

## **The New Master Plan “RESEARCH 2025” Developed**

**The Railway Technical Research Institute developed a new master plan “RESEARCH 2025” for the five years starting 2020 as a concrete plan to fulfill RTRI’s vision “We will develop innovative technologies to enhance the rail mode so that railways can contribute to the creation of a happier society”.**

### **Master Plan - Research and Development Creating the Future of Railways - RESEARCH 2025**

#### **1. Introduction**

We are facing increasingly complicated social issues including the global environmental problems, social impact of the aging population, and regional disparity of economy. Under such circumstances, “Sustainable Development Goals” (SDGs) were adopted by the United Nations in 2015. The Japanese government also proposed “Society 5.0” and the government has been addressing the goal of realizing a sustainable society where issues will be solved with state-of-the-art technologies and all the people can enjoy the benefit. Internet of Things (IoT), big data analysis and artificial intelligence (AI) have been enabled by the rapid advancement of computing technologies and high-speed, large-capacity communications technologies and they have been pushing forward the global-scale innovation toward digitalized society.

Since the Japanese economy is gradually recovering, the traffic volume of Japanese railways has been steadily increasing with an increasing number of inbound tourists. However, there is a concern that the number of railway users will decline in a longer term, due to declining total and productive-age population resulting from the decreasing number of children and aging population and diversified working patterns. Furthermore, railways are facing an urgent need to provide more effective solutions to the issues of extreme weather events, aging railway infrastructure and labor shortages. In addition, railways are expected to play an increasingly important role in creating the services that connect different transport modes seamlessly.

Railway researchers and engineers have been seeking to change railway systems drastically in order to address a number of issues by using digital technologies. It is also important that several organizations cooperate and share information to solve increasingly complicated technical issues.

Against such a background, RTRI developed a new master plan “RESEARCH 2025” for the five years starting 2020 as a concrete plan to fulfill RTRI’s vision. We need to look into the railway technologies in the decades ahead. At the same time, we are expected to provide the society with timely R&D

outcomes that will be befitting the changing business environment and developing technologies. Therefore, the term of this master plan has been set to be 5 years until the fiscal year 2024.

## **2. Basic policies**

Under the changing social and technological conditions, we will emphasize improving further safety of railways and enhancing resilience to extreme and frequent natural disasters. We will introduce digital technologies into all fields of research and development and innovate railway systems. We will produce high-quality research outcomes by pursuing excellence across all fields of activities and enhancing the global presence of Japanese railway technologies to promote further overseas development. The following are basic policies of RTRI's activities.

### **(1) Enhancing safety with an emphasis on improving resilience to natural disasters**

Research and development to further improve safety and stability of railway transport is essential. In particular, RTRI will be focusing on the research and development to enhance resilience to increasingly serious and frequent natural disasters such as heavy rainfall, strong wind and major earthquakes. We will also intensify the research and development to prevent failures of ground facilities and vehicles and to address aging of these facilities. We will conduct disasters and accidents investigations and propose restoration and prevention measures as an impartial third-party organization.

### **(2) Developing innovative railway systems based on digital technologies**

RTRI will emphasize the research and development to introduce to railways digital technologies including IoT technology, big data analysis and AI combining advanced information processing and high-speed telecommunications network such as 5G. With the digitalization, we will develop labor-saving technologies such as autonomous train operation and digitalized maintenance in order to solve the labor shortage in railway operation. We will also promote research and development for the speed-increase on Shinkansen that will not damage the trackside environment and energy-saving railway operation. In addition, RTRI will start an endeavor to create new customer services such as MaaS (mobility as a service) and contribute to the innovation of railway systems.

### **(3) Creating high-quality research outcomes by pursuing excellence across all fields of activities**

RTRI will continue the research and development for railways in the future, practical technologies to be quickly introduced to railway operation and basic research to analyze the phenomena specific to railways. We will further improve our simulation technologies and construct test and research facilities with originality. At the same time, we will continue to gather the know-how on railway technologies, develop human resources, address the issues on railways with cross-sectional teams and build trust through creating and providing high-quality research outcomes at home and abroad.

#### **(4) Enhancing international presence of the Japanese railway technologies**

We will seek to enhance international presence of the Japanese railway technologies through cooperation with overseas railway operators and research organizations and intensified information sharing. We will play a leading role in the strategic activities of international standardization to support overseas advancement of Japanese railways.

#### **(5) Creating a work environment to help the employees develop their full potential and undertake challenging tasks**

Respecting each of our personnel, we will develop researchers who are able to address the needs of railway operators and produce creative research outcomes from a global perspective. We will continue to improve safety and hygiene at workplace, pay attention to the mental health and work-life-balance of employees and provide a comfortable and open work environment where employees can be relaxed and proud of their work.

