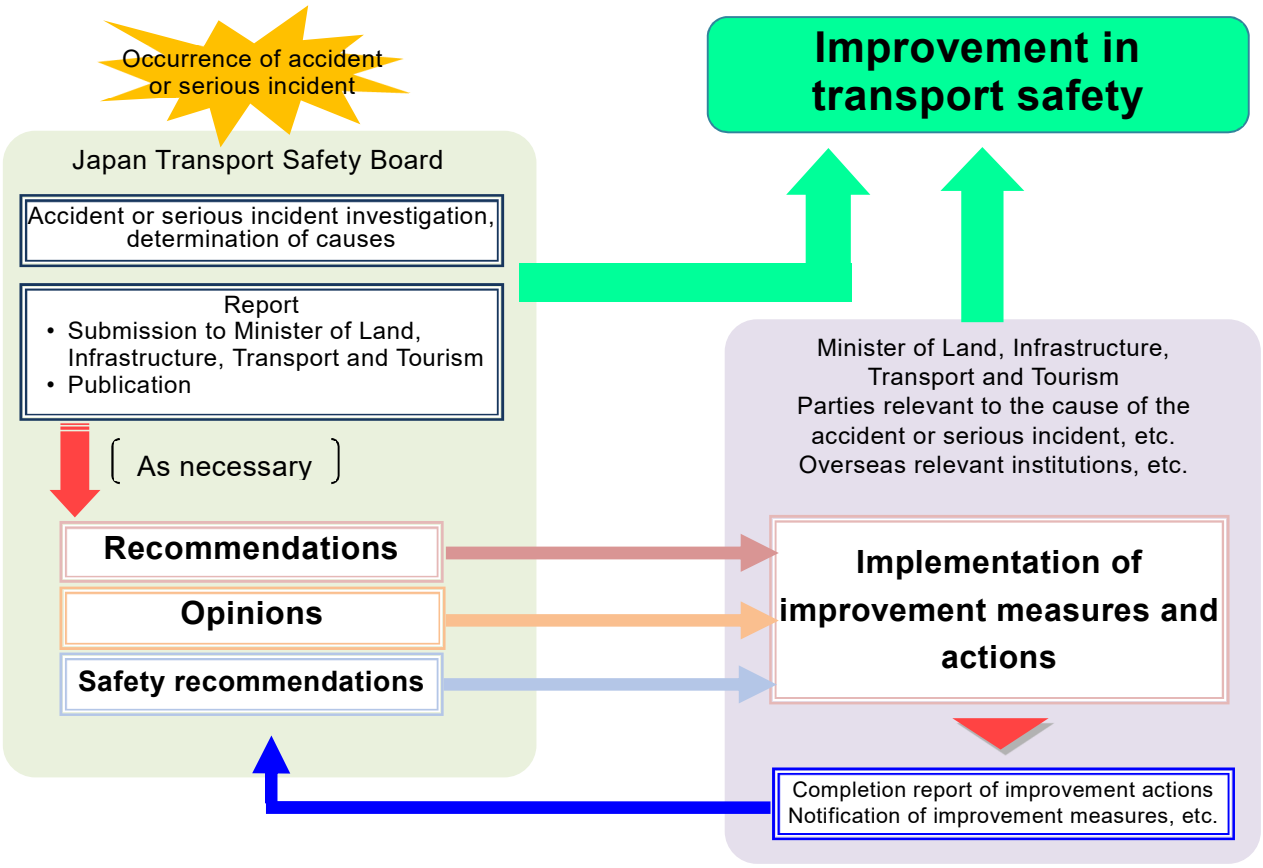
Chapter 1 Summary of recommendations and opinions issued in 2018

In order to fulfill the objectives of the law specified in Article 1 of the Act for Establishment of the Japan Transport Safety Board (hereinafter referred to as "Establishment Act"), the Japan Transport Safety Board has been established as an external bureau of the Ministry of Land, Infrastructure, Transport and Tourism based on the regulations of Paragraph 2, Article 3 of the National Government Organization Act (Article 3 of the Establishment Act). Its duty is to accurately conduct investigations identifying the causes of aircraft, railway, and marine accidents and serious incidents, as well as the causes of damage occurring due to those accidents and serious incidents, while also requesting required measures and actions to be taken by the Minister of Land, Infrastructure, Transport and Tourism or parties relevant to the causes of accidents or serious incidents, based on the results of its investigations (Article 4 of the Establishment Act).

Specifically, the Japan Transport Safety Board has the ability to give recommendations to the Minister of Land, Infrastructure, Transport and Tourism or parties relevant to the causes of accidents or serious incidents, regarding measures that should be taken for the prevention of accidents or serious incidents, or for reducing their damage, based on the results of its accident investigations. The Minister of Land, Infrastructure, Transport and Tourism must provide notifications to the Japan Transport Safety Board on measures that have been taken based on its recommendations, and if parties relevant to the causes of accidents or serious incidents do not take measures in response to recommendations that have been given, the Japan Transport Safety Board has the ability to publicly disclose that fact (Articles 26 and 27 of the Establishment Act).

In addition to actions based on individual accident investigation results, if it is recognized to be necessary at an interim stage of investigations or from investigation results of multiple past accidents, the Japan Transport Safety Board has the ability to state its opinions to the Minister of Land, Infrastructure, Transport and Tourism or the directors of related government institutions regarding measures that should be taken to prevent accidents or serious incidents and to reduce their damage (Article 28 of the Establishment Act).

In the cases of aircraft and marine accidents and serious incidents, the Japan Transport Safety Board may provide recommendations (safety recommendations) on measures that should be taken quickly in order to improve safety, to related overseas institutions or parties as necessary in any stage of accident investigations, based on international treaties.



The recommendations and safety recommendations issued by the Japan Transport Safety Board in 2018 are summarized as follows.

1 Recommendations

(1) Aircraft accident involving a CESSNA 172P (small aeroplane), registered JA3989, operated by New Central Airservice Co., Ltd.

(Recommendations on August 30, 2018)

Summary of the Accident

On Saturday, June 3, 2017, a Cessna 172P, registered JA3989, operated by New Central Airservice Co.,Ltd., took off from Toyama Airport, while flying to Matsumoto Airport, at around 14:50 Japan Standard Time (JST: UTC+9 hours, unless otherwise stated all times are indicated in JST), it crashed into the vicinity of the top of Mt. Shishi-dake (elevation about 2,700 m) in the Tateyama Mountain Range.

There were four people on board the Aircraft consisting of a PIC, a pilot and two passengers and all of them were fatally injured.

The aircraft was destroyed but there was no outbreak of fire.

Probable Cause

It is probable that as the Aircraft got into clouds during VFR flight over the mountain region, it became difficult for the PIC and the Pilot to grasp its own position and surroundings by confirming visually the terrain, then, the Aircraft approached the vicinity of the mountaintop and crashed into it.

It is somewhat likely that the Aircraft approached the vicinity of the mountaintop and crashed into it due to loss of visual contacts making the crash unavoidable, or due to failure to maintain minimum safe altitude caused by the Aircraft icing or stalled condition, or due to encountering a severe turbulence. However, it could not be determined, since the PIC and all members on board were fatally injured.

Concerning the fact that the Aircraft came to fly into clouds, it is probable that the PIC and the Pilot had not confirmed thoroughly the weather forecast for the mountainous region before departure and they delayed in making a decision to turn back during flight.

Recommendations to the Minister of Land, Infrastructure, Transport and Tourism

In view of the result of this accident investigation, the Japan Transport Safety Board recommends pursuant to the provision of Article 26 of the Act for Establishment of the Japan Transport Safety Board that the Minister of Land, Infrastructure, Transport and Tourism should take the following measures in order to prevent the aircraft accidents and reduce damage from those when they occur.

(1) Make it known to pilots that the icing conditions are extremely hazardous for the aircraft not certificated for flight in icing conditions and those aircraft should definitely avoid flying in icing conditions.

(2) Encourage pilots for small aeroplanes to fasten their seat belts and shoulder harnesses and instruct them to ask their passengers to fasten their seat belts.

(3) Provide small aeroplane users with the information on the appropriate installation and operation of the ELTs.

(4) Request relevant organizations to ensure that each search and rescue (SAR) aircraft during SAR operation shall be able to precisely listen on the distress frequencies.

(2) Contact with an approach light beacon involving the passenger ship SORA

(Recommendations on December 20, 2018)

Summary of the Accident

At around 21:29 on July 26, 2017, the passenger ship SORA, with a master and chief engineer serving as crew and 29 passengers on board, was proceeding north toward the pier of the Kobe Airport Kaijo Access Terminal in Kobe Section No. 5 of Hanshin Port after departing from the Kaijo Access Terminal of Senshu Port when she collided with the Kobe Airport East Approach Light Beacon in Kobe Section No. 6 of Hanshin Port.

Four of SORA's passengers were seriously injured and 21 passengers and two crew members received slight injuries, and the port hull and bow sustained crush damage and other damage. Additionally, the Kobe Airport East Approach Light Beacon sustained abrasions and other damage to its supports.

Probable Causes

It is probable that the accident occurred when, as the passenger ship SORA was proceeding north in the Kobe section of Hanshin Port toward the pier of Kobe Airport Kaijo Access Terminal, which is in Kobe Section 5 of Hanshin Port, at night under conditions in which the light of the E2 light on the Kobe Airport East Approach Light Beacon was difficult to see due to the light of flood lights of Port Island's container terminal, which was behind the light beacon, SORA collided with the light beacon when her master did not notice that she was heading toward the light beacon because he was keeping visual lookout only, without using the radar installed on the port side of the steering stand or the GPS plotter that overlaid the radar's images.

It is probable that the master was keeping visual lookout only, without using the radar installed on the port side of the steering stand or the GPS plotter that overlaid the radar's images, because the master was continuing to chat with the chief engineer and because he had been able to visually observe the light of the Kobe Airport East Approach Light Beacon's E2 light whenever he approached the light beacon in the past.

It is probable that the points that master had entrusted steering to the chief engineer, was operating a smartphone, was continuing to chat with the chief engineer, and was keeping visual lookout only without using the radar installed on the port side of the steering stand or the GPS plotter that overlaid the radar's images; that the master had weak awareness in terms of returning to the standard route and was navigating on the western side of the standard route without indicating the standard route on the GPS plotter that overlaid the radar's image; and that the chief engineer passed steering to the master without sharing information on the light beacon's E2 light and subsequently was checking

items noted in the engine logbook and not keeping lookout toward the bow meant that discipline was not being maintained in SORA's wheelhouse, and it is probable that such circumstances contributed to the accident's occurrence.

Given that OM Kobe Co., Ltd. did not clearly indicate and make known specific information concerning ordinary navigational watch stations that are required by stipulations in safety management regulations, and that sufficient safety education and training on the importance of keeping appropriate lookout using the radar installed on the port side of the steering stand and GPS plotter that overlaid the radar's image, sharing information among crew members, and navigating on the standard route whenever possible had not been provided, it is probable that wheelhouse discipline was not being maintained aboard SORA because OM Kobe Co., Ltd.'s safety management was not functioning effectively, and it is probable that such circumstances contributed to the accident's occurrence.

