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Train automation and its impact on the railway system

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ABSTRACT

Nowadays, the railway industry faces numerous challenges, with the increasing need for passenger and freight transport in combination with the growing trend of urbanization being in the epicentre. Technology plays a substantial role in the constant railway industry progress, responsibly meeting the needs of transportation. The European Union provides significant support towards this direction by funding innovative research programs in favor of the prospective railway world's evolution.Automation of railway systems constitutes one of the most recent significant technological achievements, which will be a milestone for future operation of transportation systems. Automation has already been developed and adopted in various public transport systems around the globe, such as metropolitan railways and monorails, which sustain common operational characteristics. There are four (4) grades of automation (GoA) from grade one (1) to grade four (4). Grades of automation depend on the train control system (automatic train protection and automatic train operation) which support the railway system. Grade 1 includes only the automatic train protection while grade 4 includes both sub-systems comprising full automation of the rail system. Nevertheless, only the first one (grade 1) has been developed in conventional lines.Over the last years, automation has been successfully introduced in several intercity railways with special interest in the pioneering United Kingdom's first automated train, which started operating in March 2018. However, significant changes to signalling systems and railway infrastructure are expected to take place in order to serve automated system requirements. Interoperability in railway signalling has already become a reality in European basis and the future challenge lies in combining railway signalling and automation.Therefore, it comes as no surprise that the actual value of technology development in terms of train automation should be effectively assessed in regard with its impact on certain railway constituents such as operational performance, cost of rail facilities and materials. It is likely that the automation will optimise the operation of railway systems, improving track capacity and passengers' services, rendering the railway industry a highly competent section of transportation. This dissertation focuses on the assessment of automation's influence, mainly as far as conventional lines are concerned, in the overall railway system constituents. The above-mentioned qualitative assessment includes automation case studies, which are, either still under investigation, or already applied. The results seem more than encouraging, since the track capacity appears increased, while energy consumption is reduced. However, the need for more secure and distinct conclusions leads to further research implications.

KEYWORDS

Grade of automation, Automatic Train Protection, Automatic Train Operation, ERTMS, CBTC