Annual Report 2009

Railway Technical Research Institute
Japan

Contents

Hisashi TARUMI
President

Foreword

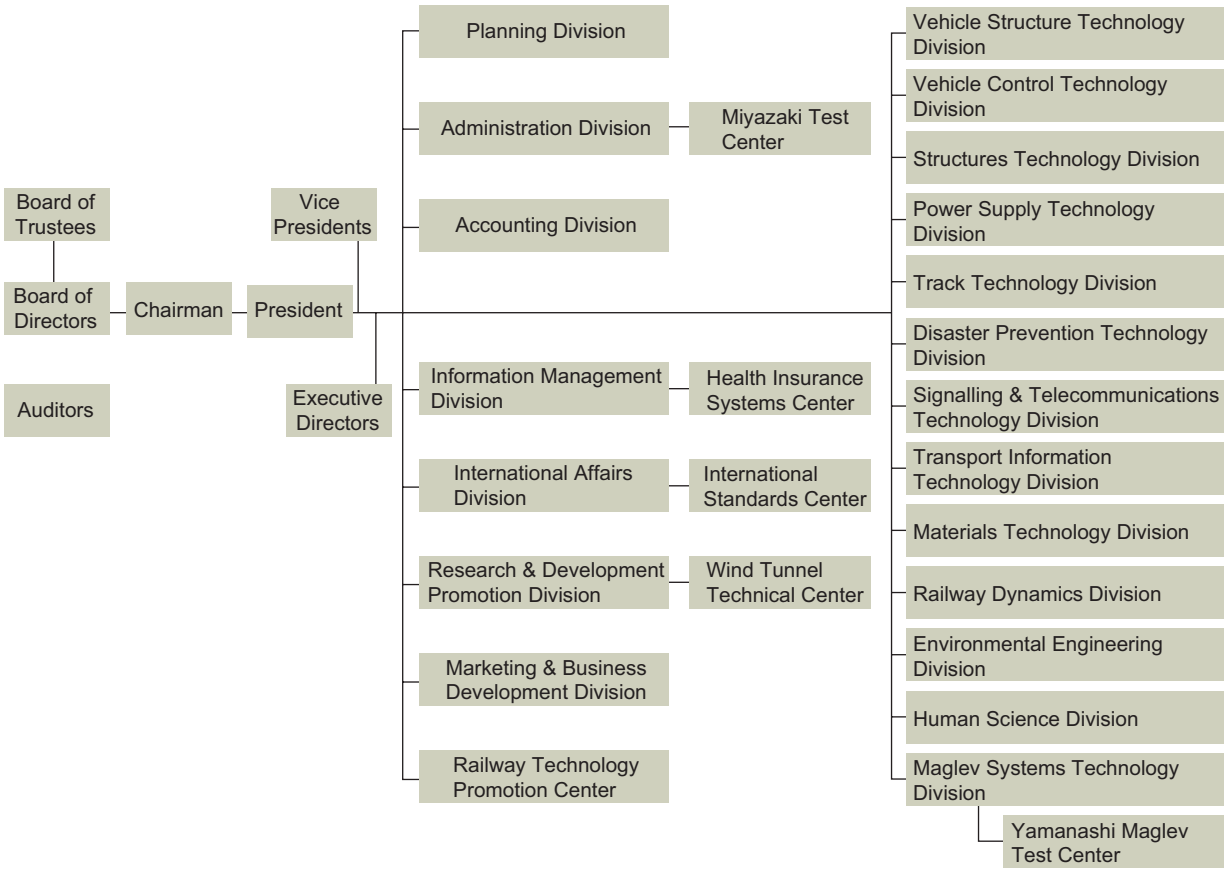
Since I took office as President of RTRI in April, 2009, RTRI has completed RESEARCH 2005, the basic plan for the previous term, drawn up the basic plan for the next term, made progress with preparations for the reform of public-interest corporations, and improved the environment and safety of the workplace. Furthermore, while RTRI has been sending out information about Japanese railway technologies to overseas railway organizations , it has taken steps to establish a system to promote the work related to international railway standards as a contribution towards the increasingly active efforts being made to export Japanese railway systems.

We have achieved most of the goals of the research activities set for the fiscal year 2009. RTRI undertook research & development for the long-term future, development of practical technologies, and basic research. In particular, RTRI has concentrated efforts on completing projects related to future-oriented research tasks with longer research timescales. Regarding contract-based projects, although the total targeted amount has not been reached, RTRI received almost 600 orders from its customers despite the recent difficult economic situation. The Railway Technology Promotion Center prepared learning materials for leading railway engineers, and it continues to revise and renew them. RTRI has secured a sufficient number of researchers by employing both new graduates and mid-career researchers, and it has actively promoted personnel exchanges with railway operating companies in order to benefit from their accumulated technical expertise and to ensure that it is passed on to younger generations. As for the test equipment, RTRI performed maintenance work continuously and, by utilizing a vibration test stand which was completed in 2008 and is capable of simulating large-scale earthquake vibrations, obtained valuable results in the research of structures and vehicles. RTRI made a larger number of patent applications than had been targeted, and consequently, the total number of patents which RTRI owns has exceeded 2,200. RTRI established a preparatory office for the Railway International Standards Center in July 2009, staffing it with personnel from railway companies and manufacturers. In the field of international activities, RTRI promoted collaborative research with France, China and Korea, supported the preparatory work to hold the World Congress on Railway Research 2011, and undertook preparations for the 10th International Workshop on Railway Noise scheduled to take place in 2010 in Nagahama.

Railways in Japan are likely to continue to have to cope with difficult economic conditions. In 2009, we formulated our master plan for the next term, RESEARCH 2010, and subtitled it “Toward Sustainable Development of Railways.” RTRI will continue to make efforts so that our research and development can further contribute to railway management. Due to a significant fall in transportation income experienced by the JR companies, it is certain that RTRI’s income from contributions from the JR companies will decrease considerably in 2010, which accounts for a large share of RTRI’s operating funds. However, RTRI intends to overcome this difficult situation with the wisdom and multidisciplinary expertise of tenacious researchers, to promote sustainable development of railways, and consequently, to contribute to the development of Japanese society and the Japanese economy. I would highly appreciate your continued support and advice to RTRI.

Organization

Organizational Structure

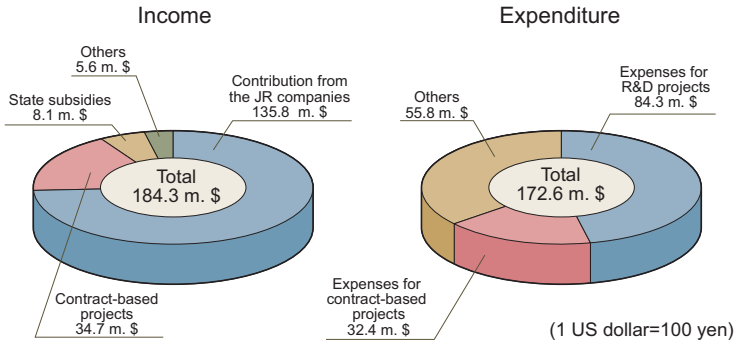


Board of Directors

Title	Name
Chairman*	Eisuke MASADA
President*	Hisashi TARUMI
Vice President*	Mitsutoshi INAMI
Vice President*	Masao UCHIDA
Executive Director*	Norimichi KUMAGAI
Executive Director*	Atsushi ICHIKAWA
Executive Director*	Atsushi KAWAI
Executive Director	Hirohiko KAKINUMA
Executive Director	Seiichiro OI
Executive Director	Tsutomu MORIMURA
Executive Director	Noriaki AZUMA
Executive Director	Shinji HAN'I
Executive Director	Toshihiko AOYAGI
Executive Director	Yoshihira FUKUSHIMA
Executive Director	Hiroyuki OTSUKA
Executive Director	Yoshihiro SUDA
Executive Director	Mami AOKI
Auditor*	Yasuhiro NAKAMURA
Auditor	Hidenori FUJII
Auditor	Yataro KIGUCHI

(* Full-time) (As of April 1, 2009)

Income and Expenditure in FY 2009



(1 US dollar=100 yen)

Human Resources

Total Number	521
Ph. D. Degree Holders	139

(as of Apr. 1, 2009)

Number of Projects

FY 2009

Category	Numbers
R&D for the Future of Railways	24
Development of Practical Technologies	141
Basic Research for Railways	99
Standards/Surveys	14
Total	278

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.

Outline of the Master Plan

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.

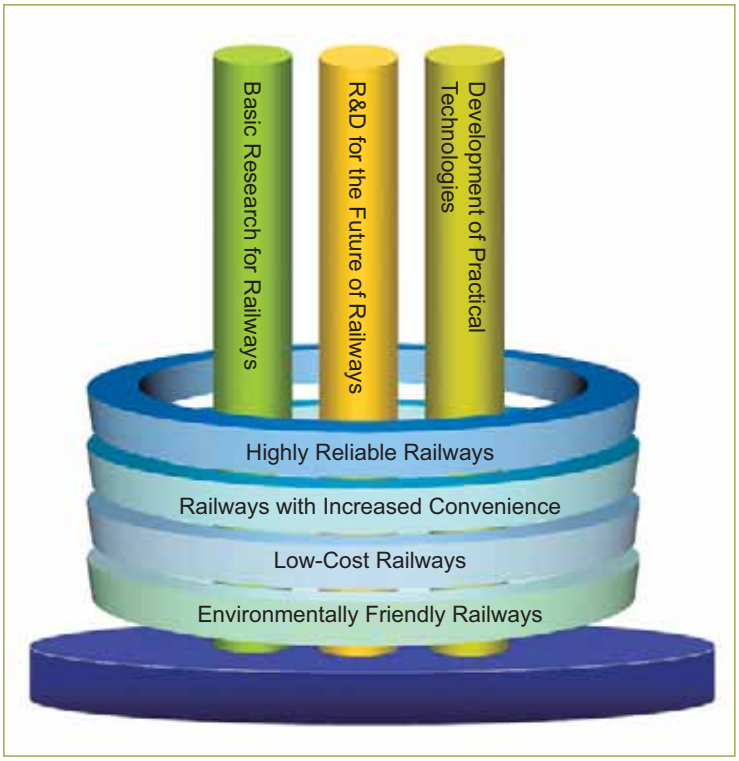


Fig.1 Basic Concept of R&D Activities at RTRI

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.

The basic concepts set up for the projects are as

Table 1 R&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

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 2009

1. Activities Related to Testing and Research

1.1 Test and Research Projects

RTRI conducted 278 R&D projects in FY 2009, 103 of which were completed. The main results of the R&D activity are as follows.

1.1.1 R&D for the Future of Railways

R&D activities for the future of railways (innovative topics for the future) aim to make technical breakthroughs and bring about system changes for the railways of tomorrow, with a view to putting these new developments into practice in about five to a little over 10 years time. According to the current basic plan, RTRI's R&D activities are based in total on 13 paths to innovation: four under the heading "High Reliability Railways"; three under the heading "Railways with Increased Convenience"; three under the heading "Low Cost Railways"; and three under the heading "Environmentally Friendly Railways." Figure 1 gives an overview of the 13 areas of work.

In FY 2009, RTRI was involved in 12 fields of research (with 24 themes) and managed to achieve almost all the predetermined objectives except for "Development of a Fuel Cell Vehicle," which was wound up after reaching completion in FY 2008.

(1) Highly Reliable Railways

a) Development of an evaluation method for vehicle movement characteristics using a hybrid simulator

- Thanks to this development, we were able to evaluate the running performance of virtual bogies with a range of different characteristics, by means of tests on the rolling stock test stand, etc. RTRI developed a versatile bogie emulator whose characteristics can be arbitrarily set by adjusting nine actuators.

b) Aseismic performance evaluation and countermeasures for existing railway facilities

- We developed measures to improve vehicle running performance such as a device to reduce the folding angle on structures, and measures to prevent damage from earthquakes to railway facilities such as masts and buildings. Further, we developed a technique to determine the priority order for earthquake proofing measures, by focusing on the life-cycle cost reduction effect deriving from reinforcement.

c) Signalling system configuration method using the RAMS index and its application

- We proposed a functional specification for a distributed train control system by which trains can continue to operate even if a component of the signal control equipment in a station area has failed, and by conducting tests at RTRI we confirmed that this was practicable. Further, we clarified the conditions for a route where the effect of introducing this system is high, by evaluation based on the concept of RAMS.

d) Application of sensing technologies and IT to asset management

- We developed sensors, data collection and transmission technology, and data analysis and evaluation technology in order to provide continuous monitoring of the soundness of viaducts, bridges, tunnels, etc. Then, we conducted evaluation tests at the site as well as in the premises of RTRI and confirmed that they were practicable.

(2) Railways with Increased Convenience

a) Development of high-speed and large-capacity information technologies for railways

- We improved the hardware and software for an optical laser system developed as a means of communication between ground equipment and components on-board trains to increase the stability of communication. Moreover, we confirmed that communication at 500 to 700 Mbps is possible at a running speed of 120 to 130 km/h. Thanks to on-track tests on conventional lines, we also confirmed that the transmission/reception of Hi-Vision video data is possible, this being one of the potential applications.

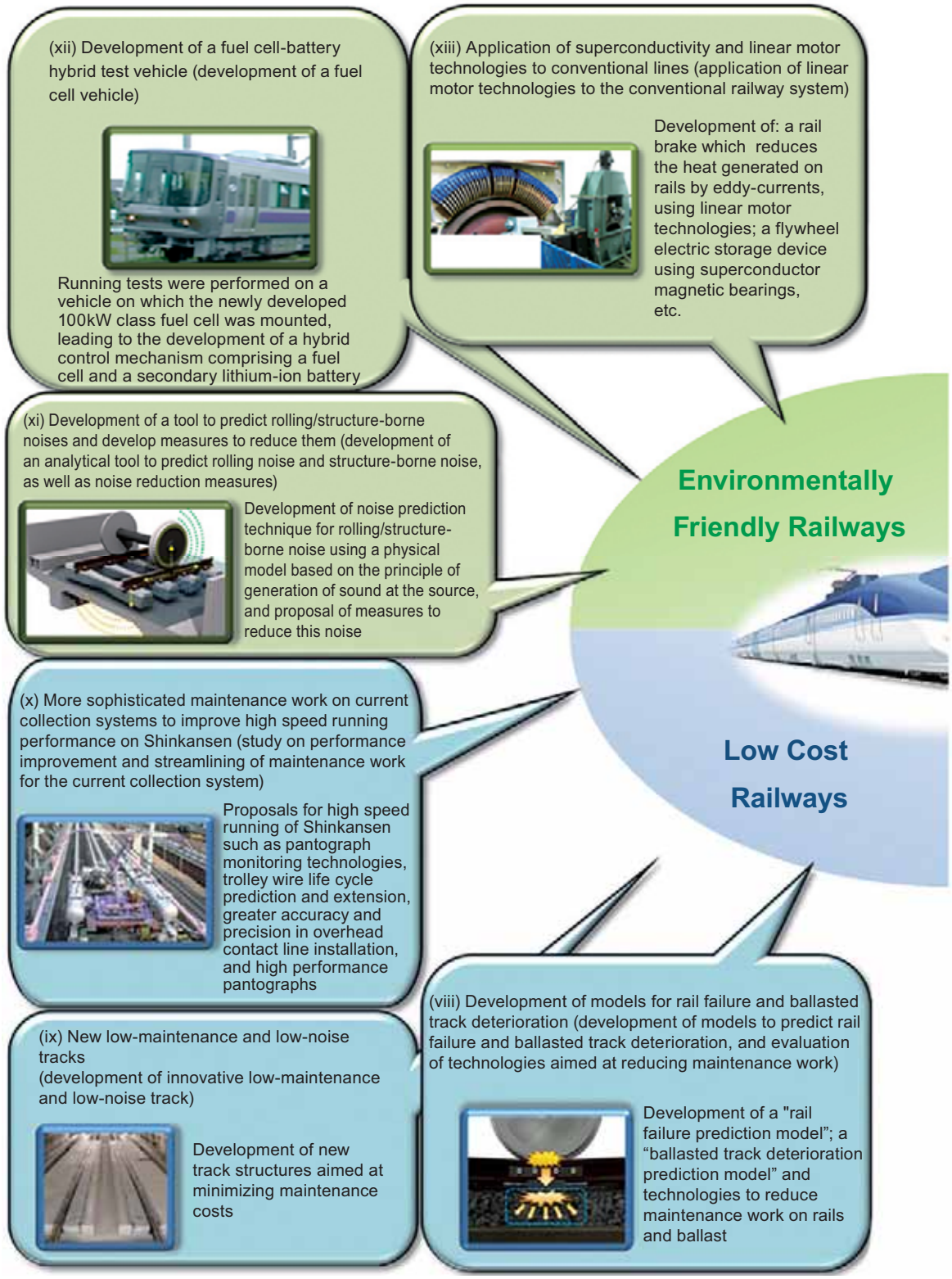
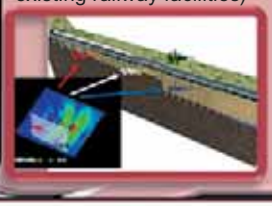


Fig. 1 R&D for the Future of Railways regarding the Master Plan of RESEARCH2005

(i) Development of a virtual vehicle running test system (development of an evaluation method for characterization of vehicle dynamics using a hybrid simulator)

Multi-DOF devices/train set test benches and real time computer simulation used together to obtain accurate rolling stock characteristics and reproduction of train set dynamics.

(ii) Aseismic performance evaluation and countermeasures for existing railway facilities, taking into account interaction between them (aseismic performance evaluation and countermeasures for existing railway facilities)



Development of an aseismic performance evaluation method and common set of countermeasures for all railway systems.

(iii) Railway facility maintenance management system with sensing and information-communicationtechnologies (application of sensing technology and IT to facility management)

Development and verification of sensors and data transmission techniques, development of interface specifications intended for transmission network connection

High Reliability Railways

(iv) Evaluation and configuration methods based on the RAMS index (signaling system configuration method using the RAMS index and its application)

Development of an evaluation and configuration method for signaling systems based on the RAMS index and establishment of basic specifications for a distributed signaling system

Railways with Increased Convenience

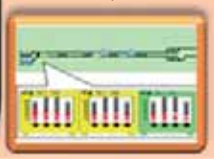
(v) Development of high speed and high capacity information communication technologiesfor railways

Construction of a high capacity mobile network, using mobile communication technologies, suitable for railway environments

(vii) Improvement of safety and ride comfort with human simulation technologies (development of human simulation technologies to improve safety and ride comfort)

Development of a wide variety of tools to apply human simulation technologies in the evaluation and estimation of railway environments

(vi) Techniques for estimating user demand and for developing efficient transportation plans (increase the efficiency of transport planning based on dynamic demand estimation)



Development of a sophisticated estimating technique for user demand; a transport planning technique, using results estimated from user demand, etc.

b) Efficiency improvement of transportation planning based on dynamic demand estimation

- We have developed a rolling stock scheduling algorithm and a crew rostering algorithm. Each algorithm can plan the allocation of rolling stock on the basis of the number of passengers, and it also takes into account the constraints imposed by vehicle inspection intervals and the working hours of train crew. By combining these algorithms with a timetable algorithm that was also developed, we are able to draw up an effective plan for passenger transportation which reflects demand.

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

- We added five new scenarios to the drivers' ability improvement programme for responding to. Further, by using station simulators and from measuring the results at actual stations, we clarified that a simulation technique for evaluating the thermal environment of station concourses is sufficiently accurate to be practicable.

