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RESEARCH RESULTS
FRA OFFICE OF RESEARCH, DEVELOPMENT & TECHNOLOGY

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FINDINGS FROM A PRELIMINARY REVIEW OF SWITCHING OPERATIONS TRAINING NEEDS

SUMMARY

The U.S. Department of Transportation (USDOT) Federal Railroad Administration (FRA) sponsored this project to develop guidelines and trainings for switching operations and shoving movements in rail yards. This project aims to produce safety themes from focus groups with yardmasters; these themes will assist FRA to identify future research areas and training for railroad worker safety in classification (switching) yards.

This project originates from a Transportation Research Board (TRB) Research Needs Statement describing the need for railroad worker safety research on switching operations and shoving movements in rail yards. Moreover, FRA incident data from 2016 through mid-May 2024 show that switching represents more than half of human factors cause codes (see Figure 1).

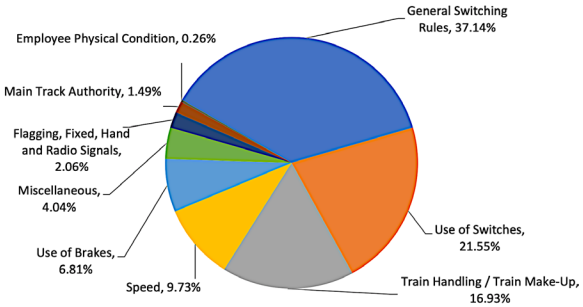

Figure 1: Human factor incident cause codes by category 2016–2024 (partial)

Through literature review, incident data analyses, and stakeholder interviews, this project identifies topics and designs switching operations curriculum, specifically including shove movements. The curriculum is intended to supplement existing new-hire and recurrency training programs at railroads. This one-year, exploratory project is also conducting research into the changing roles and responsibilities of yardmasters. The progress and results of that portion of the project will be presented in future reports.

This Research Report documents the preliminary findings, issues, gaps, and associated topics in support of a switching operations curriculum development that can be used by the railroad industry to supplement ongoing training programs.

The initial project activities highlight four main findings: (1) current classroom training and on-the-job training (OJT) for new hires would benefit from an extension in the length of time for both types of training; (2) the craft mentor role in OJT would benefit from more consistent selection criteria, mentor training, and performance assessment for the position; (3) craft representation throughout the entire new-hire training process would allow the craft perspective and experience to be more consistently reflected in the training program; and (4) training materials could provide greater emphasis on novel situational awareness techniques, such as mindfulness, to prevent distraction during switching operations.

BACKGROUND

FRA seeks to understand the influence of different training styles on the knowledge and skill acquisition, retention, and transfer of railroad workers.

Previous FRA-sponsored research efforts (e.g., Reinach & Viale, 2007) focused on the yardmaster role in switching yard safety, and

suggested that workload, fatigue, and communication were common themes. However, the landscape of yard safety has changed considerably since that research was published. Therefore, FRA requested that the daily responsibilities and workload of yardmasters be documented within the modern context of yard activity and safety.

Findings from this study will identify potential safety issues associated with recent changes in switching activities and the duties of yardmasters.

OBJECTIVES

The objectives of this one-year, exploratory project are outlining research to (a) develop supplemental switching operations training materials with an emphasis on shoving movements, and (b) conduct focus group interviews to understand the current roles and responsibilities of yardmasters. Related to objective (a), this project aims to pilot a two-day supplementary training curriculum focusing on switching practices, specifically including shove movements.

METHODS

The initial project tasks involved primary and secondary research methods. Using published datasets and literature, in addition to conducting stakeholder interviews, the project team analyzed the quantitative and qualitative data to identify trends, gaps, issues, or needs related to switching operations to inform the topics for the training curriculum, which will be developed and pilot tested in the next phase of this project.

Secondary Dataset Analyses

The project team conducted secondary dataset analyses of all incidents associated with switching operations from 2016 to the middle of 2024 through a review of the FRA Accident and Incident Report database, the NTSB Railroad Accident Investigations database, and existing research documented by FRA.

Literature Review

The project team identified current standard operating procedures (SOP), methods, issues, or gaps related to the research of switching operations, particularly shoving movements, through a review of FRA published literature since January 1, 2000.

Stakeholder Interviews

Coordinating with representatives from railroad labor, carrier, and regulatory stakeholder organizations, the project team conducted semi-structured individual and group interviews to understand current SOPs and potential gaps or needs in training related to switching operations from their industry perspectives.

RESULTS

Incident Trends

Incidents caused by human factors comprise the majority of all U.S. railroad incidents from 2016 through mid-May of 2024 (see Figure 2). More than half (59 percent) of those human factors incidents are related to switching rules or switching operations (as seen in Figure 1).

