



DERAILMENTS DECREASE AT A C³RS SITE AT MIDTERM

SUMMARY

The Federal Railroad Administration's (FRA) Office of Railroad Policy and Development believes that in addition to process and technology innovations, human factors-based solutions can make a significant contribution to improving safety in the railroad industry. To test this assumption, FRA implemented the Confidential Close-Call Reporting System (C³RS), which includes (1) voluntary confidential reporting of close-call events by employees and root-cause-analysis problem solving by a Peer Review Team (PRT) composed of labor, management, and FRA; (2) identification and implementation of corrective actions; (3) tracking the results of change; and (4) reporting the results of change to employees. Confidential reporting and joint labor-management-FRA root-cause problem solving are the most innovative of these characteristics for the railroad industry. Demonstration pilot sites are at Union Pacific Railroad (UP), Canadian Pacific Railway (CP), New Jersey Transit (NJT), and Amtrak.

FRA is sponsoring a rigorous evaluation of C³RS to examine three important aspects of C³RS functioning:

- (1) What conditions are necessary to implement C³RS successfully?
- (2) What is the impact of C³RS on safety and safety culture?
- (3) What factors help to sustain C³RS over time?

This summary is the second in a series of *Research Results* published to provide the public with the findings of the evaluation. This

summary covers C³RS' impact on safety and safety culture at one demonstration pilot site at the midterm point in the evaluation of this single railroad. (For reasons of confidentiality, this railroad is not identified.) Three sources of data are used:

- human factors-caused derailments/incidents;
- railroad safety culture survey; and
- interviews with workers, managers, and other stakeholders.

Some key findings were (1) a 31-percent improvement in cars moved between incidents; (2) improved labor-management relationships and employee engagement within the PRT and out in the field; and (3) a reduction in discipline cases.

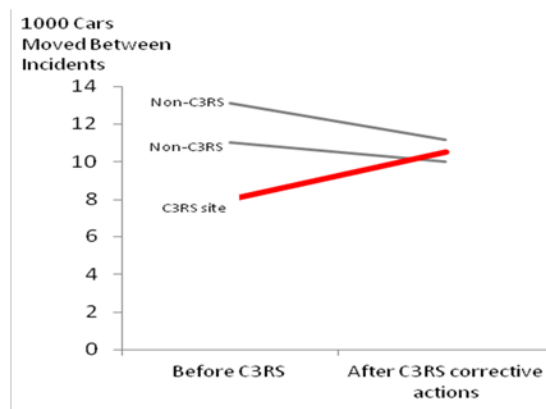


Figure 1. Thirty-One-Percent Improvement in Cars Moved between Incidents



BACKGROUND

C³RS contains two critical elements that are designed to help it succeed in railroad settings. First, employees' reports of close calls are routed through a neutral third party, the U.S. Bureau of Transportation Statistics (BTS) or the National Aeronautics and Space Administration (NASA), which removes any identifiers or personal information. Second, sanitized information from BTS/NASA is sent to a joint labor-management-FRA PRT whose members have been specially trained in collaborative, root-cause problem solving and implementing corrective actions. FRA is testing C³RS with four railroads: UP, CP, NJT, and Amtrak.

A process flow for a C³RS report has six steps: (1) A worker observes a close call and reports it to BTS/NASA. (2) BTS/NASA debriefs the worker, analyzes the incident, sanitizes identifying data, and forwards the report to the appropriate PRT. (3) The PRT determines root causes and suggests corrective actions. (4) The corrective action is reviewed, evaluated, and, if appropriate, implemented. (5) Implementation is tracked, and the results of the change are determined. (6) Results are reported. Additional information on this evaluation is available on FRA's Web site [1].

OBJECTIVES

The evaluation is intended to provide knowledge about how C³RS can be implemented successfully, its impact on safety and safety culture, and the conditions necessary for long-term viability. A previous *Research Results* [2] summarized earlier evaluation findings. This report provides findings for one of the participating railroads at midterm.

