Feature

Cooperative Benchmarking between the Dutch and Japanese Railways

Donald Hatch

Celebrating 400 years of Dutch–Japanese Contact

April 2000 marked the 400th anniversary of the arrival on Kyushu (southernmost of the four major Japanese islands) of the Dutch trading ship 'De Liefde' ('Love') after a perilous voyage of more than 2 years (see p. 17). Dutch presence on the tiny island of Dejima (Nagasaki) was the only contact with the western world that Japan tolerated until the Meiji Restoration of 1868. Fortunately, Japan and the Netherlands now cooperate in many fields, one of which is that of transport and railways.

In October 1997, JR Kyushu, which operates the trunk railway network on the south-western island of Kyushu, and NS Reizigers (NSR—Dutch passenger railways) agreed on a programme of cooperation. Both companies realized that a great deal was to be learnt from comparing performance and exchanging expertise and know-how. To date, this has taken the form of study tours for railway staff, press and government officials, and seminars on topics of mutual interest such as punctuality and marketing. An in-depth comparative study of the two companies has been undertaken, and JR Kyushu has contributed to an on-going international benchmarking exercise to compare performance and learn lessons from differences. The benchmarking will enable NSR to agree realistic performance targets in the contract with the government for services on the Dutch trunk network. At the instigation of Yoshitaka Ishii, chairman of JR Kyushu, a commemorative month-long once-only 'rail-cruise' train journey from The Hague (Den Haag) in the Netherlands to Nagasaki in Kyushu will be operated in September 2000 by the two railway companies. Thanks are also due to him and many of his colleagues for cooperating in the comparative analysis and benchmarking research which form the basis for this article.

Similarities and Differences in Transport Environment

Geography and demography

At first sight, it seems unlikely that two railways in such very different countries have much in common. Although the cultural differences are large, the two countries (Kyushu is referred to here as a 'country') and railways are however remarkably similar in size and characteristics (Fig. 1).

The island of Kyushu is approximately the size of the Netherlands (about 42,000 km^2), but with slightly fewer people (13.5 against 15.5 million). Each country has two conurbations with just over one million inhabitants (Fukuoka and Kita Kyushu; Amsterdam and Rotterdam), and the 15 largest cities represent about 40% of the total population in each country. Just as the Netherlands has its *Randstad* ('Ringcity') with a concentration of population round the Amsterdam/The Hague/Rotterdam/Utrecht ring, so is the main concentration of population on Kyushu in the 100- km wide north-Kyushu area bounded by Kita Kyushu, Fukuoka and Iizuka. Due to the mountainous interior, Kyushu's population is a little more concentrated than in the Netherlands; most roads and railways follow the coast, where most of the population is to be found. In the Netherlands, the cities are mainly inland and more evenly distributed.

