

Generating strategic timetables

A novel algorithmic planning pipeline

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Abstract

Objective:

Long-term timetabling is a complex and traditionally time-consuming process. Improved decision support tools enable planners to explore more design choices, resulting in better decisions.

Research and Methods:

Three complementary mathematical algorithms have been developed and applied in a planning pipeline:

- Macroscopic, passenger-oriented timetable planning based on travel demand (EUR, Fig. 1)
- Mesoscopic conflict resolution on corridors and interactive modification of trains (SINTEF, Fig. 2)
- Microscopic station routing and platforming ensuring feasibility and robustness (DLR, Fig. 3)

Results:

Timetables are successfully generated from scratch and iteratively refined (Fig. 1-3).

They optimize perceived travel time (Fig. 5) and ensure local delay robustness (Fig. 6).

Conclusion

The pipeline was validated by timetable planners from NS and Jernbanedirektoratet on Dutch and Norwegian instances with different characteristics. The results are very promising and indicate that the approach is broadly applicable.

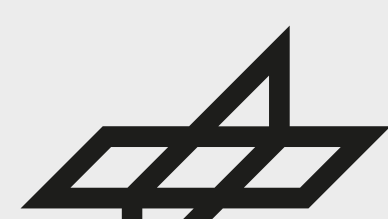
Additional Information

Erasmus
University
Rotterdam

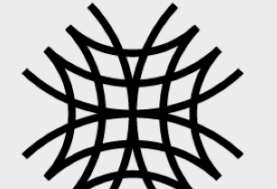
Erasmus



SINTEF



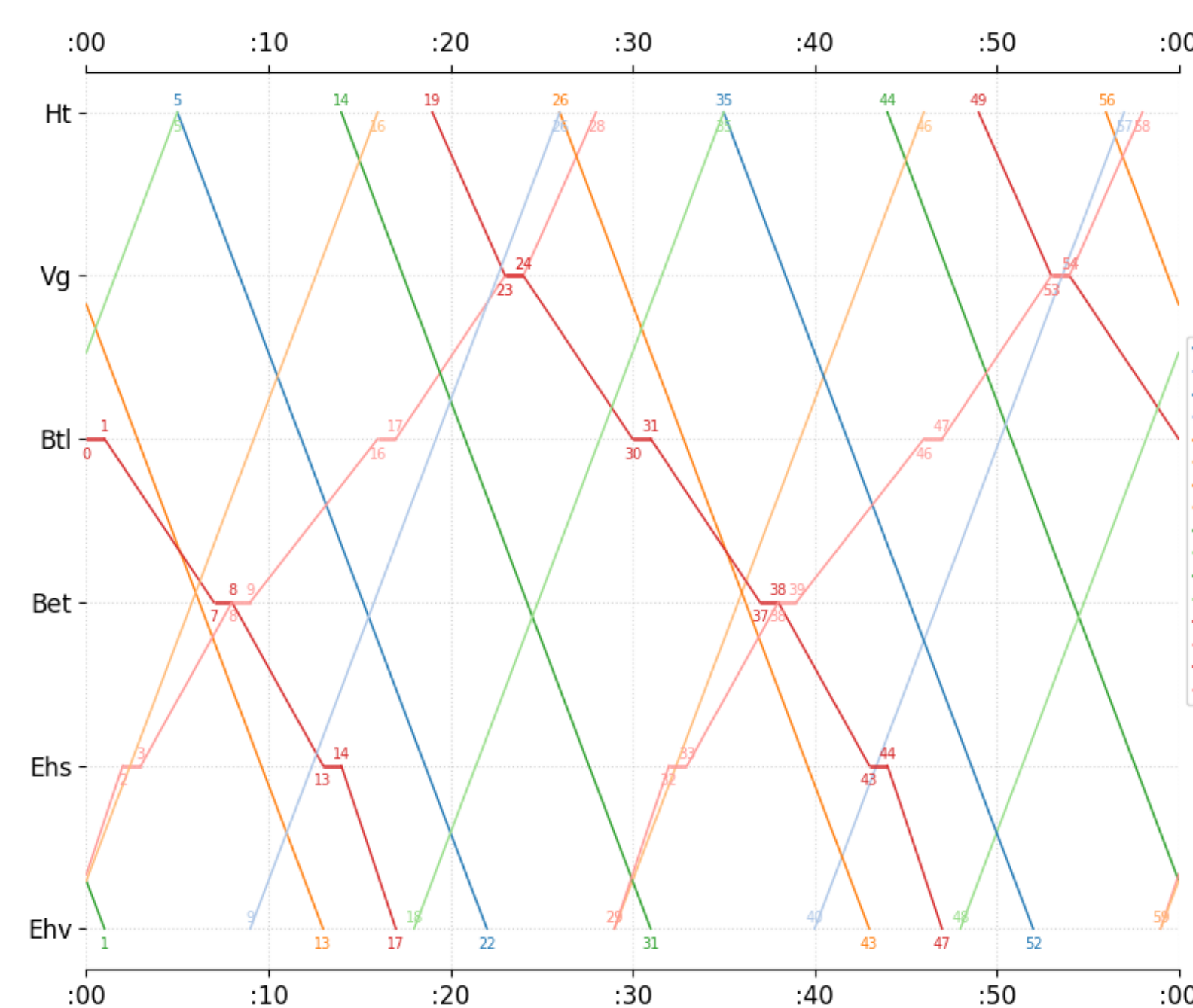
DLR



Jernbane-
direktoratet

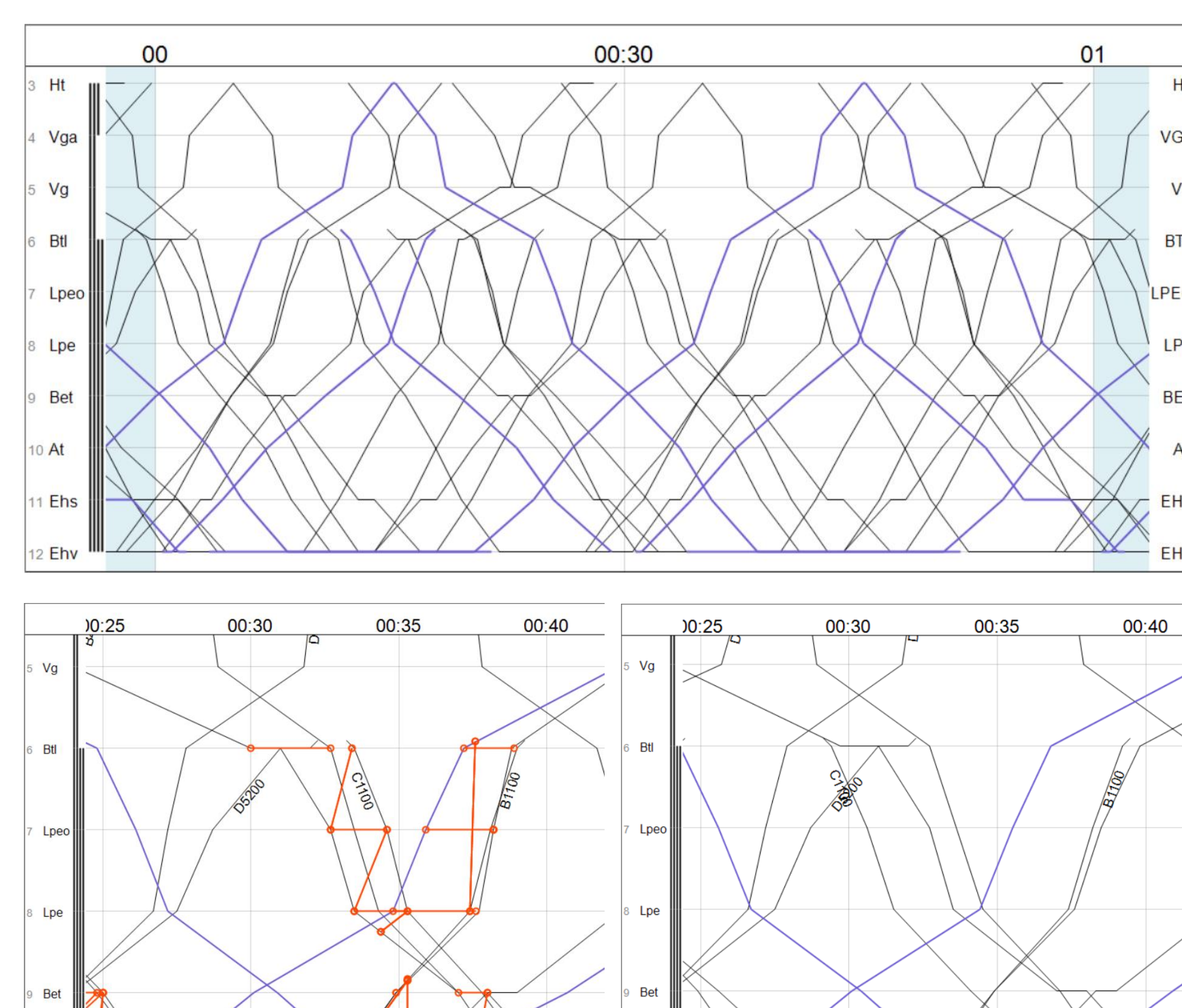
1 Passenger-oriented timetable

Build a passenger timetable with minimized passenger travel time.



