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PM Group manages the design, construction and commissioning of high-tech facilities. We are an employee owned company with over 49 years' experience working for the world's leading pharma, food, data centre, and medical technology companies. We deliver projects across Europe, the USA, and Asia.

Trusted Partners – To excel at the complex, we always seek to understand our clients' needs. At every level of our business, a culture of honesty, openness, and flexibility prevails. Our approach has led to long-term, trusted relationships with our clients.



Overview & Background to the Lean Initiative

This case study looks at Takt planning excellence in project delivery. Takt Time Planning is based on using location break-down structures to plan, with the objective of making the work flow continuously.

Implementation benefits include:

- Reduction in work phase durations and associated costs.
- Increased transparency and predictability of work flow.
- Improved ability to deliver design on time with reduced quantity of RFIs.

- Improved efficiency in the workplace with materials arriving to suit the work being executed, which leads to reduced waste (moving materials) and a safer environment to work.

This demonstration of Takt Time Planning comprises three main sections:

- Creating the Takt Plan.
- Implementing the Takt Plan.
- Maintaining the Takt Plan.

Lean Initiative Undertaken – Lean Thinking, Tools, Techniques

Creating the Takt Plan

Takt Planning starts with the Scope Breakdown structure and design areas. Construction zones and Takt zones are well-established before the end of Concept Design, and this applies to all subsequent stages of the project. The earlier this volumetric segmentation happens, the more profound the impact. The four high-level partnership groups are Vendors, Trade Partners, Client, and A&E. These four groups became the “team of teams”, and within each team there was subdivision, and, as the project progressed, their membership changed. By the time it came to construction execution, the teams were mainly trade partner and A&E construction, with design as participants.

The planning work begins with the Overall Process Analysis (OPA) where all trade partners come together to:

- Understand the scope of the works involved and agree on the constructability.
- Break the area into zones (Takt Zones) to maximize efficiency and flow of work. These Takt Zones were evolutions of the design areas and the segmentation setup to enable digital delivery.
- Generate individual tasks per trade partner that will accumulate in the completion of the works.
- Agree, as multiple trade partners working with a team ethic, on the sequence that the works need to be carried out in

each Takt Zone.

Agreement on sequence of works can be done using traditional post-it stickers or by using new technology (an online scheduling platform). The design team is a key partner in this part of the process, and the construction team has the opportunity to pull design and to target certain scope in order to make schedule improvements on site.

After the OPA sessions are completed, trade partners come to the Process Planning (PP) session with their durations and resource requirements prepared. Here, the full schedule for the work is developed. The access/start date and the target completion date are provided from the project master schedule. The data is populated



Figure 1. PP Generated from Takt to Support Project Milestone

into the digital platform at the session, and we can see where trades can work in parallel to reduce work phase durations. It is also where we strive to provide flow of work for trade partners from zone to zone.

After this Takt is completed, the next sequence of works (or next Takt) is planned out in the same way, for example:

- Cleanroom Ceiling.
- Cleanroom Flooring.
- Cleanroom Walls.

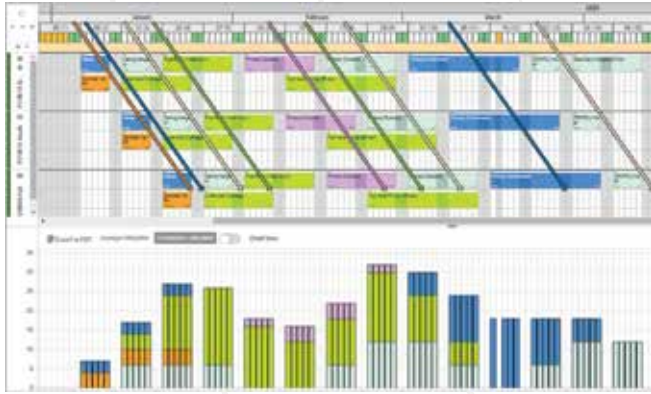


Figure 2. Takt PP illustrating Flow of Work & Levelled Personnel

Density to Suit Trade Partners

The resourcing function on the digital platform allows the group to see the personnel that will be working in the Takt Zone based on the PP that has been generated. This technology can group work fronts together to see the combined personnel across a number of Takt Zones to, for example, give the total in one building. Of note is the flow of trade partners from zone to zone, which reduces waste and is a key component of Takt Time Planning. It can also be used to see the personnel required for an individual trade partner per zone, per building, or across the whole project.



