A Guide to Short Term, Short Duration, and Mobile Work Zone Temporary Traffic Control

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16 Abstract

This guide identifies and describes specific challenges and characteristics for short-term stationary, short-duration, and mobile work zones. Typically these work zones require special consideration in terms of temporary traffic control strategies. This guide outlines possible mitigation strategies and countermeasures that will assist in maintaining both safety and mobility through these types of work zones. Example plans are also provided within this document that highlight frequently encountered work zone scenarios.

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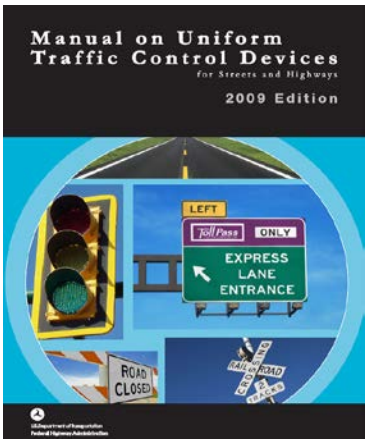
1.0 BACKGROUND



The *Manual on Uniform Traffic Control Devices (MUTCD)* provides the basic principles of design and use of traffic control devices for streets and highways. Part 6 of the *MUTCD* provides detailed information related to work zone Temporary Traffic Control (TTC). The primary function of TTC is to accommodate the safe and efficient movement of road users through or around work zones, while providing protection for other road users and workers. Within this context, special concerns arise with respect to short-term stationary, short-duration, and mobile (STSDM) work zones.

This guide identifies and describes specific challenges and characteristics of these types of work zones, which are shorter in duration and thus, may require special consideration in terms of TTC strategies. The guide outlines possible mitigation strategies and countermeasures that will assist in maintaining both safety and mobility through these types of work zones. In order to supplement these strategies, example plans are provided that highlight frequently encountered work zone scenarios. A highway work zone checklist is also included which may assist in the development of temporary traffic control plans (TTCPs) for unique roadway and site characteristics.

This guide is meant to supplement the *MUTCD* and provide strategies and examples that consider the unique aspects associated with STSDM work zones. Due to the short duration of the work, strategies that streamline setup and removal processes, while maintaining a safe environment for workers and road users are of vital importance.

2.0 CHARACTERISTICS OF SHORT-TERM STATIONARY, SHORT-DURATION, AND MOBILE WORK ZONES

One of the most important factors to consider when developing a TTCP for a work zone is the anticipated duration of the planned work. The *MUTCD* defines five categories of work duration:

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

STSDM work zones involve unique characteristics that must be considered in the development of the TTC design. Work in these types of work zones must be completed in a very short period of time. Consequently, the TTC developed for each work type must be installed and removed quickly. Simplified, more highly visible traffic control devices are often used to expedite this process. Temporary pavement markings and traffic barriers, which are often used in longer term TTC zones, are generally not practical for short-term work zones.

TTC may have to be implemented with limited planning time and, therefore, may require access to standard plans that the field personnel can quickly modify and implement. Field personnel must be trained to recognize critical safety issues and methods of alleviating them to maintain a safe work zone. These characteristics are indicative of the nature of the work being performed and described below. Specific methods for addressing these issues, through the use of appropriate TTC, are described in later sections.

STSDM work operations also may require the use of specialized vehicles and equipment. This type of equipment is essential to completing work in a timely manner. Some uses of specialized equipment require additional traffic control like the use of an aerial lift suspended over a traffic lane. Workers should be aware of these situations and implement lane closure controls accordingly.

2.1 Short-Term Stationary Work

Short-term stationary is daytime work that occupies a location for more than one hour within a single daylight period. Examples include:

- Utility work
- Traffic hardware maintenance or installation
- Roadside maintenance (traffic barrier repair, drainage structure cleanout, mowing, tree trimming, etc.)
- Placement of overhead structures (requiring closure of lanes within fall zone of material being lifted overhead)
- Localized pavement repair (patching/sealing)
- Bridge/structure inspection

2.2 Short-Duration Work

Short-duration work is work that occupies a location for up to one hour. In some cases, this work may be completed in less time than required for typical traffic control setup or removal. As such, the TTC should be simpler in order to lessen the exposure of workers and equipment to traffic.

Examples include:

- Tree trimming
- Debris clearing
- Cleaning graffiti from signs
- Surveying
- Applying pavement markings such as stop lines, legends, etc.
- Localized pavement maintenance or repair



2.3 Mobile Work

The *MUTCD* defines **mobile work** as that which moves continuously or intermittently, rarely stopping for more than a few minutes at a time. Some short-duration work may also be classified as mobile. Workers may be on foot or use vehicles. Similar to short-duration work, it is desirable to minimize the set up and removal time for the TTC. Examples include:

- Roadway striping
- Pavement crack or joint sealing
- Pothole filling
- Street sweeping or other debris clearing
- Roadside mowing and vegetation control
- Tree trimming
- Storm drain cleaning

2.4 Unanticipated and Urgent Work

Unanticipated, urgent work is another form of STSDM work zones. It is more unique in terms of the appropriate TTC strategy. When unanticipated work zones are needed, emergency responders (e.g., local police and/or fire department personnel) often are the first to arrive on the scene. These first responders contact work zone traffic control personnel to set up the appropriate traffic control. In these emergency circumstances, work crews must mobilize quickly and establish TTC appropriate for the situation, that

provide an acceptable level of safety and mobility while the work is being completed. Very often, limited time is available to prepare for TTC and this urgency may create difficulties with providing adequate advance notification of the pending work zone to road users. Unanticipated events may include:

- Utility failures or damage
- Fallen trees or branches
- Damaged or malfunctioning traffic control devices or other hardware (signs, signals, roadside safety devices, etc.)
- Localized pavement failures



3.0 TRAFFIC CONTROL STRATEGIES

The unique characteristics of STSDM work zones may adversely impact safety and mobility if not adequately addressed by the TTCP. This section presents strategies that may be applied to address these issues during all phases of the work zone process. Additional mitigation strategies dealing with work site characteristics involving field adjustment can also be found in Tables 1, 2, and 3. Specific techniques are described to:

- Minimize time for setup and removal of traffic control
- Manage traffic control for unexpected or emergency work
- Manage continuous or intermittent movement of the work area
- Maintain access to intersections, driveways, and parking
- Accommodate non-motorized road users and transit users
- Facilitate temporary re-opening of travel lanes
- Accommodate aerial lift trucks and other work vehicles over travel lanes



3.1 Minimize Time for Setup and Removal of Traffic Control

As work duration decreases, greater attention should be given to the time required for setup and removal. This is particularly true for short-duration work. Reducing setup and removal time decreases exposure for workers and road users, as well as motorist delay. Reductions in time may occur by:

- Reducing the number of traffic control devices
- Eliminating the need to remove or cover permanent traffic control devices
- Substituting vehicle-mounted devices for ground mounted devices
- Using lightweight portable sign supports
- Utilizing lighter weight and smaller channelizing devices (i.e., cones instead of drums)
- Employing work vehicles to place channelizing devices

While the *MUTCD* warns that safety should not be compromised by using fewer devices, the elimination of certain signs and/or channelizing devices is allowed for short-duration or mobile operations under certain circumstances. This includes using mounted highly visible alternative devices on work vehicle(s) and/or shadow vehicle(s) that provide warning and/or channelizing messages. The *MUTCD* provides details for several vehicle mounted devices, which include arrow boards, portable changeable message signs, and high-intensity rotating, flashing, oscillating, or strobe lights. It is also important that all work and shadow vehicles be appropriately colored and marked. While the *MUTCD* does not specifically identify all types of work where vehicle-mounted devices may be utilized in place of signs and/or channelizing devices, several specific types of short-duration work are identified. These conditions include:

- Shoulder work (ground-mounted signs and channelizing devices are replaced by a properly equipped vehicle)
- Shoulder work that encroaches into a travel lane (taper and channelizing devices are replaced by a properly equipped shadow vehicle)
- Intersection work (channelizing devices are replaced by a properly equipped vehicle)
- Work beyond the shoulder (ground mounted signs and channelizing devices may be replaced by a properly equipped vehicle)

The use of dominant vehicle-mounted devices, such as arrow boards, portable changeable message signs (PCMS), etc. should be considered for use on a case-by-case basis.

For short-term stationary and short-duration work zones where lane delineation is necessary, the *MUTCD* allows for the use of channelizing devices instead of temporary pavement markings. Although it is not practical to remove or otherwise cover permanent pavement markings, closer channelizing device spacing should be utilized to provide a more dominant delineation of the intended path. In these cases, the *MUTCD* recommends shortening the channelizing device spacing (in feet) to 0.5 × speed limit (in mph). Cones may also be used, instead of drums, to further expedite setup and removal. Using taller cones (42 inches or greater) provides improved channelization compared to shorter cones, especially where traffic speeds and/or volumes are high. Highly visible dominant devices that emphasize the appropriate path for vehicles (e.g., arrow panel) are particularly useful in such circumstances.

