Key Message: Introductory slide

Est. Presentation Time: Less than 1 minute (Total for entire module is estimated at 60 minutes)

Explanation of Cues/Builds: None

Suggested Comments: Let’s begin the Installation and Removal of Traffic Control Devices for Safe Maintenance and Work Zone Operations training module. The type of operation (moving, stationary, etc.) is a consideration for proper installation and removal although practices and principles don’t vary across different types of maintenance operations. However, the duration and location of work is an important consideration in determining the temporary traffic control strategies. This course is based on the Grant product titled “Field Guide on Installation and Removal of Temporary Traffic Control for Safe Maintenance and Work Zone Operations.”

Suggested Questions: None

Additional Information: None

Possible Problems: None
Key Message: FHWA disclaimer
Est. Presentation Time: Less than 1 minute(s)
Explanation of Cues/Builds: None
Suggested Comments: Self explanatory
Suggested Questions: None
Additional Information: Information about the grant can be found at www.atssa.com.
Possible Problems: None
Key Message: State the module objectives
Est. Presentation Time: Less than 1 minute(s)
Explanation of Cues/Builds: None
Suggested Comments: Each state or local agency may have preferences on how their agency may perform installation and removal of temporary traffic control devices, therefore designers and contractors should check with individual agencies for guidance and/or preference on these procedures.
Suggested Questions: None
Additional Information: None
Possible Problems: None
Key Message: State the types of temporary traffic control zone types that will be covered

Est. Presentation Time: Less than 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: Some of the techniques mentioned in this module can be applied to various work zone types. The types of temporary traffic control zone setups listed are some examples of the ones referred to in the slides.

Suggested Questions: None

Additional Information: None

Possible Problems: None
Key Message: Discuss installation and removal procedures

Est. Presentation Time: 2 minute(s)

Explanation of Cues/Builds: Text box appears upon click

Suggested Comments: Installation and removal activities could involve substantial risk if not done properly and with the correct safety measures in place. It represents the first and potentially highest timeframe of exposure for workers.

Suggested Questions: Is this a safe operation? What can go wrong here? Discuss the position of the worker, also.

Additional Information: The MUTCD does not discuss this material.

Possible Problems: None
Key Message: Discuss use of high visibility safety apparel

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: Installation and removal activities require use of high visibility apparel. Class 2 apparel is required when placing and removing devices, and local or state standards may require use of Class III apparel during installation and removal, especially at night. The MUTCD requires high visibility apparel for all situations where workers are exposed to traffic or work/construction vehicles.

Suggested Questions: None

Additional Information: Check state or local specifications and see MUTCD 6D.03.

Possible Problems: None
Key Message: Discuss use of vehicle delineation
Est. Presentation Time: 1 minute(s)
Explanation of Cues/Builds: None

Suggested Comments: To improve motorist and work-crew safety, equipment must be readily seen and recognized and, therefore, warning lights should be provided on the equipment to alert motorists of potentially hazardous situations. Section 6D.03 of the MUTCD states that shadow vehicles with appropriate warning lights and signs may be used to protect workers. Additionally, retroreflective tape may be used on shadow trucks and device setting vehicles to provide motorists with a better visual of the outline of the vehicle. The MUTCD states that vehicle hazard warning lights may be used to supplement other lights on vehicles, but not in place of the high-intensity rotating, flashing, oscillating, or strobe lights. These devices are used in addition to retroreflective signs, PCMS, TMAs, arrow boards, and retroreflective apparel for workers (Class II or III).

Suggested Questions: None

Additional Information: Check state or local specifications for use of warning lights. Picture courtesy of the AAA Foundation for Traffic Safety (aaaafoundation.org).

Possible Problems: None
Key Message: Discuss use of vehicle warning lights

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: Washington State DOT developed a specification for use of warning lights. This example shows two supplemental amber lights in addition to the arrow board. When an arrow board or PCMS is used at night, the adjacent flashing warning lights must be turned off to avoid glare and possible driver confusion. The policy states that red lights can be used when they flash simultaneously, and amber lights can be used either flashing simultaneously or alternating. Blue lights can only be used on emergency vehicles. Vehicle-mounted work lights on the rear of the vehicle can only be used in a work zone if the work zone is protected by traffic control equipment such as an attenuator truck.

Suggested Questions: None

Additional Information: This is one example of a policy on warning lights. Photo courtesy of WSDOT.

