

Japanese Railways and Their Outlook: An Environmental Perspective

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Railways are regarded as an environment-friendly transport mode owing to their relatively low external costs, so they are expected to play a further role in protecting the world's environment. In addition to promoting efficiency, some Japanese railways—like overseas railways—have been forced by the drastically changing transport environment in recent years to reform by introducing vertical separation. New technology can be effective in maintaining efficient operation in vertically separated railways.

Current State of Railways in Japan

Japanese National Railways (JNR) was divided and privatized in 1987 and the resultant six passenger railway companies (JRs) owning the rail infrastructure and JR Freight have now been in business for more than 20 years. Due to the good business conditions for railway transport on the

Japanese main island of Honshu (Figure 1), JR East, JR Central and JR West have successfully listed their shares after the privatization. The three other smaller JRs on the islands of Hokkaido, Shikoku, and Kyushu have managed to continue independent operations with some support from a management stabilization fund (*JRTR 50*, pp 6–11).

Along with the JRs, other private passenger railways also play an important transport role in Japan. In 2006, railways held a 29.4% share (passenger-km base) of all transport modes in Japan; this is extremely high in international terms. Non-JR private railways held a 10.9% share and most have also developed as an integrated structure.

In the freight sector, the 1987 JNR reforms resulted in JR Freight paying relatively low access charges (based on avoidable costs) to the passenger JRs owning the infrastructure. This is a mirror reversal of the situation in the USA, where Amtrak started passenger operations over tracks