3.2 Manage Traffic Control for Unexpected or Emergency Work

Circumstances that require immediate attention allow little time to prepare and implement TTCPs, provide adequate advance notification to motorists, or coordinate with other entities. Because time may not be available to gather site details and prepare TTCPs in advance, work crews must be prepared to react and respond to existing field conditions upon arrival. The nature of the work may also make it difficult to implement a full array of TTC devices. Regardless of these issues, it remains necessary to provide a highly visible warning of the work area. Strategies for providing warnings may include:

- High-intensity rotating, flashing, oscillating, or strobe lights on appropriately colored or marked vehicles to be used in place of certain signs and/or channelizing devices for short-duration or mobile work as indicated in the *MUTCD*.
- Arrow panels and/or portable changeable message signs to provide advance notification and additional traffic control messages.
- Law enforcement officers with marked patrol vehicles to draw attention to the work zone. This may be even more practical when an officer is already on the scene to control traffic at the site of the emergency situation prior to arrival of the work crew.

Due to the urgency of the situation, it may be difficult to accurately estimate work duration. Therefore, crews should be prepared to modify the TTC to accommodate longer durations if needed. This may require the use of additional traffic control devices, preparation for nighttime work or an overnight work shutdown.

3.3 Manage Continuous or Intermittent Movement of the Work Area

Mobile operations involve continuous or intermittent movement of the work area. Given this, it is not always practical to use stationary TTC devices in these situations. It is preferable to utilize vehicle-mounted devices, such as static signs, arrow boards, changeable message signs, and high-intensity rotating, flashing, oscillating, or strobe lights. These devices are particularly important for mobile operations in the travel lanes of high speed roadways and at high volume locations. Due to potential mobility impacts, it is beneficial to schedule mobile operations during off-peak hours where possible, perhaps even at night for certain operations.

Moving operations, such as pothole filling or crack sealing, may require the convoy to stop periodically at intervening points. In these cases, the decision to use a mobile work zone TTC setup, as opposed to short-term stationary or short-duration setup, may depend on:

- Duration of each stop
- Time and distance between stops
- Operating speed of the work zone convoy
- Overall total distance covered during the work period
- Traffic speed and volume on the roadway

It may be equally efficient for slow moving mobile operations (i.e., 3 mph or less) to use stationary advance warning signs that are periodically retrieved and repositioned. It may also be advisable to utilize flaggers for mobile operations that involve frequent short stops.

A shadow vehicle, equipped with an arrow board and a truck mounted attenuator (TMA), may be utilized to follow the work vehicle on roads with high speeds or volumes. Due to the nature of the work and size of the work area, mobile operations, such as roadway striping, may include a convoy of multiple vehicles. Vehicle convoys provide several advantages, which include:

- Additional protection of workers
- Enhanced work zone conspicuity
- Extended work area providing additional time for marking materials to dry
- Staggering of vehicles on multi-lane roadways providing more effective channelization

One specific issue associated with mobile work convoys is the potential for unsafe passing maneuvers and vehicular intrusion into the convoy. Maintaining appropriate longitudinal and transverse buffer space with adequate shielding of any work area are imperative for protecting workers. Specific strategies include:

- Mounting arrow boards or portable changeable message signs on vehicles
- Using TMAs on all shadow vehicles
- Observing proper roll-ahead distances between vehicles
- Periodically pulling the work convoy over to allow queued vehicles to pass (locations with adequate shoulders)
- Performing work during off-peak hours or at night where conditions allow

3.4 Maintain Access to Intersections, Driveways, and Parking

Although STSDM work operations do not occupy any particular location for a long period, it is still necessary to accommodate access to adjacent houses and businesses, pedestrians, including those with disabilities, bicyclists, and transit users. As stated in the *MUTCD*, non-motorized users must be accommodated in a way that is equivalent to that which is normally provided. Each work zone is unique in terms of the type and duration of work being performed, proximity to access points (intersections and driveways), non-motorized facilities (sidewalks, crosswalks, bicycle lanes), and transit stops. These issues should be addressed during the TTC planning stage or upon arrival at the site if adequate preparation is not available prior to arrival.

- Brief closure of access points may be inevitable depending on the nature of the work, and care should be exercised to minimize queues with flaggers. Traffic may be diverted to an alternate entry point if available.
- Road work may have to be completed in phases to allow access to adjacent properties. Coordination with the affected property owner(s) should occur if closures last for more than a very brief period.
- Existing on-street parking facilities should be preserved to the extent possible. If parking lanes are closed, channelizing devices and other TTC devices should be placed in a manner that prevents vehicles from using these spaces and providing adequate buffer space for worker protection. The closure of on-street parking may require coordination with other agencies prior to implementation of the work zone traffic control. Parking lane closures often improve placement of truck mounted traffic control devices and other work zone delineation devices.

3.5 Accommodate Non-Motorized Road Users and Transit Users

Consideration must be given to non-motorized traffic (if present) during design and implementation of the TTCP. The existing level of accessibility must be maintained at the site if the normal travel path is blocked or otherwise impeded for longer than a brief period.

- Areas where non-motorized traffic can safely traverse the work area should be identified with the alternate path accommodated as necessary, using appropriate TTC devices. Motorized and non-motorized traffic must be separated.
- The TTCP should recognize the location of all transit stops and accommodate bus and pedestrian access at each stop. They should be clearly marked or identified with clear access paths for pedestrians. Transit agencies should be notified of all work lasting more than a very brief time so that appropriate measures may be taken.
- In some cases, it may not be practical or even feasible to address these issues through the use of TTC devices, such as signs and channelizing devices due to the very short duration, setup and removal times. In these cases, a roving flagger or traffic control agent may be effective in guiding pedestrians and transit users through the TTC zone, especially if the anticipated number of pedestrians is small.

3.6 Facilitate Temporary Re-Opening of Travel Lanes

Some highway agencies may restrict certain types of road work that may adversely affect roadway capacity, often requiring them to be completed only during off-peak periods. Because STSDM work may extend over an entire day, it may become necessary to re-open affected travel lane(s) to peak-period traffic, regardless of whether or not the work has been completed, with the remaining work to be finished after the end of the peak period or carried over to the next day. This involves movement of work crews, equipment, and devices off the roadway, and may include temporary shielding of hazards in the work area. Traffic control devices such as signs, channelizing devices, or barricades, may be necessary to alert motorists of issues such as pavement defects. Consultation with the agency that maintains jurisdictional control over the roadway for additional details regarding peak-period lane restrictions would be required.

3.7 Accommodate Aerial Lift Trucks and Other Work Vehicles Over Travel Lanes

Aerial lifts such as bucket trucks, cherry pickers, or scissor lifts are commonly used in utility and maintenance operations involving power line repairs, tree trimming, signal maintenance, and overhead sign maintenance. Aerial lift trucks require specialized TTC considerations, which may include the following:

- Prudent construction practice dictates not to extend aerial lift bucket over active traffic lanes; local regulations vary and determine under which circumstances this is allowed.
- Ideally temporary lane closures using traffic control devices or flaggers should be utilized for any lane over which the bucket will be extended.
- Where feasible, particularly at non-intersection locations where longitudinal space issues are less critical, adding a TMA to the lift truck or shadow vehicle (if included) will provide further protection to workers and motorists.

Work may also occur over travel lanes that do not require equipment in the lane, such as work on an overhead bridge structure or sign support. The same principles apply here to any work that occurs over a travel lane, whether or not a work vehicle occupies the lane. As alternatives to temporary lane closures, other strategies that may be appropriate include:

- Rolling road blocks using police or shadow vehicles to provide a brief period where no traffic is present
- Brief traffic stoppage during off-peak periods
- Brief road closures using detours or a diversion across the centerline where adequate lanes and roadway width are available.

4.0 TEMPORARY TRAFFIC CONTROL PLAN DEVELOPMENT

Development of a TTCP for all work zones compliant to *MUTCD* is an essential step towards safe and efficient work zone traffic control. In 23 CFR 630 Subpart J, the "Work Zone Safety and Mobility Rule," section 630.1012 states that for all **significant projects** the State shall develop a Transportation Management Plan (TMP) that consists of a TTCP and addresses both Transportation Operations (TO) and Public Information (PI) components. For individual projects or classes of projects that the State determines to have less than significant work zone impacts, the TMP may consist only of a TTCP. However, States are encouraged to also consider TO and PI issues for such projects. The TTCP for short-term stationary projects that are not significant projects may be adequate.

Development of an efficient and effective TTCP for STSDM work zones should follow a logical process, as shown in Figure 1. The process begins with collecting site and work characteristics that are relevant to the development of work zone traffic control. Using this information allows for the selection of the appropriate typical application (TA) that most closely represents the work zone under consideration. Then, the identification of unique characteristics and traffic control strategies outlined in the previous sections of this document should be identified. Combining the appropriate TA with special considerations and unique characteristics of STSDM work zone environments will facilitate the development of an effective TTCP.

The complete process of developing a TTCP is described in detail below.

