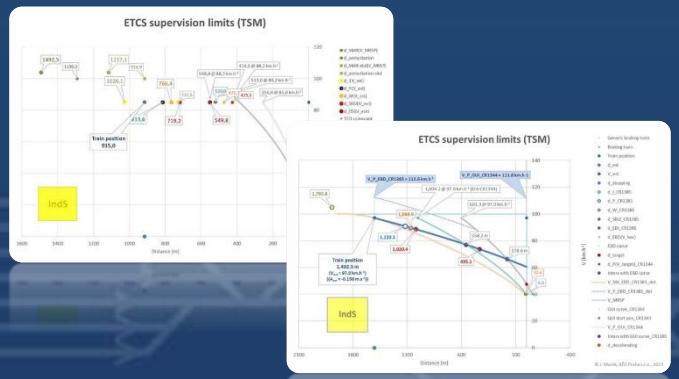
AŽD Praha s.r.o.

How can the braking curves be adapted to a more realistic behaviour of the rolling stock?

Jakub Marek

UNISIG Braking curves TF Leader, representing the AŽD Praha company

UNISIG Super Group Leader, representing the AŽD Praha company



ERA ERMTS 2024 Conference / Valenciennes, 23rd April 2024

B4R1 (reduced envelope up to SV 2.2/2.1) or B3R2

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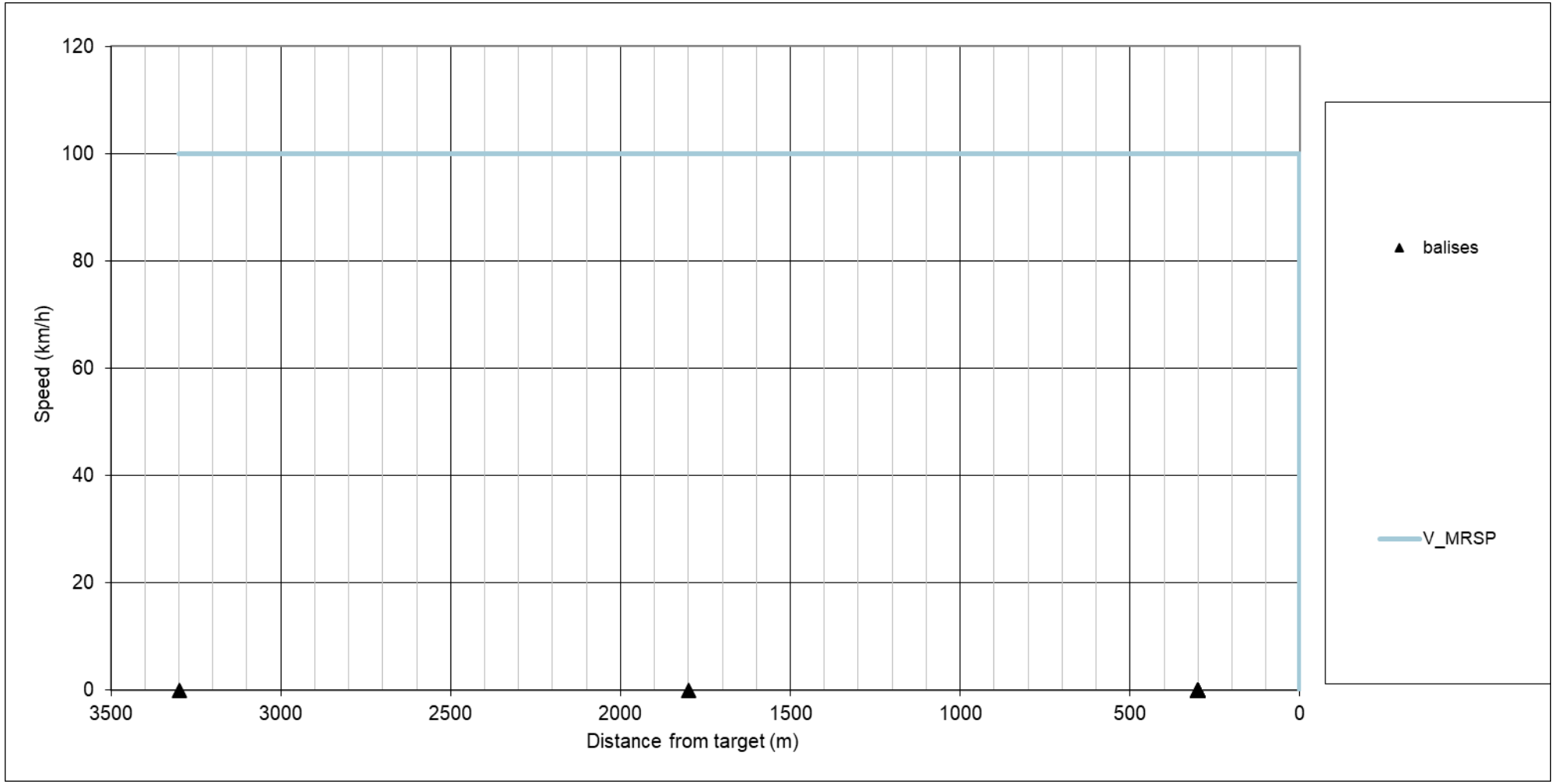

How can the braking curves be adapted to a more realistic behaviour of the RST?
» Better consideration of the actual train‘s deceleration (CR1385) «

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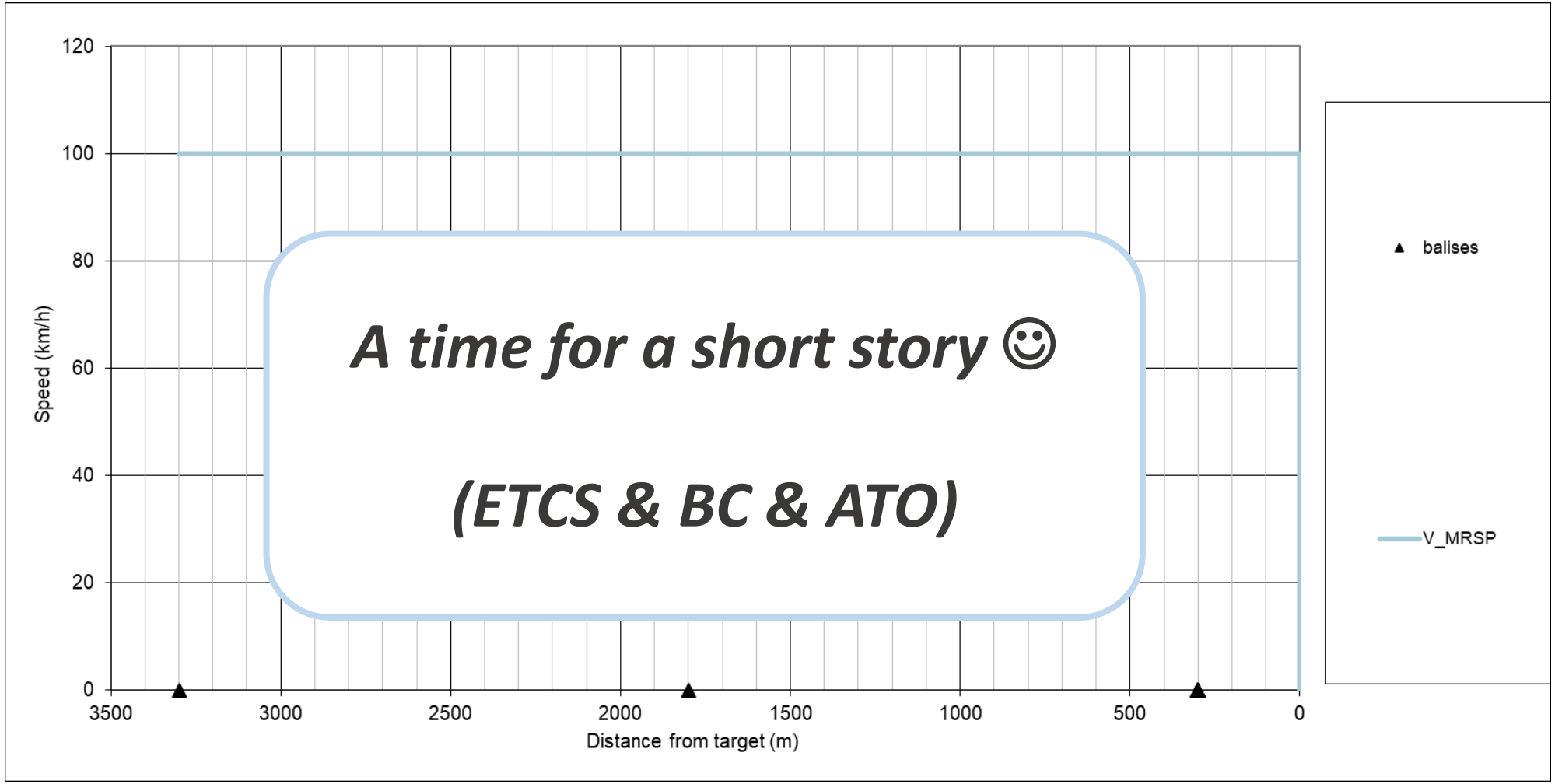

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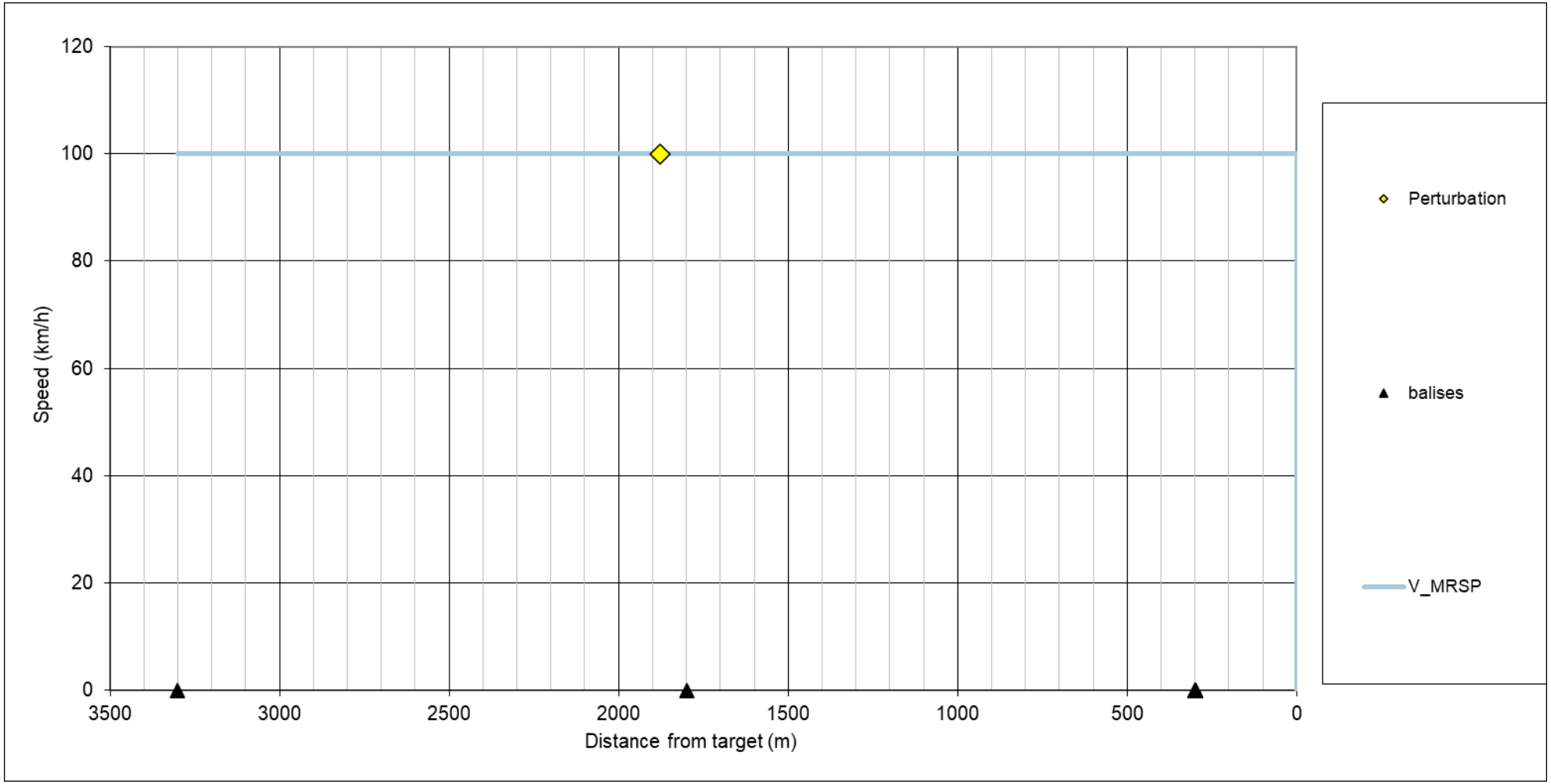

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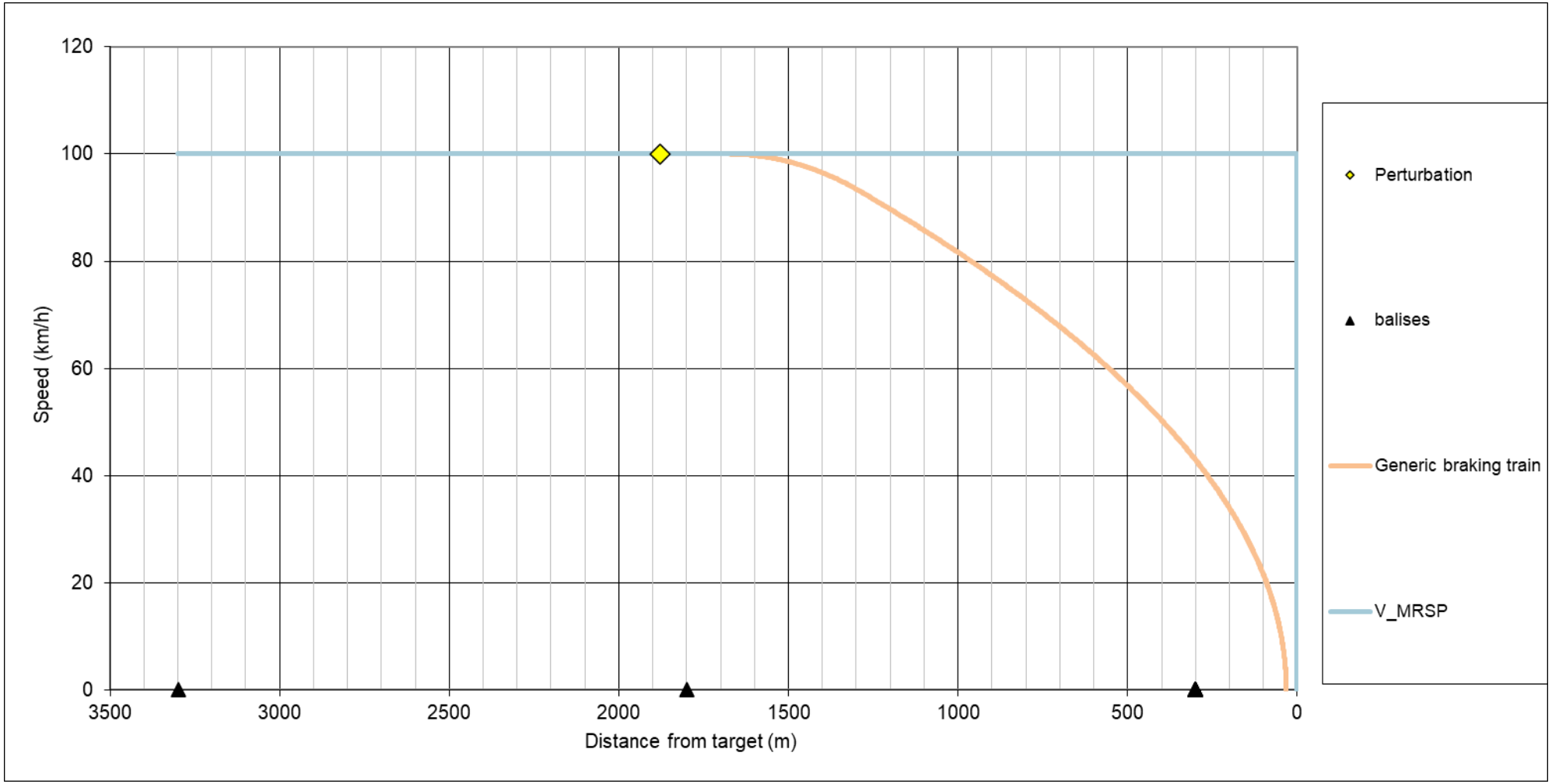

