



# Effekter av nästa generations bromssystem, energieffektiv körning och virtuella block



**FP1 MOTIONAL**  
European Rail Network and Mobility Management

**KAJT Vårseminarium**

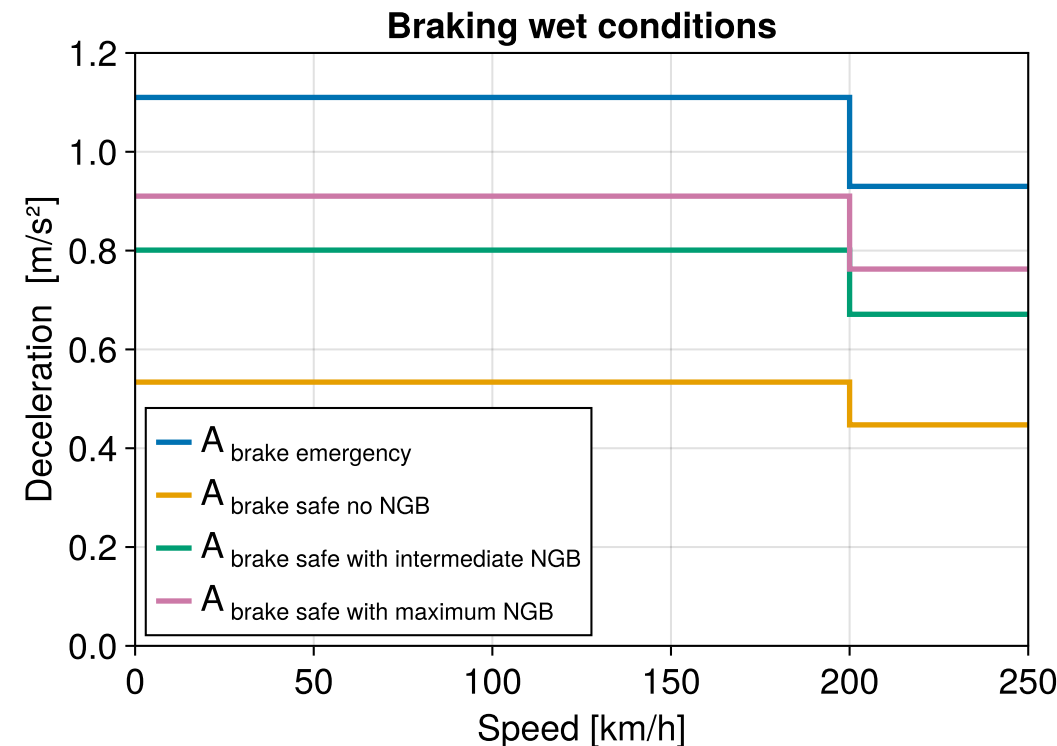
**2026-05-07**

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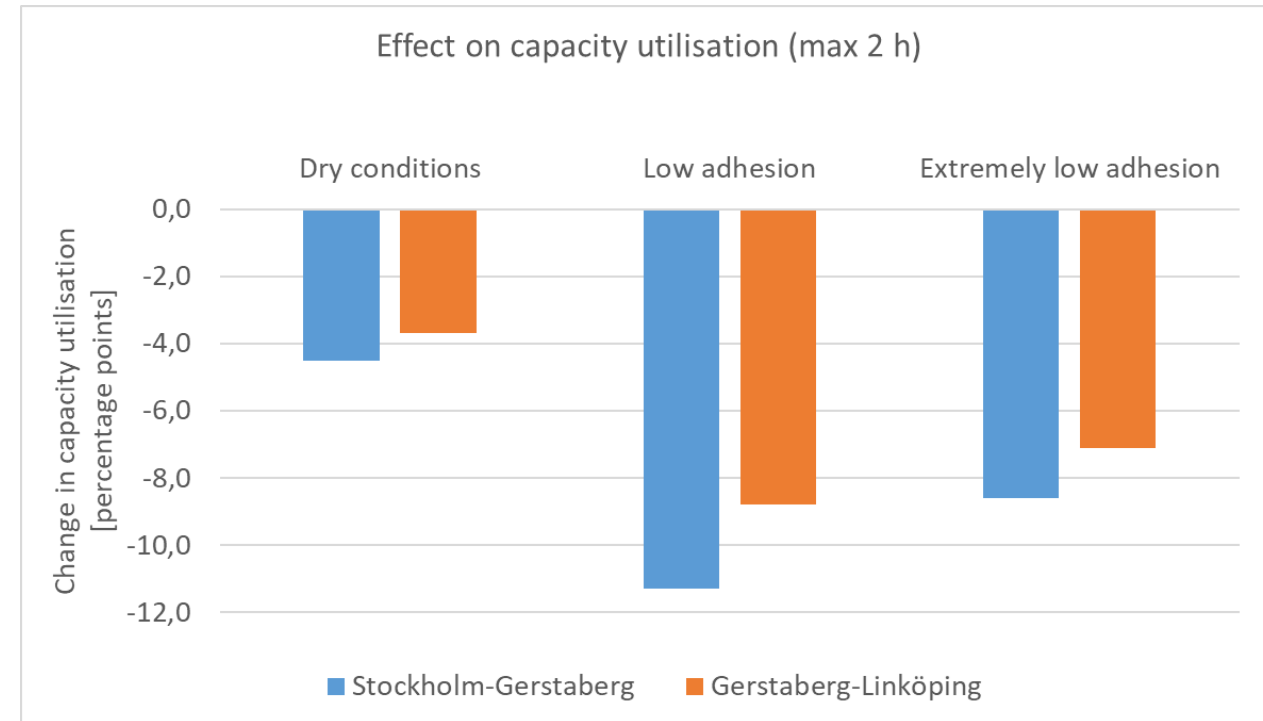
# Next Generation Braking systems (NG Brakes)

- Uses Brake and Adhesion Management System (BAMS).
  - In a future realization, the BAMS onboard will determine the current adhesion (Adhesion Detection System, ADS) or receive the predicted adhesion of the railway line ahead (from other trains). Based on this, BAMS will determine the maximum available deceleration
  - The improved knowledge on the current situation and the better system performance will result in more predictable and shorter deceleration distances in wet and dry conditions
  - Communicates with ATO onboard and ETCS
  
- Capacity effects of NG Brakes is studied using simulations in RailSys
  - Simulation area: Eastern Link, Stockholm-Linköping
  - Future timetable of 2040 and rolling stock with top speed 250 km/h and ETCS gamma braking model



