

The cover features a dark green background with a large white speech bubble containing the title. At the bottom, there are several overlapping, curved bands in shades of purple, blue, and green. The text is in a bold, sans-serif font.

# **Annual Report 2008**

Railway Technical Research Institute  
Japan



**Hisashi TARUMI**  
President

# Foreword

## Back to Basics

### - A Group of Researchers further Contributing to the Railway Operating Business -

I took up the position of President of RTRI as of April 1st, 2009. My duty for the time being is to solve the managerial problems handed down to me from the previous President's tenure. That is: complete the current master plan *-RESEARCH 2005-*, create the next master plan based on the roadmap for R&D, deal with the Public Interest Corporation Reform, promote exchanges with domestic and overseas institutes and organizations, improve the working environment, and advance safety management. Enrichment of the division that can contribute to the development of the railway business overseas, such as the project related to international standardization, is also an urgent assignment.

During the fiscal year 2008, RTRI has been able to make progress with its projects almost as scheduled, including several relatively long-term assignments. Among these projects was the development and application of a method of configuring a new signalling system, the development of a method to evaluate the characteristics of vehicle dynamics by use of a hybrid simulator, and the development and evaluation of measures taken to protect existing railway facilities from seismic damage. RTRI has also created a roadmap for long-term research projects that will contribute to the

definition of the new five-year master plan starting in the next fiscal year. Further, RTRI will continue to improve the roadmap. We expect that we shall have to introduce research results and research methods from fields outside the railway industry. RTRI will promote the integration of technology components and basic research.

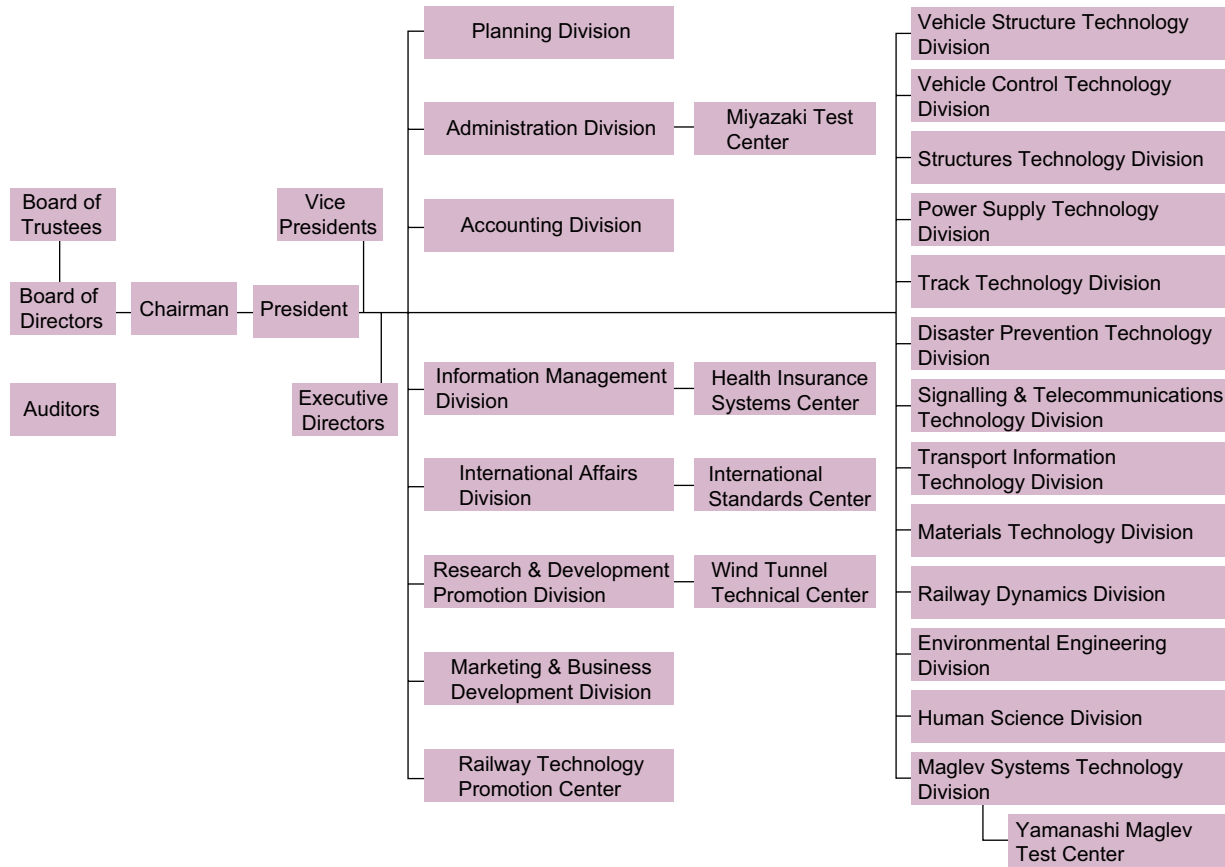
The percentage of staff who have become members of RTRI as researchers since RTRI was established as an independent organization exceeds 70%, that is to say, a group of expert researchers has come into being. It is important for the researcher group to "Back to Basics," so as to really understand the basis for the establishment of RTRI, to have it inherited by the next generation and to deepen the relationship with the railway business by making use of essential experiences accumulated to date. "Back to Basics" is my favorite motto, which I chose at the start of 2001 to guide our activities in the 21st century. At RTRI we will change our way of thinking while continuing to make use of the experience we have gained in the past and aim to build up a research group pursuing the goal of sustainable development for railways.

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# Organization

## Organizational Structure



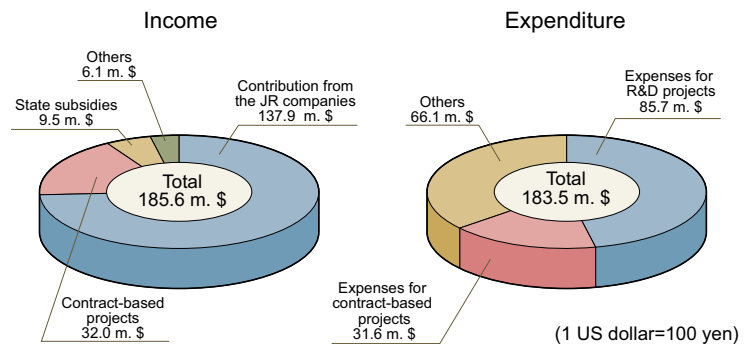
## Board of Directors

Title	Name
Chairman*	Masada Eisuke
President*	Akita Katsuji
Vice President*	Tarumi Hisashi
Vice President*	Inami Mitsutoshi
Executive Director*	Uchida Masao
Executive Director*	Fukushiro Norio
Executive Director*	Kumagai Norimichi
Executive Director	Kakinuma Hirohiko
Executive Director	Ogura Masahiko
Executive Director	Morimura Tsutomu
Executive Director	Azuma Noriaki
Executive Director	Han'i Shinji
Executive Director	Kameyama Toshiro
Executive Director	Sakamoto Tetsuro
Executive Director	Nishida Hiroshi
Executive Director	Suda Yoshihiro
Auditor*	Nakamura Yasuhiro
Auditor	Innami Takao
Auditor	Kiguchi Yataro

(\* Full-time)

(as of May 14, 2008)

## Income and Expenditure in FY 2008



## Human Resources

Total Number	518
Ph. D. Degree Holders	127

(as of Apr. 1, 2008)

## Number of Projects

FY 2008	
Category	Number
R&D for the Future of Railways	39
Development of Practical Technologies	131
Basic Research for Railways	86
Standards/Surveys	12
<b>Total</b>	<b>268</b>

# Master Plan of RTRI (RESEARCH 2005)

RTRI has carried out its R&D activities based on master plans prescribing basic policy. From FY 1999 to 2004, it operated under the master plan *RESEARCH 21*. From FY 2005, RTRI started to operate its R&D activities based on the new five-year master plan *RESEARCH 2005* formulated in consideration of the progress of R&D over the previous five years and changes in the circumstances surrounding railways.

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## Outline of the Master Plan

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### 1. Background

In formulating the master plan, the following background conditions were considered:

#### Society and Economy

In the long term, the Japanese economy's period of low growth is expected to continue despite the trend of recovery shown in recent years.

The tendency of declining birthrate and the growing proportion of elderly people will accelerate.

Information and telecommunication technologies are rapidly progressing to form a high-level information network society.

The global environment is now a matter of primary concern among people.

#### Transportation

A decline in the number of railway passengers is

expected due to a decrease in the production-age population.

Competition with other transportation modes is intensifying.

Demand for intermodal transport is increasing among railway users.

#### JR Companies and Other Research Organizations

JR companies and other railway operators are actively addressing environmental issues.

National universities and government-affiliated research institutes have become independent administrative institutions, enabling a tidal shift in the role of R&D in the country.

#### RTRI

A new fundamental policy for R&D on the magnetically levitated railway system is required.

## 2. Fundamental Policy on R&D Activities

Based on recognition of the current situation and the predictions described previously, RTRI established a fundamental policy on R&D activities as follows:

1. Create railway technologies for the 21st century.
2. Demonstrate integrated power as a group of railway engineering experts.
3. Respond quickly to needs.
4. Hand down railway technologies and accumulate basic expertise.
5. Disseminate railway technologies and transmit railway-related information.

Based on these policies, RTRI will work hard to live up to the expectations of JR companies and various other industries.

## 3. R&D (Research and Development)

### (1) Basic Concept of R&D

RTRI will concentrate its power to promote effective R&D activities. For this purpose, it set up *Targets of R&D*, which show the directions of R&D activities, and *Mainstays of R&D*, which clarify the fundamental categories of R&D (see Fig. 1).

### (2) R&D Plan

#### [Targets of R&D]

RTRI set up the following *Targets of R&D*:

1. Highly reliable railways (for safety and stability)
2. Railways with increased convenience (for rapidity, convenience and riding comfort)
3. Low-cost railways (for economy)
4. Environmentally friendly railways (for harmony with the environment)

#### [Mainstays of R&D]

RTRI set up the following three *Mainstays of R&D* in consideration of the importance of environmental issues, the development of information and telecommunication technologies, improvements in the reliability, convenience and riding comfort of railways, and the reduction of costs in railway businesses:

1. R&D for the future of railways
2. Development of practical technologies
3. Basic research for railways

In the area of R&D on the magnetically levitated railway system, RTRI will promote R&D activities mainly to apply the various accumulated technologies and know-how on superconductive magnets and linear motors to conventional railway systems. It will also conduct R&D to maintain the Maglev-related technologies required for this purpose.

### (3) R&D for the Future of Railways

RTRI promotes *R&D for the future of railways* as a collection of transversal study projects to bring about technological breakthroughs for future railways aimed at practical application within five to ten years.

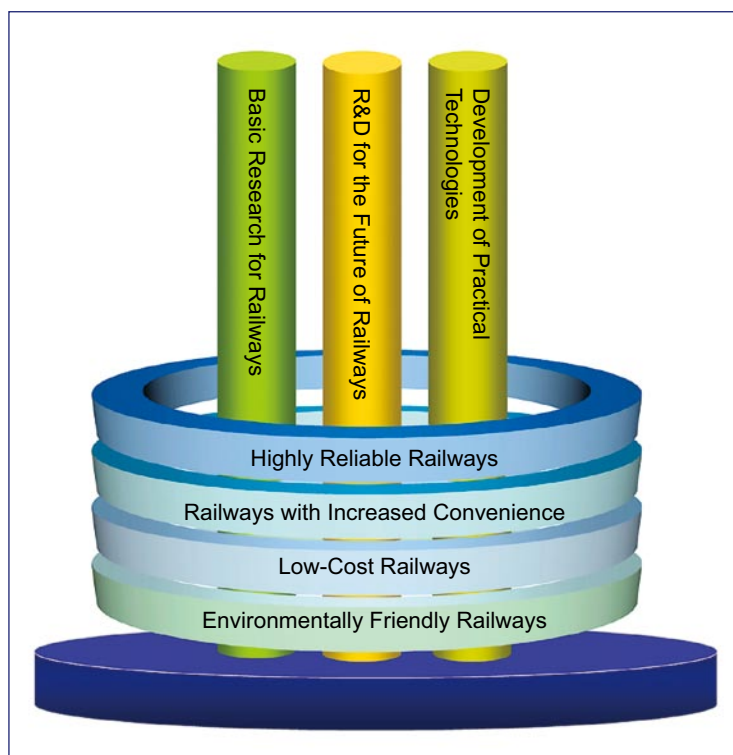


Fig.1 Basic Concept of R&D Activities at RTRI

Table 1 R&amp;D Projects for Future Railways

Target of R&D		Project Title
Highly reliable railways	[Improvement of the safety of train running]	Configuration of a signaling system using the RAMS index and its application
		Development of a method of evaluating vehicle dynamic characteristics using a hybrid simulator
	[Stable transport]	Seismic evaluation and countermeasures for existing railway facilities
		Application of IT and sensing technologies to equipment management
Railways with increased convenience	[Much more convenient railways]	Development of a broadband communication technology for railways Efficiency improvements for transport planning based on dynamic demand estimation
	[Improvement of riding comfort]	Development of human simulation technologies to improve safety and riding comfort
Low-cost railways	[Reduction of maintenance costs]	Development of a model to predict rail failure and ballast track deterioration and evaluation of maintenance work reduction technologies
		Development of an innovative low-maintenance, low-noise track
Environmentally friendly railways	[Noise reduction]	Development of an analytical tool to predict rolling noise and structure-borne noise, and measures for noise reduction
	[New forms of energy]	Development of fuel cell rolling stock
		Application of linear motor technologies to conventional railway systems

The basic concepts set up for the projects are as follows:

1. Projects should respond to the needs of JR companies and social movements.
2. Projects should be pioneering and oriented toward future railways.
3. Projects should make full use of research areas in which RTRI has a competitive edge or specific characteristics.
4. Projects should be reflected in the development of practical technologies or solutions for critical problems with such technologies.

The 12 assignments for projects set up based on the above concepts, whose research work started in FY 2005, are shown in Table 1.

#### (4) Development of Practical Technologies

To enable timely response to the diverse requirements of JR companies, RTRI continuously promotes R&D projects, as in the past, that are designated individually by JR companies to solve local or on-site problems and that can be practically applied in the field.

RTRI promotes contract-based R&D projects, not only with JR companies but also with various corporations, aimed at wide-ranging practical application of the research results.

RTRI also promotes carefully selected self-directive practical R&D projects focusing on the engineering field, especially where it has a competitive edge or advantages in development, by using its own knowledge, know-how and special or unique test facilities.

#### (5) Basic Research for Railways

RTRI promotes basic investigations to elucidate railway-inherent phenomena and to establish evaluation methods as *analytical research*; it also promotes investigations for the application of new technologies and new materials to railways as *probing and introductory research*. We recognize that this basic research should be conducted to germinate practical railway technologies or to serve as a foundation for them, and that such work is essential in solving a variety of railway-related problems.

For the magnetically levitated railway system, RTRI promotes the development of durability test and performance evaluation methods for ground coils and superconductive magnets, as well as the necessary studies on a Maglev riding comfort evaluation method to maintain the technical ability required for application to conventional railway systems. RTRI will also participate in running tests on the Yamanashi Test Line as a means of fulfilling the above R&D objectives.

## 4. Railway Technology Promotion Center (RTPC)

RTPC will promote various activities based on the principles outlined below to solve the problems of its member corporations by understanding their common technological needs and to assure the reliability of railways overall.

The Center will make efforts to promote its usefulness by providing information, and will make the necessary proposals to the government so that the results of its activities will be reflected in government policies. RTPC will also organize workshops and opinion exchange meetings to strengthen communications with members and enhance the transmission of information.

1. Maintenance and Improvement of Technological Capabilities  
(by conducting technological support and administering the Railway Design Engineer Examination)
2. Systematization of Technologies and Problem Resolution  
(by providing technical standards, conducting survey and research projects, and carrying out contract-based projects)
3. Technological Information Services  
(by providing information on technologies, safety and international standards)

## 5. Management

### (1) Basic Concept of Management

Seventeen years have elapsed since the privatization of JNR; RTRI is now facing a tide of generation change among researchers. To prevent technological gaps between the old and new generations, RTRI

pays particular attention to the transfer of technology to the next wave of researchers. RTRI takes every conceivable measure to adopt and educate its human resources - the most important asset for any research institute.

### (2) Securing and Training of Human Resources

RTRI will systematically recruit new graduates mainly in the field of railway-inherent technologies. We will also invite experienced researchers who have excellent records in other research organizations. RTRI makes efforts to secure adequate human resources through a variety of recruiting channels.

In the area of education and training for human resources, RTRI will step up personnel exchanges with railway operators, including JR companies, and will develop researchers who are very familiar with the on-site activities of railways. We also dispatch our employees to domestic and overseas research organizations and universities to introduce or absorb new technologies and research techniques.

