

Extending the Shinkansen Network

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Introduction

Today's shinkansen network has offered many benefits to the communities it serves, raising the quality of life by stimulating local economies and reducing travel times. The comfortable services have proved very safe and reliable and use less energy than other high-speed transportation modes, making the shinkansen very environmentally friendly. Due to these advantages, many of the travelling public are looking forward to further extension of the shinkansen network to other parts of Japan. As a result of the early popularity of the Tokaido Shinkansen, the Japanese government decided to promote new

construction and extensions by passing the Nationwide Shinkansen Development Law in 1970, resulting in the opening of the San'yō Shinkansen (1972), Joetsu Shinkansen (1982), and Tohoku Shinkansen (1985).

Recently Completed Constructions and Extension

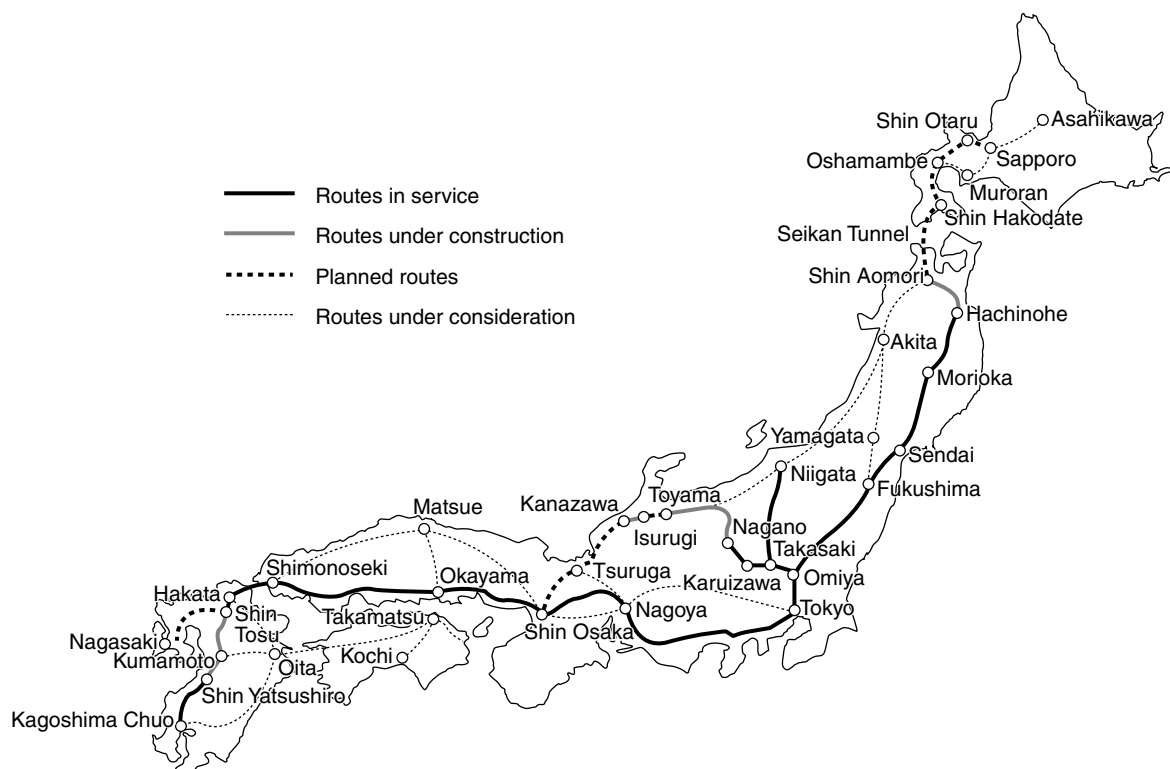
This construction boom has continued over the last 10 years with two new lines and one extension coming into service as described below.

October 1997 marked the opening of the first 117.4-km section of the Hokuriku Shinkansen between Takasaki and Nagano. The construction took a relatively short 8 years due to careful

alignment planning, development and use of new construction technology, and collaboration with local governments. The most difficult part through steep mountains between Karuizawa and Nagano was completed under-budget in just 6 years with few construction accidents. Since the opening, passengers from Tokyo to Nagano can now take the Series E2 *Asama* (name of local volcano) through service on the Joetsu Shinkansen from Tokyo Station that runs on to the Hokuriku Shinkansen at Takasaki to reach Nagano in just 1 hour and 23 minutes, cutting about 90 minutes off the previous journey.

