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## Advancing Rail Telecom Networks: The Essential Role of Drive Testing

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Industries are becoming increasingly digitised, and the railway sector is no different. Urban mobility is undergoing a huge transformation, and railways are at the very heart of freight and passenger transport on a local, national, and in some cases, international, level.

Traffic management tools, passenger information systems, signalling and real-time communication systems are just some of the areas in which digital innovation is proving useful to rail networks. According to one figure, the global digital railway market size is **expected to reach** $103 billion by 2028 – a CAGR of more than 9%.

If we think of digitisation as a set of new carriages, telecommunications networks are the tracks that support and guide them. Telecommunications serve as the backbone for operational efficiency, safety and the overall reliability of rail services. As this sector transitions from traditional systems, such as the 2G-based GSM-R, to more advanced networks like 4G and 5G, the need for rigorous network performance and reliability assessments becomes critical. Drive testing has emerged as a critical tool in this context, offering a precise method for evaluating new telecom infrastructure. Drive testing ensures that the rail telecom networks meet the high standards required for supporting current operations as well as future technological advancements. Stakeholders can verify network readiness, identify areas for improvement

and guarantee that communication systems uphold the safety and efficiency essential for modern rail operations.

## Full Steam Ahead: Leaving GSM-R Behind

5G is already promising to reshape the future of railways by offering ultra-low latency and ultra-high reliability. While GSM-R, TETRA and LTE are still the standards adopted by traffic control centres in more than 30 countries around the world today, the future is rapidly approaching. Work has already begun on FRMCS, which will leverage 5G to facilitate advanced functions such as the Internet of Things, remote monitoring, high-speed rail, driverless trains and CBTC systems. These new technologies and use cases demand fast, robust and reliable connectivity networks that can collect, transmit and process enormous volumes of data in real time. According to one European-based **study**, more than 80% of railway executives are already piloting, planning or implementing FRMCS as part of their infrastructure.

Given the breadth of potential new use cases and technologies being deployed, ensuring that FRMCS and networks supporting them are fit for purpose and able to perform under high-pressure real-world scenarios becomes vital. That's where drive testing comes in.

## What Is Drive Testing?

Drive testing is a methodical approach employed

to assess the performance and reliability of telecommunications networks, crucial for safety and efficiency. This process involves collecting data on network coverage, capacity, speed and overall quality from various points within the rail network. By simulating the user experience, drive testing provides invaluable insights into the operational integrity of telecom systems, enabling the identification and rectification of potential issues before they impact operations. Drive testing can be manual or automated, where manual testing allows for targeted, on-the-ground insights, and automated systems offer continuous, wide-scale coverage. Data collected ranges from signal strength and network latency to voice and data transmission quality, painting a detailed picture of network health and performance across the rail system.

## Drive Testing: Challenges and Strategies

Conducting drive testing effectively within the rail environment presents unique challenges, primarily due to the dynamic nature of network conditions and the imperative to minimise disruption to ongoing rail operations. The mobility of trains, varying terrain and the diverse infrastructure across urban and rural areas contribute to fluctuating network performances that require meticulous assessment. Further, ensuring that drive testing does not interfere with the daily train operations demands careful planning and execution. This balance is critical to maintaining service reliability while simultaneously conducting comprehensive tests to evaluate the telecom network's performance and resilience.

