Railway Operators in Japan 15

Untypical Railways

Yuichiro Kishi

Introduction

All the previous articles in this series have dealt with normal passenger railways with rolling stock running on rails. However, Japan has many other types of passenger systems such as straddle-beam and suspended monorails, trolleybuses, automated guided transit (AGT) systems, magnetic levitation systems, etc., that are all legally defined as railways of one category or another. This article will describe such systems in Japan that fall outside the scope of normal passenger railways, as well as other systems like ropeways, cable railways or funiculars. It also offers a brief description of the current state of the nation’s heritage railways.

Medium-capacity Urban Transit Systems

If we combine the networks of the six JR passenger railways and the other private operators, Japan has an extensive railway network of about 28,000 km. However, since public transport infrastructure cannot keep pace with the rapid spread of urbanization, many people still suffer from inconvenience. In urbanizing areas, there has been increasing expenditure to construct new railway lines such as subways, etc., but seen from the viewpoint of investment effectiveness, these proposals are only good business if there is a sufficient passenger base. In several regional cities, although there has been progress with construction of subways, etc., growth in passenger numbers is flat and in more than a few cases the business strength is weak. Recently Kawasaki City, the second largest city in Kanagawa Prefecture after Yokohama City published its decision to delay subway construction and is re-evaluating the business.

On the other hand, tramways and trolleybuses started disappearing nationwide during the 1970s as their operations became severely impacted by the effects of worsening road congestion. Today, there are only 18 tramway operators and just two trolleybus services left in operation throughout the whole of Japan. More recently, there has been increasing focus on light-rail transit (LRT) systems. In Toyama City on the Sea-of-Japan coast, there has been progress with a project to combine an existing JR line with a newly constructed tramway to form an ultra-low floor transit system that is planned to open in 2006. However, it would not be an exaggeration to say that there are very few other regional cities with these types of plans for LRTs.

Bus services provide insufficient transport capacity and their operations are adversely impacted by road congestion. As a consequence of these circumstances, a variety of new medium-capacity rail systems like monorails and AGT systems are being developed to meet the need for transport capacities that are less than that offered by a full heavy railway but are more than that offered by buses, etc.

Monorails

The first passenger monorail in Japan was opened by the Tokyo Metropolitan Government Transportation Bureau (TMG TB) in December 1957 on a 0.3-km track in Ueno Zoo. At that time, Tokyo’s urban transport needs were met largely by trams, buses and trolleybuses but there was a growing realization that the system would soon be inadequate due to growing road congestion caused by rapid increases in private car ownership. As a result, the TMG TB commenced joint development of a unique suspended-type monorail as a substitute new transportation system. The first commercial test runs were made by building a small scale monorail in Ueno Zoo using a two-car set with a total length of just 19 m. Construction of the stations, supports and rail itself was simplified by building over an existing road. Notwithstanding this, due to the promotion of subways as the main transport mode, the Ueno monorail was not really used as a commercial transit system. In the 1980s there was talk of a temporary suspension of the monorail but it was decided to continue with the space-age transportation system of children’s
dreams and 2001 saw the introduction the fourth generation monorail system. Currently, there are 11 monorails operating in Japan but their transport roles can be classified into four categories. The first role is as an air–rail link (ARL) between major cities and airports. The first example of this type in Japan is the straddle-beam type Tokyo Monorail running between Hamamatsucho on JR East’s Yamanote Line and Tokyo International Airport (Haneda). It was opened in 1964 in time for the Tokyo Olympics and soon had the major share of the airport access market. However, the 1993 opening of the Keihin Electric Express Railway to Haneda caused a rapid drop in the number of monorail passengers. In response, the operator established new rapid-express services followed by a commercial business tie-up with JR East as a new holding company in 2002 to facilitate new services such as sales of discount through tickets in the metropolitan area. Two other monorails that play some role in airport access are the Osaka Monorail, a straddle-beam system.