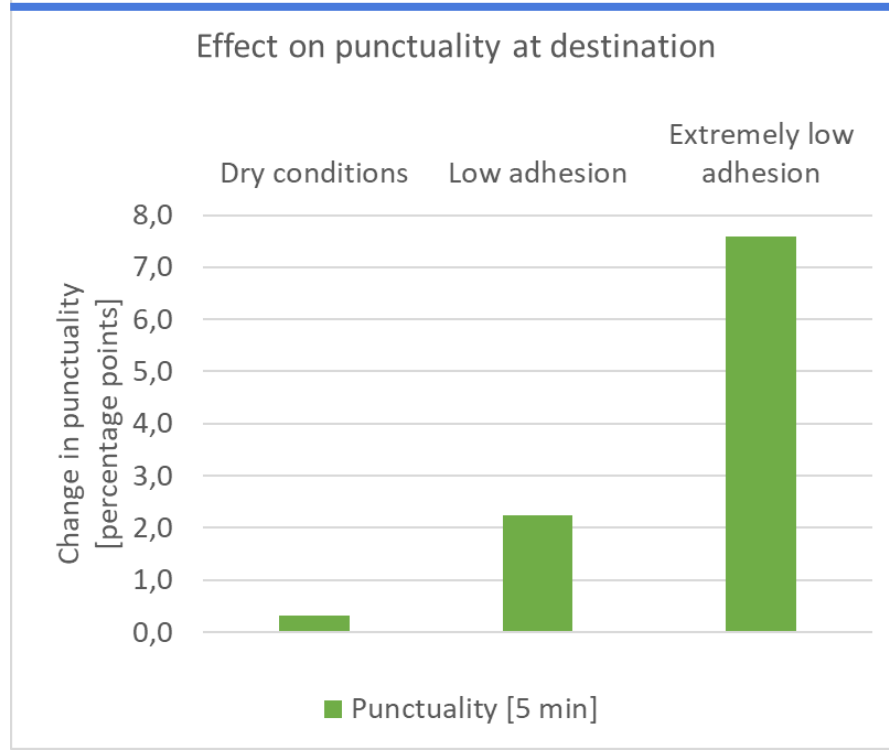
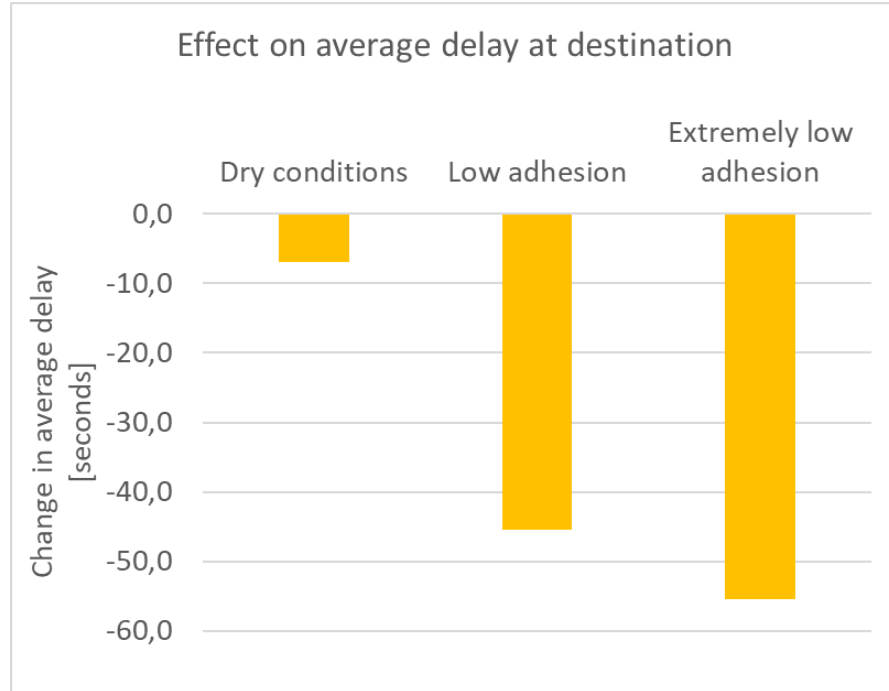
# Next Generation Braking systems (NG Brakes)

- 3 main scenarios
  - Dry conditions
  - Low adhesion (water/soap)
  - Extremely low adhesion (oil, locally)
- Running times from Stockholm to Linköping in dry conditions is reduced by approximately 20-70 s depending on train stopping pattern
- Capacity consumptions is reduced thanks to shorter running times and less restrictive braking curves
  - Affects braking towards Marker Boards -> shorter headway



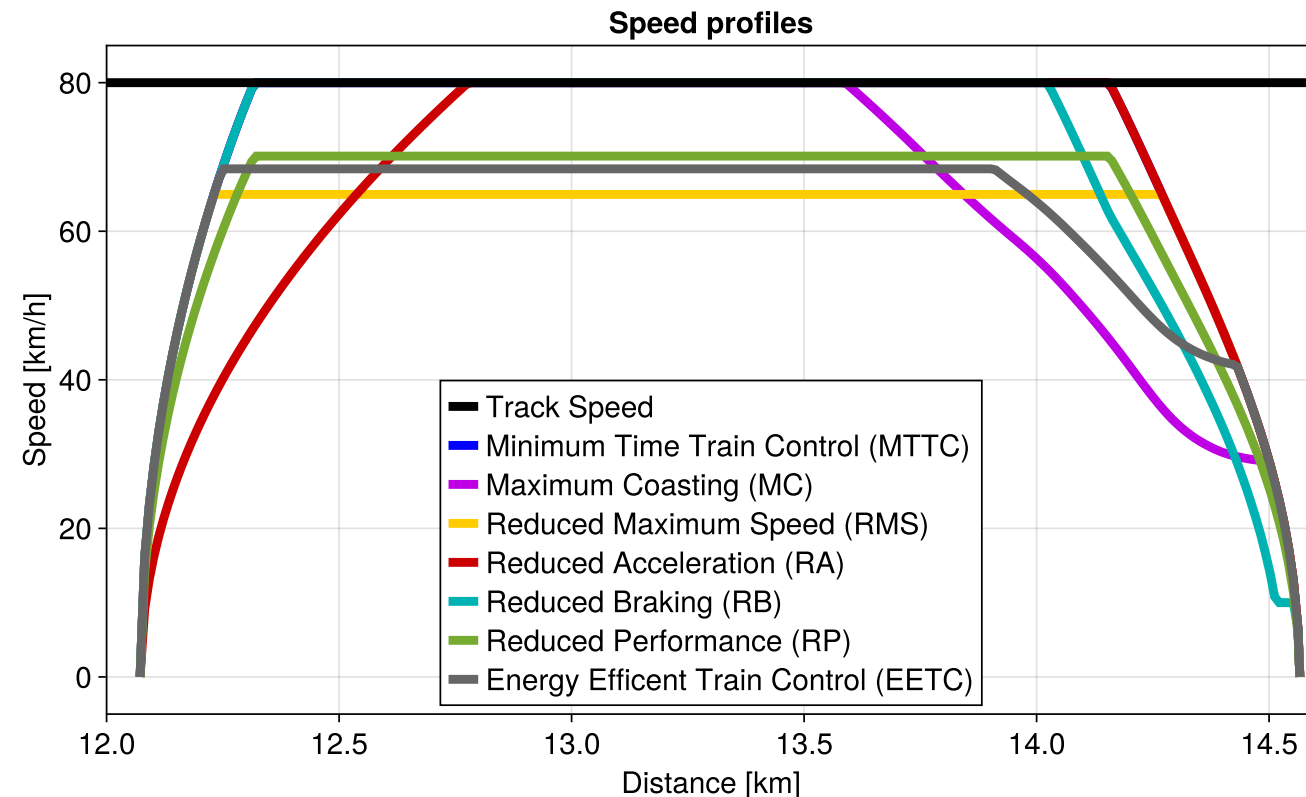
# Next Generation Braking systems

- Stochastic simulation with delays show improved performance (reduced delays)
- Small improvements in dry conditions
- Larger improvements in conditions with reduced adhesion
- Might require ATO to make use of the full potential of the system



