50 Years of Tokaido Shinkansen History

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Introduction

The Tokaido Shinkansen commenced operation on October 1, 1964 and is about to reach its 50th anniversary. The Tokaido Shinkansen, which takes on the role of Japan's main transportation artery, has served 5.6 billion passengers since its start and propped up Japan's economy. Ever since the operation commenced, the Tokaido Shinkansen has maintained a flawless record of no train accidents resulting in fatalities or injuries of passengers onboard, and has demonstrated stable and precise operation with an annual average delay of 0.9 minutes per operating train (FY2013). The maximum speed in service has risen significantly from 210 km/h, when the line initially went into operation, to 270 km/h at present. Next spring, the maximum speed is scheduled to be increased to 285 km/h. Furthermore, the Tokaido Shinkansen has improved its energy efficiency so that it places an unusually low load on the global environment, which, along with other enhancements, has helped the Tokaido Shinkansen evolve into a high-volume, high-speed transportation system unsurpassed anywhere in the world.

The primary mission of any railway operator is to ensure safe and reliable operation. The Tokaido Shinkansen has expended all possible means to achieve this objective by implementing a variety of measures, both tangible and intangible. More specifically, in accordance with the principle of "Crash Avoidance," a high level of safety, as well as high-volume, high-frequency transport is achieved by using a dedicated track for high-speed passenger rail that eliminates the risk of collisions at level crossings, and by adopting the Automatic Train Control (ATC) system, which stops trains running at high speed safely. Currently, the Tokaido Shinkansen, the world's cutting-edge high-speed rail, has attained the highest standards in terms of safety, reliability, comfort, convenience, high-speeds and other benchmarks.

Competitive Transportation Service

The most significant feature of the Tokaido Shinkansen service is that it provides transport capacity responding to demand by maintaining a certain number of trains as a regular service in the base timetable and arranging extra trains when necessary.

When the Tokaido Shinkansen commenced operation, there were 60 departures per day in a "1-1" hourly timetable with one *Hikari*, stopping only at major stations, and one *Kodama*, stopping at each station. The travel time of *Hikari* between Tokyo and Shin-Osaka was 4 hours.

