vPlanner

CPM Scheduling to Production Management: An Overview of Best Practices in the Age of Covid-19

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CPM Scheduling to Production Management:
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Themes

- The Need for Improved Production Planning
- The Last Planner System® Evolution
- Latest LPS® Improvements (2020 P2SL Process Benchmark)
- Execution Strategies and Takt Planning
- Recovery Planning & Covoid-19

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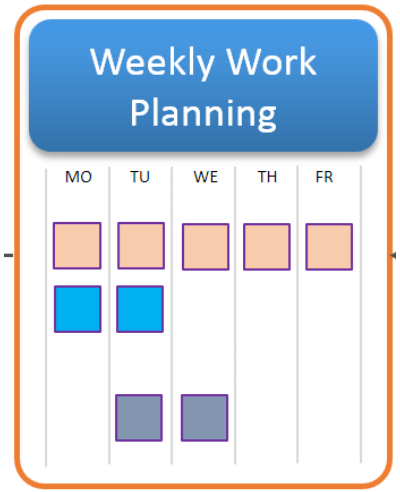
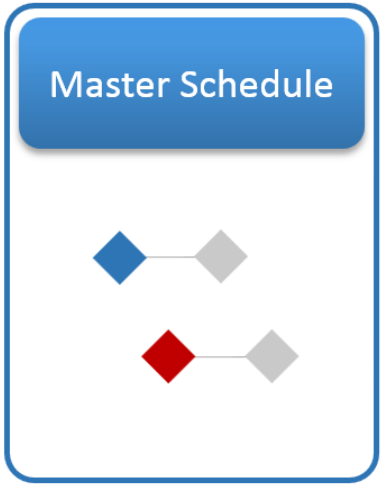
vPlanner Overview & Our Main Focus





We focus on the mechanics of production planning and control to maximize flow, reduce variation, and improve reliability so that you can take your LPS implementation to the next level.

Through the integration of

People, Processes, and Technologies

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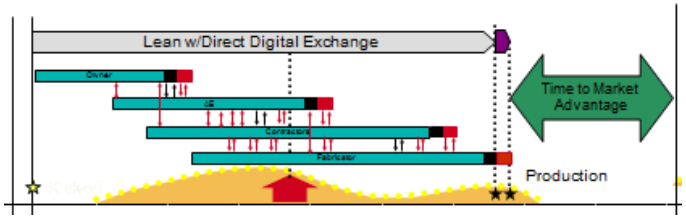
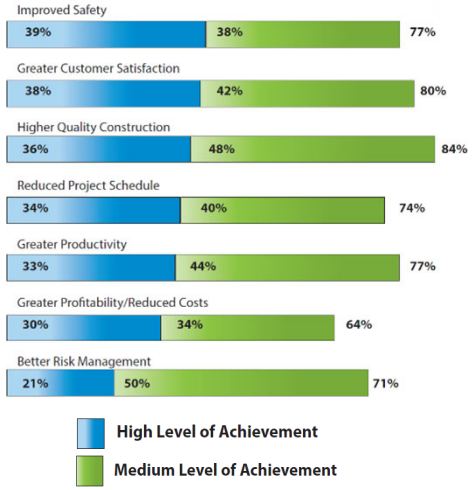
The Need for Improving Production Management



Fast-Track / Time to Market

VDC – Design for Fabrication

Pre-Assembly / JIT Delivery



Lean / IPD
(Supply Chain Focus)

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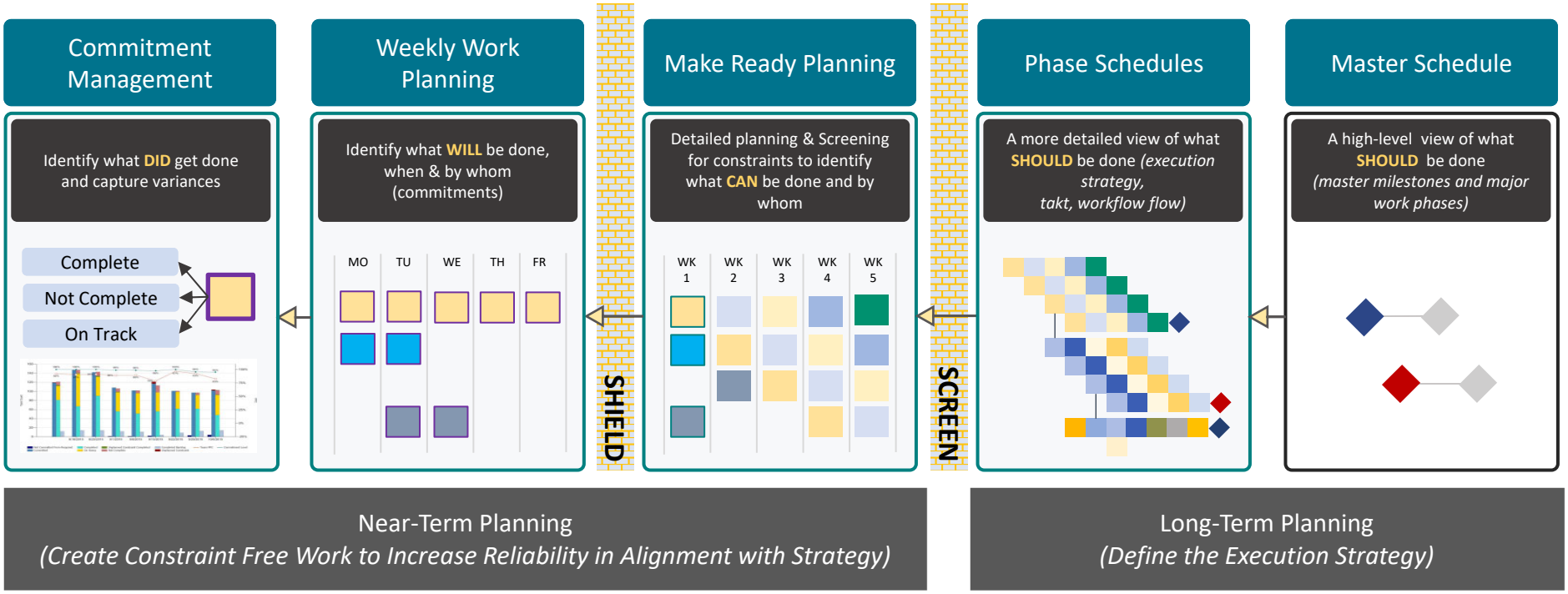
Overview of the Last Planner System® of Production Control



The Last Planner System® of Production Control: Benefits

- Improves transparency and collaboration.
- Reduces workflow variability (variability creates uncertainty).
- Improves Reliability for Execution.

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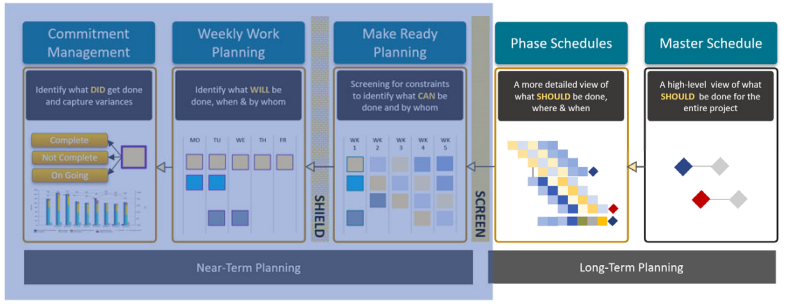
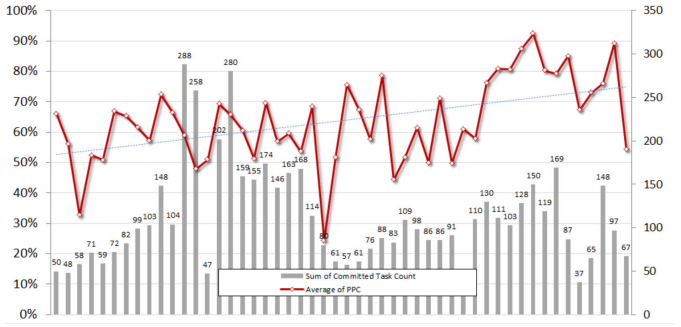
Last Planner System® Evolution

- Near-Term Focused
  - PPC = DID/WILL is a commitment reliability measure.
  - TA & TMR –measure the stability of the lookahead (rarely used).
  - Reasons for Variance
- Do not address the alignment between near-term and long-term planning horizons.
- Lacked clarity on how to define Required and Backlog work.

Result: Teams often find that they can obtain high PPC but still miss their targets!



