Railway Operators in Japan 10

Cities in Kinki Region

Masafumi Miki

Overview of Kinki Region

The Kinki region includes six prefectures: Osaka, Kyoto, Nara, Hyogo, Shiga and Wakayama. On the Pacific Ocean side, the regional climate is mild and the population density is high. Kinki has many industries and is an important transportation corridor—it was also the first region in Japan to develop culturally and politically. Yamato (present-day Nara Prefecture) was the nation's political centre from the 4th to the 8th centuries. Around the end of the 8th century, the capital was moved to Heiankyo (present-day Kyoto City) where almost every emperor lived until the capital was moved to Edo (Tokyo) in 1868 during the Meiji Restoration.

Osaka sprang up where the large Yodo and Yamato rivers flow into Osaka Bay, facilitating its subsequent development into a major economic centre and port. Kobe, which has long been known as the port of Hyogo, has a history of about 1000 years, and became an international port after the Meiji Restoration. Today, the Kinki region is dominated by the three large cities of Kyoto, Osaka, and Kobe. They extend in a fairly straight line, forming a metropolitan region with a shape that is rarely seen elsewhere.

The northern part of the Kinki region, facing the Sea of Japan, is covered in deep winter snows. The Kii Peninsula in the southernmost part of Kinki has mountains extending to the Pacific coast and the lack of a flat coastal plain has kept population levels low. Both northern and southern Kinki are known for their natural beauty and attract many tourists to national parks.

Overview of Rail Network

Japan's key rail corridor containing the Tokaido main line (Tokyo–Kobe, 589.5 km), and the Tokaido Shinkansen (Tokyo–Shin Osaka, 552.6 km) runs through the middle of the country to join the two largest metropolitan regions of Tokyo and Osaka. The Tokaido main line connects to the San'yo main line (Kobe–Shimonoseki, 506.4 km), and the Tokaido Shinkansen connects to the San'yo Shinkansen (Shin Osaka–Hakata, 622.3 km). Trains on both lines continue on to the Chugoku region and Kyushu in western Japan. The shinkansen carry long-distance passengers while the main lines carry mainly shorter-distance passengers and freight. Within the Kinki region, the Tokaido and San'yo main lines and the San'yo Shinkansen are operated by JR West while the Tokaido Shinkansen is operated by JR Central.

Other narrow-gauge lines link the Kinki region with other parts of Japan. For example, the San'in main line (Kyoto–Hatabu, 673.8 km) follows the Sea of Japan westwards to the Chugoku region; the Kansai main line (Nagoya–JR Namba, 174.9 km) links the Kinki region to points further east; and the Kisei main line (Kameyama–Wakayama-shi, 384.2 km) runs through southern Kinki. All these lines extend over considerable distances, but they serve mostly local, short-distance passenger traffic.

Private railways other than the JRs are more developed in the Kinki region than anywhere else in Japan. There are five major non-JR private operators serving the Kyoto–Osaka–Kobe metropolitan region: Hanshin Electric Railway (Hanshin), Hankyu Corporation (Hankyu), Keihan Electric Railway (Keihan), Nankai Electric Railway (Nankai), and Kinki Nippon Railway (Kintetsu). While these companies play a leading role in carrying passengers in Kinki, they have also developed real estate and promoted social facilities, such as theme parks, alongside their tracks. Indeed, their position is so strong that Kinki is nicknamed the 'Empire of Private Railways.' However, during the last few years, JR West has improved its urban network, and now competes so successfully with private operators that some are losing passengers to JR West.

Most rural lines suffer from low passenger levels, posing an economic burden to their operators, but various management strategies have been devised to keep the lines in operation so far.

This first article on railways in the Kinki region focuses only on urban railways in the three metropolitan centres of Osaka, Kyoto and Kobe. Two more later articles will cover the other area.

Metropolitan Loop Line and Urban Transit Lines

JR West's Osaka Kanjo (Loop) Line and Sakurajima Line

Of the three metropolitan centres of Osaka, Kyoto and Kobe, only Osaka has a loop line. Neither Kobe, which extends lengthwise on a thin strip of land hemmed-in between the Rokko Mountains and Osaka Bay, nor Kyoto, which lies in a relatively small basin and has been a crowded urban centre for many centuries, have a topography suiting a loop line.

