

RTRI Hosts 37th Annual Conference

The Railway Technical Research Institute (RTRI) held the 37th RTRI Annual Conference entitled “Aiming for Sustainable Development of Railways —Labor-Saving and Automatic Train Operations—.” A total of 473 participants attended the conference from railway operators, government agencies, universities, companies, and the like.

1. Time and date: From 1:00 PM to 5:20 PM on Friday, October 18, 2024
2. Venue: Yurakucho Asahi Hall (Yurakucho, Chiyoda-ku, Tokyo)



Keynote Speech

3. Program and summary of lectures

■ Opening address

Dr. Masao Mukaidono
Chairman, RTRI

This year 2024 marks the 38th anniversary since RTRI was established in December 1986 as part of the reformation of the Japanese National Railways. Through these years including the year of transition to a public interest incorporated foundation in 2011, RTRI has been conducting various R&D activities to contribute to the development of railways and the creation of a happier society. RTRI's Annual Conference has been held every year since November 1988 to inform the public about our activities and R&D results, marking the 37th anniversary this year.



The main theme of today's conference is "Aiming for Sustainable Development of Railways —Labor-Saving and Automatic Train Operations—," including solutions urgently needed in the railway industry. It is particularly good news that railway companies have been getting their business performance back on track since the end of the coronavirus crisis. However, in recent years, labor shortage issues have been becoming evident across all industries, becoming increasingly serious particularly for local railway lines. Therefore, for the railway industry to continue to develop sustainably and play a significant social role while maintaining the same level of infrastructure and service quality as before, we must take full advantage of labor-saving technologies. Nevertheless, various technical and social issues have been identified for utilizing innovative technologies in the railway industry, where safety is of the utmost importance.

RTRI has been advancing its R&D into elemental technologies, diagnostic technologies for tracks and structures using on-board measurement systems, and platforms for integrated analysis of data, focusing on "utilizing digital maintenance to save labor" and "autonomous train operations" in accordance with RTRI's five-year master plan RESEARCH 2025, which started in FY 2020. About two years ago, RTRI held its Annual Conference on the theme of "Maintenance Technologies Supporting Sustainable Development of Railways —Innovations in Inspection and Diagnosis—," introducing research cases related to saving labor for inspection and diagnosis in each technical field, as well as the importance of data sharing among specialized fields and data collaboration between railway operators for future maintenance innovations.

Today's conference focuses on the achievements obtained so far and the direction of our future efforts. The introduction of labor-saving technologies and automatic train operations is expected to improve the operational efficiency of railways, provide more comfortable and safer services for users, reduce environmental impact, and contribute to alleviating urban traffic congestion.

We hope you will enjoy today's lectures, and we would be grateful if you could give us your candid feedback on our initiatives and the direction of our R&D efforts.

■ Summary of special lecture

“User-Friendly Automatic Rail Transport Technologies —Providing Safe and Comfortable Journeys and Workplaces Where Workers Can Feel Secure—”

Prof. Takafumi Koseki

Department of Electrical Engineering and

Information Systems

Graduate School of Engineering

The University of Tokyo

In today's society with declining birthrates and aging populations, various technological fields are placing the focus of their R&D on the promotion of smart DX (digital transformation) aiming to automate operations. The key role of passenger transport is to provide people (passengers) with safe and comfortable transport services, for which human resources are essential.



Turning our gaze to overseas, we can see that fully automatic train operation systems originating in Europe and the United States are increasingly being introduced to reduce labor costs. It has been deemed to be appropriate to introduce globally standardized automatic train operation systems if their safety can be technically quantified and the safety conditions based on thus calculated values are sufficiently acceptable. Supported by such a common understanding, driverless systems have been rapidly put into practical use specifically for underground railways and elevated urban railways, which are examples of driverless operation systems aimed at pursuing economic rationality.

In Japan, automating public transport does not mean making public transport unmanned but it means reducing labor for the benefit of transport employees through the process of saving labor and pursuing economic rationality. The Japanese railway industry aims to entrust driving operations and safety to systems, and thereby reduce the physical and mental burden on those involved in railway operations and customer services, which will open up the possibility of being able to work as railway professionals with pride for longer and more comfortably, regardless of age. The practical application of automatic operations is being considered in Japan not only for urban transport but also for a wide range of other areas, including surface and high-speed railways, with a focus on the appropriate use of human power in areas other than driving operations. There are already some practical examples. We hope that this kind of automatic operations will be developed around the world, especially in Asian countries with large and aging populations, with an approach that differs from the system-centered approach originating in Europe and the United States. The automatic operations introduced like the above will be a good example of DX that is friendly and inclusive to users.

