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Work Schedules and Sleep Patterns of Railroad Train and Engine Service Employees in Passenger Operations

Office of Railroad
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13. ABSTRACT (Maximum 200 words) This report presents the results of a study designed to characterize the work/rest schedules and sleep patterns of U.S. railroad train and engine service (T&E) personnel in passenger service and to examine the relationship between these schedules and fatigue. The methodology was a survey of a random sample of U.S. railroad passenger service T&E personnel who completed a background survey and kept a daily log for 2 weeks. Two-thirds work a "straight thru" schedule, and the remainder is divided between split and extra board assignments. Those with straight thru assignments had the longest workdays, and those with split assignments the shortest. Extrapolation of survey data to 30 days indicated that if new hours of service statutory provisions applicable to T&E personnel in freight service also applied to this group, nearly 20 percent would violate limitations on consecutive days of work. All three work schedule groups obtain similar amounts of daily sleep, but their sleep strategies differ. The split assignment group tends to nap during interim release. The Fatigue Avoidance Scheduling Tool model predicted a small proportion of work time at low effectiveness (high fatigue) levels. Self-ratings of alertness found declines from the start to end of work for straight thru and extra board workers but not those on split assignments.				
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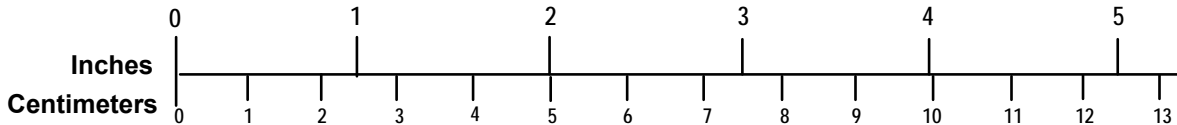
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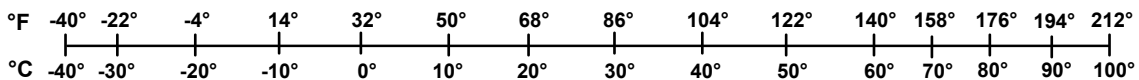
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Contents

Executive Summary	1
1 Introduction	3
1.1 Nature of Train and Engine Service in Passenger Operations	4
1.2 Objectives	5
1.3 Overall Approach	6
1.4 Scope	7
1.5 Organization of the Report	8
2 Survey Design	9
2.1 Potential Respondent Universe	9
2.2 Survey Instruments	9
2.3 Data Collection Period	10
2.4 Sampling Plan	10
2.5 Procedure	11
3 Analysis of Survey Data	13
3.1 Survey Response Rate	13
3.2 Nonresponse Bias Study	13
3.3 Worker Demographic Characteristics	14
3.3.1 Sex and Age	14
3.3.2 Type of Position	15
3.3.3 Type of Work and Work Schedule	15
3.3.4 Experience	16
3.3.5 Marital and Family Status	17
3.3.6 Health	17
3.3.7 Incidence of Sleep Disorders	18
3.3.8 Fatigue Education	19
3.3.9 Use of Caffeine	19
3.3.10 Summary of Passenger T&E Worker Demographic Characteristics	20
3.4 Job Characteristics	20
3.4.1 Call Time	20
3.4.2 Rest Days	21
3.4.3 Hours Worked	21
3.4.4 Breaks	25
3.4.5 Interim Release	26
3.4.6 Sources of Stress	27
3.4.7 Job Characteristics Summary	28
3.5 Sleep Characteristics	28
3.5.1 Daily and Primary Sleep	29
3.5.2 Comparison with Other Adult Populations	33
3.5.3 Supplementary Sleep	33
3.5.4 Sleep Quality	34

3.5.5	Sleep Quality and Sleep Disorders	35
3.5.6	Sleep Characteristics Summary	35
3.6	Alertness	36
3.7	Effectiveness	36
3.8	Textual Data	38
4	Findings and Recommendations.....	44
4.1	Key Study Findings.....	44
4.1.1	Passenger T&E Worker Health	44
4.1.2	Work Schedules.....	44
4.1.3	Effectiveness and Alertness.....	45
4.1.4	Sleep	45
4.2	Recommendations for Improvements in Study Procedures	45
4.3	Recommendations for Additional Research.....	45
5	References	46
Appendix.	Survey Materials	48
Glossary	78
Abbreviations and Acronyms	79

Illustrations

Figure 1. Overall Approach	7
Figure 2. Distribution of Respondents by Age Group	15
Figure 3. Type of T&E Work	16
Figure 4. Sick Days Taken in the Past Year	18
Figure 5. Exposure to Fatigue Education.....	20
Figure 6. Typical Workday by Daily Schedule (median)	22
Figure 7. Distribution of Break Lengths	26
Figure 8. Distribution of Length of Interim Release Periods.....	27
Figure 9. Sources and Levels of Stress	28
Figure 10. Total Daily Sleep by Type of Day and Work Schedule	32
Figure 11. Primary Sleep by Type of Day and Work Schedule.....	33
Figure 12. Daily Sleep on Workdays Compared with U.S. Working Adults	34
Figure 13. On-the-Job Effectiveness by Work Schedule.....	37

Tables

Table 1. Discrepancies between Chronological and Perceived Age by Age Group (percent)	15
Table 2. Years of Commuter T&E Experience by Type of Schedule	17
Table 3. Comparison of Passenger T&E Sick Days with U.S. Working Adults	19
Table 4. Guaranteed Rest Days by Type of Schedule	21
Table 5. Work in 2 Weeks by Type of Schedule	23
Table 6. Length of Interim Release (h:min).....	23
Table 7. Work on Rest Days in Past Month.....	24
Table 8. Conformity with RSIA Freight Rest Period Requirements (after occurrences of initiating an on-duty period on 6 or 7 consecutive d)	25
Table 9. Total Daily Break Time by Schedule Type	25
Table 10. Sleep by Type of Day and Work Schedule.....	30
Table 11. Average Sleep Quality Ratings by Type of Schedule.....	35
Table 12. Sleep Quality Ratings for Respondents with and without Sleep Disorders.....	35
Table 13. Alertness at Work by Type of Schedule (percent).....	36
Table 14. Keywords Used for Each Topic Area Search	39
Table 15. Frequency of Comments by Topic Area.....	40

Executive Summary

Federal laws governing railroad employees' hours of service date back to passage of the Hours of Service Act in 1907. These laws, collectively referred to as the hours of service laws (HOS Law) in this document, are intended to promote safe railroad operations by limiting the hours of work of three categories of railroad employees: train and engine service (T&E), signalmen, and dispatchers. The HOS Law governs the duty hours of T&E employees who work in passenger operations.

Passage of the Rail Safety Improvement Act of 2008 (RSIA) changed the statutory limits on work hours for T&E workers in freight service and kept T&E workers in passenger service temporarily subject to pre-RSIA statutory limits pending exercise of the Federal Railroad Administration (FRA) authority to prescribe different regulations for passenger T&E workers. FRA undertook the study described in this report to develop scientific data on which FRA could base its recommendations regarding HOS limitations for passenger T&E workers.

The work schedules of passenger T&E employees are highly predictable because the trains operate on a planned train schedule. Jobs in passenger service may involve either a *straight thru* or a *split* assignment. A straight thru assignment has one continuous on-duty period. With a split assignment, the individual works the morning rush, has time off in the middle of the day, and returns to work the evening rush. The period of time between the two work periods is known as interim release and is at least 4 hours (h). As is the case in freight operations, passenger railroads maintain an *extra board* of individuals who are available to fill in for regularly scheduled employees.

Survey Design

The study used two survey instruments—a background survey and a daily log. Survey participants used the background survey to provide demographic information, descriptive data about their job and work schedule, and a self-assessment of overall health. The daily log provided the means for survey participants to record their daily activities in terms of sleep, personal time, commute to/from work, break time and work time, limbo time, and interim release. Study participants also provided self-assessments of the quality of their sleep and their level of alertness at the start and end of each work period. The study used a 14-day (d) data collection period to accommodate those who hold extra board assignments.

Researchers drew a random sample of 1,275 passenger T&E workers. Mailing of the survey materials occurred on December 31, 2009.

Survey Response Rate

The overall response rate for the survey was 21 percent. The nonresponse bias study, based on age, found no difference between survey respondents and nonrespondents.

Passenger T&E Worker Demographics

Survey participants reported an average age of 47 years (yr) with 40 percent 50 yr or older. Two-thirds are conductors or assistant conductors, and the remaining participants are locomotive engineers. Nearly all (93 percent) are involved in train operation with the remainder working in yards or on work trains. Overall, the group has an average of 15.7 yr of experience. Those with the most experience work split assignments. Over 6 percent reported having a diagnosed sleep

disorder, a level not statistically different from U.S. working adults. Over half have had no fatigue education.

Job Characteristics

Two-thirds work a straight thru assignment with the remainder divided between split assignment and extra board assignment. On average, during the 2-week period of the survey, the straight thru group worked the most (90:05 (hours:minutes)), and the split assignment group worked the least (78:40). The straight thru group also had the most daily duty hours (8:44). Interim release periods average 5:26 with a quarter exceeding 6 h. A third reported working on a rest day in the past month. Nearly all had guaranteed rest days with 15 percent of the extra board group having none.

By extrapolating the 2 weeks of survey data to 30 d it was possible to assess the extent to which these individuals would fail to conform to the new freight HOS limitations if they applied. Three individuals (1 percent) would exceed the 276-hour monthly limit and 46 (19 percent) had work patterns that would violate any applicable freight rest provisions of RSIA.

Sleep Characteristics

The three schedule groups obtain similar amounts of total daily sleep but have different strategies to obtain their sleep. Straight thru workers sleep longer on rest days than on workdays. Split assignment workers supplement their workday sleep with naps, and extra board workers have similar sleep on both work and rest days. Ten percent of breaks overlapped with sleep, whereas 65 percent of interim release periods did. When compared with U.S. working adults, the passenger T&E group is less likely to be sleep deprived on workdays. Forty percent get less than 7 h of sleep on workdays in contrast to 46 percent of U.S. working adults.

Alertness

Study participants rated their alertness at the start and end of each work period. Statistical analysis found that ratings of alertness declined from the start to the end of work for straight thru and extra board workers but not split assignment.

Effectiveness

Application of the Fatigue Avoidance Scheduling Tool (FAST) model to these data found that none of the schedule groups worked at or below an effectiveness level of 70 more than 2.5 percent of their work time. An examination of effectiveness scores at the start and end of a work period found that effectiveness declines with succeeding days of work.

Findings and Recommendations

Key findings of this research are the following:

- Although many resources exist for fatigue education, over half of the passenger T&E workforce has had no fatigue training.
- Applying the current freight HOS limitations to passenger T&E employees would be problematic for the passenger service operators.
- Results of the effectiveness analysis using the FAST model indicate that a very small number of work hours occur when the employee's effectiveness is compromised.
- Passenger T&E workers take advantage of breaks and interim release to obtain adequate rest.

1. Introduction

Federal laws governing railroad employees' hours of service date back to 1907 with the enactment of the Hours of Service Act.¹ These laws, which are currently codified as amended primarily at 49 U.S.C. §§ 21101-21109 and collectively referred to in this document as the hours of service laws (HOS Law), are intended to promote safe railroad operations by limiting the hours of service of three categories of railroad employees and by ensuring that these employees receive adequate opportunities for rest in the course of performing their duties.² The groups of railroad employees covered by the HOS Law are (1) "signal employees," (2) "dispatching service employees," and (3) "train employees" (i.e., "individual[s] engaged in or connected with the movement of a train, including a hostler", (49 U.S.C. § 21101(5))). In this document "train employees" are generally referred to as "train and engine service workers" or "T&E workers." The Secretary of Transportation (Secretary) is charged with the administration and enforcement of the HOS Law. This function has been delegated to the FRA Administrator (49 U.S.C. § 103(g) (2010); 49 C.F.R. § 1.49(d), (oo) (2010)).

A number of previous studies undertaken by FRA beginning in the early 1990s through early 2009 have found that compliance with the limitations on hours of work prescribed by the HOS Law that was in effect during that period, did not prevent work schedule-related fatigue. The enactment on October 16, 2008, of the RSIA (Pub. L. No. 110-432, Div. A) not only changed the statutory limits on work hours for T&E workers in freight service (freight T&E workers), effective July 16, 2009, and kept T&E workers in intercity or commuter rail passenger service (passenger T&E workers) temporarily subject to the pre-RSIA statutory limits, but also gave FRA, by delegation, the authority to prescribe regulations for passenger T&E workers that differ from the amended statutory requirements applicable to T&E workers in freight service.³ Pursuant to 49 U.S.C. § 21102(c), effective July 16, 2009, with respect to freight T&E workers, the RSIA (specifically, 49 U.S.C. § 21103 as amended by the RSIA, which the statute designates as "new Section 21103") establishes limits per calendar month on service performed for a railroad and on time in or awaiting deadhead to final release; increases the quantity of the statutory minimum off-duty period after being on-duty for 12 h in broken service from 8 h of rest to 10 h of rest; prohibits railroads' communication with such workers during certain minimum statutory rest periods; and establishes mandatory time off-duty for such workers of 48 h after initiating an on-duty period on 6 consecutive d, or 72 h after initiating an on-duty period on 7 consecutive d (49 U.S.C. § 21103).⁴

¹ See Pub. L. No. 59-274, 34 Stat. 1415 (1907), *repealed* by 108 Stat. 1379-1380 in 1994). See also footnote 2 of this report.

² See Pub. L. No. 103-272, 108 Stat. 745-1401 (1994) (which, *inter alia*, repealed the existing general and permanent Federal rail safety statutes and revised and re-enacted them without substantive change as positive law in title 49 of the U.S. Code).

³ See Section 108 of RSIA; 49 U.S.C. §§ 21102(c), 21103, and 21109(b)-(c); and FRA Interim Statement of Agency Policy and Interpretation at 74 Fed. Reg. 30665 (June 26, 2009).

⁴ In particular, Section 108(d) of the RSIA, which became effective on October 16, 2008, provided that the requirements described above for train employees would not go into effect on July 16, 2009, for train employees of commuter and intercity passenger railroads (49 U.S.C. § 21102(c)). Section 108(d) further provided that these train employees, who provide commuter or intercity passenger rail service, would continue to be governed by the old HOS Law (as it existed immediately prior to the enactment of the RSIA, at 49 U.S.C. § 21103 prior to its 2008

In recent years, the FRA has sponsored studies to characterize the work/rest patterns of different groups of railroad workers (Gertler & Viale, 2006a, 2006b, 2007; Gertler & DiFiore, 2009). All of these studies used a consistent statistical survey methodology. The most recently completed FRA study characterizes the work schedules and sleep patterns of all T&E employees. This study, conducted in 2008, used a random sample of all actively working T&E employees in the United States. There was an inadequate number of T&E workers in commuter or intercity passenger operations in that random sample to make meaningful conclusions about this subgroup of T&E workers. The present study was undertaken to provide scientific data on which the FRA could base its recommendations regarding HOS limitations for T&E workers in commuter and intercity passenger operations.⁵ Of particular concern were those employees in commuter service who work split assignments.⁶

1.1 Nature of Train and Engine Service in Passenger Operations

T&E employees are the largest group of employees that work for a railroad. They operate the trains both between terminals and in railroad yard environments. Approximately 10 percent of all T&E employees work in passenger operations. For the most part, T&E employees who work in commuter operations return to their starting location at the end of the workday. A limited number of T&E employees in passenger operations work in a railroad yard where trains are serviced and stored between periods of peak operation.

There are five types of positions in passenger service. A *locomotive engineer* is in immediate and direct control of the motion of the train and is responsible for obeying all directions and signals as well as controlling train movement and speed between stops. A *conductor* is responsible for the train and its crew. An *assistant conductor* or *ticket collector* collects fares and attends to the passengers on the train. A *yard foreman* has responsibilities similar to those of a conductor on the train, except this individual oversees the activities of a yard crew. Although an assistant conductor or ticket collector is an assistant to the conductor on the train, a *switchman* is an assistant to the yard foreman on a yard crew.

Read in conjunction with 49 U.S.C. § 21102(c), the HOS Law at old Section 21103 (before its amendment by RSIA) currently prohibits a railroad from requiring or allowing a passenger T&E worker to remain on duty for more than 12 consecutive h in the 24-hour period that begins when the employee begins the duty tour. After 12 consecutive h on duty, the passenger T&E worker must have at least 10 consecutive h off duty before initiating a new duty period. If he or she is on duty for less than 12 consecutive h or has 12 nonconsecutive h on duty in that 24-hour period, then the old Section 21103 requires that the employee have a minimum of only 8 consecutive h

amendment (which the statute designates as “old Section 21103”), until the effective date of regulations promulgated by the Secretary (49 U.S.C. § 21102(c)). However, if no new regulations are in effect before October 16, 2011, the provisions of new Section 21103 would be extended to the passenger T&E workers at that time. *Id.*

Section 108(e) of the RSIA specifically provides the Secretary with the authority to issue hours of service rules and orders applicable to train employees engaged in commuter rail passenger transportation and intercity rail passenger transportation (as defined in 49 U.S.C. § 24102), that may be different from the statute applied to other train employees (49 U.S.C. § 21109(b)).

⁵ FRA’s proposed rule would also apply to T&E workers in tourist, scenic, historic, or excursion operations. The survey does not cover this subset of T&E workers who would be covered by the proposed rule.

⁶ A split assignment consists of two work periods on the same day separated by a period of 4 h or more.

off before returning to duty. The passenger T&E worker may work a total of 16 h (nonconsecutive) in a 24-hour period if the individual has at least 8 h off-duty between two 8-hour work periods. Old Section 21103 limits the length of the passenger T&E worker's on-duty period and provides for guaranteed time off, but unlike new Section 21103, old Section 21103 does not address either the number of consecutive days that the individual may work or guaranteed rest days and does not consider the time of day of rest periods.

As previously discussed, the RSIA amended the HOS Law by providing that, effective July 16, 2009, freight T&E workers must have 10 consecutive h of undisturbed rest in a 24-hour period, regardless of the number of hours worked, before initiating a new on-duty period, and may work no more than 276 h in a calendar month. In addition, RSIA (i.e., new Section 21103) requires that if a freight T&E employee has initiated an on-duty period on 6 consecutive d, then the employee must have 48 consecutive h off-duty at his or her home terminal. RSIA also requires 72 h off-duty following seven consecutive work starts. Because of the differences between the schedules of freight T&E workers and passenger T&E workers, this new law provides that FRA has the authority to prescribe regulations different from the statutory requirements at new Section 21103 and that those new regulations would control if they have been issued and are in effect by October 16, 2011. In the interim, old Section 21103 applies to passenger T&E workers. If the new regulations are not in effect by October 16, 2011, then new Section 21103 would apply not only to freight T&E workers but also to passenger T&E workers.

