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Review of RAIB investigations and recommendations 2007

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EXECUTIVE SUMMARY

Objectives

The Health and Safety Laboratory (HSL) was commissioned by the Office of Rail Regulation (ORR) to review Rail Accident Investigation Branch (RAIB) investigation reports. The reports (published between March and September 2007) were reviewed to facilitate the identification of common issues and themes arising, and to analyse the quality of the recommendations made.

The aims of the work were to:

- Review the RAIB reports;
- Categorise the issues arising;
- Identify common issues and themes; and
- Provide a view on the quality of recommendations.

This report is a continuation of work done by Miller and Healey (2007).

Main Findings

Thirty RAIB reports were analysed to identify individual, job and organisational factors in the causal chain leading up to the accident. The following categories emerged as most frequently occurring:

- Organisational level – inadequate risk assessment;
- Organisational level – lack of safety systems;
- Organisational level – communication;
- Organisational level – culture;
- Organisational level – resources;
- Organisational level – training and competence; and
- Job level – display and control.

Maintenance and shunting activities were commonly recurring themes in the RAIB reports.

An analysis of whether investigation report recommendations were measurable and achievable was conducted. It was found that, of 168 recommendations:

- 96% were achievable and measurable;
- 3% were questionably achievable and questionably measurable; and
- 1% were questionably achievable but measurable.

The wording of recommendations was discussed, with regard to organisation of recommendations, theory versus practical application, actions that should already be in place, use of the word ‘review’ and the characteristics of good recommendations.

1 INTRODUCTION

1.1 BACKGROUND

Office of Rail Regulation/Her Majesty's Railway Inspectorate

The Office of Rail Regulation (ORR) was established in July 2004, as an independent statutory body. It regulates health and safety on the UK's railway. The ORR is concerned with:

- Ensuring that Network Rail manages the network efficiently and in a way that meets the needs of its users;
- Encouraging continuous improvement in health and safety performance;
- Securing compliance with relevant health and safety law, including taking enforcement action as necessary;
- Developing policy and enhancing relevant railway health and safety legislation; and
- Licensing operators of railway assets, setting the terms for access by operators to the network and other railway facilities, and enforcing competition law in the rail sector. (see www.orr.gov.uk)

The Rail Accident Investigation Branch

The Rail Accident Investigation Branch (RAIB) is the independent accident investigation organisation for railways in the UK. The RAIB is concerned with:

- Improvement of the safety of railways; and
- Prevention of further accidents occurring.

This is achieved through:

- Identification of the causes of accidents; and
- Identification of other factors affecting the outcome.

The RAIB investigate all rail accidents involving a derailment or collision which result in, or could result in:

- The death of at least one person;
- Serious injury to five or more people; or
- Extensive damage to rolling stock, the infra-structure or the environment.

(see www.raib.gov.uk)

The RAIB may also investigate other incidents that have implications for railway safety, including those which under slightly different circumstances may have led to an accident.

RAIB's powers, duties and scope of work are defined by Part 1 of the Railways and Transport Safety Act 2003 and the Railways (accident investigation and Reporting) Regulations 2005

("the Regulations"). The RAIB investigations focus on safety improvement. The RAI**B** does not enforce the law or carry out prosecutions.

1.2 RELATIONSHIP BETWEEN ORR AND RAIB

RAIB investigations may result in recommendations or actions that it believes are needed to improve railway safety. Recommendations identify those parties whom the RAIB believes are best placed to mitigate identified risks (the potential implementers). The Regulations require recommendations to be addressed to the relevant safety authority (ORR) and other appropriate public bodies[1], who then consider the recommendations, establishing their own priorities and timescales and taking into account their health and safety responsibilities and the safety risk profile and safety priorities within their organisation.

The national safety authority (the ORR) has a power to require anyone to take a recommendation into consideration and, if appropriate, act on it. ORR has a duty to give details of any such implementation measures to RAIB. ORR can take enforcement action if necessary.

The Regulations require RAIB to keep ORR informed of the progress of an investigation and, so far as is reasonable practicable, to take account of any opinions ORR expresses[2]. RAIB must also give ORR the opportunity to comment on the RAIB recommendations before the investigation report is finalised and published[3].

1.3 AIMS AND OBJECTIVES

The Health and Safety Laboratory (HSL) was commissioned by the Office of Rail Regulation (ORR) to review Rail Accident Investigation Branch (RAIB) reports published between March and September 2007. Thirty reports (see Appendix A) were reviewed to facilitate the identification of common issues arising, and recommendations addressing common themes.

The aims of the work were to:

- Review the RAIB reports;
- Categorise the issues arising;
- Identify common issues and themes; and
- Provide a view on the quality of recommendations.

This report is a continuation of work done by Miller and Healey (2007)[4], which analysed thirty-four reports published up to 30/01/2007 using the same methodology.

[1] *See regulation 12 of the Regulations*
[2] *See Regulation 5 (1) of the Regulations*
[3] *See Regulation 13 (2) (b) of the Regulations*
[4] *Miller, M and Healey, N (2007) Review of RAIB investigations and recommendations. HSL Report RSU/RM/07/02*

2 METHODOLOGY

2.1 DEVELOPMENT OF CATEGORISATION METHOD

Miller and Healey (2007) developed a method for categorising immediate, causal, contributory and underlying factors of accidents. The methodology needed to take account of human factors topics in the context of the technical rail categorisation observed in the reports. The same methodology was used for this project.

