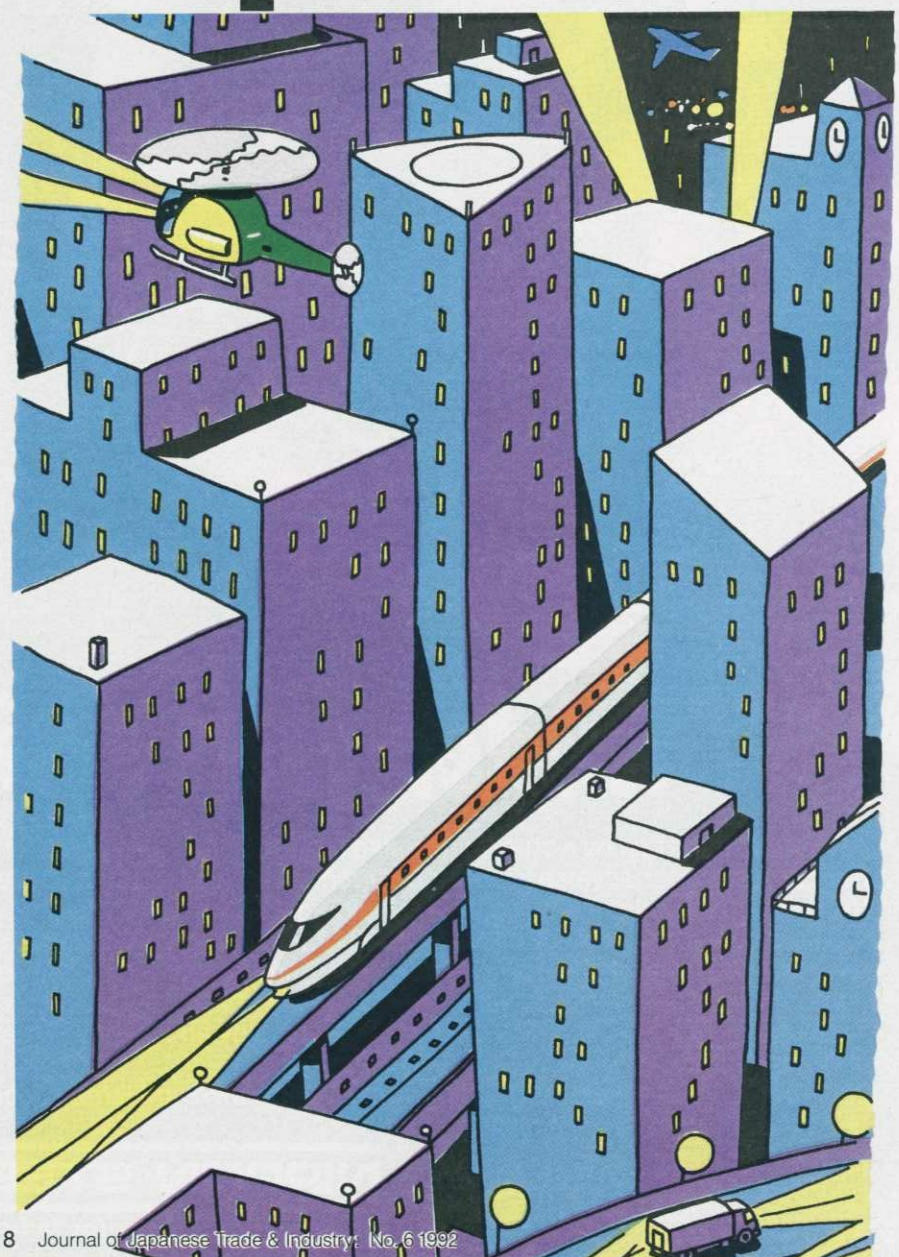
Logistics Logic In Japan

By Teruo Shirasawa



Taking office as minister of transport in November 1987, Shintaro Ishihara opened the way for the Japan Railways Group to commercialize the new magnetic levitation ("maglev") technology for trains. At the time, he said, "This is something that I want to see started during my term as minister of transport and in commercial service by the end of the century. If maglev trains can be perfected to skip across the ground at airplane speeds, it should be possible to accomplish the journey from Tokyo to Osaka (550 kilometers) in little over an hour—even with a brief stop in Nagoya the same as today's Hikari *shinkansen* trains—and people living in Osaka should be able to commute to Tokyo.