STEP 1: Collect and Identify Work and Site Characteristics

Obtain Site Characteristics

Specific characteristics pertaining to a particular site are crucial in selecting the appropriate TA. These are listed below:

- Motorized and non-motorized traffic volumes and operating speed
- Roadway and cross-sectional characteristics
    - Lane width and number of lanes
    - Presence, width and type of median
    - Presence, width and type of shoulder
    - Presence of pedestrian and bicycle facilities, including accessible pedestrian features
    - Presence of horizontal and vertical curvature
    - Location of intersections and driveways
    - Location of transit stops

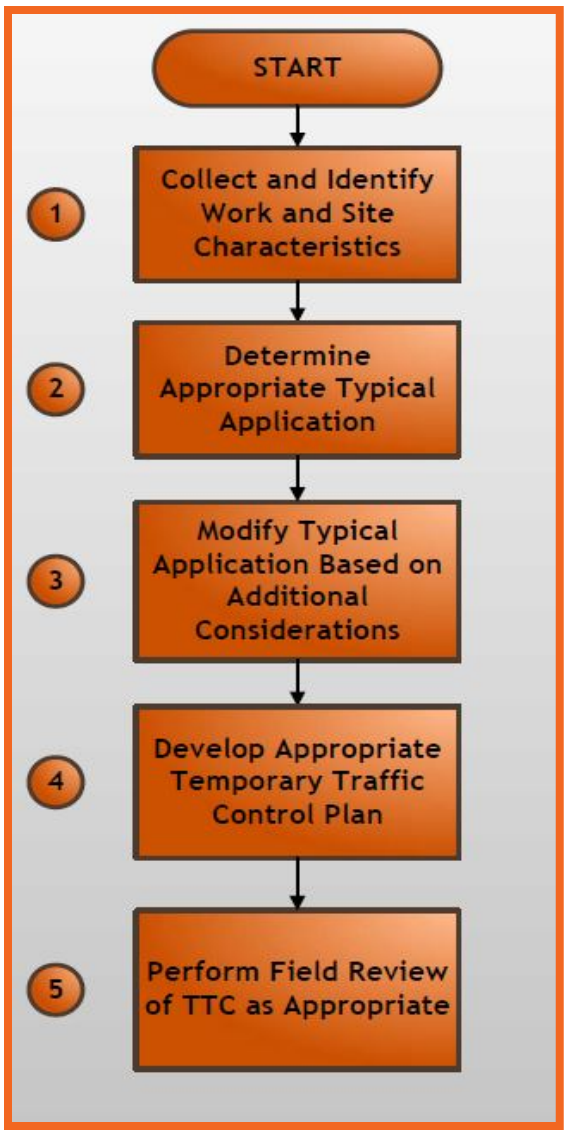


Figure 1 – Temporary Traffic Control Plan Development Flow Chart

- Existing traffic control characteristics
  - Location of existing signs and other devices
  - Posted speed limit
  - Signalized intersections
- Environmental and other surrounding characteristics
  - Area type (urban, suburban, or rural)
  - Basic surrounding land-use
  - Location of fixed objects
  - Sight distance restrictions
  - Other unique features or considerations

Obtain Work Characteristics

It is also necessary to determine specific information pertaining to the nature of the work that is to be performed, including:

- Proposed work activity
- Proposed work duration (consider the minimum and maximum duration)
- Proposed work area boundaries
- Number of workers
- Number of vehicles (indicate vehicles equipped with dominant traffic control devices)
- Other equipment
- Additional considerations for specific work activities

In order to assist in the identification of geometric, traffic control, traffic and environmental characteristics of a typical work site, a checklist is provided in Appendix I. The same checklist can be accessed and completed online at http://workzone.eng.wayne.edu/Software/CheckList/CheckList.html. Using the online checklist, a user can enter appropriate roadway, traffic, and traffic control characteristics and print or electronically save the checklist to assist in determining an appropriate TTCP. The user can then use the checklist to verify the accuracy of the data. The applicable site and work characteristics from the checklist are used as inputs for the software to determine the appropriate TA.

STEP 2: Determine Appropriate Typical Application

After determining the necessary characteristics relative to the potential work activity and site, a TA may be selected. The *MUTCD* contains 46 TAs, but many highway agencies have developed their own that are in compliance with the *MUTCD*, and may address more situations or include enhanced provisions. When an agency has developed its own TAs, these are the initial starting point for their projects.

A variety of other sources may also be consulted to locate an appropriate TA, including the Work Zone Safety Information Clearinghouse (https://www.workzonesafety.org/), and the TTCP Selection Software (http://workzone.eng.wayne.edu/Software/FlowChart/MainModule.html) that was developed as a companion to this guide. TTCP Selection Software is a decision-support tool that includes additional example plans to supplement the 46 TAs included in the *MUTCD*, and also provides access to standard TTCPs from all the States.

While a wide range of TAs is available, the work activity and site in question may vary from the depicted schematics. In a situation where an appropriate TA cannot be located that addresses the specific site characteristics, it will become necessary to modify an existing TA or develop a new one. Any modifications to or the development of a TA should be prepared by an individual with adequate knowledge and experience, and be consistent with the existing provisions of the *MUTCD*, and the highway agency having jurisdiction over the work.

STEP 3: Modify Typical Application Based on Additional Considerations

Once an appropriate TA has been selected, it may need to be modified to suit the field and work conditions for the proposed work activity. First, consider the supplementary notes provided for the TA which provide general guidance on the specifics of TTC for each plan. As previously noted, this guidance typically may provide sufficient information on how to modify the TA for conditions specific to STSDM work zones. Refer to the "Traffic Control Strategies" section of this document for guidance for identification of appropriate strategies for modification of the TA.

STEP 4: Develop Appropriate Temporary Traffic Control Plan

An effective TTCP can be developed by selecting an appropriate TA and modifying it as necessary to address site specific factors. This TTCP should include a schematic of the TTC and necessary devices. It should also include special guidance for field personnel to modify the TTC as field conditions change (e.g., increased traffic volume, extended work duration, expanded work area, temporary reopening of lanes, etc.).

STEP 5: Perform Field Review of Temporary Traffic Control as Appropriate

Field conditions may vary from the expected work and site scenario. TTC should be reviewed, both during and after implementation to ensure that strategies are appropriate for actual conditions present on that particular work day.

The following tables describe some common work site characteristics that often create challenges and could require field adjustments and possible mitigation strategies to address them. The conditions and strategies may not be applicable for every work site characteristic, but provide some guidance on how to alleviate safety challenges and suit field conditions. For example, work on a travel way at a driveway access may be better suited with the usage of a flagger rather than static TTC due to the nature of the work being performed. These strategies can be utilized to improve selected TTCPs and are shown in Tables 1, 2 and 3.

Table 1 – Short-Term Stationary Work Zones

WORK SITE CHARACTERISTICS	CONDITIONS REQUIRING REVISIONS TO STANDARD TA AND/OR FIELD ADJUSTMENT	POSSIBLE MITIGATION STRATEGIES
Work on traveled way	• Driveway access • Turning movement at intersection • Lane closure interferes with land access	• Use flagger • Turning movement prohibition • Use alternate access where feasible • Advance warning for lane closure, turn prohibition
Work in crosswalk or on sidewalk	• Pedestrian facility continuity	• Sidewalk detour • ADA compliant • Portable barrier
	• Pedestrian crossing interruption	• Pedestrian detour signs • Use flagger
Work on traveled way requiring lane closure	• Traffic congestion and unacceptable level of service	• Consider advance warning • Peak hour break for work • Plan for off-peak work
Presence of grade/ horizontal curve	• Sight distance problem due to grade	• Move lane closure taper to top of vertical curve • Use arrow board
	• Sight distance problem at horizontal curve	• Provide lane closure taper and arrow board at the tangent section
High speed, high volume roadway	• Work requiring open cut adjacent to travel lane	• Use mobile barriers to minimize worker exposure during barrier placement • Perform work during off-peak period
Roadways with driveway	• Short-term paving operation blocking access to driveways	• Use intermediate flagger to control limited access to driveways, as appropriate
Underground utility work on busy highway	• Peak hour work infeasible due to congestion	• Schedule off-period work • Multiple phase short-term work • Use steel plate to cover open portion of travel lane during peak period

Table 2 – Short-Duration Work Zones

WORK SITE CHARACTERISTICS	CONDITIONS REQUIRING REVISIONS TO STANDARD TA AND/OR FIELD ADJUSTMENT	POSSIBLE MITIGATION STRATEGIES
Work beyond shoulder	• Work vehicle placement	• Work vehicle with dominant light • Work vehicle with mounted arrow panel • Lane closure with traffic control device if work vehicle on shoulder/travel lanes
Work on shoulder	• Interrupts sidewalk	• Provide sidewalk detour signs (portable)

Table 3 – Mobile Work Zones

WORK SITE CHARACTERISTICS	CONDITIONS REQUIRING REVISIONS TO STANDARD TA AND/OR FIELD ADJUSTMENT	POSSIBLE MITIGATION STRATEGIES
Workers on foot	• Must properly protect field workers on foot	• Work/shadow vehicle with dominant devices, arrow panel
High-speed traffic	• Increased potential for errant vehicles and/or higher-speed collisions	• Temporary rumble strips • Shadow vehicle(s) with warning devices • Dominant devices • Arrow panel • Provide law enforcement officers/vehicles
High-traffic volumes	• Increased potential for errant vehicles and/or formation of queues	• Consider staging of construction • Off-peak period work • Shadow vehicle(s) • Portable changeable message sign • Arrow board • Provide alternate routes/diversions
Lack of paved shoulders	• Shadow and/or work vehicles often are intended to travel along shoulder	• Consider staging of construction • Off-peak period work • Shadow vehicle(s) • Portable changeable message sign • Arrow board

Table 3 – Mobile Work Zones (Continued)

WORK SITE CHARACTERISTICS	CONDITIONS REQUIRING REVISIONS TO STANDARD TA AND/OR FIELD ADJUSTMENT	POSSIBLE MITIGATION STRATEGIES
Roadway includes significant horizontal and/or vertical curvature	• Reduces sight distance or may impact vehicle stopping distance	• Use dominant devices, such as arrow boards, PCMS, etc. • Position shadow vehicles with arrow board for visibility
Work includes closure of multiple lanes	• Errant vehicle entering convoy	• Off-peak work • Consider staged work • Shadow vehicle(s) • Arrow board
Roadway includes high frequency of intersections and/or driveways	• Vehicles entering/exiting the traffic stream from additional access point	• Shadow vehicle(s) • Restrict turns • Provide alternate access
Roadway includes significant pedestrian and/or bicycle traffic	• Pedestrian and bicycle intrusion	• Pedestrian detour signs • ADA ramps • Pedestrian barriers
Work expected to be performed during peak period	• Peak period congestion	• Detour or diversion • Advance notification

5.0 EXAMPLE PLANS

The *MUTCD* provides 46 TAs pertaining to frequently encountered work zone scenarios. These generalized plans only minimally address specific situations, geometrics, and other characteristics of STSDM work zones. In order to supplement this information, several example plans are provided which illustrate a number of work zone scenarios specific to these types of work. It should be noted that the plans should be utilized in the same manner as the TAs provided in the *MUTCD*. They represent generalized STSDM work zone scenarios that must be modified to actual field conditions.