Regarding the occurrence of many injured passengers, including some who suffered serious injuries, it is probable that this was because many of the passengers were not using seatbelts.

Additionally, it is somewhat likely that the point that, when passengers were thrown toward the bow, they hit the seats in front of them and the seats separated from the floor and fell over contributed to the spread of damage.

Recommendations to the OM Kobe Co., Ltd.

It is probable that the accident occurred when, as the passenger ship SORA was proceeding north in the Kobe section of Hanshin Port toward the pier of Kobe Airport Kaijo Access Terminal, which is in Kobe Section 5 of Hanshin Port, at night, SORA collided with the Kobe Airport East Approach Light Beacon when her master did not notice that she was navigating toward the light beacon because he was engaged in visual lookout only, without using the radar installed on the port side of the steering stand or the GPS plotter that overlaid the radar's images.

It is probable that OM Kobe Co., Ltd.'s safety management was not functioning effectively because it did not clearly indicate and make known specific information concerning ordinary navigational watch stations that are required by stipulations in safety management regulations, and because sufficient safety education and training on the importance of keeping appropriate lookout using the radar and GPS plotter and sharing information among crew members had not been provided.

Although OM Kobe Co., Ltd. implemented various measures to prevent recurrence after the accident, given that, when navigation routes were investigated following the accident, it was found that vessels are navigating near the Kobe Airport East Approach Light Beacon, it is probable that safety education and training on the importance of navigating on the standard route whenever possible were not sufficiently provided.

(See Annex Figure: Navigation Tracks (Nighttime, October 9 to 18, 2018))

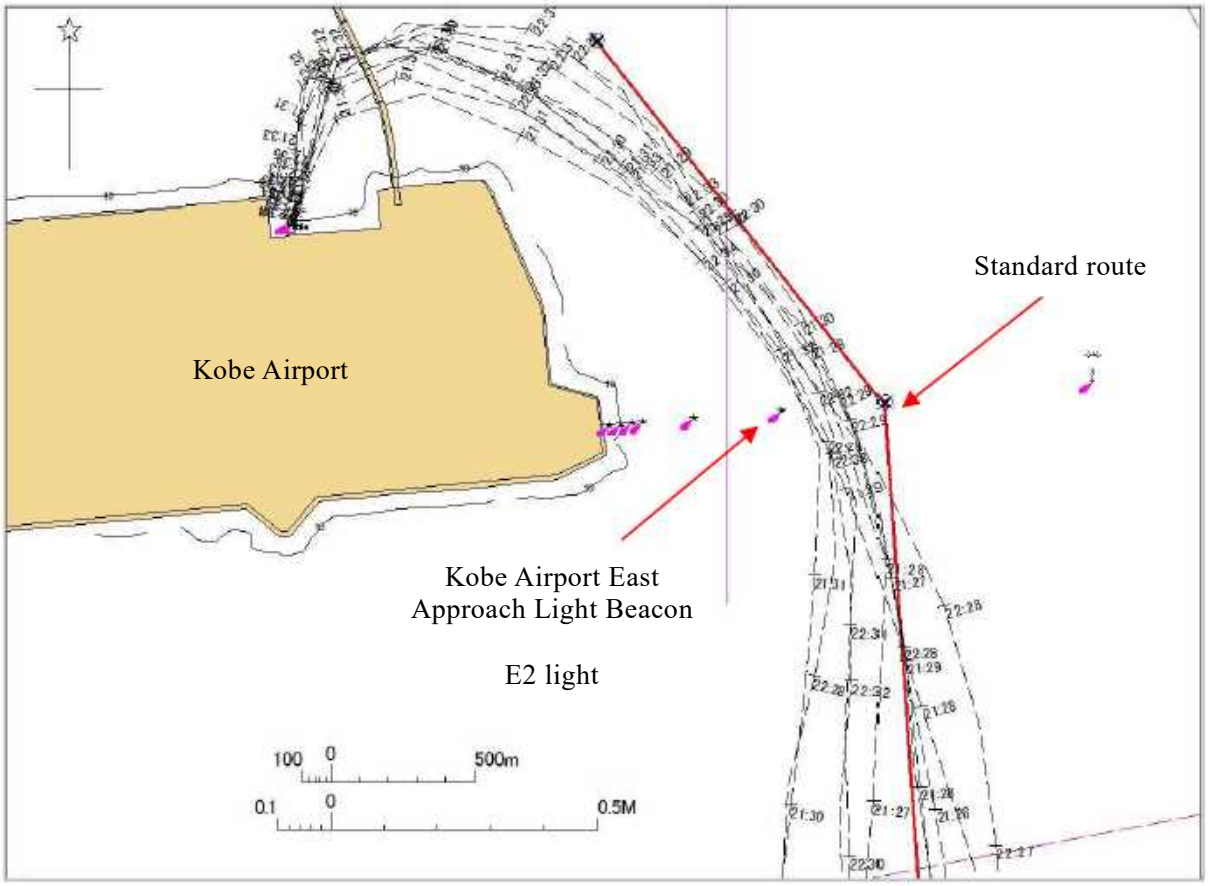
In view of the result of this accident investigation, the Japan Transport Safety Board recommends that OM Kobe Co., Ltd. implement the following measures pursuant to paragraph (1) of Article 27 of the Act for Establishment of the Japan Transport Safety Board in order to stably ensure the safety of passenger transport.

Additionally, the Japan Transport Safety Board requests that OM Kobe Co., Ltd. report measures taken based on these recommendations pursuant to paragraph (2) of the same Article.

Owing to the importance of having preventative measures continuously and reliably implemented, continuously provide education and training to crew members of operating contractors with emphasis on the following points:

(1) The importance of lookout that includes appropriate use of navigation equipment
(2) The importance of sharing information on navigational safety among crew members
(3) The importance of safe operation that includes use of equipment that aids for preventing grounding (collision)
(4) The importance of conducting appropriate ship maneuvering, including recognizing the safety of navigating on standard routes and navigating on standard routes whenever possible

Annex Figure: Navigation Tracks (Nighttime, October 9 to 18, 2018)



2 Opinions

(1) Aircraft Accident Involving a BELL 412EP (helicopter), Registered JA97NA, Operated by the Nagano Fire and Disaster Prevention Aviation Center

(Opinions on October 25, 2018)

Summary of the Accident

On Sunday, March 5, 2017, at 13:33 Japan Standard Time (JST: UTC + 9 hours; all times are indicated in JST on a 24-hour clock), a Bell 412EP, registered JA97NA, operated by the Nagano Fire and Disaster Prevention Aviation Center took off from Matsumoto Airport and was flying toward a temporary helipad in the mountains, Shiojiri City, Nagano Prefecture to conduct rescue training. At around 13:41, it collided with trees and then crashed onto the mountain's slope on Mt. Hachibuse, Matsumoto City, Nagano Prefecture.

There were nine persons on board the helicopter, consisting of a captain, eight others and all of them suffered fatal injuries.

The helicopter was destroyed, but there was no outbreak of fire.

Probable Cause

It is highly probable that in the accident occurred, while flying in a mountainous region, the helicopter collided with trees and crashed, because the helicopter did not take avoidance maneuver even getting closer to the ground.

Regarding the helicopter's not taking avoidance maneuver even getting closer to the ground while flying in a mountainous region, it is somewhat likely that the captain could not recognize the dangerous situation because the captain was in a state where the arousal level was lowered, however, it was not possible to clarify whether he actually fell into such a state.

Opinions to the Minister of Land, Infrastructure, Transport and Tourism

In the accident, it is highly probable that the captain had a past medical history and a surgical history and he was under treatment with medication. However, it is certain that he had obtained the aviation medical certificate without making a self-report on those medical information. In the examination for the Aviation Medical Certificate, it is difficult to make an appropriate judgment on whether to conform to the standards of Aviation Medical Examination unless applicants declare their medical history and information accurately.

Therefore, in view of the identified matters of the accident investigation, in order to ensure the safety of aviation, the Japan Transport Safety Board submit proposals pursuant to the provision of Article 28 of the Act for Establishment of the Japan Transport Safety Board to the Ministry of Land, Infrastructure, Transport and Tourism as follows:

When any measures were implemented according to these opinions, please notify the JTSB.

It is necessary that the Civil Aviation Bureau, Ministry of Land, Infrastructure, Transport and Tourism thoroughly instruct aircrews to accurately make a self-report on their medical information to apply for the aviation medical certification, and if non-conformity is suspected, they must not engage in the performance of aviation duties, and must receive instructions from the designated aviation medical examiners and others, even if his/her aviation medical certificate is still within validity period.

(2) Opinions on the Prevention of Train Derailments Caused by Gauge Widening

(Opinions on June 28, 2018)

Of the railway accidents investigated by the Japan Transport Safety Board, the following four train derailments caused by gauge widening occurred between October 2016 and May 2017.

October 6, 2016 Seino Railway Co., Ltd. Ichihashi Line
(Report No. RA2017-9-2 Published on December 21, 2017)
January 22, 2017 Kishu Railway Company Kishu Railway Line
(Report No. RA2018-1-2 Published on January 25, 2018)
February 22, 2017 Kumamoto Electric Railway Co., Ltd. Fujisaki Line
(Report No. RA2018-1-6 Published on January 25, 2018)
May 22, 2017 Watarase Keikoku Railway Co., Ltd. Watarase Keikoku Line
(Report No. RA2018-4-1 Published on June 28, 2018)

It is probable that the occurrence of these accidents was due to dynamic gauge widening caused by rail tilting and other factors with the presence of continuous defects in wooden sleepers and rail fastening devices.

Although different factors are recognized for each accident, there are many factors that are common among regional railways as main causes of gauge widening. Therefore, the JTSB arranged points deserving attention from the standpoint of preventing similar accidents on regional railways that are based on knowledge obtained from these accident investigations into the attached "Prevention of Train Derailment Accidents Caused by Gauge Widening."

Accordingly, the JTSB expresses the following opinions to the Minister of Land, Infrastructure, Transport and Tourism pursuant to Article 28 of the Act for Establishment of the Japan Transport Safety Board.

When any measures were implemented according to these opinions, please notify the JTSB.

1. Make the content of the railway accident investigation reports of the four train derailment accidents and "Prevention of Train Derailment Accidents Caused by Gauge Widening" attached to these opinions thoroughly known to railway operators.

2. In light of the fact that it is recognized that derailment accidents are caused by defects in wooden sleepers and rail fastening devices, endeavor to provide necessary instruction to regional railways that includes use of existing public subsidy schemes and technical assistance schemes to promote measures to prevent gauge widening, such as replacing sleepers with concrete sleepers in a systematic manner that takes account of priority locations based on the occurrence of defects, alignment, and other factors.