### (3) Personnel Plan

The number of RTRI employees at the beginning of FY 2005 was 520. RTRI continuously recruits employees needed for R&D on a priority basis, and plans to improve the efficiency of its management during the period of this master plan to reduce the number of employees to 510 by the beginning of FY 2009.

### (4) Equipment Plan

RTRI will invest funds in equipment directly related to R&D activities as a matter of top priority and update its test equipment, including the rolling stock test plant, which represents one of the advantageous features of the institute.



# Major Activities in FY 2008

## 1. Activities Related to Testing and Research

### 1.1 Test and Research Projects

RTRI conducted 268 R&D projects in FY2008, 103 of which were completed as scheduled. The following is an overview of the R&D results according to the three categories featured in the master plan *RESEARCH 2005*.

#### 1.1.1 R&D for the Future of Railways

A total of 13 assignments were conducted, including 49 projects related to R&D for the future of railways. Among them, 15 projects were completed in FY 2008.

##### (1) Highly Reliable Railways

a) Development of a method of evaluating vehicle dynamic characteristics using a hybrid simulator

- An inter-car dynamics simulator for simulating the motion of a trainset and a control program were developed. A simulator for simulating vehicle dynamics in real time and rolling stock test equipment were combined.

b) Seismic evaluation and countermeasures for existing railway facilities

- A method of predicting earthquake ground movements caused by active faults and comprehensively analyzing the behavior of structures and the running safety of trains was developed. Ground conditions and

structural conditions that would degrade the running safety of trains were identified by using this method.

c) Configuration of a signalling system using the RAMS index and its application

- A new signalling system to control a train by exchanging information between the train and wayside signalling equipment was devised; in addition, information necessary for route control and separation of trains was defined, and at the same time a control procedure was proposed.

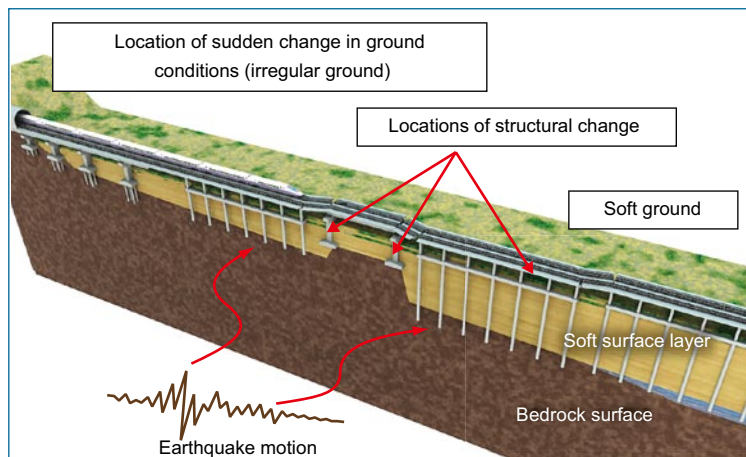
d) Application of IT and sensing technologies to facility management

- A data management system to perform transmission, processing, management, etc., of data from sensors installed in structures was developed. A prototype of the system was manufactured to remotely monitor damage using sensors embedded in bridge pier foundations.

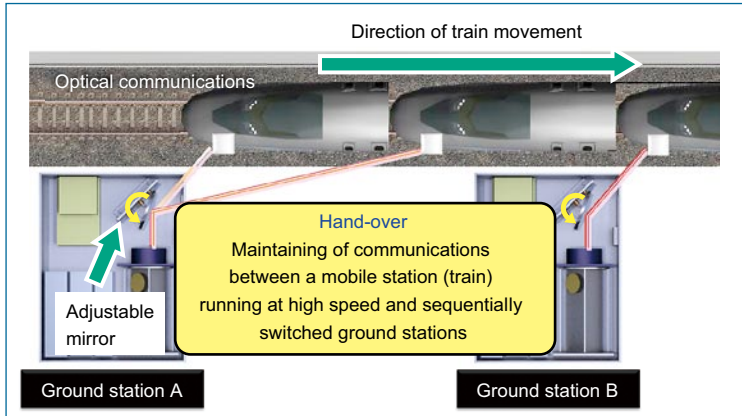
##### (2) Railways with Increased Convenience

a) Development of broadband communication technology for railways

- A high-speed handover technology involving laser communications for sequentially switching base stations on the ground side was developed. At the same time, a communication rate of 500 Mbps was



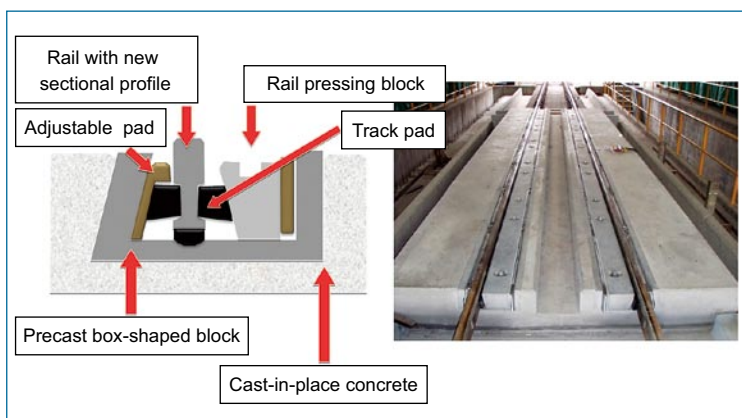
confirmed; subsequently, the possibility of achieving a target communication rate of 1 Gbps by improving the processing performance of terminal devices was also confirmed.



- b) Efficiency improvement for transport planning based on dynamic demand estimation
  - A method of estimating a use time distribution of passengers for each station from population, company and other data around stations was developed.
- c) Development of human simulation technologies to improve safety and ride comfort
  - Tests using a train operation simulator for incorporating error-inducing assignments were conducted with actual crew and the effectiveness of letting crew recognize the causes of errors was confirmed.

### (3) Low-Cost Railways

- a) Study on performance improvement and streamlining of maintenance work for the current collection system
  - The possibility of reducing variations in the local contact force in the vicinity of support points was confirmed by improving support structures, one such method being to reduce the amount of draw-out of



the contact wire in a test with the equipment installed in a Shinkansen line in commercial service.

- b) Development of innovative low-maintenance and low-noise track
  - A trial section of innovative track was constructed for testing its performance in the Hino Civil Engineering Testing Facility and the construction method and construction accuracy were confirmed. From test results obtained by a powered maintenance car running on the test track, rolling noise emitted from rails was reduced by 3 to 5 dB in the case of the innovative track compared with slab track.
- c) Development of a model to predict rail failure and ballasted track deterioration, and evaluation of maintenance work reduction technologies
  - A method of predicting the life of rail before the occurrence of gauge corner head checks was developed, and it was confirmed that the rail life could be roughly predicted by the method based on a comparison with an actual phenomenon.

### (4) Environmentally Friendly Railways

- a) Development of rolling stock powered by fuel cells
  - Running tests in RTRI test line were conducted with a hybrid configuration in which fuel cells, secondary batteries, and charging/discharging chopper units were connected. It was confirmed that the expected performance, such as a predetermined fuel consumption and energy efficiency, were obtained. This assignment is scheduled to be conducted from FY 2005 to FY 2009. However, the possibility of the availability of fuel cells on a practical scale cannot be guaranteed, and therefore, the project on this topic in the category of "R&D for the future of railways" was terminated in FY 2008 for the time being. And we decided to limit the scope of the project to cover the durability of fuel cells and fuel cell supply methods as one of the fundamental research topics from FY 2009.

- b) Development of analytical tool to predict rolling noise and structure-borne noise, and measures for noise reduction
  - In order to validate the prediction model for rolling noise, based on the TWINS model, measurements using actual trains were carried out in terms of noise and vibration. It was determined that the model gave reliable results.

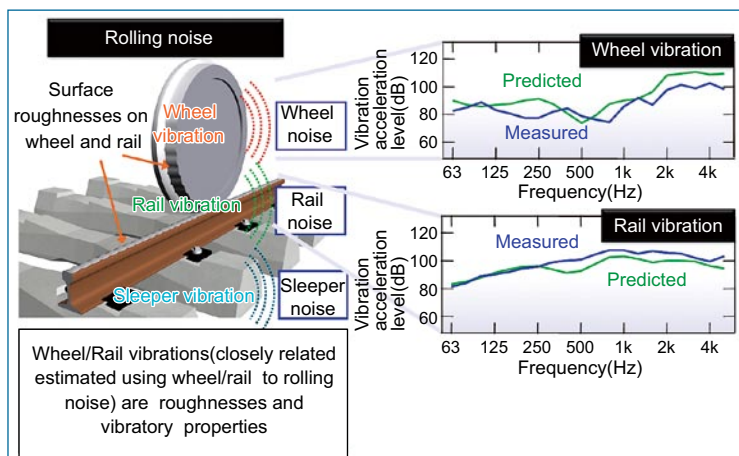
- c) Application of linear motor technologies to the conventional railway system
- The supporting force of the superconductive magnetic bearing used in the flywheel for energy storage was increased from 5 kN to 20 kN, and it was confirmed that stable levitated support was possible for a long time in a non-rotating state.

### 1.1.2 Development of Practical Technologies

A total of 131 projects related to the development of practical technologies were conducted, 57 of which were completed in FY 2008.

#### (I) Highly Reliable Railways

- a) Evaluation of the running resistance of snowploughs fitted to Shinkansen trains
- By using high-speed photography of a model and numerical simulation in the Shiozawa Snow Testing Station, the behavior of 16 types of snowplough with different shapes was analyzed and snowploughs with good performance were proposed for fitting to Shinkansen trains in regions of heavy snowfall.
- b) Development of an on-board speed-verifying type ATS-X system
- The operation of functions, such as the SPAD (Signal Passed At Danger) preventative function and the speed limit function, of on-board devices and way-side devices was verified. At the same time, safety evaluation was conducted, and it was confirmed that the performance levels satisfactory for commercial operation were obtained.
- c) Study on functional improvement of an interlocking table for automatic route setting
- The accuracy of automatic route setting was upgraded by the improvement of a function to create a track layout diagram in stations. At the same time, the function to explain the operation of the interlocking device and the function to aid route setting etc. was developed.
- d) Development of a method of improving safety awareness
- A group conversation method for improving safety awareness by sharing the experience of risk among field personnel to promote spontaneous thinking was developed and a group conversation implementation manual, a facilitator (leader) training program, etc., were created.



#### (2) Railways with Increased Convenience

- a) Practical implementation of a vertical vibration damping control system using a variable coefficient damper
- A variable coefficient damper intended to reduce cost was developed by improving a damping force control valve etc. It was confirmed during running tests in a Shinkansen vehicle that the vibration acceleration power near 10 Hz resulting from the car body primary bending could be reduced to approximately one-fifth. At the same time, a durability running test was conducted.

#### (3) Low-Cost Railways

- a) Development of an algorithm to detect internal defects in a concrete tunnel wall
- An algorithm for measuring the surface of tunnel lining concrete using a measuring laser as well as using a oscillating laser to detect internal defects from its vibration waveforms was developed.
- b) Development of a wear-resistant tongue rail
- A heat treatment method for increasing the hardness of the surface layer of a tongue rail and a sectional shape of its end section were devised based on research on actual wear conditions of the tongue rail on a conventional line. It was confirmed on a line in commercial use that the amount of wear could be reduced by approximately 30%.
- c) Development of an algorithm to draft plans to adjust freight train operation
- An algorithm to draft plans to adjust operation during periods when timetables are disrupted was developed. This algorithm also takes into consideration the daily inspection time limit and home inspection depots for each locomotive. At the same time, a

system for distributing the adjustment plans to the locomotive depots via the Internet was developed.

- d) Development of a high-performance sintered metal contact strip
- A sintered metal contact strip using a new lubricating component, such as bismuth, was developed. During running tests of a Shinkansen train with the contact strip attached to the pantograph, it was confirmed that the wear characteristics of the contact strip/contact wire were equal to or better than the contact strip that is in current use.

#### (4) Environmentally Friendly Railways

- a) Development of a method of estimating a range of radio disturbance of terrestrial digital broadcast along railway wayside
- A program for estimating the reception level of the terrestrial digital broadcast at the railway wayside during the passage of a train was created.

#### 1.1.3 Basic Research for Railways

A total of 86 basic railway research projects were conducted, 26 of which were completed in FY 2008.

##### [Analytical Research]

- a) Study on slip and re-adhesion control by one vehicle model
- A method for controlling slip by adjusting the torque of the movement of the wheel load by an inverter-controlled locomotive was developed. It was confirmed that the frequency of slip occurrence could be reduced by 20% and that the tractive effort could be improved by 4%.
- b) Study of aerodynamic noise reduction techniques for pantographs used in high-speed operation
- The hull of the Shinkansen pantograph and the

shape of the hull support were improved to reduce aerodynamic noise. At the same time, wind tunnel tests confirmed that noise could be reduced by approximately 4 dB by attaching a porous material to the frame.

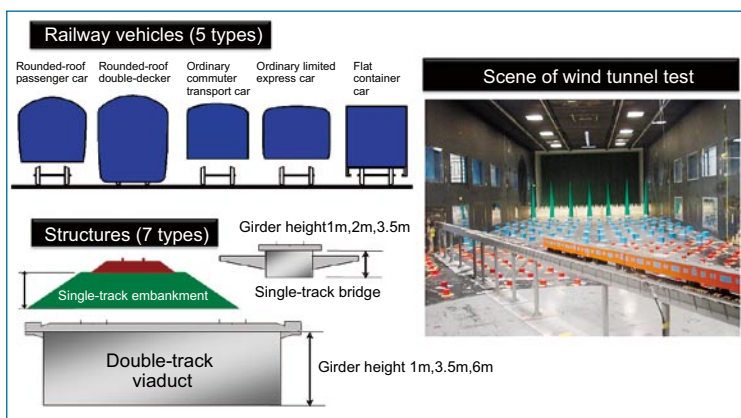
- c) Basic study on a method of evaluating obstructions to ground water flows caused by the construction of underground structures
- A method of evaluating obstructions to ground water flows caused during the construction of underground structures was developed based on the sequences of construction, such as excavation, and measures taken to prevent obstructions, such as the construction of flow pipes.
- d) Evaluation of aerodynamic forces acting on rolling stock in a turbulent boundary layer using a wind tunnel test
- A wind tunnel test for simulating natural wind was conducted by using a combination of five types of rolling stock and seven kinds of railway structures and the aerodynamic forces acting on the rolling stock on the railway structure were clarified.

##### [Exploratory and Pioneering Study]

- a) Evaluation of the application of nano-composites to railway flooring materials
- A flooring material formed by laminating a polymer film in which fine clay minerals on a nano scale were dispersed on the surface layer of a non-halogen polymer base was developed. It was confirmed that the material's resistance to combustion satisfied the criteria of the ministerial ordinance, its strength met the current specifications, and a reduction in weight was possible by using a low-density base.

##### [Magnetically Levitated Railway System]

- a) Development of non-destructive inspection and condition diagnosis technology for a ground coil
- A malfunction detection sensor was attached to the power supply of the ground coil, as well as to the data transmission part and so on. It was also confirmed using an electromagnetic vibration test that the sensor functioned normally in a ferromagnetic field.
- At the Yamanashi Test Track, data on the long-term durability of the rolling stock and ground facilities was obtained through the running tests.



## 1.2 Contract-Based Projects

RTRI conducted 524 contract-based projects including surveys, developments and studies. Below are some examples of typical projects and clients.

MLIT<sup>\*</sup>: Survey and study for maintenance of railway technical standards

Local Gov.: Survey on the effects of construction work adjacent to railway tracks

JRTT<sup>\*\*</sup>: Review on countermeasures for malfunction in switching of Shinkansen turnouts

Investigation and research for contact wire facilities in the projected Shinkansen lines

JR<sup>\*\*\*</sup>: Brake performance test

Wind tunnel test for the review of the optimum shape of a pantograph and current collecting device

Private Co.: Investigation of viaduct piers

Measurement and prediction of vibration and noise required from construction planning of buildings

## 1.3 Other Projects

### (1) Surveys

A staff member was dispatched to UIC<sup>†</sup> to assist in their activities and to conduct a survey of European railway technologies in order to make use of it in RTRI's R&D activities.

Systematic collection, analysis, and evaluation of technical information related to the future of railways were conducted. A survey on technological trends in the marine industry was conducted, following earlier surveys on automotive and aircraft industries, to compare the energy efficiency of railways with other modes of transport.

Further, the results of surveys carried out to determine future technical challenges for railways were published as a book entitled "Railways in 2030."

### (2) Technical Standards Development

RTRI drafted revised editions of Seismic Design Standards, Track Structure Design Standards, and Foundation and Retaining Structure Design Standards, and created a guideline related to a design method of tunnel linings in mountains. It also conducted surveys and studies on the design and maintenance of railway

structures, and promoted development of design tools in related R&D projects.

