

Company Overview | DPS | [dpsgroupglobal.com](http://dpsgroupglobal.com)

DPS Group is a global consulting, engineering, and construction management company serving high-tech industries around the world. DPS has sector experts in key locations in Europe, USA, Asia, and the Middle East, bringing world-class resources and the latest innovative technologies to every project. DPS delivers full-service Engineering with a 'client first' mentality and personal touch across a range of

disciplines: Project and Programme Management, Procurement, Design, Construction Management, Health & Safety Management, Commissioning, Qualification, and Start-up. DPS employ more than 1,850 people worldwide, including 300 in its Cork operations where this case study is based.

## Authors



**William Power**



**Eddie Doyle**



**Chris Solorz**

## Overview & Background to the Lean Initiative

### DPS Group

The company modestly prides itself as being an early adopter of Lean thinking and practices in both Irish and International construction sectors. The company invests heavily in staff subject matter experts, in Lean education and training, and in internal process improvement initiatives. DPS Group has previous case studies on Last Planner® System and Target Value Design published in the 2018 and 2019 LCi Annual Book of Cases respectively. As teams become more familiar with tools like LPS,

further improvement opportunities become apparent and encourage innovative solutions. One such case is the application of Takt planning to complement existing LPS implementation. A member of the DPS team had attended a client training session on Takt implementation for use on another client project, and subsequently DPS decided to trial and experiment with Takt on one of its own construction projects. This case study presents the challenges and learnings gleaned from the latter pilot implementation.

## Lean Initiative Undertaken – Lean Thinking, Tools, Techniques

### Overview

Takt is the German word for beat – the regularity with which something gets done. Takt encompasses core concepts of Lean, but is rarely witnessed in traditional construction planning. It aims to break the construction process down into smaller work tasks of equal duration that can be completed at a steady rhythm, and which leads to greater predictability in the planning and delivery process. Takt planning introduces the concept of the assembly line,

rooted in manufacturing (especially automobile assembly lines), into construction processes. This model makes Takt particularly useful when repetitive tasks exist in the construction process. Whilst the Phase and Look-ahead functions of LPS break the tasks into finer levels of granularity, Takt can complement the planning process by forcing consideration of space and time, and capacity (crew sizes). This trial of Takt focused on complementing the Phase and Look-ahead functions of LPS.

### The Project

The case project is a 4,000m<sup>2</sup> warehouse at a pharmaceutical manufacturing facility incorporating high-level racking, clean room storage, goods reception, dispatch area, office, canteen, locker room, and welfare facilities. It is a stand-alone building with varying spatial areas and, at first

glance, little suitability by way of repetition for an effective Takt implementation. However, DPS Production Planners considered elements of Takt would lead to deeper analysis of task planning and would contribute to better prepared Weekly Work Plans (WWPs) in LPS.

### Takt Methodology

The Takt methodology employed was adapted from Use of Takt Planning in Production System Design Workshop on Takt Planning by Patrick Theis (Drees & Sommer), Iris Tommelein

(University of California, Berkeley), and Samir Emdanat (vPlanner) at UC Berkeley on 26-27 September 2017.

**The main steps taken were:**

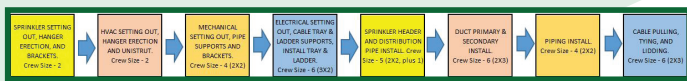
1 Overall Process Analysis (OPA) – This is an analysis completed at the LPS phase pull planning stage that aims to identify the different work areas (zone types) that correspond to construction phases. The analysis also looks to define the process steps and sequence of trades within the zone types. The OPA is conducted by dividing the building into areas that have the same process sequence. In this case study, six zones were identified that specifically related to the following trades’ first-fix works: Mechanical, Electrical, HVAC, and Sprinkler. Process steps for each trade were mapped for each zone and planners focused on breaking down steps to create as much repetition as possible. Like the manufacturing process, the idea is to minimise variation that would impact smooth flow.

Figure 1 illustrates a preliminary mapping exercise to establish the sequence of tasks and to validate the logic of the master schedule prior to dividing the floor area into work zones.



**Figure 1.** Schedule Duration and Logic Validation Exercise

2 Takt Analysis (TA) – The TA is based on the outcomes from the OPA results. During this step, the team considers the amount of work and the appropriate Takt time for the sequence per zone type. This is where the greatest challenges were encountered as detailed quantities of process and drainage pipelines, primary and secondary plumbing lines, ducting runs and bracketry, cable trays and number of cable pulls needed to be compiled per defined work zone. Figure 2 presents the sequencing and crew sizing for the first Takt run of 2.5 days and the second run of 5 days per zone.