Attachment

Prevention of Train Derailment Accidents Caused by Gauge Widening

Summary

Of the railway accidents investigated by the Japan Transport Safety Board, four train derailments caused by gauge widening occurred between October 2016 and May 2017. It is probable that the occurrence of these accidents was due to dynamic gauge widening caused by rail tilting and other factors attributable to the presence of continuous defects in wooden sleepers and rail fastening devices.

Although different factors are recognized for each accident, there are many factors that are common among regional railways as main causes of gauge widening. Therefore, the JTSB arranged the following points deserving attention that are based on knowledge obtained from these accident investigations so as to contribute to the further improvement of safety from the standpoint of preventing similar accidents on regional railways.

1. Maintenance of tracks

It is necessary to appropriately manage sleepers, rail fastening devices, rail flow, etc., by conducting periodic track inspections and making track patrols, and, depending on the situation, to implement measures to prevent gauge widening, such as replacing or adding spikes, replacing sleepers, and installing gauge ties (fixtures that maintain gauge). Regarding this point, it is necessary to pay attention to the continuity of defects in sleepers and rail fastening devices, to put priority on sharp curves with large slack, and to pay attention to not only outer rails but also inner rails.

Regarding the measurement of track irregularity, dynamic track irregularity measurement using a track inspection car is effective. When managing track irregularity with static track irregularity measurement only, it is necessary to pay attention to the danger that dynamic track irregularity caused by rail tilting, etc., could occur and to sufficiently manage sleepers and rail fastening devices.

2. Standards for track maintenance

It is necessary to properly engage in track maintenance in response to the circumstances of track irregularity in order to prevent derailment accidents caused by gauge widening. Thus, with regard to maintenance standard values, it is desirable to establish standard values that take safety limits into account and to clarify maintenance periods. Furthermore, it is desirable to establish the rules of train operation control, track maintenance, and other matters when significant track irregularity is detected as necessary in addition to track maintenance standards for conventional track maintenance.

Regarding slack on curves, it is desirable to confirm that appropriate values are established for vehicles which run on the section and, when reexamining current values, to improve onsite slack simultaneously with track improvement work.

3. Track structure

It is desirable to replace wooden sleepers (including partial replacement that takes place at a rate of one sleeper for every two or three sleepers) with sleepers made of concrete or other materials that have better durability and can be maintained more easily in a systematic manner that takes priority locations into account based on the occurrence of wooden sleeper defects, alignment, and other factors.

Moreover, when laying guardrails on curves, it is desirable from the standpoint of preventing derailment accidents to lay derailment prevention guards or derailment prevention rails whenever possible at locations that are unaffected by falling rocks or snowfall. Additionally, when laying guardrails, it is necessary to also pay attention to the laying method in terms of number of fasteners on sleepers, height differences of rails and derailment prevention rails, etc.

Introduction

Of the railway accidents investigated by the Japan Transport Safety Board, the following four train derailments caused by gauge widening occurred between October 2016 and May 2017.

October 6, 2016 Seino Railway Co., Ltd. Ichihashi Line
(Report No. RA2017-9-2 Published on December 21, 2017)
January 22, 2017 Kishu Railway Company Kishu Railway Line
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(Report No. RA2018-1-6 Published on January 25, 2018)
May 22, 2017 Watarase Keikoku Railway Co., Ltd. Watarase Keikoku Line
(Report No. RA2018-4-1 Published on June 28, 2018)

It is probable that the occurrence of these accidents was due to dynamic gauge widening[*1] caused by rail tilting[*2] and other factors with the presence of continuous defects in wooden sleepers and rail fastening devices.

Although different factors are recognized for each accident, there are many factors that are common among regional railways as main causes of gauge widening. Therefore, the JTSB arranged points deserving attention that are based on knowledge obtained from these accident investigations so as to contribute to the further improvement of safety from the standpoint of preventing similar accidents on regional railways.

It should be noted that, in the case of regional railways, it is important to undertake track maintenance and appropriately ascertain track conditions, and then to systematically execute facility repairs and replace wooden sleepers with precast concrete (PC) sleepers and other components beginning with priority locations, considering the degree of urgency according to the occurrence of defective locations. It is thought that the use of existing public subsidy schemes and technical assistance schemes is also effective toward this end.

1. Maintenance of tracks

(1) Management of sleepers and rail fastening devices

It is important to control dynamic gauge widening caused by rail tilting, etc., by appropriately managing sleepers and rail fastening devices to prevent derailment of wheels falling down between railsdue to gauge widening. (See Figure 1)

Appropriately managing dynamic gauge widening requires the periodic inspection of the condition of materials and maintenance of sleepers and rail fastening devices, record-keeping, and, depending on the situation, the implementation of measures to prevent gauge widening, such as replacing or adding spikes, replacing sleepers, and installing gauge ties (fixtures that maintain gauge).

Additionally, the condition of sleepers and rail fastening devices can be checked during

*1 "Gauge widening" refers to a situation in which a track's gauge has widened due to damage to rail fastening devices caused lateral pressure (the force generated by wheels pushing the rail laterally) or increasing rail wear. If the gauge widens beyond a certain degree, wheels on either the left or right side will become unsupportable by the rail's head and derailment will occur. Here, gauge widening caused by lateral pressure associated with running trains is called "dynamic gauge widening."

*2 "Rail tilting" refers to a phenomenon whereby a rail inclines from the load exerted by wheels on the rail.

track patrols. Track patrols can be conducted by train, on foot, or self-propelled railway inspection vehicle, or other means. However, in sections where the condition of sleepers is a concern, it is desirable to generally conduct inspections on foot, which allows better ascertainment of conditions.

Furthermore, it is necessary to pay attention to the number of spikes, method of driving spikes, etc., when using tie plates that affect rail tilting, etc. Figure 2 provides an example of standard tie plate spike driving for reference.*3

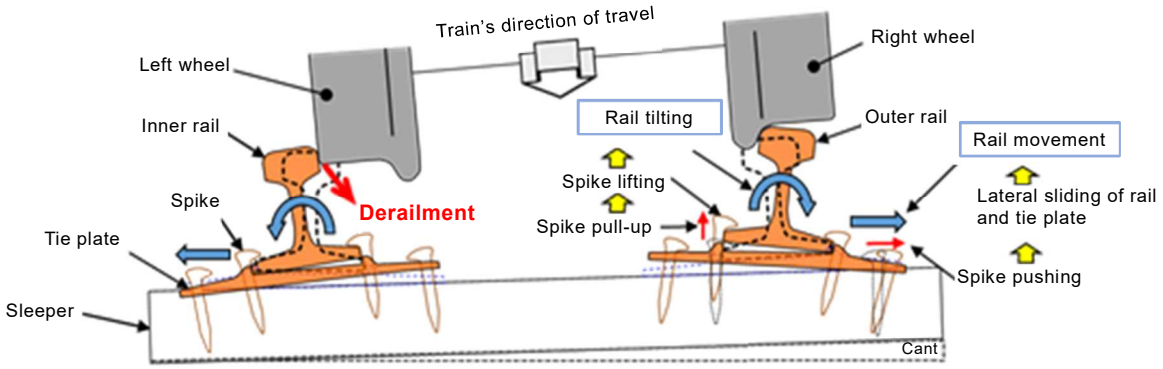
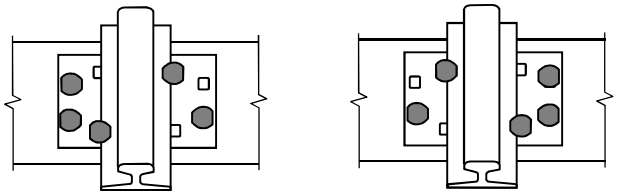


Figure 1: Example of a derailment caused by gauge widening



B-type/E-type tie plate For a curve with a radius of less than 500 m

Figure 2: Example of standard tie plate spike driving

Sleepers and rail fastening devices are track materials organized in a parallel system (rails and turnouts are a serial system), and are designed to allow the deterioration of individual components to a certain degree.*4 Accordingly, it is necessary to manage defects in sleepers and rail fastening devices with particular attention on continuity.

It is difficult to give a definitive guideline for the number of continuous defects because it depends on train speed and alignment; however, in general, up to two continuous defects is allowable.*5

Additionally, with regard to these points, it is necessary to give consideration so that maintenance is executed with priority on sharp curves with large slack, where the danger of derailment by gauge widening rises conspicuously. Moreover, in the management of sleepers and rail fastening devices on curves, there is a general tendency for more attention to be given to the outer rail, where significant lateral pressure tends to occur. However, lateral pressure that

*3 "Kido no Iji-Kanri Manyuaru" (track maintenance and management manual), Japan Railway Civil Engineering Association, March 2014, p. 115

*4 Tetsudo Kozobutsu-to Iji-Kanri Hyojun (Kido-hen) no Tebiki" (guide to maintenance and management standards for railway structures, etc. (tracks), Railway Technical Research Institute, March 2007, p. 154

*5 "Hosen no Joshiki-Hijoshiki" (common sense and irrationality in track maintenance), Hideyuki Takai, October 2009, p. 39

pushes the inner rail to the outside as a result of curve turning lateral force[*6] does occur. Thus, it is necessary to manage inner rails with the same attention as outer rails.

(2) Rail flow[*7]

When rail flow occurs on the rail gauge corner side, the rail head's metal surface is deformed and pushed inside the gauge. On the other hand, gauge is defined as the "shortest distance between the rail heads within 14 mm (or 16 mm) of the rail level." Because gauge is measured based on this, if rail flow is occurring, measurement will be from the tip of the rail flow and therefore the measured gauge will be smaller than the actual gauge by the amount of the rail flow (see Figure 3). Such a measurement suggests the danger of gauge widening, and there are cases where rail flow breaks and derailment by gauge widening occurs (see Figure 4).

Accordingly, when the occurrence of rail flow is confirmed through a periodic rail inspection, track patrol, etc., it is desirable to engage in appropriately management by removing the rail flow or taking other measures as necessary.

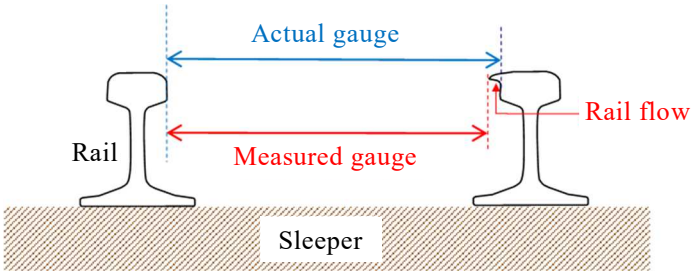


Figure 3: Gauge measurement when rail flow exists

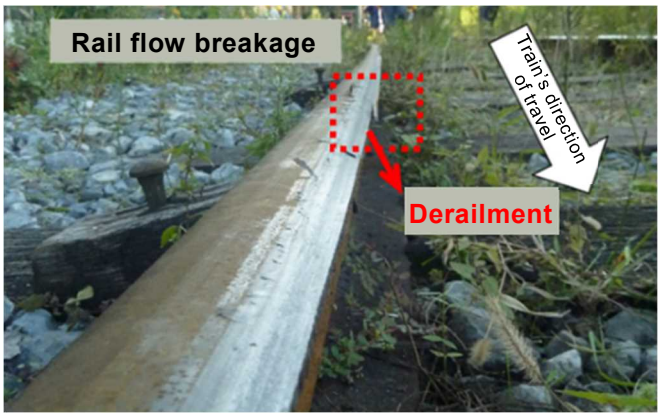


Figure 4: Example of rail flow breakage and derailment by gauge widening

[*6] "Curve turning lateral force" refers to lateral pressure that is generated when the front-axle inner rail wheel of a vehicle running on a curve resists with frictional force being pushed toward the inner rail by the outer rail wheel.