# Energy efficient driving

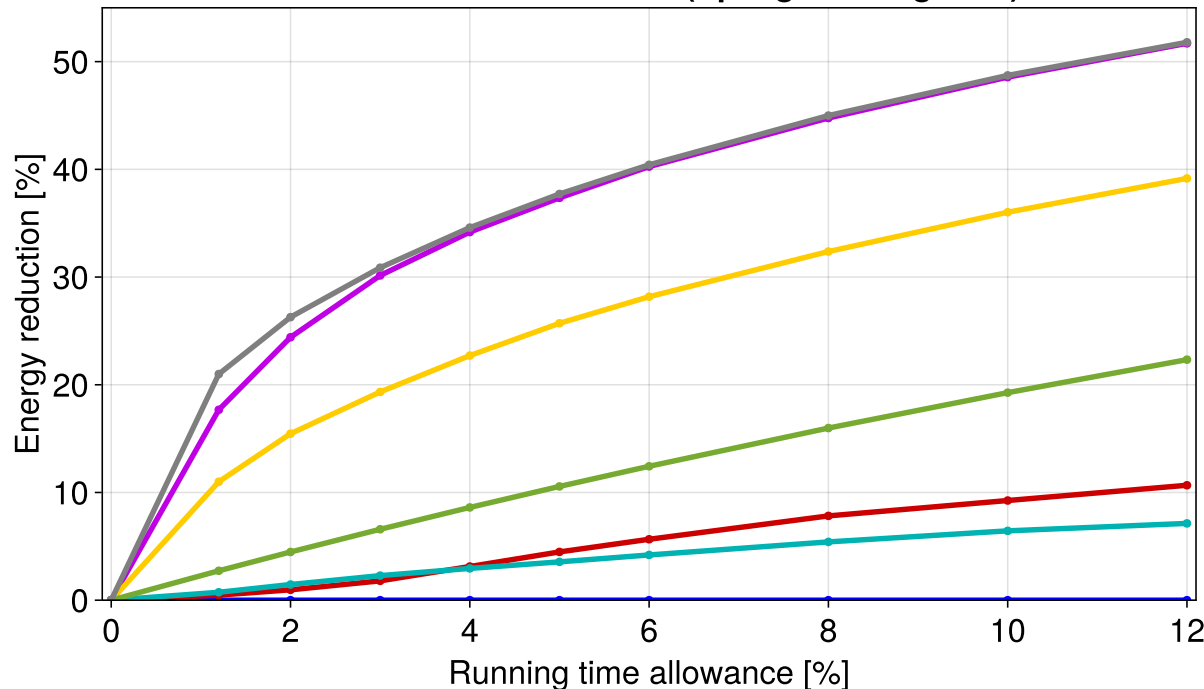
- C-DAS and ATO makes it possible to use available running time allowance in the timetable to change driving speed profiles to
  - reduce energy and wear
  - reduce delays and increase capacity
- In Europe's Rail new energy saving profiles are developed in RailSys
- In KAJT project HESE2 and within Excellence area 6 (Signalling), several speed profiles have been developed for in-house simulation models



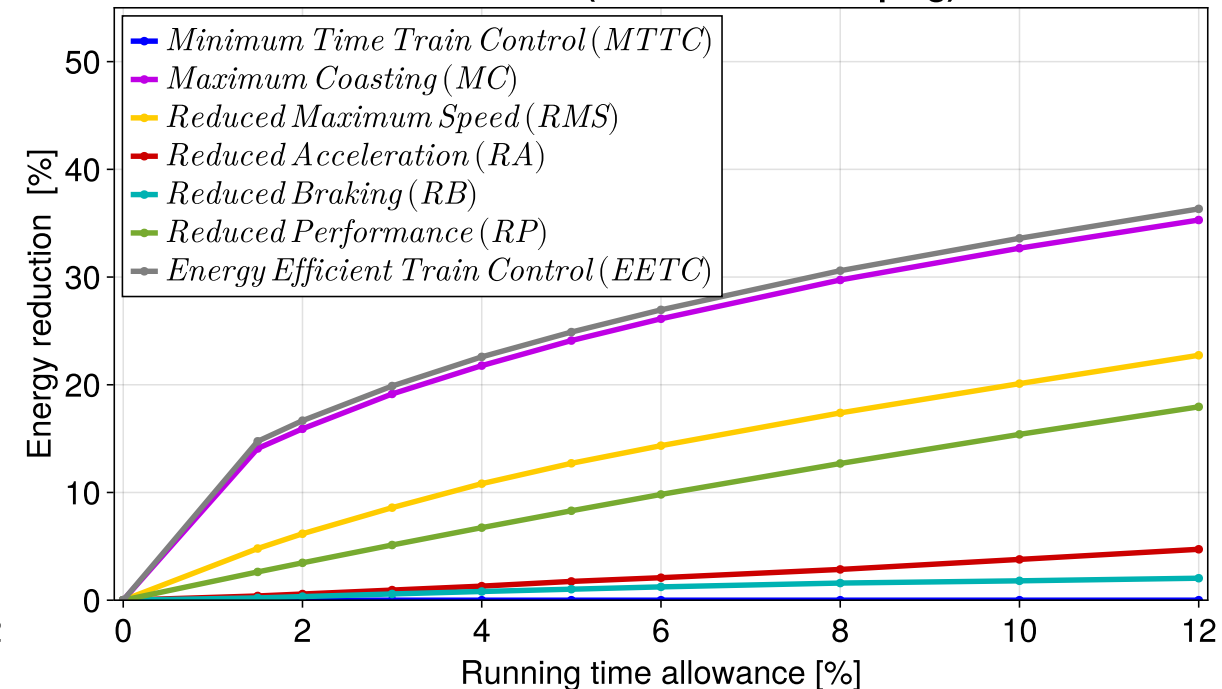
# Energy efficient driving

- Example of possible theoretical energy reduction on Stockholm commuter line and The East Link
  - Larger energy saving potential for trains that stop frequently
  - Diminishing returns for higher levels of running time allowance
  - Maximum coasting strategy almost as good as the Energy Efficient Train Control strategy

Stockholm commuter line (Spånga - Trångsund)

