

International Municipal Signal Association
presents

IMSA Work Zone Temporary Traffic Control Technician



Advancing the Future of Public Safety

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Intent of Refresher Session

- This review is not intended to cover every aspect of the exam and is not limited to the content, or questions found on the exam.
- To briefly review the required technical knowledge and understanding of a typical Traffic Control Technician gained through job experience and previous training.
- Review the latest concepts of industry standards in an overview format designed to promote group discussion and sharing of ideas.
- Questions should be asked as the presentation is underway and the topic is under discussion – others will benefit from any questions asked!

IMSA Program Clarification

- 1) IMSA certification programs include *ALL* of North America, mostly the United States and Canada
- 2) Our industry lacks continuity in education, training, knowledge, and skill set across North America
- 3) Furthermore, our certifications cover people working in all facets of public safety, such as:
 - Public Agencies, Contractors, Manufacturer's, Dealers, Tech Support Services, Design Firms, Consultants, and Education Outlets
- 4) You will see products, technologies, and other examples used in all these sectors. *You could see things that you may not be familiar with, or use in your local area, or fall outside your scope of work, because **it will be covered on the exams.***
- 5) These programs cover *everything* related to Work Zone

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Introduction

Program Goals

Students will understand basic Temporary Traffic Control (**TTC**) terms and where and how to use the standards that govern which TTC plans and devices should be installed.

Our mission:

- For each student to know the purpose of a Work Zone
- For each student to be able to find TTC standards in the MUTCD and how to use the MUTCD to find layouts, TTC devices, taper formulas, and the correct way to install a TTC zone **safely** and with minimal disruption to the traveling public.
- Students will understand how to install the different types of TTC Devices within the chosen TTC design and functions of maintaining and adjusting existing TTC Zones.

Temporary Traffic Control

Temporary traffic work zones are established on roadways to facilitate construction, maintenance, repair, or any other activities that require temporary changes to the normal flow of traffic. The purpose of these work zones is to create a safe environment for both the workers and the traveling public.

Here are some key purposes of temporary traffic work zones:

- **Safety:** The primary purpose of work zones is to ensure the safety of workers and road users. By creating a designated area for construction or maintenance activities, work zones help separate workers and equipment from moving traffic, reducing the risk of accidents and injuries.
- **Traffic Flow Management:** Work zones are designed to manage and direct traffic flow effectively. They may involve lane closures, detours, reduced speed limits, and temporary traffic control devices like cones, barriers, and signs. These measures help maintain traffic organization and minimize congestion, despite the ongoing work.
- **Worker Protection:** Work zones provide a controlled environment for workers to carry out their tasks safely. They establish a physical barrier between workers and passing vehicles, reducing the likelihood of accidents or incidents caused by close proximity.

Temporary Traffic Control

- **Infrastructure Maintenance:** Temporary work zones are often established for maintenance and repair activities such as road resurfacing, bridge repairs, or utility installations. These zones allow for necessary infrastructure improvements while minimizing disruptions to the overall transportation network.
- **Public Awareness and Communication:** Work zones also serve as a means of communicating information to the public. They display signs and warnings to inform drivers about upcoming changes, such as lane shifts, closures, or alternate routes. This helps drivers navigate through the work zone and adapt to the temporary traffic patterns.

Overall, the purpose of temporary traffic work zones is to **ensure the safety of workers and road users, manage traffic flow, and enable the completion of necessary construction or maintenance activities while minimizing disruptions to transportation networks.**

Depending on the complexity of the project requiring temporary traffic control, the TTC could be done by the local agency having jurisdiction, the contractor or agency doing the road work, or a company that specializes in temporary traffic control can be contracted.

Work Zone Facts

- **Every 14 minutes**, there is an injury in a work zone.
- During the past 5 years, **work zone crashes have caused more than:**
 - **4,400 Deaths** (85 percent of which were the driver or passenger) and **200,000 injuries**
- Drivers are the most frequent fatality in work zone crashes.
- Most work zone fatalities involve working-age adults.
- Rear-end* crashes are the most common type of work zone crash.
- Fatal work zone crashes occur most often in summer and fall.
- A large number of fatal work zone crashes occurred on roads with speed limits ≥ 50 mph.
- Stopping distance for motor vehicles at 50 mph:
 - Dry roadway ~300 ft / Wet roadway ~400 ft / Icy pavement ~1,250 ft
- A loaded 80,000lb. tractor-trailer requires almost 50% more stopping distance.
- It takes only an extra 25 seconds to cover 1 mile at 45 mph compared to 65 mph.
- Areas where traffic is entering or leaving work zones are often more dangerous because drivers may be changing lanes and merging.

TRAFFIC SIGN COLORS



RED



WHITE



ORANGE



GREEN



YELLOW



BLUE



FLUORESCENT
YELLOW GREEN



BROWN

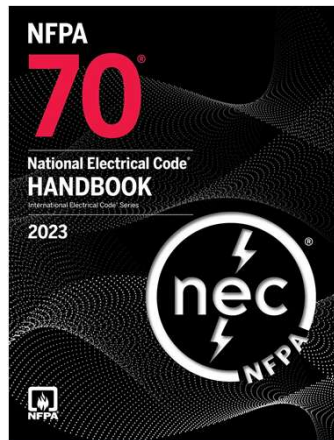
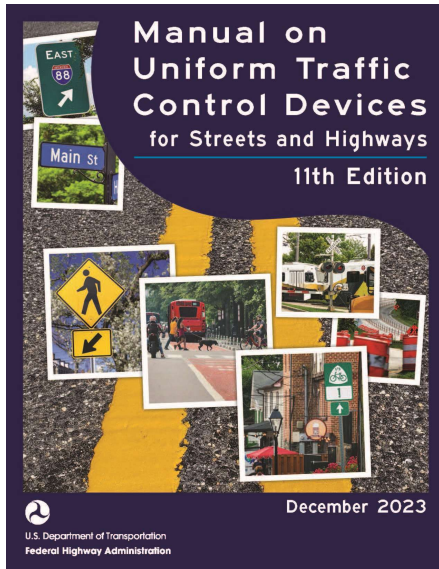


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Session 1: Standards, Specifications and References

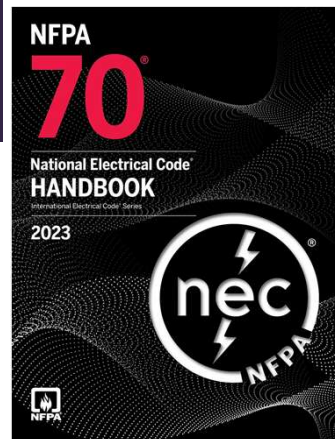
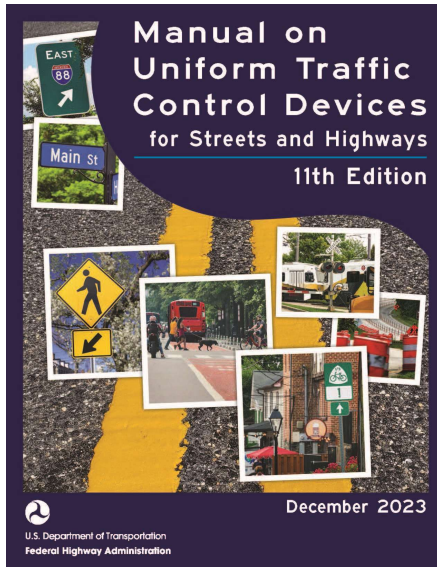
Governing Agencies and Manuals

The following are some of the primary sources of the standards and specifications that need to be followed when constructing, operating, maintaining and performing other tasks in a Work Zone.



- **FHWA** (Federal Highway Administration) publishes:
 - SHS (Standard Highway Signs) and the
 - **MUTCD** (Manual on Uniform Traffic Control Devices)
 - Uniformity and Consistency, safety, legal compliance, and efficiency and traffic flow.
- **OSHA** (Occupational Safety and Health Administration)
 - Worker Safety, Standard Setting, Compliance and Enforcement, whistleblower protection.
 - SDS: safety data sheets for chemicals
- **NEC** (National Electrical Code)
 - Electrical Safety, National Standards, Electrical System Design, and Installation and Maintenance.

Governing Agencies and Manuals



- NESC (National Electrical Safety Code)
- ANSI (American National Standards Institute)
- ITE (Institute of Transportation Engineers)
- State DOT (Dept. of Transportation) Standards
- County & Local DOT Standards

Governing Agencies and Manuals - references for Canada

- **OHS** (Occupational Health and Safety)
 - In Canada, Occupational Health and Safety is regulated and enforced by government at the provincial level. Minimum standards are set through the code and OHS Act.
- **(TAC)** Transportation Association of Canada / **(ATC)** Association des Transports du Canada
 - Publishes the **MUTCDC** for Canada among other transportation reference materials. The MUTCDC is often used as a guideline by government agencies and design consultants for traffic signal and sign designs for installations in Canada.
- **(CEC)** Canadian Electrical Code, Part 1
 - Majority of provinces and municipalities have adopted CEC as the safety standard for Electrical Installations in the areas of Traffic Signals and Streetlighting.
 - Safety Standards for Electrical Installations are governed and enforced by the Provincial Safety Act.

Standards Specifications and References

MUTCD

The **MUTCD** stands for the "Manual on Uniform Traffic Control Devices". It is a document published by the Federal Highway Administration (**FHWA**) in the United States that provides national standards and guidelines for the design, placement, and maintenance of traffic control devices.

The primary purpose of the MUTCD is to promote uniformity and consistency in traffic control devices across the country. These devices include signs, signals, pavement markings, and other elements used to regulate, warn, and guide road users.

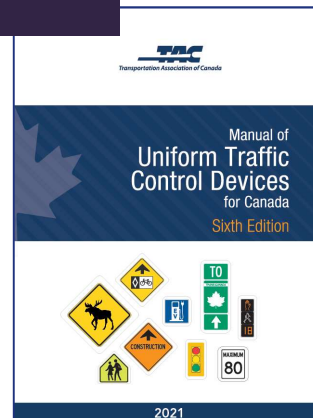
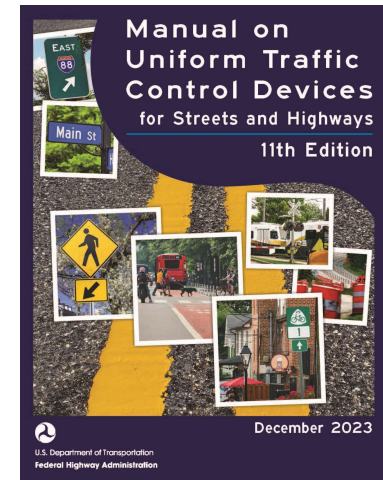
The standards for **Temporary Traffic Control** are found in **Part 6** of the manual. The recently released 2023, 11th edition, is referenced throughout this program. Students should become familiar with this document and learn how to use it.

https://mutcd.fhwa.dot.gov/kno_11th_Edition.htm

https://mutcd.fhwa.dot.gov/pdfs/11th_Edition/part6.pdf

The Manual of Uniform Traffic Control Devices for Canada (**MUTCDC**) also provides similar standards and guidelines and promotes uniformity across the Canadian provinces.

<https://www.tac-atc.ca/en/>



Manual on Uniform Traffic Control Devices MUTCD

- Part 1 – General
- Part 2 – Signs
- Part 3 – Markings
- Part 4 – Highway Traffic Signals
- Part 5 – Traffic Control Traffic Control Device Considerations for Automated Vehicles
- **Part 6 – Temporary Traffic Control**
- Part 7 – Traffic Control for School Areas
- Part 8 – Traffic Control for Railroad and Light Rail Transit Grade Crossings
- Part 9 – Traffic Control for Bicycle Facilities

Manual on Uniform Traffic Control Devices

MUTCD

When used in this Manual, the text headings of **Standard**, **Guidance**, **Option**, and **Support** shall be defined as follows:

- A. Standard** - a statement of required, mandatory, or specifically prohibitive practice regarding a traffic control device. All Standard statements are labeled, and the text appears in **bold** type. The verb “**shall**” is typically used. The verbs “should” and “may” are not used in Standard statements. Standard statements are sometimes modified by Options.
- B. Guidance** - a statement of recommended, but not mandatory, practice in typical situations, with deviations allowed if engineering judgment or engineering study indicates the deviation to be appropriate. All Guidance statements are labeled, and the text appears in *italics* type. The verb “**should**” is typically used. The verbs “shall” and “may” are not used in Guidance statements. Guidance statements are sometimes modified by Options.

Manual on Uniform Traffic Control Devices

MUTCD

- C. Option** - a statement of practice that is a permissive condition and carries no requirement or recommendation. Option statements sometime contain allowable modifications to a Standard or Guidance statement. All Option statements are labeled, and the text appears in regular, nonbold type. The verb “*may*” is typically used. The verbs “shall” and “should” are not used in Option statements.
- D. Support** - an informational statement that does not convey any degree of mandate, recommendation, authorization, prohibition, or enforceable condition. Support statements are labeled, and the text appears in regular, nonbold type. The verbs “shall,” “should,” and “may” are not used in Support statements.

Manual on Uniform Traffic Control Devices MUTCD

In this presentation most of the references and specifications will be from **Part 6** of the **MUTCD**. Specific MUTCD references will be noted when items are covered.

Whenever the acronym “**TTC**” is used in Part 6, it refers to
“**temporary traffic control.**”

The needs, safety and control of all road users (motorists, bicyclists, and pedestrians within the streets, highways, and/or site roadways open to public travel, including persons with disabilities) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

Manual on Uniform Traffic Control Devices

MUTCD

When the normal function of the roadway, or a site roadway open to public travel, is suspended, TTC planning provides for continuity of the movement of motor vehicle, bicycle, and pedestrian traffic (including accessible passage); transit operations; and access (and accessibility) to property and utilities.

The primary function of TTC is to facilitate movement of road users through or around TTC zones while protecting road users, workers, responders to traffic incidents, and equipment.

Of equal importance to the public traveling through the TTC zone is the safety of workers performing the many varied tasks within the work area. TTC zones present constantly changing conditions that are unexpected by the road user. This creates an even higher degree of vulnerability for the workers and incident management responders on or near the roadway. At the same time, the TTC zone provides for the efficient completion of whatever activity interrupted the normal use of the roadway.

Consideration for road user safety, worker and responder safety, and the efficiency of road user flow is an integral element of every TTC zone, from planning through completion. A concurrent objective of the TTC is the efficient construction and maintenance of the highway and the efficient resolution of traffic incidents.

Manual on Uniform Traffic Control Devices

MUTCD

No one set of TTC devices can satisfy all conditions for a given project or incident. At the same time, defining details that would be adequate to cover all applications is impractical. Instead, **Chapter 6P** displays 54 typical applications that depict common applications of TTC devices.

The TTC selected for each situation depends on the type of highway, road user conditions, the duration of operation, physical constraints, and the nearness of the work area or incident management activity to road users.

The TTC needs on low-volume and special purpose roads will sometimes be minimal, especially for shorter-term durations and for lower-speed roads. The use of maintenance vehicle warning flashers, a limited number of signs, or a single flagger could be adequate for these situations.

Improved road user performance might be realized through a well-prepared public relations effort that covers the nature of the work, the time and duration of its execution, the anticipated effects upon road users, and possible alternate routes and modes of travel. Such programs have been found to result in a significant reduction in the number of road users traveling through the TTC zone, which reduces the possible number of conflicts.

Manual on Uniform Traffic Control Devices MUTCD

Operational improvements might be realized by using intelligent transportation systems (ITS) in work zones. The use in work zones of ITS technology, such as portable camera systems, highway advisory radio, variable speed limits, ramp metering, traveler information, merge guidance, warning systems for vehicles exiting the workspace, and queue detection information, is aimed at increasing safety for both workers and road users and helping to ensure a more efficient traffic flow. The use in work zones of ITS technologies has been found to be effective in providing traffic monitoring and management, data collection, and traveler information.

TTC plans and devices shall be the responsibility of the public body or official or the owners of site roadways open to public travel having jurisdiction for guiding road users.

There should be adequate statutory authority for the implementation and enforcement of needed road user regulations, parking controls, speed zoning, and the management of traffic incidents. Such statutes should provide sufficient flexibility in the application of TTC to meet the needs of changing conditions in the TTC zone.

Manual on Uniform Traffic Control Devices

MUTCD

The provisions of Part 6 apply to both rural and urban areas. A rural highway is normally characterized by lower volumes, higher speeds, fewer turning conflicts, and less conflict with pedestrians or other vulnerable road users.

An urban street is typically characterized by relatively low speeds, wide ranges of road user volumes, narrower roadway lanes, frequent intersections and driveways, significant vulnerable road user activity, and more businesses and houses.

The determination as to whether a particular facility at a particular time of day can be considered to be a high-volume roadway or can be considered to be a low-volume roadway is made by the public agency or official having jurisdiction.

Special plans preparation and coordination with transit, other highway agencies, law enforcement and other emergency units, utilities, schools, trucking associations, and railroad companies might be needed to reduce unexpected and unusual road user operation situations.

FHWA SHS – Standard Highway Signs

The “Standard Highway Signs” book, commonly referred to as the **SHS**, is a publication that provides standardized designs and specifications for traffic signs and pavement markings used on public roadways in the United States.

It is published by the Federal Highway Administration (**FHWA**) and serves as a companion to the Manual on Uniform Traffic Control Devices (MUTCD).

https://mutcd.fhwa.dot.gov/kno-shs_2024.htm

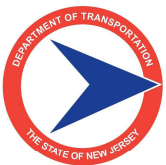
https://mutcd.fhwa.dot.gov/shsm_interim/index.htm



State and Local Standards

State, County, and City standards and specifications usually deal with specific designs, types of devices, procedures and methods of operation customized for these agencies.

New Jersey
Department of Transportation



Standard Specifications
for Road and Bridge Construction

2019

Colorado Department of Transportation

Standard Specifications
for
Road and Bridge
Construction



2023



Standard
Specifications
for Construction
and Maintenance of
Highways, Streets,
and Bridges

Adopted by the
Texas Department of Transportation
September 1, 2024

FLORIDA
DEPARTMENT
OF
TRANSPORTATION



STANDARD SPECIFICATIONS
FOR
ROAD AND BRIDGE
CONSTRUCTION
FY 2023-24



2025
STANDARD
SPECIFICATIONS
FOR
HIGHWAY
CONSTRUCTION

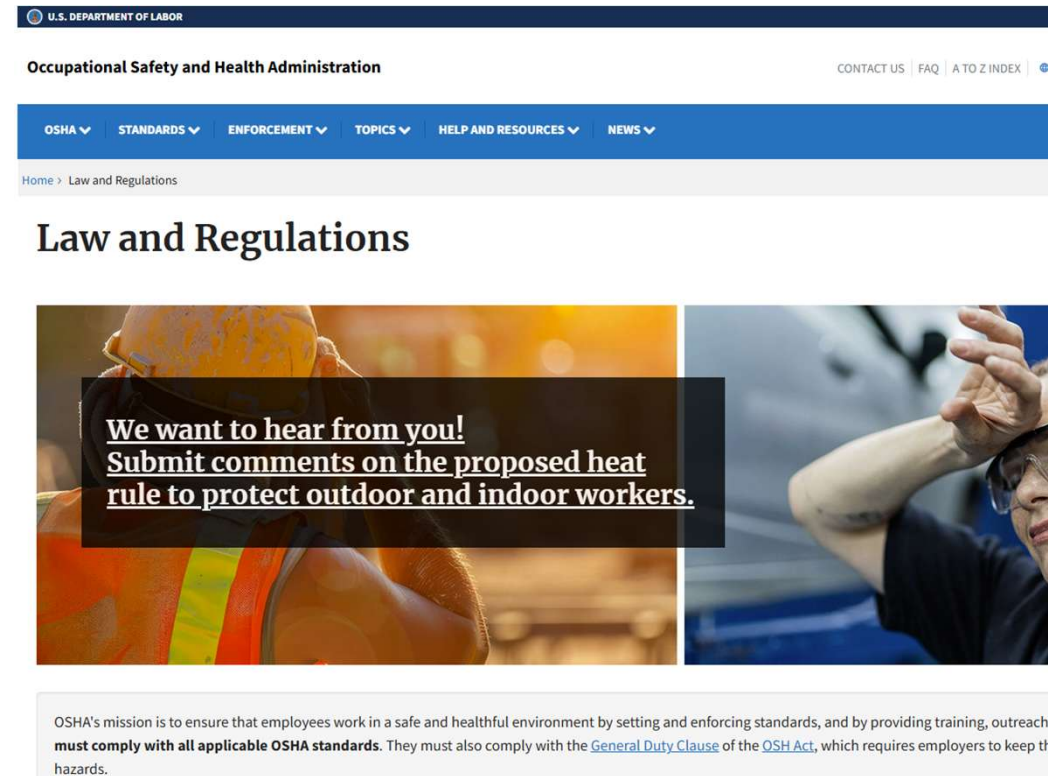
Occupational Safety and Health Administration

OSHA stands for the Occupational Safety and Health Administration. It is a federal agency within the United States Department of Labor. OSHA's primary mission is to ensure safe and healthy working conditions for employees across various industries in the United States.

Here are some key aspects of OSHA:

1. Workplace Safety Standards
2. Inspections and Compliance
3. Training and Education
4. Record keeping and Reporting
5. Whistleblower Protection
6. Partnerships and Collaboration

<https://www.osha.gov/> / 800-321-OSHA (6742)



National Electrical Safety Code - NESC

Published by the Institute of Electrical and Electronics Engineers (IEEE), the **NESC** covers a wide range of topics related to electrical safety, to include:

1. General Requirements
2. Work Rules for the Operation of Electric Supply and Communication Lines and Equipment

Safety Rules for the Installation and Maintenance of:

3. Electric Supply Stations and Equipment
4. Overhead Electric Supply and Communication Lines
5. Underground Electric Supply and Communication Lines

<https://standards.ieee.org/products-programs/nesc/>

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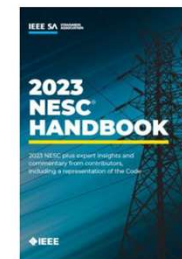
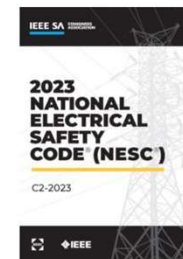
[Home](#) > [Products & Programs](#) > The National Electrical Safety Code® (NESC®)

The NESC®

Published exclusively by IEEE and updated every five years to keep the Code up-to-date with changes in the industry and technology, the National Electrical Safety Code® (NESC®) sets the ground rules and guidelines for practical safeguarding of utility workers and the public during the installation, operation, and maintenance of electric supply, communication lines and associated equipment.

[Learn More About the Value of NESC and Participation >](#)

As the definitive safety standard for more than a century, the National Electrical Safety Code continues to be the go-to resource for utility companies of all ownership structures. With the latest edition, the NESC 2023 offers the industry with the latest guidelines and best practices to help ensure the safety of utility workers, the public, and the general public.

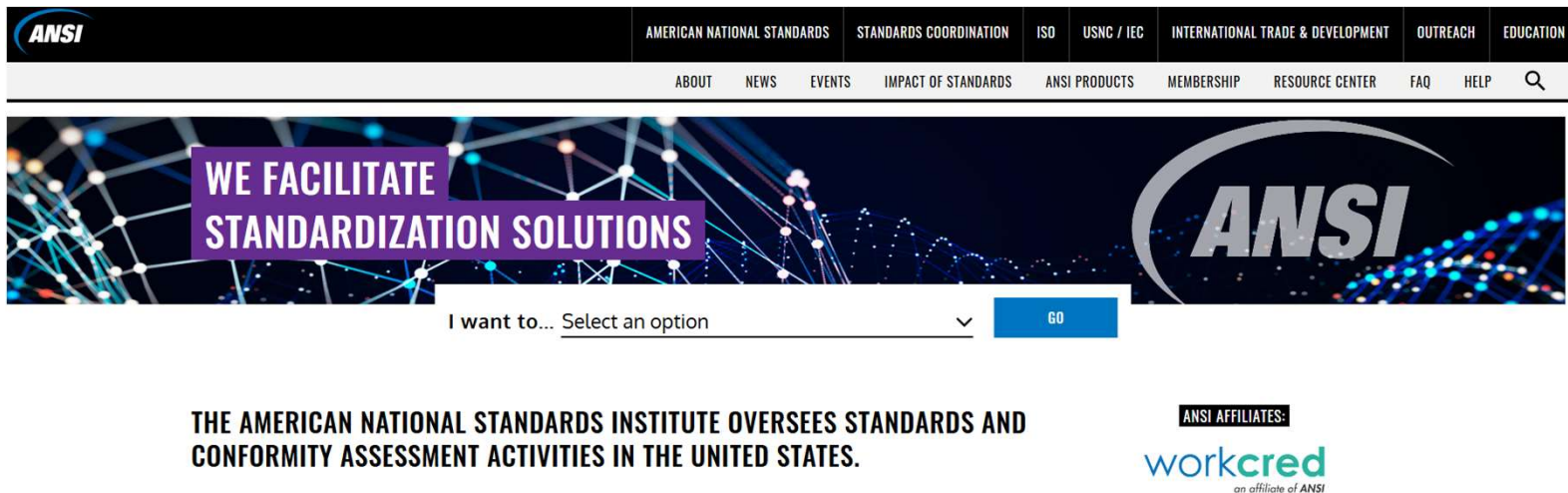


[Learn More About the 2023 NESC Edition and Related Products >](#)

ANSI – American National Standards Institute

The American National Standards Institute (**ANSI**) is a private, non-profit organization that administers and coordinates the U.S. voluntary standards in construction and industry safety. Areas that we need to become familiar with are safety clothing and equipment (PPE) and fall protection.

<https://www.ansi.org/>



Knowledge Check

What organization or document **does not** deal with or set standards for working near electrical lines?

- a) MUTCD
- b) NEC
- c) NESC
- d) OSHA

Knowledge Check

Standards for Temporary Traffic Control are in _____ of the MUTCD.

- a) Part 4
- b) Part 6
- c) Part 8
- d) Part 9

Knowledge Check

What agency sets standards for a safe and healthful work environment?

- a) MUTCD
- b) NESC
- c) ANSI
- d) OSHA

Session 2: Safety on the Job Site / PPE



Safety First



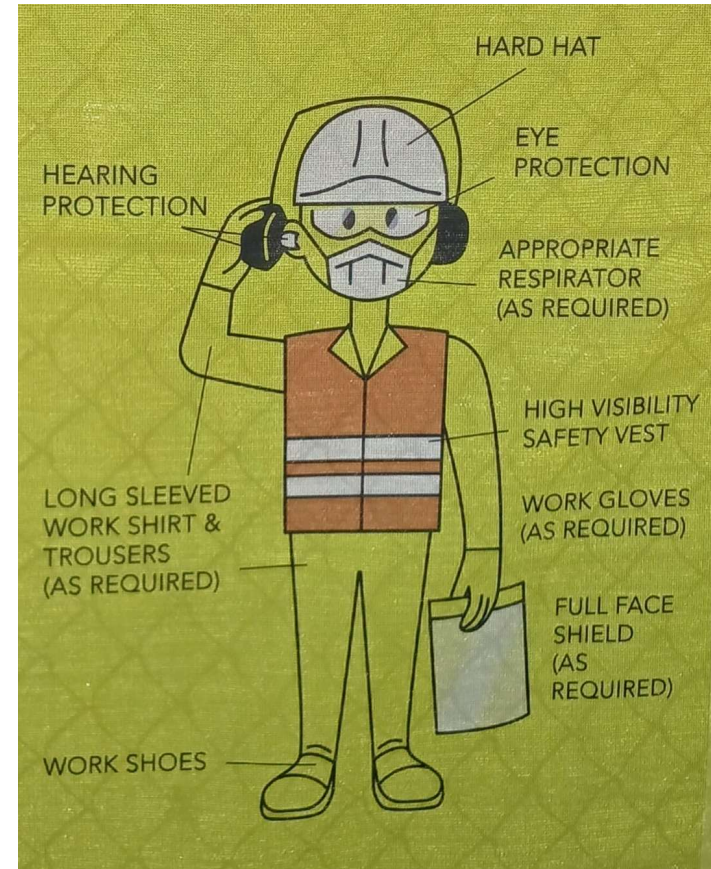
Safety on the Job Site

- **PPE** - Personal Protective Equipment
- **Aerial Lifts**
- **Electricity**
- **Underground Utilities**
- **SDS** - Safety Data Sheet
- **Other Safety Concerns**



Safety - PPE

- **Hard Hat**
- **Safety Glasses**
- **Hearing Protection**
- **Dust Masks**
- **High-Visibility Safety Apparel**
- **Work Gloves**
- **Steel Toe Work Boots**



Personal Protective Equipment - PPE

PPE requirements in work zones can vary depending on the nature of the work being performed and the specific safety regulations in place. PPE requirements should always be discussed at the Pre-Activity Meeting, prior to any work being performed.

Here are some of the most common types of PPE used in work zones:

- **Hard Hat:** A hard hat is essential to protect the head from falling objects, overhead hazards, and potential impacts.
- **High-Visibility Clothing:** Workers in work zones often wear high-visibility clothing, such as reflective vests or jackets, to make themselves more visible to other workers and motorists, especially in low-light conditions.
- **Safety Glasses or Goggles:** These protect the eyes from flying debris, dust, chemicals, or other hazards that may cause eye injuries.
- **Work Gloves:** Workers may wear gloves to protect their hands from cuts, abrasions, chemicals, or other hazardous substances. **Insulated Gloves:** For protection when working on or near live electrical lines.
- **Steel-Toed Boots:** Sturdy footwear with reinforced toes provides protection against heavy objects, falling materials, or accidental impacts. **Composite Boots:** are insulated to help protect from electric shock.

Personal Protective Equipment - PPE

- **Ear Protection:** In noisy work zones, ear protection such as earplugs or earmuffs is used to safeguard against hearing damage caused by loud machinery or equipment.
- **Respiratory Protection:** Depending on the work being performed, respiratory protection such as dust masks, respirators, or self-contained breathing apparatus (SCBA) may be required to protect against dust, fumes, chemicals, or airborne contaminants.
- **Fall Protection Equipment:** For work at heights, fall protection equipment like safety harnesses, lanyards, and lifelines are used to prevent falls and mitigate the risk of serious injuries.
- **Protective Clothing:** In certain work zones, specialized protective clothing such as flame-resistant clothing, chemical-resistant suits, or coveralls may be necessary to protect against specific hazards.

It's important to note that specific PPE requirements may vary depending on the industry, job tasks, and local safety regulations. Workers should always consult the relevant safety guidelines and regulations specific to their work zone.

Safety - PPE

According to the Occupational Safety & Health Administration (OSHA), “Employees working in areas where there is a possible danger of head injury from impact, or from falling or flying objects, or from electrical shock and burns, shall be protected by protective helmets.”

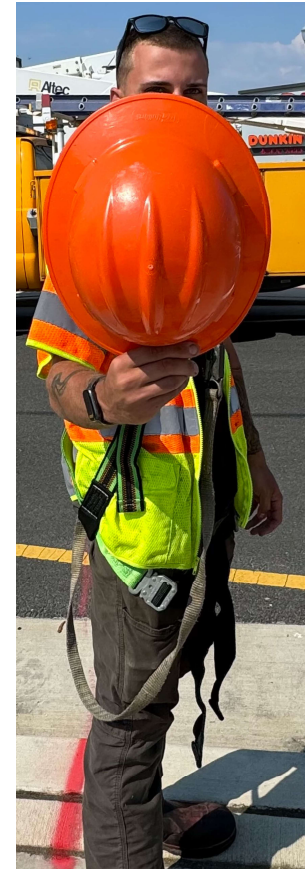
When at risk, specially designed protective helmets are required in order to counteract the dangers of electrical shock hazards.

Hard hats that are considered to be “*OSHA approved*” must meet the minimum criteria established by the American National Standards Institute (**ANSI**) and the International Safety Equipment Association (**ISEA**), in accordance with the most current ANSI/ISEA Z89.1-2014 (R2019) standard.

Hard hats do have an expected work life. Replacements will be necessary. ANSI recommends replacing hard hats every 5 years and inspecting them regularly to ensure they are safe.

Safety - PPE

Appropriate Personal Protective Equipment (**PPE**) must be worn at all times when you are on the job site.



Personal Protective Equipment (PPE)

• Who Needs High-Visibility Safety Apparel?

- All workers within the right-of-way (ROW) of a Federal-aid highway who are exposed either to traffic (vehicles using the highway for purposes of travel) or to construction equipment within the work area shall wear high-visibility safety apparel.
- These occupations include roadside workers, maintenance crews, tow truck drivers and first responders (police officers/fire personnel)
- Worker Visibility Final Rule-23 CFR 634-Worker Safety
- Section 5(a)(1) of the OSH Act, 29 U.S.C. §654(a)(1)
- The purpose of this requirement "to decrease the likelihood of worker fatalities or injuries caused by motor vehicles and construction vehicles and equipment...."

Personal Protective Equipment (PPE)

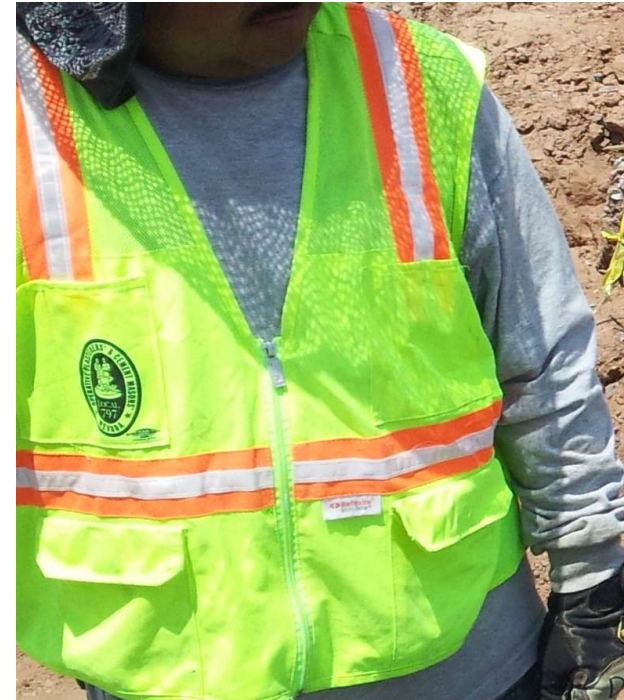
- **American National Standards Institute (ANSI) approved safety vests must meet specific criteria regarding color, retroreflective material, and the placement of reflective stripes. They are typically available in fluorescent colors like orange, yellow, or lime green to enhance visibility during the day, and the reflective stripes ensure visibility in low-light or nighttime conditions.**
- **All workers shall wear high-visibility safety apparel that meets the Performance Class 2 or 3 requirements of the ANSI/ISEA 107–2004 publication entitled “American National Standard for High-Visibility Safety Apparel and Headwear” (see Section 1A.11), or equivalent revisions, and labeled as meeting the ANSI 107-2004 standard performance for Class 2 or 3 risk exposure.**

PPE - Safety Vest

For both daytime and nighttime activities, all workers, including emergency responders, within the right-of-way and Temporary Traffic Control (TTC) zones **shall** wear high-visibility safety apparel in compliance with the ANSI/ISEA 107–2015 standards or equivalent revisions. This apparel must meet the Performance **Class 2 or Class 3** requirements based on work conditions, visibility needs, and proximity to traffic hazards.