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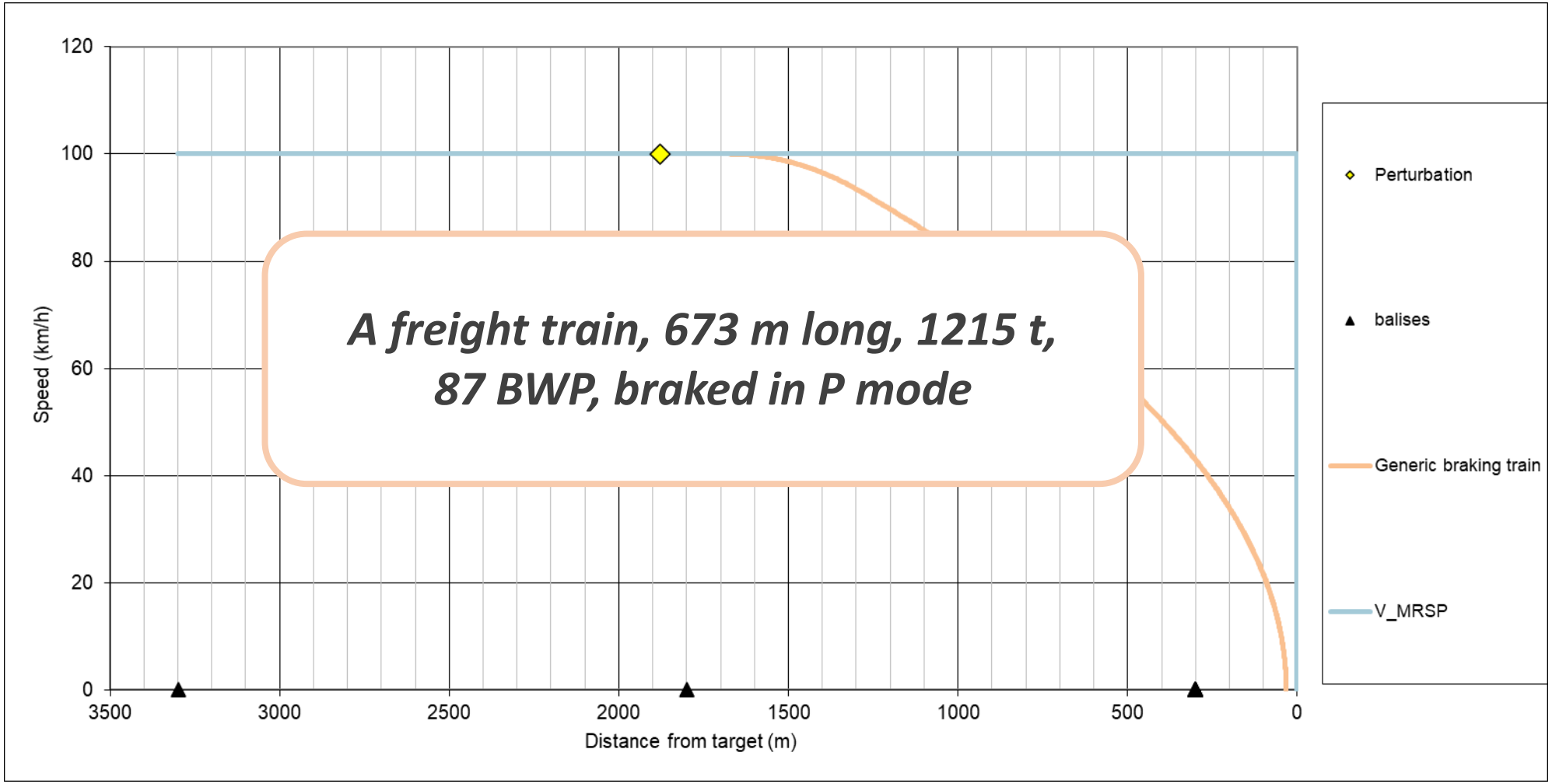

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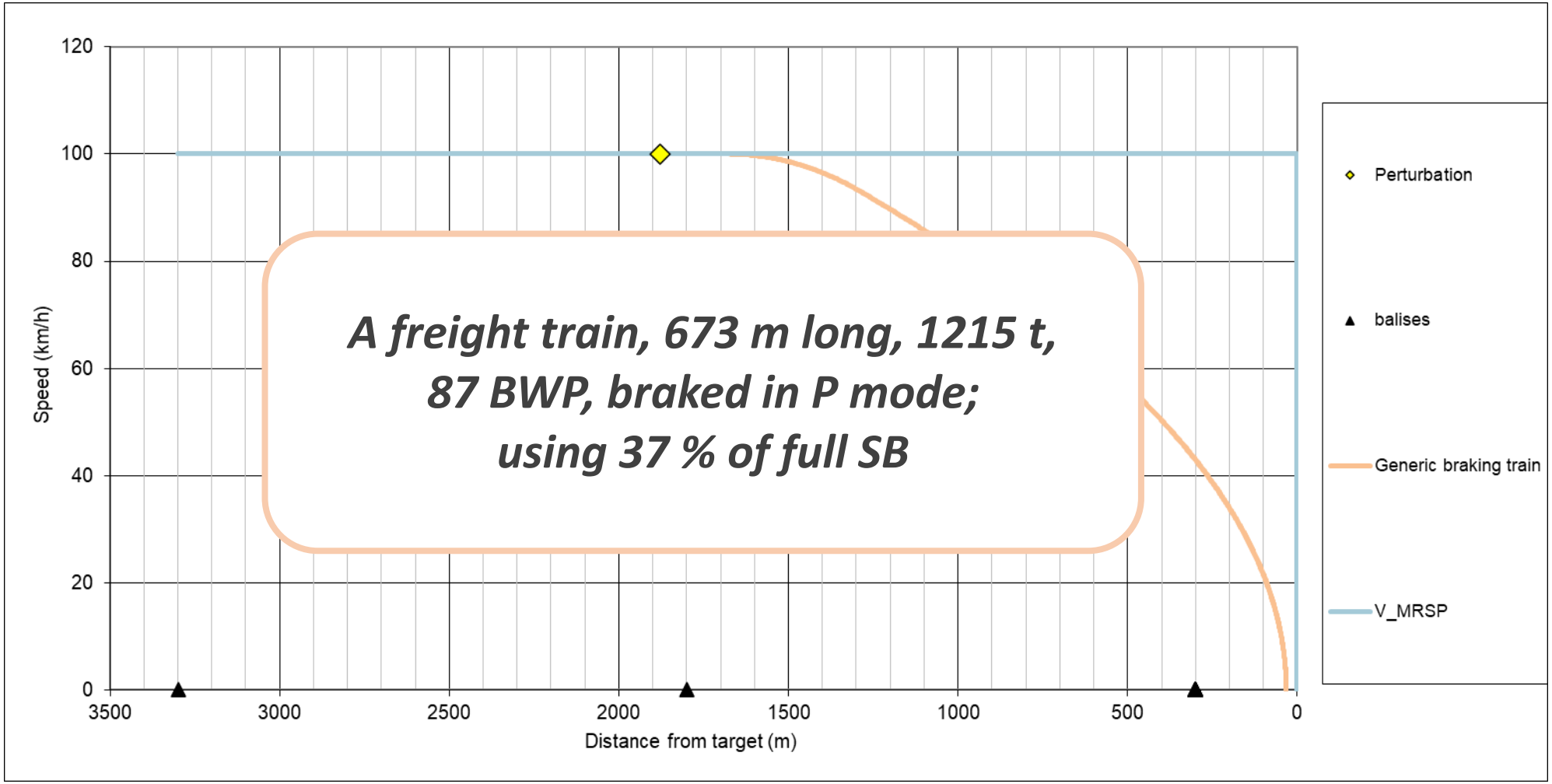

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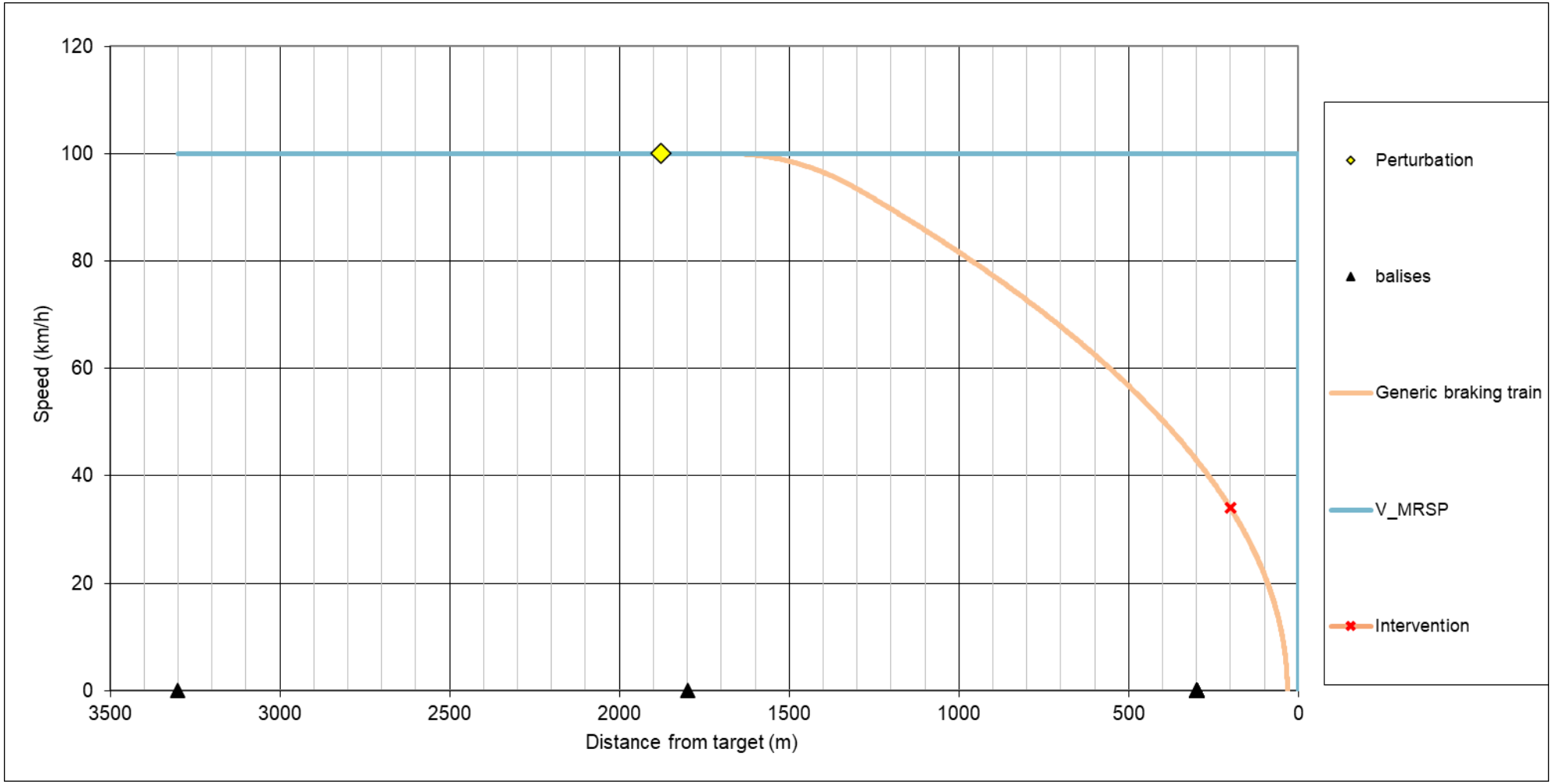

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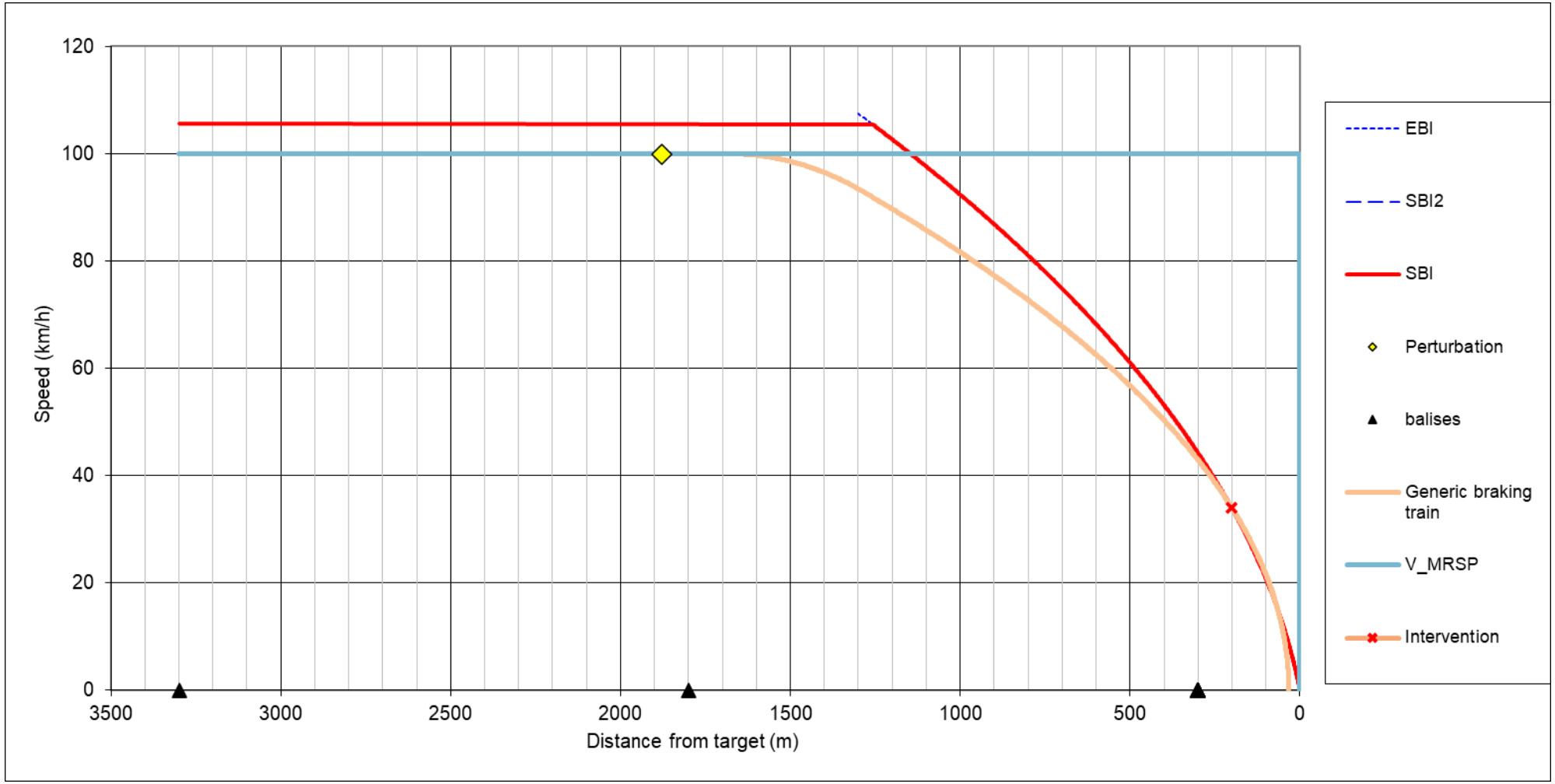

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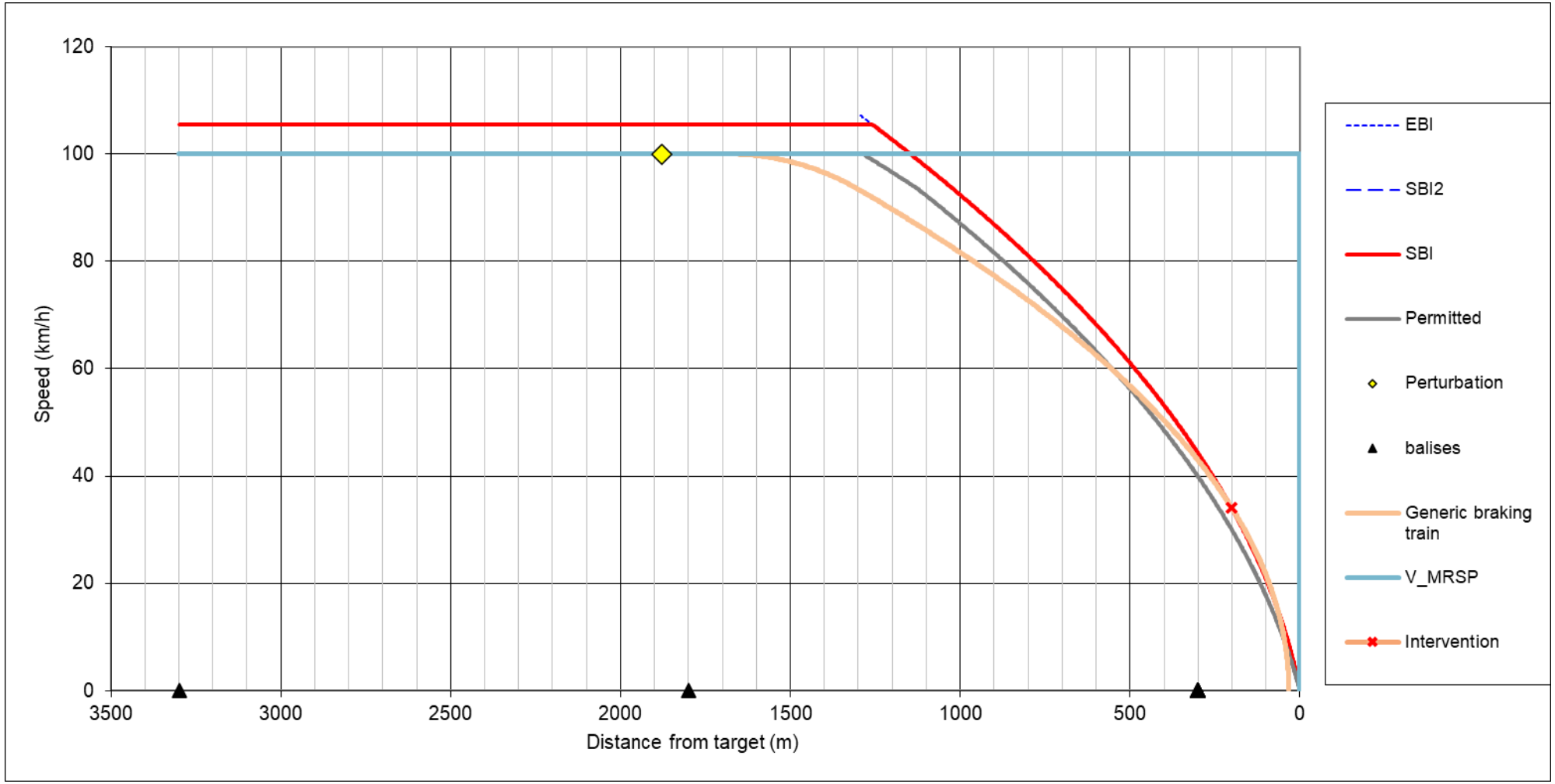