The next development was the December 2002 opening of the 96.6-km extension to the Tohoku Shinkansen

Planned Final Shinkansen Network





Newly opened section of Kyushu Shinkansen

(JRJT)



New Shin Minamata Station on Kyushu Shinkansen

(JRJT)

between Morioka and Hachinohe, cutting 44 minutes off the 593.1-km journey from Tokyo to Hachinohe with a travel time of just 2 hours and 56 minutes on the Series E2-1000 *Hayate* (Swift Wind). This new extension was soon followed by the March 2004 opening of the first section (126.1 km) of the Kyushu Shinkansen between Shin Yatsushiro and Kagoshima-chuo. Riding the Series 800 *Tsubame* (Swallow) for part of the 277.4 km cuts the journey between Hakata and Kagoshima-chuo to 2 hours and 10 minutes or 1 hour and 30 minutes less than before. Until the rest of the Kyushu Shinkansen is opened, the 151.3-km journey between Hakata and Shin Yatsushiro has to be made using the *Relay Tsubame* limited express on the conventional Kagoshima main line.

to Shin Aomori Station on JR East's Ou main line is being built by the Japan Railway Construction, Transport and Technology Agency (JRJT) with the aim of connecting to the planned Hokkaido Shinkansen through the 53.85-km Seikan Tunnel (under the Tsugaru Strait). Construction works began in March 1998 with the 26.5-km Hakkoda Tunnel, which is one of the longest land tunnels in the world. Other tunnels are presently under construction at Gonohe, Rokunohe, Sambongihara, Ushikagi and Hosogoe, and a total of 23.922 km of lined tunnel had been completed on 30 April 2004. Construction of the Shiriuchi (1200 m) and Kanahama (700 m) viaducts is progressing, as is track work for the Aomori Rolling Stock Depot. Completion of this extension is expected

to cut 40 minutes from the present 3 hours and 59 minutes between Tokyo and Shin Aomori (689.1 km) using the *Hayate* from Tokyo to Hachinohe and the Series E751 *Tsugaru* (local place name) limited express from Hachinohe to Shin Aomori.

Hokuriku Shinkansen

When fully completed, the Hokuriku Shinkansen will connect Tokyo and Osaka via Takasaki and the Hokuriku region. As explained above, the Takasaki-Nagano section is already in service and the Nagano-Toyama and Isurugi-Kanazawa sections are under construction. The 162.1-km Nagano-Toyama section will run via Iiyama Station (near Iiyama

Extensions in Progress

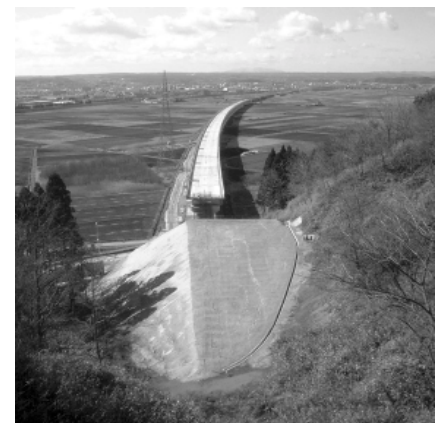
Further extensions to the Tohoku, Hokuriku and Kyushu shinkansen are presently under construction.

Tohoku Shinkansen

Following the completion of the extension from Morioka to Hachinohe, a new 81.2-km section via Shichinohe



Hakkoda Tunnel (26.5 km) under construction (JRJT)



Shiriuchi Viaduct under construction

(JRJT)



Iiyama Tunnel (22.2 km) nearing completion

(JRJT)



Supports for No. 5 Chikuma River Bridge (JRJT)

Station on JR East's Iiyama Line), Joetsu Station (to be constructed near Wakinoda Station on the Shin'etsu main line), Itoigawa Station (near Itoigawa Station on JR West's Hokuriku main line), and Shin Kurobe Station (a new station). Construction between Nagano Station and the future Joetsu Station began in March 1998 along with boring of the Iiyama Tunnel (22.2 km). Tunnels are also under construction at Koshasan (4200 m), Takaoka (6900 m) and Mineyama (7100 m) and the total length of lined tunnel was 14.974 km at 30 April 2004. The No. 4 and No. 5 Chikuma River

bridges (316 m and 622 m, respectively) and the Hekita (700 m), Nishi Kasahara (700 m) and Hiroshima (700 m) viaducts are also under construction. Construction began between Itoigawa and Uozu in September 1993 to link Joetsu Station with Toyama Station while works on other sections started in April 2001. The Shin Oyashirazu (3000 m) and Asahi (3000 m) tunnels are progressing well with a total lined length of 24.936 km at 30 April 2004. The 387-m Hokurikudo overpass over the Hokuriku Expressway is already completed and construction is moving forward on the Toumi (800 m),

