Timetabling for Interconnected LRT Lines: A Package Solution Based on a Real-world Case

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Abstract : In this real-world case, timetabling the LRT network as a whole is rather challenging for the operator: they are supposed to create a timetable to avoid various route conflicts manually while satisfying a given interval and the number of rolling stocks, but the outcome is not satisfying. Therefore, the operator adopts a computerised timetabling tool, the Train Plan Maker (TPM), to cope with this problem. However, with various constraints in the dual-line network, it is still difficult to find an adequate pairing of turnback time, interval and rolling stocks' number, which requires extra manual intervention. Aiming at current problems, a one-off model for timetabling is presented in this paper to simplify the procedure of timetabling. Before the timetabling procedure starts, this paper presents how the dual-line system with a ring and several branches is turned into a simpler structure. Then, a non-linear programming model is presented in two stages. In the first stage, the model sets a series of constraints aiming to calculate a proper timing for coordinating two lines by adjusting the turnback time at termini. Then, based on the result of the first stage, the model introduces a series of inequality constraints to avoid various route conflicts. With this model, an analysis is conducted to reveal the relation between the ratio of trains in different directions and the possible minimum interval, observing that the more imbalance the ratio is, the less possible to provide frequent service under such strict constraints.