Commuter and intercity passenger services operate in accordance with a planned train schedule. As such, the work schedules for T&E employees are highly predictable. Trains run more frequently during the morning and afternoon peak commuting times. With the exception of the Long Island Rail Road (LIRR), no commuter service runs continuously for 24 h daily. Jobs in passenger service may involve either a *straight thru* or a *split* assignment. A straight thru assignment has one continuous on-duty period. With a split assignment, the individual works the morning rush, has time off in the middle of the day, and returns to work the evening rush. The period of time between the two work periods is known as *interim release*. During this period, the employee is off-duty but may be required to be available to work if called. The interim release must be at a location where suitable food and lodging are available. Typically, the railroad provides a quiet room or other facility where the employee may rest. If the interim release period is less than 4 h, it counts as on-duty time in terms of the HOS Law, so there is a disincentive for the railroad to limit the time between the two work periods. The end result for split assignments is that the time that the employee has before and after work for personal activities and sleep becomes limited.

Yard jobs, like those in freight operations, are on a regular schedule. Depending on the size of the yard, there may be multiple shifts.

As is the case in freight operations, passenger railroads maintain an extra board of individuals who are available to fill in for regularly scheduled employees during vacations, training, and other planned absences as well as unanticipated absences. Although extra board employees usually have advance notice of their work schedule, sometimes the work assignment has a short notice. In these instances, the employee may not have adequate opportunity for rest.

1.2 Objectives

This study had two primary objectives:

- To design and conduct a survey to collect work schedule and sleep data from T&E employees in commuter and intercity passenger service.
- To analyze the survey data to characterize the work/sleep patterns and to identify work-schedule-related fatigue issues.

The goal was to characterize T&E workers in commuter and intercity passenger service as a group and not to characterize T&E workers on a specific railroad. This characterization will inform FRA's rulemaking efforts with respect to the limitations on hours of service. It will also serve as a baseline for comparison once any changes in HOS regulations take effect.

Specific research issues that the study sought to answer included the following:

- On average, how many hours does a passenger T&E employee work in 2 weeks?
- What is the distribution of passenger T&E employees among the different types of work schedules, specifically straight thru assignments, split assignments, and extra board?
- How many hours does a passenger T&E employee work daily? Does this differ for those on straight thru assignments versus split assignments?
- What is the average daily sleep of passenger T&E employees? How does this compare with other adult working populations?
- How does daily sleep vary based on type of schedule?
- How much break time is available on a typical day?
- Is there a difference in on-the-job alertness based on type of work schedule?
- Does the number of sick days taken vary by type of work schedule? How does this compare with U.S. adult norms?
- Are work schedule issues major sources of workplace stress?
- To what extent have passenger railroads provided sleep/fatigue education?
- How prevalent is sleep apnea among passenger T&E workers?

1.3 Overall Approach

Since no existing data sources could provide answers to the above issues, a survey of T&E workers in passenger service was the only means to obtain the necessary work schedule and sleep data. The research project consisted of three phases: preparation, field data collection, and data analysis (see Figure 1). The preparation phase involved designing the survey methodology and procedures, conducting a pilot survey to refine the survey instruments and data collection procedure, securing approval from the U.S. Office of Management and Budget (OMB), and preparing the final survey instruments. (Because this survey involved more than nine participants, Federal regulations required that OMB approve the overall study design.) Activities during this phase included discussions with BLET and UTU representatives to assure them the survey instruments had suitable wording and would collect the data necessary to address the research issues. A pilot survey, conducted in parallel with the OMB review process, ensured that the survey would capture the data needed to meet the survey objectives.

The second phase of the research consisted of distributing the survey materials and collecting the survey data. Coding and analysis of the survey data was the final phase. A nonresponse bias study validated that no difference existed between the survey participants and the nonrespondents. The data analysis methods for the survey data included descriptive statistics, analysis of variance (ANOVA), and textual analysis of the log book comments.

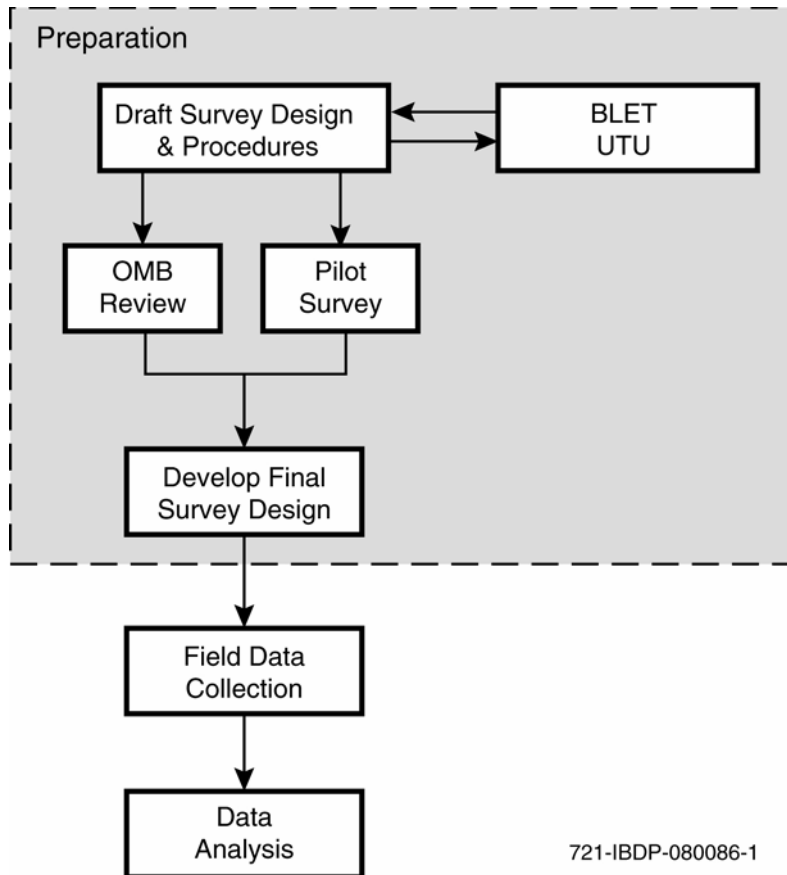


Figure 1. Overall Approach

1.4 Scope

This research involved T&E employees working in passenger operations in the United States and covered by the HOS Law. Because the effect of split assignments on worker fatigue was of particular interest, the study design focused on capturing an adequate number of individuals working this type of schedule. The study characterized three separate groups of T&E workers, those working straight thru assignments, those working split assignments, and those working on extra board assignments. The study did not attempt to characterize employees working for specific railroads. Making recommendations regarding fatigue countermeasures was beyond the scope of the study.

1.5 Organization of the Report

Section 2 describes the overall survey design and procedures. Section 3 provides an analysis of the survey results, and Section 4 contains the findings and recommendations. A list of references appears in Section 5. The Appendix contains copies of the survey materials. A glossary containing definitions for statistical and railroad terminology used in this report and a list of abbreviations and acronyms used in this report follow the Appendix.

2. Survey Design

One of the objectives of this study was to characterize the work schedules and sleep patterns of U.S. T&E workers in commuter and intercity passenger service (passenger T&E workers). Achieving this objective required a nationwide survey. The only practical means of reaching these individuals was through their labor organizations, BLET and UTU. This section describes the potential respondent universe, the survey instruments, sampling plan, and procedures that the researchers developed to survey this population. This methodology is similar that was used in the recently completed survey of all T&E workers (Gertler & DiFiore, 2009) as well as the earlier studies of railroad signalmen, maintenance-of-way workers, and dispatchers.

2.1 Potential Respondent Universe

The potential respondent universe was the 7,000 T&E employees actively working in passenger service at railroads where split assignments exist and where national labor unions represent T&E employees. The majority of these, approximately 5,700, are members of UTU. The remainder belongs to BLET.

2.2 Survey Instruments

This study used two survey instruments, a background survey and a daily log. (Copies of both instruments appear in the Appendix.) The background survey gathered demographic information, descriptive data for the passenger T&E worker's current position and work schedule, and a self-assessment of overall health. The purpose for collecting this data was twofold.

First, it provided data for characterizing this subset of the T&E worker population. Second, the survey provided identifying data that the researchers used in conjunction with the daily log to characterize the work/sleep patterns by the three primary types of work schedule in passenger operations: straight thru assignments, split assignments, and extra board assignments.

This survey instrument also asked participants to rate, using a Likert scale of 1 to 4, potential sources of stress at work. In addition, the background survey included a list of life stress events. In the event that a participant's daily log indicated frequent nighttime awakenings or excessive fatigue, the researchers could use the individual's response to this section of the background survey to ensure that nonwork circumstances were not confounding the survey data. Completion of the background survey required less than 15 min.

The daily log provided the means for survey participants to record their daily activities in terms of sleep, personal time, daily commute to and from work, interim release (by definition, a period of at least 4 consecutive h at a designated terminal) or break time (by definition, a period of less than 4 consecutive h), and limbo time.⁷ Survey participants recorded the start and end time of each activity in graphical format. They also provided self-assessments of the quality of their sleep and their level of alertness at the start and end of each work period. For those with split assignments, they rated their alertness at the start and end of each segment of their workday. The

⁷ Limbo time is neither on-duty time nor off-duty time and includes time in, or awaiting, deadhead transportation to the point of final release. For example, it is the time after an employee stops operating the train until he or she is released from duty.

subjective assessments used a five-point Likert scale. The daily log included space to record “Comments on Today’s Activities.” The instructions for the daily log encouraged participants to use that space to explain anything unusual about the day’s activities. These comments proved useful in understanding an irregular work or sleep pattern and, in general, complemented the study’s quantitative findings. Completion of the daily log required less than a total of 10 min daily.

2.3 Data Collection Period

Examination of the relationship between work schedules and fatigue requires data from each person that encompasses at least a full work cycle. Fatigue is cumulative, and its effects on the individual are not readily identified from 1 or 2 d of data. In addition, adequate data must be available from both workdays and rest days so that the individual’s ability to compensate for lost sleep on workdays can be assessed. (A rest day is one on which there is no start of a duty period.) T&E workers with a regular work schedule have a work cycle of 1 week. This study used a 14-day data collection period to accommodate those T&E workers in commuter service who hold extra board jobs and as such do not have a regular work schedule.

2.4 Sampling Plan

Both BLET and UTU maintain databases with the names, mailing addresses, and dates of birth for all of their members. Representatives from each organization identified the union locals whose members worked in passenger service at railroads where split assignments exist. The membership databases do not include the individual’s current assignment, so it was not possible to identify those on split assignments *a priori*. Only actively working union members living in the United States could be in the sampling frame. Retirees, full-time union officials, and anyone currently holding a railroad management position were not eligible for the study. The effective sampling frame was 7,175. A total of 5,665 were UTU members (79 percent), and the others (1,510) were BLET members (21 percent). The researchers drew a random sample from each group. The size of the sample from each group was proportional to that organization’s representation in the sampling frame.

One of the most important issues in conducting this study is determining how large a sample is necessary for the estimates obtained in the sample survey to be reliable enough to meet the objectives of the study. In general, the larger the sample, the greater the reliability of the resulting estimates, but this must be traded off against the expense of a larger sample. The first step in this process is to specify the level of reliability needed for the resulting estimates.

The appropriate sample size, n , for estimating the mean daily sleep time can be computed from the following (Levy & Lemeshow, 1999):

$$n \geq \frac{(z^2 NV_x^2)}{z^2 V_x^2 + (N - 1)\epsilon^2}$$

where z = reliability coefficient (1.96 for 95 percent confidence level)

N = population size

V_x = unknown population variance

ϵ = error tolerance

This estimation for sample size applies as well to other mean values, such as work and commute time, that the study seeks to estimate.

Webb (1992) estimates the standard deviation for daily sleep for the general population is 1 h. On the basis of the data from several large commuter railroads, FRA estimates that 38 percent of T&E employees work a job with a split assignment. If this estimate of standard deviation for sleep (and hence V_x , variance) is applied to the T&E commuter population working split assignments ($N = 2,727$) and if an $\epsilon = 0.15$ is used, there must be 160 (n) split assignment workers in the sample. If the 38 percent of the sampling frame has a work schedule with a split assignment, the total sample size must be 421 ($160/0.38$) to ensure an adequate number of split assignment people. Because it was not possible to know *a priori* the type of work schedule that each BLET and UTU member works, a stratified sample was not possible.

Because not every BLET and UTU member who is selected to participate in the survey would choose to do so, oversampling was necessary. The extent of oversampling is a function of the anticipated response rate. The recently completed survey of all T&E workers had a response rate of 33 percent (Gertler & DiFiore, 2009). For the purposes of establishing the size of the random sample, the researchers assumed that the present study could achieve at least this response rate. If 33 percent of the selected individuals in the random sample choose to participate in the survey, then the random sample must be 1,275 ($421/0.33$).

2.5 Procedure

In accordance with government regulations, FRA sought approval for the proposed survey from OMB. OMB approved this collection of information under OMB control number 2130-0588 on December 2, 2009.

Concurrent with submittal of the OMB application, the researchers conducted a 1-week pilot survey with seven participants. The purpose of the pilot survey was to refine the data collection procedures and survey instruments. Both BLET and UTU assisted the researchers in identifying suitable participants for this pilot survey. People working both straight thru and split assignments participated in the pilot survey. Pilot participants completed the T&E Passenger Service Employee Background Survey and T&E Passenger Service Daily Log as well as a brief Post-Survey Feedback Form to provide feedback on the survey instruments and procedures. Similar to the full survey, pilot participants received a \$75 gift certificate to a national retail establishment. On the basis of the experience with the pilot survey, the researchers made one change in the background survey. On the list of life events, the item “Marital difficulties” was changed to “Marital/relationship difficulties.”

The pilot survey identified a number of problems with the daily log. On the basis of the feedback and experience with the pilot survey, the following changes were made:

- The size of the log book pages was changed from 5.5×6.75 in to 5×7 in, and the spiral binding was placed at the top of the page.
- The space on the page for recording times was increased.
- The alertness ratings associated with work periods were moved so that they were co-located with the work period start and end times.

- The address for returning the survey materials was printed in the log book in the event an individual misplaced the provided return envelope.

BLET and UTU each identified their members who worked in commuter operations. The researchers drew a random sample of 268 BLET members and 1,007 UTU members, without replacement, from the sampling frame derived from the two lists of eligible individuals. The package mailed to each participant on December 31, 2009, consisted of the following items:

- The *T&E Passenger Service Employee Background Survey* in booklet form. Each page was 5.5 × 8.5 in, printed on white paper with no questions on the cover page.
- The *T&E Passenger Service Employee Daily Log* in spiral notebook form. Each page was 5 × 7 in. The daily log included 14 sections, one for each day of the data collection period. Brief instructions and a sample entry appeared at the beginning of the log book.
- A *cover letter* signed by the president of the passenger T&E employee's labor organization. This letter explained the purpose of the study and encouraged participation.
- *Instructions* explaining the survey procedures and how to complete the daily log.
- A *return envelope*, postage paid.
- A *\$5 bill*.

Copies of the cover letters and instructions appear in the Appendix along with the survey instruments.

All materials were printed on high-quality paper, and each letter was individually addressed to the recipient. The instruction sheet was printed on yellow paper to increase the likelihood that recipients would read it. The mailing envelope for the survey packet used the union return address rather than QNA, because it would be familiar to recipients. The purpose of the \$5 was to encourage participation. Those who returned both the background survey and the daily log also received a \$75 gift certificate to a national retail establishment.

The instructions emphasized that 14 consecutive d of data should be provided and that data should not be reported during vacation periods. Both the instructions and the log included contact information for three QinetiQ staff members, two who were available to answer questions regarding the survey instruments and procedures and an individual who could provide additional copies of the survey materials.

Ten days after distribution of the survey materials, every survey recipient received a postcard, signed by their union president, to encourage them to participate in the survey. Three weeks after distribution of the materials, every survey recipient who had not yet returned the survey materials or indicated that they were not interested in participating received a second postcard to thank those who had decided to participate and to encourage those who had not yet done so to participate in the study. The second postcard reminded participants that February 15 was the deadline for returning survey materials and provided a QinetiQ contact for duplicate survey materials.

3. Analysis of Survey Data

This chapter presents the survey findings based on data provided in respondent background surveys and daily logs. The results are organized into the following subtopic headings:

- Survey response rate
- Nonresponse bias study
- Commuter T&E worker demographic characteristics
- Job characteristics
- Sleep characteristics
- Alertness
- Effectiveness on the job
- Textual data

3.1 Survey Response Rate

The survey materials were mailed to 1,275 T&E workers in commuter and passenger service. To include as many individuals on split assignments as possible, the survey design excluded individuals from the LIRR because the LIRR does not use split assignments. However, because of an error in identifying eligible members, individuals from the LIRR were included in the random sample of UTU members. This situation was not obvious to the researchers until the survey materials were returned. Regardless, there were an adequate number of split assignments to characterize this type of commuter schedule. A total of 269 respondents returned both the background survey and the activity/sleep log. Data from 13 of these respondents could not be used because either there were problems with the log books or the respondents were not in crafts covered by the survey. (In some locations, UTU represents all employees, not just T&E. Excluding non-T&E people from the sampling frame was not possible because the UTU database does not identify members by craft.) The overall response rate was 21 percent. The final analysis used data from 256 respondents who returned both survey instruments and were T&E workers. Because the number of usable responses was less than the target level of 421, the effective error tolerance (ϵ) is 0.195 or ± 0.0975 .

3.2 Nonresponse Bias Study

OMB requires a statistical analysis assessing response bias if the response rate of a survey is less than 75 percent. The purpose of this analysis is to determine whether respondents differ from nonrespondents with respect to personal characteristics.

Personal information for nonrespondents was limited to information from the union membership databases. In addition to each member's address, these databases contain members' birth dates. Birth date (or age) is an appropriate variable to use for assessing nonresponse bias because sleep patterns are known to change as an individual ages (Van Cauter, Leproult, & Plat, 2000). In addition, age is positively correlated with years of experience. Therefore, experienced personnel with more seniority may get to choose convenient work schedules and as a result be more rested than individuals with less seniority.

The 262 individuals who returned both survey instruments were respondents. The remaining members of the sample were nonrespondents. Birth dates were not available for 27 people, so they were not included in the nonresponse bias study, reducing the number of nonrespondents to 986. An analysis comparing the mean age of respondents and nonrespondents found no significant difference, $t(1,246) = 1.795, p = 0.073$.

3.3 Worker Demographic Characteristics

This section provides demographics, as well as basic job-, family-, and health-related information based on responses in the background survey. Where appropriate, the study includes comparisons of the study results with national norms.

Characterization of the commuter T&E workforce considered many factors. These factors are sex and age, type of position and type of work, experience, overall health, sick days taken, incidence of sleep disorders, and caffeine consumption.

3.3.1 Sex and Age

The commuter T&E workforce is primarily male. Only 8.6 percent of the usable survey responses were from females, so reporting of results by sex was not meaningful. In contrast, 2 percent of T&E workers in freight service are female.

Survey respondents have an average age of 46.6 yr, and their median age is 47. As is true with other railroad craft groups, this is an aging workforce with over 40 percent being 50 or older. Figure 2 contains the age distribution of survey respondents.

