

Chapter 9

Challenges of Railway Safety Risk Assessment and Maintenance Decision Making

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ABSTRACT

Railway safety is a very complicated subject, which is determined by numerous aspects. Many of qualitative and quantitative railway safety and risk analysis techniques and methods are used in the industry. But, however, the railway industry faces problems and challenges on how to apply these techniques and methods effectively and efficiently, particularly in the circumstances where the risk data are incomplete or there is a high level of uncertainty involved in the risk data. This chapter approaches these subjects to discuss the problems and challenges of railway safety and risk analysis methods in dealing with uncertainties, and those growing needs of the industry. A well-established technique is also introduced in this chapter which can be used to identify major hazards and evaluate both qualitative and quantitative risk data, and information associated with railway operation efficiently and effectively in an acceptable way in various environments.

1. INTRODUCTION

Railways are by far one of the safest means of ground transportation, especially for their passengers and employees. However, there are serious issues involved in both maintaining this position in reality and sustaining the public perception of railway safety excellence. The railway industry now finds itself in a situation where actual and perceived safeties are real issues, to be dealt with in a new public culture of rapid change, short-term pressures, and instant communications.

Railways are a traditional industry, whose history extends for at least two centuries. Much of their safety record depends upon concepts developed many, many years ago and established practices over

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the whole of their history. After half a century of decline and public/political isolation, railways have started to expand rapidly again, but in a situation where parallel but newer industries have moved on. The parallel aerospace, nuclear and oil exploration industries in particular have developed approaches to safeguarding their assets, customers and employees which reflect their different traditions, their shorter histories and their different generic cultures. There are many possible causes of risk through operation and design of vehicles and rail infrastructure, and also from outside the railway such as vandalism and road incidents. Specifically, in the design, modification, and maintenance of plain line, the largest number of serious incidences are from derailments and vehicles fouling infrastructure such as station platforms. There are many combinations of potential causes, each involving several disciplines and work groups.

Risk management is being used increasingly to support decision making in the railway industry. While risk management is used to justify and prioritize investment, its main function and the one being considered here is in demonstrating safety. Any safety and risk information produced must be processed for decision making purposes. If risks are high, risk reduction measures must be applied or the design, operation and maintenance have to be reconsidered to reduce the occurrence probabilities or to control the possible consequences. If risks are negligible, no actions are required but the information produced needs to be recorded for certification purpose. However, the acceptable and unacceptable regions are usually divided by a transition region. Risks that fall in this transition region need to be reduced to as low as reasonably practicable (ALARP). This chapter aims to introduce a systemic bottom-up safety and risk analysis approach, which addresses the problems and challenges of railway safety and risk analysis and methods of these growing needs of the industry, and discusses standards and current practice of safety and risk management in the railway industry. A well-established technique will also be introduced in this chapter which can be used to identify major hazards and evaluate both qualitative and quantitative risk data, and information associated with railway operation efficiently and effectively in an acceptable way in various environments. A case study is used to demonstrate the application of application of railway safety and risk assessment methodology.

2. BACKGROUND

As stated in section 1, risk management is being increasingly for the railway industry in order to improve safety to safeguard their passengers and employees. The principal risks in the railway industry appear to be to people and property as a result of collision, derailment, and fire. Recent structured hazard identification work within the industry has confirmed the high-risk scenarios of these types of accidents (HSE, 2000; Railway Safety, 2003; LUL, 2001; An et al, 2006, 2007 & 2011). In the railway industry, many people had severe injuries and even were killed in relation to this industry over the past years (LUL, 2001; Gadd et al, 2003; Kennedy, 2003; Railway Safety, 2002). The figures of accidents and incidents include not only workers, but also a significant number of people not employed in the industry, including children and members of the public. In addition, more than a hundred people had their quality of life affected by railway maintenance work in the past ten years, brought about through either a major injury or an injury that rendered them unable to work for over 3 days. This shows the dangerous nature of the railway industry and demonstrates the need for increased awareness and better safety management (Railway Safety, 2003; Gadd et al, 2003; An et al, 2007 & 2011). There are many accidents and incidents occurred in the railway industry over the years, demanding improvement of safety management. To assess how this can be effectively achieved knowledge on the nature and causes of these

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