



## Summary

The purpose of the Digirail study was to explore how the renewal of the currently used train protection system can be modernised the most nationally effective and cost-efficient manner while taking the regulations of EU and future prospects into account. The study was carried out in cooperation with the Ministry of Transport and Communications, the Finnish Transport Infrastructure Agency, the Finnish Transport and Communications Agency Traficom, Traffic Management Finland Group Ltd, Finrail Ltd, VR Group Ltd and Helsinki Regional Transport. The work, which involved both Finnish and foreign experts, was overseen by a steering group set up by the Ministry of Transport and Communications.

In terms of railway systems, we are due to undergo a major change as the reliability and the economic life of the train protection system used in Finland, including trackside and train-borne equipment currently, are about to end in the 2020s. In addition, as Finland is part of the European railway area, it must fulfil its obligations of ensuring compatibility with the Trans-European Transport Network (TEN-T), for instance, and equipping its tracks with the European Rail Traffic Management System (ERTMS), the development of which is regulated by the EU. The EU also requires that all new railway projects, such as the One Hour Train and Finland Railway, are designed to include the ERTMS. It is also known that, in the future, there will be increased demand for railway capacity. By improving the technical infrastructure, the usage of the current railway network's capacity can also be optimised. Investments are thus inevitable for even maintaining the quality of Finnish rail traffic at its current level. The investments must provide maximum overall benefit to society.

The Digirail study analysed railway and communication technologies as well as their regulations and effectiveness from various perspectives. The conclusion of the study is that, in terms of technology, a radio-based European Train Control System (ETCS) is best placed to replace the current train protection system. This means that Finland must begin to use the Future Radio Mobile Communication System (FRMCS). FRMCS is based on 5G technology, and it is currently in a definition phase. The current conditions provide Finland with an opportunity to become a technological pioneer and leader in the railway industry. The experiences and skills gained can be utilised elsewhere in Europe. The train control system must comply with the requirements of an ETCS Level 2 system, which involves continuous supervision of train movement through radio signals. ETCS Level 2 systems are already provided by various suppliers. ETCS Level 2 systems can be upgraded to ETCS Level 3 systems, which allows for upgrading



the capacity of the railway network, level crossing and personal safety and the extent of automation to the highest possible level. The current and future capacity of the railway network can be improved by using the technology to shorten the headways between trains. Improving the capacity of the railway network allows for increasing the volume of transport services in rail traffic, boosting climate change mitigation efforts by moving cargo from roads to rails. Improving and using the capacity of the railway network more efficiently also helps remove bottlenecks in the network, boosts recovery from disruptions, makes it easier to plan timetables and improves punctuality. Compared with lower-level ETCS alternatives, the number of trains on the single-track routes of the current network (88% of the entire network) can be increased smoothly and effortlessly with a radio-based system. Furthermore, on certain current double-track routes, it is possible to increase the number of trains significantly, particularly in homogeneous traffic, by making a few identified investments in addition to renewing the system. The modern technology ensures realising the maximum potential of the possibilities of digitalisation, not to mention the potential to cut down CO<sub>2</sub> emissions by improving the accessibility of rail traffic and the quality of services. Digirail contributes to increasing the attractiveness of public transport, mitigating climate change effectively.

According to preliminary cost estimates, the investments required for ETCS Levels 1 and 2 as well as the modern Level 3 are approximately the same, about EUR 1.7 billion. The number of trackside equipment required for ETCS Levels 2 and 3 is considerably lower as interlocking systems are renewed with the same investment. For ETCS Level 1, there is no direct need to renew any interlocking systems. However, considering the constant need for renewing the current signalling systems, the level of investment is the same in all ETCS Levels. According to a lifecycle analysis for 2020–2065, the overall costs of the modern radio-based ETCS solution are EUR 435 lower than the costs of its closest alternative, ETCS Level 1. The current need for renewing interlocking systems on ETCS Level 1 is considered in this analysis as well. Given the large scale of the investment, the funding of the entire investment must be guaranteed. This requires long-term and new kind of commitment to financing, particularly on the Finnish Government's behalf. If the train protection system is not renewed thoroughly in the entire railway network, the quality of railway services deteriorates and the overall costs increase. This is due to the diverse types of equipment used in the system and the subsequent needs related to operations and maintenance. The modern radio-based ETCS provides a platform for digital,



intelligent rail traffic, and it is the only way to utilise data and artificial intelligence in the development of passenger and freight transport on rails.

The lifecycle of Finland's train protection system is about to end and a replacement system is required. In Europe, the focus is on modern systems that allow for automatic train operation based on digitalisation. Finland must take part in this current trend. Ambitious emission reduction targets also require efficient actions in the development of rail traffic. In terms of emission levels, rail traffic is the most environmentally friendly mode of transport (traffic total 21%, rail traffic less than 1%, market share in passenger and freight transport 6% and 27%, respectively) and an effective way to boost emission reduction efforts. In order to increase the proportion of railway transportation, improvements in the capacity and reliability of operations are required. Digirail is an ideal tool for joint efforts, which are also required in increasing the proportion of rail traffic. Well-targeted cooperation between all parties in the railway industry is required in the development efforts. The digital environment requires seamless collaboration between all stakeholders — no party is able to carry out this change alone.

The transition from roads to rails is also a goal targeted by the EU, and it is strongly emphasised in the European Commission's Green Deal's goals, for instance. As an environmentally friendly mode of transport, the aim is for rail traffic to take over a significant proportion of the freight traffic which is currently active in road transport. In order to achieve its goals, the EU must take a digital leap in rail traffic regulation. The European Commission has initiated the renewal of rail traffic regulations, the Digital Rail and Green Freight Revision programme, in cooperation with the European Union Agency for Railways (ERA).

Based on the conclusions of the Digirail study, the parties involved recommend replacing the current train protection system with a modern radio-based ETCS system, specifically a nationwide system of at least ETCS Level 2 in the initial phase. The goal is to begin extensive establishment of the system in 2028. Because of this, the steering and project groups of the Digirail study and all organisations involved in the study recommend that Finland's national ERTMS implementation plan is updated and the required system tests and further studies are carried out as soon as possible.