European Railway Agency

Intermediate report on the development of railway safety in the European Union

2013

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Safety Unit

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List of abbreviations

ATP	automatic train protection
CSI	common safety indicator
CSTs	common safety targets
CT	Channel Tunnel
ERA	European Railway Agency
ERADIS	European Railway Agency Database of Interoperability and Safety
ERAIL	European railway accident information links
EU	European Union
FWSI	fatalities and weighted serious injuries
IM	infrastructure manager
KPI	key performance indicator
LC	Level crossing
NIB	national investigation body
NRV	national reference value
NSA	national safety authority
OSP	observed safety performance
p.a.	Per annum (per year)
RSD	railway safety directive
RU	railway undertaking
SMS	safety management system

BACKGROUND

Safety of European railways is relatively high, being one of the safest modes of transport. Even so, it is essential to maintain and improve the current level of safety for the benefit of European citizens. A safe railway is more efficient and also a more attractive transport choice, enabling society to address the environmental and economic challenges of the 21st century.

The European Railway Agency (ERA) is a cornerstone of the EU strategy for railway safety. It supports national safety authorities (NSAs) and national investigation bodies (NIBs) in their tasks and provides evidence for policy actions at EU level. It develops and promotes the common safety framework as a means for achieving an open railway market in the EU. The Agency also coordinates activities such as monitoring and provides support for the further development of EU legislation.

Monitoring safety performance is one of the key tasks of the ERA. The ERA collects, processes and analyses different sets of data, in order to support recommendations on actions to be taken. In this way, the Agency facilitates evidence-based policy- making at the EU level. By continuously monitoring and analysing safety performance, the Agency provides the assurance that the objective of maintaining and improving safety where reasonably practicable can be achieved.

The Agency is requested by EU legislation ([1]) to produce a report on safety performance on biannual basis. As a biannual report was published in 2012, there is no requirement to produce such a report in 2013; therefore no regular "Railway Safety in the EU" report is published by the Agency. Nevertheless, the availability of annual evaluation of railway safety performance is of vital importance for the Agency itself, EU and national policy makers, public agencies and experts from consultancies and academia.

This intermediate report is intended to provide an updated overview of railway safety performance across the EU and present results of various analyses of that performance. It also includes the results of various benchmarking exercises that have not been previously published by the Agency. They are all intended to share knowledge available to the Agency with all interested parties and enable them to make the railway system safer, more efficient and more competitive.

This report is unique in its nature - it is a once-only publication prepared exclusively in electronic format and its content has been customised to meet the present needs of the Agency and of its stakeholders, including the European Commission. The methodology applied throughout this report stems from the presumption that one cannot improve what one cannot measure ([2]).

Although this report relies heavily on quantitative data, the ERA is starting to use qualitative information for the evaluation of railway safety in the EU and its Member States in the coming years. The assessment of processes carried by National Safety Authorities and National Investigation Bodies extends the possibility for safety monitoring beyond safety outcomes and changes its nature from reactive to proactive.

([1]) Article 9(2) of the Agency Regulation (881/2004/EC)

([2]) In the words of Lord Kelvin: "*When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely in your thoughts advanced to the state of Science, whatever the matter may be.*"

SUMMARY

This report provides an annual overview of railway safety performance of the European Union. Following the statutory biennial report published by the European Railway Agency in 2012 in accordance with the requirements of the Railway Safety Directive, this is intended as intermediate report.

Most recently available figures confirm that railways remain one of the safest modes of transport in the European Union and worldwide. However, it has become difficult to sustain the trend in reducing casualties on railways. In particular, it appears that the sector continues to struggle to reduce the number of third-party victims, which represents 90 % of all casualties on railways, excluding suicides.

Safety performance of EU Member States varies considerably, with a more than ten-fold difference in risk for all categories of railway users. These differences have not reduced over the past few years and represent a major challenge for EU policy makers.

The continuous opening of railway market does not appear to be a threat to safety: the countries with advanced market liberalization have a better safety performance than other countries and they do not appear to be losing their position with time.

Around 2 400 significant accidents occur each year on the railways of the EU Member States. Accidents to persons caused by rolling stock in motion and level-crossing accidents constitute more than three quarters of railway accidents, excluding suicides. In these accidents, around 1 200 persons are killed and a similar number of persons are seriously injured each year.

In 2011, railway safety continued to improve across the EU, with 2 342 significant accidents resulting in 1 183 fatalities and 1 032 seriously injured. Accident figures have been decreasing considerably over the past five years; the casualty numbers have seen slight, close to uniform reductions over the same period.

Level crossing users are the only category of third-party/external victims for which the number of causalities has seen a reduction over the past five years; yet this reduction was less significant than the reduction in road casualties over the same period.

The number of suicide and trespasser fatalities has not seen any significant reduction over time. In consequence, while suicide and trespasser fatalities accounted for 84 % of all fatalities in 2007; their share has increased to 90 % in 2011. External victims, i.e. suicides, trespassers and level crossing users made up 98 % of railway fatalities in 2011.

Among 2 342 significant accidents that occurred in 2011, 44 were classified as serious accidents by National Investigation Bodies (NIBs) and as such investigated independently. In total, the NIBs opened an investigation into 249 accidents and incidents that occurred in 2011.

SAFETY OVERVIEW

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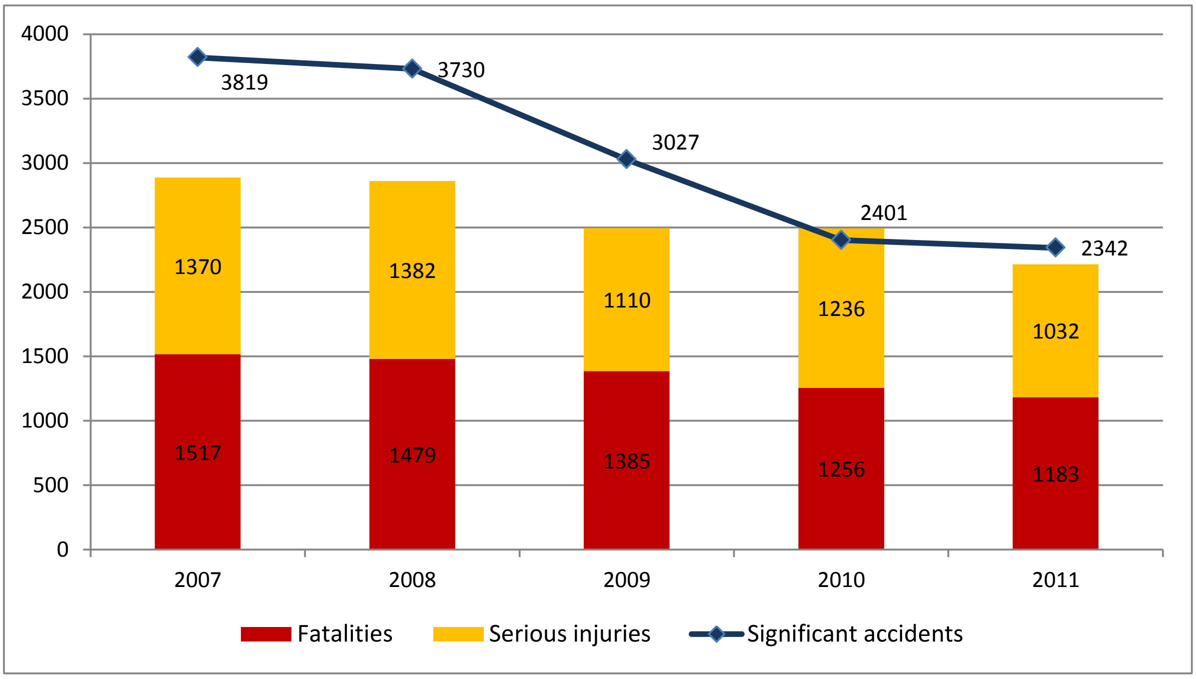


Figure 1: Significant accidents and resulting casualties for the EU-27 (2007–2011)

Comparisons of fatality risks for travelling passengers (occupants) reveals that train is one of the safest mode of transport. The fatality risk for an average passenger is about 0.15 fatalities per billion kilometres, comparable with the risk of commercial flight passengers of 0.1 fatalities per billion passenger kilometres. The fatality risk for a train passenger is three times lower than the risk for a bus/coach passenger (Table 1).

Transport mode used by user	Fatality risk (2008-2010) Fatalities per billion passenger kilometers
Airline passenger	0.101
Railway passenger	0.156
Car occupant	4.450
Bus/Coach occupant	0.433
Powered two-wheelers	52.593
Vessels passenger	N/A

Table 1: Fatality risk of passenger using different mode of transport (EU-27 in 2008-2010) ([3])

([3]) Source of data: EU transport in figures (Statistical Pocketbook 2012), DG MOVE 2012, European Commission

Historical development of railway safety

The overall level of railway safety in Europe, as measured by fatal train collisions and derailments per billion train-kilometres, has gradually improved since 1990, although there is considerable scatter from year to year. The estimated overall trend is a reduction in the accident rate of 6 % per year ([4]). This gives a fall of 70 % from 1990 to 2012 (Figure 2). The estimated underlying average number of fatal train collisions and derailments per billion train-killometers was about 4.4 in 1990 and 1.3 in 2011. Despite a positive long-term trend in the risk of fatal train collisions and derailments over the past two decades, the data in Figure 2 suggests that the progress has been slowing down, in particular since 2004.

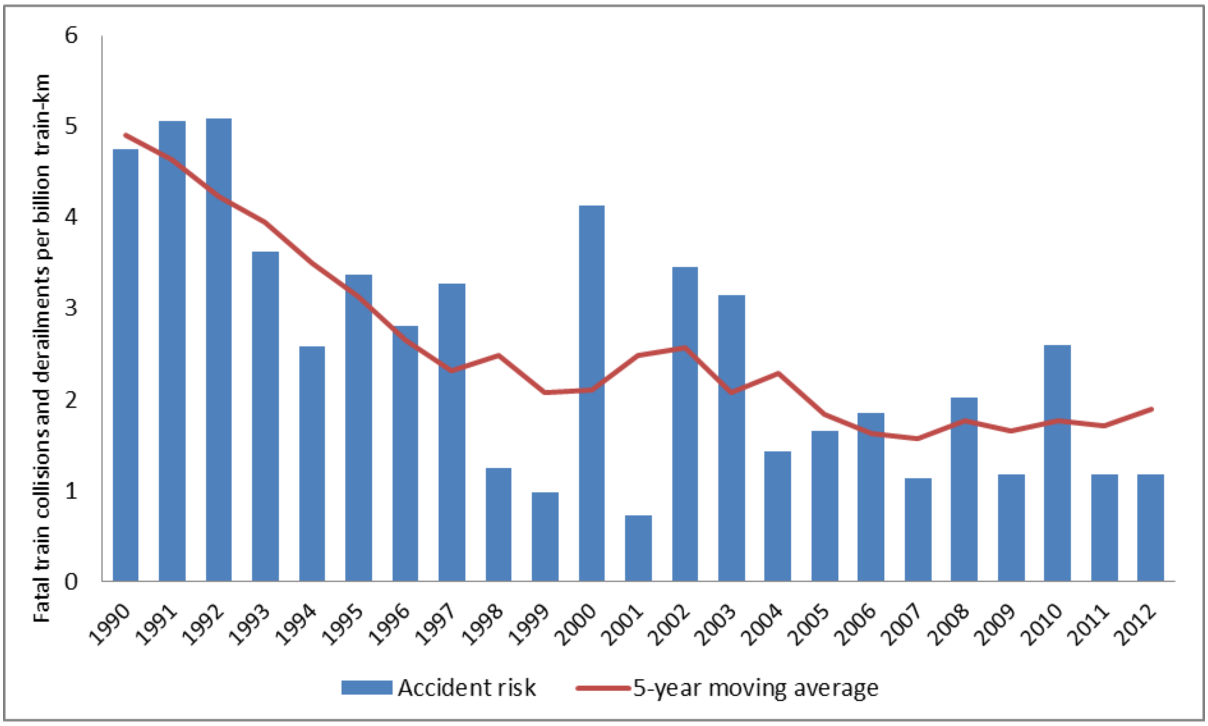


Figure 2: Fatal train collisions and derailments per billion train-kilometres in 1990–2012 for the EU-27, Switzerland and Norway ([5])

The number of fatalities in all railway accidents has seen a distinct, downward trend for all categories of accidents, except level-crossing accidents. This can be partly explained by the continuous increase in road traffic across Europe, as contributing to the likelihood of a level-crossing collision. The currently run programmes to remove or upgrade level-crossings might not be extensive enough to compensate for the increased risk of a level crossing collision.

Accidents with multiple fatalities rarely escape the attention of the media and the public, so data on these may be more complete. Figure 3 is based on data from the historical archive of railway accidents maintained by the Agency; it shows the number of major accidents and resulting fatalities for the 33 years 1980–2012. It includes not only the train collisions and derailments with 5 or more fatalities, but also the major level-crossing accidents, train fires, and accidents involving groups of persons struck by rolling stock in motion.

The trend in the accident rate per billion train-kilometres for accidents resulting in five or more fatalities is strongly downward over the period 1990–2012, but somewhat less steep if taken back to 1980–2012. Figure 3 shows that there were on average eight major railway accidents each year during the 1990s, this figure has

([4]) A. W. Evans (2011), 'Fatal train accidents on Europe's railways: 1980–2009', *Accident Analysis and Prevention* 43(1), 391–401.

([5]) Figure courtesy of Andrew W. Evans (Imperial College and University College London), based on own database of fatal train accidents and collisions and on the train-km data from the UIC, Eurostat and the ERA.

now come down to five accidents per year in the 2000s. There were four accidents with five or more fatalities in Europe in 2012, three of which were level crossing accidents.

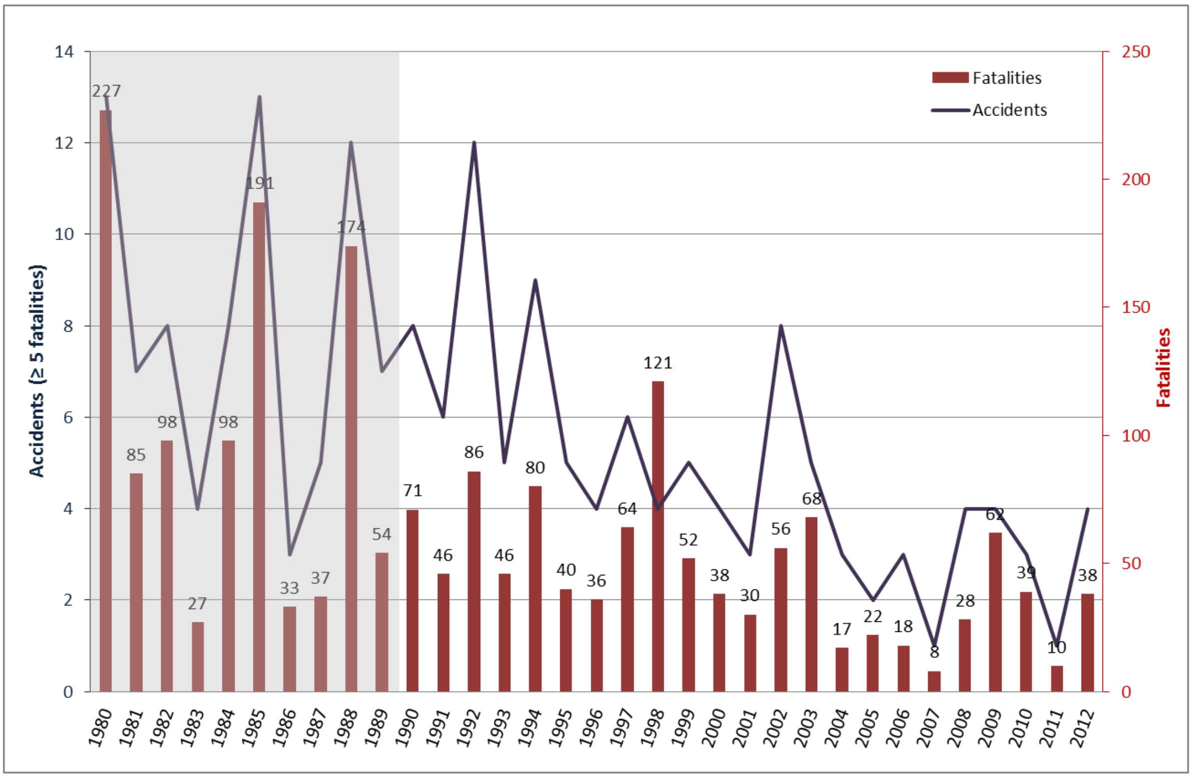


Figure 3: Railway accidents with five or more fatalities (1980–2012) ([6])

In conclusion, available historical data on fatal railway accidents shows a gradual improvement in safety over the past three decades, however restricting the analysis to the past eight years creates uncertainty about the trend in railway safety in Europe in recent years. This stems from the low number of fatal accidents and from their random nature.

([6]) All EU countries, Norway and Switzerland, excluding Romania for the period 1980–1989. Accidents on railway mainlines not covered by the RSD are also included.

Risk levels

Accident risk expressed in the number of outcomes per exposure is probably the best measure of the safety level. The framework for the evaluation of CSTs/NRVs also uses it as a basis for the assessment of safety levels at the level of Member States and the Union. Considering all railway fatalities (excluding suicides), the fatality risk per million train-km in the period 2009-2011 was 0.31 killed per million train km in the EU level. Yet the values of risk vary greatly between countries: The risk of countries in the lowest and highest 10th percentile differs by a factor of 15. (i.e. the fatality risk for Estonia (1.36) is 15 times higher than the risk for Ireland (0.09)). Interestingly, the countries with a fatality risk higher than average show much greater variations in risk than those outperforming the EU average. (The distribution of risk among countries is clearly asymmetrical, with the median value of 0.31, as compared to mean value of 0.60.) Actually, one third of countries seriously undermine the low level of risk at EU level. Six EU countries have a level of risk that is at least four times higher than the EU average as shown in Figure 4.

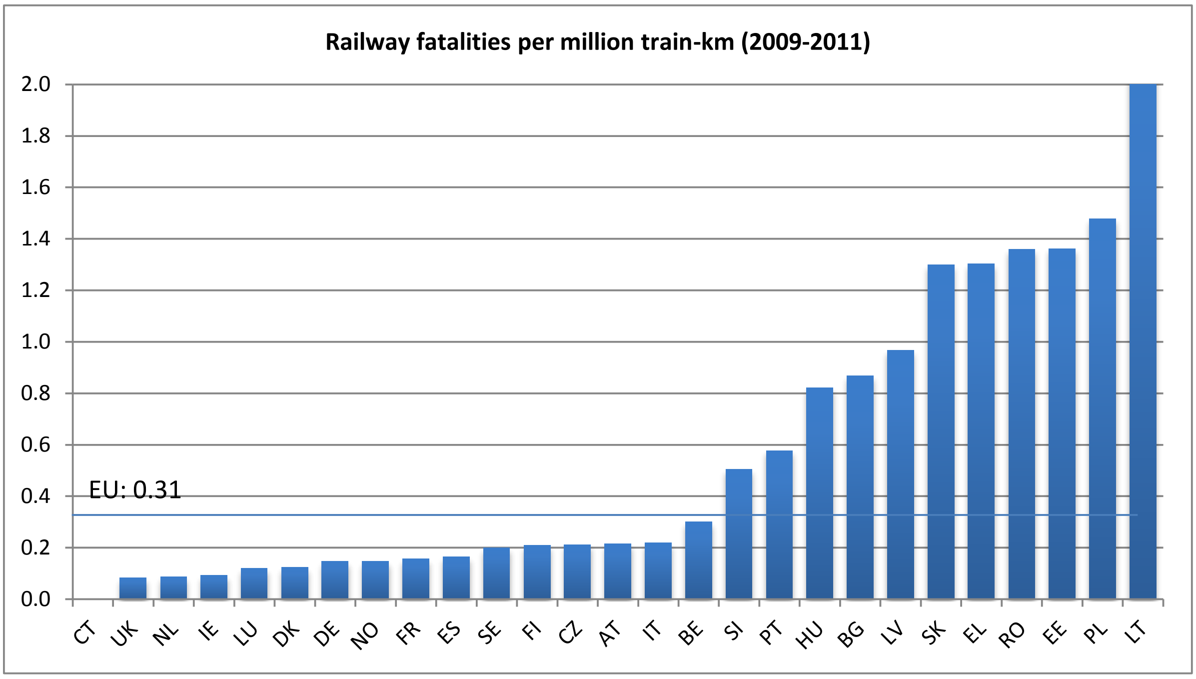


Figure 4: Fatality risk on EU railways: Fatalities per million train-km (2009-2011)

Another way to benchmark the level of risk of national railway systems is to look at the fatality risk of passengers expressed in terms of passenger fatalities per passenger kilometres. Six countries and the Channel Tunnel have recorded no passenger fatality in the period 2006-2011, thus their passenger fatality risk is zero. The countries with a level of risk higher than the average are typically those with a high risk for all persons on railways (8 countries have fatality risks for passenger and all users higher than EU average). This fact, together with the similarities in the distribution shapes, discards the common belief that the two measures of risk are not comparable and that the safety of passengers is not correlated to safety of other users.

There are certain limitations in the two benchmarking indicators: They rely on the numbers of fatalities only, since serious injury data are not believed to be fully comparable between countries and the period considered is not of the same length, because of limited compatibility of certain data before 2009. However, these limitations do not seriously undermine the conclusions that can be drawn from Figure 4 and Figure 5.

