

# Railway Operators in Japan 13

## Chugoku and Shikoku Regions

### 1. Chugoku Region

Masafumi Miki

#### Region Overview

The Chugoku region at the western end of Honshu is comprised of the prefectures of Okayama, Hiroshima, Tottori, Shimane and Yamaguchi. The Chugoku Mountains run through the middle of this long, thin part of Honshu. The winters are mild and relatively dry south of the mountains along the coast of the Seto Inland Sea. There are heavy winter snowfalls north of the mountains facing the Sea of Japan. Okayama and Hiroshima prefectures are in the southern San'yō district, while Tottori and Shimane prefectures are in the northern San'in district. Yamaguchi

Prefecture, at the western end of Honshu, straddles both districts.

The side of the region facing the Seto Inland Sea has a good environment with a mild climate and calm seas, making it ideal for coastal shipping and explaining the presence of relatively large cities and thriving coastal industrial zones. Shipbuilding as well as chemical and heavy industries are important here.

To the north, the land facing the Sea of Japan endures severe winters. In the old days, *kitamae* trading boats plied the coastal waters and brought prosperity. However, due to the growth along other transportation corridors after the Meiji Restoration (1868), the region became a

backwater and the population declined. The two large cities of Okayama and Hiroshima are regional centres. Okayama has become an important transportation node following the opening of the Honshu-Shikoku bridges in 1988. Hiroshima is well-known as the site of the first atomic bombing, and is the only city in the region designated by government ordinance.

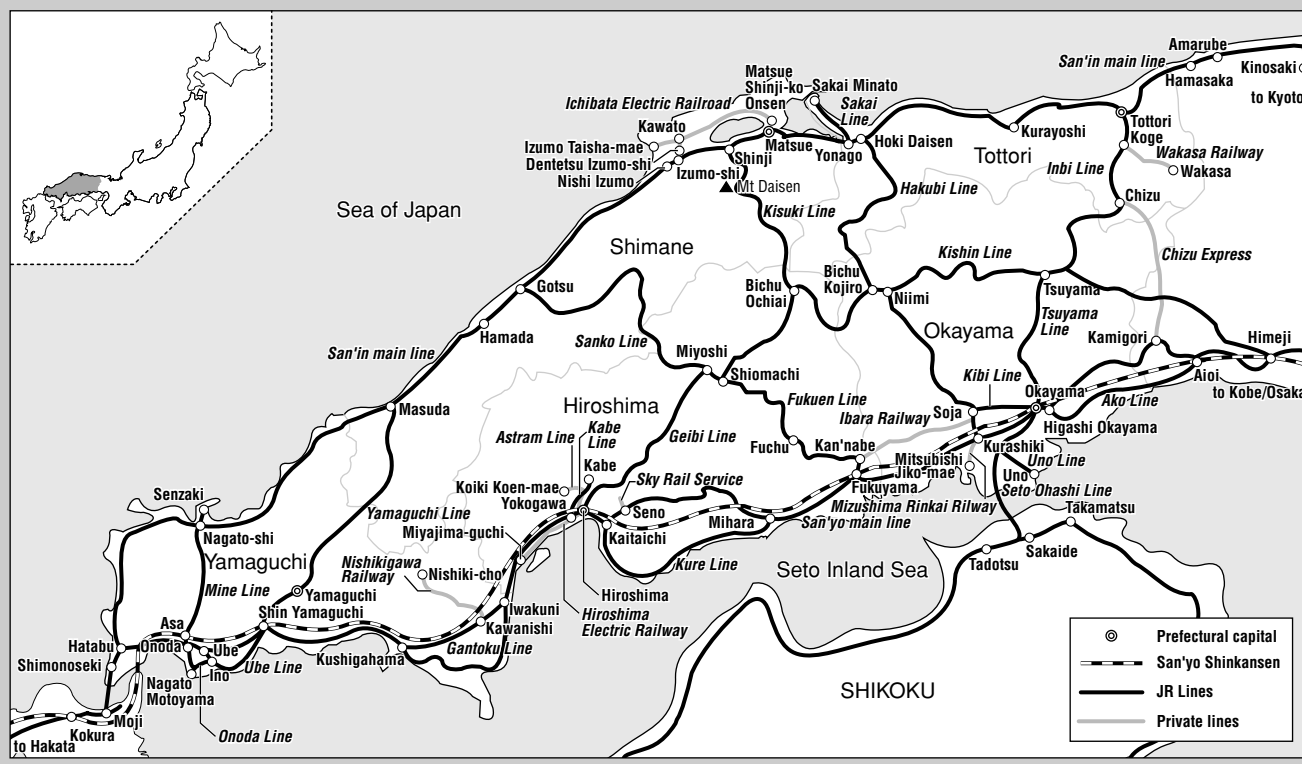
Chugoku has three national parks: the Inland Sea, San'in Coast, and Daisen-Oki. Hiroshima Prefecture has two UNESCO World Heritage Sites: the Hiroshima Peace Memorial, and the Itsukushima Shinto Shrine.

#### Outline of Rail Network

The region's trunk rail lines are:

- JR West's San'yō Shinkansen (Shin Osaka-Hakata (Fukuoka), 622.3 km)

Railway Lines in Chugoku Region



- JR West's San'yo main line along the Seto Inland Sea (Kobe–Moji, 512.7 km)
- JR West's San'in main line along the Sea of Japan (Kyoto–Hatabu, 673.8 km)

The San'yo Shinkansen joins the Tokaido Shinkansen at Shin Osaka, forming Japan's most important rail axis. The narrow-gauge San'yo main line, which follows the same transportation corridor in the district,

has overnight sleeper and rail freight traffic, but its main role now is to link cities within the region.

In the north along the San'in main line, the population base is shrinking. The line has very few passengers travelling its entire length—passengers to and from major cities along the coast generally take north–south connector lines to the San'yo Shinkansen corridor. The only electrified

sections are between Kyoto and Kinosaki (Hyogo Prefecture), and between Yonago and Nishi Izumo.

The following north–south routes have limited-express services linking cities on the Sea of Japan with the San'yo Shinkansen:

- Tottori to Osaka: Inbi Line and other lines, including line operated by Chizu Express

### Size and Financial Status of Railways in Chugoku Region

	Route-km	Number of Employees	Capital (¥1000)	Operating Revenues (¥1000)		Operating Expenses (¥1000)		Operating Profits/Losses (¥1000)		Ordinary Profits/ Losses (¥1000)
				Railway	Non-railway	Railway	Non-railway	Railway	Non-railway	
JR West	5,078.4	35,523	100,000,000	851,142,331	18,745,572	763,226,395	7,128,325	87,915,936	11,617,247	54,092,745
Chizu Express	56.1	78	450,000	2,895,338	0	2,278,347	0	616,991	0	539,905
Okayama Electric Tramway	4.7	46	200,000	444,654	1,660,184	379,039	1,661,470	65,615	-1,286	73,952
Mizushima Rinkai Railway	10.4 (freight 16.5)	49	850,000	726,834	128,484	775,448	68,522	-48,617	59,965	15,461
Ibara Railway	41.7	59	700,000	350,555	28,851	617,252	23,183	-266,697	5,668	-346,182
Hiroshima Electric Railway	34.9	910	900,000	6,538,855	12,283,047	6,254,895	11,730,848	283,960	552,199	244,564
Hiroshima Rapid Transit	18.4	183	10,000,000	4,591,778	249,145	4,632,455	123,024	-40,677	-126,121	-1,662,364
Nishikigawa Railway	32.7	20	120,000	118,901	63,678	143,285	60,472	-24,384	3,206	-16,442
Sky Rail Service	1.3	12	20,000	136,203	4,020,780	152,103	16,344	-15,900	4,436	3,708
Wakasa Railway	19.2	16	100,000	105,795	5,894	135,279	8,427	-29,484	-2,533	-31,201
Ichibata Electric Railroad	42.2	50	780,000	430,931	2,999,625	646,947	2,548,497	-216,016	451,128	-58,878

