Rail Safety & Standards Board

Workforce safety performance report

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Executive summary

This workforce safety performance report reveals that 35% of the total mainline railway risk is attributable to railway staff. This group may be divided into three subgroups – *track workers*, *train crew* and *other workforce*. Each is considered in turn in this Safety Performance Report (SPR), which covers all aspects of workforce safety and includes information up to 31 July 2006.

Some of the key safety facts presented herein are as follows:

- In the year to 31 July 2006, there were two workforce fatalities. The death of a shunter on 17 July ended a period of more than eight months without a workforce fatality.
- While the fatality rate for the construction industry (as a whole) is around two-thirds that of the railway industry (as a whole), the fatality rate for road construction operatives is some 45% higher than for track workers.
- Workforce harm (in terms of major injuries) has improved significantly, with a 26% reduction in major injuries being evident between January and July 2006 (70, against 95 for Jan-Jul 2005). At its peak in 2004, there was an average of 17.3 major injuries per month, compared to an average of 10 in 2006 (up to July). This represents a 42% reduction.
- For minor injuries, however, there has been no tangible trend between 2001 and 2006.
- Numbers of workforce on-train injuries have remained broadly consistent: there were 1,341 on-train injuries in the first seven months of 2006, compared to 1,307 for the same period in 2005. Most of these injuries were the result of assaults on train guards.
- Five incidents of runaway trains that could have affected workers on or about the track were recorded between January and July 2006; this represents a 45% improvement on the nine seen during the same period of 2005.

To help disseminate good practice throughout the industry, Rail Safety and Standards Board (RSSB) has taken a close look at the initiatives employed to improve workforce safety at both local and national level. Information was received from Network Rail and a wide range of train operating companies (TOCs). This has been tabulated in section 6. We also include a Spotlight feature on First Engineering's safety team, detailing some of the schemes the company has in place for managing its operations.

1 Introduction

On 31 October 2006, a tamper unit struck a stationary ballast regulator at the site of the former Badminton station near Bristol. Four members of the workforce were taken to nearby hospitals, including the drivers of both machines.

While falling outside this report's 31 July 2006 data cut-off, the above incident illustrates that the trackside remains a dangerous location for railway staff. Considerable risk is also accrued by the marshalling of trains. Even in the current age of automatic couplings, manual methods are still used to attach and detach vehicles. Indeed, a shunter was fatally crushed while attempting to couple a wagon to a Class 47 locomotive at Dagenham Dock Yard on 17 July 2006.

In addition to its presentation of workforce risk levels, this report takes a closer look at those involved with shunting. Recent trends are also identified to highlight areas of changing safety performance. Furthermore, the report outlines the underlying causes that contribute to the current level of risk, along with the initiatives and research projects that are in hand to improve safety further.

Fatalities and injuries are discussed throughout this document. Fatalities that occurred in a particular event, or group of events, are first considered separately. The major and minor injuries that arose are then taken into account. This enables injuries to be weighted in accordance with their relatively less serious outcome. The current weighting is 0.1 for each major injury and 0.005 for each minor injury, the combined measure being deemed 'fatalities and weighted injuries' (FWI).

We would appreciate your views on the content of this document, along with any ideas about additional information that you would like to see in future editions. Please send your feedback to Claire Chambers, whose contact details may be found on the title page.

2 Aims and objectives

Rail Safety and Standards Board's (RSSB) safety performance reports support the industry's Strategic Safety Plan (SSP) by presenting detailed information on targeted topics. They are updated periodically, so that trends in risk may be observed as the industry addresses areas of specific concern.

The key aim of this report is to present information on the risk from all hazardous events involving the workforce. This will help employers gain a greater understanding of the potential dangers and should help them focus on areas requiring further risk reduction. The report also details the many steps already being undertaken with this end in mind.

3 Scope and structure

3.1 Report scope

This report considers the rail network of Great Britain in relation to the following types of event, using safety data up to the end of July 2006:

- Workforce shock / trauma.
- Injuries within possessions.
- Irregular working incidents.
- Shunting.
- Train runaways.
- Train accidents.
- Incidents in stations.
- Incidents on trains.

Note that the risk profile section has been compiled using data from version 5 of the Safety Risk Model (SRM).

3.2 Report structure

This report is in four main sections:

Safety performance – here, key findings on fatalities, injuries, workforce shock / trauma, possession incidents, irregular working incidents, shunting, runaways and train accidents are presented, with an emphasis on current trends.

Risk profile – this section provides the results of the SRM relevant to workforce safety.

Current initiatives – national and local initiatives intended to minimise the risk of hazards to the workforce are presented in this section.

Appendices – there are two main appendices, covering workforce major injuries and relevant research projects. A glossary and table of definitions are also provided.

4 Safety performance

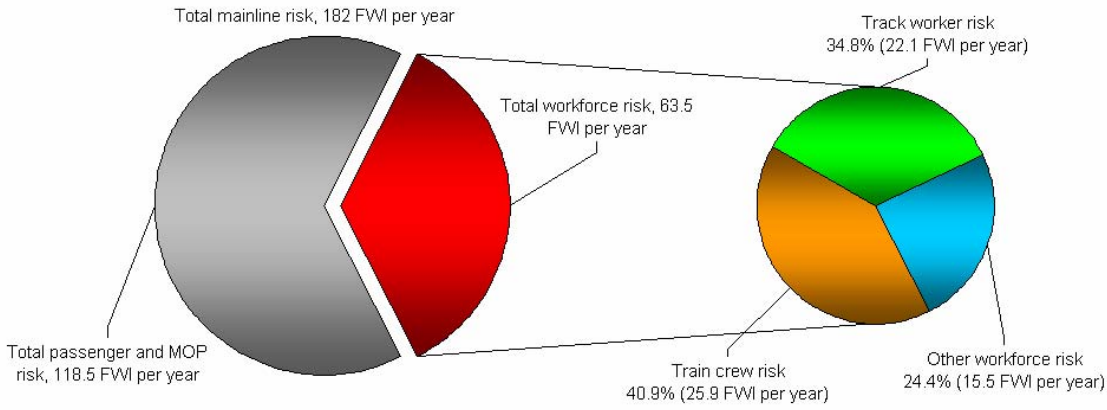
4.1 Summary

This section presents a general overview of safety performance relevant to workforce safety. A detailed assessment of each area is presented in the subsections that follow.

Chart 1 shows workforce risk in the context of overall railway risk, as measured by version 5 of RSSB's Safety Risk Model (SRM). At 63.5 FWI/year, it is approximately 35% of the total network risk. The main risk contributors are movement and non-movement accidents (resulting in 17.7% and 80% of all workforce risk respectively). The chart also illustrates how the group breaks down into three worker categories:

- *Track workers* – 34.8%. – Most exposed group to fatal risk
- *Train crew* – 40.9%. – Risk is mainly associated major and minor injuries
- *Other workforce* – 24.4%.

Chart 1. Workforce safety risk in context of overall railway risk (excl. suicide)



There were two workforce fatalities between 1 January and 31 July 2006:

On 17 July, a Frieghtliner shunter was crushed at Dagenham Dock Yard while carrying out a movement to couple a wagon to a Class 47 locomotive (SE).

On 29 July, an EWS driver was investigating smoke coming from his vehicle at Deal (SE), and was seen to slump on the conductor rail. It is believed that this was an accident and that he died from third rail electrocution.

4.1.1 Workforce fatalities and major injuries

The railway is a naturally hazardous environment for those in its employ. But the hazards are not of one type, and differ if one works on stations, near the track, on the train or in the signal box. In the last decade, only one year (1997) has seen no workforce fatalities.

With just two incidents occurring in the period covered by this report, it is difficult to define any clear trend. However, there has been a 26% drop in workforce major injuries between January and July 2006 (95, against 70 for the same period of 2005).

4.1.2 Workforce minor injuries

As one might expect, a large number of minor injuries are sustained every year. These can take a number of forms, from minor slips, trips and falls to insignificant blows from hand tools.

Underreporting means the actual numbers may be much higher, but this report reveals that around 6,700 minor injuries per year constitute the current five-year average. More information on underreporting may be found in section 4.5.

Section 4.6 also discusses the effects of witnessing traumatic events. Shock and post-traumatic stress are most likely to involve observing fatalities from trespass and suicide. However, a particularly violent verbal or physical assault can have a similar result.

4.1.3 Shunting

Since 1986, there have been 13 fatalities during train marshalling movements. Most of these involve a staff member being crushed either between vehicles or between a buffer and a fixed buffer stop. The continued need for the manual coupling of some rail vehicles requires operatives to place themselves in potentially hazardous positions. Attempting to perform such a task led to the death of an EWS shunter in 2005.

4.1.4 Working in possessions[1]

Section 4.9 deals with collisions and derailments, possession irregularities, incorrect protection arrangements, near misses and runaways. The Rule Book provides guidance on the correct procedures to ensure operations are carried out safely. Modules T3 and T4 deal with engineering work being carried out within possessions on the running line and in sidings respectively.[2] Both make it immediately clear that the proper arrangements must be made before work is begun. However, accidents can and do happen, and the reasons behind them, the associated trends and some of the mitigation measures currently being explored are presented in this document.

4.2 Railway worker risk in context

The railway environment is known to present a relatively high level of worker risk in Britain. Trackside working exposes employees to civil engineering type hazardous events, along with the additional hazards of moving trains, difficult site access and unprotected electrical supplies. A number of rail occupations have a high exposure to such hazardous events, including those involved in the shunting of trains and the inspection and maintenance of railway infrastructure. There are also occupations that have a lower level of exposure, but the same potential for a severe outcome (such as train drivers having to leave their cab to change ends or inspect their trains and fitters attending failed trains).

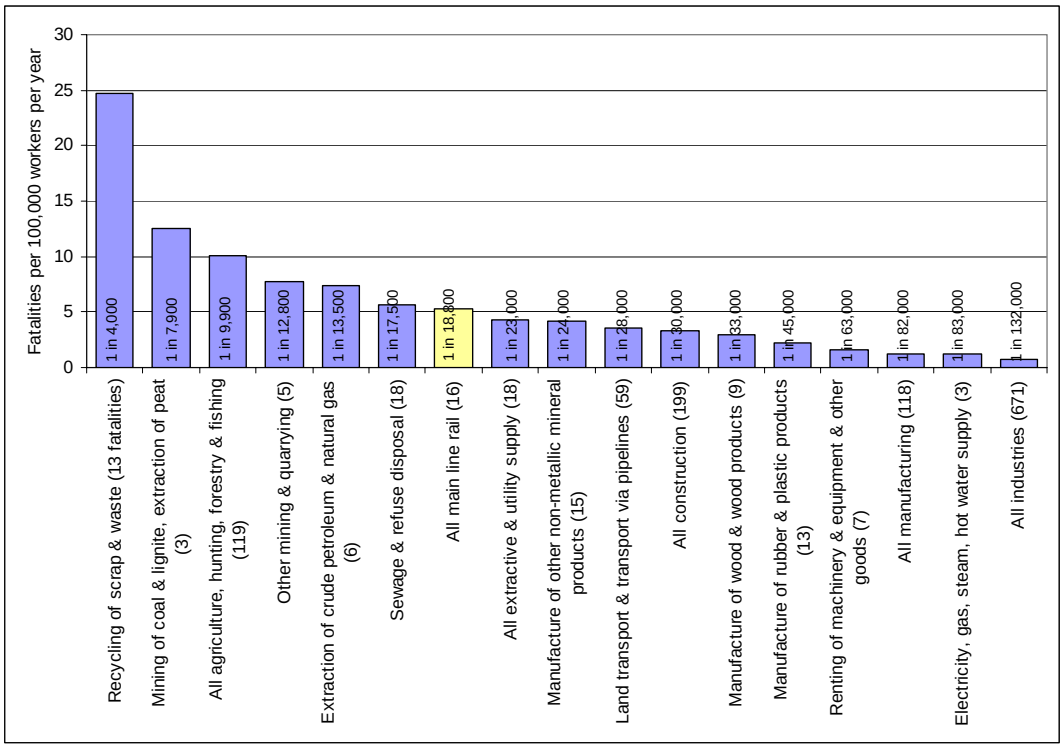
4.2.1 Industry risk

Chart 2 compares the level of risk (in terms of fatalities per 100,000 workers per year) for mainline rail against other high-risk industries. Comparative information for the non-rail industries has been obtained from Heath and Safety Executive (HSE) statistics,[3] covering a three-year period from 1 April 2004 to 31 March 2006. Data from 2005-06 is

[1] Often referred to as 'absolute possession'.
[2] Note that module T2 deals with *protecting* engineering work or a hand trolley on a line *not under possession*.
[3] *Statistics of fatal injuries 2005/06*, Health and Safety Executive. Figures used are for *workers*, which includes employees and the self-employed.

noted by the HSE to be provisional, although any changes to the finalised figures are likely to be small. The railway risk calculation is based on the same three years of data, obtained from the RSSB fatalities database.

Chart 2. Industry risk comparison



Data is from a three-year period (1 April 2004 to 31 March 2006) based on HSE statistics and RSSB fatality coding.

In Chart 2, the actual number of fatalities is shown in brackets after the industry labels on the x-axis. Inside the bars is an alternative risk measure, which presents the probability of a fatality per worker per year.

Working in the railway industry is a relatively high-risk occupation, as the average worker risk is approximately seven times the average for all industries. The rail industry is observed to pose less risk to workers than the agricultural industry, but more than the extractive and utility supply, the construction and the manufacturing industries.

The HSE[4] provides guidance for evaluating individual employee risk by defining a *region of tolerability* through the use of upper and lower limits:

- The upper limit of the tolerable region is defined by an annual fatality probability of one in 1,000. If the risk exceeds this level, it is considered unacceptable and must be reduced to a tolerable level, whatever the cost. Failing this, the activity generating the risk must be stopped.

- The lower limit is defined by an annual fatality probability of one in 1,000,000. If the risk is below this level, it is regarded as broadly acceptable and does not need to be reduced further.

[4] *Reducing Risks, Protecting People (R2P2)*, HSE Books 2001.

- If the risk falls between these limits, it is considered tolerable if it has been reduced to a level which is as low as reasonably practicable.

4.2.2 Occupational risk

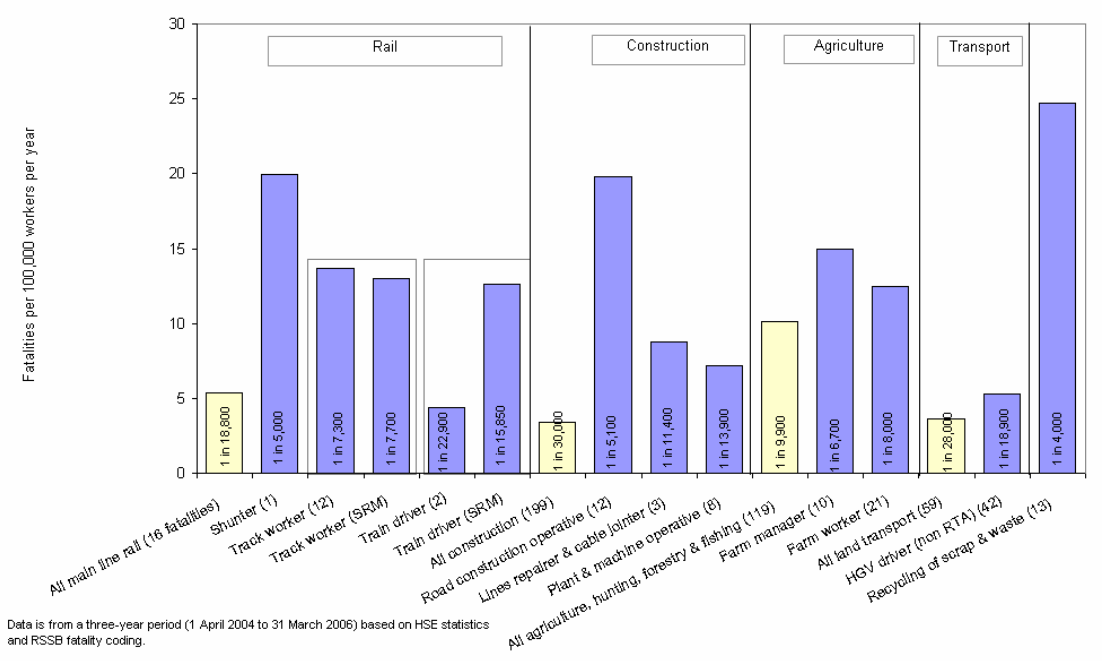
Within any industry, risk is not evenly distributed throughout the workforce. Indeed, some occupations have a significantly higher risk than others. It is therefore beneficial to compare the risk between groups of workers that undertake particular tasks.

Higher-risk occupations within specific industries are compared in Chart 3. The yellow bars show the overall risk to workers for various industries, whilst the blue bars show the risk from particular high-risk occupations within each industry. The final bar is shown for reference as it is the recycling industry that has traditionally been the highest risk industry in the UK.

Such statistics need to be treated with caution as they have the potential to misrepresent reality. Comparisons at this level of detail are somewhat imprecise as the small numbers, in terms of the number of fatalities or the number of workers, can accentuate differences and cause significant fluctuations. For example, the one shunter fatality in the three-year period under investigation (up to 31 March 2006) results in a fatality rate of nearly 20 per 100,000 workers. However, if the most recent three years were utilised instead, then the fatality rate would be nearer 40 per 100,000 workers (due to an additional fatality recorded in June 2006). Alternatively, if five years (which included July 2006) were considered, the fatality rate would be closer to 24 per 100,000 workers. This all serves to illustrate the difficulty in obtaining robust estimates of the risk when small numbers are involved, as is the case with shunters. Shunter safety is examined in more detail in section 4.8.

Both safety performance estimates and SRM-based estimates are shown on the chart for the rail section. The SRM estimates take into account the potential effects of all low-frequency, high-consequence hazardous events that could affect workforce risk (even those that have not actually occurred during the data-period on which the current estimates are based). The track worker estimates are very similar for both, while the SRM estimates a greater train driver risk as it considers all potential fatal scenarios for that subgroup; this is understood to be an indication of the average long-term risk profile.

Chart 3. High risk occupation comparison



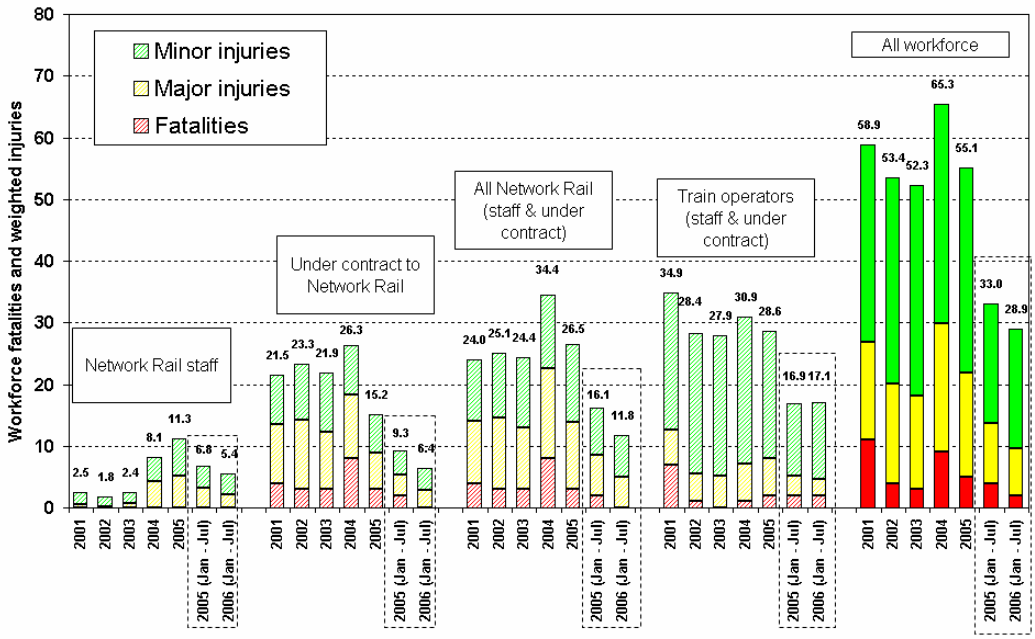
Within the industry, track workers are known to face a higher risk than most other rail workers, as borne out in Chart 3, where 12 of the 16 fatal rail accidents were to track workers. Shunters also face a risk higher than the industry average, whereas train drivers face a lower one.

Although the railways present a unique working environment, the construction industry is deemed to be closest in terms of the types of work undertaken and the potential hazards involved. Whilst the fatality rate for the construction industry as a whole is about two-thirds that of the rail industry, the fatality rate for road construction operatives is some 45% higher than it is for track workers. The fatality rate for train drivers also compares favourably with that for HGV drivers (excluding fatal road traffic accidents) within the transport industry.

Comparison of the individual risk estimates in Chart 2 with the HSE's tolerability of risk criteria in section 4.2.1 shows that all the occupations are observed to lie within the tolerable region defined by HSE.

Comparative levels of workforce harm (according to employment group) are presented in Chart 4. There is no normalisation for person-hours worked, the bars within the dashed outlines showing a like-for-like seven-month comparison between 2005 and 2006.

Chart 4. Workforce harm



4.3 Workforce fatalities

This section covers workforce fatalities up to the end of July 2006. The number of fatalities on an annual basis is shown in Chart 5, where it may be observed that only one year has seen no fatalities in the past decade[5]. A significant proportion of workforce fatalities are caused by being struck by a train, including a shunter who was crushed by a train in July 2006. The second workforce fatality also occurred in July, to an English, Welsh and Scottish Railway (EWS) driver, who was fatally injured by third rail electrocution whilst investigating smoke coming from his vehicle at Deal (South East).

[5] The figures exclude a train guard, who committed suicide by jumping from a train in June 1997.

