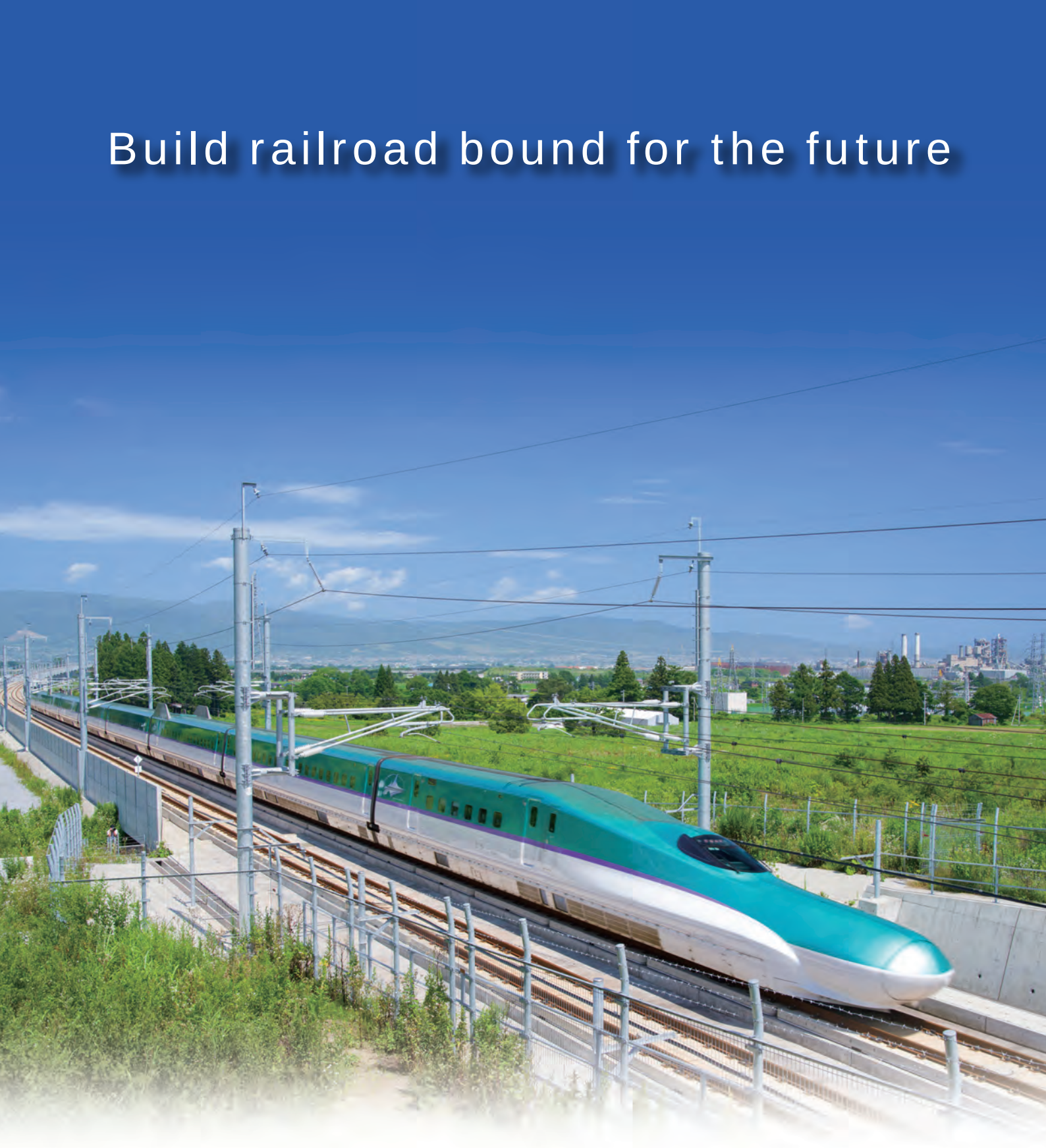
Build railroad bound for the future



JRTT

Japan Railway Construction, Transport and Technology Agency

The railway is essential infrastructure to maintain and improve people's living by transport people and objects safely and securely.

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

独立行政法人
鉄道建設・運輸施設整備支援機構
Japan Railway Construction, Transport and Technology Agency

Basic Philosophy

We contribute to building future transportation network.

- We build safe, secure and ecofriendly 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 experiences, and advanced expertise to the maximum.

Contribution to SDGs

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

SUSTAINABLE DEVELOPMENT GOALS

JRTT's role is connecting rail and rail, towns and cities by reliable technology and abundant experiences we have gained.

We create new values for people's lifestyle through railway construction, thus contribute to development of national economy and people's living.

History of JRTT

JRTT, Japan Railway Construction, Transport and Technology Agency, was organized in 2003. 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 promote regional prosperities.

JRTT has constructed various types of railways. Most notable achievement is Shinkansen High-Speed Rail, which has been known as the world first high-speed railway. Seikan Undersea Tunnel is also a great achievement as the world longest undersea rail tunnel to directly connect Japan's two major islands Honshu and Hokkaido. Other than these rails, significant number of conventional rails including urban and regional rails have been constructed by JRTT. Total length of these lines reaches more than 3,600km to date. (See page 38)

CONTENTS

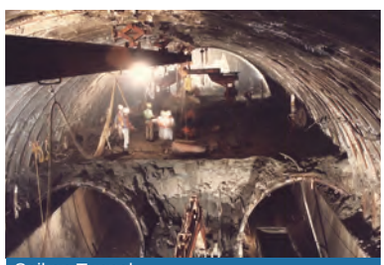

❶ Kyushu Shinkansen


❶ Hokuriku Shinkansen

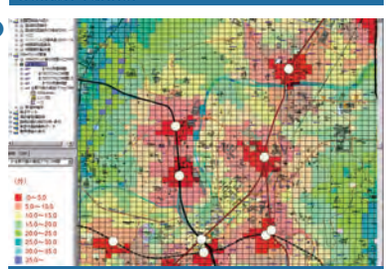

❶ Hokkaido Shinkansen / Tohoku Shinkansen


❷ Eastern Kanagawa Rail Link


❷ Tsukuba Express Line


❸ Seikan Tunnel


❹ Sanriku Railway


❺ Project Research


❻ Taiwan High Speed Rail


❼ Himekawa Bridge


❼ SENS


❼ Kurobe-Unazukionsen Station


❼ Road cum rail car, CA Mortar injection car


❼ Substation

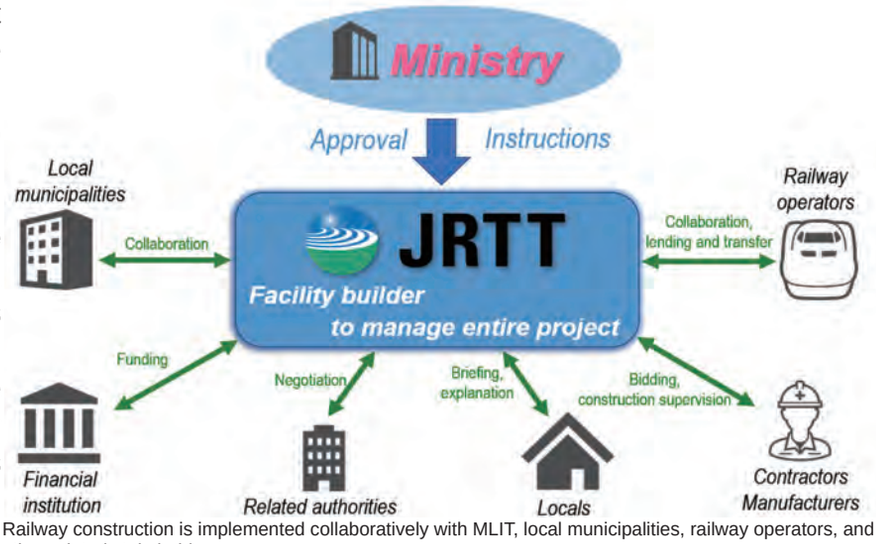
Railway Construction

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.

Not only implementing above tasks, but financial planning is also one of important roles of JRTT. JRTT considers and prepares most appropriate funding system for each railway project which requires huge amount of cost.



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

Commitment of JRTT

To conduct a large scale railway project accompanying huge cost and technically and administratively challenging tasks, JRTT promises 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 techniques.

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, railway operators can shortcut some application procedures for approval from MLIT in case that JRTT designs their structures in Japan's national rail project scheme.

JRTT with technically certified experts

Railway Construction

Process of Railway Construction

JRTT consistently involves in railway construction tasks from planning stage to the completion as an employer of the project. After completion, JRTT leases the facilities as an owner to railway operators.

From Planning to Opening of New Railway

Before construction

After decision of a new railway project by the government, JRTT starts outlining work for the new railway route and makes preliminary designs of the structures and facilities. According to the plan containing this route and structure design, Environmental Impact Assessment (EIA)* is conducted. MLIT scrutinizes the plan and result of the EIA to give an approval for the new rail project. After getting approval from MLIT, the construction work is commenced.

*Environmental Impact Assessment
To prevent serious adverse effect on environment by the project, environmental impact is surveyed and assessed at the initial stage of the planning.
The procedure includes preparing Document on primary environmental impact consideration, Draft of the assessment method, Draft Environmental Impact Statement (EIS) and Final EIS. The results are announced to at the public hearing to finalize the plan with the public and local municipalities.

Public briefing for project

Public briefings are held for local communities along the new line to ask for cooperation.

Marking of center line

Center line is marked to conduct line surveys. Geological survey is also conducted if required.

Negotiation on structural design

Based on the preliminary design, JRTT negotiates with stakeholders including local municipalities and administrators for crossing rivers and roads.

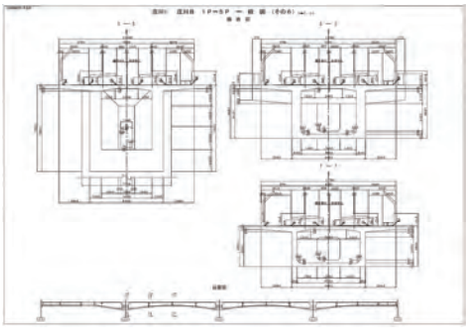
Final design

Structural design is finalized considering the cost, surrounding environment, results of geological survey and negotitation with stakeholders.

Procedures of Environmental Impact Assessment (EIA)

- Planning Phase of EIS
- EIA Scoping Document
- Survey, forecast and evaluation
- Draft EIS
- EIS
- Implementation of the project
- Submission of Final EIS

Railway crossing over the road



Design drawing of bridge

Land acquisition

JRTT negotiates with land owners to purchase the land. We shall comply with national standards to ensure proper compensation for the land owners.

Bidding for construction

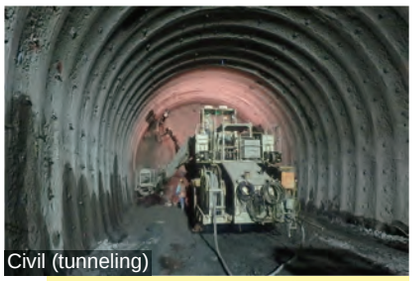
Construction is tendered at an appropriate price calculated based on the national standards for construction price.

Public briefing for construction

Briefings for locals are held to explain the construction works.

