Toward Railway Innovation

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Organizational Revision of the Railway Technical Research Institute and the Initiatives of its Technology Divisions

Introduction of the Organization of the Railway Technical Research Institute

Starting with this issue, we would like to introduce the organization of the Railway Technical Research Institute (RTRI, hereinafter) over several issues. In this issue, we would like to introduce an overview of the revised organization as of April 1, 2022, and three research divisions in the following articles.

Purpose of the Organizational Revision

Amid drastic changes seen in railway operation environments due to the growing pandemic of COVID-19, RTRI is facing challenges including more enhanced safety measures for natural disasters, digital technology-driven innovative railway systems and carbon neutrality by 2050 that need to be addressed in a prompt manner.

To that end, we announce that we have revised RTRI's organizational structure on April 1, 2022 to seek for swift and efficient research and development achievements and further operating efficiency.

The organization of RTRI currently consists of thirteen research divisions (including one research center) and eight divisions (including two centers) [Organization chart after revision]. The main points of the organizational revision are described below.

Organizational revision of research divisions

(1) New divisions responsible for research and development of innovative railway systems with digital technologies (***New divisions: Signalling and Operation Systems Technology Division and Information and Communication Technology Division*** **)**

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Editor-in-chief Kimitoshi Ashiya (Executive Vice President of RTRI)
Managing Editor Toru Miyauchi (Associate Director (International Affairs), Research & Development Promotion Division of RTRI)
Publisher Railway Technical Research Institute
Address 2-8-38 Hikari-cho, Kokubunji-shi, Tokyo 185-8540, JAPAN
URL www.rtri.or.jp/eng
Contact us International Affairs, Railway Technical Research Institute
Mail Address International_development@rtri.or.jp

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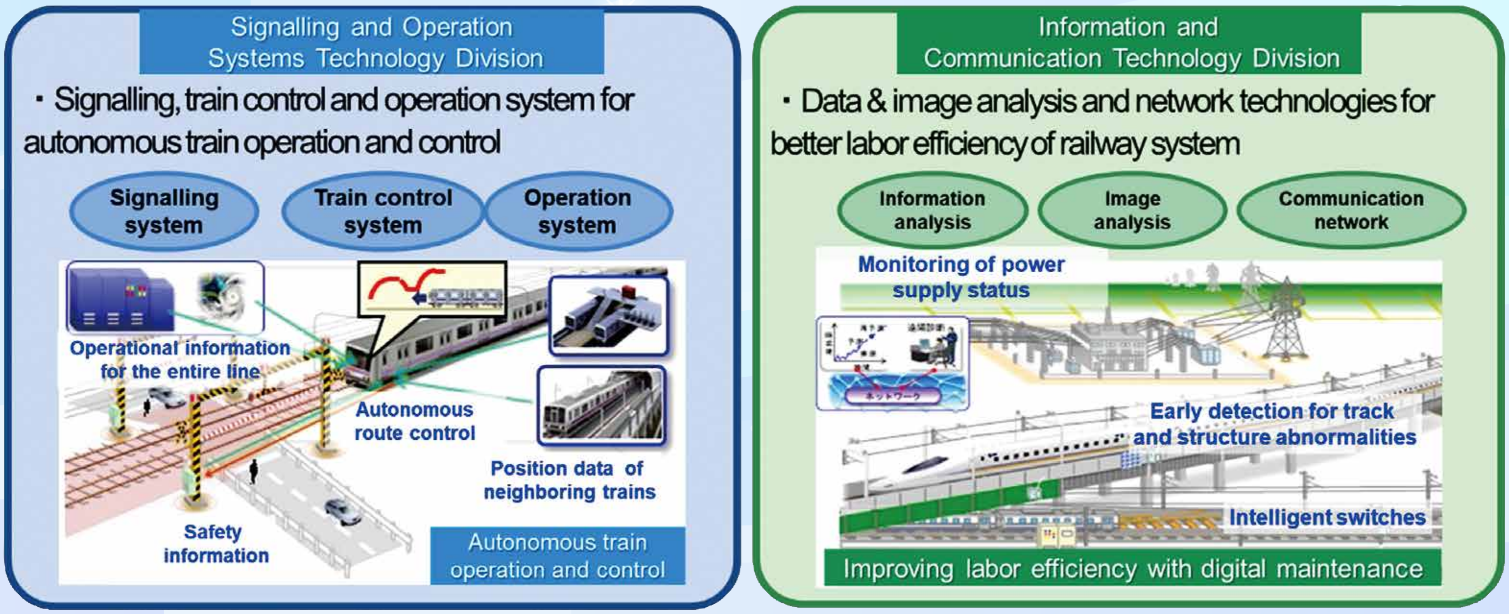


New divisions: Signalling and Operation Systems Technology Division and Information and Communication Technology Division (Main research projects shown in encircled areas)

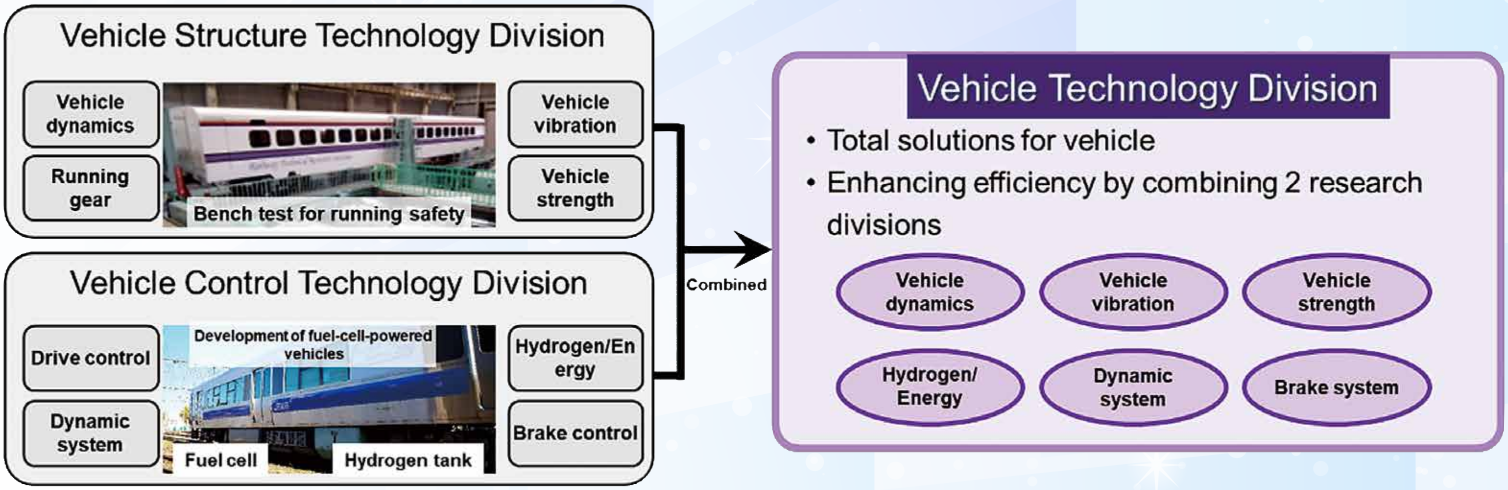
Dr. Toru Miyauchi
Managing Editor
Associate Director (International Affairs), Research & Development Promotion Division

Message from Managing Editor Dr. Toru MIYAUCHI

Under the main theme of “Reorganization of the Railway Technical Research Institute (RTRI) and the Initiatives of the Technology Divisions”, this issue of Ascent focuses on three technology divisions - Structures Technology Division, Power Supply Technology Division and Track Technology Division. As for the other divisions, they will be introduced in the next and subsequent issues .

As you may know, COVID-19 has been reclassified as a Class 5 infectious disease in Japan since May 8th, 2023. Since the reclassification, the country has seen a massive flow of Japanese going abroad and foreign tourists coming to Japan.

RTRI has also accepted visits since then and many people from overseas have visited RTRI to see our facilities and to have productive dialogue with RTRI staff. It is a great pleasure for us to have international visitors to RTRI.



New division: Vehicle Technology Division
(Main research projects shown in encircled areas)

The Signalling and Transport Information Technology Division has been separated into two divisions: the Signalling and Operation Systems Technology Division and the Information and Communication Technology Division, with the aim of more agile research and development with digital technologies to make railway systems more innovative.

These two divisions mainly focus on research into autonomous train operation and improving labor efficiency, such as unmanned and labor-saving systems and remote operations through advancing interdisciplinary research of digital technologies, respectively.

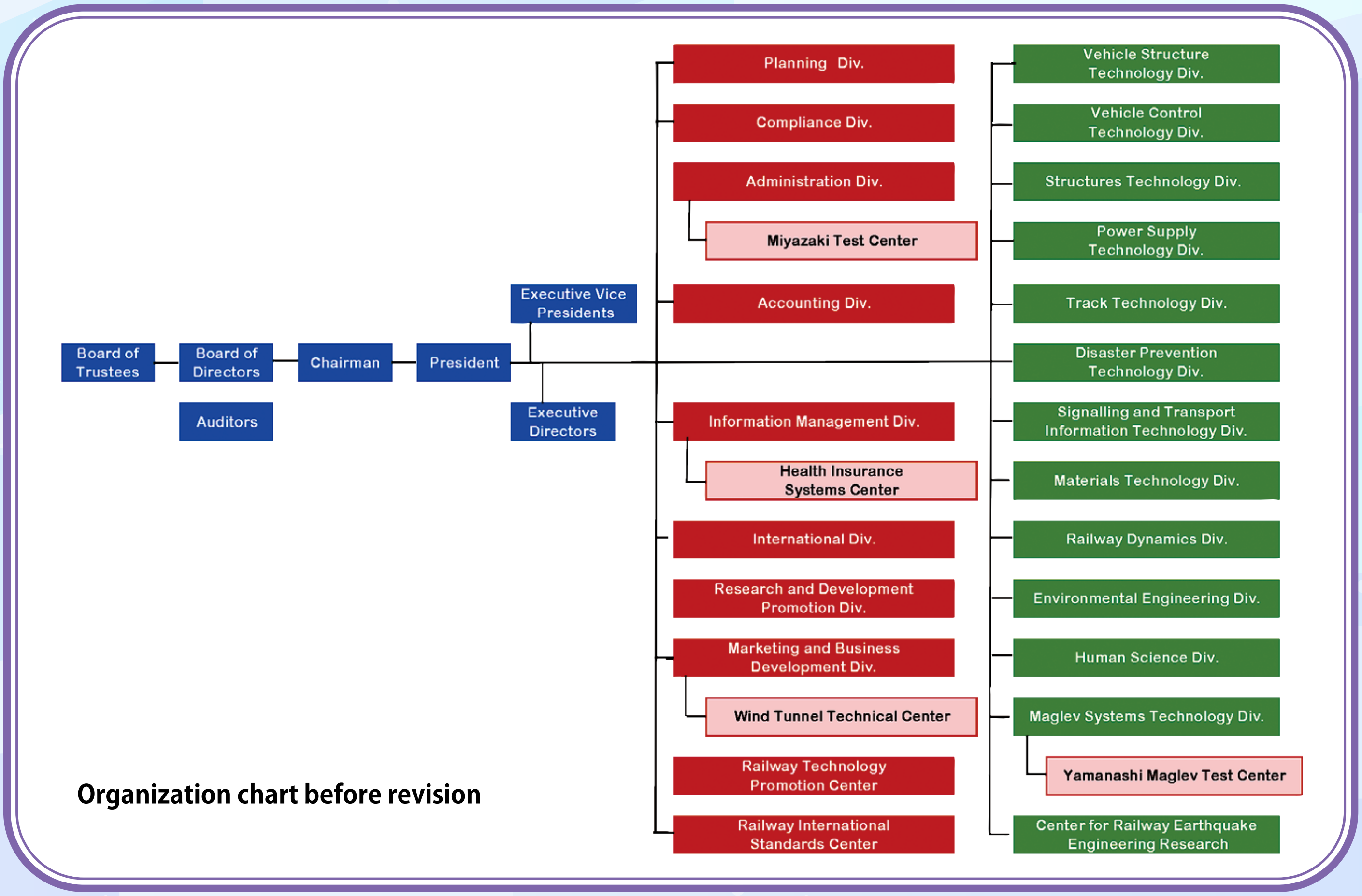
(2) New vehicle research and development division for more sophisticated and diverse R&D needs (*New division: Vehicle Technology Division*)

A Vehicle Technology Division has been established by integrating the Vehicle Structure Technology Division responsible for vehicle safe operation and the Strength and Vehicle Control Technology Division responsible for vehicle motor, internal combustion and brake control systems. Integrating the two divisions aims for collective research and development of vehicle technologies, moving forward to digital-technology-incorporated vehicle engineering, decarbonizing initiatives, global business expansion, and an effective and agile response to more sophisticated and diverse R&D needs.