Possible Problems: None
**Key Message:** Discuss use of vehicle warning lights and retroreflective markings

**Est. Presentation Time:** 1 minute(s)

**Explanation of Cues/Builds:** None

**Suggested Comments:** This slide shows excerpts from the Michigan DOT policy on vehicle visibility. The policy requires 360 degree amber warning lights on all vehicles in the work zone (no other color is allowed but the lens can be clear) with the exception of lights used to illuminate a work space. It also requires Federal Motor Carrier Safety Administration (FMCSA) recommended placement of conspicuity tape, where such tape is needed (use is not a requirement). The FMCSA standard requires a width of 50mm, 75mm, or 100mm for conspicuity tape on vehicles. MDOTs policy says that tape shall be alternating red and white, 2 inches (50mm) wide, applied to 50 percent of each side, and the full width of the rear of the vehicle.

**Suggested Questions:** None

**Additional Information:** Check state or local specifications. Also see 49 CFR 571.108 for FMCSA recommendations.

**Possible Problems:** None
Key Message: Discuss installation and removal procedures

Est. Presentation Time: 2 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: The checklist includes several items. Inventory means account for the devices you need to implement the temporary traffic control plans before proceeding to the site. Always review plans to be sure you have accounted for everything that is needed. Also be sure that they devices are available and determine a plan for how to accomplish the installation and removal. Discuss procedures and review installation and removal plans so that everyone is aware of his/her responsibilities. Make sure all workers have the appropriate training to perform their intended functions. Have a list of emergency contracts readily available. Visit the site in advance and discuss the procedures that you have reviewed, staging locations, etc. Be sure law enforcement personnel are aware of the activity as needed. Be prepared and do your homework!

Suggested Questions: None

Additional Information: The MUTCD does not discuss this material.

Possible Problems: None
**Key Message:** Discuss installation and removal procedures

**Est. Presentation Time:** 3 minute(s)

**Explanation of Cues/Builds:** Text boxes (3 separate ones) appear upon click

**Suggested Comments:** Self explanatory. Be prepared and do your homework!

**Suggested Questions:** Which point do we need to locate first in the field? The beginning of the work space! Everything is measured from there, working your way towards traffic, to mark the location of all devices. Only then are we ready to bring devices to the site for installation. For installation, install devices WITH THE FLOW OF TRAFFIC until the installation is complete.

**Additional Information:** The MUTCD does not discuss this material.

**Possible Problems:** The following slides visually show this sequence.
Key Message: Summarize sequence of installation and removal procedures

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: Text box appears upon click

Suggested Comments: In summary, erect the sign the motorists would see first, and proceed “with the flow of traffic” until you complete the installation.

Suggested Questions: Why white and pink only? All other colors are taken!

Additional Information: The MUTCD does not discuss this material. Utility color code: RED = Electric; YELLOW = Gas/Oil; BLUE = Water; GREEN = Sewer; ORANGE = Communications/Cable TV; PINK = Temporary Survey Markings; and WHITE = Proposed Excavation.

Possible Problems: These colors are generally accepted in some areas. These may differ by location.
Key Message: Summarize sequence of installation and removal procedures

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: Self explanatory

Suggested Questions: None

Additional Information: The MUTCD does not discuss this material.

Possible Problems: We just discussed the need for white or pink only, but this picture shows yellow markings. This is to illustrate the point that utility location markings are needed prior to digging for post mounted signs.
3. Install the first sign(s) motorists will see. Proceed downstream (“with the flow of traffic”)

- Cover signs that do not apply

**Key Message:** Summarize sequence of installation and removal procedures

**Est. Presentation Time:** 1 minute(s)

**Explanation of Cues/Builds:** None

**Suggested Comments:** Signs are installed on the right side of the roadway and may also be installed on the left side as an enhancement. When installing on both sides of a one-direction segment, do not cross heavy traffic on foot with signs. If there is a full shoulder on the left, drive to the location of each sign and use a shadow truck for protection. If two trucks are used at the same time with two crews, stagger the parked vehicles by several hundred feet to avoid the “gate effect” on drivers where they slow and move toward the center of the roadway.

**Suggested Questions:** What if the work zone is taken out on a daily basis? Using a similar method as described for the installation, cover the signs when not in use and uncover them the next day when work begins again.