## Size and Financial Status of Untypical Railways

| Headquarters (Location of operating lines) | Route-km | Capital (¥1000) | Operating Revenues (¥1000) | Operating Expenses (¥1000) | Operating Profits/Losses (¥1000) | Operating Ordinary (¥1000) | Regulating Laws | Types
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tokyo Monorail</td>
<td>16.9</td>
<td>3,000,000</td>
<td>14,141,248</td>
<td>311,493</td>
<td>12,952,172</td>
<td>121,808</td>
<td>1,189,076</td>
<td>189,595</td>
</tr>
<tr>
<td>Tokyo Monorail</td>
<td>16.8</td>
<td>25,530,000</td>
<td>6,176,573</td>
<td>6,705,943</td>
<td>-729,450</td>
<td>-6,198,013</td>
<td>-1,910,850</td>
<td></td>
</tr>
<tr>
<td>Shinan Monorail</td>
<td>6.6</td>
<td>8,000,000</td>
<td>1,694,016</td>
<td>201,394</td>
<td>1,492,622</td>
<td>124,400</td>
<td>285,388</td>
<td>58,944</td>
</tr>
<tr>
<td>Chiba Urban Monorail</td>
<td>15.2</td>
<td>10,000,000</td>
<td>3,177,650</td>
<td>-3,984,308</td>
<td>-886,703</td>
<td>-780,003</td>
<td>TL S</td>
<td></td>
</tr>
<tr>
<td>Shima Monorail</td>
<td>5.0</td>
<td>3,000,000</td>
<td>5,034,464</td>
<td>4,190,116</td>
<td>-840,456</td>
<td>-840,456</td>
<td>RBL S</td>
<td></td>
</tr>
<tr>
<td>Meritato</td>
<td>1.2</td>
<td>734,507,000</td>
<td>34,462,340</td>
<td>93,378,480</td>
<td>133,378,480</td>
<td>6,132,354</td>
<td>13,214,053</td>
<td>RBL S</td>
</tr>
<tr>
<td>Osaka Monorail</td>
<td>25.1</td>
<td>14,500,000</td>
<td>7,200,000</td>
<td>471,322</td>
<td>5,964,621</td>
<td>124,362</td>
<td>1,331,771</td>
<td>106,491</td>
</tr>
<tr>
<td>Sky Rail Service</td>
<td>1.3</td>
<td>2,000,000</td>
<td>176,000</td>
<td>17,141</td>
<td>193,055</td>
<td>16,887</td>
<td>-15,265</td>
<td>1,817</td>
</tr>
<tr>
<td>Kita-kyushu Urban Monorail</td>
<td>8.8</td>
<td>8,150,000</td>
<td>2,422,572</td>
<td>52,228</td>
<td>1,866,070</td>
<td>52,226</td>
<td>376,502</td>
<td>0</td>
</tr>
<tr>
<td>Okinawa Urban Monorail</td>
<td>12.9</td>
<td>7,330,000</td>
<td>1,475,570</td>
<td>-2,598,079</td>
<td>-1,122,501</td>
<td>-1,175,663</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Cable railways

- **Tokyo**
  - **Tokyo Monorail**: 16.9 km, 3,000,000 Y, 14,141,248 Y, 311,493 Y, 12,952,172 Y, 121,808 Y, 1,189,076 Y, 189,595 Y, 1,371,214 Y
  - **Shinan Monorail**: 6.6 km, 8,000,000 Y, 1,694,016 Y, 201,394 Y, 1,492,622 Y, 124,400 Y, 285,388 Y, 58,944 Y, 328,949 Y

**Tramways**

- **Osaka**
  - **Osaka Monorail**: 25.1 km, 14,500,000 Y, 7,200,000 Y, 471,322 Y, 5,964,621 Y, 124,362 Y, 1,331,771 Y, 106,491 Y, 1,917,000 Y

**Monorails**

- **Yokohama**
  - **Yokohama Monorail**: 4.3 km, 800,000 Y, 162,158 Y, 17,120 Y, 302,627 Y, 19,808 Y, 400,409 Y, 163,811 Y

**AET systems, etc.**

- **Funakomome**
  - **Funakomome Monorail**: 6.8 km, 11,693,000 Y, 8,417,371 Y, 7,125,880 Y, 1,361,391 Y, 6,866 Y

