Chapter 3 Railway accident and serious incident investigations

1 Railway accidents and serious incidents to be investigated

<Railway accidents to be investigated>

◎ **Paragraph 3, Article 2 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 1 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 paragraph 3, Article 2 of the Act for Establishment of the Japan Transport Safety Board)

1 The accidents specified in items 1 to 3 inclusive of paragraph 1 of Article 3 of the Ordinance on Report on Railway Accidents, etc. (the Ordinance);

2 From among the accidents specified in items 4 to 6 inclusive of paragraph 1 of Article 3 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) an accident found to be likely to have been caused owing to a railway officer's error in handling or owing to malfunction, injury, destruction, etc. of the vehicles or railway facilities, which resulted in the death of any person;

3 The accidents specified in items 4 to 7 inclusive of paragraph 1, Article 3 of the Ordinance which are found to be particularly rare and exceptional;

4 The accidents equivalent to those specified in items 1 to 7 inclusive of paragraph 1, Article 3 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 1 to 3 inclusive 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 each of the items of paragraph 1, Article 3 of the Ordinance on Reporting on Railway Accidents, etc.

Item 1: Train collision

Item 2: Train derailment

Item 3: Train fire

Item 4: Level crossing accident

Item 5: Accident against road traffic

Item 6: Other accidents with casualties

Item 7: 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 item 5, Article 1 of the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board)

1 From among the accidents specified in items 1 to 6 inclusive of paragraph 1 of Article 1 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 that causes five or more casualties;

2 The accidents specified in items 1 to 7 inclusive of paragraph 1 Article 1 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 Railways mutatis mutandis as specified in paragraph 1 of Article 3 of the Ordinance on Tramway Operations, the accidents equivalent to those specified in items 1 to 3 of Article 1 of the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board.

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

Item 1: Vehicle collision

Item 2: Vehicle derailment

Item 3: Vehicle fire

Item 4: Level crossing accident

Item 5: Accidents against road traffic

Item 6: Other accidents with casualties

Item 7: Heavy property loss without casualties

Railway accidents to be investigated

<table>
<tr><th>Category</th><th>Train collision</th><th>Train derailment</th><th>Train fire</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="3" rowspan="2">All accidents
(These refer to train accidents and do not include vehicle accidents on railways.*1)
[Ordinance 1-1]</td><td colspan="3">・Accidents involving the death of a passenger, crew member, etc.
・Accidents involving five or more casualties
・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 1-2]</td><td></td></tr>
<tr><td colspan="4">Accidents that are particularly rare and exceptional [Ordinance 1-3]</td></tr>
<tr><td>Dedicated railway</td><td colspan="7">Accidents that are particularly rare and exceptional [Ordinance 1-4]</td></tr>
<tr><td rowspan="2">Tramway
[Ordinance 1-5]</td><td colspan="6">Accidents involving the death of a passenger, crewmember, etc., and accidents involving five or more casualties
[Notice 1-1]</td><td></td></tr>
<tr><td colspan="7">Accidents that are particularly rare and exceptional [Notice 1-2]</td></tr>
</table>

*1: Among vehicle collisions, derailments, and fires on railways, accidents that fall under the category of level crossing accident, accidents against road traffics , or other accidents with casualties and which involve the death of a passenger, crewmember, etc. [Ordinance 1-2] or which are particularly rare and exceptional [Ordinance 1-3] are to be investigated.

(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.

The scope of railway accident investigations has been modified since April 1, 2014:

Railway Accidents

○Any fatal accident that occurs at a level crossing without an automatic barrier machine is to be investigated.

○The criteria has been modified for the subject of investigations regarding level crossing accidents, accidents against road traffic, or other accidents with casualties. It is now "A casualty figure of five or more, with at least one of the casualties dead."

○Any derailment accident involving a snowplow vehicle in operation has been excluded from the subject of investigations (except for especially extraordinary cases).

Tramway Accidents

○Any fatal accident that occurs at a level crossing without an automatic barrier machine is to be investigated.

○The criteria for the subject of investigations has been modified to "A casualty figure of five or more, with at least one of the casualties dead."

< Railway serious incidents to be investigated>

◎ **Item 2, paragraph 4, Article 2 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 2 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 item 2, paragraph 4, Article 2 of the Act for Establishment of the Japan Transport Safety Board)

1 The situation specified in item 1 of paragraph 1 of Article 4 of the Ordinance on Reporting on Tramway 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."]

2 The situation specified in item 2 of paragraph 1 of Article 4 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."]

3 The situation specified in item 3 of paragraph 1 of Article 4 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.”]

4 The situation specified in item 7 of paragraph 1 of Article 4 of the Ordinance, which caused malfunction, injury, 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.”]

5 The situation specified in item 8 of paragraph 1 of Article 4 the Ordinance, which caused malfunction, injury, 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.”]

6 The situation specified in items 1 to 10 inclusive of paragraph 1 of Article 4 of the Ordinance which is found to be particularly rare and exceptional; and
[These are referred to as: item 4 “Main track overrun”; item 5 “Violating closure section for construction”; item 6 “vehicle derailment”; item 9 “Heavy leakage of dangerous object”; and item 10 “others,” 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 in preceding items.

◎ **Article 2 of the Public Notice of the Japan Transport Safety Board** (A situation prescribed by the public notice stipulated in item 7, Article 2 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 item 1 of Article 2 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 item 4 of Article 2 of the Ordinance, which caused malfunction, injury, 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 item 5 of Article 2 of the Ordinance, which caused malfunction, injury, 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 a vehicle: Referred to as “Dangerous trouble in vehicle.”]

4 The situation specified in items 1 to 7 inclusive of Article 2 of the Ordinance which is found to be particularly rare and exceptional; and
[These are referred to as: item 2 “Violating red signal;” item 3 “Main track overrun;” item 6 “Heavy leakage of dangerous object;” and item 7 “others,” respectively.]

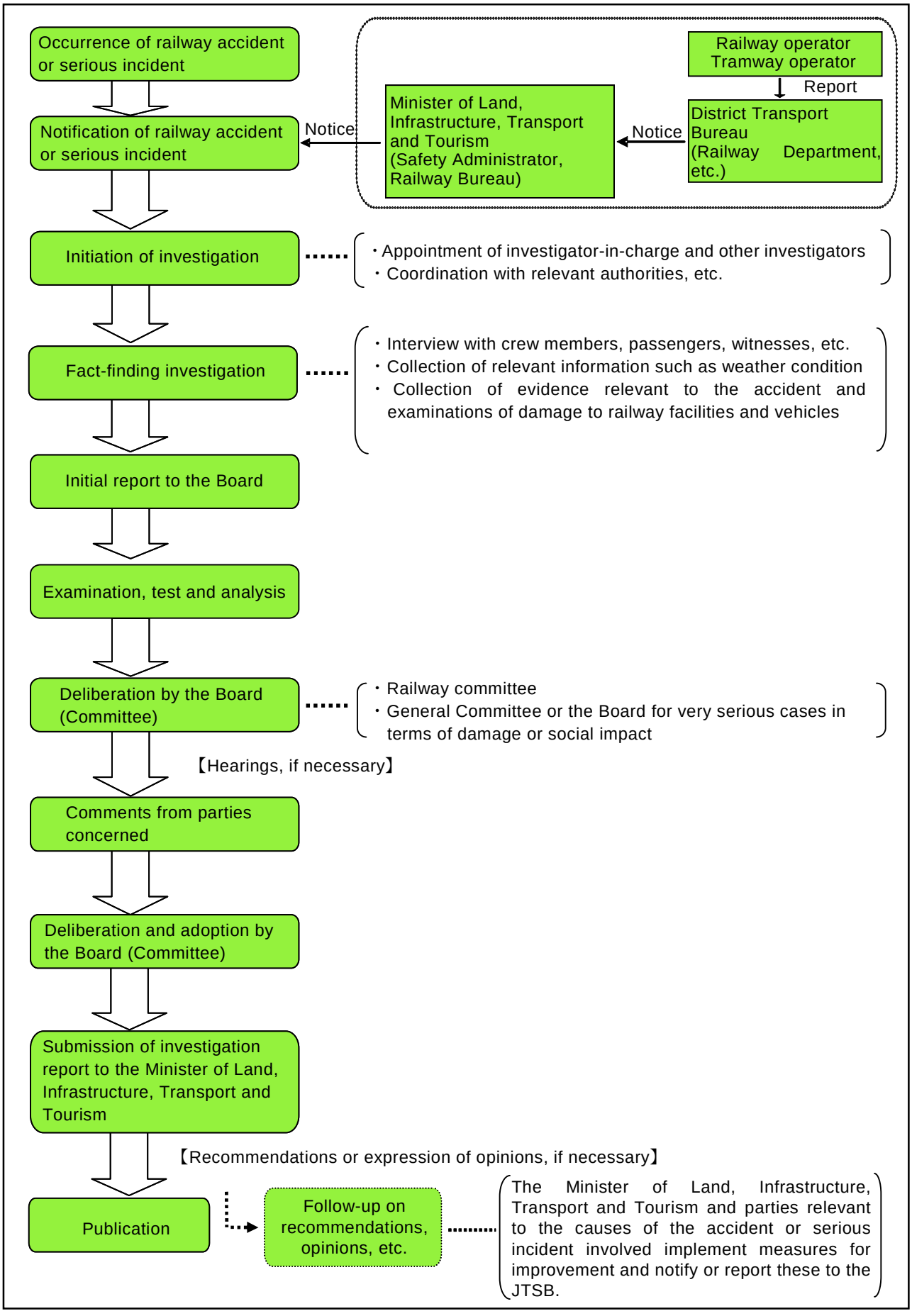
5 From among the situations occurring on a tramway operated under the application of the Ministerial Ordinances to Provide Technical Regulatory Standards Railways mutatis mutandis as specified in paragraph 1 of Article 3 of the Ordinance on Tramway Operations, the situations equivalent to those specified in items 1 to 6 of Article 2 of the Ordinance for Enforcement of the Act for Establishment of the Japan Transport Safety Board.

Serious incidents to be investigated

<table>
<tr><th>Category</th><th>・Incorrect management of safety block (Railway)
・Incorrect management of safety block (Tramway)</th><th>・Incorrect indication of signal (Railway)
・Violating red signal</th><th>Dangerous damage in facilities</th><th>Dangerous trouble in vehicle</th><th>・Main track overrun
・Violating closure section for construction (Railway)
・Vehicle derailment (Railway)
・Heavy leakage of dangerous object
・Others</th></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 2-1, 2-2, and 2-3]</td><td colspan="2">Risk of collision, derailment or fire
[Ordinances 2-4/ 2-5]</td><td></td></tr>
<tr><td colspan="5">Incidents that are particularly rare and exceptional [Ordinance 2-6]</td></tr>
<tr><td rowspan="2">Tramway
[Ordinance 2-7]</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/incident investigation



3 Statistics for the investigations of railway accidents and serious incidents

In 2013, the JTSB carried out investigations of railway accidents and serious incidents. The results are as follows. 23 accident investigations had been carried over from 2012, and 15 accident investigations were newly launched in 2013. 17 investigation reports were published in 2013, and 21 accident investigations were carried over to 2014.

