

Safety report for the railways 2009

September 2010

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Foreword

2009 saw the introduction and approval of safety management systems for the majority of undertakings in the railway sector – a year ahead of the EU's deadline. The safety management systems will in future be the linchpin of the undertakings' day-to-day work on safety in all aspects of railway operations.

The present safety report reviews the undertakings' initial experiences with practical use of the safety management systems. This is supplemented by the results obtained in the Danish Transport Authority's supervision of undertakings.

The safety report is first and foremost a status report for safety on Danish railways, and assesses the overall level of safety in Denmark in 2009 in relation to the objective of maintaining safety. Seen as a whole, safety remains very high. However, there are still challenges with respect to level-crossings. This area therefore constitutes a separate topic in the report, in which all the level-crossing accidents are analysed and incident patterns discerned.

In 2009 the Danish Transport Authority published a strategy for how Denmark should handle safety and interoperability in the years ahead while the regulatory basis of the railways is in flux. The report reviews the first elements of the strategy to be put into practice, including implementation of the European regulatory reform in the area of railway safety with minimum possible retention of special rules for Denmark.

The Danish Transport Authority hopes that the report can contribute to exchange of experience and inspiration in the Danish railway sector. The report will also be used for exchange of experience in the EU Member States and will be submitted to the European Railway Agency (ERA).

Happy reading!

Jesper Rasmussen
Director of Safety

Summary

Safety remains at a high level...

The national safety target is defined in the terms that safety must, as a minimum, remain at the 2004 level, stated as the number of fatalities and weighted serious injuries not exceeding a maximum of 0.3 per 1 million passenger train kilometres. This target figure will be adjusted as improved data material becomes available in 2010. The 2009 level is 0.2 fatalities and weighted serious injuries per 1 million passenger train kilometres. This figure is lower than for previous years.

There were 29 significant accidents (disturbances and delays of railway traffic, significant material damage, one or more fatalities or serious injury). This is a slight increase, which does not, however, affect the 5-year average for significant accidents. The increase in the number of significant accidents is caused particularly by an increasing number of accidents to persons caused by rolling stock in motion in 2009. Accidents to persons caused by rolling stock in motion (excluding suicide incidents) is the most frequently occurring railway accident, accounting for nearly two thirds of all significant accidents on Danish railways in 2009 (21 of 29).

Approximately half of the accidents to persons caused by rolling stock in motion occur in the proximity of urban areas and on railway station premises. Of the fatal accidents to persons caused by rolling stock in motion, most occurred on stretches of railway where the train travels at high speed. Some fatalities of this type may be suicide incidents.

... however, level-crossing safety remains a challenge

Every year there are, on average, five to six significant accidents at level-crossings, corresponding to more than 20% of all significant accidents. In Denmark, the safety at level-crossings is very high compared to the European average – both considered in terms of the number of level-crossings and in terms of passenger train kilometres.

In 2009, the railway accidents that had the most serious consequences occurred at level-crossings. In Soderup, there was a major accident at an active level-crossing secured by half barriers and warning signals. A lorry and a train collided at a level-crossing, causing extensive material damage, two fatalities, one person sustaining serious injuries and eight persons sustaining light injuries. Another accident caused two fatalities at Vejby, as a road user drove his vehicle in front of a train at a passive level-crossing.

Most accidents occur at level-crossings secured with active protection – signals and gates/barriers – not at

passive level-crossings. The traffic volume and the speed travelled at is typically much higher on both road and railway at secured level-crossings, for which reason the number of accidents is higher in spite of the higher level of security.

Serious injury or fatalities most often involve the level-crossing users. The number of motor vehicles and light road users involved in accidents is approximately equal.

The primary cause of accidents at level-crossings is road user behaviour. Investigation of accidents at level-crossings reveals that close to 90% of accidents are caused by erroneous behaviour by road users. The underlying cause is inadequate attention (mobile phone use, music, etc.) or conscious violation due to lack of patience, or hurry.

It is important that the design of protection systems and security of level-crossings should consider the actual behaviour of road users. This applies to elements that can make road users more alert to risk and danger at the level-crossings. When road users intentionally violate rules, improved technology does not always provide an adequate solution. Steps taken should also involve new rules, education and information aimed at road users.

Railway undertakings have introduced new safety management systems...

In 2009, most railway undertakings introduced new safety management systems, and obtained certification of the systems.

Depending on the nature of the organisation, railway undertakings use different ways to structure their safety management system to organise their activities. Common to the solutions chosen is the fact that the requirements for obtaining safety certification and safety authorisation have been met.

Management systems are still something relatively new to railway undertakings. Initial experience shows that, although it has been a challenge to implement the new approach, the railway undertakings use the management systems actively. In many cases, the system has initiated a positive development that offers benefits to the undertakings.

... but there is still some way to go before they function fully

However, there remains scope for improvement. In 2009, the Public Transport Authority performed 29 audits relating to safety certification and safety authorisation to gauge the functionality of safety management systems.



The Public Transport Authority has focused on the internal audits of the railway undertakings, which discovered many instances of non-compliance in previous years. However, no instances of non-compliance were found in the internal audits of the railway undertakings in 2009, and only in two cases were instances of non-compliance recorded with infrastructure managers. The undertakings have performed internal audits to a large extent to ensure adequate implementation of the safety management systems.

Most instances of non-compliance or non-conformance found in 2009 related to the topic areas: identification of the undertakings' norms and rules, procedures ensuring compliance with TSIs and management and documentation of maintenance of rolling stock, technical equipment and facilities.

From 2010, the Public Transport Authority will select a number of annual focus areas for auditing the undertakings' safety management systems.

Further, the Public Transport Authority performed 20 other audits, for instance, occasioned by specific incidents, follow-up on recommendations or safety directions issued, or investigation reports from the National Investigation Body.

Further, there remains some way to go before the reports have the full intended effect. Unfortunately, safety reports rarely reflect the issues considered by railway undertakings.

in their management's annual safety evaluation. The reports are generally lacking an assessment as to whether the railway undertaking is moving in the right direction and information on the areas on which the company will focus its efforts in the coming year – for instance, new safety targets or action plans.

Strategy prepared for safety and interoperability...

In the light of the European regulatory reform¹, the Public Transport Authority published a strategy for the handling of safety and interoperability in Denmark over the next three to five years in February 2009.

The main strategy items include:

- a) Implementation of EU regulation by applying as few Danish national rules as possible
- b) Increased dialogue with the railway transport industry
- c) Comprehensive approach to maintaining safety
- d) Increasing railway undertakings' audit management

... and it is now being implemented

In 2009, the Public Transport Authority primarily focused on the two first main items: a) and b).

The implementation of the European regulatory reform in the area of railway safety extends over a minimum of eight years. This work reached a significant milestone in 2009 with the issue of new Danish regulation on operations and traffic management. The initial application of the new regulations will be the establishment of new signal systems on mainline and S-train lines (i.e. greater urban lines). The regulation specifies what – the objective to be achieved – while the railway transport operators may themselves decide how – the specific approach to implementation.

¹ *Den fælleseuropæiske jernbane – en strategi for høj sikkerhed og smidig gennemførelse i Danmark, februar 2009 [The Common European Railway System – A Strategy for A High Level of Safety and Flexible Implementation in Denmark, February 2009].*



New EU regulation should be implemented comprehensively as concerns both safety and financial aspects. For this reason, the Public Transport Authority engaged the services of a consultancy firm in 2009 to assess the impact of coming and current TSI [technical specifications for interoperability] in relation to railway safety and capital investments. The overall conclusion reached, as envisaged in the strategy, is that the EU regulations as a whole do not cause significant changes. That is to say, the finances and safety relating to upgrade, renewal and construction will not be substantially different due to the application of TSI requirements as opposed to existing Danish requirements.

Further, cooperation with the railway sector has been strongly intensified through the setting up of a sector board and dialogue group meetings on technical topics, including, among other things, discussion on risk assessment methods and technical rules.

Areas of focused efforts in 2010

In 2010, the Public Transport Authority will continue its efforts to create a reasonable balance between statutory regulation and the responsibilities of the railway undertakings. Safety must be maintained, while detailed management and financial-administrative burdens must be minimised.

To achieve this objective, the Public Transport Authority will focus on creating regulation and practice in 2010 that support railway transport growth without reducing safety.

The focus areas will include improving the transparency of the authorisation process for infrastructure managers. In 2010, the Public Transport Authority will publish an order on authorisation of railway infrastructure and draft supplementary guidelines. The aim is to clarify the procedures for authorisation and thus alleviate the work of the infrastructure managers.

Further, the Public Transport Authority will initiate its work on identifying and determining minimum limit reference values for authorisation. Dialogue with the sector must help establish clearly the matters that require official approval and matters that undertakings may manage themselves.

In 2010, the Public Transport Authority will also draft guidelines for comprehensive risk assessment in connection with the authorisation of infrastructure projects. The guidelines will include specific examples of the application of risk assessment as an element of the basis for authorisation applications.

In addition, the Public Transport Authority will develop a new strategy based on the current supervision and audit strategy. The strategy will describe, among other things, the principles of Public Transport Authority auditing and supervision work, including a process description. The new elements of the strategy are the use of risk assessment as a tool of prioritisation and determination of effect targets. It is to create transparency and openness as elements of the future inspection and auditing work of the Public Transport Authority

Summary

Safety remains at a high level...

The national safety target is defined such that safety must, as a minimum, remain at the 2004 level, stated as the number of fatalities and weighted serious injuries not exceeding a maximum of 0.3 per 1 million passenger train-kilometres. This target figure will be adjusted as improved data become available in 2010. The 2009 level is 0.2 fatalities and weighted serious injuries per 1 million passenger train-kilometres. This figure is lower than for previous years.

There were 29 significant accidents (disturbances and delays of railway traffic, significant material damage, one or more fatalities or serious injury). This a slight increase, which does not, however, affect the 5-year average for significant accidents. In particular, the increase in the number of significant accidents is the result of an increasing number of accidents to persons caused by rolling stock in motion in 2009. Accidents to persons caused by rolling stock in motion (excluding suicide incidents) are the most frequent railway accidents, accounting for nearly two thirds of all significant accidents on Danish railways in 2009 (21 out of 29).

Approximately half of the accidents to persons caused by rolling stock in motion occur in the proximity of urban areas and on railway station premises. Of the fatal accidents to persons caused by rolling stock in motion, most happen on stretches of railway where trains travel at high speed. Some fatalities of this type may be suicide incidents.

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In 2009, the railway accidents that had the most serious consequences occurred at level-crossings. In Soderup, there was a major accident at an active level-crossing secured by half barriers and warning signals. A lorry and a train collided at a level-crossing, causing extensive material damage and two fatalities, with one person sustaining serious injuries and eight persons sustaining light injuries. Another accident caused two fatalities at Vejlbj, when a road user drove his vehicle in front of a train at a passive level-crossing.

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why the number of accidents is higher in spite of the higher level of security.

Serious injuries or fatalities usually involve the level-crossing users. The number of motor vehicles and light road users involved in accidents is approximately equal.

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In addition, the Danish Transport Authority performed 20 other audits, for example as a result of specific incidents, follow-up of recommendations or safety directions issued, or investigation reports from the Accident Investigation Board.

Moreover, there is still some way to go before the reports have the full intended effect. Unfortunately, safety reports rarely reflect the issues considered by railway undertakings.

The reports are generally lacking an assessment as to whether the railway undertaking is moving in the right direction and information on the areas on which the company will focus its efforts in the coming year, for example new safety targets or action plans.

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objective to be achieved, while the railway undertakings may themselves decide the specific approach to implementation.

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In addition, cooperation with the railway sector has been strongly intensified through the setting up of a sector board and dialogue group meetings on technical topics, including, among other things, discussion of risk assessment methods and technical rules.

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In 2010 the Danish Transport Authority will continue its efforts to create a reasonable balance between statutory regulation and the responsibilities of the railway undertakings. Safety must be maintained, while detailed management and financial/administrative burdens must be minimised.

To achieve this objective, in 2010 the Danish Transport Authority will focus on creating regulation and practice to support railway transport growth without reducing safety.

The focus areas will include improving the transparency of the authorisation process for infrastructure managers. In 2010 the Danish Transport Authority will publish an order on authorisation of railway infrastructure and draft supplementary guidelines. The aim is to clarify the procedures for authorisation and thus alleviate the work of the infrastructure managers.

In addition, the Danish Transport Authority will initiate work on identifying and determining minimum limit reference values for authorisation. Dialogue with the sector must help by clearly establishing the matters that require official approval and matters that undertakings may manage themselves.

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In addition, the Danish Transport Authority will develop a new strategy based on the current supervision and audit strategy. The strategy will describe, among other things, the principles of the Authority's auditing and supervision work, including a process description. The new elements of the strategy are use of risk assessment as a prioritisation tool and determination of effect targets. This will create transparency and openness as elements of the future inspection and auditing work of the Danish Transport Authority.

² *The Common European Railway System – a Strategy for a High Level of Safety and Flexible Implementation in Denmark, February 2009.*

Chapter 1. Accidents and incidents – safety in figures

Railway safety is generally high. The extent of significant accidents involving persons and the number of accidents involving personal injury both show a downward trend, although there was some change in 2009.

Accidents, incidents and safety irregularities

Most years the accident profile is dominated by individual accidents with consequences for a single individual. Major accidents on the railway are extremely rare. Information on precursors of accidents or near-misses provides an indication of where preventive measures can be introduced to avoid serious accidents.

Denmark has a safety target for the railways that is used to assess whether safety remains at a satisfactory level. The safety target is calculated on the basis of data on persons killed and seriously injured.

All the railway undertakings and infrastructure managers report data on accidents, incidents and safety irregularities to the Danish Transport Authority. These data are of great importance in assessing Denmark's level of safety.

Accident data are often scaled up to train-km and possibly passenger-km travelled; see Annex 1 for data. The information can therefore be used to compare the development from year to year. In the same way, undertakings can compare their own data with those of other undertakings, or in relation to the national average.

'The Reporting Executive Order'³ lays down the framework for the information railway undertakings and infrastructure managers must collect. The rules are expected to be updated in 2010 in accordance with EU rules on accident data. Harmonised rules make it possible to produce detailed accident statistics and compare data across undertakings and EU Member States. Definitions used in the present report can be found in Annex 2 and safety indicators for 2009 in Annex 3.

Significant accidents

After two years with a low number of significant accidents, there was a slight increase in 2009. There were 29 significant accidents, which is slightly higher than the average for the last five years.

'Significant accidents' are train accidents involving damage of over DKK 1.2 million, death or serious injury, or delays of more than six hours to train operations.

Figure 1 shows the trend in the development of significant accidents in relation to kilometres travelled. Here the 5-year average is relatively stable at under 0.4 significant accidents per million train-km. There was a fluctuation in the number of significant accidents in 2009, but not large enough to affect the 5-year average.

For the time being the methods of calculation remain too uncertain to provide a reliable measure of safety. The figure for significant accidents is assessed to be lower than the actual figure. This is because information on economic costs associated with material damage, delays, etc. is not always reported consistently to the Danish Transport Authority.

Figure 1. Significant accidents

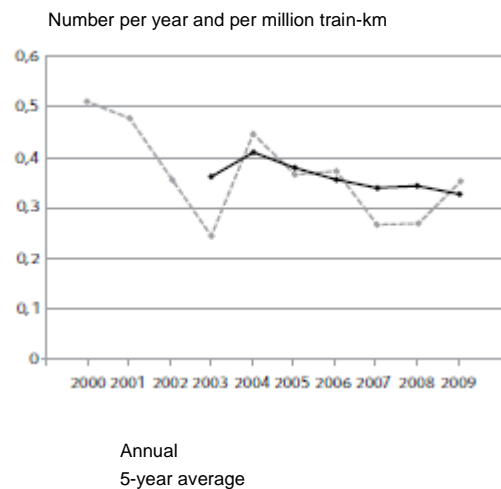


Figure 1. Significant accidents are where the consequences exceed DKK 1.2 million or where there are serious personal injuries.

The general increase in the number of significant accidents can be attributed in particular to a corresponding increase in the number of collisions with persons in 2009.

³ Executive Order No 646 of 25 June 2008 concerning the reporting of data to the Danish Transport Authority on accidents, incidents and safety irregularities.

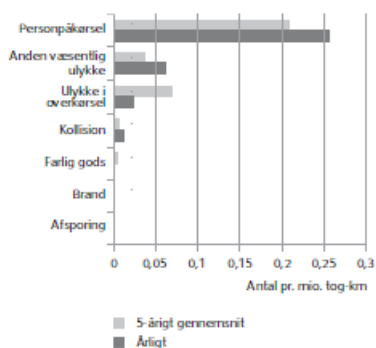
Collisions with persons were the most common form of accident in 2009, representing almost two thirds of all significant accidents on the railway. Of the total of 29 significant accidents, 21 were collisions with persons, which is an increase compared with the 5-year average.

Near-misses have attracted a higher level of attention in recent years. A total of 284 cases involving risk of collision with persons were recorded in 2009, meaning that persons being too close to the track when a train approaches, and therefore close to being hit, is something that happens on a daily basis. The figure for the year shows a ratio of approximately 1:4 between actual accidents and near-misses.

Around half of collisions with persons in 2009 took place in proximity to urban areas and station areas, e.g. when getting on and off trains. The remainder occurred on the section of line between two stations.

There were no serious collisions or derailments in 2009. One shunting accident resulted in significant material damage and is the only collision resulting in significant damage over the last five years. There were no derailments or fires in 2009, cf. Figure 2.

Figure 2. Significant accidents broken down by type of accident



Key

- Personpåkørsel = Collision with person
- Anden væsentlig ulykke = Other significant accident
- Ulykke i overkørsel = Accident at level-crossing
- Kollision = Collision
- Farlig gods = Dangerous goods
- Brand = Fire
- Afsporing = Derailment
- Antal pr. mio. tog-km = Number per million train-km
- 5-årigt gennemsnit = 5-year average
- Årligt = Annual

Figure 2. Types of accident are stated per million train-km for 2009 and as a 5-year average for the period 2005-2009.

There was an increase in the number of 'other' in 2009 (a total of five accidents). Three of these significant accidents happened as a result of people coming into contact with power lines. Two of the five significant accidents occurred in connection with maintenance work on the platform.

The number of accidents at level-crossings in 2009 was relatively low. However, the accidents with the most

severe consequences were two that took place at level-crossings. The first took place on 7 September in Vejby, where a married couple drove in front of a train on an unprotected level-crossing. Both occupants of the car were killed.

The second accident took place on 19 September in Soderup. A lorry and a train collided at a level-crossing protected by a half barrier. The accident resulted in two fatalities: the trainee in the driver's cab and the lorry driver. The train driver was seriously injured, and a train driver and eight passengers sustained minor injuries. Chapter 3 provides an in-depth analysis of level-crossing accidents.

Safety target for the railway

The safety target for the railway has been set on the basis of the average number of 'significant accidents involving persons', taking 2004 as the base year⁴. Data on the economic consequences of accidents are often deficient, which is why data on significant accidents involving persons are considered to be the best indicator of safety.

'Significant accidents involving persons' is 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 excluding suicides.

The safety target is used as a basis for assessing whether the level of safety on the railway is acceptable. The safety target is stated as a 5-year average and is scaled up to train-km. To assess the trend, the 5-year cumulative average is used to measure compliance with the safety target.

