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Research Results

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Promising Evidence of Impact on Road Safety by Changing At-risk Behavior Process at Union Pacific

SUMMARY

Changing At-risk Behavior (CAB) is a safety process that is being conducted at Union Pacific's San Antonio Service Unit with the aim of improving locomotive cab safety related to constraining signals. CAB is an example of a risk reduction method that is called Clear Signal for Action (CSA) by the Federal Railroad Administration (FRA) Human Factors Program within the Office of Research and Development (R&D). CSA combines behavior-based safety, continuous improvement, and safety leadership development. With sponsorship from FRA, Behavioral Science Technology Inc. is instructing and advising on the implementation of CAB. The impact of CAB on worker practices is evaluated in this paper using three sources of data: (1) data collected by workers as part of CAB, (2) field training exercise (FTX) test results by managers, and (3) perceptions of workers and managers as reported in interviews.

All three data sources indicate an improvement in practices. Looking at the inverse of percent safe behaviors, worker data shows risky behaviors have decreased from approximately eight percent to three percent (Figure 1), representing an improvement of at least 60 percent. Similarly, manager (FTX) data shows a decline from 3.2 to 1.9 percent (Figure 2), an improvement of 40 percent. In interviews, both workers and managers also report seeing improvements on the job. Overall results provide promising evidence that the labor and management efforts of CAB are effective at promoting safer practices under constraining signals and more safety awareness.

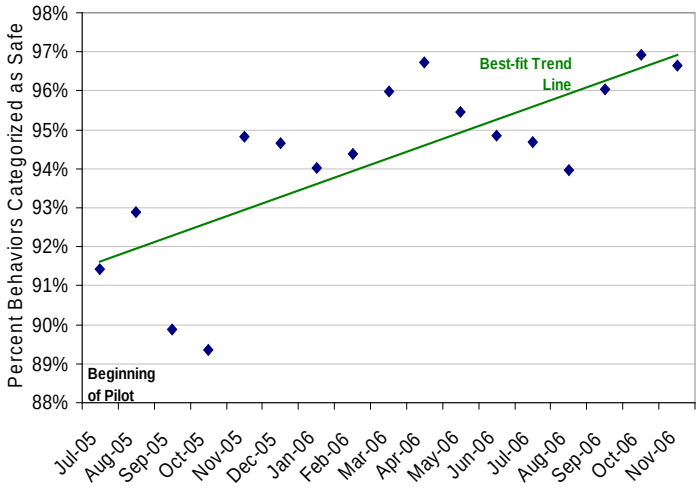

Figure 1. Worker-collected data on work practices show a trend toward greater safety.

Figure 2. Average percent passes of FTX tests before and during CAB at the SASU.

BACKGROUND

In response to a series of major accidents related to road operations under constraining signals, Union Pacific Railroad (UP), the Brotherhood of Locomotive Engineers and Trainmen (BLET), and the United Transportation Union (UTU), in collaboration with R&D's Human Factors Program, are conducting a new safety process called CAB on UP's San Antonio Service Unit (SASU). To FRA, CAB is a demonstration of a CSA process, a proactive employee-directed safety risk management method that includes the following components:

- Behavior-based safety (BBS), where trained peers provide each other with confidential, constructive feedback while working together,
- Continuous improvement, where data compiled by workers in the course of providing feedback is used to identify and implement corrective actions to improve safety, and
- Safety leadership development, where managers are trained to effectively support the process.

Behavioral Science Technology, Inc. (BST), a company that has implemented CSA-like programs in a broad range of industries, is instructing and advising on the implementation of CAB to use their Behavioral Accident Prevention Process (BAPP)®.

The CAB process began in August 2005, with the initiation of regular peer-to-peer feedback sessions. CAB initially focused on behaviors to improve alertness and teamwork for locomotive cab operations under constraining signals, a situation that UP calls *Cab Red Zone* (CRZ), for which there are specific CRZ rules in the General Code of Operating Rules. Fourteen months after its origination, the implementation broadened its focus to include safety in yard switching operations, but presently, the bulk of the effort still concerns CRZ.

Training workers on the BBS component has continued systematically since August 2005, and at the time of this paper, approximately 40 percent of the 1,100-person workforce has been trained. Safety leadership training has also been completed. Approximately 200 feedback sessions are conducted each month, a rate below what was targeted by the steering committee, but is still effective. Management has been improving the work environment in response to data supplied by workers, reportedly spending $65,000 in 1 month on one yard alone. With a strong start and increasing implementation, one would expect to soon see impacts on targeted CRZ practices.

OBJECTIVES

This paper presents part of the midterm evaluation of CAB, analyzing changes in worker practices since CAB began as indicated through:

- Data collected by workers as part of CAB,
- Field Training Exercise (FTX) test results by managers, and
- Perceptions of workers and managers as reported in interviews.

METHODS

Worker Data

To provide feedback on work practices and gather data for continuous improvement, trained workers first observe their fellow workers and, using a list developed by the implementation steering committee, check for safe and at-risk behaviors and conditions. Aggregated data from these checklists were provided to evaluate changes in practices over time. The percentage of behaviors regarded as safe among all behaviors in a given month is used as an index of the prevalence of safe CRZ practices. At the time of this analysis, data from over 2,400 samples were included.

Implementation includes calibration and coaching processes to maintain checklist consistency and accuracy over time; processes have been proven to be generally effective. An independent analysis of data from training and coaching indicates sufficient interobserver reliability (over 80 percent agreement among pairs of workers observing the same behavior) and no drift in judgments over time of safe and at-risk behavior (as indicated by comparing the worker's ratings of videos of safe and at-risk behavior).

