Build railway bound for the future

JRTT

Japan Railway Construction, Transport and Technology Agency

Railway is essential infrastructure to maintain and improve people's lives by transporting people and goods safely and reliably.

However, every railway construction project is so huge that it is not easy to complete.

JRTT

Japan Railway Construction, Transport and Technology Agency

Basic Philosophy

We Contribute to Building Future Transportation Network.

- We build safe, secure, and eco-friendly transportation network.
- Our transportation network building improves people's lives and develops national economy.
- In the course of building transportation network, we exert our reliable technical capacity, abundant experience and advanced expertise to the fullest.

Contributions to the SDGs

JRTT contributes to the SDGs through construction of resilient railway infrastructure to establish sustainable and eco-friendly transportation system.

SUSTAINABLE DEVELOPMENT GOALS

To develop railway to connect cities
with solid technology...
This is the mission of JRTT.

JRTT creates new value for people's lives through railway construction and contributes to the improvement of the lives and the development of the economy.

History of JRTT

JRTT, Japan Railway Construction, Transport and Technology Agency, was organized in October 2003 and its predecessor entity was established in 1964 as JRCC, Japan Railway Construction Public Corporation. Since the inauguration as JRCC, JRTT has consistently contributed to the development of nationwide transportation network based on mass transit system which strengthens the connections between major cities and regions and thus promoted regional prosperities.

JRTT has constructed various types of railways. The most notable achievement is Shinkansen High-Speed Rail, which is known as the world's first high-speed railway. Seikan Tunnel is also a great achievement as the world's longest undersea rail tunnel to directly connect Japan's two major islands, Honshu and Hokkaido. In addition to these, a significant number of urban and regional railways have been constructed by JRTT. The total length of these lines reaches more than 3,840 km to date.

For more information, see p.38.

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❶

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❶

Hokuriku Shinkansen

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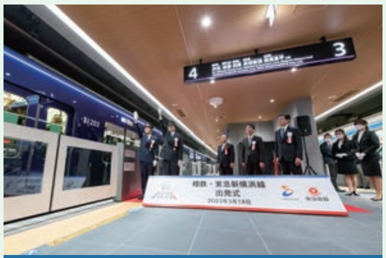

Opening ceremony at Shin-Yokohama station

❷

Tsukuba Express

❸

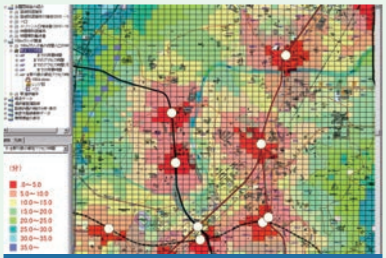
Seikan tunnel

❹

Sanriku Railway

❺

Disaster Recovery Assistance

❻

Project research

❼

Taiwan High-Speed Rail

❽

Fukui Kaihotsu viaduct

❽

Echizen-Takefu station

❽

Road cum rail car and CA mortar injection car

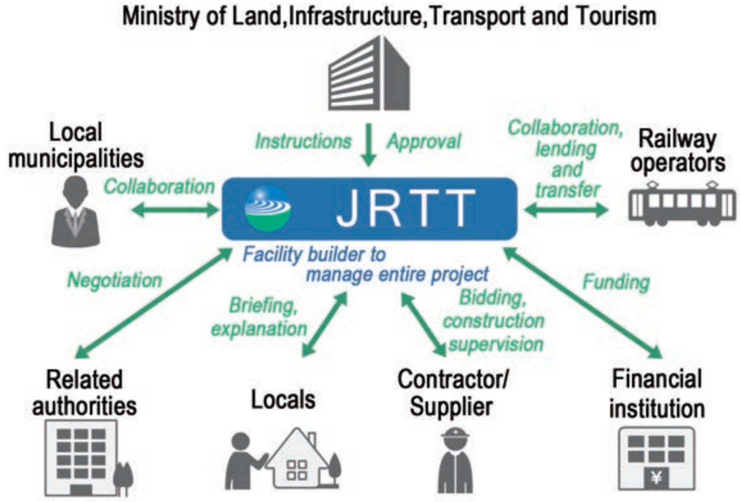
❽

Substation

Railway Construction

Mission of JRTT

JRTT's primary mission is to implement railway project as a public agency under the supervision from the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). JRTT responsibly conducts following tasks to complete railway infrastructures and facilities: initial planning and design, site survey, briefing to locals, negotiation with local authorities, bidding for construction, supervision of the construction work, inspection of completed structures and facilities, etc. These tasks are carried out with JRTT's comprehensive administrative and technical experts in the field of civil, machinery, architecture, and electrical engineering.



Railway construction is implemented collaboratively with MLIT, local municipalities and railway operators.

Commitment of JRTT

To conduct large-scale railway projects with huge costs and technically and administratively challenging tasks, JRTT makes the following commitments as a responsible and engineeringly competent public entity.

Cost Reduction

JRTT reduces the life cycle costs by improving the quality of products and introducing economical design and construction.

Efficient Construction Scheduling

As JRTT contains all technical fields required for railway construction, quick and efficient interface works are available.

Technical Development

JRTT has implemented technical development in a wide range of fields to provide state-of-the-art railway structures and facilities.

Simple Procedure for New Rail Project

As JRTT is a technically endorsed agency with certified engineers, in Japan's national rail project scheme, railway operators can omit some application procedures for MLIT approval if JRTT designs their structures.

Technically certified experts' group

JRTT

Railway Construction

Process of Railway Construction

JRTT is consistently involved from surveying to design, construction, and leasing after commissioning. Taking advantage of the extensive experience and technical capabilities we have accumulated through many years of railway construction across the country, we proactively promote projects as a public organization and a comprehensive group of engineers at every stage.

From Planning to Opening of a New Railway Line

Prepare for construction start

After outlining a route for a new railway line, JRTT preliminarily designs the railway structures and facilities. According to the plan, including these route and structure designs, an Environmental Impact Assessment (EIA)* is conducted. MLIT scrutinizes the plan and the results of the EIA to give approval for the new railway project. After approval from MLIT, the construction work starts.

*EIA: Environmental Impact Assessment
In order to prevent significant environmental impacts from development projects, this system involves investigating, predicting, and evaluating the environmental impacts at the planning stage. The procedures are carried out in the following order: Planning Stage Environmental Impact Assessment Document, Environmental Impact Assessment Method Statement, Draft Environmental Impact Statement (EIS), Final EIS, and Environmental Impact Report. The results are announced at a public hearing to compile a plan that takes environmental conservation into consideration.

EIA flow

Prepare Planning Stage EIA Document
↓
Prepare EIA Method Statement
↓
Investigate, predict, and evaluate
↓
Prepare Draft Environmental Impact Statement (EIS)
↓
Prepare Final EIS
↓
Implement Project
↓
Prepare Environmental Impact Report

Hold local briefings

JRTT holds public briefings for local communities in each area along the line to ask for cooperation regarding surveys and other entries into the area.

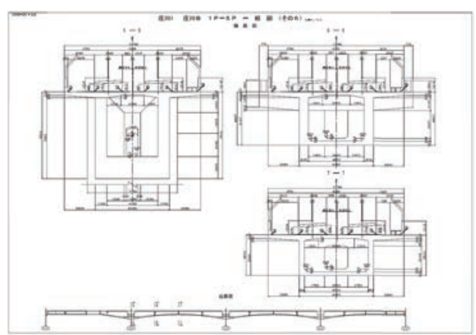
Railway line crossing over a road

Survey using a center line

JRTT drives stakes into the center line of the track and conducts both longitudinal and transverse surveying.

Negotiate structural designs

Based on the preliminary designs, JRTT negotiates with stakeholders, including the national government and local municipalities, regarding the occupation and relocation of rivers and roads that intersect with the railway line.



Design drawing of a bridge

Finalize the designs

Considering the cost, the characteristics of the surrounding environment, and the results of geological surveys, JRTT determines the structural form of bridges, tunnels, and other structures to calculate the details and prepare drawings.

Acquire land

JRTT holds explanatory meetings on compensation and other issues, conducts land surveying and building surveys to determine the land that needs to be acquired for the construction of the new line, and calculates fair and equitable compensation amounts for the land and buildings.

Invite tenders for construction

JRTT properly estimates construction costs and places construction orders.

Hold construction briefings

JRTT holds timely briefings to explain in detail how the construction will proceed.

Supervise construction

In order to ensure that the ordered construction work proceeds smoothly and economically, JRTT manages the schedule, budget, explanations and responses to local residents, consideration for the surrounding environment, and construction safety control.

Civil work (Tunnel) See p.28

Civil work (Bridge) See p.30

Track work See p.31

Architecture work See p.32

Machinery work See p.34

Electrical work See p.35

Conduct audits and inspections

After the structures are completed, a final inspection of the facilities is conducted to ensure that actual vehicles can operate safely. This includes re-checking the dimensions of the facilities.

