Test Training on Functional Testing

supported by:

openETCS

Marc Behrens

Braunschweig, 04.06.2014

General Training Information

Welcome

- **Internet is a available via Wifi: „DLR- Sfr - Gastzugang"**
    - *No password required*

WP4 Training Agenda Day 1 – part 1

09:00 - 09:20 Welcome – Marc Behrens

09:20 - 10:00 Introduction into the structure of Subset-026 - Marc Behrens

10:00 - 10:30 Introduction to breaking curves and user story (speed and distance monitoring) - Alex Nitsch

10:30 - 10:45 Question and Answers on braking curves - All Participants & Alex Nitsch

10:45 - 11:00 Coffee brake

11:00 - 11:20 What does „Braking curves mean to a railway operator" – Marc Behrens

11:20 - 11:50 Presentation of the example RT- Tester SysML model - Cécile Braunstein

11:50 - 12:00 Question and Answers on the example model on braking curves - All Participants & Cécile Braunstein

12:00 - 13:00 lunch @cantina

WP4 Training Agenda Day 1 – part 2

Practical Part Building 103 "Besprechungsraum"

13:00 - 13:30 Introduction into RT-Tester on software testing environment - Uwe Schulze

13:30 - 17:30 - All Participants & Uwe Schulze and Cécile Braunstein

- **Installation**
- **Tools set up**
- **Project creation**
- **Test generation**
- **Test execution**

17:30 - 18:30 Feedback

Dinner at the local brewery starting from 19h30

> **Schadt's Brauerei Gasthaus**
>
> **Marstall 2**
>
> **38100 Braunschweig**

WP4 Training Agenda Day 2

09:00 - 10:45 - 1st session Hands on session test modelling in groups on realistic system testing environment (Speed and distance monitoring Model) - Uwe Schulze and Cécile Braunstein

10:45 - 11:00 Coffee brake

11:00 - 12:45 - 2nd session Hands on session test modelling in groups on realistic system testing environment (Using the Braking Curve Model) - Uwe Schulze and Cécile Braunstein

12:45 - 13:45 - lunch

13:45 - 14:15 - Presenting results and feedback on model and test generation

Session: How to go on

14:15 - 14:30 Other approaches and how to combine the benefits?

14:30 - 14:50 How to co- simulate with other approaches: CPNTools - Christian Stahl

14:50 - 15:00 Feedback and sum up - How to provide a common workflow? - Marc Behrens

Legal Base

- **Technical Specification for Interoperability (TSI-CCS)**
- **Proposed by the ERA (European Railway Agency)**
- **Decided on and Published by the European Commission**

- **Current Version of the TSI-CCS:**
  - *2012/88/EU (complete Version)*
  - *2012/696/EU (Amendment with the current documents)*
    - **Annex A contains the current legal reference of Subset-026 valid for Baseline 2 and 3**
  - *Baseline 2 as well as Baseline 3 are current legal standards*
  - *Within openETCS Baseline 3 is used*

Chapters of Subset-026

- **Chapter 1 Introduction**   **No of Req.: 0**
- **Chapter 2 Basic System Description**   **No of Req.: 0**
- **Chapter 3 Principles**   **No of Req.: 737**
- **Chapter 4 Modes and Transitions**   **No of Req.: 720**
- **Chapter 5 Procedures**   **No of Req.: 487**
- **Chapter 6 Management of older System Versions**   **No of Req.: 200**
- **Chapter 7 ERTMS/ETCS language**   **No of Req.: 708**
- **Chapter 8 Messages**   **No of Req.: 166**

Number of Requirements according to the Subset-076 Traceability.

Principles of Subset-026

- ■ **Generalization: Subset-026 describes general principles and processes**
- ■ **The general principles are then limited by special cases and procedures**
  - • *E.g. degraded situations*

    Subset-026-5.4.5.2 to be applied on the Start of Mission

    "The SoM flowchart described in section 5.4.3 only includes the main paths and does not exhaustively cover the various operational situations, which could occur while performing the SoM procedure (e.g. when revised instructions are given to the driver or when the driver needs to re-enter already captured data)."