Construction management

To proceed construction smoothly and economically, we provide technical control for quality of products, schedule, and budget. Briefing to locals, environmental consideration and safety management are also crucial in the construction management.

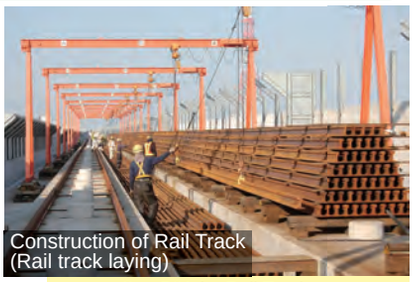


Civil (tunneling)

See P28 for Tunneling

Civil (bridge)

See P30 for Aerial Structure

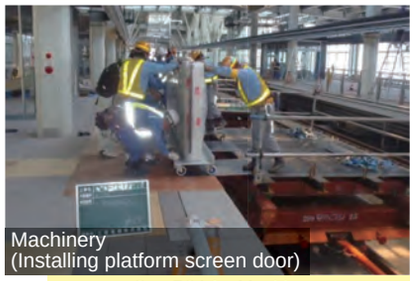


Construction of Rail Track
(Rail track laying)

See P31 for Rail Track

Architecture (station building)

See P32 for Architecture



Machinery
(Installing platform screen door)

See P34 for Machinery

Electric work

See P35 for Electrical Facilities

Integrated testing and commissioning

After completion of structures, integrated inspection of facilities is conducted to confirm safety running of actual rolling stock. Dimensions of all facilities and structures are also checked.

Measure of the gap
between train body and platform

Opening and lending

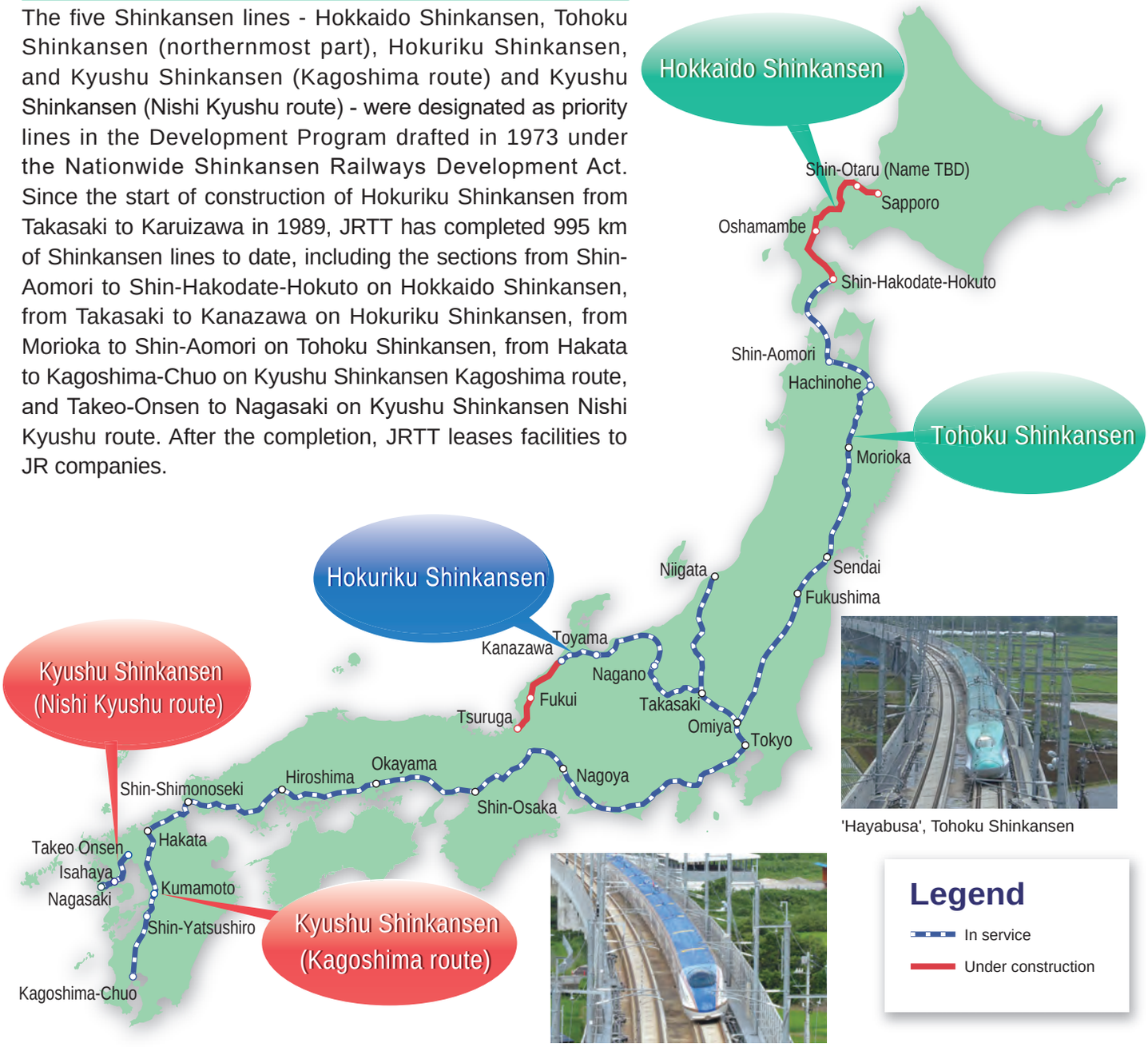
After completion, railway facilities are lent to railway operators.
(JRTT assesses opening benefits by new railways.)

Opening ceremony of Hokuriku Shinkansen
(Nagano to Kanazawa)

Construction of Shinkansen Lines

Construction of New Shinkansen Lines

The five Shinkansen lines - Hokkaido Shinkansen, Tohoku Shinkansen (northernmost part), Hokuriku Shinkansen, and Kyushu Shinkansen (Kagoshima route) and Kyushu Shinkansen (Nishi Kyushu route) - were designated as priority lines in the Development Program drafted in 1973 under the Nationwide Shinkansen Railways Development Act. Since the start of construction of Hokuriku Shinkansen from Takasaki to Karuizawa in 1989, JRTT has completed 995 km of Shinkansen lines to date, including the sections from Shin-Aomori to Shin-Hakodate-Hokuto on Hokkaido Shinkansen, from Takasaki to Kanazawa on Hokuriku Shinkansen, from Morioka to Shin-Aomori on Tohoku Shinkansen, from Hakata to Kagoshima-Chuo on Kyushu Shinkansen Kagoshima route, and Takeo-Onsen to Nagasaki on Kyushu Shinkansen Nishi Kyushu route. After the completion, JRTT leases facilities to JR companies.



'Hayabusa', Tohoku Shinkansen

'Kagayaki', Hokuriku Shinkansen

Legend

- In service
- Under construction

'Mizuho', Kyushu Shinkansen

Shorter travel time by the Shinkansen

Hokkaido Shinkansen		Hokuriku Shinkansen	
Tokyo - Sapporo		Tokyo - Fukui	
Before	7h44min	Before	3h14min
After	5h01min	After	2h52min
Kyushu Shinkansen (Nishi Kyushu route)			
Hakata - Nagasaki			
Before	1h46min		
After	1h20min		

Kyushu Shinkansen

Nishi Kyushu route

The Nishi Kyushu route is a 117km-long line connecting Shin-Tosu and Nagasaki. Among the route, the 66km-long section between Takeo-Onsen and Nagasaki opened in September 2022, which is the newest Shinkansen line in Japan.

At Takeo-Onsen station, passengers can transfer from conventional line to Shinkansen on the same platform.

* 'Nishi' stands for 'west' in Japanese.

Kagoshima route

The Kagoshima route is a 257km-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.

Takeo-Onsen to Nagasaki
[66 km]
Opened in September 2022

Hakata to Shin-Yatsushiro
[130 km]
Opened in March 2011

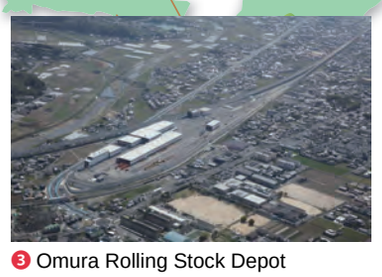
Shin-Yatsushiro to Kagoshima-Chuo
[127 km]
Opened in March 2004


5 Shin-Tosu Station


6 Kumamoto General Rolling Stock Depot

1 Takeo-Onsen Station


2 Ureshino-Onsen Station


3 Omura Rolling Stock Depot


4 Nagasaki Station

Construction of Shinkansen Lines

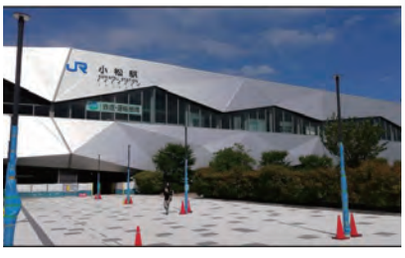
Hokuriku Shinkansen

The Hokuriku Shinkansen is a 600km-long line connecting Takasaki and Osaka. The section between Takasaki and Nagano opened in October 1997, and between Nagano and Kanazawa opened in March 2015.
Construction was started on the section between Kanazawa and Tsuruga in June 2012. The section between Tsuruga and Shin-Osaka is in the planning stage and Environmental Impact Assessment and other studies are being conducted.

⑥ Hakusan General Rolling Stock Depot

⑤ Kanazawa Station

Construction of rail track



⑦ Komatsu Station

⑨ Kuzuryu River Bridge

⑧ Hosotsubo Bridge

⑩ Fukui Bridge

⑪ Shin-Hokuriku Tunnel

④ Jinzu River Bridge

③ Toyama Station

② Joetsumyoko Station

① Iiyama Station

Takasaki to Nagano

[117 km]
Opened in October 1997

Nagano to Kanazawa

[228 km]
Opened in March 2015

Nagaoka
Niigata Prefecture
Urasa
Naoetsu
Itoigawa
Ishikawa Prefecture
Himekawa River Bridge
Shin-Oyashirazu Tunnel
Mineyama Tunnel
② Joetsumyoko
Joshin By-pass Bridge
Echigo-Yuzawa
Shin-Shirakawa
Nasushiobara
Tohoku Shinkansen
urobe-Unazukionsen
Kurobe River Bridge
① Iiyama Tunnel
Iiyama
Jomo-Kogen
Joetsu Shinkansen
akaoka
④
Jinzu River Bridge
No.1 Uozu Tunnel
Nagano Rolling Stock Depot
No.5 Chikuma River Bridge
③
Toyama
Toyama Prefecture
Nagano
Yashiro Bridge
Utsunomiya
eneral
ck Depot
ge
Nagano Prefecture
Gorigamine Tunnel
Usuitoge Tunnel
Ueda
No.2 Chikuma River Bridge
Komoro
Takasaki
Oyama
Yokokawa
Annaka-Haruna
Karuizawa
Matsumoto
Sakudaira
Honjo-Waseda
Kumagaya
Omiya
Ueno
Tokyo
Shinagawa
Shin-Yokohama
Odawara
Shin-Fuji
Nagoya
Atami
Mishima
Mikawa-Anjo
Shizuoka
Tokaido Shinkansen
Toyohashi
Kakegawa
Hamamatsu

Construction of Shinkansen Lines

Hokkaido Shinkansen / Tohoku Shinkansen

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

❶ Hakkoda Tunnel

Seikan Tunnel

Seikan Tunnel is a 53.85km long world's longest undersea tunnel. Although it was opened in 1988 for a conventional line with narrow-gauge (1,067mm) tracks, dimension of the tunnel was designed to accommodate larger Shinkansen train.
On the occasion that Hokkaido Shinkansen was constructed, additional rail for Shinkansen gauge (1,435mm) was installed on each track, thus the tracks can be shared by both Shinkansen train and conventional train.