The national target is to keep the number of significant accidents involving persons below an average of 0.3 per million train-km. The level in 2009 was lower than in the preceding years.

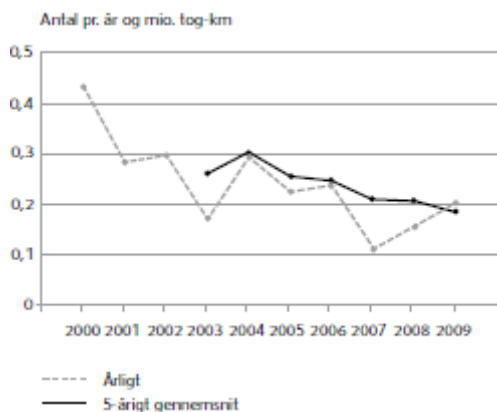
The number of significant accidents involving persons in 2009 was just under 0.2 per million train-km.

The safety target is a measure of risk output for the existing railway system. It cannot be applied directly as a risk acceptance criterion when commissioning new railway systems but should, however, be used as an indicator. As a starting point, the safety target should not be exceeded.

A downward trend in the number of significant accidents involving persons is apparent for the last 10 years. In 2009 there were 15 deaths and 15 serious injuries, giving a weighted total of 16.5. The number of significant accidents involving persons in 2009 is largely on a par with the average, cf. Figure 3.

Figure 3. Significant accidents involving persons 2000-2009

⁴ The safety target is described in the strategy 'The Common European Railway System – a strategy for a high level of safety and flexible implementation in Denmark', February 2009.

**Key**

Antal pr. år og mio. tog-km = Number per year and per million train-km

Årligt = Annual

5-årigt gennemsnit = 5-year average

Figure 3. Significant accidents involving persons is 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 excluding suicides.

The figures show an increase to 0.2 accidents involving persons (equivalent to two serious injuries per million train-km) in 2009, compared with 0.16 in the previous year. This is considered to be an acceptable level of safety for 2009. Large annual fluctuations of up to +/- 50% in the number of significant accidents involving persons can be expected as the absolute figures are very small.

Breakdown of accidents involving persons

The safety target is a combined measurement covering everyone who is injured or killed on the railway. A

Table 1. Significant accidents involving persons broken down by type of accident 2005–2009

Type of accident	Number of significant accidents	Significant accidents (%)	Number of significant accidents involving persons	Significant accidents involving persons (%)
Collision with person	84	64	48	63
Accident at level-crossing	28	21	23	30
Other	15	11	5	7
Collision of trains	2	2	0	0
Dangerous goods	2	2	0	0
Derailment	0	0	0	0
Fire	0	0	0	0
Annual:	131	100	76	100
Average per year:	26		15	

Table 1. The table shows the number of accidents involving persons in relation to significant accidents and types of accident. The number of significant accidents involving persons in connection with collision of trains is low, below 0.5, and is therefore not shown in the table. The data exclude suicides.

greater understanding of safety can be gained by breaking the target down by various safety indicators.

The first part of the chapter primarily comprised a review of types of accident. Indicators for personal injuries are other safety indicators that are interesting to assess,

The number of persons killed and seriously injured tends to be very low. In 2009, however, the level of accidents involving persons was a shade above the 5-year average.

The number of persons killed in 2009 was 0.18 per million train-km.

The number of serious injuries in 2009 was 0.18 per million train-km.

The weighted total (16.5 in 2009) includes an average of 15 significant accidents involving persons per year. The number of personal injuries provides a good indicator for undertakings when assessing their own level of safety. The undertaking's level of safety should be approximately equal to the national average, making allowance for different operating conditions, including regional conditions.

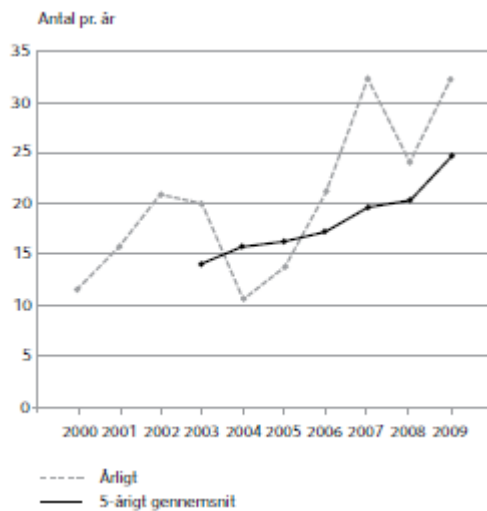
The majority of the significant accidents involving persons are individual accidents involving one injured person, and more than 60% involve collisions with persons, cf. Table 1. This is equivalent to an average of 10 deaths a year.

On average, 30% of all significant accidents involving persons happen at level-crossings (an average of four to five a year). This type of accident involves more personal injuries than the other types of accident. This is because accidents at level-crossings can cause injuries to several persons in the same accident. The two significant accidents at level-crossings in 2009 are both examples of this.

Suicides and collisions with persons are easily confused. In certain cases there is insufficient evidence to determine what has happened. This year there were two collisions where it is suspected that the victims intended to kill themselves. Suicides are not a railway accident in the traditional sense but still represent a significant cost to society and have an impact on the psychological working environment of railway staff.

The figure of 32 suicides in 2009 represents an increase in the number of suicides. It also produces an upward trend in the 5-year average. The number of suicides is more than double the total number of persons killed in accidents on the railway.

Figure 4. Number of suicides 2000-2009



Key

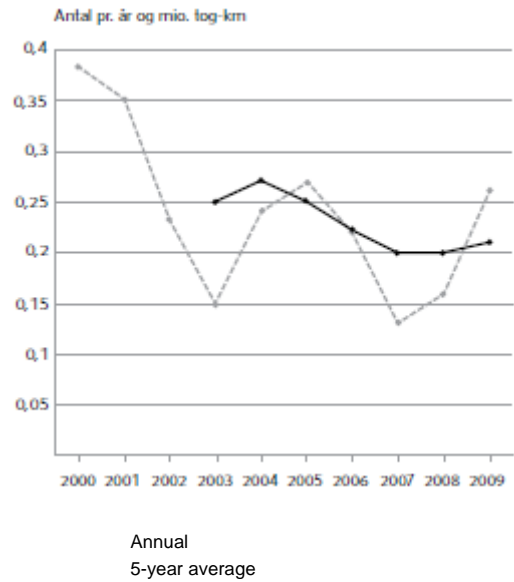
Antal pr. år = Number per year
 Årligt = Annual
 5-årigt gennemsnit = 5-year average

Figure 4. Suicides are registered on the basis of police decisions and witness reports on the accident.

Producing a more accurate figure for suicides has been in focus in the last few years. The figure is still uncertain and it is therefore expected that the number is higher than the current figure shows.

Data analysis suggests that suicides may account for a fairly significant proportion of collisions with persons on the railway. The fall in the average number of serious personal injuries may therefore be associated with an increase in the number of suicides, cf. Figures 4 and 5.

Figure 5. Number of collisions with persons 2000-2009



Key

Antal pr. år og mio. tog-km = Number per year and per million train-km

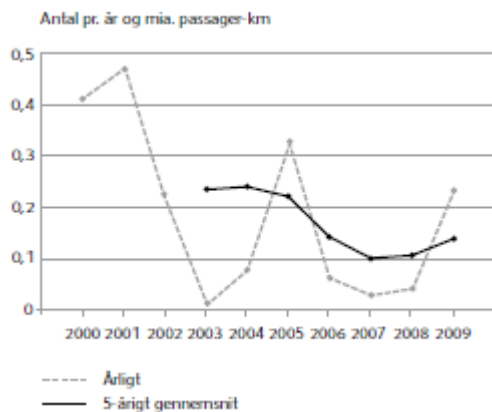
Figure 5. Significant accidents involving collisions with persons. Collisions with persons generally result in serious injury or death. The data cover 178 collisions with persons over the last 10 years.

The average number of collisions with persons is stabilising at approximately 0.2 per million train-km. The increase in 2009 has minimal influence on the average. Collisions with persons will remain a focus area.

Breakdown of injuries by group of persons

Safety for train passengers is very high. In 2009 one passenger was killed and five were seriously injured. Figure 6 shows that the level of personal injuries is generally very low – equivalent to an average of seven seriously injured passengers a year.

Figure 6. Significant accidents involving passengers 2000-2009



Key

Antal pr. år og mia. passager-km = Number per year and per billion passenger-km

Årligt = Annual

5-årigt gennemsnit = 5-year average

Figure 6. Significant accidents involving passengers is stated in relation to passenger-km travelled. One passenger-km is transport of one passenger for one kilometre and expresses the transport work performed.

The risk for passengers is calculated at 0.14 significant accidents involving persons scaled in relation to billion passenger-km. Large annual fluctuations can be expected in the light of the very small quantities of data involved. The figure shows a change in 2009, when one passenger was killed and five were seriously injured, while there were no passenger fatalities in the period 2006-2008.

Passengers and employees are primarily exposed to danger in connection with major train accidents. Fortunately, major accidents are rare. In the last 50 years there have been three accidents resulting in more than three deaths. The most recent was a train collision in Kølkær in 2000, when two train drivers and one passenger were killed and 39 persons injured.

In relation to train-km travelled, the 5-year average for number of accidents involving passengers and employees is low and relatively stable.

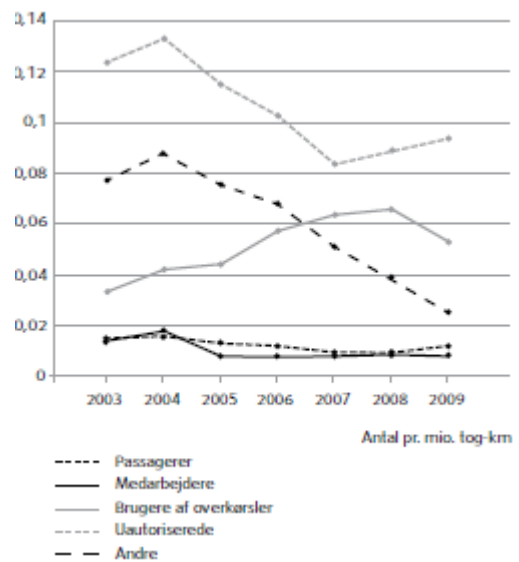
The level for passengers is approximately 0.01 serious accidents per million train-km. The level for employees is approximately 0.07 serious accidents per million train-km.

This breakdown of accidents involving persons by group of persons is an important indicator for undertakings in assessing their own level of safety.

The most vulnerable groups of persons in connection with railway accidents are those who are outside the train and are hit by it. In particular this concerns unauthorised persons on railway property who are injured.

Figure 7 shows the trend in development for the 5-year average broken down by the five different groups of persons. The data are scaled in relation to train-km.

Figure 7. Significant accidents involving persons broken down by groups of persons 2004-2009



Key

Antal pr. mio. tog-km = Number per million train-km

Passagerer = Passengers

Medarbejdere = Employees

Brugere af overkørsler = Level-crossing users

Uautoriserede = Unauthorised persons

Andre = Others

Figure 7. Significant accidents involving persons is stated as the weighted total of persons killed and seriously injured, excluding suicides.

Accidents involving persons for the group 'unauthorised persons' account for half of all accidents involving persons. The figure has been falling but is now stabilising at a level below 0.1 accidents involving persons per million train-km. This may be because suicides have historically often been categorised in this group. The method of calculation has now been changed such that suicides and the group 'others' are recorded separately.

'Others' comprises persons who are on the platform or outside railway property, e.g. people living near the railway. This group of persons is expected to account for a relatively small share of the total number of personal injuries using the new method of calculation. However, the figure remains uncertain.

The second-largest group is road users at level-crossings. In 2009 there were two accidents at level-crossings in which road users were seriously injured; four persons were killed.

There has been a significant increase in the number of serious accidents involving users of level-crossings over a long number of years. Part of the reason for the increase is that many local sections of line, which have a number of level-crossings, were only included in the statistics from 2003. However, the figure shows a downward trend in the 5-year average in 2009 to 0.05 accidents involving persons per million train-km.

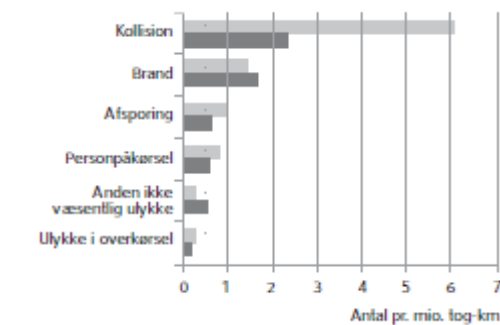
Minor accidents and incidents

Almost 500 minor accidents not involving extensive material damage (below DKK 1.2 million) or serious

personal injury were recorded in 2009. This is almost half the figure recorded in the previous year.

The most significant fall is in the category 'collision with objects', which can be attributed to changes in the undertakings' method of calculation. This category covers collisions with fixed structures or objects (parts of trains, machinery or equipment) on the track, and also includes large animals. These collisions may cause minor damage to the engine. Within this category, there are a large number of collisions with items such as bicycles and shopping trolleys, often regarded as vandalism.

Figure 8. Minor accidents broken down by type of accident



5-årigt gennemsnit
Årligt

Key

- Antal pr. mio tog-km = Number per million train-km
- 5-årigt gennemsnit =5-year average
- Årligt = Annual
- Kollision = Collision
- Brand = Fire
- Afsporing = Derailment
- Personpåkørsel = Collision with person
- Anden ikke væsentlig ulykke = Other non-significant accident
- Ulykke i overkørsel = Level-crossing accident

Figure 8. Minor accidents are those involving minor injuries or material damage of less than DKK 1.2 million. Stated in relation to train-km and as a 5-year average.

There have been relatively more fires in 2009, one of the reasons for this being a relatively large number of fires in IC3 trains. The Danish Transport Authority has been monitoring this in 2009, resulting in extra inspections of the rolling stock.

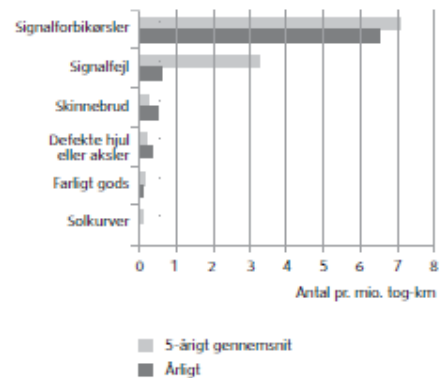
A total of 649 incidents were recorded in 2009. The number of incidents can fluctuate from year to year but typically reflects the focus areas of the railway undertakings and infrastructure managers.

Incidents are characterised as events that do not result in injury or damage, and are divided into six types: broken rails, track buckles, signals passed at danger, signal failures, broken wheels and axles, and incidents involving dangerous goods. See definitions in Annex 2.

Incidents involving signals passed at danger have historically attracted a high level of attention. This is because passing a signal, e.g. a stop signal, carries a

high risk of collision. There has been a fall in the number of signals passed at danger in 2009 in relation to the 5-year average. Signals passed at danger have been a focus area for the majority of undertakings and infrastructure managers on the main sections of line in Denmark over the last year.

Figure 9. Incidents broken down by type of incident



Key

- Signalforbikørsler = Signals passed at danger
- Signalfejl = Signal failures
- Skinnebrud = Broken rails
- Defekte hjul eller aksler = Broken wheels or axles
- Farligt gods = Dangerous goods
- Solkurver = Track buckles
- Antal pr. mio. tog-km = Number per million train-km
- 5-årigt gennemsnit = 5-year average
- Årligt = Annual

Figure 9. Incidents do not involve injury or damage but may be precursors of accidents. Stated in relation to train-km and as a 5-year average.

The method of calculation was changed in 2006 with the introduction of a large number of new categories. However, the new categories of incident have not been used to a particularly great degree, and data going back five years are subject to a high level of uncertainty. It is still too early to get a real picture of safety from this figure.

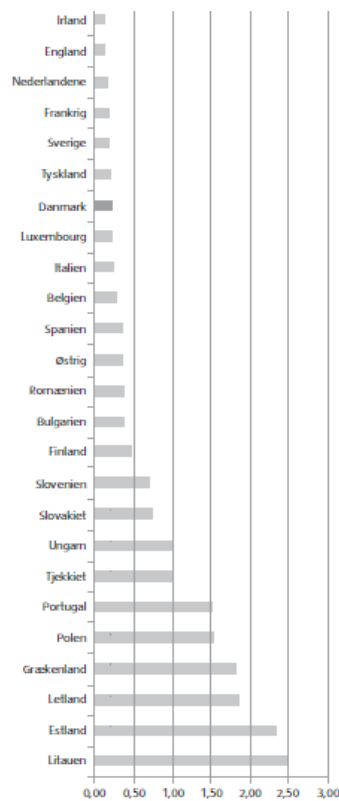
Railway safety in other countries

In 2009 the EU calculated values indicating the national level of safety in all the EU Member States. The calculation was based on the number of persons killed and seriously injured. The national level of safety is used to measure how safety is developing in the individual country. The method of calculation was chosen by the Commission in 2009⁵. The level of safety is stated as a weighted average for the period 2004-2007.

The figure for Denmark indicates that we have a very high level of safety, on a par with neighbouring countries with which we tend to compare ourselves. The value is 0.22 personal accidents per million train-km.

⁵ Commission Decision of 5 June 2009 on the adoption of a common safety method for assessment of achievement of safety targets, as referred to in Article 6 of Directive 2004/49/EC of the European Parliament and of the Council.

Figure 10. Significant accidents involving persons in the EU Member States 2004-2007



Antal pr. mio. tog km

Key

- Irland = Ireland
- England = UK
- Nederlandene = The Netherlands
- Frankrig = France
- Sverige = Sweden
- Tyskland = Germany
- Danmark = Denmark
- Luxembourg = Luxembourg
- Italien = Italy
- Belgien = Belgium
- Spanien = Spain
- Østrig = Austria
- Romænien = Romania
- Bulgarien = Bulgaria
- Finland = Finland
- Slovenien = Slovenia
- Slovakiet = Slovakia
- Ungarn = Hungary
- Tjekkiet = Czech Republic
- Portugal = Portugal
- Polen = Poland
- Grækenland = Greece
- Letland = Latvia
- Estland = Estonia
- Litauen = Lithuania
- Antal pr. mio. tog km = Number per million train-km

Figure 10. Calculation by the European Railway Agency (ERA) of the weighted total of persons killed (1/1) and seriously injured (1/10) for the period 2004 to 2007. Data for 2008 are not yet available. Significant differences in calculation methods mean that this calculation is subject to a certain degree of uncertainty and the quality will therefore be improved in future years.

Over time, a common safety target will be introduced for the entire EU. The safety target will help to ensure that safety is maintained and the level is improved when this is necessary and practicable.