Measurement of the gap between the train body and the platform

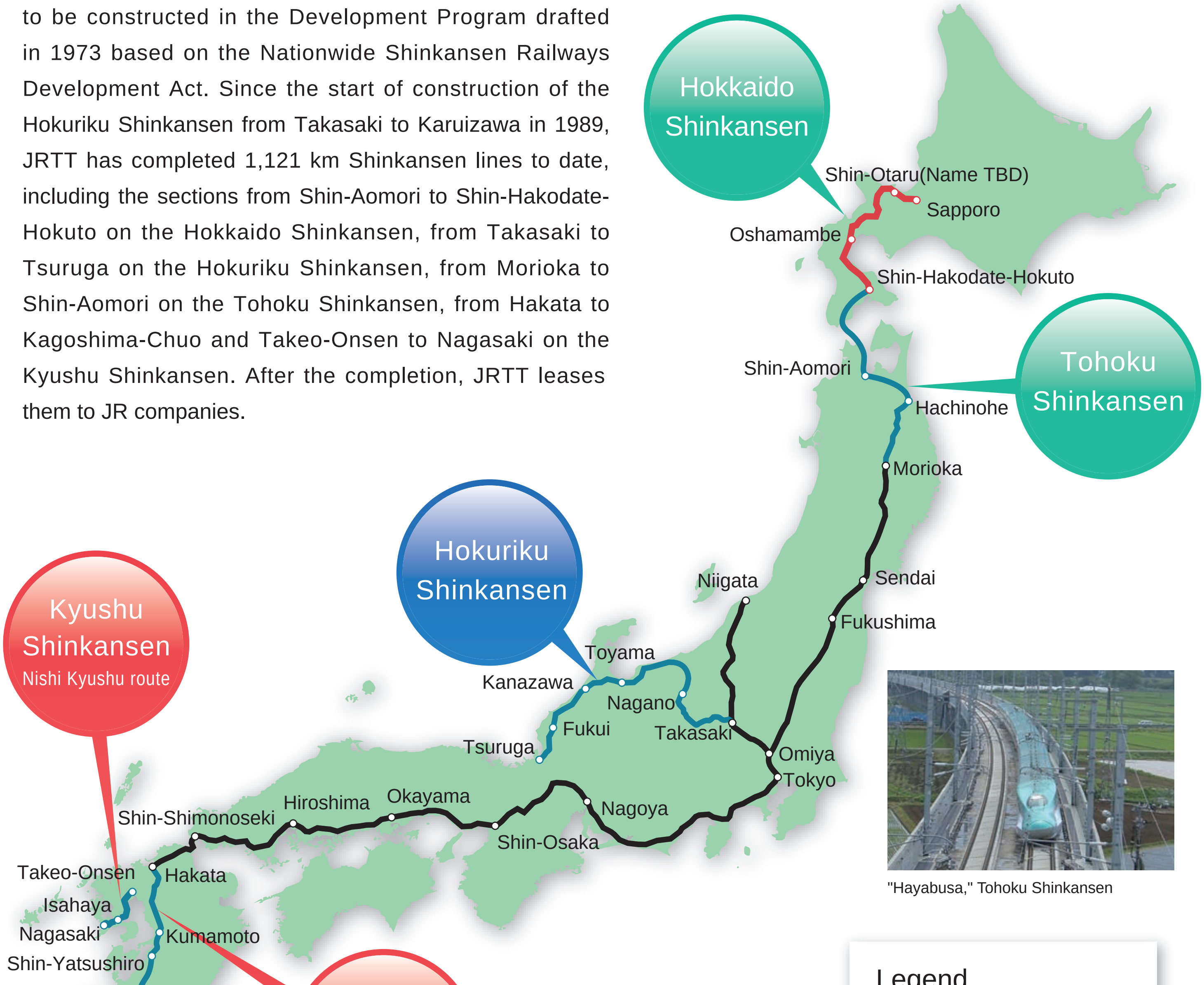
Commission and lease the line

After the commissioning, the railway facilities are leased to railway operators and used by a wide range of people. JRTT also evaluates the effects of the line after it opens.

Opening ceremony of the Hokuriku Shinkansen
(Kanazawa to Tsuruga)
(Photo provided by JR West)

New Shinkansen Lines

Five Shinkansen lines - the Hokkaido Shinkansen, the Tohoku Shinkansen (northernmost part), the Hokuriku Shinkansen, and the Kyushu Shinkansen (Kagoshima route and Nishi Kyushu route) – were designated as priority lines to be constructed in the Development Program drafted in 1973 based on the Nationwide Shinkansen Railways Development Act. Since the start of construction of the Hokuriku Shinkansen from Takasaki to Karuizawa in 1989, JRTT has completed 1,121 km Shinkansen lines to date, including the sections from Shin-Aomori to Shin-Hakodate-Hokuto on the Hokkaido Shinkansen, from Takasaki to Tsuruga on the Hokuriku Shinkansen, from Morioka to Shin-Aomori on the Tohoku Shinkansen, from Hakata to Kagoshima-Chuo and Takeo-Onsen to Nagasaki on the Kyushu Shinkansen. After the completion, JRTT leases them to JR companies.



"Hayabusa," Tohoku Shinkansen

"Kagayaki," Hokuriku Shinkansen

Legend

- Shinkansen Lines built by JRTT (In service)
- Shinkansen Lines built by JNR (In service) [Except Joetsu Shinkansen which was built by JRCC]
- Shinkansen Lines under construction by JRTT

"Kamome," Kyushu Shinkansen Nishi Kyushu route

Kyushu Shinkansen Nishi Kyushu route

The Nishi Kyushu route is a line connecting Hakata and Nagasaki. The section between Takeo-Onsen to Nagasaki opened in September 2022. At Takeo-Onsen station, passengers can transfer between the conventional line train and the Shinkansen train on the same platform.

Kyushu Shinkansen Kagoshima route

The Kagoshima route is a 257 km long line connecting Hakata and Kagoshima-Chuo. The southernmost section between Shin-Yatsushiro and Kagoshima-Chuo opened in March 2004, and the remaining section between Hakata and Shin-Yatsushiro opened in March 2011.


4 Shin-Tosu station


5 Kumamoto general rolling stock depot


1 Takeo-Onsen station


2 Omura rolling stock depot


3 Nagasaki station


6 Kagoshima-Chuo station

New Shinkansen Lines

Hokuriku Shinkansen

The Hokuriku Shinkansen Line connects Tokyo and Osaka via Nagano, Toyama and Obama. The Takasaki - Nagano section opened in October 1997, the Nagano - Kanazawa section opened in March 2015, and the Kanazawa - Tsuruga section opened in March 2024. Extension to Shin-Osaka is in the planning stage, and Environmental Impact Assessment and other studies are being conducted.


❻ Hakusan general rolling stock depot


❺ Kanazawa station


❼ Komatsu station


❽ Kaga-Hosotsubo bridge


❾ Kuzuryu River bridge


❿ Fukui station


⓫ Tsuruga station


⓬ Tsuruga rolling stock depot

4 Jinzu River bridge

3 Toyama station

2 Joetsumyoko station

1 Iiyama station

New Shinkansen Lines

Hokkaido Shinkansen/Tohoku Shinkansen

The 675 km Tohoku Shinkansen Line was finally completed by the extension from Hachinohe to Shin-Aomori in 2010. The Hokkaido Shinkansen Line is being constructed as an extension from Shin-Aomori toward Hokkaido and its length spans some 360 km to Sapporo, the seat of Hokkaido. The southern part of the Hokkaido Shinkansen Line between Shin-Aomori and Shin-Hakodate-Hokuto opened in 2016, and the remaining part between Shin-Hakodate-Hokuto and Sapporo is under construction.

Seikan Tunnel

Seikan tunnel is a 53.9 km long world longest undersea tunnel. Although it was opened in 1988 as a conventional line with narrow-gauge (1,067 mm) tracks, dimension of the tunnel was designed to accommodate larger Shinkansen trains. On the occasion that the Hokkaido Shinkansen Line was constructed, additional rail for Shinkansen gauge (1,435 mm) was installed on each track, thus the tracks can be shared by both Shinkansen trains and conventional trains.

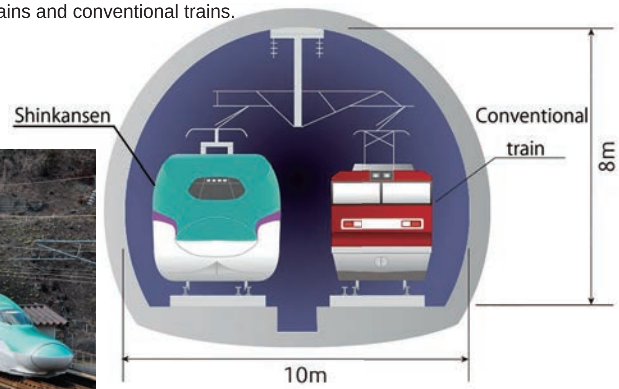


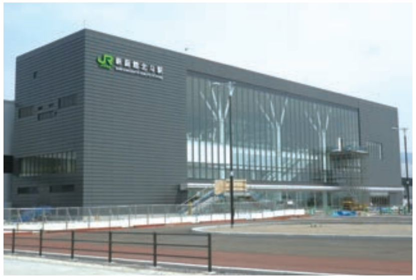
Image of tracks shared by trains of different gauges

For Seikan tunnel, see p.21


❶ Hakkoda tunnel


❹ Seikan tunnel


❷ Sannai-Maruyama bridge


❺ Shin-Hakodate-Hokuto station


❼ Tateiwa tunnel


❸ Shin-Aomori station

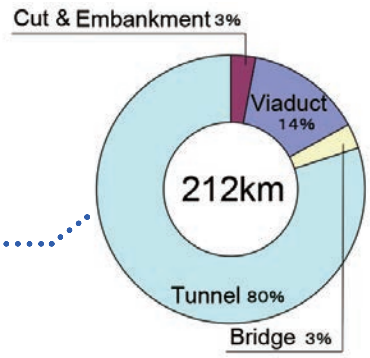

❻ Oshima tunnel


❽ Hirasato viaduct

Ratio of structures

*As of April 2024

Hokkaido Shinkansen
(Shin-Hakodate-Hokuto to Sapporo)



11 Sasson tunnel

10 Futatsumori tunnel

9 Yotei tunnel

Shin-Aomori to Shin-Hakodate-Hokuto
【149km】
Opened in March 2016

Hachinohe to Shin-Aomori
【82km】
Opened in December 2010

Hakkoda Tunnel

The 26.5 km tunnel was completed in February 2005 as the longest base tunnel in the world at that time. It remains the longest in Japan.

The Tohoku Shinkansen opened between Omiya and Morioka in June 1982 and was later extended to Tokyo.