The Osaka Kanjo Line is a full metropolitan loop line in a similar sense to Tokyo's Yamanote Line but it is much newer. (It opened in 1961 while the Yamanote Line began operations as a complete loop in 1925.) Although there was some track over much of the current circular right-of-way before 1961, it was insufficient to form a complete loop. The eastern part of the present loop, between Tennoji and Osaka stations, was called the Joto Line. It was constructed to permit trains from the Kansai main line to extend services to Osaka Station. The north-west part, between Osaka Station and the coastal industrial zone, was called the Nishinari Line, and was used mainly for freight. The western end of this line is

now called the Sakurajima Line.

Construction of the loop line was delayed by the network of old canals dating from the late 16th century. The canals were important for freight transport and large barges came right into the inner city. As a consequence, the Osaka municipal government was opposed to the construction of bridges—even railway bridges—in the western, coastal part of Osaka.

The loop opened in 1961 ran on the tracks of the Joto Line, the Nishinari Line, the Kansai main line section between Tennoji and Imamiya, part of the Osaka Rinko Line (a freight line), and a newly constructed section that closed the loop. In the early days, only loop traffic used the line.

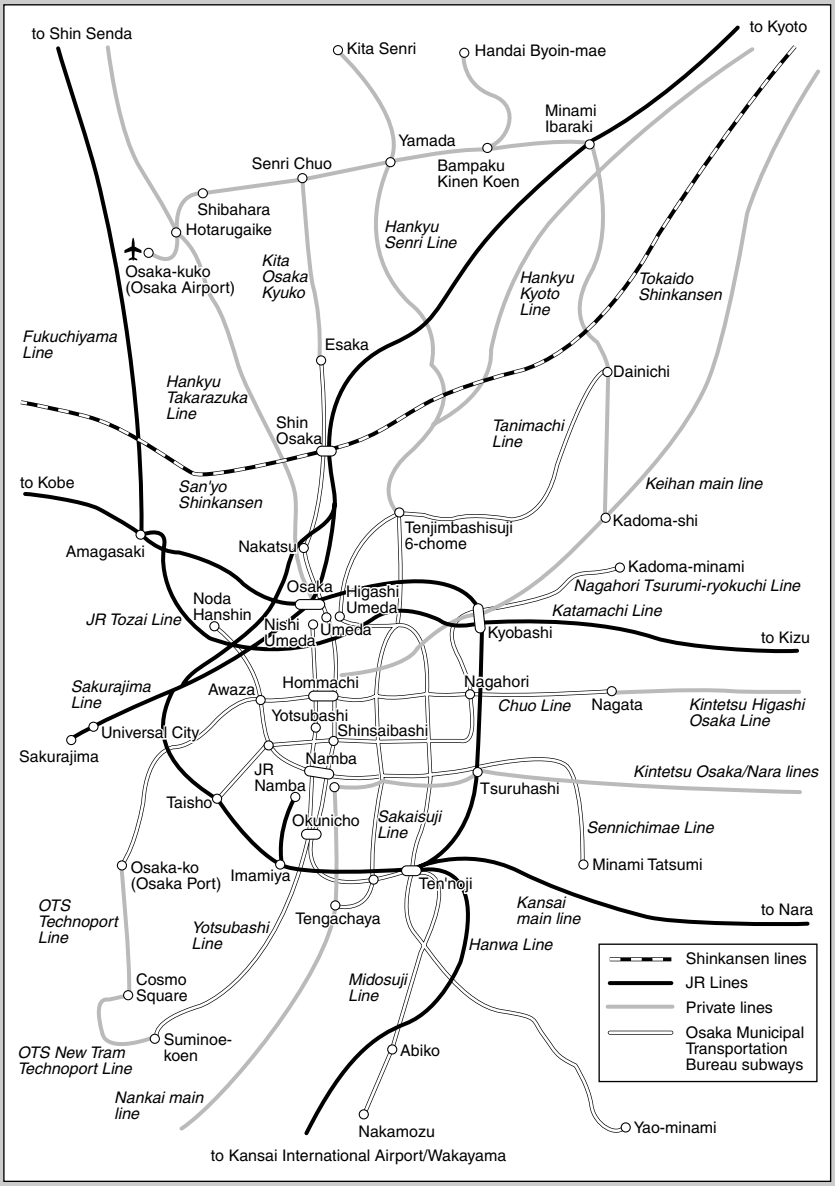
Stations on the eastern section (former Joto Line) offered connections to private railway lines (Kintetsu's Nara and Osaka lines at Tsuruhashi, and Keihan's main line at Kyobashi), so passengers levels were high and this part of the city developed quickly. But the western part of the loop (including the former Nishinari Line) passed through an industrial zone with low passenger levels. However, after the Kansai main line was electrified between Nara and Minato-machi (now JR Namba) in 1973, JNR began running direct express services on Sundays and holidays from Nara via this western section to Osaka Station. The service was so popular that it was introduced on weekdays in 1974.