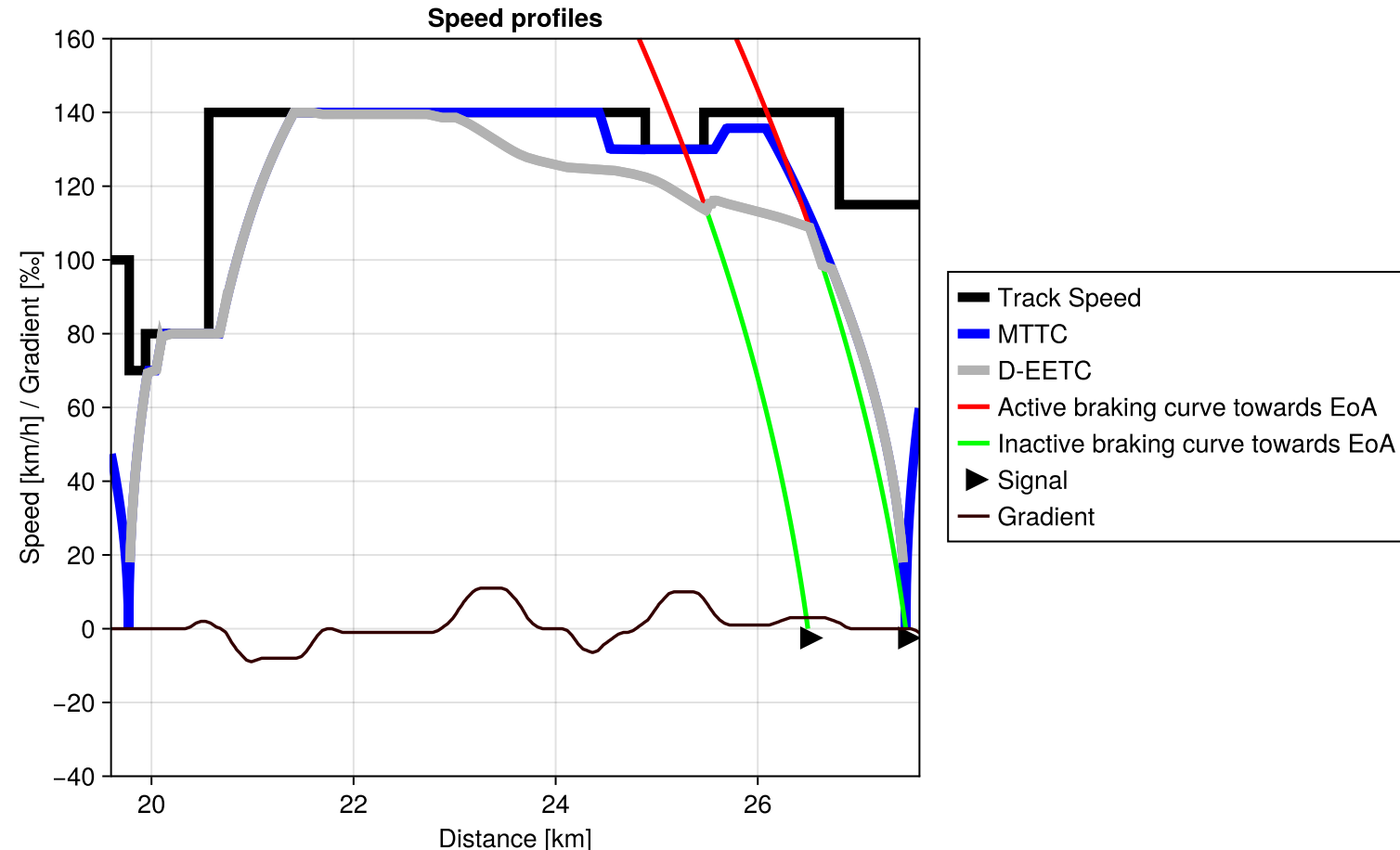


The East Link (Stockholm - Linköping)

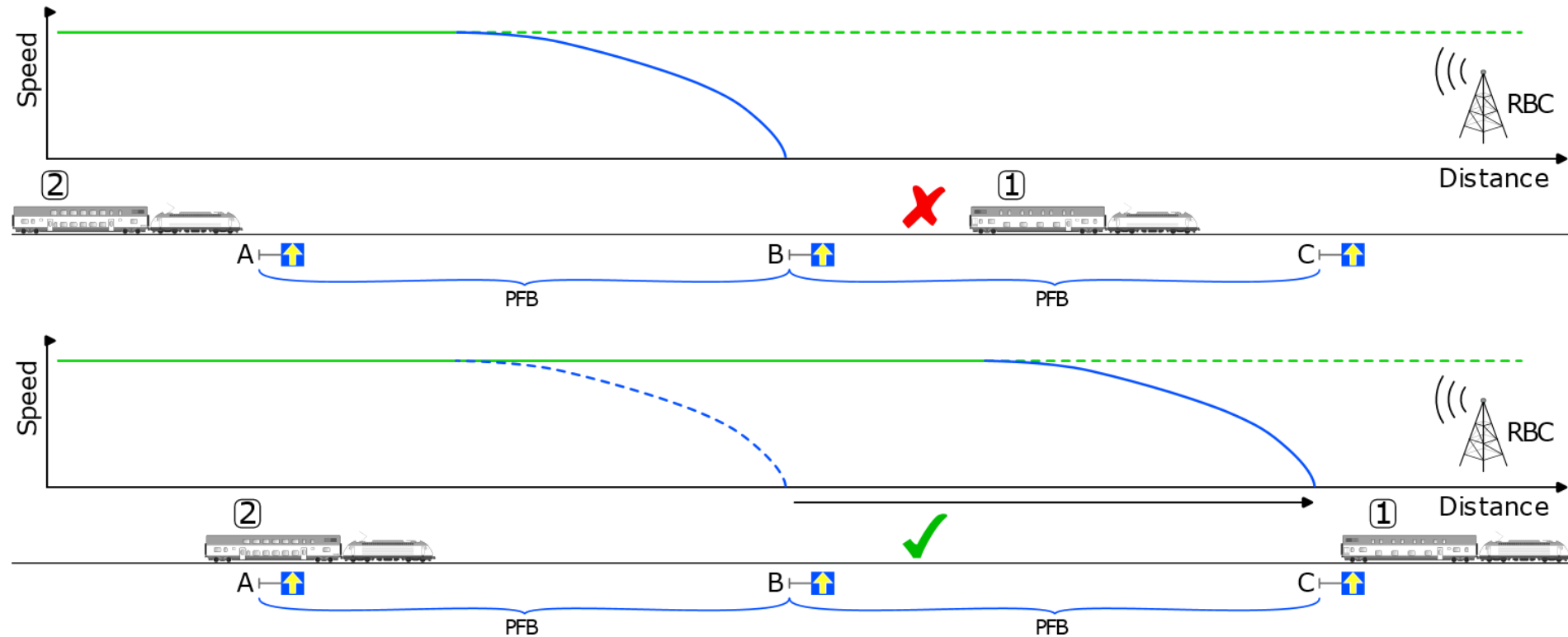


# Energy efficient driving

- Model development will continue as part of Europe's Rail wave 2 and TRV Excellence Area 6
- Energy efficient driving profiles in simulations with stochastic delays
- Dynamic speed profiles taking signalling aspects in front of the train into account
- 3 interesting use cases where energy and wear can be reduced and capacity increased
  - Single track lines (crossings)
  - Dense urban traffic (stops)
  - Double track lines (overtakings)