METHODS

Human Factors Derailments/Incidents

Outcomes were assessed by using data from railroad reports on human factors-caused accidents and incidents (derailments, collisions, etc.). Both "reportable" and "nonreportable" events were included.¹ "Baseline" data constituted incidents from several years prior to C³RS to the time of the first corrective action. "Midterm" data constituted the time from the first corrective action to date.

Additional data came from reporting trends on derailments that were provided as sanitized data by BTS. These trends were analyzed by the evaluation team and were compared with relevant data reported by the railroad.

Railroad Safety Culture Survey

The survey included validated safety culture measures drawn from research literature, specific questions concerning beliefs about C³RS, and an open-ended comment section. BTS designed the layout and administered the survey. The survey was administered at baseline (500 respondents) and approximately 2 years later at midterm (1,000 respondents).

Worker, Manager, and Other Stakeholder Interviews

Two types of interviews were conducted:

- (1) Baseline and midterm semistructured interviews with railroad employees and managers. These interviews asked about safety, labor-management relations, and C³RS program operations.
- (2) Interviews with key stakeholders such as PRT members, senior managers, labor officials, FRA, the Volpe Implementation Team, and BTS, usually conducted over the phone. These interviews asked about key events related to the implementation, functioning, and sustainability of C³RS.

MIDTERM RESULTS FOR THIS RAILROAD

¹ FRA-reportable incidents are those incidents that meet criteria set forth in 49 CFR Part 225, including track or equipment damage that exceeds a specified threshold [5].



Cars Moved between Human Factors Incidents Have Increased at This Railroad

Incident data was compared for the location where C³RS was operating with two similar non-C³RS sites. The C³RS site showed a 31-percent increase in the number of cars moved between incidents after C³RS corrective actions began (Figure 1). Analysis showed a skewness of 1.7, which indicated the propriety of using a natural logarithm transformation to reduce the impact of outliers and thus to comply with the normality assumption of the statistical tests that were applied [6]. After the transformation, a two-tailed t-test found a significant increase in cars moved between incidents. The p-value of the test was 0.055, indicating that in only about 1 in 20 times would an improvement of this size occur purely by chance. In contrast, the two non-C³RS sites showed no statistically significant change. (Fifteen-percent decrease with p-value = 0.179 and 9-percent decrease with p-value = 0.463). To explain the impact of C³RS in metrics that related to observable railroad operations, the 31-percent improvement was calculated on data that was converted back from the log transformation to cars moved between incidents.

Confidence in this statistical finding is supported by a convergence of findings from two other data sources. (1) interviews with managers whose jobs require that they pay careful attention to safety statistics, and (2) C³RS reporting (Figure 2). The proportion of C³RS reports relating to derailments showed a decrease over time (p-value = 0.03) [4]. More cars moved between incidents is important because it relates to safety, repair costs, and delay.

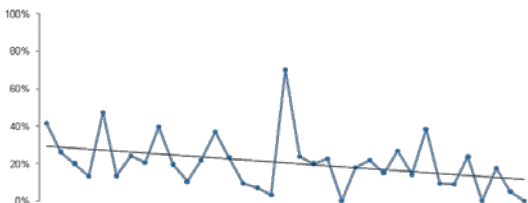


Figure 2. Derailment Close-Call Reports to BTS Decrease over Time (p-value = 0.03)

Safety Culture Has Improved at This Railroad

There was a statistically significant positive increase in nine safety culture scales with p-values ranging from less than 0.01 to 0.03 (Table 1). For example, labor’s score on the labor-management relations scale increased 9 percent. Six of the nine scales suggested an improvement in how labor viewed management. Many of the scales relate to the relationships between employees and their supervisors, showing an improvement in employee engagement (e.g., employees felt more comfortable raising concerns about safety with supervisors at midterm). Labor perceived that: (1) supervisors had become more fair and cooperative (Multiple Scales); (2) an improvement in supervisors valuing safety relative to productivity (Work Safety Priorities); and (3) peer-to-peer relationships were improving (Helping Behavior).