Research has found that a higher perceived age, relative to chronological age, can be an indicator of chronic stress and poor psychological well-being (Barnes-Farrell & Piotrowski, 1989, 1991).⁸ Overall, commuter T&E workers reported a lower perceived age (40.8 yr) in comparison with their average chronological age (46.6 yr). As shown in Table 1, the T&E population tends to feel younger as they age. This is the same pattern that Barnes-Farrell and Piotrowski found with permanent day shift workers in a manufacturing plant. They point out that younger people tend to report feeling older to reflect perceived maturity. The T&E workers' perceived age follows the pattern reported by these researchers and, as such, is not indicative of poor psychological well-being. Statistical analysis confirmed the differences in perceived versus chronological age, $\chi^2(8, N = 247) = 22.626, p < 0.01$.

⁸ Perceived age is the age that the individual reports feeling.

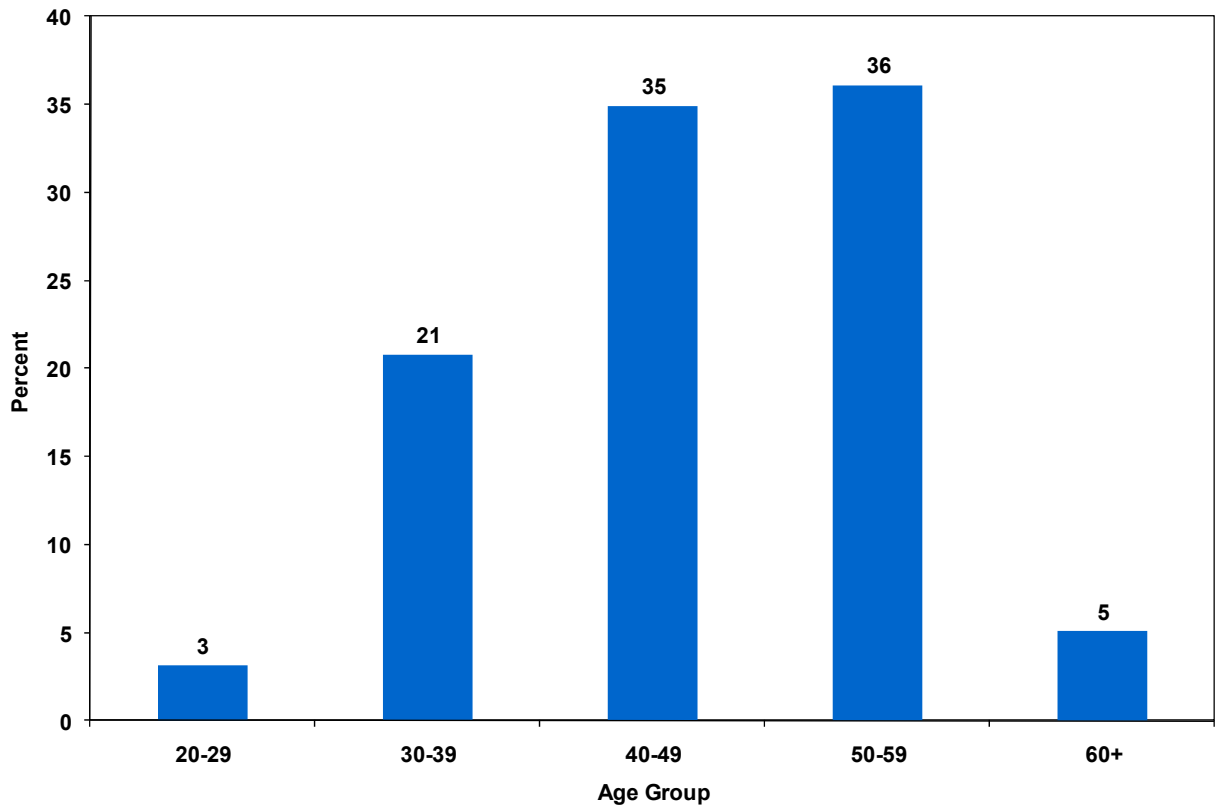


Figure 2. Distribution of Respondents by Age Group

Table 1. Discrepancies between Chronological and Perceived Age by Age Group (percent)

Age Perception	Worker Age (yr)				
	20–29	30–39	40–49	50–59	60+
Younger	45.5	55.6	63.7	81.5	90.0
Same Age	9.1	25.9	19.8	11.1	10.0
Older	45.5	18.5	16.5	7.4	0

3.3.2 Type of Position

Some T&E workers in passenger service are qualified to work in more than one position. For this reason, a small number of respondents reported working more than one type of position. Nearly half (43 percent) reported working as a conductor, and another 28 percent were assistant conductors or ticket collectors. One-third were locomotive engineers. Three people reported working other types of positions.

3.3.3 Type of Work and Work Schedule

Some T&E workers in passenger service maintain seniority to work other types of service. For this reason, some reported working in long haul and intercity service as well as other passenger

service. (Intercity service jobs are similar to commuter service in that they do not require an overnight stay at an out-of-town location.) Figure 3 summarizes the responses from survey participants.

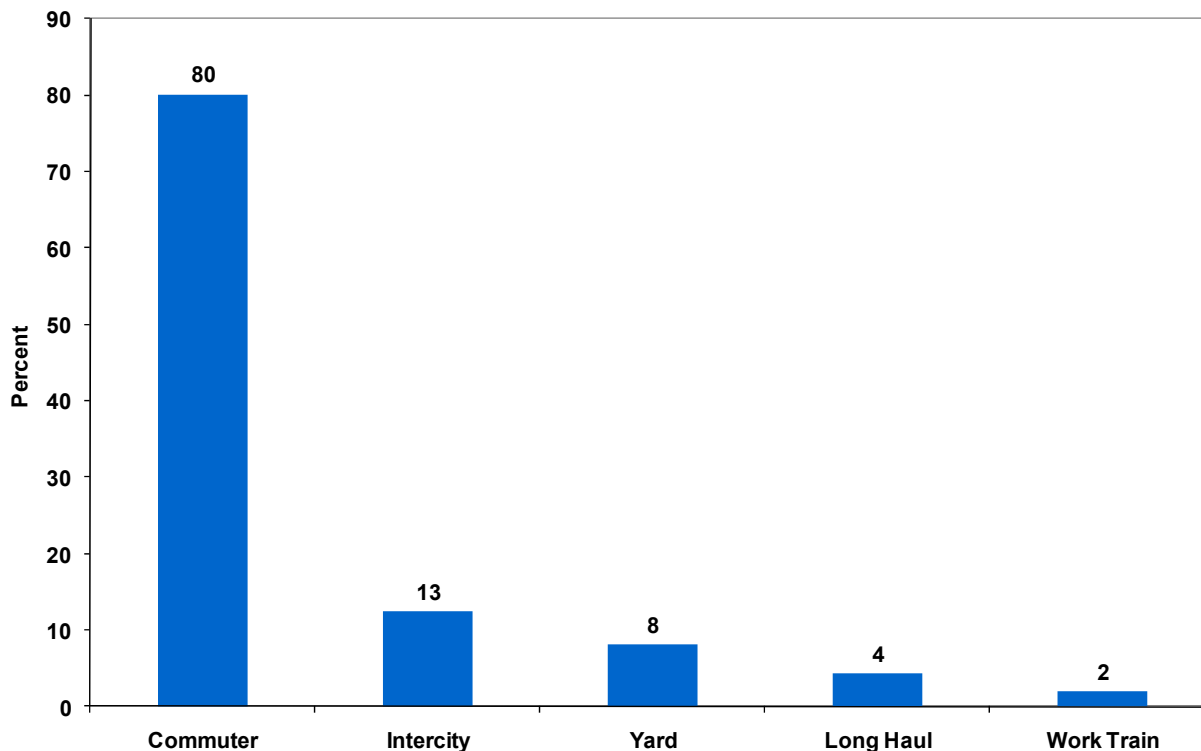


Figure 3. Type of T&E Work

Each participant’s work schedule was characterized as straight thru, split or extra board. (See Section 1.1 for an explanation of these types of work schedules.) Because some participants reported a mix of straight thru and split runs, the more frequent type of daily schedule determined the category for that person’s work schedule. For example, if a person had 3-day straight thru runs, then that person’s schedule was categorized as “straight thru” in terms of analyzing work data. Anyone who indicated on the background survey that they did not have a regular schedule was categorized as extra board. Overall, two-thirds of the survey participants had straight thru schedules, and the remainder were divided between split (17.2 percent) and extra board (16.0 percent).

3.3.4 Experience

Overall, T&E workers in the survey had an average of 15.7 yr of T&E experience and 13.2 yr with their current railroad. Since the average age of this group is 46.6 yr, some of these individuals worked in either another industry or another railroad craft prior to working in passenger service. Table 2 presents the experience levels by type of schedule. Those workers with more experience tend to work jobs with split assignments. Because jobs are chosen on a seniority basis, those with experience select the more desirable jobs, which in this case appear to be those with split assignments. Assuming that the split assignment leaves the individual at the

home terminal during the interim release, this type of schedule gives the T&E worker the flexibility to take care of personal business during the midday rather than before or after work. Both the total years of experience and years of experience with the current employer are statistically different based on schedule.

Table 2. Years of Commuter T&E Experience by Type of Schedule

	Schedule*	Mean (Std. Dev.)	Median
Total experience	Straight thru	15.1 (9.2)	13.2
	Split	23.4 (10.3)	22.4
	Extra board	10.6 (8.2)	9.6
Experience with current employer	Straight thru	12.8 (7.4)	11.0
	Split	18.3 (9.3)	20.9
	Extra board	9.8 (7.8)	8.1

*Total experience comparison among schedule types, $F(2, 237) = 19.388$ ($p < 0.001$).

Current experience comparison among schedule types, $F(2, 230) = 11.583$ ($p < 0.001$).

3.3.5 Marital and Family Status

Most recent data from the U.S. Census indicates that 70 percent of males between 45 and 54 are married (U.S. Census Bureau, 2009). For the U.S. male population 18 and older, 58.9 percent are married. At the time of the study, 75.8 percent of the respondents were married, 10.5 percent single, 10.2 percent divorced, 1.2 percent widowed, and 2.3 percent categorized themselves as other. (These were likely separated or living with a partner.)

The survey asked participants whether their family included young children, a factor that can lead to disrupted sleep. Although a large percentage of the group is married, only 6.7 percent had children under 2 yr. This finding is not surprising given the average age of this group of railroad workers.

3.3.6 Health

A recent study of the health of the American workforce (Aumann & Galinsky, 2009) found that 79 percent of the respondents rated their overall health as good (51 percent) or excellent (28 percent). The T&E background survey asked an identical question. Participants rated their health as excellent, good, fair, or poor. A total of 90 percent of commuter T&E workers rated themselves in good (59.8 percent) or excellent (30.5 percent) health. The difference in perceptions of overall health between the passenger T&E workers and the U.S. workforce may be due to the availability of health insurance to all passenger T&E workers. This difference is statistically significant, $z = 7.46$, $p < 0.001$.

Analysis of these responses by type of work schedule found no difference in perceived health among the three types of work schedules, $\chi^2(256) = 2.330$, $p = 0.675$. Similarly, no difference existed in the number of sick days based on schedule, $F(2, 254) = 1.167$, $p = 0.313$.

Figure 4 presents the frequency of sick days for all passenger T&E workers. The mean number of sick days is 4.2, and the median is 3 d. As a group, passenger T&E employees take more sick days than U.S. adults (see Table 3). Those with a straight thru schedule, who comprise two-

thirds of the total, average 4.4 sick days per year, the same as age 45–64 adults. In contrast, working U.S. adults average 3.6 d, and adult males averaged 3.0. An explanation for this small difference is not readily apparent.

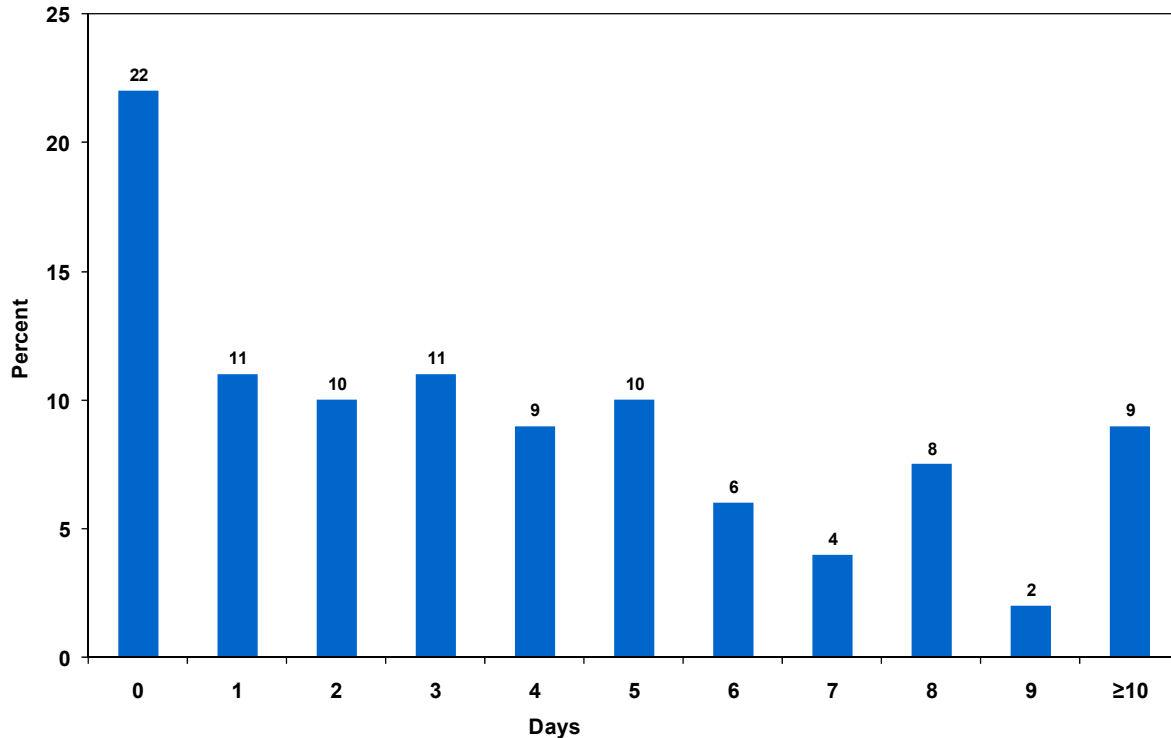


Figure 4. Sick Days Taken in the Past Year

3.3.7 Incidence of Sleep Disorders

The Wisconsin Sleep Cohort Study, a longitudinal study of cardiopulmonary sleep disorders among middle-aged working adults, estimated that 2 percent of women and 4 percent of men have sleep apnea (Young et al., 1993). (The definition of sleep apnea for this study was an apnea-hypopnea score of 5 or higher and daytime hypersomnolence.) The National Sleep Foundation (NSF) and the National Institutes of Health report the numbers from the Wisconsin study as an estimate of the prevalence of sleep apnea among U.S. adults. Some sleep researchers hypothesize that the prevalence of sleep apnea may in fact be higher because many remain to be diagnosed. According to the Wisconsin study, 9 percent of women and 24 percent of men have undiagnosed sleep-disordered breathing, a condition that in some people results in excessive daytime sleepiness.

Table 3. Comparison of Passenger T&E Sick Days with U.S. Working Adults

Group	Mean Work-Loss Days
All passenger	4.2
Straight thru assignment	4.4
Split assignment	4.0
Extra board assignment	3.2
U.S. Adults*	3.6
U.S. Adult Males*	3.0
U.S. Adults Age 18–44*	3.2
U.S. Adults Age 45–64*	4.4
Private Health Insurance (<65 yr)*	3.8

*U.S. Department of Health and Human Services, 2009.

Of the 256 participants in this study, 17 individuals, or 6.6 percent reported having a sleep disorder. All but 2 participants (5.9 percent) reported having sleep apnea, and 14 participants, or over 80 percent, reported receiving treatment. The remainder may have mild to moderate sleep apnea, which does not always require treatment or those individuals may have chosen not to seek treatment. The difference in incidence of sleep apnea between this population and U.S. adult males is not statistically significant, $z = 1.55$, $p = 0.061$.

3.3.8 Fatigue Education

The background survey asked about participants' exposure to educational materials or training on fatigue, sleep hygiene, napping, or sleep disorders. Slightly more than half (52 percent) reported having no fatigue education. A brochure was the most common type of training (see Figure 5). A total of 17 percent reported receiving more than one type of fatigue training.

3.3.9 Use of Caffeine

NSF reports that 250 mg of caffeine a day, the equivalent of a soda and a couple of cups of coffee, generally poses no harm. Nearly 90 percent of respondents reported using caffeine on a daily basis, and averaged less than 3 cups or cans a day. This level of caffeine consumption is within normal healthy limits, and the group's sleep is likely not disrupted by caffeine, unless the consumption occurs close to a sleep period (NSF, 2002).

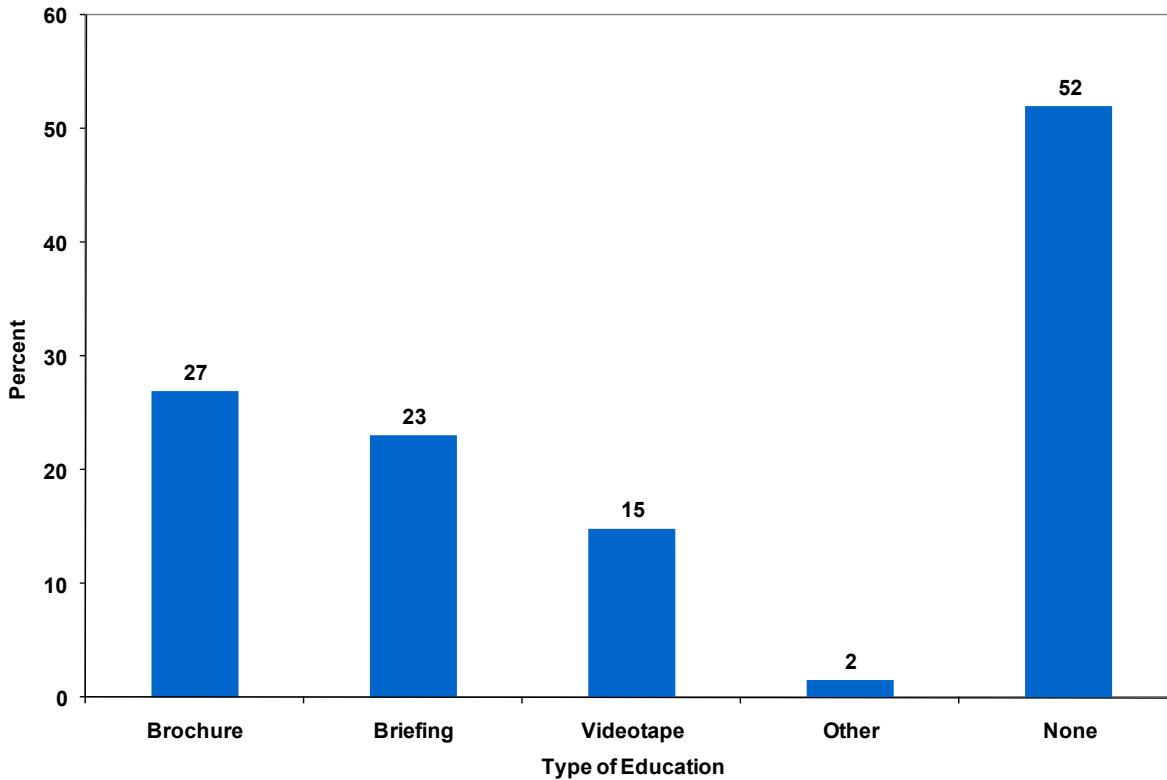


Figure 5. Exposure to Fatigue Education

3.3.10 Summary of Passenger T&E Worker Demographic Characteristics

Participants in the study reported an average age of 47 yr with 40 percent in the 50 or over category. Two-thirds are conductors or assistance conductors, and the remaining participants are locomotive engineers. Nearly all (93 percent) are involved in train operation with the remainder performing yard operations and work train activities. Overall, the group has 15.7 yr of passenger service experience, and 13.2 yr with their current employer. Those with the most experience hold the split assignments. Over 90 percent rate their health as good or excellent, but the group's use of sick days is slightly higher than that of U.S. middle-aged working males. Over 6 percent reported having a diagnosed sleep disorder; 15 of the 17 reported cases were sleep apnea. Over 80 percent are receiving treatment for their sleep disorder. Over half have not had any type of fatigue education.

