

Takt Construction

Making the most of your Last Planner System® projects



Lean Construction Institute

Provider Number **H561**



Introduction to Takt Construction

LCIV.1TP

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welcome



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Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.

Course Description

Lean approaches construction as a project-based production system. Production systems can be designed based on sound operations science. This contrasts with industry's usual approach of merely scheduling activities. The Lean approach results in safer work, shorter durations and lower costs. This presentation will explain one of these approaches – Takt Construction. “Takt” is the German word for “beat.” Takt planning establishes a beat for performing the work for a particular sequence of operations.

Learning Objectives



01.

Participants will learn five key distinctions for Lean Construction: Takt, flow unit, pull, resource efficiency, and flow efficiency.



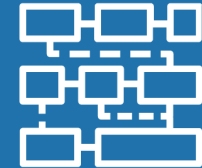
02.

Participants will learn four laws of operations: Little's Law, Law of Bottlenecks, the Law of Variation, and VUT equation.



03.

Participants will learn implications operations laws have on the design of production systems and the effects on the Last Planner System®.



04.

Participants will learn the opportunities and challenges of taking a Takt Construction approach to their projects.

Project-based Production Systems



Two Unfortunate Mistranslations

1. The bedrock principles are wrong
2. Not "respect for people," it's "respect for the nature of people."
3. Not "continuous improvement," it's "improve oneself while improving the work."
4. Lean is a human resource development strategy that has been misunderstood or mis-framed as an operations strategy

takt

A beat, rhythm or pace.
Continuous pace for some
aspect of operations.

flow unit

A significant element of the
product the customer is
buying used for structuring
work to pursue continuous
flow

pull

A control method for
signaling work replenishment

resource efficiency

The ratio of working time to total time for performing an operation

flow efficiency

The ratio of value-added time to the total duration for starting and finishing the work on a flow unit

capacity buffer

Carrying swing capacity for the sake of responding to variation in productivity, available work, and rework

inventory buffer

Maintaining extra material or work-in-process to accommodate variation in supply and in workloads