Morioka to Hachinohe
【97km】
Opened in December 2002

New Shinkansen Lines

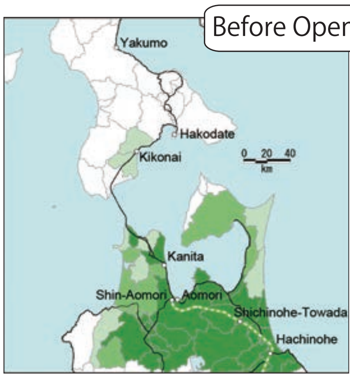
Social Benefits by New Shinkansen Lines opening

Reduce travel time

Opening of Shinkansen has considerably reduced the travel time from the area along the line to other areas and improved accessibility.

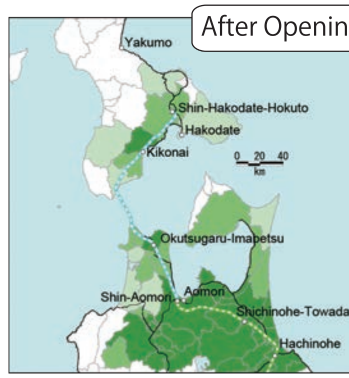
Hokkaido Shinkansen (Shin-Aomori to Shin-Hakodate-Hokuto): Travel time by train to Sendai

Before Opening



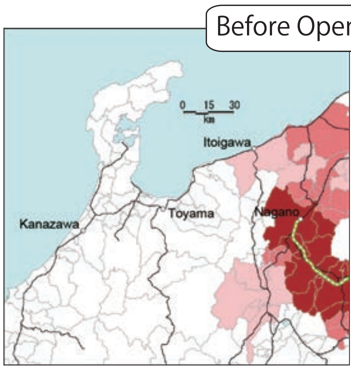
- 2.5-hour zone
- 3.0-hour zone
- 3.5-hour zone

After Opening



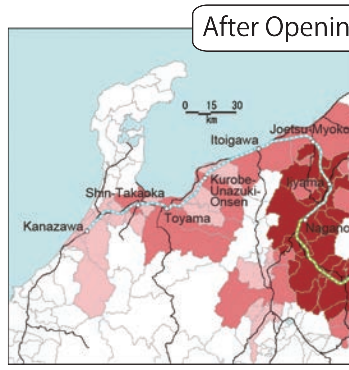
Hokuriku Shinkansen (Nagano to Kanazawa): Travel time by train to Tokyo

Before Opening



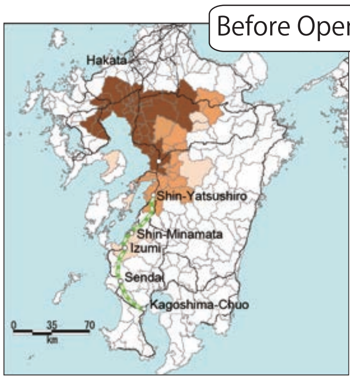
- 2.0-hour zone
- 2.5-hour zone
- 3.0-hour zone

After Opening



Kyushu Shinkansen (Hakata to Shin-Yatsushiro): Travel time by train to Hakata

Before Opening

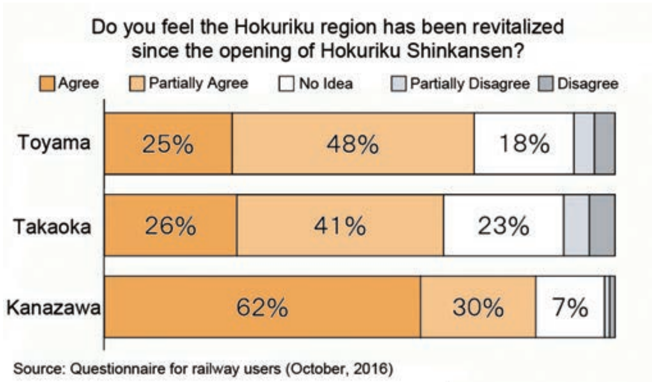


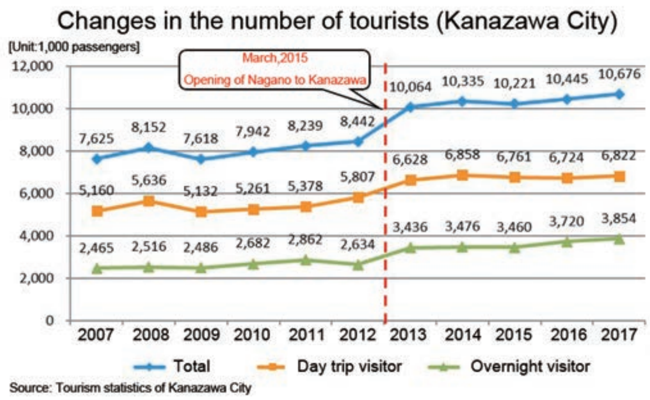
- 1.5-hour zone
- 2.0-hour zone
- 2.5-hour zone

After Opening

Increase tourists

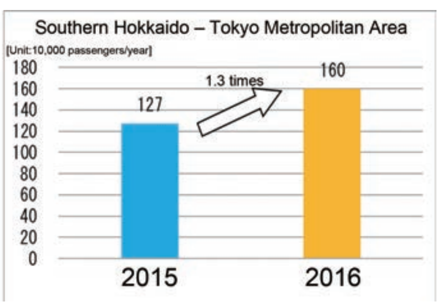
The opening of new Shinkansen lines increases the number of tourists and stimulates the regional economies and people's activities.

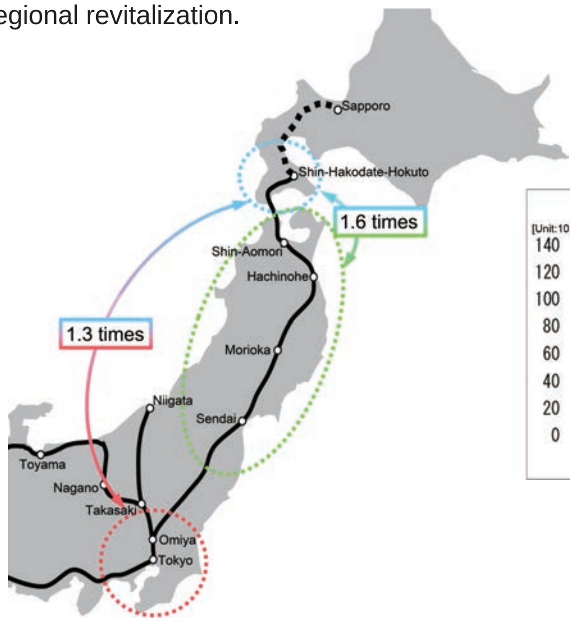


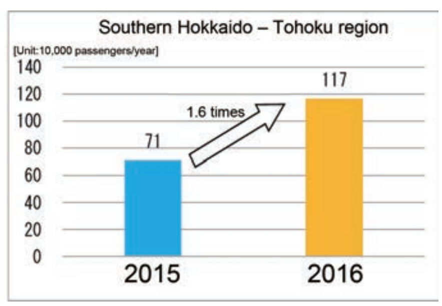


Increase inter-regional travel

Compared to before the opening of the Shinkansen, the number of inter-regional travelers including non-railway users has increased, stimulating regional revitalization.







Develop surrounding areas

Once a new Shinkansen station is built, it will become a regional transportation hub and encourage further development of the surrounding areas.

2007

2018

Toyama station, Hokuriku Shinkansen

2007

2013

Kurume station, Kyushu Shinkansen

Urban Railways

Eastern Kanagawa Rail Link (Sotetsu-JR Link Line and Sotetsu-Tokyu Link Line)

JRTT has built many urban railways such as the Rinkai Line, the Minatomirai Line, and the Tsukuba Express Line since it was called JRCC.

The Eastern Kanagawa Rail Link includes two new railway lines: the Sotetsu-JR Link Line and the Sotetsu-Tokyu Link Line. The rail link connects three existing lines: the Sotetsu Line, the JR Line, and the Tokyu Line. Because the Sotetsu Line was operated only within Kanagawa Prefecture, the passengers heading to central Tokyo had to transfer at Yokohama Station to other Tokyo-bound lines such as JR and Tokyu. Through the new link, Sotetsu train can directly go onto Tokyo-bound lines without transfer and the mobility of the people along the Sotetsu Line has been drastically improved.

Another feature of the Sotetsu-Tokyu Link Line is its connection to a Shinkansen station. Using this line, people living along the Sotetsu Line and the Tokyu Line can directly access Shin-Yokohama Station, which is an important gateway for the Tokaido Shinkansen Line in Kanagawa Prefecture. Therefore, the link contributes to the improvement of mobility and expansion in the railway network.

The project was the first case of the government's Speed-up Project under the Urban Railway Promotion Act. In this scheme, infrastructure is constructed and owned by JRTT, and trains are operated by the railway companies.

The Sotetsu-JR Link Line was opened on November 30, 2019, and the Sotetsu-Tokyu Link Line was opened on March 18, 2023.

Many new technologies were adopted in the construction of these lines. For example, the segment section and the SENS (Casting support tunneling system using TBM) section in Hazawa Tunnel were excavated consecutively with TBM.

