



U.S. Department  
Of Transportation  
**Federal Railroad  
Administration**

# Research Results

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## A Preliminary Examination Of Railroad Dispatcher Workload, Stress, and Fatigue

### SUMMARY

Railroad dispatchers play a critical role in the safe operation of the nation's railroads. In response to concerns raised by two Federal Railroad Administration (FRA) safety audits of dispatching operations in the U.S., FRA's Office of Research and Development undertook a study to examine levels of workload, stress and fatigue in the railroad dispatching environment. A field study at two dispatching operations, one freight and one passenger, provided data for this analysis. Data collected in the field included physiological measures as well as self-report data, third party observation and paper records. The results of this study include findings with respect to dispatcher characteristics and their work environment as well as levels of workload, stress, and fatigue.



*Figure 1. Modern railroad dispatching center*



## BACKGROUND

Two Federal Railroad Administration (FRA) audits of dispatching operations conducted in the early 1990s found evidence of high dispatcher stress and workload. Because of the safety critical role that dispatchers play in the safety of railroad operations, the FRA initiated this research to understand today's dispatching environment and its associated levels of workload, occupational stress and resulting fatigue.

The goals of the research were to: 1) identify the sources and magnitude of workload, stress and fatigue associated with the dispatcher's job and working life, 2) determine any related health or performance effects, and 3) refine procedures for measuring workload, stress and fatigue in the dispatcher's workplace.

### Methods

This research consisted of a field study of dispatchers at two different dispatching operations, one freight and one passenger.

### Instruments

A literature review of related studies in other fields, site visits to dispatching centers and a focus group interview with railroad dispatchers all helped to identify and evaluate candidate data collection instruments. The final set of data collection instruments is summarized in *Table 1*.

Type of Data	Measurement Instrument
Demographic and work environment	Background survey
Workload	mTAWL Activity records Dispatcher self-reports Subjective ratings
Stress	Salivary cortisol Subjective rating
Fatigue	Actigraphy Sleep logs Subjective rating
Study Feedback	Debriefing survey
Job Improvement Suggestions	Debriefing survey

**Table 1. Data collection instruments**

A background survey collected data on the demographics and health of the study population along with information about the work environment. There were three sources of workload data, including an observational technique, based on the Task Analysis Workload method, subjective ratings and activity count data. Subjective ratings were also used to collect data on dispatcher stress and fatigue. Salivary cortisol was used as a physiological measure of stress while actigraphy was used to record sleep patterns. Dispatchers also provided a record of their sleep pattern on a sleep log. Finally a debriefing survey solicited feedback from participants regarding study procedures and offered the participants an opportunity to express their suggestions for job improvements.

### Data Collection Procedures

A total of 20 dispatchers from a freight dispatching operation and 17 from a passenger operation participated in the field study. Participants volunteered and were compensated for their participation. Prior to the start of data collection each participant signed an informed consent form and completed the background survey. During the two-week data collection period, participants wore an actigraph and maintained a sleep log on both work and non-work days. While at work, participants completed subjective rating forms and provided a saliva sample upon arrival at work and every two hours thereafter. At the conclusion of the two-week period, each participant completed the debriefing survey and was paid for his or her participation.

### Participants

The typical dispatcher in this study was experienced in their job, male, married with one to two children, had at least a high school diploma and was overweight. The median job tenure was about 100 months. Twenty-three of the participants (62 percent) had five or more years of experience. Approximately four out of every five participants worked in another capacity for the railroad before entering dispatch work.

### Analysis Methods

The majority of the significance testing was accomplished through Analysis of Variance (ANOVA) and *t*-test procedures. As this is an



exploratory analysis, specific a priori hypotheses were not postulated, and statistical testing was two-tailed unless otherwise noted. A significance level of  $p < .05$  was set for this study.

## CONCLUSIONS

*Dispatcher Characteristics* - No significant differences were found between the two field study locations with respect to dispatcher characteristics. With respect to health, the younger dispatchers, aged 25 to 44, reported experiencing back pain, headaches and skin disorders at a significantly higher rate than found in the U.S. population in general.

*Work Environment* - The study results indicate that participating dispatchers worked more than a 40-hour week. Most dispatchers (89 percent) reported that, on average, they are scheduled to work a consecutive five-day workweek, but over half reported working an average of eight or more hours of overtime weekly. The dispatcher's time at work is further stressed by the fact that the dispatcher's work schedule does not provide a scheduled lunch or rest break.

Regarding the job and work environment, though nearly all the dispatchers reported that they often dealt with high workloads, most felt capable of handling emergencies and competent in all aspects of their job.

*Workload* - Comparisons of the available activity count data – number of trains and other track users, numbers of track usage authorities issued – with subjective ratings of workload, stress and fatigue revealed that subjective workload was moderately associated with reported number of trains dispatched, regardless of shift or location. Correlations between count data and the perceived workload were significant for 92 percent of the cases. Perceived stress also related to the number of trains dispatched, particularly at the freight operation where 92 percent of the correlations were significant and reliable compared with 42 percent at the passenger site. Of the three subjective ratings, fatigue had the lowest association with the number of trains and other track users, particularly among the dispatchers at the passenger operation.

*Stress* - Two distinct patterns of stressors emerged for each site. Dispatchers at the freight operation appeared to be primarily concerned with their workload. In contrast, the passenger operation dispatchers found personal interactions and the physical work environment to be their primary stressors. When these responses were analyzed by job tenure, those with two to five years of experience reported the greatest number of stressors.

In contrast to the results of the background survey, there was little evidence of a high level of stress from either the subjective stress ratings or the salivary cortisol levels. The salivary cortisol results were well within normal levels for adults.

*Fatigue* – Subjective ratings of fatigue significantly increased through the duration of all shifts, doubling or nearly doubling in all cases. Fatigue ratings for the start and end of the night shift were significantly higher than those for the day and evening shifts. Sleep patterns of the participants appeared normal and there was no evidence of an acute sleep debt.

## Discussion

This field study offers some important insights into the job demands of a railroad dispatcher and the related levels of workload, stress and fatigue. In reviewing the findings, it is important to keep in mind that the study involved only 37 dispatchers from two dispatching centers for a two-week data collection period. Therefore, the results may not be generalizable to other centers or to the nation's dispatcher population as a whole.

The results of this study suggest the following:

- Investigation into health-related problems in the U.S. dispatcher population merits further attention.
- Dispatcher workload is a more complex construct than anticipated. Future measurement of a dispatcher's workload should consider the cognitive aspects of the job.
- Stress in the dispatching environment is multivariate in nature and not completely centered on the work itself.

While the study produced little evidence to support either an acute or chronic sleep debt for this group, participants did report an increase in perceived fatigue over the course of the shift.



The use of planned breaks during the shift is one recognized strategy for alleviating this feeling of fatigue.

### **WANT MORE INFORMATION?**

Popkin, S., Gertler, J., and Reinach, S. A *Preliminary Examination of Railroad Dispatcher Workload, Stress, and Fatigue*. (Report No. DOT/FRA/ORD-01-08) Washington, DC: Federal Railroad Administration.

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