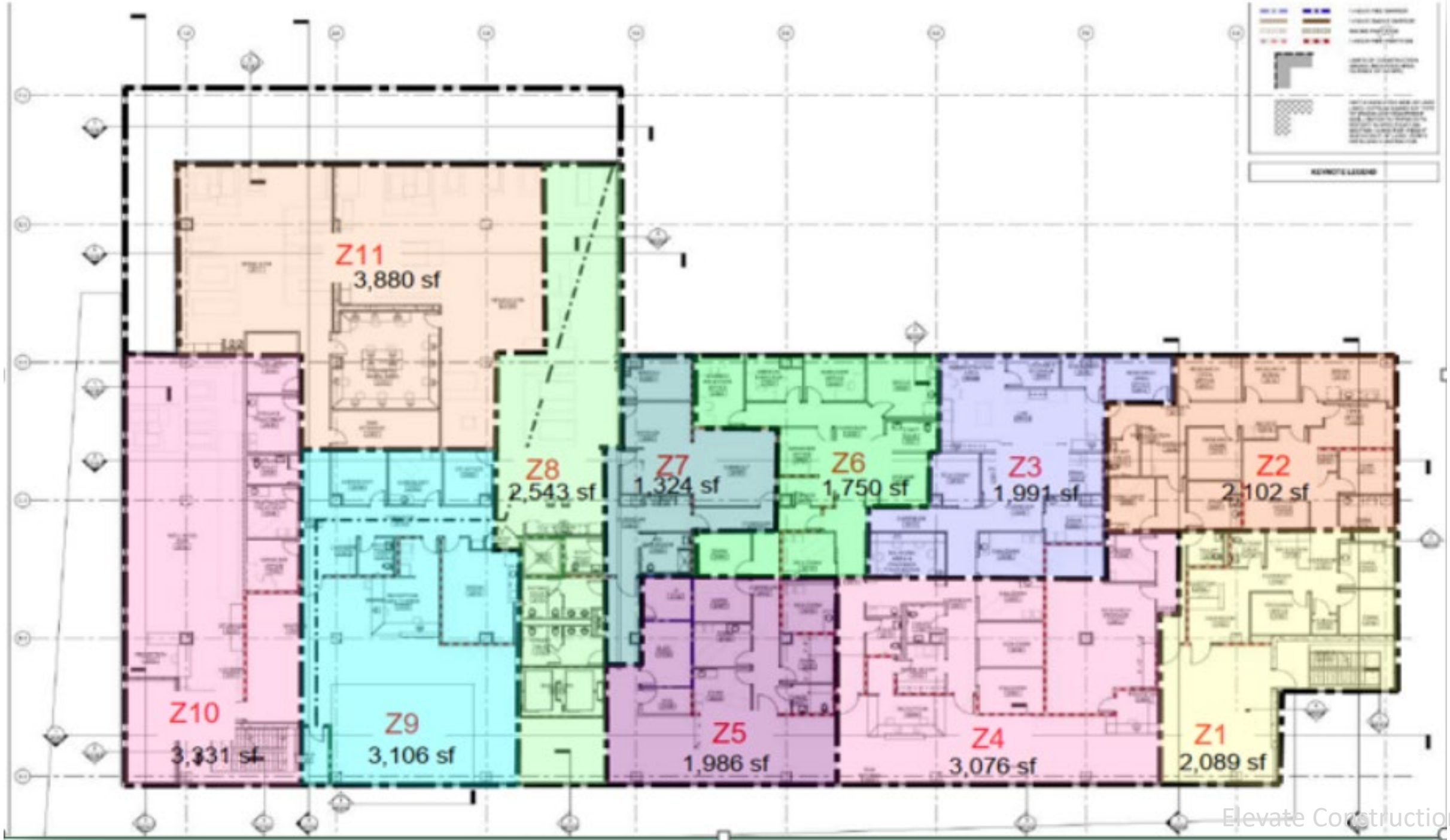


Work Density Mapping



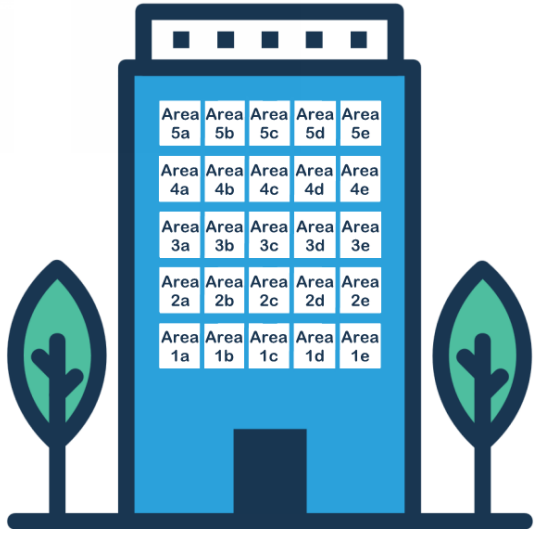
Work Density Table	
Zone	Density
1	238
2	243
3	240
4	240
5	238
6	244
7	239





Create Initial Takt Plan

(TZ + TW – 1) * TT = D



(Takt Zones + Takt Wagons – 1) * Takt Time = Duration (Throughput)

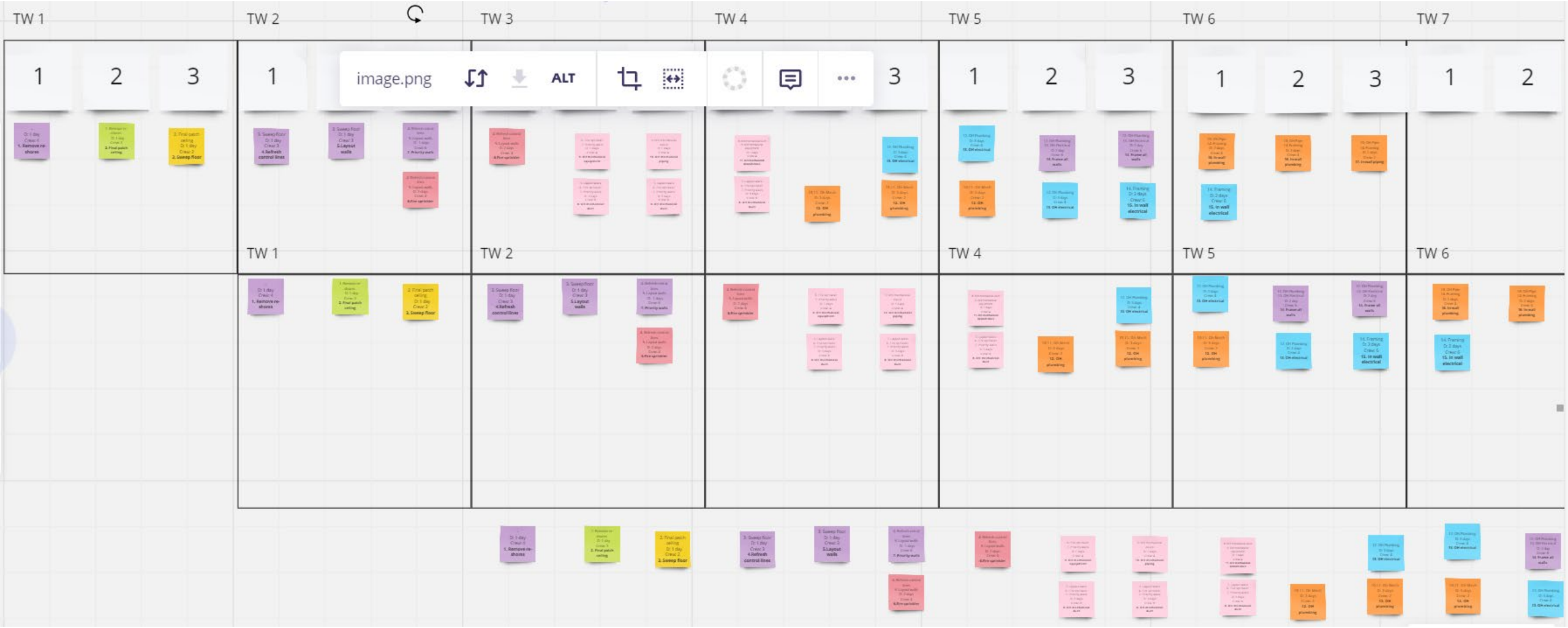
Takt Defined: Completion rate by area required to finish on time.

Formula Restated: (# Areas + # Train Cars – 1) * Pace = Duration

Scenario #1: (5 + 8 – 1) * 5 Days (per area) = 60 Days

Scenario #2: (25 + 8 – 1) * 1 Day (per area) = 32 Days

Pull Plan Flow (Sequence) for Trades



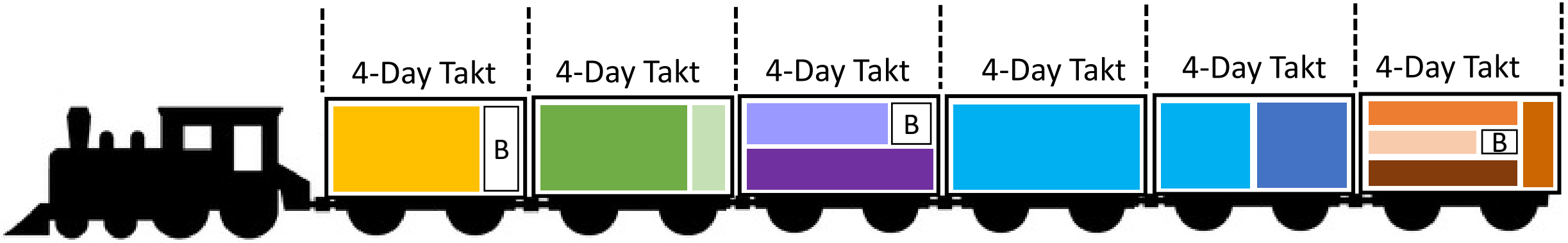
Work Packaging (Optimizing the Takt Plan)

Which tasks can occur in the same area at the same time?

