Efforts to further improve safety levels

Fostering safety-oriented personnel

■Safety education and training

To heighten safety awareness among employees by placing priority on safety education and training JR East is offering educational and training opportunities to its employees at the JR East General Education Center (Shirakawa City, Fukushima Prefecture) and General Training Centers (branch offices), and on-the-job training in each workplace.
The JR East General Education Center offers group training for personnel development and improvement of knowledge and skills, fostering the development of new train crews and also providing the necessary training for job transfers. The General Training Centers in each of our branch offices offer education and training to improve the skills of train crews by utilizing accident prevention simulators on a regular basis.
In OJT (on-the-job training), we offer education and training to suit the situations of each workplace.


JR East General Education Center



Train protection drills on training tracks

■Enhancement of educational and training facilities

We are conducting safety-related education and training based on the following principles:
① In basic education in classrooms and in on-the-job training at each workplace, importance is placed not only on work procedures, but also on the purposes, objectives, reasons, background, structures and working principles that underlie them so that trainees can think about and learn the sense of values that underpin the reasons for each action.
② During training to improve responsiveness, trainees can touch and feel actual devices and equipment so that they can encounter situations that are as similar as possible to actual situations. By experiencing failures in training, they can learn by practice and acquire the level of responsiveness required in daily operations.
③ By experiencing the most serious accidents, trainees can be ready for the worst-case scenario and take the necessary countermeasures. Engraving the importance of lives on the minds of employees will drive them to further improve their countermeasures.

To improve the levels of education and training, we are enhancing educational and training facilities at General Training Centers and Skills Training Centers at all of our branch offices by introducing cut models of actual devices and equipment. Furthermore, we are currently introducing simulators for training at all train crew offices.


Cut model of rolling stock equipment


Simulator for train crew training


Track facility at Skills Training Center

TICKET TO TOMORROW

Drive simulator for train drivers

Senior Chief Driver, Tachikawa Train Drivers Depot, Hachioji Branch Office

Tachikawa Transportation Depot is in charge of train driving for the Chuo Line, Ome Line, and Itsukaichi Line. The depot is the largest in the JR East service area with approx. 280 drivers. Currently, I am in charge of education and training for train drivers. In March 2017, a drive simulator for train drivers was introduced at the depot. Instead of CG images, the simulator uses real images of the railway line where the driver works, to make driver training more realistic.
Due to the introduction of the new simulator, we reviewed driver training methods to make them more practical and effective. Specifically, we introduced conformity in basic actions such as finger-pointing and calling, driving in bad weather, and the emergency response at a time of signal failure. We will further improve our level of driving for safer and more stable transport by fully utilizing the simulator.

■Education and training to understand the real nature of each action

For higher quality operations, it is necessary to truly understand the sense of values, objectives, and background for each basic action and rule.
For these reasons, in our education and training, trainees learn not only procedures including manuals, but also undertake practical training so that they can understand the true nature of the lessons including the reasons, structures, and working principles behind them.

■Accident History Exhibition Hall

Many of the safety-related rules and facilities have been created from our experiences of and reflection on past accidents. With the objective to further improve our safety levels by learning lessons from accidents, which is our basic policy for safety, we will never forget past accidents and are committed to pass on these valuable experiences learned from those lost lives. To this end, JR East established the Accident History Exhibition Hall at JR East General Education Center and the hall is used for various training to learn the importance of safety in railway operations.
In the 30th anniversary of the company's foundation, we are renewing the Accident History Exhibition Hall so that we can remember past accidents and pass on the lessons learned from these accidents to future generations.


Accident History Exhibition Hall

■Fostering integral safety leaders and professionals

In this time of rapid change in generations, since it is of the utmost importance to enable our employees to play major roles in securing safety in our operations, we are taking various measures as indicated below.

○Key Safety Leaders
We are fostering three capabilities in Key Safety Leaders in field organizations: comprehensively understand situations, training and fostering successors in each workplace. Key Safety Leaders have a thorough understanding of the safety rules, details of past accidents and safety weaknesses in their own workplace, offer guidance to other employees on a regular basis in the workplace, and contribute to the betterment of safety levels in field organizations.


Key Safety Leaders' meeting

○Safety Professionals
We have selected Safety Professionals from each branch office and construction work office to train them as Safety Professionals. They are expected to be professionals capable of guiding other employees through their long experience in railways and abundance of knowledge of safety rules and details of past accidents as well as their countermeasures.


Safety Professional certification ceremony

○Chroniclers of Safety (narrators of oral history)
JR East is currently experiencing a rapid change in the generations of its employees, including frontline staff and therefore needs to steadily instill successors with safety-related knowledge, leadership, and technical capabilities. We assigned ex-employees of JR who possess an abundance of knowledge and applied skills in railway safety to act as our "Chroniclers of Safety" (narrators of oral history).


Assignment of ex-employees of JR East who possess an abundance of knowledge and applied skills in railway safety to act as our "Chroniclers of Safety" (narrators of oral history)

Ingraining the cultures of safety

○The Challenge Safety Campaign

We started the Challenge Safety Campaign with the aim of encouraging our employees to actively take on the challenge of further improving safety levels, rather than just passively maintaining safety, with each one of our employees thinking about safety and autonomously taking actions. With initiatives of field staffs, in a consorted campaign with all employees JR East is working to create a corporate climate in which its employees actively engage in pursuing higher safety levels in our operations. In the campaign, each one of our employees finds their own safety issues and takes actions to solve these safety issues with support from branch offices and the Head Office.

Development of safety-related discussions in each workplace

Examples of CS Campaigns

○Challenge Safety Aoshingo (Challenge Safety Green Light)

Since April 1989, we have been publishing a monthly safety information magazine, Challenge Safety Aoshingo, to comprehensively distribute safety information to our employees. The magazine offers useful information for CS Campaigns in each workplace such as specific efforts of the campaigns in each workplace and details of past accidents.