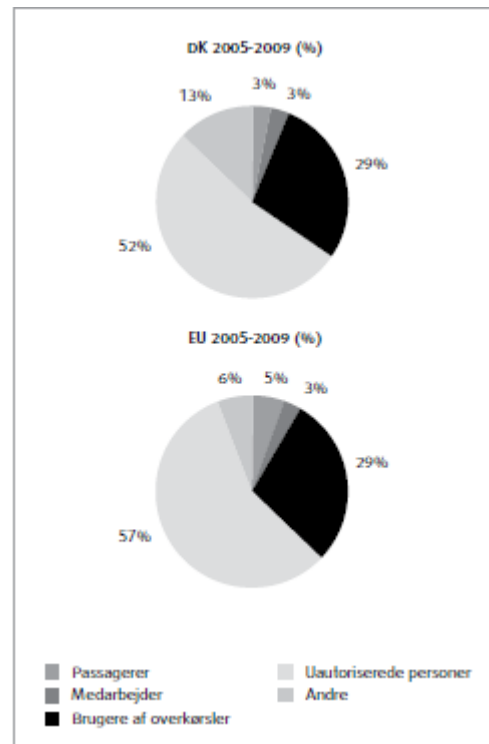
The big challenge is to improve safety in the countries where it falls below the average level. There are very big

differences in the level of safety among the Member States: a factor of more than 20 between the highest and lowest placed.

Comparison of safety for groups of persons

The Danish pattern is very close to the European average in terms of the breakdown between groups of persons. The number of persons killed in the EU breaks down such that employees and passengers are the smallest group. Users of level-crossings account for 29% in both Denmark and the EU as a whole; see Figure 11.

Figure 11. Deaths broken down by groups of persons



Key

- Passagerer = Passengers
- Medarbejder = Employees
- Brugere af overkørsler = Level-crossing users
- Uautoriserede personer = Unauthorised persons
- Andre = Others

Figure 11. Calculation of the total number of deaths in the EU (2006-2008) and in DK (2006-2009). EU data for 2009 are not yet available. Significant differences in calculation methods mean that this calculation is subject to a certain degree of uncertainty.

The figure showing the number of deaths in Denmark shows that the groups 'unauthorised persons on railway property' and 'others' together also represent almost the same proportion as for the EU as a whole. However, the breakdown between the two groups of persons is slightly skewed. This is probably because the European definitions have not been consistently applied in Denmark to the oldest data.

Safety in connection with different forms of transport

The railway is very safe in comparison with other forms of transport. The number of serious accidents involving persons on the railway is approximately one sixth of the level for roads, cf. Figure 12.

Figure 12. Accidents involving persons on the roads and railways 1999-2008

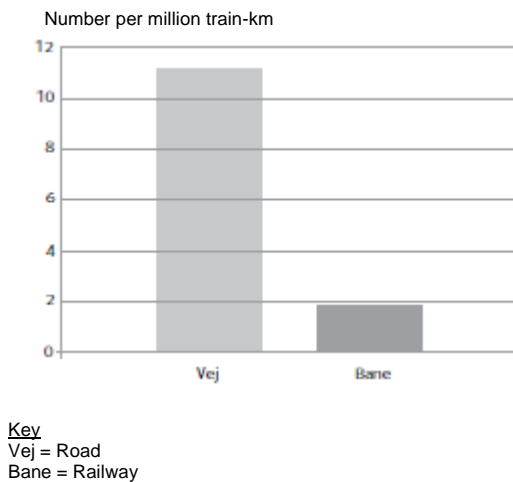


Figure 12. Accidents involving persons is the weighted total of persons killed and injured, seen in relation to person-kilometres. For road traffic, 'seriously injured persons' are persons taken to accident and emergency departments/hospitals, whereas for the railway, seriously injured persons are those hospitalised for 24 hours. Accidents involving persons are therefore considered to be a shade high for road traffic. The table does not include suicides. Source: Statistics Denmark, the National Road Directorate and the Danish Transport Authority.

There are significant differences between road and rail traffic. On the roads there are several different types of road user in the same environment. Compared with trains, passenger cars are involved in more than 10 times as many accidents involving persons per passenger-km. By contrast, buses are safer – roughly on a par with the railway.

The railway is relatively shielded from other traffic. It is only at level-crossings that trains have to cross the path of other road users. It is often other road users who are injured in railway accidents.

Safety targets and indicators from railway undertakings and infrastructure managers

Safety reports for 2009 must be drawn up by all railway infrastructure managers and railway undertakings. Three of the total of 20 reports had not been submitted by the 30 June deadline.

In accordance with current requirements, the reports must address the following four topics: safety targets, safety indicators, results of supervision and comments on railway safety⁶.

The general picture is that the safety reports from the undertakings comply with the formal requirements by describing activities within the four essential topics. Some reports require clarification in relation to guidance on safety reports⁷.

There is still a way to go to achieve good safety reports in some cases. Unfortunately the safety reports rarely reflect the deliberations that have taken place in connection with the management's annual safety evaluation.

In general, the reports are lacking an assessment of whether the undertaking is heading in the right direction and information on the priority areas the undertaking should continue to address in the year ahead, e.g. new safety targets or action plans.

Safety targets in the undertaking

Safety targets are a management tool reflecting the level of safety acceptable for the undertaking. The target expresses what is considered to be a normal state. Departures from the norm should as such lead to some form of intervention in order to prevent problems or improve safety conditions in the undertaking.

Via their safety management systems the undertakings have worked actively on their safety targets and have generally got better at setting workable qualitative targets, e.g. for the number of accidents and personal injuries.

There is no actual assessment of whether the targets have been appropriate and whether action plans drawn up on the basis of the targets have been effective. This should include the management's overall evaluation of whether the targets support the undertaking's wish to raise or maintain the level of safety.

⁶ Cf. Executive Order No 13 of 4 January 2007 on safety authorisation of railway infrastructure managers, and Executive Order No 14 of 4 January 2007 on safety certificates for railway undertakings.

⁷ 'Guidance in drawing up the annual safety report from railway undertakings and infrastructure managers', March 2010. Available [in Danish] at www.trafikstyrelsen.dk



The Danish Transport Authority recommends that the undertaking's safety target should relate to the national indicators. It should reflect the national average for significant accidents involving persons per million train-km, e.g. broken down by the number of persons seriously injured and killed and/or broken down by groups of persons (as specified earlier in the section).

The number of significant accidents, which this year is just under 0.4 per million train-km, can also be used as a target.

At the same time the safety target should relate to the undertaking's experience of accidents and what it considers acceptable, taking traffic conditions into consideration. The target can also reflect any focus areas the undertaking has chosen to improve.

Some undertakings also use qualitative safety targets, e.g. targets for the number of supervisions or inspections, targets for training or the number of railway safety meetings. Using qualitative targets can offer a big advantage in ensuring sufficient attention is given to the work on safety.

Safety indicators

There are a total of 45 safety indicators relating to accidents, incidents, personal injuries and economic consequences of accidents. All the safety indicators are calculated as absolute figures and are relative to train-km.

The method of calculation opens up the possibility of making comparisons with the national average or between undertakings, and to follow the development over time.

However, there is no actual trend and cause analysis in the undertakings' safety reports, and very few descriptions of measures initiated on the basis of the development in the undertaking.

Results of internal supervisions

The undertakings have described how many supervisions have been carried out. Often a distinction is made between supervision of operations (inspections) and of the safety management system (audits). A description of the breakdown of supervisions into inspections and audits is often lacking. Few undertakings have referred to the relevant corrective actions taken as a result of supervisions.

Chapter 2. Handling of railway safety – practical experiences

Increased cooperation between public authorities and undertakings in the railway sector provides a better basis for handling railway safety. Accordingly, there have been a large number of supervisions involving new safety certificates and safety authorisations in 2009

Safety work: strategy for safety and interoperability

At the start of 2009 the Danish Transport Authority published a strategy for handling safety and interoperability in Denmark over the next 3-5 years⁸. The strategy will form the framework for a transformation of the railway sector providing the best conditions for an efficient, safe and climate-friendly railway.

The main messages of the strategy are:

1. safety shall be maintained and measured via a safety target that continuously monitors developments;
2. as a business sector, the railway sector shall be promoted through dialogue and, gradually, greater self-management in the undertakings;
3. implementation of a European regulatory reform shall adopt a holistic view, and Danish exemptions and special rules should be avoided;
4. Danish viewpoints shall be promoted in international negotiations.

The Danish Transport Authority is working to implement the strategy on an ongoing basis. The following sections set out the initiatives and measures carried out or started in 2009.

Re 1) New safety target

In future the safety level will be measured primarily as output, i.e. the actual number of serious accidents involving persons on Danish railways. The intention is to maintain the safety level for 2004, cf. legislation on safety efforts from the same year.

On this basis the target has been calculated as maximum 0.3 serious accidents involving persons per million train-km. Read more about fulfilment of the safety target in 2009 in the previous chapter.

This target is Denmark's first attempt at setting a value. The target shall be adjusted at regular intervals. When more accident data have been collected for a longer number of years, it will also be possible to assess the safety standard for different types of sections of railway.

Methods for setting targets will be developed in collaboration with the other EU Member States. The aim is to create a common European target, so that there is no competition on safety between the Member States. An executive order concerning the method for setting safety targets for each EU Member State and for the EU as a whole was implemented in 2009.

Re 2) Appointment of sector panel, dialogue groups and committees

A sector panel has been appointed to increase the sector involvement in current and fundamental issues. The sector panel acts as a sparring partner for the Danish Transport Authority, for example in the implementation of new rules and methods in Denmark.

The panel comprises leading representatives of railway undertakings, infrastructure managers and other railway players, e.g. manufacturers and consulting companies.

Three meetings were held in 2009, discussing among other things methods for impact analysis of TSIs, incentives for increased responsibility for the sector, the approvals process and the sector's need for guidelines. In general, the participants have been satisfied with the panel's work and the topics chosen.

Dialogue groups

The Danish Transport Authority's dialogue group on risk assessment held three meetings in 2009, discussing how risk assessment can be broadened and applied in Denmark and how the CSM Regulation on risk assessment⁹ is to be interpreted.

The first meeting dealt with risk assessment in general terms, while the two subsequent meetings were

⁸ The Common European Railway System – a Strategy for a High Level of Safety and Flexible Implementation in Denmark, February 2009.

⁹ Commission Regulation (EC) No 352/2009 on the adoption of a common safety method on risk evaluation and assessment as referred to in Article 6(3)(1) of Directive 2004/49/EC of the European Parliament and of the Council.

subject-specific. The second addressed methods for assessing when technical changes are significant to safety, and the third drawing up risk logs and risk identification.

The participants in the dialogue group comprise representatives from railway undertakings, infrastructure managers, relevant organisations and engineering consultancies from Denmark, Sweden and Norway. Special technical memoranda have been drawn up and the participants have actively contributed proposals and practical experiences¹⁰.

Cooperation meetings on preparedness and protection of the railways have been established, cf. the railway legislation in the area, and are held at least four times a year. The circle of participants comprises those responsible for preparedness in the individual railway undertakings or infrastructure management companies.

Topics in 2009 included the framework and requirements of the Executive Order on preparedness, aspects concerning sector coordination, preparedness planning, supervision, crisis management unit, etc. The meetings combine information on status of progress and practical experiences, and also aim to promote cooperation between the parties in the sector.

Train drivers' committee

The train drivers' committee was wound up in 2009. It was appointed to assess the content of and admission requirements for train-driver training. The railway strategy had identified a need to achieve greater conformity between competences, the latest technological developments and European requirements in the area. In particular, it should be easier for train drivers to operate across national borders.

The committee mapped the concrete priority areas. The recommendations arising from the enquiry were as follows:

- in general, admission requirements for the training should be broader and closer to the EU requirements;
- efforts should be made to clarify the requirements regarding knowledge of languages (German, Swedish and possibly English) to expand the recruitment basis;
- in order to increase safety and make the training more effective, the teaching could include use of simulators;
- specify industrial psychology test requirements;
- greater importance should be attached to service orientation, both in the undertakings and in the training.

The committee's participants comprised representatives of railway undertakings and Rail Net Denmark.

Re 3) Holistic impact analysis of the EU regulatory reform

Clear and comprehensive technical regulations help to improve safety. Previously, the Danish technical regulations primarily comprised the undertakings'

internal rules, which had been approved by the Danish Transport Authority. The common European rules for the railways (the TSIs) have started to make up an increasingly large part of the regulatory framework, and have given ongoing cause for concern: Will they reduce safety? Does this make the railway more expensive?

In this connection a study report has been drawn up assessing the consequences of European TSI rules¹¹ in relation to railway safety and facilities financing¹².

The overall conclusion is that the EU rules as a whole do not entail significant changes. The main reason for this is that the TSIs generally set requirements that conform to the existing Danish requirements and EN standards.

The economic consequences of upgrades, renewal and new construction are not significantly different/more expensive using TSI requirements rather than Danish requirements. In some cases the new TSI requirements promote safety. This is due to a more uniform and thoroughly prepared structure compared with older national requirements.

Some TSI requirements may, however, result in changes to safety, and lower or higher construction costs respectively, but overall there is no great difference between the old regulatory regime and the new EU rules.

In 2009 the Danish Transport Authority started development work by establishing methods for adopting a holistic approach to safety, taking risk assessment and the CSM regulation as a starting point. Guidelines on holistic risk assessment will be published at the end of 2010.

Re 4) Stepping up Denmark's contribution to international negotiations

In 2009 the Danish Transport Authority stepped up efforts to promote Danish viewpoints in international negotiations. For a detailed description, see Chapter 5 and Annex 7.

Results of accident investigations

In 2009 the Danish Accident Investigation Board published seven reports on investigations into accidents and incidents. Several have prompted recommendations, which the Danish Transport Authority is following up on an ongoing basis.

- 1) Tank wagon derailed at goods yard in Odense
- 2) Train collided with combine harvester on level-crossing
- 3) Overhead lines brought down at

¹⁰ Information [in Danish] on dialogue group meetings on risk assessment can be found on the website of the Danish Transport Authority.

¹¹ The 11 TSIs for conventional rolling stock (CR TSI) comprise the following seven that have come into force: CR TSI CCS (Control, Command and Signalling), CR TSI NOI (Noise), CR TSI OPE (Operations and Traffic Management), CR TSI TAF (Telematics Applications for Freight), CR TSI WAG (Freight Wagons), CR TSI PRM (Persons with Reduced Mobility) and CR TSI SRT (Safety in Railway Tunnels); and the following four TSIs for conventional trains, which will come into force in 2010 or early 2011: CR TSI INF (Infrastructure), CR TSI ENE (Energy), CR TSI Loc and Pas (Rolling Stock) & CR TSI Tap (Telematics Applications for Passengers).

¹² The results are available [in Danish] on the website of the Danish Transport Authority.

Copenhagen central station

- 4) S-train hit displaced box girder in Allerød
- 5) Broken axle on 10-ton welding trailer
- 6) Engine fire in IC3 trainset
- 7) Unintentional coupling of metro trains

This section reviews the results of the investigations and the Danish Transport Authority's follow-up of recommendations from the Accident Investigation Board¹³.

Report (1) Tank wagon containing dangerous goods derailed at goods yard in Odense

On 29 November 2005 a 4-axle freight wagon was derailed at points when shunting. The derailed tank wagon and the following tank wagon in the shunt sequence were damaged. Both tank wagons were loaded with RID goods and, although both were damaged, the tanks were not pierced. The accident also caused damage to the points and approximately 50 metres of track.

The Accident Investigation Board concludes that the derailment was caused by the following circumstances:

- poor condition of the points
- failure to follow up issue of traffic circulars with safety-related content to the relevant railway companies
- failure to set up the necessary portable signals.

The Danish Transport Authority will use regular supervisions and safety authorisation of infrastructure managers to follow up compliance with rules and procedures in accordance with the undertaking's safety management system.

Report (2) Train collided with combine harvester on level-crossing

An Arriva train collided with a combine harvester on level-crossing 233 between Kibæk and Borris on 28 July 2008. As a result of the collision the combine harvester was thrown into a field and landed on its roof. The combine harvester burst into flames and the fire spread to a field of wheat, burning approximately 500 m². The level-crossing was destroyed and there was extensive damage to the front of the trainset.

The accident resulted in serious injuries to the train driver and minor injuries to three passengers. The driver of the combine harvester died shortly afterwards.

The Accident Investigation Board concludes that the driver of the combine harvester was probably not aware of the red signal at the level-crossing, possibly because SMS messages were being sent and received by his mobile phone. His view may have been impaired from the high position of the combine harvester's cab.

The investigation shows that if the level-crossing had been equipped with a barrier, the driver possibly would have been more aware of the level-crossing. The Danish

Transport Authority continues to work on the recommendations arising from the investigation.

Report (3) Overhead lines damaged at Copenhagen C

A pantograph was damaged as the train approached platform 5 at Copenhagen central station from Østerport on 12 June 2007. The pantograph destroyed the bearing parts of the overhead line system and an overhead line mounting above the platform, as a result of which it fell onto the platform, hitting several people.

The overhead lines remained suspended above the roof of the train in the undamaged head spans. The damaged pantograph and the bringing down of the lines caused a short circuit, leading to a momentary interruption to the current.

Seven people sustained minor injuries and there was extensive material damage to the pantograph, overhead gantry, overhead line terminals, etc.

The Accident Investigation Board concludes that a pantograph on the train hit a transverse 400 V cable that had fallen down in connection with the renovation work. The bringing down of the overhead line system caused a short circuit, which interrupted the power supply. The overhead line system was not live when it hit the people on the platform.

Since the accident there has been a focus on application of safety rules to work on the track. The Danish Transport Authority considers it unlikely that a similar accident would happen again and is therefore not taking the matter any further.

Report (4) S-train hit displaced box girder at Allerød

On 20 July 2005 an S-train hit a box girder being used in connection with boring a new road tunnel at Allerød. The box girder was part of the reinforcement intended to keep the track and sleepers in place during the work to drive the new road tunnel bore under the S-bane suburban line.

On inspection it was confirmed that the box girder was skew and had been marked as a result of the collision. Two S-train carriages were damaged but no one was injured.

The Accident Investigation Board concludes that the collision was the result of the tunnel boring being started before the last train had passed. There was a lack of control over the direction of the boring, and the bore displaced the reinforcement (the box girder). The train arrived shortly after the error was discovered. The track expert and the SR works manager were not present at the time of the incident.

By using railway safety plans or similar, the undertaking's safety management system should be able to ensure that work on the track is scheduled and performed in a safe manner. The Danish Transport Authority carries out supervision to ensure this responsibility is being discharged and that the undertakings themselves carry out adequate supervision of compliance with the design and execution of the railway safety plans.

¹³ All the reports are available [in Danish] at www.havarikommissionen.dk

Report (5) Broken axle on 10-ton welding trailer

On 15 April 2010 a 10-ton welding trailer was derailed while being transported from a welding job east of Odense to a depot at Odense station. The derailment was caused by a broken axle and happened at points. The welding trailer, points and approximately 30 metres of track were damaged.

The Accident Investigation Board concludes that the broken axle and with it the derailment were caused by two key factors: 1) the design of the axle may initiate a fatigue fracture; 2) the simple design and suspension system of the carriage makes it unsuitable for one-sided loading of heavy components, which is what it had been used for.

The Danish Transport Authority checks that undertakings respect the general conditions listed in the vehicle's operating instructions, type approval (if any) or authorisation to bring into service (max. speed, load, maintenance, etc.).

Report (6) Engine fire in IC3 trainset

On 10 October 2009 the engine driver received a fire alarm warning from the undercarriage of an IC3 trainset. The alarm was received immediately after Hjerm, and the driver continued until Struer, where the fire brigade was called.

