

other areas had been sold and developed as university towns before the war. These areas earned a reputation as good places to live and after the war, they became some of Tokyo's best residential districts. After the mid-1950s, many areas were being developed by private companies building and selling homes in subdivisions, and by the Japan Housing Corporation (now called the Urban Development Corporation), a public entity promoting construction of large apartment complexes.

The tendency was for housing to be developed first along the railway lines radiating from the city centre—now JR East's Chuo Line, Keio's Keio and Inogashira lines, Odakyu's Odawara Line, and Seibu's Shinjuku and Ikebukuro lines. The second wave of development occurred gradually in other areas, such as along branch lines and between the main lines. One good example is Tama New Town, which was started in 1966 in the Tama Hills, and was planned to house about 300,000 people.

Nishi Tama in the westernmost part of Metropolitan Tokyo is part of the Kanto Mountains and is noted for its steep slopes and valleys that attract tourists today. The population lives mainly in rural villages, and the economy used to centre on industries such as raising silkworms, weaving, forestry, and limestone mining. Limestone mining and production of lime became important industries in the late 1800s after railways were constructed to facilitate bulk freight to the Keihin (Tokyo–Yokohama) industrial district.

Railway Development— Chuo and Yokohama Lines

Kobu Railway began operating the first railway in western Tokyo between Shinjuku and Tachikawa in April 1889. The track, which now forms part of JR East's Chuo Line, was extended to Hachioji and opened in August of the

same year. The next extension opened in April 1895 between Shinjuku and Iidamachi (near today's Iidabashi Station) closer to the city centre. The line was later nationalized and then extended further to Tokyo Station with the last section opening in March 1919.

When trains began running between Shinjuku and Hachioji in 1889, they traversed mainly sparsely populated agricultural land, so there were just four stations (Nakano, Sakai (now Musashi-sakai) Kokubunji and Tachikawa) between the termini. There were only four steam-hauled services each way each day. However, passenger levels rose in line with the expanding population as Tokyo became increasingly important in the nation's political and financial life. The 1895 extension across the Yamanote Line into the city centre boosted ridership, and the track between Iidamachi and Nakano was electrified by August 1904. This was the first time in Japan that steam locomotives gave way to electric trains, and the first line in the country to be equipped with automatic signalling and a multiple-unit control system.

Kobu Railway was nationalized soon after in October 1906 but electrification continued and electric trains were operating as far as Asakawa (now Takao) by December 1930. The sections were double-tracked around the same time that they were electrified.

Hachioji developed as a post town for travellers on the old *Koshu Kaido* highway and as a market centre for the silkworm industry in surrounding areas. On the coast, Yokohama developed into a trading port. A plan to link the two cities was drawn up during the early years of Japan's modernization, and the economic boom after the Sino–Japanese War (1894–95) encouraged a number of companies to apply for a licence to build and operate the line. Yokohama Railway was granted a licence in May 1905 and opened the line in September 1908, permitting rail

transport between Hachioji and Higashi Kanagawa on Tokyo Bay. The track became known as the Yokohama Line after Yokohama Railway was nationalized on 1 October 1917.

Construction of Railways to Transport Limestone and Construction Stone

Various railways were constructed in the Tokyo area from 1910 to 1930 to transport limestone and construction stone. The limestone was extracted from the Nishi Tama district while the construction stone came from the Tama River.

After Kobu Railway launched Shinjuku–Tachikawa services in 1889, pressure grew for a track to carry limestone from Nishi Tama. Ome-Line trains began running between Tachikawa and Ome in November 1894 and the line was extended in 1895 to Hinata-wada (now Miyanohira) where limestone was being mined. The Ome deposits began running out around 1925 and plans were drawn up to extend the line to Hikawa (now Oku Tama). Oku Tama Electric Railway was in charge of the construction. Meanwhile, further south-east, Itsukaichi Railway began constructing a line primarily to carry limestone from Mt Katsubo. The line opened in April 1925, linking Haijima and Musashi-itsukaichi.

Today, JR East operates passenger services on the Nambu Line but the track was originally laid by Nambu Railway between Kawasaki and Tachikawa to carry construction stone from quarries on the Tama River and limestone from Nishi Tama to the Keihin industrial district. The first section between Kawasaki and Noborito was opened in March 1927 and then extended in stages. Tachikawa–Kawasaki services began in December 1929.

The three lines were important not only because they were used to carry limestone but also because they served munitions factories and military facilities

Size and Financial Status of Railways in Western Part of Greater Tokyo (FY 1999)

	Route-km	Number of Employees	Number of Stations	Number of Rolling stock	Capital (¥million)	Operating Revenues (¥million)		Operating Expenses (¥million)		Operating Profits/Losses (¥million)		Ordinary Profits/ Losses (¥million)
						Railway	Non-railway	Railway	Non-railway	Railway	Non-railway	
Keio Electric Railway	84.7	3,752	69	853	59,024	77,457	40,066	59,389	37,256	16,067	2,811	9,821
Odakyu Electric Railway	120.5	3,837	69	1,047	60,360	110,360	53,419	85,463	45,553	24,897	7,865	7,647
Seibu Railway	176.6	3,728	92	1,253	21,665	98,386	97,817	77,942	84,287	20,444	13,530	4,536
Tobu Railway	463.3	8,913	203	1,943	66,166	157,325	77,189	127,737	71,279	29,588	5,911	10,344
Tokyo Tama Intercity Monorail	16.0	264	19	60	20,539	2,282	0	6,273	0	-3,991	0	-5,703