Chart 5. Annual workforce fatalities

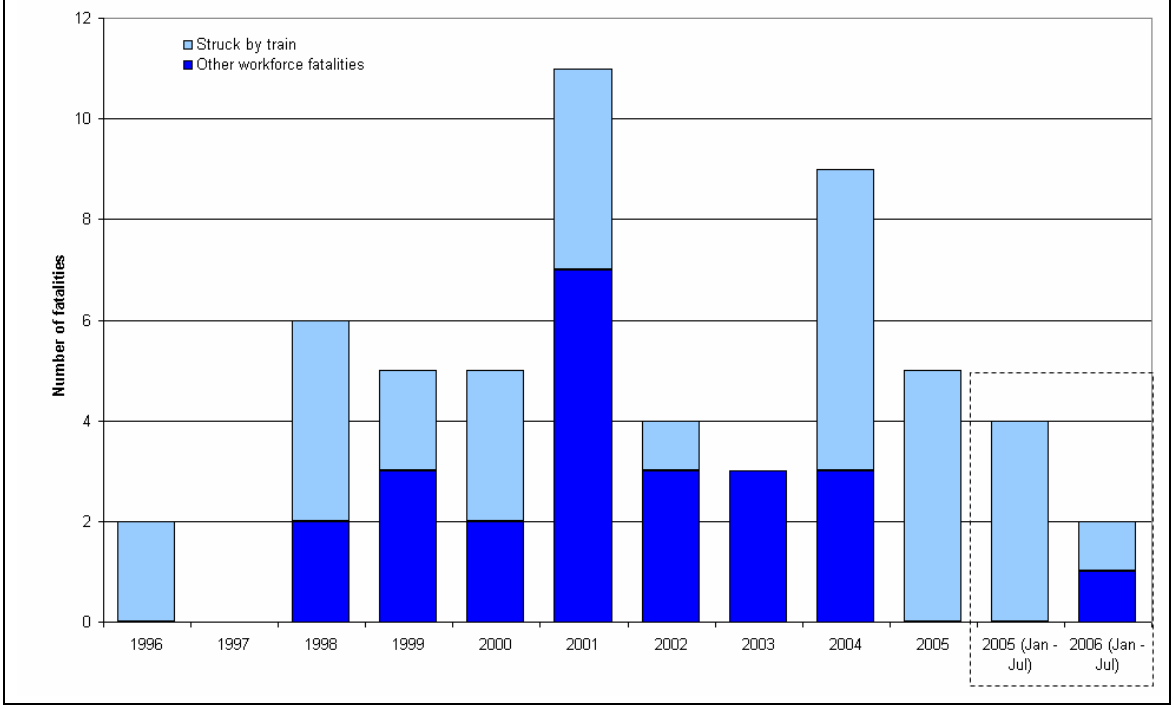
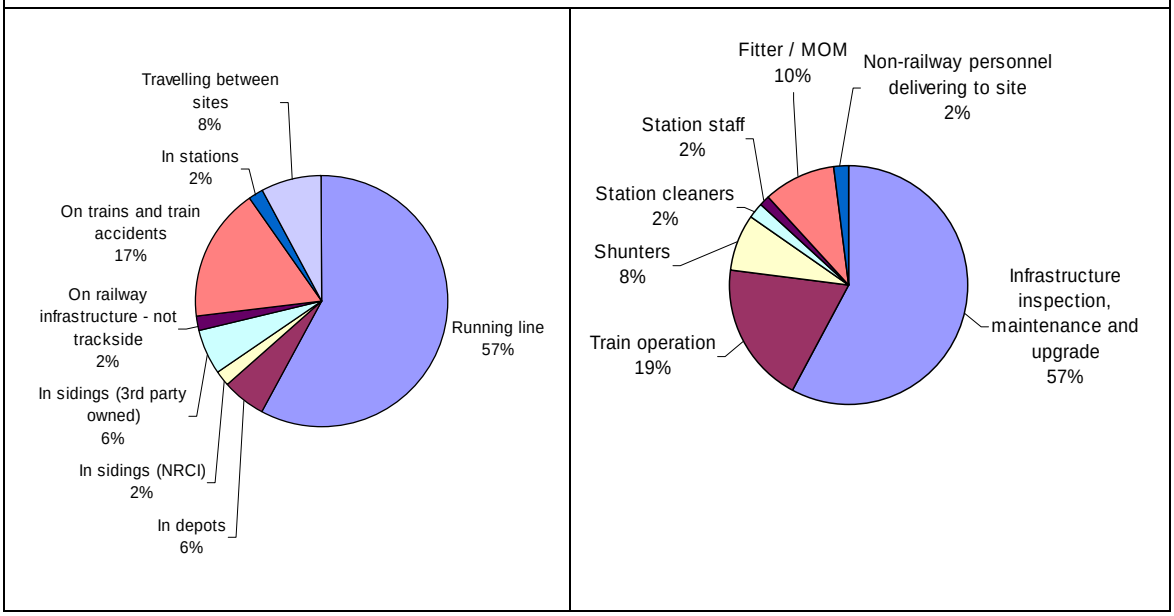


Chart 6 shows the worksite location of all workforce fatalities. The majority of fatalities occur on the running line (57%). The occupation of railway workers fatally injured since 1996 is shown in the right-hand pie chart. Note that track workers, including infrastructure inspection, maintenance and upgrade occupations, account for over half the fatalities (57%).

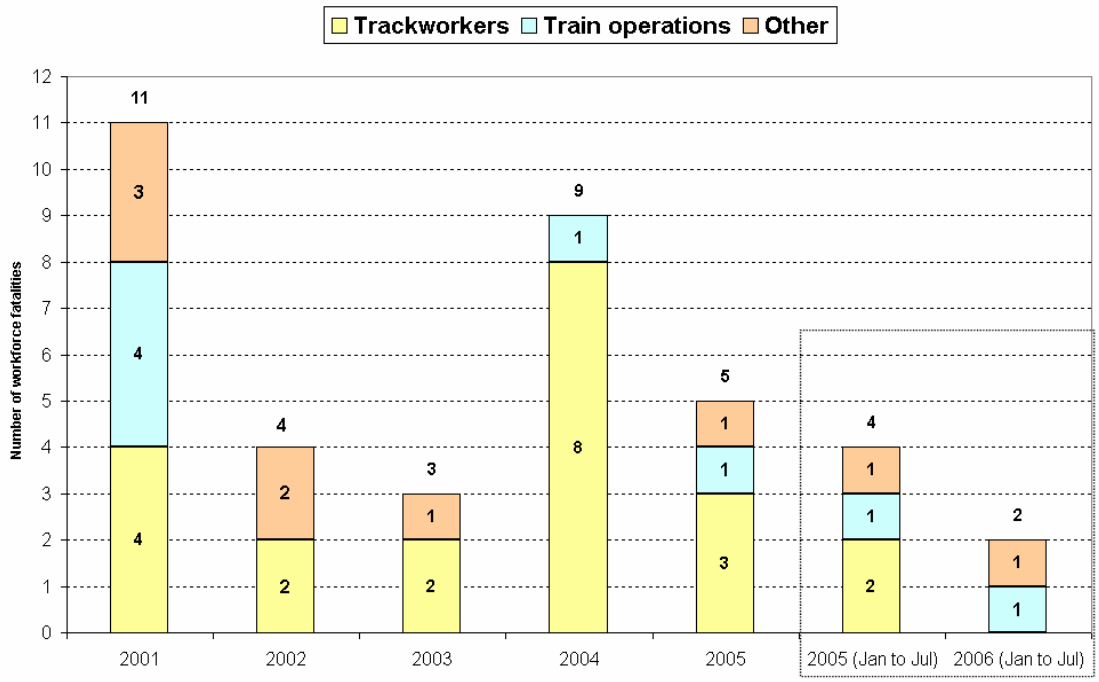
Chart 6. Railway worker fatalities by worksite location and occupation



The number of workforce fatalities over time (for different workforce groups) is shown in Chart 7. The dominance of the track worker group is clearly seen in yellow. The deterioration in workforce safety during 2004 now appears to have been a statistical anomaly due to the multiple fatality incidents of Tebay (four fatalities) and Hednesford (two). The latest figures suggest that safety performance is now better than in previous

years, with the exception of the *train operators (staff & under contract)* employee subset.

Chart 7. Workforce fatalities by workforce group



Neither of the fatalities in 2006 occurred to a track worker, but both took place at a trackside location. In the past, workforce risk analysis has concentrated on track workers, as this group is subject to the highest risk. However, other staff groups may also be exposed to risk from being in a trackside location.[6] This is illustrated by the examples provided at the start of this subsection.

Table 1 presents a breakdown of the 52 workforce fatalities that have occurred over the past 10-and-a-half years, by location type and person type. The track worker group comprises the rows outlined in green. The table shows that, over the period in question, the track worker group accounted for 58% of fatalities (30 out of 52), whilst the number of fatalities occurring in a trackside location accounted for 71% (37 out of 52). Although 87% of the track worker fatalities occurred in a trackside location (26 out of 30), 70% of the trackside location fatalities occurred to track workers (26 out of 37).

The table demonstrates the potential usefulness of analysing data by role and location. For instance, if track worker risk were identified as rising because of increased fatalities whilst travelling to work, the actions taken would likely be different from those adopted if this were due to some aspect of working in a trackside location.

[6] *Trackside* is defined as on the running line, in depots or in sidings.

Table 1. Workforce fatalities by person type and location type, 1996 to July 2006

		Travelling to worksite		Trackside location				Worksite - not trackside				Total workforce type
		Access/egress to/from worksite	Travelling between sites	Running line	In depots	In sidings (NRCI)	In sidings (3rd party owned)	On railway infrastructure - not trackside	On trains and train accidents	In stations	In stores/good yards	
Track workers	Track maintenance		1	16					1			18
	Civil structure inspection							1				1
	S&T renewal/upgrade			1								1
	Electrification maintainance			1								1
	Engineering Supervisor			1								1
	CoSS			2								2
	Hand signaller			1								1
	Lookout			4								4
	Machine operator		1									1
Train operations	Train drivers			3					5			8
	Onboard train crew								1			1
	Train guards								1			1
Other	Station staff								1			1
	Station cleaners									1		1
	Shunters				1	1	2					4
	Non-railway personnel delivering to site			1								1
	Fitter/MOM		2		2		1					5
	Total location type	0	4	30	3	1	3	1	9	1	0	52

Chart 8 shows the numbers of track worker and trackside fatalities over the past 10 years. The two trackside fatalities to non-track workers seen between January and July 2006 illustrate the importance of recording the *fatality location* as well as the employee type. But, just as some trackside deaths do not occur to track workers, not all track worker deaths occur at the trackside (as evidenced by the bar for 2004).

Chart 8. Trackside and track worker fatalities

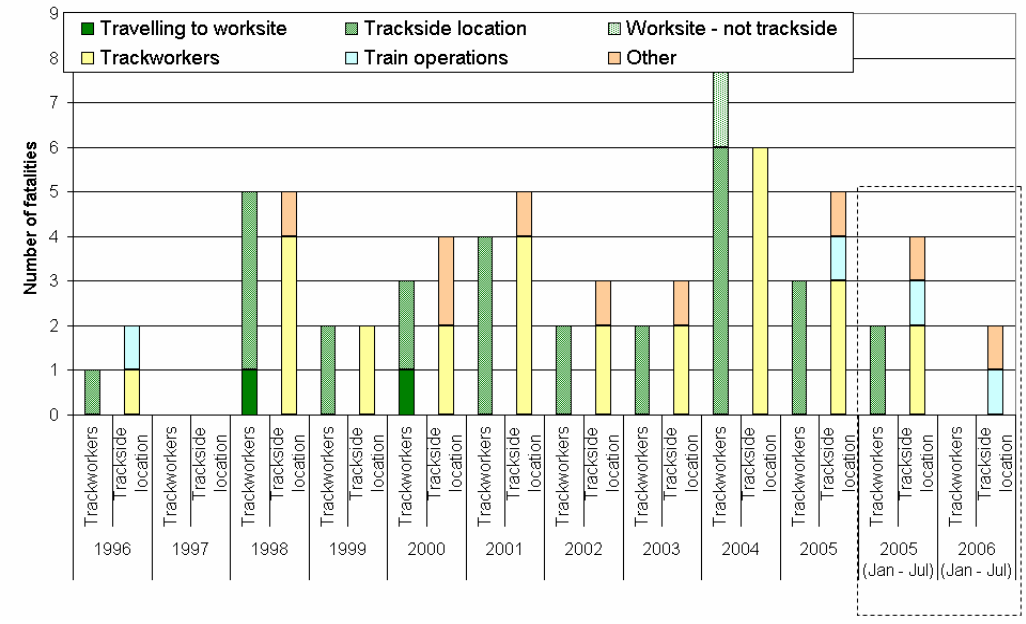
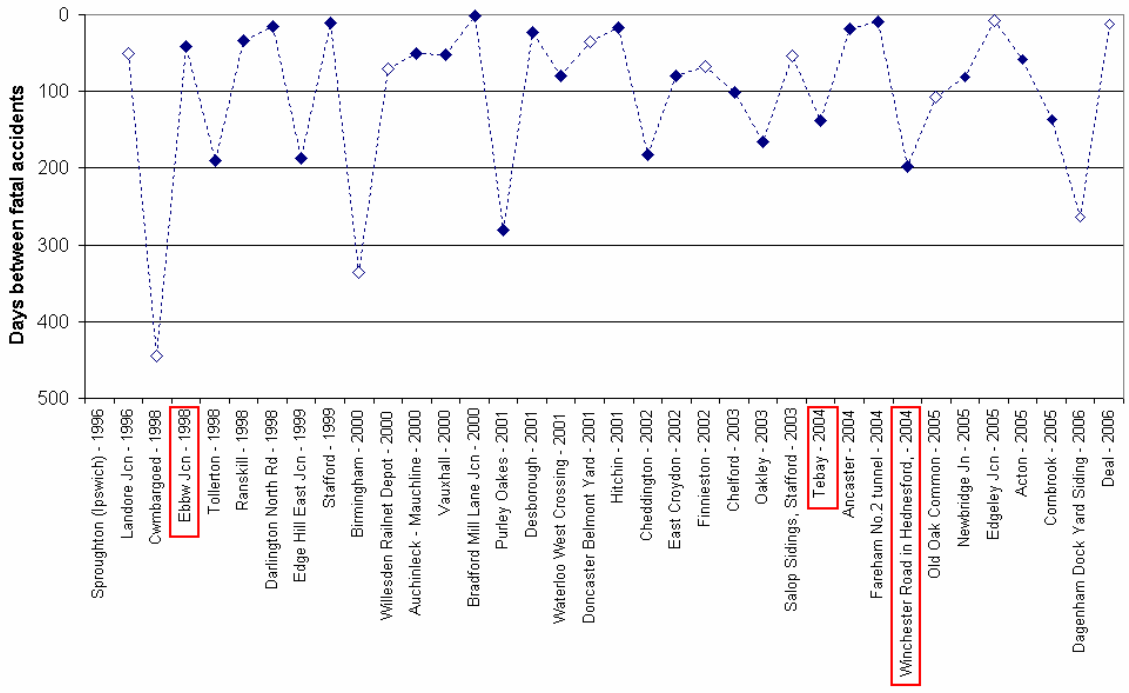


Chart 9 shows the length of time between fatal accidents to track workers (or to others in a trackside environment) over the past 10 years. Accidents that resulted in more than one fatality are shown outlined in red. Note that, of the 36 incidents, three were multi-fatality. There is no regular timeframe between track worker and trackside fatality events: the last two fatalities were only 12 days apart, whereas it had been 264 days since the fatality before that. The average time period between fatalities since 2001 is one fatal accident every 96 days.

Chart 9. Time between track worker and trackside fatality events



Multi-fatality accidents are outlined with a red box.

Track worker fatalities are shown by solid blue diamonds. Other fatalities are shown by white diamonds.

4.3.1 Trends in underlying risk

To see how the underlying level of workforce fatality risk is progressing over the longer term, some sort of normalisation is required. The most obvious metric is 'hours worked', which can be translated into (or substituted by) numbers of staff on the basis of an average number of hours per worker. However, obtaining this information for each workforce group is not straightforward, since there are many different companies involved. Some form of approximation is thus usually required.

Chart 10 presents information on fatality risk trends for two workforce groups for whom normalisation data is fairly robust: train drivers and track workers.

The track worker risk, measured on a five-year moving average basis, is shown in green. This shows a decrease of 9%, compared with the end of 2005. Train driver risk, which is measured on a 10-year moving average, is shown by the blue line. The rate in July 2006 is 17% higher than at the end of 2005. Both the blue and the green lines are normalised per 20,000 workers. This is because each relates to the individual risk per year for each role, and takes into account all types of activities that might be performed by workers in that role.

Train driver risk is measured over a longer period, because the main source of risk for this group arises from train accidents (which are relatively low-frequency events).

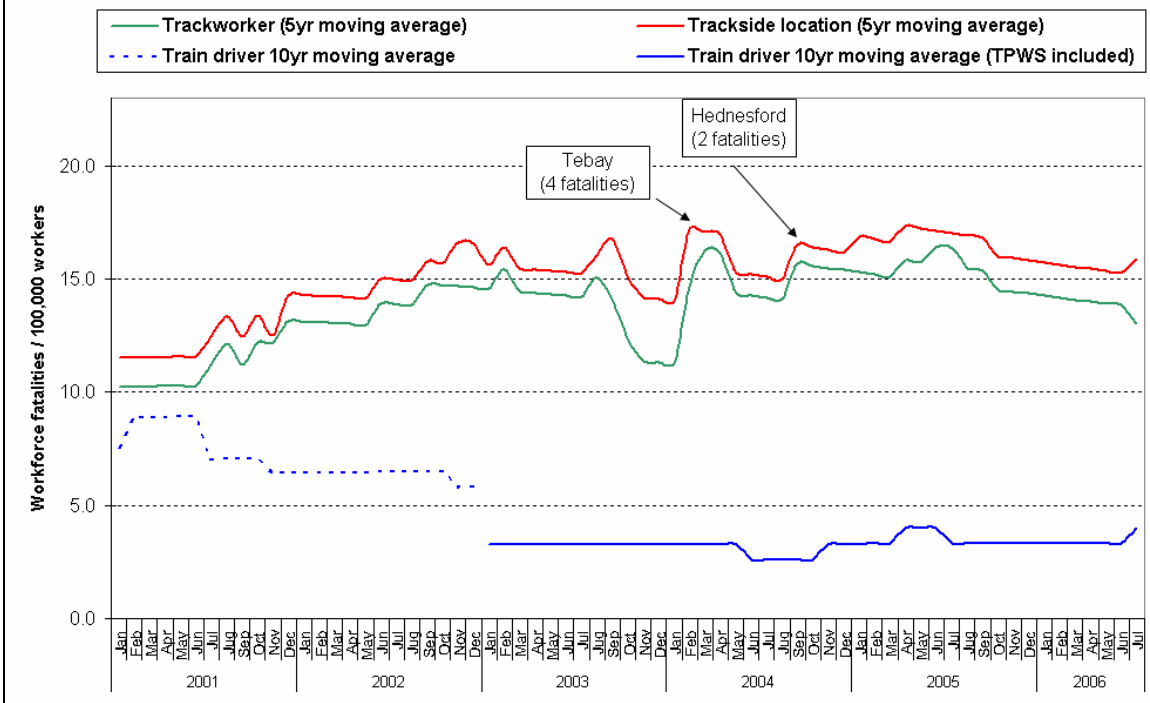
The red line shows the risk from working at a trackside location. Note the concentration on places where fatalities occurred, regardless of the roles of the workers involved. For this reason, the red line would most logically be normalised by hours, rather than number of workers, as it is the exposure to risk (in terms of the length of time engaged in being near the track) that is of interest. However, on the assumption that the additional number of hours contributed by non-track worker staff amounts to no greater than 5% of the full-time equivalent track worker population, the trackside location risk can also be normalised by the number of track workers (increased by 5%). On this basis, Chart 10 shows that trackside location risk has remained level, compared with the end of 2005. Note too that:

- Both the track worker and trackside fatality rates have shown significant increases since the end of 2000 (of 27% and 38% respectively).

- There were two workforce fatalities during the first seven months of 2006. Both occurred at a trackside location, though neither were to a track worker (the first involved a shunter, the second, a train driver).

An assessment of the significance of the current estimates of individual risk is provided in section 4.2.2.

Chart 10. Workforce fatality rates normalised by staff numbers

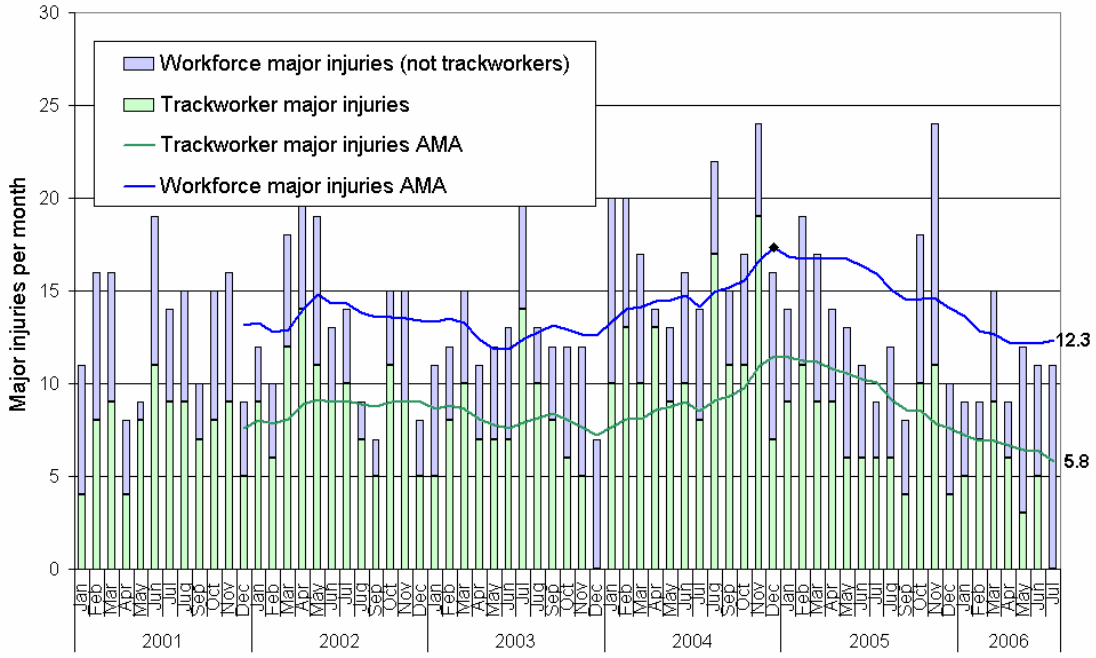


The chart shows a step fall in the fatality rate for train drivers between the end of 2002 and the beginning of 2003. This reflects the safety benefits of TPWS from this point on, which reduces train accident risk.

4.4 Workforce major injury trends

The annual moving average (AMA) of major injuries has returned to the level seen in 2003. For track workers, it is also lower than at any other time in the period portrayed by Chart 11 (which shows the numbers of major injuries to track workers, along with the corresponding AMAs). The track worker AMA is currently 5.8 major injuries per month, compared to 10 just a year ago; the total workforce AMA is 12.3, compared to 15.9 in July 2005.