3.4 Job Characteristics

This section explores several aspects of the T&E passenger service worker's job, including work/rest schedule, hours worked, call time, and sources of workplace stress.

3.4.1 Call Time

Passenger service employees who hold an extra board position, which does not have a regular schedule, have a call time associated with their job. This is the minimum length of time prior to the start of duty that the employer may call the employee for work. A total of 34 of the 41 extra

board workers in the study responded to the questions concerning call time and call window. The median call time was 3 h. The majority (78 percent) reported that they were on call 24 h a day, but 22 percent reported that they were subject to a call window, or limited time period, when they must be available for work.

Checking the lineup is a strategy that extra board employees use to gauge when they are likely to be called for work. This is a key strategy that they use in trying to plan their rest and personal activities. Those with extra board assignments reported checking the lineup an average of 2.6 times a day.

3.4.2 Rest Days

Provision for rest days differs among the three types of work schedules. The majority of those on straight thru and split assignment jobs have two consecutive days per week off, but the pattern for extra board personnel is different. Approximately 15 percent have no guaranteed days off, and the remainder has either 2 consecutive d per week or 1 guaranteed day off. The provision for guaranteed rest days was statistically different by type of schedule, $\chi^2(8, N = 254) = 73.52$, $p < 0.001$.

Table 4. Guaranteed Rest Days by Type of Schedule

Guaranteed Days	Straight thru	Split	Extra Board
None	0.6%	0%	14.6%
2 d per week	11.1%	16.7%	0
2 consecutive d per week	80.1%	71.4%	41.5%
1 d per week	6.4%	7.1%	41.5%
Other	1.8%	4.8%	2.4%

3.4.3 Hours Worked

Through the background survey, the study collected data on a nominal workweek and a typical workweek. Unfortunately, survey participants did not understand the instructions for recording their regular schedule (nominal workweek). Because so many responses were incomplete, these data were not meaningful, and the results for nominal workweek were not computed. Using the daily log book, participants recorded their actual on-duty hours as well as break time, interim release, and commute time. The log book included a place for limbo time, but there were very few entries in this category. Since limbo time rarely occurs in passenger operations, this was not unexpected.

Figure 6 compares the typical passenger T&E workday by type of schedule. The results in this figure were calculated by combining all of the work assignments reported by all of the participants. For a straight thru assignment, the duty hours are the sum of work time and break; for a split assignment, the duty hours are simply the work time. Breaks were rare for split assignments. Because the median break time for split assignments was extremely small, it is not included in the figure. The commute times were similar for the individuals working each type of

schedule, but the duty hours differed, 7.9 h for a straight thru assignment and 7.6 h for a split assignment.

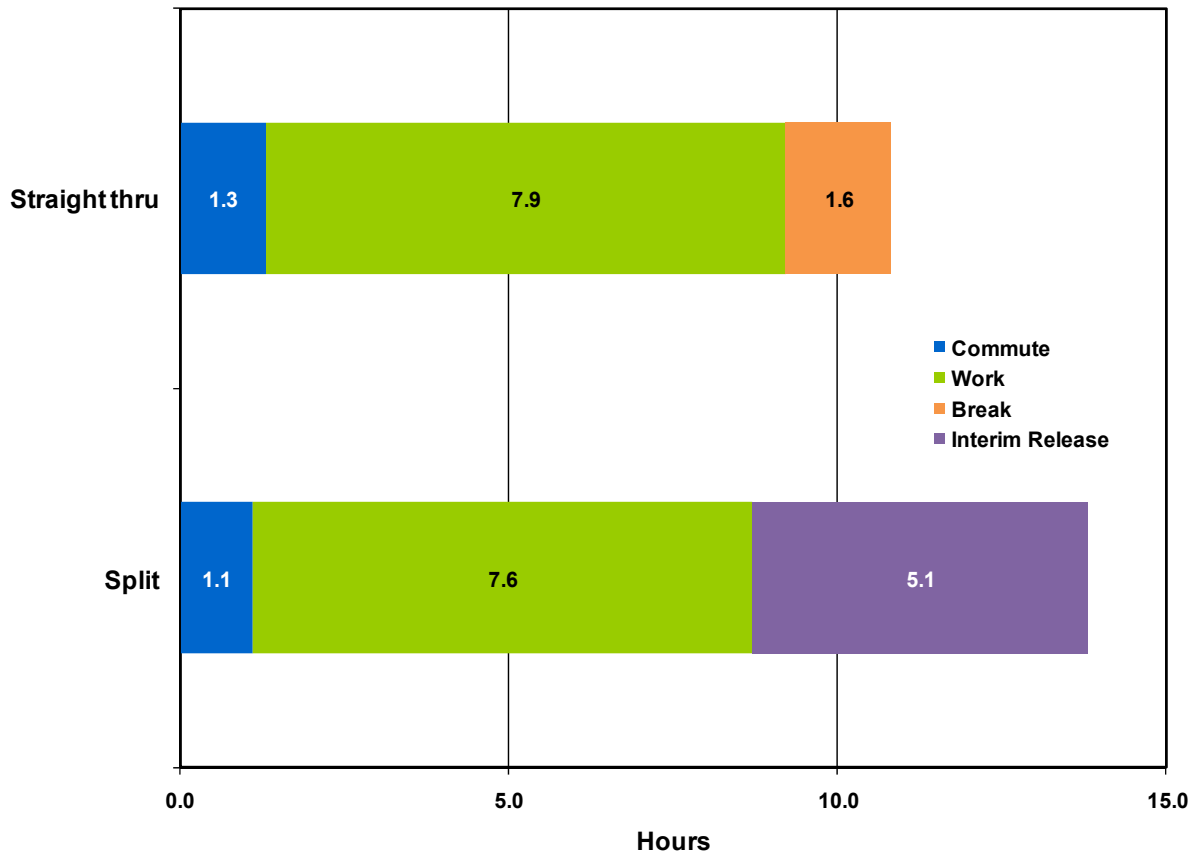


Figure 6. Typical Workday by Daily Schedule (median)

Table 5 summarizes the work time in 2 weeks for individuals in each of the three schedule groups. These results include data from only those individuals whose daily logs contained 14 complete days of data. Through the background survey, participants reported their typical weekly duty hours. The median typical hours for those with straight thru and split schedules were nearly the same at 84 and 85 h, respectively. Those working extra board positions reported typically working 100 h in 2 weeks or 50 h per week. Over the 2-week period of the study, the straight thru group worked more than either the split or extra board groups (see “Total hours worked” in Table 5). Overall, the passenger T&E group averaged 86:41 for the 2-week period. The extra board group had the largest variability in the total hours worked, but the straight thru group worked the most overtime. A quarter of the straight thru group worked 104 h or more in the 2 weeks of the study. On a daily basis, the straight thru group had the longest duty period (8:44), and the split group had the shortest (7:59). The mean daily duty hours for the extra board group, who may work a combination of both straight thru and split assignments, was 8:22, midway between the reported straight thru and split values. The median number of primary work starts (or days worked) was 10 for all schedule groups, but a quarter of the straight thru group worked at least 1 rest day and a quarter of the extra board people worked 2 or more rest days. Overall, the split assignment group worked fewer hours than the other two groups.

Table 5. Work in 2 Weeks by Type of Schedule

Type of Day	Work Schedule	Mean	Median	Standard Deviation	1st Quartile	3rd Quartile
Typical hours worked* (h:min)	Straight thru	88:32	84:00	21:56	78:00	105:00
	Split	82:56	85:00	14:46	79:00	92:30
	Extra board	96:47	100:00	26:30	86:00	110:00
	All	89:12	89:00	22:14	80:00	106:00
Total hours worked (h:min)	Straight thru	90:05	89:20	18:52	75:46	104:26
	Split	78:40	77:10	15:33	65:06	92:29
	Extra board	81:16	81:05	24:33	68:18	99:40
	All	86:41	87:07	19:43	72:57	101:08
Daily duty hours (h:min)	Straight thru	8:44	8:46	1:35	7:31	10:02
	Split	7:59	8:08	1:23	6:45	9:15
	Extra board	8:26	8:35	1:15	7:36	9:05
	All	8:33	8:35	1:31	7:25	9:45
Primary work starts	Straight thru	10.33	10	1.18	10.0	11.0
	Split	9.85	10	1.02	9.75	10.0
	Extra board	9.68	10	2.69	9.0	12.0
	All	10.15	10	1.53	10.0	11.0

*Reported in background survey. Remaining data in table from daily logs for those with 14 d of daily log data ($N = 240$).

Participants reported interim release that ranged from 4 to nearly 9 h. On average, interim release provided a period of 5.5 h when the T&E employees were free to conduct personal business. Descriptive statistics for the reported instances of interim release appear in Table 6.

Table 6. Length of Interim Release (h:min)

Mean	5:26
Median	5:06
Std. Dev.	1:01
1st quartile	4:35
3rd quartile	6:00

The background survey asked, “How many times in the past month did you work on your rest days?” Table 7 presents the responses to this question. Overall, a third reported working at least once on a rest day, with over half of the extra board people working on a rest day. The extra

board group, on average, worked more than 2 rest days in the month prior to the study. These background survey results are consistent with the log book data that indicate that a quarter of the extra board group worked 12 or more days in 2 weeks.

Table 7. Work on Rest Days in Past Month

Schedule	Worked Rest Day	Rest Days Worked	
		Mean	Median
Straight thru	32.5%	0.99	0
Split	9.5%	0.14	0
Extra board	58.8%	2.26	1.5
Total	32.2%	1.02	0

RSIA (new Section 21103(a)(1)) limits total time on duty to 276 h in a calendar month for T&E employees in freight service. Another provision of RSIA (new Section 21103(a)(4)) provides that after an employee has initiated an on-duty period on 6 consecutive d, the individual must have at least 48 h off duty, and after 7 consecutive d, the individual must have at least 72 h off duty. The survey data provide an indication of the extent of the impact that these limits might have on passenger service employees.

There were 240 survey participants whose diaries had complete work histories for 14 d. Once the 14 d of survey data is extrapolated to 30 d, it is possible to estimate the number of passenger service T&E workers who likely exceeded the 276-hour limit during the study period. Of these, there were three who would have exceeded the 276-hour limit. In addition, there were 46 individuals who exceeded the new freight statutory limit with regard to rest day requirements following consecutive workdays. Most worked straight thru schedules (33), but there were 3 on split assignments and 10 with extra board schedules.

In terms of work starts, there were 78 instances where the individual initiated an on-duty period on 6 consecutive d. Of these, 51 had less than 48 h off prior to the start of the next on-duty period, whereas 7 had 48 h or more off, and because the remainder occurred at the end of the study period, their conformance with RSIA is unknown. Of the 19 who initiated an on-duty period on 7 consecutive d, 14 had less than 72 h off before the next work start and 5 occurred at the end of the 14-day recording period. Overall, 46 (19 percent) of the study participants with 14 consecutive d of data had work patterns that would have violated the freight rest provisions of RSIA if they had applied to such participants. (Some individuals had more than one occurrence.) Table 8 summarizes these results.

Table 8. Conformity with RSIA Freight Rest Period Requirements (after occurrences of initiating an on-duty period on 6 or 7 consecutive d)

Number of Consecutive Starts	Length of Subsequent Rest Period			Total Number of Instances of Individuals Having 6 or 7 Consecutive Days
	Would Meet RSIA Freight Requirement	Would Not Meet RSIA Freight Requirement	Unknown whether Would Meet RSIA Freight Requirement*	
6	7	51	20	78
7	0	14	5	19

*Consecutive starts occurred at end of 14-day study period so cannot determine if rest occurred on subsequent days.

3.4.4 Breaks

Passenger T&E workers frequently have an opportunity for a break between the end of one run and the start of the next one. The analysis of break times includes only those days on which breaks were reported. As Table 9 indicates, those working split assignments were least likely to have breaks, whereas those with straight thru assignments had breaks on 55 percent of their workdays. These differences were statistically significant, $F(2, 255) = 19.232, p < 0.001$. On days with breaks, the total daily break time for split assignment people was about 20 min less than that for the other two groups. Over three-quarters of the breaks occurred off the train.

Figure 7 provides the distribution of break lengths for all passenger T&E employees. Over 40 percent are 1 h or less with a third in the range of 30 min to 1 h.

Table 9. Total Daily Break Time by Schedule Type

Schedule Type	Mean (h:min)	Median (h:min)	Days with Breaks (%)
Straight thru	1:46	1:37	55
Split	1:24	1:18	11
Extra board	1:48	1:34	39

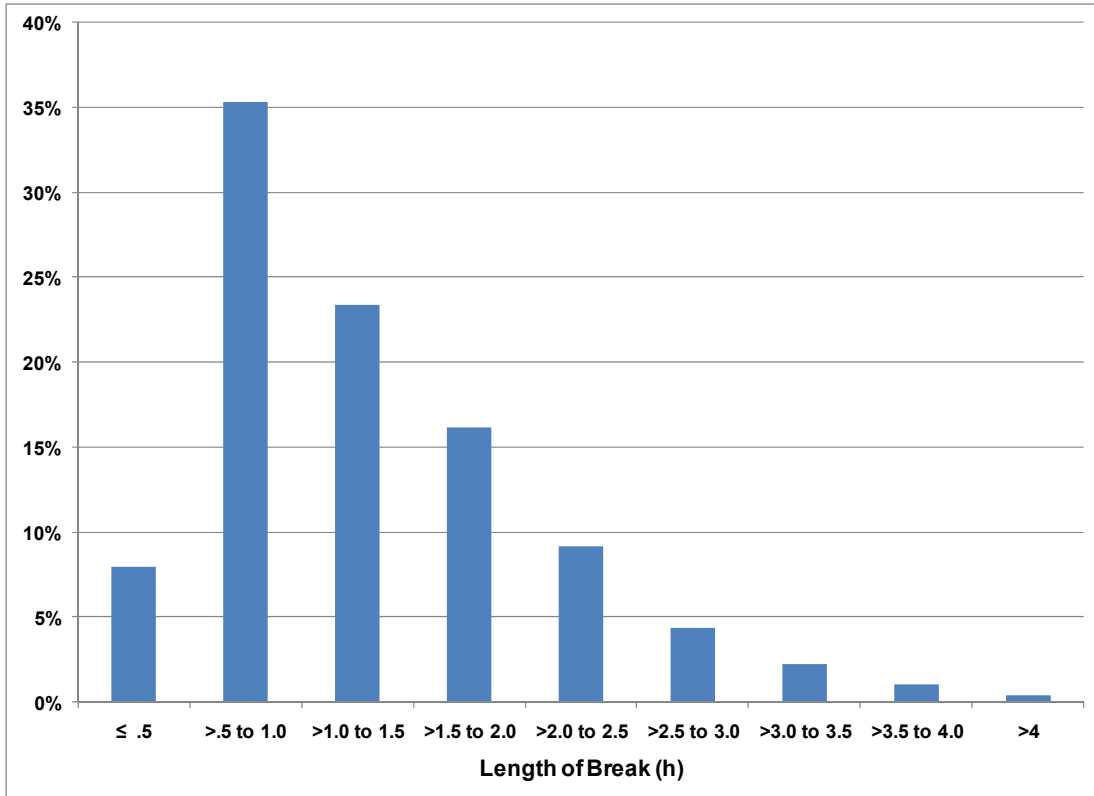


Figure 7. Distribution of Break Lengths

3.4.5 Interim Release

Reported interim release periods ranged from 4 h, the defined minimum, to 5.4 h with a median of 5.1 h (see Figure 8). A quarter of the reported interim release periods were more than 6 h. When at an away-from-home terminal or point of interim release, nearly two-thirds of the participants reported that they use the company-provided quiet room, 23 percent go home, and the remaining participants use a hotel room.

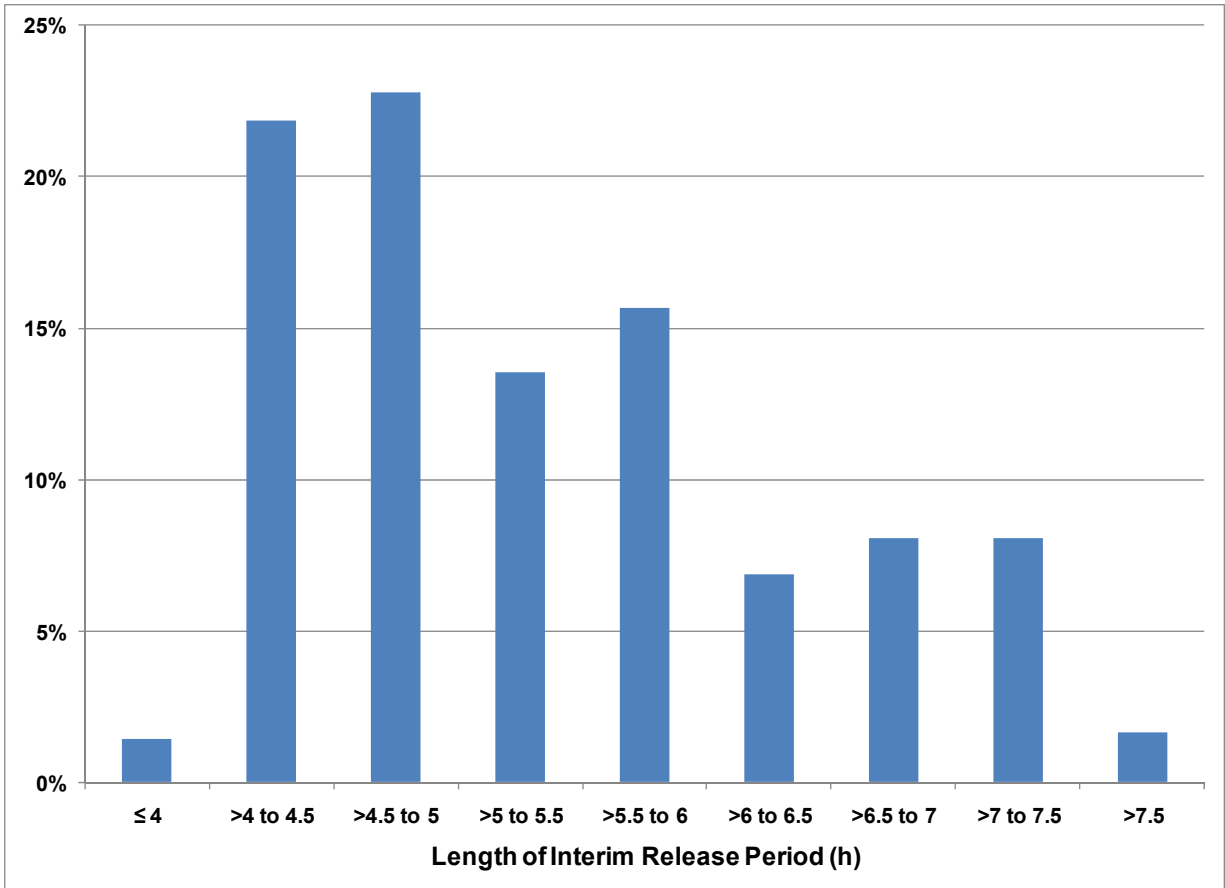


Figure 8. Distribution of Length of Interim Release Periods

3.4.6 Sources of Stress

In the background survey, passenger service workers rated job-related sources of stress. They rated stress using a Likert scale with values from 1 to 4 with 1—no stress, 2—a little stress, 3—stressful, and 4—very stressful. As Figure 9 illustrates, no one category was stressful. Rather, the “Other” category, which had 32 responses, received the highest ratings. There was no single theme to this group of responses.