Figure 1 Comparison of Population Density in Major World Economies

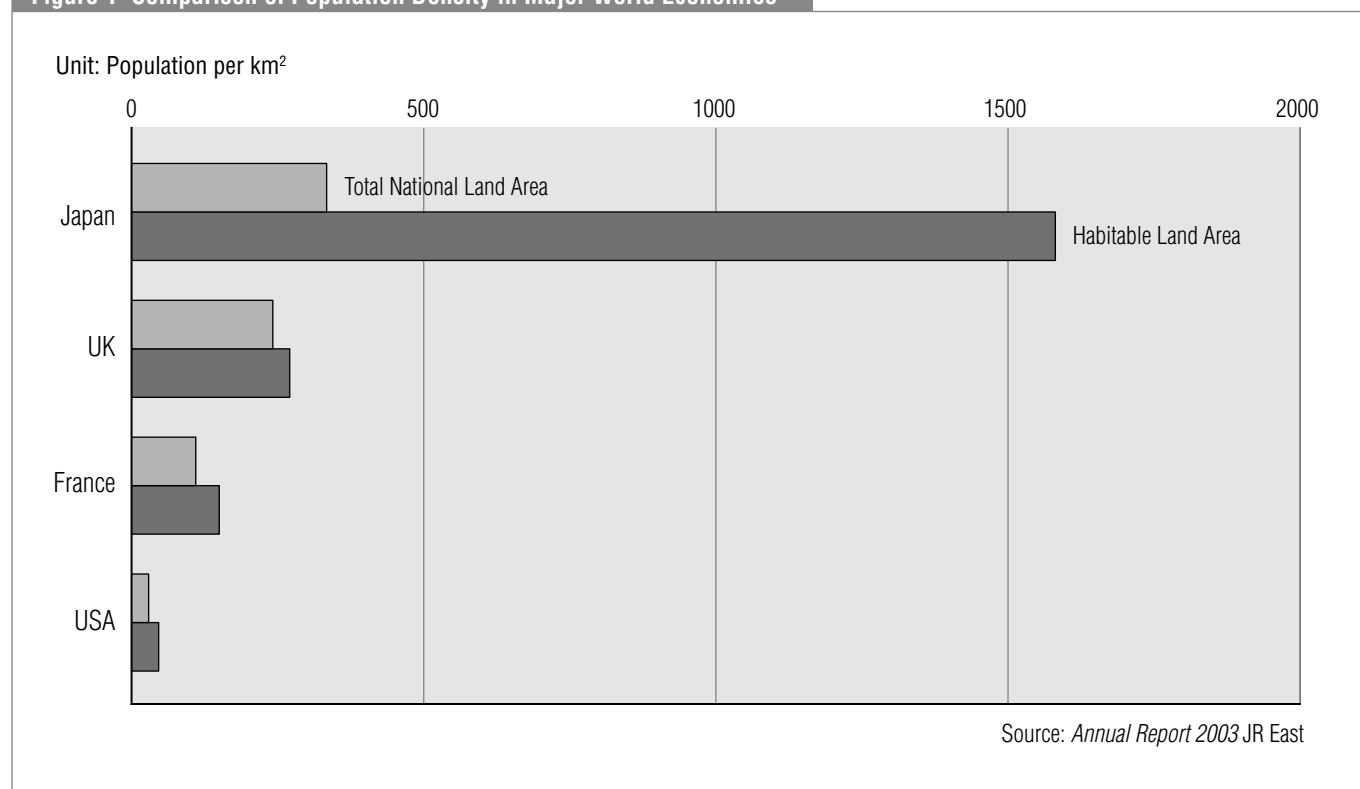