"And if the network can be expanded and subsidiary stops made along the way, it should be possible to create new lifestyles for people working in the metropolitan centers and living in the majestic hills of Yamanashi, Nagano, or Gifu. This technology holds out the promise of affordable housing in beautiful surroundings. We should be able to move everybody out to the country and sharply reduce Tokyo's population congestion."

Using magnetic repulsion of superconductivity to keep the train about 10 cm above the track for a "flying" effect as the train speeds along at 500 KPH, this maglev technology is something that Japan can well be proud of, and it is likely that the maglev Chuo Linear Shinkansen will go into service in the early years of the 21st century. The Tokaido Shinkansen, which uses ordinary train technology with the wheels resting on the tracks, now travels at about 270 KPH. Because of tunnels, curves, hills and other conditions, 300 KPH is considered the maximum speed feasible for such trains.

Maglev trains are considered the next generation in train technology. And trains are the preferred means of transportation for the future because they are more energy-efficient than automobiles and emit very little carbon dioxide.

Japan is also a maritime country, and technological advances are evident here too. For example, the superconducting electromagnetic thrust ship *Yamato-1* is expected to be able to sail at speeds of up to 100 knots (about 185 KPH).

And in aviation, people are looking forward to the development of supersonic aircraft able to fly from Tokyo to Washington in just a few hours. Technology is working major changes in Japanese land, maritime and air logistics.

Main arteries

Japan is a narrow chain of islands hugging the Asian coast and measuring about 2,500 km from north to south. Ease of transport has done much to hold the nation together and to promote economic development.

In March 1988, the world's longest underwater tunnel was completed between Aomori and Hakodate. In April 1988 the first of the chains of bridges linking Honshu and Shikoku islands was opened for service. As a result, Hokkaido, Honshu, Kyushu and Shikoku are all linked by overland routes and the distance a person can reasonably travel in a single day has been vastly expanded.

Japan's economic achievements are well-known overseas, but the underlying transport infrastructure—the convenient network of truck, rail, maritime and air transport—is less well-known. In many ways, this transport infrastructure was responsible for the miraculous recovery that Japan made after the war.

High-speed transport networks started by linking Japan's three largest cities (Tokyo, Osaka and Nagoya) along the Pacific coast. With urbanization and industrialization, there was a sharp increase in the movement of people and goods, and telecommunications was also improved. Manufacturing, information, capital and other growth factors were all enriched, and these three cities became international centers with all of the facilities anyone could want. More recently, shinkansen, telecommunications and air traffic developments have brought Sapporo, Sendai, Hiroshima, Fukuoka and other midsized cities into this network. These cities have become the centers of their own economic spheres.

According to the Ministry of Transport, each Japanese travels an average of about 8,000 km per year—which will soon be up to 10,000 km because of the longer commutes to work, the longer distances traveled for business and pleasure, and the availability of safe and efficient trains, airlines and other means of inter- and intracity transportation.

The Tohoku and Joetsu Shinkansen lines were extended to Tokyo Station in June 1991 to link up with the Tokaido and San'yo Shinkansen lines. In the 119 years since October 14, 1872, when the first Japanese train left Shimbashi Station in Tokyo to a 101-gun salute and achieved speeds of up to 32 KPH, Japan has improved its rail network to the point where four shinkansen lines with trains traveling at 220 KPH all converge on Tokyo Station.

The four shinkansen lines that are the main arteries for Japanese transport have a total track length of 1,832 km. Add to that the 92 km of Yamagata Shinkansen (using standard shinkansen track but smaller cars) that started service in July 1992 and the total comes to over 1,900 km. Among them, the four main shinkansen lines carry about 250 million passengers a year. Of this, 117 million ride the Tokaido, 62 million the San'yo, 51 million the Tohoku, and 20 million the Joetsu Shinkansen. Passenger traffic has been increasing by 2% to 3% a year.

Multiplying these passenger figures by the distances traveled yields 37.4 billion passenger/km per year for the Tokaido, making it the world's largest passenger carrier. The equivalent figures for the other lines are 15 billion for the San'yo, 9.9 billion for the Tohoku, and 3.7 billion for the Joetsu Shinkansen lines.

