

Safety report for the railways 2013

September 2014

Foreword

Each year, the safety report provides a comprehensive analysis of developments in the number of accidents and incidents and a review of the Danish Transport Authority's activities in relation to railway safety.

There have been major changes in the railway sector since the first safety report was published in 2005.

Today, all railway undertakings and infrastructure managers have approved safety management systems – including systems to ensure that undertakings' safety work is steered and channelled in the right direction.

Although some undertakings have problems with their safety management systems not being entirely consistent with the way the work is actually carried out in the undertakings, much of the key work is still borne by the safety management systems.

Undertakings are also improving the way they work with the new EU risk assessment methods. Again, there are still challenges, but considering that the application of the new methods is a relatively new discipline in the industry, the undertakings have also come a long way in this area.

The introduction of the requirement for approved safety management systems and the requirement for the application of new risk assessment methods is part of the railway industry's transformation into a new, common European legal basis.

This transformation has occurred without compromising railway safety. On the contrary, safety is slightly better than it was 10 years ago. The Danish Transport Authority hopes that the report can help disseminate positive experiences in the Danish railway sector. The report will also be used to exchange experience among the EU Member States and will be submitted to the European Railway Agency (ERA).

Happy reading!

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Resumé

Der er meget få ulykker på den danske jernbane...

Danmark har som mål, at det høje sikkerhedsniveau (målt med udgangspunkt i 2004) skal opretholdes. Der må maksimalt være 0,3 dræbte eller alvorligt tilskadekomne personer pr. mio. tog-km. Målsætningen har karakter af et loft over det antal af personskader på jernbanen, der er acceptabelt.

Danmark har i alle årene siden 2004 opfyldt målsætningen og også i år ligger sikkerhedsniveauet væsentligt under de 0,3 pr. mio. tog-km. I 2013 er antallet af væsentlige personulykker 0,14 pr. mio. tog-km. Dette er på niveau med de bedste lande i Europa.

I 2013 er 10 personer blevet dræbt på jernbanen, mens seks personer er kommet alvorligt til skade. Tallene ligger en smule lavere end sidste år, og er på niveau med det femårige gennemsnit.

Den største andel af ulykkerne med alvorligt tilskadekomne eller dræbte er *personpåkørsler* og *overkørselsulykker*, som står for hhv. 6 og 5 af de 13 alvorlige ulykker med personskade. De fleste ulykker, hvor nogen kommer til skade, sker dermed i situationer, hvor personer krydser sporene. Det er da også oftest personer udenfor toget, som kommer til skade i jernbaneulykker. Passagerer og ansatte kommer meget sjældent til skade.

... dog er der sket en stigning i antallet af registrerede nærvedpersonpåkørsler

Antallet af indberettede hændelser, hvor lokomotivføreren observerer uautoriserede personer i sporet, er stigende.

Ofte kan lokomotivføreren nå at advare med tyfonen, og en ulykke kan dermed undgås, men episoden kan have store omkostninger for lokomotivførerens arbejdsmiljø og et skred i respekten omkring banens arealer kan ikke undgå at resultere i flere jernbaneulykker på sigt.

Virksomhederne følger løbende op på, om der er steder, hvor der sker mange hændelser, og undersøger, om der kan være en årsag til dette i form af f.eks. et hul i et hegn eller lignende.

Året har for Trafikstyrelsen været præget af mange fornyelsestilsyn..

For ca. fem år siden fik virksomhederne efter krav i Jernbanesikkerhedsdirektivet godkendte sikkerhedsledelsessystemer. Der har været en del udfordringer med disse sikkerhedsledelsessystemer. Bl.a. har Trafikstyrelsen ofte konstateret, at der er uoverensstemmelser mellem de processer, der er beskrevet i sikkerhedsledelsessystemerne, og det reelle arbejde, som foregår i driften.

Samtidig er det Trafikstyrelsens oplevelse, at mange virksomheder ikke udnytter det potentiale, som der er i sikkerhedsledelsessystemerne for at arbejde med og forbedre sikkerheden.

... som har medført ændringer i Trafikstyrelsens måde at godkende sikkerhedsledelsessystemer

I forbindelse med, at mange virksomheder i 2013 skulle have fornyet deres certifikat eller sikkerhedsgodkendelse har Trafikstyrelsen benyttet lejligheden til at holde individuelle møder med virksomhederne for at fortælle om, hvad sikkerhedsledelsessystemet kan bruges til, hvis det konstrueres og anvendes på den rigtige måde.

Trafikstyrelsen har også tilrettet sin måde at godkende virksomhedernes sikkerhedsledelsessystemer. Lovgivningen er blevet ændret, så det er muligt at udstede godkendelser af mindre end fem års varighed. Den nye mulighed er blevet brugt i de tilfælde, hvor TS har vurderet, at der er brug for en mere tæt opfølgning på virksomhedens sikkerhedsledelsessystem.

2013 var det første år, hvor den nye modenhedsmodel blev anvendt

Trafikstyrelsen har udviklet en modenhedsmodel, som fra 2013 bliver anvendt til at vurdere

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modenhedsniveauet af virksomhedernes sikkerhedsledelsessystemer i forhold seks indikatorer. Årets resultat viser, at virksomhederne generelt er gode til at registrere hændelser, men at de har problemer med at lave årsagsanalyser i forbindelse med ulykker og hændelser.

Anvendelsen af risikovurderingsforordningen er blevet mere sikker...

Både infrastrukturforvaltere og jernbanevirksomheder er generelt blevet bedre til at anvende de krævede EU-risikovurderingsmetoder i. 2013 var da også sidste år, hvor Trafikstyrelsen skulle se alle infrastrukturforvalternes signifikansvurderinger.

Trafikstyrelsen oplever, at der er stor forskel på, hvor mange ændringsaktiviteter virksomhederne har, og at der derfor også er forskel på, hvor meget erfaring virksomhederne har med at anvende forordningen og hvor sikre de er i at anvende metoderne.

... der er dog stadig udfordringer

Det er Trafikstyrelsens vurdering, at upræcise systemdefinitioner; manglende eller upræcist formulerede opgavebeskrivelser for assessors arbejde og manglende afklaring af 'forslagsstillers' rolle, fører til upræcise konklusioner i assessors rapport. Det medfører, at Trafikstyrelsen må bruge mere tid til at vurdere sagerne, med deraf følgende forlænget sagsbehandlingstid.

Ansvaret for en præcis opgaveformulering ligger først og fremmest hos ansøger. En tidlig dialog mellem ansøger, assessor og Trafikstyrelsen kan være med til at sikre, at der ikke opstår problemer med gennemførelsen af risikovurdering og assessering.

Trafikstyrelsen vil i 2014 arbejde videre med at vejlede virksomheder og assessorer i, hvornår og hvordan risikovurderingsforordningen skal anvendes.

Summary

There are very few accidents on the Danish railway...

The Danish safety target is that the high level of safety (based on the safety performance of 2004) is maintained. In order to do so, the total number of fatalities or severely injured people per million train-km (FWSI) should not rise above 0.3. This target functions as a cap on the acceptable number of injuries and fatalities on the Danish railway.

Since 2004 Denmark has complied with the cap and in 2013 the safety level is once again considerably below the 0.3 per million train-km. In 2013 the number of fatalities and severely injured people per million train-km reached 0.14. This places Denmark among the best performing countries in Europe.

10 people were killed on the railway in 2013, while six people were severely injured. These figures are slightly lower than the year before, and they are in line with the five-year average.

The largest share of accidents that cause serious injuries and fatalities are accidents to persons caused by rolling stock in motion and level-crossing accidents, which account for respectively six and five of the 13 serious injuries this year. Most accidents with people involved are the result of people crossing the rails.

It is mainly people outside the train that are injured in railway accidents. Passengers and staff are very rarely injured.

... however, there has been an increase in the number of nearaccidents

The number of incidents reported where the driver observes unauthorized people on the track has increased

Often the driver is able to avoid an accident by using his horn, but the episode can be very burdensome on the driver and a decline in respect of the railway premises might lead to more rail accidents in the future.

Infrastructure managers and railway undertakings identify 'hot spots' where there are unusually many incidents and examine whether there is a reason for this, e.g. a hole in a fence or similar.

For the Danish Transport Authority this year was marked by many renewal audits...

Five years ago, many companies had their safety management system approved by The Danish Transport Authority. These safety management systems have been faced with some challenges. Among other things, the Danish Transport Authority often finds that there are differences between the processes described in the safety management systems, and the real work that takes place in the companies.

It is also the assessment of the Danish Transport Authority, that many companies do not exploit the potential that the safety management systems offer for improving safety.

... this has resulted in changes to the Danish Transport Authority's way of approving safety management systems

Because many companies in 2013 had to renew their safety certification or safety authorization, the Danish Transport Authority took the opportunity to meet individually with the companies, to share with them, what safety management systems can be used for, if constructed and used in the proper way.

The Danish Transport Authority has also restated its way of approving safety management systems in companies. There has been a change in legislation so that it is now possible to issue safety certificates with duration of less than five years. The new option has been used in situations where the Danish Transport Authority has assessed that a safety management system needs closer monitoring.

The new maturity evaluation model was used for the first time in 2013

The Danish Transport Authority has developed a maturity model, which from 2013 and onwards will be used to assess the maturity levels of the safety management systems against six indicators. The results from 2013 show that the companies generally are good at recording accidents and incidents, but that they encounter difficulties when they have to perform the required analysis of accidents and incidents.

The use of the common safety method for risk evaluation and assessment has become more confident...

Both the infrastructural managers and the railway undertakings have generally improved the way they use the European common safety methods for risk evaluation and assessment in 2013. 2013 was also the last year where the Danish Transport Authority saw all the significance evaluations performed by the infrastructure managers.

The Danish Transport Authority has observed that there are big differences in how many changes the companies perform and therefore also big differences in how much experience the companies have with the common safety method for risk evaluation and assessment.

... there are still challenges though

It is the observation of the Danish Transport Authority that inaccurate system definitions; missing or imprecise scopes of work for the assessment bodies and failure to resolve the role of the 'proposer', leads to inaccurate conclusions in the assessment reports. This results in the Danish Transport Authority spending more time on evaluating the applications for placing into service.

First and foremost the task of describing the wanted change lies with the applicant. An early dialogue between the applicant, the assessment body, and the Danish Transport Authority can help ensure that no problems arise when using the risk management process.

The Danish Transport Authority will in 2014 continue to guide companies and assessment bodies on when and how to use the common safety methods on risk evaluation and assessment.

About the data in the report:

The data in the safety report are for 2013. The reason for the relatively late publication is that the Danish Transport Authority only receives the last data from the undertakings in June, and it is an extensive process to validate the information on incidents and accidents on the railways, as reported by the undertakings.

The Danish Transport Authority is required to publish the safety report and submit it to the European Railway Agency, but the Danish Transport Authority has chosen to design the report so that it is also interesting for Danish stakeholders such as infrastructure managers, railway undertakings, the Danish Accident Investigation Board, politicians and the press.

The report therefore includes data from across the entire Danish rail network, including demarcated urban networks such as the metro and local railways, which would otherwise not be covered by the European reporting requirements. The reader must therefore be aware that the data in this report will be different from data reported for use in European statistics.

Chapter 1: Developments in railway safety

Once a year, infrastructure managers and railway undertakings report all safety-related incidents to the Danish Transport Authority. The Danish Transport Authority analyses developments in railway safety at national level, and presents the results here.

Accidents, precursors to accidents and safety irregularities

The incidents are described as accidents (including significant accidents), precursors to accidents and safety irregularities.

Figure 1: Overview of breakdown of reported incidents in 2013



Sikkerhedsmæssige uregelmæssigheder

- Foreløbere til ulykker
- Ikke væsentlig ulykke
- Væsentlig ulykke

Sikkerhedsmæssigheder	Safety irregularities
Foreløbere til ulykker	Precursors to
	accidents
Ikke væsentlig ulykke	Non-significant
	accidents

Væsentilig ulykkeSignificant accidentsOnly a small proportion of the incidentsreported are accidents. 10 out of 11 ofthe incidents reported by undertakingsare lapses in safety that have notdeveloped into an accident (see figure1).

