

Safety in Mines Research Advisory Committee

Project Summary : OTH 202

Project Title:	Investigation of the causes of transport and tramming accidents on mines other than coal, gold and platinum 83p, 4 Appendices 219p.		
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Summary

Transport and tramming accidents are one of the largest sources of occupational safety risk, especially on mines other than gold, platinum or coal. Due to the wide variety in the type of mines in the other mining sector, this project studied a range of transport and tramming operations on four mines, being an underground diamond mine, an underground chrome mine, a surface copper mine and a surface iron mine. The range of operations considered is identified in Table 1, with some of the operations being covered on more than one of the mines.

The approach adopted to identify the causes of transport and tramming accidents was to audit each operation to identify potential active failures (PAFs) which are likely to represent the immediate causes of accidents. A strong emphasis was placed on the identification of potential for human error, either slips or lapses, mistakes or violations as is appropriate for systems where the dominant causes of accidents tend not to be technical failures. Table 1 identifies the number of PAFs identified during the operation audits for each of the operations studied. For each PAF identified, a preferred route to solution was proposed. Examination of the PAFs also led to the determination of latent failures, which are essentially factors or circumstances within a mine which are likely to lead to active failures. While the details of the PAFs identified and the recommendations on how they could be addressed tend to be relatively site specific, the latent failures are more generically relevant across the sector.

Table 1
Number of potential active failures per operation studied

Operation	No PAFs
Underground	
Trackbound transfer of ore to tips	31
Trackbound transfer of supplies	11
LHD based transfer of ore to tips	21
General movement of men and supplies	32
Surface	
Loading with shovels, dozers, shovels, haultrucks	22
Haultruck transfer of ore to tips	44
Transport operations involving service vehicles	40
Transfer of ore and supplies to main railway line	8

Eight areas of latent failure have been identified, being attitudes to safety, training, organization and working methods, rules and procedures, attitude to rules and procedures, design, organizing for safety and maintenance. Most of the PAFs are influenced by more than one of the areas of latent failure listed above. Each of the latent failure types influences comparable numbers of PAFs with the exception of maintenance which is of subordinate importance.

Based on the PAFs and the latent failures identified, recommendations for improvements have been categorized under four major headings being equipment design, training, codes, rules and procedures, and safety management.

Under equipment design, ergonomics of mobile equipment is identified as a major issue, with many items of the equipment being used considered to have significant built-in accident potential. Recommendations are to impose ergonomics requirements on equipment suppliers and development of industry wide approaches for retrofitting equipment with unsatisfactory ergonomics.

On training, several needs are identified including a greater emphasis on hazard awareness and risk perception, a more systematic approach to safety training needs analysis, training of supervisory staff and safety representatives, the development of more innovative training methods, systematic evaluation of safety training effectiveness and management safety training. Specific recommendations are that the outcomes of risk assessments should include a training needs analysis and innovations such as industrial theatre to overcome difficulties of language and literacy.

It was identified that many of the codes, rules and procedures are inappropriately written such that they are impractical, incomplete, too complex, irrelevant, contradictory and too numerous. It is recommended that the rule sets on mines should be systematically re-examined by a participative team involving managers, supervisors and workers, and driven by the outcome of risk assessment. Training should also incorporate current information on the applicable rule sets.

Under the heading safety management, a need for greater pro-active safety management is identified, with recommendations that managers= and supervisors= performance should include safety as a formally measured parameter. In addition, mechanisms are required to enable organizational learning to take place systematically and effectively, with an associated change in emphasis in accident investigation to identification of the fundamental reasons why the accident happened.

Conclusions

- X Over 200 potential active failures (PAFs) were identified for a range of transport and tramming operations
- X The PAFs include the potential slips and lapses, mistakes and violations and may be attributed to eight areas of latent failure being safety attitudes, training, organization and work methods, rules and procedures, attitudes to rules and procedures, equipment design, organizing for safety and maintenance
- X Most significant improvements to the safety of transport and tramming operations could be achieved by attention in four areas being equipment design (ergonomics), modified approaches to training, re-examination of codes, rules and instructions to remove complexity and contradictions and new approaches to the safety management system