

Automatic Train Operation (ATO)

More trains, better connections – ATO with Rail Traffic Management

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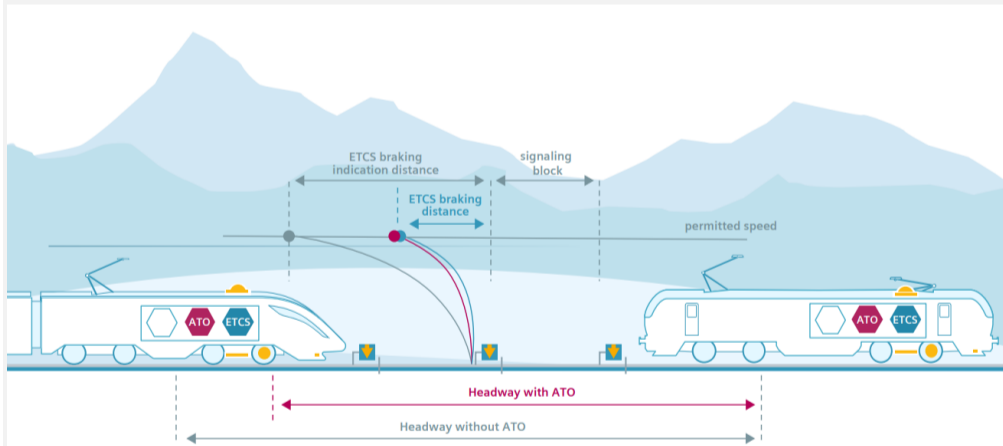
1 Introduction

Automatic Train Operation (ATO) offers solutions for automated driving in long-distance, freight and regional rail transport. European Train Control Systems (ETCS) and ATO are the perfect partners for safe and automated train operations.

2 Methods

Depending on the optimization criteria, automation systems in rail operations increase energy efficiency and track capacity. The ATO system developed by Siemens Mobility works in combination with the European Train Control System (ETCS), which ensures train spacing and monitors speeds. The already partially automated rail system provides a solid basis for further automated driving solutions.

Furthermore, the ATO system from Siemens Mobility collaborates with the Traffic Management System (TMS) to improve timetable stability, increase track capacity, and enhance energy efficiency.



3 Components

The connection to the operations control system is crucial for train control. The ATO system automates starting, acceleration, idling and braking and is connected online to TMS. This transmits up-to-date information to calculate an optimum speed profile, which determines the course of the journey and is converted into control commands for the drive and braking.

• ATO onboard system the vehicle

The ATO-OB component calculates the optimum driving profile based on infrastructure and timetable data. It controls the drive and braking devices for automated driving.

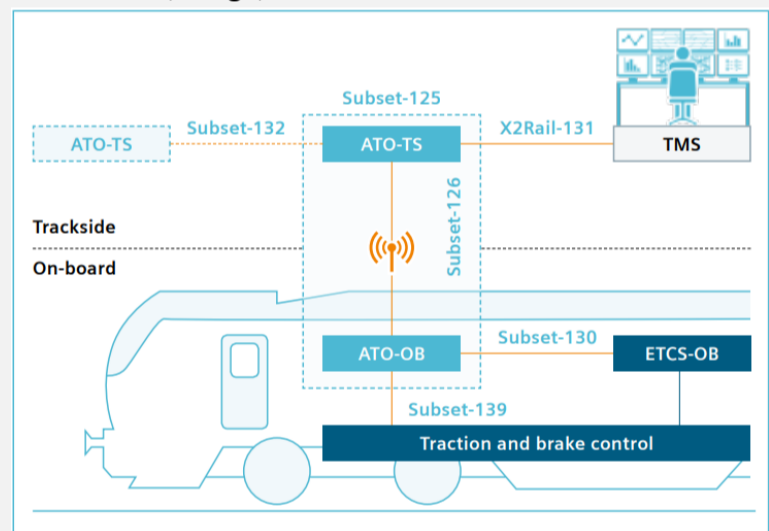
• ATO trackside system

Optimized timetable, static, and dynamic data are transmitted from the TMS to the ATO-TS, which then transmits them to the ATO-OB. These data types are crucial for generating specific journey profiles and ensuring smooth and efficient train operations.

4 Results and discussion

ATO is a central objective of current European standardization activities. The interoperability requirements for ATO essentially correspond to those of ETCS.

Siemens Mobility has leveraged its extensive experience with ATO in the CBTC environment to contribute to European standardization and has demonstrated the control behavior in various tests. These include ATO tests with SBB, Cargo, and ATO over ZBMS with RhB.



5 Conclusion and expected impact

Key benefits at a glance

Boosted infrastructure and transport capacity
by decreasing headways

Improved timetable stability and punctuality
by means of consistent driving behavior

Energy savings
by means of an optimized driving strategy

Reduced mechanical wear and tear and less noise
by means of homogeneous driving with less braking

Increased passenger comfort
by means of smoother, homogeneous driving

References

- 1. Thameslink - the world's first commercial ATO application in long-distance traffic with ETCS**
Siemens Mobility supplied rolling stock, ETCS equipment and ATO for the north-south line in London (Thameslink project). The ATO system optimizes train headways so that all trains run according to identical, optimum speed profiles. This enables the required capacity of 24 trains per hour and track to be achieved.
- 2. Digital S-Bahn Hamburg - the first realization of ATO over ETCS in Germany**
Siemens Mobility played a key role in this project in collaboration with Deutsche Bahn. They equipped four vehicles and a 23-kilometer track section with the necessary technology, enabling highly automated train operations. Additionally, Siemens Mobility demonstrated fully automated, driverless shunting operations at the Bergedorf station siding.
- 3. ATO over ZBMS at RhB**
Siemens Mobility integrated the ATO system with the ZBMS train control system for narrow-gauge railways. They conducted extensive pilot testing and validation to ensure safety and performance standards were met. This collaborative effort between RhB and Siemens Mobility aims to optimize train operations. The project seeks to enhance efficiency, safety, and reliability on RhB's network.