

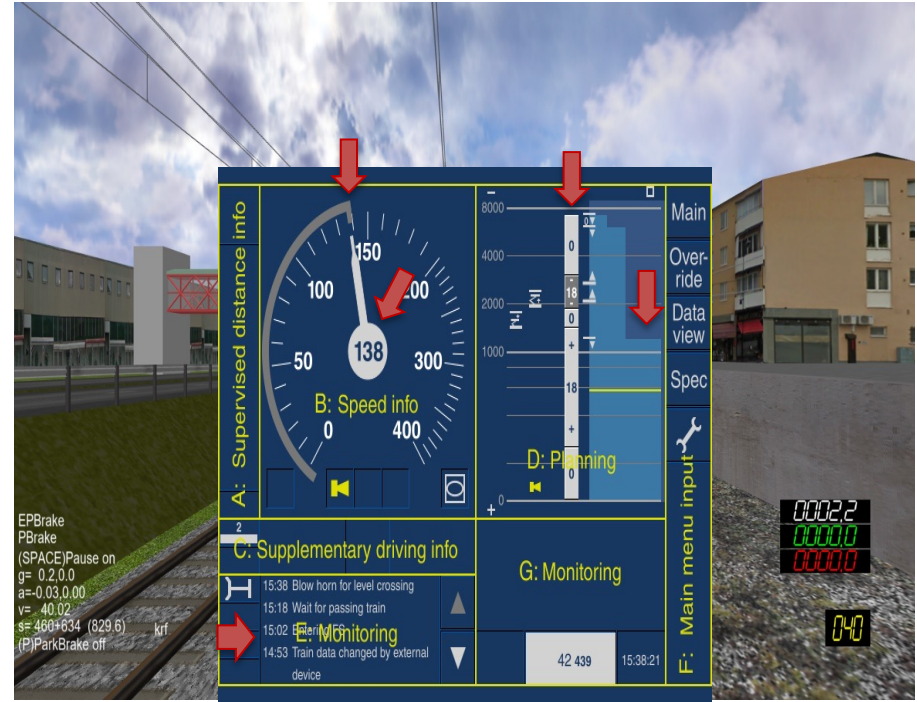
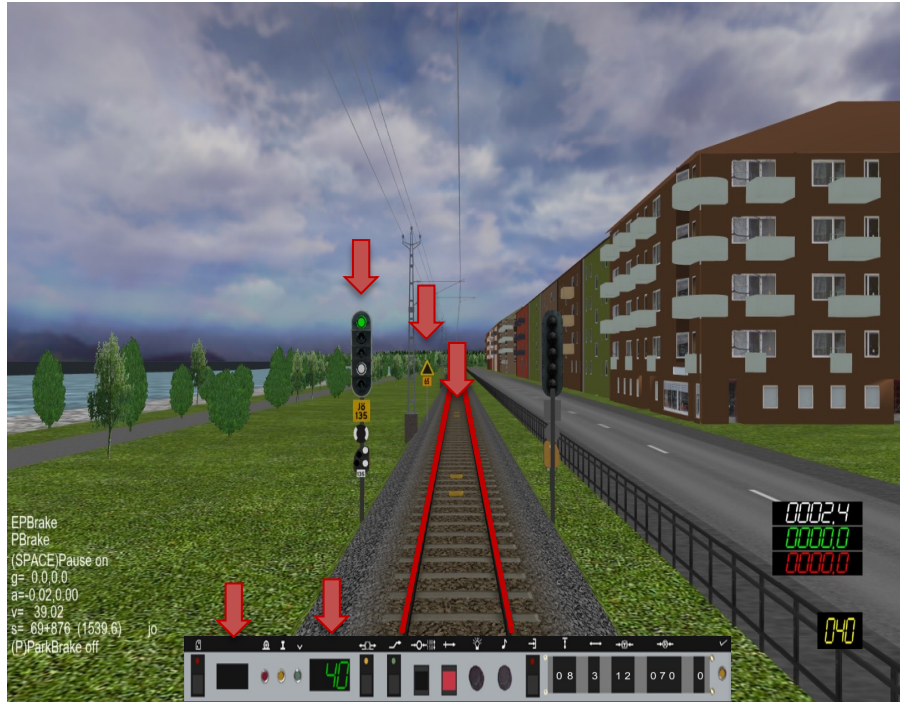
Capacity and driver workload



Tomas Rosberg & Birgitta Thorslund (VTI)

Lisa Mannerhagen & Per Köhler (Swedish Traffic Administration)

ATC vs. ERTMS Driver Perspective



VTI TRAIN SIMULATOR ON TOUR

To examine effects of

1. the signal shift
2. of various speed filters

on

Train driver:

- How is the driver effected (attention, workload, behavior)?