The following minimum requirements are essential for safety:

- **Fluorescent Background Material:** Designed for visibility in various lighting conditions, the background fabric should be a fluorescent color, such as yellow-green, orange-red, or red. This fabric improves visibility during daylight hours and in low-light environments, such as dusk and dawn.
- **Retroreflective Material:** The retroreflective strips or bands are critical for visibility at night or in low-light conditions. Standards specify that the retroreflective material must have a reflectivity rating that allows the worker to be visible from at least **1,000 feet** (305 meters) when illuminated by vehicle headlights. This is achieved by using retroreflective materials that capture and reflect light back to its source, significantly enhancing worker visibility from a distance.



PPE - Safety Vest

Performance Class Requirements:

- **Class 1 Apparel:** Designed for workers in low-impact areas with minimal vehicle traffic or moving equipment, such as warehouses or parking attendants in controlled environments. Class 1 apparel provides the lowest level of visibility, with minimal background and reflective material requirements.
Note: Class 1 is generally not recommended for TTC zones or high-traffic areas.
- **Class 2 Apparel:** Suitable for workers in environments where traffic speed is **between 25 and 50 mph** (40 to 80 km/h) or in areas where greater visibility is required in complex backgrounds. Class 2 vests provide a higher level of visibility through increased fluorescent background fabric and a minimum of **201 square inches** (0.13 square meters) of retroreflective material. These vests cover the torso and are often used by road construction crews, utility workers, survey crews, and emergency responders working near slower-moving traffic.



PPE - Safety Vest

Performance Class Requirements:

- **Class 3 Apparel:** Required for high-risk work zones, such as areas with traffic moving **over 50 mph** (80 km/h) or environments where workers are close to high-speed vehicles, **in low-light conditions**, or against complex visual backgrounds. Class 3 garments provide the maximum visibility with additional fluorescent and retroreflective material, including long sleeves or full-body coverage for 360-degree visibility. A minimum of **310 square inches** (0.20 square meters) of retroreflective material is required for Class 3 apparel, making it suitable for highway workers, emergency responders on major roads, flaggers, and any personnel in high-speed, high-risk TTC zones.

Design and Coverage for 360-Degree Visibility:

To achieve complete visibility, both Class 2 and Class 3 vests should have retroreflective bands on the torso, arms, and legs (where applicable) for consistent visibility from all angles. The apparel must maintain high contrast with the surroundings to prevent workers from blending into complex visual environments, especially at night.

These standards, outlined in the ANSI/ISEA 107–2015 publication titled '*American National Standard for High-Visibility Safety Apparel and Headwear*', or any equivalent revision, are designed to ensure that workers are visible from all angles, reducing the risk of accidents and enhancing safety for all personnel in TTC zones or near moving traffic.

Aerial Lift Safety

A properly fitted approved full body **harness** with the proper shock absorbing **lanyard** should be used at all times when working in Bucket truck, platform lift, or any aerial lift device or any elevated work area.

Also, the lanyard needs to be connected to an approved anchor point on the bucket or platform.

Most of the suppliers of fall protection equipment provide training on the proper use of the equipment that they provide.



Aerial Lift Safety

It is recommended that a **Groundman** be present when operating an aerial lift.

Do not work over an **open lane of traffic** in a bucket truck or other aerial lift!



Overhead Safety

“Look up and live” is a saying for a reason!

- Overhead power lines can be deadly; therefore, care must be taken when working near these lines.
- OSHA mandates that you **MUST maintain a MINIMUM clearance of 10 feet** from overhead power lines (table “A”).
<https://www.osha.gov/laws-regs/regulations/standardnumber/1926/1926.1408>

Understand how power poles are constructed:

- The highest voltage lines will be at top of the pole
- Potential voltages on lines reduce as you come down the pole
- Communications lines will be the lowest lines on the pole, if present
- Look for **“risers”** on poles as overhead utilities may transition to become underground utilities



Overhead Safety – Power lines in Canada

The regulation of clearance from overhead power lines in Canada involves a combination of national, provincial/territorial, and utility-specific oversight.

Here's a breakdown:

- The CEC (CSA C22.1) provides fundamental safety standards for electrical installations, including clearances. It establishes minimum requirements to prevent electrical hazards.
- Provincial/Territorial Authorities:
 - Each province and territory is responsible for adopting and enforcing the CEC. They may also introduce their own supplementary regulations or amendments to address local conditions.
 - Electrical utility companies often have their own internal standards and requirements that contractors and others must follow when working near their infrastructure. These standards may exceed the minimum requirements set out in the CEC and provincial/territorial regulations.
 - Provincial and territorial occupational health and safety regulations, such as those enforced by WorkSafeBC in British Columbia, also play a crucial role.

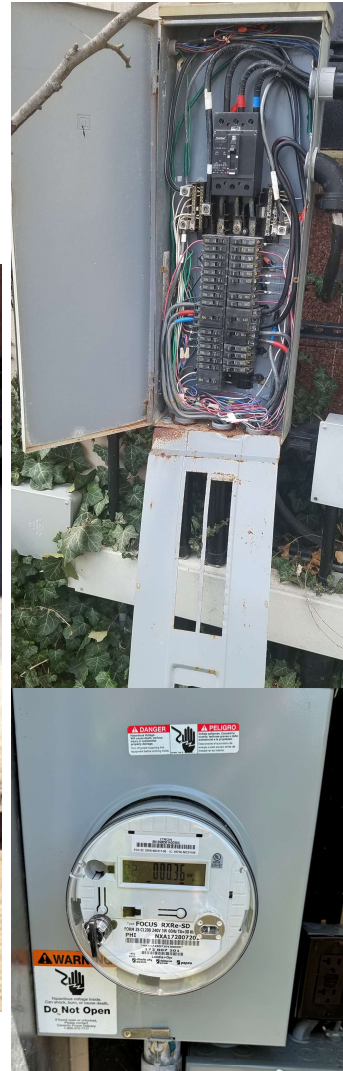
Electrical Safety

Technicians may be required to work on components or wiring while energized or (hot).

Using insulated tools, non-conductive tools and wearing gloves can reduce the chances of getting shocked.

Also, your freehand should not be touching the cabinet, pole or any other grounded device.

Follow ARC Flash requirements of additional safety equipment such as face shield.



Underground Utilities

The law requires you to call before you dig.

811 is the national call-before-you-dig phone number. Anyone who plans to dig should call 811 or go to their [state 811 center's website](#) a few business days before digging to request that the approximate location of buried utilities be marked with paint or flags so that you don't unintentionally dig into an underground utility line.

In Canada, visit clickbeforeyoudig.com for province specific information.

811 protects you and your community! Hitting a buried line while digging can disrupt utility service, cost money to repair, or cause serious injury or death.



Underground Utilities

“*Call before you dig*” is another saying for a reason.

- Underground utilities present even more hazards.
- The locate identification colors are as follows:

Locate Color	Utility
Red	Electric Power Lines
Yellow	Natural Gas, Steam, Petroleum, & Oil Lines
Blue	Potable Water Lines
Green	Sanitary Sewer & Storm Drain Lines
Orange	Communications Lines - Phone, Cable TV, Fiber Optic
Pink	Temporary Surveying Markings
Purple	Chilled Water, Reclaimed Water, Irrigation & Slurry Lines
White	Proposed Excavation
Not Specified	Military & Private Underground Facilities



**SAFETY IS IN YOUR HANDS.
EVERY DIG. EVERY TIME.**

The 811 Logo is a registered trademark of the Common Ground Alliance.



Underground Safety in Canada

In Canada, the "Call Before You Dig" process is handled through provincial one-call centers, like Ontario One Call or BC 1 Call, Alberta First Call...

These centers act as a communication link between individuals planning to dig and the owners of underground infrastructure.

When you call or click to request a locate, the one-call center notifies the relevant utility companies, who then locate and mark their underground lines on your property.

Here's a more detailed breakdown:

1. Contact the One-Call Center:

In most provinces, you can either call 811 or visit the one-call center's website to submit a locate request. Visit www.clickbeforeyoudig.com to find information on the notification service in your area.

2. Provide Project Details:

You'll need to provide information about your digging project, such as the location, the type of work, and the depth of excavation.

3. Notification:

The one-call center notifies the relevant utility companies (e.g., gas, electricity, water, telecommunications) about your planned dig.

4. Locating and Marking:

The utility companies then send out locators to mark the approximate location of their underground infrastructure with paint or flags.

5. Safe Digging:

Once the utilities are marked, you can dig safely, respecting the marked areas.

Key points to remember:

It's free and the law:

In many jurisdictions, it's required by law to contact the one-call center before any digging.

Allow sufficient time:

Give the one-call center and the utility companies ample time to respond, typically a few business days.

Respect the marks:

Carefully dig around the marked areas to avoid damaging underground utilities.

Safety Data Sheets (SDS)

OSHA requires that the chemical manufacturer, distributor, or importer provide **Safety Data Sheets** or **SDSs** (formerly MSDSs or Material Safety Data Sheets) for each hazardous chemical to downstream users to communicate information on these hazards.



Safety Data Sheet California CARB Compliant

1 - Identification

Product Name: WD-40 Multi-Use Product Aerosol

Product Use: Lubricant, Penetrant, Drives Out Moisture, Removes and Protects Surfaces From Corrosion

Restrictions on Use: None identified

SDS Date Of Preparation: August 2, 2021

Manufacturer: WD-40 Company
Address: 9715 Businesspark Avenue
San Diego, California, USA
92131

Telephone: 1-888-324-7596
Emergency: 1-888-324-7596
Information: 1-888-324-7596
Chemical Spills: 1-800-424-9300 (Chemtrec)
1-703-527-3887 (International Calls)

2 - Hazards Identification

Hazcom 2012/GHS Classification:

Flammable Aerosol Category 1

Gas Under Pressure: Compressed Gas

Aspiration Toxicity Category 1

Specific Target Organ Toxicity Single Exposure Category 3 (nervous system effects)

Note: This product is a consumer product and is labeled in accordance with the US Consumer Product Safety Commission regulations which take precedence over OSHA Hazard Communication labeling. The actual container label will not include the label elements below. The labeling below applies to industrial/professional products.

Label Elements:



DANGER!
Extremely Flammable Aerosol.

Safety Data Sheets (SDS)

In 2003, the UN adopted the Globally Harmonized System of Classification & Labeling of Chemicals (GHS).

- An internationally agreed upon system of standardized chemical hazard classification & communications.

SDS sheets offer safety information for chemicals you may use in your work environment. **Technicians are required** to maintain a file of SDS sheets for chemicals and hazardous substances that they use.

Safety Data Sheets follow a 16-section format:

- Section 1 – product identification
- Section 2 – hazard identification
- Section 3 – composition of ingredients
- Section 4 – first aid
- Section 5 – firefighting measures
- Section 6 – accidental release measures
- Section 7 – handling & storage
- Section 8 – exposure controls / PPE
- Section 9 – physical & chemical properties
- Section 10 – stability & reactivity
- Section 11 – toxicological information
- Section 12 – Ecological information
- Section 13 – disposal considerations
- Section 14 – transportation information
- Section 15 – regulatory information
- Section 16 – other information not covered above



Safety Data Sheet
California CARB Compliant

1 - Identification

Product Name: WD-40 Multi-Use Product Aerosol	Manufacturer: WD-40 Company
Product Use: Lubricant, Penetrant, Drives Out Moisture, Removes and Protects Surfaces From Corrosion	Address: 9715 Businesspark Avenue San Diego, California, USA 92131
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SDS Date Of Preparation: August 2, 2021	Emergency: 1-888-324-7596
	Information: 1-888-324-7596
	Chemical Spills: 1-800-424-9300 (Chemtrec) 1-703-527-3887 (International Calls)

2 - Hazards Identification

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Gas Under Pressure: Compressed Gas
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Note: This product is a consumer product and is labeled in accordance with the US Consumer Product Safety Commission regulations which take precedence over OSHA Hazard Communication labeling. The actual container label will not include the label elements below. The labeling below applies to industrial/professional products.

Label Elements:



DANGER!
Extremely Flammable Aerosol.

<https://chemicalsafety.com/sds-search/>

Material Safety Data Sheets (MSDS) in Canada

- In Canada, hazardous products are regulated by Canada's Hazardous Products Regulations (HPR), and Canada's national hazard communication standard, the Workplace Hazardous Materials Information System (WHMIS). These regulations are enforced through provincial or territorial government departments responsible for health and safety, or the federal labor program for federally regulated workplaces.
- In both Canada and the USA, the Globally Harmonized System (GHS) provides a standardized approach to classifying chemical substances and mixtures based on their inherent hazards.

MSDS (Material Safety Data Sheet)

There are nine (9) categories of information that must be present on an MSDS in Canada. These categories are specified in the **Controlled Products Regulations** and include:

- 1 - Product Information:** product identifier (name), manufacturer and suppliers' names, addresses, and emergency phone numbers
- 2 - Hazardous Ingredients**
- 3 - Physical Data**
- 4 - Fire or Explosion Hazard Data**
- 5 - Reactivity Data:** information on the chemical instability of a product and the substances it may react with
- 6 - Toxicological Properties:** Health Effects
- 7 - Preventive Measures**
- 8 - First Aid Measures**
- 9 - Preparation Information:** who is responsible for preparation and date of preparation of MSDS

Pedestrian Considerations

A wide range of pedestrians might be affected by TTC zones, including the young, elderly, and people with disabilities such as hearing, visual, or mobility.

These pedestrians need a clearly delineated and usable travel path.

The various TTC provisions for pedestrian and worker safety set forth in Part 6 of the MUTCD **shall** be applied by knowledgeable persons after appropriate evaluation and engineering judgment.

Advance notification of sidewalk closures shall be provided by the maintaining agency.

If the TTC zone affects an accessible and detectable pedestrian facility, the accessibility and detectability shall be maintained along the alternate pedestrian route.

Pedestrians should not be led into conflicts with vehicles, equipment, and operations.

Pedestrians should not be led into conflicts with vehicles moving through or around the worksite.

Pedestrians should be provided with a convenient and accessible path that replicates as nearly as practical the most desirable characteristics of the existing sidewalk(s) or footpath(s).

Where pedestrian traffic is detoured to a TTC signal, engineering judgment should be used to determine if pedestrian signals, or accessible pedestrian signals should be considered for crossings along an alternate route.

Other Safety Concerns

Specialized Certifications or Training may be required by local agencies involved in the project or for Specific Jobsite Conditions or Tasks such as:

- **Confined Space** - not necessarily designed for people, they are large enough for workers to enter and perform certain jobs. A confined space also has limited or restricted means for entry or exit and is not designed for continuous occupancy. Air quality can also be a concern in confined spaces and precautions should be considered.
- **Hantavirus** - serious infection that can spread to people when in contact with rodents, or their droppings and urine, or by inhalation of the virus particles in places with a lot of rodent droppings.
- **Hazmat** (hazardous materials) - substances in quantities or forms that may pose a reasonable risk to health, property, or the environment. HAZMATs include such substances as toxic chemicals, fuels, nuclear waste products, and biological, chemical, and radiological agents.
- **First Aid / CPR** etc.

Knowledge Check

PPE is an important topic during _____.

- a) Acquisition Phase
- b) Break Scheduling Overview
- c) Pre-Activity Meeting
- d) Planned Addendum Review

Knowledge Check

Workers within a TTC zone who are exposed to traffic **MUST** _____.

- a) Remain in buffer space
- b) Wear proper high-visibility apparel
- c) Use engineering judgement
- d) Remain in the activity area

Knowledge Check

How often should PPE be inspected and replaced in a work zone to maintain its effectiveness?

- a) Never
- b) Monthly
- c) Weekly
- d) Before every use

Knowledge Check

Why is it important to wear safety glasses or goggles in a work zone?

- a) To protect eyes against dust and debris
- b) To be stylish day or night
- c) So you can see better
- d) Glasses are not needed

Knowledge Check: Multiple Choice

Which class of reflective vest **MUST** be worn for Nighttime work?

- a. No Class
- b. Class 2
- c. Hi-Class
- d. Class 3

Knowledge Check

Match the correct color code with each underground utility:

Electrical Power Lines

Communications Lines, Phone,
Cable TV, Fiber Optic

Sewer & Storm Drains

Water

Natural Gas, Steam, Petroleum,
& Oil Lines

Blue

Orange

Red

Yellow

Green

Knowledge Check

Match the correct color code with each underground utility:

Electrical Power Lines

**Communications Lines, Phone,
Cable TV, Fiber Optic**

Sewer & Storm Drains

Water

**Natural Gas, Steam, Petroleum,
& Oil Lines**

Blue

Orange

Red

Yellow

Green

Knowledge Check

Technicians are required to maintain a file of _____.

- a) OSHA Rules
- b) PPE
- c) SDSs
- d) ANSI

Session 3: Temporary Traffic Control Devices



Temporary Traffic Control Devices

Traffic control devices shall be defined as all signs, signals, markings, and other devices used to regulate, warn, or guide road users, placed on, over, or adjacent to a street, highway, private roads open to public travel, pedestrian facility, or bikeway by **Authority** of a public body or official **Having Jurisdiction (AHJ)**.

All traffic control devices used for construction, maintenance, utility, or incident management operations on a street, highway, or private road open to public travel shall comply with the applicable provisions of the MUTCD.

To be effective, a traffic control device should:

- Fulfill a need
- Command attention
- Convey a clear, simple meaning
- Command respect from road users
- Give adequate time for proper response

All TTC devices shall be removed as soon as practical when they are no longer needed.

When work is suspended for short periods of time, TTC devices that are no longer appropriate **shall be removed or covered.**

Temporary Traffic Control Devices

- According to the MUTCD, **certain traffic control devices and their supports, and/or related appurtenances shall be crashworthy.** Crashworthiness provisions in this Manual shall apply to all streets, highways, and site roadways open to public travel.
- **Crashworthy**—the ability of a roadside safety hardware device or appurtenance to minimize risks to vehicle occupants by allowing a vehicle impacting the appurtenance to be slowed before stopping, redirected, or to continue without significant resistance.

Regulatory Signs

Figure 6G-1. Regulatory Signs and Plaques
in Temporary Traffic Control Zones (Sheet 1 of 2)

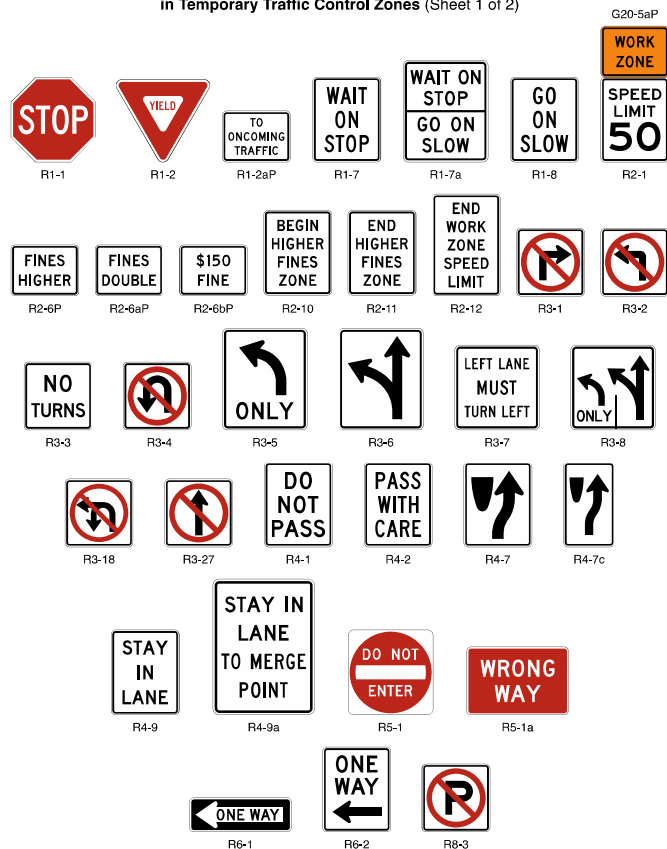
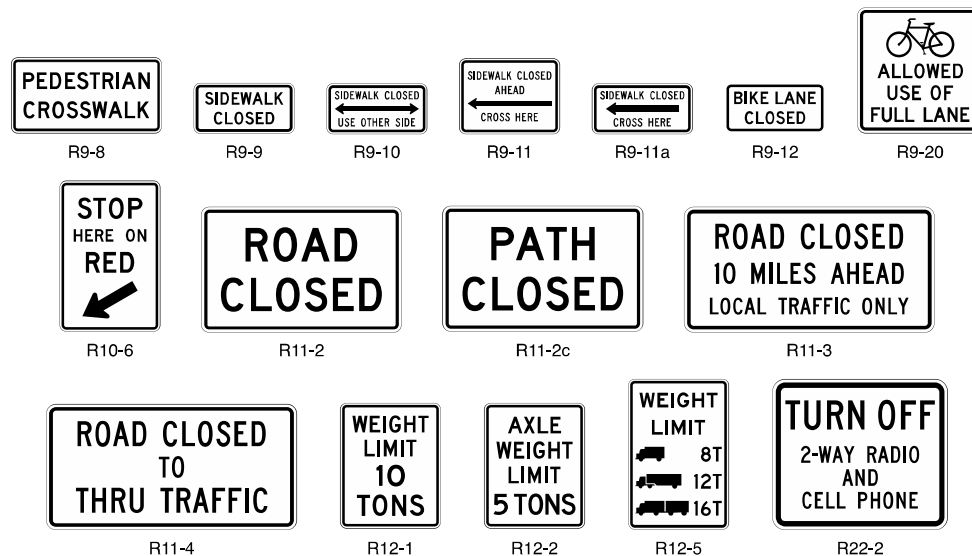


Figure 6G-1. Regulatory Signs and Plaques
in Temporary Traffic Control Zones (Sheet 2 of 2)



Regulatory signs shall be authorized by the public agency or official having jurisdiction and shall conform with Chapter 2B of the MUTCD.

Regulatory Signs

Table 6G-1. Temporary Traffic Control Zone Regulatory Sign and Plaque Sizes

Sign or Plaque	Sign Designation	Section	Conventional Road	Freeway or Expressway	Minimum
Stop	R1-1	6G.02	30 x 30*	—	—
Stop (on Stop/Slow Paddle)	R1-1	6D.02	18 x 18	—	—
Yield	R1-2	6G.02	36 x 36 x 36*	—	30 x 30 x 30
To Oncoming Traffic (plaque)	R1-2aP	6G.02	36 x 30	48 x 36	24 x 18
Wait on Stop	R1-7	6L.03	24 x 30	24 x 30	—
Wait on Stop - Go on Slow	R1-7a	6G.03	30 x 36	30 x 36	—
Go on Slow	R1-8	6L.03	24 x 30	24 x 30	—
Speed Limit	R2-1	6G.08	24 x 30*	36 x 48	—
Fines Higher (plaque)	R2-6P	6G.08	24 x 18	36 x 24	—
Fines Double (plaque)	R2-6aP	6G.08	24 x 18	36 x 24	—
\$XX Fine (plaque)	R2-6bP	6G.08	24 x 18	36 x 24	—
Begin Higher Fines Zone	R2-10	6G.08	24 x 30	36 x 48	—
End Higher Fines Zone	R2-11	6G.08	24 x 30	36 x 48	—
End Work Zone Speed Limit	R2-12	6G.08	24 x 36	36 x 54	—
Movement Prohibition	R3-1,2,3,4	6G.02	24 x 24*	36 x 36	—
Mandatory Movement Lane Control - Turn Only	R3-5	6G.02	30 x 36	—	—
Optional Movement Lane Control - Thru and Turn	R3-6	6G.02	30 x 36	—	—
Right (Left) Lane Must Turn Right (Left)	R3-7	6G.02	30 x 30*	—	—
Advance Intersection Lane Control (2 lanes)	R3-8	6G.02	30 x 30	—	—
Movement Prohibition - No U or Left Turn	R3-18	6G.02	24 x 24*	36 x 36	—
Movement Prohibition - No Straight Through	R3-27	6G.02	24 x 24*	36 x 36	—
Do Not Pass	R4-1	6G.02	24 x 30	36 x 48	—
Pass With Care	R4-2	6G.02	24 x 30	36 x 48	—

Keep Right	R4-7	6G.02	24 x 30	36 x 48	—
Narrow Keep Right	R4-7c	6G.02	18 x 30	—	—
Stay in Lane	R4-9	6G.07	24 x 30	36 x 48	—
Stay In Lane To Merge Point	R4-9a	6G.07	36 x 48	36 x 48	—
Do Not Enter	R5-1	6G.02	30 x 30*	36 x 36	—
Wrong Way	R5-1a	6G.02	36 x 24*	42 x 30	—
One Way	R6-1	6G.02	36 x 12*	48 x 18	—
One Way	R6-2	6G.02	24 x 30*	36 x 48	—
No Parking (symbol)	R8-3	6G.02	24 x 24*	36 x 36	—
Pedestrian Crosswalk	R9-8	6G.09	36 x 18	—	—
Sidewalk Closed	R9-9	6G.10	24 x 12	—	—
Sidewalk Closed, Use Other Side	R9-10	6G.10	24 x 12	—	—
Sidewalk Closed Ahead, Cross Here	R9-11	6G.10	24 x 18	—	—
Sidewalk Closed, Cross Here	R9-11a	6G.10	24 x 12	—	—
Bike Lane Closed	R9-12	6P.01	24 x 12	—	—
Stop Here on Red	R10-6	6L.04	24 x 36	—	—
Road Closed	R11-2, 2a, 2b, 2c	6G.04	48 x 30	—	—
Road Closed - Local Traffic Only	R11-3, 3a, 3b, 4	6G.05	60 x 30	—	—
Weight Limit	R12-1, 2	6G.06	24 x 30	36 x 48	—
Weight Limit	R12-5	6G.06	24 x 36	36 x 48	—
Turn Off 2-Way Radio and Cell Phone	R22-2	6G.11	42 x 36	42 x 36	—
Work Zone (plaque)	G20-5aP	6G.08	24 x 18	30 x 24	—

* See Table 2B-1 for minimum size required for signs facing traffic on multi-lane conventional roads

Notes:

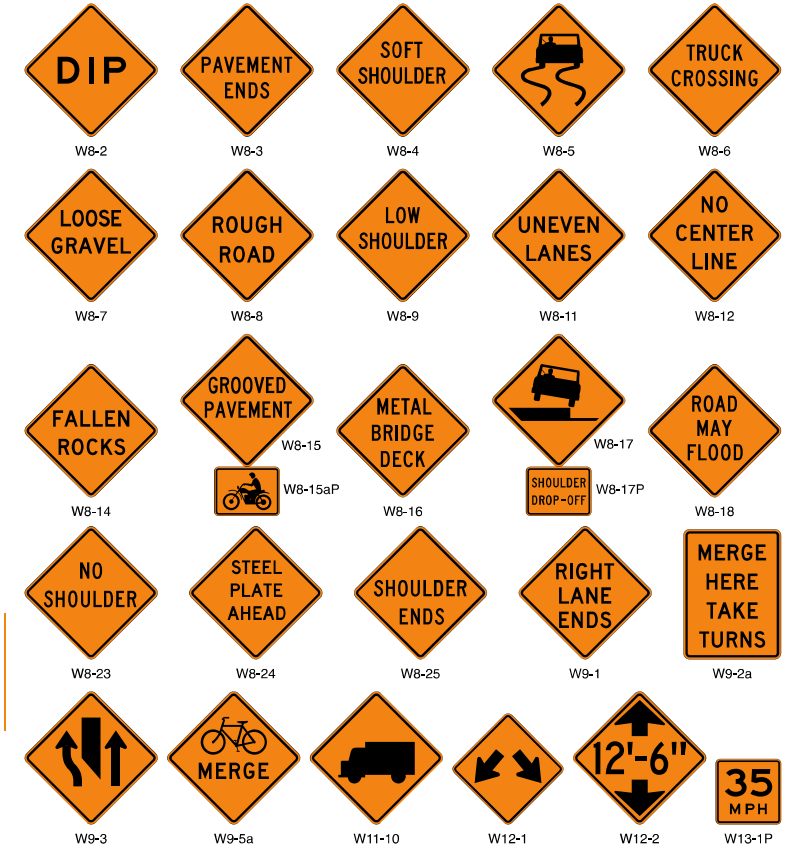
1. Larger signs may be used wherever necessary for greater legibility or emphasis
2. Dimensions are shown in inches and are shown as width x height

Warning Signs

Figure 6H-1. Warning Signs and Plaques in Temporary Traffic Control Zones (Sheet 1 of 4)



Figure 6H-1. Warning Signs and Plaques in Temporary Traffic Control Zones (Sheet 2 of 4)



Warning Signs

Figure 6H-1. Warning Signs and Plaques in Temporary Traffic Control Zones (Sheet 3 of 4)

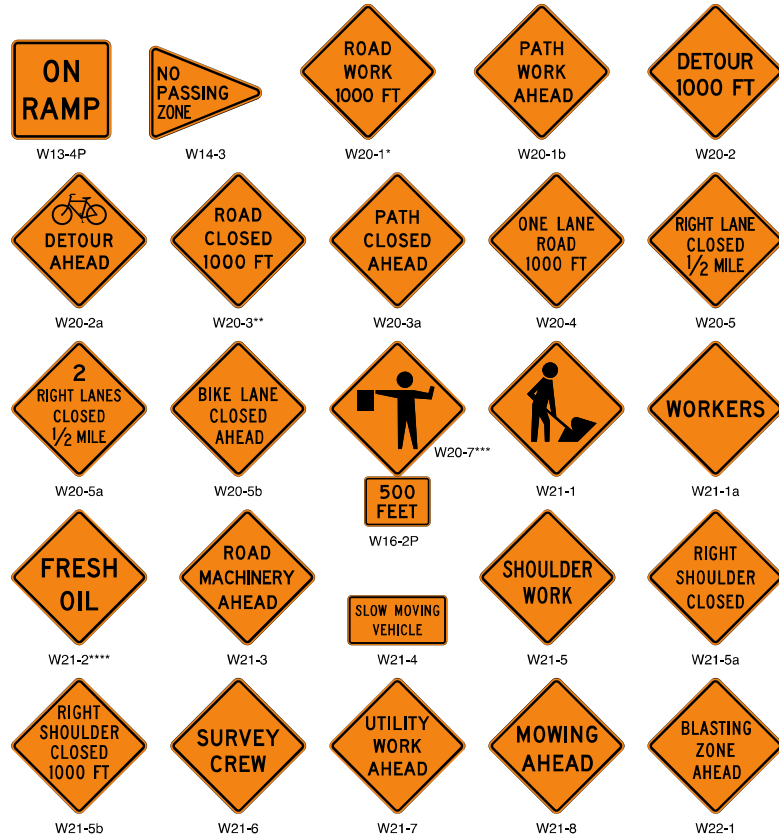
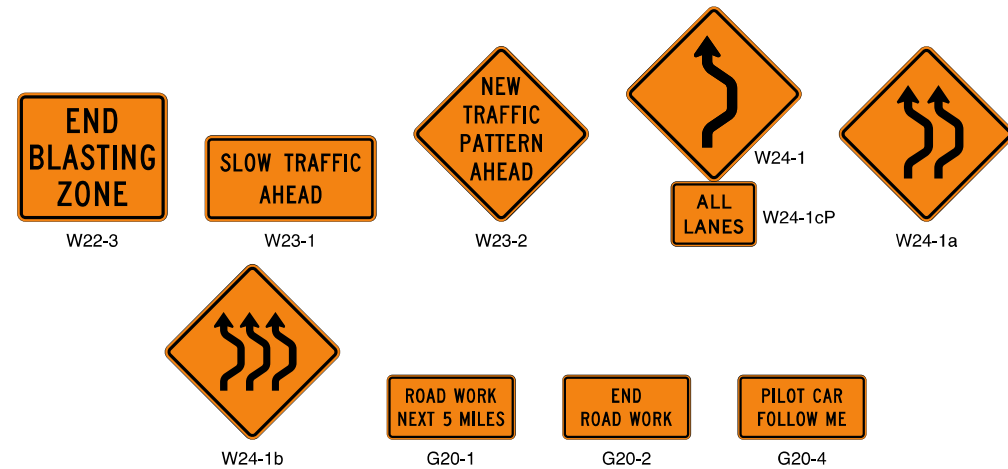


Figure 6H-1. Warning Signs and Plaques in Temporary Traffic Control Zones (Sheet 4 of 4)



TTC warning signs shall be diamond-shaped with a black legend and border on an orange background.