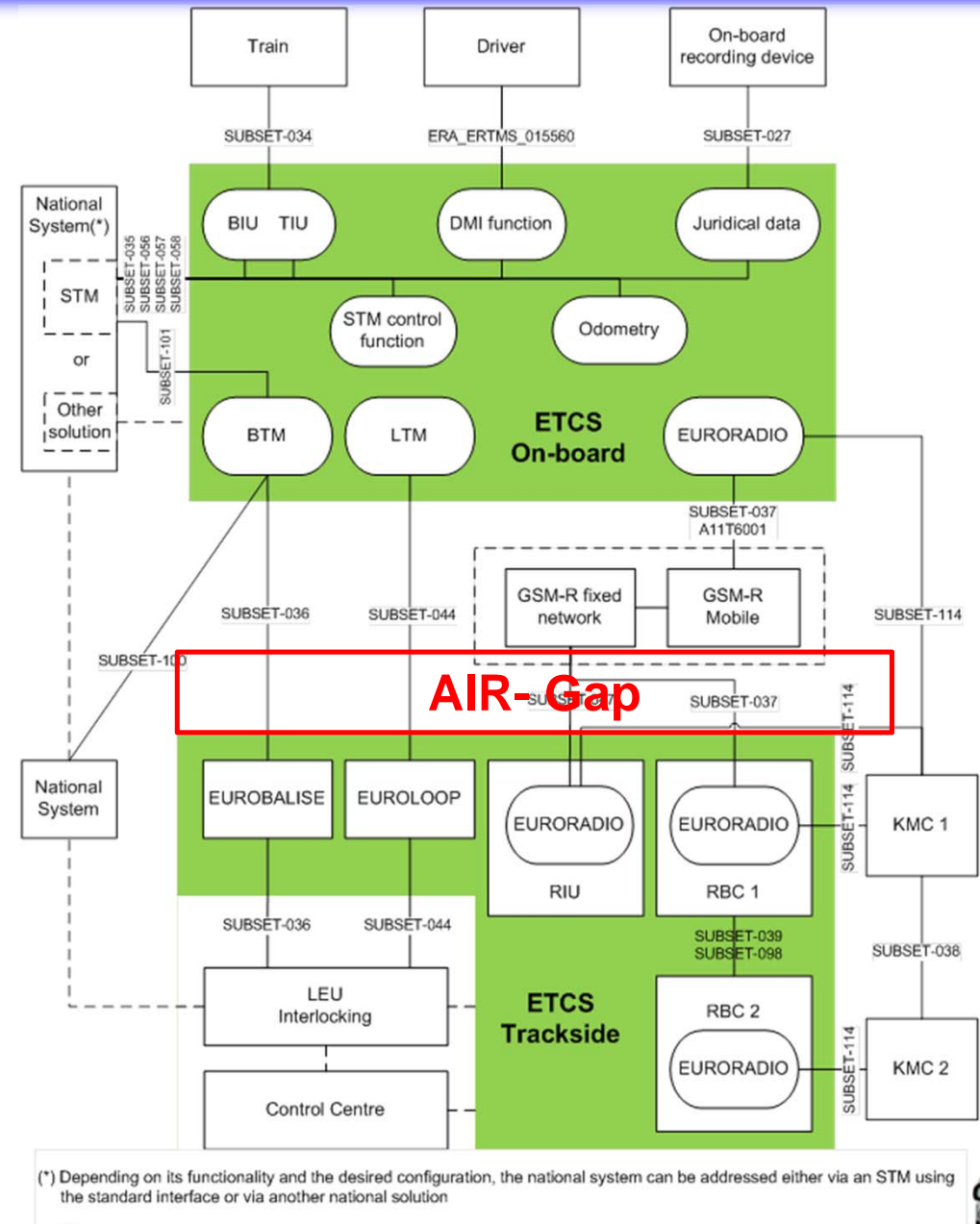→ **When modelling the Subset-026 all relevant exceptions have to be known.**