Near-Term Metrics



Typical PPC Graph

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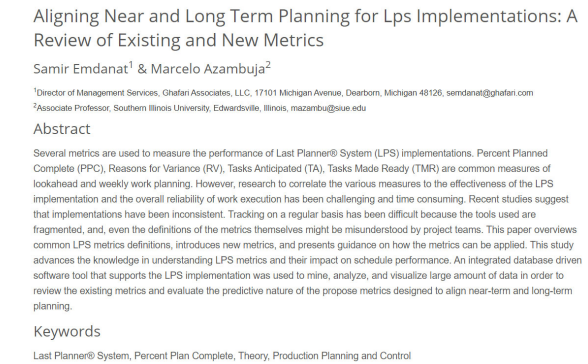
The Need for Advanced Metrics for Managing Production (Background)



Aligning Near and Long Term Planning for Lps Implementations: A Review of Existing and New Metrics

Samir Emdanat[1] & Marcelo Azambuja[2]

[1]Director of Management Services, Ghafari Associates, LLC, 17101 Michigan Avenue, Dearborn, Michigan 48126, semdanat@ghafari.com
[2]Associate Professor, Southern Illinois University, Edwardsville, Illinois, mazambu@siue.edu

Abstract

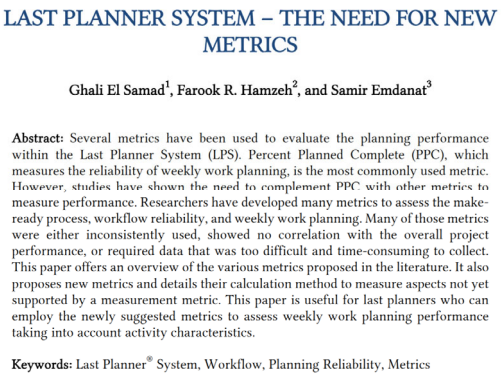
Several metrics are used to measure the performance of Last Planner® System (LPS) implementations. Percent Planned Complete (PPC), Reasons for Variance (RV), Tasks Anticipated (TA), Tasks Made Ready (TMR) are common measures of lookahead and weekly work planning. However, research to correlate the various measures to the effectiveness of the LPS implementation and the overall reliability of work execution has been challenging and time consuming. Recent studies suggest that implementations have been inconsistent. Tracking on a regular basis has been difficult because the tools used are fragmented, and, even the definitions of the metrics themselves might be misunderstood by project teams. This paper overviews common LPS metrics definitions, introduces new metrics, and presents guidance on how the metrics can be applied. This study advances the knowledge in understanding LPS metrics and their impact on schedule performance. An integrated database driven software tool that supports the LPS implementation was used to mine, analyze, and visualize large amount of data in order to review the existing metrics and evaluate the predictive nature of the propose metrics designed to align near-term and long-term planning.

Keywords

Last Planner® System, Percent Plan Complete, Theory, Production Planning and Control

Emdanat and Azambuja
IGLC 2016 & LCI Journal 2016

https://iglc.net/Papers/Details/1253
https://www.leanconstruction.org/media/docs/lcj/2016/LCJ_16_013.pdf



LAST PLANNER SYSTEM – THE NEED FOR NEW METRICS

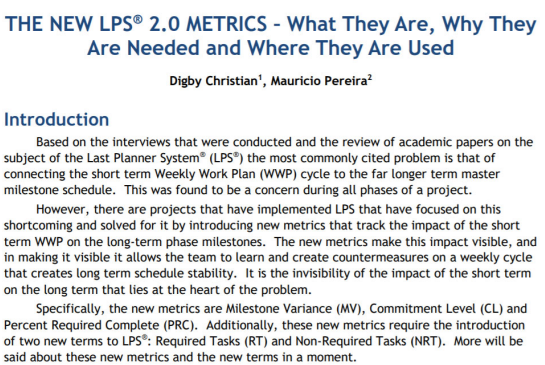
Ghali El Samad[1], Farook R. Hamzeh[2], and Samir Emdanat[3]

Abstract: Several metrics have been used to evaluate the planning performance within the Last Planner System (LPS). Percent Planned Complete (PPC), which measures the reliability of weekly work planning, is the most commonly used metric. However, studies have shown the need to complement PPC with other metrics to measure performance. Researchers have developed many metrics to assess the make-ready process, workflow reliability, and weekly work planning. Many of those metrics were either inconsistently used, showed no correlation with the overall project performance, or required data that was too difficult and time-consuming to collect. This paper offers an overview of the various metrics proposed in the literature. It also proposes new metrics and details their calculation method to measure aspects not yet supported by a measurement metric. This paper is useful for last planners who can employ the newly suggested metrics to assess weekly work planning performance taking into account activity characteristics.

Keywords: Last Planner® System, Workflow, Planning Reliability, Metrics

El Samad, Hamzah, Emdanat
IGLC 2017

https://iglc.net/Papers/Details/1368



THE NEW LPS® 2.0 METRICS - What They Are, Why They Are Needed and Where They Are Used

Digby Christian[1], Mauricio Pereira[2]

Introduction

Based on the interviews that were conducted and the review of academic papers on the subject of the Last Planner System® (LPS®) the most commonly cited problem is that of connecting the short term Weekly Work Plan (WWP) cycle to the far longer term master milestone schedule. This was found to be a concern during all phases of a project.

However, there are projects that have implemented LPS that have focused on this shortcoming and solved for it by introducing new metrics that track the impact of the short term WWP on the long-term phase milestones. The new metrics make this impact visible, and in making it visible it allows the team to learn and create countermeasures on a weekly cycle that creates long term schedule stability. It is the invisibility of the impact of the short term on the long term that lies at the heart of the problem.

Specifically, the new metrics are Milestone Variance (MV), Commitment Level (CL) and Percent Required Complete (PRC). Additionally, these new metrics require the introduction of two new terms to LPS®: Required Tasks (RT) and Non-Required Tasks (NRT). More will be said about these new metrics and the new terms in a moment.

Christian and Pereira
LCI Journal 2020

https://www.leanconstruction.org/media/docs/lcj/2020/LCJ_20_008.pdf

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Advanced Production Planning Metrics

❖ **Commitment Level (CL) = Required WILL / SHOULD**

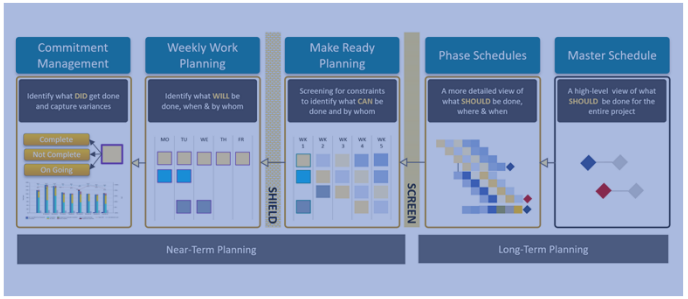
- *Are we committing to enough work to keep the targets on track?*
- *Aim to have CL = 100% for each workplan cycle.*
- *If CL is below 100% re-planning must occur during the work plan cycle to re-align the remaining work with the targets.*

❖ **Percent Required Complete (PRC) = Required DID / SHOULD**

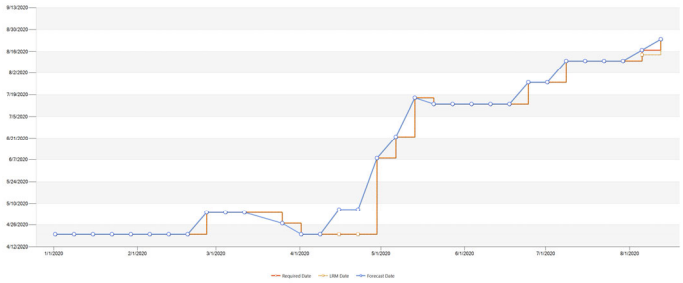
- *Note that PRC may include work that is completed but not originally committed (in vPlanner, PRC currently measures Required Did from Committed against SHOULD).*

❖ **Milestone Variance (MV)**

- *Shows the trend of the variance between the longest path to the target and the target at the time a workplan is created.*



Advanced Metrics



Milestone Variance

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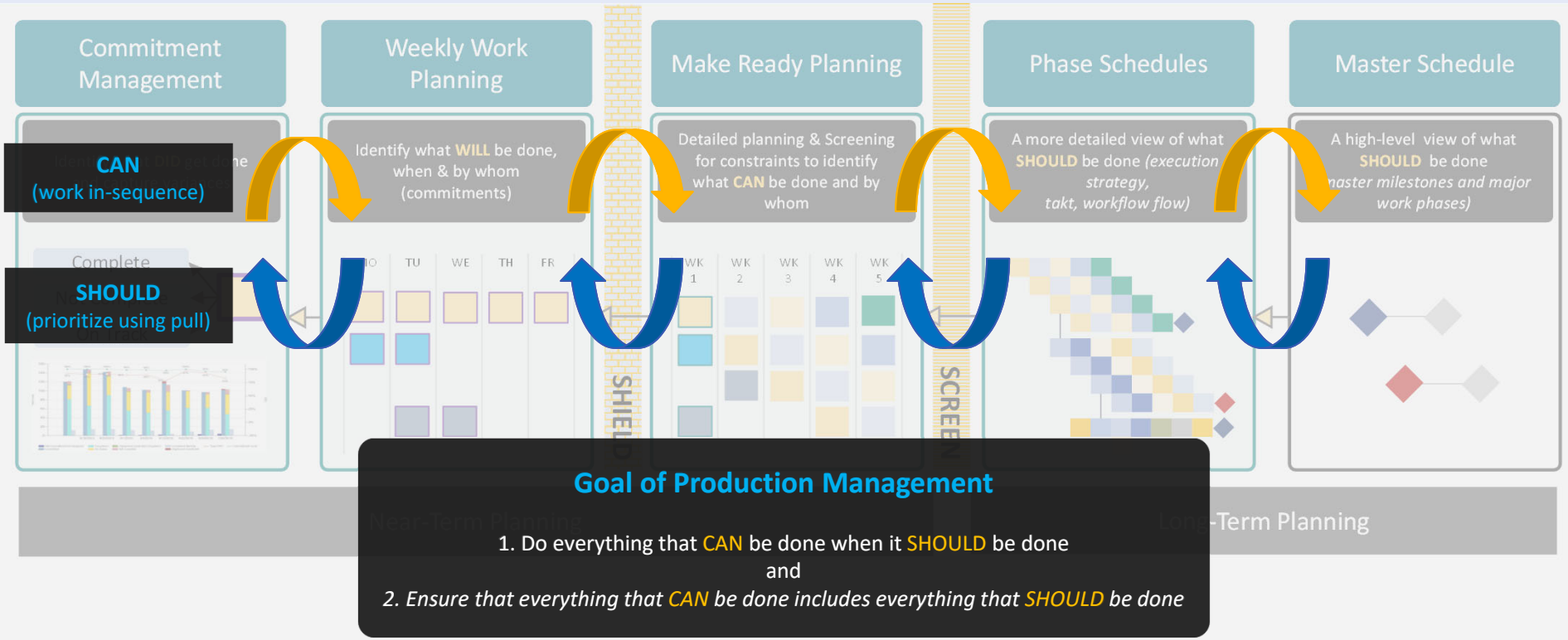
LPS® 2020 Benchmark: Alignment of CAN and SHOULD