**Trolleybuses, guideway buses**

- **Kansai Electric Power**

**Railways**

- **Osaka Monorail**: 23.8 km, 14,538,000 Y, 7,256,392 Y, 431,332 Y, 5,864,621 Y, 324,741 Y, 106,691 Y, 510,050 Y


---

1) RBL = Railway Business Law, TL = Tramway Law
2) S = Suspended, SB = Straddle beam, LGR = Lateral guidance rail, CMB = Centrally-mounted beam, L = Levitation, T = Trolley bus, GB = Guideway bus, F = Funicular
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Railway Operators</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JNR</td>
<td>12,000</td>
<td>13,164</td>
<td>13,514</td>
<td>12,951</td>
<td>13,16</td>
<td>13,36</td>
<td>13,59</td>
<td>13,82</td>
<td>13,94</td>
<td>14,04</td>
<td>14,13</td>
</tr>
<tr>
<td>JR East</td>
<td>10,373</td>
<td>10,527</td>
<td>10,610</td>
<td>10,710</td>
<td>10,921</td>
<td>11,132</td>
<td>11,343</td>
<td>11,554</td>
<td>11,765</td>
<td>11,976</td>
<td>12,187</td>
</tr>
<tr>
<td>JR West</td>
<td>7,627</td>
<td>7,826</td>
<td>7,868</td>
<td>7,907</td>
<td>7,946</td>
<td>7,985</td>
<td>8,024</td>
<td>8,061</td>
<td>8,098</td>
<td>8,135</td>
<td>8,172</td>
</tr>
<tr>
<td>Other Japanese Railway</td>
<td>1,371</td>
<td>1,432</td>
<td>1,493</td>
<td>1,550</td>
<td>1,606</td>
<td>1,662</td>
<td>1,717</td>
<td>1,771</td>
<td>1,824</td>
<td>1,874</td>
<td>1,923</td>
</tr>
<tr>
<td>Regional Railways</td>
<td>1,269</td>
<td>1,352</td>
<td>1,430</td>
<td>1,506</td>
<td>1,581</td>
<td>1,655</td>
<td>1,728</td>
<td>1,800</td>
<td>1,872</td>
<td>1,944</td>
<td>2,017</td>
</tr>
<tr>
<td>Metropolitan Railways</td>
<td>2,432</td>
<td>2,524</td>
<td>2,610</td>
<td>2,696</td>
<td>2,782</td>
<td>2,868</td>
<td>2,954</td>
<td>3,040</td>
<td>3,126</td>
<td>3,212</td>
<td>3,300</td>
</tr>
<tr>
<td>National Intercity Railways</td>
<td>2,993</td>
<td>3,099</td>
<td>3,204</td>
<td>3,310</td>
<td>3,416</td>
<td>3,522</td>
<td>3,628</td>
<td>3,734</td>
<td>3,840</td>
<td>3,946</td>
<td>4,053</td>
</tr>
<tr>
<td>Local Railways</td>
<td>7,135</td>
<td>7,465</td>
<td>7,766</td>
<td>8,067</td>
<td>8,368</td>
<td>8,670</td>
<td>8,972</td>
<td>9,274</td>
<td>9,576</td>
<td>9,878</td>
<td>10,181</td>
</tr>
<tr>
<td>International Railways</td>
<td>772</td>
<td>857</td>
<td>954</td>
<td>1,051</td>
<td>1,148</td>
<td>1,245</td>
<td>1,342</td>
<td>1,440</td>
<td>1,538</td>
<td>1,636</td>
<td>1,734</td>
</tr>
<tr>
<td>Metropolitan suburban lines</td>
<td>1,505</td>
<td>1,554</td>
<td>1,603</td>
<td>1,652</td>
<td>1,701</td>
<td>1,750</td>
<td>1,800</td>
<td>1,850</td>
<td>1,900</td>
<td>1,950</td>
<td>2,000</td>
</tr>
<tr>
<td>Local/suburban lines</td>
<td>11,736</td>
<td>12,213</td>
<td>12,683</td>
<td>13,153</td>
<td>13,623</td>
<td>14,093</td>
<td>14,563</td>
<td>15,033</td>
<td>15,503</td>
<td>15,973</td>
<td>16,443</td>
</tr>
<tr>
<td>Total Passenger Traffic</td>
<td>18,644</td>
<td>19,248</td>
<td>19,822</td>
<td>20,403</td>
<td>20,985</td>
<td>21,568</td>
<td>22,151</td>
<td>22,737</td>
<td>23,323</td>
<td>23,909</td>
<td>24,494</td>
</tr>
<tr>
<td>Source: Railway Annual Statistics, MLIT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: Passenger Density = Daily passenger-km/line-km

