Annual Railway Safety Report 2017

Finnish Transport Safety Agency - Trafi

Contents

A Introduction

This Annual Railway Safety Report presents the state of Finnish rail safety and the operations of the Finnish Transport Safety Agency (Trafi) as the National Railway Safety Authority in 2017.

Section 41 of the Railway Act (304/2011) requires Trafi to publish an annual report on rail safety by 30 September each year. The Annual Railway Safety Report is delivered to the European Railway Agency (ERA). The Annual Railway Safety Report follows the structure recommended by the ERA. The version of the report following ERA's annual safety report template is only delivered to the ERA. A version largely identical in content but intended for the public is submitted to the Ministry of Transport and Communications and published on the website of Trafi.

The information in the Annual Railway Safety Report is based on the annual safety reports and occurrence reports submitted to Trafi by railway operators. Source material includes also safety investigation authority's accident investigations and internal materials of Trafi.

B Overall safety performance and strategy

B.1 Main conclusions on the reporting year

The safety situation on Finnish railways is twofold. On the one hand, accidents in train traffic are rare and this mode of travel is extremely safe for both passengers and for those working in railways. However, at the same time, many people are killed or injured in level crossing and trespassing accidents each year and the number of incidents in track maintenance work has remained high.

In terms of train safety, we can be satisfied with the year 2017. There were no serious derailments, collisions or fires in train traffic and the number of less serious accidents was also small. There are, however, serious incidents in train traffic each year, including those where a train is running even though the ATP device is switched off.

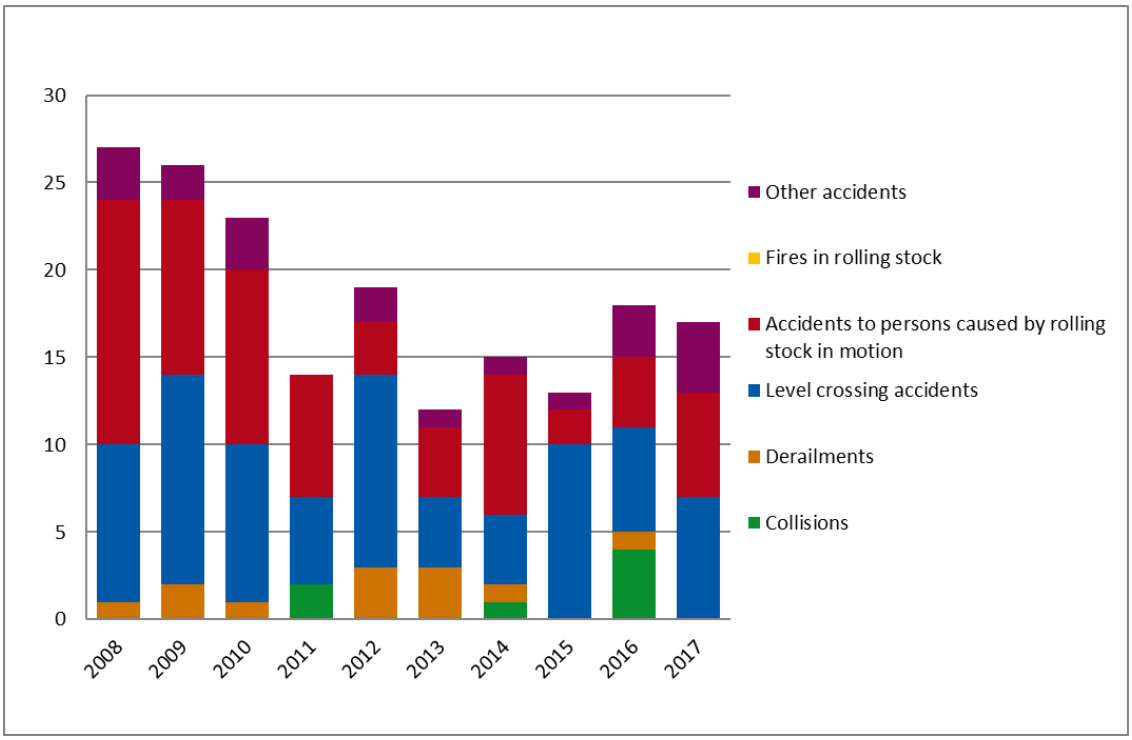

Figure 1. Significant accidents in 2008-2017 by accident type.

There was a great deal of debate in Finland about safety at level crossings during 2017. The collision between a railcar and an all-terrain vehicle of the Finnish Defence Forces in Raseborg on 26 October 2017 was the most serious railway accident in Finland in the 2000s. In the accident, three persons were killed and three suffered serious injuries. Level crossing accidents caused an unusually large number of fatalities and serious injuries in 2017, while at the same time, the total number of level crossing accidents was 33 per cent below the average of the past few years.

As in previous years, most of the fatalities in Finnish railways in 2017 resulted from trespassing accidents. A total of 57 people were killed as a result of trespassing in 2017, which is slightly above the average of the previous years. Most of the trespasser fatalities were deliberate.

Safety problems in track maintenance work have been a major safety challenge in Finnish railways for many years and there were again a large number of incidents in this area during 2017. An incident where a track work machine with only the parking brake on broke loose and reached a track section with train traffic in Ylivieska in June 2017 is one example of such incidents. Extensive use of subcontractors and temporary agency workers as well as the substantial variation in the competence of the persons working on the tracks combined with insufficient monitoring are the key factors behind the safety problems in track maintenance work.

There has been a positive trend in the safety of shunting in recent years and the number of accidents and incidents in this area has decreased considerably. Better working practices, mild winters in recent years and improvements in the condition of private sidings have helped to reduce the number of shunting incidents. Despite the positive trends, there are still

serious accidents in shunting each year. In 2017, there were three shunting accidents resulting in serious injuries and another three accidents causing substantial material damage.

Finland's railway system is facing major changes in the coming years, mainly as a result of the opening of passenger rail traffic to competition and regulatory changes. In order to ensure continuous safety improvements in an increasingly complex operating environment, smooth cooperation between different parties and improvements in the safety culture are of critical importance. The safety and efficiency of the railway system depends on the strong inputs of a large number of different parties.

B.2 National safety strategy, programmes and initiatives

Finland does not have any national railway safety strategy or plan. At the same time, however, there has been cooperation in the field of railway safety between different operators in a broad range of themes.

In its own work Trafi has used risk-based enterprise resource planning and focused supervision on operators whose operations are considered to involve particularly high risks. Trafi has also worked to develop regulation so that it can be better adapted to the rapidly changing operating environment. The Finnish Transport Agency, the infrastructure manager of Finland’s state-owned rail network, has actively promoted safety work in its own area of responsibility. Over the past few years, the Finnish Transport Agency has helped to put the work to improve safety at level crossings on a more systematic basis by preparing a level crossing safety strategy. Rail transport operators have also played an active role in the safety work connected with their own activities and paid attention to such issues as consideration of human factors in safety improvements.

Following the serious level crossing accident in Raseborg in October 2017, the Ministry of Transport and Communications decided on a programme aimed at improving safety at level crossings. The purpose of the programme is to improve safety at level crossings with all available means. As part of the programme, level crossings selected on a risk basis will be eliminated and improved, while at the same time, the introduction of solutions to improve level crossing safety that are based on new technologies will be encouraged.

Commissioned by the Ministry of Transport and Communications, Trafi is preparing an action plan aimed at improving railway safety in autumn 2018. The purpose of the action plan is to identify problem areas in railway safety and to propose measures to achieve improvements in these areas. Slowly developing safety culture, inadequacies in risk management, changes in the field of operators and the division of safety responsibilities among a growing number of parties are some of the challenges to railway safety identified in the programme. A broad range of measures of different type and scale will be included in the programme. The proposed measures will range from improved cooperation and a better flow of information, to regulatory improvements and the development of a joint incident reporting taxonomy.

B.3 Review of the previous year

Even though the year 2017 was a busy period for Trafi's railway functions, most of the tasks could be carried out without any major problems. For example, the preparation of the fourth railway package, the new rail transport act and the opening of passenger rail traffic to competition were some of issues that characterised the year in addition to the ordinary tasks of the agency.

In 2017, Trafi's representatives were actively involved in the preparation of the practices and procedures required under the fourth railway package in the EU. A large number of preparatory meetings on issues concerning the fourth railway package were also held in Finland with stakeholders.

As part of the implementation of the fourth railway package, the Finnish railway act will also be revised in 2019. Active drafting of the new act began in autumn 2017. Even though the Ministry of Transport and Communications is responsible for the drafting process, Trafi plays an important expert role in the process. The new act, to be named Rail Traffic Act, will also incorporate regulation of urban rail transport. The preparation of the new legislation on competence requirements in railways also continued during 2017. The competence legislation that entered into force in 2018 will only cover train drivers. Setting requirements for other safety related railway tasks will be the responsibility of operators' and their safety management.

In August 2017, the Finnish Government announced that passenger rail traffic in Finland will be opened to competition. The opening will take place in stages and it will start with regional train traffic in southern Finland in the early 2020s. Trafi's experts are taking part in the work of a number of working groups preparing the process.

The processing of applications for safety authorisations and safety certificates in Trafi proceeded without problems in 2017. The safety authorisations and safety certificates of a large number of holders were up for renewal in 2017. As a result, a large number of applications had to be reviewed, which caused slight delays in the process. As in recent years, the focus in Trafi's supervisory work was in the auditing of operators' safety management systems. For example, the safety management systems of VR Group Ltd, the only railway undertaking providing passenger services in Finland (whose safety certificate was renewed) and the Finnish Transport Agency, the infrastructure manager of Finland's state-owned rail network (whose safety authorisation was renewed) were thoroughly audited during the year. Trafi has been responsible for supervising the safety of the underground railway in the Helsinki region since 2016. In 2017, the underground railway was extended to Espoo, which means that it now also operates outside Helsinki. The opening of the new section caused a slight increase in the number of supervisory measures directed at the system.

B.4 Focus areas for the next year

The years 2018 and 2019 will be an interesting period in Trafi's railway functions because a large number of changes will take place in the coming years. The fourth railway package

will be implemented in 2019 and Trafi is preparing for new operating models, such as the processing of safety certificates in cooperation with ERA.

The operating models laid down in the fourth railway package will be put into effect as part of the new railway legislation to be introduced in 2019 but the legislation will also bring changes to the regulation on private sidings. Under the new provisions, most of the private sidings will be outside the scope of EU regulation. In the future, private sidings no longer have to be in accordance with a safety management system meeting EU requirements, as they can use a simpler system based on national requirements. Railway competence requirements will be revised in 2018. In the future, in accordance with the Train Driver Directive, national competence regulation only applies to train drivers and the management of competencies for other railway safety related tasks will come under the scope of operators' own safety management systems.

Preparation for the opening of passenger rail traffic to competition will continue in 2018 and 2019 and Trafi is represented in the working groups preparing the process. With the opening of passenger rail traffic to competition, the first foreign railway undertakings are also expected to submit applications for safety certificates in the near future so that they can operate on the Finnish rail network. The busy period in the processing of applications for safety authorisations and safety certificates will continue because a large number of authorisations and certificates will come up for renewal this year.

As part of the railway safety action plan under preparation in Trafi, the safety measures already started will continue and a number of new ones will be launched. Improving safety at level crossings in cooperation with the Finnish Transport Agency, promoting safety cooperation between different operators and supporting the work to improve safety culture in the sector are some of the priorities in the safety work. The aim is also to set up a cross-administrative working group working to achieve a long-term reduction in the number of trespassing accidents.

The Finnish Transport Safety Agency will be merged with the Finnish Communications Regulatory Authority on 1 January 2019. A number of tasks will also be transferred from the Finnish Transport Agency to the new Transport and Communications Agency. The new agency will continue as the national railway safety authority as before.

C Developments in safety performance

C.1 Detailed analysis of the latest recorded trends

C.1.1 Safety of train traffic

Safety of train traffic in Finland has been good throughout the 2010s and the year 2017 was no exception. Personal injuries among passengers or train staff are extremely rare in train traffic. All significant accidents occurring in train traffic in 2017 were level crossing accidents and trespassing accidents. Level crossing accidents and trespassing accidents are discussed in more detail elsewhere in this publication. For the first time in a number of years, there were no significant derailments and collisions in train traffic in 2017.

Even though accidents resulting in personal injuries are extremely rare in train traffic, there is nevertheless room for continuous improvement in railway safety. Because of high speeds and large moving masses, an accident in train traffic may have catastrophic consequences. Incidents involving train traffic in which significant accidents are mainly avoided through good luck occur every year in Finland.

Accidents

According to the statistics compiled by the Finnish Transport Agency, there were a total of 327 collisions of trains with obstacles in 2017. According to the same statistics, there was a slight increase in the collisions from 2015 and 2016. The statistics compiled by the Finnish Transport Agency also cover collisions with animals, which account almost 90 % of the total collisions. Collisions with animals rarely have any railway safety impacts but they significantly weaken the punctuality of train traffic. There have also been collisions with trees, cars on the tracks, and buffer stops. The Finnish Transport Agency is working to reduce collisions with trees with a systematic programme aimed at removing trees in risk locations. Collisions in train traffic in 2017 had only minor safety consequences and there were no significant collisions. The only collision between a train and other rolling stock during the reporting year occurred in Vainikkala on 10 November 2017 when a train carrying dangerous goods collided with an excavator standing on the tracks.

In its own statistics, VR Group does not classify collisions with animals as collisions and in other respects, too, the collision category of VR is of more limited content than the similar category of the Finnish Transport Agency. VR reported a total of six collisions with obstacles in 2017, which is slightly below the 2012–2016 average (6.6).

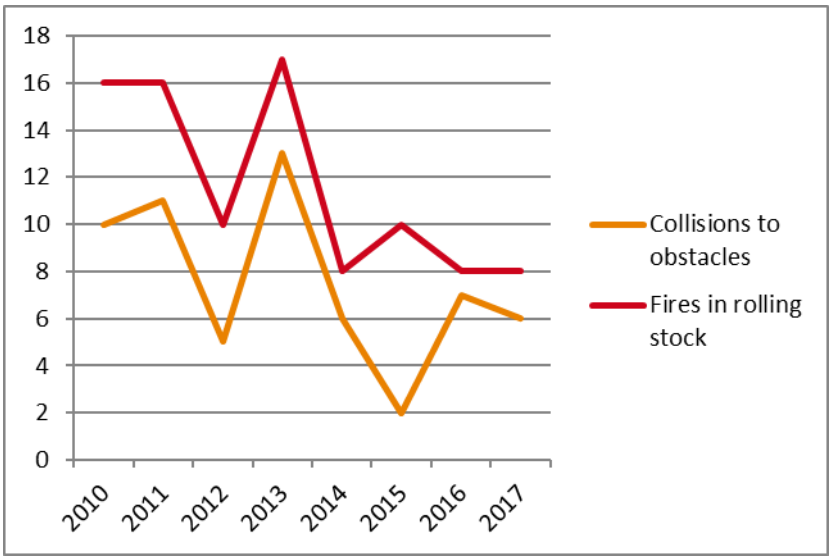

Figure 2. Collisions to obstacles and fires in train traffic 2010–2017. (VR Group statistics)

The only derailment in train traffic during the reporting year occurred on 14 May 2017 when two wheelsets of a heavy-load wagon were derailed in temporary points at the Kauklahti station. The derailment occurred at a low speed and the damage was minor. Between 2012 and 2016, there were an average of three derailments in train traffic each year.