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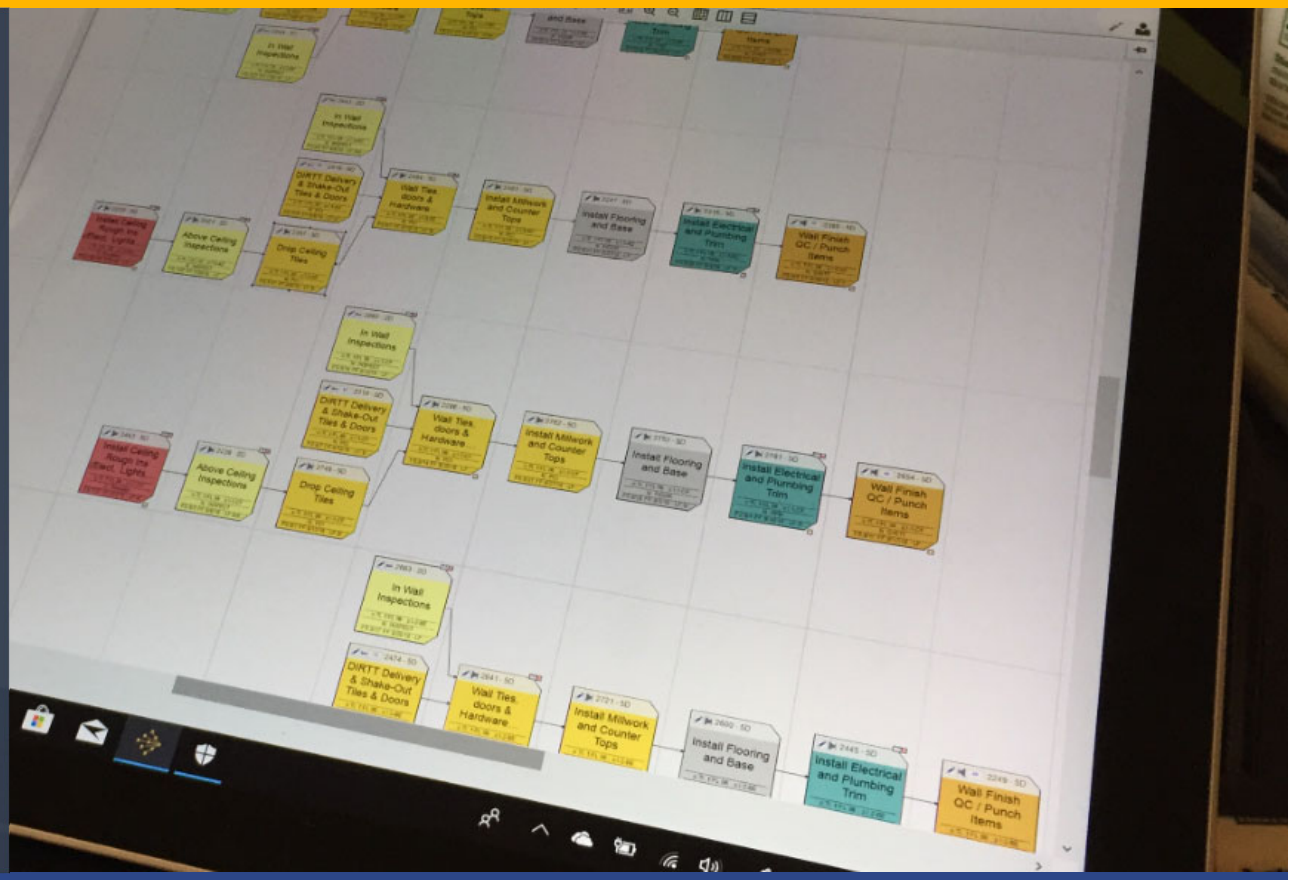
Development of Clear Execution Strategies (Takt)



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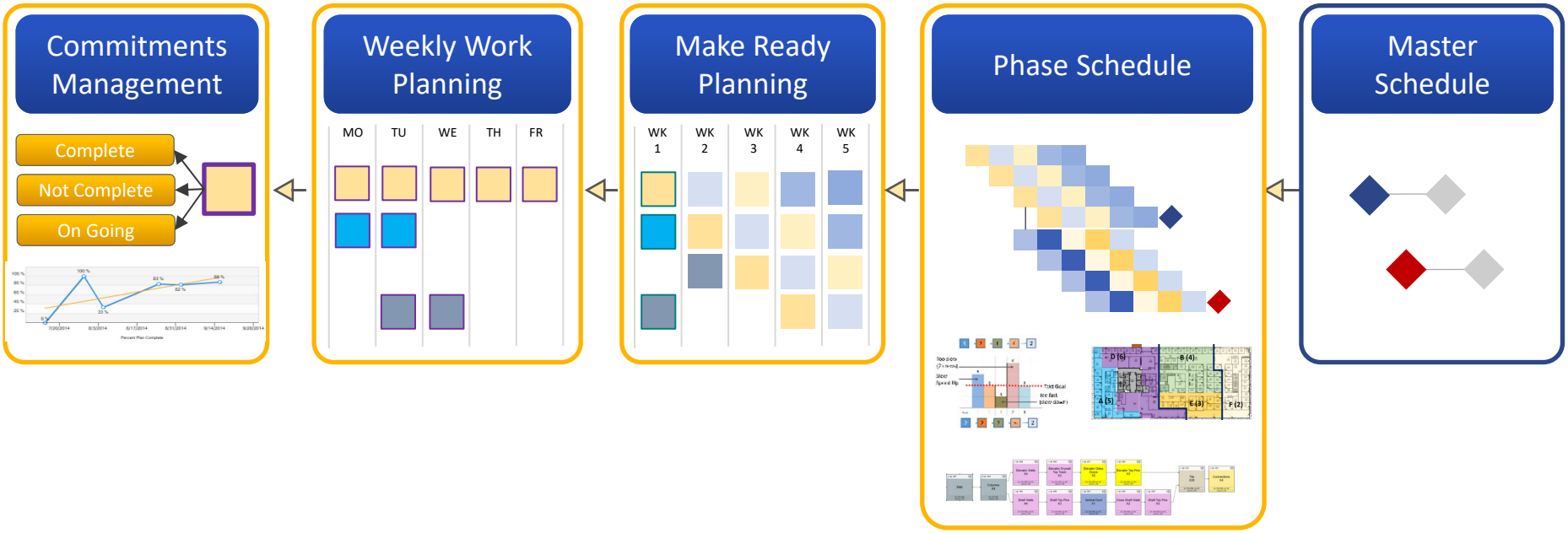
Development of Clear Production Strategies (Execution Strategies)



Goal 1: Protect Near-Term Plans from the Uncertainty of Long-Term Plans

Goal 2: Align Near and Long Term Plans

Last Planner System® is a trademark of the Lean Construction Institute

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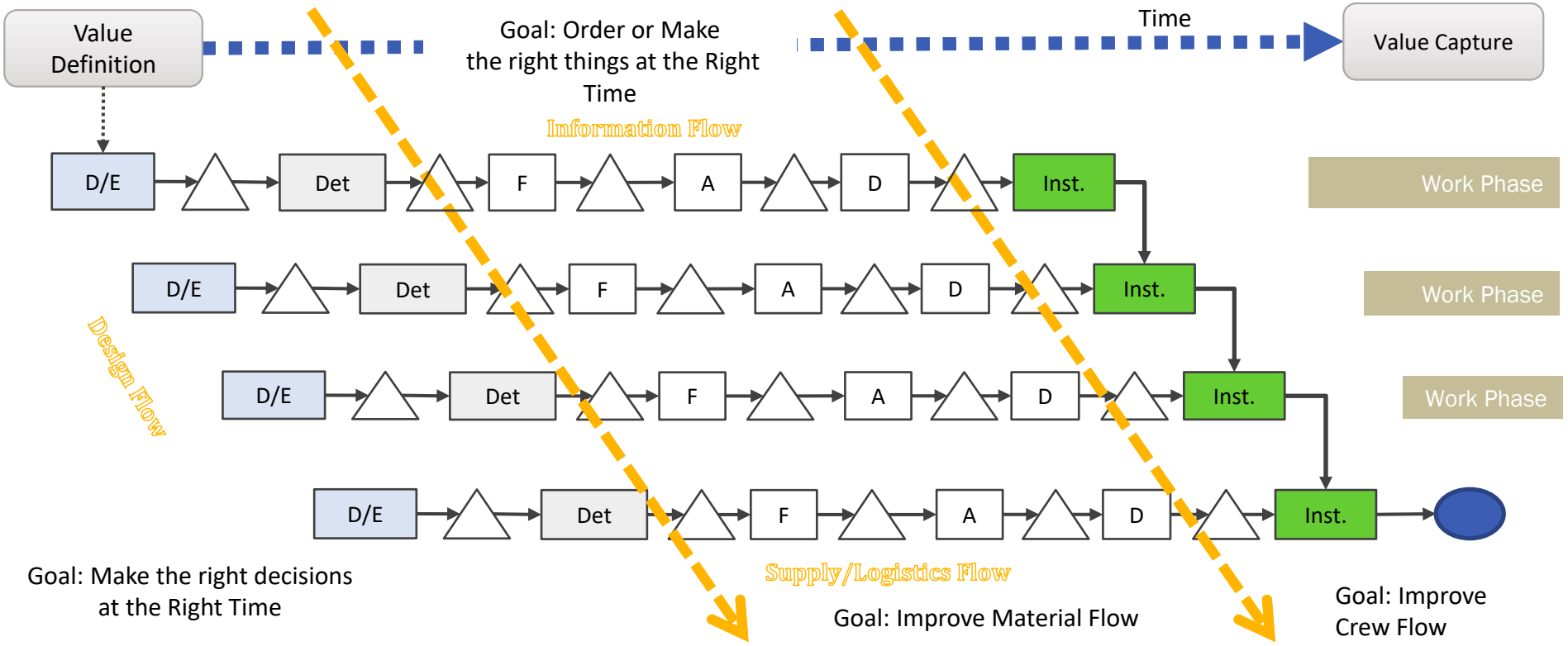
The Project as a Production System