Capacity:

- How is the capacity effected (running time, closeness to braking intervention curves)?

Energy:

- How do different line planning strategies affect the train energy consumption?





RENTAL

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Inside



41 drivers
30 men & 11 women

FIELD EXPERIMENT SETUP IN LULEÅ

SIMULATOR TRAILER AND CONTROL VAN



Research engineer Krister with Eye-tracking glasses



DRIVER TASK

- 4 runs:
 - 1 with lineside signals
 - 3 with ETCS and different speed profiles (input from the Traffic administration)
- Drive with a time-table without any margins
- 7 road crossings without road protection
- Honk the horn at every road crossing



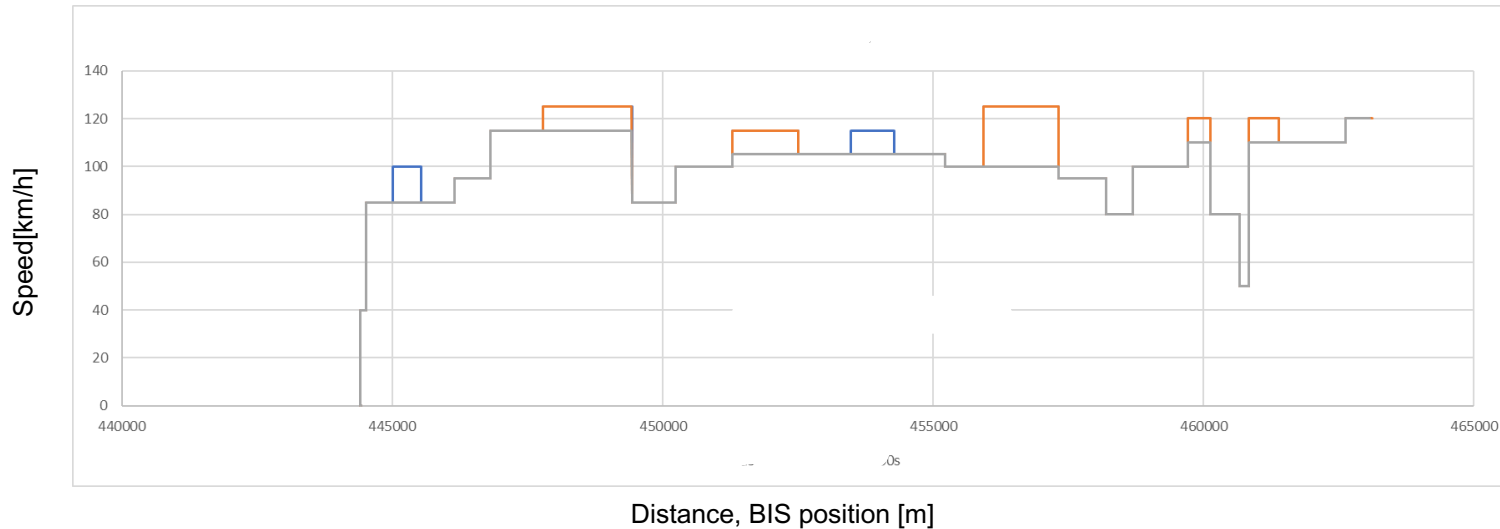
ATTENTION & WORKLOAD

- Zones are defined where any action must be performed.
- Average time looking inside vs outside cabin.
- Workload after each run measured with
 - NASA-Task Load Index (TLX)
 - Multidimensional State Boredom Scale (MSBS)