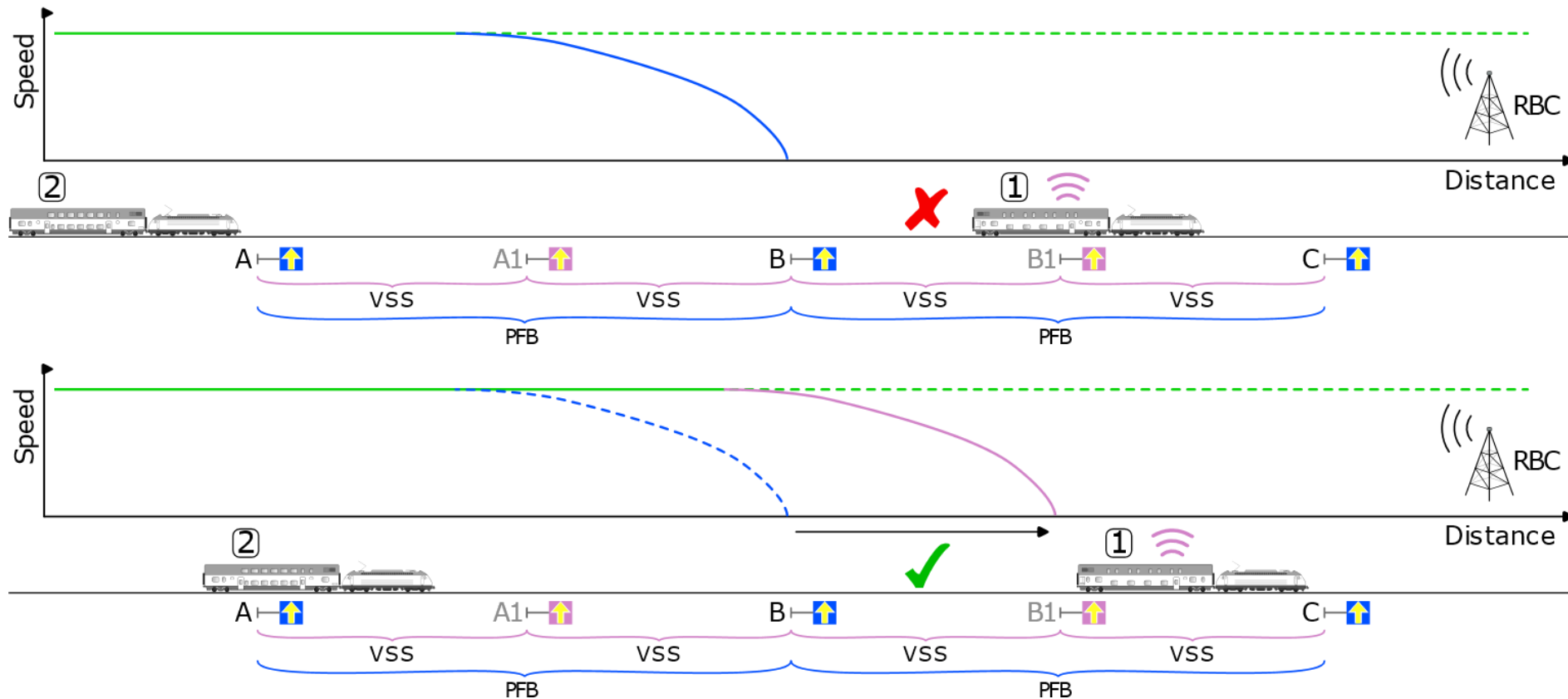


# ETCS Level 2 with physical fixed blocks



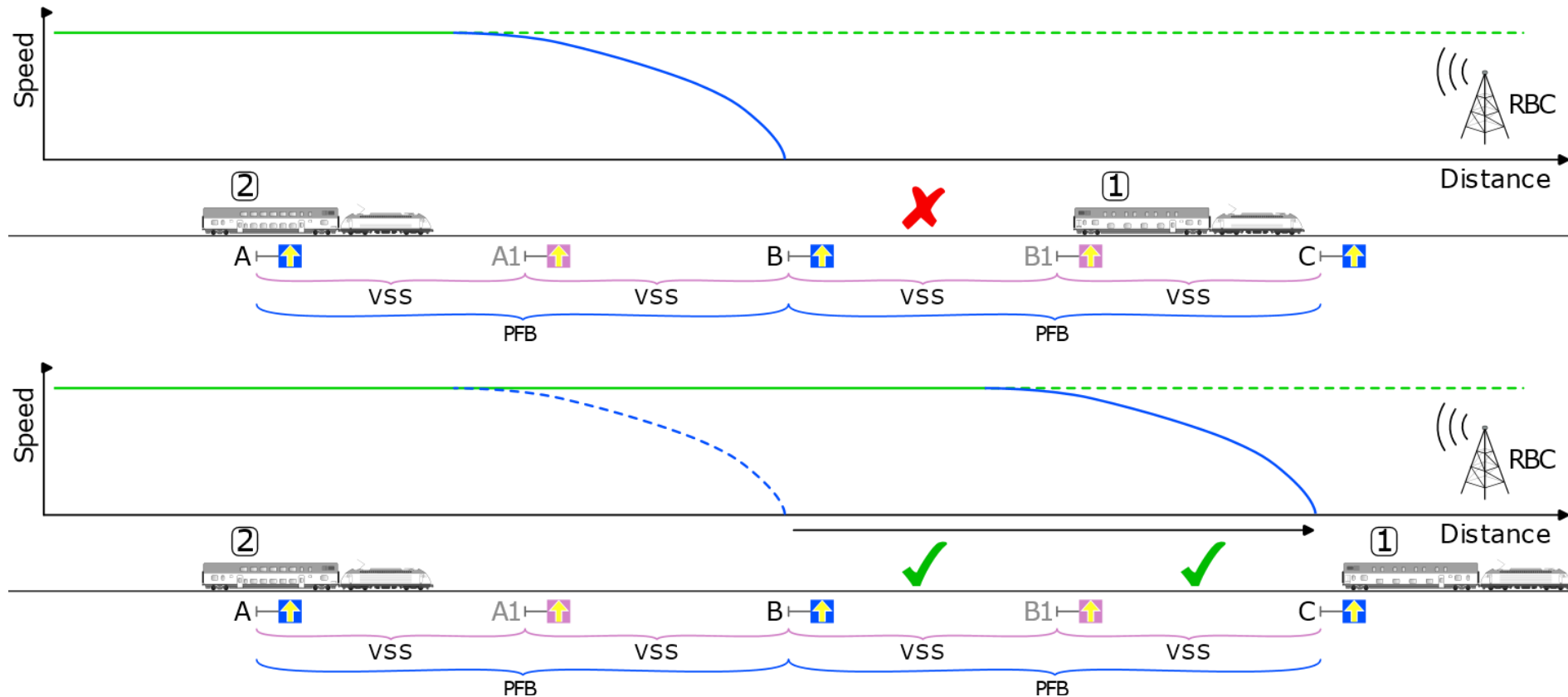
# ETCS Level 2 Hybrid Train Detection with physical fixed blocks and virtual sub-sections