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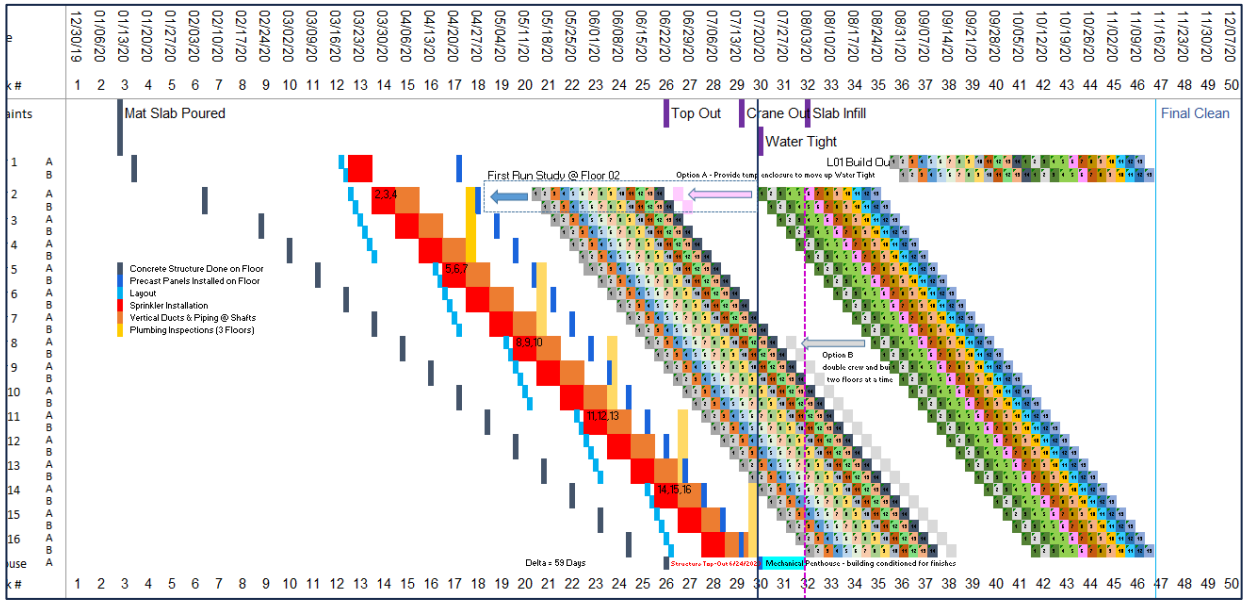
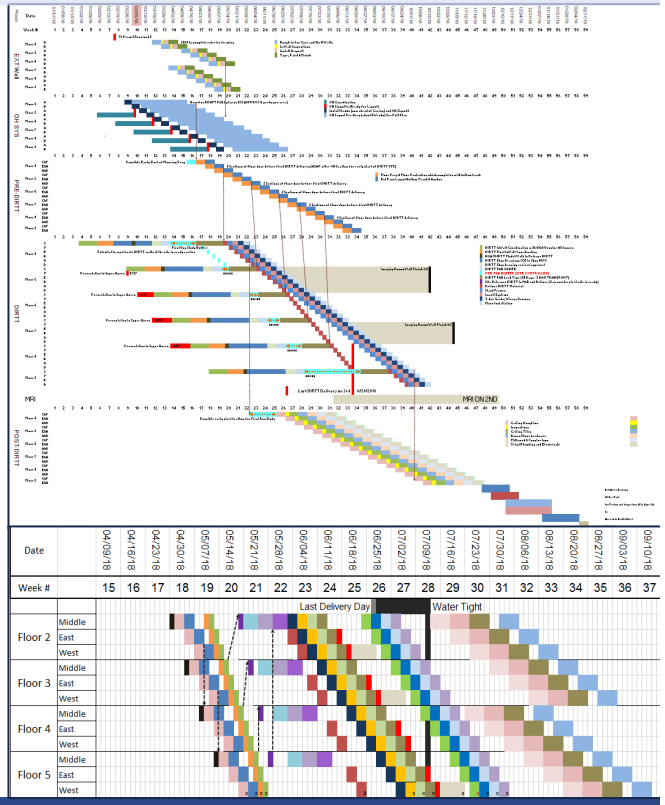
Development of Clear Production Strategies (or Execution Strategies)





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What is Takt Planning?

Takt Planning is a production planning technique that sets the goals for each step in the production system so that the work can proceed in sequence to reliably meet its production demands.

Origins in the creation of the production line.

It guides the design of the production system and gives focus to lean process improvements efforts.

Takt is a calculated value

Source: PeriscopeFilm
https://www.youtube.com/watch?v=t0J_naOcxDs

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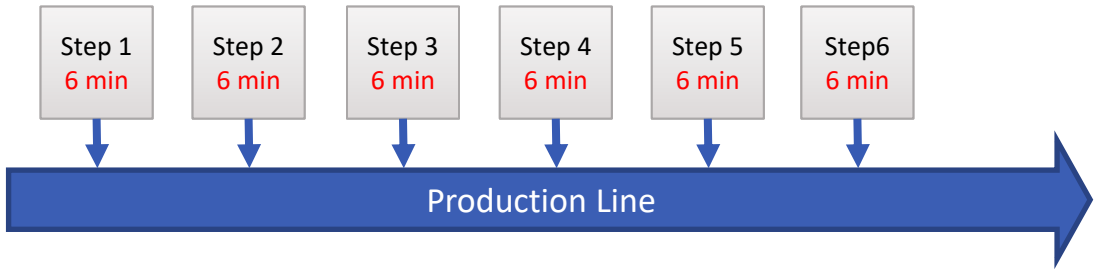
Calculating Takt in Manufacturing

Takt = Available Time to Do the Work / Demand

Example:
We need to make 40 cars in 4 hours.

Takt = 4/40 = .1 Hours or 6 Minutes

In other words, the production system must produce a car every 6 minutes to meet demand.



If we have a 6-step process to make a car, then the Cycle Time per step cannot exceed 6 minutes

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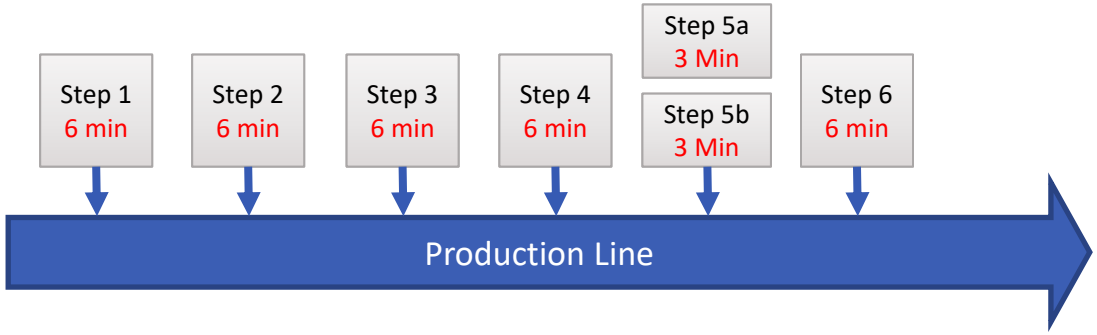
Calculating Takt in Manufacturing



Cycle Times for Steps with Sub-Steps must not exceed Takt

The Takt calculation sets the target duration for the Cycle Time
It sets goals for improvement

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Terms Defined

Takt: calculation that sets the rhythm for the production system.

Cycle Time: measured time to complete a step from start to finish (it includes value added & non-value-added time.

Production Lead Time: total time it takes to make one item. Value Stream Mapping can used to determine lead time.

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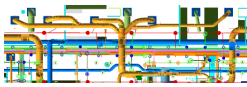
Takt Planning in Construction

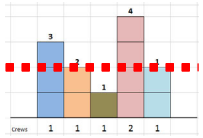
Takt can be used as the foundation for production system design (results in clear execution strategies).

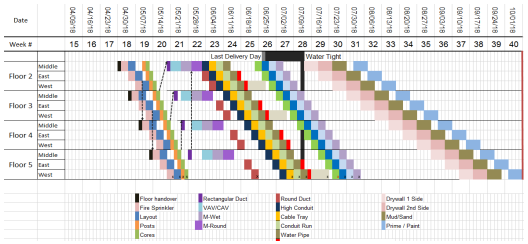
Highly collaborative to negotiate the right sequence and collect the right data from the last planners. It is also highly analytical to analyze the data and produce the appropriate execution strategy.

Elements of a good takt plan

- Clear definition of work phases.
- Clear definition of areas of similar work and areas of unique work.
- Clear definition on conditions for starting work and conditions of satisfaction for its completion.
- Clear expectation of the number of resources required to perform the work.
- Maximizes the flow of information, material, and crews through the areas.