Question

- **How to understand the reference architecture?**
- **What is the Air-Gap?**
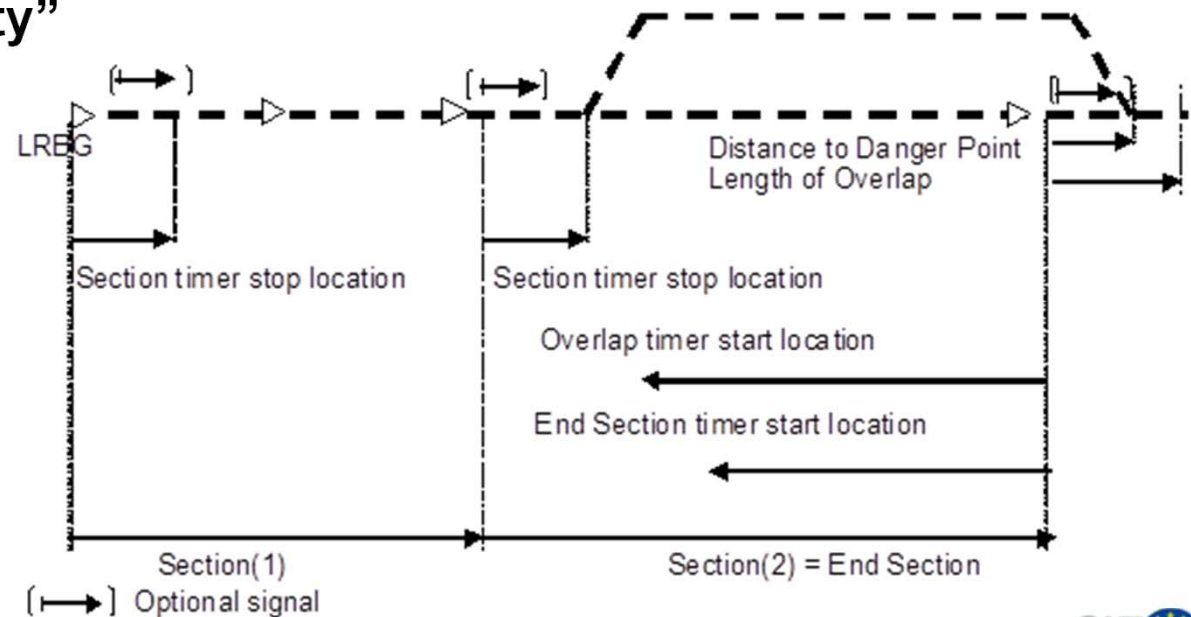
Lookup: Subset-026-2.5.3

Question

- **What are the general principles for balise, radio, train position …?**
- **What are the special functions?**
- **What is a movement authority?**
- **How is speed and distance monitoring (braking curves) defined?**

Lookup:
Subset-026-3.8 "Movement Authority"

LRBG

Distance to Danger Point
Length of Overlap

Section timer stop location

Section timer stop location

Overlap timer start location

End Section timer start location

Section(1)

Section(2) = End Section

[⟶] Optional signal

Question

- **How are the different modes defined, which responsibility is with the system, which with the driver? Subset-026-4.4**
- **For which mode is which DMI function active? Subset-026-4.7**
- **Under which special conditions are information accepted? Subset-026-4.8**
- **"Accepted information depending on the level and transmission media" Subset-026-4.8.3**
- **"What happens to accepted and stored information when entering a given level" Subset-026-4.9**
- **When is which Information deleted or to be revalidated? "What happens to accepted and stored information when entering a given mode" Subset-026-4.10**
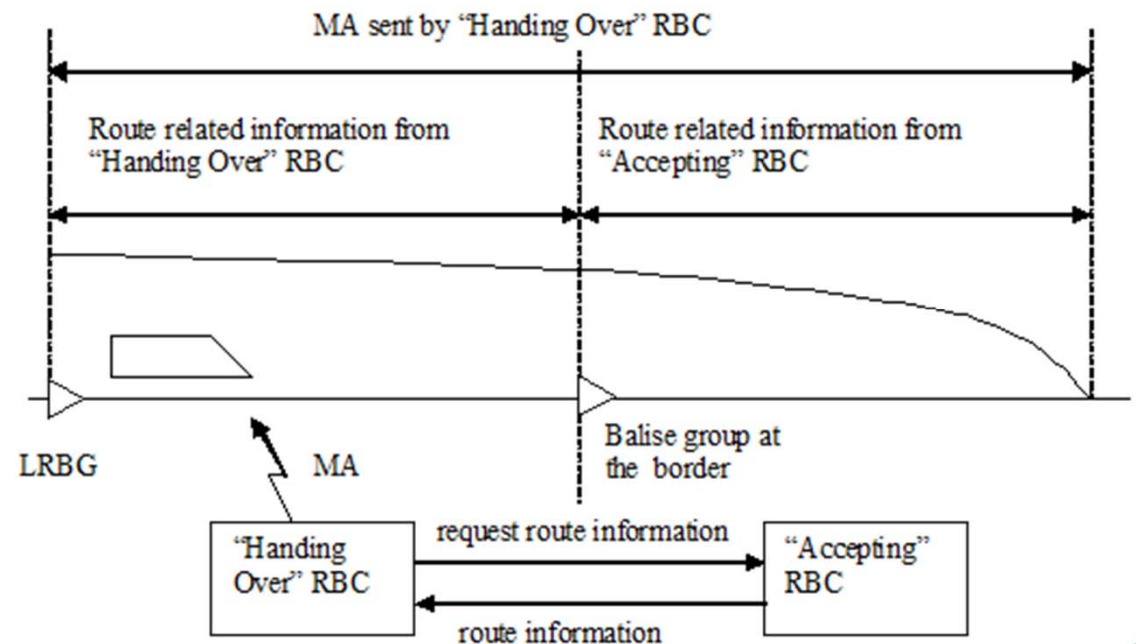
Question

