TRAFICOM
Finnish Transport and Communications Agency

Annual Railway Safety Report 2021

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1 Introduction

1.1 Purpose, scope and target group of the Annual Railway Safety Report

This Annual Railway Safety Report 2021 of the Finnish Transport and Communications Agency Traficom describes the status of railway safety in Finland in 2021. The report also discusses key points related to Traficom's activities concerning rail transport authorisations, supervision and regulation in 2021. The Annual Railway Safety Report is Traficom's annual report on railways referred to in section 17 of the Rail Transport Act (1302/2018). Under the Rail Transport Act, Traficom must each year prepare a report on its operations and the development of railway safety in Finland in the previous year and submit the report to the European Union Agency for Railways (ERA) by the end of September. The report is also submitted to the Ministry of Transport and Communications and published on Traficom's website. The main sources of the safety information presented in this report include the safety reports of infrastructure managers and railway operators, railway operators' accident and incident reports, and the Safety Investigation Authority's accident investigation reports. Information on Traficom's operations has been gathered by interviewing its public officials and reviewing documents relevant to its operations.

The structure of the Annual Railway Safety Report follows the latest version of ERA's reporting guidelines issued in April 2020. The information in Annex 1 has been reported in accordance with the 2022 template.

1.2 Summary of the safety situation in 2021

The coronavirus pandemic continued to have an impact on the volume of rail transport in 2021, particularly in passenger transport**.** According to statistics by the Finnish Transport Infrastructure Agency, the number of passenger-kilometres only increased by a few per cent compared to 2020. The level of passenger safety was good already before the coronavirus pandemic and remained excellent also in 2021.

The number of significant accidents was higher in 2021 than in preceding years. One particular reason for the increase in the total number was level crossing accidents resulting in deaths and serious injuries. In 2021, there were 25 significant rail transport accidents, of which 13 were level crossing accidents.

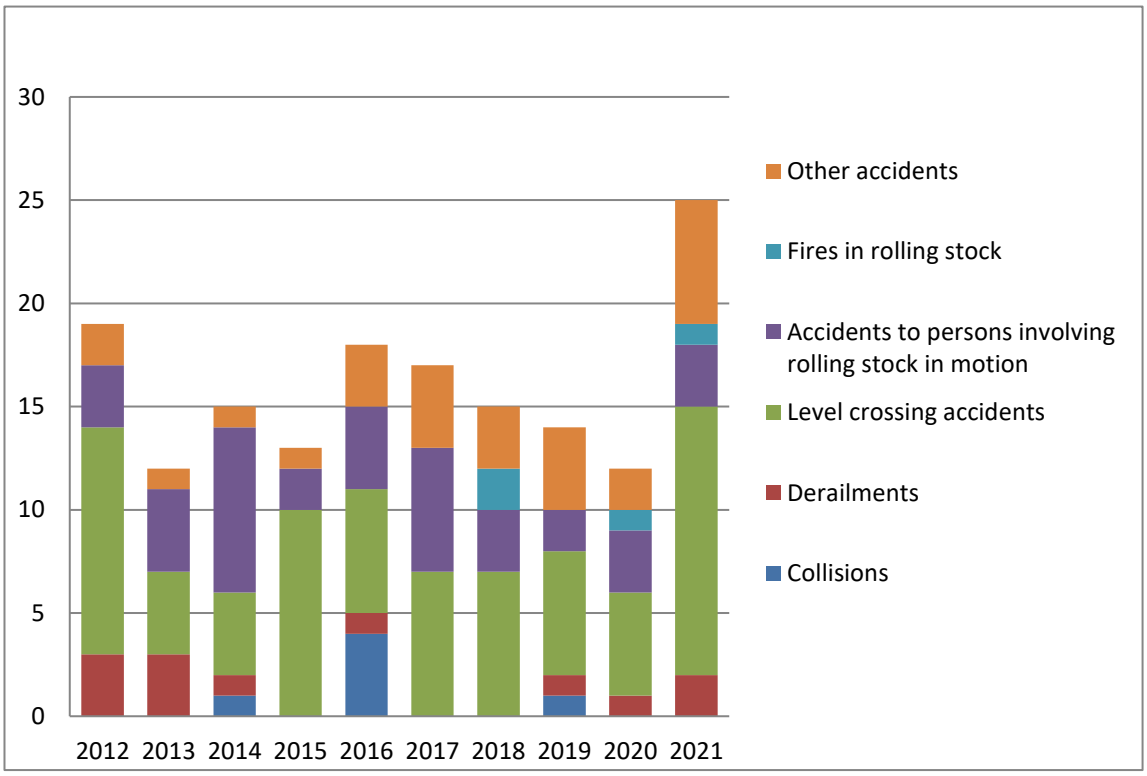

Figure 1. Significant railway accidents in Finland in 2012–2021 by accident type.

Of all significant level crossing accidents in 2021, 38% involved crossings with half barriers or with user-side warning (warning lights and audible alarms). The percentage is the same also when examining the total number of level crossing accidents. The total number of level crossing accidents in 2021 (26 accidents) was very close to the average of the previous five years (25 accidents).

It is important to note that the number of accidents in a single year is not a very descriptive indicator in assessing the overall development of railway safety because there are always multiple factors contributing to individual accidents.

Most casualties on railways are caused by accidents to persons involving rolling stock in motion. These accidents typically cause 50 to 60 fatalities every year. Most of these are deliberate. No clear trend can be observed in the annual numbers of these accidents, but in 2021 their number was below average (38).

While shunting safety has clearly improved in Finland over the past ten years, many accidents and incidents continue to occur in this work. In 2021, three derailments and one collision classified as significant accidents occurred in shunting. The number of shunting occurrences was slightly higher than the year before but remained below the level in 2019. Systematic efforts have been made to improve shunting safety, for example, by promoting a good safety culture and ensuring the use of safe work practices.

Safe coordination of track work and train traffic has been a key challenge to railway safety for a number of years. Typical occurrences related to track work, including unauthorised passing of the track work area, working without a track work permit, and errors in the opening of the track work site to traffic, pose risks to the safety of both train traffic and track maintenance workers. The factors causing safety occurrences in track work often include lack of skills and deficiencies in safety

culture. In 2021, the frequency of occurrences in track work decreased by 24% compared to 2020, and the success rate has increased year by year.

A great deal of work has been done in recent years to improve competence and the safety culture in the rail sector. While change takes time, sustained efforts can help ensure sufficient competence across the sector and support the building of a good safety culture. A good safety culture promotes the sharing of safety information, which further facilitates learning and positive safety development across the sector.

2 Traficom's safety operations and organisation

2.1 Safety strategy and plans

In 2021, Traficom continued to implement its Rail Transport Safety Programme, which has also covered urban rail transport (trams and metro) since the spring of 2020. When developing and updating the programme, Traficom has taken into account the work programmes of the European Commission and ERA, the special features and needs of the Finnish rail network as well as the views of the Ministry of Transport and Communications and other operators in the field. Traficom monitors the Safety Programme's implementation on a quarterly basis and reports on progress to the Ministry of Transport and Communications. In future, the Rail Transport Safety Programme will be replaced by a target document that will enter into force in 2022.

In 2021, the Safety Programme focused particularly on the importance of safety management and the development of risk management and safety culture. As regards reliability, efforts were continued to improve the culture of reliability and promote cyber security in rail transport. Improving reliability was also closely connected to objectives concerning the transport of dangerous goods and the use of data on accidents and incidents. The key themes covered by the programme also included clarifying the roles, responsibilities and competences particularly in practical situations that are considered difficult in a multi-operator environment.

The Safety Programme documentation describes the operators in the rail sector, their areas of responsibility and the regulatory framework applicable to the railways. While the documentation has changed little since the year before, the measures of the actual programme have been somewhat re-grouped to clarify the contents. As in the previous year, the Safety Programme comprises eight comprehensive themes, which contain a total of approximately 30 detailed actions through which Traficom strives to improve rail transport safety together with the operators in the sector. The themes aim at the overall improvement of rail transport safety. The following development themes were chosen for 2021:

1) Creating a culture of reliability in rail transport
2) Developing the cyber security of rail transport comprehensively
3) Improving safety in the transport of dangerous goods
4) Bringing the use of accident and incident data up to a new level
5) Developing risk management comprehensively
6) Promoting the safety culture
7) Enhancing the efficiency of Traficom's supervisory measures and the use of their results as well as developing supervision in matters concerning rolling stock and infrastructure

8) Promoting the clarification of the roles, responsibilities and competences in the field of rail transport and improving cooperation between different operators.

Most of the actions in the Rail Transport Safety Programme were already included in the programme in 2020, and they will continue to be developed in the years to come. Themes that have clearly grown in importance included the importance of safety management and improving cyber security, as society is constantly placing increasing demands on these areas.