Figure 1 below, is a representation of the model. Minor modifications were made to the model in this project. Training and competence was added to the organisational level – a number of reports in this sample had training or competence causes which were at an organisational level, not an individual level, and which were not covered by other organisational level topics. Vandalism was also added to the 'environment' arm.

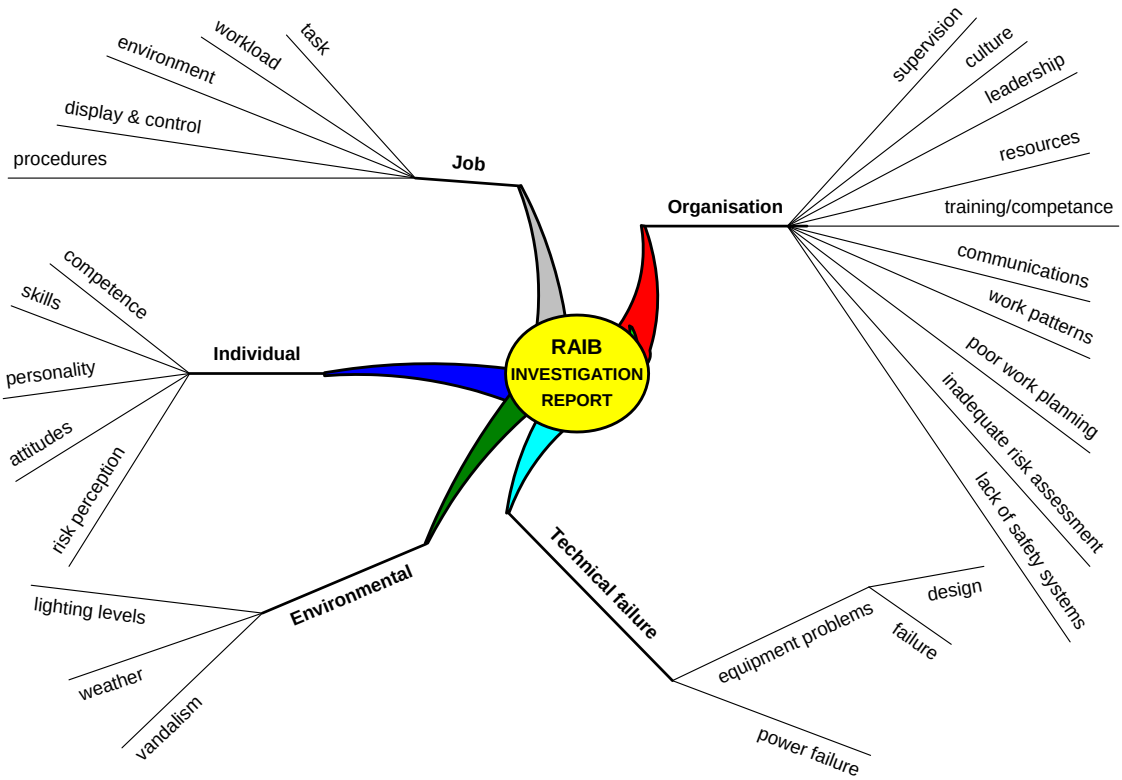

Figure 1 – Representation of framework for categorisation

2.2 ANALYSIS

When analysing investigation reports, the category that best reflected each of the immediate, causal, contributory and underlying factors was chosen (e.g. organisational supervision or individual competence).

The most relevant category for each factor was identified. In some instances, the nature of the accident or the author's style of writing resulted in the selection of more than one category (per single factor) in order to accurately reflect the causal, contributory or underlying factor identified.

The number of categories coded per report were counted to reveal the most frequently coded categories. In some instances immediate, causal, contributory or underlying factors identified in the report were not coded. The authors judged the relevance of the factor in contributing to the incident. 'No codes' were assigned generally where the contributory factor was a statement of fact and not a failing at some level.

'Additional observations' are given in many RAIB reports. The term 'additional observations' was used differently by different report authors. Where it was felt the additional observation was an underlying factor to the cause of the incident, it was coded.

Recommendations were analysed to determine whether they were capable of being implemented in order to close out the recommendation. In order to do this two criteria were used: is the recommendation achievable and/ or is the recommendation measurable.

3 RESULTS AND DISCUSSION

3.1 CATEGORISATION OF CAUSAL, CONTRIBUTORY, AND UNDERLYING FACTORS

The following sections describe the categories most frequently chosen to describe failings in the chain of events leading to the incident. The results of the analysis are presented in the categorisation diagram below. On each branch of the diagram, the number of times that the category was assigned is given in brackets.

