

Temporary Traffic Control Manual

CITY OF PORTLAND, OREGON

2025



PBOT
PORTLAND BUREAU OF TRANSPORTATION

I. PURPOSE

The Portland Bureau of Transportation (PBOT) has developed this Temporary Traffic Control Manual to assist in the planning and preparation of temporary traffic control measures for work zones and other temporary conditions within the City of Portland.

II. APPLICABLE STANDARDS AND INTENT

This manual is intended to provide guidance for the planning and implementation of temporary traffic control (TTC) within the City of Portland. It is not intended to serve as a comprehensive resource, but rather to supplement local, state, and national standards applicable to work zones and temporary traffic operations. This manual aligns with key principles outlined in the Manual on Uniform Traffic Control Devices (MUTCD) and other relevant industry standards. As with all engineering work, sound judgment and context-sensitive design remain essential when applying these guidelines to specific projects or sites.

The City of Portland places a high priority on consistent, safe, and effective temporary traffic control to support its transportation goals of safety, mobility, and equitable access. This manual outlines current practices, highlights critical technical considerations, and promotes consistency across projects and contractors. However, it is not intended to limit innovation or override professional judgment in addressing complex or unique conditions in the field.

Engineers and traffic control professionals are encouraged to develop context-responsive plans that meet the unique needs of each site, provided the designs maintain safety for all roadway users and comply with the City's standards. This manual is applicable to a variety of temporary control situations, including utility work, construction projects, special events, and emergency response. In cases where full compliance with this guidance is not feasible, the goal remains to uphold the highest level of safety possible within the given constraints.

Equity is a central consideration in temporary traffic control. Thoughtful design and implementation can reduce risks and disruptions for vulnerable communities—particularly for people walking, older adults, people with disabilities, and communities of color who may be disproportionately impacted by unsafe or inaccessible temporary conditions. Practitioners are encouraged to review PBOT's Equity Initiatives webpage for tools and examples that support more equitable outcomes in temporary traffic management.

The City of Portland ensures meaningful access to city programs, services, and activities to comply with Civil Rights Title VI and ADA Title II laws and reasonably provides: translation, interpretation, modifications, accommodations, alternative formats, auxiliary aids and services. To request these services, contact 503-823-5185, City TTY 503-823-6868, Relay Service: 711.

While this manual provides interpretive guidance, it does not change the intent of Part 4 of the Manual on Uniform Traffic Control Devices (MUTCD). This manual is a supplement to the MUTCD and applies to temporary traffic control operations on City of Portland streets. Any interpretation or clarification regarding this manual will be made by the City Traffic Engineer. See the MUTCD for definitions of words and terms not otherwise defined herein.

The City Traffic Engineer may periodically update this manual electronically.

The typical applications in this manual are not intended to recommend the use of specific traffic control devices or measures that work in every situation but are intended to illustrate and provide guidance on minimum solutions for a variety of work zone scenarios commonly encountered.

In this manual, the words “**shall**”, “**should**”, and “**may**” are used to describe specific conditions. To clarify the use of these terms, the following definitions apply.

1. **SHALL:** A mandatory condition or action.
2. **SHOULD:** The practice under normal conditions.
3. **MAY:** An option where no requirement for design, application, or standards is intended.



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1 General Requirements

1.1 PURPOSE AND INTENT

The purpose of this manual is to set forth PBOT specific practices and guidelines to be observed by all those who perform work in a public right-of-way (ROW) with the goal of providing safe and effective work areas and to warn, control, protect, and expedite all modes of traffic, including transit, bicycle and pedestrian traffic.

To increase the road user's comprehension and facilitate traffic flow, it is desirable to standardize the type and placement of traffic control devices as much as possible. This manual aims to accomplish this objective by:

- Utilizing standard traffic control measures (TCM);
- Identifying TCM practices unique to PBOT; and
- Including typical applications for a variety of situations commonly encountered.

Although each activity should be dealt with individually, conformity with the general provisions and techniques established herein is necessary. When a specific situation is not adequately covered by the provisions of this manual, the protection of the traveling public and the worksite will dictate the measures to be taken. These protections should address the transportation hierarchy by prioritizing the safety of pedestrians, bicyclists, and workers above capacity and convenience of other travel modes.

1.2 RESPONSIBILITY

All persons or agencies doing work within or infringing upon the ROW **shall** conduct said work to acceptable standards of safety and efficiency and, except where specified in their City of Portland contract, **shall** be responsible for the following:

- Obtaining all necessary authorization to perform work in the ROW from PBOT;
- Following approved temporary traffic control plans (TCP), and providing safeguards for the protection of workers and the public as outlined herein;
- Supplying, installing, and maintaining all personnel and traffic control devices (TCD) required for use of the ROW;
- Scheduling and expediting the work to minimize inconvenience to the traveling public.

Failure to meet these or other standards will subject permittees to enforcement policy, TRN-8.14. Penalties can be assessed for misuse of the privilege of taking portions of the public right-of-way out of service or implementing traffic control measures without the approval of the City Traffic Engineer. Below is an example of common violations.

Table 1.1 Example Violations and Penalties

| Description | Code |
|--|---------------|
| Closure without a permit | PCC 17.24.010 |
| Creating imminent risk of injury to public | TRN 8.14 |
| Work outside approved hours | PCC 17.24.010 |
| Violation of City Traffic Engineer's conditions | PCC 17.24.017 |
| Incorrect traffic control devices | PCC 17.24.060 |
| Sign blocking bike lane | PCC 17.24.060 |
| Missing or improper warning signs | PCC 17.24.060 |
| Missing or improper barricades/channelizing devices | PCC 17.24.060 |
| Failure to remove warning signs after the restriction has been removed | PCC 17.24.060 |
| Use of unacceptable quality traffic control devices | PCC 17.24.060 |
| Drop box within 50' of a non-signalized intersection | PCC 16.20.120 |
| Personal vehicles within workspace | PCC 16.20.510 |
| Advertising from ROW | PCC 17.44.010 |
| Failure to meet notification requirements | PCC 17.24.060 |
| Chronic offender, first occurrence | TRN 8.14 |
| Chronic offender, second or additional occurrence | TRN 8.14 |

1.3 TCP AND PERMIT REQUIREMENTS

Permission of the City Traffic Engineer is required to work in any portion of the ROW within the City of Portland. A site-specific TCP approved by the Traffic Engineer is required for work zones that:

- cannot be implemented using the typical application drawings included in this manual, or
- are classified as *long-term*, or
- detour traffic from a *busy street*, or
- reduces the capacity at a traffic signal, or
- shifts vehicle and/or bicycle lanes approaching a traffic signal.

A flowchart is shown in Figure 1.2 to help guide when a site-specific TCP should be submitted for review. A TCP may still be required based on the nature and impact of the proposed work. The City of Portland Temporary Street Use Permitting (TSUP) is the conduit for obtaining permission to work in the right-of-way. Appropriate forms and information for applying for a permit can be found on the following website:

www.tsup.info

TCPs should address the information included in the following checklist, if applicable:

Table 1.1 Temporary Traffic Control Plan Checklist

| OK | N/A | |
|----|-----|--|
| | | GENERAL Company name, onsite contact information. Number and date of the submittal. Proposed work hours. Existing conditions. Existing curbs, sidewalks, pavement striping, markings (arrows and crosswalks). Street names. Posted or statutory speed. Required signal modifications |
| | | WORK ZONE Description of work. Clearly define the workspace with dimensions. Lanes or roadways to be closed. Cone spacing. Stripe or pavement marking removal. Temporary striping or pavement marking. Conflicting traffic control, e.g. for a shift over centerline, show opposing traffic controls. Flagging. |
| | | PEDESTRIANS Existing sidewalk, pedestrian walkways, and crosswalks. Temporary pedestrian routes, with specific signage and devices for pedestrians. Temporary ADA ramps, walkways, or bridges. Sidewalks and or crosswalks to be closed (last resort only). Covered or relocated pedestrian signal heads. |
| | | BICYCLES Existing bicycle lanes or multiuse paths. Temporary bicycle routes, with specific signage and devices for bicycles. Bicycle lanes and multiuse paths to be closed (last resort only). Covered or relocated bicycle signal heads. |

| | |
|--|---|
| | TRANSIT Existing bus, streetcar or light rail stops. Existing bus, streetcar or light rail routes. |
| | MOTORIZED VEHICLES Special vehicle types and their limitations should be considered (i.e., trucks, buses, Streetcar, LRT, and Emergency vehicles). Taper lengths. Required materials, e.g., cones, candlesticks, drums, barricades. Sign sizes. Sign locations and spacing. Parking removal in 20-foot increments, including any special zones (loading, taxi, handicapped, angle, etc.). Existing and proposed lane widths. Closed or restricted driveways. |

1.4 EMERGENCY

An emergency requires immediate response to save lives, prevent serious injury or remove debris using whatever resources are available, usually in response to a crash or incident.

1.5 EMERGENT CONDITIONS

An emergent condition requires an expedient yet planned response to a situation that has the potential to cause a crash, or damage needing quick repair. Often referred to as “call outs,” these events require quick response to a report of debris, urgent repairs, or other situations where the exact nature of the work or location may not be completely known. After performing an on-site assessment, determine whether work can proceed without creating additional risks to workers or road users. Response vehicles should be able to implement mobile work zone traffic control measures, at a minimum. If work is expected to last more than 60 minutes, request additional traffic control devices needed to implement a traditional stationary work zone. Assistance from the Traffic Engineer is available to develop a TCP. Emergent conditions may develop into emergencies.

1.6 REASONABLE PUBLIC ACCESS

Access to fire stations, police stations, hospitals, public transit, businesses, and schools should be maintained. When restrictions are necessary, coordinate such access restrictions with the Traffic Engineer and the responsible person-in-charge of the affected facility.

1.7 WORK REQUIREMENTS

Provide work zone notifications in accordance with City of Portland 2020 Standard Construction Specifications 00220.03, and any project-specific provisions. For work not under contract with the City of Portland, provide the following specific notifications.

Table 1.3 Work Notification Table

| Type of Work or Closure | Who to Notify |
|-----------------------------|------------------------------------|
| Parking Closure < 2 weeks | Property Owner |
| Transit Closures | TriMet, Streetcar, CTRAN |
| Other Access Restrictions | Property/Business Owner |
| Traffic Signal Modification | Signals and Street Lighting Group |
| <i>Busy Street</i> Closure | Schools, BOEC, Transit, Fire, USPS |
| Driveway Closures | Property Owner |
| Parking Closure > 2 weeks | Property Owner |
| Within 100' of Bridge | Multnomah County, ODOT |
| Dimension Restrictions | See Section 1.23 |
| Within Rail right-of-way | Railroad |

Provide notice to property and business owners in writing (letter, email, flyer, posted sign). The notice should be on an approved form or letter, and include the project name, the name and address of the contractor, daytime and emergency phone numbers, contact person and emergency contact person's name.

1.8 GENERAL AND EMERGENCY CONTACTS

The following parties should be informed of ongoing construction activities and detours to improve coordination and response to emergencies in, around, and through work zones, if applicable. Other school districts, such as Parkrose, Reynolds, and David Douglas may need to be notified.

Table 1.4 Contacts List

| | |
|-----------------------------------|---|
| Bureau of Emergency Communication | 503-823-0911 |
| TriMet Bus | 503-962-4949 or bsc@trimet.org |
| Portland Streetcar | 503-823-2764 (Emergency) 503-823-2904 (Track Access) |
| SSL | 503-823-1700 (Emergency) 503-823-5530 (Scheduling) |

| | |
|---|---|
| TriMet Light Rail | 503-962-8138 (Rail Access) 503-962-4937 (Scheduling) |
| ODOT Rail Division | 503-986-4321 |
| Police Dispatch | 503-823-4800 |
| USPS | 503-735-9816 |
| Portland Fire Bureau Special Operations | 503-823-3930 |
| Portland Public Schools Transportation | 503-916-6901 |
| Oregon Department of Transportation | 971-673-6200 or d2bup@odot.state.or.us |
| Multnomah County | 503-988-3582 or row.permits@multco.us |

1.9 WORKER SAFETY APPAREL

All workers within the right-of-way within the work zone **shall** wear high-visibility safety apparel, as specified in the MUTCD. Safety apparel **shall** meet the requirements of the ANSI/ISEA High Visibility Safety Apparel Guidelines, or equivalent revisions, and labeled as ANSI 107-2004 or current standard performance for Class II risk exposure during day operations, and Class III risk exposure during night operations.