Note: Capital FY2002 data; all other figures, FY2001 data

### Passenger Volume and Density by Railway Company

		1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
JR West	No. of Passengers (1000)	1,779,749	1,805,090	1,805,465	1,884,460	1,887,650	1,867,987	1,843,460	1,823,236	1,812,450	1,811,812
	Passenger Density*	29,690	29,812	28,327	30,131	30,404	29,825	29,098	28,594	28,575	28,633
Chizu Express	Volume	–	–	210	928	979	1,119	1,190	1,208	1,226	1,236
	Density	–	–	1,251	2,012	2,210	2,525	2,723	2,726	2,787	2,785
Okayama Electric Tramway	Volume	4,575	4,440	4,369	4,336	4,312	4,244	4,187	4,060	3,874	3,717
	Density	4,711	4,531	4,458	4,380	4,345	4,284	4,209	4,050	3,867	3,692
Mizushima Rinkai Railway	Volume	2,289	2,441	2,421	2,389	2,304	2,252	2,117	2,032	1,917	1,821
	Density	4,199	4,395	4,367	4,273	4,135	3,990	3,714	3,547	3,316	3,181
Ibara Railway	Volume	–	–	–	–	–	–	377	1,092	1,029	1,099
	Density	–	–	–	–	–	–	2,769	1,253	957	993
Hiroshima Electric Railway	Volume	64,178	64,953	65,227	65,595	65,313	65,593	63,448	62,602	60,350	58,484
	Density	17,929	18,223	18,338	18,469	18,463	18,689	18,109	17,827	17,161	16,554
Hiroshima Rapid Transit	Volume	–	–	9,761	16,623	17,813	18,335	18,836	19,234	19,344	19,315
	Density	–	–	20,175	19,511	20,798	21,170	21,622	22,207	22,535	22,124
Nishikigawa Railway	Volume	577	551	530	485	471	447	457	439	438	450
	Density	966	923	887	816	789	746	758	720	718	736
Sky Rail Service	Volume	–	–	–	–	–	–	45	59	66	88
	Density	–	–	–	–	–	–	185	134	154	196
Wakasa Railway	Volume	575	575	553	541	564	607	638	671	658	661
	Density	903	901	906	891	895	888	890	893	866	858
Ichibata Electric Railroad	Volume	1,708	1,702	1,817	1,845	1,757	1,621	1,562	1,566	1,490	1,476
	Density	1,631	1,592	1,753	1,672	1,720	1,518	1,482	1,548	1,427	1,434

Note: Passenger Density = Daily passenger-km/route-km



JR West's Series 500 *Nozomi* (left) and Series 700 *Hikari Rail Star* on San'yo Shinkansen

(Photos: JR West)

- Yonago and Izumo-shi to Okayama: Hakubi Line
- Hamada and Masuda to Shin Yamaguchi: Yamaguchi Line

Some other lines, such as the Tsuyama, Fukuen, Kisuki and Mine lines, also link the north and south coasts, but offer no express services. Along the coast of the Seto Inland Sea, the Aka, Kure, Gantoku, Ube and other branch lines feed to the San'yo main line.

The suburban populations of Okayama and Hiroshima are growing and generating greater ridership on the urban transit systems. Okayama Electric Tramway and Hiroshima Electric Railway both operate tramways in their respective cities. Hiroshima also has a guided transportation system operated by Hiroshima Rapid Transit.

Population density is low away from the cities, creating challenges for local services offered by public-private businesses such as Nishikigawa Railway, Wakasa Railway and Ibara Railway, all of which are trying to attract more passengers.

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## JR West Lines

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### San'yo Shinkansen

The San'yo Shinkansen started as an extension to the Tokaido Shinkansen

(Tokyo–Osaka). It opened as far as Okayama in 1972, and reached Hakata (Fukuoka)—the present terminus—in 1975. The passenger density is lower than that of the Tokaido Shinkansen. The track was designed for high speed, so almost the entire line is elevated or tunnelled. Indeed, the numerous tunnels are a characteristic of the San'yo Shinkansen. The whole line from Shin Osaka to Hakata is operated by JR West, unlike the narrow-gauge San'yo main line, which is operated jointly by JR West and JR Kyushu east and west of Shimonoseki, respectively. *Kodama* (Echo) shinkansen trains stop at every station and most run back and forth along the line. However, many of the faster *Nozomi* (Hope) and *Hikari* (Light) trains provide through services onto the Tokaido Shinkansen.

Fukuoka has an airport very close to the city centre, pushing the shinkansen into a competitive struggle with air and resulting in higher speeds and better services.

- Higher speeds: In 1989, the *Grand Hikari* reached 230 km/h on the San'yo Shinkansen, using improved Series 100N rolling stock; in 1997, the Series 500 *Nozomi* achieved a world record maximum speed of 300 km/h on the same line.
- Improved services: In 1988, Series 0 *West Hikari* standard cars raised

comfort levels by changing from 3 + 2 seats per row to 2 + 2. In 2000, *West Hikari* services were replaced by the Series 700 *Hikari Rail Star* trains with 2 + 2 wide seats per row, offering comfort levels for reserved-seat passengers equal to those in executive-class (Green) cars. In addition, more through services were added to make travel between localities such as Shizuoka Prefecture and Okayama or Hiroshima more attractive by rail than by air.

*Kodama* services are generally four- or six-car train sets, and even the faster *Hikari* services are generally eight-car train sets that do not leave the line. However, *Nozomi* and other trains offering through services onto the Tokaido Shinkansen have 16 cars.

### San'yo main line

Right from the late 19th century, the San'yo main line with its connection to the Tokaido main line has been a major route through western Japan. However, the San'yo Shinkansen took over the role of transporting long-distance rail passengers (except overnight travel) in this transportation corridor in 1972. Today, the San'yo main line is used mainly for freight and relatively short intercity travel. Many container trains use the line, linking

Greater Tokyo and the Kansai district with the San'yō district and Kyushu. Demand for freight services is heavy in the Chugoku region due to the many cities and industrial zones alongside the line. Overnight sleepers also use the line, although passenger levels are dropping because of the faster shinkansen trains, the growing convenience of air travel, and the development of express buses. Sleeper trains currently offer three daily return runs between Tokyo and the Chugoku region (and onward to Kyushu), one between Tokyo and Shikoku and the San'in district, and two between Kansai and Kyushu. (A train that is coupled partway along the route is counted as one train.) There are many vacant seats except during busy holiday travel periods at the year end, etc. Nevertheless, passengers are giving positive feedback about the new Series 285 all-private sleeping cars introduced in 1998 on the *Sunrise Seto* (Tokyo–Takamatsu) and *Sunrise Izumo* (Tokyo–Izumo-shi) services operating over part of the route via the Hakubi Line. The San'yō main line offers many appealing choices for intercity travel. The *Sun Liner* rapid express between

Okayama and Fukuyama runs every 30 minutes, using Series 117 cars (two doors per side with cross-seating). In the Hiroshima area, the *City Liner* rapid express runs at 30-minute intervals during daytime hours, supplemented by the *Commuter Liner* during the morning and evening rush hours. The *Akiji Liner* offers through services onto the Kure Line. In Yamaguchi Prefecture, many JR West trains provide through services through the Kammon Tunnel (3.6 km) to JR Kyushu stations in northern Kyushu. Some trains offer through services onto the Ube Line from the San'yō main line.

