D.nr. 127/5R

# NIB ANNUAL REPORT 2022

Safety Investigation Authority

FINLAND

# PREFACE TO THE REPORT

This is the annual report of railway sector of the Safety Investigation Authority, Finland for calendar year 2022.

## National investigation ID

From the beginning of year 2012 the identifying of accident investigation reports has been changed.

## The new identifier

### Accident/incident categories

L - Aviation accidents and incidents
R - Rail accidents and incidents
M - Marine accidents and incidents
Y - Other accidents and incidents
T – Social and healthcare accidents and incidents
P - Exceptional events

**Investigation identifier**

Each investigation is designated by an identifier that consists of three parts, such as R2012-01.

- The first part refers the accident category (L, R, M, Y, T or P).
- The second part refers to the year of the accident.
- The third part is a sequence number referring to the order of the accident within its accident category in the year in question. “S” in the beginning of the number means that the investigation is a theme investigation (safety study).

## The old identifier

### Terms used in this report:

| Investigation categories | |
|---|---|
| A-investigation | Major accident |
| B-investigation | Accident or serious incident |
| C-investigation | Incident, damage or minor accident |
| D-investigation | Other incident |
| S-investigation | Safety study |

**Investigation identifier:**

Each investigation is designated by an identifier that consists of four parts, such as A1/1998R.

The first part refers to the investigation category (A, B, C, D or S).
The second part is a sequence number referring to the order of the accident within its accident category in the year in question.
The third part refers to the year of the accident.
The fourth part indicates the accident category (L, R, M or Y).

E.g. A1/1998R refers to the first major railway accident investigation in 1998.

## CONTENTS

# 1 INTRODUCTION TO THE INVESTIGATION AUTHORITY

## 1.1 Legal Basis

The Safety Investigation Authority, Finland was founded in 1996 in connection with the Ministry of Justice. The tasks of the Safety Investigation Authority are specified in the relevant national Finnish act (Safety Investigation Act 525/2011), and they also include overall directions on the methods and powers implemented in an investigation. In Finland the Safety Investigation Authority is a multimodal investigation authority, which investigates aviation, maritime, rail, other accidents and incidents and social and healthcare accidents and incidents. The Safety Investigation Act also provides for the procedure to be followed in the event of exceptional and very serious events that, while not accident, have threatened or seriously damaged the basic functions of the society. The Safety Investigation Act also enables the investigation of several similar accidents or incidents to be investigated jointly as a safety study.

The current Safety Investigation Act is in harmony with to the Railway Safety Directive.

## 1.2 Role and Mission

**The purpose of safety investigation is to promote general safety and to prevent any new accidents from occurring.**

Safety investigation examines the course of events related to the accident or incident, its causes and consequences, search and rescue operations as well as actions taken by authorities. The investigation specifically examines whether safety has adequately been taken into consideration in the activity leading up to the accident and in the planning, manufacture, construction and use of the equipment and structures that caused the accident or incident or at which the accident or incident was directed. The investigation also examines whether the management, supervision and inspection activity has been appropriately arranged and managed. If necessary, the investigation also examines possible defects in the provisions and orders regarding safety and the authorities. The goal of safety investigation is to discover factors and background causes contributing to the accident or incident in addition to its immediate cause, which may be found in e.g. the organisation, the instructions or the working methods.

When taking a decision to investigate, the seriousness and the probability that such an incident will recur are considered. An incident (or hazard) with minor consequences should be investigated if several people are in danger and if the investigation is estimated that the investigation significantly improves general safety and can prevent future accidents from occurring. SIAF does not, in general, investigate accidents and incidents that are caused deliberately or are the result of an offense.

Once a safety investigation is completed, an investigation report is published. The report contains safety recommendations that address specific issues uncovered during investigations and specify actions to help prevent similar accidents from occurring in the future. The recommendations are addressed to appropriate authorities in charge of implementing the critical changes needed to prevent future accidents and incidents from occurring.

SIAF monitors the implementation of recommendations. The purpose of safety investigation is to promote general safety, prevent further accidents and incidents from happening again, and prevent losses caused by accidents.

Safety investigations are not conducted to allocate legal liability. Other authorities and agencies are responsible for that task.

**Task of Safety Investigation Authority**

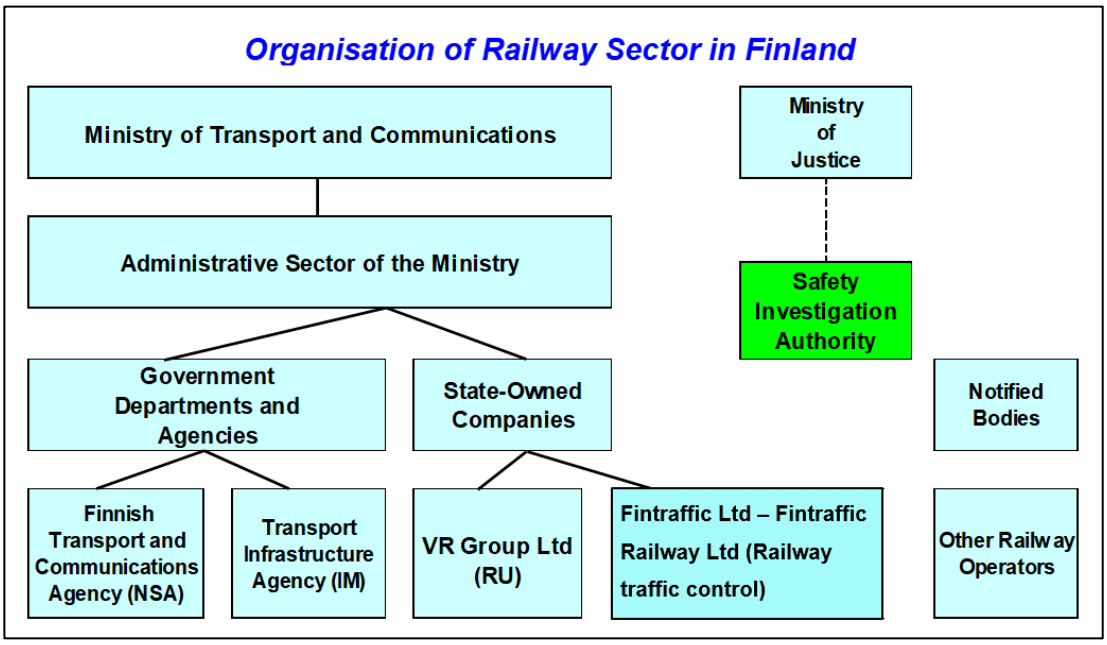
The Safety Investigation Act (525/2011) defines the task and the mandate of SIAF. The Safety Investigation Act of Finland provides for the types of accidents and incidents investigated by SIAF and how they are investigated.

**The task of the Safety Investigation Authority is to investigate all major accidents and serious incidents regardless of their type, as well as aviation, rail traffic and maritime traffic accidents and incidents.**

The Safety Investigation Authority

- ensures the general organisation, planning, guidance, provision of information, and supervision of the safety investigation
- trains persons suitable to be investigators
- maintains readiness to quickly initiate an investigation
- attends international cooperation fora connected with the safety investigation field
- issues safety recommendations and monitors their implementation.

## 1.3 Organisational flow



# 2 INVESTIGATION PROCESSES

## 2.1 Cases to be investigated

**Accidents and incidents to be investigated:**

- **Rail traffic accident**, which due to fatalities or injuries, the extent of damage incurred to the environment, property or assets, or nature of the accident can be regarded as particularly serious (**major accident**)
- **Serious railway accident** as specified in Article 3 of the Directive (EU) 2016/798 of the European Parliament and of the Council on railway safety.
  - **train collision** (with another train, a shunting unit or an object or obstacle within the clearance gauge) or **derailment**, resulting in the death of at least one person or serious injuries to five or more persons, or extensive damage to the rolling stock, the infrastructure or the environment (in excess of EUR 2 million)
  - any other railway accident with similar consequences, which has an obvious impact on railway safety (safety regulation or safety management)
    - level crossing accident, resulting train derailment, or resulting in the death of at least one or serious injuries to five or more members of the train crew or passengers, or if the accident was result of failures within the railway system, or which due to deaths or injuries, the extent of damage incurred to the environment, property or assets, or nature of the accident can be regarded as particularly serious.
    - **accident to persons** involving rolling stock in motion at a station or railway yard (personnel, passengers), or in connection with a track maintenance operation (personnel)
    - fire in rolling stock when running between the departure station and the destination (including when stopped at the departure station, the interim and destination stops), and re-marshalling operations.
    - other type of accident
- and **any similar accident in private or public rail traffic**
  - metro accident
  - tramway accident.