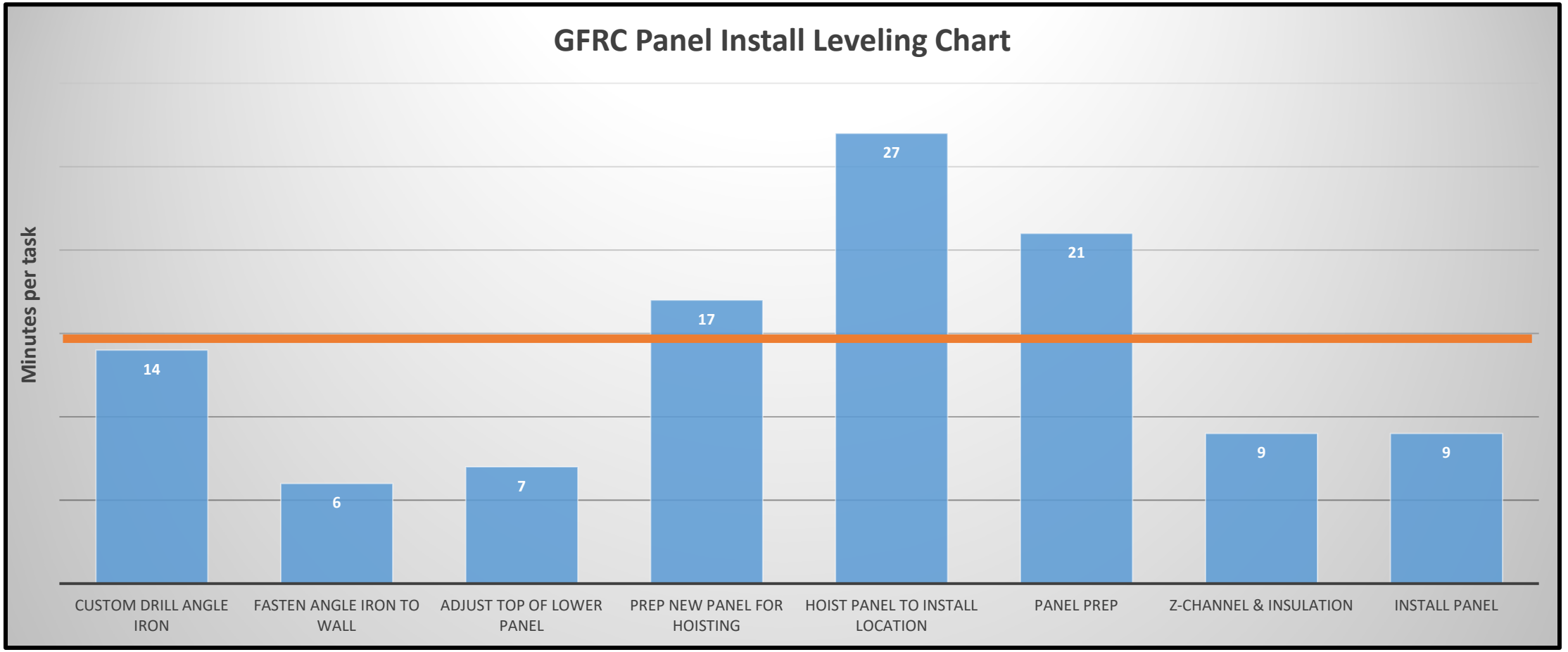
Graphics by Spencer Easton

Work Packaging (Optimizing the Takt Plan)

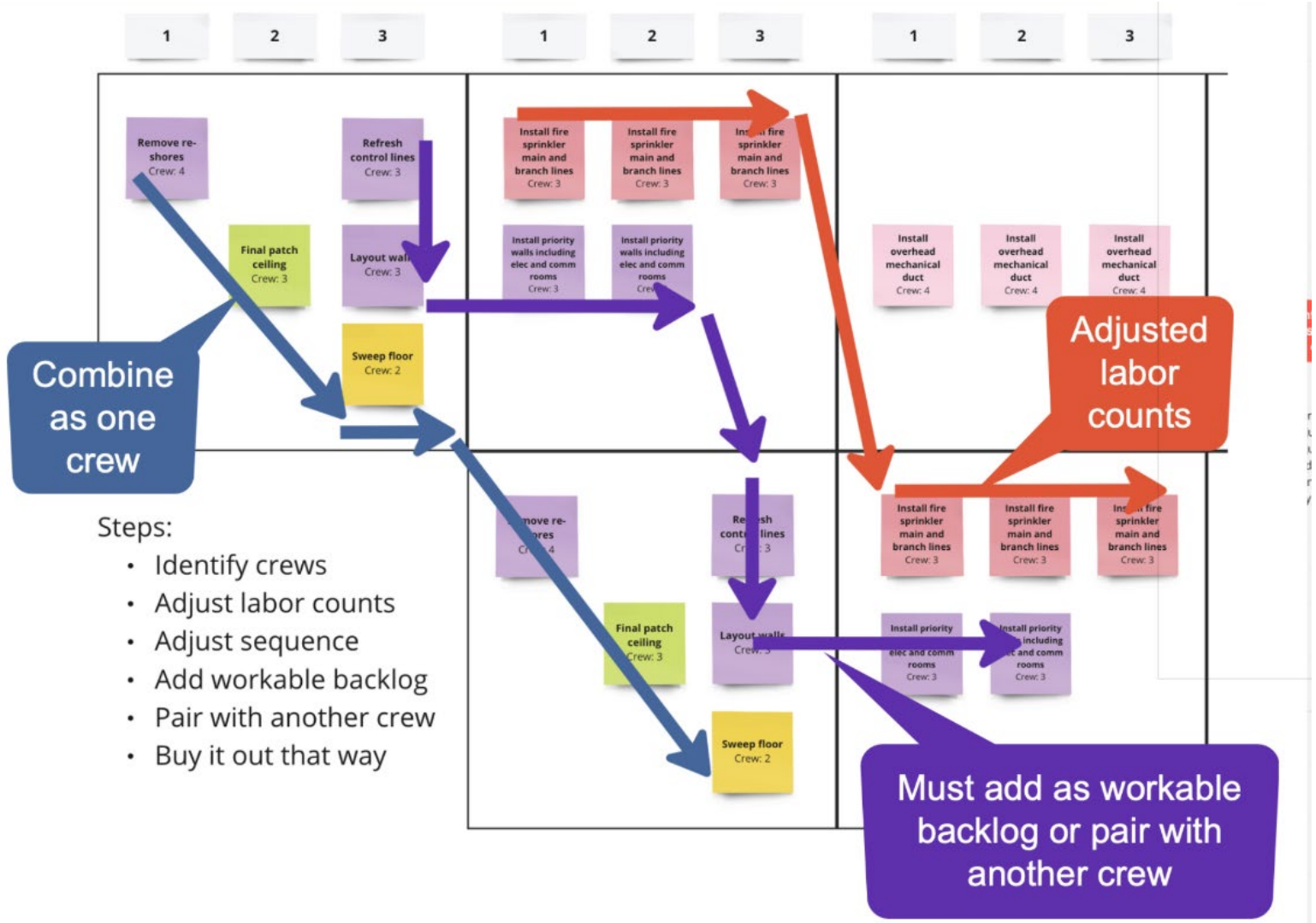
- Tasks can occur simultaneously (in parallel) or sequentially
- Packaging can occur within one subcontractor or among several
- Tasks must be leveled to match the pace (takt time) and the area size
- Train does not include planned takt buffers, but does include process buffers



Crew Leveling (Right-Sizing Crews/Tasks)

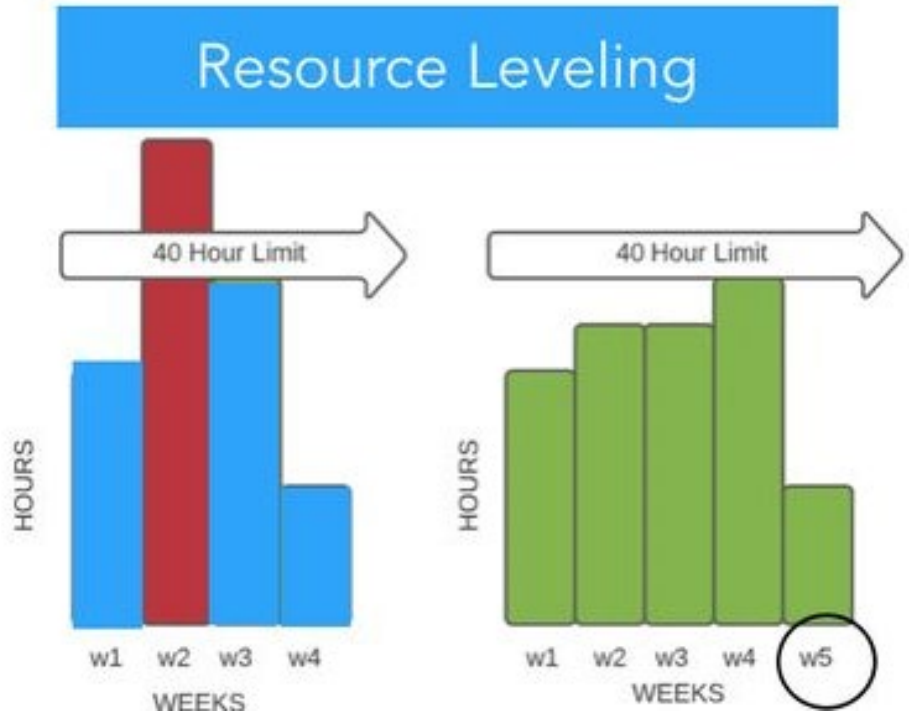


Optimize and Ensure Flow of Trades & Areas



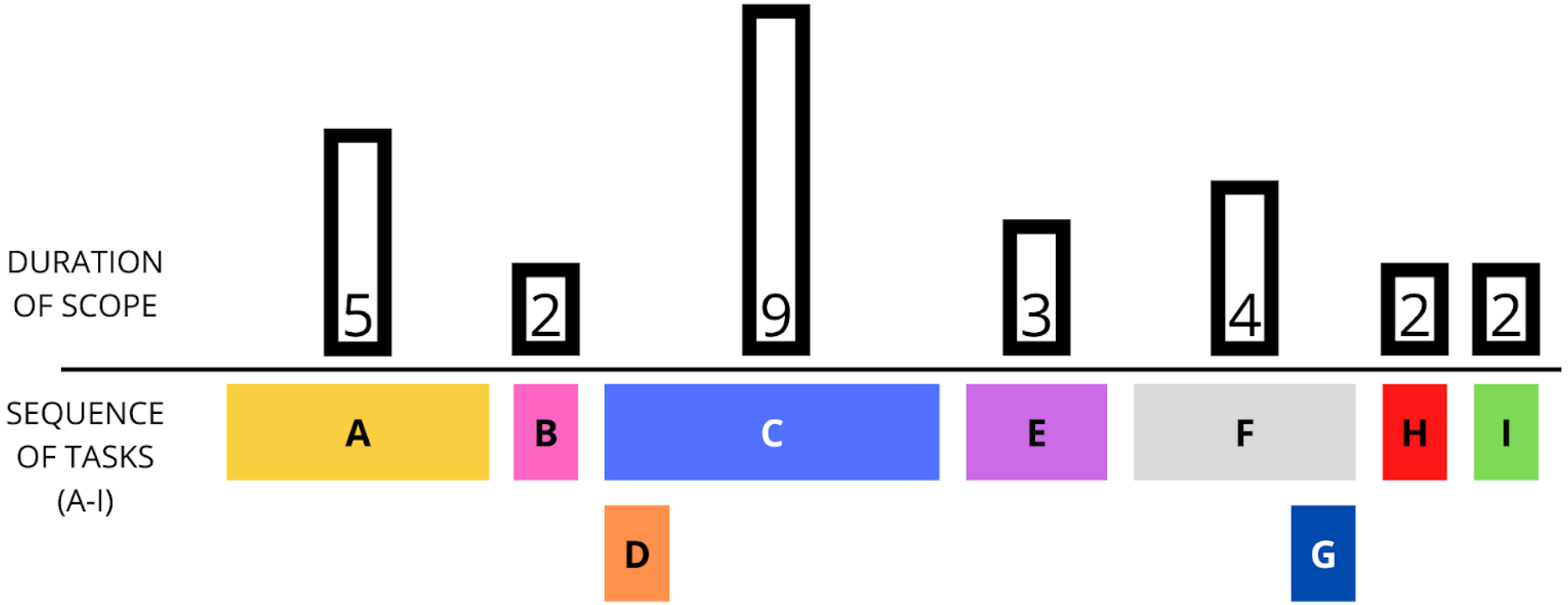
Leveling Options

- Zone (Size) Adjustments
- Takt Time Adjustments
- Work Packaging
- Prefabrication
- Takt Buffers
- Increase or Decrease Crew Sizes (Right-Sizing Crews)
- New Methods, Tools, Equip
- Standardized Work (VSM, Process Mapping)
- Training



In this case, let’s say the crew can increase in size.