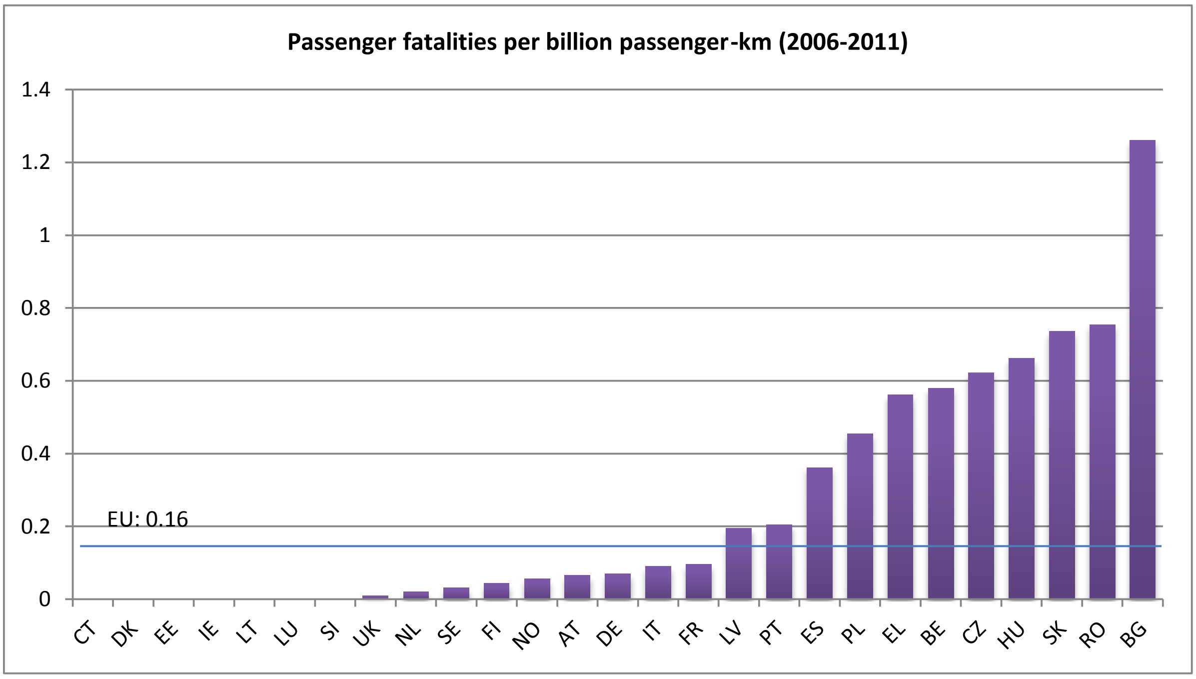


Figure 5: Passenger fatality risk: Passenger fatalities per billion passenger kilometres (2006-2011)

Similarly, one can show the levels of risk for different types of persons and different exposure. This is done in the framework of common safety targets (CSTs) and national reference values (NRVs), where the NRVs exist for 6 categories of persons and sometimes for two types of exposure. The NRVs are valid measures of risk that can be used for benchmarking similar to the one shown in Figure 5, but their value is limited due to the fact that they are not updated in regular enough intervals and often rely on relatively old data.

Selected descriptive statistics can be used to assess the development of differences in risk levels between countries over time. Fatality risk per million train kilometres for three groups of persons is considered: Passengers and employees, all railway victims except third parties (suicide, trespassers and LC victims) and all victims except suicides. The fatality risk is estimated for two periods: 2006-2008 and 2009-2011. For all three user categories under consideration, the fatality risk decreased considerably between the two periods (decrease in mean and median values). Similarly, the standard deviation characterizing how widely values are dispersed from the average value decreased over time, yet the relative decrease was more important for passengers and employees (and other) victims. When also considering level crossing users and trespassers, the relative reduction is only minor. The distribution of risk values for Member States is relatively peaked regardless the category of users considered seeing from positive kurtosis values. A relative increase in kurtosis in time suggests that the distribution has become less flat. With regard to passengers and employees, the decreases in risk variation have been driven by reductions in risk in countries which had relatively high risk values in the first period, given the increase in skewness. For other categories, the decrease in the variation of risk is a result of an overall reduction recorded for all countries.

Fatality risk per million train-km	*Period*	*Mean*	*Median*	*SD*	*Kurtosis*	*Skewness*
Passengers and employees	*2006-2008*	*0.049*	*0.039*	*0.043*	*0.021*	*0.882*
	2009-2011	*0.030*	*0.022*	*0.030*	*6.280*	*2.194*
All except third parties	*2006-2008*	*0.081*	*0.056*	*0.106*	*15.139*	*3.568*
	2009-2011	*0.048*	*0.031*	*0.054*	*9.678*	*2.871*
All fatalities except suicide	*2006-2008*	*0.724*	*0.379*	*0.665*	*0.075*	*0.973*
	2009-2011	*0.596*	*0.306*	*0.562*	*0.163*	*1.093*

Table 2: Descriptive statistics for fatality risk in periods 2006-2008 and 2009-2011

Common Safety Targets

Common safety targets (CSTs) are quantitative tools intended to monitor whether the current safety levels of the railways in the Member States are at least maintained. In the long term, they could also help to drive efforts to reduce the current differences in railway safety performance. Railway transport is the only mode of transport for which the targets have been prescribed by European legislation. The CSTs are EU-wide maximum risk values, the national reference values (NRVs) are the maximum risk levels set for individual Member States. The risks are measured by the number of weighted fatalities (FWSI ([7])) per train-kilometre. There are risk categories for passengers, employees, level-crossing users, unauthorised persons on railway premises, 'others' and as applied to society as a whole.

Second set of CSTs

As required by the RSD, the Agency proposed and the EC adopted the second set of CSTs and NRVs in 2012. The CSTs and NRVs of the second set are based on a six-year time series of data, from 2004 to 2009, that were delivered to Eurostat by Member States. The second set of CSTs and NRVs was calculated with the same method, defined in the CSM on the assessment of the achievement of CSTs, as the first set. The revisions made by the countries to Eurostat data were taken into account. Compared with the first set of CSTs and NRVs, the only difference is the extension of the period for which data was used for calculations. The calculation method, the data source and the risk categories are the same as in the first set. The values for the second set of CSTs are shown together with the values of the first set in Table 3.

Risk category / Risk in terms of FWSI per exposure			CST 1.set (× E-06) (2004–2007)	CST 2. set (× E-06) (2004–2009)
Risk to passengers	- per train-km	*CST 1.1*	0.25	0.17
	- per passenger-km	*CST 1.2*	0.00201	0.00165
Risk to employees		*CST 2*	0.0779	0.0779
Risk to level-crossing users		*CST 3.1*	0.743	0.710
		CST 3.2	n.a.	n.a.
Risk to 'others'		*CST 4*	0.0185	0.0145
Risk to unauthorised persons on railway premises		*CST 5*	2.03	2.05
Risk to the whole society		*CST 6*	2.51	2.59

Table 3: Values of the second set of CSTs for different risk categories

Figure 6 shows the values of the second set of NRVs for train passengers. The two indicators are showed at the same figure, the FWSI per passenger train-km and FWSI per 100 passenger-km. Not surprisingly, the two indicators are relatively well correlated, despite the fact that the hypothetical average train occupancy may vary considerably between MS. There are big discrepancies in terms of risk values among countries. The risk levels of Member States (estimated as NRV) differ by up to sixty times.

A detailed look at the descriptive statistics on NRV values (2004-2009) unveils huge variations in NRV values as expressed by the ratio between largest and smallest NRV value. The variation in NRV values for different categories of railway users is expressed through the coefficient of variation; the variation is most significant for the categories of passengers and for unauthorized persons.

While the extreme variation recorded for unauthorized persons is partly the result of poor statistics (suicide fatalities are often confused with unauthorized persons fatalities), the prevailing variation in risk for all categories of railway users under consideration is enormous and may be reflecting the different levels of infrastructure safety in Member States and the differences in the level of implementation of the common safety framework.

([7]) Weighted fatalities and serious injuries are the normalised measure of railway safety outcome. One seriously injured person is considered as 0.1 fatalities and added to the number of fatalities in the given year.

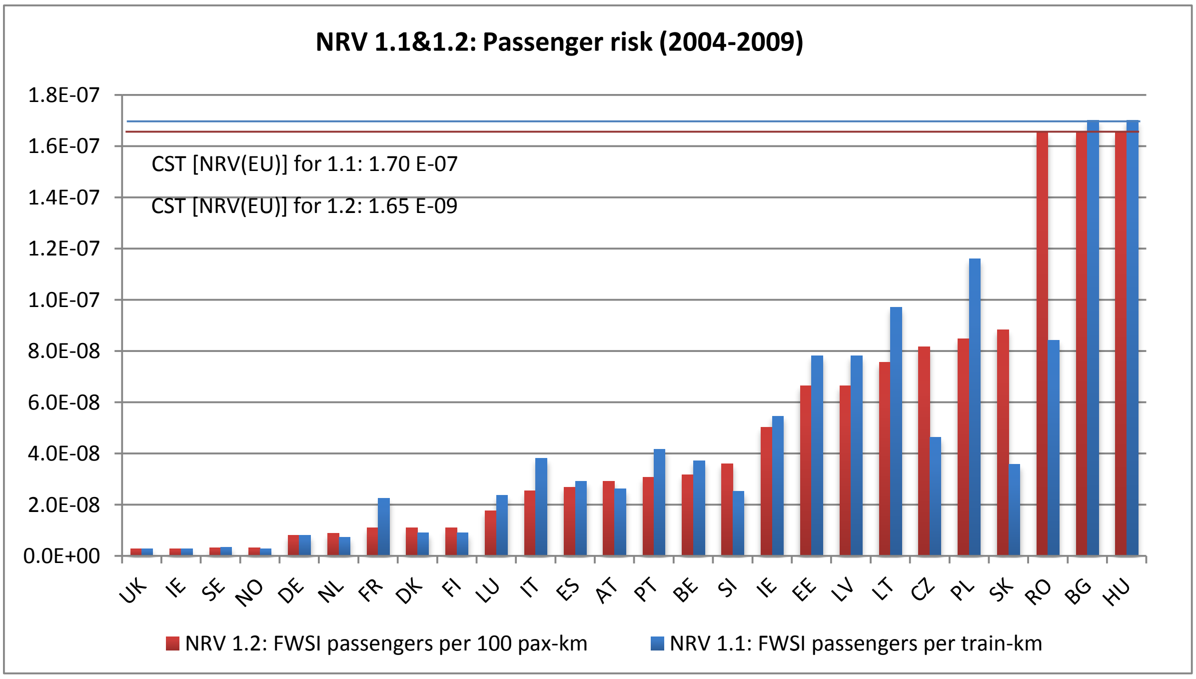


Figure 6: CST and NRVs for the passenger category (second set based on 2004–2009 data)

Two additional descriptive statistics are showed in Table 4: kurtosis and skewness. The low values of kurtosis indicate that the single NRV values are widely spread around the mean ([8]). The positive values for skewness (right skewed distribution) indicate that most values are concentrated to the left of the mean, with extreme values to the right. This means that a small number of countries have significantly higher NRVs compared with the average.

NRV (FWSI)	*Passenger*		*Employees*	*LC users*	*Others*	*Unauthorized persons*	*Whole society*
	1.1	*1.2*	*2*	*3.1*	*4*	*5*	*6*
Mean	*4.70E-08*	*4.89E-10*	*2.21E-08*	*2.18E-07*	*8.01E-09*	*4.89E-07*	*7.60E-07*
Median	*3.25E-08*	*3.00E-10*	*1.45E-08*	*1.62E-07*	*7.00E-09*	*2.02E-07*	*3.73E-07*
Largest	*1.70E-07*	*1.65E-09*	*7.79E-08*	*7.10E-07*	*1.45E-08*	*2.05E-06*	*2.59E-06*
Smallest	*2.73E-09*	*2.76E-11*	*1.36E-09*	*2.16E-08*	*2.41E-09*	*1.59E-08*	*5.09E-08*
Largest/Smallest	*62*	*60*	*57*	*33*	*6*	*128*	*51*
Coefficient of variation	*1.02*	*1.04*	*0.98*	*0.81*	*0.53*	*1.12*	*0.94*
Kurtosis	*1.61*	*1.02*	*0.93*	*0.87*	*-1.46*	*1.34*	*0.13*
Skewness	*1.45*	*1.36*	*1.39*	*1.04*	*0.32*	*1.39*	*1.01*

Table 4: Descriptive statistics for NRVs (2nd set based on Eurostat 2004-2009 data)

([8]) Leptokurtic distribution, sharper than a normal distribution, with values concentrated around the mean.

Second assessment of the second set in 2013

The second assessment of the second set was carried out by the Agency in early 2013 and delivered to the Commission at the end of March. The assessment was based on a five-year time series (2007–2011) of data on railway casualties that were delivered to Eurostat by Member States according to Annex H to Regulation (EC) No 2003/91 on rail transport statistics. The assessment was made for six risk categories of CSTs and NRVs using the method set by Commission Decision 2009/460/EC ([9]).

In general, the results of the annual assessment of achievements of CSTs/NRVs indicated that railway safety performance remains acceptable at the EU level for all categories of railway users under consideration. The results further showed other than acceptable safety performance in four Member States, usually for one category of railway users (Table 5). Only in one case the result of the assessment was "probable deterioration of safety performance". In some cases, the negative result of the assessment was due to poor quality data in years before 2007, used to set up the second set of CSTs. Following the consolidation of data carried out by NSAs at national level, the Agency recommended to the EC to revise certain values of NRVs for Slovakia, Bulgaria and Romania.

Risk category	Passengers		Employees	LC users	Others	Unauthorised persons	Whole society
	1.1 ([10])	1.2 ([11])	2	3.1	4	5	6
Possible deterioration	Slovakia	Slovakia	Romania Slovakia	None	Romania	Romania Slovakia Sweden	Romania
Probable deterioration	none	none	Bulgaria	None	None	None	None

Table 5: Results of the assessment of achievements of the second set of CSTs/NRVs - other than acceptable

Figure 7 shows the intermediate results of the second assessment of the second set of CSTs/NRVs for the category of whole society. The values of NRVs (second set) are plotted together with the values of OSP (Observed Safety Performance) in 2011 and MWA (Moving Weighted Average Value) for years 2007-2011.

To achieve an acceptable safety performance after two steps of the method, the OSP, or MWA have to be lower than the NRV stepped up by 20 %. The OSP value was however higher than NRV in nine countries (NO, SE, FR, IT, BE, SK, BG, RO, PL) and the similar observation was made for MWA value that was higher than NRV in nine countries (NO, IE, SE, IT, BE, SI, SK, RO, PL). It is largely thanks to the application of the 20 % margin that all countries but four showed acceptable safety performance in 2011.

([9]) Commission Decision 2009/460/EC on a common safety method for assessment of achievement of safety targets.
([10]) Scaling base: passenger train-km per year
([11]) Scaling base: passenger-km per year

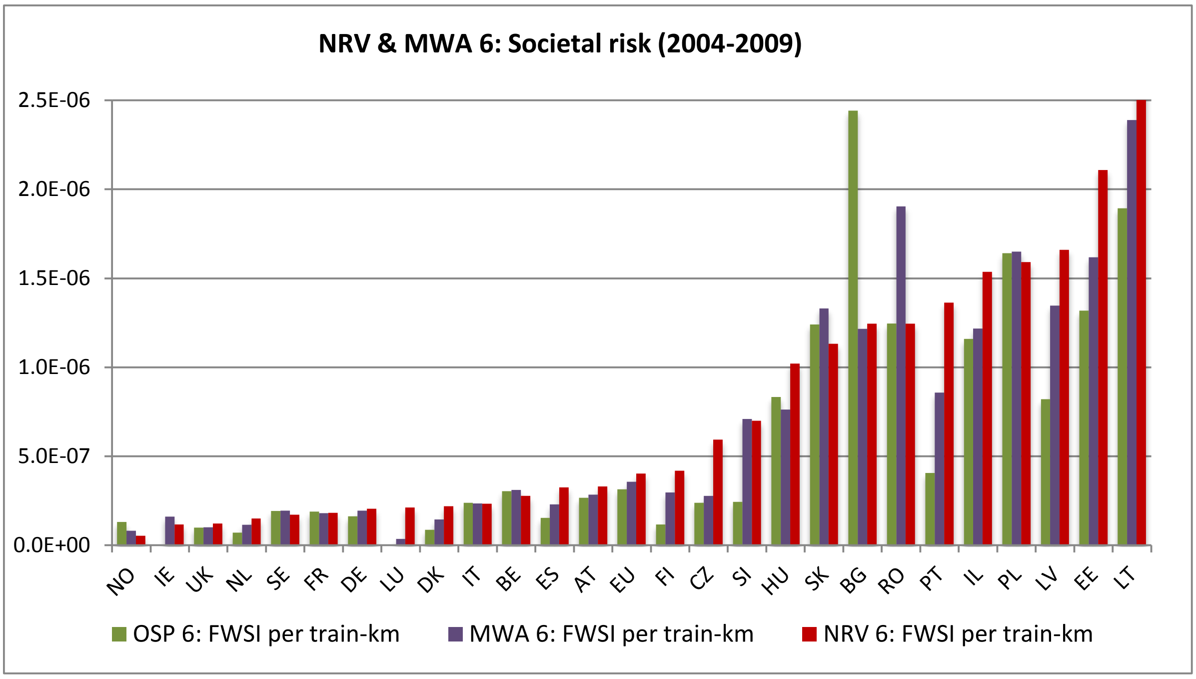


Figure 7: NRVs, OSP and MWA risk levels for the whole society (second set based on 2004–2009 data)

In the fourth assessment step, a check is made whether the number of significant accidents per train-km, with respect to the previous years, remained stable (or decreased). The criteria for this appraisal are whether there has been a statistically significant increase in the number of relevant significant accidents per train-km. This is evaluated by using an upper Poisson tolerance bound which will determine the acceptable variability based on the number of accidents that occurred in the different Member States.

In the 2011 assessment, all countries but one (Bulgaria) passed this test for all types of significant accidents under consideration. In case of Bulgaria, the number of all significant accidents and the number of accidents caused by rolling stock in motion in 2011 was higher than the number of accidents in previous years.

Accident outcomes

Significant accidents

Around 2 400 significant accidents occur each year on the railways of the EU Member States. Accidents to persons caused by rolling stock in motion and level-crossing accidents constitute more than three quarters of the total number of accidents, excluding suicides. The number of significant accidents per accident type in the period 2010–2011 is shown in Figure 8.

For collisions of trains, level crossing accidents and other accidents, the reported number of accidents in 2011 was lower than in the previous year. There was an increase in the number of accidents between 2010 and 2011 for derailments, fires and accidents to persons caused by rolling stock in motion.

On average a derailment or a collision is reported at least every second day in the EU, causing significant disruptions to railway operations.

The Member States reported 1 480 accidents to persons caused by rolling stock in motion in 2011. The risk of this type of accident is relatively high in the three Baltic countries and in some Central and East European countries (Czech Republic, Slovakia, Poland, Romania).

The number of fires in rolling stock reported for 2011 (25) is similar to the number of fires reported in 2010 (23). At least one such fire in rolling was recorded in 11 EU countries in 2011 (compared to 8 in 2010).

A wide range of accidents, not included within the specific types of accidents, are included in the category of other accidents. The 129 cases reported in 2011 include collisions and derailments of shunting rolling stock/maintenance machines, dangerous goods released during transport, objects projected by the running train, and electrocution in connection with the rolling stock in motion; the category other accidents is the third largest group of accidents.

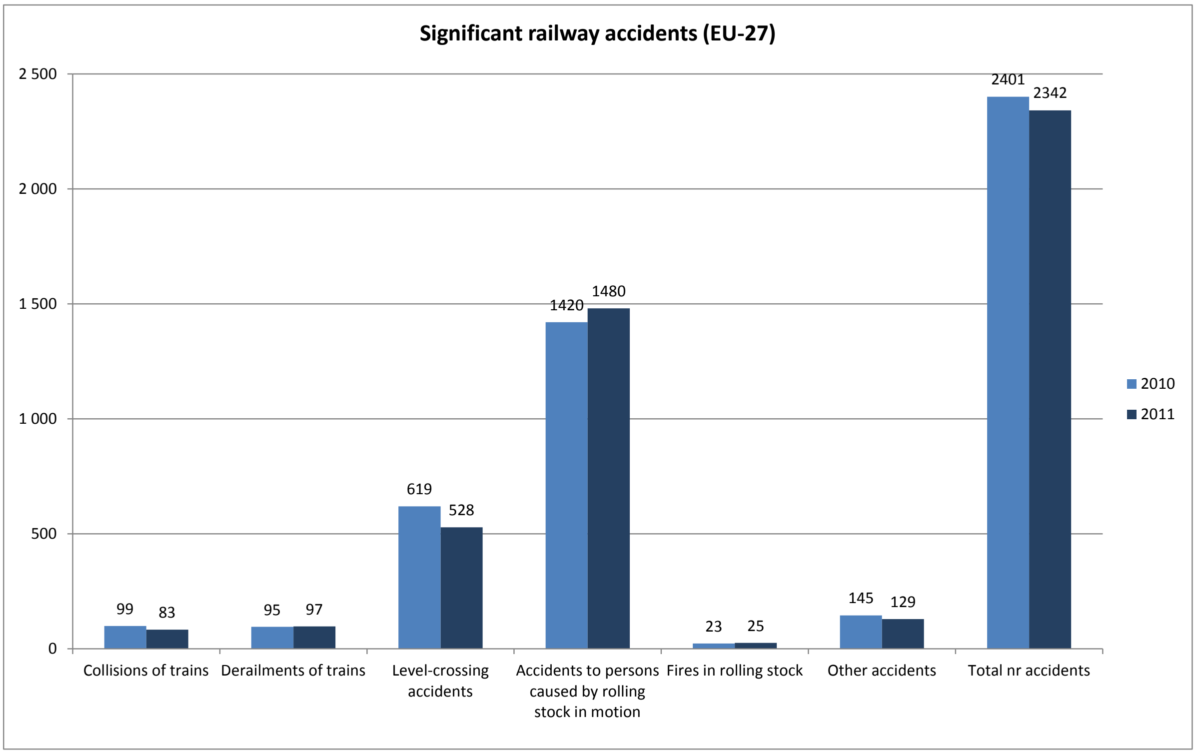


Figure 8: Reported number of significant accidents per accident category (2010–2011)

Collision types and their outcomes	Total EU	Share
Trains collisions	11	13 %
Collisions with obstacles	72	87 %
Persons killed and seriously injured in trains collisions	7	12 %
Persons killed and seriously injured in collisions with obstacles	50	88 %

Table 6: Collisions of trains by type and their outcomes (EU-27 in 2011)

In 2012, the number of collisions and relevant outcomes was reported by type for the first time, on a voluntary basis. Among 83 collisions reported in 2011, only 11 were trains collisions, the remaining 72 collisions involved a train hitting an obstacle within the clearance gauge. The number of casualties per collision type follows a similar pattern, with on average 1 person killed and 6 seriously injured in trains collisions and 50 people killed and seriously injured in collisions with an obstacle (Table 6).

Over the past five years, the number of significant accidents has seen a reduction of 38 % (9.3 % p.a. on average). This is almost twice as much as the reduction achieved for fatalities (22 %) and serious injuries (25 %). The number of significant accidents has reduced in all categories of accidents, with most important reductions in the category of collisions, derailments and fires. The lowest reduction was achieved in the category of accident to persons by rolling stock in motion.