Railway undertakings and infrastructure managers are required continually to follow up on the incidents and accidents that occur in their area.

It is part of the undertakings' safety management to carry out an investigation when something goes wrong. In the most serious cases, the Accident Investigation Board for Civil Aviation and Railways helps establish the chain of events and possible causes of the fault in the system.

There are approximately 2 700 km of railway line in Denmark. A large part is equipped with effective train control systems, which, together with competent operators, significantly reduce the risk of serious accidents. The equipment is mainly used on those lines where traffic is heaviest (see also figures for the rail system in Annex A).

Incidents are reported in accordance with the 'Reporting Executive Order'¹. The definitions used are listed in Annex C.

To minimise statistical uncertainty when indicating relatively small data volumes, the 5-year average is used to assess developments in railway safety.

¹ Executive Order No 575 of 25 May 2010 concerning the reporting of data on accidents, precursors to accidents and safety irregularities, etc. to the Danish Transport Authority, *as amended*



Figure 2 : Significant accidents 1999 – 2013

Significant accidents are train accidents involving damage costing more than DKK 1.2 million, serious personal injury or death, or delays to train operations of more than six hours. The significant accidents are shown per year and per million train-kilometres.

Significant accidents – fewer than last year

There were 14 significant accidents in 2013. The number of significant accidents is lower than last year, when there were 25 significant accidents. As can be seen in figure 2, there has been a slight decrease in the 5-year average.

Railway accidents are described in the following categories: collisions, derailments, accidents at level crossings, collisions with persons, fire and other accidents. Suicides that occur on the railways are not treated as railway accidents.

There are approximately 300-400 railway accidents a year in Denmark. Fortunately the vast majority of these accidents have few, if any, harmful consequences. For example, a collision between a train and a deer or a train and a shopping trolley that has been left on the rails will only rarely have consequences for either stock or passengers.

To distinguish between accidents with and without major consequences, the concept of *significant accidents* is used. Significant accidents are those that cause serious personal injury, death, damage of more than DKK 1.2 million or delays to train operations of more than six hours. Between 5 and 10% of railway accidents in Denmark are 'significant accidents'.

In 2013, the majority of significant accidents involved collisions with persons or accidents at level crossings. There were no significant accidents of the following types: collisions, fire or derailments – which are the types of accident with the greatest potential for causing multiple injuries.



Figure 3. Significant accidents broken down by type of accident

Accident types are given per million train-km for 2013 and as a 5-year average in the period 2009-2013. Suicides are not included.

Personpåkørsel	Collisions involving persons
Ulykke i overkørsel	Accidents at level crossings
Anden væsentilig ulykke	Other significant accidents
Brand	Fire
Afsporing	Derailment
Kollision	Collision
5 årigtgemsrit	5-year average

As can be seen in figure 3, the drop in the number of significant accidents in 2013 is due to a drop in the number of collisions involving persons.

The change in the different types of accident is a result of the fact that there is only a small volume of data. The annual change corresponds to a fall or rise of approximately one or two significant accidents in comparison with the average.

Safety target for the railways – met for 2013

The Danish safety target is established in relation to serious accidents involving persons, in other words based on the number of deaths and serious injuries.

While *significant accidents* are a measure of the number of accidents with major consequences, *significant accidents involving persons* are a measure of the number of accidents involving serious personal injury, with the accident being weighted according to the consequences.

Significant accidents involving persons are a weighted total of the number of persons killed (weighted 1/1) and seriously injured (weighted 1/10) over the year on the railways².

The national safety target is that the number of significant accidents involving persons on the railways in Denmark should be less than 0.3 per million train-km in the 5-year average.³ The target was met in 2013.

Compliance with the safety target is assessed on the basis of changes in the number of significant accidents involving persons for all railway lines in Denmark.

² The unit *number of deaths and weighted serious injuries* is abbreviated to the English FWSI: fatalities and weighted serious injuries

³ The Danish safety target is established in 'Den fælleseuropæiske jernbane. En strategi for høj sikkerhed og smidig gennemførelse i Danmark' [The common European railways – Strategy for high levels of safety and smooth implementation in Denmark] February 2009. Danish Transport Authority. The strategy is available on the Danish Transport Authority's website. Significant accidents involving persons are given as a 5-year average and scaled up to train-km travelled. Figure 4 shows that the 5-year average has been fairly stable and very low in the last 3 years. The number of significant accidents involving persons in the period 2009-2013 was 0.14 per million train-km. This was on a par with previous years, and also well below the national

Figure 4. Significant accidents involving persons 1999-2013



'Significant accidents involving persons' are a weighted total of the number of persons killed (weighted 1/1) and seriously injured (weighted 1/10). The statistics cover all groups of persons. The black line marks the Danish safety target.

Pr år	Per year
5 årigt gennemsnit	5-year average

safety target of 0.3 significant accidents per million train-km.

Breakdown of accidents involving persons – most collisions involving persons

The groups of persons most vulnerable to railway accidents are, first, those on railway property without permission. These are followed by users of level crossings. Employees and passengers are very rarely injured in railway accidents.

The number of personal injuries in railway accidents in Denmark was very low.

In all, there were 13 accidents involving death or serious injury in 2013. This covers five accidents at level crossings, six collisions involving persons and two 'other accidents'. Most of the accidents were solo accidents, in which a single person was killed or seriously injured.

However, in 2013 there were two accidents with multiple injuries/fatalities. These involved one accident in which two people were seriously injured as they boarded a train and came into contact with the traction current, and another accident in which three people in a car were killed in an accident at a level crossing.

Deaths and injuries broken down by groups of persons

In 2013, 10 people were killed in railway accidents, while six people were seriously injured. By comparison, 11 people were killed and 12 seriously injured in 2012. Although the number of significant accidents fell from 25 significant accidents to 14⁴ significant accidents between 2012 and 2013, the number of deaths and serious injuries is more or less the same.

This is due to the fact that there were fewer accidents in 2013, but the accidents were more serious with multiple fatalities.

Out of the 10 people who were killed in railway accidents in 2013, six were level-crossing users, one was covered by the category 'other persons⁵', while the remaining three people were on railway property without permission.

Of the six people who were seriously injured in a railway accident in 2013, one was a passenger, one was 'other', while three people were on railway property without permission. See table 1.

⁴ Note that besides accidents involving persons, significant accidents also include accidents that caused material damage of more than DKK 1.2 million or extensive delays. In 2013, one accident caused significant material damage. It did not result in personal injury.

⁵ 'Other persons' are persons injured in a railway accident, but who do not fall into any of the other categories: employee, passenger, level-crossing user or unauthorised. Other persons can, for example, be people standing on the platform or people using a platform crossing.

	Passe	engers	Emple	oyees	Lev cros use	/el- sing ers	Unauthorised		Other		Total	
	death	serious injury	death	serious injury	death	serious injury	death	serious injury	death	serious injury	death	serious injury
Collision	-	-	-	-	-	-	-	-	-	-	-	-
Derailment	-	-	-	-	-	-	-	-	-	-	-	-
Accident at level crossing	-	-	-	-	6	1	-	-	-	-	6	1
Collision with person	-	-	-	-	-	-	3	1	1	1	4	2
Fire	-	-	-	-	-	-	-	-	-	-	-	-
Other accident	-	1	-	-	-	-	-	2	-	-	-	3
Hazardous goods	-	-	-	-	-	-	-	-	-	-	-	-
Total	0	1	0	0	6	1	3	3	1	1	10	6

Table 1: Breakdown of accidents in 2013 involving death or serious injury according to group of person and type of accident.

In 2013, 10 people were killed and 6 seriously injured in railway accidents. Note that the category 'collisions with persons' includes all accidents with moving rolling stock that do not take place at a level crossing. Most of these accidents will be collisions with persons, but the category also includes, for example, passengers who fall from the train as a result of its movement. In the interests of clarity, they are all referred to as 'collisions with persons' in the safety report.

Suicides on the railway

Suicide is not viewed as a railway accident in the traditional sense. This is due to the fact that the causes of suicide are not directly related to the way railways are operated. Suicide on the railways is no different from suicide in other locations, and should be prevented in the same way as other suicides.

Nevertheless, it is interesting to monitor the number of suicides on the railways. Besides the fact that suicide and attempted suicide obviously have very serious consequences for those who choose to take their own lives, and their relatives, suicide also has serious repercussions for train drivers as well as any witnesses to the suicide, and a general negative effect on the railways. There are therefore many reasons why it is important to prevent suicides wherever possible.

In the EU, the number of suicides on the railways has been on the rise since 2008, when around 2 500 people committed suicide, and forward to 2012, when the number of suicides on the railways had risen to almost 3 000.

Denmark has also seen an increase in the number of suicides. In 2012, the number of suicides on the railways was unusually high. 44 people committed suicide on the railways in 2012, compared with 26 in 2011.

In 2013, the number of suicides was again back down to a level comparable with previous years. In 2013, 29 people committed suicide on the railways. See figure 5.

Figure 5. Suicides on the railways in the period 1999-2013



Suicides resulting in a fatality. Suicides are recorded on the basis of witness statements and police decisions.Dræbte pr årDeaths per year

Dræbte 5-årigt genesnit	5-year average number of deaths

When it is compared with the number of kilometres travelled on the railways, the number of suicides on the railways in Denmark is still relatively low compared with other European countries.

Given the high number of suicides in 2012, in 2013 the Danish Transport Authority discussed prevention initiatives with the industry. The Danish Transport Authority also initiated a dialogue with Livslinjen, an aid organisation for people contemplating suicide.

The high number of suicides persuaded Banedanmark and DSB to collaborate with Livslinjen to undertake a campaign against suicide. The campaign was called 'Livet tur-retur' [Life – a round trip] and ran for three weeks in October and November.

The result of the campaign was a threefold increase in the number of calls to Livslinjen.

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Figure 6. Minor accidents broken down by type of accident 2013.

Minor accidents are those involving minor injuries or material damage of less than DKK 1.2 million. The types of accident are given per million train-km and as a 5-year average for the period 2009-2013.

Kollision	Collision
Anden ikke væsentilig ulykke	Other non-significant accident
Brand	Fire
Personpåkørsel	Collision involving persons
Ulykke i overkørsel	Level-crossing accident
Afsporing	Derailment
5 årigtgemsnit	5-year average

Minor accidents – most collisions

In 2013, 301 minor accidents were recorded. In these statistics, an accident is considered 'minor' if it does not involve extensive material damage or serious personal injury. The number is fairly constant compared with previous years.

Collisions still account for most minor accidents. In the last few years, however, there has been a fall in the number of minor collisions – probably due to changed recording practices⁶. The number of fires in rolling stock has fallen. One reason may be that several undertakings are now focusing more on monitoring incidents involving fire and smoke.

This year, the number of other nonsignificant accidents is somewhat higher than the 5-year average. See figure 6. The explanation for this probably also lies in the way the accidents are recorded⁷.

⁶ In the safety report for 2011, the Danish Transport Authority identified that there seemed to be a widespread misunderstanding about what should be recorded as a collision. Inasmuch as the causes of collisions are often attributable to vandalism, there has been a tendency for events to be mistakenly recorded as vandalism. In so doing, the cause is confused with the primary event, the accident. In future, the Danish Transport Authority intends to pay special attention to this source of uncertainty. The data reported for 2012 and 2013 have therefore been reviewed and corrected for this misunderstanding.

⁷ Types of accident: collisions and derailments have very different potentials for destruction, depending on whether they occur in an area where there are passengers, or an area where there are no passengers (shunting/clearing area or the like). To distinguish between accidents with a high hazard potential and those with a low hazard potential, derailments and collisions that occur in shunting or clearing areas or the like are categorised as 'other accident'. It has been a source of error in the reporting that a large number of accidents in shunting and clearing areas have been incorrectly categorised, resulting in their being counted as collisions or derailments in the statistics. In the past few years, undertakings have become more aware of this incorrect categorisation and that is probably why we are seeing an increase in the number of accidents in the category 'other accident' and a drop in the number of accidents in the categories: 'derailments' and 'collisions'.

Accidents and incidents with dangerous goods

In 2013, no incidents or accidents involving dangerous goods were reported.



