



Night Work

Module Purpose

The purpose of this module is to provide participants with an overview of the *additional* hazards associated with highway construction *at night*. This module will address the factors that place construction workers at additional risk as a result of reduced visibility and the increased potential for driver error.

Time

50 minutes (2:40 - 3:30pm)
(A 10-minute break follows this module)

Objectives

Show slides 5.1 – 5.2.



Upon completion of this module, participants will be able to:

- Identify the types of hazards that exist during night work
- Recognize the key characteristics of these hazards
- Identify prevention, control, or abatement methods associated with reduced visibility, impaired motorists, higher traffic speeds, and glare and disorienting effects of bright lights and shadows
- Recognize additional hazards that night work creates and identify methods for reducing hazards

Materials and Resources

PowerPoint Slides: Module 5
Activities—Appendix 5-A and 5-B

Acknowledgements

Materials in this module draw upon information contained in: *Ben Cottrell, Improving Night Work Zone Traffic Control*, January 2000, Virginia Transportation Research Council

Rosa and Colligan, Plain Language About Shiftwork, July 1997, U.S. Department of Health and Human Services, National Institute for Occupational Safety and Health

Module 5: Night Work

Instructional Strategy and Course Content

Facilitator Notes

Lecture



1. What makes night work different than roadway construction carried out during the day? *Show Slides 5.3 – 5.4.*



2. What are some of the common problems identified with night work zones? *Show Slides 5.5 – 5.6.*



3. What are some of the solutions to problems of night work? *Show Slides 5.7 – 5.14.*



Lesson

1. What makes night work different than roadway construction work carried out during the day?

Many state DOT personnel and contractors have expressed considerable concern about the potentially hazardous conditions associated with night work zones. This concern has prompted some contractors to express reluctance to bid on night work.

Many contractors report situations where drivers are less attentive and travel at higher speeds at night. More alcohol- or drug-impaired drivers are reported to be involved in night work zone accidents. Also, both drivers and workers are more likely to be tired and fatigued during night hours. Because of this driver behavior and decreased visibility, many suspect that nighttime work zone accidents tend to be more severe and that lane closures are not as safe at night as they are during daytime operations.

In most instances, the traffic control currently used for night work is basically the same as that used for typical daytime work zones, despite the potential adverse conditions that may be encountered. For these reasons, there is a need to examine methods to improve traffic control and safety for night work zones. New technologies (such as intrusion alarms), modified traffic control plans, and new methods to monitor traffic can potentially provide improvements in night work zone safety.

2. What are some of the common problems identified with night work zones?

- Reduced visibility
- Driver impairment or inattention
- Fatigue
- Inadequate lighting
- Lack of maintenance of traffic control devices

3. What are some of the solutions to the problems of night work?

Contractors and state DOTs are successfully reducing these hazards by:

- Having police officers present and visible
- Making workers more visible
- Using drums in the taper
- Keeping traffic control devices in good condition, and
- Providing adequate lighting

According to a study conducted by the Virginia Transportation Research Board, although there is a perception that night work zones are less safe than daytime work zones, the traffic exposure data are insufficient to draw this conclusion. Based on the limited amount of data gathered from Virginia's research, there was no evidence of higher speeds at night. There is, however, a need to improve the visibility of workers.

Based on a motorists' survey conducted at selected sites in Virginia and the onsite review of work zones, common problem areas they identified included establishing work zones not based on the Manual for Uniform Traffic Control Devices, failing to maintain traffic control devices, and improperly aiming and aligning lighting to avoid glare.

The Virginia study recommends that traffic engineers take appropriate action to include the following provisions for night work zones in the recommended practice guidelines:

Improving Visibility of Equipment and Traffic Control Devices

- Use drums in the transition area for lane closures. Drums in the tangent section are optional.
- Consider requiring the contractor to have full-time traffic control staff to implement and maintain all traffic control operations when deemed appropriate. The road workers should also make sure that the work lights are not creating glare for the motorists and that vehicle lights are not a distraction. A good practice is to drive through the work zone (in the traffic space) after setting up temporary lighting to ensure that motorist vision is not impaired by the lighting. The contractor's and state DOT staff should make sure that the traffic control complies with the appropriate manual / state guidelines for uniform traffic control.
- For all work zones with limited sight distance because of road alignment, shift the transition area upstream to improve the visibility of the flashing arrow board and the taper. Similarly, when a lane closure merge point is near an entry ramp, shift the transition area upstream to separate the two merge points.
- Mark equipment with high conspicuity tape (or similar product) to ensure it is easily visible.