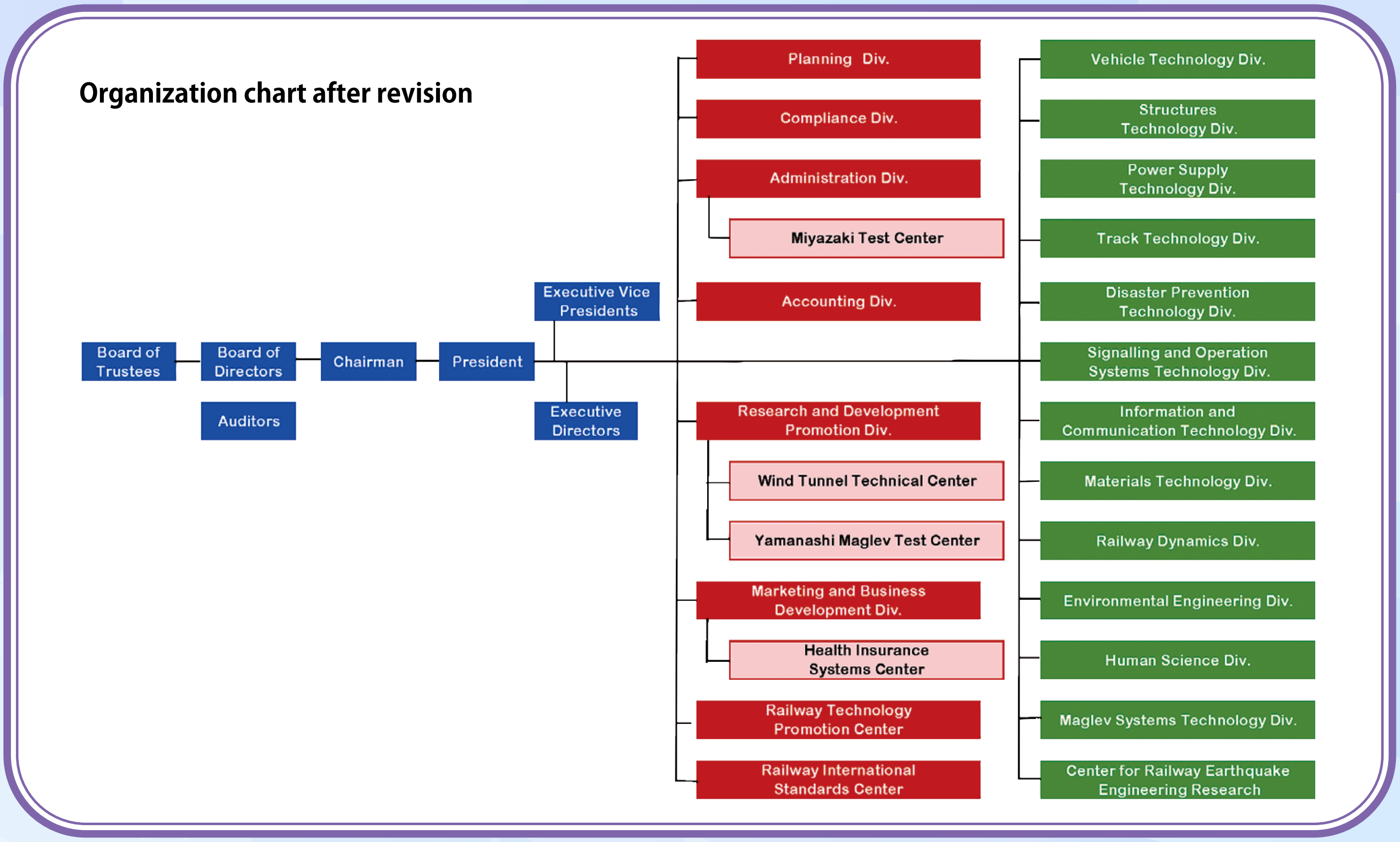
Organizational revision of divisions

Several divisions have been integrated to support R&D operations conducted by the research divisions more efficiently:

The Information Management Division and the International Division have been integrated into the Planning Division and the Research and Development Promotion Division, respectively. The Information Management Division's Health Insurance Systems Center was integrated into Marketing and Business Development Division.



Organization chart before revision



Organization chart after revision

Dr. Masayuki Koda
Director,
Head of Structures Technology Division

Structures Technology Division is engaged in research and development of railway structure technologies covering fundamental and applied research up to further solutions for commercial use.

We focus on three core objectives: "effective maintenance technology" aiming for higher labor efficiency of existing railway facility maintenance, "disaster countermeasures and early recovery technology" to help enhance the safety and expedite restoration of facilities, "construction and improvement technology" for higher productivity and cost reduction of a new construction or existing facility reinforcement.

This paper introduces some of our recent research and development projects.

Structures Technology Division

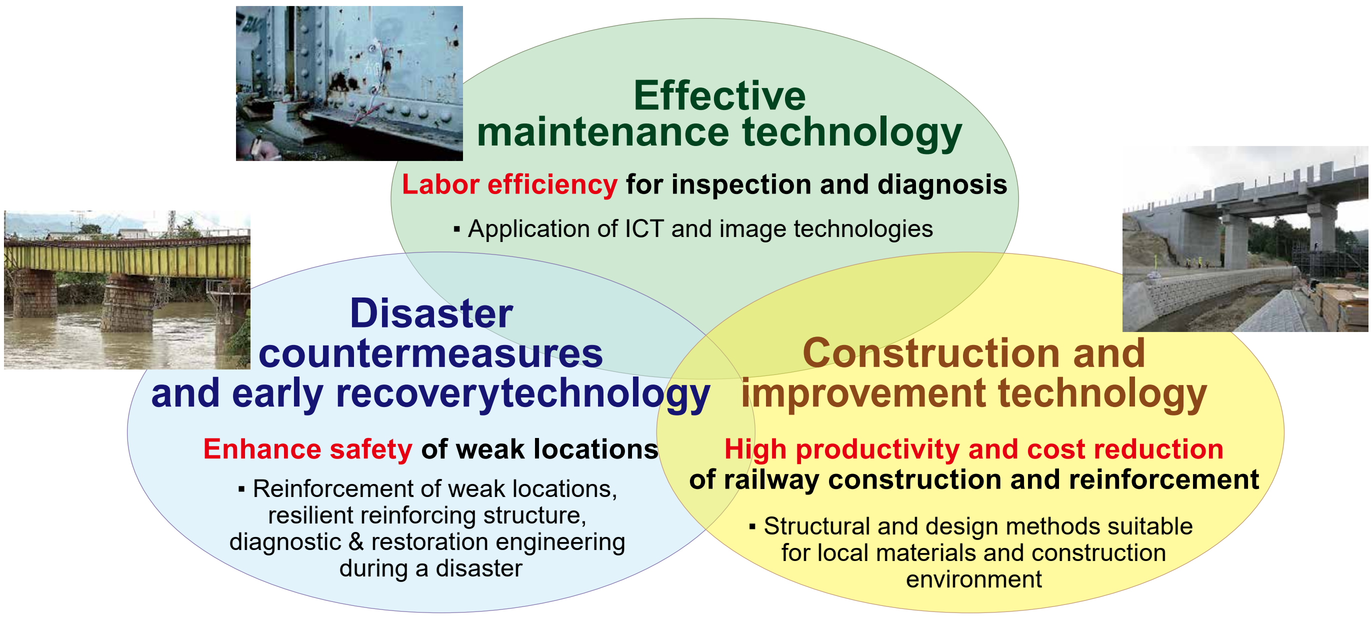
Introduction

There are growing concerns about the importance of railway structure maintenance services to ensure safe and stable railway operations. Meanwhile, serious facility damage cases are reported due to severe natural disasters, which disrupt train operations. Furthermore, as we move toward a post-pandemic society, digital strategies must be incorporated into the research and development of railway structure maintenance operations to streamline railway management.

As such, the technical field surrounding railway structures faces extensive challenges that must be addressed, from labor efficiency for maintenance works and anti-disaster measures up to early recovery.

Our division consists of five labs: Concrete Structures, Steel & Hybrid Structures, Foundation & Geotechnical Engineering, Tunnel Engineering, and Architecture Engineering, pursuing engineering excellence as a specialist team that can offer swift and diverse solutions through our fundamental and applied research for commercial use focusing on three objectives: "effective maintenance technology," "disaster countermeasures and early recovery technology," and "construction and improvement technology" (*Core objectives for research and development*).

The following is an outline of research examples based on the three abovemen-



Core objectives for research and development

tioned objectives, including another project case "development of railway technical standards" in which we worked together with the Railway Bureau of the Ministry of Land, Infrastructure, Transport and Tourism (hereinafter MLIT) and railway operators.

Structural Visual Inspection Support System using 3-Dimensional Images【Effective maintenance technology】

"Structural visual inspection support system using 3-dimensional images" has been developed to improve the labor efficiency of the railway facility's general inspection and enhance inspection accuracy by accumulating a digital database, and to foster skilled engineers (*Structural visual inspection support system using 3-dimensional images and its applications*)[1), 2)].

Using 3D image processing technology, photos obtained from video shooting during site inspection are processed into a 3D-image structure and saved as digital data on a PC.

This 3D-image structure comprises point data (location data) processed by combining the structure image and image data using a computer system, enabling workers to check and view structures at all angles or different distances on the PC. This system can also support workers so they can compare the structure at a site with the past 3D data shown on a mobile tablet brought to the site. Workers are also no longer required to go to the facility site for rechecking, if something is found unchecked, as they can perform a visual inspection with 3D structure images stored on the PC. This system also helps skilled workers to review inspection results, and to educate junior workers. A trial run of the system is under-way, and technical working group for how to use is being held with the support of railway operators and co-developers.

We consider this to be one of our research outcomes leading to an innovative solution for maintenance work for existing railway facilities.

Seismic Reinforcement Technology for Steel Railway Bridges【Disaster countermeasure technology】

Seismic reinforcement work needs to be performed for some old-type steel bridges which were constructed before the 1970s. However, some works may require building a temporal track line and bridge by securing land to keep train operations running, or railway service must be suspended during reinforcement work, or a bridge needs to be replaced.

In any case, it is high-cost time-consuming work, especially in an urban area where it is difficult to secure land. Furthermore, deterioration issues must be addressed to repair or reinforce damages like corrosion or cracks in steel girders and support parts.

To extend the life and strengthen the earthquake resistance of old-type bridges without replacing, securing land for a temporary line, or disrupting railway operations, we have developed a reinforcing technique by integrating abutment and backfill with ground reinforcing nails, connecting abutments and steel girder, so called “Seismic reinforcement method for steel railway bridges (Integration of bridge girder, abutment, and embankment) (*Seismic reinforcement technology of steel railway bridges(Integration of bridge girder, abutment, and embankment)*)[2),3)].

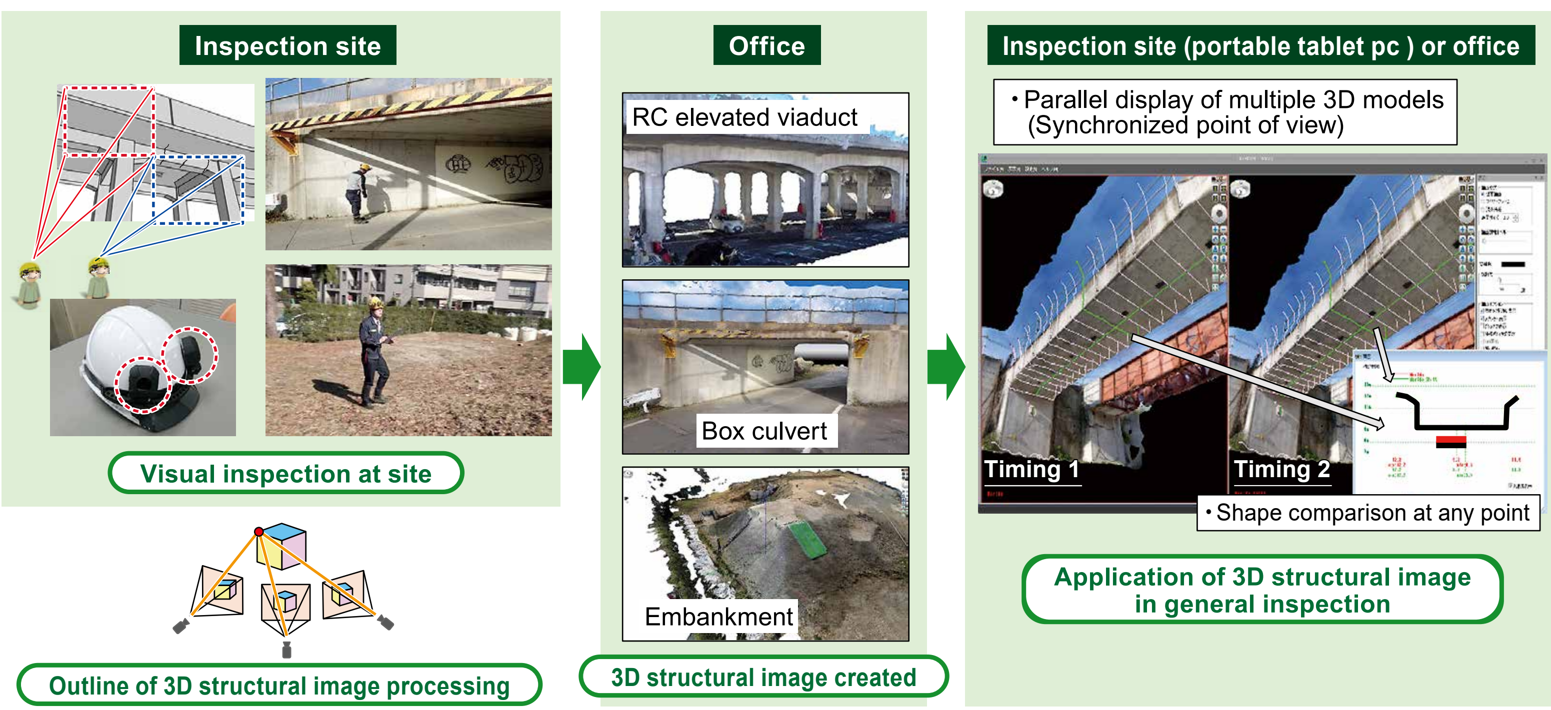
This approach increases earthquake resistance and helps reduce steel girder issues like warping or distortion by half. As the maintenance work for support parts is not required, the new structure has contribute to labor efficiency efforts for maintenance services.

