

Enhanced information design for high speed trains

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Abstract

Train drivers have traditionally 'navigated' by processing information from trackside signals and familiar landmarks, though such direct sources may be difficult to use at high speeds. Drivers have to rely on expert knowledge about the route such as movement authority, speed limits etc in order to initiate speed control actions. However, effective use of route knowledge can be compromised by the faster decision-making required at high speeds, and by temporary increases in workload and fatigue, which may reduce drivers' situational awareness (SA). A general solution is to develop enhanced cab displays to support decision-making by providing preview and predictive information. Preliminary work has employed a range of cognitive engineering techniques to assess the driver operational demands. Data analysis will consider how drivers acquire and use route knowledge to influence their decision making, what information is effective for different driving tasks, and how it impacts on their SA. Early analysis indicates that drivers employ quasi-mathematical operations obtained from route knowledge, train state indicators and environmental conditions to maintain SA and evaluate safe and efficient journey trajectories. It is anticipated that this will lead to the development of prototype display interfaces to support the effective use of route knowledge and driver SA.

Background

Train drivers have traditionally 'navigated' by processing information from knowledge of track infrastructure, trackside signals, familiar landmarks and other such geographical markers. In practice, drivers have to rely on this expert knowledge about specific route information, to adjust to movement authority, speed limits, temporary restrictions, and so on, and thus implement appropriate throttle or braking control. In the UK, the increased demand for performance in rail service delivery has resulted in an increased speed of operations. Passenger trains now operate at the maximum speed the rail infrastructure will allow within the boundaries of safety. However, as with all safety critical industries (road traffic, maritime navigation, process industries) safety and performance are often in conflict as competing goals, and the severity of rail incidents in the UK in recent years (e.g., Watford Junction, Southall, Ladbroke Grove, Hatfield, Potter's Bar), have raised public questions of rail safety. Whilst most serious accidents are attributable to poorly maintained infrastructure or a chain of events involving several people, those which occur as a

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