

Significance of Freight Transport in Regional Railways

Seiji Fukuda

Introduction

The number of passengers on Japanese railways in rural areas (regional railways) is decreasing as private transport becomes more popular, trackside populations decline and birth rates become lower.

The definition of regional railways differs slightly even in preceding research. Here, we define regional railways as 'regional passenger railways' and 'freight railways' that operate regular passenger transport described in the *Yearbook of Railway Statistics*.

Business conditions remain severe for regional railways. However, regional railways support the lives of trackside populations and are used for many purposes, such as schoolchildren travelling to school, commuting, and the elderly visiting hospitals, making railways an important mode, especially for those with restricted movement. Although services on many regional railways can be substituted by buses, this is not examined here. This argument is developed in Fukuda (2005).

This article focuses on regional railways that also carry freight, because freight transport is considered to be a major element in stabilizing the business of regional railways (Suzuki 1999). However, freight transport is disappearing rapidly on regional railways, which is thought to have made business worse and has sometimes led to line closures. Asai (2004) argues that 'local railways with little passenger demand may only be left with the option of waiting for discontinuation when they lose their precious savings from freight operation and are left only with passengers'. Yokkaichi University and Sangi Railway (2008) assert 'it is difficult for the Sangi Line to become profitable with either just passenger or just freight transport. The most achievable path for keeping the Sangi Line as community transport is to retain freight transport at all costs'.

This article looks first at recent transport and business conditions of regional railways operating freight transport (passenger/freight railways). Next, it analyzes business conditions for passenger/freight railways separately for freight and passenger fields to clarify to what extent freight plays a role in sustaining the railway business.

There has been some preceding research in this field but

none gives a detailed analysis of the role of freight transport in the passenger/freight railway business.

Tanemura (1999), Suzuki (2006a, 2006b, 2006c), Yokkaichi University and Sangi Railway (2008) each cover a single passenger/freight railway, explaining its history and current situation.

Terada (2000) and Asai (2004, 2006) cover regional railways in general. Kagawa (2002) and Suzuki (1999, 2004) cover the third sector railways (quasi-public railways). Takashima (2003) covers Rinkai (harbour) railways. Third sector railways here mean regional railway lines specified by the former Japanese National Railways (JNR) under the Japanese National Railways Management Restructuring Promotion Special Measures Law as well as railways that took over lines where closure had been planned. Rinkai railways are railways established by joint investment between the former JNR, regional governments in coastal industrial zones and companies that have set up operations in such zones. The purpose is to transport freight in coastal industrial zones. Kawashima (1998, 2003, 2004, 2007a, 2007b) covers railway business by region, and discusses passenger/freight railways.

Aoki (2003, 2006) discusses the historical developments of freight transport on private-sector railways and Aoki (2008) discusses historical developments of regional railways. All touch on passenger/freight railways.

Recent State of Passenger/Freight Railways

In FY2000, there were 11 operators of passenger/freight railways in Japan. However, Oigawa Railway has carried less than 1600 tonnes of freight since FY2000, and revenue from freight transport has decreased to less than ¥2.4 million (US\$1 = ¥98)—both extremely low figures—so it is not covered here. The other 10 operators are analyzed.

In recent years, passenger/freight railways have been gradually eliminating freight transport one by one. Kashima Railway stopped freight transport on 1 April 2002, followed by Heisei Chikuho Railway on 31 March 2004, Kamioka Railway on 31 March 2005, and Tarumi Railway on 18 March 2006. Heisei Chikuho Railway stopped freight transport on

Table 1 Number of Passengers on Passenger/Freight Railways

(Unit: thousands of passengers)

Fiscal year	Kashima Rinkai Railway	Kashima Railway	Chichibu Railway	Gakunan Railway	Kamioka Railway	Sangi Railway	Kurobe Gorge Railway	Tarumi Railway	Mizushima Rinkai Railway	Heisei Chikuho Railway
2000	2906	987	9402	747	44	3184	1560	757	1917	2732
2001	2805	946	9186	721	46	3203	1462	739	1821	2553
2002	2724	903	8899	681	49	3132	1376	717	1714	2404
2003	2583	884	8736	669	44	5225	1428	721	1680	2351
2004	2501	843	8528	690	40	5128	1341	668	1613	2202
2005	2477	776	8551	708	38	5320	1293	680	1589	2152