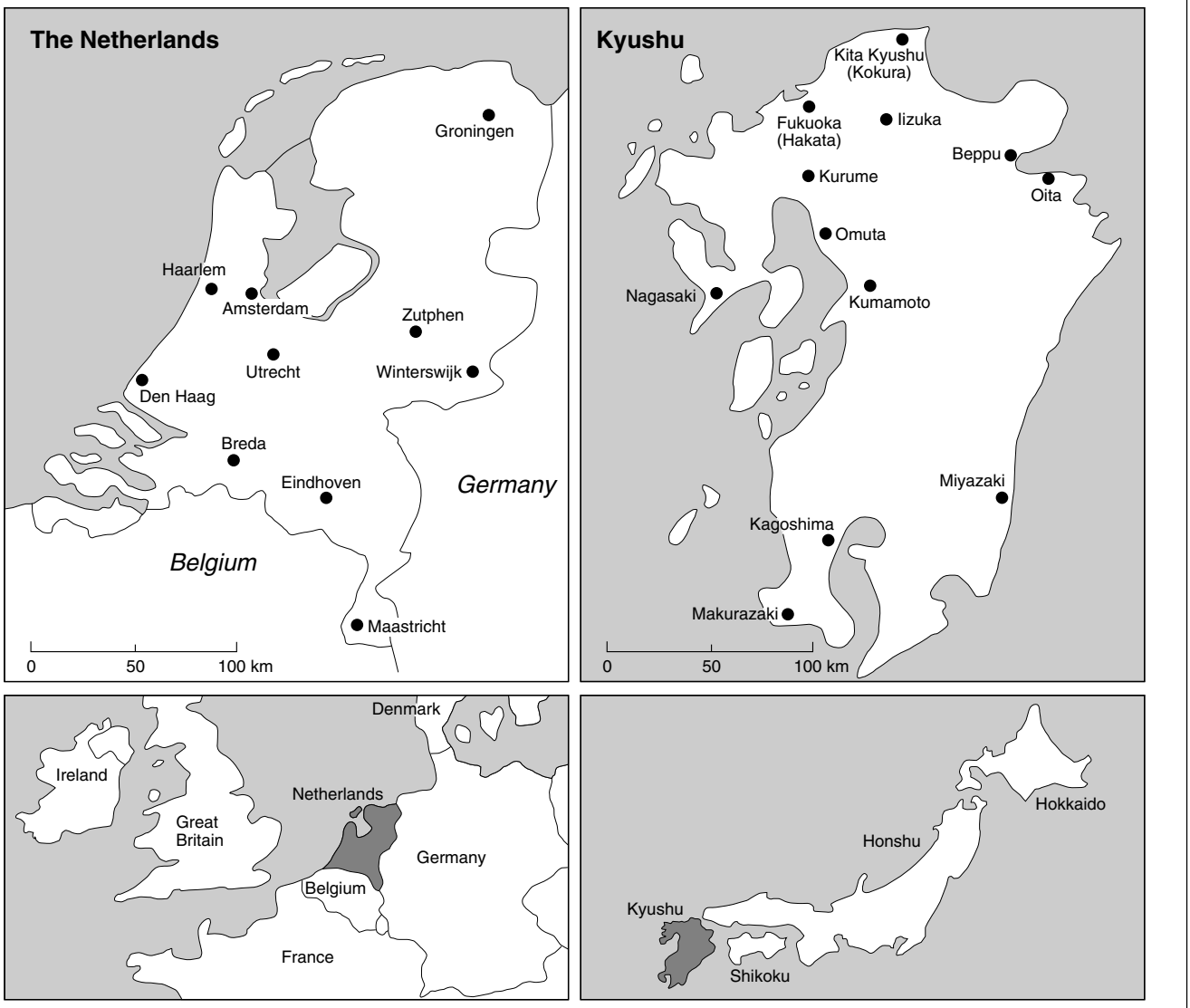
Transport infrastructure

As far as transport infrastructure is concerned, the Dutch trunk rail and road (motorway) networks are approximately similar, both in length (rail ± 1600 km, excluding 1000 km of local lines, and road 2200 km) and location. Nearly all of the 20 largest cities have direct road and rail links with the rest of the country. Journey times between city centres, both by car and train, are comparable, with average speeds of about 80 km/h being achieved. Public transport in the cities is well developed, with metro and/or tram

NSR Double-deck intercity EMU stock (Regio-runner) (NSR)

NSR Single-deck intercity EMU stock (Koploper) (NSR)

Figure 1 The Netherlands and Kyushu on the Same Scale



networks in the 4 main cities.

On Kyushu, the (toll) motorway network is limited to about 700 km, with routes between Kita Kyushu, Fukuoka and Kagoshima/Miyazaki and between Nagasaki and Oita. The major cities have metro or tram networks (Fukuoka with a metro, Kita Kyushu with a monorail, Nagasaki, Kumamoto and Kagoshima for example with trams). JR Kyushu runs the main rail network of 2100 km, but there are other operators, the largest being Nishitetsu (Nishi-Nippon Railroad), with 120 km of competing rail lines between Fukuoka and Omuta, and in the suburban Fukuoka/Kita Kyushu areas. The remainder of the private railways amount to about 420 km, mainly low volume local and rural feeder lines.

