Project Title:
Further Validation of Safety Culture Measurement Tool for Improving Safety in Commuter Rail Operations

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Research Needs:
Safety culture is shaping up as one of the more important areas of focus for safety improvement in the transportation industry. The FRA has expressed interest in studying safety culture in railroad operations and recently FRA and BNSF engaged in a joint effort to review the BNSF Safety Culture (FRA, April, 2015).[i]   Also, FRA Administrator, Sarah Feinberg, noted "improving Metro-North's safety culture, preventing accidents before they happen and increasing worker safety," was important.   FRA also state that "Multiple studies have confirmed what many have intuitively known all along" that safety culture plays a key role in accident prevention. However, visible progress towards established goals is a more effective motivator than money or personal recognition for the average worker in a world-class operation. Moving towards achievement metrics and away from failure metrics becomes increasingly vital. (FRA, August 2011)[ii] Accordingly, the present research is designed to continue the development of a viable measure of safety culture by continuing the validation process with a large commuter rail transportation organization.

Recently, Sherry & Colarossi (2016)[iii] released a study that initiated the development of a tool to measure of safety culture. The instrument was normed on a large sample of employees of a large public transportation agency (N=1909) participants were obtained.   One-way between groups analysis of variance (ANOVA), and post hoc tests provided initial evidence of the validity and reliability of the Safety Culture Scale as a measure for the transportation industry in that the scale significantly differentiated ($p<.05$) between persons who had been involved in accidents and safety violations thus demonstrating the relationship between safety culture and accident rates. (See Figure 1.) In addition, a follow-up study with a large regional transportation company demonstrated significant differences in safety culture and attitudes between key departments in the organization. (See Figure 2.)

A normative instrument designed and validated on railroad properties is needed because of the vastly different environment and set of operating practices, corporate culture, historical traditions, and unique set of working conditions. Much of the published material on safety culture has to do with nursing and hospital practices[iv] and oil and gas operations
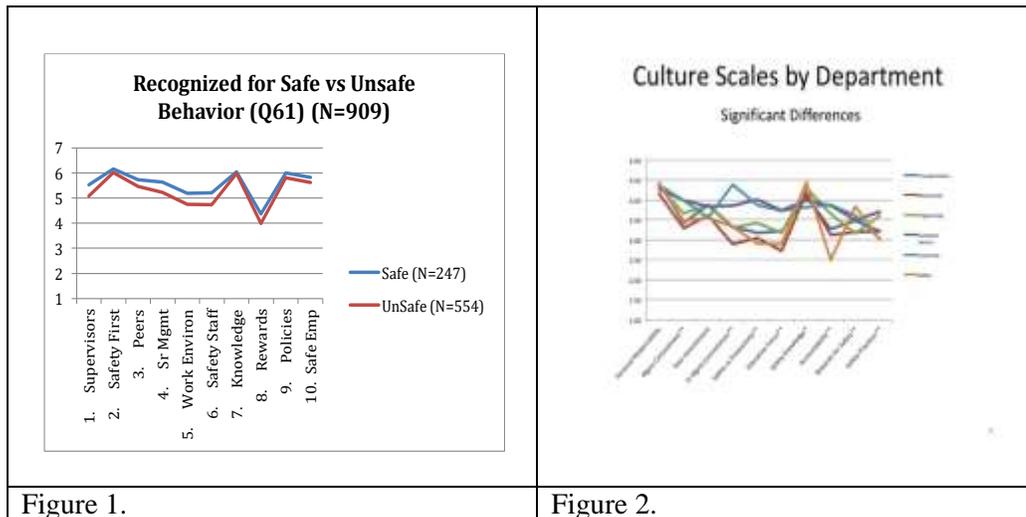

Figure 1. Figure 2.