Figure 3. Individual View of Workflows & Density

Implementing the Takt Plan

The agreed PP for an area is the main tool for coordinating the works in the field on a daily basis. Permits to work are approved if the works are scheduled in the Takt Zone as per the agreed PP. At the daily site permit meeting, the works in each Takt Zone are reviewed. If there is capacity for additional work to be completed in a Takt Zone, then this is allowable if agreed amongst all trade partners. If the trade partner Takt into that zone cannot accommodate any

additional works by others, then the work cannot progress.



Figure 4. Takt Zones & Area Coordination re Permits to Work

To reinforce the focus of the planned works through Takt, the Takt Zones were physically demarcated on site with barriers. Ingress/Egress points clearly marked with the Takt Zone identifier. The agreed PPs were on display in each Takt Zone so that PM Group area owners would be clear on what trade partners had the right to work in an area.



Figure 5. Demarcation of Takt Zones

Impact of the Covid Pandemic

After the onset of the Covid pandemic, Takt Planning became a critical enabler to keep crews separated and to manage the health of the team. The pre-Covid personnel requirements per Takt Zone were already known, as well as the maximum density of personnel per area. This information could then be used to take action after the onset of the pandemic. Revised personnel density limits were calculated for every Takt Zone with social distancing taken into account. This could then be applied to previously agreed PPs to see where action was required, like, for example:

- Shift-work in critical areas; or
- Re-scheduling in non-critical areas.



Figure 6. Personnel Density Limits & Physical Distancing Requirements

Maintaining the Takt Plan

After work in a Takt Zone has commenced, progress of the PPs are updated on a regular basis, and this was done daily on our project. The activities on the PPs were broken into daily Takt cards, with each card representing one day of work for a particular task. These cards are then placed into the Takt Boards on a rolling 4-week look-ahead basis. At the daily meeting, trade partners would turn their cards to confirm that the work for the day had been completed and that the task is on track overall. If progress is not as per plan, the card remains unturned. If there is a constraint or reason for the progress of that day not being achieved, a constraint card is placed in the board. The issue is then discussed immediately within the group at the meeting, with resolutions typically agreed there and then. Figure 7 illustrates this with the requisite QR code on the Takt card – cards can be turned in the field in advance of the meetings using smart phone or tablet.

After the onset of the pandemic, the use of the daily Takt board was no longer viable due to physical distancing. In order to keep the daily Takt updates running, we took the technology in use for the PPs and further adapted it for use as a daily Online Takt Board. A daily MS Teams meeting was set up and the cards were digitally turned with all trade partners participating online. An important part of the daily updating is the scoring system called OTP (On Time Performance).

$$OTP (\%) = \text{achieved cards} \div \text{planned cards}$$

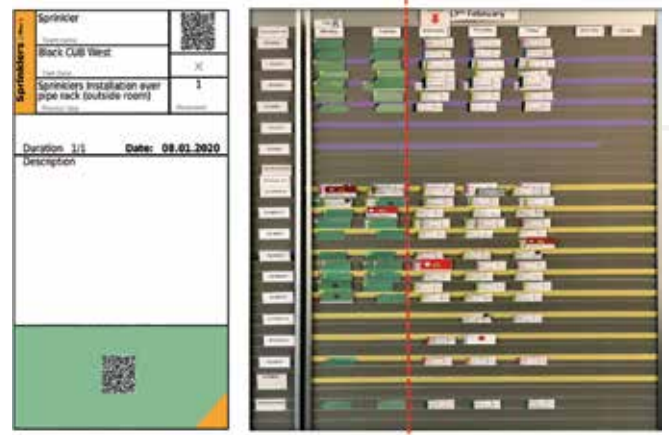


Figure 7. Daily Takt Tracking, Update of PP Tasks, QR Code

Unturned cards result in a lower OTP. Works can be re-forecasted at the sessions to ensure works continue to be coordinated between trade partners, and weekends are also available for works to be caught up on. OTP scoring can be detailed per area, per trade partner, and overall for the project.