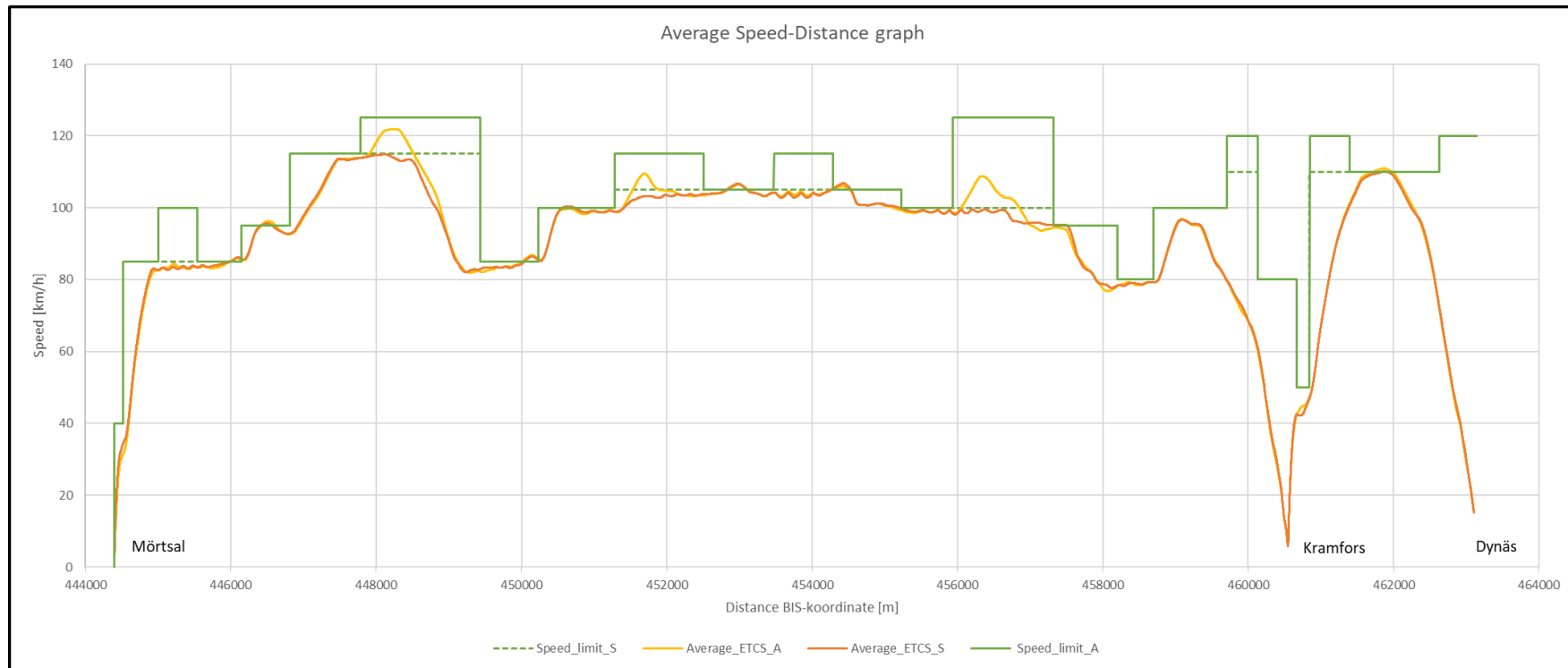


The three different ETCS speed profiles

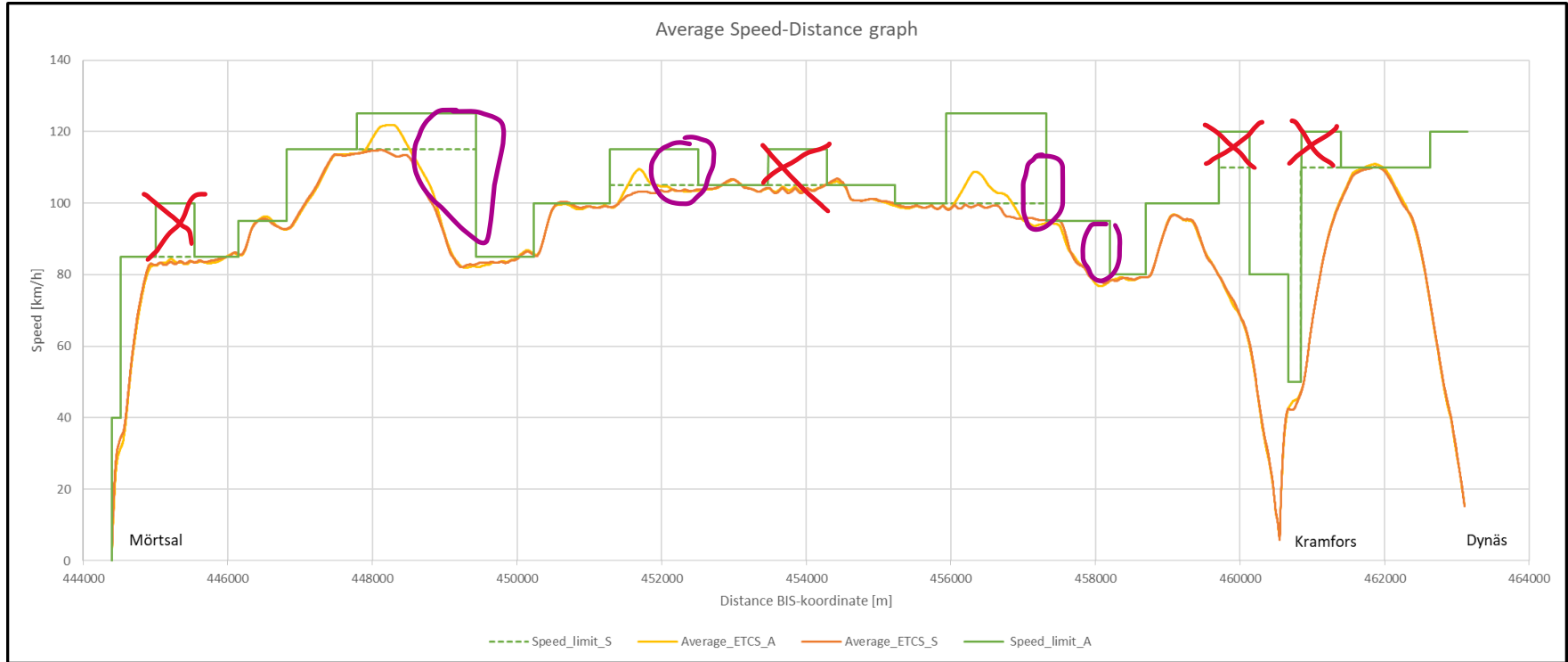
Experiment no.	Time (minutes)	Signal system	Experiment part
0	5	ETCS	Training.
1	15	ETCS	Unfiltered speed profile.