**Additional Information:** The MUTCD does not discuss this material.

**Possible Problems:** None
4. Install the shoulder taper, if used
5. If required, place an arrow board in the proper location per the TCP

Key Message: Summarize sequence of installation and removal procedures
Est. Presentation Time: 1 minute(s)
Explanation of Cues/Builds: None
Suggested Comments: Arrow boards should be on the shoulder at the beginning of the taper, or as close to the front of the taper as possible.
Suggested Questions: None
Additional Information: The MUTCD does not discuss this material.
Possible Problems: None
6. Place channelizing devices at the required spacing for the appropriate distance to form the taper.

Key Message: Summarize sequence of installation and removal procedures

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: The preferred method for placing devices is from a safe position on a moving vehicle (see platform examples later in this module). If speeds are low and the area is an urban setting, workers may be able to safely walk the devices into place. If on foot, have a shadow truck for protection.

Suggested Questions: None

Additional Information: The MUTCD does not discuss this material.

Possible Problems: None
Key Message: Summarize sequence of installation and removal procedures

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: Avoid turning your back on traffic when placing devices. Often it may be difficult to perform your duties without brief periods where you must turn your back toward traffic. If workers must be oriented where they cannot see traffic, they should use a TMA or have a spotter watching traffic with an air horn to provide warning.

Suggested Questions: What is this person doing wrong? He has his back turned to traffic and is unable to see and react to an errant vehicle.

Additional Information: The MUTCD does not discuss this material.

Possible Problems: None
Key Message: Summarize sequence of installation and removal procedures

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: Self explanatory

Suggested Questions: None

Additional Information: The MUTCD does not discuss this material.

Possible Problems: None
Step 1

Lay out the traffic control

- Measure and mark:
  - Buffer space
  - Taper length
  - Shoulder taper, if used
  - Sign spacing

**Key Message:** Discuss sequence of installation procedures

**Est. Presentation Time:** 1 minute(s)

**Explaination of Cues/Builds:** Arrow appears upon click

**Suggested Comments:** Determine beginning of work space first, then work against the flow of traffic to determine buffer space, taper length, shoulder taper (if used), and then sign spacing.

**Suggested Questions:** None

**Additional Information:** None

**Possible Problems:** None
Step 2

If post mounting signs, call for utility locations

Key Message: Discuss sequence of installation procedures
Est. Presentation Time: 1 minute(s)
Explanation of Cues/Builds: Arrow appears upon click
Suggested Comments: Consider the amount of lead time that may be needed by utility companies to locate any nearby utilities.
Suggested Questions: None
Additional Information: None
Possible Problems: None
Key Message: Discuss sequence of installation procedures

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: Arrow appears upon click

Suggested Comments: Advance warning signs provide guidance to motorists on how to maneuver through the work zone. They also warn drivers that installation activities are going on when applicable. Placement of signs and sign spacing must comply with the MUTCD. The first sign attracts attention (Road Work Ahead), the second sign tells drivers what to expect (Right Lane Closed Ahead), and the third sign tells them that the lane is ending and that they need to merge left (Lane Ends).

Suggested Questions: None

Additional Information: The MUTCD does not discuss this material.

Possible Problems: None
Key Message: Discuss sequence of installation procedures
Est. Presentation Time: 1 minute(s)
Explanation of Cues/Builds: Arrow appears upon click
Suggested Comments: Discuss as needed
Suggested Questions: None
Additional Information: None
Possible Problems: The following slide is not to scale and the number of devices needs to be calculated for every instance when using a shoulder taper. It is common to use lane width OR shoulder width to calculate the shoulder taper length. Maintenance engineers often use the shoulder width.
Key Message: Discuss sequence of installation procedures

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: Arrow appears upon click

Suggested Comments: Truck or trailed mounted arrow boards may be used continuously or intermittently. If the arrow board is always on it can be positioned and left for the remained of the project. If it is turned off at any time it should be protected or moved. When not in use, consider this priority order for positioning: 1) removing the arrow board, 2) moving it beyond the clear zone, or 3) moving it away from traffic and delineating it with channelizing devices such as drums.

Suggested Questions: None

Additional Information: For a stationary lane closure, the arrow boards should be placed on the shoulder at the beginning of the taper. If room is not available on the shoulder (for example, the shoulder is narrow), place in the closed lane as close to the front of the taper as possible. If arrow boards are used when multiple lanes are closed in tandem, the preferred position for additional arrow displays is in the closed lane at the start of the merge taper. Under various situations, such as for narrow shoulders, placement may be in the middle or at the end of the merge taper but always behind the channelizing devices. The boards shall be located behind any channelizing devices used to transition traffic from the closed lane.