Source: Annual Yearbook of Railway Statistics

Table 2 Tonnes of Freight on Passenger/Freight Railways

(Unit: tonnes)

Fiscal year	Kashima Rinkai Railway	Kashima Railway	Chichibu Railway	Gakunan Railway	Kamioka Railway	Sangi Railway	Kurobe Gorge Railway	Tarumi Railway	Mizushima Rinkai Railway	Heisei Chikuho Railway
2000	247,785	28,768	3,052,402	146,024	66,180	2,058,672	33,920	386,050	462,456	473,594
2001	296,600	6096	3,020,525	151,770	73,623	2,824,441	36,207	266,310	485,809	492,442
2002	287,407		3,063,966	125,191	51,159	2,321,708	24,338	187,930	495,064	371,792
2003	309,133		2,812,296	111,562	54,633	1,223,550	26,246	164,422	514,677	378,328
2004	291,851		2,689,419	121,919	20,183	1,036,828	26,849	149,346	507,552	
2005	306,632		2,705,407	134,473		1,049,500	30,211	104,614	512,585	

Source: Annual Yearbook of Railway Statistics

1 October 2004, but had not carried freight since 31 March 2004. Similarly, Tarumi Railway stopped freight transport on 30 April 2006, but it had carried no freight since 18 March 2006. Information on the circumstances up to the end of freight transport by individual operators and the actual closure dates are taken from the Gifu Third Sector Railway Liaison Conference (2007), materials from the Railway Bureau of the Ministry of Land, Infrastructure, Transport and Tourism (MLITT), Tarumi Railway, and Heisei Chikuho Railway. Of these, Heisei Chikuho Railway stopped freight transport because a factory owned by its sole freight shipper closed. The other three stopped freight transport because their shippers switched to truck transport. Furthermore, Kamioka Railway closed its railway business on 1 December 2006

followed by Kashima Railway on 1 April 2007.

Table 1 shows the number of passengers carried by passenger/freight railways. Chichibu Railway carries most passengers at more than 8 million people, although the number is decreasing. The second largest is Sangi Railway, which carried more than 3 million people until FY2002 and more than 5 million since FY2003. The large increase from FY2003 occurred because Sangi Railway took over Kinki Nippon Railway's (Kintetsu) Hokusei Line on 1 April 2003. The other eight operators have passenger volumes of less than 3 million, and four carried less than 1 million. Excluding Gakunan Railway, which has seen a recovery in volume since FY2004, all tend to show falling passenger numbers.

Table 2 shows the tonnes of freight carried by passenger/

Table 3 Operating Profit and Loss of Passenger/Freight Railways

(Unit: ¥1000)