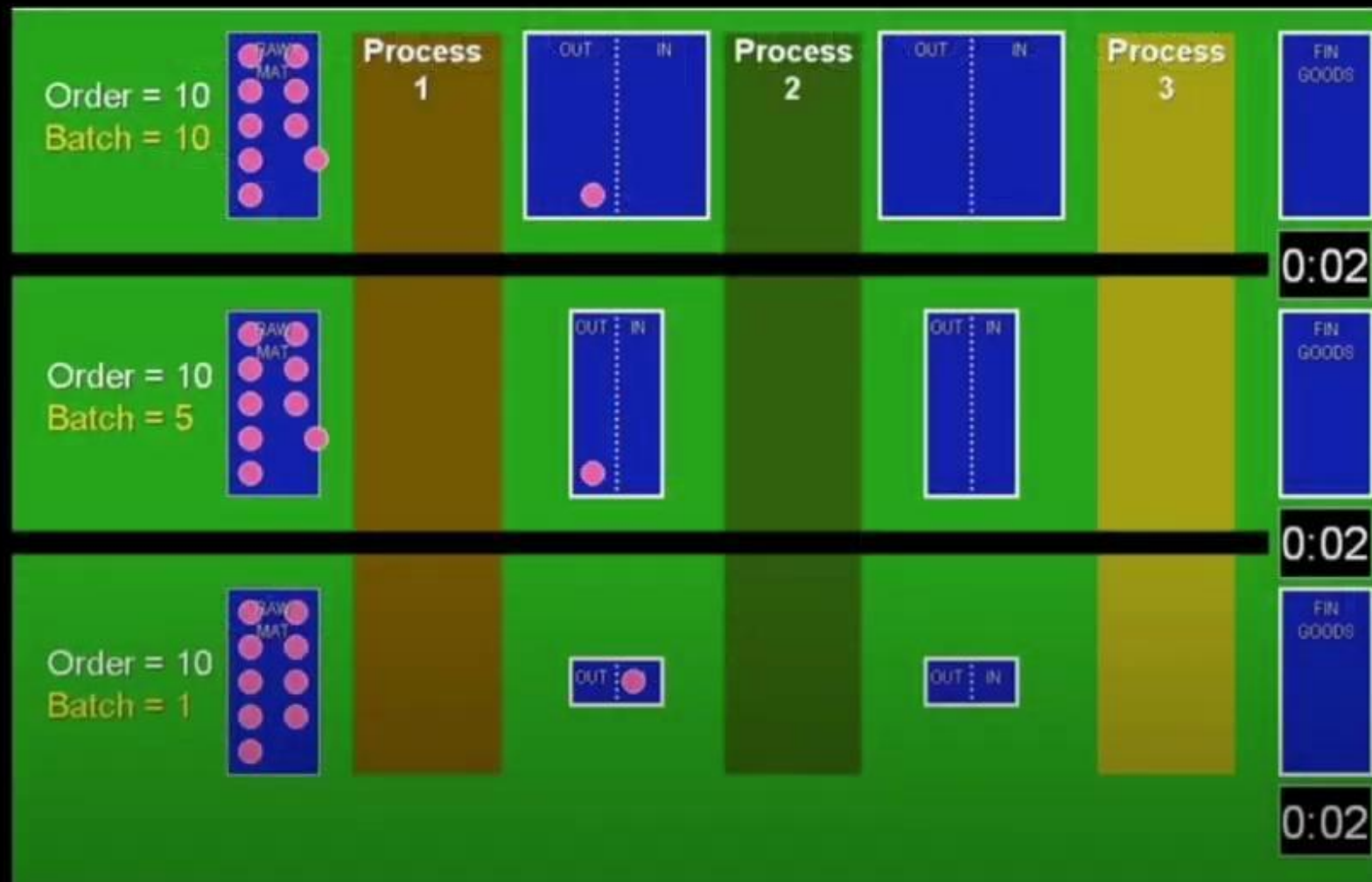
time buffer

Extra time in the process to synchronize the takt trains and to accommodate project externalities

Production Laws: Little's Law

the time average number of customers in a queueing system =
the rate at which customers arrive times the length of time they spend in
the system. It's the theory behind the practice of batching and queuing.





Production Laws: Law of Bottlenecks

the system performance is limited by the slowest operation

No amount of effort anywhere else in the system except at the bottleneck will increase throughput. Once you find the bottleneck use it to control the balance of the production system.

