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Identification and Assessment of ETCS Level 3 Impediments

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Contents:

Introduction and Motivation

Status of Rail Transportation in the Netherlands

- Expected passenger increase up to 45% until 2030
- ETCS Level 2 on the entire Dutch railway, until 2050
- Except for countries like Switzerland, why are other railway operators and infrastructure mangers not eager and enthusiastic to implement ETCS level 3?
- Are the state of the technology and recovery from degraded modes the only limiting factors?

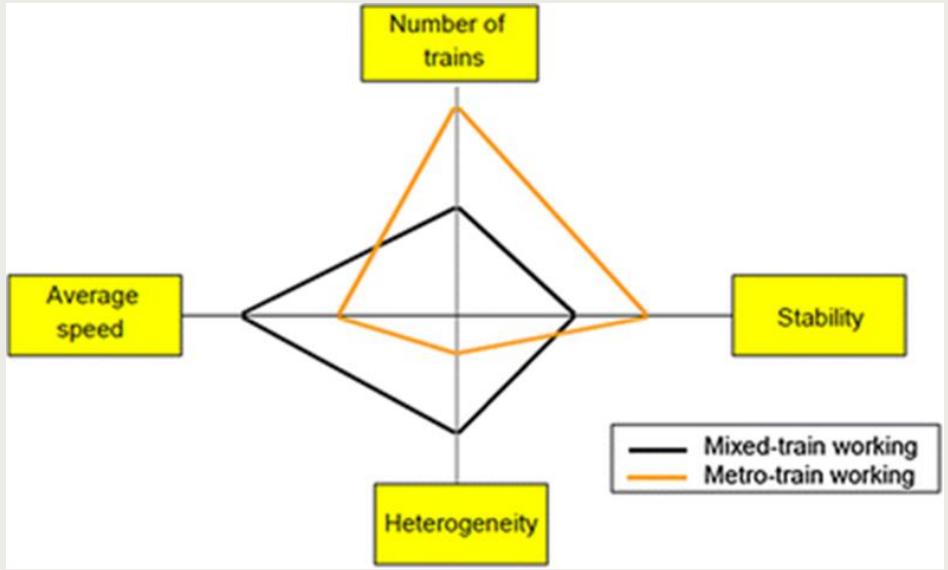
Country	ETCS Level
Sweden	2 and level 3 (regional)
Netherlands	1 and 2 (mostly)
Switzerland	2 and 3
Belgium	1 and 2
Norway	2
Germany	1 and 2
France	1 and 2
Austria	1 and 2 (mostly)
Czech Republic	2
Denmark	2
Italy	2
Spain	1 and 2
Poland	1 and 2
Finland	1

Challenge 1: Conditional Capacity Increase

Challenge Description

- Capacity definition:

UIC 406:



- ETCS Level 3: Headway ↓ Number of trains ↑ , → **stability loss!**

Challenge Assessment

Stability Gain in ETCS Level 3

- Decrease heterogeneity — Not Practical
- Increase reliability:
  - ➢ Holistic view on railway operation

Change in maintenance approach & additional budget

Also: traction power, LX opening time, etc…

ETCS Level 3 on its own cannot increase capacity!

Challenge 2: Confirming Train Integrity

Challenge Description

- No TTD for route setting in ETCS Level 3
- Integrity report in ETCS Level 3?

* TIM: on-board Train Integrity Module

* TDD: Trackside Train Detection

Challenge Assessment

Passenger trains:

- Electrical connectivity
- Reliable coupling:
  - Trainset could be “one-piece”
  - Passengers walk through trainsets

Acceptable coupler reliability

Freight trains:

- TIM requirement:
  - Life time of the sensors
  - Energy source of the sensors and recycling
  - Mounting (especially when wagons are attached / taken out)
  - Communication between sensors and on-board ETCS
  - Maintenance of sensors
  - Reliability of sensors

No feasible, reliable, practical and logically manageable solution, yet

Challenge 3: Optimization of Migration Strategy

Challenge Description

- More complex migration expected for ETCS Level 3
- Same on-board compared to ETCS Level 2
- Optimum migration strategy to ETCS Level 3?
  - ATB-EG to ETCS Level 2 and then Level 3?
  - ATB-EG to ETCS Level 3?

Challenge Assessment

- Minimizes consequences of:
  - baseline compatibility,
  - human factors,
  - reliability,
  - route suitability,
  - rolling stock and infrastructure equipment

✓ One-time upgrade from ATB-EG to ETCS Level 3

Challenge 4: Recovery from Degraded Modes

Challenge Description

- Negative impact of degraded mode and recovery time on railway KPI
- Additional concerns in ETCS Level 3:
  - Increase in number of trains
  - Change in determining train position

Challenge Assessment

- Requirement of new procedures
- Additional responsibility of train driver and dispatcher

Possible negative influence on safety and reliability in ETCS Level 3

Challenge 5: Executing Maintenance on Infrastructure

Challenge Description

- Frequent infrastructure maintenance
- Maintenance machines and possessions in ETCS Level 3?