5.1 Short-Term Stationary Work

Short-Term Asphalt Paving Operation on Divided Highway (Figure 2)

- Asphalt paving operations represent a common example of a short-term stationary work zone.
- Taller (42”) cones may be used instead of drums in order to reduce the effort required to implement channelizing devices along the entire length of the work zone, including the shoulder taper.
- Workers should never assume that shoulders are safe work areas, as vehicles may use this area for recovery.
- Restricting workers, equipment, and work vehicles to one side of the roadway will help to condense the area which requires protection from errant vehicles. This will reduce the need for additional traffic control (such as the opposite shoulder and beyond).

Note: Lane tapers (L) and sign spacing (A, B, and C) are determined based on the posted work zone speed limit as calculated in Tables 6H-3 and 6H-4 of *MUTCD*.

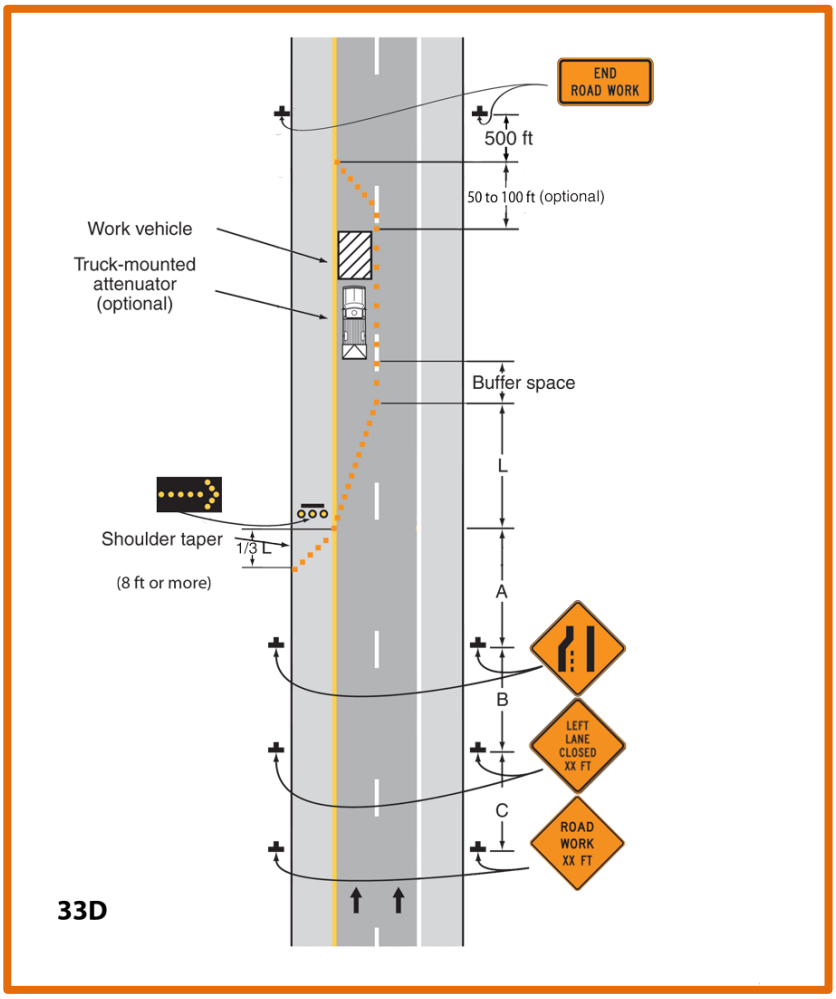


Figure 2 – Short-Term Asphalt Paving Operation on Divided Highway

Maintenance Operation near Signalized Intersection (Figure 3)

- Practicing proper aerial lift safety should be adhered to and extending the bucket over an active traffic lane should not be allowed.
- While a TMA is optional, the work vehicle should be equipped with high-intensity warning lights to warn road users along each approach.
- Advance warning signs should be placed on portable supports in order to reduce setup time.

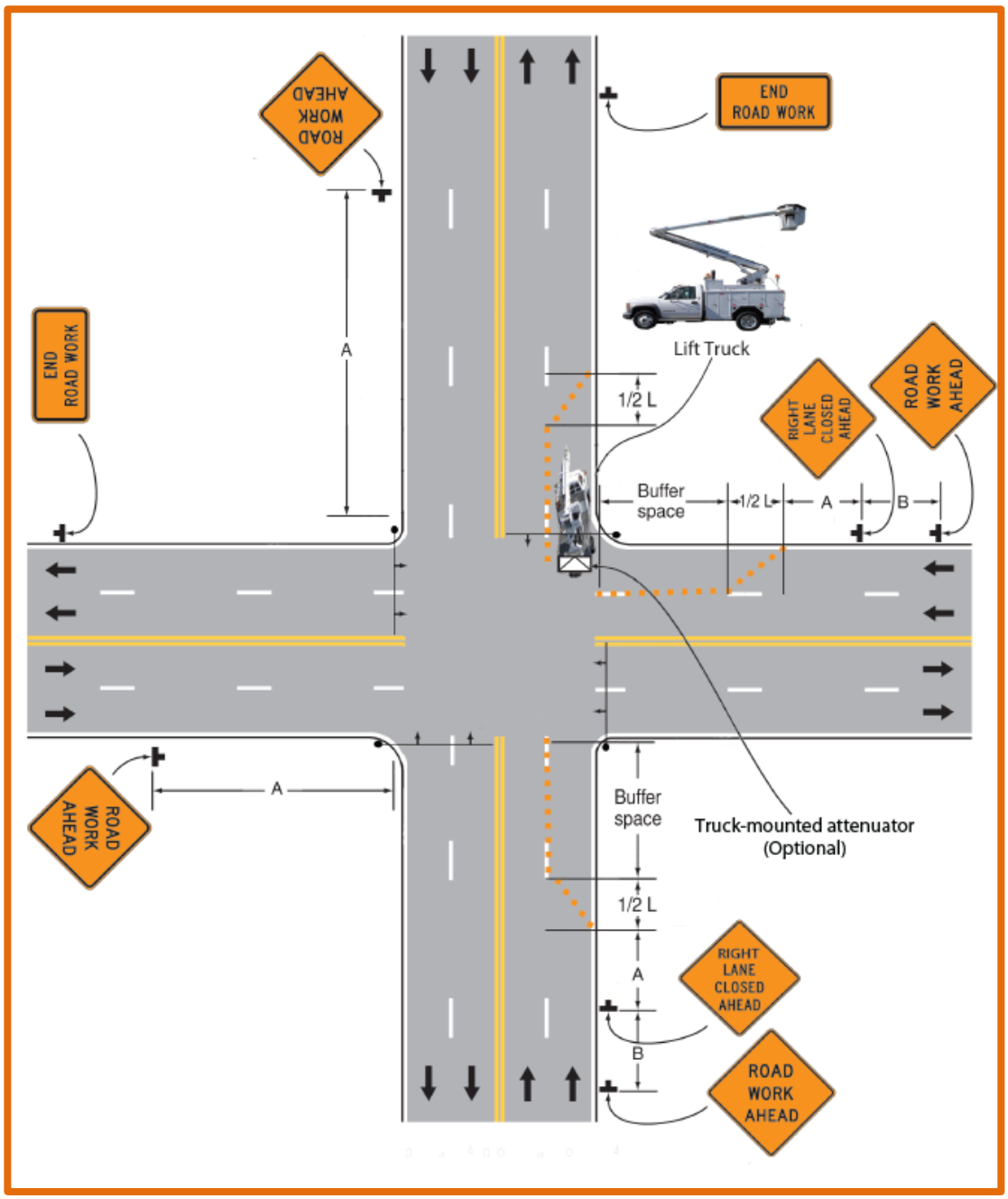


Figure 3 – Maintenance Operation Near Signalized Intersection

Short-Term Operation Requiring Flaggers (Figure 4)

- Given the unplanned nature of many short-term stationary work zones, it may be necessary to close travel lanes on short notice.
- Use of flaggers, as shown in Figure 4, is one way to implement this closure without a more extensive TTC.
- A single flagger is only appropriate when the work zone is short enough for the flagger to be easily visible to traffic from both directions. Add an additional flagger where visibility is limited.
- Advance warning signs should be mounted on portable supports, and taller (42”) cones should be used instead of drums in order to reduce implementation time.
- Use of buffer spaces may reduce risks to workers by the possible intrusion of errant vehicles.