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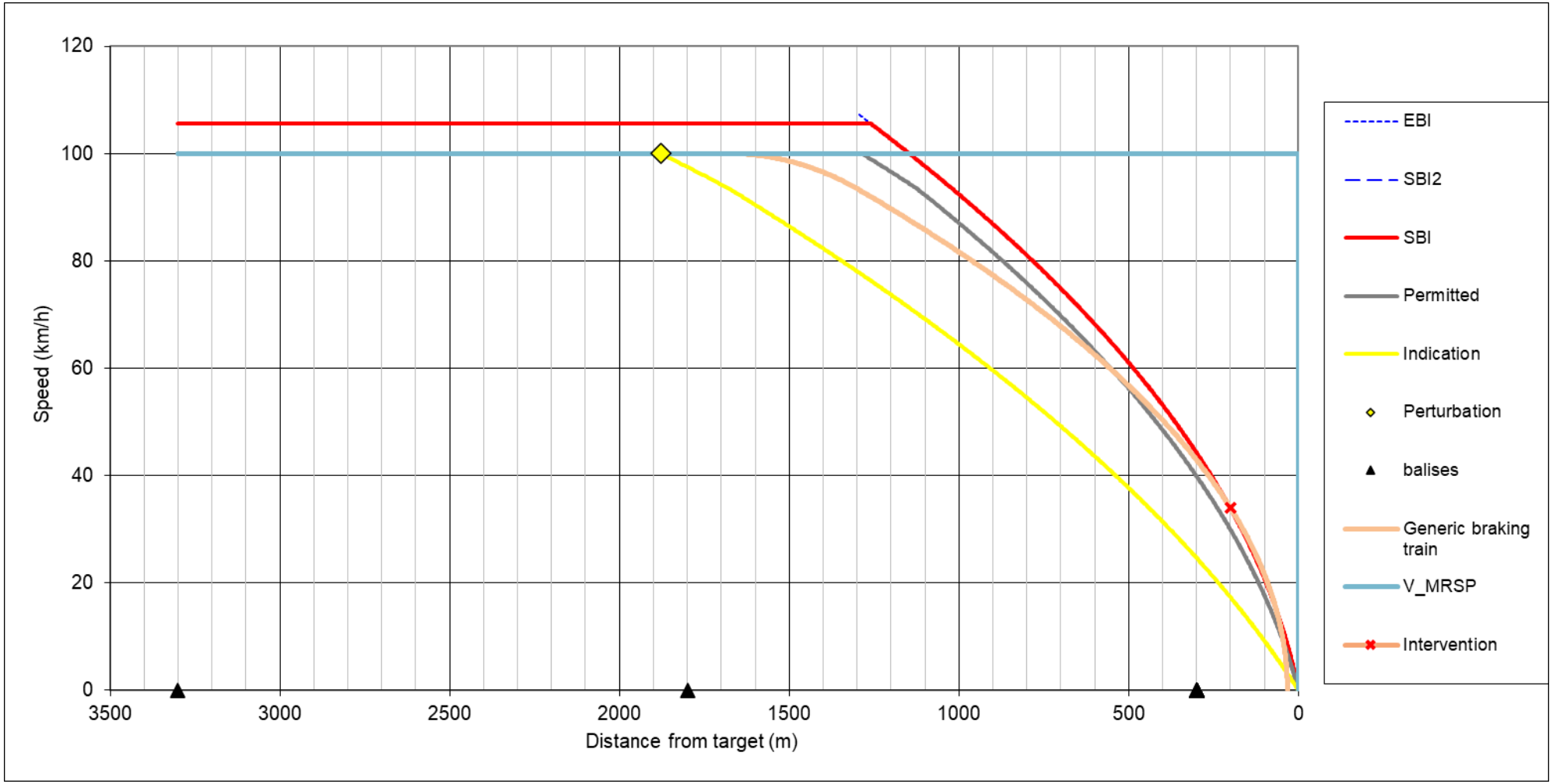

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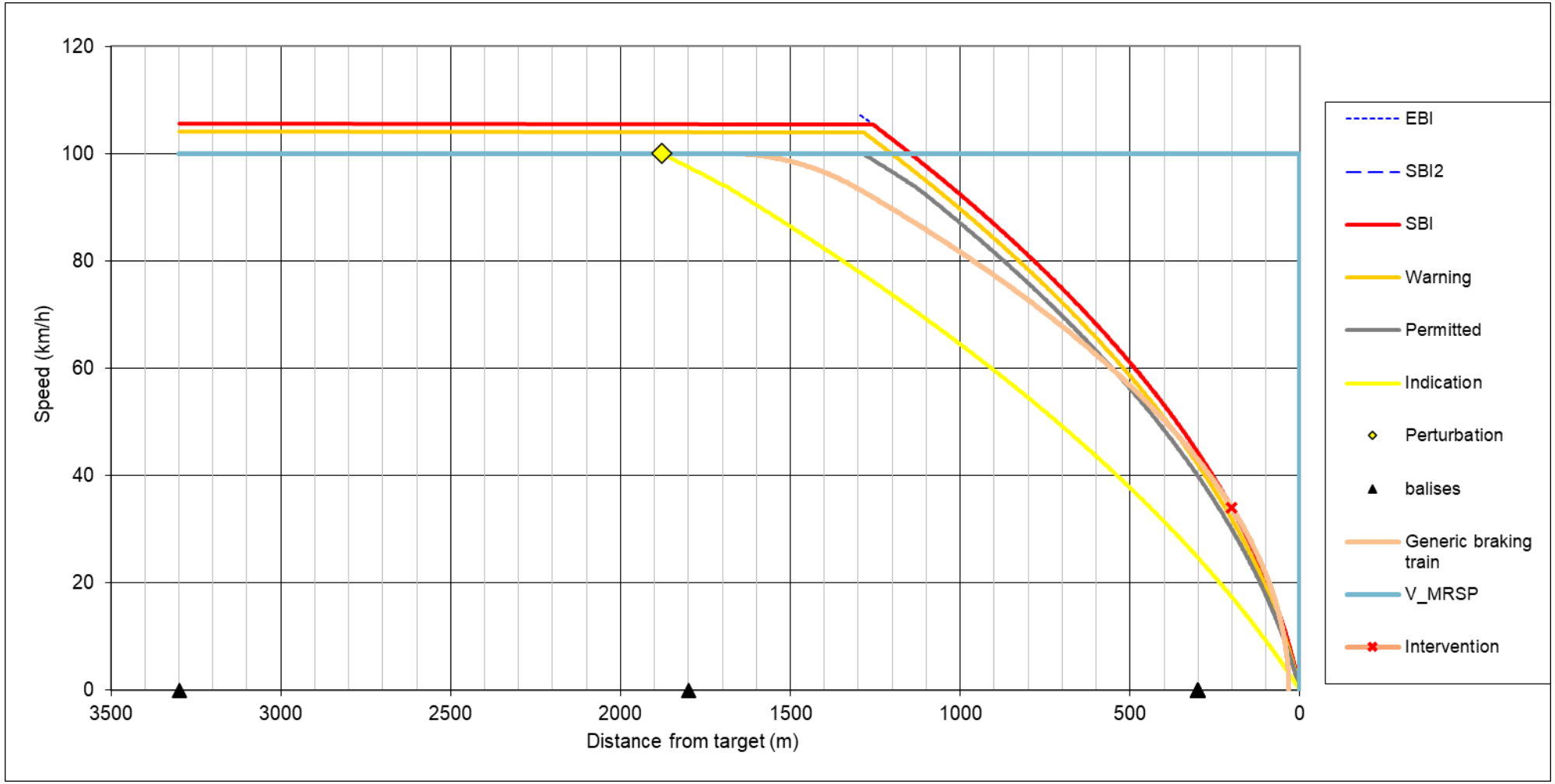

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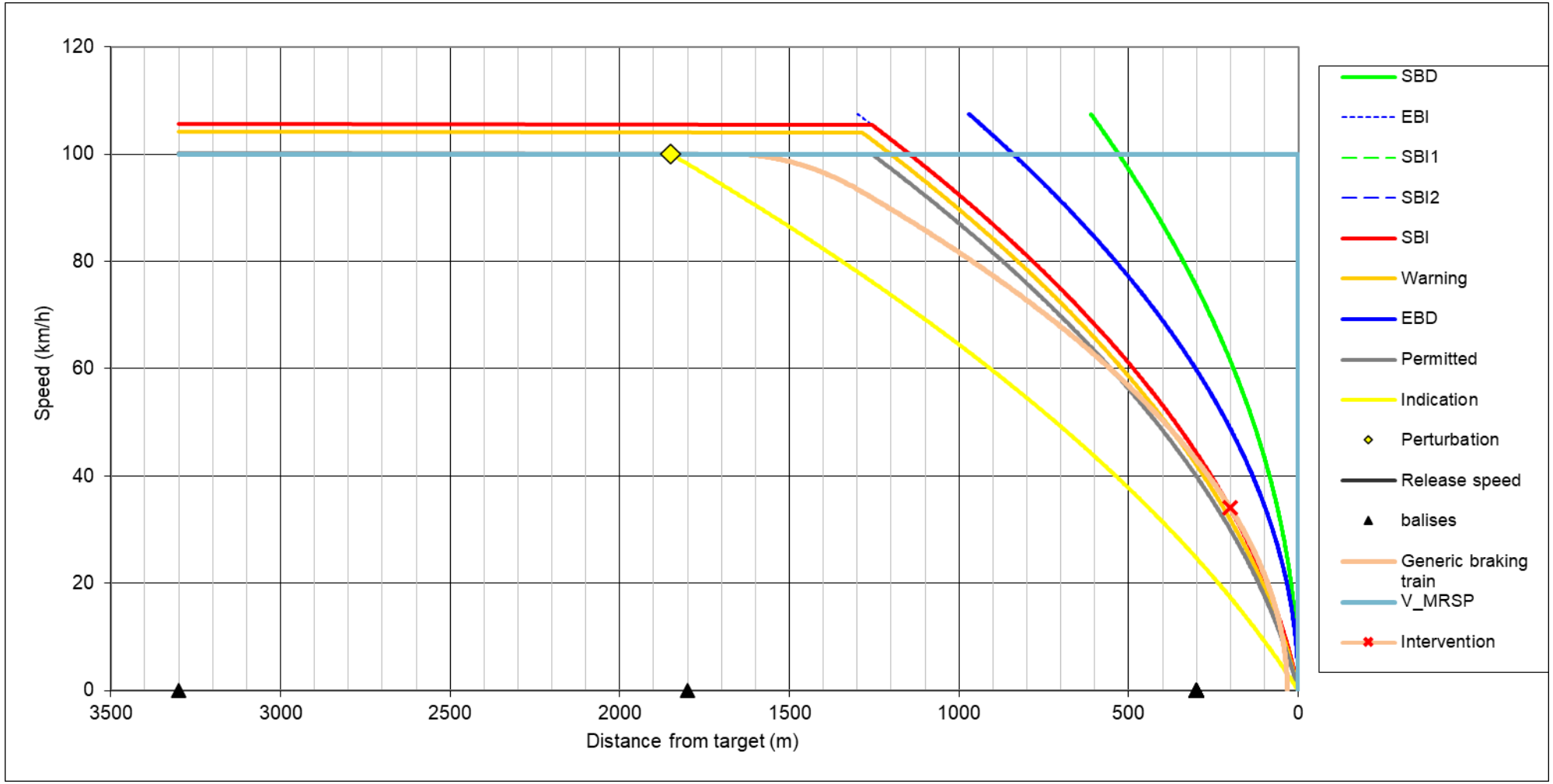

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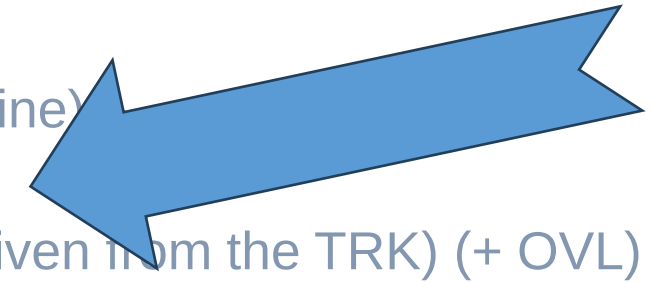
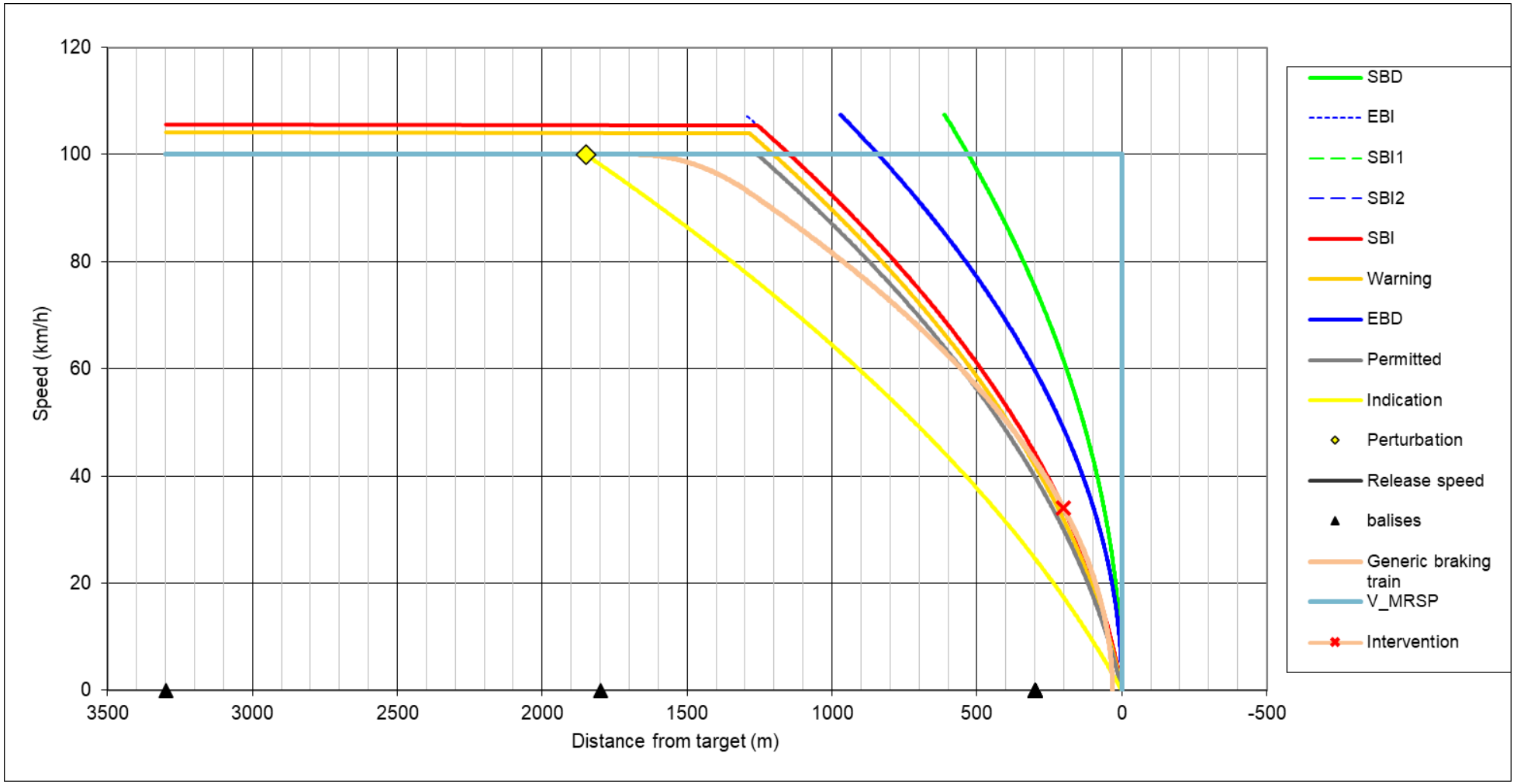
B4R1 (reduced envelope up to SV 2.2/2.1) or B3R2

- Will this train be further braked by the B3R2 ERTMS/ETCS OBU?
  - Yes, it will ☹
  - What can be done?
    - OVL by construction (on the line)
    - OVL by logic (in IXL)
    - RS (computed by OBU OR given from the TRK) (+ OVL)
    - Improving BC computations (the train can also already be braking) ☺



NOTE: We can also try to derive this with the audience; i.e., to remove it from here.

Will this train be braked by the B3R2 ETCS OBU?