(3) Low-Cost Railways

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

- We developed a trolley wire which has increased fatigue strength, and clarified with field tests that the generated strain was approximately 10% lower compared with a conventional trolley wire. Owing to this, an increase in the fatigue life of about 1.5 times can be expected. Moreover, we conducted a running test with an active pantograph whose contact force with overhead contact lines is controlled on the basis of dynamic characteristics, and we confirmed that its operation is more stable compared with the conventional method that directly feeds back the contact force.

b) Development of innovative low-maintenance and low-noise track

- We installed an experimental section of innovative track on a viaduct and on a soil roadbed in the Hino civil laboratory. As the result of running tests with motor vehicles, the level of vibration at the roadbed near the rails on the viaduct and on the soil roadbed was reduced by 10 to 15 dB compared with that of slab tracks, and the level of vibration on the underside of the viaduct was reduced by 5 to 15 dB.

c) Development of a model to predict rail failure and ballasted track deterioration, and evaluation of technologies to reduce maintenance work

- We developed an analytical procedure using the 3D finite element method that enables the dynamic response characteristics of ballasted tracks to be captured in detail, and we confirmed that this can precisely evaluate the maintenance reduction effect of the modifications made to the shape of the sleepers and the structure.

(4) Environmentally Friendly Railways

a) Development of an analytical tool to predict rolling noise and structure-borne noise, as well as noise reduction measures

- We measured the vibration and radiated sound of wheels, rails, and structures on service lines, and we confirmed that the prediction technique developed for rolling noise and structure-borne noise is sufficiently accurate to be practical.

b) Application of linear motor technologies to the conventional railway system

- We experimentally manufactured a full-scale linear rail brake for tests on the roller-rig, and we confirmed that the target brake force of 5 kN/unit could be achieved, setting this as the target for commercial operations. Thanks to the inverter control that we developed, we confirmed that braking was possible without an excitation power supply.

1.1.2 Development of Practical Technologies

A total of 155 projects relating to the development of practical technologies were conducted, and 56 of them were completed.

(1) Highly Reliable Railways

a) Behaviour analysis of Shinkansen cars during earthquakes

- We devised a simulation model representing the wheels after derailment and the track structure including the check/guard rails, in order to be able to predict the running behaviour of the cars on the ballasted track after derailment, and by means of simulation we clarified the effect of the check/guard rails, etc. based on the difference in magnitude and the characteristics of earthquakes.

b) Development of a reinforcement design method by

wrapping steel plates around the extremely-short RC columns

- We clarified the fracture mechanism of the extremely-short columns of rigid-frame viaducts which are reinforced by wrapping steel plates around them to establish this method of reinforcement, and we developed a construction method for reinforcing the beams of existing viaducts using arched steel material.

c) Development of a temporal and spatial evaluation technique to determine the risk of slope failure during rainfall

- We developed a technique to evaluate the risk of a slope that changes temporally and spatially during rainfall, and we established a method for practically utilizing the technique, such as identifying the spots having a high risk of slope failure and studying or investigating the level of rainfall when operations should be restricted

d) Measures to improve the interference-proof properties of low-frequency track circuits

- We experimentally manufactured a track circuit where the noise identification function was enhanced by sending the phase-switched current in a predetermined pattern from a transmitter and by detecting the phase variation pattern with a receiver. Then, we confirmed that the allowable value against interference current in long track circuits had been increased threefold, and that the interference-proof properties had been improved during field tests.

(2) Railways with Increased Convenience

a) Practical implementation of a vertical vibration damping control system using a variable coefficient axle damper

- We developed a variable coefficient axle damper intended to reduce costs by improvement of the damping force control valve, etc. and during running trials using the Shinkansen test car we confirmed that the vibration acceleration power of around 10 Hz due to primary bending of the car body can be reduced to about 1/5. In addition, we conducted endurance running tests.

b) Development of technology for improving the compatibility of driving cabs with drivers' physiques

- From a questionnaire about the usability of driving cabs we identified those parts of the cab which drivers considered inconvenient, and we conducted tests with 52 people by using a mock-up where the position of the driver's seat and the height of a foot stool were changed. Then, we proposed the dimensions of a driving cab which conforms to drivers with a wider range of physiques than the present design.

(3) Low-Cost Railways

a) Development of a body-mounted inertial versine measuring device

- We clarified that the standard deviation of reproducible errors of measurements was limited to 0.5 mm even with poor linear conditions during running tests on commercial lines, and that the track inspection cars offer satisfactory performance.

b) Rapid restoration method for damaged embankments

- We developed a construction method to improve the stability of embankments by utilizing large-size sand bags for preliminary restoration, and to restore a more permanent reinforced structure we used rod-type reinforcing members. We also confirmed using a 1/10-scale model that high aseismic performance can be obtained.

c) Aseismic evaluation technique of old-type steel piers in city areas

- We proposed an aseismic evaluation technique against large-scale earthquakes. Moreover, we studied/investigated the effect of various reinforcement construction methods by earthquake response analysis and clarified that the construction method by which the members between bridge piers are reinforced with braces is effective.

d) Development of a new midterm lubrication mechanism for traction motor bearings

- We developed a new replacement lubrication method where deteriorated grease is kept at a distance from the bearings and non-deteriorated grease is supplied close to the bearings; this was applied during the midterm lubrication of induction motors' bearings. Further, during bench tests we confirmed that a lubrication life corresponding to a running distance of 1.8 million km on conventional lines (compared to 0.6 to 1.2 million km previously) can be obtained by combining the optimum period of midterm lubrication and the developed lubrication method.

(4) Environmentally Friendly Railways

a) Development of an energy simulator for diesel-hybrid railway vehicles.

- We developed an energy simulator that draws up train performance curves and calculates energy consumption and the state of charge of the battery, etc., for various types of diesel-hybrid railcars.

1.1.3 Basic Research for Railways

A total of 99 projects regarding basic research for railways were conducted, and 23 of these were completed.

(1) Analytical Research

a) Technical development to improve the strength of lightweight stainless steel cars

- We captured details of the deformation behaviour of a car body structure when it is subjected to an impact on the bodyside. The method used was to conduct a weight-drop test in which a compressed plate was dropped on to the bodyside of a full-scale partial car body structure. At the same time, we established a simulation technique for the deformation behaviour of car bodies in a collision by means of the FEM (finite element method), and we confirmed that the test results can be reproduced with sufficient accuracy.

b) Quantitative evaluation of lightning protection measures for level crossing systems

- We proposed the lightning surge propagation model along rails and the lightning surge analysis model for level crossing systems taking into account the ground resistance, earth resistivity, etc., and we quantitatively evaluated the effect of measures to prevent lightning damage by changing the installation method for the surge protection devices on the electronic train detector for the level crossing.

c) Research into the effect on running safety of surface conditions after wheel grinding

- We demonstrated that the risk of derailment caused by flanges climbing the rail increases just after wheel grinding because of the increased friction coefficient. This was determined by means of running tests at car depots and in the premises of RTRI; the tests used a dual-cylinder rolling contact testing machine, and simulation, etc. Moreover, we confirmed with the help of on-track tests on conventional lines that lubrication just after wheel grinding decreases the friction coefficient of the wheel surface and that this remains the case for a certain running distance.

d) Improvement of the sound source analysis evaluation method for aerodynamic noise from car bodies and establishment of a technique to reduce the noise

- We developed a simulation technique for the air flow around the objects to which porous material had been attached. Moreover, we analyzed the structure of the sound source by combining this technique and the evaluation technique for aerodynamic sound from the condition of the vortex, and by attaching the porous material to certain parts of the pantograph the condition of the vortex was changed and the aerodynamic noise was reduced.

(2) Exploratory and Pioneering Study

a) Research into the improvement of accuracy for evaluation of current collection performance by measuring contact loss

- We devised a technique to measure contact loss at night and during the day by detecting only the ultraviolet range of arc light generated at the point of contact between trolley wires and pantographs, and we confirmed that it can be detected with sufficient accuracy by on-track tests on commercial lines.

b) Clarification of the impact load response characteristics of rail pads under quasi-static loads

- We developed an impact load testing machine that can evaluate the impact load response of rail pads when they are subjected to loads.

(3) Magnetically Levitated Railway

a) Research into the functional improvement of the Magnetically Levitated Railway Vehicle System

- We developed test equipment using a 1/12-scale model train which consists of three bogies, two car bodies plus one half-body. The equipment simulates movement of the levitated railway vehicle when running with a trainset. Further, we established a technique to simulate the movement of coupled vehicles and of the electromagnetic force, using universal software for analyzing the dynamic response of a large number of vehicles.
  In addition, on the Yamanashi Test Track, running tests were used to obtain data regarding the long-term durability of vehicles and ground installations.

1.2 Contract-Based Projects

The income for FY 2009 was about 3.2 billion yen

against the target amount of 3.5 billion yen. In addition, the total increased to 3.4 billion yen with the inclusion of other income such as patent licence fees. Further, the number of contract-based projects was 589. The main projects were:

MLIT*: Survey and study for maintenance of railway technical standards

Local Gov.: Observation and survey of ground, etc. around facilities

JRTT**: Tests, investigation and research relating to projected Shinkansen lines

JR***: Research on seismographs

Private Co.: Research into a gauge-changing train (Electric cars with variable track gauge)

Further, to inform the public about the results and achievements of research and promotion of contract-based projects, we conducted technical meetings (about 800 persons attended in total) and technical investigation meetings with individual companies, etc.

1.3 Other Projects

(1) Surveys

In order to acquire further knowledge for R&D activities, RTRI dispatched a staff member to UIC† to collect information about European railway technologies. Moreover, we conducted a survey about techniques regarding technical evaluation and application examples, for the technical trend survey that contributes to new technologies and research towards the future of railways.

(2) Technical Standards Development

RTRI drafted a revised edition of the "Design standard for composite structure of steel and concrete" and conducted surveys and research regarding the "Simple performance checking method for railway bridges," "Life extension of existing soil retaining walls," and "Car body vibration & displacement." Further, we promoted the development of design tools, etc. as a related theme of R&D.

(3) Information Services

We collected domestic and international information, publications as well as written materials/data regarding railway technologies, and made them accessible via the internet and document retrieval services, etc. In addition, to meet the objective of providing information by means of the electronic library, we continued the work of compiling the electronic database of written materials/data stocked in the library. The accumulated total number of main electronic written material/data has reached approx. 60,000 items.

(4) Publications and Workshops

RTRI published its own periodicals, such as "RTRI report," "RRR," and "QR." We also held the annual RTRI Lecture (443 attendees) under the main theme of "Aiming for safe and secure railway transportation," as well as 11 Monthly Presentations (992 attendees in total), and 29 Railway Technology Seminars (1,414 attendees in total), etc.

(5) Diagnosis and Advisory Services

RTRI offered consultancy services on 386 occasions regarding the investigation into disasters and the causes of electrical power equipment failure, etc. in addition to various types of technical guidance, at the request of various railway companies.

1.4 Railway Technology Promotion Center (RTPC) Activities

In the Railway Design Engineer Examination, 140 engineers out of 776 applicants in Tokyo and Osaka passed.

In terms of technical support, RTPC published "Railway Technologies Learned from Accidents (signalling version)," a textbook for leading engineers, and started to edit a textbook on overhead contact lines. RTPC responded to 52 inquiries from its members, conducted three on-site surveys and gave on-site advice on three occasions, as well as holding the promotion center lectures at four locations. In addition, it gave lectures and advice 13 times at training meetings held by local railway organizations arranged by rail advisers, and exchanged opinions with local railway organizations on 21 occasions. For providing information to members, RTPC made efforts to send out information using electronic media, etc.

Concerning survey and research work, RTPC conducted five project themes and completed survey and research work relating to rational aseismic reinforcement for viaducts. As to the railway safety database, RTPC added information about serious accidents that have occurred in the past and performed

* 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

analysis regarding the influence of delays and disruption from accidents causing injury or death on the level of traffic.

1.5 Other Activities

(1) International Activities

Regarding the collaborative research with China and Korea, RTRI participated in a seminar held in Beijing and made a presentation. At the same time, we selected the next theme for research. As for the collaborative research with France and England, we decided to hold a collaborative research seminar in the next year. Further, RTRI supported the preparatory work for the World Congress on Railway Research (WCRR 2011), and promoted preparatory work for staging the International Workshop on Railway Noise (IWRN 10). In addition, we opened a homepage for exclusive use and accepted applications for research papers and their selection. Further, we sent out information to domestic and international regions with newsletters, etc.

(2) Development of a Gauge Changing Train (Electric cars with variable track gauge)

As a member of the Free-Gauge Train Technology Research Association (FGT Association), RTRI participated in conducting measurements during running tests with the new trainset (on conventional lines, and on the Kyushu Shinkansen, etc.) and in the development of the new bogies, etc. Moreover, since the life of the FGT Association has been extended for 4 years (until the end of 2013), RTRI decided to continue participating in the association.

2. Others

(1) Formulation of the Basic Plan for the next period

We formulated the basic plan - RESEARCH 2010 - which shows the basic guiding principle for R&D activities, various projects, operations, etc. for the five years starting in 2010.

(2) Dealing with Public Interest Corporation Reform*

RTRI received authorization from MLIT for the selection method for councillors, and we continued to make preparations to apply for approval to make the transition to a public juridical foundation. These included making the first recommendation of candidates for councillors to the council and the board of directors.

(3) Improvement of Equipment and Facilities

RTRI carried out improvements such as increasing the vertical acceleration amplitude of the rollers of the rolling stock test facility, and in February 2010 completed, as scheduled, a programme of improvements for higher functionality of this equipment which has been in progress for five years. In addition, we completed 18 projects for new construction, improvement, and renewal of various test facilities.

Regarding general equipment, in order to deal with aging components, we carried out one project involving electrical equipment, and two water supply and drainage equipment schemes.

(4) Industrial Property Rights (Intellectual property rights)

Regarding patents, etc., RTRI made 242 applications in FY 2009 (last FY: 240 applications) in total. The number of patents granted during FY 2009 was 163 in total (last FY: 154). Consequently, the number of patents etc. possessed at the end of FY 2009 reached 2,245 in total.

(5) Visitors

Approximately 2,000 people visited the Kunitachi Institute and 140 people visited the Maibara Wind Tunnel Technical Center. Around 1,700 people attended the RTRI forum held in the Kunitachi Institute (August 27 and 28), and 3,600 visited the open house festival (October 10). Further, 8,000 visited the open house festival held in the Maibara Wind Tunnel Technical Center (October 10 and 11).

* Public Interest Corporation Reform: In the new legal system, general non-profit corporations, which consist of incorporated foundations, will be created.

Activity Plan for FY 2010

1. Fundamental Policy

The Japanese economy has been seeking the path leading to economic recovery in the midst of a concurrent slowdown of the world economy. Not only that, but the price of expressway tolls has been reduced. Thus, the circumstances surrounding the railway business continue to be difficult. On the other hand, from the viewpoint of global environmental conservation, the momentum to re-evaluate the role of railways has been growing on a worldwide basis, and further, overseas deployment of Japanese railway systems is also expected.

Given these circumstances, RTRI formulated the basic plan -RESEARCH 2010- which shows the guiding principles of R&D activities, various projects, operations, etc. for the five years starting in 2010, and approval of the council and the board of directors was obtained in November 2009.

Because FY 2010 is the first year of the new basic plan, RTRI will concentrate its efforts on commencing the various plans systematically, based on the guiding policies.

In the field of research and development, RTRI will undertake R&D work regarding intelligent trains, improving safety against natural disasters such as earthquakes, further improving energy efficiency in railways, aiming for further safety improvement and harmony with the environment. At the same time, we will advance research and development to bring about less expensive and more convenient railways by utilizing IT, etc. In addition, we will continue to upgrade our simulation technology. We will proceed effectively with R&D by strengthening collaboration with domestic and overseas universities, research institutes, etc. As to the Maglev (magnetically levitated) railway system, we will continue with our R&D activities focused on the application of a series of technologies and know-how such as superconducting technology, linear motor technology, etc., to conventional railways.

Further, RTRI established the International Railway Standards Center in April, 2010, and full-scale activity regarding international railway standards has started.

As for operations and management, we will continue to make the necessary preparations to apply for approval for the transition to a public juridical foundation by autumn 2010. Moreover, given the situation where the refund to the Development Bank of Japan is moving ahead rapidly during a time of severe economic constraint, we will ensure that major improvements are made to the operational efficiency of RTRI, and we will promote the effective utilization of expenditure. At the same time, we will endeavour to keep income other than that from contributions from the JR companies, such as revenue from contract-based projects.

In addition, we will promote occupational safety and health management and continuously strive to create safe, active workplaces.

Based on the above, the important items to be carried out in 2010 are decided as follows.

- R&D for the future of railways
- Development of practical technology
- Basic research on railways
- Promotion of contract-based projects
- Activities of the Railway Technology Promotion Center
- Activities of the Railway International Standards Center

2. Activities Related to Testing and Research

2.1 Test and Research Projects

In 2010, RTRI will make a fresh start with R&D for the future of railways and conduct the development of practical technology as well as basic research on railways. In implementing these developments, we will make special efforts to upgrade simulation technologies.

Further, in order to promote R&D efficiently, RTRI will carefully select the tasks to implement, and we will make positive use of the collaborative research & contract research that we conduct with universities as well as with other research institutes. In addition, we will make use of R&D reviews, etc. where RTRI receives advice as well as evaluation from research advisers who are external academic experts.

(1) R&D for the Future of Railways

RTRI will promote tasks covering the development of technology that has the potential to create a large ripple effect when it is implemented, and we will also undertake basic research in the expectation of achieving an epoch-making breakthrough. In 2010, we will set five new large tasks related to the four R&D targets of the basic plan and implement 11 individual tasks (see Table 1). One other task is planned to start in FY 2011.

Moreover, as for the five large tasks, we will implement them as follows, during the next five years.

For "safety, reliability improvement of railway systems," RTRI will develop intelligent trains, bogies that are resistant to derailment, and measures to prevent or limit the damage from natural disasters such as earthquakes, in order to dramatically increase the safety and reliability of railways.

For "highly efficient utilization of energy," we will propose a method to reduce the energy consumption of vehicles by reducing air resistance, improving efficiency and reducing the weight of apparatus, as well as a new power supply system for reducing operational energy consumption, in order to formulate a railway system that utilizes energy in a highly efficient way.

For "innovation in maintenance," we will establish condition monitoring techniques, fault detection/diagnosis technologies, as well as prediction techniques to identify degradation caused by age in equipment that requires maintenance. In this way we will promote a reduction in maintenance costs and develop renewal technologies for life-expired structures, etc.

For "preservation and development of railway networks," we will implement the development of technologies at/around stations that make it easier to transfer between different railways or transport modes.

We shall also proceed with the development of prediction and evaluation methods concerning the environment along railway lines where faster running is envisaged.

Further, we will develop evaluation techniques for vibration and ride quality, etc., in order to promote the

Table 1 Large tasks and individual tasks constituting "R&D for the future of railways"

Large tasks	Individual tasks
Safety, reliability improvement of railway systems	Safety, reliability improvement using intelligent trains
	Safety improvement against derailment, collision
	Safety improvement against meteorological disasters
	Safety improvement against earthquakes
Highly efficient utilization of energy	Energy saving of vehicles
	New power supply system
Innovation in maintenance	New condition-monitoring maintenance technologies
	Innovation in structure renewal technologies
Preservation and development of railway networks	Evaluation of and measures to improve in-vehicle comfort
	Evaluation of and measures to improve the environment along railway lines for faster running (Planned to start in FY 2011)
	Smooth transfers at traffic nodes
Formulation of the railway simulator	Design and development of the core system for the railway simulator

preservation and development of railway networks, by enhancing the advantages of rail travel and emphasizing the superiority of railways to boost demand.