Improving Worker and Work Vehicle Visibility

- Require all workers to wear hard hats that have retroreflective material that is visible from all sides. DOT officials and contractors are required to consider ways to make retroreflective clothing visible through the full range of body motions.

Group Activity



Instructor should assemble and demonstrate retro-reflective properties of various types and classes of garments. Slide 5.15; see Appendix 5-A.

4. Do nighttime hazards increase or decrease due to the age of the driver? Show slide 5.16.



- Consider a policy of using of flashing and warning lights on work vehicles. (Use care so as not to distract motorists.)

Managing Traffic

- When a PCMS (portable changeable message sign) is used for night work zones, use messages appropriate for the existing road conditions. The PCMS should be considered for use as a warning device in situations where there is congested traffic ahead. It can also be used as an attention-getter later at night when traffic volumes are lower. When appropriate, the message TROOPER ON SITE, SPEED LIMIT ENFORCED might be used. The use of a radar-controlled PCMS should be considered as a countermeasure for speeding.

- Position the police vehicle to maximize its visibility.

4. Do nighttime hazards increase or decrease due to the age of the driver?

While each driver has individual characteristics that will impact their ability to react appropriately to hazardous conditions typically found in work zones, there are general attributes that should be considered based upon the age of the driver.

- New drivers lack experience.*

Young drivers and other new drivers do not have a lot of experience in recognizing warnings as they approach work zones. Once in the zone, they may become nervous when operating their vehicle in narrower lanes or adjacent to concrete barriers, barrels or cones. This unfamiliarity may cause them to over correct, or react in an unpredictable way that may cause hazards to workers and other motorists.

Inexperienced drivers may also be unappreciative of the dangers found in work zones, and fail to reduce speeds or avoid distractions like talking on cell phones or adjusting the radio.

- Older drivers have poorer vision and reduced reaction time.* In most cases, a person's nighttime vision decreases with age. This condition can be compounded in work zones when signs are not well maintained, channelizing devices are not properly placed, and there are abrupt changes in the levels of lighting. The factors are also impacted negatively in poor weather conditions. As our population grows older, more consideration should be given to these physical limitations.

Facilitator Notes

5. What can be done to reduce hazards for vulnerable workers?
Show slide 5.17.



6. In addition to traffic control, what other hazards do road workers face from night work? *Show slide 5.18.*



7. Does night work increase health problems? *Show slides 5.19 – 5.20.*



Lesson

5. What can be done to reduce hazards for vulnerable drivers?

- Changeable message signs can be very useful at night to help drivers anticipate the approaching work zone hazards that may not be visible in the dark. The flashing lights of a police car are often the most effective warning.
- To enhance the safety of older drivers and workers, ensure that all signs, markings (even temporary markings), channelizing devices, and barricades are maintained in good condition. Remove devices that are dirty, disfigured, or no longer have adequate retroreflective properties.
- Consider using temporary pavement markings, and moving channelizing devices closer together during dark conditions to reduce motorist confusion. Cover or completely remove old pavement markings that may confuse drivers.
- During night work, increase the length of tapers to facilitate traffic merges where there is reduced visibility.
- In areas where bright temporary lighting is used, consider the use of lower, transitional lighting to avoid temporary blindness that may result from abrupt transitions from darkness to bright light, and from bright light to darkness. Also, caution should be taken to ensure that temporary lighting does not glare in the eyes or mirrors of passing motorists.

While older and younger populations may be more susceptible to nighttime work zone hazards, as described here, drivers of any age can have the same vulnerabilities. A clear understanding of the hazards, and implementation of commensurate traffic control plans and devices can effectively reduce nighttime hazards for all drivers.

6. In addition to traffic control, what other hazards do road workers face from night work?

Night workers often are tired and sleepy because of their work schedule. Being overly tired makes it difficult to concentrate, which increases the possibility of errors or accidents. This can be a risk both to the worker and to the motoring public.

7. Does night work increase health problems?

Working at night makes it difficult to get enough sleep. Sleep after night work usually is shorter and less refreshing or satisfying than sleep during the normal nighttime hours. Brain and body functions slow down during the nighttime and early morning hours. The combination of sleep loss and working at the body's low-point can cause excessive fatigue and sleepiness. This makes it more difficult to perform well, which

increases the risk of accidents. Also, night work can be stressful because of frequent switching from a day to night schedule (such as on weekends) and because of a separation from family and friends. These stresses can be harmful to health.