1.10 UNOCCUPIED WORK ZONES

Do not leave portions of the roadway closed unless hazards exist, or the roadway is not otherwise acceptable to traffic. If hazards exist, and the work site will be left unattended before the work is completed, maintain all appropriate warning signs and channelization devices.

The permittee shall complete the following:

- Install the appropriate warning signs in advance of changes in road surface such as rough pavement, excavations or steel plates.
- Delineate all obstructions and protect them with cones, drums, barricades.
- Steel plates left in the roadway after a lane or roadway is opened up to traffic shall be placed per 00275 of the 2020 City of Portland Standard Construction Specifications.

The permittee is responsible for maintaining all existing and temporary traffic control devices and should have them routinely inspected by a knowledgeable person for adequate compliance, visibility and condition of the traffic control devices. All temporary signs shall meet the requirements of the “acceptable” category shown in the ATSSA “Quality Guidelines for Temporary Traffic Control Devices and Features” handbook. Immediately replace all damaged or missing devices. Devices left in place should be appropriate for all expected or anticipated

conditions. The standard for vehicle channelization devices is different for unoccupied work zones, as detailed in Section 2.3, Channelizing Devices.

1.11 RESTRICTION TIMES

Generally, lane closures are not permitted on a *busy street* during the weekday *peak hours*, unless approved by the Traffic Engineer. Notify the Traffic Engineer (email) immediately if a roadway or lane need to remain closed longer than the permitted time to keep nighttime noise to acceptable levels.

Permittees **shall** acquire a noise variance permit through the Office of Neighborhood Involvement for any work approved to take place outside the hours of 7am-6pm Monday-Saturday.

1.12 POSITIVE PROTECTION

The primary function of positive protection devices is to provide a method to keep vehicles out of an area occupied by persons, while minimizing injuries to vehicle occupants. Per the MUTCD Section 6M.02, except as otherwise required, at a minimum, longitudinal traffic barriers and/or other positive protection devices should be considered in work zone situations that place workers at increased risk from motorized traffic, and where positive protection devices offer the highest potential for improved safety for workers and road users. Temporary barriers may be used when the consequence of a vehicle entering a work zone is graver than the consequence of a vehicle impacting the barrier.

1.13 EMERGENCY RESPONDERS

Fire apparatus require a minimum width of eleven feet to travel through a work zone. Traffic Engineer approval is required at unoccupied work zones which cannot maintain eleven-foot lanes, or when work cannot be stopped to open an eleven-foot passage through the work zone. A temporary emergency response plan may be required whenever access to public or private properties is restricted, or fire apparatus response time is increased because of a complete street closure. Temporary emergency response plans are generally not required for dead-end streets or cul-de-sacs whenever properties can be accessed by fire apparatus to within 250 feet of all properties at the restricted location. A temporary emergency response plan may be required if a complete road closure results in a delay in emergency response travel time of more than one-minute from the nearest PF&R fire station. Traffic flagging operations which limit the flow of traffic shall at no time restrict fire apparatus access to property locations. The PF&R Deputy Chief of Special Operations or their designee will review and approve all required emergency response plans.

1.14 SCHOOL ZONES OR ROUTES

Work zone operations near schools require consideration to ensure that children walking, and student transportation conflicts are kept to a minimum. Provide notification of all planned work activities to the school principal so that work times can be coordinated with the school schedule to minimize conflicts with children. Issues that should be considered include:

- Student path to and from the school
- Bus movements for loading and unloading students
- Coordination with crossing guards
- School hours to minimize impacts
- Parent pick-up and drop-off areas and routes

1.15 LIGHT RAIL TRANSIT TRACKS

A Track Access Permit is required for work within 5 feet of the trackway or 10 feet of the overhead contact wire of the Light Rail Transit (LRT) tracks. Contact Portland Streetcar or TriMet (See Table 1.) to obtain a permit in addition to the City's street use permit approval process. A track access training certificate may be required. All personnel should have attended TriMet's Roadway Worker Protection (RWP) training and have in their possession a current RWP card.

The overhead catenary electrical system should be considered live and hot (energized) always. In situations where it is required to remove power, electrical power removal should be confirmed in the field with the designated power personnel.

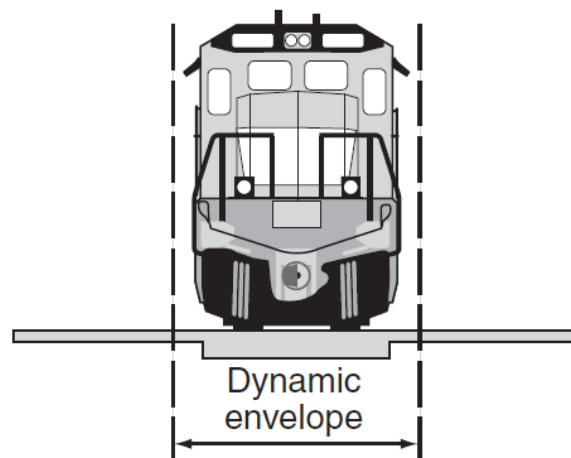


Figure 1.1 Dynamic Envelope

Unsecured fences are prohibited adjacent to LRT. Fences may be secured atop barriers so long as they do not encroach into the dynamic envelope of the train. Any damages caused by the trucks, materials or equipment encroaching into the dynamic envelope are the responsibility of the contractor and may require train repair.

The use or impact to parking spaces adjacent to streetcar requires special consideration to prevent encroachment into the dynamic envelope of the streetcar. Remove parking adjacent to streetcar unless the entire parking space and furnishing zone is completely accessible. Do not place trucks, materials, or equipment adjacent to streetcar without providing a barrier to maintain separation.

1.16 WORK AND LOADS ABOVE ACTIVE STREET

Workers

Avoid work above an active street. Whenever work is being performed over the street, close that portion of the street to public access. For instance, when working on a traffic signal, close the lane under the signal to all traffic. For work above a sidewalk, use either a pre-fab tunnel (i.e., Conex box) or scaffolding with catchment. The boom of a boom lift (such as on a Genie or JLG) may be used above an active sidewalk, but only with a spotter to stop pedestrian traffic when necessary. Areas directly under the bucket (cage), or where debris, materials, or tools may potentially fall, shall be closed to pedestrian access.

Loads

When lifting a load over a street, close the street to the public. For tower cranes, the jib (working arm) may be over an active street, but when lifting a load all affected traffic (vehicles and pedestrians) shall be closed during this period. For mobile cranes, no traffic is allowed under the load or the boom. These closures shall be identified as part of the TMP or TCP.

1.17 PROTECTION OF EXISTING TRAFFIC SIGNS AND DEVICES

Protect all existing traffic signs and devices, including pavement markings, regulatory, warning, and guide signs. Do not tear down, cover up, block from view, or otherwise remove signs from their location except as directed by the Traffic Engineer. See Section 2.11, Sign and Signal Covers, for approved devices and protocol.

If a permanent sign must be temporarily relocated, the sign shall be adequately mounted, placed as near as possible to the original locations, and remain clearly visible to approaching traffic without creating a traffic hazard as approved by the Traffic Engineer.

Damaged, missing, or improperly located STOP, YIELD, or ONE-WAY signs shall be replaced or relocated immediately. Provide manual traffic control from the time at which the problem is noted until the time at which it is corrected.

Maintain at least one set of existing street name signs at each intersection at all times during construction to provide positive route identification and information to emergency responders.

1.18 PROTECTION OF EXISTING TRAFFIC SIGNALS

Traffic signal poles, cabinets and junction boxes should be protected throughout construction. Traffic signals are intended to provide safe crossings for all users including people in mobility devices and should be operational when practical. Maintain access to and around all signal and street lighting infrastructure, including signal cabinets, poles, and lighting panels. Provide at least six feet of clearance both front and back of signal cabinets and lighting panels unless otherwise approved by the District Signal Engineer. See Section 2.11, Sign and Signal Covers, for approved devices and protocol.

In cases where signals need to be turned off, the contractor should contact SSL Scheduling per Section 1.7 *Night Flagging* of this Manual.

At unattended work zones, cover traffic signal faces not in operation. Always cover pedestrian signals not in operation. When traffic signal modifications are required, notify SSL Scheduling per Section 1.7 of this Manual. Workers should exercise caution to prevent damage to all existing traffic signal equipment. If traffic signal equipment is damaged, immediately notify SSL Emergency, as shown in Table 1., so that necessary repairs can be performed, and the traffic signals can return to normal operation.

Whenever a contractor will cut or excavate into the street, a street opening permit and utility notification (one-call locate) is required. SSL electricians will locate all existing electrical conduit in orange paint and provide conditions of approval. Conditions may require signal timing adjustments, a loop replacement plan, or temporary traffic signal detection. Temporary traffic signal detection may require the implementation of a microwave radar (Wavetronix or approved equal) or another detection type (as approved by District Signal Engineer). If a video detection unit is to be used, communication to the unit should be provided, so remote troubleshooting can be completed.

1.19 TEMPORARY LIGHTING

Do not alter, remove, adjust, or otherwise impact street lighting equipment without approval from the District Signal/Lighting Engineer. Whenever temporary lighting is required, maintain existing lighting levels, as approved by the District Signal/Lighting Engineer in a temporary lighting plan. The applicant may be required to submit a photometric analysis justifying that lighting levels meet City guidelines.

1.20 TRAFFIC CAMERAS

The Traffic Engineer may require cameras be installed at significant projects to aid with vigilance regarding traffic operations and safety. Commonly, cameras can be accessed electronically, and can archive data from a period for later review by the Traffic Engineer. Typically, large construction sites employ cameras around the site as a theft deterrent, and to monitor work operations, and at times, the Traffic Engineer can be given access to those cameras instead of requiring independent cameras be installed. Camera mounts on SSL equipment are possible and can be discussed with the SSL Division by contacting the District Signal/Lighting Engineer.

1.21 TRANSPORTATION MANAGEMENT PLAN (TMP) AND TRAFFIC ANALYSIS

Per the federal Work Zone Safety and Mobility Rule (23 CFR 630, Subpart J), *significant projects* are required to develop and implement a TMP, or Transportation Management Plan. PBOT defines a significant project as one with sustained work zone impacts to *busy* streets, or to sidewalks on *non-busy* streets for more than four weeks.

A TMP is used to document and track critical design and implementation decisions made over the course of a project. Referring to and using the contents of the TMP, the TCP can be developed to minimize traffic delays and improve safety for all road users and construction workers. Documented decisions, stakeholder partnership agreements, and previously-explored staging options can all be recalled during construction if a proposal is made to modify the TCP, staging or construction schedule that might compromise the integrity of those decisions or the TCP.

The TMP, and amount of detail within it, is relative to the scope of work – the more complex the project, the more details and information should be included in the TMP. Examples of documented details include:

- Scope of work for individual stages;
- Staging alternatives (rejected and advanced);
- Specific materials, equipment needs or construction techniques;
- Critical timeframes or constraints;
- Summary of traffic signal, vehicle detection, and street lighting modifications;
- Traffic analysis data and impact scenarios in addition to the more obvious TCP-related issues, stakeholder agreements, public notification strategies, project site conditions/restrictions, constructability concerns, budgetary compromises and other issues should also be included in the TMP.

For all significant projects, the TMP should include the following:

- **A temporary Traffic Control Plan (TCP)**
- **Transportation operation strategies** – Efforts to minimize or mitigate traffic congestion, delay, volumes, peak hour surges, etc., during construction. When impacting the capacity of an existing signal, collect peak-hour turning movement counts and perform a traffic analysis in Synchro. Provide all count data and Synchro files to District Signal/Lighting Engineer.
- **Public Information and Outreach (PI) campaigns** – Communication strategies to notify affected stakeholders and the traveling public, and inform them of project schedules, changes, alternate routes and mobility options.

1.22 OUTDOOR ADVERTISEMENT

Outdoor advertisement is prohibited from being displayed from the right-of-way at work zones. This includes scrim sheeting with advertisements placed on construction fencing located at the curb line. Private advertisements and other signs along the National Highway System are expressly prohibited per ORS 377.