There were no significant fires of rolling stock in train traffic during 2017. According to the statistics of VR Group, there were a total of eight rolling stock fires in train traffic during the reporting year. The statistics compiled by VR indicate that the trend in rolling stock fires is slightly downwards: between 2010 and 2013, there were almost 15 fires each year, whereas between 2014 and 2017, fires averaged 8.5 each year. Rolling stock fires usually involve fires in locomotive engine rooms or small fires in the electrical equipment of passenger carriages. Most of the fires only have minor consequences. On 24 March 2017, a fire broke out in the engine room of a diesel locomotive of a freight train near Luikonlahti. In the accident, which in terms of its consequences was one of the most serious fires occurring in the reporting year, the diesel engine of a locomotive of a moving training shut down and thick smoke emerged from the engine room. The driver stopped the train and managed to put out the fire with a dry powder extinguisher. The engine and the engine room of the locomotive suffered substantial damage in the accident. The fire was caused by a leak in the fuel injection system.

Incidents

While accidents in train traffic are extremely rare, it is essential to monitor the number of incidents and risk levels so that we can get a reliable picture of safety trends. Increases in the number of incidents or risk levels may be an indication of a weakening safety situation. However, changes in the number of incidents are not necessarily a direct indication of safety trends as they can also result from changes in the incident reporting culture.

One of the most significant incidents of the reporting year occurred on 26 March 2017 when a passenger train left the Vaasa station even though no route had been secured, the train had not been given a permission to depart and even though the train's ATP device was switched off. The train had left the station on schedule even though it had not been properly routed or given a permission to depart. The ATP device failed to stop the train because it was switched off. The train reached Tervajoki 30 kilometres away before the errors were noted. There were no consequences because no other trains were located on the same track section. If there had been other trains on the same section, the risk of a collision would have been significant. Absence of a visible signal in Vaasa, problems with the permissions to depart given as text messages and the absence of lights indicating that the ATP device was switched off were some of the factors contributing to the incident.

There were also several incidents between train traffic and track maintenance work during 2017 and they are discussed in more detail in the section on track maintenance safety.

There are a small number of incidents each year in which a passenger falls between the train and the platform when the train has stopped at a station. A particularly dangerous incident occurred at the Huopalahti station on 20 May 2017 when a man fell between the platform and a train that was already in motion. However, the train driver noticed immediately what had happened and the train only moved for a few metres before coming to a halt. The man itself did not suffer any serious injuries.

In 2017, there were a total of 61 incidents in which signals were passed at danger. The number of such incidents has increased in recent years: between 2011 and 2014, they

averaged 26 each year, whereas in the period 2015–2017, the figure had risen to 58. There is no clear explanation to this trend. Incidents in which signals are passed at danger constitute a significant threat to the safety of train traffic. In a typical case, the ATP brings the train to a halt soon after the signal has been passed but in incidents such as the one in Vaasa referred to above, there is a substantial risk of a serious accident.

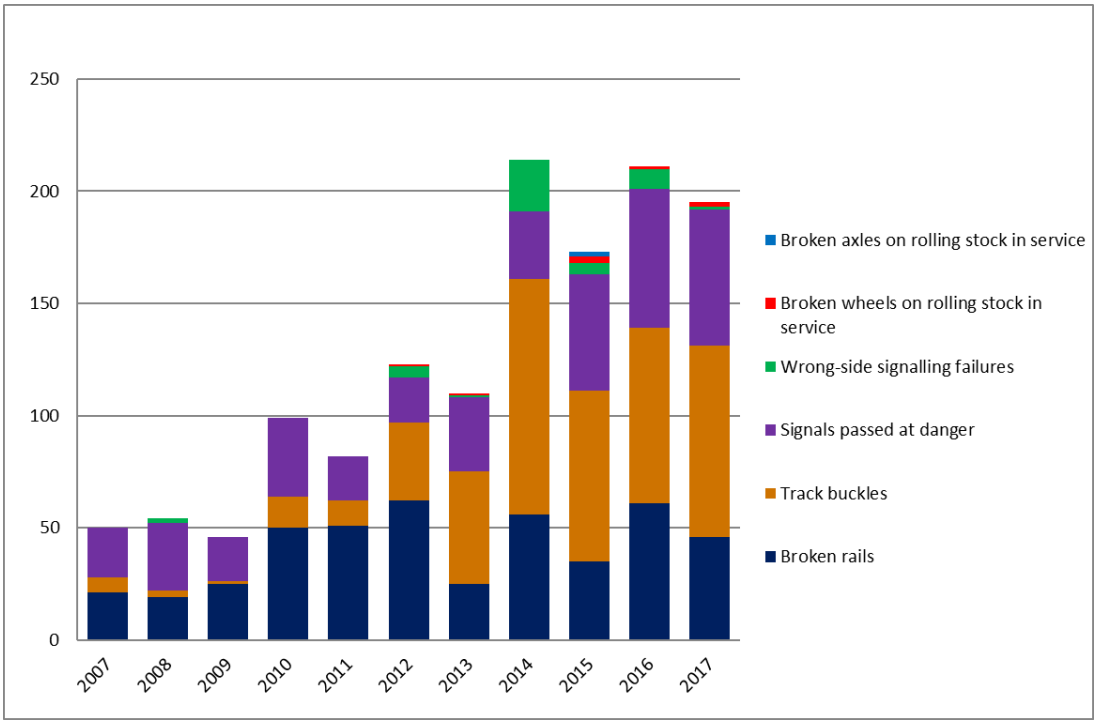

Figure 3. Precursors 2007-2017

Incidents involving the infrastructure

A total of 171 routing failures were reported in 2017. In 17 of them, the train was routed onto tracks with obstacles. The obstacle may be in the form of track maintenance work or an item of rolling stock. Routing a train onto tracks with an obstacle may lead to a collision. Routing failures have been on the increase in recent years. Between 2010 and 2015, an average of 92 cases were reported each year.[1] In 2016 and 2017, an average of 177 routing failures were reported each year. The substantial increase in reported routing failures may at least be partly due to more comprehensive reporting. In one of the most dangerous routing failures during the reporting year, a passenger train was routed onto a track work site between Haviseva and Orivesi on 26 April 2017. The incident was caused by an error committed by the traffic controller and it did not result in an accident.

According to the monitoring carried out by the Finnish Transport Agency, two thirds of all wrong routings onto tracks with no obstacles are caused by errors made by traffic controllers. One in five of all incidents result from errors in automation and in the rest of the cases, the causes remain unclear or they have not been categorised. In about 80 per cent of

[1] Theme investigation on wrong routings in train traffic in 2015. Safety Investigation Authority. Investigation report R2015-S1 (in Finnish). <*www.turval-lisuustutkinta.fi*>. Retrieved 3 August 2018.

all routing failures onto tracks with no obstacles, the train is directed to wrong tracks. In 15 per cent of the cases, the route has not been secured.

A wrong side signalling failure means a situation arising from a technical defect where the signalling information given to the train is less restrictive than that demanded. One wrong side signalling failure was reported in 2017. An average of 8.6 wrong side signalling failures were reported each year in the period 2012-2016. There were a total of 46 cases of broken rails in 2017. The number of broken rails has remained more or less unchanged in recent years, and between 2012 and 2016, they averaged 47.4 each year. Track buckle means faults related to the continuum and the geometry of track, requiring track obstruction or reduction of maximum permitted speed. A total of 85 track buckles were reported in 2016. Even though track buckles have been on the increase, the figures for different years are not fully comparable as the system of compiling statistics on them has only become well-established in recent years.

The Finnish Transport Agency also monitors the number of unlocked points. The points safety device identifies a situation where the points are momentarily unlocked, which may be caused by defects in the points. In the monitoring carried out by the Finnish Transport Agency, the number of unlocked points has varied between 124 and 271 in recent years. A total of 202 unlocked points were reported last year. The large number of unlocked points may be due to defective equipment or problems with maintenance and competence.

Incidents involving rolling stock

Two cases of broken wheels in rolling stock were reported in 2017. Between 2012 and 2016, an average of one broken wheel was reported each year. No broken axles of rolling stock in train traffic were reported last year and such incidents have also been extremely rare in previous years. A broken axle or wheel may result in a derailment.

There has been substantial fluctuation in recent years in the number of incidents involving the overheating of axle bearings of wheel sets (hot box cases). In 2017, VR reported a total of 238 such incidents, which was almost 100 more than the average for the period 2012–2016. The overheating of axle bearings may result in a bearing failure and, in the worst case, to an axle failure and a derailment. Most of the hot box cases are caused by technical faults in brakes.

A total of 18 cases where doors had been left open in VR's rolling stock were reported in 2017. There have been about 20 such cases annually in recent years. In a typical case, the door of a freight train has been left open, the door of a passenger train has been opened using the emergency button or the door of a passenger train has opened as a result of defects in the door control system.

A total of 19 cases where wagons became uncoupled were reported in 2017, which is slightly above the average for the previous five years (17). The risks associated with them are usually fairly low because the uncoupling will lead to the emptying of the brake pipe, which will stop the train.

There were no accidents in train traffic in 2017 that caused leaks of dangerous substances. No other leaks of dangerous substances were reported in train traffic either. There have been between one and two leaks of dangerous substances in train traffic in previous years.

Vandalism

The Finnish Transport Agency reported 302 cases of vandalism in 2017. The number of cases of vandalism was 34 higher than in 2016 but significantly lower than the average for the period 2012–2016 (382). In most cases, vandalism only causes minor damage to the rolling stock and the perpetrators themselves are at the greatest risk. Vandalism may, however, also cause a serious railway accident.

Event risk classifications and safety factors in train traffic

Trafi produces event risk classifications of all accidents and incidents reported to it. The event risk classification is based on an estimate of how likely similar incidents are to result in accidents and of the estimated consequences of the accidents most likely to result from the incidents. Based on the event risk classifications, the most dangerous events in train traffic (in terms of risk level) are trespassing accidents and level crossing accidents because they result in several fatalities and serious injuries each year. At the same time, signals passed at danger, routing failures, incidents involving track maintenance work and level crossing accidents are the events causing the highest risk to the train itself and the persons on the train. The risk profiles of incidents involving signals passed at danger and routing failures are very similar. The likelihood that a routing failure or an incident where a signal is passed at danger will lead to an accident is fairly low. However, the consequences of the accidents that may result from such incidents would probably, in typical cases, be fairly serious, primarily because of the personal injuries caused by any collision between a train and a unit of rolling stock. Similarly, a collision between a train and a track work machine or a vehicle may also cause serious injuries to train passengers.

The aim is to identify safety factors from the incident reports made in connection with the event risk classifications. Safety factors are factors on which safety is based or that may contribute to an accident or an incident and its development, in a negative or a positive manner. When safety factors contributing to incidents and accidents in train traffic between 2014 and 2017 are examined, it emerges that a weak situation awareness played an important role in many high-risk cases. The weak situation awareness of the train driver has led to such incidents as passing of signals at danger and situations where the train is in motion even though the ATP device is switched off. At the same, the weak situation awareness of traffic controllers has led to routing failures. Other negative safety factors typical of high-risk cases are the ergonomics of information presentation, suitability of operating practices to actual situations, as well as the practical application of procedures and information. Inadequacies concerning the ergonomics of information presentation have been highlighted in cases involving the passing of signals at danger and in situations where a train has been in motion even though the ATP device has been switched off. It is estimated that inadequacies concerning the suitability of operating practices to actual situations have contributed to incidents involving the passing of signals at danger, routing failures and in one case involving excessive speeds. Inadequacies in the practical application of procedures and

information have mainly contributed to routing failures and cases involving the passing of signals at danger.

The examination of positive safety factors describes factors that have prevented incidents from developing into accidents. Situation awareness is highlighted as the most common positive safety factor in incidents occurring in train traffic. In a typical case, the train driver notices a routing failure or the conductor notices that a door of a passenger train in motion is open before there are more serious consequences. Problem-solving and decision-making have been identified as positive safety factors in a small number of cases. Problem-solving and decision-making have been identified as positive factors in situations where the train driver has, by making the right decisions, minimised the impacts of fires in rolling stock.

C.1.2 Safety of shunting

Shunting refers to sorting items of rolling stock in support of train traffic. More accidents and incidents occur in shunting than in train traffic because, unlike in train traffic, technical safety systems play only a minor role in shunting and the shunting staff is solely responsible for ensuring the safety of the operations. However, because of low speeds, the consequences of the shunting accidents are usually less serious than those occurring in train traffic.

Safety of shunting has been a major concern in railway safety for many years. Safety of shunting has improved in recent years and the number of shunting accidents and incidents has declined continuously since 2012. Better work instructions and working practices and the improved condition of private sidings are two of reasons behind the positive trend. About half of all derailments and collisions involving shunting occur on the state-owned rail network and the rest on private sidings. The winters between 2013 and 2017 were also milder than average, which made working conditions easier and reduced the number of derailments occurring in shunting.

Despite a reduction in the number of accidents and incidents, there were several significant accidents in shunting in 2017.

There were two accidents in 2017 where a shunting worker was pressed between a shunting unit and other structures, suffering serious injuries. The first accident occurred in Valkeakoski on 6 April and the second one in Hanko on 12 June. There were also two other accidents last year where a person working on the tracks was hit by a shunting unit but these did not result in serious injuries.