42 Japan Railway & Transport Review 41 • October 2005

Railway Operators
monorail (see JRTR 36, pp. 56–63) and the Yui-rail, a straddle-beam monorail (see JRTR 39, pp. 4–14) operated by the Okinawa Urban Monorail Co., Ltd. However, considering the construction process, both these monorails probably come under the second category below. The second role is as a rail-based medium-capacity urban transport system serving the needs of growing cities; about half of Japan’s monorails come into this category. Typical examples are the suspended Shonan Monorail in Kanagawa Prefecture, the suspended Chiba Urban Monorail in Chiba Prefecture (see JRTR 33, pp. 50–59), the straddle-beam Tokyo Tama Intercity Monorail in Tama City, Tokyo (see JRTR 32, pp. 52–62), and the straddle-beam Kita-kyushu Urban Monorail in Fukuoka Prefecture. In fact, both the previously described Osaka Monorail and the Yui-rail really come into the urban monorail category. Yui-rail is the first rail-based transport system in Okinawa Prefecture since the end of WWII when an existing war-damaged line was abandoned leaving Okinawans without a railway of any sort for many years. However, with the opening of this monorail, Naha now holds the record for Japan’s most southerly (Akamine) and westerly (Naha-kuko) ‘railway’ stations. The third role is as a link with stations serving tourism destinations. Two examples of this type are the straddle-beam Disney Resort Line in Chiba Prefecture near Tokyo and the straddle-beam Monkeypark Monorail in Aichi Prefecture. The former line links Tokyo Disneyland and Tokyo DisneySea with the nearby JR East Maihama Station and is 100% owned by the theme park operators. The latter line links a theme park and the Japan Monkey Park both owned by the monorail operator to the nearest railway-station owned by Nagoya Railroad (Meitetsu). The growth of these monorails was heavily impacted by their positive image as a modern transport mode suiting theme parks and expositions, etc., but more than a few have reached the end of this role due to Japan’s aging society and the closure of leisure facilities. An example of the fourth case is the Sky Rail Service suspended monorail built to provide access to a large area of development land. It is a rather unique cross between a cableway and a monorail in which small unpowered 8-seat carriages are moved in the station by a linear motor but between stations, the carriages are moved by a connected cable. It could be described as a Rope Driven Suspended Transportation System (see JRTR 39, pp. 36–43). There are quite a few of these small volume transport systems that do not have any legal basis. For example, the Pastoral View Katsuradai in Yamanashi Prefecture is a magnetic belt transit system that could be described as a straddle-beam monorail linking high pastoral scenic areas with the nearby JR East Saruhashi Station, but in legal terms it is unclear whether it is a true railway, tramway, etc. There is no single law regulating monorails and AGT systems described above are regulated by the Railway Business Law and the Tramway Law. The early monorails opened before 1970 were regulated by the Railway Business Law (then called the Local Railway Law). But after the 1980s, since it was decided to create a new system for assisting links with the road infrastructure, some cases were interpreted as coming under the Tramway Law on the premise that construction was over roads. Monorails completed by this type of procedure were called ‘urban monorails.’