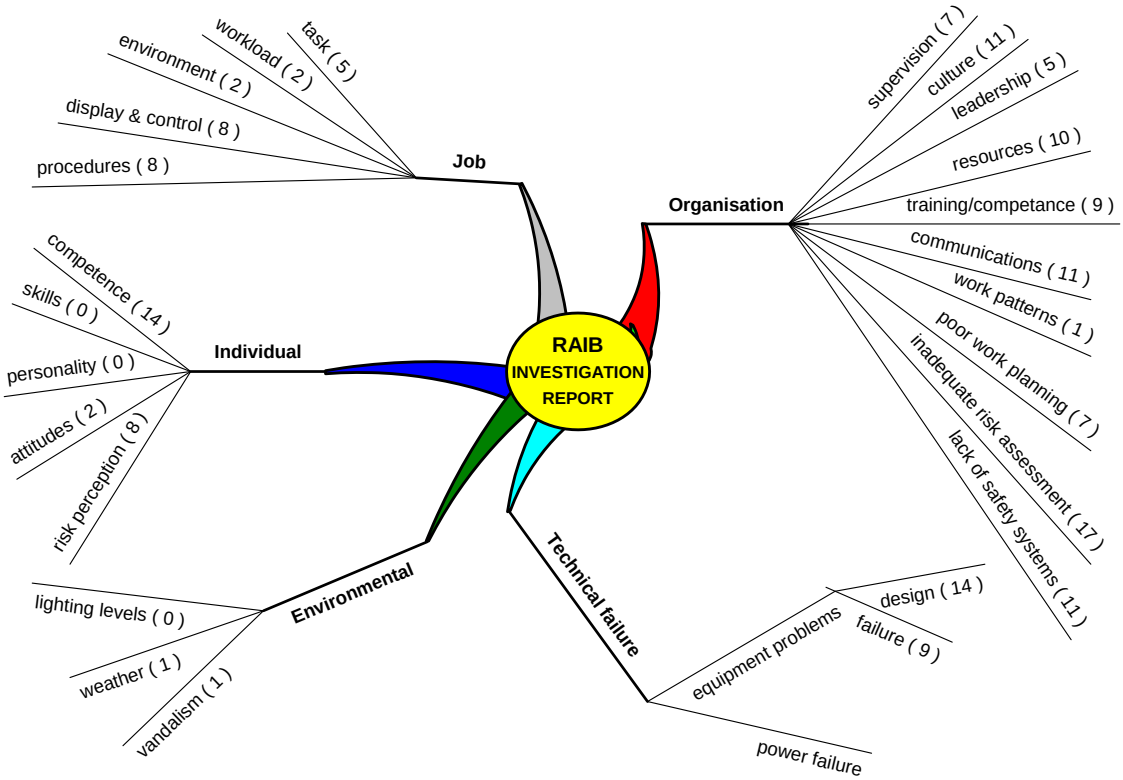

Figure 2 – Results of analyses

3.2 ORGANISATIONAL FACTORS

Organisational factors were coded 89 times in the 30 reports.

3.2.1 Organisational factors – inadequate risk assessment

As found by Miller and Healey (2007), inadequate risk assessment was frequently identified as a contributory factor. In this analysis, inadequate risk assessment was coded in 17 of the 30 reports. Typically, organisations failed to consider the complete system, and the subsequent effects that changes to one part of the system would or could have on another.

Interestingly, although 'inadequate risk assessment' continues to be a common category, the new sample has resulted in incidents of a slightly different nature. Where the previous sample consisted of accidents where the inadequate consideration and planning of maintenance activities was a result of inadequate risk assessments, accidents in the current sample were more likely to be the result of failure to consider the 'big picture'.

Frequently, accidents seemed to be the result of the organisation failing to consider the ways in which things could go wrong. However, in many investigations such failings were predictable. For example, in the Gwili Railway fatality, failings were caused by not enough staff being available for the job. It was predictable that there would not be sufficient staff on site, and staff shortages were acknowledged to be an ongoing problem. However, it was not anticipated that a shortage of staff would have a knock-on effect to site safety. If the shortages had been considered, there may, for example, have been more active supervision available, or an instruction not to start shunting movements without enough staff to complete the movement. (Fatal accident at Bronwydd Arms station, Gwili Railway 19 July 2006).

Problems with inadequate risk assessment were often linked to limited resources. It seemed companies were aware of a shortfall in standards but unable to correct the situation because of a lack of resources. This led to alternative (less than ideal) working practices/measures in the interim period (e.g. until repairs were completed). However, when such a situation continues for weeks or months, the full impact of the interim working arrangements should be considered with a risk assessment that considers the reality of the working situation for the staff involved. For example, in the Ropley investigation, it was uncovered that a temporary signalling arrangement had been in place since 1983 (Derailment at Ropley [Mid Hants Railway] 25 July 2006). It was because of these temporary signalling arrangements that the signaller was able to move the points under the train, causing the derailment. Another such example is the investigation into the fatality at Dagenham Dock freight yard where subsidence and trip hazards had been identified in previous safety audits of the site. However the audits had not been complied with, nor had it been identified that the actions were still outstanding (Fatal accident to Shunter, Dagenham Dock 17 July 2006).

Examples of more 'straight forward' risk assessment issues were:

- Insufficient consideration of the risks of using a trolley when working on gradients (Runaway permanent way trolley at Notting Hill Gate 24 May 2006).