A serious incident and another accident or incident may be investigated in accordance with the Safety Investigation Act. Also, a joint investigation of several similar accidents or incidents may be conducted in accordance with the Act.

## 2.2 Institutions involved in investigations

The Safety Investigation Authority, Finland can investigate all rail accidents. Those investigations are independent and reports thereof are public. According to The Rail Transport Act (1302/2018) the Finnish Transport and Communications Agency can investigate those occurrences that SIAF does not investigate. The investigation reports of the latter are not public.

**Level crossing accidents**

Road accident investigation teams investigate all fatal road and off-road traffic accidents in Finland, including level crossing accidents. Preventing them is crucial from the human perspective in particular, but also from the economic perspective. In addition, the teams investigate on project basis accidents that have caused serious personal injury and property damage to clarify certain specific questions.

The main aim of the investigation is to promote road safety. Accident investigations do not comment on guilt or compensation issues.

Investigation is regulated by legislation on the investigation of road and off-road traffic accidents (Act on the investigation of road and off-road traffic accidents, 1512/2016).

The Finnish Crash Data Institute (OTI) coordinates the work of road accident investigation teams but does not intervene in the independent working of the teams. OTI also takes care of the training of the teams, the use of investigation results, and information services.

There are 20 investigation teams operating in different parts of Finland. They have a total of approximately 300 members. The teams are mainly positioned according to the current regional borders. The teams independently study the reasons for road accidents and make proposals to improve safety. The investigation team members are subject to public liability and a non-disclosure obligation.

The task of road accident investigation teams is to determine the underlying reasons for an accident and to propose the necessary actions to improve traffic safety. The material collected is used in traffic safety work, the work of public authorities, international cooperation and communication. The teams do not investigate guilt or compensation issues related to accidents.

In addition to the above about the investigation of road and off-road accidents, the SIAF can investigate any accident which has taken place in Finland, including road and off-road accidents. When the SIAF has initiated an investigation, any other authority or instance that has initiated a safety investigation shall transfer any investigation material it has compiled to the SIAF. Finally, it is worth mentioning that the SIAF has investigated about 80 level crossing accidents and made four safety studies on level crossing accidents.

## 2.3 Implementation of the Commission implementing Regulation (EU) 2020/572

Investigation reports of the Safety Investigation Authority, Finland are issued following the structure described in Regulation (EU) 2020/572, as closely as possible and adapted to the type and seriousness of the accident or incident.

Summary, Conclusions and Safety Recommendations are written in a second official European language (in English and in Swedish). These translations are published at the same time as the investigation report.

SIAF sends the investigation report in Finnish and the translated parts of it in English to the Agency (ERA) in a digital format immediately after the report has been published (at the latest within 7 days).

In the following paragraphs is described, how SIAF's investigation report structure compares to the general EU/ERA structure as set in the appendix.

**1. Summary**

SIAF drafts a summary of every investigation report. The matters which have been presented in the appendix have been dealt with in the report. The summary is not the 1st section in the report but we publish it separately.

**2. Investigation and its context**

The matters that have been presented in this section have been dealt with in our investigation report in the section *Preface*, except for point 7 which has been presented in other parts of the report.

**3. Description of the occurrence**

The matters mentioned in the subsection *(a) The occurrence and background information* are handled as follows:

- Points 1, 2, 4, 5, 7 and 8 have been processed in separate *Data Summary*.
- Point 3 is in subsections *2.1 Environment, systems and equipment* and *2.2 Conditions* of the section *2 Background information*.
- Point 6 is in subsection *2.4 Personnel, organisations and safety management* of the section *2 Background information*.

The matters mentioned in the subsection *(b) The factual description of the events* are handled in section *1 Factual information*.

**4. Analysis of the occurrence, where necessary in respect of individual contributing factors**

The matters that have been presented in this section have been dealt with in our investigation report in the section *3 Analysis*. In our report the rescue operations and the actions of all relevant authorities are also analysed

**5. Conclusions**

The matters that have been presented in this section have been dealt with in our investigation report in the section *4 Conclusions*.

**6. Safety recommendations**

The matters that have been presented in this section have been dealt with in our investigation report in the section *5 Safety recommendations*.

**Table of contents of SIAF's safety investigation reports**:

# 3 INVESTIGATIONS

## 3.1 Overview of investigations completed in 2022, identifying key trends

| Type of accidents investigated | Number of accidents | Number of victims | | Damages in € (approximation) | Trend in relation to previous year |
|---|---|---|---|---|---|
| | | Deaths | Seriously Injured | | |
| **Collisions** | 0 | 0 | 0 | 0 | 0 |
| **Derailments** | 1 | 0 | 0 | 0,17 million | 0 |
| **Level crossing accidents** | 1 | 0 | 1 | 0,1 million | 1 |
| **Other** | 2 | 0 | 0 | R2021-01, over 2 million, R2021-04 0,45 million | 0 |

## 3.2 Investigations completed and commenced in 2022

### Investigations completed in 2022

| Date of occurrence | Title of the investigation (Occurrence type, location) | Legal basis | Completed (date) |
|---|---|---|---|
| 5.6.2021 | R2021-01 Fire in the Dm12 rail bus between Huutokoski and Siikamäki in Joroinen on 5 June 2021 (ERA FI-10069) | I (2) (a) | 4.5.2022 |
| 3.7.2021 | R2021-02 Derailment of a freight train in Vesanka on 3 July 2021 (ERA FI-10083) | I (2) (c) | 19.4.2022 |
| 5.10.2021 | R2021-03 Level crossing accident in Kaskinen, 5 October 2021 (ERA FI-10140) | I (2) (c) | 29.9.2022 |
| 2.12.2021 | R2021-04 R2021-04 Derailment of a train transferring rolling stock in Oulunkylä on 2 December 2021 (ERA FI-10162) | I (2) (c) | 13.9.2022 |

### Investigations commenced in 2022

| Date of occurrence | Title of the investigation (Occurrence type, location) | Legal basis |
|---|---|---|
| N/A | N/A | N/A |

**The Legal Basis for the decision to investigate accident/incident:**

I National rules imposed by implementing of the Directive on railway safety
- (1) in light of Article 20, §1
- (2) in light of Article 20, §2
  - (a) the seriousness of the accident or incident
  - (b) it forms part of a series of accidents or incidents relevant to the system as a whole
  - (c) its impact on railway safety on a Community level
  - (d) requests from infrastructure managers, the safety authority or the Member State
- (3) in light of Article 22
  - (§5) cross-border investigation or request to assistance
  - (§6) other reasons than those referred to in Article 20

II Other national rules/regulations (covering possible areas excluded in Article 2, §2 and §3)
- (2) (a) metros
- (2) (b) trams and other light rail systems
- (2) (c) networks that are functionally separate from the rest of the railway system

(3) (a) privately owned railway infrastructure, including sidings, used by the owner or by an operator for the purpose of their respective freight activities or for the transport of persons for non-commercial purposes, and vehicles used exclusively on such infrastructure
(3) (b) infrastructure and vehicles reserved for strictly local, historical or tourist use
(3) (c) light rail infrastructure occasionally used by heavy rail vehicles under the operational conditions of the light rail system, where it is necessary for the purposes of connectivity of those vehicles only
(3) (d) vehicles primarily used on light rail infrastructure but equipped with some heavy rail components necessary to enable transit to be affected on a confined and limited section of heavy rail infrastructure for connectivity purposes only

III Other national rules/regulations not referred to the Safety Directive.