Given the heterogeneous development in the number of significant accidents across the different categories of significant accidents, the relative share of accident types has changed dramatically over the past years. This is shown in Figure 9. The relative share of collisions and derailment dropped from 16 % in 2007 to 8 % in 2011, while the number of accidents involving third parties (LC accidents and accidents to persons) increased from 75 % to 86 %.

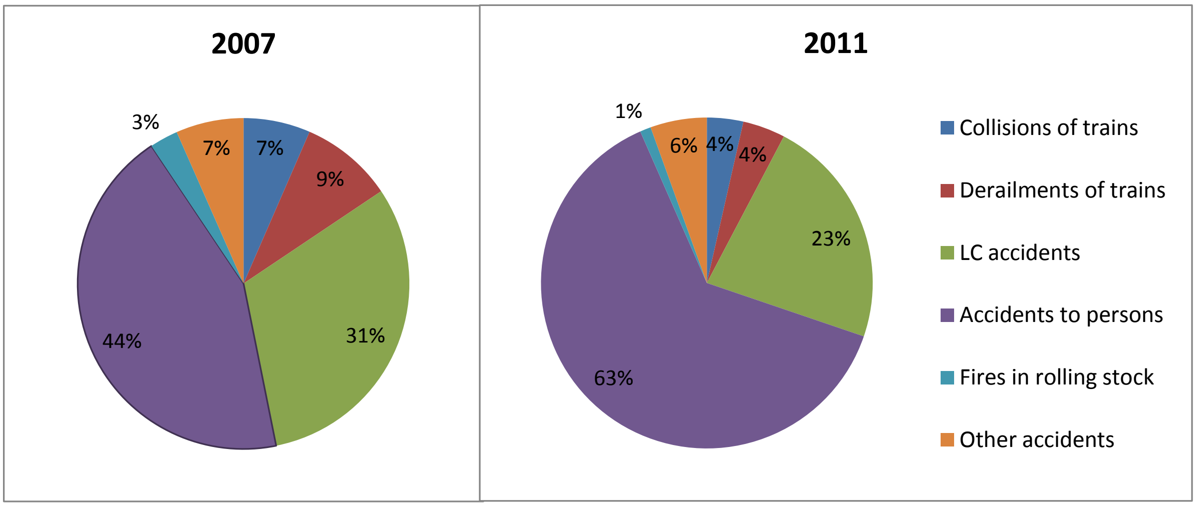


Figure 9: Reported number of significant accidents per accident category (2007 and 2011)

Dangerous goods accidents

When a railway accident involves dangerous goods, whether they are being transported or not, it must be reported under a separate category of accidents: **accidents involving dangerous goods**. Depending on the type and consequences, an accident involving dangerous goods may also be reported in duplicate as a significant accident. In 2011, Member States reported a total of 28 **accidents involving dangerous goods**; in nine of these, the transported dangerous goods were released during the accident. The 28 accidents involving dangerous goods occurred in 11 EU countries.

Dangerous goods accidents	2010	2011
Number of accidents involving at least one railway vehicle transporting dangerous goods in which dangerous goods are NOT released	17	19
Number of accidents involving at least one railway vehicle transporting dangerous goods in which dangerous goods ARE released	37	9
Total number of accidents involving at least one railway vehicle transporting dangerous goods	54	28

Table 7: Railway accidents involving dangerous goods (EU-27)

Casualties from significant accidents

In parallel with the decrease in railway accidents, the total number of casualties, excluding suicides, has fallen steadily in recent years. There were 1 183 fatalities reported for the year 2011, a six per cent decrease from the previous year (1 256 fatalities recorded in 2010). The number of passenger casualties (fatalities and serious injuries) fell down to the pre-2010 level, with 38 passenger fatalities in 2011. The unusually high number of fatalities among train passengers in 2010 was largely driven by the outcome of one single occurrence, the collision of trains in Belgium on 15 February 2010 that alone led to 19 fatalities and 35 serious injuries.

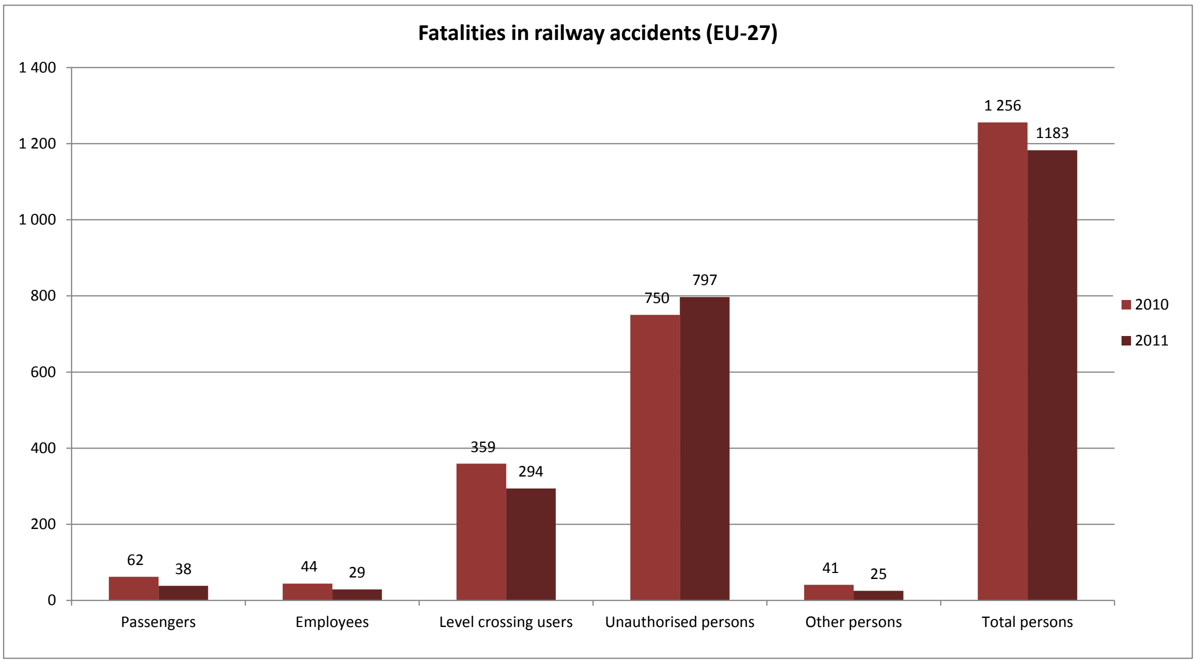


Figure 10: Number of fatalities per victim category (2010–2011)

Figure 10 shows the number of fatalities in different categories of persons over the period 2010–2011. With 797 fatalities in 2011, unauthorised persons represented 67 % of all persons killed on railway premises. The number of level-crossing fatalities of 294 in 2010 is by far the lowest ever recorded on EU railways. This figure represents 25 % of railway fatalities, but only 1.1 % of road-user fatalities. Level crossing safety might therefore be perceived as a marginal problem by the road sector, while it is a key problem for the railway - also because of its impact on railway operation.

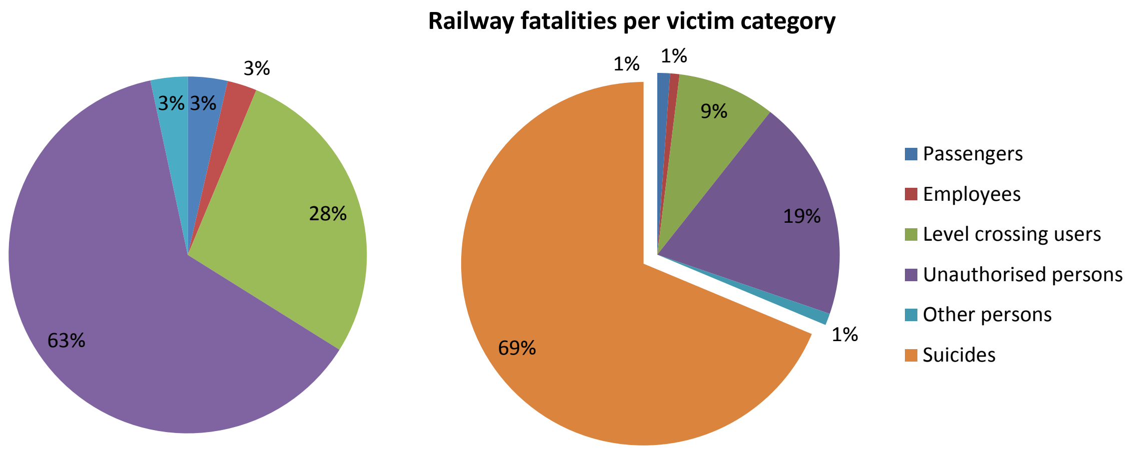


Figure 11: Relative share of fatalities per victim category among railway and all fatalities (2009–2011)

Suicides are reported separately from accident fatalities. They represent 69 % of all fatalities on railways and, together with the unauthorised person fatalities, constitute 88 % of all fatalities occurring within the railway system (period 2009-2011). In 2011, on average 8 suicides were recorded everyday on the EU railways, totalling 2 868, a record number since 2006. Several Central and Eastern European countries registered a significant increase of railway suicide fatalities in 2011; only seven EU countries saw their suicide figures falling in 2011.

Figure 11 shows that if we exclude suicide fatalities, the majority of fatalities are unauthorised persons. Level-crossing accidents account for 25 % of fatalities, whereas passenger and employees fatalities make up 6 % of the total number of deaths on railways. People strictly internal to railway operation (passengers, employees and other persons) represent only three per cent of persons killed on EU railways.

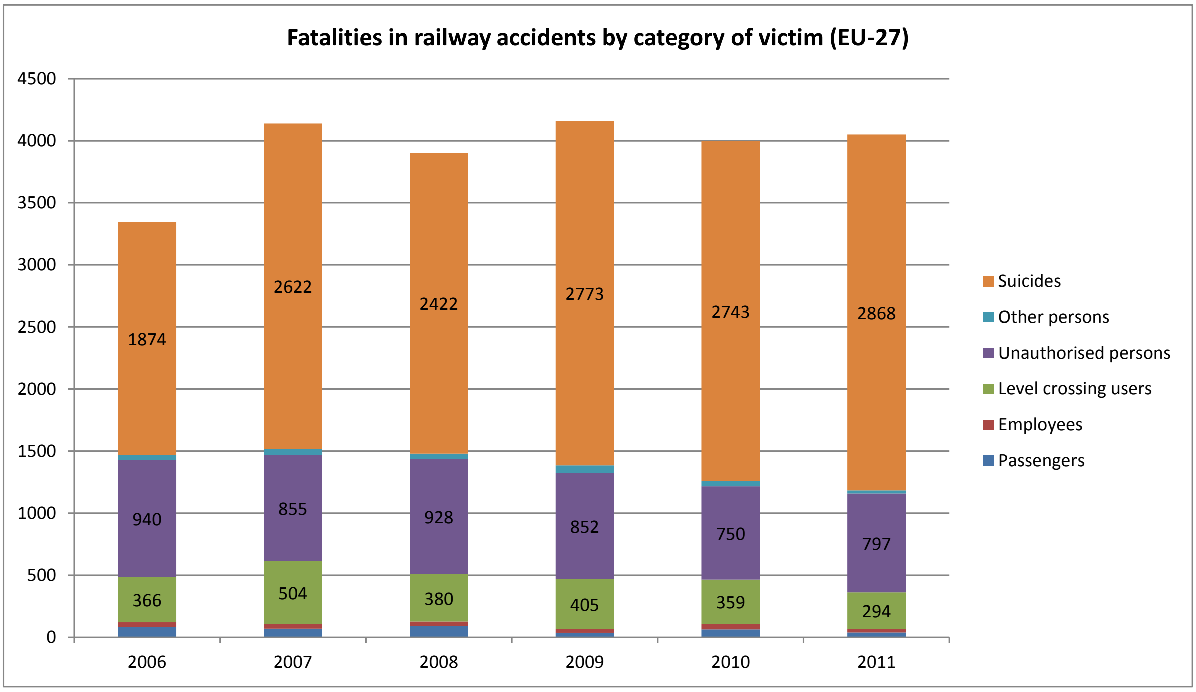


Figure 12: Fatalities on EU railways per year and victim category (2006-2011)

Figure 12 shows that although the total number of fatalities on EU railways has been steady since 2007 (with around 4 000 fatalities in total), there has been an increase in the number of suicide fatalities. Suicide and unauthorized user fatalities accounted for 84 % of all fatalities in 2007; their share has increased to 90 % in 2011. Victims not inherent to the railway system (suicides, unauthorized persons and level crossing users) make up 98 % of railway fatalities.

Over and above the number of fatalities, a large number of persons are seriously injured each year on the railways. Over the past five years, for each 10 persons killed, Member States reported some nine seriously injured persons. This ratio, illustrating the seriousness of accidents, has been constant over time, with the exception of 2009, in which there were only eight seriously injured per 10 persons killed in significant railway accidents.

In 2011, 1 032 persons were seriously injured, a decrease of 204 over 2010 when 1 236 serious injuries were reported (Figure 13). The numbers of injured passengers and level crossing users reported for the period 2010-2011 show variations beyond what might be expected from natural fluctuation).

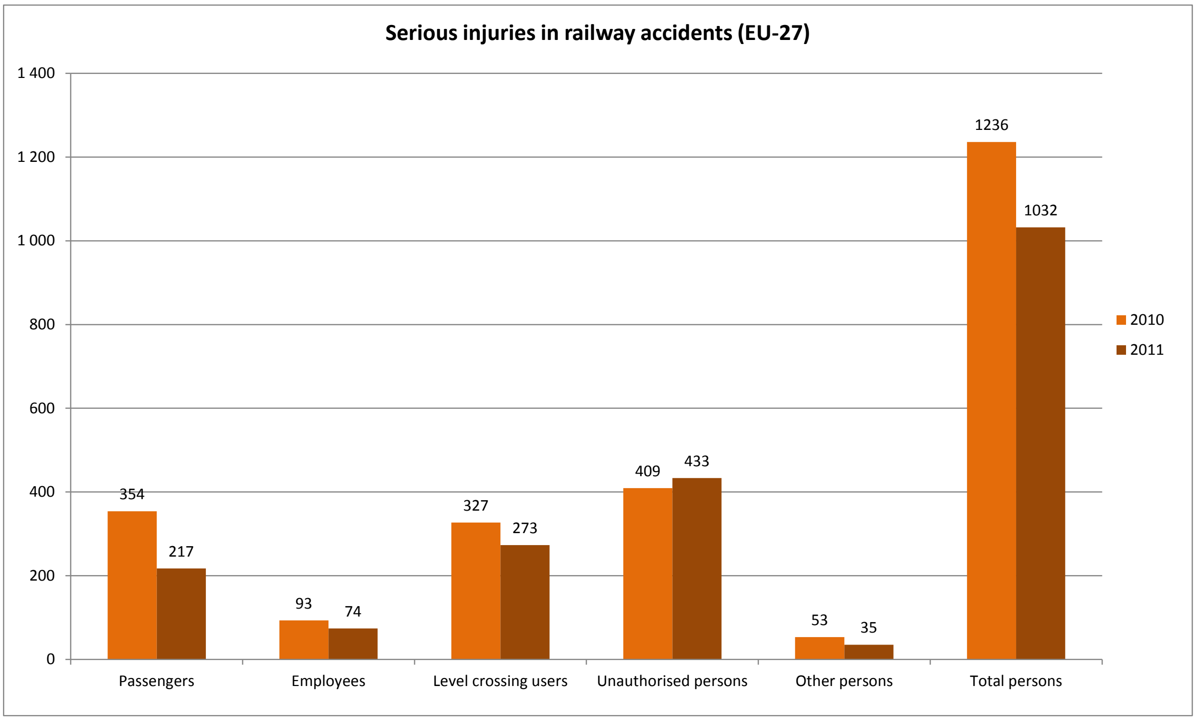


Figure 13: Number of serious injuries per victim category (2010–2011)

The decrease in the number of casualties (fatalities and serious injuries) in recent years is promising, especially in the categories of passengers, employees and other persons, who are all users internal to railway system. At the same time, the trend in the number of unauthorized person casualties is a cause of concern.

Over the past five years, there were 11 fatalities per 10 seriously injured persons on EU railways. Persons being hit by a train are the users most likely to die. There are almost two killed trespassers per one seriously injured trespasser. Among all railway users, passengers are most likely to survive in significant accidents. Passenger fatalities represent only one fifth of all railway casualties. Analysing the seriousness of injuries over time does not reveal any significant trends since 2006.

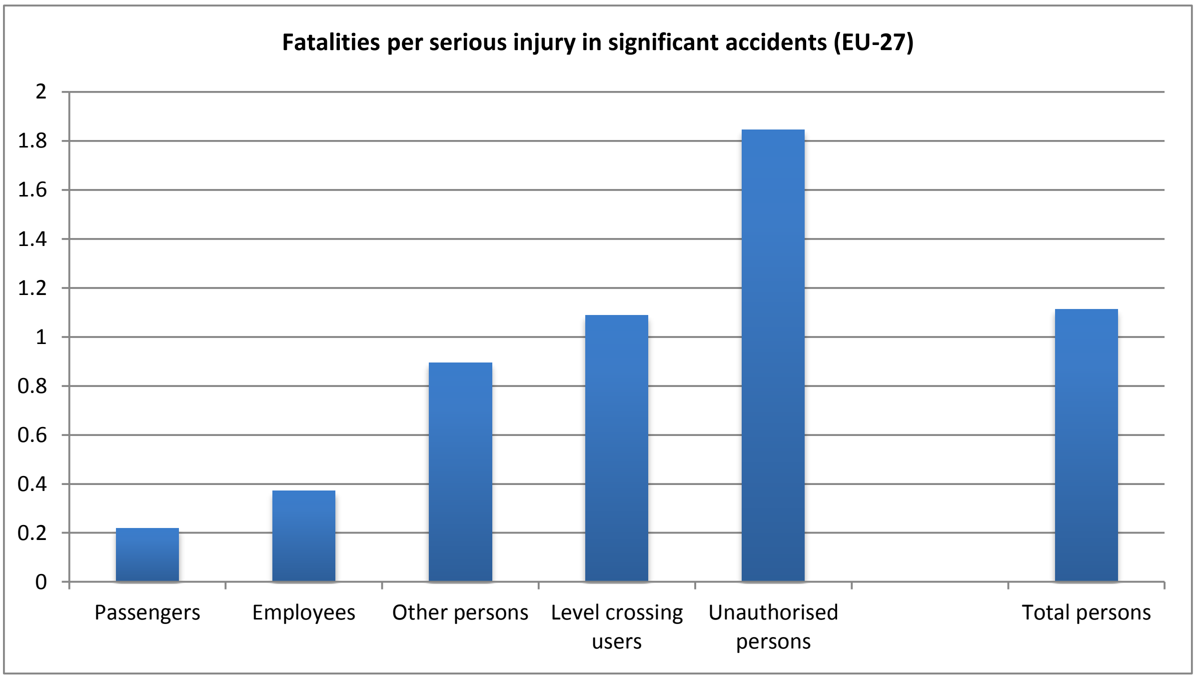


Figure 14: Seriousness of injury in significant accidents: fatalities per seriously injured (2007-2011)

Precursors to accidents

As accidents on railways are rare, the monitoring of less serious events occurring on railways is an essential tool of a proactive SMS. 'Precursors to accidents' are indicators of incidents that under other circumstances could have led to an accident. The indicators reported to the Agency are: broken rails, track buckles, signals passed at danger, wrong-side signalling failures, broken wheels and broken axles (Figure 15).

Over the period 2010–11, EU countries reported as many as 20 650 precursors to accidents; this is a ratio of more than four precursors to one significant accident. However, if we discard accidents to persons caused by rolling stock in motion, the ratio between the precursors and accidents rises to 11:1. This unveils the great potential benefit in analysing precursors in the proactive monitoring of railway safety.

Signal passed at danger is the most common type of accident precursors; it is also a precursor for which the highest absolute reduction has been registered in 2011. The most important reduction has been however achieved for the category of broken wheels and broken axles (a 40 % year-to-year reduction when taken together).

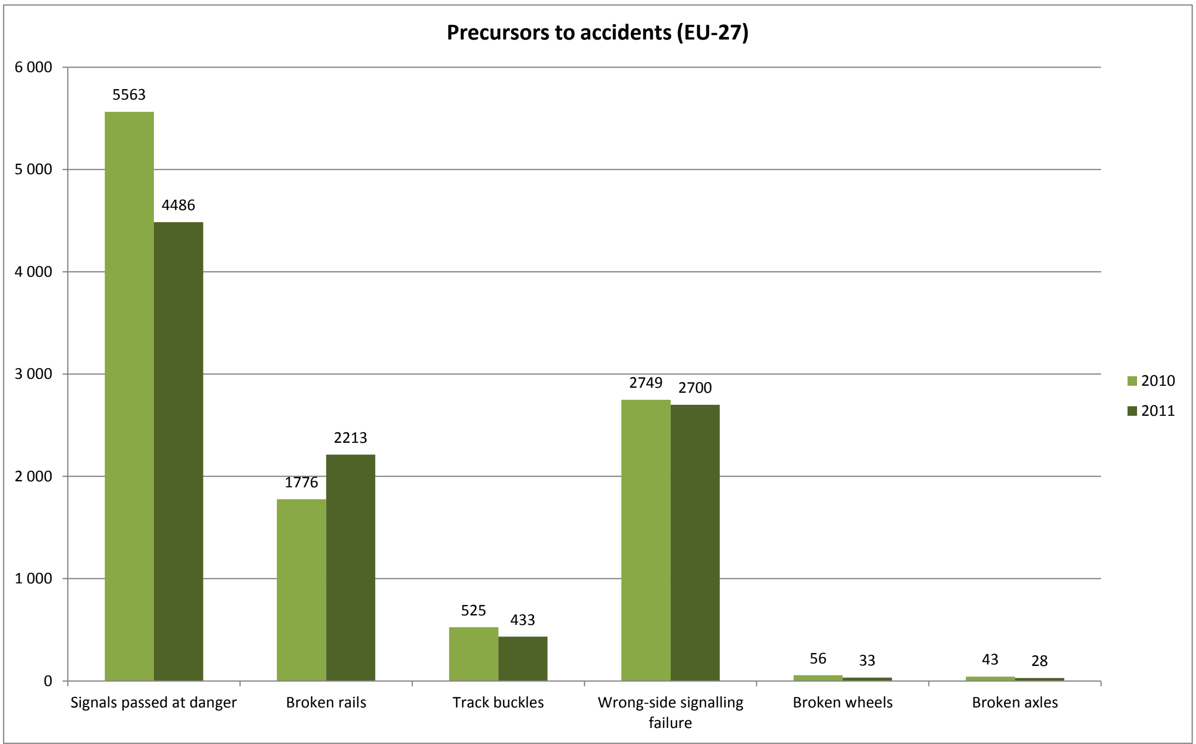


Figure 15: Reported number of precursors in 2010-2011 (EU-27 countries and Norway)

Signals passed at danger is also the most commonly investigated type of incidents as shown by the overview of the number of incidents investigations carried out by NIBs (Table 8). In the past three years (2008-2012), there were on average 13 SPADs investigated by NIBs, compared to 6 other types of incidents for which an investigation has been carried out by a NIB.