RTRI performs the role of National Secretariat for IEC<sup>††</sup> TC9, which is the railway-related technical expert committee. At the same time, RTRI held the railway section meeting in a Japan-Europe Standardization Conference.

### (3) Information Services

RTRI distributes railway technical information through its website and literature retrieval service in order to respond to internal and external requests. We also gather books and documents related to railways and scientific technologies, and we continue to computerize documents kept in RTRI's library in order to provide information by an electronic library system.

### (4) Publications and Workshops

RTRI published its own periodicals, such as RTRI Report, RRR, and QR. We also held RTRI Lecture (498 attendees) under the main theme of "Transcending Technical Boundaries - Toward Harmonization and Intellectualization of the Railway System -," Monthly Presentation 11 times (1,131 attendees in total), and 28 Railway Technology Seminars (1,407 attendees in total). Further, we started sales of DVDs of Monthly Presentations and RTRI Lectures.

### (5) Diagnosis and Advisory Services

RTRI offered consultancy services on 367 occasions mainly for railway operators. These related to the investigation into the causes of rail failures and accidents that occurred in substation facilities and so on.

## 1.4 Railway Technology Promotion Center (RTPC) Activities

RTPC organizes the Railway Design Engineer Examination - a qualification in technical expertise on managing railway design that aims to enhance the technical capabilities of railway engineers in Japan. In FY 2008, 149 engineers out of 779 applicants passed the examination.

In terms of technical support, RTPC published "Railway Technologies Learned from Accidents (track volume)," a textbook for leading engineers, and started to edit a signalling textbook. It responded to 50 inquiries from its members and conducted seven on-site

\* MLIT: Ministry of Land, Infrastructure, Transport and Tourism

\*\* JRTT: Japan Railway Construction, Transport and Technology Agency

\*\*\* JR: Japan Railway Company

† UIC: Union Internationale des Chemins de Fer / International Union of Railways

†† IEC: International Electrical Commission

surveys and gave on-site advice on four occasions, as well as holding the promotion center lecture in four locations. In addition, it gave lectures and advice six times at training meetings held by local railway organizations arranged by rail advisers (registered engineering experts) and exchanged opinions with local railway organizations on 20 occasions. To provide information to members, RTPC began distributing a mail magazine and providing a DVD of the monthly presentation.

Concerning the survey and research, RTPC conducted five projects and completed three projects including the method required for implementing substitute signalling block arrangements for rural lines. As to the railway safety database, we clarified information about critical accidents in the past, and at the same time, developed a system for provision of information.

## 1.5 Other Activities

### (1) International Activities

RTRI promoted joint research projects with overseas

railway-related research organizations and held discussions with French National Railways (SNCF) on new research project plans. In November 2008, we held the China-Korea-Japan Railway Research Seminar at RTRI. Further, RTRI started a joint research programme with the Rail Safety & Standards Board (RSSB) from October. In relation to international conferences, RTRI supported preparatory work for the 8th World Congress on Railway Research (WCRR 2008) held in Seoul, Korea, in May 2008. RTRI agreed to act as host for the 10th International Workshop on Railway Noise (IWRN 10) to be held in Nagahama, Shiga Prefecture, in October 2010.

### (2) Development of a Gauge Change Train

In the development of the gauge change train, as a member of the Free-Gauge Train Technology Research Association (FGT Association), RTRI participated in the planning of running tests on sections of conventional line and the improvement of measurements and bogies.

## 2. Others

### (1) Dealing with Public Interest Corporation Reform\*

RTRI made an effort to collect related information and to grasp the trend of the Public Interest Corporation Commission. After the three Acts\*\* to reform the Public Interest Corporation were enforced in December 2008, we proceeded to discuss the application for transition to a new legal entity.

### (2) Transition to New OA System

The new OA system, development of which was completed in FY 2007, was put into operation from May 2008. The transition was completed smoothly.

### (3) Improvement of Equipment and Facilities

A large-scale shaking table simulating the ground movement of a severe earthquake was completed. The improvement of the rolling stock test equipment was continued.

### (4) Environmental Preservation

As to preservation of the global environmental, RTRI tried to reduce power consumption based on the implementation plan in FY 2008.

### (5) Industrial Property Rights

RTRI applied for 240 patents and obtained 154 new registered patents in FY 2008. The total number of patents in its possession was 2,210 at the end of the fiscal year.

### (6) Visitors

Approximately 2,000 people visited the Kunitachi Institute and approximately 420 people visited Maibara Wind Tunnel Technical Center. Approximately 1,500 people attended RTRI technical forum held in the Kunitachi Institute (September 4 and 5), and 4,800 visited the open house festival (October 11); 8,500 visited the open house festival held in the Wind Tunnel Technical Center (October 11 and 12).

\* Public Interest Corporation Reform: In the new legal system, general non-profit corporations, which consist of incorporated foundations, will be created. By the end of 2013, existing public interest corporations may apply for approval to transfer to new public interest non-profit corporations or ask for authorization to convert to the new general non-profit corporations.

\*\* The three Acts: The following three laws came into effect on December 1st.

1) General Incorporated Association and Foundation Law  
2) Charitable Status Recognition Law  
3) Relative Transition, Modification & Repeal Law

# Activity Plan for FY 2009

## 1. Fundamental Policy

The Japanese economy has slowed down considerably as it has been affected by the collapse of the global economy triggered by the sub-prime loan problem in the USA. Therefore, it is necessary to monitor the economic situation surrounding the railway business with great care, because the problems are expected to become more severe. On the other hand, from the standpoint of measures taken to combat global warming, the expectations placed on the railway business seem to grow higher and higher. In these circumstances, RTRI will build on the technologies it has mastered in the past in various ways and at the same time, recognize anew the role it has to play as an integrated railway technical research institute, aiming to achieve further progress.

Because FY 2009 is the final fiscal year of the five-year master plan - *RESEARCH 2005* - we will take a firm hold on the current situation and endeavor to focus on the target plan, promoting each project in order to achieve the predetermined objectives of the master plan. In addition to the above, we will conduct timely R&D that can contribute to the management of the JR companies and other railway operators, striving to achieve rapid results.

Concerning R&D activities that can be easily deployed to improve the safety level of railways while maintaining a close relationship with the government, railway operators, etc., RTRI will use all its endeavors to tackle R&D projects relating to natural disasters such as earthquakes and high winds, as well as projects related to human error, etc. And at the same time, we will carry out R&D aimed at helping railways to take advantage of IT and related technologies to achieve low cost and ease of use while taking into consideration the global and wayside environments. Further, by strengthening links with domestic and overseas universities, institutes, etc. RTRI will promote R&D efficiently. In the Maglev Systems Technology Division, we will continue R&D activities focused on applying a range of technologies and know-how, such as superconducting technology and linear motor technology, to conventional railways.

In terms of operations and management, in accordance with the requirements of the three Acts to reform the Public Interest Corporation, RTRI will prepare for the transition to a new legal person.

Further, we will review the direction of medium and long-term R&D and progress steadily towards drawing up the master plan for the next term.

## 2. Activities Related to Testing and Research

### 2.1 Test and Research Projects

Because FY 2009 is the final fiscal year of the master plan - RESEARCH 2005 - RTRI will consistently carry out R&D for the future of railways and we will conduct practical R&D and basic research on railways.

To promote R&D efficiently, RTRI will positively utilize contract research and joint research projects with universities and other research organizations, conduct R&D reviews with research advisors who are assigned to give advice on our research projects and evaluate the outcome of research activities from the viewpoint of external experienced scholars.

#### (1) R&D for the Future of Railways

RTRI will promote 12 assignments including the following projects that are expected to result in technological breakthroughs toward the future of railways.

##### a) Development of a method of evaluating vehicle dynamic characteristics using a hybrid simulator

A virtual running test environment will be constructed by combining damper test equipment, an inter-car dynamics simulator for simulating the dynamics of a train set, and a bogie that can be adjusted to offer different characteristics.

##### b) Seismic evaluation and countermeasures for existing railway facilities

A method of uniformly evaluating the seismic performance of facilities of different types, such as civil engineering structures and power supply facilities will be developed using common standards. A reasonable performance improvement plan for dealing with seismic problems will also be proposed.

##### c) Study on performance improvement and streamlining of maintenance work for the current collection system

New overhead contact line erection standards will be

drawn up to alleviate the maintenance of trolley wires. This will be achieved by combining the trolley wire local wear reduction scheme and introducing novel profile trolley wires with improved fatigue strength.

##### d) Development of human simulation technologies to improve safety and ride comfort

A method of evaluating the safety and ride comfort of passengers and crew of railways will be drawn up. This will be based on a method used to evaluate ride quality that takes into consideration the physical properties and simulation technology used to evaluate the physical and mental load of crew.

##### e) Application of linear motor technologies to the conventional railway system

A scaled and partial model of a flywheel power storage system that uses superconducting bearings will be completed. At the same time, a prototype for a regenerative rail brake that makes use of linear motor technologies will be completed.

#### (2) Development of Practical Technologies

RTRI will promote technical development projects to solve specific local or on-site problems designated individually by JR companies, and will conduct R&D in the area in which RTRI has a developmental edge. In particular, RTRI proposes a new method for monitoring wind so that safe train operation is ensured even during high winds. It plans to put into practice a system for controlling vertical vibrations using a variable coefficient damper, and to develop on-board inertial mid-chord track measuring equipment. It will also develop a method for optimizing the location of depot of freight locomotives and crew. In implementing these improvements, RTRI will ensure that it fully understands the needs of railway operators by working closely with them. It will also strive to provide results quickly.



### **(3) Basic Research for Railways**

RTRI will clarify phenomena that are inherent to railways and which are necessary to solve various railway problems; it will also conduct studies into the application on railways of simulation techniques, new technologies and materials.

For the conventional railway systems, RTRI will conduct a study on the vehicle response to a sudden gust of wind, a study on remote control of signalling from a vehicle, a study on a control method for energy storage equipment, a study on a method to clarify and reducing the phenomenon of low-frequency noise generated when a high-speed vehicle is running, and a study on the contact wire and the messenger wire having a low thermal coefficient of expansion.

For the magnetic levitation railway system, RTRI will participate in running tests on the Yamanashi test line and develop a method of evaluating the performance of the ground coils and superconducting magnets, as well as an inspection method. It will also carry out R&D to ensure that technical expertise is retained to a sufficient level for the technology to be applied to conventional railways.

## **2.2 Contract-Based Projects**

RTRI will promote contract-based research projects in the fields of engineering and system integration where its integrated power can be exerted. In order to ensure that we obtain contract-based research projects and to sell our branded items, RTRI will publicize the results of our outputs through technical forums and information exchange meetings.

## **2.3 Other Projects**

### **(1) Surveys**

RTRI will systematically continue to collect, analyze, evaluate and store technological information on railways and related fields in Japan and other countries. We will also implement surveys on the technological movements in the various fields to utilize this information toward new technologies and research for railways in the future.

### **(2) Technology Standards Development**

RTRI will begin work on revision of the Design Standard for Steel/Composite Structures to take account of the performance-based design method. It will also conduct investigations and studies on a simplified verification method for bridges and on the possibility of extending the life of existing retaining walls. It will also promote R&D on related projects.

Further, RTRI will also act as the national secretariat for IEC TC9, and we will start discussions about how to deal with the activities for international standardization of railway technologies in the future.

### **(3) Information Service Projects**

RTRI will promote various projects in the same way as in past years.

### **(4) Publication and Workshop Projects**

RTRI will promote various projects in the same way as in past years.

### **(5) Diagnosis and Advisory Projects**

RTRI will promote various projects in the same way as in past years.

## 2.4 Railway Technology Promotion Center (RTPC)

RTPC will promote various projects and provide information about the contents of projects as well as reflecting the needs of members in the project activities in an appropriate way. Specifically, RTPC will extensively develop the activities of rail advisers in order to pass on their knowledge of railway technologies and prevent existing technologies from deteriorating. It will also proceed to create training aids and learning materials for leading engineers. Further, RTPC will take charge of the Railway Design Engineer Examinations in Tokyo and Osaka. It will also promote investigation and studies to ensure safety and meet the demands of members. Moreover, RTPC will provide information and enrich its safety database, at the same time strengthening communication with members and distributing information by making use of lectures in local cities and through use of electronic media.

## 2.5 Other Activities

### (1) International Activities

As a mean of maintaining co-operation with overseas railway-related research organizations, RTRI will continue to promote joint research projects with SNCF, RSSB (UK), CARS and KRRI. RTRI will also prepare to host IWRN10 to be held in Nagahama, in October 2010 and will assist in the preparations for WCRR 2011 to be held in Lille, France, in May 2011.

### (2) Development of a Gauge Change Train

As a member of FGT Association, RTRI will plan running tests for a new train set, implement measurements in the tests, and remodel the bogies used.

### (3) Preparation of Facilities

RTRI will complete improvements to the rolling stock test plant started in FY 2005.

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## 3. Others

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### (1) Dealing with the Public Interest Corporation Reform

RTRI will strive to collect information about the Public Interest Corporation Reform from various fields, and at the same time we will refer to the situation being enforced by the government office, such as certifica-

tion. We will then proceed to have the necessary discussions, such as the idea about establishing a new project section to work towards the application for the transition to a new legal entity, reviewing the method for drawing up financial statements.

# Major Results of Research and Development in FY 2008

## I. Safety/Reliability

### 1. On-Board Speed-Verifying Type ATS-X System

- We developed a new on-board speed-verifying type ATS-X system that complies with the requirements in the revised Ministerial Ordinance on Technical Standards.
- It was confirmed through function verification tests and safety assessments that the system had no problems in practical use.

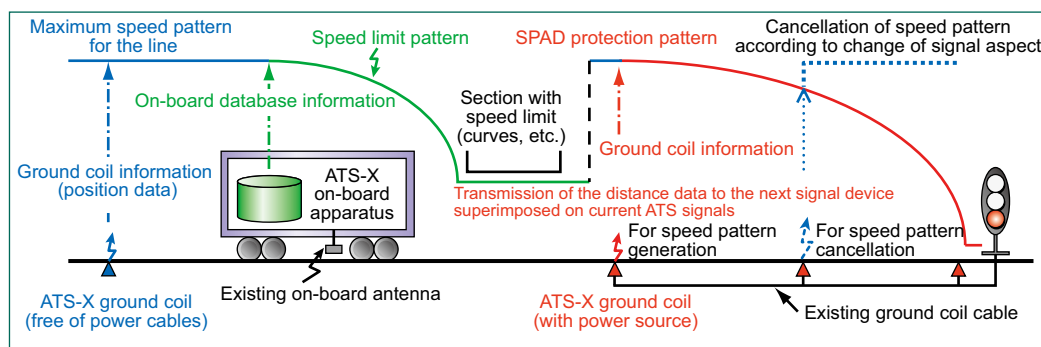


Fig. 1 Schematic diagram of ATS functions

#### Reference

Arai, H., Manabe, K. and Sato, K., "Development of Basic System on ATS-X with Continuous Surveillance Pattern", *Quarterly Report of RTRI*, Vol.48, No.2, pp.89-93, 2007.

### 2. New Snowplough Shape Suitable for Areas with Heavy Snowfall

- We developed a new snowplough shape suitable for Shinkansen trains running in areas of heavy snowfall.
- A similarity rule was proposed to convert the snow disposal force of the scale model plough to full-scale values.

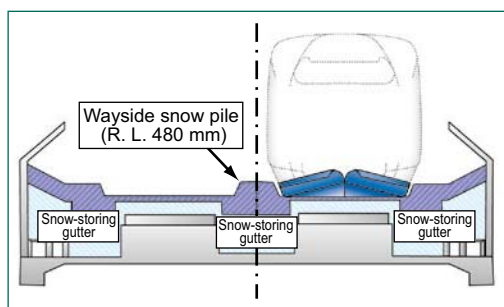


Fig. 2 Snow deposition on a snow-storing type viaduct in areas of heavy snowfall

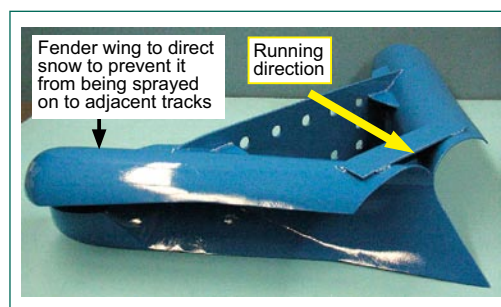


Fig. 3 Snowplough model suitable for use in areas of heavy snowfall

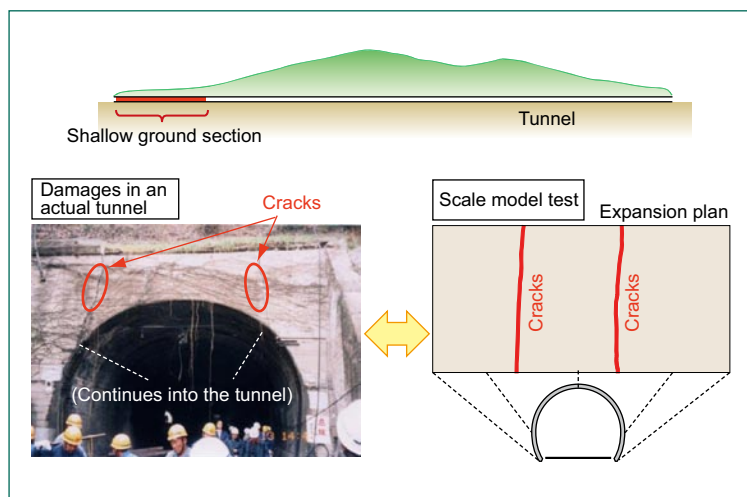


Fig. 4 Verification of earthquake damage reproducibility through experiments

### 3. Seismic Performance Evaluation Technique for Mountain Railway Tunnels Located in Shallow Ground

- We clarified the mechanism of the damage caused by earthquakes to mountain railway tunnels located in shallow ground.
- The seismic performance and effectiveness of seismic countermeasures for mountain tunnels were ascertained.
- A seismic performance evaluation technique for mountain tunnels was proposed and a seismic countermeasure manual was published.

