Chapter 4 Railway accident and serious incident investigations

1 Railway accidents and serious incidents to be investigated

< Railway accidents to be investigated >

◎Article 2 ,paragraph (3), of the Act for Establishment of the Japan Transport Safety Board (Definition of railway accident)

The term "Railway Accident" as used in this Act shall mean a serious accident prescribed by the Ordinance of Ministry of Land, Infrastructure, Transport and Tourism among those of the following kinds of accidents; an accident that occurs during the operation of trains or vehicles as provided in Article 19 of the Railway Business Act, collision or fire involving trains or any other accidents that occur during the operation of trains or vehicles on a dedicated railway, collision or fire involving vehicles or any other accidents that occur during the operation of vehicles on a tramway.

◎Article 2 of Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board (Serious accidents prescribed by the Ordinance of Ministry of Land, Infrastructure, Transport and Tourism, stipulated in Article 2, paragraph (3) of the Act for Establishment of the Japan Transport Safety Board)

1 The accidents specified in Article 3, paragraph (1), items (i) through (iii) of the Ordinance on Report on Railway Accidents, etc. (the Ordinance) (except for accidents that involve working snowplows that specified in item 2 of the above paragraph);

2 From among the accidents specified in Article 3, paragraph (1), items (iv) through (vi) of the Ordinance, that which falls under any of the following sub-items:

(a) an accident involving any passenger, crew, etc. killed;

(b) an accident involving five or more persons killed or injured;

(c) a fatal accident that occurred at a level crossing with no automatic barrier machine;

(d) an accident found to be likely to have been caused owing to a railway officer's error in handling or owing to malfunction, damage, destruction, etc. of the vehicles or railway facilities, which resulted in the death of any person;

3 The accidents specified in Article 3, paragraph (1), items (iv) through (vii) of the Ordinance which are found to be particularly rare and exceptional;

4 The accidents equivalent to those specified in Article 3, paragraph (1), items (i) through (vii) of the Ordinance which have occurred relevant to dedicated railways and which are found to be particularly rare and exceptional; and

5 The accidents equivalent to those specified in items (i) through (iii) which have occurred relevant to a tramway, as specified by a public notice issued by the Japan Transport Safety Board.

[Reference] The accidents listed in Article 3, paragraph (1), each items of the Ordinance on

Report on Railway Accidents, etc.

item (i): Train collision

item (ii): Train derailment

item (iii): Train fire

item (iv): Level crossing accident

item (v): Accident against road traffic

item (vi): Other accidents with casualties

item (vii): Heavy property loss without casualties

◎Article 1 of the Public Notice of the Japan Transport Safety Board (Accidents specified by the public notice stipulated in Article 2, item (v) of the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board)

1 From among the accidents specified in Article 1, paragraph (1), items (i) through (vi) of the Ordinance on Reporting on Tramway Accidents, etc. (the Ordinance), that which falls under any of the following sub-items:

(a) an accident that causes the death of a passenger, crewmember, etc.;

(b) an accident involving five or more casualties (with at least one of the casualties dead);

(c) a fatal accident that occurs at a level crossing with no automatic barrier machine;

2 The accidents specified in Article 1, paragraph (1), items (i) through (vii) of the Ordinance which are found to be particularly rare and exceptional; and

3 From among the accidents occurring on a tramway operated under the application of the Ministerial Ordinances to provide Technical Regulatory Standards on Railways mutatis mutandis as specified in Article 3, paragraph (1) of the Ordinance on Tramway Operations, the accidents equivalent to those specified in Article 1, items (i) through (iii) of the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board.

[Reference] The accidents specified in Article 1, paragraph (1), each items of the Ordinance on Reporting on Tramway Accidents, etc.

item (i): Vehicle collision

item (ii): Vehicle derailment

item (iii): Vehicle fire

item (iv): Level crossing accident

item (v): Accidents against road traffic

item (vi): Other accidents with casualties

item (vii): Heavy property loss without casualties

Railway accidents to be investigated

<table>
<tr><th>Category</th><th>Train collision*2)</th><th>Train derailment*2)</th><th>Train fire*2)</th><th>Level crossing accident</th><th>Accident against road traffic</th><th>Other accidents with casualties</th><th>Heavy property loss without casualties</th></tr>
<tr><td rowspan="2">Railway (including tramway operated as equivalent to railway) [Notice 1-3]</td><td colspan="4" rowspan="2">All accidents*1)
[Ordinance 2-1]</td><td colspan="3">・Accidents involving the death of a passenger, crew member, etc.
・Accidents involving five or more casualties with at least one of the casualties dead
・Fatal accidents that occur at level crossings with no automatic barrier machines
・Accidents found to have likely been caused by a railway worker's error in procedure or due to the malfunction, damage, destruction, etc., of vehicles or railway facilities, which resulted in the death of a person
[Ordinance 2-2]</td><td></td></tr>
<tr><td colspan="4">Accidents that are particularly rare and exceptional
[Ordinance 2-3]</td></tr>
<tr><td>Dedicated railway</td><td colspan="8">Accidents that are particularly rare and exceptional [Ordinance 2-4]</td></tr>
<tr><td rowspan="2">Tramway [Ordinance 2-5]</td><td colspan="7">・Accidents involving the death of a passenger, crewmember, etc.
・Accidents involving five or more casualties with at least one of the casualties dead
・Fatal accidents that occur at level crossings with no automatic barrier machines.
[Notice 1-1]</td><td></td></tr>
<tr><td colspan="8">Accidents that are particularly rare and exceptional [Notice 1-2]</td></tr>
</table>

*1 Except for derailment accidents of working snowplows. [Ordinance 2-1]
However, accidents that are particularly rare and exceptional are to be investigated. [Ordinance 2-3]

*2 If these categories occur on a tramway, the accident types shall each be renamed to “vehicle collision”, “vehicle derailment”, or “vehicle fire”.

(Note) “Ordinance” refers to the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board; “Notice” refers to the Public Notice by the Japan Transport Safety Board; and the numbers refer to the Article and paragraph numbers.

< Railway serious incidents to be investigated >

◎Article 2, paragraph (4), item (ii), of the Act for Establishment of the Japan Transport Safety Board (Definition of railway serious incident)

A situation, prescribed by the Ordinance of the Ministry of Land, Infrastructure, Transport and Tourism (Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board), deemed to bear a risk of accident occurrence.

◎Article 3 of the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board (A situation prescribed by the Ordinance of the Ministry of Land, Infrastructure, Transport and Tourism, stipulated in Article 2, paragraph (4), item (ii) of the Act for Establishment of the Japan Transport Safety Board)

【JTSB Website: https://www.mlit.go.jp/jtsb/example.pdf (See cases ①～⑩.) (Japanese only)】

1 The situation specified in Article 4, paragraph (1), item (i) of the Ordinance on Report on Railway Accidents, etc. (the Ordinance), wherein another train or vehicle had existed in the zone specified in said item;

[A situation where a train starts moving for the purpose of operating in the relevant block section before completion of the block procedure: Referred to as "Incorrect management of safety block." (case ①)]

2 The situation specified in Article 4, paragraph (1), item (ii) of the Ordinance, wherein a train had entered into the route as specified in said item;

[A situation where a signal indicates that a train should proceed even though there is an obstacle in the route of the train, or the route of the train is obstructed while the signal indicates that the train should proceed: Referred to as "Incorrect indication of signal." (case ②)]

3 The situation specified in Article 4, paragraph (1), item (iii) of the Ordinance, wherein another train or vehicle had entered into the protected area of the signal which protects the zone of the route as specified in said item;

[A situation where a train proceeds regardless of a stop signal, thereby obstructing the route of another train or vehicle: Referred to as "Violating red signal." (case ③)]

4 The situation specified in Article 4, paragraph (1), item (vii) of the Ordinance, which caused malfunction, damage, destruction, etc. bearing particularly serious risk of collision or derailment of or fire in a train;

[A situation that causes a malfunction, etc., of facilities: Referred to as "Dangerous damage in facilities." (case ⑦)]

5 The situation specified in Article 4, paragraph (1), item (viii) of the Ordinance, which caused malfunction, damage, destruction, etc. bearing particularly serious risk of collision or derailment of or fire in a train;

[A situation that causes a malfunction, etc., of a vehicle: Referred to as "Dangerous trouble in vehicle." (case ⑧)]

6 The situation specified in Article 4, paragraph (1), items (i) through (x) of the Ordinance which is found to be particularly rare and exceptional; and
[These are referred to as: item (iv) “Main track overrun” (case ④); item (v) “Violating closure section for construction” (case ⑤); item (vi) “vehicle derailment” (case ⑥); item (ix) “Heavy leakage of dangerous object” (case ⑨); and item (x) “others,” (case ⑩)respectively.]

7 The situations occurred relevant to the tramway as specified by a public notice of the Japan Transport Safety Board as being equivalent to the situations specified in the preceding items.

○**Article 2 of the Public Notice of the Japan Transport Safety Board** (A situation prescribed by the public notice stipulated in Article 3, item (vii) of the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board (Serious incident on a tramway))

1 The situation specified in Article 2, item (i) of the Ordinance on Reporting on Tramway Accidents, etc. (the Ordinance), wherein another vehicle operating on the main track had existed in the zone specified in said item;
[A situation where a vehicle is operating on the main track for the purpose of operating in the relevant safety zone before the completion of safety system procedures: Referred to as “Incorrect management of safety block.”]

2 The situation specified in Article 2, item (iv) of the Ordinance, which caused malfunction, damage, destruction, etc., bearing a particularly serious risk of collision, derailment of or fire in a vehicle operating on the main track;
[A situation that causes a malfunction, etc., of facilities: Referred to as “Dangerous damage in facilities.”]

3 The situation specified in Article 2, item (v) of the Ordinance, which caused malfunction, damage, destruction, etc., bearing a particularly serious risk of collision, derailment or fire in a vehicle operating on the main track;
[A situation that causes a malfunction, etc., of a vehicle: Referred to as “Dangerous trouble in vehicle.”]

4 The situation specified in Article 2, items (i) through (vii) of the Ordinance which is found to be particularly rare and exceptional; and
[These are referred to as: item (ii) “Violating red signal;” item (iii) “Main track overrun;” item (vi) “Heavy leakage of dangerous object;” and item (vii) “others,” respectively.]

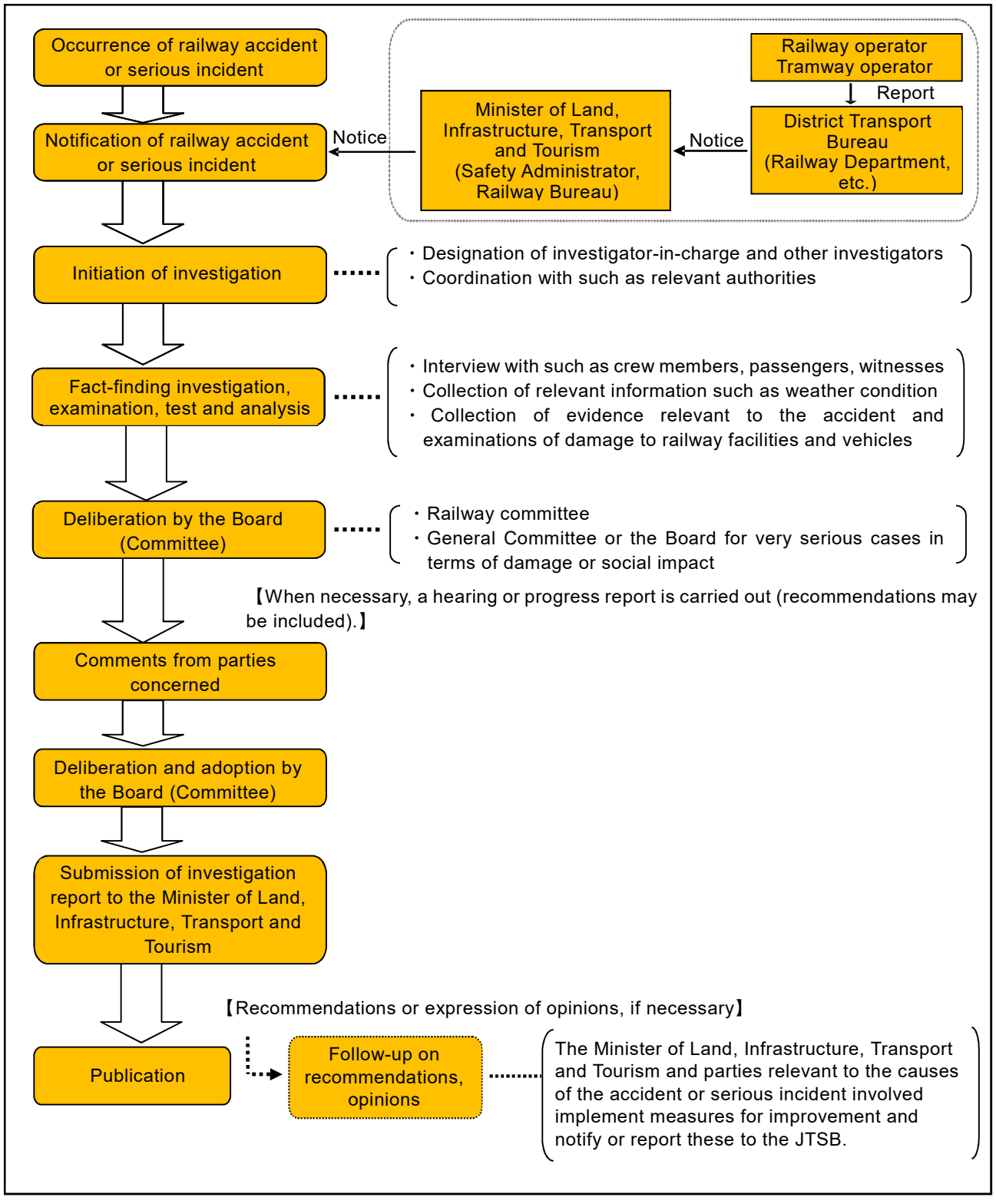
5 From among the situations occurring on a tramway operated under the application of the Ministerial Ordinances to provide Technical Regulatory Standards on Railways mutatis mutandis as specified in Article 3, paragraph (1) of the Ordinance on Tramway Operations, the situations equivalent to those specified in Article 2, items (i) through (vi) of the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board.

Serious incidents to be investigated

<table>
<tr><td>Category</td><td>・Incorrect management of safety block</td><td>・Incorrect indication of signal
・Violating red signal</td><td>・Dangerous damage in facilities</td><td>・Dangerous trouble in vehicle</td><td>・Main track overrun
・Violating closure section for construction
・Vehicle derailment
・Heavy leakage of dangerous object
・Others</td></tr>
<tr><td rowspan="2">Railway (including tramway operated as equivalent to railway) [Notice 2-5]</td><td colspan="2">Certain conditions such as the presence of another train [Ordinances 3-1, 3-2, and 3-3]</td><td colspan="2">Risk of collision, derailment or fire [Ordinances 3-4 and 3-5]</td><td></td></tr>
<tr><td colspan="5">Incidents that are particularly rare and exceptional [Ordinance 3-6]</td></tr>
<tr><td></td><td>・Incorrect management of safety block</td><td>・Violating red signal</td><td>・Dangerous damage in facilities</td><td>・Dangerous trouble in vehicle</td><td>・Main track overrun
・Heavy leakage of dangerous object
・Others</td></tr>
<tr><td rowspan="2">Tramway [Ordinance 3-7]</td><td>Certain conditions such as the presence of a vehicle [Notice 2-1]</td><td></td><td colspan="2">Risk of collision, derailment or fire [Notices 2-2 and 2-3]</td><td></td></tr>
<tr><td colspan="5">Incidents that are particularly rare and exceptional [Notice 2-4]</td></tr>
</table>

(Note) "Ordinance" refers to the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board; "Notice" refers to the Public Notice by the Japan Transport Safety Board; and the numbers refer to the Article and paragraph numbers.