## 3.3 Safety Studies completed and commenced in 2022

### Safety Studies completed in 2022

| **Date of commission** | **Title of the Study** (Occurrence type, location) | **Legal basis** | **Completed** (date) |
|---|---|---|---|
| N/A | N/A | N/A | N/A |

### Safety Studies commenced in 2022

| **Date of commission** | **Title of the Study** (Occurrence type, location) | **Legal basis** |
|---|---|---|
| N/A | N/A | N/a |

## 3.4 Summaries of investigations completed in 2022

**R2021-01 (ERA FI-10069)**

**Fire in the Dm12 rail bus between Huutokoski and Siikamäki in Joroinen on 5 June 2021**

A train consisting of two Dm12 rail bus units was travelling from Joensuu to Pieksämäki via Varkaus on Saturday 5 June 2021. While the train was in Joroinen between Huutokoski and Siikamäki, the fire extinguishing system in the engine compartment of the first unit of the train sounded the fire alarm at 17:30.

The train driver knew the section of track well and stopped the train at an advantageous location with regard to evacuation of the passengers and access to the site by pump crews. After stopping the train, the driver started to evacuate the passengers from the unit that was on fire. The driver confirmed the functioning of the extinguishing system from the function button in the cab and took a portable fire extinguisher along from the cab. The driver attempted to extinguish the fire through a crack in the casing of the engine compartment but failed.

After the extinguishing attempt, the driver disconnected the rail bus units from each other and moved the other unit to a safe distance from the unit that was on fire. After this, the driver reported the fire to the Emergency Response Centre and returned to continue first-aid extinguishing in the unit on fire. However, extinguishing was not possible with the carbon dioxide fire extinguishers found in the cab. The extinguishing attempts were also hindered by the large amounts of smoke generated that prevented the use of the extinguishing holes in the engine compartment casing.

The accident did not result in personal injuries. The dangerous situation occurred, because the evacuation of a passenger with reduced mobility was difficult due to the height difference between the lowest step of the carriage door and the bank of the railway track. There were no instructions for the evacuation, and it had not been practised.

The rail bus sustained considerable damage in the fire. The fire started due to a crack in the fuel return pipe. Fuel leaked inside the engine compartment casing, impregnating the combustible material accumulated there, which caught fire due to the heat of the turbocharger. The structure of the engine compartment of a rail bus allows impurities to accumulate inside the casing, creating favourable conditions for a fire. The purpose of the casing is to prevent problems caused by the snow and ice that accumulate around the engine during winter. Cleaning the space in railway yard conditions is difficult.

Several fires have occurred in rail buses during 2008–2021. In the incidents, it has been necessary to evacuate the passengers either on the tracks or at a halt or station. More than half of the fires

occurred at a time when there were no train personnel in the passenger cabin, and the train driver took care of the evacuation.

There are risks involved in working alone. If the train driver is incapacitated, the evacuation and its implementation depend completely on the passengers. Despite the recurrent fires, the risk assessment of working alone has not been updated in this respect after the arrangement began in 2015. The similar safety deviations caused by the eight fires that have occurred since then have not initiated a new risk assessment, even though the deviations were handled in accordance with the operator's safety management system.

In order to improve the fire safety of the Dm12 rail bus stock, the Safety Investigation Authority, Finland, issues the following recommendations:

1. *VR-Group Ltd ensures that the rolling stock is maintained in the safe condition required by the authorisation for placing in service.*

2. *The railway operators inspect the types of extinguishers available on the rolling stock and ensure that they have been selected correctly in relation to the most likely types of fire.*

3. *VR-Group Ltd updates the risk assessment concerning the effects of removing train personnel from the Dm12 rolling stock and takes the risks of fire and the potential inability of the driver to function into account in it in particular.*

4. *The Finnish Transport and Communications Agency develops its operating methods and the focus of its supervision to ensure the functioning of the operators' self-monitoring and handling of deviations in practice.*

5. *The European Union Agency for Railways (ERA) investigates the potential of expanding the possibilities of the national safety authority to monitor the operators in the field in practice.*

**R2021-02 (ERA FI-10083)**

**Derailment of a freight train in Vesanka on 3 July 2021**

The six last wagons of a freight train that was transporting empty timber wagons from Jyväskylä to Alavus were derailed in Vesanka on the section of track between Jyväskylä and Haapamäki on 3 July 2021. No personal or environmental damage was caused by the accident. The track also sustained damage over a distance of approximately 1400 metres. The material damage of the accident amounted to approximately EUR 167,000 in total. Due to the clearance and repairs of the accident site, the section of the track was closed for railway traffic during 3–7 July 2021.

The section of the track had been renovated in 1997–2002. An incomplete layer of chippings had been added on top of the gravel support layer that provided a foundation for the track that was weaker than the current requirements. Recycled rails had been used in the refurbishment of the track, and a part of the drilling in their rail joints had remained imprecise. In practice, the strength properties of the support layer of the track had become even weaker than before. As a whole, the weakened support structure of the track, the poorly functioning rail joints and the wooden sleepers created a structure that was more vulnerable to the stresses created by train traffic and the forces of nature.

During the spring and summer of 2021, the Finnish Transport Infrastructure Agency had work done on replacing the sleepers as a part of maintenance of the section of track. For planning the work, walking inspections were carried out on the section of track in late winter and spring of 2021, in which the condition of the track was assessed visually and sleepers in poor condition were marked for replacement. During the inspections, the contractor noticed non-functioning rail joints in the section of track, which were reported to the agency that ordered the work.

In May–June 2021, the maintenance contractor started the work on replacing the sleepers on the section of track. In connection with the replacements, and during the mechanised tamping of the rails, the stability of the support layer of the track deteriorated. The work on replacing the sleepers was done during the period of hottest weather of the summer. Due to the hot weather, the aim was to carry out the sleeper replacement from 5.00 a.m. to 11.00 a.m. The temperatures were monitored by measuring them, but the rail temperatures were not recorded.

The supervisors who managed the railway work monitored the progress remotely as well as on site visits twice a week. In practice, however, a track technician assigned to the task monitored the progress and quality of the work on replacing the sleepers at the worksite.

The derailment of the wagons was caused by two separate lateral movements that formed under the freight train, that is, track buckles. When the hot weather continued, the track support structure

that had become weakened further due to the railway work was not able to provide sufficient support for the tracks. The rail joints that were in poor condition were not flexible enough when the rails heated, which also contributed to the formation of track buckles.

Track buckles were observed on the section of track before and after the accident. The track buckle detected during the railway work in mid-June was handled as a deviation from normal operations, and the ongoing work on replacing the sleepers was not interrupted. A new track buckle was observed on the day after the accident, but it did not cause a dangerous situation, because the section of track was closed from railway traffic due to the accident.

A track buckle always causes the risk of a serious railway accident. On tracks with a weakened support layer, the risk of track buckles increases due to the additional stress caused by the climate change on the structure of the track. Long periods of hot weather and larger amounts of rainfall will increase the challenges of track maintenance in the future.

In order to improve the safety of railway traffic and prevent accidents due to track buckles, the Safety Investigation Authority, Finland, issues the following recommendations:

1. *The Finnish Transport Infrastructure Agency instructs that when preparing for railway work on the surface structure of sections of track where the support layer is weakened, the condition of the support layer and the rail joints should be examined, and they should be taken into account in the planning, scheduling and implementation of the work. The ability of the rail to withstand lateral forces in particular must be verified in the final inspection.*

2. *The Finnish Transport Infrastructure Agency instructs that the rail temperatures should be recorded regularly and that the parties managing, and monitoring railway work should monitor their development in real time and take measures, if necessary.*

3. *The Finnish Transport Infrastructure Agency clearly defines the criteria for interrupting railway work, the party responsible for the decision and the allocation of the costs due to the interruption.*

4. *The Finnish Transport and Communications Agency emphasises safety management methods when auditing the monitoring of deviations in everyday activities and the assessment and management of risks identified through them in addition to situations involving change.*

**R2021-03 (ERA FI-10140)**

**Level crossing accident in Kaskinen, 5 October 2021**

A work train travelling from Seinäjoki to Kaskinen collided with a bus that was transporting schoolchildren to Kristiinankaupunki at the Pyhän Eskilinkatu level crossing, which was not equipped with a warning device, in Kaskinen on Tuesday 5 October 2021. The driver of the work train tried to warn the bus driver by blowing the whistle, but the bus continued to the level crossing without stopping despite the STOP sign. The bus and the work train collided at the level crossing, and as a result, the work train was derailed.