Compared to the Netherlands with one major airport and very little domestic air traffic, Kyushu has a number of airports, mainly for flights to the rest of Japan. Fukuoka's airport is close to the city and well linked by a direct metro, and Miyazaki's airport is linked by a new rail line (5 minutes). Most of the other airports, e.g. at Nagasaki, Kagoshima and Oita, are however inconveniently located 25 to 40 km from the cities (*JRTR* 19, pp. 8–19).

A major difference concerns the management of the railway infrastructure. On Kyushu and the rest of Japan, the railway infrastructure is owned, managed and maintained by the railway companies. Access by other operators is only made possible by mutual agreement, and must be authorized by the Minister of Transport. In the Netherlands, as is the case of most European countries, rail infrastructure has been separated from operations according to the European

Table 1 Approximate Passenger Volume and Modal Split, 1998

	Journeys (%)		Passenger-km (%)	
	Kyushu	Netherlands	Kyushu	Netherlands
Car	72	91	78	89
Train* (JRK or NSR)	6	4	9	8
Train (private)	6		3	
Bus*	15	5	9	3
Air	<1	<1	<1	<1
Ferries to islands	1	<1	1	<1
Total	100	100	100	100
Passenger volume (billions)	5.5	10.4	96	166
Per head of population	410	670	7,100	10,700

*Metro included under train for Kyushu, under bus for Netherlands

JR Kyushu *Sonic Nichirin* 883 (JR Kyushu)

Union's 91/440 Directive. This policy was designed to encourage access by other, competitive, operators paying fair access charges based on clearly defined infrastructure costs. The practical implications are still being dealt with, and the infrastructure in the Netherlands will only become the direct responsibility of a government agency in 2001. NSR started paying access charges, initially a limited contribution to marginal costs, in January 2000.

Modal split

The Japanese are on average less mobile than the Dutch. On Kyushu, the average annual distance travelled is 7100 km, compared to 10,700 km in the Netherlands. Although car ownership on Kyushu is similar to that in the Netherlands (5.0 million cars compared to 5.7 million), car usage is relatively low; cars in Japan run on average 10,000 km per year compared with 16,000 km in the Netherlands. This may be explained by the strength of rail in short distance suburban commuting, and the high tolls payable on the island's limited motorway network. Journey times by car are even longer and more tedious than in the Netherlands if motorways are not used. Although petrol is cheap[1] by Dutch standards (± Euro 0.85 per liter in Japan compared to Euro 1.05 in the Netherlands), parking in cities is expensive and limited, and the motorway toll of Euro 0.19 per km amounts to a considerable variable cost. Modal split on Kyushu and in the Netherlands is shown in Table 1.

Price/Quality comparisons by mode

Travel times by car and train for comparable middle distance city centre to city centre journeys are slightly quicker by train than by car both on Kyushu and in the Netherlands. Air travel halves the 4 hour Fukuoka–Kagoshima railway trip, while the express bus is as fast as rail. Bus and air competition do not feature in the Netherlands for domestic journeys.

On Kyushu, the price per km including road tolls and rail supplements such as express surcharges, are Euro 0.25 for car, 0.22 for rail and 0.14 for bus. In the Netherlands, the comparative prices are 0.10 car and 0.13 rail, reflecting the toll-free motorways and significant taper in longer distance rail fares.

Journey motive and distribution by time

There are differences between Kyushu and the Netherlands in the motives for travel, particularly as a result of the large leisure traffic flows in the Netherlands, linked to visiting friends and relatives, recreation, etc. This is partly a result of the relatively large amounts of leisure time that the Dutch have compared to the Japanese; (days off work Japan ± 15 to 25, Netherlands ± 30 to 40, excluding however public holidays, of which there

are more in Japan). Commuter flows in Japan are a relatively larger share of total traffic, especially for the railways.