[*7] "Rail flow" refers to a phenomenon whereby a rail's surface metal flows plastically from the generation of significant contact pressure generated by the repeated passage of wheels over the rail head and the metal protrudes over the head's surface or edge.

(3) Measurement of track irregularityirregularity

It is thought that the occurrence of derailment due to gauge widening is often caused by the occurrence of dynamic gauge widening that arises from rail tilting caused by lateral pressure when trains pass, and that preventing accidents is possible through the discovery of abnormalities beforehand by measuring dynamic track irregularity[*8] and particularly the dynamic values of irregularity of gauge (hereinafter referred to as "dynamic irregularity of gauge").

Accordingly, when there are concerns of dynamic gauge widening based on the condition of sleepers and rail fastening devices, it is desirable to measure dynamic irregularity of gauge with a track inspection car or other means.

It should be noted that devices for easy measurement of dynamic track irregularity (irregularity of gauge and twist) for regional railways are currently being developed,[*9] and it is thought that they will become effective management tools when they are put into practical use.

When track irregularity is managed using static track irregularity measurement only because measuring dynamic track irregularity is difficult, it is necessary to pay attention to the danger that dynamic gauge widening caused by rail tilting, etc., could occur and to sufficiently manage sleepers and rail fastening devices in accordance with (1) above.

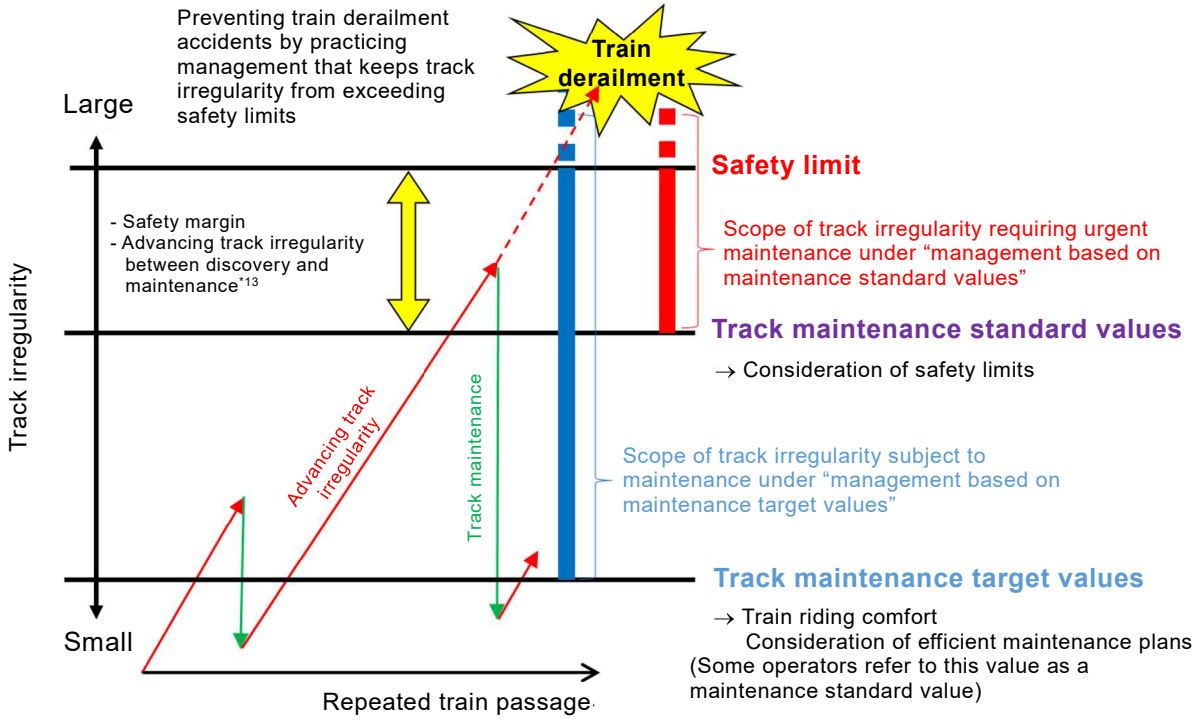
[*8] "Dynamic track irregularity" refers to track irregularity in a state in which train load is applied by a track inspection car, etc. On the other hand, track irregularity in a state in which train load (or a load equivalent to it) is not applied and measurements are made with string extended by human hands or a track inspection device is called "static track irregularity." Additionally, the measurement values of dynamic track irregularity are called "dynamic values" and those of static track irregularity are called "static values."

[*9] "Chiiki Tetsudo no Arikata ni kan-suru Kentokai Hokokusho" (report of the study group on the state of regional railways), Ministry of Land, Infrastructure, Transport and Tourism, March 2015, p. 26

2. Standards for track maintenance

(1) Maintenance standards for track irregularity*10

Maintenance standards for track irregularity include those established to ensure safe train operation and those established to ensure passenger comfort and efficient maintenance. In general, the former are called track maintenance standard values*11 and the latter are called track maintenance target values*12 (see Figure 5).



Note: Maintenance standards for track irregularity are established by each railway operator in accordance with each track section's facilities and vehicles running on the section.

Figure 5: Conceptual image of maintenance standards for track irregularity

Maintenance standards for track irregularity are set by each railway operator in accordance with the circumstances of track section's facilities and vehicles running on the section. However, in some cases operators only set values that are close to track maintenance target values.

It should be noted that some operators set time periods by which track maintenance must be conducted when a track maintenance standard value is exceeded (hereinafter referred to as "maintenance period"), but other operators do not clearly establish maintenance periods.

To prevent derailment accidents caused by gauge widening, it is important to manage track irregularity, particularly irregularity of gauge , and it is necessary to properly engage in track

*10 "Kaisetsu: Tetsudo ni kan-suru Gijutsu Kijun (Dobokuhen) Dai-san-pan"(explanation: technical standards for railways [civil engineering] third edition), Railway Bureau, Ministry of Land, Infrastructure, Transport and Tourism (supervising editor), December 2014, pp. 661-662

*11 "Track maintenance standard value" refers to a track irregularity value that was established to initiate urgent maintenance or repair work to ensure safe train operation.

*12 "Track maintenance target value" refers to a track irregularity value that was established to hold down the amount of urgent track maintenance work needed while maintaining a certain level of riding comfort.

*13 "Advancing track irregularity" refers to a phenomenon whereby track irregularity gradually becomes larger with the repeated passage of trains.

maintenance in response to the circumstances of track irregularity. Thus, it is desirable to aim for more precise management of track irregularity and, with regard to maintenance standards for track irregularity, to establish standard values that take safety limits into account and to clarify maintenance periods when those values are exceeded. (See Table 1 and Table 2)

Table 1: Track maintenance standard values Example of JR (conventional lines)

(Unit: mm)

Max. speed / Irregularity type	Maintenance standard value				
	Track section of 120 km/h or higher	Track section exceeding 95 km/h	Track section exceeding 85 km/h	Track section exceeding 45 km/h	Track section of 45 km/h or below
Gauge	・Straight track or curved track with radius exceeding 600 m 20 (14) ・Curved track with radius of between 200 m and 600 m 25 (19) ・Curved track with radius of less than 200 m 20 (14)				
Cross level	(Conduct maintenance based on the twist.)				
Longitudinal level	23 (15)	25 (17)	27 (19)	30 (22)	32 (24)
Alignment	23 (15)	25 (17)	27 (19)	30 (22)	32 (24)
Twist	23 (18) (Including cant digression)				

Remarks: (1) Figures indicate dynamic values from a high-speed track inspection car. However, figures within parentheses indicate static values.

(2) “Twist” indicates amount of level displacement per each 5 meters.

(3) Slack, cant, and versine (including vertical curve) are not included in curved tracks.

*14 “Kido no Iji-Kanri Manyuaru” (track maintenance and management manual), Japan Railway Civil Engineering Association, March 2014, p. 10

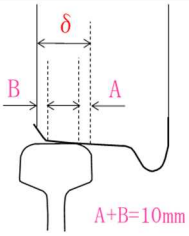
*15 “Tetsudo Kozobutsu-to Iji-Kanri Hyojun (Kido-hen) no Tebiki” (guide to maintenance and management standards for railway structures, etc. (tracks), Railway Technical Research Institute, March 2007, p. 31

Limit value gauge irregularity = δ − (10) − Margin (10) (mm)

Consideration of rail wear (A) + chamfering of wheel treadedge (B)

δ = wheel engagement with rail
= (wheel width + back gauge + flange thickness) – gauge (design value)

Gauge (design value) = gauge (basic measurements) + slack



Here, when wheel and axle measurements (minimum values), gauge (basic measurement) of 1,067 mm, and slack of 0 mm are applied, irregularity of gaugeirregularity limit value– (wheel width + back gauge + flange thickness) – gauge (design value) - 10 - 10

$$= (120+988+22) - 1,067 - 10 - 10 = 43 \fallingdotseq 40\,(\text{mm})$$

See "Kaisetsu: Tetsudo ni kan-suru Gijutsu Kijun (Dobokuhen) Dai-san-pan" (explanation: technical standards for railways [civil engineering] third edition), Railway Bureau, Ministry of Land, Infrastructure, Transport and Tourism (supervising editor)