2 Procedure of railway accident/serious incident investigation



* Opinions may be expressed in a flow chart (as above) or whenever and however necessary to prevent accidents or incidents or mitigate damage thereof.

3 Statistics of investigations of railway accidents and serious incidents

The JTSB carried out investigations of railway accidents and serious incidents in 2020 as follows:

15 accident investigations were carried over from 2019, and 13 accident investigations were newly launched. Among these, 14 investigation reports were published in 2020, and 14 accident investigations were carried over to 2021.

Moreover, two railway serious incident investigations were carried over from 2019, and two serious incident investigations were newly launched in 2020. Among these, two investigation reports were published in 2020, and two investigations were carried over to 2021.

Among the 16 investigation reports published, the JTSB provided no recommendation and no opinion.

Investigations of railway accidents and serious incidents in 2020

(Cases)

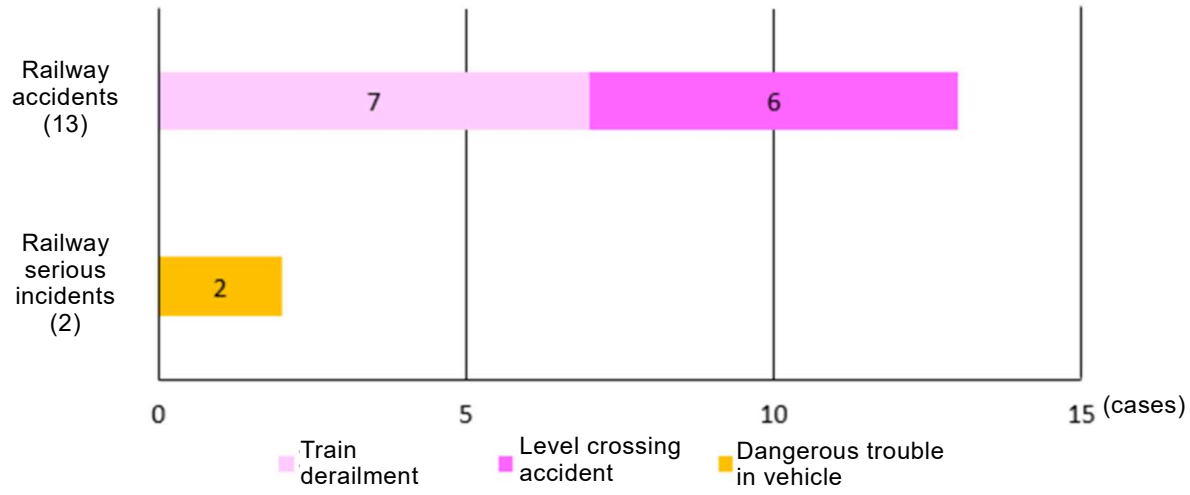
Category	Carried over from 2019	Launched in 2020	Total	Published investigation reports	(Recommendations)	(Opinions)	Carried over to 2021	(Interim report)
Railway accident	15	13	28	14	(0)	(0)	14	(0)
Railway serious incident	2	2	4	2	(0)	(0)	2	(0)

4 Statistics of investigated railway accidents and serious incidents in 2020

Regarding the number of railway accidents and incidents investigated in 2020, there were 13, a decrease of four from 17 in the previous year, and there were two railway serious incidents, the same as in the previous year.

The breakdown by type of accidents and serious incidents is as follows: The railway accidents consisted of seven derailments and six level crossing accidents. As for railway serious incidents, there was one main track overrun and one dangerous trouble in vehicle.

Number of investigated railway accidents and serious incidents by type in 2020



There were 12 persons killed or injured in 13 accidents, eight of whom were killed and four were injured.

The number of casualties (in railway accidents)

(Persons)

2020							
Category	Dead			Injured			Total
	Crew	Passenger	Others	Crew	Passenger	Others	
Casualties	0	0	8	0	4	0	12
Total	8			4			

*The above statistics include incidents under investigation so may change depending on the status of the investigation and deliberation.

5 Summaries of railway accidents and serious incidents which occurred in 2020

The railway accidents and railway serious incidents which occurred in 2020 are summarized as follows. The summaries are based on information available at the start of the investigations and therefore are subject to change depending on the course of investigations and deliberations.

(Railway accidents)

1	Date and accident type	Railway operator	Line section (location)
	January 29, 2020 Level crossing accident	Willer Trains Inc.	Kamiyukou level crossing, the class 3 level crossing equipped with road warning device but without automatic barrier machine, between Shinonome station and Tangokanzaki station, Miyazu Line, Kyoto Prefecture
	Summary	See “6 Publication of investigation reports” (Page 81, No.13)	
2	Date and accident type	Railway operator	Line section (location)
	January 31, 2020 Level crossing accident	West Japan Railway Company	Niiya No.3 level crossing, the class 4 level crossing without automatic barrier machine nor road warning device, between Takamatsucho station and

			Nakahama station, Sakai Line, Tottori Prefecture
	Summary	While the train was running between Takamatsucho station and Nakahama station at the velocity of about 57 km/h, the driver of the train noticed a motorized bicycle entering Niiya No.3 level crossing, the class 4 level crossing, from left, then applied the emergency brake immediately, but the train collided with the motorized bicycle. The driver of the motorized bicycle was dead in the accident.	
3	Date and accident type	Railway operator	Line section (location)
	March 9, 2020 Train derailment	West Japan Railway Co.	Between Tojo station and Bingo-Yawata station on the Geibi Line, Hiroshima Prefecture
	Summary	When the train was traveling, it ran over earth and sand that had flowed onto the railway and all the train wheels derailed.	
4	Date and accident type	Railway operator	Line section (location)
	March 10, 2020 Train derailment	Chikuho Electric Railroad Co., Ltd.	Between Chikuho-Katsuki station and Kusubashi station on the Chikuho Electric Railroad Line, Fukuoka Prefecture Chikuho-Katsuki No. 7 level crossing (class 1 level crossing with automatic barrier machine and road warning device)
	Summary	Train No. 92 collided with an automobile at Chikuho-Katsuki No. 7 level crossing and both axles of the front bogie derailed rightward in the travel direction.	
5	Date and accident type	Railway operator	Line section (location)
	March 18, 2020 Train derailment	Nagaragawa Railway Co., Ltd	Mino-Ota station premises on the Etsumi-Nan Line, Gifu Prefecture
	Summary	Both axles of the front bogie derailed as the train ran through the Mino-Ota station premises.	
6	Date and accident type	Railway operator	Line section (location)
	May 5, 2020 Level crossing accident	East Japan Railway Company	Higashi-Yamoto station premises on the Senseki Line, Miyagi Prefecture No. 1 Shimoura level crossing (class 3 level crossing without automatic barrier machine and with road warning device)
	Summary	The driver of the train noticed a pedestrian inside the level crossing from the left side of the travel direction, and carried out an emergency stop operation but failed to avoid collision. Later, the death of the pedestrian was confirmed.	
7	Date and accident type	Railway operator	Line section (location)
	May 8, 2020 Train derailment	East Japan Railway Company	Between Awa-Kamogawa station and Awa-Amatsu station on the Sotobo Line, Chiba Prefecture
	Summary	When the train was moving, two axles of the No. 1 bogie of the first car derailed leftward.	
8	Date and accident type	Railway operator	Line section (location)
	June 12, 2020 Train derailment	Keisei Electric Railway Co., Ltd.	Inside the Aoto station premises on the main line, Tokyo
	Summary	When the train entered Aoto station, two axles of a posterior bogie of the 7th car derailed rightward in the travel direction.	
9	Date and accident type	Railway operator	Line section (location)
	July 26, 2020 Train derailment	Toyamachiho Railroad Co., Ltd.	Between Higashi-Shinjo station and Shinjo-Tanaka station on the main line, Toyama Prefecture
	Summary	When the train was moving, the No. 1 axle of the first car and Nos. 1, 2 and 3 axles of the second car derailed rightward in the travel direction.	
10	Date and accident type	Railway operator	Line section (location)
	October 18, 2020 Level crossing accident	Japan Freight Railway Company	Between Shimata station and Hikari station on the Sanyo Line, Yamaguchi Prefecture

			Hachioji No. 2 level crossing (class 4 level crossing without automatic barrier machine nor road warning device)
	Summary	The driver of the train noticed two pedestrians entering the level crossing from the right side of the travel direction and carried out an emergency stop operation but failed to avoid collision. Later, the deaths of the two pedestrians were confirmed.	
11	Date and accident type	Railway operator	Line section (location)
	November 15, 2020 Level crossing accident	Echizen Railway Co.	Between Nakatsuno station and Washizuka-Haribara station on the Mikuni Awara Line, Fukui Prefecture Nakatuno level crossing (class 4 level crossing without automatic barrier machine nor road warning device)
	Summary	The driver of the train noticed an automobile entering the level crossing from the left side of the travel direction and took emergency stop operation but failed to avoid collision. Later, the death of the driver of the automobile was confirmed.	
12	Date and accident type	Railway operator	Line section (location)
	November 23, 2020 Train derailment	Hankyu Corporation	Between Mikage station and Rokko station on the Kobe Main Line, Kobe Prefecture Takaha level crossing (class 1 level crossing with automatic barrier machine and road warning device)
	Summary	The driver of the train noticed an automobile entering the level crossing from the left side of the travel direction and carried out an emergency stop operation but failed to avoid collision. All of the No. 1 bogie axles of the first train car derailed.	
13	Date and accident type	Railway operator	Line section (location)
	December 19, 2020 Level crossing accident	Japan Freight Railway Company	Between Higashi-Okayama station and Joto station on the Sanyo Line, Okayama Prefecture Gonotsubo level crossing (class 4 level crossing without automatic barrier machine nor road warning device
	Summary	The driver of the train noticed a pedestrian entering the level crossing from the left side of the traveling direction and carried out an emergency stop operation but failed to avoid collision. Later, the death of the pedestrian was confirmed.	

(Railway serious incidents)

1	Date and incident type	Railway operator	Line section (location)
	October 4, 2020 Main track overrun	WILLER TRAINS, Inc.	Between Tango-yura station and Kunda station on the Miyazu Line, Kyoto Prefecture
	Summary	The driver of the train noticed an abnormal noise before Kunda station and applied the emergency brake, thereby stopping the train. When exiting the train to check the noise, the train started to move. So he again applied the brake—which failed. The train passed through Kunda station and came to a stop about 242 meters past it.	
2	Date and incident type	Railway operator	Line section (location)
	December 30, 2020 Dangerous trouble in vehicle	West Japan Railway Company	Honmataga station premises on the Yamaguchi Line, Shimane Prefecture
	Summary	Immediately before stopping as the train was entering Honmataga station, the driver of the train noticed that the “door-closed indicator” was off. After coming to a stop, he inspected the train and found that a rear passenger door on the right side of the travel direction, located opposite the station platform, was open about 50 cm. No passengers fell onto the railroad tracks through the open door.	

6 Publication of investigation reports

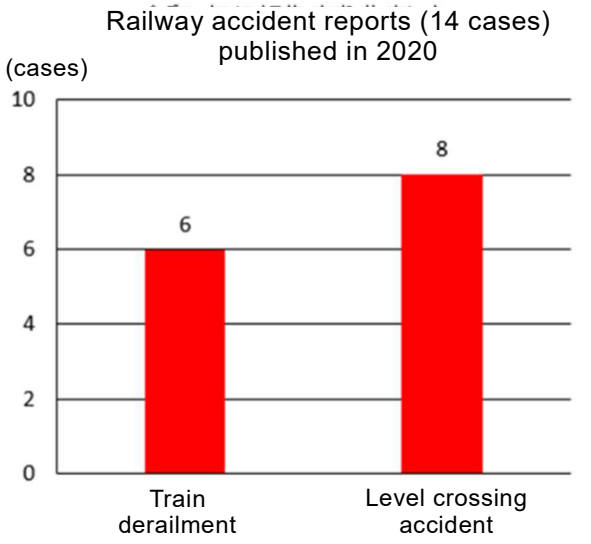
The number of investigation reports of railway accidents and serious incidents published in 2020 was

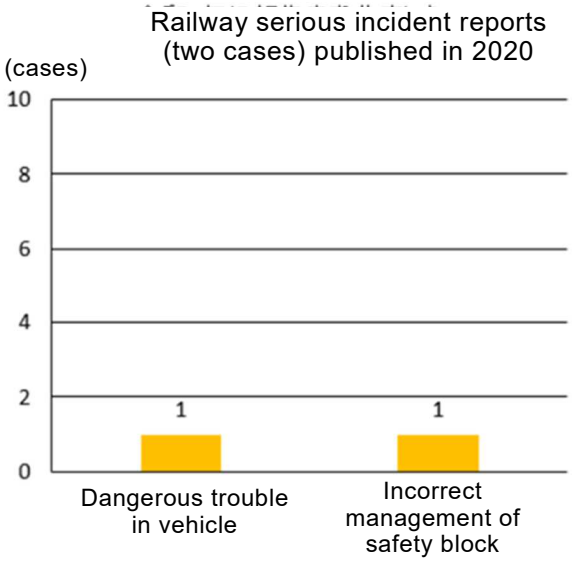
16, consisting of 14 railway accidents and two serious incidents.

Breaking them down by type, the railway accidents contained six train derailment accidents, eight level crossing accidents. The railway serious incidents contained one dangerous trouble in vehicle, and one case of incorrect management of safety block.

In the 14 accidents, the number of casualties was 14, consisting of eight deaths and six injuries.

The investigation reports on railway accidents and serious incidents published in 2020 are summarized as follows.