Responsibilities for implementing Safety Programme actions have been assigned to Traficom's personnel, a schedule for the actions has been prepared, and implementation is reviewed each quarter. Some of the actions have also been tied to Traficom's performance targets. In the future, the Safety Programme is to be updated as necessary.

2.2 Safety recommendations

Figure 2 presents the implementation status of rail transport safety recommendations issued by the Safety Investigation Authority, Finland (SIAF). Of all the recommendations, 76% have been implemented.

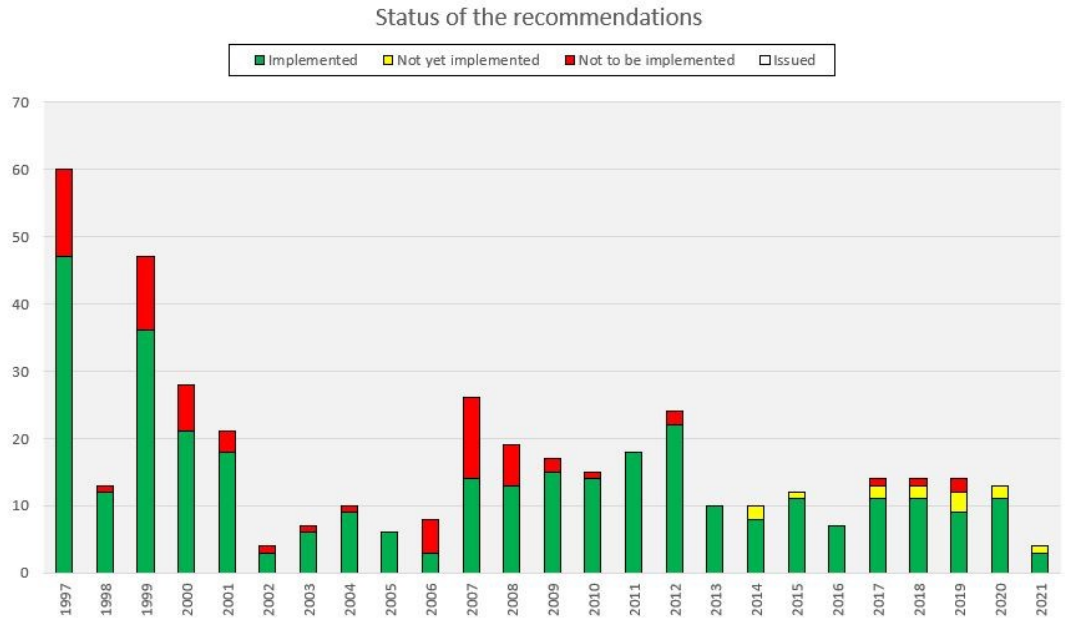

Figure. Annual number and status of rail transport safety recommendations issued by the Safety Investigation Authority, Finland in 1997–2021.

In 2021, the Safety Investigation Authority issued four recommendations, including one to ERA (2021-S1, Side collision protection for rolling stock, the European Union Agency for Railways adds requirements on protection against side collisions to regulations on diesel trains).

2.3 Actions taken on the basis of safety recommendations

The actions are monitored in annual recommendation monitoring meetings led by the Safety Investigation Authority. Participants include all the parties to whom recommendations have been issued (e.g. rail transport operators, rescue services, police, municipalities and road infrastructure managers). In the meetings, the parties review the status of all recommendations that have not been fully implemented. Table 1 presents the actions taken by Traficom regarding the recommendations that were pending in 2021.

Table 1. Actions taken by Traficom based on the Safety Investigation Authority's recommendations.

Safety recommendation	**Actions taken**	**Status of implementation**
2020-S31 The Finnish Transport and Communications Agency develops its safety occurrence information system so that it can be used to follow the processing of occurrences. Furthermore, the Finnish Transport and Communications Agency ensures that all operators in the railway industry have functional occurrence management processes.	Systems for reporting safety occurrences are being developed at EU and national level. Reacting to occurrence reports and monitoring the reports, however, has been discussed in the network for human and organisational factors (HOF) in rail transport, in connection with safety culture issues and in safety dialogues.	Partially implemented
2019-S47 The Finnish Transport and Communications Agency shall define an approval process for the risk assessment of level crossings and supervise that the corrective measures are taken.	In Traficom's view, infrastructure managers assess the risks in their own processes. The risks associated with level crossings are assessed together with other risks. The implementation of corrective measures is assessed in the context of audits.	Implemented
2019-S42 Management of the level crossing risks identified during track projects.	In Traficom's view, residual risks may remain in the identification of level crossing risks in track projects, and these residual risks must be examined later. The Finnish Transport Infrastructure Agency draws up plans for the elimination or improvement of level crossings for specific line sections or other sufficiently large areas in connection with plans for overhaul and development projects; requirements memoranda for	Implemented

	individual line sections are not sufficient.	
2018-S21 Improving the safety of most dangerous level crossings.	In Traficom's view, safety has been improved on a risk basis, and crossings posing an accident risk are being eliminated and their safety improved as necessary. The Finnish Transport Infrastructure Agency has a programme for improving level crossings. The programme has resulted in safety improvements at some 450 level crossings.	Implemented

2.4 Organisation of railway operations in central government administration and at the Finnish Transport and Communications Agency

In Finland, transport matters fall within the remit of the Ministry of Transport and Communications, which prepares the policies, strategies and legislation concerning the transport sector. Traficom serves as the national railway safety authority. The Rail Regulatory Body, which ensures well-functioning markets and the fair and non-discriminatory treatment of operators, also operates in conjunction with Traficom.

The Finnish Transport Infrastructure Agency is the infrastructure manager of the state-owned rail network and is also responsible for roads and waterways. Traffic management services are provided by Traffic Management Company Fintraffic Ltd (Fintraffic), a state-owned special task company, whose subsidiary, Fintraffic Railway Ltd, is responsible for traffic management on railways. Other subsidiaries of Fintraffic specific to each mode of transport are responsible for traffic management services for shipping, road traffic and aviation.

The Safety Investigation Authority, which operates in conjunction with the Ministry of Justice, is responsible for investigating rail transport accidents in Finland.

There were some changes to Traficom's organisation in the summer of 2021. A new organisational unit (called 'service area' in the Traficom organisation) was created for rail transport. Its main responsibilities include the duties of the national safety authority based on the Directives on interoperability, safety and qualifications. The service area for rail transport includes the following five teams:

- Rail Organisations: The team is responsible, in particular, for the authorisations of operators and the supervision of railways.
- Operation and Competences: The team is responsible for matters concerning the operation of rail transport, competences and qualifications, safety management and rolling stock maintenance, for example.
- Infrastructure and Vehicles: The team's responsibilities include approvals for rolling stock and rail infrastructure, railway plans, matters concerning assessment bodies and the transport of dangerous goods.

- Safety Culture: The team is responsible for promoting safety culture and matters concerning human and organisational factors (HOF) in rail transport.
- Reliability: The team is responsible for preparedness and reliability issues in the rail transport sector.

At the end of 2021, Traficom had more than 900 employees, and it operated in 15 cities. Approximately 30 Traficom employees worked exclusively with rail transport matters.

Traficom continued to develop its competence management and quality systems in 2021, and this also affected rail transport. There were also development projects specific to rail transport. These concerned, for example, supervision, well-being at work and competence development.

3 Status of railway safety

3.1 Safety of train traffic

In 2021, the number of significant accidents in train traffic was higher than in previous years. One particular reason for the increase in the total number of accidents was level crossing accidents resulting in multiple deaths or serious injuries. In 2021, there were 25 significant accidents, of which 13 were level crossing accidents. However, the figures for a single year do not allow the conclusion that the safety situation in train traffic is becoming poorer.

Passenger safety remained good, as it has been in previous years. VR Group Plc achieved its 2021 target regarding occurrence frequency in passenger safety.

Accidents in train traffic

VR Group Plc reported 38 collisions with obstacles, 2 derailments and 9 fires in rolling stock in 2021. There were no collisions between vehicles in 2021. Compared to previous years, there were more collisions with obstacles. The increase can be at least partly explained by the fact that in autumn and winter 2021 train drivers were requested to actively report collisions with banks of snow.