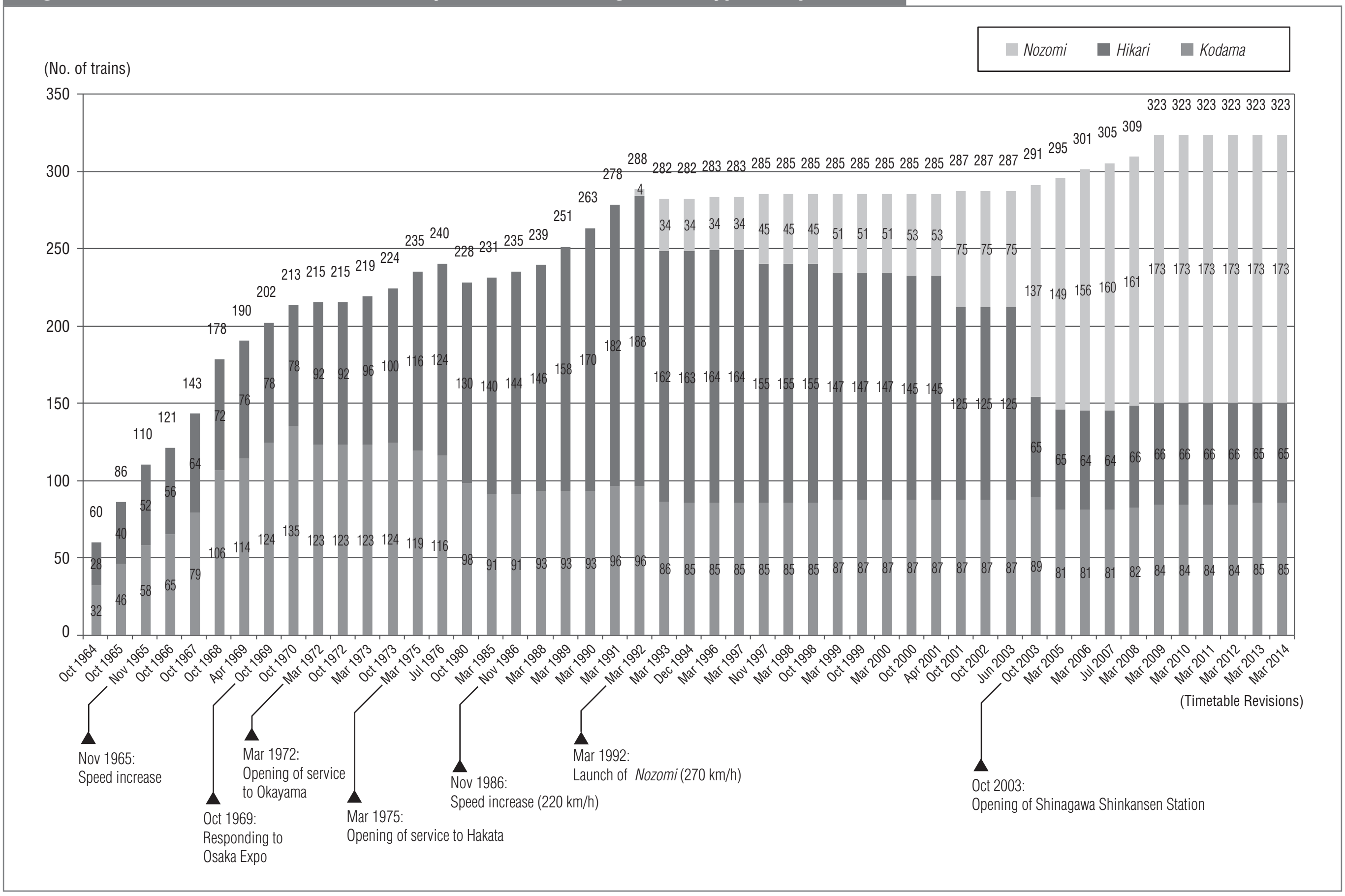
Subsequently, the number of train departures was increased time and again with the "2-2" and "3-3" hourly timetables. Revisions were made almost annually to accommodate the rapid surge in transportation volume during Japan's high-growth period. Transport capacity was boosted until the number of daily trains reached 240 in the year after the extension to Hakata was completed in 1975. When Japanese National Railways (JNR) was privatized in 1987, the timetable was the "6-4" hourly schedule.

After Central Japan Railway Company (JR Central) was founded in 1987, transport volume rose rapidly on account of Japan's broad-based prosperity and positive business expansion sustained over the ensuing 5 years. Accordingly, JR Central improved facilities and equipment, massively introduced the Series 100 rolling stock, and implemented the "7-4" hourly timetable in 1989. At the March 1991 timetable revision, the number of daily departures was up to 278. This was also the time when we started to review and plan for an increase in speed and a fundamental expansion of transport capacity in order to maintain the transport foundations for the future.

The introduction of the Series 300 rolling stock in 1992 enabled us to achieve a maximum operational speed of 270 km/h, and to begin operation of the *Nozomi*, connecting Tokyo and Shin-Osaka in 2 hours and 30 minutes. The *Nozomi*, which initially started with four trains a day, was later operated with one and then two trains per hour.

The commitment to making all of our fleet consist of trainsets with a maximum speed of 270 km/h, while coinciding with the opening of Shinagawa Station in October 2003, provided the impetus for a drastic improvement in the quality of transport along Japan's main transportation artery by making a dramatic rise in the level of service with the *Nozomi* based timetable. In that sense, this strategy may also be called the "Rebirth of the Tokaido Shinkansen", and

Figure 1 Number of Scheduled Trains by Timetable Changes and Type of Operation



was an epoch-making event for JR Central. The completion of this strategy made it possible for up to seven *Nozomi* trains to leave every hour, achieving a total of 291 departures per day. As a result, the number of stations where the *Hikari* stopped was increased, and connections with other trains including conventional line trains were improved so that the speed-up of our fleet would benefit even more passengers.

Thereafter, we have continually worked to enhance rolling stock, augment power supply systems and reinforce ground facilities to improve transportation quality and capacity significantly. With the July 2007 timetable revision, the travel time of the fastest *Nozomi* between Tokyo and Shin-Osaka was reduced to 2 hours and 25 minutes. The March 2014 timetable revision allows the operation of up to 10 *Nozomi* per hour, which has come to be known as the “10-Nozomi Timetable”.