Six railway serious incident investigations had been carried over from 2012, and two railway serious incident investigations were newly launched in 2013. Three investigation reports were published in 2013, and five railway serious incident investigations were carried over to 2014.

Of 20 published investigation reports, three were issued with recommendations.

Investigations of railway accidents and railway serious incidents in 2013

(Cases)

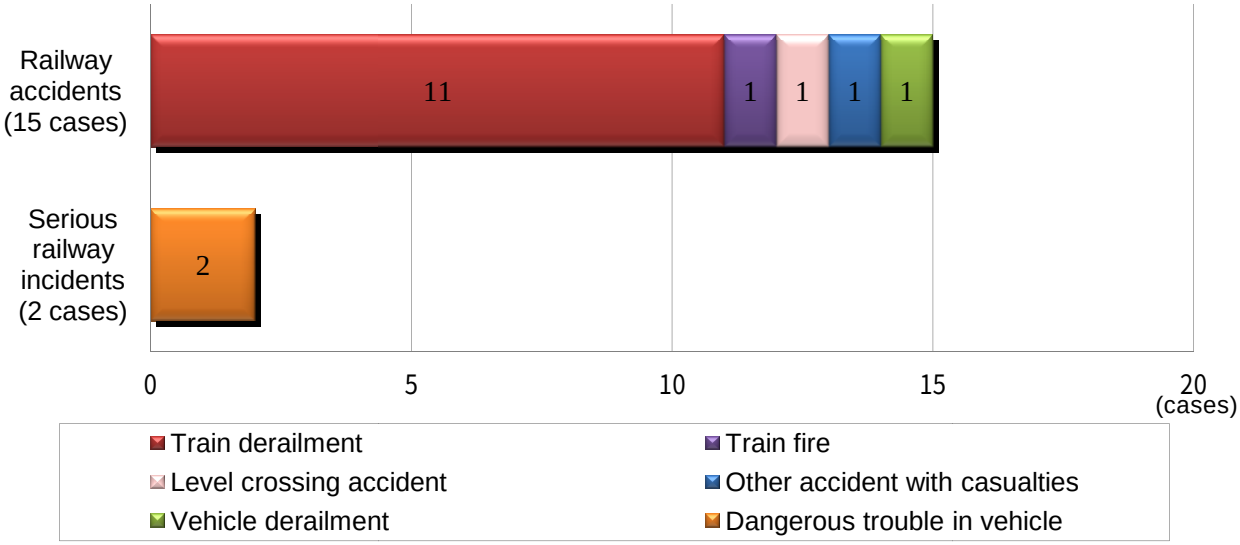
Category	Carried over from 2012	Launched in 2013	Total	Published investigation report	(Recommendations)	(Opinions)	(Remarks)	Carried over to 2014	(Interim reports)
Railway accidents	23	15	38	17	(2)	(0)	(0)	21	(0)
Railway serious incidents	6	2	8	3	(1)	(0)	(0)	5	(0)

4 Statistics for investigations launched in 2013

The railway accidents and railway serious incidents that were newly investigated in 2013 consisted of 15 railway accidents (down by five from the last year associated with 20 accidents) and two railway serious incidents (down by three from the last year associated with five incidents).

The breakdown by accident categories shows that the railway accidents are comprised of 11 train derailments, one train fire, one level crossing accident, one other accident with casualties, and one vehicle derailment. The railway serious incidents comprised of two dangerous troubles in vehicle.

Number of railway accidents and serious incidents by type



The number of casualties was 40 across the 15 accidents. These consisted of one death and 39 injured persons.

The number of casualties (in railway accidents)

(Persons)

2013							
Category	Dead			Injured			Total
	Crew	Passenger	Others	Crew	Passenger	Others	
Casualties	0	0	1	1	32	6	40
Total	1			39			

5 Summaries of railway accidents and serious incidents that occurred in 2013

The railway accidents and railway serious incidents that occurred in 2013 are summarized as follows. The summaries are based on the information available at the start of the investigations, and therefore may change depending on the course of investigations and deliberations.

(Railway accidents)

No.	Date and accident type	Operator and line section (location)	Summary
1	February 4, 2013 Train fire	East Japan Railway Company Between Tsukuda Station and Iwamoto Station, Joetsu Line (Gunma Prefecture)	While the train was running, the driver of the train felt a shock as if the cars were being pulled. He looked behind and noticed a fire from a car. He then stopped the train with the emergency brake. He was the only one in the train and he was not injured.

2	February 8, 2013 Train derailment	East Japan Railway Company Between Shimokita Station and Ominato Station, Ominato Line (Aomori Prefecture)	When the train was traveling near the Sanbonmatsu level crossing at about 60 km/h, the driver of the train sensed a shock. He then applied the brake to stop the train. He checked and found out the both of the axles in the front bogie of the first car had become derailed to the left. Out of the 11 passengers, the driver, and a track maintenance worker on board, no one died or was injured.
3	February 12, 2013 Train derailment (due to a level crossing accident)	Sanyo Electric Railway Co., Ltd. Between Iho Station and Arai Station, Main Line (Hyogo Prefecture)	While the train was running at about 95 km/h, the driver of the train noticed an obstacle at the Shinko Mae level crossing. The driver applied the emergency brake to stop the train. However, it was too late to avoid the collision with the car transportation vehicle. Out of the 50 to 60 passengers, the driver and the conductor on board, 15 people (13 passengers, the driver, and the automobile driver) were injured.
4	February 13, 2013 Other accidents with casualties	Keio Corporation Between Musashinodai Station and Tobitakyu Station, Keio Line (Tokyo)	While traveling along the left column section, the train hit a worker who was removing signal cables. The worker was died.
5	March 2, 2013 Train derailment	East Japan Railway Company Between Jinguji Station and Kariwano Station, Ou Line (Akita Prefecture)	While the train was running, the driver of the train noticed an unusual sound. He stopped to check, and found out that both of the axles in the front bogie of the first car had become derailed. None of the 130 passengers and crew members were injured.
6	April 6, 2013 Train derailment	East Japan Railway Company Between Myoko-kogen Station and Sekiyama Station, Shin-etsu Line (Niigata Prefecture)	While coasting operation at about 65 km/h, the driver of the train felt that the train cars were rising up. The driver applied the emergency brake to stop the train. A survey of the train cars revealed that both of the axles in the front bogie of the first car had become derailed to the right. Out of the 25 passengers and two crew members on board, no one was injured.
7	April 7, 2013 Train derailment (due to a level crossing accident)	East Japan Railway Company On the premises of Chigasaki Station, Tokaido Line (Kanagawa Prefecture)	The train collided with an automobile at the Jukkenzaka yard crossing in the premises of Chigasaki Station. Both axles in the front boogie of the first car were derailed. Out of the approximately 300 passengers and two crew members on board, one passenger were slightly injured. However, none of the three persons in the automobile were injured.
8	May 28, 2013 Train derailment	Kobe Electric Railway Co., Ltd. On the premises of Arimaguchi Station, Sanda Line (Hyogo Prefecture)	The driver of the train initially felt a shock when the train left from Arimaguchi Station. He applied the brake to stop the train. A survey revealed that both of the axles in the front bogie of the second car had become derailed to the right. Out of the 60 passengers and the driver on board, no one was injured.

9	July 31, 2013 Vehicle derailment	Nagasaki Electric Tramway Co., Ltd. Between Tsukimachi stop and Shimin Byoin Mae stop, Oura Branch Line (Nagasaki Prefecture)	The driver of the tram noticed a bus 10 m in front. It was on a regular route coming from the left into the car-track lane at the intersection. The driver applied the emergency brake. However, it was too late to avoid colliding with the right side of the bus. 60 passengers and the driver were in the car, and six passengers and the driver were in the bus. 13 of the passengers in the car and five of the passengers in the bus were injured.
10	August 17, 2013 Train derailment	Japan Freight Railway Company Between Yakumo Station and Yamakoshi Station, Hakodate Line (Hokkaido Prefecture)	The driver of the train noticed an obstacle in front and applied the emergency brake. After collision with the obstacle, he activated the one-touch operative emergency device, since the train appeared to be sinking. This was then followed by another impact from the upthrow. Both of the axles in the middle bogie of first car were derailed, as well as the second axles in the front bogie of the third and fourth cars. The second axle in the front bogie of the fifth car was also derailed from above the rail. The driver was on board. However, he was not injured.
11	September 17, 2013 Train derailment	East Japan Railway Company On the premises of Sagamiko Station, Chuo Line (Kanagawa Prefecture)	While the driver of the train was applying the brake to stop at Sagamiko Station, an automatic alarm started ringing when the train was running in several meters before the stop position. He then applied the emergency brake to stop the train. Out of the approximately 100 passengers and three crew members, no one was injured.
12	September 19, 2013 Train derailment	Japan Freight Railway Company On the premises of Onuma Station, Hakodate Line (Hokkaido Prefecture)	The driver of the train, sensing an abnormal feeling as if the cars were being pulled, applied the brake to stop the train. A survey revealed that both of the axles in the rear bogie of the sixth car, both of the axles in the front bogie of the seventh car, all four axles in the eighth car, and both of the axles in the front bogies of the ninth car had become derailed. The driver was the only one work on the train and was not injured.
13	November 5, 2013 Level crossing accident	Kyushu Railway Company On the premises of Takahashi Station, Sasebo Line (Saga Prefecture)	While running at about 50 km/h, the driver of the train noticed an obstacle at the level crossing in front and applied the emergency brake. However, it was too late to avoid a collision with the iron plates protruding from the loading platform of a trailer. Out of the 60 to 70 passengers and the driver on board, five passengers were injured.
14	November 24, 2013 Train derailment	Oigawa Railway Co., Ltd. On the premises of Igawa Station, Igawa Line (Shizuoka Prefecture)	The driver of the train heard an unusual sound while entering Igawa Station and stopped the train. A survey revealed that all of the axles in font bogie of first car were derailed. Out of the approximately 80 passengers, the driver, and the two conductors on board, no one was injured.

15	December 28, 2013 Train derailment	Isumi Railway Company Between Nishihata Station and Kazusa-nakano Station, Isumi Line (Chiba Prefecture)	The driver of the train noticed some unusual sound during operation and stopped the train to investigate. The driver found out that the first axle in the front bogie has become derailed. Out of the four passengers and the driver on board, no one was injured.