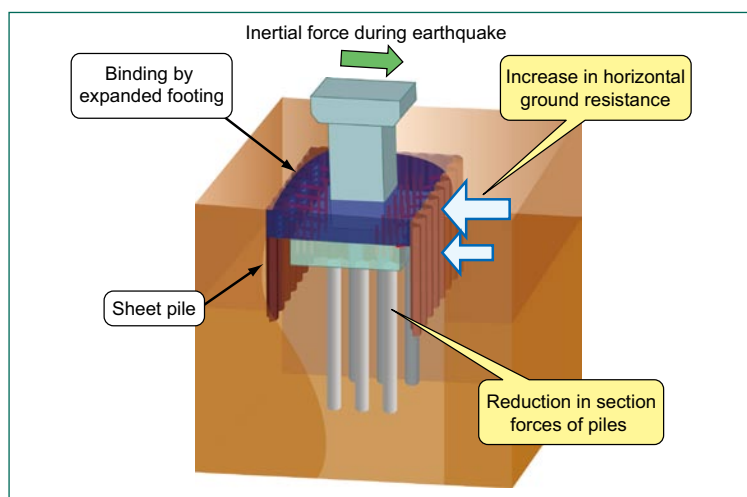


Fig. 5 Schematic diagram of seismic strengthening technique

### 4. Simple Seismic Strengthening Method for Existing Foundations using Sheet Piles

- We developed a simple and economical seismic strengthening method for existing foundations using sheet piles.
- A design method for this strengthening method was proposed, and a seismic strengthening design manual was published.

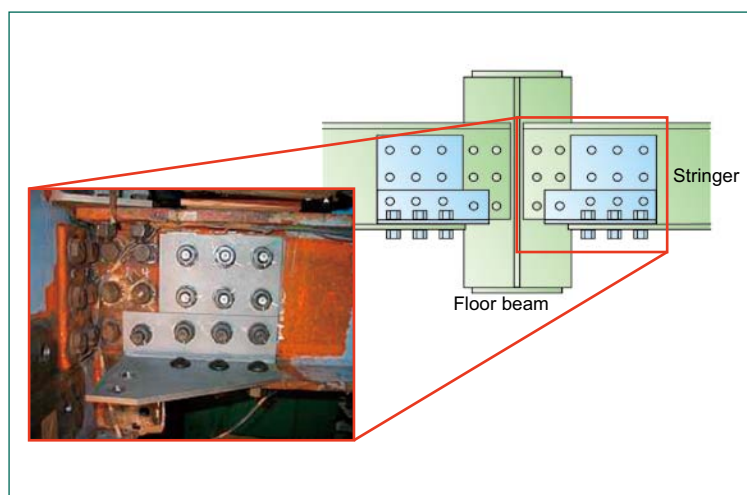


Fig. 6 Example of preventive measures for stringer lower end against fatigue crack initiation

### 5. Causes of and Remedial Techniques for Fatigue Cracks Occurring in the Floor Systems of Existing Steel Trough Girders

- We clarified the causes of fatigue cracks occurring in the floor systems of existing steel trough girders.
- Preventive measures were proposed depending on the types of fatigue cracks.

## 6. A Method for Evaluating the Effect on Passengers on Station Platforms of the Draft Caused by Passing Trains

- We clarified quantitatively the mechanical effect on passengers subjected to drafts caused by passing trains; and a method was proposed to evaluate the effect of the draft caused by the train on passengers on station platforms.

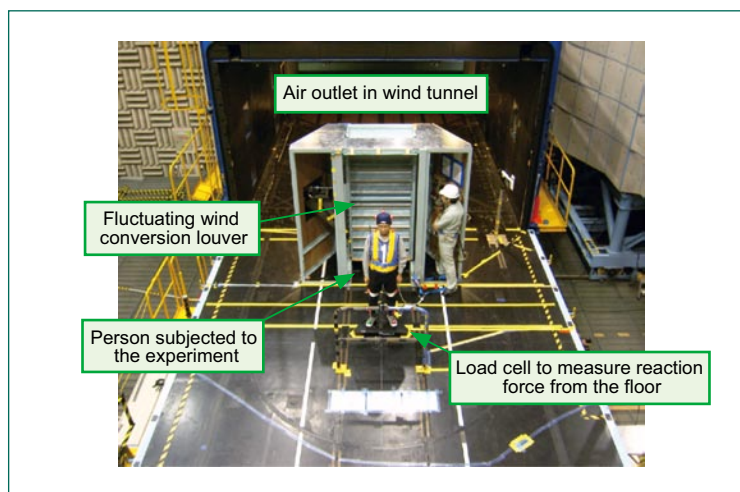


Fig. 7 Fluctuating wind sensory test in wind tunnel

## 7. Round-Table Discussion Method Designed to Raise Safety Awareness

- We reviewed the actual situation among field personnel on sharing experiences and know-how to ensure that safety was maintained; and we developed a group discussion method to enable the sharing of such experiences and know-how.
- A round-table discussion method manual was published and a training program for leaders was proposed.

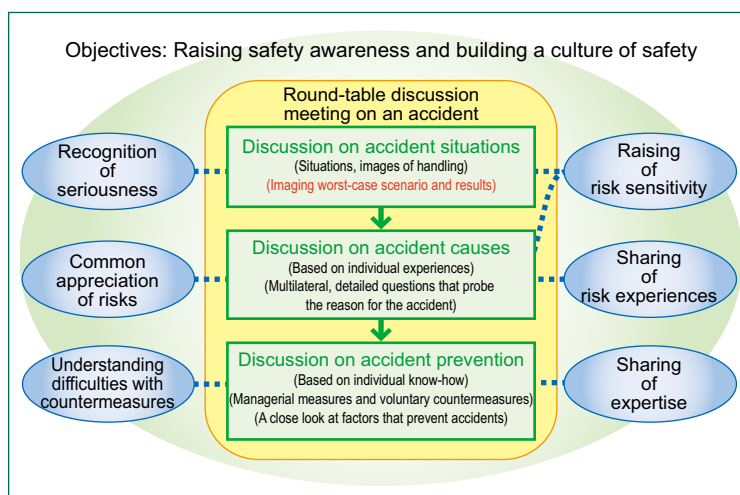


Fig. 8 Flow of round-table discussion method for raising safety awareness to prevent accidents

## 8. SQUID-based Detection for White Etching Layers on Train Rails

- We developed a SQUID\*-based inspection system that can detect the existence of a white etching layer on rail.
- Automotive measurement apparatus for white etching layers on rails was manufactured.

\*SQUID: Superconducting QUantum Interference Device

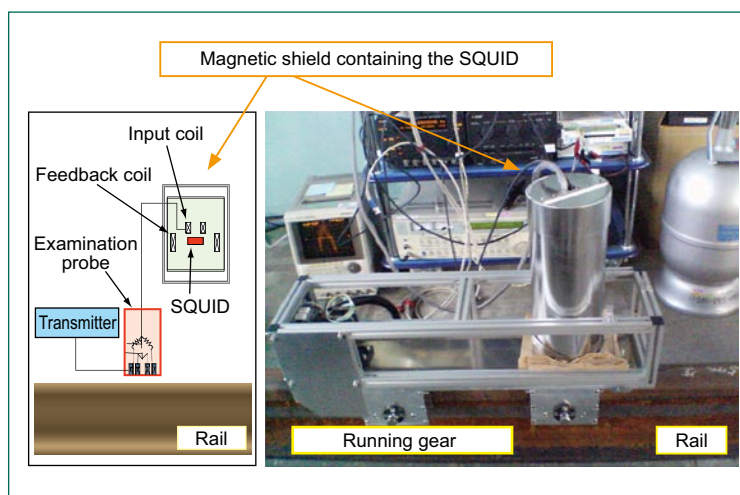


Fig.9 Configuration of measurement apparatus

## II. Economy/Efficiency



Fig.10 Wheelslip test using an actual locomotive

### 1. A Readhesion Control Method to Suppress Locomotive Wheel Slips Considering Axle-Weight Transfer

- We developed a readhesion control method when a locomotive suffers from wheelslip taking into consideration the axle-weight transfer.
- Comparative tests using an actual locomotive verified that the number of slips occurring fell by approximately 20% and tractive effort increased by approximately 40% with the help of dynamic axle-weight transfer compensation.

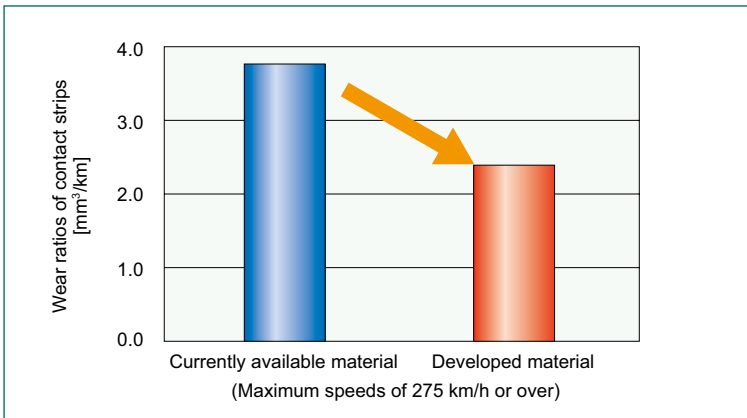


Fig. 11 Comparison of contact strip wear ratios between the currently available material and the developed material

### 2. Sintered Metal Contact Strips for Shinkansen Trains using a New Lubricating Material

- We developed sintered metal contact strips using a new lubricating material, and confirmed that the resulting wear-resistance characteristics are equivalent to or greater than the currently available material even at high speeds of 275 km/h or more.
- We confirmed that these contact strips can be used on a vehicle for through-operation between Shinkansen and conventional lines.

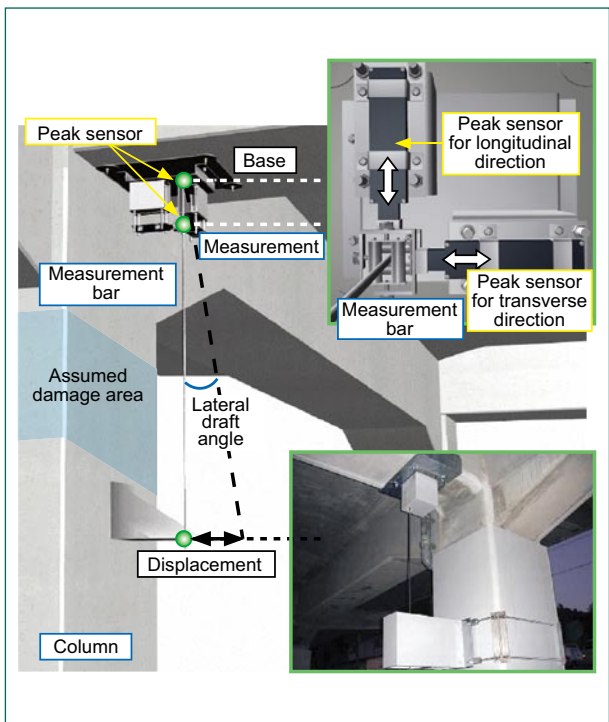


Fig. 12 Member angle measurement device

### 3. Seismic Damage Level Monitoring Device for a RC Rigid Frame Viaduct Column

- We developed a device requiring no power source for monitoring the level of seismic damage to a RC rigid frame viaduct column.
- The damage level of column can be predicted where its interior cannot be assessed because of strengthening using a steel jacket to prevent seismic damage.
- A method was proposed to select the optimum arrangement for locating the minimum number of devices for operational lines.

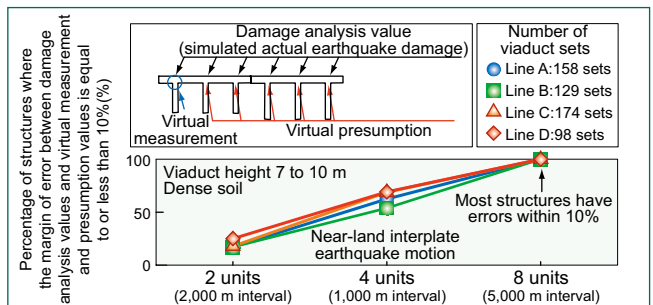


Fig. 13 Number of locations where the devices are installed and measurement errors

#### 4. Non-Destructive Inspection Technique for Concrete Members using Laser Excitation

- We developed a non-destructive inspection technique for concrete members using laser excitation.
- Enhanced examination efficiency and inspection accuracy were achieved compared with the conventional inspection method.
- Verification tests were implemented for actual structures, and the feasibility of defect detection was confirmed.

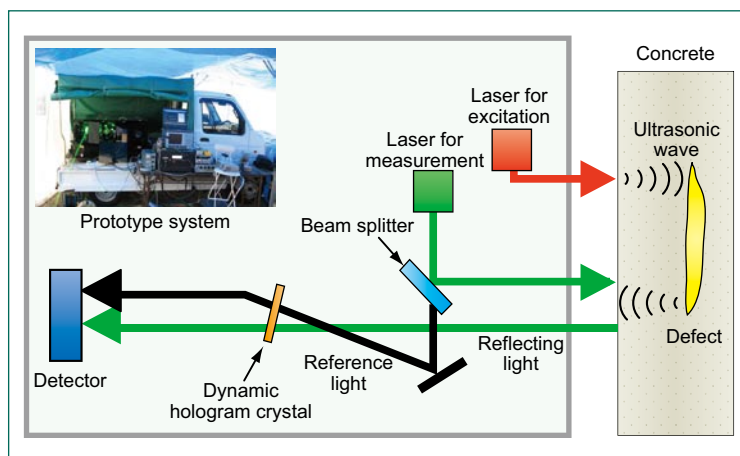


Fig. 14 Laser-based excitation/measurement system

#### 5. Wear-Resistant Tongue Rails

- We developed a wear-resistant tongue rail that satisfies JIS standards using new heat treatment conditions to enhance its wear-resistant performance.
- Installation tests were implemented on lines in commercial service, and a good level of wear-resistant performance was confirmed.

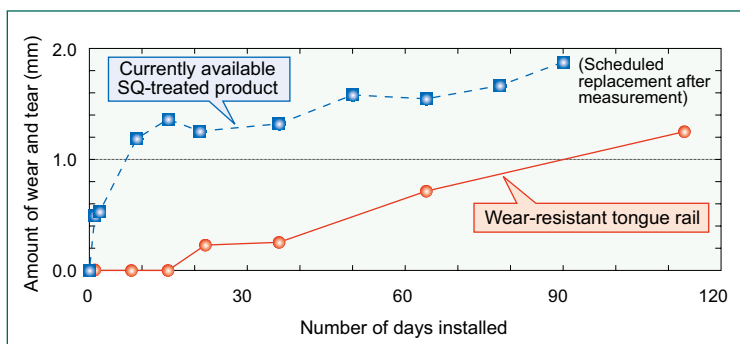


Fig.15 Comparison of the progress of wear and tear in a wear-resistant tongue rail (300 mm from tip)

#### 6. Measures to Repair Track Affected by Loose Sleepers, and to Halt Settlement of the Track around Structure Boundary

- We developed a method for repairing track by filling gaps in the ballast with polymer gel impregnated water glass that enables the rapid repair of loose sleepers in ballasted track on low-tonnage lines.
- A roadbed reinforcing method involving pre-packed concrete blocks was developed to halt settlement of the track around structure boundary.