2	15	ETCS	Speed profile lightly filtered
3	15	ETCS	Speed profile more filtered
4	15	ATC	Line side signaling with same signaling planning as (3.)



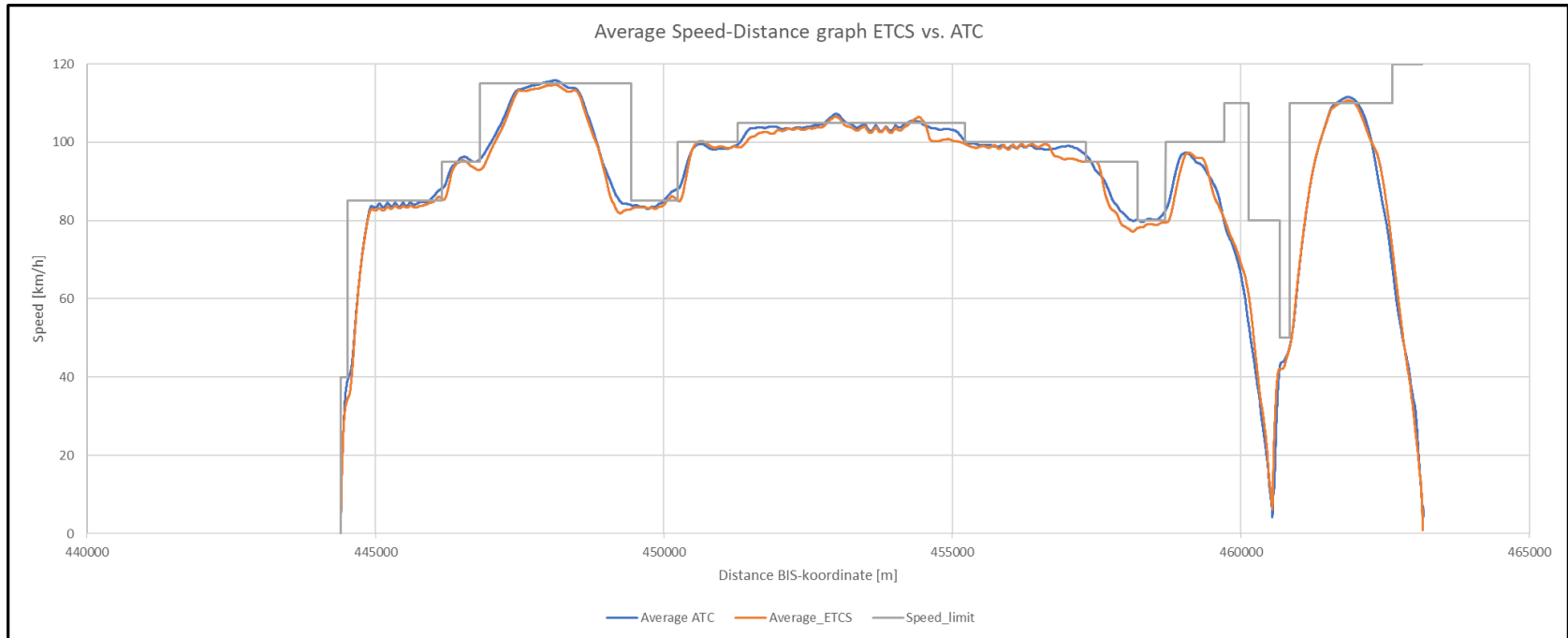
PRELIMINARY RESULTS - COMPARISON BETWEEN FILTERS