(Railway serious incidents)

No.	Date and incident type	Operator and line section (location)	Summary
1	January 7, 2013 Dangerous trouble in vehicle	Hokkaido Railway Company Between Tsunetoyo Signal Station and Kamiatsunai Station, Nemuro Line (Hokkaido Prefecture)	While driving at about 90 km/h, the door-pilot lamp went out. As a result, the driver of the train applied the emergency break to stop the train. A survey revealed that the door on the right side of the fifth car was open by about 30 cm. Out of the 37 passengers and two crew members on board, no one was injured.
2	July 6, 2013 Dangerous trouble in vehicle	Hokkaido Railway Company On the premises of Yamasaki Station, Hakodate Line (Hokkaido Prefecture)	While driving at about 130 km/h through the premises of Yamasaki Station, the driver of the train stopped the train after finding that the indicator for the engine operating status had turned off. The crew members noticed smoke coming out from beneath the fourth car. They used fire extinguishers to extinguish the fire. Out of the 200 passengers and four crew members on board, no one was injured.

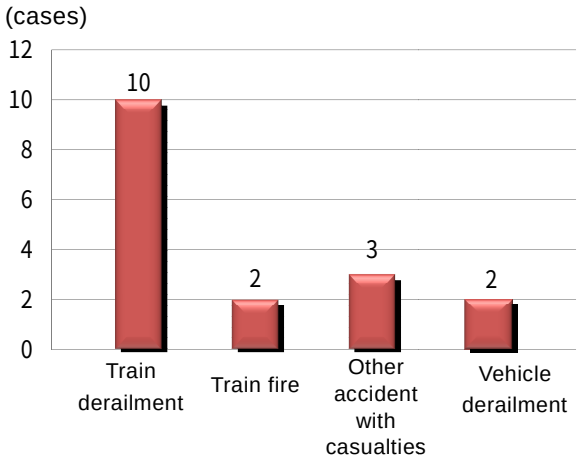
6 Publication of investigation reports

The number of investigation reports of railway accidents and serious incidents published in 2013 was 20. These consisted of 17 railway accidents and three serious incidents.

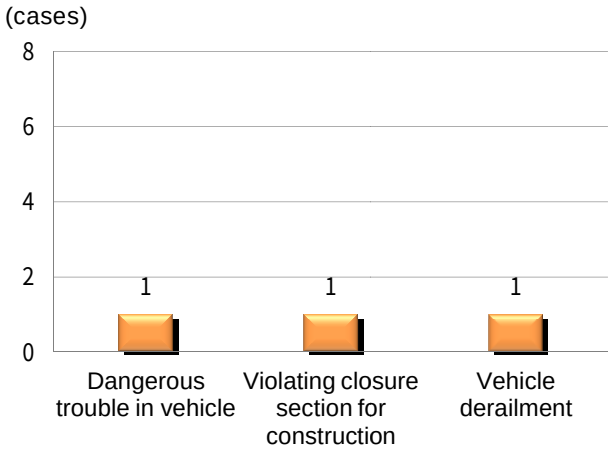
Breaking them down by category, the railway accidents contain ten train derailment accidents, two train fire accidents, three other accidents with casualties, and two vehicle derailment accidents. However, the serious railway incidents contain one dangerous trouble in vehicle, one violating closure section for construction violation of a section closed for construction, and one vehicle derailment.

In the 17 accidents, the number of casualties was 161, consisting of one death and 160 injured persons.

Railway accident reports (17 cases) published in 2013



Serious railway incident reports (three cases) published in 2013



The investigation reports for railway accidents and serious incidents published in 2013 are summarized as follows:

List of published investigation reports on railway accidents (2013)

No.	Date of publication	Date and accident type	Operator and line section (location)	Summary
1	February 22, 2013	March 11, 2011 Train derailment	East Japan Railway Company On the premises of Sendai Station, Tohoku Shinkansen Line (Miyagi Prefecture)	While the train was entering Sendai Station at a speed of about 72 km/h, the driver felt a strong vibration at the same time that the stop signal indicated in the cab signal. As a result, he applied the emergency brake. A review after the stop revealed that both of the axles in the front bogie of the fourth car were derailed to the left. This train was a test run, there were 12 vehicle inspection and repair worker and one crew member on board. However, no one was injured. Note that immediately before the accident occurred the 2011 Tohoku earthquake struck off the shore of Miyagi Prefecture with a moment magnitude of 9. This resulted in the observation of a maximum seismic intensity of 7 in the north of Miyagi Prefecture.

2	February 22, 2013	December 24, 2011 Train derailment	SEIBU RAILWAY Co., Ltd. On the premises of Higashi-Murayama Station, Seibuen Line (Tokyo)	After passing turnout No. 67 on the premises of Higashi-Murayama Station at a speed of about 32 km/h into Track 5 of the station, and when the head of the train passed the No. 66-I and RO turnouts, the driver of the train felt as if the train was being pulled from behind. Immediately after this situation, the driver noticed that the door-pilot lamp in the driver's cab had turned off for a moment. As a result, the driver applied the emergency brake. The train stopped after traveling for about 21 m after applying the brake. A survey after the stop revealed that both of the axles in the front bogie of the seventh car had become derailed to the right. Of the approximately 450 passengers and two crew members on board, no one was died or injured.
3	February 22, 2013	February 16, 2012 Train derailment	Japan Freight Railway Company On the premises of Higashi-Oiwake Station, Sekisho Line (Hokkaido Prefecture)	When entering Kawabata Station, the driver of the train was instructed by the train dispatcher of Hokkaido Railway Company that the train should pass a downbound limited express diesel train at Higashi-Oiwake, rather than at Kawabata Station. As the train was about to stop at Kawabata Station, the driver stopped briefly at the station and then departed immediately. He applied the brake to decrease the speed in order to stop at Higashi-Oiwake Station. However, the train entered into the safety siding without decreasing in speed. It penetrated the car stop and ran into the snow shelter. This resulted in the derailment of the first to fifth cars of the train, which had 16 cars in total. The only one driver was on board and was not injured.
4	February 22, 2013	March 7, 2012 Train derailment	Hokkaido Railway Company Between Hashibetsu Station and Mashike Station, Rumoi Line (Hokkaido Prefecture)	While coasting operation at about 55 km/h, the driver of the train noticed a pile of earth and sand mixed with snow about 100 m ahead on the tracks. Although he immediately applied the emergency brake, the train ran over the pile, resulting in derailment of all of the axles in the front bogie to the right. Out of the one passenger and one crew member on board, no one was injured. The front window at the driver's seat and some devices under the floor, including a snow plow, were damaged.

5	March 29, 2013	June 17, 2011 Other accidents with casualties	Nishi - Nippon Railroad Co., Ltd. Between Shimoori Station and Tofuro-mae Station, Tenjin Omuta Line (Fukuoka Prefecture)	While traveling in the left column section, the driver of the train heard a bang at the same time that overhead contact line suffered an outage. He applied the emergency brake to stop the train. At that time, sparks (or melted objects) scattered around the rear part of the third car. This caused a two-year-old passenger who was at rear right side of the car to be hurt in the abdomen. After an inspection, the train started operation again, but the service was ceased at Tofuro-mae Station and deadheaded to Chikushi Station. The cars were put into depot. After that, damage in the roof was discovered. 30 passengers and two crew members had been on board.
6	March 29, 2013	June 19, 2012 Train derailment	HAKONE TOZAN RAILWAY Co., Ltd. Between Deyama Signal Station and Ohiradai Station, Trail Line (Kanagawa Prefecture)	During a powering operation at about 20 km/h after departing from Deyama Signal Station, the driver of the train noticed a rock between the rails seven meters ahead. He immediately applied the emergency brake. However, it was too late to avoid a collision, which resulted in the derailment of the first axle in the front bogie of the first car to the left. 11 passengers and two crew members were on board, but there were no casualties. Some devices below the floor, including the water tank at the front and the foundation brake gear at the first axle of the front bogie, were damaged.
7	April 26, 2013	February 17, 2012 Other accidents with casualties	West Japan Railway Company On the premises of Nishi-Akashi Station, Sanyo Line (Hyogo Prefecture)	During a powering operation on the premises of Nishi-Akashi Station at a speed of about 106 km/h, the driver of the train realized that a general freight truck was traveling along the passage in front that crosses the railway. He immediately blew the whistle and applied the emergency brake. However, it was too late to avoid a collision with the truck. The train stopped at a point 404 m away from the intersection with the passage. Out of the 146 passengers and three crew members on board the train, nine passengers were injured. The driver on the truck was also injured in this accident. The front window glass and the coupler of the first car, as well as the window glass on the left side of the first to third cars were damaged, as well as other areas. No fire occurred despite the fact that the general freight truck was totaled.
8	May 31, 2013	May 27, 2011 Train derailment	Hokkaido Railway Company On the premises of Seifuzan Signal Station, Sekisho Line (Hokkaido Prefecture)	Refer to “7. Summaries of recommendations and opinions” (page 67-①).

9	June 28, 2013	January 4, 2012 Train fire	TOYAMA CHIHOU TETSUDOU. INC On the premises of Tateyama Station, Tateyama Line (Toyama Prefecture)	The driver of the train moved into the driver's cab in the first car, which faced the direction of travel, to prepare for departure for Dentetsu-Toyama Station. Upon doing so he discovered a fire on the floor around one meter behind the passenger door in the front right side of the car. Although he used a fire extinguisher to fight the fire, he failed to control it. Afterward, while some seats in the car were burnt, the firefighters extinguished the fire. None of the five passengers and the driver on board were injured.
10	July 26, 2013	April 4, 2012 Train fire	East Japan Railway Company On the premises of Kujiranami Station, Shin-etsu Line (Niigata Prefecture)	While operating the train at a speed of about 20 km/h due to operation control under strong winds, the driver of the train noticed an unusual sound, as well as two occurrences of an outage in the overhead contact line after coming out of the Kujiranami Tunnel. The other drivers on board checked the rear section and noticed flames around the pantograph at the front section of the second car. The driver applied the emergency brake to stop the train. The roof and ceiling around the pantograph has already become burnt, so they used extinguishers to try to control the fire. However, they were unable to control it. Afterward, firefighters arrived and extinguished the fire. Out of the 41 passengers and six crew members on board, no one was died or injured.
11	July 26, 2013	June 25, 2012 Train derailment	Shikoku Railway Company Between Konokawa Station and Iyo-Kaminada Station, Yosan Line (Ehime Prefecture)	While running the train in the section listed to the left column, the train driver noticed utility poles and piles of earth over the railway. He immediately applied the emergency brake but it was too late. The train ran into a mixture of sand and rocks and stopped with all four axles derailed. Only the driver was on board and was not injured. Some devices at the front end under the floor of the vehicle were damaged.
12	July 26, 2013	July 28, 2012 Train derailment	TOYAMA CHIHOU TETSUDOU.INC Between Kosugi Station and Kamihori Station, Kamidaki Line (Toyama Prefecture)	Refer to "7. Summaries of recommendations and opinions" (page 69-②).
13	August 30, 2013	July 24, 2012 Other accidents with casualties	Central Japan Railway Company On the premises of Higashi-Shizuoka Station, Tokaido Line (Shizuoka Prefecture)	During a coasting operation at a speed of about 92 km/h while making an entry into Higashi-Shizuoka Station, the driver of the train noticed a train watchman walking between the platform and the right-side rail of the down line in the station premises. He was walking in the direction of Shizuoka Station, with his back to the train. The driver blew the whistle and applied the service brake. However, the watchman did not escape to the outside of the railway. He then applied the emergency brake, but it was too late to avoid hitting the watchman, leading to his death. Slight damage was discovered on the right side of first car of the train. Out of the 29 passengers, the driver, and a conductor on board, no one was injured.