Figure 7. Precursors to accidents broken down by type 2013.

Precursors to accidents are given in relation to million train-km travelled, and as a 5-year average over the period 2009-2013. Precursors to accidents do not cause damage.

Signal forbikørster	Signals passed at danger
Skinneburd	Broken rails
Signal fejl	Signal failure
Solk urver	Track buckles
Defekte hjul og aksler	Broken wheels and axles
5-årgt gennemsnit	5-year average
I alt	Total

Precursors to accidents and safety irregularities

283 precursors to accidents were recorded in 2013. Precursors to accidents are lapses in safety that do not cause damage. They can be divided into five types: broken rails, track buckles, signals passed at danger, signal failure, and broken wheels and axles.

Signals passed at danger easily constituted the highest proportion of precursors to accidents again in 2013 (176 cases), as figure 7 shows. However, the number is well below the 5-year average.

Again in 2013, the Danish Transport Authority records two types of signals passed at danger:

 signals passed at danger by a train signals passed at danger by shunting rolling stock or work vehicles.

The two types of signals passed at danger will often have very different risk potentials, since signals passed at danger with shunting rolling stock and work vehicles often occur in an area where there are no passenger trains and where the speed is lower.

Figure 7 only includes signals passed at danger by a train, 176 in total. In 2013, 318 signals were also passed at danger by shunting rolling stock or work vehicles⁸.

⁸ Be aware that in the Danish Transport Authority's safety reports for 2011 and previously, the total number of signals passed at danger is listed jointly for trains and shunting rolling stock/work vehicles.

Broken rails constituted the next biggest proportion of precursors to accidents (44) in 2013, followed by signal failure (43).

Safety irregularities

Besides precursors to accidents, undertakings also report safety irregularities to the Danish Transport Authority.

Safety irregularities are described in the following categories: risk of collision with person, irregularity at level crossing, non-technical signalling error, problems with gauge conditions, brake failure, track deformation, gauge conditions, vandalism and other irregularity.

Safety irregularities are often less serious than precursors to accidents or are of such a nature that they are difficult for undertakings to avoid, since they are due to inappropriate behaviour by third parties.

The number of incidents of the type: 'risk of collision with person' rose from 433 in 2012 to 612 in 2013.

Several railway undertakings also write that they are increasingly finding people crossing the track without authorisation.

One undertaking writes in its safety report:

The overall trend is one of a lack of respect for crossings and tracks. People run across tracks or crossings if they are about to be late for the train, or the quickest way from A to B is across a track. It seems people do not believe there is any danger in crossing tracks, or a 'flashing' crossing.

Besides the great danger to which people are exposing themselves in these situations, it is also quite tough mentally for the train drivers every time they are exposed to these events. Often they have to arrange to be replaced because they are too shaken to continue driving. We are working on an information campaign to draw attention to the great danger to which people are exposing themselves and others.

The increase may be due to the fact that the number of people crossing the

tracks at places or times when they should not is rising. However, the increasing number of cases recorded could also be due in part to the fact that train drivers are paying more attention to recording when they see someone on the track.

Railway safety in other countries – Denmark fares well

The EU's safety targets

The European Railway Agency (ERA) publishes safety indicators and safety levels for EU Member States⁹. Comparison between the countries shows that Denmark has a very high level of safety, on a par with the neighbouring countries with which the country normally compares itself.

The figures in figure 8 are from the period 2007-2012. Be aware that where the figures in the rest of this chapter concern the entire Danish rail network, those given in figure 7 relate to the Danish rail network excluding the metro and local railways. This is because metros and railways, which are functionally distinct from the rest of the rail network, and which can only be used to transport passengers in local, urban or suburban areas, are not included in the official European statistics.

In the period 2007 – 2012, however, there was no major difference between the safety level for the entire Danish rail network including the metro and local railways and the safety level for the Danish railways excluding local railways and the metro.

For the entire rail network, the safety level in the period was 0.14 deaths and weighted serious injuries per million train-km in the 5-year period, while the safety level for the network excluding the metro and local railways was 0.16 deaths and weighted serious injuries

⁹ Railway Safety Performance in the European Union 2014, European Railway Agency. <u>www.era.europa.eu</u> per million train-km in the 5-year period.

Figure 8 also shows the European average, which is 0.34 significant accidents involving persons per million train-km in the reporting period. This is almost twice as high as the Danish average for the period.

Common safety targets for the whole EU were adopted in 2010 and revised in 2012¹⁰. The safety targets are based on the first four years of data collected at Community level (2004-2009).

The purpose of the European safety targets is to ensure a high level of safety on the railways across the whole EU. The EU's actions in the coming years will increasingly be focused on those countries facing the greatest challenges.

¹⁰ The common safety indicators (CSI) are reported, cf. Annex I to the Safety Directive. Published in Denmark in Order No 1293 of 23 November 2010



Figure 8. Significant accidents involving persons in the EU 2007-2012

The safety level is given as the number of deaths and weighted serious injuries over a 5-year period. Source	:
Railway Safety Performance in the European Union 2014, European Railway Agency. <u>www.era.europa.eu</u> .	

Storbritannien	UK
Irland	Ireland
Holland	Netherlands
Tyskland	Germany
Danmark	Denmark
Frankring	France
Sverige	Sweden
Spanien	Spain
Italien	Italy
Tjekkiet	Czech Republic
Finland	Finland
Østrig	Austria
Belgien	Belgium
EU gennemsnit	EU average
Slovenien	Slovenia
Portugal	Portugal
Ungarn	Hungary

Bulgaria
Latvia
Estonia
Greece
Slovakia
Poland
Romania
Lithuania
Number per 1 million train-km

Chapter 2: The Danish Transport Authority's follow-up of recommendations from the Accident Investigation Board

The Accident Investigation Board exists as an independent investigative body to ensure as much as possible is learned from accidents. It investigates accidents and incidents and makes recommendations to the Danish Transport Authority and other authorities

In 2013, the Accident Investigation Board for Civil Aviation and Railways published one report with recommendations for the Danish Transport Authority. In addition, in 2013 the Danish Transport Authority followed up on the report *Collision involving person(s)* on crossing at station from 2012. See table 4.

The Danish Transport Authority's follow-up of the two reports is outlined below.

Collision involving person(s) on crossing at station

The accident occurred on 13 February 2012 at Tølløse Station. While traversing the platform crossing the train hit a cyclist, who died. At the time of the accident, the person was within the train's profile. The warning system consisted of an acoustic signal and two lights (facing the person). The warning system was active at the time of the accident, but one of the two lamps designed to warn of oncoming trains was faulty.

The protection system is designed so that the red light in the warning system's signals is a prerequisite for trains being given the signal for the current track.

The lamp control relay, which should have prevented the train from receiving the signal if one of the lamps in the warning system was faulty, was of the wrong type, so the train was still able to receive the signal. Signalling was therefore possible even though the safety conditions had not been satisfied.

Recommendations:

It seems inappropriate that crossings on a level that provides access to public traffic across the tracks at stations are not secured in the same way as other public crossings (level crossings).

1: The Accident Investigation Board recommends that the Danish Transport Authority assess whether the safety of crossings that are

Table 4. Reports from the Danish Accident Investigation Board which the Danish Transport Authority followed up in 2013

Report date	Incident	Incident date
30-08-2013	IC4 unit passed signal at 'stop' at Marslev	07-11-2011
11-12-2012	Collision involving person(s) on crossing at station	30-02-2012

generally used for public traffic other than access to and from trains is satisfactory with the current measures.

Banedanmark has indicated how the replacement of components is checked, but firstly the replacement involved the wrong components, and secondly it has not been possible to disclose how and with what checks this was carried out.

2: The Accident Investigation Board recommends that the Danish Transport Authority ensure that Banedanmark has and applies procedures for replacing and checking safety-critical components in signal boxes.

The Danish Transport Authority's follow-up

1: The Danish Transport Authority has conducted a nationwide survey to identify platform crossings that, like the one at Tølløse, are generally used for public traffic other than access to and from trains. The Danish Transport Authority has assessed Banedanmark's proposal for additional safety measures at individual platform crossings. In connection with this work, the Danish Transport Authority has published a report, which can be found on the Danish Transport Authority's website.

The Danish Transport Authority considers recommendation 1 to have been complied with.

2: The Danish Transport Authority has previously noted that Banedanmark has and applies procedures relating to the replacement of components. At Tølløse station, however, Banedanmark had not followed these procedures. Change management is an integral part of the Danish Transport Authority overseeing the undertakings' safety management systems, and the Danish Transport Authority will therefore follow this up.

The Danish Transport Authority considers recommendation 2 to have been complied with.

IC4 unit passed signal at 'stop' at Marslev

The incident occurred on 7 November 2011, when an IC4 unit failed to brake as expected, but passed a red signal and stopped 374 m behind a freight train at a standstill.

As a result of the incident at Marslev, the Danish Transport Authority withdrew the authorisations to place into service for IC4 and IC2¹¹, until sufficient evidence was available for the train types' braking performance and braking capabilities.

On 1 July 2012, the Danish Transport Authority issued a fixed-period authorisation to place into service for IC4, which was renewed on 27 September 2012 with, *inter alia*, a mandatory speed limit during the autumn. The renewed authorisation to place into service was limited to one year, since the Accident Investigation Board's final report was then not available.

Analogously, on 25 July 2012, the Danish Transport Authority issued a fixed-period authorisation to place into service for IC2, which was renewed on 2 October 2012 also with, *inter alia*, a mandatory speed limit during the autumn. This renewed authorisation to place into service was also limited to one year, as the Danish Transport Authority was waiting for the Accident Investigation Board's final report on the Marslev incident.

Permanent authorisations to place into service for IC4 and IC2 were issued on 30 November 2013 and 20 September 2013 respectively. The permits still included the mandatory speed limit during autumn until documentation had been submitted showing that IC4 and IC2 brake in accordance with the applicable

 $^{^{11}\}mathrm{IC2}$ is a unit produced by AnsaldoBreda for DSB. The unit, which consists of two carriages, is in the same series as IC4. The braking concept for IC2 is the same as for IC4.

international standard.

A contributing factor to the Danish Transport Authority's renewed permit for the commercial use of IC4 and IC2 was thus derived from the following recommendations from the Accident Investigation Board to the Danish Transport Authority in 2013.

Recommendations:

During operation of the railways, areas of very low adhesion can occur in daily operation. The Accident Investigation Board has not been able to demonstrate current national or international standards for the testing of braking systems' functionality under conditions of adhesion below 0.03. The WSP systems could only be tested in part of the equipment's scope of application – in type tests at speeds of up to 120 km/h and in series tests at speeds of up to 160 km/h.

1: The Accident Investigation Board recommends that ERA ensure that the applicable international standards for the approval of braking systems for rail equipment are revised so that the braking system's overall functionality is documented within the equipment's overall sphere of application, including in the adhesion conditions that may be expected to occur in daily operation.

2: The Accident Investigation Board recommends that the Danish Transport Authority ensure that the applicable national standards for the approval of braking systems for rail equipment are revised so that the braking system's overall functionality is documented within the equipment's overall sphere of application, including in the adhesion conditions that may be expected to occur in daily operation.

When travelling with low adhesion, the IC4 equipment's braking system could not deliver the braking effect when running under given operating conditions that was necessary to be able to stop within the signal systems safety requirements.

3: The Accident Investigation Board recommends that the Danish Transport Authority ensure that the IC4 train type's braking performance is documented within the equipment's overall sphere of application, including *in the adhesion conditions that may be expected to occur in daily operation.*

When braking under the operating conditions that applied at Marslev, the IC4 equipment's WSP system could not prevent persistent wheel locking, whereby the correct speed and distance travelled could not be identified and recorded.

4: The Accident Investigation Board recommends that the Danish Transport Authority ensure that in daily use and under all conditions, the IC4 train type records correct data on the actual distance covered and the actual speed.

<u>The Danish Transport Authority's</u> <u>follow-up</u>

1: The recommendation was directed at the European Railway Agency (ERA).