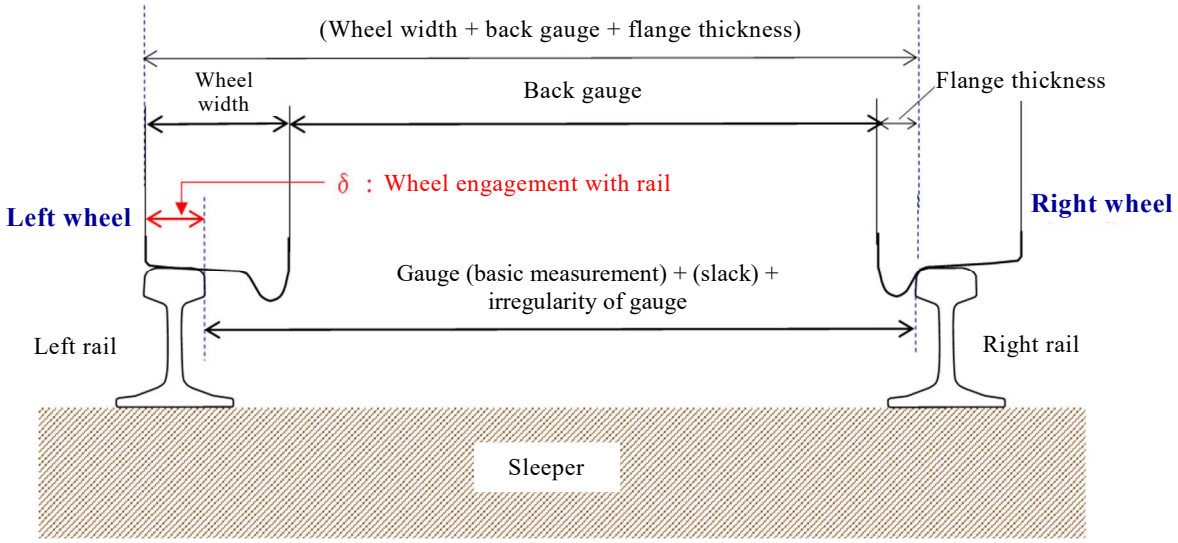


Figure 6: Limit values for iregularity of gauge

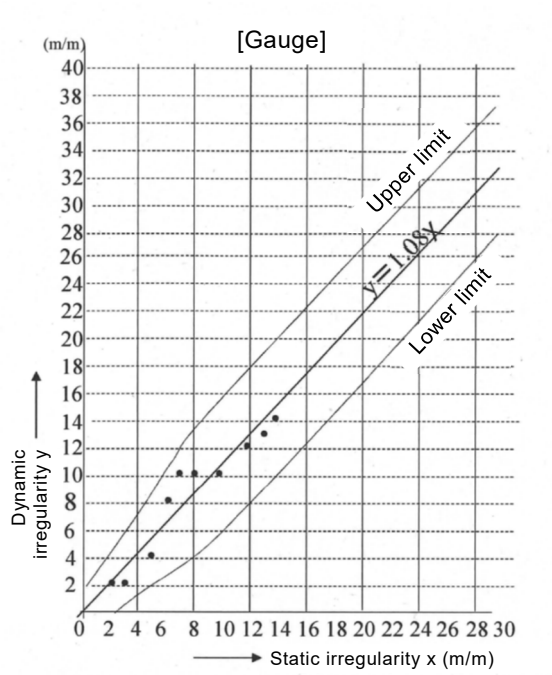


Figure 7: Relationship between dynamic irregularity of gauge and static irregularity of gauge

Table 2: Track maintenance target values　Example of JR (conventional lines)

(Unit: mm)

Irregularity type \ Max. speed		Maintenance target value			
		Track section of 120 km/h or higher	Track section exceeding 95 km/h	Track section exceeding 85 km/h	Track section of 85 km/h or below
Gauge	Location with radius of 800 m or higher	+10 (+6) -5 (-4)	+10 (+6) -5 (-4)		
	Location with radius of 200 m or higher		+15 (+9) -5 (-4)		
	Location with radius of less than 200 m		+10 (+6) -5 (-4)		
Cross level		11 (7)	12 (8)	13 (9)	16 (11)
Longitudinal level		13 (7)	14 (8)	16 (9)	19 (11)
Alighnment		13 (7)	14 (8)	16 (9)	19 (11)
Twist		-			

Remarks: (1) Figures indicate dynamic values from a high-speed track inspection car. However, figures within parentheses indicate static values.
(2) “Twist” indicates amount of level displacement per each 5 meters.
(3) Slack, cant, and versine (including vertical curve) are not included in curved tracks.
(4) Sidings are classified as 85 km/h or below.

Track maintenance standard values, which are established to ensure the safe operation of trains, are values set with consideration for margins for advancing track irregularity and other factors in the time period between the discovery of a circumstance exceeding the standard value and maintenance. Accordingly, it is desirable to establish a track irregularity value to serve as the evaluation standard (hereinafter referred to as “exceptionally large value”) and the handling of cases in which said value is exceeded beforehand, when necessary, so that operation control, such as suspension of operation, and track maintenance can be executed when an exceptionally large value that exceeds such an margin is observed at the time that track irregularity is discovered.

However, even when such exceptionally large values and their rules are established, it is important to execute track maintenance based on the track maintenance standard values and track maintenance target values.

Table 3: The rules of track irregularity and operation control
Example of the Watarase Keikoku Railway Co., Ltd.
(Established following a train derailment that occurred on May 22, 2017)

Irregularity type	Track irregularity (dynamic value)	Track irregularity (static value)	Operation control
Gauge (including slack)	+42 mm or more -12 mm or less	+38 mm or more -12 mm or less	Suspension of operation
Twist (including cant digression)	27 mm or more	21 mm or more	
Longitudinal level	39 mm or more	34 mm or more	
Alignment	35 mm or more	33 mm or more	
Longitudinal level	36 mm or more less than 39 mm	29 mm or more less than 34 mm	Slowing down, no more than 25 km/h
Alignment	34 mm or more less than 35 mm	28 mm or more less than 33 mm	

*When the track irregularity described above is confirmed, immediately make arrangements with concerned locations and execute repairs (e.g., track maintenance, etc.). Terminate operation control after confirming that the situation falls below track maintenance standard values.

(3) Setting of slack[*16]

It is desirable from the standpoint of preventing derailments caused by gauge widening for curve slack to be as small as possible in order to raise the margin.

The upper and lower limits for slack in sections that are not sections in which two-axle vehicles mainly run (i.e., are sections in which three-axle vehicles run) are as follows.

[*16] "Kaisetsu: Tetsudo ni kan-suru Gijutsu Kijun (Dobokuhen) Dai-san-pan"(explanation: technical standards for railways [civil engineering] third edition), Railway Bureau, Ministry of Land, Infrastructure, Transport and Tourism (supervising editor), December 2014, pp. 115-121

Table 4: Slack amounts

(Unit: mm)

Curve radius	3-axle car	2-axle car
Less than 200 m	20	5
At least 200 m but less than 240 m	15	-
At least 240 m but less than 320 m	10	-
At least 320 m but less than 440 m	5	-

The conditions of cars that run in each section must be considered when deciding optimum values within the range in which slack is gained. However, in many sections, the values for three-axle cars shown in Table 4 are generally thought to be appropriate if consideration is given to achieving a good balance between the smooth running of various vehicles and the margin vis-à-vis derailment by gauge widening.

Additionally, because changing slack amounts involves comparatively large-scale construction, it is desirable to make sequential improvements by, for example, executing construction together with improvement work on targeted curves.

3. Track structure

(1) Sleeper materials

It is desirable to replace wooden sleepers with sleepers made of concrete or other materials (PC sleepers, for example), that have better durability and can be maintained more easily. The replacement with concrete sleepers must be done in a systematic manner that takes priority locations into account based on the occurrence of wooden sleeper defects, alignment, and other factors.

Figure 8: Example of partial replacement with PC sleepers

However, partial replacement at a rate of one sleeper for every two or three sleepers is effective when replacing the total number of sleepers is problematic due to the cost or other factors (see Figure 8). When doing so, it is desirable to determine the ratio of sleepers to be replaced with sleepers made of concrete, etc., with consideration for vehicles running on the section, alignment, and other conditions.

(2) Guard rails on curves*17

1) Types

Guard rails on curves are laid on "curves having an estimated derailment quotient of under 1.2" that are targeted for measures to prevent accidents like that which occurred on the Eidan (now Tokyo Metro) Hibiya Line on March 8, 2000, as well as at other locations where the risk of derailment exists and locations where great damage and injury would occur if a derailment happened. Their types are "guard angles,"*18 "guard rails,"*19 and "guardrails."*20

Guard angles and Guard rails are laid for the purpose of preventing derailments in themselves, while guardrails are laid to prevent to the greatest degree possible deviation following a derailment. It is desirable from the standpoint of preventing derailment accidents to lay guard angles or guard rails whenever possible.

The general thinking regarding the laying of guardrails is "guardrails are to be laid in locations where guard angles or guard rails are necessary but troublesome to install." "Troublesome" locations are determined with consideration for falling rocks and snowfall as well as the ease of maintenance (economic efficiency) of the track.

2) Laying methods

Guard angles, guard rails, and guardrails must be appropriately laid so that their effects are demonstrated.

For laying locations, lay on the inside of the gauge of the rail on the opposite side of a location thought to be hazardous, such as a location where it is assumed that an adjacent line could be blocked in a derailment or serious damage could occur if a car overturned, and lay on both sides when necessary.

*17 "Shashin de Miru Senro Kanri no Teibiki"(photographic guide to track management), Japan Railway Civil Engineering Association, September 2016, pp. 232-234

*18 A "guard angle" is an L-shaped steel guarding device installed inside the gauge and parallel to the main rail to prevent serious accidents caused by derailment.

*19 A "guard rails" is a rail installed inside the gauge and parallel to the main rail to prevent serious accidents caused by derailment.

*20 A "guardrail" is a guiding rail laid alongside to the main rail to prevent serious accidents caused by tipping over or falling when a derailed wheel deviates outside the gauge.

However, it is thought that when a guard angle or a guard rail is lower than the main rail, the guard angle's or guard rail's engagement with inner rim face of a wheel that comes into contact with it is small, making it easier for the wheel to ride over it, and therefore it is possible that the guard angle's or guard rail's derailment-prevention functions cannot be fully demonstrated. It is therefore desirable to make the guard angle or guard rail the same height or higher than the main rail. Additionally, it is desirable to fasten guard rails to each sleeper with spikes.

Lay guardrails inside the gauge of the rail on the opposite side of the more hazardous side. However, in places where rocks fall or with heavy snowfall, lay guardrails on the outside of the gauge of the rail on the more hazardous side. It is permissible to fasten guardrails with spikes to every other sleeper.

3) Management with periodic inspections and track patrols

It is necessary to inspect and check the materials and maintenance of guard rails through periodic inspections and track patrols and to make repairs as conditions require.

It should be noted that, in the case of guard rails laid on curves (attention is particularly required for guard angles and guard rails), the guard rail's face and the face of the wheel's inner rim come into contact in a derailment, etc. Consequently, if there are abrasion marks on a guard rail's face, it is necessary to consider the possibility of derailment (derailment by gauge widening or flange climb derailment) and to make necessary inspections and repairs. It is possible to prevent derailment accidents by taking these steps.

Measures Taken Based on These Opinions

Based on knowledge obtained from accident investigations of the four train derailment accidents caused by gauge widening that occurred between October 2016 and May 2017, the Japan Transport Safety Board expressed opinions to the Minister of Land, Infrastructure, Transport and Tourism on June 28, 2018, from the standpoint of preventing similar accidents on regional railways and received the following notification concerning measures that were implemented based on the opinions on August 21, 2018.