1.23 MOBILITY NOTIFICATION

Whenever construction or maintenance work will close or restrict the width, length, height or weight of trucks within a work zone on a highway or ramp, a Highway Restriction Notice Form should be completed.

Restrictions or closures on ODOT facilities should be submitted to the Motor Carrier Transportation Division 35 days prior to the restriction beginning. The highway restriction notice form and procedures manual is available at:

<https://www.oregon.gov/odot/ProjectDel/Pages/Mobility.aspx>

Restrictions or closures on PBOT facilities should be submitted to PBOT Over Dimension Permits 10-14 days in advance of the restriction at:

www.tsup.info

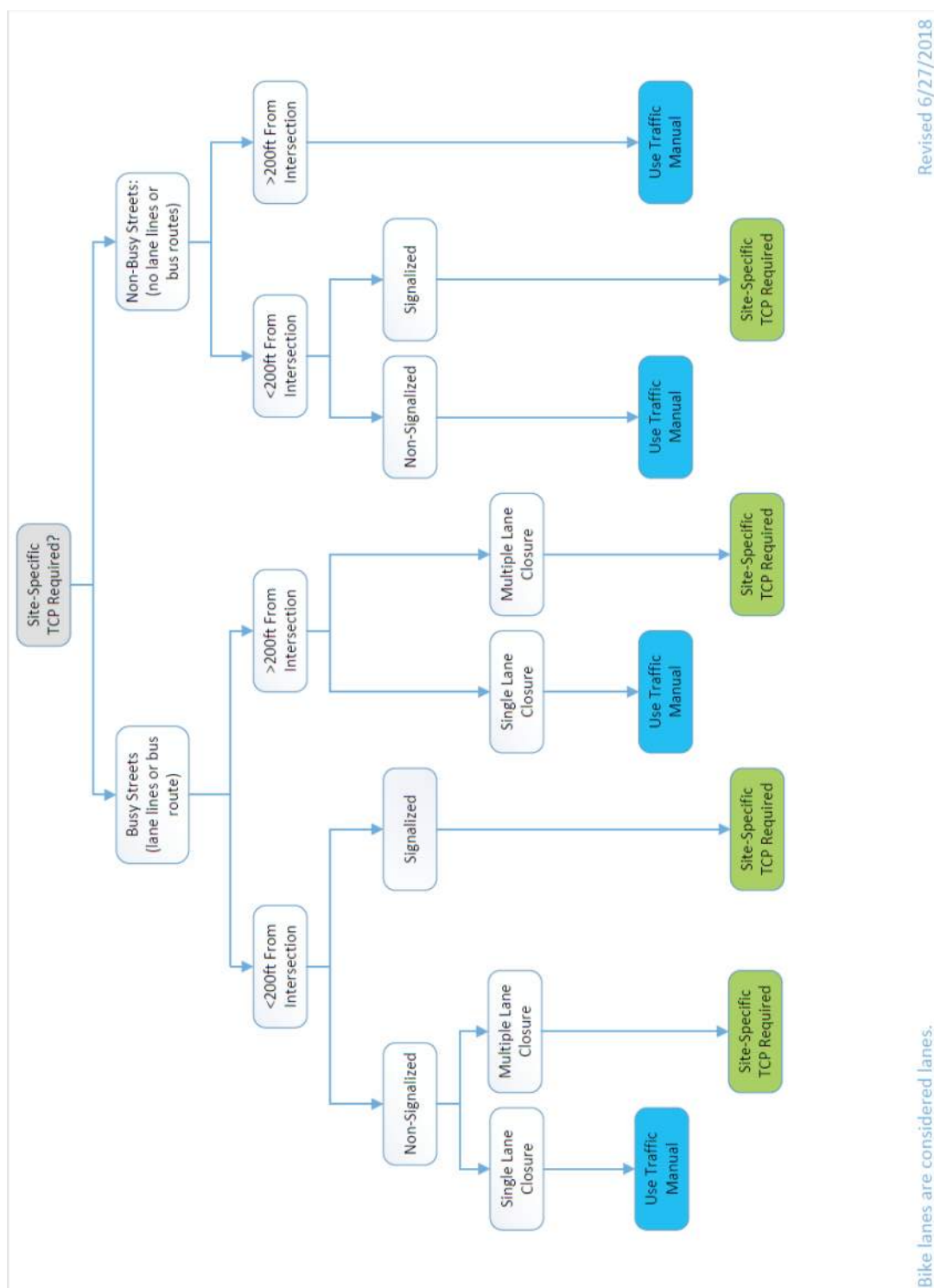


Figure 1.2 Site-Specific TCP Flowchart

2 Traffic Control Devices

2.1 PURPOSE AND PRINCIPLES OF TCD

Traffic control devices shall be defined as all signs, signals, markings, channelizing devices, or other devices that use colors, shapes, symbols, words, sounds, 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.

The needs and control of all road users (pedestrians, bicyclists, transit, and motorists) open to public travel including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA) through a temporary traffic control zone shall be an essential part of any construction, utility work, maintenance operations, and the management of traffic incidents.

The primary purpose of Traffic Control Devices (TCD) is to provide for the safe movement of traffic through or around the work zone. Safety for roadway users and workers within the work zone is enhanced through uniform usage of TCD. Temporary traffic control devices are used to regulate, warn, and guide. TCD used in work zones should exhibit the following characteristics:

- Fulfill a need
- Command attention
- Convey a clear and simple meaning
- Command respect from the road user
- Give adequate response time

TCD that are not needed for the current conditions within the work zone should be turned away from traffic, covered, or removed from the roadway. Maintain all TCD to the "Acceptable" category shown in the ATSSA "Quality Guidelines for Temporary Traffic Control Devices and Features" handbook.

2.2 SIGNS

Warning signs in work zones **shall** have a black legend and border on an orange (or fluorescent orange) background except for emergency response which may use a fluorescent pink background. All signs used at night **shall** be retroreflective. Use type VIII or IX sheeting for aluminum, plywood, or other substrates. Use type VI sheeting for roll-up signs.

Signs should be placed so that neither the sign nor support restrict bike lanes or sidewalks to less than 4 feet in width; for this reason, 48-inch warning signs are typically prohibited except on *high-speed* streets (35mph and faster). Along roads with bike lanes adjacent to the curb with

curb-tight sidewalks, or other locations where typical sign placement may restrict sidewalks, bike lanes, paths, or vehicle lanes, consider the following:

- Place sign behind the sidewalk.
- Adjust sign spacing so that the sign can be placed behind the sidewalk.
- Install the signs on an existing utility pole, street light pole, or other sign support with permission from the owner of the support.
- Install the sign on a new perforated steel tube sign support (PSST) with a flange base.
- Use more prominent devices (PCMS, Arrow Boards).
- Install the sign on a temporary sign support per ODOT Std. Dwg. TM821.



Figure 2.1 Typical Sign Supports

When signs are placed in a parking lane, parking should be removed in advance of the sign to provide a clear and unobstructed view by an approaching vehicle. Twenty feet of parking space should be removed in front of the sign along streets where the operating speed is 30mph or less. Forty feet of parking spaces should be removed in front of the sign along streets where the operating speed limit is 35mph or greater.

On one-way streets with two or more lanes, signs should be used on both the left and right sides of the street.

Signs should be removed from the road or covered when the condition they warn of is no longer in effect.

Roll-up signs or signs on portable sign supports may be used for 48 hours. Roll-up signs should not be mounted to vehicles. Sandbags may be used to weigh down portable sign supports; manhole riser rings or other devices may not be used as ballast.

For *long-term* work, signs should be mounted on a wood post, TSS, PSST, or barrier support. See ODOT Standard Drawing TM821, PBOT Standard Drawings P-400, P-405 & P-406. Pedestrian signs should be placed on Type II barricades, or Pedestrian Channelization Devices. The barricade(s) or channelization device may be secured to the sidewalk or asphalt so that they are not moved.

Install temporarily relocated STOP signs on a support approved for *long-term* work.

2.3 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. Because space is more constrained in the urban environment, narrower devices may frequently be chosen in lieu of more prominent, conspicuous devices. Contractors should choose devices that do not encroach into or block a sidewalk or bicycle lane. See below sub-categories for further details on channelizing devices.

When channelizing devices conflict with pavement markings, space the devices at no more than $\frac{1}{2} S$ feet, where S is the speed in mph. For example, when it is necessary to create a temporary center line on a 30mph street that is not consistent with the pavement markings, reduce the spacing between channelizing devices to 15 feet. Channelizing device spacing may also be reduced for night work, when shifting traffic, or when it is otherwise desirable to create a more conspicuous path for drivers to follow.

2.3.1 Barricades

Barricade rails consist of orange and white stripes sloping downward at an angle of 45 degrees in the direction road users are to pass. Select barricades from the CPL, or equal. When barricades are used to close a sidewalk, they should extend the full width of the sidewalk surface and include a detectable edging meeting the requirements of a pedestrian channelizing device.

2.3.2 Cones

Cones should not be used in unoccupied work sites, as they are prone to move in high wind. Cones should be 28 inches tall on *busy streets*. On lower classification streets, cones used only during daylight may be 18 inches tall. Cones used at night **shall** be at least 28 inches tall and retroreflective. All cones should have a weighted base and be capable of remaining upright and in place during normal traffic flow and wind conditions.

Cones shall not be used for pedestrian channelization nor to protect pedestrians from work areas.

2.3.3 Plastic Drums (Barrels)

Drums should be used in place of cones or tubular markers for merging tapers on *high-speed* streets. Drums may also be used where it is desirable to provide a more effective visual separation between the work area and active travel lanes. Two rubber ballast rings may be used to prevent drums from moving out of position due to winds.

For multi-lane roadways with a speed limit of 30 mph or greater that requires a travel lane to be closed overnight, drums **shall** be placed within any merge or shift taper to provide a larger area of retro-reflectivity for approaching vehicles.

2.3.4 Tubular Markers

Tubular markers should be at least 28 inches tall. Tubular markers used at night **shall** be at least 28 inches tall and retroreflective. Tubular markers are typically used to override existing pavement markings for temporary traffic control setup when it is not otherwise practical to provide clear delineation with pavement markings.

Surface-mount tubular markers should be used to restrict the movement of the device, or when a smaller base width is preferred (e.g. adjacent to a bike lane). Surface-mount tubular markers are preferred to tubular markers with weighted bases for *long-term* work.

Blue tubular markers should be used to delineate business accesses within a work zone.

Tubular markers shall not be used for pedestrian channelization nor to protect pedestrians from work areas.

2.3.5 Vertical Panels

Vertical panels are used to display narrow signs, as channelizing devices, and to replace barricades where space is limited. Vertical panels **shall** be at least 36 inches tall.

2.3.6 Pedestrian Channelizing Devices (PCD)

Longitudinal barricades meeting the ADA Standard may be used to provide a continuously detectable edge along a temporary pedestrian access route. When used in the street, PCDs should have retroreflective markings for enhanced visibility.

Pedestrian Channelizing Devices are not intended to function as a re-directive barrier. PCD products are typically made of light-weight, low-density, polyethylene (LDPE) plastic formed into either hollow or solid panel-style segments that can be moved by hand. Systems can be supported and ballasted using any combination of metal, plastic or recycled rubber legs or

bases, and ballasted using 20-lb sandbags or by filling some designs with small amounts of water or sand.