14	September 27, 2013	June 11, 2012 Vehicle derailment (caused by trouble with road traffic)	OKAYAMA ELECTRIC TRAMWAY Co Ltd. Between Kencho-dori stop and Saidaiji-cho stop, Higashiyama Main Line (Okayama Prefecture)	In the section from the Kencho-dori stop toward the Saidaiji-cho stop, the driver made the tram coasting operation at about 30 km/h. The driver of the tram noticed a automobile coming into the tram tracks from the opposite lane so that it could turn right at the intersection. The automobile was about ten meters in front of the tram. Although the tram driver immediately applied the emergency brake, the electric tram collided with the automobile, went through the intersection, and stopped at a point about 20 m ahead in a derailed state. The automobile collided with a utility pole and stopped. Out of the 71 passengers and the driver on board the tram, eight passengers were injured. The only one driver was in the automobile and was not injured.
15	September 27, 2013	September 15, 2012 Vehicle derailment (caused by trouble with road traffic)	Tosa Electric Railway Co., Ltd. Between Nagasaki stop and Kogome-dori stop, Gomen Line (Kochi Prefecture)	During a powering operation through the line along National Route (NR) 195 at a speed of about 30 km/h, the train driver noticed a general freight hauler with a large trailer coming into the intersection of NR 195 and NR 32 from the left. This occurred within the section described in the left column. He immediately blew the whistle and applied the emergency brake. However, it collided with the hauler. The train was stopped and was derailed to the right. Out of the ten passengers and the driver on board, four of the passengers and the driver were injured. A driver on the general hauler was also injured. The train suffered damages to the windows at the front and in the passenger room. The hauler also suffered damages to the front and right side surface of the body. No fire happened in the general freight hauler.
16	September 27, 2013	September 24, 2012 Train derailment	Keikyu Corporation Between Oppama Station and Keikyu Taura Station, Main Line (Kanagawa Prefecture)	During a coasting operation at about 72 km/h, the driver of the train noticed a pile of earth and sand on the tracks 30-40 meters ahead. He immediately applied the emergency brake, but it was too late to avoid running into the pile of sand. The train stopped after traveling a further 84 m. All the four axles in the first car, both of the axles in the front bogie of the second car, and both of axles in the front bogie of the third car were derailed to the right. When the train stopped, the part of the train from first car to the middle of fourth car was in the Funakoshi Daiichi Tunnel. Out of the approximately 700 passengers and two crew members on board, 55 passengers and the driver were injured.
17	December 20, 2013	December 15, 2012 Train derailment	Kyushu Railway Company Between Setoishi Station and Kaiji Station, Hisatsu Line (Kumamoto Prefecture)	After the train went out of the Koudabe Tunnel and went through a right curve, the driver noticed a large rock about 30 m ahead on the tracks. Although he immediately applied the emergency brake, it was too late to avoid the collision with the rock before stopping. A check by the driver revealed that the second axle in the front bogie of the second car had become derailed to the left. Out of the 45 passengers and two crew members on board, no one was injured.

List of published investigation reports on serious railway incidents (2013)

No.	Date of publication	Date and incident type	Operator and line section (location)	Summary
1	October 25, 2013	June 27, 2012 Vehicle derailment	Sangi Railway Co., Ltd. On the premises of Higashi-Fujiwara Station, Sangi Line (Mie Prefecture)	Refer to "7. Summaries of recommendations and opinions" (page 70-③).
2	November 29, 2013	August 9, 2011 Dangerous trouble in vehicle	Tenryu Hamanako Railroad Co., Ltd. Between Hamamatsu Daigaku Mae Station and Miyakoda Station, Tenryu Hamanako Line (Shizuoka Prefecture)	While applying the brake to stop at Miyakoda Station, the driver of the train used the brake handle to stop the train immediately after the passenger door in the front right section of the car opened. A survey after the stop revealed that the passenger door in the front right section of the car was fully open, and the passengers were coming into the train through the passenger door at the rear right side. Afterward, in accordance with the instructions from the operation dispatcher, the train was operated with the door that had been experiencing problems locked. The vehicle was exchanged for another one at Tenryu Futamata Station. There were dozens of passengers on the train, but no one was injured due to falling.
3	December 20, 2013	July 13, 2012 Violating closure section for construction	East Japan Railway Company On the premises of Takasaki Station, Takasaki Line (Gunma Prefecture)	The assistant stationmaster of Takasaki Station received an application to approve the launch of construction to close the railway for the up and down lines. This application was left from the construction manager. After confirming that the up line train in the Joetsu Line had departed from the section to be closed, he approved the launch. A down line train from Takasaki to Yokokawa of Shin-etsu Line departed from Track No. 6 on time, and made its way into the section to be closed after the approval.

7 Summaries of recommendations and opinions

The recommendations and opinions issued in 2013 were summarized below:

① Hokkaido Railway Company: Train derailment accident on the premises of Seifuzan Signal Station in the Sekisho Line

(Recommendation issued on May 31, 2013)

○ Summary of the accident

On May 27, 2011, an up line train of six cars, from Kushiro Station to Sapporo Station, operated by Hokkaido Railway Company, departed from Tomamu Station two minutes behind schedule.

While the train was running toward Seifuzan Signal Station, the conductor at the conductor's

cabin in the fourth car noticed unusual sounds and vibrations. As a result, the conductor notified the driver of the event. The driver immediately made arrangements to stop the train. It was in the Dai-ichi Niniu Tunnel on the premises of the signal station.

Smoke from a fire that broke out in one of the cars then came flying inside the other cars. The driver tried to move the train out of the tunnel, but the train would no longer start.

There were 248 passengers, the driver, the conductor and two cabin attendants on board train. All of them escaped out of the tunnel on foot. 78 passengers and the conductor were injured.

The first axle in the rear bogie of the fifth car was derailed to the left. One of the transmissions of the train in the rear of the fourth car was damaged. The components of the broken transmission were scattered around the line from 2 km back from the place that the train stopped. The fire burnt all the six cars of the train.

○ Probable Causes

In this accident, the falling off of the hanger pin for the reduction gear at the rear of fourth car was considered to be the cause of both the axles in the rear bogie of the fourth car, as well as the first axle in the rear bogie of the fifth car, becoming derailed. It is though that events proceeded as follows:

(1) The reduction gear was hanging down around the axle and facing frontward. The propeller shaft was also hanging down at a later stage. These factors resulted in damage to an universal joint and separation of the reducer gear and the propeller shaft.

(2) After the separation, the hanging part of the rotating reducer gear came into contact with one of the 12-RO turnout's lead rail while on the premises of Seifuzan Signal Station. This contact pushed the rear bogie of the fourth car to the left along the rail, causing the first axle and then the second axle to be derailed. The two axles then returned back to the line at the 11-I turnout.

(3) The bevel gears fell off from the hanged reduction gear and into the gauge. The rear bogie of the fifth car came in contact with the bevel gears. This caused the bogie to be pushed up, forcing the first axle to become derailed.

It is thought that the hanger pin for the reduction gear fell off in the following procedure of events. In terms of the cause, it is considered that the irregular circular shape of the left wheel of the first axle in the rear bogie of the fourth car played a role in the occurrence of the large vibration.

(1) The split pins of fluted hex nuts on the hanger pins for the reduction gear and cotter pins on the upper part of the hanger pins suffered a local abrasion due to contact with the other components.

(2) The loosened fluted hex nuts imposed a repetitive load on the split pins, resulting in them falling off.

(3) The fluted hex nuts then loosened even further and fell off.

(4) The cotter pins on the upper part of the hanger pins for the reduction gear fell off due to the repetitive load received from the hanger pins.

(5) After fluted hex nuts and cotter pins fell off, the hanger pins for the reduction gear also fell

from the prop stick of the reduction gear.

The cause of the cars of the train being burnt in this accident is considered to be the damage to the fuel tank at the front of the sixth car. This was caused by the fallen bevel gear of the reduction, which leaked light oil that scattered around the wooden railroad ties. A fire then broke out near the generator or the rear upper edge surface of the engine and spread to a wider area.

A overhaul analysis of the devices under the floor, which suffered considerable damage from the fire, as well as of the devices that generated heat during the operation, revealed that all of them were burnt by an external source. It was therefore impossible to identify the precise point that the fire broke out or its cause.

○ Description of the recommendation to Hokkaido Railway Company

Hokkaido Railway Company should establish proper plans and processes for inspection and thoroughly manage the state of the wheel treads. This is to prevent the use of wheels that have too much abrasion on their tread or too long peels.

② Toyama Chihou Tetsudou, Inc.: Train derailment accident between Kosugi Station and Kamihori Station, Kamidaki Line

(Recommendation issued on July 26, 2013)

○ Summary of the accident

On July 28 2012, a driver was operating a Toyama Chihou Tetsudou No. 624 two-car local train from Iwakuraji Station to Dentetsu-Toyama Station. On the way, he noticed unusual sounds and shocks when stopping at Kamihori Station. He then applied the emergency brake to immediately stop the train. A check after the train stopped revealed that all eight of the axles were derailed.

There were 20 passengers and the driver on board the train. No one was injured.

○ Probable Causes

In our opinion, at the outlet-side transition curve of the left-hand curve, which is followed by a reverse right-hand curve, the lateral displacement of the track (track irregularity) was larger than allowed under the maintenance criteria and decreased the fastening force of the rail fastening system. This caused the lateral force associated with the running of the train to extend the gauge, leading the left wheel inside the rail to derail to the right.

The causes of these are considered to be:

(1) The looseness of the bolts of the line's rail fastening system, which was caused by repetitive lateral force of trains. This had not been modified since the rail had been replaced two months before the accident.

(2) The excessive shifting of track that had not been modified. However the track irregularity was larger than allowed under the criteria for maintenance at the time of rail replacement, the rails had been in use with this situation not being addressed. Also, the result of a regular

inspection on the shifting of track after the rail replacement had remained unanalyzed.

○ Description of the recommendation to Toyama Chihou Tetsudou, Inc.