There were several serious collision accidents in shunting during 2017. In Kouvola, a shunting unit collided with wagons standing on the tracks on 21 September 2017. The shunting foreman was seriously injured in the accident after he had jumped from the shunting unit immediately before the collision. As a result, the wall of a tank container wagon coupled to the shunting unit was pierced and about 11,000 litres of hydrogen peroxide leaked to the soil. The accident also resulted in damage worth EUR 85,000 to the locomotive and wagons. Excessive speed and vagueness concerning the shunting order were

two factors contributing to the accident. Because the accident resulted in serious injuries, it is classified as significant in the railway safety monitoring based on the EU criteria. [2]

There were also three other serious collision accidents involving shunting during 2017: A collision between two Flirt trains at Ilmala on 19 August. A collision of a pair of radio-controlled locomotives with a buffer stop in Joutseno on 22 August, and an incident in Riihimäki on 4 October in which empty dangerous goods wagons broke loose and collided with a locomotive.

According to the statistics compiled by VR Group, there were a total of 56 collisions in shunting during 2017. Even though the statistics compiled by VR do not cover all shunting performed in Finland, they are currently the most comprehensive presentation of the subject. The number of collisions is substantially below the average for 2012-2016 (81).

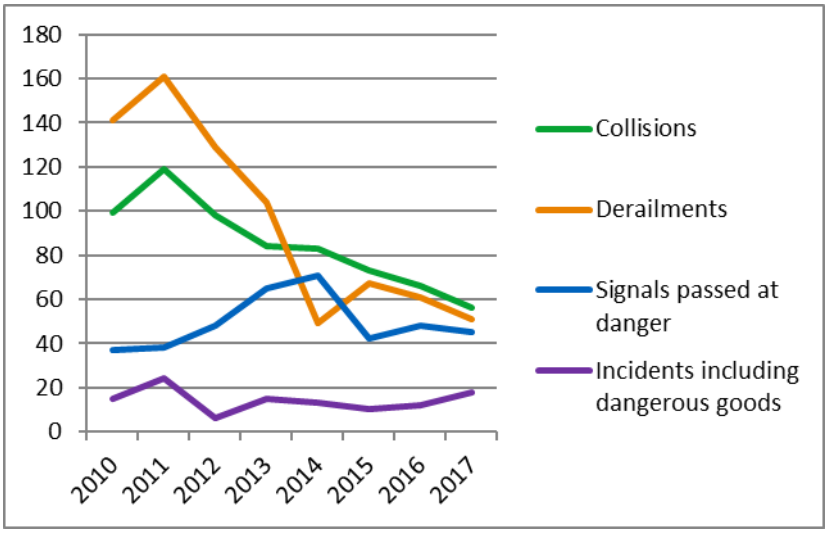

Figure 4. Incidents in shunting 2010-2017. (VR Group statistics)

There were three derailments in shunting during 2017 that are classified as significant accidents. In Alavus, two locomotives doing shunting were derailed resulting in material damage totalling about EUR 200,000. The locomotives were derailed by a derail device left on the rails after the shunting foreman had forgotten to request a permit to continue the shunting. On 13 June 2017, a pair of locomotives and one wagon were derailed in points in Äänekoski in a pulling movement. In this accident, too, the damage exceeded the lower limit set for a significant accident (EUR 150,000). Two locomotives were derailed in points in Oulu on 10 September 2017 and this accident also resulted in material damage of more than EUR 150,000.

VR Group's rolling stock was involved in 51 derailments during 2017. The number of derailments was substantially below the average for the period 2012-2016 (82).

The involvement of dangerous goods always increases the risk level in shunting accidents. The most serious accident in 2017 involving dangerous goods was the collision in Kouvola

[2] Collision between shunting unit and wagons standing on the tracks in Kouvola on 21 September 2017. Safety Investigation Authority. Investigation report R2017-02 (in Finnish) <*www.turvallisuustutkinta.fi*>. Retrieved 14 August 2018.

referred to above and the hydrogen peroxide leak resulting from it. In 2017, VR Group recorded 18 collisions, derailments or leaks in shunting involving the transport of dangerous goods. The number of incidents involving dangerous goods was substantially above the average for the period 2012-2016 (11).

In 2017, there were a total of 45 incidents where signals were passed at danger during shunting operations. This is slightly below the average for the period 2012-2016 (55).

Event risk classifications and safety factors in shunting

Trafi produces event risk classifications of all of the shunting incidents as well. Based on event risk classifications, the most serious risks in shunting are connected with level crossing accidents, collisions between units of rolling stock, collisions with obstacles, signals passed at danger and trespassing accidents. There are relatively few level crossing and trespassing accidents in shunting but the personal injuries resulting from them mean that their risk level is high. Over the last few years, there have been a number of incidents with a high risk level involving collisions between units of rolling stock, such as the collision in Kouvola on 21 September 2017. However, most of the derailments and collisions with obstacles occurring in shunting are of fairly low risk level.

Safety factors are identified also from the reports considering shunting. Situation awareness and practical application of procedures are highlighted as negative safety factors contributing to shunting incidents. Lack of situation awareness has been highlighted in several cases involving passing of signals at danger, routing failures and derailments. Practical application of procedures and information as a negative safety factor may, for example, involve a situation where action in violation of work instructions has contributed to a collision, passing of signal at danger, or a routing failure. Inadequate observation or communications are typical examples of problems involving the practical application of procedures and information.

Availability of information at the right time, situation awareness, problem-solving and decision-making are highlighted as positive safety factors (factors helping to minimise the consequences of the incidents) in shunting. Availability of information at the right time has helped to minimise the consequences of the incidents in situations where a smooth flow of information has helped to stop runaway rolling stock. At the same time, high situation awareness and the resulting rapid reaction have prevented an incident involving a routing failure or a level crossing incident from developing into an accident.

C.1.3 Safety of track maintenance work

Challenges involving track work safety, especially the safe coordination of track work and train traffic, have been a major concern in railway safety for many years. The trend in track work safety remained negative in 2017, and a large number of safety incidents occurred.

The number of accidents and cases of damage occurring in track maintenance work declined in 2017, compared with 2016, but at the same time, there was a slight increase in the number of incidents. The Finnish Transport Agency monitors track work safety by means of incident frequency in which the number of safety incidents is proportioned to the number of track

work permits. There was a slight increase in incident frequency concerning the activities violating the track work safety instructions in 2017, compared with 2016. The most common incident categories in track work are *damage caused by the track work to track structures, errors in the opening of the track work site to traffic, working without a track work permit,* and *unauthorised passing of the track work boundary.*

One of the most serious track work incidents of the reporting year occurred in Ylivieska on 28 June 2017 when a track work machine moved of its own accord from a track work site to the Ylivieska station. The tamping machine has been left standing overnight in the crossover between a track under construction and tracks used by train traffic. The machine began moving of its own accord and slowly rolled to the Ylivieska station about one kilometre away where it stopped. When in motion, the track work machine occupied a track section south of the Ylivieska station. As a result, a signal turned red and a passenger train approaching the site from the south stopped at the red signal. Lowering of the pressure in the pneumatic brakes of the machine caused the brakes to be released and as a result, the machine (which was located in an incline) started moving. The parking brake of the machine was not on and stop blocks were not used. The crew of the machine had not been provided with clear instructions on how to use the brakes. The location where the track work machine was standing was not in accordance with the work plan and the crew had not been familiarised with the plan.[3]

There were also other near misses involving track maintenance work and train traffic during 2017. An error by the traffic controller caused a passenger train to be routed onto a track work site between Haviseva and Orivesi on 26 April 2017. An error concerning the securing of track work caused a passenger train to be routed onto a platform area through the track work site in Pasila on 16 December 2017. In the incident, a reach stacker moving on the rails and its operator were in danger of being run over by the train. In Kerava on 22 February 2017, a track work group continued to work on the tracks after the track work permit had expired. The situation was caused by vagueness in oral communications.

The Finnish Transport Agency has noted that track work incidents often involve the following background factors:

- inadequate induction into site-specific practices
- inadequate induction into track work instructions
- problems with communication within track work groups
- inadequacies in the standard-format oral communications between traffic control and the persons overseeing the track work
- inadequacies concerning the location of the track work and the track work site
- wrong assumptions made in the work
- inadequate competence concerning the railway system

[3] Runaway of a maintenance machine in Ylivieska on 28 June 2017. Safety Investigation Authority. Investigation report R2017-01 (in Finnish). <*www.turvallisuustutkinta.fi*> . Retrieved 27 June 2018.

- excessive workload of the traffic control and inadequacies concerning electronic tools.

Over the past few years, track work contractors have transferred an increasing proportion of the work to subcontractors and temporary agency workers. The safety incidents show that the safety culture and rail-related competence suffer as long subcontracting chains and temporary agency workers are used. The skills and competence of well-established operators are often at good level but with the introduction of subcontracting and temporary agency workers, employees with varying degree of competence and understanding of one's own role in railway safety have entered the sector.

A multi-volume study on the impact of the human factor and safety culture on how individuals act in railway construction was published in Finland in 2017.[4] The focus in the study was on main contractors in railway construction and no consideration was given to subcontractors. According to the study, the safety culture in railway construction and maintenance has now reached the mid level when examined by means of a maturity survey. A great deal of work has been made to improve the safety culture but much still needs to be done. The study highlighted the stressful nature of the work as a key challenge in the sector. The stress is caused by such factors as working in the slots determined by traffic stops and night work. This often highlights the role of the human factor and for this reason, keeping the stress arising from the work under control should be a key objective in the railway sector. The work burden can be managed by careful planning and by providing new employees with adequate induction. According to the study, there should be continuous inputs into communications, participation, induction and training so that the safety culture can be kept up to date.

In its discussions with contractors, the Finnish Transport Agency has also noted that there have improvements in the safety culture. Safety issues are taken seriously at management level and few companies try to hide incidents in this area. In fact, the main challenge in the sector is to ensure that the improvements in the safety culture and competence are also adopted by all those working in track maintenance tasks.

The Finnish Transport Agency and the operators in the sector are constantly working to improve track work safety. The year 2017 saw the testing of an alert system that warns track maintenance workers of an approaching train and progress was also made in the development of a mobile platform application for track work contractors. The mobile application for track work contractors, introduced in 2018, puts existing track work documents into digital form, facilitates the location of track work sites and ensures that the traffic controllers and the persons overseeing the work have the same information on the work.

[4] Inhimillinen tekijä ja turvallisuuskulttuurin vaikutus yksilön toimintaan rautatierakentamisessa. Liikennevirasto tutkimuksia ja selvityksiä 30/2017. Liikennevirasto, Helsinki 2017. <*https://julkaisut.liikennevirasto.fi/pdf8/lts_2017-30_inhimillinen_tekija_web.pdf*>. Retrieved 27 June 2018.

One the most important steps in the development of track work safety in recent years has been the opening of the learning centre for track construction and maintenance in Kouvola in 2017. In the centre, track work personnel can be trained for the maintenance of points, electrical equipment and safety devices in conditions corresponding to the real situation. The Finnish Transport Agency rents out the premises for companies. Following the changes in the railway competence regulation in summer 2018, the competence requirements for persons overseeing track maintenance work are no longer laid down in the law. In the future, the competence requirements for safety-critical track maintenance tasks and the methods for ensuring the competence will be described in the safety management system of the Finnish Transport Agency. The learning centre for track construction and maintenance will play a key role in the training of track maintenance personnel and the ensuring of their competence.

C.1.4 Safety at level crossings

The year 2017 was exceptional in terms of safety at level crossings: when measured with the number of level crossing accidents, it was one of the safest years of the 2000s but with respect to fatalities and personal injuries resulting from level crossing accidents, it was one of the worst. There were a total of 24 level crossing accidents in Finland in 2017. Between 2012 and 2016, there were an average of 36.6 level crossing accidents each year. Seven of the level crossing accidents that occurred in 2017 are classified as significant accidents on the basis of the fatalities and serious injuries resulting from them.

The number of level crossing accidents in Finland have been declining throughout the 2000s. During the first decade of the 2000s, level crossing accidents averaged more than 50 each year. In the 2010s, the figure has been 33. Even though the number of level crossing accidents has decreased, they still constitute one of the most significant risks in railways. They account for almost half of all significant accidents occurring on the Finnish rail network. In addition to fatalities, personal injuries and material damage, level crossing accidents also cause disruptions to traffic.

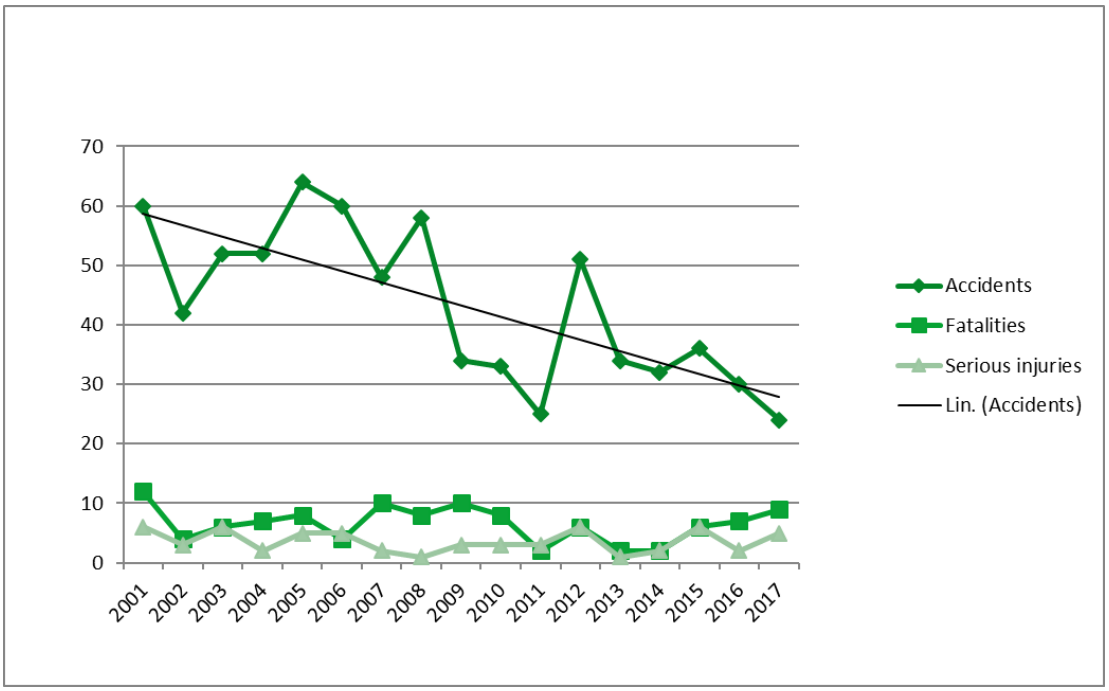

Figure 5. Level-crossing accidents, fatalities and serious injuries 2001–2017.

In 2017, level crossing accidents in Finland caused an unusually large number of fatalities (10) and serious injuries (5). The year 2017 was the worst year in this respect since 2001 when a total of 12 people were killed and 6 seriously injured in level crossing accidents. Between 2012 and 2016, an average of 4.6 persons were killed and 3.4 persons seriously injured in level crossing accidents each year.