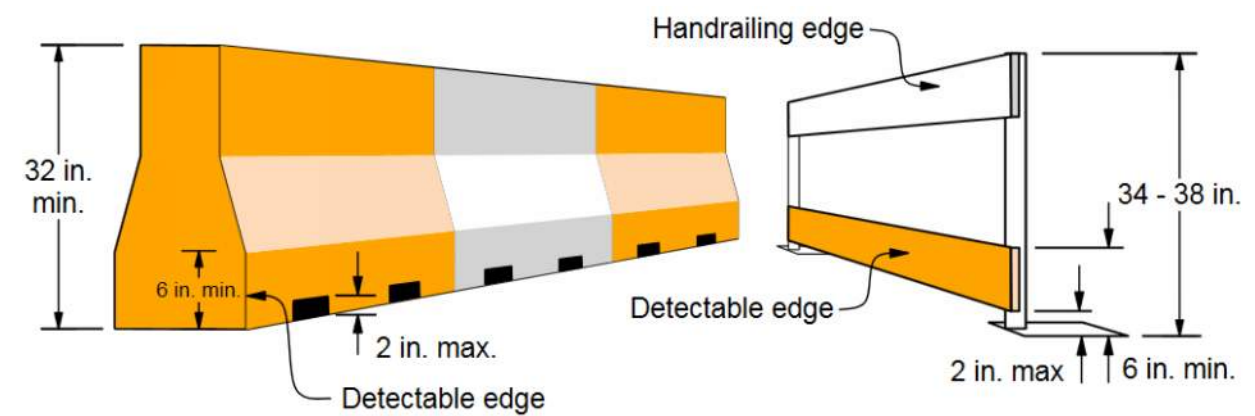


Figure 2.2 Typical Pedestrian Channelizing Devices

1. To prevent any tripping hazard, locate ballast and supports outside of the pedestrian route when not internal to the device.
2. Provide continuously detectable edges for long canes that extend at least six inches above the walkway surface and have color or markings contrasting with the walkway surface.
3. Do not block water drainage from the walkway. A gap height or opening from the walkway surface up to two inches is allowed for drainage purposes.
4. Objects may not protrude into the walkway clear space, except as allowed by the ADA Standard.
5. The minimum height is 32 inches.
6. When hand guidance is required, provide a continuous top rail or surface meeting the following specifications: be in a vertical plane perpendicular to the walkway above the detectable edge; be continuous at a height of 34 to 38 inches above the walkway surface; and be supported with minimal interference to the hands or fingers.
7. Remove all sharp or rough edges, and round all fasteners (bolts) to prevent harm to hands, arms or clothing.
8. Devices should interlock such that gaps do not allow pedestrians to stray from the channelized path.
9. Devices not allowed: caution tape strung between candlesticks, barricades, cones, or other objects.

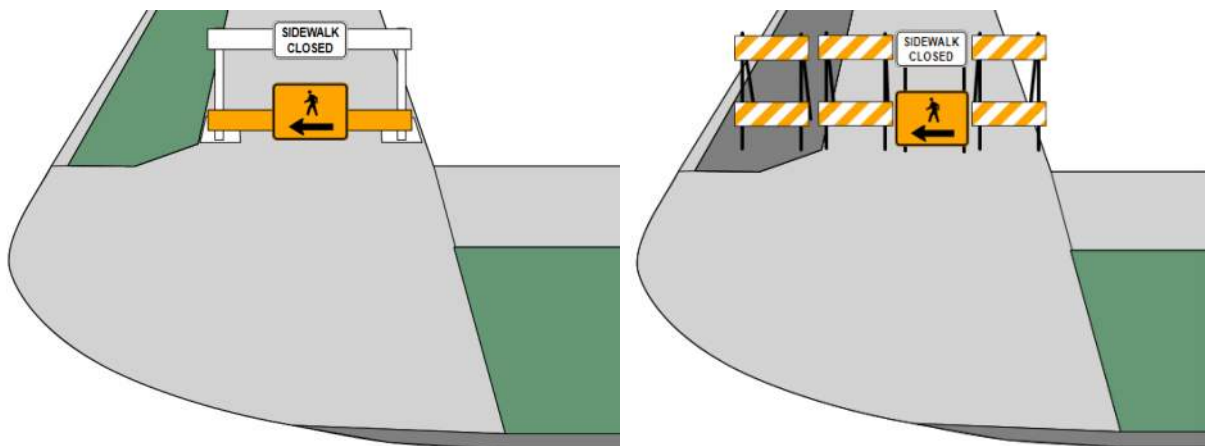


Figure 2.3 PCD or Type II Barricades for Sidewalk Closure

2.3.7 Bicycle Channelizing Devices (BCD)

Longitudinal devices designed primarily to separate bicycles from the workspace. These devices may be used between an auto lane and a multi-use path or where bicycles will not need to merge with auto traffic to execute a turn or other movement.

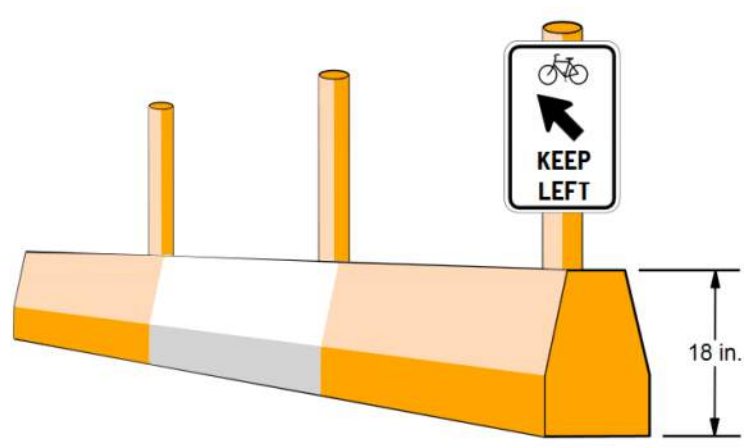


Figure 2.4 Typical Bicycle Channelizing Device

2.4 TEMPORARY PAVEMENT MARKINGS

Paint should be used for temporary pavement markings applied with a stencil, e.g. bicycle symbols, lane use arrows, words. Paint should also be used for lane line markings for long-term work more than two weeks where tape or flexible pavement markers will require frequent replacement. Four-inch wide lines may be used to simulate permanent lines, except for crosswalk markings, which **shall** be at least six inches wide.

Non-removable tape should be used only when the pavement surface will be removed or overlaid, however, paint is more commonly used to save costs.

Temporary, removable, reflective preformed tape may be used instead of paint for temporary crosswalk striping, as it provides the same function, is easily removed, and does not damage the roadway surface or leave "ghost" markings. Remove temporary crosswalk markings in a manner that is not destructive to the pavement, to the method and satisfaction of the Traffic Engineer, else grind and inlay the entire crosswalk.

Temporary, removable, non-reflective preformed (blackout) tape should be used to cover conflicting existing pavement markings. In situations where blackout tape is not performing well, black paint may be used so long as it is regularly maintained to completely cover existing pavement markings.

Temporary flexible pavement markers may be used for temporary lane line markings and crosswalks. These devices are typically used when the roadway will be opened to traffic following grinding or paving in advance of permanent pavement markings. Do not use temporary flexible pavement markings for more than two weeks without replacement. For skip lines, place three single markers spaced five feet apart to simulate a 10-foot skip line with a gap of 15 feet to the next. For solid lines place a single marker spaced 10 feet apart. Marker colors **shall** match the color of the line they are simulating.

2.5 TEMPORARY CURB RAMPS

Temporary curb ramps should be used along accessible routes to transition people from the sidewalk to the street surface. A sample is shown below, with detail requirements. Handrails are required for ramp runs with a rise greater than six inches. All Temporary Curb Ramps shall meet the requirements and guidelines of ODOT Std. Dwg. TM845 "Temporary Sidewalk Ramps".

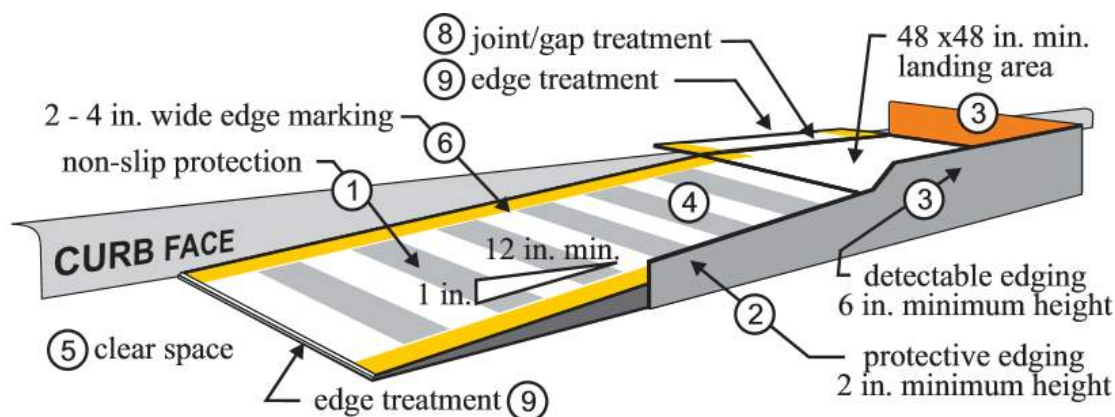


Figure 2.5 Temporary Curb Ramp Parallel to Curb

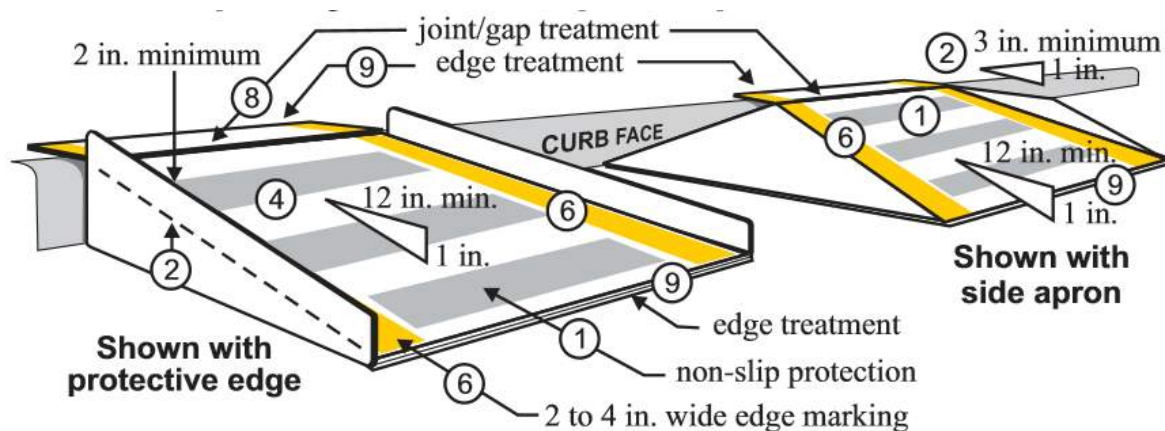


Figure 2.6 Temporary Curb Ramp Perpendicular to Curb

1. Curb ramps are required to be at least 36 inches wide with a firm, stable, and non-slip surface.
2. Handrails are required for ramp runs with a rise greater than six inches.
3. Edge protection with a two-inch minimum height is required for ramps with a rise greater than six inches or a side apron slope greater than 33 percent.
4. Edge protection is required on ramps with a vertical elevation over six inches and show a contrasting color where the walkway changes direction (turns).
5. Curb ramps and landings are required to have a two-percent maximum cross slope.
6. Provide a clear space of at least 48 inches by 48 inches above and below the curb ramp.
7. Mark the curb ramp walkway edge with a contrasting color two to four inches wide unless color-contrasting edging is used, as required by item 3 above.
8. Water flow in the gutter should have minimum restriction.
9. Limit lateral joints or gaps between surfaces to be less than half an inch wide.
10. Changes between surface heights should not exceed half an inch. Lateral edges should be vertical up to 0.25 inches high and beveled at 1:2 when between 0.25 and 0.5 inches high.

2.6 DETECTABLE WARNING DEVICES

Detectable warnings are required to alert people with vision impairments of their approach to a street crossing or hazard. They are used where pedestrian and vehicle routes cross.

Install temporary truncated domes across the entire width of a TPAR at locations where pedestrians are entering an environment shared with motorized traffic, such as at crosswalks and construction entrances. See section 00759.12 of the CPL for a list of acceptable devices.

Temporary guide strips or directional surfaces may be used where vertical detectable devices, such as PCDs, cannot be otherwise used. For example, traffic lane separators may be used to separate a multi-use path from an auto lane.



Figure 2.7 Temporary Curb Installation as Detectable Edging

2.7 LIGHTS AND LIGHTED SIGNS

2.7.1 Beacons

Vehicle-mounted high-intensity rotating, flashing, oscillating, or strobe lights (beacons) may be used on work vehicles to provide advance warning of a potentially hazardous situation. Because they do not inform road users of the nature of the hazard, they should be used only as a supplemental warning device or when it would otherwise be more hazardous to implement more explicit traffic control measures. Only vehicles operated by police officers may be equipped with blue lights.