Possible Problems: None
Key Message: Discuss sequence of installation procedures
Est. Presentation Time: 1 minute(s)
Explanation of Cues/Builds: Arrow appears upon click
Suggested Comments: Discuss as needed
Suggested Questions: None
Additional Information: The maximum spacing between devices is equal to the posted speed.
Possible Problems: Removed the shoulder taper for visual appearance of slide.
Key Message: Discuss sequence of installation procedures

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: Arrow appears upon click

Suggested Comments: The devices are installed to form the longitudinal buffer space. The lateral buffer space is the offset from these devices to the work space as measured perpendicular to the arrow shown.

Suggested Questions: None

Additional Information: The MUTCD does not discuss this material. The maximum spacing between devices along the buffer is equal to two times the posted speed.

Possible Problems: None
**Step 8**

Install channelizing devices along the **work space**

Allow space for equipment, materials and vehicles between the work space and buffer space.

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**Key Message:** Discuss sequence of installation procedures

**Est. Presentation Time:** 1 minute(s)

**Explanation of Cues/Builds:** Arrow appears upon click

**Suggested Comments:** Self explanatory

**Suggested Questions:** None

**Additional Information:** The MUTCD does not discuss this material. The maximum spacing between devices along the work space is equal to two times the posted speed.

**Possible Problems:** None
Step 9

Install channelizing devices to form the **termination taper, if used**

Termination areas are typically optional on short duration operations of 12 hours or less

**Key Message:** Discuss sequence of installation procedures

**Est. Presentation Time:** 1 minute(s)

**Explanation of Cues/BUILDs:** Arrow appears upon click

**Suggested Comments:** Discuss as needed.

**Suggested Questions:** None

**Additional Information:** None

**Possible Problems:** None
Key Message: Discuss sequence of installation procedures
Est. Presentation Time: 1 minute(s)
Explanation of Cues/Builds: Arrow appears upon click
Suggested Comments: Discuss as needed.
Suggested Questions: None
Additional Information: The MUTCD does not discuss this material.
Possible Problems: None
Key Message: Discuss sequence of installation procedures

Est. Presentation Time: 2 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: Now that the installation is complete, the next step is to perform a drive-through inspection. Drive-through inspections may be mandated at the state level and are encouraged at the federal level. If the closure extends overnight, a drive-through inspection should also be conducted after sunset to assess traffic control under all applicable conditions.

Suggested Questions: Why do we do a drive-through at night? To see how visible devices are and whether drivers might have any difficulties seeing them and reacting appropriately.

Additional Information: MUTCD section 6B.01: “To provide acceptable levels of operations, routine day and night inspections of TTC elements should be performed.”

Possible Problems: Drive-through inspection is usually required by the State.
Key Message: Discuss sequence of removal procedures

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: Arrow appears on click.

Suggested Comments: Removal may start after the work space is clear.

Suggested Questions: What would you remove first? The termination area, to leave the advance warning area up for as long as possible. The main objective is safety for workers, motorists, and pedestrians.

Additional Information: The MUTCD does not discuss this material.

Possible Problems: None
Key Message: Discuss sequence of removal procedures

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: Removal may start after the work space is clear.

Suggested Questions: How is this accomplished – which way should the truck be pointed and how does it move? This may vary by location. Some states require the vehicle to proceed with legal traffic movements and therefore require the vehicle to back up in the closed lane. Other states require removal of devices to the shoulder prior to pick up, and typically a truck would drive with the flow of traffic on the shoulder once the devices are out of the travel way. If driving in reverse, an attenuator could be used on the truck to protect motorists from impact. When driving forward against the flow of traffic, some consider the engine to provide some protection to the work vehicle in the event of impact compared to rear impact without an attenuator (impact is away from the gas tank, etc.). This, however, may be less safe for the motorist.

Additional Information: The MUTCD does not discuss this material. Try to create discussion about the local policy/practice.

Possible Problems: None
Key Message: Discuss sequence of removal procedures

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: Removal may start after the work space is clear of devices and free of debris. The work space should be clear of anything that was present during the work activity.

Suggested Questions: See slide

Additional Information: The MUTCD does not discuss this material.