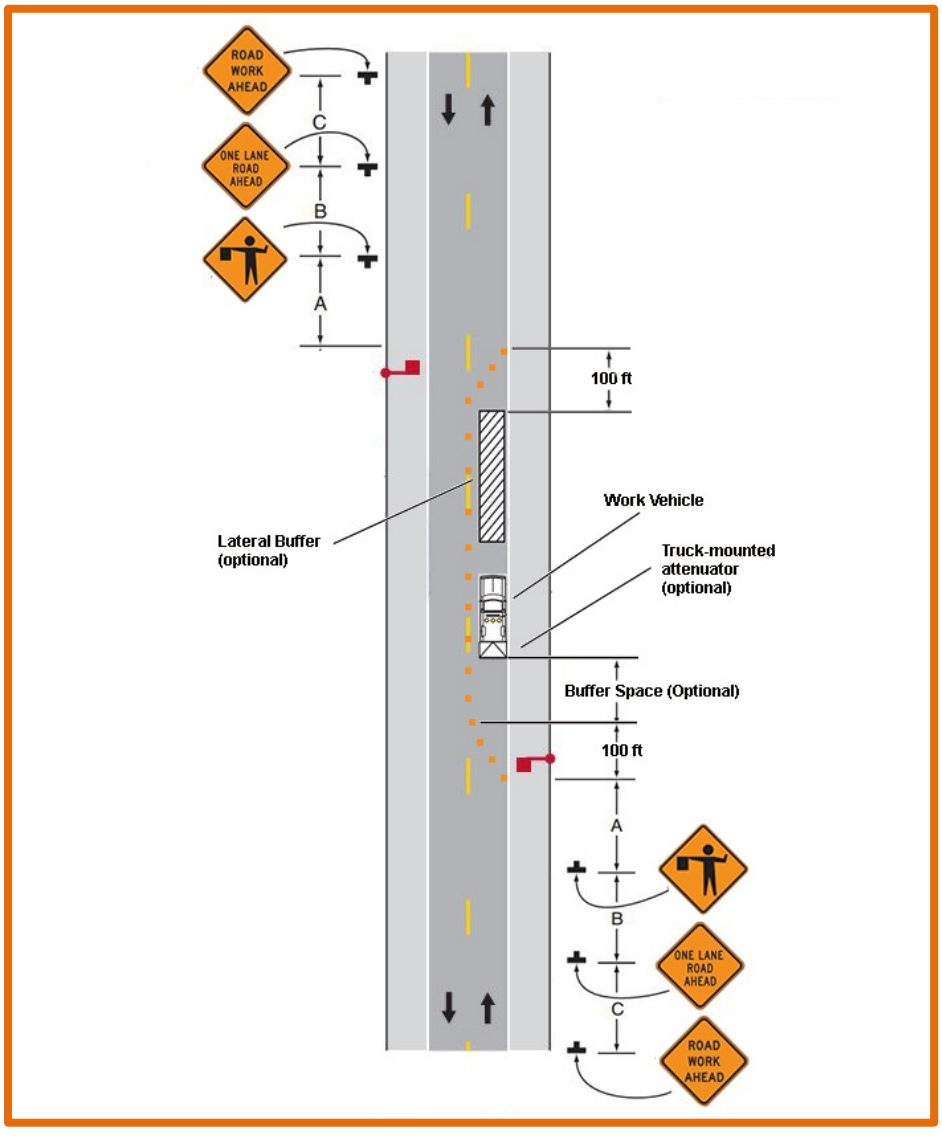


Figure 4 – Short-Term Operation Requiring Flaggers

5.2 Short-Duration Work

Traffic Signal Maintenance (Figure 5)

- Traffic signal repair often takes less than one hour allowing it to be addressed as short-duration work.
- High-intensity warning lights and retro-reflective markings should be used on the work vehicle to warn approaching road users.
- Practicing proper aerial lift safety should be adhered to and extending the bucket over an active traffic lane should not be allowed. Flaggers should be used to stop traffic if the bucket must swing over an open lane.
- Traffic cones should be used for channelizing devices, (tall cones are appropriate for higher speed roadways) and 10 feet of paved traveled way must remain for all open travel lanes. If 10 feet cannot be maintained, one lane should be closed and flaggers used to control alternating one-way traffic. Flaggers may also be needed to control turning movements.
- Advance warning signs should be placed on portable supports to reduce traffic control set up time.

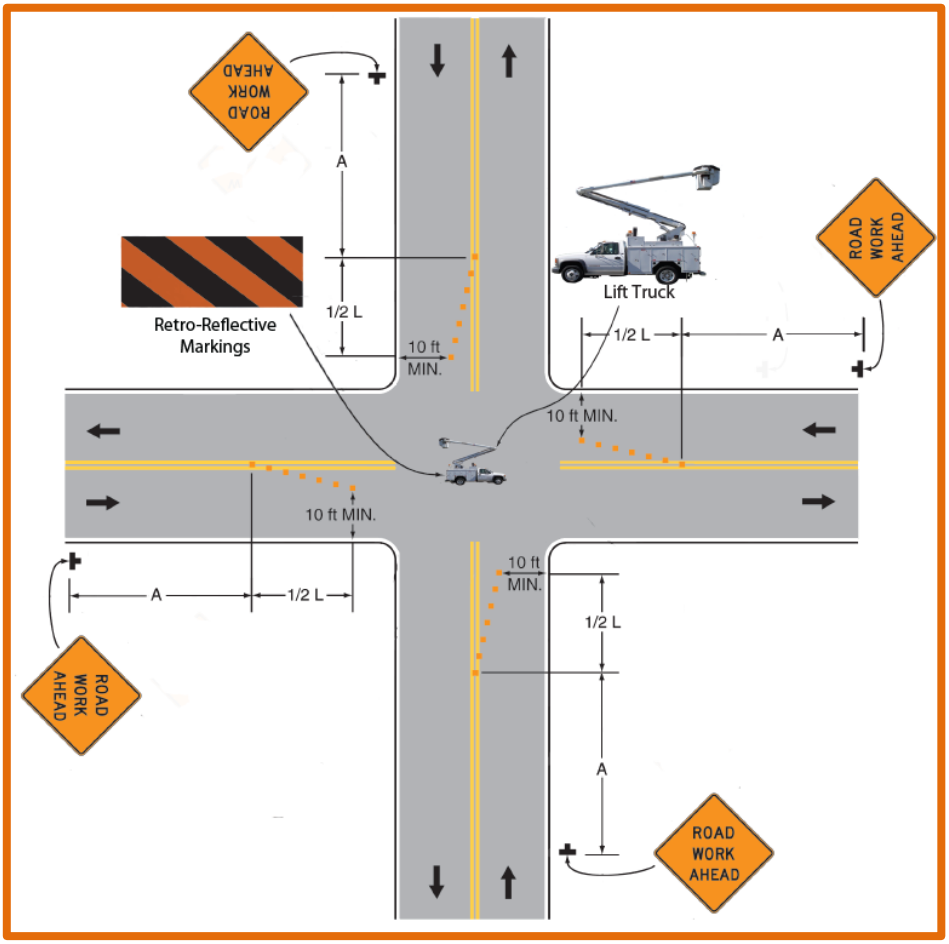


Figure 5 – Traffic Signal Maintenance

Tree-Trimming or Removal Operation on a Two-Lane Roadway (Figure 6)

- Overhanging or fallen trees requiring quick trimming or removal is a typical example of an unplanned short-duration operation. However, even if a tree trimming/cutting operation requires more than one hour, changing the duration to short-term stationary, this same TA may still be applicable.
- Workers should never assume shoulders are safe from traffic intrusion, as vehicles may use this area for recovery.
- Traffic cones should be utilized as channelizing devices to reduce setup/removal time, and a minimum lane width of 10 feet is required to maintain traffic in both directions.
- In some cases, there may be a risk of tree limbs or other objects falling into or very near to open travel lanes. The use of flaggers to temporarily stop traffic may be necessary if there is any potential for this to occur.

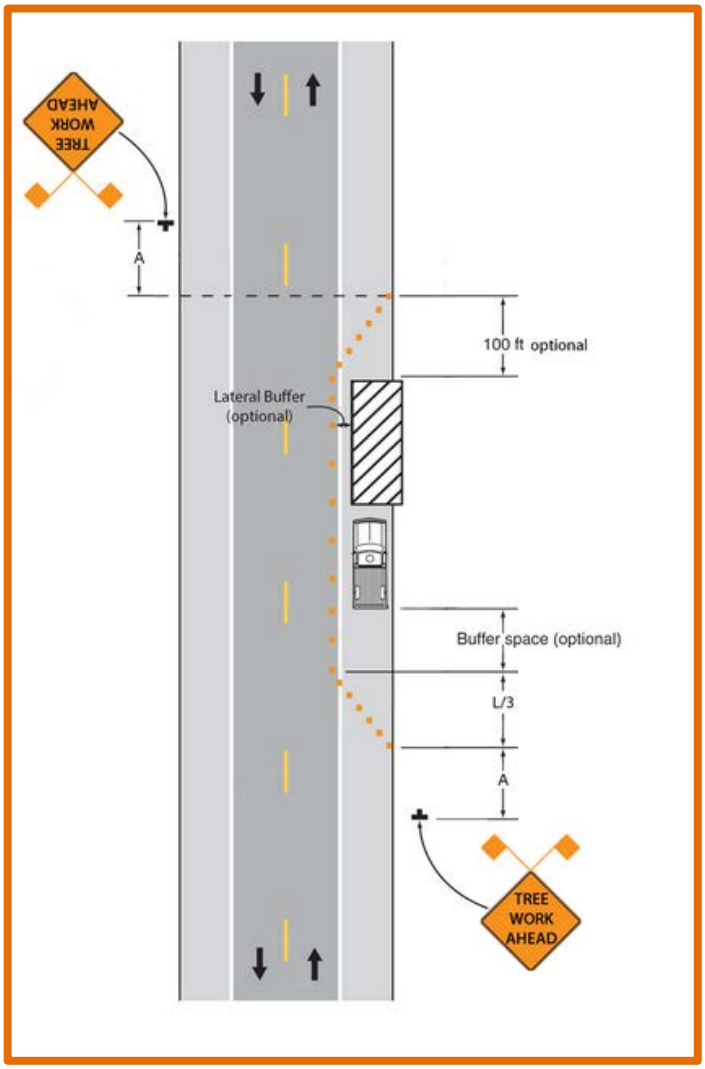


Figure 6 – Tree-Trimming or Removal Operation on a Two-Lane Roadway

Mid-Block Maintenance or Repair Operation (Figure 7)