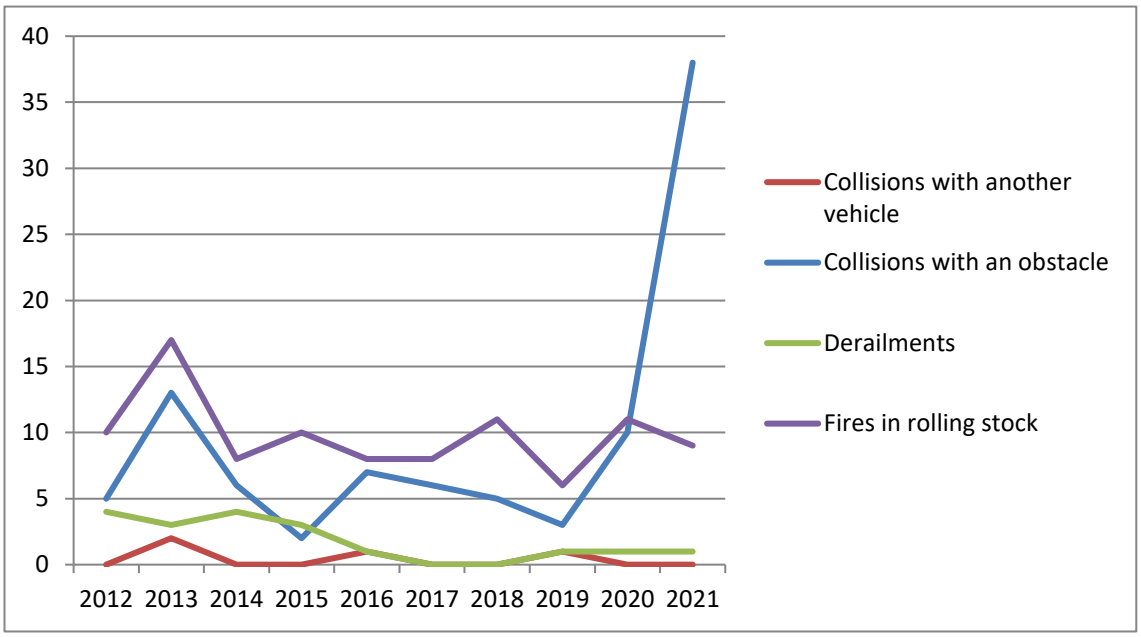

Figure 3. Number of train traffic accidents in VR Group Plc's statistics by accident type in 2012–2021.

For 2021, VR reported no collisions of trains with other rail vehicles. Such collisions have been rare in recent years: only one case belonging to this category has occurred in 2017–2021.

There were nine fires in rolling stock in train traffic in 2021, and one of these was classified as a significant accident. In 2016–2020, on average nine such fires were reported yearly. Typically, fires in rolling stock start in locomotive engine rooms or passenger carriages' heating equipment.

Incidents in train traffic

As accidents in train traffic are rare and random variations play a major role in their yearly numbers, the short-term trend in accident numbers is not the best indicator for the development of safety. Incidents happen more frequently, and by monitoring their numbers and risk levels, a more accurate picture can be obtained of the development of safety. A change in the number of reported incidents may indicate not only changes in the safety situation but also in the culture of reporting occurrences.

According to VR Group's train traffic statistics, there were 27 cases of passing a signal at danger in 2021. In 2016–2020, an average of 33 cases of signal passed at danger have been reported yearly. These incidents occur at low speeds, and the automatic train protection (ATP) device stops the rolling stock as soon as the signal has been passed. When operating without ATP, however, the risks associated with passing a signal at danger are higher.

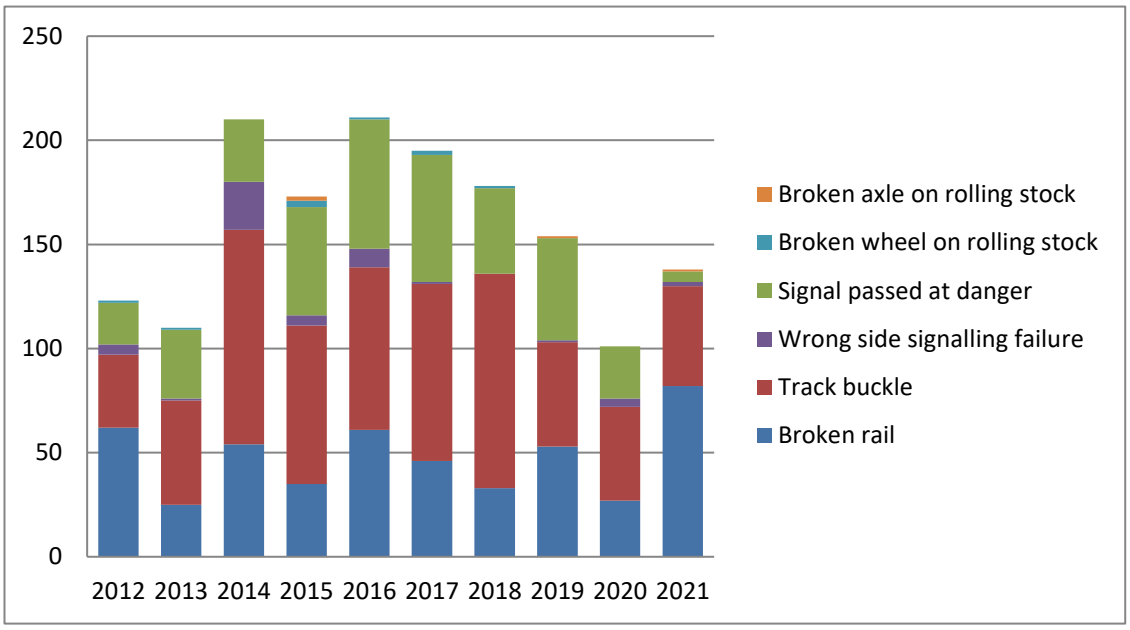

Figure 4. Number of incidents on railways and their precursors according to the EU Common Safety Indicators in 2012–2021.

According to VR's statistics, there were 4 hot axle box incidents caused by bearing failure and 260 hot axle box alarms caused by dragging brakes. Dragging brakes are a problem especially in the winter when snow and ice can accumulate on bogies and cause brakes to drag. In 2016–2020, there were an average of 154 hot axle box alarms each year.

3.2 Safety of shunting

Shunting refers to the moving and sorting of vehicles to support train traffic. More accidents and incidents usually occur in shunting work than in train traffic because, unlike in train traffic, technical safety systems play only a minor role in shunting, and the responsibility for ensuring the safety of the work mainly lies with shunting staff. Because of the low speeds involved, however, the consequences of shunting accidents are usually less serious than those occurring in train traffic. Nonetheless, extremely serious accidents may occur in shunting, too, because of the great masses of the vehicles and the potential of dangerous goods being present.

A clear decreasing trend can be discerned in the numbers of shunting accidents and incidents in the 2010s. The factors contributing to increased safety have included at least better work instructions and working practices and the improved condition of private sidings. In 2021, the number of shunting occurrences was slightly higher than the year before but remained below the 2019 level.

The causal factors of shunting accidents and incidents are frequently associated with the shunting foreman's or driver's incorrect practices, such as keeping insufficient lookout or using excessive speed. Incorrect work practices are often a result of a feeling of being in a rush, tiredness, a poor level of alertness or challenging winter conditions, for example.

In 2021, three derailments and one collision classified as significant accidents occurred in shunting:

- In Niirala, wagons derailed at a turnout on 15 April 2021, causing damage to the track worth more than EUR 150,000.
- In Vainikkala, a shunting unit derailed on 7 July 2021, causing damage to the track worth approximately EUR 350,000.
- In Lieksa, three empty freight wagons derailed on 11 October 2021, interrupting traffic on the line section between Lieksa and Nurmes for more than six hours.
- At the Tampere railway station, a trainset collided with another train during shunting work on 12 December 2021, causing damage to the vehicles worth more than EUR 150,000.

According to VR Group's statistics, 50 derailments occurred in shunting work in 2021 (Figure 5). Even though the statistics compiled by VR Group do not cover all shunting work performed in Finland, they currently provide the most comprehensive data on the subject. The number of derailments in 2021 was slightly smaller than the average in 2018–2020 (67 cases a year).

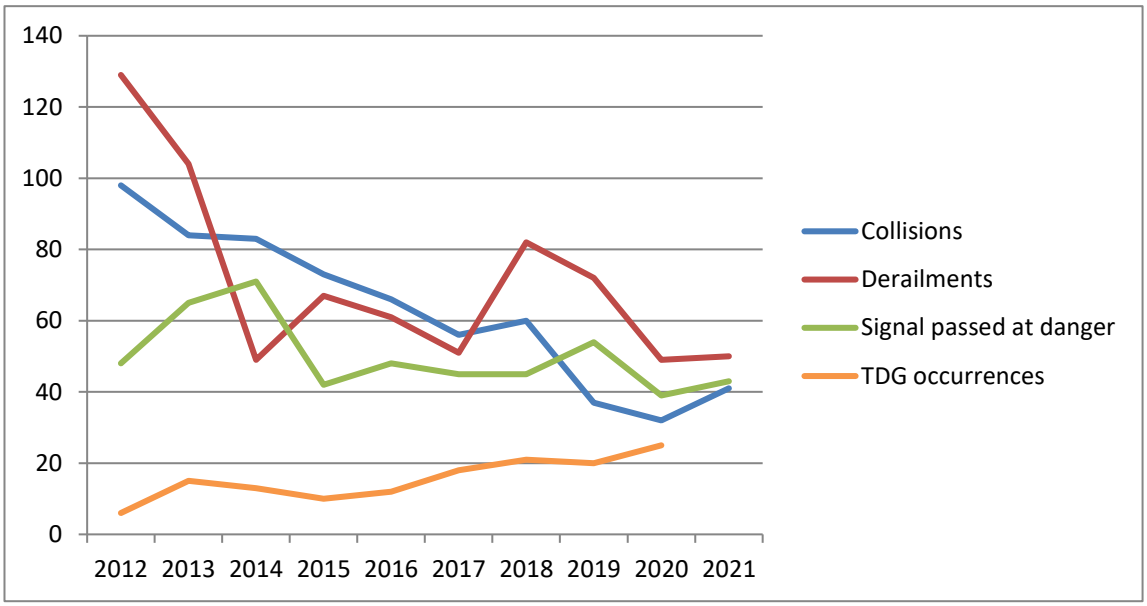

Figure 5. Number of shunting occurrences in VR Group's statistics by occurrence type in 2012–2021.