Opening of the Sotetsu-Tokyu Li


Opening ceremony


First train departing ceremony


❹ Hazawa tunnel


❺ Shin-Yokohama station

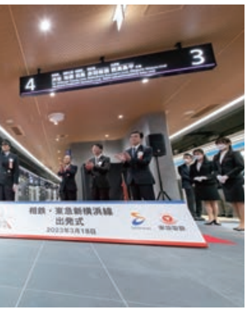

❸ Hazawa-yokohama-kokudai station

Opening of the Sotetsu-JR Link


Opening ceremony


Hazawa yokohama-kokudai

Link Line



ny (Photo provided by Sagami Railway and Tokyu Railways)

❻ Shin-Yokohama tunnel

❼ Shin-Tsunashima station

nk Line

station

❶ Nishiya station

❷ Nishiya tunnel

Urban Railways

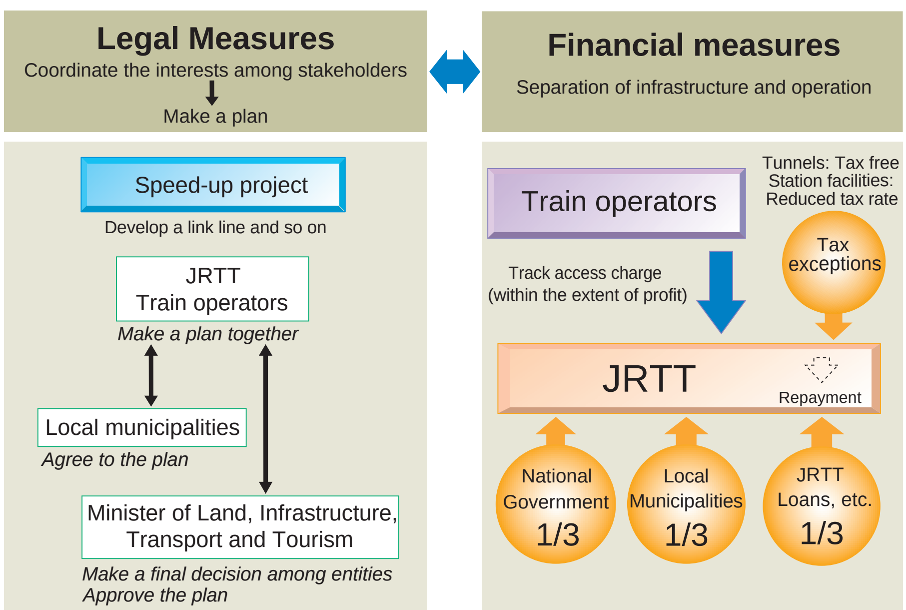
Eastern Kanagawa Rail Link (Sotetsu-JR Link Line and Sotetsu-Tokyu Link Line)

Project Overview

	Sotetsu-JR Link Line	Sotetsu-Tokyu Link Line
Construction section	Nishiya (Sotetsu Line) to Yokohama-Hazawa (JR Tokaido Freight Line)	Yokohama-Hazawa (JR Tokaido Freight Line) to Hiyoshi (Tokyu Toyoko and Meguro Lines)
Operation section	Sotetsu Line: Ebina/Shonandai – Nishiya – Hazawa-yokohama-kokudai – JR Lines: To Shinjuku	Sotetsu Line: Ebina/Shonandai – Nishiya – Hazawa-yokohama-kokudai – Tokyu Line: To Shibuya/ Meguro
Length	2.7 km	10.0 km
Facility builder	JRTT	JRTT
Train Operator	Sagami Railway Co., Ltd. (Sotetsu)	Sagami Railway Co., Ltd. (Sotetsu) Tokyu Railways Co., Ltd.
Frequency of operation (Peak time)	Morning rush hour: 4 trains/hour Other time: 2 to 3 trains/hour	Morning rush hour: 10 to 14 trains/hour Other time: 4 to 6 trains/hour
Opening day	November 30, 2019	March 18, 2023

Overview of the Urban Railway Promotion Act

This act stipulates new railway development measures aimed at speeding up trains and facilitating accessible station design by utilizing existing railway infrastructure. The act also stipulates the development scheme in which rail infrastructure is constructed and owned by a public entity while trains are operated by railway companies. JRTT is one of the possible public entities. JRTT, the rail owner, and railway companies, the train operators, jointly apply to be "approved development planners" with a conceptual proposal of new railway. After receiving approval from the Minister of Land, Infrastructure, Transport and Tourism, the approved development planners submit a detailed plan. Once the Minister approves the plan, the planners are regarded as licensed railway developers under the Railway Business Act. In the Eastern Kanagawa Rail Link project, the construction cost is evenly covered by three stakeholders: the Government, the local municipalities (Kanagawa Prefecture and the city of Yokohama), and JRTT. The train operators, Sotetsu and Tokyu, pay track access charges to JRTT, which are calculated based on the profit that the train operators could make from the new lines.



Other Urban Railways Commissioned to JRTT

Rinkai Line: Opened in December 2002

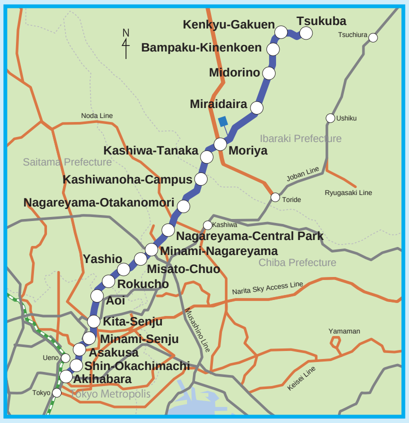
The Rinkai Line runs from Shin-Kiba to Osaki through Tokyo Waterfront Area. JRCC was commissioned to construct this line by Tokyo Waterfront Area Rapid Transit, Inc. The first section of the Rinkai Line between Shin-Kiba Station and Tokyo Teleport Station opened in 1996. The remaining section between Tokyo Teleport Station and Osaki Station was opened in 2002.

Minatomirai Line: Opened in February 2004

Bashamichi station

The Minatomirai Line runs from Yokohama station to the central business district called “Minatomirai 21” and to popular tourist destinations such as Yamashita Park, Motomachi District and Yokohama China Town. JRCC signed an agreement with Yokohama Minatomirai Railway Company in March 1992 to construct this line.

Tsukuba Express Line: Opened in August 2005



The Tsukuba Express Line is 58 km long and runs from Akihabara to Tsukuba in 45 minutes at a maximum speed of 130 km/h. JRCC signed an agreement with Metropolitan Intercity Railway Company in February 1993 to construct this line.

Urban Railways

Other Urban Railways Commissioned to JRTT

Narita Sky Access Line: Opened in July 2010

The Narita Sky Access Line connects Narita Airport and central Tokyo at a maximum speed of 160 km/h.

In April 2005, JRTT was commissioned by Narita Rapid Railway Access Co., Ltd. to construct the line. The construction started in 2005 and completed in 2010.

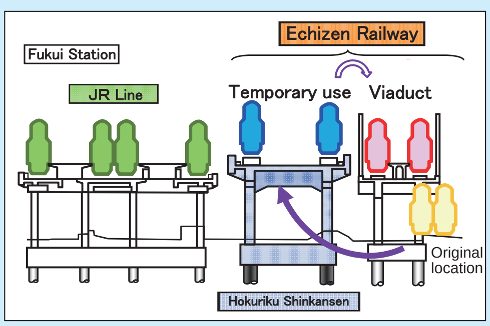
Sendai Subway Tozai Line: Opened in December 2015

Tatsunokuchi bridge, a double-decked truss bridge for rail and road

The Sendai Subway Tozai Line covers the Sendai city from west to east via Sendai Station.

JRTT was commissioned by the city of Sendai in November 2005 to construct the westernmost 4.3 km section from Yagiyama Zoological Park station to Ogizaka tunnel.

Grade Separation of Echizen Railway: Completed in December 2018



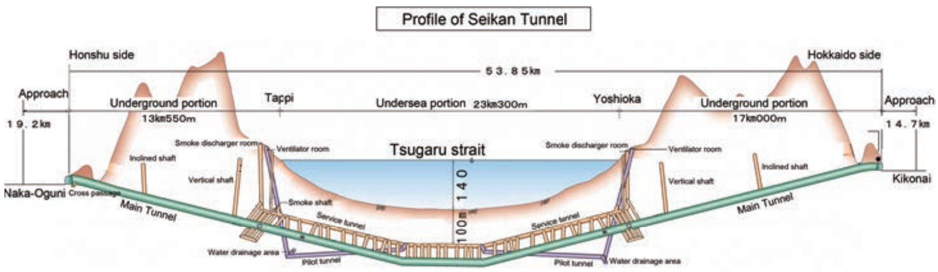
Grade Separation of Echizen Railway was a project to build consecutive railway viaducts for 2.5 km from Fukui Station. The new viaducts have reduced traffic jams and accidents on the road and eliminate the areal division caused by ground level rail track. JRTT was commissioned by Echizen Railway to construct the line in November 2013 and completed it in December 2018.

Seikan Tunnel

Overview

Construction of Seikan Tunnel was spurred by the capsize of Toya-Maru Ferry boat during a severe typhoon in 1954, which was the second worst maritime disaster in history. Unprecedented difficulties including four major water inrush incidents occurred during the construction, especially during the excavation of the undersea section. After overcoming these tough situations, the tunnel was opened in 1988. Various new tunneling technologies were developed and applied during the construction.

Seikan Tunnel is the only infrastructure directly connecting Honshu and Hokkaido. In 2016, the long-awaited Shinkansen line was laid through the tunnel and the role of the tunnel as an artery of Japan’s land axis has become even more important.




Excavation during construction

Renovation Projects


Train fire detector


Drainage pump for water

The facilities for train operation and disaster control in the undersea tunnel have been aging and deteriorating under severe conditions. In addition to monitor minor deterioration since the tunnel opened, JRTT conducted a full-scale inspection for the first time ten years after the opening and started renovation projects in 1999 to repair and maintain the tunnel based on the results.

To date, drainage pumps and fire detectors for running trains have been repaired and reinstalled throughout the tunnel.