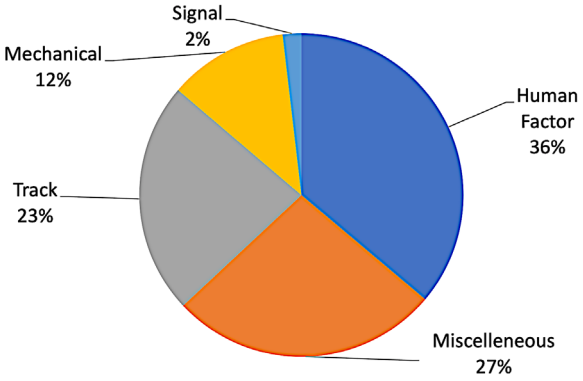

Figure 2: Rail incident cause codes by major categories 2016–2024 (partial)

The number of fatalities in switching operations has decreased over time, yet the percentage of those fatalities involving shove movements has increased, as reported by the Switching Operations Fatalities Analysis (SOFA) Working Group, which has analyzed the fatality incidents since 1992. Figure 3 shows SOFA results for the 10-year period of 2011–2021, illustrating that

shove movements have emerged as a concern area to target through educational efforts.

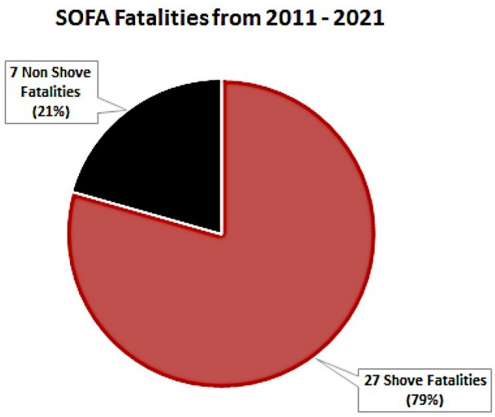

Figure 3: SOFA briefing illustrating that the majority of switching fatalities between 2011–2021 were shove moves

New-Hire Training Programs
While federal regulations require approved certification programs for locomotive engineers and conductors (the positions involved in switching operations), the carrier training programs vary across the industry. Variability relates to the specific characteristics of carriers, such as railroad class, location, or freight material/goods.

Training delivery methods include classroom learning, field/hands-on training, and OJT. Classroom learning can involve lectures, scenarios, computer-based instruction, games, simulators, virtual learning, and proficiency exams. Carriers tend to standardize classroom learning content. For some large systems, classroom learning can have centralized delivery, such as at a training center or headquarters location. However, the length of time allotted for classroom learning differs across railroads and has been found insufficient at some railroads through FRA audits of their certification-related training programs.

OJT is generally terminal-specific, so the length of the training and craft mentorship experience varies, and supplemental training may be required. For example, an FRA audit of a Class I certification training program determined that the OJT was deficient in structure, consistency, and oversight. Moreover, the OJT instructors were designated without the concurrence from the designated employee representative (FRA, 2023).

Training Gaps
Concerning gaps are evident in both the content and delivery of training. The most critical content gaps are between standardized training curricula regarding regulatory requirements and the locational, equipment, situational, and environmental knowledge necessary to operate safely. Experienced operators become aware of most of these factors only after considerable time on the job, sometimes only after safety incidents have occurred. Other content gaps include the lack of opportunities to practice critical processes, such as preparing for, executing proper radio communications during, and recovering from high-risk situations.

Such gaps can be partially addressed through structured OJT. However, given operational pace, organizing for high-quality OJT often becomes a secondary concern. As a result, mentors may often be unprepared to provide the level and quality of guidance necessary. Rushed rotational schedules prevent mentors from effectively assessing trainee progress and providing consistent feedback.

CONCLUSIONS

The direct involvement of experienced craft employees emerged as a key need area in both new-hire and recurrency training. While experienced craft employees act as mentors, they are not typically involved in the content development or ongoing revision, where a ballast-level perspective or feedback could be useful. Railroads should involve craft employees at each step of the way, not only in OJT delivery/supervision.

The process and criteria for selecting, training, and evaluating craft mentors may need to be addressed through supplemental training because of wide variability in execution.

Additionally, situational awareness emerged as a key topic to include in the supplemental training curriculum to be developed in this project, particularly mindfulness to prevent distraction in key moments.

FUTURE ACTION

The next major activities for this project include designing a switching operations course outline, developing the training content and materials, reviewing the curriculum with key stakeholders, delivering the pilot course, and collecting pilot feedback. The project team will publish a technical report describing these activities and associated results. An additional technical report will be published describing the current context and emergent themes related to the yardmaster role and responsibilities, particularly in regard to rail yard safety.

REFERENCES

Federal Railroad Administration. (2023). Section 22410 Operating Crew Member Training, Qualification, and Certification Summary of Audit Activities 2022-2023. Washington, DC: USDOT.

Reinach, S., & Viale, A. (2007). Yardmasters and Yard Safety in the U.S. Railroad Industry: An Exploratory Study. Washington, DC: Federal Railroad Administration, USDOT.

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