2.7.2 Warning Lights

Warning lights are portable, powered, yellow, lens-directed, enclosed lights. Do not add warning lights to any channelization device (drums, barricades, etc.)

2.7.3 Arrow Boards

Arrow boards may be used in conjunction with other delineating devices on multi-lane roads to help warn of lane closures requiring merging of travel lanes. Arrow boards shall only be used to indicate a lane closure. Do not use an arrow board to indicate a shift in traffic. Arrow board panels should be 6 feet wide by 3.5 feet tall. Place arrow boards outside of active automobile and bike lanes. If there is not additional room on the shoulder, place the arrow board within the closed travel lane.

Arrow boards shall be placed for any lane closure left overnight requiring traffic to merge on roadways with speeds of 30 mph or higher.

An arrow board in the arrow or chevron mode **shall** be used only for lane closures on multi-lane roadways not to indicate a lane shift. When arrow boards are used to close multiple lanes, a separate arrow board **shall** be used for each closed lane. Vehicles displaying an arrow board **shall** be equipped with beacons.

2.7.4 Flood Lights

Floodlights should be used during night operations to illuminate the work space, equipment crossings, and other areas as required to perform the work. Floodlights **shall** not produce a disabling glare for approaching road users, flaggers, or workers.

2.7.5 Portable Changeable Message Signs

Portable Changeable Message Signs (PCMS) **shall** conform to the requirements of the MUTCD and the ODOT PCMS Handbook (https://www.oregon.gov/ODOT/Engineering/Docs_TrafficEng/PCMS-Handbook.pdf). PCMS messages should be no more than two panels. PCMS panels should be 6 feet wide by 3.5 feet tall.

Continuous use of PCMS can desensitize roadway users and should be limited to alert users of changes. PCMS are typically used to alert road users to a new condition and may not be required for the entire duration of a *long-term* project. For example, install PCMS one week in advance of major roadway impacts, and remove PCMS after implementation of the TCP. If there will be a second phase of the project with new roadway impacts, install the PCMS again for two weeks with a new message.

2.8 SHADOW AND PROTECTION VEHICLES

A *shadow vehicle* is used as a warning and traffic control vehicle in a mobile work zone. Shadow vehicles provide both the advance warning and lane or shoulder closures for a mobile work zone.

A *protection vehicle* may be used in stationary or mobile operations to protect the workers and work activity.

Shadow and Protection Vehicles are strategically placed to protect the workers and work activity and to warn traffic of the operation ahead. A Truck-Mounted Attenuator (TMA) may be used on either vehicle (see Truck-Mounted Attenuators). If using shadow or protection vehicles, flashing warning lights should be installed on or attached to all vehicles, where practical. Electronic arrow boards in “caution” mode mounted to shadow or protection vehicles may be used to supplement flashing warning lights.

The protection vehicle is placed after the buffer space. For stationary operations, the vehicle should be at least 30 feet in advance of the work space. For mobile operations, the vehicle should be at least 50 feet in advance of the work space. Do not place the vehicle so far in advance of the work space that road users drive around the protection vehicle. Protection vehicles should have a mass of at least 27,000 lbs. on *high-speed* streets, and 17,000 lbs. on all other streets to reduce the likelihood that it rolls ahead into the work zone in a crash.

2.9 BARRIERS

Steel and concrete barriers may be used to provide positive protection or channelization. Select barriers from the CPL, or equal. TL-1 approved devices may be used for operating speeds up to 30mph. TL-2 approved devices may be used for operating speeds up to 45mph. Barriers used for a merging taper **shall** be delineated.

Barriers may move upon impact, thus, either all obstructions should be removed from the expected lateral deflection area behind the barrier or the barrier should be pinned to the road surface. Connect barriers together so that they function as designed. Protect blunt ends with impact attenuators, or flare away from traffic toward the curb at a rate consistent with ODOT standard drawing TM800 until the barrier is outside of the clear zone.

Table 2.1 Barrier Taper Rates from ODOT Std. Drg. No. TM800 (as of 06/1/2023)

| CONCRETE BARRIER FLARE RATE TABLE | |
|--|---------------------------|
| ★ SPEED (mph) | MINIMUM FLARE RATE |
| ≤ 30 | 8:1 |
| 35 | 9:1 |
| 40 | 10:1 |
| 45 | 12:1 |

Narrow-site impact attenuators may be used in lieu of barrel-arrays in constrained environments. Barriers should be reflectorized with type VIII or IX reflective panels.

There are many longitudinal channelization devices that resemble barriers. These devices are not designed to prevent a vehicle from entering the work area. Plastic water-filled barricades do not provide positive protection for pedestrians or workers. Such devices typically have a posted decal to identify that they do not provide positive protection.

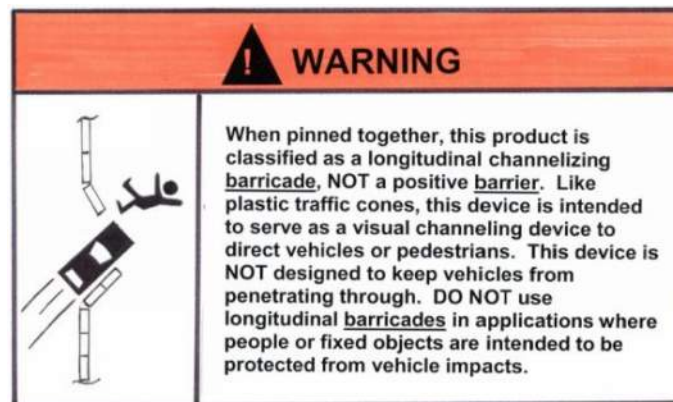


Figure 2.2 Typical Barricade Decal

2.10 TRUCK-MOUNTED ATTENUATORS

Truck-mounted attenuators (TMAs) are crash cushion systems that lower the severity of a collision an errant vehicle. TMAs are mounted on protection vehicles or trailers towed by protection vehicles and located to protect workers within the work area. Consider the manufacturer's rating when choosing equipment for any job site. When traveling to or from the work site, the TMA **shall** be in an upright position. When used, the attenuator should be in the full down and locked position. See section 00226.23 of the PBOT Standard Specifications for further details regarding TMA's.

2.11 SIGN AND SIGNAL COVERS

Covers for signs are required to be of sufficient size and density to completely block out the message so that it is not visible either during the day or at night. Securely fasten covers to prevent movement caused by wind action. Devices listed on the CPL may be used to cover signs.

Traffic signal heads, including pedestrian signal heads, are required to be covered with a product that is specifically designed to cover the signal. Coverings should be canvas and display the legend "NOT IN SERVICE" in contrasting lettering.

3 Flaggers and Training

3.1 FLAGGING AND OTHER TRAFFIC CONTROL MEASURES

A variety of Traffic Control Measures (TCM) may be used to control traffic through one-lane, two-way work zones. Flagging, pilot cars, portable signals and Automated Flagger Assistance Devices (AFAD) are effective devices.

Flagging operations are typically used when one direction of a roadway is closed, and traffic shares the remaining lane in an alternating manner. When flagging, accommodate all road users, including non-motorized users. Flaggers can also be used to hold traffic for truck entering or exiting the activity area, and to assist pedestrians and bicyclists through the work zone.

Additionally, take special care whenever a work zone causes traffic to backup up to and/or across a rail crossing.

3.2 FLAGGING QUALIFICATION

Flaggers, who have completed formal training and have certification in Oregon, Washington, Idaho, or Montana, may practice as a Certified Flagger in Oregon. Training **shall** be repeated every three years.

3.3 FLAGGING PRINCIPLES

- Flaggers **shall** be used only when other traffic control methods are inadequate to safely guide traffic through a work space or assure the safety of workers.
- Do not control traffic by flagging in conflict with normal intersection traffic control. Only uniformed police officers may control traffic by flagging in conflict with traffic control devices under Oregon law (ORS 811.265). Traffic cannot be flagged to proceed through a traffic signal when facing a red traffic signal light or STOP sign, nor flagged to stop when the traffic signal is green except in an emergency. In rare circumstances, with approval of the Traffic Engineer, flaggers can be used to hold traffic during a green light, so long as there is a separate flagger for each lane of traffic, and they begin to hold vehicles during the red phase of the signal.
- For work which requires traffic signal to be turned off or modified, flagging shall continue until the signal is back in operation or until alternative traffic control is in place.
- Under normal conditions, vehicles should not be delayed longer than five minutes at the flagger station. In emergency situations or for clearing the road in operations such as blasting, longer delays may be allowed with advance signing and Traffic Engineer approval. Every effort should be made through media communications to alert the public of long delays.

- Flaggers should provide priority to busses, and clear busses from queueing traffic to minimize rider delays.
- Flaggers should lead out pedestrians and people riding bikes and allow them to clear the work space before allowing auto traffic to proceed.
- Flagger should not be used to slow traffic.

To slow traffic on *high-speed, high-volume* streets, consider using PCMS messages, tighter channelization device spacing, additional static signing, or other mechanical measures. Use of a TMA may provide additional protection for workers where it is difficult to slow traffic.

3.4 FLAGGER STATION PRACTICES

Under normal operating conditions:

- Flagger stations **shall** be located such that approaching road users will have sufficient sight distance to be able to stop at the intended stopping point;
- Flagger stations should be kept clear of all equipment and vehicles;
- Flaggers should identify an unobstructed escape route to avoid errant vehicles;
- Flagger stations should include one to three cones on the shoulder in front of the flagger station to enhance the visibility of the flagger station;
- Flaggers should stand within closed lanes or on the shoulder;
- After stopping the first few vehicles, flaggers may move from the shoulder to near centerline to be more visible to approaching traffic;
- Flaggers should stand alone, never permitting a group of workers to congregate around the flagger station.

3.5 FLAGGING SIGNS & EQUIPMENT

The Flagger Ahead (CW23-2) sign **shall** be placed in advance of flaggers.

The FHWA Standard Highway Signs (SHS) Flagger symbol sign (W20-7a), showing a flagger holding a flag instead of a STOP/SLOW paddle, should not be used. The Flagger Ahead (CW23-2) sign and the BE PREPARED TO STOP (W3-4) sign **shall** be removed, covered or turned away from traffic when flagging is not being done. Flags on portable signs **shall** also be removed or turned down.

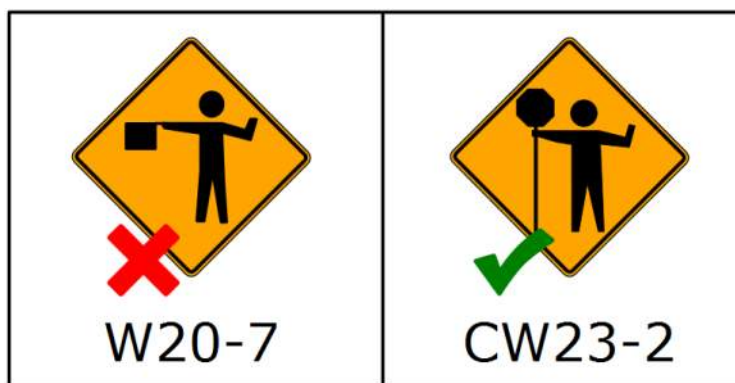


Figure 3.1 Incorrect and Correct Flagger Warning Signs

Extended traffic queues can form when a line of vehicles stopped at the beginning of a work zone extend beyond the initial warning sign. When extended queues repeatedly develop, install additional ROAD WORK AHEAD (W20-1) and BE PREPARED TO STOP signing upstream of the beginning of the traffic queue in accordance with the sign spacing table shown in Appendix A.

- Flaggers **shall** use a minimum 18-inch by 18-inch octagon-shaped retro reflective STOP/SLOW paddle. The paddle **shall** be made of a rigid material and the full face of the STOP and the SLOW sides **shall** be visible and legible whenever the paddle is in use. A 24-inch by 24-inch paddle is recommended on *high-speed* streets or in other situations where increased visibility is needed. Roll-up STOP/SLOW paddles are only for emergency use.
- Do not use a flag to control traffic, except in an emergency.
- Flaggers **shall** use only those hand signals approved as shown in the MUTCD, Figure 6E-3.
- If using a staff or extended handle for the STOP/SLOW paddle, the bottom of the sign should be above the flagger's eye level. Equipment or other objects attached to the staff **shall** be secured and not allowed to hang freely or loosely. Do not tie clothing to the staff.