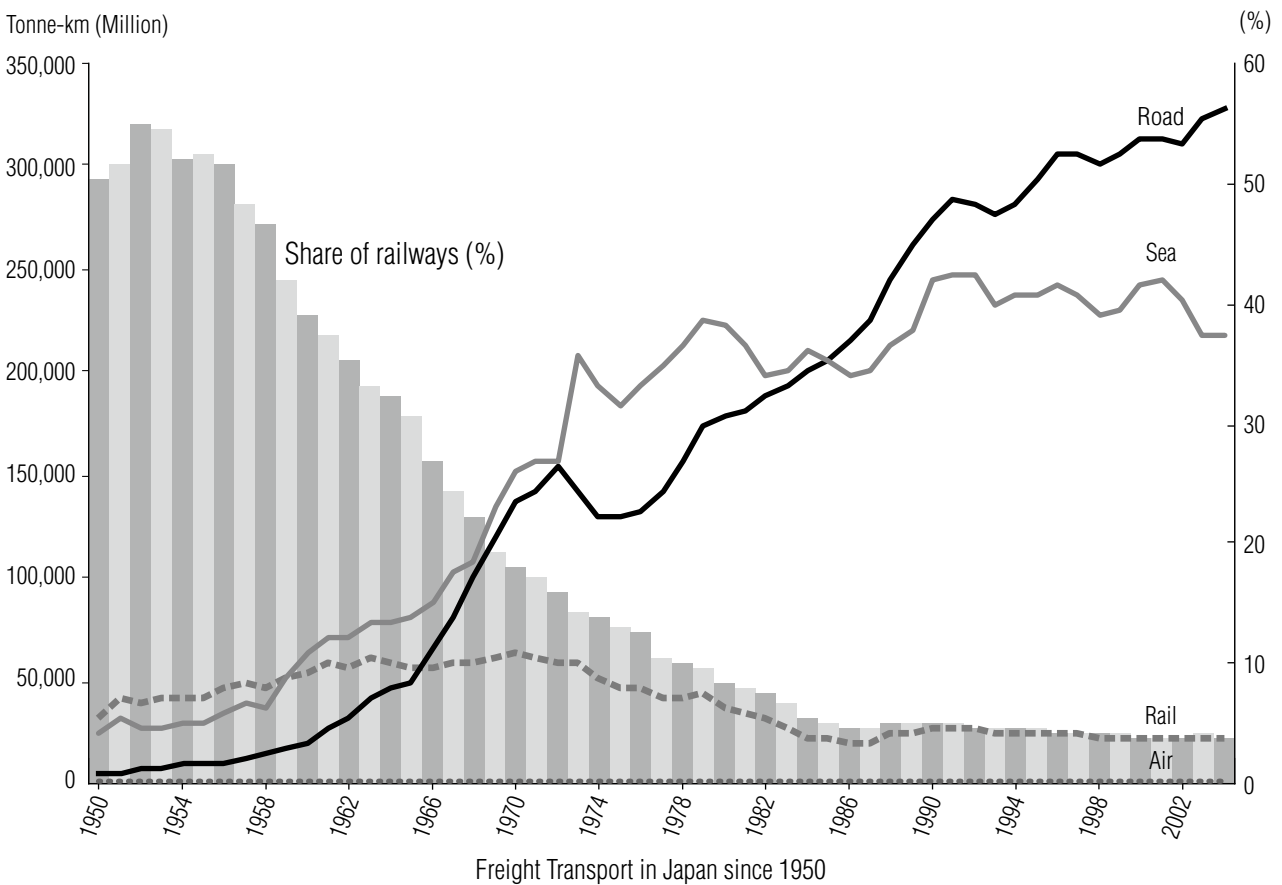
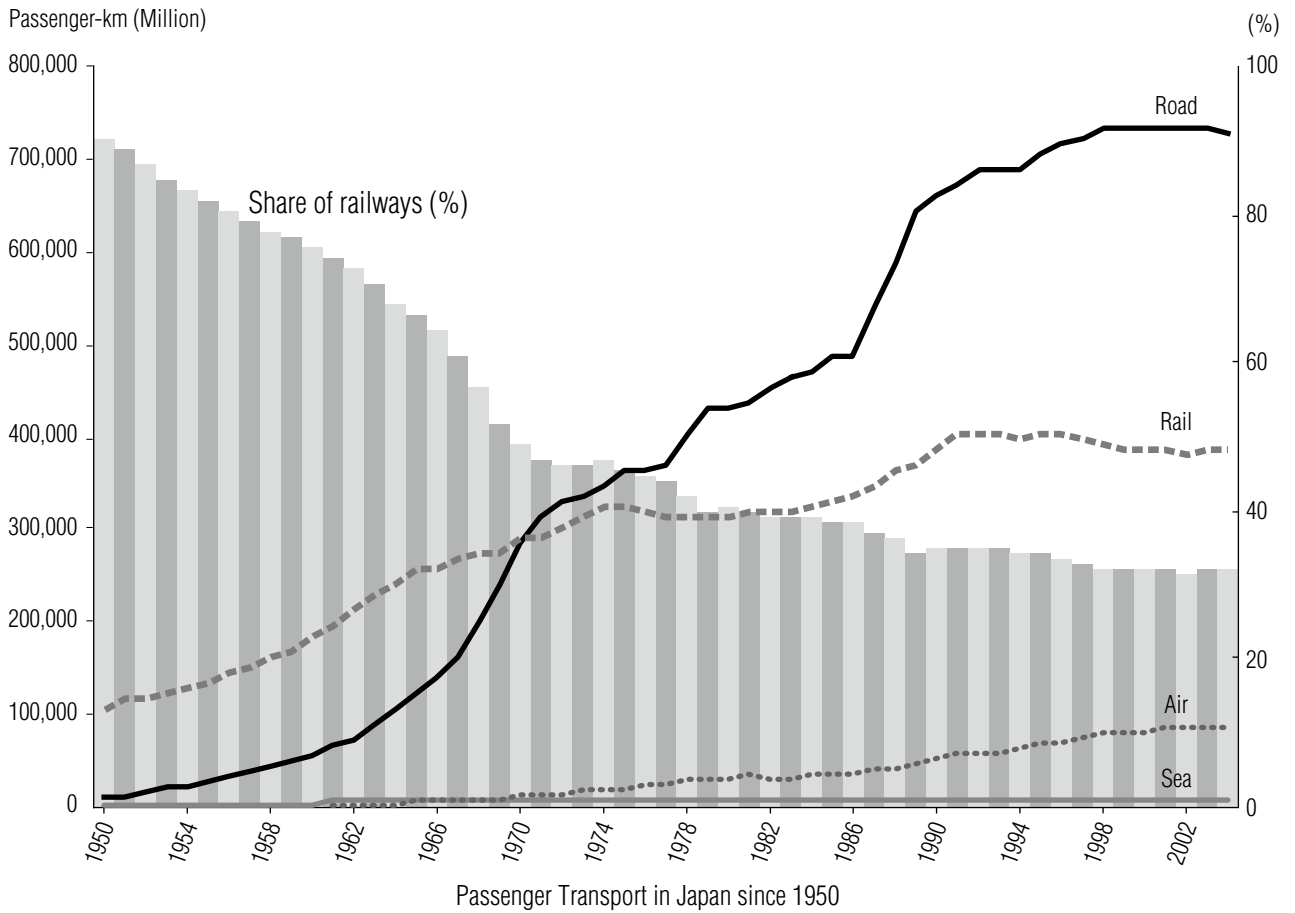