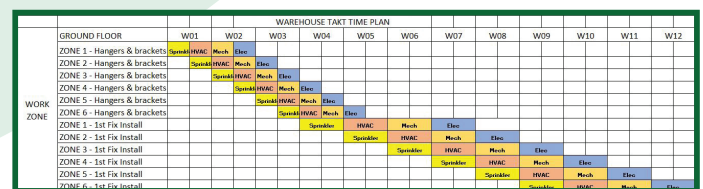


**Figure 2.** Standard Process Steps & Crew Sizing

As a planning exercise, this was beneficial in visualising the scope and scale of the works to be completed in each zone. However, the trade supervisors deemed the work cumbersome as they were more comfortable dealing with issues and conflicts as they arose. When allocating quantities of work to be executed against available space

– the pre-defined work zone – the planners were able to start generating optimum crew sizes whilst identifying which crews required time in each zone. The idea is to establish a suitable Takt time that can work for all trades in all zones. We found that some trades may have their work complete in less than the Takt time, and therefore a backlog of available work (outside the Takt zones) is needed to utilise the crews. On the other hand, larger crew sizes than the trade supervisor would have preferred may be necessary to ensure that the requisite works are completed within the Takt time. In an ideal application, the client may offer to financially supplement the extra resources or equipment needed to keep production within the Takt time. In our application, we strived to break down the task into smaller batches so that instead of having a three-person crew that needed to be four persons, we split the tasks to enable multiple smaller crews (two persons) to move more productively through the work zones. This concept is described as a “Takt Train”.

3 Applying Takt Planning to Organise the Phase Schedules – This is the step where the pre-planning work is collated to develop the Takt phase schedule. The planning team has defined how the Takt Train will be moving through the building, how many Takt zones will be handled at the same time, and what dependencies between the zones must be considered. The phase selected on this project was specifically for the first-fix installation, and it is important to note that separate Takt planning exercises should be conducted for separate phases of the project, including for example, second-fix, fit-out phase, and the commissioning and handover phase. The progression of trades through the zones is viewed as one trade in each wagon that stops in each zone for the agreed Takt time period. For example, on this pilot we simplified the durations into 2.5 days for the hangers and brackets install, and 5 days for the first-fix install. With tight daily management of zones and crew performance, it is possible to create smooth reliable flow with no idle time. The Takt plan is shown in Figure 3.



**Figure 3.** Warehouse Takt Time Plan

## Lean Initiative Improvements & Impact

We acknowledge that there is much ongoing action research into Takt application in construction, and note that this pilot implementation was primarily concerned with the DPS Production Planning team and the trade supervisors learning about the potential offered by Takt planning.

The study contributed towards improved coordination of trades on-site, and confirmed that Takt and LPS complement one another. Takt and OPA demand a much deeper analysis than our traditional Pull Planning sessions were achieving. Considering space as both a constraint and an input to the production process generated greater appreciation of the importance of when a trade obtains possession of dedicated space and when it must pass that space onto the following trade. The process of sizing each task (based on quantity to be produced, for example, metres of cable tray to be fitted or number of ducting hangers to be erected) along with developing a regularity around time, and aligning this with space and optimal crew size, forced a deep analysis of the step-by-step building construction process. In turn, this exposed many conflicting issues which traditionally would be deferred and ultimately crisis-managed when it came to execution of the work. Interestingly, greater emphasis was placed on getting work ready to perform – the consequence of not getting in and out of a zone on time would cause detrimental impact to following trades. Despite the obvious benefits that would become apparent from a rigid and structured Takt application, we found that major obstacles exist within current delivery models that would inhibit a more complete implementation, including:

- If required, financial compensation must be in place to enable crews work “inefficiently”. For example, a usual two-person crew may need to be increased to a three-person crew for a duration. While appearing to contradict some principles of Lean thinking, this under-utilisation may be required to ensure reliability of the Takt plan.

### Summary

As an overall summary, we were ambitious with the undertaking given that the construction process was non-repetitive in nature, and, whilst the first three weeks stayed on track, as soon as cumulative issues started impacting the plan, crews started to fall back into traditional crisis management. The Production Planners continued adjusting the Takt plan to accommodate change, but the discipline and trust to stick with the plan faded. The sight of floor space lying idle as some crews finished early was too tempting for both site and trade management; the urge to fast-track certain zones meant a movement away from the master Takt plan.

- Resources must be readily available to replace crew members who do not turn up on the day, either through sickness or other absence. Trade commitment is critical as the Takt Train must keep moving as the entire process is adversely affected by absenteeism or reduced crew size. Buffers may be created within the plan, for example, extended working hours or Saturday work (financial compensation may be necessary), but ideally these buffers should be held in reserve for reasons other than resource unavailability.
- Lean education is an essential pre-requisite. Understanding concepts like small batch production, reliable-promises, right-first-time, 5S, SMED (applied to ensure consistent preparedness to execute the task), and PDCA are all key ingredients for successful task execution.
- Behavioural and mindset change is required for those who are unfamiliar with the level of micro-planning expected.

### The positive learnings from the implementation are as follows:

- The detailed micro-planning required by the OPA and TA stages contributes to greater success on the WWP. The increased preparedness of work tasks being committed to the WWP contributes to better PPC, and results in less firefighting and crisis-management. Activities of the correct size and sequence are provided to the Production Planner as well as a clear outlook on upcoming work.
- The concept of small batches of work assigned in the Takt-time cycle permits tighter crew planning and management.
- A mature LPS implementation and trades experienced in LPS are desirable prerequisites to introduction of Takt.
- Return to work start-up post-COVID was able to utilise Takt concepts to enable social distancing in trade coordination.
- The challenges encountered are now a good starting point for the impending Takt implementation on the current on-site project.

However, the detailed planning was a success and the OPA approach continued to add positively to the WWPs – the intense focus on reduction of variability and minimisation of potential disruptors to workflow is a prerequisite for Takt. Therefore, LPS and Takt should complement each other at early stages of an implementation. The concept behind Takt assisted the post-COVID lockdown start-up planning, and both client and senior management are now committed to developing Takt concepts and increasing LPS and Takt alignment.