After JNR was divided and privatized in 1987, JR West set out to improve its inherited urban network. One such effort was the introduction of more direct services from the suburbs to the inner city using the loop line. In 1989, JR West laid a short section of track at Tennoji Station where the Hanwa and Kansai lines meet, permitting through limited express services from the Kisei main line onto the loop. The through services were extended to Shin Osaka Station via a freight line from a location near Fukushima Station and then further again to Kyoto.

When Kansai International Airport opened in 1994, a new rail service was launched. The *Haruka* limited express trains offer through services from the airport to Shin Osaka and Kyoto stations, following the route taken by limited expresses coming from the Kisei main line and boosting connections to the Tokaido and San'yo shinkansen.

Series 221 *Yamatoji* rapid train at Bentencho Station on Osaka Kanjo Line (JR West)

Railway Lines in Osaka Area



Kanku rapid express services offer direct connections from the airport to Osaka and Kyobashi stations, following the same loop line route as rapid trains coming from the Kansai main line. Since 1999, carriages of some trains from the airport are uncoupled at Hineno Station on the Hanwa Line to permit direct services to Wakayama City as well as points south. This new service is called the *Kishuji* rapid express service.

The Universal Studios Japan theme park was opened in 2001 next to the Sakurajima Line. As a result, JR West improved through services to the line and also introduced a direct limited express service from the Hokuriku main line to Universal City Station next to the park. Today, the Osaka Kanjo Line is used both as an inner-city commuter route and also for longer-distance trains, making it a vital part of Osaka's railway network.

JR West's Tozai Line

For many years, the Osaka municipal government maintained tight control over transport within the city limits, making it difficult for private railways and even JNR to lay new track in the central district. As a consequence, most tracks from the suburbs terminated outside the inner city, causing increasingly severe road congestion in the downtown core. Therefore, in 1971, an urban

Size and Financial Status of Railways in Kinki Region

	Route-km	Number of Employees	Capital (¥1,000)	Operating Revenues (¥1,000)		Operating Expenses (¥1,000)		Operating Profits/Losses (¥1,000)		Ordinary Profits/ Losses (¥1,000)
				Railway	Non-railway	Railway	Non-railway	Railway	Non-railway	
JR West	5078.4 (24.8)*	38,107	100,000,000	1,120,200,000	8,300,000	765,800,000	5,700,000	354,400,000	2,600,000	357,000,000
Kansai Kosoku Railway	12.5	11	75,280,000	15,180,000	8,594	6,770,720	7,823	8,409,280	771	-2,832,259
Kyoto Transportation Bureau	26.4	669	–	20,143,643	21,456,574	32,840,264	27,302,990	-12,696,621	-5,846,416	-32,530,767
Kyoto Kosoku Railway	3.3	134	15,602,000	5,527,756	1,944,773	3,255,918	1,893,733	2,271,838	51,040	-3,483,667
Osaka Transportation Bureau	122.2	6,479	–	57,665,914	123,482,925	141,978,058	28,206,182	15,687,856	-4,723,257	-18,101,566
Osaka Port Transport System	3.7	180	4,000,000	2,088,795	3,166,489	3,208,762	1,975,176	-1,119,967	1,191,313	-511,535
Kita-Osaka Kyuko Railway	5.9	97	1,500,000	5,107,943	827,966	4,399,481	578,301	708,462	249,665	559,630
Osaka Kosoku Railway	23.8	152	10,573,000	6,594,459	244,347	6,043,867	181,730	550,592	62,617	-315,577
Kobe Transportation Bureau	30.6	802	–	19,381,241	15,339,143	15,262,692	21,822,424	4,118,549	-6,483,281	-5,911,106
Kobe New Transit Co., Ltd.	10.9	181	208,000	4,416,179	232,518	3,897,368	213,716	518,811	18,802	157,028
Kobe Kosoku Railway	7.6	152	2,000,000	3,914,239	0	3,592,791	0	321,448	0	-99,667
HokushinExpress Railway	7.5	59	3,200,000	2,175,565	0	1,633,881	0	541,684	0	-719,074

* Figure in parentheses is total length of Osaka Loop and Sakurajima lines.