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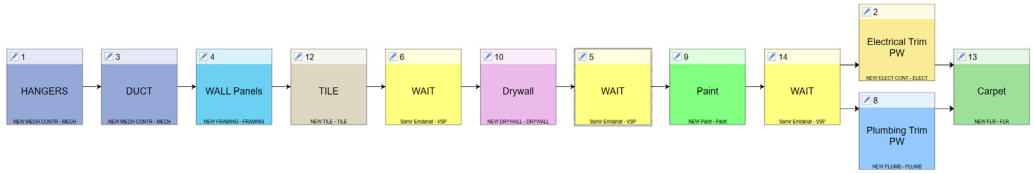
The Takt Planning Process: Definitions

Standard Work: are the work process steps that must be in done **in-sequence** to perform a similar kind of work.

- No durations
- What must be done in sequence
- What can be done in parallel
- Clear definition of each step / clear handoffs

Cycle Time: is the time from start to finish to complete a step in the sequence (make sure the steps are well defined). *Cycle time must not exceed takt.*



Work Phase (Phase): is what results from performing the Standard Work across all the areas where the Standard Work applies (examples overhead work, in-wall work, finishes where similar steps exist)

Crew: is the minimum number of people required to perform a process step.

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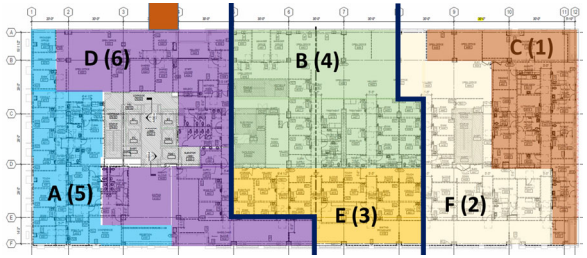
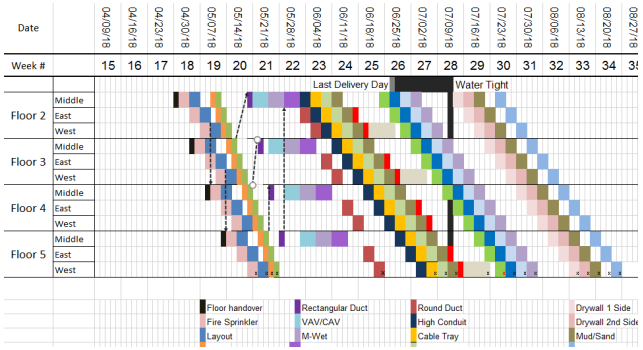
The Takt Planning Process: Definitions

Takt Area: is a location on the floor plan where the Standard Work steps will be performed in sequence.

Note: Takt Area size is defined by the work density in the area. The more density the smaller the area.



Production Lead Time: total time it takes to make one item. Value Stream Mapping can used to determine lead time.



Takt Plan: is a clear visual representation of the overall execution strategy, showing work phases and their key handoffs.

- It is produced <u>after the crews are balanced</u> to fit the required takt goal.
- It shows the work sequence, its duration, where it is performed, and by which trades
- It defined the number of crews required to perform the work

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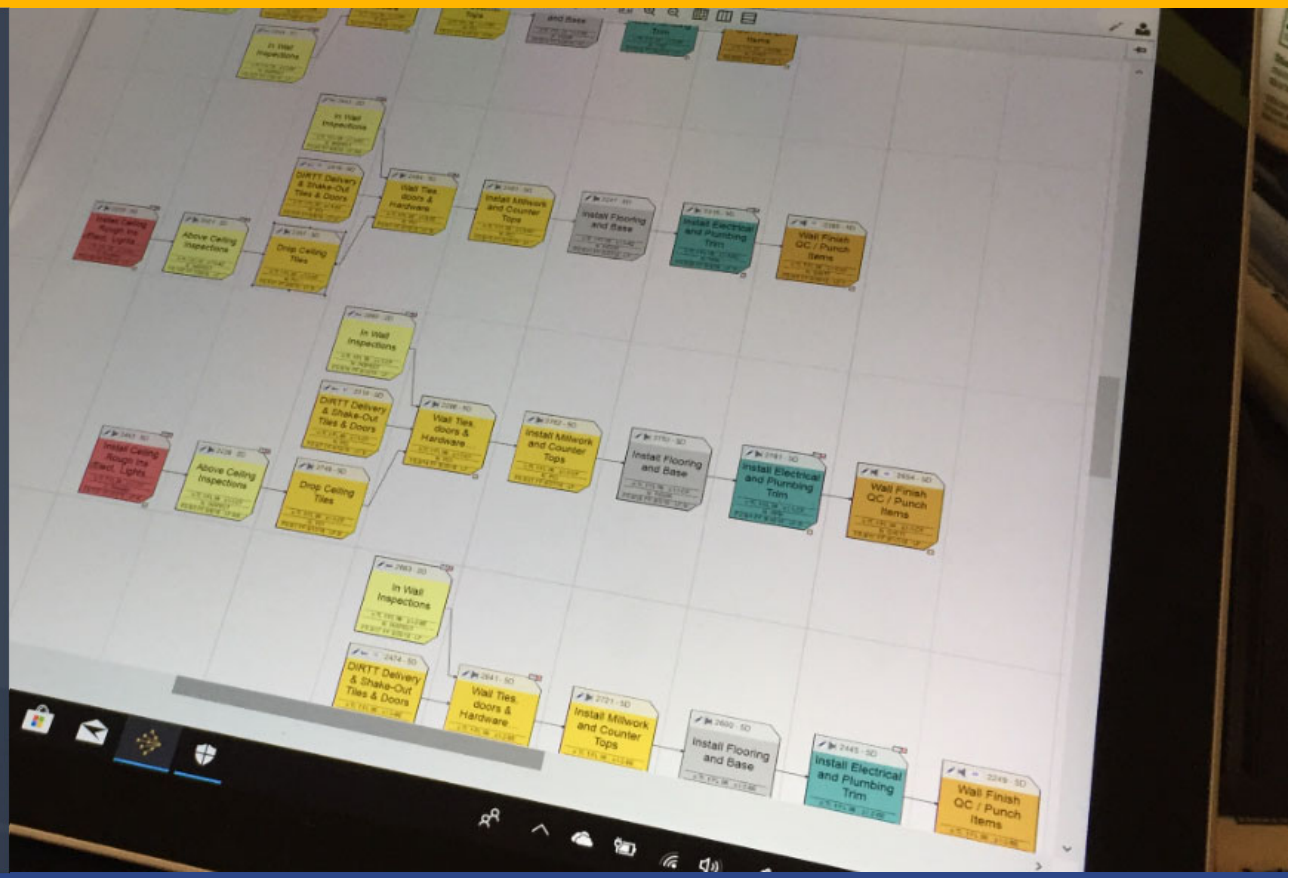
Construction Production Planning using Takt



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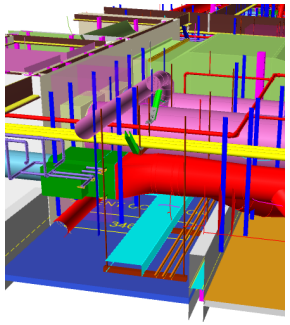
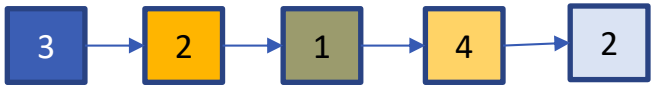
Takt Planning Process Steps – Identifying Standard Work

Identify Work Phases
A geographic location on the floor plan that contains similar processes defined by a process diagram that illustrates the work steps (sequence of work)



Identify Standard Work Steps for Each Phase



Note! You may need to split your phases into more phases. For example, Overhead work: High Overhead, Low Overhead

Important! Do not pre-define takt areas yet. The work density should determine the size of the work areas based on Takt!

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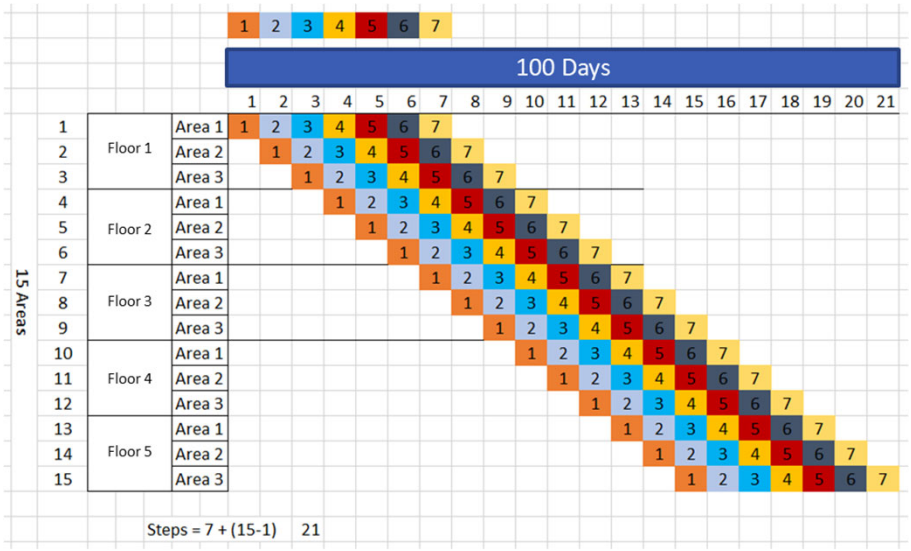
Takt Planning Process Steps – Calculate Takt

Takt = Total Duration / Total Number of Steps to perform the work in all applicable areas



Example:

We have 5 story building.
Total Duration to perform all the work for a phase is 100 days

Standard Work steps is 7

The number of Takt Areas is related to Takt and provides us with options for designing the production system.

Option 1: **Assume 3 Takt Areas (shown)**

Takt 1 = 100 / (7+ (5*3) -1) = 4.7 Days
Takt Goal is then 4 Days.

Option 2: **Assume 4 Takt Areas**

Takt 1 = 100 / (7 + (5*4) -1) = 3.8 Days
Takt Goal is then 3 Days.