The bus driver and the seven passengers on the bus sustained injuries of varying degrees in the collision. The material damage caused by the collision was extensive. The accident did not affect commercial rail traffic.

The bus involved in the accident was carrying out a school transport arranged as a part of regular service, meaning that the criteria for school transports had not been applied to its procurement. When school transport is arranged as a part of regular service in this way, the client cannot set safety criteria or define them in agreements. In addition, the investigation found that the tools and instructions for school transport route planning do not take safety in level crossings into account.

The safety management of the bus company did not provide instructions on how to react in an exceptional situation, and partly for this reason, the orientation of the new driver remained deficient with regard to the route and the vehicle. The driver had had problems with handling the vehicle and staying on the route, and the passengers had given strong feedback to the driver about those issues on the previous day. In general, the bus transport sector does not have any requirements concerning safety management systems.

Out of the eight people in the bus, only two were wearing a seatbelt. Based on this, not wearing a seatbelt is still common in buses.

Cooperation between the authorities was efficient from the start and preparing for a potential larger and more serious accident was realized as planned. The current operating models of rescue services and emergency medical services in the Kaskinen area functioned appropriately in connection with the accident.

To improve safety, the Safety Investigation Authority recommends the following:

1. *The Finnish National Agency for Education should instruct education providers to ensure that safety issues are taken into account regardless of how school transports are arranged*

*and notify transport operators and education providers about the goals and existence of instructions.*

2. *The Ministry of Transport and Communications proposes that the Railway Act should be changed so that clearing the areas of unobstructed visibility to ensure their safety could also be done as smoothly as possible in level crossings, in which there are existing buildings or vegetation in the areas of unobstructed visibility.*

In addition to the new recommendations, the Safety Investigation Authority repeats a previous recommendation:

3. *The Ministry of Transport and Communications should draw up regulations that help to implement a safety management system in the bus transport sector as a whole.*

In addition, the Safety Investigation Authority reopens a safety recommendation issued earlier to the predecessor of the Finnish Transport Infrastructure Agency:

4. *It is recommended that the Finnish Transport Safety Agency should enable the introduction of low-cost warning devices and ensure that the Finnish Transport Infrastructure Agency will continue the investigation into the suitability for use of low-cost warning devices and start to introduce them in practice.*

**R2021-04 (ERA FI-10162)**

**R2021-04 Derailment of a train transferring rolling stock in Oulunkylä on 2 December 2021**

A train transferring rolling stock was derailed in Oulunkylä on 2 December 2021. The train was transferring an overhauled metro without brakes from the Ilmala depot to the metro depot via the Vuosaari harbor track.

The train broke in two between the locomotive and the metro. The break occurred because the towing adapter and the metro coupling malfunctioned at the same time. After the train broke up, the brakes of the locomotive locked up automatically after the brake pipe was cut off. A measurement carriage had been connected after the metro to act as the braking unit. However, due to the implementation of the temporary brake pipe, its brakes did not work and as a result, the metro collided with the locomotive. During the collision, the coupling of the metro came loose and fell under the train, derailing the other axle of the metro. The metro suffered significant damage in the accident. The damage to the locomotive and the track were less severe.

The metro was one of the trains included in the metro overhaul project HKL had commissioned from VR-FleetCare. The overhauled trains were transferred by towing them on the railway as special transports, and an exemption for their transfers had been received from the Finnish Transport and Communications Agency.

When the transfer of the train involved in the accident was prepared, the connection between the units seemed successful and it functioned during the test towing. The characteristics and structure of the adapters prevented the users from having an option to confirm that the connection was locked. The investigation also found that the adapter model used had a hidden connection fault that prevented the locking of the adapter connection. In addition to the incomplete locking of the adapter, the breaking up of the train was also enabled by a hidden fault in the coupling on the metro side, which similarly prevented it from locking.

Even though the adapters had been used for temporary transfers for more than 20 years, all characteristics of the adapters were not known and no instructions on their use had been made. Their safe usability, especially the indication of a locked connection, had not been sufficiently taken into account in the design of the device. The adapters had not been identified and no maintenance programme had been created for them, either.

A hose had been attached to the chassis of the metro as a temporary brake pipe. The hose did not meet the requirements of a brake pipe; it was thinner and more flexible. The risk caused by a thinner hose and the lack of fastening of its ends had not been identified in practice. The ease of installation was emphasized in the selection and attachment of the hose.

It is difficult for the supervisory authority to monitor the safety of installations made in the field, such as the brake installations. In that case, the monitoring of safety arrangements is based on the self-monitoring of the companies carrying out the transfer. It would be extremely important to focus on the areas most critical to the safety of operations in self-monitoring.

Trains break up from time to time, but the functioning of the brake system should prevent accidents. Problems may occur in special transports when local solutions are used in brakes. The risk assessment does not always reach the solutions made in the field when implementing temporary transfers.

In order to improve the safety of transports that differ from normal operation, the Safety Investigation Authority, Finland, issues the following recommendations:

1. *When auditing the safety management systems of railway operators, the Finnish Transport and Communications Agency should evaluate whether the assessments are updated as needed in addition to the risk assessment procedures.*

2. *Railway operators should ensure that the towing adapters and other auxiliary devices they use for connections have been identified and are included in the maintenance programme and that there are instructions for their use.*

3. *Railway operators should verify that brakes work in transfers of rolling stock implemented with special arrangements and take the risk of the train breaking up into account.*

## 3.5 Comment and introduction or background to the investigations

**Investigations commenced in 2022 and not followed**

| Date of occurrence | Title of the investigation (Occurrence type, location) | Legal basis | Reason of non-following or suspension of investigations | Who, why, when (decision) |
|---|---|---|---|---|
| | | | | |

## 3.6 Accidents and incidents investigated during last five years (in 2018–2022)

**Rail investigations in 2018–2022**

| Accidents investigated | | 2018 | 2019 | 2020 | 2021 | 2022 | TOT |
|---|---|---|---|---|---|---|---|
| Serious accidents (Art 20.1) | Train collision | 0 | 0 | 0 | 0 | 0 | **0** |
| | Train collision with an obstacle | 1 | 0 | 0 | 0 | 0 | **1** |
| | Train derailment | 0 | 0 | 0 | 0 | 0 | **0** |
| | Level crossing accident | 1 | 0 | 1 | 0 | 0 | **2** |
| | Accident to person caused by RS in motion | 0 | 0 | 0 | 0 | | **0** |
| | Fire in rolling stock | 0 | 0 | 0 | 1 | 1 | **2** |
| | Involving dangerous goods[1] | 1 | 0 | 0 | 0 | 0 | **1** |
| Other accidents (Art 20.2) + (Art 22.6) | Train collision | 0 | 1 | 0 | 0 | 0 | **1** |
| | Train collision with an obstacle | 0 | 0 | 0 | 0 | 0 | **0** |
| | Train derailment | 0 | 1 | 0 | 2 | 1 | **4** |
| | Level crossing accident | 0 | 0 | 0 | 1 | 1 | **2** |
| | Accident to person caused by RS in motion | 0 | 0 | 0 | 0 | 0 | **0** |
| | Fire in rolling stock | 0 | 0 | 0 | 0 | 0 | **0** |
| | Involving dangerous goods[1] | 0 | 1 | 0 | 0 | 0 | **1** |
| | Incidents in train traffic | 0 | 0 | 0 | 0 | 1 | **1** |
| | Accidents or incidents in shunting work | 0 | 7[2] | 6[2] | 0 | 0 | **13** |
| **TOTAL** | | **3** | **10** | **7** | **4** | **4** | **26** |

## 3.7 Preliminary investigations

The Safety Investigation Authority has conducted in compliance with section 8 of the Safety Investigation Act (525/2011), preliminary investigations. The SIAF has decided on the basis of a preliminary investigation, that the special characteristics of the case do not require a full investigation. The report on the preliminary investigation is sufficient to yield desired safety advantages. The events leading to the accident and immediate and indirect causes of the accident/incident are described briefly in the report on the preliminary investigation. The reports are published in Finnish and Swedish.