3.6 FLAGGING THROUGH INTERSECTIONS

Other traffic control measures (e.g. full closures with detours) that minimize impacts to the normal operation of the intersection should be considered to accommodate the work. Concepts applicable to all intersections include:

- Contact the Traffic Engineer to determine what closures or detours can be set up.
- Avoid flagging during *peak hours*, especially on major commuter routes.
- There should be one flagger for each approach, and sometimes one flagger for each movement on one approach (i.e. left turn lane and through lane). One flagger may be

used to control the entire intersection if the intersection has a total approach volume less than a *low volume* road (<400ADT). Additional flaggers may be required to direct pedestrian traffic.

- With multiple flaggers, designate one as the lead flagger. Effective means of communication, such as radio devices, should be used.
- Approach lanes should be reduced to a single through lane, or one flagger for each lane will be needed. Consider closing lanes that are not a major movement, such as right turn lanes with only occasional use. Consider prohibiting left turns if there is work or obstruction within the intersection.
- Dedicated lanes may be provided for major turning movements with appropriate regulatory signing such as RIGHT TURN ONLY (R3-5) or RIGHT LANE MUST TURN RIGHT (R3-7) signs. Non-conflicting turning movements may be combined with other movements.
- Conflicting regulatory signs, such as STOP, YIELD or RIGHT TURN ONLY, **shall** be covered.

3.7 NIGHT FLAGGING

When flaggers and/or pilot cars are necessary during night operations, flagger stations **shall** be illuminated separately from the work space. ANSI Class III high visibility safety apparel should be worn during night operations.

Nighttime Flagger illumination strategies should include the following.

- Select flagger station lighting from the CPL. Locate lighting on the same side of the roadway as the flagger, shield from traffic, and illuminate the flagger from 18 feet \pm 3 feet.
- Place the flagger station lighting to direct the lighting away from the approaching traffic in the near lane at approximately a 15° horizontal angle \pm 10° perpendicular to the centerline of the roadway.
- Aim all the luminaries directly at the flagger.
- Increase the output wattage or number of luminaries as the luminance from, and number of, surrounding and background lights increases. Do not provide a total output of more than 2,500 watts, unless otherwise directed.
- The flagger should be visible and discernible as a flagger from 1,000 feet.
- When flagging-station lighting is in use, have on the project site, the following:
 - Repair equipment and electronic components recommended by the manufacturer.
 - At the beginning of each shift, have approved backup flagger station lighting available for immediate use in event of failure.
 - Sufficient fuel to maintain continuous operation of a diesel generator.

- For low volume roads and emergencies, where there is no room for the light equipment on the shoulder, the flagger illumination may be stationed on the roadway. Consider using the following to increase visibility during night flagging:
 - LED lights on the STOP/SLOW paddle, as allowed by the MUTCD;
 - Using a 24-inch by 24-inch STOP/SLOW paddle;
 - Adding two-inch-wide diagonal bands of alternating white and red retro reflective sheeting on the staff of the STOP/SLOW paddle;
 - Lighted safety apparel.

3.8 FLAGGING ON BRIDGES AND OTHER STRUCTURES

Avoid locating flagger stations on a bridge, viaduct or other roadway section where there is no feasible escape route. When possible, move flagger stations to the ends of bridges to provide an escape route. Where an escape route is not available, include a *buffer space* between the Flagger and the *work space*.

3.9 SPOTTERS

A spotter's duty is to provide immediate warning of approaching vehicles, equipment, or other hazards to co-workers, assist with construction equipment backing maneuvers, and help pedestrians or people biking through the work zone when a temporary route cannot be provided. A spotter is not a flagger. Do not use a spotter to stop automobile traffic.

Prior to the beginning of a shift, the spotter and operators should agree on hand signals and positioning to perform backing operations.

4 Traffic Control Measures

4.1 GENERAL DESIGN CONSIDERATIONS

4.1.1 Work Protections Guiding Principle

Traffic control measures implemented should be proportional to the scope of the work. For example, pothole repair will more often utilize beacons and a short taper of cones than warning signs and arrow boards. Thus, select measures that reduce worker exposure and adequately warn, regulate, and guide road users.

4.1.2 Implementing the Temporary Traffic Control Plan

Operations to set up and take down traffic control often are the times when crews are at their greatest exposure. Due to the multiple variations of crew size, available equipment and location, no one procedure can fit all situations. To provide consistency and guidance on how to best perform the operation, the following steps should be taken:

- Prior to any operation beginning and before any crew member is exposed to live traffic the crew will discuss the daily pre-activity safety plan involving the activity with the crew leader or lead flagger.
- Within the pre-activity safety plan, discussion regarding the procedure for the setup and take down operation for the traffic control is to be decided and all crew members will be fully aware of their duties and what is expected of them.
- The traffic control plan being implemented for the work operation will be discussed and any modifications to the plan will be noted by the supervisor and the plan will be onsite during work operation.

4.1.3 Adjust to Fit Field Conditions

Typical taper lengths and sign spacing may vary depending upon site conditions. If the work is near a crest curve or hill that hinders sight distance additional warning signs may need to be added. If the work is in an urban area, additional warning signs may be required on multiple approaches to the work zone.

Adjustments to device and sign spacing may be required when working on Portland's 200-foot blocks or in commercial districts where available curb space is limited. Rather than remove parking to provide adequate sight distance to warning signs, consider placing signs in nearby locations without conflicting parking, such as downstream from a crosswalk or driveway.

4.1.4 Lane Requirements

Motorized vehicle travel lanes should be maintained to 10 feet minimum where no vertical obstruction exists unless otherwise required for emergency responders as indicated in section

1.13, or busses as indicated in section 4.4. There may be instances such as in freight districts where 11'-12' lane widths may be required.

4.1.5 Shy Distance and Buffer Space

Shy distance is the lateral distance from the edge of the traveled way beyond which a roadside object will not be perceived as an immediate hazard by the typical driver to the extent that the driver will change the vehicle's placement or speed. At least one foot of shy distance should exist from low, fixed objects such as curbs. At least two feet of shy distance should exist from vertical objects greater than one foot tall, such as barriers, fences, dumpsters, or crane outriggers. Thus, wherever practical, an existing 10-foot lane should be increased to an 11-foot lane when adjacent to a curb, or 12-foot lane when adjacent to a barrier.

Buffer space is a lateral or longitudinal area that separates road user flow from the work space or an unsafe area and might provide some recovery space for an errant vehicle. Lateral buffer space provides space between the driver and the active work space, traffic control device, or to a potential hazard such as an abrupt lane edge or drop-off. At least two feet of lateral buffer space should separate traffic from the work zone. Devices used to separate the driver from the work space should not encroach into adjacent lanes. If encroachment is necessary, it is recommended that the adjacent lane be closed to maintain the lateral buffer space. In the case of lane closure operations, the adjacent lane may need to be closed, or traffic may need to be temporarily shifted onto a shoulder to maintain a lateral buffer space. Longitudinal buffer is the space between the end of the taper and the buffer vehicle or active work zone. Longitudinal buffers should be provided when space is available but are optional.

4.1.6 Night Time Operations

Night time can pragmatically be defined as any time where street lights are on. On clear days, this can include civil twilight, approximately one hour before dawn and after dusk. Working at night time when there is less traffic on the road can be the only practical way to accomplish some work tasks. Any time drivers require the use of their headlights for visibility is considered "night-time conditions." Use the following basic principles for adjusting your traffic control for night-time operations.

1. Use enough lighting to provide a safe environment in the work zone. Avoid creating glare for oncoming traffic.
2. All TCDs **shall** be retro reflective, including signs, channelization devices, and flagger STOP/SLOW paddles.
3. All TCDs and worker safety apparel should be kept in good condition, without damage or graffiti, and provide sufficient reflectivity to be visible from 1000 feet.
4. Pedestrian diversions, detours, and vehicle lanes adjacent to sidewalk closures should be adequately lit.
5. In residential areas, avoid aiming work space floodlights into homes or yards.

6. For information on flagging at night, see the Flagging Section.

4.1.7 Mobile Work

Mobile work zones include planned work activities that last up to 60 minutes at any one location. Due to the short work time, the time it takes to set up a full complement of signs and devices could approach or exceed the time required to perform the work, so simplified traffic control measures can reduce worker traffic exposure. Mobile work may reduce worker exposure to traffic hazards by using larger, more mobile equipment instead of smaller devices.

Examples of mobile work zone operations include, but are not limited to:

- Loading and unloading equipment
- Striping
- Re-lamping
- Pothole patching and other minor repairs
- Surveying
- Bridge inspection
- Field reconnaissance
- Pre-work layout
- TTC placement and removal
- Sanitation pickup
- Street sweeping
- Pavement marking
- Traffic signal and sign maintenance.

Although these are very short duration activities, always consider the key work zone elements. High worker exposure locations dictate the traffic control measures. It is recommended to apply more work zone safety measures if the level of safety can be raised without adding to worker exposure time. Working in teams of two, where one worker can act as a spotter from a safe location, is a good example of an additional safety measure. The workers' ability to maintain awareness of traffic conditions and potential hazards is a key concern.

For work vehicles that travel slowly or stop for brief periods, display at least the following based on the time at each location:

- **Up to 15 minutes:**
 - Vehicle hazard warning lights.
 - One beacon.
- **16 to 60 minutes:**
 - Short taper of cones (at least 50 feet long with six 28-inch-tall cones).
 - Vehicle hazard warning lights.

- One beacon.
 - One advance warning sign, arrow board or portable changeable message sign.
- Any Duration Lane Closure on *High-Speed Streets*:
 - Mobile truck-mounted impact attenuator
 - Truck-mounted Arrow Board

Locate beacons and arrow boards so that they always remain in full view, front and rear, and are not obscured by dump beds, mounted equipment, trailers, or work activity. Mount arrow boards seven feet from the ground to the bottom of the board, except when installed on vehicles, where they should be mounted as high as practicable.

When a work vehicle will stop on a sidewalk and block the pedestrian route, provide a spotter to assist pedestrians through the work zone.

When a work vehicle will stop in a bike lane, place an appropriate warning sign, such as BIKE LANE CLOSED AHEAD, 50 feet in advance of the work zone, and/or BIKES MERGE WITH AUTOS. Do not use The BICYCLES ON ROADWAY sign, or some other variant, as they are confusing and not acceptable within the City of Portland.

Mobile work zones are not permitted within or adjacent to existing active work zones without prior approval from the Traffic Engineer, and a plan to adjust TCM to adapt to the mobile work.

4.1.8 Steel Plating

All steel plating required within a travel lane, bike lane, and/or pedestrian walkway must meet the requirements of City of Portland Standard Construction Specifications Section 00275 - Trench Protection.

4.1.9 Shifting and Merging Through Intersections

Traffic may be shifted laterally through an intersection if minimum shifting tapers can be maintained in accordance with the MUTCD. Shifting tapers should begin before the intersection to give vehicles positive guidance as to the direction of the shift. Consider temporary skip markings through the intersection, particularly when shifting on multilane roadways. Check turning movements, especially the paths of left-turning vehicles, to ensure that vehicles will be able to make turns without conflicting with stopped vehicles on a cross-street.

Merging two travel lanes into one **shall** be done either before or after an intersection.

When lanes are shifted at signalized intersections the angle of view to the traffic signal should be within the angle required in MUTCD (20 degrees left and right of center). Consideration should be given for traffic signal detection, as sensors may not function as designed. See 1.18, Protection of EXISTING Traffic Signals.

4.1.10 Heavy Rail Crossings

If the queuing of vehicles across active rail tracks cannot be avoided, flaggers **shall** be provided to prevent traffic from stopping within 15 feet on either side of the rail, even if automatic warning devices are in place. When sufficient downstream storage becomes available, and there are no approaching trains, the flaggers may release traffic. The TCP should be specific about the expected flagging operation and the city crew, inspector, or other project representative should talk to the flagger(s) on site prior to the work zone implementation to discuss the flagging operation.

Roadway Worker Protection (RWP) Safety Training may be necessary for any work zones in proximity of a rail crossing. The implementation and oversight of RWP training is handled by each railroad. Accordingly, contact a carrier before beginning work to determine how the railroad's specific training is to be accomplished.

