KOPIDLNKA

Experimental line of AŽD

Kopidlno – Dolní Bousov

technology for the future

technology for the future

technology for the future

technology for the future

technology for the future → → → → → →

KOPIDLNO – DOLNÍ BOUSOV LINE

When the first regular train on the Kopidlno – Dolní Bousov – Bakov nad Jizerou railway, intended primarily for the transport of sugar beets, departed on August 26, 1883, no one could have imagined the fundamental transformation this line would undergo in the future. More than 140 years later, the Kopidlno – Dolní Bousov section has become a highly modern private experimental line where trains run in normal operation completely autonomously, without drivers.

It is a technological revolution directed by the Czech company AŽD, which bought the line from the state in 2016 together with the Plum Railway (Čížkovice – Obrnice) as unnecessary property. This was followed by a complete overhaul of the track substructure and superstructure and the gradual installation of state-of-the-art technologies with the aim of building an experimental line on which a fully autonomous train will run without drivers.

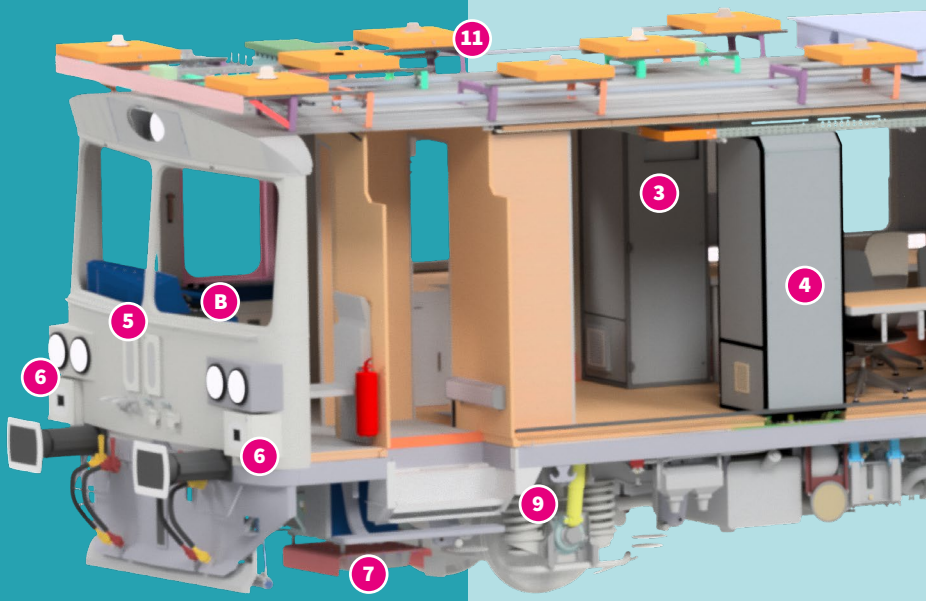
The 23,991 km long Kopidlnka line (22,370 km owned by AŽD) with one railway station Dětenice and seven stops Ledkov, Libáň, Osenice, Rokytňany, Rabakov, Domousnice and Řitonice is currently equipped with:

- Electronic interlocking **StationSWing ESA 51** of version **DIGITAL 4.0**.
- European Train Control System **ETCS Level 2**.
- Line signalling systems **RailSWing AH-ESA-07** and **AHP-03D**.
- Level crossing safeguarding systems **GateSWing PZZ-J**, **PZZ-GTS** and **PZZ-ACE**.
- Train Detection System – axle counters Frauscher type **FAdC**.
- ATO (Automatic Train Operation) in the design of **ERTMS/ATO**.
- Full **GSM-R** coverage with the extension of **5G** technology for high-capacity data transmissions.
- **Communication systems** via **GPRS**, **LTE**, **WLAN** including **sensors of line state for autonomous operation**.
- **Interface and data transmission** with the connecting stations Kopidlno and Dolní Bousov of the Správa železnic Infrastructure manager for the purpose of fully ensuring railway safety operations on the entire operated railway line including adjacent stations.

The experimental line is controlled from the Kopidlno railway station by the centralised traffic control system **TrafficSWing DOZ-1**. The dispatcher's activity is supported by the **TrafficSWing GTN** a technological system with graphical data interpretation and the **ASVC** (automatic route setting). In the railway station Dětenice, within the **AŽD Competence Centre** containing a training and presentation polygon, a backup control workstation has been set up,

GMS-R mast with 5G transmitter at the Competence Centre in Dětenice →

EDITA
811.111-4



1 **Control system rack**, containing

- *Central Vehicle Controller & Automatic Train Operation (CRV & AVV)*
- *Wheel slide protection unit*
- *Control unit of TEDOM Diesel engine*

2 **AŽD ETCS rack**, containing

- *European Vital Computer (EVC) – Central ETCS unit*
- *Balise Transmission Module (BTM)*
- *Global System for Mobile Communications – Railway (GSM-R) – Digital radio system for railway applications*