Passenger Volume and Density by Railway Company

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
JR East Chuo Line	No. of Passengers (1,000)	1,109,864	1,139,407	1,165,568	1,162,868	1,152,971	1,154,494	1,161,369	1,143,352	1,140,193	N/A
	Passenger Density*	N/A	N/A	N/A	N/A	608,814	601,665	614,222	606,758	610,747	N/A
JR East Ome Line	Volume	94,940	99,945	103,000	104,533	104,389	104,416	106,173	104,529	103,157	N/A
	Density	N/A	N/A	N/A	N/A	64,523	64,824	66,457	65,273	64,889	N/A
JR East Itsukaichi Line	Volume	14,903	15,525	15,948	16,237	16,612	16,843	16,825	16,546	16,336	N/A
	Density	N/A	N/A	N/A	N/A	26,299	26,714	26,812	26,305	26,027	N/A
JR East Nambu Line	Volume	223,065	229,863	236,204	242,713	244,290	243,716	244,382	240,662	238,255	N/A
	Density	N/A	N/A	N/A	N/A	142,502	145,118	147,791	146,600	144,891	N/A
JR East Yokohama Line	Volume	214,496	228,029	239,903	243,381	246,002	250,460	254,848	257,522	258,183	N/A
	Density	N/A	N/A	N/A	N/A	183,984	189,175	194,433	233,997	196,936	N/A
JR East Hachiko Line	Volume	16,920	17,227	17,328	17,622	17,340	17,147	16,825	16,546	16,336	N/A
	Density	N/A	N/A	N/A	N/A	13,651	12,948	13,573	13,773	14,166	N/A
Keio Electric Railway	Volume	564,877	586,100	587,018	587,690	587,477	587,998	587,024	580,787	587,412	582,093
	Density	212,935	220,397	222,075	223,098	224,079	224,078	224,156	220,854	224,782	221,389
Keio Line	Volume	420,382	438,529	442,987	446,631	448,495	450,348	452,763	449,725	455,030	450,315
	Density	208,402	216,510	219,287	221,383	223,083	223,524	224,539	221,745	225,871	222,027
Inogashira Line	Volume	204,898	208,843	204,983	201,366	198,891	197,368	193,145	188,539	190,874	190,172
	Density	242,715	242,260	237,757	232,747	229,681	227,189	222,000	215,841	218,652	218,245
Odakyu Electric Railway	Volume	693,568	711,702	711,277	710,575	707,285	703,946	697,141	686,933	683,038	672,179
	Density	251,593	253,074	254,589	248,926	247,442	243,948	242,620	236,732	235,661	235,637
Seibu Railway	Volume	656,565	674,214	672,308	667,259	661,786	657,011	651,976	641,437	624,032	615,749
	Density	146,919	150,509	150,812	149,769	148,386	146,627	146,146	143,480	140,268	139,784
Ikebukuro Line	Volume	343,127	352,174	354,197	351,901	348,930	346,942	343,725	336,592	324,764	320,033
	Density	159,885	163,436	165,045	164,183	162,695	160,728	159,348	155,408	150,757	149,156
Shinjuku Line	Volume	338,922	348,082	343,555	341,049	338,275	336,244	333,756	329,798	323,432	319,706
	Density	167,990	172,413	171,279	169,735	167,986	166,631	166,617	164,777	162,463	165,089
Tobu Tojo Line	Volume	382,377	398,018	401,004	400,670	401,378	402,456	395,899	388,999	382,129	378,704
	Density	184,870	192,261	194,662	196,210	197,887	197,624	194,979	191,094	185,943	184,795
Tokyo Tama Intercity Monorail	Volume	-	-	-	-	-	-	-	-	2,387	11,059
	Density	-	-	-	-	-	-	-	-	1,535	5,646

* Density = Daily Passenger-km/Route-km

* Sources: *Tetsudo tokei nempo* (Railway Annual Statistics), Ministry of Transport Railway Bureau and *Tetsudo yoran* (Railway Directory), Ministry of Land, Infrastructure and Transport Railway Bureau

near the tracks. Due to their strategic value, all three lines were purchased by the government railways in April 1944, becoming the Ome, Itsukaichi and Nambu lines. Another reason for the purchase of Nambu Railway's line was because it provided a convenient link between the Chuo and Tokaido lines. At purchase, the section of the Ome Line between Mitake and Hikawa was still under construction and it was added to the government railways network after it was completed.

Development in North-west Greater Tokyo

In the 1890s, Kawagoe on the Musashino Plateau was the largest city in Saitama Prefecture. At the time, two railway lines operated by Kōbu Railway and by Nippon Railway ran along the edges of the plateau, bypassing Kawagoe. Beginning in the Edo period (1603–1867), boats plied the Shinkashi River between Kawagoe and Edo (today's Tokyo) and Kawagoe flourished as a market centre for nearby farming villages. When Kōbu Railway began operating its

east-west line from Shinjuku, it provided an opportunity for development of a new transport route through what is now south-west Saitama Prefecture to Kawagoe. Kawagoe Railway was established to build and operate a line linking Kawagoe to Kokubunji, a station on Kōbu's line. This line now forms part of Seibu's network. When trains started running in December 1894, they could only travel between Kokubunji and a temporary station near Kumegawa, but the line was opened as far as Kawagoe in the following March. This permitted travel by train between

Kawagoe and Tokyo by an indirect route with a change at Kokubunji—an inconvenience for people living near Kawagoe and in cities like Tokorozawa en route. Tojo Railway was the first company to offer a direct Kawagoe–Tokyo connection in May 1914 when it began running trains from Ikebukuro in Tokyo to Tanomosawa via Kawagoe—the track now forms part of Tobu’s Tojo Line.

A route from Tokyo to Hanno was constructed by Musashino Railway. It opened in April 1915 and provided services from Ikebukuro via Shakuji (now Shakuji-koen), Kiyose, Tokorozawa and Toyooka-machi (now Iruma-shi) to Hanno. Today, the line is operated by Seibu Railway as the Seibu Ikebukuro Line.

Kawagoe Railway became Seibu Railway (a different business from today’s company) through amalgamation in November 1922. It constructed a new direct line from Higashi Murayama to Takadanobaba on the Yamanote Line, beginning operations in April 1927. An extension from Takadanobaba to Shinjuku was opened in March 1952. The entire line forms today’s Seibu Shinjuku Line.

Development in South-west Greater Tokyo

Koshu Kaido was (and still is) one of the five old highways linking Edo (Tokyo) with the provinces. As soon as merchants realized the business potential of railways they began calling for construction of a line parallel to the highway. The part following the old highway is today’s Keio Line and was operated by Keio Electric Tramway. The company name reflects the fact that it was treated as an electric tramway operator under legislation then in effect and because part of the track ran on the highway’s right of way. Keio Electric Tramway was established to construct a line from Shinjuku to Hachioji and opened the first section between

Sasazuka and Chofu in April 1913. The extension to Shinjuku (near today’s Shinjuku 3-chome) was delayed until May 1915 because of difficulties in purchasing the right of way. The other end of the line was extended to Fuchu (an old post town on Koshu Kaido) in October 1916.