Passenger Volume and Density by Railway Company

		1992	1993	1994	1995	1996	1997	1998	1999	2000
JR West	No. of Passengers (1,000)	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
	Passenger Density*1	29,690	29,812	28,327	30,131	30,404	29,825	29,098	28,594	28,575
Kansai Kosoku Railway	Volume	–	–	–	–	–	–	–	–	–
	Density	–	–	–	–	–	–	–	–	
Kyoto Transportation Bureau	Volume	73,677	74,215	74,257	75,566	76,105	93,553	110,405	110,429	111,276
	Density	76,551	77,401	77,658	78,809	79,306	61,730	55,459	55,539	56,428
Kyoto Kosoku Railway	Volume	–	–	–	–	–	–	–	–	–
	Density	–	–	–	–	–	–	–	–	–
Osaka Transportation Bureau	Volume	1,024,446	1,013,653	996,415	1,002,023	990,789	982,696	956,541	924,480	901,092
	Density	146,415	144,284	143,399	145,151	143,270	134,775	128,720	123,698	120,552
Osaka Port Transport System	Volume	–	–	–	–	–	2,672	10,815	11,663	11,345
	Density	–	–	–	–	–	6,527	26,417	28,425	26,722
Kita-Osaka Kyuko Railway	Volume	67,815	67,624	66,958	67,598	66,678	65,483	63,536	61,995	60,537
	Density	141,312	141,210	139,919	140,937	139,725	137,094	133,178	129,622	127,034
Osaka Kosoku Railway	Volume	7,827	8,373	8,766	10,523	10,992	21,485	26,298	27,591	28,499
	Density	12,917	13,797	11,664	11,707	12,355	19,458	21,192	21,338	22,028
Kobe Transportation Bureau	Volume	92,555	94,743	88,634	104,966	103,700	120,849	97,945	95,737	92,036
	Density	96,827	100,445	99,133	113,166	114,860	112,607	112,352	109,752	105,458
Kobe New Transit Co., Ltd.	Volume	27,912	29,558	22,785	19,379	28,375	26,618	25,871	24,750	24,323
	Density	26,385	28,498	27,505	20,976	27,364	25,507	24,704	23,578	23,217
Kobe Kosoku Railway	Volume	–	–	–	–	–	–	–	–	–
	Density	–	–	–	–	–	–	–	–	–
Hokushin Express Railway	Volume	8,963	9,077	9,686	12,486	10,375	9,895	9,350	9,453	9,149
	Density	24,489	24,864	26,532	34,116	28,420	27,105	25,612	25,828	23,347

transportation council proposed laying tracks to join the Katamachi Line to the Fukuchiyama Line (both operated by JNR). It took 10 years to obtain permission to lay the track (provisionally known as the Katafuku Line) but JNR's financial difficulties delayed construction. In 1988, JR West joined forces with the governments of Osaka and Hyogo prefectures and the cities of Osaka and Amagasaki to establish a public–private entity called Kansai Kosoku Railway Co., Ltd. The company would build the line, own the infrastructure, and lease it to JR West.

The now renamed Tozai Line opened in 1997. It has added flexibility to operations in areas near Osaka and on the Tokaido and San'yo main lines, including through services from Shin Sanda on the Fukuchiyama Line to Kizu on the Katamachi Line, and from Matsuiyamate on the Katamachi Line to Nishi Akashi on the San'yo main line. As another example, when the Tozai Line opened, JR West's rapid (*kaisoku*) and new rapid (*shin kaisoku*) services began stopping at Amagasaki Station on the Tokaido main line, making transfers far easier for passengers.

Metropolitan Subways

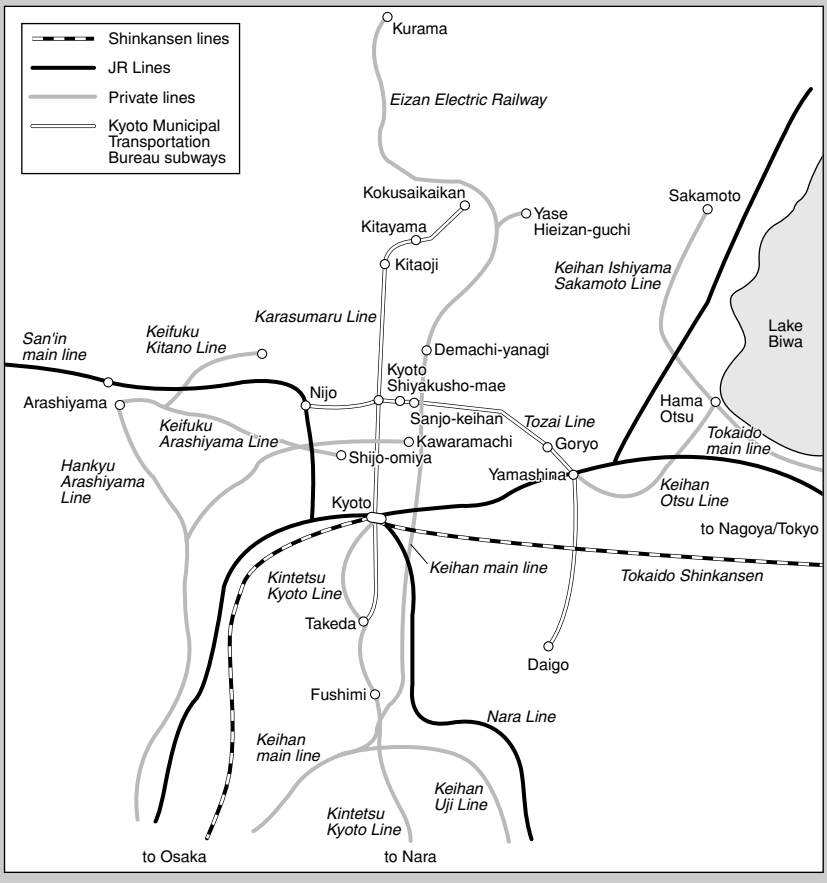
Kyoto municipal government and Kyoto Kosoku Railway