Challenge Safety Aoshingo (Mar. 2018 issue)

○Railway Safety Symposium

With objectives to improve the safety awareness of each one of our employees and to further vitalize various safety improvement activities including Challenge Safety Campaigns, JR East started Railway Safety Symposiums in 1990. Symposiums are attended by approximately 700 people including employees of group companies. We invite key figures from outside of the company to host panel discussions and introduce detailed safety examples of other companies. Participants bring back what they learn at symposiums to their workplaces and share safety awareness with other employees.

The 25th Railway Safety Symposium in FY2017

○Round table discussions between front-line employees and executive officers

We are increasing the frequency of opportunities for the exchange of opinions between front-line employees and executive officers to further deepen mutual understanding.
Through direct discussions between front-line employees and Head Office executive officers, we have mutually confirmed efforts to solve safety-related issues in order to take specific measures to further improve the safety levels of our operations.

Round table discussions with front-line employees

Group-wide efforts to further improve safety

○JES-Net (JR East Safety Network)

As the division of work increasingly progresses among Group and partner companies, to further improve safety levels it is inevitable that there is a sharing of common safety values and cooperation. When we started the Safety Plan, the JR East Safety Network (JES-Net) was established in FY2005 as a safety promotion network consisting of 25 JR East Group and partner companies that are engaged in work directly affecting train operations. As of March 2018, the number of companies in this network had expanded to 37.
JR East Group continues to promote measures for improvement and share issues to enhance safety levels across the whole group through JES-Net Presidents' Meetings with presidents of each group and partner company and JR East's top management; through safety collaboration camps with safety-related managers of branch offices and JES-Net member companies to discuss safety issues; and through safety reviews where frontline staffs exchange various opinions on site.
Additionally, through active exchanges of human resources among JES-Net members, we are working to improve safety levels and sharing safety awareness across the whole group.

JES-Net presidents' meeting

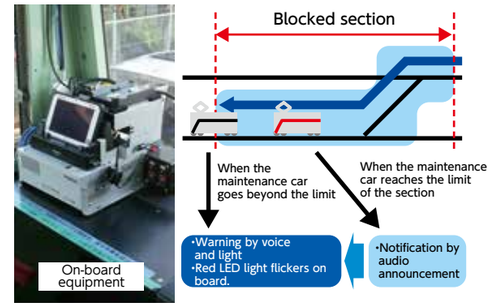
Safety-related research and development

JR East Group conducts various safety-related research and development activities with the Research & Development Center of JR East Group as its core.
Research themes at these organizations include those related to promoting the sharing of safety information and knowledge, in addition to efforts among employees; development of systems to prevent accidents due to failures in maintenance work procedures; research on safety evaluation of natural disasters such as wind, earthquake, heavy rain and snow; research on the safety of railcars to prevent flange climb derailment at low speed; and research to ensure the safety of customers at stations.
Research themes at these organizations include those related to major accidents such as derailments, systemization of maintenance work, promoting the sharing of safety information and knowledge among employees by utilizing human factors, safety evaluations of natural disasters such as strong winds, earthquakes, and heavy rain.

○Development of the maintenance car location detection system

As a countermeasure in light of the derailment accident at Kawasaki Station in Feb. 2014, we developed the maintenance car location detection system. The system activates an alarm when it detects an unauthorized maintenance car (including a road railcar) in an unblocked section, where train operations are not yet blocked for maintenance work.

We developed a rotary encoder method to detect a train location by the number of axle revolutions. As a method to support the prevention of train collisions with maintenance cars in the ATACS sections, we introduced the system to the Saikyo Line between Ikebukuro and Omiya in Nov. 2017.



Maintenance car location detection system (rotary encoder system)

○Development of a system to detect abnormality in the wheel load balance

We developed a warning system to detect wheel load unbalance by using a strain gage attached on the side of a rail. A wheel load unbalance could lead to a derailment accident.
We started test operations in Mar. 2018 and are currently conducting verification tests on the system.

Wheel load unbalance detection system

Strain gage

○R&D related to human factors

We developed a tool to measure the safety capability of employees so that they can identify their key strengths and then utilize and foster that strength in their work.

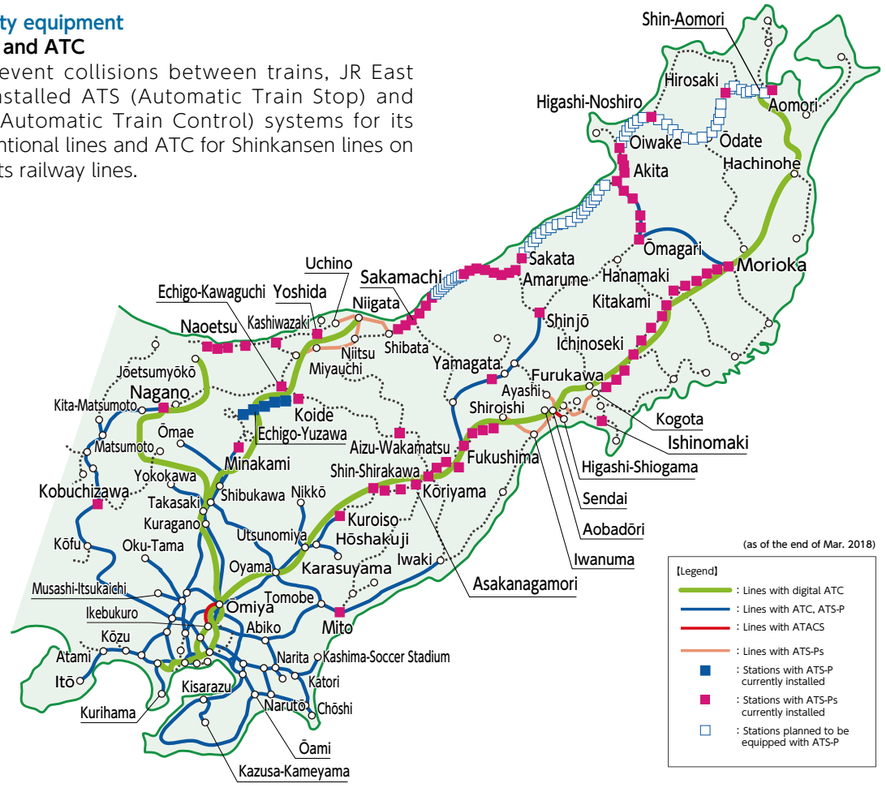
Development of a tool to measure safety capability of employees

Measures to prevent train collisions

■Safety equipment

○ATS and ATC

To prevent collisions between trains, JR East has installed ATS (Automatic Train Stop) and ATC (Automatic Train Control) systems for its conventional lines and ATC for Shinkansen lines on all of its railway lines.