This reinforcement technology brought a novel structure concept, moving from a steel girder and abutment-type bridge to an integrated one, and achieving a higher seismic resilient performance and longer service life of existing bridges.

Application Method of Mechanical Anchorage Method for the Beam-to-Column Joint of RC Viaducts 【Construction and improvement technology】

The application mechanical anchorage method for longitudinal steel bars could be a countermeasure for dense rebar at the beam-to-column joint of RC viaducts (*Mechanical anchorage method for the beam-to-column joint of RC viaducts*).

Beam-to-column joint sections can get congested with beam rebars being arranged from 3 to 4 directions beside column rebars. Furthermore, they require more space owing to being folded at their edge to be secured firmly.



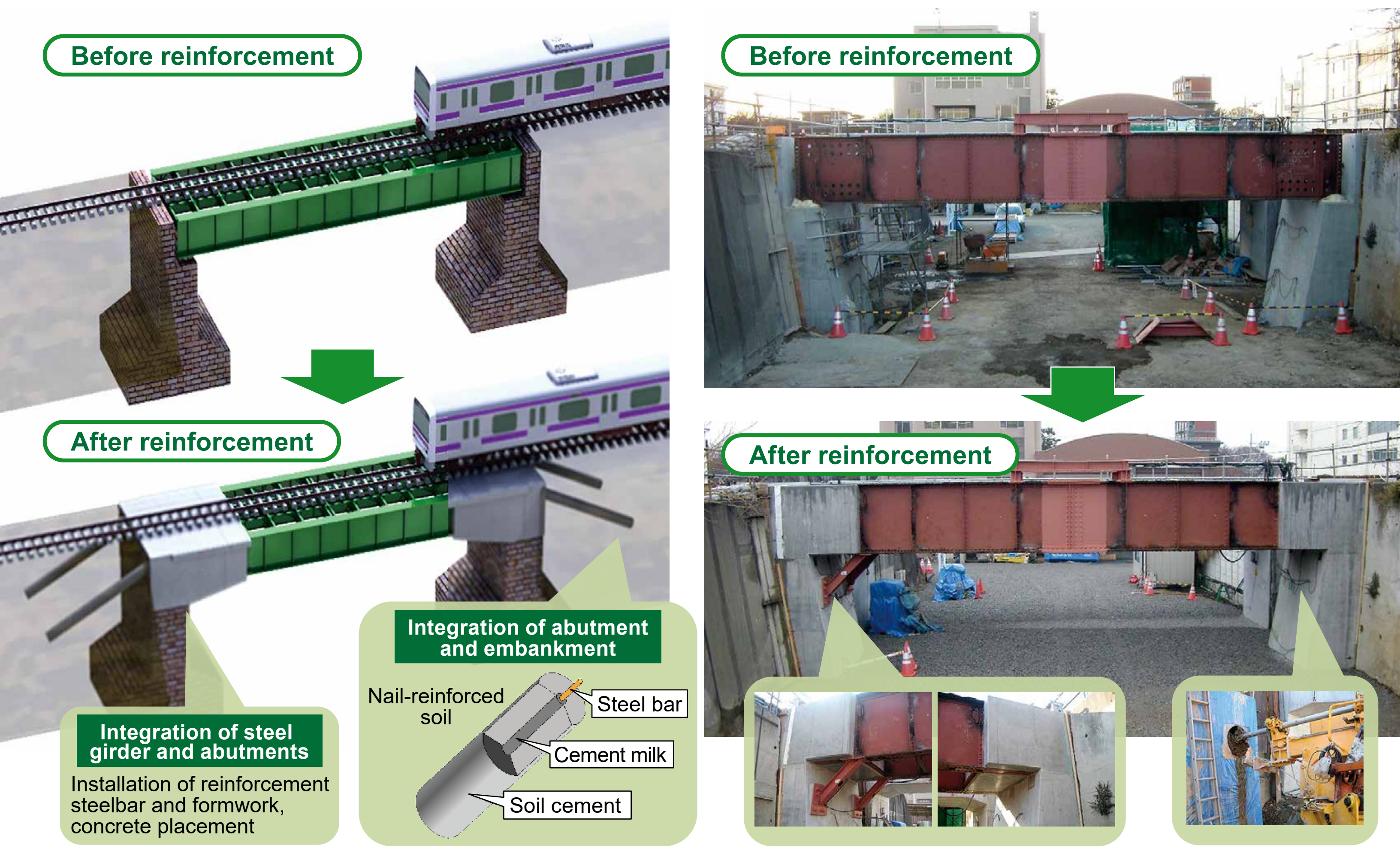
Structural visual inspection support system using 3-dimensional images and its applications

To save space, the mechanical anchorage method is applied, as shown in the photos. As productivity will be improved with this method, using the method is recommended by MLIT under the program called "i-Construction". However, the behavior of the anchorage has not been clarified at the parts where constraint by concrete is weak, such as the beam-to-column joints. Therefore, load tests and finite element analysis were performed to clarify its behavior when applying mechanical anchorages to longitudinal steel bars at the beam-to-column joint and proposed conditions under which the mechanical anchorage method can be applied to the beam-to-column joint (*Mechanical anchorage method for the beam-to-column joint of RC viaducts*) [4].

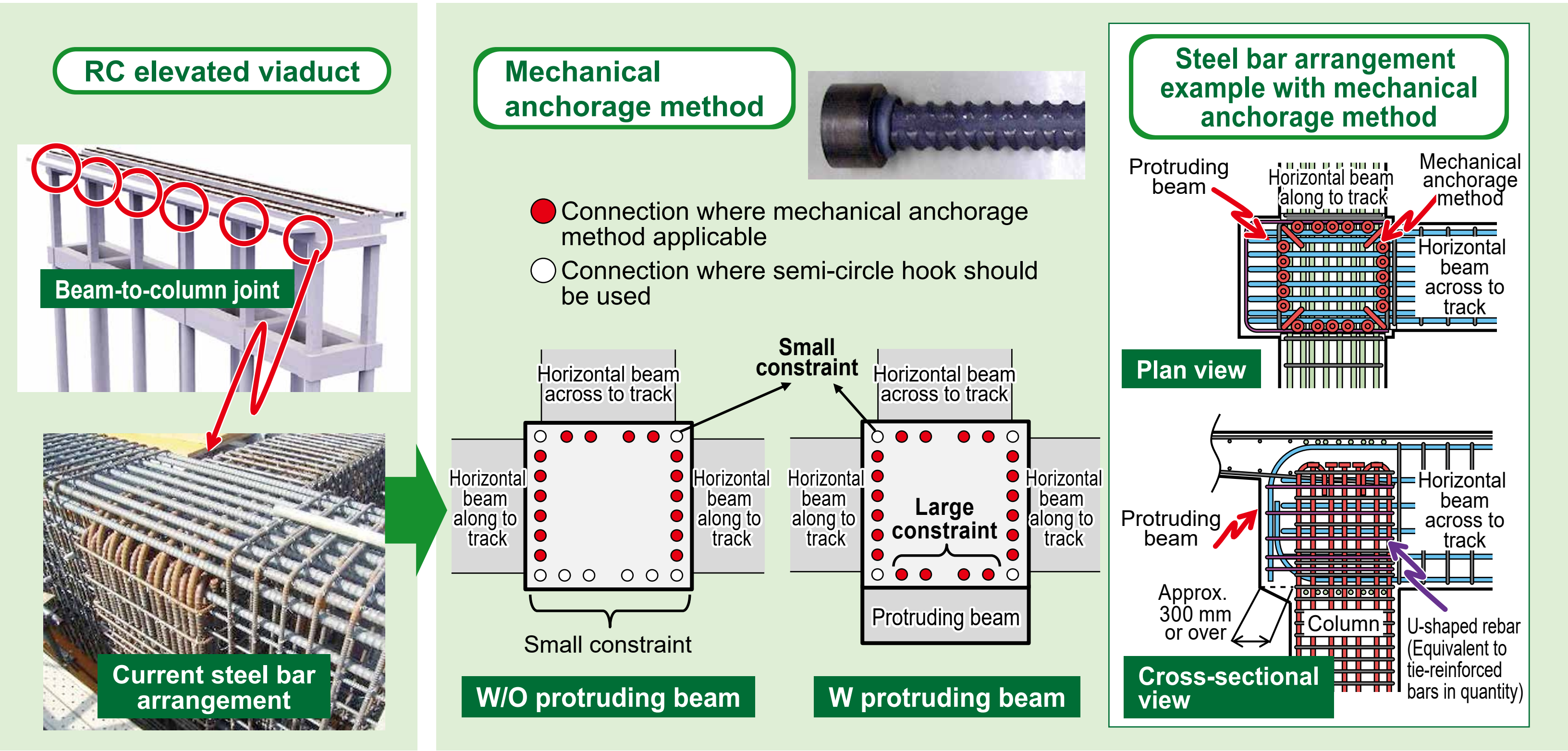
We consider it one of our research outcomes that contribute to higher productivity and labor efficiency of the rebar arrangement of railway construction work or improving the work of existing facilities.

Guideline on the design of support part for platform screen door【Development of technical standards】

Installing a platform screen door program has been promoted, aiming to prevent passengers from accidental falling off a platform or possible contact with trains. However, no reference standard was available to design the parts to support the platform screen door, and railway opera-



Seismic reinforcement technology of steel railway bridges (Integration of bridge girder, abutment, and embankment)



Mechanical anchorage method for the beam-to-column joint of RC viaducts

tors determined design loads or designing methods at their discretion based on RTRI's other guidelines set forth for the Transfer Overbridge Design Guideline.

To aid in making the design process more appropriate and efficient, the Railway Bureau of MLIT and RTRI served as secretariat, it held four technical committees in August 2020 to discuss the platform screen door design methodology with members from academics, research institutes, and associations led by Hidemasa Yoshimura, a specially appointed professor at the Osaka Institute of Technology. Discussions were conducted to determine a reasonable design method for the support part, taking into consideration the conditions under which the screen door is actually used.

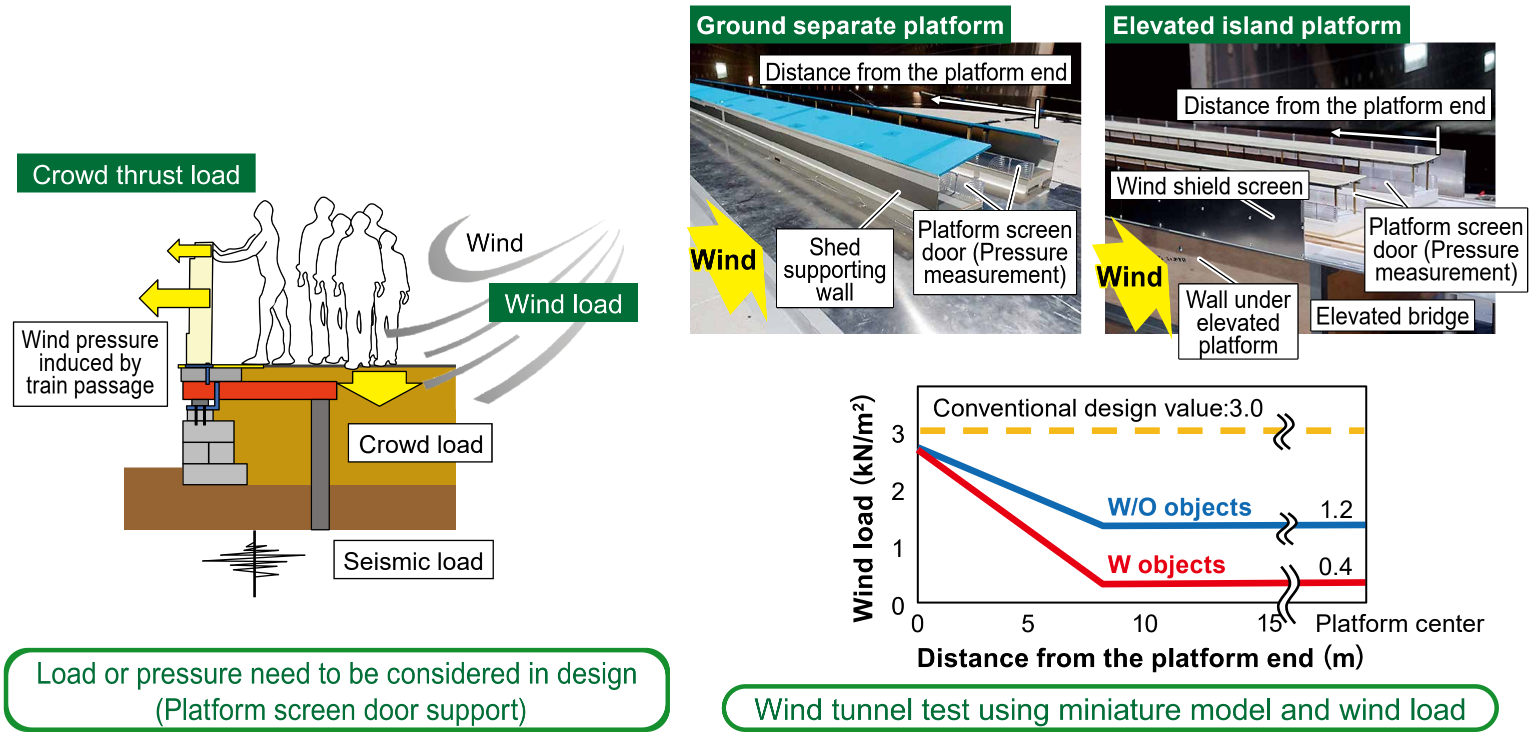
RTRI's research outcomes of wind load or crowd thrust load to the gate system under the condition of the presence or absence of hindering objects nearby were used in preparing the "Guideline of platform door support design" to aid designers in engineering (*Guideline of platform screen door support design*) [5].