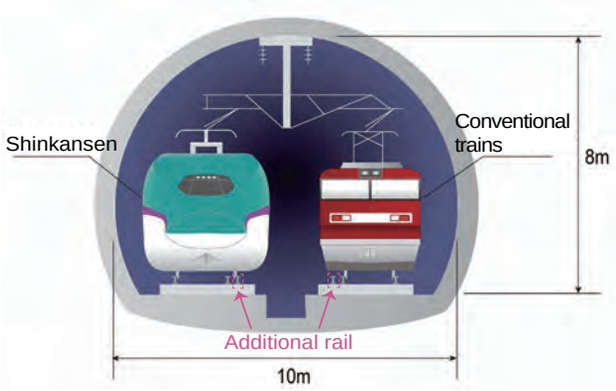


Image of tracks shared by trains of different gauges

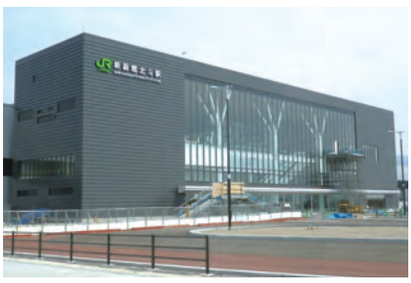
See P21 for Seikan Tunnel

❷ Sannai-Maruyama Bridge

❹ Seikan Tunnel

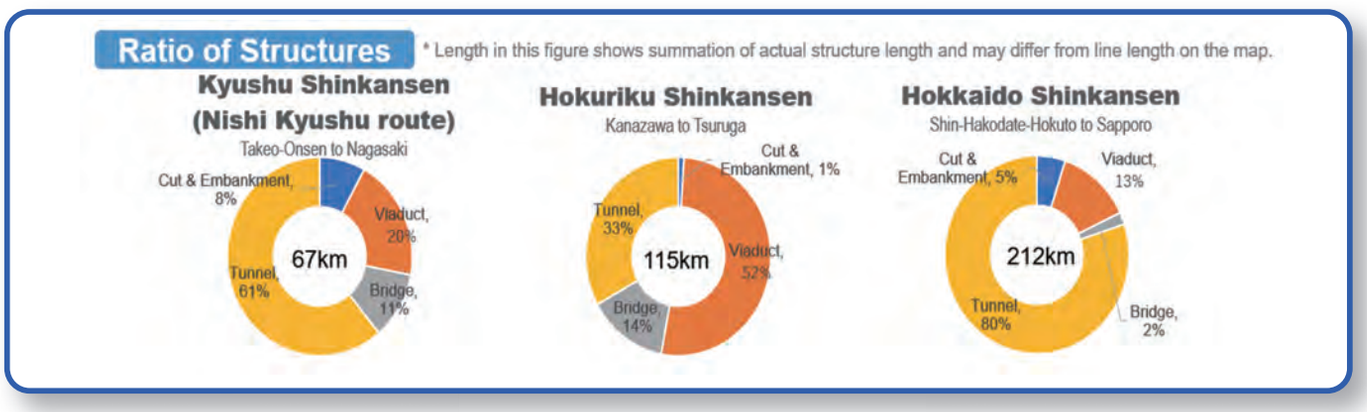
❼ Tateiwa Tunnel

❸ Shin-Aomori Station



❺ Shin-Hakodate-Hokuto Station

❻ Oshima Tunnel



Shin-Hakodate-Hokuto to Sapporo
[212km]
Under construction


⑩ Sasson Tunnel (launching shaft)


⑨ Futatsumori Tunnel



⑧ Yotei Tunnel

Shin-Aomori to Shin-Hakodate-Hokuto
[149 km]
Opened in March 2016

Hachinohe to Shin-Aomori
[82km]
Opened in December 2010

Hakkoda Tunnel
A 26.5 km tunnel was completed in February 2005 as the then world's longest base tunnel.

Morioka to Hachinohe
[97km]
Opened in December 2002

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

Shin-Otaru (Name TBD)
Otaru
Iwamizawa
⑩ Sasson Tunnel
Sapporo
Shiribeshi Tunnel
Futatsumori Tunnel ⑨
Kutchan
New Chitose Airport
Uchiura Tunnel
Yotei Tunnel ⑧
Tomakomai
Hokkaido
Oshamambe
Tateiwa Tunnel ⑦
Muroran
Yurappu River Bridge
Shin-Yakumo (Name TBD)
⑥ Oshima Tunnel
⑤ Shin-Hakodate-Hokuto
Esashi
Shin-Moheji Tunnel
Hakodate General Rolling Stock Depot
Oshima Tobetsu Tunnel
Hakodate
Kikonai
④ Seikan Tunnel
Okutsugaru Imabetsu
Tsugaru-Yomogita Tunnel
Aomori Rolling Stock Depot
Aomori
③ Shin-Aomori
Noheji
② Sannai-Maruyama Bridge
① Hakkoda Tunnel
Shichinohe-Towada
Sanbongihara Tunnel
Oirase River Bridge
Aomori Prefecture
Hirosaki
Hachinohe
No.3 Mabechi River Bridge
Kintaichi Tunnel
Ninohe
Noshiro
Iwate-Ichinohe Tunnel
Iwate Prefecture
Iwate-Numakunai
No.5 Kitakami River Bridge
Akita Prefecture
Akita
Morioka

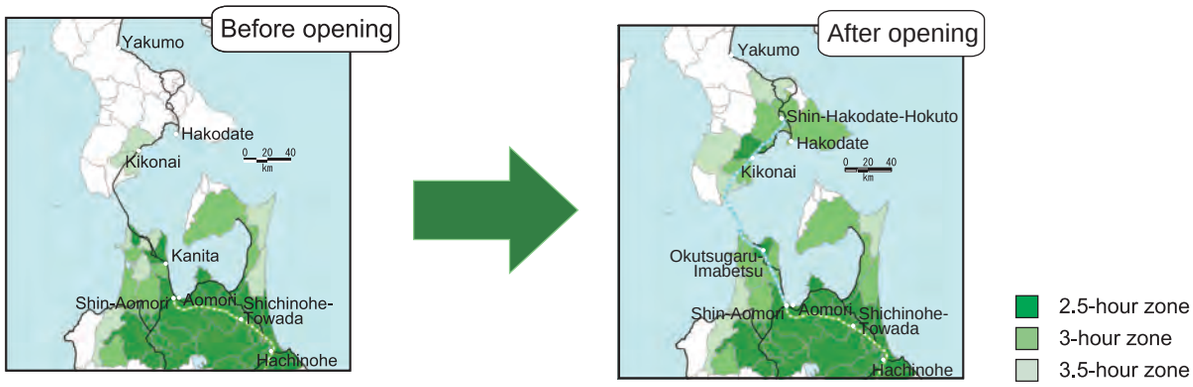
Construction of Shinkansen Lines

Opening Benefits by New Shinkansen Lines

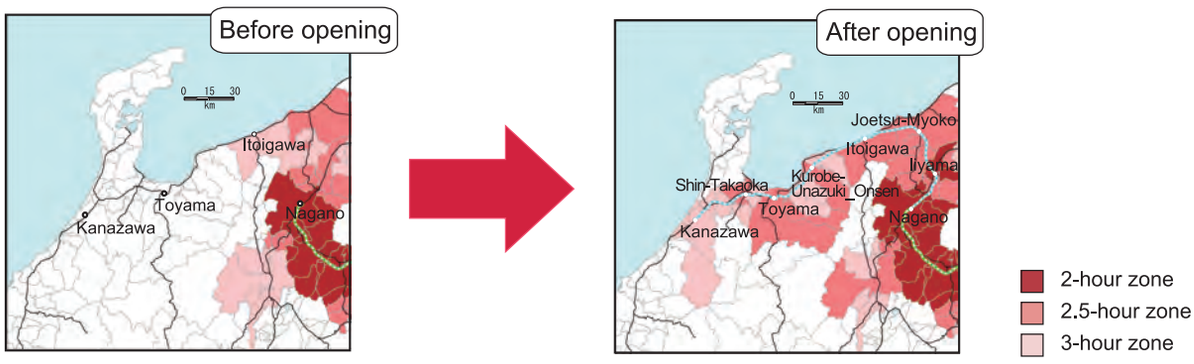
Many People to Travel Faster by Expansion of Shinkansen Network

Opening of Shinkansen considerably reduces the travel time from the area along the line to other areas and improves accessibility for many people.

Hokkaido Shinkansen (Shin-Aomori to Shin-Hakodate-Hokuto): Travel Time to Sendai



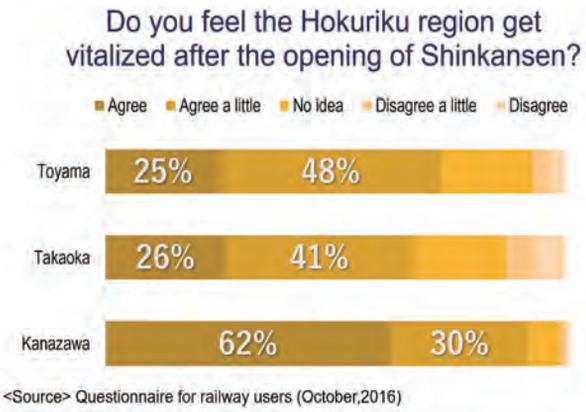
Hokuriku Shinkansen (Nagano to Kanazawa): Travel Time to Tokyo



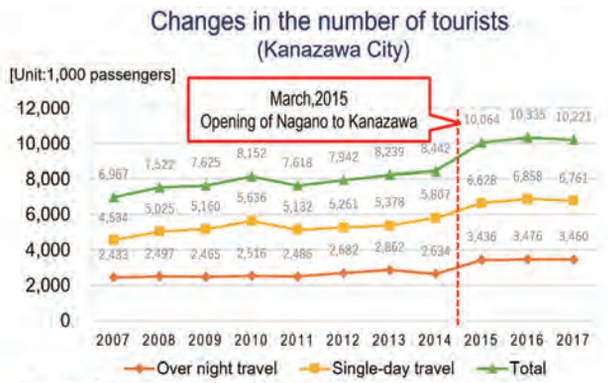
Kyushu Shinkansen (Hakata to Shin-Yatsushiro): Travel Time to Hakata