The following lines branch from the San'yō main line:

- Ako Line (57.4 km) from Aoi (Hyogo Prefecture) to Higashi Okayama (Okayama Prefecture) both also on San'yō main line
- Uno Line (32.9 km) from Okayama to Uno (both in Okayama Prefecture)—The northern section of this line is also used by trains crossing from Honshu to Shikoku on the Seto Ohashi Line.
- Kibi Line (20.4 km) from Okayama to Soja (both in Okayama Prefecture)—Soja is on the Hakubi Line.

- Kure Line (87.0 km) from Mihara to Kaitaichi (both in Hiroshima Prefecture and both on San'yō main line)
- Gantoku Line (43.7 km) from Iwakuni to Kushigahama (both in Yamaguchi Prefecture and both on San'yō main line)
- Ube Line (33.2 km) from Shin Yamaguchi to Ube (both in Yamaguchi Prefecture and both on San'yō main line)
- Onoda Line (11.6 km) from Ino to Onoda (both in Yamaguchi Prefecture)—The line links the Ube Line at Ino with the San'yō main line at Onoda; a 2.3-km spur runs from Suzumeda on the Onoda Line to Nagato Motoyama.

All these branch lines except the Kibi Line are electrified and many offer through services onto the San'yō main line.

### San'in main line

This line runs through an area with little urbanization and most sections are not electrified, so the line is no longer a major long-distance route. Two overnight sleeper trains do offer long-distance travel: the *Izumo* limited express from Tokyo to Izumo-shi, and the *Daisen* (place name) express from Osaka to Yonago (partly taking the Fukuchiyama Line). All other trains on the San'in main line, including freight trains, use only parts of the line, or turn off onto a north–south connector to the Seto Inland Sea coast.

The San'in main line lost its role as a long-distance main line because it is far from major transportation corridors; has a declining trackside population; is not electrified; and has difficulties keeping services on schedule due to a problem with the Amarube Viaduct. This bridge, which is one of Japan's longest (310 m) and highest (41 m), is located between Yoroi and Amarube in Hyogo Prefecture. A train was blown off the bridge during a severe winter gale in 1986 and bridge



JR West's Series 285 *Sunrise Seto* sleeper express running through San'yō main line

(JR West)



JR West's local train on San'in main line

(JR West)

crossings have frequently been curtailed during strong winds since then.

At present, the only limited-express trains offering through services between Hyogo and Tottori prefectures are the above-mentioned *Izumo* and the *Hamakaze* (Beach wind) from Osaka to Tottori or Hamasaka (Hyogo Prefecture) running via the Bantan Line (see *JRTR 37*, pp. 44–51). West of Tottori, there are express services using new Series 187 diesel-powered rolling stock: the *Super Matsukaze* (Pine wind) from Tottori to Masuda in Shimane Prefecture, and the *Super Oki* (island name) from Tottori to Shin Yamaguchi. The *Isokaze* (Shore wind) runs from Masuda to Kokura in Fukuoka Prefecture. Local services are even more segmented than on the San'yo main line. Typical examples are: Kyoto to Kinosaki in Hyogo Prefecture on an electrified section; Kinosaki (or Toyooka) to Hamasaka (both in Hyogo Prefecture); Hamasaka to Tottori; Tottori to Yonago (both in Tottori Prefecture); Yonago to Masuda; Masuda to Nagato-shi in Yamaguchi Prefecture; and Nagato-shi to Shimonoseki in Yamaguchi Prefecture.

The line also supports the *Tottori Liner*

(Tottori–Yonago) and the *Aqua Liner* (Yonago–Masuda) intercity rapid services. The San'in main line has two branch lines: the 17.9-km Sakai Line from Yonago to Sakai Minato, and the 2.2-km San'in main line branch from Nagato-shi to Senzaki (both in Yamaguchi Prefecture).

### North–south connector lines

Years ago, north–south connector lines were built to link communities on the Seto Inland Sea and the Sea of Japan. When the San'yo Shinkansen started running, some of connector lines remained local, secondary lines while others grew in importance and offered limited-express services bound for shinkansen stations. Typical examples of the latter are the Fukuchiyama (see *JRTR 37* pp. 44–51), Hakubi, Yamaguchi and Inbi lines, as well as the Chizu Express operated by a public–private business with through operations on the Inbi Line.

The 138.4-km Hakubi Line runs from Kurashiki (in Okayama Prefecture on the San'yo main line) to Hoki Daisen (in Tottori Prefecture on the San'in main line). When the San'yo Shinkansen opened, *Yakumo* (place name) limited expresses began frequent services between Okayama and Yonago (Tottori Prefecture) and Izumo-shi (Shimane Prefecture). In 1982, the San'in main line was electrified by Japanese National Railways (JNR) as far as Chiinomiya (now Nishi Izumo) just west of Izumo-shi and Series 381 rolling stock with a tilting mechanism was



Chizu Express's Series HOT7000 *Super Hakuto* running between Koijamagata and Chizu

(Chizu Express Co.)

introduced to increase speeds on curves and offer more frequent services. Today, the Hakubi Line is an important connector linking the Seto Inland Sea coast to the central San'in district. The above-mentioned *Sunrise Izumo* limited express also uses the line.

The 93.9-km Yamaguchi Line runs from Shin Yamaguchi (in Yamaguchi Prefecture on the San'yo Shinkansen) to Masuda (in Shimane Prefecture on the San'in main line). It is not electrified, but is used by the *Super Oki* limited expresses feeding the San'yo Shinkansen. The Yamaguchi Line was the first in Japan to see the rebirth of steam in 1979 when JNR started hauling the *SL Yamaguchi-go* using a Class C57 steam locomotive.

Chizu Express operates a 56.1-km line from Kamigori (Hyogo Prefecture) to Chizu. JNR started building the line in 1966, but abandoned the project. It was subsequently taken up by a public-private business and opened in 1994. The most important trains are the *Super Hakuto* (White rabbit), which runs from Kyoto on the Tokaido and San'yo main lines, switches to the Chizu Express, and then runs through on the Inbi Line from Chizu to Tottori. Some runs continue to Kurayoshi on the San'in main line. Another important train is the *Super Inaba* (region name), which runs from Okayama, follows the San'yo main line, and then takes the same route as the *Super Hakuto* from Kamigori.

The local, secondary north-south connector lines are:

- Kishin Line (158.1 km) from Himeji (Hyogo Prefecture) to Niimi (on Hakubi Line in Okayama Prefecture)
- Tsuyama Line (58.7 km) from Okayama to Tsuyama (on Kishin Line in Okayama Prefecture)
- Fukuen Line (79.4 km) from Fukuyama (on San'yo main line in Hiroshima Prefecture) to Shiomachi (on Geibi Line in Hiroshima Prefecture)

- Geibi Line (159.1 km) from Bichu Kojiro (on Hakubi Line in Okayama Prefecture) to Hiroshima
- Kisuki Line (81.9 km) from Shinji (on San'in main line in Shimane Prefecture) to Bingo Ochiai (on Geibi Line in Hiroshima Prefecture)
- Sanko Line (108.1 km) from Gotsu (on San'in main line in Shimane Prefecture) to Miyoshi (on Geibi Line in Hiroshima Prefecture)
- Kabe Line (14.0 km) from Yokogawa (on San'yo main line in Hiroshima Prefecture) to Kabe (in Hiroshima Prefecture)
- Mine Line (46.0 km) from Asa (on San'yo main line in Yamaguchi Prefecture) to Nagato-shi (on San'in main line in Yamaguchi Prefecture)

All these lines face difficult economic times because of falling passenger levels. The Fukuyama-Fuchu section of the Fukuen Line and the Kabe Line are electrified. Both were purchased from private railways, and added to the government railways' network during WWII. Today, they serve suburban areas of their respective cities (Fukuyama and Hiroshima). None of the other lines have been electrified and



Okayama Electric Tramway's new LRV *Momo* (Peach) (Okayama Electric Tramway)

costs are being cut by measures such as running small diesel railcars.