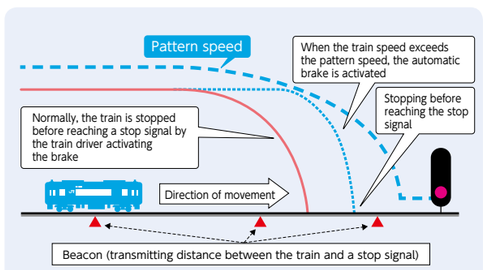
[Installation plan for ATS-P and ATS-Ps systems]

	Areas for planned installation	Installation status as of the end of FY2018
ATS-P system	Mainly for railway sections with frequent train operations in the Tokyo metropolitan area	Completed installation in 5 major stations and railway sections for 2,405.8km (service km)
ATS-Ps system	Provincial city areas and major railway sections excluding the Tokyo metropolitan area	Completed installation in 72 major stations and railway sections for 210.8km

○ATS (Automatic Train Stop)

Currently, JR East is installing ATS-P and ATS-Ps systems with improved safety capabilities on its railway lines.
With ATS-P and ATS-Ps, based on information from ground equipment, on-board equipment calculates the allowed train speed to stop at a stop signal. When the train exceeds the speed pattern, the system automatically activates its automatic brake to stop the train. The system also responds to speed limits for curves and turnouts.

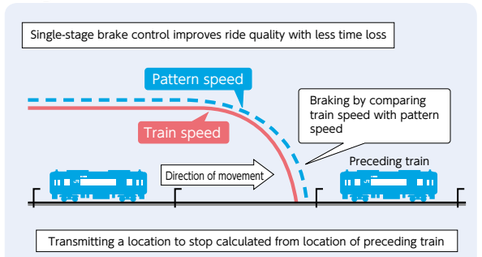
[Overview of ATS-P system]



○ATC (Automatic Train Control)

In this system, ground equipment continuously transmits signals to trains via the rails. The transmitted signals are indicated in the driver's cab and the system automatically activates the emergency brake if the train exceeds its permitted speed.
On the Shinkansen and the Yamanote, Keihin Tohoku and Negishi Lines, we have replaced the systems with digital ATC. This system transmits the location information of the preceding trains to the following train so that on-board equipment can control the train speed based on a speed pattern calculated from the information.

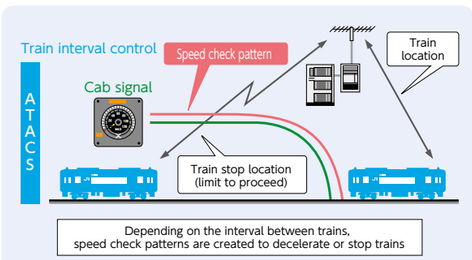
[Digital ATC]



○ATACS (Advanced Train Administration and Communications System)

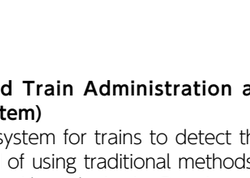
This is a totally new system for trains to detect their own locations instead of using traditional methods of train location detection with track circuits. By using radio communications for the transmission of train location information between ground and on-board facilities, we can control train operations. JR East began using ATACS on the Senseki Line between Aobadōri and Higashi-Shiogama in October 2011 and on the Saikyo Line between Ikebukuro and Omiya in Nov. 2017.

[ATACS]



TICKET TO TOMORROW

Introduction of ATACS and its further development



Chief, ATACS Saikyo, Tokyo Electrical Construction and System Integration Office

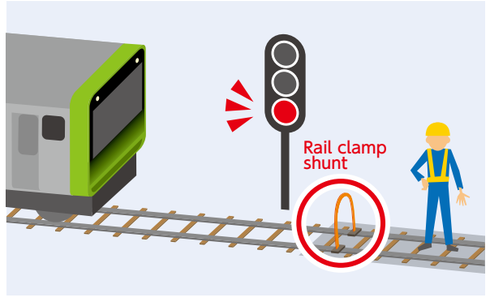
Following the introduction of the Advanced Train Administration and Communications System (ATACS) on the Senseki Line, we introduced the system on the Saikyo Line in Nov. 2017. This was the first implementation in the Tokyo metropolitan area. Though we faced some difficulties such as ensuring radio quality and arranging construction work to take account of other projects, thanks to detailed meetings with related parties and repeatedly reviewing construction methods we were able to complete construction and start to use the system.
Currently, I am in charge of the introduction of the level crossing control functions of ATACS. Compared with the conventional level crossing control method, we expect that the level crossing control method of ATACS will lead to further improvements in safety and the optimization of the alarm duration. With the aim of offering better systems, I will continue in my efforts to design systems as well as more safe and stable transportation, and we will also work on optimizing the functions of ATACS and assessing system for introduction on other lines.