2: The norms and standards that form the basis for type approvals are the norms and standards that applied at the time the contract between AnsaldoBreda and DSB was concluded in 2000. Since then the standards have been revised, and new improved versions are available that take account of travelling on smooth rails. The Danish Transport Authority sees no need for specific national provisions in Denmark for braking systems, and considers the revised international standards sufficient when the opportunities for additional requirements contained in the standards are used.

3: The IC4 and IC2 braking systems were approved after a formal safety process that includes, *inter alia*, an independent assessment of the train's design in accordance with the required standards and subsequent tests of whether the train brakes as prescribed. This documentation is at the basis of the type approvals for IC4 and IC2 that the Danish Transport Authority has hitherto issued.

Based on the incident at Marslev and subsequent recommendations from the Accident Investigation Board to it in 2013, the Danish Transport Authority has set the following conditions on the general authorisation to place into service for IC4: 'Trainsets may travel at a maximum of 140 km/h in the period from 1 October to 30 November.'

Which is justified as follows:

'The speed restriction to a maximum of 140 km/h during autumn may be lifted when documentation has been submitted to the Danish Transport Authority showing that the trainset brakes in accordance with the applicable international standard within the equipment's scope of application, including in the adhesion conditions that may be expected to occur in daily operation.'

This therefore means that IC4 must be tested in accordance with the latest applicable international standards in order to obtain permission to run at maximum speed in the period from 1 October to 30 November.

4: Analysis of the incident at Marslev showed that the axle that is used to provide the ATC system with correct information is liable to lock, and therefore does not always provide the train with correct information on speed and distance travelled. This fact ties in with the observations made in relation to the WSP system, and to date DSB has decided that the compressed-air brake on axle 5 (where the ATC measures speed) may not be put into operation (SIN DSB Circular 128/2012). This is still true, and until new documentation is available showing that the WSP does not lock up the axle, the Accident Investigation Board's recommendation has been complied with in this way.

Disconnecting the compressed air to axle 5 also means that the train's brake weight (force) is automatically reduced, which means the train has a longer braking distance and starts braking earlier than if axle 5 had been connected. This therefore not a safetycritical situation.

Against this background, the Danish Transport Authority considers recommendations 1 and 2 to have been complied with. DSB has set up safety barriers to counter the risks underlying the Accident Investigation Board's recommendations 3 and 4. The Danish Transport Authority considers that these barriers are sufficient until recommendations 3 and 4 have been complied with.

Chapter 3: Supervision of railway safety in 2013

The Danish Transport Authority has developed a method for assessing the maturity of undertakings' safety management systems. The method was used for the first time in 2013. It shows that undertakings have generally gained a greater understanding of safety management systems, but that there are still a number of challenges

The Danish Transport Authority supervises undertakings' safety management systems and ensures that the relevant safety requirements are being met. Its supervision is planned on the basis of a risk-based assessment of undertakings, so that efforts can be concentrated where the risk is considered to be the greatest.

It is the Danish Transport Authority's assessment that in recent years, undertakings have gained a greater understanding of safety management systems, their purpose and use. However, there are still a number of areas where the undertakings' level should be raised.

Supervision strategy and supervision plans

The Danish Transport Authority's supervision strategy

In 2011, the Danish Transport Authority produced a supervision strategy¹². The strategy describes the criteria that the Danish Transport Authority uses when prioritising its supervisory efforts. The criteria were defined on the basis of two objectives – one long-term and one short-term:

The long-term objective for supervisory activities is that the national safety targets (cf. chapter 1) are adhered to.

However, the long-term objective is too general to be used to prioritise supervisory efforts year on year. The Danish Transport Authority has therefore identified a short-term endpoint in its supervision strategy:

The short-term objective for supervisory activities is to maintain and preferably increase the undertakings' ability to manage their own risks.

In 2012 and 2013, the Danish Transport Authority worked on establishing and further developing a method to be able to measure this objective.

The Danish Transport Authority takes as its starting point the fact that an undertaking's ability to manage its own risks can be assessed in terms of two parameters: its ability to comply with regulations and its ability to learn.

Based on this, the Danish Transport Authority has identified six indicators of compliance with regulations/learning in undertakings' safety management systems¹³:

- Implementation of legal requirements
- Targets and action plans
- Recording of incidents
- Management of corrective and preventive actions
- Internal audits
- Management evaluation

For each area, the Danish Transport Authority has formulated five levels of

¹² Strategi og praksis for tilsyn med jernbanesikkerhed [Strategy and practice for supervising railway safety], Version 2, December 2011. See <u>www.trafikstyrelsen.dk</u>

¹³ See also Annex E for a full overview of the model

maturity (Level 1 to 5), based on which	management system, the undertaking
undertakings are assessed. The lowest	is proactively improving safety
level (1) means the undertaking has	throughout the organisation. See table
not implemented safety management.	2.
The middle level (3) means the undertaking has implemented safety management that just meets the Danish Transport Authority's requirements. The highest level (5) means that through its safety	Through annual supervision, from 2013 the Danish Transport Authority wants to assess trends in undertakings' ability to manage their own risks and thereby also assess the effect of its supervision

Maturity level	Brief definition	Elaboration
1	Haphazard	The undertaking has not implemented safety management
2	Things are done without procedures	The undertaking has implemented safety management, but it is not systematised and documented (sporadic and based solely on the experiences of individuals)
3	Procedures / system have been implemented	The undertaking has implemented systematic and documented safety management that only just meets the requirements set out in the orders on safety certificates and safety approval
4	Improvement based on analysis of data (past / present - reactive) / Learning	The undertaking has implemented a safety management system that ensures continuous improvements in safety levels based on systematic analysis of recorded data. The safety management system is continuously developed based on the undertaking's risk profile
5	Improvement based on where the undertaking wants to go (future / proactive), entire organisation	The undertaking has implemented a safety management system that proactively ensures improvements in safety levels through prevention. Safety 'stems' from management, and the safety management system has been implemented in all relevant parts of the undertaking

Table 2: Overview of maturity levels for undertakings' safety management systems

Results of the maturity assessment

In 2013, the first maturity assessment of railway undertakings' and infrastructure managers' ability to manage risks in their own safety management system was undertaken. It is the Danish Transport Authority's impression that undertakings normally have an understanding of the assessment performed by the Danish Transport Authority of the undertakings' level of maturity.

The assessment was carried out during supervisory visits to the undertakings (either in connection with follow-up or renewal of certificate / approval). The following undertakings were included in the assessment for 2013¹⁴:

- Arriva Tog
- CFL Cargo Danmark
- DB Schenker Rail Scandinavia
- DSB Øresund
- Lokalbanen
- Metro Service
- Midtjyske jernbaner
- Nordjyske jernbaner
- Regionstog

DSB, Banedanmark and Øresundsbron were not assessed in 2013. These undertakings will be included in the assessment relating to the renewal process in 2014-15.

The overall picture for 2013 broken down into the 6 indicators can be seen in figure 9^{15} .

¹⁴All the undertakings have an A-certificate as a railway undertaking and/or safety approval as an infrastructure manager.

¹⁵In these statistics, each undertaking is included only once, even if it is both a railway undertaking and an infrastructure manager. Note that 'implementation of legal requirements' is assessed on a scale of 1-4. This is because 'implementation of legal requirements' cannot be said to reach maturity level 5 in the same way as the other indicators, which is the level where the undertaking is proactive in relation to the issue.



The figure shows the average of how the Danish Transport Authority assessed the 9 undertakings in the maturity assessment. Undertakings that are both infrastructure managers and operators are only counted once.

Ledelsens evaluering	Management evaluation
Mål og handlingsplaner	Targets and action plans
Intem revision	Internal audits
Håndtering af korrigerende	Management of corrective
og	and
Hændelsesregistrering	Recording of incidents
Implementering af lovkrav	Implementation of legal
	requirements

Figure 9: Baseline for maturity assessment 2013

While the undertakings are generally good at recording incidents (on average a maturity level of 3.7, cf. figure 9), the Danish Transport Authority found that many undertakings face challenges in the following two areas:

- Management of corrective and preventive actions
- Internal audits

Management of corrective and preventive actions

There is a general need for undertakings to work on improving their methods of root cause analysis. Undertakings must become better at identifying the underlying problems that cause an incident or nonconformities and develop actions precisely to resolve the underlying problems.

There is also a need for more companies to improve their systems for following up non-conformities, action plans and the like. Undertakings must ensure that ongoing initiatives are implemented, and not least that the impact of these is assessed.

Internal audits

Understanding of the purpose – and methods – of internal audits has increased in recent years. However, it is an area that continues to call for improvements. In particular, undertakings' ability to plan and implement supervision of the entire safety management system must be strengthened. In many cases it was found that it is the performance of the work that is supervised, not whether the management system works.

It is also absolutely vital that undertakings develop their risk profiles further, and use these as an integral part of an improvement cycle.

Other activities

During the year, the Danish Transport Authority cooperated with other countries' authorities where issues were of a cross-border nature.

Fact box:

Cooperation with other countries' authorities concerning supervisory activities

In 2013, Denmark entered into a verbal agreement with the safety authorities in Sweden and Norway, on the mutual exchange of information in relation to possible problems with common operators.

Denmark also organises annual meetings with the safety authorities in Sweden and Norway. The purpose of these meetings is to exchange mutual information on current topics concerning, for example, railway operators, new legislation or other matters and to reach a common understanding of EU legislation, for example.

Other results of supervision

In 2013, the Danish Transport Authority issued 7 renewed safety certificates with a 5-year term and 4 safety approvals with a 5-year term to a total of 7 undertakings, 4 of which are both railway undertakings and infrastructure managers.

In 5 of the undertakings there were outstanding issues in relation to the implementation of the safety management system on renewal. This involved:

- lack of risk profile
- parts of documentation (procedures / instructions) not implemented in the safety management system
- lack of implementation of change management in relation to CSM-RA
- lack of contract management

The undertakings have produced action plans for all the outstanding issues. The Danish Transport Authority will monitor their implementation.

Non-conformities in 2013

In 2013, the Danish Transport Authority issued undertakings with a total of 27 non-conformities.

Generally, undertakings have become better at following up non-conformities, and several manage these in the same systems as their own non-conformities in relation to internal audits.

Another common feature is that undertakings establish corrective actions to resolve non-conformities, but that the corrective actions are not sufficiently based on a thorough root cause analysis of the problem. This can lead merely to the symptoms being rectified and not the underlying causes of the problems.

The Danish Transport Authority seeks to remedy this through dialogue with the undertakings, and written communication, to make it clear that the undertakings must both produce a root cause analysis and an action plan, where previously they merely responded with an action plan.

General assessment

When you sit down on a train in Denmark, you can do so in the knowledge that the railway is safe.

However, as identified in the Danish Transport Authority's safety report for 2012, there seems to be a general problem with the link between the implementation of undertakings' safety management systems and the actual day-to-day work.

If railway safety is to be maintained at the high level we have today, the safety management systems must be used more to manage risks.

Things are, however, on the right track. The Danish Transport Authority estimates that undertakings' understanding of their safety management systems, the purpose and use of the systems will become better and better.

The reason for this lies in undertakings' understanding of safety management systems and their efforts to improve this. In 2013, the Danish Transport Authority sought to support these efforts with individual instruction sessions to supplement the ongoing dialogue with the undertakings.

One of the areas where several undertakings still have difficulties (in addition to the above) is managing competencies for people with safetyrelated tasks.

In many undertakings, employees have been there for many years. Attitudes are therefore often shaped against the background of these employees' training and experience.

Thus, some undertakings are unclear about what competency requirements should actually be placed on the various safety-related tasks in the organisation.

In 2014, therefore, supervision will continue to focus on:

- Managing competencies
- Managing changes in relation to CSM-RA
- Contract management and
- Evaluation of undertakings' maturity

Fact box:

Danish Transport Authority's response options

The Danish Transport Authority supervises undertakings' compliance with legislation $^{16}\!\!\!\!$.

If the Danish Transport Authority determines that an undertaking does not meet the requirements of applicable laws and regulations, etc., it has various response options, which depend on the nature and extent of the issue. Among other things, the response depends on whether the issue could have repercussions for railway safety.

Non-conformities

The Danish Transport Authority uses non-conformities when it finds that the undertaking is not complying either with its own procedures or applicable regulations and requirements.