Table 1. Improvements in Safety Culture

	Significant Improvement	
	Managers	Labor
Labor-Management Relations	✓	✓
Organizational Fairness During Change	✓	
Supervisor Fairness	✓	✓
Supervisor-Employee Relationship		✓
Management Safety	✓	✓
Raising Concerns with Supervisors		✓
Work Safety Priorities		✓
Helping Behavior		✓
Coworker Safety	✓	

Other survey responses suggested that employees also became more engaged in the C³RS program. At midterm, 74 percent of them were willing to submit a C³RS report versus 58 percent at baseline. Both labor and management were more convinced at midterm that C³RS was effective and that the identities of those who reported close-call events remained confidential.

Interviews Reveal Positive Impacts

Interview data supported the survey finding about improved labor-management relations. Many responses indicated improved cooperation within the PRT and between labor and management in daily non-C³RS activities.



Interviewees indicated that disciplinary cases decreased drastically (by over 90 percent) since C³RS was implemented, thus reducing large amounts of time and paperwork that labor and management must spend to resolve each case.

PRT and senior management interviewees indicated that C³RS revealed otherwise unknown safety issues and root causes. They were able to effectively implement multiple corrective actions. The evaluation findings helped the Volpe Implementation Team and the railroad to improve C³RS with respect to problem-solving, analysis of trends, cross-functional approaches to corrective actions, and communication of success to the company.

CONCLUSIONS

C³RS was implemented successfully at this demonstration site yielding a positive impact on incidents/derailments, safety culture, and discipline by midterm.

FUTURE DIRECTIONS FOR C³RS EVALUATION

This report focuses on midterm improvements at one of the four C³RS demonstration sites. As data becomes available, future reports will include a final report for this railroad as well as reports on other railroads.

REFERENCES

- [1] C³RS Web site. www.closecallsrail.org/.
- [2] Confidential Close Call Reporting System: Preliminary Evaluation Findings. FRA Research Results, December 2008. DOT/FRA/RR08-33.
- [3] Transformation of Safety Culture on the San Antonio Service Unit of Union Pacific Railroad. March 2011. Unpublished manuscript.
- [4] C³RS Reporting Rates across C³RS Sites. Spring 2011. BTS. Unpublished manuscript.
- [5] 2010 FRA Guide for Preparing Accident/Incident Reports. safetydata.fra.dot.gov/officeofsafety/.
- [6] Winer, B. J., Brown, D. R., & Michels, K. M. (1991). *Statistical Principles in Experimental Design* (3rd ed). New York: McGraw Hill.

ACKNOWLEDGMENTS

This study would not have been possible without the cooperation of a large number of managers and employees at Amtrak, UP, CP, and NJT. Thanks also to Dr. Jonathan Morell of Fulcrum Corporation and to Melinda Davey of Jacobs Technology, Inc. Dr. Michael Zuschlag of the Volpe National Transportation Systems Center advised on data analysis. Thanks also to those who participated in the Lessons Learned interviews: FRA and railroad members from the PRT, the Volpe Implementation Team, and BTS. Additional thanks to BTS for providing sanitized data, designing the survey layout, and administering the survey. The work is being performed under an interagency agreement between FRA's Human Factors R&D Program and the Volpe Center's Behavioral Safety Research and Demonstration Division.

CONTACT

Dr. Joyce Ranney

Behavioral Safety Research and
Demonstration Division
Research and Innovative Technology Administration
Volpe National Transportation Systems Center
55 Broadway, RVT-81
Cambridge, MA 02142
(617) 494-2095; Joyce.ranney@dot.gov

Dr. Thomas Raslear

Chief, Human Factors Research Division
Federal Railroad Administration
Office of Research and Development
1200 New Jersey Avenue, SE – Mail Stop 20
Washington, DC 20590
(202) 493-6346; Thomas.raslear@dot.gov

KEYWORDS

Close calls, human factors, safety culture, risk reduction, continuous improvement, employee involvement, passenger rail

Notice and Disclaimer: This document is disseminated under the sponsorship of the United States Department of Transportation in the interest of information exchange. Any opinions, findings and conclusions, or recommendations expressed in this material do not necessarily reflect the views or policies of the United States Government, nor does mention of trade names, commercial products, or organizations imply endorsement by the United States Government. The United States Government assumes no liability for the content or use of the material contained in this document.