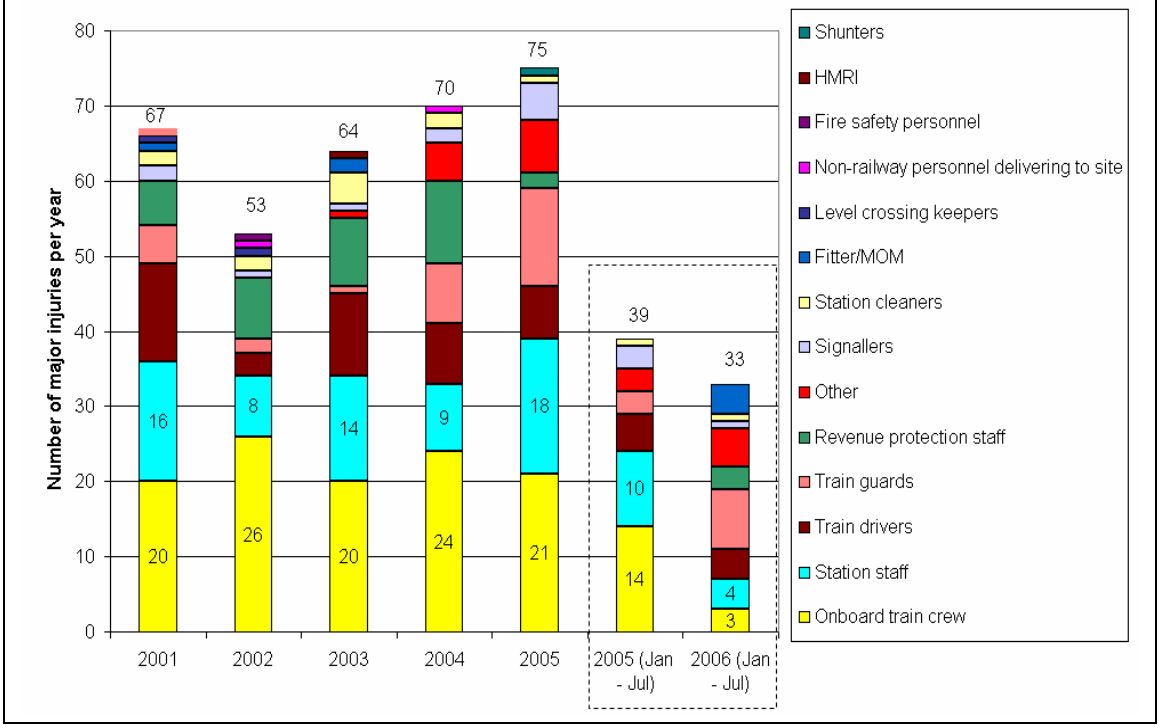
Chart 11. Major injury trends for track workers and the workforce as a whole



Appendix 1 lists all major injuries by worker activity. There has been a 26% reduction in the major injuries recorded between January and July 2006 (70, against 95 for Jan-Jul 2005). The main activity leading to workforce major injuries is track maintenance. There have been fewer incidents between January and July this year (34) than were seen during the same period in 2005 (43).

Chart 12 shows the major injuries to employees other than track workers, grouped by employee type. The highest injury frequency occurs to on-board train crew. There have been 128 major injuries over the past five-and-a-half years in this category, with only three of these occurring between January and July 2006. In contrast, there has been an increase in the number of train guard injuries, which is up from three in Jan-Jul 2005 to eight so far in 2006.

Chart 12. Workforce major injuries to non-track workers by employee type



4.4.1 Workforce major injuries at a trackside location

The number of workforce major injuries at a trackside location up to July 2006 is significantly lower than in previous years. Chart 13 shows that the reduction of major injuries has occurred away from the trackside (which is thus as dangerous as it ever was). Fewer major injuries occurred at stations and on non-trackside NRCI sites, such as signal boxes, level crossings and bridges.

Chart 13. Workforce major injuries at a trackside location

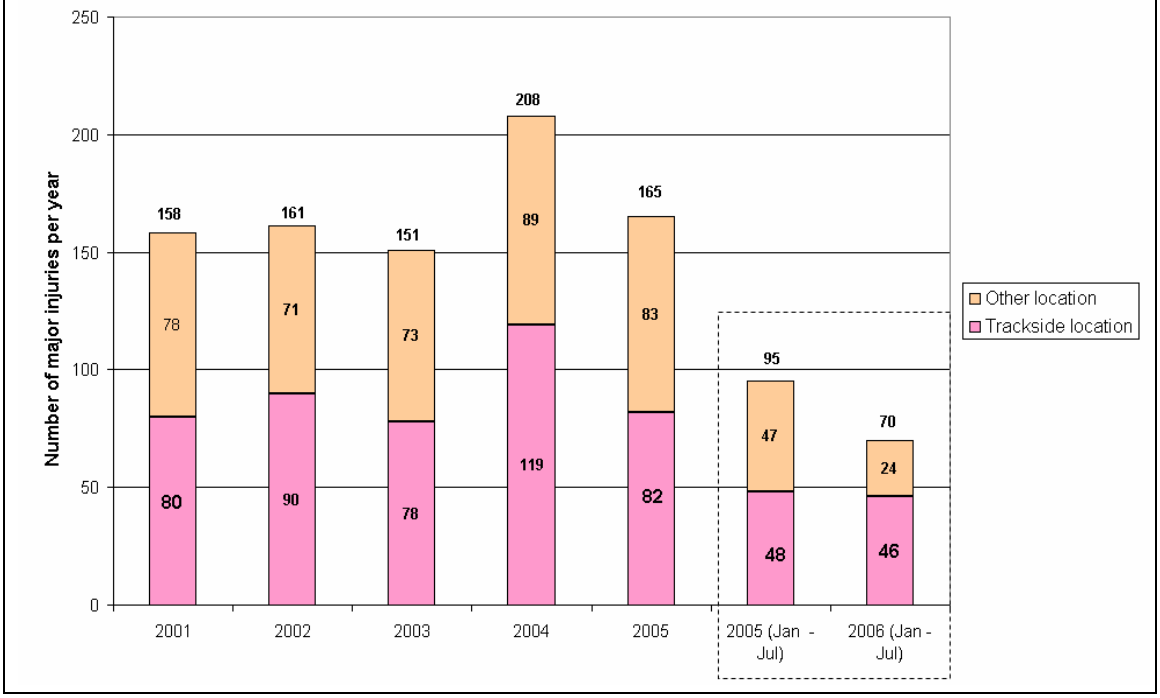


Table 2 shows trackside injuries by the employee activity. Track maintenance injuries dominate this table, with an average of 80.4%. This has dropped recently, accounting for 73.9% of trackside major injuries in the first seven months of 2006.

Table 2. Trackside major injuries by activity

Trackside injuries by activity	2001	2002	2003	2004	2005	2005 (Jan - Jul)	2006 (Jan - Jul)	Total
Civil structure inspection	2	0	0	1	1	1	0	**5**
Civil structure maintenance	6	2	6	6	4	2	0	**26**
Civil structure renewal/upgrade	1	0	1	1	1	1	0	**5**
CoSS	0	0	0	1	0	0	0	**1**
Electrification inspection	1	0	0	0	0	0	1	**2**
Electrification maintenance	0	1	0	1	1	1	0	**4**
Fitter/MOM	0	0	2	0	0	0	4	**6**
HMRI	0	0	1	0	0	0	0	**1**
Lookout	0	0	1	0	0	0	0	**1**
Machine controller	0	0	0	1	0	0	0	**1**
Machine operator	0	0	3	1	2	2	0	**8**
Onboard train crew	0	1	0	0	0	0	0	**1**
Other	0	0	1	0	1	0	3	**5**
S&T maintenance	2	4	1	5	4	1	2	**19**
Shunters	0	0	0	0	1	0	0	**1**
Signallers	0	0	0	1	0	0	1	**2**
Track inspection	0	0	0	1	1	0	0	**2**
Track maintenance	65	81	60	97	62	38	34	**437**
Track renewal/upgrade	0	0	0	1	2	2	0	**5**
Train drivers	3	1	2	2	1	0	0	**9**
Train guards	0	0	0	0	1	0	1	**2**
Total	**80**	**90**	**78**	**119**	**82**	**48**	**46**	**543**

4.5 Workforce minor injury trends

Thousands of reported minor injuries are sustained from workforce activities each year. However, underreporting means that the actual number is likely to be a lot higher. There are many reasons for this, including: work culture, the time it takes to report, knowledge of the correct reporting channels, and so on. The proportion of workforce minor injuries that resulted in a hospital visit are likely to be better reported, as those involved will have physically had to stop work and leave the worksite.

Table 3 lists the number of workforce minor injuries per year. It shows that:

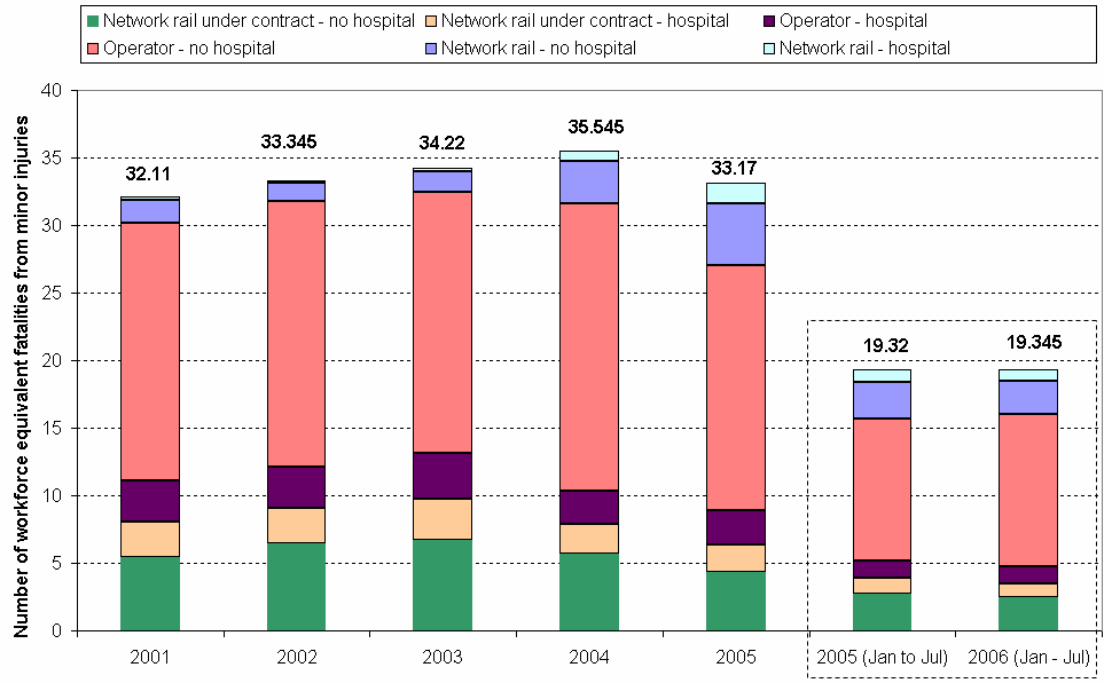
- 82% of workforce members who sustained minor injuries did not attend hospital.
- 35% of workforce minor injuries were sustained at a station.
- A five-year average of 6,736 workforce minor injuries per year has been recorded.
- There is no tangible minor injury trend over the five-year period, the numbers remaining fairly static.

Table 3. Workforce minor injuries

	2001	2002	2003	2004	2005	2005 (Jan - Jul)	2006 (Jan - Jul)
Workforce minor injuries	**6422**	**6669**	**6844**	**7109**	**6634**	**3864**	**3869**
No hospital	5237	5501	5514	6009	5421	3188	3230
: station site	2014	2049	1976	2152	2038	1165	1137
Hospital	1185	1168	1330	1100	1213	676	639
: station site	344	358	376	262	315	172	149
Level crossing site	5	6	3	5	0	0	0

The issue of workforce minor injuries may not be seen as serious it itself, but it is worth noting that an average of 33.7 FWI is derived from workforce minor injuries each year. There is therefore huge scope for improving safety in this area. Chart 14 indicates that an average of 58% of workforce FWI from minor injuries occurred to an *operator* employee without the need for hospital treatment. This chart also highlights the need for consistency in reporting of injuries across the industry, as there is a higher proportion of minor injuries without hospital treatment to operators than for Network Rail staff and those under contract to Network Rail. This is likely to be due to a difference in reporting cultures resulting in the underreporting of less serious minor injuries by Network Rail staff and those under contract to it.

Chart 14. Workforce fatalities and weighted injuries rate from minor injuries by employee type



4.6 Effects of witnessing traumatic events

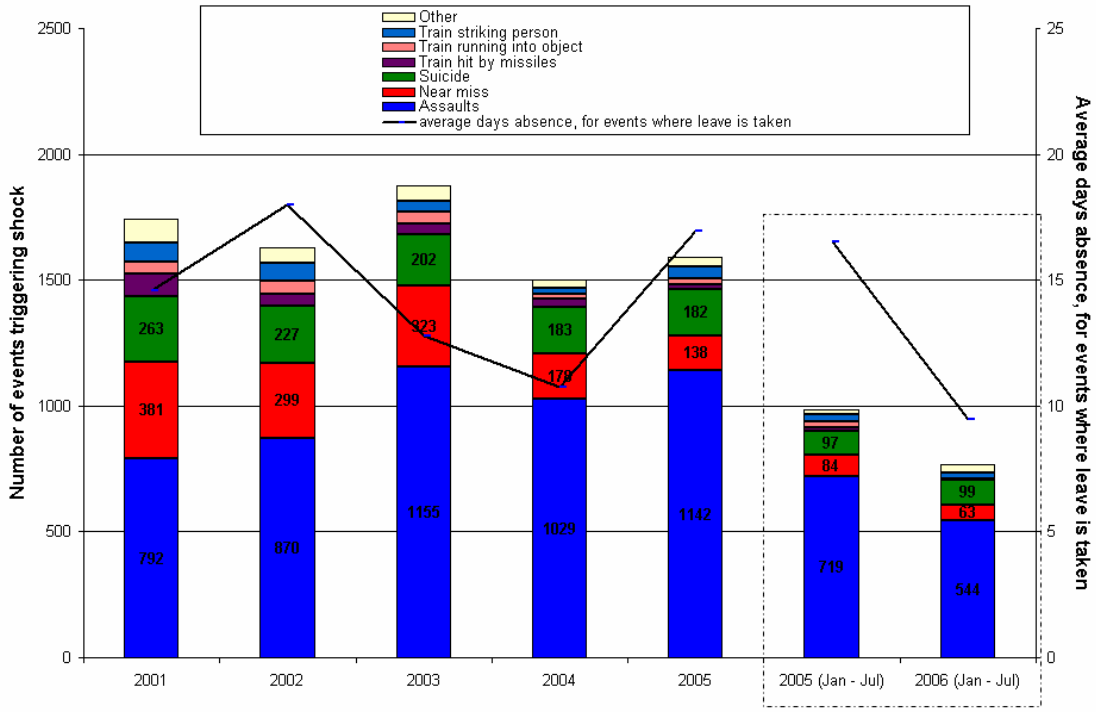
Among the effects of witnessing harmful events are shock and post-traumatic stress, both of which can result in chronic reactions.

Within the railway industry, *shock* refers to momentary or short-term distress or disturbance, whereas *trauma* describes a severe psychological problem that requires specialist treatment.

The levels of reported shock reflect culture and expectations as much as the incidence of psychological discomfort experienced by staff. The reactions of management and colleagues can also be influential as to whether sufferers suppress their reactions, or seek support or time away from work to assuage reactions.

Chart 15 presents information on the events that trigger workforce shock. Assaults are clearly the biggest cause. However, the numbers shown in the chart relate to assaults that result in shock/trauma and no physical injury, so other events that result in physical injury and stress/trauma are excluded. Near misses and suicides are the second and third largest categories in the events list. Jan-Jul 2006 has the lowest average days' absence (9.5, compared to the five-year average of 14.6) for events where leave is taken; it also shows a 22% reduction in the number of shock incidents, compared to the same period in 2005. Caution should be exercised here as events with a long absence may not yet be recorded (or, at best, the period of absence may not be known).

Chart 15. Workforce shock broken down by trigger events



4.7 Workforce on-board train injury analysis

There has been little coverage of workforce on-board train injuries in the safety performance report suite, although (on average) 35% of all workforce injuries occur on trains. Table 4 displays details of these injuries as a part of all workforce reported injuries.

Jan-Jul 2006 has seen a slight increase in the total number of on-board train injuries (1,341, compared to 1,307 for the same period in 2005). Minor injuries account for the entire rise; note too that the number of major injuries has dropped from 11 to nine, while the number of fatalities is the same, with zero.

Table 4. Workforce on-board train injuries

Year	Fatal		Major		Minor		Total	
2001	4	11	20	158	2286	6422	2310	6591
2002	1	4	20	161	2340	6669	2361	6834
2003	0	3	19	151	2464	6844	2483	6998
2004	2	9	23	208	2585	7109	2610	7326
2005	0	5	24	165	2214	6634	2238	6804
2005 (Jan - Jul)	0	4	11	95	1296	3864	1307	3963
2006 (Jan - Jul)	0	2	9	70	1332	3869	1341	3941

All workforce injuries
Workforce on-board train injuries

Chart 16 shows a yearly breakdown of staff types for on-board injuries. There are very few changes year-on-year for the total and for individual workforce activity groups. This area of workforce safety is stable; that is, it is currently neither improving nor declining.

Chart 16. Number of workforce on-board train injuries per year per workforce activity

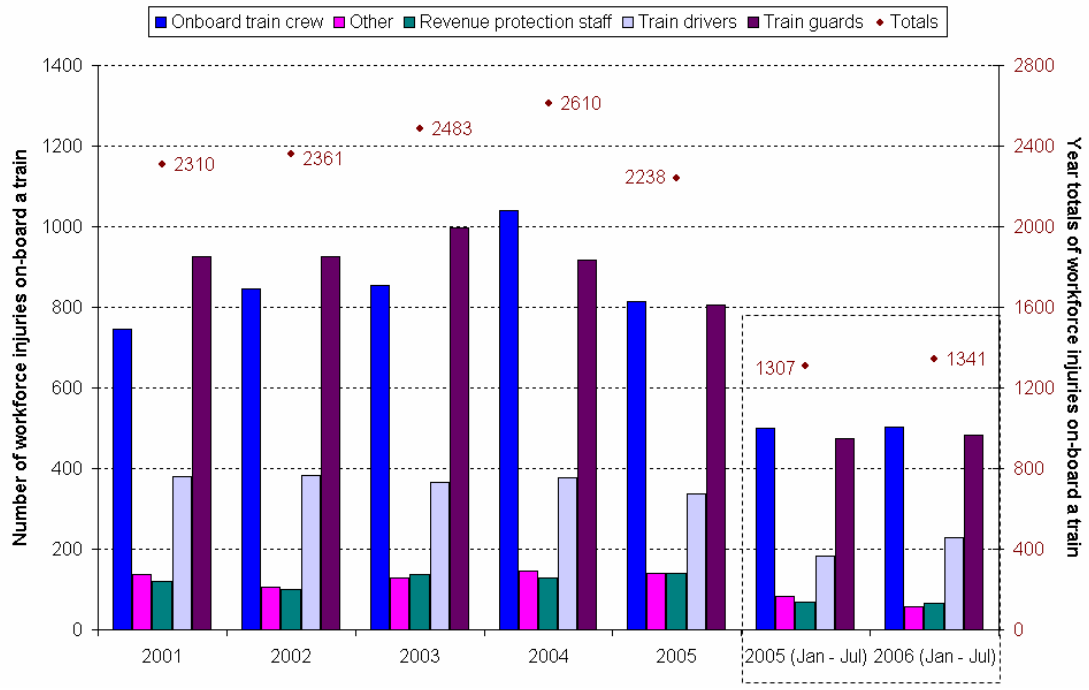


Table 5 uses workforce on-board train injury data. It lists the top five workforce activities and their top three precursors and shows that the highest frequency of injuries were physical assaults to train guards, with 1,163 injuries from 2001 to July 2006. This is nearly twice as many as the next highest group.

Table 5. Workforce onboard train activities and their top three precursors leading to injury.

Workforce activity	Activity precursor	2001	2002	2003	2004	2005	2005 (Jan - Jul)	2006 (Jan - Jul)
Onboard train crew	scald/burn	142	107	107	144	82	53	55
	strike against object eg fixed seating etc.	88	119	132	118	101	60	39
	strikes part of body eg head, knee, ribs etc due to train lurching	71	118	109	101	84	46	46
Other	strike against object eg fixed seating etc.	22	23	24	24	21	14	7
	caught by internal train doors (either slam or power)	7	16	8	9	5	3	6
	* assault: physical on train	10	9	10	2	8	6	2
	* caught by sharp object	12	4	9	10	5	3	4
Revenue protection staff	assault: physical on train	66	51	71	58	63	27	23
	strikes part of body eg head, knee, ribs etc due to train lurching	12	8	15	16	16	8	4
	caught by internal train doors (either slam or power)	1	7	11	13	13	9	8
Train drivers	other defect on the train	6	85	89	74	96	55	26
	strike against object eg fixed seating etc.	100	73	69	61	55	26	42
	caught by internal train doors (either slam or power)	37	9	16	30	18	12	12
Train guards	assault: physical on train	220	215	236	212	194	112	86
	strike against object eg fixed seating etc.	155	91	125	83	95	60	38
	strikes part of body eg head, knee, ribs etc due to train lurching	79	77	78	91	78	44	42

* Equal number of injuries

4.8 Shunting

4.8.1 Fatal accidents

On 17 July, a shunter died from crush injuries at Dagenham Dock Yard Siding, thus ending a period of more than eight months without a workforce fatality. Two days later, a member of staff was killed in a shunting move on the Gwili Railway near Carmarthen. Although this incident falls outside the scope of RSSB's safety reporting (having occurred on a heritage line), it emphasises the potential danger to those involved with the marshalling of trains.

In the previous 10 years, four members of the workforce were fatally injured during shunting moves. Brief descriptions of the incidents are as follows:

27 January 1998, Cwmbargoed (Rhymney Valley line)

An EWS shunter was run over by a train that was being berthed in a siding ready for loading. After a previous shunting move involving the same train, the points were not reversed and the locomotive propelled the train back into the siding where the shunter was standing.

29 June 2000, Willesden Railnet depot

A trainee EWS shunter was trapped between the buffer stops and a vehicle during a shunt move. He was a new employee with less than two months' shunting experience.