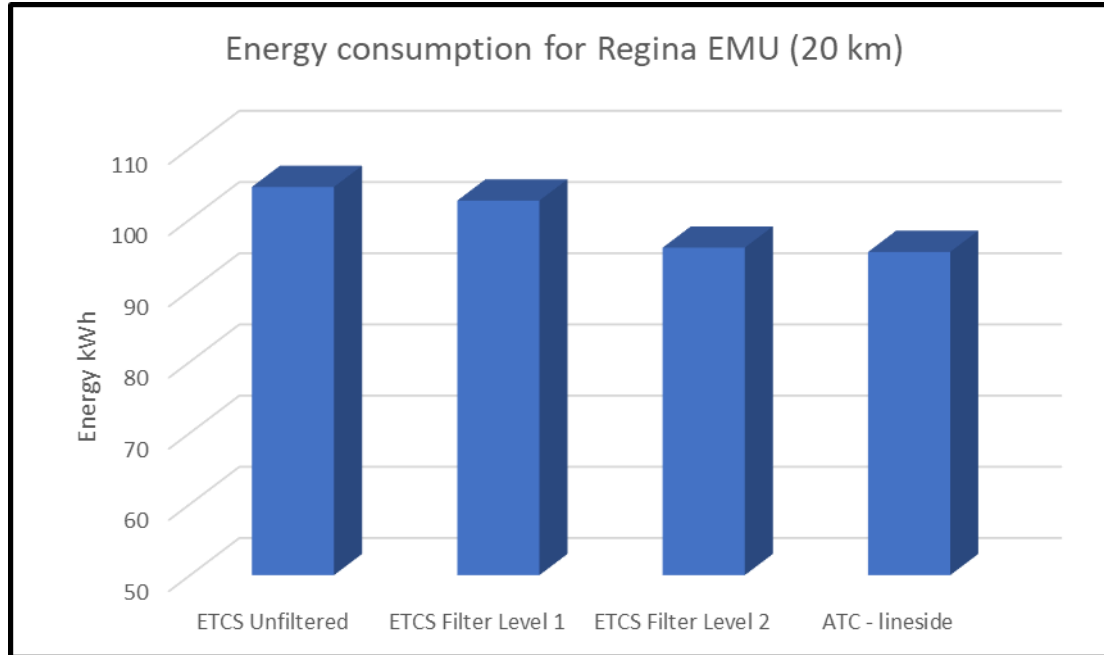
WHATS HAPPENING DURING THE JOURNEY?



LINESIDE VS. ETCS WITH IDENTICAL SIGNALING



ENERGY CONSUMPTION AND FILTERING



QUESTIONNAIRE

- Driving task with low effort
- More experience of ERTMS leads to:
 - Lower workload (NASA-TLX)
 - Less boredom (MSBS)
- Higher age is related to
 - Less boredom (MSBS)
 - Lower effort to reach performance goals on ATC **but** higher on ERTMS (NASA-TLX)
- Speed profile affects
 - Experienced performance: less speed changes -> higher performance



An aerial photograph of a city street intersection. A large white rectangle is centered over the image, containing the text 'THANKS FOR LISTENING!'. The street below shows a crosswalk, a bicycle lane with a bicycle symbol, and a building with a red sign. The text 'RUSS' is visible on a building facade. The overall scene is captured from a high angle, showing the layout of the road and surrounding urban environment.

THANKS FOR LISTENING!

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