Increase of Tourists

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



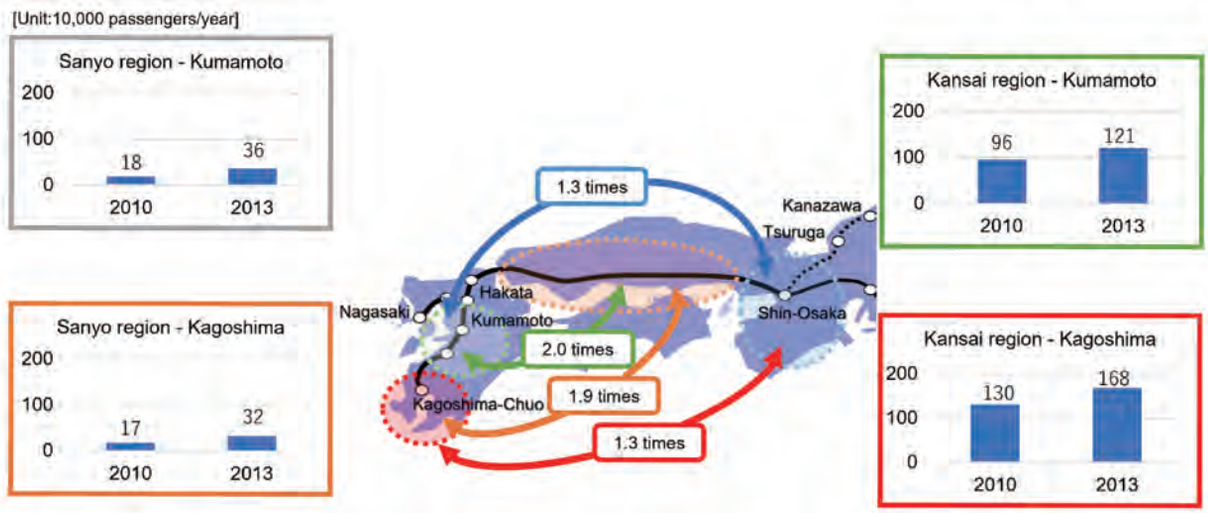
<Source> Questionnaire for railway users (October,2016)



<Source> Tourism statistics of Kanazawa city

Increase of Inter-regional Travelers

Thanks to the expansion of Shinkansen, the number of inter-regional travelers including non-railway users is increasing, thus regional economies are vitalised.

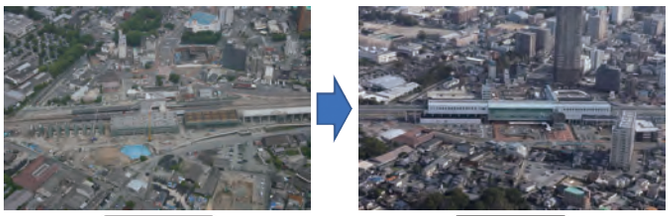


Contribution to the Regional Development

Along with the construction of new station, the station square is redesigned as a transportation hub to contribute to the regional development.

2007 2018

Toyama Station (Hokuriku Shinkansen)



2007 2013

Kurume Station (Kyushu Shinkansen)

Construction of Urban Railways

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

Progress of Construction

The Eastern Kanagawa Rail Link contains two new railway lines: Sotetsu-JR Link Line and 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 isolated and operating only in Kanagawa Prefecture, the passengers on the line for 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 thus mobility of the people along the Sotetsu line is drastically improved.

The Sotetsu-Tokyu Link Line has another feature: connection to Shin-Yokohama Station. Shin-Yokohama Station is an important gate of Tokaido Shinkansen High-Speed Rail in Kanagawa Prefecture. By this line, people along the Sotetsu line and the Tokyu line can have direct access to Shinkansen Station, thus the link contributes to improvement of mobility and expansion of the railway network.

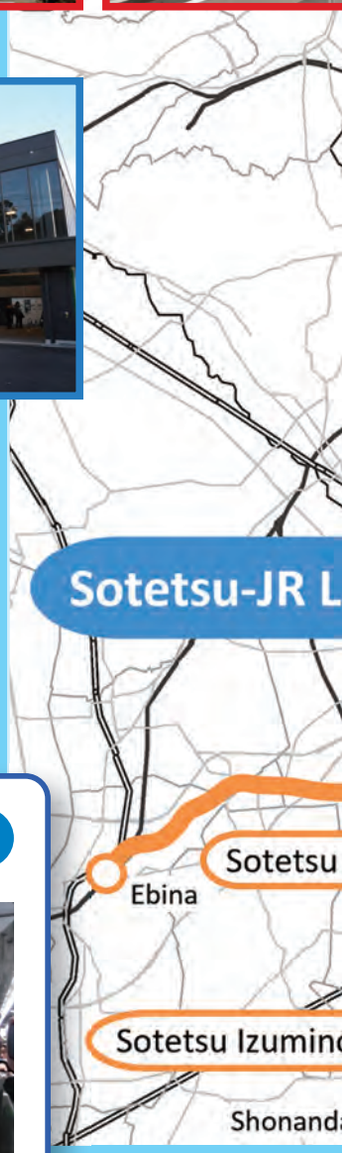
The rail link is constructed as the first case of the government's Speed-up Project under the Urban Railway Promotion Act. In this scheme, infrastructure is constructed and owned by JRTT and trains are operated by railway companies.

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

4 Hazawa Tunnel

5 Shin-Yokohama Statio

3 Hazawa yokohama-kokudai Station



Opening of the Sotetsu-JR Link Line

Opening ceremony

Hazawa yokohama-kokudai Station

Station

6 Shin-Yokohama Tunnel

7 Shin-Tsunashima Station

1 Nishiya Station

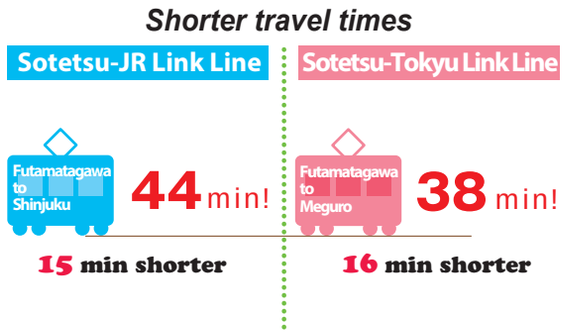
2 Nishiya Tunnel

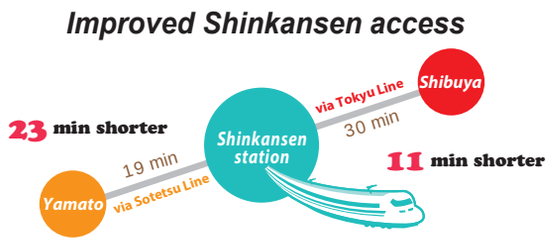
Construction of Urban Railways

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

Project Overview

	Sotetsu-JR	Sotetsu-Tokyu
Construction section	Nishiya (Sotetsu Line) to Yokohama-Hazawa (JR Tokaido Freight Line)	Yokohama-Hazawa (JR Tokaido Freight Line) to Hiyoshi (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	2.7km	10.0km
Facility builder	JRTT	JRTT
Train Operator	Sagami Railway Company	Sagami Railway Company Tokyu Corporation
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 year	November 2019	March 2023





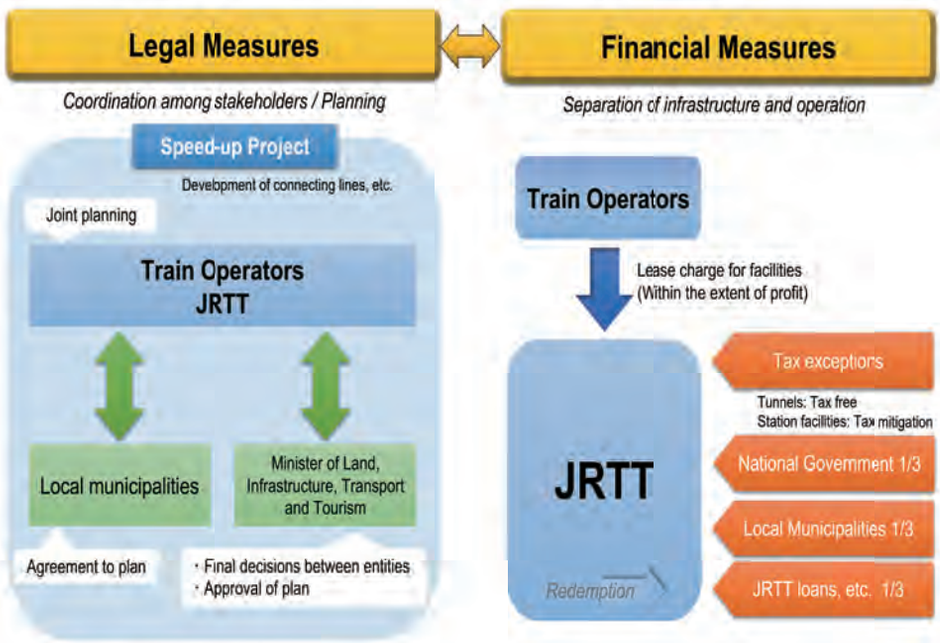
Institution for Implementing Urban Railway Promotion Project

The Urban Railway Promotion Act

This act stipulates new railway development measures aiming speed-up of trains and facilitation of accessible station design by utilizing existing railway infrastructure. The act also stipulates the development scheme in which rail infrastructure is constructed and owned by public entity (JRTT is one of possible candidates) while trains are operated by railway companies.

JRTT (rail owner) and railway companies (train operator) jointly apply to be 'approved development planner' with a conceptual proposal of new railway. After approval from the Minister of Land, Infrastructure, Transport and Tourism, the approved development planners submit 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, construction cost is evenly covered by three stakeholders: The government, the local municipalities (Kanagawa Prefecture and the city of Yokohama), and JRTT. Train operators (Sotetsu and Tokyu) pay the track access charge to JRTT. The charge is calculated from the amount of profit that the train operator could gain from the new line.



Other Urban Railways Commissioned to JRTT

Rinkai Line: opened in December 2002

First section of Rinkai Line between Shin-Kiba station and Tokyo-teleport station opened in 1998. The remaining section between Tokyo-teleport and Osaki was opened in 2002.
JRCC, former entity of JRTT was commissioned to construct this line by Tokyo Waterfront Area Rapid Transit, Inc.

Minatomirai Line: opened in February 2004

Bashamichi Station

Minatomirai Line runs from Yokohama station to newly developed central business district (“Minatomirai 21”) and popular tourist destination, like Yamashita Park, Motomachi and Yokohama China Town.
JRCC contracted with Yokohama Minatomirai Railway Company to construct this line in March 1992.

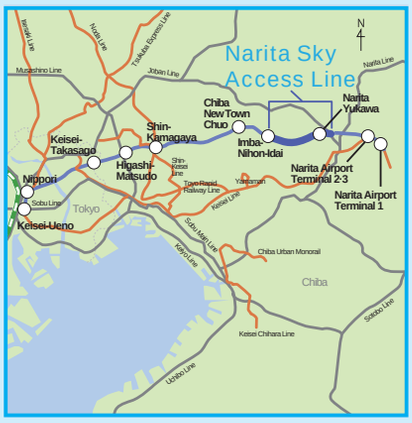
Tsukuba Express Line: opened in August 2005

The Tsukuba Express Line is a 58km urban railway, connecting Akihabara station and Tsukuba station with a maximum speed of 130km/h in 45 minutes. As passengers increasing, JRTT also constructed new spur line to double the track to Moriya Rolling Stock Depot and Shop in 2017.