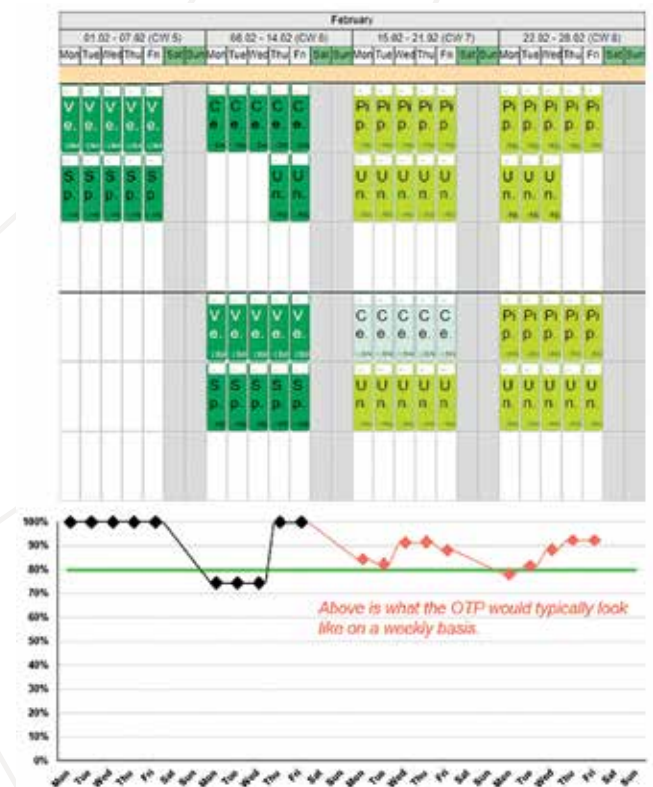


Figure 8. Online Takt Board

Lean Initiative Improvements & Impact

The implementation of Takt Planning on the project, coupled with other Lean project initiatives listed below, led to significant schedule savings, including:

- Tiered Agility.
- One Team Approach.
- Right First Time Construction Quality Culture.
- Enabling information flow through an RFI turnaround-focused metric.

Takt Planning enabled a visual demonstration of the work progress through the Takt zones, as well as of people and material. It communicated clearly the construction sequence intent in detail for the design team to focus their efforts in providing the correct information at the correct time (i.e. Flow). The colour coding of Takt Zones, coupled with the physical demarcation in the field and daily permitting meeting reviews, facilitated both the Trade Partners and PM Group area owners calculate the area occupation and capacity.

It was an easy headcount check thereafter to confirm personnel numbers within the defined zones.

The control granted by the Takt Planning also facilitated the following:

- Governing numbers of people within strict zones.
- Monitoring progression through the zones of the trades.
- Regulating the flow of material to and around site.
- Permitting of works by zone.
- Trade partner personnel forecasting.

Milestone	'20 Q1	'20 Q2	'20 Q3	'20 Q4	'21 Q1	'21 Q2
Room Handover			07-Aug 05-Aug			
Production Building Rooms Handover			17-Sep 21-Aug			
Spine Room Handover			29-Sep 15-Sep			
Warehouse Room Handover					09-Mar 20-May	
Mechanical Completion - 1					22-Feb 27-Jan	
Mechanical Completion - 2					12-Mar 05-Feb	

Figure 9. Project Milestones Achieved/Bettered

An unforeseen benefit of the Takt Planning was witnessed during the Covid pandemic after the return to construction sites was permitted. The previously defined Takt Zones had personnel allocations that were easily revisited and revised to allow for new maximum occupancies to accommodate the social distancing requirements. Proof of the benefits of Takt Planning can be seen in how we used it to specifically target the most critical milestones on our project with successful results in all cases. On a project that adopted a take-off-site approach at the concept stage, the trade partners used the Takt process to further enable off-site modularisation even into the construction stage of the project.

Testimonial

“By creating this culture, we enabled the team, including the very important voices from key trades, to redesign the work to reduce waste and improve flow of information, decisions, fabrication, and work in the field. Takt became a foundation for everyone. By taking the time to plan together, from the bottom up, each trade learned how to better coordinate work among themselves. By resizing work and crews to optimise the whole project using Takt, we created a much better work flow.” (Executive Director, Global Engineering Solutions, MSD).