Incident	2006	2007	2008	2009	2010	2011	2012
SPAD	4	3	6	16	13	14	15
Other	2	0	4	7	4	8	9

Table 8: Number of incidents investigated by NIBs (2006-2012)

Level crossing safety

Level crossings constitute a significant safety concern. In recent years, on average, every day, one person has been killed and close to one seriously injured at level crossings in Europe. This is shown in Figure 16 that summarizes the development of level crossing accident casualties since 2007.

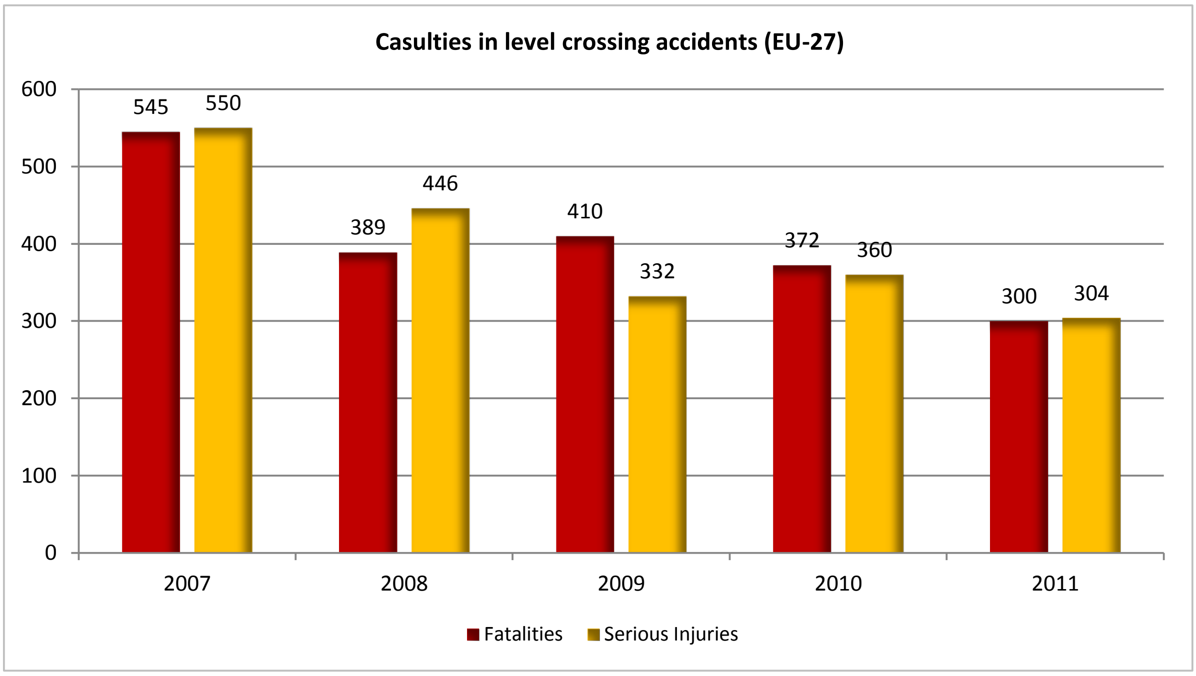


Figure 16: Development of casualties in level crossing accidents (EU-27)

Level crossing accidents and fatalities represent more than one fourth of all railway accidents on EU railway. However, level crossing fatalities make up only one per-cent of all road deaths. While level crossing safety has been traditionally viewed as a road safety problem by railway infrastructure managers, road authorities often struggle to address the problem in relation to other urgent road safety problems they seek to address. The concept of shared and delegated responsibility often fails to deliver the targeted results when it comes to level crossing safety and may need to be revised at both EU and national level.

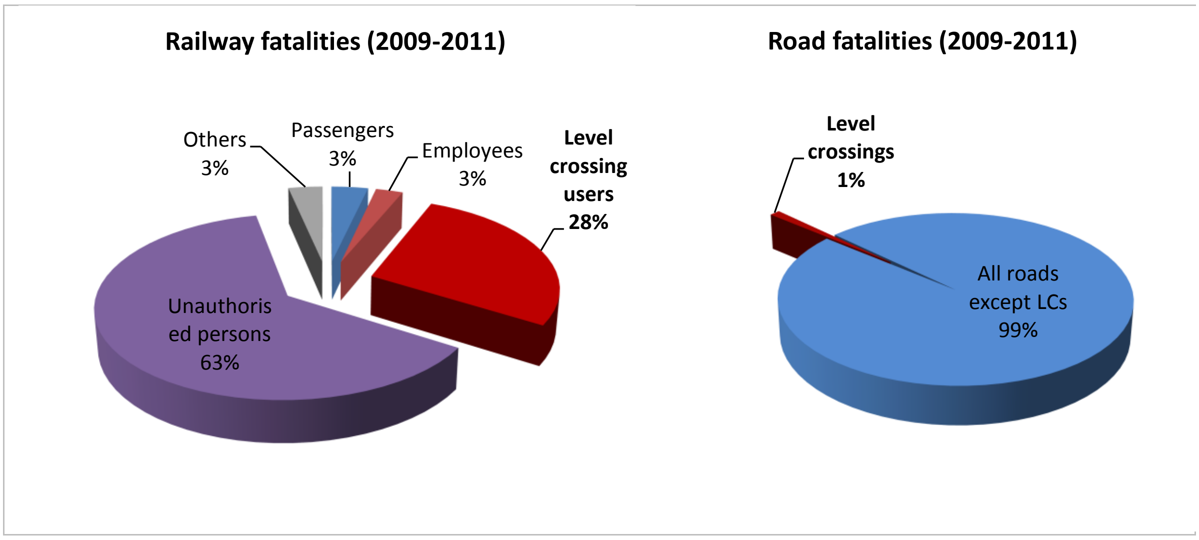


Figure 17: Share of fatalities in level crossing accidents in all other railway and road accidents (2009-2011)

There has been a sound reduction in level crossing accident fatalities in recent years; level crossing user deaths have been decreasing by 5.7 % per year on average. However, the reductions in the number of deaths in all other types of railway and road accidents have been even more significant; their numbers have been decreasing at an average annual rate of 6.3 and 8.0 % respectively.

Fatalities by type	2006	2007	2008	2009	2010	2011	% change p.a.
LC fatalities	366	504	380	405	359	294	5.7 %
All other railway fatalities	1105	1013	1099	980	897	897	6.3 %
All other road fatalities	42 700	42 000	38 550	34 400	30 500	30 200	8.0 %

Table 9: Development in level crossing accident fatalities compared to all other types of accidents (EU-27)

The fatality risk at level crossings in EU countries was estimated for the period 2009-2011 and the countries were ranked in Figure 18. The difference in risk between the countries with the smallest fatality risk at level crossings (United Kingdom with 19 deaths per billion train km) and the country with the highest level of risk (Greece with 537 deaths per billion train km) is huge, there is a 28 fold difference in the estimated risk of fatality at level crossings. The variance in risk remains significant, even if we disregard the 10th percentiles of countries with highest and lowest risk levels.

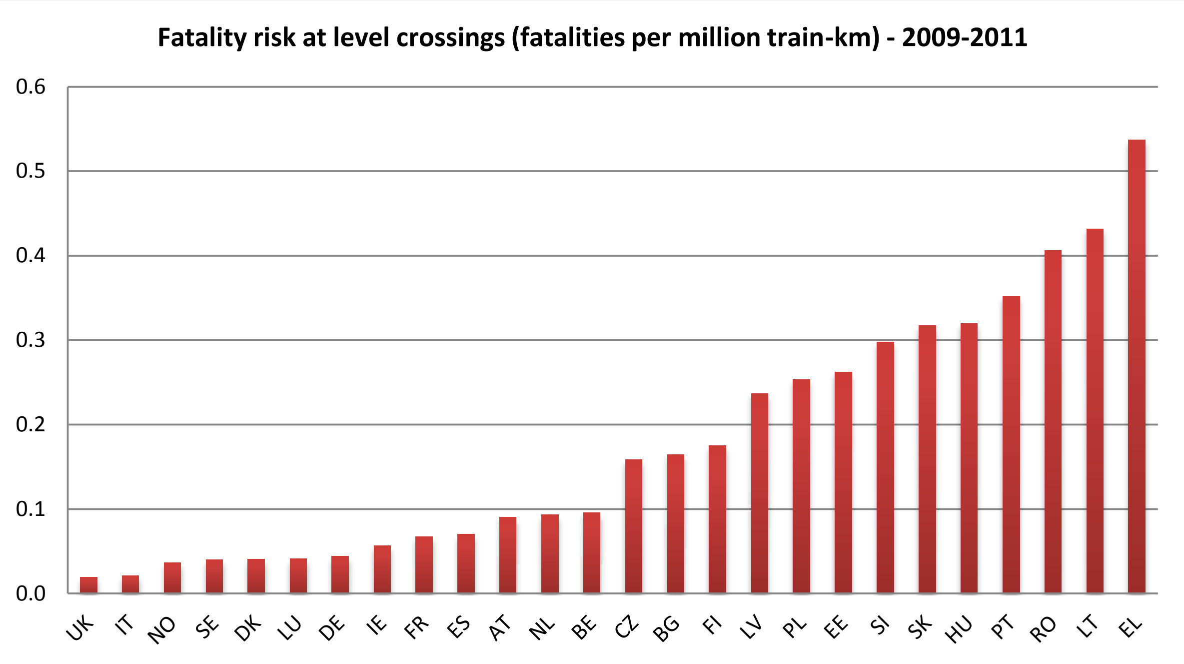


Figure 18: Fatality risk at level crossings: Level crossing fatalities per million train-km (2009-2011)

The estimation of trends in accidents and other outcomes for EU countries reveals that while the number of significant accidents on level crossings has been decreasing at a steady pace since 2006 (by 15 per cent per year on average), the number of casualties (fatalities and serious injuries taken together) was almost constant. At the same time, casualties on railways have been decreasing by about 4 % per year, on average. In other words, while there has been a marked reduction in level crossing accidents (and casualties) over the past five years, this reduction disappears when one looks at the development in railway casualties. This finding is surprising; one would expect a strong correlation between the trend in the number of accidents and related casualties. Possible causes of this discrepancy include poor reporting practice and a sudden increase in the seriousness of LC accidents. A longer time series is needed to confirm the estimated trends in order to draw clearer conclusions.

One can assess the level of risk at LCs alongside progress in its reduction in different EU countries. This analysis is limited to 21 countries, for which the relevant data (casualties, train-km) were available for the whole period under consideration (2006-2010). In Figure 19, KSI risk (number of killed and seriously injured people in LC accidents per million train kilometres) for the past three years (2008-2010) is plotted horizontally against the estimated average annual percentage change in LC casualties. The EU averages of the two indicators are used to divide the diagram into four quadrants. Three countries with the highest annual number of train-km (Germany, United Kingdom and France) appear in the left-hand part of the graph among countries with lower than average casualty risk at LCs, weighting heavily on the EU average. Only France, Germany, Denmark and Sweden achieved lower than average KSI risk after higher than average reductions in KSI risk. The graph also shows that there is no correlation between the level of casualty risk and the trend in risk.

The estimated values of the annual average percentage change in Figure 19 are sensitive to sudden changes in the number of casualties, behaving as random variables. A longer time series of data would be needed to assess the trend with a higher degree of reliability.

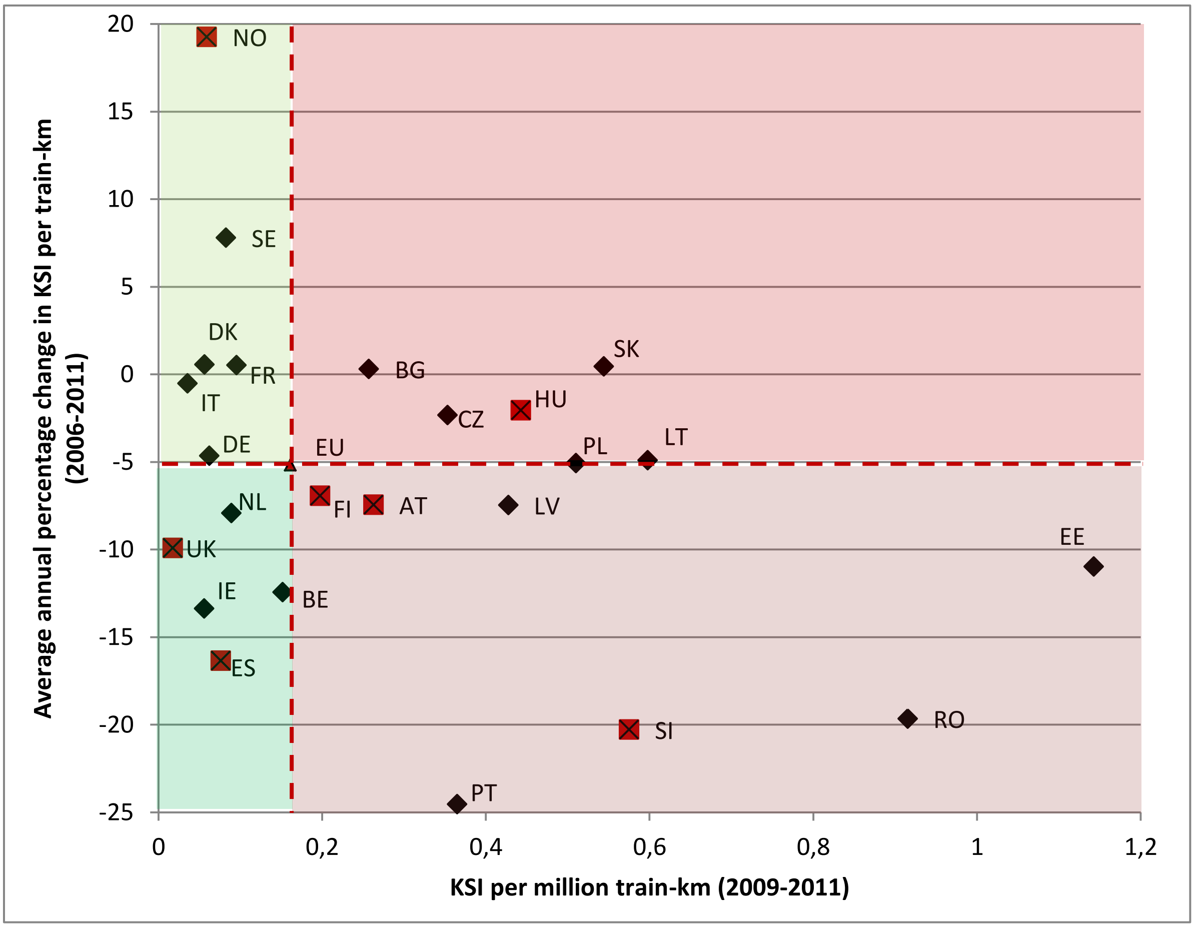


Figure 19: Casualty risk (killed and seriously injured per million train kilometres) versus average annual percentage change in casualty risk from 2006 to 2011

With about 50 accident investigations into LC accidents by NIBs per year, not even one tenth of all fatal LC accidents are subject to independent investigation. In many cases, these investigations do not seek root and underlying causes, significantly limiting their value. Although these investigations cost money, it is a worthwhile investment, if we consider the costs to society of these accidents.

Infrastructure managers (IMs) of EU countries regularly issue statements that about 95 % of LC accidents are caused by LC users, who break (road traffic) rules, either intentionally or unintentionally. The liability is then often confused with responsibility, being quite a different issue. When an in-depth accident investigation into a LC accident is carried out, problems are frequently identified with specific safety barriers. Moreover, not all IMs apply a holistic and analytical approach for LC safety improvements.

Railway suicides

Railway suicides are persons recorded and classified as suicide by competent national authorities. While the classification approach is mature in most Member States, some incertainty prevails in a few countries, where some suicide fatalities may be confused with trespasser fatalities.

The number of suicide fatalities continues to rise across the EU. Every year, more than 2 500 suicide fatalities and additional 800 trespasser fatalities occur on EU railways (Figure 25). While accounting for 8 % of all suicides, the societal impact of suicides on railways remains considerable. The consequences are not only trauma for all parties involved, but also significant costs incurred by delays, deployment of rescue services, loss of productivity or employees involved etc..

On average, railway suicides account for 8 % of all suicides across the EU. Only in the Czech Republic, Germany, the Netherlands and Slovakia is their share higher than 10 %. In Greece, Ireland, Poland and Romania, the share of railway suicide as a proportion of all suicides is below 1 %. This may be due to the relatively small railway network and low density of population.

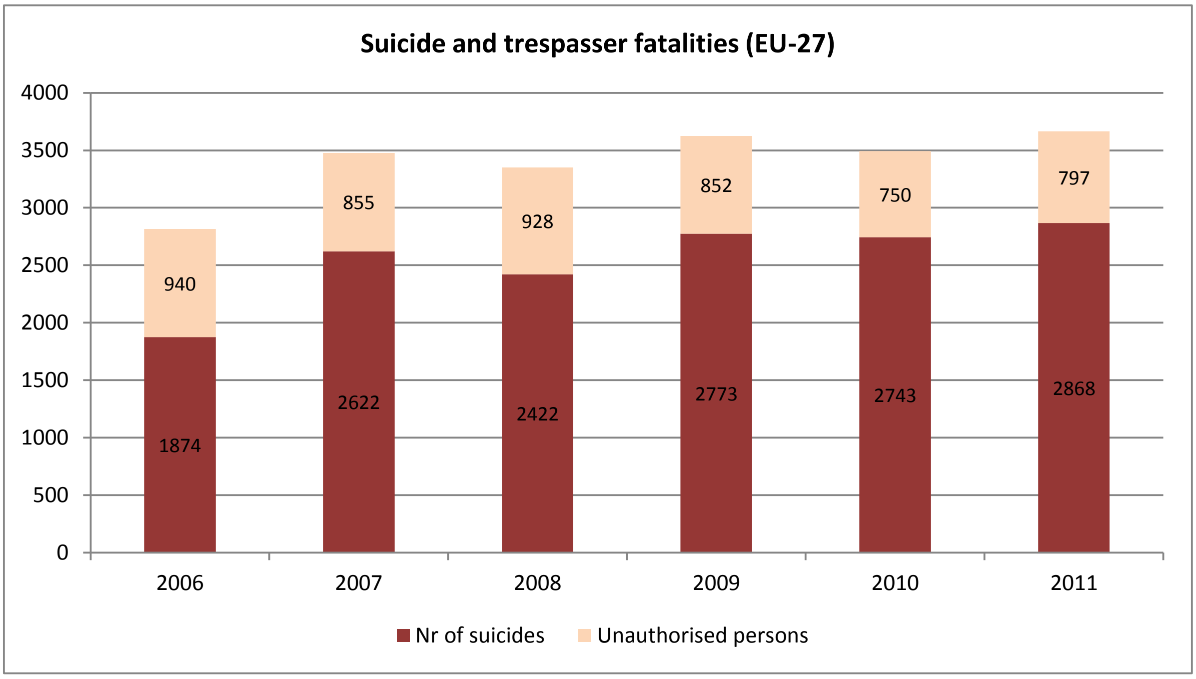


Figure 20: Suicide and unauthorized person fatalities (EU 27 in 2006-2011)

Railway suicides, and more generally, all suicides are relatively well correlated with unemployment rates. This may partly explain an increase in railway suicide fatalities in 2007 and 2009, visible at EU level. This correlation is however not traceable anymore at country level.

Railway suicides are relatively common on EU railways: there were 700 suicides per billion train-km on average in the past three years. The railway suicide rate is highest in the Netherlands, followed by Portugal, Hungary and the Czech Republic. In these four countries, the suicide rate is above one suicide per million train kilometres.

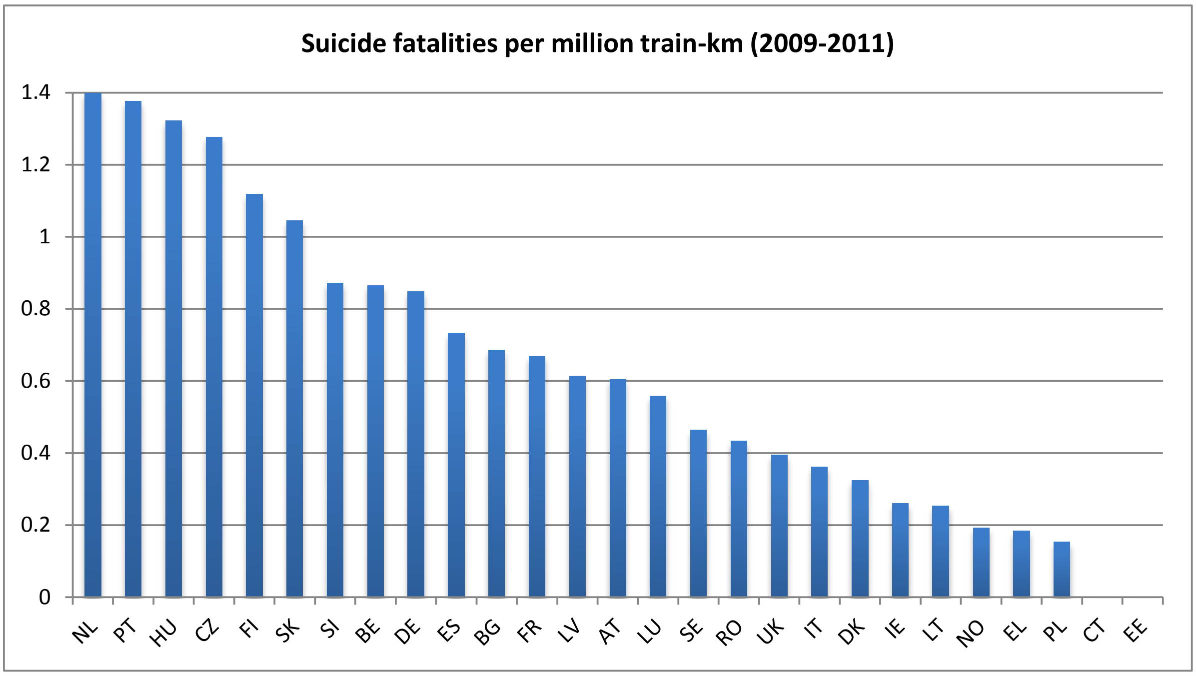


Figure 21: Suicide rates: number of suicide fatalities per million train kilometres (EU 27 in 2009-2011)

The costs of delays due to suicides (and trespasser fatalities) represent a significant share of total costs of delays incurred to railway undertakings. It typically takes up to 2 hours to open a railway line when a person is struck by a train. This is a significantly longer time compared to delays caused by some technical failures.