Non-conformities are used when safety is not directly threatened.

Non-conformities are a dialogue tool where, within a given period, the undertaking must submit documentation to the Danish Transport Authority showing that the situation has been rectified, as well as an action plan for how the undertaking will ensure that a similar non-conformity does not occur in the future.

Non-conformities are documented in a so-called non-conformity template, which the undertaking signs with the date of posting of the action plan to remedy the non-conformity.

This type of non-conformity, where the Danish Transport Authority alone must have forwarded renewed or revised documentation, is not a decision of the authorities but a procedural step to guarantee that the undertaking has a safety management system that ensures that applicable regulations and provisions are followed.

Injunctions and bans

If the non-conformity could have repercussions for railway safety, the Danish Transport Authority has the power to issue injunctions or bans.

The Danish Transport Authority can, for example, issue an injunction ordering an undertaking to take the necessary measures, immediately or within a set time limit, so that it complies with the applicable safety requirements. The Danish Transport Authority can ban operation on a specific route or ban operation with specified rolling stock.

Additionally, in special cases a ban or injunction can lead to the withdrawal of a safety certificate or safety approval or police report.

Injunctions and bans are initially issued verbally, but are followed by a written injunction or ban within 14 days if not acted upon.

¹⁶The requirements placed on undertakings are set out in 'Executive Order No 13 of 04/01/2007 on the safety approval of railway infrastructure managers' and in 'Executive Order No 14 of 04/01/2007 on safety certificates for railway undertakings'. The Danish Transport Authority's powers to supervise undertakings are defined in the Railways Act.

Chapter 4: Certification and approval of safety management systems in undertakings

Some undertakings face challenges exploiting the potential that there is in their safety management systems for improving safety. In 2013 – as a prelude to a large amount of renewalrelated supervision – the Danish Transport Authority therefore held meetings to advise undertakings on how the safety management system should ideally be set up and used

In 2008 and 2009, a large number of railway undertakings and infrastructure managers in Denmark were safety-certified or safety-approved.

Because a safety certificate/safety approval¹⁷ is normally valid for 5 years, 2013 was characterised by renewals of safety certificates and safety approvals.

The Danish Transport Authority emphasises mutual dialogue with undertakings. Through dialogue with undertakings and through general experience with the supervision of undertakings, the Danish Transport Authority became aware that many undertakings are not using the potential of safety management systems to improve safety.

This led to the Danish Transport Authority adjusting the way renewals are handled – among other things, the Danish Transport Authority offered undertakings individual introductory meetings, where the purpose and potential of the safety management system was discussed. In some cases it

¹⁷ Railway undertakings and infrastructure managers must be able to document and demonstrate that they have introduced and implemented a safety management system. This is done by applying for a safety approval in the case of infrastructure managers and a safety certificate in the case of railway undertakings. was also necessary to issue safety certificates or safety approvals that are valid for less than 5 years.

The Danish Transport Authority's guidance of undertakings

Written guidance

The Danish Transport Authority has a publicly accessible website where it has generally described the conditions and procedure for obtaining a safety certificate and safety approval.

Here, undertakings can find forms with associated guidelines for applying for safety certificates and safety approval. The same form is used for new issues, renewals and amendments of certificates or approvals.

In 2013, the Danish Transport Authority published a new safety management guide: 'Vejledning i Sikkerhedsledelse' [Guide to Safety Management]¹⁸

The aim of the guide is to describe how the requirements for a safety management system can be met¹⁹.

¹⁸ In accordance with Executive Orders Nos 13 and 14 of 4 January 2007 and Commission Regulation (EU) No 1078/2012.

¹⁹ The requirements are documented in 'Executive Order No 13 of 04/01/2007 on the safety approval of railway infrastructure managers' and 'Executive Order No 14 of 04/01/2007 on safety certificates for railway undertakings'.

The guide also includes a description of how undertakings can meet the requirements of 'Commission Regulation (EU) No 1078/2012 on a common safety method for monitoring to be applied by railway undertakings and infrastructure managers after receiving a safety certificate or safety authorisation etc.'.

Introductory meetings

In 2013, the Danish Transport Authority held 10 one-day sessions aimed at undertakings to reconcile its expectations of undertakings' safety management systems with the undertakings' expectations.

At these sessions, the Danish Transport Authority had a dialogue with each individual undertaking, highlighting how a safety management system should be set up based on the undertaking's activities and risk profile.

There was a particular focus on the following topics:

- system definition
- risk assessment and risk profile
- safety management system documentation
- safety targets
- internal audits
- monitoring, root cause analysis and corrective actions
- management evaluation

The sessions were essentially held as introductory meetings, immediately before each undertaking was required to begin the supervision process to renew a safety certificate and/or safety approval.

Those undertakings not facing the immediate renewal of their safety certificate/safety approval were also invited to an introductory meeting, so that all undertakings with a safety certificate A and/or a safety approval in Denmark were offered a meeting.

Changes in how the Danish Transport Authority issues safety approvals and safety certificates

The Danish Transport Agency has documented its strategy and work processes for supervision and the issuing of safety certificates and safety approvals. In relation to these processes, there were certain changes and discussions in 2013.

Period of validity of safety certificates and safety approvals

In 2013, the law was changed to make it possible to issue safety certificates and safety approvals with terms of less than 5 years. This led to several undertakings being issued safety certificates with terms of just 1 to 2 years.

The Danish Transport Authority felt this short term was necessary because there was a need for increased monitoring of these undertakings' safety management systems, which had undergone major changes during the period.

Premature renewal of safety certificates and safety approvals

In connection with the issue of renewed safety certificates and safety approvals, in some cases the Danish Transport Authority renewed the certificate or approval before the current certificates or approvals expired.

This practice was used in situations where the undertaking had a safety certificate and a safety approval with different expiry dates, and where the Danish Transport Authority considered it appropriate to synchronise these. Such synchronisation will potentially result in fewer supervisory visits, thereby cutting costs for the Danish Transport Authority and the undertaking.

This practice was also used when all outstanding issues after renewal supervision had ended were complete, and the undertaking was therefore ready to renew the safety certificate or safety approval earlier than scheduled in the original plan, which was based on the existing expiry dates.

Conditional renewal of safety certificates and safety approvals

As previously mentioned, in 2013, the Danish Transport Authority issued 7 renewed safety certificates and 4 safety approvals to a total of 7 undertakings, 4 of which are both railway undertakings and infrastructure managers. In 5 of the undertakings there were outstanding issues in relation to the implementation of the safety management system on renewal.

These outstanding issues were identified as non-conformities in connection with the supervision, where the undertaking's action plans/ corrective actions were not able to be implemented before the current safety certificates and safety approvals expired.

In this case, the Danish Transport Authority considered it necessary to issue the certificates or approvals with conditions that the undertakings follow their action plans, and regularly report on their status to the Danish Transport Authority – as instructed by the Danish Transport Authority.

The Danish Transport Authority therefore monitors the undertaking closely in these situations, and once the action plan has been implemented the condition is removed, and the result is followed up through future supervision.

A relatively large proportion of undertakings had outstanding issues in the implementation of their safety management system. The Danish Transport Authority believes the reason for the high number is to be found in the challenges faced by the undertakings in describing their own risk profile.

Use of CSM-RA for changes to certificates / approvals

Since July 2012 there has been a requirement that CSM-RA also be used in connection with changes within operation and organisation.

This could, for example, involve changes to the routes covered by the

undertaking, or changes in the organisation's size or composition.

The discussions had not ended at the end of 2013, and are ongoing in 2014. The use of CSM-RA in connection with operation and organisation is still a developing area, including when a change in operation and organisation means there must be a change in or renewal of the safety certificate or safety approval.

Feedback

Complaints

In 2013, the Danish Transport Authority received one written complaint in connection with the renewal of an undertaking's safety approval. The complaint related to a condition imposed in connection with the renewal of the safety approval. The Danish Transport Authority upheld the undertaking's complaint, and withdrew the condition.

In 2013, the Railways Board did not receive any complaints from undertakings in relation to safety certification or safety approval.

Other feedback

A number of companies expressed satisfaction with the Danish Transport Authority's supervision, and the dialogue that took place. The undertakings felt the dialogue was positive, and that the Danish Transport Authority was able to provide the undertakings with knowledge about safety management systems.

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Chapter 5: Implementation of the Railway Safety Directive

It should be cheaper and easier to run trains across Europe with no compromises on safety. This is the purpose of 'the Railway Safety Directive', which is the European legislation that provides a framework for the harmonisation of safety regulations across Europe

Traditionally, countries in Europe developed their own national regulations and standards for the railways. This has made it difficult and expensive to run trains across borders in Europe.

The purpose of the Railway Safety Directive²⁰, which was adopted in 2004, is to ensure that railway safety in the EU is maintained, and that access to the market is improved.

The Safety Directive provides a framework for the harmonisation of national safety regulations, safety certificates for railway undertakings, tasks and roles for the national safety authority and the national investigation authority.

The purpose of harmonising these regulations is to alleviate the administrative burden for undertakings and make it easier and cheaper to travel across Europe by train.

The implementation actions and experiences with legal instruments in 2013 that are derived from the Safety Directive are described below. The following legal instruments from 2013 implement the Safety Directive:

- Regulation on the Common Safety Method for Risk Analysis

 Regulation No 402/2013/EU
- Executive Order No 691 of 14 June 2013 amending the order on safety certificates for railway companies.

New regulation on the common safety method for risk evaluation and assessment²¹

The new Risk Evaluation Regulation CSM RA (Regulation No 402/2013/EU) replaces the existing CSM RA (Regulation No 352/2009/EC), which was issued by the Commission in 2009.

The new regulation came into force on 23 May 2013. The regulation must be applied from 21 May 2015.

The regulation is directed at railway undertakings and infrastructure managers, as well as entities in charge of maintenance (ECM), and is intended to provide undertakings with common guidelines for making changes, which may be of a technical, operational or organisational nature. As regards organisational changes, only changes that could have an impact on operating conditions are taken into consideration.

The main changes in the regulation are:

²⁰ Directive 2004/49/EC, as amended by Directive 2008/110/EC and 2009/149/EC

- New requirement that assessors must be either accredited or recognised (Art. 6).
- New requirement for what should be included in the assessor's safety assessment report²²
- An expansion of the existing requirements on an assessor's competencies²³

In 2013, the Danish Transport Authority worked in particular on the new requirement that assessors must be either accredited or recognised, including which scheme should apply in Denmark. The Danish Transport Authority issued an order to that effect in 2014.

In 2012, work was carried out with significance assessments in the railway infrastructure area. This work has resulted in the transitional period for notifying significance assessments to the Danish Transport Authority being extended until the end of 2013. See next chapter.

Amendment of the safety certificate order

In 2012, the Commission undertook a study of EU countries' implementation of the Railway Safety Directive – a socalled pilot project. In this context, the Commission considered that Denmark had not implemented the Railway Safety Directive precisely enough in the executive order on safety certificates for railway undertakings.

Against this background, the safety certificate order was amended *inter alia* such that it makes it quite clear that applications for a safety certificate may be submitted in Danish, Swedish, Norwegian and English, and that if the applicant is asked to submit further information in connection with the Danish Transport Authority's handling of the case, the applicant must submit this information immediately. In addition, it is clarified that railway undertakings also have responsibility

²³ Annex II

for and control of risks arising from the activities of other parties, where this is appropriate and reasonable.

Finally, minor clarifications were made, such as the period of validity for a safety certificate does not always have to be 5 years, since the Railway Safety Directive provides for the possibility of a shorter period.

The order came into force on 1 July 2013.

²² CSM-RA Art. 7 and Annex III

Chapter 6: Experiences with the application of the Risk Assessment Regulation

There are differences in how much experience the individual undertakings have of risk assessment. This is due to major differences in the size and extent of undertakings' change activities. In 2013, the Danish Transport Authority provided varying guidance to the industry depending on the undertakings' needs. Both railway undertakings and infrastructure managers have generally become better at applying the methods in the Risk Assessment Regulation (CSM-RA). However, there are still challenges, both for undertakings and assessors.