14 January 2005, Old Oak Common

An EWS shunter was caught between two vehicles, one of which was being shunted. He had attempted to lift the buckeye coupling on a stationary coach without first stopping the movement.

17 July 2006, Dagenham Dock Yard Down Siding

A Freightliner shunter was crushed whilst carrying out a movement to couple a single wagon and a Class 47 locomotive. This accident is currently subject to two investigations (led by the RAIB and Freightliner Ltd respectively).

For comparison, there were nine fatal injuries during shunting in the 10 years from 1986 to 1995. Although the difference is not statistically significant, this suggests that there may have been a reduction in the risk from shunting activities. Some of this could have resulted from the use of auto-couplers on multiple-unit trains, which makes coupling and uncoupling easier and reduces the requirement for shunters to position themselves between rail vehicles. Other relevant factors could include improved competence management, and developments in safety critical communications.

4.8.2 Individual risk

Individual risk is discussed in section 4.2, which notes that it is difficult to obtain robust estimates of the risk for shunters because of the infrequency of fatal accidents and (in comparison with other activities) the relatively small numbers of employees carrying out this work. Basing estimates on longer time periods reduces the *statistical* uncertainty, but historical data is unlikely to be representative of the risk from shunting operations on the modern railway.

Over the previous three years (September 2003-August 2006), two shunters were fatally injured on the mainline railway. RSSB estimated in November 2005 that approximately 1,670 people were employed as shunters across the industry[7]. Most of these work for freight operating companies, with EWS employing the majority.

The statistics suggest an annual fatality probability for shunters of approximately one in 2,500 (based on three years' data). However, there is a large degree of uncertainty. For example, the figure would be substantially different had there been one or three fatal accidents, rather than two. A 90% confidence interval puts the fatality probability at somewhere between one in 11,400 and one in 920 per year.

If the period on which the calculation is based were extended to five years (which was used as the basis for estimating track worker and train driver risk for the 2005 Annual Safety Performance Report), the annual fatality probability for shunters would be estimated at one in 4,200 (with 90% confidence bounds of one in 19,000 and one in 1,500). These figures are again based on two fatalities (no shunters were fatally injured between 2001 and 2004). Chart 3 earlier showed shunter risk along side other high risk occupations, with an estimated risk of 1 in 5,000 from the three year period 1 April 2004 to 31 March 2006.

[7] This figure was obtained from an RSSB survey of train and freight operating companies for the previous workforce safety report. It excludes a number of railway staff who undertake occasional shunting duties but predominantly perform different roles.

Although there is a degree of uncertainty over the exact value, we can be reasonably confident that the risk to shunters lies within – but towards the upper end of – the tolerable region for individual risk.

A standard dropped buckeye coupling arrangement – seen here on a Mark I carriage, but still in use on some locomotives (Class 33/1, 73, 90/0 and 91) and rolling stock.

4.8.3 Injuries to shunters

The industry's Safety Management Information System (SMIS) contains some accidents that occur in depots, yards and sidings (where businesses use the system to record all workforce injuries, regardless of where they occur). However, as there is no obligation to report such events, the data is far from comprehensive. Historically, some of the owners of depots, yards and sidings have not had access to SMIS.

Reporting rates vary considerably from one year to the next. Without more consistent data, it is difficult to analyse changes in underlying safety. If all shunting events were entered into SMIS, then a far richer set of information would be available. This would be a greater aid to duty holders who need to manage the risk arising from shunting activity, both on NRCI and in other facilities associated with the mainline network. The issues relating to possible expansion of the scope of SMIS to included depots, yards and sidings will be discussed with the industry during 2007.

From the data that is entered into SMIS, the most common causes of injury are:

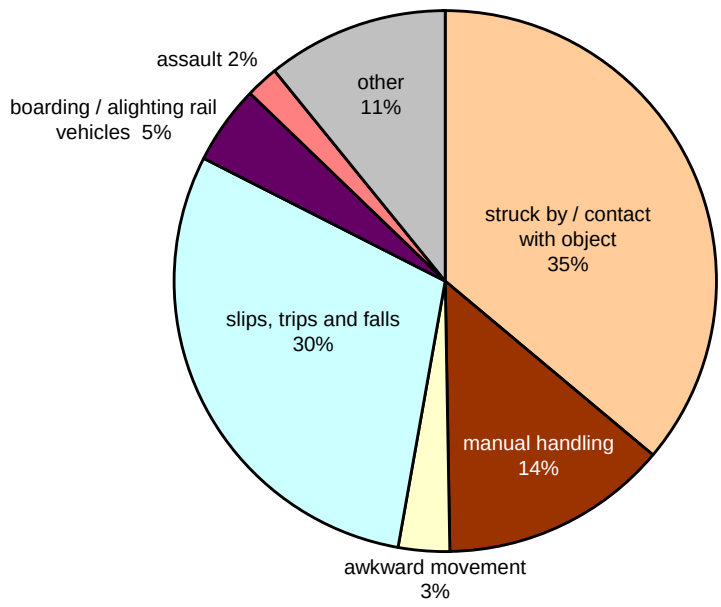
Struck by objects Typical injuries involve being struck by cables, buckeyes and shackles when coupling or uncoupling (with injuries especially prevalent where connections are stiff and/or gloves are not worn). Blows to the head when standing up, or when moving around rail vehicles, also figure.

Slips, trips and falls Shunters, like others who work trackside, are prone to accidents when moving about rails and ballast, especially when it is dark, the ground is slippery or there are other hazards (such as missing manhole covers).

Manual handling There are many cases of strains and sprains from pulling manual points and signal levers, and from coupling and uncoupling – particularly when equipment is stiff or otherwise poorly maintained, or the proper technique is not used.

Chart 17 shows the types of accident that lead to minor injuries for shunters.

Chart 17. Shunter minor injuries by accident type



Fatalities usually occur when shunters are crushed by moving trains. The types of accidents that lead to non-fatal injuries tend to be different, although some generic causal factors (such as corner-cutting and failure to follow the correct procedure) can be common to both sets of events. Only a small number of the non-fatal events recorded in SMIS involve rail vehicles in motion. The most serious of these (in terms of the resulting injuries) occurred in March 2005, when an employee lost his footing during a shunting move and had his leg severed by a wheel, and June 2004, when a shunter required surgery after his hand became trapped between his shunt pole and a buffer.

4.8.4 Industry initiatives relating to shunting

Train operators employ competence management and monitoring systems, as well as other good safety management practices (such as audits, regular meetings and safety briefings) to ensure the safety of their workforce. There are also a number of local developments and initiatives aimed specifically at improving the safety of shunters. Some of these are listed below:

- The introduction of new fleets with cab-controlled coupling mechanisms.
- Introducing lower speed restrictions, reducing the number of concurrent shunt moves in depots, and controlling movements using centralised depot signalling systems.
- Location risk assessments and redesigns.
- Unobtrusive monitoring (including the use of CCTV and radio scanners) to observe the way that shunt moves are carried out, providing a more realistic assessment of on-the-job competence than traditional practical assessments.

- Revising operating rules to lessen shunters' exposure to risk. For example, removing the requirement to walk ahead of a propelling move (providing a set of conditions that ensure the safety of the movement have been established prior to it taking place).

Nevertheless, and despite all of the good work being done, there is a growing groundswell of opinion within the industry that there would be benefit from a push to improve the safety of this high-risk group of workers.

4.9 Working in possessions

When a section of the railway is taken out of normal use for maintenance or repair, train operations are suspended to allow engineers to 'take possession' and carry out the necessary work. Bar exceptional and/or emergency circumstances, all possessions are published the *Weekly Operation Notice* or the *Engineering Notes*.

4.9.1 Collisions and derailments in possessions

Chart 18 illustrates the trend in possession derailments since 2000. Each incident has been categorised according to the type of vehicle derailment that occurred. A SMIS-based dataset has been used. However, this contains references to various types of vehicles and machinery and contains language inconsistencies in the event descriptions. The following groups have thus been adopted to allow more accurate and meaningful categorisation:

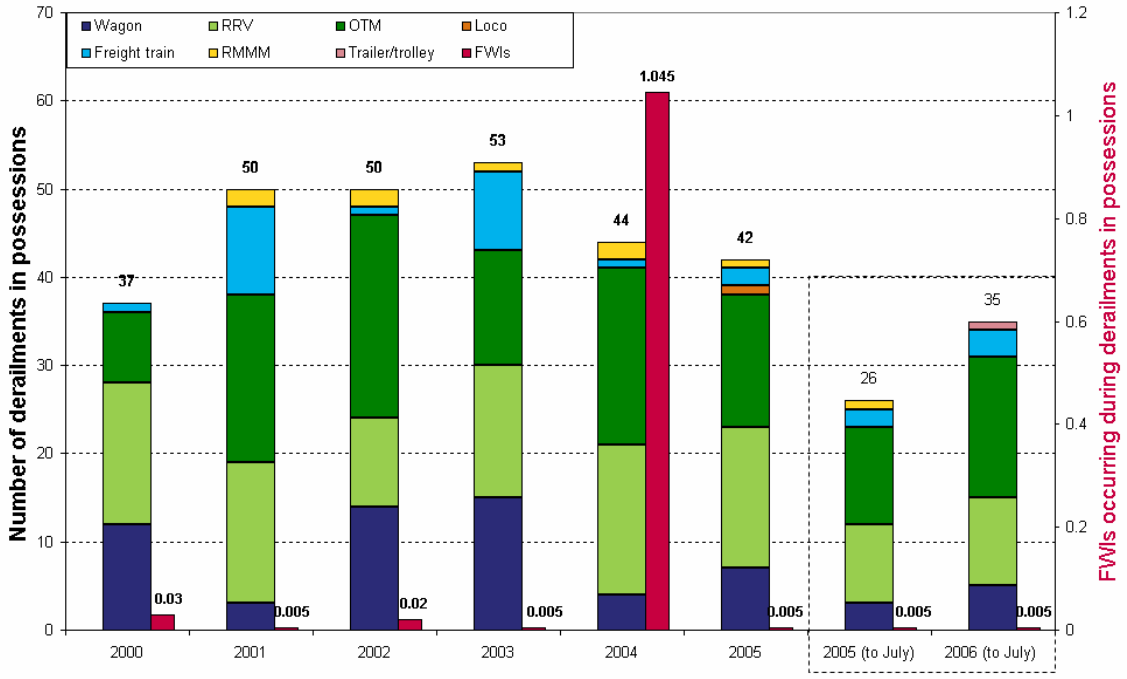
- Loco.
- Rail mounted maintenance machine (RMMM).
- Road rail vehicle (RRV).
- Wagon.
- Freight train (both loco and wagon(s)).
- On-track machines (OTM) (other than RRVs and RMMMs).

The chart shows that:

- For all types of vehicles, the number of derailments increased year-on-year between 2000 and 2003, after which it fell in 2004 and 2005 (although the level in those years was very similar). In 2006 (to July), derailments are 35% higher than in the same period of 2005, indicating a possibility of the first yearly increase since 2003.
- The types of vehicles that contribute most to the total number of derailments when viewing the data since 2000 are OTMs and RRVs.

In general, the number of injuries occurring in these incidents is low, although 2004 was a particularly bad year (one fatality and nine minor injuries). The fatality was the result of an RRV striking and derailing an OTM, which caused a track worker to fall from the OTM; he was then crushed by the excavator bucket of the RRV. This incident highlights the fact that, while only a small percentage of derailments in possessions cause injuries, serious harm is always a very real possibility.

Chart 18. Derailments in possessions by vehicle type since 2000



It is suspected that there may be a degree of underreporting where these derailments are concerned. This may be especially relevant to the lighter RRVs, which can be re-railed with relative ease – a view that was substantiated during a series of workshops[8] held by RSSB to develop a risk profile for machine movements inside and outside possessions. Although underreporting is believed to occur, serious incidents (where injuries are sustained) are believed by all industry representatives to be very well reported into SMIS.

The number of collisions between vehicles in possessions from 2001 to June 2006 is detailed in Table 6. The following categories of vehicles have been used:

- Empty coaching stock (ECS).
- Freight train (locomotive and wagons).
- Locomotive.
- OTM.
- RMMM.
- RRV.
- Freight wagon.

The table shows that:

- The total number of collisions in possessions fell from 10 in 2001 (year-on-year) to a low of four in 2004. In 2005, eight occurred – double the previous year. The good news is that only two had occurred in the first seven months of 2006, compared to five in the same period of 2005, indicating a possible decrease in 2006 as a whole.

[8] 70% of the industry was represented at these sessions.

- On a 'type of vehicle' basis, collisions in possessions occur sporadically, showing no real trend.

- The types of vehicles that contribute the most to the total number of collisions are RRVs (involved in 17 of the 37 collisions over the period) and OTMs (involved in 15 of the 37 collisions over the period).

Table 6. Collisions in possessions

Collision between		2001	2002	2003	2004	2005	2005 (Jan - Jul)	2006 (Jan - Jul)
Freight train	ECS	1	0	0	0	0	0	0
	Freight train	1	0	2	0	2	1	0
	OTM	0	0	1	0	1	0	0
	RRV	0	1	0	0	1	1	1
Loco	Loco	0	1	0	0	0	0	0
	OTM	1	0	0	1	1	0	0
OTM	OTM	0	0	0	2	1	1	0
	RMMM	1	0	0	0	0	0	0
	RRV	1	0	2	1	1	1	0
	Wagon	0	1	0	0	0	0	0
RMMM	RMMM	2	1	0	0	0	0	0
RRV	RRV	3	3	1	0	1	1	1
Total		**10**	**7**	**6**	**4**	**8**	**5**	**2**

Table 7 details the numbers of injuries occurring in collisions between vehicles. It also shows the injuries in possession derailments that have occurred between 2001 and June 2006. Where there was both a collision *and* a derailment, the event has been classified as a collision to avoid the double-counting of injuries.

The table shows that:

- Few injuries occur in these types of incidents. Those that do are mostly minor in nature, although a fatality occurred in 2004, highlighting the possibility of serious consequences if the circumstances allow.

Table 7. Injuries resulting from collisions between vehicles and derailments in possessions

Accident type	Inury degree	2001	2002	2003	2004	2005	2005 (Jan - Jul)	2006 (Jan - Jul)
Collision	Fatal	0	0	0	1	0	0	0
	Major	0	0	0	0	0	0	0
	Minor	1	4	1	0	0	0	0
Derailment	Fatal	0	0	0	0	0	0	0
	Major	0	0	0	0	0	0	0
	Minor	0	0	0	9	1	1	1
Total		**1**	**4**	**1**	**10**	**1**	**1**	**1**

The nine minor injuries during derailments in 2004 occurred in three accidents, two of which involved RMMMs. Although these vehicles are designed to carry a limited number of staff, there have been some reported incidents where injuries have resulted from the transportation of larger groups. For this reason, accidents with RMMMs tend to lead to higher numbers of injuries than when other single-operator vehicles are involved.

4.9.2 Possession irregularities

Chart 19 shows the number of possession irregularities per quarter from 2000. The dataset is derived from the *operating irregularities* section of the Network Rail daily incident log, since it is believed that these types of incidents are underreported into SMIS.

In November 2006, SMIS will be enhanced to enable fuller reporting of all irregular working incidents. This should expand the range of data analysis that can be performed to produce productive conclusions.

Operating irregularity descriptions that contained references to *possession* and *irregularity* have formed the focus of the analysis. The type of possession irregularity covered by the chart is *trains entering and leaving possessions without the correct authority*.

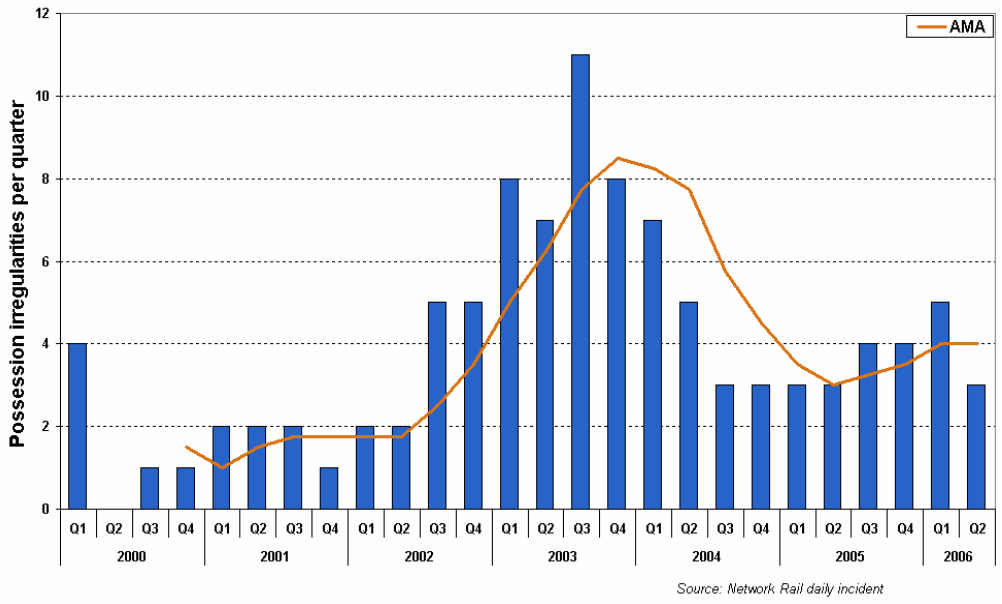
The chart shows that:

- The number of incidents reported in the log is generally low, with a maximum of 11 in quarter 3 2003.

- The number of reported irregularities increased significantly from quarter 3 2002 and stayed quite high through to quarter 1 2004. This was due to Network Rail's introduction of an initiative to improve reporting.

- Once the initiative was over, the level of reported possession irregularities fell back to a much lower level, marginally more than prior to the start of the initiative. It has remained fairly constant since then.

Chart 19. Trains entering and leaving possessions without authority.



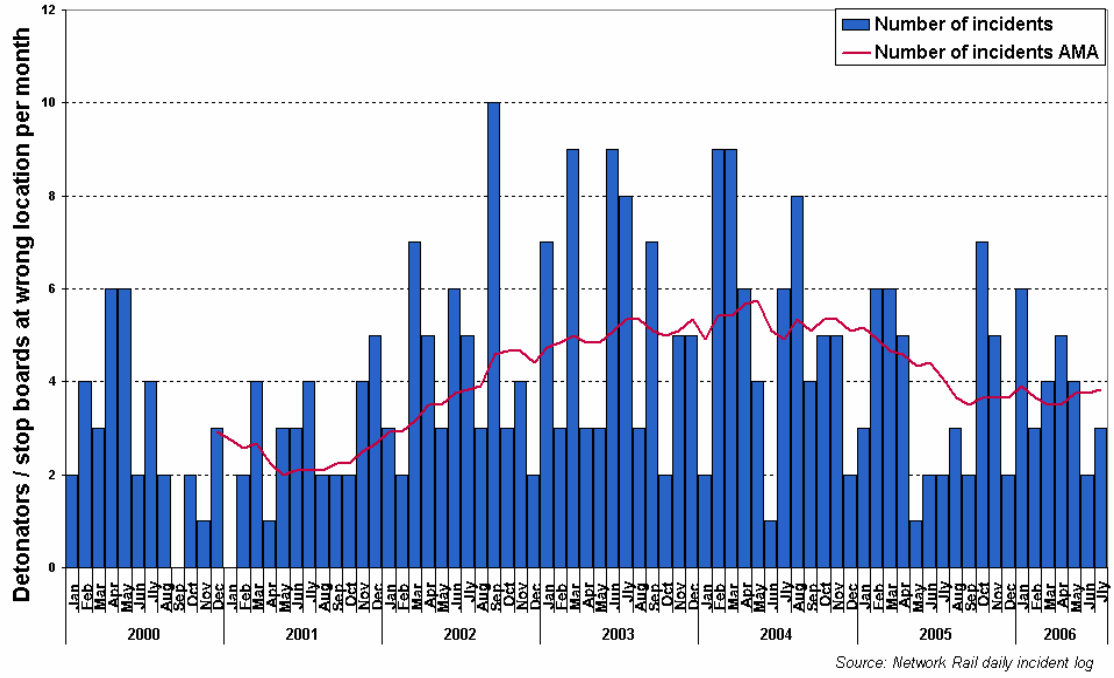
4.9.3 Incorrect possession protection arrangements

Chart 20 illustrates the number of incidents (on a monthly basis) where detonators or stop boards have been incorrectly placed in possessions. These types of incident can lead to serious consequences, such as collisions and derailments. Again, data has been collated from the *operating regularities* section of Network Rail's daily incident logs.

The chart shows that:

- The number of incidents month-on-month varies to a great extent (from zero to ten).
- The underlying trend *in incidents* increased from mid-2001 to mid-2004. Since then, the trend decreased every month until mid-2005, when it reached an average of just under four incidents per month. This level has remained quite constant for the last year.

Chart 20. Detonators and stop boards placed in the wrong location since 2000



There is no indication that any collisions, derailments, workforce fatalities or major injuries occurred as a result of the misplacement of this type of protection. The research project T507[9] was commissioned by RSSB to measure the effectiveness of detonator protection. It assessed the need for the continued use of detonators (or fog signals) for operational protection and asked whether alternative protection methods would provide the same (or better) protection levels.

Given recent advances in technology, it is perhaps surprising to find the absence of a viable alternative to detonators. Several were examined, but it was found that none would provide adequate protection in all circumstances. Whilst the research supports the continued use of detonators, there are hazards involved with their employment (although these are being mitigated to some extent by new storage arrangements). The main output of the research therefore concentrated on ways of reducing the incidences of irregular use and misplacement. Full details may be found on www.rssb.co.uk.

[9] T507: Review of the continued use of detonators.

A track worker placing a detonator next to a possession limit board in accordance with Rule Book module T3 (section 5, clause 3: How to provide detonator protection).

As noted earlier, there is a perception across the industry that incidents in possessions are underreported. Another recent study investigated the use of RRVs and RMMMs in possessions[10]. The report contained five complementary programmes of work that were undertaken to provide an insight into the key issues and make recommendations to reduce risk.

On the topic of incident reporting and management, the report compared reported occurrences of precursor and accident data with the results of a workforce survey (where track workers were asked to note how often they had seen various types of incident). The report found that there is a very significant degree of underreporting of accidents and their precursors. Current practice suggests that the triggers for reporting incidents seem to be when a signaller becomes aware of it, there is significant asset damage or a person is injured. Reporting of incidents and precursors is required for effective safety management. Therefore, the Railway Group Guidance for reporting information to SMIS (GE/GN8547) needs to be reinforced, as it is highly applicable to work in possessions.