Measures Taken by the Ministry of Land, Infrastructure, Transport and Tourism based on the Opinions

Regarding the subject matter of the opinions provided in UN-I-SAN No. 43 dated June 28, 2018, this is to provide notification, with associated materials, that the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) issued "Regarding Response to the Opinions of the Japan Transport Safety Board" (KOKU-TETSU-GI No. 55, KOKU-TETSU-SHI No. 82, KOKU-TETSU-AN No. 27), "Regarding the Promotion of Gauge Widening Prevention Measures on Regional Railways" (KOKU-TETSU-SHI No. 84), and "Regarding Railway Accident Investigation Reports, etc., of the Japan Transport Safety Board (Published in June)" (administrative communication) on June 28 of this year.

Accordingly, MLIT made the content of the Japan Transport Safety Board's opinions and the attachmet "Prevention of Train Derailment Accidents Caused by Gauge Widening" and the railway accident report concerning Watarase Keikoku Railway Co., Ltd. fully known to railway operators under its jurisdiction through district transport bureaus. Additionally, with regard to item 2 of the Opinions, MLIT instructed railway operators under its jurisdiction to check the management of their sleepers and other facilities and to take necessary measures based on the results.

Furthermore, MLIT adds that, of the four accident investigation reports involving train derailment that were attached to the Opinions, it had completed notifying railway operators under its jurisdiction through district transport bureaus with an administrative communication dated December 21, 2017, in the case of Seino Railway Co., Ltd. and an administrative communication dated January 25, 2018, in the case of Kishu Railway Company and Kumamoto Electric Railway Co., Ltd., and that it will continue instructing regional railway operators to firmly establish activities toward preventing train derailments caused by gauge widening through district transport bureaus.

*The content of the notification and its associated materials is provided on the JTSB's website.
http://www.mlit.go.jp/jtsb/railkankoku/railway-iken4re-1_20180828.pdf

(3) Opinions on the Railway Serious Incident (Dangerous Trouble in Vehicle) for Trains Operated by the West Japan Railway Company that occurred on the Tokaido Shinkansen line

(Opinions on June 28, 2018)

Summary of the Serious Incident

On Monday, December 11, 2017, the inbound 34A train (Nozomi No. 34), composed of 16 vehicles of West Japan Railway Company started from Hakata Station bound for Tokyo Station, departed from Hakata Station of Sanyo Shinkansen on schedule (around 13:33). Immediately after leaving Hakata Station, crew members and others noticed an odor inside the train and abnormal noises coming from under a vehicle's floor. However, the train continued operating to Shin-Osaka Station and its operation was subsequently assumed by Central Japan Railway Company.

At around 16:53, when the train arrived at Nagoya Station of Tokaido Shinkansen, car maintenance personnel who had been dispatched to Nagoya Station under instructions contained in operational orders from Central Japan Railway Company confirmed that abnormal noises were coming from the fourth vehicle, and they conducted an underfloor inspection at Nagoya Station at around 17:03.

As a result of the inspection, an oil leak was found in a bogie of the fourth vehicle (near the gear case) and therefore the operation of the train was suspended.

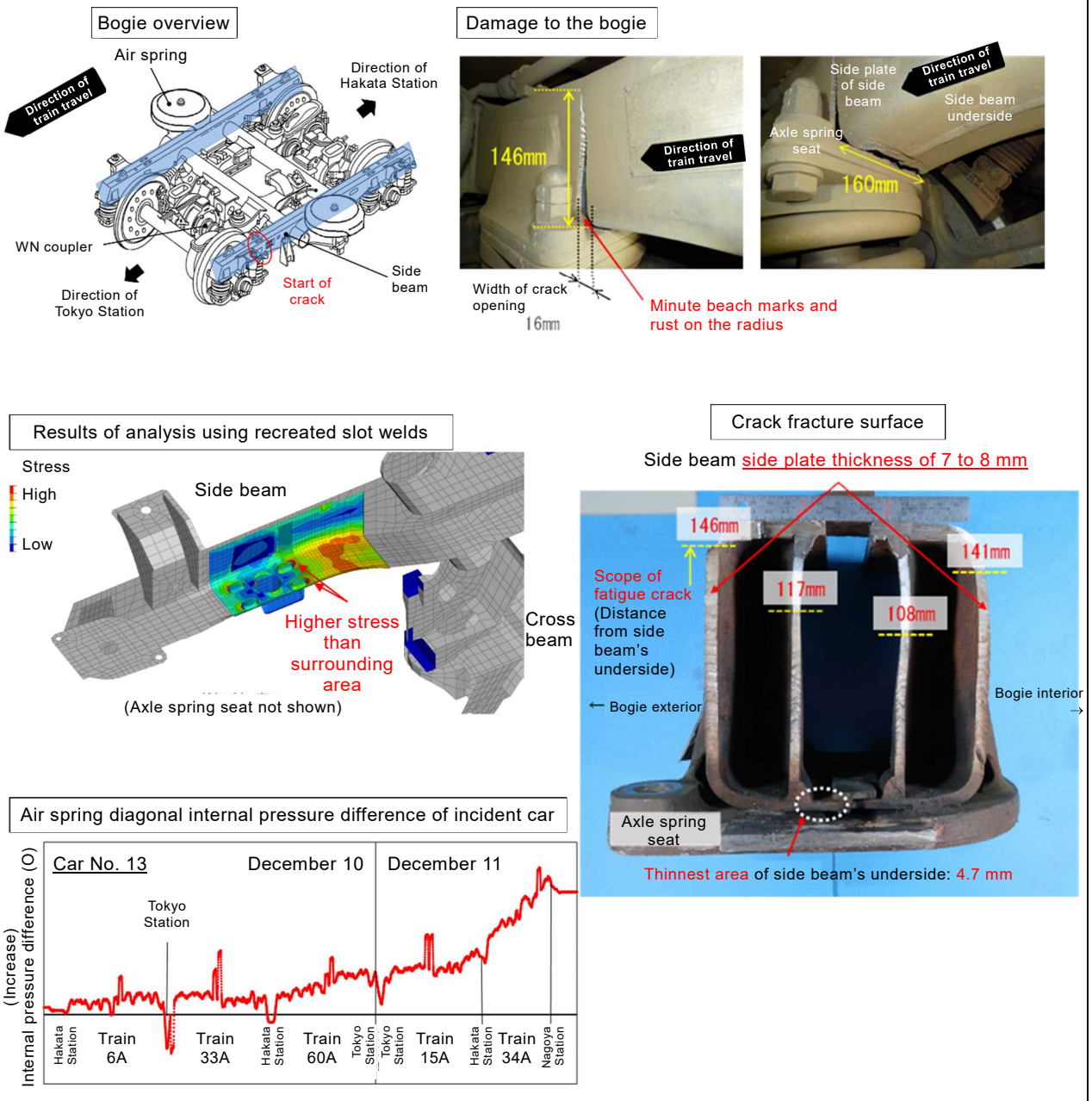
Subsequently, when work was underway to move the vehicle to a depot (Nagoya Rolling Stock Depot), a crack was discovered in the left side beam of the bogie frame of the front bogie of the fourth vehicle at around 23:40.

When the train arrived at Nagoya Station, there were approximately 1,000 passengers and seven crew members (one driver, three conductors, and three pursers) aboard; however, no one was injured.

The vehicles operating as the 34A train belong to West Japan Railway Company.

Factual Information and Analysis Contained in the Interim Report (Summary)

- It is highly probable the starting point of the crack is near two slot welds that attach the axle spring seat to the underside of the side beam.
- It is thought possible that grinding of the side beam's undersurface at the time of the bogie frame's manufacture (ordinarily plate thickness is at least 7 mm, but the thinnest part of the affected area was 4.7 mm) and overlay welding on the axle spring seat's undersurface contributed to breakage of the slot welds, the occurrence of a fatigue crack, and the crack's growth. It is thought that grinding of the side beam's underside influenced the speed at which the crack grew.
- When an analysis was conducted using a model of the actual structure near the crack (a structure made by overlaying and joining the side beam and axle spring seat), a situation in which stress was higher near the crack's starting point than the surrounding area was observed.
- From air spring internal pressure records, it is thought that the crack had progressed to a degree that it affected the side beam's rigidity on the previous day, and that the crack had spread to the point that it affected other bogie components on the day of the incident.



Opinions to the Minister of Land, Infrastructure, Transport and Tourism

It is thought that work at the time of the bogie frame's manufacture may have contributed significantly to the crack in the bogie in this serious incident. The JTSB arranged the following matters that should be addressed in order to prevent recurrence in the bogie frame manufacturing process as well as at each stage—including design/inspection and use—based on results obtained from studies and analyses on bogie frames conducted heretofore.

The Minister of Land, Infrastructure, Transport and Tourism should take necessary measures to address these matters.

1. Matters concerning manufacturing

(1) Thoroughly execute manufacturing management in the manufacture of bogie frames to ensure that manufacturing processes do not cause losses of component strength so that design strength

is maintained.

(2) Develop a system that can reliably execute the following as a framework whereby only sound products are put into actual use.

1) Whenever a problem involving trouble or difficult in production arises at a bogie frame manufacturing site and it becomes necessary to explore solutions that involve component processing, etc., evaluate as a systematic response how the problem and its solution will affect the safety of bogie frames.

2) If a problem arising in production or its solution will affect the safety of bogie frames, cease operations, investigate the cause by going back to the manufacturing process or design, study measures to address the cause, and confirm that the results of the measures are favorable before resuming operations.

2. Matters concerning design and verification

(1) In computer-based strength analysis (FEM analysis) during strength design of a bogie frame that will use a new structure, bear in mind that it is important to reproduce to the degree possible the structural characteristics of locally joining plates of different rigidities as well as the constraining conditions of positions that will support load in order to get a picture of stresses that is closer to reality, and also to consider ascertaining the tendencies of areas that are subject to high stress based on the special qualities of calculation error in FEM analysis from the results of that analysis.

(2) Even in the case of an existing bogie frame, consider reconfirming the calculation models used during strength design to determine whether or not the structural qualities of locally joining plates of different rigidities and the constraining conditions of positions that support load are reproduced as much as possible, improving the calculation models, and then again ascertaining the tendencies of individual areas that are subject to high stress.

3. Matters concerning inspection

(1) In flaw tests using magnetic particle inspection or penetrant inspection that are conducted in periodic bogie inspections, consider ascertaining the tendencies of individual areas that are subject to high stress and then adding specified areas for flaw tests based on safety rates for welded joints, etc.

(2) Bogie frames have places where high stress tendencies are observed in areas that cannot be seen from outside, even if a crack has advanced and passed through a component, because of the presence of other components (i.e., areas that cannot be inspected with magnetic particle inspection or penetrant inspection). Thus, consider conducting ultrasonic inspections or other tests of pertinent areas with appropriate frequency.

4. Matters concerning detection of abnormalities

Consider mechanisms that effectively utilize data for air spring internal pressure, etc., to notify crew members of abnormalities so as to permit the early and precise detection of cracks

and other abnormalities in bogies.