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Takt Planning Process Steps – Collect Data using Colors Ups

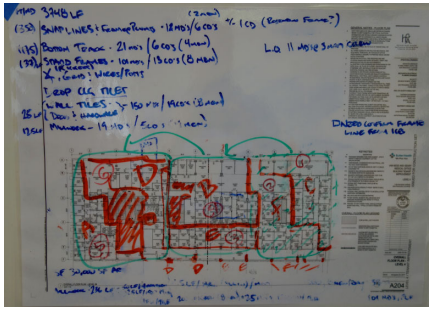
Work with the Team

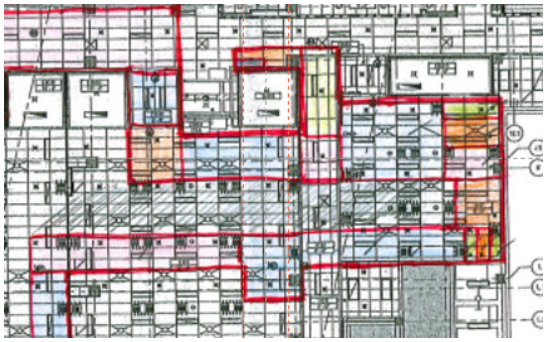
Prepare a set of floor plans the show clearly the work describes in the various steps. You need a copy per work step in the Standard Work.

Ask each Last Planner to highlight how much work their minimum crew can perform in a unit of time.

Notes:

- All Last Planners must use the same unit of time for the Duration.
- Duration of unit of time should be 1 or 2 days for construction (if you have coordination level information)
- Duration can be longer (4 or 5 days) if you have design level information.





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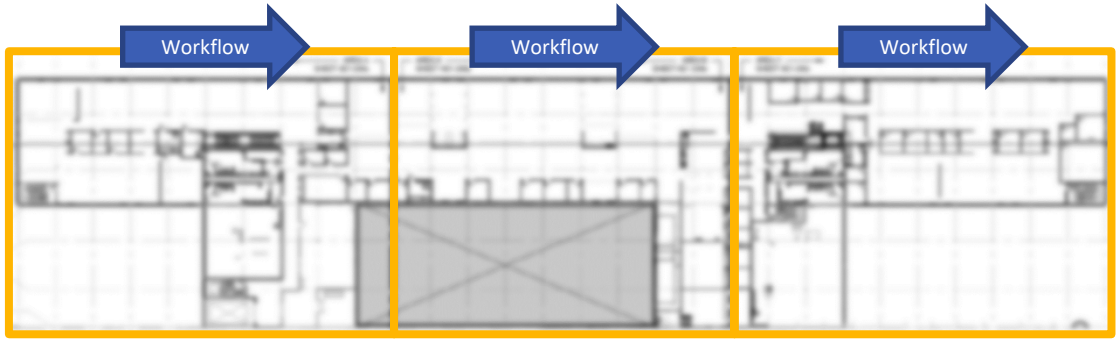
Area Definitions: Ineffective Planning Practices



vPlans Before: Three Areas A,B,C
(always something that is not done)

	Description	Subcontractor	Duration	Current Start	Current Finish
Third Floor - North Mechanical Room					
228	Install Prepurchased AHU - 009	S - Z	8	27-Jul	5-Aug
229	Install Prepurchased AHU - 032	S - Z	6	2-Aug	19-Aug
	Reroute Existing MEP	Electrical	2	13-Aug	14-Aug
	Demolition of Existing MEP	Demo	2	10-Aug	12-Aug
	Prepare Ductwork Shop Drawings	Partitions	7	17-Aug	24-Aug
	Approval of Ductwork Shop Drawings	Partitions	1	24-Aug	24-Aug
	Fabrication of Ductwork	Partitions	10	21-Sep	2-Oct
	Prepare Walls for Ductwork	Partitions	2	12-Aug	13-Aug
	Install Ductwork	Partitions	10	3-Oct	14-Oct
	Install/Final Connection of Chilled Water Piping	Piping	5	7-Oct	12-Oct
	Install Fire Protection Piping	FP	2	12-Oct	13-Oct
	Insulation of Ductwork and Piping	Mechanical	3	14-Oct	16-Oct
	Install Control Wiring and Devices	Controls	3	15-Oct	17-Oct
	Install Electrical Conduit and Panels	Electrical	7	16-Oct	22-Oct
	Final Electrical Connection to Mechanical Equip.	Electrical	3	21-Oct	23-Oct
230	Install Heat Transfer Unit	Piping	3	14-Sep	17-Sep
231	Install New Chilled/Hot Water Coil	Piping	12	2-Aug	15-Aug
348	Start up and Testing	All	12	28-Sep	11-Oct

Logs

The team was using an electronic planning solution but was not able to make all the necessary logic ties between the various phases of work

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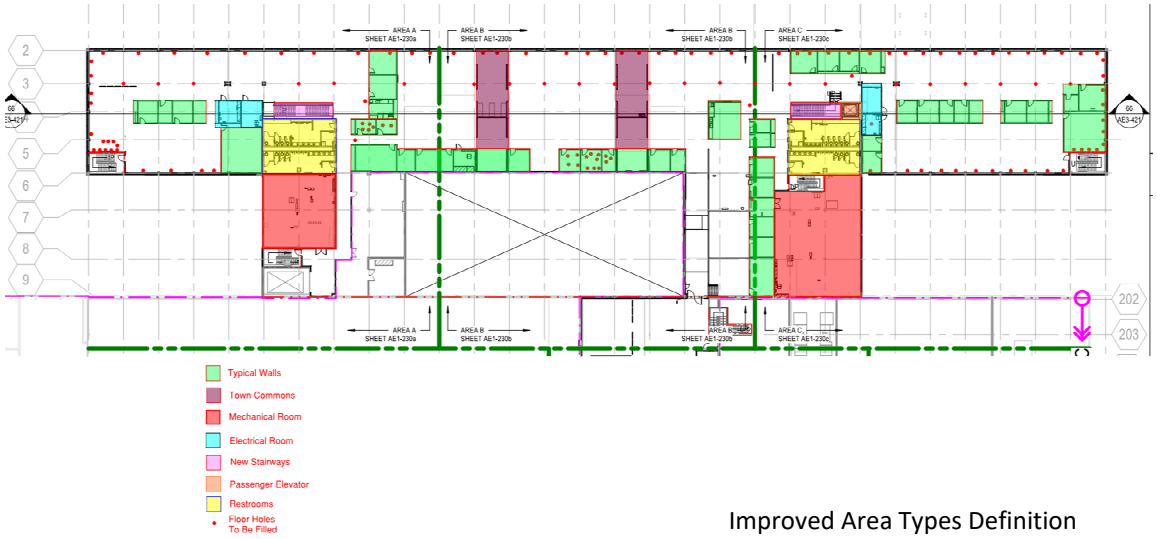
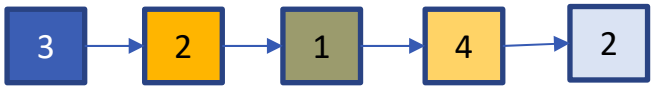
Improved Area Definitions

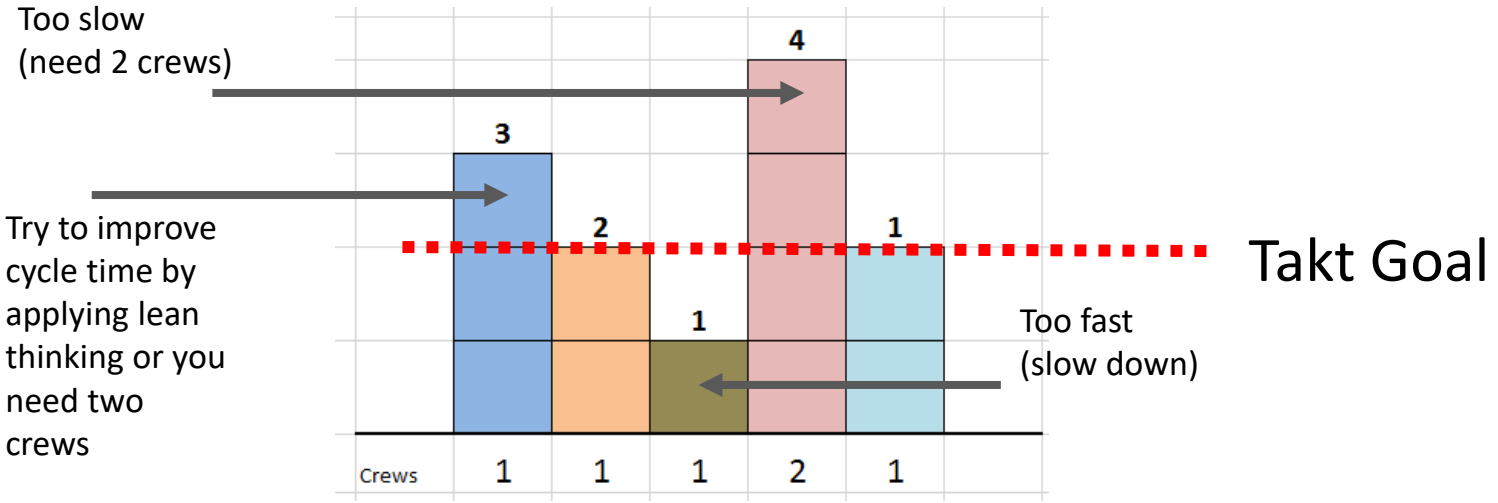


Improved Area Types Definition
(Results in Better Phase Plans)

Takt Planning Process Steps – Takt Analysis and Balancing the Crews



Analysis Step
Calculate the Crew Duration for each standard step then graphically chart the results