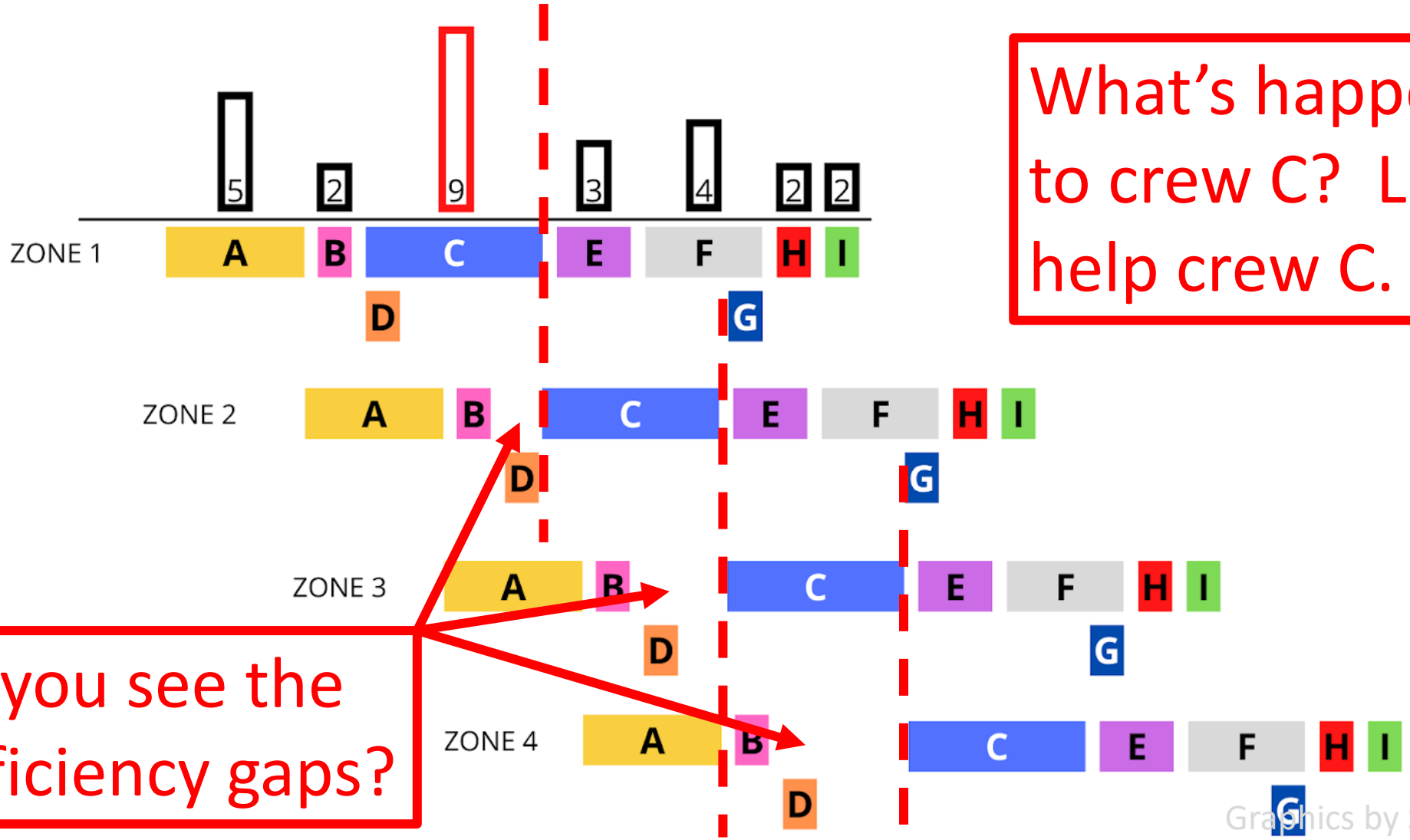
Leveling the Tasks in the Construction Sequence



Which trade is the bottleneck? Why does it matter?

Graphics by Spencer Easton

Leveling the Tasks in the Construction Sequence

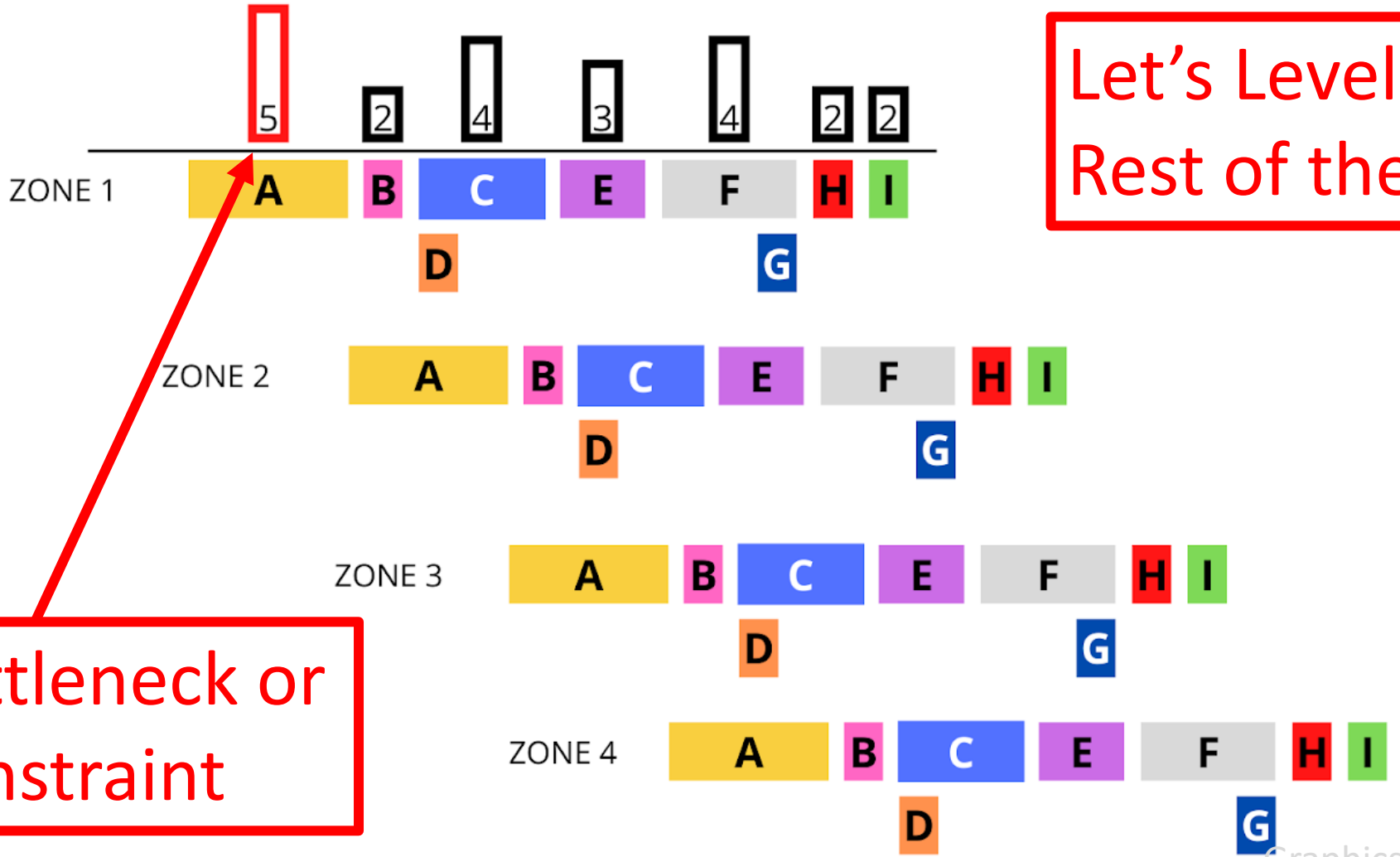


What's happening to crew C? Let's help crew C.

Can you see the inefficiency gaps?

Graphics by Spencer Easton

Leveling the Tasks in the Construction Sequence

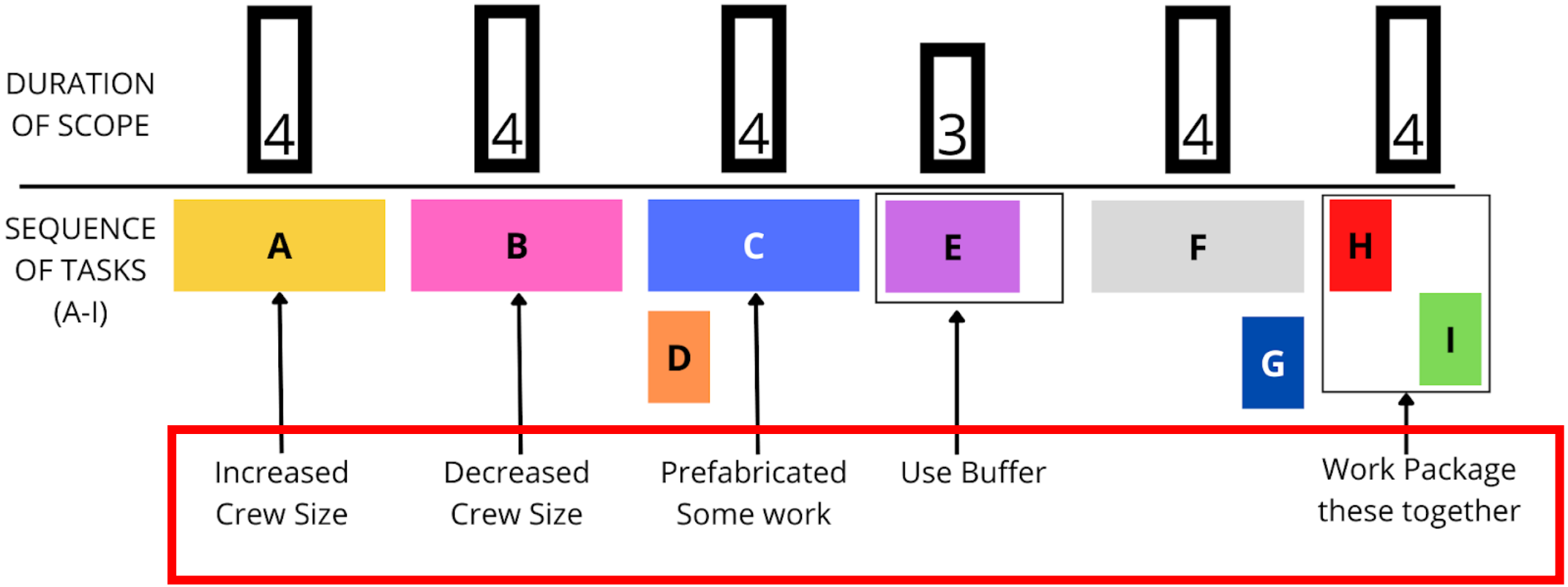


Let's Level the Rest of the Trades.