People who work in the late night or early morning hours often feel sleepy and fatigued during their shift. This happens because their body rhythm (also called *circadian rhythm*) tells them to be asleep at those times. Night workers also must sleep during the day, when their circadian rhythm tells them to be awake. Because of this, day sleep is short and feels "light" or unsatisfying. Often, night workers don't get enough sleep during the day to combat nighttime fatigue and sleeplessness.

Some research has suggested that night workers have more upset stomachs, constipation, and stomach ulcers than day workers. Other research has not backed up this suggestion. Digestive problems could be more common in shift workers because digestion follows a circadian rhythm. Usually people eat at regular times during the day. They also eliminate waste at regular times during the day. Night work can interfere with regular eating and digestive patterns by changing work and sleep times frequently.

Heart problems have also been noted more often among shift workers than day workers. Researchers found that the longer people worked shifts, the more likely there were to develop heart disease. However, the way in which the work schedule affects the heart is not at all clear. Work schedule stress might cause heart disease, but it is more likely a combination of stress, diet, smoking, and drinking habits, other life stresses, and family history of heart disease.

8. Do people get "used" to working at night?

One might think that permanent night workers adapt or get used to their work times. Usually, the longer somebody does something, the easier it becomes. With experience, many night workers figure out tricks or personal methods to fight off some of the nighttime fatigue. However, research tells us that most permanent night workers never get used to the schedule. That is, there are many nights when they still feel tired and sleepy.

Fatigue occurs because most night workers go back to a day schedule on their days off. This is not surprising because family and friends are active during the day. Also, many errands and chores (like getting the car fixed) must be done during the day. Because most night workers often return to a day schedule, they never completely allow their sleep and body rhythms to adapt to being awake at night. They also sleep less during the day, so they don't recover from fatigue. This fatigue can

carry over from day to day. Over several days, fatigue can accumulate to unsafe levels.

9. Does one need extra rest when doing night work?

Obviously, the more a person works, the less time he or she will have for rest. People who work an 8-hour shift will have 16 hours left in a day to do everything else, and to rest. People who work a 12-hour shift have only 12 hours to do everything else and rest. In a situation like this, the extra work hours mean more tiredness and less time for rest. This is a two-edged sword. For example, many times a worker's home responsibilities, such as taking care of children, cannot change from day to day. So, if workers do overtime of a 12-hour shift, they still take care of home duties. Since these duties take the same amount of time every day, workers may sacrifice rest and sleep after a long workday. This example shows us how important the length of shift can be in terms of stress and fatigue.

When looking at work versus rest, we must also consider how many breaks are taken during the shift and the length of breaks. Depending on the type of work and length of the day, several short breaks might be better than a few long breaks. Short breaks might be better particularly for jobs requiring heavy physical labor.

How tired a worker is also depends partly on how many days in a row he or she works. ~~Fatigue builds up over several workdays, as well as~~ over a single workday. This happens especially when a person gets less sleep between workdays than on rest days. As we mentioned earlier, a worker might not get enough sleep between long workdays because of home responsibilities. So, if a person works several days in a row, for example six or seven, a good deal of sleep might be lost. Then the worker feels quite tired during the last one or two shifts.

10. What are the effects of sleep loss?

Sleep loss makes it much easier to fall asleep at inappropriate times. This affects a worker's ability to perform safely and efficiently. Sleepiness can affect performance both on and off the job. Driving to and from work is a major concern. Sleepiness affects our ability to concentrate or pay attention, and driving or operating heavy equipment requires us to pay attention at all times. This risk is not simply a matter of falling completely asleep. After sleep loss, it is possible to have very brief periods of sleep that last only a few seconds. Most people may not even realize these short sleeps are happening. During those few seconds of sleep, they are not paying attention at all. If something dangerous happens at those times, the worker or somebody else could get seriously hurt.

12. What can I do to reduce the chances that I will get hurt during night work? What experiences can participants share?



*Flip Chart Discussion
(Write student responses and night work experiences on the flip chart.)*

After discussion show Slide 5.22.

11. What is the Circadian Rhythm?

The circadian rhythm is a major body rhythm with regular ups and downs in the 24-hour day. Many systems in the body are very active at certain times of the day, and not active at all other times of the day. Usually the most activity happens in the late afternoon or early evening. For example, the body's ability to produce energy from food (metabolism) is highest in the afternoon to evening. The least activity usually happens in the middle of the night when most people are asleep. This is one reason people feel most active and alert around 4 to 6 o'clock in the afternoon, and sleepest at 4 to 6 o'clock in the morning.