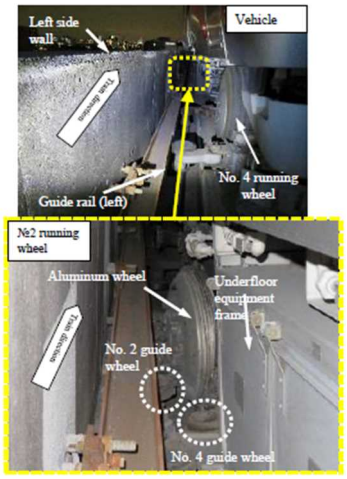




Railway accident investigation reports published in 2020

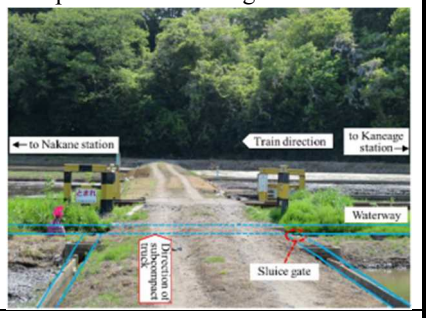
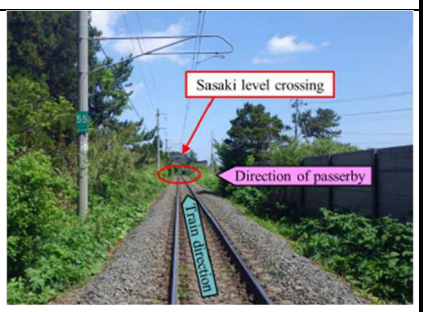
1	Date of Publication	Date & Accident type	Railway operator	Line section (location)
	October 29, 2020	January 16, 2019 Train derailment	Saitama New Urban Transit Co., Ltd.	Between Kamonomiya Station and Tetsudohakubutsukan Station on the Ina Line, Saitama Prefecture
	Summary	The train departed Kamonomiya Station on time. The driver of the train was traveling at a speed of about 30 km/h between Kamonomiya Station and Tetsudohakubutsukan Station when he heard a strange "bong" sound from the rear of the train and then applied the brakes. After stopping, the situation was confirmed through the inside of each vehicle, and when the sixth car was seen from the gangway behind the fifth car, the front part of the vehicle body of the sixth car was tilted to the left and shifted by about 50 cm. The attendant who arrived after receiving a call from the control center confirmed that the left front of the sixth car had made contact with the side wall of the viaduct, and the left tire of the first axle had been damaged and had deviated from the running track. The coaxial right tire was also damaged. About 100 passengers and one driver were on board the train, but no one was injured. Unlike railways with steel wheels, this accident occurred on a railway that used rubber tires as wheels.		

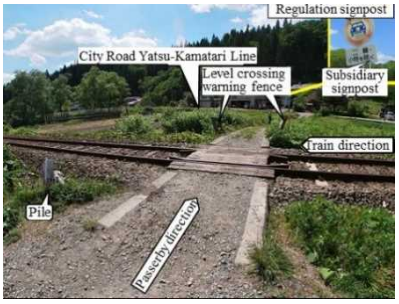
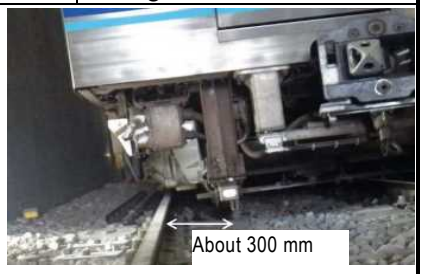
	Probable Causes	It is highly probable that the accident have occurred when the air pressure suddenly dropped due to damage to the left tire on the front axle of the vehicle, and the vehicle traveled with the damaged tire, which damaged the Nakago(safety wheel), causing the guide wheels to move off the guide rail downwards and the running wheels to deviate from the track, resulting in derailment. As for the damage to the tire, it is highly probable that the wires of the steel belt broke due to the train running with the inner surface of the tire and the Nakago(safety wheel) in contact due to extreme underinflation of the tire. With regard to the extreme underinflation of the tire, it is probable that the wires of the belt broke because the tire was run with the steel belt exposed due to wear of the tread, and some of the wires reached the inner surface of the tire, causing air leakage. As for the fact that the tires ran with the steel belt exposed due to wear in the tread area, it is probable that the depth of the main grooves was not measured during the temporary inspection, and the tires were not checked for wear during the train inspection, so they continued to be operated without sufficiently checking the situation where the main grooves in the tread area had disappeared due to wear.
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-5-1e.pdf https://www.mlit.go.jp/jtsb/railway/p-pdf/RA2020-5-1-p.pdf (Explanatory materials (Japanese only))
	Reference	Column (page 96), Case Studies (page 98)



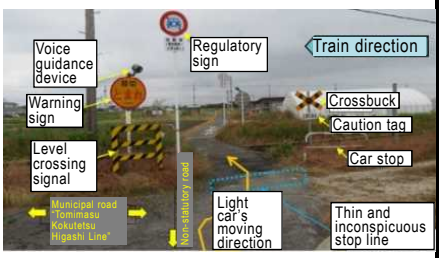
2	Date of Publication	Date & Accident type	Railway operator	Line section (location)
	March 26, 2020	March 21, 2019 Level crossing accident	East Japan Railway Company	Yamanone level crossing, the class 4 level crossing without automatic barrier machine nor road warning device, in the premises of Zushi station, Yokosuka Line, Kanagawa Prefecture
	Summary	While the train was running in the premises of Zushi station at the velocity about 53 km/h, the driver of the train noticed the abnormal sound at around Yamanone level crossing, then operated the emergency stop procedure and the train protection radio. As the result of the investigation of the scene, the injured person was found in the railway track, and found as dead although the ambulance was called. After that it was found out by the image records that the dead person was the passerby of the level crossing entered from southward of the concerned level crossing and collided with the concerned train.		
	Probable Causes	It is highly probable that the concerned accident was caused by that the pedestrian collided with the concerned train because the pedestrian passing Yamanone level crossing, the class 4 level crossing without automatic barrier machine nor road warning machine, entered the up track in the concerned level crossing in the situation that the train was approaching in the up track. It could not be determined the precise situation why the concerned pedestrian entered the up track in the situation that the train was approaching in the up track , because the pedestrian was dead, although it is likely that the pedestrian did not notice the approaching train , and that it was related with the difficult y to cross through the concerned level crossing only by the safety check when entered the level crossing as the structure of the concerned level crossing was in the status as the main track s could not be viewed by the parking vehicles depending on the		

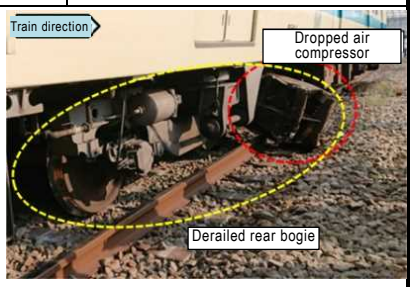
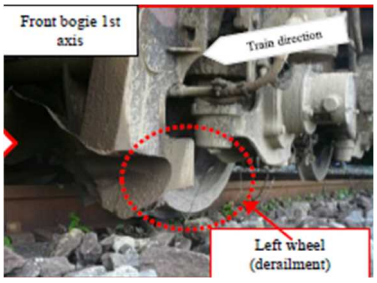
		circumstances, in addition there were many tracks to be crossed and the length of the level crossing road was long as 35.5 m.		
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-2-1e.pdf (Synopsis) https://www.mlit.go.jp/jtsb/railway/p-pdf/RA2020-2-1-p.pdf (Explanatory materials (Japanese only))		
	Reference	Case Studies (page 99)		
3	Date of Publication	Date & Accident type	Railway operator	Line section (location)
	February 27, 2020	April 14, 2019 Train derailment	Konan Tetsudo Co., Ltd.	Between Chuo Hirosaki station and Hirokoshita station, Owani Line, Aomori Prefecture
	Summary	While the train was passing through the 160 m radius left curved track between Chuo Hirosaki station and Hirokoshita station at the velocity of about 30 km/h, the driver of the train noticed a shock and applied the emergency brake to stop the train. After the train stopped, the driver checked the situation and found that the 1st axle in the front bogie of the forefront vehicle had been derailed. There were 10 passengers and the driver onboard the train, but no one was injured. 		
	Probable Causes	It is probable that the concerned accident was caused as that the left wheel of the 1st axle in the front bogie of the forefront vehicle fell to inside gauge because the gauge widened significantly while the train was passing through the 160 m radius left curved track. As for the significantly widened gauge, it is probable that the gauge widened dynamically by the rail tilting, etc., due to the lateral force caused by the running train, because of the large static irregularity of gauge and the continuously existed poor sleepers and the poor rail fastening status in the concerned curved track. It is probable that the static irregularity of gauge had been large, related with that the maintenance standard value for the irregularity of gauge was larger than the appropriate value because the slack had not been considered. It is probable that the poor sleepers and the poor rail fastening status had been continuously existed, related with the insufficient repairing works for the sleepers and the rail fastening devices due to the inadequate records and measuring methods in the sleeper inspections. In addition, it is probable that the occurrence of the concerned accident was related with that the margin against the derailment to inside gauge had been small because the slack had been relatively large in the concerned curved track, and the insufficient implementation of the measures responding to the opinion for the purpose to prevent the train derailment accident due to the wide gauge, issued by the Japan Transport Safety Board on June 28, 2018.		
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-1-3e.pdf (Synopsis) https://www.mlit.go.jp/jtsb/railway/p-pdf/RA2020-1-3-p.pdf (Explanatory materials (Japanese only))		
4	Date of Publication	Date & Accident type	Railway operator	Line section (location)
	February 27, 2020	May 4, 2019 Level crossing accident	Hitachinaka Seaside Railway Co., Ltd.	Mitanda No.1 level crossing, the class 4 level crossing without automatic barrier machine nor road warning device, between Kaneage station and Nakane station, Minato Line, Ibaraki Prefecture

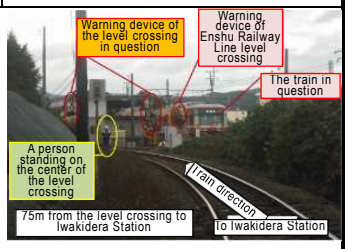
	Summary	While the train was running between Kaneage station and Nakane station at the velocity of about 60 km/h, the driver of the train noticed a subcompact truck entering Mitanda No.1 level crossing, the class 4 level crossing, then applied the emergency brake and sounded the whistle immediately, but the train collided with the subcompact truck. The driver of the subcompact truck was dead and the fellow passenger of the subcompact truck was injured in the accident. 		
	Probable Causes	It is highly probable that the subcompact truck collided with the train in the concerned accident because the subcompact truck entered Mitanda No. 1 level crossing, the class 4 level crossing without automatic barrier machine nor road warning device, in the situation that the train was approaching. It could not be determined the reason why the subcompact truck entered the level crossing in the situation that the train was approaching, because the driver of the subcompact truck was dead, although it is likely that the driver of the subcompact truck did not notice the approaching train.		
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-1-1e.pdf (Synopsis) https://www.mlit.go.jp/jtsb/railway/p-pdf/RA2020-1-1-p.pdf (Explanatory materials (Japanese only))		
5	Date of Publication	Date & Accident type	Railway operator	Line section (location)
	March 26, 2020	May 22, 2019 Level crossing accident	East Japan Railway Company	Sasaki level crossing, the class 3 level crossing equipped with road warning device but without automatic barrier machine, between Yomogita station and Gousawa station, Tsugaru Line, Aomori Prefecture
	Summary	While the train was running between Yomogita station and Gousawa station in the coasting operation at the velocity of about 73 km/h, the driver of the train noticed the abnormal sound when passed Sasaki level crossing, the class 3 level crossing, then applied the emergency brake to stop the train. After the train stopped, the driver checked around the concerned level crossing and found the passerby fallen in the track side. The concerned passerby was dead in the accident.		
	Probable Causes	It is probable that the concerned accident was caused by that the passerby collided with the concerned train because the passerby entered Sasaki level crossing, the class 3 level crossing equipped with the road warning device in the situation that the road warning device had been operating responded to the approaching train. It could not be determined the reason why the passerby entered the level crossing in the situation that the road warning device had been operating responded to the approaching train because the concerned passerby was dead, although it is likely that the passerby did not notice the approaching train. 		
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-2-2e.pdf (Synopsis) https://www.mlit.go.jp/jtsb/railway/p-pdf/RA2020-2-2-p.pdf (Explanatory materials (Japanese only))		
6	Date of Publication	Date & Accident type	Railway operator	Line section (location)
	February 27,	June 1, 2019	Akita Nairiku Jukan	Kamatari level crossing, the

	2020	Level crossing accident	Tetsudo Railway Co., Ltd.	class 4 level crossing without automatic barrier machine nor road warning device, between Ugo Nagatoro station and Yatsu station, Akita Nairiku Line, Akita Prefecture
	Summary	While the train was running between Ugo Nagatoro station and Yatsu station at the velocity of about 80 km/h, the driver of the train noticed the agricultural apparatus, i.e., a rice planting machine, halting in Kamatari level crossing, at about 150 m before Kamatari level crossing, then sounded a whistle and applied the emergency brake immediately, but the train collided with the passerby riding on the agricultural apparatus. The passerby riding on the agricultural apparatus was dead in the accident. 		
	Probable Causes	It is highly probable that the concerned accident was caused by that the train hit the passerby riding on the agricultural apparatus who had been halting in Kamatari level crossing, the class 4 level crossing without automatic barrier machine nor road warning device, in the situation that the train was approaching. It could not be determined the reason why the passerby had been halting in the level crossing in the situation that the train was approaching, because the passerby was dead in the accident.		
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-1-2e.pdf (Synopsis) https://www.mlit.go.jp/jtsb/railway/p-pdf/RA2020-1-2-p.pdf (Explanatory materials (Japanese only))		
7	Date of Publication	Date & Accident type	Railway operator	Line section (location)
	February 27, 2020	June 6, 2019 Train derailment	Transportation Bureau, City of Yokohama	Between Shimoiida station and Tateba station, Yokohama Municipal Subway No.1 Line, Kanagawa Prefecture
	Summary	After the train departed from Shimoiida station on schedule, the driver of the train received the shock as being thrusted from the floor. Therefore, the driver applied the emergency brake, and reported to the operation dispatcher that he felt the shock as being thrusted from the floor together with the extraordinary large sound then he applied the emergency brake and stopped the train. After that, obeying the instruction from the operation dispatcher, the driver implemented the measure to prevent wheel rolling of the train and let the passengers get off the train and guided to Shimoiida station in cooperation with the staffs rushed from Shimoiida station. When the driver implemented the measure to prevent wheel rolling of the concerned train, he found that the right wheel of the train ran onto the set-off device, i.e., the set-off rail, and had been derailed to left of the rail. There were 121 passengers and the driver onboard the train, and the driver was slightly injured. 		