Financial difficulties prevented the company from extending the line to west of Fuchu some time and trains did not begin running as far as Higashi Hachioji (now Keio Hachioji Station) until March 1925.

The track now known as the Inogashira Line (operated by today’s Keio Electric Railway between Shibuya and Kichijoji) was built by Teito Electric Railway (a business affiliate of Odawara Kyuko Railway) during the economic boom in the late 1920s. Services began between Shibuya and Inogashira-koen in August 1933 and were extended to Kichijoji in April 1934.

Following the example of the Keio Line, plans were drawn up to construct a railway running southwest from Tokyo parallel to the *Oyama Kaido* built during the Edo period partly for pilgrims visiting shrines on Mt Oyama. Odawara Kyuko Railway began construction in September 1925 and opened the line in April 1927, linking Shinjuku to Odawara via Atsugi, Isehara and Hadano. In the early days, electric trains covered the entire distance in 2 hours and 23 minutes at a headway of 45 minutes. Some sections had more frequent services with a headway of only 10 to 15 minutes. A branch line from Sagami-ono to the popular seaside destination of Enoshima opened in April 1929.

Consolidation of Private Railways under 1938 Land Transport Business Coordination Law

Any description of the private rail network in western Greater Tokyo must mention the effect of the 1938 Land Transport Business

Coordination Law that formed the basis of a report in 1940 recommending consolidation of all private railways south of the Chuo Line in south-west Tokyo into one entity. The result was an amalgamation of various railways under the umbrella of Tokyo Kyuko Electric Railway (nicknamed Dai Tokyu meaning Big Tokyu).

In May 1942, Tokyo Kyuko Electric Railway merged with its former subsidiaries, Odakyu Electric Railway (the name had changed from Odawara Kyuko Railway in March 1941) and Keihin Electric Railway. Teito Electric Railway had already merged with Odawara Kyuko Railway in May 1940. Tokyo Kyuko Electric Railway urged Keio Electric Tramway to merge with it and did so in May 1944 after some resistance.

Although this merger did not contravene any anti-monopoly laws, etc., after WWII, the company’s employees indicated their dissatisfaction with the merger conditions. As a result, Dai Tokyu was broken up in June 1948 to create today’s Keio Electric Railway (the name changed from Keio Teito Electric Railway in July 1998), Odakyu Electric Railway, Keihin Electric Express Railway, and Tokyu Corporation. Former Keio Electric Tramway had a comparatively short track and recognized that the breakup would undermine its economic base because the shared power supply would disappear, so its track was added to Teito Electric Railway’s network, creating what is now Keio Electric Railway. The Land Transport Business Coordination Law was also the basis for a recommendation to consolidate private railways in north-west Greater Tokyo. In 1943, Yasujiro Tsutsumi (1889–1964), the president of Musashino Railway, became president of the former Seibu Railway, indicating that the two companies would eventually merge. The merger in September 1945 created today’s Seibu Railway.

Postwar Population Increase and Railway Development

The rapid postwar expansion of the Japanese economy attracted many people to settle in Greater Tokyo, especially on the western side. As a result, the Chuo Line was the first line to experience the great increase in commuters. Commuter services before the war had been improved when the track between Nakano and Tokyo stations was quadrupled and served by electric express trains. After the war, Japanese National Railways (JNR) set out to improve conditions for rush-hour commuters. It tackled this objective with great energy by introduction of 10-car train sets (1,400 passengers) for rapid services in 1956; introduction of 20-m long Series 101 cars each with four sliding double doors per side; introduction of joint through services on Teito Rapid Transit Authority's (TRTA) Tozai subway line in April 1966—the first through service on JNR and subway tracks; and elevation and quadrupling of tracks between Nakano and Ogikubo in April 1966, and between Ogikubo and Mitaka in April 1969.

Housing developments sprang up along all lines, although the outbreak periods varied and the resulting population densities were different. Each company made considerable efforts to improve its tracks in response.

The improvements made by Keio Electric Railway are a good example. Before the war, the Keio Line used mainly two-car train sets with small cars. But as ridership increased after the war, Keio introduced longer trains with more spacious rolling stock and moved its track from the Koshu Kaido to a dedicated right of way. Then, in the early 1960s, the company introduced 18-m Series 5000 cars on the Keio Line along with Series 3000 stainless-steel cars on the Inogashira Line. In 1975, the company began running 8-car train sets on the Keio Line with the result that

the 1975 rush-hour capacity was about 356% greater than in 1955.

These improvements aimed to meet demand from the growing suburban population. However, although the boosted ridership increased railway income, costs also surged, especially for companies building new tracks. Their solution was to adopt a comprehensive approach by making money through housing development, etc., and then spending it on new tracks.

Keio Electric Railway is a good case. It promoted a massive (940,000 m²) trackside housing development in a subdivision of Hachioji to gain extra revenue and then opened the Takao Line (Kitano to Takaosanguchi) in October 1967 to serve the new resident commuters. Part of the line was built on the road bed of the abandoned Keio's Goryo Line.

However, large housing developments need huge initial capital investment to buy the land and build homes, so most major developments have been supported by public bodies. For example, Tama New Town in the Tama Hills was developed by the Tokyo Metropolitan Government, Tokyo Housing Service Public Corporation, and Japan Housing Corporation. To promote rail links between Tokyo and Tama New Town, the Japan Railway Construction Public Corporation (JRCC) applied a new framework of subsidies to compensate the private Keio and Odakyu railways for interest incurred on railway-construction loans. In addition, the developers shared some of the railway construction costs. Supported by this assistance, Keio extended its Tamagawara Line (Chofu–Keio-tamagawa) to Tama Center in the middle of Tama New Town. (When the new extension opened in October 1974, it was called the Sagami-hara Line.) For its part, Odakyu began operating a new line from Shin Yurigaoka to Nagayama in June 1974 and extended services to Tama Center in April 1975. The two lines have

since been extended west and south—Keio's Sagami-hara Line has terminated at Hashimoto since March 1990, and Odakyu opened the Tama Center–Karakida extension in March 1990.