12. What can I do to reduce the chances that I will get hurt during night work?

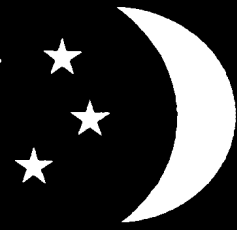
In night work, as in any situation, the key to remaining safe and healthy on the job is to understand the hazards that one faces and to remain alert to avoid conditions that may lead to dangerous situations. When doing night work, the challenge to remain attentive is even greater because of the issues we have noted related to motorist impairment, visibility, fatigue and sleep.

The following ideas may be useful to night shift workers:

- Get plenty of rest. Don't try to carry on a full range of daytime activities and then try to work a night shift.
- Be aware of your surroundings and the operations adjacent to your work area. Dangerous conditions are more difficult to see at night. Take the time to find out what is going on around you so that you are not surprised by unknown hazards.
- Wear high visibility garments. Make yourself visible to motorists and fellow workers.
- Make sure that your traffic control plan and devices are set-up and maintained properly. Take time to consider conditions that may require changes to the plan, such as merge areas, road alignments, weather conditions, local population demographics (age), and utilization of advanced warning systems.
- Plan your work. Avoid situations where workers are exposed to passing traffic without positive protection. Set up internal traffic control procedures to minimize pedestrian worker proximity to heavy construction trucks and equipment.
- Consider lighting options carefully to ensure that temporary lighting for workers does not create distractions or temporary blindness to motorists.

NIOSH TIPS FOR IMPROVING SHIFT WORK SCHEDULES

- ✓ Avoid permanent (fixed or non-rotating) night shift.
- ✓ Keep consecutive night shifts to a minimum.
- ✓ Avoid quick shift changes.
- ✓ Plan some free weekends.
- ✓ Avoid several days of work followed by four to seven day “mini-vacations.”
- ✓ Keep long work shifts and overtime to a minimum.
- ✓ Consider different lengths for shifts
- ✓ Examine start-end times.
- ✓ Keep the schedule regular and predictable.
- ✓ Examine the rest breaks.



Facilitator Notes

Group Activity



13. Group Activity: Demonstration of properties of high visibility apparel. *Slide 5.23; see appendix 5-B.*

14. Elicit additional questions and summarize. *Slide 5.24.*

15. Transition to prepare participants for Module 6.

? Questions ?

Lesson

13. Group Activity – High Visibility Apparel Demonstration

14. Questions and summary period.

15. Transition to Module 6.

Night Work – Participants Share Experiences

Objective: This activity is designed to encourage participant involvement by soliciting experiences that they may have had during night work. At the conclusion of this activity, students should recognize the additional hazards night work creates, and have some ideas for better reducing those hazards, based upon the shared experiences of their classmates.

Materials:

- Slips of paper
- Pens or pencils
- Bowl, box or other such container
- Prizes (candy, highlighters, stickers, etc.)

Time: 10 minutes

Note: Students are asked to write their name on the slip of paper along with few words about an experience they had (good or bad) during night time roadway construction. (Participants with no night-work experience may refrain.) After giving the students a few minutes to write fill out the paper, the instructor will gather the slips in the bowl (or container). The instructor will select a class member to draw a slip of paper from the container and read the "experience". Class members will then guess who wrote the paper. The one who guesses correctly will win a prize. The person who wrote the slip will explain his/her experience and the class will discuss what was done incorrectly – or correctly.

High Visibility Apparel

Objective: This activity is designed to show students the retroreflective properties high visibility garments. Upon conclusion of this demonstration, students should appreciate the added visibility that high visibility garments provide them, and understand the need for proper use and maintenance of the garments.

Materials:

- Various types of high visibility clothing (vests, hats, pants, cones, barrels, etc.)
- High powered flashlight or spotlight.

Time: 5 minutes

Activity: Pass the high visibility garments around the class, explaining the use of fluorescent colors and retroreflective materials. After explaining how the garments work under different light conditions, demonstrate their reflective characteristics by darkening the room and shining a high-powered flashlight or spotlight on the garments. The instructor may ask a student to don the clothing and stand at the front of the class, showing how a worker appears to a motorist at night. The instructor may want to show various types and brands of garments to show how placement of the retroreflective stripping can make a worker more visible.

If available, the instructor may also want to demonstrate the reduced visibility of poorly cared for, and worn clothing.