Fig. 16 Filling work using air pressure

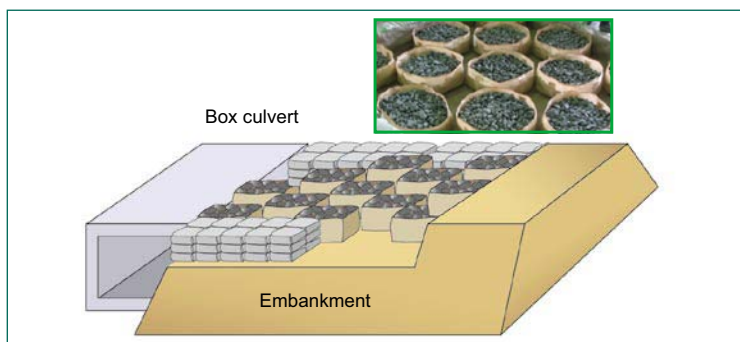


Fig. 17 Roadbed reinforcing method involving pre-packed concrete blocks

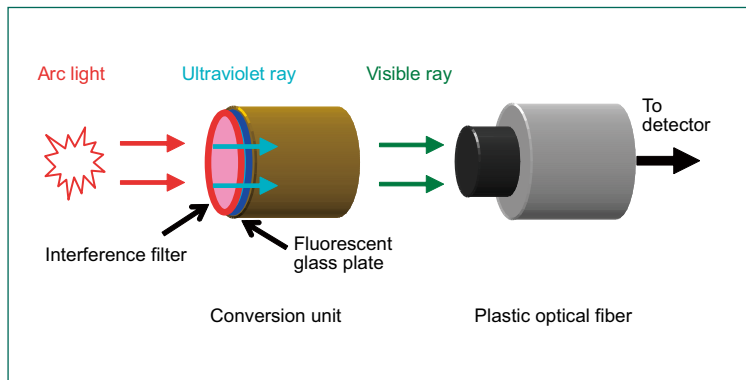


Fig. 18 An outline of the contact-loss measuring system with ultraviolet ray detection using plastic optical fibers

### 7. Development of a Contact-Loss Measuring System Using Ultraviolet Ray Detection

- We developed an apparatus able to measure contact loss during both day and night by detecting only particular wavelengths (in the ultraviolet ray region) from arcing generated during loss of contact.
- Performance tests on conventional lines confirmed that a high level of detection sensitivity can be obtained.

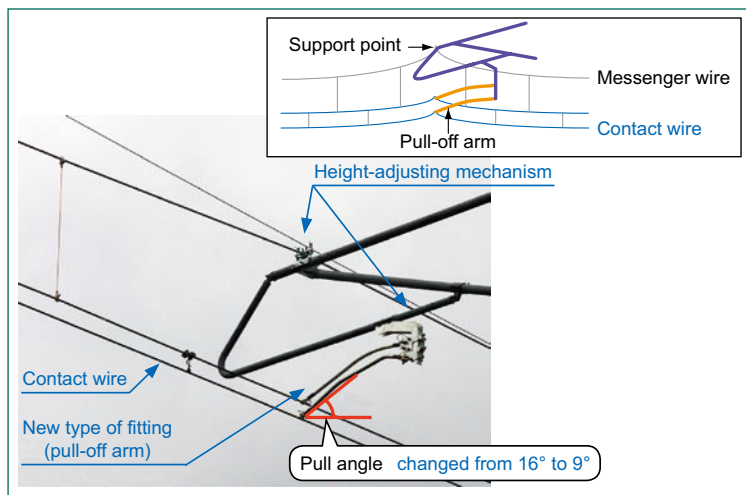


Fig. 19 Overview of new support structure

### 8. Support Structure Aimed at Reducing Localized Wear of Contact Wires

- We developed a support structure that relieves the localized lifting of overhead contact wire seen near its support points, so reducing wear and tear of the overhead contact wire.

Name	Number	Locking
Home signal	To ○○	A 2R ○○
As above	As above	B ○○
Starting signal	A	To xx 3R ○○
As above	B	As above 4R ○○

Fig. 20 Example of a screen showing the commentary function on an interlocking device

### 9. Additional Functions for an Interlocking Diagram Creation Support System

- We added an automatic generation function for interlocking diagrams, which incorporates conditions not described in track layout diagrams, to the Interlocking Diagram Creation Support System.
- Functions were added to allow a commentary to be provided and to permit simulation of an interlocking operation in an interlocking diagram, which is made for the purposes of verification support and educational support.



## 10. Automatic Job Assignment System for Maintenance Personnel

- We developed a job assignment system to generate monthly work scheduling tables for maintenance personnel.
- This generates a job assignment within short periods of time and complies with various constraints and conditions.

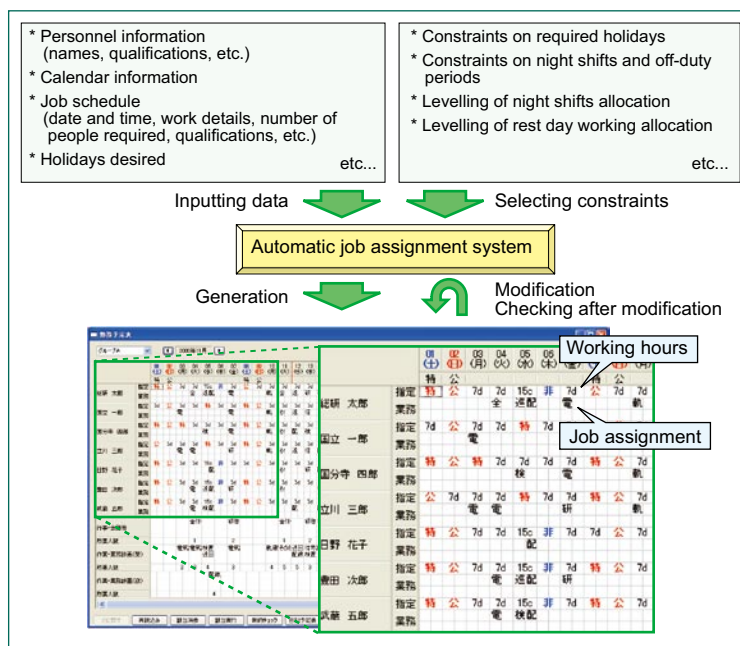


Fig. 21 System outline

## 11. Automated System for Generating a Rescheduling Plan for Freight Train Locomotives after Periods of Disruption

- We developed a system to automatically generate locomotive rescheduling plans when services have been disrupted.
- Within 90 seconds the system can generate a rescheduling plan which covers a three-day schedule for operation of high-frequency freight trains.

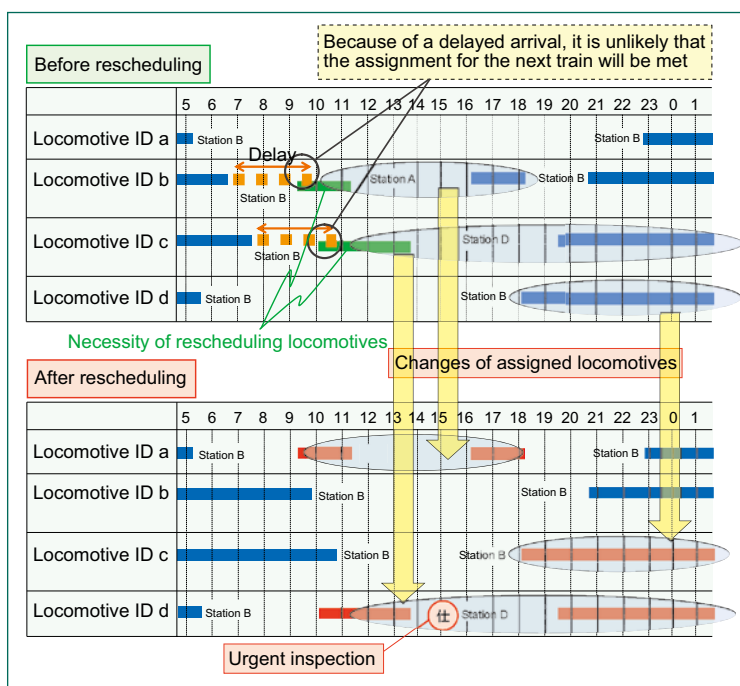


Fig. 22 Example of automatically generated rescheduling plan

### III. Comfort/Convenience

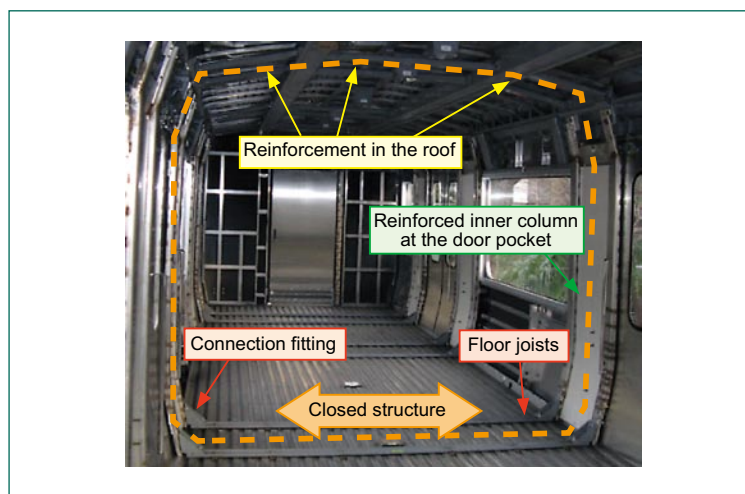


Fig. 23 Car body model for rigidity test (closed structure)

#### 1. Improvement of Ride Comfort and Increase of Car Body Strength by Increasing the Rigidity of the Inner Frame of the Car Body

- We proposed a technique to increase the bending rigidity and improve the vibration characteristics of car bodies which affect ride comfort by attaching reinforcing members to form a closed structure for the inner frames.
- By modelling part of the structure, we confirmed that the strength of the car bodyside increased thanks to adoption of the closed structure.

#### Reference

Takigami, T., Tomioka, T. and Aida, K., "Improving the Rigidity of Railway Vehicle Carbodies Using Non-Structural Members," *Quarterly Report of RTRI*, Vol.50, No.2, pp.63-69, 2009.

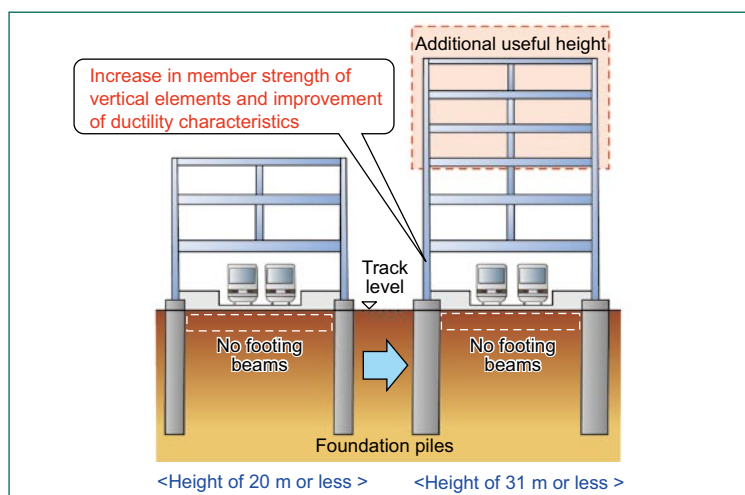


Fig. 24 The trend for constructing high-rise buildings over railway tracks

#### 2. Structural Design Method Suitable for High-Rise Buildings Constructed over Railway Tracks

- We developed a structural design method that corresponds to the demand for constructing high-rise buildings over railway tracks. This enables station buildings to be designed for a height of up to 31 m.

#### 3. Evaluation Technique to Determine the Ease of Walking in Stations

- We developed a simulation system to evaluate passenger flows in which the ease of walking in stations is quantified; this is based on walking tests in which congestion in stations is replicated.

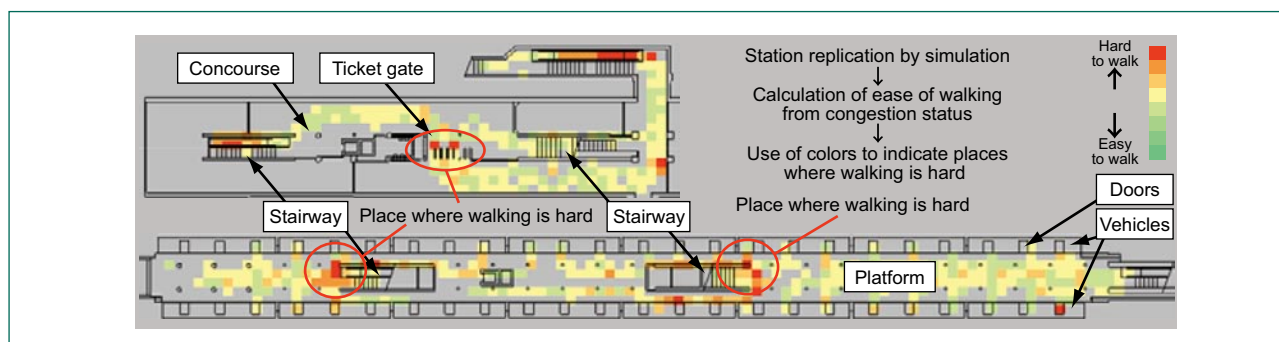


Fig. 25 Simulation to evaluate passenger flows

## IV. Harmonization with the Environment

### 1. Hybrid Electric Test Train using Fuel Cells and Batteries

- We developed a lithium-ion battery, and a chopper apparatus which controls the charging and discharging of the battery, so achieving a hybrid rail vehicle with fuel cells.
- It was confirmed that a two-car trainset can run without power being supplied from the catenary system using this apparatus.



Fig. 26 Hybrid electric test train using fuel cells and batteries

### 2. Sheet Flooring Material Formed of Nano-Composites for Railway Vehicles

- We produced experimentally a flame-resistant and lightweight flooring sheet for railway vehicles using nano-composites.
- It was confirmed that the performances of the prototype satisfy the specifications of ministerial ordinances and similar requirements.

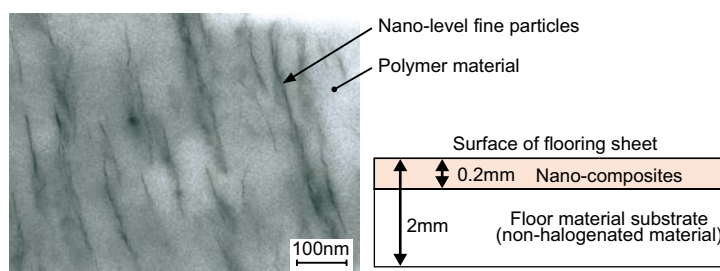


Fig. 27 Microscopic image of the nano-composites and section structure of the flooring sheet for railway vehicles

#### Reference

Ito, M. and Nagai, K., "Evaluation of degradation on Nylon-6 and Nylon-6/ montmorillonite nanocomposite by color measurement," *Journal of Applied Polymer Science*, Vol.108, Issue 6, pp.3487-3494, 2008.

### 3. Technique to Reduce Aerodynamic Noise from High-Speed Pantographs

- We developed a technique to reduce noise emissions from pantographs. The components involved included the pan head, the pan head supports, knuckle and baseframe, which are the main sources of pantograph aerodynamic noise. The improvement was achieved by improving the shape of the components and by attaching porous material to them.
- In wind tunnel tests, the aerodynamic noise reduction effect compared with the products currently in use was approximately 4 dB.

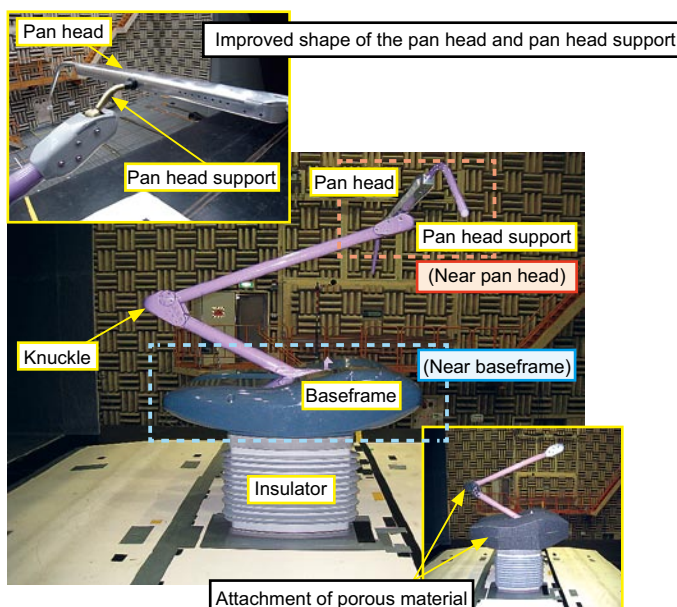


Fig. 28 Measures for aerodynamic noise reduction of Shinkansen pantographs

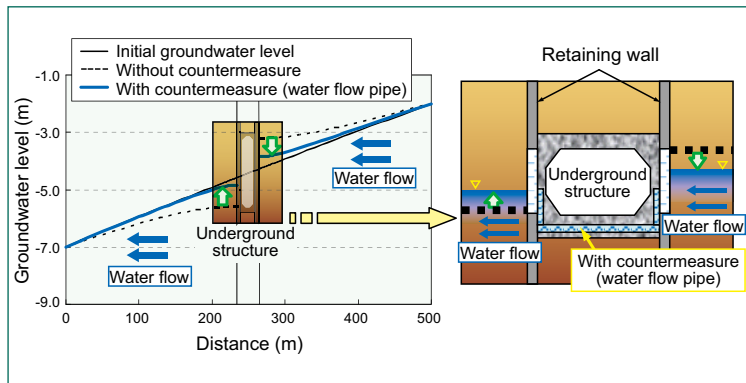


Fig. 29 Evaluation example of measures taken to counteract interruption of the flow using the analysis program

#### 4. Three-Dimensional Infiltration Flow Analysis Technique to Evaluate Interruptions to Groundwater Flows

- We evaluated the interruption of groundwater flows caused by the construction of underground structures. We also developed a three-dimensional seepage analysis program to design the measures needed to counteract interruption of the flow.