New Bottleneck or New Constraint

Graphics by Spencer Easton

Leveling the Tasks in the Construction Sequence



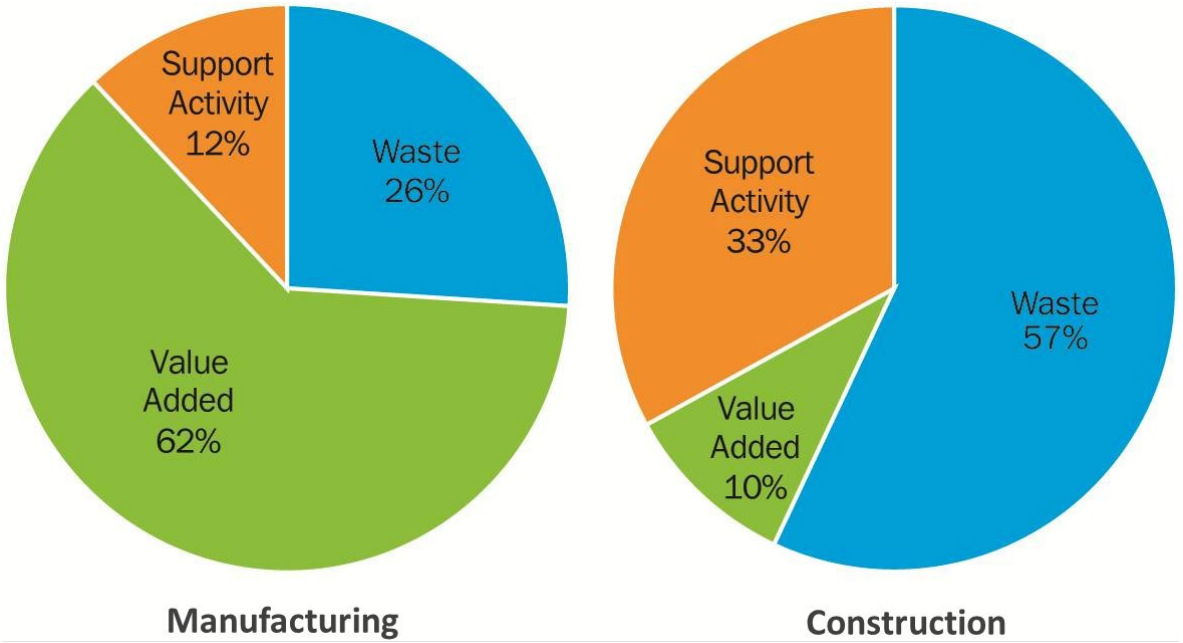
Graphics by Spencer Easton

Manpower/Staffing

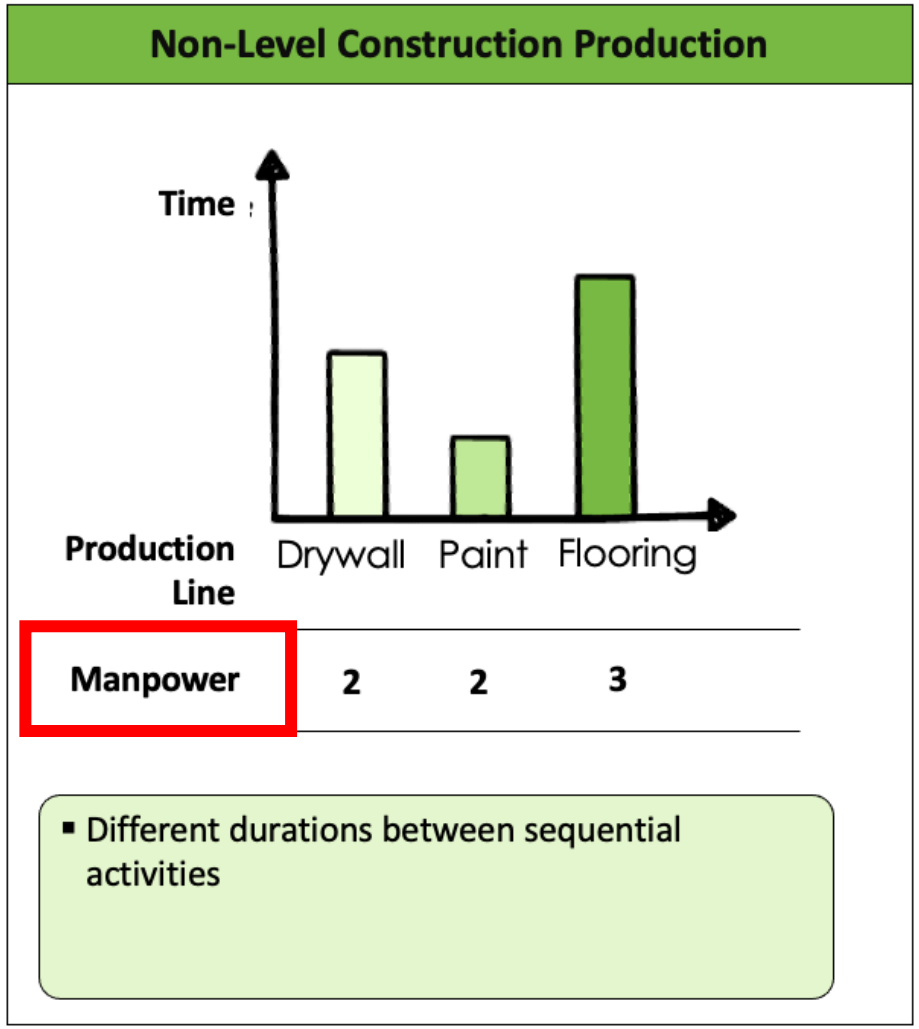
Why does a subcontractor staff the project the way they do?

- The takt plan is NOT communicated effectively before bidding
- Trades should be required to bid a project according to a takt rhythm
- Additionally, trades should be prepared to be flexible with manpower

A poorly communicated plan ALWAYS introduces **WASTE** into the project.
That's why we are here – to learn to see the waste so that we can remove it from our projects.



Leveling the Tasks in the Construction Sequence



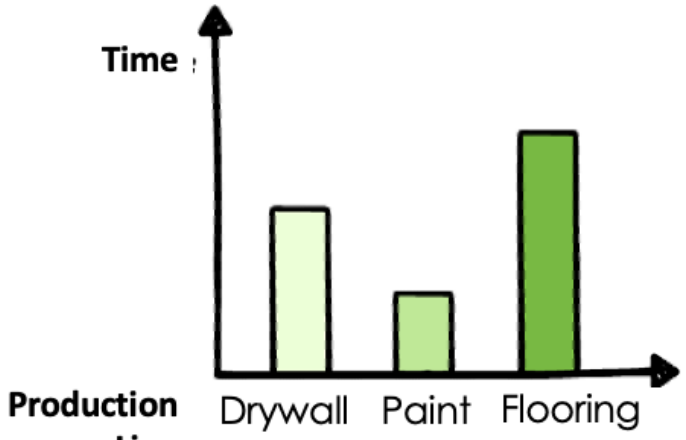
Leveling Options

- Zone Adjustments
- Takt Time Adjustments
- Work Packaging
- Prefabrication
- Increase or Decrease Crew Sizes (Right-Sizing Crews)
- Takt Buffers
- New Methods, Tools, Equip
- Standardized Work (VSM, Process Mapping)
- Training