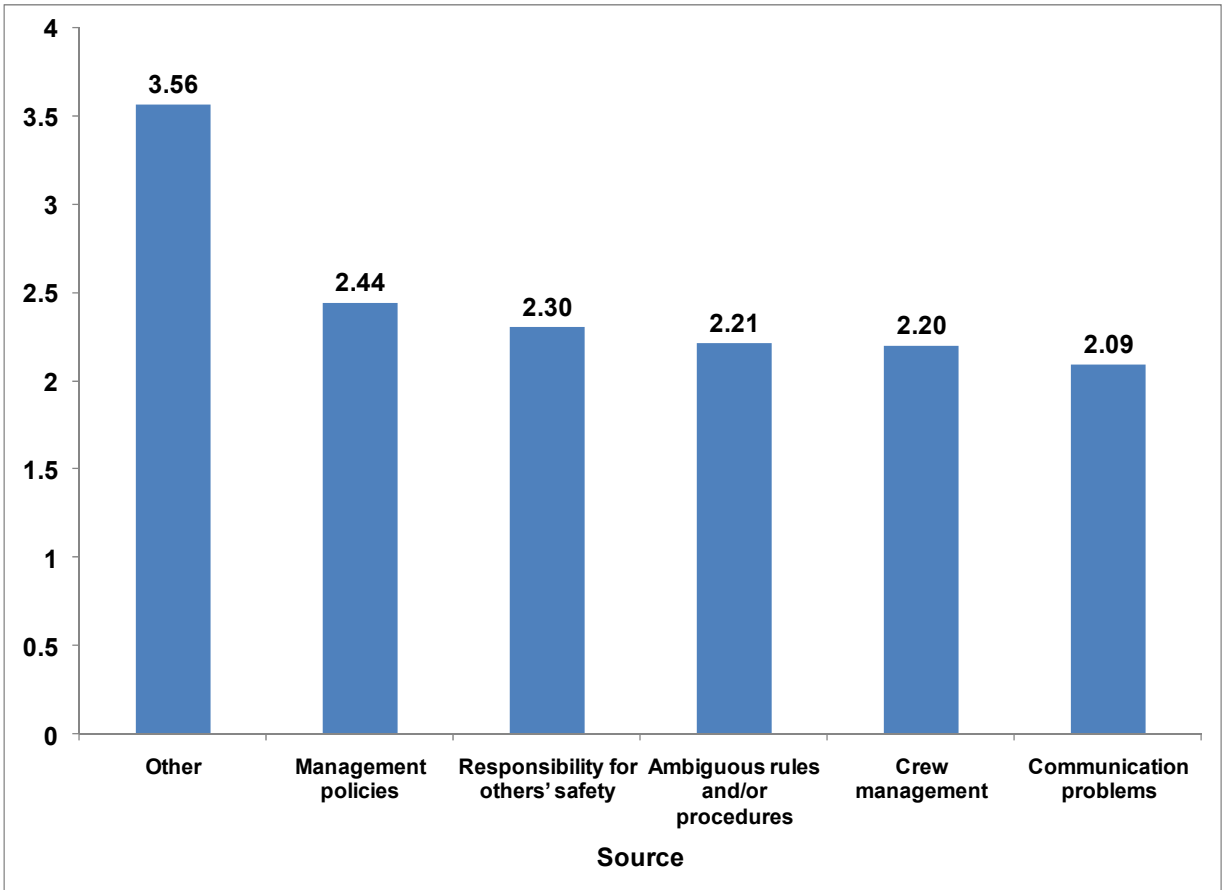


Figure 9. Sources and Levels of Stress

3.4.7 Job Characteristics Summary

Two-thirds of passenger T&E workers hold jobs that have a straight thru schedule. The remainder is evenly divided between split assignments and extra board. Extra board workers are subject to call and reported a median call time of 3 h. Over 80 percent of those with a straight thru schedule reported 2 consecutive d off per week, whereas 71 percent of those with a split assignment had the same rest day arrangement. Nearly all had some provision for guaranteed rest days. There was some variability in daily hours worked with those on straight thru assignments having the most work hours per day and split assignments having about 40 min less. Those on split assignments reported the shortest amount of daily break time. The median interim release was 5.1 h, but a small number in excess of 7 h were reported. Overall, this group does not have high levels of work-related stress.

3.5 Sleep Characteristics

This section reports the results from analyzing the sleep data of passenger T&E employees. The sleep analyses focus on primary and daily sleep, the number of sleep periods per day, supplementary sleep, and the quality of sleep. The study examines sleep characteristics with respect to the type of schedule (straight thru, split, or extra board), the location of sleep (home or away), and the prevalence of sleep disorders.

For the purpose of the study, primary sleep for a given calendar day is the longest sleep period ending on that day. Likewise, daily sleep is the sum of all sleep periods that end on a calendar day. Each sleep period ending on a calendar day is counted to determine the number of sleep periods per day. Finally, the study examines workday and rest day sleep characteristics. Workdays have at least one work start time reported on the activity log for a calendar day. By contrast, rest days have no work starts occurring on a calendar day. If a sleep period ends on a workday, it is classified as workday sleep. Otherwise, if a sleep period ends on a rest day, it is considered rest day sleep. Understanding the method for categorizing sleep as workday or rest day sleep is important when reviewing the sleep results.

3.5.1 Daily and Primary Sleep

Table 10 presents descriptive statistics for daily sleep, primary sleep, and average number of sleep periods per day by type of schedule and type of day (work or rest).

A 2 (type of day) \times 3 (schedule) mixed-model ANOVA examined the average length of daily sleep for respondents who reported 14 consecutive d of data and at least 1 rest d ($n = 235$). Figure 10 shows a bar chart of the means by schedule and type of day. The results indicated no overall difference in daily sleep among the three schedule groups, $F(2, 232) = 0.83, p = 0.44$. The main effect for type of day was significant $F(1, 232) = 8.30, p < 0.01$, demonstrating that regardless of schedule, respondents slept more on rest days than workdays. There was a significant interaction between schedule and type of day, $F(2, 232) = 4.00, p < 0.05$, suggesting that the length of daily sleep on workdays and rest days varied based on the type of schedule. A simple effects analysis of the interaction showed that respondents working a straight thru assignment sleep significantly longer on rest days than workdays $F(1, 158) = 35.74, p < 0.001$. Respondents working a split or extra board assignment got a comparable amount of sleep on both workdays and rest days, $F(1, 35) = 1.70, p = 0.20$ and $F(1, 39) = 0.03, p = 0.87$, respectively. Figure 10 shows a bar chart of total daily sleep by schedule and type of day.

Although daily sleep statistics are informative, they do not capture information about the sleep strategies that workers undertake to ensure they have adequate rest. Previous studies examining railroad employees show that workers sometimes nap, or engage in supplementary sleep, to offset any sleep deficits they accrue because of inadequate primary sleep periods, typically nighttime sleep (Gertler & Viale, 2007; Gertler & DiFiore, 2009). The results of an examination of primary sleep using a 2 (type of day) \times 3 (schedule) mixed-model ANOVA were similar to the daily sleep results. There was no overall effect of schedule on primary sleep, $F(2, 232) = 2.73, p = 0.07$. The main effect of type of day on primary sleep demonstrated that rest day sleep periods were longer than workday sleep periods, $F(1, 232) = 38.25, p < 0.001$. The length of primary sleep on workdays and rest days varied based on the type of schedule as evidenced by the significant interaction between the two factors, $F(2, 232) = 7.27, p < 0.01$. A different pattern emerged for primary sleep (compared with daily sleep) as revealed by a simple effects analysis of the interaction indicating that both straight thru and split assignment employees had longer primary sleep periods on rest days than workdays, $F(1, 158) = 42.81, p < 0.001$ and $F(1, 35) = 48.57, p < 0.001$, respectively. The length of primary sleep on workdays and rest days was not significantly different for extra board employees, $F(1, 39) = 0.09, p = 0.76$. Figure 11 shows a bar chart of the primary sleep means by schedule and type of day.

Table 10. Sleep by Type of Day and Work Schedule

Type of Day	Work Schedule	Mean	Median	Standard Deviation	1st Quartile	3rd Quartile
Daily Sleep						
Workday	Straight thru	7:07	7:09	0:59	6:22	7:49
	Split	7:26	7:19	1:01	6:57	7:49
	Extra board	7:17	7:22	0:49	6:43	8:01
Rest Day	Straight thru	7:50	7:44	1:24	7:00	8:39
	Split	7:43	7:32	0:59	7:03	8:29
	Extra board	7:19	7:19	1:41	6:40	8:20
Primary Sleep						
Workday	Straight thru	6:53	6:59	1:04	6:11	7:42
	Split	6:16	6:12	0:49	5:47	6:54
	Extra board	6:59	7:01	0:53	6:23	7:42
Rest Day	Straight thru	7:41	7:36	1:51	6:55	8:30
	Split	7:37	7:23	1:05	6:57	8:29
	Extra board	7:03	7:11	1:37	6:21	8:18
Number of Daily Sleep Periods						
Workday	Straight thru	1.2	1	.32	1.0	1.2
	Split	1.7	1.8	.39	1.4	2.0
	Extra board	1.2	1.0	.29	1.0	1.3
Rest Day	Straight thru	1.1	1.0	.23	1.0	1.0
	Split	1.1	1.0	.19	1.0	1.0
	Extra board	1.1	1.0	.21	1.0	1.2

Given that split assignment employees get comparable amounts of daily sleep on workdays and rest days, but significantly less primary sleep on workdays suggests that these employees engage in supplementary sleep on workdays. Examining the average daily number of sleep periods for workdays and rest days confirmed this hypothesis. A 2 (type of day) × 3 (schedule) mixed-

model ANOVA revealed significant main effects for type of day and schedule, $F(1, 232) = 91.36, p < 0.001$ and $F(2, 232) = 13.19, p < 0.001$, respectively, as well as a significant interaction, $F(2, 232) = 40.08, p < 0.001$. These results indicate that respondents, in general, had more sleep periods on workdays ($\bar{x} = 1.34$) than rest days ($\bar{x} = 1.10$), and split assignment workers had more sleep periods ($\bar{x} = 1.36$), in general, than either straight thru ($\bar{x} = 1.14$) or extra board workers ($\bar{x} = 1.15$). A simple effects analysis of the interaction showed that the average number of workday sleep periods exceeded rest day sleep periods for both straight thru, $F(1, 158) = 10.304, p < 0.05$, and split assignment employees, $F(1, 35) = 78.27, p < 0.001$; however, the mean difference was larger for split assignments (mean difference, 0.58) than for straight thru schedules (mean difference, 0.075). There was no significant difference between workday and rest day sleep periods for the extra board schedule, $F(1, 39) = 2.225, p = 0.14$.

The sleep results, in general, indicate that there is no difference in daily sleep among the three types of schedules, although there are differences among the types of schedules with respect to primary sleep and the average number of daily sleep periods. Straight thru workers tend to sleep longer on rest days, suggesting they make up for any sleep deficits that occur during workdays. Split assignment employees have comparable daily sleep on workdays and rest days. Their primary sleep is less on workdays than rest days; however, they tend to have more sleep periods on workdays than the other two schedule types, suggesting they make up for any workday sleep deficits by napping on workdays. Extra board employees tend to have comparable workday and rest day sleep regardless of sleep metric (daily, primary, or sleep periods). This latter finding is consistent with a previous study that examined extra board sleep schedules (Gertler & DiFiore, 2009). The authors speculated that because extra board employees are not able to predict their rest days because of the variability of scheduling, their sleep patterns are indistinguishable on rest days and workdays.

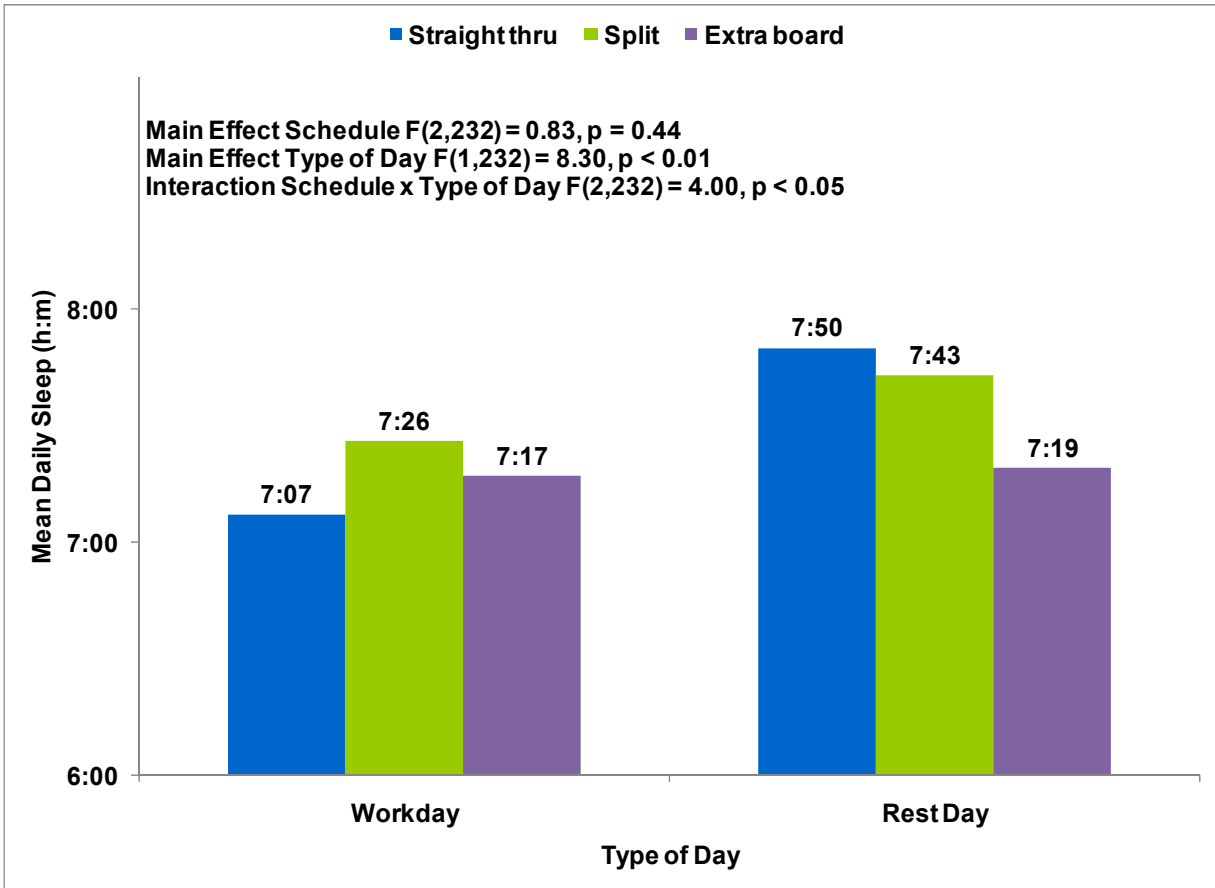


Figure 10. Total Daily Sleep by Type of Day and Work Schedule

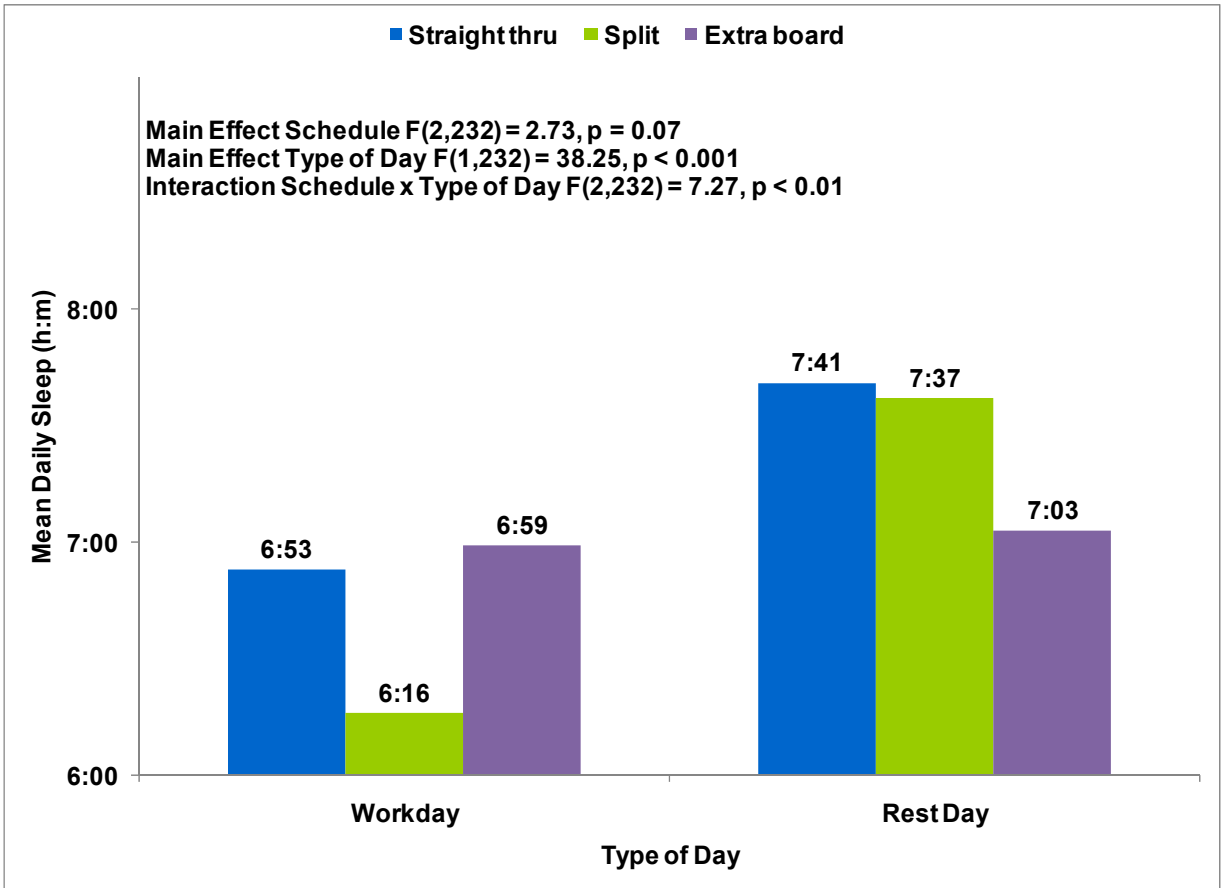


Figure 11. Primary Sleep by Type of Day and Work Schedule

3.5.2 Comparison with Other Adult Populations

NSF's 2008 *Sleep in America Poll* reports nighttime sleep for U.S. working adults as total daily sleep time. Because people with daytime jobs usually get their daily sleep at night, comparison of passenger T&E worker daily sleep with the NSF data is reasonable. Data from the NSF survey show that as a group, the sleep pattern for passenger T&E workers is better in some respects than that of U.S. working adults. Forty-six percent of U.S. working adults get less than 7 h of sleep in comparison with 41 percent of passenger T&E workers. Also, 40 percent of passenger T&E workers get from 7 to less than 8 h, whereas 33 percent of U.S. working adults average this amount of sleep on workdays (see Figure 12).