Track quadrupling is an effective but expensive way to boost capacity in metropolitan centres like Tokyo. To reduce the financial burden, a special reserve system was established by the government in April 1985, allowing operators to levy a temporary surcharge on fares to cover future construction costs with revenues from the surcharge held in a tax-free reserve. Seibu is currently quadrupling track from Sakurada to Shakuji-koen on its Ikebukuro Line using this system, while Odakyu is doing the same from Higashi Kitazawa to Izumitama-gawa on its Odawara Line.

Over the last few years, carriers have improved passenger services in various other ways, such as introducing air-conditioned cars (all rolling stock is now air conditioned), installing elevators, escalators and ramps in stations to promote barrier-free travel, and providing space in carriages for wheelchairs. Since October 2000, users transferring between 20 private railways, including Keio, Odakyu, Seibu and Tobu, now enjoy the convenience of the stored fare (SF) card system, Passnet.

Description of Lines

JR East's Chuo Line from Tokyo to Takao

The Chuo Line was one of the first lines currently operated by JR East to be the focus of efforts to raise capacity for commuters. The efforts began before WWII, and were continued by JNR in the postwar period when 10-car train sets and Series 101 rolling stock were introduced before any other part of the JNR network received them. Congestion on the Chuo Line is about the worst on the JR East

Capacity, Ridership and Congestion Rates on Selected Major Line Sections, 1955–99

		Most congested hour						Entire day					
		No. of trains	No. of cars traversing section	No. of cars per train set	Capacity	No. of passengers	Congestion rate	No. of trains	No. of cars traversing section	No. of cars per train set	Capacity	No. of passengers	Congestion rate
JR East Chuo Line, rapid service (Nakano to Shinjuku) ¹⁾	1955	29	243	8.4	33,950	95,030	280	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	1965	30	300	10.0	42,000	121,350	289	214	2,140	10.0	299,680	351,600	117
	1975	28	280	10.0	39,200	102,100	260	211	2,110	10.0	295,400	325,010	110
	1985	28	280	10.0	39,200	101,560	259	210	2,100	10.0	294,000	325,220	111
	1995	30	300	10.0	42,000	95,600	228	275	2,750	10.0	385,000	368,200	96
	1999	30	300	10.0	42,000	92,760	221	288	2,880	10.0	403,200	363,350	90
JR East Nambu Line (Musashi-nakahara to Musashi-kosugi) ²⁾	1955	15	43	2.9	4,730	15,250	322	159	431	2.7	47,410	53,890	114
	1965	19	114	6.0	13,680	30,840	225	202	1,044	5.2	124,865	133,230	107
	1975	20	114	5.7	15,960	34,700	217	189	1,959	5.1	134,260	125,050	93
	1985	20	120	6.0	16,800	38,250	228	185	1,100	6.0	153,400	135,470	87
	1995	20	120	6.0	16,800	40,850	243	176	1,056	6.0	147,840	120,770	82
	1999	21	126	6.0	17,640	39,900	226	177	1,062	6.0	148,680	119,420	80
Tobu Tojo Line (Kita Ikebukuro to Ikebukuro)	1955	16	58	3.6	7,313	17,700	242	186	587	3.2	75,245	67,200	89
	1965	25	145	5.8	20,180	52,807	262	307	1,797	5.9	244,403	170,497	70
	1975	27	186	6.9	25,668	56,493	220	327	2,062	6.3	284,556	202,218	69
	1985	26	244	9.4	33,672	60,189	179	303	2,598	8.6	358,524	215,949	60
	1995	27	270	10.0	37,260	61,861	166	333	3,262	9.8	450,156	251,010	56
	1999	27	270	10.0	37,260	55,381	149	337	3,326	9.9	458,988	228,469	50
Seibu Ikebukuro Line (Shiina-machi to Ikebukuro)	1955	22	80	3.6	8,083	16,970	210	252	838	3.3	84,688	76,234	90
	1965	28	190	6.8	25,708	62,842	244	313	1,516	4.8	203,963	184,603	91
	1975	28	244	8.7	34,160	76,933	225	321	2,366	7.4	331,240	270,398	82
	1985	28	256	9.1	35,840	72,754	203	326	2,650	8.1	371,000	268,048	72
	1995	29	266	9.2	37,246	72,253	194	357	3,034	8.5	424,760	286,225	67
	1999	28	256	9.1	35,840	62,799	175	356	3,082	8.7	417,704	245,862	59
Keio Line (Shimo Takaido to Meidaimae) ⁴⁾	1955	24	82	3.4	7,036	15,920	226	275	825	3.0	70,785	75,000	106
	1965	24	132	5.5	15,731	36,467	232	315	1,517	4.8	159,544	142,935	99
	1975	30	198	6.6	25,080	54,331	217	309	2,011	6.5	253,040	195,163	77
	1985	30	240	8.0	31,660	61,237	193	315	2,146	6.8	289,200	223,902	77
	1995	30	300	10.0	42,000	70,858	169	356	3,116	8.8	436,240	271,487	62
	1999	30	300	10.0	42,000	70,571	168	358	3,146	8.8	440,440	272,098	62
Odakyu Odawara Line (Setagaya-daita to Shimo Kitazawa) ⁵⁾	1955	19	60	3.2	6,251	14,664	235	252	715	2.8	74,494	64,210	86
	1965	30	178	5.9	21,137	48,743	231	288	1,407	4.9	165,902	161,921	98
	1975	29	212	7.3	29,596	67,887	229	337	2,118	6.3	270,243	233,010	86
	1985	29	254	8.8	35,948	74,100	206	355	2,872	8.1	351,057	287,209	82
	1995	29	272	9.4	38,612	76,261	198	375	3,306	8.8	420,268	303,249	72
	1999	29	272	9.4	38,612	73,315	190	368	3,237	8.8	417,706	305,343	73

¹⁾ Until 1985, Shinjuku to Yotsuya

²⁾ Until 1985, Oguchi to Higashi Kanagawa

³⁾ Until 1985, Shitte to Kawasaki

⁴⁾ Until 1975, Hatsudai to Shinjuku

⁵⁾ Until 1955, Sangu-bashi to Minami Shinjuku

network. During the morning rush hour, trains run at a 2-minute headway but the congestion between Nakano and Shinjuku rate during the most crowded 1-hour period was still 221% in FY1999.