## Private Railways

Private railways in the Chugoku region are far smaller than those in Greater Tokyo or the Kansai (Osaka) district. Local private railway operations consist of tramways, new guided transport systems, public-private (third) sector operations, and regional railway companies.

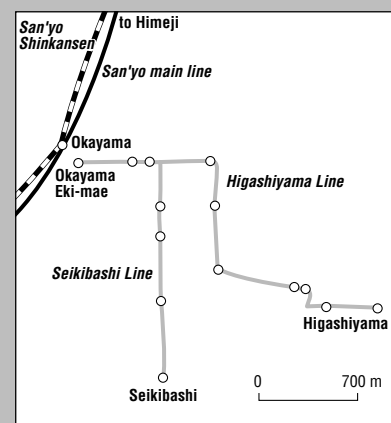
### Tramways

The two regional cities of Okayama and Hiroshima have tramways.

Okayama Electric Tramway operates the 3.05-km Higashiyama and the 1.63-km Seikibashi lines. Both are 600-Vdc double-track lines with a gauge of 1067 mm and neither has a segregated right of way. During the last few years, the company has promoted its system by introducing ultra-low-floor light rail vehicles (ULF-LRVs) with inner-city flat fares of ¥100 (= US\$0.97).

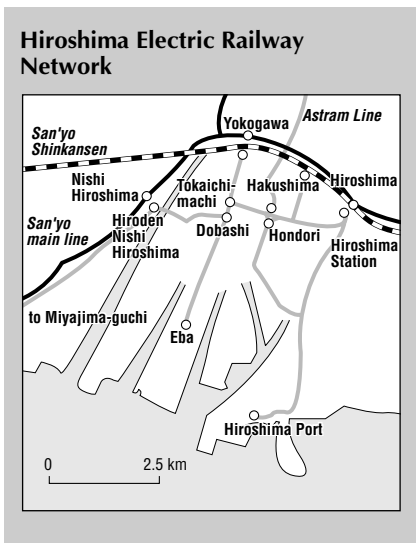
Hiroshima Electric Railway's 600-Vdc network consists of 19.0 km of tramways and 16.1 km of light rail all at 1435-mm gauge. The total fleet

### Okayama Electric Tramway Network





Hiroshima Electric Railway's Series 1900 formerly owned by Kyoto City at Tokachi-machi Station (left) and Series 5000 Green Mover (Photos: Hiroshima Electric Railway)



numbers 267 carriages (108 tramcars and 159 LRVs). The popular cars have a mixed parentage—some were inherited from the Kansai district and some came from Hannover and Dortmund in Germany. The company has introduced some ULF-LRVs over the last few years, and operates what has become one of Japan's busiest tramways. The light rail line takes passengers to the ferry to Miyajima Island where Itsukushima Shrine is

located, and provides through connections on the urban tram network, offering convenient transit for some suburban residents. (For more details, see the special feature on LRT systems on pp. 10–16 and pp. 30–40 in *JRTR* 38.)

### New guided transport systems in Hiroshima

Urban growth on the outskirts of Hiroshima has prompted the development of two innovative suburban routes. One is the 18.4-km Astram Line, a guided transport system operated by Hiroshima Rapid Transit. It opened in 1994, and runs from Hondori in central Hiroshima to Koiki Koen-mae in the hilly region to the west. The entire line is double-tracked, and runs on elevated track in the suburbs and underground in the city centre. The six-car train sets seat 286 passengers, and run at a minimum interval of 2 minutes and 30 seconds during the morning rush hour. The other (operated by Sky Rail Service) is Japan's first cable-powered suspended transport system. This unique cross between a cableway and monorail opened in 1998, and runs 1.3 km from

Seno Station on the JR West San'yo main line to the New Town urban development project in the eastern suburbs.

### Regional railway companies

One of the biggest regional railways operating in rural parts of the region is the public-private Chizu Express described above. All the other lines use a gauge of 1067 mm and none—except the line operated by Ichibata Electric Railroad—have been electrified. The origin of the single-track mostly-elevated Ibara Railway goes back to when JNR started building a line in 1966, but then abandoned the project as part of restructuring. As happened with Chizu Express, construction was taken up by another group, which opened the 41.7-km line from Kan'nabe (on the Fukuen Line in Hiroshima Prefecture) to Soja (on the Hakubi Line in Okayama Prefecture) in 1999. Some trains offer through services on the Fukuen Line to as far as Fukuyama. Nishikigawa Railway was established in 1987, and assumed control of the JR West's Gan'nichi Line in Yamaguchi Prefecture. The 32.7-km line runs from



Hiroshima Rapid Transit's Series 6000 Astram Line running between Ushita and Fudo-in-mae (Hiroshima Rapid Transit Co., Ltd.)



Ichibata Electric Railroad's Series 50 running along Lake Shinji (Ichibata Electric Railroad)

Kawanishi (on the JR West's Gantoku Line) to Nishiki-cho. All trains offer through services on the Gantoku Line as far as Iwakuni. The line runs through the scenic Nishikigawa Valley but the local population is declining, making finances difficult.

Wakasa Railway took over the Wakasa Line from JNR in 1986. The line runs 19.2 km from Koge (on the JR West Inbi Line) to Wakasa. Some trains offer through services on the Inbi Line as far as Tottori. The trackside population is declining with high-school students forming the bulk of the passenger base so the company is in financial difficulties. Mizushima Rinkai Railway in Okayama Prefecture is the last remaining local railway of the many that once operated along the coast of the Seto Inland Sea. (Some, such as the Fukuen and Kabe lines, were purchased and absorbed into the larger railway network.) The line goes back to 1943, when Mitsubishi Heavy Industries built it for wartime freight transport. In 1948, the operator was granted a local railway licence for both passenger and freight transport. The Kurashiki municipal government operated the line until it was taken over by Mizushima Rinkai

Railway in 1970. Although the line is 16.5-km long, passengers can only travel 10.4 km from Kurashiki-shi to Mitsubishi Jiko-mae. The track passes through built-up areas of Mizushima City, so revenues from the fare box are similar to income from freight haulage and the finances are in good health. Ichibata Electric Railroad in Shimane Prefecture opened in 1911. Today, it has only two lines: the 33.9-km Kita Matsue Line from Dentetsu Izumo-shi to Matsue Shinji-ko Onsen, and the 8.3-km Taisha Line from Kawato (on the Kita Matsue Line) to Izumo Taisha-mae. Part of the former line passes along scenic Lake Shinji. The JR West San'in main line runs along the other side of the lake and interurban services in the Izumo area

have recently been improved, allowing Ichibata Electric to increase the frequency of local trains in this transport niche. ■