For "formulation of the railway simulator," we will formulate the design of a highly-functional railway simulator which recreates the behaviour of each part of the railway system. The simulator will be able to duplicate the entire behaviour of the railway system by comprehensively combining the different constituents.

(2) Development of Practical Technology

RTRI will conduct technical development to solve specific problems in the railways identified by the respective JR companies, and, after careful selection, RTRI will carry out tasks in which it enjoys superior knowledge or advanced development.

In particular, we will develop a train control system for quiet lines by using general-purpose radio, we will use the flow-field control method to reduce aerodynamic noise from pantographs, and we will use the preservation/control method for post-tension type PC beam, etc.

In pursuing these various developments, RTRI will ensure that it fully understands the needs of the railway companies by working closely with them, and it will also strive to achieve results quickly.

(3) Basic Research on Railways

While reflecting the needs of railway companies, RTRI will conduct research to clarify phenomena that are inherent to railways and which are needed to solve various railway problems. This research will include the application of new technologies and materials, and the work will also address research methodology and ways to upgrade simulation technologies.

In particular, for conventional railways, we will conduct research on the quantitative risk evaluation index of bedrock slopes, research into the improvement of evaluation accuracy for the aerodynamic force acting on vehicles caused by side winds, and research into operational errors committed by drivers, etc.

Further, for the Magnetically Levitated Railway System, RTRI will participate in running tests on the Yamanashi Test Track, and conduct research for an inspection method for the ground coils, and for improved performance of the high-temperature superconducting magnet, etc.

2.2 Contract-based Projects

RTRI will continue the practical application of the achievements of its R&D work, mainly with system integration and technical consulting. For this purpose, we will positively promote contract-based projects, such as the introduction of RTRI's achievements through technical forums and technical meetings, etc., and endeavour to achieve the income target of 3.3 billion yen as well as balance the profit and loss. Further, when we promote contract-based projects, we will ensure thorough quality control.

2.3 Other Projects

(1) Surveys

RTRI will systematically and continuously collect, analyze, evaluate and store technical information about domestic and overseas railway technologies and related fields. We will also implement surveys on technical trends in the various fields which contribute to new technologies and research for the future of railways.

(2) Technology Standards Development

RTRI will engage in checking the performance of steel/concrete composite structures, and conduct investigation/research regarding a simple checking method for bridges, and life extension of existing soil retaining walls, etc. Further, we will promote R&D in relevant fields.

(3) Information Services

RTRI will collect and make available domestic/overseas publications, written materials regarding railway technologies, and provide information utilizing the internet, as the information communication facility that can quickly provide correct technical information about railways for railway-related engineers and researchers.

(4) Publication and Workshops

RTRI will issue periodical publications of "RTRI report," "RRR," "QR," and hold the annual RTRI Lecture,

Monthly Presentations, and Railway Technology Seminars, etc.

(5) Diagnosis and Advisory Services

RTRI will provide consultancy services such as investigating the causes of accidents, offering technical guidance, and supplying lecturers, at the request of railway companies, etc.

2.4 Railway Technology Promotion Center (RTPC)

RTPC will promote various projects, and at the same time continue to provide information on its activities, reflecting the needs of members in the work it undertakes. Specifically, RTPC will fully 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 prepare 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 research based on the requests of members. Moreover, RTPC will provide information and enrich its safety database. At the same time, it will perform activities in co-operation with local railway organizations, and strengthen communication with members as well as sending out information.

2.5 Railway International Standards Center

The Railway International Standards Center was established in April 2010 and it has commenced full-scale activity regarding international railway standards. Based on the policy and proposals, etc. indicated by the Railway Technology Standardization Research and Examination Committee, the Standards Center conducts activities as the domestic council organization of the International Electrical Commission (IEC), TC9 which is the railway-related (= Electrical Equipment and Systems for Railways) expert committee. It also engages in activities for the council secretariat of railway-related standards of the International Organization for Standardization (ISO). Further, it promotes strategic study/investigation of international standardization and puts forward new proposals for international standards as well as providing support for the utilization of published standards, etc. Moreover, it sends out information to railway-related staff and the general public, and also endeavours to contribute internationally.

2.6 Others Activities

In October 2010, the 10th International Workshop on Railway Noise (IWRN 10) will be held at Nagahama, in Shiga Prefecture. As part of its collaboration with overseas railway-related research institutes, RTRI will continue to implement collaborative research with SNCF (Société Nationale des Chemins de Fer Français = French Railways), with the UK Railway Safety and Standards Board, with the China Academy of Railway Sciences, and with the Korea Railroad Research Institute. Further, we will support preparatory work for the 9th World Congress on Railway Research (WCRR 2011) to be held in May, 2011 in Lille, France.

Regarding development of the Gauge Changing Train, RTRI will conduct planning for the running tests with the new trainset, carry out measurements during the running tests and contribute to the improvement of the new bogies, etc., as a member of the Free-Gauge Train Technology Research Association.

3. Others

(1) Dealing with Public Interest Corporation Reform

RTRI is making efforts to collect a wide range of information relating to the public interest corporation reform, and RTRI will undertake the specific work needed to apply for approval to make the transition to a public juridical foundation. Given the need to obtain approval from administrative bodies to implement the change, the target is to complete this by autumn 2010.

Major Results of Research and Development in FY 2009

I. Safety/Reliability

1. Formation of a Running Test Environment for a Virtual Train Set Using HILS

- RTRI developed a HILS system for railway vehicle as a virtual running test environment to replace actual test runs.
- It also developed a rapid prototyping bogie whose component characteristics can be changed using software.

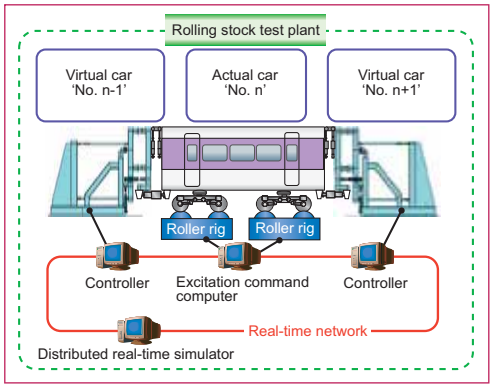


Fig. 1 Configuration of the running test environment for the simulated train set

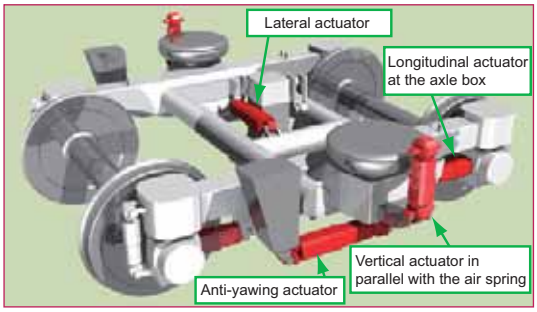
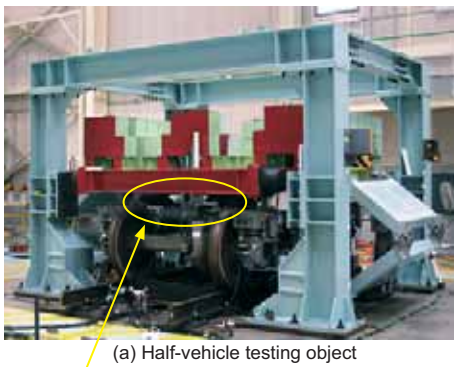


Fig. 2 Rapid prototyping bogie

2. A Lateral Damper to Prevent Vehicle Derailment in Earthquakes



(a) Half-vehicle testing object

(b) Anti-earthquake damper

Fig. 3 Vibration experiment on an actual bogie

- RTRI developed a lateral damper for vehicles to prevent derailment in earthquakes.
- It also performed an actual bogie vibration experiment and simulation, and confirmed that the developed damper increases the limit of amplitude for running safety by 17% at the maximum.

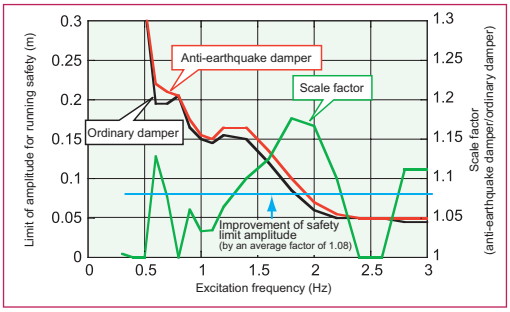


Fig. 4 Limit of running safety for a Shinkansen vehicle equipped with anti-earthquake dampers

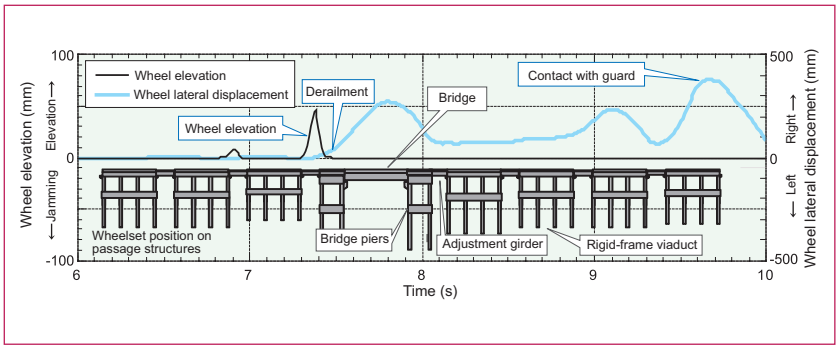


Fig. 5 Example of post-derailment vehicle behavior analysis

3. Simulation of Post-Derailment Vehicle Behavior

- RTRI developed a vehicle behavior simulation that can be used to quantitatively evaluate the effects of a guard to prevent secondary abnormalities after derailment.
- This simulation method allows comprehensive investigation of the effects of countermeasures for vehicles, tracks and structures during earthquakes.

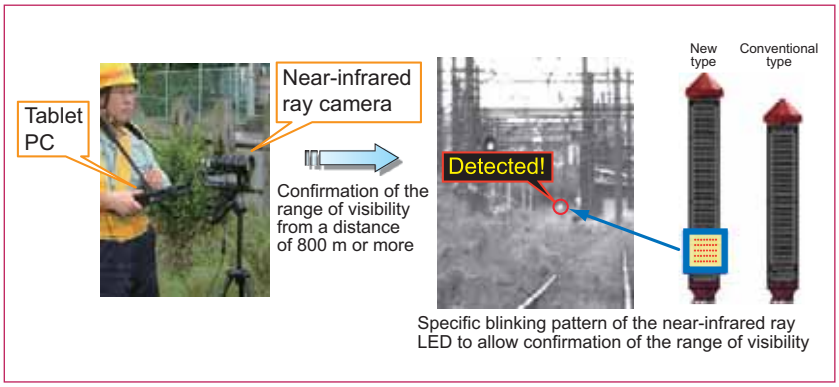


Fig. 6 Obstruction warning signal visual confirmation system

4. An Image Processing System for Recognition of Special Signals

- RTRI developed an image processing technique for recognizing slow-speed notification signals from the inside of vehicles.
- It also developed an obstruction warning signal that can confirm the range of visibility and a related recognition device.

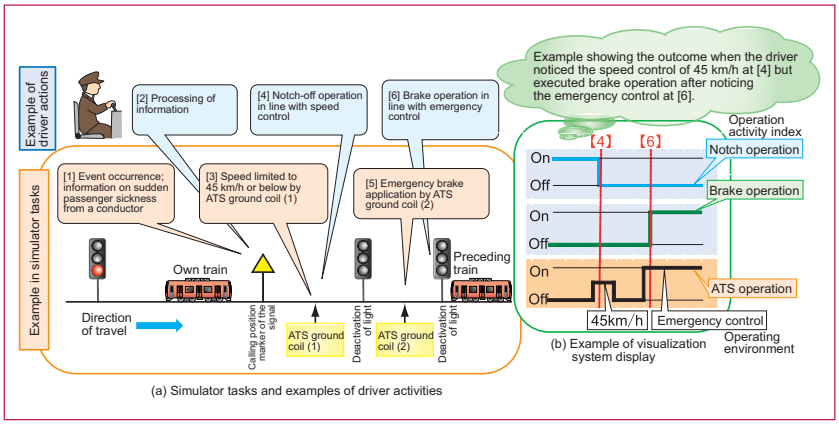


Fig. 7 Example of a task involving block signal deactivation

5. A Program to Develop Drivers' Ability to Respond to Problems

- RTRI developed an educational training program to improve drivers' ability to respond to problems/abnormal situations.
- It also developed a system of visualizing results in order to enhance the effects of education by awareness.

6. A Technique to Reinforce RC Rigid Frame Viaduct Beams Using Arch-Shaped Steel Plates

- RTRI developed an effective rehabilitation method for the beams of existing RC rigid frame viaducts.
- It also confirmed through repair work that it is possible to reduce the construction period and costs compared to those of the existing rehabilitation method.

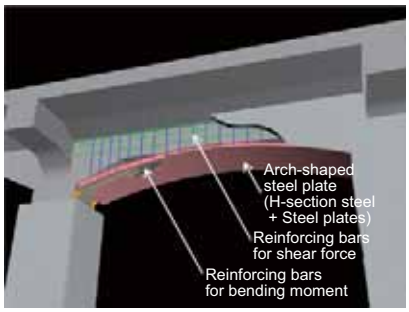


Fig. 8 Outline of the rehabilitation method using arch-shaped steel plates

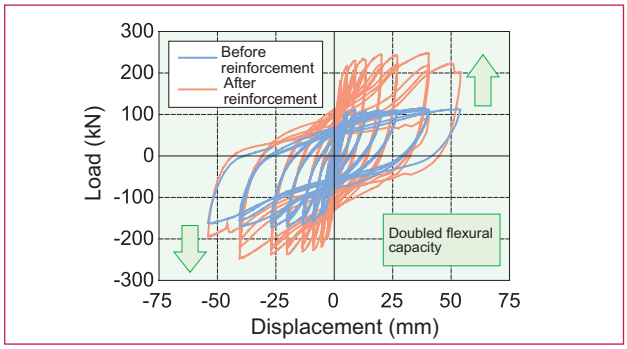


Fig. 9 Example of flexural reinforcement of beams

7. Techniques to Reinforce the Tunnel Linings Using FRP Plates

- RTRI developed an inner-surface reinforcement method for tunnel linings using FRP plates.
- Reinforcement can be performed with almost no reduction in internal spaces of tunnels.
- RTRI also confirmed outstanding reinforcement effects/workability and presented basic specifications.

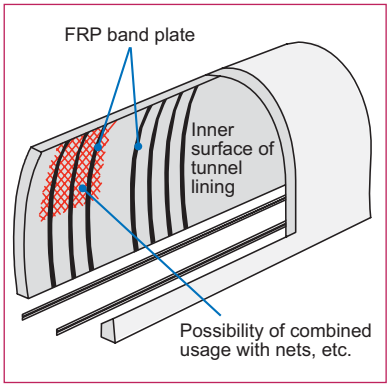


Fig. 10 Outline of the FRP band plate adhesion method

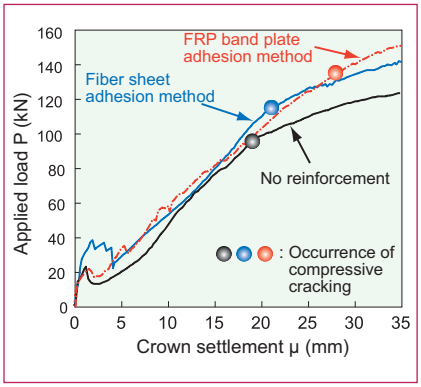


Fig. 11 Effects of reinforcement

8. Development of a Technique to Judge the Priority of Earthquake Damage Countermeasure Application for Railways Facilities

- RTRI proposed a technique to enable judgment of priority for earthquake countermeasures to be applied to railways facilities using the amount of reduction in life cycle costs (DLCC) before and after such countermeasures.

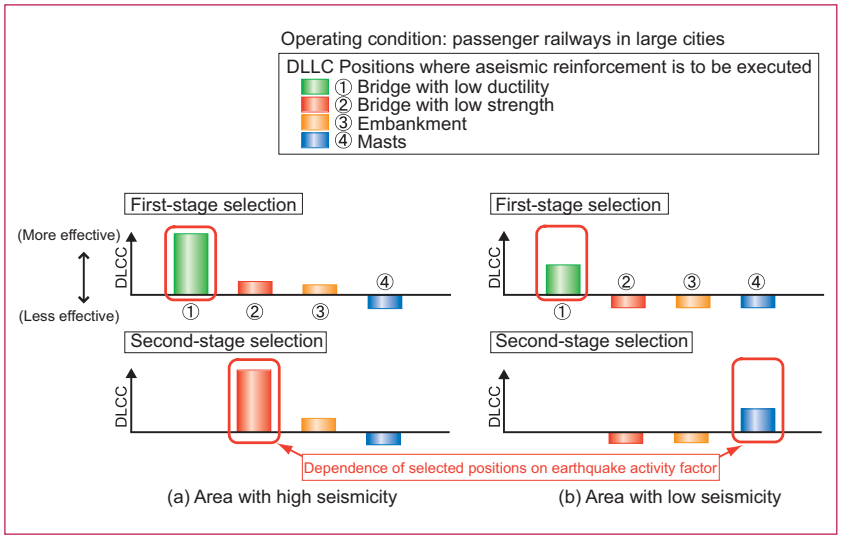


Fig. 12 Example of earthquake countermeasure priority judgment using the proposed technique

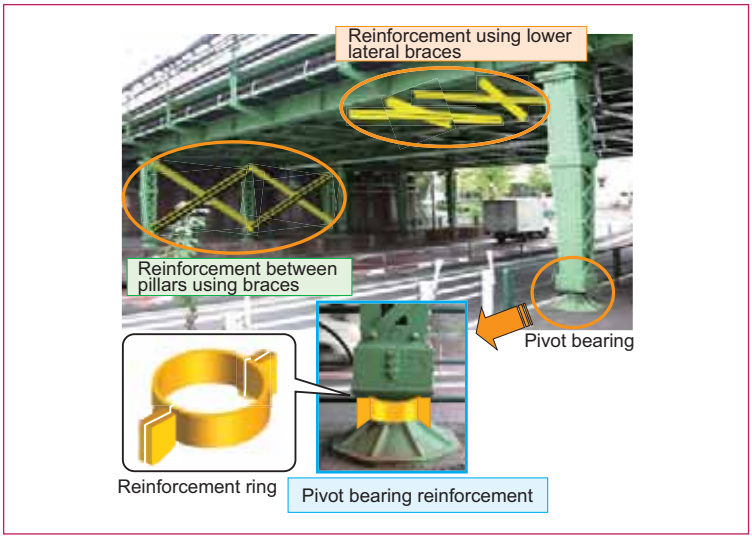


Fig. 13 Various reinforcement methods for old-type steel structures

9. An Aseismic Evaluation Technique and Reinforcement Methods for Old-Type Steel Structures with Pivot Bearings

- RTRI developed an aseismic evaluation technique for the old type steel structures with pivot bearings often found in cities.
- It also proposed a method of reinforcing girders and pillars with pivot bearings and clarified the effects of such reinforcement against a large-scale earthquake.