Possible Problems: None
Key Message: Discuss sequence of removal procedures

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: Removal may start after the work space is clear.

Suggested Questions: None

Additional Information: The MUTCD does not discuss this material.

Possible Problems: None
Key Message: Discuss sequence of removal procedures
Est. Presentation Time: 1 minute(s)
Explanation of Cues/BUILDs: None
Suggested Comments: Removal may start after the work space is clear.
Suggested Questions: None
Additional Information: The MUTCD does not discuss this material.
Possible Problems: None
Remove Advance Warning signs last!

Why?

They tell drivers to look for you!

Key Message: Discuss sequence of removal procedures

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: Removal may start after the work space is clear. In Maryland, the preference is to remove the advance warning signs last, with the flow of traffic, as workers are no longer protected by channelizing devices.

Suggested Questions: See slide

Additional Information: The MUTCD does not discuss this material.

Possible Problems: None
Key Message: Summarize sequence of removal procedures
Est. Presentation Time: 1 minute(s)
Explanation of Cues/Builds: Text box appears upon click.
Suggested Comments: Reverse the process so the advance warning area is removed last! Remove “against the flow of traffic.”
Suggested Questions: Why?
Additional Information: The MUTCD does not discuss this material.
Possible Problems: This is just a summary slide.
**Removing Stationary Lane Closures**

1. Make sure the activity area is clear
2. If required, see that appropriate pavement markings are in place
3. **Remove channelizing devices “against the flow of traffic”**

**Key Message:** Summarize sequence of removal procedures

**Est. Presentation Time:** 1 minute(s)

**Explanation of Cues/Builds:** None

**Suggested Comments:** Self explanatory

**Suggested Questions:** None

**Additional Information:** The MUTCD does not discuss this material.

**Possible Problems:** This slide discusses in words what you just discussed with pictures.
4. Place removal vehicle on shoulder and remove devices upstream from taper by hand
5. Remove the arrow board after ensuring the roadway is clear
6. Remove the advance warning signs last after all temporary traffic control devices are removed

**Key Message:** Summarize sequence of removal procedures

**Est. Presentation Time:** 1 minute(s)

**Explanation of Cues/Builds:** None

**Suggested Comments:** Self explanatory

**Suggested Questions:** None

**Additional Information:** The MUTCD does not discuss this material.

**Possible Problems:** This slide discusses in words what you just discussed with pictures.
Key Message: Discuss options for installation and removal

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: This photo shows installation practices demonstrated in a closed training environment in Washington State.

Suggested Questions: Is this photo illustrating installation, removal, or both? What are the different ways to remove devices (think about the orientation of the truck)? If this were a highway open to the public, and the truck was being used to remove devices, then it would be driven forward against the flow of traffic. It could also be backed up against the flow of traffic, depending on access to the devices from the other side of this particular truck. The third way would be to remove devices to the shoulder (if possible) and then drive with the flow of traffic to pick them up. What are the pros and cons of each? We examine them on the next slide.

Additional Information: Photo source: WSDOT

Possible Problems: None
Key Message: Discuss alternatives for removing devices

Est. Presentation Time: 2 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: There are a few primary techniques for removing devices. A recent inquiry into removal practices documented that all responding state agencies (26) allow backing against the flow of traffic for removal of devices. One agency requires contractors to remove devices this way, but allows in-house crews to remove devices by driving forward against the flow of traffic. One agency stated that they do not allow crews to drive forward against the flow of traffic. Eight agencies allow driving with the flow of traffic for removal of devices. Seven out of these 8 agencies noted a requirement that shadow vehicles with attenuators be used for protection of the crew when removing devices with the flow of traffic. This setup is similar to a mobile operation (see associated typical application(s) from the MUTCD for mobile operations). Police services may also be utilized to provide a rolling roadblock while crews remove devices (only one agency referenced this practice). It is important to make sure signs are always visible to motorists while crews are installing and removing devices.

Suggested Questions: What are the pros and cons of each?

Additional Information: This information came from 26 state DOT responses to a question posed via the Work Zone Safety Clearinghouse (http://www.workzonesafety.org).