Kyoto is one of Japan's most historic cities and the first place in the country to have commercial electric tram services, starting in 1895 in time for the opening of the 4th National Industrial Exposition in Kyoto. The line was built and operated by Kyoto Electric Railway and ran from Kyoto Station (now operated by JR West) to Fushimi, a barge terminal on the Yodo River at that time. The company later transferred ownership of the line to the Kyoto municipal government, which expanded the network to different parts of the city. However, increasing road congestion lead to the closure of all tram lines by 1978.

The plan was to construct and open a subway before closure of the tramways. This would have offered convenient transport within the city, but construction was delayed and transit users had to depend on buses in the meantime. The result was frequent traffic jams, especially during the tourist season.

Construction of Kyoto's first subway—the Karasumaru Line—began in 1974. It runs north–south through almost the full length of the city. The first section opened in 1981 runs from Kitaoji to Kyoto stations. A track gauge of 1435 mm and 1500-Vdc catenary wires were used to permit later through services with the Kintetsu Kyoto Line. The line was extended from Kyoto Station to Takeda in 1988 and new track from Takeda Station connected with Kintetsu's Kyoto Line. Through services operated by the subway and Kintetsu then began running on each other's lines between Kitaoji and Shin Tanabe, via Takeda (the Takeda–Shin Tanabe section is on the Kintetsu line). In 1990, the Karasumaru Line was extended north from Kitaoji to Kitayama and then on to Kokusaikaikan-mae in 1997. Each subway line extension also extended Kintetsu's services. Then in 2000, Kintetsu extended through services a considerable distance south from Shin Tanabe to Nara, permitting through express services from

Railway Lines in Kyoto Area



Kyoto Subway's Series 51 at Tozai Line's Daigo Depot (Kyoto Municipal Transportation Bureau)

Kokusaikaikan-mae to Nara using six-car train sets running at intervals of 4 to 7 minutes.

Another subway line for east–west traffic opened in 1997 as the Tozai Line. The first section runs from Daigo (south-east Kyoto) to Nijo. Part of the infrastructure (between Goryo and Sanjo-keihan) had been built by Keihan for its Otsu Line but Keihan abandoned it and turned it over to the subway construction. The east–west line was built by Kyoto Kosoku Railway, a public–private sector company, and is now operated by the Kyoto municipal government. Keihan trains from the Otsu Line use the section between Kyoto Shiyakusho-mae and Goryo, providing through services with four-car train sets as far as Hama Otsu. The track gauge is 1435 mm and power is provided by a 1500-Vdc catenary. Subway trains consist of six cars and run at intervals of 3 to 10 minutes. Platforms at stations on the Tozai Line have screen doors to prevent passenger accidents.

Although Kyoto was the last of the three major cities in the Kinki region to open a subway, it has actively promoted through services with private railways. To make fare payments easier, the municipal transportation bureau has introduced the convenient *Surutto Kansai* card.

Osaka municipal government, Kita-Osaka Kyuko Railway, and Osaka-ko Transport System

Osaka's modern transit system began in 1903 with construction of a tramway. Osaka was (and still is) Japan's second city after Tokyo, but it was very small with a crowded built-up area and a canal network that made construction of horse-drawn and electric trams difficult. This explains why Osaka's urban transit system developed later than in Tokyo and Kyoto.