Measures Taken Based on These Opinions

The Japan Transport Safety Board issued a progress report on June 28, 2018, concerning the serious incident involving cracking and other problems in a bogie frame that occurred on the Tokaido-Sanyo Shinkansen "Nozomi 34" (cars operated by West Japan Railway Company) on December 11, 2017. The JTSB also delivered opinions concerning this serious incident to the Minister of Land, Infrastructure, Transport and Tourism and received the following notification concerning measures that were implemented based on the opinions on August 21, 2018.

Measures Taken by the Ministry of Land, Infrastructure, Transport and Tourism based on the Opinions

Regarding the subject matter of the opinions provided in UN-I-SAN No. 46 dated June 28, 2018, the Ministry of Land, Infrastructure, Transport and Tourism (MLIT) issued "Regarding Response to 'Regarding Response to the Progress Report of the Investigation of the Serious Railway Incident'" (KOKU-TETSU-GI No. 56, KOKU-TETSU-GI No. 56-2, KOKU-TETSU-GI No. 56-3, KOKU-TETSU-AN No. 28) and notified railway operators under its jurisdiction and concerned bodies of the content of the Japan Transport Safety Board's progress report and opinions through district transport bureaus on June 28 of this year.

Furthermore, following a study of this serious incident by the "Study Group on Measures Concerning Railway Transport Troubles" and MLIT's recent receipt of the study group's report on those measures, MLIT issued "Regarding the Report of the Study Group on Measures Concerning Railway Transport Troubles" (Kokutetsuso No. 129, KOKU-TETSU-GI No. 79, KOKU-TETSU-GI No. 79-2, KOKU-TETSU-GI No. 79-3, KOKU-TETSU-AN No. 29, KOKU-TETSU-SHI No. 118) on July 30 of this year and instructed railway operators under its jurisdiction and concerned bodies to make efforts to study and implement measures to reduce railway troubles based on the intent of the report through district transport bureaus.

MLIT hereby provides notification of the above with associated materials.

MILT added that it will continue instructing railway operators to firmly establish activities toward preventing bogie cracking through district transport bureaus.

*The content of the notification and its associated materials is provided on the JTSB's website.
http://www.mlit.go.jp/jtsb/railkankoku/railway-iken3re-1_20180828.pdf

(4) Regarding Opinions Concerning the Rescue of Fishing Passengers of Recreational Fishing Vessels and Fishing Ferries who Fall Into the Sea

(Accident resulting in the death of a fishing passenger of the fishing ferry KASUGA MARU)

(Opinions on February 22, 2018)

Opinions to the Director-General of the Fisheries Agency

1. Fishing ferry accidents

It is probable that this accident resulting in the death of a fishing passenger of the fishing ferry KASUGA MARU (hereinafter referred to as "the Accident") occurred when, as the fishing ferry KASUGA MARU was gathering fishing passengers at Minohana, near the northwestern shore of Futaoijima Island, on December 29, 2016, she received a wave with a height exceeding approximately 3 meters, a result of which was that the hull moved and a fishing passenger lost his balance and slid down into a low depression from the point where he had begun to board and into the sea. In subsequent rescue activities, the skipper threw a life buoy into the water and pulled the fishing passenger toward the vessel's side, but he could not pull the fishing passenger up onto the vessel and the fishing passenger died by drowning.

On the other hand, in an accident in which a fishing passenger of the fishing ferry HAIYA MARU fell into the sea and died that occurred on the day after the Accident, it is somewhat likely that a life buoy was not used in rescue because the skipper did not think of using a life buoy and the storage location of life buoys was not made known to fishing passengers, and that this situation contributed to the fishing passenger's drowning.

In investigation reports issued by the Japan Transport Safety Board between October 2008 and December 2017, which included that for the HAIYA MARU accident, there were 330 accidents and incidents involving recreational fishing vessels, 54 accidents and incidents involving fishing ferries, and one collision between a recreational fishing vessel and a fishing ferry, making a total of 385 accidents and incidents, that were in addition to the Accident. Of these accidents and incidents, there were 26 accidents that involved 38 fishing passengers falling into the sea, and of those who fell overboard, 13 died (11 of whom died by drowning).

2. Necessary matters for the rescue of fishing passengers who fall into the sea

Although the circumstances of the Accident and HAIYA MARU accident differ, both involved a fishing passenger's falling into the sea when boarding at a landing spot and, although the fishing passenger was subsequently observed to be alive, rescue could not be made and the fishing passenger died by drowning. Moreover, in addition to the Accident, 13 fishing passengers died (11 of whom died by downing) in 26 accidents in which a fishing passenger aboard a recreational fishing vessel or fishing ferry, including the HAIYA MARU accident, fell into the sea.

In order to prevent the occurrence of cases in which people falling into the sea and raise the probability of survival in the event that a person falls into the sea, it is considered necessary for skippers and operations managers to implement the following.

(1) Skippers and operations managers avoid situations in which landing or boarding on rocks is

difficult through early grasping of the conditions of fishing passengers and rocks by obtaining the latest weather and sea information, fully complying with operational regulations, and patrolling rocks.

(2) Because floating by obtaining buoyancy is important for rescue when a person falls into the sea, users of fishing ferries wear and appropriately use lifejackets and other devices that are products that have received type approval for the usage environment or have performance exceeding such products. Additionally, in situations of high and rough waves, rescue the fallen person quickly due to the danger that the person will accidentally inhale seawater.

(3) Inform fishing passengers to quickly and surely grasp thrown life buoys if they fall into the sea and, on recreational fishing vessels and fishing ferries that have few crew members, inform fishing passengers of where life buoys are stored and how to use them in preparation for cases in which fishing passengers will conduct rescue activities as well as cases in which a fishing passenger who falls in the sea must be rescued.

(4) On recreational fishing vessels and fishing ferries with few crew members, have ladders and other devices ready on the vessel to make it easier to lift a person who has fallen into the sea onto the vessel.

(5) Conduct periodic training for scenarios in which a person has fallen into the sea, as training can lead to awareness of necessary actions and consciousness and to resolution of areas requiring improvement in onboard equipment, and it can help crew members master appropriate actions through repetition and raise the level of safety.

It is thought that the actions described in (1), (3) and (4) were not executed in the case of the Accident and the actions of (3) and (4) were not executed in the case of the HAIYA MARU, and as a result the two fishing passengers who fell into the sea died by drowning. Moreover, in addition to the Accident, 13 fishing passengers died in 26 accidents in which a fishing passenger aboard a recreational fishing vessel or fishing ferry, including the HAIYA MARU accident, fell into the sea.

3. Measures pertaining to necessary matters for the rescue of fishing passengers who fall into the sea

It is probable that a system for preventing the occurrence of cases in which people falling into the sea and raising the probability of survival in the event that a person falls into the sea will be built with the unfailing execution of all actions described in 2 (1) to (4), and that the appropriate operation of such a system will be possible with the action described in 2 (5).

When recreational fishing vessels and fishing ferries engage in operations, their operators are required to operate after establishing operational regulations based on Model Operational Regulations established by the Fisheries Agency. Because Article 15 paragraph 2 of the Model Operational Regulations stipulates that skippers must implement thorough measures to ensure the safety of human lives, measures to prevent the spread of accidents, and measures to dispel users' concerns when a marine accident occurs or is likely to occur, it is thought that prefectural governors must provide instruction to recreational fishing vessel and fishing ferry operators concerning the execution of the actions described in 2.

In accordance with the above, the JTSB expresses the following opinions to the Director-

General of the Fisheries Agency, who oversees the Act on Regulation of Sportfishing Boat Service, pursuant to Article 28 of the Act for Establishment of the Japan Transport Safety Board.

When any measures were implemented according to these opinions, please notify the JTSB.

The Director-General of the Fisheries Agency should advise prefectural governors so that operators of recreational fishing vessels and fishing ferries execute the following measures, and should also study means of having the measures executed with certainty, such as using the opportunities provided by training of operations managers on recreational fishing vessels.

(1) Skippers and operations managers of fishing ferries fully comply with operational regulations and periodically patrol rocks on which fishing passengers have landed.
(2) Skippers and operations managers of fishing ferries urge users to wear and appropriately use lifejackets and other devices that are products that have received type approval for the usage environment or have performance exceeding such products, and, in situations of high and rough waves, conduct rescue quickly due to the danger that a person in the sea will accidentally inhale seawater.
(3) Skippers and operations managers of recreational fishing vessels and fishing ferries inform users of where life buoys are stored and how to use them.
(4) Operators of recreational fishing vessels and fishing ferries have ladders and other devices ready on the vessel that can provide help when lifting a person who has fallen into the sea onto the vessel.
(5) Operators of recreational fishing vessels and fishing ferries conduct periodic training for scenarios in which a person has fallen into the sea.

Measures Taken Based on These Opinions

The Japan Transport Safety Board delivered opinions to the Director-General of the Fisheries Agency on February 22, 2018, and received the following notifications concerning measures that were implemented based on the opinions on March 27, 2018, and October 23, 2018.

Measures Taken by the Fisheries Agency Based on These Opinions

Notification 1 (March 6, 2018)

This is to provide notification that the Fisheries Agency has received “Regarding Opinions Concerning the Rescue of Fishing Passengers of Recreational Fishing Vessels and Fishing Ferries who Fall Into the Sea” through UN-I-SAN No. 286, dated February 22, 2018, and has notified prefectural governors and organizations that train operations managers of recreational fishing vessels as separately attached in order to ensure the safety of recreational fishing vessel users.

Summary of the attachment

- Advice to prefectural governors to provide guidance to recreational fishing vessel operators, etc., under their jurisdiction
- Request to organizations that train operations managers of recreational fishing vessels to make the content of the Opinions known during training and to work to ensure an even high level of safety.

・Revision of the Model Operational Regulations, which are regulations concerning the conduct of recreational fishing vessel business

*The content of the notification and its attached materials is provided on the JTSB's website.
http://www.mlit.go.jp/jtsb/shiphoukoku/ship-iken13re-1_20180327.pdf

Notification 2 (October 22, 2018)

The Fisheries Agency previously notified the JTSB that it received "Regarding Opinions Concerning the Rescue of Fishing Passengers of Recreational Fishing Vessels and Fishing Ferries who Fall Into the Sea" (UN-I-SAN No. 286, dated February 22, 2018), issued on February 22, 2018, and that it notified prefectural governors and organizations that train operations managers of recreational fishing vessels of "Regarding Opinions Received from the Japan Transport Safety Board" (Suikan No. 291, dated March 5, 2018) in order to ensure the safety of recreational fishing vessel users. This is to notify the JTSB that the Fisheries Agency has revised the Model Operational Regulations as shown in the separately attached.