It is the Danish Transport Authority's experience that the quality of the industry's application of the methods in CSM-RA varies. Some – typically large – undertakings have acquired more experience than other – typically smaller – undertakings.

Those undertakings that have many change projects find to a greater degree than other undertakings that the application of CSM-RA brings something positive to risk assessment work, while those undertakings that only have a few significant changes generally face greater challenges applying the regulation.

The application of CSM-RA must therefore be seen as a continuous learning process. It requires time and resources for undertakings to acquire expertise in CSM-RA.

The Danish Transport Authority works to support the industry's process of transformation. This is done through general guidance, supervision and continuous dialogue with specific projects, as well as dialogue with the assessors. Among other things, the Authority has established an assessor forum, which gives assessors the opportunity to meet and share experiences, as well as to discuss matters of common interest with the Authority.

Experiences in the area of infrastructure

In 2012 and 2013, the Danish Transport Authority received all the infrastructure managers' significance assessments for assessment.

This made it possible to define more precisely what are to be regarded as significant changes among infrastructure managers. In addition, they engaged in dialogue with assessors through supervision, where any outstanding issues/misunderstandings in connection with the assessors' work were discussed.

In 2013, many of the major infrastructure projects (mega-projects) took on more concrete form, meaning that many of them began construction activities. These included København-Ringsted, Ringsted-Femern, Elektrificeringsprogrammet, Signalprogrammet, Metro Cityringen and Aarhus Letbane.

Due to the complexity and the length of the project, it was necessary to have a close dialogue in advance with the mega-projects, which resulted in a mutual good understanding between the projects and the Authority. The common insight also serves to anticipate any subsequent problems in the projects.

The Danish Transport Authority has been able to observe ever greater

understanding of the various terms and processes that come with CSM-RA among infrastructure managers in 2013. These are in particular *hazard identification*, which has improved, and the application of the three *risk acceptance principles* (recognised practice, reference systems and explicit risk estimation).

One of the biggest challenges during 2013 in relation to CSM-RA was to get the right competencies into the projects throughout the entire process, from significance assessment to demonstrating safety requirements.

Significance assessments

2013 was the last year in which significance assessments in the area of

infrastructure were submitted to the Danish Transport Authority for assessment.

The Danish Transport Authority believes that understanding of how a significance assessment should be prepared and how significance assessment criteria should be interpreted has become greater among infrastructure managers.

Table 3 shows how the Danish Transport Authority and the infrastructure managers assessed the significance assessments in 2012 and 2013. Note that the figures only include those significance assessments which the applicant assessed as not significant.

Table 3 Figures on infrastructure managers' significance assessments submitted to the Danis	sh
Transport Authority in 2012 and 2013	

	Correspondence in significance assessments 2012 - 2013, number				
	1 st half 2012	2 nd half 2012	1 st half 2013	2 nd half 2013	Total
Yes	15	43	40	42	140
No	14	4	3	3	24
Total	29	47	43	45	164
	Correspondence in significance assessments 2012 - 2013, percentage				
	1 st half 2012	2 nd half 2012	1 st half 2013	2 nd half 2013	Average
Yes	52	91	93	93	85
No	48	9	7	7	15
Total	100	100	100	100	100

The significance assessments are reported according to how far there was correspondence in the Danish Transport Authority's and the applicant's assessment of the significance of the change. All changes in the figures were assessed as not significant by the applicant. Changes that were assessed as significant by the applicant were generally not submitted to the Danish Transport Authority for assessment.

The figures show that during the period in question, the Danish Transport Authority and the infrastructure managers were more in agreement on what changes are significant²⁴. The majority of the significance assessments were submitted by Banedanmark, and the Authority usually only asked relatively few requests for clarification in relation to these significance assessments.

The smaller infrastructure managers had fewer changes and thus fewer significance assessments. The smaller infrastructure managers therefore gained less experience in making significance assessments and there was a longer process time and disagreement about the results of the significance assessments.

²⁴ Infrastructure managers chose to withdraw 13 significance assessments in 2013 – these were not included in the overview. The Danish Transport Authority chose to gather additional information in barely 30 cases to be able to assess the significance of the changes.

In the course of the year, the megaprojects in particularly argued that parts of the projects can be regarded as separate non-significant changes and therefore be exempted from the assessor's assessment. This fundamental discussion was begun in 2013 and continued in 2014.

For example, the Danish Transport Authority was in dialogue with an infrastructure manager regarding a large quantity of pipe culverts that have to be re-laid five years before the rest of the work on a stretch is planned to be carried out. The infrastructure manager argued that the culverts should be regarded as separate changes, as they are so far removed in time from the rest of the project.

The Danish Transport Authority's general attitude has been that it is not possible to take individual activities out of a significant project and assess them separately. In the specific cases in 2013, however, the Danish Transport Authority was in dialogue with the projects in order to assess the applicant's request on the basis of the specific change.

Approval and use of assessors

In connection with all approvals of assessors, the Danish Transport Authority has asked the infrastructure manager to inform the Authority at the time when the safety requirements are available. This information is used to begin early supervision of the assessor.

On several occasions, early supervision of the assessor, i.e. before the application for authorisation to place into service is submitted to the Danish Transport Authority, resulted in a situation that would have delayed proceedings being resolved in good time. However, it was the experience in 2013 that not all projects chose to inform the Authority that the safety requirements were available – with the result that supervision only took place after the application for authorisation to place into service had been received.

In addition to the supervision of the assessor in the specific projects, in 2013 the Danish Transport Authority continued to have contact with the assessors within the context of the assessor forum. Here, more general and fundamental situations were discussed.

Experiences in the area of vehicles

In the area of vehicles, undertakings had to submit significance assessments to the Danish Transport Authority for assessment either in 2012 or 2013.

During 2013, the Danish Transport Authority supervised whether undertakings' safety management systems handle non-significant changes in a satisfactory manner²⁵. Supervision was carried out at 4 railway undertakings.

It is the Danish Transport Authority's general impression that the undertakings have implemented CSM-RA in their management systems in a satisfactory manner, and that procedures are in place which essentially ensure that changes that could have an impact on safety are identified and assessed in terms of their significance.

It has, however, proven difficult to define precisely when a change affects safety – and thus should be assessed in terms of its significance. In many cases, undertakings use such a general definition that the assessment actually depends on who is making it.

In addition, a dialogue was held with DSB, on how CSM-RA should be applied in relation to the replacement of train components 'replacement components'. DSB SOV has prepared a more detailed description of when 'replacement components' are involved – i.e. replacement with an equivalent component that is so similar to the original component that it can be said that this does not affect safety. DSB's

²⁵ cf. paragraph 12 of Executive Order No 56 on the approval of railway vehicles, undertakings with a safety certificate or a safety approval can implement 'non-significant changes' under their own safety management system without involving the Danish Transport Authority. The question of significance must be assessed and decided by the proposer in accordance with CSM-RA, and documented in the vehicle's lifetime, regardless of whether or not a change is significant.

check tables will be 'test-run' by DSB maintenance in the course of 2014.

Approval and use of assessors

Undertakings that make significant changes to technical sub-systems must submit the change to the Danish Transport Authority for a decision on whether to issue a new authorisation to place into service²⁶. In addition, when applying for authorisations and approvals, an assessor should be used, who must prepare a safety assessment report in accordance with CSM-RA. When the change is submitted, it must be accompanied by a project description containing the proposer's significance assessment, a preliminary system definition and a preliminary risk analysis.

In the course of 2013, the Danish Transport Authority processed 11 change proposals. These can be grouped together as follows:

- Change of maintenance
 documentation
- Changes to historic train
 equipment
- Reconstruction of IR4 after fire
- Test runs with IC2 and MR trainset
- Upgrading of EA locomotives

To these can be added a series of changes to IC4/IC2 trainsets, the incorporation of GSM-R and CBTC in suburban trains and the incorporation of ETCS/STM in an MR trainset.

The Danish Transport Authority notes the widely varying quality of the material submitted.

In 2013, the Danish Transport Authority issued revised guidelines on the formulation of system definitions, including an annex that provides detailed guidelines on how system definitions for test runs should be formulated. It is the Danish Transport Authority's assessment that there is a need for a general raising of the quality of system definitions. This is expected to happen on an ongoing basis, as undertakings gain more experience in working with CSM-RA. Generally there are problems identifying which TSI requirements and national requirements should be applied to a change, and therefore when to use NoBo and DeBo.

Some of the cases referred to are so advanced that the Danish Transport Authority has also received a safety assessment report prepared by the assessor. In some cases, the assessor was involved too late in the project, and therefore had many comments about system definition – and the project's safety management in accordance with CSM-RA. In one case this led to a further delay of the project. The Danish Transport Authority therefore recommends that assessors be involved as early as possible in change projects.

The quality of the safety assessment reports that are prepared is generally satisfactory, although in some cases the Danish Transport Authority would like to see the assessor's conclusions regarding any cases identified as a lack of compliance with the provisions of the CSM Regulation and of the assessor's own recommendations being listed more consistently.

It is the Danish Transport Authority's assessment that inaccurate system definitions, missing or imprecisely worded task descriptions (SoW) for the assessor's work and a lack of clarification of the role of the 'proposer' lead to imprecise conclusions in the assessor's report. As a result, the Danish Transport Authority must spend more time assessing cases, with a consequently extended case processing time. Responsibility for an accurate description of the task lies first and foremost with the applicant. Timely dialogue between applicant, assessor and the Danish Transport Authority can help ensure that no problems arise in relation to the process of implementing a risk assessment.

The Danish Transport Authority must therefore conclude that there is a need for further dialogue with the industry about when and how CSM-RA should be applied.

²⁶ cf. paragraph 13 of Executive Order No 56 on the approval of railway vehicles.

Experiences from the undertakings

Each year, the undertakings submit safety reports to the Danish Transport Authority. Among other things, the safety reports include the undertakings' considerations on applying the methods in CSM-RA.

The Danish Transport Authority processed 16 safety reports. Five undertakings wrote in their report that they have no experience with CSM-RA, as they have not implemented any changes that have an impact on railway safety.

Among the remaining 11 undertakings, there are shared experiences of the application of the regulation.

Some feel the regulation resulted in a better change process, in which the undertaking gained a better insight into the issues that had to be clarified in connection with the change.

Most estimate, however, that the process is too cumbersome and inflexible, and that the process can be difficult to see through. Three undertakings chose to use outside assistance in connection with the management of changes.

In the context of supervision, the Danish Transport Authority also estimated that some undertakings do not possess the necessary competencies to manage changes themselves. These undertakings must therefore continue to submit all envisaged changes to the Danish Transport Authority for assessment. Eight undertakings state that they have updated their processes for managing changes, or that they are in the process of doing so.

The larger undertakings have gained experience in the use of assessors. These undertakings point out that the assessor's task does not seem sufficiently clearly defined, and that there can be significant differences between the individual assessor's approach to, and level of detail in, the work. It is also felt that there is a lack of capacity in the industry.

Finally it is stated that there is a general lack within the industry of a structured compendium of experience and dialogue on the Risk Assessment Regulation and its application.

In 2014, the Danish Transport Authority wants to continue its work providing guidance for undertakings in the use of the Risk Assessment Regulation. This guidance will be provided partly in the context of supervision of undertakings' safety management systems and partly within the context of supervision of assessors.

The Danish Transport Authority also wants to investigate the possibilities for developing more guidance material in collaboration with the DTU [Technical University of Denmark], which can be used by undertakings to supplement the methods described in the Risk Assessment Regulation. Safety report for the railways 2013

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Annex A: The railways in figures

Table 3. Information on railway infrastructure

Railway infrastructure	2012	2013
Number of infrastructure managers	9	9
Total length of lines *	2 649	2 636
Total length of track	4 070	4 070
Length of electrified lines *	642	642
km of lines with ATC, ATC train stopping/ACT equipment	1 438	1 438
Total number of level crossings**	1 362	1 372
 Automatic level crossing with warning signal system, half or full barriers and tracks-side protection in the form of detection in the road or similar 	237	93
 Automatic level crossing with warning signal system and half or full barriers 	463	661
 Automatic level crossing with warning signal system 	196	168
 Manually operated level crossing with warning signal system 	1	1
- Manually operated level crossing with barrier system	13	10
- Level crossing without protection	452	439

Figures from railway infrastructure managers. Source: infrastructure managers' safety reports for 2011 and 2012. However, data marked * are from Statistics Denmark. **Note that the 2012 figures for level crossings contain errors.