Osaka's first public transport system consisted of ferries plying the canals, but they were unable to meet demand, so the Osaka municipal government invested large sums in widening roads, replacing bridges, and constructing an electric tram system. When the system came into operation, the government decided to manage it solely and to use the income to pay off the large construction debts. This marked the start of the municipal government's policy to keep inner city transport in its own hands.

However, demand created by city expansion in the 1930s soon overwhelmed the trams and road congestion caused by more buses, taxis and other motor vehicles also severely hampered tram operations. Consequently, the municipal government decided to build a rapid transit rail system either underground or on elevated tracks. Subways were generally preferred and a subway line opened between Umeda and Shinsaibashi in 1933. The track gauge was 1435 mm and trains were powered using a third rail at 750 Vdc. This first section is part of today's Midosuji Line.

The early days of subway planning were strongly influenced by Hajime Seki, Osaka's seventh mayor and a pioneer in urban transit policy. Seki urged construction of an advanced rapid transit system providing direct links between the inner city and suburbs. His early plan called for extending the Midosuji Line south to Abiko and north to Esaka, but WWII intervened to delay the plan. During the war, the line was extended and opened only within the inner city. After the war, rapidly increasing road traffic created jams that further hindered tram services. Against this backdrop and to support Expo 1970, Osaka launched a massive subway construction project with the result that all tram lines had been abandoned by 1969.

The Midosuji subway line (Line No. 1) follows Midosuji Avenue, a vital north–south road in central Osaka. The 24.5-km line links Esaka in the north with Nakamozu (in Sakai City) in the south. A line from points further north, operated by Kita-Osaka Kyuko Railway, links with the subway terminus at Esaka, permitting the two companies to operate through operations over a total distance of 30.4 km as far north as Senri Chuo (Toyonaka City). An elevated track carries most of the subway line north of Nakatsu as well as the Kita-Osaka Kyuko line. The Midosuji Line offers connections to JR West's Osaka Station and terminals of five private railways. The many passengers transferring from these suburban lines contribute greatly to the subway's passenger levels. Both the Midosuji and the Kita-Osaka Kyuko lines operate 10-car train sets at 2-minute intervals during weekday rush hours.

The Tanimachi subway line (Line No. 2) follows Tanimachi Avenue another major north–south road running a few blocks east of Midosuji Avenue. It stretches 28.3 km from Dainichi (Moriguchi City) to Yao-minami (Yao City) which is above ground. Six-car train sets operate at 3-minute intervals during weekday rush hours but ridership is lower than on the Midosuji Line.

The Yotsubashi subway line (Line No. 3) runs through the inner city following Yotsubashi Avenue, a north–south road running a few blocks west of Midosuji Avenue. The line stretches 11.8 km entirely underground from Nishi Umeda to Suminoe Koen. Like the Tanimachi Line, six-car train sets operate at 3-minute intervals during weekday rush hours.

The 15.5-km Chuo subway line (Line No. 4) runs more or less east–west through the middle of the city following Nagahori Avenue from Osaka-ko (Osaka Port) to Nagata. The section from Osaka-ko to Awaza was the first in Osaka's subway network to be built on elevated track. The line connects with Kintetsu's Higashi Osaka Line at Nagata in the east, permitting through services by both operators to and from Ikoma (Ikoma City, Nara Prefecture). At the west end, the subway connects at Cosmosquare with track operated by Osaka-ko Transport System (OTS), permitting through services by various companies over a total of 27.7 km of lines. The subway, Kintetsu, and OTS operate six-car train sets at 4-minute intervals during weekday rush hours.

The 13.1-km Sennichimae subway line (Line No. 5) follows Sen'nichimae Avenue south of Nagahori Avenue from Noda Hanshin to Minami Tatsumi. Four-car train sets operate at 4-minute intervals during weekday rush hours.

All five subway lines have a gauge of 1435 mm with a third rail carrying 750 Vdc, permitting mostly standardized rolling stock.

As mentioned above, the Osaka municipal government did not favour operations by other rail carriers within the city, making it difficult for the subway system, private railways, and JR West to offer through services on each other's networks. The situation in Tokyo was quite different with the Teito Rapid Transit Authority (TRTA) subway system being opened up for through services at an early stage. The Osaka municipal government relaxed its policy gradually from 1970 to permit introduction of such through services. However, this was achieved simply by extending the subway tracks to lines of Kita-Osaka Kyuko Railway, OTS and Kintetsu Higashi Osaka.