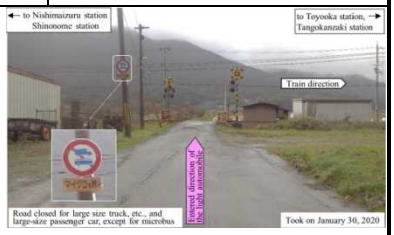
	Probable Causes	It is highly probable that the concerned accident was caused by that the plural right wheels of the concerned train ran onto the set-off rail and derailed to left, because the concerned train moved to the place where the works had finished as the set-off rail was covering right rail of the main track due to forget the put back procedure to put-back the set-off rail for the right rail of the main track, in the periodic inspection of the movable set-off device. It is highly probable that the set-off rail for right rail of the main track was forgotten to be put back, because the confirmation of the put back status of the set-off rail for right rail of the main track, which should be implemented when finished the works, was not implemented. In addition, it is likely that above situation was related with that the worker was convinced to confirm the put back status of the set-off rail by checking the turned off warning light, etc., because the concerned set-off device was composed as that the operation of the alarm lights, etc., could be stopped even in the status that the set-off rail had not been put back. Here, it is likely that the insufficient study and training to enforce the observance of the regulations, and the inadequate education etc., for the staffs who had not been charged in the periodic inspection for several years, were related to forget the confirmation procedure that should be implemented when finished the works.		
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-1-4e.pdf (Synopsis) https://www.mlit.go.jp/jtsb/railway/p-pdf/RA2020-1-4-p.pdf (Explanatory materials (Japanese only))		
8	Date of Publication	Date & Accident type	Railway operator	Line section (location)
	July 30, 2020	June 7, 2019 Level crossing accident	West Japan Railway Company	Between Yumigahama station and Wadahama station on the Sakai Line, Tottori Prefecture Tomimasu No. 5 level crossing (class 4 level crossing without automatic barrier machine nor road warning device)
	Summary	When the train was traveling at the velocity of about 79 km/h between Yumigahama station and Wadahama station, the driver of the train noticed about 50 m from Tomimasu No. 5 level crossing (class 4 level crossing) a light automobile entering the level crossing from the left side of the travel direction, so he immediately sounded the whistle and applied the emergency brake but collided with the car. This accident resulted in the death of the driver of the light automobile.		
	Probable Causes	It is certain that this accident occurred when the train was approaching Tomimasu No. 5 level crossing (class 4 level crossing without automatic barrier machine nor road warning device) and a light automobile entered the level crossing, resulting in a collision with the train. It is likely that the reason the light automobile entered the level crossing despite the approaching train due to the driver concentrating on the operation of his vehicle to notice the approaching train. Since the accident resulted in the death of the driver, the definitive cause could not be determined.		
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-3-1e.pdf (Synopsis) https://www.mlit.go.jp/jtsb/railway/p-pdf/RA2020-3-1-p.pdf (Explanatory materials (Japanese only))		
9	Date of Publication	Date & Accident type	Railway operator	Line section (location)
	March 26, 2020	June 19, 2019 Train derailment	Odakyu Electric Railway Co., Ltd.	Hon-Atsugi No.13 level crossing, the class 1 level crossing equipped with automatic barrier machine

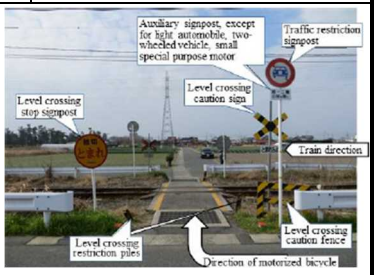


				and road warning device, between Hon-Atsugi station and Aiko-Ishida station, Odawara Line, Kanagawa Prefecture
	Summary	While the train was running between Hon-Atsugi station and Aiko-Ishida station at the velocity of about 100 km/h, the driver of the train noticed the standard sized automobile halting in Hon-Atsugi No.13 level crossing, the class 1 level crossing, then applied the emergency brake and sounded the whistle immediately, but the train collided with the automobile and all two axles in the rear bogie of the 1st vehicle derailed to left at Hon-Atsugi No.14 level crossing, the class 1 level crossing, located at 73 m beyond Hon-Atsugi No.13 level crossing. A passenger was injured in the accident.		
	Probable Causes	It is probable that the concerned train derailed at Hon-Atsugi No.14 level crossing, located at 73 m ahead of Hon-Atsugi No.13 level crossing, caused by the collision with the standard sized automobile which entered Hon-Atsugi No.13 level crossing, in the status that the road warning device was operating responded to the approaching train, and stopped in the level crossing because the crossing rod lowered before the concerned automobile went out of the level crossing, in the concerned accident. As for that the driver of the concerned automobile entered the concerned level crossing in the status as the road warning device of the concerned level crossing was operating, it is likely that it was the first time for the driver of the concerned automobile to pass the concerned level crossing by driving the concerned automobile, and his consciousness was not paid toward the on and off red flash lamps and the alarm sound of the road warning device in the concerned level crossing because his consciousness had been concentrated to drive the automobile carefully as the obstacle detection system of the concerned automobile uttered the warning sound when moved the concerned automobile into the concerned level crossing. In addition, as for that the concerned automobile stopped in the concerned level crossing, it is certain that the driver of the concerned automobile stopped the concerned automobile in the concerned level crossing because the driver of the concerned automobile did not know that the automobile can get out of the concerned level crossing as the crossing rod would be raised by pushing the cross rod by the automobile.		
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-2-3e.pdf (Synopsis) https://www.mlit.go.jp/jtsb/railway/p-pdf/RA2020-2-3-p.pdf (Explanatory materials (Japanese only))		
10	Date of Publication	Date & Accident type	Railway operator	Line section (location)
	July 30, 2020	June 28, 2019 Train derailment	East Japan Railway Company	Between Shibukawa Station and Shikishima Station on the Joetsu Line, Gunma Prefecture
	Summary	The train departed Shibukawa Station on time. The train driver immediately applied the emergency brake because he found a fallen tree on the track in front of him while driving between Shibukawa Station and Shikishima Station at a speed of about 76 km / h, but it collided with dirt and sand including the fallen tree that had flowed into the track and stopped. The first axis of the front bogie of the first car derailed to the left. About 80 passengers and two crew members (driver and conductor) were on board the train, and one passenger was injured.		
	Probable Causes	It is highly probable that the accident caused the train to derail due to the collision of the train with dirt and sand including fallen trees that flowed into the track due to the collapse		

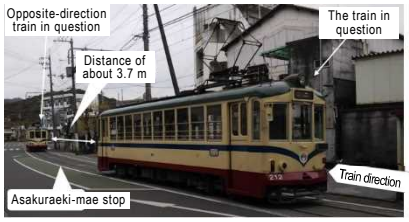
		of the slope along the railway. Regarding the collapse of the slope, fallen leaves and the like had accumulated in the waterway laid above the collapsed slope, which hindered the water flow function of the waterway, and the water overflowing from this area was discharged to the slope. It is likely that this led to the fact that the surface soil of the slope became unstable due to the increased water content of the soil.		
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-3-2e.pdf https://www.mlit.go.jp/jtsb/railway/p-pdf/RA2020-3-2-p.pdf (Explanatory materials (Japanese only))		
	Reference	Case Studies (page 101)		
11	Date of Publication	Date & Accident type	Railway operator	Line section (location)
	October 29, 2020	December 2, 2019 Level crossing accident	Tenryu Hamanako Railroad Co., Ltd.	Tounokisaka level crossing, the class 3 level crossing equipped with road warning device but without automatic barrier machine, in the premises of Nishikajima station, Tenryu Hamanako Line, Shizuoka Prefecture.
	Summary	While the train was running in the premises of Nishikajima station at the velocity of about 55 km/h, the driver of the train noticed the passerby entering Tounokisaka level crossing, the class 3 level crossing, then applied the emergency brake and sounded the whistle immediately, but the train collided with the passerby. The concerned passerby was dead in the accident.		
	Probable Causes	It is highly probable that the concerned accident was caused as that the passerby entered Tounokisaka level crossing, the class 3 level crossing equipped with road warning device but without automatic barrier machine, in the situation that the road warning device had been operating responded to the approaching train, and collided with the concerned train. As for the reason why the concerned passerby entered the concerned level crossing in the situation that the road warning device had been operating responded to the approaching train, it is likely that the concerned passerby misunderstood the situation because the level crossing protection device of the class 1 level crossing of the other railway operator, located ahead of the concerned level crossing, started its operation earlier. In addition, it is likely that the concerned passerby did not notice the operation of the road warning device in the concerned level crossing related with the external factors such as the weather, the structural factors of the concerned level crossing, and physical factors of the concerned passerby, but it could not be determined, because the concerned passerby was dead.		
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-5-2e.pdf (Synopsis) https://www.mlit.go.jp/jtsb/railway/p-pdf/RA2020-5-2-p.pdf (Explanatory materials (Japanese only))		
12	Date of Publication	Date & Accident type	Railway operator	Line section (location)
	November 26, 2020	December 24, 2019 Train derailment	Aizu Railway Co. Ltd.	Between Tonohetsuri station and Yagoshima station, Aizu Line, Fukushima Prefecture
	Summary	While the train was passing the 200 m radius right curved track between Yagoshima station and Tonohetsuri station at the velocity of about 44 km/h, the driver of the train felt the impact, then operated the		

		emergency brake to stop the train. When inspected the vehicle after stopped, it was found that the 1st axle in the front bogie of the vehicle had been derailed to left. There were three passengers and two train crews boarded on the train, but there was no injured person.
	Probable Causes	It is probable that the concerned accident was caused as that right wheel of the 1st axle in the front bogie fell to inside gauge because the gauge widened significantly while the train was passing through the 200 m radius right curve. It is probable that the gauge widened significantly because the rail tilting and the lateral displacement of rails occurred due to the lateral force acted while the train was running caused by the continuously existed poor sleepers and the floating spikes in the rail fastening devices, in addition to the large track irregularity of gauge in the concerned curved track. It is likely that the poor sleepers and the floating spikes of the rail fastening devices had been existed continuously, because the track maintenance responding to the status had not been implemented, as the status of the sleepers and the rail fastening devices, i.e., the level and the continuity of the poor status, considering the risks against the wide gauge, were not comprehended well in the sleeper inspection, etc. In addition, it is likely that the occurrence of the concerned accident was related by that the works to replace the wooden sleepers by the PC sleepers had not been completed before the occurrence of the concerned accident because the steep curved section where is dangerous for the wide gauge was not considered as higher priority, although there was the plan to replace the wooden sleepers by the PC sleepers.
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-6-1e.pdf (Synopsis) https://www.mlit.go.jp/jtsb/railway/p-pdf/RA2020-6-1-p.pdf (Explanatory materials (Japanese only))

13	Date of Publication	Date & Accident type	Railway operator	Line section (location)
	October 29, 2020	January 29, 2020 Level crossing accident	Willer Trains Inc.	Kamiyukou level crossing, the class 3 level crossing equipped with road warning device but without automatic barrier machine, between Shinonome station and Tangokanzaki station, Miyazu Line, Kyoto Prefecture
	Summary	While the train was operating in the coasting operation between Shinonome station and Tangokanzaki station at the velocity of about 55 km/h, the driver of the train noticed a light automobile entering Kamiyukou level crossing, the class 3 level crossing, from right, at before the concerned level crossing, then applied the emergency brake and sounded the whistle, but the train collided with the light automobile and stopped. After the train stopped, the driver reported to the train dispatcher on the accident, checked the status of the driver of the light automobile, and asked the arrangement of the ambulance. The driver of the light automobile was dead and two passengers of the concerned train were slightly injured in the accident.		
	Probable Causes	It is probable that the concerned accident was caused as that the light automobile entered Kamiyukou level crossing, the class 3 level crossing equipped with road warning device, from right in the situation that the road warning device was operating responded to the approaching train, and collided with the train. It could not be determined the reason why the light automobile entered the concerned level crossing in the situation that road warning device was operating responded to the approaching train, because the driver of the light automobile was dead, although it is likely that the driver of the light automobile did not notice the approaching train.		
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-5-3e.pdf (Synopsis) https://www.mlit.go.jp/jtsb/railway/p-pdf/RA2020-5-3-p.pdf (Explanatory materials		

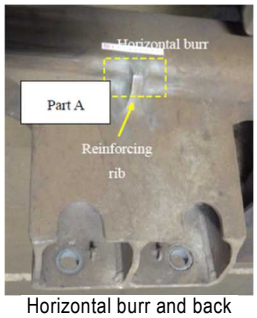
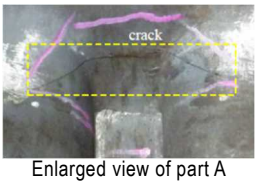
		(Japanese only))		
14	Date of Publication	Date & Accident type	Railway operator	Line section (location)
	October 1, 2020	January 31, 2020 Level crossing accident	West Japan Railway Company	Niiya No.3 level crossing, the class 4 level crossing without automatic barrier machine nor road warning device, between Takamatsucho station and Nakahama station, Sakai Line, Tottori Prefecture
	Summary	While the train was running between Takamatsucho station and Nakahama station at the velocity of about 57 km/h, the driver of the train noticed a motorized bicycle entering Niiya No.3 level crossing, the class 4 level crossing, from left, then applied the emergency brake immediately, but the train collided with the motorized bicycle. The driver of the motorized bicycle was dead in the accident. 		
	Probable Causes	It is certain that the concerned accident was caused as that the train collided with the motorized bicycle because the motorized vehicle entered Niiya No.3 level crossing, the class 4 level crossing without automatic barrier machine nor road warning device, in the situation that the train was approaching. It could not be determined the details why the motorized bicycle entered the concerned level crossing in the situation that the train was approaching, because the driver of the motorized bicycle was dead, although it is likely that the driver of the motorized bicycle entered the concerned level crossing without noticed the approaching train.		
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-4-1e.pdf (Synopsis) https://www.mlit.go.jp/jtsb/railway/p-pdf/RA2020-4-1-p.pdf (Explanatory materials (Japanese only))		

Railway serious incident investigation reports published in 2020

1	Date of Publication	Date and serious incident type	Railway operator	Line section (location)
	July 30, 2020	March 25, 2019 Incorrect management of safety block	Tosaden Traffic Co., Ltd.	Between Asakura stop and Yashiro stop, Ino Line, Kochi Prefecture
	Summary	The vehicle to depart from Asakura stop, located in the single track section, without carrying the tablet in the situation that vehicles should be operated in the tablet instrument block system instead of the pilot system that had been enforced temporary between Kagamigawabashi stop and Asakura stop.  After that, while the concerned driver moved the vehicle to about 6 m before Asakuraeki-mae stop, he found the facing outbound 332 vehicle, composed of one vehicle started from Ino stop bound for Monjudori stop, in ahead, then he stopped the 333 vehicle immediately. On the other hand, the driver of the 332 vehicle, while running in Asakura intersection, located between Asakurajinja-mae stop and Asakuraeki-mae stop, noticed the 333 vehicle halting in ahead, then stopped the 332 vehicle at about 5 m before Asakuraeki-mae stop after passed the concerned intersection. There were eight passengers and the driver boarded on the 333 vehicle, and five passengers and the driver boarded on the 332 vehicle, but there was no injured person.		
	Probable Causes	It is certain that the concerned serious incident occurred because the driver of the 333 vehicle started the 333 vehicle from Asakura stop, in the single track section between Asakura stop and		

		Yashiro stop where the tablet instrument block system was enforcing, without carrying the tablet by himself and entered the safety section where the 332 vehicle was existed. It is probable that the driver started the 333 vehicle from Asakura stop without carrying the tablet by himself, related to that the mutual confirmation on the noticed contents, such as to let the driver of the 333 vehicle recite the notified contents which is the fundamental procedure, was not implemented after the stationmaster of Kagamigawabashi stop notified the safety block system to the driver of the 333 vehicle, in addition to that the driver could not judge and apply, responding to the situation, the contents that the drivers were educated on the pilot system and the tablet instrument block system. As for that the driver could not judge and apply the educated contents on the pilot system and the tablet instrument block system responding to the situation and that the mutual confirmation on the noticed contents by the stationmaster of Kagamigawabashi stop was not implemented, it is likely that the system and the contents of the education for the drivers and the stationmasters on the handling of train operation in the concerned company had been insufficient.
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RI2020-1-1e.pdf (Synopsis) https://www.mlit.go.jp/jtsb/railway/p-pdf/RI2020-1-1-p.pdf (Explanatory materials (Japanese only))
	Reference	Case Studies (page 100)

