

# Shiftwork Solutions



**Effective Shiftwork Operations Management**

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## **Shift Schedule Attributes that Affect Employee Sleep/Alertness Is Your Shift Schedule Depriving Employees of Their Sleep?**

(This article originally appeared in the March 1, 2008 issue of *Occupational Health & Safety*. It was written by Jim Dillingham and Bruce Oliver of Shiftwork Solutions LLC)

Facilities that operate across multiple shifts face a significant challenge when it comes to maintaining the alertness of their employees. According to the National Sleep Foundation:

“Sleep deprivation is greatest among shiftworkers, who average only 6.5 hours of sleep compared to 6.8 hours for people on regular ‘9 to 5’ work schedules and 6.9 hours for all respondent...Shift workers are more likely to suffer from insomnia as well as excessive daytime sleepiness. They are also more likely to drive while fatigued and almost twice as likely to fall asleep at the wheel.”

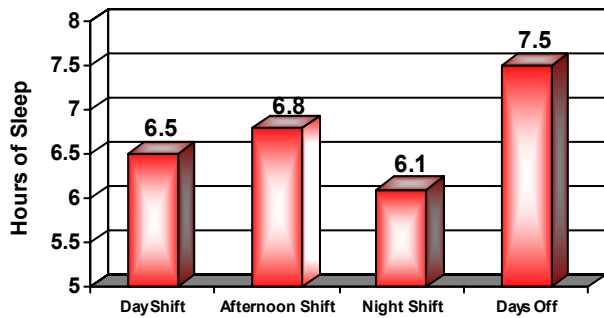
This is a serious issue for management, since the lack of sleep or poor quality sleep can lead to accidents, injuries, absenteeism, and lower productivity.

Although most managers are aware that shiftworkers don’t sleep as well as other employees, few understand how their organization’s shift schedule contributes to the problem. In this article, we examine three major shift schedule attributes that affect employee sleep: (1) shift length, (2) fixed vs. rotating shifts, and (3) shift start times. The data comes primarily from our proprietary database of employee surveys conducted with over 20,000 shiftworkers.

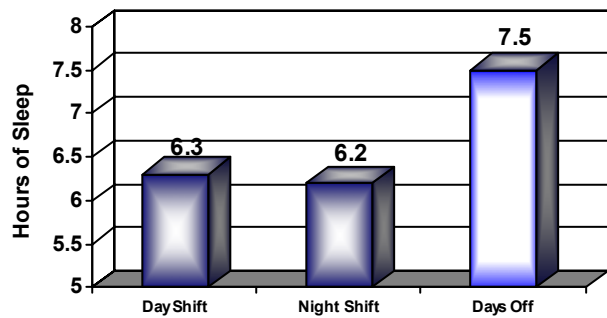
### **Shift Length**

When we compare the survey results of people working 8-hour shifts with those working 12-hour shifts, we can see how shift length affects the amount of sleep that shiftworkers get. The average daily hours of sleep for people working 8-hour shifts are shown in Figure 1. The average daily hours of sleep for people working 12-hour shifts are shown in Figure 2.

**Figure 1: Daily Sleep on 8-Hour Shifts**



**Figure 2: Daily Sleep on 12-Hour Shifts**



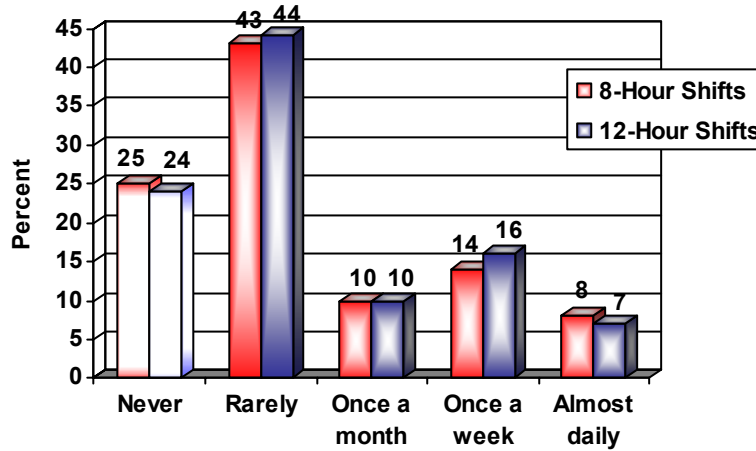
At first glance, it appears that the people working 12-hour shifts get less sleep than those on 8-hour shifts. But this is not the case over a span of several days or weeks, because 12-hour shifts provide twice as many days off and employees sleep longer on their days off. Figure 3 shows the average hours of sleep over a four-week period. Regardless of whether you compare someone working day shifts only, night shifts only, or a rotating shift schedule, the average hours of sleep over the four week period is greater on 12s.

**Figure 3: Average Hours of Sleep on 8-Hour and 12-Hour Shifts over a 4-Week Period**

Schedule	Shift Length	Days of Work	Hours of Sleep	Days Off	Hours of Sleep	Average
Days only	8 hours	21	6.5	7	7.5	6.8
	12 hours	14	6.3	14	7.5	6.9
Nights only	8 hours	21	6.1	7	7.5	6.5
	12 hours	14	6.2	14	7.5	6.9
Rotating shifts	8 hours	21	6.5	7	7.5	6.7
	12 hours	14	6.3	14	7.5	6.9

There have been a number of articles written about safety risks with 8-hour shifts vs. 12-hour shifts. The results are mixed. Although our shiftworker surveys rely on self-reported safety problems rather than documented incidents, the survey results suggest that longer shifts are just as safe as 8-hour shifts, as shown in Figure 4.