[1] Belongs also to another category and is not calculated another time to the total amount.
[2] Cases belong to the theme investigation on shunting work accidents and incidents in railway traffic.

In 2013 we started to publish reports of preliminary investigations on the SIAF web pages. In 2017 we developed a new layout of the report. Layout was updated in 2022 and reports were published in html-format.

During the year 2022 SIAF published four preliminary investigation reports of rail occurrences:

1. **R2021-E2 Collision between Sm3 train units during shunting operation at Tampere station on 12 December 2021**. Report was published 4.2.2022.
    - Collision was caused by insufficient preliminary information and a wrong situation picture when moving units.
    - The train driver and the shunting work supervisor carrying out the transfer were not aware that there were two Sm3 train units on the track and placed themselves in different units by mistake.
    - Even though the instructions were followed during the transfer, it was not noticed during the situation that one unit was moving while the other was staying in place.
    - The instructions do not require identifying the unit to be transferred, and it is not usually done during shunting work.
2. **R2022-E1 Collision of a freight train into empty timber wagons at Kuusankoski marshalling yard 13.5.2022.** Report was published 30.6.2022.
    - The traffic controller assumed the switches were still in the same position where they had remained the day before.
    - There are still marshalling yards in Finland where switches and signalling are controlled manually.
    - The possibility of human error is always present in these cases, especially if people are under heavy workload.
3. **R2022-E2 Dv12-diesel locomotive axel failure at Sysmäjärvi 26.5.2022.** Report was published 29.8.2022.
    - Focus on maintenance of safety critical components.
    - Axel gearbox inner bearing nut had been tightened 2 times during maintenance before the accident, but this had not triggered any other maintenance actions.
    - Construction of gearbox is such, that loosening of inner bearing nut can only be caused by bearing or axel failure.
    - Maintenance system should react to this kind of service activities

4. **R2022-E3 Incident in automatic train dispatch system at Muurola 13.6.2022**. Report was published 15.7.2022.

    - Unique automatic train dispatch system used in especially in northern Finland is designed so that in case of an error in the system, ATC stops the train. The dispatch system itself does not detect or react to errors.

    - It was found that errors where messages are sent to wrong trains have also been noted previously in the system.

    - Everything works well as long as unit is equipped with ATC, but what if there happens to be for example a track maintenance vehicle (tamping machine etc.) without ATC?

## 3.8 Fatal level crossing accidents investigated by the road accident investigation teams

In 2022 occurred a total of 12 level crossing accidents. Three persons were fatally injured in the accidents, one injured seriously and 7 injured slightly. Of the fatal accidents, one involved a passenger car and two involved pedestrians.

The road accident investigation team investigated the three fatal level crossing accidents. Below are short summaries of these three fatal accidents. It was found during the investigation that both fatal accidents involving pedestrians were intentional. Therefore, summaries of these accidents are shorter.

### 1. Fatal level crossing accident in Vaasa on 1st of April 2022

On Friday 1st of April 2022 at 04.55, a level crossing accident involving a pedestrian and a passenger train occurred on the Mustasaari protected level crossing.

An elderly person had left his home located about 700 meters from railway and walked to nearby level crossing. He was standing on the tracks when driver of the incoming passenger train noticed him from the distance of 400 meters. Train was traveling at the speed of 80 km/h. Train driver applied emergency braking and used whistle, but the distance was too short for train to stop. Train collided with the person at the speed of 55 km/h. Person died immediately.

The direct cause (*the key event*[3]) was that the person was standing on the tracks just as the train was approaching.

*Background risk factors*[3]:

- The deceased had a long history of mental health issues. He had attempted suicide several times in the past.
- Visibility from the level crossing to the direction where train was coming is limited, so the train driver had no possibility to prevent the collision.

[3] Terms used by the road accident investigation teams.

In order to prevent similar accidents, the investigation team made the following improvement *proposals and safety recommendations*[3]:

- More effective treatment of mental health issues.
- Replacing the level crossing with a tunnel.

## 2. Fatal level crossing accident between Alavus and Ähtäri on 12th of June 2022

On Sunday 12th of June 2022 at 14.15, a level crossing accident involving a pedestrian and a rail bus occurred on the Kallio unprotected level crossing

An elderly driver was driving a passenger car on a private road. When approaching the level crossing, she stopped the car. At the same time a rail bus was approaching the level crossing at the speed of 100 km/h. Train driver noticed that the driver of the car was looking left while the train was approaching from right side of the car. With her head still turned to left, driver drove the car directly in front of the train. Train driver started emergency braking at the distance of 100 meters before collision and used whistle. Train collided in the middle of right side of the car. Car rolled over and stopped on its roof at the distance of 50 meters from the level crossing. Train stopped 250 meters after collision.

Driver of the car died immediately. Car was destroyed in the collision. Automatic coupler and the front corners of the rail bus were damaged.

The direct cause (*the key event*[4]) was that the car drove into the level crossing while train was approaching. It is possible that the driver did not see the train because she was looking the other way when driving into level crossing. Train driver did not have time to prevent the collision.

*Background risk factors*[3]:

- Level crossing was not protected.
- Visibility in the level crossing is limited to the direction of the train due to curve in the track.
- Angel of the road and form of the waiting area in the level crossing also make the observations difficult.
- Elderly car drivers health issues and driving abilities may have also contributed in the accident.

In order to prevent similar accidents, the investigation team made the following improvement *proposals and safety recommendations*[3]:

- Removal of level crossings when possible.
- Equipping unprotected level crossings with warning signals or barriers.
- Changing the angle between road and track so that it is ideal 90°.
- Improving the wating areas of level crossings.
- Monitoring the health and driving abilities of elderly drivers as a part of normal healthcare.

[4] Terms used by the road accident investigation teams.

### 3. Fatal level crossing accident at Pedersöre on 23rd of August 2022

On Tuesday 23rd of August 2022 at 9.00, a level crossing accident involving a pedestrian and a freight train occurred on the Bennäsvägen unprotected level crossing.

A person had left her home located about 300 meters from railway and walked to the level crossing while a freight train was approaching it at the speed of 60 km/h. Person walked over the tracks and stopped by the tracks. When the train was at the level crossing, person stepped on the tracks and was immediately run over by train. Train driver noticed the person and used whistle to alarm her but did not have time to brake. The person died immediately.

The direct cause (*the key event*[5]) was that the person stepped on the tracks just as the train was approaching.

*Background risk factors*[3]:

- The deceased had history of mental health issues. She had also physical health issues and pains. She had seen healthcare recently, but treatment focused solely on physical issues.

In order to prevent similar accidents, the investigation team made the following improvement *proposals and safety recommendations*[3]:

- More effective treatment of mental health issues.
- Better availability of mental health services.
- Taking also mental issues into account when treating physical health issues.

[5] Terms used by the road accident investigation teams.