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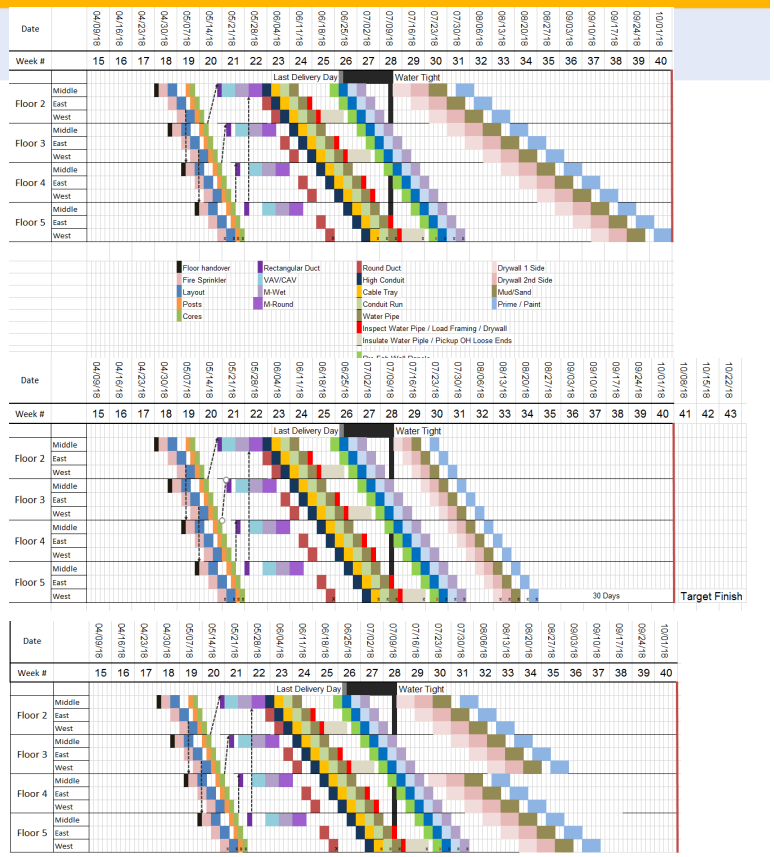
Communicate Execution Strategies

Create narratives that define the prerequisites for each step, and the expectations when it is complete.

Identify lead time steps for each takt activity working backwards.

You have all the information you need to manage the supply chain:

- Logistics and lifting capacity.
- Total number of workers.
- Deliveries and batch size.
- Laydown space
- Key decision points
- Setting priorities for key design decisions.
- Impact of not making key decisions on time.



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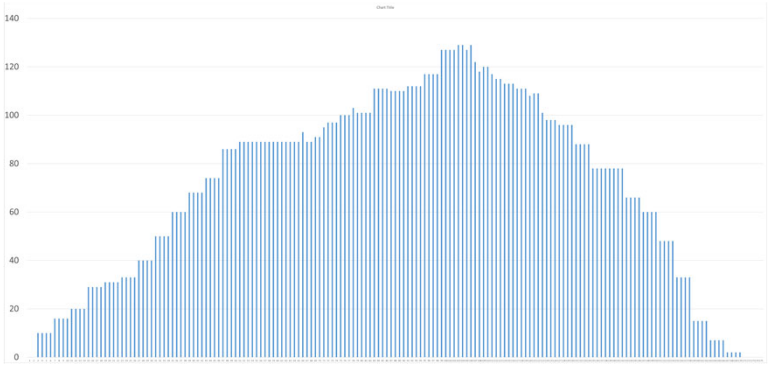
Managing Takt Plans

Keep in mind: not everything will go according to plan, so:

- If a crew falls behind, they must pick up the lost time by working overt time.
- If a crew finishes early, have some backlog work available
- Some takt steps will be “done enough” to start the next task. Track Go-Back Work.
- If you run into major problems, stop the takt for a while, pull plan the problem areas and look for a future time to re-start the takt.
- If you stop at the Takt Strategy Step, you will fail. Implement the rest of the Last Planner System® (Make Ready Planning, WWP, Commitments, Learning)



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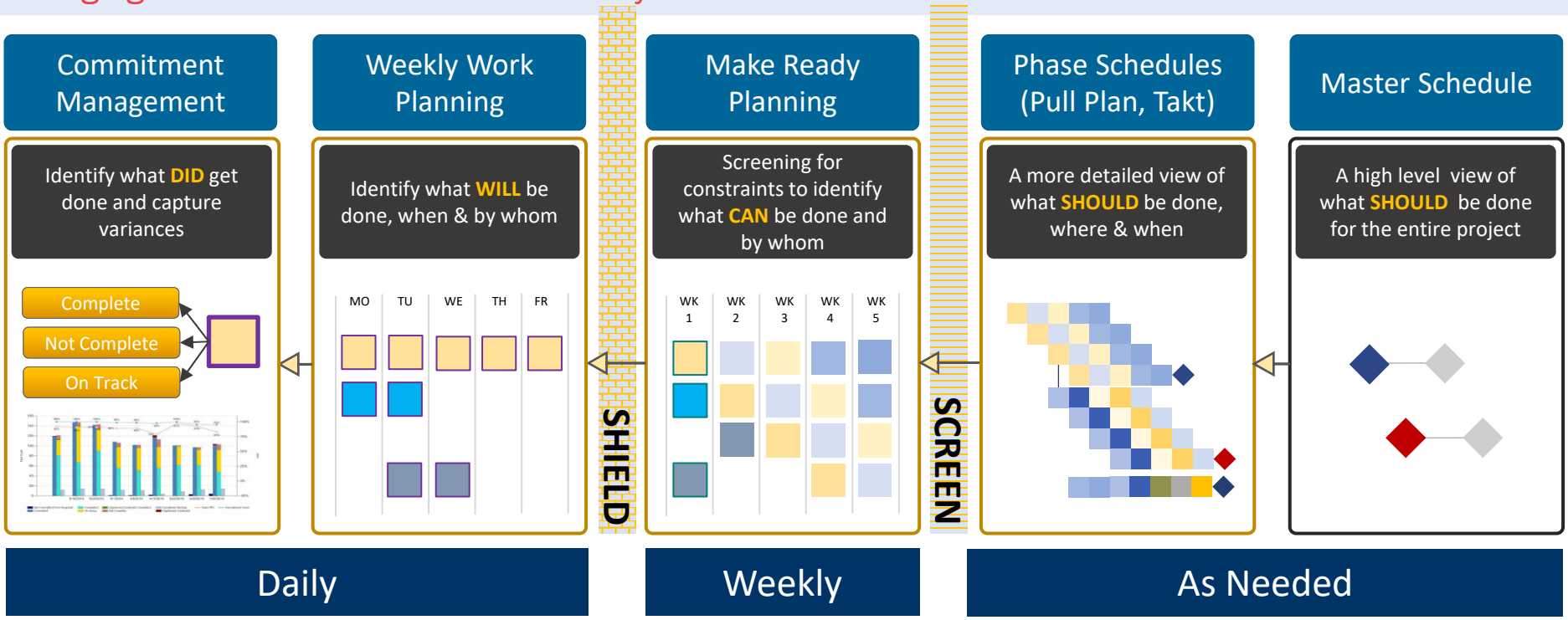
Managing Takt Plans: The Last Planner® System of Production Control



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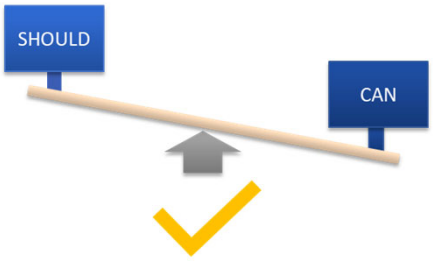
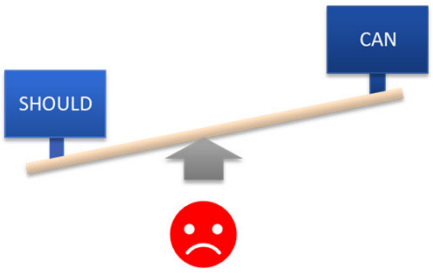
Aligning the Near-Term & Long-Term

- **Improve Alignment** between CAN and SHOULD.
- **Improve the Visibility** of how tasks in the near-term impact long-term goals and milestone targets.
- **Drive Action** by focusing team behaviors to recognize variance early and re-plan to maintain alignment with targets.