Construction of Urban Railways

Other Urban Railways Commissioned to JRTT

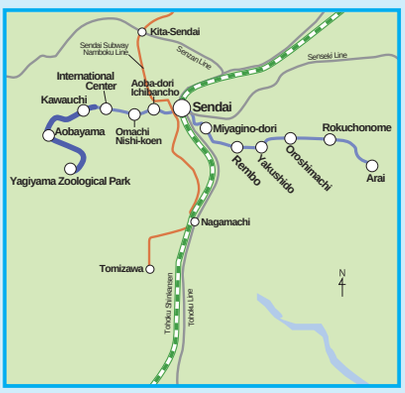
Narita Sky Access Line: opened in July 2010



Narita Sky Access Line connects Narita Airport and central Tokyo with a maximum speed of 160 km/h. The construction started in 2005 and completed in 2010.
JRTT was commissioned to construct this line by Narita Rapid Railway Access Co. Ltd. in April 2005.

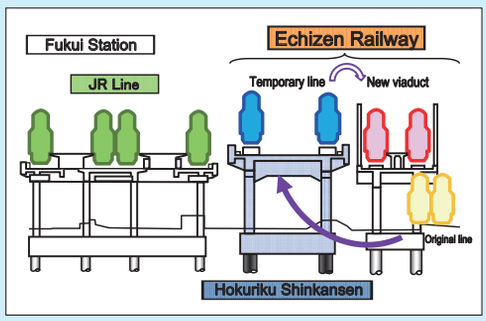
Sendai Subway Tozai Line: opened in December 2015

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



The Sendai Subway Tozai Line covers the city of Sendai from west to east via Sendai Station in downtown area.
JRTT was commissioned to constract part of the line by Sendai city in November 2005. JRTT constructed westernmost 4.3km section between Yagiyama Zoological Park Station and Ogizaka tunnel.

Construction of Elevated Echizen Railway: completed in June 2018

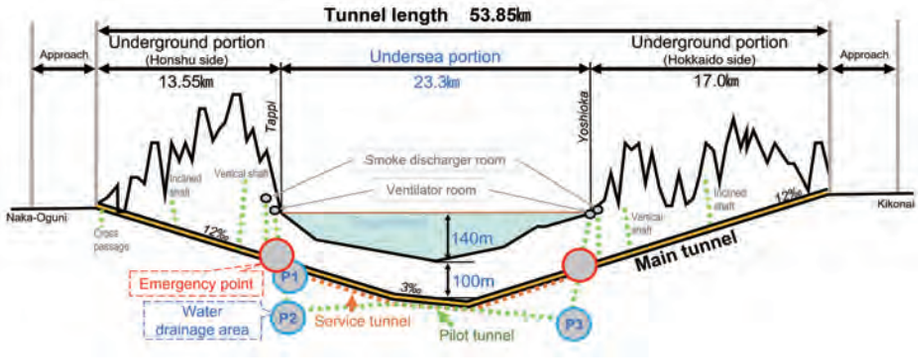


Elevating of Echizen Railway is Fukui prefecture's project to create consecutive railway viaducts for grade separation about Fukui station. JRTT constructed 2.5km of the line on the Fukui station side. The new viaducts contribute to decrease of traffic jams and accidents on the roads and correction of areal division caused by ground level rail track.

Seikan Tunnel

Overview

Construction of Seikan Tunnel was spurred by the shipwreck of Toya Maru ferry in 1954 by a severe typhoon, which was worst maritime disaster in history. Unprecedented difficulties had occurred during construction, particularly for the excavation of the undersea portion, including four cases of major water inrush. Through these challenging situations, the tunnel was finally opened in 1988. Various new technologies for tunneling had been developed and applied during the construction.
Seikan Tunnel is the only infrastructure to directly connect Honshu and Hokkaido. In 2016, long-dreamed Shinkansen line was laid through the tunnel and the role of the tunnel has been more crucial as an artery of the land axis of Japan.



Excavation during construction

Renovation Projects

Train fire detector

Drainage pump for water

Facilities for train operation and disaster control in the undersea tunnel have been aging and deteriorating under the severe condition. Although JRTT had been monitoring minor deteriorations since its opening, we conducted full-scale survey for the first time 10 years after its opening and started constant repair and maintenance works in 1999.
To date, drainage pumps and fire detectors for running train have been repaired and reinstalled throughout the tunnel.

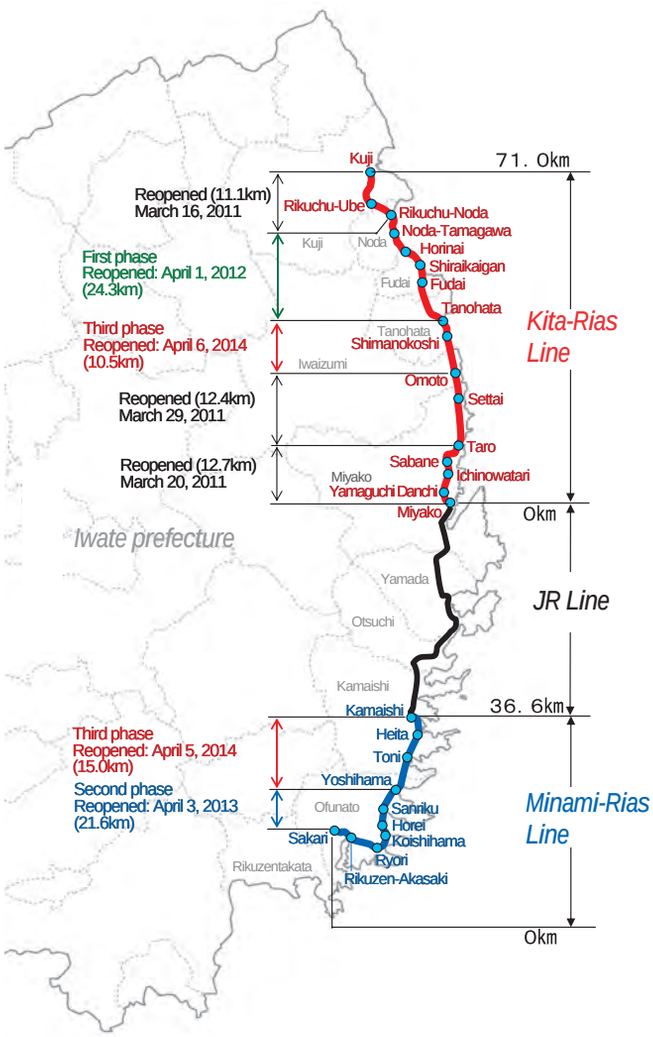
Assitance for Restration of Railways after the Great East Japan Earthquake

Sanriku Railway Rias Line: fully reopened in April 2014

Sanriku Railway 'Rias Line' was originally planned as a National Railway line along the Sanriku Rias coast in 1960s. Though some sections had been completed by JRCC, former entity of JRTT, construction of other parts was once abandoned due to the privatization of National Railways. To complete the entire line, local municipalities along the line established half-governmental 'Sanriku Railway Company' in 1981 and the company commissioned JRCC to construct unfinished parts. The entire line opened in 1984.

In 2011, enormous tsunamis generated by the Great East Japan Earthquake devastated the Sanriku Railway Lines. Sanriku Railway Company commissioned JRTT to reconstruct the railway. This works mainly consisted of reconstructing embankments, tracks, and communication cables which had been swept away by the tsunamis. Operation on the lines had resumed in some phases and the lines were fully reopened in 2014.

Route Overview



Progress of Restoration

Kita-Rias Line:
Tanohata to Rikuchu-Noda
(Embankment)

AFTER

Kita-Rias Line:
Komoto to Tanohata
(Embankment and bridge)

AFTER

Minami-Rias Line:
Sakari to Yoshihama
(Embankment and bridge)

AFTER

Minami-Rias Line:
Yoshihama to Kamaishi
(Bridge)

AFTER

Reopening of Lines

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

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

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

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

Sanriku Railway train
in Tofugaura area

Sanriku Railway train at
Shimanokoshi Station

Sanriku Railway train
in Tomari area

Sanriku Railway train
crossing Owatari River

Sendai Airport Access Line: opened in March 2007

The Sendai Airport Access Line was constructed by JRTT and opened in 2007. On March 11, 2011, the Great East Japan Earthquake attacked the Sendai region, and the line was also devastated. The Miyagi prefectural government and Sendai Airport Transit Company requested JRTT to assist the reconstruction of the railway. JRTT soon dispatched an advance team to observe damages by the earthquake. Seeing the serious results reported from the team, JRTT organized an assistance team and deployed two JRTT engineers to the company to make plans for examination of damaged structures and reconstruction of them. With the persistent efforts of engineers, the entire line was reopened on October 1, 2011, just seven months after the earthquake.

Sendai Airport Station
Operation control office

After

Inside the airport tunnel

After

Entrance to the airport tunnel

After

Project Research

Survey by JRTT

JRTT has sophisticated functions to conduct reliable field study required to realize efficient transportation network. The contents of the study vary from basic research in the conceptual stage to the final scrutiny for the decision making of a project.
JRTT has implemented various types of transportation studies based on the requests from the Government, local municipalities, and railway companies.

Experienced technical intelligence

JRTT provides a wide array of appropriate scrutiny and proposal.

Suitable framework for each project

To implement the project effectively and efficiently, most appropriate project scheme is established and proposed to the policy makers.

Neutral Survey

As a public institution, JRTT conducts surveys objectively and impartially.

Detailed research and suitable for site conditions

Because our regional branches cover the whole country, JRTT can provide support timely and appropriately for respective site conditions.

Flow of Project Surveys

Preliminary observation
- Collection of needs for railway and grasp of national and local development plans

Basic research
- Current traffic condition
- Transportation volume
- Analyses of necessity and urgency of the targeted route
- Applicable scheme for the project

Outlining of the route
- Survey of route conditions and comparison of alternatives
- Estimation of overall project cost
- Estimation of transportation demand and operation timetabling

Advanced route
- Studies of project feasibility, evaluation of socioeconomic impacts, etc.
- Determination of routes, locations of stations and other required facilities

Project scheme
- Determination of applied scheme including project entities and financing

Construction planning
- Geological survey and land survey, study of design conditions
- Alignment design, structure type planning
- Preliminary design of structures, estimation of construction cost and project licensing
- Negotiation with stakeholders, EIA, finalization of urban planning and other procedures

Construction work

GRAPE Transportation Plan Assistance System

GIS for Railways Project Evaluation

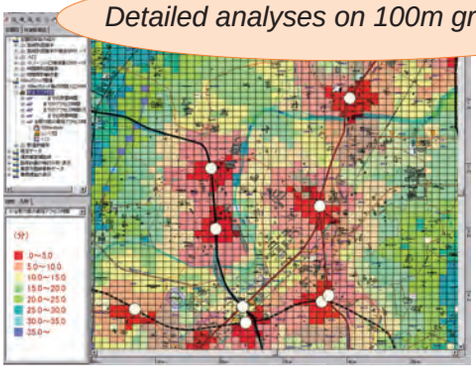
JRTT developed GRAPE system to assist in the development of transportation plans including railway network. The system provides visual and intelligible assistance for project evaluation and transportation analyses.