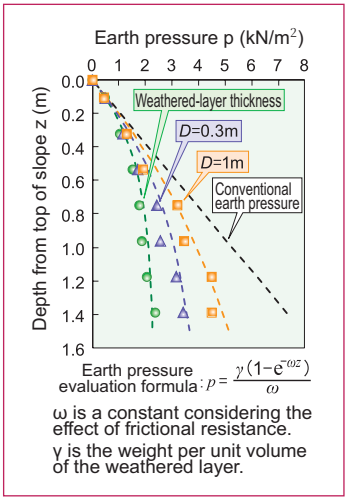


Fig. 14 Weathered layer earth pressure characteristics clarified by the experiment and calculation using the earth pressure evaluation formula

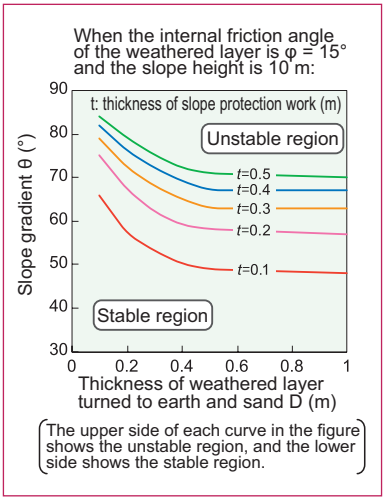


Fig. 15 Stability evaluation nomogram for slope protection work considering the cut-earth weathering layer thickness

10. Method to Evaluate the Soundness of Slope Protection Work on Cut Earth Sections

- RTRI clarified the earth pressure characteristics of the weathered layer applied in slope protection work on cut earth and proposed an earth pressure evaluation formula considering the effects of weathered-layer thickness.
- It also prepared a stability evaluation nomogram for slope protection work considering weathered-layer thickness on cut earth.

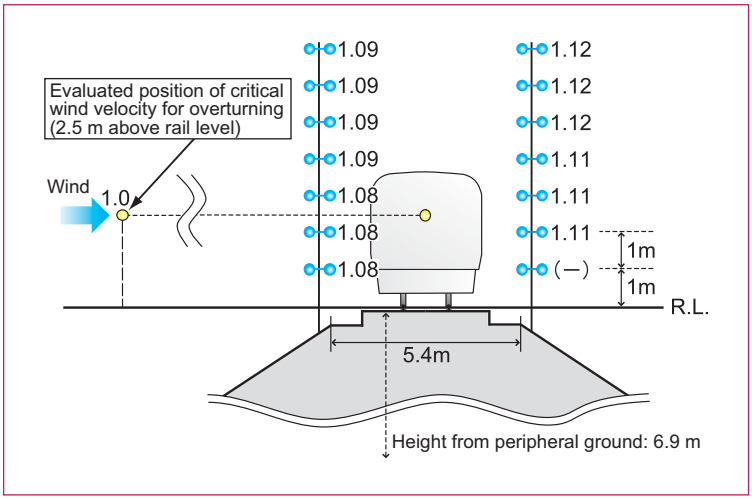


Fig. 16 Example of the ratio of maximum instantaneous wind velocity at the position of an anemometer when the wind velocity at the evaluated position of critical wind velocity for overturning is set to 1.0
(Embankment case: The wind direction is 90° against the track.)

11. Safety Evaluation for Trains in Strong Winds

- RTRI clarified the characteristics of vehicle dynamics, aerodynamics forces acting on vehicles and strong-wind under cross winds, and established a technique for quantitative evaluation of safety.
- These achievements can be utilized as countermeasures for strong winds from both sides for hardware and software.

12. A Vibration-Damping Device for Poles

- RTRI developed a vibration-damping device for poles to improve aseismic capacity and suppress overhead contact line vibration.
- The device can be easily introduced in existing facilities.

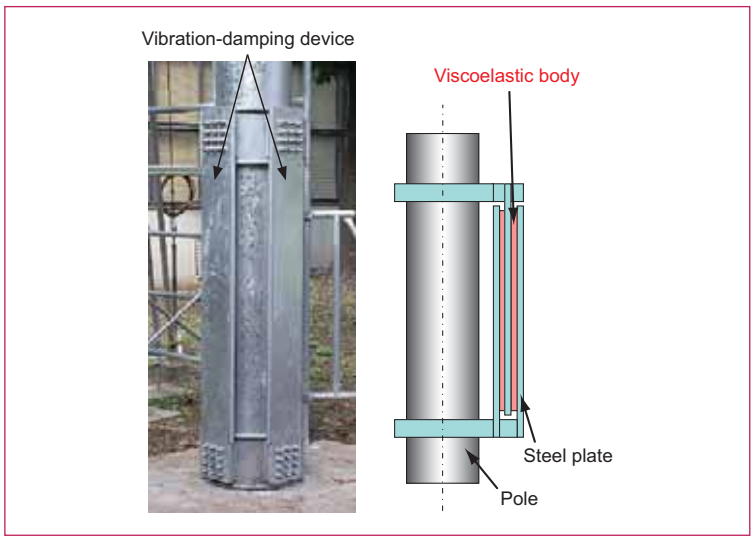


Fig. 17 Vibration-damping device for poles

13. Quantitative Evaluation of Lightning Protection Measures for Signaling Equipment due to Simulation

- RTRI proposed a lightning surge analysis model for the quantitative evaluation of lightning protection measures applied to signaling equipment installed near rails.
- It also performed an experiment to confirm that the model offers a sufficient accuracy for practical use.

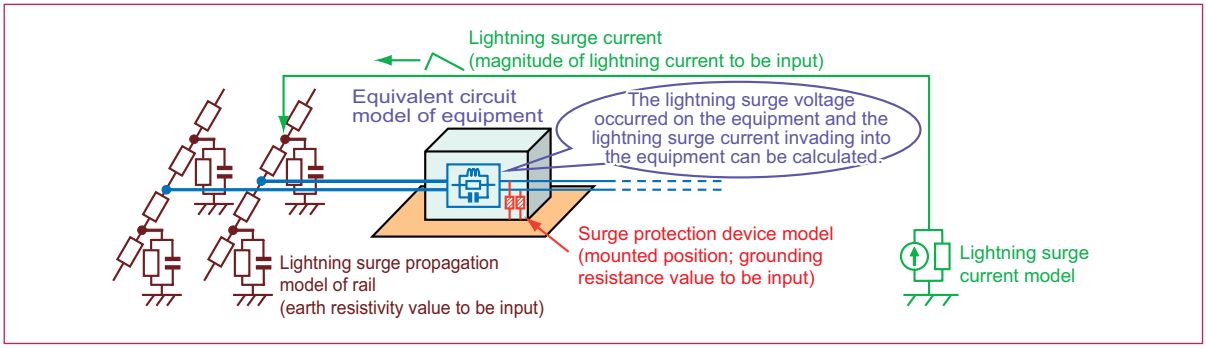


Fig. 18 Lightning surge analysis model of level crossing equipment

14. A Track Circuit with Improved Tolerance to Disturbance

- RTRI developed a new track circuit that has a large tolerance to disturbance and can respond to various section conditions.
- It also developed a method to increase tolerance to disturbance in long track circuits with only partial equipment replacement.

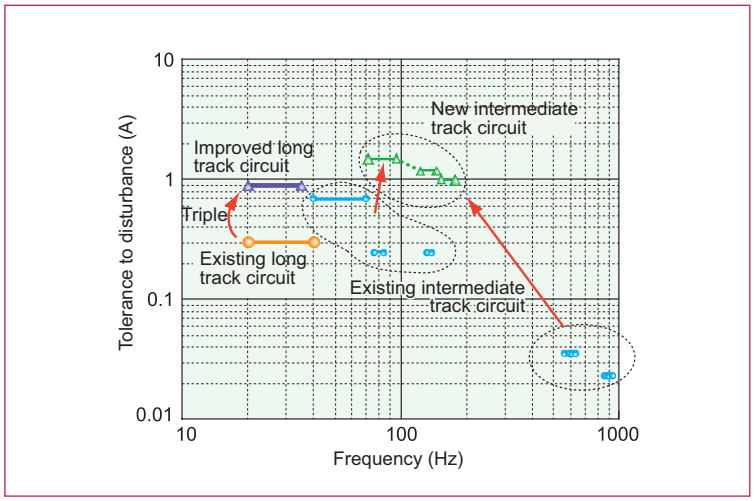


Fig. 19 Tolerance against disturbance in the intermediate track circuit developed

II. Economy/Efficiency

1. A Midterm Lubrication Mechanism Involving the Replacement of Grease for Traction Motor Bearings

- RTRI developed a lubrication mechanism to ensure the replacement of deteriorated grease with non-deteriorated grease.
- It also clarified the midterm lubrication period that maximizes the life of lubricant effectiveness.
- A lubrication life corresponding to 1.8 million km of running on conventional lines was confirmed through a bench test.

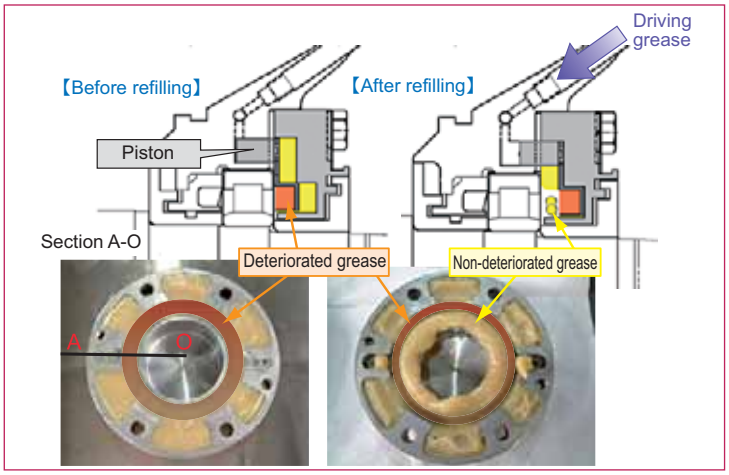


Fig. 20 The new lubrication mechanism and the state of grease refilled

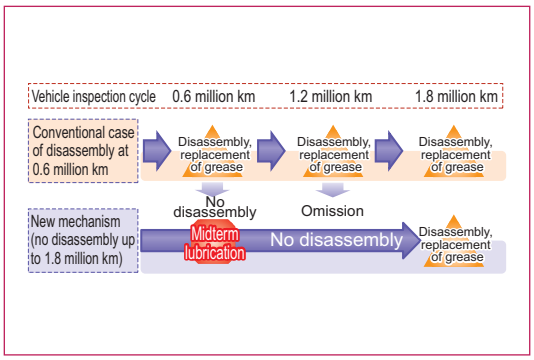


Fig. 21 Traction motor maintenance

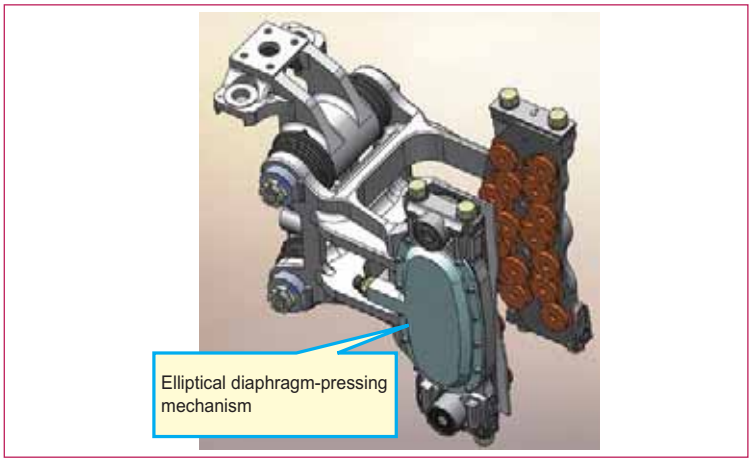


Fig. 22 Pneumatic-type floating caliper

2. A Pneumatic-Type Floating Caliper for Shinkansen Vehicles

- RTRI developed a pneumatic type of floating caliper for Shinkansen vehicles that is interchangeable with the hydraulic type.
- It also confirmed through testing that a level of brake performance equivalent to that of the hydraulic type can be achieved.

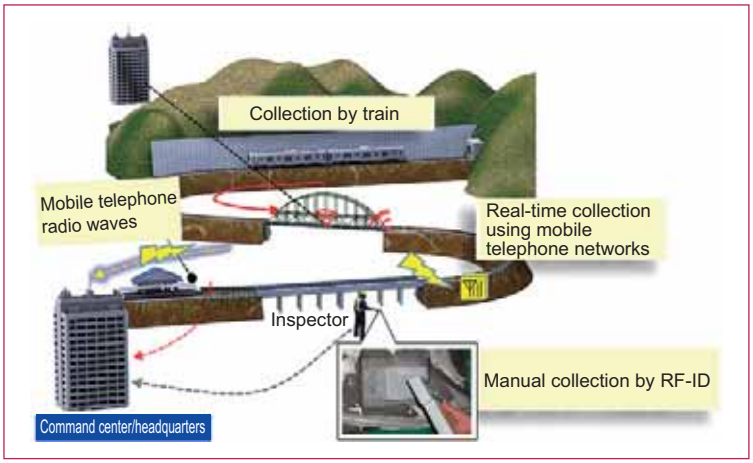


Fig. 23 Railway structure monitoring system

3. A Health Monitoring System for Railway Structures

- RTRI developed a prototype health monitoring system incorporating a sensor to respond to major harmful alterations (deformation) to railway structures and various means of data collection/transmission.
- The system can select a sensor and transmission device suitable for the purpose of monitoring in ordinary or abnormal states.

4. An Early Reinforcement ReconStruction Method for Damaged Embankments

- RTRI developed a reconstruction method to reinforce embankments in the early stages using large sandbags and reinforcing rods.
- After preliminary recovery, continuous construction work can be performed toward regular recovery while maintaining train operation for the reconstruction method.

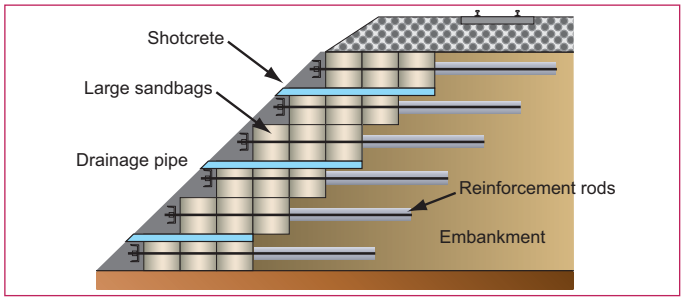


Fig. 24 Outline of the proposed reconstruction method

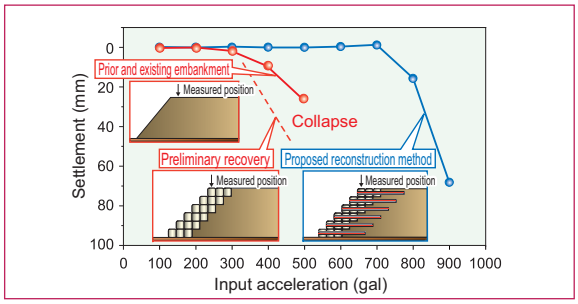


Fig. 25 Aseismic capacity with the proposed reconstruction method

5. An Index Allowing Effective Evaluation of Patch Repair Materials for Concrete

- RTRI proposed a coefficient of permeability for the interface between concrete and repairing material as an index to allow evaluation for the quality of patch repair materials.
- Control using this index enables durability enhancement after reinforcement and suppression of redeterioration.

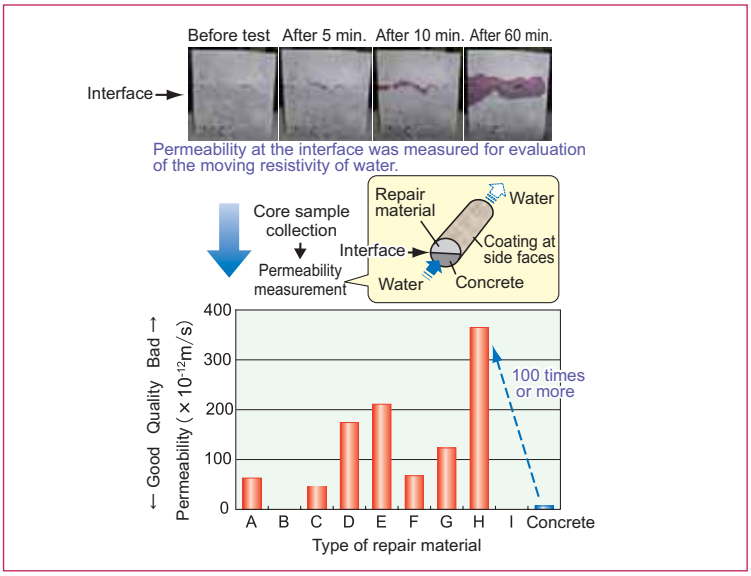


Fig. 26 Moving resistivity of water at the interface between concrete and repair material

6. A Carbody-Mounted Inertial mid-Chord Offset Method Track Inspection Device

- RTRI developed an inertial mid-chord offset method track inspection device to be mounted to the underfloor of carbodies for commercial vehicles.
- A single device set can ascertain the 10 m-chord versine waveform (as opposed to the three sets at least required in conventional track inspection), making it compact and economical.

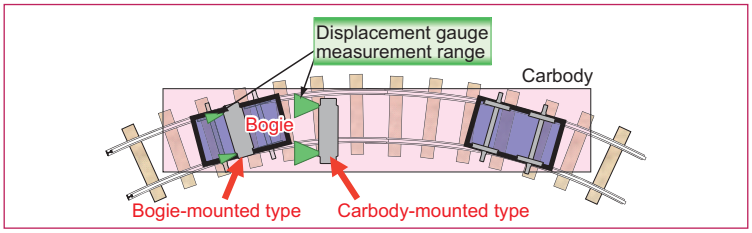


Fig. 27 Differences between bogie-mounted type and carbody-mounted type

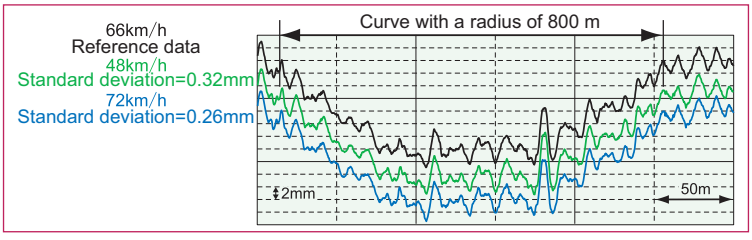


Fig. 28 Results of repeated inspections for the alignment of a 10 m-chord versine in a curved section

III. Comfort/Convenience

1. A Vertical Vibration Suppression System by Controlling Variable Damping Vertical Dampers in Parallel with Air Springs

- RTRI developed a system of variable damping vertical dampers mounted in parallel with air springs to reduce carbody rigid-body-mode vibration and bending vibration.
- It was confirmed in running tests that the system effectively improves ride quality.

