

Cognitive Ergonomics and Resilience Engineering Assessment of Driver Advisory System



CLIENT: KIWIRAIL

YEAR: 2014-2015

New Zealand's national rail operator, KiwiRail, procured the TTG Energymiser® Driver Advisory System to cut energy consumption and environmental emissions, while maintaining on-time running of trains. Following a successful trial 182 freight trains were to be retrofitted for the new device. An initial risk assessment had been conducted and it was noted that there was a possibility of drivers becoming distracted by the inclusion of new technology into the cabs.

As a result, KiwiRail requested that HFEx conduct a human factors assessment to include the following:

- a review of relevant research in this area that may help to inform the approach and analysis
- a cognitive ergonomics assessment of the device in the freight operational environment
- a usability review of the device
- a human factors assessment of the support mechanisms; e.g. training and communications
- a physical ergonomics assessment

The following details how HFEx successfully conducted a human factors assessment of a device in an operational environment.

HfEx Ltd's approach

HfEx began their work with the business unit by familiarising themselves with both the device and the operational environment. This gave HfEx the benefit of starting to know the people, the implicit knowledge and the challenges drivers face on a daily basis.

The next phase consisted of a goal-directed task analysis along with systems modelling of some of the high workload activities of freight rail operations. Part of this involved conducting structured interviews with experienced drivers in order to extract detailed information about their tasks. Taking a resilience engineering approach and Functional Resonance Analysis Method modelling, it quickly became apparent where the sources of error and distraction may occur.

Trials in the operational environment were then conducted on a sample set of drivers across the country. The first stage involved conducting a baseline trial followed by accompanying the drivers through their certification and on-job training. This was then followed by numerous trials focusing on the high workload operational situations such as type of track, time of day, train load, and speed related restrictions.

The HfEx team obtained video graphic, verbal and observational data. Systems modelling highlighted weaknesses in individual resiliency to everyday variability. Observational methods provided verbal and non-verbal cues to behaviour. Verbal approaches helped gauge levels of cognition and situational awareness associated with operating the device.

Challenges

Working operationally is quite different to working in a laboratory or simulated environment. HfEx had to work with numerous challenges including availability of participants, rostering, widespread operational challenges and physical work environment. It involved the HfEx team having to travel significantly around the country, often at short notice. Some work involved night shifts and the team were only too happy to step up to the challenge.

Working in an operational environment also challenges the scientific robustness of the work at hand as many elements are out of the team's control. Therefore, in this case (and also in most other contracts) the team collaborated with relevant academic subject matter experts to maximise the scientific integrity of the work.

Benefits and outcomes for the client

The findings provided the customer with the following:

- Increased confidence in the device – design and operation
- Suggestions to improve the user interface of the device
- Awareness of current behaviours associated with the device, as well as those likely to develop over time
- The level of risk associated with distraction and how to mitigate it
- Information on human reliability concerning operating the device appropriately
- Presented at the International Ergonomics Association 2015 Triennial Congress in Melbourne

The customer believes the device will save them approximately 10% in fuel costs and their success was dependent on ensuring the device would not compromise the safety of the driver, the asset and the environment, which was dependent on the success of the project conducted by HfEx.