Fiscal year		Kashima Rinkai Railway	Kashima Railway	Chichibu Railway	Gakunan Railway	Kamioka Railway	Sangi Railway	Kurobe Gorge Railway	Tarumi Railway	Mizushima Rinkai Railway	Heisei Chikuho Railway
2000	Revenue	1,244,327	325,248	4,195,254	260,151	89,772	1,425,467	2,433,525	348,819	862,851	500,251
	Costs	1,361,328	449,925	4,426,566	298,028	121,684	1,453,208	2,448,636	389,511	859,509	545,163
	Profit/loss	-117,001	-124,677	-231,312	-37,877	-31,912	-27,741	-15,111	-40,692	3342	-44,913
2001	Revenue	1,371,121	265,460	4,182,777	261,704	96,485	1,595,302	2,331,055	281,990	726,831	488,863
	Costs	1,395,752	413,722	4,295,086	294,222	127,563	1,579,547	2,422,862	357,852	775,448	541,035
	Profit/loss	-24,631	-148,262	-112,309	-32,518	-31,078	15,755	-91,807	-75,862	-48,617	-52,172
2002	Revenue	1,344,861	236,587	4,151,989	238,798	98,691	1,468,812	1,891,326	255,281	707,700	441,215
	Costs	1,345,003	338,963	4,161,004	280,600	146,293	1,461,553	2,065,666	382,710	759,078	452,716
	Profit/loss	-142	-102,376	-9015	-41,802	-47,602	7259	-174,340	-127,429	-51,378	-11,501
2003	Revenue	1,298,682	231,391	3,959,115	223,358	89,795	1,504,124	2,081,691	237,904	716,646	432,512
	Costs	1,303,569	300,781	3,958,117	304,724	147,807	2,026,002	2,137,696	307,960	742,034	456,811
	Profit/loss	-4887	-69,390	998	-81,366	-58,012	-521,878	-56,005	-70,056	-25,388	-24,299
2004	Revenue	1,231,810	224,868	3,853,109	250,765	36,849	1,401,692	2,083,220	215,519	706,679	337,701
	Costs	1,236,477	286,730	3,832,242	274,640	107,065	1,878,626	2,133,338	311,455	748,712	409,361
	Profit/loss	-4667	-61,862	20,867	-23,875	-70,216	-476,934	-50,118	-95,936	-42,033	-71,660
2005	Revenue	1,231,923	206,008	3,902,949	265,352	20,207	1,479,849	2,040,053	211,206	706,383	366,897
	Costs	1,247,035	262,712	3,873,589	291,488	89,245	1,845,279	2,136,202	327,597	738,309	416,999
	Profit/loss	-15,112	-56,704	29,360	-26,136	-69,038	-365,430	-96,149	-116,391	-31,926	-50,102

Source: Annual Yearbook of Railway Statistics

freight railways. Chichibu Railway and Sangi Railway carry more than 1 million tonnes every FY. Five railways carry between 100,000 and 500,000 tonnes; three carry less than 100,000 tonnes.

Every operator that stopped freight transport saw falling transport volumes just before they stopped. Transport volumes on the Sangi Railway declined markedly after FY2003, because it had been carrying earth and sand for the now-completed Central Japan International Airport from July 2000 to December 2002 (Yokkaichi University and Sangi Railway 2008). Other operators have remained at about the same volume or have seen a slight decrease.

Table 3 shows the operating profit and loss of passenger/freight railways. Seven operators posted operating losses

for all years in this table. Kashima Railway posted annual losses of more than ¥50 million, with losses of more than ¥100 million up to FY2002. Kurobe Gorge Railway and Tarumi Railway have had annual losses of more than ¥50 million since FY2001, as has Kamioka Railway since FY2003. Heisei Chikuho Railway has had annual losses of more than ¥50 million since FY2004.

The other three operators have also posted operating losses for most years, confirming that business conditions are severe. Sangi Railway has had major losses since FY2003, mainly because it took over operation of Hokusei Line from Kintetsu.

Table 4 Passenger Operating Profit and Loss of Passenger/Freight Railways

(Unit: ¥1000)

Fiscal year		Kashima Rinkai Railway	Kashima Railway	Chichibu Railway	Gakunan Railway	Kamioka Railway	Sangi Railway	Kurobe Gorge Railway	Tarumi Railway	Mizushima Rinkai Railway	Heisei Chikuho Railway
2000	Revenue	964,889	260,868	2,328,520	152,848	17,470	507,145	2,141,194	182,823	383,559	406,551
	Costs	1,231,039	423,630	2,173,701	203,413	73,898	499,667	2,183,845	265,796	429,841	505,615
	Profit/loss	-266,150	-162,761	154,820	-50,565	-56,428	7479	-42,651	-82,974	-46,282	-99,064
2001	Revenue	972,334	251,887	2,437,350	142,445	17,023	565,605	2,029,837	172,322	307,758	390,923
	Costs	1,237,249	411,069	2,120,166	197,111	83,548	447,094	2,156,361	265,492	355,430	497,695
	Profit/loss	-264,914	-159,182	317,184	-54,666	-66,525	118,511	-126,523	-93,170	-47,672	-106,772
2002	Revenue	968,291	236,587	2,256,820	145,937	15,872	508,882	1,653,883	173,341	291,943	371,190
	Costs	1,191,923	338,963	2,041,740	198,546	97,365	487,198	1,888,538	307,569	340,875	419,813
	Profit/loss	-223,633	-102,376	215,080	-52,608	-81,493	21,684	-234,655	-134,228	-48,932	-48,623
2003	Revenue	898,156	231,391	2,217,023	144,402	18,152	864,072	1,818,699	169,482	293,502	358,291
	Costs	1,145,024	300,781	2,024,636	242,521	104,151	1,374,668	1,928,794	244,170	329,483	423,414
	Profit/loss	-246,868	-69,390	192,387	-98,119	-85,999	-510,597	-110,095	-74,688	-35,981	-65,123
2004	Revenue	861,409	224,868	2,181,695	158,378	17,933	876,961	1,849,937	151,107	275,951	337,701
	Costs	1,086,438	286,730	2,016,552	211,372	80,389	1,384,056	1,936,770	254,700	335,540	409,361
	Profit/loss	-225,029	-61,862	165,143	-52,994	-62,456	-507,095	-86,832	-103,594	-59,589	-71,660
2005	Revenue	846,887	206,008	2,203,610	160,450	20,207	918,608	1,788,222	166,025	272,044	366,897
	Costs	1,098,391	262,712	2,060,100	216,362	89,245	1,375,820	1,916,202	274,697	319,417	416,999
	Profit/loss	-251,503	-56,704	143,510	-55,912	-69,038	-457,212	-127,980	-108,672	-47,373	-50,102