- **How is the Start of Mission/ End of Mission defined?**
- **When does the OBU request a MA?**
- **How does shunting, override, train trip, changing train orientation, RBC/RBC handover, track conditions, limited supervision work?**

Lookup:

Subset-026-5.15

   RBC/RBC Handover

MA sent by "Handing Over" RBC

Route related information from "Handing Over" RBC

Route related information from "Accepting" RBC

LRBG

MA

Balise group at the border

"Handing Over" RBC — request route information → "Accepting" RBC

route information

Question

- **How are compatible an incompatible system versions defined?**
- **What are the requirements for on-board and trackside when dealing with older versions?**
- **Principle: The on-board has to fulfil all requirements relevant for the version (for BL3 it has to understand BL2).**

Lookup:
Subset-026-7.5.1.7.9 „M_VERSION"

Name	Version of ETCS system
Description	This gives the version of the ETCS system
	Each part indicates the first and second number of the version respectively.
	- The first number distinguishes not compatible versions. (The three MSB's)
	- The second number indicates compatibility within a version X. (The four LSB's)
000 XXXX	Previous versions according to e.g. EEIG SRS, UIC A200 SRS
001 0000	Version 1.0, introduced in SRS 1.2.0 and re-used in SRSs 2.0.0, 2.2.2, 2.3.0
001 0001	Version 1.1, introduced in SRS 3.3.0
001 0010	Not valid
….	
001 1111	Not valid
010 0000	Version 2.0, introduced in SRS 3.3.0
010 0001	Reserved for future use (this is a valid value)
…	…
111 1111	Reserved for future use (this is a valid value)

Question

- **Which variables are contained in the radio-, balise- and loop-air-gap packages?**
- **What is the meaning of the variables?**
- **Which Variables can be nationally set.**

Structure:

- **Packages are divided into „Track to Train" and „Train to Track"**

Lookup:

      Subset-026-7.4.2.1.1 „Packet Number 3: National Values"

          Subset-026-7.5.1.75.1 „M_NVEBCL"

Question

- **Which packets are contained in which radio air-gap message?**

Structure:

- **Messages are divided into „Track to Train" and „Train to Track"**

Lookup: Subset-026-8.7.2   Message 3: Movement Authority

| Field No.	VARIABLE	Remarks
1.	NID_MESSAGE	
1.	L_MESSAGE	
1.	T_TRAIN	
1.	M_ACK	
1.	NID_LRBG	
1.	Level 2/3 Movement Authority	Packet 15
1.	Optional packets	

Thank you for your attention!

Braking Curves responsibilities in reality

What does „Braking curves mean to a railway operator"