(1) Toyama Chihou Tetsudou, Inc. (TCT) should establish a solid management system for the maintenance of tracks. Within this system, the measurement results for the shifting of track should be analyzed and evaluated immediately after measurement. Any problems should be quickly resolved in accordance with an established repair plan.

(2) TCT should not only develop a detailed implementation plan regarding the following items, with the active involvement of its business administrations, including its safety management committee, but also properly manage the implementation status of such a plan.

① All the items of the preventive measures defined by TCT in response to the train derailment accident occurred on the premises of Nakakazumi Station in 2008.

② Thorough checks after working on the tracks and management of a fastening system for PC rail ties, as well as the management system for the maintenance of tracks that was developed in (1).

③ Sangi Railway Co., Ltd.: Serious railway incident on the premises of Higashi-Fujiwara Station on the Sangi Line

(Recommendation issued on October 25, 2013)

○ Summary of the serious incident

At about 3:00 P.M. on June 27 2012, one of Sangi Railway Co., Ltd.'s 18-car shunting train (two electric locomotives and 16 freight cars) sets started from the private siding of a cement factory for the downbound main line in Higashi-Fujiwara Station.

The driver of the train set, noticing an abnormal condition when it was passing the Higashi-Fujiwara No. 13-I turnout, immediately applied the emergency brake to stop the train. The first axle in the front bogie of the second locomotive was derailed to the right.

A driver was working in the second locomotive, and two guides were in the first one, as well as a switchman in the third one. None of them were injured.

○ Probable Causes

This serious incident occurred when the set of 18-car shunting train (two electric locomotives and 16 freight cars) was running along the section of the base line side of a turnout that goes in the same direction as the curve. The turnout was in a section that contained four consecutive curves. The situation was attributable to an increase in the derailment coefficient, which occurred at the same time as a decrease in the threshold derailment coefficient. As a result, the right wheel in the first axle of the second locomotive's front bogie subsequently ran up the outside rail and derailed to the right.

The increase in the derailment coefficient is considered to be a result of the increase in lateral force, as well as a decrease in the wheel weight. This situation can be deduced from the following

factors: the track was deformed in a direction that results in the reduction of the radius; the twist of the track increased so that the train leaned to the front right, and; it is assumed that the train was running with excess of cant, which was due to its low-speed. The shift of the axle load due to the power running at an ascent can also be considered as a factor.

The decrease in the threshold derailment coefficient is considered to result from a shifting of track, which is associated with an excessive reduction of the radius, resulting in an increase in the angle of attack for the first axle of the front bogie.

The rapid shifting of track and the increase in twists may have resulted from their poor management of the shapes and shifts of the tracks. They did not understand the specification of plain curves, or did not inspect the shifts of the tracks in the turnouts. As a result, they were not able to recognize that the state of the tracks exceeded the allowances of its maintenance criteria.

○ Description of the recommendation to Sangi Railway Co., Ltd.

Sangi Railway Co., Ltd. should make sure that their tracks are well maintained. They should do so by grasping the design values for maintenance and management and by inspecting shifts properly in accordance with the “Practice Criteria for construction works” in sections involving curves and/or turnouts.

8 Actions taken in response to recommendations in 2013

Actions taken in response to recommendations were reported with regard to one railway accident and one serious railway incident in 2013. Summaries of these reports are as follows.

① Hokkaido Railway Company: Serious railway incident on the premises of Oiwake Station, Sekisho Line (dangerous damage in facilities)

(Recommendation issued on November 30, 2012)

On November 30, 2012, the Japan Transport Safety Board (JTSB) published an investigation report and issued a recommendation to Hokkaido Railway Company, parties concerned, regarding the serious railway incidents that occurred on the premises of Oiwake Station in Sekisho Line between June 14 and June 16, 2011. JTSB then received the following report regarding the measures (implementation plans) to be taken based on the recommendation.

○ Summary of the serious incident

First incident:

On June 14 2011, one of Hokkaido Railway Company’s westbound one-car local trains from Oiwake Station to Sapporo Station departed from Track No. 1 at Oiwake Station on time.

A signaler at the station’s signal cabin noticed that even though the train departed from Track No. 1, the indicator of the track’s starting signal did not light off on the indicator panel to provide an indication to stop. Instead, it stayed lit-up in green. The sequence recorder of the interlocking device

stated that the starting signal did not indicate a red stop light at the time.

Second incident:

On June 14 2011, a westbound four-car local train from Sapporo to Obihiro departed from Track No. 1 in Oiwake Station on time.

The same signaler involved in the first incident noticed that even though the train departed from Track No. 1, the indicator for the track's starting signal did not light off on the indicator panel to provide an indication to stop. Instead, it stayed lit-up in green. The sequence recorder of the interlocking device stated that the starting signal did not indicate a red stop light at the time.

Third incident:

On June 15 2011, a westbound five-car local train from Sapporo to Obihiro departed from Track No. 1 in Oiwake Station on time.

A different signaler from the one involving the first and second incidents noticed that even though the train departed from Track No. 1, the indicator for the track's starting signal did not light off on the indicator panel to provide an indication to stop. Instead, it stayed lit-up in green. A construction worker also confirmed that the starting signal did not indicate the stop signal.

Fourth incident:

On June 16 2011, a westbound one-car local train from Chitose to Yubari departed from Track No. 4 in Oiwake Station two minutes behind the schedule.

A staff other than the ones involved in the first to third incidents noticed that even though the train departed from Track No. 4, the indicator for the track's starting signal did not light off on the indicator panel to provide an indication to stop. Instead, it stayed lit-up in green. The sequence recorder of the interlocking device stated that the starting signal did not indicate a red stop light at that time.

○ Probable Causes

This serious incident can be attributed to an incorrect circuit being made during the improvement work for the future implementation of CTC and PRC. In the circuit, the signal control relay for the starting signals received a feedback current when the westbound starting signals for Sekisho and Muroran lines were set up at the same time. Therefore, it is likely that every time a train reached the westbound starting signal for the Sekisho Line, the signal did not change from the proceed to stop indication.

In its wiring operation:

(1) No switching plugs were used to connect the anodes of the new relays to the existing facilities.

(2) The cathodes of the new relays were connected each other.

(3) New relays had been inserted into the relay rack.

Therefore, if the routes for Sekisho Line and for Muroran Line were set up at the same time, a circuit passing the cathodes of the interconnected new relays would be generated. This would result in the current flowing back into the signal control relay that corresponds to the configured route.

These likely to related to:

(1) Non-compliance with the provisions of its office regulation, which require a switching plug to be inserted into both the anodes and cathodes of the existing facilities when using a switching plug to improve these facilities.

(2) A lack of adherence to the rule that any wiring work to existing facilities that in any way improves an interlocking device as a signaling system should be regarded as having the possibility of influencing the operation of trains.

(3) The absence of a prior check for the portions related to wiring by using wiring diagrams showing the switching plugs. This was the case even though the electric connection diagrams were double-checked.

(4) The wiring was conducted before the wiring diagram had been approved.

(5) Improper progress management for the wiring.

It is possible that the absence of a prior check for the wiring diagrams of the portions was attributable to the situation where both the supervisor and the subcontractor of the wiring were busy with other construction work. This resulted in the omission of a large part of the prior check.

In this case, similar incidents occurred many times. The reasons for thinking this are because: a) even though the signal was not operating correctly (it did not indicate a stop light when it should have), it was not regarded as an incident, b) no emergency contact system was launched, and c) staff members did not properly take over their jobs.

○ Description of the recommendation to Hokkaido Railway Company

(1) Hokkaido Railway Company has defined its preventive measures as being: a) the need to develop a procedure for construction in order to avoid influences on the existing signaling system, including checks for the position of inserted switching plugs and checks for various drawings. As well as, b) the need for the operation manual to describe some of the measures to be taken when a signaler recognizes an event where a signal that should indicate a stop signal is not lighting off properly. These measures are considered effective for the prevention of reoccurrence. However, it is essential to continuously educate the company's employees so that they fully understand the point of these measures and take appropriate measures against any abnormal situations.

(2) The company also experienced a serious incident on the Hakodate Line on January 15, 2009 where a block signal that should have indicated a stop light did not so. This serious incident occurred despite the fact that some of the preventive measures had already been taken after the former incident. Considering this, the company should re-inspect the system for construction and the measurement methods, and train everyone engaged in construction, including outside partners, so that they can acquire the basic operations for construction related to signaling equipment. By doing so, they should discuss safety measures and take all necessary measures

to prevent any more serious events.

○ Measures to be taken based on the recommendation (implementation plan)

I. Ask for that preventive measures be understood and undertake continuous training of employees

1 Measures already taken

After this serious incident, we have taken the following four measures to prevent similar accidents relating to signal wiring:

① When using plug jacks, make sure to disconnect both sides of the wiring so as to avoid wiring to existing facilities while the lines active.

② So as to avoid making a circuit flowing current back into the circuit through relays, no relay should be inserted until the launch of the renewed facility, except for test runs.

③ The wiring of active lines to existing circuits should be treated as a task that can influence the operation of trains. This task should therefore be done only after a temporary stopping procedures for operating equipment.

④ In order to prevent errors in wiring, make sure to use approved drawings. Also make sure to hold a meeting between the supervisor and subcontractors to discuss in detail the specifics of the wiring, necessary procedures, and the impacts on existing facilities. Use the diagrams while doing so. Furthermore, make sure to control the progress of the wiring.

In addition, an instruction for station staff has been added to its station operation manual. It states that if they notice any false signal in the control panel or the display panel, they must force all the signals to indicate stop, as well as notify the train dispatcher and related manager of electric facilities of the event.

2 Measures to be taken later

Continuously conduct the educational training shown in (1) to (3) below, which relates to the purposes of the preventive measures.

(1) Educational training for those engaging in signal work

① For employees engaging in work on the signaling system, the following content should be added in the annual education curriculum developed in the electricity plan division, so that educational training can continue:

i. In the safety training for employees working with electricity, which is performed every year for all employees engaging in work with signaling system, the preventive measures should be taught.

ii. Every year after 2012, a joint education on interlocking devices and wiring should be performed for those who are engaging in the change of interlocking devices. Preventive measures are also taught for this area.

iii. Every year after 2012, we should perform practical trainings relating to the approval of drawings and wiring work, including hands-on training for wiring in training facilities. This is so we can enable anyone to perform wiring work in accordance to the

rules for wiring.

iv. Preventive measures should be taught in the on-site training for signaling protective systems (e.g., level crossing protective devices). These should be guided by the staff of the electricity planning division from 2012.