# 4 RECOMMENDATIONS

## 4.1 Short review and presentation of recommendations

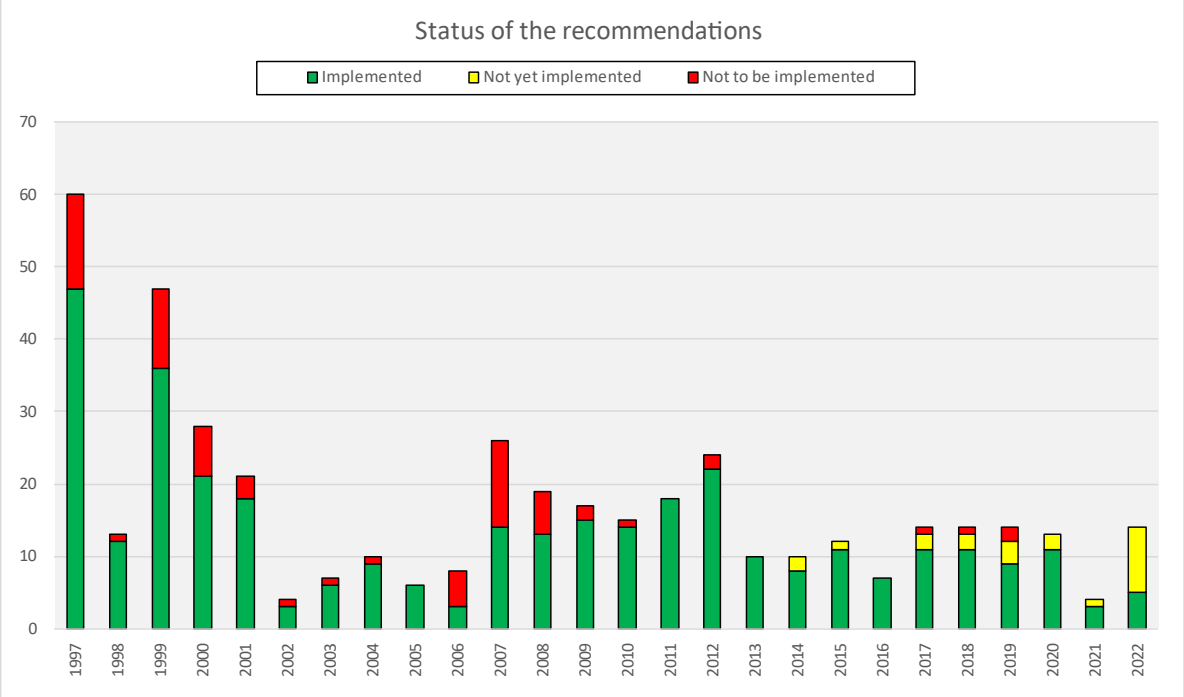
### Implementation of recommendations during 2008–2022

| Recommendations issued | | Recommendation implementation status | | | | | |
|---|---|---|---|---|---|---|---|
| | | Implemented | | In progress | | Not to be implemented | |
| Year | [No.] | [No.] | [%] | [No.] | [%] | [No.] | [%] |
| **2008** | 19 | 13 | 68,4 | 0 | 0,0 | 6 | 31,6 |
| **2009** | 17 | 15 | 88,2 | 0 | 0,0 | 2 | 11,8 |
| **2010** | 15 | 14 | 93,3 | 0 | 0,0 | 1 | 6,7 |
| **2011** | 18 | 18 | 100,0 | 0 | 0,0 | 0 | 0,0 |
| **2012** | 24 | 22 | 91,7 | 0 | 0,0 | 2 | 8,3 |
| **2013** | 10 | 10 | 100,0 | 0 | 0,0 | 0 | 0,0 |
| **2014** | 10 | 8 | 80,0 | 2 | 20,0 | 0 | 0,0 |
| **2015** | 12 | 11 | 91,7 | 1 | 8,3 | 0 | 0,0 |
| **2016** | 7 | 7 | 100,0 | 0 | 0,0 | 0 | 0,0 |
| **2017** | 14 | 11 | 78,6 | 2 | 14,3 | 1 | 7,1 |
| **2018** | 14 | 11 | 78,6 | 2 | 14,3 | 1 | 7,1 |
| **2019** | 14 | 9 | 64,3 | 3 | 21,4 | 2 | 14,3 |
| **2020** | 13 | 11 | 84,6 | 2 | 15,4 | 0 | 0,0 |
| **2021** | 4 | 3 | 75,0 | 1 | 25,0 | 0 | 0,0 |
| **2022** | 14 | 5 | 35,7 | 9 | 64,3 | 0 | 0,0 |
| **TOTAL** | **205** | **168** | **82,0** | **22** | **10,7** | **15** | **7,3** |

Changes in implementation statuses of recommendations during 2022 are described in detail in Annex 1.

A total of 435 recommendations have been issued from 1997 through 2022. According to information available on 27th June 2023, 343 (78.9 %) recommendations were implemented. On 70 (16.1 %) issued recommendations, the SIAF received a reply stating that they would not be implemented.

From 2008 through 2022 a total of 205 recommendations have been issued. 168 (82,0 %) have been implemented. On 15 (7.3 %) issued recommendations, the SIAF received a reply stating that they would not be implemented. 22 (10.7 %) are currently under implementation.




## 4.2 Recommendations 2022

### 2022-S10 Ensuring the appropriate maintenance of rolling stock (ERA FI-10069/1)

Based on the investigation, there is no structural fault in the Dm12 rail bus that would make it unusually vulnerable to fire. When new and after a basic overhaul, Dm12 rail buses operate for years without a fire.

First and foremost, dirty engine compartments and liquid leaks have been the cause of fires, which in turn results from wear and tear. For example, the casings in the chassis have become damaged during use so that plenty of combustible material can accumulate inside them. These systematic failures have not been addressed during maintenance. The aim has been to manage the risk by cleaning the engine compartments during the V5 maintenance carried out every 5,000 km. Due to costs, some of the V5 maintenance is carried out in railway yard conditions. In practice, however, cleaning the engine compartment during V5 maintenance in railway yard conditions cannot be done thoroughly enough during the time allocated and with the methods available.

The Safety Investigation Authority recommends that the Finnish Transport and Communications Agency (Traficom) ensure the implementation of the following recommendation:

*VR-Group Ltd ensures that the rolling stock is maintained in the safe condition required by the authorisation for placing in service. [2022-S10]*

The responsibility for maintaining the rolling stock does not rest only on the company that is officially responsible for its maintenance. The basic requirement for appropriate maintenance is sufficient funding by the owner of the rolling stock

**2022-S11 Selection and use of the types of extinguishers (ERA FI-10069/2)**

In the case examined, the first aid extinguishing by the train driver was not effective, even though the driver used several fire extinguishers for the purpose. This was due to the ineffectiveness of the carbon dioxide fire extinguishers easily available on the rolling stock in case of a fuel fire. The effective use of carbon dioxide and other gaseous fire-extinguishing agents also requires that the space is as enclosed as possible, which is not the case in the engine compartment of a Dm12 rail bus, for instance, because its casing is almost invariably damaged. In such cases, a dry powder or a suitable liquid fire-extinguishing agent would be more effective.

The Safety Investigation Authority recommends that the Finnish Transport and Communications Agency (Traficom) ensure the implementation of the following recommendation:

*The railway operators inspect the types of extinguishers available on the rolling stock and ensure that they have been selected correctly in relation to the most likely types of fire. [2022-S11]*

With the placement of small hand extinguishers in the rolling stock, it must be ensured that a small hand extinguisher of the correct type can be used quickly. The differences in types of extinguishers must also be taken into account in the first aid extinguishing training of the personnel.

**2022-S12 Updating the risk assessment on the removal of train personnel from the Dm12 rail buses (ERA FI-10069/3)**

The risk assessment on the removal of train personnel from the Dm12 rail bus rolling stock was carried out at a time when the rolling stock had just undergone a basic overhaul, and no fires had occurred for several years. Therefore, a fire and the resulting evacuation of passengers was not considered to be a major risk, and no measures were taken because of it. A situation, in which the train driver was incapacitated, or the passengers would need to exit the train unit on their own initiative for some other reason, was not recognised as a significant risk, either. In the cases investigated, the successful evacuation of the passengers and avoidance of personal injuries was based on the driver being able to act and, moreover, acting in an exceptionally systematic and effective manner.