Warning Signs

Table 6H-1. Temporary Traffic Control Zone Warning Sign and Plaque Sizes (Sheet 1 of 2)

Sign or Plaque	Sign Designation	Section	Conventional Road	Freeway or Expressway	Minimum
Turn and Curve Signs	W1-1,2,3,4	6H.01	36 x 36	48 x 48	30 x 30
Reverse Curve (2 or more lanes)	W1-4b,4c	6H.30	36 x 36	48 x 48	30 x 30
Large Arrow (1-direction)	W1-6	6H.01	48 x 24	60 x 30	—
Chevron Alignment	W1-8	6H.01	18 x 24	30 x 36	—
Stop Ahead	W3-1	6H.01	36 x 36	48 x 48	30 x 30
Yield Ahead	W3-2	6H.01	36 x 36	48 x 48	30 x 30
Signal Ahead	W3-3	6H.01	36 x 36	48 x 48	30 x 30
Be Prepared to Stop	W3-4	6H.01	36 x 36	48 x 48	30 x 30
Reduced Speed Limit Ahead	W3-5	6H.01	36 x 36	48 x 48	30 x 30
XX MPH Speed Zone Ahead	W3-5a	6H.01	36 x 36	48 x 48	30 x 30
Merging Traffic	W4-1,5	6H.01	36 x 36	48 x 48	36 x 36
Lane Ends	W4-2	6H.08	36 x 36	48 x 48	30 x 30
Added Lane	W4-3,6	6H.01	36 x 36	48 x 48	30 x 30
No Merge Area (plaque)	W4-5aP	6H.01	18 x 24	24 x 30	—
Road Narrows	W5-1	6H.01	36 x 36	48 x 48	30 x 30
Narrow Bridge	W5-2	6H.01	36 x 36	48 x 48	30 x 30
One Lane Bridge	W5-3	6H.01	36 x 36	48 x 48	30 x 30
Ramp Narrows	W5-4	6H.10	36 x 36	48 x 48	30 x 30
Divided Highway	W6-1	6H.01	36 x 36	48 x 48	30 x 30
Divided Highway Ends	W6-2	6H.01	36 x 36	48 x 48	30 x 30
Two-Way Traffic	W6-3	6H.16	36 x 36	48 x 48	30 x 30
Narrow Two-Way Traffic	W6-4	6H.17	12 x 18	12 x 18	—

Hill	W7-1	6H.01	36 x 36	48 x 48	30 x 30
Next XX Miles (plaque)	W7-3aP	6H.33	24 x 18	36 x 30	—
Bump	W8-1	6H.01	36 x 36	48 x 48	24 x 24
Dip	W8-2	6H.01	36 x 36	48 x 48	24 x 24
Pavement Ends	W8-3	6H.01	36 x 36	48 x 48	30 x 30
Soft Shoulder	W8-4	6H.26	36 x 36	48 x 48	30 x 30
Slippery When Wet	W8-5	6H.01	36 x 36	48 x 48	30 x 30
Truck Crossing	W8-6	6H.21	36 x 36	48 x 48	30 x 30
Loose Gravel	W8-7	6H.01	36 x 36	48 x 48	30 x 30
Rough Road	W8-8	6H.01	36 x 36	48 x 48	24 x 24
Low Shoulder	W8-9	6H.26	36 x 36	48 x 48	24 x 24
Uneven Lanes	W8-11	6H.27	36 x 36	48 x 48	30 x 30
No Center Line	W8-12	6H.29	36 x 36	48 x 48	30 x 30
Fallen Rocks	W8-14	6H.01	36 x 36	48 x 48	30 x 30
Grooved Pavement	W8-15	6H.01	36 x 36	48 x 48	30 x 30
Motorcycle (plaque)	W8-15aP	6H.34	24 x 18	30 x 24	—
Metal Bridge Deck	W8-16	6H.34	36 x 36	48 x 48	30 x 30
Shoulder Drop Off (symbol)	W8-17	6H.26	36 x 36	48 x 48	30 x 30
Shoulder Drop-Off (plaque)	W8-17P	6H.26	24 x 18	30 x 24	—
Road May Flood	W8-18	6H.01	36 x 36	48 x 48	24 x 24
No Shoulder	W8-23	6H.01	36 x 36	48 x 48	30 x 30
Steel Plate Ahead	W8-24	6H.28	36 x 36	48 x 48	30 x 30
Shoulder Ends	W8-25	6H.01	36 x 36	48 x 48	30 x 30
Lane Ends	W9-1,2	6H.01	36 x 36	48 x 48	30 x 30
Merge Here Take Turns	W9-2a	6N.19	36 x 48	36 x 48	—
Interior Lane Shift Ahead	W9-3	6H.07	36 x 36	48 x 48	30 x 30

Warning Signs

Sign or Plaque	Sign Designation	Section	Conventional Road	Freeway or Expressway	Minimum
Bicycles Merging	W9-5a	6P.01	30 x 30	—	18 x 18
Grade Crossing Advance Warning	W10-1	6H.01	36 dia.	48 Dia.	—
Truck	W11-10	6H.21	36 x 36	48 x 48	24 x 24
Double Arrow	W12-1	6H.01	30 x 30	36 x 36	—
Low Clearance	W12-2	6H.01	36 x 36	48 x 48	30 x 30
Advisory Speed (plaque)	W13-1P	6H.32	18 x 18	24 x 24	18 x 18
On Ramp (plaque)	W13-4P	6H.09	36 x 36	36 x 36	—
No Passing Zone (pennant)	W14-3	6H.01	48 x 48 x 36	64 x 64 x 48	40 x 40 x 30
XX Feet (2-line plaque)	W16-2P	6H.01	24 x 18	30 x 24	—
Road Work (with distance)	W20-1	6H.03	36 x 36	48 x 48	30 x 30
Path Work (with distance)	W20-1b	6P.01	36 x 36	—	30 x 30
Detour (with distance)	W20-2	6H.04	36 x 36	48 x 48	30 x 30
Bike Detour (with distance)	W20-2a	6P.01	36 x 36	—	30 x 30
Bike Diversion (with distance)	W20-2b	6P.01	36 x 36	—	30 x 30
Road Closed (with distance)	W20-3	6H.05	36 x 36	48 x 48	30 x 30
Path Closed (with distance)	W20-3a	6P.01	36 x 36	—	30 x 30
One Lane Road (with distance)	W20-4	6H.06	36 x 36	48 x 48	30 x 30
Lane(s) Closed (with distance)	W20-5,5a	6H.07	36 x 36	48 x 48	30 x 30
Bike Lane Closed (with distance)	W20-5b	6P.01	36 x 36	—	30 x 30
Flagger (symbol)	W20-7	6H.15	36 x 36	48 x 48	30 x 30
Flagger	W20-7a	6H.15	36 x 36	48 x 48	30 x 30
Slow (on Stop/Slow Paddle)	W20-8	6D.02	18 x 18	—	—
Workers	W21-1,1a	6H.18	36 x 36	48 x 48	30 x 30
Fresh Oil	W21-2	6H.19	36 x 36	48 x 48	30 x 30

Table 6H-1. Temporary Traffic Control Zone Warning Sign and Plaque Sizes (Sheet 2 of 2)

Road Machinery Ahead	W21-3	6H.20	36 x 36	48 x 48	30 x 30
Slow Moving Vehicle	W21-4	6N.05	36 x 18	—	—
Shoulder Work	W21-5	6H.22	36 x 36	48 x 48	30 x 30
Shoulder Closed	W21-5a	6H.22	36 x 36	48 x 48	30 x 30
Shoulder Closed (with distance)	W21-5b	6H.22	36 x 36	48 x 48	30 x 30
Survey Crew	W21-6	6H.23	36 x 36	48 x 48	30 x 30
Utility Work (with distance)	W21-7	6H.24	36 x 36	48 x 48	30 x 30
Mowing Ahead	W21-8	6N.05	36 x 36	48 x 48	30 x 30
Blasting Zone Ahead	W22-1	6H.25	36 x 36	48 x 48	30 x 30
End Blasting Zone	W22-3	6H.25	42 x 36	42 x 36	36 x 30
Slow Traffic Ahead	W23-1	6H.11	48 x 24	48 x 24	—
New Traffic Pattern Ahead	W23-2	6H.14	36 x 36	48 x 48	30 x 30
Double Reverse Curve (1 lane)	W24-1	6H.31	36 x 36	48 x 48	30 x 30
Double Reverse Curve (2 lanes)	W24-1a	6H.31	36 x 36	48 x 48	30 x 30
Double Reverse Curve (3 lanes)	W24-1b	6H.31	36 x 36	48 x 48	30 x 30
All Lanes (plaque)	W24-1cP	6H.31	24 x 18	30 x 24	—
Road Work Next XX Miles	G20-1	6H.35	36 x 18	48 x 24	—
End Road Work	G20-2	6H.36	36 x 18	48 x 24	—
Pilot Car Follow Me	G20-4	6H.37	36 x 18	—	—

* See Table 2C-1 for minimum size required for signs facing traffic on multi-lane conventional roads

Notes:

1. Larger signs may be used wherever necessary for greater legibility or emphasis
2. Dimensions are shown in inches and are shown as width x height

Guide Signs

Figure 6I-1. Exit Open and Closed and Detour Signs and Plaques

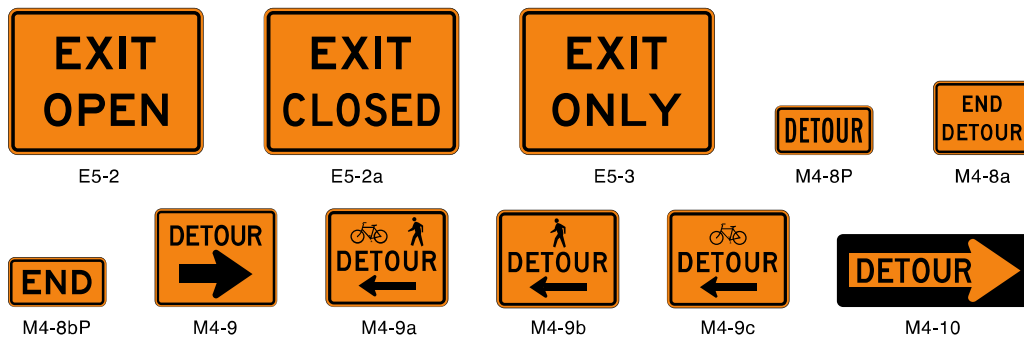


Table 6I-1. Temporary Traffic Control Zone Guide Sign and Plaque Sizes

Sign or Plaque	Sign Designation	Section	Conventional Road	Freeway or Expressway	Minimum
Exit Open	E5-2	6H.12	48 x 36	48 x 36	—
Exit Closed	E5-2a	6H.12	48 x 36	48 x 36	—
Exit Only	E5-3	6H.13	48 x 36	48 x 36	—
Detour	M4-8P	6I.02	24 x 12	30 x 15	—
End Detour	M4-8a	6I.02	24 x 18	24 x 18	—
End (plaque)	M4-8bP	6I.02	24 x 12	24 x 12	—
Detour	M4-9	6I.02	30 x 24	48 x 36	—
Bike/Pedestrian Detour	M4-9a	6I.02	30 x 24	—	—
Pedestrian Detour	M4-9b	6I.02	30 x 24	—	—
Bike Detour (with arrow)	M4-9c	6I.02	30 x 24	—	—
Detour	M4-10	6I.02	48 x 18	—	—

Notes:

1. Larger signs may be used wherever necessary for greater legibility or emphasis
2. Dimensions are shown in inches and are shown as width x height

If **additional temporary guide signs** are used in TTC zones, they **shall have a black legend** and border on an **orange background**.

Pavement Markings in TTC Zones

- Pavement markings are installed, or existing markings are maintained or enhanced in TTC zones to **provide road users with a clearly defined path for travel through the TTC zone** in day, night, and twilight periods under both wet and dry pavement conditions.
- The work should be planned and staged to provide for the placement and removal of the pavement markings in a way that minimizes the disruption to traffic flow approaching and through the TTC zone during the placement and removal process.
- Pavement markings shall match the alignment of the markings in place at both ends of the TTC zone.
- Pavement markings shall be placed along the entire length of any paved detour or temporary roadway prior to the detour or roadway being opened to road users.

Pavement Markings in TTC Zones

- For long-term stationary operations, pavement markings in the temporary traveled way that are no longer applicable should be removed or obliterated as soon as practical.
- Pavement marking obliteration should remove the non-applicable pavement marking material, and the obliteration method should minimize pavement scarring.
- Painting over existing pavement markings with black paint or spraying with asphalt shall not be accepted as a substitute for removal or obliteration.
- Removable, non-reflective, preformed tape that is approximately the same color as the pavement surface may be used where markings need to be covered temporarily.

Temporary Markings

- Temporary markings are those pavement markings or devices that are placed within TTC zones to provide road users with a clearly defined path of travel through the TTC zone when the permanent markings are either removed or obliterated during the work activities.
- Temporary markings are typically needed during the reconstruction of a road while it is open to traffic, such as overlays or surface treatments or where lanes are temporarily shifted on pavement that is to remain in place.
- Unless justified based on engineering judgment, temporary pavement markings should not remain in place for more than 14 days after the application of the pavement surface treatment or the construction of the final pavement surface on new roadways or over existing pavements.
- Warning signs, channelizing devices, and delineation shall be used to indicate required road user paths in TTC zones where it is not possible to provide a clear path by pavement markings.

Temporary Raised Pavement Markers

- Retroreflective or internally illuminated raised pavement markers, or non-retroreflective raised pavement markers supplemented by retroreflective or internally illuminated markers, may be substituted for markings of other types in TTC zones.
- If used, the color and pattern of the raised pavement markers shall simulate the color and pattern of the markings for which they substitute.
- If temporary raised pavement markers are used to substitute for broken line segments, a group of at least three retroreflective markers equally spaced at no greater than 5 feet shall be installed every 40 feet.
- If temporary raised pavement markers are used to substitute for solid lines, the markers shall be equally spaced at no greater than 10 feet, with retroreflective or internally illuminated units at a spacing no greater than 20 feet.
- Temporary raised pavement markers may be used to substitute for broken line segments by using at least two retroreflective markers placed at each end of a segment of 2 to 5 feet in length, using the same cycle length as permanent markings.

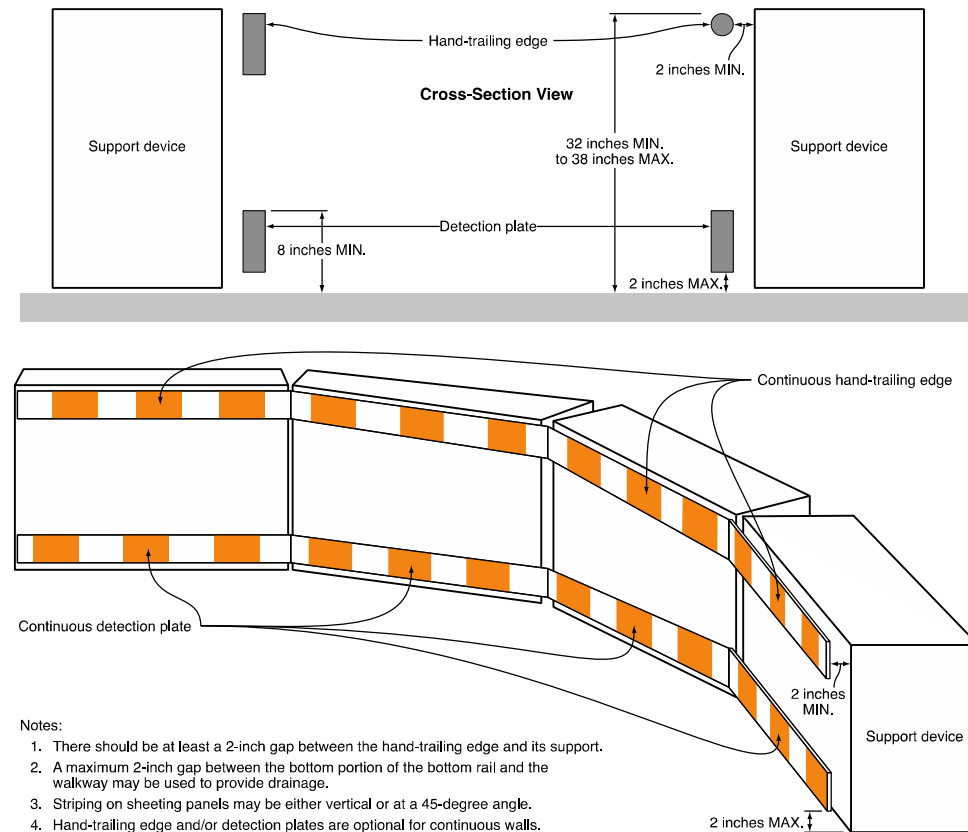
Pedestrian Channelizing Devices

- **Pedestrian channelizing devices indicate a suitable path of pedestrian travel around or through the work zone.**
- Pedestrian channelizing devices **should be provided when work activities impact sidewalks or other pedestrian facilities** or when the design of the temporary pedestrian facility does not otherwise include accessibility features consistent with the features in the existing pedestrian facility.
- **The pedestrian channelizing devices should be used both to close sidewalks and to delineate an alternate route.**
- The width of the existing pedestrian facility should be provided for the temporary facility if practical.
- Traffic control devices and other construction materials and features should not intrude into the usable width of the sidewalk, temporary pathway, or other pedestrian facility. When it is not possible to maintain a minimum width of 60 inches throughout the entire length of the pedestrian pathway, a 60 x 60-inch passing space should be provided at least every 200 feet to allow individuals in wheelchairs to pass.
- An example of a pedestrian channelizing device is depicted in Figure 6K-2 (next slide).
- Pedestrian channelizing devices shall be crashworthy when exposed to vehicular traffic.
- Devices used to channelize pedestrians shall be detectable to users of long canes and visible to pedestrians with vision disabilities.
- When used as a sidewalk closure, the device shall cover the entire width of the sidewalk.

Pedestrian Channelizing Devices

- Pedestrian channelizing devices shall have continuous detection plates and hand-trailing edges.
- The bottom of the detection plate shall be no higher than 2 inches above the walkway.
- The top edge of the detection plate shall be at least 8 inches above the walkway.
- The top of the hand-trailing edge shall be no lower than 32 inches and no higher than 38 inches above the walkway.
- The top surface of the hand-trailing edge shall be smooth to optimize hand trailing.
- Both the detection plate and the hand-trailing edge shall share a common vertical plane.

Figure 6K-2. Pedestrian Channelizing Device

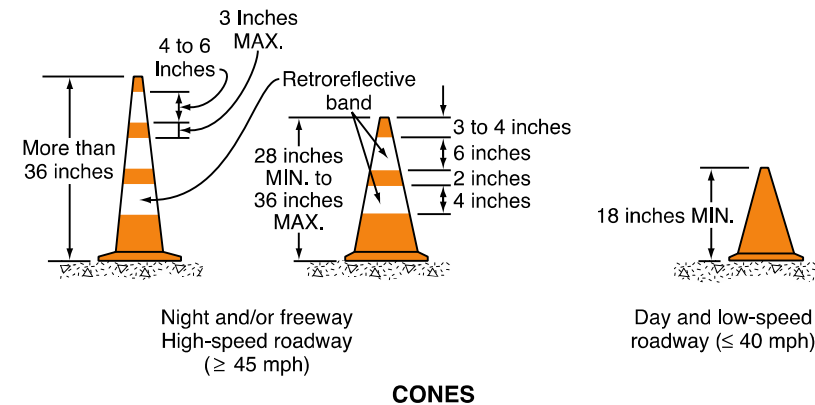


Channelizing Devices

- The function of channelizing devices is **to warn road users of conditions** created by work activities in or near the roadway **and to guide road users**.
- **Channelizing devices include cones, tubular markers, vertical panels, drums, barricades, and longitudinal channelizing devices.**
- **Channelizing devices provide for smooth and gradual vehicular traffic flow from one lane to another**, onto a bypass or detour, or into a narrower traveled way. They are also used to channelize traffic away from the workspace, pavement drop-offs, pedestrian or shared-use paths, bicycle facilities, or opposing directions of vehicular traffic.
- The **spacing** between cones, tubular markers, vertical panels, drums, and barricades **should not exceed a distance in feet equal to 1 times the speed limit in mph** when used for taper channelization.
- **Warning lights** (see Section 6L.07) may be added to channelizing devices in areas with frequent fog, snow, or severe roadway curvature, or where visual distractions are present.
- The **retroreflective material** used on channelizing devices **shall display a similar color day or night**.

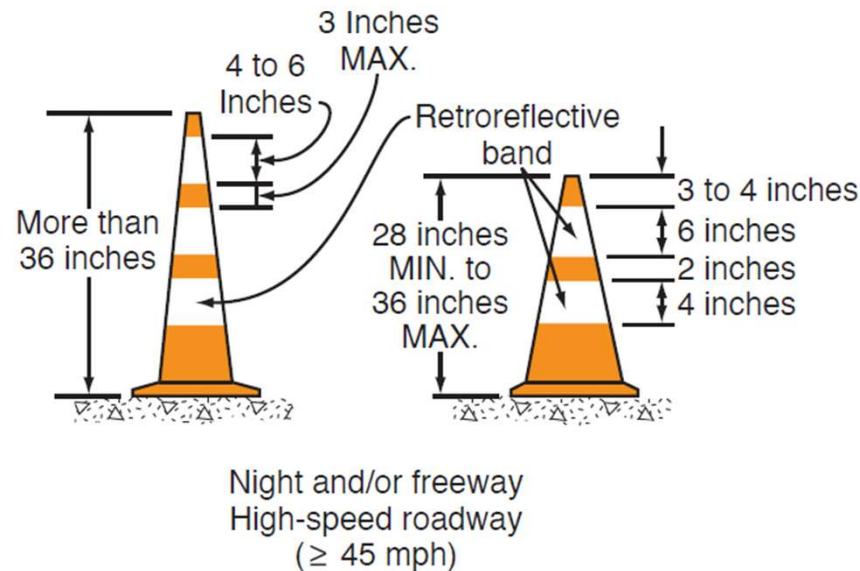
Channelizing Devices - Cones

- **Cones shall be predominantly orange** and shall be made of a material that can be struck without causing damage to the impacting vehicle. **For daytime and low-speed roadways, cones shall be not less than 18 inches in height.**
- When cones are used on **freeways and other high-speed highways or at night** on all highways, or when more conspicuous guidance is needed, **cones shall be a minimum of 28 inches in height.**
- Traffic cones may be used to channelize road users, divide opposing vehicular traffic lanes, divide lanes when two or more lanes are kept open in the same direction, and delineate short-duration maintenance and utility work.
- For **nighttime** use, cones **shall be retroreflectorized or equipped with lighting devices** for maximum visibility.
- Retroreflectorization of cones that are 28 to 36 inches in height shall be provided by a 6-inch-wide white band located 3 to 4 inches from the top of the cone and an additional 4-inch-wide white band located approximately 2 inches below the 6-inch band.



Channelizing Devices - Cones

- Steps should be taken to minimize the possibility of cones being blown over or displaced by wind or moving vehicular traffic.
- Some cones are constructed with bases that can be filled with ballast. Others have specially weighted bases, or weight such as sandbag rings, that can be dropped over the cones and onto the base to provide added stability.
- **Cones may be doubled up to increase their weight.**
- **Ballast should be kept to the minimum amount needed.**



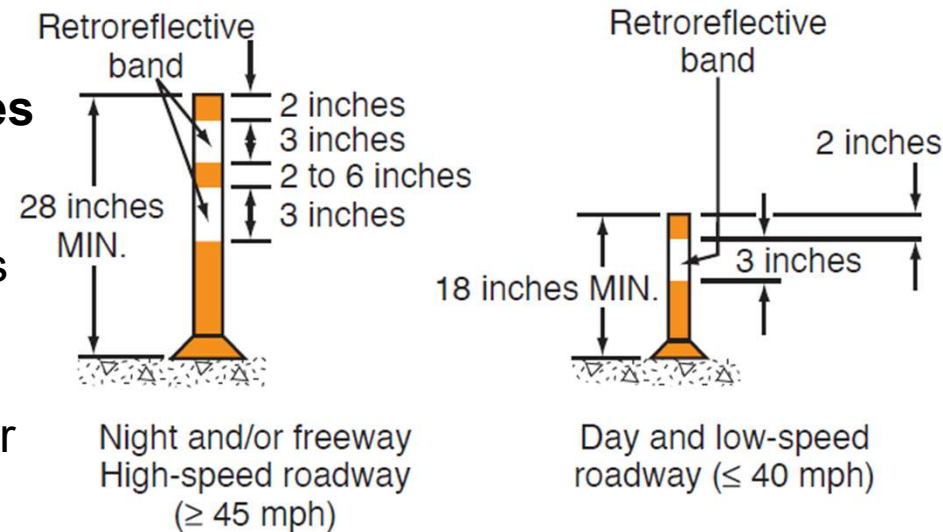
Channelizing Devices - Delineators

- Delineators provide drivers with guidance along the travel path within a work zone.
- They may be used in TTC zones to indicate the alignment of the roadway and to outline the required vehicle path through the TTC zone.
- When used, **delineators shall combine with or supplement other TTC devices**. They shall be mounted on crashworthy supports and shall be in accordance with Chapter 3G.
- Spacing along roadway curves should be as set forth in **Section 3G.04** and should be such that several delineators are visible to an approaching driver.



Channelizing Devices - Tubular Markers

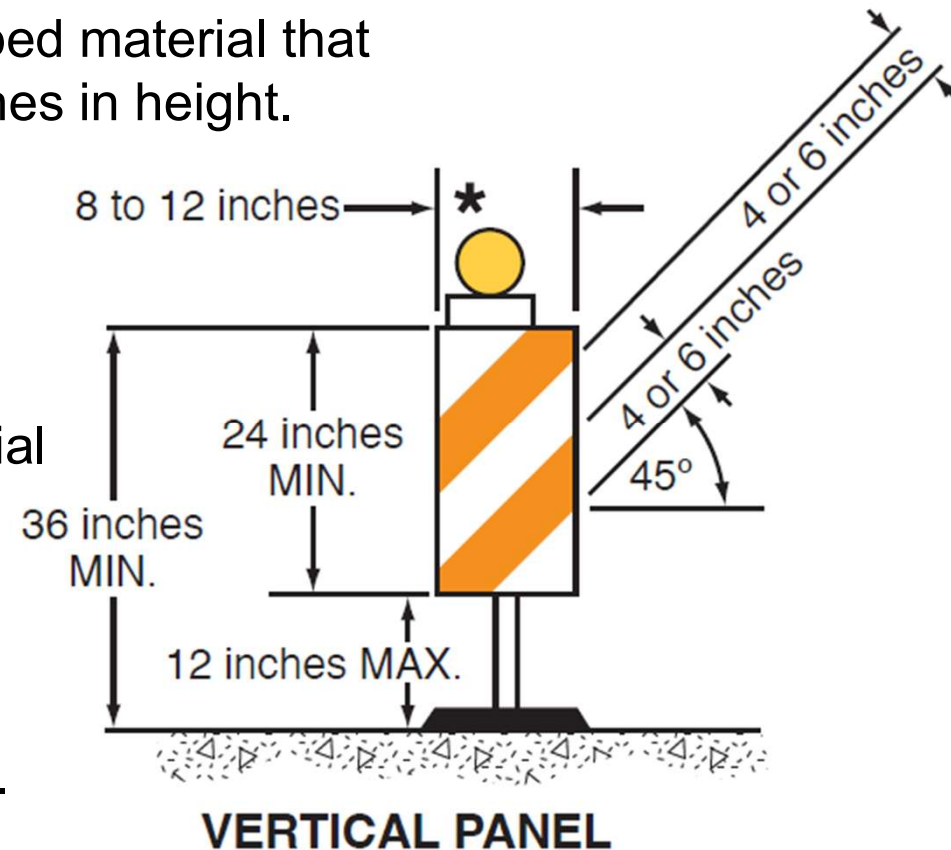
- Tubular markers **shall be predominantly orange for TTC zone** applications and shall be **not less than 18 inches high and 2 inches wide** facing road users.
- Tubular markers shall be a **minimum of 28 inches in height when they are used on freeways and other high-speed highways**, on all highways during **nighttime**, or whenever more conspicuous guidance is needed.
- For **nighttime** use, tubular markers **shall be retroreflectorized**. Retroreflectorization of tubular markers that have a height of less than 42 inches shall be provided by two 3-inch-wide white bands placed a maximum of 2 inches from the top with a maximum of 6 inches between the bands.



TUBULAR MARKERS

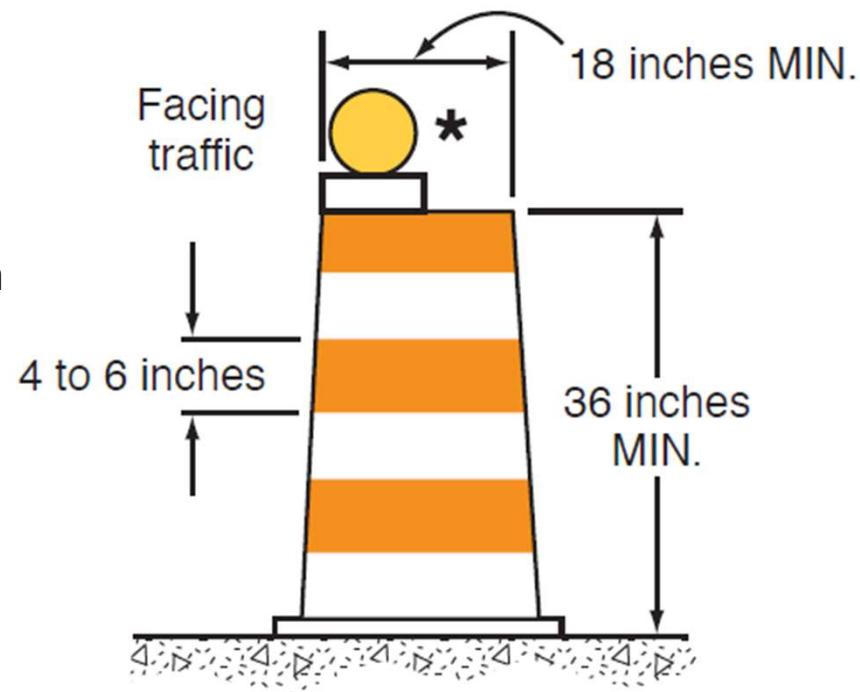
Channelizing Devices - Vertical Panels

- Vertical panels shall have retroreflective striped material that is 8 to 12 inches in width and at least 24 inches in height.
- They shall have alternating diagonal orange and white retroreflective stripes sloping downward at an angle of 45 degrees in the direction vehicular traffic is to pass.
- Where the height of the retroreflective material on the vertical panel is less than 36 inches, a stripe width of 4 inches may be used.
- Where space is limited, vertical panels may be used to channelize vehicular traffic, divide opposing lanes, or replace barricades.



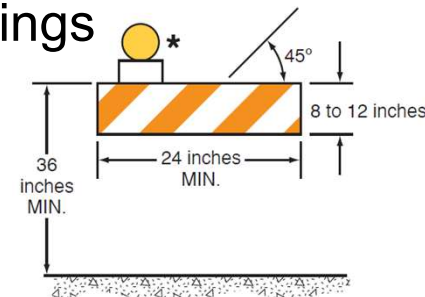
Channelizing Devices - Drums

- **Drums** (also called **Barrels**) are highly visible, have good target value, give the appearance of being formidable obstacles and, therefore, command the respect of road users.
- They are portable enough to be shifted from place to place within a TTC zone in order to accommodate changing conditions, but are generally used in situations where they will remain in place for a prolonged period of time.
- Although drums are most commonly used to channelize or delineate road user flow, they may also be used alone or in groups to mark specific locations.
- Drums should not be weighted with sand, water, or any material to the extent that would make them hazardous to road users or workers when struck. **Ballast shall not be placed on the top of a drum.**
- **Special Rings made from recycled tires should be used for weighting.**

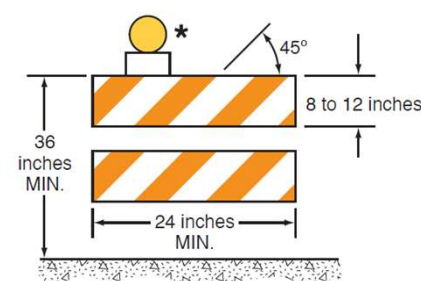


Channelizing Devices - Barricades

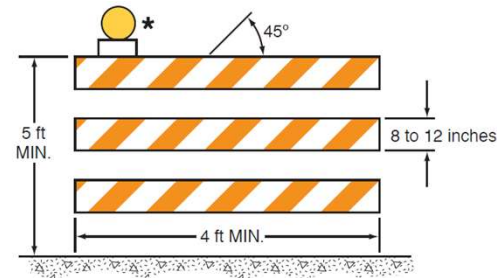
- A barricade is a portable or fixed device having from one to three rails with appropriate markings and is used to control road users by closing, restricting, or delineating all or a portion of the right-of-way.
- Barricades are classified as Type 1, Type 2, or Type 3.
- Stripes on barricade rails shall be alternating orange and white retroreflective stripes sloping downward at an angle of 45 degrees in the direction road users are to pass.
- The minimum length for Type 1 and Type 2 Barricades shall be 24 inches, and the minimum length for Type 3 Barricades shall be 48 inches.



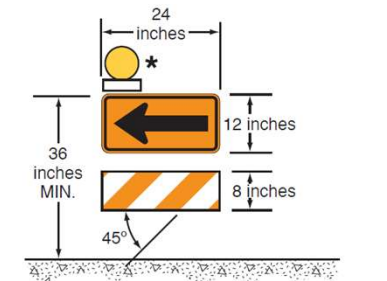
TYPE 1 BARRICADE **



TYPE 2 BARRICADE **



TYPE 3 BARRICADE **



DIRECTION INDICATOR BARRICADE **

* Warning lights (optional)

** Rail stripe widths shall be 6 inches, except that 4-inch wide stripes may be used if rail lengths are less than 36 inches. The sides of barricades facing traffic shall have retroreflective rail faces.

Portable Changeable Message Signs

- **PCMS** devices provide drivers information in regards to upcoming conditions or changes in traffic pattern.
- **PCMSs should be used as a supplement to, and not as a substitute for, conventional signs and pavement markings.**
- PCMSs used on roadways (with speed limits of 55 mph or higher) **should be visible from ½ mile** under both day and night conditions. The maximum distance that a driver can read the message is the legibility distance, which can be dependent on the message.
- CMSs should be limited to **three lines of eight characters per line** or should consist of a full matrix display. Newer CMSs have the ability for more characters per line and still stay in compliance. It depends on the **Spacing between Message Characters (Table 2L-1)**.
- Section 2L.04: The spacing between characters in a word should be between 25 and 40 percent of the letter height. The spacing between words in a message should be between 75 and 100 percent of the letter height. Spacing between the message lines should be between 50 and 75 percent of the letter height.



Crash Cushions

- Crash cushions are systems that mitigate the effects of errant vehicles that strike obstacles, either by smoothly decelerating the vehicle to a stop when hit head-on, or by redirecting the errant vehicle.
- Crash cushions in TTC zones help protect the drivers from the exposed ends of barriers, fixed objects, shadow vehicles, and other obstacles.
- The two types of crash cushions that are used in TTC zones are **stationary crash cushions and truck-mounted attenuators**.
- Stationary crash cushions are used in the same manner as permanent highway installations to protect drivers from the exposed ends of barriers, fixed objects, and other obstacles.