Graphics by Spencer Easton

Leveling the Tasks in the Construction Sequence

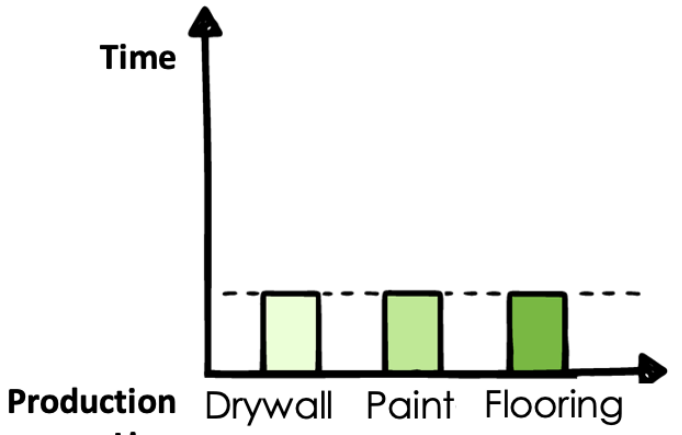
Non-Level Construction Production



Manpower	2	2	3

- Different durations between sequential activities

Level Construction Production

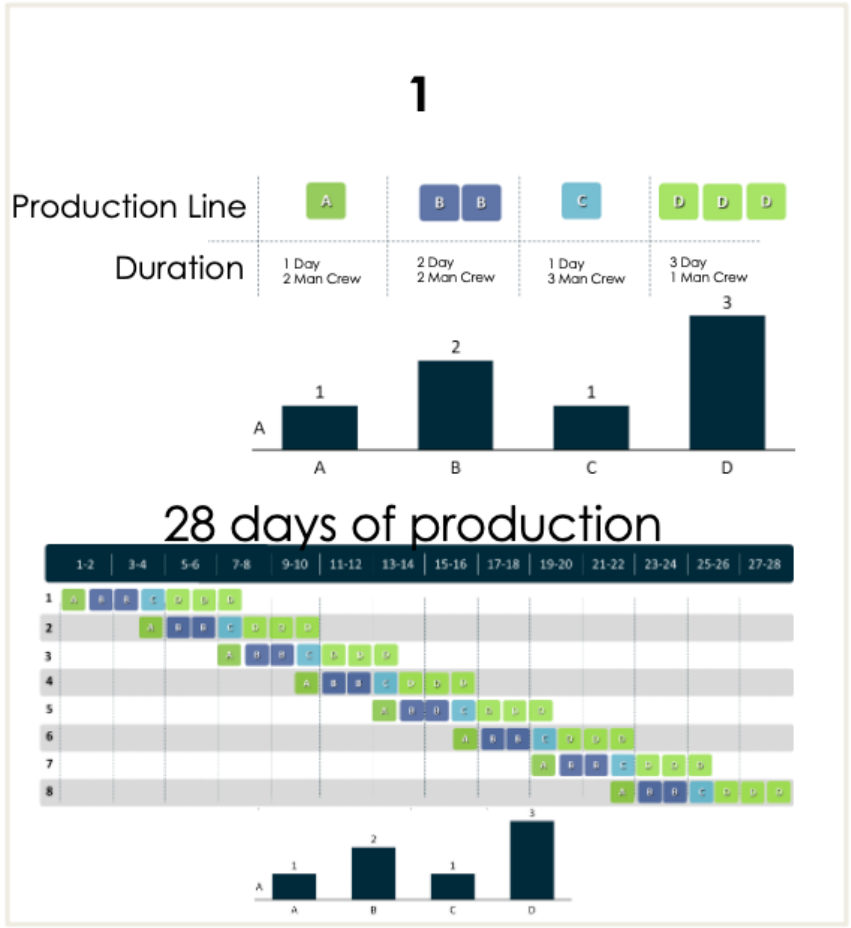


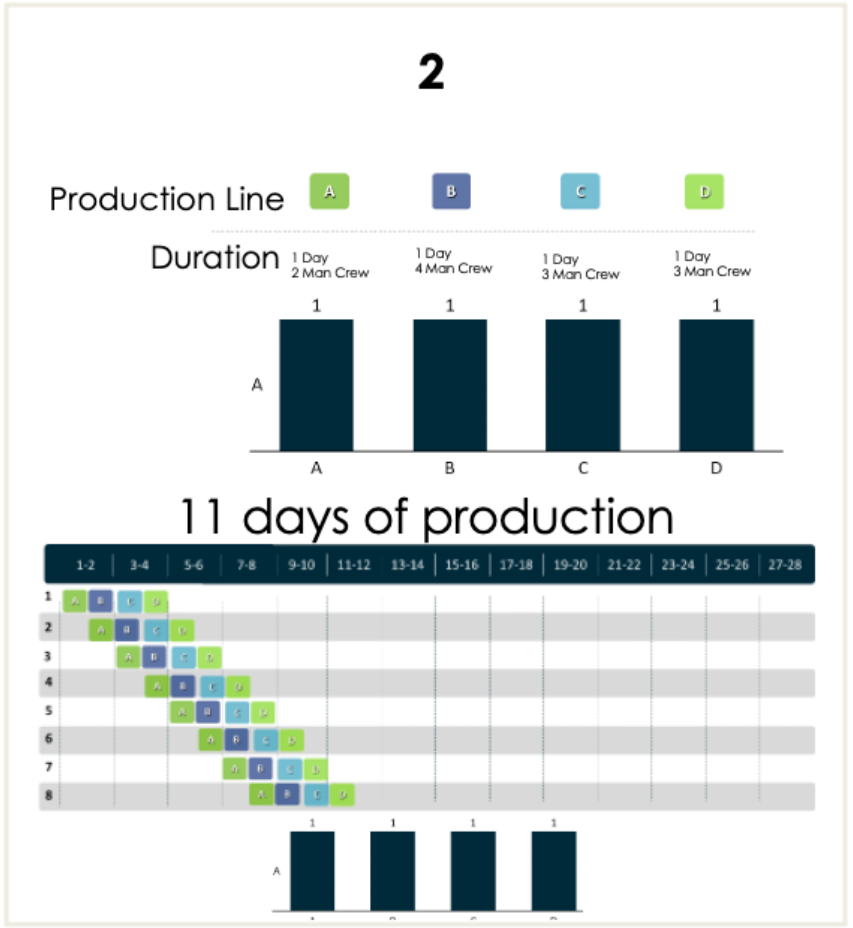
Manpower	4	2	6

- **Even Takt Time**
- **Adjustment to Manpower**

Graphics by Spencer Easton

Leveling the Tasks in the Construction Sequence



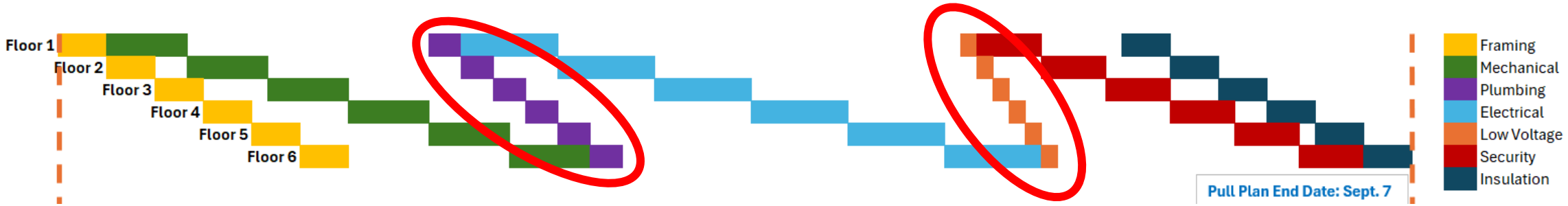


The same amount of work is done on both plans, but plan 2 has a shorter time because we have evened out the work by adjusting manpower.

Graphics by Spencer Easton

Manpower Collaboration – Flexible Productivity

- More often than not, the answer is to have **less manpower** because durations in takt schedules are shorter (smaller areas)
- Trades that naturally go fast are usually a problem in takt planning
- Smaller crews (less manpower) will allow the work to finish sooner (not faster)
- **Advanced Takt practitioners spend much of their time leveling and work packaging the trades**
- Unbalanced (unleveled) flow interrupts the system's flow



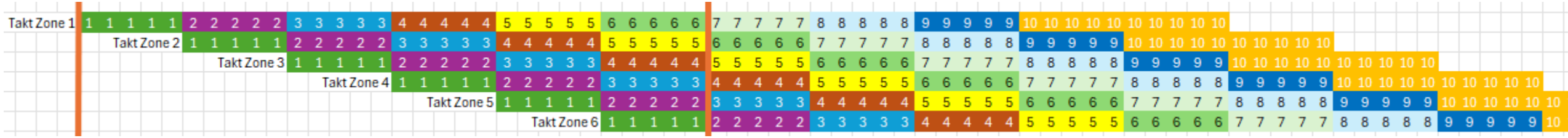
Optimizing Flow through Work Packaging

Activites (Train Sequence)	Duration	Visual Duration
In-Wall Priority Walls	7	X X X X X X X
In-Wall Inspection	1	X
Hang Drywall Priority Walls	3	X X X
Finish Drywall Priority Walls	2	X X
Initial Paint Priority Walls	2	X X
High OH	8	X X X X X X X X
Fire Protection	8	X X X X X X X X
High Plumbing	8	X X X X X X X X
Plumbing Test	2	X X
OH Ductwork	10	X X X X X X X X X X
Duct Insulation	5	X X X X X
Low Branch Conduits	15	X X X X X X X X X X X X X X X
Pull Wire	10	X X X X X X X X X X
Frame Ceiling/ACT Grid	3	X X X
MEP Ceiling Rough	5	X X X X X
Ceiling Inspection	1	X
Final Drywall	5	X X X X X
Cut in ACT Tile for Devices	5	X X X X X
Cable Tray	5	X X X X X
Hang Lights	10	X X X X X X X X X X
Flooring	10	X X X X X X X X X X
Seal Concrete	10	X X X X X X X X X X
Caulk Joints	10	X X X X X X X X X X
Wall Coverings	5	X X X X X
Wall Specialties	5	X X X X X
Casework	5	X X X X X
Doors & Hardware	5	X X X X X
MEP Trim	5	X X X X X
Sum	170	
Average	6.1	
Minimum Buffer (5%)	8.5	
Maximum Buffer (20%)	34.00	

	Activites (Train Sequence)	Duration	Packaged Visual Duration
1	In-Wall Priority Walls A	5	X X X X X
2	In-Wall Priority Walls B	2	X X
2	In-Wall Inspection	1	X B B
3	Hang Drywall Priority Walls	3	X X X
3	Finish Drywall Priority Walls	2	X X
4	Initial Paint Priority Walls	2	X X B B B
5	High OH A	5	X X X X X
6	High OH B	3	X X X B B
7	Fire Protection (Increase Crew Size)	5	X X X X X
8	High Plumbing	5	X X X X X
	Plumbing Test	2	X X B B B
10	OH Ductwork	10	X X X X X X X X X X
11	Duct Insulation	5	X X X X X
12	Low Branch Conduits	15	X X X X X X X X X X X X X X X
13	Pull Wire	10	X X X X X X X X X X
14	Frame Ceiling/ACT Grid (Decrease Crew Size)	4	X X X X B
15	MEP Ceiling Rough	5	X X X X X
16	Ceiling Inspection	1	X B B B B
17	Final Drywall	5	X X X X X
17	Cut in ACT Tile for Devices	5	X X X X X
17	Cable Tray	5	X X X X X
18	Hang Lights	10	X X X X X X X X X X
19	Flooring	10	X X X X X X X X X X
19	Seal Concrete	10	X X X X X X X X X X
19	Caulk Joints	10	X X X X X X X X X X
20	Wall Coverings	5	X X X X X
21	Wall Specialties	5	X X X X X
22	Casework	5	X X X X X
22	Doors & Hardware	5	X X X X X
23	MEP Trim	5	X X X X X
	Sum	165	
	Average	5.5	
	Minimum Buffer (5%)	8.25	
	Maximum Buffer (20%)	33.00	

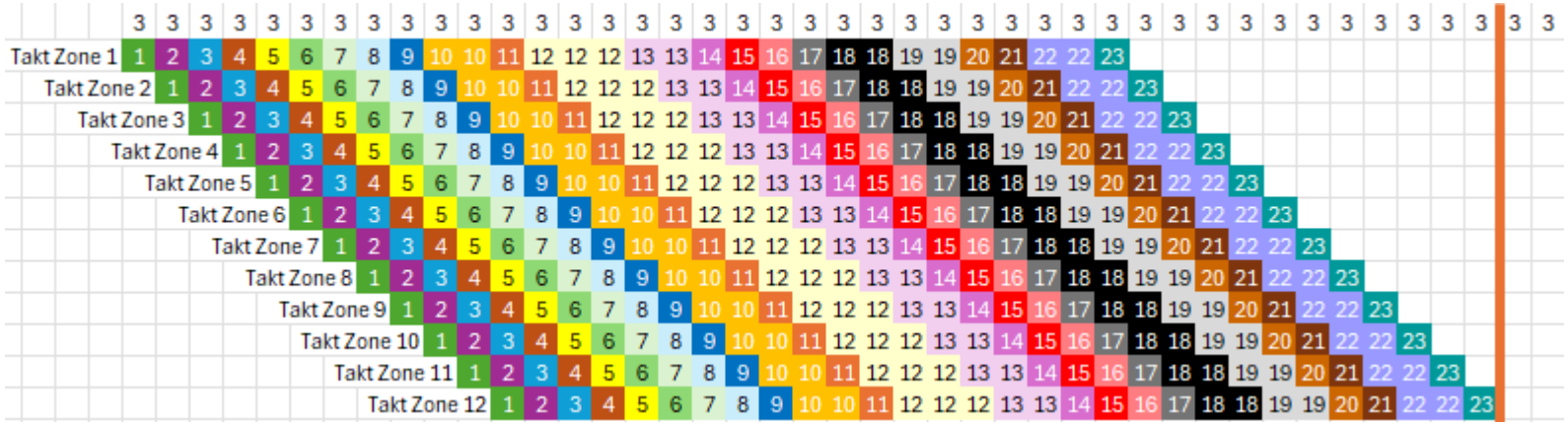
Optimizing the Takt Plan

- 30 Takt Wagons
- 6 Takt Zones
- 5 Day Takt Time
- Duration? 175 days



Takt Wagon #1 shows 30 days on the project

Optimizing the Takt Plan

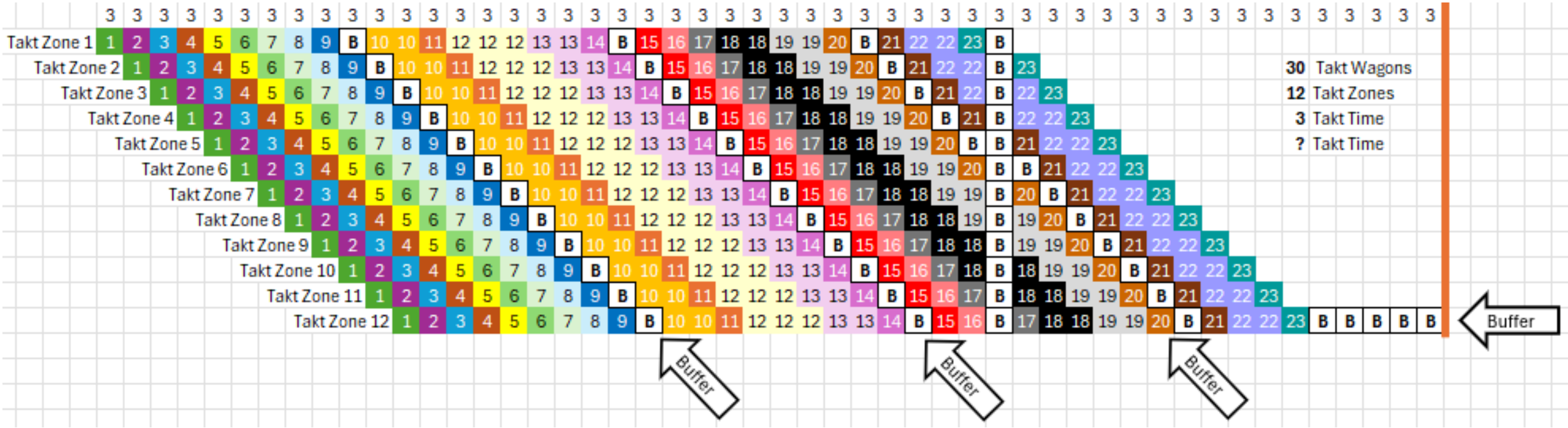


What if we doubled the zones & cut the takt time?