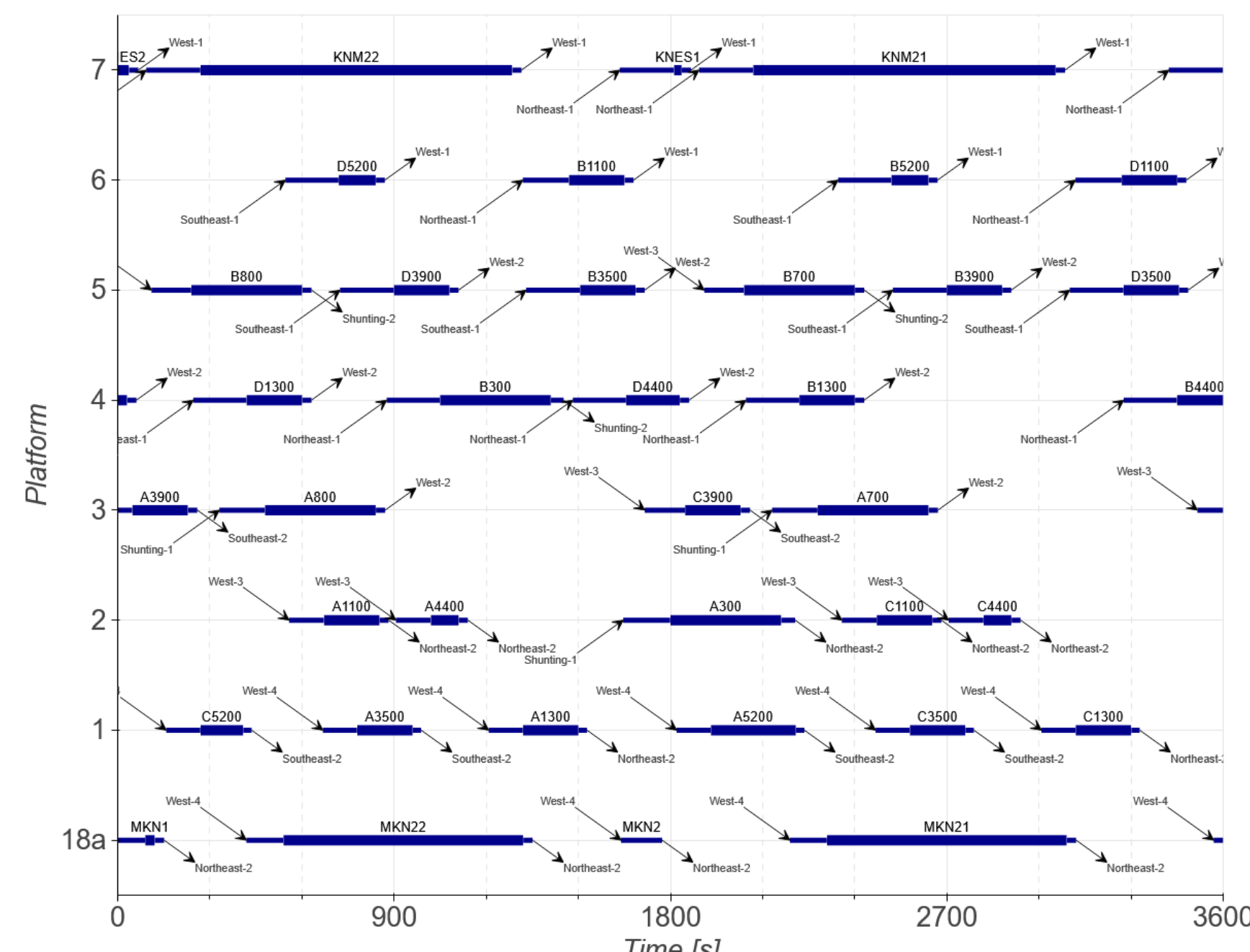
2 Conflict resolution

Resolve mesoscopic conflicts and insert freight trains interactively.