- Utility work or other maintenance operations located mid-block is a frequently encountered short-duration work zone scenario.
- Practicing proper aerial lift safety is a key concern in these situations, including not extending the bucket over an active traffic lane.
- Advance warning signs should be placed on portable supports to reduce setup/removal time.
- A minimum lane width of 10 feet is required to maintain travel in the lane adjacent to the work space. If 10 feet of width cannot be maintained, the lane should be closed on the opposite direction and the lane adjacent to the work space shifted onto the opposing direction – see *MUTCD* TA 32.
- While a TMA is optional in this example, it should be included on high speed roadways to reduce crash severity if errant vehicles strike the work vehicle.

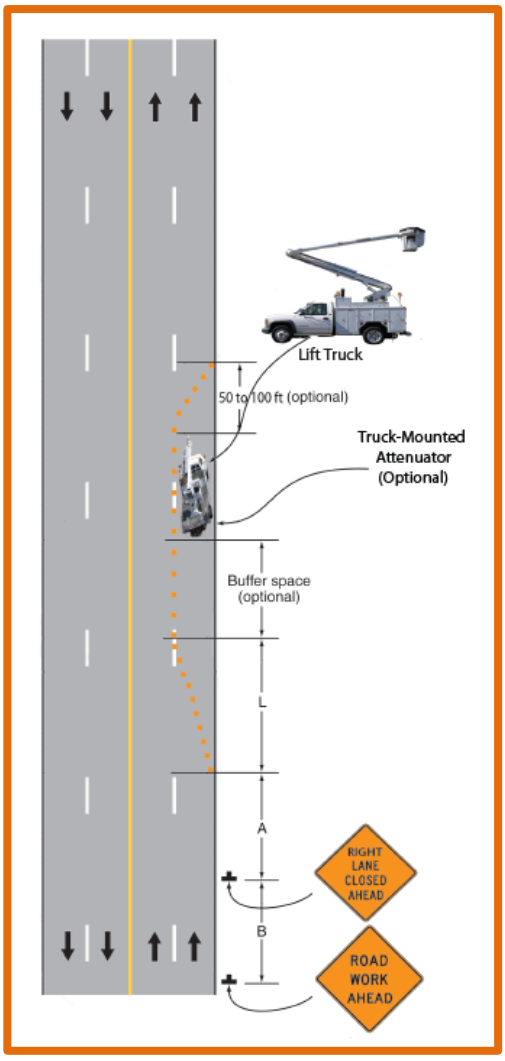


Figure 7 – Mid-Block Maintenance or Repair Operation

5.3 Mobile Work

Mobile Striping Operations (Figures 8 & 9)

- Pavement marking operations are a common example of mobile work that often take place within the lane (Figure 8) or straddling the centerline (Figure 9).
- While the use of TMAs is optional, they should be included on high speed roadways in order to reduce impact severity if errant vehicles strike the work vehicle.
- Optional arrow boards shown may help to alert road users and portable changeable message signs may also be used.
- Workers should be aware of long queues and, if practical, work vehicles should pull off the roadway periodically to allow the queue to dissipate.