4.9.4 Near misses at trackside locations

Chart 21 shows the number of near misses with staff working at trackside locations (per month), using data from the Network Rail daily incident log. These data points have been selected in a similar way to the methods used in the previous charts, the criteria being that they contain a reference to a near miss between a member of staff working at a trackside location and a train.

The chart shows that:

- As with the misplacement of detonators and stop boards, the variation in numbers of near misses with staff at trackside locations and trains is high between months.

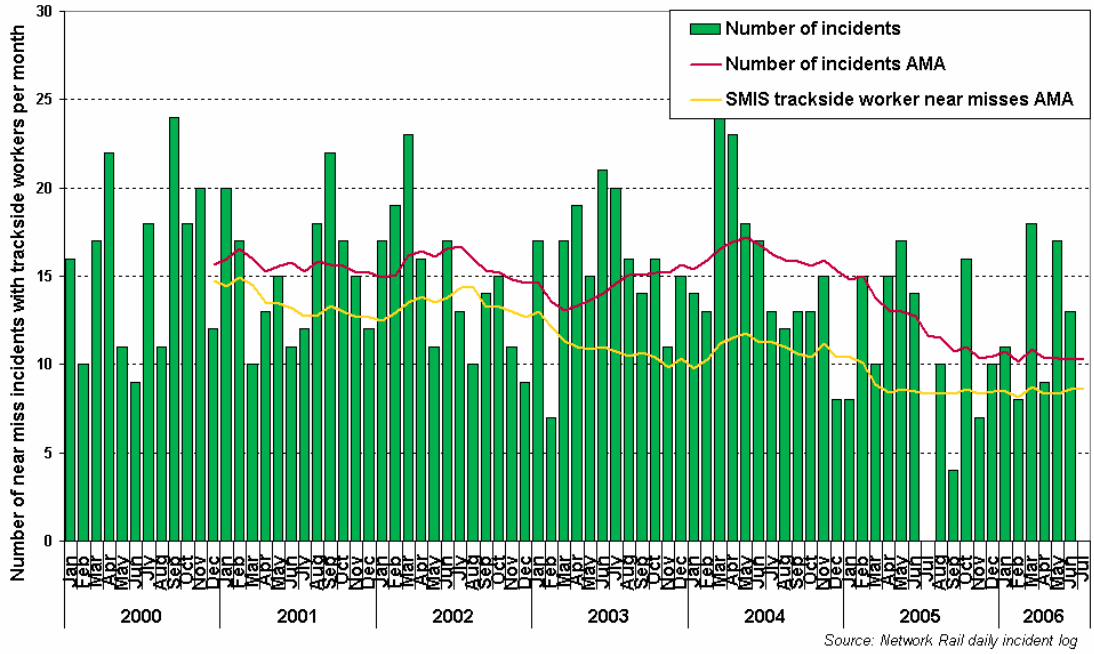
- The underlying trend in near misses reported in the log has gradually decreased over the analysis period. A high rate of decrease in the underlying trend was

[10] Road rail vehicle and rail mounted maintenance machine special topic report, RSSB, currently being prepared for publication in early 2007.

especially prevalent from mid-2004 to mid-2005, with the trend now at a constant average of around 10 near misses per month.

- The trend in the number of near misses with trains (as reported in SMIS) is also generally downward over the analysis period. The numbers reported on a monthly basis are slightly lower than those in the daily incident log; however, they do show a very similar pattern, when the moving averages are considered.

Chart 21. Near miss incidents with trackside workers

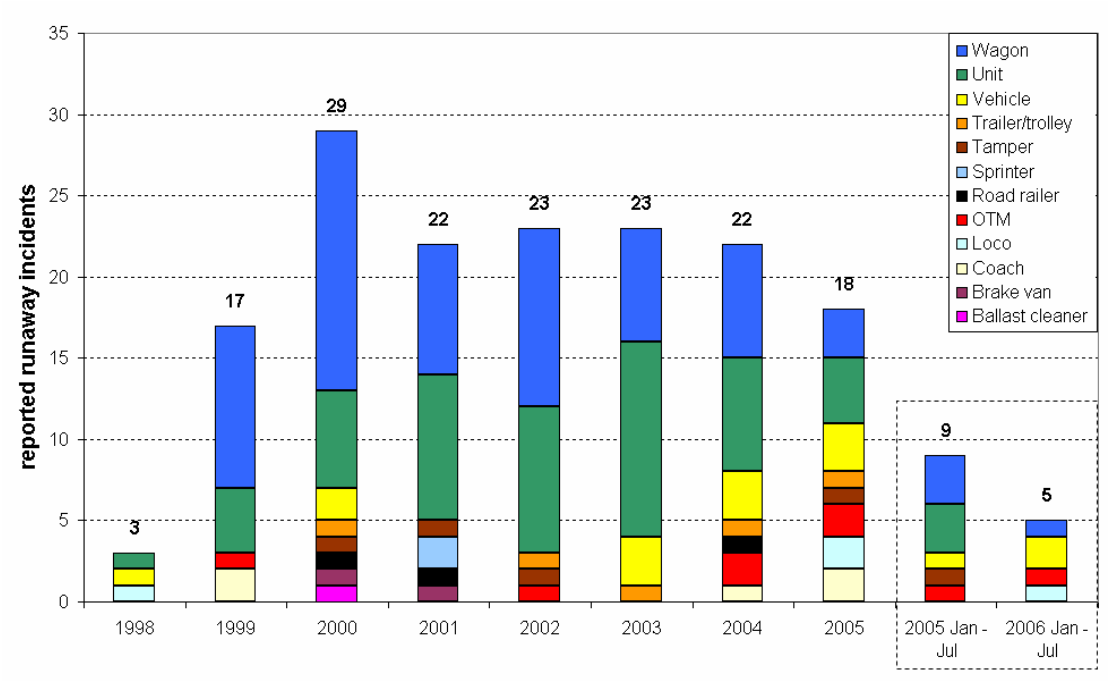


4.9.5 Runaway trains

Although relatively rare, runaway trains are not unknown on Britain's railways. The incident at Tebay in February 2004, when four track workers were killed by a runaway trolley, has been well documented. However, Chart 22 shows that locomotives can also be involved in these types of incident. On 27 August 2006, for example, a Class 66 diesel-electric ran away, passing worksites on the down Styal line near East Didsbury (LNW). It eventually came to rest following a gradient change at Burnage. The locomotive had been the rear power unit of a 'top and tail' formation and absconded when a wagon coupling broke. No injuries or further damage were reported.

The chart plots a downward trend in the aftermath of Tebay, with this year looking set to follow the same pattern: five incidents were recorded between January and July 2006, compared to nine during the same period last year (a 45% improvement).

Chart 22. Runaway trains



5 Risk profile

The workforce risk profile for this report has been derived from version 5 of RSSB's Safety Risk Model (SRM), which now includes explicit modelling of the risk from OTP movements inside possessions[11]. The SRM provides a quantification of risk resulting from hazardous events occurring on the mainline railway[12] that have the potential to lead to fatalities, major injuries or minor injuries to passengers, staff and members of the public.

Version 5 of the SRM was completed in August 2006, the results being published in Issue 5 of the Risk Profile Bulletin (RPB).

5.1 Overall workforce risk profile

5.1.1 Overview

The total workforce risk is 63.5 FWI per year (5.5 fatalities, 175 major injuries and 8,083 minor injuries per year). The most significant risk contributions are from movement and non-movement accidents, resulting in 17.7% and 80.0% of the total workforce risk respectively. The Overall risk profile for the railway workforce is illustrated in chart 1 (section 4.1).

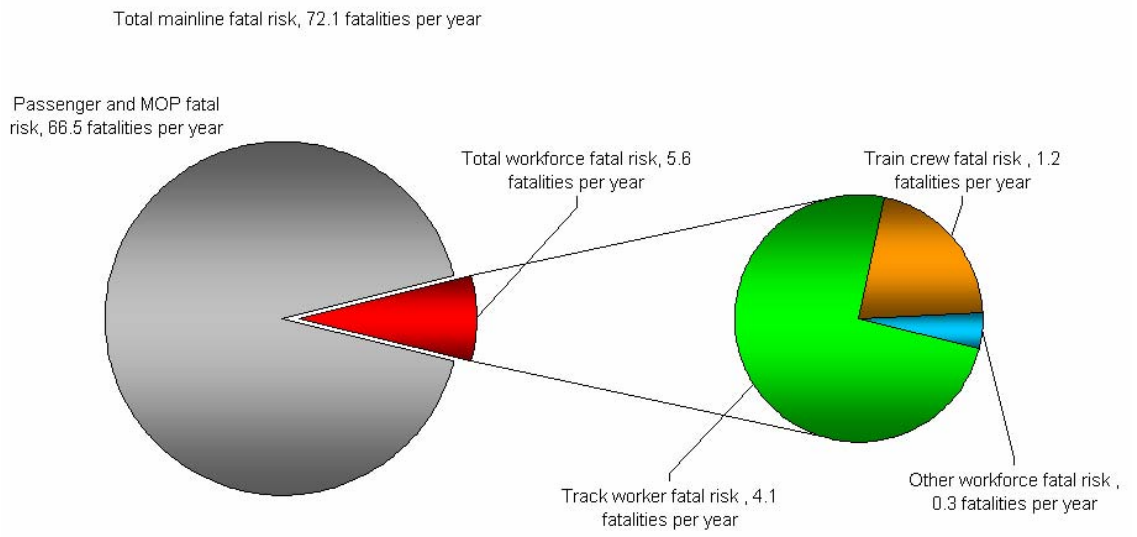
Representing approximately 35% of the total mainline risk, the risk attributable to the workforce can be broken down further to identify the exposure to track workers, train crew and other workforce member categories. The workers in each group comprise the following:

- *Track workers* – including those involved in OTP operations inside a possession.
- *Train crew* – train drivers, guards, on-train cleaners, catering staff and revenue protection officers.
- *Other workforce* – station staff, turn-around cleaners, ticket office staff, loading/unloading staff, level-crossing keepers, signallers and fitters.

[11] The OTP SRM was formulated in 2004 to provide a structured representation of the causes and consequences of the potential accidents resulting from the movement and operation of on-track plant on the mainline railway. The scope of the OTP SRM partially overlapped the scope of the main SRM, leading to duplication between the two models. In order to remove this duplication and maintain the main SRM as the single source or risk information, the OTP SRM has been incorporated into the main SRM version 5. The SRM now explicitly models the risk from the movement of OTP inside possessions.

[12] Shunting activities and events occurring within yards, siding and depots are not included within the SRM. However, those events relating to the movement of trains entering and leaving yards, sidings and depots, and events relating to the condition of trains joining the system from the depots have been included.

Chart 23. Overall workforce fatal risk profile

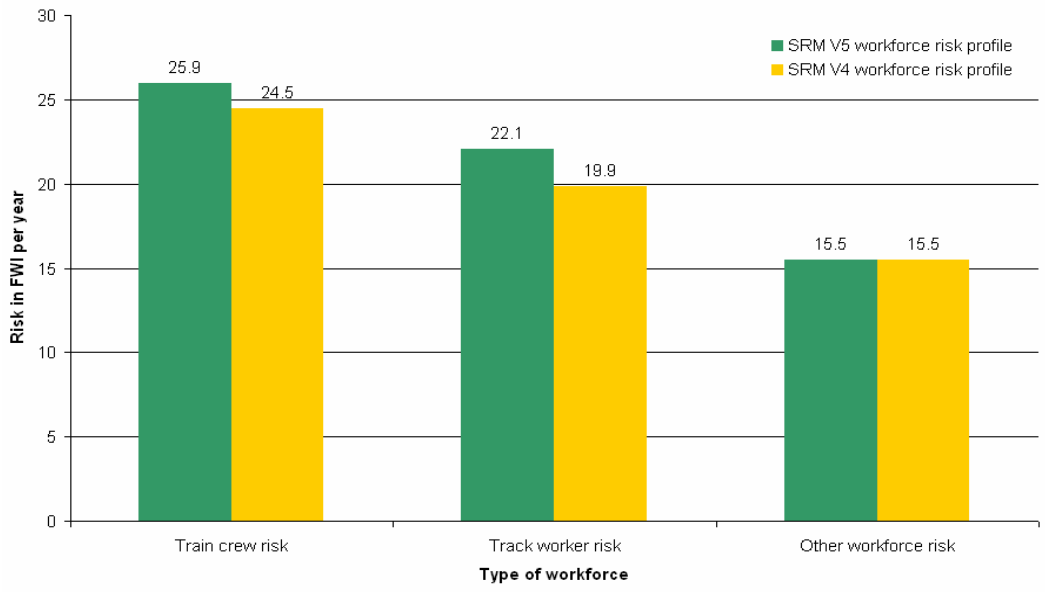


In terms of fatal risk, *track workers* are by far the most exposed group, with a contribution of 4.1 fatalities per year (as shown in Chart 23). Whereas the risk to which *train crew* are exposed is mainly associated with major and minor injuries. *Train crew* fatal risk is 1.2 fatalities per year, which makes up around 5% of the total risk to which the group is exposed.

5.1.2 Comparison between version 4 and version 5 of the SRM

When compared with version 4 of the SRM, the overall workforce risk has increased by 3.7 FWI per year (approximately 6%) to 59.8 FWI per year. Almost half of this increase is accounted for by the inclusion of risk from a new hazardous event (HEN-74 *Workforce manual handling*) in version 5. Chart 24 shows a comparison of the overall risk exposed to the workforce groups in SRM versions 4 and 5.

Chart 24. Risk comparison between SRM V4 and V5 workforce risk

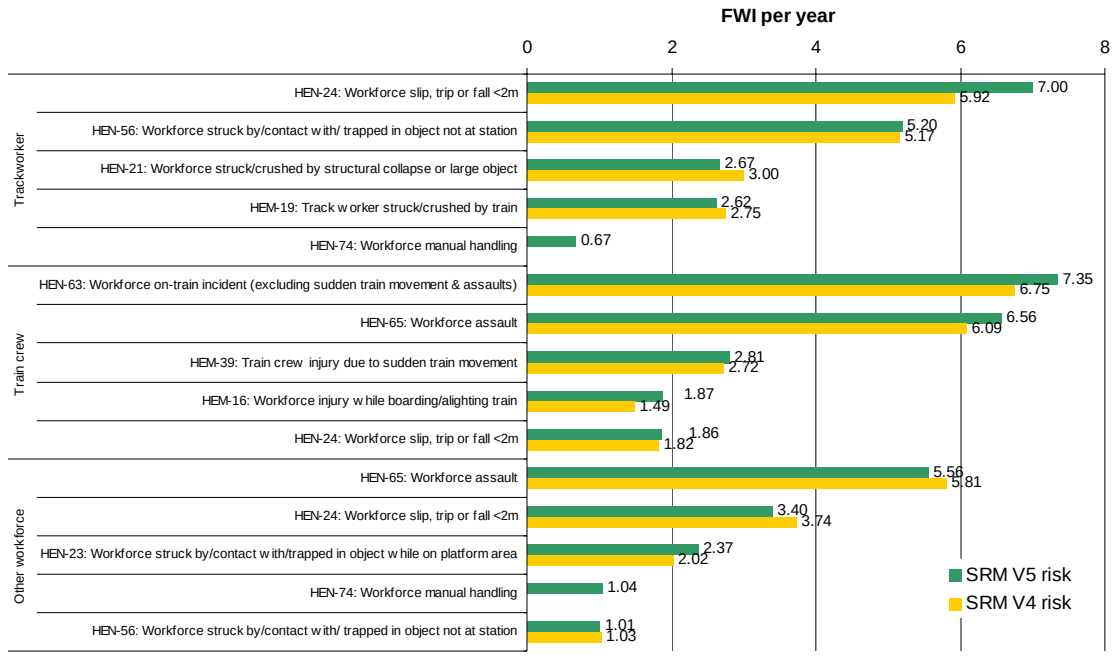


Discounting the effect of the new hazardous event (HEN-74), the level of risk for both *track workers* and *train crew* demonstrates a marginal increase form version 4 to version 5 of the SRM. Chart 25 shows that the overall risk contribution from *other workforce* remains unchanged. This is despite the inclusion of HEN-74, which therefore indicates that the workforce overall risk has seen a reduction since version 4 of the SRM was unveiled.

Further comparison between versions 4 and 5 of the SRM is provided in Chart 25, which presents the risk from the top five hazardous events of each work group, totalling up to 82.0% of workforce risk.

HEN-24 *Workforce slip, trip or fall* is the top contributor to *track worker* risk, with 7.0 FWI per year (or 31.7% of track worker risk). HEN-24 also has considerable weighting on the risk related to the other two workforce groups, where it is the second largest contributor to *other workforce* risk and the fifth to *train crew* risk. The risk contribution from HEN-24 remained static for *train crew* between versions 4 and 5 of the SRM. However, it rose by 18.2%, from 5.92 to 7.0 FWI per year for *track worker* and reduced by 9.1%, from 3.74 to 3.4 FWI per year, for *other workforce* during the same period.

Chart 25. Risk comparison between SRM V4 and V5 workforce risk (detailed)



Train crew risk is dominated by the risk contribution from HEN-63 *Workforce on-train accident (excluding sudden train movement & assault)* and HEN-65 *Workforce assault*. At 7.35 and 6.56 FWI respectively, they form 53.7% of the *train crew* risk. At 5.56 FWI per year, HEN-65 is also the top contributor of risk related to *other workforce*. When comparing between version 4 and 5 of the SRM, the risk contribution from HEN-65 has increased by 7.7%, from 6.09 to 6.56 FWI per year, for *train crew* and reduced 4.3%, from 5.81 to 5.56 FWI per year, for *other workforce*.

5.1.3 Train accidents

Workforce risk from train accidents amounts to just 1.47 FWI per year. This forms 2.3% of the workforce risk and is therefore a minor component of the total.

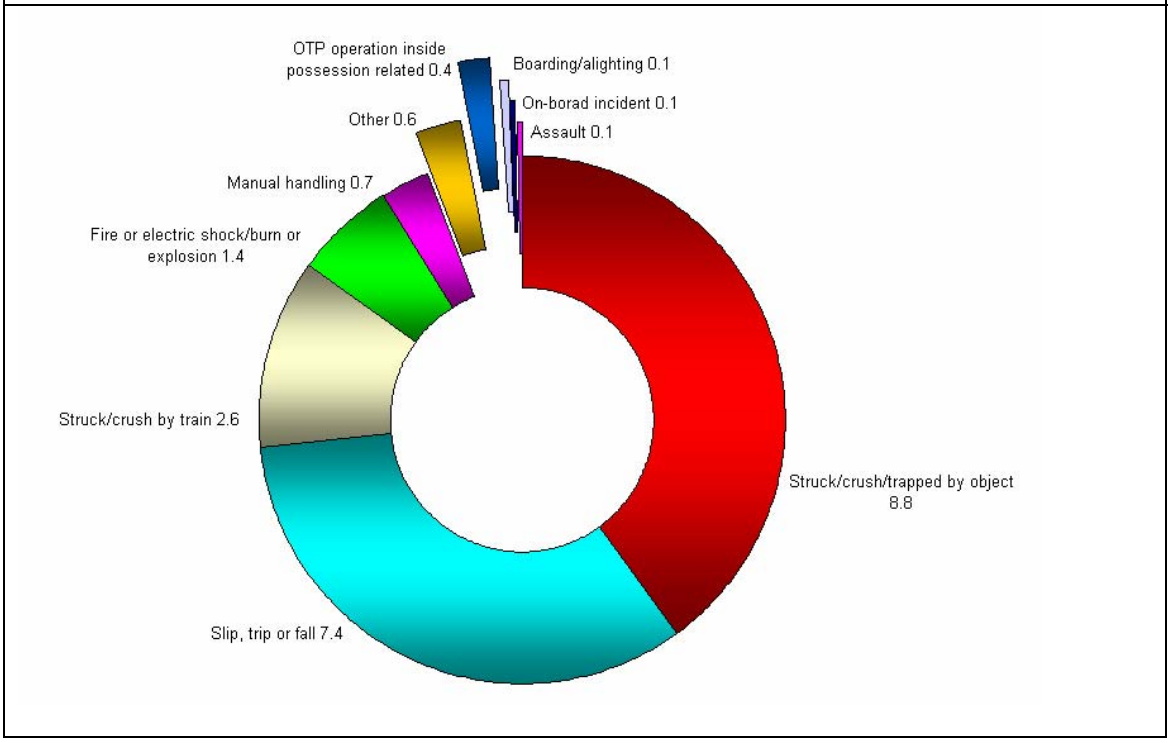
The main contributor in terms of risk from train accidents that affect *train crew* is HET-12 *Derailment of passenger trains*, with a contribution of 0.41 FWI per year. This is just 0.6% of the workforce risk and stands at seventh position in terms of the most significant *train crew* risk. The prime contributor in terms of risk from train accidents that affect the *track worker* and *other workforce* groups is negligible. The most significant hazardous event is HET-13 OTP *Derailment of OTP inside possession* for *track workers* with a contribution of 0.07 FWI per year.

5.2 Track worker risk profile

5.2.1 Overview

Although *track worker* risk is not the top contributor to the overall FWI related workforce risk, Chart 23 shows that it is by far the highest in terms of fatality risk. *Track worker* is therefore perceived as being working in the most hazardous environment when compared with *train crew* and *other workforce*. Chart 26 provides an overview of the *track worker* risk contribution in terms of the various hazardous event groups.

Chart 26. Overview of track worker risk profile by hazardous event group in FWI per year



It may be seen that the top three hazardous event groups, which form approximately 85% of *track worker* risk, are:

1. *Struck/crush/trapped by object*, with a contribution of 8.8 FWI per year.

2. *Slip, trip or fall*, with a contribution of 7.4 FWI per year.

3. *Struck/crush by train*, with a contribution of 2.6 FWI per year.

5.2.2 Track worker risk profile by hazardous events

Chart 27 shows the top 10 hazardous events that contribute to the track worker risk profile.