Company Comparison JR Kyushu and NSR

Business profile

JR Kyushu was created when the Japanese National Railways (JNR) were 'privatized' (split into corporate entities) in 1987. 13 lines with large losses were replaced by bus services before JR Kyushu was established, and 2 were taken over by third parties with once-off funding of Euro 250,000 per route km. NSR was created as an NS subsidiary in 1994 to operate passenger services. Other NS subsidiaries manage rolling stock, stations and real estate, while freight traffic has been merged with that of the German railways, and the responsibility for the development, maintenance and allocation of infrastructure capacity will be fully in the hands of government agencies by 2001. Government policy in the Netherlands is to tender out rail services that are not deemed part of the trunk network, while the services on this have been granted to NSR in an exclusive 10-year concession to be regulated by a performance contract.

In addition, there are about 900,000 passenger journeys per day in Kyushu on the private railways and metros (Table 2), amounting to about 3000 million passenger-km. In the Netherlands, the figure for private railways is negligible; the single private operator Lovers Rail closed down during 1999 (see article by Didier van de Velde on pp. 10–16), although regional operators are beginning to take over some local lines.

JR Kyushu's policies since its creation have been to reduce costs, (particularly those for labour), improve product quality, and diversify business in preparation for sale of shares in the company, currently planned for 2001. The first few years were spent in improving the quantity and quality of train services, which has successfully reversed the downward trend of traffic, and absorbing the considerable overmanning inherited from JNR, partly by diversifying the business. Recent improvements include the introduction of faster services on the Hakata (Fukuoka)–Kokura–Oita route (*Sonic Nichirin* trains with tilt), new rolling stock for other routes, and improvements to track, stations and traffic control. In recent years, JR Kyushu has expanded into other businesses than the rail, bus and ferry services. With interests in hotels, shops, leisure complexes, etc., a much larger share of its total turnover is now non-rail compared with the situation in 1987.

A comparative measure of how efficiently the railways both utilize track capacity, and generate passenger traffic is given in a comparison of the number of passenger-km per route-km of track. Figure 2 illustrates that NSR performs extremely well on this aspect, but that JR Kyushu also scores better than nearly every other European railway.

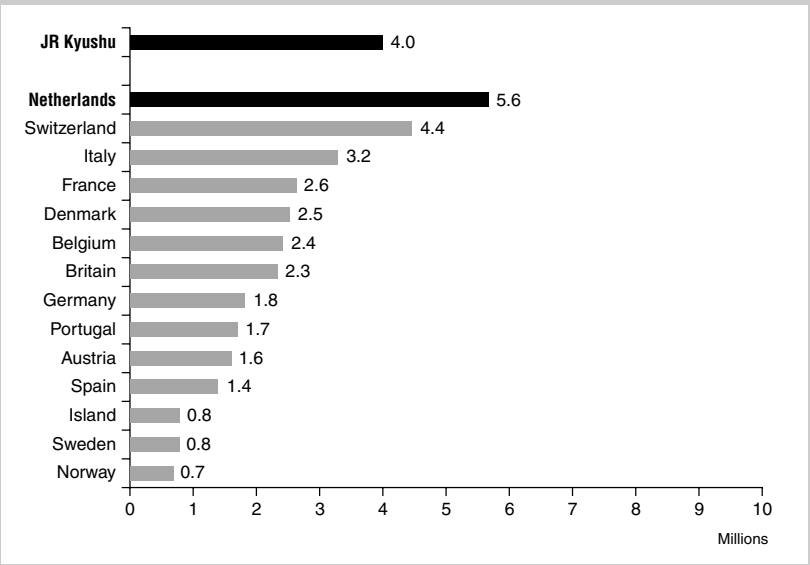
As a response to the current debate in the

Table 2 Key Traffic Statistics, 1998

	JR Kyushu	NSR
Number of passenger journeys per day (1000)	840	880
Passenger-km (million)	8,280	14,880
No. of trains operated per day	2,632	4,918
Average length of journey (km)	27	46
Passenger-km per route-km (1000)	3,940	5,780
Rail journeys per head of population*	23	21

*Excludes metros, and private rail companies (±25 on Kyushu, ±10 in Netherlands)