**Figure 4: Frequency of Safety or Performance Problems Due to Sleepiness**



**Fixed vs. Rotating Shifts**

When we compare the survey results of people working rotating shifts with those working fixed or “steady” shifts, we can see how this schedule attribute affects sleep. As seen in Figure 5, people working a rotating shift schedule average roughly the same amount of sleep over a four-week period as people working a fixed night shift schedule. They get less sleep than people working a fixed day shift or fixed afternoon shift.

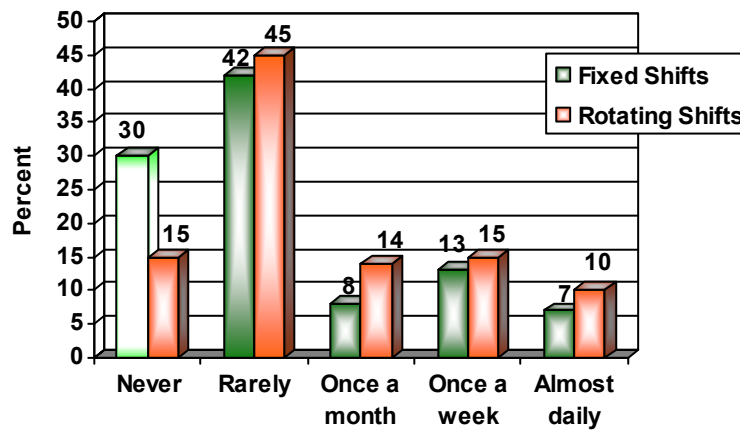
**Figure 5: Average Hours of Sleep on Fixed and Rotating Shifts over a 4-Week Period**

Schedule Format	Shift	Days of Work	Hours of Sleep	Days Off	Hours of Sleep	Average
Fixed shifts	Days	21	6.6	7	7.6	6.8
	Afternoons	21	6.9	7	7.6	7.0
	Nights	21	6.2	7	7.6	6.6
Rotating shifts		21	6.4	7	7.5	6.6

In addition to improved predictability, fixed shifts allow shift workers to sleep at approximately the same time each day. This avoids the physical stress (and poor quality sleep) most people experience when they adjust their circadian rhythm to a new sleep period with each rotation. This benefit is realized by those working fixed day, evening and voluntary night shifts. Unfortunately, many people assigned to work on a fixed night shift try to rotate back to a day routine on their days off, mitigating some of this benefit.

With regard to safety or performance problems due to sleepiness, Figure 6 shows that workers on rotating shifts report problems more frequently than workers on fixed shifts.

**Figure 6: Frequency of Safety or Performance Problems Due to Sleepiness**



### Shift Start Times

A large auto manufacturing plant we worked with had two different schedules that were an hour apart. Three-quarters of the workers on day shift started work at 6:30 a.m. The rest started an hour later. When surveyed, employees with the later starting time said they got an average of 34 minutes more sleep on the days they worked than the employees with the early start time did. Employees with the earlier start time did not go to sleep earlier, probably because of personal, family or social activities. On their days off, both groups got about the same amount of sleep.

The later start times had mixed results with the afternoon and night shifts at the plant. As seen in Figure 6, the afternoon shift with late start times got a little more sleep and the night shift with late start times got less sleep. The day shift experienced the most significant change.

**Figure 6: Average Hours of Sleep on Early and Late Start Times over a 4 Week Period**

Shift	Group	Shift Hours	Days of Work	Hours of Sleep	Days Off	Hours of Sleep	Average
Days	Early start	0630 - 1430	21	5.8	7	7.7	6.2
	Late start	0730 - 1530	21	6.3	7	7.7	6.7
Afternoons	Early start	1430 - 2230	21	6.5	7	7.5	6.7
	Late start	1530 - 2330	21	6.6	7	7.3	6.8
Nights	Early start	2230 - 0630	21	6.0	7	7.7	6.4
	Late start	2330 - 0730	21	5.8	7	7.4	6.2

Asked how often they had problems with safety or performance due to sleepiness, the group with the later starting time reported they had frequent problems 31% less often than the employees on the earlier day shift. In addition, the “later starters” accounted for only 14% of the reported accidents over a one-year period, despite representing 24% of the total workers.

This is not an isolated case. The National Institute for Occupational Safety and Health (NIOSH) and the Finnish Institute of Occupational Health found that a one-hour delay in morning shift start times at a steel mill increased worker sleep and improved waking alertness during the shift. They concluded that sleep was truncated when workers have early start times because of family and social activities in the evenings. They found that the evening and night shifts were affected negatively by starting work later; however, the results were less consistent across all measures.

## **Summary**

This article examined three schedule attributes with significant potential for affecting employee sleep. First, it was shown that 12-hour shifts result in more sleep than 8-hour shifts over a period of time, because the longer shifts provide more days off and employees sleep more on those days off. Second, it was shown that fixed shifts result in more sleep than rotating shifts, because the rotating shifts disrupt a person’s sleep patterns. Finally, it was shown that later start times on day shift result in more sleep than earlier start times, because people are reluctant to go to bed early.

This article focused on the sleep effects of three schedule attributes. Ideally, business requirements and employee preferences also will be taken into account when selecting the “best” shift schedule for your site.