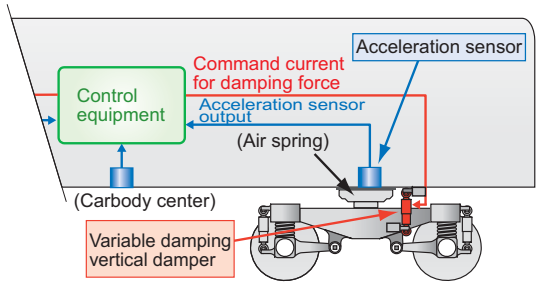


Fig. 29 Vibration control system configuration

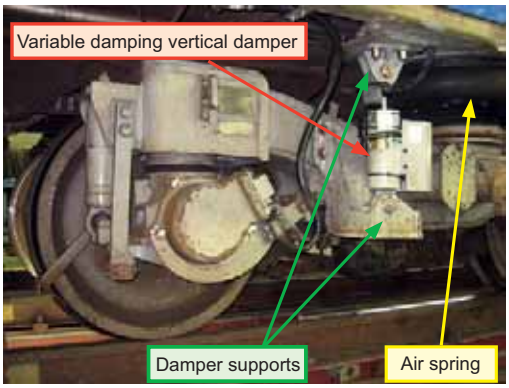


Fig. 30 Installation of the variable damping vertical damper

2. Phenomenon of Interior Explosive Sound Inside a Slab-Tracked Tunnel and a Countermeasure for its Reduction

- RTRI clarified the generation mechanism of interior explosive sound when Shinkansen train encounters a compression wave inside a slab-tracked tunnel.
- It clarified that countermeasures to reduce micro-pressure waves (e.g., tunnel entrance hood) are also effective for the reduction of the interior explosive sound.

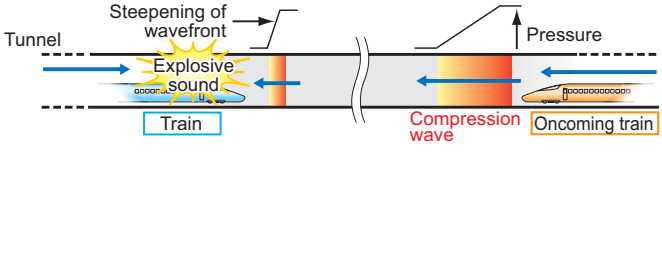


Fig. 31 Phenomenon of impact noise inside a vehicle

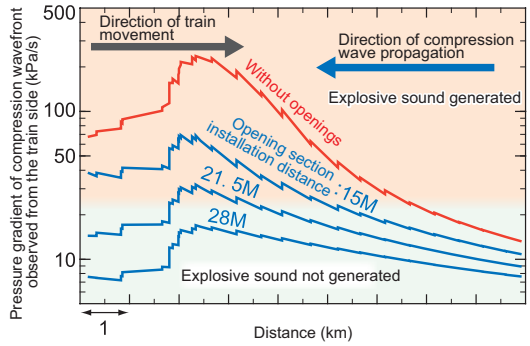


Fig. 32 Effect of countermeasures at the stage of entry of oncoming trains

3. Techniques to Estimate the Vibration Characteristics of Structural Members

- RTRI established a technique for estimating the vibration characteristics of structural members up to 200 Hz using train excitation.
- It also drew up a quick-reference chart enabling simplified estimation of member vibration characteristics and judgment of resonance generation.

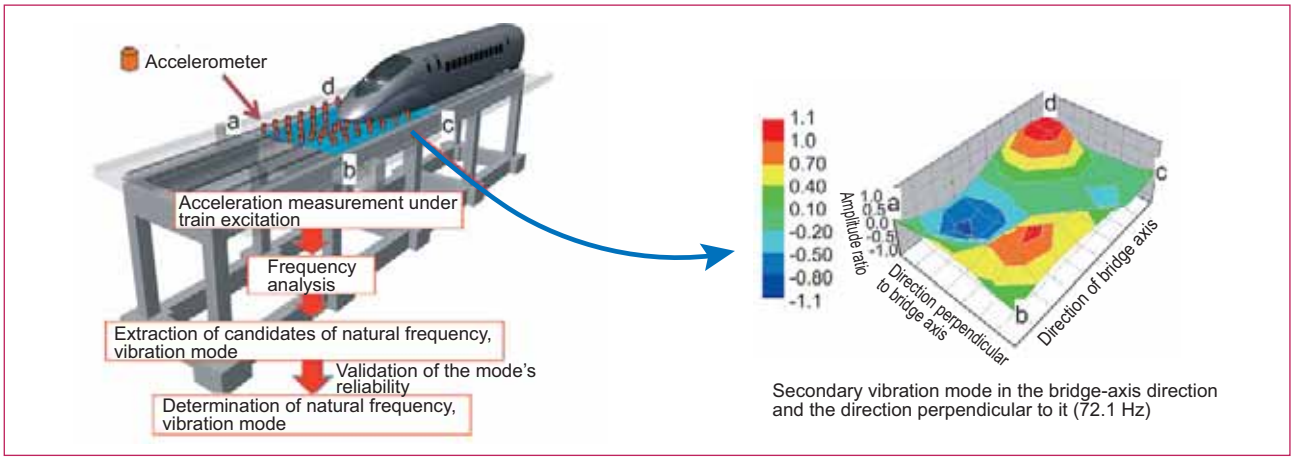


Fig. 33 Technique to estimate member vibration characteristics and an example of estimation for the vibration mode of an intermediate slab

4. Installation Guidelines Regarding Overhead Contact Lines Suitable for High-Speed Shinkansen Running

- RTRI proposed a new standard (installation guidelines) for overhead contact line installation to realize stable current collection even in high-speed running beyond 300 km/h.

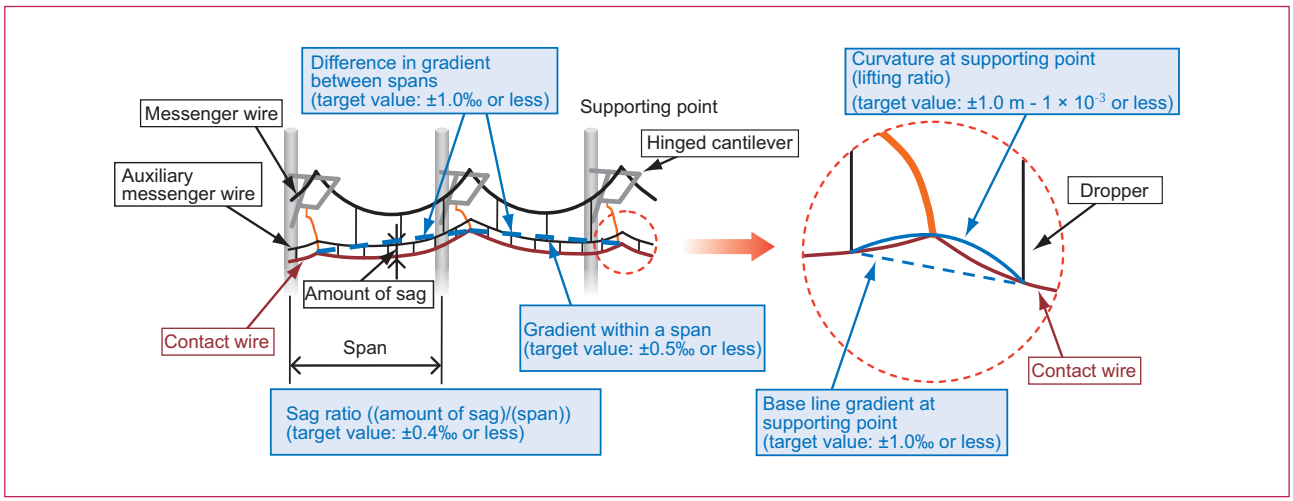


Fig. 34 Installation error index and target values (example of 300 km/h)

IV. Harmonization with the Environment

1. An Energy Simulator for Diesel Hybrid Vehicles

- RTRI developed an energy simulator for diesel hybrid vehicles that can be used to draw up a train performance curve and calculate energy consumption.
- The simulator is applicable to various hybrid system configurations.

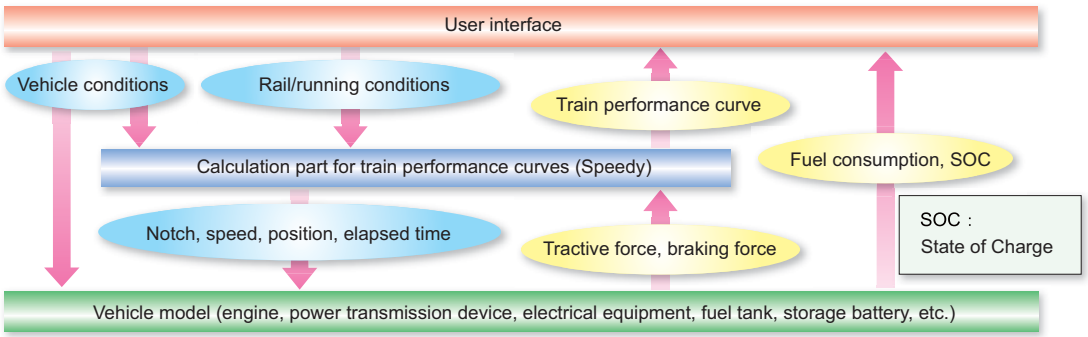


Fig. 35 Overall simulator configuration

2. Prediction Model for Rolling Noise/Concrete-Bridge Noise and Evaluation of the Effects of Countermeasures

- RTRI developed a prediction model for rolling noise and concrete-bridge noise.
- The effects of countermeasures for rolling noise/concrete-bridge noise are estimated.

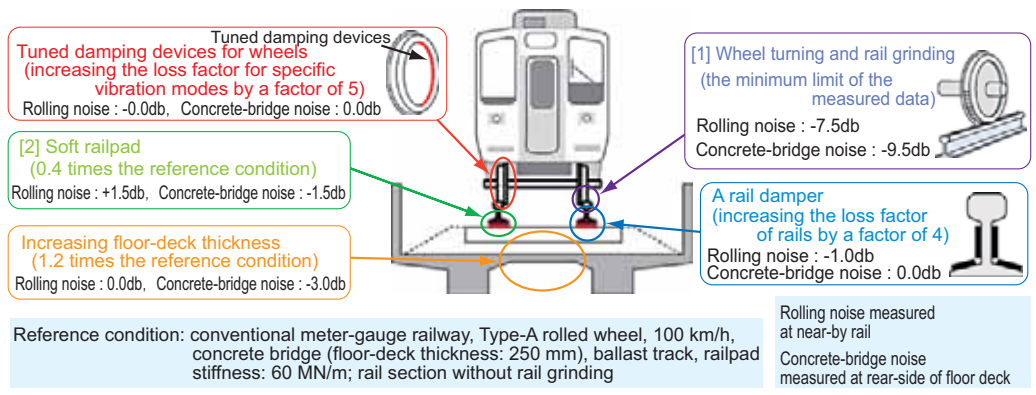


Fig. 36 Estimation of the noise reduction using the prediction model for rolling noise and concrete-bridge noise

V. Basic Research

1. Simulation-Based Clarification of Aerodynamic Noise Reduction Mechanism by Pasting Porous Material

- RTRI implemented simulation and wind tunnel experiment to clarify that aerodynamic noise can be reduced through stable airflow formation by applying porous material to allow air suction and blowing into/from the material.

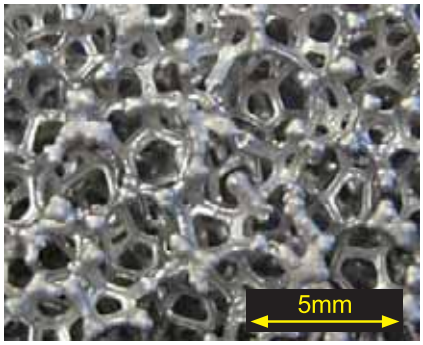


Fig. 37 Porous material with open cells

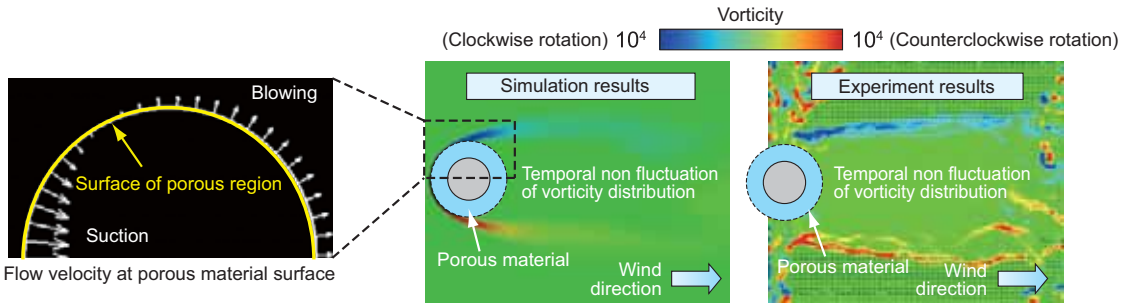


Fig. 38 Vorticity and flow velocity with porous material

2. Numerical Simulation of Flow Around Vehicles Subjected to Lateral Winds

- RTRI developed a numerical simulation program that models natural wind and reproduces the flow around structures and vehicles.

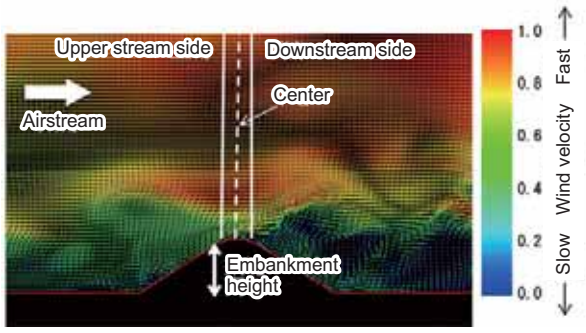


Fig. 39 Vector of instantaneous wind velocity near an embankment

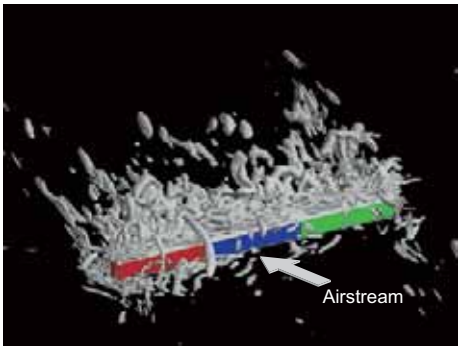


Fig. 40 Flow around the vehicles of a three-train set (visualization of vortex structure)

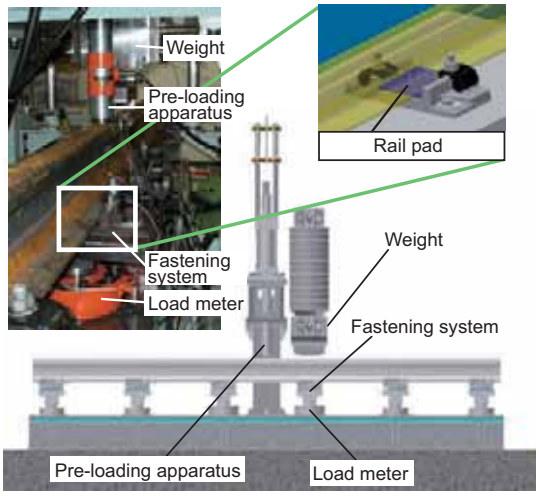


Fig. 41 Impact experiment apparatus developed

3. Evaluation Techniques for the Buffering Performance of Rail Pads

- RTRI developed apparatus for impact experiments considering the load conditions of actual tracks.
- It also developed a technique to evaluate the buffering performance of rail pads by measuring impact response variables such as rail pressure using the apparatus for impact experiments.

4. A Linear Rail Brake Prototype

- RTRI experimentally produced a linear rail brake and confirmed that a braking force of up to 6 kN and a reduction effect on rail heat generation of 20 to 50% can be achieved with a roller rig testing machine.
- It also developed an inverter control system capable of brake operation even in the event of feeder circuit failure.

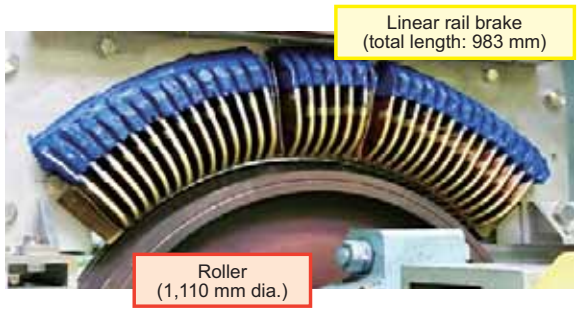


Fig. 42 Linear rail brake prototype

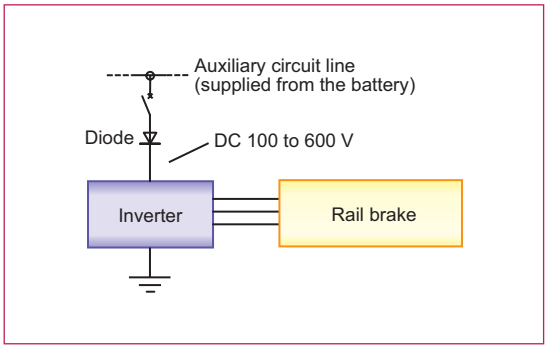


Fig. 43 Circuit configuration capable of operation even during feeder circuit failures (example of battery use for auxiliary circuit)

5. Small Scale Superconducting Magnet Using 2nd-Generation High-Temperature Superconducting Wire

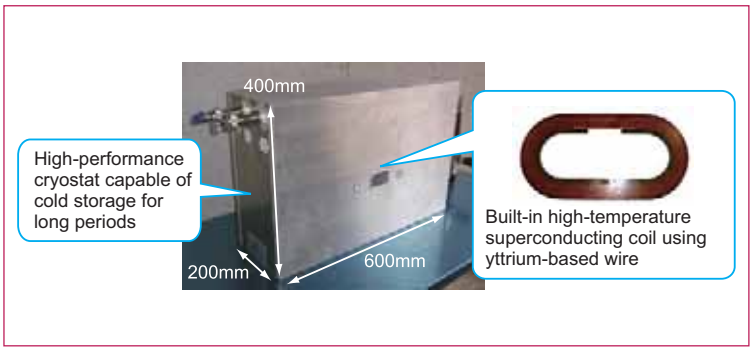


Fig. 44 Small scale superconducting magnet

- RTRI manufactured a high-temperature superconducting coil that can generate a magnetic field of 1 T at 50 K.
- It also developed a high-performance cryostat that can keep the coil below 50 K for nine hours without a cryocooler.
- From the above, small scale superconducting magnet that can generate a magnetic field of 1 T for long periods was developed.

International Activities

1. Collaborative research with overseas institutes

RTRI has three major agreements to collaborate at an international level: with China and Korea, with SNCF in France, and with RSSB in the UK. In 2009, RTRI collaborated on various fields of research under all three agreements.

In addition, several research divisions also implemented collaborative research separately with overseas railways and universities.

(1) China-Korea-Japan research collaboration

The China-Korea-Japan collaborative research agreement was originally two separate bilateral relationships: RTRI and CARS, China Academy of Railway Sciences, and RTRI and KRRI, Korea Railroad Research Institute. These two collaborative research programmes have evolved into a single trilateral programme of collaboration among the three organizations, and, since 2001, a China-Korea-Japan research seminar has been held every year, rotating among the three countries for the presentation of research results and exchange of technical information. The 9th seminar was held in Beijing where CARS hosted the event in December 2009.

Currently RTRI is participating in projects relating to life-cycle cost, soil contamination, measurement technology for overhead contact lines and pantographs, safety of high-speed vehicles against derailment, EMC testing methods, and investigation and sharing of literatures about railway technologies.

(2) SNCF-RTRI research collaboration

RTRI and French National Railways (SNCF: Société Nationale des Chemins de Fer Français) have been collaborating in the research field since the two organizations signed an agreement in November 1995. In May 2007, a research seminar was held in France, and the fourth phase of collaborative research started.

