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IMPLEMENTING TAKT PLANNING AND TAKT CONTROL INTO RESIDENTIAL CONSTRUCTION

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Research background

- Recently, production planning and control methods *Takt Time Planning* (TTP) and *Takt Planning and Takt Control* (TPTC) have received attention within the Lean Construction community
- Amongst other advantages, TTP and TPTC have shown great potential in radically decreasing production durations, and for example, Frandson et al. (2013) and Binninger et al. (2018) have documented 55% and 70% reductions, respectively, in durations by implementing takt production
- The benefit of takt surfaces from its structured and methodological way of planning as well as daily control of the production, and therefore, achieving stability and continuous flow

Research gap

- As takt planning and control is by its nature suitable for highly repetitive work, it would appear to be suited especially well for the interior phase of residential construction. However, little empirical research exists on takt implementation in residential construction projects.
- Also, only a few studies have documented the actual implementation and critical analysis of takt control phase.

Research aim

- Therefore, research is needed on investigating that are the methods used in other instances applicable to repetitive residential construction.
- Research questions:

  1) Is takt production suitable for improving flow efficiency and shortening overall duration in the interior phase of a residential construction project?

  2) Which barriers, enablers and possible actions for development appear while implementing takt production in residential construction?

Research methods – a qualitative case study

- **Case**: Interior phase of Finnish residential project
- **Data sources**: 14 interviews, site visits, project documentation, digital planning and monitoring tools (no quantitative analysis, only to support the findings)
- **Focus areas:** technical aspects (planning, control, management, training, visualization) and social aspects (involvement, leadership, satisfaction)
- **The analysis** aimed to identify lessons learned as well as required future development actions in takt implementation

Takt planning

(1) Gather information,
(2) Define areas of work (zones)
(3) Understand the trade sequence
(4) Understand the individual trade durations
(5) Balance the workflow
(6) Establish the production plan