By taking advantage of timetables mainly comprised of *Nozomi* since 2003, we have sought to maintain seat reservations so that passengers may book whenever they like, as well as maximizing transport capacity during peak periods. We are continuously making an effort to ensure our train schedule can respond more flexibly to demand than ever.

Subsequently, although the number of daily departures excluding extra service has remained at 323 since the March 2009 timetable revision, the number of departures, including extra service, has increased markedly such that one-day average departures numbered 342 in FY2013, and a record 426 trains were operated on August 8, 2014.

Continually Evolving Operation

When the Tokaido Shinkansen first started operation, the Centralized Traffic Control (CTC) system was introduced to control the operation of the 60 daily trains with the control staff monitoring an array of data on CTC operation display panels. However, with the increase of departures, the Shinkansen operation control system COMTRAC (COMputer aided TRAffic Control) was placed in use conjointly with the start of service to Okayama in 1972 (COMTRAC is currently in its ninth generation). Later, with the commencement of the Hakata service in 1975, the General Control Center would manage the 1069.1 km between Tokyo and Hakata in addition to 28 stations and 7 rolling stock depots.

After the 1995 Hanshin-Awaji Earthquake, JR Central decided to construct a second control center together with

Figure 2 Successive Shinkansen Generations (Series 0 to N700A)

Series 0 (©Central Japan Railway Company)

Series 100 (©Central Japan Railway Company)

Series 300 (©Central Japan Railway Company)

Series 700 (©Central Japan Railway Company)

West Japan Railway Company (JR West) to strengthen the emergency response system in times of natural disasters. This facility started operation in 1999. Thereafter, the Second General Control Center has exercised actual control over the system once annually and is used for quarterly training of control staff. It provides redundancy so that if the General Control Center in Tokyo were to suffer damage during a disaster, operational control can be switched to the Second General Control Center.

In addition, along with ensuring safety, we have enhanced the quality of response to typhoons, cloudbursts, heavy snowfall and other such abnormal conditions. This has been achieved both tangibly and intangibly through the revision of regulations tailored to facility reinforcements, early resolution of delays, operational arrangements such as not having trains stop between stations, as well as improvements in passenger information and communication systems with the utilization of information tools.

Improvements in Rolling Stock Technology

The Series 0 was the first rolling stock that appeared when the Tokaido Shinkansen commenced. It was the world's first rolling stock designed for high-speed rail, and was developed using the most advanced technology of the time. The most prominent feature was the adoption of an electric multiple-unit system, which distributed power throughout the trainset and equalized the axle loads. This enabled track and structure standards to be optimized, thereby holding down construction costs.

The Series 100, which adopted the technological progress and experience gained over the preceding 20

Series N700 (©Central Japan Railway Company)

N700A (©Central Japan Railway Company)

years, was planned and manufactured to replace the Series 0 rolling stock and went into commercial operation in October 1985. The Series 100 improved passenger service by introducing the double-deck first-class cars and private compartments for the first time and new cabin amenities.

In 1988, shortly after JR Central was established, we began to develop a new type of rolling stock that would achieve higher speeds. The development goal was set to raise the maximum speed to 270 km/h and reduce the travel time between Tokyo and Shin-Osaka to 2 hours and 30 minutes. The development resulted in the Series 300, which began its commercial service as the *Nozomi* in March 1992. To attain substantial improvements in speed while taking into account noise, ground vibration, and other wayside environmental aspects, the latest technology was adopted from a variety of fields and weight reductions were instituted to details of car bodies and bogies.

In tandem with the development of the Series 300, the Shinkansen Experimental Train 300X was used for running test from 1995, in pursuit of the latest and best high-speed rail system. Speed-increasing tests elucidated the relationship between speed and vehicle running stability, ride comfort, current collection performance, aerodynamic phenomena and other factors. During this process, the 300X set a domestic maximum speed record of 443 km/h in 1996.

The Series 700 integrates the technology acquired from the 300X test train, and was placed in commercial service in March 1999. In addition to achieving a wide, comfortable interior with little vibration due to the introduction of a semi-active vibration control system and other features, the Series 700 adopts improved single-arm pantographs and insulator covers, reducing noise and considerably improving its environmental compatibility along with achieving qualitative improvements in transport service.