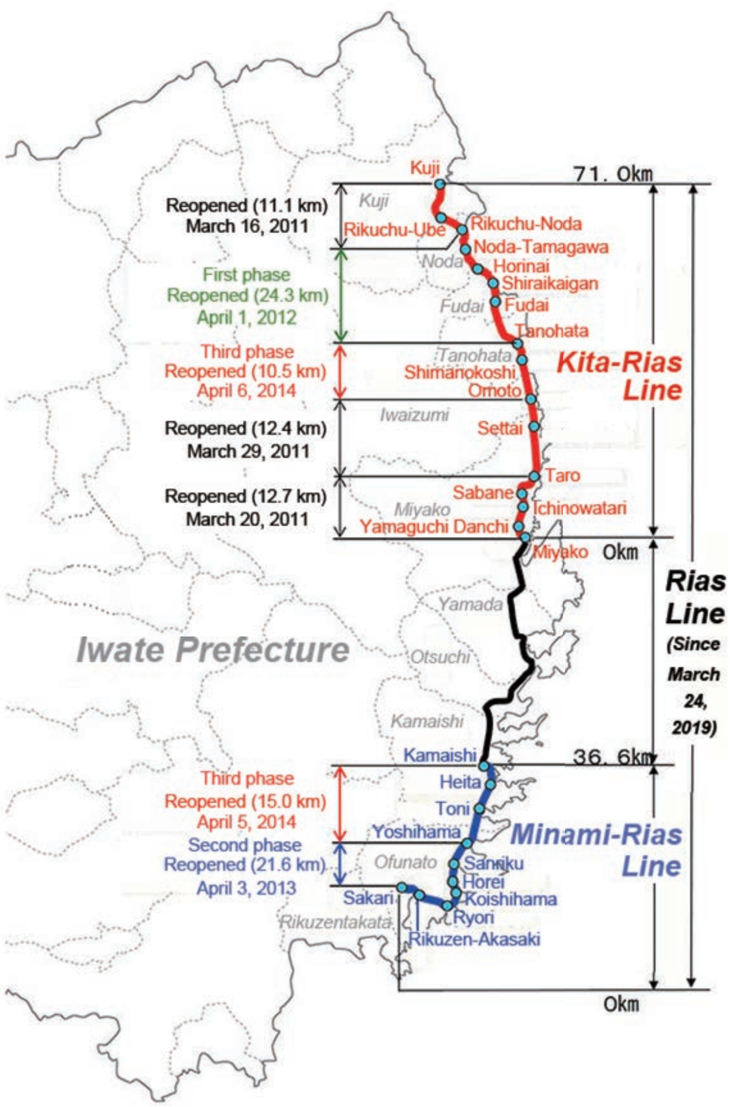
Assistance for Restoration of Railways after the Great East Japan Earthquake

Sanriku Railway Rias Line: Fully reopened in April 2014

The Sanriku Railway Rias Line was originally planned as a Japan National Railway line along the Sanriku Rias coast in the 1960s. While some sections were completed by JRCC, the former entity of JRTT, the construction of the remaining sections was once abandoned due to the restructuring of the Japan National Railway. In order to complete the entire line, local municipalities along the line established an agency called "Sanriku Railway Company" in 1981 and they commissioned JRCC to construct the unfinished sections. The entire line opened in 1984.

In 2011, enormous tsunamis from the Great East Japan Earthquake devastated the line. Sanriku Railway Company commissioned JRTT to reconstruct the line. The main work included reconstructing the embankments, tracks, and communication cables which had been washed away by the tsunamis. Operations on the lines were resumed in some phases and the lines were fully reopened in 2014.

Route Overview



Progress of Restoration

Kita-Rias Line: Embankment between Tanohata to Rikuchu-Noda

Kita-Rias Line: Embankment and bridge between Komoto to Tanohata

Minami-Rias Line: Embankment between Sakari to Yoshihama

Minami-Rias Line: Bridge between Yoshihama to Kamaishi

Reopening

April 1, 2012
Kita-Rias Line:
Tanohata to Rikuchu-Noda

April 6, 2014
Kita-Rias Line:
Komoto to Tanohata

April 3, 2013
Minami-Rias Line:
Sakari to Yoshihama

April 5, 2014
Minami-Rias Line:
Yoshihama to Kamaishi

Sanriku Railway train running in Tofugaura area

Sanriku Railway train at Shimanokoshi station

Sanriku Railway train running in Tomari area

Sanriku Railway train crossing Owatari river

Sendai Airport Access Line: Reopened in October 2011

The Sendai Airport Access Line was constructed by JRTT and opened in 2007. In March 2011, the Great East Japan Earthquake hit the Sendai region as well, and the line was devastated. The Miyagi Prefectural Government and Sendai Airport Transit Company requested JRTT to assist with the reconstruction of the line. JRTT immediately dispatched an advance team to inspect the damage caused by the earthquake. Seeing the serious results reported by the team, JRTT organized an assistance team and sent two JRTT engineers to the company to plan the inspection and reconstruction of the damaged structures. The entire line was reopened on October 1, 2011, just seven months after the earthquake.

Sendai Airport Station Operation Control Office

Inside the airport tunnel

Entrance to the airport tunnel

Disaster Recovery Assistance

Railway Disaster Investigation Team(RAIL-FORCE)

When a railway structure is severely damaged by a natural disaster, the Railway Disaster Investigation Team (RAIL-FORCE) is immediately sent to the site to assist the railway operator upon request from the railway company through MLIT.


Investigation of embankment spillage


Reporting the investigation to the railway operator

How RAIL-FORCE is sent

Railway Company

- Increasing frequency and severity of disaster
- Lack of technician and expertise
- Difficulty in early recovery

→ **Consult** → **MLIT** → **Request** → **JRTT**

JRTT

- Assess the damage
- Inspect the damage to individual facilities
- Assist with faster recovery

*No costs related to the above will be charged.

← **Dispatch of engineers and Technical Support** (JRTT → Railway Company)

Dispatch records of RAIL-FORCE

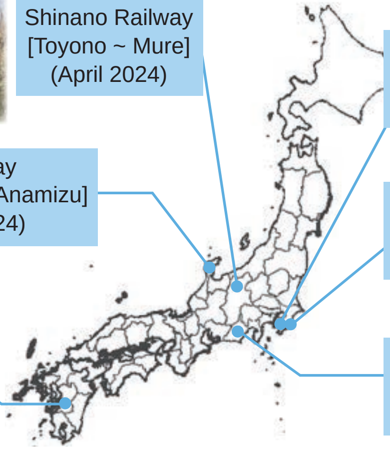

Shinano Railway [Toyono ~ Mure] (April 2024)


Kominato Railway [Satomi ~ Kazusa-Nakano] (September 2023)


Noto Railway [Wakura-Onsen ~ Anamizu] (January 2024)


Isumi Railway [Fusamoto ~ Kazusa-Nakano] (September 2023)


Kumagawa Railroad [Hitoyoshi-Onsen ~ Higo-Nishinomura] (October 2023)




Oigawa Railway [Ieyama ~ Senzu] (June 2023)

Project Research

Research by JRTT

JRTT has sophisticated capabilities to conduct reliable field studies required to realize an efficient transportation network. These studies range from basic research at the conceptual stage to detailed investigations at the final decision-making stage on a project.

Based on requests from the government, local municipalities, or railway companies, JRTT conducts various types of transportation studies.

Solid technical knowledge

JRTT provides a wide array of appropriate studies and proposals based on the rich experiences.

Appropriate framework

In order to implement projects effectively and efficiently, JRTT proposes the most appropriate project scheme to the policy makers.

Neutral position

As a public institution, JRTT conducts highly objective and reliable research.

Suitable and detailed research

JRTT's regional bureaus covering the whole country enable us to provide timely and appropriate research and assistance for each site condition.

Process of Railway Project Research

Preliminary observation

- Understand line development needs and national and local government plans

Foundation research

- Investigate current traffic conditions
- Survey traffic volumes
- Analyze the need and urgency of the target route
- Study applicable project schemes

Route outline

- Examine route conditions and compare with alternatives
- Estimate total project cost
- Estimate traffic demand and consider service schedules

Route finalization

- Consider business feasibility and evaluate socio-economic and other impacts
- Determine routes, station locations, and other required facilities

Project scheme

- Determine an applicable scheme including project entities and financing

Construction Plan

- Investigate geological conditions, conduct a land survey, and study design conditions
- Design alignment and consider structure types and forms
- Design outline of structures, calculate construction costs, and apply for project approval
- Negotiate with stakeholders, comply with EIA, and complete urban planning and other procedures

Construction

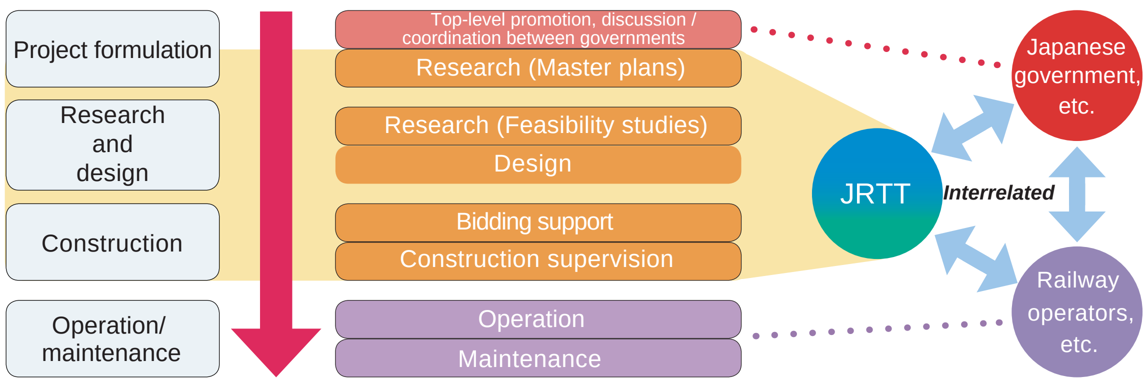
Overseas Expansion of Japan's Railway Technology