Train 1 is equipped with Train Integrity Monitoring System (TIMS)



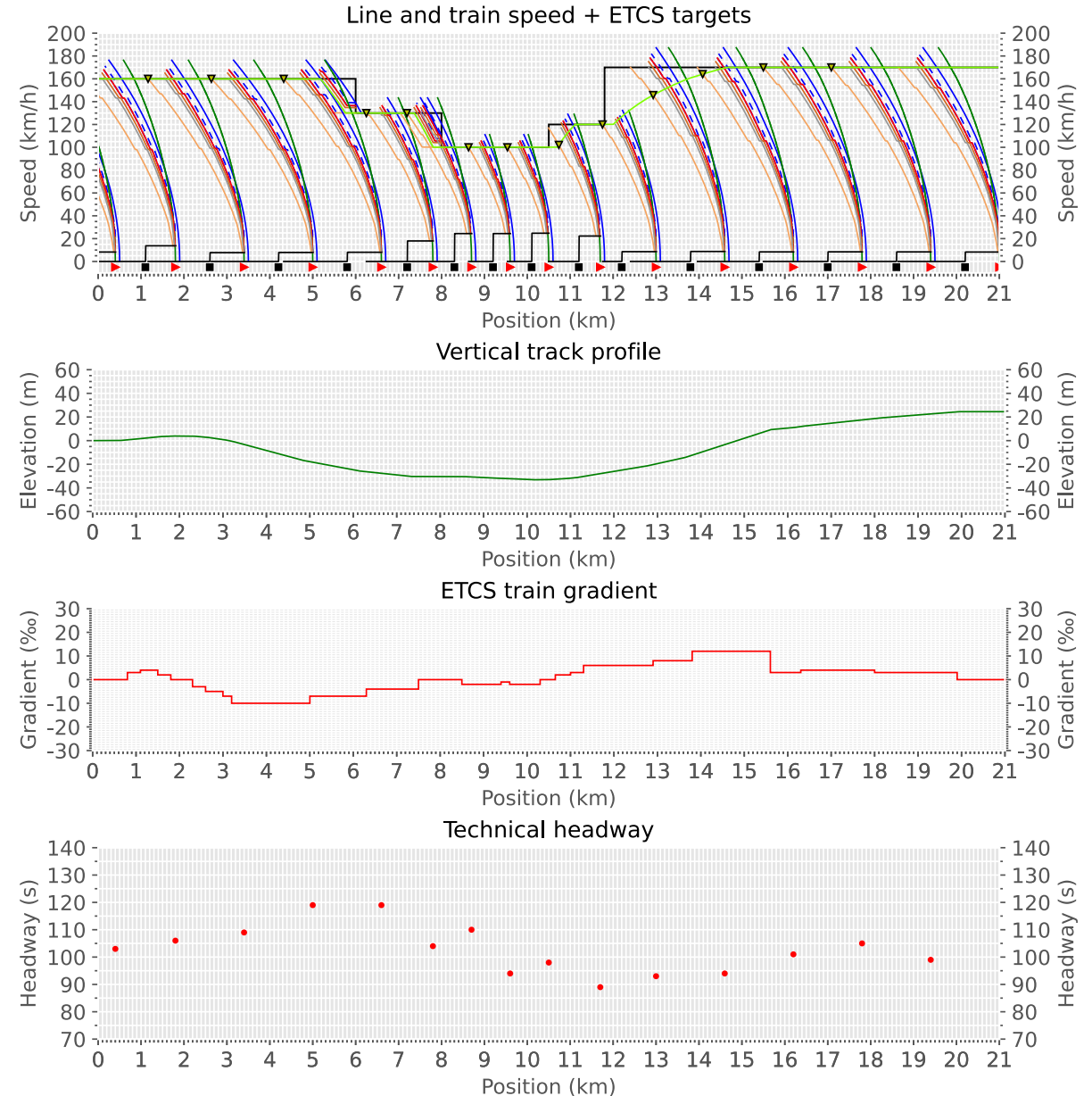
# ETCS Level 2 Hybrid Train Detection with physical fixed blocks and virtual sub-sections

Train 1 is not equipped with Train Integrity Monitoring System (TIMS) or the train rear end position and/or train integrity reporting is not working.



# Output from HESE tool Example

- ETCS targets
  - End Of Authority (EOA)
  - Most Restrictive Speed Profile (MRSP)
- Train speed profile
- Vertical track profile
- ETCS gradients
- Technical headway



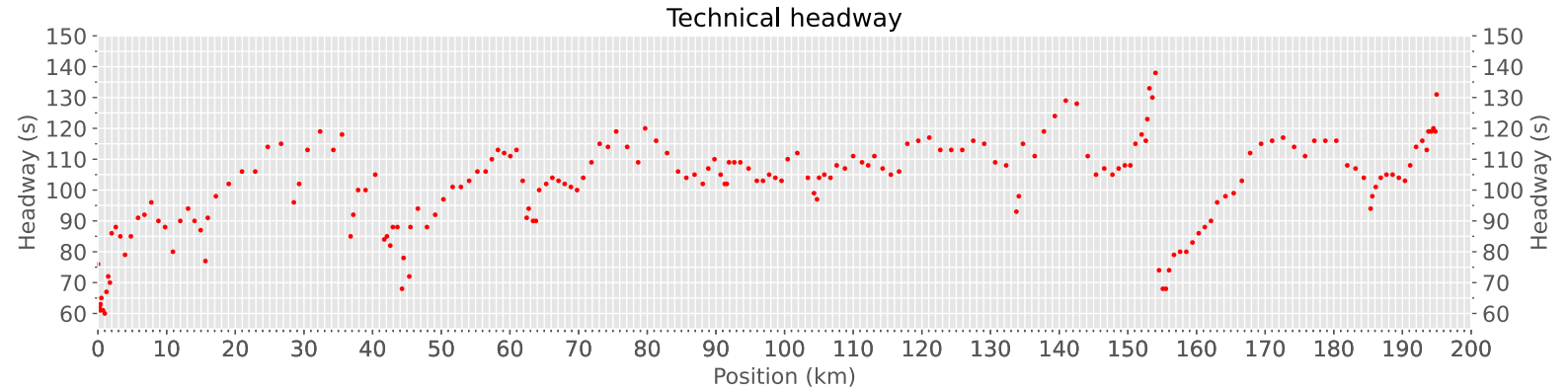
# Example from East Link

- From Stockholm to Linköping (southbound)
- Track and signal data from Trafikverket RailSys model