Figure 2 Trends in Passenger (Top) and Freight (Bottom) Transport Volume and Share



owned by freight railways. Following the JNR reforms, JR Freight managed to reverse the long-term decline in rail freight, which had been dropping since the 1960s. However, Japan is an archipelago, so coastal shipping is still very competitive with road and rail, which holds no more than 4% of the domestic total freight market. Like other countries, rail freight and passenger services in Japan face stiff competition with other transport modes, especially roads, causing major environmental issues (Figure 2).

Future Outlook and Changes

Signs of change

As mentioned above, most passenger railways in Japan have retained an integrated structure where they own and maintain their infrastructure. However, with recent changes in the transport market and increased awareness about the environment, some Japanese railways are showing signs of change like overseas railways.

A good first example has been the post-1987 construction of shinkansen using funds from central and local governments where a public institution owns the infrastructure and the JR operating the shinkansen pays a lease, based on the expected benefits to the company.

A second example is the 2005 law for promoting the convenience of urban railways, which aims to enhance the network functions of railways using through-services, as well as to develop and integrate stations with their surroundings. Based on this law, approved urban railway facilities, such as shortcuts between two lines, can be constructed using public funds, even if a private railway takes over operations.

A third example is the recent policy to cope with difficulties in maintaining railway operations in the face of increasing private car ownership and an aging society, which is causing serious business difficulties for many local railways. The 2007 law to support and activate public regional transport considers the change of railways to a vertically separated structure where local government owns the infrastructure. Railways based on any of these three schemes are vertically separated with a different infrastructure owner and railway operator. This means that even in the Japanese passenger transport market with high population density, it is still difficult to secure returns on large-scale construction costs. Furthermore, railways are having difficulties paying maintenance costs for rural infrastructure.

In rail freight, JR Freight runs services over tracks owned by the JRs but finds it difficult to obtain time slots, especially on main and urban lines, where track capacity is limited by the high number of passenger services. Consequently, although there is potential demand for rail, freight transport between major urban areas still relies heavily on road transport using expressways. Certainly, measures are needed to further

develop rail freight, considering the environmental advantages of rail. As an example, a recent proposal suggested using the central reservation of the New Tomei Expressway now under construction between Tokyo and Osaka to build a new freight line. Various issues prevented the success of this proposal and it still seems difficult to establish the optimal rail freight system in Japan.

Further increases in roles of railways from environmental perspective

Although Japanese railways developed with an integrated structure, several have recently introduced vertical separation to develop and sustain transport. In general, this change is regarded as the proper approach to putting railways on an equal footing with other modes and achieve a socially optimum transport system.

In Europe, public funds are commonly used for railway construction and sometimes for maintenance and operation based on social cost-benefit analysis. Accordingly, vertical separation is common in European railways following the 1988 reforms lead by Swedish Railways where track access charges paid by operators cover only 5% of total infrastructure expenses (ECMT, 2005). In addition, public subsidies are paid to unprofitable passenger rail services based on franchise contracts. Owing to the active financial contribution from the public purse and operational efforts by the franchised operators, the recent growth rate of rail transport in Sweden has exceeded that of road transport. Certainly, the situation in Sweden is very different from that in Japan, where railways have largely operated using their own financial resources. However, their experiences offer important lessons for Japan from an environmental perspective.