Overseas High-Speed Rail Projects

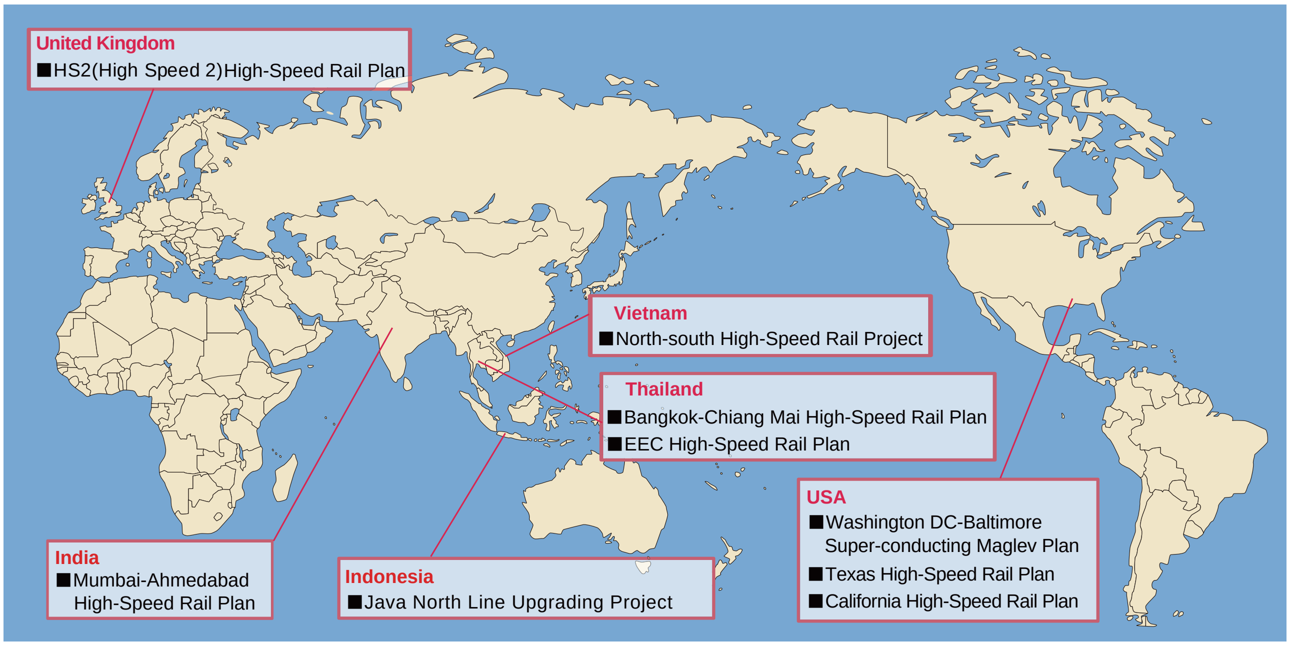
Recently, awareness of global environmental issues has been growing and the demand for efficient transportation has been increasing along with economic growth in developing countries in Asia and elsewhere. Especially, expectations for railways have increased as an excellent mass transit system with a small environmental burden. Many railway projects are being planned and investigated throughout the world and the railway market is estimated to be around 30 trillion yen per year (Annual average from 2025 to 2027).

Whereas the construction of high-speed rail requires concerted efforts by engineers from civil, architecture, tracks, machinery, and electricity, private companies in overseas projects may require abilities to fully execute all these functions in addition to interface coordination among these technical fields. As an experienced agency, JRTT is expected to play a proactive role in coordinating construction of high-speed rail in the world. To encourage the public agencies including JRTT to take part in the overseas projects, the Japanese government enacted 'the Act on the Promoting the Export of Infrastructure System' in 2018. Thus, JRTT has embarked to the world rail project market to contribute to the realization of sustainable development through railway construction.

Main Roles of JRTT



Major High-Speed Rail Projects



Excerpt: 2023 Action Plan for Infrastructure System Export Strategy by MLIT

Overseas Technical Cooperation

Since 1964, JRTT has contributed to overseas railway development by dispatching railway experts under the Government's coordination. To date, we have dispatched more than 2,000 experts to a total of 70 countries and regions. We have also hosted more than 4,000 trainees from 100 countries and regions, introducing Japan's railway technologies.

Specific Efforts for Overseas Technical Cooperation

Taiwan High-Speed Rail Project

Taiwan High-Speed Rail opened in 2006 and it was the first export case of the Shinkansen system. JRTT dispatched engineers and cooperated with the project from the planning stage in 1989.
Specifically, we had our engineers participate in the feasibility study during the investigation stage, and we provided recommendations and close investigations of written proposals from a technical perspective during the bidding stage. After the decision was made to introduce the Shinkansen system, we dispatched engineers specialized in the core systems of track and electricity, and provided technical cooperation during the construction stage and comprehensive inspections prior to the opening.

This project is not only a successful example of the export of the Shinkansen system, but also a successful example of the utilization of JRTT's comprehensive railway construction technology and knowledge cultivated in Japan and applied overseas from the planning stage to the opening.

India High-Speed Rail Project

At the summit meeting in December 2015, the governments of India and Japan concluded a memorandum of understanding regarding the introduction of the Shinkansen system. Both two governments decided that India's high-speed rail between Mumbai and Ahmedabad would adopt the Japanese Shinkansen system. Since the feasibility study, JRTT has proactively cooperated with the project by dispatching railway experts. In addition, JRTT has hosted trainees from India and organized observation tours to help them further understand construction techniques and safety management at actual Shinkansen construction sites.

Technical Exchange with Sweden

As interest in high-speed rails grows in Sweden, MLIT and the Swedish Ministry of Industry concluded a memorandum of understanding regarding cooperation in the railway sector. Based on this memorandum, JRTT has been exchanging high-speed rail technologies with the Swedish Transport Agency since 2013.

The technical exchange includes activities such as participating in high-speed rail working groups and having our employees serve as lecturers at various seminars. While we introduce Japanese railway technologies to the Swedish side, we also learn about Swedish railway technologies. We have also hosted officials from Sweden and deepened our exchange through activities such as Shinkansen construction site tours.

Technologies for Railway Infrastructure

Tunnel

Tunneling

NATM (New Austrian Tunneling Method)

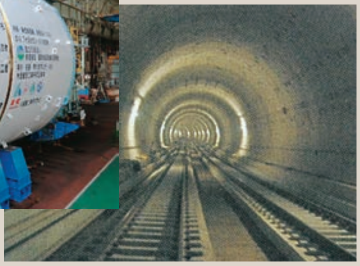
NATM (New Austrian Tunneling Method), also called sequential excavation method, was developed from conventional excavation, and excavates tunnel by drilling and blasting or boom-type road header. In this method various types of auxiliary tunnel supporting have been developed suitable to the wide range of ground conditions and made it possible to excavate even shallowly covered tunnel.

TBM (Tunnel Boring Machine)

TBM (Tunnel Boring Machine) consists of the cutterhead to excavate the ground and following 'shield part' which supports surrounding soil. Concrete segments are assembled in the shield as a permanent lining thus tunnel can be constructed safely.

TBM (Slurry type: cutterhead is colored in blue.)

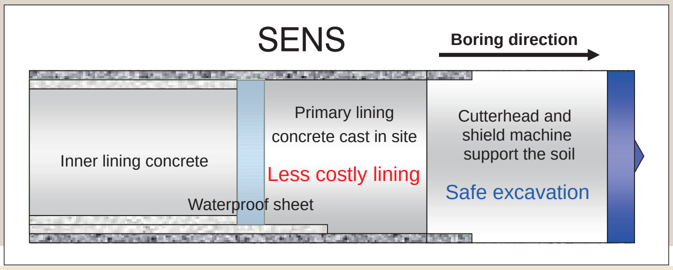
Double track size circular tunnel

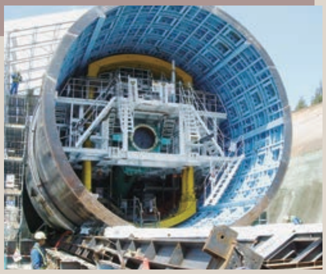


SENS (Site-cast Concrete Lining System with TBM)

TBM is advantageous in safety, but costly due to the machine itself and the concrete segments for lining which are manufactured in factory, whereas NATM is less costly but less safe.

JRTT developed a new TBM boring system in which tunnel is lined by less costly site-cast concrete. This system was named SENS, abbreviation from Shield, ECL (Extruded Concrete Lining), and NATM System, which means it contains various advantages of each boring system.





Inside the shield (Tail side view)

Pneumatic Caisson Method

The Pneumatic Caisson is constructed on the ground and then sunk into the ground by excavating the soil inside with preventing underground water seepage by pressurized air. In the Chuo Shinkansen, the largest underground structure in Japan (depth: 79 m, outside diameter: 39 m) was constructed by Pneumatic Caisson Method.

Tunnel Lining

Tunnel lining is a concrete wall placed inside the bored tunnel with the mobile formwork shown in the photo. The functions of the lining are: to support the ground, to prevent leakage of groundwater, and to install brackets to hang electrical facilities.

FILM, brand-new waterproofing for tunnel lining

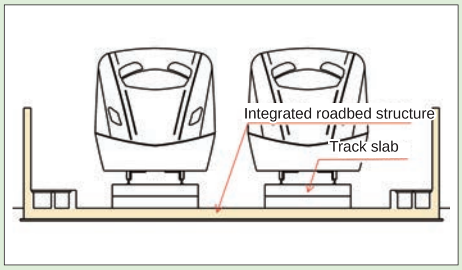
Waterproof sheet are placed on the primary shotcrete lining to prevent water leaking into the tunnel. However, uneven shotcrete surface generates large gap behind the sheet and causes disfunction of the linings. FILM, Flat Insulated Lining Method, is a solution for filling the gap and smoothing the waterproof sheet to secure the total soundness of the linings.

Tunnel Entrance Hood

When a Shinkansen train enters a tunnel at high speed, a "micro-pressure wave" is generated and causes noise or vibration nearby the other entrance of the tunnel exit (piston effect). To mitigate micro-pressure wave, tunnel entrance hood with larger diameter than the tunnel is constructed in front of the tunnel portal.

Roadbed

Integrated Roadbed Structure for Slab Tracks



Since a robust roadbed is required to support slab tracks without deformation, slab tracks were formerly available only on concrete structures. JRTT had developed this new technology to increase the robustness of roadbed by integrating earth structure and roadbed. Thanks to this new roadbed, slab track is available on the earthwork structure.

Technologies for Railway Infrastructure

Bridge and Viaduct

Genshu bridge
Nishi Kyushu Shinkansen

GRS-integrated bridge with PC girder is economical and requires less maintenance because the beams and the abutments are rigidly connected without bearings. Even longer girders can be constructed with advanced prestressing techniques.