According to VR Group's statistics, there were a total of 41 collisions in shunting work in 2021. In 2018–2020, an average of 43 collisions occurred each year. In the early 2010s, the annual average was almost one hundred collisions; thus, there is a clear downward trend in collision numbers. Collisions in shunting are typically caused by inappropriate practices during shunting work, including excessive speeds or keeping insufficient lookout.

In 2021, VR Group reported 43 cases of signal passed at danger in shunting work. Between 2018 and 2020, an average of 46 cases of signals passed at danger were reported each year.

Occurrences related to the transport of dangerous goods in shunting (i.e. derailments, collisions and leaks) numbered eight according to VR Group's statistics

for 2021. The number of these occurrences was below the average of 22 over the years 2018–2020. In 2021, the volumes of dangerous goods transported were smaller than in previous years.

Systematic efforts have been made to improve shunting safety, for example, by promoting a good safety culture and ensuring the use of safe work practices. While some improvements have been achieved in shunting safety in recent years, the high number of occurrences shows that a great deal still remains to be done.

3.3 Safety of transport of dangerous goods

The volumes of dangerous goods transported have decreased from the level in the 1990s. Dangerous goods are transported almost across the entire railway network, but railway sections in Southeast Finland are a clear focal point for these operations. Services for the chemical industry account for a majority of the dangerous goods carried by rail.

The most comprehensive statistics on accidents and incidents related to the transport of dangerous goods by rail are currently contained in VR Group's railway safety report, which is a compilation of data from VR's accident and incident reports. VR Group is responsible for most transports of dangerous goods in Finland, and the company's statistics thus provide a relatively comprehensive picture of occurrences in the field.

Apart from leaks, accidents related to the transport of dangerous goods are rare, but incidents do occur from time to time. Most incidents related to the transport of dangerous goods occur during shunting. Most of the leaks of dangerous goods during shunting have concerned liquids leaking via inlet and discharge valves.

No clear trend can be observed in the annual total numbers of occurrences in the transport of dangerous goods by rail. The consequences of these occurrences are typically minor; derailments do not usually result in leaks, and any leaks are mainly minor ones through valves. As a rule, the dangerous goods most often involved in accidents and incidents are the same as the ones most commonly transported over the railway network – inflammable liquids, corrosive substances and gases.

In addition to VR Group, there is another operator (Operail Oy) transporting dangerous goods in Finland. A third operator (Fenniarail) has the ability to begin transporting dangerous goods on the Finnish railway network.

3.4 Safety of work on tracks

Track work refers to work carried out on the tracks or in their vicinity that may affect traffic safety. The safe coordination of track work and train traffic has been a key challenge to railway safety for a number of years.

Typical occurrences related to work on tracks, such as working without a track work permit, inadequate protection of the work site and errors in the opening of the track work site to traffic, pose risks to the safety of both rail transport and track work.

The majority of track work in Finland is carried out on the state-owned railway network, which is managed by the Finnish Transport Infrastructure Agency. The

Finnish Transport Infrastructure Agency gauges the development of the safety situation in track work by occurrence frequency, in which the number of accidents, incidents and human errors in railway infrastructure management is examined in proportion to the number of track work permits. In 2021, the occurrence frequency in track maintenance work decreased by 24% compared to 2020 (Table 2).

Table 2. Occurrence trends in railway infrastructure management in 2017–2021 by category. (Finnish Transport Infrastructure Agency, 2021)

Occurrence type	Change 2017 -> 2021	Change 2020 -> 2021
Collisions in track work or collisions with obstacles related to track work	-60%	-33%
Unauthorised track work or passing of the track work area	-44%	-10%
Errors in determining the location of track work sites or opening the work site to traffic, other errors by track work manager	-54%	-13%
Errors in the use of safety men	-52%	-43%
Errors concerning speed limits and ATP	-61%	-61%
All occurrences	**-50%**	**-24%**

In its 2021 safety report, the Finnish Transport Infrastructure Agency analysed the safety of track work by examining the numbers of key occurrences and the success rate (Figure 6). As Figure 6 shows, the number of key occurrences has decreased and the success rate improved from 2017 to 2021.

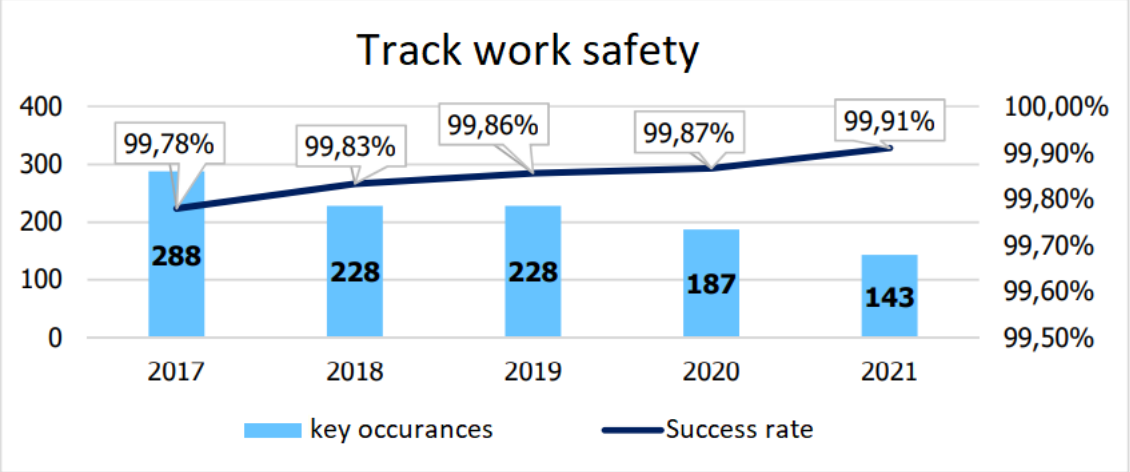

Figure 6. Developments in track work safety (number of key occurrences & success rate) in 2017–2021. (Finnish Transport Infrastructure Agency, 2021)

There were a few incidents involving persons and rolling stock in motion in track work. In the cases, employees did not follow the safety guidelines, and in one case, the driver of a work machine with rail wheels and a person working nearby did not notice each other. Other reported accidents involving persons include, for example, electric shocks during track work and other accidents on tracks not involving rolling stock.

3.5 Level crossing safety

There were more level crossing accidents in Finland in 2021 than the year before. There were 26 level crossing accidents, of which 25 took place on the state-owned railway network. In the previous year, the figures were 20 and 16 respectively. This means that the share of accidents on the state-owned railway network out of all level crossing accidents was higher in 2021 than the year before. During the five preceding years (2016–2020), there were on average 25 level crossing accidents per year; thus, the figure for 2021 is very close to the average of the five preceding years.

In 2021, level crossing accidents involved more serious casualties than in 2020. However, the figures are so small that the difference may be explained by random variation. Over a longer term, the number of level crossing accidents has decreased. Figure 7 illustrates the declining trend in these accidents.

The numbers of accidents and casualties in individual years are a poor indicator of level crossing safety because the figures are small and random variation may explain great fluctuations. It seems that the number of level crossing accidents in 2021 was an exceptional deviation from the trend. By the end of August 2022, there have been nine level crossing accidents with only one fatality in total, which seems to suggest a turn towards the long-term average.