The guideline has three key features, including 1) applying performance-based design with allowable stress design, 2) categorizing two different platform conditions: daily condition (normal) and other conditions (abnormal), and 3) indicating characteristic values of wind load and crowd thrust load.

This guideline became available after the Railway Bureau of MLIT shared it with other transportation bureaus in December 2021, and we consider this another case of our research projects contributing to standardizing the design of platform screen door support where safety is secured and operating conditions are considered.

Conclusion

This paper introduced some of our recent research, including "structural visual inspection support system using 3-dimensional images," "seismic reinforcement technology for steel railway bridges (Integration of bridge girder, abutment, and embankment)," "application method of mechanical anchorage method for the beam-to-column joint of RC viaducts," and "guideline on the design of support part for platform screen door." However, our division has



Guideline of platform screen door support design

many more research outcomes that have already been applied for commercial operations.

For more details, please visit our website at **https://www.rtri.or.jp/eng/rd/division/rd43/**

"Structures Technology Division, Railway Technical Research Institute"

Our division continues pursuing research and development based on the following objectives: "effective maintenance technology," "disaster countermeasures and early recovery technology," and "construction and improvement technology," contributing to better railway management.

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Power Supply Technologies Contribute to Sustainable Railway Network

Power Supply Technology Division engages in the research and development of railway power supply systems, which in turn also includes the current collection systems. In recent years, we have been focusing on establishing a sustainable railway power system that would help us move towards a sustainable society. We aim to achieve "reduction in CO_2 gas emission by railways" and "reduction in labor and cost for maintenance of railway infrastructures." I introduce the research done by our division on these initiatives recently.

Dr. Hidenori Shigeeda
Director,
Head of Power Supply Technology Division

Introduction

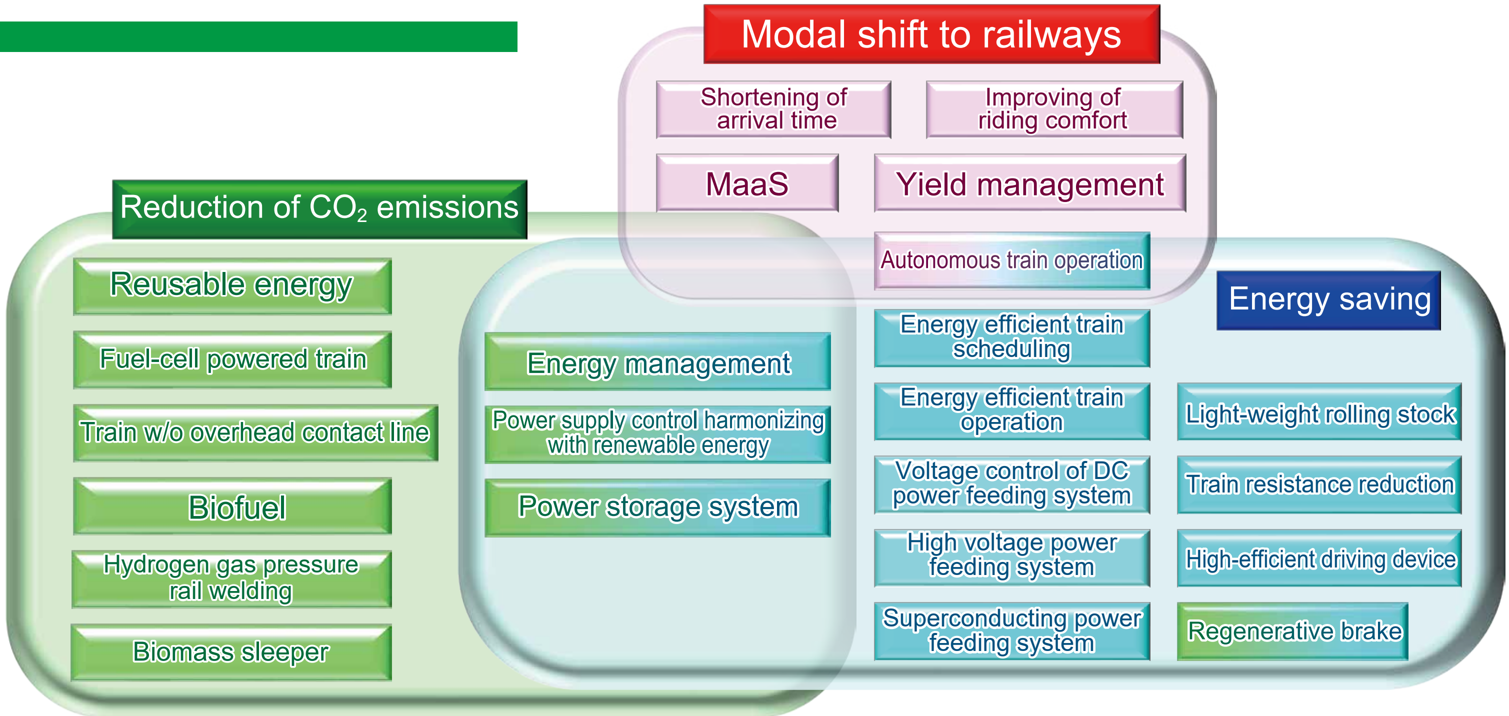
Power Supply Technology Division has three laboratories, "Power Supply Systems," "Current Collection Maintenance " and "Contact Line Structures," where research and development is being conducted with the principle aim of establishing a railway power supply system for the realization of a sustainable society. This initiative has two objectives: one is a socially sustainable effort to fight global warming by utilizing railway assets and the other is to create a sustainable national railway network and reducing cost of railway infrastructure maintenance. Both these issues require immediate attention. In this paper , the latest information regarding the research and development we have been conducting in this field is explained.

Efforts towards reduction of greenhouse gas emissions

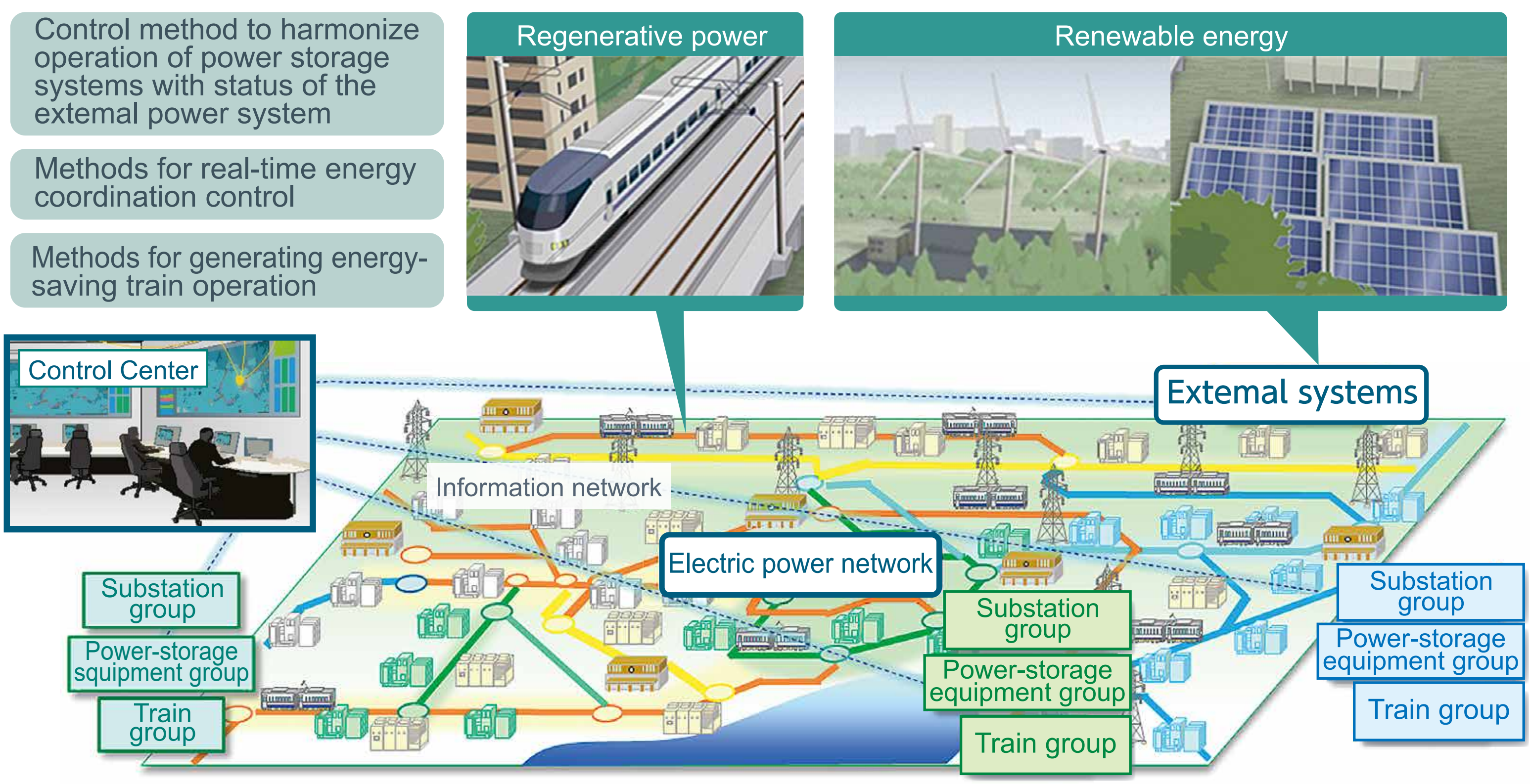
Approach adopted for CO_2 reduction

Japan has announced a policy to achieve carbon neutrality by 2050, and to this effect, by FY2030, the country has set an ambitious goal of reducing greenhouse gas emissions by 46% of those produced in FY2013. Since carbon dioxide (CO_2) emitted from energy sources accounts for most of greenhouse gas emissions in Japan, it is important to reduce these emissions . The Ministry of Land, Infrastructure, Transport and Tourism (MLIT) is pushing forward a project with the following three objectives for the railway sector:

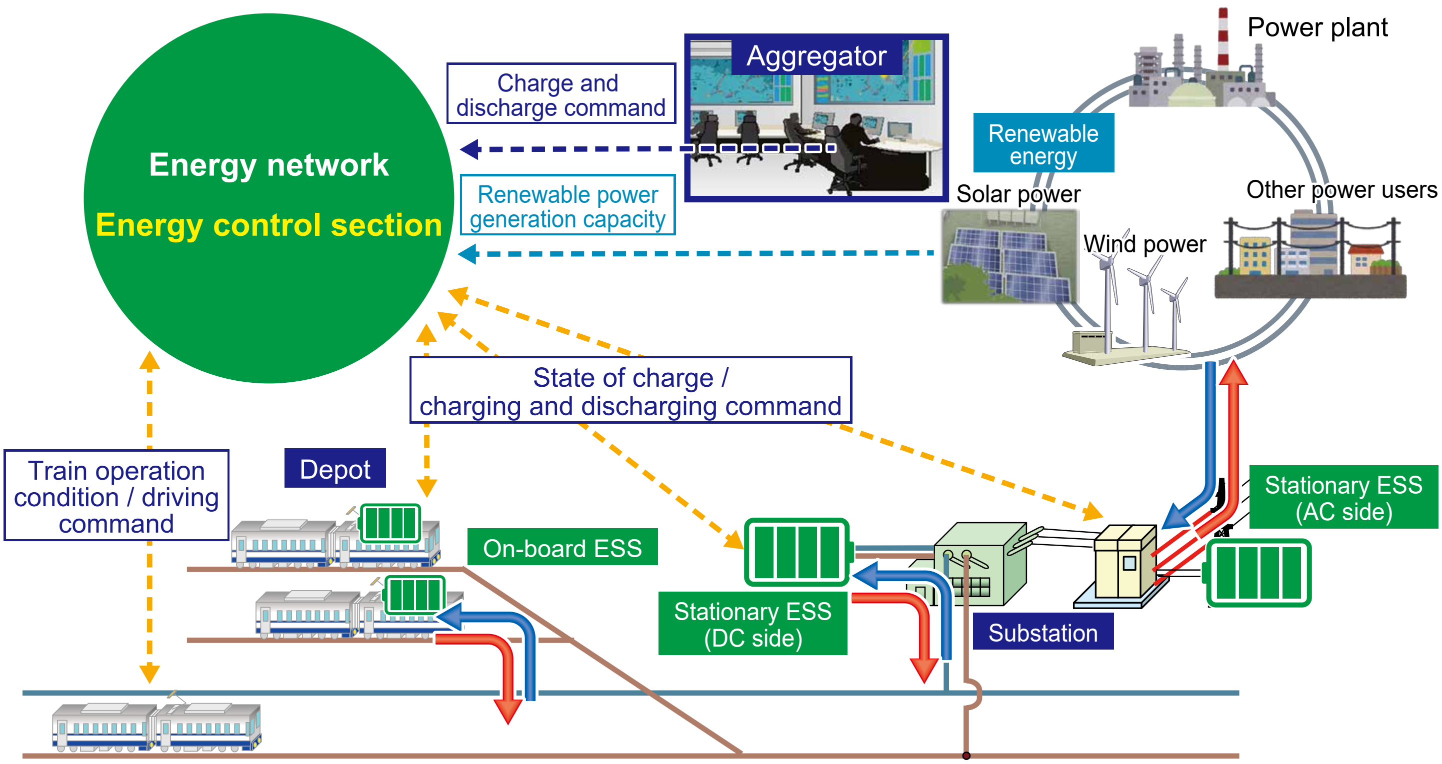
- "Decarbonization of railways" to reduce CO_2 emissions through energy conservation and electrification of diesel railcars.
- "Decarbonization by railways" to generate, transport and store renewable electric power or hydrogen energy by utilizing railway assets.
- "Decarbonization supported by railways" to reduce CO_2 emissions by promoting the use of railway services among people.