Several reports in news media have also questioned the commitment to a safety culture some railroads. (*Rail Workers Raise Doubts About Safety Culture As Oil Trains Roll On*[v]). The report noted that, "Critics claim the railway has long prioritized speed and profits over safety, with a history of retaliating against workers who report accidents, injuries and safety concerns."[vi] In addition, Canada's Transportation Safety Board identified a number of factors that likely contributed to the Lac-Mégantic derailment[vii] that resulted in a significant loss of life by noting that "In all, we found 18 factors that played a role -- take any one of them out of the equation and this accident may not have happened," TSB Chairwoman Wendy Tadros. Moreover, according to the report the railroad's upper management perpetuated "a weak organizational safety culture, refusing to update operating practices even as shipments of hazardous materials shot upward."[viii] In addition, the TSB noted the Montreal, Main and Atlantic (MMA), that owned the railroad, ""was a company with a weak safety culture that did not have a functioning safety management system to manage risks," the agency said.[ix]

Clearly, to continue to improve safety culture more than just rhetoric is needed. In fact, the development and implementation of a standard metric of safety culture is needed. Such a metric would enable the comparison of pre-post interventions as well as the normative comparison of organizations to each other. In addition, such an instrument will aid greatly in the identification of areas within an organization, such as departments, relationship between management and labor, training programs and other areas that are in need of improvement relative to establishing a strong safety culture. Essentially, such a tool could be used to create a road map towards the development of a more robust culture within in an organization.

Thus, the proposed study will attempt to gather data that will continue to validate and provide normative comparison data on safety culture that will aid organizations in the development.

Research Objectives:
The objectives of this project are as follows

1) Identification of a suitable organization engaged in various activities to be able to complete the safety culture assessment instruments.
2) Review of current literature on safety culture
3) Briefing and education key stakeholders in a organization on the importance of Safety Culture
4) Assessment of employees of organization on Safety Culture through interviews, online, and paper and pencil administration.
5) Analysis of data.
6) Feedback presentations to stakeholders
7) Writing of report
8) Development of recommendations
9) Posting on web site
10) Presentations at conference

Research Methods:
The project will primarily utilize survey and interview methodology to gather data which will use statistical techniques to review and evaluative the data.

Measures & Data Collection

Questionnaire Data. The data on safety culture will be obtained through the administration of Safety Culture Scale (SCS) (Sherry & Colarossi, 2016). The SCS was developed using a large sample of employees from a large public transportation agency (N=1909). Confirmatory factor analysis (CFA) compared the fit of likely models. One-way between groups analysis of variance, and post hoc tests provided initial evidence of the validity and reliability of the SCS as a measure for the transportation industry in that the scale significantly differentiated ($p<.05$) between persons who had been involved in more accidents and safety violations thus demonstrating the relationship between safety culture and accident rates. Implications of these findings are that the safety culture survey could be used to assess safety awareness and safety culture of trucking or transport companies, small communities, and other organizations involved in transport. By carefully monitoring scores on the SCS efforts could be made in various communities and organizations to improve attitudes towards safety and ultimately to reduce accidents and improve road safety.

Observational Data. A team of investigators will conduct onsite inspections and observations of work behavior and conditions of the sample railroad during a one week period of observation. The inspectors will be looking for examples of safe and unsafe worker behavior. A checklist of typical railroad work behaviors will be prepared prior to the onsite visit.

Historical Data. Reports on the accident incident rate of the study organization will be examined. Data will be gathered and compared to scores obtained on the survey instrument (SCS). Both analysis of variance and regression analysis will be sued to obtain estimates of the relationship between and the impact of safety culture variables on the occurrence of accidents and incidents. Since this is a correlational field study only associational relationships will be possible to determine.

Expected Outcomes:

The research will identify the relationship between a measure of safety culture and the occurrence of accidents and incidents in the organization. The identification of statistical patterns and degrees of association between those patterns

Relevance to Strategic Goals:

This project will contribute to the safety of employees and personnel of the railroad industry by further validating a measure of safety culture in the commuter rail industry. Despite the fact that the measure has been used a few times before it is necessary to develop a large set of normative data from a number of railroads to be able to successfully calibrate the instrument and to use it as an effective means of comparison between organizations. In addition, it will enhance and contribute to the safety of the rail industry and the public at large. The project will enhance the existing federal effort by contributing to safety, economic competitiveness and efficiency and developing the work force in the transportation system in the US.