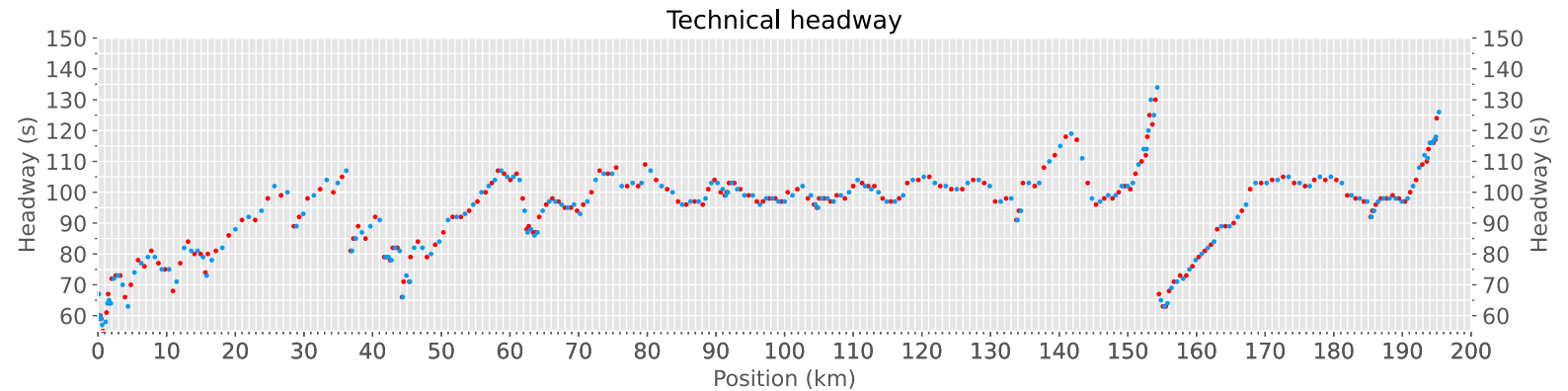


# Example from East Link

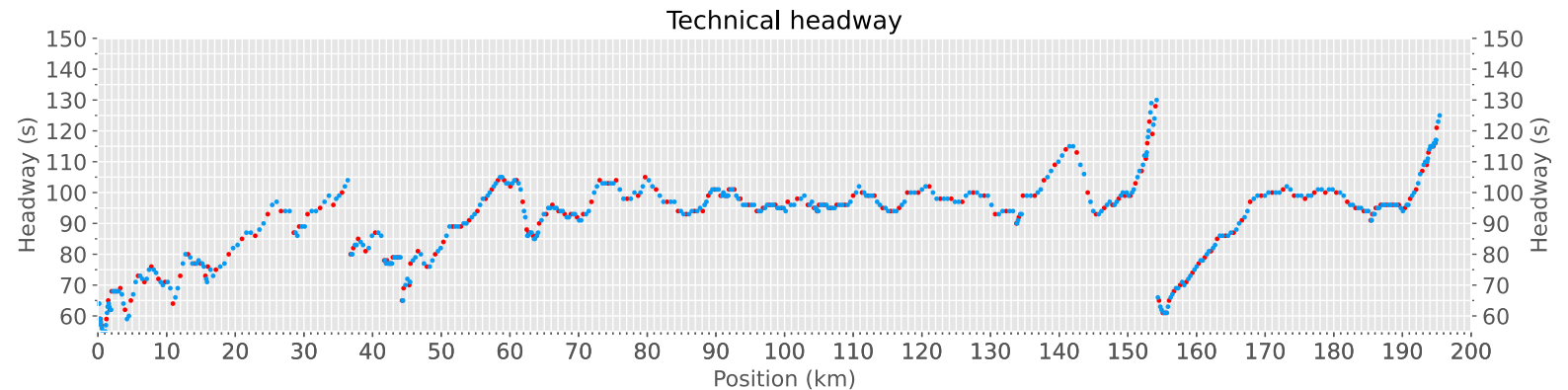
Reference case with physical fixed blocks



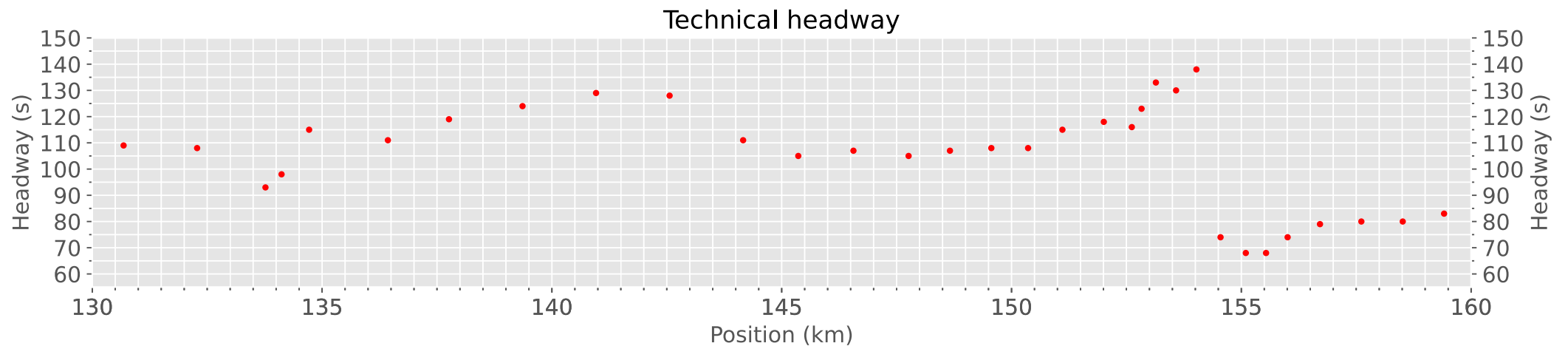
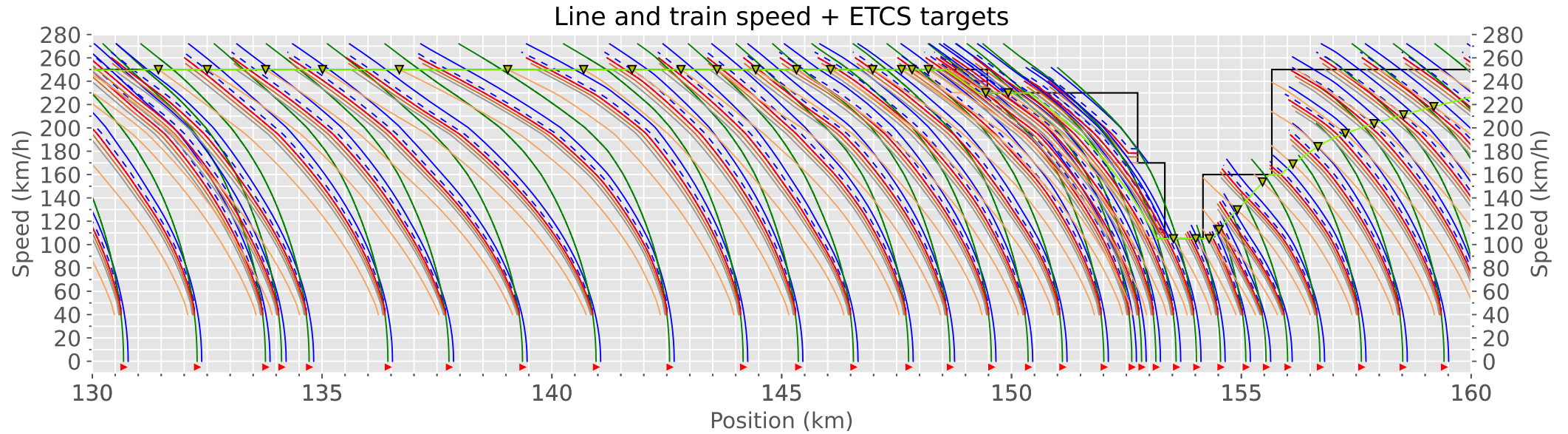
Physical fixed blocks split into **two** virtual sub-sections