### **3. Activities of RTRI**

RTRI will implement the following eight fields of activities for public-interest purposes:

- Research and development
- Investigation
- Technical Standard Services
- Information services
- Publishing and Training
- Diagnosis and Consulting
- International Standardization
- Qualifications

RTRI will also strategically and systematically promote the activities of the Railway Technology Promotion Center and Railway International Standards Center in coordination with rail-related engineers in other organizations and contribute to enhancing international presence of Japanese railway technologies. In addition, we will implement profit-making activities to promote the wide use of R&D results by railway companies.

#### **【Research and development】**

##### **(1) Principles for research and development**

###### **① Enhancing safety with an emphasis on improving resilience to natural disasters**

RTRI will focus on R&D to enhance safety. In particular, we will develop a system to evaluate the risks of natural disasters in real time and to support quick train operation control to ensure safety and early recovery by utilizing the weather and earthquake data measured by the advanced, high-density observation network of a public institution and our simulation

technologies.

② Developing innovative railway systems based on digital technologies

RTRI will gather basic knowledge and knowhow on advanced information processing technologies and high-speed telecommunications network and send researchers to research organizations dedicated to each field on a long- and short-term basis. Through these efforts, we will develop research capability to fully utilize the most advanced digital technologies. We will outsource the research work that requires use of AI technologies.

③ Creating high-quality research outcomes by pursuing excellence across all fields of activities

RTRI will address basic research and development that will solve railway-specific issues and will be the source of innovative technologies and, at the same time, intensify the development of practical technologies having strong impact on actual railway operation. In particular, RTRI will increase the resource to be appropriated for the development of much-needed practical technologies.

RTRI will further strengthen collaborative relationships with universities, research institutes and companies at home and abroad and address railway technical issues with multidisciplinary approaches. RTRI will keep effectively providing quality research outcomes by using newly-constructed large-scale test facilities and further construct facilities with originality directly contributing to research and development.

## (2) Goals and pillars of research and development

RTRI has set the following four goals of research and development:

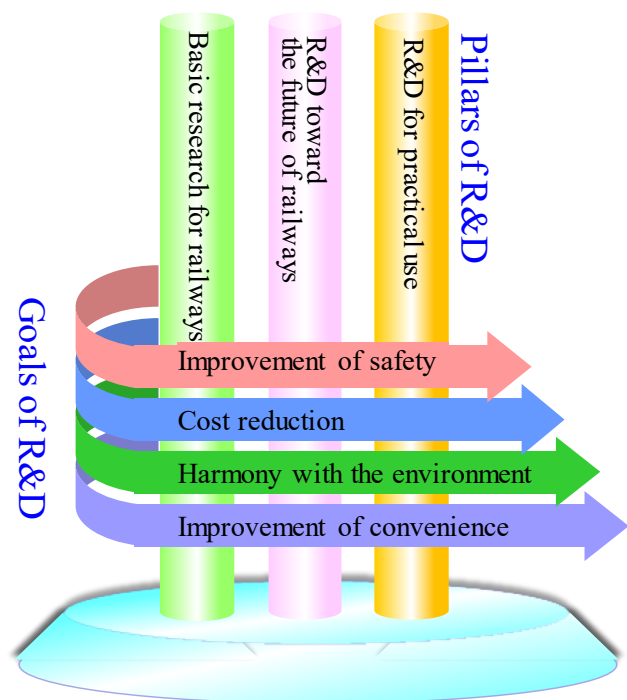
“Improvement of safety” such as enhancing the resilience to natural disasters

“Cost reduction” such as labor saving in maintenance

“Harmony with the environment” such as low-carbon power feeding networks

“Improvement of convenience” such as further speed increase

Three pillars of research and development, “Research and development toward the future of railways”, “Research and development of technology for practical use” and “Basic research



for railways” have also been set in order to promote research and development effectively with efficient use of the resource.

### (3) Research and development toward the future of railways

Aiming at introduction to commercial services within a few decades, RTRI will address the research topics needed by the society and railway operators. In particular, RTRI will put emphasis on the issues in the fields where RTRI has outstanding research capabilities and unique test facilities and the topics that require multidisciplinary approaches.

The following six research targets have been set:

- Enhancing resilience to extreme weather disasters
- Autonomous train operation
- Labor saving by digital maintenance
- Low-carbon power feeding networks by coordinated power control
- Speed increase on Shinkansen considering trackside environment
- Improving simulation technologies



Research and development toward the future of railways

### (4) Research and development of technology for practical use

RTRI will develop technologies quickly effective for actual railway operation in order to provide railway companies with practical and timely solutions.

## **(5) Basic research for railways**

RTRI will intensify basic research and development that will solve railway-specific issues and will be the source of innovative technologies. The topics for the basic research will be prediction of weather disasters, running stability of vehicles and improvement of trackside environment in the area of “Analysis and prediction of phenomena”, the mechanism and inspection methods for deterioration and damage and human factors in “Building analysis, tests and assessment methods”, and wear and service life extension and AI in “Introduction of new technologies, materials and research methods”.

