Human Factors of Run Through Switches in US Rail Operations
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Introduction
Rail yard operations frequently require conductors using remote control devices (McDonald, Kazi, Darling, Durso & Glover, 2014) to align switches for desired movements. Passing through switches that are not correctly aligned may result in damage and potential derailment. Ranney and Raslear (2013) found from a voluntary close-call reporting system that run through switches (RTS) accounted for 28% of all near miss incidents. There has been a push towards using human factors approaches to understand the underlying causes of switching accidents. For example, past research has identified a variety of factors that can contribute to these errors, including operator experience, training, communication, and train resource management (SOFA working group, 1999, 2013). The current research study further investigated the underlying causes of run through switch incidents for CSX Transportation through archival analyses and structured interviews of remote control operators (RCOs). CSX Transportation is one of four commercial rail operations in the United States. CSX operates largely in the Eastern US, providing traditional rail service and transporting intermodal containers and trailers.

Practice Innovation
Preliminary archival analyses were conducted using the CSX Rail Accident Reporting (RAR) system to identify potential trends among RCO-related RTSs. From these analyses, six rail yards were identified that had the most RTS incidents from January 1st, 2011 to October 18th, 2013; the date we began the analyses. We investigated the RCO’s shift, consecutive workdays, total cars, experience, weather, and visibility to identify potential trends that led to RTSs.

In addition to archival analyses, the research team also conducted Critical Incident (CI) interviews with employees from three yards. The CI interview is a structured interview technique used to generate a timeline of events and identify underlying breakdowns in the system that led to the incident (Kirwan &
Two yards were selected because of their relatively high rates of RTS incidents. The third yard had relatively few RTSs, thus was chosen for comparison. A total of 15 CI interviews were conducted across locations and were audio recorded.

**Findings**

Archival analyses revealed the following trends in RTS. The top two RTS yards had on average one RTS every five weeks. More switches were run through in the first half of the shift (Figure 1). More RTSs also occurred after a regular day off. Not surprisingly, novices (less than 2 years) accounted for a plurality (43%) of RTS accidents (Figure 2). Nevertheless, even experts (more than 10 years of experience) were subject to this error (12%). Weather, visibility, and shift did not seem to have an effect on RTSs.

Analyses of the CI interviews revealed several factors that may contribute to the occurrence of RTSs. Each of the following factors has received some support from the interviews: professional courtesies (e.g., realigning switches for a colleague), communication (e.g., informing others of switch positions), cognitive factors (e.g., interruptions, disengagement, memory lapses, cognitive tunneling, distraction, confirmation bias), abnormal conditions, fatigue, downtime, and production (time) pressure.

**Discussion**

The archival analysis indicated that RTSs occur most often during the beginning of a shift or after the conductor returns from having scheduled time off. This finding suggests a hypothesis that getting mentally situated into the job takes time; errors tend to occur before the conductor gets situated. This “Head-in-the-Game” hypothesis, should it prove correct, suggests that RCOs’ Situation Awareness (SA) improves as a function of the time on the job. In addition, the cognitive variables, inconsistency of courtesies, and communication elicited from the interviews are also known to impact SA of the RCOs.

Interventions could be designed to increase task engagement and improve SA. Broadly speaking, in the current case we believe such interventions could be aimed at changing policy, enhancing communication, developing new technological aids, or implementing training.

In conclusion, both sources of data – archival data on RTSs and critical incident interviews, highlighted multiple factors that may lead to RTSs.
**Keywords:** Rail, Transportation

**Tables**

![Figure 1](image1.png)

Figure 1. Mean frequency of RTSs for each hour into a shift

![Figure 2](image2.png)

Figure 2. Frequency of RTSs and experience levels at the time of the RTS

**References**