Yanagida (1000 m), Oienosho (1100 m) and Kurobe (1100 m) viaducts, and on the bridge (164 m) over the Ogawa River. Somewhat unconventionally, the section between Isurugi and Kanazawa is being built to a different type of plan that calls for narrow-gauge rolling stock to run provisionally on shinkansen-standard infrastructure. The section will branch from the Nishi Isurugi signal box built 1 km west of Isurugi Station on the Hokuriku main line and runs 24.0 km to Kanazawa. Construction began in August 1992. All eight tunnels comprising 47% of the section, including the Shin Kurikara Tunnel (6600 m), have been completed. Viaduct construction is proceeding smoothly and work near Higashi Kanazawa Station to relocate the narrow-gauge track and freight station to the new shinkansen-standard infrastructure is nearly completed. The Kosaka (1300 m) and Otomaru (1400 m) viaducts are now under construction.



Viaduct under construction for Shin Kurobe Station (provisional name) (JRJT)



Ogawa River Bridge (JRJT)



Takadatajiri Viaduct under construction (JR TT)



Uto Viaduct under construction (JR TT)



Kikuchi River Bridge under construction (JR TT)

Kyushu Shinkansen (Hakata–Kagoshima Chuo)

When completed, the Kyushu Shinkansen from Hakata to Kagoshima-chuo will be 257-km long. As mentioned above, the southern section between Shin Yatsushiro and Kagoshima-chuo is already in service and the northern terminus at Hakata connects with the San'yō Shinkansen.

Construction of the 129.9-km northern section from Hakata to Shin Yatsushiro started in March 1998 and there will be stations at Shin Tosu, Kurume (next to the existing Kurume Station), Shin Omuta, Shin Tamana, and Kumamoto (next to the existing Kumamoto Station).

Work on the Funagoya–Shin Yatsushiro section started first, progressing to other parts in April 2001. Fourteen tunnels are now under construction at Chikushi (11,900 m), Miike (5400 m), Tamana (6800 m), Shin Tabaruzaka (3000 m) and elsewhere. The total length of lined tunnel at 30 April 2004 was 13.618 km.

Surface structures currently under construction include the Nishi Muta (1200 m), Takadatajiri (2000 m), Sedakaminami (2400 m), Uto (1500 m), Matsubase (2200 m), Ozaya (2600 m) and Shimadakita (2700 m) viaducts, and a bridge (400 m) over the Kikuchi River.

Completion of the northern section will cut some 50 minutes off the current time of 1 hour and 33 minutes between Hakata and Shin Yatsushiro.

Other Routes

March 1996 saw announcements of plans for the Hokuriku Shinkansen between Nan'etsu and Tsuruga, followed by a February 1998 announcement of plans for the Hokkaido Shinkansen between Shin Aomori and Sapporo and the Kyushu Shinkansen branch between Takeo Onsen and Shin Omura (near Nagasaki). No construction has been started, but environmental studies have been conducted in accordance with the recently passed Environmental Impact Assessment Law. Applications were submitted in January 2002 for approval of construction plans for two previously assessed sections: the Shin Aomori–Sapporo section of the Hokkaido Shinkansen, and the Takeo Onsen–Nagasaki branch line of the Kyushu Shinkansen. Preparatory work aimed at rapidly promoting other extensions includes studies on design construction methods for sections not yet started, such as the Seikan Tunnel linking Honshu and Hokkaido; shinkansen

passenger operations over freight tracks, free-gauge rolling stock; and demand forecasting.

Conclusion

Japan's shinkansen is recognized as an environment-friendly high-speed transportation system with an excellent speed and safety record that makes it the ideal choice for the nation's greying population in the 21st century.

The JR TT is continuing its work on further extensions to the network by promoting development and adoption of new technologies to reduce construction and operating costs, further improve safety and durability, and ensure that the shinkansen meets the needs of urban and local communities, while protecting the environment. ■

Editor's Note:

After this article was written, the government decided in December 2004 to start the construction works of the following sections: Shin Aomori–Hakodate section of Hokkaido Shinkansen, Takeo Onsen–Shin Isahaya (near Nagasaki) section of Kyushu Shinkansen's Nagasaki branch, Toyama–Isurugi section of Hokuriku Shinkansen.



Takashi Kitagawa

Mr Kitagawa is Director of the Shinkansen Department at JR TT. He joined the Japan Railway Construction Corporation in 1975 after graduating in civil engineering from Nagoya University. He has been closely involved with the planning and construction of many shinkansen works, including the Joetsu, Hokuriku and Tohoku shinkansen.