Educational Benefits:

Several graduate students will assist with the project thereby contributing to the development and education of graduate students who will later be employed in the industry. These students will gain experience in the data collection techniques commonly used in the rail industry. In addition, they will gain an understanding of the theory and best practices associated with safety and safety culture.

Work Plan:

Achieving the overarching goal of this project requires the completion of several different tasks. Since the project will be built upon the previous work and studies we anticipate that the results will be a significant contribution to the existing literature. In addition, it will not be necessary to invest time and effort into developing the assessment tools thereby shorten the overall project. Permission from railroads will be needed to implement these data gathering efforts with the railroads.

Task 1 - Literature Review

Various sources will be consulted to identify relevant psychological, operational, and experimental studies and papers. These papers will be reviewed for their

identification of relevant work practices relevant to the measurement and development of safety culture and the associated risk of accident of injury.

Task 2 – Data Collection
Data collection in the various methods and techniques outlined above (survey, observation, and historical).

Task 3 – Data Analysis
Data will be analyzed to assess the relationship between the various measures, observed work practices and the accidents and injuries associated with indicators of safety culture.

Task 4 - Reporting Writing
A draft report will be produced describing the results of the research and identification of successful countermeasures. Recommendations for the implementation of countermeasures to the work schedules will also be reviewed. These results will first be discussed with stakeholders and then disseminated at regional and national meetings where members attend and posted on relevant web sites. The results will be presented at national conferences and disseminated in the form of scholarly papers which will be published in reputable journals.

Task 5 – Meetings with Stakeholders

A series of meeting with stakeholders and interests parties will be held following the completion of the draft report. The draft report will be shared with stakeholders and relevant feedback will be obtained and integrated into the report.

Task	Months							
	1 – 3		4 – 6		7 - 9		10 – 12	
1	▓	▓						
2		▓	▓					
3				▓	▓	▓		
4					▓	▓	▓	▓
5							▓	▓

Project Cost:
Total Project Costs: $185,054
MPC Funds Requested: $ 92,527
Matching Funds: $ 92,527

Source of Matching Funds: PI time and effort, and MBTA (Keolis).

Categories	Total
Center Director Salary	
Faculty Salaries	108000
Administrative Staff Salaries	

Staff Fringe Benefits	31034
Student Salaries	
Student Fringe Benefits	
Total Personnel Salaries	108000
Total Fringe Benefits	32729
TOTAL Salaries & Fringe Benefits	140729
Travel	25000
Equipment	
Supplies	
Contractual	
Construction	
Other Direct Costs (Specify)*	
TOTAL Direct Costs	165729
F&A (Indirect) Costs	19325
TOTAL COSTS	185054
Federal Share	92527
Matching Share	92527

TRB Keywords: Fatigue, Human Factors, Safety, Hours of Service

References:

1. Sherry, P. & Colorossi, D. (2016). Development and validation of a measure of transportation safety culture. National Center for Intermodal Transportation, Research Report, January 2016.

[i] http://www.fra.dot.gov/eLib/details/L16311

[ii] https://proactsafety.com/articles/establishing-a-sustainble-safety-culture

[iii] http://www.ncit.msstate.edu/PDF/reports_76_2012_22_Sherry_&_Colarossi_Safety_Culture_Measure_Report_NCITEC.pdf

[iv] Vogus, T.J., & Sutcliffe, K.M. (2007). The safety organizing scale: development and validation of a behavioral measure of safety culture in hospital nursing units. *Medical Care.* 2007;45:46–54.

[v] http://ijpr.org/webclip/rail-workers-raise-doubts-about-safety-culture-oil-trains-roll#stream/0

[vi] http://www.opb.org/news/article/workers-question-safety-culture-in-railroads-hauli/

[vii] http://www.tsb.gc.ca/eng/rapports-reports/rail/2013/r13d0054/r13d0054.pdf

[viii] http://www.eenews.net/stories/1060004704

[ix] http://www.cbc.ca/news/canada/montreal/lac-m%C3%A9gantic-tsb-finds-company-had-weak-safety-culture-1.2739921