Chapter 1
Factory Railway System

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Abstract In this study, a coloured Petri net conceptual model and an Arena® simulation model were developed for analysing the railway flow of hot steel coils in a steel factory. The simulation goal was to analyse a number of flow and storage management policies in order to identify which scenario reduces the total number of mobile railway resources needed for the internal transportation of the coils. This study was part of a larger study whose main objective was to redesign a factory railway system and a harbour steel terminal, in order to cope with a considerable increase in steel production.

1.1 Introduction

In this case study we propose analysing a factory railway system’s ability to cope with a major increase in production. The factory produces flat steel from hot coils. The managers aim to increase production from 1.2 million to 1.8 million tons per year, comprising 351 consecutive working days. Managers are concerned about the capacity of the railway infrastructure to respond to the new demands. A simulation study is proposed to identify current limitations and potential investments.

This case study is a simplification of a more extensive study. Neither the supply chain nor the railway resources have been included, and other, minor aspects have been simplified, since our main aim is to discuss the methodology. The study is confined to the analysis of the flow of hot steel coils in the factory, because the amount of railway resources needed depends heavily on the flow management policy.
1.2 Aims of the Study

Our main aim is to propose improvements to the current logistics of the railway system in order to minimise the amount of railway resources needed for transport operations. In the original project, a second aim was to propose improvements or new investments in the railway infrastructure and in the harbour terminal. Since this goal lies outside the scope of this case study, we will assume that the railway system will be able to transport the required transportation orders.

The original study was executed in two steps. First, the initial operating conditions were modelled and simulated. The model was verified and validated using real data. Because the factory managers were involved in the project, they became more confident about the validity of the simulation approach. Second, the future load was included in the model and the proposed improvements were tested. In this case study we generated synthetic data on expected future production levels.

1.3 Description of the System

In this section we describe the system and the data used in the simulation. Although the data acquisition stage is not described here, we should not ignore the difficulties and the amount of time needed for this stage, which may take up to 40% of the time required for a simulation project.

1.3.1 The Factory

Figure 1.1 shows the system, the hot-coil storage areas and the internal railway system used to transport the hot coils.

   The hot coils arrive at the factory via two different channels:

1. By the external, national railway. The hot coils are stored directly in the A2 storage area.
2. By ship. The capacity of the A1 storage area located in the harbour is limited. The hot coils that cannot be stored there must be moved to the A2 area using the internal railway system.

There are three storage areas for the hot coils:

1. A1, which is located in the harbour and has a maximum capacity of 20,000 t.
2. A2, which is located inside the factory and has a maximum capacity of 150,000 t.
3. A3, which is used to feed the factory processing line with hot coils and has a maximum capacity of 8,000 t. In the initial configuration, A3 is not used as a storage area.