Figures from „ ERA_ERTMS_040026"
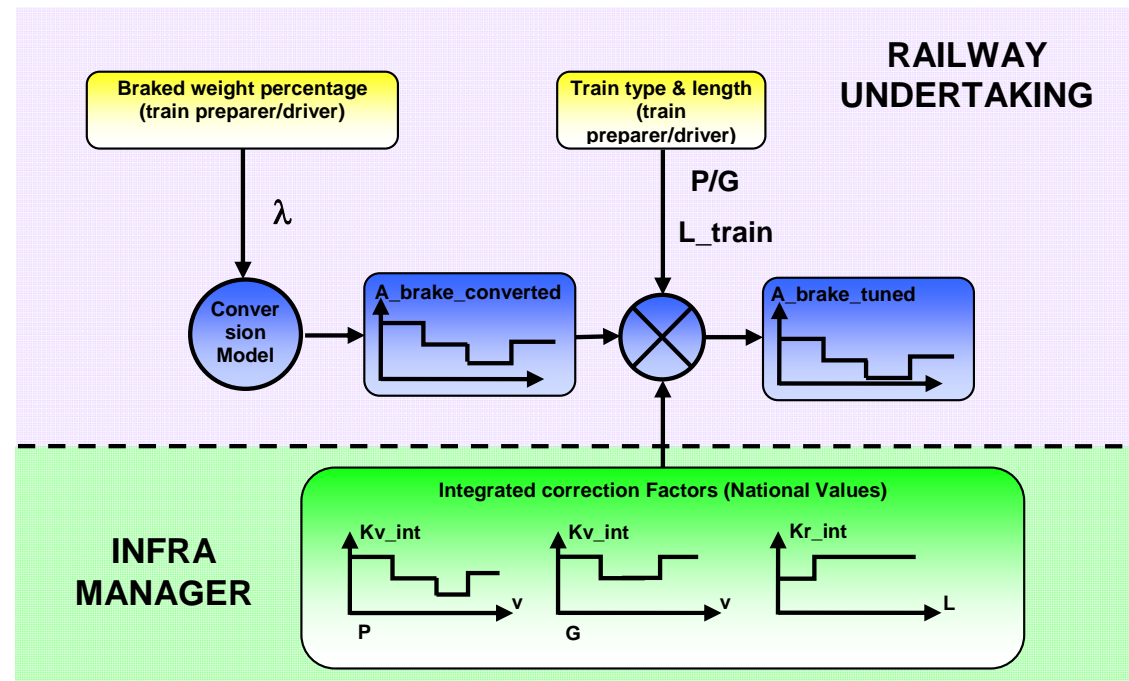
Introduction to ETCS Braking curves

Gamma Trains – Responsibility factors
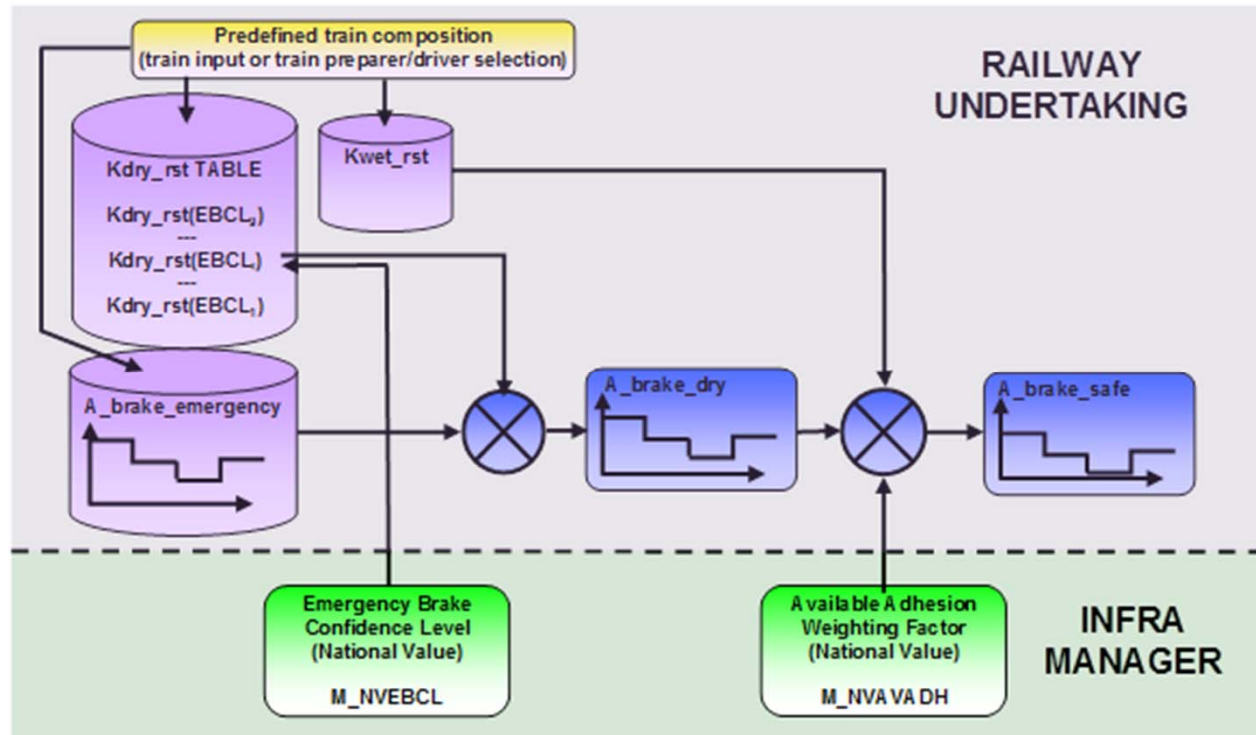
Figure 6: Rolling stock correction factors for Gamma trains – split of responsibility RU/IM