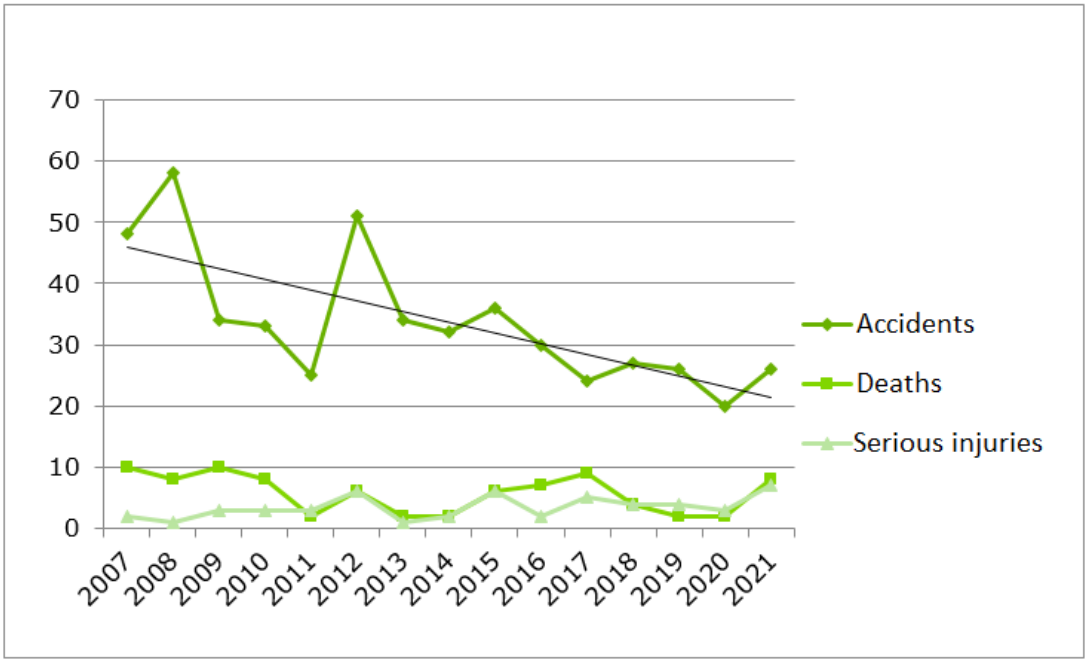

Figure 7. Numbers of level crossing accidents and resulting casualties in 2007–2021.

Despite the declining trend in the number of level crossing accidents over the long term, they still constitute one of the greatest safety risks in the Finnish railway system. Level crossing accidents account for approximately a half of all significant accidents occurring on the Finnish railway network (52% in 2021). In addition to casualties and material damage, level crossing accidents also reduce the punctuality of train traffic.

In 2021, level crossing accidents resulted in 8 fatalities, and 7 persons sustained serious injuries. In the previous five years (2015–2019), there were an average of

5 fatalities in level crossing accidents each year, while 4 persons sustained serious injuries. However, the figures are small and the differences are within random variation. Eleven of the level crossing accidents that occurred in 2021 are classified as significant accidents because of the serious casualties they caused, one because of the material damage caused and one because traffic on the main railway line was interrupted for more than six hours. Of all significant level crossing accidents in 2021, 5 (38%) took place at a level crossing equipped with half barriers or user-side warning (warning lights and audible alarms). The remaining 8 significant level crossing accidents occurred at passive level crossings.

One accident resulted in the deaths of two persons, and another accident in one fatality and one serious injury.

As the infrastructure manager of the state-owned rail network, the Finnish Transport Infrastructure Agency has drawn up a programme for improving level crossing safety for 2018–2024. Level crossing safety will be improved by eliminating level crossings and by technical means (e.g. by increasing the number of level crossings with half barriers and improving visibility). Once the programme is fully completed, a total of 455 level crossings will have been eliminated or improved.

3.6 Safety of private sidings

Private sidings are tracks owned by industrial plants, ports and municipalities that connect to the state-owned railway network. There are approximately 120 managers of private sidings in Finland. The length of private sidings varies from spur tracks of less than a hundred metres to networks of dozens of track kilometres. In practice, traffic on private sidings is always shunting.

Only a small proportion of the safety occurrences on private sidings are reported, and the reported number does not correspond to the actual number of occurrences. However, the reported occurrences and the safety reports produced by private siding managers do give a good picture about the types of occurrences seen on private sidings.

The most common accident type reported on private sidings is derailment. Derailments are often caused by the accumulation of snow, ice or litter on grooved rails (lifting the railway vehicle off the rails) and stop blocks left on the track.

Level crossing incidents and accidents are the second most common occurrence type reported on private sidings. They are typically caused by vehicle drivers, but the contributing causal factors often include challenging conditions at level crossings on private sidings. On private sidings, the track often crosses a road at multiple points. Visibility at level crossings on private sidings is also sometimes poor. In recent years, investments in level crossing safety have been made on many private sidings, for example by installing warning systems.

The third most common incident type reported on private sidings is collision with an obstacle. Typical obstacles include buffer stops and the gates of factory areas. In a typical case, the collision is caused by a human factor associated with shunting work, such as keeping insufficient lookout or excessive speed.

In addition to occurrence reports, private siding managers also report to Traficom on safety development in their annual safety reports. A safety report for 2021 was submitted to Traficom by 83 managers of private sidings. Nearly a half (37) of the private siding managers that submitted a safety report noted that no accidents or incidents occurred on their rail network in 2021. Some managers described their observations in more detail, reporting dozens of observations involving usually only a few occurrences. Some managers only reported serious occurrences to Traficom. Based on the safety reports, the most common occurrences on private sidings are level crossing incidents and derailments.

According a majority of the reports by private siding managers, no significant changes had taken place in the safety situation during the reporting year. A number of operators reported that improved safety management had increased safety at private sidings by leading to a clearer division of responsibilities and higher awareness of risks, among other things.

The safety targets of private sidings are often associated with the number of accidents and incidents. Zero rail accidents is a common target. The targets are often also linked to indicators measuring an industrial plant's occupational safety occurrences, for example. Other common targets include issues related to railway network maintenance and development, such as track renovations or improving level crossing safety.

3.7 Casualties in railway accidents

In 2021, railway accidents resulted in more serious injuries and fatalities than in the preceding three years on average (Figures 8 and 9). Both fatalities and serious injuries were mainly caused by level crossing accidents (for more information, see section 4.5 on level crossing safety). The number of accidents involving deaths is at the same level as in 2017 (Figure 8).

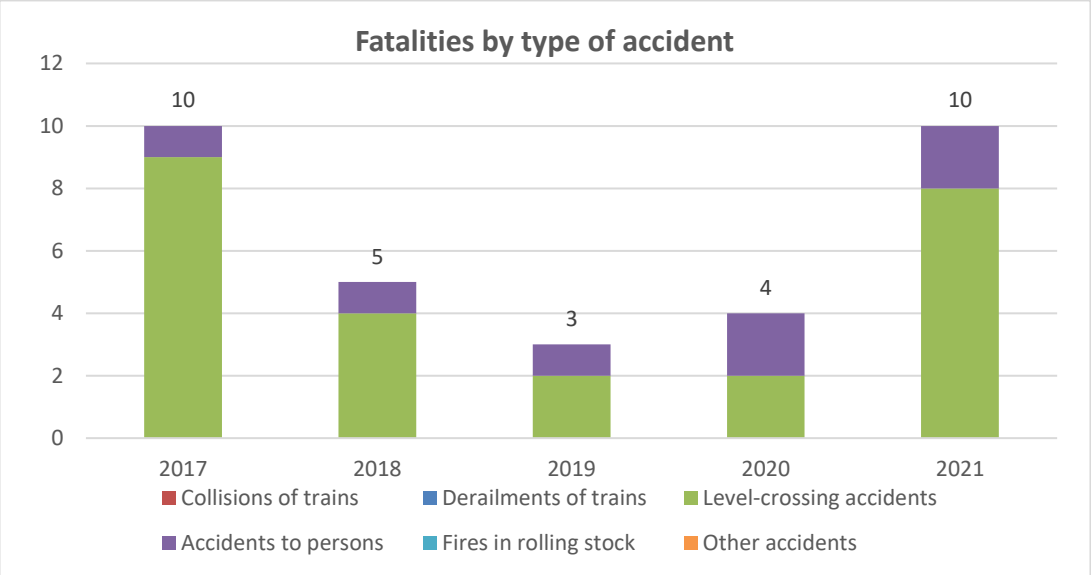

Figure 8. Numbers of accidents resulting in fatalities by accident type in 2017–2021.