2	Date of Publication	Date and serious incident type	Railway operator	Line section (location)
	November 26, 2020	August 24, 2019 Dangerous trouble in vehicle	Nankai Electric Railway Co., Ltd.	Suminoe inspection ward, Osaka Prefecture

Summary	Train Rapit β 41 left the Nankai Main Line Namba Station on time. While traveling between Sakai Station and Kishiwada Station, the conductor noticed the sound of rub against the connecting part of the 2nd and 3rd cars (hereinafter, vehicles etc. are counted from the outbound direction, and the left and right are based on the traveling direction of the outbound train). After that, while the train bounded for Namba Station (the train number went up and became No. 250 train) after arriving at Kansai Airport Station was running, the same conductor confirmed the same sound from the connection between the 2nd and 3rd cars between Kishiwada Station and Sakai Station. For this reason, the conductor reported the occurrence of abnormal noise to the transport commander via train radio. The commander sent two car inspection staff from Izumisano Station to the train bound for Kansai Airport Station (the train number went down and became No. 249 train) after arriving at Namba Station. They checked the condition of the vehicle, but there was no abnormality. Therefore, they instructed to check the vehicle after the operation on the day. After the operation, when the car inspection staff checked the vehicle again at the Suminoe inspection area, a crack of about 140 mm was found on the back of the 1st axis traction motor seat of the 2nd bogie of the 2nd car.  Horizontal burr and back of traction motor seat  Enlarged view of part A
Probable Causes	It is highly probable that this serious incident was caused by the cracks that occurred in the weld between the side of the bogie frame of the vehicle and the reinforcing ribs on the back of the traction motor seat, which developed due to fatigue and reached the outer surface. Regarding the fact that a crack occurred in the welded part between the side of the bogie and the reinforcing rib on the back of the traction motor seat, it is highly probable that it occurred because the groove processing was not performed when the manufacturer attached the reinforcing rib to the back of the traction motor seat, which resulted in the crack. Regarding the fact that the groove processing was not carried out, there is no description about the groove in the work plan issued by the bogie technical management office of the bogie manufacturer to the welding workplace where the groove processing is performed, and there is no clear work instruction. Therefore, it is probable that it was related to the fact that the workers in the welding workplace did not know that the groove had to be processed. In addition, the part where the crack occurred was not designated as a priority inspection part after reinforcement, and the magnetic particle inspection was not conducted, so even if the

		crack had already occurred at the time of the regular inspection, it is likely that this could not be found.
	Report	https://www.mlit.go.jp/jtsb/eng-rail_report/English/RI2020-2-1e.pdf https://www.mlit.go.jp/jtsb/railway/p-pdf/RI2020-2-1-p.pdf (Explanatory materials (Japanese only))
	Reference	Feature 4 (page 9), Case Studies (page 102)

7 Actions taken in response to recommendations in 2020 (railway accidents and serious incidents)

A summary of the actions taken in response to recommendations and opinions in 2020 is as follows.

(1) Opinions on the improvement of safety of the freight train operation

(Opinions on December 17, 2015)

The JTSB published their accident investigation reports and provided their opinions to the Minister of Land, Infrastructure, Transport and Tourism on December 17, 2015, regarding three cargo train derailments that had occurred on the Esashi Line in April to June, 2012 and received the ministry's notification regarding the following measures taken based on the JTSB's opinions:

○ Summary of the Accidents

The first of the three accidents (Esashi I)

The 3061 train, high speed freight train composed of 20 cars, starting from Hiroshima Freight Terminal station bound for Sapporo Freight Terminal station, departed from Aomori signal station at 03:52 on schedule, and arrived at Goryokaku station at 06:13, April 26, 2012.

The transport staff waiting for the train at Goryokaku station found smoke rose from the freight wagon, 18th car of the arrived train, and notified to the station office. The rushed station staffs fought the fire of the freight wagon that the smoke rose from around the bogie.

On the other hand, the switching malfunction of the turnout occurred in the premises of Kamaya station, Esashi Line, at 05:09 of the same day. The track maintenance staffs of Hokkaido Railway Company checked track condition in the premises of Kamaya station, and found that the turnout was damaged and there were traces of derailment on the sleepers around it.

The freight wagon emitting smoke at Goryokaku station was not derailed but judged as it had derailed once, by the results of the inspection about status of the wheels of the freight wagon.

A train driver was onboard the train, but there was no injury.

The second of the three accidents (Esashi II)

On September 11, 2012, the inbound High Speed Freight 2050 train, composed of 21 vehicles, starting from Goryokaku station bound for Miyagino station of Japan Freight Railway Company, departed from Goryokaku station at 18:58, 62 minutes behind the scheduled time, i.e., 17:56. As the

train stopped by an emergency brake acted automatically at around the up line starting signal in Izumisawa station, the train driver got off the locomotive and check the situation of the train according to the instruction from the train dispatcher, and found that the coupler of the brake pipe hose between the 9th and the 10th vehicle, freight wagons, was decoupled and all two axles in the rear bogie of the 9th vehicle derailed to left.

There were the driver in charge and the other driver scheduled to operate the other train from Aomori signal station to Goryokaku station, but there was no casualty.

The third of the three accidents (Esashi III)

On June 22, 2014, the High Speed Freight 7066 train, composed of 21 vehicles, starting from Sapporo Freight Terminal station bound for Utsunomiya Freight Terminal station of Japan Freight Railway Company, departed from Goryokaku station at 03:38, on schedule.

The train, while running at about 69 km/h in the premises of Satsukari station, the brake pipe pressure decreased suddenly and, at the same time, an emergency brake acted automatically, and stopped.

After the train stopped, the driver checked the train and found that the all two axles in the rear bogie of the 20th vehicle, freight wagon, derailed to right. Furthermore, the 21th vehicle, freight wagon, decoupled from the 20th vehicle and stopped at about 17 m behind the 20th vehicle.

There was the train driver onboard the train, but he was not injured.

○ Probable Causes

The first of the three accidents (Esashi I)

It is probable that the outside wheel climbed up to the top of outside rail, i.e., it was the flange climb derailment, by the increased derailment coefficient for the outside wheel, because the lateral force acting on the outside wheel had increased by the increased wheel load of the inside wheel, and the wheel load of the outside wheel had decreased, due to the large unbalance in the static wheel loads between right and left wheels of the freight wagon loaded containers, compared to the wagon with balanced static wheel load, while the train passed in the curved track of 300m radius, in this accident.

It is highly probable that the uneven loading in the containers caused the large unbalance in the wheel loads in the derailed freight wagon.

In addition, it is likely that the combination of track alignment and cross-level, which should be managed in the section where freight trains are operated, had relatively large at the point climbing up by the wheel started, promoted the decrease of wheel load of the outside wheel.

The second of the three accidents (Esashi II)

It is probable that the accident occurred as the first axle in the rear bogie of the Ko-Ki 106 type freight wagon climbed up the outer rail and derailed, because the wheel load of the outer rail side wheel reduced at the accident site while the train passed the 300 m radius right curved track.

It is probable that the wheel load acting on the outer rail side wheel reduced by a large rolling

vibration of the freight wagon running around the accident site.

Although statuses of the train operation, the maintenance of the vehicles and the railway track were implemented in accordance with the regulations of Japan Freight Railway Company and Hokkaido Railway Company, established based on the ministerial ordinance, it is probable that the freight wagon vibrated in rolling mode significantly by the combination of the following factors.

[1] The specification of the suspension device of the Ko-Ki 106 type freight wagon was that the rolling motion of the vehicle body would not converged in a short time, as the damping was small compared to the Ko-Ki 104 type freight wagon, when the loaded weight is relatively light.

[2] The load was relatively light and the center of gravity of the freight wagon was in a high position.

[3] The combination of alignment and cross-level at around the accident site, which were relatively large as close to their maintenance standard values, and were distributed along the track including the wave length components liable to introduced rolling motion of the body against the balanced speed in the curved track, had possibilities to promote the generation of rolling motion of the body.

The third of the three accidents (Esashi III)

It is likely that the accident occurred as the wheel in the outer rail side of the Ko-Ki 107 type freight wagon, climbed up the rail and derailed to right because the derailment coefficient increased due to the decrease of the wheel load and increase of the lateral force for the outer rail side wheel, as the body of the freight wagon was excited to vibrate in rolling mode significantly while the train was running in the 350 m radius left curved track.

It is probable that the significant roll vibration was excited to the vehicle body due to the existence of the large combination of alignment and cross-level which should be maintained, in the track before the point where the wheel started climbing up the rail.

It is likely that the existence of the large alignment to shorten the radius of curvature effected to increase the lateral force in the outer rail side wheels.

It is likely that the large combination of alignment and cross-level which should be maintained had existed because the on-site track maintenance section could not understand the existence of the plural kinds of the combination of alignment and cross-level measured by the high speed track inspection car, and these situation was caused in relation with the improper method to decide the necessity of the maintenance work by communication of the inspected results to the on-site track maintenance section, and a lack of the knowledge about the combination of alignment and cross-level in the on-site track maintenance section.

Although it could not be determined whether the unbalanced loading actually related to the occurrence of derailment, it is likely that the status of loading just before the accident became to a factor to promote derailment.

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

The three derailment accidents by the freight train, which occurred from April, 2012, to June, 2014

at Esashi Line, have the common situation such as that the outer rail side wheels of the freight wagon in the freight train running in relatively sharp curve near the limited speed, derailed by flange climbing.

As the probable causes for each accident were described in each investigation report, it was probable that these accidents were caused by complex combination of the factors, such as vehicle, track, loading of the freight etc., although their effected levels were different.

In addition, the Japan Transport Safety Board analyzed the issues to be dealt with cooperation by the parties concerned towards the improvement of the safety and the prevention of the derailment accidents of the freight train due to the complex combination of the factors such as vehicle, track, freight loading, etc., based on the knowledge obtained from the previous investigations, integrating the investigated results of these three derailment accidents of the freight train occurred in Esashi Line. (Refer to the attachment.)

The railway system is the integration of the various technology area, such as civil engineering, vehicle technology, electric engineering, operation, etc. Hence, the interested parties of the freight railway transportation, such as the passenger railway operators charged with track maintenance, the freight railway operators charged with vehicle management and operation etc., the freight transporters and the freight senders charged with loading freight and the railway vehicle makers manufacturing the freight wagons, are related with each other.

So that, in view of the results of these accident investigations, the Japan Transport Safety Board expresses its opinion as follows to the Minister of Land, Infrastructures, Transport and Tourism, pursuant to Article 28 of the Act for Establishment of the Japan Transport Safety Board in order to promote the parties concerned to consider the issues analyzed by the Board to improve safety for the freight train operation.

Here, when some measures were implemented according to the following opinions, please notify the Board.

1. Let the context of the accident investigation reports about the three derailment accidents of freight train occurred in Esashi Line and the attached Opinion, well known widely, to the railway operators provided tracks to freight train operation, freight railway operators, freight transporters using freight trains, railway vehicle manufacturers, etc.
2. To supervise and guide the railway operators based on the laws and ordinances, to implement smoothly the required measures for prevention of recurrence described in each accident investigation report.
3. To promote the persons concerned in railway operators, railway vehicle manufacturers, freight transporters using freight trains, freight senders, research and development organization, etc., to investigate in cooperated with each other, about the issues related with vehicles such as design of freight wagon, issues related with track such as track category and track technology in each section, issues related with freight such as loading methods, etc., towards the improvement of safety for the freight train operation.

(Attachment)

Improvement of safety of the freight train operation

Summary

Three derailment accidents of the freight train occurred in Esashi Line, from April, 2012, to June, 2014. It is probable that these accidents were caused by complex combination of the factors, such as vehicle, track, loaded freight, etc.

To prevent recurrence of the same sort of the accidents and to improve running safety of freight train further, it is required for the parties concerned in railway operators providing their tracks for freight train operation, freight train operators, freight transporters using freight trains, freight senders, railway vehicle manufacturers, research and development organizations, etc., in cooperated with each other, to grapple with issues related with vehicles such as design methods of suspension device for freight wagons, issues related with tracks such as maintenance methods for track irregularity, and issues related with loading freights such as the loading methods considering prevention of unbalanced loading and height of the gravity center of freights etc., based on the analyzed results during investigation of the derailment accidents in Esashi Line, and obtain appropriate margins against derailment as a whole. The Ministry of Land, Infrastructure, Transport and Tourism is expected to implement the proper management to promote these activities steadily.

1. Preface

A series of derailment accidents of freight trains composed of container-carrying wagons, occurred in Esashi Line, denoting in the following text as "the Esashi Line derailment accidents" which is a set of three accidents, i.e., "Esashi I" accident occurred on April 26, 2012[1], "Esashi II" accident occurred on September 11, 2012[2], and "Esashi III" accident occurred on June 22, 2014[3], have the common situation that the outer rail side wheels of the freight wagon in the freight train running in relatively sharp curve at near the limited speed, derailed by flange climbing, denoting as “Flange climb derailment accidents of freight wagon,” in the following text. As the probable causes of these accidents are described in each investigation report, it is probable that these accidents were caused by complex combination of the factors, such as vehicle, track, loading freight etc.

The results of analyses about "the Esashi Line derailment accidents" and the similar accidents occurred in the past, and the issues towards measures to prevent recurrence of the accidents required to examine in the future, are shown in the following text.

(Refer to the Attached table "Summary of the Esashi Line derailment accidents")

2. Flange climb derailment accidents of freight wagon and already implemented measures to prevent derailment

Figure 1 shows the data about flange climb derailment accidents and the similar accidents occurred

after FY1952[4]-[6]. The flange climb derailment accidents of freight wagons at main tracks had occurred frequently until around 1980, and probable causes of these accidents were determined as combination of various factors while the vehicles and the tracks were maintained within the criterion values for control, and so called as "multiple-factor derailments". The Tsurumi accident, occurred in Tokaido Main Line in November, 1963, was the multiple collision accident originated by derailment of freight wagon, and became to the disastrous accident killing 161 people. To respond this accident, Japan national railway, at that time, established the investigate committee to conduct a variety of examination including on-track tests, and implemented the measures to prevent multi-factor derailments from the viewpoints of both vehicle and track[7], i.e., softened spring constants of the secondary suspension of the TR-41 series bogie, remodeled to use with oil dampers, added the combination of alignment and cross-level to the items in the management of track irregularity, etc. As the results of implementation of these measures, there was no multiple-factor derailment accident after FY1982, however, in recent years, the same sort of derailment accidents came to happen again.