- At Bratts Blackhouse level crossing – there was not enough time for the car driver to see if a train was approaching unless he poked the bonnet of the car out onto the crossing and then stopped to look for the train. This type of cautious behaviour is unlikely to occur with every motorist, and the level crossing should have been designed and maintained so that such behaviour was not necessary for crossing safely (Train collision with a road vehicle at Bratts Blackhouse No 1 User Worked Crossing, near Sizewell, Suffolk 22 May 2006).

Some reports highlighted the difficult task of balancing different risks. For example at Long Millgate a type of hard wearing rail was chosen because the rail was sunk into concrete as it was in a pedestrianised area and the hard wearing rail had a long 'lifespan'. It was chosen to cause minimal disruption by maintenance because of its location. However, this meant that when the rail did need to be maintained, it was very difficult to do it in situ, and this led to inadequate, temporary repairs being made, which contributed to the derailment of a tram (Derailment at Long Millgate, Manchester 22 March 2006).

3.2.2 Organisational factors – communication

As found by Miller and Healey (2007), poor communication was a commonly occurring factor in the chain of events leading to an incident. Communication was raised in 11 out of 30 reports. Typically, information was not clearly communicated between individuals or between companies.

In many reports the type of failure was a failure of the company to adequately inform their staff about the risks associated with the nature of their work. One example of this was at Deal, where it appears that the driver who was fatally injured was not aware that the direct current (DC) line was electrified. From interviews with his colleagues it was clear that most of them would have assumed that the DC line was isolated. This was despite them attending site briefings. The RAIB concluded that it was likely the driver would have made this assumption too (Fatal accident involving a train driver, Deal 29 July 2006).

Communication was also implicated as an area of organisational failing where unclear or ambiguous communication resulted in accidents. An incident at Manor Park (Possession irregularity, 19 March 2006) involved changes made to possession limits during the planning stage of the work. These changes were not adequately communicated, and the controller of site safety (COSS) on site was unaware of any changes to the possession. This resulted in one work group continuing to work on an open high-speed line without any form of protection. In this instance the lack of clear communication and a mutual understanding between different parties was contributory to the accident. Similarly, another accident, a collision between a train and a road vehicle, (M20 overline bridge, Aylesford 5 February 2007) was the result of ambiguous communications between key individuals, the bridge inspector and a contractor. The worksite details changed, and staff were not adequately briefed of changes.

In such instances the contributory factor is coded as an organisational communications issue. However, it is recognised that the individuals involved should have followed communication (and other) protocols when communicating information, thus ensuring consistent understanding of the messages being communicated. If there was an individual communication error committed as well, this would also have been coded.

3.2.3 Organisational factors – culture

Culture was coded in 11 reports where there was a series of problems and failures. It often indicated that the company understood that standards of work or safety were not as high as they should have been but corrective action was not taken. Often culture was coded in conjunction with multiple organisational level failings.

3.2.4 Organisational factors – lack of safety systems

Lack of safety systems were coded in 11 reports. It often describes a situation where a safety back-up either does not exist, is inadequate or has failed.

For example, at Crofton Old Station level crossing, interlocking that should have protected the crossing was not in place, which allowed a train to pass the level crossing while the gates were open to the public road (Two near misses at Crofton Old Station No. 1 Level Crossing, near Wakefield, West Yorkshire 1 and 18 May 2006). An example where the safety system was inadequate is demonstrated by the incident at Huntingdon where a member of the public became trapped in a train door. The train driver had CCTV to enable him to check that the platform was clear, but it gave an unclear image (Huntingdon train door incident 15 February 2006).

3.2.5 Organisational factors – resources

Resources were recorded in 10 reports where there was insufficient manpower to do the work necessary or not enough time available to complete the work satisfactorily. In many reports, it was inferred that a lack of resources was a contributory factor to the events preceding the accident, i.e. acted as an underlying factor that increased the likelihood of other latent failures being realised. In some reports, it was inferred because problems had been known about for a long time and not acted upon.

3.2.6 Organisational factors – training and competence

Training and competence was added to the categorisation model because the sample contained 9 reports with an organisational failing in the training and competence area. This lack of training for staff involved in incidents sometimes meant that key issues were not identified. For example, the train driver in the Desborough incident (Passenger door open on a moving train near Desborough 10 June 2006) did not stop his train as soon as he realised that a door was open, but instead proceeded to the next signal post telephone. Lack of training on this issue from his employer and a lack of specific guidance in the rule book was identified by the RAIB as a contributory factor. At Deal (Fatal accident involving a train driver, Deal 29 July 2006), training was identified as an issue where the driver involved in the incident, and many other staff on the worksite were not explicitly aware that the third rail was electrified within the possession. Despite general advice that all staff should consider the third rail to be live unless advised otherwise, it was uncovered by the RAIB that many staff would have assumed that the third rail was isolated at all points within a possession. Other incidents where training and competence was coded were where the training was not provided or not suitable and sufficient.

3.3 JOB FACTORS

Job factors were identified as a factor in the chain of events leading to an incident 25 times across the 30 reports.