Most of the accidents occur at passive level crossings. Six of the seven significant level crossing accidents in 2017 occurred at passive level crossings.

The accident at the Skogby level crossing in Raseborg on 26 October 2017 was the most serious railway accident in Finland in the 2000s. Three people were killed and three seriously injured when a railcar collided with an all-terrain vehicle of the Finnish Defence Forces. Three conscripts on board the all-terrain vehicle were killed in the accident. The seriously injured persons were also conscripts on board the military vehicle. The all-terrain vehicle was in the process of crossing the tracks when the railcar collided with it at a speed of 110 km/h. The military vehicle was completely wrecked in the collision. The Skogby level crossing did not have any warning devices and the angle of the crossing made it difficult for the driver of the army vehicle to see the train. According to the accident investigation, it was almost impossible for the driver to see the train that was approaching obliquely from the rear from the right behind the army vehicle. The level crossing was closed after the accident.[5]

[5] Level crossing accident which led to four deaths at Raasepori on 26 October 2017. Safety Investigation Authority. Investigation report R2017-03 (in Finnish). <*www.turvallisuustutkinta.fi*>. Retrieved 8 June 2018.

Following the accident at Raseborg, the Ministry of Transport and Communications announced a programme to improve safety at level crossings. The programme includes the following measures:

- More than 60 level crossings will be eliminated or undergo improvements between 2018 and 2020. In terms of their location and traffic volumes, the level crossings included in the programme are among the most critical on the Finnish rail network.
- The Finnish Transport Agency will design, prepare and implement a lightweight warning system on the state-owned rail network comprising such devices as warning lights or warning lights and barriers). The system will be installed on the track section between Lahti and Heinola.
- The Finnish Transport Agency will examine the use of train positioning based on satellite navigation to provide real-time warning of trains at level crossings.[6]

The Government has proposed an appropriation of two million euros for the programme start in connection with the supplementing of the state budget proposal. A total of EUR 2.7 million had already been budgeted for improvements in safety at level crossings for 2018.

The main reason for the reduction in the number of level crossing accidents in the long run has been the decline in the number of level crossings. In 1975, there were almost 8,000 level crossings on Finland's state-owned rail network. At the end of 2017, the total was 2,748. In 2017, a total of 22 level crossings were removed from the state-owned rail network and private sidings. Until now, most of the level crossings have been removed and improved in connection with track renovation projects aimed at permitting higher speeds. This means that the priority has not been given to the level crossings deemed to be the most dangerous. In the future, the Finnish Transport Agency plans to select the level crossing for elimination and improvements on the basis of risk assessments.

Improving safety at level crossings is a long-term project and it is difficult achieve significant results on a nationwide basis in a short time. In fact, to achieve safety improvements at level crossings, adequate resources should be allocated to systematic and risk-based safety work in the long run.

Despite improvements in recent years, safety at level crossings is weaker in Finland than in other Nordic countries. Between 2012 and 2016, the number of significant level crossing accidents was higher in Finland than in Denmark or Norway, though in Sweden, they were more numerous than in Finland. When the number of significant level crossing accidents is examined in relation to traffic volumes, it can be seen that the number of accidents is significantly higher in Finland than in other Nordic countries (Figure 6).

[6] Ministry of Transport and Communications has decided on a programme to improve safety at level crossings. Press release of the Ministry of Transport and Communications 22 November 2017 (in Finnish). *<https://www.lvm.fi/-/lvm-paatti-tasoristeysten-turvallisuuden-parantamisohjelmasta-957831>*. Retrieved 8 June 2018.

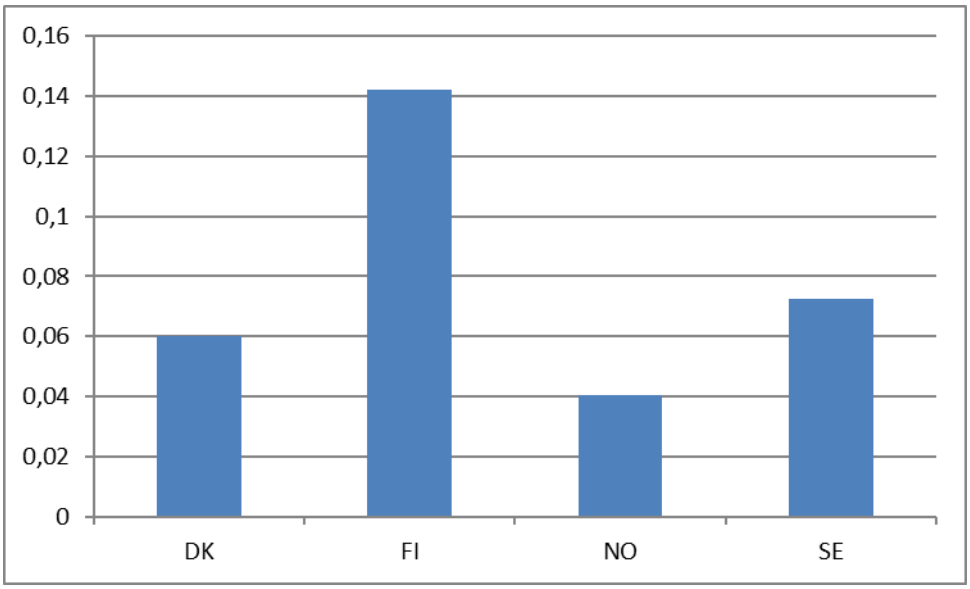

Figure 6. Significant level-crossing accidents related to train-km in Nordic countries 2010-2016.

In Norway and Sweden, safety at level crossings seems to be higher in Finland even though there are also many passive level crossings in these two countries (Figure 7). Trafi is planning to do a study that digs in to the factors behind the differing level-crossing safety levels in Nordic countries.

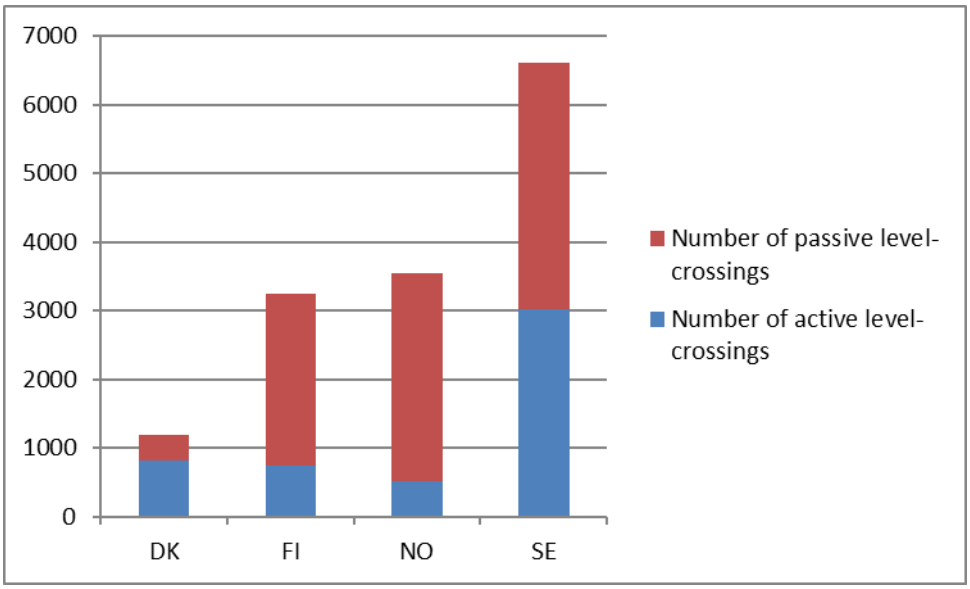

Figure 7. Number of active and passive level-crossings in Nordic countries 2016.

C.1.5 Safety of private sidings

Private sidings are tracks owned by industrial plants, ports and municipalities and connected to the state-owned rail network. There are about 130 private siding managers in Finland. The length of private sidings varies from a few hundred metres to dozens of track kilometres. Private sidings play a key role in freight traffic in railways because most of the freight trains start or end their journeys on private sidings. Traffic on private sidings is mostly in the form of shunting.

Safety situation on many of Finland's private sidings was quite weak at the start of the 2000s and the poor condition of the sidings caused a small number of serious accidents. Over the past ten years, the safety situation on private sidings has improved, infrastructure managers have become aware of their responsibilities, and higher priority is now given to track maintenance.

Safety situation on private sidings on the basis of incident and safety reports

A total of 59 accidents and incidents occurring on private sidings were reported to Trafi between 2015 and 2018. Only a small proportion of the incidents occurring on private sidings are reported and the number of reported incidents does not correspond to the actual number of incidents. The reported incidents and the safety reports produced by private siding managers do, however, give a good picture of the incidents occurring on private sidings.

According to the reported incidents and the safety reports produced by infrastructure managers, derailment of a freight wagon is the most common railway accident on a private siding. Derailments account for nearly one half of all incidents on private sidings reported to Trafi. About one half of all reported derailments on private sidings occur when rolling stock (typically empty freight wagons) climbs off the rails due to snow and ice that have accumulated in the channel rail. Incidents where tracks give way under heavy freight wagons have become much less frequent in recent years even though they still occur on sidings with poorly secured rails. Derailments on private sidings are occasionally also caused by defective points and stop blocks left on the rails. There have also been a small number of cases where a wagon has been accidentally lifted off the rails by a reach stacker during unloading.

Accidents and incidents at level crossing are a second common type of incidents on private sidings. There are a small number of level crossing accidents and several incidents at level crossings on private sidings each year. Typically, an accident or incident at level crossing on a private siding is caused by the lack of attention by the driver of the vehicle crossing the tracks. On many locations, asphalt fields are criss-crossed with private sidings, which means that it is difficult for road vehicle drivers to notice all dangerous spots and the risk of level crossing accidents increases. Moreover, there are also places where buildings or piles of goods obstruct the view at level crossings. Measures have been taken to improve traffic safety on many private sidings by changing the routes used by road vehicles or by equipping level crossings with barriers or warning lights. This means that improvements in the safety of level crossings are also taking place on private sidings.

Collisions with obstacles have been the third most reported incident type on private sidings in recent years. Collisions with a buffer stop are the most common collisions but there have also been collisions with road vehicles parked too close to the tracks and rolling stock standing on the tracks. In a typical case, the collision is caused by a human factor connected with the shunting, such as inadequate observation or other misjudgements. Occasionally there are also leaks of dangerous substances, broken rails, runaway rolling stock, overloaded wagons, and shunting units entering a siding even though the infrastructure manager's personnel have not been noticed of them.

In 2017, there were two serious railway accidents on private sidings and in both of them, the shunting foreman was serious injured after having been run over by a shunting unit. Occasionally, level crossing accidents and accidents involving the transport of dangerous goods also have serious consequences on private sidings.

According to the 2017 safety reports produced by private siding managers, following measures have been taken to improve safety on private sidings: infrastructure renovation, updating of safety guidelines, installing of warning devices at level crossings, training of personnel and placing of railway safety issues on the agenda of management reviews and safety briefings. Many of the private siding managers mention in their safety reports that the introduction of safety management systems has helped to make the infrastructure management more organised and systematic. Better cooperation between infrastructure managers and operators as well as the expertise provided by outside experts are also mentioned as positive trends in recent years.

Observations made by Trafi as part of its supervisory work

According to the observations made by Trafi as part of its supervisory activities, safety situation on private sidings has improved in recent years and safety matters on private sidings are mostly well-managed. Safety work on private sidings is not always in accordance with the description given in the infrastructure manager's safety management system but at practical level, key safety matters are managed in one way or another. This is partially due to the complex requirements concerning the safety management system contained in the private siding regulations.

Nowadays, most private siding managers take good care of the safety of their infrastructure, the condition of the tracks has improved and the most worn-out tracks have been closed or renovated. In addition to the railway legislation, occupational health care legislation and economic incentives are also a factor motivating private siding managers to ensure the safety of their railway operations. Especially the operators for whom rail transport plays a central role, give high priority to the maintenance of their rail infrastructure. Many chemical sector operators with long traditions in safety management, also have well-maintained tracks and up-to-date safety management procedures.

Only a small number of private siding managers have a poorly maintained infrastructure or indifferent attitudes towards railway safety. Trafi has audited most of the private siding managers at least once and some of the operators have been audited several times. Trafi has noted that the guidance and support provided as part of the audits have prompted private siding managers to give more consideration to safety issues.

Commitment to safety at management level and extensive cooperation with operators in the sector have been typical positive audit observations in the past few years. Lack of systematic in-house control and inadequacies in operational instructions have frequently been noted as deviations in the audits. The instructions may be inadequate or too complicated. Moreover, it is not always clear who is responsible for the instructions, or the instructions are completely lacking. It has often been noted that in large and complex organisations no particular party is specifically responsible for the infrastructure management.

Outsourcing of infrastructure maintenance and the development and updating of the safety management systems has been a growing trend in private siding management in recent years. This has had both negative and positive impacts. As consultancies take a strong role in the development of safety management systems, the result has been that the descriptions of the methods presented in the system are not always in accordance with the actual operations on the private sidings. The strong role of consultancies in infrastructure management has in some cases also led to a situation where the actual private siding manager has failed to understand the wider issues concerning the management. On the other hand, consultancies have helped to introduce good practices and processes as well as expertise into the management of private sidings. In practice, the outsourcing of the maintenance and safety management has led to a situation where the undertaking responsible for the private siding maintenance keeps the infrastructure in good condition irrespective of the expertise possessed by the private siding manager.

C.1.6 Fatalities and serious injuries in railway accidents

The year 2017 was characterised by an unusually large number of fatalities (10) and serious injuries (11) in railway accidents. This was more than any year since 2010 (Figure 8). The level crossing accident in Raseborg on 26 October 2017 in which three people were killed and three seriously injured accounted for one third of the total. Deliberate trespasser fatalities are discussed separately at the end of the text and they are not included in the above figures.