As shown in Table 1, seven accidents of the same sort of derailment occurred from 1998 to the present, and the recent three accidents occurred at Esashi Line. Here, Esashi Line became to the track section where freight trains run very frequently after connected with Kaikyo Line in 1988, has the features that there are many relatively sharp curves. Generally, margins against derailment is reduced in the curved section of small radius with large track irregularity, then it is somewhat likely that there were the trends liable to reduce margins against derailment in Esashi Line, compared with the other section. Here, although further precise analyses are needed, it is required to investigate on the same sort of derailment in the track sections where freight trains are operated, as it is probable that these situations are not peculiar to Esashi Line only

The types of the derailed freight wagons were Ko-Ki 106, Ko-Ki 107 and Ko-Ki 200*. All of them are relatively new type freight wagons manufactured after 1997, i.e., the first Ko-Ki 106 type freight wagon was manufactured in 1997, the first Ko-Ki 200 type wagon was manufactured in 2000, and the first Ko-Ki 107 type wagon was manufactured in 2006.

* "Ko-Ki": "Ko" means freight wagon for containers, "Ki" means loading capacity over 25 tons

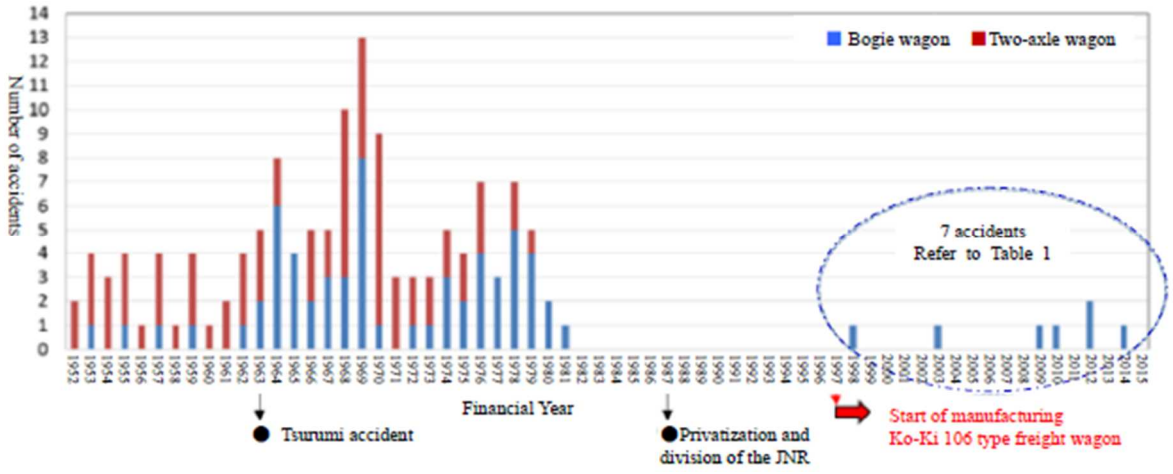


Figure 1 Changes of flange climb derailment and similar derailment accidents of freight wagon

Table 1 Recent flange climb derailment accidents of freight wagon

No	Date of accident	Line name	Accident site	Wagon type	Velocity	Radius of curve	Operators * (vehicles - track)	Remarks
1	Aug. 26, 1998	San-yo Line	Between Seno station and Hachihommatsu station	Ko-Ki 106	55 km/h	300 m	JR Freight - JR West	
2	May 22, 2003	Tokaido Line	In the premises of Tokyo Freight Terminal station	Ko-Ki 106	42 km/h	About 268 m	JR Freight -JR Freight	# Simple turnout No.12
3	Dec. 19, 2009	Nippo Line	Between Sotaro station and Ichitana station	Ko-Ki 200	60 km/h	300 m	JR Freight - JR Kyushu	
4	Mar. 10, 2011	Narita Line	Between Kuzumi Station and Namegawa station.	Ko-Ki 200	57 km/h	406 m	JR Freight - JR East	
5	Apr. 26, 2012	Esashi Line	Between Izumisawa station and Kamaya station	Ko-Ki 107	57 km/h	300 m	JR Freight - JR Hokkaido	"Esashi I"
6	Sept. 11, 2012	Esashi Line	Between Kamaya station and Izumisawa station	Ko-Ki 106	59 km/h	300 m	JR Freight - JR Hokkaido	"Esashi II"
7	Jun. 22, 2014	Esashi Line	Between Izumisawa station and Satsukari station	Ko-Ki 107	63 km/h	350 m	JR Freight - JR Hokkaido	"Esashi III"

* JR Freight : Japan Freight Railway Company, JR West : West Japan Railway Company, JR East : East Japan Railway Company, JR Kyushu : Kyushu Railway Company, JR Hokkaido : Hokkaido Railway Company.

3. Toward prevention of recurrence.

It is probable that the Esashi Line derailment accidents were caused by complex combination of the factors, such as vehicle, track, loading freight etc., as their degrees of influence differ in each accident. In this chapter, analyses are implemented about issues to be investigated, related with vehicle, track, and loading freight, that the party concerned should grapple in cooperated with each other, to improve margins against derailment as a whole, to prevent recurrence of the same sort of the accidents and further improvement of running safety of the freight train, based on the analyzed results about vehicles, track, and loading freight in the Esashi Line derailment accidents.

[Refer to the Attached diagram "Factors of the Esashi Line derailment accidents and their degrees of influence, etc."]

3.1 Issues related with vehicles

According to investigation results about the accidents "Esashi II" and "Esashi III", it was found that Ko-Ki 106 type freight wagons and wagons manufactured after that still used coil spring type secondary suspension with enlarged spring constant as to load heavy international ISO standard type containers, etc., under restriction of height of the couplers, responding the needs such as higher efficiency, faster speed, and internationalization in the freight transport market, while the bolster dampers were designed to select conventional devices aiming to use common parts.

When the freight wagons of these types run on the track where there is combination of alignment and cross-level having the property to excite rolling motion of vehicle bodies largely, there are the cases to decrease running safety by the significantly decreased dynamic wheel loads due to enlarged rolling notion of the vehicle body, compared with the freight wagons equipped with smaller spring constant type secondary suspensions [8]-[12]. It was found from the investigation results of the

accident “Esashi II”, that there exists “the disadvantageous situation against running safety”, in which the damping characteristics of the bolster damper could not demonstrate its ability well according to situation of loaded freight, and these trends become remarkable especially in Ko -Ki 106 type freight wagons and wagons manufactured after that. Here, in the “Esashi II” accident, it is probable that the freight wagon derailed by the combination of relatively large combination of alignment and cross-level in relatively sharp curve, relatively light loaded freight and their gravity center was in higher position, in addition to above mentioned factors.

Then, as for the vehicle, the parties concerned should investigate to use the suspension device with proper damping characteristics and to equip suspension device which can obtain proper damping characteristics regardless of quantity of loaded freight, referring to methods of freight loading and situation of the track section where freight trains are operated, etc., to realize safe operation of the concerned freight wagons with proper margins against running safety.

3.2 Issues related with Tracks

It is probable that the decreased wheel load promoted by the large combination of alignment and cross-level will effect relatively large as the factors related to tracks in the probable causes of the flange climb derailment accidents of freight wagons.

The management system for combination of alignment and cross-level was investigated and implemented for bogie wagons using TR41 series bogie or two-axle wagons of Wa-La-1 type, etc., as one of the measures preventing recurrence of multiple-factor derailment described in the above Chapter 2, and was introduced in around 1980, in almost the same contents with the present system. The present management system can be estimated as effective at a certain level, because the multiple-factor derailment accidents were extremely reduced after the present management system was introduced, and the similar accidents did not happen until recent years, provided that the freight wagons, which were the target of improvement at that time, became not in use at present.

On the other hand, a part of flange climb derailment accidents of freight wagons, occurred in recent years, were caused by the combination of alignment and cross-level which were not satisfied the values of the maintenance standard. It is suggested that there is the possibility to reduce margins for safety by the management methods covered by the present management system of combination of alignment and cross-level, provided that there are the other factors than the track, for example, unbalance of loaded freight in the accident "Esashi I" and lack of damping in suspension device in the accident "Esashi II".

Then, in the issues related with track, in addition to implement proper management of combination of alignment and cross-level based on the present management system, including general measures such as investigation about the range to install guard angle, the parties concerned in railway operators and research institutes are required to investigate the management system of track irregularity in the section where freight trains are operated, considering the characteristics of freight wagons based on characteristics of track section and loading methods of freight loads.

3.3 Issues related with loading freight

In the issues related with loading freight, there are issues such as unbalanced loading of freight and height of the gravity center of loaded freight.

As for the unbalanced loading of freight, the following measures are described in the investigation report about “Esashi I” accident, these are, Japan Freight Railway Company asked the transport operators using railway to let noticed their employees well the context of the contract on freight transport such as prevention of unbalanced loading and confirmation of loaded status, and Japan Freight Railway Company will confirm the status of loaded freight in corporation with the transport operators using railway, from viewpoints of preventing unbalanced loading in the containers to avoid large unbalance of static wheel weight in freight wagons. In response to these activities, at present, the Ministry of Land, Infrastructure, Transport and Tourism and the operators concerned established "Investigation meeting on measures against unbalanced loading in railway freight transport", and the measures at a certain level were implemented based on the intermediate summaries of the meeting.

As for the height of the gravity center of loaded freight, it was found by the investigation results on the accident "Esashi II" that there is the case that rolling motion of the vehicle cannot be damped well by poor damping characteristics when the weight of loaded freight is relatively light, due to the switching condition of damping characteristics of the bolster damper of freight wagons, and the margins against derailment will be reduced when the gravity center of vehicle body is high even when weight of loaded freight is relatively light, in these situation.

Then, as for the issues related with loading freight, the "Investigation Committee on measures against unbalanced loading in railway freight transport" is expected to investigate successively about introduction of the system that can detect easily the unbalance of wheel weight of the wagon loaded containers, in addition to the measures to prevent unbalanced loading. Furthermore, the meeting is also required to investigate the loading methods considering weight and the height of the gravity center of loaded freight, adding the characteristics of the freight wagon in operation.

4. Conclusion

Railway is the integrated system of various technology areas, such as civil engineering, vehicle technology, electric engineering, operation, etc., then it is very important to obtain safe operation that every technology divisions corporate with each other. In the railway freight transportation, the passenger railway operators charged with track maintenance etc., the freight railway operators charged with vehicle management and operation etc., the freight transporters and the freight senders charged with loading freight, and the railway vehicle makers manufacturing the freight wagons, are related.

After this, the research institutes in addition to these parties concerned with freight transport are requested to grapple with each other towards the further improvement of running safety of freight trains, obtaining proper margins against derailment as the whole, considering possibilities of realization based on the status of characteristics and operation of freight wagons, and the status of track maintenance etc., in the investigation of various issues including the issues analyzed in the

previous Chapter 3. Ministry of Land, Infrastructure, Transport and Tourism is expected to take proper responses to promote steady implementation of these activities.

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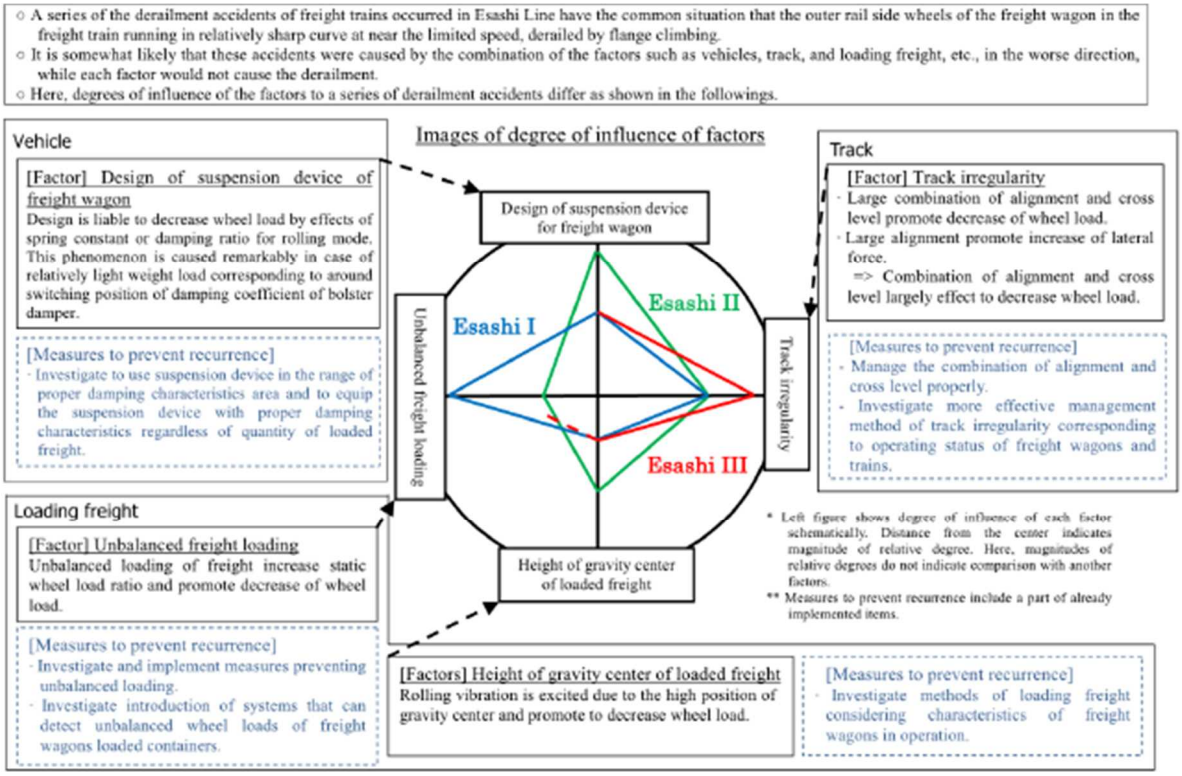
Attached table: Summary of the Esashi Line derailment accidents