The role of railways and other public transport modes is becoming increasingly important in Japan to protect the environment and sustain local public transport. As in Europe, there are increasing demands in Japan to use public funds to help the railway sector develop. In Europe, public financing for public transport is raised through taxes on other transport modes with high external costs such as automobiles; this kind of policy could be something that Japan might study. Nash (2007) commented, 'it does appear that preparing the ground for a systematic approach to the provision of rail subsidies on a well-planned basis and in a way which does not compromise efficiency of operation, is a priority for Japan over the coming years.'

Overcoming Issues Caused by Changes

Currently, Japan has seen only slight early signs of change. Nevertheless, as reviewed above, vertical separation is one desirable option that should be introduced more commonly to cope with management difficulties of local railways and

to protect the environment. However, introduction of vertical separation in the railway sector raises new issues too.

More complex infrastructure asset composition

Even in a relatively simple organizational structure where only one passenger railway company performs operations, the composition of assets gradually becomes complex over time because public infrastructure constructed by a (regional) government is utilized and operated by a (private sector) railway. In addition to ordinary maintenance, the operator may invest in the infrastructure as a result of management decisions. For example, if the operator decides to reduce maintenance costs by replacing the original ballast track with slab track, the initial public assets might become replaced by the operator's assets. Accordingly, the asset structure of infrastructure tends to become complex during operation as demonstrated by the British Railways reform using vertical separation in the 1990s. Although there are only a few examples of vertical separation in Japan so far,

similar problems have been identified. Traditionally, railway operators have managed fixed assets using diagrams and ledgers. However, as fixed assets become more complex, they must be managed using digital information systems. Looking at future reforms through vertical separation, digital asset management will be essential in a railway sector sharing complex information between the infrastructure owner (usually a public body) and the operator.

Operational separation between infrastructure and operation

Unlike road transport, railway transport requires a close relationship between the rolling stock and infrastructure. When the operator is one passenger company, integrated railway operation controlling both infrastructure and operation can be retained even if finances are vertically separated. However, if another operator, such as a freight company, operates over the same tracks, the controller of the tracks and signalling is different from the freight operator, requiring