On 22 October 2009 another fire alarm was triggered from the undercarriage of an IC3 trainset. The alarm was received before Viby station. The engine driver confirmed the smell of smoke in the first-class compartment. He disconnected the diesel engines and the fire brigade was called to Viby station.

The Accident Investigation Board concludes that the two incidents have the same cause. One of the hose clamps on the crankcase exhaust pipes had damaged a fuel pipe, such that it was able to spray diesel oil onto hot engine parts.

The detection system in the train shut down the faulty diesel engines and stopped the fire spreading. There was, however, fire damage to both trains, but no one was injured in the accidents.

As a follow-up to the incidents, an action plan is being drawn up for inspection and possible repair of the trainsets in question.

Report (7) Unintentional coupling of metro trains

The Accident Investigation Board has investigated the circumstances of three cases of unintentional coupling of two metro trains on the holding tracks at Metroservice's workshop. The incidents did not result in any damage.

The Accident Investigation Board concludes that the three incidents have three different types of cause:

- the incident on 21.10.2006 was due to software error;
- the incident on 21.08.2007 was due to transmitter power being incorrectly set and software error;
- the incident on 21.10.2006 was due to incorrect use of a command in the control centre.

By means of supervision the Danish Transport Authority will monitor that undertakings validate and verify railway safety in connection with changes to their systems in accordance with their safety management systems.

Supervision of safety authorisations and certificates

Safety certificates and safety authorisations have a maximum period of validity of five years. During this period the Danish Transport Authority conducts a number of follow-up supervisions. This is done to ensure that the undertaking still fulfils the relevant requirements.

In January each year the Danish Transport Authority publishes a schedule of supervisions for the year. The supervision schedule reflects where and when supervisions will be carried out, and any subjects which are subject to special focus.

The content and scope of the supervision is determined on the basis of a number of parameters such as the undertaking's size, area of responsibility and safety indicators, and experiences of the Danish Transport Authority. All undertakings shall as a minimum be visited twice in the period to which the certificate or authorisation relates (five years).

Follow-up supervision of a safety certificate or safety authorisation is tailored to the individual undertaking. The aim is to provide objective evidence that the undertaking's safety management system is being implemented in accordance with the undertaking's documentation. Objective evidence is obtained by reviewing the undertaking's activities, randomly reviewing documentation of activities carried out and interviewing randomly selected employees.

In 2009 there was a special focus on all infrastructure managers and railway undertakings having a safety authorisation or safety certificate in accordance with the new rules. The requirement for safety management systems is new for the undertakings and is therefore subject to follow-up on an ongoing basis.

One particular topic has been supervision of maintenance of large bridges and transport of dangerous goods. At the same time there have been continuous evaluations of the use of risk assessments in the undertakings, including use of risk registers.

During 2009 the Danish Transport Authority had a total of six employees engaged in supervision. Supervisions are performed by a supervision team, which usually comprises two persons: a senior supervisor and another supervisor. In some cases there is also a technical specialist involved.

The supervisor and senior supervisor are persons with a superior knowledge of the railway sector supplemented by certified training as an auditor. Among other things the Danish Transport Authority ensures professional execution of supervision by means of uniform training and teaching of supervisors and ongoing coordination of the supervision team. All supervisors receive railway-specific training, e.g. how to behave on and near the railway, safety rules and risk assessment.

When a supervision reveals circumstances in contravention of current rules and guidelines, the supervision team must react. The Danish Transport Authority has the option to ban a specific activity or order an undertaking to bring circumstances into compliance with the rules and guidelines.

The undertaking may receive a non-conformity notice if it is established that it does not comply with its own safety procedures or requirements for the safety management system. A non-conformity notice is an objective confirmation that a given requirement is not being fulfilled in full.

Follow-up of orders and non-conformity notices is agreed in each case with the railway undertaking or infrastructure manager involved. Failure to act on a ban, order or non-conformity notice may have consequences for the undertaking's safety certificate or safety authorisation.

The Danish Transport Authority carried out 49 supervisions in 2009, breaking down into 29 in connection with safety authorisations and certificates, and 20 others with a specific focus area.

Number of supervisions of safety authorisations and certificates

Of the 29 supervisions carried out in connection with safety authorisations and certificates, 13 involved railway undertakings and 16 infrastructure managers, cf. Table 2; six of these were follow-up supervisions.

In connection with a supervision, the Danish Transport Authority satisfies itself that all areas of the certification/authorisation are being followed up.

The Danish Transport Authority uses a special form of supervision, known as functional supervision. Functional supervision combines different control methods. A review is carried out of documentation of selected parts of the safety management system, documentation of activities carried out and a random sample of the activities in practice. This may lead to interviews with employees, monitoring of activities, and control of data in workshops, on the track or in operations.

Of the 29 supervisions mentioned above, seven were carried out as document reviews and 22 as functional supervisions. Three of the scheduled supervisions were cancelled and two were postponed.

Table 2. Number of supervisions in 2009

Supervisions, certificates and authorisations	Issue, renewal and amendment		Follow-up		Total
	Railway undertakings	Infrastructure managers	Railway undertakings	Infrastructure managers	
Laid down in the supervision schedule	10	12	0	0	22
Unscheduled	1	5	5	1	11
Carried out	8	15	5	1	29

Table 2. Supervisions in 2009 broken down by issue, renewal and amendment of certificates and authorisations and follow-up supervisions. The table shows that both scheduled and unscheduled supervisions are carried out.

The above supervisions have resulted in the Danish Transport Authority's issuing:

- 4 new safety certificates part A;
- 5 new safety certificates part B;
- 3 new safety authorisations.

The Authority has also amended:

- 2 safety certificates part A;
- 3 safety certificates part B;
- 1 safety authorisation.

Other supervisions

Each year the Danish Transport Authority carries out a number of supervisions in response to sudden events, e.g. accident investigations by the Accident Investigation Board and the undertakings themselves, or enquiries from the general public. Follow-up of non-conformity notices and orders that have been issued may also give rise to joint follow-up with the undertaking concerned.

The Danish Transport Authority designates focus areas of particular interest. In 2009 these included supervisions based on the specified focus areas maintenance of large bridges and transport of dangerous goods.

The Danish Transport Authority carried out 20 supervisions of this type in 2009.

Results of supervisions

The 49 supervisions the Danish Transport Authority carried out in 2009 resulted in the issue of five bans, four orders and three non-conformity notices.

The five bans were issued within the following two areas:

- use of staff for tasks for which it cannot be documented that they have the necessary skills or training;
- use of vehicles for which it cannot be documented that maintenance has been carried out in accordance with the rules.

The four orders were issued within the following three areas:

- lack of documentation of monitoring and maintenance of infrastructure;
- lack of documentation showing that vehicles used in operation had been duly authorised;

- lack of communication and monitoring of the effectiveness of the undertaking's safety management system.

The Danish Transport Authority has identified a number of non-conformities in connection with certification of the undertakings' safety management systems. Non-conformity exists when there is lack of compliance between the undertakings' safety management systems and the requirements that these must fulfil, or where the undertaking is not complying with the frameworks or guidelines laid down in the safety management system.

The Danish Transport Authority has identified 60 non-conformities in connection with supervisions in 2009.

The non-conformities have been identified in a number of areas in the undertakings' safety management systems, mainly within the following three areas:

- identification of standards and rules for the undertaking's safety-related activities;
- description of how the undertakings will ensure compliance with relevant TSIs;
- control of vehicles, technical equipment and plant, and documentation that these are maintained in accordance with approved monitoring and maintenance schedules.

The Danish Transport Authority has focused on the undertakings' internal supervisions, which in previous years have given rise to non-conformity notices. However, no non-conformity notices were issued for the railway undertakings' supervisions in 2009, and only in two cases were non-conformity notices issued to infrastructure managers.

The undertakings have largely used supervisions to ensure implementation of the safety management systems in their organisations. From 2010 the Danish Transport Authority will select a number of annual focus areas for supervision of the undertakings' safety management systems.

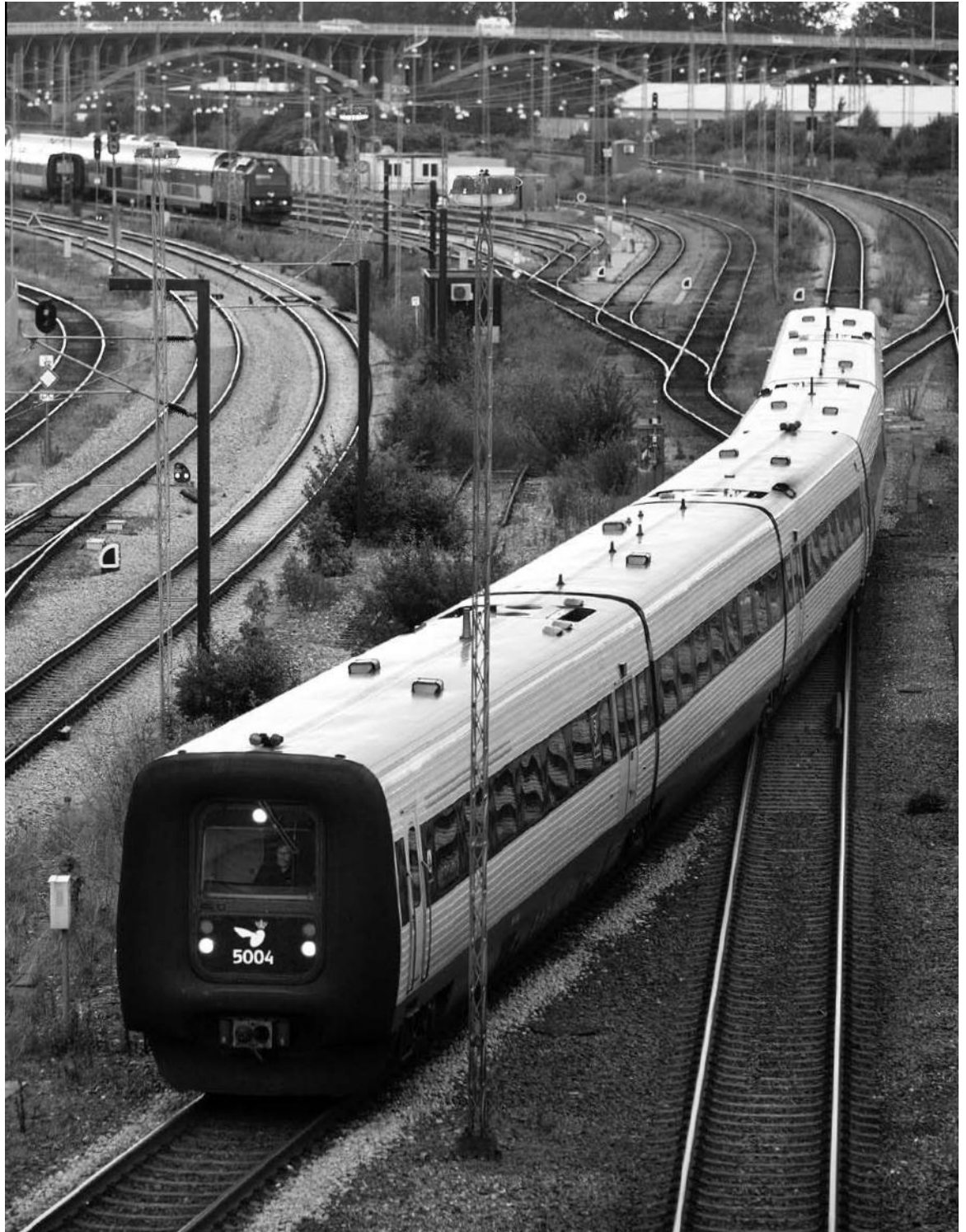
The Danish Transport Authority has not received any complaints about decisions in connection with supervisions in 2009.

Supervision of licences

When issuing licences to railway undertakings and infrastructure managers, the Danish Transport Authority must check compliance with a number of basic economic, insurance and legal conditions.

The Danish Transport Authority's supervision of licences is usually based on documents. The undertaking submits documentation showing compliance with the current requirements. Relevant authorities such as the Danish tax authority, municipalities and the National Police Board are consulted, and the submitted documentation is assessed.

The Danish Transport Authority issued one licence to a railway undertaking in 2009.



Two licences were subject to reassessment: one on the basis of a merger and the other as a result of changes in the company structure. Both are undertakings that function both as a railway undertaking and infrastructure manager. The Danish Transport Authority also conducted a detailed economic supervision of one

undertaking to ensure that it still fulfilled the statutory requirements regarding level of equity.

The Danish Transport Act has received insurance documentation from all the railway undertakings and infrastructure managers.

Chapter 3. Topic: Accidents at level-crossings

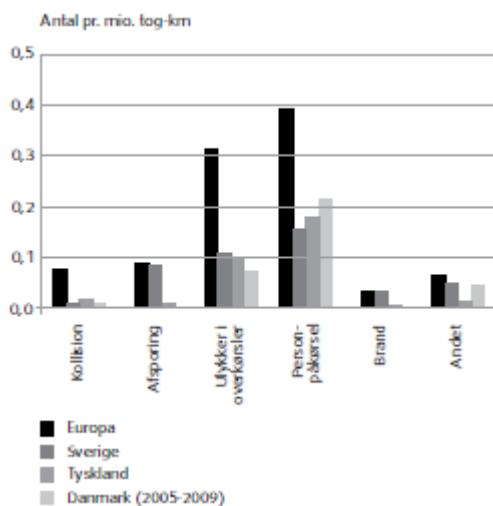
Accidents at level-crossings are a focus area for railway safety. Accidents of this type account for more than 20% of the significant accidents in Denmark – often resulting in personal injury. Inappropriate behaviour by road users is the primary cause of the accidents.

Level-crossing accidents in the EU

For the EU as a whole, accidents at level-crossings account for approximately 30% of all significant accidents¹⁴. The breakdown of accidents in Europe shows that collisions with persons and accidents at level-crossings account for the largest number of significant accidents.

Denmark has a low number of significant accidents per kilometre travelled. The breakdown between different types of accident shows the same picture in Europe and Denmark, as well as neighbouring countries with which we compare ourselves; see Figure 13.

Figure 13. Comparison of accident breakdowns in Europe 2007



Key

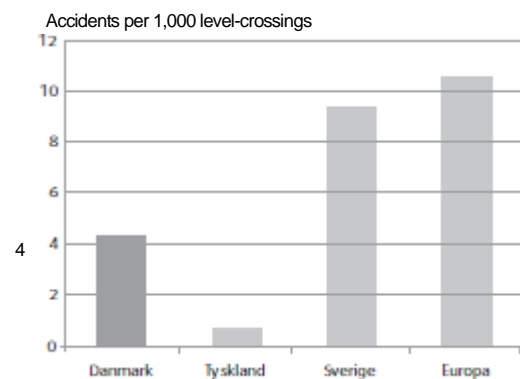
- Antal pr. mio. tog-km = Number per million train-km
- Kollision = Collision
- Afsporing = Derailment
- Ulykker i overkørsler = Level-crossing accidents
- Personpåkørsel = Collision with persons
- Brand = Fire
- Andet = Other
- Europa = Europe
- Sverige = Sweden
- Tyskland = Germany
- Danmark = Denmark

Figure 13 shows the number of significant accidents per million train-km for Europe as a whole and for Denmark and neighbouring countries with which we usually compare ourselves. As the volume of data for Denmark is relatively small, it is stated as a 5-year average. There are two 0-values for Denmark for derailments and fires. Before the common definitions were introduced, there were national differences in the method of calculation. Source: The European Railway Agency (ERA). Data for 2008 are not yet available.

In Denmark there were 0.07 significant accidents at level-crossings per million train-km, which is lower than in our neighbouring countries. For comparison, there are 0.3 significant accidents at level-crossings per million train-km in Europe as a whole.

The number of level-crossing accidents per level-crossing is low. We have approximately 0.004 accidents per level-crossing, whereas the figure for Europe is one and a half times higher¹⁵; cf. Figure 14.

Figure 14. Significant accidents at level-crossings in Europe 2007



Key

- Danmark = Denmark
- Tyskland = Germany
- Sverige = Sweden
- Europa = Europe

Figure 14. The number of significant accidents per level-crossing in Europe as a whole and in Denmark and our neighbouring countries in 2007. There is some uncertainty concerning the calculation method for number of level-crossings and the data should therefore be treated with caution. The Danish figure includes all level-crossings on operational lines, including local railways. Source: The European Railway Agency (ERA). Data for 2008 are not yet available.

¹⁴ Data from the European Railway Agency (ERA) for 2007 and 2008.

¹⁵ 'Railway Safety Performance in the European Union 2009', European Railway Agency, 2009. The report is based on data from 2006 and 2007.

Looking at our neighbouring countries, Germany has a very low level of accidents per level-crossing. In Sweden the number of accidents per level-crossing is more than twice the figure for Denmark. The figures should be treated with caution, as there may be differences in the calculation methods in the different countries.

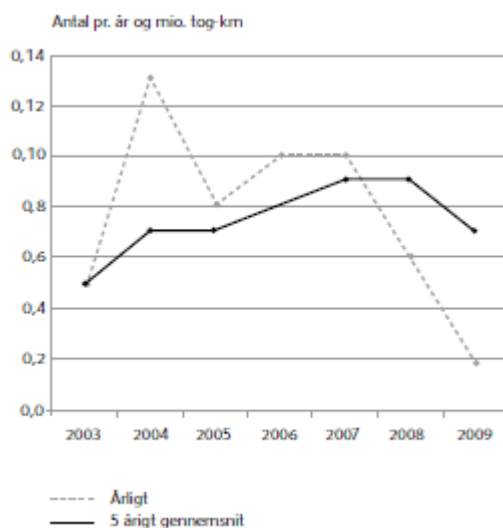
The relatively low number of accidents per level-crossing in Germany may be explained by the fact that there has been a tradition of surveillance at level-crossings. There may also be other unknown factors that may explain the difference.

In 2009 Denmark experienced a number of level-crossing accidents with serious consequences, putting the extent of personal injuries at the same level as the EU average despite the lower number of accidents; cf. Chapter 1 of the report on the breakdown of personal injuries.

Significant accidents at level-crossings in Denmark

There are an average of five to six significant accidents at level-crossings in Denmark per year, equivalent to approximately 0.07 per million train-km. The development in the number of significant accidents at level-crossings shows that there has been an upward trend in the 5-year average, though with a fall in 2009; cf. Figure 15.

Figure 15. Significant accidents at level-crossings



Key

Antal pr. år og mio. tog-km = Number per year and million train-km
 Årligt = Annual
 5 årigt gennemsnit = 5-year average

Figure 15. The development in the number of significant accidents at level-crossings involving serious personal injury and/or extensive material damage.

The quantities of data are relatively small, for which reason changes from year to year are readily apparent. The extreme points show a spread of two significant accidents in 2009, compared with a figure of 10 in 2004.

There were relatively few accidents resulting in injury or damage in 2009. But of all the significant accidents, the two accidents at level-crossings had the most severe consequences.

The first accident happened on 7 September 2009 in Vejlbj, when a married couple drove in front of a train at an unprotected level-crossing. Visibility and markings at the level-crossing were in order. According to the Accident Investigation Board, the accident was caused by the driver noticing the train too late and as a result not being able to bring the vehicle to a halt. Both occupants of the car were killed.