Possible Problems: None
Key Message: Discuss options for removal of devices

Est. Presentation Time: 1-2 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: Maine DOT recently changed to primarily using trailer mounted attenuators. Removal vehicles with trailer mounted attenuators have issues with backing. Due to the issue of controlling the trailer, Maine DOT considered removing devices with the flow of traffic. After much discussion, they later decided that when a vehicle with truck mounted attenuator is available, devices are removed by backing against the flow. When only a trailer mounted attenuator is available, they remove the trailer and back against the flow of traffic. They considered the option of driving with the flow of traffic as mobile operation using multiple trailer mounted attenuators with arrow boards, but decided that the exposure was short enough that there was less risk from backing without an attenuator compared with the mobile operation. For the mobile operation, a shadow vehicle would follow within 100 feet of the removal truck and another shadow vehicle would stay back to show the flashing arrow and always be in a visible position for motorists approaching. Some agencies may also use another shadow on the shoulder in this setup. In Maine, striping operations on interstates have had issues with shadow vehicles getting hit (moving 20-25 mph); therefore, with slower speeds the trucks in the removal operation would be even more likely to get hit. Overall, backing without an attenuator posed less risk of safety issues.

Questions/Information/Problems: None
**Key Message:** Summarize sequence of removal procedures

**Est. Presentation Time:** 1 minute(s)

**Explanation of Cues/Builds:** None

**Suggested Comments:** Self explanatory

**Suggested Questions:** Always follow that sequence. There is only one exception. Which one and why?

**Additional Information:** The MUTCD does not discuss this material.

**Possible Problems:** None
Key Message: Discuss why detours are an exception

Est. Presentation Time: 2 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: How would you install and remove this detour? Drivers would look for signs that are not there yet! So detours are installed “backwards” or “against the flow of traffic”.

Suggested Questions: What would happen if we install devices with the flow of traffic? Drivers would look for signs that are not there yet! Poor public relations?

Additional Information: MUTCD 6B.01: Before any new detour or temporary route is opened to traffic, all necessary signs shall be in place.

Possible Problems: None
**Key Message:** Summarize sequence of installation and removal of detours

**Est. Presentation Time:** 1 minute(s)

**Explanation of Cues/Builds:** None

**Suggested Comments:** Self explanatory

**Suggested Questions:** None

**Additional Information:** The MUTCD does not discuss this material.

**Possible Problems:** None
3. Begin installation with the last sign in the detour series before establishing activity signing and placing devices (unless those signs are covered until detour is in effect)
4. Detour signs should be removed downstream
5. Drive through the detour

Key Message: Summarize sequence of installation and removal of detours
Est. Presentation Time: 1 minute(s)
Explanation of Cues/Builds: None
Suggested Comments: Self explanatory
Suggested Questions: None
Additional Information: The MUTCD does not discuss this material.
Possible Problems: None
Key Message: List some field measurement techniques

Est. Presentation Time: 2 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: To approximate the distance in the field, some methods are available:

- **Roller Tape**: Use a roller tape device for shorter distances (up to ½ mile).

- **Vehicle Odometer**: Use the vehicle odometer to measure longer distances such as longer sign spacing distances in the advance warning area.

- **Intermediate Reference Location Signs**: Approximate distances using Reference Signs (typically located at one-tenth of a mile spacing).

- **Survey Markings**: On construction projects, station markings or other survey markings may be used if visible and distances are available.

- **Skip-Line Method**: Upon arrival at the scene, determine the pattern of the skip lines. Most skip lines are on a “10-30” pattern. This means that the painted lines are 10 feet long and the gap between them is 30 feet long.

- **Pacing Method**: In advance, determine the length of your stride and how many paces it would take you to cover the distances needed.

Questions/Information/Problems: None
**Key Message:** Introduce TMA as a shadow vehicle to protect workers

**Est. Presentation Time:** 1 minute(s)

**Explanation of Cues/Builds:** None

**Suggested Comments:** Self explanatory

**Suggested Questions:** Now we know the meaning of these diagonal lines. What is it? Cars should pass on the slide that the lines slope down toward.

**Additional Information:** The MUTCD does not discuss this material.

**Possible Problems:** In some states, shadow trucks with TMAs are required during installation. TMAs are discussed in the TCS course in more detail. The discussion here is from the perspective of protecting workers during installation and removal.
Use of Truck-Mounted Attenuators

It is highly recommended that a shadow vehicle with a Truck Mounted Attenuator (TMA) with appropriate warning lights be used when installing and removing devices on multi-lane highways and whenever the shoulder width prevents setup completely off the traveled way.