- 30 Takt Wagons
- 12 Takt Zones
- 3 Day Takt Time
- Duration? 123 days

Takt Wagon #1 shows 36 days on the project - 6 extra days to complete their work. That is true for all 30 Takt Wagons.

Adding Extra Buffers to the Takt Plan

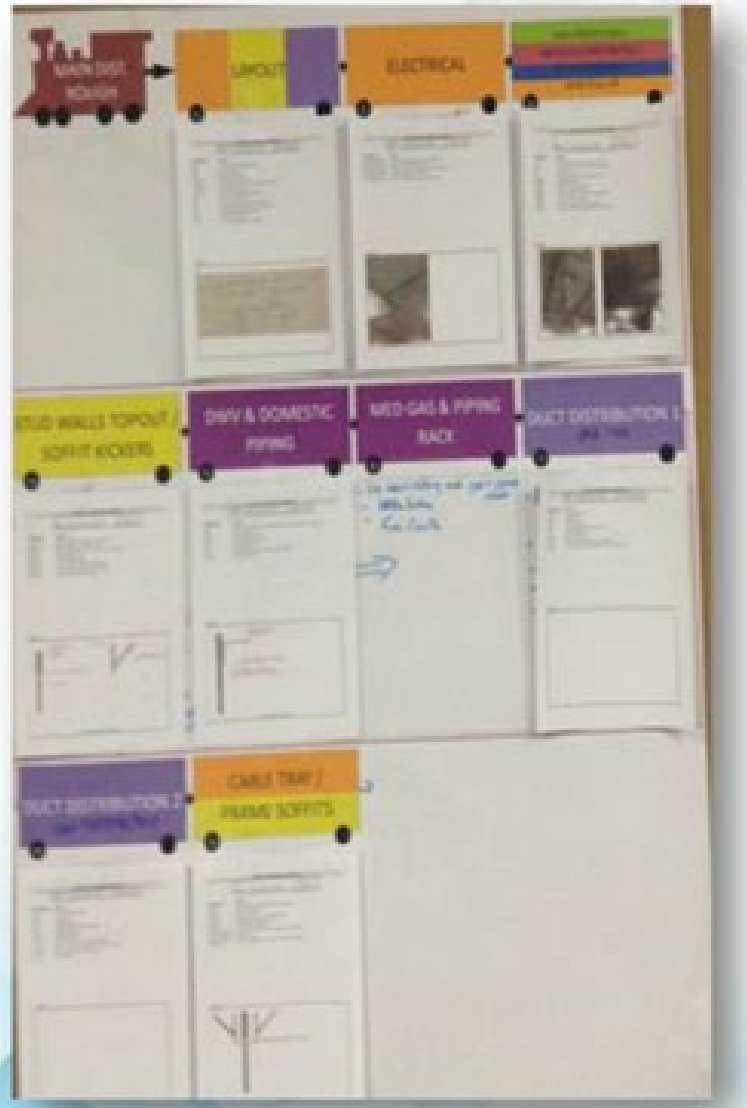


Add strategic buffers to into the Takt Plan to ensure crews can meet the schedule and to absorb likely delays in construction. Build in contingency for potential problems.

Go to Takt Calculator

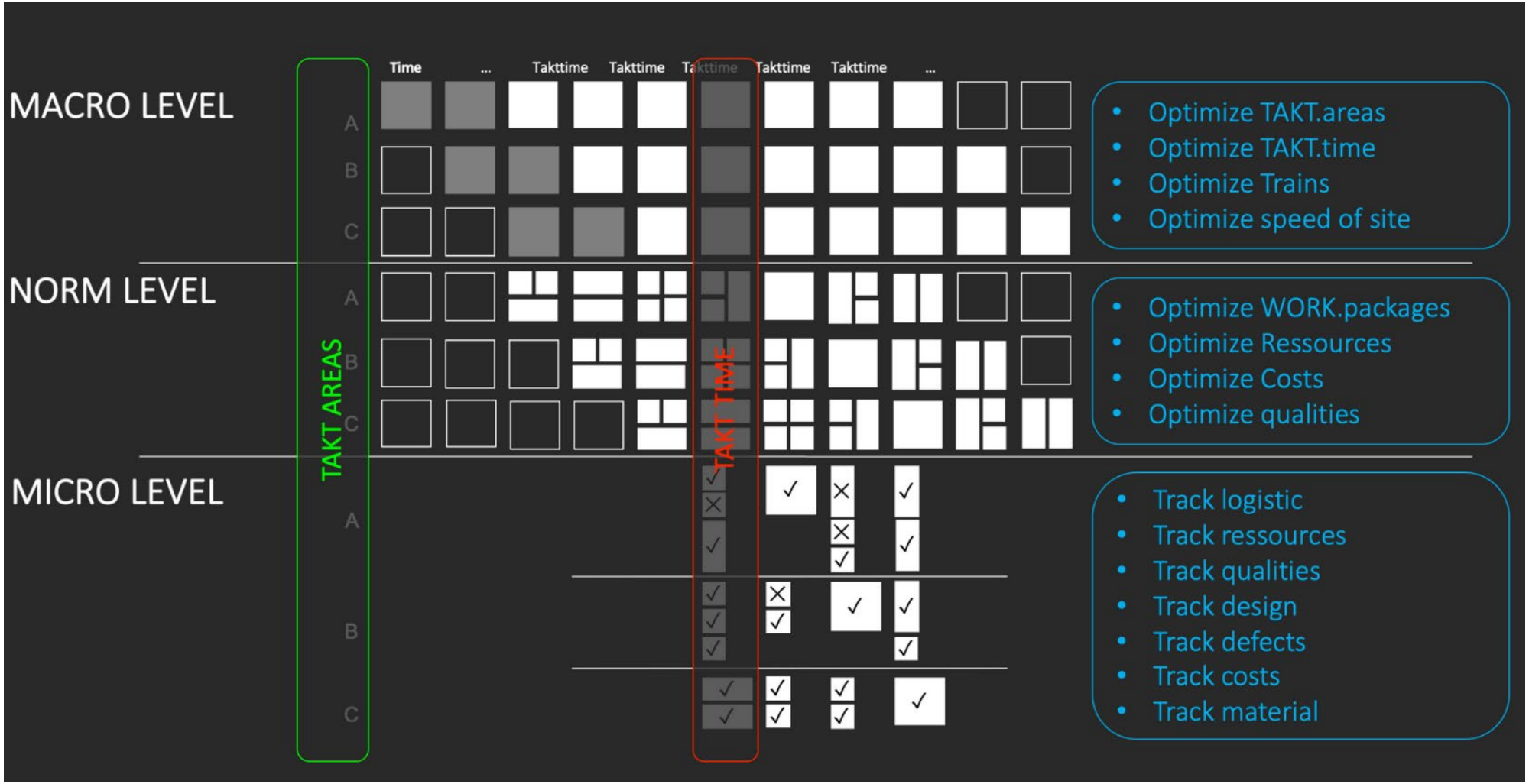
Trade Execution (WIIFM? – for Subcontractors)

Takt Train Cars with Handoffs



How will we complete the work?

Get Granular, Get Detailed (Managing Takt)



Standard Work Example

- Step-by-step process with images, task descriptions, time averages by task, with quality considerations.
- Best (& most efficient) practices incorporated into one visual document.
- Created by a team of experts
- Benefits:
  - Training
  - Quality control
  - Consistency of product
  - Consistency of production time
  - Takt time & production analysis

Standard Work Operation: "Lion" Paper Airplane

Visual	Control	Step	Description	Manual Time	Critical to Quality
		1	Take one A4 sized piece of paper	2 Sec.	
		2	Fold longways exactly in half. Open it back up again.	4 Sec.	Q
		3	Fold top corners at a 45° so the corners meet exactly at the centre l	6 Sec.	Q
		4	Fold the top 45° edges precisely to the center line again.	6 Sec.	Q
		5	Fold the tip of the plane down 10.5 cm from the top.	3 Sec.	
		6	Fold tip up 2.5 cm down from the top.	3 Sec.	
		7	Fold again along the centre line.	2 Sec.	
		8	Fold down one wing 2.9 cm parallel to the base of the fuselage.	4 Sec.	Q
		9	Fold the 2nd wing down on the other side	4 Sec.	Q
		10	Straighten wings horizontal to the working surface.	3 Sec.	Q

Total Cycle Time: 37 Sec.

Takt Time: 40 Sec.

Created by RW: 10.24.12

In conjunction with...