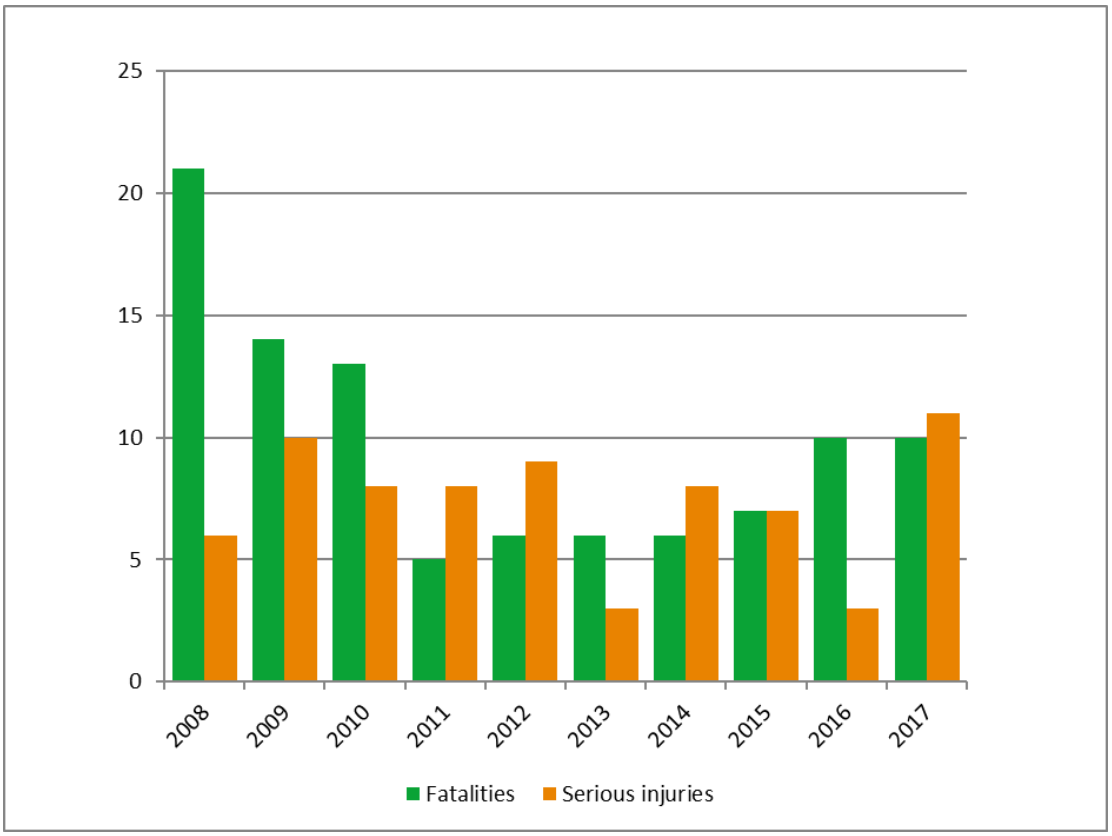

Figure 8. Fatalities and serious injuries in railway accidents 2008-2017.

Nine of the fatalities resulted from level crossing accidents and in one case, the victim was an unauthorised person on railway premises. All of the victims in level crossing accidents were level crossing users. As shown in Figure 9, most of the fatalities in railway accidents in

the 2010s have been level crossing users. Level crossing users and unauthorised persons on railway premises are also by far the largest groups among fatalities in railway accidents at EU level. However, at EU level, a significantly larger number of unauthorised persons on railway premises are killed in railway accidents than level crossing users. Cases of deliberate trespassing are not included in these figures.

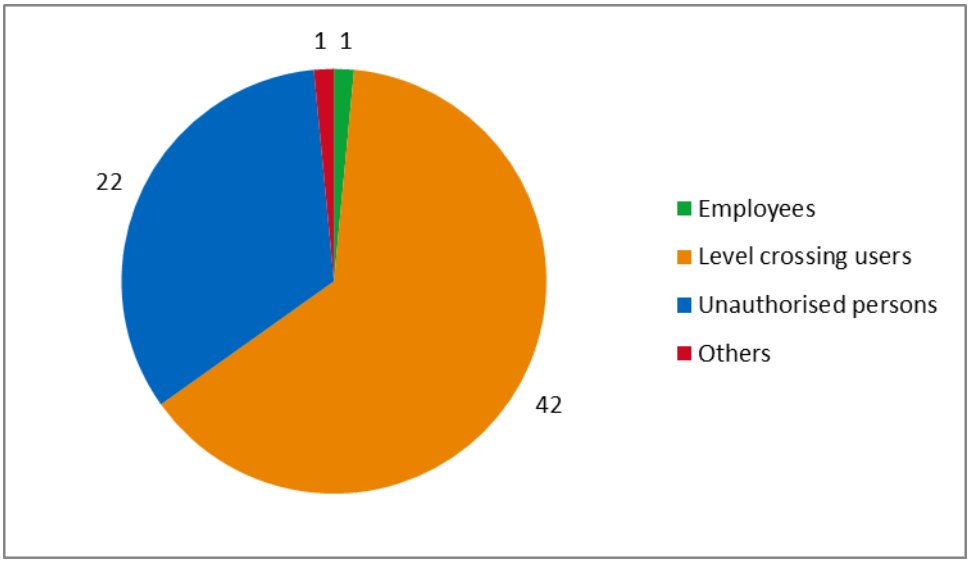

Figure 9. Fatalities in railway accidents by category 2010-2017.

Of the seriously injured persons, five were level crossing users, three were unauthorised persons on railway premises and three were railway employees. Most of the persons suffering serious injuries in railway accidents in the 2010s have been level crossing users and unauthorised persons on railway premises (Figure 10). Among railway employees and passengers, serious injuries resulting from railway accidents have been more common in the 2010s than fatalities caused by them.

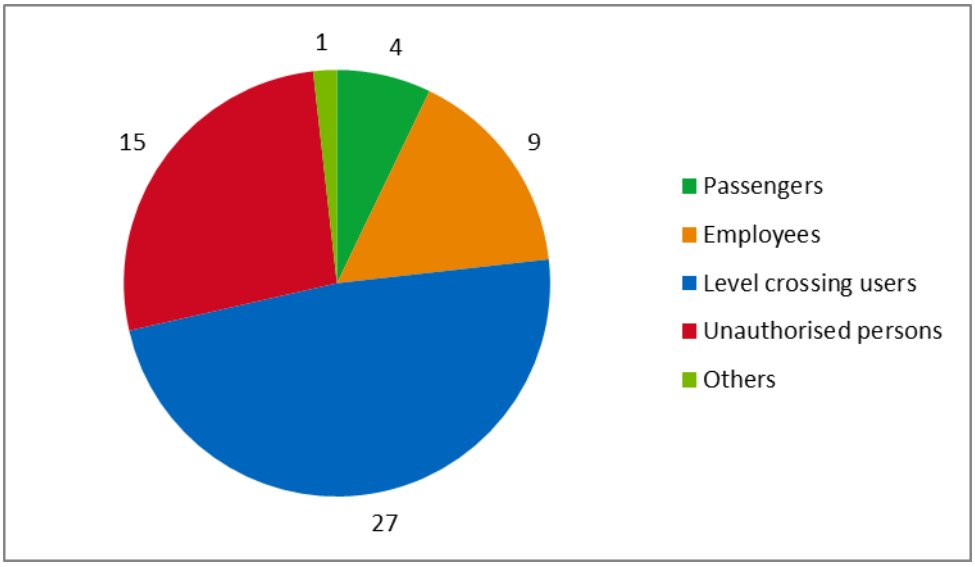

Figure 10. Serious injuries in railway accidents by category 2010-2017.

In Finland, a total of 56 persons were killed in trespassing accidents considered deliberate in 2017. Between 2007 and 2016, there were an average of 52 such deaths each year.

Classifying a trespassing as deliberate or accidental is always a matter of some uncertainty and the railway authorities do not necessarily have detailed information about the nature of the case. According to the statistics, there were two cases of deliberate trespassing in 2017 resulting in serious injuries.

Deliberate trespasser fatalities account for more than 80 per cent of all trespasser fatalities in Finnish railways. In overall terms, suicides have been on the decline in Finland for more than two decades.[7] At the same time, however, the number of cases involving deliberate trespassing in railways remained unchanged between 2005 and 2017.

Reducing the number of trespassing accidents in railways is not easy but it is possible. Trafi and other Finnish railway operators have promoted research on trespassing accidents in which the typical characteristics of the accidents have been examined and measures to reduce them presented. Most of the trespassing accidents in Finland occur near major population centres. Concrete results can be achieved by focusing the measures aimed at reducing trespassing accidents near large population centres on an area comprising a relatively small proportion of the Finnish rail network.

Trespassing accidents in railways are a multifaceted problem and their consequences concern a broad range of different operators and authorities. For this reason, cooperation between railway authorities, health authorities, municipalities, infrastructure managers, railway operators and researchers is essential in the efforts to reduce trespassing accidents.

C.2 Results of safety recommendations

Table 1. Implementation of safety measures triggered by safety recommendations

Safety recommendation	Safety measure	Status of implementation
2017-S3. SSAB should specify the binding of slit coil packs and verify it by calculations, taking the stresses due to handling at the factory into account in addition to the lateral accelerations on the coil pack during railway transport.	Calculations are in progress. Preliminary calculations are available, the calculations are still being checked. The required measures will be planned and implemented on the basis of the calculation results.	Partially implemented
2017-S4. VR should determine the best placement for the coils in the wagons in order to improve the running characteristics of a loaded coil wagon and take the results	The coils should be placed as middle of the wagon as possible, in which case the lateral forces directed at them in the curves are as small as possible.	Implemented

[7] Official Statistics of Finland (OSF): Causes of death [online publication]. 2016. Slight increase in the number of suicides from the year before. Helsinki: Statistics Finland. http://www.stat.fi/til/ksyyt/2016/ksyyt_2016_2017-12-29_kat_006_en.html Retrieved 1 August 2018.

into account in the loading instructions.		
2017-S5. In order to identify risks, SSAB should collect information about deviations related to binding, storage handling and transport, and deal with them.	SSAB has updated its instructions and reviewed them with its personnel so that the deviation information can be verified. The new operating model has also been discussed at safety briefings with the company personnel.	Implemented
2017-S6. The Finnish Transport Safety Agency (Trafi) and railway operators should improve the supervision of shunting.	Trafi now carries out more supervision as part of its audits, and operators' in-house control has also become more extensive.	Implemented
2017-S7. Infrastructure managers should ensure that the usable track length in railway yards is consistent regardless of the system.	Some of the infrastructure managers have implemented the measure, while others have not provided any information.	Partially implemented
2017-S8. Railway undertakings should comply with local emergency plans in ports and other areas where other companies are also operating.	Uniform instructions apply to the state-owned network and drivers are familiar with them. Private sidings do not have any uniform instructions or emergency plans.	Partially implemented
2017-S9. Infrastructure managers should modernise buffer stops on tracks where shunting is done related to the transport of dangerous goods.	Buffer stops at Finnish Transport Agency's marshalling yards used in the transport of dangerous goods have been examined, and the upgrading work is awaiting funding. Partially implemented on private sidings.	Partially implemented
2017-S28. The Finnish Transport Agency should restrict trains running on tracks that are not under technical centralised traffic control.	According to the Finnish Transport Agency and railway undertakings, the changeover from train traffic to shunting may mean more risks. The Finnish Transport Agency is in the process of carrying out a pilot project in which a specific part of the work is carried out as shunting. A report on the pilot will form the basis for further work on the matter.	Pending
2017-S29. The Finnish Transport Agency should harmonise and clarify the	According to the Finnish Transport Agency, the recommendation has been partially implemented to the extent	Partially implemented

instructions on centralised traffic control.	that the instructions on marshalling yard traffic control and the instructions on rail traffic control have been merged into a single document.	
2017-S30. The Finnish Transport Safety Agency (Trafi) should order that engine drivers keep a lookout when in train traffic.	According to Trafi, this belongs to the matters on which traffic operators must provide internal guidelines and for this reason, Trafi will not issue any guidelines on the matter. Railway undertakings have added the matter to their internal guidelines.	Partially implemented.

C.3 Measures implemented not in relation to safety recommendations

Table 2. Safety measures not triggered by safety recommendations

Area of concern/Description of the trigger	**Safety measure introduced**
(IM) Many parties are unfamiliar with the safety management system of the Finnish Transport Agency because it has not been properly put into practice.	Ensuring the commitment of Finnish Transport Agency staff and service providers.
(IM) Incorrect working practices in track maintenance work as a result of inadequate competence.	Updating and expanding the track maintenance training programmes of the Finnish Transport Agency. Establishment of the learning centre for track construction and maintenance, more effective supervision of track work sites.
(IM) Track work employees are not familiar with the instructions as they are constantly updated and are not properly put into practice.	Updating the track maintenance training programmes of the Finnish Transport Agency. Defining the hierarchy of the instructions. Less frequent updating of the instructions. Providing information on the instructions.
(IM) Inadequate competence of the track work subcontractors, vague responsibilities and difficulty understanding the railway system as a whole.	Shortening the subcontractor chains. Better mechanisms for ensuring competence and increasing awareness of responsibilities.

(IM) Inadequate safety cultures mean that not all employees give priority to safety matters.	Familiarising undertakings and their employees with the safety culture and principles of the Finnish Transport Agency.
(IM) Inadequacies in incident analyses arising from the lack of resources and inadequate baseline data.	Introducing cause factor definitions. Development of the information system. Familiarisation with the manner in which safety incidents are investigated. Ensuring adequate resources.
(IM) Safety at level crossings has not improved as expected.	Providing more resources and implementing the action plan to improve safety at level crossings.
(IM) There are differences in quality between service providers.	Developing the management of service providers. Developing procurement methods.
(RU) Following the accidents and incidents in train traffic and shunting in 2016, it was decided to launch a separate development programme.	The railway safety programme was mostly implemented as planned in 2017.
(RU) Paying attention to the human factor as a factor impacting railway safety.	The human factor development programme was continued as planned.
(RU) Challenges in ensuring that rolling stock does not start moving of its own accord.	Developing the procedures to ensure that rolling stock does not start moving of its own accord.

D Supervision

D.1 Strategy and plans

Trafi prepares an annual supervision plan, which will guide the following calendar year's supervisory work. The plan lays out the monthly supervision schedule and the preliminary dates for supervisory events. Planning of the supervision is based on prioritisation and a risk-based approach. In railway supervision, the highest priority is given to passenger traffic and the transport of dangerous goods. The largest national railway organisations are selected for supervision each year on the basis of the prioritisation. The risk-based approach means that the supervision is directed at organisations and sectors of the safety management system involving the highest risks. The information used in the risk-based direction of the supervision includes the following: The information collected during the assessment of the safety management systems, results of previous supervisory activities, information on permits and approvals, accident investigation reports and safety recommendations, other

reports and details of accidents and incidents, safety and annual reports submitted to Trafi and complaints received from the public. Traffic Analysis, the Trafi unit carrying out safety monitoring and analysis, takes part in the preparation of the supervision plan each year by presenting proposals for supervision priorities on the basis of safety observations.