Figure 2 Passenger Kilometers per Route-km, 1997



Source: Analysis of UIC and company data, 1997

Netherlands on the future of the rail industry, which now suggests that privatization is not a short-term objective, and the political desire to tender operations on local lines and also on the high speed line, (Amsterdam–Rotterdam–Antwerp–Brussels, due for completion in 2005), NSR recently launched its 'Destination: customer' programme designed to justify the government's decision to award the company a 10-year concession to be sole operator of trains on the trunk network. Aims of the programme are to improve quality and customer satisfaction, leading to growth in peak hour rail traffic to help solve road traffic congestion. NSR also aims to have staff that are proud to work for the company, and is looking to learn from Japan how to become the 'best run railway' in Europe.

Employment

Railways are not only capital intensive, but also very labour intensive, so improvements in efficiency are correlated with manpower reductions. One of the main causes of the enormous losses that led to the end of JNR was the tremendous overmanning in the 1970s and 1980s, caused in part by taking on ex-military at the end of the war. Staff numbers began in fact to fall dramatically well before the splitting up of JNR in 1987 (Table 3).

Table 3 Employment at JR Kyushu and NS

	JR Kyushu	NS (total)
1970	49,500	n.a.
1975	43,900	27,630
1980	40,700	27,410
1985	29,700	27,300
1987	15,000	27,390
1990	14,180	27,560
1995	13,750	29,250
1998	12,570	28,480

These totals include infrastructure, and non-rail subsidiaries, with part-timers corrected to full time basis; there is a trend break in the NS figures between 1990 and 1995. There was a further fall in employment at JR Kyushu to 11,900 in 1999, the reductions being achieved by natural wastage and redeployment. The total numbers employed at NS has proved very resilient, in spite of a number of campaigns to reduce staff overhead.

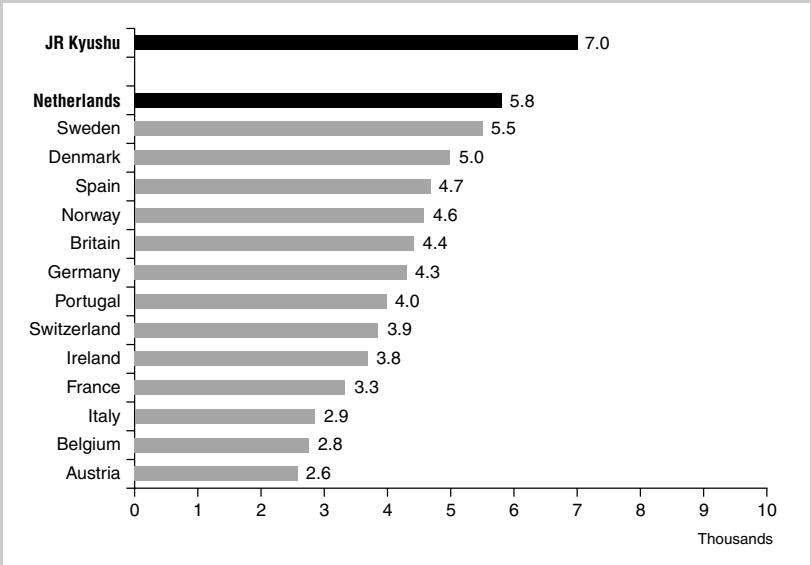
Comparisons of staffing can only be approximate due to, for example, differences in definitions, the contracting out of activities and the degree to which workers are part time, but based on a 'best estimate' of the number of full time equivalent staff needed to run the railway, and excluding those involved in the maintenance of infrastructure and in freight operations (JR Kyushu has none), the total figures suggest that NS has about double the number of JR Kyushu. One of the many possible measures to compare efficiency between railways is the number of train kilometers run per employee. Figure 3 illustrates the relative efficiency of both JR Kyushu and NSR, in terms of staff productivity, compared to a number of European railways.