Production Laws: Law of Variation

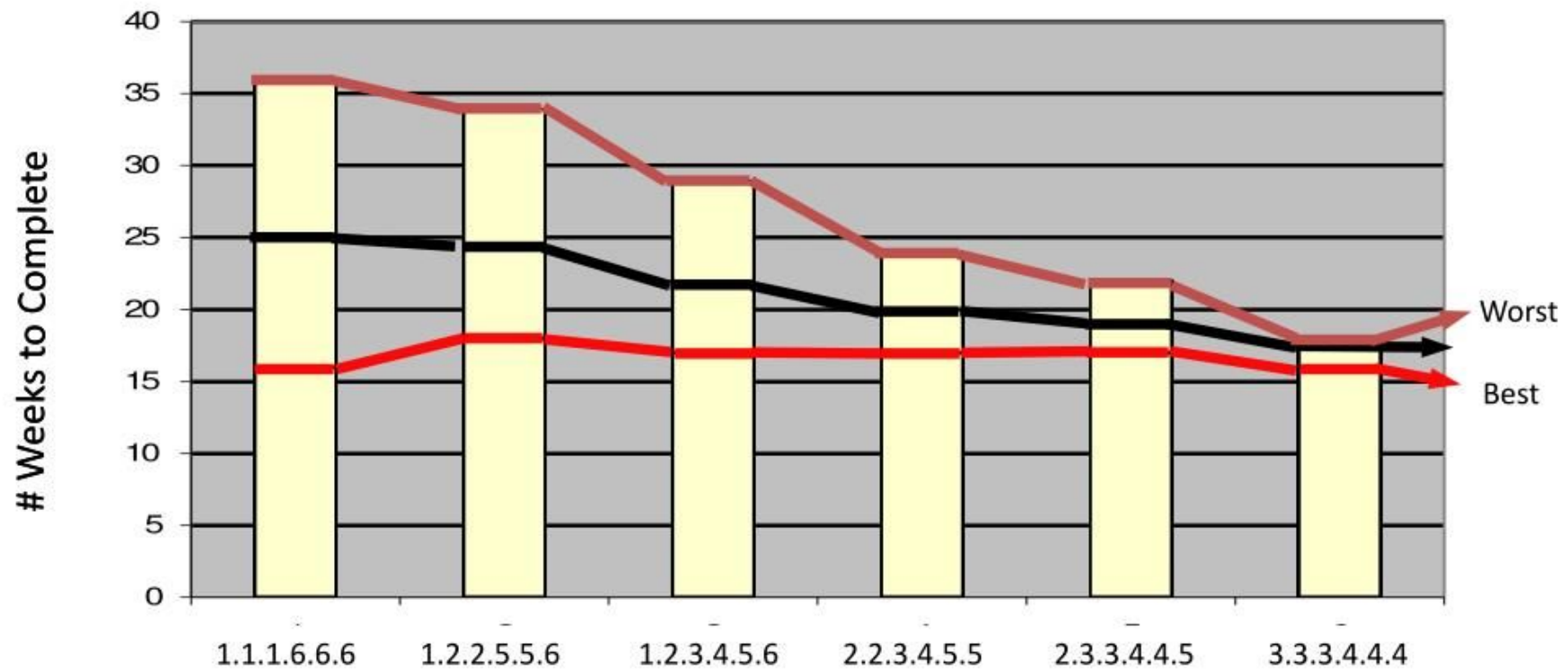
variation compounds with dependence



Reducing variation throughout the production process is the best way to improve project outcomes

Parade of Trades

Parade of Trades Results



Production Laws: Kingman's Formula

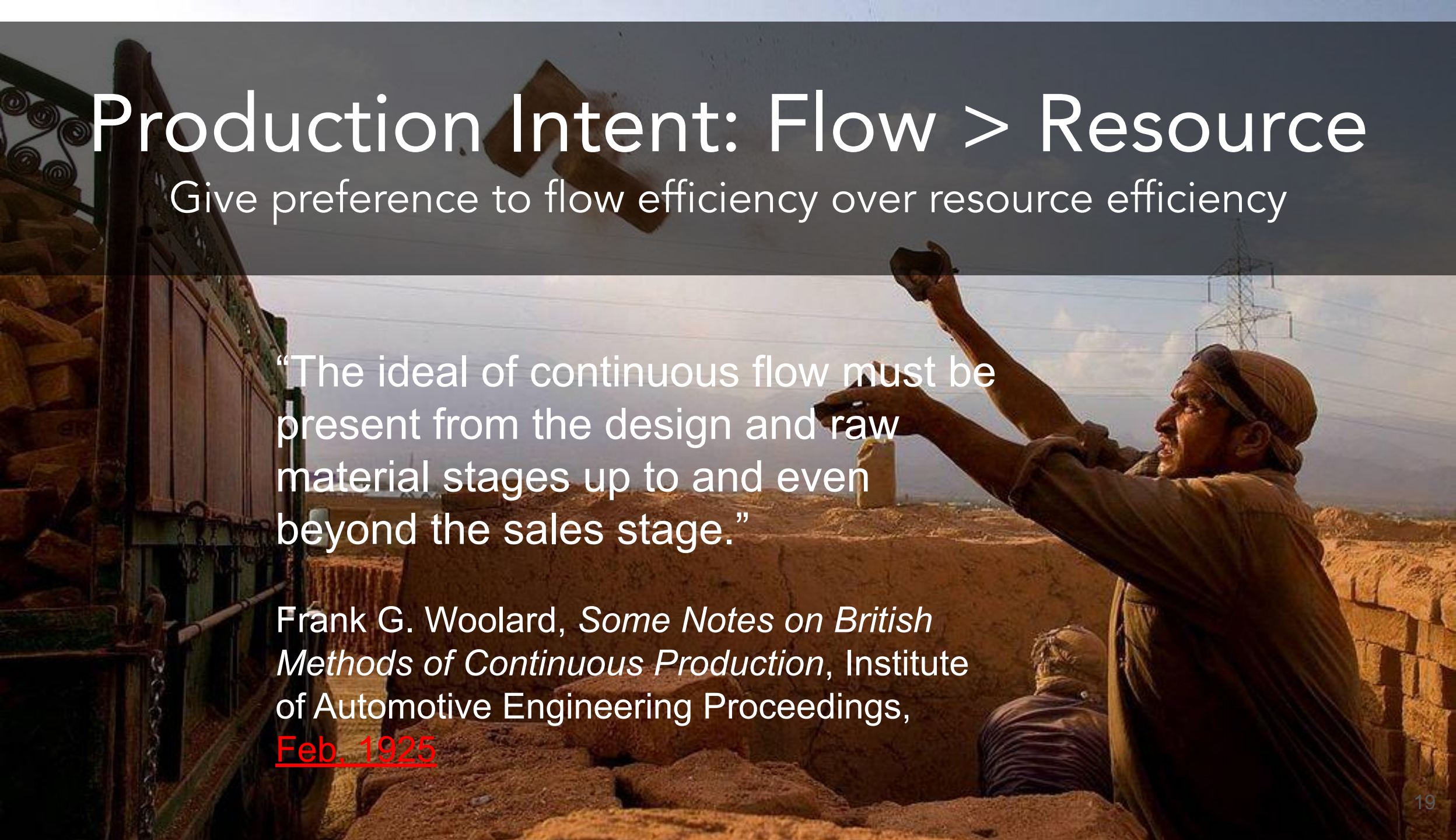
waiting time = variation x utilization x lead time