■Others

○Dual safety measures

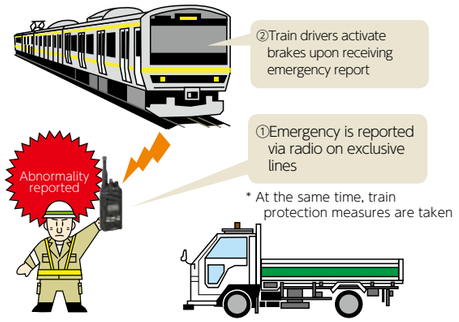
When conducting track construction, maintenance, or inspection, we close tracks so that other trains cannot enter these particular railway sections. However, in the case of a failure of a track closure as a result of human error, it could result in a train mistakenly entering a closed section during construction, maintenance or inspection. To prevent this from happening, we undertake dual safety measures. In addition to the above-mentioned track closure procedure, by installing rail clamp shunts on the closed section, signals will change to a stop signal to prevent trains from proceeding to that closed section.

[Dual safety measures]



○Collision prevention support radio system

Learning lessons from the derailment accident in the Kawasaki Station premises of the Keihin Tohoku Line in Feb. 2014, JR East introduced a collision prevention support radio system to help maintenance workers stop trains in case of an emergency during maintenance work.
The collision prevention support radio system alerts neighboring trains of an emergency by operating exclusive radio terminals in the case of an abnormality to immediately stop trains. The system is installed on all conventional line trains and when the emergency signal is transmitted, drivers receiving the signal promptly stop their trains.
However, depending on radio and line availability, the signal might not reach all neighboring trains. For this reason, the collision prevention support radio system is used as a supplementary method for train protection.

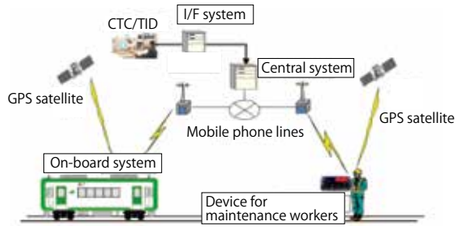


○Train approach alarm system

JR East utilizes alarm systems to warn maintenance workers on tracks of approaching trains. For railway sections with track circuits*installed, we use a TC-type wireless train approach alarm system to warn workers of approaching trains by track circuit. For railway sections without track circuits, we developed a GPS train approach alarm system to inform workers of train locations by locating the positions of trains and workers on GPS. We started use of these systems on both the Iiyama Line and the Hachikō Line from April 2016.

*Track circuit: A section of rail is used as a part of the electric circuit. By short-circuiting the rail using the wheels of the train, the position of the train can be detected.

[GPS train approach alarm system]



Preparedness against natural disaster

■Our measures against earthquakes

Learning from earthquakes in the past, JR East has employed the following three anti-earthquake measures:

①Preventing structural damage (seismic reinforcement measures)

②Stopping trains immediately (emergency train stop measures)

③Minimizing secondary accidents following derailment (preventive measures against derailed trains leaving the track area)

○Seismic reinforcement measures

In order to be prepared for the expected earthquake whose epicenter is anticipated to be located directly beneath the Tokyo metropolitan area, since FY2013 we have been working on the seismic reinforcement of embankments, cuttings, brick arch viaducts, power poles, and the prevention of the collapse of ceilings and walls on platforms and in other parts of stations. Additionally, we have proceeded with the seismic reinforcement of bridge pillars and elevated bridge columns ahead of schedule. Moreover, due to the Great East Japan Earthquake in 2011, we are pressing forward with the seismic reinforcement of station buildings that have daily passenger traffic of 3,000 persons or more and also of Shinkansen power poles that were greatly damaged by the earthquake at the time.
Based on changes in the expected intensity of the possible earthquake whose epicenter would be directly beneath the Tokyo metropolitan area and information on active faults, from FY2018, we started to work on the expansion of the reinforcement areas and also the implementation of new measures in order to manage the potential damage to each facility and the effects of the earthquake on our railway lines.


Seismic reinforcement of cuttings

[Seismic reinforcement measures taken after the Great East Japan Earthquake and progress made (As of the end of March 2018)]

Major measures		Total completed / Planned total	Completed ratio
Elevated bridge columns	Shinkansen	Approx. 8,640 units / Approx. 8,640 units	Completed
	Conventional Lines	Approx. 6,240 units / Approx. 6,600 units	95%
Bridge columns	Shinkansen	Approx. 620 units / Approx. 680 units	91%
	Conventional Lines	Approx. 1,640 units / Approx. 1,910 units	86%
Embankments	Near Ochanomizu (embankment on the river side)	Approx. 1.2 km / Approx. 1.2 km	Completed
	Height of 8m and over	Approx. 8 km / Approx. 8 km	Completed
	Height of 6m and over, and below 8m	Approx. 10.0 km / Approx. 11 km	91%
Cutting (Including near Ochanomizu)		Approx. 13.3 km / Approx. 23 km	58%
Embankments and anti-derailing guards before and after bridges		Approx. 74km / Approx. 74km	Completed
Station buildings		62 buildings / Approx. 85 buildings	72%
Ceiling of station buildings and platforms		Approx. 410 stations / Approx. 560 stations	73%
Walls of station buildings and platforms		56 stations / 56 stations	Completed

○% Completion ratio of 80% and over Completed Completed

[Additional reinforcement started from FY2018]

Major measures		Planned total
Elevated bridge columns	Shinkansen	Approx. 2,630 units
	Conventional Lines	Approx. 180 units
Embankments		Approx. 12 km
Embankments and anti-derailing guards before and after bridges		Approx. 50 km


Seismic reinforcement

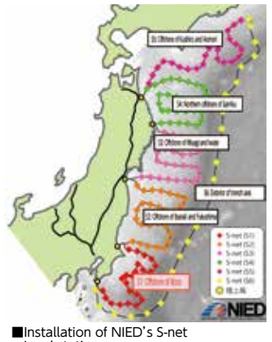
○Emergency train stopping measures

For Shinkansen lines, to automatically stop trains as quickly as possible JR East utilizes the Shinkansen early earthquake alert system, which is based on the installation of wayside and coastal seismometers to detect primary tremors (P-waves). Additionally, the time required for the activation of emergency braking is shortened by approx. 1 second. To be prepared for an earthquake with an epicenter directly beneath the Tokyo metropolitan area and also for inland earthquakes, seismometers are installed at 30 locations and JR East started using the Earthquake Early Warning of the Japan Meteorological Agency from October 2012.
For conventional lines, using information from the Shinkansen early earthquake alert system and also the Earthquake Early Warning of the Japan Meteorological Agency, JR East utilizes the Early Earthquake Alert System for conventional lines to activate the emergency brake of trains in the necessary sections at the time of a large-scale earthquake.
By further improving the functions of seismometers installed along Shinkansen lines, along the seashore, and inland of the Tokyo metropolitan area, we are shortening the time required to stop a train after the detection of an earthquake on Shinkansen and conventional lines.