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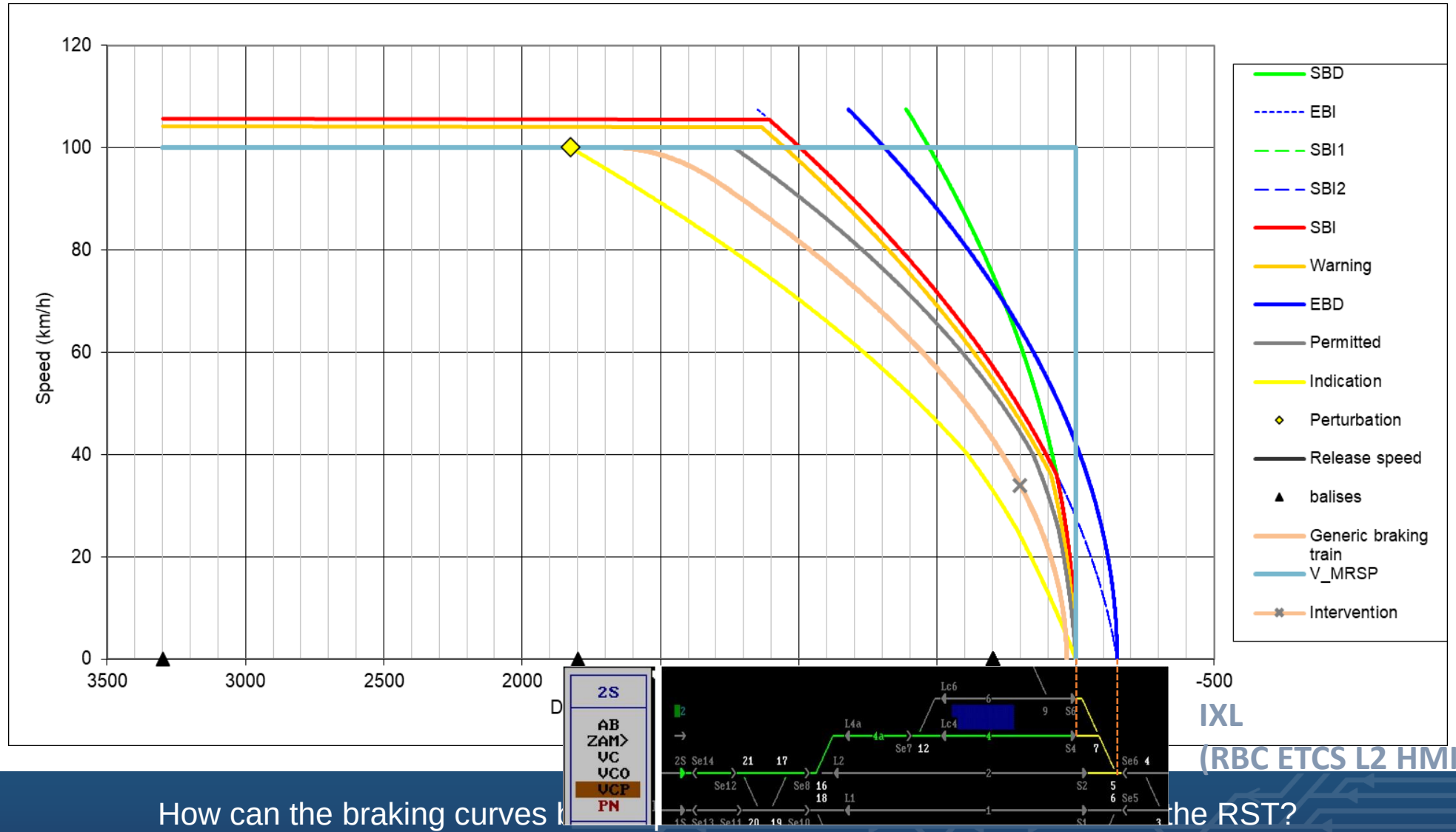
Overlap (OVL) 150 m – possibly locked too much



IXL
(RBC ETCS L2 HMI)

How can the braking curves b… the RST?
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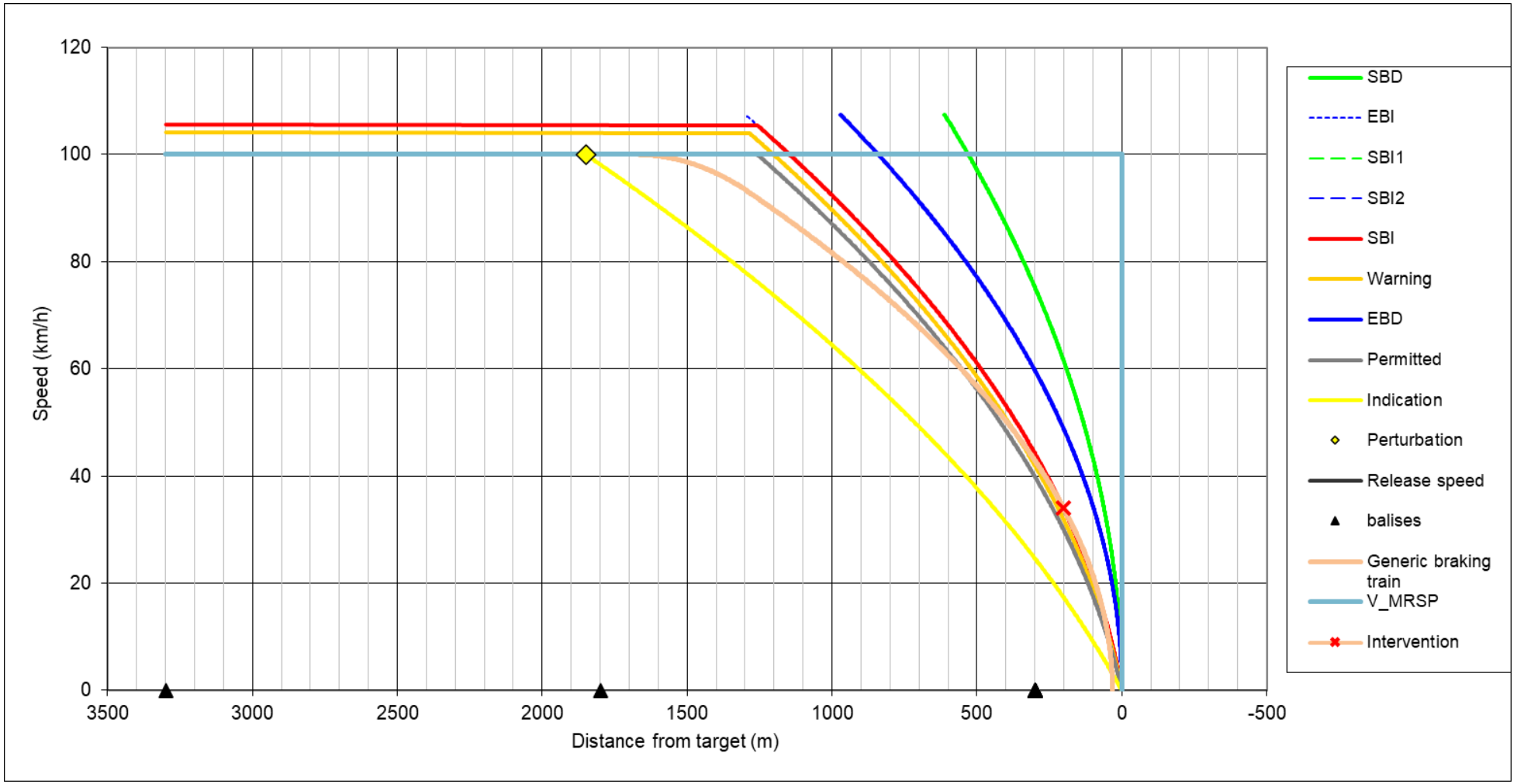

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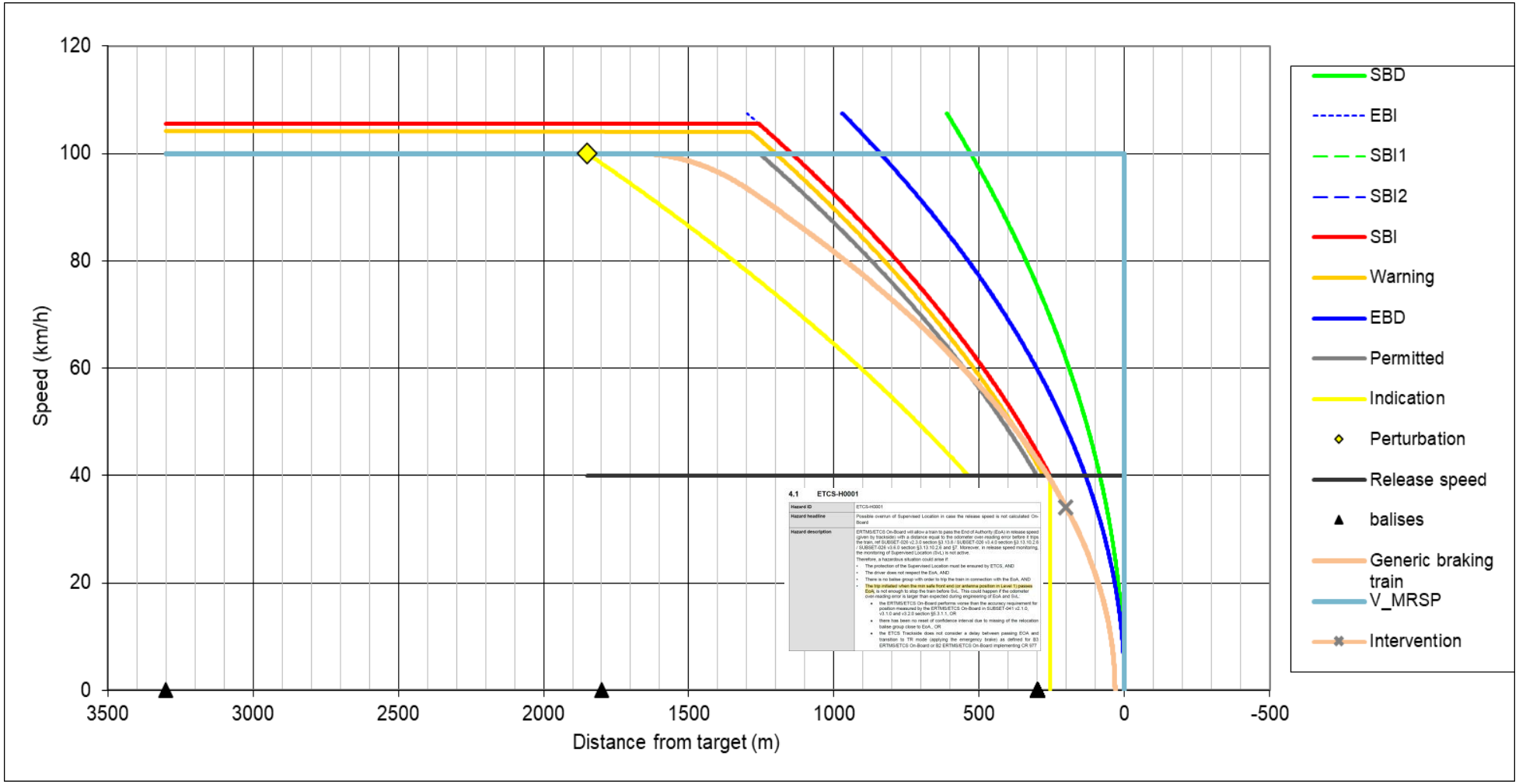
Release speed (RS) 40 km/h – possible risk (H0001)



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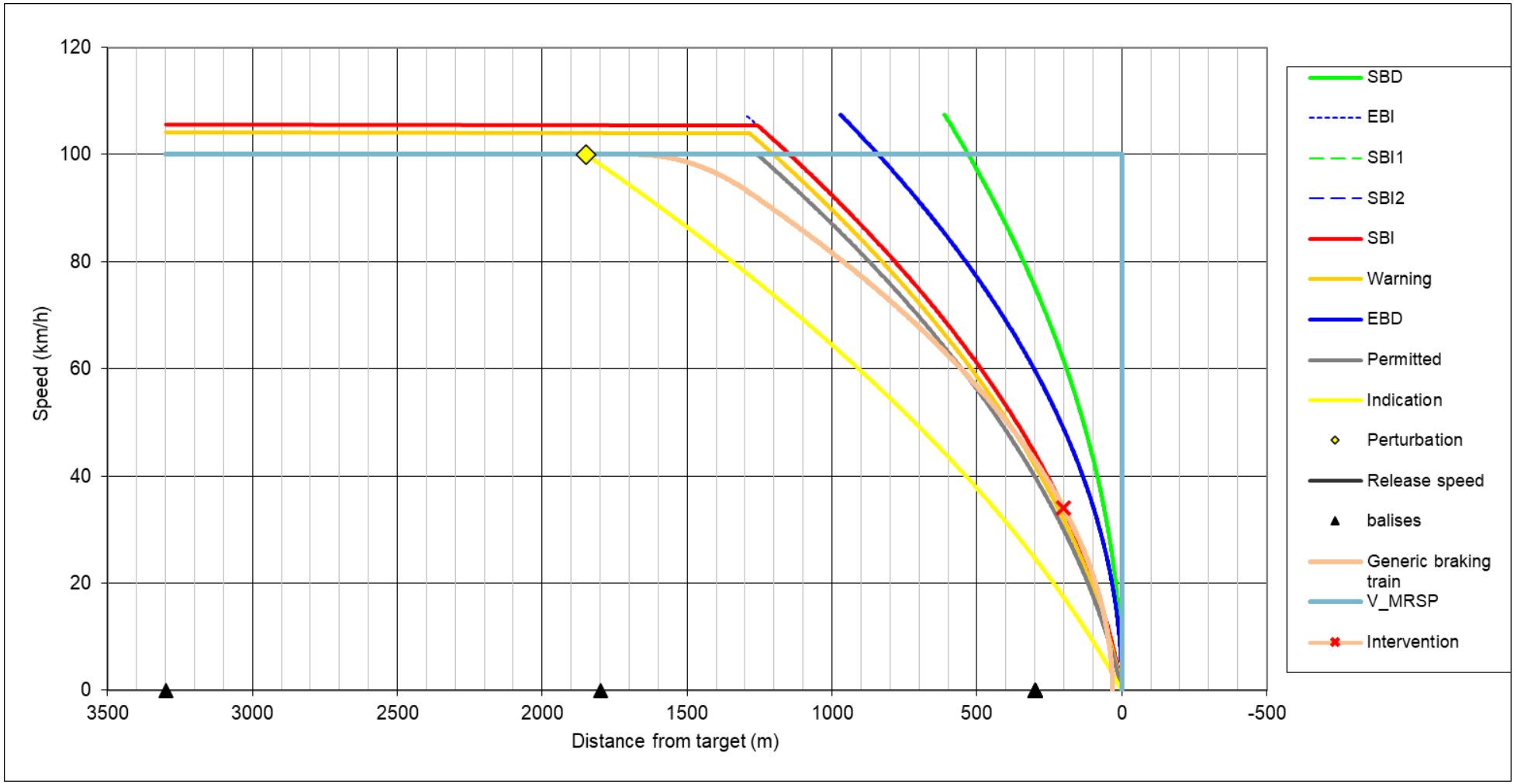

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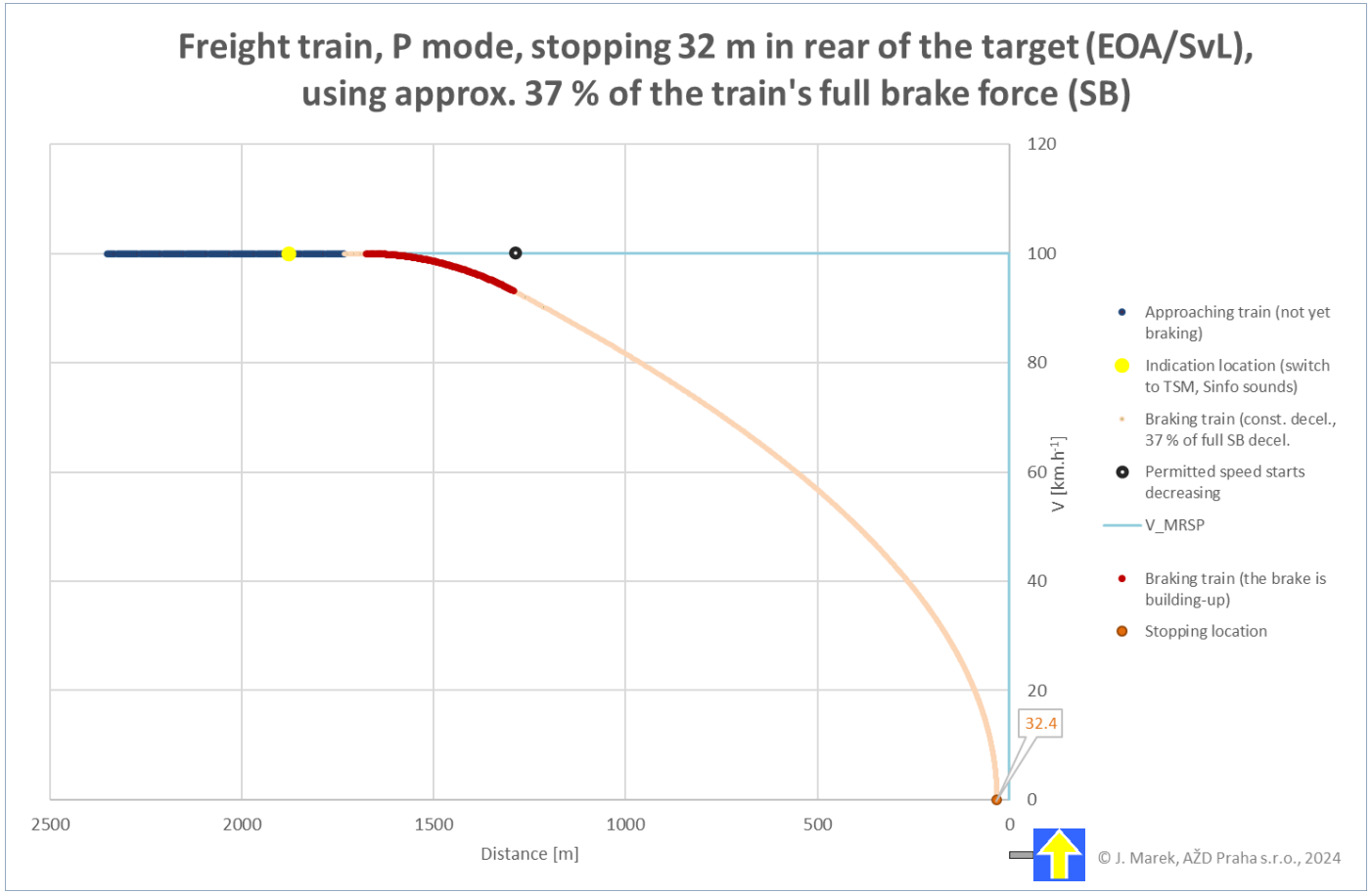
CR1385 (better handling with the measured decel.)