Source: Annual Yearbook of Railway Statistics

Business Analysis by Passenger and Freight Separately

Here, we describe the operating profits and losses by passenger and freight operations separately. If an operating profit is posted for freight transport it suggests that freight transport is an element in stabilizing business of passenger/freight railways. However, the *Yearbook of Railway Statistics* does not describe miscellaneous revenues from transport and operating costs separately by passenger and freight. Consequently, they must be allocated some other way. An appropriate criterion for this allocation is the ratio of operation-km for passenger and freight rolling stock because many costs are thought to be proportional to the kilometers of

rolling stock operation. Therefore, the operation-km for rolling stock were distributed separately by passenger and freight, and miscellaneous revenues from transport and operating costs were allocated based on the derived ratio, taking three points into account:

- Tarumi Railway uses diesel locomotives for both passenger and freight transport while Kurobe Gorge Railway uses electric locomotives. Consequently, operation-km are distributed based on the ratio of operation-km of passenger carriages and freight wagons pulled by these locomotives.
- Chichibu Railway primarily uses electric locomotives for freight transport so operation-km of electric locomotives were used.

Table 5 Freight Operating Profit and Loss of Passenger/Freight Railways

(Unit: ¥1000)

Fiscal year		Kashima Rinkai Railway	Kashima Railway	Chichibu Railway	Gakunan Railway	Kamioka Railway	Sangi Railway	Kurobe Gorge Railway	Tarumi Railway	Mizushima Rinkai Railway	Heisei Chikuho Railway
2000	Revenue	279,438	64,380	1,866,734	107,303	72,302	918,322	292,331	165,996	479,292	93,700
	Costs	130,289	26,295	2,252,865	94,615	47,786	953,541	264,791	123,715	429,668	39,548
	Profit/loss	149,149	38,084	-386,132	12,688	24,516	-35,220	27,540	42,282	49,624	54,152
2001	Revenue	398,787	13,573	1,745,427	119,259	79,462	1,033,527	301,218	109,668	419,073	97,940
	Costs	158,503	2653	2,174,920	97,111	44,015	1,132,453	266,501	92,360	420,018	43,340
	Profit/loss	240,283	10,920	-429,493	22,148	35,447	-98,926	34,716	17,308	-945	54,600
2002	Revenue	376,570		1,895,169	92,861	82,819	959,930	237,443	81,940	415,757	70,025
	Costs	153,080		2,119,264	82,054	48,928	974,355	177,128	75,141	418,203	32,903
	Profit/loss	223,491		-224,095	10,806	33,891	-14,425	60,315	6799	-2446	37,122
2003	Revenue	400,526		1,742,092	78,956	71,643	645,841	256,043	70,548	429,921	69,226
	Costs	158,545		1,933,481	62,203	43,656	651,334	208,902	63,790	412,551	33,397
	Profit/loss	241,981		-191,389	16,753	27,987	-5492	47,141	6757	17,370	35,829
2004	Revenue	370,401		1,671,414	92,387	18,916	524,731	233,283	64,412	430,728	
	Costs	150,039		1,815,690	63,268	26,676	494,570	196,568	56,755	413,172	
	Profit/loss	220,362		-144,276	29,119	-7760	30,161	36,714	7658	17,556	
2005	Revenue	385,036		1,699,339	104,902		561,241	251,831	45,181	434,339	
	Costs	148,644		1,813,489	75,126		469,459	220,000	52,900	418,892	
	Profit/loss	236,391		-114,150	29,776		91,782	31,831	-7719	15,447	