Safety and market opening

Setting up a common safety regulatory framework for the EU is a part of the wider EU policy to create more efficient railway market in Europe. Gradual opening of national railway markets carries inherent safety risks that are being addressed by the provisions of EU safety legislation. The two figures below seek to shed light on the impact of market opening on safety at country level.

The measurement of the degrees of market opening is relatively complex and any benchmark proposed would inevitably have its limitation. However, one measurement index, the rail liberalization index, has recently gained recognition and acceptance by railway community. The index has been produced by IBM Global Business Services ([12]) since 2002. It reflects legal and de facto barriers to market access from the perspective of an external railway undertaking seeking access. It reflects the market shares of external RUs active in addition to the incumbent as a practical consequence of existing barriers to open market.

The fourth edition of the index published in 2011 benchmark the rail market opening of MSs as of 1st January 2011 and ranks countries from those most advanced to those delayed in terms of rail market opening. Three categories of countries are considered based on the value of the index: six countries are considered as delayed, 15 countries on schedule and six countries advanced, in terms of rail market opening.

The IBM rail liberalization index is plotted against the casualty risk for passengers and employees in Figure 22. While it is impossible to find a correlation between the two variables, it appears that countries from advanced group have lower casualty risk than the countries in the two other groups.

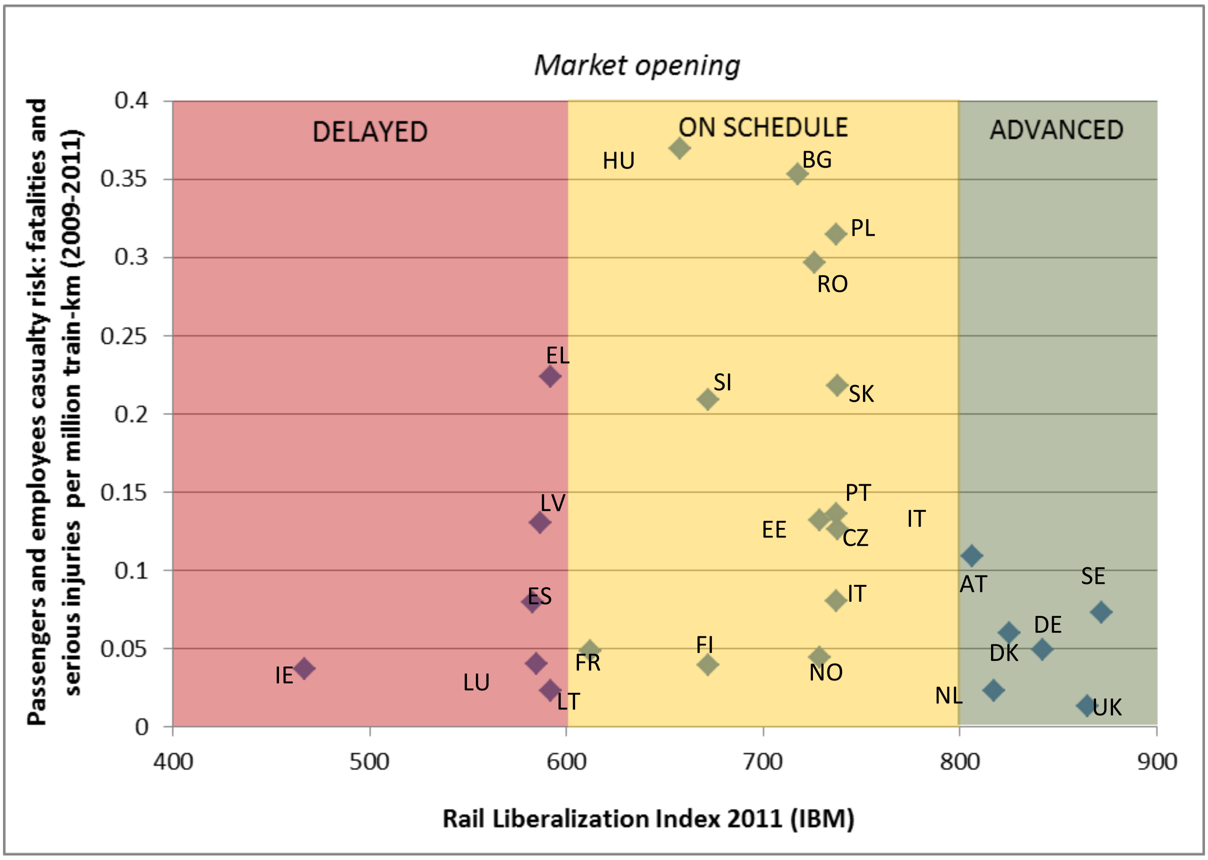


Figure 22: Fatality risk versus rail liberalization index (IBM 2011) for EU countries

([12]) Rail liberalization index 2011, IBM Germany with Prof. Kirschner, Deutsche Bahn, 2011

A separate look at the development of railway safety in the advanced group of countries as compared to all other countries confirms that there are no significant differences in trends in casualty risk for passengers and employees in countries with a higher liberalization index.

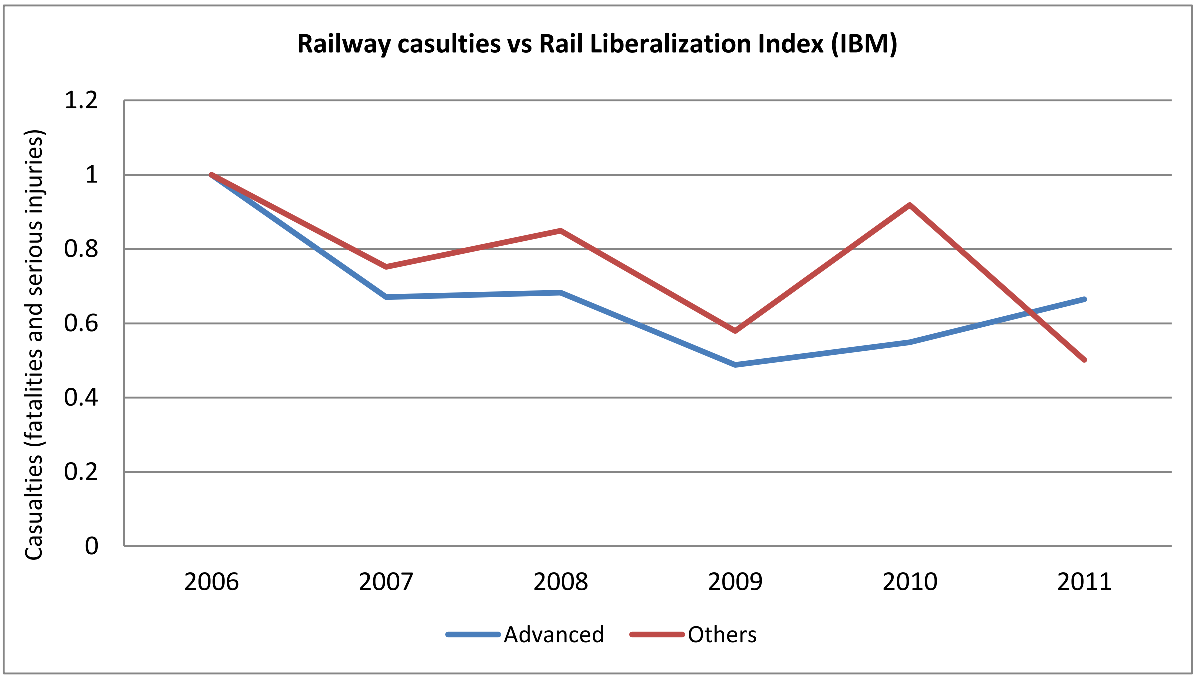


Figure 23: Fatality risk versus rail liberalization index (IBM 2011) for EU countries

Accident costs

The data on the cost of accidents show a wide variation over time and between countries. It is also evident that Member States continue to have problems in establishing reporting regimes for this set of CSIs.

The economic impact of significant accidents in 2011 is shown in Figure 24. It has five components: Costs of fatalities, cost of injuries, costs of material damage, costs of damage to the environment and costs of delays. While the first two components are available for all countries, the number of countries providing information on the costs of damage to infrastructure, to the environment and delays is limited.

Societal costs of casualties represent the majority of costs of significant accidents. For countries that reported costs for all five categories of costs is their share 73 % (Austria) and higher.

By adding together the costs of fatalities and of serious injuries, we obtain a value exceeding EUR 2.5 billion, which gives a broad idea of the overall economic burden of rail casualties in 2011. Other reported costs of accidents for all EU countries account for little more than EUR 200 million.

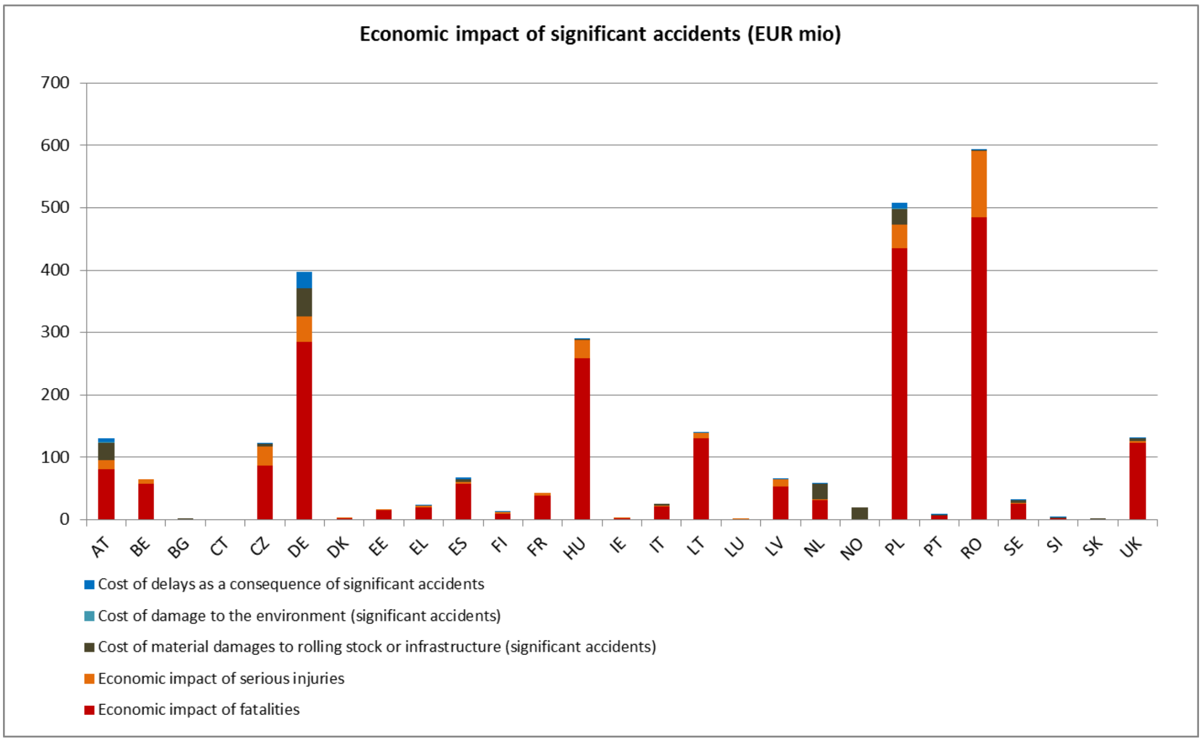


Figure 24: Economic impact of significant accidents in 2011 (in million EUR)

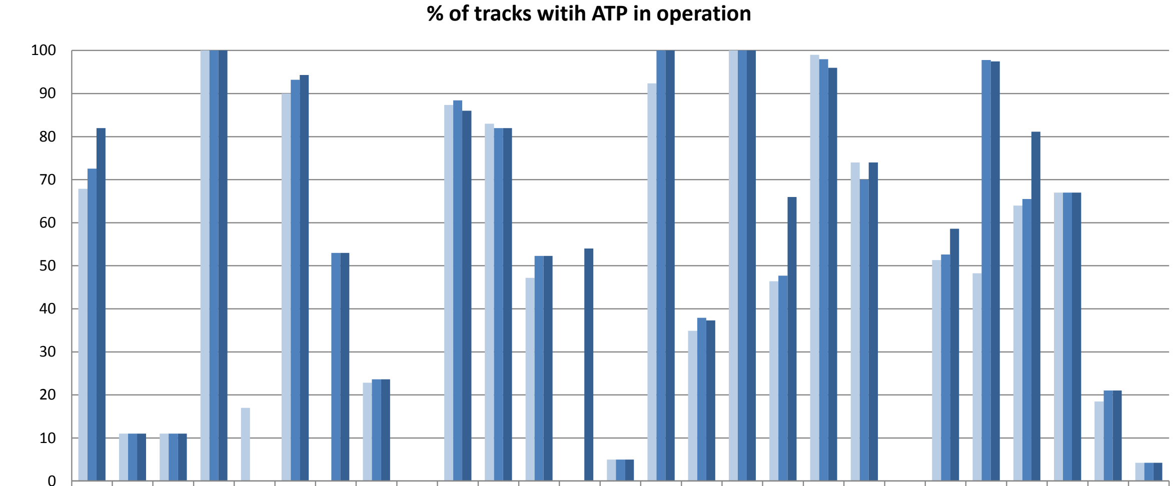
The significant accident costs of material damage to rolling stock and infrastructure per train-km are relatively high in Norway, Austria, the Netherlands and Poland (more than EUR 100 per 1 000 train-km).

Safety of infrastructure

Three CSIs concern railway infrastructure, the first is a measure of the coverage of automatic train protection (ATP) systems on the lines (Figure 25); the second is the number of level crossings (Figure 26), normalised by the length of the network expressed in track kilometres; and the third gives information on the type of protection at level crossings (Figure 27).

ATP ([13]) systems is widely considered to be the most effective railway safety measure that infrastructure managers can implement to reduce the risk of collisions on mainline railways ([14]). A relatively high density of train protection is typical in countries with high traffic density such as the Netherlands, Italy and Germany. This can be seen in Figure 25.

The percentage of tracks equipped with an ATP system has seen a marked increase of 2 % from 2010 to 2011 ([15]). This was largely driven by progress in ATP implementation achieved by France, Latvia, Sweden and Norway. However, the data seem to be reported in an inconsistent manner across the EU, reducing their comparability.



	AT	BE	BG	CT	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE	IT	LT	LU	LV	NL	NO	PL	PT	RO	SE	SI	SK	UK
2009	67.9	11.0	11.0	100.	17.0	90.0		22.8	0.0	87.4	83.0	47.2		5.0	92.4	34.9	100.	46.4	99.0	74.0	0.0	51.3	48.3	64.0	67.0	18.5	4.2
2010	72.6	11.0	11.0	100.	0.0	93.2	53.0	23.6	0.0	88.4	82.0	52.3		5.0	100.	37.9	100.	47.7	98.0	70.0	0.0	52.6	97.8	65.5	67.0	21.0	4.2
2011	82.0	11.0	11.0	100.		94.3	53.0	23.7	0.0	86.0	82.0	52.3	54.0	5.0	100.	37.3	100.	66.0	96.0	74.0	0.0	58.6	97.5	81.2	67.0	21.0	4.2

Figure 25: Percentage of tracks equipped with automatic train protection (2009–2011)

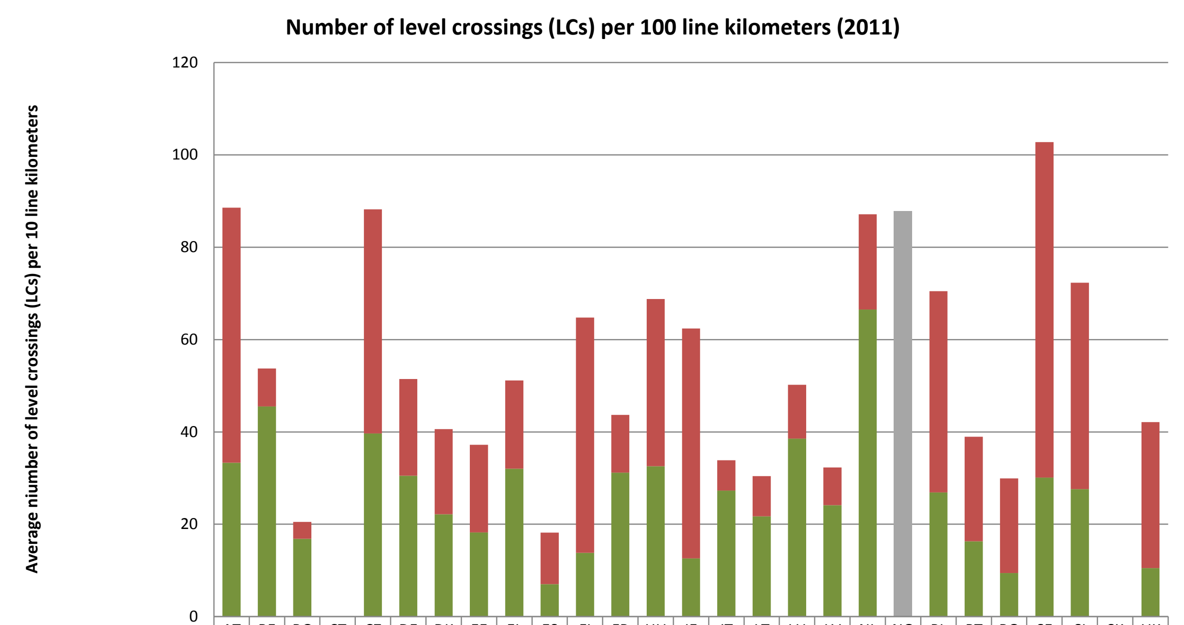
There were 114 615 level crossings in the EU countries in 2011. On average, there are five level crossings per 10 line-km in the EU; only 24 % of them are active level crossings with user-side protection ([16]). Sweden, Austria, the Czech Republic, the Netherlands and Norway have the highest density of level crossings in terms of level crossings per line-kilometre. Of these, the Netherlands has the highest ratio of active level crossings to all level crossings. A low ratio of active level crossings to all level crossings is typical for the less densely populated countries (Figure 26). Spain has the lowest average number of level crossings per line-kilometre: there is one level crossing per 5 line-km.

([13]) Automatic train protection (ATP) means a system that enforces obedience to signals and speed restrictions by speed supervision, including automatic stop at signals. Systems where track signalling information is substituted and/or supplemented by cab signalling are included. The part of the definition relating to 'automatic stop at signals' is intended to include also automatic stops at conflict points between clearance gauges.

([14]) Interfleet (2011). *Investigating the links between historic accident rate reduction and the underlying changes*, Report prepared for ERA in 2011. Report can be downloaded from the ERA website.

([15]) Estimate for EU-27 countries excluding France and Denmark.

([16]) Protection is typically provided by arm barriers.



	AT	BE	BG	CT	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE	IT	LT	LU	LV	NL	NO	PL	PT	RO	SE	SI	SK	UK
Passive LCs per line-km	55	8	4	0	49	21	18	19	19	11	51	12	36	50	7	9	12	8	21	0	44	23	20	73	45	0	32
Active LCs per line-km	33	46	17	0	40	31	22	18	32	7	14	31	33	13	27	22	39	24	67	88	27	16	9	30	28	0	11

Figure 26: Number of active and passive level crossings per 100 line-km in 2011

Detailed statistics are available on the type of active level crossings at European level. In Figure 27, the data for EU countries ([17]) show that level crossings with automatic user-side protection and warning (barriers with lights) (34 %) are the most common type of active crossings (24 %), followed by the level crossings with user-side warning (11 %). Passive (unprotected) level crossings represent 53 % of all level crossings in the EU.