Topics

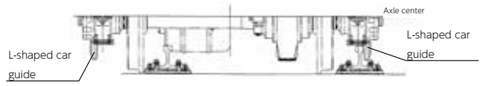
Early detection of earthquakes by utilizing information from ocean bottom seismographs

In Oct. 2017, JR East signed an agreement with National Research Institute for Earth Science and Disaster Resilience (NIED) to enable JR East to use the earthquake observation data of the Institute's S-net, a Seafloor Observation Network for Earthquakes and Tsunamis along the Japan Trench. From Nov. 2017, we have been using S-net's earthquake observation data for the offshore of the Boso peninsula (S1) for the Shinkansen Early Earthquake Detection System. We are currently preparing for the utilization of earthquake observation data for other areas. In comparison to earthquake detection by utilizing seismometers installed along the seashore, earthquake detection using earthquake observation data produced by seafloor seismographs enables us to shorten detection time by approx. 20 sec. at its fastest.



■Installation of NIED's S-net Land station
(Partial modification of NIED's figure)

○**Prevention of secondary accidents after derailment**
During the Niigata Chuetsu Earthquake in Oct. 2004, one of our Joetsu Shinkansen trains derailed. Fortunately, passengers and crew were uninjured. However, by learning lessons from the earthquake, JR East has taken preventive measures for Shinkansen trains and tracks. For Shinkansen trains, we have installed L-shaped car guides on bogies. By guiding the derailed trains along the rail, the L-shaped car guides prevent Shinkansen trains from completely leaving the track in a derailment. We have also improved glued insulated joints to reduce the impact of wheels and bogie parts in the event of a derailment. Additionally, we completed the installation of rail rollover prevention devices to guide the wheels along the rails following a derailment, thereby preventing a rail rollover and the rails from completely deviating from the track even after a train derails and the rail fasteners are broken.




L-shaped car guide


Before improving glued insulated joints


After improving glued insulated joints


Rail rollover prevention devices

■Preparing rescue kits and first aid kits
In the case of an earthquake directly beneath the Tokyo metropolitan area, many passengers might be injured and we might need to save the lives of passengers with the help of a limited number of our employees before the arrival of rescuers. For a major earthquake, placing top priority on saving the lives of the injured, JR East has prepared the following first aid kits and is also conducting drills to give personnel necessary first aid skills.

○**Rescue kits to save injured persons**
We installed rescue kits (crowbars, jacks etc.) at each station of the five branch offices in the Tokyo metropolitan area.


Rescue kits

○**First aid kits to provide first aid to injured persons**
We installed first aid kits (triangular bandages, etc.) at each station within 30km of Tokyo.


First aid kits


Rescue and life-saving training

○**General emergency drills**
JR East conducts general emergency drills to prepare for an earthquake during disaster preparedness week around Sep. 1st, every year. The drills include the following:
•Drills to operate an on-site disaster countermeasure headquarters at the Head Office and each branch office
•Drills for rescuing, life-saving, guiding passengers during an evacuation, and initial firefighting in each district.
Additionally, we participate in disaster drills run by local municipalities.

General emergency drills

■Measures against tsunamis
Before the Great East Japan Earthquake, we had set operational restriction methods and tsunami danger zones for each location, prepared manuals, and were holding study sessions and conducting drills on guiding passengers to de-board trains for evacuation. We believe that these efforts led to the prompt evacuation of passengers away from tsunami danger zones at the time of the earthquake.


Tsunami evacuation manual


Drill to guide passengers to alight from a train for evacuation

○**Formulating action guidelines for evacuation to avoid tsunamis**
To prepare for a case when there is no time before the arrival of a tsunami, JR East formulated action guidelines for evacuation during tsunamis for each one of its employees to follow in January 2012.

■Action guidelines for evacuation to avoid tsunamis
1. At a time of a large earthquake, be prepared for tsunamis. Gather information by yourselves and if communication lines are disconnected, make your own decisions for evacuation. (Do not be afraid to make a mistake.)
2. Once decided to evacuate, by judging the conditions of customers, promptly guide customers to evacuate.
3. In alighting from trains, evacuating and gathering information, ask customers and local people to cooperate.
4. Even after evacuation, go to a higher place without being satisfied and thinking this would be high enough.
5. Stay evacuated with customers and do not return to field offices or trains while tsunami warnings are still issued.

○**Tsunami evacuation navigation system**
We developed the Tsunami Evacuation Navigation System to assist train crews in evacuating passengers from unfamiliar places along railway lines through the use of their tablet devices.


Tsunami evacuation navigation system

○**Improvement of evacuation signs and routes and conducting drills for evacuation during tsunamis**
For railway lines such as the Hachinohe Line, which resumed operations following damage caused by tsunamis, we have improved the signs and routes for evacuation from tsunamis. We will also improve evacuation signs and routes for other railway sections.

Furthermore, in FY2018, we conducted drills on guiding passengers to alight from trains and escape from a tsunami at tsunami-prone locations, assuming that there was no time before the arrival of the tsunami. We will continue these drills every year at the same time of year.

Tsunami evacuation sign (Hachinohe Line)


Evacuation route (Hachinohe Line)


Drill to guide passengers to alight from a train during a tsunami

■Measures for rainfall

○**Measures for rainfall**
To protect tracks from landslides due to rainfall, JR East takes disaster prevention measures for wayside embankments in all railway sections in accordance with its plans. Especially in the Tokyo metropolitan area and for all Shinkansen routes, we take thorough measures to secure safe and stable transport.