3.5.3 Supplementary Sleep

Employees found the opportunity for supplementary sleep during work breaks and interim release. The background survey included a question regarding sleeping arrangements when at an away-from-home terminal or point-of-interim release. Of the 98 individuals who answered this question, over two-thirds indicated that their employer provides them with a quiet room and 22 percent indicated that their employer provided sleep accommodations. A few reported that their employer does not provide either sleep/rest accommodations or per diem allowance, whereas the majority have access to either company-paid accommodations or a quiet room.

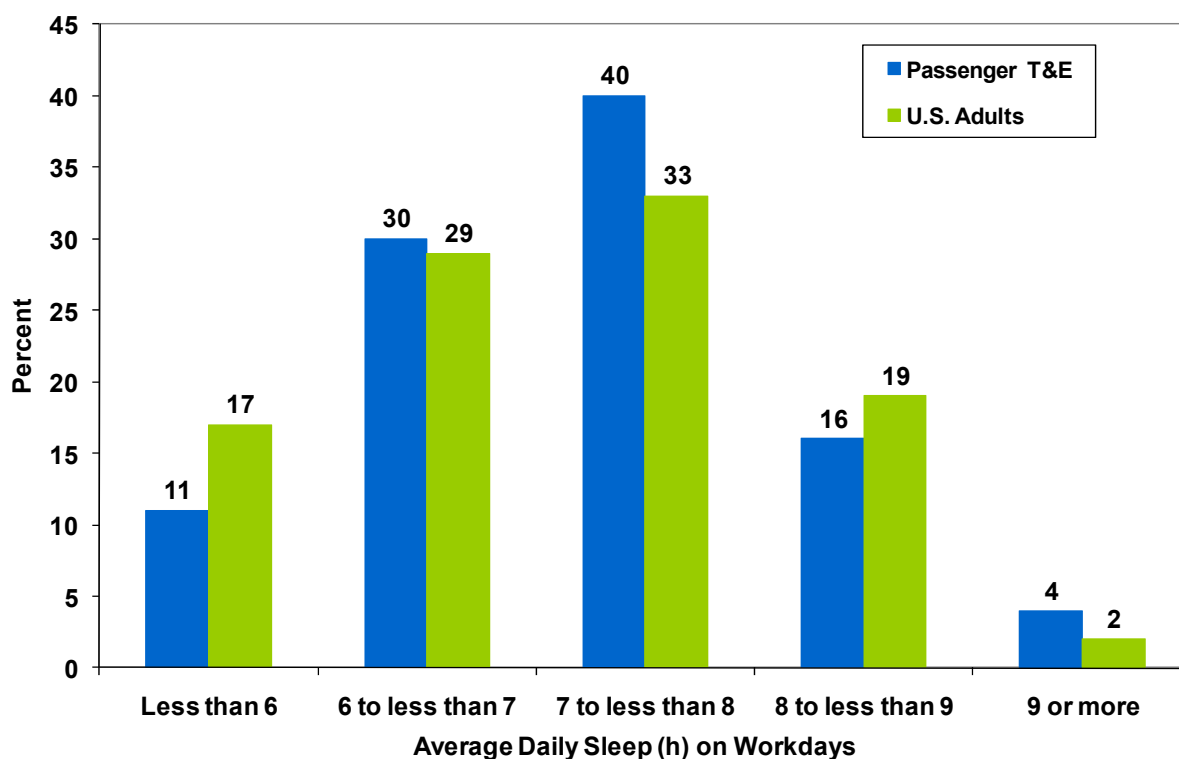


Figure 12. Daily Sleep on Workdays Compared with U.S. Working Adults

Only 10 percent of the breaks overlapped with sleep. When sleep overlapped with break, it occupied over half (54 percent) of the break time. In contrast to the break periods, on average, nearly two-thirds (65 percent) of the interim release periods overlapped with sleep, and nearly 80 percent of these sleep periods took place away from home. Over one-third (34 percent) of interim release was spent sleeping.

3.5.4 Sleep Quality

Participants rated the quality of their primary sleep period on a Likert scale from 1 to 5. Lower ratings indicate poorer sleep quality. Table 11 lists the average sleep quality ratings for participants by type of schedule. One-way between subjects ANOVAs showed that sleep quality varied significantly by schedule group (see Table 11). Posthoc Scheffé tests showed that the extra board group rated its sleep higher than the straight thru group for each quality category ($p < 0.05$); they rated their sleep higher than the split assignment group for the “ease of arising,” “length of sleep,” “quality of sleep,” and “alertness upon arising” categories. The extra board group is younger than either of the other two groups, which may explain the higher sleep quality ratings.

Posthoc Sheffé tests revealed no significant differences between the straight thru and split assignment groups.

Table 11. Average Sleep Quality Ratings by Type of Schedule

Sleep Rating	Straight thru	Split	Extra Board	Statistical Test
Primary sleep duration (h:min)	7:13	6:40	7:00	$F(2, 232) = 2.733, p = 0.067$
Ease of falling asleep	4.10	4.13	4.25	$F(2, 3,533) = 5.21, p < 0.01$
Ease of arising	3.61	3.63	3.86	$F(2, 3,527) = 12.40, p < 0.001$
Length of sleep	3.72	3.69	3.86	$F(2, 3,529) = 5.10, p < 0.01$
Quality of sleep	3.83	3.86	3.96	$F(2, 3,530) = 4.49, p < 0.05$
Alertness upon arising	3.79	3.81	4.04	$F(2, 3,530) = 15.25, p < 0.001$

3.5.5 Sleep Quality and Sleep Disorders

Table 12 presents the average sleep quality ratings for respondents with and without sleep disorders. One-way between subjects ANOVAs with three levels (untreated sleep disorder, treated sleep disorder, and no sleep disorder) calculated for each sleep quality rating resulted in significant differences for ease of falling asleep, ease of arising, and quality of sleep. Individuals without sleep disorders had higher sleep ratings than individuals with treated sleep disorders. The results for untreated sleep disorders are not meaningful given a small n .

Table 12. Sleep Quality Ratings for Respondents with and without Sleep Disorders

Sleep Rating	Untreated Sleep Disorder ($n = 3$)	Treated Sleep Disorder ($n = 14$)	No Sleep Disorder ($n = 239$)	Statistical Test
Ease of falling asleep	5.0	3.65	4.15	$F(2, 3,381) = 32.107, p < 0.001$
Ease of arising	5.0	3.30	3.66	$F(2, 3,375) = 23.486, p < 0.001$
Length of sleep	4.0	3.67	3.73	$F(2, 3,377) = 0.924, p = 0.397$
Quality of sleep	3.86	3.68	3.87	$F(2, 3,378) = 23.486, p < 0.05$
Alertness upon awakening	3.86	3.80	3.82	$F(2, 3,578) = 0.063, p = 0.939$

3.5.6 Sleep Characteristics Summary

The results show that straight thru, split assignment, and extra board employees get comparable amounts of daily sleep but have different sleep strategies to achieve the near equality. Straight thru workers sleep longer on rest days than on workdays. Split assignment workers supplement their sleep on workdays with naps. Extra board workers equally distribute their sleep between workdays and rest days, most likely because these workers are not able to predict when they will have a rest day. When compared with U.S. working adults, the passenger T&E workers in some instances obtain more sleep than the U.S. adult working population. Passenger T&E workers supplement their sleep during work breaks and periods of interim release. Ten percent of breaks overlapped with sleep, whereas 65 percent of interim release periods overlapped with sleep. Extra board workers rated their sleep quality higher, in general, than workers with straight thru or split assignments.

3.6 Alertness

Through a question on the background survey, passenger T&E workers rated their overall alertness at work. All schedule groups reported being alert either frequently or always a majority of their time at work. The differences are not statistically significant, $\chi^2(6, N = 256) = 8.232, p = 0.22$.

Table 13. Alertness at Work by Type of Schedule (percent)

Alert at work?	Straight thru	Split	Extra Board
Never	0.6	2.4	2.4
Occasionally	15.6	28.6	12.2
Frequently	67.1	50.0	73.2
Always	16.8	19.0	12.2

Study participants rated their alertness at the start and end of each work period and recorded this rating in their daily log. A 2 (start and end rating) \times 3 (schedule) mixed-model ANOVA revealed significant differences between ratings for the start and end of work, $F(1, 2,372) = 56.93, p < 0.001$, as well as differences among the three schedule types, $F(2, 2,372) = 10.73, p < 0.001$. The pattern of start and end of work ratings also varied based on the type of schedule as revealed by the significant interaction between these two levels, $F(2, 2,372) = 34.56, p < 0.001$. A simple effects analysis of the interaction showed that ratings of alertness declined from the start to the end of work for straight thru and extra board workers, $F(1, 1618) = 216.89, p < 0.001$ and $F(1, 344) = 35.44, p < 0.001$. End of work alertness ratings were higher than the start of work alertness ratings for split assignment workers; however, this trend was nonsignificant, $F(1, 410) = 3.05, p = 0.08$.

3.7 Effectiveness

The Sleep, Activity, Fatigue, and Task Effectiveness (SAFTE) Model is a biomathematical model for predicting fatigue based on sleep schedule. The SAFTE algorithm is incorporated in the Fatigue Avoidance Scheduling Tool (FAST), a software tool for analyzing work schedules (Hursh, Balkin, Miller, & Eddy, 2004) and predicting the individual's effectiveness or lack of fatigue during the work period. The FASTBatch software provides the capability to analyze multiple schedules in one batch analysis.

This analysis used the FASTBatch software tool to compute effectiveness. FASTBatch predicts effectiveness at work based on the sleep pattern and the number of hours since awakening. The FAST effectiveness metric is a score based on predicted speed on a psychomotor vigilance test. FAST computes effectiveness as the percentage of the performance of the average well-rested daytime worker. The FASTBatch results, provided in a Microsoft Access database, include an effectiveness score for each half hour of work time. If these results for all work periods and all individuals in a specified group are combined, it is possible to create a cumulative distribution of the percentage of work time spent at or below specified efficiency levels (see Figure 13). Of particular interest is the time spent working at or below 70 percent efficiency. This efficiency level corresponds to a reaction time that is 1.4 times that of a well-rested person, cognitive

throughput that is 81 percent of a well-rested individual, and five times the likelihood of a lapse in attention relative to a well-rested person.

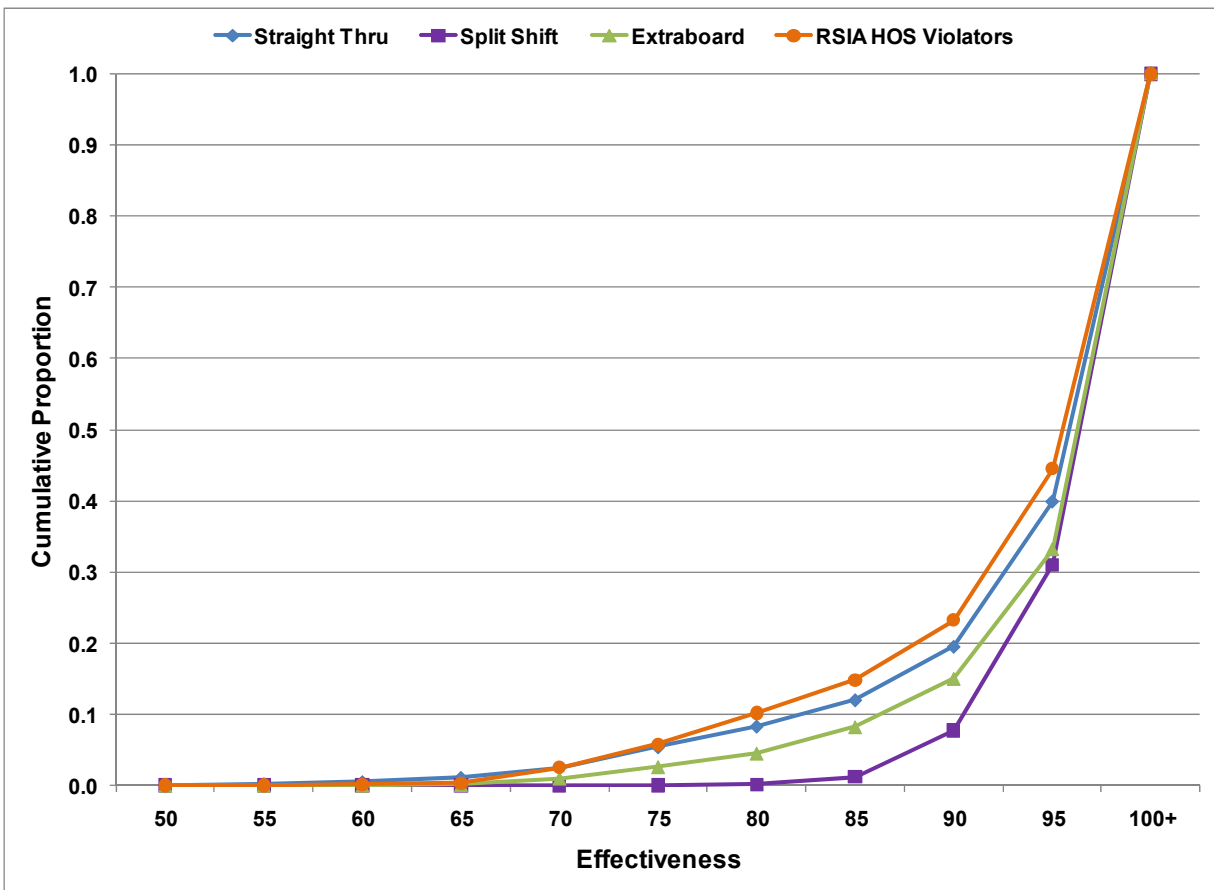


Figure 13. On-the-Job Effectiveness by Work Schedule

A one-way between subjects ANOVA calculated for the three types of schedule showed that the groups were significantly different from one another, $F(2, 238) = 3.17, p < 0.05$. A posthoc Scheffé test indicated that the average effectiveness of the split assignment group was significantly greater than the effectiveness of the straight thru group. As Figure 13 indicates, none of the passenger T&E schedule groups worked at or below an effectiveness level of 70, more than 2.5 percent of their work time. Both the straight thru group and the 46 individuals who would violate the new freight HOS limits for rest periods following consecutive days of work, if those limits were applied to them, had 2.5 percent of their work time at or below that level. The other groups had less time at or below this effectiveness level. The majority, over 90 percent, of the 240 people for whom there were complete 2-week work schedules had no work time at 70 or below. There were nine individuals who had more than 2 percent of their work time at 70 or below, including one individual with nearly 15 percent in that range.

An examination of the effectiveness scores at the start and the end of a work period as a function of consecutive days on the job yielded two significant negative correlations. Effectiveness at both the beginning and end of a work assignment decreases as the number of consecutive days on the job increases, $r(2650) = -0.154, p < 0.001$ and $r(2650) = -0.106, p < 0.001$, respectively.

3.8 Textual Data

The daily log included space for participants to record any comments regarding their sleep and work periods each day. This section presents an overview of participants' comments on their sleep and work experiences throughout the 2 weeks of the study.

Although not a requirement for participation, commenting on sleep and work experiences presented participants with the opportunity to explain parts of their day. Not all participants chose to record daily comments. As such, these data are not statistically meaningful. However, the content of the participants' comments does provide valuable qualitative information regarding common themes in the work and personal lives of T&E employees. The following topics emerged from a review of the log book comments:

1. Alertness/Fatigue
2. Breaks
3. Management
4. Naps
5. Personal Issues (family, leisure activities)
6. Sleep
7. Stress
8. Travel
9. Work Schedule

Table 14 lists the keywords that were the basis for each topic area search.

These categories were not mutually exclusive because a single comment may have contained keywords of multiple topic areas. As a result, comments fell into more than one category. For example, a comment may have been counted in both the stress and work schedule categories because the comment contained the keywords "stress" and "schedule." The most frequently mentioned topics were sleep, work schedule, personal issues, and alertness/fatigue. The high frequency of the keyword "nap" (associated with the sleep topic) warranted including a separate topic category for this item. Table 15 presents more detailed results of keyword searches.

The comments complement the quantitative survey results by exemplifying the personal effects of work or sleep patterns present in the survey data. For example, people working split assignments frequently commented that their schedule allowed them to nap during interim release and that this restored their alertness. Similarly, those working at night commented on their problems getting restorative rest and difficulties sleeping during the day. In this way, the comments provide a more complete picture of passenger T&E employees' concerns regarding the effects of job-related fatigue.

The summaries below highlight the common themes raised by the respondents with regard to each topic. Selected illustrative quotes follow the summaries.