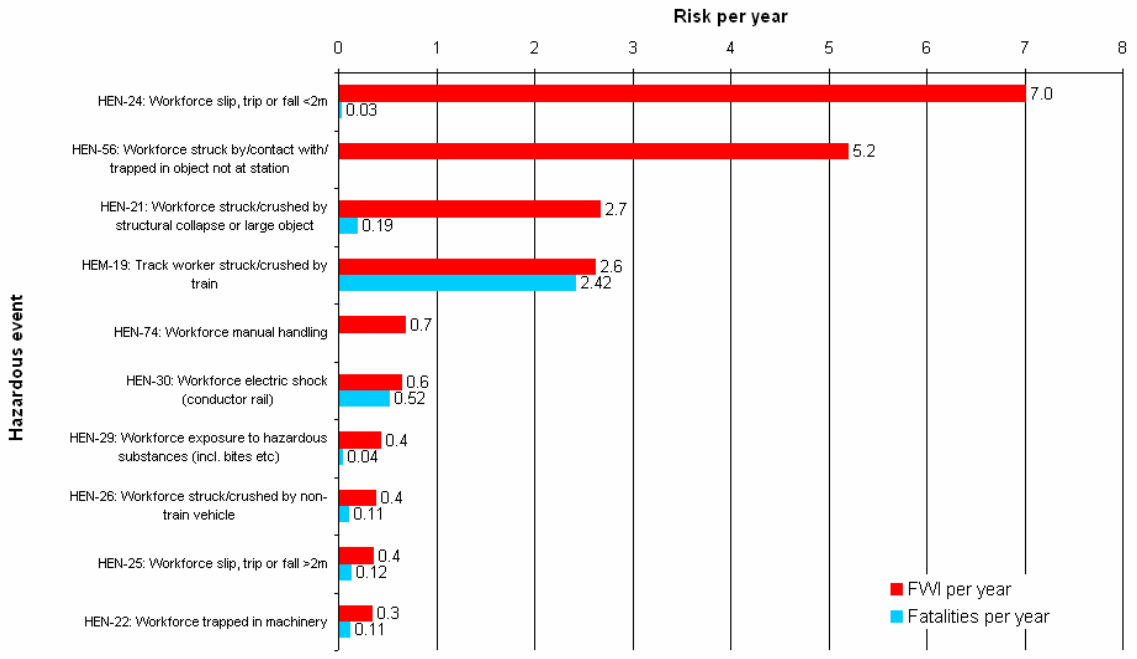
As stated in section 5.1.2, HEN-24 *Workforce slip, trip or fall* is the largest contributor to *track worker* risk. The risk contribution from HEN-24 is 7.0 FWI per year (or 31.7% of *track worker* risk).

The second largest risk contributor is HEN-56 *Workforce struck by/contact with/trapped in object not at station*, with 5.2 FWI per year (or 23.5% of *track worker* risk).

HEN-21 *Workforce struck/crushed by structural collapse or large object* is the third largest contributor, with 2.7 FWI per year. Together, contributions from these hazardous events make up 67.4% of the total *track worker* risk. However this risk is mainly associated with major and minor injuries.

The hazardous events exhibiting the greatest level of fatality risk to track workers are HEM-19 *Track worker struck/crush by train* and HEN-30 *Worker electric shock (conductor rail)*. However, both these hazardous events contribute just 14.4 % of the total *track worker* risk.

Chart 27. Track worker risk profile – Top 10 hazardous events

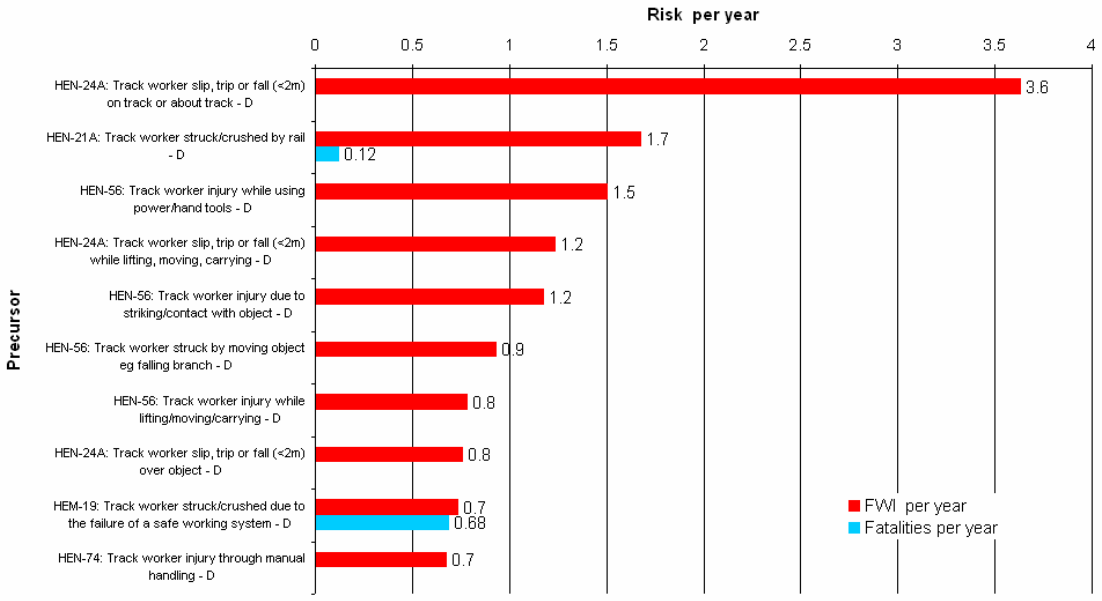


Track workers are the most exposed workforce group to fatal risk, with a contribution of 4.1 fatalities per year (73.8% of the total workforce fatal risk). The total fatal risk from HEM-19 and HEN-30 is 2.94 fatalities per year. This is more than half the total workforce fatal risk and amounts to over 70% of *track worker* fatal risk.

5.2.3 Track worker risk profile by precursors

Chart 28 presents the top 10 precursors that contribute to the *track worker* risk profile. The precursors presented come from five hazardous events and collectively total 13.08 FWI per year, accounting for almost 60% of *track worker* risk. There are four precursors from HEN-56 in Chart 28, three from HEN-24, and one each from HEN-21, HEN-74 and HEM-19.

Chart 28. Track worker risk profile – Top 10 precursors



The greatest single precursor contribution to *track worker* risk is HEN-24A *Track worker slip, trip or fall (<2m) on track or about the track*. This contribution of 3.62 FWI per year consists of 19.7 major injuries per year and 331.3 minor injuries per year. Chart 28 also shows that HEM-19 *Track worker struck/ crushed due to failure of a safe working system* is dominated by fatal risk.

Chart 29. Track worker fatal risk profile – Top 10 precursors

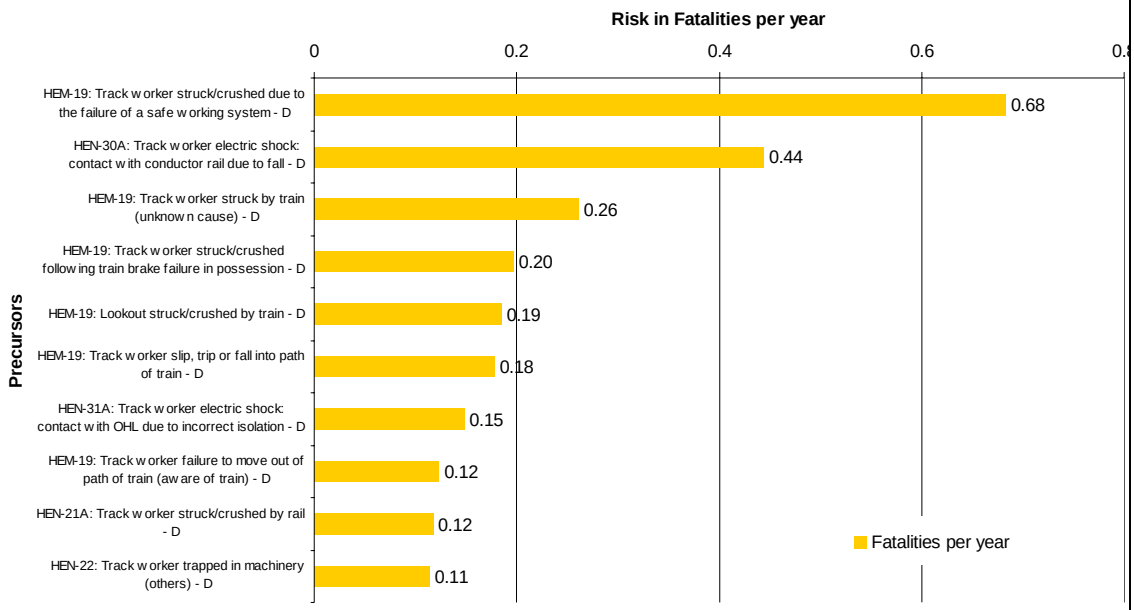
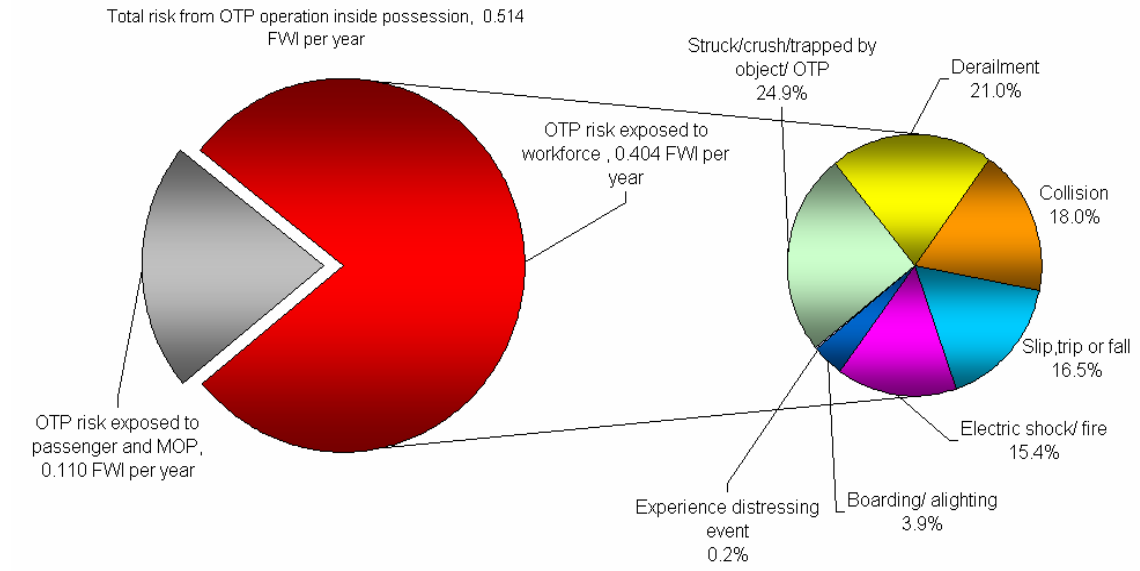


Chart 29 shows the top 10 precursors associated with *track worker* fatal risk. They contribute 2.45 fatalities per year, which accounts for almost 60% of *track worker* fatal risk. The chart shows that the greatest single precursor in terms of fatal risk is HEM-19 *Track worker struck/crushed due to failure of a safe working system*. The contribution from this precursor is 0.68 fatalities per year. Chart 29 also shows that six of the top 10 precursors are associated with HEM-19. They contribute 1.63 fatalities per year, forming almost 40% of *track worker* fatal risk.

5.2.4 Risk related to OTP operation inside possession

The overall risk attributable to OTP movements inside possessions is 0.514 FWI per year, of which 78.5% (or 0.404 FWI) per year is associated with the workforce. As shown in Chart 30, hazardous events relating to *Struck/crush/trapped by object/ OTP*, *Derailment*, *Collision*, *Slip, trip or fall* and *Electric shock/fire* are the major contributors of the risk exposed to OTP workforce members during OTP operations inside possessions.

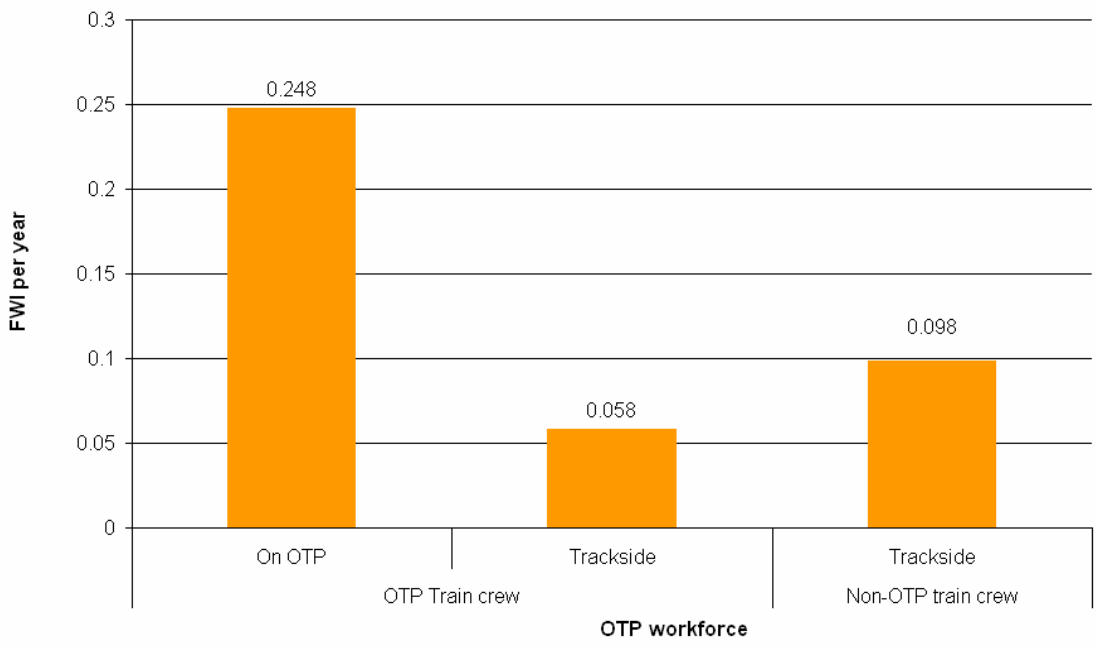
Chart 30. Overall Track worker risk from OTP operation inside possession



Categorising the OTP risk contribution with respect to workforce[13] type provides another interesting perspective, as shown in Chart 31. The risk to which the OTP train crew is exposed during OTP movements inside possessions is 0.31 FWI per year. However, not all of this is associated with the OTP train crew whilst actually on board the OTP. Chart 31 shows that 19.0% of the OTP train crew risk is trackside-related (0.058 FWI per year). This mainly consists of risk contributions from hazardous events relating to coupling/uncoupling the OTP, slipping, tripping and falling, and electric shocks from contact with the conductor rail.

[13] The OTP workforce consists of OTP train crew and Non-OTP train crew. They are both considered as track workers, hence their risk contribution forms part of the *track worker* risk in Chart 1.

Chart 31. OTP inside possession risk by workforce



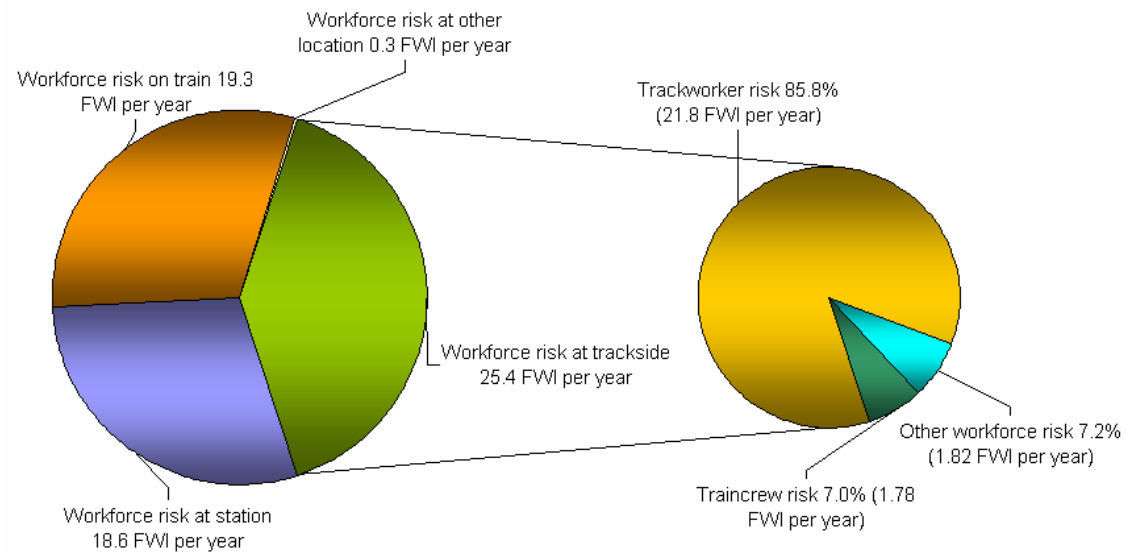
The risk associated with OTP train crew on OTP amounts to 0.248 FWI per year. This mainly consists of risk from hazardous events relating to OTP collisions or derailments, workforce members being struck by objects while on the OTP and electric shocks/fires on the OTP.

The risk to non-OTP train crew during OTP operations inside possessions is revealed in Chart 31 to be 0.098 FWI per year, forming 24.2% of the total OTP workforce risk. The major contributors to this are derived from hazardous events relating to falling from the OTP, being struck by objects, OTP derailments while in possessions and electric shocks/fires.

5.3 Workforce risk at the trackside

Of the locations on the mainline where staffs undertake their activities, the trackside location (*track workers, train crew* and *other workforce* needing to be in the trackside environment) presents the highest risk. Chart 32 shows that the workforce risk at the trackside is 25.4 FWI per year, forming 40.0% of the total workforce risk. With a risk contribution of 21.8 FWI per year, the track worker is exposed to approximately 86% of risk at the trackside. The risk contribution from *other workforce* and *train crew* trackside is 1.82 FWI and 1.78 FWI per year respectively.

Chart 32. Workforce risk at the trackside



As there has been much discussion on *track worker* risk in section 5.2, it will not be considered further here. Instead, *train crew* and *other workforce* risk at the trackside will be examined. Chart 33 (below) gives a breakdown of the trackside risk associated with the two workforce groups by hazardous event grouping.

Chart 33. Train crew and other workforce risk at trackside

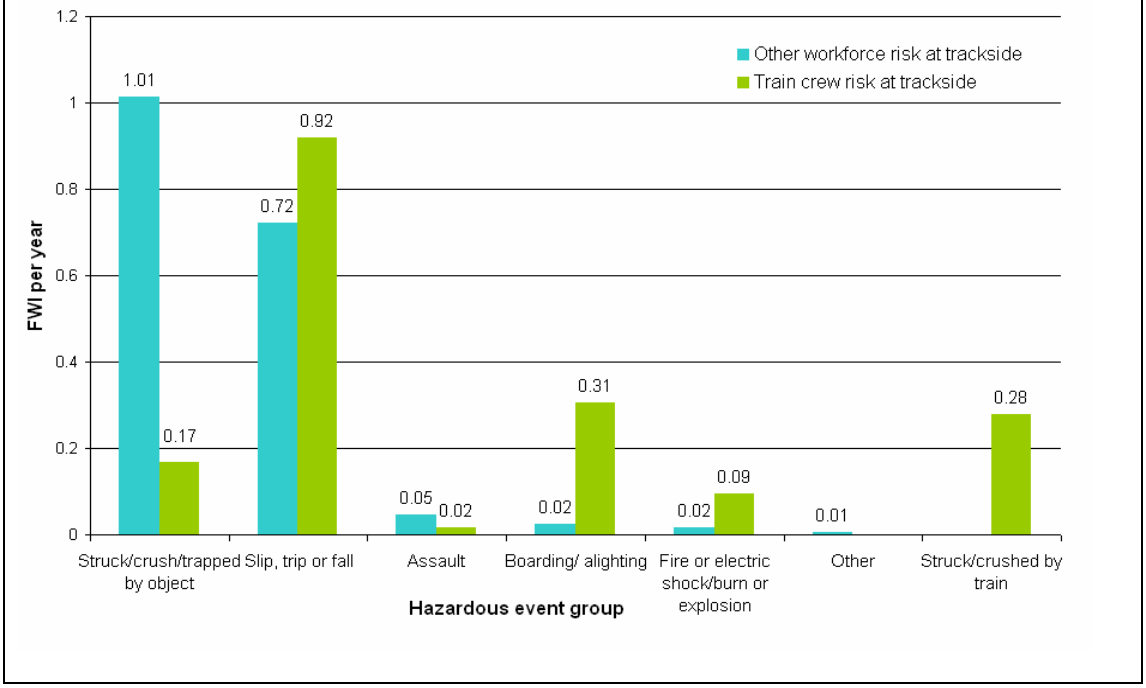


Chart 33 shows that the risk associated with *other workforce* at the trackside is dominated by contributions from hazardous events relating to *Struck/crush/trapped by object* and *Slip/trip or fall*. The risk from both these hazardous event groups is 1.73 FWI per year, forming 95% of the risk for the *other workforce* group at the trackside.

The major contributors of *train crew* risk at trackside are hazardous events related to *Slip/trip or fall*, *Boarding/ alighting* and *Struck/ crushed by train*. Their contributions sum to 1.51 FWI per year (approximately 85% of the total *train crew* risk at the trackside).

Comparing the two workforce groups by the types of hazardous events by which they are affected at the trackside can be informative. As shown in Chart 33, *Struck/crushed/trapped by object* is the top contributor of *other workforce* risk at these locations, but it is only the fourth largest for *train crew*. This latter group is more exposed to the risk from *Slip/trip or fall* at the trackside than *other workforce* by about 28%. The *train crew* risk from *Struck/crushed by train* at the trackside is 0.28 FWI per year, while the *other workforce* group is not affected by hazardous events of this nature.

5.4 Risk profile summary

The total risk attributable to the workforce is 63.5 FWI per year (5.5 fatalities, 175 major injuries and 8,083 minor injuries per year). The most significant risk contributions are from movement and non-movement accidents resulting in 17.7% and 80.0% of the total workforce risk respectively. The risk profile breakdown of railway workforce is summarised in Table 8, below.

Table 8. Breakdown of workforce risk profile

Group	Total risk in FWI per year	Fatality risk in fatalities per year
Train Crew	25.9	1.2
Track Worker	22.1	4.1
Other	15.5	0.3

In terms of overall risk *train crew* are the most exposed group with assaults and on-train related incidents providing the highest contributions to the risk.

Track workers are the most exposed workforce group to fatal risk. With a contribution of 4.1 fatalities per year, it forms 73.8% of the total workforce fatal risk. The *track worker* fatal risk profile is dominated by contributions from HEM-19 *Track worker struck/crush by train* and HEN-30 *Worker electric shock (conductor rail)*. The total fatal risk from HEM-19 and HEN-30 is 2.94 fatalities per year. This is more than half the total workforce fatal risk and amounts to over 70% of *track worker* fatal risk.

