ADJUSTMENT MECHANISMS FOR DEMAND- ORIENTED OPTIMISATION IN TAKT PLANNING AND TAKT CONTROL

Marco Binninger[1], Janosch Dlouhy[2], Dominik Steuer[3] and Shervin Haghsheno[4]

1 BACKGROUND

Construction sites are dynamic systems, which require continuous adjustments (Park et al. 2003, p. 213). The Takt Planning and Takt Control method provides a flexible production system (Binninger et al. 2017). The Takt Plan serves as a framework for planning and controlling and the Takt Time serves as a standardised timeframe. The structure provided by the standardisation enhances predictability and routine in the processes. The Takt Plan, as a specialised form of a schedule generated for each project, offers the flexibility that is necessary to adjust to project changes in various forms. These adjustment mechanisms can be flexibly implemented depending on the circumstances and the desired approach.

2 STRUCTURE

At the beginning of the paper the efficiency and flexibility gained by applying the method of Takt Planning and Takt Control is described. Then the adjustment mechanisms, which are offered by the flexibility of Takt Planning to react to changes, are described and categorised. Afterwards a selection of mechanisms is presented.

3 CASE STUDY OF TAKT PLANNING

The selected case study considers a building, which is divided into functional clusters by initial analysis. For each function cluster the SSU is determined. Takting requires only the work sequence for one SSU and the relative work packages for that unit. In the second step of Takt Planning the volume per SSU for each working step is determined and multiplied by a performance factor. As a result in a work distribution diagram is created for each work package within the SSU (Binninger et al. 2016). In this case the Takt time is defined as one week. The process to generate an initial Takt plan takes only a few hours. Subsequently the production plan along with associated costs, crew sizes and material flows is approved and agreed upon by all participants. At this early planning stage, mechanisms such as reducing crew sizes, incorporating required buffers, adapting interfaces, parallelising trades or accelerating the Takt plan can be used. Likewise, there are additional adjustment mechanisms for later control. The established adjustment mechanisms from practice are listed and categorised.

3.1 Description and categorisation of the identified adjustment mechanisms

The 31 identified adjustment mechanisms are registered and named. It is determined whether these are primarily used in Takt Planning, Takt Control or both. In many cases this is not a trivial categorisation. Furthermore the associated effect on the construction process is briefly described. Based on the frequency of usage, the adjustment mechanisms are allocated into three categories. An excerpt of the list is shown in the following table.

#	Name	Planning	Control	Category	Description	Effect
1	Decoupling of Takt areas	X	X	A	Reorganising the sequence for completing Takt areas	Change in the order areas are completed

[1] Research Fellow, Karlsruhe Institute of Technology, Germany
[2] Research Fellow, Karlsruhe Institute of Technology, Germany
[3] Employee, BMW AG, Germany
[4] Professor, Karlsruhe Institute of Technology, Germany

Table 1: Categorisation of adjustment mechanism

4 Selected Adjustment Mechanisms

The following section will describe the Category A adjustment mechanisms more in detail. These are according to the authors' experience the most frequently used ones.

4.1 Decoupling of Takt area

If individual Takt areas cannot be completed to follow the order of the train, they can be decoupled and reallocated. This mechanism is implemented the same way as in production industries.

4.2 Buffer waggons

A buffer waggon is planned buffer, which can ensure stability in certain situations. It can be implemented to account for drying times.

4.3 Phase interlinking

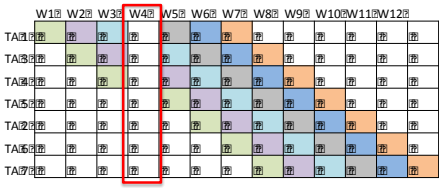
The goal of this mechanism is to reach a very close interlinking and the proper selection of the same batch size and Takt time. Therefore the amount of slack should be reduced to increase the efficiency of the project.

4.4 Soft start

If multiple trains are used, the choice between a soft and a hard start is possible. A soft start means that not all trains start at the same time. The experience from the first train can be used for the second train. A disadvantage is the fluctuation of manpower and a slow start of the construction site.

4.5 Train stoppage

Train stoppage leads to a disruption of the construction process. The reason for this is the occurrence of a problem that is not immediately solvable (i.e. within the Takt). This type of disruption means that the entire train must be stopped until a sustainable solution has been found.



5 Conclusions

Previous theories are challenged by enabling an unprecedented level of flexibility while implementing the Takt Planning and Takt Control methods during the designing and execution phases. The list with the 31 adjustment mechanisms must not be viewed as exhaustive. Future additions and further investigation are necessary.