■ Summary of keynote lecture

“Aiming for Sustainable Development of Railways —Labor-Saving and Automatic Train Operations—”

Dr. Masamichi Sogabe
Executive Director, RTRI

The sustainable development of the railway industry requires fundamental technological innovations that contribute to improvements in productivity. To achieve this, RTRI must play a role in three ways, namely, “Platform,” “Forefront,” and “Code.”



Platform

To build collaborative platforms that transcend the boundaries between technical fields and operators, RTRI is developing integrated analytics platforms, linking new platforms to existing platforms, developing a common set of modules, and creating a learning database to be shared, in order to create a foundation for applying digital technologies with the potential to change society (e.g., imaging and AI technologies) to the railway business.

Forefront

To elucidate the real nature of various issues by using cutting-edge technologies, RTRI is working to create innovative technologies by strengthening its core R&D technologies, proposing solutions, integrating its core technologies with digital technologies, identifying scientific evidence, and combining such evidence with technical standards.

Code

To support the social implementation of the proposed solutions, RTRI is working on safety and reliability evaluations and on meeting technical standards and international standards that are highly compatible with labor-saving and automatic train operations. RTRI is also increasing its technical flexibility, introducing innovative technologies, and responding flexibly to the individual circumstances of each railway line. Through these efforts, we hope to create sustainable railway systems and contribute to the development of railways as well as to the creation of a happier society.

■ Summaries of lectures

“Labor-Saving Technologies in the Technological Fields of Vehicles and Electrical Systems”

Dr. Tadao Takigami

Director

Head of Vehicle Technology Division, RTRI

Railway vehicles and electrical equipment are regularly maintained to ensure that trains can be operated safely. However, maintenance often relies on human workforce, particularly on visual inspection. In light of the current situation, where it is becoming increasingly difficult to secure the required number of engineers and skilled workers, we are working to “innovate operations” by promoting deskilling through the automation of tasks and evaluations thereof. Concurrently, we are working to “innovate operations and management” by extending inspection and maintenance intervals based on scientific and technical evidence, and by moving towards condition-based maintenance using, for example, constant monitoring systems. To accelerate these technological innovations, it is necessary to make use of sensor information including camera images, and to introduce AI into maintenance work at an early stage for object recognition and condition evaluations. RTRI is pushing forward with the reduction of labor by ensuring the quantity and quality of learning data sets and the elucidation of the grounds for AI-based evaluations.



“Labor-Saving Technologies in the Technological Fields of Tracks “

Dr. Yoshitsugu Momoya

Director

Head of Track Technology Division, RTRI

For the reduction of labor in the future construction and maintenance of tracks, three types of innovations are required, namely “operational and management innovations,” “task innovations,” and “material and structural innovations.” To accomplish these innovations, RTRI is proceeding with R&D efforts in: building platforms to share equipment and inspection data; inspecting and diagnosing track components by using images and AI; creating longer-lasting and maintenance-free track components; and streamlining track structures and reducing reinforcement bars. The key to successful labor-saving track inspections lies in establishing management methods using new indicators obtained by the introduction of CBM (condition-based maintenance) and RBM (risk-based maintenance). Another key to success is to consider the compatibility of new maintenance systems and technical standards. Through the social implementation of our R&D results, we are pushing forward with our R&D to create tracks that help realize safer and more stable train operations and require fewer workforce and less cost.



“Labor-Saving Technologies in the Technological Fields of Structures”

Dr. Toshiya Tadokoro

Director

Head of Structures Technology Division, RTRI

It is becoming increasingly difficult to secure sufficient human resources for construction and maintenance of railway structures. The workload involved therein is increasing year-on-year due to the aging of railway structures, the increasing severity and frequency of natural disasters, and other numerous factors. To solve these issues, RTRI has been conducting R&D aimed at reducing labor required for construction and maintenance, including the development of precast structures and tunnel inspection support systems. To further reduce the number of workers required for construction, RTRI is promoting performance design using finite element analysis, construction management using digital technologies, and design and construction supported by platforms such as BIM and CIM. To reduce the workforce required for maintenance, RTRI is proceeding with labor-saving using digital technologies for surveys, such as drones, performance prediction using simulations and databases, and extending inspection cycles. We are aiming to achieve sustainable railway systems by supporting the development of technical standards for implementing our innovative technologies throughout society.