Attenuator Trucks

- An attenuator truck, also known as a crash truck, impact protection vehicle, or safety truck, is a vehicle used in construction zones, especially in highway and freeway maintenance operations, to improve safety for workers and motorists. The purpose of these trucks is to absorb and minimize the impact of a vehicle collision in a roadwork zone to protect the workers and equipment on-site.
- The key feature of an attenuator truck is the crash cushion, also known as an impact attenuator, installed on the rear of the vehicle. The attenuator is a specially designed device, often accordion-like in design, that crumples and absorbs the energy of a colliding vehicle. It can reduce the severity of an accident by slowing down the colliding vehicle in a controlled manner, which can potentially save lives and reduce property damage.



Attenuator Trucks

These trucks are often deployed in various traffic work zones where workers are present on the road, for example:

- **1. Road maintenance or road construction zones:** These could be long-term construction projects or short-term maintenance work. Attenuator trucks are used to create a safety buffer between the flow of traffic and the workers and equipment in the work zone.
- **2. Incidents or emergencies:** In case of a car accident or a vehicle breakdown, an attenuator truck can be deployed to provide a safe environment for first responders and the individuals involved in the incident.
- **3. Highway operations:** During operations such as line painting or asphalt repair, attenuator trucks can protect workers from the flow of traffic.

Attenuator trucks are usually brightly colored or have high-visibility striping and flashing lights to be easily seen by approaching motorists. They may also display signs or arrows to guide drivers safely around the work zone

Arrow Boards



Arrow Boards

- **Arrow boards should be used in combination with appropriate signs, channelizing devices, or other TTC devices.**
- Arrow board elements shall be capable of at least a 50 percent dimming from full brilliance. The dimmed mode shall be used for nighttime operation of arrow boards.
- An arrow board shall have the following three mode selections:
 1. A Flashing Arrow, Sequential Arrow, or Sequential Chevron mode;
 2. A Flashing Double Arrow mode; and
 3. A Flashing Caution or Alternating Diamond mode.
- An arrow board in the arrow or chevron mode shall be used only for stationary or moving lane closures on multi-lane roadways.
- For shoulder work, for blocking the shoulder, for roadside work near the shoulder, or for temporarily closing one lane on a two-lane, two-way roadway, an arrow board shall be used only in the caution mode.



Merge Right



Merge Right



Merge Right



Arrow Boards

- **Type A** Arrow Boards are appropriate for use on low-speed urban streets.
- **Type B** Arrow Boards are appropriate for intermediate-speed facilities and for maintenance or mobile operations on high-speed roadways.
- **Type C** Arrow Boards are intended to be used on high-speed, high-volume motor vehicle traffic control projects.
- **Type D** Arrow Boards are intended for use on vehicles authorized by the State or local agency. Vehicles displaying Arrow Boards shall be equipped with high-intensity rotating, flashing, oscillating, or strobe lights.
- Arrow Boards shall only be used to indicate a lane closure.
- Arrow boards shall not be used to indicate a lane shift.

Arrow Boards

Figure 6L-3. Advance Warning Arrow Board Display Specifications

Operating Mode	Display (Type C arrow board illustrated) (right arrow shown; left is similar)			Arrow Board Type	Minimum Size	Minimum Legibility Distance	Minimum Number of Elements
1. At least one of the three following modes shall be provided:							
Flashing Arrow	 Merge Right						
Sequential Arrow				A	48 x 24 inches	1/2 mile	12
		Merge Right		B	60 x 30 inches	3/4 mile	13
				C	96 x 48 inches	1 mile	15
Sequential Chevron				D	None*	1/2 mile	12
		Merge Right					
2. The following mode shall be provided: Flashing Double Arrow	 Merge Right or Left						
3. At least one of the following modes shall be provided: Flashing Caution or Alternating Diamond Caution		or					
	Flashing Caution		or				
				Alternating Diamond Caution			

*Length of arrow equals 48 inches, width of arrowhead equals 24 inches

Flashing Beacons and Warning Lights

- **Lighting devices should be provided in TTC zones based on engineering judgment.**
- Flashing beacons and/or warning lights may be used to supplement retroreflectorized signs, barriers, and channelizing devices.
- **Type A Low-Intensity** Flashing warning lights are **used to warn road users during nighttime hours** that they are approaching or proceeding in a potentially hazardous area. Type A warning lights may be mounted on channelizing devices.
- **Type B High-Intensity** Flashing warning lights are **used to warn road users during both daylight and nighttime hours** that they are approaching a potentially hazardous area. Type B warning lights are designed to operate 24 hours per day and may be mounted on advance warning signs or on independent supports
- **Type C Steady-Burn** warning lights and **Type D 360-degree Steady-Burn** warning lights may be used during nighttime hours to **delineate the edge of the traveled way**.
- When used to delineate a curve, Type C and Type D 360-degree warning lights should only be used on devices on the **outside of the curve**, and not on the inside of the curve.

Automated Flagger Assistance Devices

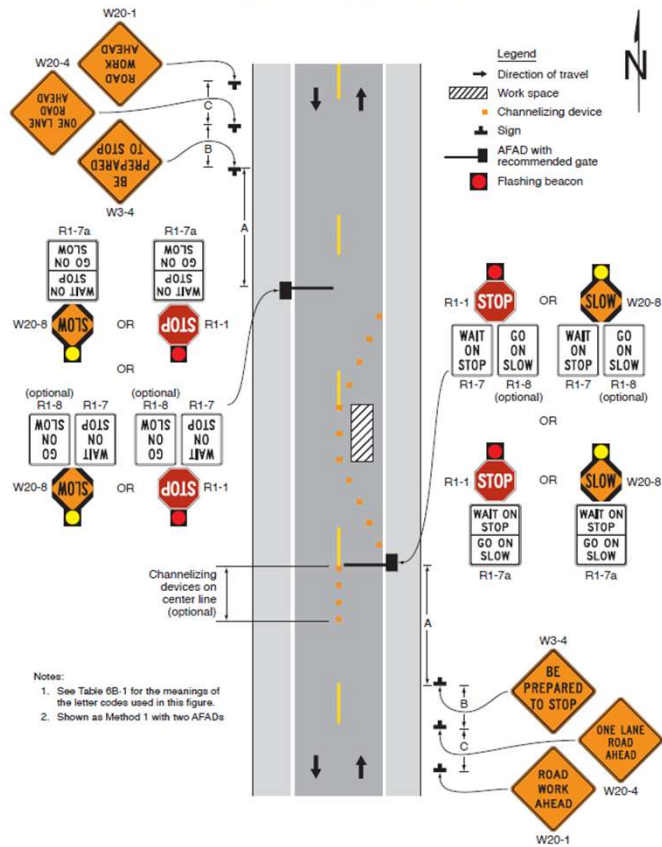
- Automated Flagger Assistance Devices (**AFADs**) **enable a flagger to be positioned out of the lane of traffic** and are used to control road users through temporary traffic control zones.
- These devices are designed to be remotely operated either by a single flagger at one end of the TTC zone or at a central location, or by separate flaggers near each device's location.
- AFADs shall only be used in situations where there is only one lane of approaching traffic in the direction to be controlled.
- AFADs shall **not be used as a replacement for temporary traffic control signals**.

There are two types of AFADs:

- An AFAD that uses a remotely controlled **STOP / SLOW sign** on either a trailer or a movable cart system to alternately control right-of-way.
- An AFAD that uses remotely controlled **Red and Yellow lenses** and a gate arm to alternately control right-of-way.

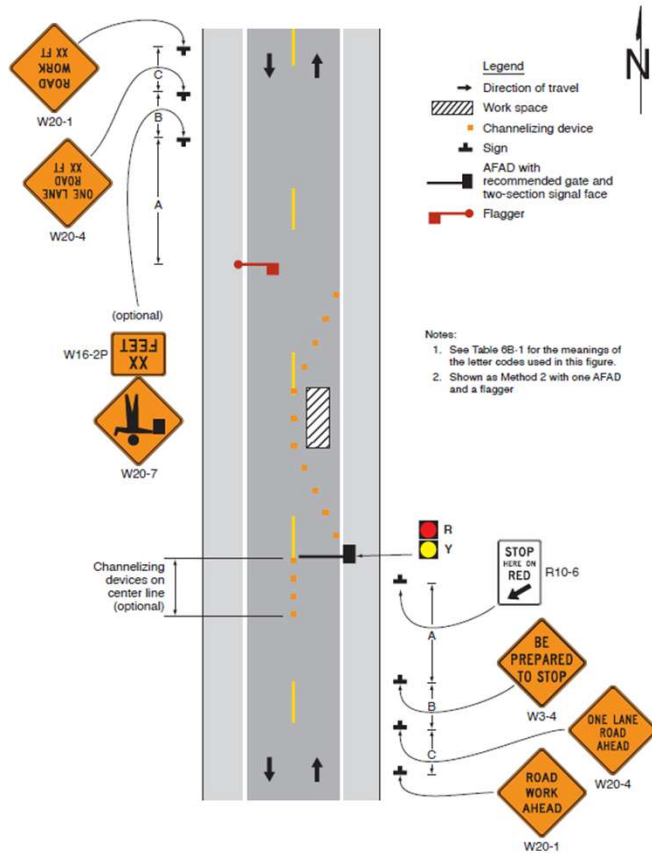
Stop / Slow AFADs

Figure 6L-1. Example of the Use of a STOP/SLOW Automated Flagger Assistance Device (AFAD)



Red / Yellow AFADs

Figure 6L-2. Example of the Use of a Red/Yellow Lens Automated Flagger Assistance Device (AFAD)



Other TTC Devices

Other devices that may be used in a TTC:

- **Lighting Devices:** For nighttime work, various types of lighting devices are needed to illuminate the work zone and make it clearly visible to approaching drivers.
- **Temporary Traffic Signals:** These can be used for single-lane work zones where alternating traffic flow is needed.
- **Rumble Strips:** Temporary rumble strips can be used to alert drivers that they are approaching a work zone.
- **Portable Barriers:** These can protect workers from errant vehicles and can also be used to segregate different areas of the work zone.
- **End of Queue Warning Systems:** These systems detect when queue lengths approach unsafe conditions and activate warning messages on changeable message signs.
- **Screens** are used to block the road users' view of activities that can be distracting. Screens might improve safety and motor vehicle traffic flow where volumes approach the roadway capacity because they discourage gawking and reduce headlight glare from oncoming motor vehicle traffic.

Knowledge Check

Per the MUTCD, what would be the recommended ballast weight for cones?

- a) The maximum weight allowed
- b) The minimum weight needed
- c) 36lbs
- d) 18lbs

Knowledge Check

Warning signs in work zones should have what color scheme?

a) Black legend and border on Orange background



b) Black legend and border on Yellow background



c) White legend and border on Blue background



d) Red legend and border on White background



Knowledge Check

In which of the following situations can truck-mounted Attenuators (TMAs) be used?

- a) Highway Maintenance Operations
- b) Pedestrian Detour routes
- c) Work performed 10 feet away from pavement
- d) Work zone lengths longer than 1,000 feet

Knowledge Check

According to the MUTCD, what is a PCMS?

- a) Portable Changeable Message Sign**
- b) Portable Channeling Message Sign**
- c) Portable Charging Message Sign**
- d) Portable Collapsing Message Sign**

Knowledge Check

On Type I and Type II barricades, the stripes on the horizontal reflective rail directs drivers in which direction?

- a) Away from the direction of travel**
- b) Downward, towards the direction of travel**
- c) Towards a stop ahead condition**
- d) Upward, towards the lane closure signs**

Knowledge Check

FHWA policy requires that all roadside appurtenances used on the National Highway System meet which criterion?

- a) Adjustability
- b) Crashworthy
- c) Cleanliness
- d) Age

Knowledge Check

The two types of (AFAD) Automated Flagger Assistance Devices are:

- a) Stop / Slow and Red Flag
- b) Stop Sign and Go Sign
- c) Stop / Slow and Red / Yellow Lens
- d) Stop / Go and Red / Green Lens

Session 4: Temporary Traffic Control Elements



7 Fundamental Principles

The Seven Fundamental Principles of TTC (MUTCD 6A.02):

- 1. General plans or guidelines should be developed to provide safety for motorists, bicyclists, pedestrians, workers, enforcement/emergency officials, and equipment, with the following factors being considered:**
 - A. The basic safety principles governing the design of permanent roadways and roadsides should also govern the design of TTC zones. The goal should be to route road users through such zones using roadway geometrics, roadside features, and TTC devices as nearly as possible comparable to those for normal highway situations.
 - B. A TTC plan, in detail appropriate to the complexity of the work project or incident, should be prepared and understood by all responsible parties before the site is occupied. Any changes in the TTC plan should be approved by an official who is knowledgeable (for example, trained and/or certified) in proper TTC practices.

7 Fundamental Principles

2. Road user movement should be inhibited as little as practical, based on the following considerations:

- A. TTC at work and incident sites should be designed on the assumption that drivers will only reduce their speeds if they clearly perceive a need to do so.
- B. Frequent and abrupt changes in geometrics such as lane narrowing, dropped lanes, or main roadway transitions that require rapid maneuvers, should be avoided.
- C. Work should be scheduled in a manner that minimizes the need for lane closures or alternate routes, while still getting the work completed quickly and the lanes or roadway open to traffic as soon as possible.
- D. Attempts should be made to reduce the volume of traffic using the roadway or freeway to match the restricted capacity conditions. Road users should be encouraged to use alternative routes. For high volume roadways and freeways, the closure of selected entrance ramps or other access points and the use of signed diversion routes should be evaluated.
- E. Bicyclists and pedestrians, including those with disabilities, should be provided with access and reasonably safe passage through the TTC zone.
- F. If work operations permit, lane closures on high-volume streets and highways should be scheduled during off-peak hours. Night work should be considered if the work can be accomplished with a series of short-term operations.
- G. Early coordination with officials having jurisdiction over the affected cross streets and providing emergency services should occur if significant impacts to roadway operations are anticipated.

7 Fundamental Principles

3. Motorists, bicyclists, and pedestrians should be guided in a clear and positive manner while approaching and traversing TTC zones and incident sites.

The following principles should be applied:

- A. Adequate warning, delineation, and channelization should be provided to assist in guiding road users in advance of and through the TTC zone or incident site by using proper pavement marking, signing, or other devices that are effective under varying conditions. Providing information that is in usable formats by pedestrians with visual disabilities should also be considered.
- B. TTC devices inconsistent with intended travel paths through TTC zones should be removed or covered. However, in intermediate-term stationary, short-term, and mobile operations, where visible permanent devices are inconsistent with intended travel paths, devices that highlight or emphasize the appropriate path should be used. Providing traffic control devices that are accessible to and usable by pedestrians with disabilities should be considered.
- C. Flagging procedures, when used, should provide positive guidance to road users traversing the TTC zone.

7 Fundamental Principles

- 4. To provide acceptable levels of operations, routine day and night inspections of TTC elements should be performed as follows:**
- A. Individuals who are knowledgeable (for example, trained and/or certified) in the principles of proper TTC should be assigned responsibility for safety in TTC zones. The most important duty of these individuals should be to check that all TTC devices of the project are consistent with the TTC plan and are effective for motorists, bicyclists, pedestrians, and workers.
 - B. As the work progresses, temporary traffic controls and/or working conditions should be modified, if appropriate, in order to provide mobility and positive guidance to the road user and to provide worker safety. The individual responsible for TTC should have the authority to halt work until applicable or remedial safety measures are taken.
 - C. TTC zones should be carefully monitored under varying conditions of road user volumes, light, and weather to check that applicable TTC devices are effective, clearly visible, clean, and in compliance with the TTC plan.
 - D. When warranted, an engineering study should be made (in cooperation with law enforcement officials) of reported crashes occurring within the TTC zone. Crash records in TTC zones should be monitored to identify the need for changes in the TTC zone.

7 Fundamental Principles

5. **Attention should be given to the maintenance of roadside safety during the life of the TTC zone by applying the following principles:**
 - A. To accommodate run-off-the-road incidents, disabled vehicles, or emergency situations, unencumbered roadside recovery areas or clear zones should be provided where practical.
 - B. Channelization of road users should be accomplished by the use of pavement markings, signing, and crashworthy, detectable channelizing devices.
 - C. Work equipment, workers' private vehicles, materials, and debris should be stored in such a manner to reduce the probability of being impacted by run-off-the-road vehicles.
6. **Each person whose actions affect TTC zone safety, from the upper-level management through the field workers, should receive training appropriate to the job decisions each individual is required to make. Only those individuals who are trained in proper TTC practices and have a basic understanding of the principles (established by applicable standards and guidelines, including those of this Manual) should supervise the selection, placement, and maintenance of TTC devices used for TTC zones and for incident management.**

7 Fundamental Principles

7. Good public relations should be maintained by applying the following principles:

- A. The needs of all road users should be assessed such that appropriate advance notice is given and clearly defined alternative paths are provided.
- B. The cooperation of the various news media should be sought in publicizing the existence of and reasons for TTC zones because news releases can assist in keeping the road users well informed.
- C. The needs of abutting property owners, residents, and businesses should be assessed and appropriate accommodations made.
- D. The needs of emergency service providers (law enforcement, fire, and medical) should be assessed and appropriate coordination and accommodations made.
- E. The needs of railroads and transit should be assessed and appropriate coordination and accommodations made.
- F. The needs of operators of commercial vehicles such as buses and large trucks should be assessed and appropriate accommodations made.

Standard:

Before any new detour or temporary route is opened to traffic, all necessary signs shall be in place. All TTC devices shall be removed as soon as practical when they are no longer needed. When work is suspended for short periods of time, TTC devices that are no longer appropriate shall be removed or covered.

Work Duration (6N.01)

Work duration is a major factor in determining the number and types of devices used in TTC zones. The duration of a TTC zone is defined relative to the length of time a work operation occupies a spot location.

The five categories of work duration and their time at a location shall be defined as follows:

1. **Long-term Stationary** is work that occupies a location more than 3 days.
2. **Intermediate-term Stationary** is work that occupies a location more than one daylight period up to 3 days, or nighttime work lasting more than 1 hour.
3. **Short-term Stationary** is daytime work that occupies a location for more than 1 hour within a single daylight period.
4. **Short Duration** is work that occupies a location up to 1 hour.
5. **Mobile** is work that moves intermittently or continuously.

Work Duration (6N.01)

1. Long-term stationary is work that occupies a location more than 3 days.

- Since long-term operations extend into nighttime, retroreflective and/or illuminated devices shall be used in long-term stationary TTC zones.

2. Intermediate-term stationary is work that occupies a location more than one daylight period up to 3 days, or nighttime work lasting more than 1 hour.

- Since intermediate-term operations extend into nighttime, retroreflective and/or illuminated devices shall be used in intermediate-term stationary TTC zones.
- It might not be feasible or practical to use procedures or devices that would be desirable for long-term stationary TTC zones, such as altered pavement markings, temporary traffic barriers, and temporary roadways. The increased time to place and remove these devices in some cases could significantly lengthen the project, thus increasing exposure time.

3. Short-term stationary is daytime work that occupies a location for more than 1 hour within a single daylight period.

- Most maintenance and utility operations are short-term stationary work.

Work Duration (6N.01)

4. Short duration is work that occupies a location up to 1 hour.

- As compared to stationary operations, mobile and short-duration operations are activities that might involve different treatments. Devices having greater mobility might be necessary such as signs mounted on trucks. Devices that are larger, more imposing, or more visible can be used effectively and economically. The mobility of the TTC zone is important.
- During short-duration work, it often takes longer to set up and remove the TTC zone than to perform the work. Workers face hazards in setting up and taking down the TTC zone. Also, since the work time is short, delays affecting road users are significantly increased when additional devices are installed and removed.
- Considering these factors, simplified control procedures may be warranted for short-duration work. A reduction in the number of devices may be offset by the use of other more dominant devices such as high-intensity rotating, flashing, oscillating, or strobe lights on work vehicles.

5. Mobile is work that moves intermittently or continuously.

- Mobile operations shall have appropriate devices on the equipment (that is, high-intensity rotating, flashing, oscillating, or strobe lights, signs, or special lighting), or shall use a separate vehicle with appropriate warning devices. Although vehicle hazard warning lights are permitted to be used to supplement high-intensity rotating, flashing, oscillating, or strobe lights, they shall not be used instead of these devices. A rolling roadblock is a method of TTC used to slow or stop traffic as a means of temporarily removing traffic from a roadway segment downstream of the roadblock. The rolling roadblock closes all lanes of traffic by using pacing vehicles to create a gap so that construction activities can be performed.

Night Work

Conducting highway construction and maintenance activities during night hours could provide an advantage when traditional daytime traffic control strategies cannot achieve an acceptable balance between worker and public safety, traffic and community impact, and constructability.

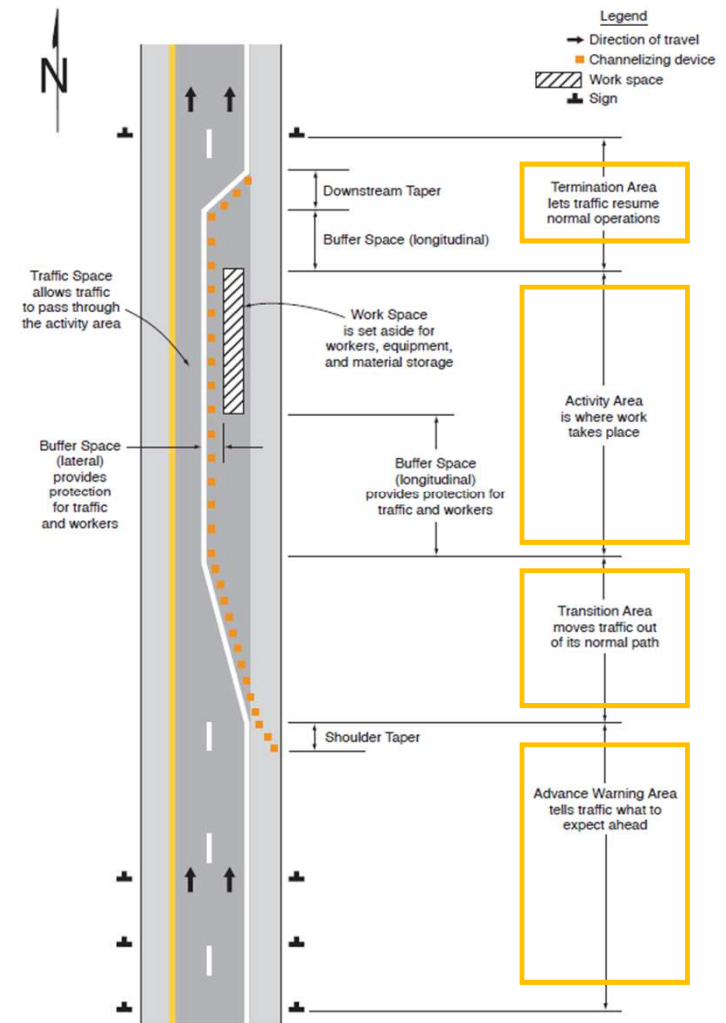
- The two basic advantages of working at night are reduced traffic congestion and less involvement with business activities. The two basic conditions that must normally be met for night work to offer any advantage are (1) reduced traffic volumes and (2) easy set up and removal of the traffic control patterns on a nightly basis.
- Although working at night might offer advantages, it also increases safety issues. Reduced visibility inherent in night work impacts the performance of both drivers and workers. Because traffic volumes are lower and congestion is minimized, speeds are often higher at night necessitating greater visibility at a time when visibility is reduced.
- Working at night also involves other factors, including construction productivity and quality, social impacts, economics, and environmental issues.
- A decision to perform construction or maintenance activities at night normally involves some consideration of the advantages to be gained compared to the safety and other issues that might be impacted.

Components

Components of Temporary Traffic Control Zones (MUTCD 6B.03)

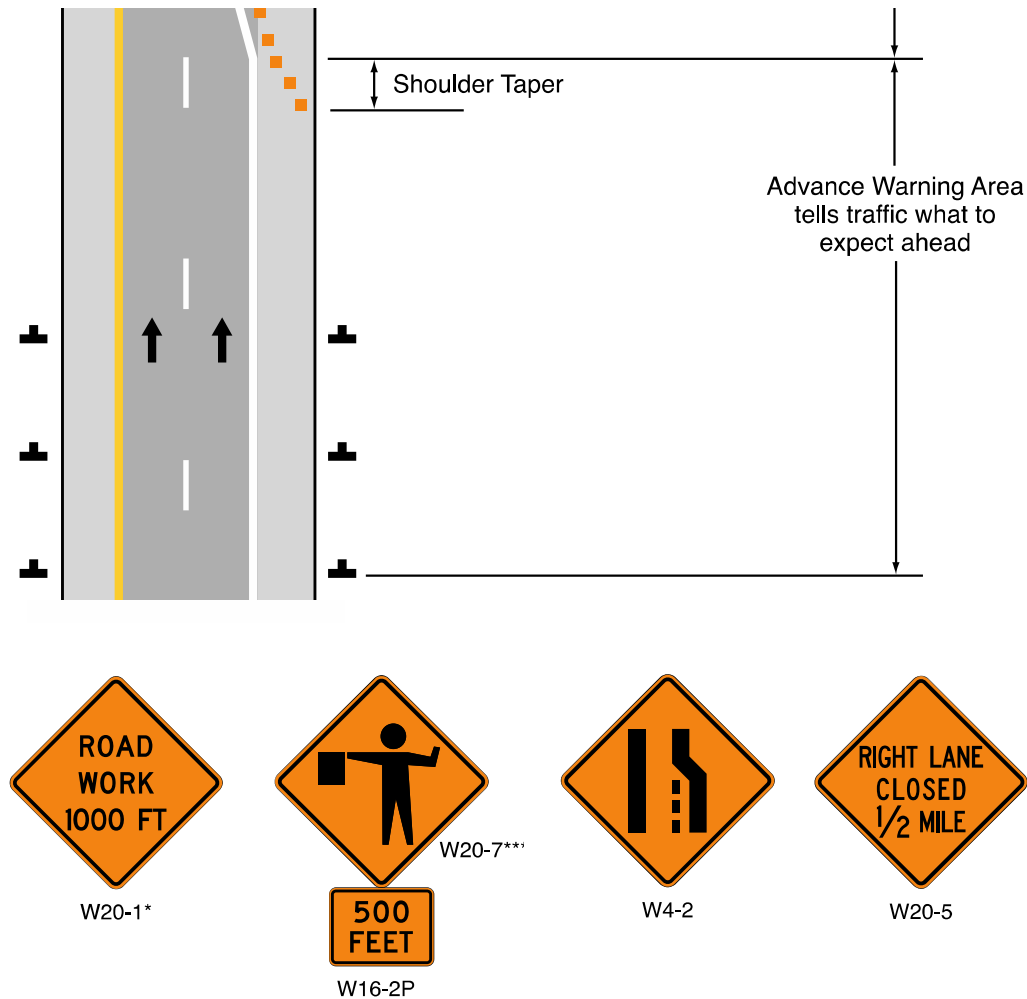
- Most TTC zones are divided into four areas:
 - Advance Warning Area
 - Transition Area
 - Activity Area
 - Termination Area

Figure 6B-1. Component Parts of a Temporary Traffic Control Zone



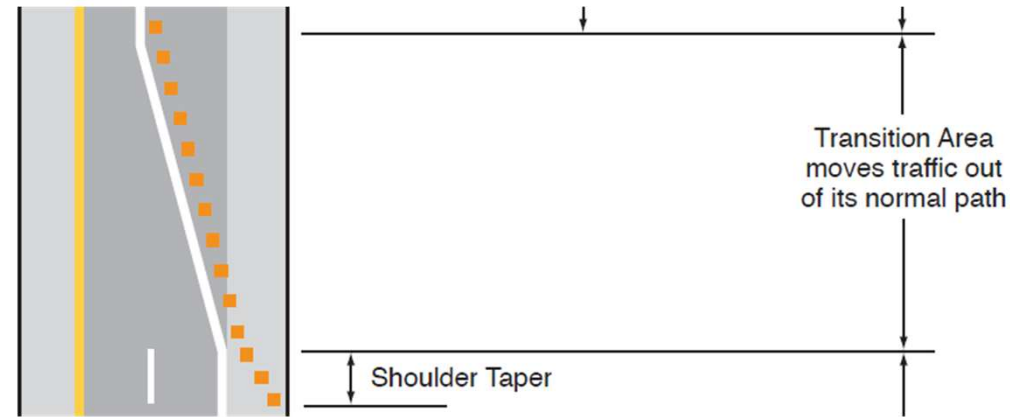
Advance Warning Area

- The Advance Warning Area is the section of highway where road users are informed about the upcoming work zone or incident area.
- The Advance Warning Area may vary from a single sign or high-intensity rotating, flashing, oscillating, or strobe lights on a vehicle to a series of signs in advance of the TTC zone activity area.



Transition Area

- The Transition Area is that section of highway where road users are redirected out of their normal path.
- Transition Areas usually involve strategic use of tapers, which because of their importance are discussed separately in detail.
- Because it is impractical in mobile operations to redirect the road user's normal path with stationary channelization, more dominant vehicle-mounted traffic control devices, such as arrow boards, portable changeable message signs, and high-intensity rotating, flashing, oscillating, or strobe lights, may be used instead of channelizing devices to establish a transition area.



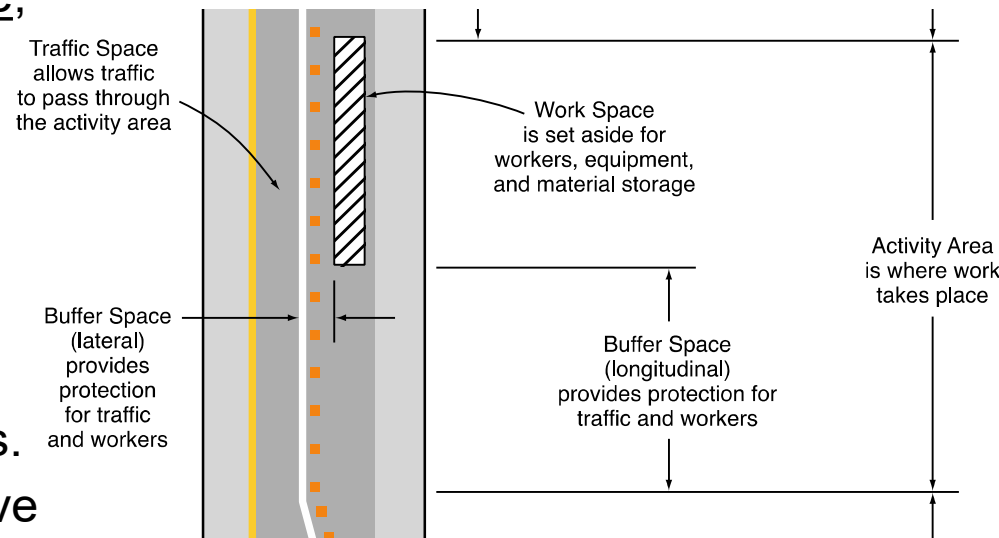
W1-6



W1-8

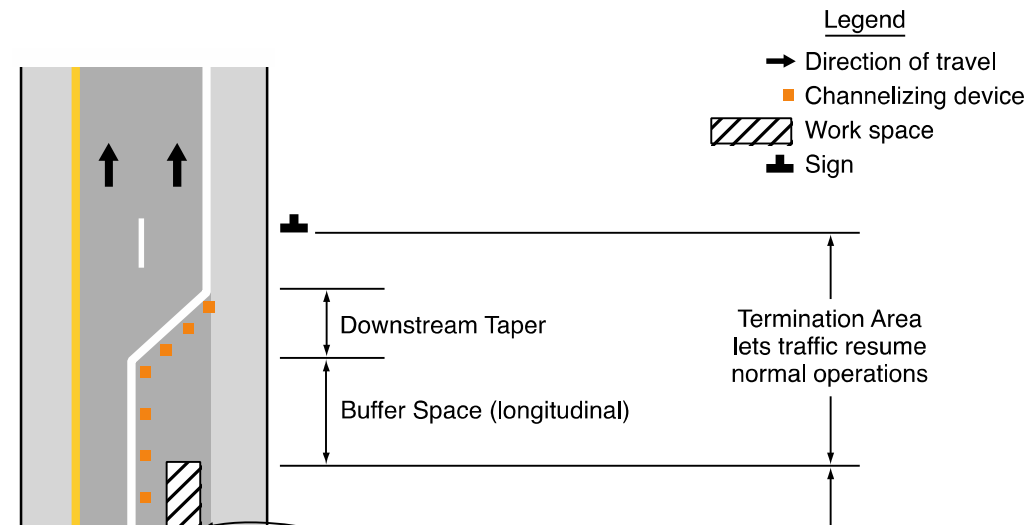
Activity Area

- The Activity Area is the section of the highway where the work activity takes place. It is comprised of the Work Space, the Traffic Space, and the Buffer Space.
- The Work Space is that portion of the highway closed to road users and set aside for workers, equipment, and material, and a shadow vehicle if one is used upstream.
- Work Spaces are usually delineated for road users by channelizing devices or, to exclude vehicles and pedestrians, by temporary barriers.
- The Work Space may be stationary or may move as work progresses.
- The Traffic Space is the portion of the highway in which road users are routed through the activity area.



Termination Area

- The Termination Area is the section of the highway where road users are returned to their normal driving path.
- The Termination Area extends from the downstream end of the work area to the last TTC device such as END ROAD WORK signs, if posted.
- An END ROAD WORK sign, a Speed Limit sign, or other signs may be used to inform road users that they can resume normal operations.
- A longitudinal buffer space may be used between the Work Space and the beginning of the downstream taper.