[Countermeasures for rainfall]

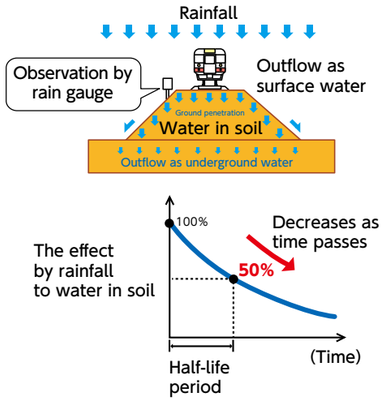

Cutting slope protection (spray frame work)


Embankment slope protection (spray frame work)


Natural slope protection (spray frame work)

○**Operational restrictions for rainfall**
For heavy rainfall, JR East ensures the safety of train operations by introducing operational restrictions such as limiting train speeds and suspending operations. Since June 2008, we have been using effective rainfall values which are highly related to landslide disasters due to rainfall. Effective rainfall is the amount of underground water remaining after changes over time in ground penetration and outflow. Since many of the disasters due to rainfall result from rainwater seeping into the ground, the effective rainfall index is more appropriate as an operational restriction index for railways.
With this indicator, we can more precisely predict the occurrence of landslide disasters, thereby improving the safety and reliability of our train operations.

[The concept of the effective rainfall]



■Efforts against wind

Uetsu Main Line train derailment accident
On December 25th, 2005, a derailment of the limited express train Inaho No.14 on the Uetsu Main Line between the Sagoshi and Kita-Amarume Stations caused the death of five passengers and injured 31 passengers. We would like to report on the measures we have taken since this accident.


State of derailment accident

○**Issuing tentative early restrictions for all lines**
For all railway sections of conventional lines with operational restrictions for wind, after the resumption of operations of the Uetsu Main Line on January 19th, 2006 we reviewed the criteria for operational restrictions as indicated below.
For locations with windbreak fences, we use prior general restrictions.

Restriction type	Wind speed (meters/sec.)	
	General restrictions	Early restrictions
Speed restriction (max. 25 km/h)	25 - 30	20 - 25
Operation halted	30 -	25 -

○**Installation of windbreak fences**
Since 1991, in order to reduce wind force on trains, we have installed windbreak fences at 29 locations as of the end of March 2018.


Uetsu Main Line, between Sagoshi and Kita- Amarume

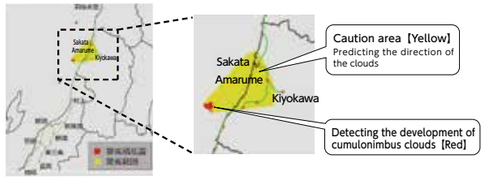

Keiyō Line, between Shiomi and Shin-Kiba

○**Foundation of Disaster Prevention Research Laboratory**
JR East founded the Disaster Prevention Research Laboratory at the Research & Development Center of the JR East Group in Feb. 2006. The Laboratory undertakes various research and development activities related to meteorological and terrestrial phenomena.

○**Expanded introduction of the gale warning system**
JR East has been using gale warning systems on the Keiyō Line since Aug. 2005 and has installed the systems in all 296 locations as of the end of Mar. 2018 on its conventional lines with a gale operational restriction, including the accident location between Sagoshi and Kita-Amarume of the Uetsu Main Line. The gale warning system restricts or suspends operations not only when the actual wind speed measured by anemometers exceeds restriction thresholds, but also when the projected maximum wind speed exceeds these limits.

○**Utilizing meteorological information to test methods for operational restrictions**
Local gusts are meteorological phenomena, and are difficult to observe with conventional observation equipment such as anemometers. Through meteorological information such as the intensity of rainfall obtained from the Japan Meteorological Agency's radars and Nowcast that supports detection of tornados, and by detecting the development of cumulonimbus clouds, we developed a method to forecast the occurrence of local gusts and to apply that information to our operational restrictions. Every year between November and the following March, we test the system in six sections of railway lines along the Sea of Japan including the Uetsu Main Line between Niitsu and Ugo Honjo.

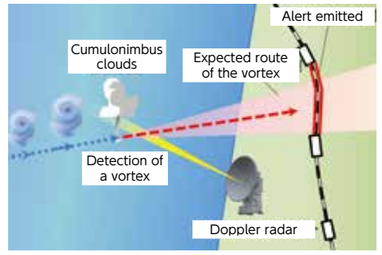
[Display of operational restriction area by utilizing
meteorological information (image)]



○**Research on a Doppler radar observation method**
Doppler radar is an observation system that can be used to ascertain the wide-area distribution of wind conditions. Jointly with the Meteorological Research Institute of the Japan Meteorological Agency, we have been developing a system that can detect a vortex of gusty wind in the air and emit an alarm to stations along the expected direction of the vortex to warn of possible adverse effects on train operations. In FY2017, we installed a higher performance Doppler radar on a hill of the Shonai Plain in Yamagata Prefecture, which is close to the ocean where local gusts are generated. In Dec. 2017, for part of the Uetsu Main Line and Riku-u West Line, we started to utilize the Doppler radar for train operation restrictions when there are local gusts.


Doppler radar


Antenna



Local gust monitoring (image)

○**Introduction of operational restriction methods by evaluating wind force on trains**
The wind force on trains constantly changes. We have been researching the following methods to properly evaluate the wind force on our trains and to further improve our operational restrictions to enhance the safety levels of our operations, while incorporating opinions from external experts.