TMA requirements vary by State

Key Message: Introduce TMA as a shadow vehicle to protect workers
Est. Presentation Time: 1 minute(s)
Explanation of Cues/Builds: None
Suggested Comments: It is highly recommended that a shadow vehicle with a Truck Mounted Attenuator (TMA) with appropriate warning lights be used when installing and removing devices on multi-lane highways and whenever the shoulder width prevents setup completely off the traveled way.
Suggested Questions: None
Additional Information: The MUTCD does not discuss this material.
Possible Problems: In some states, TMAs are required during installation.
### Typical Needs When Setting Up a Work Zone

- Installation commonly requires 3 to 4 people
- Additional crew needed for shadow vehicles and advance warning vehicles
- Also may need flagging devices, channelizing devices, signs and supports, PCMS, arrow boards, etc.

**Key Message:** Discuss typical needs for setting up a work zone

**Est. Presentation Time:** 1 minute(s)

**Explanation of Cues/Builds:** None

**Suggested Comments:** Commonly, it may take 3 to 4 crew members to set up a work zone. Additional crew may be needed to operate shadow vehicles and advance warning vehicles.

**Suggested Questions:** None

**Additional Information:** None

**Possible Problems:** None
**Recommendations for Common Issues and Challenges**

- Determine the best positioning to minimize exposure
- Follow the traffic control plan (ask about the TCP if in doubt or don’t have one)
- Select the most appropriate devices (cones = short duration; drums = longer duration)
- Use shadow trucks with TMAs

**Key Message:** Discuss ideas for alleviating common issues and challenges

**Est. Presentation Time:** 1 minute(s)

**Explanation of Cues/Builds:** None

**Suggested Comments:** These ideas can help reduce exposure when installing the temporary traffic control zone.

**Suggested Questions:** None

**Additional Information:** None

**Possible Problems:** None
Key Message: Discuss one example for how to minimize exposure

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: A traffic control plan will likely already be designed when installers get involved in the project. The idea here to illustrate a common sense approach to laying out traffic control. This is referred to as the Iowa Weave (although it is no longer in use by the Iowa DOT) or the “Arkansas Shift.” When there is a need to work on both sides of the roadway, a quick change of devices in the shift will allow for closure of either side without the need for removing and reinstalling the merging taper. Consideration must be given to exposure during the phase change.

Suggested Questions: Why merge traffic just to shift them back? To reduce exposure compared with taking up the closure and then reinstalling it when needing to work on the left lane.

Additional Information: This sample was provided by Iowa DOT.

Possible Problems: None
Key Message: Discuss Typical Application (TA) 38 from the MUTCD

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: Installation of this setup is similar to the concepts we have described – removal may require extra precautions. The first step is to close the left lane and then install a lane shift to move traffic from the center lane back to the left lane. Installation and removal sequence still follows the principles we have discussed (install with the flow and remove against the flow). Shadow vehicles are highly recommended along with law enforcement assistance to provide protection both during installation and removal (both left lanes may be closed temporarily using shadow trucks and arrow boards to avoid crew exposure in the middle of the roadway while placing and removing devices).

Suggested Questions: What are the pros and cons? Enhanced capacity and reduce exposure, respectively.

Additional Information: Some agencies and contractors may not use a TTC setup like the one shown here except in situations where no viable alternative exists. The reason being that the crew may have added exposure in the center lane during installation and also after all devices have been removed if the right lane and center lane remain open to traffic. A crossover is also an option to borrow a lane from the other direction for a long term application with high volumes.

Possible Problems: None
**Key Message:** Discuss Typical Application 39 from the MUTCD

**Est. Presentation Time:** 1 minute(s)

**Explanation of Cues/Builds:** None

**Suggested Comments:** This TA provides guidance on how to close two lanes in one direction on a four lane freeway (2 lanes in each direction). Installation of this setup is similar to the concepts we have described. The first step is to close the lane on the side of the freeway that will accept the diverted traffic. Next, close a lane on the “closed side” of the freeway and shift traffic to the inner lane on the other side. Installation and removal sequence still follows the principles we have discussed (install with the flow and remove against the flow). Shadow vehicles are highly recommended along with law enforcement assistance. Pavement markings are placed on the outside of the devices as shown.

**Suggested Questions:** None

**Additional Information:** Other typical applications are available in the MUTCD for review of installation and removal considerations. The MUTCD also states that pavement markings shall be in place prior to opening a temporary roadway or detour route to traffic. Temporary markings may be used for up to 2 weeks prior to installation of permanent markings.