The track has been quadrupled as far as Mitaka, permitting rapid services on one pair of tracks and local services on the other pair between Mitaka and Ochanomizu. During daytime operations, through connections to Tokyo Station are provided solely by rapid and special rapid trains, although local trains offer through connections in the early morning and midnight. Most rapid services run from

Tokyo Station to Takao Station, or terminate at stations closer to Tokyo, such as Musashi-koganei, Tachikawa or Toyoda. Between Tokyo and Nakano, rapid services stop only at major stations. Special rapid service trains stop at even fewer stations with about four trains per hour during the day (one train per hour stops at stations on the Ome Line, after switching to the line at Tachikawa). The fastest journey from Tokyo Station to Takao Station is 57 minutes by the special rapid service. As a rule, special rapid services connect with an earlier rapid service train at Mitaka and Kokubunji. During the

morning rush hour, JR East operates five Tokyo-bound special rapid commuter trains that stop at even fewer stations than the special rapid service trains. Two of these trains use the Ome Line before joining the Chuo Line. On the other hand, during the evening rush hour, the rapid commuter trains stop at more stations than special rapid trains.

During the day, local trains stop at all stations between Mitaka and Ochanomizu (or the shorter distance between Nakano and Ochanomizu for about half of local trains), then leave the Chuo Line at Ochanomizu and continue



JR East's Series 201 rapid train (right) and Series 209 local train (left) running parallel to each other on quadruple track between Mitaka and Ochanomizu on Chuo Line (Author)

onto the Sobu Line for destinations in Chiba. The track section between Nakano and Mitaka is also used by TRTA's Tozai Line subway trains. Further west, during regular daytime hours, two trains (one offering special rapid services) switch from the Chuo Line to the Ome Line each hour; from Takao, special rapid trains offer five-and-a-half return runs to and from Otsuki outside the Greater Tokyo area. The extended services on both lines were introduced to serve the growing population in those areas.

Although the Chuo Line is one of the most congested lines in Greater Tokyo, its track has been quadrupled only between the city centre and Mitaka. One pair of tracks for rapid trains is also used by trains providing through services from the Ome Line and by limited express trains from Shinjuku bound for Kofu, Matsumoto and other western destinations. Consequently, the tracks cannot offer more capacity for commuters during the day. Level crossings west of Mitaka are another problem. Construction is underway along the Mitaka-Tachikawa section of elevated track, and track quadrupling is in planning.

Keio Electric Railway lines

Keio Electric Railway operates a total of 84.7 km of railway lines: the Keio Line (37.9 km from Shinjuku to Keio Hachioji); the Takao Line (8.6 km from Kitano on the Keio Line to Takaosan-guchi); the Sagami-hara Line (22.6 km from Chofu to Hashimoto); the Keibajo Line (0.9 km from Higashi Fuchu to Fuchu-keiba-seimonmae); the Dobutsuen Line (2.0 km from Takahatafudo to Tama Dobutsukoen); and the Inogashira Line (12.7 km from Shibuya to Kichijoji).

Rail ridership in FY2000 was 584 million. Of this total, 350 million (59.9%) were commuter-pass (season-ticket) holders. Passenger revenues in FY2000 were ¥72.5

billion. The Keio Group also has non-railway businesses—some of the Group's 36 companies offer bus services (mostly providing links to Keio stations) and let real estate in station buildings and other developments.

Keio Electric Railway presently offers special express services at 20-minute intervals between Shinjuku and Keio Hachioji (34 minutes). JR East's Chuo Line also connects these two destinations and is therefore a competitor with a travel time of 36 minutes on special rapid trains. Some Keio trains departing Shinjuku offer direct connections to stations on the Takao and Sagami-hara lines, providing semi-special express, express and rapid services.

Both Keio and Odakyu offer links from Tokyo to Tama New Town, but Keio's Sagami-hara Line is more important because it offers many direct connections from Tama New Town to the city centre, while most trains on Odakyu's Tama Line—except for a few during rush hour—only offered a shuttle service to Shin Yurigaoka until March 2002.

Keio's Inogashira Line has a unique track gauge so it is operated independently of the other lines.

From 1987 to 1997, Keio used the special reserve system to introduce 10-car train sets for all morning rush-hour trains on the Keio Line and to build Series-1000

Comparison of Keio's Sagami-hara Line and Odakyu's Tama Line

	Keio Sagami-hara Line	Odakyu Tama Line
No. of passengers using Tama Center Station daily (2000)	84,193	32,290
Capacity (1999)		
1-hour period, peak times (train: passengers)	11: 15,400	9: 9,408
Entire day (train: passengers)	141: 162,680	107: 97,400
No. of passengers travelling toward Shinjuku (1999)*		
No. of journeys by commuter-pass holders	20,378,040	4,059,930
No. of journeys by non-commuter-pass holders	9,117,450	1,347,185

Note: No. of passengers indicates, in the case of Keio, those disembarking from Sagami-hara Line trains at Chofu and transferring to Tokyo-bound trains and, in the case of Odakyu, those disembarking from Tama Line trains at Shin Yurigaoka and transferring to Tokyo-bound trains.

Source: Metropolitan Transport Yearbook, and profiles of railway companies



Keio Electric Railway's Series 6000 (right) and Series 7000 (left) running near Keio Nagayama on Sagami Line connecting central Tokyo and Tama New Town
(Author)



Construction site of quadruple track near Soshigaya-okura Station
(Odakyu Electric Railway)

rolling stock (20-m carriages) for the Inogashira Line. The results are noticeable now that the rolling stock is in use; on the Keio Line between Shimo Takaido and Meidaimae, capacity during the most congested time period increased from 31,660 in FY1985 to 42,000 in FY1999 and congestion rates dropped from 193% to 168%. On the Inogashira Line between Shibuya and Shinsen, capacity during the most congested time period increased from 17,280 in FY1985 to 19,980 in FY1999. To improve services further, Keio Line trains running late at night on weekdays have included a female-only car since March 2001.