Source: Annual Yearbook of Railway Statistics

- Rolling-stock maintenance costs within operating costs are distributed based on the ratio of passenger and freight operation-km. However, operation-km for rolling stock owned by the shipper and other operators were excluded from the figures.

Tables 4 and 5 show the separate results for passenger and freight transport. Excluding Chichibu Railway and Sangi Railway, passenger transport on all the other railways made losses in all years shown in the table. Chichibu Railway has large passenger volumes so it had operating profits for all years. Sangi Railway has had operating losses since FY2003 due to the takeover of Hokusei Line.

Five operators made freight profits in all years in the table. Of the five making freight losses, Kamioka Railway and

Tarumi Railway showed losses only in the FY they stopped freight transport. Mizushima Rinkai Railway also had small losses in some FYs. Sangi Railway has made freight profits since FY2004. Chichibu Railway was the only operator with large freight losses every FY.

What about operating profits and losses before and after four operators stopped freight transport? Table 6 shows operating profits and losses for each operator before and after stopping freight transport as a whole and for passenger and freight transport separately. Kashima Railway saw a drop of about ¥64 million in freight operating revenue due to stopping freight transport, while operating revenue for passenger transport also fell by about ¥24 million. However, operating costs for passenger transport decreased greatly

Table 6 Operating Profit and Loss of Railway Operations Before and After Stopping Freight Transport

(Unit: ¥1000)

Operator	Fiscal year	Railway	Passenger	Freight	Operator	Fiscal year	Railway	Passenger	Freight		
Kashima Railway	2000	Revenue	325,248	260,868	64,380	Heisei Chikuho Railway	2002	Revenue	441,215	371,190	70,025
		Costs	449,925	423,630	26,295			Costs	452,716	419,813	32,903
		Profit/loss	-124,677	-162,761	38,084			Profit/loss	-11,501	-48,623	37,122
	2002	Revenue	236,587	236,587	0		2004	Revenue	337,701	337,701	0
		Costs	338,963	338,963	0			Costs	409,361	409,361	0
		Profit/loss	-102,376	-102,376	0			Profit/loss	-71,660	-71,660	0
	Increase/decrease	Revenue	-88,661	-24,281	-64,380		Increase/decrease	Revenue	-103,514	-33,489	-70,025
		Costs	-110,962	-84,667	-26,295			Costs	-43,355	-10,452	-32,903
		Profit/loss	22,301	60,385	-38,084			Profit/loss	-60,159	-23,037	-37,122
Kamioka Railway	2003	Revenue	89,795	18,152	71,643	Tarumi Railway	2004	Revenue	215,519	151,107	64,412
		Costs	147,807	104,151	43,656			Costs	311,455	254,700	56,755
		Profit/loss	-58,012	-85,999	27,987			Profit/loss	-95,936	-103,594	7658
	2005	Revenue	20,207	20,207	0		2006	Revenue	181,918	181,918	0
		Costs	89,245	89,245	0			Costs	300,145	300,145	0
		Profit/loss	-69,038	-69,038	0			Profit/loss	-118,227	-118,227	0
	Increase/decrease	Revenue	-69,588	2055	-71,643		Increase/decrease	Revenue	-33,601	30,811	-64,412
		Costs	-58,562	-14,906	-43,656			Costs	-11,310	45,445	-56,755
		Profit/loss	-11,026	16,961	-27,987			Profit/loss	-22,291	-14,633	-7658

Source: Annual *Yearbook of Railway Statistics* and Gifu Third Sector Railway Liaison Conference (2007)

by about ¥85 million. Along with the drop of about ¥26 million in freight operating costs due to stopping freight transport, overall railway operating costs were cut by about ¥111 million, which increased profitability. However, Kashima Railway then got out of the railway business altogether.