- Principle: For the trains braking enough (A_{est}), remove the ETCS BCs



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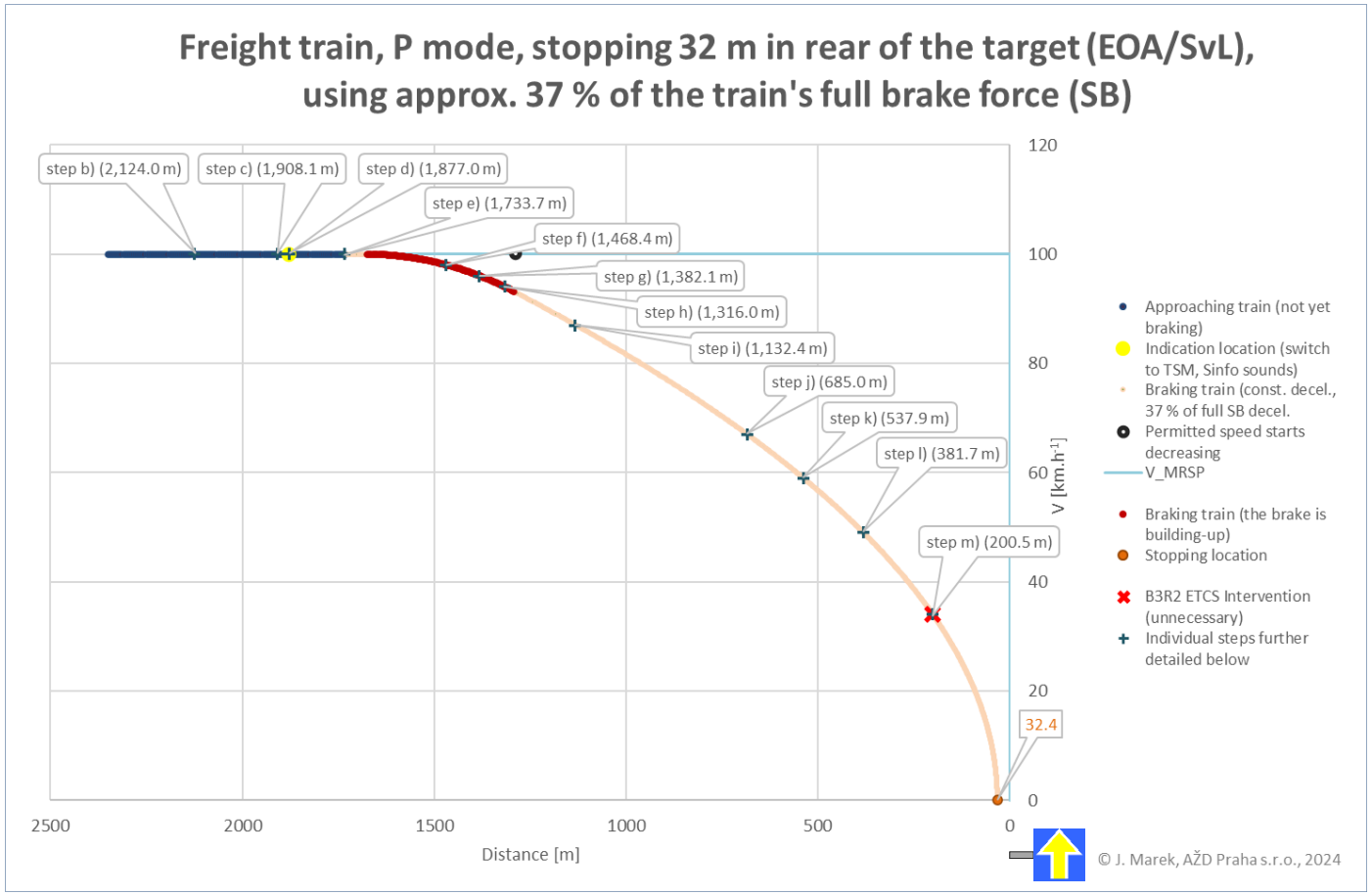

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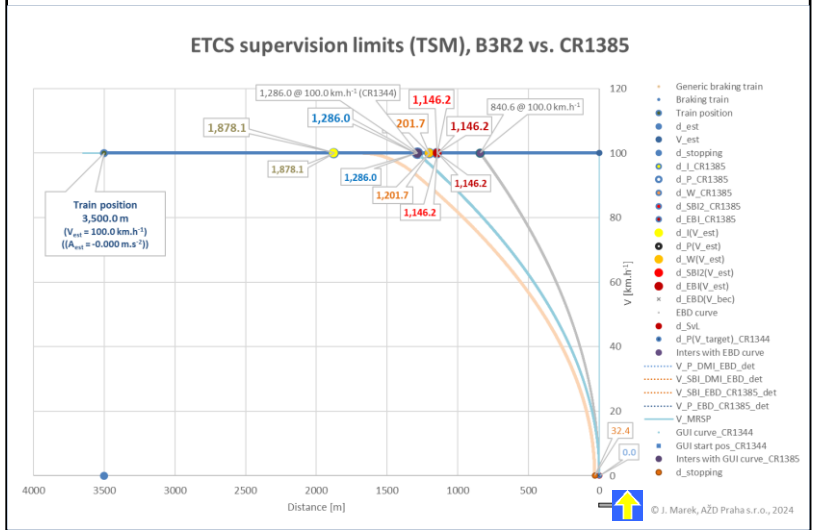
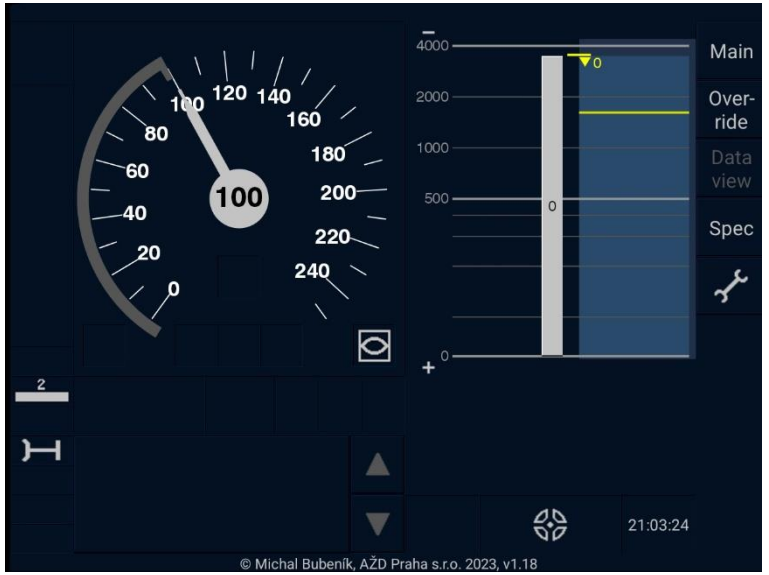
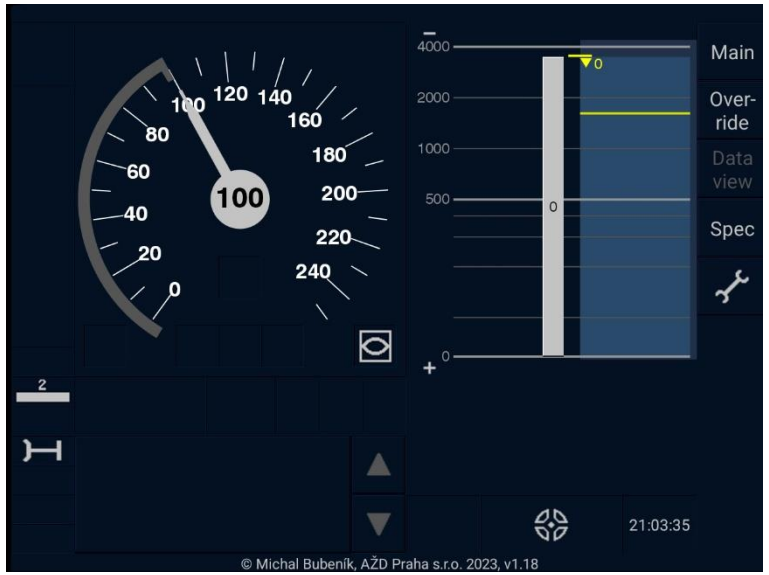
Locations of the ETCS supervision limits acc. to [B3R2 SUBSET-026] vs. [CR1385]	Corresponding display on the DMI – calculations according to	
	ETCS B3R2 SUBSET-026 & DMI	CR1385, orig. Marek, Myslivec, Bubeník, and Drápal (S+D (112) 3 and 6/2020)
a) The train is approaching a target (EOA/SvL), d_{est} = 3,500 m, V_{est} = 100 km.h^{-1}, A_{est} = 0 m.s^{-2}		
		

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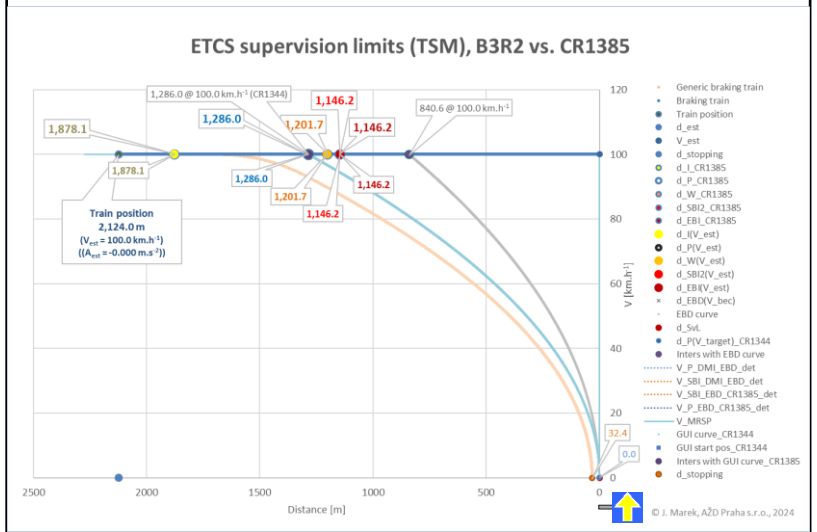
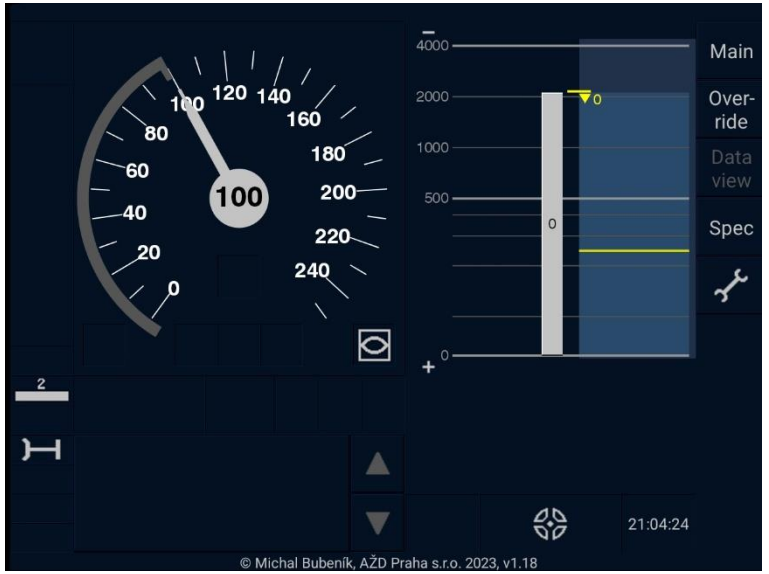
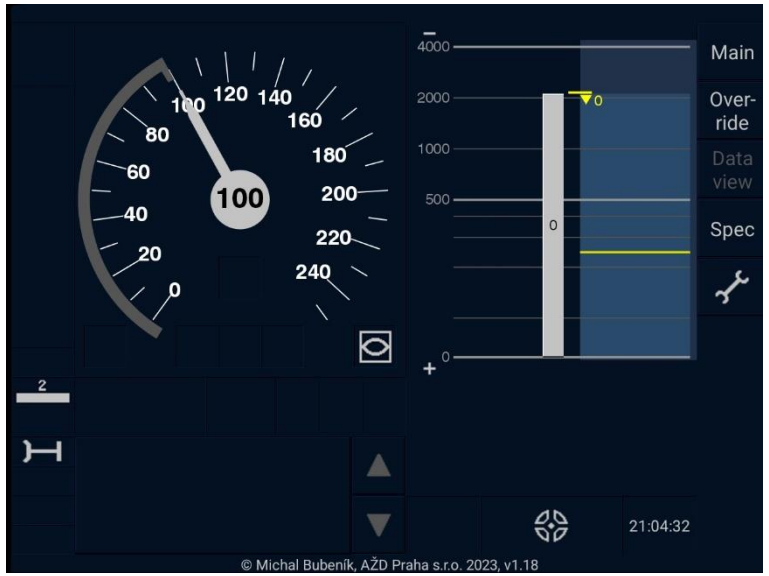
b) The train is approaching a target (EOA/SvL), d_{est} = 2,124 m, V_{est} = 100 km.h^{-1}, A_{est} = 0 m.s^{-2}		
		

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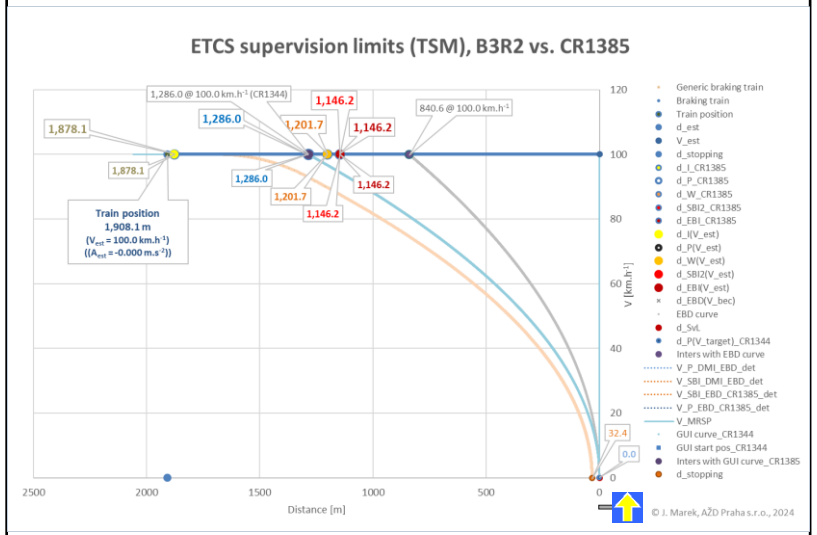
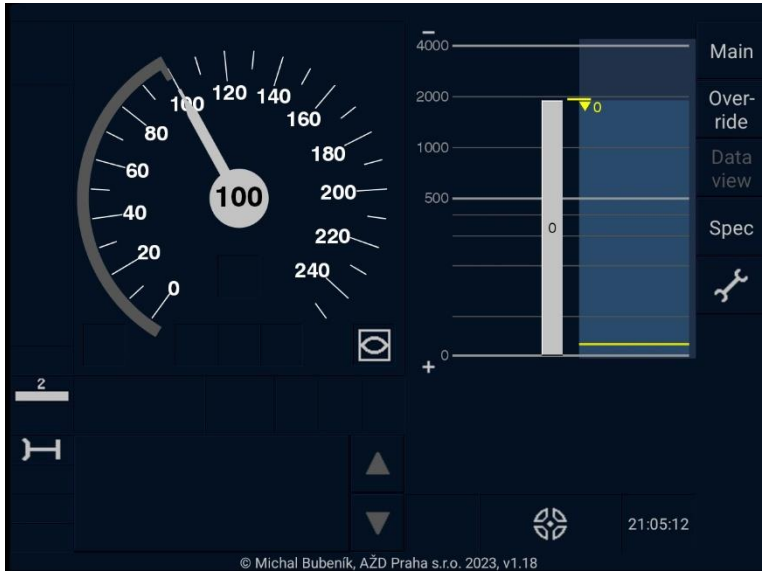
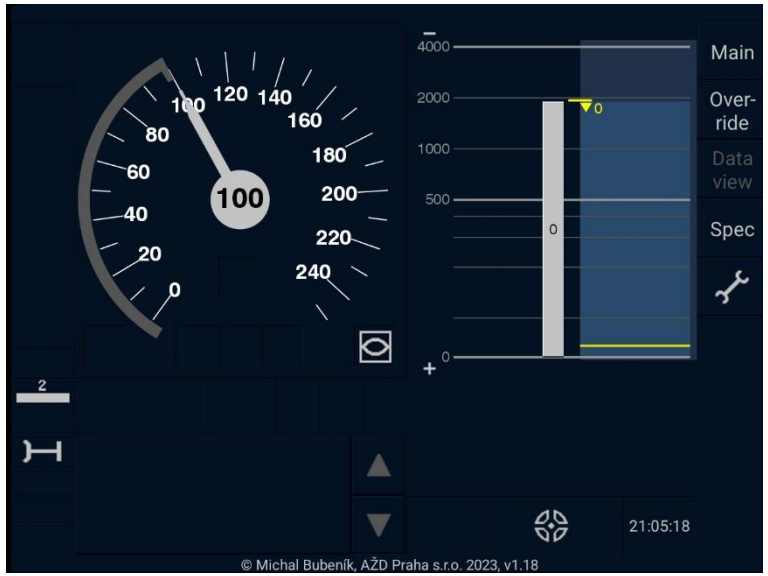
c) The train is approaching a target (EOA/SvL), d_{est} = 1,908 m, V_{est} = 100 km.h^{-1}, A_{est} = 0 m.s^{-2}		
		