For a few years, Trafi has used the organisation profiles of the railway operators as a tool to guide the risk-based planning of the supervision. Organisation profiles are a way of assessing organisation-specific risks. Organisation profiles are compiled on the basis of supervision results and other safety-related information. Using the organisation profiles, it can be determined how frequently an organisation should be audited. In 2017, Trafi held an interim year in the compilation of organisation profiles as system development work related to them was carried out.

The supervision plan is updated and reviewed on a regular basis and each year, a small number of targets outside the original plan are selected for supervision. Changes in the plan during a calendar year may be due to the information on the operations of an organisation received by Trafi, which show that a safety risk must be verified and more effective measures taken to start corrective action. In a typical case, changes to the plan are made after Trafi has received information on new risks observed in an operator's activities.

D.2 Human resources

In the 2010s, the focus in Trafi's railway supervision has shifted from traditional field supervision to the audits of safety management systems. At the same time, more personnel resources have been allocated to the work. In 2017, Trafi had seven persons whose main task was to supervise holders of safety authorisations and safety certificates and the entities in charge of maintenance (ECM). The same persons are also responsible for the processing of the applications for safety authorisations and safety certificates. In addition to these seven persons, two other Trafi staff members also took part in a small number of audits. In 2017, Trafi’s assessment groups also had staff from a consultancy firm as members.

In 2017, Trafi carried out six audits of safety certificate holders and 13 audits of safety authorisation holders. All audits were performed by two or three persons. Each of the auditors spent an average of two working days (16 hours) on one audit. The work comprised the preparation of the audit, the audit itself and the finalisation of the audit. A total of 760 working hours were spent on the audits.

The number of audits performed in 2017 was slightly lower than the total for 2016. This was mainly due to the large number of applications for safety authorisations and safety certificates, which meant that a great deal of time had to be spent on processing the applications and there was less time for audits.

Trafi’s auditors conducted two audits of entities in charge of maintenance (ECM). Two persons took part in the ECM audits and each of them spent two working days on each audit. This means that a total of 64 hours was spent on the ECM audits.

The auditors also performed four audits of marshalling yards used in the transport of dangerous goods and two audits of education institutions. A total of 160 hours was spent on these audits.

As a whole, a total of about 984 hours was spent on all audits and inspections. The total number of hours spent on audits is roughly the sum of the working hours spent on the audits by seven auditors. This means that one auditor spent about 141 hours on supervision during the year. This was about nine per cent of the annual working hours (1,600 hours) of each auditor.

D.3 Competence

Trafi has a system for managing the competence of all its staff members. The system, named Sympa, contains the employees' qualification and competence data, information on critical competence in individual functions, information on each employee's competence goals and personal development plans. Sympa allows the compilation of an overview of competence throughout the organisation and of the competence development needs. The system can be used in personnel turnover situations, temporary resource shortages and job rotations.

Organisation Services, Trafi's department responsible for railway and aviation supervision, has work instructions for the management of the core competence of the department's staff. The purpose of the instructions is to harmonise the management of personnel competence. The key principle in the instructions is that each auditor takes part in familiarisation and training available in their sectors. On practical level, railway auditors are provided with training in audits and the railway system. For example, all railway auditors possess the lead auditor competence. In 2017, most of the railway auditors took part in the risk manager training in which the focus was on the management of risks. The department also cooperates extensively with units supervising different modes of transport and the aim is to learn from each other's best practices.

D.4 Decision making

The Railway Act (304/2011) provides the statutory basis for safety management system audits performed by Trafi. The conformity of the safety management systems is examined in the audits on the basis of the Commission regulations covering the subject (1158/2010 and 1169/2010). These criteria are mentioned in the invitation to the audits sent to the entities to be audited and in the audit reports. If deviations are identified in the audits, the article of the Commission regulation containing the appropriate audit criterion is mentioned in the audit report.

The audit observations are reviewed in the final audit briefings. The aim is to resolve any disagreements concerning the audit observations in the final briefings. No complaints were received from railway operators concerning the supervisory activities or supervision results.

D.5 Coordination and cooperation

There were no supervision arrangements or agreements with other NSA's during the reporting year. There aren't any railway undertakings that operate in Finland and in some other member state. Trafi has had informal co-operation e.g. with Norway's and UK's NSA's on issues concerning development of supervision.

The amount of cross-border traffic with Finland and other member states is very limited. There is small-scale regular freight train traffic between Sweden and Finland in Finland's only cross-border connection with other member state in Tornio-Haparanda. Decades old agreement concerning the cross-border traffic between Sweden and Finland and its supervision is planned to be updated in 2019.

D.6 Findings from measures taken

Main findings from evaluation of measures taken by RUs and IMs to remedy non-compliances were changes in the SMS and enforcement of the SMS in the organisation.

E Certification and authorisation

E.1 Guidance

Instructions for applying for safety authorisations and certificates are available on the Trafi website. The instructions discuss the practical details of applying for a safety authorisation or certificate. The website also contains information about safety management systems, links to essential forms and to ERA's guidance on safety management systems. Description of the application and assessment process and list of contact persons can also be found in the instructions.

The latest update to Trafi's instructions was made in 2015. In the instructions it is in particular emphasized that it would be preferable that the applicant should be in contact with the staff of Trafi before submitting the application. These pre-application contacts are meant to improve the quality and maturity off the applications.

E.2 Contacts with other NSA's

So far, no foreign operators have applied for a safety certificate in Finland, and no Finnish operators have applied for one abroad.

Trafi's railway operators -unit has had informal co-operation meetings with NSA's of Sweden, Norway and UK on issues concerning development supervision, authorisation and certification practices.

E.3 Procedural Issues

Safety authorisations were issued or renewed to 18 infrastructure managers in 2017. Most of these were renewals of authorisation. In May 2018 safety authorisations have been issued to 117 infrastructure managers altogether. There are still a few infrastructure managers who

have not applied for safety authorisation. In most cases where an infrastructure manager has not applied for safety authorisation, the reason is either that the infrastructure manager is unaware of the requirement or that the infrastructure has not been in use for a while and its future is uncertain. Trafi has strived to contact infrastructure managers who do not yet have safety authorisation and to disseminate information on the subject.

According to the Finnish railway act private sidings need to have a safety authorisation. The experiences from recent years have shown that safety authorisation demand is a heavy burden for private sidings. At the moment Trafi and ministry of transportation are planning to lighten the demands concerning private sidings. The deregulation of private sidings is planned to happen simultaneously with the implementation of the fourth railway package in 2019.

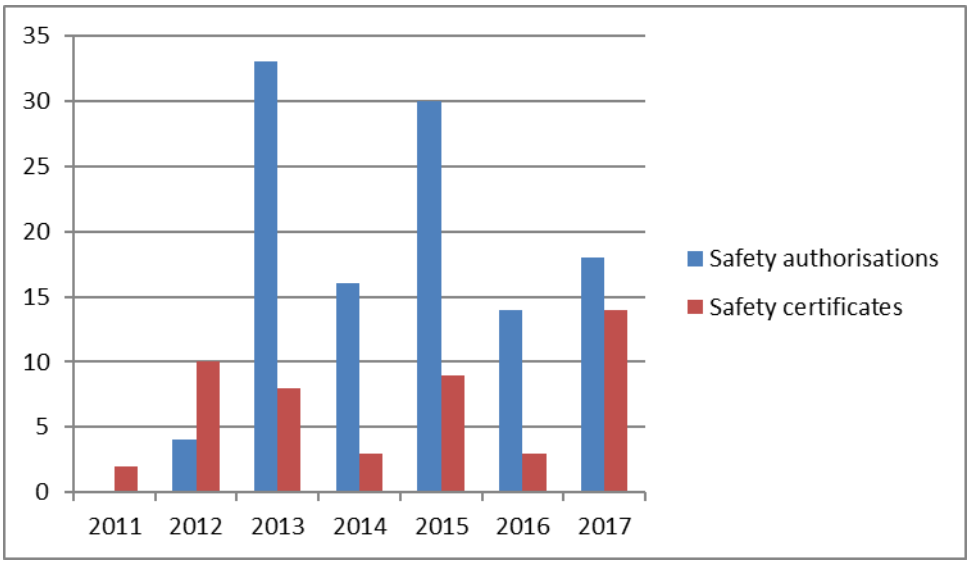

Figure 11. Granted safety certificates and safety authorisations by year.

In 2017, Trafi issued 3 new safety certificates and renewed 11 safety certificates. In May 2018 36 rail transport operators had valid safety certificates in Finland. The majority of safety certificate holders are shunting or heritage railway operators and rail maintenance companies. In Finland there are two railway undertakings which practice commercial train traffic.

In most cases, infrastructure managers and rail transport operators have to be asked to supplement their safety authorisation or certificate applications. In many cases, additional information is needed regarding descriptions of risk management and maintenance procedures and, in the case of infrastructure managers, traffic control arrangements.

There is a great deal of variation in the quality of safety authorisation and certificate applications, particularly with regard to descriptions of safety management systems. Describing the safety management system in the detail required by the application process frequently presents a significant challenge, particularly to smaller operators. Revisions are often needed in the application process, due to poorly prepared applications.

The infrastructure manager of the national railway network Finnish Transport Agency renewed its safety authorisation in 2017. The renewal process was quite problematic because

there were major deficiencies in the SMS description and the SMS didn't always reflect real life procedures. However, Trafi renewed the authorisation but the authorisation had many preconditions considering the development of Finnish Transport Agency's SMS. The processes to guarantee the developments of Finnish Transport Agency's SMS are still going on in May 2018.

In Finland, several individual private siding managers can apply for safety authorisation through a joint application. In order to save time and money, even very different kinds of private siding managers jointly apply for safety authorisation. The problem frequently presented by these applications is that they attempt to describe the procedures of different types of operators as part of a single safety management system, which can lead to the description not actually corresponding to the procedures of any of the operators in practice.

Similarly to previous years, there were minor disagreements with some safety authorisation and certification applicants about the interpretation of requirements related to the safety management system, but these were resolved through discussions.

E.4 Feedback

The rail transport operators unit sends a questionnaire regularly to the safety certification and authorisation applicants and holders concerning the satisfaction of customers. In the questionnaire, the customers can express their opinions for example on the availability of application documents, application processing schedule and quality of guidance. On the grounds of feedback, the rail transport operators unit strives to develop its processes.

Representatives of Trafi and of the companies applying for a safety authorisation or certificate are also in regular contact, and the application process is interactive. Feedback is given and received at these meetings.

Trafi sends also annually a general customer satisfaction questionnaire to a wider group of customers.

An appeal against any Trafi decision may be filed at the Helsinki Administrative Court.

F Changes in legislation

F.1 Railway safety directive

Issues related to the header are presented in table 1 of annex B.

F.2 Changes in legislation and regulation

Issues related to the header are presented in table 2 of annex B.

G Application of the CSM on risk evaluation and assessment

G.1 NSA experience

The majority of applications for authorisations for placing infrastructure in service come from the Finnish Transport Agency, which is the infrastructure manager of the state railway network, and the rest are from private siding managers. The Finnish Transport Agency has several years of experience of evaluating risks in accordance with the Regulation. Authorisation for placing into service is not required from small scale infrastructure improvements on private sidings. Most of the infrastructure projects on private siding are really small scale so private siding managers have less experience of the risk management procedures laid down in the Regulation.

According to the Regulation 402/2013 the proposer decides if the proposed change is significant. The fact that proposer decides the significance of the change has led to a situation where proposers sometimes tend to underestimate the significance of the change. When the change is assessed as insignificant the proposer can make the risk assessment according the methods included in its safety management system, which usually is more economical for the proposer. The Finnish Transport Agency does the risk assessment for significant and insignificant changes almost identically; the difference is that independent safety assessment is not included in the risk assessment of insignificant changes.

For assessing the significance of changes the Finnish Transport Agency has a form which is based on the criteria presented in CSM-regulations article 4. Sometimes the decision considering the significance of change is made with quite narrow expertise, which may cause neglect of some interfaces. Usually the changes proposed by Finnish Transport Agency are so complex that it is difficult for NSA's experts to question the decisions on significance. The changes proposed by IM's of private sidings are usually simpler, so it is possible for experts of NSA to take a stand on the validity of decision made on significance of change. However, the NSA doesn't have many possibilities to act if they disagree on the decision made on significance of change.

Regulation No 402/2013 repealed Regulation No 352/2009 in the spring of 2015, effecting a change to the application of the Regulation. As the new Regulation applies to all changes for which authorisation for placing in service is being sought, it is no longer necessary to carry out risk assessments pursuant to the Regulation. The effect of the change soon became visible, as in approximately one in three of the infrastructure projects for which authorisation for placing in service has been required after the amendment, the change has not been considered significant enough to warrant a risk assessment pursuant to the Regulation. If a change is not considered to be significant, operators follow the risk assessment procedures laid down in their own safety management systems. It is not possible to draw direct conclusions on whether changes have been deemed as not significant on questionable grounds. In some cases, where a change has not been deemed as significant, there has nevertheless been reason to question whether the interfaces of the change had been given enough attention.

In cases where infrastructure managers have deemed a change to be significant, they have applied the risk assessment procedure laid down in the Regulation appropriately, and independent assessment bodies have contributed to the evaluation of these processes.

The applicant for an authorisation for placing rolling stock in service must assess the significance of the change and, should the change be significant, a risk evaluation, as laid down in the Regulation, must be appended to the application. When the requirement entered into force a few years ago, there was particularly strong opposition to it among small operators because in their view no assessment bodies were available in Finland. After the initial difficulties, the application of the risk management laid down in the Risk Management Regulation has, however, got off to a good start. Assessment bodies are available and their services are used in an appropriate manner.

In connection with changes to rolling stock, the changes are occasionally deemed to be of minor significance and thus, no risk assessment, as laid down in the Regulation, has been carried out. In such cases, Trafi will review the significance of the change itself. If Trafi is of the view that the change is significant, it will return the application to the applicant for completion. When applications for authorisation for placing new rolling stock in service are submitted, the risk assessments have been carried out as laid in the Regulation and independent assessment bodies have been used.

G.2 Feedback from stakeholders

Rail transport operators and infrastructure managers are asked to share their experiences of the application of the Common Safety Method in their annual safety reports.

The majority of Finland’s railway operators have not applied the risk assessment procedure laid down in the Common Safety Method, as they operate on a small scale and no significant changes have taken place in their operations. Most of these small operators are private siding infrastructure managers. Many operators have begun to apply the risk assessment principles of the Common Safety Method and have introduced a hazard record despite no significant changes taking place in their operations. Others, such as infrastructure managers who operate in the chemical industry, have been applying risk management principles that are consistent with the Common Safety Method for years.