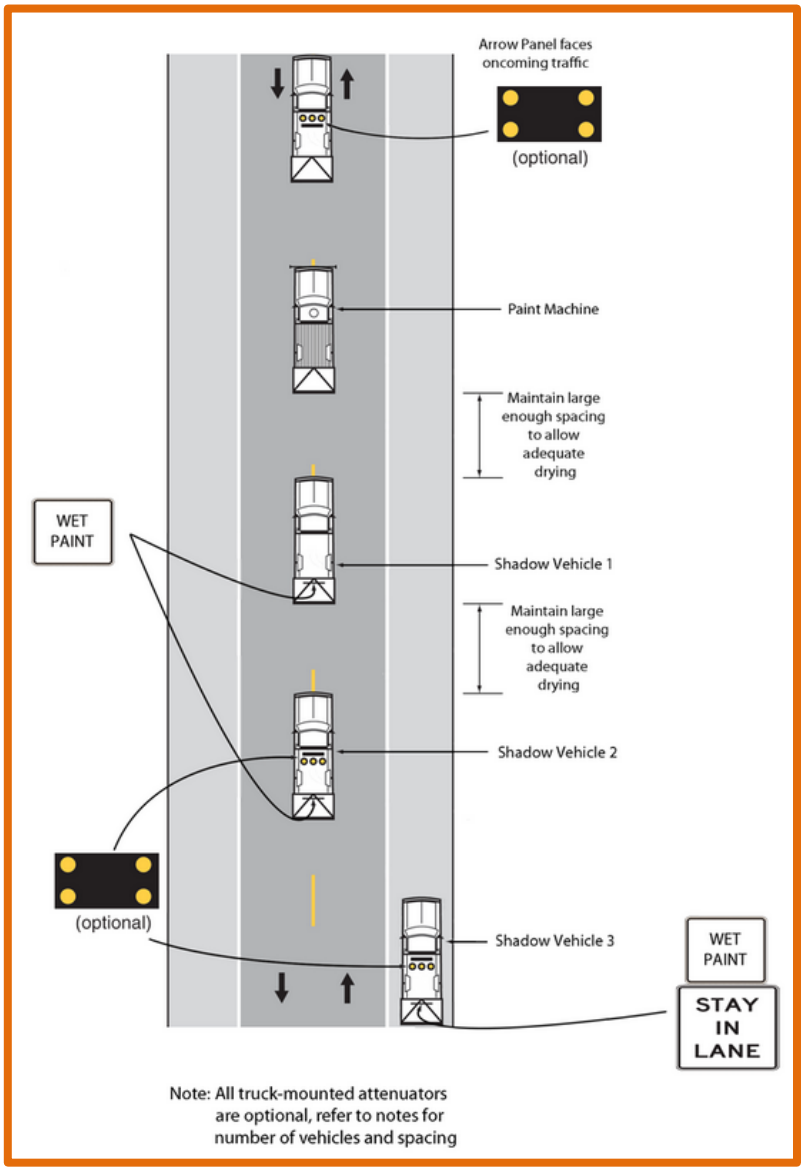


Figure 8 – Mobile Striping Operation - Straddling Centerline

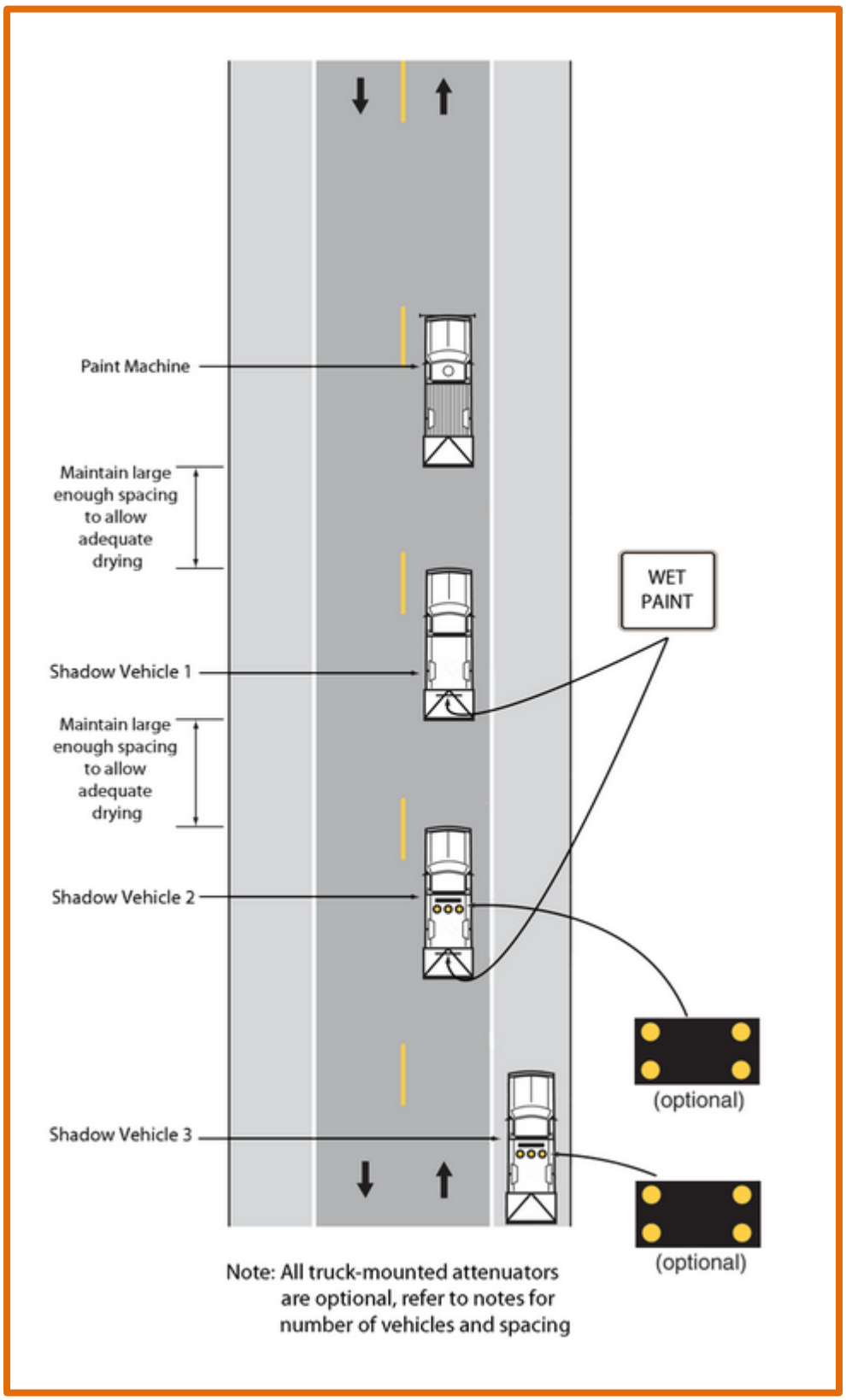


Figure 9 – Mobile Striping Operation - In Lane

Pothole Patching Operation (Figure 10)

- Pothole patching or other roadway maintenance activities on an interior lane of a 3 or more lane roadway require the closure of more than one travel lane. The potential for errant vehicles to enter the work convoy may become significant in this situation.
- Space between shadow vehicles should be minimized to limit the potential for errant vehicles entering the work convoy.
- Care should be taken to ensure that vehicle-mounted signs are not obstructed by other work vehicles, equipment or supplies.
- These operations should be performed during daylight off-peak hours or at night, depending on traffic volumes and roadway capacity.
- One arrow board should be used for each lane closed in such an operation.

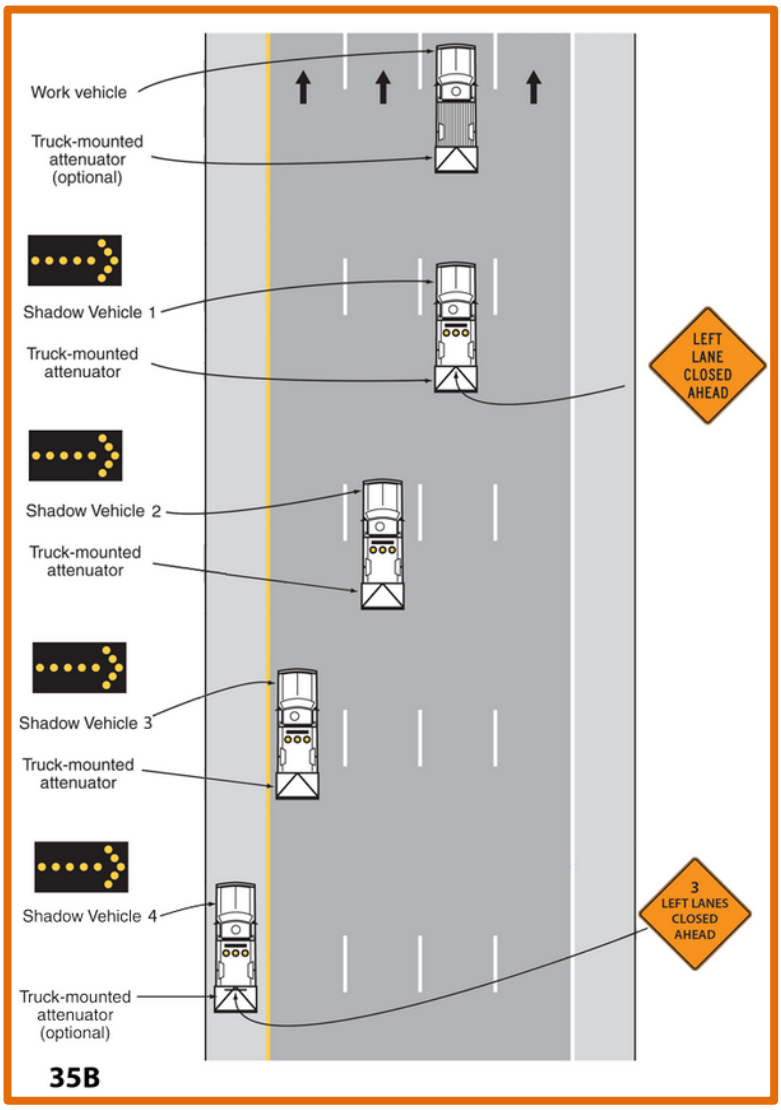


Figure 10 – Pothole Patching Operation

6.0 ADDITIONAL RESOURCES

Refer to the Wayne State University – Transportation Research Group Work Zone Safety Website (workzone.eng.wayne.edu) for copies of this document, other products developed under the FHWA Work Zone Safety Grant, as well as the *Temporary Traffic Control Plan Selection Software* and *Work Zone Safety Compendium of Documents.*

Further information on highway work zone safety can be found in the following resources:

- Federal Highway Administration: http://www.ops.fhwa.dot.gov/wz/index.asp
- National Work Zone Safety Information Clearinghouse: http://www.workzonesafety.org/
- Manual on Uniform Traffic Control Devices: http://mutcd.fhwa.dot.gov/htm/2009r1r2/html_index.htm
- 23 Code of Federal Regulations, Part 630, Subpart J: http://www.ecfr.gov/cgi-bin/text-idx?rgn=div5&node=23:1.0.1.7.21#sp23.1.630.j and Subpart K: http://www.ecfr.gov/cgi-bin/text-idx?rgn=div5&node=23:1.0.1.7.21#sp23.1.630.k
- Developing and Implementing Transportation Management Plans for Work Zones, Federal Highway Administration, 2005: http://www.ops.fhwa.dot.gov/wz/resources/publications/trans_mgmt_plans/trans_mgmt_plans.pdf
- Traffic Control and Work Zone Safety for High Volume Roads, Final Report: http://www.nj.gov/transportation/refdata/research/reports/FHWA-NJ-2013-002.pdf
- American Road and Transportation Builders Association: http://www.artba.org/
- American Traffic Safety Services Association: http://www.atssa.com/
- Institute of Transportation Engineers: http://www.ite.org/
- National Highway Institute: http://www.nhi.fhwa.dot.gov/home.aspx
- Occupational Safety and Health Administration: http://www.osha.gov/
- Texas Transportation Institute: http://tti.tamu.edu
- Transportation Research Board: http://www.trb.org/

7.0 GLOSSARY

Arrow Board: Illuminated sign capable of showing directional displays to provide road users additional warning for an upcoming merging action or flashing displays to indicate road user to proceed with caution

Channelizing Devices: Drums, tubular markers, vertical panels, cones, or barricades used in a closure caused by a work zone to transition vehicular traffic from one lane to another area

Countermeasure: Action intended to improve safety and reduce crash frequency for a problematic site

Manual on Uniform Traffic Control Devices (*MUTCD*): National document containing standards used by transportation practitioners to install and maintain traffic control devices on all public streets, highways, bikeways, and private roads open to public travel

Mobile: Work zone that moves intermittently or continuously

Portable Changeable Message Sign (PCMS): Illuminated device capable of showing a variety of messages to advise road users of an unexpected situation, such as a closure, speed reduction, work zone advisory, or special event

Short-Duration: Work zone that occupies a location up to one hour

Short-Term Stationary: Daytime work zone that occupies a location for more than one hour within a single daylight period