The reasons these four lines and the Yamagata line are so popular are that they offer the same safe, sure, and comfortable service from station to station that the Tokaido Shinkansen does. Having gone into service in 1964—the same year Tokyo hosted the Olympic Games—the Tokaido Shinkansen has not had a fatal accident in all of its 28 years of service. Although it is not as fast as going by air, the shinkansen is able to compete successfully for passenger traffic within 500km of Sendai, Tokyo, Osaka and Hakata. Adding to the attraction, shinkansen station access is much more convenient than airport access is.

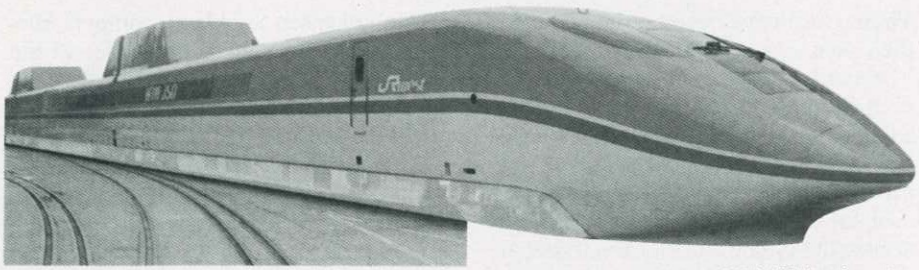
As Keio University Professor Takemochi Ishii has pointed out, "The shinkansen are far more important for passenger traffic than either highway travel or air travel in the 300–750 km range. In addition, they have revitalized numerous towns along the rights of way and helped to alleviate the drift to overconcentrations of people and industry."

Japan Air Lines' president, Matsuo Toshimitsu, says, "Now that the new Nozomi trains are running, the shinkansen has cut the traveling time between Tokyo and Osaka to two and a half hours. Yet we do not see this as a threat. Rather, we view it as a constructive challenge, and we intend to respond with even better service." When the Nozomi trains go into service offering 270 KPH transportation between Tokyo and Hakata in 1993, the railways will also be competitive with the airlines on their Tokyo-Fukuoka routes.

New *seibi* shinkansen

Seeking continued budgetary authority for the new *seibi* shinkansen in fiscal 1993, Yutaka Hatano, Railway Supervision Bureau director general at the Ministry of Transport, said recently, "Of the five routes on the three lines where work has already been begun, we intend to have the Hokuriku Shinkansen line between Takasaki and Nagano completed in time for the Nagano Winter Olympics in 1998. And the Tohoku Shinkansen between Morioka and Aomori and the other three routes will be operative within a decade."

In addition to the Takasaki-Nagano and Morioka-Aomori new *seibi* shinkansen, the other lines are the Takaoka-Kanazawa and Itoigawa-Uotsu Hokuriku lines and the Yatsushiro-Nishi-Kagoshima Kyushu new *seibi* shinkansen routes. Originally the plan was to have these new *seibi* shinkansen use the same tracks as the other shinkansen and to use 60-ton cars seating 100 people. However, when the Ministry of Transport did its



Japan's fastest *shinkansen* bullet train is the WIN350, a new test model of JR West, which hit 345.8 KPH last August.

feasibility calculations a few years back, it found that doing all of these lines this way would cost about ¥3 trillion ($25 billion at the rate of ¥120/$), that it would be very difficult to raise that kind of money, and that most of the lines would end up operating in the red.

Thus the ministry decided that the heavily traveled Takasaki-Nagano line should be built to standard specifications but the other lines should be mini-shinkansen or super-express trains using the older (narrower) track that is already in place. The decision is expected to save well over ¥1 trillion in construction costs alone, and work has finally started on all five routes.

For fiscal 1993, the Ministry of Transport is asking for ¥159.1 billion—48% more than in 1992—for new *seibi* shinkansen construction, with a special emphasis on the Takasaki-Nagano route. The new *seibi* shinkansen are also asking for money from the regional JR and from local communities that expect to benefit.