The Finnish Transport Agency, in its capacity as the infrastructure manager of Finland’s state-owned rail network, has applied the risk assessment procedure laid down in the Regulation in dozens of projects and it is more experienced in the application of the Regulation than any other actor in Finland. The assessment of the significance of the change connected with the agency’s projects and the risk management laid down in the Risk Management Regulation is integrated in the agency’s occurrence and risk management system. With its occurrence and risk management system, information on the risks entered into the hazard record can be widely disseminated. 98 changes went through significance assessment in 2017 on Finnish Transport Agency’s projects.

In October 2017, the Finnish Transport Agency arranged the annual CSM risk management event for its stakeholders. The main themes discussed at the event were changes in

conformity assessment protocol of safety management systems, development of safety culture and new risk management guidelines.

The risk assessment procedures meeting the requirements of the Risk Management Regulation are gradually becoming a well-established practice in the operations of the incumbent railway undertaking VR Group. VR Group carried out 36 assessments of the significance of the change. In four of them, the conclusion was that the change was significant and safety-relevant and the risk assessment was conducted in accordance with the Regulation.

Smaller railway undertakings operating on the national railway network did not report experiences from the CSM risk assessment procedure from 2017 because none of the changes were considered as significant.

G.3 Revision of NSRs to take into account the EC regulation on CSM on risk evaluations and assessment

No changes relating to the risk assessment procedure laid down in the Common Safety Method were introduced to national regulations in 2017.

H Derogations regarding ECM certification scheme

ECM certificates have been issued to two operators in Finland: VR Group Ltd and Teräspyörä Oy.

In 2017, VR Group Ltd and Fenniarail, two undertakings with freight traffic operations, applied for a derogation under Article 14(8) of the Railway Safety Directive with regard to the maintenance of the Russian rolling stock. The applications concerned the maintenance of the Russia freight wagons operated by the two undertakings on the Finnish rail network. No entity in charge of maintenance (ECM) has been designated in Finland for Russian rolling stock used in Finland. The derogations were granted to both undertakings.

The rolling stock entering Finland from Russia is subjected to technical inspection on the border and the technical details of the rolling stock are relayed to Trafi. The inspections on the border are performed in accordance with the agreement on rail links between Finland and Russia. VR is responsible for carrying out the inspections and Fenniarail purchases the service from VR for the wagons that it operates.

In practice, the border stations are notified of all trains arriving from Russia. The system inspects the wagons' service permits and their measurements. It is also checked that the condition of the wagons is such that they do not require any servicing in Finland. The condition of the wagons is checked on the border visually and by means of technical inspections. Particular attention is given to such matters as the condition of the wheelsets, suspension, towing devices and brakes, as well as the bogies. The wagons are also weighed. Any unauthorised wagons are turned back to Russia.

Annex A. Common Safety Indicators

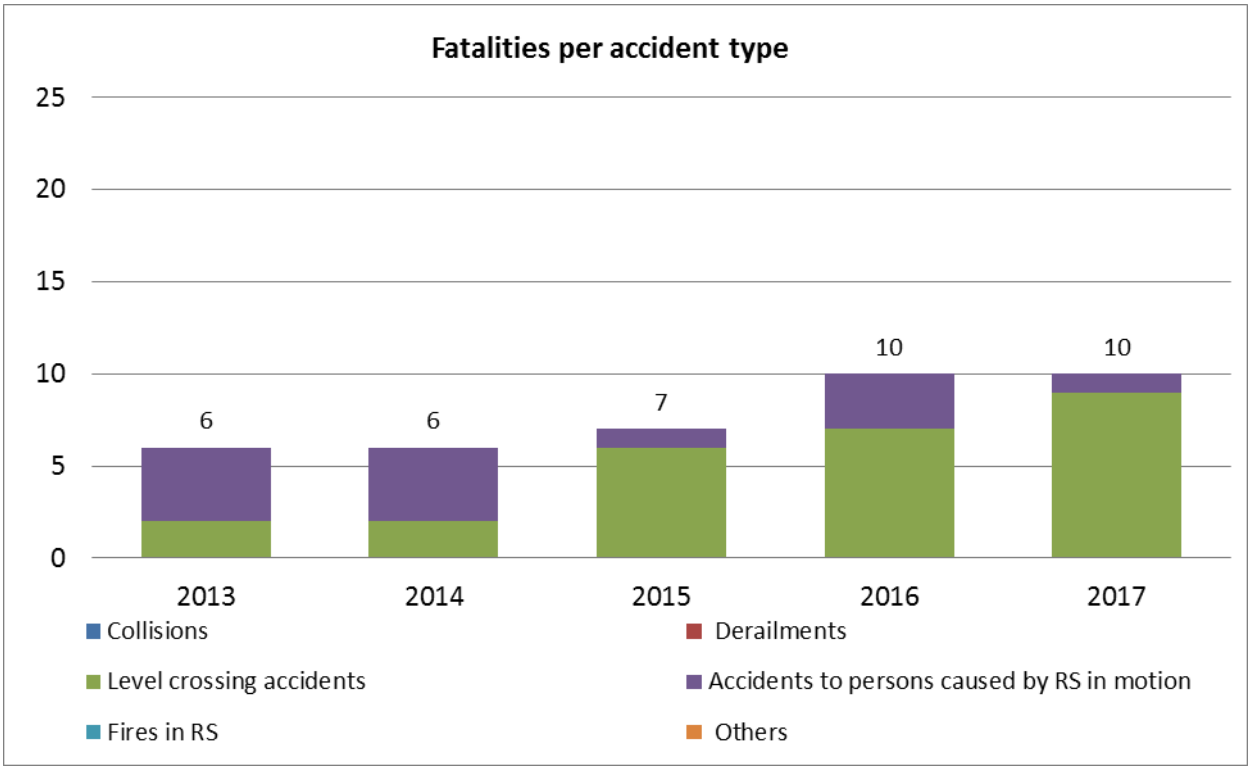

Figure A.1 Fatalities in railway accidents by accident type 2013–2017.

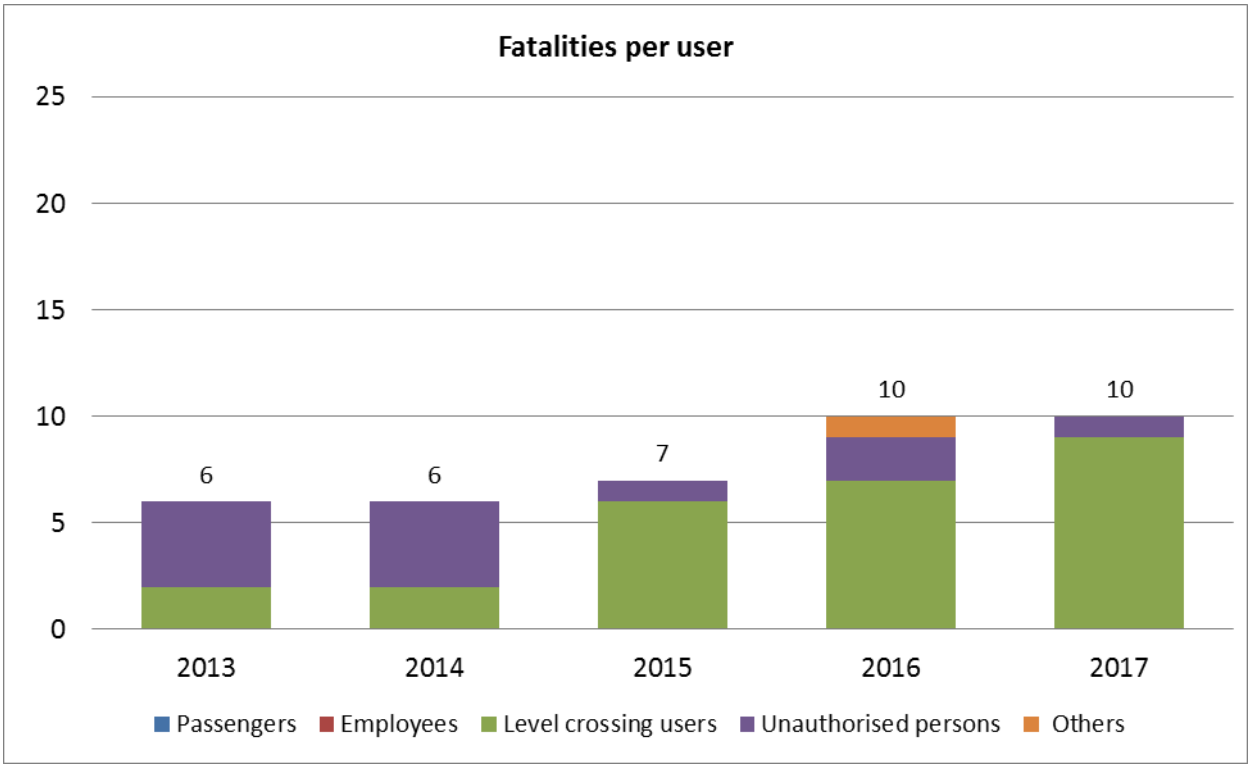

Figure A.2 Fatalities in railway accidents by user group 2013–2017.

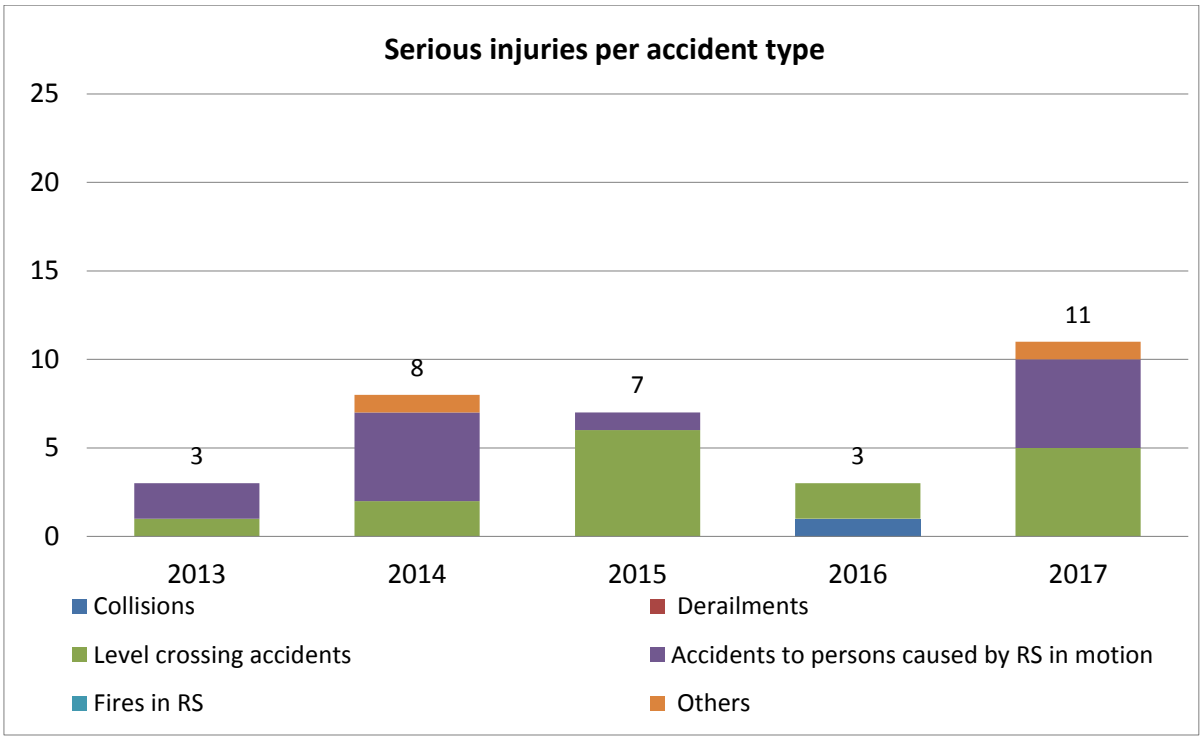

Figure A.3 Serious injuries in railway accidents by accident type 2013–2017.

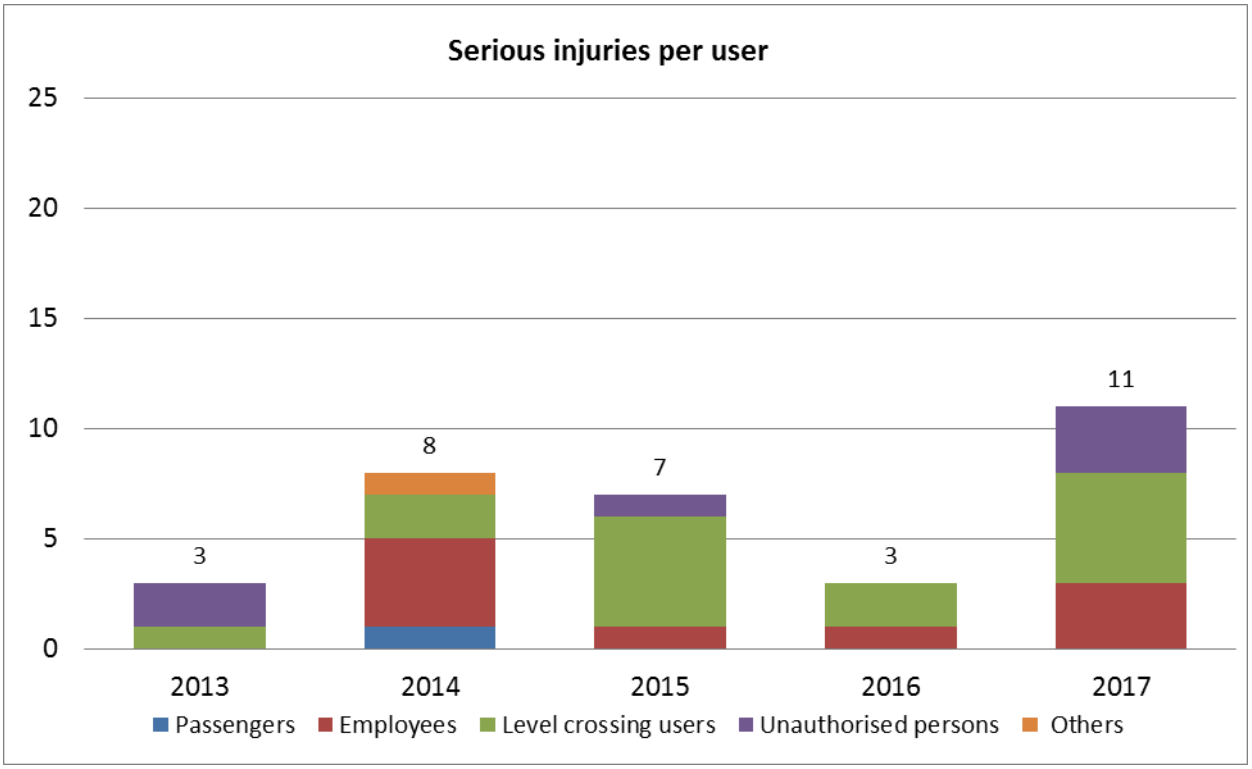

Figure A.4 Serious injuries in railway accidents by user group 2013–2017.