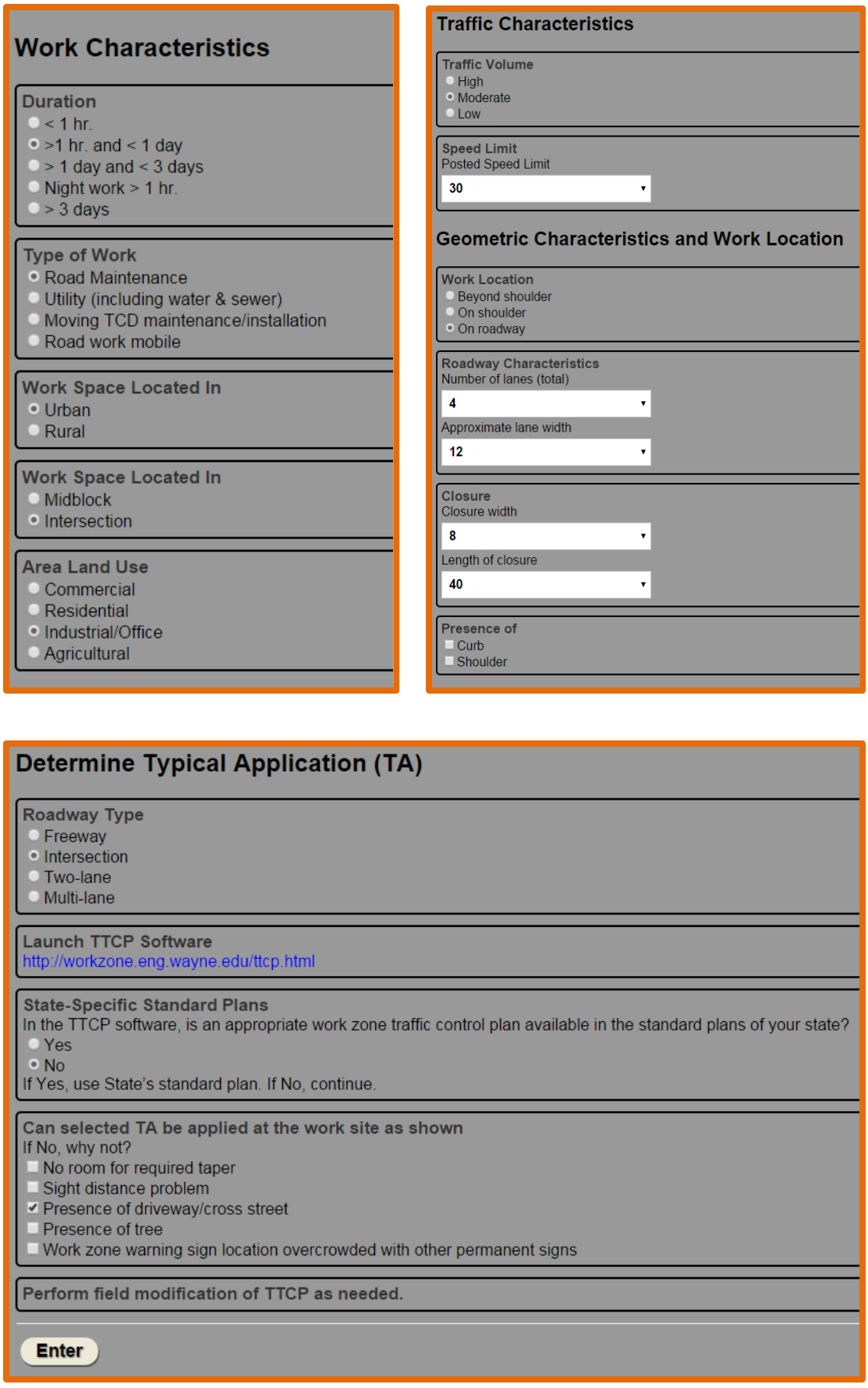
Temporary Traffic Control (TTC): Warning devices such as signs, signals, markings, arrow boards, portable changeable message signs, and channelizing devices used to warn and guide all road users around a work zone

Temporary Traffic Control Plan (TTCP): Drawing / schematic diagram used to display traffic control devices for warning all road users, including motorists, bicyclists, and pedestrians through a work zone

Typical Application (TA): Plans included in *MUTCD* showing TTC setup for various work zone conditions

Work Zone: Area of roadway containing a construction, maintenance, or utility work activity, typically identified by temporary traffic control or work vehicles

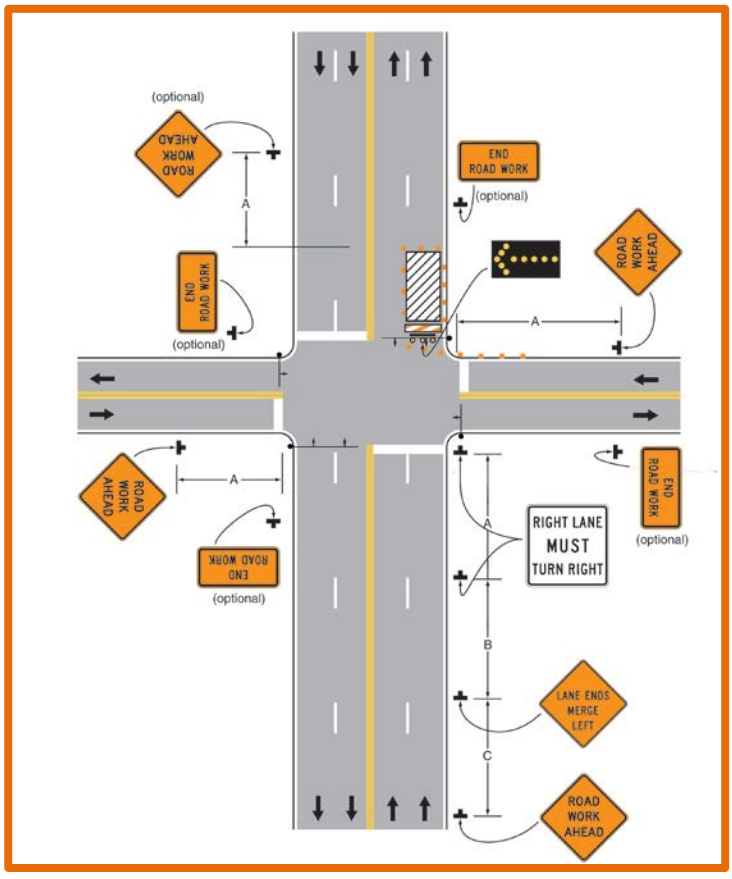
APPENDIX I – TEMPORARY TRAFFIC CONTROL PLAN DEVELOPMENT CHECKLIST


Work Characteristics
Duration
< 1 hr.
>1 hr. and < 1 day
> 1 day and < 3 days
Night work > 1 hr.
> 3 days
Type of Work
Road Maintenance
Utility (including water & sewer)
Moving TCD maintenance/installation
Road work mobile
Work Space Located In
Urban
Rural
Work Space Located In
Midblock
Intersection
Area Land Use
Commercial
Residential
Industrial/Office
Agricultural
Traffic Characteristics
Traffic Volume
High
Moderate
Low
Speed Limit
Posted Speed Limit
30
Geometric Characteristics and Work Location
Work Location
Beyond shoulder
On shoulder
On roadway
Roadway Characteristics
Number of lanes (total)
4
Approximate lane width
12
Closure
Closure width
8
Length of closure
40
Presence of
Curb
Shoulder
Determine Typical Application (TA)
Roadway Type
Freeway
Intersection
Two-lane
Multi-lane
Launch TTCP Software
http://workzone.eng.wayne.edu/ttcp.html
State-Specific Standard Plans
In the TTCP software, is an appropriate work zone traffic control plan available in the standard plans of your state?
Yes
No
If Yes, use State's standard plan. If No, continue.
Can selected TA be applied at the work site as shown
If No, why not?
No room for required taper
Sight distance problem
Presence of driveway/cross street
Presence of tree
Work zone warning sign location overcrowded with other permanent signs
Perform field modification of TTCP as needed.
Enter

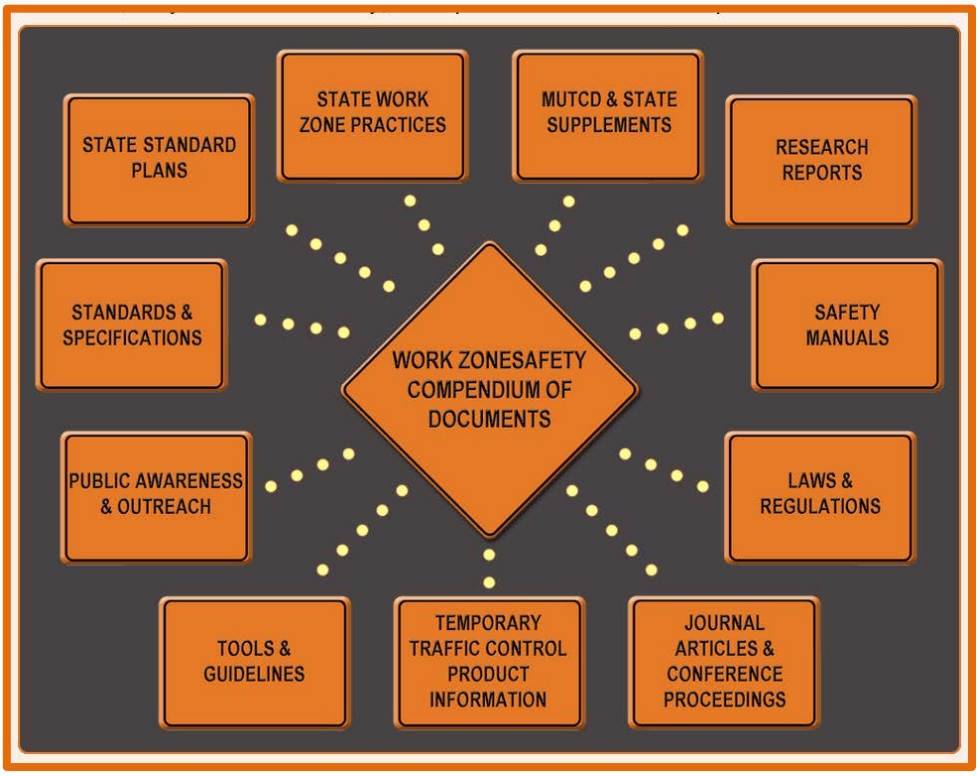
Question	Answer
Work Duration	>1 hr. and < 1 day
Type of Work	Road Maintenance
Work Space Located In:	Urban Intersection
Area Land Use	Industrial/Office
Traffic Volume	Moderate
Speed Limit	30
Work Location	On roadway
Number of lanes	4
Approximate lane width	12
Closure width	8
Length of closure	40
Presence of	
Roadway Type	Intersection
State-Specific Standard Plans	No
Can selected TA be applied at the work site as shown	Presence of driveway/cross street

TTCP software link: http://workzone.eng.wayne.edu/Software/FlowChart/MainModule.html

Example of an Intersection TTCP



Work Zone Compendium



Link: http://workzone.eng.wayne.edu/#compendium