Table 14. Keywords Used for Each Topic Area Search

Topic	Keywords
Alertness (mental)/Fatigue (physical)	Alert*, atten*, awake, aware*, energy, exhaust*, fatigue*, prepared, sleepy, tired, vigilant, watchful, weak*, weary
Breaks	Break
Management	Administration, boss, chief, company, control, inadequate, manage*, organization, policy, rule*, staff, supervis*
Naps	Nap
Personal Issues (family, etc.)	Baby, child*, daughter, domestic, family, father, girlfriend, grand*, husband, in-law, kid*, mother, personal, private, relative*, son, wife
Sleep (including location)	Accommodation*, away from home, bed, hotel, lodging, motel, nois*, quarters rest, room*, sleep*
Stress	Anx*, pressure, strain, stress*, tense, worr*
Travel	Car, commute, driv*, drove, travel, truck, van
Work Schedule	Call time, deadhead, extra*, hours, limbo, overtime, relief, respond, rest day, schedul*, time off, interim release

Note: The symbol “*” indicates that all words starting with this combination of letters were identified. For example, searching for “stress*” would result in all words starting with s-t-r-e-s-s including any ending (such as stressful, stressor, etc.).

Alertness/Fatigue

The majority of comments described the participants’ alertness level. Participants that listed themselves as alert frequently reported that they were well rested. Trouble sleeping, lack of sufficient breaks between shifts, long commutes, and work schedules (either too long or frequent schedule changes) were cited as some of the common causes of lack of alertness. Several individuals indicated that they used coffee or naps to help boost their alertness level. The following quotes are examples of some of the respondents’ comments related to alertness.

- “At 1100 I listed my alertness as a 2 but was very tired. Not falling asleep, just tired and achy. Change of hours on my fifth start throws your system off.”
- “Once again I have no significant break. As week drags on, my alertness decreases.”
- “Again even when it’s hard to get up a cup of coffee can give me an alert feeling. I rely heavily on coffee.”

Table 15. Frequency of Comments by Topic Area

Topic	Frequency
Sleep	586
Work Schedule	435
Personal Issues	208
Alertness/Fatigue	167
Naps	103
Travel	91
Breaks	83
Stress	32
Management	23
Total	1,728

Breaks

Many of the comments merely stated the times and duration of the breaks. Several respondents, however, mentioned that they were not able to take a break during work. Some who did take breaks commented that they were not able to relax during their break time because of a lack of facilities where they could relax. Others commented on the restorative value of their breaks. Respondents who were able to return home during their break or interim release time reported that they were well rested when returning to work.

- “My break time is spent at home which helps to make me more relaxed. It is the first time in 25 years that I went home layover. My break is usually spent at work where it is loud and noisy and there is no place to relax.”
- “I’m currently working a yard switching job and our work and breaks vary. Our lunch breaks vary also. Sometimes we don’t get any at all. If there are breakdowns and emergencies, our job is posted to work Mon.–Fri., 06:00–16.”
- “13+ hour assignment was not a problem when coupled with a 4+ hour break, so long as rest facilities are provided.”
- “Once again I make it thru a week. These no break jobs...are a killer! Someone [is] going to get in an accident from lack of sleep/break. You are at the throttle all day long.”
- “I work a regular job and have a pretty regular schedule. I am never really sleepy when I am running the train but if I don’t get a 15–20 min nap on one of my breaks I will feel it in the evening.”
- “Caught some sleep in crew room. This yard does not have a quiet area so passenger crews sign up in same room. There are always people coming in and out.”

Management

There were few comments focused on management. These comments tended to focus on policies regarding the work schedule and breaks, but one individual commented on the cab environment.

- “No break again. Company knows and never does anything about it.”
- “Operating cab of my train substandard. Seat is painful to sit in. Uniform is very uncomfortable. These issues have been brought up to company but promptly ignored.”

Naps

Many individuals took naps during their breaks or during downtimes. Almost all reported that the naps made them feel rested and more alert. Many respondents also mentioned the location of their naps. Examples include maintenance facilities, storage rooms, and deadhead train. Two respondents stated that they took naps against company rules.

- “Was tired at work, napped during break.”
- “Took a small nap in quiet room at maintenance facility before second half of day.”
- “Felt a little groggy upon rising but shower and coffee got me going. Nap 11:00–12:00 before afternoon run.”
- “I couldn’t sleep. I felt tired just I just could fall asleep. I got up and drank 2 cups of coffee felt alert when I got to work. Took a very good nap on the break.”
- “It’s Monday and Mondays are the hardest days of the week. I am so tired on Mondays! Although after my 2.5 hr nap I usually feel great. My afternoon is always the time when I feel energized and well rested.”
- “Hard sleeping from changing shifts from p.m. to a.m. Nap at lunch really helps.”
- “Rest facility is common rooms in basement of train station. No quiet or individual rooms. Mostly old broken recliners—quality of rest on interim release is poor.”

Personal Issues

Several respondents stated that personal commitments or concerns affect their sleep, leading to greater stress or fatigue at work. Many of the other comments were explanations of how the individual spent his or her personal day. Most of these comments stated that the individuals spent the day with their families.

- “With 3 kids age 6, 4 and 23 months a good night’s sleep is currently somewhat inconsistent. My wife always tries to let me sleep but obviously is difficult at times. Combined with my early schedule, power naps are a must for me and they truly help. I don’t like coffee but tea and diet sodas are a help too. I’ve worked early morning runs for years so I’m accustomed to it now.”
- “This is my toughest day because I am used to falling asleep at 1–2 a.m. from working the weekend, but I must get to bed earlier and wake up earlier so I can drive my kids to school. The fact that I work a relief job with different end times takes its toll at the end of the week.”
- “Second assigned day off. Not restful. Unable to sleep past 6:00. Unable to relax due to work life concerns and unresolved personal matters delayed by workplace concerns. Physically uncomfortable with joint pain and germ symptoms.”

- “I would say that overall I do get enough rest. The times that I don’t get enough typically are because of personal issues. Those personal issues are due to having young kids.”

Sleep

Most comments relayed what time the respondent went to sleep. Several individuals did comment on how they have trouble sleeping because of work-related or personal stress and commitments. Many individuals felt that they did not receive enough sleep and took power naps to help alleviate their sleep deficit.

- “I notice that as the week progresses I am prone to be more tired as my shift goes on. Thus I fall asleep faster when I get home and sleep later if conditions allow.”
- “I am a morning person by nature. When I work late and go to bed late, I still wake up early. Just can’t sleep even though I am still tired. Function well on early jobs even though tired. Tired on late jobs even though rested.”
- “Today is my scheduled day off. I am always available for overtime. The day was solely spent on personal time. Day 5 I had a great night sleep and plenty of rest. Knowing you do not have to work in the morning makes a great difference.”
- “The length of time on duty has less to do with fatigue than the constant change of sleep pattern. Going from a.m. to p.m. shifts causes more problems than all the other factors combined.”

Stress

Most respondents reported they felt little or no stress when they had a “quiet day.” Individuals who did report stressful days attributed the stress mostly to adverse weather conditions and their work commute, but some reported work-related stress.

- “Impending assignment changes creating tension - stress - lack of focus.”
- “Roads were a little icy. Driving to work in the winter raises the stress level when the weather is bad.”
- “Anxiety about work related issues is constant.”

Travel

The majority of individuals who stated that they had a long commute to work reported higher levels of stress and lack of sleep. Weather patterns significantly impacted many of the respondents’ commutes to work. A few respondents stated that they had trouble sleeping because they stayed at hotels because of work travel.

- “The commute to and from work was a nightmare. Had to work 2 hours late to make up our usual trains. Very little time for lunch - I’m exhausted.”
- “It is an advantage residing close to work. With my short commute I am able to maximize my personal time. In the morning I felt ease getting up. I felt well rested and received enough rest. As indicated below I am very alert.”

Work Schedule

Over a hundred of the comments were “relief day” and many of the other comments simply recounted the number of hours they slept or worked in a day. Some individuals complained that

their work schedule contributed to their lack of sleep yet others commented on how their work assignment was regular and not fatiguing.

- “My hours are regular because I have 32 years service and hold a regular assignment with weekends off. Co-workers with less seniority face much more difficult sleep patterns. I know from many years on extra list.”
- “Extremely difficult work week! Trouble focusing at time due to fatigue from schedule change. Slowly adjusting. Exercised 13:00–15:00, napped 16–17. Awoke confused, extremely tired. Struggled to finish the workday! Our morale level and work conditions overall are contributing to stress and fatigue at work!”
- “Working [an] assignment which has very little break time in between trains. Just enough time to remit cash taken cutting tickets. Not enough time to take care of personal business, eating or bathroom if I have to eat on train or use bathroom on train.”
- “The railroad has no business releasing employees at 1217am and returning to work at 0930 the next morning! 8 hours ‘rest’ is wrong. The railroad doesn’t consider how long employees take to get home and get to bed. Many employees have much longer commutes home than me and I only got 4 hours sleep! The 8 hour ‘rest’ period should be abolished. A minimum of 10 hours between shifts should be the rule. A rested employee is an alert employee!”
- “On our extra list you can call and be told you are out with 3 for the morning. Next thing you know they call you at 2 a.m. This makes getting enough sleep tough. You take the info given by the crew caller, go to bed according to that info and end up with 2 or 3 hours of sleep making the workday tough to say the least.”
- “I have been on the assignment for over 6.5 years now. At 59 years of age I have never felt it overbearing or tiring. The routine of the assignment is to my liking. I get all of the rest I require and am off most of the day to attend to my needs. I have never felt fatigued on any other issues that may have affected my alertness. After almost 39 years of railroading this assignment is a gift compared to working a freight pool.”

4. Findings and Recommendations

Analysis of the data from this study provides some insights into the demographics of the U.S. railroad T&E worker population in passenger service as well as their work schedules and sleep patterns. The data came from a random sample of passenger T&E workers who are members of either the BLET or the UTU. Nevertheless, the results are representative of the U.S. railroad industry's passenger T&E populations at the time of the survey, because the vast majority of the Nation's railroad employees in this segment of the industry are represented by these two labor organizations. It is reasonable to assume that the work schedules and sleep patterns of passenger T&E employees who are either nonunion or are represented by another labor organization are similar to the study populations because of the limitations of the HOS Law.

4.1 Key Study Findings

The following subsections highlight the key study findings with regard to worker health, work schedules, sleep, and alertness.

4.1.1 Passenger T&E Worker Health

Self-ratings of overall health from passenger T&E employees are higher than those of the U.S. workforce in general. This may be due to the availability of health insurance that railroad employees have. In spite of this, T&E employees average 4.2 lost workdays as a result of sickness in contrast with 3.6 d for all adults and 3.0 d for adult males. The reason for this difference is not apparent. The availability of paid sick time for passenger service employees is a possible explanation.

The reported incidence of sleep apnea among this population does not differ from that among U.S. working adults. This is somewhat surprising because the job of a locomotive engineer is a sedentary one, predisposing the individual to weight gain, which increases the risk of developing sleep apnea.

Many resources, such as TCRP Report 81, *Toolbox for Transit Operator Fatigue* and *Commercial Transportation Operator Fatigue Management Reference*, exist. In spite of this, nearly half of the study participants reported never receiving any type of fatigue education. The opportunity exists for the industry to expand its education efforts on this important subject. A fatigue education program should be an integral part of a passenger rail operator's overall fatigue risk management plan.

4.1.2 Work Schedules

During the study period of 14 d, this group of railroad employees worked an average of 86:41 (h:min) with those on split assignments averaging 78:40 and the straight thru group 90:05. A quarter worked 101:08 or more than 2 d of overtime during the period. The median number of work starts overall was 10. Overall, 46 individuals (17 percent of those providing complete work histories) had work schedules that would violate the new HOS limitations regarding work following consecutive days worked for freight operations if they applied to passenger T&E workers. (This analysis did not include interim release when identifying consecutive starts.) Three, or 1 percent, would violate the 276-hour limit if it applied. Applying the freight HOS

limitations to T&E employees in passenger operations would be problematic for the passenger service operators.

4.1.3 Effectiveness and Alertness

Analysis of the log book data with the FAST tool predicted that passenger T&E employees are working below an acceptable effectiveness level less than 3 percent of the time. Those on straight thru assignments and the 46 individuals who would have violated the RSIA HOS rest day limits for freight T&E workers, if applicable, had 2.5 percent of their work time at that level. Those on split assignments never went below a FAST effectiveness level of 70, and those on the extra board exceeded acceptable effectiveness during 1 percent of their work time. Subjective alertness ratings from the participants indicate that alertness declines over the workday for straight thru and extra board assignments but not for split assignments, probably because those on split assignments take advantage of the midday break to supplement their nighttime sleep.

4.1.4 Sleep

As a group, passenger T&E employees sleep more on workdays than U.S. working adults, but there are differences based on work schedule. Those working split assignments sleep more on workdays than their counterparts with different schedules, but this group has more daily sleep periods and a shorter primary sleep period, indicating that they take advantage of their midday break to supplement their nighttime sleep. Those working extra board schedules reported the highest sleep quality ratings, but this may be because this is the youngest group.

4.2 Recommendations for Improvements in Study Procedures

This was the fifth FRA-sponsored study of work schedules and sleep patterns of a group of railroad workers. Each successive study has led to improvements in the subsequent one in terms of study design as well as procedures for coding and analysis of the data. The experiences of the passenger T&E study suggest only one possible improvement for future studies of this population.

The background survey contained a section where the participant was to indicate his or her nominal schedule. This is the days and times that the individual must be on duty. A similar section was a part of the earlier studies and participants filled it out as intended. For some reason, this population did not understand what information to provide, and many filled it out incorrectly. As a result, the researchers were unable to report the nominal work hours for this population.

4.3 Recommendations for Additional Research

The results of the present study, as well as the four earlier studies, provide a baseline for comparison after the new HOS regulations for passenger T&E workers or new Section 21103 takes effect instead for passenger T&E workers. A study, using similar methodology, could be conducted several years after the changes are implemented. Comparison of the results of a subsequent study with those presented here will provide an indication of the success of the measures in reducing fatigue in the railroad industry.

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Appendix.

Survey Materials

This appendix contains copies of the following survey materials:

- Cover letters from the BLET and UT Presidents
- Instructions to participants
- T&E Passenger Service Employee Daily Log (1 day)
- T&E Passenger Service Employee Background Survey

BROTHERHOOD OF LOCOMOTIVE ENGINEERS AND TRAINMEN

EDWARD W. RODZWICZ
National President

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Phone: 216.241.2630
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Enter Date

Whole Name
Address1
Address2
Location

Dear Sister or Brother:

As you may know, the Rail Safety Improvement Act of 2008 has charged the Federal Railroad Administration (FRA) with the responsibility for promulgating regulations to govern the hours of service for operating crews working in intercity passenger and commuter service. In order to create an objective and scientifically-based hours of service regulation, the FRA, with the cooperation of the BLET and the United Transportation Union, is conducting a fatigue study that focuses on intercity passenger and commuter operating crews. You have been randomly selected to participate in this very important scientific study. The results of the study will provide a clearer picture of work schedules and sleep patterns of intercity passenger and commuter operating crews. The study will also provide the statistical basis necessary to identify the appropriate areas for change to mitigate fatigue.

You are among a group of randomly selected BLET members working in intercity passenger and commuter service that are being asked to fill out work/sleep diaries for a two-week period. Your participation in this study involves: (1) completing a brief background survey; and (2) keeping a daily log for 14 consecutive days of your sleep and work times along with self-assessments of your level of alertness five times per day.

To insure that your personal information is kept private FRA has engaged the services of QinetiQ for executing the study. The names and personal information of the participants will be kept private to the extent permitted by law, and the data gathered will only be used to compile the information as a group. After the study's conclusion, the personal data gathered will be destroyed and only the compiled information will be distributed.

Completing the background survey should take less than 15 minutes; making entries in the daily log should require no more than a total of 10 minutes per day. As a reward for your participation in this study, you will receive a \$75 gift certificate to either Home Depot or Sears. *You must provide 14 consecutive days of data and a completed background survey to receive the gift certificate.*

The purpose of the study is to develop a better understanding of the work/rest schedules and sleep/napping behavior of intercity passenger and commuter operating crews and to evaluate the relationship between these schedules and fatigue. Your participation is critical to the success of this study and it is essential that you record your work, sleep and nap schedules truthfully. Only accurate data will allow us to identify where, if any, fatigue-related problems exist in our crafts. Once we have the data, we will be able to work toward creating an hours of service regulation that reduces the risk of fatigue-related accidents, improves the quality of life while minimizing the financial impact to our members.

Please read the enclosed instructions carefully before beginning your data collection. Thank you for your participation in this important research study.

Fraternally yours,

National President

A Division of the Rail Conference – International Brotherhood of Teamsters

Computer-Generated Letterhead

M. B. FUTHEY JR.
International President

ARTHUR MARTIN III
Assistant President

KIM N. THOMPSON
General Secretary and Treasurer

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NATIONAL LEGISLATIVE DEPARTMENT

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Dear Sister or Brother:

As you may know, the Rail Safety Improvement Act of 2008 has charged the Federal Railroad Administration (FRA) with the responsibility for promulgating regulations to govern the hours of service for operating crews working in intercity passenger and commuter service. In order to create an objective and scientifically-based hours of service regulation, the FRA, with the full cooperation of the United Transportation Union (UTU) and the Brotherhood of Locomotive Engineers and Trainmen (BLET), is conducting a fatigue study that focuses on intercity passenger and commuter operating crews. You have been randomly selected to participate in this very important scientific study. The results of the study will provide a clearer picture of work schedules and sleep patterns of intercity passenger and commuter operating crews. The study will also provide the statistical basis necessary to identify areas for improvements and fatigue mitigation.

You are among a group of randomly selected UTU members working in intercity passenger and commuter service that are being asked to fill out work/sleep diaries for a two-week period. Your participation in this study involves: (1) completing a brief background survey; and (2) keeping a daily log for 14 consecutive days of your sleep and work times along with self-assessments of your level of alertness five times per day.

To insure that your personal information is kept private, the FRA has engaged the services of QinetiQ for executing the study. The names and personal information of the participants will be kept private to the extent permitted by law, and the data gathered will only be used to compile the information as a group. After the study's conclusion, all the personal data gathered will be destroyed and only the compiled information will be distributed.

Completing the background survey should take less than 15 minutes; making entries in the daily log should require no more than a total of 10 minutes per day. As a reward for your participation in this study, you will receive a \$75 gift certificate to either Home Depot or Sears, in addition to helping improve your lifestyle. *You must provide 14 consecutive days of data and a completed background survey to receive the gift certificate.*

The purpose of the study is to develop a better understanding of the work/rest schedules and sleep patterns of intercity passenger and commuter operating crews and to evaluate the relationship between these schedules and fatigue. Your participation is critical to the success of this study. The data will allow us to identify any fatigue related problems specific to our crafts. Once we have the data, we will be able to work toward creating an hours of service regulation that reduces the risk of fatigue-related accidents and incidents and improves the quality of life for our members.

Please read the enclosed instructions carefully before beginning your data collection. Thank you for your participation in this important research study.

Fraternaly yours,

A handwritten signature in cursive script that reads "M. B. Futhey, Jr.".