Consequently, formulating effective drive testing strategies from the outset is crucial. Choosing appropriate – representative – test routes is a good starting point. Equally important is determining the frequency of tests to capture a comprehensive data set that reflects both peak and off-peak conditions, further informed by any known issues or areas of concern within the network. Integrating testing activities with regular rail operations, possibly through the use of operational trains for testing purposes, can also help to mitigate disruptions and breaks in service. If possible, both portable and fixed testing solutions should be deployed to maximise coverage of extensive networks; portable devices facilitate focused assessments in areas
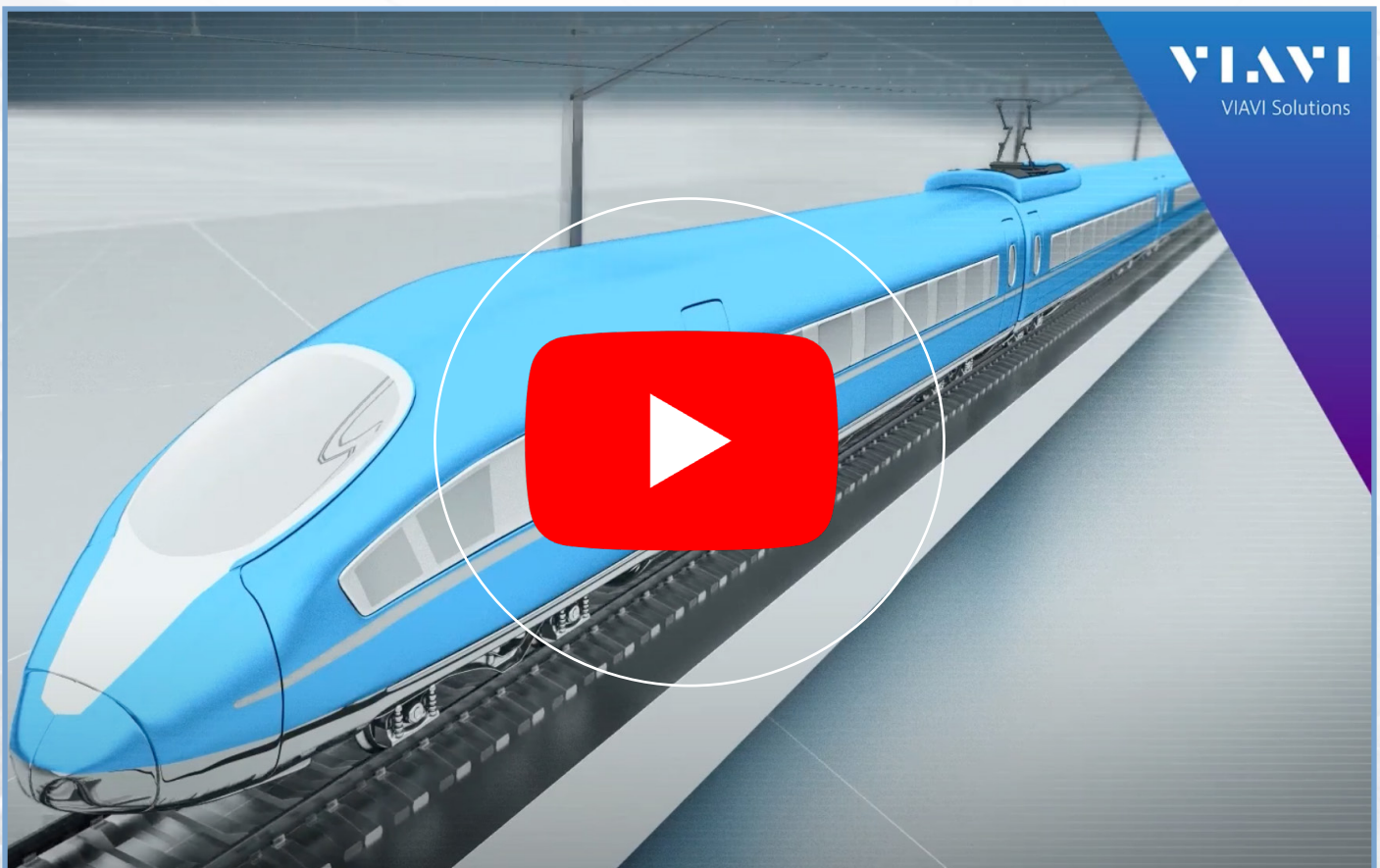
network improvements, strategic investments and compliance with regulatory standards. This data-driven approach will ensure that rail telecom networks are not only equipped to meet today's demands for high-speed and reliable communications but are also future-ready, capable of adapting to the fast-paced advancements in telecommunications technology and the ever-growing expectations of operators, businesses and passengers.

that might be temporarily affected by environmental factors or undergoing infrastructural changes, while fixed installations offer ongoing monitoring capabilities, ensuring a consistent level of network quality is maintained across all operational areas.

As we move toward 5G-enabled FRMCS, the rich data harvested through drive testing provides a solid foundation for making informed decisions about

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