4.1.11 Use of Police Officers

Uniformed law enforcement officers and marked law enforcement vehicles should be considered in special cases where their presence can reduce the overall complexity of TCP and increase road user's compliance in complex situations. Because only police officers may flag traffic against an active traffic signal (ORS 811.265), police have been used in special events and community events based on engineering judgment.

The Portland Police Association may provide an opportunity for a permittee to hire off-duty officers. The Portland Police Association (PPA) may be contacted at 503-225-9760.

4.2 PEDESTRIAN ACCOMMODATIONS

When existing pedestrian facilities are disrupted, closed, or relocated in a TTC zone, the temporary facilities **shall** be detectable and include accessibility features consistent with the features present in the existing pedestrian facility. Accommodate pedestrians in accordance with Bureau of Transportation Administrative Rule TRN-8.12, Safe Accommodation for Pedestrians and Cyclists in and Around Work Zone. When an existing walkway or sidewalk is disrupted or closed, a diversion should be implemented rather than a detour. Detours should not last more than three days on a *busy street*, or one week on other streets. A pedestrian route may be given priority over parking, bicycle, and vehicle lanes.

4.2.1 Priority

The method for providing safe accommodations for pedestrians should be prioritized as follows:

- A. Maintain the existing pedestrian route and provide protection from the worksite.
- B. Provide a temporary pedestrian route in a parking lane and protect it from adjacent traffic.

- C. Provide a multi-use path in an existing bike lane (eight-feet minimum).
- D. Provide a pedestrian route in an existing bike lane, protect it from traffic, and merge cycles with traffic on streets with operating speeds of 30mph or less.
- E. Provide a pedestrian route in an existing traffic lane.
- F. Provide a pedestrian detour route.

4.2.2 Accessible Route Standards

The following technical standards apply to accessible routes:

- Six-feet minimum unobstructed width, ideal width.;
- Five-feet minimum unobstructed width, acceptable width.;
- Eight-feet minimum unobstructed width where e bicycle traffic is expected to share with people walking;
- The route may be reduced to 36 inches for no more than 200 feet, with Traffic Engineer approval;
- The route may be reduced to 32 inches for no more than two feet around fixed objects, with Traffic Engineer approval;
- Two-percent maximum cross slope;
- 80-inches minimum overhead clearance (or 96-inches for a multi-use path);
- The route should be continuously detectable and free of obstructions such as temporary fence support legs, signposts, and scaffolding;
- Barricades used to close the sidewalk should span the entire width of the walkway surface.

Do not use caution or warning tape to delineate the path of travel or create a barricade. Use only approved pedestrian channelizing devices (PCDs) or barricades and other devices meeting the requirements of a PCD to close a pedestrian route or prevent pedestrians from entering an area.

Barriers, barricades, fences, or PCDs should be used to separate pedestrians from hazards, including excavations, open utility access, overhanging equipment, or other such conditions. Install detectable edging or PCDs between accessible routes and travel lanes along streets with operating speeds less than 35mph. Consider barriers to provide positive protection to pedestrians along streets with operating speeds greater than 30mph.

Accessible routes should be continuously detectable and safely guide pedestrians back to the original sidewalk or walkway. Detectable edges should be provided along the bottom of any obstacles, such as signs or barricades. See section 2.3.6 of this manual for specifications.

When an accessible route is transitioned to a surface with a different elevation, such as from the sidewalk to the parking lane, the route should cross the transition at right-angles.

4.2.3 Short-Term Impacts

If an existing sidewalk or walkway is impacted by *short-term* work that is attended by workers, establishing an accessible route may not be necessary if the work can be stopped and pedestrians can navigate the work zone safely. When an accessible route extends through an active work zone, it is the permittee's responsibility to maintain a safe passage. Pedestrians may be held for a short period for project personnel to move equipment and materials to facilitate passage. Project personnel may also assist people with disabilities through the work zone. Pavement markings or temporary tactile warning devices may be placed on the sidewalk and additional warning signage may be used to alert pedestrians of the beginning of a work zone.

4.2.4 Closing Crosswalks

When an existing crosswalk is closed, the entire width of the crosswalk should be closed with a, PCD, multiple Type II Barricades, or barrier. In instances where such a measure would obscure viewing angles for intersection traffic, smaller devices such as type II barricades, may be used.

At signalized intersections, cover existing pedestrian signal heads on both sides of the closed crosswalk. Access to the pedestrian push buttons for traffic signals or pedestrian hybrid beacons should be maintained in all cases unless the contractor has approval from SSL to set the traffic signal on pedestrian recall. The maximum reach requirement for a pedestrian push button is 10 inches per the ADA Standard.

4.2.5 Temporary Marked Crosswalks

Temporary marked crosswalks or crossing enhancements should not be installed without the support of an engineering study. Such a study should consider the volume of pedestrians and automobiles, the distance between the curbs, a gap distance analysis, vehicle speed, pedestrian walking speed, and observed use. The use of the methods outlined in NCHRP 562 is a currently acceptable practice before a decision is made whether to install a marked or enhanced crosswalk. Curb parking **shall** be prohibited for at least 50 feet in advance of a temporary midblock crosswalk. Parking should be prohibited for at least 20 feet in advance of a temporary marked crosswalk at a legal crossing. Temporary marked crosswalks should be installed based on the current guidelines and design criteria listed in section 1.2.3 of the Portland Traffic Design Manual, Crosswalks.

Temporary crosswalk pavement markings should be installed per section 2.4.

4.3 BICYCLE ACCOMMODATIONS

Accommodate bicycles in accordance with Bureau of Transportation Administrative Rule TRN-8.12, Safe Accommodation for Pedestrians and Cyclists in and Around Work Zone. When an existing bicycle lane or path is disrupted or closed, a temporary bicycle facility should include the features and characteristics present in the existing facility. For example, if a bike lane will be

closed, a temporary bike lane should be created to guide bikes past the work zone, rather than closing the bike lane. Temporary bicycle facilities may be given priority over parking and general-purpose auto lanes on a multilane road, as determined by the Traffic Engineer. Bicycles should be separated from automobile traffic whenever possible. In situations where it is not feasible to provide an exclusive bicycle facility, bicycles should be directed to a facility shared with pedestrians (e.g. a temporary pedestrian route, or a sidewalk) before being directed to share a travel lane with automobile traffic.

4.3.1 Priority

The method for providing safe accommodations for cyclists should be prioritized as follows:

- A. Provide a temporary bike lane on the same roadway past the work zone by shifting and narrowing the adjacent traffic lanes.
- B. Provide a temporary bike lane in an existing traffic lane on multilane streets.
- C. Merging cyclists and adjacent traffic into a shared travel lane (except on *high-speed* streets).
- D. Directing cyclists onto a shared path with pedestrians.
- E. Provide a bicycle detour route.

4.3.2 Bike Lane Standards

Do not merge bikes with autos on streets with operating speeds of 35mph and greater.

Maintain four-foot wide temporary bicycle lanes. The Traffic Engineer may approve temporary bike lanes as narrow as three feet wide. When there is insufficient roadway width to maintain a separate bicycle and automobile lanes, mitigations should be made with relevant traffic control measures, e.g. advisory speed zone, warning signage, bike route detours, or auto detours.

4.3.3 Multi-Use Path Standards

A temporary multi-use pedestrian/bicycle path (MUP) should be maintained to a minimum width and vertical clearance of eight feet. Separate the path from the work space in accordance with 4.2.2, Accessible Route Standards. When the path is located on the roadway surface, separate it from automobile traffic with barriers, BCDs, or detectable edging. Give proper notice to bicycles, pedestrians, and vehicles regarding a change in use to a shared route.



Figure 4.1 Shared Facility Signs

4.3.4 Work Space Protections

People riding bikes will frequently ride behind a line of channelizing devices, such as cones, when they do not perceive a hazard, even if it is not safe to ride in the work space. To prevent cyclists from entering the work space, place appropriate regulatory signs, as shown in

Figure 4.2, along the work space following access points and at regular intervals throughout a longer work zone as a reminder bicycle traffic. Caution tape or cone bars may also be used to prevent bicycles from encroaching into the work space. Temporary ramps can be used to maintain the bike lane over temporary hoses and bypass pipes.



Figure 4.2 Bicycle Regulatory Signs



Figure 4.3 Bicycle Work Space Protections

4.3.5 Bike Facilities on Streets with Tracks

Do not shift bicycle into lanes with parallel rail tracks. When shifting or merging traffic into a lane with parallel rail tracks, plan an alternate route for bikes that is smooth and free of tracks or other obstructions which may be hazardous to bicycles.

Bike routes should be directed to cross tracks at an angle of at least 60 degrees. A perpendicular crossing of 90 degrees is ideal. Do not cross cyclists over tracks within a curve, as bicycles must be able to cross tracks fully upright and not leaning. When bike lanes will be transitioned across tracks, warning signs should be used to alert people on bikes of the hazard. Some examples of such signs are shown below.

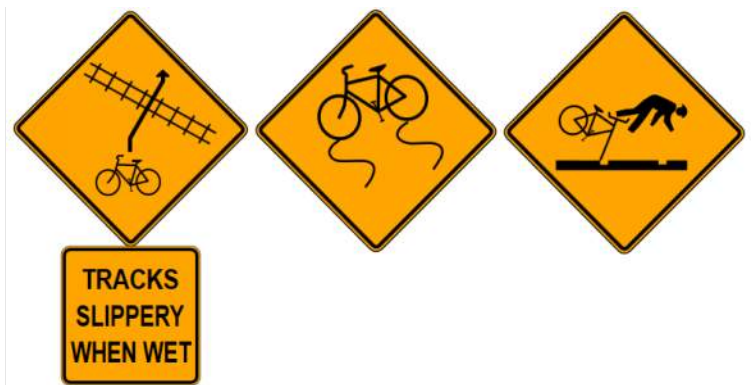


Figure 4.4 Warning Signs for Bicycles Near Rail

4.4 TRANSIT ACCOMMODATIONS

Visit ride.trimet.org to identify current bus routes and stops potentially impacted by the work. When an existing bus stop is disrupted or closed, a temporary bus stop will be considered by TriMet. Contact TriMet early to address impacts and mitigations. Temporary bus stops should be given priority over parking.

TriMet buses require a minimum width of eleven feet to travel through a work zone. The newest busses (Gillig 3000 series and later) are 10.66 feet, including mirrors. When busses operate in lanes less than eleven-feet wide, they must straddle adjacent vehicle, buffers, or bike lanes. Physical constraints less than eleven feet precludes bus service and requires a bus detour or route closure. Because bus routes have priority over parking and construction worker convenience, bus detours should only be implemented as a last resort after parking removal and work hour changes have been considered.

4.5 BUSINESS ACCOMMODATIONS

Use BUSINESS ACCESS (CG20-11) signs based on engineering judgment. Specific business names (e.g. "Chevron", "Burger King", "Fred Meyer", "Woodburn Factory Stores", "Washington Square", etc.) **shall not** be used on BUSINESS ACCESS signs or riders. Use blue plastic tubular markers with blue reflective bands to delineate the radii for all affected business accesses. Use blue BUSINESS OPEN AHEAD signs in advance of businesses that have been isolated by an adjacent sidewalk closure which has eliminated pass-by traffic.

4.6 COVERED WALKWAYS

Whether overhead protection is required for an accessible route is determined based on the Oregon Structural Specialty Code (2010 OSSC Section 3306.7). Table 3306.1 from the OSSC is shown below for reference.

Table 4.1 OSSC Overhead Protections Excerpt

| TABLE 3306.1 PROTECTION OF PEDESTRIANS | | |
|---|--|-----------------------------|
| HEIGHT OF CONSTRUCTION | DISTANCE FROM CONSTRUCTION TO LOT LINE | TYPE OF PROTECTION REQUIRED |
| 8 feet or less | Less than 5 feet | Construction railings |
| | 5 feet or more | None |
| More than 8 feet | Less than 5 feet | Barrier and covered walkway |
| | 5 feet or more, but not more than one-fourth the height of construction | Barrier and covered walkway |
| | 5 feet or more, but between one-fourth and one-half the height of construction | Barrier |
| | 5 feet or more, but exceeding one-half the height of construction | None |

For SI: 1 foot = 304.8 mm.