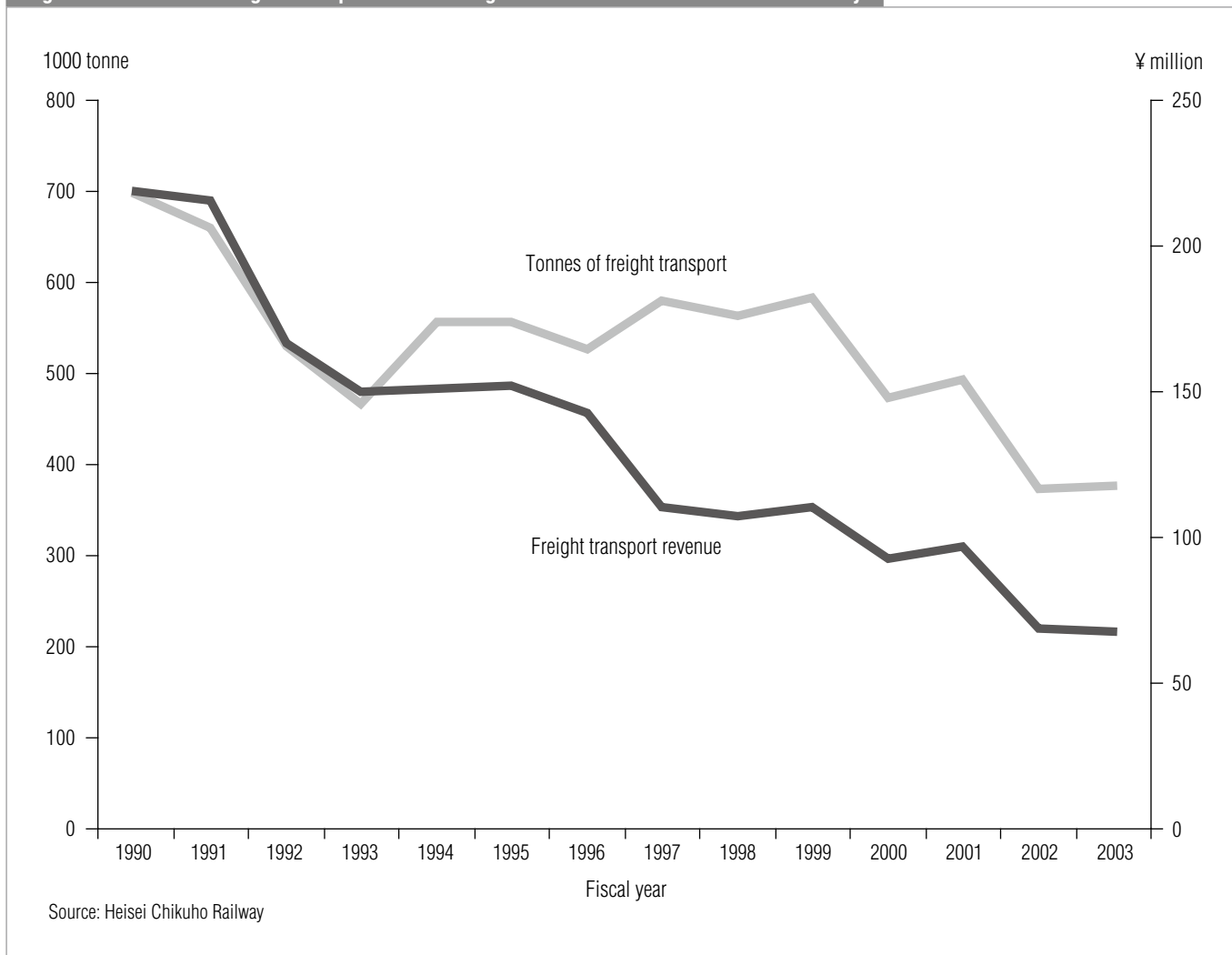
After stopping freight transport, the other three operators saw worsening profitability due to the larger decreases in freight operating revenue than in overall railway operating costs. At these operators, freight transport seems to have at least secured enough revenue to cover avoidable costs. Ponsonby (1963) reviewed in Okano (1980), call services that do not cover avoidable costs as unremunerative services. A large percentage of Kamioka Railway's operations was freight transport (Tables 4 and 5) so it could not easily sustain railway

operations when freight transport stopped and consequently withdrew from railway operations altogether.