Odakyu Electric Railway lines

Odakyu Electric Railway operates a total of 120.5 km of lines: the Odawara Line (82.5 km from Shinjuku to Odawara); the Enoshima Line (27.4 km from Sagami-ono to Katase-enoshima); and the Tama Line (10.6 km from Shin Yurigaoka to Karakida). Odakyu also operates department stores, supermarkets and other retail outlets, most located near stations, as well as hotels, real estate businesses and other enterprises. It is also actively involved in developing the tourism of Hakone.

Odakyu was split off from Tokyo Electric Express Railway after WWII and established as an independent company. Odakyu's tourism strategy in Hakone area and its special express services between Shinjuku and Hakone-yumoto will be

described in the next issue.

Odakyu commuters endure some of the worst crowding in Greater Tokyo. For example, the congestion was 190% between Setagaya-daita and Shimo Kitazawa during the most crowded time period in FY1999.

To reduce congestion on track sections near Shinjuku, Odakyu and TRTA began offering through connections on each other's lines from Yoyogi-uehara (Odawara Line/Chiyoda subway line) in March 1978. As an additional measure, Odakyu is using the special reserve system to quadruple the section between Higashi Kitazawa and Izumi-tamagawa (10.4-km). The 2.4-km section between Kitami and Izumi-tamagawa was quadrupled and entered service in June 1997. When the work is completed between Kitami and Higashi Kitazawa, Odakyu anticipates that congestion will drop to between 160% and 169% with the journey by express between Shinjuku and Mukogaokayuen dropping from the current 29 minutes to 21 minutes.

Seibu Railway lines

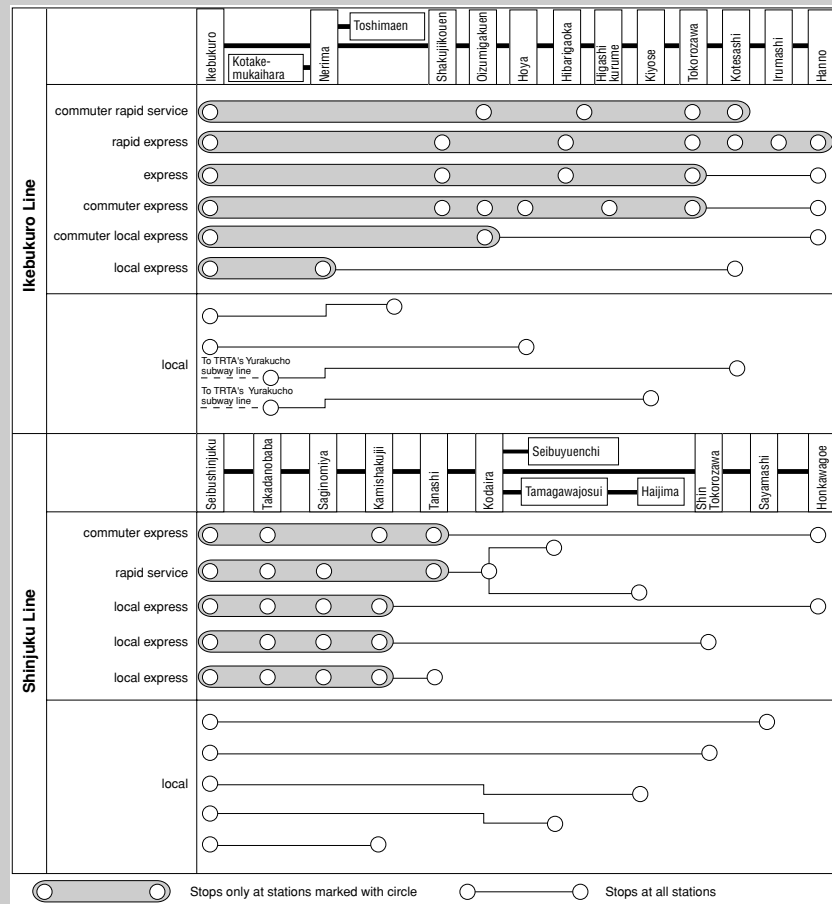
Seibu Railway operates a total of 176.6 km of railway on 12 passenger lines: the Ikebukuro Line (57.8 km from Ikebukuro to Agano); the Seibu Chichibu Line (19.0 km from Agano to Seibu Chichibu); the Seibu Yurakucho Line (2.6 km from Nerima to Kotake-mukaihara); the Toshima Line (1.0 km from Nerima to Toshimaen);

the Sayama Line (4.2 km from Nishi Tokorozawa to Seibu Kyujomae); the Yamaguchi Line (2.8 km from Seibu Yuenchi to Seibu Kyujomae); the Shinjuku Line (47.5 km from Seibu Shinjuku to Hon Kawagoe); the Seibuen Line (2.4 km from Higashi Murayama to Seibuen); the Kokubunji Line (7.8 km from Kokubunji to Higashi Murayama); the Haijima Line (14.3 km from Kodaira to Haijima); the Tamako Line (9.2 km from Kokubunji to Seibu Yuenchi); and the Seibu Tamagawa Line (8.0 km from Musashi-sakai to Koremasa). Seibu also owns a 3.2-km freight line from Minami Otsuka to Ahina although it is not presently in operation. Rail ridership in FY2000 was 609.84 million of whom 63% were commuter-pass holders. Seibu Railway also owns the Seibu Lions professional baseball team and operates the Seibu-En Amusement Park. It has branched out into hotel management and development of real estate and other enterprises located both near to and far from its tracks. In FY2000, 49.8% of Seibu's sales came from railway operations, a low ratio compared to other major private railways in Japan.

Seibu's two main lines, the Shinjuku and Ikebukuro lines, intersect at Tokorozawa but the operation systems are different.

The Shinjuku Line links Shinjuku with Kawagoe (an important city in south-west Saitama Prefecture) and is used mainly by commuting workers and students. During the morning rush hour, Seibu runs 26

Seibu Railway Scheduled Operations During a One-hour Segment of Morning Rush Hour



Source: Survey of Railway Companies in Japan, Seibu Railway 2001

trains each hour classified as commuter express, rapid service, local-express, and local trains.

The Ikebukuro Line from Ikebukuro terminates at Agano where it connects with the Seibu Chichibu Line. It serves commuting workers and students living between Hanno and Tokyo and also takes tourists to the scenic Chichibu region. A track section was constructed in April 1989 to link Seibu's Chichibu Line to the line operated by Chichibu Railway, making it possible to offer through services. Seibu offers 25 and one half return runs on weekdays (23 and one half runs on holidays) using the *Chichibu* and *Musashi* limited-express trains (with surcharge levy), cutting the journey time from Ikebukuro to Seibu Chichibu to 78 minutes. Other rapid express trains make

a few station stops east of Hanno.

