Operational experiences as lessons for future ETCS L2 projects

VLADIMÍR KAMPÍK
AŽD PRAHA

PRAHA
AŽD Praha and ETCS

• **AŽD Praha**
  
  • CZ company with more than 60 years tradition on railway market especially in control command and signalling
  • Member of UNIFE, UNISIG, JU SHIFT²RAIL
  • Implementation of ATO over ETCS already in 2008

• **ETCS projects AŽD**
  
  1. CZ – ETCS L2 Pilot application Poříčany – Kolín
  2. CZ – ETCS L2 Section Kolín-Břeclav-state border A/SK - Pan-European corridor IV/ Freight corridor E - 277km, 8 RBCs, HOV CZ-A, mixed traffic
  4. CZ - ETCS L2 for vehicles testing at Test Centre VUZ Velim (1 RBC) and modification of ETCS L1 ETCS
Modification and lessons from the projects

- ETCS exclusion function
- Mixed traffic
- Relay based
  - IXL – track occupancy info for RBC
  - Automatic line block functionality built-in RBC
- Train entry to an occupied track
- OS mode on station track avoided
- Dynamic switching between ETCS Levels of infrastructure
- GSM-R Quality of Service
ETCS exclusion function

- For the case of errors, repairs at ETCS trackside or track itself
- Exclusion function implemented into RBC for Open line track, Station or Whole RBC area

- ETCS trains are switched to mode LNTC (LSTM)/SN or L0/UN at the beginning, and back to L2 (FS or other mode) at the end of traffic excluded area
ETCS exclusion function

PRELIMINARY ETCS exclusion
- RBC inhibits extending of MA into the excluded area
- MA only till the closure border
- Set manually by dispatcher

FULL ETCS exclusion
- RBC revokes extending of MA into excluded area
- MA granted/provided only up to the exclusion border
- Shortening MA → emergency stop to all ETCS trains in the closure area
- Set manually by dispatcher or automatically when IXL GENERAL CLOSURE introduced

Lesson: RBC generic SW has to be modified and automatic traffic closure increases safety in emergency cases
Mixed traffic, Relay based systems

- Mixed traffic
  - No special signal aspect for ETCS trains → absolute signals valid also for ETCS train
  
  **Lesson:** Possible but no significant safety increase

- Relay based IXL
  - Fast ETCS implementation vs. costs
  - Large junction stations not upgraded, occupancy info transferred by fail-safe data collector to RBC
  
  **Lesson:** Need to judge cost of fail-safe collector vs. ETCS implementation delay

- Automatic line block in RBC
  - Relay based decentralised line block function
  - Only occupancy and line consent status transferred to RBC
  - Fast ETCS implementation vs. costs

  **Lesson:** RBC may efficiently take over also functions of conventional signalling
Train approach to the occupied track

- Train arrival on occupied track → call-on signal aspect at entry signal → OS mode
- Possible risk for trains regularly approaching to the occupied track
- SW modification of IXL and introducing new signal aspect without the necessity for adding new signal lamps
- Appropriate modification in RBC

Lesson: Introducing new dedicated signal aspect at entry signal allows FS mode in switch area and OS mode needed only when approaching occupied station track
OS mode on station track voided
Train route beyond EOA

Standard solution
- Arrival to the platform in FS mode
- $t > 1-2$ minutes $\text{FS} \rightarrow \text{OS}$ mode
- Departure from platform in OS mode
- FS mode from departure signal / marker

New IXL feature
- IXL continually checks all possible train/shunting routes leading to the occupied track
- IXL: no route in collision = RBC $\rightarrow$ FS mode kept
- IXL: route in collision = RBC $\rightarrow$ OS mode

Lesson: Modification of IXL system + RBC function $\rightarrow$ Departure in FS mode, no need of TAF (Track ahead free) procedure
Dynamic switching of ETCS Levels on infrastructure

- VUZ Test centre Velim as ETCS testing facility
- ETCS Testing equipment
  - ETCS + electronic IXL for test purposes only
  - Safety at test ring by relay based IXL
  - ETCS L1, L2, LSTM (type LS) and L0 and transitions
  - Special line conditions, speed restrictions, pantograph, doors, etc.
- RBC / LEU implementation for switching ETCS LEVELS
- 6 Combinations of L1, L2 and LSTM/L0 transitions
- RBC equipped with main 3 different specific application SWs
  - Pure Level 2
  - Level 2 + Level 1 transition
  - Level 2 + LSTM/L0 transition
- RBC System SW changed by customer according to ETCS test preparation needs
Dynamic switching of ETCS
Track layout and stations

CD VUZ Test circuit Velim divided into four parts
• Real station A
• Virtual station B
• Line blocks A-B and B-A

ETCS delivery
- Balise – Siemens
- Balise – Ansaldo
- LEU – Thales
- RBC – AZD Praha
Dynamic switching of ETCS
Transitions L1 - L2 - LSTM/L0 combinations

Lesson: Unique experience discovering new possibilities in implementing ETCS within the standard ERTMS specifications
GSM-R Quality of Service (QoS)

- Testing of ETCS L2 by special AŽD ETCS measuring car
- Lot of errors in connections → unstable/loose train to RBC connection → transition from FS mode to TRIP mode
  - GSM-R project separated
  - Project take over test for coverage and voice only, not data with QoS check !!!
- → delay in delivery of ETCS L2 into operation

Lesson: Infrastructure manager shall always ask performing and results of QoS tests
Summary

- Special installations and requests from clients lead to discovering new fields and possibilities of ETCS system implantations.

- Every experience with requirements for advanced features is an impulse for better ETCS solution within the standards.

- All special requirements of the Client fulfilled without any need for change request of the official Specifications.

- ETCS shows its robust design while all standard functionalities are maintained and the system remain interoperable.