Railway undertaking	2012	2013
Number of railway undertakings	14	15
Number of locomotives*	133	130
Number of trainsets (passenger transport)*	681	700
Number of train drivers	2 399	3 031
Volume of passenger transport (million passenger-km)*	7 020	7 076
Volume of passenger transport (million passenger-train-km)*	79.8	81.00
Volume of freight transport (million tonne-km)*	2 278	2 448
Total number of kilometres travelled (million train-km)*	83.4	84.6

Table 4. Information on railway undertakings

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Figures from railway undertakings. Source: railway undertakings' safety reports for 2012 and 2013. However, data marked * are from Statistics Denmark.

Annex B: Safety indicators for 2013

Data

The statistical data in the annex were recorded by railway undertakings and railway infrastructure managers in the period 2009-2013. Some of the figures in the report are based on data that go back to 1999, but data for private and local lines is only available to a limited extent before 2003.

Data are reported in accordance with the Reporting Executive Order²⁷. The definitions used can be found in annex C and are described in greater detail in the guidelines on the reporting of accidents, precursors to accidents and safety irregularities that can be found on the Danish Transport Authority's website.

Some categories of data contain relatively small quantities of data, and can give rise to big fluctuations in the statistics from year to year. This is why 5-year cumulative averages are calculated for comparison with annual figures.

Overview of national safety indicators

Indicators	Total in 2013	Total in 2013/million train-km	5-year average/million train-km
Significant accidents	14	0.17	0.26
Minor accidents	301	3.56	4.78
Precursors to accidents	256	3.03	4.03
Safety irregularities	2 619	30.97	30.53
Persons killed*	10	0.12	0.12
Serious injuries	6	0.07	0.13
Suicides	29	0.34	0.37

Table 5. Safety indicators for 2013

Safety indicators for the railways. Significant accidents are accidents involving serious personal injuries, damage in excess of DKK 1.2 million or significant delays to traffic. * The figures for 'persons killed' exclude suicides, as these are given separately.

Significant accidents	Total in 2013	Total in 2013/million train-km	5-year average/million train-km
Collision of trains	0	0.00	0.01
Derailment	0	0.00	0.01
Level-crossing accidents	5	0.06	0.06
Accidents involving persons	6	0.07	0.16
Fire	0	0.00	0.00
Other significant accidents	3	0.04	0.03
Total significant accidents	14	0.17	0.26

Table 6. Indicators relating to significant accidents

Significant accidents are accidents involving serious personal injuries, damage in excess of DKK 1.2 million or significant delays to traffic.

Table 7. Indicators relating to persons killed

Persons killed	Total in 2013	Total in 2013/million train- km	5-year average/million train-km
Passengers	0	0.00	0.00*
Staff	0	0.00	0.00*
Level-crossing users	6	0.07	0.04
Persons on railway property without permission	3	0.04	0.08
Other	1	0.01	0.00*
Total persons killed	10	0.12	0.12

The figures for persons killed do not include suicides. *zero indicates that the 5-year average is extremely small (< 0.01).

Serious injuries	Total in 2013	Total in 2013/million train-km	5-year average/million train-km
Passengers	1	0.01	0.03
Staff	0	0.00	0.01
Level-crossing users	1	0.01	0.03
Persons on railway property without permission	3	0.04	0.05
Other	1	0.01	0.01
Total serious injuries	6	0.07	0.13

Table 8. Indicators relating to serious injuries

The figures for serious injuries do not include attempted suicides.

Table 9. Indicators relating to minor accidents

Minor accidents	Total in 2013	Total in 2013/ million train-km	5-year average/million train-km
Collision of trains	122	1.44	1.72
Derailment	0	0.00	0.35
Level-crossing accidents	9	0.11	0.12
Accidents involving persons	27	0.32	0.64
Fire	57	0.67	1.14
Other minor accidents	86	1.02	0.80
Total minor accidents	301	3.56	4.78

Minor accidents are accidents not causing serious injuries or death and where any material damage is below DKK 1.2 million.

Table 10. Accidents and incidents involving dangerous goods

Accidents and incidents involving dangerous goods	Total in 2013	Total in 2013/ million train-km	5-year average/million train-km
Accidents involving dangerous goods	0	0.00	0.02
Incidents involving dangerous goods	0	0.00	0.03

Here is listed any incident or accident that must be reported in accordance with chapter 1.8.5 of the RID/ADR

Table 11. Indicators relating to precursors to accidents

Precursors to accidents	Total in 2013	Total in 2013/ million train-km	5-year average/million train- km
Broken rails	44	0.52	0.51
Track buckles and other faults in the relative position of the track	3	0.04	0.03
Signal failure	43	0.51	0.58
Signals passed at danger	165	1.95	2.76
Broken wheels and axles	1	0.01	0.15
Total precursors to accidents	256	3.03	4.03

Precursors to accidents have no harmful consequences.

Safety irregularities	Total in 2013	Total in 2013/ million train-km	5-year average/million train-km
Risk of collision with person	612	7.24	4.76
Fault in braking system	30	0.35	0.61
Irregularity at level crossing	87	1.03	1.27
Deformation of tracks	9	0.11	0.11
Non-technical signalling error	302	3.57	2.99
Gauge conditions	165	1.95	2.04
Vandalism	149	1.76	2.63
Other irregularity	1 265	14.96	16.12
Total safety irregularities	2 619	30.97	30.53

Table 12. Indicators relating to safety irregularities

Safety irregularities have no harmful consequences.

Annex C: Definitions used

Accidents

- *Accident* is understood to mean an unwanted or unintended sudden incident or a specific chain of such incidents that has harmful consequences. Accidents are broken down into the following categories: train collision, train derailments, accidents at level crossings, personal injury caused by moving rolling stock, fire and other²⁸.

- Train collision is understood to mean a train collision, including a collision with obstacles within the structural gauge limits (collision), a head-on collision between two trains or a collision between the front and rear of two trains or a sideways collision between part of one train and part of another train, or a train in collision with shunting rolling stock or objects that are fixed in place or are temporarily on or near the track, except at level crossings, if the objects have been lost by crossing vehicles or persons.

- *Derailment* is understood to mean any incident in which at least one of the train's wheels comes off the rails.

- Accidents at level crossings is understood to mean accidents at level crossings involving at least one railway vehicle and one or more crossing vehicles, other crossing users, e.g. pedestrians, or objects temporarily on or near the track if these have been lost by crossing vehicles or users.

– Personal injury caused by moving rolling stock is understood to mean injury to one or more persons who are either hit by a railway vehicle or by an object attached to or which has been dislodged from the vehicle. The definition also covers persons who fall out of railway vehicles, and persons who fall or are hit by loose objects while travelling in railway vehicles.

- *Fire in rolling stock* is understood to mean fires and explosions, including of loads, under way between a departure station and a destination, including while stopped at the departure station, the destination or while stopped on the way and while shunting.

 Other types of accident is understood to mean all accidents other than train collisions, derailments, accidents at level crossings, personal injury caused by moving rolling stock and fire in rolling stock.

Significant accidents

- Significant accidents is understood to mean any accident involving at least one moving railway vehicle and which results in at least one person being killed or seriously injured, or in the extensive destruction of rolling stock, track or other plant or the environment or in extensive disruption to traffic. Accidents in workshops, warehouses and depots are excluded.²⁹

– *Extensive destruction of rolling stock, track or other plant or the environment* is understood to mean destruction valued at least DKK 1.2 million.

- *Extensive disruption to traffic* is understood to mean that train traffic is at a standstill for six hours or more on a main line.

²⁸ §3 of Exec. Order No 575 of 25 May 2012 on the reporting of data on accidents, precursors to accidents and safety irregularities, etc. to the Danish Transport Authority, as amended

²⁹ Commission Directive 2009/149/EC of 27 November 2009, Annex 1. Implemented by Exec. Order No 1293 of 23/11/2010.

Suicide

- *Suicide* is understood to mean an action by which a person intentionally takes his own life, and which is recorded as such by the competent authorities.

Dangerous goods

- *Dangerous goods* is understood to mean substances and objects that may not be transported under the Regulation concerning the International Carriage of Dangerous Goods by Rail (RID), or may only be transported under conditions defined in the RID.

 Accidents in connection with the transport of dangerous goods is understood to mean any accident or incident that must be reported in accordance with Chapter 1.8.5 of the RID or the European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR).

Precursors to accidents

- *Precursors to accidents* is understood to mean broken rails, track buckles, signal failure, passing a stop signal, broken wheels and axles on rolling stock in operation.³⁰

Broken rails is understood to mean any rail that has broken into two or more pieces, or any rail from which a piece of metal has broken away, leaving a hole more than 50 mm long and more than 10 mm deep on the running surface.

- *Track buckles and other faults in the relative position of the track* is understood to mean a fault in the continuum or geometry of the track which for safety reasons requires the immediate closure of the track or a reduction of the permissible speed.

- Signal failure is understood to mean any failure in the signal system, either on the infrastructure or on the rolling stock, which results in a less restrictive signal than required.

- *Passing a stop signal* is understood to mean any situation where any part of the train travels further than allowed.

 Broken wheels and axles is understood to mean a breakage that affects the key components of the wheel or axle, thereby creating a risk of accident in the form of derailment or collision.

Personal injury

Personal injury is recorded according to five different types of person (passenger, employee, level-crossing users, unauthorised persons on railway property and others) and according to the seriousness of the injury (fatality, serious injury and less serious injury).

 Passenger is understood to mean anyone who undertakes a journey by railway, excluding train staff. In accident statistics this also includes persons who attempt to board or alight from a moving train.

- *Staff, including contract staff* is understood to mean any person employed in connection with a railway and who is at work at the time of the accident. The definition includes train staff and persons operating rolling stock and infrastructure plant.

³⁰ §3 para. 2 of Exec. Order No 575 of 25 May 2012 on the reporting of data on accidents, precursors to accidents and safety irregularities, etc. to the Danish Transport Authority.

- *Level-crossing users* is understood to mean anyone who uses a level crossing to cross the railway with the help of a vehicle or on foot.

- Persons on railway property without permission is understood to mean all persons on railway property where this is prohibited, excluding level-crossing users.

 Other persons is understood to mean all persons not covered by the definitions of passenger, staff, level-crossing users or persons on railway property without permission.

 Fatality is understood to mean a person who is killed immediately or dies within 30 days as a result of an accident. Suicides are not included.

- Seriously injured person is understood to mean a person who has been admitted to hospital for more than 24 hours as a result of an accident. Attempted suicides are not included.

 Less seriously injured person is understood to mean a person who has suffered injury. Deaths and serious injuries are not included.

Costs

- Costs of environmental damage is understood to mean costs that must be met by railway undertakings and infrastructure managers, estimated on the basis of their experience, in returning a damaged area to its condition before the railway accident.

- Costs of material damage to rolling stock or infrastructure is understood to mean the costs of purchasing new rolling stock or constructing new infrastructure with the same functionality and technical parameters as the rolling stock or infrastructure damaged in the accident, as well as the costs of returning rolling stock or infrastructure that can be repaired to its condition prior to the accident. Both parts must be estimated by the railway undertakings and infrastructure managers on the basis of their experience. Costs of leasing rolling stock to replace damaged vehicles that are not available are also covered by this definition.

Level crossings

– *Level crossing* is understood to mean any level crossing between the railway and roads and paths that is recognised by the railway infrastructure manager, and which is open to general traffic. Platform crossings and walkways over tracks that may only be used by employees are not covered by this definition.³¹

- Level crossing with automatic protection or user-side warning signal system is understood to mean a level crossing where the protection or warning signal is activated by the approaching train.

 Track-side protection is understood to mean a signal or other operational safety system that only allows trains to pass if the level crossing is protected on the user side, and no-one is about to cross; this is checked by means of monitoring or detection of obstacles.