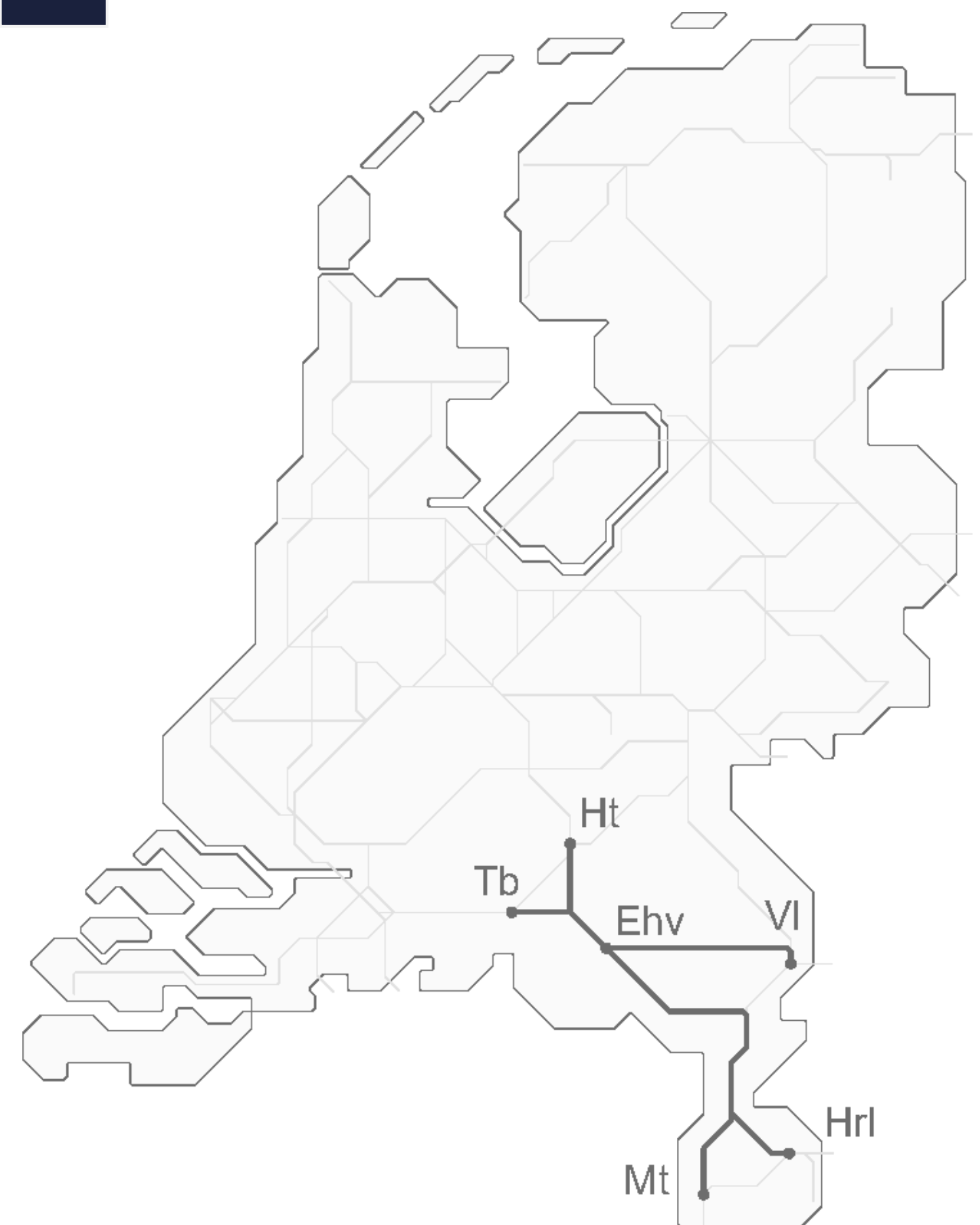


3 Station routing

Construct a compatible, feasible and delay-robust station routing.