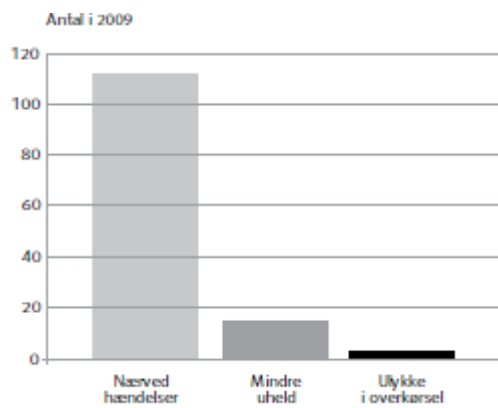
The accident with the most severe consequences took place on 19 September 2009 in Soderup. A lorry and train collided at a level-crossing protected by a half-barrier system. The train hit the driver's cab of the lorry, trapping a trainee train driver. Following the collision the train derailed, and the lorry was pushed to the side and burst into flames. The accident resulted in two deaths: the trainee in the driver's cab and the driver of the lorry. The train driver was seriously injured, and a train driver and seven passengers sustained minor injuries.

The accident in Soderup is a 'high-risk' accident, with the large vehicle on the level-crossing causing extensive damage to the train and several persons in the train being injured. It has been confirmed that the level-crossing was laid out in accordance with current guidelines and that the train was being driven correctly. The accident investigation shows that the lorry stopped too late and therefore drove into the barrier, which had come down. Reduced visibility as a result of fog and the lorry driver's raised blood concentration of THC (hash) may also have been significant to the accident.

Near-misses at level-crossings

As well as the two significant accidents involving serious personal injuries or extensive material damage, each year there are approximately 20 minor accidents at level-crossings and a number of near-misses. 'Near-misses' at level-crossings are when the train driver reports an irregularity. This is a situation where the road user should not be on the level-crossing but where no injury is sustained and no damage caused. The cause may be technological failure or human error. Figure 16 shows the breakdown between the three categories.

Figure 16. Significant accidents, minor accidents and near-misses at level-crossings



Key
 Antal i 2009 = Number in 2009
 Nærvæd hændelser = Near-misses
 Mindre uheld = Minor accidents
 Ulykke i overkørsel = Accident at level-crossings

Figure 16. Collisions and near-misses in 2009.

There is a ratio of approximately 2:10:100 between significant accidents involving serious injury or damage, minor accidents and near-misses. Minor accidents typically arise as a result of users of the level-crossing driving into parts of the level-crossing facility.

Level-crossings in Denmark

In 2009 there were a total of 1,364 level-crossings on trafficked sections of line in Denmark (see Annex 1). The majority of the level-crossings are on regional and local railways. There are few level-crossings on main sections of line where trains run at high speed. Dismantling the remaining level-crossings on main sections of line remains an objective. A high proportion of level-crossings in Denmark have automatic protection systems. A protected level-crossing warns users of the level-crossing when a train is coming. There are red lights, bells and possibly a barrier, which is activated automatically when users cannot use the level-crossing.

In all, 56% of level-crossings in Denmark have automatic protection (a total of 760 protected level-crossings in 2009). Germany is on a par with Denmark, but for the EU as a whole the proportion of level-crossings that are protected makes up 48% of the total. The proportion in Sweden is significantly lower, with just 33% of level-crossings being protected.

In Denmark a high proportion of the level-crossings are equipped with warning systems and barriers (45% in total). The remaining group of protected level-crossings are equipped with warning signal systems comprising red lights and bells, but no barrier (11%).

The proportion of level-crossings without automatic protection is 44%. These level-crossings do not warn users of approaching trains. The level-crossings are equipped solely with a gate or simply with markings, and sight zones are protected by land registration. The size of the sight zone depends on the speed of the railway and road traffic, to allow users to get their bearings before the train passes.

The probability of an accident at a protected level-crossing is four times higher than an accident at a level-crossing without automatic protection; see Table 3.

There were 32 accidents (around two thirds of the total) at level-crossings with half- or full-barrier systems.

It is not that level-crossings with barriers are inherently unsafe; the reason for the high number of accidents is more that there is a different traffic pattern at protected level-crossings. Level-crossings protected by barriers are typically located in areas close to towns but have a higher level of safety than an ordinary crossroads.

The probability of an accident at a level-crossing protected by a warning system is also higher than an accident at a level-crossing without automatic protection. This shows beyond a doubt that the number of accidents depends, among other things, on the annual daily traffic.

Risk highest for road users

It is rare for passengers or train staff to be injured in level-crossing accidents. In the period from 1999 to 2009 there were four accidents of this type, resulting in two deaths and three serious injuries to train staff. In addition, there were five serious and eight minor injuries to passengers.

The primary risk group in level-crossing accidents is level-crossing users. Light road users (pedestrians, cyclists and moped riders) account for just over half of those injured in significant accidents at level-crossings. The other half of the risk group comprises motorised vehicles.

Approximately 10% of the accidents can be considered high-risk accidents. These are accidents involving heavy vehicles, e.g. lorries and agricultural vehicles, which represent a significant risk of injury to train drivers and passengers.

Table 3. Significant accidents broken down by type of level-crossing (1999-2009)

Level-crossing	Level-crossings (%)	Significant accidents 1999-2009	Significant accidents (%)
Half- or full-barrier system	45	32	64
Warning signal system	11	8	16
No automatic protection	44	10	20
Total	100	50	100

Table 3. Number of significant accidents broken down by type of level-crossing. Data from 50 significant accidents 1999-2009. The number of level-crossings was calculated by all infrastructure managers in 2009; see data in Annex 1.

Passenger cars dominate, being involved in more than one third of the significant accidents; see Table 4.

Table 4. Counterparty in significant accidents at level-crossings

User	Number	Percentage
Goods vehicle	2	4
Tractor	5	9
Bicycle	7	13
Moped	10	18
Pedestrian	11	20
Passenger car	19	35
Lorry	1	2
Total	55	100

Table 4. Number of persons killed or seriously injured in significant accidents at level-crossings broken down by type of road user. Data on type of traffic are available for 55 significant accidents.

The majority of the accidents involving light road users happened at level-crossings with barriers. In fact, in the period 1999-2009 there were 18 accidents involving light road users at level-crossings with half barriers and three at level-crossings with full barriers.

Five accidents involving light road users occurred at level-crossings without automatic protection and level-crossings with warning signal systems. The probability of light road users being injured at a level-crossing with a

barrier proves to be 10 times higher than at an unprotected level-crossing.

Looking at significant accidents where the counterparty is a motorised vehicle, around half happened at level-crossings with barriers. The probability of accidents involving persons in motorised vehicles is, however, higher at level-crossings with warning signal systems relative to the number of level-crossings.

Protection of level-crossings is a key element when it comes to safety. It is worth noting, however, that by far the vast majority of accidents involving light road users, as well as most accidents involving motorised vehicles, happen at protected level-crossings.

The probability of accidents at unprotected level-crossings is very low in relation to the number of level-crossings. Unprotected level-crossings often have a low number of users. When accidents do occur, however, it tends to be motorised vehicles that are involved.

Investigations of collisions at level-crossings

Accidents at level-crossings may be subject to investigation by the Accident Investigation Board. The aim is to map the circumstances involved in accidents and establish the cause, with a view to future prevention.

Table 5. Risk to light road users broken down by type of level-crossing

Level-crossing	Level-crossings (%)	Accidents involving light road users	Accidents (%)
Half- or full-barrier system	45	21	81
Warning signal system	11	3	12
No automatic protection	44	2	8
Total number of level-crossings	100	26	100

Table 5. Breakdown of number of light road users (cyclists, moped riders, pedestrians) by type of level-crossing. The number of level-crossings was calculated in 2009. See data in Annex 1. Figures for personal injuries relate to the period 1999-2009

Table 6. Risk to motorised vehicles broken down by type of level-crossing

Level-crossing	Level-crossings (%)	Accidents involving motorised vehicles	Accidents (%)
Half- or full-barrier system	45	10	48
Warning signal system	11	4	19
No automatic protection	44	7	33
Total number of level-crossings	100	21	100

Table 6. Breakdown of number of motorised vehicles by type of level-crossing. The number of level-crossings was calculated in 2009. See data in Annex 1. Figures for personal injuries relate to the period 1999-2009

The following section presents the results of the investigations carried out in the period from September 1996 to December 2009. There has been a focus in this period on investigating and preventing accidents involving motorised vehicles, as the injuries and damage in these cases can be more extensive.

The analysis is based on a total of 37 accidents at level-crossings involving a collision between a train and another motorised vehicle. The small number of investigations involving light road users is not included. None of the accidents was the result of suicide or attempted suicide.

The physical circumstances of the accidents

The Accident Investigation Board's investigations show that the majority of the accidents happened on sections of line subject to a speed restriction for trains of 75 km/h.

The proportion of accidents at 'protected level-crossings' was approximately 65% of those investigated (24 accidents), while the proportion of accidents at 'unprotected level-crossings' was approximately 35%. This is largely in line with the general average for motorised vehicles, as we saw in Table 6.

Table 7. Accidents broken down by type of level-crossing (1996-2009)

Type of protection	Unprotected/protected	Accidents investigated
Gate	Unprotected	6
Marking	Unprotected	7
Warning signal system	Protected	10
Half-barrier system	Protected	12
Full-barrier system	Protected	1
Manually operated	Protected	1
Total		37

Table 7. Breakdown of number of accidents by type of level-crossings based on investigations of 37 accidents in the period 1996-2009. Source: Accident Investigation Board.

The accident analyses do not include data on the road categorisation in relation to e.g. traffic volume or the actual width of the road at the accident site.

In most cases it has been estimated that the speed of the road vehicle was 50-80 km/h or that it had stopped at the crossing. It can be stated that most accidents happened on work days, in the morning rush hour. Typically, at this time there are more train departures

and, at the same time, more crossings of the level-crossing.

Consequences of accidents at level-crossings

Accidents at level-crossings often have serious consequences. The train is rarely able to stop because the train driver is unable to establish that the level-crossing is occupied until it is too late. In 17 of the 37 cases, the train driver reacted and tried to bring the train to a halt before the level-crossing.

In 35 of the 37 accidents investigated there was contact between a train and a road vehicle. In one single case the train was even hit by two vehicles. When there has been contact between a train and vehicle, there has been damage to both the road vehicle and often also to the rolling stock. In two of the incidents the road user only drove into the barrier. Around one quarter of the accidents caused damage to the level-crossing facility, and in some cases there was also damage to the track.

Personal injuries were sustained in 23 of the accidents. The counterparty in the accident was usually a passenger car (which conforms to the general statistics for all significant accidents; cf. Table 3). There were a total of 55 personal injuries, with the largest number of fatal accidents involving users of the level-crossing; cf. Table 8.

Table 8. Personal injuries in accidents investigated

Injuries	Staff	Passengers	Road users
Deaths	1	0	13
Serious injuries	4	0	5
Minor injuries	1	23	8
Total	6	23	26

Table 8. Personal injuries broken down into train staff, train passengers and road users. Source: Accident Investigation Board.

In the case of road-traffic accidents, data are available on the gender and age of those involved but it is not possible to derive these data from the investigations. Typically, some groups of persons will be more vulnerable than others.

Causes of accidents at level-crossings

In efforts to prevent accidents at level-crossings, particular attention should be given to the behaviour of road users. The Accident Investigation Board concludes in its investigations of accidents at level-crossings that 31 of the 37 accidents, or 84%, are caused by errors on

the part of road users. Errors also occur on the part of the railway, but not as often.

Overall, most accidents involved a passenger car travelling on dry roads with good visibility. Witnesses of accidents at level-crossings state that level-crossing users do not always comply with the warning signals and road barriers. Greater focus has therefore been given to the behaviour of road users in traffic, particularly how they act at a level-crossing.

Behaviour of road users

One possible interpretation of the investigations is that users of level-crossings think there is just time to sneak over the crossing when the warning or barrier system has just started to operate. There is a tendency for road users only to perceive an active warning signal system when the road traffic is abreast of the stop line and the warning sign.

One of two things happens for the road user: either they fail to register the level-crossing and the sign as intended, e.g. due to inattention, or they register the level-crossing but choose to ignore the warning.

The underlying explanations for violations given by road users are often as follows:

- traffic regulations/signals and signs not interpreted as intended;
- the speed and forces of the train are difficult to judge;
- the road user is inattentive and fails to register markings and signals;
- the road user becomes distracted, e.g. by the sun low in the sky, mobile phone, etc. and does not react;
- for many road users with local knowledge it has become habit to cross the level-crossing even when it has been activated;
- the road user is trapped between lowered barriers, e.g. because the vehicle breaks down or there is a queue across the crossing;
- the layout of the level-crossing prevents road users from assessing their options.

It is important to consider what can be done to change the inappropriate behaviour. One solution is technical means of protecting the level-crossing. Another possibility may be to use speed-reducing measures or information/warnings at the level-crossing to attract the attention of drivers and cyclists. Users of level-crossings must be aware of the dangers the crossing presents.

Impatience

Danish drivers are accused of being impatient, and patience is particularly important in traffic. If drivers were more patient, road traffic would be safer. But everyone is in a hurry and this leads to people forgetting the most important traffic rule of all, namely driving according to the conditions and giving way.

As a whole, many road users forget to put themselves in the position of other people. For example, we become irritated when we have to stop at a red light, although we

know full well that it is essential for traffic to function. We are very protective of our own rights in traffic¹⁶.

Of the selected investigation reports, six of the accidents took place at level-crossings protected by gates. In half of these cases it was clear that the gate had not been closed after crossing the track and had therefore not served its purpose in securing the safety of road traffic.

This may testify to the fact that road users do not have the overview, the time or simply the patience to comply with the rules for crossing a railway using a level-crossing equipped with a gate, where the road user has to cross the track five times in order to cross correctly by vehicle (four times on foot, to open and close the gate, and once in the vehicle).

Inattention

In 28 of the 37 accidents investigated, the road user did not stop ahead of the level-crossing for orientation before crossing the railway. Twelve cases involved an unprotected level-crossing and 16 a protected one. Seen in relation to the proportion of level-crossings, this suggests that an unprotected level-crossing is easier to overlook.

Some of the accident investigations revealed that the road user had incorrectly judged that it was possible to cross the track before the train would pass the level-crossing, even though the protection system had been activated with red lights, ringing bells and possibly a barrier coming down. In some cases the road user perceived the level-crossing too late and was unable to brake in time.

Often the train driver registers a vehicle that fails to stop ahead of a level-crossing and is able to start emergency braking but a collision is unavoidable. In four of the cases the train driver tried to warn the road user by sounding the train's horn, but without the road user responding by bringing the vehicle to a halt.

Errors on the part of the railway

An error in railway operation was established in six of the accidents investigated. This is equivalent to errors on the part of the railway being a contributory factor in approximately 16% of the accidents.

Some of these errors are the result of passing signals at danger, something that often happens on sections of track without train control systems. Others may happen as a result of confusion in the communication between the train driver and traffic controller. This means that the train driver or traffic controller has been the direct cause of the accident.

The following errors on the part of the railway have been established:

- the level-crossing system was not activated in connection with the collision due to a fault in the system;
- signals passed at danger;
- the traffic controller gave permission for a slow-moving vehicle to cross the

¹⁶ Taken from www.trafikliv.dk

level-crossing.

The direct cause of the accidents was specifically technical errors in the level-crossing system. At a protected level-crossing there will be a fail-safe device that gives a stop signal to the train driver if the system is not activated. However, if the train driver does not respond correctly in danger situations, the train driver's behaviour becomes a contributory factor in the accident.

Experience of accident prevention at level-crossings

Collisions with persons and level-crossing accidents are focus areas for the European Railway Agency (ERA) as they account for the highest proportion of personal injuries on European railways.

Work is under way on all aspects of harmonising safety at level-crossings. This naturally includes modification of TSIs. At the same time it is important to improve road users' awareness of railway safety.

The initiative is known as 'the three Es' after the overarching principles of engineering, education and enforcement¹⁷.

The policy is based on the fact that while level-crossing accidents are primarily caused by road users, road users also cause problems for operation of the railway.

Future activities for level-crossing stakeholders will comprise:

- further harmonisation of signage at level-crossings;
- risk assessment of level-crossings (topology, annual daily traffic on the road and number of trains);
- modification of the level-crossing's design and equipment;
- improvement of road users' awareness by means of information campaigns on the risk;
- classification of rules for road users driving on level-crossings;
- improvement of learner driver training to focus on level-crossings;
- advising local authorities on risk management of level-crossings, including narrowing of bridges and tunnels.

It is recommended that the above measures are administered under the supervision of the European Commission's European Level-crossing Forum.

Example 1: France

France has made extra efforts to improve safety at level-crossings. There were approximately 14,700 level-crossings in France in 2007, and around 115 significant accidents resulting in an average of 36 deaths a year. Compared with France, Denmark has roughly half as many significant accidents per level-crossing.

The French infrastructure manager has worked with regional and local authorities to draw up criteria for the investments that will bring about a significant reduction in the number of level-crossing accidents in the long term. The priorities have been as follows:

- closure of the level-crossings with the most accidents;
- installation of extra safety equipment on the most heavily used level-crossings;
- upgrading of unprotected level-crossings in the event of increased train speed;
- level-crossings to be equipped with diagnostic equipment to reduce the number of critical errors in the systems.

In the case of the level-crossings with the most accidents, the equipment and layout or sight conditions have been improved. Road speeds have also been reduced.

One particular objective was to improve safety at unprotected level-crossings by warning road users using traffic lights and barriers. There was also a wish to close several unprotected level-crossings, which is an obvious but unacceptable or expensive solution.

The problem is that France has 3,800 unprotected level-crossings and the costs of protecting these would be enormous. At the same time, the number of accidents at unprotected level-crossings is relatively small.

Closer investigation showed that the number of accidents and personal injuries depends on the speed of the train. At speeds below 40 km/h there were virtually no fatal accidents, and at speeds above 90 km/h a certain increase in the number of accidents and an increase in the number of fatalities were apparent.

The final action plan prioritised the measures depending on the speed of the section of line at the level-crossings.

On sections with a train speed below 40 km/h, no improvement measures were introduced. Around 800 level-crossings on single-track stretches of railway with speeds of 40-90 km/h will be upgraded with road signals but no barrier. On single-track stretches of railway with speeds over 90 km/h and double-track sections over 40 km/h, 350 level-crossings will be upgraded with half barriers and lights.

It is expected that France can reduce the number of accidents by up to 10% on the most vulnerable stretches.

Example 2: the UK

The UK has the best safety record on level-crossings in the EU and has made some changes in its approach to prevention. It is assessed that around 95% of level-crossing accidents are caused by road users. It is thought that the accidents are the result of incorrect use of the level-crossing on the part of road users, lack of understanding (error) or deliberate actions (contraventions).

An investigation programme in the UK revealed that traffic information to road users was delivered using a

¹⁷ The European Commission Workshop on Level-Crossing Safety took place on 15 and 16 April 2010.

complex mix of fixed signs, traffic signals and acoustic warnings that has evolved over time.

A large number of guidelines for design of level-crossings are laid down in law, some in accordance with international treaties (such as the Vienna Convention of 1968). Most of the guidelines were, however, developed long before knowledge of the human factor was developed and applied in such situations.

It is, for example, not self-evident that all drivers can interpret the road signs and traffic lights at level-crossings if they deviate from the signage seen elsewhere on the road network. At the same time, many signs and signals at the same place can reduce situational perception, causing errors.