9th China-Korea-Japan Railway Research Technical Meeting, December 2009

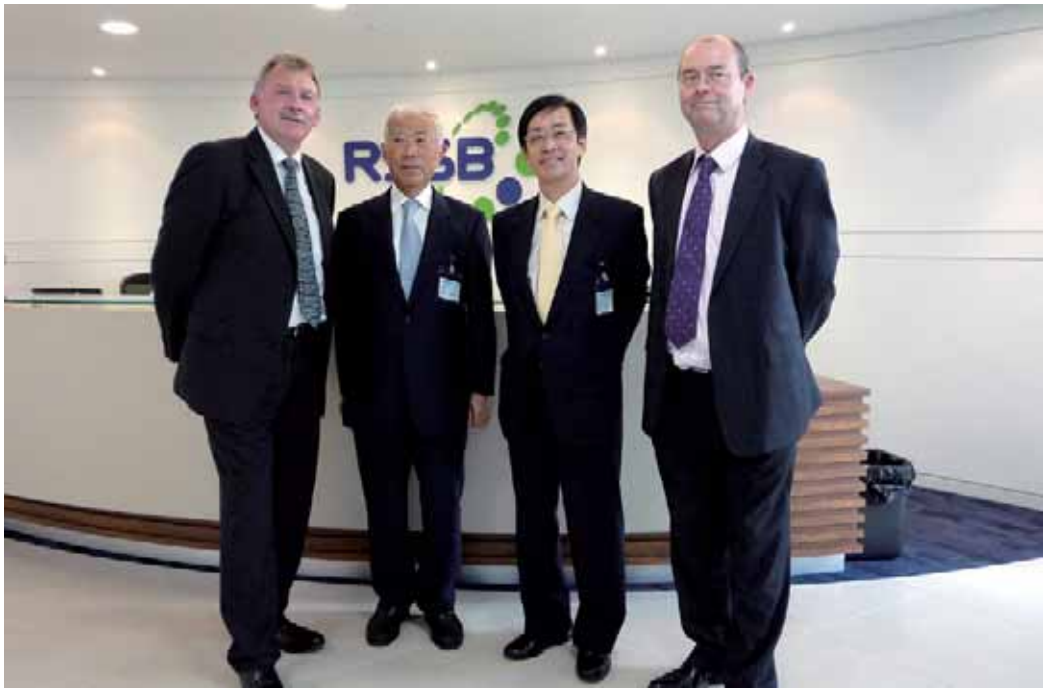
The main fields of research are vehicles, track, power collection, track circuits, ride comfort, fuel cells, and measures against derailment; a further seminar was held in Tokyo in April 2010.

(3) RTRI-RSSB collaborative research

RTRI and Railway Safety & Standards Board (RSSB) of the United Kingdom signed a collaborative research agreement in October 2008, and collaborative research has been in progress since December 2008. The main fields of research are a safety database and technologies for detecting flaws in axles.

(4) Collaborative research with other institutes

Regarding railway companies, RTRI signed a research co-operation agreement with Swiss Federal Railways and has been conducting collaborative research in the field of transit information. RTRI has also been conducting collaborative research with universities such as GeoDelft (GD; Delft geo-research institute) in the Netherlands (durability of city tunnels), the University of Newcastle (tracks) in the UK, Massachusetts Institute of Technology (MIT; materials) in the USA, and Cambridge University (structures) in the UK.



RTRI and RSSB meeting, September 2009

2. Support for WCRR events

The World Congress on Railway Research (WCRR) originated with an international seminar held by RTRI in Tokyo in 1992, when RTRI invited executives from major railways around the world, who are in charge of research and development, to come and share their experience. It has developed into a series of international congresses, in which railway engineers and researchers from all around the world participate, focusing primarily on railway technologies, especially on research activity.

To support the organization of WCRR 2011, which is planned to be held in May 2011 in Lille, France, RTRI has been sending executive directors and staff members to the Organizing & Executive Committee. Through the work of organizing and executive committees, RTRI has been striving to encourage the submission of research papers, to seek sponsors and to identify organizations that will take part in the exhibition.

3. Co-operation with domestic organizations

RTRI has co-operated with domestic rail-related organizations and contributed to the strengthening of relationships with overseas railways.

RTRI participated in intergovernmental working-level meetings between Japan and the UK in Tokyo, between Japan and Korea in Seoul, between Japan and China in Tokyo, and between Japan and Vietnam in Hanoi, which were organized by the Ministry of Land, Infrastructure, Transport and Tourism (MLIT).

RTRI also participated in meetings about high-speed rail projects in California and Brazil in co-operation with MLIT, Japan Railway Technical Service (JARTS), and Japan-China Railway Friendship Promotion Association. In addition, RTRI accepted long-term trainees from China and visitors from various overseas organizations.

4. Collection of overseas technical information

RTRI has seconded researchers to UIC (International Union of Railways = Union Internationale des Chemins de Fer) and gathered information on research and development in European railways. Further, RTRI participated in the UIC's meetings of experts, and made a presentation at the UIC high-speed rail workshop.

5. Other activities

(1) International conferences

RTRI is well advanced with preparations for hosting the 10th International Workshop of Railway Noise (IWRN 10) in Nagahama in October 2010.

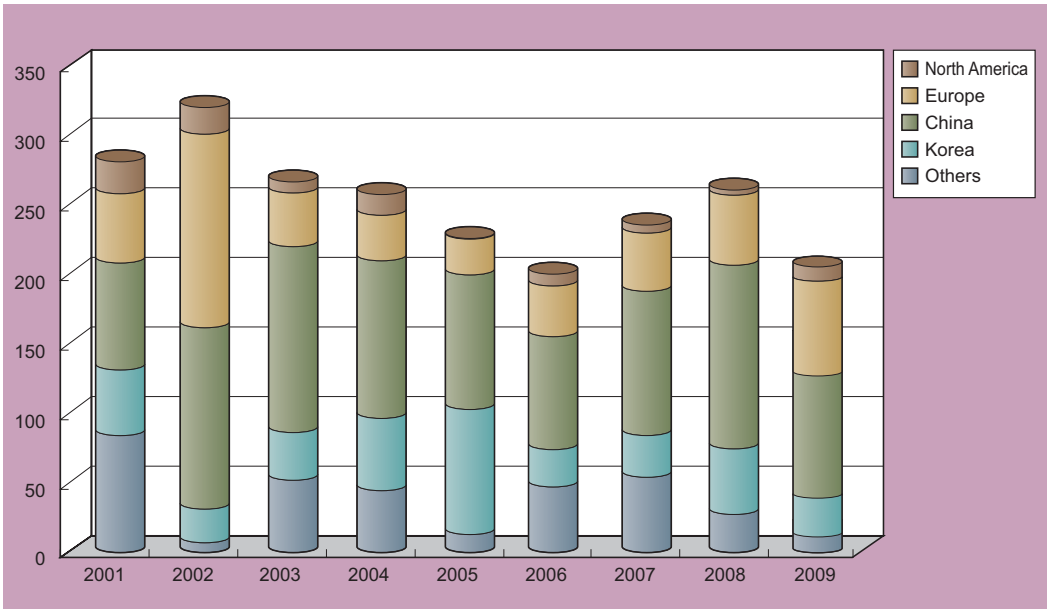
(2) Sending out information

RTRI has issued its regular Newsletter four times, and further, it issued the annual report for 2008 in English.

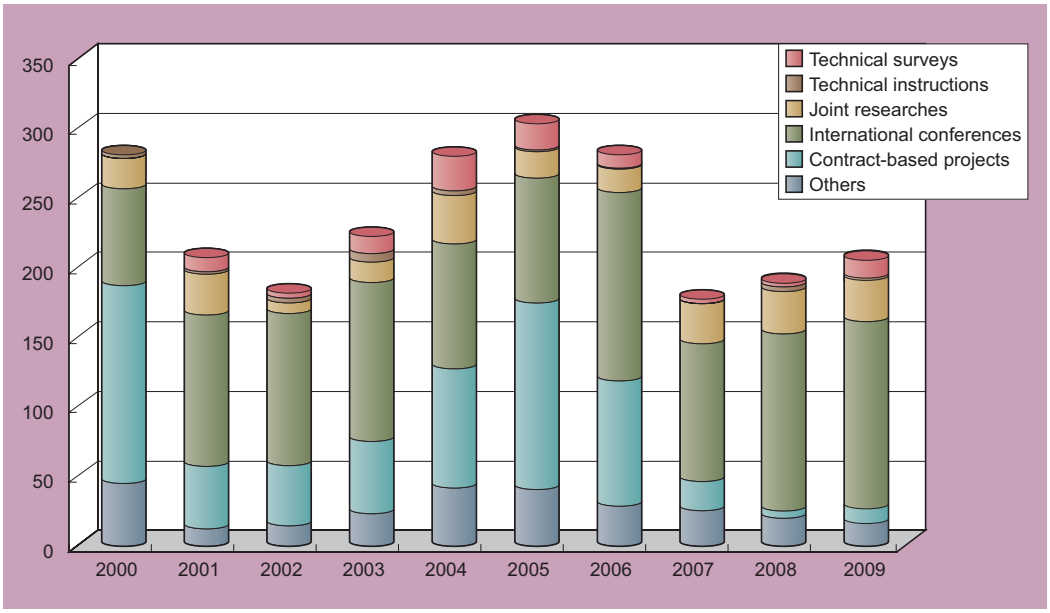
6. Visitors and Business trips

The statistics on visitors to RTRI from overseas (classified by country) and on RTRI staff who made business trips abroad (classified by purpose of visit) are shown in the following figures.

(1) Visitors from overseas



(2) Business trip to overseas



7. International Standards Survey Center

As a domestic review organization of the International Electrotechnical Commission (IEC) TC9 (= Electrical Equipment and Systems for Railways), RTRI held domestic committee meetings of TC9 as well as various working group conferences; it also reviewed various proposed standards. RTRI promoted the development of standards which were proposed by Japan for the short-stator linear induction motor (LIM), for the in-train communication network (TCN) of the Ethernet type, and for capacitors for rolling stocks (electrolytic capacitors and electric double layer capacitors). Regarding standards for radio-based train control, RTRI performed a feasibility study and prepared to deal with new proposals in the ad hoc group.

In November, RTRI joined the JISC-CENELEC information exchange meeting held in Milano, exchanging information with the railway working group.

RTRI held an international standards seminar in January 2010, targeting domestic railway-related personnel. Moreover, RTRI supported a workshop hosted by the IEC activity promotion conference (IEC-APC) of the Japanese Standards Association (JSA), targeting the railway field, and a member of RTRI gave an address.

8. Preparatory Office for Railway International Standards Center

RTRI established the Preparatory Office for the Railway International Standards Center in the International Affairs Division in July 2009. With the objective of advancing international standardization activities in the field of railway technologies in the International Organization for Standardization (ISO), in addition to the conventional IEC/TC9, in an integrated fashion, RTRI took the following steps in preparation:

(1) RTRI sought and recruited members who were in agreement with the organisation's objectives.
(2) RTRI co-ordinated the functions of domestic review organizations dealing with railway-related ISO standards in order to take over the responsibilities of the secretariat for railway-related matters.
(3) RTRI revised its internal regulations in order to set up the Railway International Standards Center.

Appendix

A Brief History of RTRI

Date		Events
1907		Founded as an in-house research institute of the Japanese government.
1949		Became an in-house research institute of the Japanese National Railways (JNR).
1986	Dec. 10	Establishment of RTRI as an independent organization authorized by the Minister of Transport.
1987	Apr. 01	RTRI inherited the R&D arm of JNR upon its division and privatization.
	Jun. 17	Running tests of the MLU002-type car started at the Miyazaki Maglev Test Track.
1988	Sept. 27	RTRI Seminar on deep-underground railways held.
	Nov. 09	First RTRI Lecture on "Improving the Railway System."
1990	Jun. 25	Basic plans of the technological development of the superconducting magnetically-levitated transport system and the construction of the Yamanashi Maglev Test Line approved by the Minister of Transport.
	Nov. 15	New rolling stock test plant completed.
1991	Mar. 22	RTRI's Mid- and long-term master plan formulated.
	Mar. 31	Test Plant E (human science) completed.
	Oct. 16	First railway technology exhibition (forerunner of the current RTRI Forum).
1992	Sept. 29	First lecture series on education (forerunner of the current Railway Technology Courses).
	Oct. 13	International railway research seminar on "R&D in World Railway -Today and Tomorrow-" (later developed into WCRR).
	Dec. 15	Japan-China joint research started.
1993	Jan. 31	Brake Test Stands completed.
1994	Nov. 04	RTRI website went on-line as the world's first official site on railway technologies.
	Nov. 13	Agreement on cooperative research concluded with the International Union of Railways (UIC).
1995	Jan. 17	Hyogo-ken Nambu earthquake (participation in recovery support activities).
	Jan. 26	MLU002N-type car attained 411 km/h in manned running at the Miyazaki Maglev Test Track.
	Mar. 29	Mid- and long-term master plan revised.
	Nov. 13	Agreement on cooperative research concluded with French National Railways (SNCF).
1996	Jun. 05	Large-scale low-noise wind tunnel completed.
	Jul. 01	Yamanashi Maglev Test Center opened.
	Jul. 01	Railway Technology Promotion Center opened.
1997	Mar. 21	First railway design engineer examination administered.
	Apr. 03	Vehicle running tests started on the Yamanashi Maglev Test Line.
	Jun. 01	RTRI joined UIC.
	Sept. 03	RTRI Technical Forum was held.
1999	Oct. 19-23	World Congress on Railway Research 1999 (WCRR '99) held at RTRI.
2000	Mar. 09	The Committee for the Evaluation of the Technological Feasibility of Maglev commented that the JR Maglev has the practicality for ultra-high speed mass transportation system.
	Apr. 01	RTRI's Master Plan "*RESEARCH 21*" started.
	Jun. 28	Japan-Korea joint research started (forerunner of the current Japan-China-Korea joint research).
2002	Mar. 19	Current-collection testing facilities improved to perform testing at 200 km/h.
2003	Mar. 31	Rail Advisor Program established at the Railway Technology Promotion Center.
	Dec. 02	The world speed record of 581 km/h for a manned train (MLX01) attained on the Yamanashi Maglev Test Line.
2004	Oct. 14	Railway Technology Promotion Center won the Japan Railway Awards' Special Award for 2004.
	Oct. 23	Niigata Chuestu earthquake (participation in recovery support activities).
	Nov. 16	Two-train crossing test at a relative speed of 1026 km/h on the Yamanashi Maglev Test Line.
2005	Mar. 11	The Committee for the Evaluation of the Technological Feasibility of Maglev commented that the key technology for practical application has been established.
	Apr. 01	New Master Plan (*RESEARCH 2005*) formulated.
	Nov. 02	New test car introduced.
2006	Apr. 26	Running test of fuelcell railway vehicle succeeded.
2007	Aug. 08	Accumulated running distance of the Maglev trains reached 600 thousand kilometer at the Yamanashi Maglev Test Track.
	Oct. 25	A battery-driven, energy-recycling light-rail vehicle opened to the Public.
2008	Oct. 31	Completed Large-scale shaking table.
2009	Jul. 01	Launched a section tasked with preparing for the Railway International Standards Center.

Details of Research Subjects

Research subjects			The number of research subjects
Highly reliable railways	Ensuring safety	Prevention of natural disasters	16
		Improving running safety	16
		Improving passenger safety	2
	Ensuring stable transportation	Improving reliability of facilities	25
		Safety control	6
Highly convenient railways	Improving journey times and convenience	Increasing speed on existing lines	5
		Increasing speed on the Shinkansen	3
		Strengthening and increasing flexibility of transportation	3
	Improving transportation service	Improving transportation in urban districts	2
		Improving ride quality	2
		Barrier-free facilities	1
		Improving information service	4
Low cost railways	Improving inspection technology and diagnosis technology	Enhancing efficient inspection	6
		Increasing inspection accuracy and diagnostic accuracy	7
	Improving security	Extending the life of vehicles, facilities, and materials	16
		New design methods, repair methods, and structures	28
	Systematic organisation of security	Efficient processing of security information	2
	Efficient transportation works	Enhancing efficient transportation control and planning	5
Environmentally friendly railways	Improvement of wayside environment and in-vehicle environment	Measures to reduce noise and low-frequency sound	7
		Measures to reduce vibration	1
	Promotion of ecology	Energy-savings	6
		Other environmental measures	2
Basic research of railways (Conventional railways)	Analytical research	Dynamics and Tribology specific to railway technology	11
		Simulation	20
		Safety and reliability	35
		Human factors	7
	Leading-edge research	New technologies (sensing technology, monitoring technology, etc.)	12
		New materials	5
Basic research of railways (Levitated railways)	Clarification of phenomena during high-speed running		2
	Evaluating the performance of superconducting magnet, etc. and diagnosis technology for the performance, etc.		6
Technical standards			9
Survey study			5
Total			278

Industrial Properties

	Independently Owned	Jointly Owned	Total
Patents	1264	954	2218
Utility Models	0	0	0
Designs	21	0	21
Total	1300	966	2266

(as of March 31, 2010)

Number of Foreign Patents

Number of Registered Patents	Number of Countries where Patents are Registered
57	126

(as of March 31, 2010)

Master Plan of RTRI (RESEARCH 2010)

A five-year master plan covering the activities of the Railway Technical Research Institute (RTRI) has started. Since April 2010, RTRI's research and other activities have been based on the New Master Plan.

The name of the New Master Plan has been defined as "RESEARCH 2010 - In Pursuit of Sustainable Development for Railways". By reflecting the progress of research and development and changes in the circumstances surrounding railways, this New Master Plan is aimed at effectively promoting activities to fulfill RTRI's commitments to various industries. The Plan aims to ensure that RTRI will carry out a comprehensive range of activities as a railway technical research institute and pursue sustainable railway development. For this purpose, RTRI has set out the following basic policies:

(1) Creation of new technologies aimed at sustainable development of railways

(2) Accurate and quick response to demand

(3) Information transmission and dissemination of results from its activities

(4) Inheritance of railway technologies and using foundation technologies as the basis for more advanced research

(5) Demonstration of expertise in research across the whole railway engineering spectrum as a railway engineering group

Moreover, for targets of research and development,

In the area of railways, RTRI will further pursue:

- Improved safety
- Harmony with the environment
- Low cost
- Improved convenience

At the same time, RTRI will expand its specialist area by making greater use of simulation technologies. Figure 1 shows research and development activities in the New Master Plan. Regarding research and development for the future of railways, five major themes have been set, as shown in Fig.2, and several sub-themes composed of multiple research/development topics have been set within the respective themes, as shown in Table 1. Each sub-theme has been determined so as to promote a systematic way of working, according to targets set within the major themes. Tables 2 and 3 also provide lists of typical themes in the development of practical technologies and basic research for railways.

For the operational side, RTRI will make special efforts for the inheritance of railway technologies to ensure that knowledge of railway technologies acquired in the past is transferred to today's research teams, so that technical gaps will not open up between old and new generations. In 2010, the first year of the Master Plan, a new organization, the Railway International Standards Center, has been established, and RTRI will support this new organization.

We, the staff members of RTRI, are determined to make efforts to support and develop the Japanese railway industry and so contribute to the development of Japan's social economy. This role goes back to the principle of establishing the Research Institute when reforms associated with the privatization of JNR were introduced. Now, RTRI is at the stage of implementing wide-ranging advanced research and development, working from basic research to sophisticated applications, while promoting close co-operation with railway companies and enterprises.