A different approach was taken for the 8.1-km Sakaisuji subway line (Line No. 6), stretching north–south through the city centre from Tenjinbashi-suji 6-chome to Tengachaya. It runs about halfway between the Midosuji and Tanimachi lines and was designed to permit through connections with the Hankyu Senri. Consequently, it has a track gauge of 1435 mm and a 1500-Vdc catenary. Subway trains run as far north as Kita Senri (Suita City) on Hankyu's Senri Line and to Takatsuki-shi (Takatsuki City) on the Kyoto Line. Some trains provide through services as far as Kawara-machi (Kyoto City) on the Kyoto Line. On the subway section, eight-car train sets run at 3-minute intervals during weekday rush hours.

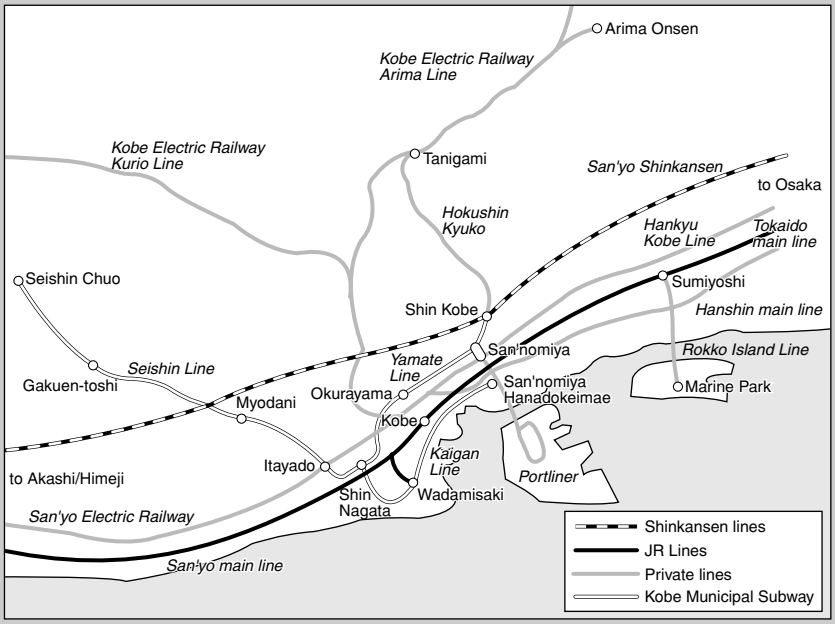
Quite clearly, Osaka's rapid transit system is basically a subway network. Subway construction under a developed city is a very expensive so subways are usually avoided in areas with low potential ridership. To cut construction costs, studies on smaller cross-section tunnels were made in the 1980s. A smaller tunnel cross-section can be achieved using a linear-motor system, and Japan's first linear-motor subway was Osaka's 15-km Nagahori Tsurumi-ryokuchi Line (Line No. 7) from Taisho to Kadoma-minami, running generally east–west between the Chuo and Sen'nichimae subway lines. The track gauge is 1435 mm with power provided by a 750-Vdc catenary. Four-car train sets operate at 3-minute intervals during weekday rush hours.

Kobe's transit systems

Kobe is one of Japan's largest and most famous port cities with an urban landscape that is controlled by the topography. As mentioned previously, the Rokko Mountains and the coast have forced the city development into a long, thin strip of land oriented east–west. Urban transit began here when the private Kobe Electric Railway built an electric tramway in 1910. The Kobe municipal government took over ownership in 1917 and continued expanding the network.

Osaka Subway's Series 70 at Taisho Station on Nagahori Tsurumi-ryokuchi Line
(Osaka Municipal Transportation Bureau)

Railway Lines in Kobe Area



From around 1900 to 1930, various railway operators extended their lines to Kobe from nearby cities—Hanshin and Hankyu from Osaka in the east, San'yo Electric Railway (San'yo) from Akashi and Himeji in the west, and Kobe Electric Railway from Arima in the north. However, the problem was that each terminal was in a different part of Kobe with connections provided by trams running on heavily congested roads, especially in the morning and evening. Another problem was that east–west services traversing the entire city were provided only by the government railway's Tokaido and San'yo main lines. Consequently, a plan was drawn up to link the various terminals of the private railways and provide more convenient east–west services through the city. In 1958, the Kobe municipal government established Kobe Rapid Transit Railway as a public–private sector company. Ten years later, this company began work on a line to join tracks operated by Hanshin and Hankyu with a San'yo station and Kobe Electric Railway. Kobe Rapid Transit Railway's construction projects made connections to suburban lines more convenient with the result that all Kobe's municipal tramways had been abandoned by 1971.