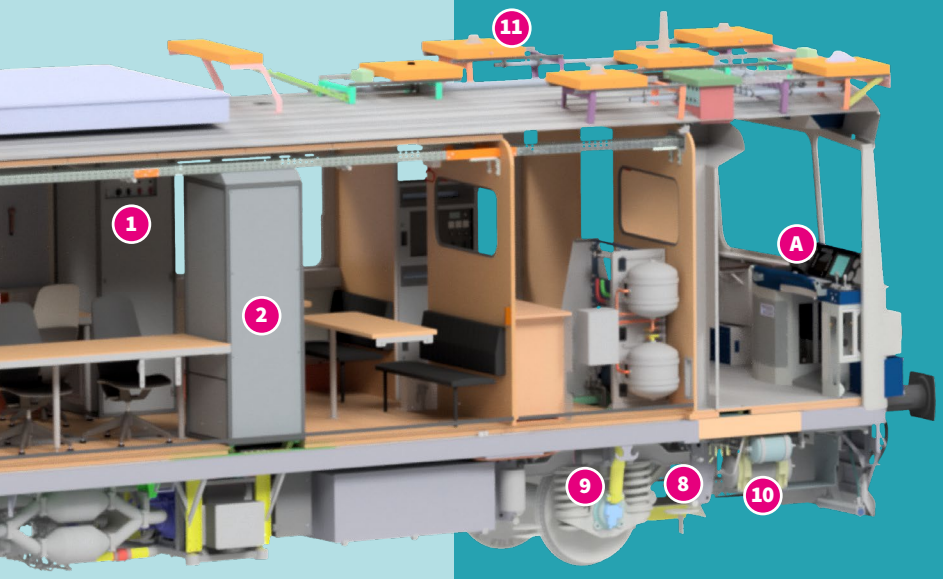
3 **Obstacle detection rack**, containing

- *Obstacle detection system*
- *Global Navigation Satellite System*
- *GSM-R*

Testing the autonomous functions of the EDITA vehicle ↘

4 **CAF Signalling ETCS rack**, containing

- *EVC*
- *BTM*
- *GSM-R*
- *Juridical Recording Units (black box)*
- *Speedometer*
- *Vigilance control system*



5 **Cameras**

6 **Lidars**

7 **CAF Signalling balise antenna**

8 **AŽD balise antenna**

9 **Wheel speed sensors**

10 **Doppler radar**

11 **Antennas**

A **Driver's desk A**

B **Driver's desk B**

which can be used to take over the control of the entire railway line, all level crossings and line signalling equipment, as well as the control of the RBC radio-block centre.

The experimental line Kopidlno - Dolní Bousov is equipped with telecommunication and passenger information systems according to the usual standards to ensure passenger comfort, which is also supported by an intelligent stop in Domousnice, integrated with other line and onboard systems of the autonomous railway.

EDITA

For autonomous operation AŽD has it's own vehicle **EDITA** – Experimental Rail Vehicle for Innovative Technologies AŽD 811.111-4 (modernized purchased railcar of 810.111-5). It is equipped with the latest technologies for autonomous operation on an entire line including the **CRV & AVV expert control system**. Based on input signals, it **generates traction and brake requirements**. Input signals can come from the train driver (manual or speed control) or from the autonomous driving system, which uses:

- **Obstacle and risky situation detectors** – cameras and lidars combined with external sensors to ensure the necessary traffic safety in places with poor visibility conditions.
- **Traffic Support Systems** – management of digital maps and autonomous train missions.
- **Diagnostic systems** – information about the physical health of the infrastructure.

The autonomous driving system can work:

- In the **GoA2 level**, the system autonomously controls the vehicle to follow the time table with optimal energy consumption and stops autonomously at the stop. The driver commands the train to start, reacts to obstacles

← *Driver's cab, driver's desk*

and emergencies, and controls the boarding and alighting of passengers.

- In the **GoA3 level** when train goes autonomously with staff located in the passenger compartment. This supervises the movement of passengers in the area of stops and stations and only confirming the order to close the doors and to depart.

The experimental line Kopidlno - Dolní Bousov and the **EDITA** vehicle are still in the process of improvement. Based on the results of test runs, during which various operational and safety scenarios will be examined, AŽD developers will gradually integrate further technologies. At the same time, intensive work will be carried out in the legislative process with the aim of achieving the codification of autonomous railway operation as a possible way of operation.

All this with one goal – to take railway transport to a higher level in accordance with the motto of AŽD:

Safely to your destination!

AŽD Praha s.r.o.

Žirovnická 3146/2
Záběhlice
106 00 Praha 10
Czech Republic

E-mail: kopidlnka@azd.cz
www.kopidlnka.cz

Innovation never stops – the future of rail is being born right now! → → →