

# R&D for the Future of Railways



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On behalf of the Railway Technical Research Institute (RTRI), I would like to extend my sincere greetings to our readers.

Guided by its vision, “We will develop innovative technologies to enhance the rail mode so that railways can contribute to the creation of a happier society,” RTRI has advanced its activities through a five-year master plan designed to realize this vision. Under its master plan, “Research and Development for Creating the Future of Railways—RESEARCH 2025,” launched in FY2020, RTRI has focused its research and development (R&D) on improving railway safety, particularly by bolstering resilience against intensifying natural disasters, developing innovative railway systems that make full use of digital technologies, and decarbonizing railways toward achieving carbon neutrality by 2050.

To effectively utilize its resources and advance its R&D activities, RTRI has established three pillars of R&D: (1) R&D for the future of railways, (2) development of practical technologies, which provides immediate benefits for railway operation, and (3) basic research for railways, which serves as the driving force for addressing different railway issues and as a source of innovative technologies.

“R&D for the future of railways” targets technologies for practical applications approximately a decade ahead. It addresses themes that respond to the evolving needs of railway operators and changes in society while fully utilizing the high research capabilities, distinctive facilities, and collective technical strength of RTRI. Within this framework, six major R&D themes have been established: (1) enhancement of resilience against intensifying natural disasters, (2) autonomous train operation, (3) labor saving through digital maintenance, (4) building low-carbon power-feeding networks by coordinated power control, (5) increasing the speed of

Shinkansen trains in a manner suitable for their wayside environment, and (6) sophistication of simulation technologies. These six major themes comprise 22 associated projects and 51 research topics, conducted through cross-disciplinary collaboration. The current issue of this journal features the outcomes of these R&D efforts.

Since its inception, the master plan of RTRI has faced considerable challenges due to the COVID-19 pandemic, which placed severe constraints on our operations. Even under these challenging circumstances, we undertook a careful reassessment of the importance and urgency of all of our activi-

ties and worked to reprioritize our operations. In parallel, we have made every effort to secure R&D funding wherever possible and have strived to manage our R&D operations with a well-balanced and targeted approach. Consequently, we believe that we have largely accomplished our anticipated R&D goals.

In recent years, changes in the social, economic, and industrial environments surrounding railways in Japan have been accelerating. The railway sector now faces pressing challenges such as labor shortages, aging infrastructure, and the business continuity of regional railway companies.

Addressing these challenges requires continuous technical innovation. To achieve this goal, it is vital to promote collaboration and data sharing among different technical fields and organizations, thereby creating new values, enhancing the quality of R&D outcomes, and shortening development timelines.

Under its new master plan, RESEARCH 2030, which commenced in FY2025, RTRI will continue to play a significant role in promoting collaboration for technical innovation and will contribute to the realization of sustainable railway systems for the future.

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Front cover photo: **Upper left:** Airflow analysis results and a predicted wind speed map along a railway line generated based on forecast data from the Japan Meteorological Agency and other sources  
**Lower left:** Display screen of the integrated analysis platform  
**Right:** Test train equipped with a front obstacle detection system