## **[International standards activities]**

RTRI will strategically promote international standardization for railways in order to maintain and improve Japanese railway technologies and to support their advancement into overseas markets.

As a Japanese mirror committee of ISO (International Organization for Standardization) and IEC (International Electrotechnical Commission), RTRI will propose draft railway standards from Japan and take the lead in reflecting Japanese design policy and technologies in the standards proposed by other countries. At the same time, RTRI will conduct research into the standardization activities by internationally influential railway-related organizations and take necessary actions. Together with related organizations, RTRI will also address the other issues regarding standardization which the Japanese railway sector is currently facing, including codifying Japanese technologies and knowhow and examining the certification scheme.

## **[International activities]**

In order to enhance its technical capabilities and global presence, RTRI will expand joint research activities with overseas universities and research bodies, increase the number of researchers who will be sent abroad and improve the quality and quantity of the information that RTRI will globally share. RTRI will also boost the speed and quality of its research activities through intensifying investigations of the latest overseas research trends and accepting a larger number of visiting researchers from overseas. RTRI will continue its contribution to developing Japanese railway technologies to overseas markets. For this purpose, RTRI will support railway operators and related companies to advance into overseas markets, help their human development and promote overseas development of RTRI's technologies.

## **4. Management of RTRI**

Observing Japanese laws and regulations and its articles of incorporation as a public-interest corporation, RTRI will seek sound and fair management.

**[Compliance with laws, rules and ethical codes and concepts]**

RTRI will provide educational programs and on-the-job training regularly in order to raise the employees' awareness of work ethics and to ensure their compliance with laws, rules and ethical codes and concepts.

**[Information control]**

RTRI will strictly control the research and development information and others and implement more strict security measures for information management and sharing.

**[Personnel management]****(1) Recruitment**

RTRI needs to recruit researchers and engineers necessary for the research and development in the fields of particular significance in a medium- and long-term perspective. For this goal, RTRI will enhance the awareness and deepen the understanding of RTRI's research activities by researchers and students through the efforts of strengthening the collaborative relationships with universities and other research bodies and promoting internship programs. RTRI will continue recruiting researchers regularly in order to maintain technical continuity.

RTRI will diversify the way of recruitment and recruit mid-career experts so that it can employ outstanding experts in the state-of-the-art technologies such as digital technologies and advanced simulation.

**(2) Human resources development**

RTRI will develop researchers capable of inheriting the technologies that have been accumulated over years at RTRI, responding the needs of railway operators and promoting original and creative research and development. For this purpose, RTRI will improve on-the-job training and educational programs designed for each job level from newly-recruited employees to management people. The personnel exchange programs with JR group and other companies will be further expanded to management-level employees as well as younger employees.

Researchers will also be sent to research organizations dedicated to the most advanced technical fields such as digitalization in a short- and long-term basis. RTRI will further promote joint studies and personnel exchange with overseas universities and research bodies in order to develop the personnel who will be able to contribute to enhancing the international presence of Japanese railway technologies from a global perspective.



Researchers will be strongly recommended to obtain doctoral degrees and the certification of the professional engineer and to actively join the activities of academic associations in order to develop their own research abilities, gain expertise and enhance the presence of RTRI.

### **(3) Work environment that provides employees a sense of achievement**

RTRI will make the workplace safer and more hygienic, care about the mental health of employees, and support the reform of working practices and nurturing the next generation people. Furthermore, RTRI will create the work environment where they can choose work styles flexibly and pursue their tasks without worry, enjoying mental and physical health.

RTRI will provide a work environment where the researchers of wide-ranging technical fields will be able to have candid discussions beyond the difference between generations and job positions, and all the employees will be highly motivated and satisfied with their work.

## **5. Concluding remark**

We will have to address immediately the issues of unprecedented weather disasters and the serious labor shortage due to declining working-age population. However, it is difficult to solve these problems within the current framework.

In order to solve them, technological innovation is indispensable. RTRI will take a leading role in railway technical innovation and pursue the research and development to solve the challenging issues that railways are facing, build a sustainable society and create the future of railways in cooperation with railway operators, research bodies and related companies.

RTRI will accumulate know-how on railway technologies, conduct accident and disaster investigations and propose restoration and prevention measures as an impartial third-party organization.

RTRI will strictly observe laws, regulations and articles of incorporation and further enhance the credibility of RTRI. Since RTRI does not own railway tracks and facilities for commercial services, it will promote personnel exchange with railway operators more actively in order to develop researchers who have a good understanding of actual train operation and its issues and to steadily pass on the technologies to younger generations.

RTRI will implement “Master Plan - Research and Development Creating the Future of Railways - RESEARCH 2025” based on its vision “We will develop innovative technologies to enhance the rail mode so that railways can contribute to the creation of a happier society”.