No.2 Takeda River bridge
Hokuriku Shinkansen

The 125 m span is the longest among three-span continuous PC rigid frame railway bridges in Japan.

Fukui Kaihotsu viaduct
Hokuriku Shinkansen

As the first case for the rigid frame viaduct in the railway civil works in Japan, the full precast method was introduced to improve the productivity and significantly shorten the construction period.

Kaga-Hosotsubo bridge
Hokuriku Shinkansen

The 155 m span is the longest among Shinkansen bridges. The ingenious design controls the deflection that often occurs in long-span bridges.

Railway Track

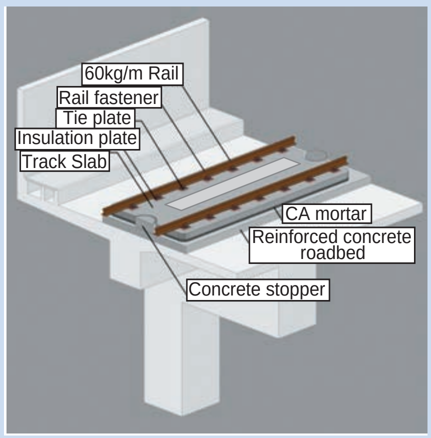
Track Structure for Shinkansen High-Speed Rail

Slab tracks are generally used for Shinkansen high-speed rail except for the Tokaido Shinkansen. Their stiffness and accuracy are advantageous for high-speed train operation and maintenance compared to conventional ballasted tracks.

In the early days of slab track, its shape was "flat type." Later, lighter and more economical "frame type" slabs were invented and have been used in tunnels and less snowy areas.

Flat type slab (Tohoku Shinkansen)

Frame type slab (Kyushu Shinkansen)



Slab Track

Track Structure for Urban Railway

Urban railway tracks need to blend in with their surroundings, and "solid bed track with resilient sleepers" has recently been used to reduce noise and vibration.

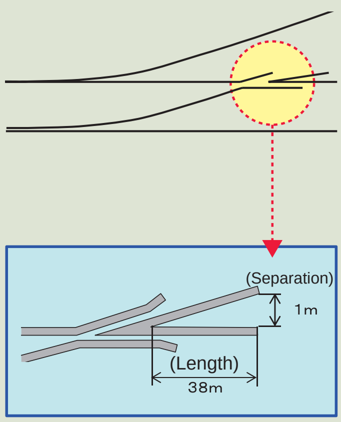
This type of track is suitable for labor-saving maintenance and supports stable transportation in urban railways.

Solid bed track with resilient sleepers
(Sotetsu-JR Link Line)

Turnout for High-Speed Rail

Turnouts can be a cause for trains to slow down. When the Hokuriku Shinkansen Line was connected to the existing Joetsu Shinkansen Line, JRTT developed a turnout to allow trains to pass through the turnout side at a speed of 160 km/h.

This type of turnout is also equipped on the Narita Sky Access Line.



Technologies for Railway Infrastructure

Architecture

Harmonious with the Community

JRTT reflects public opinions to create a new station as a symbolic landmark with regional identity and culture.


Shin-Omura station, Nishi Kyushu Shinkansen


Echizen-Takefu station, Hokuriku Shinkansen

Collaborative with the Community

JRTT constructs accessible stations that everyone can use safely and securely, involving local communities by exchanging opinions on universal design, using local materials, and so on.


Discussion forum with disabilities people about the universal design of Nishi Kyushu Shinkansen Line stations


Discussion forum with non-Japanese residents about JRTT-designed multi-language guide signs for Hokuriku Shinkansen Line stations

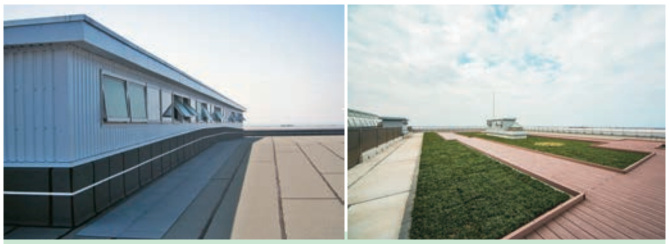

Ceramic tiles with a picture carved by local residents, used as an interior in a station on the Nishi Kyushu Shinkansen Line


Sightseeing spot in the region displayed on a safety fence on the Hokuriku Shinkansen platform
(in collaboration with Fukui Prefecture)

Eco-Friendly

In the construction of various railway buildings such as station buildings and rolling stock depots, we proactively take measures to improve the global environment, including taking measures against global warming.

Louvered ceiling made of locally sourced wood at Komatsu station, Hokuriku Shinkansen



Natural ventilation systems and rooftop greenery at Hakusan general rolling stock depot, Hokuriku Shinkansen Line

Use local products

Using locally sourced wood is an eco-friendly solution that fixes carbon dioxide and saves transportation energy. The use of wood for station building interiors creates comfortable atmospheres. Shin-Hakodate-Hokuto Station is awarded the Practical Use of Wood Special Award at the Practical Use of Wood Competition.

Use renewable energy

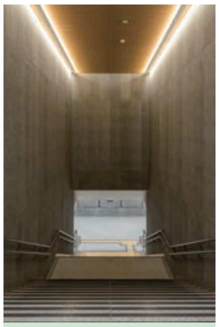
We proactively use sunlight, natural wind for ventilation, and other renewable energy sources in station buildings.

Green roofs and railway premises

We plant trees and other greenery on rooftops and railway premises to mitigate the heat island effect and prevent global warming.

Use products made from waste materials

From the viewpoint of reducing waste and making effective use of resources, we use eco-friendly products such as tiles made from construction waste including stone, brick, ceramic, roofing tiles, and other materials.



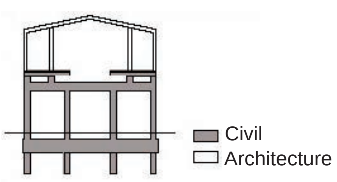
Recycled interior board made of used coffee grounds at Shin-Yokohama station, Sotetsu-Tokyu Link Line

Cost-Effective and Well-Designed

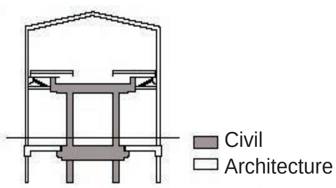
To shorten the construction period, reduce costs, and improve design flexibility, JRTT has developed a “hybrid structure” in which the civil and building structures are integrated, and has used it on various lines.

By replacing a conventional four-pillar viaduct with a two-pillar one and integrating the pillars on both sides and the roof, the layout of the station facilities, such as concourses, escalators, and elevators, can be more flexible.

Conventional structure



Hybrid structure



Architectural exterior covering the viaduct at Ureshino-Onsen station, Nishi Kyushu Shinkansen

Technologies for Railway Infrastructure

Machinery

Rolling Stock Depot Facility

Trainsets require regular inspection and repair to provide passengers with a safe and comfortable ride. Rolling stock depots contain various pieces of equipment to inspect, repair, and wash trainsets to maintain their proper condition.


Train body washing machine


Cab car repair machine


Bogie replacement machine

Air Conditioning, Ventilation & Smoke Exhaust Equipment

Air conditioning, ventilation, and smoke exhaust equipment for platforms, concourses, station offices, and other areas, as well as ventilation and smoke exhaust equipment for tunnels, ensures the safety and comfort of underground stations and tunnels.


Air conditioner in an underground station


Tunnel ventilator

Station Facility

Platform screen doors, elevators, escalators, and other facilities are installed to ensure all passengers can move safely and smoothly.


Screen door on a platform


Elevator

Snow Damage Prevention Equipment

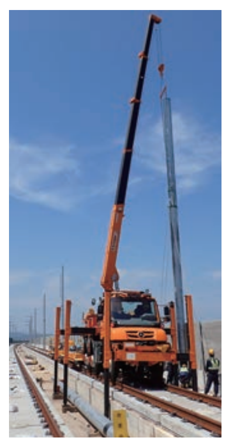
In regions with heavy snowfall, various snow damage prevention measures for railways are installed, including sprinklers to melt the snow and quick snow removers around turnouts, to maintain stable transportation in winter.


Snow removal sprinkler


Quick snow remover for turnout

Construction Machinery

JRTT develops and introduces special machinery for railways, used in track work to lay rails and the electrical work to install overhead wires to ensure safe and efficient construction.

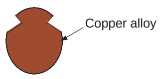

Specialized vehicle for planting a electric pole

Electricals

Economical Overhead Wire for High-Speed Operation

A simple overhead electric line using PHC (Precipitation Hardening Copper) trolley wire is economical and is used as standard for the Shinkansen lines. PHC trolley wire has advantages such as light weight, high tensile strength, and excellent electrical conductivity, due to the precipitation hardening copper alloy made of oxygen-free copper, chromium, zirconium, and other elements, making it suitable for high-speed operation.