Example factors to be considered by the RTRI for decarbonization



Main tasks involved in "Low-carbon power feeding networks by coordinated power control"



Smart energy storage system

Activities of Power Supply Technology Division

Example factors to be considered by the RTRI for decarbonization shows the factors related to the decarbonization aspects that RTRI has been working on. Under the category of "decarbonization of railways," we are aiming for energy saving and energy conversion programs. We are also promoting R&D in energy management and energy storage system (ESS) under the category "Decarbonization by railways," and reducing the time of commute and improving the riding comfort under "Decarbonization supported by railways."

Power Supply Technology Division is also working towards reducing CO_2 emitted from the use of electricity that accounts for most of the CO_2 emissions from railways. This is achieved by focusing on "low-carbon power feeding networks by coordinated power control" (*Main tasks involved in "Low-carbon power feeding networks by coordinated power control"*), which is one of our R&D tasks set for the future. The main feature of this task is to develop a new method for coordinated control of railway ESSs and power grids through the active use of power derived from renewable energy sources, in addition to energy conservation that we have been working on for some time in order to promote decarbonization in railways. The "smart energy storage system" under study as part of this project is shown in *Smart energy storage system*.

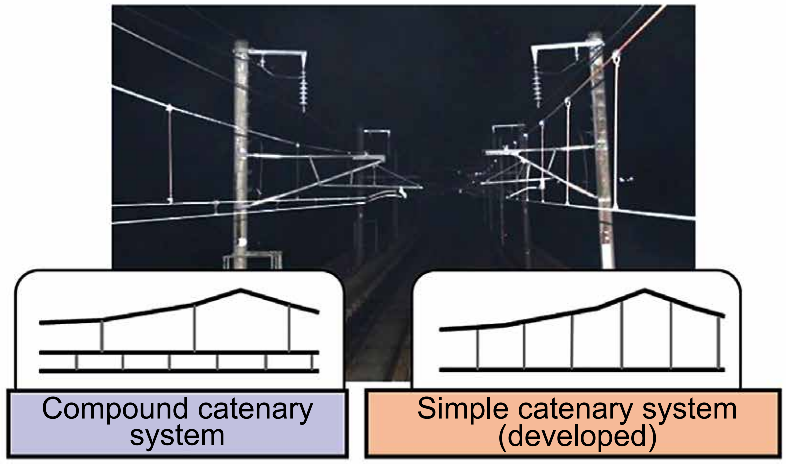
This smart energy storage system allows us to control each energy storage device in a well-coordinated manner and usually works independently in the railway power grid. In this way, regenerative electric power is utilized more efficiently, enhancing the energy-saving effect. In addition, by coordination between the renewable energy and ESSs, we aim to improve the utilization rate of renewable energy in railway operations and introduce renewable energy to the power grid system, which has the ability to deal with the fluctuation in power supply. We are currently developing an algorithm to control multiple energy storage devices in a coordinated manner, and improving the existing simulator to test its effectiveness and determine the battery life when used for several cycles of charging and discharging.

Labor efficiency and cost reduction for maintenance work

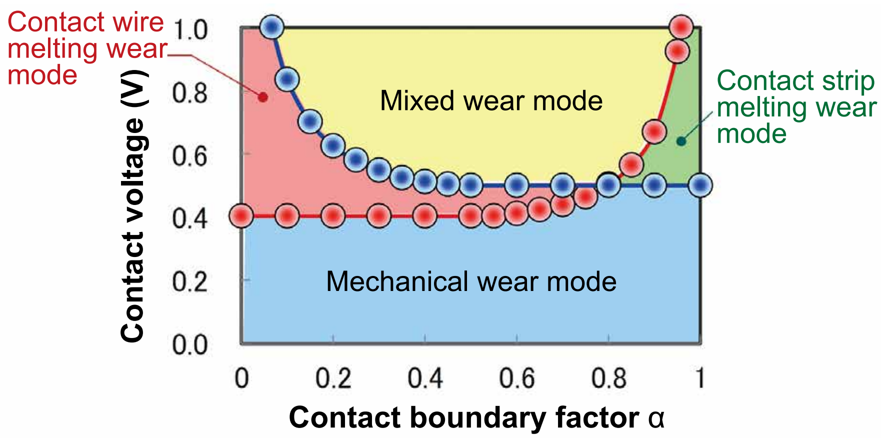
As Japan's birthrate declines and the population ages, it is expected to become increasingly difficult to secure maintenance personnel for railway infrastructure. Moreover, the recent decrease in passenger traffic caused by the spread of the new variant of coronavirus has significantly impacted the financial situation of railway service businesses. Given this background, research and development to reduce labor and maintenance costs associated with the power supply systems, especially train tracks, is desired. Hence, we are working on projects such as “streamlining of maintenance works” to reduce inspection check items for facilities, “prolonging facility service life” to extend the renewal cycle of facilities, and “mechanization and automation” for maintenance works. It is important that these activities are conducted without safety and reliability being compromised.

In streamlining of maintenance works, we have developed a simple catenary system for Shinkansen lines to replace an existing compound catenary system comprising a messenger wire, an auxiliary messenger wire and a contact wire. The new system works without the auxiliary messenger wire and supports speeds of over 300 km/h (*Installation situation of overhead contact lines*).

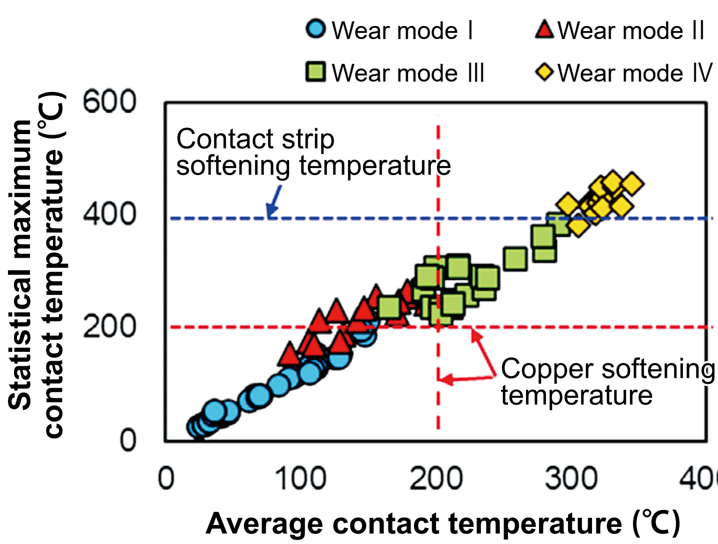
To improve the service life of facilities, we conducted basic research on current collecting materials. We are investigating their wear mechanism with a view to develop long service-life current collecting materials in the future (contact wire and contact strip). In our previous research, we revealed the electrical wear mechanism caused by Joule heat, the mechanical wear mechanism caused by frictional heat as well as heat transition characteristics of each wear mode (*Wear mode map under the effect of flowing electric current* & *Mechanical wear mode with respect to contact temperature*). We intend to continue



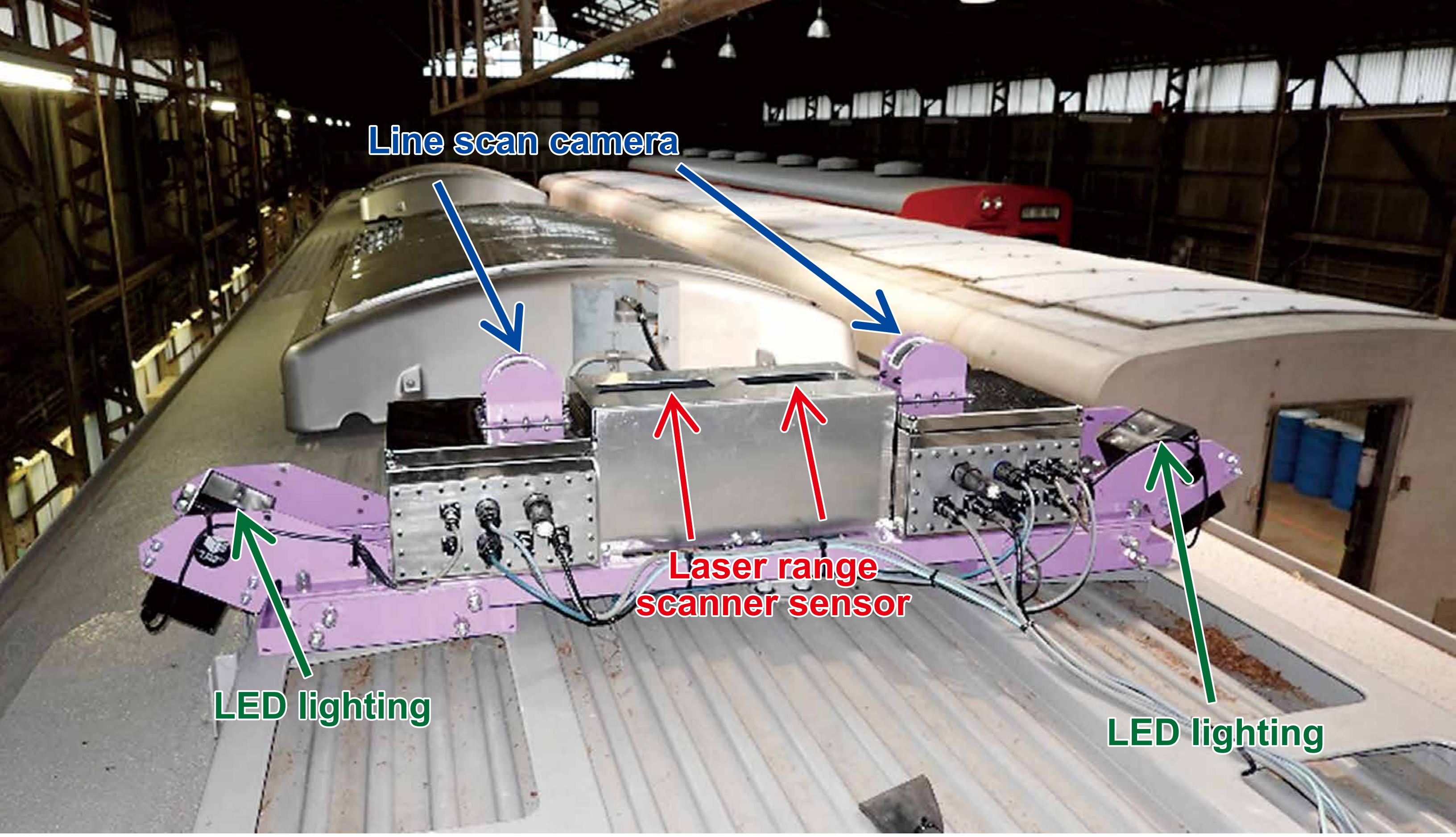
Installation situation of overhead contact lines



Wear mode map under the effect of flowing electric current



Mechanical wear mode with respect to contact temperature



Contactless OCL measuring device

material research with respect to bulk temperature.

For mechanization and automation of maintenance operations, we are working on inspection and diagnosis practices for overhead contact lines (OCL) using digital technologies. We have already developed a *contactless OCL measuring device* that enables 3-dimensional measurement of OCL wire positions (*Contactless OCL measuring device*). Furthermore, we are conducting research on detecting OCL fittings using machine learning techniques from OCL images acquired by the measuring device to determine the condition of the fittings.

Conclusions

Introducing an electrical power system with clean energy is an effective way to help reduce greenhouse gas emissions. It is also important to reduce labor and costs involved to maintain and promote the electric railway systems. Our division will continue to work to identify effective solutions for these issues.

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Recent Research of Track Technology Division

Dr. Yoshitsugu Momoya
Director,
Head of Track Technology Division

The Track Technology Division is engaged in railway track research and development to make their outcomes available for commercial use to enable "social implementation." This is to ensure that our technology is widely adopted in the operations of railway companies.

Our track development initiative starts with fundamental research. It brings our technology up to the level wherein test installation is performed in some commercial lines to introduce the technology to many railway operators.

The public does not directly use track-related technologies; however, many passengers indirectly use them via railway operators that use them. This paper describes track technologies that our division applied in developing and introducing certain technologies already in commercial use and implemented in society or in a transition phase from trial installation to social implementation, as well as the ones currently under development for future implementation.

Track technologies that have been implemented in society

Since ballasted tracks become deformed under the stress of train load over time, periodic repair work is required. To prevent this, slab track (*Slab track*) that does not considerably deform under stress was developed by the Research and Development Institute of the former Japanese National Railways (JNR), the predecessor of the Railway Technical Research Institute (RTRI).

A slab track consists of approximately 5-meter concrete slabs that directly support rails in the structure.

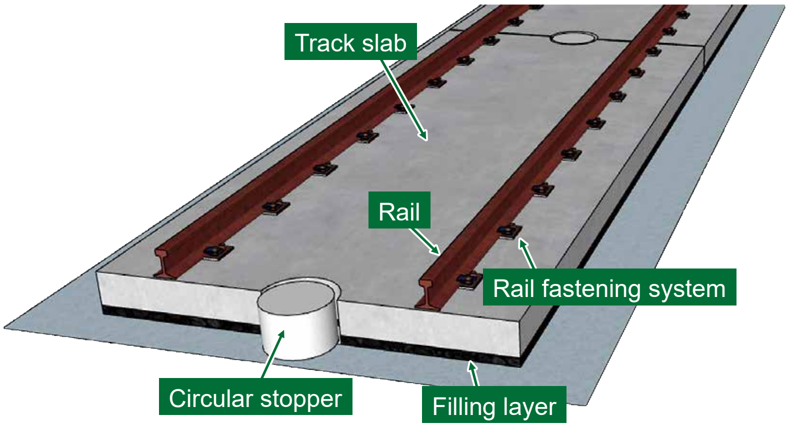
For the Tokaido Shinkansen line, a ballasted track system was used, but later, a slab track system was introduced in earnest for Shinkansen lines including Sanyo Shinkansen and the subsequent Shinkansen lines.