3.3.1 Job factors – display and controls

Seven reports in the current sample implicated the standard of displays and controls as contributory to the accident. Missing, obscured, ambiguous, or inconspicuous displays were all identified as factors in this sub category.

Examples include:

- Poorly sited or maintained signage at level crossings;
- Inconspicuous points indicators, displays, and signals (trackside);
- Lack of clear, overt indicators within cabs (Train management system, Train protection warning system/Automatic warning system); and

- Quality of CCTV footage affected by small disparity in stopping location of trains on platform.

3.4 INDIVIDUAL FACTORS

Individual factors were identified as a factor in the chain of events leading to an incident 24 times in 30 reports. In the majority of accident reports an individual factor was identified as an immediate cause, with organisational or job factors (i.e. less than adequate organisational communication or procedures) commonly identified as the causal, contributory and underlying factors.

As noted by Miller and Healey (2007), individual competence and risk perception were frequently identified as individual factors relevant to an accident. Typically, this was identified by the RAIB through satisfaction that the individual had received the appropriate training required, but had still failed to perform the correct action.

Miller and Healey (2007) identified a tendency for the RAIB reports to focus on the individual factor, a tendency reflected in the focused nature of the report recommendations. Analysis of the current sample of accident reports shows an improvement. The RAIB reports regarding accidents where an individual failing was identified tended to consider the 'job' and 'organisational' level factors to a greater extent.

The authors generally found the identification of the relevant 'Individual' sub-categories difficult, due to the level of detail included in the reports. It was often observed that information concerning an individual's contribution to an accident was limited or omitted from the RAIB reports.

The authors recognise the value this information (i.e. individual failings) could contribute to reducing accidents occurring, through supporting an increased understanding and awareness of common individual failings, and how these may be appropriately mitigated.

4 THEMES RECURRING WITHIN INVESTIGATIONS

4.1 MAINTENANCE INCLUDING WORKSITES

Eleven incident investigations reported maintenance related activities in one form or another.

Five investigations highlighted problems in train maintenance depots:

- In the Camden Road incident, a faulty train was returned to service after maintenance. Traction control wiring had been incorrectly connected and the fault had not been identified by testing staff (Traction control failure causing a signal to be passed at danger, Camden Road 7 April 2006).

- The runaway locomotive in the East Didsbury investigation, (Locomotive runaway near East Didsbury 27 August 2006), noted that Magnetic Particle Inspection (MPI) testing of the locomotive drawhook was not done and that records were falsified. The consequence was a locomotive with a weak drawhook being returned to service. The maintenance depot did not have any staff available with up to date competence certificates for this maintenance activity.

- The Trooperslane incident investigation noted that the maintenance depot responsible for maintaining the ballast regulator involved in the accident had never referred to the manufacturer's maintenance manual for the vehicle. If they had done, they might have understood the significance of the torque arm that subsequently failed, and identified that there was no protection system for it in the event of failure (Derailment at Trooperslane near Carrickfergus, Northern Ireland 23 April 2006).

- The maintenance depot in the Ravenglass and Eskdale derailment incident had modified the suspension of the vehicles without anticipating that the reduced tolerance of the vehicle could contribute to a derailment under rough riding conditions (Passenger train derailments on the Ravenglass & Eskdale Railway 29 May & 5 July 2006).

- The Deal incident highlighted sloppy behaviours during wagon maintenance, where oil had contaminated the brake pads (Fatal accident involving a train driver, Deal 29 July 2006).

These five incidents all demonstrated a lack of management control over maintenance activities in one way or another.

Two reports highlighted a lack of staff resources for maintenance:

- The Epsom investigation demonstrated that there were not enough staff in the Wessex area to carry out routine track maintenance activities (Derailment at Epsom 12 September 2006).

- The Bratts Blackhouse investigation highlighted routine maintenance work, such as maintaining level crossing gates and cutting back vegetation, which had not been done. The report implied that this was because of a lack of staff resource (Train collision with a road vehicle at Bratts Blackhouse No 1 User Worked Crossing, near Sizewell, Suffolk 22 May 2006).

Two reports indicated problems with the planning of track maintenance work and definition of the worksite itself:

- This resulted in an 'arrangement which permitted the two machines to travel long distances on the same section of line simultaneously, with neither the protection of the signalling system nor suitable operational measures to control the risk arising' (Collision at Badminton 31 October 2006). The two machines then collided. The resulting investigation uncovered a lack of clear definition of a 'worksite' in the rule book, thus enabling the worksite to be so long that it made it difficult for the engineering supervisor to 'comply with the Rule Book'.

- A similar incident near Manor Park (Possession irregularity near Manor Park 19 March 2006) involved changes made to the possession limits. These changes were not adequately communicated. The COSS on site was unaware of any changes to the possession and so the work group continued working, on an open high speed line 'without either a block or any lookout protection'. The planning of the worksite, specifically the 'size and number of jobs within it' was identified as a contributory factor. In this instance the lack of clear communication and a mutual understanding between different parties was contributory to the accident.

Two tram incidents indicated a lack of management control over repair work:

- At Long Millgate, a repaired rail failed because the rail had a temporary weld that did not hold. The repair was not carried out correctly and the investigation showed that there had been no formal design change process or quality control (Derailment at Long Millgate, Manchester 22 March 2006).