- Level crossing with manually operated protection or warning signal system is understood to mean a level crossing where the protection or warning signal system is activated manually and is not linked to a railway signal that only allows the train to pass if the protection or warning signal system has been activated.

 $^{^{31}}$ Exec. Order No 1142 of 07/12/2011. Executive Order on safety measures at level crossings managed by Banedanmark that are open to general traffic

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- Unprotected level crossing is understood to mean a level crossing where no form of warning system or protection is activated if users cannot use the crossing safely.

Annex D: The Danish Transport Authority's supervision planning and prioritisation in 2013

The Danish Transport Authority has planned audits based on a comprehensive, systematic and transparent risk assessment of undertakings' circumstances every year since 2010. This includes, *inter alia*, the year's experiences with the undertakings, as well as the undertakings' ability and willingness to manage their own risks and make improvements over a number of years.

The assessment is performed by the Danish Transport Authority's Supervision Team (Railways Centre) with input from the Railways Centre's approval teams.

The assessments are based on a basic assessment of the undertakings, including their size, volume of traffic, complexity of operation and organisation and exposure to third parties.

The undertakings are then assessed on the basis of the experience gained by the Danish Transport Authority with the undertakings over the year. This assessment is based on incident data, experiences from supervision, including the undertakings' ability to manage their own risks, and experiences from the approval of rolling stock, infrastructure and staff.

The number of audit days for the coming year is determined based on the overall assessment of the individual undertaking. The number may be reduced for undertakings that have both a safety certificate and safety approval, as there is a significant overlap between supervisory areas for these. Likewise, the number of days may be increased in connection with renewals of safety certificates and safety approvals.

Finally, the number of days may be adjusted in relation to the human resources available to the Danish Transport Authority to implement its supervision.

Fact box:

Supervisory areas

The Danish Transport Authority supervises **all requirements** for the safety management system at least once during the safety certificate's / safety approval's period of validity³².

Each year, the Danish Transport Authority supervises the 6 indicators for the *maturity* of undertakings' safety management systems³³.

The Danish Transport Authority also defines a series of **focus areas** for that specific year. The focus areas are selected on the basis of the annual risk analysis as well as trends and developments in the industry.

Finally, the Danish Transport Authority may choose to carry out **themed supervision**, which is supervision across the industry within a specific subject, e.g. dangerous goods. Themed supervision is carried out either as independent inspections or in connection with other supervision. The themes are often repeated several years in succession. A common aspect of the themed supervisory activities is that they are

³² The requirements are described in 'Executive Order No 13 of 04/01/2007 on the safety approval of railway infrastructure managers' and in 'Executive Order No 14 of 04/01/2007 on safety certificates for railway undertakings'.

³³ 'Implementation of legal requirements', 'Targets and action plans', 'Recording of incidents', 'Management of corrective and preventive actions', 'Internal audits' and 'Management evaluation'

carried out across the industry within a specific subject.

Besides planned supervisory operations, the Danish Transport Authority carries out *inspections* in the light of incidents or critical situations recorded on a continuous basis. The inspections can be initiated on the basis of information, an event or a submission to the Danish Transport Authority regarding a specific problem, and therefore are not generally announced or planned. They do not therefore form part of the Danish Transport Authority's published supervision schedule.

The Danish Transport Authority's supervision schedule for 2013

In January each year, the Danish Transport Authority publishes a schedule of its planned audits of safety management systems with railway undertakings and railway infrastructure managers.

The supervision schedule provides an overview of the quarters in which the Danish Transport Authority has planned 1) follow-up supervision during the period of validity of the safety certificate or safety approval, and 2) supervision to be carried out in connection with the renewal of safety certificates or safety approvals.

In 2013, 18 follow-up supervisory activities and 13 supervisory activities relating to the renewal of safety certificates or safety approvals were planned.

2013 was the first year in which undertakings' maturity was systematically supervised. The Danish Transport Agency therefore selected the 6 indicators as focus areas for the year. ('Implementation of legal requirements', 'Targets and action plans', 'Recording of incidents', Management of corrective and preventive actions', 'Internal audits' and 'Management evaluation').

Besides carrying out supervisory activities, among other things, the Danish Transport Authority's Supervision Team held 10 1-day sessions aimed at undertakings. The purpose of these sessions was to ensure a reciprocal image of the expectations placed on a safety management system.

Changes to the supervision schedule for 2013

The Danish Transport Authority's supervision schedule for the railways for 2013 was published on 30 January 2013.

In February, the Danish Transport Authority was forced to amend its supervision schedule due to a lack of resources³⁴.

In this context, the Danish Transport Authority prioritised the implementation of the 7 renewals of safety certificates as well as the 4 renewals of safety approvals that were to be implemented during 2013³⁵.

Therefore, 7 follow-up supervision visits were cancelled and 5 postponed until 2014. Responding to the Danish Transport Authority's risk-based approach to supervision planning, the Authority chose only to cancel or postpone follow-up supervision visits with those undertakings that had to have a renewal supervision visit in the course of 2013 or the first half of 2014 anyway.

The Danish Transport Authority chose to hold a series of meetings that had already been planned with all undertakings. The purpose of the meetings was to inform the undertakings of the Danish Transport Authority's expectations regarding the undertakings' safety management systems. The Danish Transport Authority felt the

³⁴ During 2013 there were major changes in the Danish Transport Authority's supervision team in the Railways Centre. As of 1 January 2013, the team consisted of 5 employees. Of these, 1 employee was in training. In the course of the year, 2 employees left the team and 3 new ones were recruited. By the end of the year the team therefore consisted of 6 employees, 3 of whom were in training.

³⁵ In addition, one planned renewal supervision was moved to the beginning of 2014 and one renewal supervision was cancelled because the undertaking was incorporated into another undertaking.

impact of these meetings would be greater than the impact of the follow-up supervision. See also next chapter.

Resources used on supervision in 2013

In 2013, the Danish Transport Authority performed 40 audits, relating to undertakings' safety management systems in connection with safety certification and safety authorisation and the follow-up of these. The total number of audit days amounted to 89. Audit days are those days on which the Danish Transport Authority is physically present in the undertaking – i.e. the actual 'confrontation time'.

Fact box:

Competency requirement for employees of the Danish Transport Authority

The Danish Transport Authority requires employees who are involved in supervisory activities to have been trained to perform the task.

Thus, the Danish Transport Authority requires employees who perform the role of Lead Auditor³⁶ to have in-depth knowledge of – and experience with – management systems and to have passed the examination in approved training as a Certified Lead Auditor.

The Danish Transport Authority has also prepared a syllabus designed to guarantee lead auditors a basic knowledge of the job as well as legal knowledge, through courses in:

- movement on and by the railways
- standards and safety regulations
- basic infrastructure knowledge
- risk assessment
- administrative law and legislation

The Danish Transport Authority also requires employees who perform the role of assistant auditor³⁷ to have at least completed an approved 2-day course as an internal auditor.

The following table shows the hours spent on supervision in the Danish Transport Authority, Railways Centre. The number of hours covers both time spent on audit days (follow-up audit, certification supervision and approval supervision), and time spent on inspections – both parts including preparation and follow-up³⁸.

Hours spent on follow-up audit	968 hours
Hours spent on certification supervision	1 470 hours

³⁶ The lead auditor is responsible for the preparation, implementation and follow-up of the supervision and is the Danish Transport Authority's contact person for the undertaking. The lead auditor leads the individual supervision visit and decides on the composition of the supervision team to guarantee the necessary competencies in the team. The lead auditor administers and reviews the necessary documentation and ensures that the objective of the supervision is achieved. Cf. Strategi og praksis for tilsyn med jernbanesikkerhed [Strategy and practice for supervising railway safety], Version 2, December 2011. See www.trafikstyrelsen.dk

³⁷ It is the assistant auditor's role to assist the lead auditor in all aspects of supervision. The assistant auditor helps administer and review documentation and assists with notes and supplementary questions. Cf. Strategi og praksis for tilsyn med jernbanesikkerhed [Strategy and practice for supervising railway safety], Version 2, December 2011. See www.trafikstyrelsen.dk

³⁸ Audit *days* and *hours* used for supervision cannot be directly compared, since an audit day counts for *one* audit day no matter whether the supervision employees spent 2 hours at the undertaking or 10 hours.

Hours spent on approval supervision	376 hours
Hours spent on inspections	1 387 hours
Total hours spent on supervision*	4 201 hours

*Supervision: audits and inspections

Annex E: Matrix of maturity levels in relation to indicators

Evaluation table					
Undertaking:					
	Maturity level 1	Maturity level 2	Maturity level 3	Maturity level 4	Maturity level 5
indicators	Haphazard	Things are done without procedures	Procedures / system have been implemented	Improvement based on analysis of data (past / present - reactive) / Learning	Improvement based on where the undertaking wants to go (future / proactive), entire organisation
Targets and action plans (§§ 12, 13.)	The undertaking has not established targets that can be related to railway safety e.g. has simply transferred all safety indicators as its safety targets)	The undertaking has defined targets and established action plans for these	The undertaking has defined and documented realistic targets based on its risk profile, and has established documented action plans for these	The undertaking follows the action plans and monitors continuous achievement of targets. Targets and action plans are adjusted as required. The work is documented, and the results reported to management	The undertaking works proactively to improve railway safety through target management. Targets are broken down at department or function level, and it must be able to be documented that all relevant parts of the organisation are involved
Implementation of legal requirements (§§ 13, 14.)	The undertaking does not identify relevant legislation	The undertaking identifies relevant legislation without documented procedures and mostly based on the commitment and knowledge of individuals	The undertaking has implemented written procedures to identify, implement and comply with applicable legislation. Implementation of applicable legislation in the undertaking's safety management system can be documented	The undertaking's management and safety organisation take a proactive approach to new legislation	-

Recording of safety concerns (§§ 22, 23. para. 1:)	The undertaking does not have a system that ensures systematic recording of railway accidents, incidents and other safety concerns	The undertaking has a recording system for reporting railway accidents, incidents and other safety concerns	The undertaking has implemented written procedures to ensure that railway accidents, incidents and other safety concerns are recorded, investigated and reported	Safety concerns are assessed and dealt with. Data are compiled, and trends assessed. Any trends are analysed and dealt with equally	Own data are related to relevant figures from across the industry and the undertaking collaborates with other undertakings to work together to develop safety work
Management of corrective and preventive actions (§§ 22, 23. para. 2)	The undertaking does not ensure implementation of remedial, corrective or preventive actions	The undertaking implements correct actions, and these are documented	The undertaking has implemented documented procedures to ensure root cause analysis and implementation and follow-up of corrective and preventive actions	One function has the complete overview of ongoing corrective and preventive actions in relation to ensuring implementation / follow-up. The effectiveness of corrective and preventive actions is evaluated.	The undertaking uses the analysed data throughout the undertaking proactively for preventive actions. (e.g. training planning). When dealing with corrective and preventive actions the risks are assessed, and the undertaking's risk profile is used / updated as an integral part of the work
Internal audits (§§ 23, 24)	The undertaking does not implement internal audits of the safety management system	The undertaking implements internal audits of parts of the safety management system, but this is not systematically and exhaustively documented	The undertaking has implemented documented procedures to implement internal audits to ensure that the entire safety management system is reviewed during the period of validity of the safety certificate or safety approval. The undertaking has guarantee the relevant competencies for those who perform internal audits	The risk assessment is used when planning internal audits. The results of internal audits are processed in accordance with the undertaking's procedure for corrective actions. The processing of the results is documented	Internal audit efforts are planned on the basis of the risk assessment. Internal audits are enshrined in the management and organisation, for example by appointing internal auditors across the organisation

	The company	The company	At least once a	Management	The undertaking's
	does not	implements	year, the	evaluation is used	senior
	implement	management	undertaking's	actively to	management uses
§§ 24, 25. Management evaluation	evaluation	not on the basis of a pre- determined set of data and the result is not systematically documented	management implements 'management evaluation' of the safety management system based on internal audits, updating of risk assessment, status of action plans, analysis of incidents and other information. The data basis and result are documented	improve the safety management system. Management evaluation is an integral part of the management work for the undertaking's senior management	evaluation to continuously improve railway safety on a proactive basis in relation to pre- determined targets

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