The Series N700, which was introduced in July 2007, incorporates the technology developed at the Komaki Research Center, our company's technology development center, and other facilities. The Series N700 was the first shinkansen to employ the Body Inclining System in order to increase speed over the many curves along the Tokaido Shinkansen. With the Body Inclining System and other features, the Series N700 shaved as much as 5 minutes off the time required between Tokyo and Shin-Osaka. The Series N700 also has outstanding energy performance. The introduction of cover-all hoods and elimination of level differences in window glass as well as other improvements have reduced running resistance. The number of speed adjustments in curves has decreased thanks to body inclining, reducing power consumption by 19% in comparison to the Series 700. Since March 2009, wireless internet has been available in cars, offering a more convenient interior.

The successor Series N700A started operation in February 2013. It was created by incorporating technology developed at the Komaki Research Center based on the Series N700 as well as using results achieved in running tests with the Series N700 pre-mass production trainset. In addition to the Series N700's already high level functions, the N700A newly employs High Performance Wheel Mounted Brake Disks, Bogie Vibration Detection System, Cruise Control System, and other features. The N700A has achieved further improvements in safety and stability as well as reduced environmental load. Since April 2013, JR Central has instituted improvements by adding some N700A functions to all of the 80 Series N700 trainsets. By the end of FY2016, about 80% of all trainsets will be either the Series N700A or the upgraded Series N700.

Railway Structures Supporting High-Speed Operation

For the opening of the first shinkansen service in 1964, designs were formulated for rails, sleepers, turnouts and other track materials based on the latest railway technology at the time. These were put through numerous tests before being installed as the world's first railway structures to support operation at 210 km/h. Continuous welded rails, movable nose crossings and other engineering developments, which are considered ordinary shinkansen equipment today, were also originally employed at the

High-speed inspection Trains (T2: Right T4: Left) (©Central Japan Railway Company)

New Ballast Scraper (NBS) (©Central Japan Railway Company) opening of service. Furthermore, the latest technologies and approaches have also been adopted for track maintenance methods, such as periodic maintenance of tracks mainly using Multiple Tie Tampers and other heavy machinery as well as the introduction of Rail Flaw Detection Cars, which search for flaws in rails while running along the line. These technologies have continually been improved upon even after entering service. For example, rails with a larger cross section and strength (60-kg rails) were developed to address the steadily increasing number of departures after service opened. Over a period of approximately 10 years beginning in 1972, these replaced all 50T rails (50-kg rails) that had been used up to that point.

In raising the speed to 270 km/h, the issues we faced included an increase in the impact on tracks as well as an increase in centrifugal force while running. However, thanks to the rolling stock's lightweight technology and other improvements, the impact on railway track when the Series 300 ran at 270 km/h was verified to be the same as that when either the Series 0 or Series 100 ran at 220 km/h. To address the increase in centrifugal force, a large-scale project was initiated to increase the amount of track cant (from a maximum of 180 mm to 200 mm) over approximately 240 track-km (total of east and westbound lines) or the equivalent of approximately one-quarter of the total line.

As operation at 270 km/h, which began in 1992, was extended subsequently to all trains, methods for managing ground facilities also underwent significant changes during this period.

First, along with the start of 270 km/h operation, significant controls were instituted on long-wave track distortion (track irregularity), which has a considerable impact on ride comfort. From 1974, the Series 0-based T2 trainset was used as high-speed inspection trains measuring track irregularities. However, the T2 could only make measurements at a speed of 210 km/h. Therefore, in 2001, the Series 700-based T4 trainset was developed and introduced for taking measurements at 270 km/h.

In order to supplement measurements taken by high-speed inspection trains, the Real-time Acceleration Inspecting Device with Automatic Recording System for Shinkansen (RAIDARSS), which had been used to control oscillation on the Series 100, was also implemented on the Series 300 and Series 700, running at 270 km/h. Moreover, since 2009, an upgraded version of RAIDARSS is installed on some trains for measuring track distortion (irregularity of longitudinal level) in the east-and-west directions in addition to oscillation, and has been monitoring track conditions on a daily basis.