#### Further Reading

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## 2. Shikoku Region

*Yuichiro Kishi*

The two Chinese characters (called *kanji* in Japanese) used to make Shikoku mean 'four countries,' a name that originates from the four old fiefs of Iyo, Sanuki, Awa,

and Tosa, which are now called Ehime, Kagawa, Tokushima and Kochi prefectures, respectively. With a land area of only about 18,800 km<sup>2</sup> and a



population of 4.1 million, Shikoku is the smallest of the four largest islands comprising the Japanese archipelago (Hokkaido, Honshu, Kyushu, and Shikoku). Each of Shikoku's prefectures has a coastline; Ehime, Kagawa, and Tokushima border the Seto Inland Sea separating Shikoku from the main island of Honshu. Ehime and Kochi both face Kyushu, but part of Kochi also faces the Pacific Ocean. The topography is rugged terrain and the centre of the island has steep mountains including Mt Ishizuchi (1982 m) and Mt Tsurugi (1955 m). Narrow coastal plains are found along the coasts of the Seto Inland Sea and Pacific sides of the island. The main cities are centred on the coast and several large cities on the Seto Inland Sea have populations in the order of 50,000–

100,000. Each prefectural capital is on the coast and the estimated populations in October 2003 were 480,000, 340,000, 330,000 and 270,000 for Matsuyama, Takamatsu, Tokushima, and Kochi, respectively.

The north and south sides of Shikoku are divided by central mountains and have different regional characteristics—the north side has had long cultural and trading relationships with the south side of the Chugoku region of Honshu on the opposite side of the Seto Inland Sea and comprised of Yamaguchi, Hiroshima and Okayama prefectures. The north-east side of Tokushima Prefecture has seen deepening relations with the Kansai district. Various large-scale heavy industries have grown along the Seto coastal belt in the cities of Matsuyama,

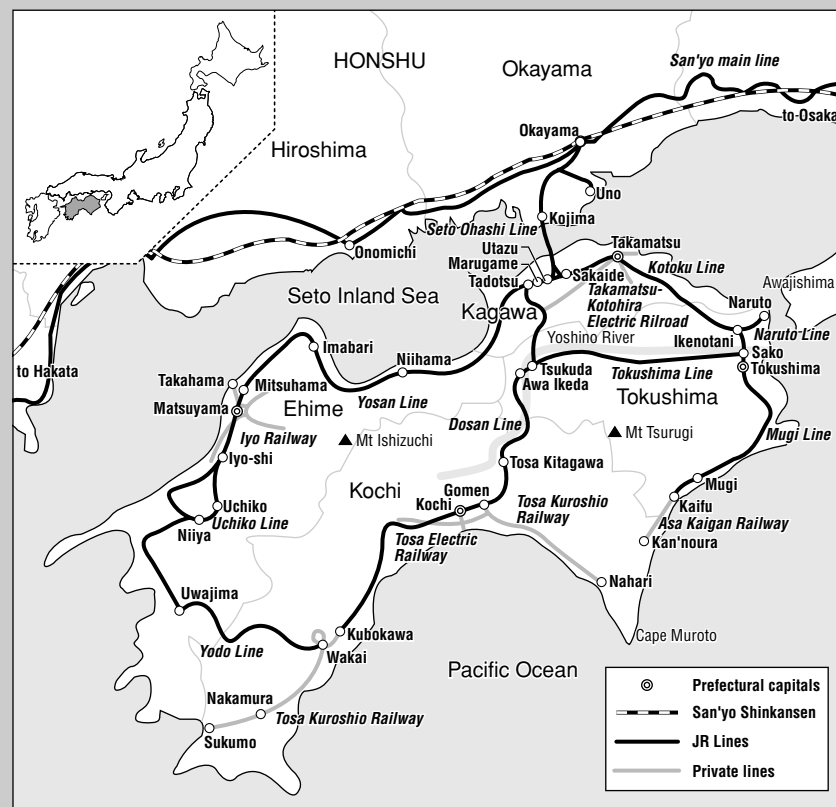
Imabari, Niihama, etc., and some have populations in excess of 100,000. In contrast, other than Kochi City, the Pacific coast of southern Shikoku has no large cities with a population exceeding 100,000.

### Growth of Railway Network

Shikoku's transportation network was for a long time centred around coastal shipping including extensive exchange with the larger neighbouring islands of Kyushu and Honshu. The opening up of westward shipping routes during the Edo period (1603–1867) saw the long-term development of coastal ports in the Seto Inland Sea. Small- and medium-sized coastal shipping businesses were established west of the Kansai district after the Meiji period (1868–1912) and the opening of the railway between Osaka and Kobe in 1874 forced steamship operations to shift to coastal shipping routes in the Seto Inland Sea, improving sea transport.

As a result, railway operators on Shikoku were slow to develop their networks, restricting their operations to small local services centred on the major cities. This explains why Matsuyama was the last prefectural capital in Japan (excluding Okinawa) to get a government railways' station (1927) and why the railway networks of the four Shikoku prefectures were not linked into a network until 1935. The October 1888 opening of the private Iyo Railway between Mitsuhamma Bay and Matsuyama is noteworthy because not only was it the first railway in Shikoku but it was also the third private railway in Japan, and was built before the opening of private lines in Hokkaido and Kyushu. The specifications were simple with a gauge of 762 mm. In the following year, Sanuki Railway was opened linking Marugame (a key point in the coastal shipping network on the Seto Inland Sea)

Railway Lines in Shikoku Region





Much of JR Shikoku's network runs along the sea with ocean scenery. There are temporary stations on the Mugikago Line for summer bathers. (Author)



JR Shikoku's Takamatsu Station (built in 2001) is the busiest station with 13,000 passengers daily. (Author)

and Kotohira (near the famous Kotohira Shrine) via Tadotsu. It was soon extended to Takamatsu, becoming the predecessor of JR Shikoku's Dosan and Yosan lines today. Interestingly, in December 1904, Sanuki Railway was taken over by San'yō Railway (the predecessor of the JR West's San'yō main line today), which had tracks running along the Honshu coast of the Seto Inland Sea. Since the aim of San'yō Railway was to link Honshu and Shikoku, it needed to build a ferry, becoming an unusual case of a railway operator uniting its railway network separated by a sea! Tokushima Railway (now JR Shikoku's Tokushima Line) opened in 1899 to westward line from Tokushima along the Yoshino River; 1904 saw the opening of Tosa Electric Railway in Kochi Prefecture, the first electric railway in Shikoku, marking the birth of rail services in all four prefectures of Shikoku.

Unlike the private investment in local railways, the government railways made absolutely no attempt to build lines in Shikoku until 1906 when it adopted a policy of extending the national main-line network by purchasing existing private railways. Subsequent development of the railway infrastructure was promoted by extending, realigning, etc., the purchased private lines. Extensions to the lines forming today's JR Shikoku Yosan and

Tokushima lines were opened in quick succession from 1913. During and after the Taisho period (1912–1926) as the railway infrastructure came into government hands, heavy emphasis was placed on linking up local railway networks in different regions. The Yosan Line running east–west parallel to the south coast of the Seto Inland Sea linked the cities of Matsuyama and Takamatsu in 1927 while the north–south Dosan Line was pushed through the central mountain range to connect with the previously opened Tokushima Line in 1935, finally linking the four prefectural capitals by rail. In addition, lines were gradually built around the Shikoku coast to link the smaller peripheral cities. As well as purchasing the private forerunner of today's Naruto Line in the north-east of Shikoku, progress was made in completing the Kotoku Line between Takamatsu and Tokushima by 1935. At the same time, a private line running south from Tokushima was purchased and extended successively towards Cape Muroto, finally reaching Mugikago in southern Tokushima Prefecture by 1942. Elsewhere in west Shikoku, by 1945, the Yosan Line had been extended from Matsuyama to reach Uwajima, the major city in the south-west of Ehime, where a connection was made with the purchased, upgraded

and extended Uwajima Line (now part of the JR Shikoku's Yodo Line).