**Possible Problems:** None
Key Message: Discuss some examples of platforms for setting devices

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: These platforms are in use in some states and have been evaluated by OSHA. This one is in use by the Illinois Tollway Authority. The platforms hold a person or persons and devices that are being placed in the roadway. It is highly recommended that a shadow vehicle follow the installation and removal platform truck to shield the workers from traffic. The platforms shown in the next few slides are designed for installation and removal of different types of channelizing devices (cones, drums, etc.) and can be used to set out portable signs.

Suggested Questions: None

Additional Information: The MUTCD does not discuss this material. Note that harnesses are not recommended as a method of fall protection, as the worker would have to be tethered so tightly (to avoid being dragged behind the vehicle) that it would not allow for feasible placement of devices.

Possible Problems: None
Key Message: Discuss some examples of platforms for setting devices

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: These platforms are in use in some states and have been evaluated by OSHA. This truck is used to install and remove devices. The truck holds the installer as the truck moves slowly downstream / upstream, depending on whether installation or removal is occurring, and depending on the policy for removal (direction of travel).

Suggested Questions: None

Additional Information: The MUTCD does not discuss this material.

Possible Problems: None
Key Message: Discuss some examples of platforms for setting devices

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: These platforms are in use in some states and have been evaluated by OSHA. This one is from Guidelines Pavement Striping, Inc.

Suggested Questions: None

Additional Information: The MUTCD does not discuss this material.

Possible Problems: None
**Key Message:** Discuss some examples of platforms for setting devices

**Est. Presentation Time:** 1 minute(s)

**Explanation of Cues/Builds:** None

**Suggested Comments:** These platforms are in use in some states and have been evaluated by OSHA. This one is from Guidelines Pavement Striping, Inc.

**Suggested Questions:** None

**Additional Information:** The MUTCD does not discuss this material.

**Possible Problems:** None
**Key Message:** Discuss some examples of platforms for setting devices

**Est. Presentation Time:** 1 minute(s)

**Explanation of Cues/Buils:** None

**Suggested Comments:** These platforms are in use in some states and have been evaluated by OSHA. This one attaches to the lift gate.

**Suggested Questions:** None

**Additional Information:** The MUTCD does not discuss this material.

**Possible Problems:** None
Key Message: Discuss some examples of platforms for setting devices

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: These platforms are in use in some states and have been evaluated by OSHA. This one is from Superior Road Striping, Inc. and has platforms built into each side of the truck bed. This platform is mainly used for installation and removal of channelizing devices such as cones and possibly drums.

Suggested Questions: None

Additional Information: The MUTCD does not discuss this material.

Possible Problems: None
Key Message: Discuss some examples of platforms for setting devices

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: These platforms are in use in some states and have been evaluated by OSHA. This one is from Superior Road Striping, Inc. and has platforms built into each side of the truck bed. This platform is mainly used for installation and removal of channelizing devices such as cones and possibly drums.

Suggested Questions: None

Additional Information: The MUTCD does not discuss this material. These lowered platforms with rails are especially good designs for installation and removal of devices.

Possible Problems: None
Key Message: Discuss some examples of platforms for setting devices

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: This example is from the Minnesota Department of Transportation. It is an automatic cone setting and retrieval truck. The University of California at Davis Advanced Maintenance and Highway Technology Research Center (AHMTC) has also developed some prototypes for cone placement and retrieval.

Suggested Questions: None

Additional Information: The MUTCD does not discuss this material.

Possible Problems: None
Key Message: State the module objectives
Est. Presentation Time: Less than 1 minute(s)
Explanation of Cues/Builds: None
Suggested Comments: Each state or local agency may have preferences on how their agency may perform installation and removal of temporary traffic control devices, therefore designers and contractors should check with individual agencies for guidance and/or preference on these procedures.
Suggested Questions: None
Additional Information: None
Possible Problems: None
Key Message: Recap module

Est. Presentation Time: 1 minute(s)

Explanation of Cues/Builds: None

Suggested Comments: Answers: 1. The beginning of the work space; 2. The advance warning signs / End road work sign; 3. End road work sign / Advance warning signs; 4. A detour.

Suggested Questions: None

Additional Information: None

Possible Problems: Avoid telling the audience the answers to these questions. Their purpose is to gauge understanding.