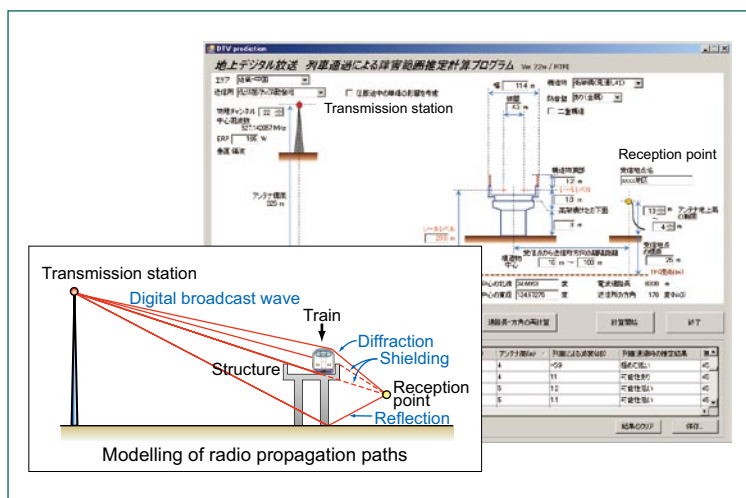


Fig.30 Developed computation and evaluation program

#### 5. Computation and Evaluation Program on Digital Terrestrial Broadcasting Reception Levels at Railway Lineside Locations

- We proposed a technique to compute digital terrestrial broadcasting reception levels at railway lineside locations.
- The program was developed to compute and evaluate the intensity of interferences caused by the passage of trains using the proposed technique.

## V. Maglev System

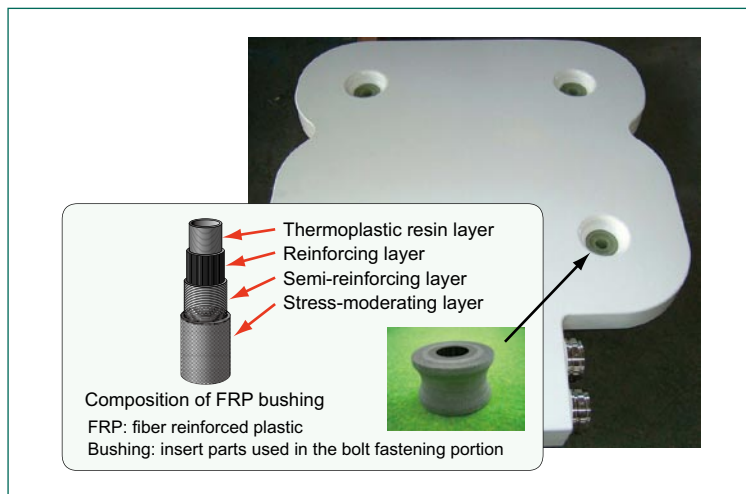


Fig. 31 Laminated FRP bushing

#### 1. Ground Coil Fastening Portions Applied to Laminated FRP Bushings

- We developed inexpensive laminated FRP bushings for the bolt fastening part of the ground coils.
- It was verified that these bushings can significantly moderate the stress concentration near the fastening part of the coils.
- The durability of the bushings was confirmed through dynamic electromagnetic vibration.

# International Activities

The major international activities of RTRI are the promotion of international exchanges and development of co-operative relationships with overseas railway research related organizations, and promotion of international standardization in the railway field.

## 1. Joint Research with Overseas Organizations

### (1) Asia

Chinese, Korean and Japanese (CKJ) trilateral joint research activity has been extensively conducted among CARS\*, KRRRI\*\* and RTRI. It originates from two separate bilateral joint research activities between CARS and RTRI which started in 1992, and KRRRI and RTRI which started in 1999. In 2000, the three parties agreed to hold a technical meeting to report joint research projects.

The first CKJ Railway Research Technical Meeting was held at KRRRI in 2001. Since then, the railway research technical meetings have been held annually, rotating between each institute so that presentations

could be made about the fruits of the research and the latest information exchanged.

RTRI hosted the 8th CKJ Railway Research Technical Meeting in the Kunitachi Institute in October 2008.

The total number of current joint research projects is 8 and RTRI is involved in the following 3 projects.

- Monitoring system for railway infrastructure
- Life cycle assessment for railway system
- Management of polluted railway track

\*CARS: China Academy of Railway Sciences

\*\*KRRRI: Korea Railroad Research Institute



8th China-Korea-Japan Railway Research Technical Meeting, October 2008

## (2) Europe and US

RTRI and SNCF<sup>†</sup> agreed to conduct joint research projects in November 1995 and have since been performing extensive technical exchanges and mutual visits.

In May 2007, a research seminar meeting was held in Tokyo, and we decided to start the 4th phase joint research projects pertaining to the fields of rolling stock, tracks, current collection, track circuits, riding comfort, fuel cells and derailments.

RTRI and RSSB<sup>††</sup> agreed to conduct joint research in October 2008 and started the following two projects.

- Influence of human factor in risk assessment, and classification method of human action
- Research and survey on design, manufacture and maintenance of axles and wheelsets

RTRI and SBB<sup>†††</sup> signed a research collaboration agreement in March 2007 and has been co-operating in the field of transport information technology.

RTRI is also co-operating currently with the following universities and research organizations: Cambridge University in England (structures), Newcastle University in England (track), Technical University at Braunschweig in Germany (signalling), Cagliari University in Italy (track), Geo Delft in the Netherlands (durability of urban tunnels) and Massachusetts Institute of Technology in the USA (materials).

<sup>†</sup>SNCF: Société Nationale des Chemins de Fer Français / French National Railways

<sup>††</sup>RSSB: Rail Safety & Standards Board

<sup>†††</sup>SBB: Swiss Federal Railways



RTRI and RSSB meeting, October 2008

## 2. International Standardization

### (1) Activities for IEC TC9

RTRI has been handling the work of the secretariat of the Japanese national committee for IEC TC9. We sent experts to the TC9 Plenary meeting and its various working group meetings, and held a large number of domestic committee meetings. In 2008, new proposals to develop a standard for a train communication network (TCN) and a standard for capacitors for rolling stock were made by Japan, and we began our preparation of the working drafts. Meanwhile, the draft of the standard for short-primary type linear induction motors fed by power converters is almost complete.

### (2) Collaboration related to International Standardization

A JISC-CENELEC information exchange meeting was held in October in Spain to foster general collaboration related to standardization between Japan and Europe. Extensive information exchanges were also conducted among railway experts.

### (3) Publicity Activities

RTRI has been publicizing activities for international standardization in the railway field in Japan. We held the 4th seminar on international standards in Tokyo.



JISC-CENELEC information exchange meeting of railway WG, October 2008

### 3. Other Activities

#### (1) WCRR

The World Congress on Railway Research (WCRR) has its roots in an international seminar held in Tokyo in 1992 organized by RTRI that invited executives in charge of R&D from the world's major railway operators. The seminar developed and expanded as an essential international conference for railway research engineers in the world to exchange information and stimulate discussions on updated and innovative railway technologies.

RTRI has co-operated closely with the organization committee to prepare WCRR2008 (held in Seoul, Korea) by dispatching executives, submitting papers in the various fields, and inviting sponsors and exhibitors. RTRI also exhibited a booth coordinating JR group companies.

#### (2) Co-operation with UIC

RTRI has cooperated with UIC\* activities by sending a member of staff to work in the headquarters and to exchange technical information with the European railways. RTRI hosted a UIC Panel of Structural Experts Meeting and held the UIC Technical Exchange Seminar in Tokyo in September 2008.

\*UIC: Union Internationale des Chemins de Fer / International Union of Railways

#### (3) IWRN10

RTRI became the host organization for the 10th International Workshop on Railway Noise (IWRN10), which will be held in Nagahama in October 2010.

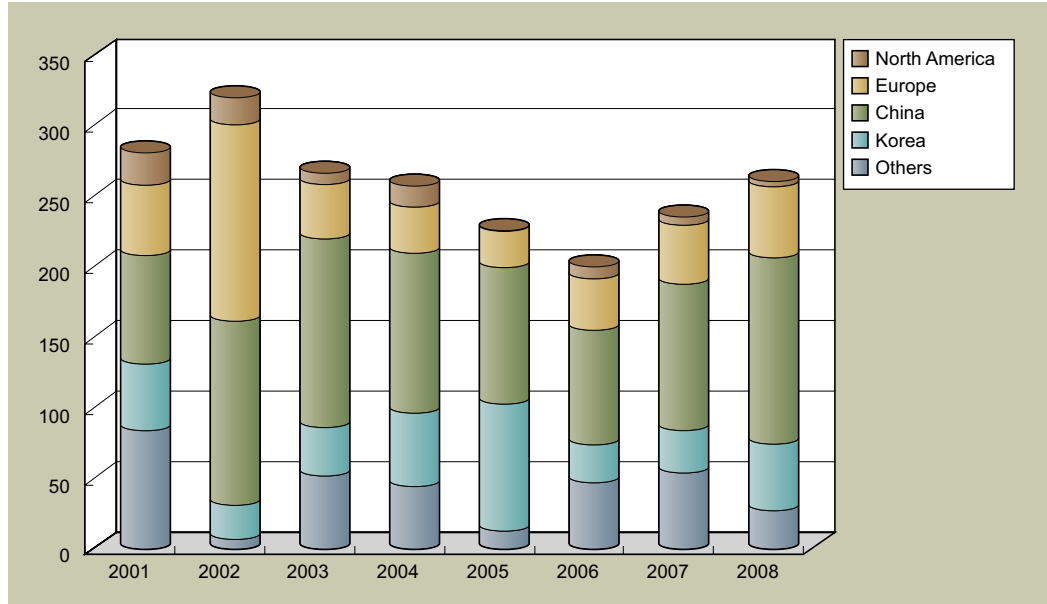


Exhibition of RTRI and JR Group in WCRR 2008, May 2008

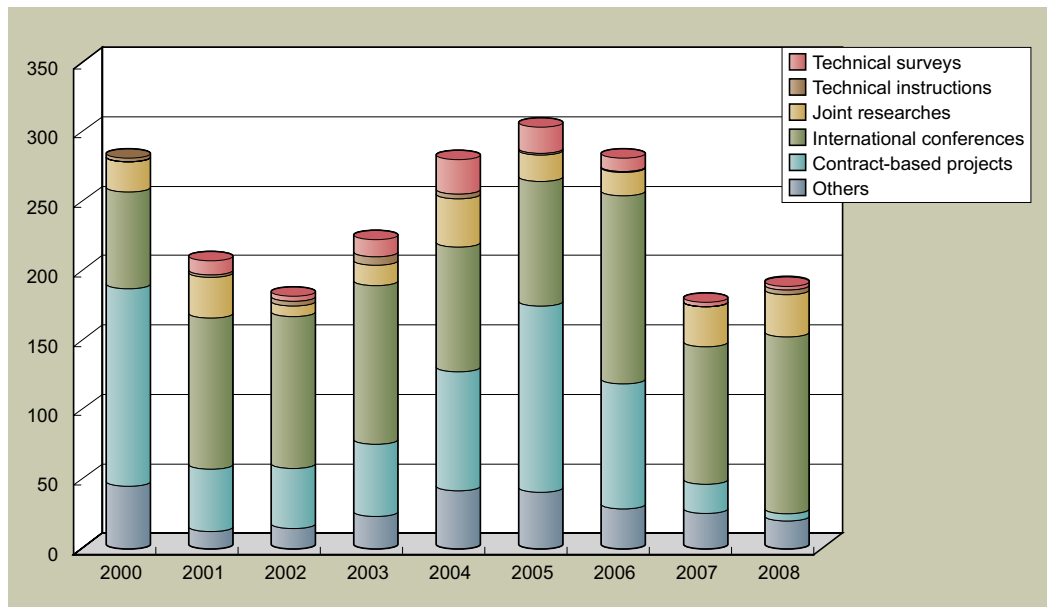
## 4. Visitors and business trips

The statistics on visitors to RTRI from overseas and on RTRI staff members who made business trips to overseas are shown in the following figures.

### (1) Visitors from overseas



### (2) Business trip to overseas





# Appendix

## Highlights of FY2008

Date		Events
2008	May 12	Outlines of <i>Design and Maintenance Standards for Railway Structures and Commentary</i> published in English.
	May 18-22	WCRR2008 in Seoul.
	Sept. 4-5	RTRI Technical Forum at Kunitachi.
	Sept. 16-20	UIC PoSE Committee and UIC Railway Bridge & Tunnel Exchange Seminar at Kunitachi.
	Sept. 23	Research collaboration with RSSB started.
	Sept. 23-26	RTRI products (Cerajet and FRIMOS) exhibited at InnoTrans 2008 in Berlin.
	Oct. 6-8	Researchers contributed to JISC-CENELEC Information Exchange Meeting in Madrid.
	Oct. 11	RTRI Open House (Heibei Festival) at Kunitachi.
	Nov. 3-7	Researchers contributed to IEC/TC9 Plenary Meeting in Stockholm.
	Nov. 6	21st RTRI Lecture in Tokyo.
	Nov. 17	Large-Scale Shaking Table Test Facility completed.
	Nov. 19-21	8th China-Korea-Japan Railway Research Technical Meeting in Kunitachi.

## Industrial Properties

	Independently Owned	Jointly Owned	Total
Patents	1153	963	2116
Utility Models	0	0	0
Designs	34	9	43
<b>Total</b>	<b>1187</b>	<b>972</b>	<b>2159</b>

(as of Jan. 31, 2009)

## Number of Foreign Patents

Number of Registered Patents	Number of Countries where Patents are Registered
61	145

(as of Jan. 31, 2009)