We are continually improving precision, efficiency, and safety of track maintenance work by utilizing data acquired from high-speed inspection trains, RAIDARSS, and other equipment. For instance, in 1997, full-scale introduction of the Dynamic Track Stabilizer (DTS) was achieved, which stabilizes track after performing ballast exchange work, a process which had accounted for the majority of train slowdowns. DTS shortened the margin time for slowdowns, allowing the *Nozomi* to travel the Tokyo to Shin-Osaka corridor in 2 hours and 30 minutes even while making a stop at Shin-Yokohama. In addition, the New Ballast Scraper (NBS), which JR Central developed in 2002, is capable of simultaneously excavating old ballast and spreading new ballast—operations which used to be performed separately. NBS has greatly improved work efficiency, including reducing the manpower necessary for the task and increasing the nightly length of track work. This change has also remarkably enhanced labor safety.

Natural Disaster Countermeasures

Over half the civil engineering structures along the Tokaido Shinkansen are embankments, excavations or other earth structures. Embankments gradually settle over time after construction, but rainfall often washes down the soil from embankment slope during the early stages before the embankment settles sufficiently. Consequently, countermeasure work has been performed at locations where damage occurred and is expected, so the soil does not wash away. From 2000, JR Central started surfacing embankments with concrete to enhance resilience to rainfall, and this work was completed in 2003. Because such tangible countermeasures to rainfall were completed for the most part, vulnerability to rainfall was ameliorated considerably and operation restrictions during rainfall were relaxed in 2003.

In addition, earthquake countermeasures have been implemented ever since the Tokaido Shinkansen opened by introducing cutting-edge aseismic technologies. After the 1995 Hanshin-Awaji Earthquake, the viewpoint was to prevent structures from collapsing due to a large earthquake in order to avoid interruptions to train service for significant periods of time. Seismic retrofitting work was performed, as necessary, on elevated track columns, bridge piers, embankments and other engineering structures on all lines, and measures were implemented on bridge girders to prevent bridges from collapsing. This work was nearly completed in 2013. Furthermore, although railway structures did not suffer significant damage during the 2004 Chuetsu Earthquake, the Joetsu Shinkansen nevertheless derailed, which led to the implementation of measures to counter derailment and deviation, beginning in 2009. These countermeasures involved a redundant system consisting of Derailment Prevention Guards and Deviation Prevention Stoppers. Derailment Prevention Guards are installed along

Derailment Prevention Guards (©Central Japan Railway Company)

Countermeasures against viaduct displacment (©Central Japan Railway Company)

the tracks to prevent derailment wherever possible. And even if a greater-than-anticipated shock causes a derailment, train deviation would be prevented as far as possible by the Deviation Prevention Stoppers mounted on the cars. In order for derailment prevention guards to function effectively, additional measures have also been implemented to curb displacement of civil engineering structures.

There has also been a continuing commitment to develop systems that quickly decelerate and stop trains when an earthquake occurs. In 1965, shortly after the service commenced, the world's first alarm seismometers were installed, completely automating the process from earthquake detection to alarm output. In 1992, the Urgent Earthquake Detection and Alarm System (UrEDAS) was adopted; it detects the initial shock (P-wave) during an earthquake and issues an alarm. Moreover, in 2005, the Tokaido Shinkansen EaRthquake Rapid Alarm System (TERRA-S) was developed and introduced, improving the detection time and accuracy. Since then, the latest knowledge has been integrated and improvements have been made in operations to decelerate and stop trains even earlier and with greater precision.

Reinforcement of Power Supply Systems

Japan's commercial power frequency is 50 Hz east of the Fuji River flowing through eastern Shizuoka Prefecture, and 60 Hz to the west; the Tokaido Shinkansen crosses this 'frequency border'. Frequency conversion (FC) substations were installed above ground to standardize the entire line at 60 Hz, because the 50-Hz track section comprises a relatively short length of about 140 km of the entire 515 km between Tokyo and Shin-Osaka, and there was a plan to construct the Sanyo Shinkansen which would make the ratio of 50-Hz track section much smaller. Initially, these FCs were a "Rotary Type" that coupled a 50-Hz electric motor and a 60-Hz generator directly using the same axle. Later, an "Electronic Type" was also adopted, applying the latest technology in power electronics. The "Rotary Type" has superior resistance to brief overloads, and the "Electronic Type" has the advantage of low maintenance and management. Currently, both schemes are applied, utilizing the benefits of each type.

As the power supply capacity of the Tokaido Shinkansen determines transport capacity directly, the power supply systems have been augmented and improved in line with the increase of transportation volume.