M. B. Futhey, Jr.
International President


Survey of Work Schedules and Sleep Patterns of Train and Engine Passenger Service Employees

****Please Read Before Making Entries in Daily Log****

- Note** You must complete the daily log exactly as explained in the instructions. If you don't, you will not receive compensation (gift card), as the information cannot be included in our analysis and recommendations.
- Using the Daily Log** The log has 14 sections. Start a new section for each new day. Starting with Day 1, write the date on the first page of each section. Begin your log on a day you will be working. **You must provide data for 14 consecutive days.** If you have scheduled vacation or holiday time, do not begin the log until after these days.
- Complete the log for every day of the study, not just the days you work. **We need a record of your sleep for all 14 days.**
- Rate your sleep quality after waking up and your alertness before and after each work period. To accurately capture this information, make your log entries as soon as possible after waking and immediately at the start and end of each work period. **If you work a split assignment,** rate your alertness at the start and end of each of the two segments of your assignment. If for any reason you do not record data at the appointed time, fill out your log as soon as possible to the best of your ability. The study results will not be meaningful without complete log entries from you.
- Log your daily activities in the appropriate row (sleep, work, etc.) by marking the start and end times with two vertical lines connected by a horizontal line (e.g., |—|). In the Start/End Times row for each activity or sleep period, write the exact start and end times. **Please use military time, 0-24 hr.**
- The log contains two sample entries for 2 days, one for a split assignment and the other for a straight-through assignment. Please review these examples to make sure that you understand how to make entries in the log.
- Sleep Periods (complete daily)** Record your main sleep periods as well as any supplementary sleep periods or naps. Enter quality ratings for your longest sleep period ending on each day. If your sleep is interrupted (for any reason) for more than 15 minutes, please record this on the log by showing two separate periods. Treat interruptions of less than 15 minutes as continuous sleep. In the Location row, under the vertical lines in the sleep row, write an "A" to indicate that you slept away from home or "H" to indicate that you slept at home.
- You should report all naps that you take during on-duty time, break, interim release, or limbo time. Sleep can overlap with work, break, interim release, or limbo.**
- Explain anything unusual about your sleep on the comments page.

Please turn page over→

- Work Periods** Make entries on the activity page to record your travel to/from your reporting point (Commute), your on-duty period (Work), and limbo time or period of interim release or break, if any. Record as Commute the period from leaving home or lodging until you arrived at your reporting location. **If you arrive at your reporting point in advance of your sign-on time, record this time as commute. Similarly, if you do not leave company property immediately following the end of your service, record the time as commute.**
If you work a split assignment, please provide two sets of alertness ratings. Rate the first part of the work assignment as well as the second part following interim release.
Explain anything unusual about your work period on the comments page.
- Study Compensation** **You must return a completed background survey and 14 consecutive days of sleep and work schedule information to receive compensation.** You will receive a \$75 gift card to a retail establishment as compensation for your participation in this study. Complete the last page of the log to indicate your preference. You should receive the card within 4 weeks of returning your materials.
- Returning Study Materials** Return your Background Survey and Daily Log in the postage-paid envelope by **February 15**. If you lose it, contact Talin Chaparian, talin.chaparian@QinetiQ-NA.com or 781-684-4160, for a replacement.
- Questions or Problems?** If you have questions on any aspect of these instructions, are not sure how to report specific work or sleep information, or need additional survey materials, please contact Amanda DiFiore, amanda.difiore@QinetiQ-NA.com, 781-684-3978, or Judy Gertler, judy.gertler@QinetiQ-NA.com, 781-684-4270.



OMB No. 2130-0585

T&E PASSENGER SERVICE EMPLOYEE DAILY LOG

Important: Be sure to read the instructions before entering your responses.

M09 132

ID _____

If you have questions, please contact:

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FRA F6180.131 (07/09)

Instructions for T&E Passenger Service Employee Log

This log is in 14 sections, one for each day you will be recording data. Each section has a page for recording your assessments of your sleep. A table for recording sleep, personal time, commute to / from work, work periods, breaks / interim release, and limbo time follows the sleep ratings.

Please assign the time in each day to one of the six categories. Draw a horizontal line in the appropriate row to indicate the time you spent in that activity. Put a vertical bar at each end of the horizontal line to indicate the beginning and end of the activity. Enter the actual start and stop time of each activity period. Below the horizontal line in the "Sleep" row, write "A" if you slept away from home or "H" if you slept at home. Be sure to record all sleep periods, including naps. You should report all naps that you take during work, break / interim release, and limbo.

For the purpose of the survey, a **break** is a period less than 4 hours long when you are not operating the train but are still considered on duty. **Interim release** is a period of 4 hours or more at a designated terminal. Record breaks and interim release in the same row. Place a "T" below a period of interim release or break if the time is spent on a train. Place an "O" below these periods if the time is spent off a train.

Limbo time is time that is neither on-duty nor off-duty. It is the time after which you stop operating the train until you're released from duty. A common example of limbo time is waiting for a taxicab or van, or deadheading to the point of final release, including time spent traveling to it.

If you like, you may use the blank page following each daily entry for comments about the day's activities.

The following pages contain sample entries for two consecutive days, to illustrate how to record information. The first example is for a straight-through assignment. The second is an example that shows how to log a split assignment.

Study Compensation

Complete the last page of this log to indicate your preference for compensation.

Sample Entry 1 - Straight-Through Assignment

Sunday night you go to sleep sometime before midnight, and you wake up at 6:30 a.m. Monday morning. You are scheduled to begin work today at 5 p.m. During the day, you work around the house, run errands, and interact with your kids, until you have to get ready for work. You prepare for work, get in your car at 4:15 p.m., and arrive at work at 4:50 p.m. You report for duty at 5 p.m.

You proceed to work through the night into Tuesday morning. Your shift ends at 1:45 a.m. You drive home and watch television for a half an hour before you go to bed at 2:50 a.m. At 7 a.m. you are awakened by your family leaving for work and school. You go back to sleep and finally wake up at 10:30 a.m.

During the day you mow the lawn and go to a doctor's appointment. Before you pick up your kids from school, you take a short nap from 2 to 3 p.m. After you pick the kids up, you have an early dinner and then leave the house once again at 4:15 p.m. arriving at work at 4:45 p.m. You report for work at 5 p.m.; however, the train is delayed by 10 minutes. You work through midnight.

Activity Page

For all activities, mark the start and end times with two vertical lines connected by a horizontal line (eg., (|—|)). Then write the actual start and end times on the next line.

Sleep can overlap with work, break, interim, or limbo.

Indicate the location of your sleep on the Location row by writing "A" for sleep away from home or "H" for sleep at home.

Sample Entry 1 - Day 1

	Midnight	0200	0400	0600	0800	1000	1200	1400	1600	1800	2000	2200	Midnight
Sleep (—)													
Start/End Times	0630												
Location (A=away, H=home)	H												
Personal (—)													
Start/End Times	0630 1615												
Commute (—)													
Start/End Times	1615 1700												

For **work**, write your alertness ratings number in the line labeled Alertness Ratings. Rate your alertness at the start and end of each duty period using the following scale:

1 Falling Asleep	2 Sleepy	3 Neither Alert Nor Sleepy	4 Alert	5 Very Alert
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For **break** or **interim** release, indicate your location during this time by writing "T" if you are on a train or "O" if you are not on a train.

Sample Entry 1 - Day 1

	Midnight	0200	0400	0600	0800	1000	1200	1400	1600	1800	2000	2200	Midnight
Work (—)													
Start/End Times	1700												
Start/End Alertness Ratings	4												
Break/ Interim Release (—)													
Start/End Times													
Location (T=on train, O=off train)													
Limbo (—)													
Start/End Times													

Activity Page

For all activities, mark the start and end times with two vertical lines connected by a horizontal line (eg., (|—|)). Then write the actual start and end times on the next line.

Sleep can overlap with work, break, interim, or limbo.

Indicate the location of your sleep on the Location row by writing "A" for sleep away from home or "H" for sleep at home.

Sample Entry 1 - Day 2

	Midnight	0200	0400	0600	0800	1000	1200	1400	1600	1800	2000	2200	Midnight	
Sleep (—)		—							—					
Start/End Times		0250					1030		1400 1500					
Location (A=away, H=home)		H							H					
Personal (—)		—					—	—						
Start/End Times		0220 0250					1030 1400 1500 1615							
Commute (—)		—								—				
Start/End Times		0145 0220								1615 1700				

For **work**, write your alertness ratings number in the line labeled Alertness Ratings. Rate your alertness at the start and end of each duty period using the following scale:

1 Falling Asleep	2 Sleepy	3 Neither Alert Nor Sleepy	4 Alert	5 Very Alert
----------------------------	--------------------	---	-------------------	------------------------

For **break** or **interim** release, indicate your location during this time by writing "T" if you are on a train or "O" if you are not on a train.

Sample Entry 1 - Day 2

	Midnight	0200	0400	0600	0800	1000	1200	1400	1600	1800	2000	2200	Midnight
Work (—)	[Timeline with bars indicating work periods from 0145 to 1700 and 1800 to 0000]												
Start/End Times	0145						1700						0000
Start/End Alertness Ratings	2						4						2
Break/ Interim Release (—)	[Empty timeline]												
Start/End Times	[Empty]												
Location (T=on train, O=off train)	[Empty]												
Limbo (—)	[Empty timeline]												
Start/End Times	[Empty]												

Sample Entry 2 - Split Assignment

It's Thursday night and your last day of work for the week is tomorrow. You go to sleep sometime before midnight and you wake up at 4 a.m. Friday morning. You have breakfast, get ready, and depart from your home at 5:15 a.m. You arrive at work at 5:45 a.m. and report for duty at 5:50 a.m. At 10:30 a.m. you have interim release and report to the company-provided quiet room. You read for a short while before you take a nap from noon to 2 p.m. Before returning to duty, you take a short walk. After a 4.5 hour interim release, you work from 3 p.m. to 7:40 p.m.

After work you immediately drive home arriving at 8:10 p.m. You shower, get ready, and go out for a late dinner and a movie. You get back home, go to bed at midnight and wake up at 8 a.m.

During the day you visit your family and then run errands. You spend the rest of the day with friends, returning home at 10 p.m. You go to bed at 10:30 p.m.

For **work**, write your alertness ratings number in the line labeled Alertness Ratings. Rate your alertness at the start and end of each duty period using the following scale:

1 Falling Asleep	2 Sleepy	3 Neither Alert Nor Sleepy	4 Alert	5 Very Alert
----------------------------	--------------------	---	-------------------	------------------------

For **break** or **interim** release, indicate your location during this time by writing "T" if you are on a train or "O" if you are not on a train.

Sample Entry 2 - Day 1

	Midnight	0200	0400	0600	0800	1000	1200	1400	1600	1800	2000	2200	Midnight
Work (—)													
Start/End Times	0550 1030 1500 1940												
Start/End Alertness Ratings	3 4 5 3												
Break/ Interim Release (—)													
Start/End Times	1030 1500												
Location (T=on train, O=off train)	O												
Limbo (—)													
Start/End Times													

For **work**, write your alertness ratings number in the line labeled Alertness Ratings. Rate your alertness at the start and end of each duty period using the following scale:

1 Falling Asleep	2 Sleepy	3 Neither Alert Nor Sleepy	4 Alert	5 Very Alert
----------------------------	--------------------	---	-------------------	------------------------

For **break** or **interim** release, indicate your location during this time by writing "T" if you are on a train or "O" if you are not on a train.

Sample Entry 2 - Day 2

	Midnight	0200	0400	0600	0800	1000	1200	1400	1600	1800	2000	2200	Midnight
Work (—)													
Start/End Times													
Start/End Alertness Ratings													
Break/ Interim Release (—)													
Start/End Times													
Location (T=on train, O=off train)													
Limbo (—)													
Start/End Times													

Day 1

Date ___/___/2010

Sleep Quality Assessments

Rate your sleep upon rising from longest sleep period.

Ease of falling asleep				
1	2	3	4	5
Very difficult				Very easy

Ease of getting up				
1	2	3	4	5
Very difficult				Very easy

Length of sleep				
1	2	3	4	5
Wholly insufficient				More than sufficient

Quality of sleep				
1	2	3	4	5
Very poor				Very good

Indicate how you feel now				
1	2	3	4	5
Very sleepy				Very alert

Activity Page

For all activities, mark the start and end times with two vertical lines connected by a horizontal line (eg., (|—|)). Then write the actual start and end times on the next line.

Sleep can overlap with work, break, interim, or limbo.

Indicate the location of your sleep on the Location row by writing "A" for sleep away from home or "H" for sleep at home.

	Midnight	0200	0400	0600	0800	1000	1200	1400	1600	1800	2000	2200	Midnight
Sleep (—)													
Start/End Times													
Location (A=away, H=home)													
Personal (—)													
Start/End Times													
Commute (—)													
Start/End Times													

For **work**, write your alertness ratings number in the line labeled Alertness Ratings. Rate your alertness at the start and end of each duty period using the following scale:

1 Falling Asleep	2 Sleepy	3 Neither Alert Nor Sleepy	4 Alert	5 Very Alert
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For **break** or **interim** release, indicate your location during this time by writing "T" if you are on a train or "O" if you are not on a train.

	Midnight	0200	0400	0600	0800	1000	1200	1400	1600	1800	2000	2200	Midnight
Work (—)													
Start/End Times													
Start/End Alertness Ratings													
Break/ Interim Release (—)													
Start/End Times													
Location (T=on train, O=off train)													
Limbo (—)													
Start/End Times													

OMB No. 2130-0585

ID Number _____

T&E Passenger Service Employee Background Survey



The Federal Railroad Administration (FRA) is conducting a study of the work schedules and sleep patterns of railroad operating crews. The purpose of the study is to develop an understanding of the issue of work schedule-related fatigue of train and engine (T&E) passenger service employees. The study results will inform possible future FRA policy and regulatory actions in passenger service, will assist the railroad industry in addressing any work-schedule related fatigue issues of passenger service employees, and, in general, will contribute to overall railroad operational safety.

The data collected from this study will be used primarily for statistical purposes, and is authorized by law (49 U.S.C. 20901). Your participation in this study is completely voluntary. Your personal information will be kept private to the extent permitted by law, and will not be disclosed to anyone other than employees and contractors who work on this study.

Public reporting burden for this information collection is estimated to average 15 minutes per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing this collection of information. Please note that an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The OMB control number for this information collection is OMB No. 2130-0585 and the expiration date is December 31, 2012.

About Yourself

1. Age: ____ years
2. Sex: ____ male ____ female
3. How long have you worked in commuter/passenger service?
____ years and ____ months
4. How long have you worked in commuter/passenger service at your current railroad?
____ years and ____ months
5. What type of work do you currently do?
____ commuter service
____ intercity service
____ long haul
____ other (please explain) _____
6. My current position is
____ conductor ____ locomotive engineer
____ asst. conductor/ticket collector
____ yard foreman ____ switchman
____ trainee
____ other (please explain) _____
7. What is your marital status?
____ single ____ divorced ____ other
____ married ____ widowed
8. How many children or other dependents do you have (not including your spouse)? _____
9. How many of your dependents are under the age of 2 years? _____
10. a) Do you drink caffeinated beverages?
____ yes ____ no
b) On average, how many cups and/or cans of these beverages do you drink per day? _____

Your Health

1. How many times have you marked off sick in the last year? ___ days
2. In general, how would you rate your health? Circle one:
Poor Fair Good Excellent
3. Some people feel younger or older than their biological age. How old do you feel? ___ years
4. What type of educational materials or training has your railroad provided you on fatigue, sleep hygiene, napping, or sleep disorders?
___ videotape ___ safety briefing
___ brochure ___ none
___ other (please explain) _____
5. Have you been diagnosed as having a sleep disorder?
___ yes ___ no (skip questions 6 and 7)
6. Do you have sleep apnea?
___ yes ___ no
7. Are you receiving medical treatment for your condition?
___ yes ___ no

Sleep/Rest Arrangements

Please complete this section *only* if your job requires you to spend time at an away terminal or interim release point.

1. When held at the away-from-home terminal or point of interim release, most times:
___ I share a hotel room with one or more other workers.
___ I sleep in an individual room, not shared with anyone.
___ I use the company-provided quiet room.
___ I go home to sleep.

2. When at an away terminal or point of interim release, the company:

___ Provides me with sleeping accommodations.

___ Provides a daily per diem and I must find my own accommodations.

___ Provides me with a quiet room.

___ Does not provide either sleep/rest accommodations or daily per diem.

Your Work Schedule

1. a) If you work a job that has a regular schedule, please describe your work schedule using this table. Leave rest days blank and use military time.

	S	M	T	W	Th	F	S
On-duty time							
Off-duty time							
Break/interim release length							

b) If you work a job that does not have a regular schedule, please answer the following:

call time _____(hr:min)

call window ___ 24 hr *or* from _____ to _____

On average, how many times a day do you check the line up? _____

2. On average, how many on-duty hours do you work per week, not including interim release? _____

3. How does your job provide for rest days?
- no guaranteed rest days 2 consecutive days per week
 2 days per week 1 day per week
 other (Please explain. For example, 7 on/2 off, 8 on/2 off)

4. How many times in the past month did you work on your rest day? _____

5. How often do you feel well rested and alert over the course of your work period? Circle one:

Never Occasionally Frequently Always

Stress at Work

Use the following scale to rate how much each factor below contributes to your stress at work:

No Stress	A Little Stress	Stressful	Very Stressful
1	2	3	4

Please assign a rating to *each* of the following items:

- Lack of control over work schedule
- Loss of sleep
- Lack of guaranteed uninterrupted rest
- Coordination with other departments
- Ambiguous operating rules or procedures
- Management policies and decisions
- Job security
- Communication problems
- Inadequate staffing
- Crew management
- Responsibility for safety of others
- Lack of break time
- Inadequate time off
- Oversight of new hires
- Other (please specify) _____

Life Events

Please indicate with a ✓ whether any of the events listed below has occurred to you in the last 6 months:

- Personal illness or injury
- Marital/relationship difficulties
- Birth of a child
- Death of a spouse
- Change in sleeping habits
- Difficulty with the law
- Illness/injury of family member or friend
- Financial difficulties
- Change in living conditions
- Change in social activities
- Death of a close family member

Glossary

convenience sample – a sample from a population that is selected because it is readily available and convenient. Generalizations about the population cannot be made using data from a convenience sample.

extra board – a list of employees who fill in when regularly scheduled employees are not available to work

interim release – a period of 4 consecutive h or more between two on-duty periods at a designated terminal.

limbo time – time that is neither on duty nor off duty. It includes time awaiting deadhead transportation to the point of final release and time in deadhead transportation to the point of final release.

split assignment – a work assignment consisting of two work periods separated by a period of interim release.

straight thru assignment – a continuous work assignment that does not involve interim release.

statistical sample – a sample from a population that was selected in a way to assure that it is representative of the entire population and that conclusions about the entire population can be drawn from the sample data.

Abbreviations and Acronyms

ANOVA	analysis of variance
BLET	Brotherhood of Locomotive Engineers and Trainmen
d	day(s)
FAST	Fatigue Avoidance Scheduling Tool
FRA	Federal Railroad Administration
h	hour(s)
HOS	Hours of Service
in	inch(es)
min	minute(s)
OMB	U.S. Office of Management and Budget
PVT	psychomotor vigilance test
RSIA	Rail Safety Improvement Act of 2008
SAFTE	Sleep, Activity, Fatigue, and Task Effectiveness
T&E	train and engine service
UTU	United Transportation Union
yr	year