The Safety Investigation Authority recommends that the Finnish Transport and Communications Agency (Traficom) ensure the implementation of the following recommendation:

*VR-Group Ltd updates the risk assessment concerning the effects of removing train personnel from the Dm12 rolling stock and takes the risks of fire and the potential inability of the driver to function into account in it in particular. [2022-S12]*

Based on the observations during the investigation, the emergency signs on the doors that are important for the independent exit of passengers also require further clarification. Passenger safety, such as in situations, in which the driver has been incapacitated, can be improved by returning the train personnel back to the units especially in Dm12 trains that operate with more than one unit.

**2022-S13 Self-monitoring and handling of deviations as a part of the supervision of safety management (ERA FI-10069/4)**

Currently, ensuring the safe operating condition of the railway rolling stock is based on self-monitoring by the railway operators and the party responsible for maintaining the rolling stock. The aim is to identify the risks caused by the rolling stock through safety deviations and address them.

Based on the investigation, it can be stated that self-monitoring and the supervision of its implementation in their current form are not enough to guarantee the safety of rail traffic. The connection between the fires and the deteriorating condition of the Dm12 rolling stock was not recognised in the self-monitoring, and the recurring fires in the rolling stock have not been addressed sufficiently. The risk to passenger safety caused by several similar incidents has not been identified, either.

The Safety Investigation Authority recommends that

*The Finnish Transport and Communications Agency develops its operating methods and the focus of its supervision to ensure the functioning of the operators' self-monitoring and handling of deviations in practice. [2022-S13]*

The recommendation can be implemented by including the matters as a part of the supervision focus area programme of the Finnish Transport and Communications Agency.

**2022-S14 The European Union Agency for Railways (ERA) investigates the potential of expanding the possibilities of the national safety authority to monitor the operators in the field in practice. (ERA FI-10069/5)**

The national safety authority is obliged to supervise the safety management systems of operators in rail traffic. This investigation noted that even though the safety management system and its supervision have been implemented according to the instructions, the activities in accordance with the system are not realised in practice. The same issue has been observed in previous rail traffic investigations. The supervision procedure must be changed so that the monitoring confirms the functionality of the safety management system in addition to its existence.

The supervision by the national safety authority is based on the EU Directive 2016/798 on railway safety. The authority has stated that it cannot increase supervision within the framework of the directive. In its own investigations, the authority has also observed the problems mentioned above in implementing the safety management systems in practice and especially in self-monitoring. For reasons due to the directive, however, it does not

feel that it is able to address them. Therefore, improving safety requires changes on the EU level.

The Safety Investigation Authority recommends that

*The European Union Agency for Railways (ERA) investigates the potential of expanding the possibilities of the national safety authority to monitor the operators in the field in practice. [2022-S14]*

The requirements of Article 17, Supervision, of the directive cannot be implemented in practice with the current supervision options.

**2022-S6 Preparations for railway work and final inspection on tracks with a weakened support layer (ERA FI-10083/1)**

The surface structure of the section of track being examined is based on a gravel support layer supplemented with an incomplete support layer of chippings in the early 2000s. The characteristics of the support layer make the surface structure of the track vulnerable to environmental conditions and the external stress caused by the railway work. Due to the weakened characteristics of the support layer, the correct operation of rail joints is especially important in these sections of track. Currently the instructions do not require a sufficient investigation into these matters in the planning of railway work, and they are not taken into account in the monitoring or final inspection of the work. Extensive railway work on the support layer, such as replacing the sleepers, always affects the stability of the track. In order to ensure the safety of traffic once the railway work is complete, the sufficient lateral support of the track should be confirmed with measurements.

The Safety Investigation Authority recommends that the Finnish Transport and Communications Agency (Traficom) ensure the implementation of the following recommendation:

*The Finnish Transport Infrastructure Agency instructs that when preparing for railway work on the surface structure of sections of track where the support layer is weakened, the condition of the support layer and the rail joints should be examined and they should be taken into account in the planning, scheduling and implementation of the work. The ability of the rail to withstand lateral forces in particular must be verified in the final inspection. [2022-S6]*

A simple visual inspection of the track in connection with a walking inspection before starting the railway work is not enough to verify the real condition of the track support layer and the rail joints. Following the instructions of the Finnish Transport Infrastructure Agency is recommended when inspecting the condition of the track support layer and verifying the functioning of the rail joints. When the railway work is complete, it is recommended that limited speed is used in the traffic until the condition of the track has been confirmed.

**2022-S7 Recording and monitoring rail temperatures in railway work (ERA FI-10083/2)**

Railway work is mainly carried out in the summer, when the temperature of the rails is likely to exceed the safe limits. Traditionally, the risk has been managed by scheduling the work during the night, when it is cooler. Due to the climate change, periods of hot weather will become longer and the temperatures during the night will also rise. This causes more requirements on the monitoring of temperatures during railway work.

At the moment, the instructions state that temperatures must be measured. However, they do not instruct that the temperatures should be recorded or communicated to the parties managing and monitoring railway work. This, together with potential remote management, may pose a risk of rising temperatures not being identified and the management of railway work not being able to address the issue.

The Safety Investigation Authority recommends that the Finnish Transport and Communications Agency (Traficom) ensure the implementation of the following recommendation:

*The Finnish Transport Infrastructure Agency instructs that the rail temperatures should be recorded regularly and that the parties managing and monitoring railway work should monitor their development in real time and take measures, if necessary. [2022-S7]*

Using a centralized computer system would be the most effective way of recording and monitoring the temperatures.

**2022-S8 Specifying clear interruption criteria and procedures for railway work in exceptional environmental conditions (ERA FI-10083/3)**

Even though railway work has specified rail temperature limits, above which the work must be interrupted, the interruption process has not been defined. This means that it is possible to continue work even in temperatures with a high risk. In the instructions, the responsibility for monitoring temperatures is divided between several parties, but there is no clear specification on who makes the decision to interrupt work. In addition, the financial impact that will likely be caused by the interruption makes it more difficult to make the decision.

The Safety Investigation Authority recommends that the Finnish Transport and Communications Agency (Traficom) ensure the implementation of the following recommendation:

*The Finnish Transport Infrastructure Agency clearly defines the criteria for interrupting railway work, the party responsible for the decision and the allocation of the costs due to the interruption. [2022-S8]*

At the moment, financial considerations strongly guide the maintenance of the track and the related work processes, among other things. The responsible parties and criteria must be defined so clearly that the costs of interrupting the work due to safety considerations

does not result in any ambiguities, and no financial sanctions are caused by taking safety into account.

**2022-S9 Taking deviations from normal operation such as track buckles into account in safety management systems (ERA FI-10083/4)**

Currently safety management and systems are mainly focused on managing the risks of situations involving a change. Track buckles and other deviations in the surface structure of the track always pose a serious risk to the safety of railway traffic. They are handled in accordance with the instructions on deviations, but they may not lead to immediate decision-making or a change in the operating methods. Handling deviations and developing operations are a part of safety management, and their processes are defined in the safety management systems required from actors. The problem is that the potentially cumulative risks of deviations that occur in daily activities are not identified.

The Safety Investigation Authority recommends that:

*The Finnish Transport Infrastructure Agency clearly defines the criteria for interrupting railway work, the party responsible for the decision and the allocation of the costs due to the interruption. [2022-S8]*

The recommendation can be implemented by including the proposed issue as one of the focus areas of annual monitoring, for example.

**2022-S23 Taking safety into account in arranging school transports (ERA FI-10140/1)**

The education provider is obliged to arrange school transports. If school transports are arranged as a part of regular service, the criteria for school transport are not usually applied to the procurement. Taking safety into account remains often the sole responsibility of the transport operator in transports arranged as a part of regular service, and the education provider does not have the opportunity to set safety conditions on the transports.

The Safety Investigation Authority recommends the following:

*The Finnish National Agency for Education should instruct education providers to ensure that safety issues are taken into account regardless of how school transports are arranged, and notify transport operators and education providers about the goals and existence of the instructions. [2022-S23]*

The instructions can be included in the guide on school transports by the Finnish National Agency for Education, for example. Information can be provided to transport operators via the Linja-autoliitto organization for bus operators and the Taksiliitto organisation for taxi entrepreneurs, for instance.