Slab tracks, however, have no tolerance for large subsidence, and this limited their use to only viaducts or tunnel sections until the 1980s.

Since the 1990s, the slab track structure has been laid on earth structures constructed with high-quality subgrade and concrete roadbed [1] (*Slab track on earth structure*) .

Furthermore, since the 2000s, an integrated RC roadbed has been developed, which combines the roadbeds of double tracks, making it possible for slab tracks to be laid on relatively soft ground [2] (*Integrated RC roadbed (Before a track slab is laid)*).

Commissioned by the Japan Railway Construction, Transport and Technology Agency, the RTRI was involved in a project for the technological development of slab



(a) Slab track structure

(b) Example of a slab track being laid

Slab track

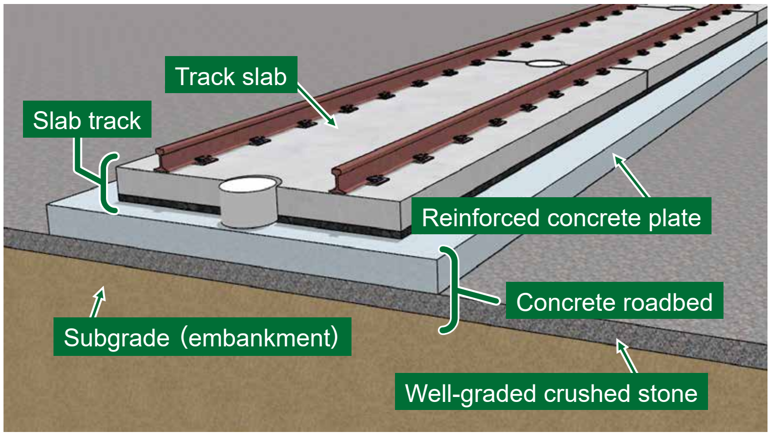
tracks applied to earth grounds and contributed to their implementation in society.

In the 1980s, the slab track system was constructed in conventional lines. However, railway noise became an issue in urban areas, as the noise levels were higher when a train ran on slab tracks than when it ran on ballasted tracks. To address this issue, the former JNR's research institute developed a track system equipped with resilient sleepers (sleepers fitted with under sleeper pads). This system reduces noise via an elastic rubber material installed underneath the sleeper, which is supported by a concrete track bed.

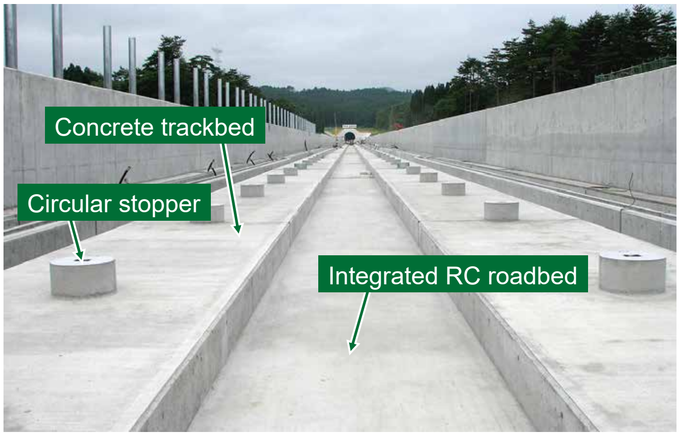
A structure called B-type solid-bed track equipped with resilient sleepers [3] is laid as the track structure for the Shinkansen line between the sections of Ueno to Omiya station. In the 1990s, RTRI developed a D-type track system, wherein the elastic material beneath the sleepers is replaceable [4].

Various railway operators in Japan and overseas have widely used the D-type track system. In the latter half of the 2010s, further improvements were made to streamline the concrete track bed as a cost-cutting effort, and it was upgraded to an S-type version [5] (*Solid-bed track equipped with resilient sleepers using the shear-key*) . The S-type track system has been adopted for public work projects launched in the vicinity of the Nagasaki or Matsuyama stations, where multiple existing level crossings were replaced with overhead crossings. This is another practical case, and we believe this technology is a step closer to being implemented in society.

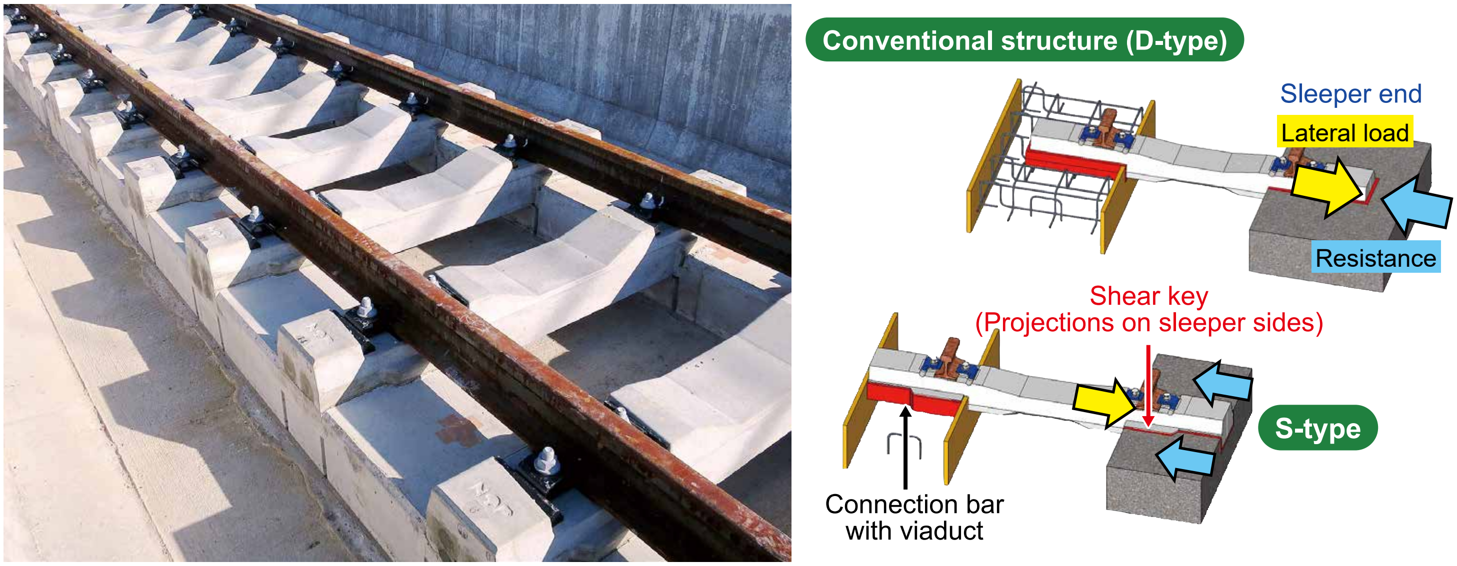
Meanwhile, in a track management field, a waveform data processing tool called LABOCS [6] was developed by the former JNR's research institute. LABOCS has since



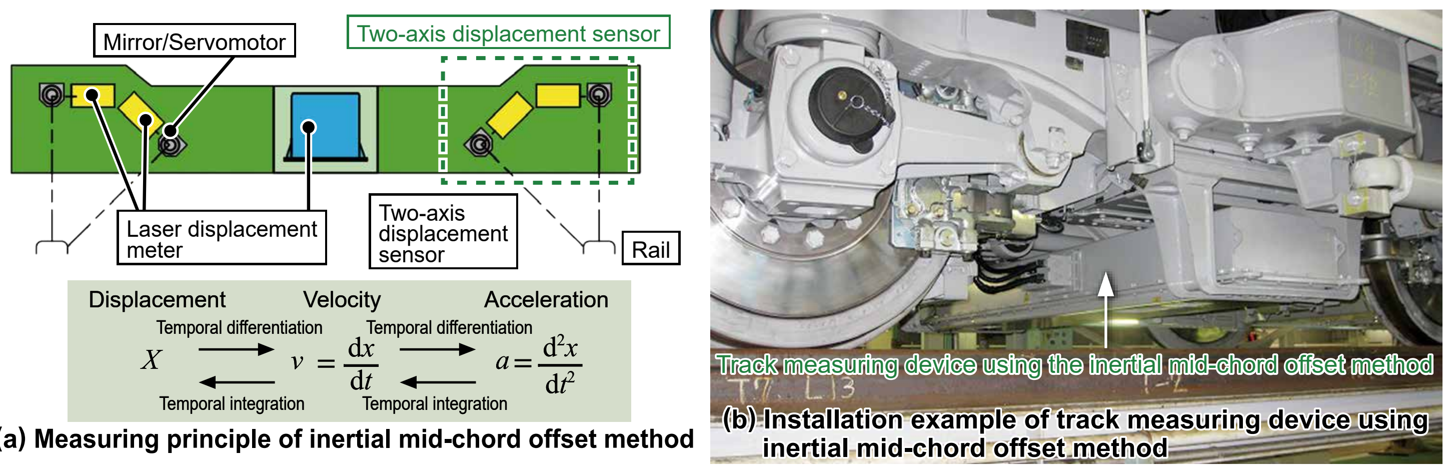
Slab track on earth structure



Integrated RC roadbed（Before a track slab is laid）



Solid-bed track equipped with resilient sleepers using the shear-key



(a) Measuring principle of inertial mid-chord offset method

(b) Installation example of track measuring device using inertial mid-chord offset method

Track measuring device with the inertial mid-chord offset method

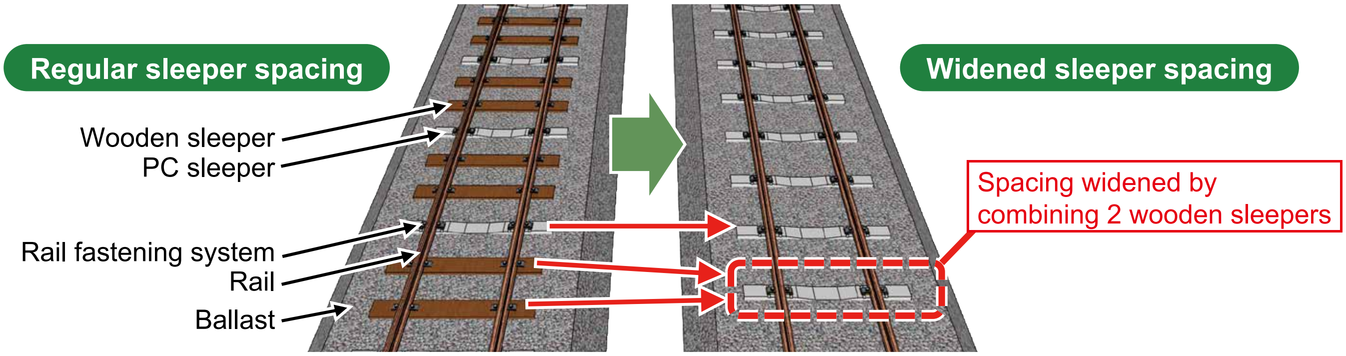
evolved, focusing on track irregularity management, and since the 1990s, it has been adopted by many railway operators. In recent times, upgrading effort with new technologies is underway to incorporate features such as correcting the distance discrepancy of the data measured by a track recording vehicle using cross-correlation methods or predicting the displacement amount of floating sleepers.

As for track measurement research, we have been developing the inertial mid-chord offset method since the 1990s [7] (*Track measuring device with the inertial mid-chord offset method*). This method enables the downsizing of a track measuring device such that it can be mounted on commercial railway vehicles. This technology enables track irregularity monitoring at high frequency by commercial vehicles. Thus, a more flexible track maintenance management is achieved according to track conditions.

Track technologies shifting from test installation in commercial lines to social Implementation

One technology moving toward social implementation is a scheme of widening sleeper spacing, which some railway operators have adopted [8].

Ballasted track sleepers are generally laid at a space of approximately 60 cm. Increasing this space as wide as 1 m would help reduce the number of sleepers installed,



Widening of sleeper spacing

Low-strength stabilization method

contributing to cost reduction efforts (*Widening of sleeper spacing*).

Widening sleeper spacing has been achieved after carefully verifying factors such as track subsidence property, track lateral stability, and track material safety during our research.

Meanwhile, ballasted tracks have a limitation wherein crashed or refined ballast particles may cause the bearing capacity of ballast to decrease during rainfall, resulting in a large subsidence. For a general resolution, those deteriorated ballasts must be replaced. However, because ballast replacement entails a relatively high cost, an alternative method has been sought to prevent ballasted track subsidence at a lower cost.

A low-strength stabilization method [9] has been developed to stabilize ballasts. In this method, repair material comprising of ultrarapid hardening cement and polymeric material is mixed with deteriorated ballasts and tamped at the repair work site (*Low-strength stabilization method*).

A pilot run of this method has been conducted on several commercial lines, and we are now working to expand the applications aimed at social implementation.

We have also developed a technology to help improve labor efficiency in ballasted track maintenance and management. In this "Ballastless track with super-fine particle cement [10]," track subsidence can be mitigated by grouting a super-fine particle cement (SFC) fluid into the ballasted track. Some railway operators are also adopting this technology, and it is expected to be socially implemented soon.