When compared to version 4 of the SRM, the total risk attributable to workforce has increased by 3.7 FWI per year from 59.8 FWI per year. Accounting for almost 50% of this increase is the inclusion of risk from the new hazardous event, HEN-74 *Workforce manual handling*. As indicated in section 4.3 there was deterioration in workforce safety during 2004 that is reflected in version 5 of the SRM[14]. However this coincided with a period of major change, when Network Rail brought maintenance in-house and more recent safety performance suggests that this was a short-term increase with fatality and major injury rates now reducing.

[14] SRM version 5 was undertaken with an update of data, which form the basis of this analysis, to the end of December 2005.

6 Initiatives

6.1 National initiatives

6.1.1 Rail Personal Security Group

The Rail Personal Security Group (RPSG) has produced a DVD called SWeRVe (Stop Workplace Related Violence) to help prepare staff for dealing with difficult customers and conflict situations. This was launched in September for use across the industry as a module within conflict management courses. It includes a series of scenarios and gives advice on techniques that may be used in potentially difficult situations.

Contact Alan Davies on 020 7904 7964 alan.davies@rssb.co.uk to order copies.

6.2 Network Rail

Network Rail has developed a programme of initiatives and various leadership groups to tackle issues that impact workforce safety. The various groups have been listed below and were created to help change attitudes, improve visibility and promote engagement.

6.2.1 Strategic Safety Group (SSG)

This group is chaired by the Network Rail Chief Executive and has executive and non-executive directors among its members, as well as influential senior managers. The group sets the strategic safety objectives for Network Rail.

6.2.2 SAF 6 Communication Skills

This has been implemented to engender consistent competency training for all safety critical personnel and key frontline suppliers' supervisory teams. The work involved requires a steering group with Network Rail and all suppliers and industry representatives.

6.3 Network Rail projects and engineering

6.3.1 Projects Safety Leadership Group

The Projects Safety Leadership Group (PSLG) was established to provide a consistent leadership within the Network Rail Projects and Engineering organisation. The group is led by Network Rail and counts the leaders of major suppliers and industry organisations among its members. It also reviews safety performance and continually engages with the projects workforce to understand key issues.

6.3.2 Safety Improvement Team

The Safety Improvement Team (SIT) has been appointed by the PSLG both to review industry data/trends and identify key projects and programmes to improve the safety of the workforce. The team addresses performance, workforce engagement, communications, and consistent Network Rail and supplier application and compliance. It is currently developing and implementing the following improvement projects:

6.3.2.1 Safety Improvement Team initiatives

Workforce and site conditions

Personal protection equipment (PPE): A new standard has been introduced that raises the level of equipment provided to Network Rail and aims to ensure that all personnel are adequately supplied. Network Rail's suppliers have until June 2007 to implement this new improved standard.

Welfare arrangements: A new standard has been introduced to improve the site welfare arrangements on project sites. This covers the provision of messing, toilet and washing facilities and their number, quality and cleanliness. The new standard became effective on 1 October 2006.

Access/egress: Network Rail is investing money in improving the provision and suitability of access points and under foot conditions. The SIT is developing criteria to evaluate the condition of access points and gain the maximum benefit from this investment.

On-track plant

The SIT is working with the Rail Plant Association to develop plans to address the top ten safety issues and improve the management of plant within multiple-worksite possessions.

Method statements

Network Rail, its suppliers and RSSB have developed new formats for a new method statement process. The new format for the Project Health and Safety Plan, Work Package Plan and Task Briefing provides an improvement on the way hazard and risk management information is organised, presented and briefed. The new system has been developed and trialled in 2006 and will begin implementation in 2007 (for completion by July).

Working at height

The SIT is addressing this issue and has begun by developing new guidelines on the use of mechanically elevated work platforms.

Knowledge transfer and improved briefing

A training scheme for controllers of site safety (COSS) is being developed in how to plan and execute an effective brief. It is anticipated that this will be supported by a video programme showing good and bad examples of work group briefings.

Working hours

Data is being gathered on working hours and travel time with the aim of reducing excessive working hours.

For further details, contact Andy Dunnett on Andy.Dunnett@networkrail.co.uk.

Making a Difference Initiative

Network Rail is currently trialling a cultural change programme called 'Making a Difference' (MAD). This initiative is based on a coaching technique, which uses frontline staff (rather than management) to make people more aware of how choices they make each day can impact not only on their own safety, but also that of their colleagues.

The programme is rolled out through a series of learning modules by a number of trained coaches, typically frontline supervisors, on a three-and-a-half-day 'introduction to coaching' workshop. This training course provides the coaches with guidance on how to conduct briefings in an active and engaging manner to allow staff to concentrate on behaviours rather than processes. The programme is designed to enhance skills and offer supporting solutions by fitting in with existing systems, as opposed to replacing them.

Contact Emma Barratt on Emma.Barratt@networkrail.co.uk to arrange training sessions.

6.4 Network Rail operations

Network Rail Operations has a leadership group that deals with *other workforce* safety, including maintenance track workers, signallers and other operational members. This Tactical Safety Group is chaired by the deputy Chief Executive and reviews safety performance and leads safety initiatives.

Safety 365 brand

Network Rail has launched Safety 365 as a goal and brand through which to promote improvements and initiatives that aim to reduce workforce accidents and injuries. Each depot/site has a goal to achieve 365 days without a RIDDOR-reportable injury. The message contained in the brand is that safety is a year-long priority. This brand is used on boards, posters, leaflets, videos, vans, and other promotional material. It is being used for all Network Rail safety promotions.

Safety 365 status board

Notice boards are prominently positioned at each site, displaying accident performance indicators for the relevant operations.

Safety 365 trucks

Five trucks have been fitted out as mobile briefing rooms, complete with audio-visual and presentation facilities. Network Rail and suppliers can call upon trucks to visit sites to promote safety initiatives and deliver key messages. The vehicles can accommodate around 24 people at one time and have been used to deliver key communications to more than 12,000 people.

Manual handling training

An extensive and innovative training programme has been introduced to reduce the number of manual handling injuries. The course has been developed by experienced weight-lifting athletes and is being delivered to around 17,000 workers in the maintenance organisation.

For more information, contact Ron Cameron on ron.cameron@networkrail.co.uk.

6.5 Current research

The RPSG also contributed to the review of the BTP Staff Assault Guide booklet, which is about to be republished, and has acted as the main stakeholder for the T542[15] research project. The latter informs the industry about the effective design of conflict management training courses for frontline staff; it provides companies with the information to plan and resource training in this area more effectively and to measure the benefits of improved staff safety, performance and retention.

A list of workforce-related research commissioned for the industry by RSSB is given in Appendix 2.

[15] T542: Conflict avoidance training for frontline railway staff.

6.6 Local initiatives

In accordance with our standard practice, we have listed some of your best workforce safety practices in section 6.6.2. We hope this continues to help the sharing and communicating of ideas vital to minimising railway related risk.

6.6.1 *Spotlight:* First Engineering

For this SPR's *Spotlight* feature, we have chosen to focus on First Engineering (FE), a company that began as one of British Rail's infrastructure service units shortly before privatisation in 1996.

6.6.1.1 One Team Safety

FE promotes its safety culture chiefly through a behavioural safety program. A Safety Roadshow was delivered by senior management to all employees across the country earlier this year to promote the philosophy of 'One Team Safety'.

Audiences consisted of FE employees and invited members of the client and sub-contractor production teams. Each roadshow ended with question-and-answer sessions and each attendee was invited to complete safety questionnaires, which were subsequently analysed for trends, opportunities for improvement and best practices.

This message was underpinned by a supervisor behavioural safety programme. All supervisors underwent an intensive course over several days, which included classroom learning, syndicate work and real-life scenario testing. The programme aims to assist FE staff to identify both positive and negative behaviour indicators, recognising the benefits of the former and the adverse impact that the latter can have on safety.

6.6.1.2 Safety Tours and Inspections

During 2006, FE enhanced its 'safety tours and inspections' programme. All trends and analyses are now collated and reported at a senior management safety meeting. The current highest-ranked issues are addressed by corrective action plans agreed at the meeting and then implemented through the management chain to improve front-line safety.

An example of this is the 'gloves' policy. This helps ensure that gloves are worn at all times on-site to reduce the severity and occurrence of hand injuries. Key to all FE's safety improvement activities is rapid communication throughout the company of lessons learned and best practice observed.

6.6.1.3 Communication counts

Communication has also been enhanced by the implementation of a reporting process known as 'Day 1'. This is a 'snapshot' of an accident or incident, whereby the local management team is required to complete a form which gathers all of the available information on the event available within 24 hours of its occurrence. The Day 1 report is circulated to the chief executive's office, the directors and other senior management figures within FE. They are intended to provide an immediate communication of what is known at the time. While not prejudicing any subsequent investigations, analysis of the trends identified by this means have helped the company to focus on specific risk areas and develop action plans to reduce accidents and incidents.

FE has also made extensive use of the Network Rail 365 Safety Trucks, supporting the activity by seconding staff to act as presenters on the trucks/bus that operates out of

Glasgow. The truck/bus has visited many FE sites and generated tangible information on areas where frontline safety improvements can be gained.

Safety improvements have many factors, but central to FE's approach is to have the processes in place which allow speedy communication of concerns of front line staff, lessons learned from experience and the implementation of the processes which influence good safety practises amongst all employees.

6.6.1.4 About the team

First Engineering has two regional SQE teams (North and South) in the UK. The regional teams are headed up by a regional SQE manager based in York and Glasgow. The regional teams are supported by the corporate SQE team headed up by the corporate SQE manager based in Glasgow.

The regional team's activities include:

- Producing and reviewing risk assessments.
- Providing support and expertise on accident and incident investigations.
- Carrying out safety audits, tours and inspections.
- Collation of regional KPI data.
- Operational SQE advice and consultancy.

The corporate team's activities include:

- Management, review and update of the SQE systems, policies and procedures.
- Management of the audit plans both internal and external.
- Collation, publication and trend analysis of the company wide KPI statistics.
- Management of the Railway Safety Case and Contractors Assurance Case.
- Company wide advice and consultancy on SQE systems and legislation.

All SQE staff attend internal meetings to discuss safety improvement issues and meet with the client on a regular basis to review and discuss safety performance.

For more information about any of the schemes currently being operated by First Engineering, contact Frank Monaghan, *frank.monaghan@firstengineering.co.uk*.

First Engineering's on-track plant

6.6.2 Examples of local initiatives

RSSB has invited industry colleagues to submit details of any local initiatives that they are currently employing to improve workforce safety. We believe by adding this type of information to our reports it will encourage the sharing of good practice and promote wider learning.

Company	Initiative	Contact
Dean & Dyball	Dean & Dyball is introducing a new behavioural safety initiative, under the heading 'Right from the Start'. This message had previously been applied to management safety initiatives and is to be re-launched in November 2006 in an attempt to convey that no task should be begun until it is absolutely safe to do so. The initiative will run for at least two years and will focus on a new theme every two months. Dean & Dyball has also formed a workforce safety committee, comprised of non-supervisory employees. This will have a direct input on safety-related matters, such as new procedures, protective clothing, competence issues and incident reviews. All managers now assemble every two months, when presentations are given by directors and health and safety staff on safety performance issues. Managers are encouraged to discuss incidents that have happened under their control openly and without blame. The aim is to make sure that lessons are learned.	Olavlawrence@deandyball.co.uk
Northern Rail	**Injuries** Northern Rail has a predominance of slip, trip fall accidents, with other significant cause categories being contact with static objects, being hit by objects and manual handling	Gary.Stewart@northernrail.org

	injuries (usually more related to posture than actual lifting). Since its incorporation in December 2004, Northern has been implementing a single safety management system. It has thus been training managers in such skills as risk assessment and planned general inspections. The company has also developed a close working relationship with Trades Union safety representatives. A comprehensive structure of local safety meetings and a company-wide joint safety forum are now in place. Joint occupational safety training for managers and safety representatives was also started during 2006. **Safety Culture Strategy** Northern's most recent initiative is the development of a long-term Safety Culture Strategy, recognising that most accidents are caused by unsafe acts, and that influencing staff behaviour and attitudes is the way to reduce accidents further.	
Trans-Pennine Express	**Training** TransPennine Express recently undertook a live evacuation exercise for its new Class 185 units. A mixture of employees and volunteers were present on the day to simulate evacuation under emergency conditions. Carriages were filled with artificial smoke to simulate a fire on board. The exercise was also filmed and the footage has been used as the basis for a training DVD. This will be distributed to aid employee briefings. **SPAD initiative** The Operations Standards Team within TransPennine Express recently launched a new initiative to help reduce the level of SPADs. The 'Drivers Attention Zone' initiative or 'DAZ' is designed to remind drivers to focus their mind fully at the critical moment of concentration when approaching a signal at danger. A poster campaign has been launched within depots and at signing-on points. **Injury Prevention Programme** The Injury Prevention Programme (IPP) is currently being rolled out throughout First Group. It is designed to reduce the levels of accidents/near misses through increased interaction and safety conversations between employees. All employees are issued with a handbook, in which safety conversations are recorded. Employees are also encouraged to carry out safety conversations, not only to discuss unsafe behaviour/conditions, but to praise colleagues regarding good practice in addition. Completed forms are collated by managers.	Desmond.Lowe@firstgroup.com
Arriva Trains	**General safety** A strategic accident section has been established at the	Catherine.Tryon@

Wales	Safety Management Group, which transmits transferable lessons across Arriva Trains Wales (ATW). ATW has introduced fleet regimes and inspections, in order to reduce the risk from on-board injuries, by carrying out refurbishments to seats, chairs and tables. **General accidents/incidents** To reduce the number of accidents and incidents at 'hot spot' locations, ATW has written site-specific action plans (at maintenance depots /key stations, for example). The boarding and alighting toolkit has also been developed to target other common hazards (such as slips, trips and falls on the level). **2007 safety plan** ATW interfaces with its human resources department on the occupational health issues and targeted campaigns. Next year will see a focus on muscular skeletal disorders. **Training** Conductor training and awareness/customer service training and hazard awareness have been implemented along with: Induction training is currently under review. This will include a review of manual handling, disability awareness, safety/scalds/sharps/D&A and will also include an enhanced customer service module to include managing confrontation plus another added slot which will be for emergency evacuation training for all staff. ATW is considering bringing in-house a tailored environmental training course. This will include power tools/COSHH etc, along with the possibility of including IOSH training and fork lift truck training (2007). All conductors and drivers attend a mandatory safety training update day (STUD), which is run every 16 weeks. There is now a focus group and preview days for all STUDs during 2007.	arrivatw.co.uk
GrantRail	**Reducing injuries to track workers** GrantRail has various initiatives in place to reduce the number of injuries to track workers, the most important being a return to basic management and supervisory principles to deal with 'at risk' behaviour. A strict intolerance is also practiced towards those who condone unsafe behaviour. The involvement of senior directors and managers in driving this forward has brought about an improvement in safety performance over the last four years. To create a culture of discipline, track workers follow a firm	Christopher.Hext@grantrail.co.uk

	regime, under the guidance of the company control centre, before being allowed access to the track. This ensures that they are competent and that safe systems of work are implemented before work begins. **Reporting ladder** All accidents/incidents are reported through the company control centre, where the level of investigation is established. Inquiries are held and appropriate remedial actions identified to prevent recurrence. The company safety executive reviews all accidents/incidents and the resultant remedial actions to ensure lessons are learned.	
AMEC Spie Rail (UK)	**Behavioural safety** AMEC SPIE Rail (UK) has adopted a Behavioural Safety Programme. Fifteen courses have been run for around 250 individuals, which includes client and sub-contractor representatives. The introduction of these courses played a significant part in reducing the company's accident frequency rate (AFR) to 0.11. **Initiatives** To reduce accidents, and engage the workforce to 'think and act' safely, various schemes have been introduced at project level, including the use of Charitable Donations, Supplier Engagement, and Safety Missions for Managers and Supervisors. AMEC has also adopted Network Rail good practice, with the 365 Trucks and MAD initiatives now in place. (See sections 6.2 and 6.3.)	barry.osgood@asrsluk.com
Carillion Rail	**Target Zero** In October 2004, Carillion launched a new health and safety strategy called 'Target Zero' across the whole of its business, both in the UK and overseas. The aim of Target Zero is to reduce the number of RIDDOR reportable accidents and cases of occupational ill-health to zero by 2010. **AC^{2}E Model** Carillion has also developed a cultural assessment tool called the 'AC^{2}E Model' to support the delivery of Target Zero. This is presented on a multi-media CD-ROM that explains the structure of the model, as well as providing the process for its implementation. **'Don't Walk By'** Part of Carillion's management of health and safety is to create an environment of awareness and openness to ensure that any health and safety concerns are identified and corrected using the 'Don't Walk By' initiative. This deals with changing attitudes and behaviour to achieve a safer working environment. Employees (and anyone who interfaces with Carillion) are strongly encouraged to identify and challenge any unsafe acts and conditions, and, if necessary, report	Robert.N.Richardson@nrra.co.uk

	them. **Recording incidents** Since the beginning of 2005, Carillion has used a single 'Plc Incident Database' to record and monitor injuries and other incident data. Competent users are able to access accurate and up-to-date information to analyse data and trends, giving greater insight into causes of accidents. This, in turn, allows for more targeted health and safety initiatives to be undertaken. **Behavioural Based Safety (BBS)** Since 2004, Carillion has been using the principles of Du-Pont and the Dr Scott Geller process as the foundations of its BBS initiative. The company uses a range of tools to inform its employees, supporting them to improve the safety culture through: Safety Action Groups, Improved Knowledge (through IOSH Courses) and supporting Behavioural Observation Teams.	
'one' railway	**Assaults on staff** An issue amongst all TOCs, 'one' has implemented several initiatives to reduce the risk of assault and to manage effectively the consequence of an assault after the incident. The RPSG's SWeRVe DVD (see section 6.1.1) is to be incorporated into induction and existing conflict awareness courses. 'one' is also trialling the use of phones which have a tracker alarm installed. **Stations** 'one' has recently undertaken a joint review (with HMRI) of the welfare facilities available for staff. A review has been undertaken into the provision of first aid training to frontline staff. **Depots** Noise and vibration assessments are currently being undertaken amongst the company's key locations, in accordance with new requirements. Walkway barriers, for example, are being installed at Ilford Depot to prevent the risk of falls from height. **Occupational health** Following the publication of RSSB research into occupational health management within the railway industry, 'one' is working with an RSSB representative to decide on the most appropriate way to take this information forward. It also aims to establish an occupational health management system.	Joanne.Beesley@onerailway.com
WA Develop	**Near miss reporting** Comparisons were made with the HSE and Birds 'Accident Triangles', which confirmed WA Developments' (WAD)	robmcmillan@wadevelopments.com

ments	concerns about near miss underreporting. It was decided that WAD would use this issue to provide financial support to the local air ambulance, which relies heavily on charitable donations. As an incentive to the workforce, a commitment was made to donate £1.00 to Cumbria Air Ambulance for every near miss reported. Numbers of reports increased almost immediately. To complement this initiative, a member of the safety team implemented a programme of company briefings to everyone in the organisation, highlighting the importance of near miss reporting and how such data can be analysed for use in accident and incident prevention strategies. Those who name themselves when reporting a near miss are contacted as soon as practicable to discuss the issue and identify possible improvements. Where no name is given, the details are logged onto WAD's accident, incident and near miss reports spreadsheet for periodic analysis. The results of which are discussed at management and workforce meetings and will be published in a future edition of the company magazine.	
Birse Rail	Birse Rail undertook a holistic analysis of previous safety assurance performance which led to the development of a targeted approach to making improvements. **Buried services** The buried services procedure and associated work systems permit were simplified and re-briefed to operational staff. Gaining as much information as possible is crucial to reducing risks; therefore the use of ground probing radar and new technologically advanced cable-locating equipment was introduced as mandatory across all Birse Rail projects. The training course was extended and the syllabus improved to include safe digging techniques, reading of service drawings, and use of trackside cable locating equipment. Additional one-day workshops have been held to reinforce safe working practises. To date, these actions have delivered a 76% reduction in service strikes. **Occupational health** The first phase of implementation of the Birse Rail Occupational Health Strategy involved increasing workforce awareness of health-related issues, such as musculoskeletal disorders, dermatitis, hand/arm vibration syndrome and noise induced hearing loss. Each work gang now reports its daily activities in relation to health hazard exposures. This has shown an increased understanding of health risks and increased ownership amongst the workforce for their own and their colleague's health. **Near miss reporting** For European Health and Safety Week, Birse Rail launched	shelly.stretton@birse.co.uk

	an initiative to increase near miss reporting and remove some of the numerous barriers to reporting these types of incidents. A DVD showing examples of near misses was shown as part of a presentation explaining their importance. Birse Rail has opened up new routes for reporting near misses: intranet, freepost postcards and a near miss hotline. Feedback on near miss reporting is being distributed throughout the business in a newspaper, 'Near Miss News'.	
Atkins Rail	In 2005/06, Atkins Rail was one of the first major companies to achieve the Network Rail target of zero major or reportable accidents for 365 days. Atkins has implemented a number of initiatives to improve safety, such as an in-house two day training course (Safety Licence) to improve health and safety competency for track workers. This course includes the following modules: • Manual handling. • Emergency first aid. • Working at height. • Fire awareness. • Working at height. Other initiatives implemented by Atkins include: • A control centre for track workers – to ensure the correct paperwork is in place and that additional measures for lone workers are also in place. • Working with the industry to improve the method statement process. • Adopting an internet accident and incident reporting system. • A guidance booklet was produced for all managers as part of European Safety Week ('young people in the workplace'). • Safety, Health and Environment induction e-learning introduced for all new starters. • A 'safe drivers' handbook was produced to give vital guidance in this area. Atkins has also sent those who drive as a major part of their work on defensive driving courses.	Linda.Simpson@atkinsglobal.com

6.7 CIRAS

Information on workforce safety may also be gleaned from the industry's confidential incident reporting system (CIRAS). Outputs from CIRAS differ from SMIS and conventional accident investigations, in that they rarely describe actual accidents and incidents. Reporters mainly focus on 'near miss' events or perceived deficiencies in safety systems and arrangements.