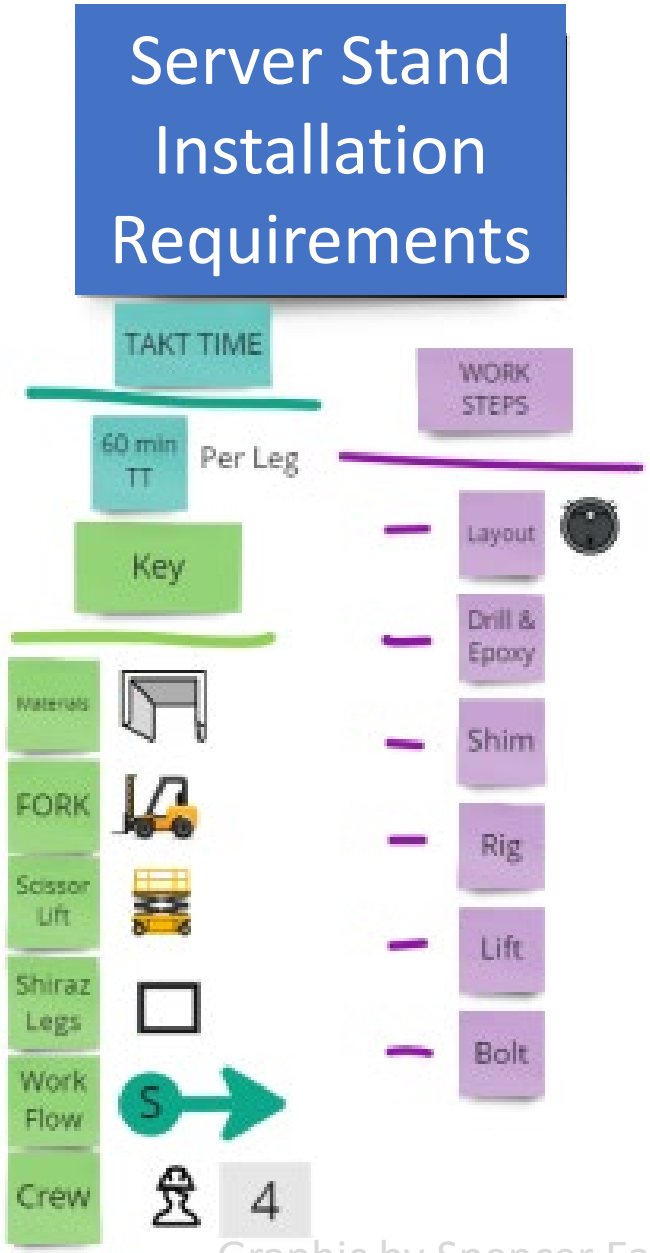
paperaeroplanes.com

Standard Work Descriptions

Define the following <u>in detail</u>:

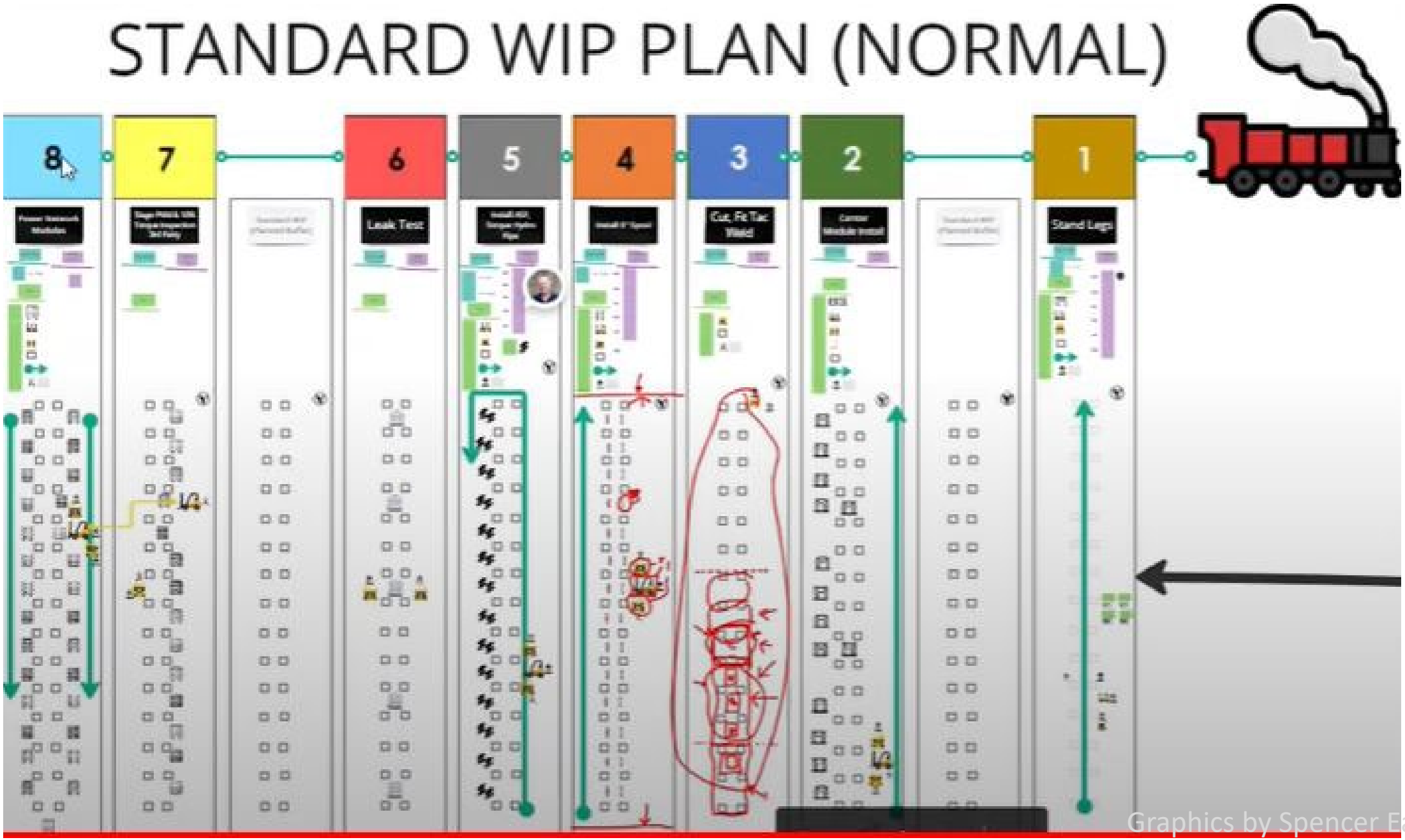
- Work steps/requirements by area
- Material process/logistics by area
- Productivity requirements
- Manpower needs
- Just-in-time deliveries by area
- Safety plan by area
- Equipment plan
- Quality process
- Hand-off process to next trade

(checklists, diagrams, plans, diagrams, lists, spreadsheets, flow chart, metrics, kanbans, etc.)



Graphic by Spencer Easton

STANDARD WIP PLAN (NORMAL)



Graphics by Spencer Easton

Trade Accountability

PPC: Percent Plan Complete

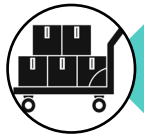
$$\frac{\text{Completed Daily Tasks}}{\text{Daily Planned Tasks}} = \text{PPC Score}$$

$$\frac{11 \text{ Completed Tasks}}{19 \text{ Planned Tasks}} = 58\% \text{ PPC Score}$$

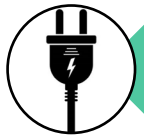
PPC Goal: 90% or better

No Trash Hist the Ground
- Trash cans available in work areas and emptied promptly

Just in Time Deliveries
- Materials & equipment are not to be stored on site for excessive periods of time



Everything on Wheels, Pallets or Dunnage
- Hard surfaces = Everything on wheels, otherwise dunnage or pallets



Cord Management
- Use cordless tools OR elevate cords off the ground

Clear Walkways & Access
- All access/egress clearly identified & unobstructed

Organized Workspaces
- A place for everything & everything in its place (5S - work areas, gang boxes, office space, laydown yard, etc.

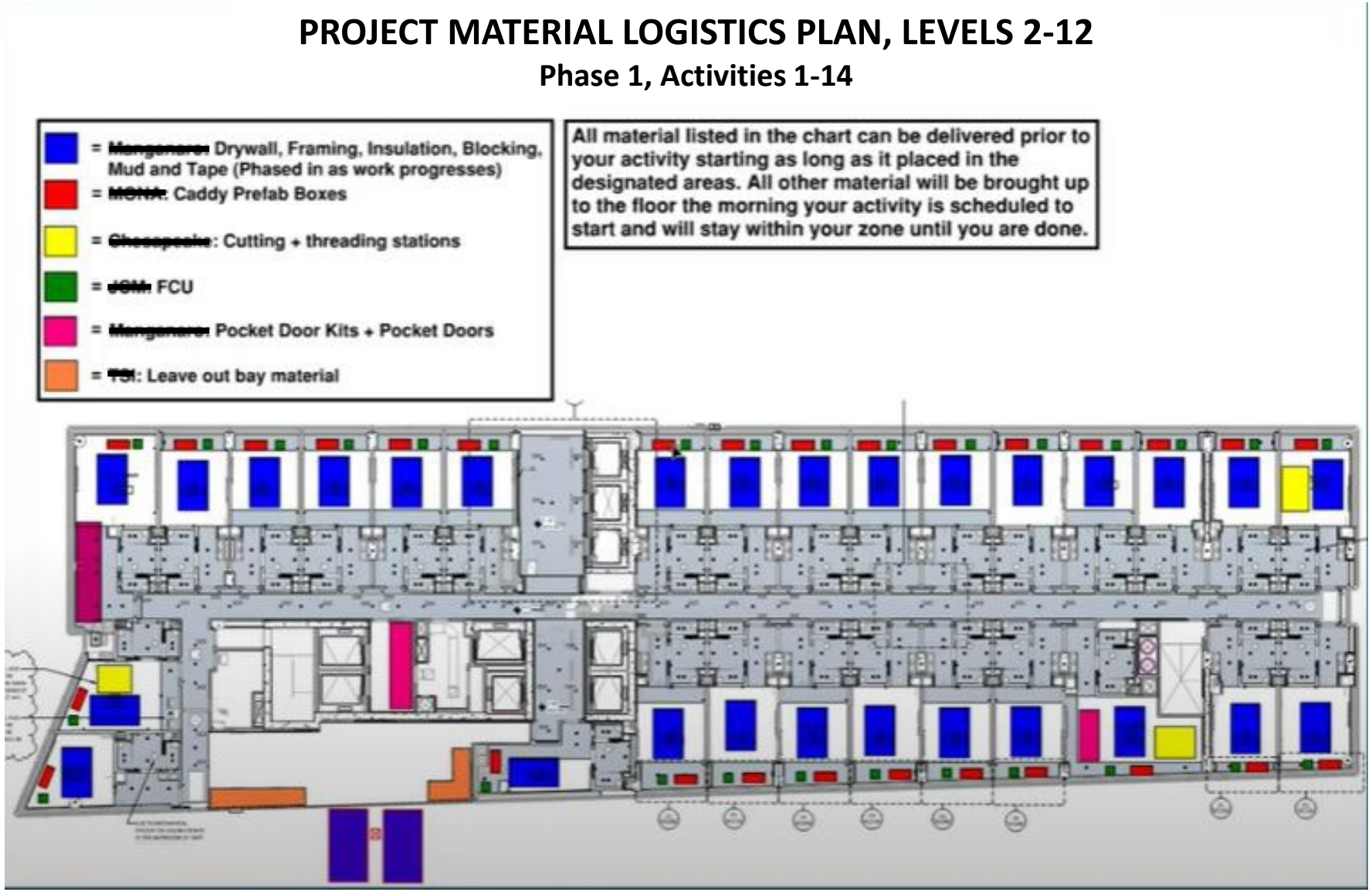
Work Area Readiness
- Nothing left behind, broom swept, clean for next trade

Expectations & Accountability
- Expectations& hand-offs are clear for all trades from the start and team members are accountable to each other

Standardized Hand-Off (per Area/Zone)

- Itemized Material lists
- Fully Defined & Detailed Work Tasks
- Manpower/Crew Requirements
- Logistics Tasks (storage locations & deliveries)
- Quality Process Defined
- Equipment Requirements
- Hand-off Agreements with Next Subcontractor