**2022-S24 Making it easier to clear areas of unobstructed visibility at level crossings with deficient conditions (ERA FI-10140/2)**

A level crossing without a warning device and with deficient conditions on a track with a low traffic volume is a typical site of an accident in Finland. Deficiencies in the areas of unobstructed visibility at level crossings in particular have been in the background of several previous level crossing accident investigations.

The right of the track manager to clear out areas of unobstructed visibility at level crossings has been specified in the Railways Act. However, the right to clear areas defined by law is partially subject to interpretation. Problems occur especially in level crossings, in which there are existing buildings or vegetation in the areas of unobstructed visibility. This may sometimes make it difficult to improve the conditions at level crossings quickly.

The Safety Investigation Authority recommends the following:

*The Ministry of Transport and Communications proposes that the Railway Act should be changed so that clearing the areas of unobstructed visibility to ensure their safety could also be done as smoothly as possible in level crossings, in which there are existing buildings or vegetation in the areas of unobstructed visibility. [2022-S24]*

**2022-S20 Updating the risk assessment (ERA FI-10162/1)**

The risk assessment on the transfer of metros in the railway network was made when the transfers were only at the planning stage. The assessment was not updated after the implementation method and technical solutions used in the transfers were confirmed. The effects of the technical solutions selected on risks were not identified, either.

Even when a comprehensive risk assessment is carried out at the start of the project, it is often impossible to take all risk factors that occur in practice into account. Similarly, the solutions used in the implementation may change from the planning stage. Therefore, the existing risk assessment should be updated when changes to the plans are made. This is the only way to identify and react to risks that emerge during the project or operation.

The Safety Investigation Authority recommends that:

*When auditing the safety management systems of railway operators, the Finnish Transport and Communications Agency should evaluate whether the assessments are updated as needed in addition to the risk assessment procedures. [2022-S20]*

Risk assessments should be updated in all processes, in which they are carried out, not only in case of changes or exceptional situations

**2022-S21 The use and maintenance of towing adapters and other auxiliary devices used for connecting trains (ERA FI-10162/2)**

The equipment used in temporary transfers, such as towing adapters, has not always been handled as critical to safety in rail traffic. The towing adapters used in the transfer of the metro did not have a maintenance programme, and the adapters had not been identified. This meant that it was not possible to confirm whether the adapter was functional. As a component, however, the adapter is just as critical to safety as the actual automatic coupling of a train or locomotive.

There were no separate instructions on the use of the adapter; in that respect, the instructions of the automatic coupling were followed. This meant that it was not possible to take the special characteristics of the adapter into account.

The Safety Investigation Authority recommends that the Finnish Transport and Communications Agency (Traficom) ensure the implementation of the following recommendation:

*Railway operators should ensure that the towing adapters and other auxiliary devices they use for connections have been identified and are included in the maintenance programme and that there are instructions for their use. [2022-S21]*

The structure of a device and the way it is used must be taken into account in drawing up instructions and a maintenance programme. The potential changes in the safety features of the equipment in particular must be taken into account and managed.

**2022-S22 Taking the risk caused by the train breaking up into account (ERA FI-10162/3)**

In the accident, the train broke in two between the locomotive and the metro that had been connected to it with a towing adapter. The collision of the metro with the locomotive and the resulting derailment was due to the deficiencies in the installation of the brake pipe used to control the brakes of the measurement carriage connected to the metro, which had no brakes.

A train breaking up is a known risk in rail traffic. The break is not assumed to cause an accident, because in a normal situation, the brake arrangements will ensure that the parts of the train will come to a safe and controlled stop. This risk should be taken into account in temporary transfers, however.

The Safety Investigation Authority recommends that the Finnish Transport and Communications Agency (Traficom) ensure the implementation of the following recommendation:

*Railway operators should verify that brakes work in transfers of rolling stock implemented with special arrangements and take the risk of the train breaking up into account. [2022-S22]*

As far as possible, the arrangements of temporary transfers should be implemented in accordance the regulations that guide safe operation. The correct implementation of a temporary brake pipe and coupling hoses in particular is important for ensuring the safe operation of the brakes.

## ANNEX 1: Changes in implementation statuses of previous recommendations during 2022 and actions taken by the addressees

1. **Recommendation number: 2022-S10 (ERA FI-10069/1)**

**Recommendation:** VR-Group Ltd ensures that the rolling stock is maintained in the safe condition required by the authorisation for placing in service.
**Issued in investigation:** R2021-01 Fire in the Dm12 rail bus between Huutokoski and Sikamäki in Joroinen on 5 June 2021
**Previous status:** Under implementation
**New Status in 2022:** Implemented
**Description on implementation:** VR Group Ltd and VR FleetCare have stated that they commit to maintaining their rolling stock in a safe condition in accordance with their safety management systems. Based on the response, the following measures are used to ensure that the condition of the Dm12 stock is safe:
• End user maintenance was discontinued in June 2021, and until further notice, the rolling stock has been directed to maintenance at depots (including V5 maintenance)
• Basic renovation of the engine and transmission package throughout the rolling stock
• Replacement of engine casings throughout the rolling stock
• Regular cleaning and inspection of the engine compartment
• Installing fire seals in through holes
• Redefining the engine maintenance interval
• Updating the instructions for heavy maintenance and specifying the maintenance targets

2. **Recommendation number: 2022-S11 (ERA FI-10069/2)**

**Recommendation:** The railway operators inspect the types of extinguishers available on the rolling stock and ensure that they have been selected correctly in relation to the most likely types of fire.
**Issued in investigation:** R2021-01 Fire in the Dm12 rail bus between Huutokoski and Sikamäki in Joroinen on 5 June 2021
**Previous status:** Under implementation
**New Status in 2022:** Implemented
**Description on implementation:** Based on the responses, railway operators have inspected the types and locations of extinguishers by the end of 2022.

3. **Recommendation number: 2022-S12 (ERA FI-10069/3)**

**Recommendation:** VR-Group Ltd updates the risk assessment concerning the effects of removing train personnel from the Dm12 rolling stock and takes the risks of fire and the potential inability of the driver to function into account in it in particular
**Issued in investigation:** R2021-01 Fire in the Dm12 rail bus between Huutokoski and Sikamäki in Joroinen on 5 June 2021
**Previous status:** Under implementation
**New Status in 2022:** Implemented
**Description on implementation:** The risk assessment of the change in the operating model was updated in August 2022. An evacuation training programme was arranged for Dm12 engineers in 2021, and online support material was drawn up. New emergency procedure cards in three languages have been added to the cabs, and instructions on how to open the doors in case of emergency have been updated.

**4. Recommendation number: 2022-S21 (ERA FI-10162/2)**
**Recommendation:** Railway operators should ensure that the towing adapters and other auxiliary devices they use for connections have been identified and are included in the maintenance programme and that there are instructions for their use.
**Issued in investigation:** R2021-04 Derailment of a train transferring rolling stock in Oulunkylä on 2 December 2021
**Previous status:** Under implementation
**New Status in 2022:** Implemented
**Description on implementation:** Based on the responses, adapters are used by one railway operator that has taken the recommendation into account in its operations (towing adapters and their instructions have been revised). Other railway operators do not use adapters.

**5. Recommendation number: 2022-S22 (ERA FI-10162/3)**
**Recommendation:** Railway operators should verify that brakes work in transfers of rolling stock implemented with special arrangements and take the risk of the train breaking up into account.
**Issued in investigation:** R2021-04 R2021-04 Derailment of a train transferring rolling stock in Oulunkylä on 2 December 2021
**Previous status:** Under implementation
**New Status in 2022:** Implemented
**Description on implementation:** Some railway operators state in their responses that they do not carry out transport of this kind. Other respondents state that they intend to take this recommendation into account in their operations if any rolling stock transfers are to be implemented with special arrangements at the latest.