**AGT Systems**

Automatic Guideway Transit systems offering medium transport capacities similar to monorails between the high capacity levels of railways and the smaller capacities of buses became a popular form of city transport from the 1980s. Some use rubber-tyred articulated vehicles running along a dedicated guideway. In addition, use of high-technology drive and control systems has achieved high-reliability automated operation and better safety, and some operators have introduced driverless services using automatic train operation (ATO) systems. At the same time, AGTs are reducing pollution, such as noise and vibration, commonly caused by existing transport systems, such as railways, buses and private cars. Against this background of rapid development of these types of medium transport systems, the AGT systems have been introduced in various cities in Japan.
capacity transit system, construction in publicly owned spaces such as above roads, has made it possible to cut construction costs by eliminating land purchase costs so that new infrastructure can be built at lower costs than railways. In addition, another merit is the fact that the track supporting structures can be built as part of the road funded as a public works project, while the operator only has to bear the financial burden of providing the other infrastructure such as rolling stock, power supply, signalling equipment, station infrastructure, etc. In more recent years, to be able to receive the above-described public assistance, new monorail and AGT operators have established themselves as third-sector businesses with the majority of capital being provided by regional public bodies. However, although it is possible to build infrastructure for AGTs over publicly owned roads, even the main roads in many Japanese cities are very cramped and restricted so there have been a number of instances where construction has been undertaken after road widening projects. Furthermore, the high initial investment costs in new technologies coupled with low transport volumes have caused financial headaches for operators of AGT systems. Japan's first AGT system was introduced in the Kansai district (encompassing Osaka, Kobe and Kyoto) with the February 1981 opening of the 9.2-km Port Island Line in Sannomiya, Kobe City (see JRTR 16, pp. 4–14, JRTR 26, pp. 58–67, JRTR 36, pp. 56–63) and the March 1981 opening of the 6.6-km Nanko Port Town Line in Osaka City. In the Kanto district (encompassing Tokyo, Yokohama, Kawasaki and Chiba), the first AGT systems were the Yukarigaoka Line operated by the Yamaman Co., Ltd opened in Chiba Prefecture in 1982 (see JRTR 31, pp. 44–54), the 13-km Saitama New Shuttle linking Ina Town to the JR East Omiya Station opened in 1985 and the Seibu Railway's Yamaguchi Line also opened in 1985. Lines in the Kansai district have often been built to link newly reclaimed coastal land with the nearest main line railway station and are mostly third-sector businesses with infrastructure built using government assistance. Conversely, lines in the Kanto district have often been built to link newly reclaimed coastal land with the nearest main line railway station and are mostly third-sector businesses with infrastructure built using government assistance. In other words, nationwide operators of AGT systems are using a few train sets from a variety of makers, meaning that there is little progress with specification compatibility. Moreover, except for the Nippori–Toneri Line currently under construction in northern Tokyo and extensions planned by two other operators, no other new infrastructure for AGT systems is currently being planned in Japan. It is unlikely that future costs...
will drop with the spread of AGT systems. The maintenance costs of vehicles and infrastructure such as elevated guideways, signalling and control systems, etc., will remain comparatively high, so operators cannot achieve the low operation costs as expected. The Peach Liner in Aichi Prefecture used much lower-cost specifications than other AGT systems but even so its operations have continued to run in the red due to extremely low passenger levels with accumulated losses exceeding ¥600 million. Furthermore, after more than 10 years of operations, the expensive time for renewing vehicles and infrastructure, etc., is arriving and solutions such as abandoning current operations or changing to another system are being investigated.

**Through Operations**

Since AGT systems have good transportation capacity, they are sometimes used when normal buses are unable to meet demand as in the case of the Nagoya Guideway Bus introduced in 2001 in Aichi Prefecture. The buses run on a dedicated elevated guideway in the centre of Nagoya City where traffic congestion is very severe but run on normal roads away from the city centre. This rather unique dual-mode system combines a road transport system and trackless transport system. Operations are managed as a third-sector company and the cost of building the elevated guideway infrastructure was borne by the Nagoya City roads budget. The sides of the buses have guiding devices mounted on them to perform automatic steering while the bus is running on the guideway, freeing the driver from the need to steer the bus. Like a train driver, the bus driver just has to accelerate, decelerate and stop. This setup permits them to run safely at high-speed along the narrow guideway and allows the buses to keep on schedule, which is a problem for normal buses. In addition, although the vehicles are simply modified buses with a normal diesel engine, when running on the elevated guideway, they are subject to the Tramway Law in the same way as tramway services and some other AGT systems, and the driver is required to obtain a trolleybus driver’s licence. Moreover, with future large expansion of transport demand and practical application of elevated guideways, there is a possibility of a move towards AGT systems.