	Esashi-I (Occurred on April 26, 2012)	Esashi-II (Occurred on September 11, 2012)	Esashi-III (Occurred on June 22, 2014)
Track	Left curve of 300m radius with 100mm cant.	Right curve of 300m radius with 100mm cant.	Left curve of 350m radius with 90mm cant.
	Enhancement of track strength and minor improvement of track shapes were implemented in the construction works improving Esashi Line from class 4 (Hei) to class 2, along with connection to Kaikyo Line.		
Wagon type	Ko-Ki 107 type	Ko-Ki 106type	Ko-Ki 107 type
Derailed vehicle	18th vehicle of 20 vehicle train set.	9th vehicle of 21 vehicle train set.	20th vehicle of 21 vehicle train set.
First derailed axle	Front axle in the rear bogie (3rd axle)	Front axle in the rear bogie (3rd axle)	Front axle in the rear bogie (3rd axle)
Velocity	About 57 km/h	About 59 km/h	About 63 km/h
Probable causes	It is probable that the outside rail side wheel climbed up to the top of the rail and derailed, due to the increased derailment coefficient for the outside wheel, because the lateral force acting on the outside wheel had increased by the increased wheel load of the inside wheel, and the wheel load of the outside wheel had decreased, due to the large unbalance in the static wheel loads between right and left wheels of the freight wagon loaded containers, compared to the wagon with balanced static wheel load, while the train passed in the curved track of 300m radius, in this accident. It is highly probable that the unbalanced loading in the containers caused the large unbalance in the static wheel loads in the derailed freight wagon. In addition, it is somewhat likely that the combination of alignment and cross-level, which should be managed in the section where freight trains are operated, had relatively large at the point before the wheel started to climb up, promoted the decrease of wheel load of the outside wheel.	It is probable that the accident occurred because wheel loads of outer rail side wheel in the first axle in the rear bogie of the Ko-Ki 106 type freight wagon was decreased at around the accident site, while the train passed the 300 m radius right curved track, and the wheel climbed up the outer rail and derailed. It is probable that the wheel load acting on the outer rail side wheel reduced by a large rolling vibration of the freight wagon running around the accident site. Although statuses of the train operation, the maintenance of the vehicles and the railway track were implemented in accordance with the regulations of Japan Freight Railway Company and Hokkaido Railway Company, established based on the ministerial ordinance, it is probable that the freight wagon vibrated in rolling mode significantly by the combination of the following factors. [1] The specification of the suspension device of the Ko-Ki 106 type freight wagon was that the rolling motion of the vehicle body would not converged in a short time, as the damping was small compared to the Ko-Ki 104 type freight wagon, when the loaded weight is relatively light. [2] The load was relatively light and the center of gravity of the freight wagon was in a high position. [3] The combination of alignment and cross-level at around the accident site, which were relatively large as close to their maintenance standard values, and were distributed along the track including the wave length components liable to introduced rolling motion of the body against the train velocity, had possibilities to promote the generation of rolling motion of the body.	It is somewhat likely that the accident occurred as the outer rail side, right, wheel of the Ko-Ki 107 type freight wagon, climbed up the rail and derailed to right because the derailment coefficient increased due to the decrease of the wheel load and increase of the lateral force for the outer rail side, right, wheel, as the body of the freight wagon was excited to vibrate in rolling mode significantly while the train was running in the 350 m radius left curved track. It is probable that the significant roll vibration was excited to the vehicle body due to the existence of the large combination of alignment and cross-level which should be maintained, in the track before the point where the wheel started climbing up the rail. It is somewhat likely that the existence of the large alignment to shorten the radius of curvature effected to increase the lateral force in the outer rail side wheels. It is somewhat likely that the large combination of alignment and cross-level which should be maintained had existed because the on-site track maintenance section could not understand the existence of the plural kinds of the combination of alignment and cross-level measured by the high speed track inspection car, and these situation was caused in relation with the improper method to decide the necessity of the maintenance work by communication of the inspected results to the on-site track maintenance section, and a lack of the knowledge about the combination of alignment and cross-level in the on-site track maintenance section. Although it could not be determined whether the unbalanced loading actually related to the occurrence of derailment, it is somewhat likely that the status of loading just before the accident became to a factor to promote derailment.

Attached diagram: Factory of the Esashi Line derailment accidents and their degree of influence, etc.



○Measures taken by the Minister of Land, Infrastructure, Transport and Tourism in response to the JTSB's opinions

The minister issued instructions "Regarding Railway Accident Investigation Reports on Train

Derailment Accidents on the Esashi Line Operated by Japan Freight Railway Company" (Kokutetsuan Nos. 62, 62-2 and 62-3) dated on December 17, 2015 to inform domestic railway business operators, railroad vehicle manufacturers and consigned freight transportation business operators of the JTSB's railway accident investigation reports and opinions.

The minister checked the railway accident investigation reports based on Article 5 of the Ordinance on Report on Railway Accidents, etc. (submitted from Japan Freight Railway Company to the Hokkaido District Transport Bureau Director) and confirmed that the measures against the recurrence of the accidents in question were completed. The ministry will continue administrative guidance to the companies involved in the accidents and railway business operators who own facilities similar to those involved in the accidents by conducting safety inspections and other means when necessary.

The "Review Meeting for Improving Cargo Train Operation Safety" the members of which consist of railway business operators, consigned freight transportation business operators, other relevant bodies and research institutions as well as the Ministry of Land, Infrastructure, Transport and Tourism was set up. The results of its review of the above measures were compiled in and issued as the "Safety Improvement of Cargo Train Operations" (kokutetsugi No. 66 and Kokutetsushi No. 141) dated September 30, 2020. The ministry instructed the aforementioned railway business operators to take on measures consistent with the contents compiled by the review.

On the basis of the "Safety Improvement of Cargo Train Operations" (administrative circular) dated on September 30, 2020, the ministry will develop implementation plans on measures for train vehicles and railway trucks and monitor their progress.

8 Provision of factual information in 2020 (railway accidents and serious incidents)

The JTSB provided no factual information in 2020.

Colum

Investigations of derailment accidents involving trains using rubber wheels

Railway Accident Investigator

There are railways on which trains run with rubber tires, not iron wheels, such as guide rail-type railways (e.g. new transportation system) and monorails. In this column, I will show some examples of new transportation system derailments that occurred due to tire damage.

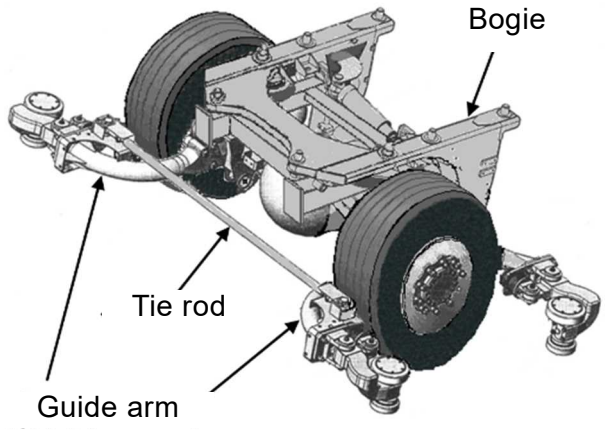
An example of a running wheel being used on the new transportation system

Functions such as operation control and safety devices for new transportation system vehicles we investigated were similar to those of common railway vehicles, but the parts that are most integral to locomotion (wheels) are almost identical to those of automobiles.

Therefore, tires for the new transportation system are hardly different from those of common automobiles and each of them has a "Nakago," (Safety wheel) made of cast aluminum alloy that makes it possible for the train to continue on a short distance even if puncture—to a rail yard for example.

In most of the accidents sites we investigated, railway tracks were strewn with debris of various sizes from tires and safety wheel over areas of more than 700-meters. Various damages to railroad components also noted.

An example of a traveling section used for the new transportation system



Key points in the estimation of the chain of events leading to derailments are the locations and sizes of the tire and safety wheel pieces, the degree of damage to railroad components and their relative positions. In our investigations, we made a point of not overly focusing on damage to each tire and safety wheel, while estimating various factors that likely led to tire damage without excluding potentially relevant factors. We subsequently eliminated less potentially factors one by one. (see page 66 for causes and factors in investigation reports).

Since it is often difficult to determine which tire and safety wheel was damaged first, for example, we checked their structural integrity based on their mechanical properties, such as component material and strength of the safety wheel.

If damage to the tire of a running wheel was only due to puncture, the vehicle would be able to continue on, but if the tire is torn and the concrete road surface and the safety wheel come into direct contact, the Nakago is likely to be damaged even after a short distance.

On the other hand, since the analysis of a rubber tire requires technical knowledge that is different from that required for an iron wheel analysis, we requested that damaged tires be inspected by the Japan Automobile Tyre Manufacturers Association (general incorporated association) toward the identification of factors resulting in their damage.

There are only eight domestic business operators using the new transportation system (side guide rail type railways). To collect as much information as possible regarding other business operators' maintenance management methods, malfunction records and the situation of puncture-detection device installation, the JTSB conducted questionnaire research for such information with their cooperation.

I would like to take this opportunity to thank parties involved in our research, including the Japan Automobile Tyre Manufacturers Association, for their vital cooperation.

9. Summaries of major railway accident and serious incident investigation reports (case studies)

Derailment due to punctured tires on the new transportation system

A train derailment that occurred between Kamonomiya Station and Tetsudo-Hakubutsukan Station on the Ina Line of Saitama New Urban Transit Co., Ltd.

Summary: On January 16, 2019, during travel, the driver heard a strange sound like “bang” from the rear of the train, so he applied the brake. After stopping, the situation was confirmed through the inside of each vehicle, and when the sixth car was seen from the gangway behind the fifth car, the front part of the vehicle body of the sixth car was tilted to the left and shifted by about 50 cm. The attendant who arrived after receiving a call from the control center confirmed that the left front of the sixth car had made contact with the side wall of the viaduct, and the left tire of the first axle had been damaged and had deviated from the running track. The coaxial right tire was also damaged.

About 100 passengers and one driver were on board the train, but no one was injured.

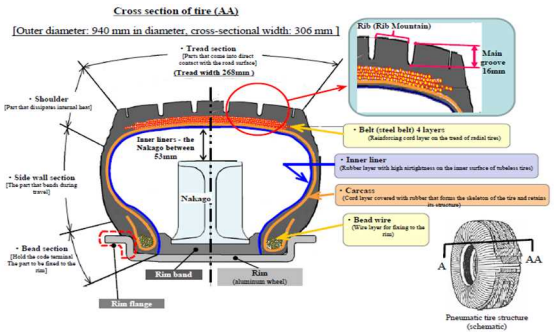
Findings

Damage to the tire on the left side of the front axle

- A fracture on the curcass and peel-off of tread occurred.
- Damage was more conspicuous at the tread section than the side section. The whole inner surface of the tread was damaged.
- The steel belt was exposed due to tread wear.

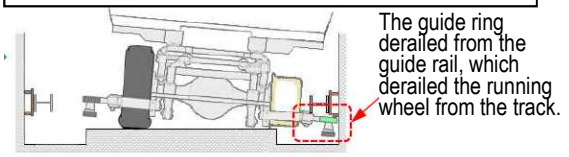
It is highly probable that, after losing air pressure, the train kept running while the inner surface off the tire and the Nakago (safety wheel) were in contact with the rail, which ultimately resulted in damage to the Nakago.

- Some tires with worn tread patterns were found on other vehicles.
- In the extraordinary inspection carried out nine days before the accident, the inspector did not measure the depth of the tread patterns and, after visual inspection, replaced only tires with exposed steel belts .



- In inspections performed every 90 days, only grooves with the least wear among the four were measured.
- In inspections performed every eight days, tire wear was not checked.

An image of post-accident tire without safety wheel



Due to main tire groove inspections often failing to include the most severely worn portions and due to the inspection intervals being long relative to travel distances, it is probable that the tire wear situation was not discovered in a timely

Probable causes: It is highly probable that the accident occurred when the left tire on the front axle of the vehicle was damaged, causing the air pressure to drop drastically, and the vehicle ran with the tire damaged, causing the safety wheel to break, the guide wheels to come off the guide rail below, and the running wheels to deviate from the track, resulting in derailment.

As for the damage to the tire, it is highly probable that the wires of the steel belt broke due to running with the inner surface of the tire and the safety wheel in contact due to extreme under inflation of the tire.

With regard to the extreme air pressure shortage of the tire, it is probable that the wires of the belt were broken because the tire was run with the steel belt exposed due to wear of the tread section, and some of the wires reached the inner surface of the tire, causing air leakage.

As for the fact that the train was running with the steel belt exposed due to wear of the tire tread, it is probable that the depth of the main grooves was not measured during the temporary inspection, and the wear condition of the tires was not checked during the train inspection, so the situation where the main grooves of the tread had disappeared due to wear was not sufficiently confirmed and that they continued to operate the trains without sufficiently checking the condition of the main grooves on the treads.

See the accident investigation report published on October 29, 2020 for detailed investigation results at the following:
https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-5-1e.pdf

Train collision with a pedestrian entering a class 4 level crossing

A level crossing accident at Yamanone level crossing inside the yard of Zushi Station on the Yokosuka Line of East Japan Railway Company

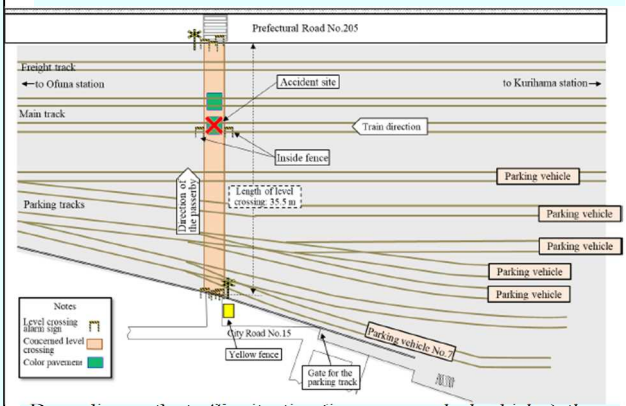
Summary: On March 21, 2019, while the train was operating in the yard of Zushi Station, the operator noticed an abnormal sound near Yamanone level crossing, so he carried out an emergency stop and activated a wireless alarm. As the result of the investigation of the scene, an injured person was found in the railway track, and found as dead although the ambulance was called. After that it was found out by the image records that the dead person was a passerby having entered the level crossing from its south side and collided with the concerned train.

Findings

- It is highly probable that the speed of the train at the time of the accident was 53 km/h.
- The length of the level crossing is 35.5 m.
- The line-of-sight distance from the location where the pedestrian entered to a train of the same travel direction is 300 m.
- The level crossing has structural problems related to the large volume of lines that cross it and its excessive length of 35.5 m, which make it difficult for pedestrians to view the overall traffic situation.

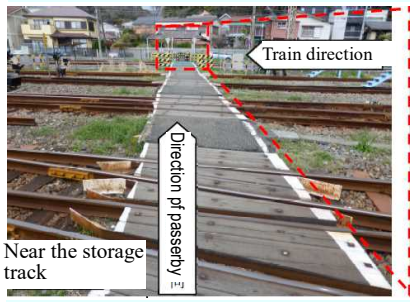
Due to these structural problems, it is probable that the pedestrian could not have reached the opposite side before being struck, even if the pedestrian had checked both ways before entering the level crossing.

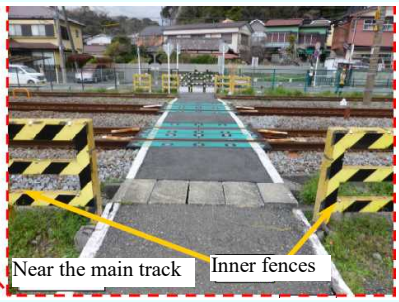
A prefectural road (without a sidewalk) running parallel with the railroad and located north of the level crossing has no place to install a level crossing safety appliance within the railroad yard.



Depending on the traffic situation (i.e., many parked vehicles), there are many potential blind spots for pedestrians.

Even as the accident occurred, the business operator managing the level crossing (hereinafter referred to as the "company") was aware of this dangerous situation and was proposing its abolition to the municipal government and others but the negotiations did not progress quickly enough, then accident occurred.





The JTSB recommended the following desirable measures for preventing the recurrence of the level crossing accident

- Emergency measures taking into account the special characteristics of the level crossing, such warning users of the danger
- The necessity of parties concerned, including the company, Zushi City and local residents to prioritize safety by discussing the abolition of the level crossing, the construction of an alternative railroad crossing facility and other safety measures, proceed with the discussion, decide policy promptly and implement concrete measures

Probable causes: It is highly probable that the concerned accident was caused by that the pedestrian collided with the concerned train because the pedestrian passing Yamanone level crossing, the class 4 level crossing without crossing gate nor road warning machine, entered the up track in the concerned level crossing in the situation that the train was approaching in the up track.