Basic Research & Analyses

Superimposing display and analysis of various data

Superimposing railway lines and stations on aerial photographs

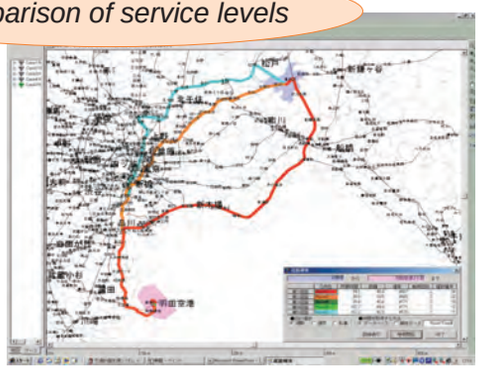
Detailed analyses on 100m grid sheet



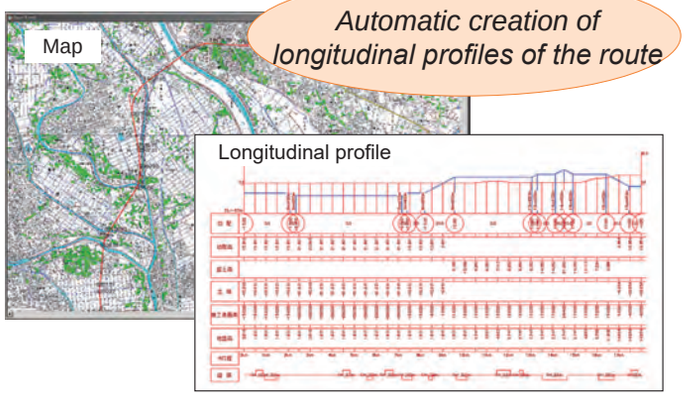
Required time to stations

Outlining of the Route, Alternative Analysis

Comparison of service levels

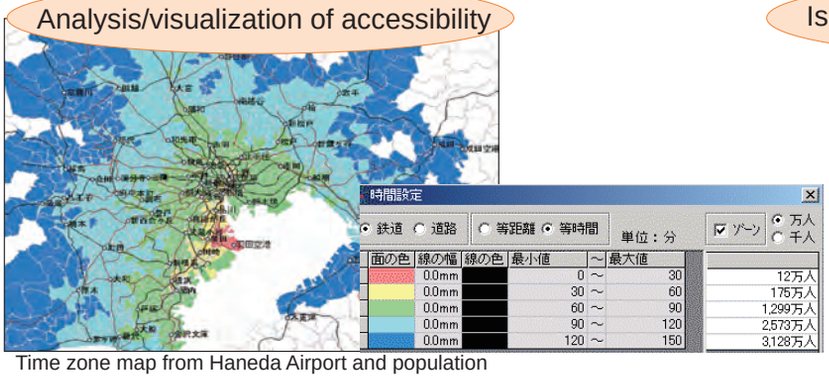


Automatic creation of longitudinal profiles of the route



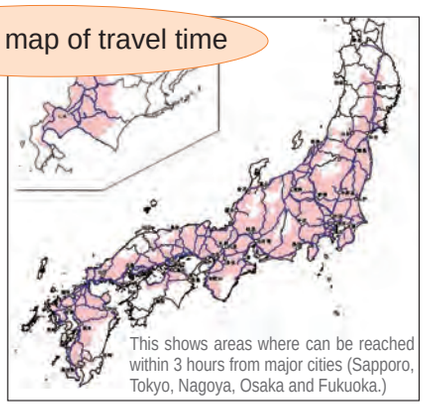
Route Evaluation

Analysis/visualization of accessibility



Time zone map from Haneda Airport and population

Isochrone map of travel time



This shows areas where can be reached within 3 hours from major cities (Sapporo, Tokyo, Nagoya, Osaka and Fukuoka.)

Overseas Expansion of Japan's Railway Technology

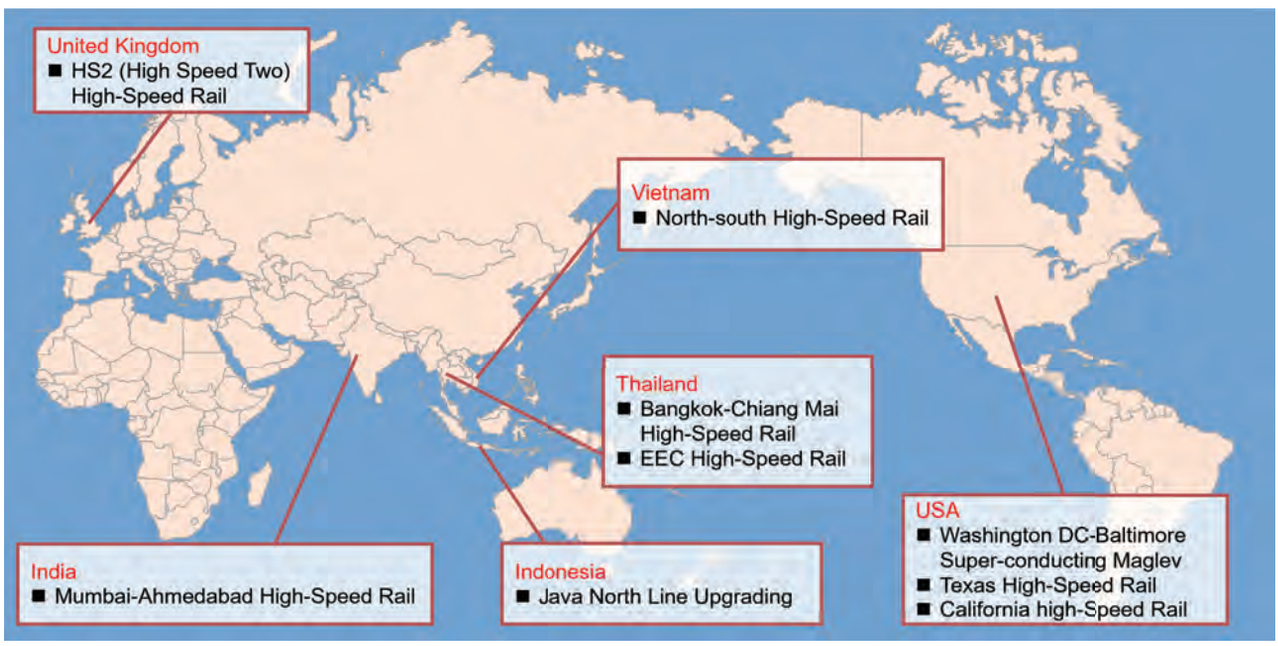
Overseas High-Speed Rail Projects

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. Therefore, many railway projects are being planned and investigated throughout the world, and the railway market is projected to expand to roughly 27 trillion yen per year by 2025.

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

Prominent High-Speed Rail Projects



Source: 2022 Action Plan for Infrastructure System Export Strategy by MLIT

Overseas Technical Cooperation

Since 1964, JRTT has contributed to overseas railway developments by dispatching railway experts through 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 accepted more than 4,000 fellows from 100 countries and regions, and have introduced Japan's railway technology.

Specific Efforts in Overseas Technical Cooperation

Taiwan High-Speed Rail Project

Taiwan High-Speed Rail which opened in 2006 marked the first export case of Shinkansen system. JRTT had dispatched engineers and cooperated with the project since the planning stage in 1989. Specifically, our cooperation started with the participation of our engineers in the feasibility study during the investigation stage, and continued into the bidding stage where we provided recommendations and close investigations of written proposals in technical terms. After the decision was made to introduce the Shinkansen system, we had dispatched numerous engineers specialized in the core systems of tracks and electricity, and provided technical cooperation during the construction stage and for comprehensive inspection prior to opening.

This project is successful example not only for the export of the Shinkansen system but also for utilization of JRTT's comprehensive railway construction technology and know-how cultured in Japan and put to work overseas from the planning stage to the opening.

JRTT provided technical assistance in the field of rail track and electrical facilities.

India High-Speed Rail Project

At the head meeting between the states in December 2015, the governments of India and Japan concluded a memorandum of understanding regarding the introduction of a Shinkansen type rail system; the two governments decided that India's high-speed rail between Mumbai and Ahmedabad would adopt the Japanese Shinkansen system. JRTT has cooperated proactively with the project by dispatching railway experts since the feasibility study.

In Japan, we have accepted officials from India, and provided technical visits to Shinkansen construction sites to help them further understanding in construction techniques and safety management in actual construction sites.

Bangkok-Chiang Mai High-Speed Rail Plan

In Thailand, it is planned to construct 670km-long high speed railway which connects Bangkok, the capital of the nation and Chiang Mai, the seat of the northwest region.

In August 2016, both governments of Thailand and Japan signed a memorandum, and now planning and investigation to construct dedicated rail track by the Shinkansen system are underway.

JRTT conducts several investigations on reduction of project costs by reviewing facility plans such as civil engineering and track structures, and exchanges opinions with Thai experts.

Technologies for Railway Infrastructures

Tunnelling

Tunnel Boring Techniques

NATM (New Austrian Tunnelling Method)

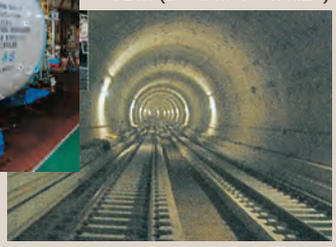
New Austrian Tunnelling Method (NATM), also called sequential excavation method, was developed from conventional excavation, and excavates tunnel by drilling and blasting or boom-type roadheader.

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 (Shield tunnelling)

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 (EPBM type: blue part is the cutterhead)

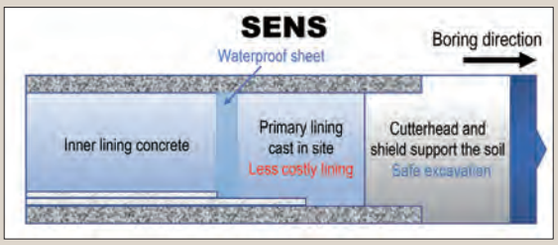


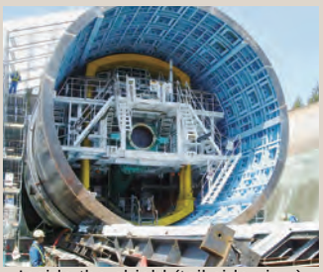
Completed tunnel by TBM (Double track size)

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 unsafe.

JRTT developed a new TBM boring system in which tunnel is lined by less costly site-cast concrete. This system was named SENS, acronym standing for 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

This is an emergency exit (shaft) of great depth underground tunnel in the urban section of Chuo Shinkansen. This is the largest underground structure in Japan (depth: 79m, outside diameter: 38m), which 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.

Waterproofing

Waterproof sheet is placed on the primary shotcrete lining to prevent water leaking into the tunnel.
In case that shotcrete is uneven and gap with the secondary concrete lining is large, fillers are inserted behind the sheet on the dedicated mobile formwork.
By this method, waterproof and isolation between two linings are secured. This method is named as FILM, Flat Insulated Lining Method.

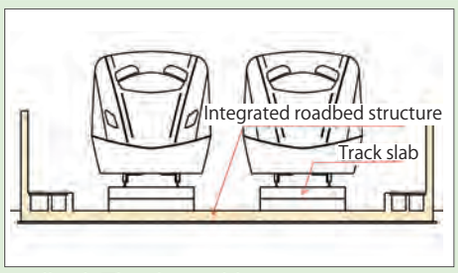
Tunnel Entrance Hood

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 the micro-pressure wave, tunnel entrance hood with larger diameter than the tunnel is constructed in front of the tunnel portal.