On the other hand, there is some progress in development of AGT systems making use of railway infrastructure that has been badly affected by loss of passengers to JR Hokkaido’s Dual Mode Vehicle during test runs on the Sassho Line. This microbus-based vehicle was developed to revitalize business on under-used lines in Hokkaido. It has been in testing on commercial lines and public roads since 2004 and development of a two-vehicle coupled set is underway to strengthen future transport capacity.
other transport modes. In 2002, JR Hokkaido announced a dual-mode vehicle (DMV) consisting of a device for allowing a microbus to run on rails but which could also switch to running on normal roads. On a normal road, it operates in the same way as a normal microbus, and when on the railway section, it is able to achieve speeds of 70 km/h running on rubber tyres using metal wheels following the rails as guides. As a result, in addition to offering the railways' advantage of on-time scheduling and high speeds, this system also offers the advantages of bus maneuverability and low initial and maintenance costs. Furthermore, tests are also underway to secure sufficient transport capacity for the evening and morning rush hours by coupling two buses together. If this system is put into revenue operation, JR Hokkaido has high hopes that it might bolster revenues on under-used sections and has various high expectations for this sensational AGT system. For example, they are investigating the possibilities of using the ability of this system to climb steep grades that cannot be passed easily by conventional railways to provide access to airports on higher land, revitalize regional railways in difficult economic circumstances, link tourist spots and town areas with the nearest railway station, etc.

**Magnetic Levitation (MAGLEV)**

Two years before the 1964 opening of the Tokaido Shinkansen, engineers at Japanese National Railways (JNR) were already embarking on development of the next-generation of high-speed railways. The idea was to break the mold of the old concept of adhesion between metal wheels running on metal rails, which imposed maximum speed limits, by starting R&D into a superconducting magnetic levitation technology using the repulsive interaction between superconducting magnets installed on the vehicles and electromagnetic coils installed on the ground infrastructure to levitate and propel the vehicle at very high speeds exceeding 500 km/h. Following the 1987 JNR division and privatization, R&D into the system was started under the leadership of the Railway Technical Research Institute (RTRI) and JR Central. An 18.4-km test track was built in Yamanashi Prefecture in 1997, where test runs achieved a manned world speed record of 581 km/h in 2003. Based on these test results, in 2005 the Ministry of Land Infrastructure and Transport's Superconducting Maglev Commercialization Technology Evaluation Committee decided to establish the basic technology needed for commercial application. Although the aim is to build a magnetic levitation (MAGLEV) system from Tokyo through the central part of Honshu Island linking Nagoya and Osaka, there are still many remaining problems before such a system can become reality, not least of which is the funding.

Elsewhere, other private sectors started development of MAGLEV railways in 1972, 10 years after JNR. At that time, Japan Air Lines (today's JAL) was investigating and promoting a RAL system named HSST for access to New Tokyo International Airport (Narita). They held test runs at various regional expositions in the late 1980s to build up experience and in 1989 were joined by Meitetsu and Aichi Prefecture in building a 1.5-km test track in Aichi Prefecture. They performed various types of tests positioning the HSST as a medium-capacity transport system with good ability to climb steep grades and low infrastructure costs. In 1993, the then Japanese Ministry of Transport (now Ministry of Land, Infrastructure and Transport) expressed the opinion that there were no technical problems with commercialization and in March 2005, Japan's first non-superconducting maglev train using a linear motor entered permanent commercial service as the Linimo operated at speeds up to 100 km/h by the Aichi Rapid Transit Company to serve the Aichi Exposition. Like the earlier AGT systems, the infrastructure was built by the local government and the other equipment was constructed by Aichi Rapid Transit, JR Central's MLX01-901 Maglev on RTRI's Yamanashi Test Track opened in 1997. The new long-nose lead carriage design was introduced in 2002 and is currently in testing. (RTRI)
operating as a third sector company. The propulsion system uses a linear induction motor (LIM), which is different from the linear synchronous motor used by JR. The earlier JR levitation method used magnetic repulsion whereas the HSST uses attraction. In other words, when current is passed through electromagnets mounted under the carriages, attraction generated by magnetic force causes the carriage to float 6 mm above the rail. As a result, there is much less running noise or vibration than conventional railways and there is little effect caused by bad weather conditions such as heavy rain or snow accumulation. In addition, since there are few parts like rails and wheels to wear, maintenance costs are expected to be very low. It has been a success using computer-controlled driverless operation to carry more than 1.5 million people in the first month after the Expo opened.