The initial operation plan of the Tokaido Shinkansen set the maximum speed at 210 km/h with 12 cars in one trainset, and ran one *Hikari* and one *Kodama* each hour. The power supply system was also based on these assumptions. Subsequently, power supplies were reinforced to match the high transportation volume for the 1970 Osaka Expo and the opening of the Sanyo Shinkansen service to Okayama and then Hakata. As transportation volume increased after JR Central's establishment in 1987, the company introduced Static Var Compensators (SVC) to counter voltage drops in overhead catenary as well as Static Var Generators (SVG) to control voltage fluctuations at power companies. Since 2007, feeding system Railway Static Power Conditioners (RPC) have been adopted, combining both the SVC and SVG functions.

Power supplies on different phases face at substation boundaries along the Tokaido Shinkansen because of its Alternating Current (AC) feeding system. Since the shinkansen's high-speed running is compromised when transiting such boundaries by coasting as done on conventional lines, changeover sections were developed to allow transit while running under power. Changeover switches, which are used at changeover sections, evolved from air-blast circuit breakers, which were used when the line initially opened, to vacuum circuit breakers. JR Central has already started to install static changeover switches with lower failure rates and easy maintenance features.

Changes in Signaling Systems

The shinkansen design was based on the principle of "Crash Avoidance," which eliminates the possibility of a collision. The Automatic Train Control (ATC) system is the device that puts this principle into practice. Because the shinkansen runs at high speeds, it is difficult for a driver to verify ground signals visually. It is not possible to stop the train within a driver's vision range due to the long braking distance, therefore a display inside the cabin indicates the permitted speed, and the brakes are automatically controlled when the train speed exceeds the permitted speed. In spite of multiple modifications to the ATC specifications since the line opened, its initial design concept remains unchanged even today.

The first generation ATC (ATC-1A) was introduced on the Tokaido Shinkansen after application tests were conducted on conventional lines from 1960 to 1962.

An upgrade to the second generation ATC (ATC-1D) was made between 1980 and 1988. This new system added additional information and improved reliability of ATC signals through a combination of two signals, a main signal and a sub signal. A monitoring system (commonly called the "ATC monitor") to monitor system parameters was also employed. In addition, before *Nozomi* started operations in 1990, signals began to be added, supporting operation speeds of 270 km/h.

The second generation system was upgraded to the third generation ATC (ATC-NS) between 1999 and 2006. This system changed from the previous multi-stage brake control system to an in-vehicle main-type digital ATC with a single stage brake control system. Control data is transmitted from ground devices to onboard devices where the braking curve is computed based on the train's position, performance, track alignments and other factors so as to provide optimal brake control. Systems using the ATC-NS have also been installed on the Taiwan High Speed Rail and Kyushu Shinkansen.

Shinkansen Multipurpose Inspection Trains

Once every 10 days, the Class 923 Shinkansen Multipurpose Inspection Train (common known as "Dr. Yellow") conducts

Training on Conductor Simulator (©Central Japan Railway Company)

a detailed check of facility conditions while it runs at 270 km/h, the same speed as commercial trains. The results are sent to maintenance bases and used as basic data for facility maintenance.

The first-generation Class 922 inspection train (T1 trainset) was an electric inspection train converted from a shinkansen prototype (B trainset), and there was a separate track inspection vehicle. Later, in 1974, the Class 922 Shinkansen Multipurpose Inspection Train (T2 trainset) was introduced based on the Series 0 and combined both electric and track inspection functions. In 1979, the sister vehicle T3 trainset was added and used interchangeably with the T2 trainset. In 2001, the Class 923 Shinkansen Multipurpose Inspection Train (T4 trainset), which was based on the Series 700, was introduced in conjunction with an upgrade of the T2 trainset. Then, in 2005, JR West adopted the T5 trainset to replace the T3 trainset, and the T5 trainset has been operated interchangeably with the T4 trainset.

Improved Personnel Training

Based on the philosophy that people are our greatest asset, JR Central provides personnel training centered on the three pillars of on-the-job training (OJT), group training and self-development. As Tokaido Shinkansen technology advances at a rapid pace, the environment around our employees has also been changing significantly. To respond effectively to these changes, JR Central has been improving personnel training both tangibly and intangibly.