Earthwork

Integrated Roadbed Structure for Slab Track

Slab track requires robust roadbed to support the track without deformation and had been 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 availableon the earthwork structure.



Technologies for Railway Infrastructures

Aerial Structure (Bridge & Viaduct)

Genshu Bridge
(GRS-integrated bridge with PC girder)
Kyushu Shinkansen

This structure is economical and requires less maintenance because beam and abutments are rigidly connected without bearings. Longer girder is also available thanks to advanced prestressing techniques.

No.2 Takeda River Bridge
Hokuriku Shinkansen

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

Himekawa River Bridge
Hokuriku Shinkansen

This seven-span continuous PC finback bridge strikes a fine balance between the curve shape of the structure and mountain range in the background.

Sannai-Maruyama Bridge, Tohoku Shinkansen

The 150m spans are the longest among any Shinkansen bridges, and the ingenious design controls the deflection that often occurs in long bridges, thus provides safety and better riding comfort.

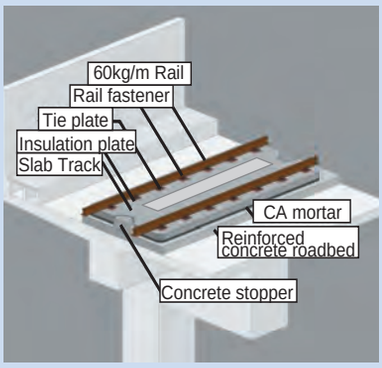
Rail Track

Track for Shinkansen High Speed Rail

The slab track is a standard track structure on Shinkansen high speed rails except the first Tokaido Shinkansen. Its stiffness and accuracy are advantageous for high speed train operation and maintenance compared to conventional ballasted track.
In the early days of the slab track, its shape was 'flat type'. Then lighter and more economical 'frame type slab' was invented and used inside tunnel and less snowy area.

Flat type slab (Tohoku Shinkansen)

Frame type slab (Kyushu Shinkansen)



Slab Track

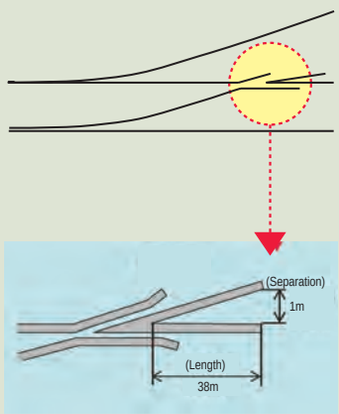
Track Structure on Urban Railway

To mitigate noise and vibration, less noisy and vibration-proof 'solid bed track with resilient sleepers' are used on urban railways.
Ballastless track with this 'solid bed track with resilient sleepers' can also reduce maintenance efforts and its stiffness contributes to stable urban transportation.

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

Turnout for Fastest Speed on Diverging Track in Japan

As Hokuriku Shinkansen is connected to previously constructed Joetsu Shinkansen, all trains toward Hokuriku Shinkansen must go through the diverging track of turnout which causes slowing trains. JRTT developed new turnout on which train can diverge at the speed of 160km/h. This turnout is also equipped on the Narita Sky Access Line.



Technologies for Railway Infrastructures

Architecture

Symbolic Stations Harmonizing with Surrounding Communities

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

Shin-Hakodate-Hokuto Station on the Hokkaido Shinkansen, opened in March 2016

Kurobe-Unazukionsen Station on the Hokuriku Shinkansen, opened in March 2015

Safe, Comfortable and Accessible Station

Universal design is to realize safe, comfortable and accessible station facilities for all people regardless of age, ability or disability.

See-through type elevator at Shin-Tosu Station, Kyushu Shinkansen (Observation tour before opening)

Multifunction restroom with a variety of functions including ostomy toilet

Safety measures for visual impaired passengers at Shin-Tosu Station, Kyushu Shinkansen (Braille signs and blocks, platform screen doors, etc.)

Wider ticket gate and passenger service center at Kanazawa Station, Hokuriku Shinkansen

Ecofriendly Station

We proactively undertake measures to tackle global warming to improve natural environment in the design of station building, train depot building and other railway structures.

Louver ceiling made of locally sourced wood
at Shin-Hakodate Hokuto Station, Hokkaido Shinkansen

Natural ventilation systems, green roofs
at Hakusan General Rolling Stock Depot, Hokuriku Shinkansen

Use of recycled tiles
at Narita Yukawa Station,
Narita Sky Access Line

Use of local products

Using locally sourced wood is an ecofriendly solution that fixes carbon dioxide and saves transportation energy. In addition, 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 of renewable energy

We proactively use sunlight, solar heat, natural wind for ventilation, and other renewable energies in the station buildings.

Greening of roofs and railway premise

We plant trees and undertake other greening efforts on the roofs of buildings and on railway premises to mitigate the heat island effect and global warming.

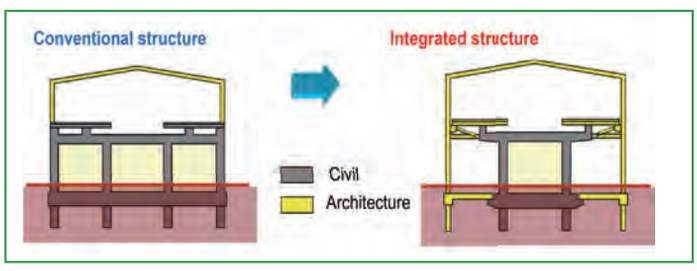
Use of recycled materials

We use recycled materials like tiles, stones, bricks, ceramics, roof tiles and other wasted materials from construction sites, and contribute to reduction of trash and effective use of natural resources.

Cost-efficient Station with Excellent Design by 'Hybrid Structure' Concept

JRTT developed 'hybrid structure' which integrated civil-architectural designs. This concept drastically improved the flexibility of architectural design of station building and saved cost and time.

In this structure, conventional four-pillar viaduct structure are replaced to a two-pillar structure, incorporating the pillars on each side into the roof to open up more options for the layout of concourses, escalators, elevators and other station facilities.



Shin-Tamana Station, Kyushu Shinkansen
The architectural exterior completely covers its civil engineering structure.

Technologies for Railway Infrastructures

Machinery

Robust Transportation in Snowy Weather

Various snow-proof facilities have been installed in heavy-snowfall region including sprinkler to melt snow on the track and quick snow remover around turnout to maintain robust transportation in winter.

Snow removal sprinklers

Quick snow remover for turnout

Accessible Station

Platform screen doors, elevators, escalators and other facilities enable everyone to move safely and smoothly.

Screen door on the platform

Elevator

Air Conditioning & Ventilation in Underground Station and Tunnel

Air conditioner, ventilator, and smoke discharger are crucial to keep air clean and safe in underground areas.

Air conditioner in underground station

Ventilator for tunnel

Maintenance Service for Train at Depot and Shop

Train depot and shop contains various pieces of equipment to inspect, repair, and wash trainset for safe and comfortable riding.

Bogie replacement machine, Hokkaido Shinkansen

Special Machinery for Railway Construction

JRTT has developed and introduced machineries dedicated to railway construction such as track works and overhead wires during electrical construction. These machineries enable us to perform construction work safely and efficiently.

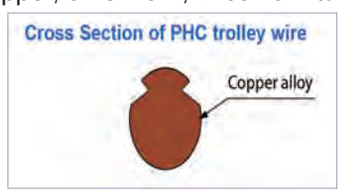
Overhead wire vehicle
(Catenary revolving deck lift vehicle)

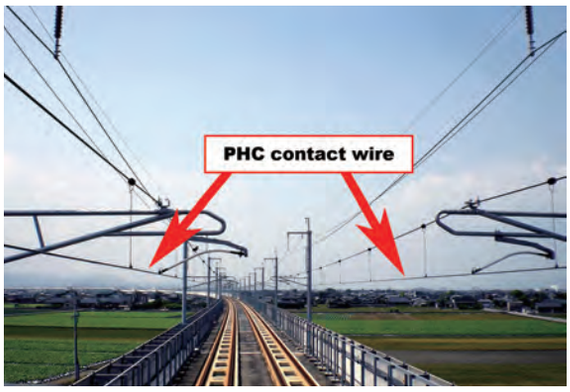
Road cum rail car (right),
CA Mortar injection car (left)

Electrical Facilities

Economical Overhead Wires for High-Speed Operation

Simple overhead electric line with PHC (precipitation hardening copper) trolley wire is economical and standardly used for the high-speed Shinkansen lines. PHC trolley wire has advantages such as lightweight, high tensile strength, and excellent electroconductivity by precipitation hardening copper alloy made of oxygen-free copper, chromium, zirconium and other additive.



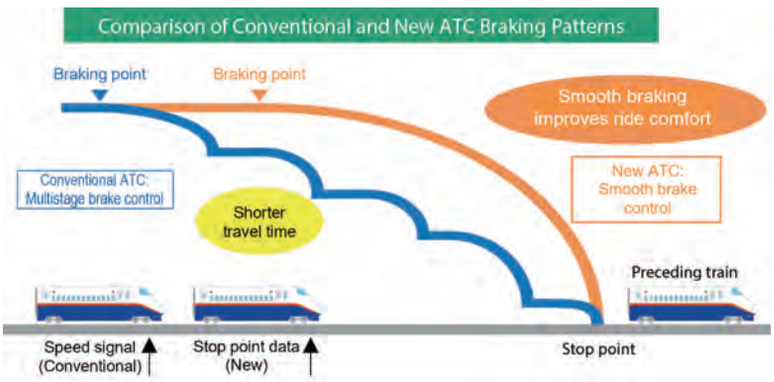


Train Control System for Ride Quality

JRTT introduced an on-board oriented Automatic Train Control (ATC) system on the Tohoku Shinkansen between Morioka and Hachinohe aiming to improve ride comfort and shorten headway.

Based on this system, uninsulated track circuit was installed on the entire extension to Shin-Aomori as the first case in Shinkansen, simplifying the equipment alongside the track and reducing maintenance.

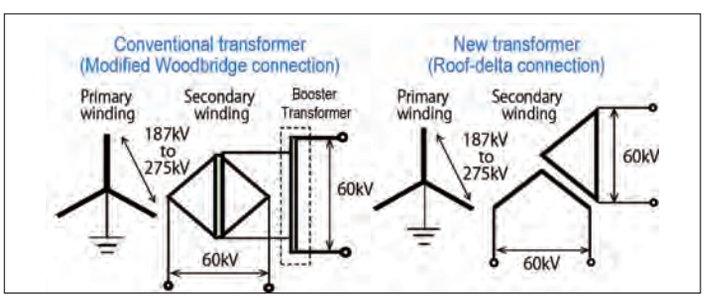
Applying these achievements, JRTT developed this system to adapt to the 60Hz frequency section in Hokuriku Shinkansen. On the Hokkaido Shinkansen (Shin-Aomori to Shin-Hakodate-Hokuto) with Seikan Tunnel in which Shinkansen and conventional lines share the track, we introduced an ATC compatible with both Shinkansen and conventional trains.



Ecofriendly Roof-Delta Connected Transformer

Instead of modified woodbridge-connected transformers, JRTT developed roof-delta connected transformers, and it has been installed in Tohoku Shinkansen (Hachinohe to Shin-Aomori).

Compared to the conventional type, the new transformer has a simpler structure which enables downsizing, less power loss and ecofriendly.