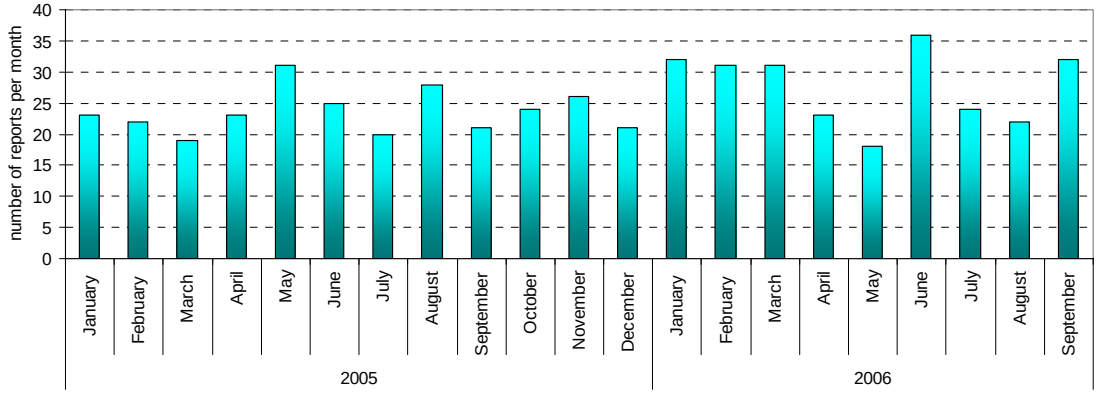
Because of its confidential nature, CIRAS reporters may be able to state their real concerns and describe underlying causes more openly than they might to a manager or formal investigation panel. This means that CIRAS has the potential to give additional insights into causes, supplementing those from conventional analyses.

In May 2005, the structure of CIRAS changed significantly. After a lengthy review period, a single national core unit was established, at which all reports are now received. The system was also expanded to include all staff working in the railway industry. Previously, reports were only accepted from individuals identified as being 'safety critical'. The changes increased the pool of potential reporters substantially, but created a challenge to ensure recognition and awareness of CIRAS within this new group.

6.7.1 A review of CIRAS reports over recent years

The number of reports received each month between January 2005 and September 2006 is shown in Chart 34, below:

Chart 34. CIRAS reports by month Jan 2005 – Sept 2006



Source: CIRAS

The middle of 2004 saw a decline in numbers, attributed to the need to establish new communication channels, while concentrating on revising the CIRAS internal structure. Comparing the first nine months of 2005 with the same period in 2006 shows there to have since been an increase in percentage terms. Between January and September 2006, 249 reports were received (as opposed to 212 for the previous year). This represents an increase of 37 reports, or 17.4%.

Structured surveys of potential and existing reporters (as well as key managers) were also carried out, the responses engendering the following changes (which now form part of CIRAS's standard procedures):

- Providing a formalised response, which is sent to reporters' home addresses. In addition, their comments and feedback on the whole process are collected.
- Enhanced telephone interviews to gather new information from reporters.
- Improved rigour in confidentiality to protect reporters' identities.
- Improved company responses through assessment against a set of objective criteria.

- Improved trend identification and analysis of issues.

With an average of 28 reports now being received each month (against 24/month for the whole of 2005), signs of a reverse in the decline are now emerging. However, note that the quarterly peaks evident over the first seven months of 2004 (correlating to the release of the CIRAS newsletter) are no longer apparent.

6.7.2 Recent CIRAS projects

CIRAS regularly releases reports on various aspects of its findings. Details of some of the main examples from the last 12 months are provided below.

Complacency (November 2005)

This report focuses on the issue of complacent attitudes towards safe systems of work. CIRAS reporters suggested that planning alone does not guarantee a safe environment. The main reasons for complacency were found to be: distraction, insufficient safety checks, ignoring instructions, over-confidence and rule-breaking (through the gradual 'wearing down' of local practices). The report concludes that track worker training and management vigilance could do much to reduce this problem.

SPAD precursors (February 2006)

This report looks at both train and freight operating companies, based on data collected between June 2000 and September 2005. It shows two distinct patterns of underlying SPAD precursors: distraction and fatigue.

Distraction was the most common SPAD precursor reported by staff from TOCs (accounting for nearly 24% of all precursors reported). Signalling equipment problems, rolling stock problems and rules and procedure issues made up the majority of this group.

Fatigue accounted for 30% of responses received from the freight companies. Of this, 70% of CIRAS reporters cited rostering as a major cause of tiredness. Further analysis suggested that shift design and shift length were thought to be responsible.

Non-compliance with Rules (August 2006)

This document reviews two years' data to June 2006, analysing non-compliance information from Network Rail, Network Rail contractors, TOCs and the London Underground. Non-compliance reports rose in the period covered from 4.1% of all CIRAS reports in 2004-2005 to 13.7% in 2005-2006.

Three types of non-compliance were identified in the 51 reports under consideration: intentional rule violations (51%), rule violations (17.6%) and best practice ignored (31.4%).

Where safety issues are concerned, CIRAS reporters most often cited the pressure to meet performance targets as the reason for non-compliance. Other factors included staff shortages, inadequate training, poor management and poor planning.

Cab temperature (October 2006)

This document discusses the 16 CIRAS reports relating to cab temperature received between January 2003 and June 2006. Excessive heat and cold were the subjects of many; hence, it was the summer and winter (June-August and December-February), rather than the spring and autumn (March-May and September-November), which yielded the most reports. It was noted that complaints about the cold are as common as complaints about excess heat.

Some comments received from drivers also referred to the accessibility of the temperature controls. The additional point was made that while air-conditioning may cool the cab, it can also have a detrimental effect on air quality, by making it drier.

Crucially, analysis showed there to be a perceived link between the discomfort experienced in the cab whilst driving and the risk from passing a signal at danger.

More information on CIRAS may be found at: www.ciras.org.uk.

Appendix 1. Workforce major injuries

Workforce major injuries by worker activity

Worker activity	2001	2002	2003	2004	2005	2005 (Jan - Jul)	2006 (Jan - Jul)	Grand total
Track maintenance	69	85	62	104	69	43	34	466
Onboard train crew	20	26	20	24	21	14	3	128
Station staff	16	8	14	9	18	10	4	79
Civil structure maintenance	14	16	14	18	8	4	0	74
Train drivers	13	3	11	8	7	5	4	51
Train guards	5	2	1	8	13	3	8	40
Revenue protection staff	6	8	9	11	2	0	3	39
S&T maintenance	3	4	2	5	4	1	2	21
Other	0	0	1	5	7	3	5	21
Signallers	2	1	1	2	5	3	1	15
Station cleaners	2	2	4	2	1	1	1	13
Civil structure renewal/upgrade	2	1	1	3	2	2	0	11
Machine operator	0	0	3	1	2	2	0	8
Fitter/MOM	1	0	2	0	0	0	4	7
Civil structure inspection	2	0	0	2	1	1	0	6
Track renewal/upgrade	0	0	0	1	2	2	0	5
Electrification maintenance	0	1	0	1	1	1	0	4
CoSS	0	0	2	1	0	0	0	3
Machine controller	0	0	2	1	0	0	0	3
Electrification inspection	1	0	0	0	0	0	1	2
Non-railway personnel delivering to site	0	1	0	1	0	0	0	2
Track inspection	0	0	0	1	1	0	0	2
Level crossing keepers	1	1	0	0	0	0	0	2
Lookout	0	1	1	0	0	0	0	2
Shunters	0	0	0	0	1	0	0	1
HMRI	0	0	1	0	0	0	0	1
Control room staff	1	0	0	0	0	0	0	1
Fire safety personnel	0	1	0	0	0	0	0	1
Grand total	158	161	151	208	165	95	70	1008

Key = Track worker activities

Appendix 2. Workforce safety research projects

RSSB's Research and Development (R&D) programme is responsible for the development and delivery of the railway industry's safety-related research projects. It recognises that safety management is one element of managing business risk and is therefore aimed at providing and implementing viable business improvements for the industry. R&D's principle objectives are to identify and shape ways of reducing safety risk and the cost of delivering a safe railway, and to improve the quality and cost-effectiveness of safety management across the network.

R&D is being conducted across 12 topics, ranging from the engineering of the wheel-rail interface to human factors and operational research policy issues, such as risk tolerability. The following section presents those projects connected with workforce safety. The table below summarises the types of accidents under scrutiny in each.

Table 9. Workforce safety research by accident type

Project	Alcohol / substance abuse	Communications	Depot working	EU directives	Human factors	Procedural	Trackside
T013							X
T014		X					
T045							X
T050	X						
T051							X
T059					X		
T133	X						
T138					X		
T145						X	
T147					X		
T148					X		
T299					X		
T315				X			
T328					X		
T341			X				
T365		X					
T382					X		
T385					X		
T389					X		
T443					X		
T506						X	
T507							X
T541					X		

The full reports (where available) may be downloaded from the RSSB website at www.rssb.co.uk. For further information on the research programme, or to provide comments on it, please e-mail the research team at research@rssb.co.uk.

Table 10. Workforce safety research details

Number	Title	Brief description	Status
T013	Green zones: thinking strategically	Investigating cross-company co-operation processes to produce space in the timetable for regular infrastructure maintenance regimes.	Published
T014	Safety critical communications	Defining the problem of poor safety critical communication between drivers and signallers, using data from site surveys. Categorising error types and identifying contributory factors. Guiding the development of remedial measures.	Published
T045	Root cause analysis of red zone working	Identifying, analysing and understanding the reasons for selecting red zone working and the barriers to green zone working. Making this knowledge available for decision-making by those developing strategies for track safety.	Published
T050	Survey of policies relating to alcohol and substance abuse in a range of industries	Surveying alcohol and drug policies in other industries involved in safety-critical work, identifying their strengths and weaknesses and comparing them with railway industry practice. Developing a 'best practice' policy for piloting in the railway industry.	Published
T051	Discharge of toilet waste from trains onto the track	Verifying the results of previous theoretical studies that showed the health and safety risks to workers from toilet waste discharged onto the track from trains to be low.	Published
T059	Human factors study of fatigue and shift work	Investigating the effects of fatigue on train drivers and optimising shift work practices to reduce risks arising from fatigue and to improve performance.	Published
T133	Review of drug testing methodologies	Evaluating the key drug testing methods and determining their accuracy in assessing the possibility of impaired performance due to drug abuse.	Published
T138	Management strategies for workplace trauma	Identifying good practice in training, management and monitoring to minimise the effects of workplace trauma.	In progress
T145	Safety critical rule compliance	Investigating the causes of non-compliance with rules and procedures and deriving a list of the key influencing factors as a basis for developing tools to improve compliance.	Published
T147	Mental workload assessment for train drivers	Defining a mental workload assessment tool for the rail industry, and developing and validating it for use by railway personnel.	Published
T148	Human factors associated with human error and violation	Investigating driver behaviour to understand the use, benefits and risks associated with protective devices aimed at preventing SPADs, and investigating the ‘post-break phenomenon’.	Published

Number	Title	Brief description	Status
T299	Human factors study of sleep apnoea in train drivers	Developing a screening tool to investigate the presence of obstructive sleep apnoea (OSA) in a sample of train drivers.	In progress
T315	EU Physical Agents Directives: vibration and noise consultation response	Providing definitive information for an RSSB facilitated stakeholder response to the HSE consultation on proposed vibration and noise regulations.	Published
T328	Human factors of CCTV monitoring.	Investigating human factors questions associated with the use of CCTV on the railway. Producing a good practice guide to effective CCTV application.	In progress
T341	Reducing accidents and collision damage in maintenance depots	Analysing the precursors of accidents and collisions within maintenance depots, with particular reference to depot design and layout. Evaluating mitigation measures.	Published
T365	Collecting and analysing railway safety critical communication error data	Understanding the importance, cost and types of safety-critical communications failures involving frontline railway staff by capturing and analysing risk and error data from voice recordings and incident reports.	Published
T382	Management of health conditions and diseases	Identification of the top five highest priority health conditions or diseases affecting employees in the railway industry and developing guidance on how these conditions should be monitored and controlled.	Published
T385	Managing the health risks from dealing with human or livestock body parts	Developing operational guidance to ensure that rail industry personnel are adequately protected from possible disease when dealing with human and livestock remains.	In progress
T389	Management of health needs	Development of guidance on the identification and good practice management of the health needs of safety critical and other railway workers.	Published
T443	Improving teamwork on the railway	Training industry stakeholders to use the toolset generated by the successfully completed project 'T146 - Improving teamwork in the railway'. Demonstrating the ease of use and effectiveness of the tools.	Published
T506	Safety critical rule compliance toolkit	Validation of the Safety Critical Rule Compliance toolkit for the industry to use to improve compliance with rules and procedures.	Published
T507	Review of the continued use of detonators	This project assessed the need for the continued use of detonators (or fog signals) for operational protection and whether there are alternative protection methods that would provide the same or better protection levels.	Published
T541	Human Factors CD-ROM version 5	Disseminating current knowledge about human factors in the railway industry, by publishing a catalogue in the form of a CD ROM. Creating the fifth version of the CD ROM.	Published

Glossary

Acronym	Expansion
AFR	accident frequency rate
AMA	annual moving average
ASPR	Annual Safety Performance Report
ATW	Arriva Trains Wales
BTP	British Transport Police
CIRAS	Confidential Incident Reporting and Analysis System
COSHH	Control of Substances Hazardous to Health Regulations 1988
COSS	controller of site safety
CSI	common safety indicator
CSM	common safety method
CSPG	Community Safety Partnership Group
CSSG	Community Safety Steering Group
CSSU	Community Safety Support Unit
CST	common safety target
DfT	Department for Transport
ECS	empty coaching stock
EWS	English Welsh and Scottish Railway
FE	First Engineering
FOC	freight operating company
FWI	fatalities and weighted injuries
GB	Great Britain
GF	ground frame
HEM	hazardous event movement
HEN	hazardous event non-movement
HET	hazardous event train
HMRI	Her Majesty's Railway Inspectorate
HS	High-speed
HSE	Health and Safety Executive
IOSH	The Institute of Occupational Safety and Health
LC	level crossing
LC/LX	level crossing
LNE	London North East
LNW	London North West
MOM	mobile operations manger
MOP	member of the public
MPJ	million passenger journeys
MSS	maximum safe speed
MTM	million train miles
MWL	miniature warning lights
NCC	National Control Centre
NCRS	National Crime Recording Standard
NEBOSH	National Examination Board in Occupational Safety and Health
NGfL	National Grid for Learning
NMF	network modelling framework
NR	Network Rail
NRCG	National Route Crime Group
NRCI	Network Rail controlled infrastructure
OOARL	on or affecting a running line
OPSRAM	operations risk and mitigation
ORR	Office of Rail Regulation
OTDR	on-train data recorder
OTP	on-track plant
OTM	on-train machine

Acronym	Expansion
AFR	accident frequency rate
PHRTA	potentially higher risk train accident
PIM	Precursor Indicator Model
PRM	persons of reduced mobility
PSR	permanent speed restriction
PTS	personal track safety
RAIB	Rail Accident Investigation Branch
RCF	rolling contact fatigue
RFMG	Rail Fatalities Management Group
R&D	Research and Development
RGM	Railway Group Member
RGS	Railway Group Standard
RGSP	Railway Group Safety Plan
RIDDOR	Reporting of Injuries, Diseases and Dangerous Occurrences Regulations
RISAS	Railway Industry Supplier Approval Scheme
RISB	Rail Industry Safety Body
RMMM	rail-mounted maintenance machine
ROGTS	Railways and Other Guided Transport Systems (Safety) Regulations 2006
ROSCO	rolling stock leasing company
RPB	Risk Profile Bulletin
RPSG	Rail Personal Security Group
RRV	road-rail vehicle
PSLG	Projects Safety Leadership Group
RSSB	Rail Safety and Standards Board
RV	road vehicle
SC	Scotland
SCCFG	Safety Critical Communications Focus Group
SE	South East
SIC	System Interface Committee
SIT	Safety Improvement Team
SMIS	Safety Management Information System
SRA	Strategic Rail Authority
SRM	Safety Risk Model
SSP	Strategic Safety Plan
SSG	Strategic Safety Group
SWT	South West Trains
TCOD	track circuit operating device
TOC	Train operating company
TPWS	train protection and warning system
WAGN	West Anglia Great Northern

Definitions

Term	Definition
Accident	An unexpected, unplanned occurrence, resulting in physical harm to an individual, damage to property, a loss or any combination of these effects.
Accidental death	Such has occurred if the victim had no intention to take his/her own life or cause self-injury. Note that if reasonable doubt exists, the death is treated as accidental, and not a suspected or attempted suicide. Accidental death can occur to those engaging in dangerous activities, including trespass, as well as those going about their legitimate business.
Child	A person aged 15 years or below.
Collision in-running: open track	This occurs in circumstances where trains are not intended to be in close proximity on the same line. The speed of one or both of the trains involved may be high.
Coupling: open track	Similar to 'shunting collision at station', but occurs away from a station.
Fatality	Including where death occurs within one year of an incident.
Level crossing	This is the ground-level interface between a road and the railway. A table defining the many individual types of crossing is given in Chapter 7 (section 7.2).
Major injury	This is as defined in RIDDOR 1995, and applies to passengers, staff and members of the public. Injuries such as fractures, amputations, loss of sight or those resulting in admittance to hospital for a period of more than 24 hours are included in this category.
Minor injury	This is defined as injuries to passengers, staff or members of the public that are not major injuries. Note that while shock is not classified as a minor injury in RIDDOR 1995, it has been included as such in the Safety Risk Model.
Movement accidents	These are accidents to people involving trains (in motion or stationary), but excluding injuries sustained in train accidents.
Network Rail Controlled Infrastructure (NRCI)	This falls within the boundaries of Network Rail's operational railway and includes the permanent way, land within the lineside fence, and plant used for signalling or exclusively for supplying electricity for operational purposes to the railway. It does **not** include stations, depots, yards or sidings that are owned by, or leased to, other parties. However, it does include the permanent way at stations and plant within these locations used for signalling or exclusively for supplying electricity for operational purposes to the railway.
Network Rail: under contract	Persons working under contract to Network Rail, either as direct employees of organisations within the Railway Group (for example, infrastructure companies), or contractors to such organisations (like Mowlem).
Non-movement accidents	These are accidents unconnected with the movement of trains, occurring to people on railway premises.
On-track plant	This refers to rail-borne vehicles used to repair/maintain the track (such as rail grinders, ballast tampers and on-track machines).
Passenger	A person travelling or intending to travel whether in possession of a ticket or not. Passengers who are trespassing are **not** included – these are dealt with under 'Public'.
Pedestrian	This refers to a person travelling on foot.

Term	Definition
Permissible speed	The maximum speed at which trains are permitted to run over a section of line.
Permissive working	A method of working that allows running movements into an occupied section of track on designated lines and platforms.
PHRTA	This stands for 'potentially higher risk train accident' and refers to accidents that have the potential to result in harm to any or all person types on the railway. PHRTAs comprise train derailments (excluding road vehicle strikes on level crossings), train collisions (excluding roll backs), trains striking buffer stops, trains striking road vehicles at level crossings (including derailments), and trains running into road vehicles not at level crossings (with no derailment).
Possession	The complete stoppage of all normal train movements on a running line or siding for engineering purposes.
Precursor Indicator Model (PIM)	An RSSB-devised means of assessing the underlying risk from train accidents by calculating the monthly risk from 84 distinct precursors.
Public (members of)	Persons other than passengers or workforce members (that is, trespassers, persons on business and other persons). This includes passengers who are trespassing (when crossing tracks between platforms, for example).
RIDDOR	This, the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations, 1995, is a set of health and safety regulations that require any major injuries, illnesses or accidents occurring in the workplace to be formally reported to the enforcing authority. It defines major injuries and lists notifiable diseases - many of which can be occupational in origin. It also defines notifiable dangerous occurrences - such as explosions, structural collapse, electrical overloads, fires, and so on - where no injury occurs but subsequent investigations may be needed.
Road vehicle	All vehicles that travel on the highway, including motorcycles, but not pedal cycles.
Roll-back collision	This is when a train rolls back (while **not** under power) into a train on the same line (including one from which it has decoupled).
Safety Risk Model (SRM)	A quantitative representation of the safety risk that can result from the operation and maintenance of the GB rail network. It comprises 120 individual computer-based models, each representing a type of hazardous event (defined as an event or incident that has the potential to result in injuries or fatalities).
SMIS	This, the Safety Management Information System, is a national database used by Railway Group members to record any safety related events that occur on the railway. SMIS data is accessible to all members, so that it may be used to analyse risk, predict trends and focus action on major areas of safety concern.
Station accidents	These are movement, non-movement and train accidents ascribed to stations. Movement accidents are those associated with platform management (occurring during boarding or alighting, for example).
Suicide	Where a Coroner's verdict is suicide.
Suspected suicide/ Attempted suicide	Where objective evidence of suicide exists (other than a Coroner's verdict). This is an assessment based on the application of Ovenstone criteria adapted for the railways. These are based on the findings of a 1970 research project into rail suicides and cover aspects such as the presence (or not) of a suicide note, the clear intent to commit suicide, behavioural patterns, previous suicide attempts, prolonged bouts of depression and instability levels.

Term	Definition
Train Protection and Warning System (TPWS)	A safety system that automatically applies the brakes on a train which either passes a signal at danger, or exceeds a given speed when approaching a signal at danger, a permissible speed reduction or the buffer stops in a terminal platform. A 'TPWS activation' is where the system applies the train's brakes after the driver has already initiated braking. A 'TPWS intervention' occurs when the system applies the train's brakes without this action having been taken by the driver first.
Trackside/lineside	A person is on the lineside if they are within the area between the railway boundary fencing and a point 3 metres from the nearest rail of any line (beyond which is termed 'on or near the line').
Track workers	Workforce members employed in engineering or technical activities on or near the line or lineside (as defined in the Rule Book, including within 4 feet of the platform edge). Note that train crew members are not included in this category.
Train accidents	In general, this refers to accidents occurring to trains and rolling stock, as reportable under RIDDOR 1995 (see introduction to Chapter 6). However, non-RIDDOR reportable incidents that occur in yards, depots or sidings (such as shunting derailments that do not foul a running line) are also classed as 'train accidents'.
Trespass	The term 'trespass' is defined as occurring when people go where they are **never** authorised to be, rather than where they behave inappropriately (either from error or violation) at places where they are allowed to be at certain times and under certain conditions (such as level crossings).
Violent assaults	These include homicide, attempted murder and serious assault (that is, grievous bodily harm, wounding, threats to kill and actual bodily harm).
Workforce	All persons working for the Railway Group (either as direct employees or contractors).
Weighted injury	In this document, the numbers of major and minor injuries are weighted in recognition of their relatively less serious outcome in comparison to a fatality. The current weighting is 0.1 of a fatality for each major injury and 0.005 for each minor injury. The combined measure is designated 'fatalities and weighted injuries' (FWI). The term FWI replaces 'equivalent fatalities', which was used previously within the industry.