After WWII, moves were made to develop the railway infrastructure in the south-west and south-east parts of Shikoku with the aim of developing local resources and the Yodo and Nakamura lines (now Tosa Kuroshio Railway's Nakamura Line) were opened. However, a freeze was put on further construction while the JNR reforms were in progress. During the latter part of this period, parts of some of these lines were transferred to local governments and reopened as third-sector railway companies like Asa Kaigan Railway, and the Sukumo and Gomen–Nahari lines of Tosa Kuroshio Railway.

Finally, the 1988 opening of the Seto Ohashi Line linking Shikoku with Honshu across the Honshu–Shikoku bridges (*JRTR* 11, pp. 4–12, pp. 60–63, and *JRTR* 13 pp. 50–53) marked a turning point in opening up Shikoku to the rest of the Japanese railway network as described later in this article.

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### Railway Modernization

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Not only did Shikoku's main lines see few extensions or upgrades after the early

**Size and Financial Status of Railways in Shikoku**

	Headquarters	Route-km	No. of Employees	Capital (¥1000)	Operating Revenues (¥1000)		Operating Expenses (¥1000)		Operating Profits/Losses (¥1000)		Ordinary Profits/Losses (¥1000)
					Railway	Non-railway	Railway	Non-railway	Railway	Non-railway	
JR Shikoku	Kagawa	855.2	2527	3,500,000	35,074,743	4,085,124	42,522,813	4,588,115	-7,448,070	-502,991	83,968
Takamatsu-Kotohira Electric Railroad	Kagawa	60	308	250,000	2,841,743	1,155,568	2,917,800	1,160,533	-76,157	-4,965	-324,443
Iyo Railway	Ehime	43.5	327	1,500,000	3,219,966	8,645,121	3,185,976	7,263,874	33,990	1,381,247	1,508,921
Tosa Electric Railway	Kochi	25.3	188	660,000	1,172,596	4,544,224	1,344,363	4,393,544	-171,767	150,680	-138,370
Tosa Kuroshio Railway	Kochi	109.3	71	499,000	961,972	23,199	1,021,748	30,945	-59,776	-7,746	-81,435
Asa Kaigan Railway	Tokushima	8.5	11	100,000	16,588	1,454	73,946	20	-57,358	1,434	-53,264

Sources: *Tetsudo tokei nempo* (Railway Annual Statistics), MLIT, 2001 and *Tetsudo yoran* (Railway Directory), MLIT, 2003

**Passenger Volume and Density by Railway Company**

		1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
JR Shikoku	No. of Passengers (1000)	65,351	64,608	65,800	63,869	64,895	64,417	61,839	59,237	57,391	55,246	53,625
	Passenger Density <sup>1)</sup>	6,779	6,619	6,658	6,271	6,341	6,348	6,122	5,812	5,633	5,422	5,295
Takamatsu-Kotohira Electric Railroad	Volume	19,658	18,702	18,296	17,234	16,548	15,838	16,954	16,084	15,112	14,440	13,876
	Density	7,864	7,465	7,292	6,854	6,621	6,365	6,680	6,377	5,992	5,747	5,575
Iyo Railway	Volume	23,995	23,483	23,358	22,090	21,905	21,619	20,305	19,404	18,592	17,830	17,740
	Density	6,835	6,768	6,657	6,265	6,199	6,184	5,771	5,513	5,208	5,058	4,984
Tosa Electric Railway	Volume	9,154	8,994	8,687	8,134	7,770	7,821	7,583	7,399	7,047	6,902	6,742
	Density	3,829	3,759	3,689	3,457	3,291	3,273	3,192	3,141	3,009	3,127	3,216
Tosa Kuroshio Railway	Volume	1,047	1,001	1,000	963	914	886	1,130	1,263	1,333	1,306	1,265
	Density	1,720	1,647	1,677	1,643	1,605	1,594	1,491	1,269	1,346	1,311	1,291
Asa Kaigan Railway <sup>2)</sup>	Volume	9	177	150	135	142	124	125	123	118	103	92
	Density	1,235	385	323	289	302	263	263	259	247	216	194

Source: *Tetsudo tokei nempo* (Railway Annual Statistics), MLIT

1) Passenger Density = Daily passenger-km/route-km

2) Asa Kaigan Railway opened on 26 March 1992.

days, they also remained largely unchanged after WWII with most trains continuing to be hauled solely by steam locomotives. There were absolutely no electrified sections and there were also many difficulties in increasing train speeds due to the poor track conditions on many sections. As a consequence, from the late 1960s, JNR started putting a great deal of effort into upgrading Shikoku's railway services based on the catchphrase, 'low-cost, quick and no waiting.' In concrete terms, this meant speeding up operations by introduction of diesel vehicles as well as increasing frequencies on lightly used sections through use of railbus. In addition, to relieve the bottleneck of the single-track Yosan Line around Takamatsu, double-tracking programme was undertaken along with gradual introduction of coupled operation of express trains over some track sections with decoupling at a junction. Today, the

system has been completely electrified so most express services have been elevated to limited-express services to make the best use of the advantages of electric rolling stock.

Compared to the Tokaido and San'yo main lines on Honshu, main lines on Shikoku have many sections with poor track characteristics, such as sharp curves and high grades, and track realignment and new construction have been ongoing projects since the first JNR days. Typical recent large-scale works were the 1986 realignment of the Yosan Line via the 6-km shortcut further inland to eliminate the endless series of sharp curves along the older coastal route and shorten the journey time between Matsuyama and Uwajima. Similarly, many difficult mountainous sections on the Dosan Line made speed increases difficult and there were also frequent rockfalls, etc., resulting in frequent upgrade works. Especially

noteworthy was the large-scale realignment using a new tunnel and bridge near Tosa Kitagawa Station and the interesting use of a truss bridge incorporating a station and signal box.

Double-tracking totalling 34.1 km was undertaken between Tokushima and Sako on the Kotoku Line in 1963; between Takamatsu and Utazu in Kagawa Prefecture on the Yosan Line from 1965 to 1970; between Marugame and Tadotsu on the Yosan Line; and immediately before the opening of the Honshu-Shikoku bridges when the double-tracked Seto Ohashi Line (18.1 km) was opened. No further double tracking has been performed since JR Shikoku took over from JNR but faster speeds have been achieved on single-track sections by building a straight passing track at stations. The introduction of centralized traffic control (CTC) on the Dosan Line between Tadotsu and Kochi in July 1967 was the



Series 2000 tilting limited express entering Utazu Station on Yosan Line

(Author)

third case in JNR, with the entire Shikoku network coming completely under CTC in November 1991.

Electrification of the main-line network was greatly delayed and did not start until the last days of JNR when parts of the Yosan and Dosan lines in Kagawa Prefecture were electrified in March 1987. The section of the Yosan Line between Takamatsu and Matsuyama and Iyo-shi was not electrified until 1993 and there are now a great many electric services.

