The train drivers work situation and use of information – a system safety perspective

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Abstract

The TRAIN project investigates the train driver work situation and use of information focusing on the driving task for commuter and high speed trains. It is an on-going project funded and managed by the Swedish National Rail Administration and carried out by independent researchers. The project provides a multi-disciplinary investigation using task and ergonomic analyses, a usability evaluation of the ATP (automatic train protection) system and analyses of stress, mental workload and work hours. The purpose of the project is to identify traffic safety related risks and to suggest safety enhancing measures.

Phase one of the project included a literature review as well as an in-depth investigation of eighty accident reports. The results showed that there is a lack of human factors data in accident investigation reports and that there is a need to apply a structured, railway specific methodology for accident investigations. Also, there is a great need for studies concerning human factors and railway safety.

Phase two of the project included an analysis of the train drivers work task as well as two questionnaires. The first concerned stress, mental workload and work hours and the second concerned the drivers use of information and interaction with the ATP system.

Drivers employed at one train operating company driving both commuter and high speed trains based in the Stockholm area were investigated during 1998-1999. The drivers work hours were highly irregular.

The results suggest that the driver manages his task in two time horizons; the first being the immediate supervision of ATP indications and railside signal and the second being planning the driving task ahead. The ATP and railside information presented to the driver supports the immediate driving task although attentional conflicts could be identified. Little information supporting the planning task is presented to the driver.
The results from the usability evaluation of the ATP system indicates problems concerning the drivers understanding of ATP functions as well as of the complex relationship between the ATP system and other parts of the signaling system and the safety rules.

Also, a group of drivers having a more reactive driving style taking action based directly on the indications and warnings presented by ATP could be identified. This behavior was consistent across drivers for both the commuter and high speed train driving task.

Concerning stress, workload and workhours 25-30% of the drivers reported chronic sleepiness or fatigue problems. These drivers were at high risk for developing chronic fatigue and burnout. Critical errors at work could be related to fatigue, stress, lack of motivation and sleep disturbances (Ingre et.al., 1999).

Still, the ATP system is a very valuable safety support system for the driving task especially in situations of high sleepiness and reduced vigilance.

In conclusion, situations where ATP supervision is degraded provides a risk for the train driver, especially those drivers having a more reactive driving style and for drivers with sleep and fatigue problems.

Important target areas for safety enhancing measures are to improve the man-machine interface to support the planning task and to improve the drivers understanding of ATP system. Also, creating a healthy and motivating work task and work environment as well as better work schedules should be given more attention. Measures should be taken to reduce fatigue at work such as improving work schedules with shorter shifts and more time for rest.

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