



ERTMS/ETCS LEVELS



DIFFERENT LEVELS TO MATCH CUSTOMER'S NEEDS

Currently, there are four ERTMS/ETCS levels (L0, LNTC, L1 and L2). The different ERTMS/ETCS application levels are a way to express the possible operating relationships between track and train. Level definitions are related to the trackside equipment used, the way trackside information reaches the on-board units, and the functions that are processed in the trackside and on-board equipment, respectively. Different levels have been defined to allow each railway administration to select the appropriate ERTMS/ETCS application trackside, according to their strategies, trackside infrastructure and the required performance. Furthermore, the different application levels permit the interfacing of individual signalling systems and train control systems to ERTMS/ETCS. The ERTMS/ETCS "levels" define different uses of ETCS as a train control system,

ranging from track-to-train communications (Level 1) to continuous communications between the train and the Radio Block Centre (Level 2). Level 2 fixed block / moving block, formerly Level 3, which has been merged into Level 2 with the CCS TSI 2023, enhances ETCS' potential. This enhancement results in increased capacity, reduced costs by eliminating trackside equipment for train detection, and efficiency gains through heightened automation. ERTMS/ETCS Level 0 is used to operate non-equipped (unfitted) lines or lines equipped with a train control system(s), but operation under their supervision is currently impossible. In ERTMS/ETCS Level, the NTC train equipped with ERTMS/ETCS operates on a line equipped with a national system.

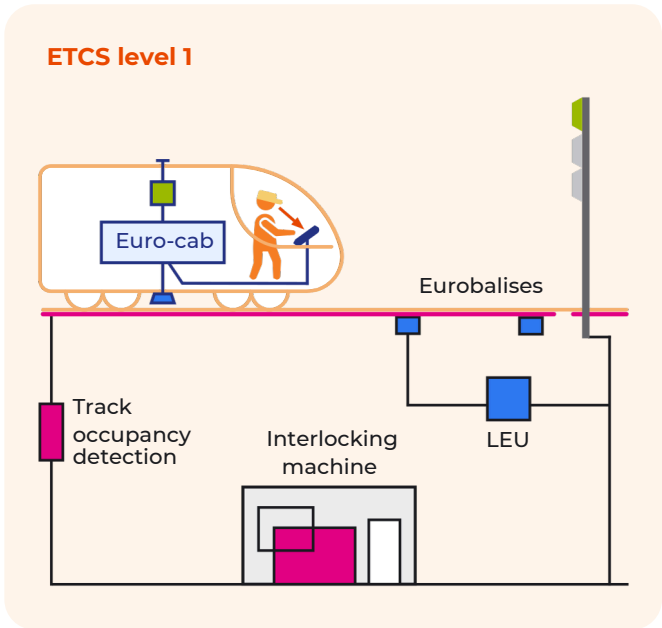
WHAT IS THE DIFFERENCE BETWEEN ERTMS/ETCS "LEVELS" AND ERTMS/ETCS "BASELINES"?

ERTMS/ETCS "baselines" (or System Requirements Specifications – SRS) designate the technical baseline of the ERTMS/ETCS system. There are the baselines B2 with SRS 2.30d, B3MR1 with SRS 3.4.0, B3R2 with SRS 3.6.0 and B4 with SRS 4.0.0. All currently operating levels are defined in each ERTMS/ETCS baseline.

WHAT IS ERTMS/ETCS LEVEL 1? WHAT ARE THE ADVANTAGES?

ERTMS/ETCS Level 1 is an add-on system designed to work on existing conventional railway lines already equipped with lineside signals and train detectors. Especially Level 1 Limited Supervision offers a cost-effective way to upgrade safety and interoperability without completely replacing existing infrastructure. Communication between the track and the train is ensured by dedicated balises (known as "Eurobalises®") located on the trackside adjacent to the lineside signals at required intervals and connected to the train control centre. When the movement authority is received through Eurobalises, the ETCS onboard equipment automatically calculates the maximum speed of the train and the next braking point, considering the train braking characteristics and the track description data. This information is displayed to the driver through a dedicated screen in the cabin. The ETCS onboard equipment continuously supervises the speed of the train.

The main benefits brought by ERTMS/ETCS Level 1 are interoperability (between suppliers and countries) and safety since the train will automatically brake if exceeding the maximum speed allowed under the movement authority.