## Recognition Record

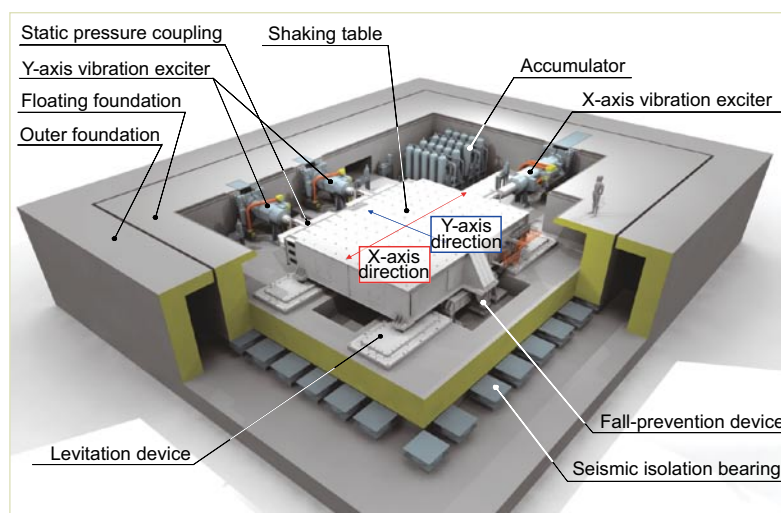
Date	Award Winner	Award	Accomplishment	Sponsoring Organization
April 9, 2008	Railway Technical Research Institute	Special Award, 37th Japan Industrial Technology Judging Committee	Development and Practical Application of a New Tunnelling Construction Method that Has Combined NATM and the Shield Tunnelling Method	NIKKEI KOGYO SHIMBUN
April 15, 2008	Kimiaki SASAKI	Science Technology Award: Development Division	Development of Vibration Control system by Variable Damping Device for Railway Vehicles	Ministry of Education, Culture, Sports, Science and Technology
April 29, 2008	Masaru TATEYAMA	Medal with Purple Ribbon		
May 2, 2008	Railway Technical Research Institute	Invention Achievement Contribution Award	Development and Implement of a Ladder Track System	Japan Institute of Invention and Innovation
May 2, 2008	Hajime WAKUI, Nobuyuki MATSUMOTO	Japan Patent Attorneys' Association Presidential Award	Invention of a Ladder Track System	Japan Institute of Invention and Innovation
May 2, 2008	Kimitoshi ASHIYA, Shinji SATO	Invention Award	Invention of a Method of Estimating Early Earthquake Parameters by a Single Seismic Observation Point	Japan Institute of Invention and Innovation
May 22, 2008	Mitsuyoshi FUKUDA, Natsuki TERADA	Railway Electrical Engineering Award	Improvement of an Analysis Method for Electromagnetic Shielding Effect of a Mountain Tunnel	Railway Electrical Engineering Association
May 22, 2008	Mitsuyoshi FUKUDA	Society Magazine Excellent Work Award	Shunting Phenomenon in Track Circuits	Railway Electrical Engineering Association of Japan
May 23, 2008	Norimichi KUMAGAI and 34 other persons	Letter of Thanks	Contribution to the Authors of "Interdisciplinary Technology"	Japan Railway Engineer's Association
May 30, 2008	Nobuyuki MATSUMOTO, Hajime WAKUI, Masamichi SOGABE	Tanaka Prize, Japan Society of Civil Engineers, FY 2007	A Dynamic Interaction Analysis Model for Railway Vehicles and Structures Which Takes into Account Non-Linear Response	Japan Society of Civil Engineers
May 30, 2008	Akihito KAZATO	Autumn Most Excellent Lecture Award, FY 2007	Vertical Vibration Suppression of Railway Vehicle with Air Spring Installed Orifice Control Valve	Japan Fluid Power System Society
May 30, 2008	Yukihiro TANIMURA	Award for Best Paper, FY2007	Experimental Study on Pile Head Joint using Steel Pipe	Japan Society of Civil Engineers
July 11, 2008	Toshiya TADOKORO	30th Concrete Engineering Lecture Annual Paper Promotion Award	Experimental Research on the Fracture Properties of a Rigid-Frame Viaduct Column Damaged by an Earthquake	Japan Concrete Institute
August 28, 2008	Taketoshi KUNIMATSU	Excellent Paper Award, The Institute of Electrical Engineers of Japan, FY 2007	A prediction System of Train Operation Time and Passengers' route Choice Behaviour in the Face of Unexpected Disturbance of Train Operation Considering the Presence of Guidance for Passenger	The Institute of Electrical Engineers of Japan
October 20, 2008	Hiroki NAGASAWA	International Standardization Business Prize by Minister of Economy, Trade and Industry	Vital work for the Development of Industrial Standards	Ministry of Economy, Trade and Industry
October 20, 2008	Hideki SHIGEEDA	Incentive Award for International Standardization by Industrial Science and Technology Policy and of the Environment Bureau Director	Contribution to Activities for International Standards	Ministry of Economy, Trade and Industry
November 2, 2008	Masahiro SUZUKI	The 2008 certificate of merit for best presentation	Flow Simulation Around a Circular Cylinder Covered with a Porous Material	The Japan Society of Mechanical Engineers
November 3, 2008	Mitsuo ABOSHI	Shibusawa Award	Contribution to Improving the Safety of Current Collection Facilities of Electrified Train Lines	Japan Electric Association
November 6, 2008	Keisuke SATO, Chikara HIRAI, Naoto FUKUMURA	9th Railway Freight Promotion Excellent Award	Development of a Prototype System for Rescheduling of Freight Train Drivers	Railway Freight Promotion Award Operating Committee

Date	Award Winner	Award	Accomplishment	Sponsoring Organization
November 21, 2008	Masaru IWAMATSU, Hiroshi SEINO	Best Technical Contribution Award	Basic Study of Bogie Structures to Reduce Superconducting Magnet Vibration in Maglev	The Japan Society of Applied Electromagnetics and Mechanics
November 21, 2008	Yoshiki MIYAZAKI	Incentive Award	Fundamental Examination of Rail Inspections for Railway by SQUID	The Japan Society of Applied Electromagnetics and Mechanics
November 26, 2008	Mitsuo ABOSHI	Electrical Science and Engineering Promotion Award	Development of Contact Wire Wear Detection Side Equipment by Image Analysis	Promotion Foundation for Electrical Science and Engineering
March 18, 2009	Satoshi KADOWAKI	Excellent Presentation Award, The Institute of Electrical Engineers of Japan, the 2008 Annual Meeting, FY 2007	Economic Evaluation of the Contact-wireless LRT Applied to the Extended Railway	The Institute of Electrical Engineers of Japan

## Newly Installed Testing Facilities in 2008

### [Large-scale Shaking Table]

A large-scale shaking table was constructed in November 2008. This facility is able to simulate two-dimensional earthquake motions with a seismic intensity of 7. Using this facility, shaking tests of scale models of civil engineering structures, full-scale track segments and full-scale vehicle bogies can be conducted. The maximum displacement amplitude of the facility is  $\pm 1.0$  m, and maximum loading capacity is 490 kN. The foundations of the facility were isolated from the ground in order not to transmit vibration to the surrounding residential area.



Construction of the vibration test machine

### [Station Mock-up]

A full-scale station mock-up was constructed in February 2008. It was constructed in order to determine the optimum patterns of passenger flows, to obtain the know-how for maintaining a comfortable temperature environment and to ensure a good acoustic environment. The mock-up was built as it is difficult to conduct tests and surveys in real station facilities.



## RTRI Report

Vol. No.	Titles
Vol.22 No.4 Apr. 2008	<p><b>Special Features: Materials Technology</b></p> <p>REVIEW: Recent Trend of Research and Development on Materials for Railway  PAPERS: Development of Axle Bearing Rotary Shaft Lip Seal for Speed-up of Shinkansen  PAPERS: Extension of Grease Service Life for Improved Grease Pocket  PAPERS: Improvement of Frictional Property of Cast-Iron Brake Shoes by Combining SiC Filters  PAPERS: Development of Earth Device for Freight Car's Plain Bearing  PAPERS: Evaluation of Dark Spot Resistance of Bainitic Steel Rail in Long-Term Durability Test  PAPERS: Investigation on Rail Pad Impact Load Response Characterization by the Impact Load Test  PAPERS: Preparation and Properties of Environmentally Conscious Concrete Using Geopolymer Method  PAPERS: Improvement of the Superconducting Properties of High-temperature Superconductors with a Technique to Impregnate Bi-Pb-Sn-Cd Alloys and Resins  PAPERS: Electrical and Mechanical Property Tests of Superconducting Traction Transformer for Railway Rolling Stock</p>
Vol.22 No.5 May 2008	<p><b>Special Features: Research on Environment Technology</b></p> <p>REVIEW: Recent Studies on Environmental Technology along Waysides of Railways  PAPERS: Wind Tunnel Experiments on Reducing Separated Flow Region around Front Ends of Cars of Narrow Gauge Railway Lines  PAPERS: The Aerodynamic Noise Reduction by Porous Materials and Application to a Current Collector  PAPERS: Analytical Study on Vibration and Acoustic Characteristics of Railway Wheels with Different Shapes  PAPERS: An Investigation on the Influence of Wheel and Track Parameters upon Rolling Noise  PAPERS: Vibration Reduction Effect of Softer Rail Pads for High Speed Trains  PAPERS: Assessment of the Effects of Airborne Microorganisms on Indoor Air Quality of Railway Stations  PAPERS: Evaluation of Mutagenicity by Exposure to Intermediate Frequency Magnetic Fields in <i>in Vitro</i>  OTHER PAPERS: Countermeasures Against Flow-Induced Vibration of Train in Tunnel by Use of Modifications of Train Shapes  OTHER PAPERS: Characteristics of Wind Velocity Distribution over Embankment in Turbulent Boundary Layer Obtained by Wind Tunnel Experiment</p>
Vol.22 No.6 Jun. 2008	<p><b>Special Features: Transport Information Technology</b></p> <p>REVIEW: Recent Research and Development on Transport Information Technologies  PAPERS: Development of the Algorithm for Train-set Scheduling  PAPERS: An Algorithm for the Train Stop Planning Problem  PAPERS: Development of a Method to Predict Passenger Numbers upon Resumption of Train Service  PAPERS: Development of Systems to Support Guarantee of Train Connection and Providing Information to Passengers at Midnight  PAPERS: Basic Study on and Prototyping of On-board Automatic Ticket Gate with Bi-parting Leaf Moving on a Vertical Plane  PAPERS: Development of a Sensor Data Collecting System for Health Monitoring of Railway Structures  PAPERS: Analysis on the Effectiveness of Transport Cost Reduction by Using Railway for Interregional Surface Freight  REVIEW: Current Status of Broadband Wireless Communication Technologies in Railways and Future Challenges to Them</p>
Vol.22 No.7 Jul. 2008	<p><b>Special Features: Human Factors</b></p> <p>REVIEW: Human Scientific Approach to Railway Transport Research; Recent Topics and Potential Developments  PAPERS: New Psychological Aptitude Tests System for Train Operation Staff  PAPERS: Validity Improvement of the Prediction Method of Workload Evaluation for Train Drivers  PAPERS: Basic Study on a Passenger Evacuation Behavior with the Use of a Station-Simulator  PAPERS: Estimation of the Tolerance of Human Postural Stability to the Train Draft  PAPERS: An Effect of Decreased Duration of Train Departure Melody to Passengers' Behavior upon Train Boarding  PAPERS: A Suicide Behavior Model of Railway Suicides  PAPERS: An Effect to Safety due to Release of Obligatory Temporary-stops Passing Railroad Crossings  PAPERS: Design of Train Operation Information Display System that Informs Train Location to Passengers  PAPERS: Predicting Customer Satisfaction with Train Schedules</p>
Vol.22 No.8 Aug. 2008	<p><b>Special Features: Track Technology</b></p> <p>REVIEW: Subjects on Track Technology focussed on from Tribological Point of View  PAPERS: A New Design Method of Ballasted Track Taking into Consideration on Track Irregularity Growth  PAPERS: Estimation Method of Plastic Deformation of Ballasted Track under Cyclic Moving Wheel Loads by FE Analysis  PAPERS: Mechanism and Preventing Method of Sleeper Skewing  PAPERS: Development of Measurement Techniques for Dynamic Pressure on a Sleeper Bottom and Dynamic Behavior of Ballast Stone Induced by Running Train  PAPERS: Performance Evaluation of Reinforced Concrete Roadbed on Clay Subgrade  PAPERS: The Management Method for Large Wheel Load and Lateral Force Applying Axle-box Acceleration and Track Irregularity  PAPERS: Development of Position Adjustable Rail Fastener for Bridge Sleeper  PAPERS: Development of Gas Pressure Welding Method Applying Hydrogen Gas</p>
Vol.22 No.9 Sept. 2008	<p><b>Special Features: Vehicle Technology</b></p> <p>REVIEW: Researches and Developments for Energy Saving of Rolling Stock  PAPERS: Fundamental Tests of Assist Steering System for Bolsterless Truck  PAPERS: Improving Rigidity of Railway Vehicle Carbody by Utilizing Non-Structural Members  PAPERS: Fundamental Examination of The Traction Motor Noise Evaluation Method Using Fluid Acoustic Analysis  PAPERS: Development of Method on Reduction of Surge Voltage on AC Railcar's Body  PAPERS: Development of a Dual Voltage Contact-wire/Battery Hybrid Power Conversion Circuit and Control Sequence  PAPERS: Development of a Quick Charge System at Tram Stops for Contact-wire-less LRV  PAPERS: Development of a Measure to Suppress Temperature Rising of Batteries Boarded on a Contact-wire-less LRV  PAPERS: Study on Cost of Contact-wire-less LRV to be Introduced  REVIEW: The Trend of Fuel Consumption Standard in Vehicular Traffic Field and an Effort Forward the Energy Saving  INTERNATIONAL CONFERENCE REPORT: Outline of Presentation Papers at WCRR2008</p>

Vol. No.	Titles
Vol.22 No.10 Oct. 2008	<p><b>Special Features: Structures Technology</b></p> <p>REVIEW: The Latest Achievements and Future Theme of Research and Development on Structural Technology  PAPERS: Renewal of Existing Railway Steel Bridges by Structural Improvement Composing with Concrete Slabs  PAPERS: Influence of Prestrain on Material Characteristics of An Aged Steel Material Used for Bridges  PAPERS: Evaluation Method for Shear Strength of Reinforced Concrete Beam Subjected to Antisymmetrical Moment  PAPERS: Seismic Response Characteristics and Seismic Design Method of the Platform Shed Constructed on Viaduct  PAPERS: Methodology to Predict Structure Damage and Vehicle Running Safety due to Earthquake  PAPERS: Rationalization of Shear Design Method for Upper Slabs of Caisson Foundation Based on Load Carrying Mechanism  PAPERS: A Calculation Method of Design Bearing Capacity of Piles for Several Construction Methods by Statistical Analysis of Loading Test Data Base  PAPERS: Evaluation of Long-term Behavior by Finite Element Method of Rail Yard Embankment on Soft Ground  PAPERS: Development of Prediction Method of Tunnel Deformation Using the Time-dependent Ground Deterioration Model  PAPERS: Development on Tunnel Soundness Diagnosis System</p>
Vol.22 No.11 Nov. 2008	<p><b>Special Features: Maglev Technology and its Application</b></p> <p>REVIEW: R&amp;D on Superconducting Maglev and New Applicable Attempts on Conventional Railway System  PAPERS: Examination of Fundamental Characteristics of Vehicle Dynamics Using a Maglev Vehicle Model Experiment Apparatus  PAPERS: Fundamental Study on the Effect of High Frequency Vibration on Ride Comfort  PAPERS: Stress Evaluation on the PLG Ground Coil with FRP Fastening Devices  PAPERS: A Properties Measuring System for HTS Wires  PAPERS: Basic Characteristics of Rail Brake Systems Using Linear Motor Technology  PAPERS: Study of the Magnetic Bearing Consisting of Coupling of Superconductors Applicable to the Support Bearing of Flywheel Energy Storage System  PAPERS: Study of Zero-sequence Harmonic Resonance in MAGLEV Feeding Circuit  OTHER PAPER: Estimation of Aerodynamic Force Affecting Vibration of Narrow Gauge Train Running Through Tunnel  INTERNATIONAL CONFERENCE REPORT: Outline of 2008 Applied Superconductivity Conference</p>
Vol.22 No.12 Dec. 2008	<p><b>Special Features: Power Supply Technology</b></p> <p>REVIEW: Recent State of Researches on Power Supply Technology for Electric Railways  PAPERS: Evaluation of Resistance at Supporting Pulley of Messenger Wire and Its Influence on Current Collection Characteristics  PAPERS: Improvement of Mechanical Characteristics of AC Section Insulator  PAPERS: Development of Contact Loss Measuring System Using Ultraviolet Rays  PAPERS: Basic Study on Performance Upgrade of Pantograph Using Variable Stiffness  PAPERS: Feeding Protection Relay Applicable to 50Hz / 60Hz Dual Frequencies  PAPERS: Analysis Method and Abatement Measure of Electric Magnetic Fields Emitted from Electrified Railway Substations  PAPERS: Application of Automatic Generation Method of Drawing to Contact Line Specification Data Check Tool  OTHER PAPER: Methods of On-Demand Transport Scheduling and Their Application to Railway Freight Services</p>
Special No.52	Simulation Analysis on Derailment of Shinkansen Vehicles due to the Mid Niigata Prefecture Earthquake in 2004
Vol.23 No.1 Jan. 2009	<p><b>Special Features: Signalling and Telecommunications Technology</b></p> <p>REVIEW: Research and Development on Railway Signalling and Telecommunications Technologies  PAPERS: A Study on Evaluation Methods for Railway Signalling Systems from the View Point of Availability  PAPERS: A Method of Designing Railway Signalling System Based on RAMS Indicators  PAPERS: Effective Automatic Generation of an Interlocking Table by Presetting the Uncertainty Elements  PAPERS: An Influence of the Ground/Rail Potential Rise due to Lightning on Railway Signalling Equipments, and its Protection Measures  PAPERS: Tasks and Methods of Improving Lock System of the NS-A Type Electric Switching Machine  PAPERS: Detection of Slow-Speed-Notifying Signal from Front View of Train  PAPERS: Estimation Method of Frequency Characteristics of Transmission Loss in Loading Telecommunication Line and Its Application  PAPERS: Basic Study on a Method to Calculate Fluctuations of Strength of Radio Disturbance Wave Emitted from Railway Systems to Railway Side  PAPERS: Railway Fundamental Geospatial Data for National Spatial Data Infrastructure Applicable to Train Control  INTERNATIONAL RESEARCH PROJECT REPORT: An Outline of International Research Project on Enhancement of Level Crossing Safety</p>
Vol.23 No.2 Feb. 2009	<p><b>Special Features: Railway Dynamics</b></p> <p>REVIEW: Recent Studies on Railways Dynamics  PAPERS: A Predictive Method of Wear Profile of Rail Head  PAPERS: Modeling Techniques for Three-Dimensional Discrete Element Analysis of A Conventional Ballasted Railway Track and Its Application  PAPERS: Equipment for Contact Loss Measurement by Detecting UV Ray  PAPERS: A Study on Aerodynamic Interference between a Panhead and an Articulated Frame by Applying CFD Technique  PAPERS: Development of A Ballasted Ladder Track Equipped with A Vehicle Guide Device  PAPERS: Evaluation of Displacement Control Method for Shinkansen RC Rigid-frame Viaduct during Earthquake  PAPERS: Development of Silent Steel Railway Bridge Equipped with Floating Ladder Track and Floating Reinforced-Concrete Deck  PAPERS: New Experimental Device to Investigate Creep Force between Wheel and Rail</p>
Vol.23 No.3 Mar. 2009	<p><b>Special Features: Disaster Prevention Technology</b></p> <p>REVIEW: Recent State of Research and Development on Disaster Prevention Technology  PAPERS: An Estimation Method of the Probability that A Train Encounter the Gust in An Operating Section  PAPERS: A Method to Calculate Probability of Rainfall-related Slope Failures  PAPERS: A Method of Determining Priorities for Investment in Disaster Prevention for Rainfall-related Slope Failures  PAPERS: An Estimating Method for Scouring Apprehended Bridge Piers and the Analysis of the Occurrence Factor  PAPERS: Development of Deflector to Decrease Snow-Accretion to Truck of a Vehicle  PAPERS: Method of Evaluating Snow Resistance Working Against Snowplow by Model Experiment  PAPERS: New Seismic Parameters and Their Application to Railway System  PAPERS: Assessment of Physical Property Values based on Lithostratigraphic Classification of Sandy Ground</p>