A good implementation of LPS®
CAN > SHOULD



A poor implementation of LPS®
SHOULD > CAN

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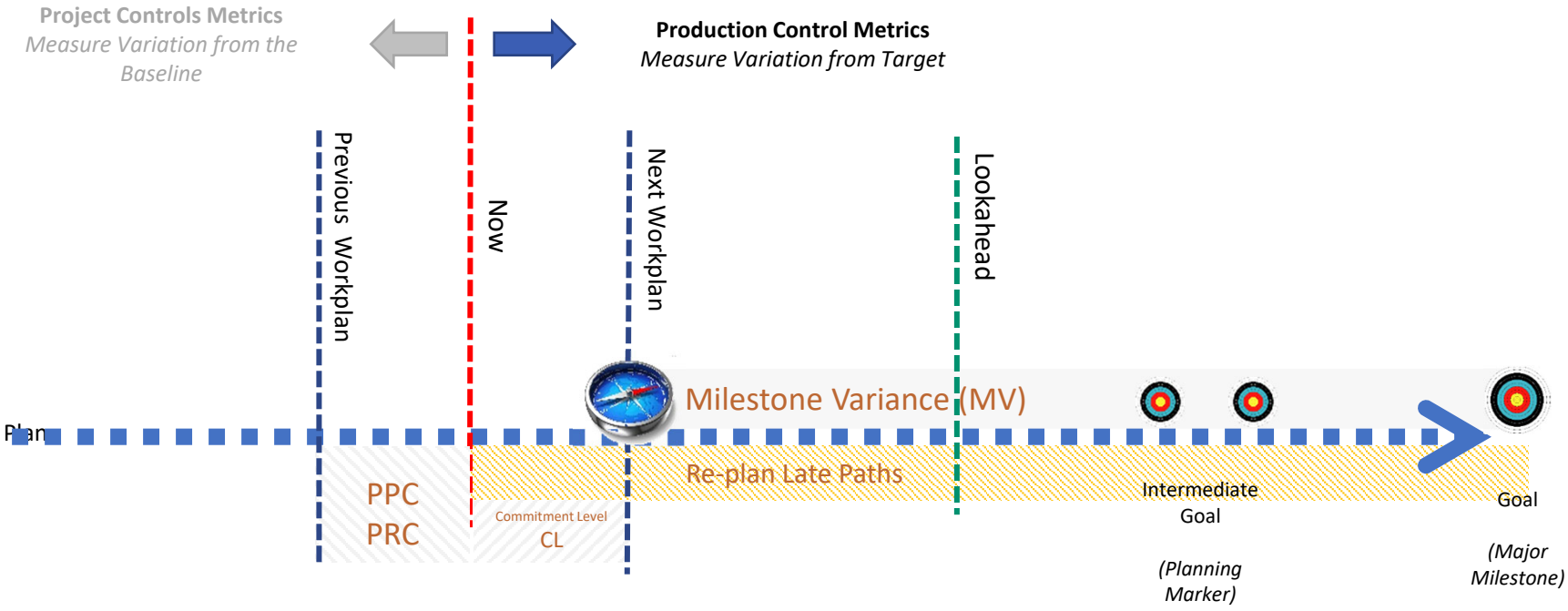
Goal of Production Control is to Steer Production Towards Targets



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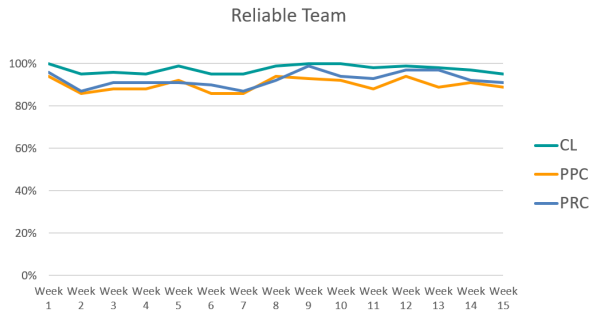
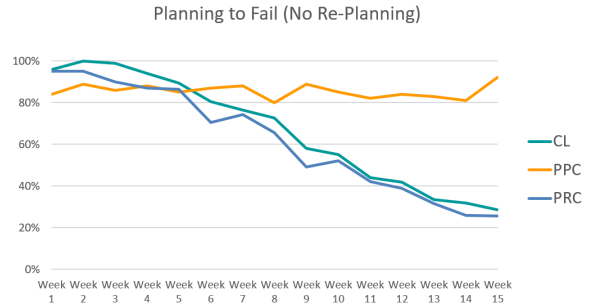
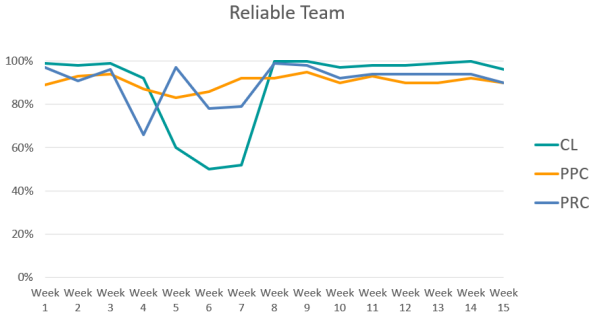
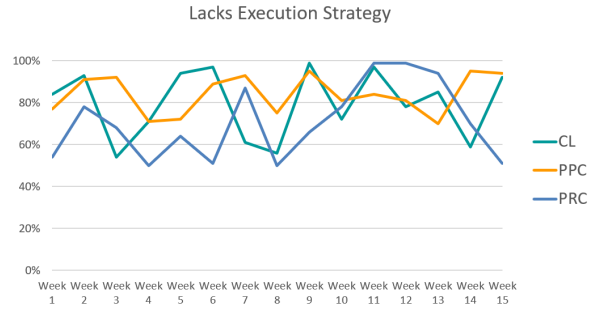
Using the Advanced Metrics to Steer Production Towards Targets









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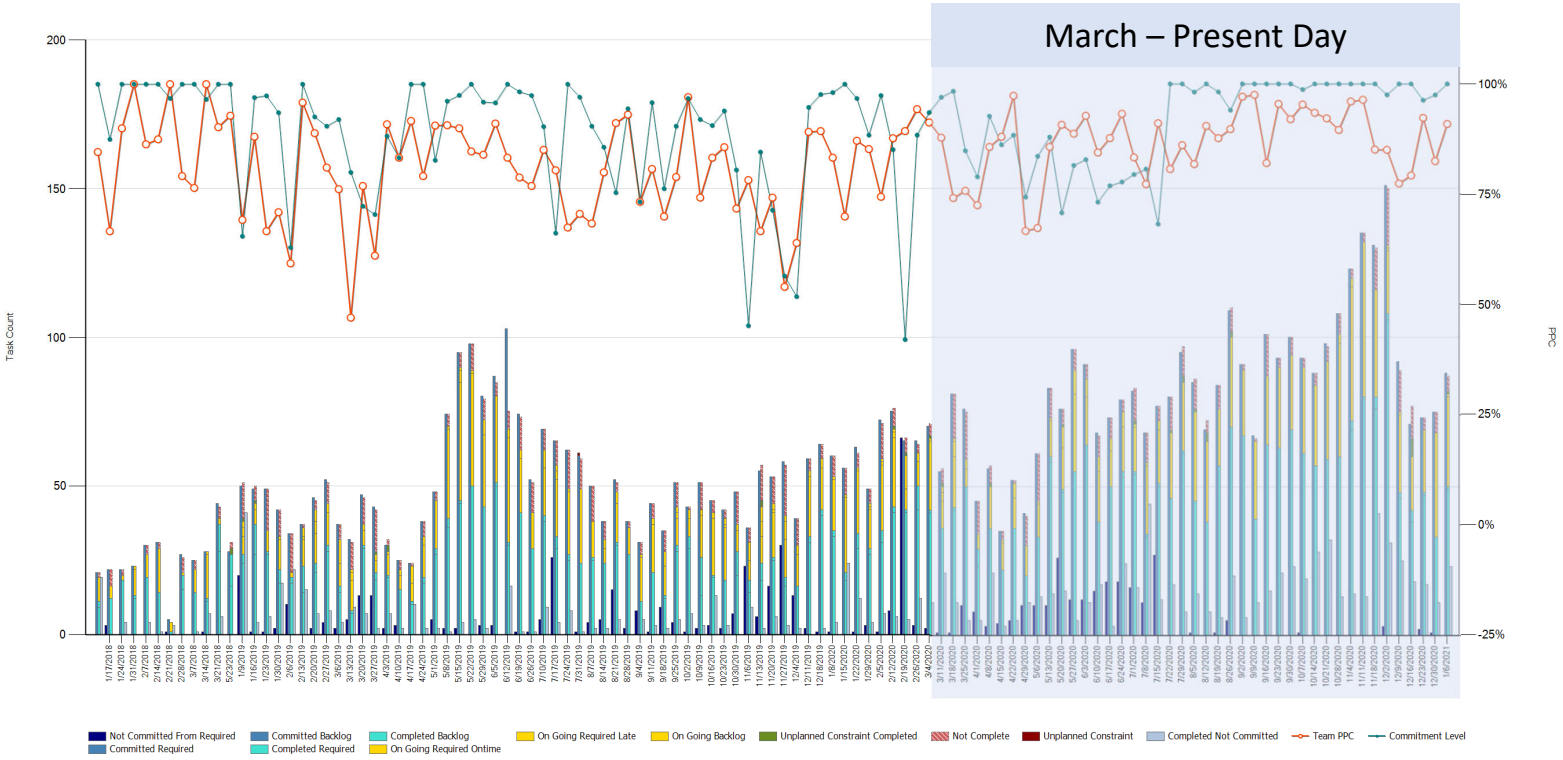
Project Example 1: Metrics to Date



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Production Planning During Covid-19

Impact of Covid-19 on Project Workflow

Impacts
- Uncertainty
- Social Distancing
- Supply Chain Disruption
- Availability of Workers

Initial Reaction
- Assessment
- Safety
- Confusion

Review Project Controls
- Contract documents and terms
- Scheduling terms and conditions.
- Determine impact of delays
- Review compliance requirements.
- Insurance / indemnity

Last Planner System / Path Forward
- Assess current state.
- Map out work sequences / handoffs
- Takt when possible
- Identify and resolve bottlenecks.
- Predict path to completion and set new targets.
- Measure and implement improvements.

Parade of Trades Disruption **Looks Back** **Looks Forward**

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Production Planning During Covid-19 – Two Types of Projects

Teams already using takt before Covid-19, had clear geographic locations, work sequences, and crew sizes.

Covid-19 presented new challenges:

- Lifting capacity bottle neck issues.
- Social distancing issues.
- Supply chain issues.
- Missing crews.

To mitigate, they could:

- Add buffer between takt activities.
- Takt activities with too many people can be split into two activities in sequence (reduces people count per area.
- Re-sequence Standard Work.

Teams that did not have a clear takt execution strategy could still create recovery plans that could be completed more reliably.

- Identify areas of similar work (implement takt)
- Identify areas of unique work (pull plan)
- Visually identify areas with most work remaining
- Map out standard work sequence to completion for areas with most work remaining.
- Collect data using color ups.
- Forecast path to completion using pull and takt with crew density in mind.
- Add risk buffers where appropriate.

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Questions & Discussion

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