② Continuously train staff from any subcontractor in accordance with the following content:

i. In the education for those engaging in tasks directly related to the operation of trains, which is conducted every year by the electricity planning division, lectures on the preventive measures should be added to the curriculum for those engaging in the construction of signaling system.

ii. In the lecture about the qualifications that signal work technicians are required to finish once every three years, lectures on the preventive measures should be added to the curriculum.

iii. The purposes for the preventive measures should be added to the training materials produced by the subcontractors. The electricity planning divisions should check the achievement of the subcontractor's training for preventive measures. They should do so by looking at the achievement records.

③ Continued achievement of the education shown in ① and ② should be explicitly stated in our operation manual for construction of the train protection system.

(2) Education and training for station attendants

The following education about operations should be achieved for the station attendants so that they can take preventive measures as well as operation suspension arrangements. This is necessary in case they are forced to stop trains due to an accident or any related risks.

① The station operation manual and other materials should be used for the in-house training for existing station attendants and for the training for new signalers at each station. It should be used to teach detailed operations, such as the structure of automatic blocks and how to use the interlocking devices, as well as how to respond to failures in an interlocking device. The station planning division should make sure it is aware of the staff's degree of understanding and the educational records.

Furthermore, the station planning division should draft a guideline for the education of the station staff that specifies detailed steps, such as the structure of automatic blocks and how to use the interlocking devices, as well as how to respond to failures in an interlocking device.

② The station planning division should add how to respond to failures in an interlocking device to the curricula for the general training for station masters, signalers, and transport officers. The station planning division should grasp the degree of understanding through end-of-course examinations.

(3) Education and training for dispatchers

The example of this set of serious incidents should be added to the case studies of incidents taught in the in-house education. This will ensure that the trainees understand that

when they notice false signals in the display panel, or are notified of false signals in the station, they should set up all the related signals in the station yard to stop and notify the signal and communication dispatchers to inspect the facilities. To continue the education, our guideline for education and training for dispatchers should explicitly state that this item should be taught at least once a year.

II. Safety measures for construction of the signaling system

1 Measures already taken

After this serious incident, the measures of ① to ③ have already been taken as preventive measures:

① To reinforce the construction management systems, we have defined a rule that staff members at our construction technology center, which is in charge of design, should supervise constructions that change the actions of interlocking devices.

② In order to avoid mistakes or leaked items in the wiring diagram and test checklist for interlocking devices, a dedicated checker should be assigned to the electricity planning division to check wiring diagrams and test checklists. This should be done in addition to the conventional checks made by the Construction Technology Center, which is in charge of the supervision and electricity offices responsible for field construction. The reason for this is to reinforce the management system of drawings.

③ Before the launch of new or improved interlocking devices, a launch meeting should be held consisting of a selection of responsible staff. We have thus established a system of mutual checks for in-house examinations and construction structures.

2 Measures to be taken later

The electricity planning division should refer to examples of wiring used by other companies and conduct the following rechecks:

(1) Education and training have been undertaken for those engaging in the construction of signaling systems in the curriculum stated above in section I, such as for preventing serious incidents like this one. However, in addition to this, the staff members of the electricity planning division should also visit the office of the contractor to recheck whether the defined rules are being correctly performed regarding the quality management of documents and the progress for the wiring work. This includes checks for applied drawings, procedures of approval and adherence to the rules.

(2) We should recheck for discrepancies in the related regulations or insufficient content in the preventive measures for case studies of past accidents.

(3) We should immediately take safety measures against any problems identified in the checks stated above in (1) and (2). We should also teach these problems in the education stated above in I if necessary.

Based on the results of the checks the following actions should be taken. Firstly, the field

manager for construction should continuously check whether the defined rules and basic operations are being adhered to. Secondly, the electricity planning division should regularly inspect the items in (1), as well as the performance of safety checks. Thirdly, any problems that need to be corrected should be taught and instructed in a way that allows the workers to acquire the skills for basic operations as soon as they are identified. To realize these actions, standardize the inspection methods for safety checks and countermeasures in regards to problems and results.

* The implementation plan is available on the board's website:
http://www.mlit.go.jp/jtsb/railkankoku/railway-kankoku2re-1_20130220.pdf

② Hokkaido Railway Company: Train Accident on the premises of Seifuzan Signal Station in the Sekisho Line

(Recommendation issued on May 31, 2013)

On May 31 2013, the Japan Transport Safety Board (JTSB) published an investigation report and issued a recommendation to Hokkaido Railway Company, who was responsible for the accident. The report and recommendation were in regards the train accident that occurred on the premises of Seifuzan Signal Station in the Sekisho Line, which was managed by the company, on May 27 2011. The JTSB then received the following report regarding the measures (implementation plans) to be taken based on the recommendation.

○ Refer to "7. Summaries of recommendations and opinions (page 67-①)" for the overview, cause, and recommendation for the accident.

○ Measures to be taken based on the recommendation (implementation plan)

1 Measures already taken

Our vehicle planning division has already taken the following measures to strictly manage the states of wheels and tread surfaces:

(1) Continuous sets of detachments on the tread (detachments from abrasion or from heat cracks) are treated as single detachments. Daily inspections and regular inspections include checks for the state of the wheel treads, including checks for continuous detachments. If the inspection results reveal that the allowable criteria has been exceeded, operations are immediately stopped so that the wheels can be turned or replaced. These measures are to be detailed in the corporate regulation, which states the purpose of establishing a system of continuous inspections.

(2) It was decided in a meeting of wheel inspection managers that all the field staff must be instructed to observe the rule described in (1), in addition to the conventional criteria.

(3) We held a technical session for field managers and wheel management staff to educate them on the importance of wheel management and distinguishing unavailable wheels. We did so by reviewing actual wheels that had been damaged and lectures from wheel manufacturers.

(4) We drafted a document to help educate the wheel managers, and use this to reeducate the wheel management staff and daily inspection staff, as well.

(5) We held a new integrated training, known as the "Wheel Management Course." This was held in order to teach wheel management to the wheel management staff and daily inspection staff. This training should be stated in the Educational Guidance (annual education plan) and be held regularly.

(6) We delivered samples of wheels that contained detachments to the six places where vehicles are arranged. We did so to teach about heat cracks and wheel detachments to the wheel management staff and daily inspection staff.

(7) We determined that the interval of wheel turning, as an indication of car mileage, for the 283 Series diesel railcars is 100,000 km in the summer and 80,000 km in the winter. We made this standard known through the technical sessions for field managers and wheel management staff.

2 Measures to be taken later

To prevent similar accidents from occurring, our vehicle planning division should take the following measures to improve quality:

2.1. Items regarding wheel inspections

(1) Establish a system to constantly check the wheels for states of abrasion and detachment. This includes using a procedure to record any discovered abrasions or detachments below the criteria in the inspection book, which should be inspected again in order to understand how much the wheels have deteriorated.

(2) Staff in our vehicle planning division should visit each field twice a year to understand the status of wheel management and wheel inspections. They should also guide and review the inspection methods if necessary.

(3) Introduction at a system should be discussed as early as possible in order to continuously and quantitatively detect heat cracking and abrasions (including detachments) on the wheel. The system should be able to be executed while the train is operating and should be able to detect issues.

2.2. Items regarding the drafting of wheel turning intervals

(1) Since "detachment through heat cracks" is gradually generated around the wheel surface, we should investigate the relationship that it has with the vibration that occurs while the train is in operation. We should also investigate the progress of the detachment

over a period that covers multiple winters.

(2) Through the achievement of (1), we should try to optimize the wheel turning interval for each type of vehicle.

(3) We should validate the necessity of reviewing conventional criteria for the length of the tread cracks and detachments for high-speed vehicles, as well as for vehicles with wheels that have a small diameter.

* The implementation plan is available on the board's website:
http://www.mlit.go.jp/jtsb/railkankoku/railway-kankoku3re-1_20130809.pdf

9 Information dissemination in the process of investigations in 2013

There were no cases of information dissemination in 2013.

10 Summaries of major railway accident and serious incident investigation reports

The seismic vibration from the main shock of the Great East Japan Earthquake forced a Shinkansen train to be derailed

Train Derailment in Sendai Station, Tohoku Shinkansen Line, East Japan Railway Company

Summary: On Friday, March 11, 2011, a ten--car train set departed from the Sendai rolling stock depot on time at 2:40 P.M. During the train's entrance into Sendai station at 72 km/h, the driver felt a strong tremor and noticed at the same time that the stop signal had been activated in the cab signal. the driver immediately applied the emergency brake. After the stop, a review from inside and outside of the cars revealed that both axles in the front bogie of the fourth car had become derailed to the left.

It was a test run, and 12 vehicle inspectors and one crew member were on board. However, no one was killed or injured.

At 2:46 P.M. on the day that "the Great East Japan Earthquake" occurred, which had a moment magnitude of 9 centered at the shore of Miyagi Prefecture, the maximum seismic intensity of 7 was observed in the north of Miyagi Prefecture.

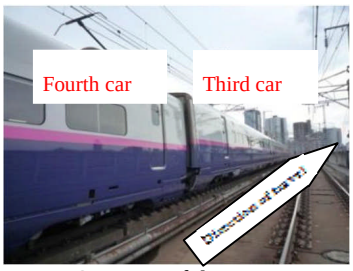
Findings

The train stopped just after the cars received strong horizontal vibrations. After that, vehicle inspectors confirmed the derailment. The train is presumed to have derailed due to the seismic vibrations from the main shock of the Great East Japan Earthquake.

It is somewhat likely that the external force of the Earthquake's seismic vibration caused the train to undergo upper center rolling (*1), which means that the wheels of both sides severely hit the rails as the train rolled.

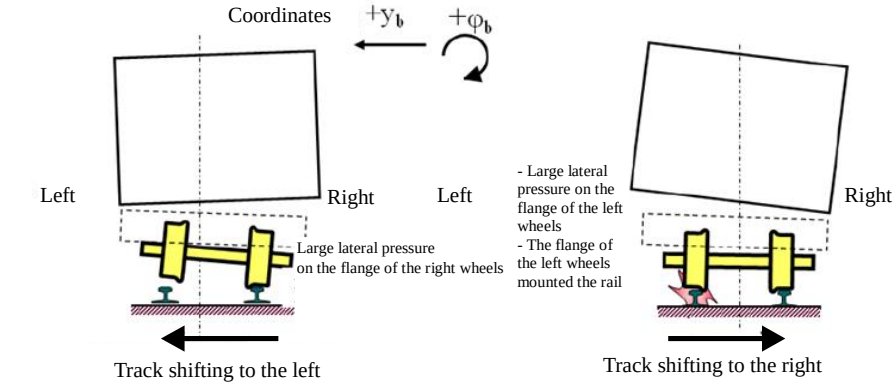
Considering the results of the vehicle movement simulations, the upper center rolling could have been caused by the large shaking at the No.3 Odawara viaduct, which had a frequency exceeding 1.5-1.7 Hz. Shaking of this magnitude is prone to generating upper center rolling of an orthogonal direction in the rails).