“Sophistication of Automatic Train Operations”

Dr. Hideki Arai

Director

Head of Signalling and Operation Systems

Technology Division, RTRI

In the railway industry, one of the key issues is how to secure the required number of workers in the future including train drivers. One solution is driverless automatic train operations on standard railway lines with level crossings and other systems. To make this a reality, it is essential to ensure safety on the train tracks. The Automatic Operation Technology Study Group on Railways chaired by Prof. Koseki lists the following as implementation requirements for automatic train operations: considering rational and executable introduction of technologies taking cost efficiency into account; and “ensuring safety through comprehensive evaluations” based on the measures taken, for example, strengthening and reinforcing safety barriers and introducing sensor technologies to detect obstacles. Meanwhile, RTRI has been promoting R&D into autonomous train operations, which are expected to reduce the number of workers required for overall train operations by using technologies such as forward obstacle detection and onboard automatic evaluations. At present, the automation of railway operations is an



urgent issue especially for regional railways. To sophisticate automatic train operations for the future, we must work on our R&D into automatic operations using existing equipment that can be introduced to regional railways and provide technical support. This will contribute to the development of technical standards for the social implementation and widespread adoption of automatic train operations.

■ Proposal

“Toward Social Implementation of Labor-Saving and Automatic Train Operation Technologies”

Dr. Yoshitaka Murono
General Director of Research and
Development Promotion Division, RTRI

For the sustainable development of the railway industry, it is important to focus our innovations on deskilling, labor-saving, and automatic operation technologies. For promoting the social implementation of what has been achieved so far through such innovations, it is important (1) to build platforms for pushing forward the standardization of technologies and data sharing, and (2) to develop technical standards and new ways of thinking, both of which were created by means of the innovative technologies. To this end, RTRI is continuously enhancing technological innovations and supporting the development of technical standards which are inseparable from the further development of labor-saving and automatic train operations. In addition, RTRI is creating environments that facilitate collaboration between relevant parties, such as government ministries and railway operators, by building railway image-sharing platforms for utilizing railway technology information databases and AI technologies. Furthermore, RTRI is promoting further technological innovations by means of the data obtained through collaboration and is playing a role as an adhesive that will strengthen the bonds between relevant parties.



■ Closing Address

Dr. Ikuo WATANABE
President of RTRI

I would like to express my sincere gratitude to you all for taking the time to attend the 37th RTRI Annual Conference. Today, we held lectures and discussion sessions on the theme of “Aiming for Sustainable Development of Railways — Labor-Saving and Automatic Train Operations—.”



I greatly appreciate Prof. Takafumi Koseki of the University of Tokyo for his special lecture entitled “User-Friendly Automatic Rail Transport Technologies —Providing Safe and Comfortable Journeys and Workplaces Where Workers Can Feel Secure—.” Based on a wealth of examples from Japan and overseas, Prof. Koseki explained very intelligibly the trends and concept of introducing automatic train operations, and the roles people and machines play to ensure safety. In addition, his speech gave a powerful message that automatic driving in Japan should aim to “save labor with a focus on the benefits for people.”

Today RTRI introduced the case studies of our past R&D and the direction we are heading in, focusing on “Labor-Saving and Automatic Train Operations.” Also introduced are the roles that RTRI should play in order to succeed in labor-saving and automatic train operations, including: building platforms that serve as the basis for collaboration between operators and between sectors for the improvement of operational efficiency; promoting the development of technologies and modules that can be commonly used; strengthening the core technologies of R&D and efficiently proposing solutions; and supporting the creation of technical standards based on innovative technologies to assist in the implementation of the proposed solutions in society. Based on the aforementioned context, each presenter introduced the initiatives for the development of labor-saving technologies and the advancement of autonomous operations, which are being taken in their respective fields of vehicle/electrical systems, track, and structures.

Having experienced the coronavirus pandemic, society and the economy have changed significantly. The railway industry has also been affected. To overcome the labor shortage under these circumstances, railway operators must cooperate and collaborate with each other and effectively utilize common technologies that can replace labor-saving and automatic operation technologies. Amidst such trends, RTRI will contribute more than ever before to the sustainable development of railways by promoting collaboration with everyone in sharing technical information and data, as well as in developing technical standards.

RTRI will continue to collaborate with you all to the best of our ability in R&D and other activities. I would like to conclude today's closing remarks by asking for your continued guidance and support.