

INCREASING INFRASTRUCTURE CAPACITY HOW ERTMS IMPROVES RAILWAY PERFORMANCE

Today, railway operations in several parts of the world and in Europe in particular require a constant and increasingly intense flow of trains on busy routes. By allowing a reduction of headways between trains, signalling systems play a major role in increasing capacity on railway networks, as more trains can run on the same track. Whilst the primary objective behind its creation was to ensure interoperability in Europe, ERTMS also offers considerable benefits in terms of infrastructure capacity, which explain its increasing success outside Europe.

How can signalling affect rail infrastructure capacity?

Whilst signalling originally aims to control railway traffic safely and avoid collisions between trains, it increasingly plays an important role in increasing capacity, i.e. influencing the number of trains on a given line and the distance between them, and has therefore become a crucial part of railways' competitiveness.

In the early days, "Movement Authorities" (i.e. the commandment for a train to continue its run at a given speed or brake in order to stop at a given location) were passed on to train drivers by flagmen or elevated flags located on the various sections of the track. These were replaced over time by lineside signals (traffic lights) which are nowadays still largely present on most railway networks.

However, the emergence of High Speed trains and the need to ensure a higher level of safety led to the emergence of Automatic Train Protection (ATP) systems in the 1970-1980s. As opposed to the previous lineside signalling systems, ATP will automatically apply the brakes if the driver fails to respect the Movement Authority – thereby removing the risk of a human error and allowing for higher speeds and shorter headways between trains.

Is signalling the only way to increase capacity on a given rail network?

No – there are a number of options to increase capacity, from building additional lines or renewing existing tracks, lengthening trains and loops or platforms, to operating more frequent services and higher density trains.

However, by opting for a modern signalling system like ERTMS, operators may easily increase the frequency of trains on a given line. Instead of building another line or lengthening trains and platforms, upgrading to ERTMS represents the easiest, most economic and least disruptive way of increasing capacity on a line or network.

What gains can be expected from moving from a conventional trackside signalling system to a cab-signalling ATP system like ERTMS?

Infrastructure capacity is always a result of several technical and operational factors, and this makes it difficult to provide a generic figure. However, it is commonly acknowledged and demonstrated by experience that the use of an ATP system like ERTMS with an appropriate block system enables up to 40% capacity increase on currently existing infrastructure. This is considerable and explains why countries all over the world are massively opting for ERTMS when building new lines or re-signalling their network, with nearly 50% of the total ERTMS sales being made outside Europe.



A number of ATP systems are already in operation. Does ERTMS offer any additional capacity as compared to them?



As the most recent signalling system, ERTMS is publicly acknowledged to have better performance in terms of capacity than its predecessors. This is due to the cab signalling features and the ability of ERTMS to take into account the braking compatibilities of each individual train – thereby allowing for shorter headways between trains and higher speeds.

Concretely, how many trains per hour can run on an ERTMS line?

As already mentioned, this depends on a variety of factors which make it difficult to provide a generic estimate. A 2008 study by RWTH Aachen University (Institute of Transport Science) for the International Union of Railways (UIC) provides a first estimates of the line capacity when using different ERTMS levels, concluding for instance that using ERTMS level 2 with optimised block sections allows to have a minimum headway of only 2.51 minutes between two high speed trains and 1.62 minutes between regular intercity trains, depending on the assumptions.

In practice, real gains can however be calculated by taking examples of ERTMS lines which are already in operation.

A typical example of a high-capacity ERTMS lines is given in the Swiss case of the Mattstetten – Rothrist line, which operates in level 2. An estimated 242 trains – both freight and passengers run on the line everyday, at speeds of up to 200 km/h. The headway between trains has been reduced to less than two minutes (110 seconds), allowing for a considerable capacity increase!

SBB infrastructure manager reported (ETR, September 2008) a 15% capacity increase with ERTMS Level 2 on already optimised lines. In case of lines with mixed traffic (passengers plus freight), a capacity increase of up to 25% was reported.

Many other examples may be found, such as the Very High Speed Line Roma - Napoli where 33 runs per day are made on a 216km line at speeds of 300km/h, with headways of less than 5 minutes.

Does ERTMS level 2 enable higher capacity increase than level 1?

Basically, the use of ERTMS level 2 can offer considerable advantages in terms of capacity increase. Indeed, when using level 2 a continuous stream of data informs the driver of line-specific data and signals status on the route ahead, allowing the train to reach its maximum or optimal speed but still maintaining a safe braking distance factor. This therefore enables higher operational speeds and reduced headways (see dedicated factsheet #3 on “ERTMS levels”).



Is this ‘capacity advantage’ of ERTMS recognised globally?

Yes – all across the globe ERTMS is seen by the railways as “the” way to increase capacity on busy routes. For instance, ERTMS is already in service in the route between New Dehli and Agra (one of the busiest lines in India) and will soon be installed on the Mexico City suburban line Cautitlan – Buenavista, as well as in busy parts of the dense Chinese railway network.

Together with other advantages, capacity increase has made ERTMS a very successful standard across Europe (see ERTMS factsheet #7 on “Deployment outside Europe”) as well as the most demanded signalling system elsewhere for new and upgraded lines.

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