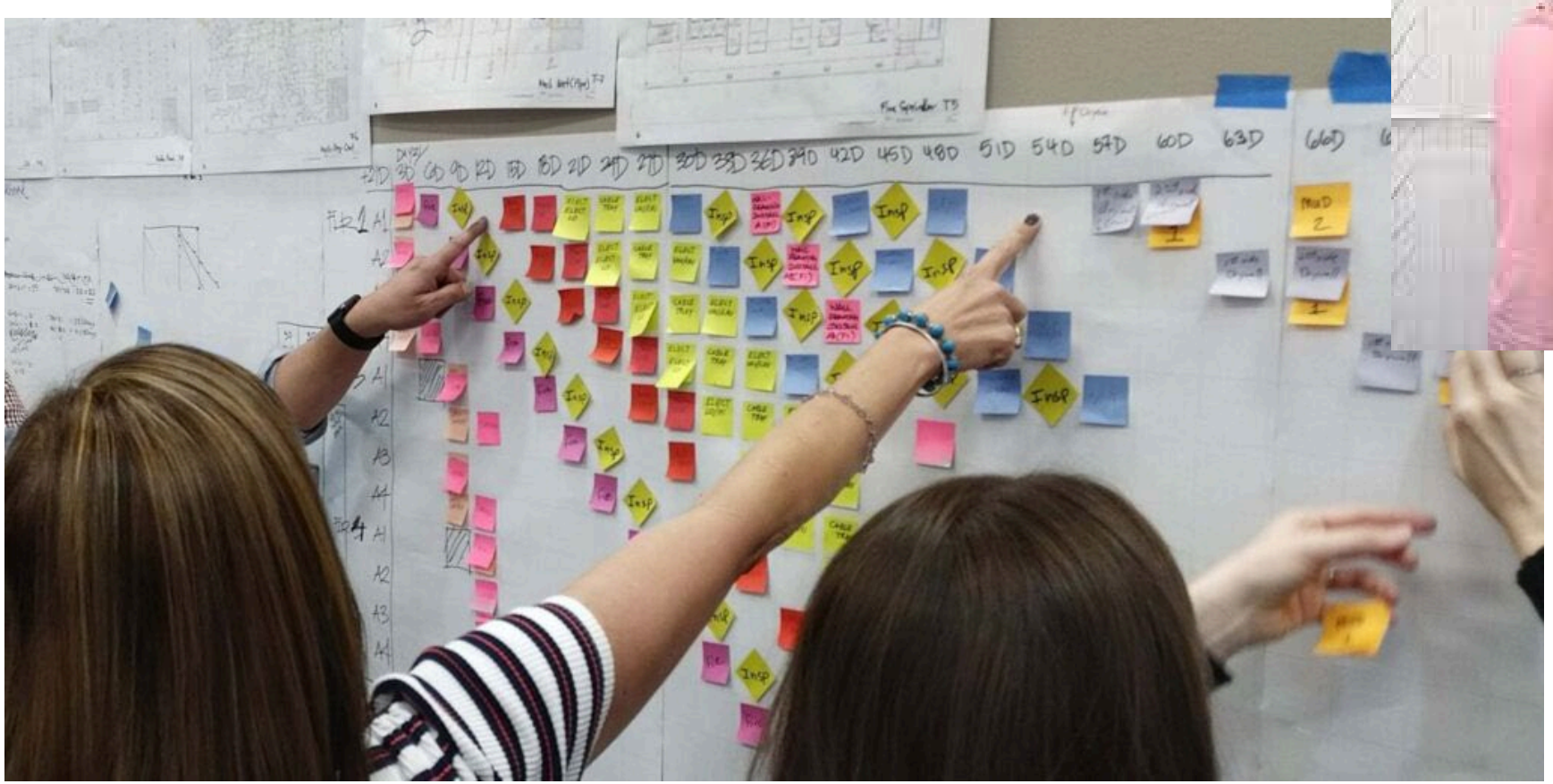
Pull Planning vs. Takt Planning



Managing the Plan Daily (Daily Huddles)

Managing the Plan Daily

- Daily Huddles



Self-Regulating Crews

Plan the work

- then -

Work the plan!

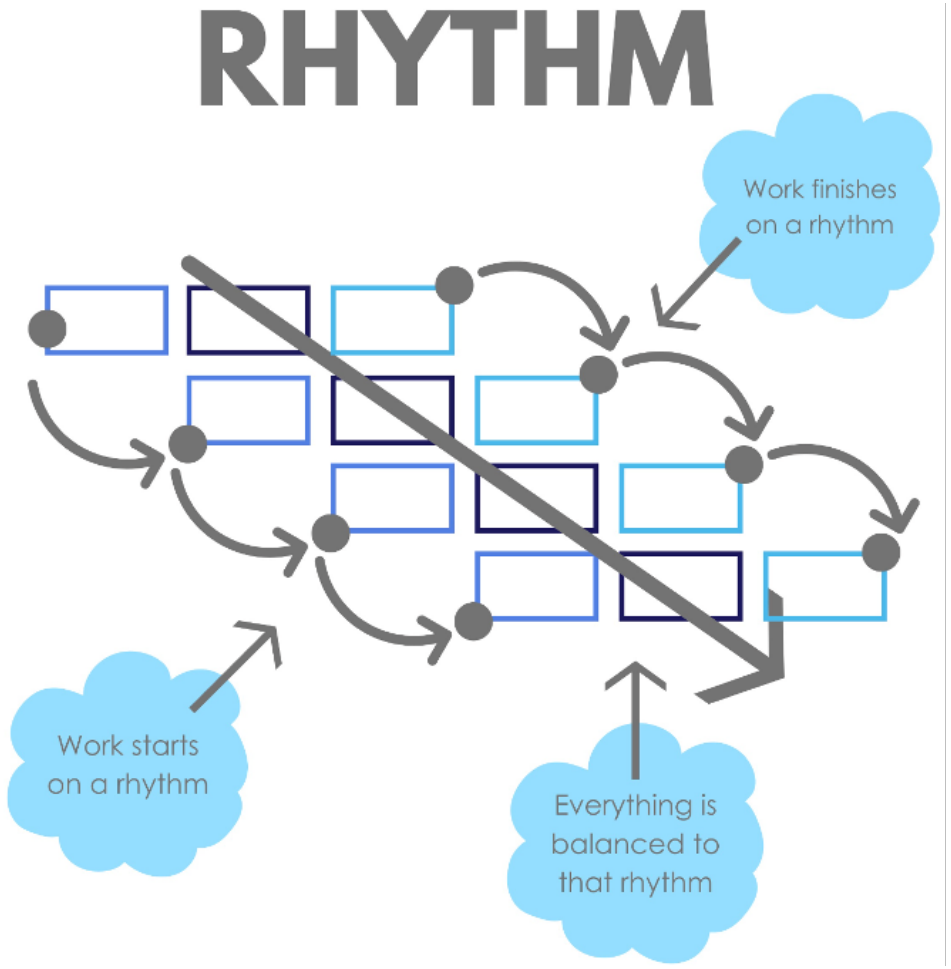
Why would a trade contractor appreciate working within a well designed takt plan?

Takt Planning = Teamwork!

- Optimize the project, not the trade.
- Optimizing the trade creates **wasteful** gaps in the schedule.
- Create a customized **production system** for the project.
- When the project stakeholders work together as a **TEAM** (instead of individual trades) they all WIN!
- Takt Planning = True Teamwork

Takt Planning Metrics (Results)

- Speed up work (with more trade time)
- Maintain quality
- Emphasizes hand-offs (hand-overs)
- Reduce crew size (manpower)
- Improves material delivery planning
- Improves trade reliability
- Built in quality control vs. inspected QC
- Reduces constraints
- Predictable workflow
- Visual project management




Questions?
Hot Summer Months
Cold Winter Months
Sitework Complete
Foundation Complete
Structure complete
Power On
Air On
Interior Complete
Exterior Complete
Sitework
Foundations
Structure
Interiors
Exteriors
Substantial Completion
Final Completion + Financial Completion
NTP

One Piece Flow Videos

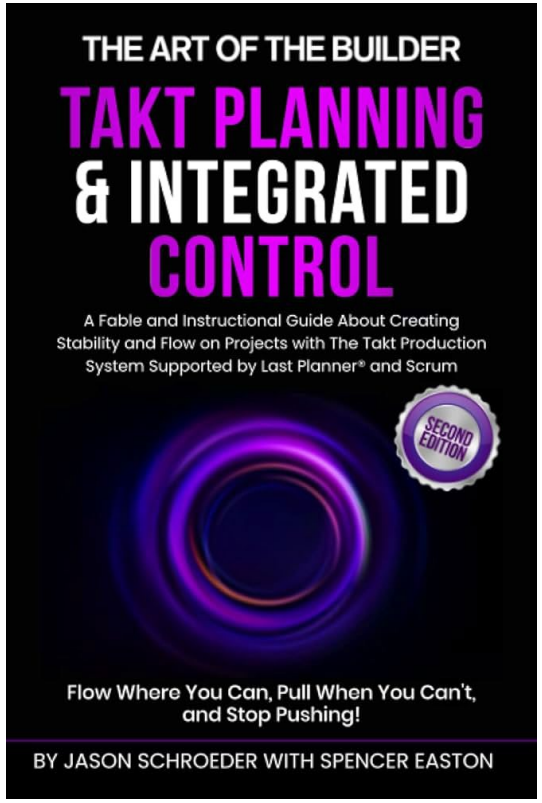
- https://www.youtube.com/watch?v=ciJckWCMvpA
- https://www.youtube.com/watch?v=jPp_3-zfPaQ
- https://www.youtube.com/watch?v=GxxvdXcuQjM
- https://www.youtube.com/watch?v=kRyBJPtm5D0
- https://www.youtube.com/watch?v=wOcfvQV72MU

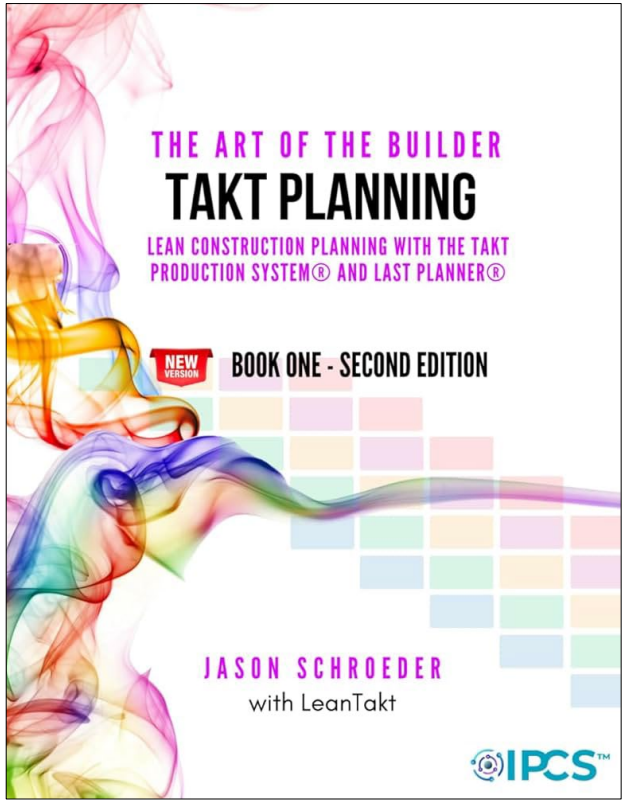
Takt Time Webinar

- https://www.youtube.com/watch?v=Y3PXQpNbSc4

Takt Time Blog Articles

- What is a Takt plan? (leanconstructionblog.com)
- Introduction To Takt Planning (leanconstructionblog.com)
- Creating a Takt Plan (leanconstructionblog.com)
- Leveling Construction Production with Takt (leanconstructionblog.com)
- file:///C:/Users/10568354/Downloads/A_Beginners_Guide_to_Takt_Planning__Control.pdf





Takt Time Books