Profit and loss

Neither JR Kyushu's nor NSR's rail businesses cover their total costs if the infrastructure is included. It was realized when JNR was split up in 1987 that rail operations on Kyushu (and also on the other islands Hokkaido and Shikoku) would not cover their costs. A special Management Stabilization Fund (MSF) was set up so that the interest could support these island rail operations. JR Kyushu's capital fund of Yen 3.2 billion yielded Euro 130 million in 1998. Table 4 gives the companies' profit and loss figures for 1998.

It should be noted that NSR is not comparable with JR Kyushu as NSR only started paying for the use of the infrastructure in 2000, with charges rising to about Euro 0.1 billion per annum likely to be made as a contribution to the total marginal costs, estimated to be about Euro 0.2 billion for maintenance, repair and

Figure 3 Passenger Train Kilometers per Employee



Source: Analysis of UIC and company data, 1997

Table 4 Rail Operations Profit and Loss, 1998

(Euro billion)

	JR Kyushu	NSR
Railway operating income	1.02	1.10
Other transport income	0.31	0.13
Operating costs, (NSR excl. infrastructure)	1.43	1.11
Net income	-0.11	0.12
MSF income/subsidy*	0.14	0.05
Net result	0.03	0.17

* JR Kyushu : mainly Management Stabilization Fund (Euro 0.13 billion)
NSR : government grant for loss-making lines

replacement alone. A similar sum is required by JR Kyushu to maintain its infrastructure, and this is included under 'Operating costs' in Table 4.

Rail operations

JR Kyushu has a narrow gauge (1067 mm) network of which only half is electrified (NSR 75%) and a quarter double track (NSR two-thirds). It has a great many stations—currently 569, (NSR 375)—with stations, even on the longer routes, every few km, where only local trains stop.

Kyushu's passenger timetable features frequent (hourly or half-hourly) services on the main routes Hakata (Fukuoka) to Kagoshima, Miyazaki and Nagasaki. On local cross country routes such as Kumamoto–Oita or Kurume–Oita, there are only a few 'limited express' services a day. On the Kumamoto–Oita route for example only 3 trains a day have 11 instead of the 35 stops by local train. The timetable on twisting coastal routes such as Kagoshima–Makurazaki in the far south is, partly as a result of single line working, irregular, slow and infrequent. The 88 km (45 km by road) take 2 hrs 30 mins with 35 stops. On NSR's quietest routes, at least an hourly ('*boemel*') service is offered every day of the week at a reasonable speed; e.g. Zutphen–Winterswijk (now tendered to a regional operator) 45 km in 38 mins with 4 stops. In most cases the services are half-hourly.

A major difference concerns to what extent the railway is operated as a network. NSR, with its interlocking connecting services, physical coupling of trains, and network of heavily trafficked main routes with frequent express, fast and local services, represents much more of a network than JR Kyushu where most lines are operated as separate entities, although the timetable is designed to provide connections. There is little through running, and the rolling stock is dedicated to each line. The degree of single-tracking, the reliability of connections, and the number of lightly trafficked routes justify this approach.

Competition

One of JR Kyushu's main competitors is Nishitetsu, operating three rail lines in the Fukuoka area, the main one to Omuta competing, for some passenger journeys, with the JR Kyushu Kagoshima main line. Frequencies are similar, but the JR Kyushu train is faster, which is reflected in the 25% higher fare. Nishitetsu is also Japan's largest bus operator, with intercity (night) services to major destinations on Honshu and day services to major cities on Kyushu. In addition, Nishitetsu operates local bus services in greater Fukuoka.

In the Netherlands, an experiment with direct competition on the railway with services operated by Lovers Rail between Amsterdam and Haarlem was a failure, with the Lovers trains attracting little more than a handful of passengers. The Ministry of Transport has started to competitively tender a number of local routes outside the trunk network, upon which NSR has a 10-year concession to operate services. There are at present plans to open operations on the future Dutch HSL to competitive tender, and bids are expected this year from a number of international consortia, as well as from NSR. Such tendering has not been used for any lines in Japan, and is therefore not contemplated in the case of the Kyushu Shinkansen.