- At Phipps Bridge, a set of points were known to be unreliable. Despite this, there was no systematic approach to investigating and rectifying faults for the points mechanism (Derailment at Phipps Bridge on Croydon Tramlink 25 May 2006).

4.2 SHUNTING

Injuries or fatalities resulting from shunting movements are recognised as being relatively rare. However, normalised statistics reveal a fatality rate six times higher for shunting staff than for railway track or operational staff (Fatal accident at Bronwydd Arms station, Gwili Railway 19 July 2006).

A number of accidents in the current sample were identified as occurring during shunting movements. Shunting activities can be unplanned or involve a deviation from the planned movements, and may take place as a function of extraneous circumstances (e.g. unexpected change/lack of resource).

These risks are compounded where shunting takes place on heritage railway sites, where individuals are often volunteers, and are more likely to act in multiple roles (i.e., there will not be a dedicated shunter). This means that they may be less familiar with shunting tasks. One example of such an incident is the Fatal accident at Bronwydd Arms station (Gwili Railway 19 July 2006), where confusion regarding the roles of individuals during a shunting movement and the hand signals used resulted in a fatal accident.

Distraction during shunting movements also seems a persistent problem as acknowledged in the collision at Pickering station (North Yorkshire Moors Railway 5 May 2007). This incident is attributed to the driver engaging in conversation with members of the public, and overlooking his responsibility to move the points. Thus the locomotive (incorrectly) re-entered the same platform and collided with the carriages it had just been uncoupled from.

5 QUALITY OF RECOMMENDATIONS

Recommendations were analysed to verify whether they are capable of closure, in other words are they achievable and are they measurable?

5.1 FINDINGS

Consistent with Miller and Healey (2007), recommendations were judged as measurable and achievable based on the researchers' knowledge and experience of accident investigations, human factors, safety management and the rail and other high hazard industries. Generally, the decision on whether the recommendations were measurable and achievable could be based solely on the wording and phrasing of the recommendation. The scope of the project excluded judgements about the quality and appropriateness of the recommendation in relation to the issues highlighted in the investigation.

The current analysis identified and counted the number of recommendations. Recommendations that were split into parts a), b), and c) were counted as a single recommendation. Altogether the 30 investigation reports generated 168 recommendations.

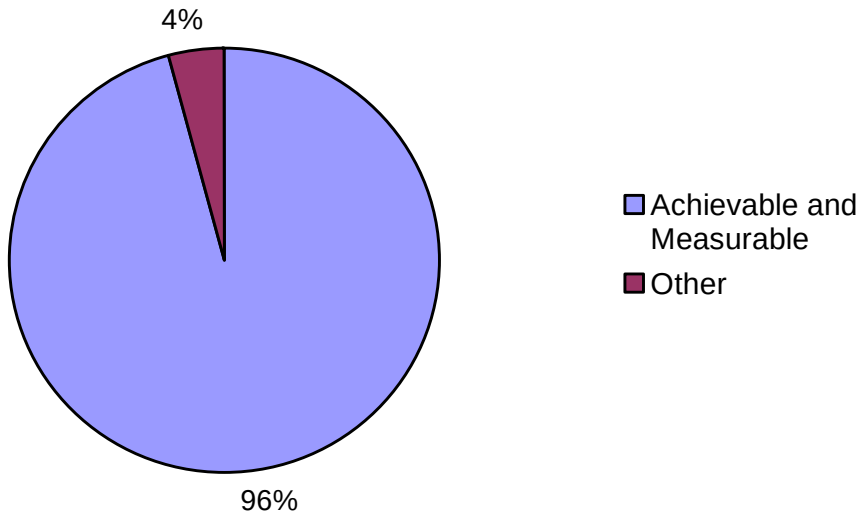

Figure 3 – Pie chart to show number of recommendations identified as achievable and measurable in comparison to the whole sample (n = 168)

Of the 'other' recommendations, 3% (n = 5) were identified as questionably achievable and questionably measurable, whilst the remaining 1% (n = 2) were identified as questionably achievable but measurable.

As previously observed (Miller and Healey 2007), the largest category of recommendations were those classed as both achievable and measurable, with an increase to 96% observed in the current sample.

5.2 OBSERVATIONS REGARDING RECOMMENDATIONS

A number of observations were made with regard to the recommendations in the current sample of accident reports. These are discussed in the following sub-sections.

5.2.1 Organisation of recommendations

Inconsistency was observed in the organisation of recommendations across the RAIB reports. The main methods of organisation observed were:

- Each different recommendation focused on a single issue;
- Recommendations subdivided into a number of parts (or bullet points), each addressing a single issue; and
- Recommendations that incorporate a number of issues and actions in one recommendation.

The authors felt that recommendations (or subdivided recommendations) addressing single issues ensured those issues were simpler to identify, adding clarity.

The authors felt that where multiple recommendations were given in one long sentence or paragraph, benefit could be sought from splitting the issues into bullet points, or preferably, differently numbered recommendations.