FTX

In FTX, managers observe train crews, record compliance with various rules, and debrief crews on their observations. The aggregated percent passes of these tests provide a second measure of worker practices. Of particular interest for this evaluation are the percent passes of the rules for practices in CRZ, given that CRZ practices were the primary focus of CAB.

The FTX data are similar to the worker data, in that they represent direct observations of worker practices. However, FTX data are:

- Routinely collected by managers. The test is one where the outcome can add or subtract points from the worker's Employee Development

Review score, rather than being conducted by workers on anonymous coworkers.

- Available from before the beginning of the implementation, allowing a comparison of practices *during* the implementation with a baseline of *before* the implementation.
- Available from other service units, making it possible to statistically control the general changes over time associated with characteristics of the region, company, or industry. In an attempt to isolate changes in FTX due to CAB, changes in FTX associated with the other three service units of UP's Southern Region (Fort Worth, Houston, and Livonia) were subtracted.

Interviews

Qualitative data on the perspectives of workers and managers were collected by semistructured interviews of 18 employees and managers who work in transportation, most of whom had some involvement in CAB. They were selected by union and management stakeholders involved in CAB as people who were respected, credible, and pro-safety (as opposed to being pro-labor or pro-management) in order to obtain a neutral domain expert's view of the implementation.

Among other issues, the interviews covered the perceived impacts of the implementation. Three researchers independently categorized the quotes obtained during the interviews into themes or summary topics. Researchers then conferred with one another to cross-check and consolidate themes.

RESULTS

Worker Data

From the beginning of CAB until the most recently acquired worker data a strong trend was seen toward increasing safe practices month to month on all checklist items combined (r = 0.823, n = 21, p < 0.0001, see Figure 1). Eighty-five percent of the checklist items show a trend toward increasing safety. Plotting a mathematically best-fit straight line on the monthly percent safe data indicates that on average, risky behavior has gone from approximately 8 percent to approximately 3 percent of all observed behavior, a decrease of over 60 percent.

FTX

The percentage of passes of management-conducted field tests for CRZ rules has on average been significantly higher during CAB (M = 98.1%) than before CAB (M = 96.8%), a difference that persists when statistically controlling for regionwide changes (F(1, 179) = 8.105, p = 0.005). This represents a decrease in test *failures* from 3.2% to 1.9%, meaning that FTX failures of the CRZ rules were being observed 40 percent less often than since the start of CAB. Also, a significant increase in the percent of passes for *non-CRZ* rules occurred since the instantiation of CAB (before M = 98.6% to during M = 98.9%, F(1, 238) = 15.345, p < 0.001, statistically controlling for other service units). However, the increase was greater for CRZ rules than non-CRZ rules (F(1, 368) = 4.855, p = 0.028, (See Figure 2). While failure rates for CRZ rules have been cut by 40 percent, failure rates of non-CRZ rules have been cut 21 percent. This is consistent with CRZ being the focus of CAB, but the process also has spillover impacts on general safety awareness of the service unit.

Two service units in UP's Southern Region have also seen improvements in FTXs during the same time period; only SASU has seen improvements in both CRZ and non-CRZ rules. The Fort Worth Service Unit has improved significantly for CRZ rules but not non-CRZ rules. Livonia Service Unit has experienced a significant improvement for non-CRZ rules, but not CRZ rules.[1]

Interviews

Consistent with the results from worker data and FTXs of CRZ rules, most workers and half of the managers interviewed credited CAB with improving safety practices, particularly related to CRZ. Most also credited CAB with increasing awareness about safety.

CONCLUSIONS

Overall, strong evidence indicates that worker practices are becoming safer under constraining signals and risks are being reduced. Systematic recording of CRZ practices by both workers and managers show improvements in interviews workers and managers also report seeing improvements on the job. The improvements at SASU are apparently more consistent than, and separate from, any improvements at other service units in UP's southern region. Transportation workers and managers also report increasing awareness about safety in general, which is consistent with milder

[1] Livonia started a CSA program of its own one year after SASU, focusing on yard operations rather than CRZ, which may account for these results, but further analysis is necessary.

improvements seen for non-CRZ FTX results. Because of the design of this field evaluation, it is not possible to assess the relative impacts from each of the three components of CSA (BBS as practiced by workers, safety leadership as practiced by management or continuous improvement as practiced by both). Instead, these results should be regarded as the joint impact of labor and management working together. Moreover, other safety programs, such as FTX, were also focused on improving CRZ practices and may have contributed to observed impacts in some way.

FUTURE DIRECTION AND ACTIVITIES

Further analyses will evaluate impacts further "downstream" from work practices. Specifically, with these changes in practice, one can predict a reduction in engineer decertifications related to CRZ. Furthermore, with the implementation expanding to work practices and conditions related to yard operations, analyses will also be done on yard-related practices and downstream impacts such as personal injuries and derailments.

WANT MORE INFORMATION?

For more details about CAB at SASU:

Clear Signal for Action Program Addresses Locomotive Cab Safety Related to Constraining Signals, May 2006, Research Results RR07-08.

Findings from another CSA project:

Behavior-Based Safety at Amtrak-Chicago Associated with Reduced Injuries and Costs, March 2006, Research Results RR07-07.

Both papers are available on the FRA Web site (http://www.fra.dot.gov/us/content/1920).

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