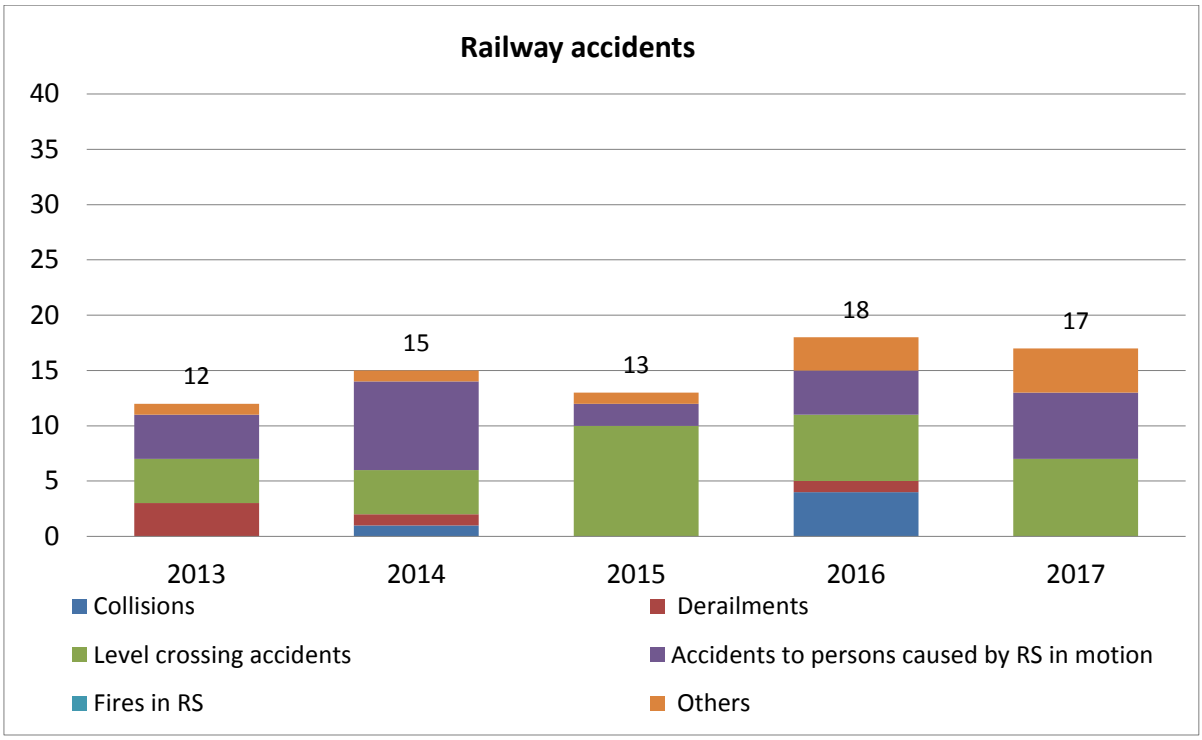

Figure A.5 Significant rail accidents 2013–2017.

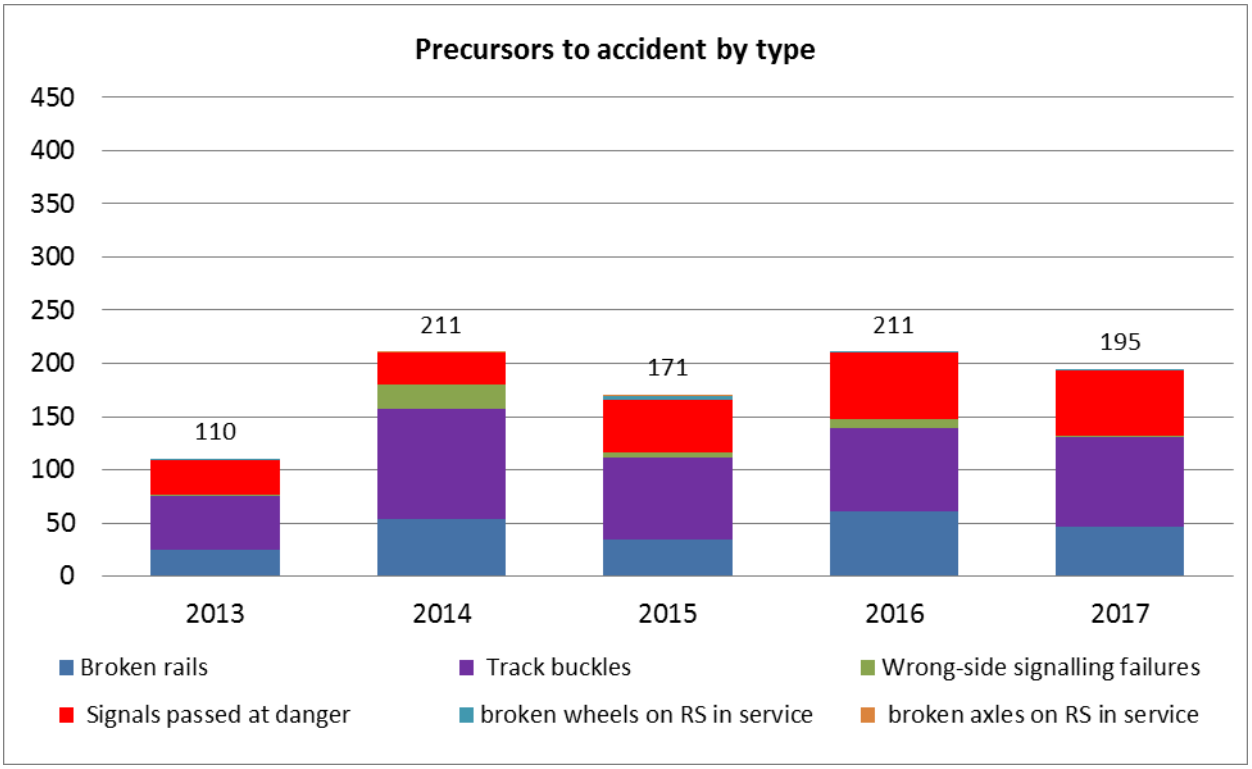

Figure A.6 Precursors to accidents 2013–2017.

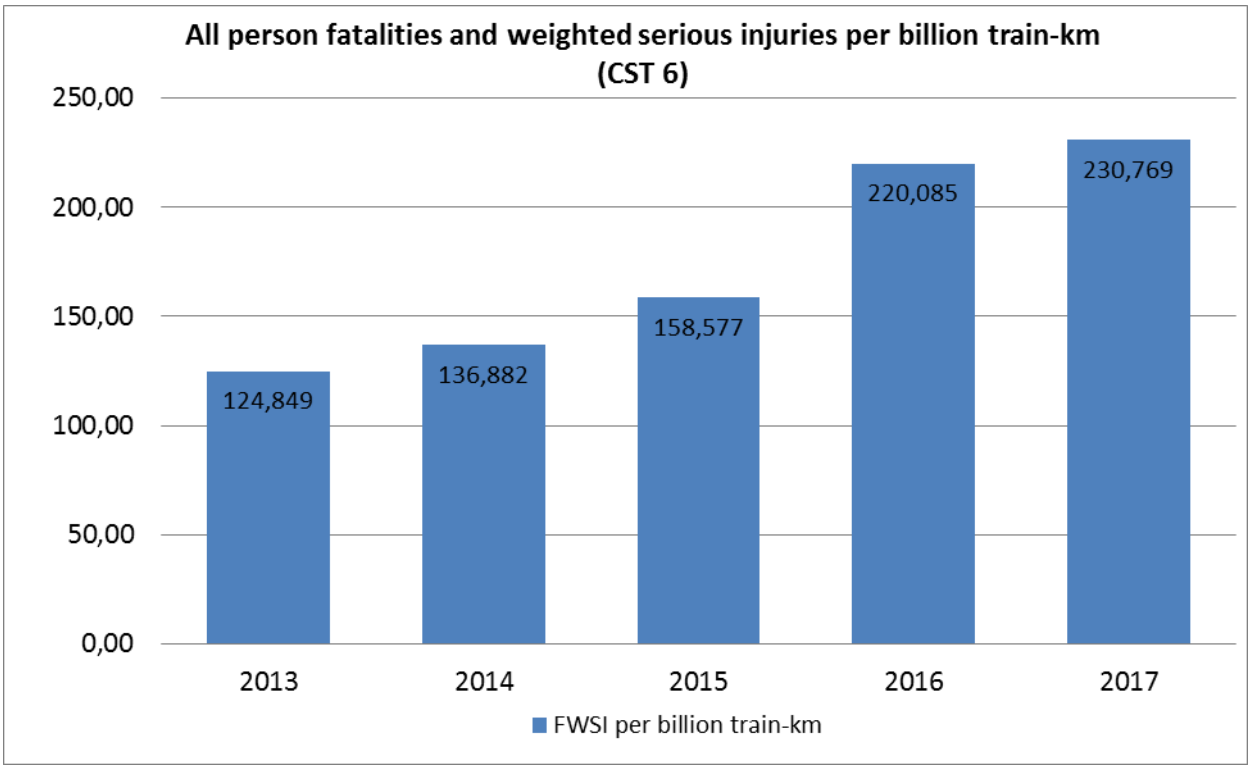

Figure A.7 Number of fatalities and weighted number of serious injuries per billion train-km on railway accidents 2013-2017.

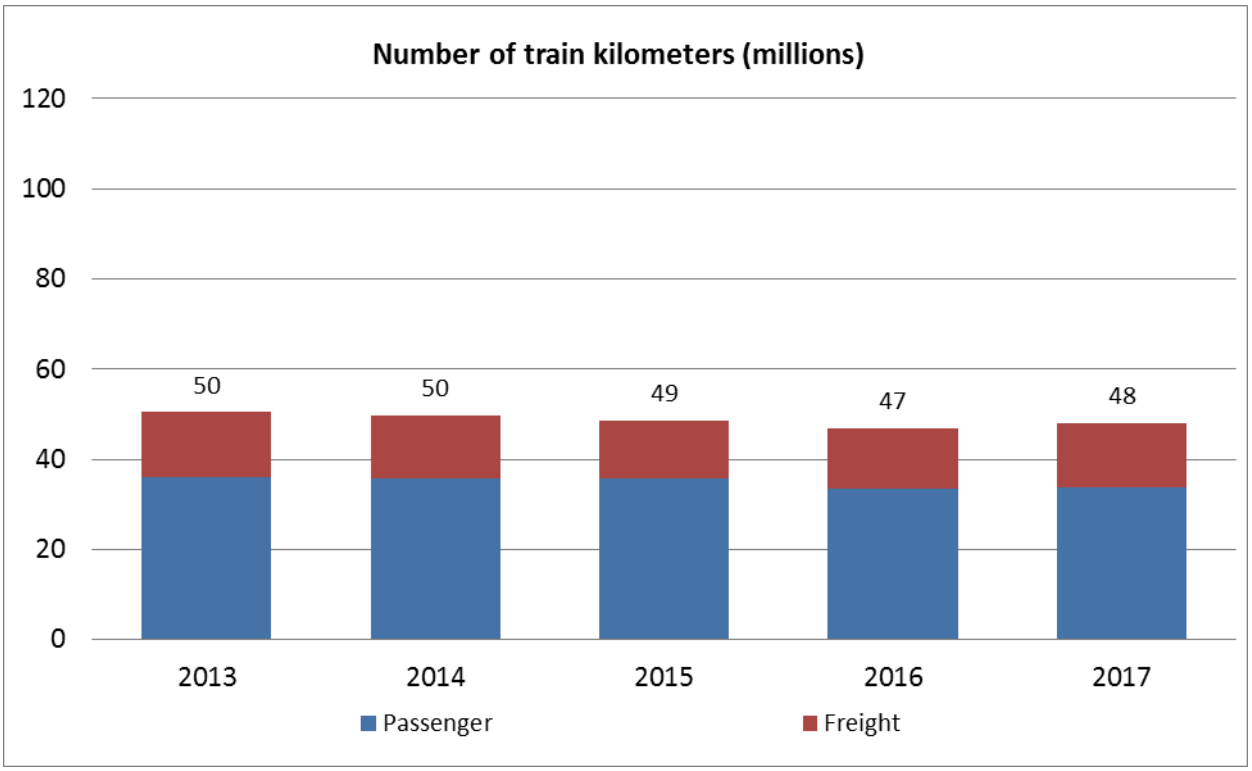

Figure A.8 Number of train kilometers (millions) 2013-2017.

Annex B. Changes in legislation

Table 1.

AMENDMENTS TO RSD	Transposed (Y/N)	Legal reference	Date of entry into force
Directive 2008/57/EC	Y	Governmental Decree 1094/2013	1.1.2014
Directive 2008/110/EC	Y	Railway Act 304/2011	15.4.2011
Commission Directive 2009/149/EC	Y	Governmental Decree VNA 1094/2013 NSA Regulation (TRAFI/19402/03.04.02.00/2014)	1.1.2014 1.1.2015
Directive 2012/34/EU	Y	Act amending the Railway Act 1394/2015	8.12.2015
Commission Directive 2014/88/EU	Y	Governmental Decree 859/2015 NSA Regulation (TRAFI/19402/03.04.02.00/2014)	30.7.2015 1.1.2015
Directive (EU) 2016/798 of the European Parliament and of the council on railway safety	N	Transposing of the directive is ongoing	

Table 2.

LEGISLATION AND REGULATION	Legal reference	Date of entry into force	Description of change	Reasons for the change
Concerning the NSA	-			
Concerning NoBos, DeBos, ABs, third party entities for registration, examination, etc.	-			
Concerning RUs/IMs/ECMs	-			
Implementation of other EU requirements (if concerning railway safety)	Transport services act (320/2017)	1.7.2018	Legislation implementing directive on the certification of train drivers (2007/59/EU) was revoked and the implementing acts of that directive were transferred to Transport services act.	Big national legislation renewal, which included all transport modes.