- Keep clear of high utilization
- Persistently reduce variation
- If you have high utilization, then lower variation
- If you have high variation, then lower utilization

Production Laws: Pull vs Push

Use pull to advance work.

Flow where you can. Pull where you can't.
~~Push where you must!~~



Production Intent: Flow > Resource

Give preference to flow efficiency over resource efficiency

“The ideal of continuous flow must be present from the design and raw material stages up to and even beyond the sales stage.”

Frank G. Woolard, *Some Notes on British Methods of Continuous Production*, Institute of Automotive Engineering Proceedings,

[Feb. 1925](#)

Production Laws Discussion

1. What are the implications of small batches?
2. What are the implications of managing bottlenecks?
3. What are the implications of law of variation?
4. What are the implications of high utilization?

Let's Takt

“Takt planning applies to **all** projects
— no exceptions —
including non-repetitive (sequential) work.”

Dr. Iris Tommelein, Director of Project Production Systems Lab (P2SL),
UC Berkeley, speaking at IGLC-28, July 2020

The Takt Process

Five stages that iterate

1. Collect data
2. Define zones and takt time
3. Identify trade sequences
4. Balance the plan
5. Finalize production schedule

Use bottlenecks and buffers for control

1. Limit the operations that perform at full takt (bottlenecks)
2. All time buffers are at the end of a phase plan or the project as a whole
3. Inventory buffers held as WIP - flow units
4. Assign swing (buffer) capacity to workable backlog (inventory buffer)
5. Swing capacity from workable B/L to the trains or from the trains to workable B/L.

Rule of thumb: find the smallest crew that can do the most work in a day.
Establish that as the batch. All other trades scale capacity to match that rate.

Implications

when designing to Production Laws

- Small batches always produce shorter projects than large batches
- Use bottlenecks to maintain pace through the process
- Pacing production through takt time construction counteracts the variation in operation times
- Size the crews to match the takt time
- Underload crews to create swing (stand-by) capacity
- Use workable backlog (inventory buffers) to maintain crew productivity
- Avoid high utilization coupled with high variation
- Continuously improve the flow in the process by reducing variation