5.2.2 Theoretical v practical application

The increase in percentage of recommendations identified as achievable and measurable is a positive aspect of the current analysis.

However, it is crucial to note that the authors' judgements are based on the (necessarily) limited information provided in the RAIB reports. Therefore the authors appreciate that there are instances where additional information (e.g. what is reasonable/possible within a specific context) may affect the judgements made regarding report recommendations.

A number of reports provide evidence of limited resources (people and finance), a factor that may impact on whether a recommendation is *realistically* achievable (or measurable). This point is especially relevant when considering that the recommendation itself frequently addresses an issue that initially resulted from a lack of resources. A very clear example of this was Recommendation 1 of the Epsom incident:

"Network Rail should review the resourcing of the track maintenance organization in the Wessex area, Wimbledon section to ensure that it is adequate for its existing and planned workload. The review should consider the recruitment and retention arrangements in the area, the numbers of posts and the necessary competences, the arrangements for ensuring that all sections of line are given appropriate levels of attention, and the technical and professional support available to the inspection and maintenance staff" (Derailment at Epsom 12 September 2006).

This investigation highlighted how a lack of staff contributed to the incident, and a recommendation to review staffing levels is appropriate. However, it is clear that what the recommendation *really means*, is to recruit more staff. Whilst it is achievable and measureable to conduct a review of staffing levels, it may not be achievable and measureable to adequately

address the problems the review is likely to raise, either because of budget constraints or a skills shortage.

It is, therefore, reasonable to presume that although the wording of a recommendation may result in it being classified as achievable and measurable, this will not *definitely* translate to a recommendation that is capable of being 'completed'. Therefore, it is possible for recommendations to be achievable and measurable in *theory*, but for some reason, not in *practice*.

Another example is recommendation 3 of the fatal accident at Dagenham Dock (27 July 2006), which states 'Freightliner should designate safe walking routes between frequently used parts of its yards. This includes making or signing any hazards, and should include an instruction not to use walkways with substandard clearances where moving trains are present'.

The report stated that some of these changes had already been considered but not implemented due to the infrequent use of these particular lines. However, humans are inclined to take the easiest route and since it is easier to walk on a walkway than loose ballast, individuals will continue to do so unless these walkways are removed (even if they are banned). However, removal of such walkways may be impractical due to their utility when there are no moving trains nearby.

5.2.3 Actions that should already be in place

A common finding was recommendations prescribing actions that should be (or were) already in place. This usually followed accidents where a failing within an existing system or procedure was implicated as causal or contributory to the accident.

An example would be recommendation 1, part iii (Tram collision at Soho Benson Road, Midland Metro 19 December 2006), which states 'amend their procedures to ensure that fleet checks are carried out to a standard sufficient to correctly identify faults'. The authors infer that the purpose of a fleet check (prior to and following this accident) is to 'correctly identify faults', and therefore deem this recommendation unhelpful.

The incident at Soho Benson Road was due to a problem with sunblinds in the driver cabs, which was a topic not included in the original fleet checks (prior to the incident). Requiring the company to think of problem areas that they previously had not identified is a difficult task. In this instance a better recommendation could have considered alternative methods of achieving this, for example, promoting staff suggestions and ensuring suggestions are consistently acted upon (to further promote staff suggestions). These and other alternative solutions could have been considered and recommendations made accordingly.

Although there are many cases where a recommendation of this nature is logical, other factors should be considered (e.g. factors affecting why things were not being done in the first place). In addition the issue of 'what will ensure this is done now when it was not previously' should be considered.

5.2.4 The word 'review'

As discussed in Miller and Healey (2007) recommendations suggesting action such as 'conduct a review of procedures' are considered to be very poorly worded, because they do not specify action to be taken. A company could respond by stating that it has reviewed its procedures and decided not to make any changes. However, the reason that the RAIB suggested such a recommendation is generally because there is a shortcoming of some kind in the existing procedures. Therefore, the authors strongly advise that the words 'review of procedures' is

never used in a recommendation. Despite a general improvement in the wording of recommendations, it was felt that the main problem with the recommendations was the frequency of the 'review of procedures' type recommendation, although it is noted that the rate of occurrence is less frequent than before.

5.2.5 Characteristics of good recommendations

Overall the authors identified a number of characteristics of a 'good' recommendation.

- Who is responsible for the prescribed action? This is generally done well, with recommendations being assigned to a specific company.

- What the prescribed action is. Where appropriate, this should include what the action consists of (e.g. breaking a recommendation down into smaller parts).

- Why the prescribed action (above) is deemed appropriate. This is commonly done briefly, but the authors felt that clearer rationale would assist interpretation of the *intent* of the recommendation.

- Information regarding the limits of the prescribed action (physical, resource etc). Often giving the recommendation limits makes it achievable. For example to review a system for one area is possible to achieve, whereas reviewing all systems for all areas is unlikely to be done, and even more unlikely to be done well or quickly.

- It may also be useful for the recommendation to give an indication of an appropriate timescale. Such information would help to assess whether the recommendation is realistic and achievable because if it is not achievable within a reasonable time period (e.g. 12 months) then is it worth recommending? If it cannot be achieved within a reasonable time period, can it be achieved ever?