The conclusion was that signage should be reduced so that road users can be better informed. This will reduce the number of misunderstandings but will probably not have any great impact on deliberate contraventions. It was therefore recommended that the initiative be supplemented by a 'Don't run the risk' information campaign, and the first European Day of Action, which was held in 2009¹⁸.

A supplementary analysis has been carried out to survey best practice relating to information for road users. One predominant issue, for example, is whether there should be a green light signal to assure road users that it is safe to cross the track. This would provide better conformity with other road signals. Another important conclusion of the analysis is that road speed limits are of crucial importance to the level of risk at the level-crossing.

In a European context, the UK is one of the countries with the fewest accidents at level-crossings. However, accidents and fatalities involving the railway and road users are seen as a major problem, and a matter of public and political interest.

Conclusion on safety at level-crossings

On average there are five to six significant accidents each year at level-crossings in Denmark, or 0.07 significant accidents at level-crossings per million train-km.

Safety at level-crossings is very high in comparison with the European average, with Denmark having only half as many significant accidents as the average figure for Europe relative to the number of level-crossings.

Most accidents take place at level-crossings protected by barriers. It is therefore assessed that the number of users of level-crossings is significant to the number of accidents. Several experiences show that the speed on both the road and railway can also be significant to the number of accidents that take place and the extent of injury or damage.

The probability of accidents at unprotected level-crossings is very low in relation to the number of level-crossings. When accidents do occur however, it is usually motorised vehicles that are involved.

Accidents involving motorised vehicles are high-risk accidents. The focus on preventing these accidents should be maintained. Errors on the part of the railway must be avoided and staff training must remain in focus in order to prevent accidents.

At the same time it is important to remember the light road users, who sustain roughly half of the serious personal injuries received.

Experience shows that they cross the crossing because they do not perceive it to be dangerous. It may be the sight conditions, lack of barriers or open gates that give the impression there is no danger.

The primary cause of accidents at level-crossings is the behaviour of road users. This can be attributed either to lack of attention or conscious violations as a result of impatience and being in a rush.

Better protection of level-crossings may make road users more aware of the risk at level-crossings. But if road users deliberately violate the rules, protected level-crossings are not always a solution. In such cases rules, education and information are possible methods targeted at road users that may help to change bad habits.

Danish efforts in the area of level-crossings

In connection with the adoption of 'A green transport policy' by the government and supporting parties on 29 January 2009, an amount of DKK 36 million per year in the period 2009-2014 was originally allocated to close down or upgrade level-crossings.

In connection with the negotiations in October 2009, it was decided to accelerate the process and expedite investments of DKK 72 million for the period 2010 to 2020. It is expected that all unprotected level-crossings on Rail Net Denmark's network, which is where section speeds are highest, can be closed down or protected by the end of 2018.

Pools are allocated each year in the Green Transport settlements. In 2009 Rail Net Denmark was awarded funding to trial the use of new technology at level-crossings.

In 2010 the Danish Transport Authority will publish rules for level-crossings. The Authority's target is to set rules for protection and design of level-crossings relative to the circumstances in which they will be used. This is based on standards already in use governing the layout of road aspects of level-crossings.

¹⁸ More information at www.rssb.co.uk



Chapter 4. Issued certificates and authorisations

The focus is on streamlining the process for carrying out technical authorisations. By 2009 the majority of undertakings on the railway had a safety management system in place to handle safety in standard operations in the light of changes in the organisation and technical systems.

New certificates and safety authorisations

In 2009 the railway undertakings had their first experiences with safety management systems.

In the first phase of implementation it has been a challenge to ensure a common interpretation of when the requirements for safety certificates and authorisations are fulfilled¹⁹.

Different types of undertaking have different ways of organising themselves, building up safety management system and addressing operational challenges. The Danish Transport Authority's assessment is therefore based on the characteristics of the individual undertaking.

Encouraging the entire organisation to embrace the new way of working has been a challenge for the undertakings. At the follow-up supervisions however, the Danish Transport Authority has been able to establish that the undertakings are making active use of the safety management system. In many cases there has been a dynamic development of both system and organisation to the benefit of the undertaking.

The Danish Transport Authority wishes to conduct an ongoing dialogue with railway undertakings and infrastructure managers so that any problem areas can be dealt with directly with the Authority, via dialogue group meetings or the sector panel.

Safety certification

Safety certificates comprise a part A and a part B. Together, the two parts of the certificate cover the undertaking's safety-related activities as described in the Executive Order.

Part A of the safety certificate sets general requirements for the undertaking, including developing a safety management system. The railway undertaking must have a safety certificate part A in the country where it

has its main operations. This is valid throughout the EU for a maximum of five years.

Part B focuses on the specific infrastructure that the railway undertaking uses. The railway undertaking must have been issued with a safety certificate part B for each country in which it wishes to carry out railway transport.

Safety certificate part A

In 2009 the Danish Transport Authority issued four new safety certificates to railway undertakings.

In addition, the Authority amended two safety certificates on application. The one change resulted from a change in the name of the undertaking, and the other from an expansion of the undertaking's activities.

The Danish Transport Authority is not aware of any railway undertakings with a safety certificate part A from Denmark that have applied for a safety certificate part B in another EU Member State.

In three of the four cases where safety certificates part A were issued, the processing time was more than four months. This was because the undertakings wished to postpone the process. In these cases the Danish Transport Authority maintained a constant dialogue with the undertakings on development of the safety management system.

Safety certificate part B

In order to be issued with a safety certificate part B, checks are required to ensure that the railway undertaking's safety management system covers national requirements and conditions relating to the infrastructure intended to be used. A check is carried out on conformity between part A of the safety certificate and the new application for a part B.

All railway undertakings with a safety certificate part A in Denmark simultaneously receive a safety certificate part B to operate in Denmark. The requirements for both safety certificates are dealt with in one and the same process.

For railway undertakings with a safety certificate part A from another EU Member State, an application for a safety certificate part B is dealt with as a separate process. Safety certificates part B have been issued in Denmark to two railway undertakings with safety

¹⁹ The requirements for undertakings wishing to carry out railway operations in Denmark are specified in Executive Order No 13 of 4 January 2007 concerning safety authorisation of railway infrastructure managers and Executive Order No 14 of 4 January 2007 concerning safety certificates for railway undertakings.

certificates part A issued in another EU country. In both cases the undertakings are based in Sweden.

The Danish Transport Authority attaches importance to the undertaking ensuring coherence between the solutions the undertaking has described in part A and the solutions the undertaking has chosen to fulfil the requirements for part B. This can lead to the Danish Transport Authority asking about parts of the safety management system that have already been approved by a national authority in another EU country. In one of the cases the Danish Transport Authority considered it necessary to ask about the supervision on which part A had been based. The Danish Transport Authority subsequently found out that the undertaking's safety management system had been changed.

During 2009 the Danish Transport Authority amended three safety certificates part B. In two cases this was because the undertaking had changed name. In the final case, the undertaking wanted to expand operations on a new section of railway.

Safety authorisation

Safety authorisation requires the infrastructure manager to have built up a safety management system and to be able to document that the undertaking is able to control risks on the railway network. The infrastructure manager must undertake a coordinating role with respect to the railway undertakings that operate on its sections of track.

Two infrastructure managers received safety authorisations in 2008 in accordance with the new rules. During 2009 the Danish Transport Authority issued a further three safety authorisations to infrastructure managers. There are three infrastructure managers outstanding, all of which have had their safety authorisations extended while their applications are pending.

The Danish Transport Authority also amended one safety authorisation in 2009. Further to a merger, the undertaking's safety authorisation was to be extended to include an extra line, which requires the infrastructure manager to have the safety authorisation amended.

Annex 4 provides an overview of safety certificates/authorisations in 2009.

Personal certification

The Danish Transport Authority approves training programmes for persons who carry out safety-classified functions on the railway. The Authority also certifies train drivers. At the end of 2009 there were 3 009 persons with a valid train driver's licence registered with the Authority. Of these, 304 licences had been issued in 2009. The number of valid licences has increased by 11% compared with 2008, while the number of active train drivers is stable.

The Danish rules for certification of train drivers were updated in 2009 and brought into line with the provisions of the EU's Train Driver Directive. The new Executive Order²⁰ means that all current train drivers must have

been issued with new licences and certificates by November 2011. The requirement for frequency of in-service training is being adjusted, while medical requirements are being made more stringent (frequency and scope of medical examinations).

The Danish Transport Authority has continued its collaboration on public-sector train-driver training with the Ministry of Education, the railway sector, the examiners on the programme and the two colleges responsible for the theoretical part of the train-driver programme. An audit of public-sector train-driver training in accordance with the EU requirements has been initiated under the auspices of the Ministry of Education.

Medical certificates

The Danish Transport Authority issues medical certificates to persons who carry out safety-classified functions. A total of 3 780 medical certificates were issued in 2009 (2008: 3 178). One single complaint was made concerning a decision on a medical certificate taken by the Danish Transport Authority.

The Danish Transport Authority has chosen to recognise Swedish medical certificates issued for all types of safety-classified function. In addition, the Authority recognises German medical certificates for train drivers and employees in the undertakings not covered by the current agreements on mutual recognition. This has been done in order to give equal status to all undertakings and individuals who have been issued with a medical certificate in Germany or Sweden.

Technical safety authorisations

The Danish Transport Authority carries out safety authorisations for both technical and functional subsystems. This covers the safety-related systems in the infrastructure, the rolling stock and the rules that, together with technical safety, help to maintain a satisfactory level of safety on Danish railways.

Railway infrastructure managers and railway undertakings apply for authorisation to bring equipment into service in connection with any changes and implementation of new subsystems. Prior to this, the manufacturer of the new technical system must have a type approval stating how the system can be used in railway operations.

The undertakings shall assess whether the system complies with current safety requirements and can be implemented safely in the undertaking's operations. Documentation of this risk assessment is sent to the Danish Transport Authority as a basis for issue of authorisation to bring into service.

Authorisation of rolling stock

A significant milestone was reached in 2009 with the publication of Executive Order No 686 of 2 July 2009 on the authorisation of rolling stock in the railway area. The Executive Order reflects previous practice in the area, and specifies the requirements for documentation when applying for authorisation of rolling stock (see Chapter 5).

²⁰ Executive Order No 1116 of 1 December 2009 concerning certification of train drivers./

The Danish Transport Authority has drawn up an application form reflecting the provisions of the Executive Order. Check boxes on the application form provide the applicant with information on the documentation required. This increases the chances of an efficient administrative procedure.

In future all vehicles used in international traffic will have to be registered in the national vehicle register (NVR)²¹. With a few exceptions, vehicles that are only used nationally must be registered by 9 November 2010.

In 2009 the Danish Transport Authority therefore established a national vehicle register and implemented the registration of vehicles used for international traffic – to the extent applications were made for this. Accordingly, vehicles liable to registration may only be used when they have been registered.

First registration of a vehicle comprises allocation of a unique European vehicle number (EVN) and registration of the vehicle's authorisation to bring into service, information on the owner, keeper and person responsible for maintenance, and any restrictions on use of the vehicle.

Specific cases

Around 500 vehicle authorisations were issued in 2009, up 25% on the previous year. As in previous years, there were a large number of authorisations for works vehicles for modernisation and maintenance of the infrastructure. See Annex 5.

There were four very important cases in 2009:

1. new double-decker carriages
2. IC2 letter MP
3. IC4
4. Lint 41.

Re 1) In 2009 DSB applied for authorisation to bring into service a further 44 double-decker carriages (designated ABs, Bk and B). The carriages are of equivalent design to the 67 carriages for which DSB has previously obtained similar authorisation. The design has now been modified on a number of points, which is why TSI SRT (Safety in Railway Tunnels) has been applied for the first time in Denmark. Following an examination of the design of the carriages and the requirements of the TSI, it was established that the carriages conform to the transitional provisions and can therefore be taken into use.

Re 2) IC2 letter MP is a 2-carriage variant of the IC4. The train is designed for a maximum speed of 180 km/h and has an intercity interior equivalent to the IC4. The first project meeting between the producer AnsaldoBreda, DSB and the Danish Transport Authority was held in December 2009. The authorisation process will follow the new authorisation requirements and, in compliance with these, will use an independent third-party assessor.

Re 3) In 2009 AnsaldoBreda was granted type approval for the IC4. In the first instance the type approval

covered trainsets for single unit operation. DSB obtained authorisation to bring into service 14 trainsets, which were deployed in regional passenger traffic. DSB later obtained type approval for a trainset for coupling to another trainset. This type approval was used for the test operations.

Re 4) In the spring of 2009 the regional train operator Regionstog applied for authorisation to bring into service five LINT 41s. The manufacturer had obtained type approval of the train type. LINT 41 is a series-produced trainset of the CORADIA type prior to the application. The five new LINT 41 trainsets are broadly identical to the LINT 41 trainset previously delivered to Denmark, but specifically the trainset's control software has undergone extensive updating. The trainsets also needed to fulfil TSI NOISE, which had entered into force. The authorisation was issued and the trainset has subsequently been taken into use with a declaration of conformity for the type.

Authorisation of infrastructure

The year 2009 was characterised by a rising level of activity on the railway, which has generated a large number of applications for authorisation of small and large projects.

Taking a starting point in Danish law and EU legislation, work has been carried out on new executive orders for authorisation of infrastructure projects. Over the year new guidelines and guides have been taken into use to help applicants.

Examples of concrete cases

The rising level of activity meant approximately 250 new cases in 2009 in addition to completion of a number of earlier cases, including authorisation of the last stage of the existing Copenhagen Metro from Lergravensvej to Kastrup Airport.

In 2009 Metroselskabet, the company operating the Copenhagen Metro, wanted to be able to change the principles for establishing emergency shafts on the Metro Cityring, as this could save a lot of money. In this connection the Danish Transport Authority allowed Metroselskabet to waive the general BOSTrab regulations for tramway, metro and light rail operations. The specific design of the facility must demonstrate that the level of safety is not compromised.

One of the major projects on Denmark's railways in 2009 was the renovation of Sydbanen. Along the way it emerged that many changes were needed to the project. The challenge in the authorisation process lay in the fact that in many cases the Danish Transport Authority received the final application materials very late in relation to the desired date of bringing into service. This required a disproportionately high use of resources at the Danish Transport Authority to ensure that operations could be maintained.

Rail Net Denmark's extremely extensive Signalling Programme started in earnest in 2009. The aim is to replace all Denmark's signalling and interlocking systems over the next 10-12 years. The current schedule aims for the first S-bane section using CBTC (Communication Based Train Control) to be brought into

²¹ Cf. Commission Decision 2007/756/EC of 9 November 2007 adopting a common specification of the national vehicle register.

service in 2014. The first section of long-distance track using ERTMS (European Rail Traffic Management System) will be brought into service in 2017.

The new standard signalling systems will be introduced, while in the migration period the track network will continue to operate on a safe and commercial basis using the familiar 'old-fashioned' signalling and interlocking systems. A number of start-up meetings to plan the authorisation process were held in 2009²².

Regionstog applied to upgrade Odsherredsbanen, Tølløsebanen and Østbanen by increasing the section speed from 75 km/h to 100 or 120 km/h. The upgrade requires close cooperation with the Road Directorate on the aspects relating to level-crossings. Technical safety authorisation was not issued to Regionstog in 2009 and still requires considerable efforts by both Regionstog and the Danish Transport Authority. The upgrade project has several interfaces to track, interlocking technology, traffic management and warning systems at stations, bridges and other structures where risks to safety need to be assessed and documented.

There has been good cooperation throughout 2009 between Rail Net Denmark and the Danish Transport Authority on the guidelines for when Rail Net Denmark shall apply for authorisations to bring infrastructure into service. Among other things, this has resulted in a concrete basis for Rail Net Denmark's screening of projects prior to a possible application for authorisation.

Approval of safety rules

'Safety rules' refers to the railway infrastructure managers' and railway undertakings' technical and traffic-related safety rules, and regulations for the areas of infrastructure, rolling stock, training and traffic safety. It is the responsibility of the individual railway infrastructure manager and railway undertaking to obtain approval for the rules needed to maintain safety.

Among other things an application for approval of new or revised rules with safety-related content must contain a description of the amendment or addition being made and an assessment of the significance of this in terms of safety.

The Danish Transport Authority assesses whether the applicant has documented that the level of safety in the undertaking's new or revised rules conforms to the legislation, and whether these rules may have a bearing on other rules, standards or regulations. More extensive risk assessments are carried out in complex cases.

The largest single case within the area of traffic-related safety rules in 2009 was the work to approve a series of new rules for undertakings. This is the result of the work carried out in the railway sector in the last few years to split Rail Net Denmark's traffic-related safety rules (SR, SIN, etc.) into rules for railway infrastructure managers and railway undertakings respectively. From 13 December 2009 the traffic-related safety rules for infrastructure managers cover only specific transport rules for operations on the track, whereas all other instructions for operation of train technology and the

actions of train staff, etc. will in future come under rules issued by the individual railway undertaking.

²² For information on the Signalling Programme [in Danish] see: <http://www.trafikstyrelsen.dk/DA/Sikkerhed/Signalprogrammet.aspx>



Major cases include approval of a number of construction provisions drawn up by Regionstog A/S for the forthcoming speed upgrades on the Odsherreds-, Tølløse- and Østbanen railways, and abolition of Rail Net Denmark's Accident Regulations and inclusion of relevant rules from this in the Safety Regulations 1975.

In 2009 there were only a small number of minor amendments to the technical safety rules. The majority

of cases involved various waivers in connection with renewal projects on the railway.

Work was carried out on a number of major sets of regulations (e.g. concerning platforms, buffers and continuously welded tracks), which will probably be approved in 2010.

Chapter 5. Regulatory work: Laws and regulations

Implementation of the European regulatory reform has been in focus in 2009 and the international work has been stepped up.

Regulation of the sector – safety and interoperability

Based on a new strategy²³, in 2009 the Danish Transport Authority continued to work on implementing the European regulatory reform in the area of railway safety. One important milestone in this work was achieved in connection with publication of new Danish operational and traffic management rules.

In addition, cooperation with the sector on implementation has been significantly stepped up – partly via improved communication on the Danish Transport Authority's website concerning the new regulatory basis and partly via the appointment of a sector panel, dialogue group meetings, etc. for discussion of the new rules, among other things, cf. Chapter 2.

In 2009 the Danish Transport Authority developed and published a long series of guidelines on the Authority's website with a view to facilitating the work of the undertakings, including in connection with applications for authorisation. The Danish Transport Authority has also drawn up an Executive Order on authorisation of rolling stock, something which the sector has long asked for.

International work

In 2009 the Danish Transport Authority continued to implement the international strategy in the EU's working groups and decision-making bodies.

The Authority has taken a proactive role in the Commission's working group on extending the scope of the Interoperability Directive to cover the entire railway network.

The Authority has also participated and negotiated in the working groups under the European Railway Agency (ERA) drawing up proposals for legal provisions and the forums under the Commission and OTIF that take decisions on legal provisions.

The work was stepped up in 2009, particularly in the EU Commission's working group the Railway Interoperability and Safety Committee (RISC). Denmark supported the Commission's decisions on Common Safety Indicators (CSI), the TSI for Control, Command and Signalling (CCS) and extension of the TSI to Freight Wagons (WAG).