Iteration with subcontractors

Takt control

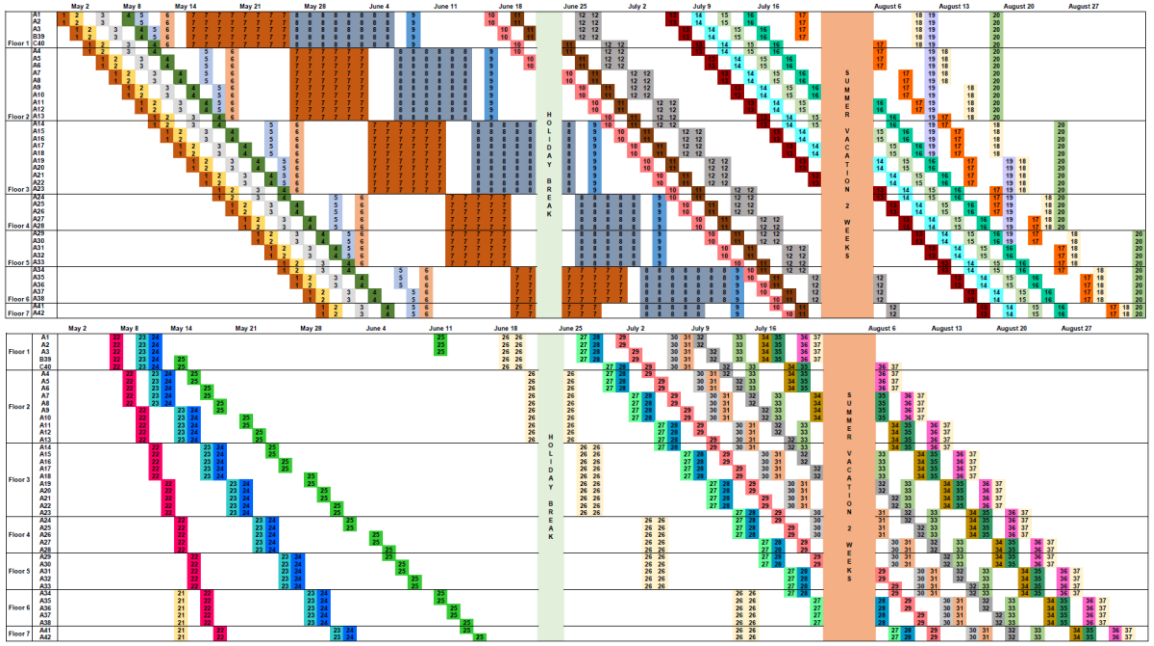
Weekly takt control meeting

Weekly contractor meeting

Weekly site manager meeting

Daily control with discussions & digital tools

Implementation aim:
increased flow efficiency and radical duration decrease



EARLY-STAGE PRODUCTION AND RAMP-UP

1	Dry walls 1st side
2	Electricity: cabling & central box
3	Ceiling HVAC
4	Dry walls 2nd side & lowered ceilings
5	Cleaning & measurements for equipment
6	Floor screeding
7	Wall levelling
8	Painting

MID-STAGE PRODUCTION

9	Electricity: ceiling equipment
10	Electricity: sockets and switches
11	Kitchen furniture installation
12	Tiling for kitchen
13	Floor laminate installation

END-STAGE PRODUCTION AND HANDOVER

14	Door and floor moulding installation
15	Electricity: light fixtures, central box finish
16	Electricity: cooker hood and terminal installations
17	Household appliances installation and testing
18	Cleaning
19	Household equipment installation and testing
20	Supervisor inspection

EARLY-STAGE PRODUCTION AND RAMP-UP

21	Floor screeding
22	Wall levelling
23	Waterproofing of walls 1st round
24	Waterproofing of walls 2nd round
25	Wall tiling

MID-STAGE PRODUCTION

26	Seaming, 1st round
27	Waterproofing of floor, 1st round
28	Waterproofing of floor, 2nd round
29	Floor tiling
30	Seaming, 2nd round
31	Silicon seaming
32	HVAC pipe installation

END-STAGE PRODUCTION AND HANDOVER

33	HVAC pipe insulation
34	Lowered ceilings
35	Ventilation equipment installation
36	Other equipment installation
37	Cleaning

Lessons learned related to planning

Category	The most significant barriers	Recommended enablers and actions
Design operations	Unique and unfinished design solutions	• *Proactive and co-creative design management;* • *Implementation of modular solutions*
Procurement operations	Subcontractors and material suppliers not prepared for the intensive takt production	• *Ability to commit on takt should be addressed in the procurement process;* • *More effective revenue models*
Takt planning	Logistic and material control plan, control of drying and specified critical tasks were not planned thoroughly before production	• *Co-operation with other pre-production operations;* • *control of drying;* • *detailed planning of logistics and determined critical, early-stage tasks*
Previous production phases	Lack of link of frame erection schedule	• *Takt planning should extend from affecting the individual construction phase towards a holistic approach*

Lessons learned related to control

Category	The most significant barriers	Recommended enablers and actions
Takt control	takt implementation was not fully addressed beforehand, hard start was too intense	• *Mutual understanding of takt production requirements should be ensured through intensive training and a softer start*
Management of trades and tools	Daily control was not fully addressed; advantages of new implemented tools not fully realized until the last stages	• *Daily control and full awareness of every actor on the site is required; effective learning requires better mutual understanding*

Conclusions

- Takt was found suitable for improving flow efficiency and reducing duration of the interior phase of a residential construction project.
  - Duration reduced approximately 30%
  - Better transparency and possibility for continuous learning
  - Better proactive tackling of problems as they appear
  - However, the implementation required significantly increased effort
- **Planning**: Holistic approach to takt production between design, planning and procurement – ”design for takt”
- **Control**: Clear methods for management, better collaboration with participants in production
- The found barriers should be actively tackled through continuous improvement over projects

Avenues for future research

- Further research is required to generalize the results.
- The future research could include
  - (1) addressing long-term effects takt production over several projects, and
  - (2) more thorough comparison of different takt methods and implementation cases.

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Thank you!


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