Moreover, we have several other developments that are a step closer to being implemented in society, including the railhead crack repair method using the thermit welding technology [11], a dynamic track measuring device for gauge and twist that costs less than the inertial mid-chord offset track measurement device [12] (*Dynamic track measuring device for gauge and twist*) or an image analysis system for detecting obstacles within a structure gauge of railroad track [13].

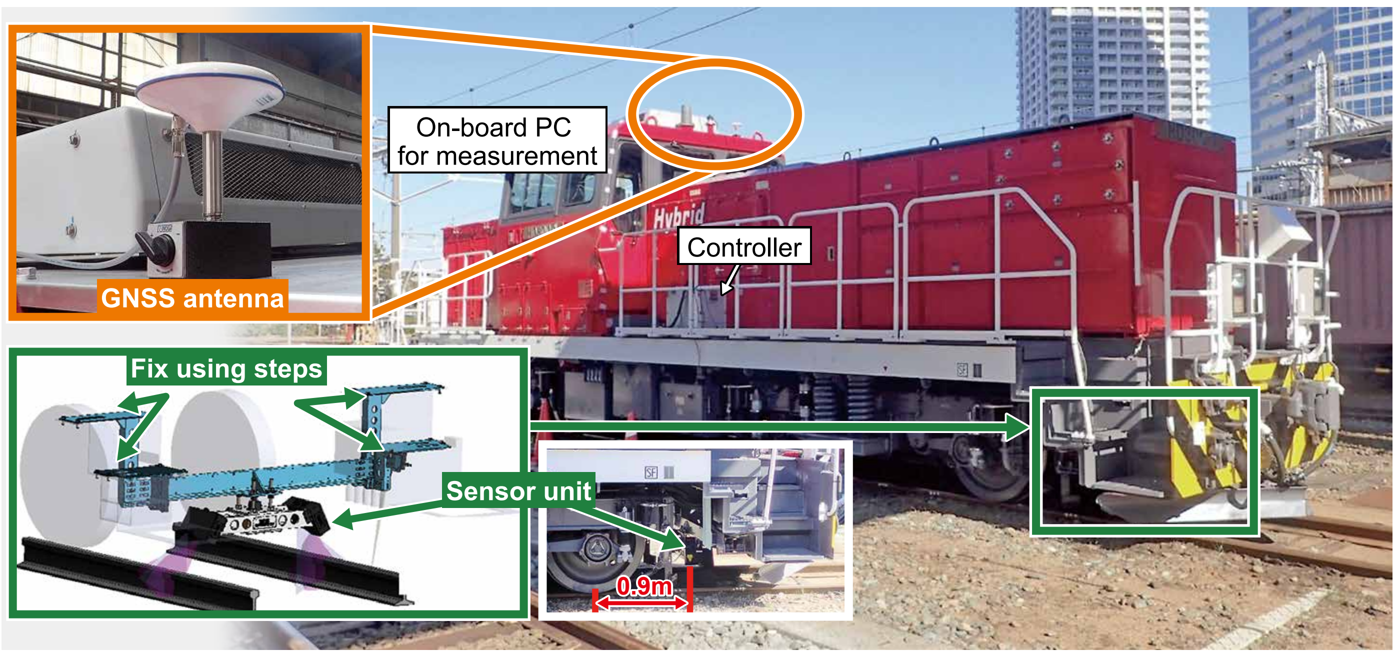
Track technologies under development aimed at future social implementation

An intelligent turnout is an example of a product under development for future social implementation (*Intelligent turnout*).

This turnout allows streamlining of the structure by incorporating the switching device into a sleeper. It also enables controlling and monitoring of the switching force at all times to eliminate the labor of the operator's inspection work.

In addition, we have developed a floating solid-bed track system equipped with resilient sleepers (*Anti-vibration slab track*).

In this track system, a concrete track bed equipped with resilient sleepers is supported by low-elastic antivibration materials such that the track support spring coefficient is significantly reduced, which would



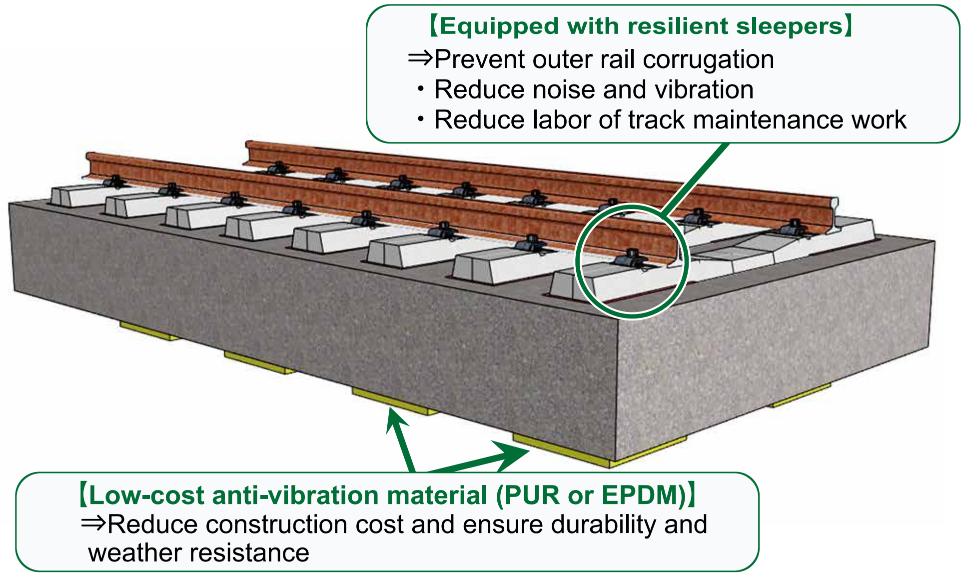
Dynamic track measuring device for gauge and twist

Intelligent turnout

help mitigate noise and ground vibration.

Conclusions

This paper introduced the status of the social implementation of track technologies being developed by RTRI. To achieve this, accurately understanding the needs of railway operators and setting the direction of research and development are critical. The Track Technology Division will continue to develop technologies that contribute to the innovative operations of railway companies.



Anti-vibration slab track

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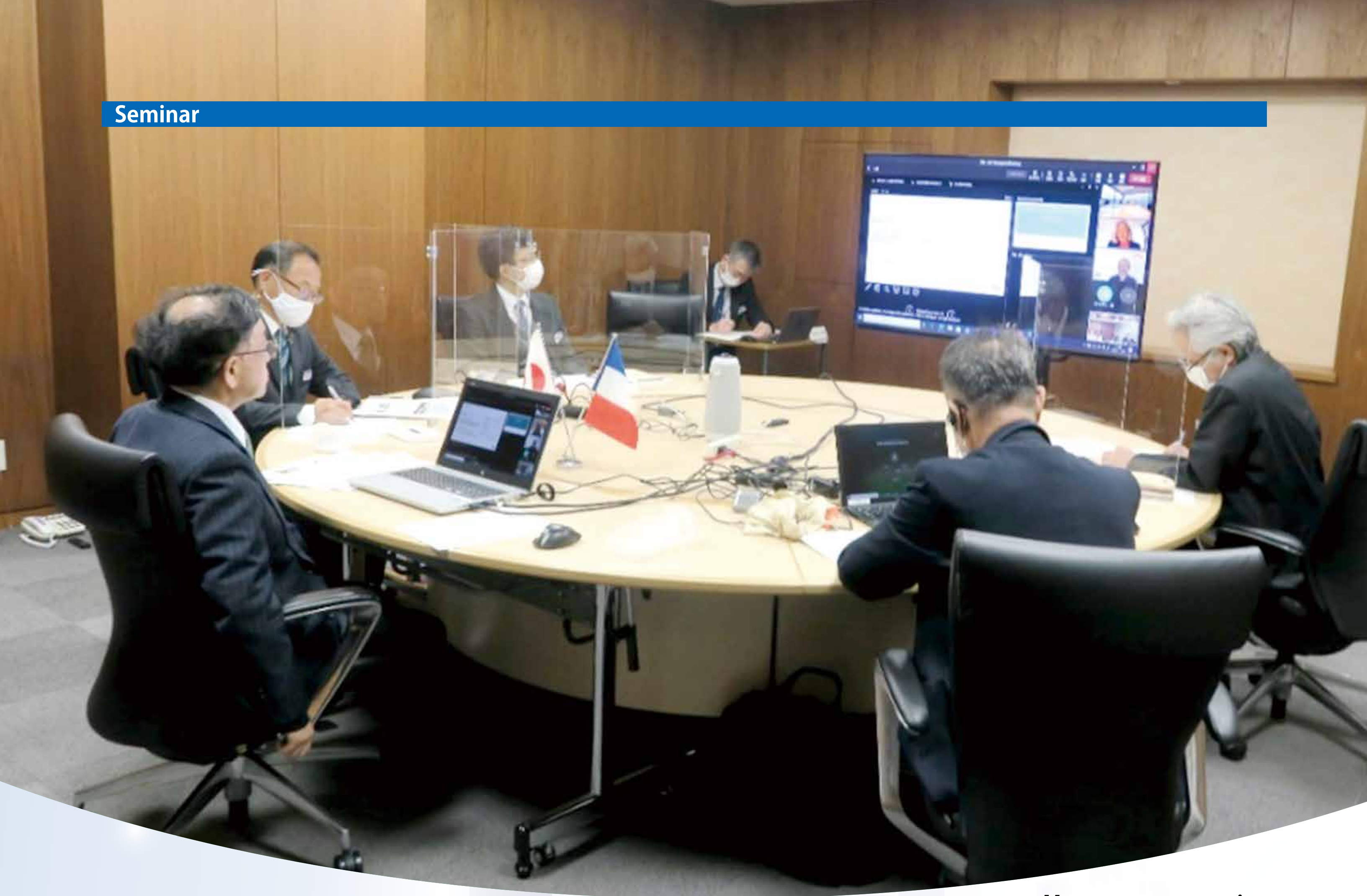


Management meeting

The 10th SNCF-RTRI Collaborative Research Seminar Takes Place

The Railway Technical Research Institute (RTRI) and SNCF held their 10th collaborative research seminar on November 30, 2022.

RTRI and SNCF concluded an agreement on collaborative research in 1995. Since then, the two organizations have been collaborating in railway technical research and sharing information. The collaborative research seminar has been organized every two years to present research results, discuss how to manage railway technical research and plan the collaboration in the ensuing phase.

In this 10th seminar, about 50 people participated. Carole Desnost, Chief Innovation Officer, and David De Almeida, Head of Science and Research, of the Technology, Innovation and Group Projects Division, of SNCF, Atsushi Furukawa, Executive Director, and Yasushi Ujita, General Director of Research and Development Promotion Division, of RTRI and researchers from both organizations took part in this seminar.

The seminar was organized as a web meeting like the previous one in 2020, although travel restrictions due to Covid-19 had already been lifted.

Management Meeting

At the Management Meeting, executives of SNCF and RTRI discussed how to plan and implement future research collaboration. After SNCF made a presentation on energy saving in railway operation and RTRI introduced their research to apply digital technologies to railways, they discussed the backgrounds and future goals.

In addition to the existing collaborative research and information exchange, they decided to set up a new framework, "Focus Group Discussions," in order to have discussions regularly on the technical issues which are yet to be included in the formal topics for collaborative research and on other challenges in railway operation.

Presentation Meeting

Researchers of SNCF and RTRI made presentations on the results of two collaborative research and eight information exchange projects of the 10th Phase which were implemented from 2020 to 2022. The researchers held active discussions on the presentations regarding projects including the following three:

Information exchange to analyze cases of scouring disasters

As one of the measures to mitigate natural disaster damage, scouring cases were analyzed and risk points were identified using machine learning technologies.

Further utilization of energy storage systems and high-voltage converters, for higher environmental and cost performance

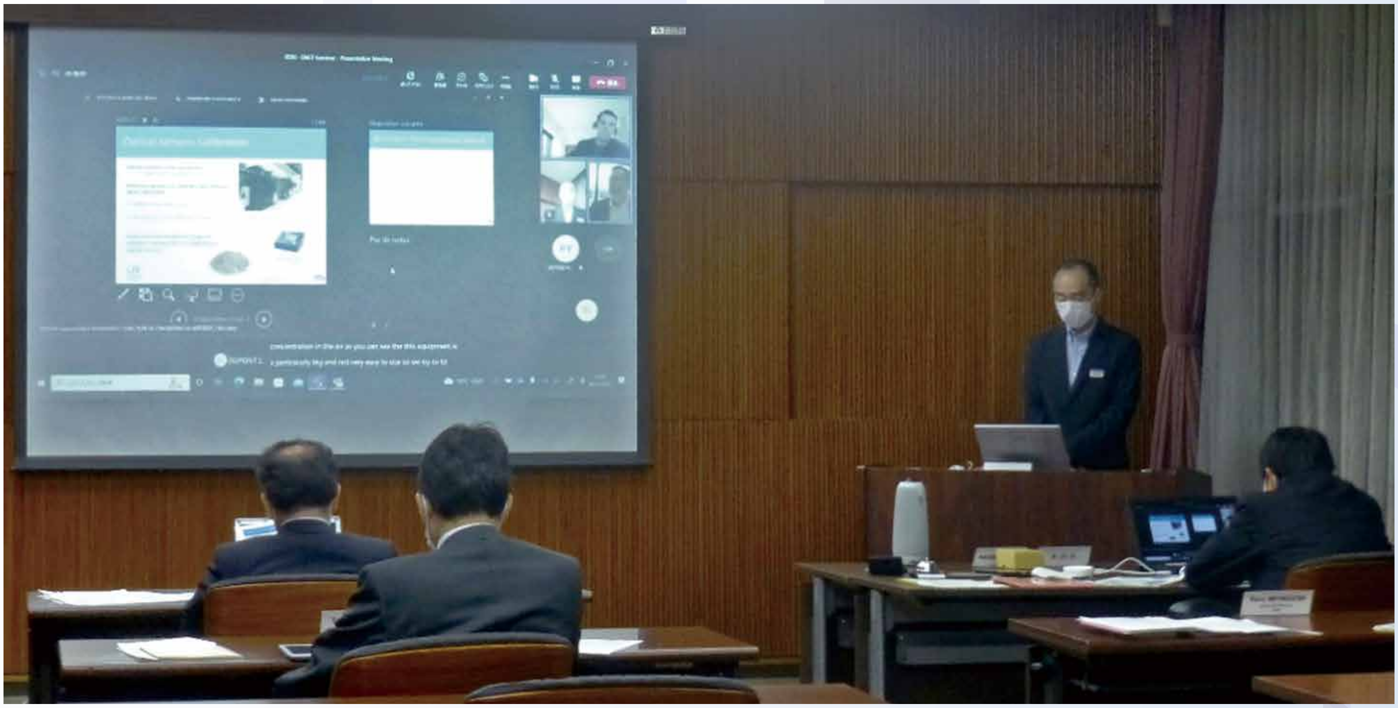
Research to use fuel-cell vehicles and ground energy storage systems efficiently and to predict degradation of vehicle-mounted batteries, to work toward decarbonization of railways.

