

# Production Replenishment with a Milk-run

## Designing routes using a local search algorithm

### Student



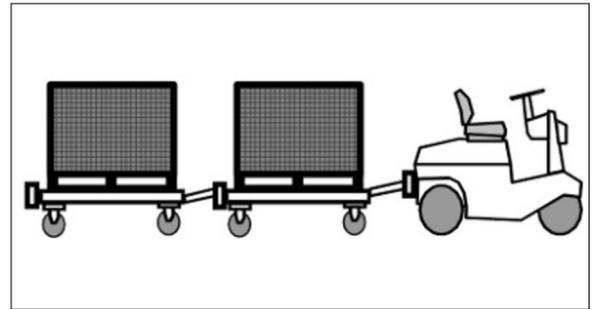
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**Problem:** Milk-runs are a popular concept for material delivery based on the philosophy of pull, keeping low inventories and making material supply easier. thyssenkrupp Presta AG has implemented such a system in their modern production facility in Hungary, Jászfényszaru. The supermarkets at the production lines are replenished by tigger trains. The trains are operated by drivers with experience in the work. In recent years, the production plant has been expanded with additional production lines and expects more to come soon. As production has expanded and the number of trains, drivers and cycle time remains the same, it increases the requirements set for the drivers to fulfil efficient deliveries. Drivers arbitrarily determine the routes due to the fact that not all lines are operating all the time. Concurrently, the number of possible route permutations has increased, which means that there can exist more optimal routes than the ones the drivers are choosing. The goal of this thesis was to develop an algorithm for thyssenkrupp Presta AG, to find the most optimal route in their Hungarian plant.

**Approach:** To start the task, the current setting was analysed with the aid of interviews and data. A distance matrix was created between the central storage and the points of use. Constraints were defined regarding the number of stops, the number of trains, and the storage capacity per stop. Current problems were identified. The analysis of past data revealed fields of improvement. Based on standard literature, an overall concept for a milk-run was developed considering the identified constraints to the plant in Hungary. Finally, an algorithm prototype was created to help set up several different scenarios by modifying the constraints and routes.

**Result:** This thesis presents a milk-run concept that aims to reduce variance by defining fixed routes and intervals based on the production lines in operation at the Hungarian production plant. An algorithm determined a schedule and batch sizes, and two prototypes of potential optimal routes and schedules were discussed and visually displayed. These suggestions serve as prototypes and will require testing and further adjustments.

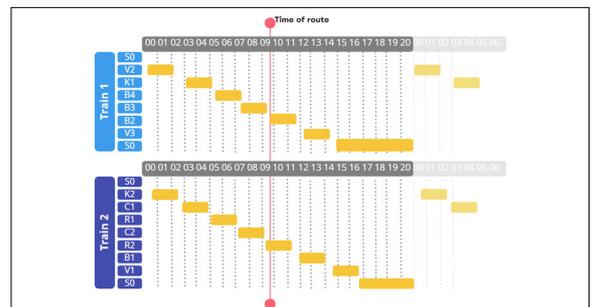
Illustration of a tigger train with two trollies attached.  
Keuntje, C., Kelterborn, M., & Günthner, W. A. (2017).



An extract of the Hungarian production plant layout in thyssenkrupp Presta AG.  
thyssenkrupp Presta AG, internal document (2022).



A scheduling plan for the two trains based on the algorithm prototype.  
Own presentment



### Advisor

Prof. Dr. Katharina Luban

### Subject Area

Business Engineering

### Project Partner

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