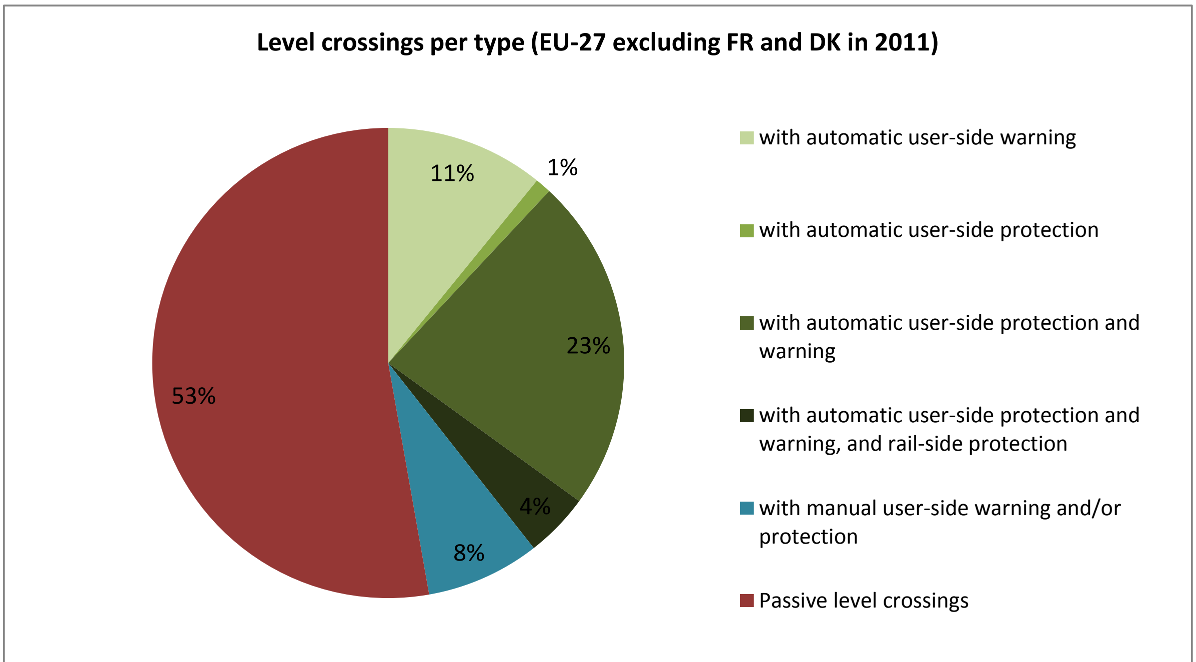
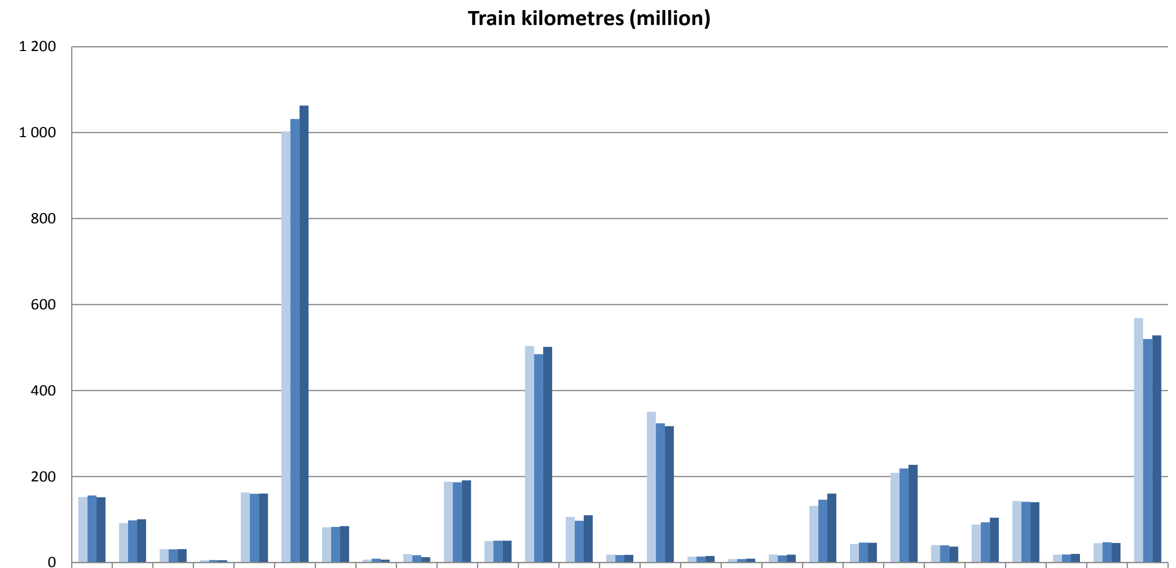


Figure 27: Breakdown of active level crossings according to the level of protection in 2011 (EU countries)

([17]) EU-27 countries excluding Denmark and France

Traffic volumes

The number of train-kilometres continued to rise in 2011, with a 2 % annual increase at the EU level. The number of freight train-km increased by 6 % between 2010 and 2011. At the same time, the number of passenger-kilometres reported in 2011 is similar to that of 2009 and 2010: slightly less than 400 billion train-km. The average number of passengers per train was 122 in Europe in 2011; i.e. the ratio of number of passenger-kilometres to passenger train-kilometres.



	AT	BE	BG	CT	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE	IT	LT	LU	LV	NL	NO	PL	PT	RO	SE	SI	SK	UK
2009	152.3	91.87	31.49	5.652	163.1	1002.	82.15	6.820	19.61	188.1	50.01	504.0	106.2	18.18	350.5	14.05	8.063	18.72	132.0	43.27	208.6	40.58	88.50	143.0	18.20	44.95	568.5
2010	156.1	98.00	30.63	5.714	160.1	1032.	83.08	8.934	16.96	186.7	51.00	484.7	97.40	17.69	323.9	14.13	8.161	16.62	146.2	46.46	219.0	40.00	93.52	141.3	18.84	47.53	520.0
2011	152.2	100.5	31.24	5.600	160.6	1063.	84.78	7.000	12.53	191.3	51.07	501.5	110.2	18.05	317.3	15.32	8.861	18.47	160.5	45.85	227.3	37.20	104.2	140.3	20.33	45.38	528.4

Figure 28: Number of million train-kilometres (2009–2011)

Germany is the country with the highest number of train-kilometres, accounting alone for one quarter of all train-kilometres in the EU.

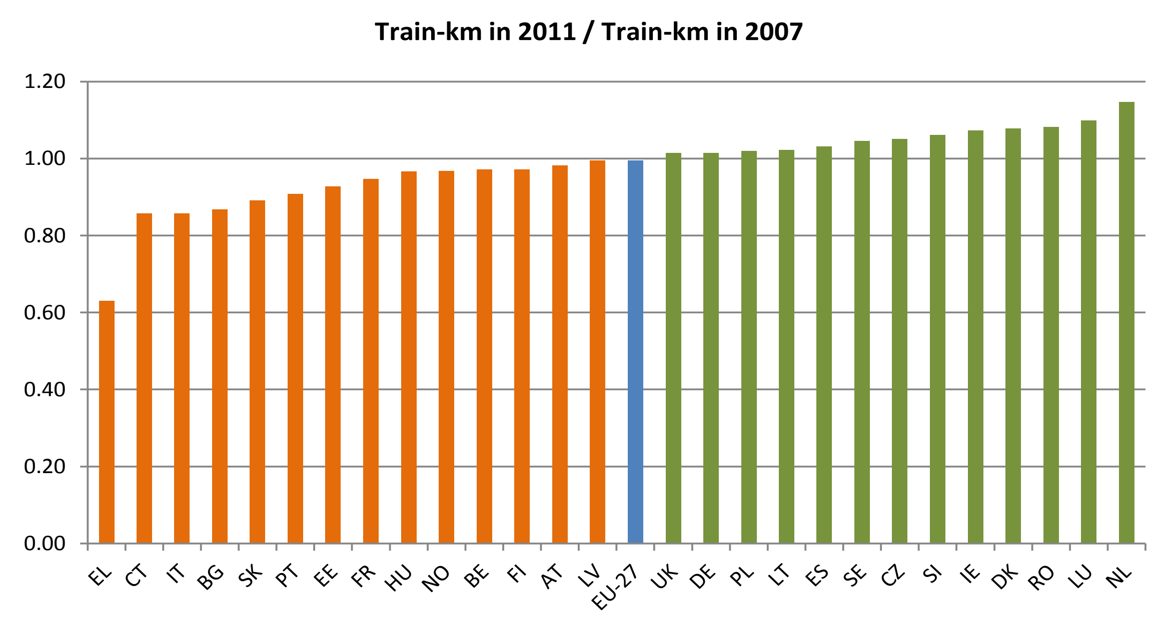


Figure 29: Relative change in the number of train-kilometres between 2007 and 2011 (Train-km in 2011 / Train-km in 2007)

Looking at figures for passenger train-kilometres and freight train kilometres separately allows identification of countries with important share of freight train traffic (three Baltic countries, Slovenia and Poland). At the level of Union, passenger traffic represented 80 % of all train-kilometres in 2011. The share of passenger train-kilometres exceeded 90 % in Ireland, Denmark, Greece, the UK and the Netherlands (Figure 30).

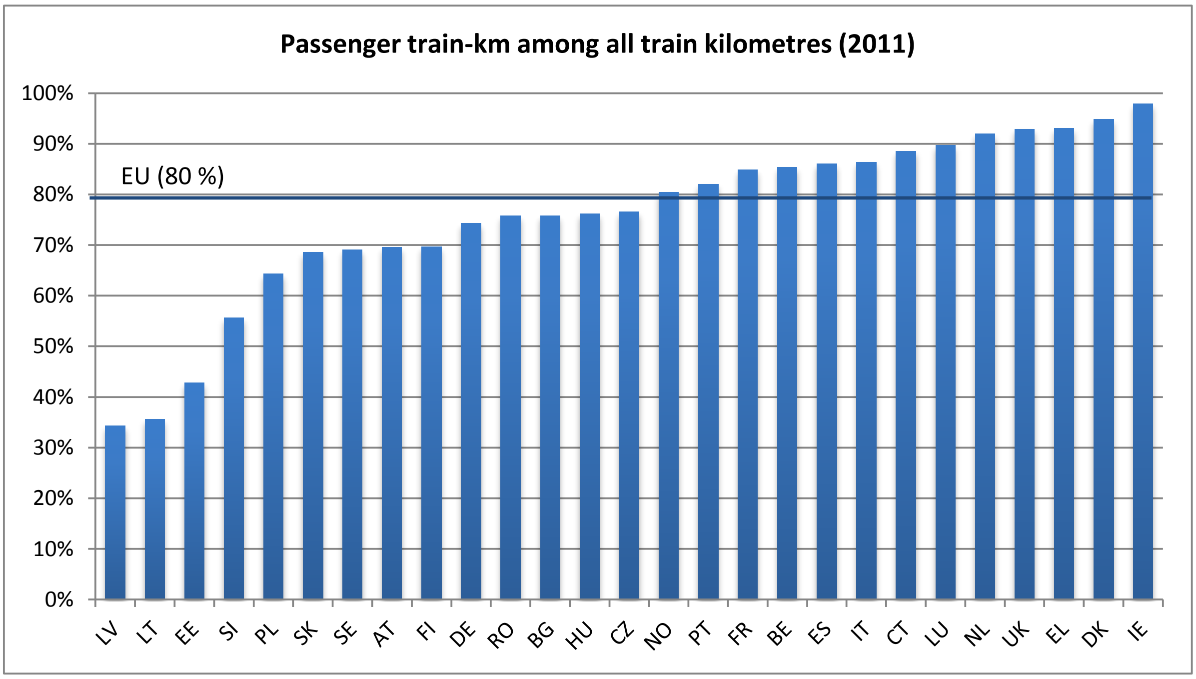


Figure 30: Percentage of passenger train-kilometres among all train-kilometres in 2010 in all countries

Four countries with the highest passenger volumes (Germany, France, Italy and the UK) together account for two thirds of all passenger-kilometres. In two of them (Germany and the UK), have passenger volumes been increasing over the past three years, as shown in Figure 31.

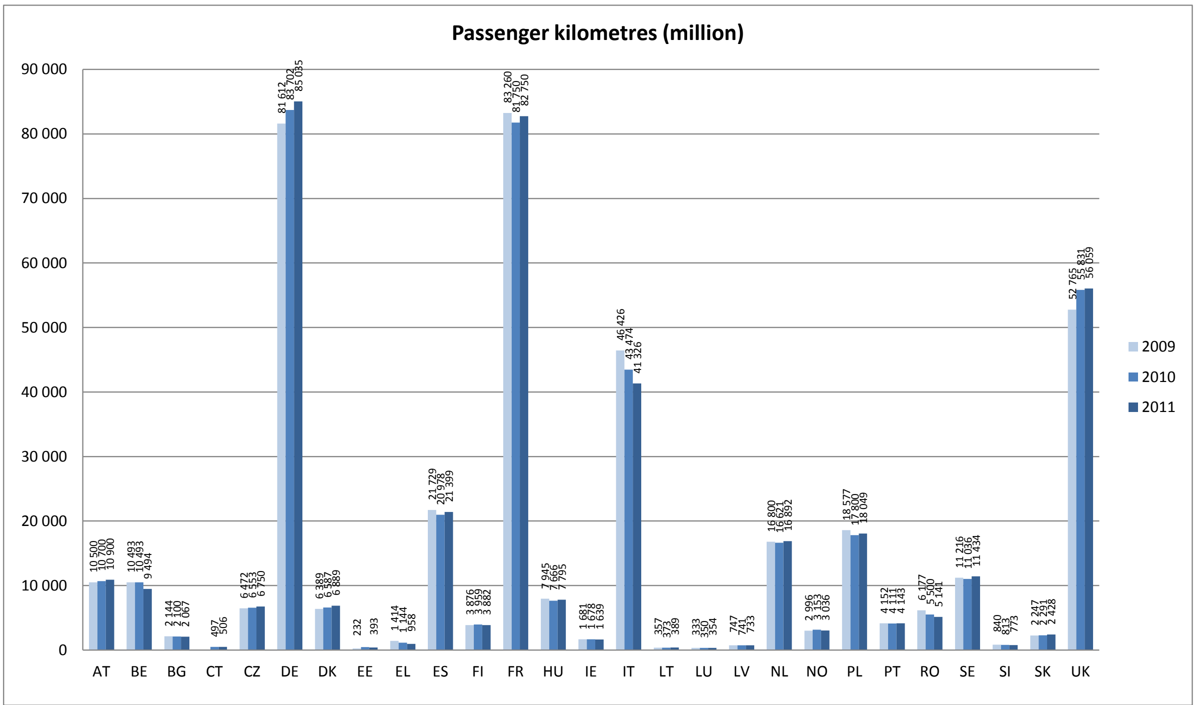


Figure 31: Number of million passenger-kilometres (2009–2011)

Railway transport operation efficiency

The operational efficiency of railway transport can be implicitly expressed by a simple ratio of passenger kilometres per passenger train kilometres and freight tonne kilometres per freight train kilometres.

Passenger trains

The theoretical average passenger train load in the EU-27 was 122 passengers in 2011 (1 % increase compared to 2010). The average passenger train load appears to be primarily a function of country size; Romania, Estonia and Latvia are an exception to this rule. Given the limits of international passenger traffic across Europe, the share of domestic long-distance services is the most important factor here.

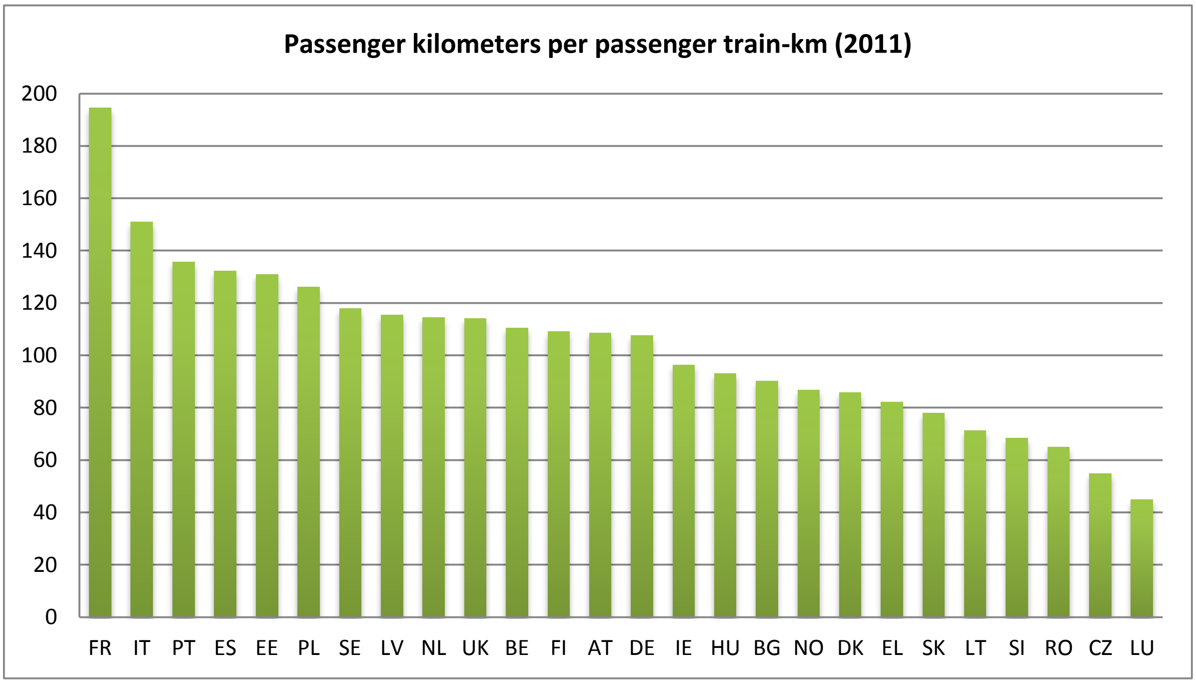


Figure 32: Passenger kilometres per passenger train kilometres in 2011

In case of passenger rail traffic, France together with Italy has the highest ratio of theoretical average train occupancy, with more than 150 passengers travelling on board of an average passenger train. The theoretical average train occupancy is lowest in Luxembourg, Czech Republic and Romania. The ratio is a function of prevalent types of services operated in the given country, as well as of its geographical aspects. Yet, different positions of countries with huge number of similarities (Baltic countries, Nordic countries) in the ranking presented in Figure 32 is surprising and may be pointing to differences in operational arrangements and minimum public service strategies.

Freight trains

The average load ratio for freight trains on European railways gives only a very limited idea about the efficiency of freight train operations, since it is a function of the load mix transported. Raw materials represent a high proportion of transported goods in Baltic countries and in some Central European countries, leading to a relatively high theoretical average load ratio (Figure 33). A high degree of interoperability of railway systems of Baltic countries and the Russian one contributes to their relative outperformance.

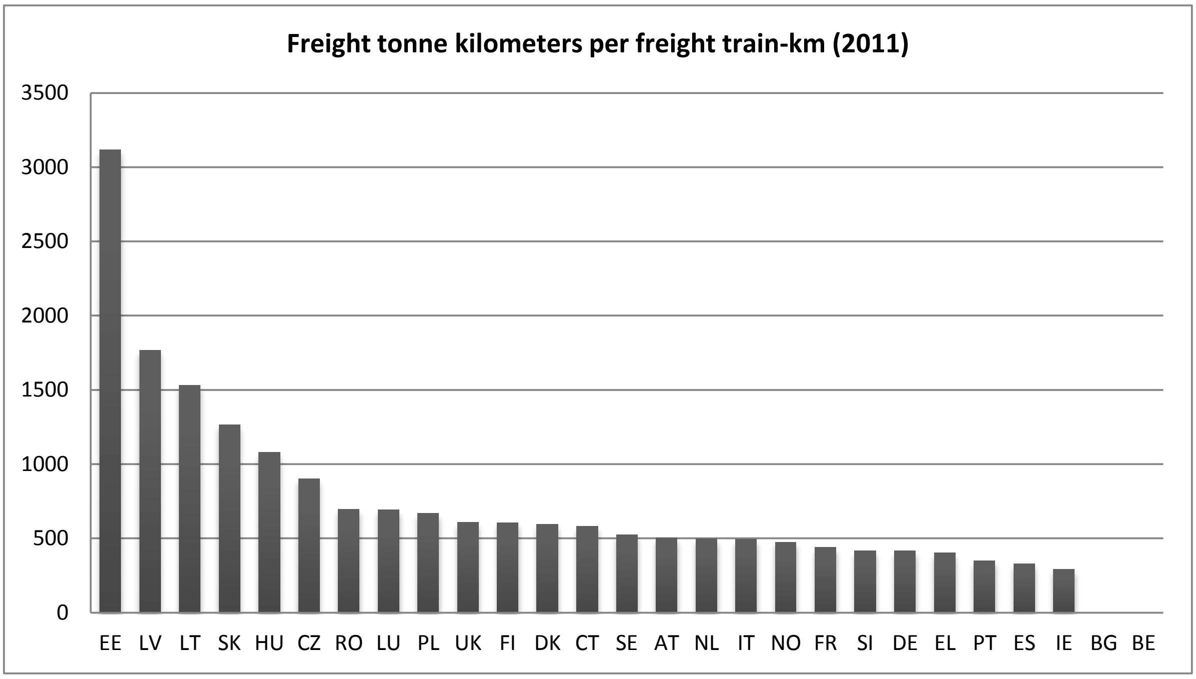


Figure 33: Freight tonne kilometres per freight train kilometres in 2011

Independent accident investigation

Every year, more than 200 of accidents and incidents are investigated by NIBs of MSs. This number has been slightly increasing in time in recent years, since more and more NIBs decide to open an investigation into other than serious accidents. The number of serious railway accidents investigated by NIBs has been stable since 2007 with some 40 serious accidents into which a NIB investigation started (Figure 34).

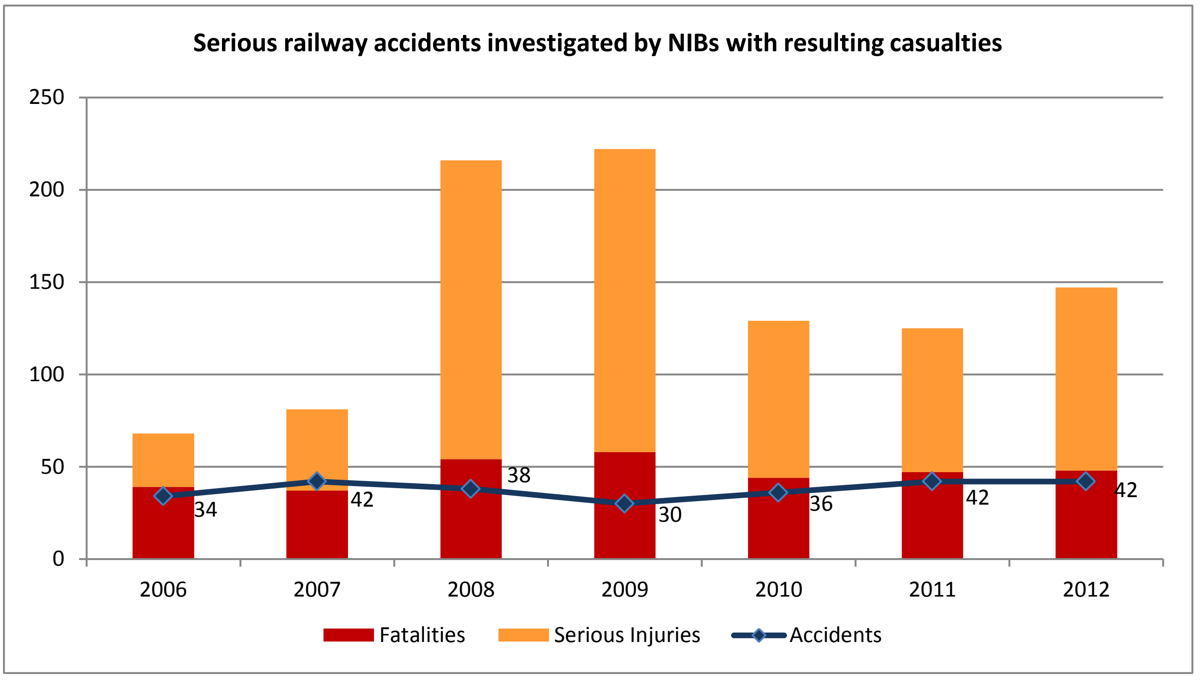


Figure 34: Serious railway accidents investigated by NIBs together with the resulting casualties (EU-27)

A detailed look into the type of serious accidents investigated by NIBs shows that level crossing accident is the most commonly investigated type of serious accidents, followed by train derailment and train collisions (Figure 35).