We ask for your support and encouragement.

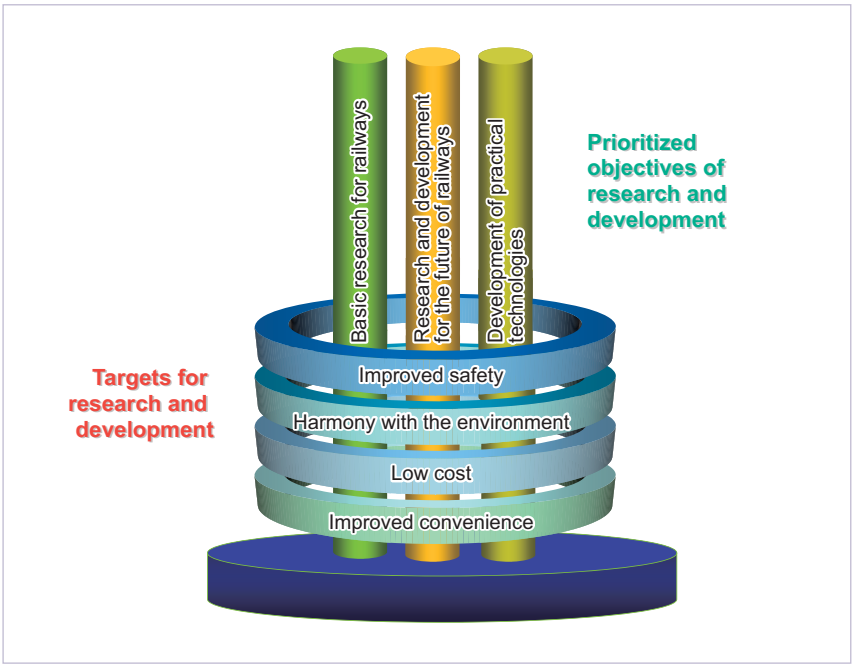


Fig. 1 Research and development activities at RTRI

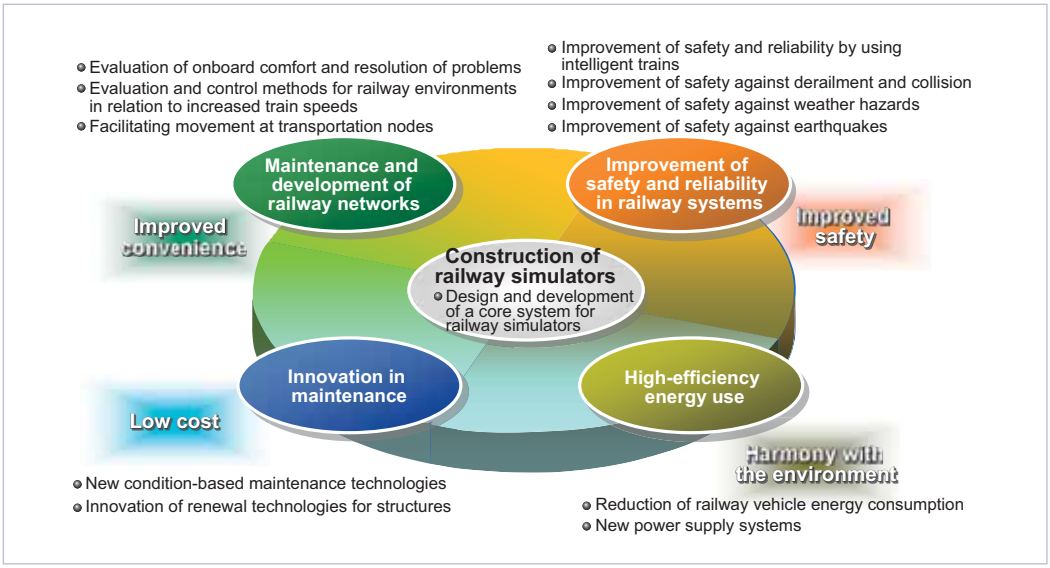


Fig.2 Research and development for the future of railways

Table 1 Sub-themes regarding R&D for the future of railways

Major theme: Improvement of safety and reliability in railway systems
[Purpose] Drastic improvement of safety and reliability in railways is targeted through the promotion of development toward highly intelligent railway systems and anti-derailment bogies as a means of preventing railway accidents, and through the promotion of measures against natural disasters such as earthquakes.
[sub-themes and main efforts] » Improvement of safety and reliability using intelligent trains • Advanced train safety control systems • Onboard sensing • Train's driver support » Improvement of safety against derailment and collision • Anti-derailment bogies • Collision safety evaluation methods » Improvement of safety against weather hazards • Local weather simulation models • Hazard mapping technology • Rainfall and landslide hazard evaluation methods » Improvement of safety against earthquakes • Structural safety evaluation methods and countermeasure technology for large-scale earthquakes

Major theme: High-efficiency energy use
[Purpose] The construction of railway systems capable of high-efficiency energy use is targeted through the proposal of vehicles featuring reduced energy consumption thanks to lower air resistance, efficiency improvements and weight reduction of equipment, etc., and new power supply systems with reduced running energy consumption per passenger-kilometer.
[sub-themes and main efforts] » Reduction of railway vehicle energy consumption • Weight reduction using new materials • Reduction of air resistance • Improvement of efficiency for onboard equipment • Consumption energy evaluation simulation » New power supply systems • Superconducting flywheels • Superconducting feeding cables • Low-loss semiconductor elements • Use of natural energy

Major theme: Innovation of maintenance
[Purpose] The reduction of maintenance costs is targeted through the establishment of status monitoring methods, abnormality detection and diagnosis technologies, aging prediction methods for maintenance targets and the development of renewal technologies for structures requiring large-scale improvement.
[sub-themes and main efforts] » New condition-based maintenance technologies • Condition-based maintenance technologies for targets • Aging prediction methods » Innovation of renewal technologies for structures • Structure renewal methods

Major theme: Maintenance and development of railway networks
[Purpose] Maintenance and development of railway networks by leveraging the advantages of railways and thus boosting demand for railway transport are targeted through the development of evaluation methods for ride comfort, prediction and evaluation methods for railway environments accompanied with increased train speeds, and movement facilitation technologies for stations and surrounding areas.
[sub-themes and main efforts] » Evaluation of onboard comfort and resolution of problems • Evaluation and control methods for vibration and noise based on sensory characteristics » Evaluation and control methods for railway environments in relation to increased train speeds • Evaluation and control methods for railway environments » Facilitating movement at transportation nodes • Movement facilitation at stations and in surrounding areas • Railway-centered inter-modal transportation plans • Evaluation methods for passenger and freight transportation networks

Major theme: Construction of railway simulators
[Purpose] Development of simulators to realize actions in various fields constituting a railway system is targeted. An integrated combination of such equipment is utilized as an advanced railway simulator.
[sub-themes and main efforts] » Design and development of a core system for railway simulators • Ground and structure group models • Airflow and aerodynamic noise simulators • Overhead contact line and pantograph simulators • Virtual railway test line prototypes

Table 2 Typical theme examples in the development of practical technologies

Theme
- Post-earthquake early operation restart support system - Automatic fault locator for railway AC power lines - Efficient track repair for low-traffic sections - Assessment of aerodynamic force reduction effects provided by windbreak fences

Table 3 Typical themes in basic research for railways

Classification	Theme
Sophistication of simulation technologies	- Construction of a crack-life simulation model for wheels and axles - Study on the elucidation of lateral aerodynamic characteristics on running vehicles through numerical simulation
Elucidation of factors causing deterioration and damage	- Analysis of mass movement and chemical reaction inside concrete members - Construction of abrasion and crushing models for ballast
Enhancement of various assessment technologies such as risk assessment	- Analysis method for potential demand and modal shift possibilities for railway freight - Creation of a risk assessment model in view of social conditions - Method for measuring and assessing magnetic field spatial distribution
Human factors	- Study on signs for driving and control errors - Construction of a safety and security model in view of social factors

Recognition Record

Sponsoring organization	Award winner	Award	Date of commendation
Commendation by Minister of Education, Culture, Sports, Science and Technology	Yoshihiro Terashita	Originality and ingenuity award for distinguished service	April 13, 2009
Commendation by Ministry of Economy, Trade and Industry	Hiroyuki Nozawa	Encouragement award for international standardization	October 15, 2009

Sponsoring organization	Award
Academic associations	• The Japan Society of Mechanical Engineers: Award of the Japan Society of Mechanical Engineers • The Japanese Geotechnical Society: Excellent Paper award for Young Researchers of the year 2008 • Japan Society of Civil Engineers: Research paper award, Technology development award, Encouragement award for excellent presentation at the Tunnel Engineering Workshop, Award for excellent presentation in the Tunnel Engineering Workshop, Research paper incentive award of the Japan Society of Civil Engineers • The Institute of Electrical Engineers of Japan: Excellent research paper publication award of the Institute of Electrical Engineers of Japan • The Institution of Mechanical Engineers (IMechE), UK: PE publisher award selected by the editorial committee • The Japan Society of Mechanical Engineers: Excellent research paper & lecture in the transport, logistics division, General assembly award in the transport, logistics division, Performance award in the transport, logistics division • The Japan Fluid Power System Society: Best lecture award • The Carbon Society of Japan: Technical award of the Carbon Society of Japan
Other associations	• Nationwide invention award of the Japan Institute of Invention and Innovation, Director-General's award of the Japan Patent Office, Invention working performance award, Invention award • Fluid Power Technology Promotion Foundation: Research paper public commendation • Japan Electric Association: Shibusawa award • The Japan Railway Civil Engineering Association: Technical award • The Japan Railway Civil Engineering Association: Sakata memorial award – Outstanding performance award • Japan Railway Electrical Engineering Association: Railway electrical engineering award • Association of Railway Architects: ARA prize • The Promotion Foundation for Electrical Science and Engineering: Incentive award of the Promotion Foundation for Electrical Science and Engineering
RTRI's in-house award	[Outstanding achievement award for research & development] • Development and practical implementation of the ATS-X on-board speed checking system • Research into re-establishing adhesion during wheelslip in consideration of axle weight transfer [Outstanding achievement award] • Production of large vibration test equipment • Synoptic evaluation of aseismic capacity, targeting whole line sections • Investigation of causes for earth faults in a substation circuit breaker [Achievement award for research & development] • Development of a monitoring device for seismic damage of viaduct piers • Evaluation technique for winds caused by trains passing station platforms • Development technique for the shape of snow ploughs suitable for regions of heavy snowfall • Development of a verification method for measures to prevent derailment when running at high speed using model vehicles • Research for evaluation of the aerodynamic force caused by natural winds and a dynamic analysis technique for vehicles [Achievement award] • Implementation of the railway technology lectures • Restructuring of the welfare system • Co-ordination and promotion of improvement for the safety and health management system • Implementation of diagnosis of the safety climate in workplaces • Improvement of the working environment by disposing of unnecessary items such as test apparatus/ instruments

Newly Installed Testing Facilities in 2009

As for general facilities, a total of 29 items were dealt with, including improvements to electrical facilities, safety measures to buildings and facilities, and alterations to the water supply and discharge facilities. This was necessary because the equipment had become out of date.

As for testing apparatus, a total of 18 items were dealt with, including new installations, improvements, and replacement of testing apparatus. An outline of the major items is described below, and the main testing equipment is shown in the attached document 7.

(1) Improvement of vehicle testing apparatus (Fig. 1)

Regarding the testing apparatus completed in 1990, improvements in safety and functionality, and renewal of aging equipment were carried out over a period of five years, with all work being completed in February 2010, on schedule. These improvements were implemented with the help of a state subsidy. The safety improvements include the installation of a new derailment prevention guide and frame to prevent a vehicle body from overturning. Functional improvements include an increase in the vertical vibration amplitude, and the installation of a new simulator for inter-carbody motion which reproduces the movement of coupled vehicles. The renewal of aging equipment such as hydraulic apparatus and a control panel was also carried out. The installation of a simulator for inter-carbody motion allows the motion of a vehicle on a test bench to be determined. The results obtained from experiments with the simulator can be fed back into the vehicle design process, so improving the efficiency of vehicle development work.

Fig.1 Vehicle-testing apparatus adding simulator for inter-carbody motion

(2) Installation of new high-speed material testing machine (Fig. 2)

The testing machine can determine precise tensile stress-strain characteristics of various materials within a wide strain rate range (approximately from 10^{-2} to 10^{-3} s^{-1}) covering all possibilities from the quasi-static deformation rate zone to the high-speed deformation zone. The maximum load is 5 kN, and the maximum displacement is 10 mm, and thus a flat plate-shaped specimen having a thickness of 0.6 to 1.6 mm can be tested.

Fig. 2 High-speed material testing machine

(3) Installation of new low-vacuum scanning electron microscope equipped with energy dispersion type element analysis function (Fig. 3)

The scanning electron microscope performs quantitative analysis of the three-dimensional surface shape of specimens such as fracture surfaces of rocks and weathering products, in addition to performing precision analysis of mineral chemical composition on the surface of rock samples without applying vapour deposition. The magnification of the electron microscope ranges from 15 to 100,000, and the resolution is about 8 nm, which allows observation in high-vacuum mode and low-vacuum mode.

Fig. 3 Low-vacuum scanning electron microscope equipped with energy dispersion type element analysis function

(4) Replacement of supercomputer (Fig. 4)

A supercomputer had been used in order to perform high-grade analysis and simulation in research and development work. Responding to the future computation demand, the supercomputer was replaced by the next-generation model. The supercomputer adopted in FY2009 was selected for its reliability and economy, for its ability to accept the transfer of existing applications, for its suitability for general use, and for its ability to cope with future requirements, etc., thus the chosen model is a combination of a specialized Cray XT4 for massively parallel computation with a specialized Cray CX1 for application operation. The total processing capacity has become 10.8 Tflops (capable of executing 10 trillion and 800 billion floating-point operations a second) which is about 16 times more than the existing computer. From now on, the supercomputer will be utilized for numerical simulation, etc. which is essential to analyze various phenomena relating to railways.

The main specification of the supercomputer is shown in Table 1, and the exterior appearance is shown in Fig. 4.

Table 1 Main specification of the replacement supercomputer

	XT4	CX1
Function	Massively parallel computation	Application operation
Number of processors (the number of cores)	268 (1072 cores)	24 (84 cores)
Memory capacity	2 TB	256 GB
Disk capacity	21 TB	1.5 TB
Operating system	CLE2.1 (Cray Linux Environment)	Linux (RedHat + EL5)
Theoretical computation performance	9.8 TFlops	1 TFlops

Fig. 4 Appearance of supercomputer (XT4)

RTRI Report

Vol. No.	Titles
Vol.23 No.4 Apr. 2009	**Special Features: Vehicle Technology** REVIEW: Recent Research on Simulation Techniques for Railway Vehicles PAPERS: A Method of Building a Vehicle Model for Hardware in the Loop Simulation and Evaluation of Amplitude-frequency Response Tests Executed for Its Improvement PAPERS: Characteristic Identification of Oil Dampers for Railway Vehicle by Using Neural Network PAPERS: Fatigue Life Estimation of Welds on Truck Frames for Rolling Stock Based on Stress Frequency Distribution Caused by Service Loads PAPERS: Effect of Vehicle Running Conditions on Stress Frequency Distribution of Welds on Truck Frames PAPERS: Dynamic Mechanical Properties of Aluminum Alloys Used for Railway Vehicles PAPERS: Development of a Method for Measuring and Evaluating Exhaust Emissions from Diesel Railcars PAPERS: Development of a Braking System Equipped with Deceleration Feedback Control RESEARCH REPORT: Failure Investigation of On-board Electronic Equipments for Trains
Vol.23 No.5 May 2009	**Special Features: Design Technology for Steel an Composite Structure** REVIEW: An outline of the revision of the Design Standard for Railway Structures (Steel and Composite Structures) PAPERS: Applicability Evaluation of Railway Steel Bridge Composed of Ni-advanced Weathering Steels and High Performance Steel Materials PAPERS: Evaluation Method of Buckling Resistances of Steel Members based on the Performance Based Design Method PAPERS: Fatigue Design with Cumulative Fatigue Damage for Members of Steel Bridge PAPERS: Fatigue Design Considering Simultaneous Train Loading On Double-track Bridges PAPERS: Shear-Capacity Evaluation Method for the Shear Connectors for Composite Girders PAPERS: The Design Method of the Continuous Composite Girders that Takes into Consideration Crack Formation of Concrete Slab PAPERS: Verification of Overturning of Girders Under Severe Earthquakes by Simple Analysis Model REVIEWS: An Outline of the Standards of Fabrication and Construction for Railway Structures (Steel and Composite Structures) REVIEWS: Trial Design and Evaluation for the Revised Design Standard for Steel Structures and Composite Girders
Vol.23 No.6 Jun. 2009	**Special Features: Materials Technology** REVIEW: Recent Trend of Research and Development on Materials for Railway PAPERS: Environmental Assessment for Materials in the Railway PAPERS: Effect of Temperature on Corrosion Rate of Reinforcing Bar in Concrete PAPERS: Improvement of Concrete-Adhesive Water-Proof Sheet PAPERS: Development of Rail Noise Insulating Material for Rail Joint Considered for Maintenance PAPERS: Fundamental Study on Application of Traction Oil to Wheel/Rail Lubricants PAPERS: Improvement of Wear Resistance of Solid Lubricant Coated Wheel Material Aimed at Application to Railway Wheel Flange PAPERS: Evaluation of Fatigue Strength and Wear Property of Bolts for Fixing Contact Strips Made of Carbon-fiber Reinforced Carbon Composite PAPERS: Improvement of the Superconducting Properties of High Temperature Superconducting Wires for Railway System RESEARCH REPORT: The Current Situation of the Use of the Rare-metals in Railways RESEARCH REPORT: The Trend survey for Application of the New Advanced Materials to the Railway
Vol.23 No.7 Jul. 2009	**Special Features: Environment Technology** REVIEW: Recent Studies on Environmental Technology PAPERS: Analysis of Wayside Low-Frequency Noise from a High-Speed Train PAPERS: A Numerical Prediction Method of Aerodynamic Noise Applicable to High Frequency Problems PAPERS: Development to Reduce the Rolling Noise of Narrow-Gauge Wheels PAPERS: Study on Prediction Model of Railway Noise at High-rise Buildings PAPERS: The Methods for Analysis of Volatile Compounds Related to Odor in Railway Stations, etc. PAPERS: Development of a Measuring Method for Microbial Degradation of Environmental Pollutants OTHER PAPER: Measurement of Under-floor Air Flow on Board the Train and on the Ground
Vol.23 No.8 Aug. 2009	**Special Features: Transport Information Technology** REVIEW: Recent Research and Development on Transport Information Technologies PAPERS: Development of Demand Estimation Models for Inner-Regional Shinkansen Passengers PAPERS: An Approach for Real-time Estimation of Railway Traveler Flow PAPERS: A Train Rescheduling Algorithm Using Estimated Passenger Demand PAPERS: Freight Train Driver Rescheduling Algorithm after Disruptions PAPERS: Development of the Algorithm for the Station Shunting Scheduling PAPERS: An Evaluating Method for an Economic Loss of the Passengers Who Encountered with Rail Transport Disorders PAPERS: Development of a Job Assignment System for Maintenance Workers PAPERS: Development of Middleware Supporting Interactive Data Measurement and Record System for Facilities Maintenance REVIEW: Current Status of Sensor Network Research and its Applicability to Railways
Vol.23 No.9 Sept. 2009	**Special Features: Human Factors** REVIEW: Interdisciplinary Human Scientific Approach to Railway Transport Systems PAPERS: The Development of an Vocational Training Program for Improving Train Driver Abilities of Coping with Extraordinary Conditions PAPERS: Accident Round-table Discussion (ARD) Method for Improving Safety Awareness PAPERS: Development of Evaluation Method of Risk of Train Driver's Error with Consideration on Inducement Factors PAPERS: Development of Evaluation Method of Safety Climate in Work Site PAPERS: Estimation of the Effects of Train Draft on Maintenance Workers PAPERS: Effect of High Frequency Vertical Vibration on Ride Comfort PAPERS: Simulation Experiment on Ride Quality for Long Travel PAPERS: Questionnaire Survey on Railway Passenger's Behavior after an Assumed Earthquake Disaster PAPERS: Improvement in Provision of Information at Stations upon Suspended Train Services in PA System