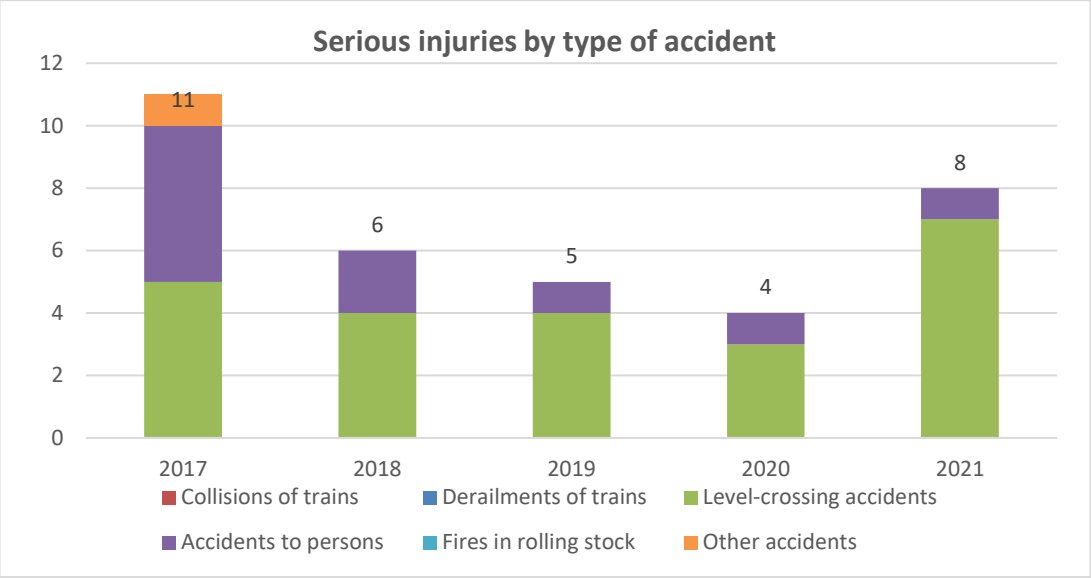

Figure 9. Numbers of accidents resulting in serious injuries by accident type in 2017–2021.

Table 3 includes a list of safety occurrences related to trespassing on railway premises in 2017–2021 compiled by the Finnish Transport Infrastructure Agency.

Table 3. Safety occurrences relates to trespassing on railway premises in 2017–2021. (Finnish Transport Infrastructure Agency, 2021

Numbers of accidents involving personal injuries and cases of trespassing	2017	2018	2019	2020	2021
Accident to a person involving rolling stock in motion 1)				56	38
Incident with a person involving rolling stock in motion 2)				9	19
Trespassing 3)				194	254
Other accident involving personal injury (4)				32	10
Personal injury	6	5	4		
Suicide	64	56	58		
Incident involving personal injury	7	12	5		
Suicide attempt	48	38	11		
Trespassing	108	124	91		
Trespassing with intention of self-harm			80		
Other personal injury 5)	3	4	3		
Vandalism	59	53	53	394	251
Other accident or incident 6)	0	2	3	312	335
Incident caused by a party outside the railway system 7)	111	113	202		
Metal theft 8)	3	2	6		
Criminal traffic mischief 9)	240	152	152		
TOTAL	**649**	**561**	**665**	**997**	**907**

1) Includes previous categories Personal injury and Suicide.
2) Includes previous categories Incident involving personal injury and Suicide attempt.
3) Includes previous categories Trespassing and Trespassing with intention of self-harm.
4) Includes all accidents involving personal injuries related to the railway system with the exception of accidents to persons involving rolling stock in motion (including accidents involving personal injuries that were previously reported as other accidents).
5) In 2020, all personal injuries are reported in the summary concerning accidents involving personal injuries (Appendix 7).
6) Prior to 2020, the category only included other accidents. As from 2020, it also includes incidents.
7) No separate category in the taxonomy. In 2020, the cases are included in the category Other accident or incident.
8) No separate category in the taxonomy.
9) No separate category in the taxonomy. In 2020, the cases are included in the category Vandalism.

Most casualties on railways are caused by accidents to persons involving rolling stock in motion. No clear trend can be observed in the annual numbers of these accidents, although they were fewer in 2021 than in the year before. Most of these accidents are deliberate.

4 Changes in legislation

4.1 Changes in legislation

The Rail Transport Act (1302/2018) was amended in 2021 by the Act 1254/2020, which entered into force on 1 February 2021. The amendments concerned, in particular, provisions on the registration of vehicles and railway infrastructure because of the changes in the European Union legislation on railways. In accordance with the Commission implementing regulations adopted under the EU's 4th Railway Package, certain duties related to the registration of vehicles and railway infrastructure were transferred from national safety and registration authorities to the European Union Agency for Railways (ERA). Even though the new provisions were adopted in the form of directly applicable Commission implementing regulations, certain specifications had to be made to the Rail Transport Act, for example, with respect to terminology. Other amendments with a national scope concerned matters regarding reliability, for instance.

In 2021, Traficom issued three regulations on rail transport. The first one to enter into force (1 February 2021) was an update to the regulation on the management of private sidings. Another regulation was issued on the transport of dangerous goods by rail with the aim of improving safety in the transports. In addition to these, the regulation on information on the demand for and supply of passenger transport services and price information on taxi services also covers rail transport and is therefore included in the changes to legislation listed here.

As in previous years, Traficom informed stakeholders about regulatory amendments, for example, by organising cooperation group meetings and an information session to ensure that the drafting process would be as open and transparent as possible. Traficom also engaged in active cooperation to improve cyber security in rail transport, which clearly emerged as a new need for joint development efforts in 2020. Discussions on the topic were also begun with ERA and the national safety authorities of other EU Member States. In Traficom's view, this collaboration was fruitful and a necessary precondition for the successful development of regulation.

Even though Finland implemented the EU legislation of the 4th Railway Package already in 2019, Traficom continued to monitor regulatory fitness in 2021. Based on Traficom's own observations and discussions with its stakeholders, the new regulatory framework is mainly functioning well.

5 Certificates and authorisations

5.1 Safety certificates and authorisations

Safety certificates

Traficom issued seven single safety certificates in 2021: five new certificates and two renewed certificates. No safety certificates were revoked in 2021. At the end of 2021, 32 railway operators in Finland had a safety certificate. Three of them were railway undertakings operating commercial rail transport and the rest were shunting operators, track maintenance companies and operators of rolling stock in historical use.

On 16 June 2019, an information system maintained by ERA was introduced in the processing of safety certificate applications. Applicants submit their safety certificate applications to the One Stop Shop (OSS), and they can choose to have their applications processed by either ERA or Traficom. If the applicant operates in more than one Member State, ERA will be automatically selected. In 2021, no applications were addressed to ERA in which the operating area was Finland.

From an authority's point of view, ample experience has accumulated on the use of the OSS in the processing of safety certificate applications. No major problems have been discovered in the system, but times when the service was out of use constituted challenges in 2021. These service interruptions frequently occurred in the morning, during Finnish office hours. They did not affect the processing of applications, and the availability of the service has now improved. In minor issues, the ERA service point has quickly provided help and assistance.

In the assessment of safety certificate applications, attention has been focused on operational guidance and the integration of human and organisational factors into the procedures of the safety management system. Other focus areas include risk management and monitoring, where audits have revealed the most room for improvement. Overall, safety management systems have improved considerably over the past years.

Safety authorisations

At the end of 2021, 53 infrastructure managers had valid safety authorisations. The number of safety authorisations decreased in 2021 because the majority of managers of private sidings could opt for a simpler notification procedure under national legislation, if they wished. In 2021, safety authorisations were issued to 13 infrastructure managers.

Two holders of safety authorisations decided to discontinue their operations and cancel their authorisations in 2021. Managers who had transferred to the notification procedure were not required a separate application to cancel their safety authorisations.

A total of 82 notifications submitted by managers of private sidings under national regulation were in force at the end of 2021. Of these, 24 notifications were submitted in 2019, 22 in 2020 and 36 in 2021. Notifications that have later been cancelled have not been taken into account in the figures. Three notifications were cancelled in 2021.

Vehicle authorisations for placing in service or on the market

Since mid-2019, Traficom has mainly issued authorisations for placing on the market in accordance with the new Directive. These authorisations are processed in an information system managed by ERA. For vehicles governed by national regulation, authorisations for placing in service may also still be issued.

Traficom issued an authorisation for placing in service or on the market to 58 vehicles in 2021. Most of these authorisations were for renewed vehicles. First authorisations (vehicle type authorisations and vehicle authorisations for placing on the market) were issued to one new passanger coach.

Traficom engages in active and instructive interaction with applicants throughout the authorisation process. Consequently, there have been very few problems with the actual applications and none have been rejected.

5.2 ECMs

In 2021, the vehicle register maintained by Traficom included 34 entities in charge of maintenance (ECMs). Two of these (VR Kunnossapito Oy and Teräspyörä Oy) have been issued with ECM certificates for freight wagon maintenance.

The ECMs in Finland are railway operators' internal entities or separate undertakings. Excluding the two certified ECMs, the activities of maintenance entities are small in scale, and their clients mainly consist of a single operator. By virtue of derogations granted under the ECM Regulation and section 74 of the Rail Transport Act, most of these operators will remain outside the scope of mandatory certification in the future, even though the EU Regulation extends the ECM certification obligation to all vehicles in 2022.