Figure 3 Railway GIS

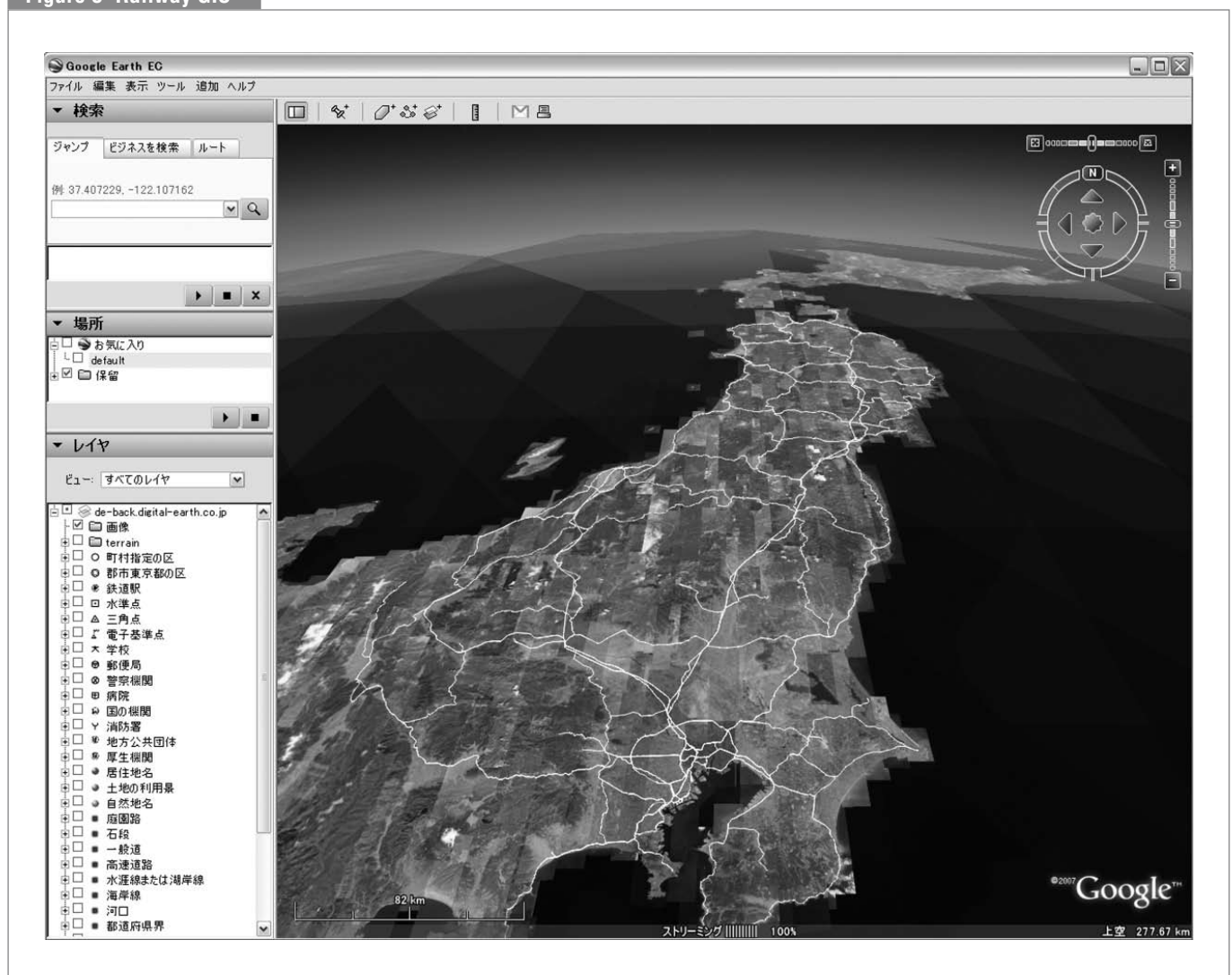
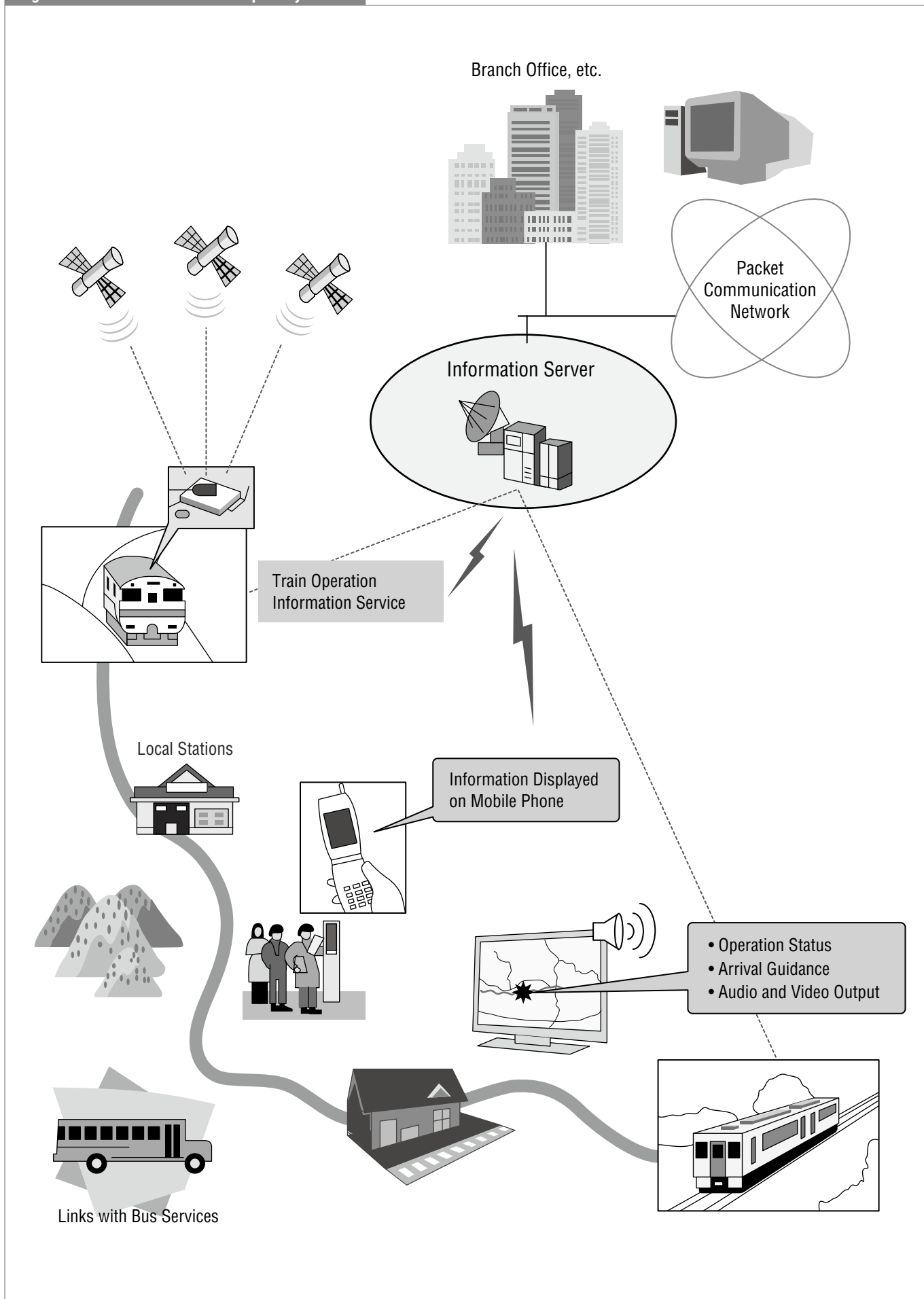