Prices

JR Kyushu's rail fares are fairly simple in structure at about Euro 0.15 per km for a journey of 100 km, (NSR Euro 0.12). Both have degression, a reduction in price per km, by distance. Monthly commuter passes, which represent about 95% of peak hour flows, are at about the price of 13–15 returns. For non-commuting longer distance traffic, the use of express trains requires a substantial supplement. JR Kyushu has various kinds of discounted tickets for all passengers including tickets targeted at specific groups based on age, motive or time of travel. There is limited promotion of off-peak services with for example the 'Nice going card' for Euro 4 per year which gives 40% discount on longer distance weekend train travel by young people.

NSR prices have a substantial degression by distance, with a maximum fare for return journeys over about 220 km of Euro 33. In addition, passengers can save 40% on off peak journeys using the off-peak discount card (Euro 45 per year). All students over 18 years have an annual free pass for all public transport in the Netherlands. All other forms of public transport, including certain urban NSR lines, are paid for by using a simple

national 'trip-ticket' zonal system.
Fares on JR Kyushu have scarcely risen since 1987; the average revenue staying at about Euro 0.13. NSR has raised fares in recent years only at the rate of inflation; between 1992 and 1994, fares rose annually about 4% faster than inflation.

Product development —high speed line (shinkansen)

Both JR Kyushu and NSR see the completion of the extension of existing HSL routes as fundamental to their future success. The planned construction of the Kyushu Shinkansen, extending the existing San'yo Shinkansen onwards from Hakata (Fukuoka) to Kagoshima with 9 intermediate stations, dates from the early 1970s. However, all the planned nation-wide extensions were frozen after the opening of the Tohoku and Joetsu shinkansen in 1985, because of JNR's great financial difficulties and the implementation of the JNR reform itself. Construction of the Kyushu Shinkansen restarted in 1991 on the southern section of a revised scheme, but the predicted traffic flows are light and construction costs high compared to the early shinkansen lines. Completion of the whole line is not expected before 2010. Traffic flows to Kagoshima will be augmented by services to the other 9 stations serving cities of 100,000 people or more; a complicated train schedule with splitting and combining of trains, and different stopping patterns will be needed to keep average speeds high and provide enough capacity given the short distances between some stations. With standard gauge shinkansen operation, journey time from Hakata (Fukuoka) to Kagoshima will fall from 225 to 80 minutes.
The financing is 2/3 national government and 1/3 local; JR Kyushu will not be burdened with the financing of the line but will pay an access charge based not on the construction costs but on a forecast of the long term benefits the line creates for JR Kyushu (extra revenue less extra operating costs). JR Kyushu will pay for normal maintenance out of its own cash-flow. The line is owned by a government agency (Japan Railway Construction Public Corporation) and no third parties will be allowed access to the line.
In the Netherlands, the planned HSL from Amsterdam/Schiphol airport to Antwerp linking with the Brussels–Paris/London routes will also provide extra capacity for accelerated domestic train services running off the HSL to destinations on conventional lines, for example, from Amsterdam via Breda to Eindhoven. Open tendering of both construction of, and services on the new line is planned by the government, with a positive contribution expected to cover at least part of the government funded construction costs. NSR will compete with more than ten other companies for the concession. Its bid will include the operation of an integrated pattern of both domestic and international services running from the HSL onto other parts of the trunk network.

JR Kyushu *Tsubame* (Swallow) crossing bridge near Kurume Station on Kagoshima main line (JR Kyushu)

Punctuality

Although there are many factors which influence the choice of mode, and the level of satisfaction with a rail journey, the punctuality of trains and the related extent to which connections are made are universally regarded as of paramount importance. The Japanese railways are famous for their punctuality, which is achieved in spite of tremendous traffic flows on some lines, limited infrastructure (single track working for example) and considerable problems with the environment (heavy rains and landslides, earthquakes, etc.).
JR Kyushu achieved an average delay on arrival for all trains in 1997, a relatively poor year, of 36 seconds, approximately equal to 95% of trains arriving within 3 minutes of schedule. NSR recorded an average delay in 1997 of about 90 seconds, i.e. only about 85% of trains arriving within 3 minutes of schedule. Improving train punctuality is at present the most important concern for NSR management. The short term target is 90% of trains arriving within 3 minutes, and some success has been achieved, with 87% of trains arriving within 3 minutes in 1999. Punctuality will be one of the items in the performance contract to be signed

with the government, and international comparisons will form part of the basis for the benchmark. In spite of NSR Management's concern about punctuality, surveys reveal that only about 17% of Dutch rail passengers are dissatisfied or very dissatisfied on this point, and in fact Dutch rail punctuality compares well with most other European railways, only the Swiss Federal Railways having a better record.