The above points are not intended to be a conclusive guide to writing recommendations, merely a reflection on the differences observed within the current sample.

6 CONCLUSIONS

Overall, the main themes which emerged from the analyses of reports were similar to those found in the last review (Miller and Healey, 2007). This was expected for a number of reasons – the serious underlying problems facing the UK railway industry (e.g. funding and resourcing issues), the difficult task of effective safety management in general, and the quirks of the sample chosen for investigation (i.e. the accident rate does not accurately reflect the success (or otherwise) the industry has in risk management, and the accidents analysed by the RAIB are only a small sample of the accidents, incidents and near misses which occurred in the time period analysed).

Overall, the authors felt that the RAIB had demonstrated a good standard of investigation and report. However, some investigations were very focused on technical issues (for example, the way in which metal has rusted or broken) at the expense of generating an understanding of how the management systems had allowed the failing to develop or not be identified and corrected. It is these issues that will prevent a recurrence of such an accident in the future. Overall, the authors felt that a greater concentration on human factors and safety management issues would improve the quality of the investigations. There were a small number of reports which do not clearly communicate an understanding of what happened or why – this was felt to be a combination of the individual writing style of the author and, sometimes, a focus on the technical issues (a focus on exactly what happened, not why it happened).

6.1 SUGGESTIONS FOR FURTHER WORK

- The project should be repeated when a sufficient number of new reports have been published by the RAIB. Because of the random nature of incidents investigated by the RAIB there may be new topics for investigation and discussion.

- A study could compare the wording of recommendations with the close out rate (as determined by ORR). Comparison could also be made between report recommendations from 2007 and 2008, to potentially highlight improvements.

- Further work to explore the definition of an ‘excellent formula’ for writing recommendations. This could be done by investigating with companies involved and the ORR which recommendations have been closed, which have been ‘nearly’ or ‘partially’ closed and which are still outstanding. Discussion with the ORR could also investigate what is needed to demonstrate that the recommendation has been closed and whether this is different from actually completing the action only. This may be of particular relevance to ‘ongoing’ recommendations.

- Further development of the categorisation model. The model could be further developed to provide more detailed definitions for each branch. This would allow others to use the model in a consistent manner to the authors of the model. It could be utilised as a communication tool to explain the influence of organisational issues in particular on accident/incident causation and also as an investigation prompt to ensure that issues at the individual, job and organisational level are all adequately addressed by the investigation.

- A human error study could be commissioned to further explore the issue of signallers moving points under trains. This has been investigated in a few reports by the RAIB and one of these (Maltby) referenced six similar incidents that were investigated by Network Rail. This appears to indicate a persistent problem which merits further investigation. The study could investigate aspects of the task, the environment and the influencing factors in

the incidents to come up with a detailed understanding of the reasons for such errors and also a strategy for prevention of further such accidents in the future.

7 APPENDIX A – SAMPLE RAIB REPORTS

Derailment at Long Millgate, Manchester 22 March 2006

Train collision with a road vehicle at Bratts Blackhouse No 1 User Worked Crossing, near Sizewell, Suffolk 22 May 2006

Traction control failure causing a signal to be passed at danger, Camden Road 7 April 2006

Huntingdon train door incident 15 February 2006

Runaway permanent way trolley at Notting Hill Gate 24 May 2006

Locomotive runaway near East Didsbury 27 August 2006

Fatal accident involving a train driver, Deal 29 July 2006

Derailment at Starr Gate, Blackpool 30 May 2006

Two near misses at Crofton Old Station No. 1 Level Crossing, near Wakefield, West Yorkshire 1 and 18 May 2006

Tram collision at Soho Benson Road, Midland Metro 19 December 2006

Collision between a tram and a road vehicle at New Swan Lane Level Crossing on Midland Metro 8 June 2006

Unauthorised train movement at High Street Kensington 29 April 2006

Derailment at Ropley (Mid Hants Railway) 25 July 2006

Derailment of a tram on the Seaton Tramway 18 March 2007

Fatal accident at Bronwydd Arms station, Gwili Railway 19 July 2006

Fatal accident to Shunter, Dagenham Dock 17 July 2006

Derailment of a freight train at Maltby North 28 June 2006

Derailment at Trooperslane near Carrickfergus, Northern Ireland 23 April 2006

Possession irregularity near Manor Park 19 March 2006

Signal T172 passed at danger at Purley station, Surrey 18 August 2006

Derailment at Phipps Bridge on Croydon Tramlink 25 May 2006

Collision at Pickering station North Yorkshire Moors Railway 5 May 2007

Passenger door open on a moving train near Desborough 10 June 2006

Passenger train derailment near Fisherground on the Ravenglass & Eskdale Railway 12 May 2007

Fatal collision between a super voyager train and a car on the line at Copmanthorpe 25 September 2006

Derailment at Epsom 12 September 2006

Collision at Swanage station 16 November 2006

Collision between a train and a road vehicle, M20 overline bridge, Aylesford 5 February 2007

Passenger train derailments on the Ravenglass & Eskdale Railway 29 May & 5 July 2006

Collision at Badminton 31 October 2006.