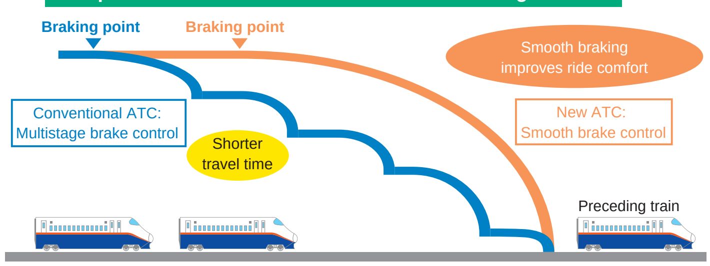
Cross Section of PHC trolley wire



Train Control System to Improve Ride Quality

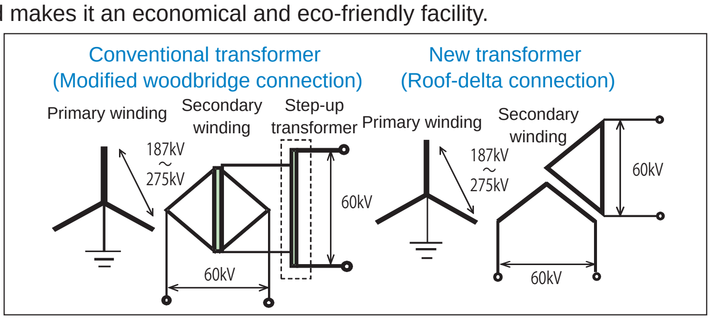
The Tohoku Shinkansen Line between Hachinohe and Shin-Aomori was equipped with new on-board oriented Automatic Train Control (ATC) system, enhancing the system that been used on the Tohoku Shinkansen Line between Morioka and Hachinohe, to improve ride quality, shorten travel time, and reduce headway. Based on this system, non-insulated track circuits were installed along the entire extension to Shin-Aomori for the first time among the Shinkansen Lines, simplifying the equipment along the track and reducing maintenance. Applying these achievements, JRTT has developed a new ATC system to adapt to the 60 Hz frequency section of the Hokuriku Shinkansen Line. For the Hokkaido Shinkansen Line (Shin-Aomori to Shin-Hakodate-Hokuto), where the Shinkansen and conventional lines share the track, we introduced an ATC system compatible with both Shinkansen and conventional trains.

Comparison of Conventional and New ATC Braking Patterns



Eco-Friendly Roof-Delta Connected Transformer

JRTT developed a roof-delta connected transformer to replace the conventional modified woodbridge-connected transformer, and it has been installed since the Tohoku Shinkansen Line (between Hachinohe and Shin-Aomori). Compared to the conventional type, this transformer has a simpler structure, which makes it smaller and lighter, reduces power loss, and makes it an economical and eco-friendly facility.



Shin-Isahaya substation, Nishi Kyushu Shinkansen

Major Awards

JRTT has received various awards not only from within Japan but also from overseas for its railway development technologies.

Railway Projects

Shinkansen Line

■ Hokkaido Shinkansen between Shin-Aomori and Shin-Hakodate-Hokuto

2016 Outstanding Civil Engineering Achievement Award from JSCE

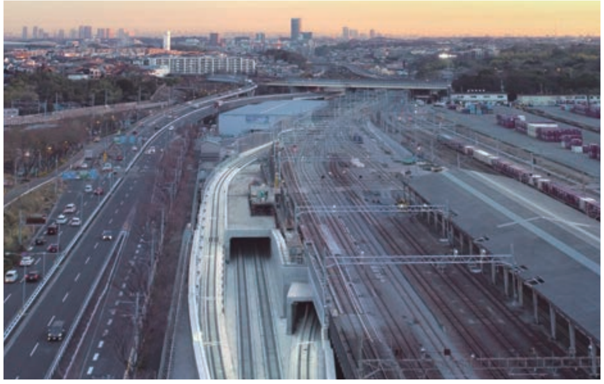
■ Kyushu Shinkansen Nishi Kyushu route

2022 Outstanding Civil Engineering Achievement Award from JSCE

Urban Railways and Restoration Railways after Disaster

■ Eastern Kanagawa Rail Link

2019 Outstanding Civil Engineering Achievement Award from JSCE (Sotetsu-JR Link Line)
2023 Outstanding Civil Engineering Achievement Award from JSCE (Sotetsu-Tokyu Link Line)
Japan Railway Grand Prize in 23rd Japan Railway Award (Sotetsu-Tokyu Link Line)



■ Restoration of Sanriku Railway damaged by the Great East Japan Earthquake

2014 Outstanding Civil Engineering Achievement Award from JSCE
2014 Special technology Award from the Japan Railway Civil Engineering Association
2014 Zenken Award from the Japan Construction Engineers' Association

Civil Engineering

■ Cost-effective Tunneling by SENS which can Switch Lining Type from/to concrete Segment to/from Cast-in-place Lining

2020 Outstanding Civil Engineering Achievement Award from JSCE

■ Invention of Pipe Roof Construction Method Applicable to Geology including Large Boulder

2020 Outstanding Civil Engineering Achievement Award from JSCE

■ Construction of a large-section tunnel at a railroad station using the rectangular element jacking method

2022 Outstanding Civil Engineering Achievement Award by JSCE

■ Adoption of batter pile foundation for rigid frame viaduct with excellent seismic resistance and cost-effectiveness in soft ground

2022 Outstanding Civil Engineering Achievement Award by JSCE

Architecture

■ Shin-Tosu Station, Kyushu Shinkansen
2011 Brunel Award from the Watford Group
2011 Station Building Award from the Association of Railway Architects in Japan

■ Nagasaki Station, Kyushu Shinkansen Nishi Kyushu route
2022 Station Building Award from the Association of Railway Architects in Japan

Electrical Equipment

■ Development of Non-insulated DS-ATC for Shinkansen
2016 Electrical Science and Engineering Promotion Award (former Ohm Award)

■ Development and implementation of pin-yoke type fitting equipment for Shinkansen train
The 78th IEEJ Technical Development Award

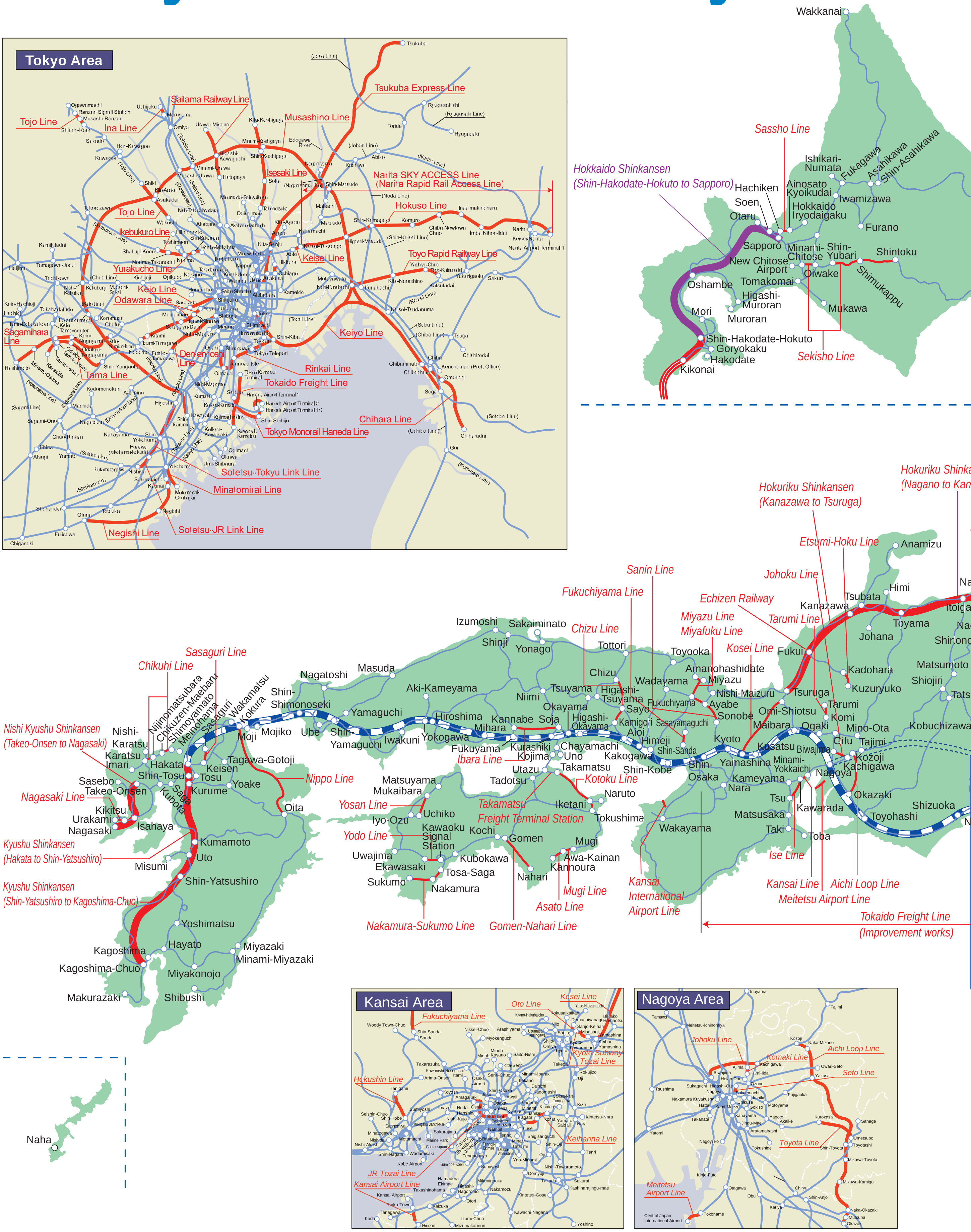
■ Lighting of Shin-Hakodate-Hokuto Station, Hokkaido Shinkansen
2016 Hokkaido Outstanding Lighting Technology Award,
The Illuminating Engineering Institute of Japan

■ Implementation of train line pole with slip-joint structures
2022 Shibusawa Award from the Japan Electric Association

Others

■ Seikan Tunnel ■ Keiyo Line ■ Joetsu Shinkansen ■ Hokuriku Shinkansen ■ Toyo Rapid Railway Line
■ Rinkai Line ■ Hokuso Line ■ JR Tozai Line ■ Sendai Airport Access Line ■ Aichi Loop Line
■ Chizu Express Line ■ Yamanashi Maglev Test Line ■ Odakyu Odawara Line ■ Kyushu Shinkansen
■ Tohoku Shinkansen ■ Narita Sky Access Line ■ Minatomirai Line ■ Tsukuba Express Line and others...

Railway Lines Constructed by JRTT



Legend

[Shinkansen Lines]
- Under construction
- Under construction (Maglev)
- In operation

[Conventional Lines]
- Under construction
- In operation

[Existing Lines Constructed by Other Than JRTT]
- Shinkansen Lines
- Conventional Lines

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YouTube Official Account: @jrtt_official

Instagram Official Account: @JRTT_PR

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鉄道建設・運輸施設整備支援機構
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