In addition to the above-described infrastructure upgrades, policies such as introduction of tilting trains have also been adopted. In 1989, soon after JR Shikoku took over operations from JNR, the company developed and introduced its Series 2000 DMU limited express—the world's first natural pendulum tilting diesel rolling stock—for faster operations mainly on the Dosan Line. In addition to reducing carriage weight, the high-output diesel engine and tilting body allow faster speeds through curved sections, thereby decreasing journey times. Moreover, in 1992, JR Shikoku increased maximum speeds to 130 km/h

with the introduction of Series 8000 limited-express electric services, soon followed in 1998 by new Series 2000 DMUs with a more powerful diesel engine capable of operations at 130 km/h. These introductions of new rolling stock supporting faster operations allowed JR Shikoku to eliminate the older express rolling stock remaining from the JNR days in advance of other JR operators. Now, 90% of JR Shikoku limited-express services are operated using these new series.

Due to these efforts, 22, 41, and 27 minutes have been cut from the journey times between Takamatsu and Matsuyama, Kochi, and Tokushima, respectively, compared to the times soon after the start of JR Shikoku in 1987.

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### Linking Shikoku and Honshu

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The nearest two points on each side of the strait separating Shikoku and Honshu are only a few kilometers apart. The coastal regions on each side have long had thriving relations and their regional

economies are deeply linked. As a consequence, a large number of ferry services linking Honshu and Shikoku were started, leading to excess competition. The earliest two railways in Shikoku—Iyo Railway and Sanuki Railway—both started laying tracks to provide access to the main ferry ports. Iyo Railway soon realized that a ferry was needed to serve passengers and freight arriving at Mitsuhaman Port, while Sanuki Railway came to the same conclusion about passenger and freight demand at Tadotsu Port. In 1903, a steamship company was established to link up with the railways and ferries were soon operating between the cities of Takamatsu and Okayama and between Tadotsu and Onomichi. In 1910, the base of operations on the Honshu side was moved to Uno, which was more convenient for land and sea links and the steamer services became focused on the route between Takamatsu and Uno. Meanwhile, Takamatsu Station was also moved to a more convenient location for changing to the ferry and a floating railway bridge was soon built to facilitate between the rail and ferry. As a consequence, both stations became able to live up to their reputations as the gateways linking Honshu and Shikoku. Uko (meaning Uno–Takamatsu) ferries became the major transport corridor between Honshu and Shikoku.

They continued in this historic role for another 78 years until the 18.1-km Honshu–Shikoku bridges were opened in April 1988. The Line crosses the Honshu–Shikoku bridges, a chain of six suspension cable-stayed and truss bridges spanning the narrow 9.4-km strait between Kojima on Honshu and Sakaide on Shikoku, providing the first fixed road and rail links. The bridges carry an expressway on upper deck and a double track railway on the lower deck, on which JR Shikoku operates about 160 passenger and freight services each day. Since the opening of the

Honshu–Shikoku bridges, JR Shikoku *Marine Liner* rapid services running at about 130 km/h have cut the journey time between Takamatsu and Okayama to about 55 minutes compared to the old Uko ferries that used to make the link in about 1 hour and 40 minutes (or about 1 hour by hovercraft).

Moreover, the opening of the Honshu–Shikoku bridges created both new and substitute passenger demand as shown by the approximate 2.5-fold increase to 30,000 passengers a day travelling on the Seto Ohashi Line immediately after the line opened compared to 11,700 passengers a day in the last months of the Uko ferries. We can surmise that some of this increase has come from passengers on other ferries also transferring to the Seto Ohashi Line.

On the other hand, JR Shikoku has seen major changes to passenger flows and train operations; previously, the main flow was from Kochi and Matsuyama to Takamatsu but after the opening of the Seto Ohashi Line, about 70% of passengers from Utazu cross to Honshu. Much of the 70% flow is composed of people changing to the San'yō Shinkansen

at Okayama and going to the Kansai district.

In particular, the Seto Ohashi Line is said to have greatly improved convenient access between Kochi, Matsuyama and the Kansai district. Additionally, five- to seven-car *Marine Liner* rapid expresses depart from Takamatsu every 30 minutes during the day, carrying an average of 13,067 passengers each day during FY2002 and causing relatively congested travel conditions during the morning and evening rush hours. In fact, the numbers of workers and students crossing the Seto Inland Sea grew massively from just 21 people each day towards the end of the Uko ferry services to 2795 each day in FY1996.

As a consequence, universities in Kagawa Prefecture have seen reverse growth in numbers with more students from Okayama Prefecture in Honshu than local students from Kagawa Prefecture.

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### Competition with Expressways

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Modern road network was slow in coming to Shikoku. Interestingly, even Iyo

Railway—Shikoku's first line—was built between Matsuyama and the main gateway port of Mitsuhamma because the road conditions were so poor. Under these circumstances, local railways were urgently requested by the inhabitants of interior regions where roads were poor and railway construction had a major impact on local economies. This explains why railways long remained the main mode of land transport in Shikoku compared to other regions of Japan. However, around 1970, the focus shifted towards planning for high-speed road infrastructure and the priority gradually swung in favour of expressways when parts of the Matsuyama Expressway opened in March 1985. Since JR Shikoku obtains most of its income from its railway business, it saw the shift from railways towards private motor transport caused by construction of a road network as an impending crisis that could be a deathblow for the company. To counter the problem, the company quickly set about staged upgrading of rail infrastructure that would support higher speeds as well as development of high-performance rolling stock that could run at higher operations speeds.

Meanwhile, expressway construction was progressing at fever pitch. Of the planned 663 km of road extensions, 222 km running east–west had been opened by July 2000 and 214.1 km of the remaining planned 441 km running north–south across the central mountain range were just opened in April this year to link all four of the island's prefectures.

As a consequence, most of JR Shikoku's main lines have a completed expressway running parallel to them and their railway business is faced with a severe situation. For example, a four-lane expressway running parallel with most of the Takamatsu–Matsuyama section of the Yosano Line (JR Shikoku's busiest line) was completed in 2003. Since this expressway offers a convenient shortcut compared to



Series 5100 *Marine Liner* rapid train with double-decker car linking Honshu and Shikoku

(Author)



JR Shikoku's first electric Series 8000 limited express on Yoson Line linking Matsuyama in Ehime Prefecture and Okayama on Honshu at 130 km/h (Author)

the Yoson Line that follows the Ehime coastline, automobiles can make the journey between the two cities in under 2 hours, which is shorter than the journey time required by limited expresses travelling at 130 km/h on the Yoson Line. As a result, passenger levels on the Yoson Line are dropping and are now only 80% of the level at the time of the boom following the opening of the Honshu-Shikoku bridges. Moreover, conditions on the Dosan Line linking the Seto Inland Sea side with Kochi have also become severe with a drop to 60% or 70% compared to the boom time.

Clearly, the older conventional railway lines on Shikoku are facing a crisis resulting from increased competition with expressways, but the Seto Ohashi Line, which was very successful soon after its opening in 1988, is also in crisis too. The 1998 opening of the Akashi Kaikyo Bridge between Tokushima and Awajishima created a new direct link for automobiles between Kobe in Honshu and Shikoku and completion of the expressway network has seen a sudden surge in

express buses making the journey between the major cities of the Kansai district and the island. Not only have the express buses managed to cut more than 1 hour off the journey time between Takamatsu, Tokushima and the Kansai district, but the bus fare is also only about one-half of the rail fare (including shinkansen charge). As a consequence, it is no exaggeration to say that the market share of rail and bus services between Tokushima and the Kansai district has been completely reversed in favour of buses.