JR Kyushu is also determined to improve punctuality in spite of its good record, since Japanese customers are known to be critical and to expect high levels of quality. Although in November 1998, only 2 to 3% of JR Kyushu's customers were dissatisfied or very dissatisfied with punctuality, almost 20% gave no more than an 'average'. The level of satisfaction for 'limited express' services was slightly higher than that for local and rapid services.

Understanding the reasons for delays is the first step in improving punctuality, and although JR Kyushu is faced with the same causes of delay as NSR, there are clear reasons why JR Kyushu's trains are more punctual:

- Infrastructure—JR Kyushu has fewer failures of the track, signalling and communications, and fewer unplanned delays caused by late completion of track maintenance work
- Rolling stock—JR Kyushu has rolling stock dedicated to specific lines, duplication of systems and more rigorous maintenance, and more frequent and complete overhauls and replacement of vulnerable spare parts
- Timetabling—JR Kyushu has only a small number of services that run through between the various lines, with most routes served by separate (and independent) train groups using dedicated rolling stock
- Staff motivation—Japan has a national culture that ensures that staff regard punctuality as of paramount importance, and where absenteeism is much less common
- Passengers—Japanese passengers are better disciplined in using public transport, particularly boarding and leaving crowded trains in an orderly manner
- Third parties—JR Kyushu has far fewer suicides and level crossing collisions (in spite of having more crossings), and less vandalism

The enviable level of punctuality at JR Kyushu is coupled with an extremely tight timetable. Recovery time is much less than NSR's 7%. On the 200 km Hakata (Fukuoka)–Oita route, only 2 minutes recovery time are allowed and for this reason, trains rarely if ever arrive early. Infrastructure failures at JR Kyushu cause only about 20 delays of more than 30 minutes annually. (In addition, there are about 150 cases of similar delays caused by 'disasters' such as typhoons, landslides, earthquakes, volcanoes etc., a problem fortunately less prevalent in the Netherlands). The high Dutch level of infrastructure failures and non-availability after planned maintenance are of considerable concern, and there is as yet no evidence that the decision to transfer the infrastructure to government agencies will improve this unsatisfactory situation.

Conclusions

Both NSR and JR Kyushu can learn from the similarities and differences between the two companies. Because of the basic similarities, investigating the major differences is likely to identify practical improvements to our services, and to contribute to our aim of becoming a 'best practice railway'. This goal, which JR Kyushu shares, comprises a high quality of service for passengers at affordable prices, growth in rail traffic to contribute to the nation's mobility problems, motivated staff and a financially stable business outlook. JR Kyushu is also building its marketing capability using some insights into expanding off peak traffic, an area in which NSR has achieved a fair degree of success. We expect therefore our cooperation to be an ongoing one which will continue to bear fruit in the future. ■

(1) There have been considerable fluctuations in the value of the Yen compared to the Euro in recent times. In addition, the purchasing power parity is not reflected by the exchange rate. In this article, we use a rate of Euro 1 = Yen 120, as was the case in October 1999. The purchasing power parity is closer to Euro 1 = Yen 200, i.e. you need on average 200 Yen to purchase what Euro 1 will purchase in Europe. For example, posting a letter in Japan costs Yen 80 (Euro 0.67) against a price in the Netherlands of Euro 0.36; a newspaper is Yen 130 in Japan (Euro 1.10) against a price in the Netherlands of Euro 0.75. Euro 1 = US$0.89, and NLG2.20 (May 2000).

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