Figure 4 Links with Public Transport Systems



close data exchange between the two for safe and efficient operation. Therefore, in this type of vertical separation, the data needed for train operation, such as restriction of train speed due to track works, must be managed/exchanged by computerized systems rather than by traditional paper-based information and face-to-face meetings.

Railway GIS Solution

JR East Consultants Company, an affiliate of the JR East Group, has worked on digitizing infrastructure information to simplify the asset management. The company successfully developed a new system called Railway GIS. Originally, it was an asset management system for railway companies, but its functions have been expanded through links with other systems, such as Google Earth®. Railway GIS has already been introduced at JR East and JR Kyushu and is going to be introduced soon at JR Shikoku (Figure 3).

Digitized data on railway infrastructure contributes to efficient administration because updated information can be shared easily by different departments. In addition, links with GPS support accurate acquisition of train position, allowing introduction of regional train location information. This system has been introduced already on some local JR East lines because it is less expensive than other systems. Furthermore, Railway GIS is future-proof because it can be developed into a more convenient transport information system, especially for local public transport, by combination with bus and other public transport systems (Figure 4).

Future Outlook

Due to their low external costs, railways are expected to play an important role in protecting the environment. At the same time, separation of infrastructure and operation, which is already the norm in many countries, is showing early signs of introduction in Japan too. Although vertical separation of railways raises new issues, they can be solved by new technologies, such as digitized information about infrastructure. Like other countries, railways in Japan are experiencing severe competition with other transport modes, especially roads. As a result, railways must adapt and make best use of their strengths in protecting the environment by studying the experiences of railways overseas. On the other hand, Japan has had a large impact on the railway world as demonstrated by the 1964 opening of the shinkansen and 1987 JNR reforms. Fortunately, railways in Japan still receive high marks for frequency, punctuality, safety, customer-oriented services, etc., and we hope that Japan can lead the way in demonstrating how rail can help solve global environmental problems too. ■

Further Reading

Nash, C.A. (2007) *Railway Policy: comparing Europe with Japan, Transportation and Economy*, December 2007

ECMT (2005) *Railway Reform & Charges for the Use of Infrastructure*, ECMT



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