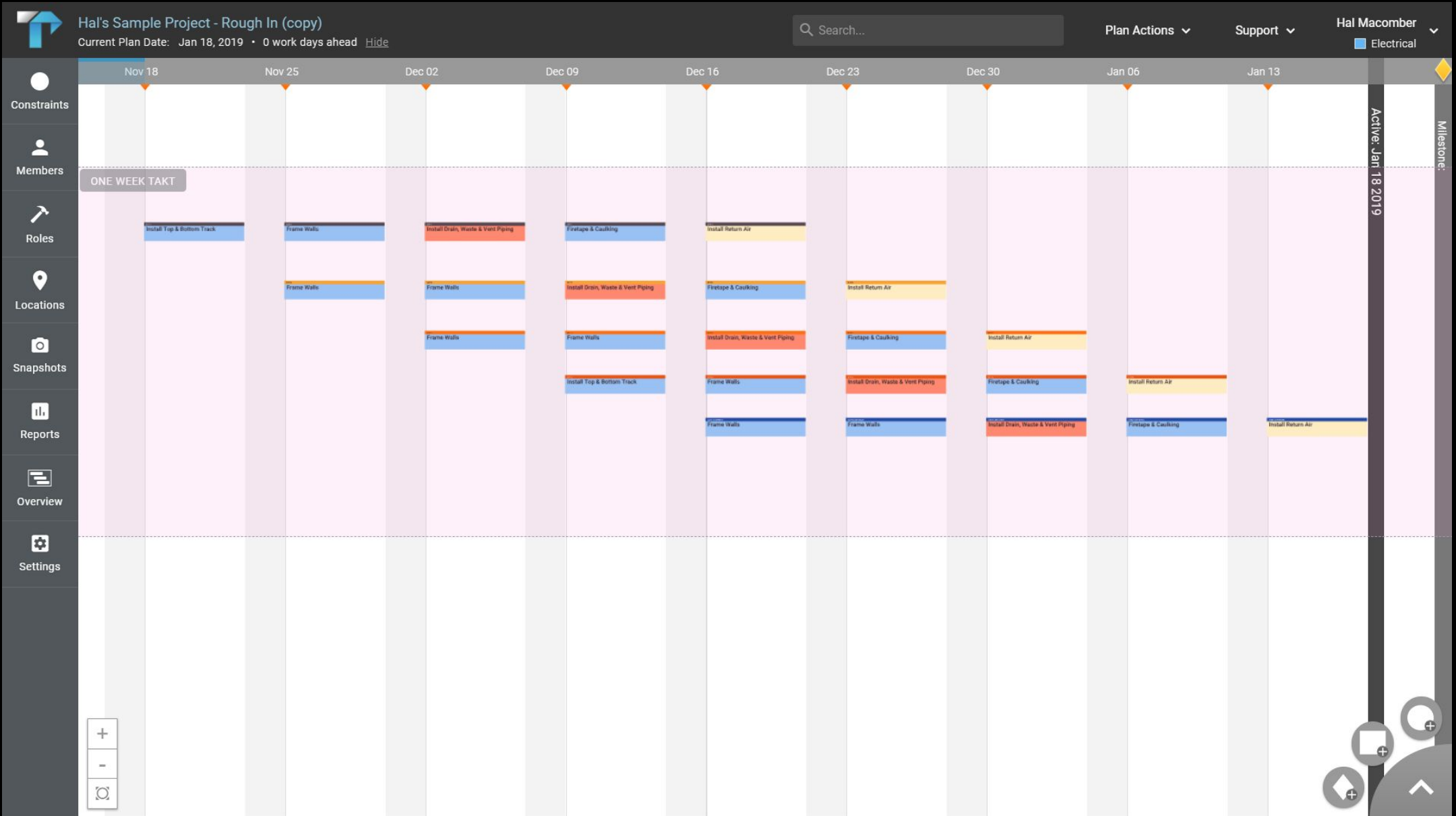
Let's Takt

Exercise goes here
One train of 10 Ops

More Implications

When operating Takt Construction

- Takt Construction may appear to be a technocratic approach. Yes, and it's a human-centered one, too. It's better known as a sociotechnical system.
- Success requires *responsible autonomy* of all participants including "pull the cord."
- We will not get Takt Planning and Control right from the start. And, we can improve our way there by systematically addressing variation.
- Variation is the enemy of Takt Construction.
- Takt Construction depends on people...all the people performing the direct value adding work and those performing indirect work that supports the direct work.
- We need to hear from people frequently throughout the process. In particular, no later than the end of shift, but better each time they go on breaks.
- We must listen to them, address their concerns, and support them in improving their work and themselves.