Specific to Gamma Trains: <u>finite number of predefined</u> compositions, on-board automatically preconfigured data/ -is selectable
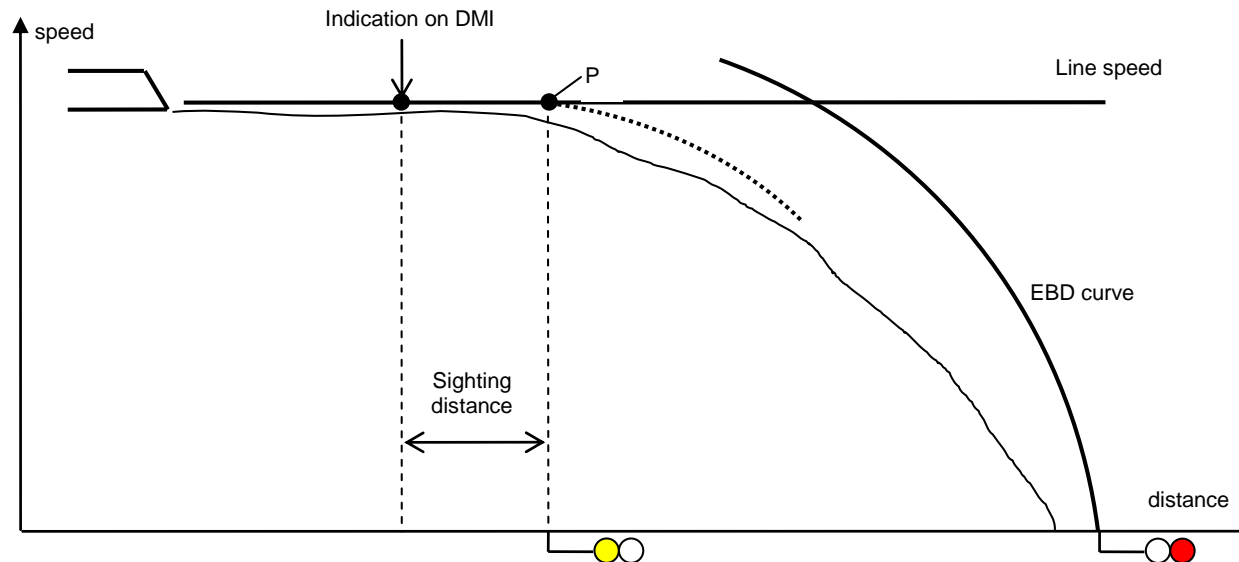
Lambda Train – Responsibility factors

*Figure 7: Integrated correction factors for lambda trains*

Specific to Lambda Trains: The braked weight percentage of the train is obtained by dividing the sum of the braked weight of all the individual vehicles.