In 2021, a large part of the operation in Finland was railway traffic between Finland and Russia, which takes place within the framework of an agreement on a direct international rail link between the two countries. Under this agreement, the freight wagons used in traffic between the countries are inspected at the border crossing before being used on the Finnish railway network. As vehicles approved and registered in Russia do not have an ECM determined under EU regulation, three railway undertakings (VR Group Plc, Fenniarail Oy and Operail Finland Oy) have been granted a derogation from the ECM obligations under Article 15 of the Railway Safety Directive.

5.3 Train driving licences

In 2021, Traficom issued 14 new train driving licences and renewed one licence. Five duplicates were issued, four previously issued licences were updated/amended and 147 licences were revoked. Reasons for revocation included the driver's retirement, moving to other tasks and failure to meet the medical requirements. The validity of two licences was restored once the licence conditions were once again met.

In total, 2,783 train driving licences had been issued in Finland by the end of 2021, and 2,290 licences were valid at year end.

5.4 Authorisations for placing structural subsystems in service

In 2021, Traficom issued 27 authorisations for placing structural subsystems in service. This figure is similar to the numbers of authorisations issued in previous years. The scope and complexity of railway projects issued with authorisations for placing in service varied greatly from comprehensive track improvement projects to smaller-scale sites concerning individual tracks. During the year 2021, no authorisations for placing in service were granted to new track routes in Finland.

Authorisations for placing structural subsystems in service are processed as set out in the Interoperability Directive (2016/797/EU) and the national Rail Transport Act (2018/1302).

5.5 Information exchanges between Traficom and operators

An effort has been made to keep the threshold for information exchanges between Traficom and railway operators very low. Channels for liaising with the operators include information events organised by Traficom for stakeholders, one-to-one meetings between Traficom and operators, and direct discussions between Traficom's public officials and an operator's representatives. Traficom holds regular one-to-one cooperation meetings and engages in safety dialogues with the largest operators to discuss topical issues and other themes the operators wish to address. There is also a great deal of more informal cooperation where necessary, and contacts with VR Group and the Finnish Transport Infrastructure Agency, in particular, are very frequent.

On operators' requests, Traficom coordinates various cooperation forums. These include, for example, the network for human and organisational factors in rail transport, the rail transport safety and analysis group and the group on reducing accidents to persons involving rolling stock in motion. During the year, Traficom also discussed with stakeholders practical questions concerning safety authorisations, safety certificates and other licences.

6 Supervision

6.1 Strategy, plan and decision making

Each year, Traficom prepares a supervision plan for the railways for the following year. In accordance with this plan, Traficom supervises rail sector operators by means of audits, its own inspections and complementary means of supervision, such as safety discussions, safety dialogues and assessments. The primary focus of supervision is on auditing railway operators' and infrastructure managers' safety management systems and inspecting their operations. The operations of ECMs are also supervised.

In addition to railway operators, infrastructure managers and ECMs, Traficom also supervises training organisations in the sector as well as the work of railway doctors and psychologists, for example.

Traficom reviews the implementation of its rail transport supervision plan quarterly. If necessary, the schedule of the supervision plan is modified, and certain targets may be prioritised during the validity of the plan. The emergence of new risks and exceptional events, for example, may make it necessary to update the plan. The

recommendations of the Safety Investigation Authority may also redirect supervision.

In 2021, the audits carried out in connection with rail transport supervision focused particularly on the following themes: operators' internal monitoring and operational indicators, management of qualifications by operators, operation of transport, track work safety and traffic management procedures, availability of the railway network, implementation of legislative amendments, reliability, cyber security, operators' risk management abilities, safety in the transport of dangerous goods and safety culture. The audits conducted by Traficom are planned in cooperation with the organisations audited. The objective is to ensure that audits are supportive and encouraging. During the audit, Traficom strives to arrive at a shared view with the audited organisation of the audit observations and possible deviations.

6.2 Supervision results

Traficom audited the safety management systems of 22 railway operators and infrastructure managers in 2021. In addition, Traficom audited four ECMs and three training organisations. Four yards used for the transport of dangerous goods were inspected.

In the safety management system audits carried out in 2021, the main non-conformities observed concerned the identification, assessment and management of risks (8), the performance of internal audits (8), monitoring practices (7) and competence management (4). All non-conformities observed were minor.

Traficom's interaction with the large operators, including the Finnish Transport Infrastructure Agency and VR Group, has been continuous. In addition to audits, matters related to supervision were discussed at one-to-one cooperation meetings and safety dialogues between Traficom and the operators. In 2021, safety dialogues concerned, for example, monitoring practices, human and organisational factors, cyber security, and safety-related instructions and their management. Contacts with smaller operators are less systematic, and in some cases limited to audits and inspections.

6.3 Supervisory cooperation with national safety authorities in other EU Member States

Traficom did not engage in cooperation related to supervision with national safety authorities in other Member States in 2021.

7 Application of Common Safety Methods

7.1 Application of the Common Safety Method for safety management systems

Overall, the quality of safety management by operators has clearly improved for several years. Because the Finnish railway sector includes operators of different types and sizes, there is naturally some variation. Quality depends greatly on the available resources and the willingness to invest in safety.

Larger organisations have more resources for safety management, which makes them better equipped for developing their activities than smaller organisations with

scarce resources. In large organisations, challenges may be posed by the increasing complexity of operations and taking safety management practices from the management level to the level of practical work. Low hierarchies, on the other hand, enable closer cooperation between the management and employees, and the practical implementation of safety management may be easier than in large organisations.

Operators have begun focusing more on human and organisational factors (HOF), but substantial improvements are still needed regarding HOF-related competences and the definition of a systematic, comprehensive approach, in particular.

7.2 Application of the Common Safety Method for risk evaluation and assessment

Assessments of the significance of changes are mainly carried out in connection with railway projects. An infrastructure manager or a railway operator applying for an authorisation for the placing in service of a subsystem must assess the significance of the change to be made in the early stages of the project. If the change is considered significant, the operator must carry out a risk assessment in compliance with the Common Safety Method (CSM) for risk evaluation and assessment (Regulation (EU) No 402/2013). If the change is not significant, the risk assessment should be carried out following the applicant's safety management system. Most changes are considered not significant.

If an operator applying for an authorisation for the placing in service of a structural subsystem considers the change to be significant, they must submit to Traficom a safety assessment report prepared by an independent assessment body as proof of having applied the CSM. Involving an independent assessment body incurs expenses, which may be one reason why changes are often considered not significant. The significance of the change is assessed based on six criteria, which leave operators scope for interpretation when deciding whether the change is significant.

The infrastructure projects of the Finnish Transport Infrastructure Agency, which is the infrastructure manager of the state-owned rail network, involve changes, some of which are considered to be significant and some not significant. Many of the changes are considered not significant, but the largest projects are considered significant changes. When assessing the risks of changes that are not significant, the Finnish Transport Infrastructure Agency applies a procedure that is almost identical to the risk assessment of significant changes, with the difference that the former does not include input from an independent assessment body. The projects carried out by managers of private sidings include a higher number of not significant changes. Very small-scale projects on private sidings are not required to apply for an authorisation for placing in service.

No changes were made to the national guidelines or processes related to the CSM for risk evaluation and assessment in 2021.

7.3 Application of the Common Safety Method for monitoring

Traficom has published guidelines for operators on preparing safety reports (TRAFICOM/89239/03.04.02.01/2019). The guidelines include a short description of what the report should contain in terms of monitoring actions.

Almost all of the operators who submitted a safety report also reported on monitoring. However, the descriptions varied greatly. Some operators followed the guidelines closely, while others only included a single sentence noting that monitoring had been carried out in 2021.

Approximately one operator out of three who included a description of their monitoring reported on its results using a table prepared in a specific format, which lists the management reviews and internal audits/inspections carried out, followed by the operator's monitoring priorities, targets and findings, any further actions and an assessment of effectiveness. Most operators describe these aspects in free form.

Most operators described their key monitoring priorities, while some included no information on their priorities in the descriptions of their monitoring activities. The monitoring priorities of those operators who used the table template for reporting on their monitoring were very similar.

In the case of many operators, it remained unclear how the monitoring had been carried out or what the targets and possible findings of internal audits were if the operator had included them as monitoring actions.

Those operators that used the table template for reporting on their monitoring provided the clearest descriptions of their findings. Based on the monitoring results reported by the operators, the monitoring indicators used were qualitative rather than quantitative.

The operators that used the table template for describing their monitoring activities in their safety reports also provided the clearest descriptions of their actions and their evaluation.

To sum up, the safety reports indicate that some of the operators understand, plan, implement and report on methodical monitoring in the spirit of Regulation (EU) No 1078/2012. Based on the descriptions in the safety reports, some operators only partly carried out monitoring as required under the Regulation. Thus, it seems that some operators may not recognise and understand monitoring as a tool for the continuous development of their own activities and safety.