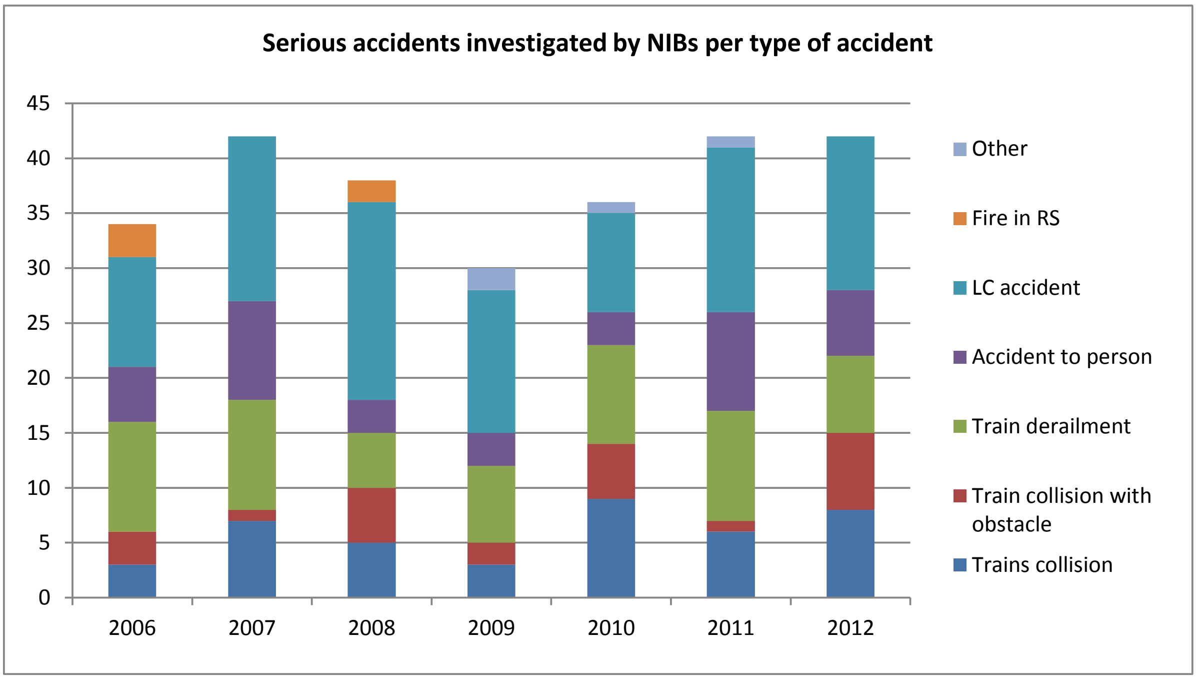


Figure 35: Serious accidents investigated by NIBs per type of accident (EU-27 countries in 2006-2012)

Not all significant accidents have to be investigated by NIBs. Serious accidents that must be investigated by NIBs represent a fraction of significant accidents[18]. In addition to serious accidents, the NIBs sometimes investigate accidents and incidents which under slightly different conditions might have led to serious accidents. This is however not a common practice in all MSs, in particular when it comes to incidents and other minor accidents.

Each year, the NIBs notify the Agency that they have opened about 250 investigations into serious accidents and other accidents and incidents. The NSAs report about 2 500 significant accidents a year (Table 10). Among those occurrences investigated by the NIB, only about 12 % of investigated occurrences were serious accidents as referred to in Art. 19(1) of the RSD. As the railway undertakings (RUs) and infrastructure managers (IMs) should normally investigate all serious accidents as part of their safety management systems (SMSs), those accidents which have not been investigated by the NIBs, will be investigated by railway operators.

Year of reporting	National safety authorities (NSAs)		National investigation bodies (NIBs)
	Significant accidents	Precursors	Notifications of opened investigations
2009	3 027	9 565	177
2010	2 401	10 712	247
2011	2 342	9 893	368

Table 10: Number of events reported to the ERA in the period 2009–2011 (EU-27)

The share of significant accidents (reported under CSIs) as a proportion of all investigated accidents per type is showed in Figure 36, which unveils that train derailments are the preferred type of accident into which the NIBs decide to open an investigation, with 46 % of these accident types being investigated by NIBs. Less than one third of significant train collisions and fires in rolling stock are investigated by NIBs of Member States. Only 8 % of level crossing accidents are subject to independent investigation. This may appear surprising since in these accidents, the IMs responsibility for managing the risks of the infrastructure is likely to be relevant. Establishing causes of accidents to persons caused by rolling stock in motion is usually straightforward; the investigation into this type of accident is typically limited and carried out by the operators in cooperation with judicial authorities.

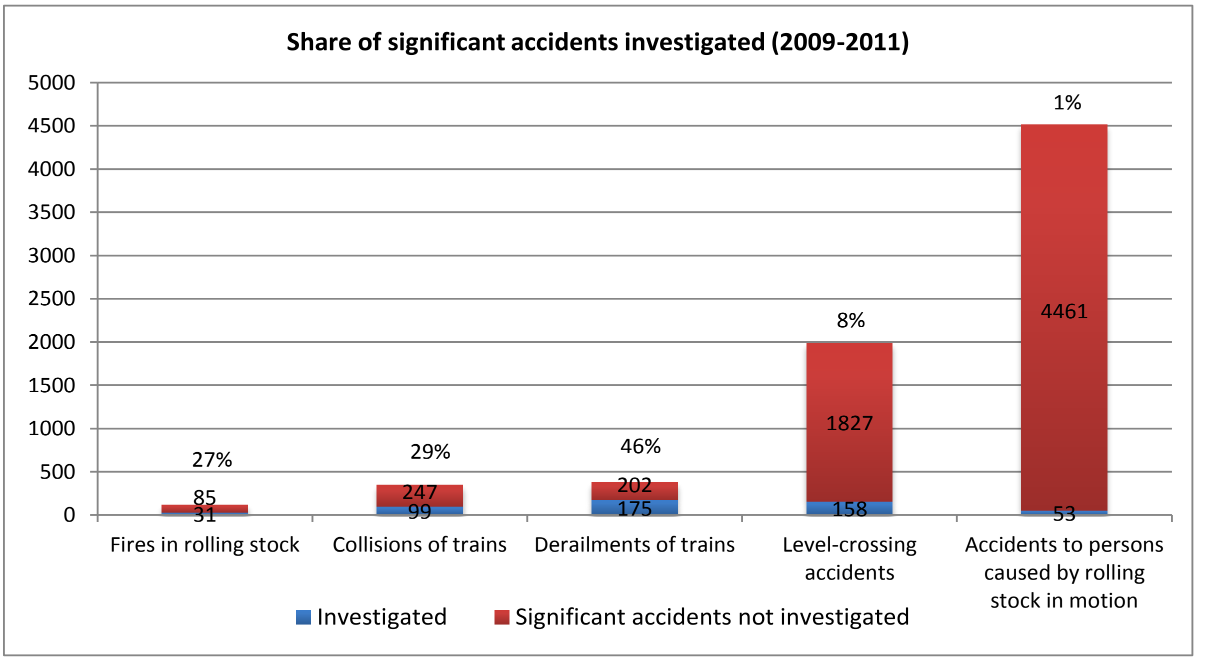


Figure 36: Serious railway accidents investigated by NIBs together with the resulting casualties (EU-27)

([18]) Collision or derailment of trains resulting in the death of at least one person or serious injuries to five or more persons or damage above EUR 2 million and any other similar accidents – see Background information for RSD definition.

The overview of the number of investigations carried out by NIBs in Europe is showed in Figure 37. There was a drop in the number of investigated occurrences that occurred in 2009; since then the number of occurrences investigated by NIBs across Europe has been rising. The figure also shows that over the past four years, the percentage share of investigation that were closed during the year following the occurrence has been rather stable, at about 70 %.

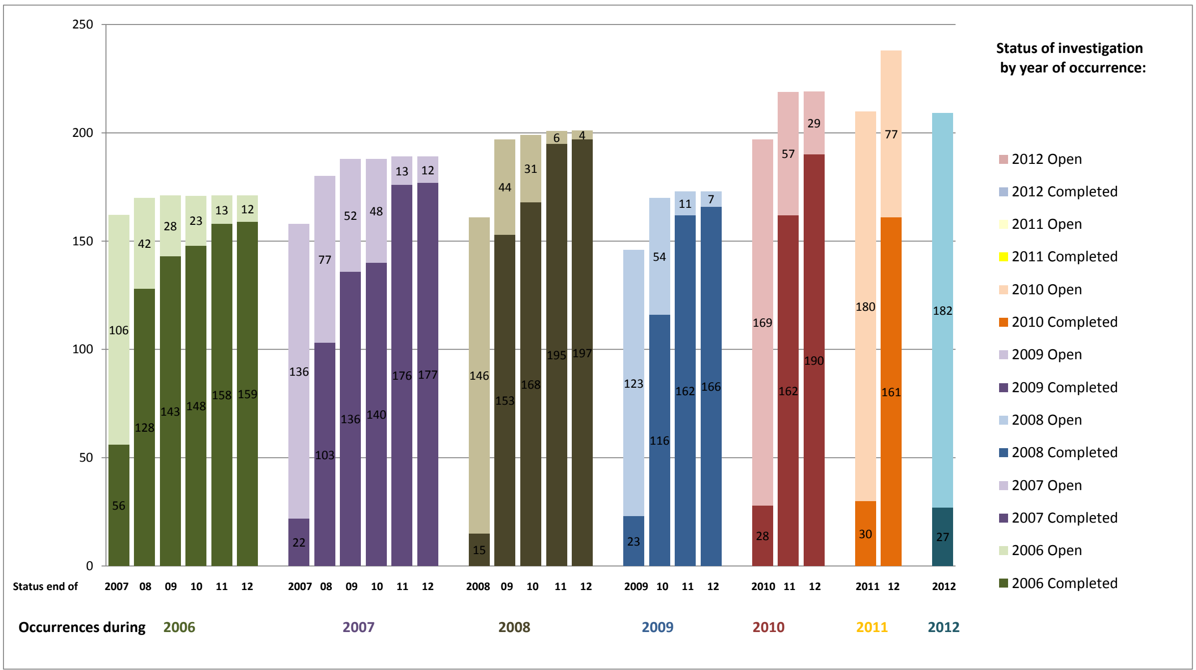


Figure 37: NIB investigation carried out since 2006 with the status of investigation (ERAIL database)

The average number of days between the accident occurrence and the notification on starting an investigation to the Agency has been decreasing over time: It now stands at less than 50 days ([19]) in average. Despite an improvement recorded over time, an important proportion of started investigation is not notified to the Agency within 10 days after the decision has been taken on the investigation to start ([20]).

The final investigation reports on the investigations carried out by NIBs should be made public as soon as possible, and normally not later than one year after the date of the occurrence. The average number of months before the final report is submitted to the Agency has also been decreasing over time: from more than 15 months for accidents occurring in 2008 to around 10 months for accidents occurring in 2011.

Year of occurrence / average number of days between occurrence and	2008	2009	2010	2011	2012
Notification	91	60	49	50	35*
Final investigation report	460	402	377	313	-

Table 11: Average time span between occurrence and accident notification and between occurrence and the submission of the final investigation report to the Agency (in days)

The list of serious accidents (collisions and derailments) that occurred in 2012 is shown together with basic information in Annex 2. The status of the investigation and the reference in ERAIL database of investigated occurrences is provided.

([19]) Estimate based on the assumption that the time-span between the occurrence and the decision to start an independent investigation by NIB is usually short (single days).

([20]) RSD, Art. 24(1): “Within one week after the decision to open an investigation the investigating body shall inform the Agency thereof.”

Background information

The report *Railway safety performance in the European Union* summarises information on the development of railway safety in Europe. The primary purpose is to provide safety intelligence and information on risks to EU policy-making bodies, NSAs and NIBs, and to the general public. The report reviews the performance levels achieved during 2011 across a number of topic areas. It includes basic statistical analyses on a wide range of safety performance indicators and highlights significant findings.

The report is based on the common safety indicators (CSIs) data reported to the ERA by 5 November 2012. Any changes after that date have not been taken into account. Information presented on serious accidents and their investigations is based on reports available to the ERA on 4 March 2013. Any event occurring after that day is not covered by this report. This report covers the railways in 25 of the 27 EU countries; Cyprus and Malta do not have railway systems that are covered by EU legislation. These 25 Member States are referred to as 'Member States', 'EU', or 'EU countries' in the report. The Channel Tunnel (CT) is a separate reporting entity, so that relevant data are given separately to the French and UK data. The data are also reported by Norway. Therefore, there were a total of 27 reporting entities in 2011; the term 'Europe' was sometimes used for this complete group in the report.

European legislation requires Member States to report to the ERA on significant accidents and serious accidents occurring on their territory. The NSAs must report all significant accidents. The NIBs must investigate all serious accidents, notify the ERA of these investigations and, when closed, send the investigation report to the ERA. The term significant accident covers a wider range of events than serious accidents. The legislation provides the following definitions for these two groups of accident:

Significant accident	Serious accident
Directive 2004/49/EC, Commission Directive 2009/149/EC and Regulation (EC) No 91/2003	Directive 2004/49/EC
'significant accident' means **any accident** involving at least one rail vehicle in motion, resulting in at least one killed or seriously injured person, or in **significant damage** to stock, track, other installations or environment, or extensive disruptions to traffic. Accidents in workshops, warehouses and depots are excluded ([21]). Significant damage is damage that is equivalent to EUR 150 000 or more.	'serious accident' means 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 ([22]).
Reporting of CSIs by NSAs	Accident investigation by NIBs
Each year the safety authority shall publish an annual report concerning its activities in the preceding year and send it to the Agency by 30 September at the latest. The report shall contain information on: the development of railway safety, including an aggregation at Member State level of the CSIs laid down in Annex I ([23])	Within one week after the decision to open an investigation the investigating body shall inform the Agency thereof. The investigating body shall send the Agency a copy of the final report normally not later than 12 months after the date of the occurrence ([24]).

Table 12: Accidents reported to the ERA according to the EU legislation

([21]) Appendix to Annex I to the RSD, Article 1.1.
([22]) Article 3(l) of the RSD.
([23]) Article 18 of the RSD.
([24]) Article 24 of the RSD.

The current legislative framework does not require Member States to collect information on all railway accidents. The reporting is often limited to significant accidents and a selection of other events. Data on incidents are not necessarily collected by RUs/IMs and the NSAs do usually rely on accident data when planning their supervision activities.

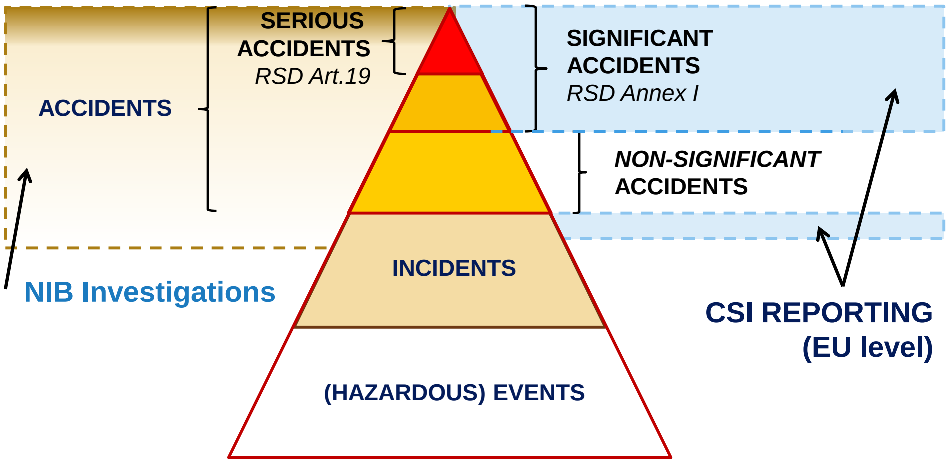


Figure 38: Pyramidal model for railway safety management

Moreover, the information about less serious accidents and incidents are not systematically collected at the EU level; some Member States do not have such a database as well. This may represent an obstacle to efficient learning and early identification of recurring safety issues in EU railway system.

There are certain limitations in respect to the current EU railway safety monitoring approach. It relies exclusively on outcome indicators such as number of accidents and resulting casualties. With these indicators moving ultimately towards zero at country level, the approach has severe limitations in terms of reactivity and capability to capture underlying raising safety issues.

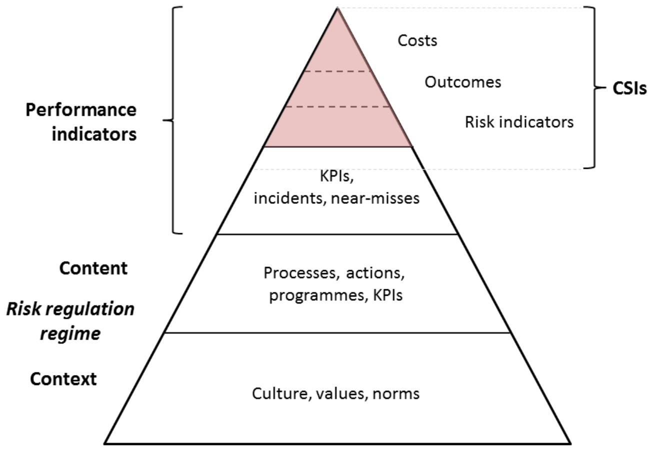


Figure 39: Pyramidal model for railway safety management

Not all safety performance indicators are covered by the CSIs; so new indicators may be introduced in the future. Similarly, there is no common approach towards the measurement of a risk regulation regime at Member State level. Indicators reflecting corresponding levels of the pyramid may be developed in the future. Not all of them are traditional quantitative indicators such as CSIs or key performance indicators (KPIs). They may lead to a new approach to the assessment of railway safety management systems at both Member State and EU levels.

Annexes

Annex 1 — Common safety indicators

List of CSI data tables

Table Nr	Name
1	Fatalities by category of person
2	Serious injuries by category of person
3	Number of accidents by type of accidents
4	Number of accidents involving at least one railway vehicle transporting dangerous goods
5	Number of suicide
6	Traffic and infrastructure data

For full set of CSI data, please go to **http://erail.era.europa.eu**

Legend

(light green)	Natural variation
(dark green)	Natural variation due to a single accident
(pink)	Change of definition or reporting procedure
(grey)	Unknown reason for variation
(outlined box)	Further detailed explanation available

Table 1	Fatalities by category of persons																													
	Year	AT	BE	BG	CT	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE	IT	LT	LU	LV	NL	NO	PL	PT	RO	SE	SI	SK	UK	Total	EU
Passengers	2008	2	2	12	0	13	1	0	0	1	5	0	10	10	0	4	0		0	1	0	8	3	15	0	0	2	0	89	89
	2009	1	2	1	0	1	3	0	0	0	2	0	7	0	0	5	0	0	1	0	0	8	0	4	0	0	2	0	37	37
	2010	0	18	0	0	2	0	0	0	1	15	0	2	3	0	7	0	0	0	0	0	7	1	4	2	0	0	0	62	62
	2011	0	0	1	0	5	9	0	0	0	2	0	7	3	0	0	0	0	0	0	0	10	0	0	0	0	1	0	38	38
Employees	2008	2	1	1	0	4	8	0	0	2	1	0	2	1	0	5	2		2	0	0	1	1	4	0	0	0	1	38	38
	2009	0	1	1	0	0	4	1	2	1	0	1	1	1	0	5	1	1	1	1	0	1	1	3	0	1	0	1	29	29
	2010	0	1	2	0	5	8	0	1	0	3	1	1	2	0	5	0	0	0	0	0	6	1	4	2	0	2	0	44	44
	2011	2	2	1	0	3	10	0	0	0	0	1	2	1	0	1	0	0	0	0	0	2	0	2	2	0	0	0	29	29
Level crossing users	2008	17	10	4	0	24	50	3	1	6	15	8	38	42	1	6	6		6	18	0	39	15	38	4	4	11	14	380	380
	2009	12	8	4	0	21	41	3	3	13	16	11	36	28	0	5	8	1	2	13	2	72	17	40	6	7	25	13	407	405
	2010	13	9	8	0	34	44	4	2	12	9	8	29	30	2	11	5	0	5	8	3	54	11	35	7	6	9	4	362	359
	2011	21	8	2	0	17	28	0	3	5	8	2	29	27	0	15	6	0	2	10	1	60	4	22	7	1	11	6	295	294
Unauthorised persons	2008	18	8	27	0	3	78	8	7	8	23	13	40	62	2	49	32		15	1	1	260	23	151	9	9	41	41	929	928
	2009	19	5	22	0	4	103	11	5	8	13	2	31	63	1	36	24	0	8	0	3	284	14	103	13	3	44	36	855	852
	2010	17	5	6	0	6	80	6	9	16	10	4	37	47	1	48	26	0	13	0	3	216	9	96	31	7	44	16	753	750
	2011	12	15	33	0	4	82	6	6	8	15	2	50	53	1	49	20	0	8	3	4	244	10	76	15	3	37	45	801	797
Other persons	2008	0	0	0	0	0	27	1	0	0	2	0	4	0	0	0	0		6	0	0	0	0	0	0	0	2	2	44	44
	2009	2	0	0	0	0	19	0	0	0	0	0	1	0	0	30	0	1	5	0	1	0	0	0	0	0	1	3	63	62
	2010	0	11	0	0	1	14	0	0	0	0	0	0	0	0	0	0	0	4	2	3	0	0	0	0	1	3	5	44	41
	2011	0	2	0	0	0	11	0	0	0	0	0	0	0	0	0	0	0	3	1	0	4	0	0	0	0	0	4	25	25
Total persons	2008	39	21	44	0	44	164	12	8	17	46	21	94	115	3	64	40		29	20	1	308	42	208	13	13	56	58	1480	1479
	2009	34	16	28	0	26	170	15	10	22	31	14	76	92	1	81	33	3	17	14	6	365	32	150	19	11	72	53	1391	1385
	2010	30	44	16	0	48	146	10	12	29	37	13	69	82	3	71	31	0	22	10	9	283	22	139	42	14	58	25	1265	1256
	2011	35	27	37	0	29	140	6	9	13	25	5	88	84	1	65	26	0	13	14	5	320	14	100	24	4	49	55	1188	1183