It could not be determined the precise situation why the concerned pedestrian entered the up track in the situation that the train was approaching in the up track, because the pedestrian was dead, although it is likely that the pedestrian did not notice the approaching train , and that it was related with the difficulty to cross through the concerned level crossing only by the safety check when entered the level crossing as the structure of the concerned level crossing was in the status as the main track s could not be viewed by the parking vehicles depending on the circumstances, in addition there were many tracks to be crossed and the length of the level crossing road was long as 35.5 m.

See the accident investigation report published on March 26, 2020 for detailed investigation results at the following:
https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-2-1e.pdf (Synopsis)

Departure without carrying a tablet and entry into a safety block section where another vehicle was present

A serious incident (incorrect management of safety block) between Asakura Stop and Yashiro Stop on the single-track Ino Line, Tosaden Traffic Co., Ltd.

Summary: On March 25, 2019, the driver (A) of train A departed Asakura stop (a single track section) without carrying a tablet although he was supposed to drive the train after shifting from the pilot system (ad-hoc safety block) to the tablet system required between Kagamigawabashi stop and Asakura stop. When the train A came to within six meters before Asakuraeki-mae stop, driver A noticed the oncoming inbound single-vehicle (train B) and immediately stopped the train. At the same time, while train B was running through Asakura Intersection, the driver noticed the train A standing at the front, so he stopped his train past the intersection (about five meters before Asakuraeki-mae stop). Eight passengers plus driver A were on board train A and five passengers plus driver B were on board train B but nobody was injured.

Findings

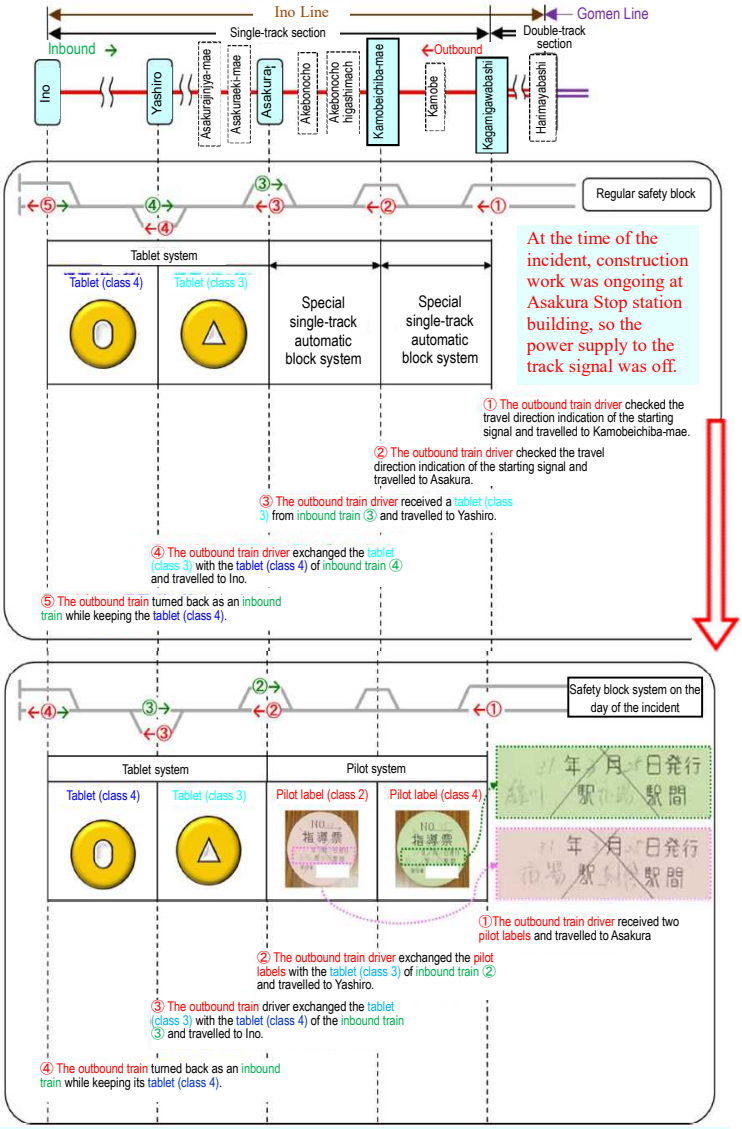
Testimony by driver A
"The train operation that resulted in this serious incident was my first time driving a train by the pilot system."

Testimony of the driver who was on board the train A as driver A's instructor for pilot system
"In a single-track section, a train operation tends to get delayed even with a skilled driver, so I thought it difficult for a newcomer to drive without a delay while learning the pilot system and I myself drove the train instead of him to show him a good example."

Testimony by Kagamigawabashi Stop Stationmaster
"A safety-block shift to the pilot system was carried and notified several times in the past, but I have never been instructed as to how I should communicate data from an operation notification ticket or how to confirm whether or not they were understood."

After the stationmaster notified driver A of the safety-block shift, he failed to have driver A recite his notification and mutually check the contents of the notification.

The video image recorded before the train A departed Asakura Stop shows that driver A picked up and checked the pilot label but failed to carry the tablet and perform "finger pointing and call" in front of the train operation timetable.



It is probable that driver A did not correctly understand the track section described in the pilot label and the operation notification ticket nor the meaning of "finger pointing and call" using the train operation timetable.

Probable causes: In this serious incident, it is certain that the driver of train A departed Asakura Stop (section between Asakura Stop and Yashiro Stop: a single-track section where the tablet system was in force) without carrying a tablet and entered a safety block section where oncoming train B was present. Regarding the driver started train A from Asakura Stop without his tablet, it is probable that he could not appropriately judge and apply what he was instructed regarding the pilot and tablet systems and because, after the Kagamigawabashi Stop stationmaster notified the safety block to the driver, he neglected to engage in basic mutual checks such as making the driver recite his notification. As for the reasons why the driver could not judge and apply according to the situation what he was educated regarding the pilot and tablet systems and why the stationmaster neglected the mutual check of the notification contents, it is likely that the company's train operation education system for both drivers and stationmasters was inadequate.

For detailed investigation results, see the accident investigation report published on July 30, 2020 at the following:
https://www.mlit.go.jp/jtsb/eng-rail_report/English/RI2020-1-1e.pdf (Synopsis)

Train derailment after encountering soil and sand from a collapsed slope

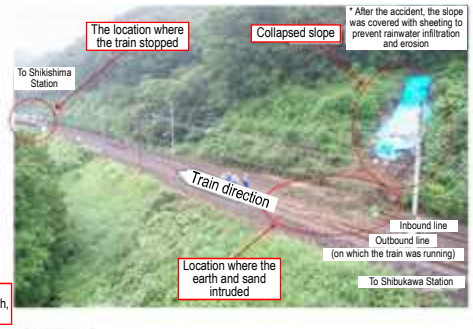
Train derailment accident between Sibukawa and Shikishima Stations on the Joetsu Line, East Japan Railway

Summary: On June 28, 2019, when the driver was operating the train at about 76 km/h between Shibukawa Station and Shikishima Station, he saw a fallen tree ahead on the railroad, so he immediately applied emergency brake but the train collided with earth and sand that had fallen with the fallen tree onto the railroad before stopping. The first axle of the front bogie of the first train derailed leftward.

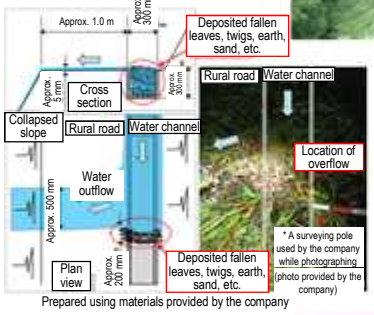
About 80 passengers and 2 crew members (the driver and conductor) were on board and one passenger was injured.

Findings

It is likely that a relatively large amount of rainfall had occurred at the site before the accident. A water channel is present at the upper side of the collapsed slope, so it is probable that intense water outflow from the channel spilled onto the rails.



The above-mentioned water channel is an open conduit without a screen (i.e., a weir) and was managed by its users on a voluntary basis. Therefore, branches and leaves easily deposited inside it. It is probable that it was not appropriately managed despite its deposition-prone structure.



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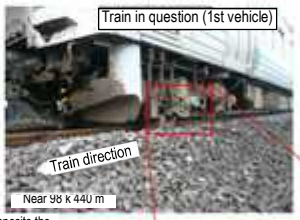
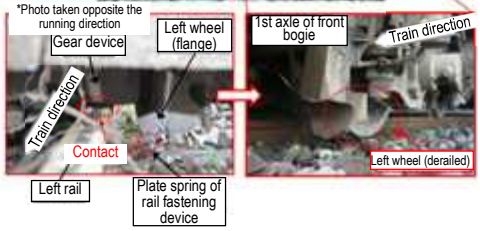




It is probable that the intense flow of water from the water channel flooded the rails. It is likely that the slope collapsed due to an increased amount of water saturated into surface soil which destabilized it.

The JTSB pointed out as follows, measures for preventing the recurrence of this accident.

- The owner of this water channel should discuss problems with concerned parties including users to structurally strengthen the channel and prevent blockage of water flow. It is also necessary for the owner to cooperate with concerned parties to continuously manage and maintain daily functions by means of inspections and appropriate dredging.
- It is recommended that measures be taken such as installing equipment for disaster detection at the slope in question and providing slope-protecting measures. When vital railroad accident prevention measures are outside sites owned by the company, the company should request the cooperation of and provide information to relevant land managers and discuss the measures with parties concerned.
- It is desirable for the company to investigate locations similar to the accident site and take preventive measures such as identifying railroad facilities where focused patrols and monitoring are necessary according to water passage structures and surrounding situations.
- It is also desirable for the company to make further efforts for accident prevention, for example by not only investigating and assessing the risks of nearby water channels in order to ascertain unstable locations to the extent possible but also by utilizing obtained data especially from regular slope inspections.

Probable causes: It is highly probable that this accident occurred due to the collapsed slope and fallen tree near the rail track along with soil and sand from the collapse were impacted by the train.

Due to fallen leaves and other sediments accumulating inside the water channel installed on the upper part of the slope in question, it is likely that water flow was blocked and an intense overflow traveled over the slope, which destabilized and collapsed the slope.

For detailed investigation results, see the accident investigation report published on July 30, 2020 at the following:
https://www.mlit.go.jp/jtsb/eng-rail_report/English/RA2020-3-2e.pdf

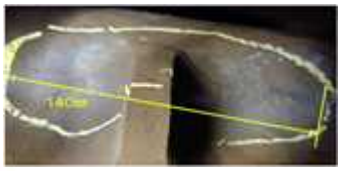
An abnormal noise during a train operation – A crack found by a post-operation vehicle check
A serious incident (vehicle damage) in Suminoe inspection ward, Nankai Electric Railway Co., Ltd.

Summary: The train left the Nankai Main Line Namba Station on time on August 23, 2019 (Friday). While traveling, the conductor noticed the sound of rub against the connecting part. After that, while the train was running, the same conductor confirmed the same sound from the connection. For this reason, the conductor reported the occurrence of abnormal noise to the transport commander via train radio. The commander sent two car inspection staff to the train. They checked the condition of the vehicle, but there was no abnormality. Therefore, they instructed to check the vehicle after the operation on the day.
After the operation, when the car inspection staff checked the vehicle again at the Suminoe inspection area, a crack of about 140 mm was found on the back of the 1st axis traction motor seat of the 2nd bogie of the 2nd car. (Around 0:10 on August 24, 2019)

Findings

The crack was found at the weld spot connecting the side of the bogie and the reinforcing rib of the back of the main (traction) motor seat.

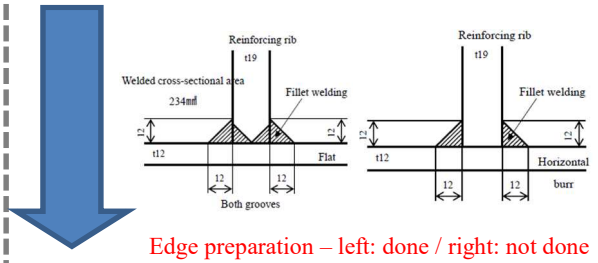
When a crack was found on a traction link (traction rod) seat, the bogie frame was reinforced as a preventive measure (by a bogie manufacturer in 2005).
・A reinforcing rib was attached to the back of the main motor seat.



The crack part (reinforcing rib welded part)
Traction motor seats are welded on the horizontal burr

(See Feature: bogie models (page 9))

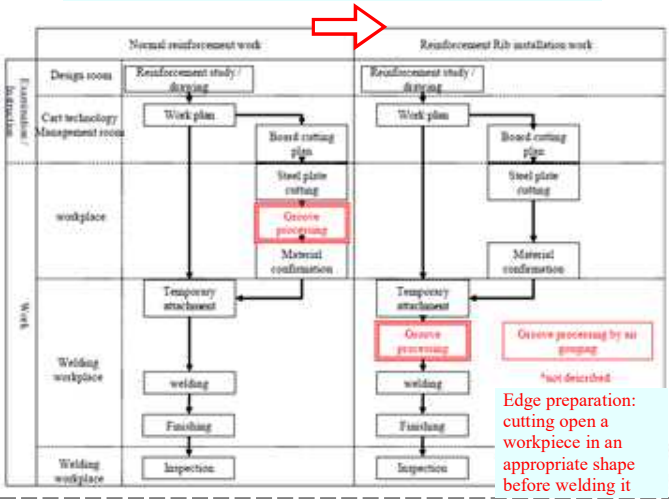
The procedure proposed to the weld shop did not mention edge preparation. It is likely that the bogie technology management office did not adequately explain edge preparation to the work manager.
It is likely that the welder who was instructed by the work manager temporarily welded reinforcing rib (tack welding) in a way similar to normal reinforcement work and then welded it without edge preparation.



Edge preparation – left: done / right: not done

It is highly probable that, as a result of welding without edge preparation, the weld spot between the side of the bogie and the reinforcing rib became defective.

The member is too small for the equipment of the cutting workshop to process it.



Edge preparation: cutting open a workpiece in an appropriate shape before welding it

Probable cause: It is highly probable that this serious incident was caused by the cracks that occurred in the weld between the side of the bogie frame of the vehicle and the reinforcing ribs on the back of the traction motor seat, which developed due to fatigue and reached the outer surface.
Regarding the fact that a crack occurred in the welded part between the side of the bogie and the reinforcing rib on the back of the traction motor seat, it is highly probable that it occurred because the groove processing was not performed when the manufacturer attached the reinforcing rib to the back of the traction motor seat, which resulted in the crack.
Regarding the fact that the groove processing was not carried out, there is no description about the groove in the work plan issued by the bogie technical management office of the bogie manufacturer to the welding workplace where the groove processing is performed, and there is no clear work instruction. Therefore, it is probable that it was related to the fact that the workers in the welding workplace did not know that the groove had to be processed. In addition, the part where the crack occurred was not designated as a priority inspection part after reinforcement, and the magnetic particle inspection was not conducted, so even if the crack had already occurred at the time of the regular inspection, it is likely that this could not be found.

For detailed investigation results, see the accident investigation report published on November 26, 2020 at the following:
https://www.mlit.go.jp/jtsb/eng-rail_report/English/RI2020-2-1e.pdf