Challenge Assessment

Track Possession

- Work zones or space between fixed objects
- Means to ensure clear track after maintenance

Manageable (similar to the procedures used for axle counters)

Yellow Fleet

- **Requirement to install ETCS Level 3 on-board:**
  - Receive MA
  - Route setting

- Financial resources
- Availability of space
- TIM requirement

Challenge 6: Level Crossing Protection

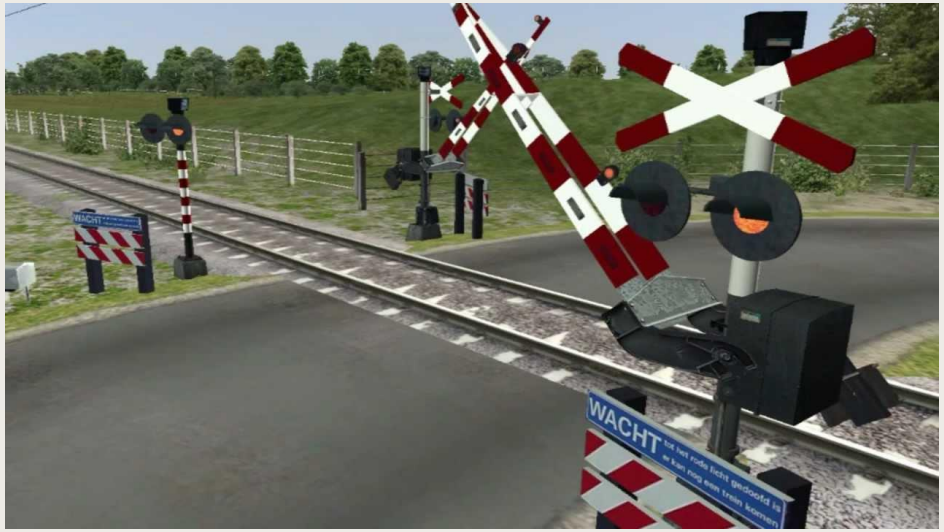
Challenge Description

- Autonomous level crossings in the Netherlands, activated by trackside train detection equipment
- Possible solution in ETCS Level 3: train data! (e.g. CWT) but:
  - New technical architecture,
  - Degraded operation modes
- Increase in number of trains in ETCS Level 3 → Increased risk of car driver impatience

* CWT: Constant Warning Time

Challenge Assessment

- Trackside train detection equipment for activation of level crossings
  - Same level of risk as today
- Close / replace crossings at grade with bridges / underpasses



Challenge 7: Life Cycle Costs

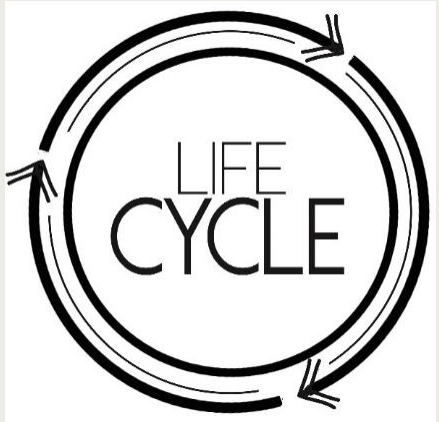
Challenge Description

- Shorter life cycle of ETCS equipment as well as GSM-R (< 20 yrs)
- Acquisition cost of ETCS Level 3 due to more on-board equipment
- Maintenance cost of ETCS Level 3:
  - Less trackside train detection
  - More on-board equipment and frequent software updates expected
  - Obsolescence management

Challenge Assessment

- Actual life cycle costs of ETCS level 3 not easily predictable:
  - Lack of real data for operation and maintenance costs
  - Uncertainties

Project Risk



Challenge 8: Deployment of ETCS in Busy Stations

Challenge Description

- GSM-R limitation to support busy stations
- Migration to ETCS Level 3 at stations:
  - Availability
  - Capacity
  - Punctuality
  - Integration
  - Transition

Challenge Assessment

- Need for another communication technology
  - Agreement on operational frequencies, function and system requirements
  - Migration

Conclusions

ETCS Level 3 Impediments

- Limited Capacity Increase
  - Additional investments for stability gain
- Confirmation of Train Integrity (freight trains and yellow fleet)
  - No feasible and manageable solution yet
- Resuming from Degraded Modes
  - Safety risks due to increased involvement of operational staff
- Deployment of ETCS in Station Areas
  - Limitations of GSM-R and slow progress towards radio communication systems

Future Work / Recommendations

- Shift2rail project:
  - TIM
  - Optional TDD
- Pilot:
  - Groningen – Roodeschool

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Thank you

Questions?