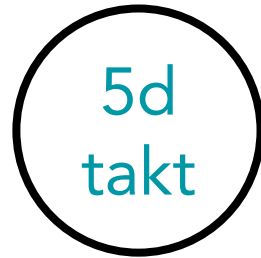
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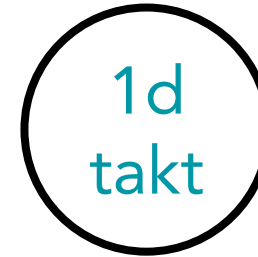
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Choose Your Takt Wisely

5 floors, same 5-step process, same 5 days/trade/floor



- 1st floor finishes in 25 days
- Project phase finishes in 45 days



- 20% of 1st floor finishes in 5 days - whole floor finishes in 9 days
- Project phase finishes in 29 days - 53% of the time of a one week takt

Calculate Phase Plan Duration with Takt
 $(\# \text{train activities} \times \text{takt}) + ((\# \text{trains} - 1) \times \text{takt})$

Takt Discussion

1. How could takt construction help your current project?
2. How could takt construction help your project team?
3. What impediments do you see to adopt takt construction?
4. What drivers do you see to adopt takt construction?

MassArt Treehouse Residence, 2011

Background

- Suffolk Construction, Boston, MA
- 15 rooms/floor with 27 beds in one, two and three-room suites on 17 floors
- 10 month schedule
- Eight weeks behind when we started in July
- First Last Planner® System project for the team and the Boston office

Approach

- Full implementation of LPS practices using paper system
- Training for trade partner foremen
- Two-day takt time
- About 25 finish operations per suite

Results

- Finished eight weeks early - picked up 16 weeks during 8 months
- Targeted use of overtime to counteract variation
- Suffolk management embraced Last Planner System





Sparrow Hospital Pediatric Nursing, 2016

Background

- Granger Construction, Lansing, MI
- 26 patient rooms, nursing core
- \$3,100,000
- Six month schedule with desired finish by Christmas
- Eight-week delayed start
- Active cardiac and nursing floors above and below
- Significant add'l scope mid-project
- First Last Planner[®] System project for the team

Approach

- Full implementation of LPS practices using Touchplan[®]
- Training for trade partner foremen
- One-day takt time
- 20 operations per patient room

Results

- Finished six weeks early
- Added scope
- Granger staff & client enthusiastic to do more LPS projects



Lahey Clinic General Internal Medicine, 2018

Background

- Bond Brothers, Medford, MA
- 40,000 SqFt, 84 exam rooms + imaging + diagnostics
- \$8,500,000
- Seven-month schedule
- Six-week delayed start
- Significant redesign mid-project
- Delays in owner provided equipment
- First Last Planner® System project for the team

Approach

- Full implementation of LPS practices using Touchplan®
- Training for trade partner foremen
- Study-Action Team using *This Is Lean*, by Modig and Ahlstrom
- One-day takt time
- 16 operations per exam room

Results

- Finished five weeks early
- CM and trade partners returned over \$300,000 to owner
- Bond & trade partners enthusiastic to do more LPS projects

Takt Time Comparisons

- Sparrow Pediatric Unit
 - 13 pairs of patient rooms
 - 20 operations each
 - Five-day takt: 5 days/operation to finish half 100 days + 5 days for balance = 105 days
 - One-day takt: 20 days to finish the first pair + 12 days for balance = 32 days
- Lahey General Internal Medicine
 - Two groups of 42 exam rooms (84 total) with dedicated crews for each group
 - 16 operations each
 - Five-day takt: 5 days/operation to finish group x 16 groups = 80 days
 - One-day takt: 16 days to finish the first 7 rooms + 5 days for the balance = 21 days

Patient rooms and exam rooms came off the critical path!