Kobe's population was expanding around the same period, creating very tight housing conditions within the long, thin built-up city. As a result, a massive housing development project was started in the Seishin district in the western suburbs, creating a need for better transportation services. Construction began on the Seishin/Yamate subway linking the Seishin district with the inner city in 1972. It has a track gauge of 1435 mm with a 1500-Vdc catenary. The section between Myodani and Shin Nagata opened in 1977, followed by the Myodani–Gakuentoshi and Okurayama–Shin Kobe sections in 1985. Construction of this last section provided links to numerous lines: at San'nomiya to JNR's Tokaido main line as well as to lines operated by Hanshin, Hankyu and Kobe Rapid Transit Railway; and at Shin Kobe to the San'yo Shinkansen and Hokushin Kyuko lines. However, the subway line runs parallel to the Kobe Rapid Transit line between Itayado and San'nomiya, forcing both operators to compete for the same passengers over a short distance in central Kobe. In 1987, the subway was extended from Gakuentoshi to Seishin Chuo. Services are provided using six-car train sets at intervals of 3 to 8 minutes.

In 1988, Hokushin Express Railway opened a line from Shin Kobe to Kobe Electric Railway's Arima Line bypassing numerous stations on another line and offering direct connections from Shin Kobe to the municipal subway's Seishin/Yamate Line. This cut about 30 minutes off the travel time to San'nomiya in the city centre compared with parallel services offered by Kobe Electric Railway. The bypass line has only two stations—Shin Kobe and Tanigami. Much of the track runs under the mountains with grades as high as 33.3 per mill.

Despite these improvements, people in intercity areas who once used the municipal trams continued to depend on buses. This situation continued for some time until the new Kaigan subway line finally opened between Shin Nagata and San'nomiya-Hanadokei-mae in 2001. The catenary carries 1500 Vdc to power the linear-motor system. The track gauge is 1435 mm and four-car train sets operate at intervals of 6 to 10 minutes.

New Types of Guided Transport

Waterfront in Osaka and Kobe has been the focus of development since the late 1970s. The completion of major housing projects led to a need for new transit systems with less capacity than that required in the inner city but more capacity than that offered by buses. Automated guided transport (AGT) systems were chosen with a capacity between that of a subway train and a bus. In Osaka, the municipal transportation bureau that operates the subway system began operating an AGT called New Tram in 1981. The first 6.6-km section opened

Kobe Subway's Series 50 for Seishin Line
(Kobe Municipal Transportation Bureau)


Osaka Monorail and Tokaido Shinkansen intersecting near Dainichi Station
(Osaka Monorail Co. Ltd.)

between Suminoe Koen (on the Yotsubashi subway line) and Nakafuto (on the Nanko Port Town Line). The entire line is elevated and double tracked and collects power at 600 Vdc from side contact strips. The rubber-tyred cars are guided automatically.

In 1997, OTS introduced the same type of system for its 1.3-km New Tram Technoport Line and trains from the two operators now offer through services on each other's tracks.

In 1981, a public–private sector company called Kobe New Transit launched a similar *Port Liner* service with rubber tyres and an automated guide system in Kobe. This 3.4-km Port Island Line runs from San'nomiya to Port Island Terminal, and from Naka Koen to Minami Koen. The entire line is elevated and power is supplied from a third rail at 600 Vdc. In 1990, a similar system began running to the newly reclaimed Rokko Island. This Rokko Island Line measures a total of 3 km from Sumiyoshi to Minami Uozaki and from Island Kitaguchi to Marine Park.

The Osaka Monorail

Greater Osaka's rail network was basically composed of lines radiating from the city centre. Few transit systems connected the satellite cities on different lines. To provide such a link, Osaka Kosoku Railway was established as a public–private sector business financed by a group of Osaka-based railways and municipalities served by the lines. This business group constructed a straddle-beam type monorail powered at 1500 Vdc. The first 6.6-km section opened in 1990 linking Senri Chuo (on Kita-Osaka Kyuko Railway) to Minami Ibaraki (on Hankyu's Kyoto Line). Subsequent sections were added: a 3.6-km section in 1994 from Shibahara to Senri Chuo; a 3.1-km section in 1997 from Shibahara to Osaka Kuko (Osaka Airport); a 7.9-km section in 1997 from Minami Ibaraki to Kadoma-shi (Keihan's main line); and a 2.6-km spur in 1998 from Banpaku Kinen Koen to Handai Byoin-mae. The track is now the longest monorail in Japan.

The monorail offers connections to stations on all the private lines mentioned above as well as to two others—Hankyu's Takarazuka and Senri lines at Hotaruike and Yamada, respectively. It has also improved access to Osaka Airport, which was not served previously by a railway line. ■

Further Reading

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