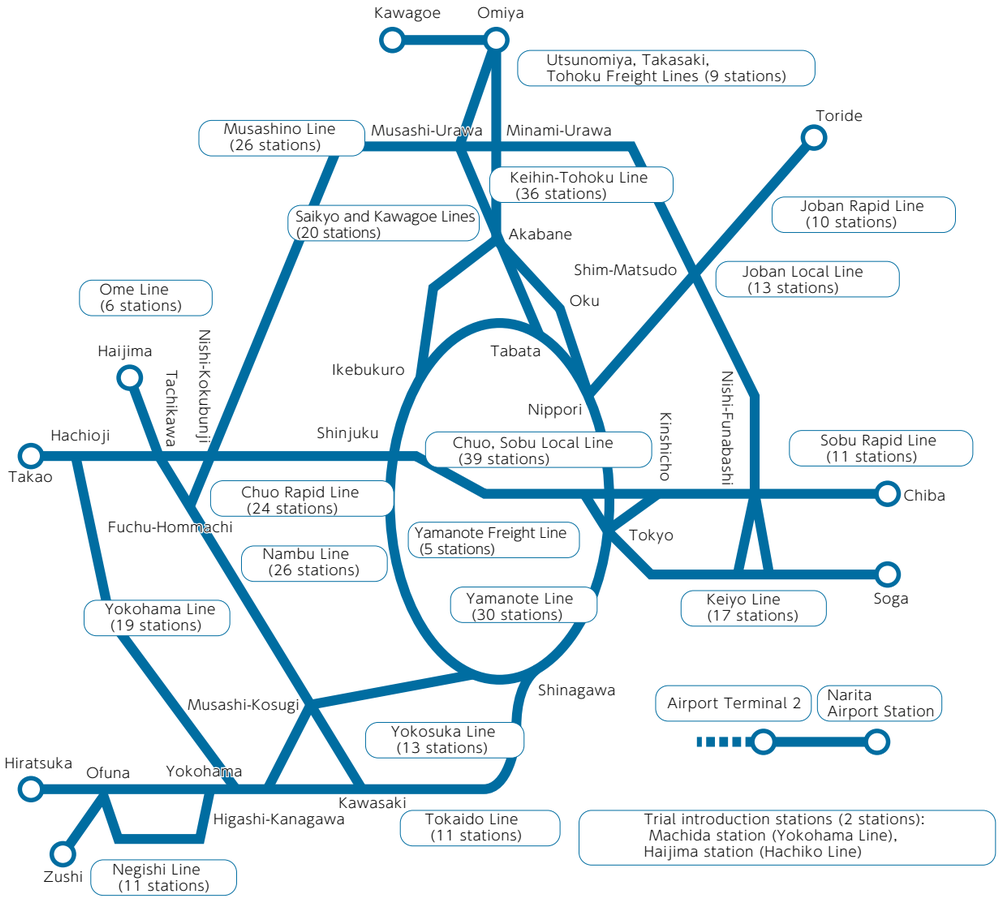
1) Further improved wind observation methods by anemometers
2) Calculation methods for rolling stock windproof stress taking account of track conditions and railcar shapes

These two methods have been utilized on railway lines including the Uetsu Main since Dec. 2011.

Safety measures at platforms

To prevent accidents involving customers falling from platforms or coming into contact with trains, we are installing platform doors.
By the beginning of FY2018, we had completed the installation at 24 out of 30 Yamanote Line stations (including Shinagawa New Station (provisional name)), excluding stations that have large-scale improvements in the pipeline, and at 6 stations on the Keihin Tohoku and Negishi Lines. We plan to further increase the number of stations with platform doors and also to accelerate the speed of installation, and by around the end of FY2033 we plan to have installed platform doors at all the stations on major conventional lines in the Tokyo metropolitan area (330 stations, including 32 stations to be completed by the end of FY2018).

[Platform door installations to be completed by around the end of FY2033 (330 stations)]



*No. of stations is counted by line, e.g., Tokyo Station is counted as 6 stations for 6 lines: Chuo Rapid Line, Yamanote Line, Keihin-Tohoku Line, Tokaido Line, Yokosuka and Sobu Line [Rapid Service], and Keiyo Line

Furthermore, JR East is currently working to install an increased number of emergency stop buttons on platforms and dot-Braille blocks that indicate which direction is away from the edge of the platform.
Moreover, to ask customers for their cooperation in preventing accidents, we are promoting platform zero accident campaigns.

Emergency stop buttons on platforms

By pushing an emergency stop button installed on platform pillars, people on platforms can notify drivers, conductors, and station staffs of danger.

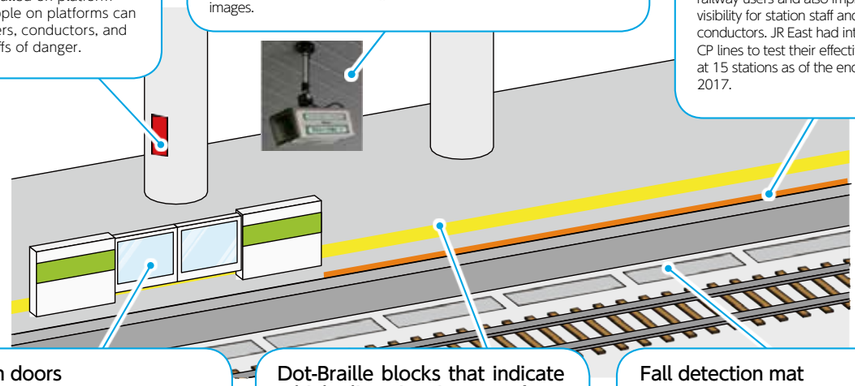
ITV for station platforms and concourses

Conventional ITV　　High resolution ITV

By installing monitoring cameras on station platforms and in concourses, we continue our efforts to improve safety on platforms and strengthen security in station premises. Additionally, at some stations, we have installed high resolution ITVs for more vivid monitor images.

CP (color psychology) lines

Painting the ends of platforms red or orange to create CP lines promotes awareness among railway users and also improves visibility for station staff and train conductors. JR East had introduced CP lines to test their effectiveness at 15 stations as of the end of Mar. 2017.



Platform doors

To improve visibility, glass is used for platform doors.

