



Research Results

Work Schedules and Sleep Patterns of Railroad Maintenance of Way Workers

SUMMARY

The Federal Railroad Administration (FRA) Office of Research and Development sponsored a project to study the work schedules and sleep patterns of U.S. railroad maintenance of way (MOW) workers and to examine the relationship between these schedules and level of alertness of the individuals working the schedules. The methodology for this study was a survey of a random sample of currently working U.S. MOW workers who completed a background survey and kept a daily log for 2 weeks. MOW workers are a predominantly healthy male population. They work either production (construction) or non-production (maintenance) jobs. Within each of these categories, some jobs involve work on track infrastructure and others involve work on bridges and buildings. Both production and non-production workers get the same amount of nighttime sleep but their sleep on workdays is far less than U.S. adult norms. While 39 percent of U.S. adults get less than 7 hours of sleep on workdays, 66 percent of MOW workers have this amount of sleep. Nearly a quarter of non-production MOW workers and 16 percent of production workers experienced start time variability at least once during the study period, most likely as a result of an emergency call or unscheduled work period. Many MOW jobs require travel on personal time to an out-of-town lodging or rally point. Overall, 24 percent reported this type of travel. The study examined several possible explanatory factors for daytime alertness levels. While the correlations were statistically significant, the relationships were weak. Based on the experience of this study, several methodological changes are suggested for future studies of this type.

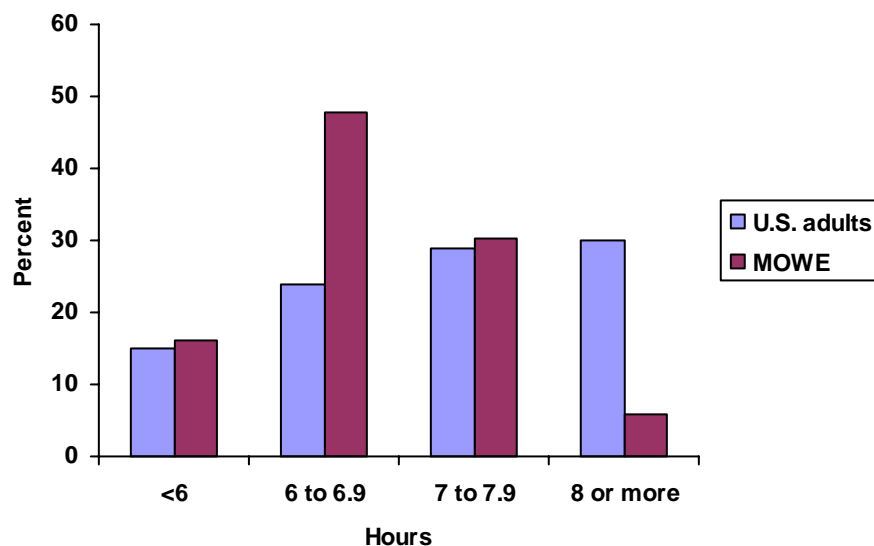


Figure 1. Duration of nighttime sleep on workdays for railroad MOW workers versus U.S. adults



BACKGROUND

In 2001, the FRA suggested, and the North American Rail Alertness Partnership agreed, on the need to study the fatigue issues of the non-operating crafts. An initial study focused on signalmen (see Research Results RR05-04). The study described here focused on MOW workers.

There are two fundamental types of MOW jobs, production (construction) and non-production (maintenance). Production jobs involve either track or bridge and building construction while non-production jobs are responsible for inspection, maintenance, and repair of the same infrastructure. In addition to a regular daily work period, non-production workers are subject to call at night and on weekends to respond to emergencies. Railroads typically assign non-production workers to a specific geographic area that may encompass several hundred miles end-to-end.

In contrast, a production MOW worker may be assigned anywhere on the railroad's system. As a result, he/she may have to travel a long distance on his/her own time to reach the lodging site or "rally point" for a construction project.

Unlike the operating crafts and signalmen, there are no statutory limits on the number of hours that MOW workers may work. A few railroads have taken voluntary steps to reduce fatigue by limiting work hours, but this is the exception rather than the norm.

OBJECTIVES

The objectives of the research were to:

- Document and characterize the work/rest schedules and sleep patterns of U.S. MOW workers, and
- Examine the relationship between these schedules and level of alertness/fatigue for the MOW workers who work the schedules.

METHODS

This research involved a survey of actively working U.S. railroad MOW workers. The study used two survey instruments, a background survey and a daily log. The background survey was designed to gather demographic information, descriptive data for the MOW worker's job type and work schedule, and a self-

assessment of overall health. The daily log was developed for recording sleep and work periods on both regular workdays and planned days off for a 2-week period.

In June 2004 the survey materials were distributed to a random sample of 845 U.S. MOW workers. The overall response rate was 31 percent.

RESULTS

MOW Worker Demographics

The survey respondents held primarily track non-production (maintenance) jobs (52 percent) and track production (construction) jobs (34 percent). The remainder worked bridge and building jobs, either production or non-production. Since the number of respondents working bridge and building jobs was small, all analysis by job type was done for production versus non-production jobs. No differentiation was made between track, and bridge and building.

Average MOW worker experience was approximately 23 years, with those working production and non-production having nearly the same level of experience. As with years of experience, the average age for production and non-production MOW workers was the same, 47 years. Nearly half were 50 years or older.

Nearly 80 percent reported their health as good or excellent. The vast majority, 89 percent, had not taken a day off due to illness in the last 6 months. The low number of workdays lost due to illness may be due in part to the fact that MOW labor agreements do not provide compensation for sick days.