Shin-Hakodate Substation

Awards

JRTT has received plenty of awards from various organizations for technology we have developed to date.

Awards for Railway Projects

Shinkansen Line

■ Hokuriku Shinkansen between Nagano and Kanazawa

2015 Outstanding Civil Engineering Achievement Award from the Japan Society of Civil Engineers (JSCE)

Japan Railway Award from the Railway Day Executive Committee

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

2016 Outstanding Civil Engineering Achievement Award from JSCE

Urban Railways and Restoration Railways after Disaster

■ 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

■ Eastern Kanagawa Rail Link (Sotetsu-JR Link Line)

2019 Outstanding Civil Engineering Achievement Award from JSCE

Awards for Railway Construction Technology

■ High-speed excavation using SENS, a method on the boundary of Mountain Tunnelling method and Shield method

2012 Outstanding Civil Engineering Achievement Award from JSCE

■ Confirmation of soundness of Seikan Tunnel by newly established evaluation method

2013 Outstanding Civil Engineering Achievement Award from JSCE

■ GRS-integrated bridge with PC girder

2018 Outstanding Civil Engineering Achievement Award from JSCE

■ Establishment of anti-snow measures

2016 Outstanding Civil Engineering Achievement Award from JSCE

Awards for 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

- Toyama Station, Hokuriku Shinkansen
  2015 First prize from the Award, Association of Railway Architects in Japan

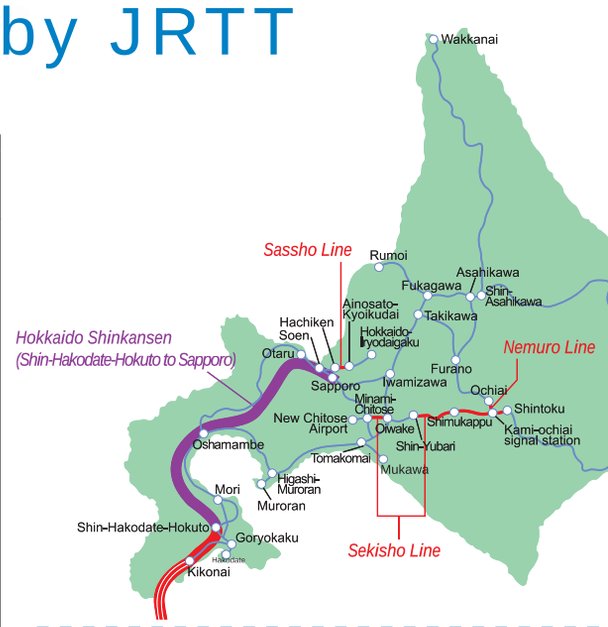
Awards for Electrical Equipment

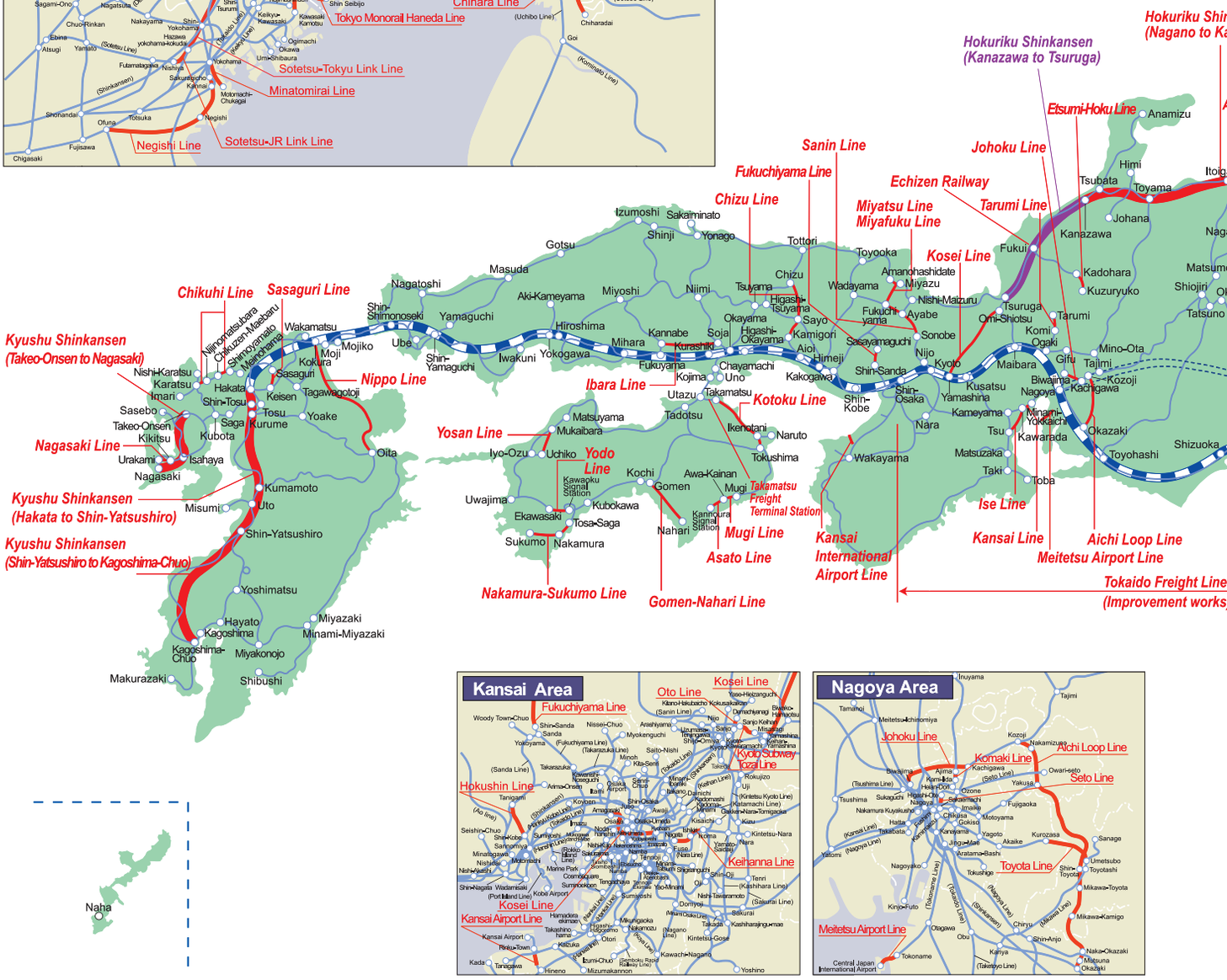
- Development of non-insulated DS-ATC for Shinkansen Line
  2016 Electrical Science and Engineering Promotion Award (former Ohm Award)
- Realization of economical different frequency jamming prevention equipment for ATC by sophisticated prediction calculations, Hokuriku Shinkansen
  The 74th IEEJ Technical Development Award
- Lighting of Shin-Hakodate-Hokuto Station, Hokkaido Shinkansen
  2016 Hokkaido Outstanding Lighting Technology Award, The Illuminating Engineering Institute of Japan
- Development of simple overhead electrical lines for Shinkansen with PHC trolley wire
  2018 Shibusawa Award from the Japan Electric Association

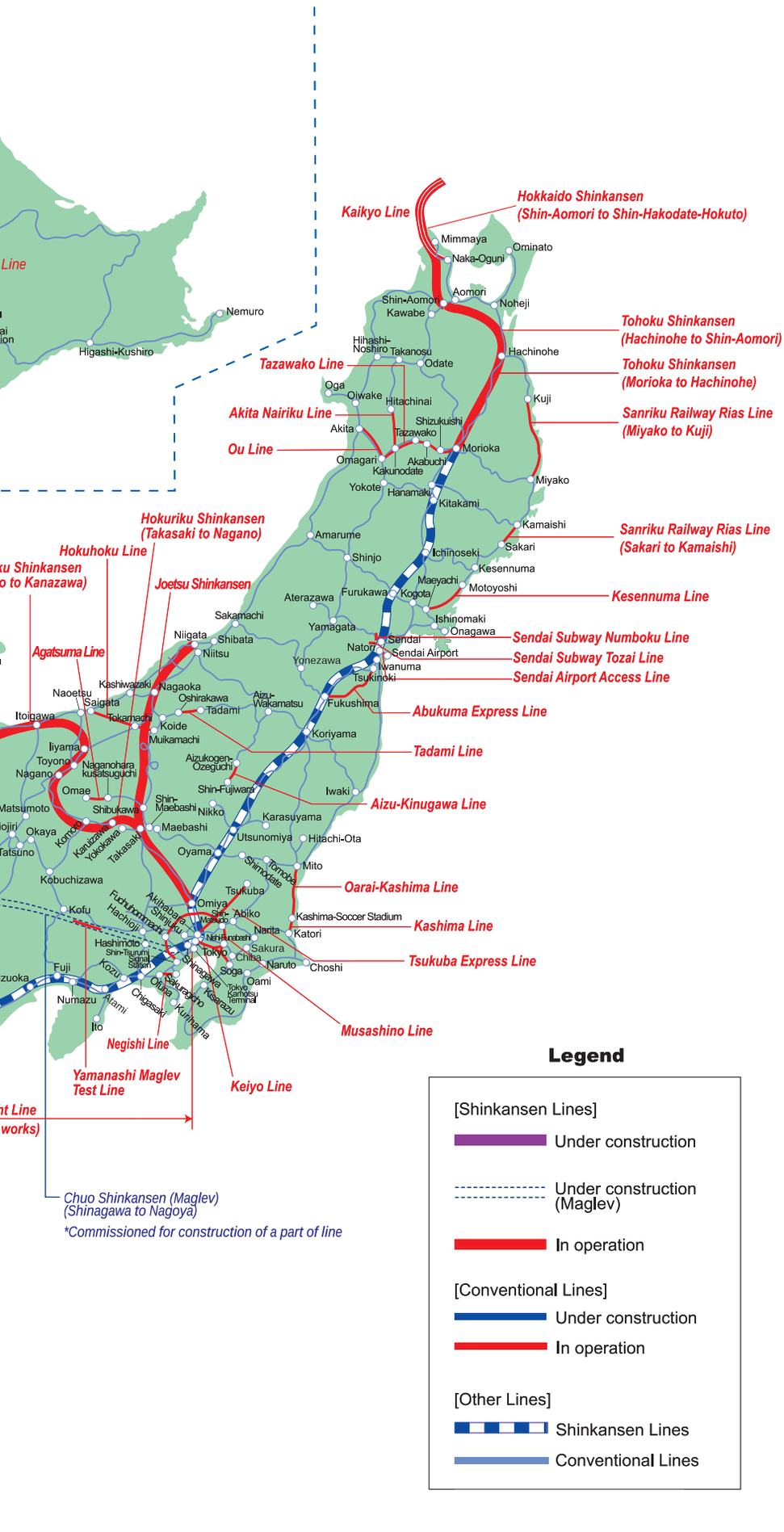
Others

Seikan Tunnel ■ Keiyo Line ■ Joetsu Shinkansen ■ Hokuriku Shinkansen ■ Toyo Rapid Railway ■ Rinkai Line ■ Hokuso Line ■ JR Tozai Line ■ Sendai Airport 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

Railways Constructed by JRTT







Legend

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

[Conventional Lines]
- Under construction
- In operation

[Other Lines]
- Shinkansen Lines
- Conventional Lines

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