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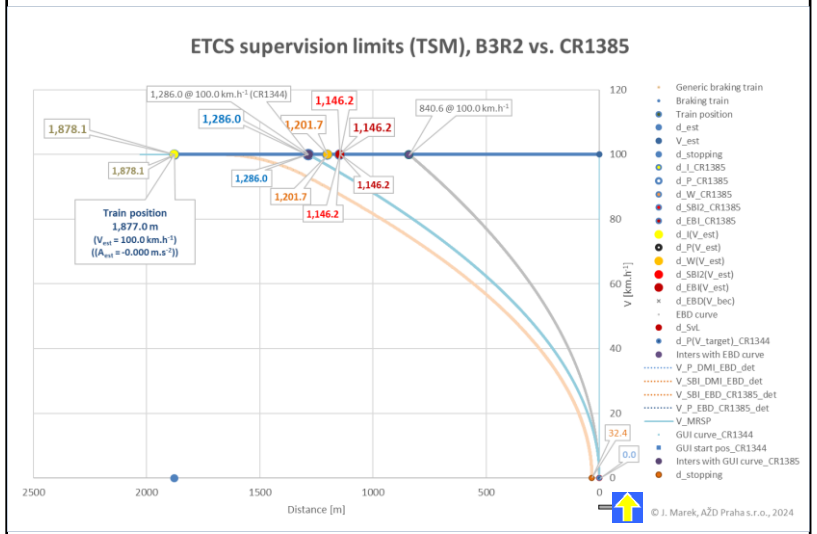
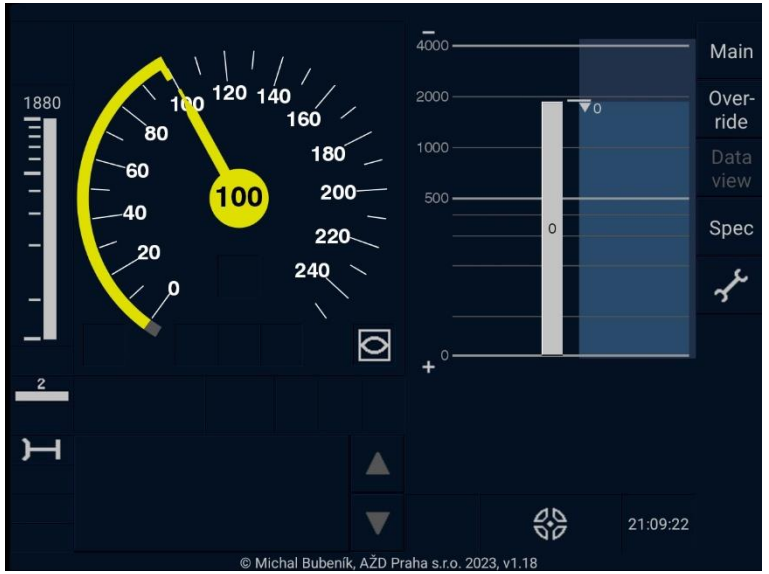
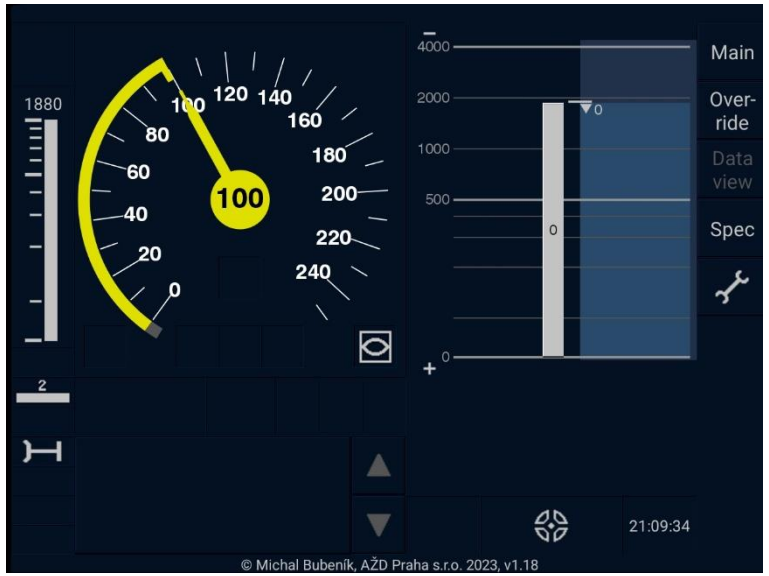
d) The train driver gets the first indication, d_{est} = 1,877 m, V_{est} = 100 km.h^{-1}, A_{est} = 0 m.s^{-2}		
		

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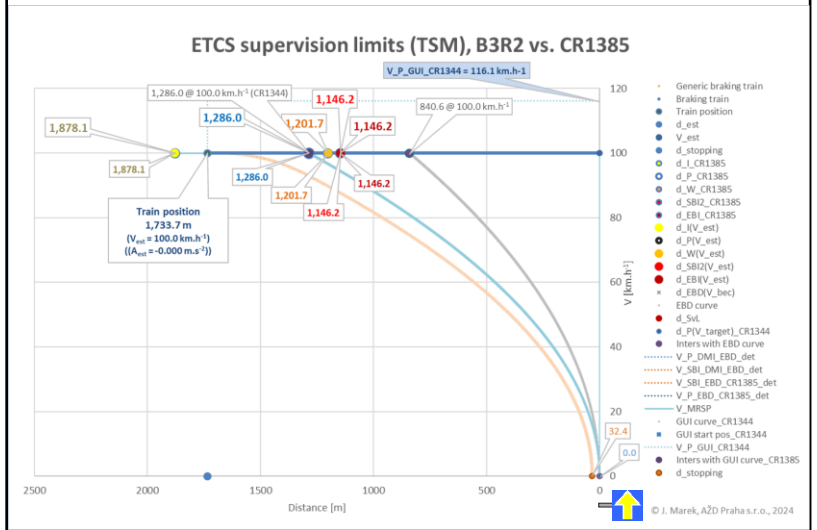
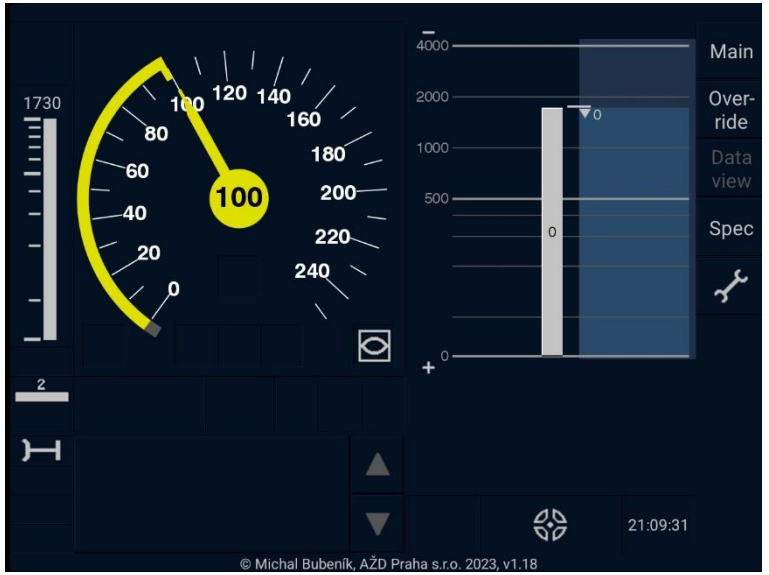
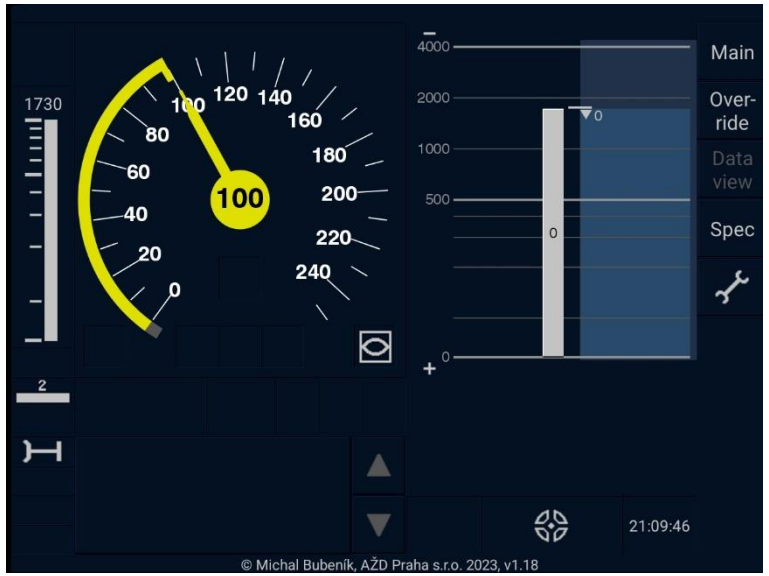
	ETCS B3R2 SUBSET-026 & DMI	CR1385, orig. Marek, Myslivec, Bubeník, and Drápal (S+D (112) 3 and 6/2020)
e) The train driver (ATO-OB) triggers the brake application, d_{est} = 1,734 m, V_{est} = 100 km.h^{-1}, A_{est} = -0.266 m.s^{-2}		
		

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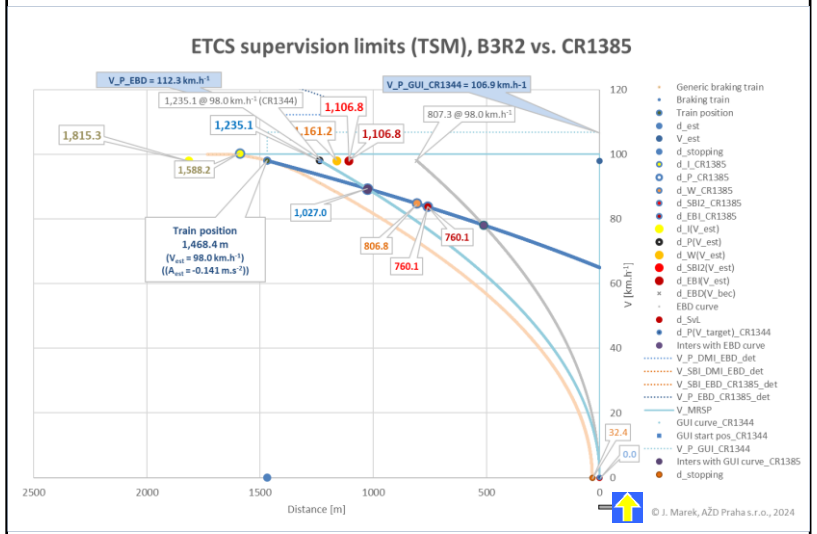
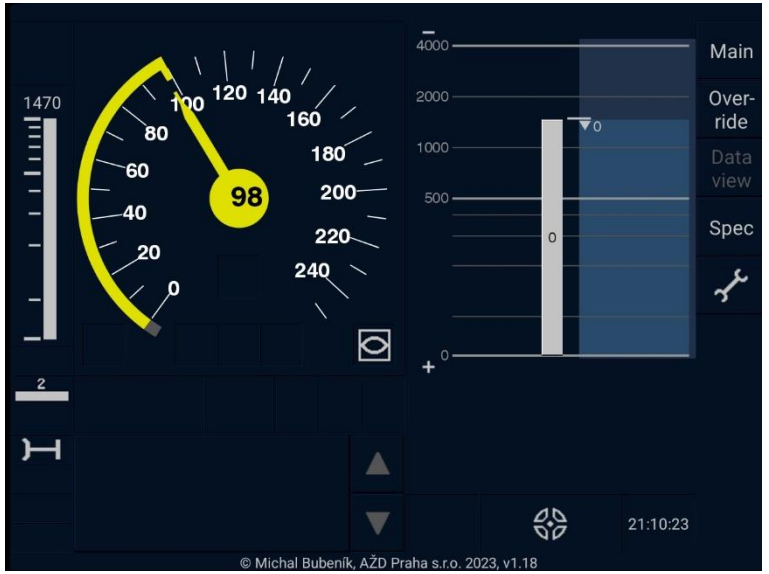
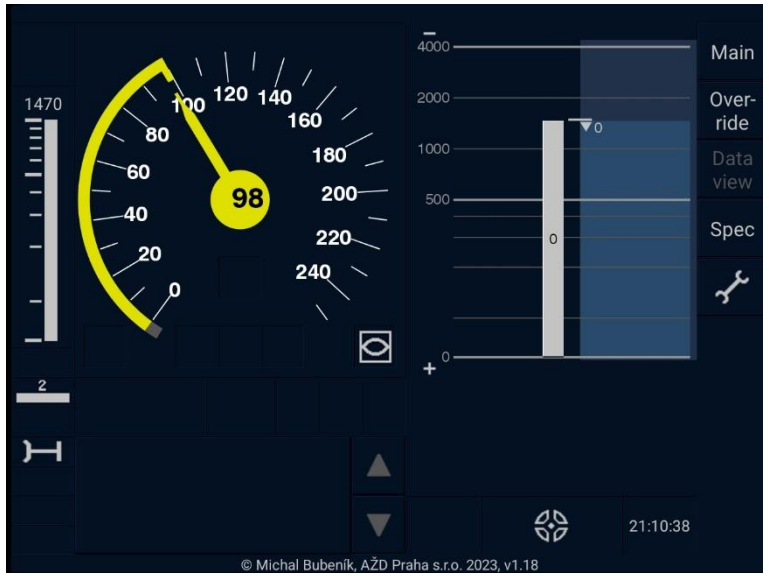
f) The brake is building-up (to 37 % of its full SB application), d_{est} = 1,468 m, V_{est} = 98 km.h^{-1}, A_{est} = -0.141 m.s^{-2}		
		