Closer to Ikebukuro, the line is used mainly by commuting workers and students. In 1999, the section between Shiina-machi and Ikebukuro had a congestion rate of 175% during rush hours. During this time period, Seibu runs 36 trains per hour, offering a total of seven stop patterns ranging from commuter rapid (very few stops) to local trains. Some trains offer through connections to the city centre on TRTA's Yurakucho subway line. In north-west Tokyo, commuters and tourists use Seibu's Toshima, Sayama and Seibuen branch lines terminating at popular attractions. For example, the Seibu Dome home turf of the Seibu Lions baseball team is close to Seibu Kyujomae Station on the Sayama Line and extra services are run to carry supporters to and

from games.

Seibu has also increased capacity by arranging through services with TRTA on each other's tracks (via TRTA's Yurakucho subway line). Through services were started between Nerima and Kotake-mukaihara in December 1994—a shorter through service, linking Shin Sakuradai and Kotake-mukaihara had already started in October 1983—and Nerima Station was modified in March 2000 to further facilitate services.

Capacity will also be improved on the Sakuradai–Shakujii-koen section when grade separation and quadrupling are completed.

Tobu Railway's Tojo and Ogose lines

Tobu Railway operates the Tojo Line (75.0 km from Ikebukuro to Yorii in Saitama Prefecture), and the Ogose Line (10.9 km, branching from the Tojo Line at Sakado and terminating at Ogose). Apartment complexes and houses sprang up alongside these lines after the Japanese economy began expanding rapidly and this boosted demand for more transport capacity. Tobu began introducing 10-car train sets in 1976, finished quadrupling the Tobu Line section between Wako-shi and Shiki in August 1987, and began through services with TRTA via the Yurakucho subway line. These efforts have reduced congestion to less than that of other major private railways in Greater Tokyo. During the morning rush hour, Tobu runs 27 Ikebukuro-bound trains per hour at a headway of 2 minutes and 10 seconds. In FY1999, Ikebukuro-bound trains carried an average of 55,381 passengers per hour between Kita Ikebukuro and Ikebukuro at a congestion rate of 149% during the busiest time of the day.

During normal daytime operations, Tobu's express trains stop only at major stations between Ikebukuro and Kawagoe-shi and then stop at all stations further down the

line. Semi-express trains make no stops from Ikebukuro until Narimasu and then stop at all stations down the line. Other trains run on various shorter sections, stopping at all stations.

Tobu is taking advantage of the special reserve system to fund construction projects that will boost capacity.

The company operates a shuttle service between Sakado and Ogose on its Ogose Line with stops at all stations. The headway is 10 minutes during rush hours and 15 minutes at other times of day.

JR East's Ome, Itsukaichi and Nambu lines

As described earlier, the tracks for today's Ome, Itsukaichi and Nambu lines were first laid for transporting limestone and construction stone. However, as factories and housing sprang up, the lines catered increasingly to commuters. A number of munitions factories were built near the lines before WWII, but from around 1955, more land was developed for housing.

The Ome Line runs 37.2 km from Tachikawa to Oku Tama. Bedroom communities predominate along the Tachikawa–Ome stretch but mountains close in between Ome and Oku Tama to the west and many passengers are tourists. Ridership is quite low, so most non-rush-hour daytime trains during the week terminate at Ome. An average of five trains per hour run west to Ome with just two per hour continuing beyond Ome.

Through services from the Chuo Line to the Ome Line began in 1959 and have increased in frequency over the years. At present, JR East offers two through services per hour in the daytime, including the morning rush hour. One is called the 'Ome special rapid.' On holidays, 'holiday rapid trains' offer three daily through rapid return services between Shinjuku and stations giving access to popular spots like Mt Mitake and Lake Oku Tama.

The Itsukaichi Line (11.1 km) is also becoming an important commuter line.

Through connections to the Chuo Line are offered by two Tokyo-bound morning trains and one outbound evening train. During the rush hour, many other Itsukaichi-Line trains provide through services to the Ome Line as far as Tachikawa. On holidays, holiday rapid trains from Shinjuku bring tourists to the Akigawa region, following the pattern of through services onto the Ome Line.

Although most lines in Greater Tokyo's rail network radiate from the city centre, the Nambu Line is an exception. Instead, it runs south-west in the west part of the region, crossing many radial lines. Kawasaki, the south-eastern terminus of the Nambu Line, serves JR's Tokaido Line. Passengers travelling north-west from Kawasaki on the Nambu Line can transfer (in order) to the Tokyu's Toyoko Line at Musashi-kosugi, the Tokyu's Den'en Toshi Line at Musashi-mizonokuchi, the Odakyu's Odawara Line at Noborito, JR East's Musashino Line at Fuchuhonmachi, Keio's Keio Line at Bubaigawara, and three lines (Chuo, Ome and Tokyo Tama Intercity Monorail) at Tachikawa, the north-west terminus. Ridership patterns for the Nambu Line show that these stations are used by the vast majority of passengers and that many do indeed transfer to another line.

Six-car train sets travel the 35.5 km between Kawasaki and Tachikawa in 53 minutes stopping at every station. Other trains serve only the Kawasaki–Noborito section or the Kawasaki–Inagi–naganuma section. Housing is becoming denser along the line, resulting in an increase in passengers, but infrastructure is already at its limit and JR East finds it practically impossible to run longer trains or increase frequencies. Future challenges include eliminating level crossings and increasing capacity.

JR East's Yokohama Line

The Yokohama Line runs 42.6 km from Higashi Kanagawa to Hachioji. It opened in 1909 but efforts to boost capacity to

cope with the growing population along the line were made only relatively recently. The entire line was single track until the 1960s and during regular daytime hours most services used two-car train sets reminiscent of prewar days, running at intervals of 25 minutes. By 1968, JNR finished double-tracking between Higashi Kanagawa and Kozukue in Yokohama but double track only reached Hachioji in March 1988. Many trains now run the entire length of the line, although some run only between Higashi Kanagawa and Hashimoto, or between Higashi Kanagawa and Machida. The Yokohama Line crosses Odakyu's Odawara Line at Machida and more passengers use Machida Station than any other station on the Yokohama Line. Many Yokohama Line trains offer through connections from Higashi Kanagawa onto JR East's Keihin Tohoku Line, running as far as Sakuragicho, Isogo or Ofuna.