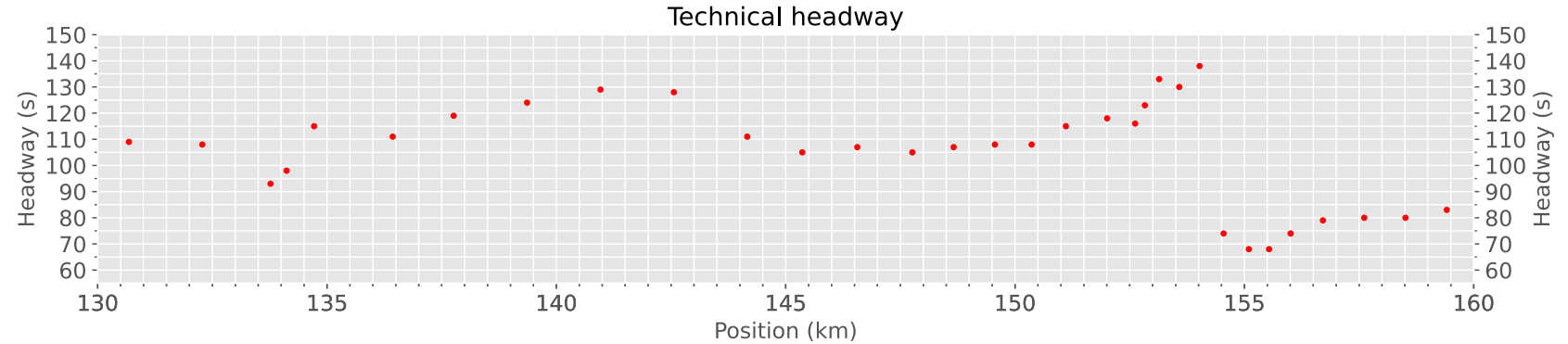
Physical fixed blocks split into **three** virtual sub-sections



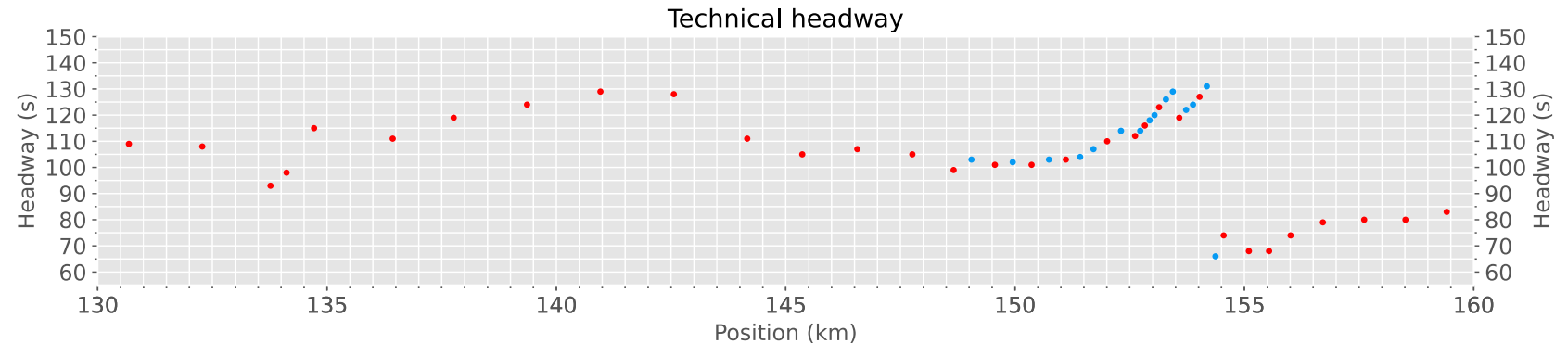
# East Link – approaching Norrköping



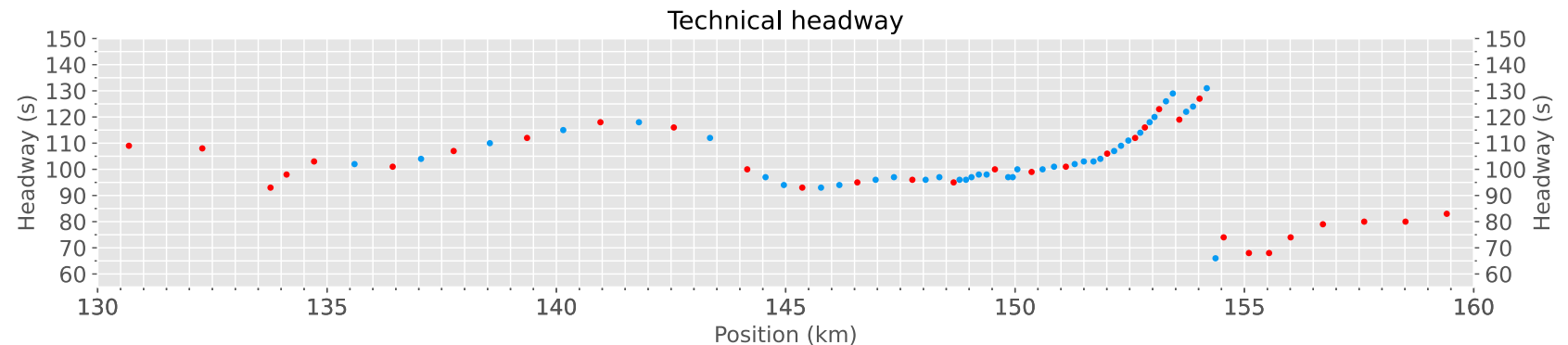
Reference case with physical fixed blocks



Physical fixed blocks combined with virtual sub-sections



Physical fixed blocks combined with, even more, virtual sub-sections



# Thanks!