Old Principles: Train fitting to the line

Figure 8: Train braking performance fitting the line (warning signal location and line speed), analogy between Cab signalling and Lineside signalling,
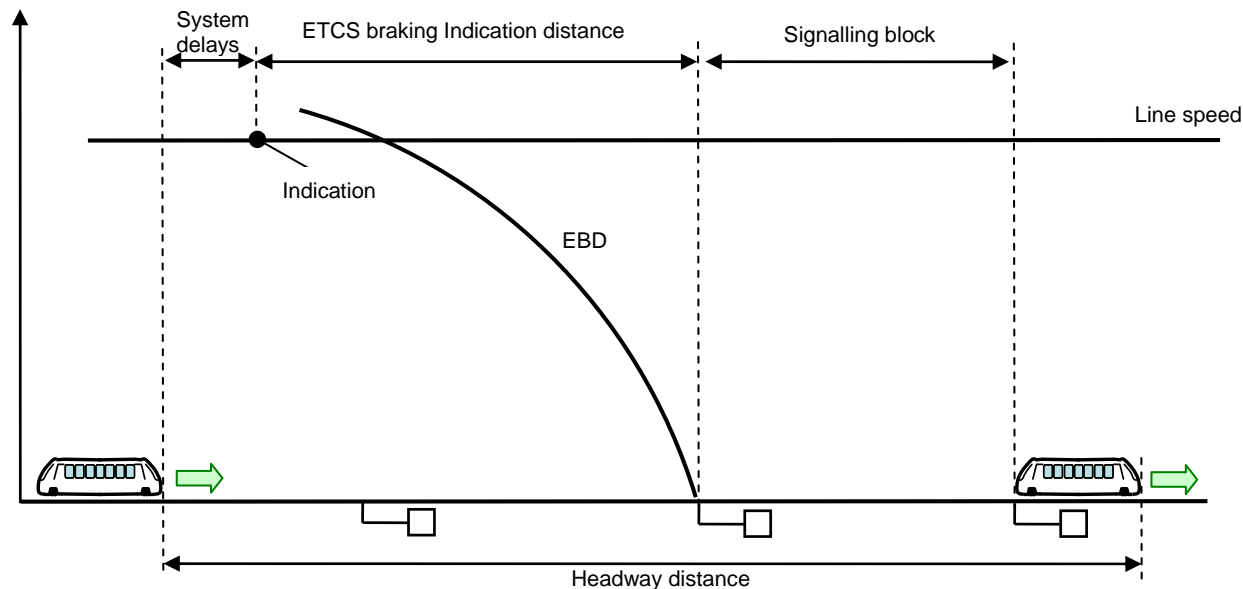
Lower train braking performance
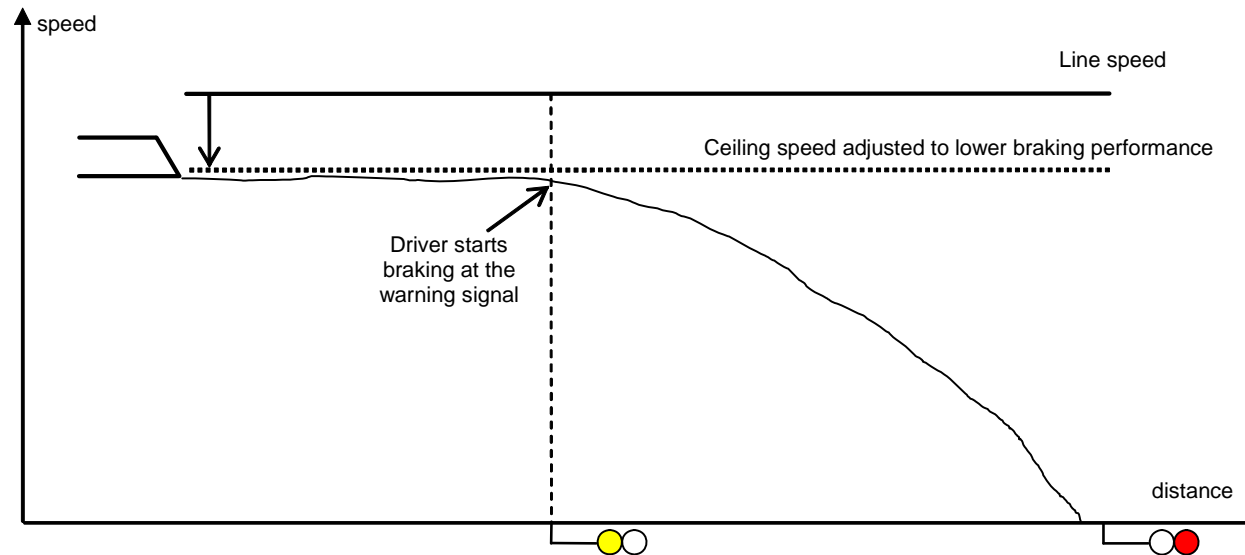
*Figure 9: Lower train braking performance,
Lineside signalling without ETCS*

→ **Performance of track is reduced: To brake at a correct distance with lineside signalling, the permitted speed to drive is reduced**

Better train braking performance

Figure 11: Contribution of the ETCS braking curve to the headway

→ **Cab Signalling allows shorter headway**

➔ **more trains can be drive over the same track during a fixed timeslot**

Thank you for your attention!