In addition, an interest-free loan from the Railway Development Fund is covering part of the cost of building a new station in Tokyo's Shinagawa to accommodate the heavier passenger load that Central Japan Railway Co. (so-called JR Tokai) is planning for. Including the cost of acquiring the land, the new station is expected to cost ¥500 billion ($4.16 billion) to build. Although JR Tokai has operating profits of about ¥100 billion a year from the Tokaido Shinkansen, it will still have a hard time finding the money for this new project. It still has, for example, a ¥5.4 trillion debt overhang from the purchase of the rails, signal equipment and other shinkansen facilities from the Shinkansen Railway Holding Organization in 1991. Hence the Ministry of Transport's decision to have the Railway Development Fund make it an interest-free loan.

When all of this is done, Japan will have a nationwide network of shinkansen trains (albeit some of them merely shinkansen-like) by the early 21st century.

Up to 350 KPH

Hiroshi Suda, president of JR Tokai, which operates the Tokaido Shinkansen, has said, "The new Nozomi trains went into service between Tokyo and Osaka in March 1992 at speeds up to 270 KPH, and we hope to be operating trains in the 300–350 KPH range before long. The Tokaido Shinkansen has a lot of tunnels and curves, but we should be able to come up with technological answers to these problems."

It is an ambitious vision pushing the envelope of friction-based trains. (In that they rely on friction between the track and the wheel, too-high speeds can result in a loss of traction.) Shoji Sumita, president of East Japan Railway Co. (JR East), which is responsible for the Tohoku and Joetsu Shinkansen, and Masataka Ide, president of West Japan Railway Co. (JR West), which operates the San'yo Shinkansen, have both told their engineers to find ways to achieve faster speeds on their shinkansen lines.

In February 1991, JR Tokai used the new Nozomi train for some test runs that achieved a top speed of 325.7 KPH on the shinkansen tracks between Maibara and Kyoto. Shortly afterward, JR East ran its own tests that recorded 336 KPH on the Joetsu Shinkansen tracks between Jomo-Kogen and Urasa. Joining the competition, JR West achieved in August 1992 345.8 KPH speeds with its new test model WIN350 on the San'yo Shinkansen tracks between Ogori and Shin-Shimonoseki. All three of the JR lines are in this race for speed, but JR West seems to have the edge.

However, the results are not really comparable, since JR Tokai used a 16-car train and the other two lines used 6-car test trains. Nor are the results that applicable, since all three selected relatively flat and straight sections and measured their speeds over short distances. In effect, they designed the tests to make it easy to get good results, and it would be unrealistic to expect a fully loaded, full-length train to achieve 345.8 KPH over a normal stretch of track with all of the grades, tunnels and curves that characterize shinkansen routes. I was in the engineers' compartment in February 1991 when the Nozomi hit 325.7 KPH and found it an unnerving experience. Not only was there considerable sideways vibration, the only thing I could watch was the distant scenery, since I got nauseous trying to concentrate on the passing scene.

26,903 km of track

Including the six JR passenger lines, the major private lines, the subways and everything else, Japanese railways have a total of 26,903 km of track. Of this, the six JR companies account for 20,174 km, the 15 major private lines (such as Odakyu, Kintetsu and Seibu) 2,874 km, and the 10 urban subway lines 514 km. The rest is with local lines.

Although the Japanese railway network stretches nationwide, most lines and most passengers are concentrated in the Tokyo, Kinki (Osaka, Kyoto, Kobe), and Nagoya areas. Tokyo metropolitan area is home to 35 million people or over one-third of the Japanese population.

According to the Ministry of Transport's Seventh Urban Transport Census, about 9.5 million people commute to school or work by train or subway on an average day in the Tokyo area. This is about four million in the Kinki area and about one million in the Nagoya area. Representing increases of 17% for the Tokyo area and 11% for the Kinki area over the previous survey (the Nagoya area

number having stayed about the same), these figures are indicative of the increasing concentration of transportation needs in the Tokyo area.

While the Ministry of Transport, JR and major private lines are cooperating to alleviate the crowding during the morning and evening peak rush hours, there is little that they can do to ease the crush. Even now, trains run every two-and-a-half minutes, and it is impossible to put on more trains.