It is considered probable that out of the frequency components of the earthquake's seismic vibrations, the vibrations around 1.8 Hz, which are the natural frequency of the bridge, have enlarged significantly by resonance, even more so than the other frequency ranges.



Situation of the train

*1 The rotating movement of vehicles that is centered on the antero-posterior axis is called rolling; if the center of the rolling is above the barycenter, it is called "upper center rolling." It is also called "lower center rolling" if occurs under the barycenter. Whether the center of rolling is upper, lower, or a combination of both depends mainly on the vibration frequency.



(a) Large lateral pressure on the right wheels at near 60.5 sec
Left wheels rose 63 mm at near 60.6 sec

(b) Large lateral pressure on the left wheels just before 60.8 sec
Wheel flange just above the rail at near 60.8 sec

Movement of the train and cars just before derailment (conceptual diagram)

Vehicle Movement Simulation

We conducted a vehicle movement simulation that was similar to the method used to determine the cause of the train derailment accident in the Joetsu Shinkansen Line, which was caused by the Niigata Chuetsu Earthquake. (Simulation times are shown on the left)

Probable causes: It is considered highly probable that the train was derailed by the seismic vibration of the main shock from the Great East Japan Earthquake. It is also considered highly probable that, when the accident occurred there were no problems with the railway facilities including the tracks, the train or any of its operations. Furthermore, the time of the derailment is thought to be just after the time when the main shock from the Great East Japan Earthquake had arrived at Sendai city.

For details, please refer to the investigation report.
(Published in Japanese on February 22, 2013)
http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2013-1-1.pdf

A train moved onto the turnout's tongue rail, traveled in the incorrect direction, and then derailed

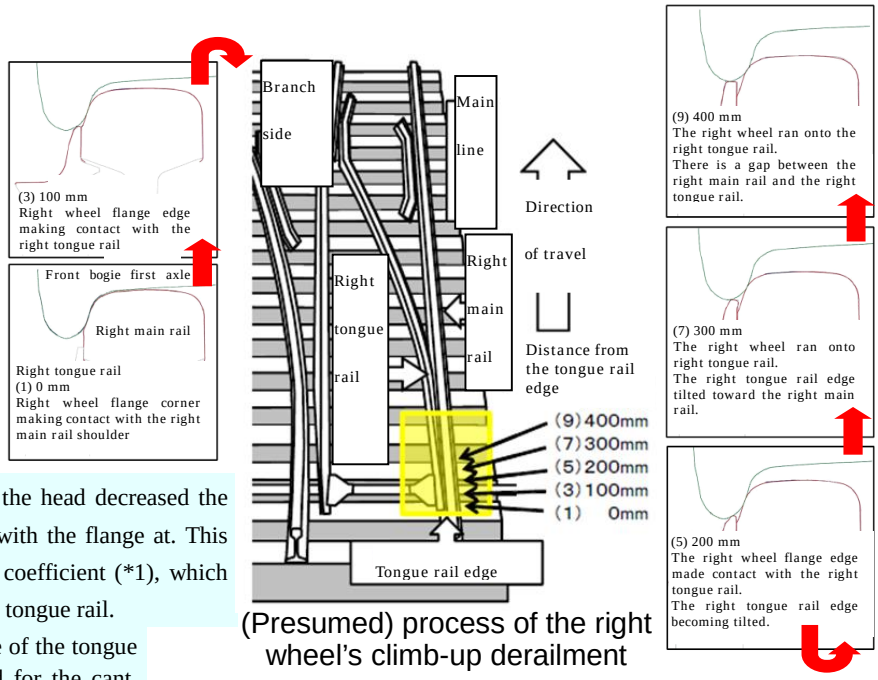
Train derailment accident in Higashi-murayama Station, Seibuen Line, Seibu Railway Co., Ltd.

Summary: On Saturday, December 24, 2011, an eight-car upbound train set departed from Seibuen Station on time. After passing turnout No. 67 on the premises of Higashi Murayama Station at a speed of 32 km/h into Track 5 of the station, the driver of the train felt as if the train was being pulled from behind when the front part of the train passed near I-RO turnout No. 66. Immediately after noticing this, the driver checked the instrument and noticed that the driver-noticing light had turned off for a moment. The driver then applied the emergency brake immediately. The train stopped after traveling for about 21 m after the brake. A survey after the stop revealed that the first and the second axles in the front bogie of the seventh car had become derailed to the right.

Out of the approximately 450 passengers and two crew members on board, no one was killed or injured.

Findings

It is considered probable that at curved turnouts in the same direction, if there is an excessive difference in the number of trains running between the main line and the branch line, the progress of abrasion in the rails will be also different between the lines, the gap between the main line rails and the tongue line rails was occurred to be a result of these differences, and the reason that the tongue rail head tilted towards the main rail.



(Presumed) process of the right wheel's climb-up derailment

It is considered probable that the tilt of the head decreased the angle that the tongue rail made contact with the flange at. This resulted in a lower threshold derailment coefficient (*1), which made it easier for the train to run onto the tongue rail.

The speed at the time of passing the edge of the tongue rail was lower than the balancing speed for the cant. Therefore, it is considered highly probable that, compared to the static wheel loads, the load on the left wheel increased while the load on the right wheel decreased.

With the increasing pressure to one of the axles from a left wheel to the right direction (lateral pressure), in addition to the decreased load on the right wheel, it is considered probable that the derailment coefficient probably increased. Derailment coefficient refers to the ratio of lateral pressure and the wheel load.

*1 The "threshold derailment coefficient" is calculated from the balancing equation of the wheel loads and the lateral pressure that affect the point of contact between the rail and wheel flanges when the wheel flange slides up on the rail. The larger the coefficient of friction, or the smaller the angle of contact (the angle of the wheel flange), the lower the threshold derailment coefficient becomes. When a derailment coefficient gets larger than the threshold, the possibility of derailment becomes greater.

*2 The "angle of attack" is the relative angle of the rolling wheel and the rail. The larger the angle is, the more dangerous the derailment becomes.

At turnout No. 67, the curve radius rapidly reduced from 300 m to 184 m. It is considered probable that this leads the angle of attack (*2) to increase.

As described above, it is considered probable that the branch line side of the turnout was prone to producing climb-up derailments. This is due to multiple factors. It is considered probable that this situation caused the vehicle to derail.

Probable causes: It is considered probable that this accident is thought to have the following background. The right wheel of the first axle in the front bogie of the seventh car slid up onto the outer tongue rail of No. 67 curved turnout in the same direction. This forced the train to enter the wrong direction to the main line side. The train was then pulled by its front cars in the branch line, causing the seventh car to become derailed to the right of the branch line rail.

For details, Please refer to the investigation report.
(Published in Japanese on February 22, 2013)
http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2013-1-2.pdf

Reduction gear parts fell from a diesel car that made contacted with a bogie, leading to derailment and fire

Train derailment accident at Seifuzan Signal Station, Sekisho Line, Hokkaido Railway Company

Summary: On Friday, May 27, 2011, a six-car upbound train set limited express train (Super Ozora 14) departed from Tomamu station two minutes behind schedule. While running the train for Seifuzan Signal Station, the conductor, who was in the conductor's cabin on the fourth car, heard unusual sounds and felt vibrations. The conductor notified the driver of the event. The driver immediately made arrangements to stop the train in the signal station's tunnel. Thereafter smoke from a fire that broke out in one of the cars poured inside of the other cars. The driver tried to move the train out of the tunnel, but the train would no longer start. The first axle in the rear bogie of the fifth car was derailed to the left, and the transmission at the rear of the fourth car was damaged. The components of the broken transmission were scattered around the line from 2 km back from the place that the train had stopped. The fire burnt all six of the train's cars.

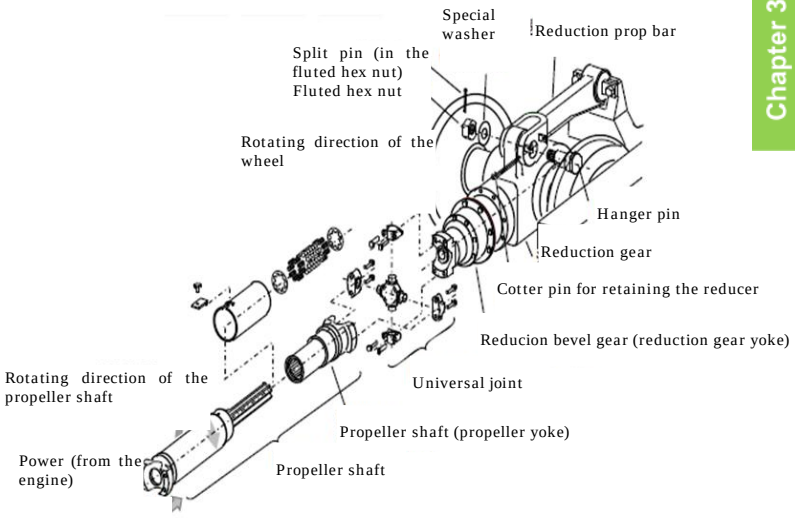
There were 248 passengers, the driver, the conductor and two crew members on board in the train. All of them escaped out of the tunnel on foot. 78 passengers and the conductor got injured.

Findings

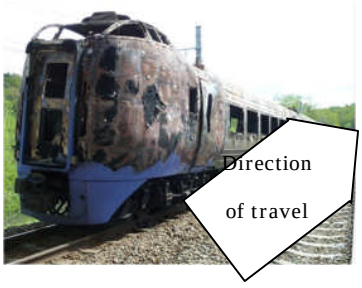
Operating with irregularly shaped wheels and dented tread can give significant vibrations on unsprung devices. It is considered probable that this leads to bolts loosening and devices falling out.

It is considered probable that the reason the fluted hex nuts' hanger pins fell off could be due to the repetitive effects of vibrations during the operation.

The hanger pins for the reduction gear fell off and then the reduction gear and propeller shaft started hanging down. This caused the reduction bevel gear on the universal joint to begin making contact with the propelling axle. After this, it is considered probable that the bevel gear was further dangled, resulting in the universal joint becoming locked and damaged.



Transmission system in the vehicle



Status of the burnt cars

The universal joint that was damaged could have led to the separation of the reducion gear and the propeller shaft. The external cylinder and the joints of the shaft had then fallen off, and lubricant oil had become scattered from the reducer. The reducion bevel gear dangled down began making contact with the sleepers. On top of this, the damaged reduction gear box then hit the dangled the reduction bevel gear, which is thought to have then caused the rear bogie of the fifth car to be pushed up, resulting in the first axle becoming derailed to the left.

The cause for the cars of the train to become burnt in this accident is thought to be the damage to the fuel tank at the front of the sixth car. This caused the light oil to scatter around the incinerated wooden rail sleepers. As a result, a fire broke out and spread from near the generator or the rear edge surface of the engine. It then expanded into the cars by entering in through their side windows.