To supplement OJT, which is the main pillar for training younger employees, various types of group training are conducted at the General Education Center. With group training, systematic improvement in knowledge and skills can be expected by bringing together employees who share the same purpose, and the General Education Center assumes a central role in this process. By utilizing excellent practical facilities for training, such as the General Training Simulator for multiple job skill improvement and emergency response as well as the Training Tracks with signaling communication facilities, overhead catenary and rails, practical training is conducted under realistic conditions without interfering with actual operation and maintenance of rolling stock or railway tracks.

In order to maintain and improve the skills of each member of the train crew, driver simulators were introduced in 1993 and conductor simulators in 2004. Currently, such simulators are deployed at the General Education Center as well as at train crew depots in Tokyo, Nagoya and Osaka. They are used for daily training and educating incoming train crew candidates.

In addition, numerous rules have been established to safeguard operations, taking into account bitter lessons learned in the past, so as to avoid operational accidents as well as work-related accidents. These rules include such everyday measures as formulating meticulous plans in advance, performing work in accordance with procedures to avoid errors, and engaging in thorough confirmation after the work is done. Also, not only have such rules been established, but the safety awareness, knowledge and skills of employees engaging in operations is consummated through efforts to have personnel question “why,” then think about, discuss and thoroughly understand the nature of work mechanisms and rules. In the future as well, to achieve safe, reliable, comfortable and high-speed Tokaido Shinkansen service, many personnel involved in operations and maintenance will be trained; they will then further polish the techniques and spirit handed down successively from their predecessors, and later pass these down to the next generation.

Overseas Deployment of High-Speed Rail System

There are many environment-friendly high-speed railway (HSR) construction projects underway worldwide. JR Central is promoting the overseas deployment of HSR systems by leveraging its comprehensive HSR technology, which is at the world’s highest level. Overseas deployment of HSR systems maintains and strengthens domestic manufacturers’ technology and skills as well as produces technological innovation in railway-related components as a consequence of an extended HSR market. We believe that this effort is significant for ourselves in leading to the stable supply of materials and equipment as well as cost reductions. In actual overseas HSR projects, JR Central will play roles to provide consulting and coordination for safe and reliable HSR operations.

When considering target corridors in other countries, the most important thing is that JR Central’s HSR system be adopted as a total system with newly constructed dedicated tracks for high-speed passenger rail. In addition, the conditions called for are that the country has firmly established intellectual property rights, an established social norm for honoring agreements, a full legal infrastructure in place, and a stable political landscape. Furthermore, the country must have the economic strength to make the huge infrastructure investment.

Taking this view into account, we have identified the United States as a prime target. Currently, JR Central is promoting a Tokaido Shinkansen-type HSR system, called the “N700-I Bullet”, in Texas, and the Superconducting Maglev, “SCMAGLEV”, for the Northeast Corridor connecting New York and Washington D.C. The Japanese government has also provided active support, particularly regarding the SCMAGLEV project; Prime Minister Abe proposed introduction of SCMAGLEV in the United States to President Obama at the US-Japan summit in February of last year and again in April this year.

In April of this year, JR Central agreed with the Taiwan High Speed Rail Corporation (THSRC), which operates the Taiwan High Speed Rail, to provide technical consulting services for issues such as the line extension from Taipei Station to Nangang Station. JR Central is assisting THSRC with high-quality technical consulting services.

Futhermore, on the occasion of the 50th anniversary of the Tokaido Shinkansen in October 2014, the International High-Speed Rail Association (IHRA) was founded together with JR East, JR West and JR Kyushu in April this year to establish Japan’s high-speed rail system—which is based on the principle of “Crash Avoidance” (eliminating the possibility of a collision by means of a dedicated tracks and the Automatic Train Control (ATC) system)—as an international standard.

In Closing

This year, we observe the 50th anniversary of the Tokaido Shinkansen. When the Chuo Shinkansen opens in 2027, a strong structure will be necessary to ensure the three generations of railway (conventional line, Shinkansen, and SCMAGLEV) can harness their respective distinguishing features to the maximum extent possible. We will continue to provide safe and stable transport, and constantly incorporate cutting-edge technologies so that we may more vigorously promote our commitment to safeguarding the environment. Moreover, we will continue our steady effort to refine our employees’ knowledge and skills with the aim of furnishing a high-quality service suited to our passengers’ diverse needs. ■

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