Cable Railways or Funiculars and Ropeways

Cable railways or funiculars carry cars pulled by a wire cable along a track built over the ground. In the three main islands of Honshu, Shikoku and Kyushu, there are 22 operators of 26 cable systems. Many are about 1-km long the longest is the 2.0-km Sakamoto Cable Railway at Hieizan in Shiga Prefecture. It links Sakamoto with the Hieizan Enryakuji Buddhist Temple by an 11-minute ride. The shortest is the 0.3-km Beppu Wonder Rakutenchi Cable Railway in Oita Prefecture. Many cable railways in Japan are located at famous sites such as mountain temples and shrines, or at tourist sights such as panorama viewing platforms. There are almost none serving daily life activities.

Japan’s first cable railway was opened in 1918 to carry people to the Hozan Temple at Mt Ikoma in the Kansai District. It was incredibly popular as the first funicular ride and marked the start of a subsequent cable railway boom. The second cable railway was opened at the world-famous Hakone Mountains with rich hot springs in the Kanto District in 1921. These two cable railways are still very popular and Hakone Tozan Railway’s cable system (1.2-km) is now using 4th generation cars built by Swiss Von Roll. It is Japan’s first cable railway using trains composed of permanently coupled two cars. There was a sharp drop in cable railway construction, coming to a complete stop after the 1988 opening of the Seikan Tunnel Memorial Hall in Aomori Prefecture. This cable system was built in an inclined shaft for excavating the undersea tunnel, but was then remodelled into a passenger service. As a result, more than 30 years have passed since the last true new build for passenger operation opened as the Tateyama-Kurobe Kanko’s cable system in 1969 in Toyama Prefecture. Currently, worn-out vehicles and infrastructure are being upgraded, but some operators are withdrawing from the market due to worsening business conditions.

At the end of March 2004, there were 2888 ropeways in Japan; 185 localities are classified as ‘ordinary ropeways’ using enclosed cabin to carry passengers or both passengers and goods, while 2703 localities are ‘special’ ropeways using the open chairs. The former type are usually called ropeways or gondola lifts while the latter are known as either ski lifts or chair lifts. In both cases, the majority are located at tourist destinations, particularly in Hokkaido, Tohoku, Hokuriku and Shin’etsu where heavy snow falls attract a lot of skiers to the slopes.

In 2001, the world’s longest ropeway nicknamed the Dragondola was opened between Naeba and Tashiro (5481 m) at the Naeba Ski Resort in Niigata Prefecture. Some ropeways also introduced very large gondolas; Mt Hakodate Ropeway introduced in 1988 gondolas each carrying 126 passengers, followed by the Ryuo Ropeway in Nagano Prefecture and the Yuzawa Onsen Ropeway introducing 166-passenger gondolas in 1991. 1998 marked the opening of the 2nd Shin Hotaka Ropeway in Gifu Prefecture using Japan’s first two-storey gondolas each carrying 121 people. There have also been speed increases and currently both Kokudo’s Hakkaisan Ropeway (Niigata
Prefecture) and Shikoku Cable’s Umpenji Ropeway (Kagawa Prefecture) have the fastest speeds in Japan of 10 m/s. From the technical viewpoint, the Hashikurayama Ropeway in Tokushima Prefecture and the Hakone Ropeway in Kanagawa Prefecture were upgraded in 1999 and 2002, respectively to the Double Loop Mono Cable Gondola (DLM) Funitel method. In mountainous areas like Hakone, high wind speeds causing suspension of services for about 30 days a year were limiting business. To solve this problem, in addition to increasing the gondola size, the Funitel system with a double loop and a wider body than the gondola was introduced for more stable operation. This has resulted in a 50% increase in transportation capacity per hour and has greatly reduced waiting times during the tourist season.