Table 2 **Serious injuries by category of persons**

	Years	AT	BE	BG	CT	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE	IT	LT	LU	LV	NL	NO	PL	PT	RO	SE	SI	SK	UK	Total	EU
Passengers	2008	6	36	8	1	40	30	3	0	9	3	0	14	28	0	5	0		2	0	1	44	6	26	3	11	5	1	282	281
	2009	9	10	10	1	9	13	5	0	0	2	0	14	43	1	35	0	0	2	1	1	49	4	20	2	2	0	2	235	234
	2010	4	171	0	0	14	8	1	0	3	14	0	12	29	0	6	0	0	0	5	0	35	3	14	10	1	17	7	354	354
	2011	5	3	14	0	13	33	3	0	0	5	3	14	32	1	4	0	0	0	0	1	58	2	15	2	5	4	1	218	217
Employees	2008	12	28	2	0	4	33	2	0	2	1	3	4	1	0	4	1		2	1	0	5	2	7	1	10	1	5	131	131
	2009	9	1	0	0	2	18	2	0	3	0	0	3	0	0	7	0	0	2	1	1	9	2	2	4	2	0	3	71	70
	2010	14	4	1	0	3	18	0	0	3	2	0	4	1	0	5	0	0	0	0	0	10	2	12	5	0	3	6	93	93
	2011	6	1	2	0	4	28	3	0	0	0	0	5	1	0	0	0	0	1	2	3	11	0	5	2	1	1	1	77	74
Level crossing users	2008	23	16	6	0	42	32	2	0	12	2	1	14	16	0	8	4		7	5	0	113	10	74	1	0	15	5	408	408
	2009	27	6	1	0	33	22	0	1	16	4	3	22	11	0	0	3	0	4	4	0	50	5	50	7	7	14	2	292	292
	2010	23	4	9	0	45	32	4	10	8	3	3	17	22	0	3	2	0	5	1	1	52	3	65	5	7	2	2	328	327
	2011	25	9	8	0	21	25	3	7	6	3	3	9	21	0	1	2	0	5	3	1	46	3	50	3	5	14	1	274	273
Unauthorised persons	2008	12	2	22	0	52	38	2	5	6	13	2	6	15	0	21	8		15	0	0	111	20	126	1	20	15	6	518	518
	2009	9	1	11	0	48	39	7	6	3	5	7	21	30	0	16	9	0	1	0	1	89	7	115	2	3	20	7	457	456
	2010	8	1	12	0	45	29	3	0	6	8	5	11	18	0	18	13	0	7	3	0	91	8	91	5	4	17	6	409	409
	2011	7	4	18	0	36	41	3	0	8	2	2	23	22	0	29	9	1	13	3	0	93	5	81	8	1	20	4	433	433
Other persons	2008	0	1	0	0	1	23	0	0	0	0	0	2	0	1	0	0		5	0	0	4	1	0	0	0	2	4	44	44
	2009	6	0	0	0	0	26	1	0	0	1	0	1	0	0	13	0	0	3	3	1	2	0	0	0	0	1	1	59	58
	2010	0	6	0	0	0	29	0	4	0	0	0	2	0	0	0	0	0	3	1	4	0	0	0	0	0	6	2	57	53
	2011	2	5	0	0	0	20	1	0	0	0	0	2	0	0	0	0	0	2	0	0	1	0	0	0	0	0	2	35	35
Total persons	2008	53	83	38	1	139	156	9	5	29	19	6	40	60	1	38	13		31	6	1	277	39	233	6	41	38	21	1383	1382
	2009	60	18	22	1	92	118	15	7	22	12	10	61	84	1	71	12	0	12	9	4	199	18	187	15	14	35	15	1114	1110
	2010	49	186	22	0	107	116	8	14	20	27	8	46	70	0	32	15	0	15	10	5	188	16	182	25	12	45	23	1241	1236
	2011	45	22	42	0	74	147	13	7	14	10	8	53	76	1	34	11	1	21	8	5	209	10	151	15	12	39	9	1037	1032

Table 3 **Accidents by type of accidents**

Accident types	Years	AT	BE	BG	CT	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE	IT	LT	LU	LV	NL	NO	PL	PT	RO	SE	SI	SK	UK	Total	EU
Collisions of trains	2008	3	94	3	0	5	13	0	0	1	4	0	97	1	0	2	1		1	2	6	8	0	0	4	4	12	8	269	263
	2009	5	34	3	0	5	16	1	0	2	1	0	7	0	1	7	4	0	1	2	6	18	0	2	1	1	6	17	140	134
	2010	3	5	2	0	3	13	1	1	4	2	0	15	1	0	2	0	1	1	5	9	4	2	10	3	0	13	8	108	99
	2011	2	0	0	0	6	18	1	0	1	4	2	12	0	0	6	0	0	0	4	15	8	1	1	2	1	11	3	98	83
Derailments of trains	2008	7	21	0	0	2	12	0	2	2	15	1	97	1	1	10	1		0	1	3	105	3	1	14	0	6	14	319	316
	2009	1	41	0	0	3	7	0	0	2	7	2	14	1	0	6	1	0	0	2	3	63	1	1	7	0	3	12	177	174
	2010	2	2	1	0	3	19	1	0	2	7	1	14	1	0	3	1	0	0	3	4	17	3	0	7	0	2	6	99	95
	2011	2	3	1	0	5	14	1	0	0	7	0	11	1	0	4	0	0	1	1	4	23	2	1	7	0	7	6	101	97
Level-crossing accidents	2008	36	56	9	0	53	76	5	12	17	18	9	115	44	1	16	19		10	21	0	278	20	86	6	41	63	23	1034	1034
	2009	36	31	5	0	42	64	2	7	26	19	12	49	39	1	7	14	5	8	13	2	288	15	57	13	11	51	16	833	831
	2010	33	17	10	0	57	73	9	17	16	11	9	36	42	2	15	6	2	10	9	3	86	14	58	14	16	50	7	622	619
	2011	43	16	7	0	34	56	2	15	8	8	5	40	38	0	18	6	0	8	14	2	86	7	43	7	6	50	11	530	528
Accidents to persons caused by rolling stock in motion	2008	35	25	52	1	72	193	13	12	19	43	14	57	79	3	83	42		45	1	2	397	49	314	13	14	78	57	1713	1711
	2009	37	34	40	1	62	201	21	12	11	22	10	64	136	2	83	33	2	19	4	4	400	27	235	20	2	74	49	1605	1601
	2010	29	15	20	0	61	166	10	13	17	24	10	64	96	1	80	37	0	27	5	3	341	22	190	38	4	116	34	1423	1420
	2011	30	32	65	2	51	175	14	13	15	23	7	76	104	2	78	27	1	26	3	6	366	17	166	28	3	102	54	1486	1480
Fires in rolling stock	2008	0	24	1	1	1	6	0	0	1	0	0	24	0	0	2	5		0	0	3	9	0	0	3	0	8	0	88	85
	2009	1	6	0	0	1	4	0	0	0	0	0	16	1	0	9	3	0	0	0	1	3	0	0	1	0	14	6	66	65
	2010	0	0	0	1	0	2	0	0	0	0	0	6	0	0	0	0	0	0	1	1	0	0	2	0	0	9	2	24	23
	2011	0	0	1	0	1	4	1	0	0	0	0	2	0	0	0	0	0	0	1	1	0	0	1	2	1	9	2	26	25
Other accidents	2008	16	0	0	0	0	29	4	0	0	0	3	63	30	0	3	0		5	1	0	92	1	10	6	6	50	2	321	321
	2009	8	0	0	0	0	18	5	0	1	2	2	21	3	1	7	0	0	2	1	0	71	0	9	4	5	88	4	252	252
	2010	12	1	6	0	1	24	1	0	0	1	3	20	2	0	3	0	0	3	1	0	1	1	11	7	1	41	5	145	145
	2011	7	0	0	0	2	18	1	0	0	0	0	13	4	0	2	0	0	0	6	7	5	0	5	8	0	56	2	136	129
Total nr accidents	2008	97	220	65	2	133	329	22	26	40	80	27	453	155	5	116	68		61	26	14	889	73	411	46	65	217	104	3744	3730
	2009	88	146	48	1	113	310	29	19	42	51	26	171	180	5	119	55	7		22	16	843	43	304	46	19	236	104	3043	3027
	2010	79	40	39	1	125	297	22	31	39	45	23	155	142	3	103	44	3	41	24	20	449	42	271	69	21	231	62	2421	2401
	2011	84	51	74	2	99	285	20	28	24	42	14	154	147	2	108	33	1	35	29	35	488	27	217	54	11	235	78	2377	2342

Table 4 **Dangerous goods accidents**

	Year	AT	BE	BG	CT	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE	IT	LT	LU	LV	NL	NO	PL	PT	RO	SE	SI	SK	UK	Total	EU
Accidents involving at least one railway vehicle transporting DG	2010	0	2	0	0	0	4	2	0	0	1	0	0	0	0	5	3	0	2	0	0	32	1	2	0	0	0	0	54	54
	2011	0	0	0	1	0	3	2	0	0	4	0	2	0	0	0	3	0	2	3	0	6	0	1	0	0	0	1	28	28
Accidents involving at least one railway vehicle transporting DG in which DG are NOT released	2010	0	0	0	0	0	2	1	0	0	1	0		0	0	0	3	0	0	0	0	8	1	1	0	0	0	0	17	17
	2011	0	0	0	0	0	1	2	0	0	4	0	0	0	0	0	2	0	1	2	0	5	0	1	0	0	0	1	19	19
Accidents involving at least one railway vehicle transporting DG in which DG ARE released	2010	0	2	0	0	0	2	1	0	0	0	0		0	0	5	0	0	2	0	0	24	0	1	0	0	0	0	37	37
	2011	0	0	0	1	0	2	0	0	0	0	0	2	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	9	9

Table 5 **Suicide fatalities**

	Years	AT	BE	BG	CT	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE	IT	LT	LU	LV	NL	NO	PL	PT	RO	SE	SI	SK	UK	Total	EU
Total nr of suicides	2008	93		27	0	160	714	24	1	1	174	52	289	111	7	137	0		9	164	7	29	50	29	71	20	58	202	2429	2422
	2009	101	69	19	0	185	875	32	0	3	163	62	337	139	2	111	2	4	10	197	8	25	69	25	67	10	56	210	2781	2773
	2010	90	84	18	0	198	899	23	0	2	124	44	328	121	6	109	4	3	13	201	7	47	51	23	68	15	48	224	2750	2743
	2011	87	98	27	0	235	853	26	0	4	128	64	332	155	6	140	5	7	10	215	11	28	42	76	62	25	40	203	2879	2868

Table 6	**Traffic volumes and infrastructure**																												
	Year	AT	BE	BG	CT	CZ	DE	DK	EE	EL	ES	FI	FR	HU	IE	IT	LT	LU	LV	NL	NO	PL	PT	RO	SE	SI	SK	UK	EU
Train km (million)	2008	158	93	35	6	175	1044	82	7	21	193	53	541	109	20	367	16		20	139	47	224	42	96	138	20	49	549	4197
	2009	152	92	31	6	163	1003	82	7	20	188	50	504	106	18	351	14	8	19	132	43	209	41	89	143	18	45	569	4059
	2010	156	98	31	6	160	1032	83	9	17	187	51	485	97	18	324	14	8	17	146	46	219	40	94	141	19	48	520	4019
	2011	152	101	31	6	161	1063	85	7	13	191	51	502	110	18	317	15	9	18	161	46	227	37	104	140	20	45	528	4114
Passenger km (billion)	2008	10.60	10.40	2.33	0.00	6.66	82.5	6.47	0.27	1.66	22.07	4.05	87.00	8.29	1.98	49.41	0.40	0.00	0.95	16.50	2.86	20.14	4.15	6.96	10.84	0.83	2.28	53.00	409.75
	2009	10.50	10.49	2.14	0.00	6.47	81.6	6.39	0.23	1.41	21.73	3.88	83.26	7.95	1.68	46.43	0.36	0.33	0.75	16.80	3.00	18.58	4.15	6.18	11.22	0.84	2.25	52.76	398.38
	2010	10.70	10.49	2.10	0.50	6.55	83.7	6.59	0.46	1.14	20.98	3.96	81.75	7.67	1.68	43.47	0.37	0.35	0.74	16.62	3.15	17.80	4.11	5.50	11.04	0.81	2.29	55.83	397.20
	2011	10.90	9.49	2.07	0.51	6.75	85.0	6.89	0.39	0.96	21.40	3.88	82.75	7.80	1.64	41.33	0.39	0.35	0.73	16.89	3.04	18.05	4.14	5.14	11.43	0.77	2.43	56.06	398.18
Passenger train km (million)	2010	105	81	23	1	123	777	79	5	16	158	35	410	85	17	280	5	7	6	134	35	146	32	71	94	11	33	485	3221
	2011	100	86	23	1	123	790	80	3	12	162	36	426	84	17	274	5	8	6	147	35	143	31	79	97	11	31	491	3266
Freight train km (million)	2010	45	16	7	0	37	255	4	4	1	26	16	75	12	0	44	9	1	10	12	9	73	8	23	41	8	15	35	775
	2011	44	15	7	0	38	273	4	4	1	26	15	76	26	0	43	10	1	12	13	9	80	7	25	43	9	14	38	825
Other train km (million)	2010	7	1	1	5	0	0		0	0	3	0		0	1	0	0		0	0	3		0		6	0	0	0	23
	2011	8	0	1	5		0		0		3			0	1	1	0	0	0	0	2	5	0		0	0	0	0	23
Freight tonne km (billion)	2010	22	0	0	0	34	107	3	14	0	0	10	33	0	0	20	13	1	17	6	4	49	3	11	23	3	0	19	389
	2011	22	0	0	0	34	113	3	12	0	9	9	0	28	0	21	15	1	21	6	4	53	2	18	23	4	18	23	436
Line kilometres	2010	5807	3540	3973	108	9628	33803	3613	900	2552	13853	5919	42039	8657	1683	16794	1768	275	1897	3016	4114	20045	2842	17263	11066	1228	3622	15777	231668
	2011	5188	3587	3946	159	9614	33736	2650	918	2523	13965	5944	29297	7915	1683	16789	1768	275	1865	3035	4114	20066	2794	17220	11206	1209	3624	16187	217164
Track kilometres	2008	8197	6282	5116	159	11554	51851	3800	2133	3062	17960	8848	45951	10577	2110	25720	2180		4731	6700	4080	28673	3528	20348	16075	2192	4638	31534	323917
	2009	8154	6426	5154	159	11554	51780	3687	2166	3070	17972	8847	46007	10577	2141	26174	2182	614	3396	6868		28836	3528		15349	2187	4638	31571	303037
	2010	8049	6344	5154	159	11554	63839		2167	3070	18967	8862	42039	10577	2165	24370	2148	614	3395	6830	4341	28743	3531	20171	15347	2187	4638	31631	326551
	2011	7201	6344	5154	200	11554	63067	4094	2164	3041	19372	8885	42088	10577	2165	24377	2184	614	3998	7000	4341	28730	3483	20129	15601	2177	4641	31108	329948

Annex 2 — List of serious accidents – collisions and derailments - occurring in 2012 and notified to ERA

Title	Date of occurrence	Occurrence type	Fatalities	Serious injuries	Available casualties details	Reference ERAIL
Trains collision with an obstacle, 13/01/2012, Langenhorn Schl.; Strecke Westerland - Elmshorn (Germany)	13/01/2012	Trains collision with an obstacle	1	2	1 passenger fatality, 2 passenger serious injury	DE-1329
Train derailment, 15.02.2012, On Vestfoldbanen, between Nykirke and Holmestrand station (Km 92,000) (Norway)	15/02/2012	Train derailment	0	5	2 passenger serious injuries	NO-1359
Trains collision, 2012-03-03, Line 64 section Sprowa-Starzyny km point. 21,150 electrified double-track line; track No 1 (Poland)	03/03/2012	Trains collision	16	2	13 passenger fatalities	PL-1378
Trains collision with an obstacle, 06/04/2012, CH 29+500 Thessaloniki-Athens at Kryoneri (Greece)	06/04/2012	Trains collision with an obstacle	4	0	4 other fatalities	EL-1434
Trains collision, 13/04/2012, Mühlheim (Main) - Hanau (Germany)	13/04/2012	Trains collision	3	6	6 serious passenger injury	DE-1395
Trains collision, 21-4-2012, Amsterdam Singelgracht Aansluiting - Heavily used 6-way track between Amsterdam Central Station and Amsterdam Sloterdijk Station, equipped with switches and crossings. (The Netherlands)	21/04/2012	Trains collision	1	23	1 passenger fatality, 22 passenger serious injury	NL-1413
Trains collision with an obstacle, 14/06/2012, Line 25 track A at the end of a platform in the railway station of Duffel (Belgium)	14/06/2012	Trains collision with an obstacle	1	1	1 other fatality, 1 other serious injury	BE-1436
Trains collision, 26.07.2012, Hosena (Germany)	26/07/2012	Trains collision	1	1	1 other fatality	DE-0131

Annex 3 — List of national safety authorities and national investigation bodies

Code	Country	National safety authority	National investigation body
BE	Belgium	Federale Overheidsdienst Mobiliteit en Vervoer Directoraat-generaal vervoerte Land Service Public federal Mobilité et Transports Direction générale Transport terrestre http://www.mobilit.fgov.be	Federale Overheidsdienst Mobiliteit en Vervoer Onderzoeksorgaanvoor Ongevallen en Incidenten op het Spoor Service Public federal Mobilité et Transports Organisme d'enquête sur les accidents et les incidents ferroviaires http://www.mobilit.fgov.be/
BG	Bulgaria	Ministry of Transport — Railway Administration Executive Agency www.iaja.government.bg	Ministry of Transport — Railway Accident Investigation Unit http://www.mtitc.government.bg
CZ	Czech Republic	Drážní Úřad (DU) — Rail Authority http://www.ducr.cz	Drážní inspekce (DI) — Rail Safety Inspection Office http://www.dicr.cz/
DK	Denmark	Trafikstyrelsen http://www.trafikstyrelsen.dk	Havarikommissonen for Civil Luftfart og Jernbane http://www.havarikommissionen.dk
DE	Germany	Eisenbahn-Bundesamt (EBA) http://www.eba.bund.de	Bundesministerium für Verkehr, Bau und Stadtentwicklung Eisenbahn-Unfalluntersuchungsstelle http://www.bmvbs.de
EE	Estonia	Tehnilise Järelevalve Amet http://www.tja.ee	Ohutusjuurdluse Keskus (OJK) — Safety Investigation Bureau http://www.ojk.ee
IE	Ireland	Railway Safety Commission http://www.rsc.ie	Railway Accident Investigation Unit http://www.raiu.ie
EI	Greece	Hellenic Ministry of Infrastructure, Transport and Networks Department of Railway Safety http://www.yme.gr	Hellenic Ministry of Infrastructure, Transport and Networks Committee for Accident Investigation http://www.yme.gr
ES	Spain	Dirección General de Infraestructuras Ferroviarias http://www.fomento.es	Ministerio de Fomento Comision de Investigación de Accidentes ferroviarios http://www.fomento.es
FR	France	Établissement public de sécurité ferroviaire (EPSF) http://www.securite-ferroviaire.fr	Bureau d'Enquêtes sur les Accidents de Transport Terrestre http://www.bea-tt.equipement.gouv.fr
IT	Italy	Agenzia Nazionale per la Sicurezza delle Ferrovie http://www.ansf.it	Railway Safety Commission http://www.mit.gov.it
LV	Latvia	Valsts dzelzceļa tehniskā inspekcija — State Railway Technical Inspectorate http://www.vdzti.gov.lv	Transporta nelaimes gadījumu un incidentu izmeklēšanas birojs — Transport Accident and Incident Investigation Bureau (TAIIB) http://www.taiib.gov.lv
LT	Lithuania	Valstybinė geležinkelio inspekcija State Railway Inspectorate http://www.vgi.lt	Katastrofų tyrimųvadovas National Investigation Body http://www.sumin.lt

LU	Luxembourg	Ministère du Développement durable et des Infrastructures Administration des Chemins de Fer (ACF) http://www.gouvernement.lu	Administration des Enquêtes Techniques http://www.mt.public.lu/transports/AET/
HU	Hungary	Nemzeti Közlekedési Hatóság — National Transport Authority http://www.nkh.gov.hu	Közlekedésbiztonsági Szervezet — Transportation Safety Bureau http://www.kbsz.hu
NL	Netherlands	Inspectie Leefomgeving en Transport (ILT) http://www.ilent.nl	The Dutch Safety Board http://www.safetyboard.nl
AT	Austria	Bundesministerium für Verkehr, Innovation und Technologie Oberste Eisenbahnbehörde http://www.bmvit.gv.at	Bundesanstalt für Verkehr (VERSA) Unfalluntersuchungstelle des Bundes, Fachbereich Schiene http://versa.bmvit.gv.at
PL	Poland	Urząd Transportu Kolejowego http://www.utk.gov.pl	Państwowa Komisja Badania Wypadków Kolejowych (NIB) http://www.mi.gov.pl
PT	Portugal	Instituto da Mobilidade e dos Transportes Terrestres http://www.imtt.pt	Gabinete de Investigação de Segurança e de AcidentesFerroviários (GISAF) http://www.iot.gov.pt (site under construction)
RO	Romania	Autoritatea Feroviară Română (AFER) — Romanian Railway Safety Authority http://www.afer.ro	Organismul de Invesigare Feroviar Român (OIFR) — Romanian Railway Investigating Body http://www.afer.ro
SI	Slovenia	Javna agencija za železniški promet Republike Slovenije (AŽP) — Public Agency of the Republic of Slovenia for Railway Transport http://www.azp.si	Ministry of Transport Railway Accident and Incident Investigation Division http://www.mzp.gov.si
SK	Slovakia	Úrad pre reguláciu železničnej dopravy (URZD) — Railway Regulatory Authority http://www.urzd.sk	Ministry of Transport Posts and Telecommunication http://www.telecom.gov.sk
FI	Finland	Liikenteen turvallisuusvirasto — Finnish Transport Safety Agency (TraFi) http://www.trafi.fi	Onnettomuustutkintakeskus — Accident Investigation Board of Finland http://www.onnettomuustutkinta.fi
SE	Sweden	Transportstyrelsen — Swedish Transport Agency http://www.transportstyrelsen.se	Statens haverikommission http://www.havkom.se
UK	United Kingdom	Office of Rail Regulation (ORR) http://www.rail-reg.gov.uk	Rail Accident Investigation Branch http://www.raib.gov.uk/
NO	Norway	Statens Jernbanetilsyn (SJT) — Norwegian Railway Authority http://www.sjt.no	Statens havarikommisjon for Transport — Accident Investigation Board Norway (AIBN) http://www.aibn.no
CT	Channel Tunnel	Channel Tunnel Intergovernmental Commission (IGC) Commission intergouvernementale Tunnel sous la Manche http://www.channeltunneligc.co.uk www.cigtunnelmanche.fr	See the relevant authority or body in France or United Kingdom for the respective part of the Channel Tunnel