The Authority has further participated in both multilateral and bilateral discussions with the Commission and the other Member States, including on the following subjects:

- the Commission's work programme
- Common Safety Methods (CSM)
- Common Safety Targets (CST)
- certification of train drivers
- the ERTMS train control and communications system
- extended geographical scope of the TSIs
- mutual acceptance of non TSI-conforming vehicles (cross-acceptance)
- further development and audit of TSIs.

Targeted work has been carried out in the EU Commission's working group on Transport of Dangerous Goods (TDG) to safeguard Danish interests in safe transport of dangerous goods through railway tunnels (Great Belt and Øresund), and to retain sector expertise in handling transport of dangerous goods.

Denmark has also been involved in the Task Force for ERVID (European Rail Vehicle Information Database), which is planned as a database for the railway sector, including operation, safety, maintenance, dangerous goods, environment and energy.

As in 2008, one measure given special priority was the Authority's participation in working groups under the ERA. The aim of this is to put a Danish stamp on the recommendations that the European Railway Agency submits to the Commission.

Consequently, the Authority has participated in TSI working groups on Control, Command and Signalling (CCS), Operations and Traffic Management (OPE), Safety in Railway Tunnels (SRT), Persons with Reduced Mobility (PRM), Infrastructure (INF), Energy (ENE), Freight Wagons (WAG), Noise (NOI), Rolling Stock (LOC & PAS) and in working groups for CSM, CST, CSI and safety certification, ERTMS, and in working groups working on licensing and training of train drivers.

Denmark has participated with great interest in the ERA's Cross-acceptance unit. The working group is drawing up a common reference document containing rules for essential requirements that can be applied across national borders. The aim is to standardise rules wherever possible, with a view to simplifying the bringing into service of vehicles between neighbouring countries.

Annex 7 contains examples of what the Danish Transport Authority has achieved as a result of participation in the various groups and forums.

²³ *The Common European Railway System – a Strategy for a High Level of Safety and Flexible Implementation in Denmark, February 2009.*

New and amended regulations

The following executive orders or railway safety regulations (BJs)²⁴ were issued in 2009:

Provisions for operational and traffic management rules

The first milestone in implementation of the regulatory reform was achieved with the issue of new Danish rules on operation and traffic management²⁵.

The new Danish rules on operation and traffic management shall be applied in connection with establishment of new signalling systems on long-distance and suburban lines. The new rules integrate interoperability-related requirements from relevant common European regulations (TSIs) with special Danish requirements drawn up pursuant to the Safety Directive.

This means that the rules only specify what must be achieved, while the undertakings are free to determine the specific implementation themselves.

Executive Order on medical requirements

The Order amends the previous Executive Order on medical requirements. Among other things the amendment means that:

- persons engaged in cross-border traffic must observe the rules on intervals for medical examinations laid down in the TSI rules on operation and traffic management;
- conditional medical certificates may be issued e.g. in connection with treatment of heart conditions or alcoholism;
- blood, sweat and urine samples may be taken in connection with medical examinations. The samples are used to show whether someone is abusing e.g. alcohol or psychedelic drugs.

Executive Order on light railways (the Copenhagen Metro)

The Order trims the previous Metro orders and repeals a number of requirements for e.g. terms and conditions, transport in the light railway area, relationship of operating contractors to citizens, insurance and compensation. These aspects are regulated instead in the Railways Act.

Executive Order on publication

The Order means that BJs and RID (Regulations for the international transport of dangerous goods by rail) may be published on the Danish Transport Authority's website, and come into force simultaneously.

This ensures fast and efficient publication, particularly of very large documents, e.g. the Technical Specifications for Interoperability (TSIs).

Executive Order on implementation of the Dangerous Goods Directive

The Order implements the Dangerous Goods Directive²⁶, which brings together the codes of practice for transport

of dangerous goods by road, railway and inland waterway.

The Directive enables the Member States to exempt certain transports of dangerous goods on condition safety is not compromised. Denmark has made use of this opportunity and had a reference to national legislation included in the annex to the Directive, specifically 'Provisions on transport of explosives in the Great Belt and Øresund railway tunnels, 15 February 2005'.

Executive Order concerning authorisation of rolling stock

Based on EU rules and current practice, the Order lays down the authorisation process for rolling stock. Different processes are specified depending on whether the authorisation concerns changes to the new rolling stock (renewal or upgrading) or authorisation of *new* rolling stock.

Executive Order on regulation

An order is issued each year regulating the compensation and insurance amounts that railway undertakings and infrastructure managers must pay or cover as a minimum.

The minimum insurance amount for 2009 for personal injury or loss of main provider and property damage is DKK 357 million. A lower minimum amount applies to historic railways.

Executive Order concerning certification of train drivers

The Order implements parts of the Train Driver Directive²⁷. The Order lays down that train drivers must have a licence and a certificate in a harmonised EU format. This will make labour more mobile and, among other things, support cross-border rail traffic.

²⁴ See detailed description in Annex 6.

²⁵ BJ 5-1-2009 DTR

²⁶ Directive 2008/68/EC of the European Parliament and of the Council of 24 September 2008 on the inland transport of dangerous goods.

²⁷ Directive 2007/59/EC of the European Parliament and of the Council of 23 October 2007 on the certification of train drivers operating locomotives and trains on the railway system in the Community.



Executive Order concerning public liability insurance for railway undertakings and infrastructure managers

The Order sets requirements for railway undertakings' and infrastructure managers' public liability insurance, including requirements for sum covered, excess and rights of injured parties.

The Order states that it is the undertakings that have an objective responsibility in relation to injury/damage to passengers, assets and third parties, and that they must be insured for this.

It also clarifies that specified types of event must not be exempted from undertakings' insurance cover, e.g. terrorism.

Technical Specifications for Interoperability (TSIs)

The following four Technical Specifications for Interoperability (TSIs), all applicable to high-speed trains, were implemented in 2009:

- HS TSI Infrastructure
- HS TSI Operations and Traffic Management
- HS TSI Energy
- HS TSI Rolling Stock.

At present there are no high-speed lines in Denmark but the EU Member States are legally required to implement TSIs adopted in the European Community and, were a high-speed line to be established in Denmark, the TSIs for high-speed trains would be observed.

The Danish Transport Authority has also implemented the following amendments to:

- TSI CCS Control, Command and Signalling for conventional and high-speed trains
- Commission Decisions 2006/861/EC and 2006/920/EC concerning the TSI relating to subsystems of the trans-European conventional rail system.

Amendment of TSI CCS (Control, Command and Signalling subsystem)

The amendment consists in the fact that there is now a schedule for how and when ERTMS will be implemented in the European countries. The TSI calls this schedule

'the European development plan'. The schedule has been drawn up by the Commission on the basis of the national implementation plans.

Amendment of Decisions 2006/861/EC and 2006/920/EC

The amendments concern the subsystems freight wagons (TSI WAG) and traffic operations and management (TSI OPE).

The amendment of TSI WAG means that the ERA can publish certain technical documents on freight wagons. In addition, the TSI states under which technical conditions authorisation to bring into service issued in one Member State is valid in others.

Annex P5 of TSI OPE (subsystem traffic operations and management) concerning requirements for marking of wagons has been amended. The amendment only concerns wagons with authorisation to be brought into service pursuant to the new Interoperability Directive.

The Safety Directive and secondary legislation

No further legal instruments were drawn up in Denmark in 2009 concerning the Safety Directive, but the Commission has laid down the following instruments in accordance with the Safety Directive, all of which are directly applicable in Danish law:

Commission Regulation (EC) No 352/2009 of 24 April 2009 on the adoption of a common safety method on risk evaluation and assessment

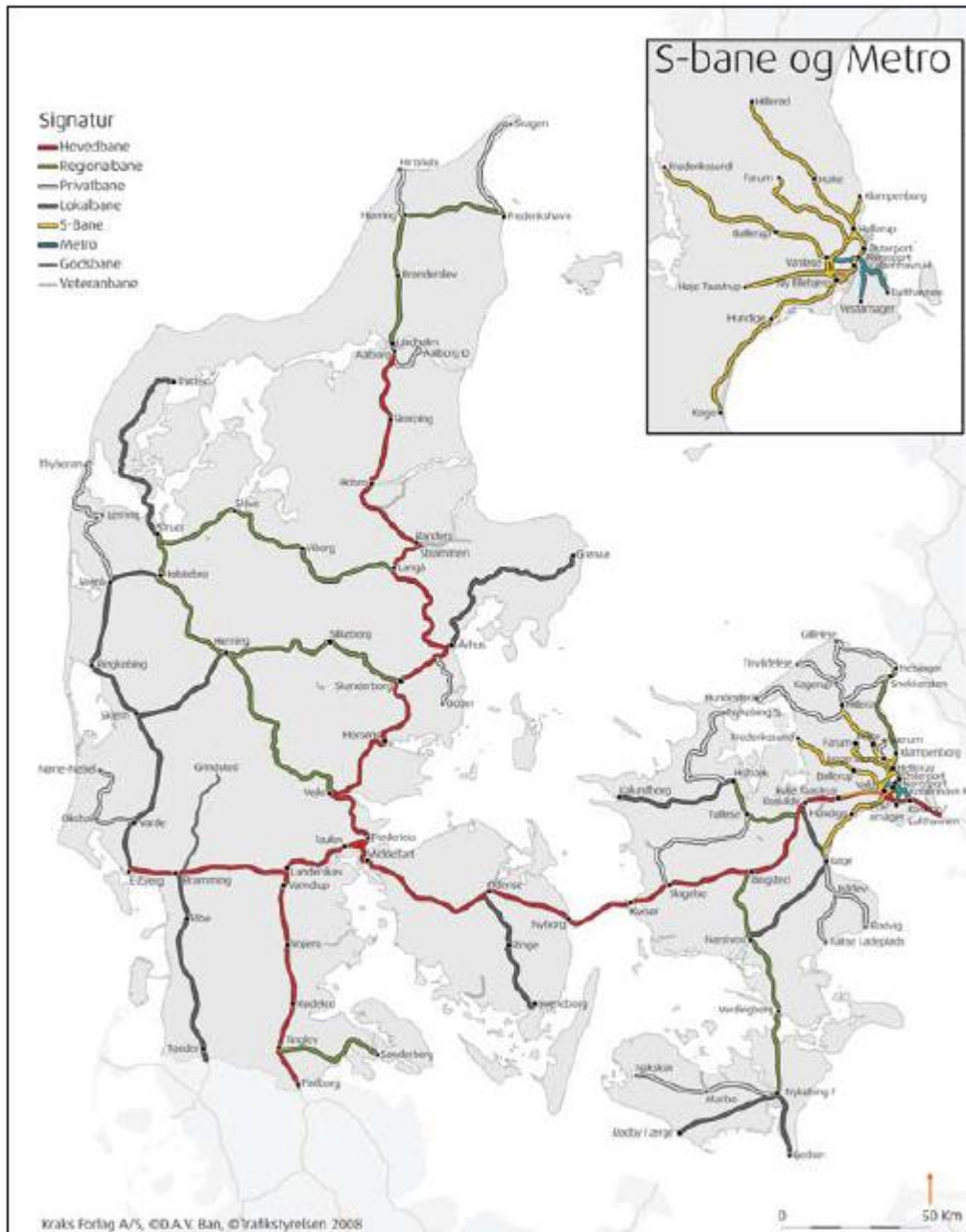
In brief, the Regulation addresses requirements relating to the risk assessment process. The Regulation is based on methods that have contributed to the level of safety in the European railway system. However, it does not come into force until 19 July 2010.

Commission Decision on the adoption of a common safety method for assessment of achievement of safety targets

The Decision will be used by the European Railway Agency to calculate and assess whether the Member States are achieving the common safety targets. The safety targets will be laid down by the Commission in a separate instrument in 2010.

Annex 1: The railway system in Denmark

Figure 17. The railway in Denmark 2009



Key
 Signatur = Legend
 Hovedbane = Main lines
 Regionalbane = Regional lines
 Privatbane = Private lines
 Lokalbane = Local lines
 S-Bane = Suburban lines
 Metro = Copenhagen Metro
 Godsbane = Goods lines
 Veteranbane = Historic lines
 S-bane og Metro = Suburban lines and Copenhagen Metro

Figure 17. Map of the various classes of line and their distribution in Denmark

Table 9. Information on railway infrastructure

Railway infrastructure	2008	2009
Number of infrastructure managers	11	11
Total length of lines	2838	2741
Length of lines with multiple tracks	962	946*
Length of lines with single track	1876	1721*
Length of electrified lines	687	705
Km of lines with ATC, ATC train stopping/ACT equipment	1436	1469
Total number of level-crossings	1563	1364
- Level-crossings with half or full barriers	652	610
- Level-crossings with warning signal systems	210	150
- Level-crossings without automatic protection	701	604
Number of mandatory signals	4187	4140

Table 9. Figures from railway infrastructure managers. *Figure for length of line is supplemented by information from Statistics Denmark.

Table 10. Information on railway undertakings

Railway undertaking	2008	2008
Number of railway undertakings	15	15
Number of locomotives	152	173
Number of trainsets (passenger transport)	547	634
Number of train drivers	2446	3249
Volume of passenger transport (million passenger-km)*	6474	6389
Volume of freight transport (million tonne km)*	1867	1698
Total number of kilometres travelled (million train-km)*	82.49	82.15

Table 10. Figures from railway undertakings. *Figures from Statistics Denmark

Annex 2: Definitions used

This annex indicates the definitions used for accidents and incidents.

Accident

'An unwanted or unintended sudden event or a specific chain of such events which have harmful consequences. Accidents are divided into the following categories: collisions, derailments, accidents at level-crossings, accidents involving persons caused by rolling stock in motion, fires and other.' [Executive Order No 646 of 25 June 2008, the Reporting Executive Order].

Serious accident

'Any train collision or derailment of trains resulting in the death of at least one person or serious injuries to five or more persons or extensive damage to rolling stock, the infrastructure or the environment, and any other similar accident with an obvious impact on railway safety regulation or the management of safety; 'extensive damage' means damage that can immediately be assessed by the investigating body to cost at least EUR 2 million in total' [Railway Safety Directive 2004/49/EC].

Significant accident

A significant accident differs from an accident in that it has more serious consequences. A significant accident results in death or serious injury, or serious damage to rolling stock, infrastructure or the environment which exceeds DKK 1.2 million or interruption of operation for more than six hours.

Minor accident

Minor accidents are accidents which have caused minor damage – costing less than DKK 1.2 million – and have not caused any serious injuries, and which cannot therefore be designated 'significant accidents'.

Incident (precursor to accident)

'Any occurrence, other than an accident, associated with the operation of trains and affecting the safety of operation' [Executive Order No 646 of 25 June 2008, Reporting Executive Order].

Safety irregularity

'An event on railway property which has not caused an accident or incident but which might have been of significance to railway safety' [Executive Order No 646 of 25 June 2008, Reporting Executive Order].

Significant accident involving a person

Significant accidents involving persons are determined as a weighted total of the number of persons killed (weighted 1/1) and seriously injured (weighted 1/10).

Person killed

'Any person killed immediately or dying within 30 days as a result of an accident, excluding suicides' [Commission Regulation (EC) No 1192/2003].

Person seriously injured

'Any person injured who was hospitalised for more than 24 hours as a result of an accident, excluding attempted suicides' [Commission Regulation (EC) No 1192/2003].

Categories of accident

- Collision, including collision with objects within the clearance gauge. A frontal or front-end collision between two trains or a side-on collision between a part of one train and a part of another train which is within the clearance gauge. This includes a collision with a train during shunting, e.g. running into, turning, push shunting, hard shunting and collision with moving carriages (excluding collision between works vehicles during shunting).
- Collision with objects, collision between a train and objects on or near the track. Obstructions may be fixed structures, such as buffers, bridges or tunnels, or objects temporarily located on or near the track (except at level-crossings) such as stones, earth, sand, trees, parts of rolling stock, road vehicles and machines or equipment for track maintenance. In railway statistics, animals are considered equivalent to objects. A collision is synonymous with that described in the Railway Safety Directive.
- Derailment, where at least one of the train's wheel sets has derailed
- Accidents at level-crossings involve at least rolling stock and a road vehicle, pedestrians or objects temporarily on or near the track if left behind by a user of the road (accidents at level-crossings also include footbridges and tractor paths). Accidents at level-crossings are synonymous with those described in the Railway Safety Directive.
- Personal injury caused by rolling stock in motion, accidents in which one or more persons is or are hit by rolling stock or an object which is, or has been, attached to the rolling stock, and persons who fall from the train or are hit by loose objects while travelling on the train (excluding suicide).



- Suicide or attempted suicide: suicide is an act to deliberately injure oneself resulting in death, as recorded and classified by the competent national authority (suicide is not considered a railway accident, but is recorded under this category). Attempted suicide is also recorded here: an act to deliberately injure oneself resulting in serious injury, but not in death, as recorded and classified by the competent national authority [Commission Regulation (EC) No 1192/2003].
- Fires in rolling stock, fire or explosion arising in the rolling stock (including freight) when it is in motion between a departure station and a destination, including at stops along the way and in shunting yards.
- Accidents involving dangerous goods: any accident involving escape of dangerous goods resulting in serious injury to persons, material damage or damage to the environment costing more than EUR 50 000, or the involvement of authorities or emergency services and the evacuation of persons or closing of public transport routes for at least three hours and which must be reported in accordance with section 1.8.5 of RID.
- Other: all accidents other than collisions, collisions with objects, derailments, accidents at level-crossings, injury to persons caused by rolling stock in motion, fire in rolling stock and accidents involving dangerous goods. This may be a collision/derailment of works vehicles during shunting and maintenance, accidents involving power supply or objects thrown from trains such as ballast, ice, etc.

Categories of incident

- Broken rails, all continuous breaks of rails and cracks on the running surface which are more than 50 mm wide and 10 mm deep.
- Buckling, faults relating to the joints and geometry of the track leading to a reduction in the permitted speed for safety reasons. Buckling is synonymous with track buckles, cf. the Railway Safety Directive.
- Signal failures which can be attributed to technical conditions, faults in the signalling system (either in rolling stock or in infrastructure, provided that the system fulfils its safety functions) which result in a missing signal or the presentation of a less restrictive signal than is required.
- Failing to stop at signal, any instance of rolling stock continuing in motion beyond the permitted area, including an unauthorised movement which would be anticipated and prevented in automatic train control systems or in safety regulations. An unauthorised movement may be passing a signal displaying stop, including written and verbal signalling, signs or hand signals, but not buffers. (Instances where the signal does not display stop in time for the train driver to stop are not included, nor are moving wagons.)
- Defective wheels and axles on rolling stock, faults on essential parts of wheels or axles entailing risk of an accident (derailment or collision).
- Incident involving dangerous goods: any incident with minor losses (damage costing less than DKK 325 000), with imminent danger of loss of contents, or with the involvement of the authorities or emergency services; incidents which must be reported under section 1.8.5 of RID.

Annex 3: Safety indicators for 2009

Data

The report's statistical analyses contain data from railway undertakings and infrastructure managers registered in the period 1999-2009. For private and local lines however, only limited data are available prior to 2003.

As the quantities of data per year are relatively small, individual accidents can give rise to big fluctuations in the statistics. This is why 5-year cumulative averages are calculated for comparison with annual figures.