The number of regular customers for cable railways and ropeways in mountainous regions with poor transport is dropping due to diversification of leisure activities and easier access to tourist sites by cars and tourist buses. As a result, more than a few operators have experienced drops in passenger numbers. Moreover, some regional operators are withdrawing from the market due to the high costs of maintaining aging infrastructure. In 2004, the Yashima Tozan Railway applied for bankruptcy and suspended operations, while the Komagatake Ropeway of Izu-Hakone Railway experienced a 5% drop in passengers during the high season and decided to withdraw from the business in 2005.

### Heritage Railways

Unfortunately, Japan has yet to make the same investment in heritage railways as seen in the UK. In addition to Japan being relatively late in preserving railways and railway infrastructure as a cultural asset, there are strict regulations governing railways, public volunteers are not able to manage railways themselves. However, there have been long-term movements to preserve historic rolling stock starting with steam engines across the country from Hokkaido to Kyushu. These preservation activities can be split into three types. First, railway operators are operating historic rolling stock on their own lines. Second, preservation groups are operating rolling stock on lines.
borrowed from railway operators. Third, historic rolling stock is being operated on dedicated tracks inside facilities such as parks and museums that are not connected to commercial lines.

JNR retired steam engines from revenue service in 1975, but the private Oigawa Railway in Shizuoka Prefecture took over some of JNR’s abandoned steam locomotives, starting steam operations between regular services from the summer of 1976. Today, they have five locomotives in working order, which they operate throughout the year except weekdays in the off-season. To meet requests from railway enthusiasts not to abandon steam engines and to celebrate the 100th anniversary of Japanese railways in 1972, JNR opened the Umekoji Steam Locomotive Museum in part of the former Umekoji Depot where a large number of steam locomotives were preserved in working order. Following this, in 1979, steam operations were started on the Yamaguchi Line in west Honshu using the preserved locomotives from the Umekoji museum. This operation was taken over by JR West, and subsequently JR East, JR Kyushu and JR Hokkaido started running steam trains.

As an example of the second type of operation, the Japan National Trust, a non-profit organization funded by public donations, purchased an old Class C12 steam locomotive and passenger carriages that they loan to Oigawa Railway where it is operated as the Trust Train.

Examples of the third type of operation are seen in various railway museums. Apart from the short-distance demonstration at the above-mentioned Umekoji museum, the Mikasa Railway Museum and Otaru Transportation Museum (both in Hokkaido) are proud of their short-distance steam operations using surviving very old small locomotives, as well as their good collection of rolling stock from former JNR and private coal mine railways. The Usui Pass Railway Monument Park in Gunma Prefecture attracts people with its rich collections of electric and diesel locomotives. Both the Mikasa and Usui Pass museums provide intending visitors with an opportunity to learn how to drive a steam (Mikasa) or an electric (Usui) locomotive. Furthermore, recently, volunteers groups centred around railway enthusiasts have been rescuing important rolling stock from the breaker’s yard. In 1973, the Rasuchijin Railway Association (RASS) was formed for the purpose of preserving 610-mm narrow gauge steam locomotives, etc. They are presently operating some stock on a 500-m track (to be extended to 2 km in the future) at the Narita Yume Bokujo park site in Chiba Prefecture. On the other hand, preservation of 1067-mm narrow-gauge stock in working order is mainly focussed on old abandoned stations. For example, the Katakami Railway Preservation Group (Okayama Prefecture), Kaya Railway Preservation Group (Kyoto), and Ohata Line Kiha 85 Working Order Preservation Group (Aomori Prefecture) run operations with historic stock about once a month. None of these groups are railway operators as defined by law, so they operate with the same legal status as amusement facilities.

In the future, there are some hopes that heritage railways can be established in Japan following the UK model.

Yuichiro Kishi
Mr Kishi is Curator of the Transportation Museum, Tokyo. He obtained Masters degree in 2000 from Tokyo Gakugei University. His main research interests are the management history of local private railways and the history of museum development. He is co-author of Zenkoku torokko resha (Trolley Trains in Japan) published by the JTB.