SUMMARY

Maintenance for railway infrastructure is expensive and it often connects to a large cost investment. The maintenance work, which is implemented in track possessions, can also cause inconvenience to train operators and passengers. Therefore, Planning for maintenance and track possession is important in terms of economy and rail operations.

This study presents two types of Phase-based Decision Support System (PDSS), i.e. Functional Phase-Based Planning Approach (F-PBPA) and Process-Oriented Phase-Based Planning Approach (PO-PBPA). They are used for decision support for the planning of the railway infrastructure maintenance activities at the strategic planning level. The objective is to achieve better economy, as well as improve cost efficiency.

F-PBPA consists of five main phases: Data Collection, Technical Optimization (TeO), Economic Optimization (EcO), Constrained Optimization (CoO), and Evaluation. In this thesis, two railway planning problems are formulated in Mixed Integer Linear Programming: Railway Preventive Condition-Based Tamping Scheduling Problem (RPCBTSP), which is presented in Papers 1-2, and Railway Track Possession Scheduling Problem (RTPSP), which is presented in Paper 3. The proposed models are tested based on the real data collected from two Danish railway corridors. A comparison of the results obtained by using the proposed PDSS with the result obtained from the literature (RPCBTSP) and the current practice (RTPSP), shows a cost reduction for both scheduling problems.

The proposed PDSS (F-PBPA) represents a step forward in solving railway scheduling problems. It can help Infrastructure Managers (IMs) gain a better understanding of the application of optimization in railway planning tasks. There are three optimization phases, TeO, EcO and CoO, that can be performed in sequence. First carries out a technical optimization (EcO), in which the minimal maintenance work can be identified by pure technical conditions. This is followed by an economic optimization (EcO), which results in an economic plan covering the same technically defined maintenance needs

while minimizing the costs. Finally, constrained optimization (CoO) includes additional constraints and it allows the railway expert to adjust input parameters, thereby to obtain alternative maintenance plans.

PO-PBPA contains another systematic phase based process. With a focus on Life Cycle Cost (LCC), PO-PBPA can guide IMs, step by step, to estimate the total project cost for railway projects and to identify the solutions that are economically advantageous. Paper 4 suggests a new LCC framework for IMs to consider costs at the strategic planning level, and Paper 5 considers costs at the project planning level. The case studies show that LCC has influence on the decisions regarding the choice of the track possessions. Similarly, it appears that decisions may change compared to today's practice if other LCC elements are included into the cost estimation, e.g., passenger loss due to delay.

A phase-based process such as the proposed PDSS, has great potential to support railway IMs to improve maintenance planning in practice, and reduce the overall costs without affecting railway infrastructure quality.