Probable causes: This accident can be summarized as follows. It is considered probable that the hanger pins supporting the reduction gear at the rear of the fourth fallen off and by the reduction gear dangled and damaged both the axles in the rear bogie of the fourth car, as well as the first axle in the rear bogie of the fifth car to become derailed. The cars were burnt because of the leaked light oil that scattered around the wooden rail sleepers from the fuel tank at the front of the sixth car, which was damaged by the fallen bevel gear of the reduction gear. The oil caused the fire to break out near the generator or the rear edge surface of the engine. The fire then spread across a wide area.

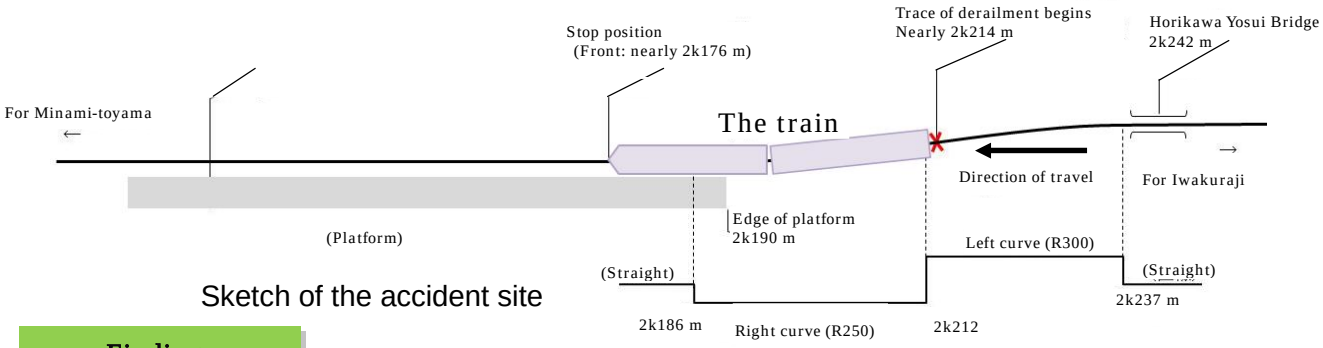
For details, please refer to the investigation report.
(Published in Japanese on May 31, 2013)
http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2013-4-1.pdf

By the fastening force of the rail fastening system degraded,facilitated gauge expansion due to lateral pressure, leading to derailment

Train derailment accident between Kosugi Station and Kamihori Station, Kamitaki Line Toyama Chiho Railroad Co., Ltd.

Summary: On Saturday, July 28, 2012, the driver of a two-car upbound train set noticed unusual sounds and shocks when stopping at Kamihori Station during a one-man operation. The driver applied the emergency brake to immediately stop the train. A check after the stop revealed that all the eight axles of the car had become derailed.

There were twenty passengers and two drivers on board the train. No one was killed or injured.



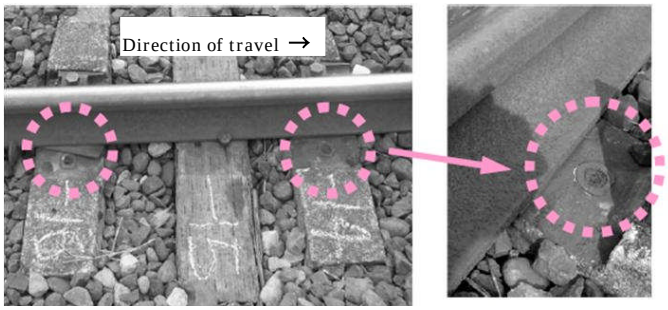
Sketch of the accident site

Findings

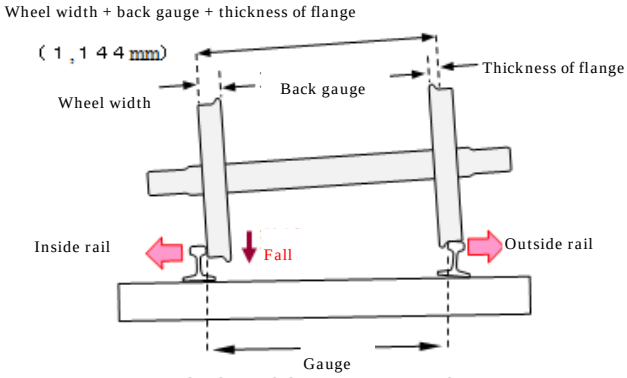
The irregularity of gauge exceeded the limit allowed in the maintenance criteria from two months prior, when the rails had been replaced. The degree of shifting is considered to have become slightly larger after the replacement.

Pushing force was applied in the direction from the inside to the outside rail while its wheelsets were running on the curve, probably leading to an enlargement in lateral pressure on the wheels on the outside rail.

The company did not have any knowledge or experience in tightening the fastening bolts. As a result, the bearing capacity of the rail fastening system near the accident site got lower and lower as external forces from passing trains were repeatedly applied on the system.



Damage of inserts of rail fasteners on PC



Relationship between the rails and wheelset

Over a period of two months prior to the accident, the traffic of trains continuously reduced the capacity to bear the rails. As a result, it is considered probable that the irregularity of gauge have increased.

With the significantly weakened fastening force of the rail and the increased the irregularity of gauge, the left wheels of the first axle in the first car fell between the rails from the left rail head. It is considered probable that this caused the irregularity og gauge to become wider toward the right, causing all of the left wheels of the second axle in the first car and behind to fall between the rails near the site.

Probable causes: It is considered probable that, at the outlet-side transition curve of the left-hand curve that is followed by a reverse right-hand curve, the lateral displacement of track (the shifting of track) was larger than allowed by the maintenance criteria. This decreased fastening force of the rail fastening system and made the action of lateral force associated with the running of the train extend the gauge, leading to the derailment of the left wheels between the rails.

For details,please refer to the investigation report.
(Published in Japanese on July 26, 2013)
http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2013-6-3.pdf

A landslide caused by heavy rain piled up earth and sand on the track, causing derailment

Train derailment accident between Oppama Station and Taura Station, Main Line of Keikyu Corporation

Summary: On Monday, September 24, 2012, an eight-car train set departed from Oppama station one minute behind schedule. During a coasting operation at 72 km/h, the driver noticed a pile of earth and sand on the railway approximately 30 to 40 meters ahead. Although the driver immediately applied the emergency brake, it was too late to avoid running onto the piled-up sand. The train stopped after traveling approximately 84 m further. All four axles in the first car, both the axles in the front bogie of the second car, and both the axles in the front bogies of the third car became derailed to the right. When the train stopped, the section of the train from the first car to the middle of fourth car was in the tunnel.

Out of the approximately 700 passengers and two crew members on board the train, 55 passengers and the driver were injured.

Findings

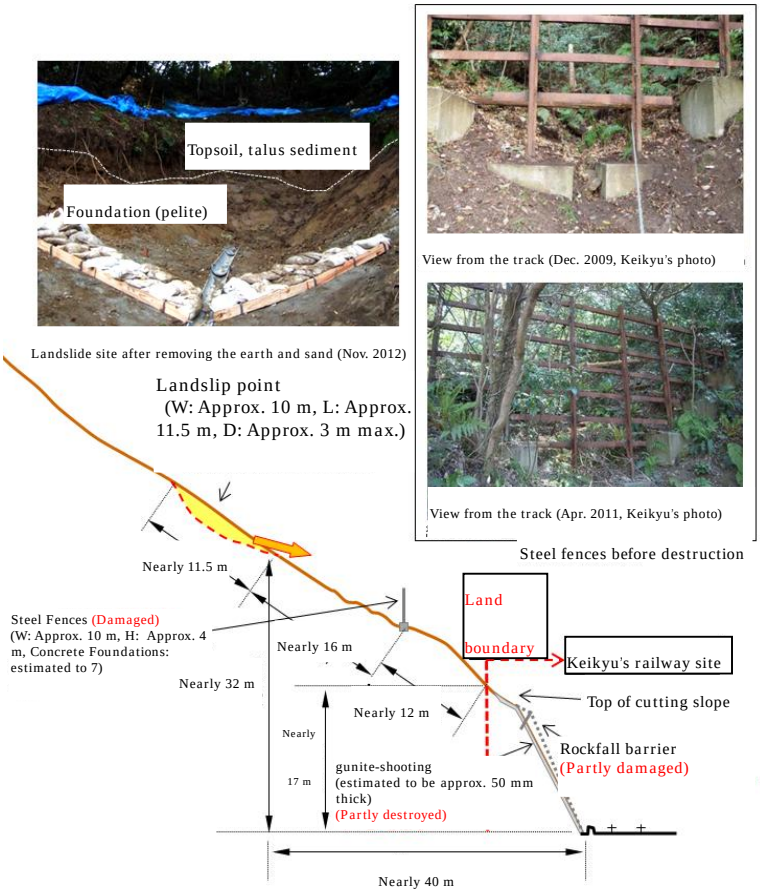
It is considered highly probable that a large amount of rain was falling for a short time around the slope at the time of the accident.

It is considered probable that the surface, as well as the top of the bedrock layer under the surface around the site of the landslide, had become fragile due to the long-term influence of rainfall and springwater.

Although the area (including the landslide site) above the cut slope face where the steel fences were is private land, it is considered highly probable that the area (including the fences) had been viewed as a survey area that should be paid attention to.

Earth and sand containing large amounts of water from heavy rain flew down from the slope failure nearly 20 m above the steel fences. It is considered probable that the multiple concrete foundations collapsed in the slope or fallen to the bottom of the slope.

It is considered highly probable that the train collided with a pile of earth, sand, and one of the concrete foundations, which had all become accumulated on the track. The front bogie then ran onto the foundation, resulting in derailment, with the bogie jumping up one meter.



Conditions of the slope and landslide site

Probable causes: It is considered highly probable that this train derailment accident was caused by the accumulated earth and sand, which contained a concrete foundation, flowing down from the collapsed slope face, and then the front bogie ran onto them. It is considered highly probable that the concrete foundation that came into contact with the first car's bogie made the situation even worse. It is considered probable that the cause of this landslide is to be the rise in the level of groundwater in the surface of the slope. It is considered somewhat likely that this happened due to the large amount of rainwater that fell on the surface, as well as on the top of the bedrock layer under the surface, which had possibly become fragile. It is unclear why the steel fences' concrete foundations, which were built on the slope, fell down. This is due to a lack of records detailing the reasons for building the fence, or structural drawings. However, it is considered somewhat likely that the cause was the deterioration of the foundation, in addition to the flow of an amount of earth and sand that was larger than expected in the original plan.

For details, please refer to the investigation report.
(Published in Japanese on September 27, 2013)
http://www.mlit.go.jp/jtsb/railway/rep-acci/RA2013-8-3.pdf