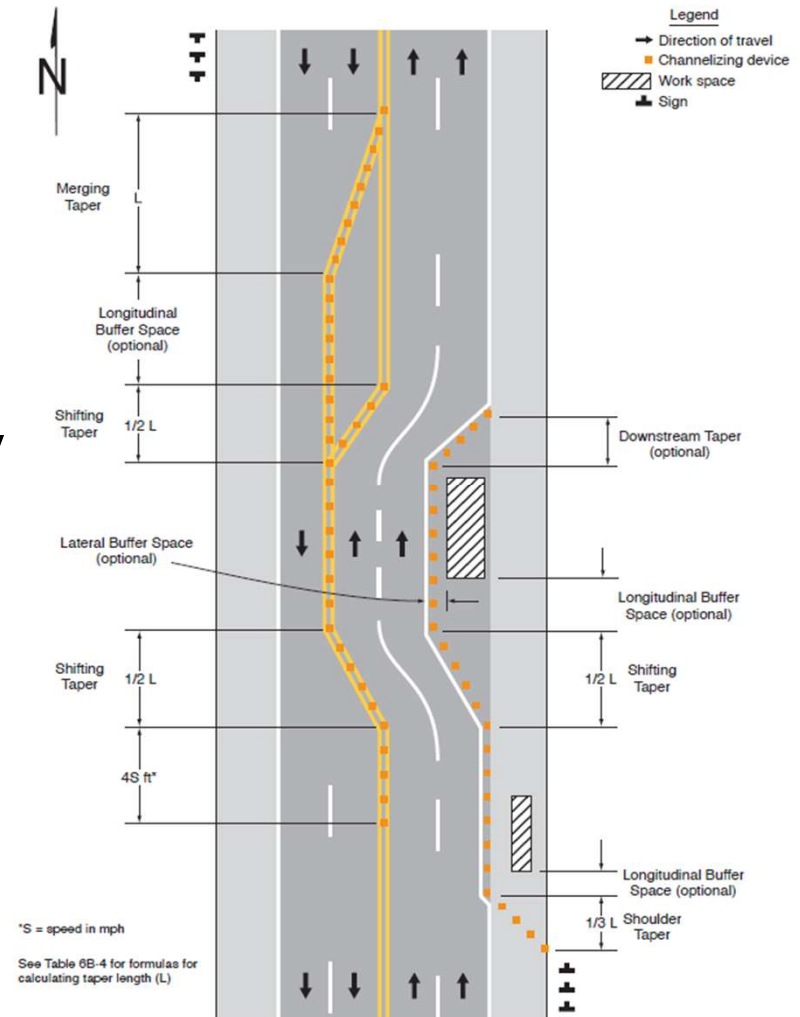


G20-2

Tapers

- Tapers may be used in both the transition and termination areas.
- Whenever tapers are to be used in close proximity to an interchange ramp, crossroads, curves, or other influencing factors, the length of the tapers may be adjusted.
- Tapers are created by using a series of channelizing devices and/or pavement markings to move traffic out of or into the normal path.

Figure 6B-2. Types of Tapers and Buffer Spaces



Tapers

In work zone management, tapers are used to guide traffic safely and smoothly through construction or maintenance areas. Tapers help drivers transition from normal traffic conditions to a reduced number of lanes or detours. Here are some common types of tapers used in work zones:

- **Lane Closure Taper:** This is the most basic type of taper used when closing one or more lanes. It involves a gradual reduction in the number of lanes through the use of signs, cones, and/or barrels to guide drivers into the available lanes.
- **Merge Taper:** A merge taper is used when two lanes of traffic are being funneled into one. It is typically formed by a series of diagonal lines of cones or barrels, directing vehicles to merge into the open lane.
- **Shift Taper:** A shift taper is used when traffic needs to be shifted from its normal path to an adjacent lane or detour. It involves a gradual shifting of lanes through the use of signs, pavement markings, and delineators.
- **Shoulder Taper:** In some cases, the shoulder of the road may be used as an additional travel lane to accommodate traffic during work zones. A shoulder taper is employed to guide vehicles onto the shoulder and maintain a safe distance from the work area.
- **Bypass Taper:** A bypass taper is used when a temporary bypass or detour is created to divert traffic away from the work zone. It involves clear signage, pavement markings, and traffic control devices to direct drivers onto the alternate route.
- **Entrance / Exit Taper:** When a work zone affects entrance or exit ramps of a highway or road, entrance and exit tapers are used to guide vehicles safely into or out of the work zone. These tapers provide advance warning and proper lane guidance.

Tapers

Longer tapers are not necessarily better than shorter tapers (particularly in urban areas with characteristics such as short block lengths or driveways) because extended tapers tend to encourage sluggish operation and to encourage drivers to delay lane changes unnecessarily.

- The appropriate taper length (L) should be determined using the criteria shown in **Tables 6B-3 and 6B-4**.
- The maximum distance in feet between devices in a taper should not exceed 1.0 times the speed limit in mph.
- It's important to note that the specific design and layout of tapers can vary depending on factors such as the speed limit, volume of traffic, work zone length, and local regulations.
- Work zone managers and traffic engineers carefully plan and design tapers to ensure the safety and efficiency of traffic flow through construction or maintenance areas.

Table 6B-3. Taper Length Criteria for Temporary Traffic Control Zones

Type of Taper	Taper Length
Merging Taper	at least L
Shifting Taper	at least 0.5 L
Shoulder Taper	at least 0.33 L
One-Lane, Two-Way Traffic Taper	50 feet minimum, 100 feet maximum
Downstream Taper	50 feet minimum, 100 feet maximum

Note: Use Table 6B-4 to calculate L

Table 6B-4. Formulas for Determining Taper Length

Speed (S)	Taper Length (L) in feet
40 mph or less	$L = \frac{WS^2}{60}$
45 mph or more	$L = WS$

Where: L = taper length in feet
W = width of offset in feet
S = posted speed limit, or off-peak 85th-percentile speed prior to work starting, or the anticipated operating speed in mph

Tapers

Taper Length, L (ft)		Posted Speed Limit, mph (Prior to Work Zone)									
		25	30	35	40	45	50	55	60	65	70
Offset / Lane Width (ft)	8	83	120	163	213	360	400	440	480	520	560
	9	94	135	184	240	405	450	495	540	585	630
	10	104	150	204	267	450	500	550	600	650	700
	11	115	165	225	293	495	550	605	660	715	770
	12	125	180	245	320	540	600	660	720	780	840
	13	135	195	266	347	585	650	715	780	845	910
	14	146	210	286	374	630	700	770	840	910	980
	15	157	225	307	400	675	750	825	900	975	1050

Detours and Diversions

- A detour is a temporary rerouting of road users onto an existing highway in order to avoid a TTC zone.
- Detours should be clearly signed over their entire length so that road users can easily use existing highways to return to the original highway.
- Detour Signs should be installed from the end of the detour to the beginning of the detour and removed from the beginning of the detour to the end of the detour.
- A diversion is a temporary rerouting of road users onto a temporary highway or alignment placed around the work area.



Detours and Diversions

Standard:

Before any new detour or temporary route is opened to traffic, all necessary signs shall be in place. All TTC devices shall be removed as soon as practical when they are no longer needed. When work is suspended for short periods of time, TTC devices that are no longer appropriate shall be removed or covered.

Special Consideration for Installation and Removal for Detour Routes When the traffic control plan requires a detour route, installation and removal procedures are different than for a normal stationary lane closure.

For installation of a detour:

- First install the last sign motorists will see (the sign that guides motorists back to the route they were detoured from).
- Second, install the remaining signs working back toward the beginning of the detour. This procedure allows motorists to detour only after all the signs are in place.

Detours and Diversions

Standard:

Before any new detour or temporary route is opened to traffic, all necessary signs shall be in place. All TTC devices shall be removed as soon as practical when they are no longer needed. When work is suspended for short periods of time, TTC devices that are no longer appropriate shall be removed or covered.

For removal of a detour:

- First remove the sign at the beginning of the detour route.
- Second, remove the other signs with the flow of traffic.

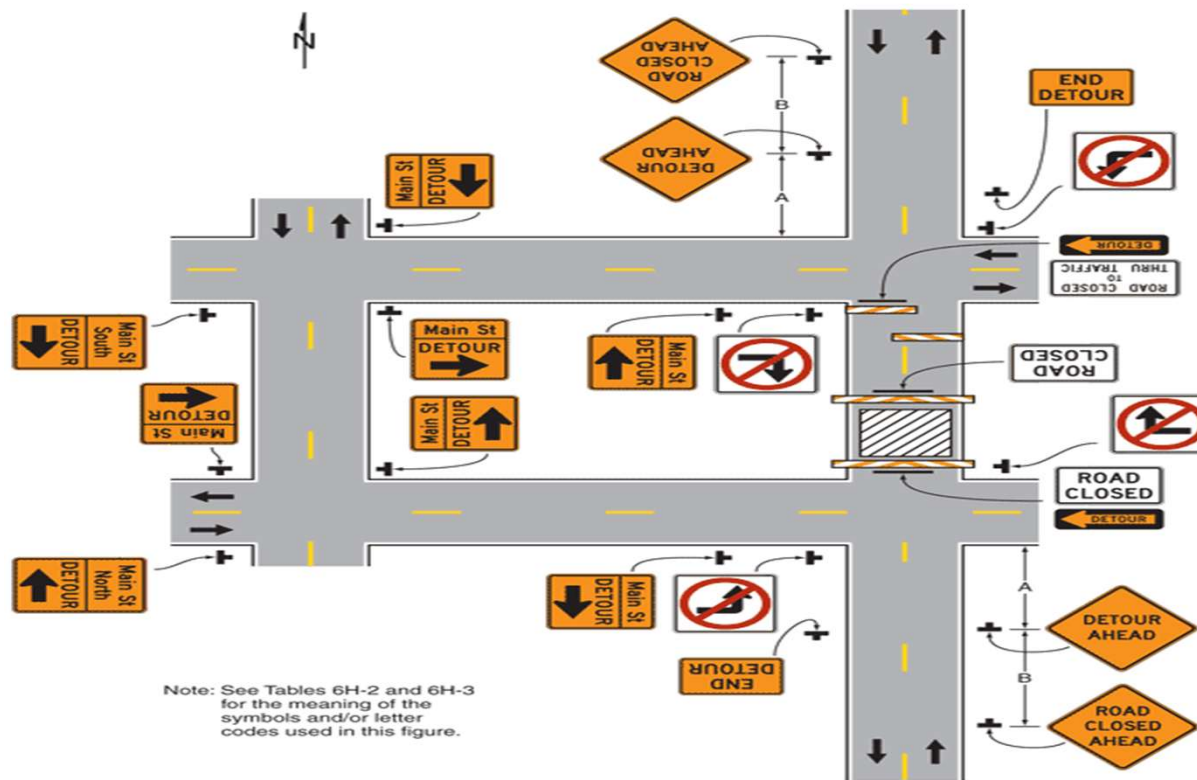
With the appropriate level of staff available, all detour signs may be placed in the field at the same time. Additionally, detour signs can be placed one by one and covered until ready for use.

Figure 6H-7. Road Closure with a Diversion (TA-7)



Detours and Diversions

Figure 6H-20. Detour for a Closed Street (TA-20)



Typical Application 20

Knowledge Check

The taper of the work zone _____.

- a) Is not to be modified
- b) Is determined by a set of criteria found in the MUTCD
- c) Can be reduced by the senior technician
- d) Should be set up by the senior technician

Knowledge Check

In a work zone, the transition area is _____.

- a) Not required for speed below 55 MPH
- b) Used to channel traffic from the normal path to a new path of traffic
- c) Used to advise motorists of actions that are required ahead
- d) The area after the work zone where traffic moves back to the normal path of traffic

Knowledge Check

Which statement about a detour is CORRECT?

- a) A detour diverts traffic through the existing roadway by shifting traffic flow
- b) A detour redirects traffic to another roadway to bypass the work zone
- c) A detour must be paid for under a separate pay item
- d) A detour must be approved by the Police Department

Session 5: Flagger Control



Flagger Control

Because **flaggers are responsible for public safety** and make the greatest number of contacts with the public of all highway workers, they should be trained in safe traffic control practices and public contact techniques.

Flaggers should be able to satisfactorily demonstrate the following abilities:

- A. Ability to receive and communicate specific instructions clearly, firmly, and courteously.
- B. Ability to move and maneuver quickly in order to avoid danger from errant vehicles.
- C. Ability to control signaling devices (such as paddles and flags) in order to provide clear and positive guidance to drivers approaching a TTC zone in frequently changing situations.
- D. Ability to understand and apply safe traffic control practices, sometimes in stressful or emergency situations.
- E. Ability to recognize dangerous traffic situations and warn workers in sufficient time to avoid injury.

Flagger Control



Flagger Control

The Lead Flagger

- There must be a Lead Flagger”
- The job of the “Lead Flagger” is to prevent conflicts.
- The “Lead Flagger” coordinates the work.



Flagger Control

Table 6E-1. Stopping Sight Distance as a Function of Speed

Speed*	Distance
20 mph	115 feet
25 mph	155 feet
30 mph	200 feet
35 mph	250 feet
40 mph	305 feet
45 mph	360 feet
50 mph	425 feet

Flagger Control

According to the MUTCD, a "YIELD TO ONCOMING TRAFFIC" sign should be used at an intersection within a work zone when only one lane is available for traffic, requiring drivers to yield to oncoming vehicles to allow them to pass through safely; typically used in situations where traffic volume is too low to warrant full lane control measures like portable signals or traffic control personnel

- Considerations:**

- Traffic volume and visibility are key factors in determining if this sign is necessary.



Rolling or Roadblock closures

A rolling roadblock, also known as a temporary road closure, rolling block, pacing operation, or traffic pacing, is a common highway traffic control technique used to temporarily slow or stop traffic upstream of construction, maintenance, and utility work activities requiring a short-term full closure of the roadway.

Transportation agencies around the country are actively utilizing rolling roadblocks for a variety of road work activities such as:

- Bridge construction and/or replacements.
- Placing or removing overhead lights or sign structures.
- Overhead utility work.
- Blasting for rock excavation or debris removal.

Rolling roadblocks allow for faster completion of road work activities by allowing workers full access on and above a roadway, and the opportunity for a safe environment by completely removing vehicles that would normally be in close proximity to workers.

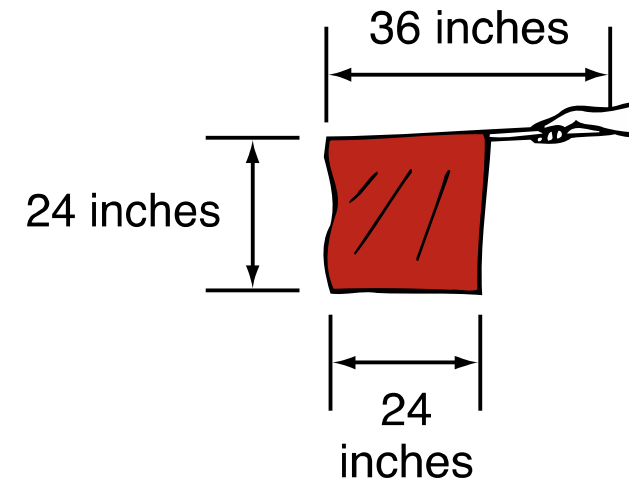
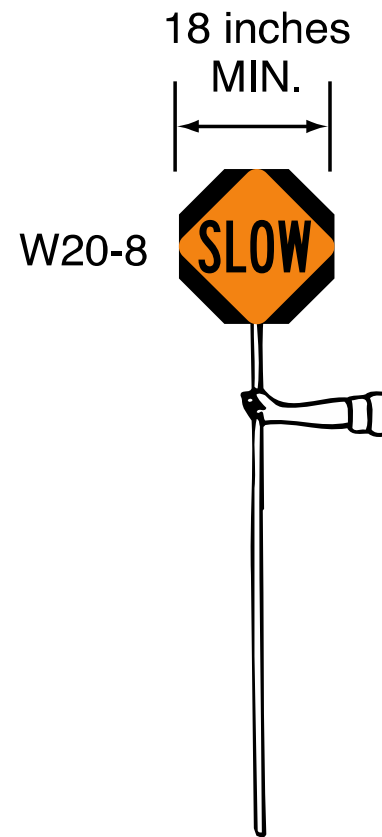
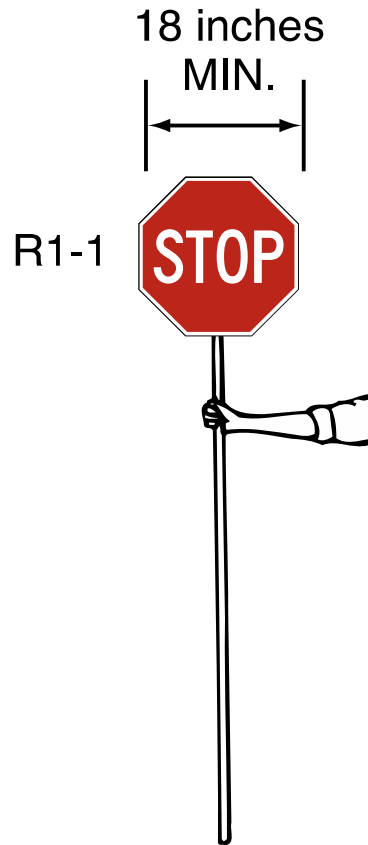
High-Visibility Safety Apparel

- For daytime and nighttime activity, all workers, including emergency responders, within the right-of-way who are within the TTC zone shall wear high-visibility safety apparel that meets the Performance Class 2 or 3 requirements of the ANSI/ISEA 107–2015 publication entitled “American National Standard for High-Visibility Safety Apparel and Headwear.”
- The apparel background (outer) material color shall be fluorescent orange-red, fluorescent yellow-green, or a combination of the two as defined in the ANSI standard. The retroreflective material shall be orange, yellow, white, silver, yellow-green, or a fluorescent version of these colors and shall be visible at a minimum distance of 1,000 feet.
- When uniformed law enforcement personnel are used to direct traffic, to investigate crashes, or to handle lane closures, obstructed roadways, and disasters, high-visibility safety apparel as described in this Section shall be worn by the law enforcement personnel.

Hand-Signaling Devices

- The STOP / SLOW paddle should be the primary and preferred hand-signaling device because the STOP / SLOW paddle gives road users more positive guidance than red flags.
- Use of flags should be limited to emergency situations.
- The STOP / SLOW paddle shall have an octagonal shape on a rigid handle.
- STOP / SLOW paddles shall be at least 18 inches wide with letters at least 6 inches high.
- The STOP (R1-1) face shall have White letters and a White border on a Red background.
- The SLOW (W20-8) face shall have Black letters and a Black border on an Orange background.
- When used at night, the STOP / SLOW paddle shall be retroreflectorized.

Hand-Signaling Devices



Hand-Signaling Devices

- If flashing lights are used on the STOP face of the paddle, their colors shall be all White or all Red.
- If flashing lights are used on the SLOW face of the paddle, their colors shall be all White or all Yellow.
- If more than eight flashing lights are used, the lights shall be arranged such that they clearly convey the octagonal shape of the STOP face of the paddle and/or the diamond shape of the SLOW face of the paddle.
- If flashing lights are used on the STOP / SLOW paddle, the flash rate shall be at least 50, but not more than 60, flashes per minute.

Flags

- **Use of flags should be limited to emergency situations.**
- Flags, when used, shall be Red or fluorescent Orange/Red in color, shall be a minimum of 24 inches square, and shall be securely fastened to a staff that is approximately 36 inches in length.
- The free edge of a flag should be weighted so the flag will hang vertically, even in heavy winds.
- When used at nighttime, flags shall be retroreflectorized Red.



Flashlights

- When a flashlight is used for flagging in an emergency situation at night in a non-illuminated flagger station, the flagger shall hold the flashlight in the left hand, shall hold the paddle or flag in the right hand as shown in Figure 6D-1, and shall use the flashlight in the following manner to control approaching road users.
- To inform road users to stop, the flagger shall hold the flashlight with the left arm extended and pointed down toward the ground, and then shall slowly wave the flashlight in front of the body in a slow arc from left to right such that the arc reaches no farther than 45 degrees from vertical.
- To inform road users to proceed, the flagger shall point the flashlight at the vehicle's bumper, slowly aim the flashlight toward the open lane, then hold the flashlight in that position.
- The flagger shall not wave the flashlight.
- To alert or slow traffic, the flagger shall point the flashlight toward oncoming traffic and quickly wave the flashlight in a Figure eight motion.

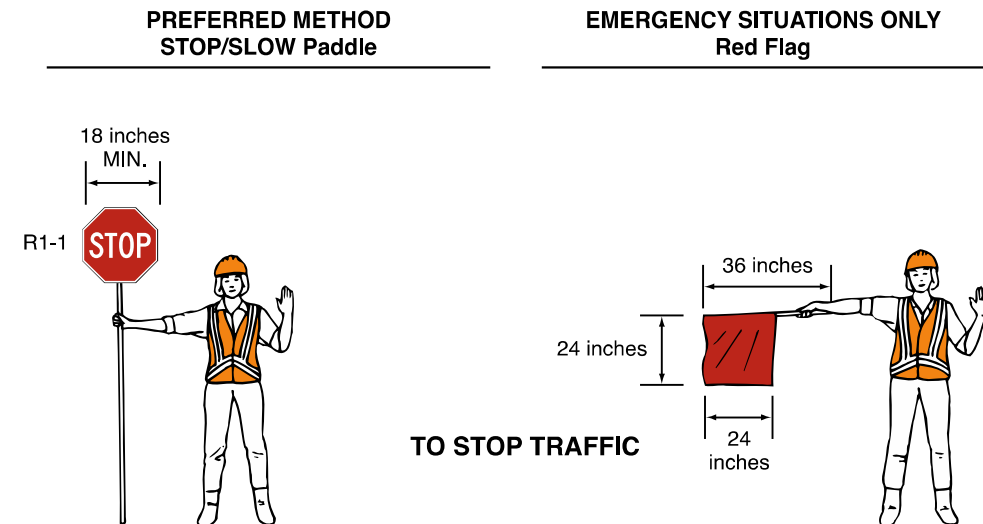
Flagger Procedures

- Flaggers shall use a STOP / SLOW paddle, a flag, or an Automated Flagger Assistance Device (AFAD) to control road users approaching a TTC zone.
- The use of hand movements alone without a paddle, flag, or AFAD to control road users shall be prohibited except for law enforcement personnel or emergency responders at incident scenes as described in the MUTCD.
- If a temporary traffic control, technician or flagger is confronted by a citizen, he should direct that person to the supervisor or foreman the job.

Use of Hand-Signaling Devices

- To stop road users, the flagger shall face road users and aim the STOP paddle face toward road users in a stationary position with the arm extended horizontally away from the body.
- The free arm shall be held with the palm of the hand above shoulder level toward approaching traffic.

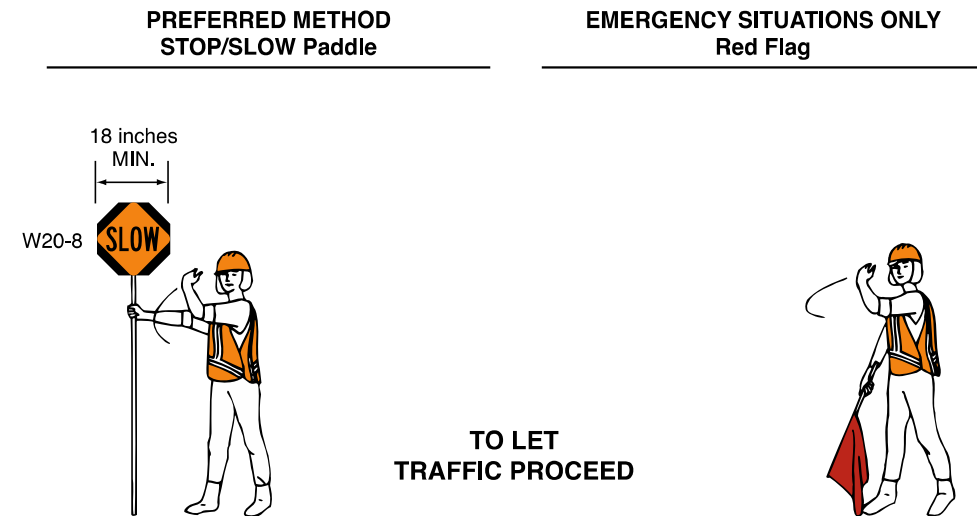
Figure 6D-1. Use of Hand-Signaling Devices by Flaggers



Use of Hand-Signaling Devices

- To direct stopped road users to proceed, the flagger shall face road users with the SLOW paddle face aimed toward road users in a stationary position with the arm extended horizontally away from the body.
- The flagger shall motion with the free hand for road users to proceed.

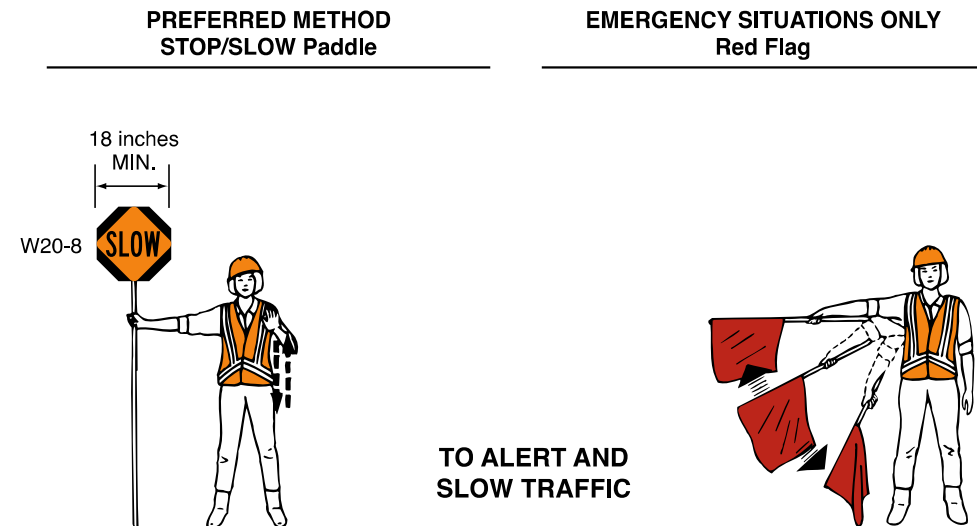
Figure 6D-1. Use of Hand-Signaling Devices by Flaggers



Use of Hand-Signaling Devices

- To alert or slow traffic, the flagger shall face road users with the SLOW paddle face aimed toward road users in a stationary position with the arm extended horizontally away from the body.
- To further alert or slow traffic, the flagger holding the SLOW paddle face toward road users may motion up and down with the free hand, palm down.

Figure 6D-1. Use of Hand-Signaling Devices by Flaggers

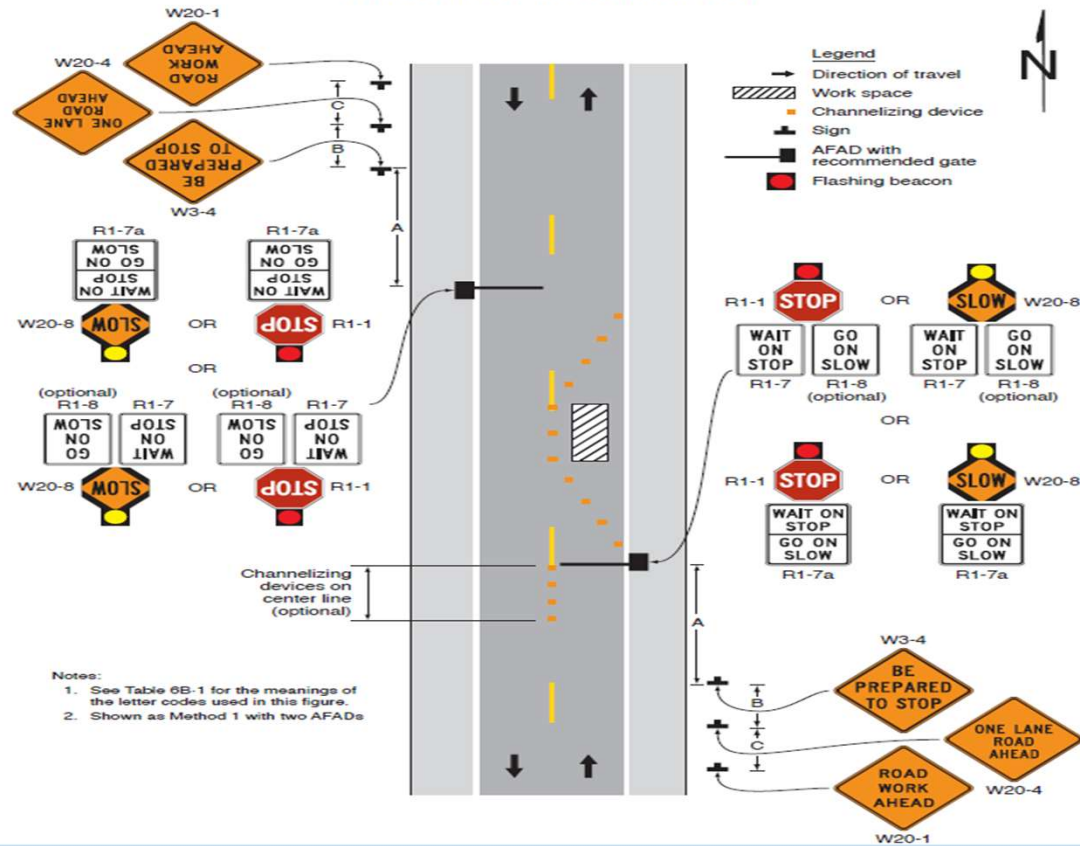


AFADs

- Automated Flagger Assistance Devices (AFADs) enable a flagger to be positioned out of the lane of traffic and are used to control road users through temporary traffic control zones.
- These devices are designed to be remotely operated either by a single flagger at one end of the TTC zone or at a central location, or by separate flaggers near each device's location.
- Because AFADs are not traffic control signals, they shall not be used as a substitute or a replacement for a continuously operating temporary traffic control signal.
- AFADs shall meet the crashworthy performance criteria.

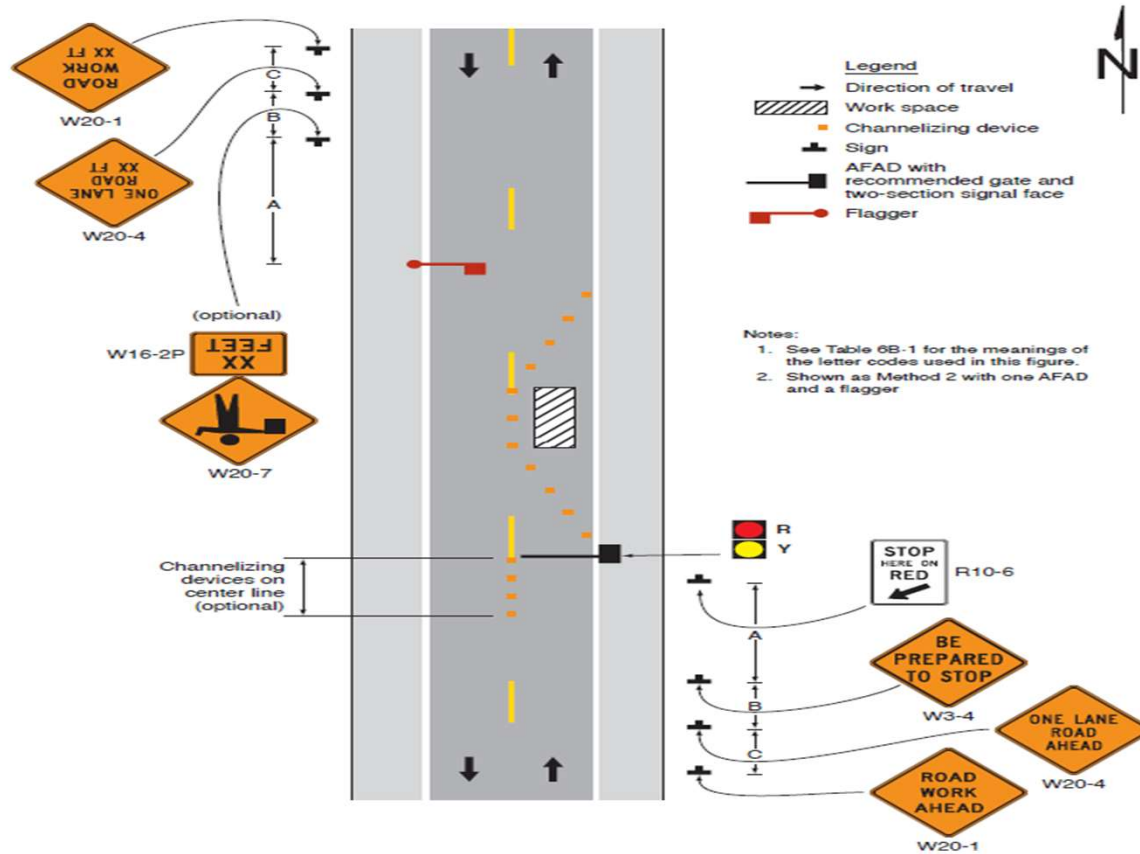
Stop / Slow AFADs

Figure 6L-1. Example of the Use of a STOP/SLOW Automated Flagger Assistance Device (AFAD)



Red / Yellow AFADs

Figure 6L-2. Example of the Use of a Red/Yellow Lens Automated Flagger Assistance Device (AFAD)



One-Lane, Two-Way Traffic Control

- When traffic in both directions must use a single lane for a limited distance, movements from each end shall be coordinated.
- Provisions should be made for alternate one-way movement through the constricted section via methods such as flagger control, a flag transfer, a pilot car, traffic control signals, or stop or yield control.
- Control points at each end should be chosen to permit easy passing of opposing lanes of vehicles.
- If the work space on a low-volume street or road is short and road users from both directions are able to see the traffic approaching from the opposite direction through and beyond the worksite, the movement of traffic through a one-lane, two-way constriction may be self-regulating.

One-Lane, Two-Way Traffic Control

Flagger Method

- Except as provided in Paragraph 2 of this Section, traffic should be controlled by a flagger at each end of a constricted section of roadway.
- One of the flaggers should be designated as the coordinator.
- To provide coordination of the control of the traffic, the flaggers should be able to communicate with each other orally, electronically, or with manual signals. These manual signals should not be mistaken for flagging signals.
- When a one-lane, two-way TTC zone is short enough to allow a flagger to see from one end of the zone to the other, traffic may be controlled by either a single flagger or by a flagger at each end of the section.
- When a single flagger is used, the flagger should be stationed on the shoulder opposite the constriction or work space, or in a position where good visibility and traffic control can be maintained at all times.
- When good visibility and traffic control cannot be maintained by one flagger station, traffic should be controlled by a flagger at each end of the section.