International cargo

Importing vast amounts of oil, iron ore, wheat and other vital resources and exporting automobiles, consumer electronics equipment and other manufactured goods, Japan maintains a vast fleet of tankers, container ships and cargo ships plying the seven seas. Although Japan used to have the largest oceangoing fleet in the world, the big shipping companies such as Nippon Yusen and Mitsui O.S.K. Lines now constitute only the world's third-largest fleet. In part, this is because modernization has allowed smaller crews to carry bigger cargoes, and in part it is because high-wage Japanese crews have given way to lower-wage foreign crews. Today (as of 1991), there are 419 ships with Japanese registration, only about one-third of the peak number.

Yet there has been very little decline in the amount of cargo hauled by Japanese shipping companies, mainly because they are making up for the lack of Japanese-flagged ships by chartering foreign-flag vessels. Using chartered ships means that their operating costs are lower and is thus to their advantage on the very price-sensitive Japan-U.S. routes.

At the same time, ships are slowly coming to account for a greater share of domestic transport, and they are taking business away from the truckers as trucks encounter more highway congestion and scheduling difficulties. In addition, the truckers are having to contend with environmental concerns as well.

Air deregulation

Ministry of Transport Civil Aviation Bureau Director General Michihiko Matsuo says, "Japanese airlines carry about 30 million people on international routes every year, of whom 20 million fly out of the Tokyo area and the other 10 million from Osaka and Nagoya. There are 43 countries seeking landing rights in Japan, and this could well escalate into an international problem if we do not grant these rights pretty soon. Happily, the New Kansai International Airport in Osaka will be ready in another two years and the talks on enlarging Narita seem to be making progress."

With only one airport dedicated solely to international flights—and that Tokyo's inconvenient single-runway airport at Narita—the government is hard pressed to find a solution.

In the Sixth Five-year Airport Development Program begun in fiscal 1992, the Ministry of Transport plans to spend ¥3.19 trillion ($26.6 billion) to enlarge Haneda and Narita airports and to speed up completion of the New Kansai International Airport for international flights. In addition, work is going forward on building a new Chubu International Airport off Tokoname (in the Ise Bay) that will accommodate supersonic HSCT (high-speed civil transport) aircraft able to fly to New York in just four hours. Rounding out the plans, the ministry wants to build a third airport to serve the Tokyo area, but it is being careful not to stir up environmental problems and spark a replay of the furor that continues to plague Narita.

Plans are also afoot to enhance the New Chitose, Sendai, Hiroshima, Fukuoka and other key local airports so that air transport facilities match Japan's international importance.

The Ministry of Transport eased airline restrictions in 1986 allowing Japan Air Lines, All Nippon Airways, Japan Air System and other lines to compete on both international and domestic routes. Civil aviation deregulation is also under way in Europe preparatory to market integration. Seeking to compete with the U.S. megacarriers such as United, American and Delta, Germany is working to enhance Berlin and Frankfurt airports and France to enhance Paris's DeGaulle airport. When I asked EC headquarters in Brussels about the aviation industry in November 1991, they said they wanted to formulate a common civil aviation policy that could also apply to the United States and Japan. Yet there is a very real possibility that they may simply be marshaling the European airlines to defend the fortress, and the outlook is for considerable turbulence among Japan, the United States and Europe.

Intermodal links

The development of land, sea and air transport modes and the constant technological advances in these fields have been unaffected by the recession. Progress continues to be made, and it is expected that today's shinkansen, Tomei and Meishin expressways, maritime shipping and air routes will be supplemented by such new technological advances as commercial maglev train services, the No. 2 Tomei and Meishin expressways, supersonic aircraft, and new superconducting electromagnetic thrust ships to create an ultramodern intermodal network running the length and breadth of Japan.

There are plans to build a maglev train through the mountainous interior linking Tokyo, Nagoya and Osaka at speeds of up to 500 KPH. The basic research has been done, and work has been started on a 43 km experimental track in Yamanashi Prefecture for completion by 1994. It is estimated that this maglev Chuo Linear Shinkansen route, to be built at a cost of ¥5 trillion ($41.7 billion), will have ¥10 trillion in economic impact. Likewise, the No. 2 Tomei and Meishin expressways have been approved with four lanes each way, as have the New Kansai International Airport and the Chubu International Airport for completion in the early 21st century. All of this will create an intermodal corridor linking Japan's largest cities and further stimulating domestic demand. ■

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