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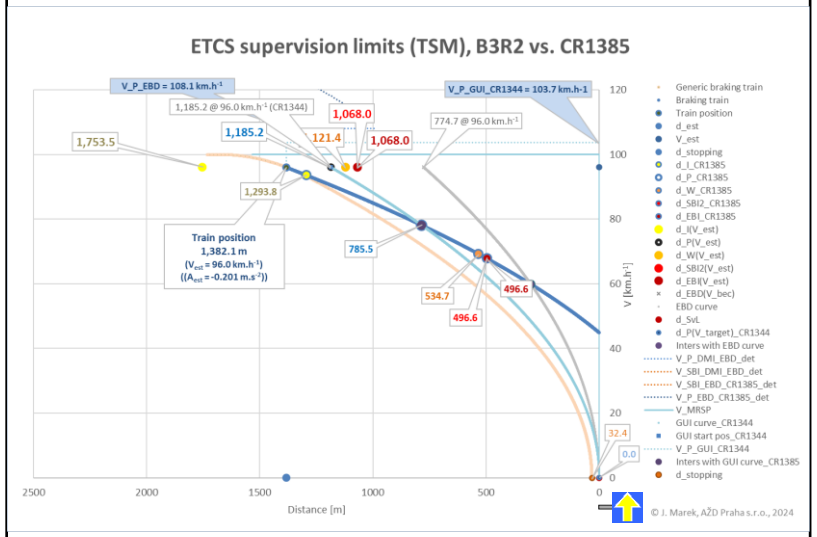
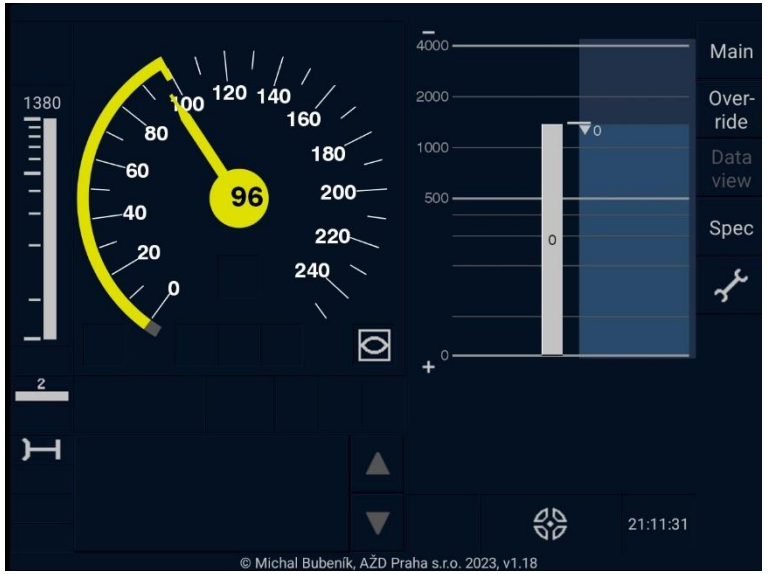
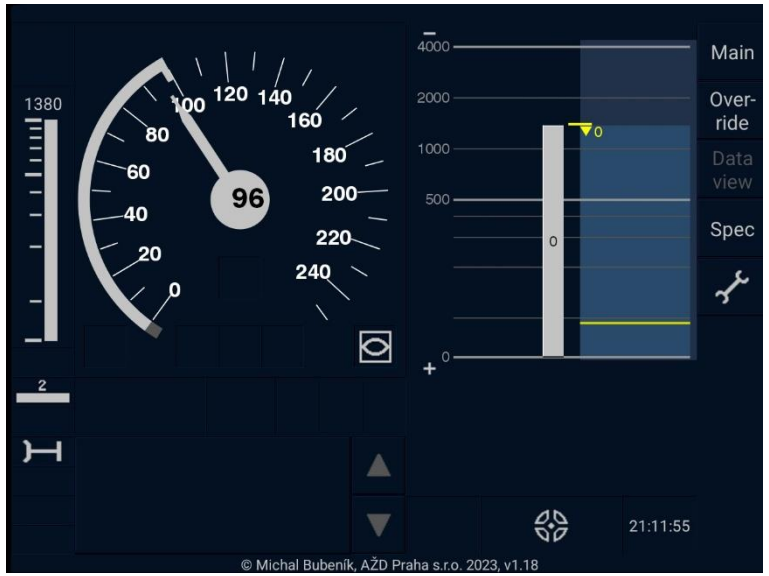
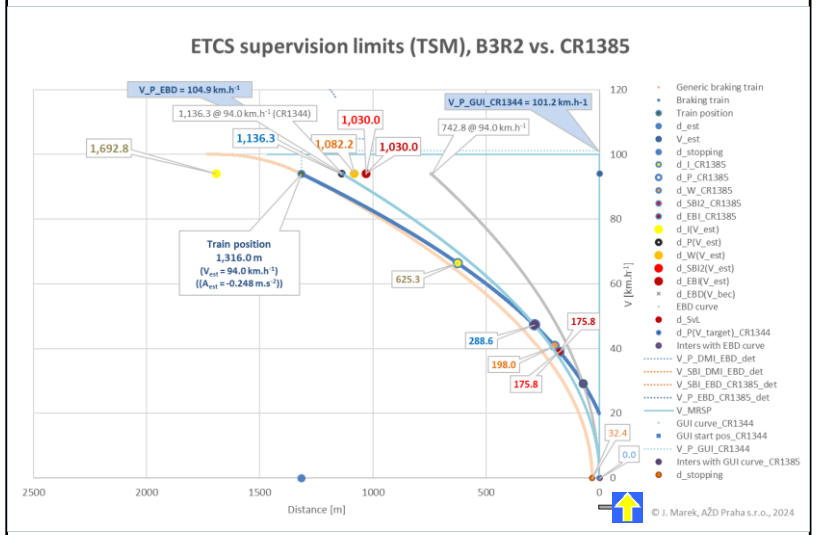
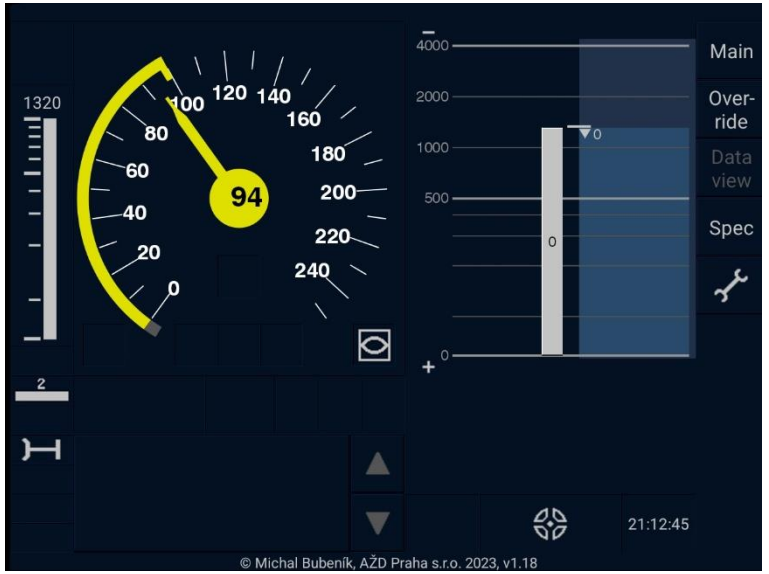
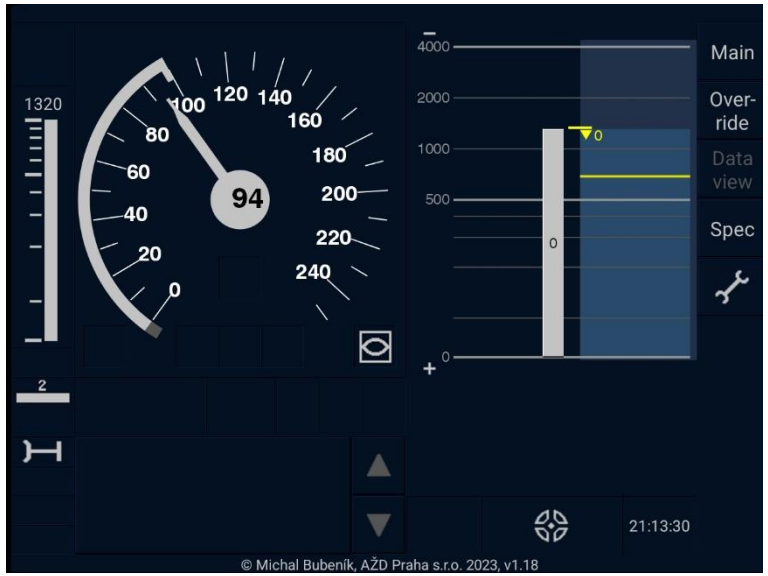
Locations of the ETCS supervision limits acc. to [B3R2 SUBSET-026] vs. [CR1385]	Corresponding display on the DMI – calculations according to	
	ETCS B3R2 SUBSET-026 & DMI	CR1385, orig. Marek, Myslivec, Bubeník, and Drápal (S+D (112) 3 and 6/2020)
g) The brake is building-up (to 37 % of its full SB application), d_{est} = 1,382 m, V_{est} = 96 km.h^{-1}, A_{est} = -0.201 m.s^{-2}		
		

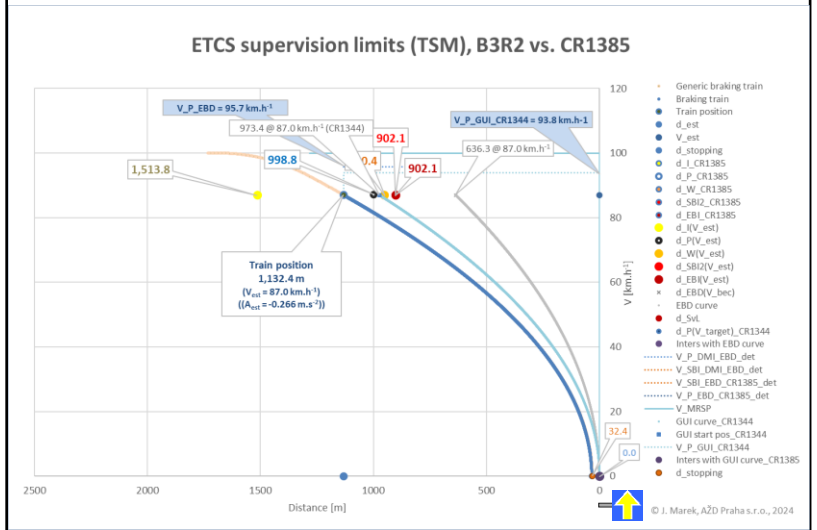
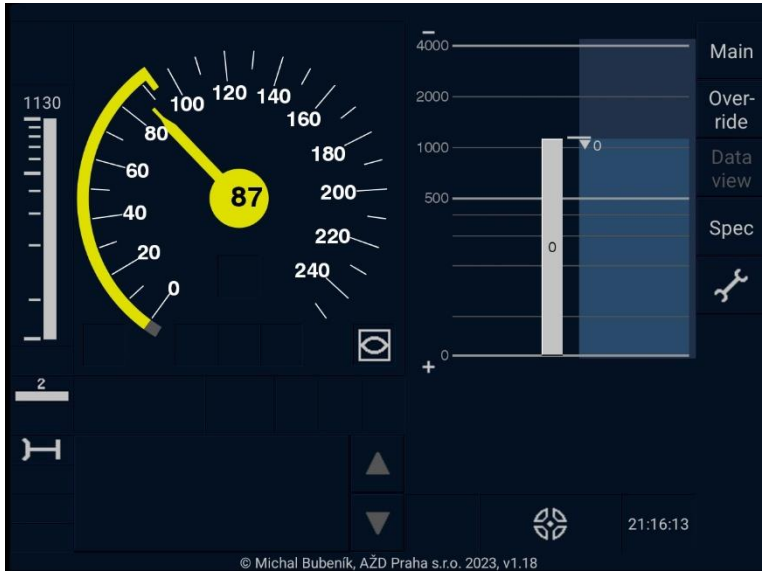
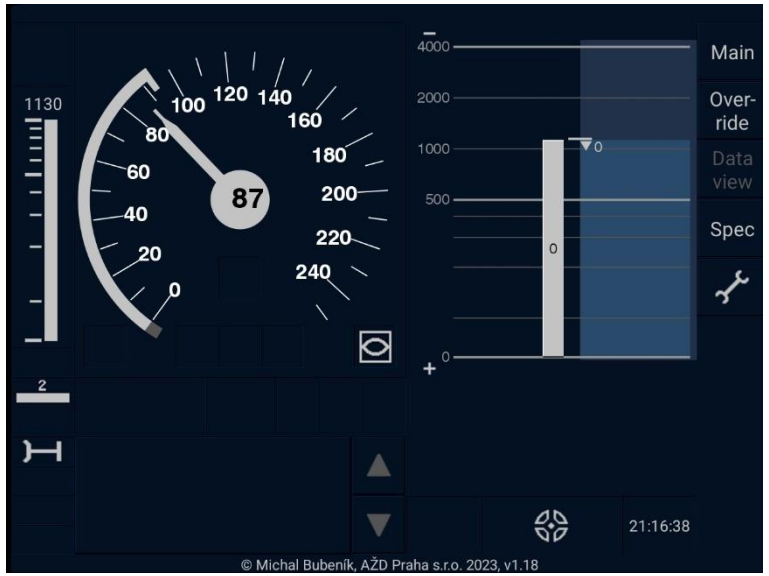
CR1385 (better handling with the measured decel.)

- Principle: For the trains braking enough (A_{est}), remove the ETCS BCs

Locations of the ETCS supervision limits acc. to [B3R2 SUBSET-026] vs. [CR1385]	Corresponding display on the DMI – calculations according to	
	ETCS B3R2 SUBSET-026 & DMI	CR1385, orig. Marek, Myslivec, Bubeník, and Drápal (S+D (112) 3 and 6/2020)
h) The brake is building-up (to 37 % of its full SB application), d_{est} = 1,316 m, V_{est} = 94 km.h^{-1}, A_{est} = -0.248 m.s^{-2}		
		

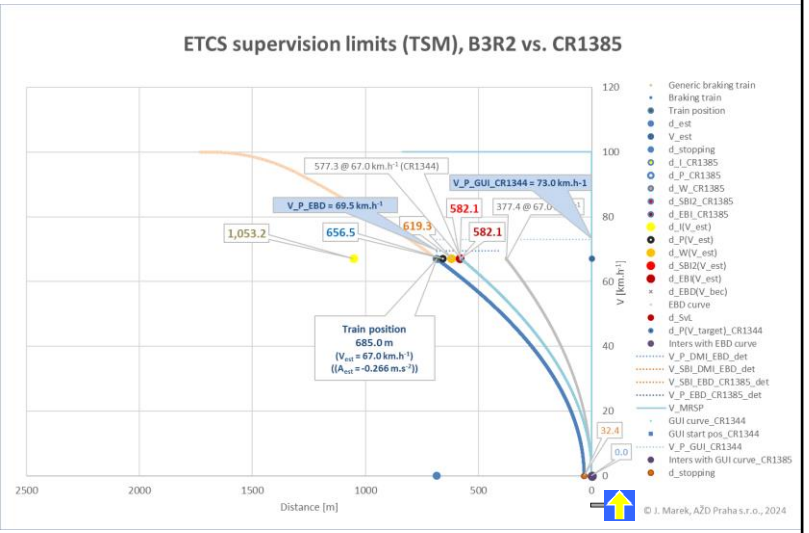
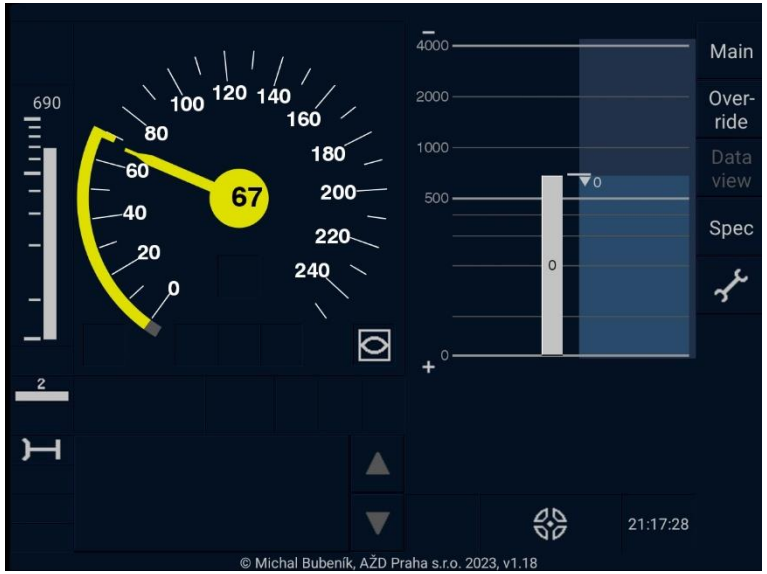
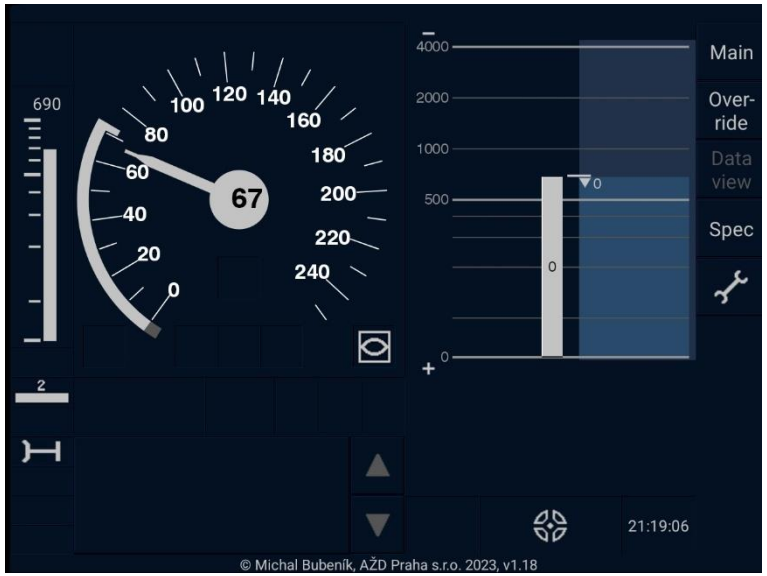
CR1385 (better handling with the measured decel.)

- Principle: For the trains braking enough (A_{est}), remove the ETCS BCs

Locations of the ETCS supervision limits acc. to [B3R2 SUBSET-026] vs. [CR1385]	Corresponding display on the DMI – calculations according to	
	ETCS B3R2 SUBSET-026 & DMI	CR1385, orig. Marek, Myslivec, Bubeník, and Drápal (S+D (112) 3 and 6/2020)
i) The brake has built-up to 37 % of its full SB application, d_{est} = 1,132 m, V_{est} = 87 km.h^{-1}, A_{est} = -0.266 m.s^{-2}		
		

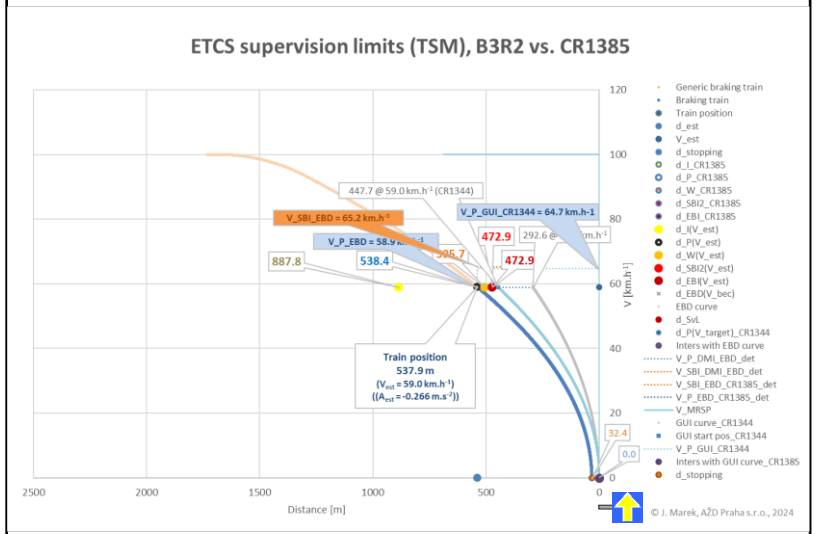
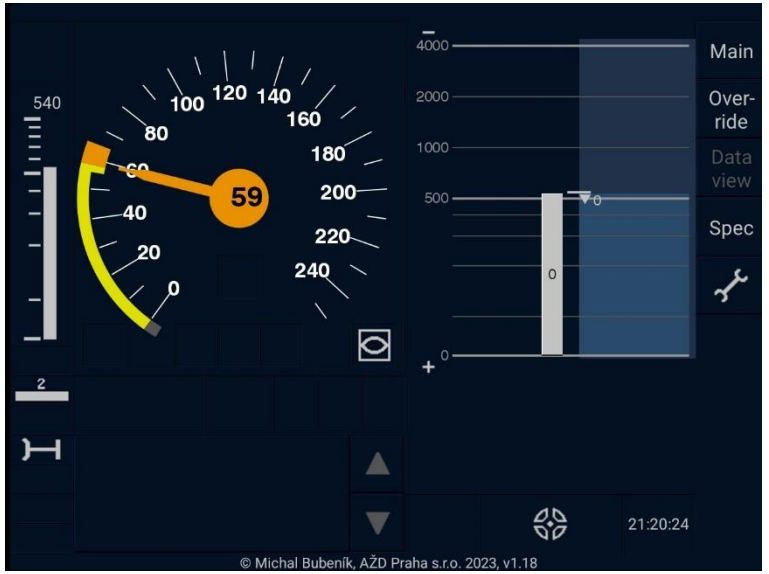
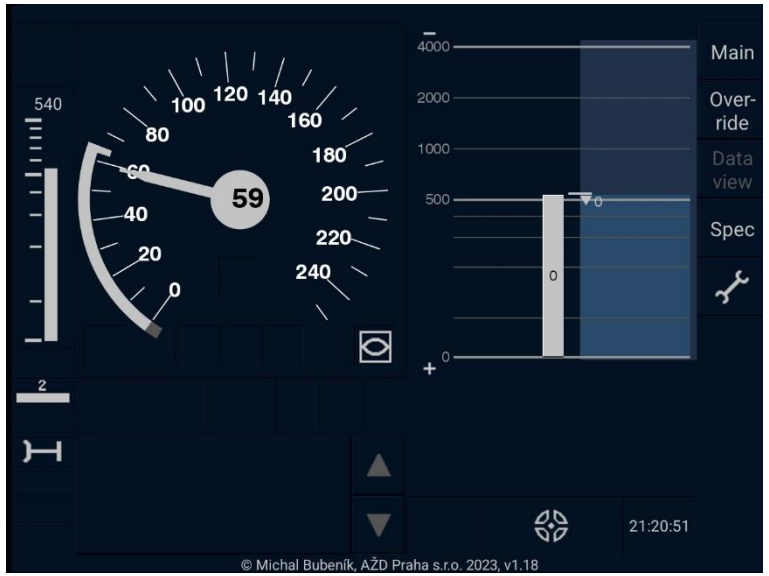
CR1385 (better handling with the measured decel.)