Significance of Freight Transport and Future Issues

As experienced by most other regional railways, the volume of passenger transport by passenger/freight railways is tending to decline. However, the volume of freight transport by operators still carrying freight is either mostly stable or declining slightly less than passenger transport. As shown by the estimated separate operating profits and losses for passenger and freight transport, and by the worsening profitability of most railway operations after stopping freight

Figure 1 Tonnes of Freight Transported and Freight Revenue of Heisei Chikuho Railway



transport, freight transport plays some role in supporting railway business and stabilizing business conditions. However, there are other issues in continuing operation of passenger/freight railways.

First, even if freight posts operating profits, this does not necessarily mean that railway operations as a whole post operating profits. Although passenger transport needs every possible business improvement, no matter how small, large increases in passenger volumes cannot be expected. Meanwhile, operators are all making major cost reductions, so further reductions become increasingly difficult (Asai 2006). As a result there is little chance of improved profitability for passenger transport. Even if freight transport continues, some public funding will still be necessary to sustain railway operations.

The reason for retaining railway operations using public funds is to secure transport for trackside residents, especially for those with restricted mobility. Consequently, public funding should compensate for all passenger transport losses; compensation for operations that include freight

profits is inappropriate because it is cross-subsidized by freight operation, which is not the purpose of public help. Cross subsidies here mean the public sector is bearing only one part of funding required to accomplish the policy objective of securing transport for trackside residents while another part of that funding is borne by the freight shipper (who is not concerned with the policy objective). Chujo (1988) discusses the inefficiency of cross subsidies in detail.

Second, passenger/freight railways often rely heavily on specific freight shipper, so the operator's freight business and overall railway business are greatly affected by trends in the shipper's business and demands. Even if the passenger/freight railway secures a steady volume of freight, sometimes it may be forced to cut rates at the shipper's demand and due to competition with truck transport, resulting in a drop in operating revenues.

Figure 1 shows the tonnes of freight carried by Heisei Chikuho Railway and its freight revenue from FY1990 to FY2003 when it stopped carrying freight. In FY1993, it carried about 470,000 tonnes, increasing to about 580,000 tonnes in

FY1997. However, freight revenue declined from ¥150 million to ¥110 million between those FYs. The type of freight did not change, so falling freight rates caused the decline.

It is unlikely that there would be other shippers with large freight volumes on the same line, making it difficult to remove the 'captive' railway's situation. If the shipper switched to trucks, it is quite possible that the railway business becomes unstable and its continuation becomes difficult.

Even when a shipper expresses an inclination to switch to trucks, the public sector should act to have the shipper continue using railways in consideration of logistics policy. Many passenger/freight railways carry either bulk products such as limestone or cement, or hazardous products such as chemicals and petroleum. Switching to trucks increases environmental burdens and decreases safety. As an example, Tarumi Railway and Kamioka Railway are both third sector railways; one reason for Tarumi Railway taking over the former JNR Tarumi Line was because the switch to truck transport would cause traffic pollution. Similarly, Kamioka Railway took over the former JNR Kamioka Line because the main freight transport was sulphuric acid, which is a hazardous road cargo (Gifu Third Sector Railway Liaison Conference (2007)). However, both railways have since stopped freight transport.