In 2021, Traficom conducted two surveys concerning monitoring and performance evaluation. The surveys were targeted at railway operators and infrastructure managers and supplemented other supervisory measures. The survey questionnaire was sent to 30 railway operators, and the response rate was 60% (18). The answers in this respondent group indicated that the operators had defined their monitoring objects based on the information available on their own activities and some monitoring objects also seemed to be linked to a risk-based approach. Operators also said that they use monitoring as a tool for the development and continuous improvement of their operations.

The other survey questionnaire was sent to 65 infrastructure managers, and the response rate was 35% (23). Based on the survey responses, monitoring was considered to improve the maintenance of railway lines and general safety.

Based on the responses, monitoring by railway operators focuses on vehicle maintenance, driver behaviour and actions, occupational safety, regulations by the authorities, risk management and the effectiveness of internal auditing in the system. Infrastructure managers, on the other hand, focus on maintenance, risk

management, safety objectives, management reviews and the effectiveness of internal auditing.

The responses suggest room for improvement in the processing and analysis of monitoring results. Together with risk assessment results, these steps should help target future monitoring activities.

The safety reports, the conformity assessment and the monitoring surveys suggest that Traficom should continue its efforts not only to verify that operators' descriptions of their monitoring activities are compliant with the Regulation but also to ensure that operators have understood the purpose of monitoring and that they plan and carry it out as required under the Regulation.

One of Traficom's areas of focus in its 2022 rail transport supervision plan is to observe the development of monitoring practices. This will be done, for example, by conducting surveys supplementing supervision, engaging in safety dialogues with operators and evaluating performance (audits).

7.4 Participation in EU-wide activities

In 2021, Traficom took part in the activities of the European Year of Rail, a theme campaign organised by the European Commission. During the year, Traficom actively distributed information about current affairs in rail transport and its own work in the sector. The aim of the European Year of Rail was to highlight the benefits of rail transport as a safe, reliable, environmentally friendly and efficient mode of transport and travel.

During the year, Traficom raised awareness about the wide range of work carried out in the railway sector in particular to maintain and promote the safety and reliability of railways. Traficom highlighted many themes and projects that are important to the future of rail transport, such as the Digirail project, the cyber security programme for rail transport, international cooperation and environmentally friendly mobility, not forgetting efforts related to safety culture. The European Year of Rail also underlined the role of rail transport in future transport and mobility solutions.

In addition to activities related to the European year, Traficom also organised its own theme day on rail transport and the environment in the autumn of 2021. The event brought together various rail transport experts and operators. The aim of the day was to raise awareness of the European green transition and the role of rail transport as a sustainable and environmentally friendly choice in the context of European connection and common objectives.

8 Safety culture

8.1 Evaluation and monitoring of safety culture

In 2021, the European Union Agency for Railways (ERA) launched the European Rail Safety Climate Survey (ERA-SCS). Traficom took part in the survey as a partner and received a report on the organisation's own results. Different versions of the survey were designed for national safety authorities and railway operators. In

addition to Traficom, other ERA-SCS partners in Finland included the Finnish Transport Infrastructure Agency, VR Group and NRC Finland.

Safety culture was evaluated and discussed with certain operators in safety dialogues, which were piloted in 2021. Safety dialogues provide an opportunity for deeper conversations about specific safety-related topics than is possible during audits.

Traficom observes the safety culture in connection with safety audits.

8.2 Safety culture development projects

Traficom launched in 2021 a project on how safety culture and human and organisational factors (HOF) are linked to the safety management system. The project was carried out by Lilikoi Consulting. The project began with an analysis of the relationship between ERA's safety management system model and safety culture model. The models were found to overlap in certain respects but not to be inconsistent with each other.

The project also issued recommendations on how Traficom should take the links between safety culture and the safety management system into account when evaluating safety culture. The recommendations included three different models for the evaluation of safety culture: (1) targeted evaluation of elements not covered by the safety management system, (2) detailed evaluation including interviews, documentary analyses and a survey, and (3) detailed evaluation including interviews and an audit. Interview and audit question templates were prepared for all evaluation models. The project identified the need for Traficom to develop its audit procedure in the future so that audits enable Traficom to gather information that is related to safety culture and closely associated with the safety management system.
The interview questions formulated in the project will be tested in interviews at Traficom. The questions were modified to better suit the work of an authority.

8.3 Communication about safety culture development projects

Traficom informed operators in the rail sector about projects concerning the development of safety culture and about safety culture and HOF during 2021 in the rail transport HOF network. The network includes operators associated with rail transport, such as the Safety Investigation Authority, education and training institutions and consultants. At network meetings, the operators also shared information about their own projects concerning safety culture and HOF.

Within its own organisation, Traficom presented information on safety culture in briefings and information sessions and by presenting the theme at different levels of the organisation (teams, service areas) and the security and privacy function. For example, an information session on the Safety Climate Survey (SCS) was organised for the Rail Transport service area. Safety culture and the SCS were also discussed in the HOF network.

A Traficom specialist attended the ERA webinar Enhancing Rail Safety in 2021 as a speaker.

Annex 1: Progress with Interoperability

1. Lines excluded from the scope of IOP/SAF Directive (end of year)

1a	Length of lines excluded from the scope of application of the IOP Directive [km]	17
1b	Length of lines excluded from the scope of application of the SAF Directive [km]	17

2. Length of new lines authorized by NSA (during the reporting year)

2a	Total length of lines [km]	0

3. PRM adapted stations (end of year)

3a	PRM TSI compliant railway stations	28
3b	PRM TSI compliant railway stations - partial TSI compliance	5
3c	Accessible railway stations	2
3d	Other stations	163

4. Train driver licenses (end of year)

4a	Total number of valid European licenses issued in accordance with the Directive 2007/59/EC (as amended)	2290
4b	Number of newly issued European licenses (first issuance)	14

5. Number of vehicles authorised under the interoperability Directive (EU) 2016/797 (during the reporting year)

5a	**First authorisations (article 14(1)(a) Regulation (EU) 2018/545) - total**	**1**
5aa	Freight wagons	0
5ab	Passenger coaches	1
5ac	Thermal or electric traction units	0
5ad	Self-propelling thermal or electric passenger trains	0
5ae	Special vehicles/OTM	0
5b	**Renewed vehicle type authorisations (article 14(1)(b) Regulation (EU) 2018/545) - total**	**0**
5ba	Freight wagons	0
5bb	Passenger coaches	0
5bc	Thermal or electric traction units	0
5bd	Self-propelling thermal or electric passenger trains	0
5be	Special vehicles/OTM	0
5c	**Extended area of use authorisations (article 14(1)(c) Regulation (EU) 2018/545) - total**	**0**
5ca	Freight wagons	0
5cb	Passenger coaches	0
5cc	Thermal or electric traction units	0
5cd	Self-propelling thermal or electric passenger trains	0
5ce	Special vehicles/OTM	0
5d	**New authorisations (article 14(1)(d) Regulation (EU) - total**	**5**
5da	Freight wagons	1
5db	Passenger coaches	0
5dc	Thermal or electric traction units	0
5de	Self-propelling thermal or electric passenger trains	0
5df	Special vehicles/OTM	4

5e	**Authorisations in conformity to type (article 14(1)(e) Regulation (EU) - total**	**52**
5ea	Freight wagons	32
5eb	Passenger coaches	6
5ec	Thermal or electric traction units	14
5ee	Self-propelling thermal or electric passenger trains	0
5ef	Special vehicles/OTM	0

6. ERTMS equipped vehicles (total fleet, end of year)

6a	Tractive vehicles including trainsets equipped with ERTMS Level 1	42*
6b	Tractive vehicles including trainsets equipped with ERTMS Level 2	0
6c	Tractive vehicles including trainsets – no ERTMS installed	619**

7. Number of NSA staff (full time equivalent employees) by the end of year

7a	FTE staff involved in safety certification	8/26
7b	FTE staff involved in vehicle authorization	5/26
7c	FTE staff involved in supervision	16/26
7d	FTE staff involved in other railway-related tasks	7/26

* Number of vehicles with ERTMS equipment. Currently these vehicles are approved only for STM operation with national Class B system, because there are no ERTMS tracks in Finland.

** Tractive vehicles include line locomotives, multiple units/railcars and light maintenance railcars. Pure shunters and vehicles in historical use are excluded.

Annex 2: Acronyms and Definitions

Acr/Abbr	Meaning
ATP	Automatic train protection system
CSI	Common safety indicators
ECM	Entity in charge of maintenance
ERA-SCS	European Rail Safety Climate Survey
HOF	Human and organisational factors
IM	Infrastructure manager
NSA	National security authority
SIAF	Safety Investigation Authority, Finland
RSD	Railway Safety Directive
RU	Railway undertaking
SMS	Safety management system
TDG	Transport of dangerous goods

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