One-Lane, Two-Way Traffic Control

Pilot Car Method

- A pilot car may be used to guide a queue of vehicles through the TTC zone or detour.
- The pilot car should have the name of the contractor or contracting authority prominently displayed.
- The PILOT CAR FOLLOW ME (G20-4) sign (see Figure 6H-1) shall be mounted on the top or on the rear of the pilot vehicle (see Section 6H.37).
- The pilot car operation shall be coordinated with flagging operations or other methods of control at each end of the one lane section of the work zone.
- If an Automated Flagger Assistance Device (AFAD) (see Section 6L.02) is used in pilot car operations, the AFAD shall be operated by a flagger positioned near and within the line of sight of the AFAD. The AFAD shall not be left unattended at any time that the AFAD is being used.
- If temporary traffic control signals are used in pilot car operations and long wait times will be encountered by road users, consideration should be given to using signs to notify drivers of the wait time and/or pilot car operation, based on engineering judgment.

One-Lane, Two-Way Traffic Control

Temporary Traffic Control Signal Method

- Traffic control signals may be used to control vehicular traffic movements in one-lane, two-way TTC zones (see Figure 6P-12 and Chapter 4O).

Stop or Yield Control Method

- STOP or YIELD signs may be used to control traffic on low-volume roads at a one-lane, two-way TTC zone when drivers are able to see the other end of the one-lane, two-way operation and have sufficient visibility of approaching vehicles.
- If the STOP or YIELD sign is installed for only one direction, then the STOP or YIELD sign should face road users who are driving on the side of the roadway that is closed for the work activity area.

Knowledge Check

Automated Flagger Assistance Devices shall NOT be used _____.

- a) As a replacement for a temporary traffic control signal
- b) During short term work
- c) For a bridge maintenance work zone
- d) For a pavement patching work zone

Knowledge Check

One reason to assign the duty of flagger to well rested individuals is for their ability to _____.

- a) Keep moral up during a long working day
- b) Locate the car of a platoon and communicate that to fellow workers
- c) Recognize dangerous traffic situations and warn other workers
- d) Understand time management during the project

Knowledge Check

The _____ should be the primary and preferred hand-signaling device.

- a) AFAD
- b) Stop / Slow Paddle
- c) Red Flag
- d) Stop Sign

Knowledge Check

Flaggers are responsible for all the following, EXCEPT _____.

- a) Performing inspection of advance warning signs
- b) Protecting and warning project personnel of errant vehicles
- c) Protecting self by evaluating escape routes
- d) Providing safe, courteous and authoritative directions to motorists

Knowledge Check

When standard orange flags or flashing warning lights are used in conjunction with signs, they shall not block the sign face.

- a) True
- b) False

Session 6: Designing a TTC Plan

Gathering Information

Jobsite Visit

- Survey existing signs, pavement markings, businesses, driveways, pedestrian and bicycle facilities, curves, hills, number of lanes, curbs, and other items affecting the TTC plan.

Location of Work

- The choice of TTC needed for a TTC zone depends upon where the work is located.
- As a general rule, the closer the work is to road users (including bicyclists and pedestrians), the greater the number of TTC devices that are needed.
- Examples of Location types would be: Urban / Rural / Freeway / On the Shoulder / In the Median / In the Traveled Way / At an Intersection.

Gathering Information

Work Duration

Work duration is a major factor in determining the number and types of devices used in TTC zones. The duration of a TTC zone is defined relative to the length of time a work operation occupies a spot location.

The five categories of work duration and time at a location shall be defined as follows:

- A. Long-term Stationary is work that occupies a location more than 3 days.
- B. Intermediate-term Stationary is work that occupies a location more than one daylight period up to 3 days, or nighttime work lasting more than 1 hour.
- C. Short-term Stationary is daytime work that occupies a location for more than 1 hour within a single daylight period.
- D. Short Duration is work that occupies a location up to 1 hour.
- E. Mobile is work that moves intermittently or continuously.

Gathering Information

- For Short-term and Mobile Operations, many agencies do not allow lane closures during peak traffic periods. Typically, the work is scheduled between 9:00 AM and 4:00 PM
- During Short Duration Work, it often takes longer to set up and remove the TTC zone than to perform the work.
- Workers face hazards in setting up and taking down the TTC zone. Also, since the work time is short, delays affecting road users are significantly increased when additional devices are installed and removed.
- Considering these factors, simplified control procedures may be warranted for short-duration work.
- A reduction in the number of devices may be offset by the use of other more dominant devices such as high-intensity rotating, flashing, oscillating, or strobe lights on work vehicles.

Gathering Information

Nighttime Work

- If the work extends into nighttime, determine if any of the following need to be used:
- Temporary Roadway Lighting
- Steady-burn Lights used with Channelizing Devices
- Flashing Lights for Isolated Hazards
- Illuminated Signs
- Floodlights
- Flashlights

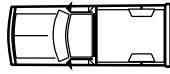
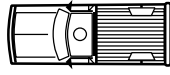
Developing the TTC Plan

Once the necessary information has been collected, refer to the Fundamental Principles of Temporary Traffic Control (TTC).

- Go to chapter **6P of the MUTCD** and select one of the 54 typical applications that best fits your project.
- TTC plans may deviate from the typical applications described in this Chapter to allow for conditions and requirements of a particular site or jurisdiction.
- If a walkway is within the work zone, safe access must be provided for pedestrians.
- If Road work is to be performed on an urban arterial with heavy traffic during morning and afternoon peak hours, there may be time restrictions. Typically, closures are not allowed before 9:00 AM and after 4:00 PM.
- Other devices may be added to supplement the devices and device spacing may be adjusted to provide additional reaction time or delineation.
- Fewer devices may be used based on field conditions.
- For Short-term and Short Duration Operations, Basic Simple Plans can be preapproved.

Developing the TTC Plan

Table 6P-2. Meaning of Symbols on Typical Application Diagrams

	Arrow board		Shadow vehicle
	Arrow board support or trailer (shown facing down)		Sign (shown facing left)
	Changeable message sign or support trailer		Surveyor
	Channelizing device		Temporary barrier
	Crash cushion		Temporary barrier with warning light
	Direction of temporary traffic detour		Traffic or pedestrian signal
	Direction of travel		Truck-mounted attenuator
	Flagger		Type 3 barricade
	High-level warning device (Flag tree)		Warning light
	Longitudinal channelizing device		Work space
	Luminaire		Work vehicle
	Pavement markings that should be removed for a long-term project		

Developing the TTC Plan

Table 6B-1. Recommended Advance Warning Sign Minimum Spacing

Road Type	Distance between Signs**		
	A	B	C
Urban (low speed)*	100 feet	100 feet	100 feet
Urban (high speed)*	350 feet	350 feet	350 feet
Rural	500 feet	500 feet	500 feet
Expressway / Freeway	1,000 feet	1,500 feet	2,640 feet

Use Table 6B-1 to determine the Advance Warning Sign Distances

- * Speed category to be determined by the highway agency or owner of site roadways open to public travel.
- ** The column headings A, B, and C are the dimensions shown in Figures 6P-1 through 6P-54 The A dimension is the distance from the transition or point of restriction to the first sign. The B dimension is the distance between the first and second signs. The C dimension is the distance between the second and third signs. (The “first sign” is the sign in a three-sign series that is closest to the TTC zone. The “third sign” is the sign that is furthest upstream from the TTC zone.)

Developing the TTC Plan

Use Tables 6B-3 and 6B-4 to determine the Proper Taper Lengths

- Tapers may be used in both the Transition and Termination Areas. Whenever tapers are to be used in close proximity to an interchange ramp, crossroads, curves, or other influencing factors, the length of the tapers may be adjusted.

Table 6B-3. Taper Length Criteria for Temporary Traffic Control Zones

Type of Taper	Taper Length
Merging Taper	at least L
Shifting Taper	at least 0.5 L
Shoulder Taper	at least 0.33 L
One-Lane, Two-Way Traffic Taper	50 feet minimum, 100 feet maximum
Downstream Taper	50 feet minimum, 100 feet maximum

Note: Use Table 6B-4 to calculate L

Table 6B-4. Formulas for Determining Taper Length

Speed (S)	Taper Length (L) in feet
40 mph or less	$L = \frac{WS^2}{60}$
45 mph or more	$L = WS$

Where: L = taper length in feet
W = width of offset in feet
S = posted speed limit, or off-peak 85th-percentile speed prior to work starting, or the anticipated operating speed in mph

Developing the TTC Plan

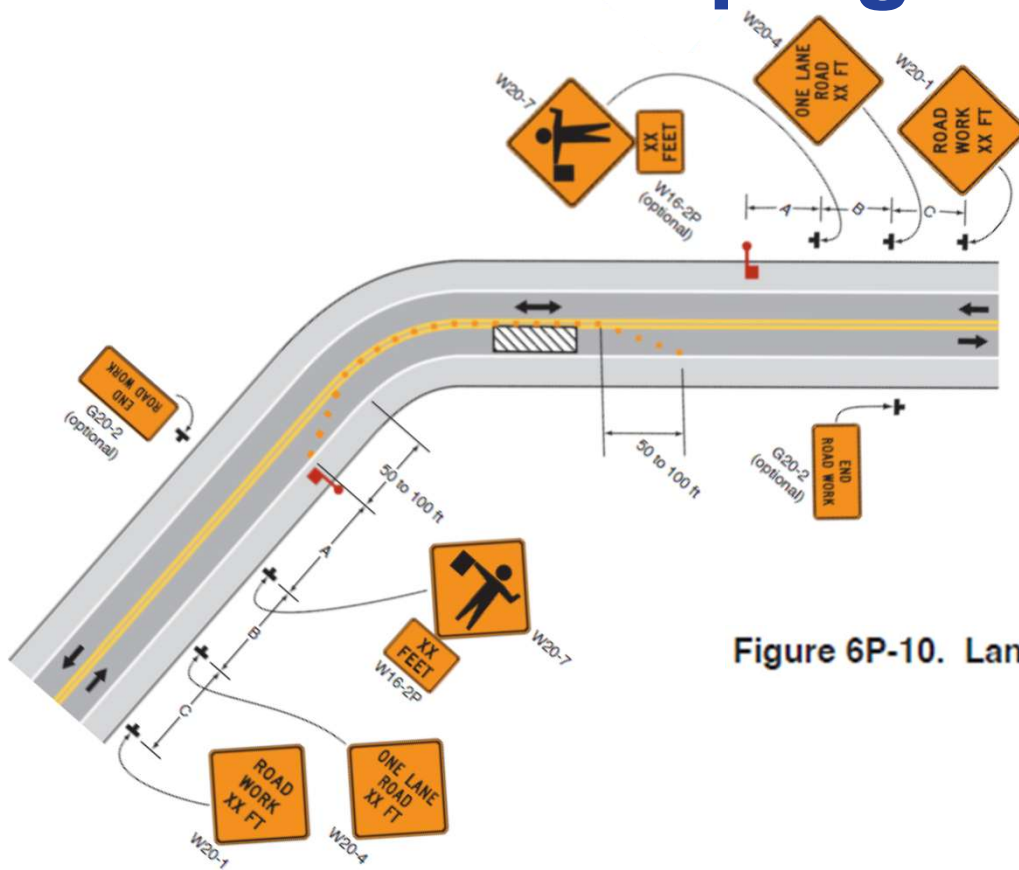


Figure 6P-10. Lane Closure on a Two-Lane Road Using Flaggers (TA-10)

Developing the TTC Plan

- A TTC plan describes TTC measures to be used for facilitating road users through a work zone or an incident area. TTC plans play a vital role in providing continuity of effective road user flow when a work zone, incident, or other event temporarily disrupts normal road user flow. Important auxiliary provisions that cannot conveniently be specified on project plans can easily be incorporated into Special Provisions within the TTC plan.
- TTC plans range in scope from being very detailed to simply referencing typical drawings contained in the MUTCD Manual, standard approved highway agency drawings and manuals, or specific drawings contained in the contract documents. The degree of detail in the TTC plan depends entirely on the nature and complexity of the situation.
 - *TTC plans should be prepared by persons knowledgeable (for example, trained and/or certified) about the fundamental principles of TTC and work activities to be performed. The design, selection, and placement of TTC devices for a TTC plan should be based on engineering judgment.*

Developing the TTC Plan

- **Traffic control planning should be completed for all highway construction, utility work, maintenance operations, and incident management including minor maintenance and utility projects prior to occupying the TTC zone. Planning for all road users should be included in the process.**
- **Provisions for effective continuity of accessible circulation paths for pedestrians should be incorporated into the TTC process. Where existing pedestrian routes are blocked or detoured, information should be provided about alternative routes that are usable by pedestrians with disabilities, particularly those who have visual disabilities.**

Developing the TTC Plan

- **Provisions may be incorporated into the project bid documents that enable contractors to develop an alternate TTC plan.**
- **Modifications of TTC plans may be necessary because of changed conditions or a determination of better methods of safely and efficiently handling road users. This alternate or modified plan should have the approval of the responsible highway agency prior to implementation.**

Developing the TTC Plan

- **Reduced speed limits should be used only in the specific portion of the TTC zone where conditions or**
- **restrictive features are present. However, frequent changes in the speed limit should be avoided. A TTC plan should be designed so that vehicles can travel through the TTC zone with a speed limit reduction of no more than 10 mph.**
- **A reduction of more than 10 mph in the speed limit should be used only when required by restrictive features in the TTC zone. Where restrictive features justify a speed reduction of more than 10 mph, additional driver notification should be provided. The speed limit should be stepped down in advance of the location requiring the lowest speed, and additional TTC warning devices should be used.**

Developing the TTC Plan

- **Reduced speed zoning (lowering the regulatory speed limit) should be avoided as much as practical because drivers will reduce their speeds only if they clearly perceive a need to do so.**
- **Research has demonstrated that large reductions in the speed limit, such as a 30 mph reduction, increase speed variance and the potential for crashes. Smaller reductions in the speed limit of up to 10 mph cause smaller changes in speed variance and lessen the potential for increased crashes. A reduction in the regulatory speed limit of only up to 10 mph from the normal speed limit has been shown to be more effective.**

Developing the TTC Plan

Impact Study for Temporary Traffic Control

An impact study for temporary traffic control assesses the potential effects and consequences of implementing temporary traffic control measures in a specific area or during a particular event. It aims to evaluate the impact on traffic flow, safety, and the surrounding environment. The study typically involves gathering data, analyzing existing conditions, and making predictions based on various scenarios.

Developing the TTC Plan

- **Average Daily Traffic and Annual Average Daily Traffic Counts**
- Average daily traffic (ADT) counts represent a 24-hour count at any specified location. These counts are obtained by placing an automatic counter at the analysis location for a 24-hour period. Accuracy of the ADT data depends on the count being performed during typical roadway, weather, and traffic demand conditions. Local levels of government will typically conduct this type of count.
- Annual average daily traffic (AADT) counts represent the average 24-hour traffic volume at a given location averaged over a full 365-day year. AADT volume counts have the following uses:
 - measuring or evaluating the present demand for service by the roadway or facility
 - developing the major or arterial roadway system
 - locating areas where new facilities or improvements to existing facilities are needed programming capital improvements

Developing the TTC Plan

- **A low-volume road shall be a facility lying outside of built-up areas of cities, towns, and communities, and it shall have a traffic volume of less than 400 annual average daily traffic (AADT).**
- **A low-volume road shall not be a freeway, an expressway, an interchange ramp, a freeway service road, a road on a designated State highway system, or a residential street in a neighborhood. In terms of highway classification, it shall be a variation of a conventional road or a special purpose road as defined in Section 1A.13.**
- **A low-volume road shall be classified as either paved or unpaved.)**

Developing the TTC Plan

- **Here are the key components typically included in an impact study for temporary traffic control:**
- **Traffic Flow Analysis:** This involves assessing the existing traffic patterns, volume, and congestion levels in the area under consideration. It includes collecting data on peak hours, traffic counts, and travel speeds. This analysis helps determine how temporary traffic control measures may affect the overall traffic flow and identify potential bottlenecks.
- **Safety Assessment:** Evaluating the impact on safety is crucial. The study considers potential risks to motorists, pedestrians, and workers during the implementation of temporary traffic control measures. It may involve analyzing accident data, identifying high-risk areas, and proposing safety improvements or alternative traffic routes.

Developing the TTC Plan

- **Environmental Impact Evaluation:** Temporary traffic control measures can have environmental effects, such as increased emissions and noise pollution. The study assesses the potential impact on air quality, noise levels, and other environmental factors in the vicinity. It may also propose mitigation measures to minimize adverse effects.
- **Stakeholder Engagement:** Engaging with relevant stakeholders, such as local authorities, transportation agencies, and community members, is essential. The study may include public consultations, surveys, and interviews to gather feedback and incorporate community concerns into the impact assessment.

Developing the TTC Plan

- **Simulation and Modeling:** Using traffic simulation software or models can help predict the impact of temporary traffic control measures. By inputting data on proposed changes, such as lane closures or detours, the models can estimate the effects on traffic flow, travel times, and congestion levels.
- **Cost Analysis:** Assessing the financial implications of temporary traffic control measures is crucial for decision-making. The study should consider the costs associated with implementing and maintaining the measures, as well as potential economic impacts resulting from disruptions to businesses or local commerce.

Developing the TTC Plan

- **Mitigation and Recommendations:** Based on the findings of the impact study, recommendations should be provided to mitigate the potential negative effects of temporary traffic control measures. This may involve suggesting alternative traffic routes, optimizing timing and sequencing of work, or proposing additional signage and safety measures.
- Overall, an impact study for temporary traffic control aims to provide a comprehensive assessment of the effects of implementing traffic control measures and guide decision-making processes to minimize disruptions and maximize safety for all stakeholders involved.

Obtaining Permits and Authorizations

- **Obtaining permits and authorizations for temporary traffic control can vary depending on your location and the specific requirements of the project. However obtaining a permit is typically required during the planning stage. Here are some general steps you can follow:**
 - **Determine the scope of your project:** Understand the nature of the work you plan to undertake that requires temporary traffic control. This could include road construction, maintenance, special events, or any other activity that affects traffic flow.
 - **Identify the responsible authority:** Determine which governmental or regulatory body is responsible for issuing permits and authorizations for temporary traffic control in your area. This could be a local transportation department, public works agency, or a specific permit office.

Obtaining Permits and Authorizations

- **Research requirements:** Contact the responsible authority to gather information about the specific requirements for obtaining permits and authorizations. They will provide you with guidelines, forms, and any supporting documentation you need to submit.
- **Submit your application:** Submit your completed application along with the required documentation to the appropriate office or department. Be sure to follow the specified submission process, which may include in-person submission, online application portals, or mailing the documents.

Obtaining Permits and Authorizations

- **Pay applicable fees:** Some permits and authorizations may involve fees. Check the guidelines provided by the responsible authority to determine the cost and payment process. Ensure that you include the required fees with your application, if applicable.
- **Review and approval:** Once your application is submitted, it will undergo a review process by the responsible authority. They will assess your project plans, traffic control measures, and any other relevant factors to ensure compliance with safety and traffic regulations.
- **Obtain the permit:** If your application is approved, you will receive the permit or authorization for temporary traffic control. This document will outline the specific conditions, dates, and requirements for implementing traffic control measures.

Obtaining Permits and Authorizations

- **Implement traffic control measures:** With the approved permit in hand, you can proceed with implementing the necessary traffic control measures as specified in the permit. This may involve signage, barricades, detours, or other measures to ensure the safety of workers and the public.
- **Compliance and inspections:** During the project, the responsible authority may conduct inspections to ensure that you are complying with the conditions outlined in the permit. Cooperate with any inspections and address any issues or concerns raised by the authorities.
- **Remember that these steps are general guidelines, and the specific process for obtaining permits and authorizations may vary depending on your location and the nature of the project. It's crucial to contact the responsible authority early in your planning process to understand their requirements and ensure compliance with local regulations.**

Obtaining Permits and Authorizations

- **Determining public relations needs for temporary traffic control involves understanding the specific goals, challenges, and stakeholders involved in the project. Here are some steps to help you determine the public relations needs for temporary traffic control:**
- **Identify project goals: Start by clarifying the objectives of the temporary traffic control project. Are you aiming to minimize disruptions, enhance public safety, or improve public perception of the project? Understanding the goals will help you shape the public relations strategy accordingly.**

Obtaining Permits and Authorizations

- **Define target audience:** Determine the key stakeholders and audiences affected by the temporary traffic control. This may include local residents, commuters, business owners, emergency services, public transportation users, and community organizations. Each group may have different concerns and information needs.
- **Conduct stakeholder analysis:** Analyze the concerns, expectations, and interests of the identified stakeholders. Identify any potential conflicts or points of contention. This analysis will help you tailor your public relations messages and initiatives to address these specific concerns.

Obtaining Permits and Authorizations

- **Assess communication channels:** Determine the most effective communication channels to reach your target audience. Consider using a mix of traditional media (newspapers, radio, TV), digital media (websites, social media platforms), community meetings, signage, and direct mailings. Adapt your communication channels based on the preferences and accessibility of your target audience.
- **Develop key messages:** Craft key messages that align with the project goals and address the concerns of your target audience. These messages should be clear, concise, and easy to understand. Emphasize the benefits of the temporary traffic control measures and how they contribute to public safety or improved infrastructure.

Obtaining Permits and Authorizations

- **Establish a communication plan:** Create a comprehensive plan outlining the timeline, objectives, and tactics for your public relations efforts. Include details on how you will disseminate information, handle inquiries and complaints, and address any unexpected challenges. Assign responsibilities to team members and establish a mechanism for monitoring and evaluating the effectiveness of your communication efforts.
- **Engage with stakeholders:** Actively engage with your target audience and stakeholders throughout the project. Seek feedback, listen to their concerns, and respond promptly and transparently. Use various engagement methods such as public meetings, online surveys, or community outreach events to foster dialogue and build trust.

Obtaining Permits and Authorizations

- **Monitor and evaluate:** Continuously monitor the effectiveness of your public relations efforts. Measure the reach and impact of your messages through metrics like media coverage, website traffic, social media engagement, or feedback received. Use this data to refine your approach and make adjustments as needed.
- **Remember, effective public relations for temporary traffic control requires proactive communication, transparency, inform the roadway user of the adjustments to traffic flow and a focus on addressing the needs and concerns of the affected stakeholders.**

Determine Public Relation Needs

Determining public relations needs for temporary traffic control involves understanding the specific goals, challenges, and stakeholders involved in the project. Here are some steps to help you determine the public relations needs for temporary traffic control:

Identify project goals

- Start by clarifying the objectives of the temporary traffic control project. Are you aiming to minimize disruptions, enhance public safety, or improve public perception of the project? Understanding the goals will help you shape the public relations strategy accordingly.

Define target audience

- Determine the key stakeholders and audiences affected by the temporary traffic control. This may include local residents, commuters, business owners, emergency services, public transportation users, and community organizations. Each group may have different concerns and information needs.

Determine Public Relation Needs

Conduct stakeholder analysis: Analyze the concerns, expectations, and interests of the identified stakeholders. Identify any potential conflicts or points of contention. This analysis will help you tailor your public relations messages and initiatives to address these specific concerns.

Assess communication channels: Determine the most effective communication channels to reach your target audience. Consider using a mix of traditional media (newspapers, radio, TV), digital media (websites, social media platforms), community meetings, signage, and direct mailings. Adapt your communication channels based on the preferences and accessibility of your target audience.

Determine Public Relation Needs

Develop key messages: Craft key messages that align with the project goals and address the concerns of your target audience. These messages should be clear, concise, and easy to understand. Emphasize the benefits of the temporary traffic control measures and how they contribute to public safety or improved infrastructure.

Establish a communication plan: Create a comprehensive plan outlining the timeline, objectives, and tactics for your public relations efforts. Include details on how you will disseminate information, handle inquiries and complaints, and address any unexpected challenges. Assign responsibilities to team members and establish a mechanism for monitoring and evaluating the effectiveness of your communication efforts.

Determine Public Relation Needs

Engage with stakeholders: Actively engage with your target audience and stakeholders throughout the project. Seek feedback, listen to their concerns, and respond promptly and transparently. Use various engagement methods such as public meetings, online surveys, or community outreach events to foster dialogue and build trust.

Monitor and evaluate: Continuously monitor the effectiveness of your public relations efforts. Measure the reach and impact of your messages through metrics like media coverage, website traffic, social media engagement, or feedback received. Use this data to refine your approach and make adjustments as needed.

Remember, effective public relations for temporary traffic control requires proactive communication, transparency, inform the roadway user of the adjustments to traffic flow and a focus on addressing the needs and concerns of the affected stakeholders.

Knowledge Check

According to the MUTCD, good public relations should be maintained by applying which of the following principles?

- a) The needs of all road users should be assessed such that **appropriate advance notice** is given and clearly defined alternative paths are provided.
- b) The needs of all road users should be assessed such that estimated advance notice is given and clearly defined alternative paths are provided.
- c) The needs of all road users should be assessed such that precise advance notice is given and clearly defined alternative paths are provided.
- d) The needs of all road users should be assessed such that some advance notice is given and clearly defined alternative paths are provided.

Knowledge Check

What Speed Limit type should be used to determine taper lengths?

- a) Advisory
- b) Posted
- c) Design
- d) Advisory – 15%

Knowledge Check

When planning a work zone, communication to the public _____.

- a) Should be as generic as possible with very little detail
- b) Is transmitted via the 811 system
- c) Is not required
- d) Should be clear, informative, and presented in a positive manner

Knowledge Check

In evaluating a pre-work zone condition what should be considered **first**?

- a) The type of funding source
- b) The type of equipment that will be used to perform the work
- c) The type of personnel that will be used to perform the work
- d) The type of work that will be performed

Knowledge Check

What agency created the standard that shall be used when developing or implementing a temporary traffic control plan?

- a) NEC
- b) MUTCD
- c) NFPA
- d) OSHA

Knowledge Check

Road work is planned on a two-way, two-lane street.
Which of the following is typically required during the planning stage?

- a) A Davis-Bacon Act authorization permit
- b) Type II and Type III barricades
- c) Approval from adjacent property owners
- d) A permit from the jurisdiction having authority

Knowledge Check

Which of the following is considered an Authority Having Jurisdiction that may need to be contacted about an upcoming work zone on a local road?

- a) County Tax Office
- b) Local Public Agency
- c) OSHA
- d) State Construction Board

Session 7: Setting Up and Maintaining a Work Zone



Pre-Activity Meeting

Pre-activity meetings for temporary traffic control are essential to ensure the safety and efficiency of road work or construction projects. This is for anyone involved with the work.

- Law enforcement should be there to know their responsibilities. Anyone for that day's assignment needs to be there.
- These meetings are generally done right before work assignments, which are based on needs and qualifications.

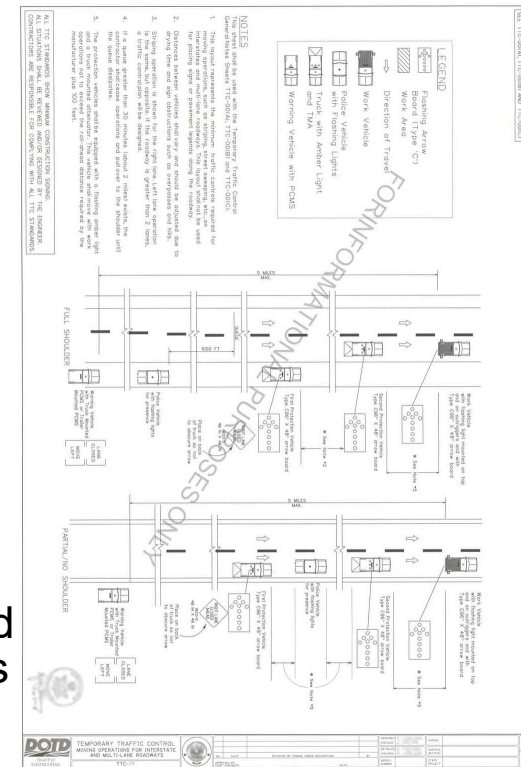
Here's a [step-by-step guide to conducting a pre-activity meeting](#) for temporary traffic control:

- **Introduction:** Begin the meeting by introducing yourself and welcoming the participants. State the purpose of the meeting, which is to discuss temporary traffic control plans and safety measures.
- **Attendees:** Confirm the presence of all necessary personnel, including project managers, supervisors, traffic control coordinators, and relevant workers.
- **Review Project Details:** Provide a brief overview of the project, including its location, scope, and duration. Discuss any specific challenges or considerations related to the project that may impact traffic control measures.



Pre-Activity Meeting

- **Temporary Traffic Control Plans:** Present the temporary traffic control plans for the project. Display diagrams, maps, or drawings to help illustrate the traffic control measures. Explain the purpose of each control measure, such as signage, flaggers, lane closures, detours, or speed reductions.
- **Roles and Responsibilities:** Clarify the roles and responsibilities of each team member involved in traffic control. Assign specific tasks to individuals or groups and ensure they understand their duties. Emphasize the importance of communication and coordination among team members.
- **Safety Procedures:** Discuss safety procedures and guidelines that must be followed at all times. Address personal protective equipment (**PPE**) requirements, such as high-visibility vests, hard hats, and safety footwear. Highlight potential hazards, such as moving vehicles, heavy machinery, or hazardous materials, and discuss mitigation strategies.
- **Communication:** Review communication protocols and channels to be used during the project. Discuss radio procedures, hand signals, and other means of communication between workers, flaggers, and supervisors. Provide contact information for key personnel in case of emergencies or issues.



Pre-Activity Meeting

- **Traffic Management:** Explain how traffic will be managed during the project, considering factors like peak hours, nearby intersections, and pedestrian safety. Discuss the sequence of traffic control measures and any phasing required. Address any concerns or questions from the team regarding traffic management.
- **Emergency Response:** Outline emergency response procedures in case of accidents, injuries, or other incidents. Provide information on the location of first aid kits, fire extinguishers, and emergency exits. Encourage workers to report any incidents or near-misses promptly.
- **Q&A and Closing:** Allow time for questions, clarifications, or suggestions from the team members. Address any outstanding concerns or issues raised during the meeting. Summarize the key points discussed and thank everyone for their participation. Remind the team of the importance of adhering to the temporary traffic control plans and safety protocols.

Remember to document the meeting minutes and distribute them to all attendees for future reference. Regularly review and update the temporary traffic control plans as needed throughout the project.

Gathering Required Devices

- **Implement traffic control measures:** With the approved permit in hand, you can proceed with implementing the necessary traffic control measures as specified in the permit. This **may involve signage, barricades, detours, or other measures** to ensure the safety of workers and the public.
- **Compliance and inspections:** During the project, the responsible authority may conduct inspections to ensure that you are complying with the conditions outlined in the permit. Cooperate with any inspections and address any issues or concerns raised by the authorities.

Remember that these steps are general guidelines, and the specific process for obtaining permits and authorizations may **vary depending on your location and the nature of the project.**

It's **crucial to contact the responsible authority** early in your planning process to understand their requirements and ensure compliance with local regulations.



Gathering Required Devices

When setting up a temporary traffic control zone, it's important to have the necessary equipment to ensure the safety of both workers and road users.

Here's a list of commonly required equipment for a temporary traffic control zone:

- **Traffic Cones:** These are essential for marking the boundaries of the work area, lane closures, or detours. Use cones with reflective strips for increased visibility, especially during low-light conditions.
- **Traffic Signs:** Include signs such as "Road Work Ahead," "Detour," "Lane Closed," and "Merge" signs, as necessary. These signs help provide clear directions to drivers and communicate changes in traffic patterns.
- **Barricades:** Use barricades to close off entire sections of road or to create a physical barrier between the work area and traffic. Reflective barricades are highly recommended for nighttime operations.

Gathering Required Devices

- **Traffic Delineators:** These devices help guide drivers along the desired path by separating traffic lanes or indicating lane shifts. Delineators are particularly useful during nighttime operations.
- **Traffic Drums (Barrels):** used as road user warning or channelization, shall be constructed of lightweight deformable materials. Minimum of 36 inches in height and have at least an 18-inch minimum width regardless of orientation. Minimum of two orange and two white stripes with the top stripe being orange.
- **Temporary Rumble Strips:** Use these strips to alert drivers to slow down and pay attention to changing road conditions. Rumble strips create noise and vibrations, helping to enhance driver awareness.
- **Traffic Lights or Signals:** If the temporary traffic control zone requires complex traffic management, you may need portable traffic lights or signals to control the flow of vehicles and pedestrians.

Gathering Required Devices

- **Flagging Equipment:** Provide high-visibility vests, hard hats, and flags for traffic controllers or flaggers who are responsible for directing traffic safely through the work zone.
- **Message Boards:** Electronic message boards can be used to display real-time information about lane closures, detours, or upcoming traffic delays. These boards improve communication with drivers and help manage traffic flow.
- **Pavement Marking Tape:** If you need to temporarily mark the road, consider using removable pavement marking tape that can be easily applied and removed after the work is completed.

Remember, the specific equipment required may vary depending on the nature and scale of the work being performed, local regulations, and the level of traffic control needed. Always consult local authorities and traffic control experts to ensure compliance with safety standards and regulations for your specific location.