Approximately 7 percent of this population of railroad workers reported having a diagnosed sleep disorder and a third have gone without treatment.

Job Characteristics

The work schedules of production and non-production MOW workers differ in several respects. While both job types are defined to work 80 hours in a 2-week period, a majority of non-production jobs (74 percent) have a 5-day workweek but less than a third of production jobs have this schedule (see Table 1). Nearly half of all production jobs work a 4-day week and 20 percent work 8-on 6-off (8-on 6-off is referred to as a compressed work schedule).



Table 1. Work schedule by job type (percent)

Work schedule	Job Type	
	Production	Non-production
4-day week	46.5	23.4
5-day week	32.5	74.0
8-on 6-off	20.0	2.6
Other	1.0	0.0

During the 2-week period of the survey, non-production workers spent 87:01 hours at work while production people averaged 89:28 hours. Both groups reported that this was about what they typically work. Had these data been collected during the winter months when there are weather-related track problems, the results likely would have been different.

One-third of the survey participants had an unscheduled work period at least once during the survey period. A MOW worker was ten times more likely to be called for an unscheduled work period on a planned day off than on a regular workday. For those called back to work on a work night, alertness levels the following morning were significantly lower than on mornings not following a callback, however, the effect size for this relationship was small.

Table 2. Start time variability by job type (percent)

Number of start time variations (in 2-week period)	Job Type	
	Production	Non-production
0	84.0	77.9
1	10.0	15.6
2	3.0	5.8
3	2.0	0.6
4+	1.0	0

Start time variability can lead to fatigue if it disrupts the worker's normal sleep pattern. Nearly a quarter of non-production MOW workers experienced start time variability at least once during the survey period, most likely as a result of an emergency call or unscheduled work (see Table 2). (Start time variability was defined as a change in start time of more than 1 hour from the previous day.) In contrast, only 16 percent of production MOW workers experienced start time variability.

Many MOW jobs, both production and non-production, require the worker to travel, usually on his/her own time, to an out-of-town meeting

point. (This location is referred to as the lodging or rally point.) Overall, 23.6 percent of the MOW workers reported this type of travel. Half of these individuals made more than one trip during the 2-week survey period. Production MOW workers traveled more than the non-production people, with 41 percent of the production MOW workers making at least one trip to a lodging/rally point over the 2 weeks of the study. In contrast, only 12 percent of the non-production jobs had this type of travel.

As shown in Table 3, travel on days off is significantly longer than on workdays. A quarter of those traveling on a planned day off traveled over seven hours. This amount of travel may compromise personal time that would otherwise be available to spend with family members and to attend to personal business. This travel may also compromise the worker's sleep time.

Table 3. Travel time to lodging/rally point by type of day (h:min)

Type of day	25 th percentile	Median	75 th percentile
Regular workday	1:30	2:05	2:38
Planned day off	3:41	5:00	7:34

Sleep Characteristics

MOW workers get less nighttime sleep on workdays than U.S. adults, as shown in Figure 1, but their sleep on planned days off exceeds that of U.S. adults. They average 6:42 hours on workdays but over an hour more sleep on days off. Both groups gave higher ratings to their sleep on planned days off than on workdays.

Two thirds of MOW workers get less than 7 hours of sleep on work nights in contrast with 39 percent of U.S. adults. In addition, 15 percent of MOW workers get less than 6 hours of nighttime sleep on workdays. Research has shown that performance declines, even with mild sleep restriction, and sleep-deprived individuals are poor judges of their impaired performance. These individuals are probably unaware of the extent of their fatigue-caused performance degradation.

MOW workers tend not to nap. For those who do, nearly half of all naps on workdays begin between 2 p.m. and 6 p.m., which corresponds with the circadian afternoon nadir making it a convenient time for naps. This time period also follows the end of the workday for many MOW workers.



Nearly all survey participants reported that their employer provides sleeping accommodations or a per diem when the work location requires sleeping away from home. The type of sleeping arrangement did not lead to statistically significant differences in sleep quality ratings.

While there was no difference in average hours of nighttime sleep, those with untreated sleep disorders reported a significantly lower quality of sleep than those who had been treated.

CONCLUSIONS

This study was conducted during the summer so that an adequate number of production MOW workers would participate. Had the survey taken place in the winter, the results would likely have been somewhat different, particularly in terms of emergency calls due to weather-related track.

Key findings of the study include the following:

- The overall nominal length of the MOW workday, including commuting and lunch breaks, allows adequate time for nighttime sleep. Overtime work, emergency call, and travel to a lodging/rally point, may compromise the MOW worker's ability to get adequate rest.
- While the average hours worked do not indicate excessive overtime, one quarter of the production MOW workers worked at least 8 hours of overtime per week. This level of overtime, if done on a regular basis, may prevent the employee from achieving full rest and recovery.
- A total of 15 percent of MOW workers are getting less than 6 hours of nighttime sleep on workdays. Research has shown that this level of sleep leads to decreased performance and that the individual is likely unaware of his/her degraded performance. Railroad industry and labor organizations' emphasize the performance consequences of inadequate sleep.
- MOW workers with diagnosed but untreated sleep disorders should be encouraged to seek treatment. Fatigue education programs should point out the potential performance consequences of untreated or poorly controlled sleep disorders.

Based on the experiences of this study, several methodological changes should be a part of any future studies of this nature. The recommended changes include the following:

- The background survey should inquire whether or not the participant has been diagnosed with sleep apnea as well as a sleep disorder so that the results can be compared with U.S. adult norms for sleep apnea.
- The data collection period should avoid holidays.

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KEYWORDS

Maintenance of way worker, work schedule, fatigue, sleep pattern