One reason why freight shippers switch to truck transport is the age of their freight wagons, sidings and other infrastructure. If a shipper cannot upgrade these assets using its own funds, social-benefit arguments offer some rationale for the public sector financing upgrade funds for shippers. ■

Further Reading

- Aoki, E. Roles and significances of private-sector freight railways, *The Railway Pictorial* Vol. 53, No. 11, 2003: pp 10–20
- Aoki, E. Limestone and Cement in Japan and Railways, Aoki, E. ed. *Japan's Regional Private Railways and Regional Society*, Kokon Shoin, 2006: pp 64–86
- Aoki, E. Issues of Postwar Regional Railways, *Transportation and Economy* Vol. 68, No. 3, 2008: pp 41–50
- Asai, K. Is there a Future for Local Lines?, *Study of Regional Railways and Streetcars*, Kotsushimbunsha, 2004
- Asai, K. Recent Regional Railway Trends, Asai, K. ed. *Editorial: Regional Transport*, Kotsushimbunsha, 2006: pp 16–47
- Chujo, U. Injustice of Participation Regulation + Cross Subsidization System, *1987 Annual Report on Transportation Economics*, 1988: pp 15–28
- Fukuda, S. *Public Transport in Rural Areas: Investigation into Sustainable Maintain Policies*, Hakuto Shobo, 2005
- Kagawa, M. *Third Sector Railways (revised edition)*, Seizando Shoten, 2002
- Kawashima, R. *Study of Japanese Railway Conditions: Northern Nagoya/Gifu Edition (2)*, Soshisha, 1998
- Kawashima, R. *Study of Japanese Railway Conditions: Northern Tokyo/Saitama Edition (2)*, Soshisha, 2003
- Kawashima, R. *Study of Japanese Railway Conditions: Joban Edition*, Soshisha, 2004
- Kawashima, R. *Study of Japanese Railway Conditions: Kyushu Edition (2)*, Soshisha, 2007a

- Kawashima, R. *Study of Japanese Railway Conditions: Chugoku Edition (1)*, Soshisha, 2007b
- Okano, Y. Negative earnings and cross-subsidisation, *Journal of Economic Studies*, The University of Tokyo Vol. 46, No. 1, 1980: pp 2–10
- Ponsonby, G. J. What is an Unremunerative Transport Service?, *Institute of Transport Journal* Vol. 30, No. 3, 1963: pp 90–94
- Suzuki, F. Third Sector Railways: Issues in Self-Sustainability, *Railway Journal* Vol. 33, No. 8, 1999: pp 67–76
- Suzuki, F. The Struggle of Sanriku Railway: Reality of the Switch to Third Sector, *Railway Journal* Vol. 38, No. 8, 2004: pp 14–23
- Suzuki, F. Regional Railway Report 29: Gakunan Railway, *Railway Journal* Vol. 40, No. 9, 2006a: pp 84–91
- Suzuki, F. Regional Railway Report 30: Tarumi Railway, *Railway Journal* Vol. 40, No. 10, 2006b: pp 82–89
- Suzuki, F. Regional Railway Report 31: Kamioka Railway, *Railway Journal* Vol. 40, No. 11, 2006c: pp 86–93
- Takashima, S. Status of Ten Coastal Railways, *The Railway Pictorial* Vol. 53, No. 11, 2003: pp 56–69
- Tanemura, N. Heisei Chikuho Railway in Search of a Path to Survival: Shades on the Third Sector Honor Roll, *Railway Journal* Vol. 33, No. 8, 1999: pp 32–43
- Terada, H. *Japan's Local Private Railways 2000*, Neko Publishing, 2000
- Yokkaichi University and Sangi Railway. *Role of Regional Railways in Community Revitalization: The Case of Sangi Railway*, Kotsushimbunsha, 2008
- Overview of Third Sector Railways in Gifu Prefecture (2007 edition)*, Gifu Third Sector Railway Liaison Conference, 2007
- Railway Bureau of the Ministry of Land, Infrastructure, Transport and Tourism. *Yearbook of Railway Statistics* annual editions, Government Data Research Center of Japan



Seiji Fukuda

Dr Seiji Fukuda is an associate professor in the Faculty of Commercial Science at Seinan Gakuin University. Prior to his current position, he was a lecturer at Ritsumeikan University, Osaka University of Economics, Kansai University, and Meiji University. His major publications are *Public Transport in Rural Areas: Investigation into Sustainable Maintain Policies*, Hakuto Shobo, 2005, *The Coastal Railways: their Situations and Perspectives*, *Journal of Prize Winners for Encouragement of Rail Freight*, 2006, and *Cable Cars: the Significance in Tourism*, *Journal of Public Utility Economics*, 2008.