As a result, the 10 to 11 million people using the Seto Ohashi Line annually soon after it opened in 1988 had dropped precipitously to between 8 and 9 million by FY2000. As a countermeasure, in addition to shortening journey times and increasing the number of new Series 5000 *Marine Liner* services, JR Shikoku is strengthening its transport capacity by making a joint investment with JR West to increase the number of platforms for its Seto Ohashi Line at JR West's Okayama Station.

On the other hand, the many single-track sections on the JR West's Uno Line connecting with the Seto Ohashi Line create a bottleneck on transport capacity so Okayama prefectural government, Shikoku's four prefectural governments, and JR West are promoting work to double-track some sections. In addition, commercialization of a so-called free-gauge train that can run on track sections with different gauges is being examined as a possible future method of allowing through operations between narrow-gauge lines in Shikoku and shinkansen on Honshu and elsewhere in Japan.

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### Urban Transport

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The electrification works on parts of the Yoson and Dosan lines completed at the end of the JNR era were to prepare for the opening of the Seto Ohashi Line, but were also targeted at improving capacity on routes from the Takamatsu to south-west parts of Kagawa Prefecture. Furthermore, JR Shikoku embarked on a continuing electrification programme in Ehime Prefecture. In addition to reducing journey times, the frequency and quality of services was raised by introduction of new Series 7000 EMUs capable of driver-only operation. These efforts resulted in a large increase in the number of regular services offering more convenience for passengers. To raise the notch one level higher around Matsuyama, in March 2002, the number of rapid services was doubled, journey times were greatly shortened, and the timetable was revised to make it easier for passengers to understand.

Non-JR private lines still play an important role in Shikoku urban transport; companies in three of the prefectural capitals have extensive networks with long histories dating to before WWII; Takamatsu-Kotohira Electric Railroad in Takamatsu, Iyo Railway in Matsuyama,



Takamatsu-Kotohira Electric Railroad replaced old worn stock with carriages purchased from private railways in Tokyo and Nagoya Municipal Subway. (Author)



Lisbon tram dating from 1947 operated by Tosa Electric Railway (Author)

and Tosa Electric Railway in Kochi are all fully electric operations. Part of Iyo Railway and all of Tosa Electric Railway are defined as tramways by the Tramway Law.

Takamatsu-Kotohira Electric Railroad was formed by the wartime merger of three companies with tracks extending into the centre of Takamatsu and 16 bus companies. It has three lines totalling 60 km and is mainly supported by a customer base consisting of commuters and students travelling around Takamatsu. However, the number of passengers has fallen to nearly half of the peak levels and the bankruptcy of a related company in December 2001 forced it into bankruptcy as well. There were proposals to cut the route length but the complete network is being maintained for the time being while restructuring plans with assistance from the national, prefectural and municipal governments are being examined. Future plans for re-establishing a healthy business include upgrading rolling stock, introducing joint rail and bus ticketing using IC cards, building new stations, and providing Park & Ride car parks at all out-of-city stations.

Iyo Railway is the light railway described in *Botchan*, a novel set in Matsuyama by Soseki Natsume (1867–1916), as the ‘matchbox steam train.’ Today, it is

principally a 36.6-km urban railway linking Matsuyama with nearby towns but it also has a 6.9-km suburban loop line within the city. The once-thriving Mitsuhamma Port is now very quiet, but the Matsuyama Tourist Port for ferries to and from Honshu and Kyushu and nearby Takahama Station terminus are linked by frequent bus services.

The tramway uses popular reproductions of period tramcars to carry more than 8 million visitors a year to Dogo hot springs in Matsuyama. More recently, positive steps have been taken to revitalize the business by replacing old electric cars with modern low-floor vehicles.

Tosa Electric Railway started business in 1904 as an electric tramway serving Kochi and its surrounding areas. Today, it has a total network length of 25.3 km and is the oldest surviving tramway business in Japan. Unlike the previously described urban Iyo Railway which runs solely within Matsuyama, Tosa Electric Railway is a typical suburban railway that crosses Kochi to link with surrounding towns and villages. Tosa Electric Railway used to own a railway line in the south-east part of the prefecture and the electric tramway provided through operations on this line. As part of its strategy to revitalize business, the company has imported tramcars from Lisbon (Portugal), Stuttgart (Germany),

Oslo (Norway), and Gratz (Austria). More recently, it tried introduction of low-floor articulated trams but it seems difficult to obtain sufficiently good returns on the investment and the plan has come to a halt with only one set.

### Third-Sector Local Lines

JNR's postwar railway construction was coming to an end after improvements on main-line infrastructure were finished and planners started construction of local lines with low riderships. Lines were constructed through regions with low trackside populations, such as the extreme end of the Dosan Line west of Kochi; the Yodo Line crossing Ehime and Kochi prefectures; the Nakamura and Sukumo lines branching from the Dosan Line to Uwajima via Sukumo; and the Asa Line passing through Kochi and Tokushima prefectures via Cape Muroto. When JNR urgently need to restructure its poor finances, it decided to freeze all construction of new lines with no good economic prospects and to dispose of loss-making local lines. In 1988, JR Shikoku abandoned three JNR lines but ownership of the Nakamura Line was transferred to Tosa Kuroshio Railway, a third-sector company, so only two lines



Restored special tourist train hauled by diesel engine resembling steam locomotive on suburban tracks of Iyo Railway (Author)



Special-specification open carriages operate as part of some services on Gomen–Nahari Line of third-sector Tosa Kuroshio Railway opened in 2002. (Author)

with a total length not exceeding 8.8 km (excluding freight lines) were actually closed. The Yodo Line inherited by JR Shikoku was saved because there was no expressway parallel to the line and it is still in operation. However, there are future plans to build a high-grade road parallel to the line, so passenger trends are a focus of attention.

On the other hand, the Asa and Sukumo lines in Kochi and Tokushima prefectures—construction of which had been frozen and both of which had no prospects of ever opening—received investment from the prefectural governments and trackside municipalities enabling construction to continue with the intention of opening as a third-sector railway businesses. As a result, the Sukumo Line opened in 1997 as Tosa Kuroshio Railway's Sukumo Line, while the Asa Line in Kochi Prefecture opened in 2002 as the Tosa Kuroshio Railway Gomen–Nahari Line. The part of the Asa

Line in Tokushima Prefecture became the Asa Kaigan Railway in 1992.

Tosa Kuroshio Railway's 23.6-km Sukumo Line is characterized as an extension of the JR Shikoku Dosan Line via Tosa Kuroshio Railway's 43.0-km Nakamura Line. It has reasonably good levels of passengers taking limited-express services from Takamatsu. Conversely, the 8.5-km Asa Kaigan Railway functions substantially as an extension of JR Shikoku's Mugi Line but since it runs mostly through sparsely populated local regions, the total number of passengers in FY2002 was just 100,000 and the company accrued an annual loss of more than ¥52 million (¥100 = US\$0.97), a figure that matches the Tosa Kuroshio Railway, which is 10 times longer. The 42.7-km Gomen–Nahari Line was originally constructed as part of JNR's Asa Line with Asa Kaigan Railway, and is Shikoku's newest railway line. It is operated by the Committee for the

Activation of the Gomen–Nahari Line, a group comprised of the prefectural government and trackside municipalities that provides support by holding local events, etc., to encourage ridership on the line and its future seems secure for the present. Bus services were running on a road parallel to the line before it opened but the appearance of a punctual railway offering express services and short journey times created severe competition and the number of bus passengers dropped by about 20% even after the bus fare was reduced to the same level as the rail fare. ■



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