Summary of the attachment

・Partial revision of Model Regulations Concerning the Conduct of Recreational Fishing Vessel Business (Operational Regulations) (October 22, 2018)
Red: Additional provision Blue: Existing provision

Measures to be taken by recreational fishing vessel operators, etc.	Corresponding provision, etc., of the Model Operational Regulations
(1) Periodic patrols of rocks	Annexed Table 9 (Matters to be observed to ensure safety) Periodically patrol shores on which users have been landed to confirm their safety.
(2) Promotion of wearing/use of lifejackets suitable for use environment	Annexed Table 8 (Matters to be made known to ensure safety) Except when inside a cabin, wear a lifejacket or other device (a device that meets requirements established by the Ministry of Land, Infrastructure, Transport and Tourism for the type of vessel and area of navigation that is provided on the vessel or brought aboard) while on board.
(3) Life buoy storage locations, etc.	Annexed Table 8 Storage locations and use of lifejackets and life buoys
(4) Onboard furnishment of ladders, etc.	Article 7 (Omitted) 2 Operators shall equip recreational fishing vessels with ladders and other devices that can provide help when lifting a user who has fallen into the sea onto the vessel. Annexed Table 8 Storage locations and use of ladders, etc., to assist when lifting a person in the sea onto a vessel
(5) Implementation of periodic training	Article 9 (Omitted) 3 Operators shall conduct periodic training for scenarios in which a person has fallen into the sea so that the operator and employees can rescue a person in the sea with precision.

・Advice to prefectural governors
Make the revisions to the Model Operational Regulations known to recreational fishing vessel operators under their jurisdiction and direct those operators to quickly modify their operational regulations.

・Request to organizations that train operations managers
Provide instruction on accident-prevention measures that are based on the revised Model Operational Revisions in training.

*The content of the notification and its attached materials is provided on the JTSB's website.
http://www.mlit.go.jp/jtsb/shiphoukoku/ship-iken13re-2_20181023.pdf

(5) Regarding Opinions Concerning the Prevention of Collision Accidents Involving Recreational Fishing Vessels

(Opinions on July 24, 2018)

Opinions to the Director-General of the Fisheries Agency

1. Collisions by recreational fishing vessels

Among the investigation reports on accidents and incidents that the Japan Transport Safety Board issued between October 2008 and March 2018, 176 concerned collisions by recreational fishing vessels. A total of 352 vessels were involved in those accidents, of which 190 were recreational fishing vessels.

Of those accidents, 93 resulted in death or injury to 195 people, and of those killed or injured, 82 were fishing passengers (1 dead, 2 with serious injuries, and 79 with minor injuries) and 16 were crew members on recreational fishing vessels, and 97 (2 dead, 15 with serious injuries, and 80 with minor injuries) were on other vessels.

2. Major factors leading to collision

The following are identified as major factors based on analysis of the reports.

(1) A total of 144 of the accidents involved a collision by a recreational fishing vessel that was underway (approximately 82% of the total). Of them, 109 involved a collision between a recreational fishing vessel that was underway and a vessel that was drifting or at anchor (approximately 76% of accidents involving a vessel underway).

The main factors leading to collisions by recreational fishing vessels that were underway were as follows.

(a) Not conducting lookout that compensated for a blind spot

(b) Navigating while operating a fish finder or navigation equipment

(c) Maneuvering while looking at another vessel or another direction

(d) Not maintaining continuous lookout of the other vessel

(2) A total of 45 accidents involved a collision with a recreational fishing vessel that was drifting or at anchor (hereinafter referred to as “recreational fishing vessels that were drifting, etc.”) (approximately 26% of the total).

The main factors leading to collisions by recreational fishing vessels that were at drifting, etc., were as follows.

(a) Not maintaining continuous monitoring or delay in raising attention or taking avoiding action due to belief that the other vessel would avoid own vessel or had a reason for approaching own vessel

(b) Preoccupation with handling fishing passengers

Additionally, the vessels that were underway were largely unaware of the presence of the recreational fishing vessels that were drifting, etc., and this situation was attributable to their

not conducting lookout that compensated for a blind spot, engaging in other operations, finding fishing grounds with a fish finder, etc.

3. Matters required of skippers of recreational fishing vessels

When recreational fishing vessels engage in operations, their operators are required to operate after establishing operational regulations based on Model Operational Regulations established by the Fisheries Agency (obligation on operators to provide notification pursuant to Article 11 of the Act on Regulation of Sportfishing Boat Service). Article 14 of the Model Operational Regulations stipulates that skippers must engage in safe navigation by complying with safety laws and ordinances at sea while also paying sufficient attention to maintaining the safety of users during navigation, and, while allowing users to harvest aquatic animals and plants, must constantly strive to ascertain the movements of other vessels by keeping appropriate lookout and engage in appropriate maneuvering to avoid collisions with other vessels. Skippers of recreational fishing vessels are therefore required to execute said actions.

In accordance with the above, the JTSB expresses the following opinions to the Director-General of the Fisheries Agency, who oversees the Act on Regulation of Sportfishing Boat Service, pursuant to Article 28 of the Act for Establishment of the Japan Transport Safety Board.

When any measures were implemented according to these opinions, please notify the JTSB.

The Director-General of the Fisheries Agency should advise prefectural governors so that operators of recreational fishing vessels execute the following measures, and should also study means of having the measures executed with certainty, such as using the opportunities provided by training of operations managers on recreational fishing vessels.

(1) Skippers of recreational fishing vessels constantly keep appropriate lookout during navigation, such as when going to and from fishing places and moving within fishing places.

(2) Skippers of recreational fishing vessels maintain lookout even when drifting or at anchor and take avoiding action when necessary.

(3) In addition to (1) and (2), skippers of recreational fishing vessels understand the characteristics of the collision accidents described in JTSB Digests Issue No. 29 “For Prevention of Collisions of Recreational Fishing Vessels,” comply with operational regulations, and make efforts to ensure users’ safety.

Measures Taken Based on These Opinions

The Japan Transport Safety Board delivered opinions to the Director-General of the Fisheries Agency on July 24, 2018, and received the following notification concerning measures that were implemented based on the opinions on August 9, 2018.

Measures Taken by the Fisheries Agency Based on These Opinions

This is to provide notification that the Fisheries Agency has received “Regarding Opinions Concerning the Prevention of Collision Accidents Involving Recreational Fishing Vessels” through UN-I-SAN No. 64 dated July 24, 2018, and has notified heads of prefectural departments in charge

of fisheries and organizations that train operations managers of recreational fishing vessels as separately attached in order to prevent collision accidents involving recreational fishing vessels and to ensure the safety of recreational fishing vessel users.

Summary of the attachment

- Advice to prefectures to instruct recreational fishing vessel operators under their jurisdiction to rigidly enforce lookout, comply with operational regulations, and ensure users' safety.
- Request to organizations that train operations managers of recreational fishing vessels to make the content of Japan Transport Safety Board's Opinions known during training.

*The content of the notification and its attached materials is provided on the JTSB's website.
http://www.mlit.go.jp/jtsb/shiphoukoku/ship-iken14re_20180828.pdf

3 Safety Recommendations

(1) Fire on the Cargo Ship TAI YUAN

(Safety Recommendations on October 25, 2018)

Summary of the Accident

At around 13:20 on April 24, 2017, as the cargo ship TAI YUAN, with a master and ten other crew members aboard, was waiting to begin loading of waste metal and other miscellaneous scrap at the No. 16 Berth of Hakozaki Wharf, Hakata Port, Fukuoka City, Fukuoka Prefecture, a fire broke out in the aft cargo hold.

At around 04:54 on the following day, April 25, TAI YUAN foundered during firefighting and became a total loss. An oil spill occurred, but there were no fatalities or injuries.

Probable Causes

It is probable that the accident occurred when, as the Vessel was moored for the purpose of cargo-handling at Hakata Port, a fire that broke out within the scrap loaded into the aft cargo hold spread because firefighting by water-spraying was ineffective and appropriate firefighting methods using the Vessel's carbon dioxide gas firefighting equipment were not employed.

It is probable that effective firefighting methods using the carbon dioxide gas firefighting equipment were not employed because the Master did not think of using the carbon dioxide gas firefighting equipment.

It is probable that the Master did not think of using the carbon dioxide gas firefighting equipment because he did not have experience with fire drills for a fire in the Vessel's cargo holds and because the Vessel and Miki Shouji Co., Ltd. did not share information on effective firefighting methods for times of fire.

It is somewhat likely that firefighting by water-spraying was not effective because the sprayed water was blocked by the scrap's surface layer and did not reach the fire's origin.

Regarding the fire that broke out inside the scrap, it is somewhat likely that a spark created by contact between metal objects, a battery, etc., was the source of the fire, and that the source ignited combustible material. However, it was not possible to determine the circumstances leading up to the fire.

Safety Recommendations to the TAI YUAN (HONG KONG) INTERNATIONAL SHIPPING CO., LTD.

It is probable that the accident occurred when a fire that broke out within the scrap loaded into the aft cargo hold spread because firefighting by water-spraying was ineffective and appropriate firefighting methods using TAI YUAN's carbon dioxide gas firefighting equipment were not employed.

It is probable that effective firefighting methods using the carbon dioxide gas firefighting equipment

were not employed because the Master did not think of using the carbon dioxide gas firefighting equipment because the Master did not have experience with fire drills for a fire in TAI YUAN's cargo holds and because TAI YUAN and Miki Shouji Co., Ltd. did not share information on effective firefighting methods for times of fire.

Additionally, it is probable that, as a result of the accident, oil that spilled from the foundered TAI YUAN spread through a large area of Hakata Bay and caused harm to the fishing industry.

In view of the result of this accident investigation, the Japan Transport Safety Board recommends that Tai Yuan (Hong Kong) International Shipping Co., Ltd., which is the owner of TAI YUAN, take the following measures for the purpose of preventing the occurrence of a similar accident and reducing damage:

Tai Yuan (Hong Kong) International Shipping Co., Ltd. shall provide thorough instruction to masters of its vessels to unfailingly execute the following measures and shall also implement training in accordance with said measures:

(1) Build a thorough system for appropriate and smooth firefighting in case of fire with the loading business by considering and determining effective firefighting methods in accordance with the cargo's characteristics beforehand and conveying this information to the loading business.

(2) Pay full attention to the following points regarding firefighting methods for fires within piled scrap:

1) Firefighting by water-spraying may not be effective because the sprayed water can be blocked by the scrap's surface layer and not reach the fire's origin.

2) Insulation material and other combustible items with low specific gravity may float in a burning state even when the water level in the cargo holds rises from continuous water-spraying and continue to burn on the water's surface.

3) Firefighting using carbon dioxide gas firefighting equipment is effective.

4) When a vessel has multiple cargo holds, measures such as immediately closing and sealing the hatch covers of cargo holds other than the cargo hold with the fire shall be taken to prevent the spread of fire.

(3) Reliably provide information on firefighting equipment aboard the vessel to the firefighting organization.

(4) Implement measures as soon as possible to control oil, such as closing air vents and setting up oil fences, whenever the danger of an oil spill from a vessel arises.