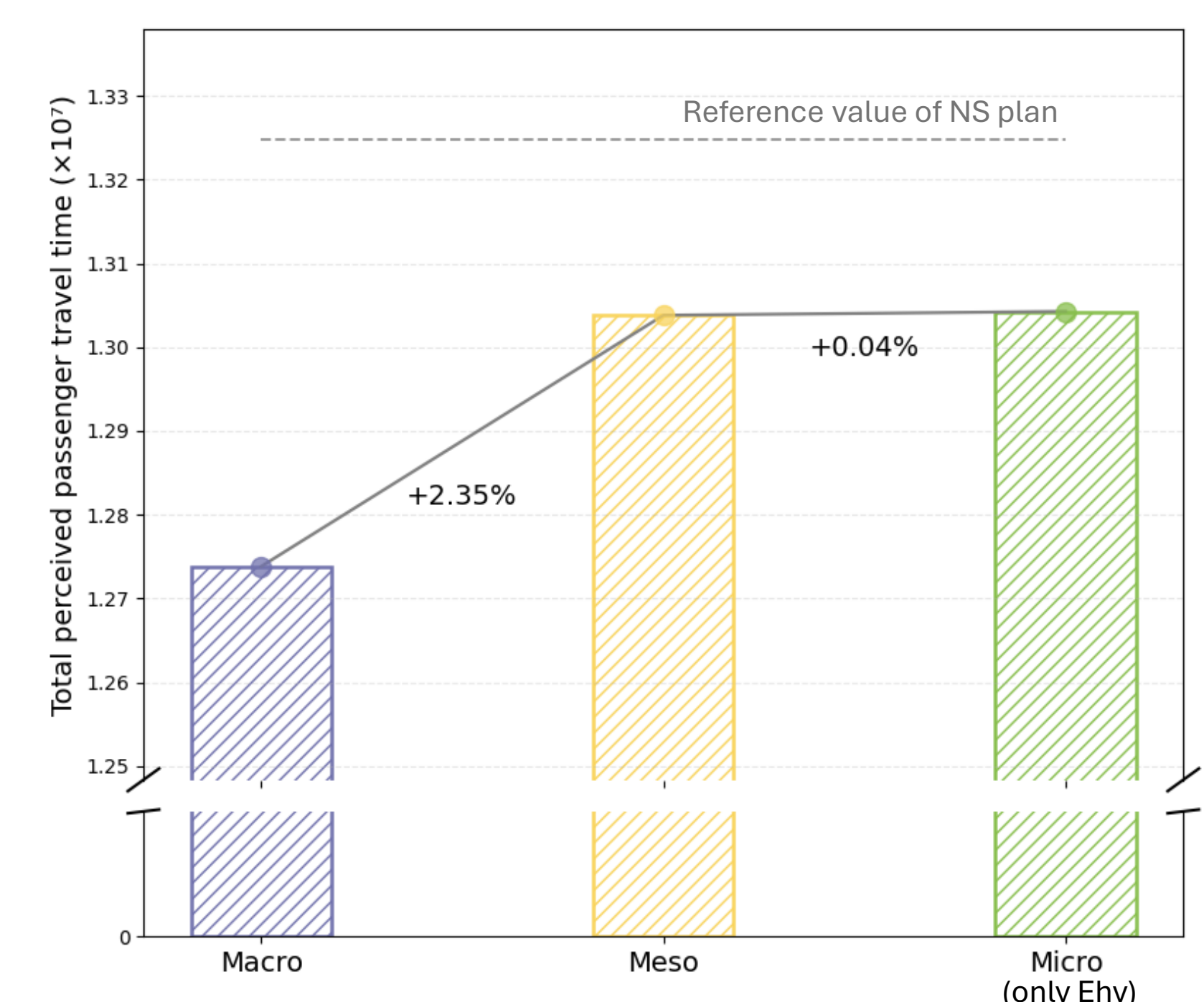


4 Dutch test network



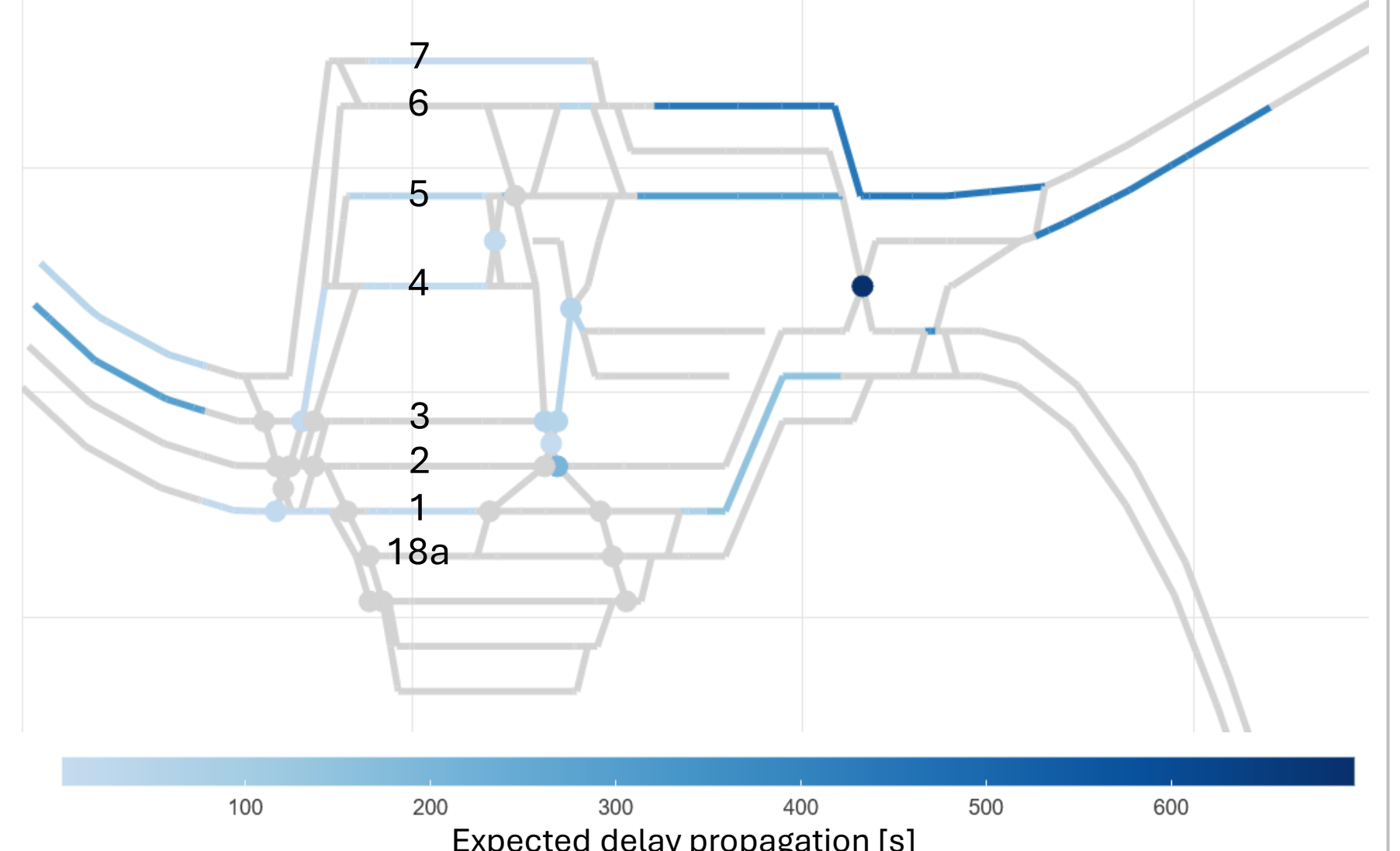
5 Objective: Passenger travel time

Perceived passenger travel time (weighting of waiting / driving / transfer times) for timetables after each step in the pipeline.



6 Objective: Delay propagation

Delay propagation in a station is minimized, critical points in the solution can be analyzed.



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