Machida is an important city in the Sagami region, and began developing as a bedroom community in the 1960s. It is now an important commercial centre with many large department stores and other retailers near the station. Until April 1980, the Yokohama-Line station was called Hara Machida and was about 700 m from Odakyu's Machida Station. A redevelopment project launched in 1978 in the Hara Machida district integrated the two stations with a station building complex between them.

Today, Yokohama-Line trains run at intervals of 3 or 4 minutes during the morning rush hour. During the rest of the day, there are 8 trains per hour in each direction (one offering a rapid service). In FY1999, trains carried an average of 38,350 passengers per hour between Kozukue and Shin Yokohama at a congestion rate of 201% during the busiest times of day.

JR East's Hachiko Line

The Hachiko Line runs close to the eastern

base of the Kanto Mountains, and stretches 92.0 km from Hachioji to Kuragano. The line grew in stages; the northernmost section (provisionally called the Hachiko-kita Line) opened in July 1931 to connect Kuragano to Kodama. The southernmost section (provisionally called the Hachiko-minami Line) opened in December 1931 to connect Hachioji to Higashi Hanno. The entire Hachioji–Kuragano stretch began full operations in October 1934.

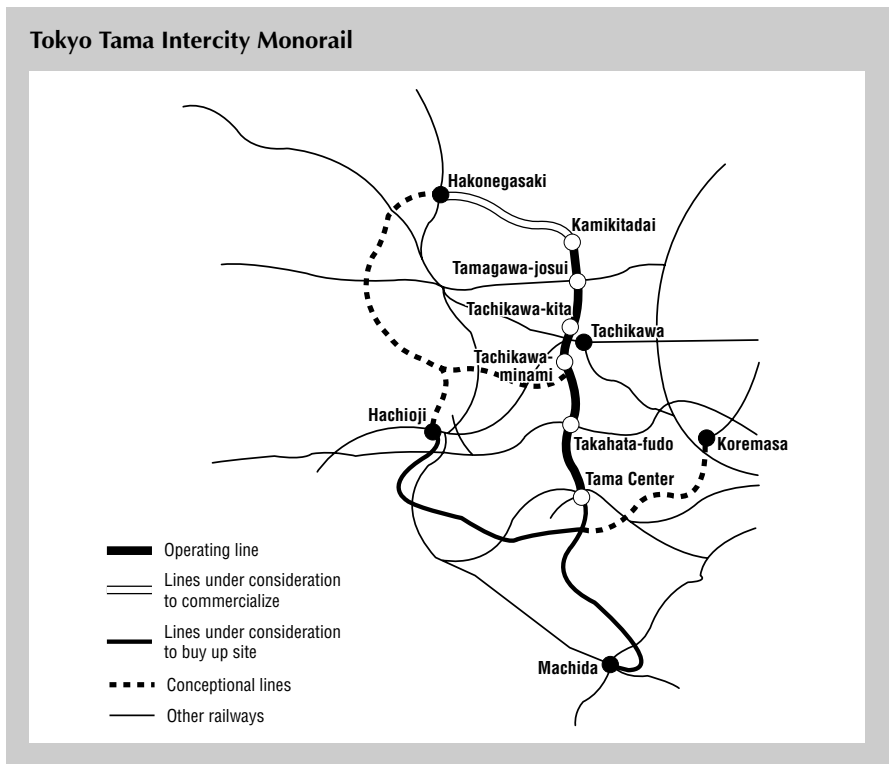
Until recently, the line presented a rural appearance with two- or three-car diesel train sets running during regular daytime hours. The population along the line began increasing in the 1980s but JNR showed little interest in investing large sums of money to raise service frequency. The schedule was improved to provide a headway of 30 minutes during regular daytime hours only in March 1985. Part of the line was finally electrified in March 1996. Today, rush-hour trains run at intervals of close to 20 minutes between Hachioji and Komagawa with a headway of 30 minutes at other times.

Many of the electric trains offer through services to the Kawagoe Line at Komagawa. Through services are provided elsewhere too—during the morning rush hour, two trains departing Komagawa switch to the Ome Line at Haijima and then run on the Chuo Line to Tokyo Station.

The Komagawa–Kuragano section has still not been electrified and during normal daytime hours diesel railcars run at intervals of about 90 minutes, reminding users of transportation conditions in rural Japan. These trains do not terminate in Kuragano but one station beyond at Takasaki.

Tokyo Tama Intercity Monorail

The rail network in west Tokyo has most lines oriented more or less east–west with very few north–south routes. A new north–south route provided by the ALWEG-style Tokyo Tama Intercity



Monorail opened in November 1998. The southern terminus is at Tama Center on Keio's Sagami-hara and Odakyu's Tama lines. The monorail also connects with other stations on Keio's lines, the JR East Chuo Line, and the Seibu Haijima Line. The northern section from Kamikitadai to Tachikawa-kita opened in November 1998, while the southern section from Tachikawa-kita to Tama Center opened in January 2000. The 16.0-km route from Tama Center to Kamikitadai with 19 stations in all is covered in 36 minutes. The operator is a public–private entity financed by the Tokyo Metropolitan Government, municipalities served by the line, and railway companies. Construction costs were subsidized through a Ministry of Construction (now

Ministry of Land, Infrastructure and Transport) support programme for urban monorails, greatly reducing the burden of infrastructure costs.

The monorail serves major commercial districts like Tama Center and Tachikawa, as well destinations such as the National Showa Memorial Park and a number of universities. In FY2000, the ridership was 29.13 million. Trains run at 6-minute intervals during busy periods and at 10-minute intervals during other hours. Plans call for the construction of another 7-km section between Kamikitadai and Hakonegasaki. ■



Makoto Aoki

Mr Aoki is an Associate Professor in the Faculty of Economics at Toyama University. He has published articles on management of private railways and transportation policy in local cities and holds a Master's degree in business and commerce from Keio University.