More information is available on the following website.  
URL: [http://www.rtri.or.jp/infoce/rtrirep\\_E.html](http://www.rtri.or.jp/infoce/rtrirep_E.html)

## Quarterly Report of RTRI

Vol. No.	Titles
Vol.49 No.2 May 2008	Development of Sheet-Pile Foundation that Combines Footing with Sheet Piles Proposal of Guideline for Judgment of Adjacent Level on Adjacent Construction of Existing Tunnels Evaluation of Response Spectrum Considering the Stochastic Characteristics of the Phase Spectrum of Earthquake Motion Evaluation Method for Air Pressure Variation and Station Facility Member Deterioration Caused by High-Speed Train Passage in Stations Development of Simple Catenary Equipment Using PHC Contact Wire for Shinkansen Development of Transition Structures between Overhead Rigid Conductor Line and Catenary-Type Contact Line High-resistance Grounding Fault Detector by Use of Feeding Current Reduction of Vibrations in Maglev Vehicles Using Active Primary and Secondary Suspension Control Durability Evaluation Tests of Mold Resin for Ground Coil Force Density of Magnetic Bearings Using Superconducting Coils and Bulk Superconductors
Vol.49 No.3 Aug. 2008	Evaluation of Environmental Pollution Caused by Heavy Metal Elements in Natural Ground Prediction of Strong Ground Motion over Wide Areas by Coupling the Stiffness Matrix Method and FEM Analysis A Method of Predicting the Shape and Scale of Rainfall-related Embankment Collapse Study on Quantifying and Reducing Electrical Resistance between Wheels and Rails Evaluation of Train Control Method Using Prediction Control Application of Formal Methods to Signalling Systems Using Techniques Based on Stepwise Refinement Numerical Analysis Focusing on the Running Safety of an Improved Bogie during Seismic Vibration Development of the U-Doppler Non-contact Vibration Measuring System for Diagnosis of Railway Structures Evaluation Method of Low-Frequency Aeroacoustic Noise Source Structure Generated by Shinkansen Pantograph
Vol.49 No.4 Nov. 2008	Structure of an Independent-wheel-system Bogie with a DDM and its Performance at High Speed Boosting Input Voltage of Traction Inverter Using Energy Storage Equipment and its Energy-saving Performance An Air Spring Model with Non-Linear Damping for Vertical Motion Evaluation Method of the Limit State of Collapse for Viaduct Columns Subjected to Repetitive Seismicity Quakeproof Reinforcement Method of Brick Pier Supported by Old Foundation Nonlinear Hysteresis Model Considering Strength Degradation by Cyclic Loading for RC Members An Improved Grease Pocket for Extended Grease Service Life Development of Axle Bearing Lip-type Seal for High-speed Shinkansen Vehicles Development of Earth Device for Freight Car's Plain Bearing
Vol.50 No.1 Feb. 2009	The Influence of Railway Freight Transport on Logistics Costs A Train Stop Deployment Planning Algorithm Using a Petri-net-based Modelling Approach Sensor Data Collection System for Health Monitoring of Railway Structures Wind Tunnel Experiments on Reducing Separated Flow Region Around Front Ends of Vehicles on Meter-Gauge Railway Lines Aerodynamic Noise Reduction using Porous Materials and their Application to High-speed Pantographs The Influence of Wheel and Track Parameters on Rolling Noise A New Set of Psychological Aptitude Tests for Train Operation Staff Safety Considerations Regarding the Abolition of Compulsory Stopping before Entering Railroad Crossings Tolerance Estimation of Human Postural Stability against Train Drafts

More information is available on the following website.  
URL: [http://www.rtri.or.jp/infoce/qr\\_E.html](http://www.rtri.or.jp/infoce/qr_E.html)

## Monthly Presentations

Date	Number	Main Theme	Venue
Apr. 14, 2008	211th	Recent R&D on Power Supply Technology	Oval Hall (Osaka)
May 29, 2008	212th	Recent R&D on Vehicle Technology	STeC Information Building (Shinjuku)
Jun. 18, 2008	213th	Recent R&D on Signalling & Telecommunications Technology	Kogakuin University (Shinjuku)
Jul. 16, 2008	214th	Recent R&D on Disaster Prevention Technology	Kogakuin University (Shinjuku)
Aug. 20, 2008	215th	Recent R&D on Materials Technology	Kogakuin University (Shinjuku)
Sept. 17, 2008	216th	Latest Measurement Technologies on Railway Dynamics	Kogakuin University (Shinjuku)
Oct. 16, 2008	217th	Recent R&D on Vehicle Technology	Oval Hall (Osaka)
Dec. 11, 2008	218th	Recent R&D on Structural Technology	Kogakuin University (Shinjuku)
Jan. 15, 2009	219th	Simulation Analysis on Seismic Motion and Running Behavior of Vehicle during the Mid Niigata Prefecture Earthquake in 2004	Kogakuin University (Shinjuku)
Feb. 18, 2009	220th	Recent R&D on Transport Information Technology	Kogakuin University (Shinjuku)
Mar. 18, 2009	221th	Recent R&D on Human Science	Kogakuin University (Shinjuku)

## Railway Technology Avalanche (Newsletter of RTRI)

No.	Titles
No.22-23, Jul. 2008	The Need for Balance and Co-operation in Railway Technologies Development of Contact-Wire/Battery Hybrid LRV Human Factor Analysis Method for Improving Safety Management Evaluation of Compression Behavior of the End-Structure of Intermediate Car A Properties Measuring System for HTS Wires
	<b>Special Issue: WCRR2008 in Seoul</b> A Report on WCRR 2008 Damage Evaluation of Railway Structures Based on Train-Induced Secondary AE Parameters Development of an Assisted Steering Bogie System for Reducing Lateral Forces Exerted on the Track Experimental Reproduction of Wheel Thermal Cracks Study of Under-Floor Air Flow to Reduce the Phenomenon of Flying Ballast Vibration Reduction Methods for Superconducting Maglev Vehicles Effects of Current Collection Noise and Lineside Obstructions on GPS Signal Reception A Method to Measure the Pantograph Contact Force on the Overhead Catenary System Development of Friction Moderating System to Improve Wheel/Rail Interface in Sharp Curves
No.24, Sept. 2008	Research and Development for the Safety of Railways against Natural Disasters Technical Discussion of LRT without Contact Wires Development of a Damage Detection System for Structural Members in the Ground Preventing Fatigue Breakage of Contact Wires Research to Evaluate the Remaining Service Life of Aged Rails Train Operation Control Indices for Use during Earthquakes in Japan
No.25, Dec. 2008	The Progress of the RTRI's Five-Year Master Plan UIC Panel of Structural Experts Meeting and Exchange Seminar in Japan A Study of Evaluation Methods for Railway Signalling Systems from the Viewpoint of Availability A Method for Failure Detection Based on Monitoring Data from Existing Facilities Long-Term Field Durability Testing and Practical Application of Shelling Damage-Resistant Bainite Rail Measurement and Discrete Three-Dimensional Modeling Techniques of Dynamic Behavior of Ballasted Track
No.26, Mar. 2009	Commercialising the Results of Research Collaboration with the Rail Safety and Standards Board in the U.K. Predicting Landslides a Few Months in Advance of Their Occurrence by Observing the Chemical Composition of Groundwater Improvement for Provision of Information upon Suspended Train Services Development of a Cooling System for High-Temperature Superconducting Traction Transformer for Railway Rolling Stocks An Ultrasonic Flaw Detector for Hollow Axles of Narrow-Gauge Railway Cars

More information is available on the following website.  
URL: <https://entry.rtri.or.jp/index.html>

## RTRI Lecture

**Main Theme:** Transcending Technical Boundaries - Toward Harmonization and Intellectualization of the Railway System -

**Date:** November 6, 2008 (Thursday) 10:00 to 17:10

**Venue:** Yurakucho Asahi Hall (Yurakucho Marion, 11th Floor)

Titles	Speakers	Affiliates
<Invited Lecture> Challenge to Research Beyond Boundaries - An Attempt on Cross-Industrial Research Involving Researchers from Other Industries	Yoshihiro SUDA	Professor, Institute of Industrial Science, The University of Tokyo
<Keynote Lecture> Research Integration for Better Railway System	Norimichi KUMAGAI	Executive Director, RTRI
Dynamics of Vehicle/Track/Structure System	Hiroaki ISHIDA	Director, Railway Dynamics Division, RTRI
Interdisciplinary Technology on the Overhead Contact Line/Pantograph System	Mitsuru IKEDA	Senior Researcher, Laboratory Head, Current Collection, Railway Dynamics Division, RTRI
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## Plan for Global Warming Countermeasures (Excerpt)

### † Basic policy for promoting global warming countermeasures

RTRI organized "The Global Environment Committee," and it has since been making concerted efforts aimed at conservation of the global environment. In particular, by promoting the Plan-Do-Check-Act (PDCA) cycle, RTRI emphasizes the activities of raising awareness among its employees, improving the efficiency of electrical systems, adopting energy-saving equipment, and promoting and encouraging a policy of reuse, reduce and recycle. RTRI combines these activities with the measures established during the basic fiscal year period, and it will implement greenhouse gas reduction measures accounting for 6% of the basic discharge by FY2009.

### † Expected total discharge of greenhouse gases in FY2009 (the final fiscal year in the scheduled period)

3,502 tonnes

### † Target for the expected total discharge of greenhouse gases

Within the scheduled period, countermeasures will reduce the discharge of greenhouse gases by 193 tonnes.

## Report of Discharge of Greenhouse Gases in FY2008 (Excerpt)

### 1. Scheduled period for Global Warming Countermeasures

FY2005 to FY2009

### 2. Results for the total discharge of greenhouse gases

- Total discharge of greenhouse gases in preceding fiscal year  
[CO<sub>2</sub>] 3,544 tonnes
- Total basic discharge and changes in the total discharge of greenhouse gases compared with preceding fiscal years

	Basic discharge	First fiscal year	Second fiscal year	Third fiscal year	Fourth fiscal year	Fifth fiscal year
Total discharge	3,695	3,622	3,191	3,692	3,544	-
Increase-decrease rate to the basic discharge	-	2%	14%	0%	4%	-

### 3. Progress of actions relating to the elimination of discharges of greenhouse gases

Progress of actions in each countermeasure category (Implementation of the action)	Basic measures	Partly completed
	Operative measures (included in the basic measures)	Partly implemented
	Target measures	Partly implemented

Reduction achieved by the target measures	Estimated reduction achieved (by the target measures)	102 tonnes CO <sub>2</sub>
	Estimated reduction rate (by the target measures)	2.7 %
Target reduction rate		3.2 %



#### 4. Summary of progress of actions relating to the elimination of discharges of greenhouse gases

At RTRI, the discharge of greenhouse gases caused by the consumption of electric power has reached 98% of the total discharge of greenhouse gases. Because of this, RTRI is focusing on a reduction in power consumption. The plan to reduce power consumption shows good progress in FY2008 through the adoption of high efficiency lamps (ceramic metal halide lamps) in the laboratory, the introduction of low-loss transformers, the control of air-conditioner temperature setting levels, etc. Compared with power consumption in the basic fiscal year, consumption in FY2008 was reduced by 3.8%. In addition, the estimated reduction rate (in the progress table) has reached 2.7%.

#### 5. Policy for actions during this fiscal year and in succeeding fiscal years

RTRI will implement the following measures to achieve further energy savings:

- Replacement of fluorescent lamps to inverter lighting types;
- Change to high efficiency lamps (ceramic metal halide lamps) in the laboratory;
- Adoption of low-loss transformers;
- Control of air-conditioner temperature setting levels.

(FY2008=2008.4.1-2009.3.31)

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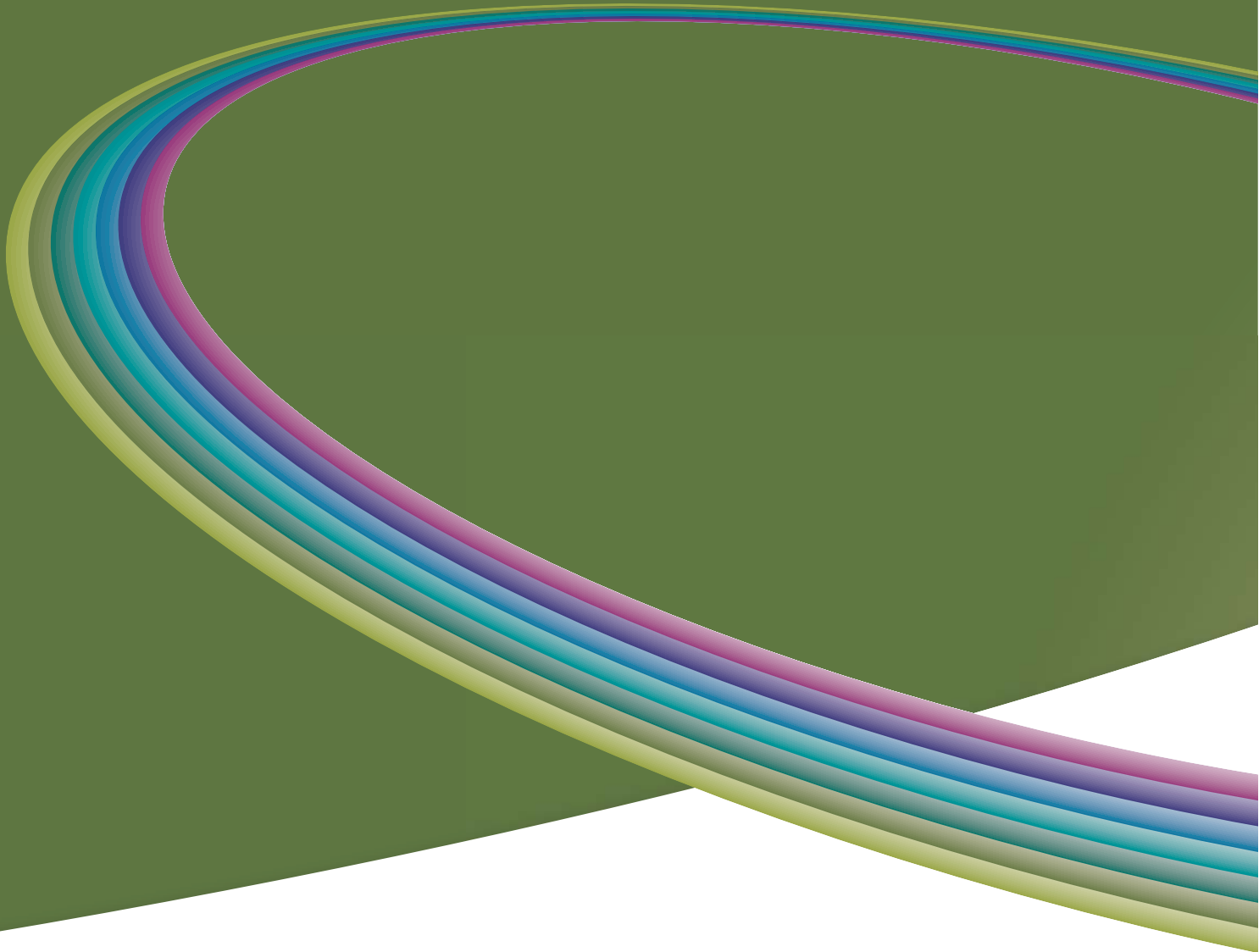
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