Best practice international solutions for mitigating human factor causes of signal passed at danger

Full report: www.nzta.govt.nz/resources/research/reports/595

NZ TRANSPORT AGENCY WAKA KOTAHI

New Zealand Government

Tool aims to reduce major rail industry risk

A new tool has been developed to allow rail operators to explore their organisational strengths and weaknesses for preventing railway signals being passed at danger. Outputs from the tool can then be used to develop risk mitigation strategies.

Internationally, and in New Zealand, signal passed at danger (SPAD) incidents are viewed by the rail industry as a major safety issue. Such incidents can cause train collisions, leading to fatalities. A high number of SPAD, even if no collisions result, can have a significant negative impact on the reputations of rail operators.

NZ Transport Agency funded research, carried out by SNC Lavalin Rail and Transit Engineering, in New Zealand and the UK, has developed a SPAD strategy evaluation tool.

The tool draws on an extensive literature review into the human factors that can lead to SPAD, the measures being used by rail and non-rail organisations worldwide to address human-factor risks, and the barriers to the implementation of these measures. It is based on concepts derived from the 'Swiss cheese model' of incident causation, and has been developed with input from rail experts within the Transport Agency and the New Zealand rail industry.

The literature review identified the importance of adopting a multi-factorial model for SPAD causation and risk reduction. The tool applies the principles from organisational assessment tools used by the UK rail and health industries and derived from the Swiss cheese model.

The Swiss cheese model is commonly used with respect to incident causation, and is widely known within rail and other high-hazard industries, such as the health, chemical process, aviation and nuclear sectors. The model describes layers of protection within the organisation used to control risk. The layers of protection are likened to 'slices of cheese'. The principle of the model is that at any one time there will be weaknesses and inadequacies in these layers of protection, which are likened to the 'holes' in the Swiss cheese. Incidents can occur when these holes align.
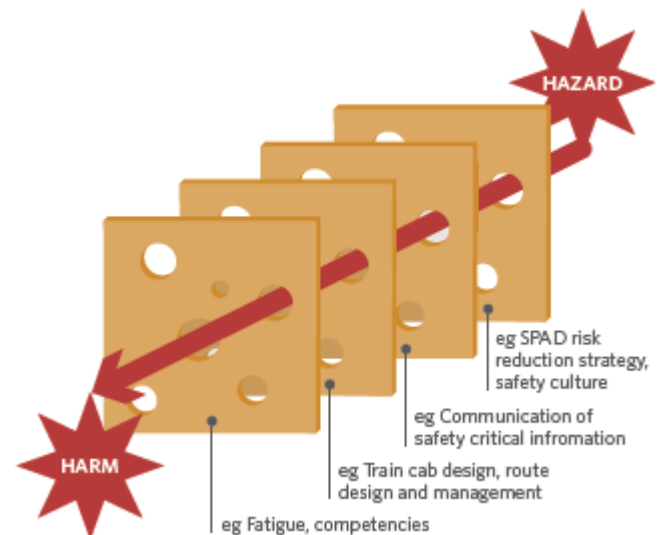
The research used these tools and models to develop a systems approach to preventing SPAD, based on the principle that humans cannot be expected to perform 100% error free, but that human error can, to some extent, be predicted. Within the tool, the systems approach is used to identify four layers where risk mitigation protection measures can be targeted:

- organisational factors
- work practices and processes
- work environment
- individual factors.

The figure below shows how the Swiss cheese model and systems approach interact within the tool.

Simplified Swiss cheese model

eg SPAD risk reduction strategy, safety culture

eg Communication of safety critical infromation

eg Train cab design, route design and management

eg Fatigue, competencies

The evaluation tool

The SPAD strategy evaluation tool aims to help rail participants evaluate how their organisations address SPAD risk. It is designed for use as a self-assessment tool, rather than for external audit purposes.

Organisations can use the tool to understand the different practices and processes that provide resilience against SPAD risk. It provides a basis for discussions about the initiatives that work well within an organisation, what can be improved, the benefits from improvements, and any barriers or limitations to implementing those improvements.

The tool also provides a consistent means of evaluating the resilience of the organisation at the four different levels identified in the systems approach -organisational factors, working practices and processes, work environment and workplace, and individual factors. This means organisations can track their improvements over time.

The tool consists of a user guide and a Microsoft Excel evaluation spreadsheet. Both parts of the tool are available in the research report.

The user guide provides background on the tool, its aims and objectives, and detailed guidance on how to use the tool as a self–assessment process to inform an organisation's SPAD risk reduction programme. It incorporates a five–step self–assessment process, which culminates in the development of a SPAD risk reduction plan, and its ongoing monitoring and review. An important initial process of the tool is to help users understand there is no one fix to addressing SPAD risk, and that all parts of the organisation need to be considered.

The SPAD strategy evaluation spreadsheet incorporates an evaluation matrix, against which organisations can assess their levels of performance in terms of SPAD risk reduction, record evidence and identify potential areas for improvement. Once completed, the evaluation spreadsheet generates a graphical profile for the organisation against each of 16 critical dimensions (representing the layers of protection within the organisation).

Operators' experience in using the tool

The research project incorporated a trial of the evaluation tool by three rail industry participants.

Two of the participants (both large operators) found the tool useful, and have adopted it to guide their future SPAD risk–reduction strategies. The third participant (a smaller rail operator) found it more difficult to apply, largely because some aspects of the tool were not appropriate to smaller scales. This led to a recommendation that the tool could be modified to remove those points that were less relevant for smaller operators.

Overall the research concluded the tool was successful in shifting organisational focus away from individual events after the fact, towards a broader, proactive consideration of contributory causes and mitigation strategies, which will be more effective for addressing risk.

'There is a danger that SPAD investigations emphasise single events leading to action plans put in place for the driver (locomotive engineer) involved, while the company misses the opportunity to look for common patterns across events and the more systemic issues that the tool considers,' the report says (p38).

Another advantage of the tool is that it provides a dashboard of leading indicators for organisations to adopt, as opposed to the traditional SPAD lag indicator measurement. Lead indicators are forward–looking, proactive measures that can indicate 'holes' in safety, rather than lag indicators that only identify these after an incident.

'This is especially important for those organisations, such as small heritage operators, that may not have comparable opportunities to learn from near misses in the way that larger operators do,' the report says (p8).

While focused on the prevention of SPAD, the research project is of value to anyone attempting to make organisational activities more robust to human error.

The Transport Agency has a variety of rail safety prevention and assessment resources available online. See: www.nzta.govt.nz/roads-and-rail/rail/resources/