Dot-Braille blocks that indicate which direction is away from the edge of the platform

The inner line of the blocks is trimmed with lined bumps so that visually challenged customers can tell which side is away from the edge of the platform.

Fall detection mat

A mat placed on the tracks along the platform detects whether a person has fallen onto the tracks and notifies incoming trains to stop.

○About the trial introduction of new-type platform doors

On a trial basis, we are introducing smart platform doors with wider openings, at lower costs and a shorter construction period at Machida Station on the Yokohama Line.

Smart platform door®

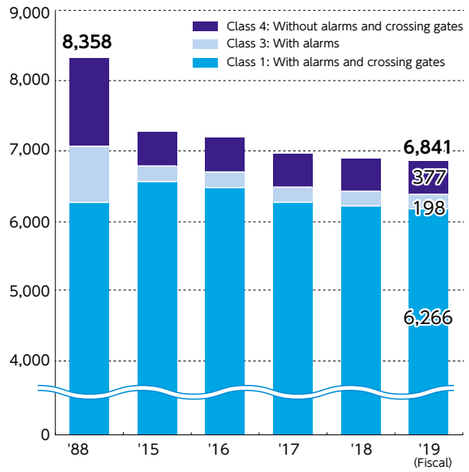
Functions to detect persons or objects stuck between railcar doors

209 Series and later railcars are equipped with a function to weaken the closing power of doors when the system detects that the bodies of customers or their belongings are stuck between train doors. For the rubber part of the door, from the floor to 30cm height, hard rubber is used so that the system can detect objects such as strollers.

Measures to prevent level crossing accidents

As safety measures at level crossings, in cooperation with local communities, JR East is working on the elimination of level crossings with the introduction of grade-separated crossings, thereby integrating and reducing the number of level crossings.
To further improve our safety measures, we are further increasing the installation of large obstacle detectors and level crossing alarm systems. Additionally, as a measure to improve visibility at level crossings, we are installing crossing warning devices in a higher position for better visibility.
Additionally, based on the Act on Promotion of Railway Crossings revised in April 2016, for level crossings requiring improvement, depending on the situation at each level crossing, we will take measures such as introducing overhead crossings instead of level crossings, and increasing the width of crossings. Where necessary, we will also apply colored paint to level crossings and overhead pedestrian bridges.
Moreover, we are promoting level crossing zero accident campaigns to ask for the cooperation of pedestrians and automobile drivers in accident prevention at level crossings.

[Changes to the number of level crossings (as of April every year)]



○Efforts to abolish level crossings

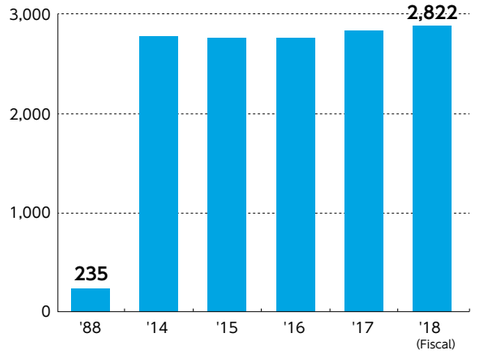
[No. of level crossings abolished due to measures such as the introduction of grade-separated crossings (excluding those transferred to semi-public sectors)]

FY	2013	2014	2015	2016	2017
No. of abolished level crossings	12	37	17	37	20

○Obstacle detectors

The detectors notify trains of danger by detecting a stalled automobile or an obstacle on a level crossing.
Currently, we are developing a highly-functional three-dimensional laser radar obstacle detector to expand the detection range.

[No. of locations with obstacle detectors]



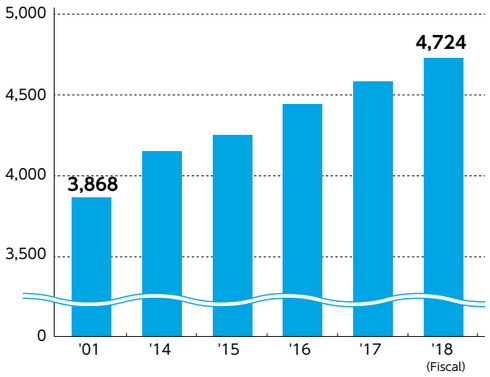
Three-dimensional laser radar obstacle detection method (large obstacle detector)

Based on three-dimensional data measured by laser beams, the system detects obstacles in monitoring areas.

○Level crossing alarm system

Automobile drivers or pedestrians can notify trains of dangers by using the system when they are stuck on level crossings.

[No. of locations with level crossing alarm systems]



Level crossing alarm system

○Increasing visibility of level crossing alarm system and standardization of display

We are improving the visibility of all level crossing emergency buttons so that pedestrians and drivers can immediately push the emergency button in case of an emergency on a level crossing. By using high-luminance reflective panels, furigana for Chinese characters, an English-language sign, and a pictograph, we will make it easier for children and people from abroad to use the emergency buttons.

Before ➡ After

○Measures to improve visibility at level crossings

JR East implements various measures to improve visibility at level crossings for pedestrians and automobile drivers.

[A crossing warning device located in a higher position for better visibility]

By installing alarms in a higher position, level crossings become more visible to pedestrians and drivers.

[Omnidirectional warning light]

The warning light can be seen from all directions.

○Separating level crossings for pedestrians and for automobiles

In cooperation with road administrators, we are increasing the width of level crossings and separating crossings for pedestrians from those and for automobiles.

○Efforts in snowfall areas

We utilize road heating for level crossings with heavy traffic in snowfall areas.

○Measures to prevent accidents at Class 4 rail crossings without crossing gates and alarms

For Class 4 level crossings that do not have crossing gates or alarms, in cooperation with neighboring communities, we are either closing them or upgrading them to Class 1 crossings by installing crossing gates and alarms. Additionally, to prevent accidents at level crossings, we are taking measures such as installing solar-powered illuminated signs or whistling signs to alert pedestrians to approaching trains.

Class 4 level crossing