MPC- 409

January 1, 2013- December 31, 2013

**Project Title:**

Identification of Low-Risk Adjusted Work Schedules Designed to Manage Fatigue During Peak Service Demand Periods in the Shortline Railroad Industry

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**Research Needs:**

Based on input from representatives of the Short Line Railroad Association (ASLRRA) it is apparent that there is an issue with the impact of the hours of Service rules as generated by the Rail Safety Improvement Act of 2008 that creates difficulty for short line railroad operators during peak harvest season. Since the service demands are very extreme it is difficult for crews to operate within the time constraints. Consequently, there is a need to address ways to assist operating crews in better managing the fatigue associated with long hours of work.

The Hours of Service law (HSL), first enacted in 1907 and most recently amended in 2008, control how many hours train employees, dispatching service employees, and signal employees may work.  The statute provides maximum on-duty periods for each group of employees, minimum off-duty periods for train employees and signal employees, and establishes how time on duty is to be calculated.  The statute also provides additional limitations on consecutive-days and certain monthly limitations on the activity of train employees.

In the Rail Safety Improvement Act of 2008, FRA received regulatory authority to establish hours of service limitations for train employees providing commuter and intercity rail passenger transportation service and on August 12, 2011, FRA published its final rule providing new limitations for passenger train employees which necessitated the evaluation of work schedules for risk of fatigue.

In previous studies in railroad operational settings crew work schedules were analyzed to determine the extent to which persons working long hours were experiencing excessive levels of fatigue. Based on extensive research the FRA determined various cutoffs that suggested that individuals who exceed such cutoffs were more likely to be at risk for accidents and injury (Raslear, 2009). The research determined that a bio-mathematical model exists that can be used to estimate the likelihood that a person will experience fatigue and thus be at a greater risk for a fatigue related accident or incident.

Little work has been done however to identify work schedules that will permit railroad employees to work safely when working long hours. In addition, the strategic placement of various fatigue countermeasures has not been examined to assess the mitigating effects of these interventions in the operational setting (Raslear & Coplan, 2004).

*There exists no research identifying various adjustments to work schedules that are less prone to fatigue nor the inclusion of or assessment of various fatigue countermeasures that could be included that could lead to more efficient and sustained performance.*

The proposed study will attempt to identify several key work schedules that will be less prone to fatigue risk and also to identify appropriate counter measures that will likely lead to a more effective performance. These adjusted schedules and the appropriate countermeasures will be posted on the web sites and distribute to the ASLRRA.

**Research Objectives:**

The objectives of this project are as follows

1. Identification and assessment of typical short-line Railroad work schedules.
2. Identification of fatigue risks associated with schedules worked during peak hours.
3. Identification of work schedule modifications that may lead to reduced fatigue.
4. Identification of work schedules that are adjusted with the inclusion of fatigue countermeasures or interventions that are likely to lead to a reduced level of fatigue risk.
5. Recommendations for best practices to implement findings.

**Research Methods:**

The project will begin with review of available literature on fatigue and fatigue countermeasures in the railroad industry. The literature review will help in identifying what adjustments and countermeasures have already been utilized. These efforts may have already taken place in the passenger industry.

Following the literature review, efforts will be made to obtain railroad schedule information from several different short-line railroad companies. In conjunction with the ASLRRA who has agreed to provide schedule information, these work schedules will be subjected to review using the existing models identified by FRA.

Next, the existing schedules will be codified using both, length, frequency to determine the most efficacious work schedules for dealing with peak service demands.

Finally, the adjusted schedules will also be examined following the inclusion of several fatigue countermeasures to assess the impact on fatigue risk and the maximization of productivity.

**Expected Outcomes:**

The research will generate a listing of the fatigue risk associated with existing work practices in the short-line industry. Second, there will be an identification of adjusted schedules that minimize risk. Third there will be an identification of fatigue countermeasures that augment the effectiveness of adjusted schedules. Fourth, this information will be made publicly available to inform the other shortline.

**Relevance to Strategic Goals:**

This project will contribute to the state of good repair of the employees and personnel of the railroad industry by examining the safety risk of various employee work schedules in the short-line railroad industry. 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 in achieving a **state of good repair, contributing to safety, and developing the work force** in the transportation system in the US.

**Educational Benefits:**

A graduate student will assist with the project thereby contributing to the development and education of graduate students who will later be employed in the industry.

**Work Plan:**

Achieving the overarching goal of this project requires the completion of several different tasks.

**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, schedules, and proposed fatigue countermeasures that have been thought to reduce fatigue and the associated risk of accident of injury.

**Task 2 – Identification of existing Schedules**

In cooperation with the ASLRRA the investigators will gather typical work schedules during peak season of several short line railroads. The work schedules will be subjected to the FRA recommended fatigue model and further examined and reviewed for the likelihood of fatigue risk.

**Task 3 – Identification of Adjusted Work Schedules**

Based on the review of the literature, the examination of the existing work schedule and other relative factors, the investigators will identify and propose several new and adjusted work schedules. These new and adjusted work schedules will subjected to analysis with a bio-mathematical model for the determination of the likelihood of risk for fatigue (Hursh, Redmond, et. al., 2004).

**Task 4 – Identification of Adjusted Schedules Enhanced with Fatigue CMS**

The adjusted work schedule will then be examined with the intention of include or incorporating several fatigue countermeasures into the schedule. These countermeasures will be obtained from the input of the ASLRA as well as the scientific literature and the practices that seem to be most appropriate. These countermeasures will likely include strategic naps, use of natural stimulants, staggered task assignment, spilt schedules and shifts and the like. These adjustments and countermeasures will then be subjected to the FRA recommended fatigue models to assess the impact of the interventions on fatigue risk. Thus, proposed new schedules, designed to specifically address the high service demand periods will be constructed and evaluated using the recommended FRA fatigue models to maximize the likelihood safe work practices and work schedules being implemented.

**Task 5** **- Reporting and Dissemination**

A final report will be produced describing the results of the research. Recommendations for the identification of schedule that are at risk, adjusted schedules that have less risk, and adjusted and enhanced schedules will also be identified. These results will be 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.

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|  | Months | | | | | | | | |
| Task | 1-2 | 3-4 | 5-6 | 7-8 | 9-10 | 11-12 | 13-14 | 15-16 | 17-18 |
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**Project Cost:**

Total Project Costs: $250,000

MPC Funds Requested: $ 125,000

Matching Funds: $ 125,000

Source of Matching Funds: PI time and effort, and ASLRRA (short-line railroad association )

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

**References:**

1. Raslear, T. (2009). Validation and calibration of a fatigue assessment tool for railroad work schedule. US Department of Transportation Federal Railroad Administration. DOT/FRA/ORD -06/21.
2. Hursh, S., Redmond, DP, Johnson, ML, et. Al. (2004). Modeling fatigue for applied research. Aviation Space and Environmental Medicine, 2004, 7, 3, (Suppl) A44-A53.
3. Raslear, T., & Coplan, M. (2004). Fatigue models as practical tools: Diagnostic accuracy and decision thresholds. Aviation Space & Environmental Medicine, 75, 3, (Suppl), A168-A-172.