- Principle: For the trains braking enough (A_{est}), remove the ETCS BCs

Locations of the ETCS supervision limits acc. to [B3R2 SUBSET-026] vs. [CR1385]	Corresponding display on the DMI – calculations according to	
	ETCS B3R2 SUBSET-026 & DMI	CR1385, orig. Marek, Myslivec, Bubeník, and Drápal (S+D (112) 3 and 6/2020)
j) The train is braking to a stand with 37 % of its full SB application, d_{est} = 685 m, V_{est} = 67 km.h^{-1}, A_{est} = -0.266 m.s^{-2}		
		

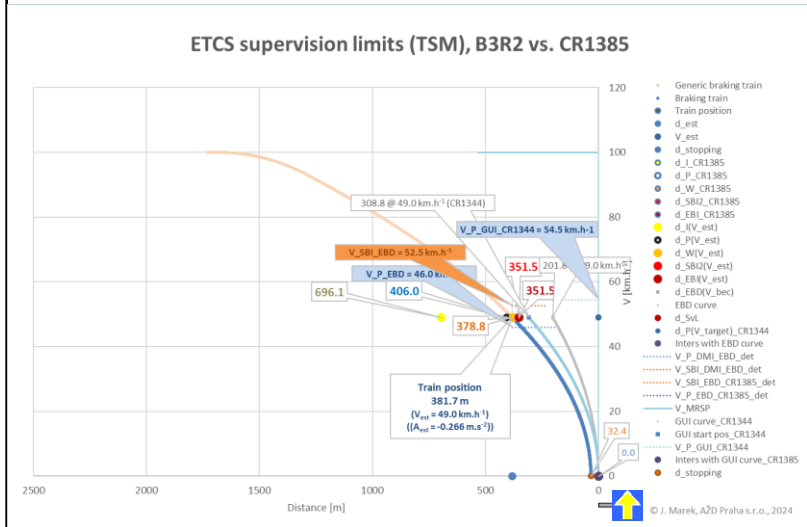
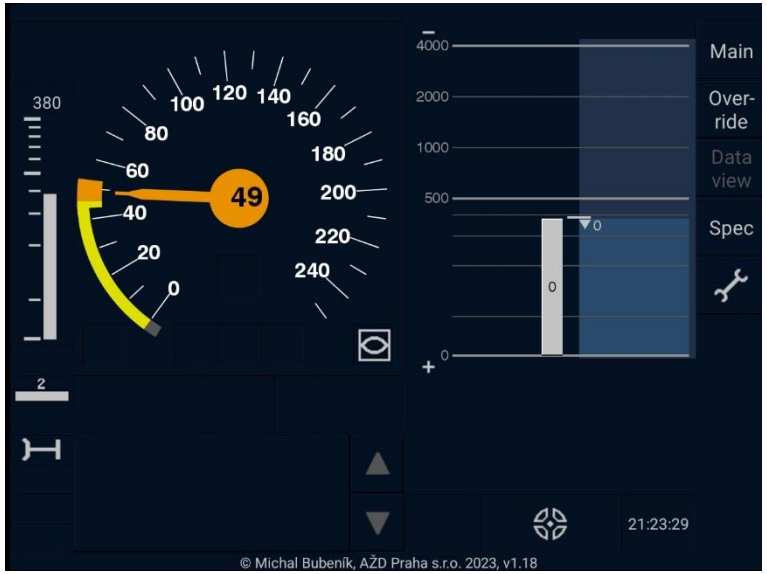
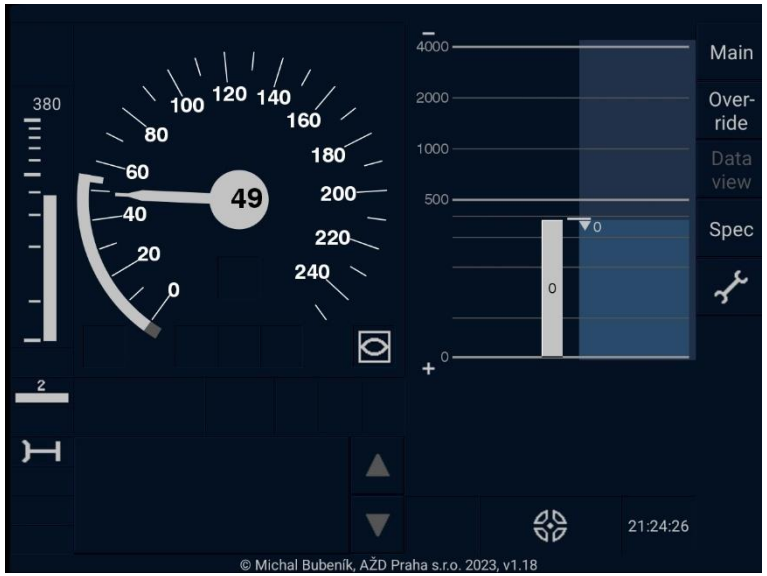
CR1385 (better handling with the measured decel.)

- Principle: For the trains braking enough (A_{est}), remove the ETCS BCs

Locations of the ETCS supervision limits acc. to [B3R2 SUBSET-026] vs. [CR1385]	Corresponding display on the DMI – calculations according to	
	ETCS B3R2 SUBSET-026 & DMI	CR1385, orig. Marek, Myslivec, Bubeník, and Drápal (S+D (112) 3 and 6/2020)
k) The train is braking to a stand with 37 % of its full SB application, d_{est} = 538 m, V_{est} = 59 km.h^{-1}, A_{est} = -0.266 m.s^{-2}		
		

CR1385 (better handling with the measured decel.)

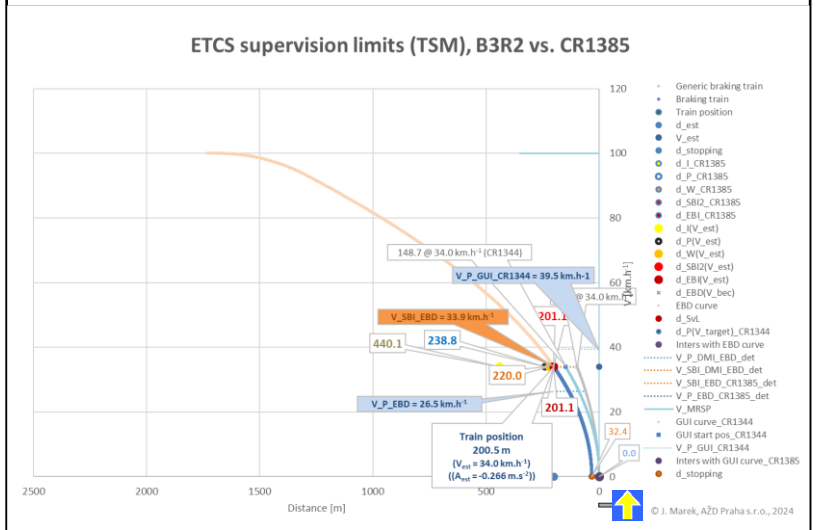
- Principle: For the trains braking enough (A_{est}), remove the ETCS BCs

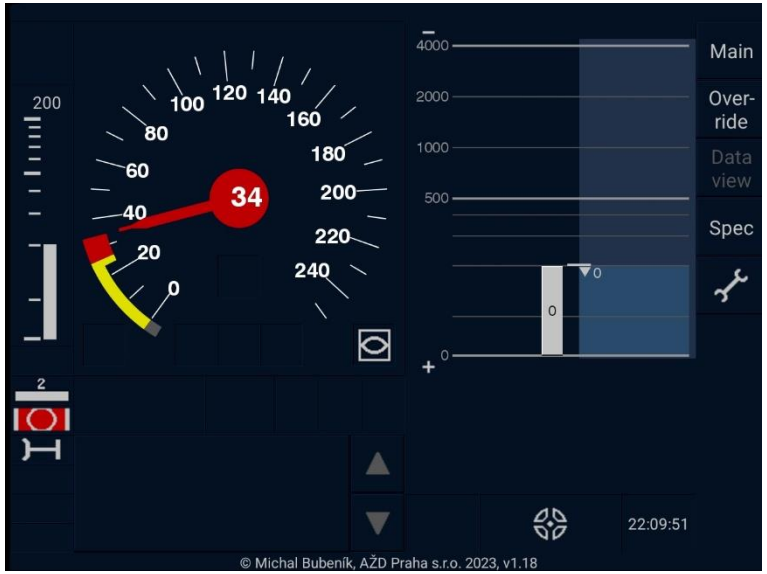
Locations of the ETCS supervision limits acc. to [B3R2 SUBSET-026] vs. [CR1385]	Corresponding display on the DMI – calculations according to	
	ETCS B3R2 SUBSET-026 & DMI	CR1385, orig. Marek, Myslivec, Bubeník, and Drápal (S+D (112) 3 and 6/2020)
l) The train is braking to a stand with 37 % of its full SB application, d_{est} = 382 m, V_{est} = 49 km.h^{-1}, A_{est} = -0.266 m.s^{-2}		
		

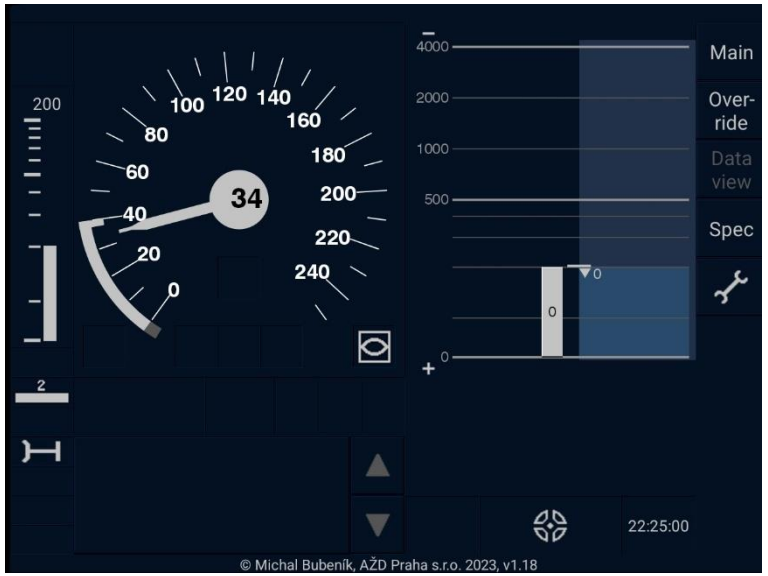
CR1385 (better handling with the measured decel.)

- Principle: For the trains braking enough (A_{est}), remove the ETCS BCs

Locations of the ETCS supervision limits acc. to [B3R2 SUBSET-026] vs. [CR1385]	Corresponding display on the DMI – calculations according to	
	ETCS B3R2 SUBSET-026 & DMI	CR1385, orig. Marek, Myslivec, Bubeník, and Drápal (S+D (112) 3 and 6/2020)
m) The train is braking to a stand with 37 % of its full SB application, d_{est} = 201 m, V_{est} = 34 km.h^{-1}, A_{est} = -0.266 m.s^{-2}		



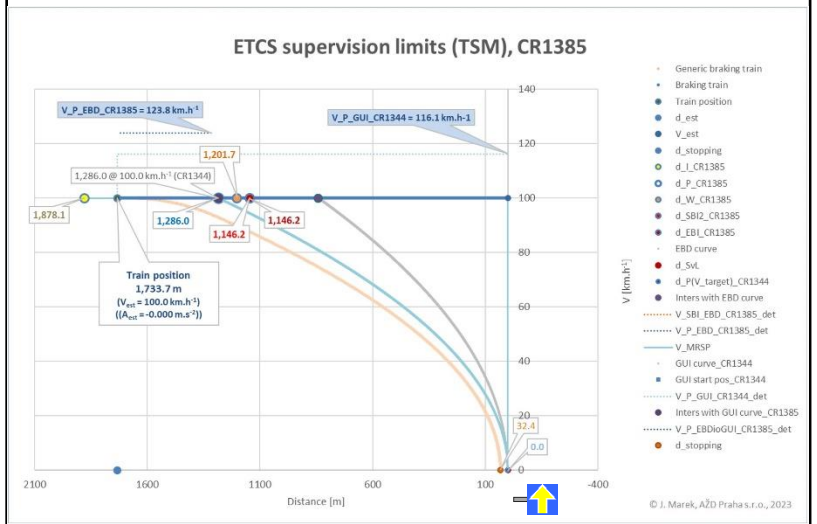
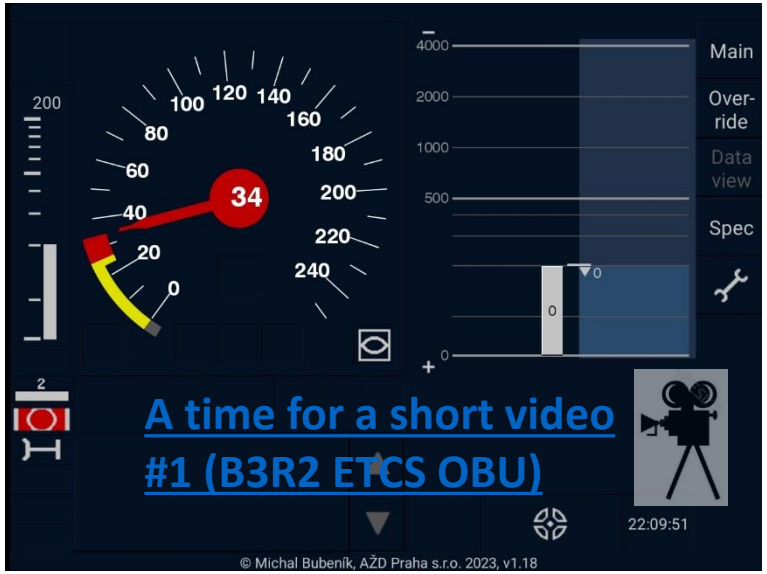
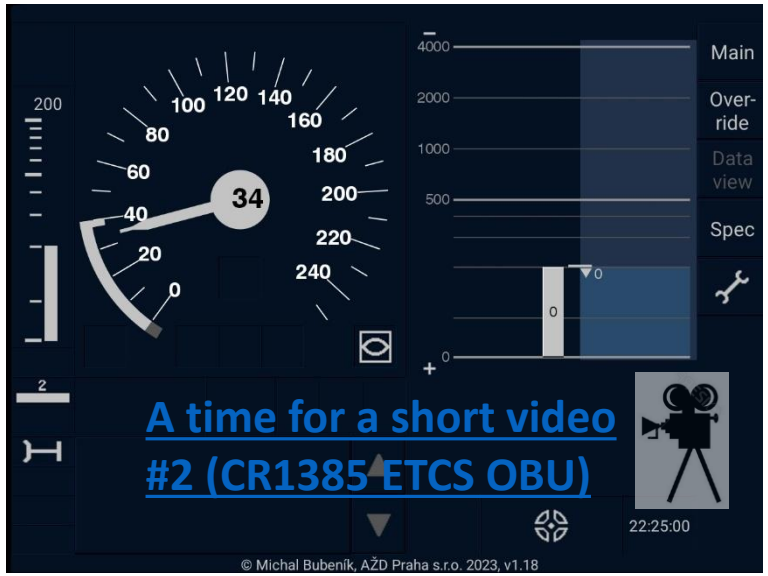




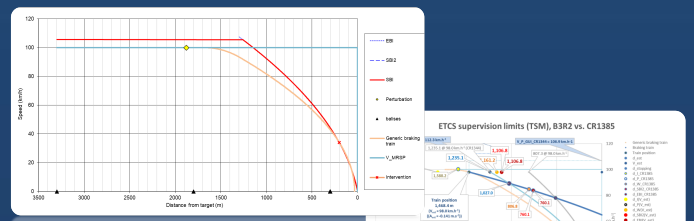
CR1385 (better handling with the measured decel.)

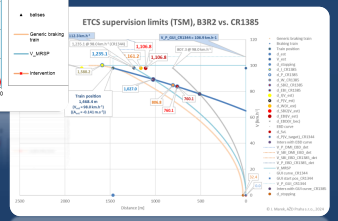
CR1385 (better handling with the measured decel.)

- Principle: For the trains braking enough (A_{est}), remove the ETCS BCs

Locations of the ETCS supervision limits acc. to [B3R2 SUBSET-026] vs. [CR1385]	Corresponding display on the DMI – calculations according to	
	ETCS B3R2 SUBSET-026 & DMI	CR1385, orig. Marek, Myslivec, Bubeník, and Drápal (S+D (112) 3 and 6/2020)
*) The train is braking to a stand with 37 % of its full SB application, stopping 32 m in rear of the EOA/SvL		
		

Thank you for your attention!





J. Marek

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