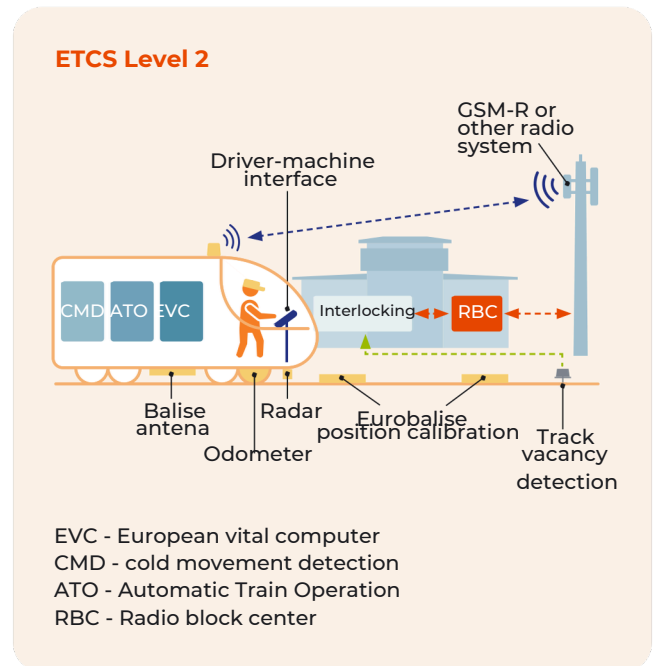


1 Fixed virtual block / moving block allows managing the spacing between train dynamically based on real-time information, enhancing safety and efficiency.

WHAT IS ERTMS/ETCS LEVEL 2? WHAT ARE THE ADVANTAGES?

ERTMS/ETCS Level 2 is a radio-based signalling system that displays signalling and movement authorities in the cab, eliminating the need for lineside signals. Movement authority is communicated directly from a Radio Block Centre (RBC) to the on-board unit via GSM-R/ FRMCS radio. Still, train detection and train integrity supervision remain in place at the trackside. The onboard computer continuously monitors data from passive balises and the RBC to determine its position and maximum permissible speed. This continuous data stream informs the driver of line-specific information and signals status on the route ahead, allowing the train to reach its maximum or optimal speed while maintaining a safe braking distance.

Whilst providing the same interoperability and safety benefits of Level 1, ERTMS/ETCS Level 2 has the additional possible benefit of reduced CAPEX and maintenance costs because lineside signals are optional only. Train detection and integrity checks could be performed by the track-side equipment beyond the scope of ERTMS/ETCS or managed within the scope of the ERTMS/ETCS system. Implementing L2 (incl. former L3) enables increased line capacity by enabling higher operational speeds and reducing headways, resulting in an improved passenger experience.



I READ ABOUT ERTMS/ETCS LEVEL 3 – WHY IS THIS NOT COVERED?

ERTMS/ETCS Level 3 has been merged into ERTMS/ETCS Level 2 with the CCS TSI 2023. Therefore, it is no longer a differentiator for specific functionalities, like fixed virtual block/moving block, with assurance of train integrity and location within the ERTMS/ETCS solution.

IS IT POSSIBLE TO UPGRADE FROM ONE LEVEL TO THE OTHER?

Yes, because ERTMS/ETCS is designed to allow for a smooth migration from one level to another. For instance, upgrading Level 1 to Level 2 mainly necessitates the installation of the radio network, the Radio Block Centre and some additional balises for positioning. ERTMS/ETCS levels and baselines are backwards compatible, meaning an ETCS Level 2-equipped train will also be able to run on a Level 1-equipped trackside structure.

WHY SHOULD I OPT FOR ONE ERTMS/ETCS LEVEL OR ANOTHER?

ERTMS/ETCS has been designed to meet the railways' needs, reflected by the available levels. The existence of another signalling system on the line, the possibility of equipping the line with GSM-R, the maximum speed allowed, and capacity upgrades are among the factors that come into play when choosing a particular ERTMS/ETCS level. However, today, it is commonly acknowledged that ERTMS/ETCS Level 2 brings the full benefit of the system to reality, as it delivers increased safety, capacity and significant cost savings by removing lineside signals.

Next to the common Levels 1 and Level 2, there are two additional levels: Level 0, which refers to trains equipped with ETCS running on non-equipped lines; as well as Level NTC, which describes trains equipped with ETCS operating on tracks equipped with the legacy national system (i.e. Class B system). Within the NTC level, ETCS acts as an interface between the driver and the national train protection system.