Vol. No.	Titles
Vol.23 No.10 Oct. 2009	**Special Features: Track Technology** REVIEW: Subjects on Track Technology Focussed on from Dynamical Point of View PAPERS: Proposal of Evaluation Index for Rail Roughness and Planning System for Optimum Operation of Rail Grinding Car PAPERS: Estimation Method of Short Wave Length Track Irregularity with Short Length Chord Versine PAPERS: Evaluation of Effects of Roadbed Stiffness on Deformation Properties of Ballasted Track with DDA PAPERS: Development of a Repairing Method for Ballasted Track by Filling Composite Gel Consisting of Water Glass and Polymer PAPERS: An Effect of Automatically Irregularity Correcting Sleepers on Maintaining Track Level around Conversion Part between Different Track Structures PAPERS: Development of Short Fiber Reinforced Concrete Roadbed on Earth Structure PAPERS: Development of New Design Tongue Rail Adopting New Arrangement of Heat Treatment and New Material of Improved Wear Resistance PAPERS: A Study on Increasing Running Speed Limited Due to Installing Emergency Rail Cramp at a Spot of Rail Failure PAPERS: Examination of the Micro Crack Propagation Caused by Rail White Layer and the Grinding Method PAPERS: Initiation Condition and Preventive Measures for Center-line Shrinkage in Thermite Welds
Vol.23 No.11 Nov. 2009	**Special Features: Vehicle Technology** REVIEW: Recent Trends of a R&D of Propulsion Systems in Abroad PAPERS: Effect of Frequency of Crosswind on Dynamic Behavior of Railway Vehicles PAPERS: Improved Effect of Carbody Side Strength by Ring Structure Composed of Inner Sub-Frames PAPERS: Energy Efficiency Evaluation of Fuel cells and Batteries Hybrid Railway Test Vehicles PAPERS: Ac Loss Reduction and Cooling Characteristic Improvement for Putting Superconducting Traction Transformer into Practical Use PAPERS: Energy-Saving Effect of High Efficient Traction Motors in Electric Train PAPERS: Influence of the Leveling Valve on Vehicle Dynamics at Low Speed on a Sharp Curve PAPERS: Development of a Vibration Evaluation System for Railway Vehicles by Stationary Tests with Field-Portable Actuators PAPERS: Effect of an Improved Control Technique of Wheel Tread Cleaner or Restraining Adhesion Phenomenon in Abrasive Block PAPERS: Study on the Factors Influencing Generation of Scorings of Wheelseats of the Railway Axles and the Effectiveness of Surface Treatment Methods
Vol.23 No.12 Dec. 2009	**Special Features: Structures Technology** REVIEW: Recent Research and Development on Structural Technology PAPERS: Simulation of Earthquake Motions Based on Inversion of Phase Spectrum PAPERS: Earthquake Damage Evaluation Method of Viaduct Group by Measurement of Response Angle of Columns PAPERS: Seismic Damage Mechanism and Assessment of Aseismic Performance of Mountain Tunnels for Railways PAPERS: Seismic Reinforcement Method for Existing Pile Foundations by Installing Sheet Piles around Footing and Connecting them Together PAPERS: Development of Non-destructive Inspection Method for Concrete Material with Laser-induced Vibration PAPERS: Development of a Beam-Column-Pile Joint of Rigid Frame Viaduct Using Steel Fiber Reinforced Concrete PAPERS: Development of Internal Reinforcement Method for Tunnel Lining by FRP Plate PAPERS: The Structural Design Method for Over-Track Middle-Rise Buildings PAPERS: Evaluating Influence of Underground Construction on Groundwater Flow Interruption PAPERS: A Passenger Flow Simulation to Evaluate Ease of Walking in Station
Vol.24 No.1 Jan. 2010	**Special Features: Maglev Technology and its Application** REVIEW: R & D on Superconducting Maglev and Attempts of Applications of its Technology to Conventional Railway System PAPERS: Study on Applicability of Rare Earth High-temperature Superconducting Wires to Superconducting Magnet for Maglev System PAPERS: Shock Assessment-resistant of a Surface Protection Layer for the Maglev System Ground Coils PAPERS: Development of the Maintenance Management Method for Ground Coil Applied Information Technology PAPERS: Evaluation of Characteristic of the Linear Motor Type Rail Brake Using an Electrical Equivalent Circuit PAPERS: Numerical Analysis and Evaluation of Electromagnetic Forces in Superconducting Magnetic Bearings and Non-contact Permanent Magnetic Clutch PAPERS: Non Destructive Test of the White Layer on Rail Surface by the SQUID OTHER PAPER: Reduction of Micro-pressure Wave Emitted from Portal of Side Branch of High-speed Railway Tunnel RESEARCH REPORTS: The Results of a Survey on the Non-contact Power Supply Systems RESEARCH REPORTS: Investigation of Possibility to Apply a Superconducting Cable to a Feeder INTERNATIONAL CONFERENCE REPORT: Report on MAGLEV' 2008
Vol.24 No.2 Feb. 2010	**Special Features: Power Supply Technology** REVIEW: Recent State of Researches on Power Supply Technology for Electric Railways PAPERS: Development of New Protective Relay for Long Feeding Circuit PAPERS: Reliability Improvement of Ground Fault Protection System in AC Feeding System Using an S-Type Horn Attachment Gap PAPERS: Vibration Suppression Method of Electric Railway Pole with Viscoelastic Damper PAPERS: Estimation Method of Contact Wire Strain based on Contact Force between Pantograph and Catenary PAPERS: Pantograph Contact Force Monitoring on Commercial Lines PAPERS: Methods of Reducing Local Wear of Contact Wires at Support Points PAPERS: Applicability of Rain Flow Method on Fatigue Life Estimation of Contact Wire PAPERS: Influence of Cross-sectional Shape and Structure on Antifatigue Property of Contact Wire
Vol.24 No.3 Mar. 2010	**Special Features: Signalling and Telecommunications Technology** REVIEW: Recent Research and Development of Railway Signalling and Telecommunications Technologies PAPERS: Development of ATS-Dx with Permissible Speed Profile Using an On-board Database PAPERS: Improvement of Low Frequency Track Circuit against Noise using Simple Encoding PAPERS: Modeling of Load Transmit Characteristics of Switching Equipments at Operation of a Switch-and-lock Movement PAPERS: Application of GPS to Train Control System for Secondary Lines PAPERS: Train and Traffic Prediction Control Method Adapted to Line Conditions PAPERS: A Risk Evaluation Method for the Improvement of Railway Signalling Systems PAPERS: A Method to Predict Quality of Digital Terrestrial Television Broadcasting Picture Received in the Area along Railway Lines PAPERS: Development of Radio Transmission Line Simulator along a Railway OTHER PAPER: Improvement of Detection Accuracy of Tunnel Cracks Using Image Processing

More information is available on the following website.
URL: http://www.rtri.or.jp/infoce/rtrirep_E.html

Quarterly Report of RTRI

Vol. No.	Titles
Vol.50 No.2 May 2009	Improving the Rigidity of Railway Vehicle Carbodies Using Non-Structural Members Reduction Method of Surge Voltage on AC Railcar's Body Development of a System to Calculate Energy Consumed by Diesel Railcars Prediction Method of Tunnel Deformation Using Time-dependent Ground Deterioration Model The Influence of Seismic Motion with Ground Irregularity on the Dynamic Behavior of Railway Vehicles Analytical Studies on the Load Carrying Capacity of Riveted Steel Girders Subjected to Collision Damage Techniques to Measure Effects of Passing Trains on Dynamic Pressure Applied to Sleeper Bottoms and Dynamic Behavior of Ballast Stones Performance Evaluation of Reinforced Concrete Roadbed for Slab Track on Clay Subgrade Management Method for Large Wheel Loads and Lateral Forces Using Axle-box Acceleration and Track Irregularity
Vol.50 No.3 Aug. 2009	Development of Contact-Loss Measuring System Using Ultraviolet Ray Detection Evaluation of Resistance at Supporting Pulley of Messenger Wire and Its Influence on Current Collection Characteristics Analysis Method and Abatement Measure of Magnetic Fields Emitted from Electrified Railway Substations Evaluation Methods for Railway Signalling Systems from the Viewpoint of Availability Method to Calculate Fluctuations in the Strength of Radio Noise Emitted from Electric Railway Systems Detection of Slow-Speed-Notifying Signals Using Image Recognition from the Driver's Cabin Evaluation System for Transport Current Properties of High-Temperature Superconducting Wires Basic Characteristics of Rail Brake Systems Using Linear Motor Technology Study of a High-temperature Superconducting Magnetic Bearing for Flywheel Energy Storage Systems
Vol.50 No.4 Nov. 2009	Building a Railway Vehicle Model for Hardware-in-the-loop Simulation Fatigue Life Estimation of Welds on Truck Frames of Rolling Stock Based on Stress Frequency Distribution Measurement and Evaluation of Exhaust Emissions from Diesel Railcars Probability Calculation of Rainfall-related Slope Failure A Method to Determine the Priority of Investment in Disaster Prevention for Rainfall-related Slope Failure A Method to Estimate the Probability of a Train Encountering Gusts in an Operating Section Numerical Estimation of Aerodynamic Interference between Panhead and Articulated Frame Development of Ballasted Ladder Track Equipped with a Vehicle Guide Device Development of a New Device for Investigating Creep Force between Wheels and Rails
Vol.51 No.1 Feb. 2010	New Concrete with Low Environmental Load Using the Geopolymer Method Environmental Evaluation of Railway Material Changes Using LCA Fundamental Study on the Application of Traction Oil as a Wheel/Rail Lubricant Development of a Measuring Method for Microbial Degradation of Environmental Pollutants Experimental Investigation of Low-frequency Wayside Noise from High-speed Train Methods for Analysis of Odor-related Volatile Compounds in Railway Facilities Evaluation of Applicability for Ni-advanced Weathering Steels and Bridge High-performance Steels to Railway Steel Bridges Fatigue Design in Consideration of Simultaneous Train Loading on Double-track Bridges REVIEW: Outline of Revision of the Design Standards for Railway Structures (Steel and Composite Structures)

More information is available on the following website.
URL: http://www.rtri.or.jp/infoce/qr_E.html

Monthly Presentations

Date	Number	Main theme	Venue
Apr.15 ,2009	222th	Recent R&D on Environmental Engineering	Oval Hall(Osaka)
May.21,2009	223th	Recent R&D on Maglev Systems Technology	STeC Information Building (Shinjuku)
Jun.18,2009	224th	Recent R&D on Track Technology	Kougakuin University (Shinjuku)
Jul.16,2009	225th	Recent R&D on Rolling-stock Technology	Kougakuin University (Shinjuku)
Aug.19,2009	226th	Recent R&D on Signalling & Telecommunications Technology	Kougakuin University (Shinjuku)
Sept.16,2009	227th	Recent R&D on Disaster Prevention Technology	Kougakuin University (Shinjuku)
Oct.15,2009	228th	Toward Optimization of Dynamics System of Railways	Oval Hall(Osaka)
Dec.16,2009	229th	Recent R&D on Power Supply Technology	Kougakuin University (Shinjuku)
Jan.13,2010	230th	Recent R&D on Structural Technology	Kougakuin University (Shinjuku)
Feb.17, 2010	231th	Recent R&D on Rolling-stock Technology	Kougakuin University (Shinjuku)
Mar.17, 2010	232th	Recent R&D on Transport Information	Kougakuin University (Shinjuku)

Railway Technology Avalanche (Newsletter of RTRI)

No.	Titles
No.27, Jun. 2009	President's Inaugural Address Development of a Large Two-Dimensional Shaking Test Facility to Determine How Railway Equipments and Structures are Damaged or Destroyed during an Earthquake The 10th International Workshop on Railway Noise The 8th China-Korea-Japan Railway Research Technical Meeting Structural Improvement of Existing Steel Bridges by Combining the Steel Girders with Concrete Decks Development of a Contact-Loss Measuring System Using Ultraviolet Ray Detection A Method of Managing Wheel Loads and Lateral Forces Using Axle-Box Acceleration
No.28, Sept. 2009	Support for the Safety of Train Operation A Life-Size Station Building Model Development of Quakeproof Reinforcement Methods for Masonry Walls Mechanical Performance Analysis of a Switch-and-Lock System for Shinkansen An Algorithm for Rescheduling Freight Train Locomotives and Drivers Extension of Grease Service Life for Induction Traction Motors for Railways
No.29, Dec. 2009	Keywords are “Safety” and “Ecology” New Supercomputer System of the Railway Technical Research Institute Improvement of Pantograph Performance by Use of a Variable Stiffness Spring Evaluating the Emission of “Musty” Smells An Accident Round-table Discussion (ARD) Method Designed to Increase Safety Awareness Development of an Eddy Current Rail Brake Derived from Linear Motor Technology
No.30, Mar. 2010	The Information Infrastructure in RTRI Report of the China-Korea-Japan Railway Research Technical Meeting A Model of Two Types of Leveling Valve The Restraint Effect of a Scoring Phenomenon in an Abrasive Block Used for Cleaning Wheel Treads Using Changed Control Techniques A Non-Destructive Inspection Method for Concrete Elements in Tunnel Linings Using Remote Laser Sensing Mitigating the Low Frequency Magnetic Field Generated by Substations on Electric Railways

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

RTRI Lecture

Main Theme: Towards Safe and Comfortable Railway Transportation
Date: November 13 , 2009 (Friday) 10:00 to 16:35
Venue: Yurakucho Asahi Hall (Yurakucho Marion, 11th Floor)

Titles	Speakers	Affiliates
<Invited Lecture> A Bridge to Safe Structures and Comfort	Masao Mukaidono	Professor, School of Science and Technology, Meiji University
<Keynote Lecture> Approach towards Research and Development for Establishing Safe and Comfortable Railway Systems	Atsushi Ichikawa	Executive Director, RTRI
Preparing for Earthquakes	Masaru Tateyama	Director, Structures Technology Division, RTRI
Preparing for Weather Disasters	Hideo Kiya	Director, Disaster Prevention Technology Division, RTRI
Safety of Signalling Systems	Shigeto Hiraguri	Senior Researcher, Laboratory Head, Signal System Laboratory, Signalling & Telecommunications Technology Division, RTRI
Utilizing Information Technologies	Koichi Goto	Director, Transport Information Technology Division, RTRI
Human Factors and Safety & Comfort	Koji Omino	Senior Researcher, Laboratory Head, Ergonomics Laboratory, Human Science Division, RTRI

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 FY2009 (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_2] 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	3,252
Increase-decrease rate to the basic discharge	-	2%	14%	0%	4%	12%

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)	142 tonnes CO_2
	Estimated reduction rate (by the target measures)	3.8 %
Target reduction rate		2.0 %

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 FY2009 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 FY2009 was reduced by 16%. In addition, the estimated reduction rate (in the progress table) has reached 3.8%.

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.

(FY2009=2009.4.1-2010.3.31)

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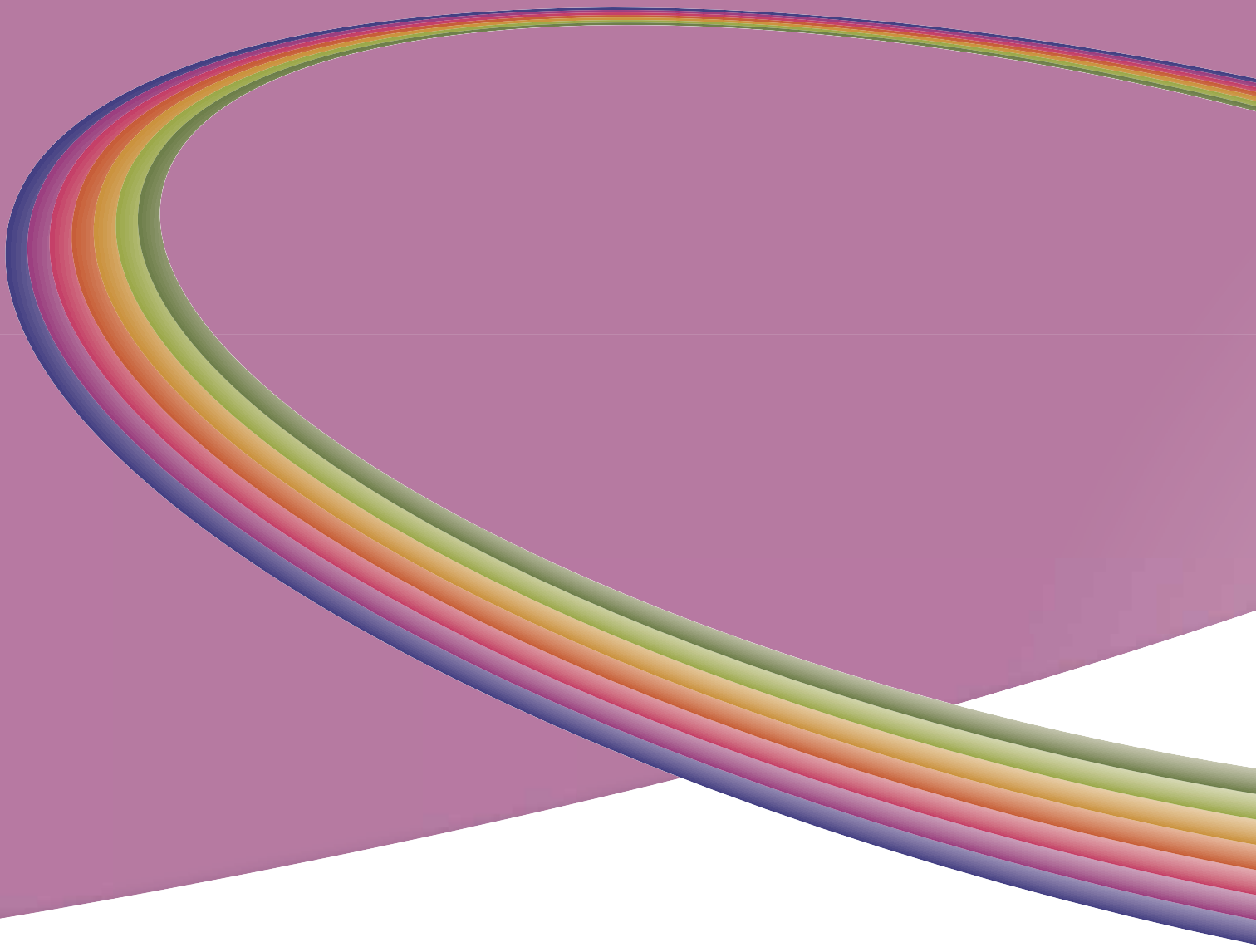

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