Information exchange on utilization of AI in railways and its concept

Research to apply image analysis techniques and artificial intelligence to passenger flow analysis and obstacle detection.

The research plans for three collaborative research and seven information exchange projects for the 11th Phase collaboration from 2022 to 2024 were reported.

The next collaborative research seminar is scheduled to be held in the fall of 2024 in Tokyo.



Presentation meeting

RTRI's Researchers Commended for Their Contribution to Developing Industrial Standards and for Achievement in IEC/TC 9 Activities

Dr. Mitsuru Hosoda won the Award for International Standardization Contributor as one of the Year 2022 Awards for Contribution to Industrial Standardization.

Mr. Hiroshi Tanaka was given the IEC (International Electrotechnical Commission) 1906 Award for the Year 2022. The award giving ceremony was held on October 24 in Tokyo.

Award winner :
Dr. Mitsuru Hosoda,
Senior Researcher, Rail Maintenance and Welding
Track Technology Division

Award for International Standardization Contributor, Year 2022 Awards for Contribution to Industrial Standardization given by Director-General of Industrial Science and Technology Policy and Environment Bureau

This award is given to individuals and organizations that made distinguished contributions to developing and spreading international and Japanese industrial standards. It is given by the Ministry of Economy, Trade and Industry in order to promote industrial standardization and contribute to developing Japanese economy and industry and to improve the life of the Japanese people.

Award winner: Dr. Mitsuru Hosoda, Senior Researcher, Rail Maintenance and Welding, Track Technology Division

Achievement for commendation:

Since ISO/TC 269 (railway applications) /SC 1 (Infrastructure) /WG 7 (Fastening systems) was launched, Dr. Hosoda has joined the WG Secretary and contributed with European conveners to develop a total of 7 international standards in 6 years. As he has steadily promoted the project, the presence of Japan has been enhanced and an agreement has been made on the proposal of a testing method used in Japan. As an expert of track technology, he has also served for 5 working groups and contributed to reflecting Japanese technologies to international standards. He made efforts to start ISO/TC 269/SC 1 mirror committee and to share Japanese technologies in Thailand, Malaysia and Vietnam. He is expected to further contribute to the international standardization based on his experience.

2022 IEC 1906 Award for the Year 2022

This award was estabished to commemorate the centennial of the foundation of IEC in 1906 and is given by IEC to recognize distinguished contribution and achievement in standardization of electronic technologies and related activities. In 2022, 36 Japanese persons were given this award.

Award winner: Mr. Hiroshi Tanaka, Senior General Director, Railway International Standards Center

Achievement for commendation:

He was given this award for his achievement in the activities of IEC/TC 9 (Electrical equipment and systems for railways).

Activities of RISC Related to International Standards in the Railway Field

Dr. Toshiki Kitagawa
General Director,
Railway International Standards Center

Introduction

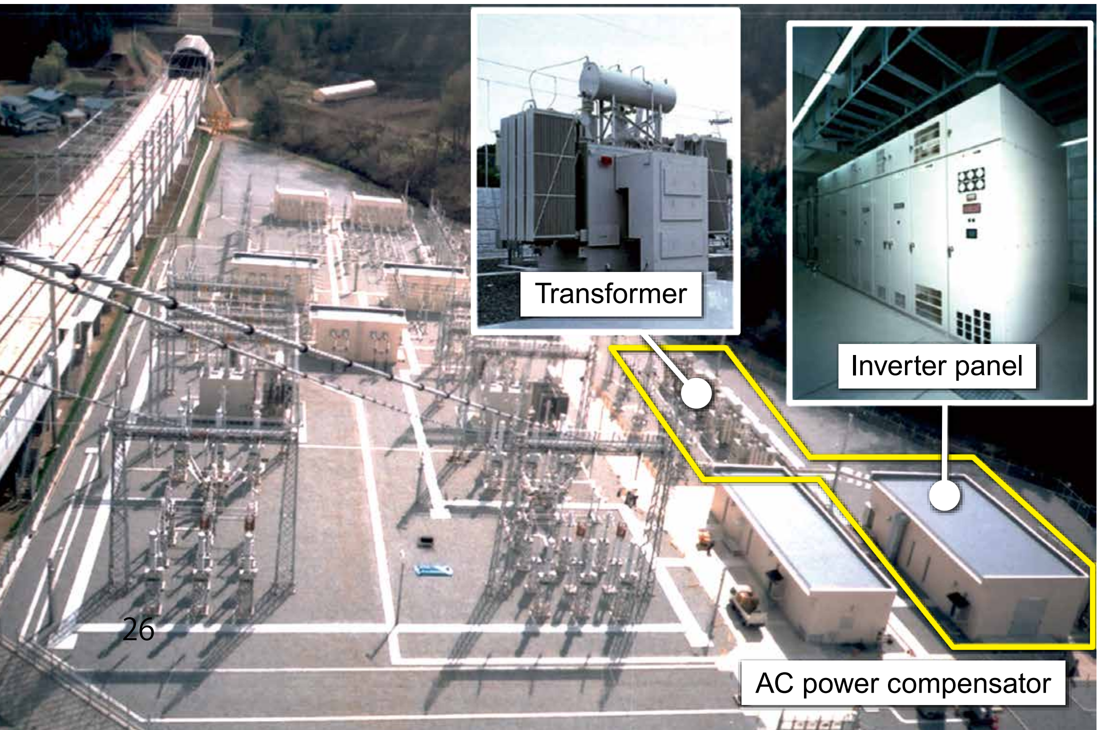
Due to the rapid globalization of information and markets in the railway field and the implementation of standardization in Europe triggered by the European Union's integration, activities closely related to international standardization have been widely carried out by both the railway operators and the railway-related industries. Under these circumstances, in April 2010, the Railway International Standards Center, RISC, was established and commenced activities in the Railway Technical Research Institute. Since then, RISC has contributed to the development of international standards for railway technologies, together with the member organizations of RISC. In RISC, the experts have carefully examined the details of the proposed standards so that they can be applied effectively in many countries including Japan. They are also involved in the deliberations of the standards with foreign experts. Through its activities related to the standardization, RISC has encouraged global use of the railway technologies developed in Japan. This paper briefly shows the activities of RISC related to international standardization in the railway field.

Activities related to international standards

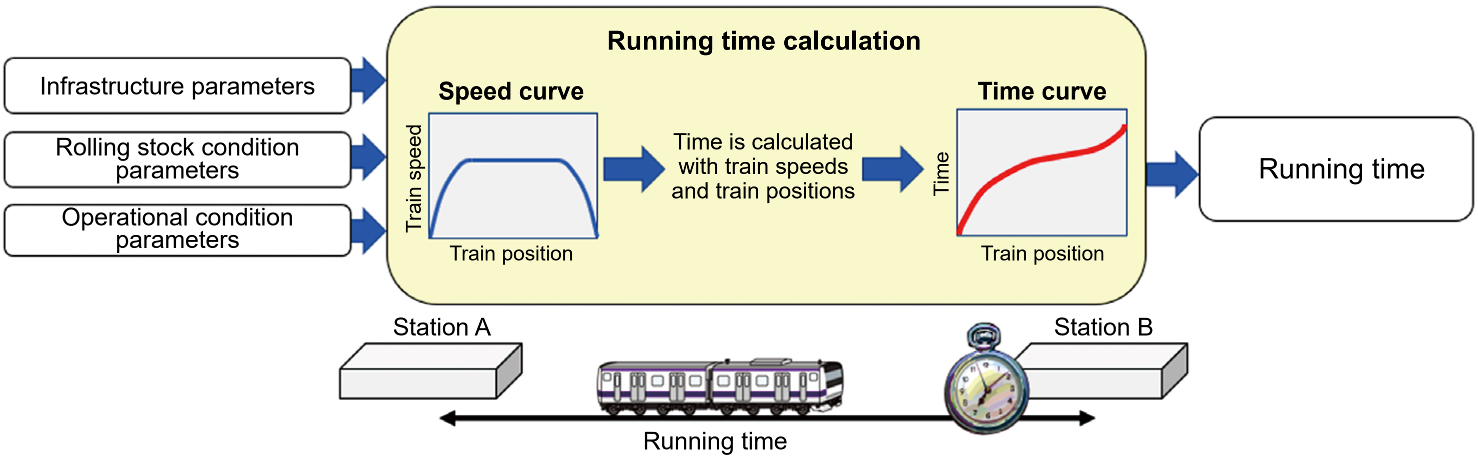
For international standards in the railway field, the deliberations are performed mainly within two organizations, i.e. IEC/TC 9 and ISO/TC 269.

Activities in IEC/TC 9

The International Electrotechnical Commission, IEC, which was established in 1906, is an international standardization organization in the electrotechnical field. IEC/TC 9, established in 1924, is a technical committee, TC, which corresponds to the railway field including rolling stock, fixed installations, and signal systems for railway operation. For IEC/TC 9, the chair country is Italy, and the secretariat country is France. In Japan, although the Institute of Electrical Engineers of Japan was in charge of the national secretariat of IEC/TC 9, RTRI took on the role of the secretariat in 2004, and since 2010, RISC has been in charge of the secretariat. RISC has contributed to the deliberation progress on the standards mainly proposed



Railway substation (Provided by the Japan Railway Construction, Transport and Technology Agency)



Running time calculation

by European countries and has also made proposals for railway technology standards developed in Japan. As a recent topic of IEC/TC 9 related to Japan, the international standard for AC power compensators (IEC 62590-3-1), was issued in August 2022[1]. AC power compensators are devices which are capable of reducing imbalance at the interface to the three-phase AC power supply network[2] (*Railway substation*). The manufacturers and railway operators in Japan have been developing the AC power compensators and currently foreign manufacturers are also developing similar devices. However, international standards for the compensators were not yet to be developed. Therefore, in order to promote Japanese technologies to the world, development of standards for the compensators was proposed by Japan in 2017. In the standard, basic requirements for railway system compensators, assessment methods to introduce the compensators and testing methods are shown.

Activities in ISO/TC 269

The International Organization for Standardization, ISO, which was established in 1947, is an international standardization organization, and mainly covers the technical fields with the exception of the electrotechnical field. In 2011, Germany and France made a new proposal about the establish of a TC which mainly covers the railway field. In April 2012, this proposal was approved by ISO, and a new technical committee, ISO/TC 269, was established. By showing that Japan would actively contribute to this TC, the countries concerned agreed that the chair country would be Japan. RISC has taken on the role of the national secretariat of this TC in Japan. In 2016, three sub-committees, SCs, were established under ISO/TC 269, i.e., SC 1 (infra-structure), SC 2 (rolling stock) and SC 3 (operation and service). For ISO/TC 269/SC 3, Japan is the secretariat country, and plays a significant role on the management of the SC with Italy, which is the chair country. In ISO/TC 269 and its SCs, new proposals for international standards tend to be increasing significantly. Although most of the proposals are made by European countries and China, Japan also has taken an active role in developing several proposals. In 2022, four international standards proposed by Japan were issued, i.e. Polymeric composite sleepers (ISO 12856-3), Heating, ventilation and air conditioning systems for rolling stock (ISO 19659-3), Driving simulator for driver's training (ISO 23019)[3] and Running time calculation for timetabling (ISO 24675-1)[4]. For the running time calculation, in order to achieve punctual train operation, it is necessary to prepare an appropriate timetable that specifies a departure time and an arrival time of each train at each station according to each route and type of train (*Running time calculation*). The fundamental technology required to design the timetable suitably is the running time calculation. This means that it would be better that international standards for the running time calculation be established in order to enhance the quality of railway transport services with punctual train operation. Therefore, development of the standard of the calculation was proposed to ISO/TC 269/SC 3 by Japan in 2018. In the standard, input parameters and verification process required for the calculation are shown. At present, deliberation is in progress to develop the second part of the standard.

Conclusion

The development of international standards for railway business has become increasingly important. RISC will continue to contribute to the sustainable future development of the railway worldwide.

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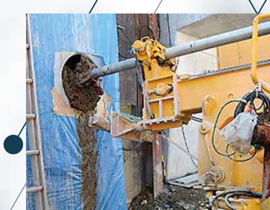

Railway Technical Research Institute