Setting Up

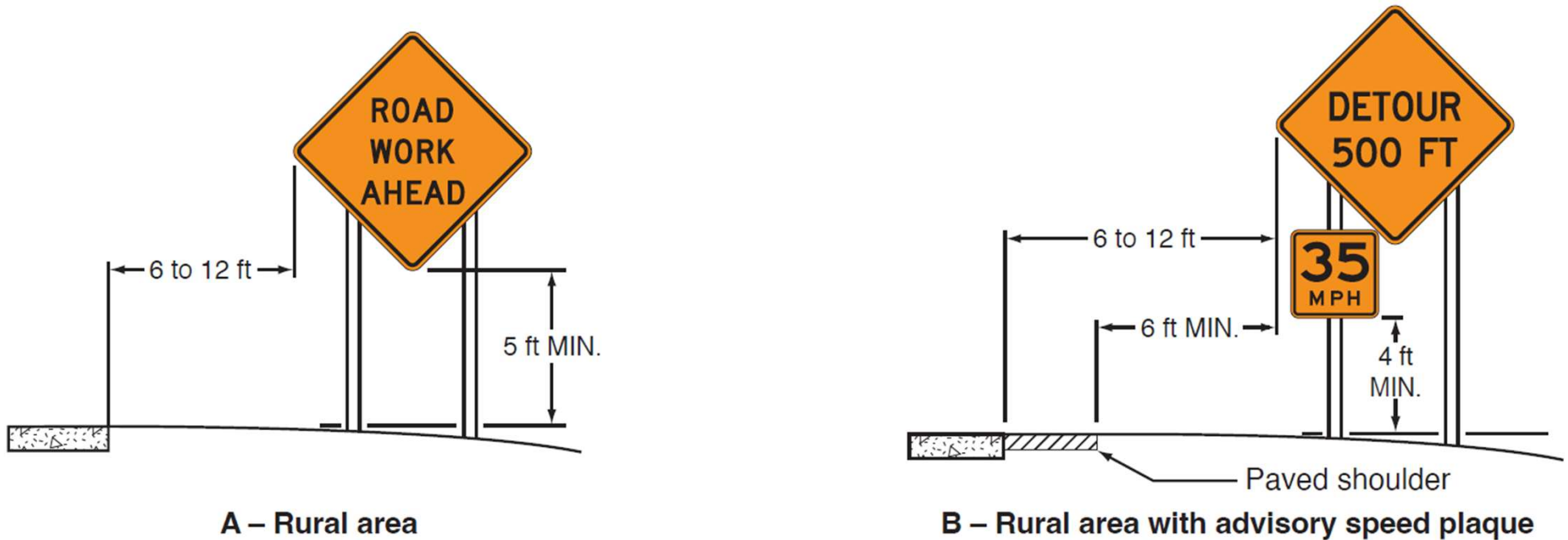
When setting up temporary traffic control zones, it's important to follow the plan that was designed for the project.

- The specific requirements may vary depending on your location. Each TTC zone is different.
- The goal of TTC in work zones is safety with minimum disruption to road users.
The key factor in promoting work zone safety is proper judgment.
- Set up should be from the beginning to the end, starting with the Advance Warning area and ending with the Termination area.
- Take down should be the opposite of the set up, starting at the Termination area and ending with the Advance Warning area.
- Height and Lateral location of all signs should follow MUTCD figures 6F-1 and 6F-2.
- Sign Sizes should follow MUTCD charts 6G-1 and 6H-1, Temporary Traffic Control Zone Regulatory Sign and Plaque Sizes and Temporary Traffic Control Zone Warning Sign and Plaque Sizes.



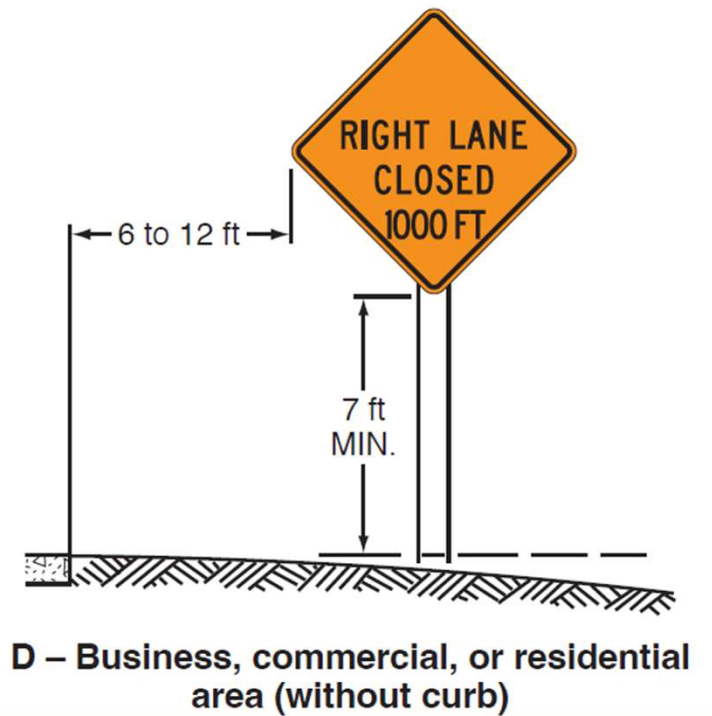
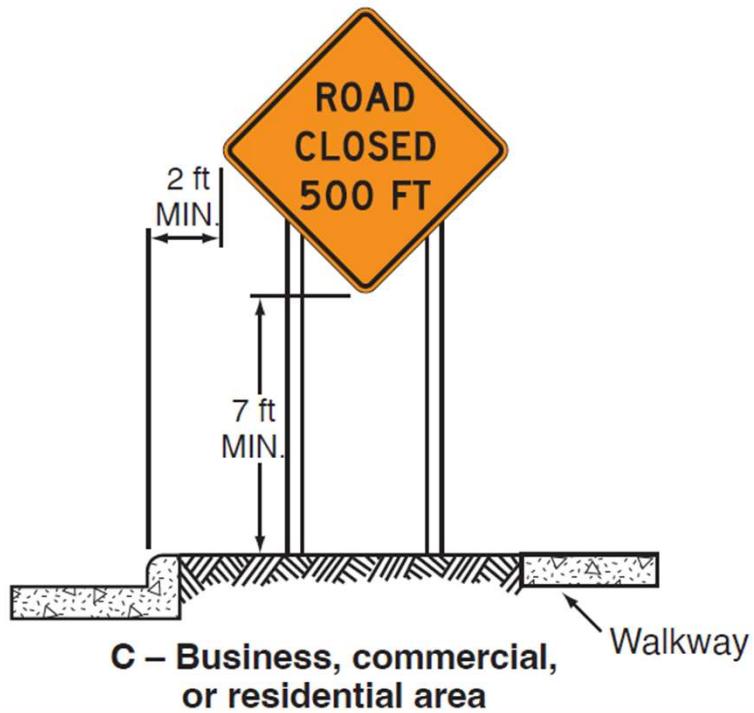
Setting Up

Figure 6F-1. Height and Lateral Location of Signs—Typical Installations



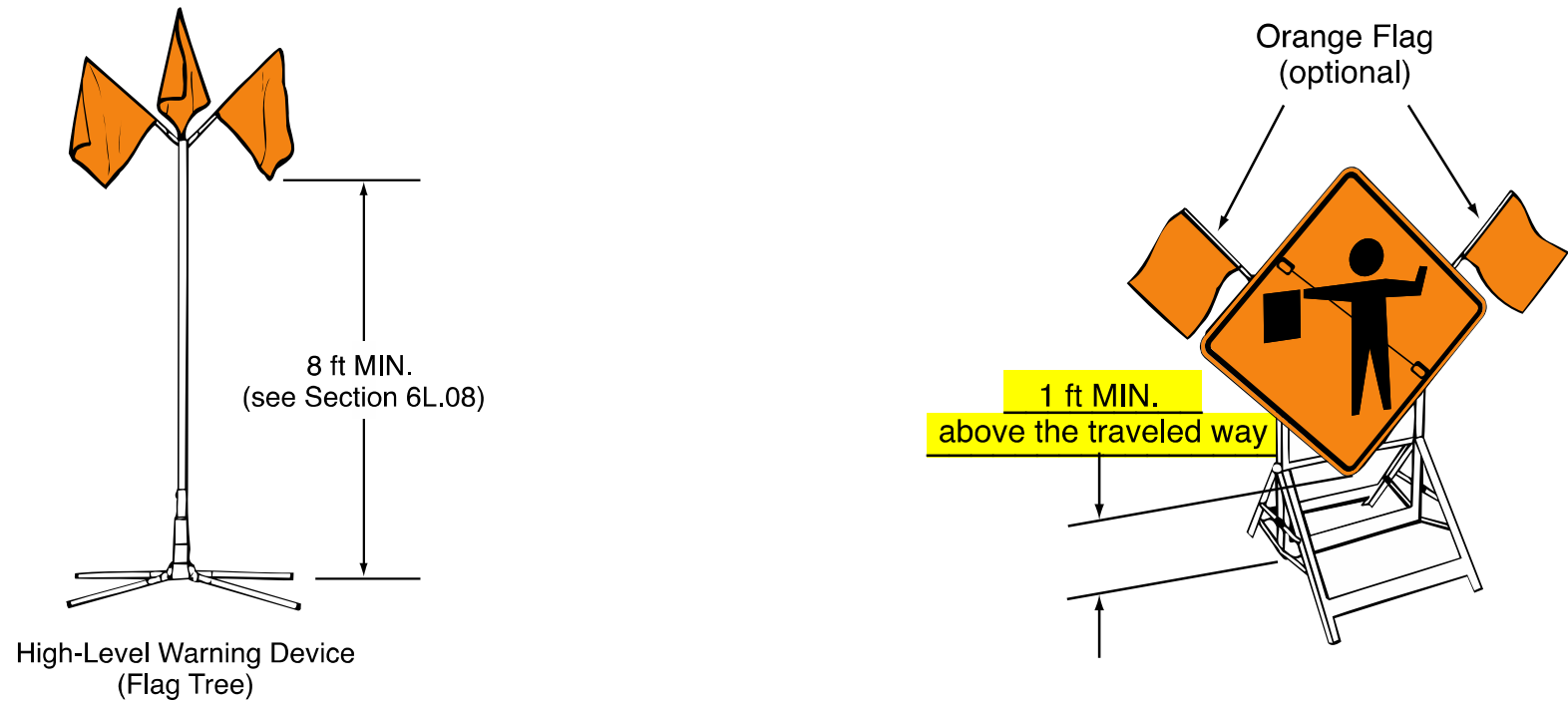
Setting Up

Figure 6F-1. Height and Lateral Location of Signs—Typical Installations



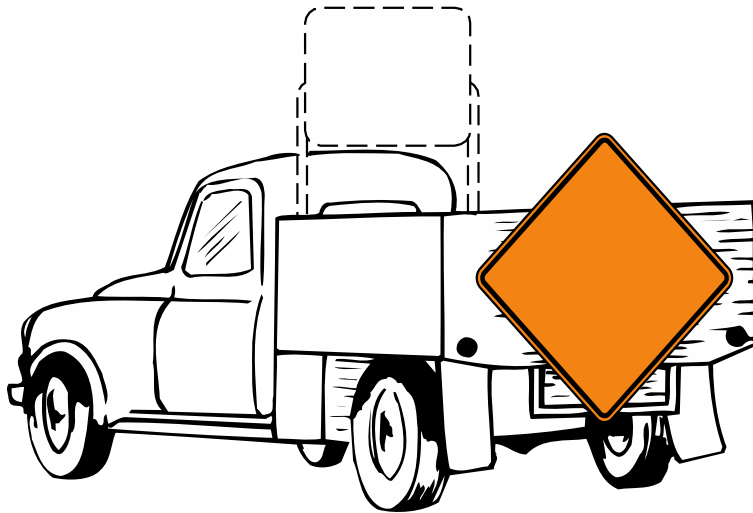
Setting Up

Figure 6F-2. Methods of Mounting Signs Other Than on Posts

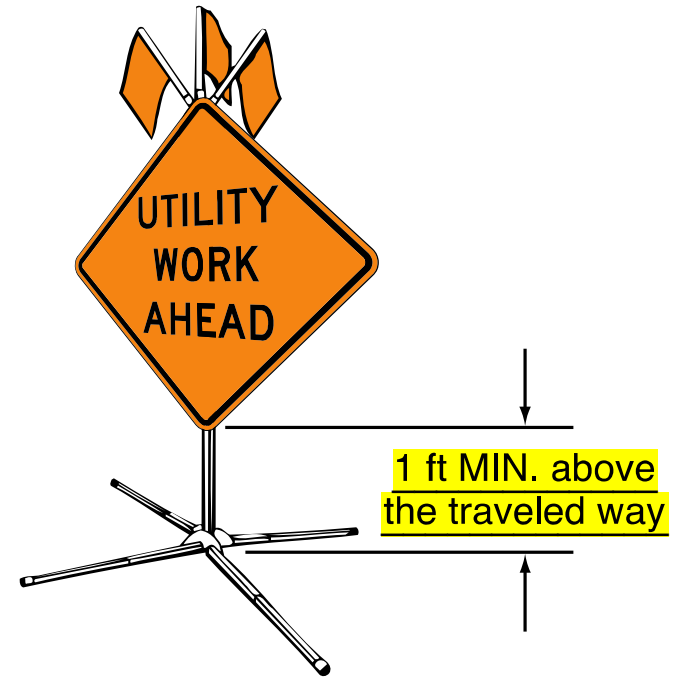


Setting Up

Figure 6F-2. Methods of Mounting Signs Other Than on Posts

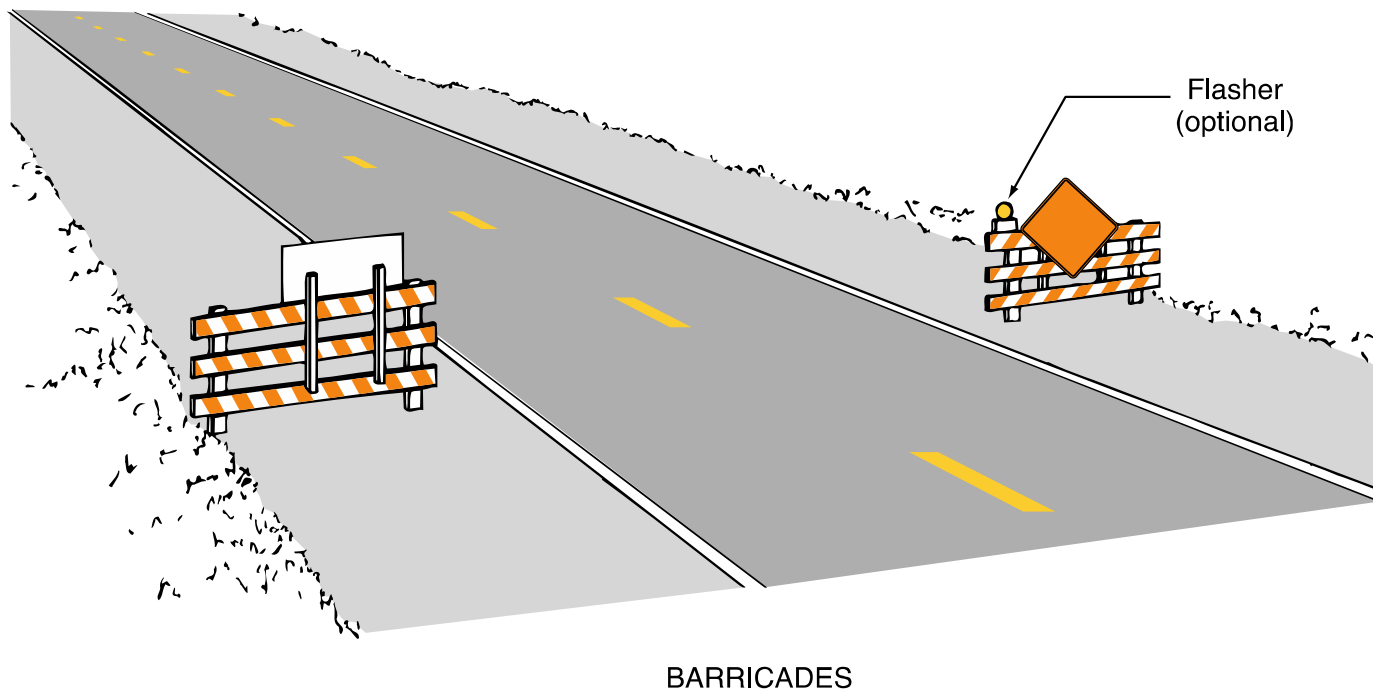


PORTABLE AND TEMPORARY MOUNTINGS



Setting Up

Figure 6F-2. Methods of Mounting Signs Other Than on Posts



Set Up Advance Warning Area

- Install advance warning signs in advance of the work zone to alert drivers of upcoming changes in traffic patterns or conditions.
- Refer to table 6B-1 to determine the proper sign Spacing.

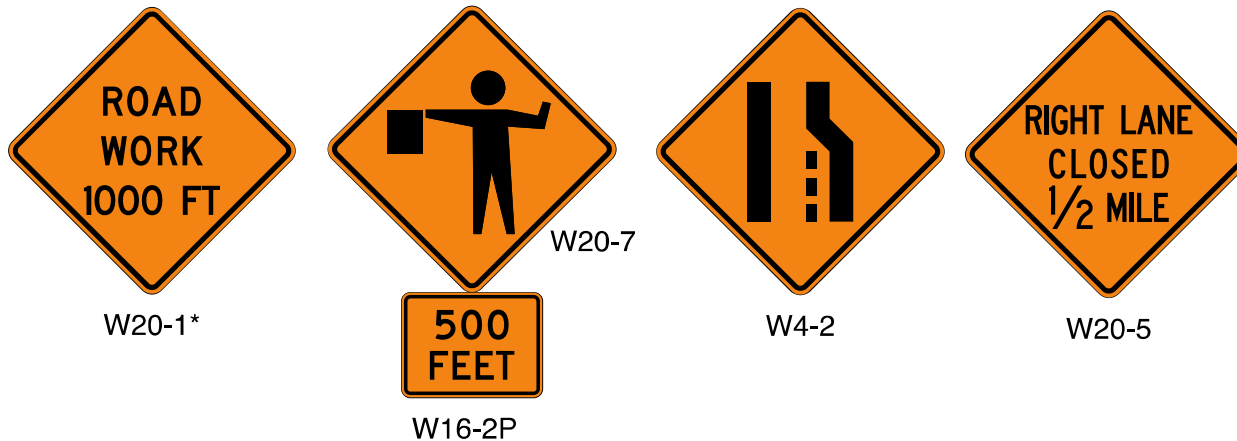
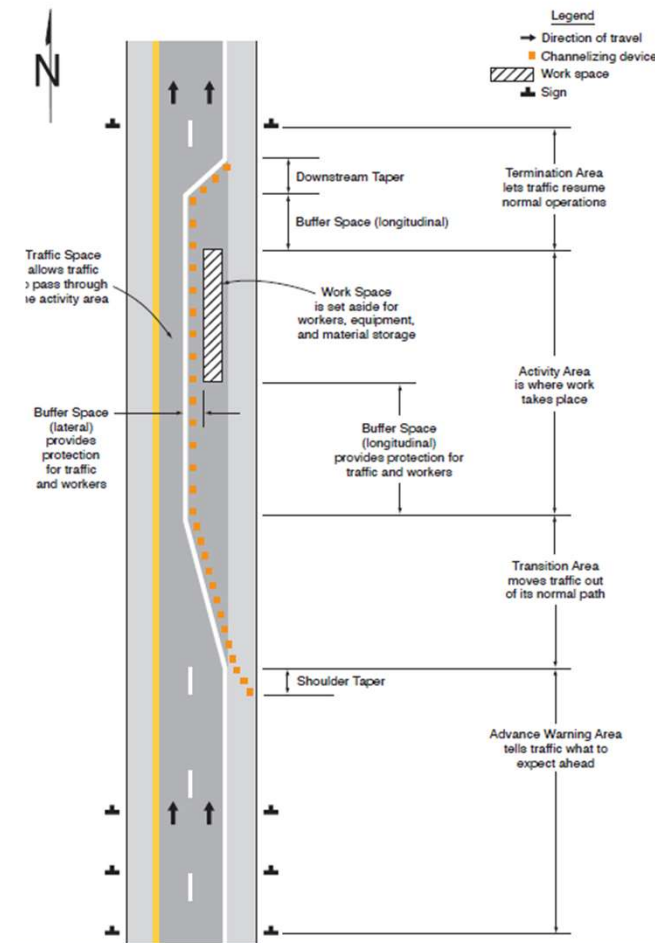


Figure 6B-1. Component Parts of a Temporary Traffic Control Zone



Set Up Advance Warning Area

Table 6B-1. Recommended Advance Warning Sign Minimum Spacing

Road Type	Distance between Signs**		
	A	B	C
Urban (low speed)*	100 feet	100 feet	100 feet
Urban (high speed)*	350 feet	350 feet	350 feet
Rural	500 feet	500 feet	500 feet
Expressway / Freeway	1,000 feet	1,500 feet	2,640 feet

* Speed category to be determined by the highway agency or owner of site roadways open to public travel.

** The column headings A, B, and C are the dimensions shown in Figures 6P-1 through 6P-54. The A dimension is the distance from the transition or point of restriction to the first sign. The B dimension is the distance between the first and second signs. The C dimension is the distance between the second and third signs. (The “first sign” is the sign in a three-sign series that is closest to the TTC zone. The “third sign” is the sign that is furthest upstream from the TTC zone.)

Set Up Transition Area

- Use signs and pavement markings to guide drivers through the transition area between the normal roadway and the work zone.
- Set up channelizing devices like cones, tubular markers, or delineators to create a clear path for vehicles.
- Consider using temporary traffic signals or flaggers to direct traffic if necessary.
- A series of sequential flashing warning lights may be placed on channelizing devices that form a merging taper in order to increase driver detection and recognition of the merging taper.



W1-6



W1-8



Set Up Transition Area

Use Tables 6B-3 and 6B-4 to determine the Proper Taper Lengths

- Tapers may be used in both the Transition and Termination Areas. Whenever tapers are to be used in close proximity to an interchange ramp, crossroads, curves, or other influencing factors, the length of the tapers may be adjusted.

Table 6B-3. Taper Length Criteria for Temporary Traffic Control Zones

Type of Taper	Taper Length
Merging Taper	at least L
Shifting Taper	at least 0.5 L
Shoulder Taper	at least 0.33 L
One-Lane, Two-Way Traffic Taper	50 feet minimum, 100 feet maximum
Downstream Taper	50 feet minimum, 100 feet maximum

Note: Use Table 6B-4 to calculate L

Table 6B-4. Formulas for Determining Taper Length

Speed (S)	Taper Length (L) in feet
40 mph or less	$L = \frac{WS^2}{60}$
45 mph or more	$L = WS$

Where: L = taper length in feet
W = width of offset in feet
S = posted speed limit, or off-peak 85th-percentile speed prior to work starting, or the anticipated operating speed in mph

Set Up Activity Area

- Place temporary traffic control devices, such as drums (barrels), cones, or barricades, to guide traffic and delineate the work area.



W9-3

G20-5aP



R2-1



Set Up Activity Area

- Place signs indicating specific instructions or warnings related to the work being performed.
- Use barricades or other barriers to separate the work area from the traffic flow.
- Ensure that equipment and personnel are positioned safely within the activity area.
- Provide adequate lighting during nighttime operations to enhance visibility.
- Follow any additional guidelines or requirements specific to your project or jurisdiction.
- The Work Space of the Activity Area is where project equipment and materials are stored.



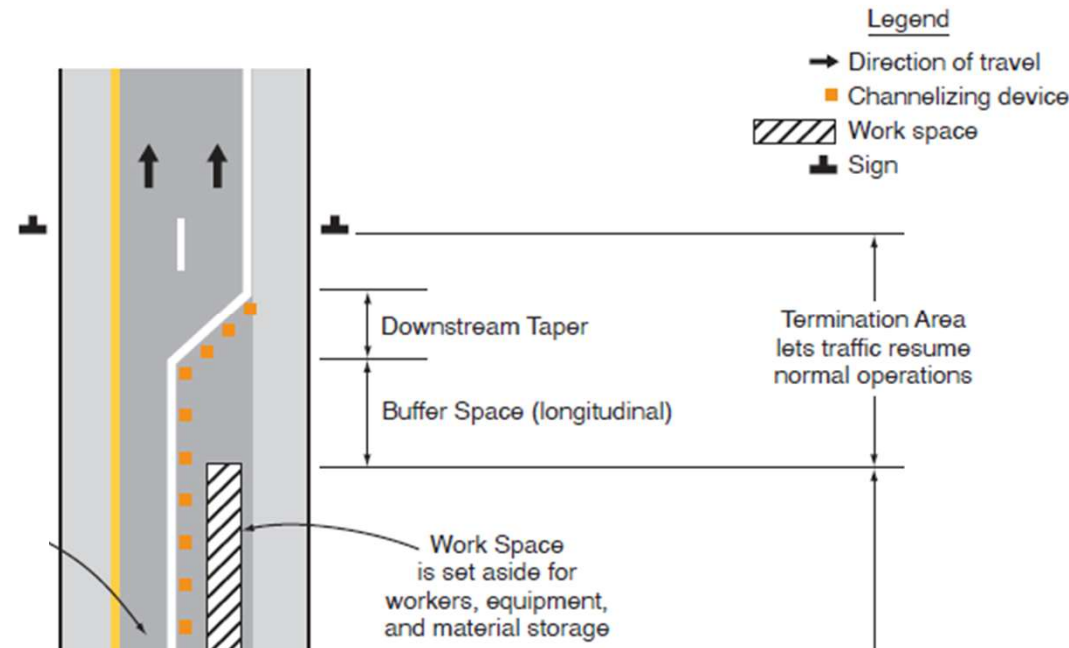
W21-5a

Set Up Termination Area

- Following the TTC plan, set up the channelizing devices using the proper tapers.
- Set up the proper signs per plan.



G20-2



Incident management

A traffic incident is an emergency road user occurrence, a natural disaster, or other unplanned event that affects or impedes the normal flow of traffic.

- A '**Traffic Incident Management Area**' is an area of a highway where temporary traffic controls are installed (as authorized by a public authority or the official having jurisdiction of the roadway) ***in response to*** a road user incident, natural disaster, hazardous material spill, or any other unplanned incident. It is a type of TTC zone and extends from the first warning device (such as a sign, light, or cone) to the last TTC device or to a location when vehicles return to the original lane alignment and are clear of the incident.
- Traffic incidents can be divided into three general classes of duration, each of which has unique traffic control characteristics and needs. These classes of traffic incidents are:
 - A. Major** - expected duration of more than 2 hours
 - B. Intermediate** - expected duration of 30 minutes to 2 hours
 - C. Minor** - expected duration under 30 minutes

Major Traffic Incidents

- Major traffic incidents are typically traffic incidents involving hazardous materials, fatal traffic crashes involving numerous vehicles, and other natural or man-made disasters. These traffic incidents typically involve closing all or part of a roadway facility for a period exceeding 2 hours.
- A road closure can be caused by a traffic incident such as a road user crash that blocks the traveled way. Road users are usually diverted through lane shifts or detoured around the traffic incident and back to the original roadway.
- Some traffic incidents, such as hazardous material spills, might require closure of an entire highway. Through traffic control methods and devices, road users must have adequate guidance around the traffic incident. Maintaining good communication and public relations is desirable.
- The cooperation of the news media in publicizing the existence of, and reasons for, traffic incident management areas and their TTC plan can be of great assistance in keeping road users and the general public well informed.

Intermediate Traffic Incidents

- Intermediate traffic incidents typically affect travel lanes for a time period of 30 minutes to 2 hours and usually require traffic control on the scene to divert road users past the blockage or hazard.
- Full roadway closures might be needed for short periods during traffic incident clearance to allow traffic incident responders to accomplish their tasks.



E5-2a



W3-4

Minor Traffic Incidents

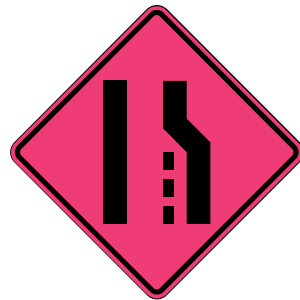
- Minor traffic incidents are typically disabled vehicles and minor crashes that result in lane closures of less than 30 minutes.
- Diversion of traffic into other lanes is often not needed or is needed only briefly. It is not generally possible or practical to set up a lane closure with traffic control devices for a minor traffic incident. For this reason, traffic control for a minor traffic incident will most often be the responsibility of on-scene responders. On-scene responders are typically law enforcement and towing companies, and occasionally highway agency service patrol vehicles.
- When a minor traffic incident blocks a travel lane, the vehicles involved in the incident should be moved from the blocked lane to the shoulder as quickly as possible.

Incident Management

Figure 6O-1. Examples of Traffic Incident Management Area Signs



W3-4



W4-2



W9-3



E5-2a



M4-8a



M4-9



M4-10

Section 6O.01 Par. 10 - Warning and guide signs used for TTC traffic incident management situations may have a Black legend and border on a Fluorescent Pink background.

Use of Emergency-Vehicle Lighting

- The use of emergency-vehicle lighting (such as high-intensity rotating, flashing, oscillating, or strobe lights) is essential, especially in the initial stages of a traffic incident, for the safety of emergency responders and persons involved in the traffic incident, as well as road users approaching the traffic incident.
- However, **Emergency-vehicle lighting** provides warning only and **provides NO effective traffic control**.
- The use of too many lights at an incident scene can be distracting and can create confusion for approaching road users, especially at night. Road users approaching the traffic incident from the opposite direction on a divided facility are often distracted by emergency-vehicle lighting and slow their vehicles to look at the traffic incident posing a hazard to themselves and others traveling in their direction.
- The use of emergency-vehicle lighting can be reduced if good traffic control has been established at a traffic incident scene. This is especially true for major traffic incidents that might already require emergency vehicles.

Monitor and Evaluate

- Continuously monitor the effectiveness of your public relations efforts. Measure the reach and impact of your messages through metrics like local news/media coverage, website traffic, social media engagement, or feedback received.
- Use this data to refine your approach and make adjustments as needed.
- Remember, effective public relations for temporary traffic control requires proactive communication, transparency, and a focus on addressing the needs and concerns of the affected stakeholders.
- Temporary Traffic Control Devices that have been damaged should be repaired or replaced, as necessary.

Taking Down

- When the project is completed, the TTC Devices should be taken down in the opposite order that they were installed.
- The permanent devices need to be uncovered or restored to their normal locations.
- The jobsite needs to be cleaned with all construction debris removed.
- The area should look as good or better than before the project started.
- When the work zone is completed, the temporary traffic control devices should all be inspected and then cleaned, repaired or replaced, as necessary.

Pavement Markings Removal

Pavement Marking Removal Methods: A common issue for every work zone is the removal of permanent or temporary pavement marking as adjustments are needed for the work zone.

The provisions of this Section 6F.72 shall not be considered applicable for short-term, mobile, or incident management TTC zones.

Pavement markings shall be maintained along paved streets and highways in all long- and intermediate-term stationary (see [Section 6G.02](#)) TTC zones.

Pavement Markings Removal

All pavement markings shall be in accordance with Chapters [3A](#) and [3B](#), except as indicated in Section 6F.72. Pavement markings shall match the markings in place at both ends of the TTC zone.

Pavement markings shall be placed along the entire length of any surfaced detour or temporary roadway prior to the detour or roadway being opened to road users.

Warning signs, channelizing devices, and delineation shall be used to indicate required road user paths in TTC zones where it is not possible to provide a clear path by pavement markings.

All pavement markings and devices used to delineate road user paths shall be carefully reviewed during daytime and nighttime periods.

Pavement Markings Removal

For long-term stationary operations, pavement markings in the temporary traveled way that are no longer applicable shall be removed or obliterated as soon as practical.

Pavement marking obliteration shall leave a minimum of pavement scars and shall remove old marking material.

Painting over existing pavement markings with black paint or spraying with asphalt shall not be accepted as a substitute for removal or obliteration.

Pavement Markings Removal

Pavement markings can be removed through several methods, each with its own benefits and drawbacks.

Most common ones used are:

- **Grinding:** This involves using a grinding machine to wear down the marking. The biggest benefit of grinding is that it's fast and efficient, but the downside is that it can damage the surface of the pavement if not done carefully.
- **Water Blasting:** Also known as hydroblasting or water jetting, this method uses pressurized water to remove the markings. Water blasting is considered more gentle on the pavement surface than grinding, but it can be more time-consuming and might not fully remove the markings, particularly if they are very thick or deeply ingrained.

Pavement Markings Removal

- Sandblasting: Sandblasting uses small particles, usually sand, to remove the pavement markings. This method is effective, but it can be messy and may damage the pavement surface.
- Chemical Removal: Some companies use chemicals to break down and remove the markings. However, this method has environmental concerns and can be harmful if the chemicals are not managed properly.
- Thermal Lance/Heat: This method uses high temperatures to burn off or evaporate the markings. It can be effective, but it also has a high risk of damaging the pavement and may result in an uneven surface.

Pavement Markings Removal

- Shot Blasting: Shot blasting propels small steel balls at high speed towards the surface, thereby removing the markings. This method is quick and effective but can cause damage to the surface if not done correctly.
- Scraping: Scraping uses blades to scrape off the pavement marking. This is a slower method, and like grinding, it has the potential to damage the surface if not done carefully.

Pavement Markings Removal

The 3 most common methods for Markings removal are:

Grinding:



Water Blasting:



Pavement Markings Removal

Sand Blasting:



Knowledge Check

During the Pre-Activity, personnel are assigned tasks based on _____.

- a) Need and qualifications
- b) Presence and quantity
- c) Seniority and availability
- d) Size and appearance

Knowledge Check

When discussing the work zone during a pre-activity meeting, which of the following is reviewed for need and location?

- a) Refueling safety zones
- b) Hydration replenishment stations
- c) Inspection review points
- d) Traffic control devices

Knowledge Check

The **minimum height** of the bottom of TTC signs is _____ above the traveled roadway.

- a) 1 foot
- b) 2 feet
- c) 3 feet
- d) 4 feet

Knowledge Check

Road work is to be performed on an urban arterial with heavy traffic during morning and afternoon peak hours.

Which of the following is the **Best** time period to schedule the work?

- a) Between 5:00 PM and 1:00 AM
- b) Between 5:00 AM and 1:00 PM
- c) Between 9:00 AM and 4:00 PM
- d) Between 12:00 PM and 8:00 PM

Knowledge Check

In what order (from first to last) should the traffic control devices be placed when installing a work zone on a one-lane closure of a two-lane two-way street?

- a) Advance Warning, Transition, Activity, Termination
- b) Activity, Transition, Termination, Advance Warning
- c) Termination, Activity, Transition, Advance Warning
- d) Transition, Activity, Termination, Advance Warning

Knowledge Check

A Major Traffic Incident has an expected duration of _____.

- a) Less than 30 minutes
- b) Less than 2 hours
- c) More than 30 minutes
- d) More than 2 hours

Knowledge Check

In what order (from first to last) should the traffic control equipment be removed in a single lane freeway closure?

- a) Advance Warning, Active, Transition, Termination
- b) Advance Warning, Transition, Active, Termination
- c) Termination, Activity, Transition, Advance Warning
- d) Termination, Transition, Active, Advance Warning

Knowledge Check

When the work zone is completed, the temporary traffic control devices should be _____.