Effects of Short Takt Times

1

Primary effects (benefits) of a shorter project

- Exposure to safety hazards are reduced
- “First quality” improves because errors don’t propagate across the project.
- Construction period financing is reduced
- General conditions are reduced
- Lower project costs

2

Secondary effects (benefits) of a shorter project

- More frequent conversations with your “customer” results in learning and improving.
- Punchlists & worklists (failure demand) minimized & associated superfluous work reduced
- Trust and relationships build as performers declare complete to their “customer” on a frequent basis.
- Confidence builds as work is reliably completed.
- Significant reduction in project hassles

Begin Your Experiments with Takt

- Start with non-repetitive flow-units, e.g. "the lobby"
 - Use the five-step process collaboratively with trade partners for seven or more operations
 - Set takt at one or two days
 - Have swing capacity available assigned to workable backlog
 - Conduct an end-of-day stand-up in the field for learning, adjusting, and improving
 - Repeat two or three times for other flow units to build proficiency and refine your approach
- Repetitive flow-units
 - Use your refined approach
 - Put attention on reducing variation
 - Allocate more time for end-of-day stand-ups to tightly couple learning with action reducing delay
 - Conduct a weekly retrospective: stop doing, start doing, continue doing

Always work from a hypothesis. It's essential for learning.

Action Discussion

1. What new possibilities do you see from the cases?
2. What support do you or your team need to start?
3. What conversation will you have? With whom?
4. What hesitancy do you have? What hesitancy do others have?

Learn More

Contact us for help adopting Takt Construction on your Last Planner® System projects.

- Sparrow Pediatric Unit Takt Time Case <http://info.touchplan.io/blog/granger-case-study>
- Lahey Clinic GIM Takt Time Case <http://info.touchplan.io/blog/bond-case-study>
- Touchplan conversation with Hal Macomber and Dr. Colin Milberg on takt time planning <https://www.touchplan.io/blog/takt-time-planning-and-laws-of-production-getting-the-most-out-of-lps>
- Project Production Systems Laboratory (P2SL) research initiative on Takt Planning led by Dr. Iris Tommelein <http://p2sl.berkeley.edu/research/initiatives/takt-planning/>
- *Collaborative Takt Time Planning of Non-Repetitive Work*, Tommelein <https://goo.gl/tW9cdA>
- Lean Takt, an Elevated Company, has more resources than you'll need to get started <https://www.elevateconstructionist.com/takt-planning>

Learn More

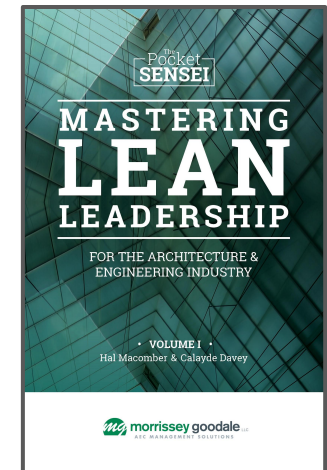
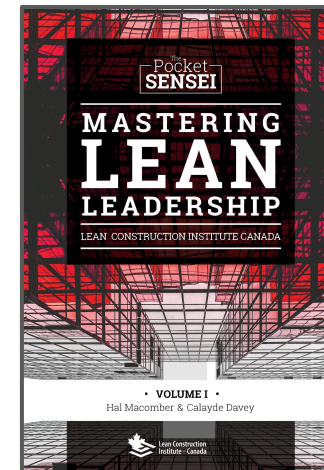
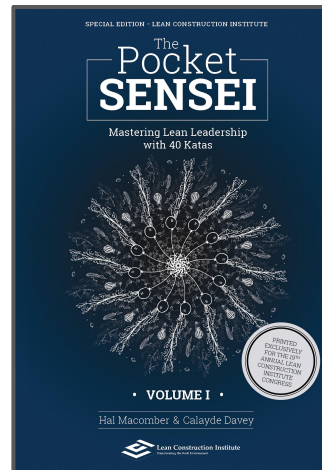
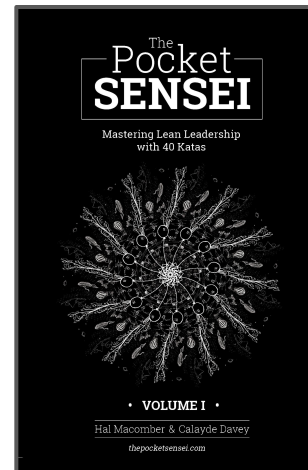
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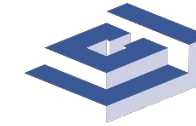
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