Data are reported in accordance with the Reporting Executive Order (Executive Order No 646 of 25 June 2008). The definitions used are given in Annex 2 and described in greater detail in the guidance on reporting of accidents, incidents and safety irregularities.

Not all the figures were calculated using a common method in 2008, resulting in unstable data. All the data have undergone thorough quality reviews with a particular focus on adjusting discrepancies in accidents and personal injuries.

New categories of accident, incident and safety irregularity have been under development for some time and have gradually been implemented by all railway undertakings and infrastructure managers. The statistical information will be subject to a certain degree of inaccuracy until the new definitions have been in use for several years. The tables use () to indicate calculations of 5-year averages where data are unreliable because the calculation method has changed significantly over the 5-year period.

Current overview of national safety indicators

Table 11. Safety indicators for 2009

Indicators	Total in 2009	Total in 2009/million train-km	5-year average / million train-km
Significant accidents	29	0.35	0.37
Minor accidents	487	5.93	9.74
Incidents	649	7.90	10.83
Safety irregularities	2640	32.14	35.95
Persons killed	15	0.18	0.17
Serious injuries	15	0.18	0.16
Suicides	32	6.79	3.0
Costs associated with serious personal injuries, DKK million	150	0.39	0.31

Table 11. Safety indicators for the railway. Significant accidents are recorded in situations giving rise to serious personal injuries or material damage in excess of DKK 1.2 million, excluding suicides. Costs are calculated using the Ministry of Transport's price index, 2008.

Table 12. Indicators relating to significant accidents

Significant accidents	Total in 2009	Total in 2009/million train-km	5-year average / million train-km
Collision of trains	1	0.01	0
Derailment	0	0	0
Level-crossing accidents	2	0.02	0.07
Accidents involving persons	21	0.26	0.21
Fire	0	0	0
Accidents involving dangerous goods	0	0	0
Other	5	0.06	0.04

Table 12. Significant accidents are recorded in situations giving rise to serious personal injuries or material damage in excess of DKK 1.2 million. The total number of accidents in 2009 was 29.

Table 13. Indicators relating to persons killed

Persons killed	Total in 2009	Total in 2009/million train-km	5-year average / million train-km
Passengers	1	0.01	0.005
Staff	1	0.01	0.005
Users of level-crossings	3	0.04	0.050
Unauthorised persons on railway property	10	0.12	(0.09)
Others	0	(0)	(0.02)

Table 13. The figures for persons killed do not include suicides.

Table 14. Indicators relating to serious injuries

Serious injuries	Total in 2009	Total in 2009/million train-km	5-year average / million train-km
Passengers	5	0.06	0.060
Staff	2	0.02	0.022
Users of level-crossings	0	0	0.028
Unauthorised persons on railway property	7	0.09	(0.040)
Others	1	0.01	(0.018)

Table 14. The figures for serious injuries do not include attempted suicides.

Table 15. Indicators relating to minor accidents

Minor accidents	Total in 2009	Total in 2009/million train-km	5-year average / million train-km
Collision of trains	193	2.35	(6.03)
Derailment	50	0.61	0.93
Level-crossing accidents	14	0.29	0.17
Accidents involving persons	47	0.80	0.57
Fire	138	1.41	1.68
Other accidents	45	0.28	0.55

Table 15. Minor accidents not causing serious injuries and where any material damage is below DKK 1.2 million.

Table 16. Indicators in connection with incidents

Incidents	Total in 2009	Total in 2009/million train-km	5-year average / million train-km
Broken rails	40	0.22	(0.49)
Track buckles	2	0.04	(0.02)
Signal failures	43	0.52	(3.20)
Signals passed at danger	531	6.46	7.05
Broken wheels or axles	26	0.32	(0.20)
Incidents involving dangerous goods	7	0.09	0.12

Table 16. Figures for the six types of incident defined in the Reporting Executive Order (Executive Order No 646 of 25 June 2008).

Table 17. Indicators in connection with safety irregularities

Safety irregularities	Total in 2009	Total in 2009/million train-km	5-year average / million train-km
Risk of collision with person	284	3.46	(3.06)
Fault in braking system	66	0.8	(1.01)
Irregularity at level-crossing	111	1.35	(1.05)
Deformation of tracks	9	0.11	(0.28)
Signalling error	271	3.30	(8.34)
Gauge conditions	189	2.30	(3.39)
Vandalism	347	4.22	(5.01)
Other	1361	16.57	(13.80)

Table 17. Figures for the eight types of safety irregularity defined in the Reporting Executive Order (Executive Order No 646 of 25 June 2008).

Annex 4: Certification, safety authorisation and supervision

Safety certificates

Table 18. Safety certificates part A pursuant to Directive 2004/49/EC

	Updated/ amended	New	Updated/ amended	Renewed	Issued previously
Number of valid safety certificates part A issued to railway undertakings in 2009	Registered in Denmark	4	2	0	6
	Registered in other Member States	0	0	0	0

Table 18. Figures for safety certificates part A in 2009.

Table 19. Safety certificates part B pursuant to Directive 2004/49/EC

	Updated/ amended	New	Updated/ amended	Renewed	Issued previously
Number of valid safety certificates part B issued to railway undertakings in 2009	Registered in Denmark	5	3	0	6
	Registered in other Member States	0	0	0	0

Table 19. Figures for safety certificates part B in 2009.

Table 20. Applications for safety certificates part A

			A	R	P
Number of applications for safety certificates part A submitted by railway undertakings in 2009	Registered in Denmark	New certificates	1	0	0
		Updated/amended certificates	2	0	0
		Renewed certificates	0	0	0
	Registered in other Member States	New certificates	0	0	0
		Updated/amended certificates	0	0	0
		Renewed certificates	0	0	0

Table 20. Applications for safety certificates part A in 2009. Note that a safety certificate part A issued in 2009 may be the outcome of an application in a previous year.

A: Application accepted, certificate issued.

R: Application rejected, no certificate issued.

P: Case pending, no certificate issued as yet.

Table 21. Applications for safety certificates part B

			A	R	P
Number of applications for safety certificates part B submitted by railway undertakings in 2009	Registered in Denmark	New certificates	1	0	0
		Updated/amended certificates	3	0	0
		Renewed certificates	0	0	0
	Registered in other Member States	New certificates	0	0	0
		Updated/amended certificates	0	0	0
		Renewed certificates	0	0	0

Table 21. Applications for safety certificates part B in 2009. Note that a safety certificate part B issued in 2009 may be the outcome of an application in a previous year.

A: Application accepted, certificate issued.

R: Application rejected, no certificate issued.

P: Case pending, no certificate issued as yet.

Safety authorisations

Table 22. Safety authorisation pursuant to Directive 2004/49/EC

	New	Updated/ amended	Renewed	Issued previously
Number of valid safety authorisations issued to infrastructure managers in 2009	3	1	0	2

Table 22. Number of safety authorisations in 2009.

Table 23. Applications for safety authorisation

		A	R	P
Number of applications for safety authorisation submitted by infrastructure managers in 2009	New authorisations	3	0	3
	Updated/amended authorisations	1	0	1
	Renewed authorisations	0	0	0

Table 23. Number of safety authorisations in 2009 broken down into A: Applications accepted, authorisation issued; R (rejected): Applications rejected, no authorisation issued; P (pending): Case pending, no authorisation issued as yet.

Annex 5: Authorisation of rolling stock

Table 24. Authorisation of rolling stock in 2009

Licences for rolling stock	2009
Authorisations to bring into service for rail operators	160
Authorisations to bring into service for infrastructure managers and contractors	261
Authorisations to bring into service for historic rolling stock	7
Licence for transport of damaged rolling stock and rolling stock for audit, etc.	27
Permits for test runs and waivers	22
Authorisations of safety-related changes	44
Type approvals	10
Operational permits and other enquiries	8
Total	539

Table 24. Number of authorisations and permits issued by the Danish Transport Authority.

Annex 6: Amendments to legislation and regulations

Table 25. Amendments to legislation and regulations in 2009

Legislation	Instrument	Date of entry into force	New or amending legislation	Comments
Railways Act	Act No 134 of 24 February 09	Day after publication in the Gazette	Amending legislation	Among other things the amendment grants powers to set rules to the effect that certain rules need not appear in the Gazette.
Railways Act	Act No 532 of 12 June 09	1 July and 3 December 2009 respectively	Amending legislation	Among other things the amendment clarifies the infrastructure manager's responsibilities in terms of traffic management – and provides the authority to set rules concerning insurance.
Executive Order on medical requirements in the area of the railways	Executive Order No 72 of 02 February 09	5 February 2009	Amending legislation	On the one hand the amendment provides the authority to set conditions for medical certificates and the possibility of taking various samples (e.g. blood) and on the other an update pursuant to TSI Operations and Traffic Management with a view to cross-border traffic.
Executive Order on railway operations on light railways (the Copenhagen metro)	Executive Order No 73 of 02 February 09	5 February 2009	Amending legislation	The Executive Order adjusts and clarifies the regulatory basis for the Copenhagen Metro. Among other things it repeals provisions on business terms, insurance and compensation, transport in the light railway area, operating contractors' relationship to citizens, and penalty provisions and control fees.
Executive Order on publication of RID regulations and certain regulations from the Danish Transport Authority	Executive Order No 172 of 10 March 09	13 March 2009	New legislation	The Executive Order means that BJs and RID can be published on the Danish Transport Authority's website and come into force at the same time.
Executive Order on authorisation of rolling stock	Executive Order No 686 of 02 July 09	6 July 2009	New legislation	The Executive Order sets down the Danish Transport Authority's practice in authorisation matters concerning authorisation to bring rolling stock, etc. into service adjusted in connection with new EU rules.
Executive Order on transport of dangerous goods by rail	Executive Order No 601 of 23 June 2009	29 June 2009	New legislation	Among other things the Executive Order implements parts of the Dangerous Goods Directive (2008/68/EC). The Directive sets out the general framework for regulation in the area of dangerous goods. The regulations for transport of dangerous goods by road, rail and inland waterway are brought together in one directive.
Executive Order on certification of train drivers	Executive Order No 1116 of 1 December 2009	3 December 2009	Amending legislation	The Executive Order implements the Train Driver Directive (2007/59/EC) and sets competence requirements for train drivers driving trains on the Danish rail network. Among other things the Directive introduces a uniform certification scheme in all EU Member States. The Executive Order simultaneously repeals the BJ on requirements for train drivers (BJ No2-020.001).
Executive Order on regulation of insurance and levels of compensation under the Railways Act	Executive Order No 943 of 30 September 2009	1 January 2010	New legislation	The Executive Order regulates the annual compensation and insurance amounts applicable to railway undertakings' and infrastructure managers' statutory public liability insurance.
Provisions for operations and traffic management in the area of the railways	BJ 5-1-2009	1 January 2010	New legislation	Issues new Danish operational and traffic management rules in connection with the establishment of new signalling systems on long-distance and suburban railways. The BJ is being issued at an early stage because Rail Net Denmark's Signalling Programme needs to have the rules in place in connection with the tender process for construction consultancy and assessor tasks.

Legislation	Instrument	Date of entry into force	New or amending legislation	Comments
Executive Order on public liability insurance for railway undertakings and infrastructure managers	Executive Order No 1461 of 15 December 2009	1 July 2010	Amending legislation	The Executive Order lays down requirements for railway undertakings' and infrastructure managers' statutory public liability insurance, including cover amount, excess and rights of injured parties.
Executive Order implementing Commission Decision of 6 March 2008 concerning a technical specification for interoperability (TSI) relating to the energy subsystem of the trans-European high-speed rail system	Executive Order No 200 of 11 March 2009	11 March 2009	New legislation	TSI Energy for high-speed trains lays down requirements for the energy subsystem of high-speed trains.
Executive Order implementing Commission Decision of 1 February 2008 concerning a TSI relating to the operation subsystem of the trans-European high-speed rail system	Executive Order No 201 of 11 March 2009	11 March 2009	New legislation	TSI Operations and Traffic Management for high-speed trains lays down requirements for this subsystem.
Executive Order implementing Commission Decision of 20 December 2007 concerning a TSI relating to the infrastructure subsystem of the trans-European high-speed rail system	Executive Order No 202 of 11 March 2009	11 March 2009	New legislation	TSI Infrastructure for high-speed trains lays down requirements for the infrastructure subsystem for high-speed trains.
Executive Order implementing Commission Decision of 21 February 2008 concerning a TSI relating to the rolling stock subsystem of the trans-European high-speed rail system	Executive Order No 203 of 11 March 2009	11 March 2009	New legislation	TSI Rolling Stock for high-speed trains lays down requirements for the rolling stock subsystem for high-speed trains.
Executive Order implementing amendment to Commission Decisions 2006/861/EC and 2006/920/EC concerning the TSIs relating to subsystems of the trans-European conventional rail system (BJ No 6-04)	Executive Order No 9918 of 30 June 2009	1 July 2009	Amending legislation	The amendments concern two subsystems. In connection with the freight wagon subsystem the ERA can now publish certain technical documents. It further states under which technical conditions authorisation to bring into service issued in one Member State is valid in others. In connection with Operations and Traffic Management, there is an amendment to Annex P5 as a result of requirements for marking of wagons. This only concerns wagons with authorisation to bring into service pursuant to the Interoperability Directive 2008/57/EC.

Table 25. The summary shows where amendments have been made to acts or regulations with reference to the relevant instrument and a short description of what the amendment involves.

Annex 7: Examples of international work

Derailment Detection Device (DDD)

The Commission's RISC working group dealt with the issue of mandatory use of a mechanism to register derailment (DDD). The Danish Transport Authority was closely involved in the working group, which became more topical as a result of the railway accident in northern Italy (the Viareggio accident). The Danish position is that reactive measures such as derailment detection once the accident is developing should not prevent the use of more effective preventive measures in connection with maintenance. The Danish position is further that DDD should not result in the train being stopped automatically but should simply give a signal to the train driver.

The final text accommodates the wish for conditionality such that the Community will not take a decision until March 2012, based on the results of the relevant studies. This is important for Denmark, which does not wish to get into a situation where installation of (expensive) equipment is required that will not necessarily deliver the best solution.

Common Safety Indicators (CSI)

The aim of the ERA working group has been to implement Article 5 and Annex 1 of the Railway Safety Directive, with a particular focus on achieving a more uniform statistical basis with a view to assessing the level of safety in the Member States, i.e. by 'fleshing out' the indicators listed in the original Annex 1 to the Directive. A key aspect for the Danish Transport Authority has been ensuring that the common European requirements for reporting by undertakings do not unnecessarily burden the undertakings. The Authority was able to make its mark on the Commission Decision, including in terms of deletion of one indicator (reporting requirement) for number of lost working hours for staff as a result of accidents.

Common Safety Methods (CSM) for Conformity Assessment

The ERA working group shall provide proposals for common methods for the authorities' assessment of the railway undertakings' and infrastructure managers' safety management systems. The aim is to establish a greater degree of uniformity in relation to the issue of safety certificates and safety authorisations. The Authority has worked to achieve a balanced approach that both ensures detailed, uniform requirements and at the same time does not constrict the undertakings' ability to report their safety management systems in the way that suits them. The Commission's current draft Regulations seem to capture this balance between

degree of detail and accommodation of aspects specific to individual undertakings.

TSI Infrastructure (INF)

In connection with the decision on TSI INF in the Commission's RISC working group, Denmark had a provision introduced to the effect that in particular terrain conditions that affect the line, including geographical, urban or environmental restrictions, the line may be permitted to fulfil a lower speed or train length than laid down in the TSI. This avoids unnecessary costs that, according to Rail Net Denmark, could otherwise affect the Køge-Ringsted link, among others.

TSI Control, Command and Signalling (CCS)

The Danish Transport Authority has participated in the ERA working groups revising TSI-CCS, the ERTMS Focus Group and ERTMS Operational Harmonisation. The aim is to ensure uniform implementation of operational rules in the various goods corridors such that the ERTMS sections are subject to the same rules. The Authority is also helping to increase the possibility of the specifications for the coming version of ERTMS (Baseline 3) being error-free, tested and approved in 2012. The last-mentioned is considered to be very important for the roll-out of the Signalling Programme, which is based among other things on ERTMS.

TSI Operations and Traffic Management (OPE)

Through its participation in the ERA working group, the Danish Transport Authority has ensured that TSI-OPE is on a level with the new Danish code of practice for operations and traffic management (DTR) so that it does not (immediately) need to be changed in the new DTR rules, which among other things form part of the tender material for the Signalling Programme.

TSI Rolling Stock (RST or LOC & PAS)

The ERA working group is drawing up the proposal for the TSI for Rolling Stock. The Danish Transport Authority is focusing in particular on the TSI's requirements for drivers' cabs and dead man's handle devices. Work has been carried out to ensure that the TSI requirements harmonise with international standards already in use (UIC leaflets). The current status is that the formulated requirements for the driver's cab harmonise with the above standards, while it is still too early to assess the final format of the requirements for the dead man's handle device.

Extended geographical scope of the TSIs

The ERA's working group shall lay down a strategy for a revision of the TSIs (both those in force and not yet in force) that will make it possible for the TSIs to be applied not only on the Trans-European Network but throughout the European railway network. The Danish Transport Authority has strived to promote implementation of key stages on the way to full application of TSIs, including that:

- it is the Member States that categorise the railway infrastructure (and with it which level of requirements will apply to individual sections);
- coherence is ensured between the requirements of the TSIs;
- subjects in the TSIs that the Member States must/can set requirements for (open points) are largely covered by common EU requirements;
- evaluation of the economic effect is taken into account in the revision work.

It is impossible to calculate the effect of the Danish efforts as the working group's strategy proposal is not yet ready.

was entered into with Sweden and Germany, which both supported Denmark's request. The Commission's Committee on Transport of Dangerous Goods approved the two Danish requests in December – the only railway exemptions – and all that is required now is endorsement by Parliament.

International railway traffic in OTIF

Under the auspices of the international railway organisation OTIF, the Danish Transport Authority has participated in meetings of the RID Committee of Experts, where final decisions have been taken on additions/amendments to the RID regulations applicable to railways, as well as in OTIF's Committee of Technical Experts (CTE). The Authority has worked to bring two annexes to COTIF 99 (ATMF on technical rules and APTU on international railway traffic) into line with the EU's directives and TSIs. This will enable Denmark to subscribe to the two annexes and repeal its declaration pursuant to Section 42 of the Convention.

Under the auspices of the Council's land transport group, the Authority has also been involved in drawing up a proposal for the Community to subscribe to COTIF 99. This creates the general basis for Denmark to withdraw its declarations from the annexes to COTIF 99, and for Denmark not to be prevented from exercising exclusive competence where possible.

Dangerous goods

A common directive on inland transport of dangerous goods was adopted in the EU in 2009. In the EU Commission's working group on Transport of Dangerous Goods, the Danish Transport Authority worked in particular to uphold a high level of safety on transports through tunnels in Denmark.

The Authority has achieved two exemptions such that Danish quantity restrictions for transport of explosives through the Great Belt and Øresund Tunnels remain at 5 000 kg and 1 000 kg per wagon respectively. Working closely with the Commission, the process was effectively brought to an end in 2009. As a condition, an agreement



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Safety on the railway in Denmark in 2009 remains high. However, level-crossings continue to represent a challenge, and are a particular focus area in this report. 2009 was the year when safety management systems were introduced and approved for the majority of undertakings in the sector, enabling them to take a more systematic approach to railway safety.

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