- a) Sent to recycling
- b) Left in the right of way for the maintaining agency
- c) Reused regardless of condition since they are considered temporary devices
- d) Inspected and cleaned, repaired, or replaced

Knowledge Check

When closing down and/or removing a work zone area, the permanent signs _____.

- a) Are of no concern since the project has been accepted
- b) Can be left as is, the maintaining agency will repair or replace them
- c) Will need to be uncovered or placed back into pre-work zone condition
- d) Need not apply to MUTCD standards

Session 8: Final Inspection and Post Activity Review

Conducting Final Inspection

When conducting a final inspection upon removing work zones, there are several key steps you should follow to ensure that everything has been properly completed, and the area is safe for public use.

Here's a general guideline for conducting a final inspection:

- **Safety check:** Begin by conducting a thorough safety check of the entire work zone. Look for any remaining hazards such as loose debris, exposed wires, or uneven surfaces. Make sure that all safety barriers, signage, and markings have been removed or properly relocated.
- **Cleanliness assessment:** Check the cleanliness of the area. Remove any remaining construction materials, tools, or equipment. Sweep or clean the surfaces to ensure that they are free from dust, dirt, or debris. If necessary, arrange for waste removal services to clear any leftover debris.
- **Structural integrity evaluation:** Inspect any structures that were part of the work zone, such as roads, sidewalks, or barriers. Ensure that they are in good condition and have been restored to their original state. Look for signs of damage or deterioration that may require further attention.
- **Review the work order:** Familiarize yourself with the scope of the project and the specific tasks that were planned for the work zone. This will help you ensure that all the necessary work has been completed.

Conducting Final Inspection

- **Utilities and services:** Verify that all utilities and services affected by the work zone, such as water lines, gas lines, or electrical cables, have been properly restored and are functioning correctly. Ensure that any temporary connections or modifications have been removed.
- **Compliance with regulations:** Check that the work zone removal has been carried out in compliance with relevant regulations, permits, and codes. Ensure that any necessary inspections or approvals have been obtained.
- **Documentation and records:** Maintain comprehensive records of the final inspection. Take photographs or video footage of the work zone before and after the removal process. Keep a log of any findings, issues, or observations made during the inspection.
- **Final sign-off:** Once you are satisfied that all necessary steps have been completed and the work zone is safe for public use, sign off on the final inspection report. This document should outline the inspection details, any outstanding issues, and the actions taken to address them.

Remember that the specific requirements for a final inspection may vary depending on the nature of the work zone and local regulations. Always consult relevant guidelines and regulations to ensure compliance with specific requirements in your area.

Post-Activity Review

A post-activity review for work zones is an important step in evaluating the effectiveness and safety of work zone operations. It helps identify strengths and areas for improvement, ultimately leading to enhanced future work zone planning and execution.

Here are some key steps and considerations to conduct a post-activity review for work zones:

- **Define the Objectives:** Clearly outline the objectives of the review. This may include assessing the effectiveness of traffic management strategies, evaluating worker safety measures, analyzing project timelines, or examining the impact on traffic flow and user experience.
- **Gather Relevant Data:** Collect all pertinent data related to the work zone activity. This may include traffic data, accident reports, project timelines, field observations, feedback from workers, and any other relevant information. The more comprehensive the data, the better the review.
- **Assess Traffic Management Strategies:** Evaluate the effectiveness of the traffic management strategies employed during the work zone. Analyze if the implemented measures, such as signage, barriers, and lane closures, were appropriate and successful in guiding motorists safely through the work zone. Consider the impact on traffic flow, congestion, and any reported incidents.

Post-Activity Review

- **Review Worker Safety Measures:** Examine the safety protocols and measures implemented for the workers. Assess if appropriate safety equipment, such as personal protective gear, barriers, and warning signs, were utilized effectively. Analyze any incidents or near misses that occurred and identify potential improvements to enhance worker safety.
- **Analyze Project Timelines:** Review the timeline of the work zone project, including the planned schedule and the actual duration. Identify any delays or issues that may have affected the completion of the project within the set timeframe. Consider factors such as weather conditions, resource availability, and any unforeseen challenges.
- **Evaluate Communication and Public Outreach:** Assess the effectiveness of communication and public outreach efforts during the work zone activity. Review if the public was adequately informed about the work zone, including its purpose, duration, and potential impacts on traffic. Analyze feedback received from the public and identify any areas for improvement in communication strategies.
- **Identify Lessons Learned:** Identify key lessons learned from the work zone activity. Consider both positive aspects and areas that need improvement. These lessons can be used to develop best practices for future work zones and to enhance overall project management.

Post-Activity Review

- **Develop Recommendations:** Based on the findings of the review, develop actionable recommendations for improving work zone operations. These recommendations may include adjustments to traffic management strategies, enhanced safety measures, improved communication plans, or modifications to project scheduling.
- **Implement Improvements:** Ensure that the recommendations are communicated to relevant stakeholders and implemented in future work zone activities. Track the progress of these improvements and conduct periodic reviews to assess their effectiveness.
- **Document the Review:** Compile a comprehensive report summarizing the post-activity review findings, recommendations, and action plans. This document will serve as a valuable reference for future work zone projects and as a record of lessons learned.

Remember, a post-activity review for work zones should be conducted in a collaborative manner involving key stakeholders, including project managers, traffic engineers, safety personnel, and workers involved in the work zone activity. Their insights and perspectives will contribute to a more comprehensive and effective review process.

Post-Activity Review

Sign Maintenance:

1. Signs should be properly maintained for cleanliness, visibility, retroreflectivity, and correct positioning.
2. Signs that have lost significant legibility should be promptly replaced.

FYI – Regulatory, warning, and guide signs and object markers, shall be retroreflective or illuminated to show the same shape and similar color by both day and night, unless otherwise provided in this Manual for a particular sign or group of signs.

Where the color black is specified for the legend or background of a sign, an opaque and nonretroreflective material shall be used.

The requirements for sign illumination shall not be considered to be satisfied by street or highway lighting.

Post-Activity Review

Knowledge Check

What should be done if a problem is found with the arrow panel during the post-activity review?

- a) The panel should be corrected immediately
- b) The panel should be covered or removed until it can be corrected
- c) The panel should be left as is to see if the motorist notice
- d) The panel should be left as is until the change is approved

Knowledge Check

What four items should be checked for during final inspection?

- a) Railroad hazards, permanent signs restored, pavement markings restored, and remaining traffic control equipment
- b) Road hazards, permanent signs restored, pavement markings removed, and remaining traffic control equipment
- c) Road hazards, permanent signs restored, pavement markings restored, and remaining traffic control equipment
- d) Road hazards, temporary signs restored, pavement markings restored, and remaining traffic control equipment

Knowledge Check

When work is complete and the temporary traffic control is removed, the area should be inspected for _____.

- a) Litter abatement
- b) Road hazards and construction debris
- c) Speed enforcement
- d) Traffic congestion

Knowledge Check

When performing the final inspection, which of the following is **most important** to have knowledge of?

- a) The temporary traffic control plan and state and local standards
- b) The type of pavement that the inspection is being conducted on
- c) The type of permanent signs that are being installed
- d) The type of road that the inspection is being conducted on

Knowledge Check

What activity should always be done prior to leaving a work zone?

- a) Say goodbye to the citizens
- b) Organize work truck
- c) Pick up all trash and debris
- d) Clean tools, if dirty

Pedestrian and Worker Safety Considerations



Advancing the Future of Public Safety

Pedestrian and Worker Safety Considerations



IS YOUR WORK ZONE ADA COMPLIANT?

Pedestrian and Worker Safety Considerations

Pedestrian Considerations

A wide range of pedestrians might be affected by TTC zones, including the young, elderly, and people with disabilities such as hearing, visual, or mobility. These pedestrians need a clearly delineated and usable travel path.

- The various TTC provisions for pedestrian and worker safety set forth in Part 6 of the MUTCD shall be applied by knowledgeable (for example, trained and/or certified) persons after appropriate evaluation and engineering judgment.
- Advance notification of sidewalk closures shall be provided by the maintaining agency.

Pedestrian and Worker Safety Considerations

Pedestrian Considerations

A wide range of pedestrians might be affected by TTC zones, including the young, elderly, and people with disabilities such as hearing, visual, or mobility. These pedestrians need a clearly delineated and usable travel path.

- If the TTC zone affects the movement of pedestrians, adequate pedestrian access and walkways shall be provided. If the TTC zone affects an accessible and detectable pedestrian facility, the accessibility and detectability shall be maintained along the alternate pedestrian route.
- It must be recognized that pedestrians are reluctant to retrace their steps to a prior intersection for a crossing or to add distance or out-of-the-way travel to a destination.

Pedestrian and Worker Safety Considerations

Pedestrian Considerations

The following three items should be considered when planning for pedestrians in TTC zones:

- ✓ *Pedestrians should not be led into conflicts with vehicles, equipment, and operations.*
- ✓ *Pedestrians should not be led into conflicts with vehicles moving through or around the worksite.*
- ✓ *Pedestrians should be provided with a convenient and accessible path that replicates as nearly as practical the most desirable characteristics of the existing sidewalk(s) or footpath(s).*

Pedestrian and Worker Safety Considerations

To accommodate the needs of pedestrians, including those with disabilities, the following considerations should be addressed when temporary pedestrian pathways in TTC zones are designed or modified:

- ❖ Provisions for continuity of accessible paths for pedestrians should be incorporated into the TTC plan.
- ❖ Access to transit stops should be maintained.
- ❖ A smooth, continuous hard surface should be provided throughout the entire length of the temporary pedestrian facility. There should be no curbs or abrupt changes in grade or terrain that could cause tripping or be a barrier to wheelchair use. The geometry and alignment of the facility should meet the applicable requirements of the "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)".

Pedestrian and Worker Safety Considerations

To accommodate the needs of pedestrians, including those with disabilities, the following considerations should be addressed when temporary pedestrian pathways in TTC zones are designed or modified:

- ❖ The width of the existing pedestrian facility should be provided for the temporary facility if practical. Traffic control devices and other construction materials and features should not intrude into the usable width of the sidewalk, temporary pathway, or other pedestrian facility. When it is not possible to maintain a minimum width of 5ft or 60 inches throughout the entire length of the pedestrian pathway, a 60 x 60-inch passing space should be provided at least every 200 feet to allow individuals in wheelchairs to pass.

Pedestrian and Worker Safety Considerations

Pedestrian Considerations

Where pedestrian routes are closed, alternate pedestrian routes shall be provided. When existing pedestrian facilities are disrupted, closed, or relocated in a TTC zone, the temporary facilities shall be detectable and shall include accessibility features consistent with the features present in the existing pedestrian facility.

A pedestrian route should not be severed and/or moved for non-construction activities such as parking for vehicles and equipment.

Pedestrian and Worker Safety Considerations

Pedestrian Considerations

Consideration should be made to separate pedestrian movements from both worksite activity and vehicular traffic. Unless an acceptable route that does not involve crossing the roadway can be provided, pedestrians should be appropriately directed with advance signing that encourages them to cross to the opposite side of the roadway. In urban and suburban areas with high vehicular traffic volumes, these signs should be placed at intersections (rather than midblock locations) so that pedestrians are not confronted with midblock worksites that will induce them to attempt skirting the worksite or making a midblock crossing.

Pedestrian and Worker Safety Considerations

Pedestrian Considerations

Blocked routes, alternate crossings, and sign and signal information should be communicated to pedestrians with visual disabilities by providing devices such as audible information devices, accessible pedestrian signals, or barriers and channelizing devices that are detectable to the pedestrians traveling with the aid of a long cane or who have low vision. Where pedestrian traffic is detoured to a TTC signal, engineering judgment should be used to determine if pedestrian signals or accessible pedestrian signals should be considered for crossings along an alternate route.

Pedestrian and Worker Safety Considerations

Pedestrian Considerations

When channelization is used to delineate a pedestrian pathway, a continuous detectable edging should be provided throughout the length of the facility such that pedestrians using a long cane can follow it. These detectable edgings should comply with the provisions of Section 6F.74 of the MUTCD.

Signs and other devices mounted lower than 7 feet above the temporary pedestrian pathway should not project more than 4 inches into accessible pedestrian facilities.

Pedestrian and Worker Safety Considerations

Pedestrian channelizing devices should be provided when work activities impact sidewalks or other pedestrian facilities or when the design of the temporary pedestrian facility does not otherwise include accessibility features consistent with the features in the existing pedestrian facility.

The devices should be used both to close sidewalks and to delineate an alternate route.

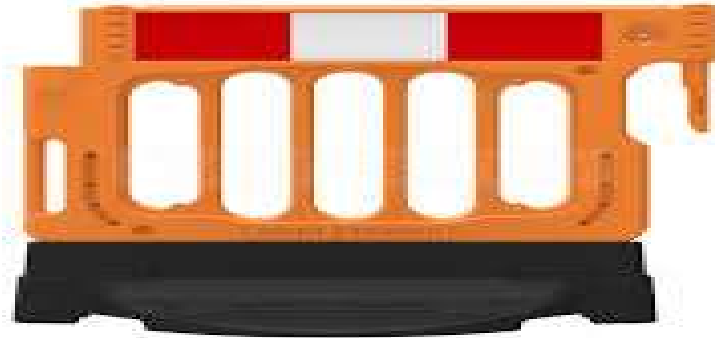
They devices shall be crashworthy when exposed to vehicular traffic.

Devices used to channelize pedestrians shall be detectable to users of long canes and visible to pedestrians with vision disabilities.

When used as a sidewalk closure, the device shall cover the entire width of the sidewalk.

Pedestrian and Worker Safety Considerations

Pedestrian channelizing devices shall have continuous detection plates and hand-trailing edges. The bottom of the detection plate shall be no higher than 2 inches above the walkway. The top edge of the detection plate shall be at least 8 inches above the walkway. The top of the hand-trailing edge shall be no lower than 32 inches and no higher than 38 inches above the walkway. The top surface of the hand-trailing edge shall be smooth to optimize hand trailing. Both the detection plate and the hand-trailing edge shall share a common vertical plane



Pedestrian and Worker Safety Considerations

Worker Safety Considerations

The following are the key elements of worker safety and TTC management that should be considered to improve worker safety:

- ❑ **Training**—all workers should be trained on how to work next to motor vehicle traffic in a way that minimizes their vulnerability. Workers having specific TTC responsibilities should be trained in TTC techniques, device usage, and placement.
- ❑ **Temporary Traffic Barriers**—temporary traffic barriers should be placed along the work space depending on factors such as lateral clearance of workers from adjacent traffic, speed of traffic, duration and type of operations, time of day, and volume of traffic.

Pedestrian and Worker Safety Considerations

Worker Safety Considerations

The following are the key elements of worker safety and TTC management that should be considered to improve worker safety:

- ❑ **Worker Safety Planning**—a trained person designated by the employer should conduct a basic hazard assessment for the worksite and job classifications required in the activity area. This safety professional should determine whether engineering, administrative, or personal protection measures should be implemented. This plan should be in accordance with the Occupational Safety and Health Act of 1970, as amended, “General Duty Clause” Section 5(a)(1) - Public Law 91-596, 84 Stat. 1590, December 29, 1970, as amended, and with the requirement to assess worker risk exposures for each job site and job classification, as per 29 CFR 1926.20 (b)(2) of “Occupational Safety and Health Administration Regulations, General Safety and Health Provisions”.

Pedestrian and Worker Safety Considerations

Worker Safety Considerations

The following are the key elements of worker safety and TTC management that should be considered to improve worker safety:

- ❑ **Activity Area**—planning the internal work activity area to minimize backing-up maneuvers of construction vehicles should be considered to minimize the exposure to risk.
- ❑ **Speed Reduction**—reducing the speed of vehicular traffic, mainly through regulatory speed zoning, funneling, lane reduction, or the use of uniformed law enforcement officers or flaggers, should be considered.

Pedestrian and Worker Safety Considerations

Worker Safety Considerations

All workers, including emergency responders, within the right-of-way who are exposed either to traffic (vehicles using the highway for purposes of travel) or to work vehicles and construction equipment within the TTC zone shall wear high-visibility safety apparel that meets the Performance Class 2 or 3 requirements of the ANSI/ISEA 107–2004 publication entitled “American National Standard for High-Visibility Safety Apparel and Headwear” (see Section 1A.11), or equivalent revisions, and labeled as meeting the ANSI 107-2004 standard performance for Class 2 or 3 risk exposure, except as provided in Paragraph 5. A person designated by the employer to be responsible for worker safety shall make the selection of the appropriate class of garment.

Pedestrian and Worker Safety Considerations

Worker Safety Considerations

The following are additional elements of TTC management that may be considered to improve worker safety:

A. Shadow Vehicle—in the case of mobile and constantly moving operations, such as pothole patching and striping operations, a shadow vehicle, equipped with appropriate lights and warning signs, may be used to protect the workers from impacts by errant vehicles. The shadow vehicle may be equipped with a rearmounted impact attenuator.

B. Road Closure—if alternate routes are available to handle road users, the road may be closed temporarily to facilitate project completion and thus further reduce worker vulnerability.

Pedestrian and Worker Safety Considerations

Worker Safety Considerations

The following are additional elements of TTC management that may be considered to improve worker safety:

C. Law Enforcement Use—in highly vulnerable work situations, particularly those of relatively short duration, law enforcement units may be stationed to heighten the awareness of passing vehicular traffic and to improve safety through the TTC zone.

D. Lighting—for nighttime work, the TTC zone and approaches may be lighted.

E. Special Devices—these include rumble strips, changeable message signs, hazard identification beacons, flags, and warning lights. Intrusion warning devices may be used to alert workers to the approach of errant vehicles.

Pedestrian and Worker Safety Considerations



R9-8



R9-9



R9-10

SIDEWALK CLOSED signs (see Figure 6G-1) should be used where pedestrian flow is restricted.

The SIDEWALK CLOSED (R9-9) sign should be installed at the beginning of the closed sidewalk, at the intersections preceding the closed sidewalk, and elsewhere along the closed sidewalk as needed.

The SIDEWALK CLOSED, (ARROW) USE OTHER SIDE (R9-10) sign should be installed at the beginning of the restricted sidewalk when a parallel sidewalk exists on the other side of the roadway

Pedestrian and Worker Safety Considerations



R9-11



R9-11a

The SIDEWALK CLOSED AHEAD, (ARROW) CROSS HERE (R9-11) sign should be used to indicate to pedestrians that sidewalks beyond the sign are closed and to direct them to open crosswalks, sidewalks, or other travel paths.

The SIDEWALK CLOSED, (ARROW) CROSS HERE (R9-11a) sign should be installed just beyond the point to which pedestrians are being redirected.

Knowledge Check: Multiple Choice

- **When shall pedestrians be provided with access and safe passage through the work zone?**
 - a. **When two or more lanes are closed**
 - b. **When multiple turn lanes are closed**
 - c. **When the work is being done on expressways**
- **d. When an existing pedestrian way exists within the work zone**

Knowledge Check: Multiple Choice

- Road work is to be performed on an urban arterial with heavy traffic during morning and afternoon peak hours, which of the following is the **BEST** time period to schedule the work?
 -
 - a. Between 5:00 PM and 1:00 AM
 - b. Between 5:00 AM and 1:00 PM
 - c. Between 9:00 AM and 4:00 PM
 - d. Between 12:00 PM and 8:00 PM

Knowledge Check: Multiple Choice

- **What Speed Limit type should be used to determine taper lengths?**
 - **a. Advisory**
 - **b. Posted**
 - **c. Design**
 - **d. Advisory – 15%**

Knowledge Check: Multiple Choice

- **Crosswalks having an uneven surface greater $\frac{1}{4}$ inch should**
 -
 - **a. Be closed to pedestrian traffic**
 - **b. Require a mid-block crossing**
 - **c. Not require any modifications**
 - **d. Have temporary apron constructed**

Knowledge Check: Multiple Choice

- **When planning a work zone, communication to the public**
 - **a. Should be as generic as possible with very little detail**
 - **b. Is transmitted via the 811 system**
 - **c. Is not required**
 - **d. Should be clear, informative, and presented in a positive manner**

Conclusion

IMSA Work Zone Glossary

Glossary of Terms

- **Accessible Pedestrian Signal** - a device that communicates information about pedestrian signal timing in a non-visual format such as audible tones and/or speech messages and vibrating surfaces.
- **Advisory Speed** - a recommended speed for all vehicles operating on a section of highway and based on the highway design, operating characteristics, and conditions.
- **Annual Average Daily Traffic (AADT)** - the total volume of traffic passing a point or segment of a highway facility in both directions for one year divided by the number of days in the year. Normally, periodic daily traffic volumes are adjusted for hours of the day counted, days of the week, and seasons of the year to arrive at annual average daily traffic.
- **Authority Having Jurisdiction (AHJ)** -Traffic control devices shall be defined as all signs, signals, markings, and other devices used to regulate, warn, or guide road users, placed on, over, or adjacent to a street, highway, private roads open to public travel, pedestrian facility, or bikeway by Authority of a public body or official Having Jurisdiction (AHJ).
- **Average Daily Traffic (ADT)** - the average 24-hour volume, being the total volume during a stated period divided by the number of days in that period. Normally, this would be periodic daily traffic volumes over several days, not adjusted for days of the week or seasons of the year.
- **Average Day** - a day representing traffic volumes normally and repeatedly found at a location, typically, a weekday when volumes are influenced by employment or a weekend day when volumes are influenced by entertainment or recreation.

Glossary of Terms

- **Buffer-Separated Lane** - a preferential lane or other special purpose lane that is separated from the adjacent general-purpose lane(s) by a pattern of standard longitudinal pavement markings that is wider than a normal or wide lane line marking. The buffer area might include rumble strips, textured pavement, or channelizing devices such as tubular markers or traversable curbs, but does not include a physical barrier.
- **Center Line Markings** - the yellow pavement marking line(s) that delineates the separation of traffic lanes that have opposite directions of travel on a roadway. These markings need not be at the geometrical center of the pavement.
- **Changeable Message Sign** - a sign that is capable of displaying more than one message (one of which might be a “blank” display), changeable manually, by remote control, or by automatic control. Electronic-display changeable message signs are referred to as Dynamic Message Signs in the National Intelligent Transportation Systems (ITS) Architecture and are referred to as Variable Message Signs in the National Electrical Manufacturers Association (NEMA) standards publication.
- **Channelizing Line** - a solid wide or double white line marking used to form islands where traffic in the same direction of travel is permitted on both sides of the island.

Glossary of Terms

- **Collector Highway** - a term denoting a highway that in rural areas connects small towns and local highways to arterial highways, and in urban areas provides land access and traffic circulation within residential, commercial, and business areas and connects local highways to the arterial highways.
- **Contiguous Lane** - a lane, preferential or otherwise, that is separated from the adjacent lane(s) only by a normal or wide lane line marking.
- **Crashworthy** - the ability of a roadside safety hardware device or appurtenance to minimize risks to vehicle occupants by allowing a vehicle impacting the appurtenance to be slowed before stopping, redirected, or to continue without significant resistance. Section 1D.11 contains additional information about crashworthiness.
- **Crosswalk** – (a) that part of a roadway at an intersection included within the connections of the lateral lines of the sidewalks on opposite sides of the highway measured from the curbs or in the absence of curbs, from the edges of the traversable roadway, and in the absence of a sidewalk on one side of the roadway, the part of a roadway included within the extension of the lateral lines of the sidewalk at right angles to the center line;
(b) any portion of a roadway at an intersection or elsewhere distinctly indicated as a pedestrian crossing by pavement marking lines on the surface, which might be supplemented by contrasting pavement texture, style, or color.

Glossary of Terms

- **Crosswalk Lines** - white pavement marking lines that identify a crosswalk.
- **Delineator** - a retroreflective device mounted at the side of the roadway in a series to indicate the alignment of the roadway, especially at night or in adverse weather.
- **Detection Plate** - a smooth continuous plate used on pedestrian channelizing devices to facilitate the use of low-vision canes for pedestrians with vision disabilities. The bottom edge of the detection plate shall be no more than 2 inches above the walkway and the top edge of the detection plate shall be at least 8 inches above the walkway. The detection plate shall share the same vertical plane as the hand trailing edge of the pedestrian channelizing device.
- **Downstream** - a term that refers to a location that is encountered by traffic subsequent to an upstream location as it flows in an “upstream to downstream” direction. For example, “the downstream end of a lane line separating the turn lane from a through lane on the approach to an intersection” is the end of the lane line that is closest to the intersection.
- **Edge Line Markings** - white or yellow pavement marking lines that delineate the right or left edge(s) of a traveled way.

Glossary of Terms

- **Engineering Judgment** - the evaluation of available pertinent information including, but not limited to, the safety and operational efficiency of all road users, and the application of appropriate principles, provisions, and practices as contained in the MUTCD and other sources, for the purpose of deciding upon the design (see Section 1D.03), use, installation, or operation of a traffic control device. Engineering judgment shall be exercised by a professional engineer with appropriate traffic engineering expertise, or by an individual working under the supervision of such an engineer, through the application of procedures and criteria established by the engineer.

Documentation of engineering judgment is not required.

- **Engineering Study** - the analysis and evaluation of available pertinent information including, but not limited to, the safety and operational efficiency of all road users, and the application of appropriate principles, provisions, and practices as contained in the MUTCD and other sources, for the purpose of deciding upon the design (see Section 1D.03), use, installation, or operation of a traffic control device. An engineering study shall be performed by a professional engineer with appropriate traffic engineering expertise, or by an individual working under the supervision of such an engineer, through the application of procedures and criteria established by the engineer.

An engineering study shall be documented in writing.

Glossary of Terms

- **Expressway** - a divided highway with partial control of access.
- **Flagger** - a person who actively controls the flow of vehicular traffic into and/or through a temporary traffic control zone using hand-signaling devices or an Automated Flagger Assistance Device (AFAD).
- **Freeway** - a divided highway with full control of access.
- **General-Purpose Lane** - a highway lane or set of lanes, other than a Managed Lane (see definition in this Section) or a Preferential Lane (see definition in this Section), that all or most of the traffic that is allowed on that highway is also allowed to use. Certain classes of vehicles, such as commercial vehicles or vehicles exceeding a certain weight or size, might be prohibited from using one or more of the general-purpose lanes. A general-purpose lane might also be restricted to certain uses, such as passing or turning or as an auxiliary lane.
- **Guide Sign** - a sign that shows route designations, highway names, destinations, directions, distances, services, points of interest, or other geographical, recreational, or cultural information.
- **Highway** - a general term for denoting a public way for purposes of travel by vehicles and vulnerable road users, including the entire area within the right-of-way.

Glossary of Terms

- **Island** - a defined area between traffic lanes for control of vehicular movements, for toll collection, or for pedestrian or bicyclist refuge. It includes all end protection and approach treatments. Within an intersection area, a median or an outer separation is considered to be an island.
- **Lane Line Markings** - white pavement marking lines that delineate the separation of traffic lanes that have the same direction of travel on a roadway.
- **Longitudinal Markings** - pavement markings that are generally placed parallel and adjacent to the flow of traffic such as lane lines, center lines, edge lines, channelizing lines, and others.
- **Major Street** - the street normally carrying the higher volume of vehicular traffic.
- **Minor Street** - the street normally carrying the lower volume of vehicular traffic.
- **Multi-Lane** - more than one lane moving in the same direction. A multi-lane street, highway, or roadway has a basic cross-section comprised of two or more through lanes in one or both directions. A multi-lane approach has two or more lanes moving toward an intersection, including turning lanes.
- **Neutral Area** - the paved area between the channelizing lines separating an entrance or exit ramp or a channelized turn lane or channelized entering lane from the adjacent through lane(s).

Glossary of Terms

- **Object Marker** - a device used to mark obstructions within or adjacent to the roadway.
- **Opposing Traffic** - vehicles that are traveling in the opposite direction. At an intersection, vehicles entering from an approach that is approximately straight ahead would be considered to be opposing traffic, but vehicles entering from approaches on the left or right would be considered to be conflicting traffic rather than opposing traffic.
- **Pedestrian** - a person on foot, in a wheelchair, on other devices determined by local law to be equivalent, which might include skates or a skateboard.
- **Plaque** - a traffic control device intended to communicate specific information to road users through a word, symbol, or arrow legend that is placed immediately adjacent to a sign to supplement the message on the sign. The difference between a plaque and a sign is that a *plaque cannot be used alone*. The designation for a plaque includes a “P” suffix.
- **Post-Mounted Sign** - a sign that is placed to the side of the roadway such that no portion of the sign or its support is directly above the roadway or shoulder.
- **Posted Speed Limit** - a speed limit determined by a law or regulation and displayed on Speed Limit signs along the roadway.

Glossary of Terms

- **Principal Legend** - place names, street names, and route numbers displayed on guide signs.
- **Professional Engineer (P.E.)** - An individual who has fulfilled education and experience requirements and passed examinations that, under State licensure laws, permit the individual to offer engineering services within areas of expertise directly to the public.
- **Public Road** - any road, street, or similar facility under the jurisdiction of and maintained by a public agency and open to public travel.
- **Regulatory Sign** - a sign that gives notice to road users of traffic laws or regulations.
- **Road User** - a vehicle operator, bicyclist, or pedestrian, including persons with disabilities, within the highway or on a site roadway open to public travel.
- **Roadway** - that portion of a highway improved, designed, or ordinarily used for vehicular travel and parking lanes, but exclusive of the sidewalk, berm, or shoulder even though such sidewalk, berm, or shoulder is used by persons riding bicycles or other human-powered vehicles. In the event a highway includes two or more separate roadways, the term roadway as used in the MUTCD shall refer to any such roadway separately, but not to all such roadways collectively.

Glossary of Terms

- **Serviceable** - a condition in which a traffic control device appears (day and night) and operates as intended, beyond which it requires replacement due to damage or wear. Whether a device is serviceable will depend on the type of device under consideration. In general, if the device is capable of being serviced with minimal effort or replacement parts so that it continues to appear and operate as intended, and the device is otherwise substantially intact, then it can be considered to be in serviceable condition. If the device is damaged or not operational beyond reasonable repair, then it is likely no longer serviceable.
- **Shared Roadway** - a roadway that is officially designated and marked as a bicycle route, but which is open to motor vehicle travel and upon which no bicycle lane is designated.
- **Shoulder** - a longitudinal area contiguous with the traveled way that is used for accommodation of stopped vehicles for emergency use and for lateral support of base and surface courses, and that is graded for emergency stopping. A shoulder might be paved or unpaved. A paved shoulder might be opened to part-time travel by some or all vehicles and might also be available for use by pedestrians and/or bicycles in the absence of other pedestrian or bicycle facilities.
- **Sidewalk** - that portion of a street between the curb line, or the lateral line of a roadway, and the adjacent property line or on easements of private property that is paved or improved and intended for use by pedestrians.

Glossary of Terms

- **Sign** - *with regard to controlling traffic*, any traffic control device that is intended to communicate specific information to road users through a word, symbol, and/or arrow legend. Signs do not include highway traffic signals, pavement markings, delineators, or channelization devices.
Signs whose purpose is unrelated to traffic control are addressed in Section 1A.02.
- **Sign Illumination** - either internal or external lighting that shows similar color by day or night. Street or highway lighting shall not be considered as meeting this definition.
- **Sign Panel** - a separate panel or piece of material containing a word, logo, pictograph, symbol, and/or arrow legend that is affixed to the face of a sign.
- **Site Roadways Open to Public Travel** - Roadways and bikeways on sites of shopping centers, office parks, airports, schools, universities, sports arenas, recreational parks, and other similar business, governmental, and/or recreation facilities that are publicly or privately owned but where the public is allowed to travel without full-time access restrictions. Two types of roadways are not included in this definition: (1) roadways where access is restricted at all times by gates and/or guards to residents, employees, or other specifically-authorized persons; and (2) private highway-rail grade crossings. Site roadways open to public travel do not include parking areas (see definition in this Section), including the driving aisles (see definition in this Section) within those parking areas.

Glossary of Terms

- **Speed** - speed is defined based on the following classifications:
 - a) **Average Speed** - the summation of the instantaneous or spot-measured speeds at a specific location of vehicles divided by the number of vehicles observed.
 - b) **Design Speed** - a selected speed used to determine the various geometric design features of a roadway.
 - c) **85th-Percentile Speed** - the speed at or below which 85 percent of the motor vehicles travel.
 - d) **Operating Speed** - a speed at which a typical vehicle or the overall traffic operates. Operating speed might be defined with speed values such as the average, pace, or 85th-percentile speeds.
 - e) **Pace** - the 10-mph speed range representing the speeds of the largest percentage of vehicles in the traffic stream.
- **Statutory Speed Limit** - a speed limit established by legislative action (such as Federal or State law) that typically is applicable for a particular class of highways with specified design, functional, jurisdictional, and/or location characteristics and that is not necessarily displayed on Speed Limit signs.

Glossary of Terms

- **Symbol** - the approved design of a pictorial or graphical representation of a specific traffic control message for signs, pavement markings, traffic control signals, or other traffic control devices, as shown in the MUTCD.
- **Temporary Traffic Control Zone** - an area of a highway, pedestrian or bicycle facility where road user conditions are changed because of a work zone or incident by the use of temporary traffic control devices, flaggers, uniformed law enforcement officers, or other authorized personnel.
- **Traffic Control Device** - all signs, signals, markings, channelization devices, or other devices that use colors, shapes, symbols, words, sounds, and/or tactile information for the primary purpose of communicating a regulatory, warning, or guidance message to road users on a street, highway, pedestrian facility, bikeway, pathway, or site roadway open to public travel. Section 1A.02 contains information regarding items that are not traffic control devices.
- **Traveled Way** - the portion of the roadway for the movement of vehicles, exclusive of the shoulders, berms, sidewalks, and parking lanes.

Glossary of Terms

- **Upstream** - a term that refers to a location that is encountered by traffic prior to a downstream location as it flows in an “upstream to downstream” direction. For example, “the upstream end of a lane line separating the turn lane from a through lane on the approach to an intersection” is the end of the line that is furthest from the intersection.
- **Urban Street** - a type of street normally characterized by relatively low speeds, wide ranges of traffic volumes, narrower lanes, frequent intersections and driveways, significant pedestrian traffic, and more businesses and houses.
- **Worker** - a person on foot whose duties place him or her within the right-of-way of a street, highway, or pathway, such as construction and maintenance forces; survey crews; utility crews; responders to incidents within the right-of-way; and law enforcement personnel when directing traffic, investigating crashes, and handling lane closures, obstructed roadways, and disasters within the right-of-way.