4.7 LANE CLOSURES AND DETOURS

Lane use changes should be clearly marked to direct the traveling public through a safe route. Traffic volumes should be considered whenever closing lanes, as drivers may not anticipate extended traffic queues. Where extended queues are expected, install warning signage upstream of the expected 95th percentile queue length.

Do not detour *busy street* traffic through non-*busy streets*, unless approved by the Traffic Engineer. Whenever implementing long-term detours, consult the District Signal/Lighting Engineer concerning signal timing adjustments.

Detour signs should have street name rider plaques placed above the detour signs. Include advance detour signs, e.g. NEXT LEFT, DETOUR RIGHT, along detour routes in advance of decision points that require lane changes and slowing to safely follow the route.

4.8 WORK ZONE SPEED REDUCTION

Under some circumstances, it may be necessary or advantageous to implement a temporary speed reduction through a work zone. Speed zones are not enforceable unless an official Speed Zone Reduction Order is approved and signed by the City Traffic Engineer. Temporary speed zone reductions **shall** be implemented in accordance with ORS 810.180(8).

In general, construction speed zone reductions are not warranted under the following conditions.

- Activities which are more than ten feet from the edge of the traveled way
- Activities which require an intermittent or moving operation on the shoulder

National Cooperative Highway Research Program (NCHRP) study 581/482 provides conditions under which temporary speed zones may be warranted. Below are combinations of ODOT and

NCHRP conditions which are considered when evaluating requests for temporary reduced speed zones.

- A high crash rate within the work zone.
- Workers present for extended periods within 10 feet of the traveled way unprotected by barriers.
- Traffic control devices encroaching on a lane open to traffic or within a closed lane but within 2 feet of the edge of the open lane that can't be moved to a safer location.
- Barrier or pavement edge drop-off within 2 feet of the traveled way.
- Horizontal curvature with a safe speed of 10 or more mph lower than the posted speed.
- Reduced design speed for detour or transitions (radius of curvature, super-elevation and sight distance) when the distance between restrictions is less than $\frac{1}{4}$ mile.
- Lane width reductions of 1 foot or more with resulting lane width less than 10 feet.
- Unusual conditions which are hard to sign or otherwise communicate to travelers effectively.

Work zone speeds are signed with a fluorescent orange Speed Reduction (W3-5) sign followed by a WORK ZONE (G20-5ap) above a SPEED LIMIT XX (R2-1) sign, as shown below. This will more clearly identify that it is a temporary speed zone.

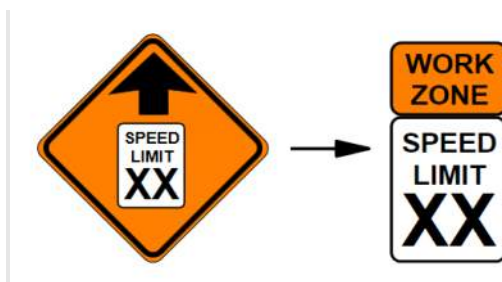


Figure 4.5 Speed Zone Reduction Signage

Include the following in a temporary speed zone order:

- the affected roadways,
- the beginning and ending location of the speed zone order measured in feet from the nearest cross-street,
- the temporary construction zone speed,
- the dates the order is in effect,
- the reason for the speed zone order.

Speed zone orders should be sent to ODOT State and Region 1 Traffic Division, and acting Captain of the Portland Police Bureau Traffic Division.

There are non-enforceable alternatives to warn of conditions that warrant reduced speeds, including:

- Advisory Speed (W13-1) riders below warning signs;
- ROAD WORK XX MPH (CW20-1a);
- Curve (W1-2a) with an advisory speed included on the sign face.



Figure 4.6 Warning Signs with Advisory Speeds

Advisory speeds **shall** only be used where an engineering study determines the need to advise drivers of an advisory speed for a condition. Advisory speed plaques **shall** be fluorescent orange and in 5 mph increments. The speed displayed on the sign should be determined through engineering judgment and have Traffic Engineer approval.

Avoid creating a temporary situation that would require an advisory speed of more than 10mph below the pre-construction posted speed. Reducing the posted speed of a facility through a Temporary Speed Zone reduction or by signing an advisory speed does not constitute a reduction in the design speed for traffic control measures or the traffic control plan.

Glossary

ACCESSIBLE ROUTE

An accessible route is a continuous, unobstructed path specifically designed to provide access for individuals with disabilities, including those using wheelchairs or mobility devices. Accessible routes **shall** conform to the ADA Standards.

ADA STANDARDS

The 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design and, if any, supplemental ADA standards for application within the public right-of-way, as adopted by the US Department of Justice and US Department of Transportation.

BUSY STREET

Streets with either lane markings or on a transit bus route.

BIKEWAY

A generic term for any road, street, path, or way that in some manner is specifically designated for bicycle travel, regardless of whether such facilities are designated for the exclusive use of bicycles or are to be shared with other transportation modes. As a general guide, any city street or path with bicycle lanes, "sharrows", or other bicycle amenities can be considered a bikeway.

CENTRAL BUSINESS DISTRICT (CBD)

The Special Traffic Control District as defined by Portland City Code chapter 17.23. This is generally the area bounded by the Willamette River and I-405, with some exceptions.

CENTRAL CITY

The urban center with the densest population of people. The Central City stretches from the West Hills to SE 12th Avenue, and from the Lloyd and Pearl districts to Powell Boulevard and South Waterfront.

CITY FORCES

Bureau of Transportation, Portland Water Bureau, and Bureau of Environmental Services employees performing repair and maintenance, and Portland Parks & Recreation employees performing tree trimming and mowing operations in the right-of-way.

CITY TRAFFIC ENGINEER

The City Traffic Engineer is designated by the City Administrator with duties defined in Portland City Code chapter 16.10.200.

CONSTRUCTION PRODUCTS LIST (CPL)

A list of devices pre-approved for use as prescribed in Standard Specifications.

CONTRACTORS

Persons other than city forces. For example: utility contractors, development contractors, people under contract with the City, the public.

DISTRICT SIGNAL/LIGHTING ENGINEER

Traffic Engineer working for the SSL division who is responsible for managing the operation and maintenance of the traffic signals, street lighting, and Intelligent Transportation System (ITS) within a geographical district.

HIGH SPEED STREET

Road with an operating speed of 35 MPH or greater.

HIGH VOLUME STREET

Road with traffic volume greater than 5,000 AADT (Annual Average Daily Traffic).

Rule of thumb: if volumes are unknown, count the number of vehicles in both directions that pass a single reference point in five minutes between 7am and 6pm. If more than fifty vehicles, the road can be considered a high-volume road for establishing temporary traffic controls.

LOW VOLUME STREET

Road with automobile traffic volume less than 400 AADT (Annual Average Daily Traffic), and not designated on the State or National Highway System.

Rule of thumb: if volumes are unknown, count the number of vehicles that pass a single reference point in five minutes between 7am and 6pm. If less than three vehicles, the road can be considered a low volume road for establishing temporary traffic controls.

PEAK HOURS

Generally, 7am to 9am and 4pm to 6pm Monday through Friday.

Peak hours may vary depending on location such as freight districts and industrial districts. All hours will be reviewed and approved by the Engineer.

PERMITTEE

Contractor or City forces working in the right-of-way, permitted through a general or specific permit approved by the City Traffic Engineer or designee.

PORTABLE CHANGEABLE MESSAGE SIGN (PCMS)

A traffic control device that can display a variety of messages to inform motorists of unusual driving conditions. A PCMS is housed on a trailer or on a truck bed and can be deployed quickly for meeting the temporary requirements frequently found in work zones or accident areas.

SIGNIFICANT PROJECT

A project with sustained work-zone impacts to *busy streets*, or to sidewalks or *non-busy streets* for more than four weeks.

SIGNALS AND STREET LIGHTING (SSL)

The Signals, Street Lighting, Intelligent Transportation System (ITS) and maintenance division of PBOT.

SPOTTER

A spotter is an employee whose sole duty is to provide immediate warning of approaching vehicles, equipment, or other hazards to co-workers. A spotter is not a flagger.

STREET

Street includes all elements of the public right-of-way, including the travel, turn, and parking lanes, curb, and sidewalk.

TEMPORARY TRAFFIC CONTROL PLAN (TCP)

A plan that describes the TCM to be used for facilitating road users through a work zone. TCPs range in scope from being very detailed to simply referencing typical plans contained in this Manual, or specific drawings contained in City of Portland contract documents.

TEMPORARY PEDESTRIAN ACCESSIBLE ROUTE (TPAR)

An area within a work zone, marked by signing, delineation and TCD, for the use of pedestrians to navigate through or around the work area.

TRAFFIC CONTROL DEVICES (TCD)

Devices used to regulate, warn, and guide traffic safely through a work zone. Some devices may be designed to protect the public or workers if a road user departs from the intended path of travel. Should copy our standard spec definitions, “Signs, signals, markings, and other devices placed on, over, or adjacent to a roadway to regulate, warn, or guide public traffic by authority of a public body or official having jurisdiction.”

TRAFFIC CONTROL MEASURES (TCM)

Tools and strategies employed to optimize the safety and effectiveness of the work zone for both road users and highway workers. TCM may range from a single traffic control device to a complex variety or sequence of devices, personnel, materials and equipment used to control traffic through a work zone. Change to language from standard specs to stay consistent, “Elements of the traffic control plan including, but not limited to, traffic control devices, personnel, materials, and equipment used to control public traffic through a work zone.”

TRAFFIC ENGINEER

Traffic engineering staff designated by the City Traffic Engineer to review temporary traffic control plans.

TRAFFIC INCIDENT

Any emergency, natural disaster or other unplanned event that affects or impedes the normal flow of traffic.

TRANSPORTATION MANAGEMENT PLAN (TMP)

A document that includes strategies to manage the work zone impacts of a project. A typical TMP will include a TCP, TPAR, address transportation operations, and public information and outreach components.

TRUCK MOUNTED ATTENUATOR (TMA)

An impact attenuator or crash cushion mounted on a construction vehicle that is designed to reduce damage to structures, vehicles, and motorists resulting from a collision.

WORK DURATION

The three categories of work duration and their time at a location are:

Mobile is work that occupies a location for up to one hour, moves intermittently or moves continuously.

Short-term stationary is work that occupies a location up to three days.

Long-term stationary is work that occupies a location for more than three days.

WORK 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.

WORK ZONE

An area identified by advanced warning where construction, repair, utility, or maintenance work is being done by workers on or adjacent to the street, regardless of whether workers are present. The work zone begins with the initial warning sign or traffic control change and ends at the last traffic control device or where traffic resumes normal operation.

Typical Applications

The typical applications herein represent traffic control measures that can be applied to a variety of scenarios. These illustrations are not backed by engineering analysis, or calculations. These typical applications should be used as standard details to quickly add detail to a specific project and may require modification by the project professional of record or Traffic Engineer. Specific situations, not specifically illustrated, need to be addressed making best use of the general principles described in this manual, the MUTCD, and these illustrations.

GENERAL

General Conditions, and Tables

Commonly Used Regulatory and Guide Signs

Commonly Used Warning Signs

SIDEWALKS

TA-S1 Diversions

TA-S2 Detours

TA-S3 Corner Ramp Working Hrs.

TA-S5 Corner Ramp Non-Working Hrs.

BIKE LANES

TA-B1 Low-Speed Bikes Merge with Autos

TA-B2 Low-Speed Autos Merge with Bikes

TA-B3 High Speed Bike Lane Closure

INTERSECTIONS

TA-I1 Left Turn Lane Closure

TA-I2 Interior Lane Closure

TA-I3 Exterior Lane Closure

TA-I4 Shift Through Shoulder/Parking

TA-I5 Shift through Left Turn Lane

TA-I6 Flagging

TWO-WAY STREETS

TA-T1 Half-Street Road Closure

TA-T2 Two-Way Left-Turn Lane Closure

TA-T3 Work in Center of Road

TA-T4 Shift through Two-Way, Left-Turn Lane

TA-T5 Shift over Centerline

TA-T6 Shift on Multilane Road

NON-BUSY STREETS

TA-L1 Road Closure on City Bikeway

TA-L2 Road Closure

TA-L3 Half-Street Closure

TA-L4 Flagging

TA-L5 Shift Over Centerline

TA-L6 Self-Regulating Lane Closure

ONE-WAY STREETS

TA-O1 Merge

TA-O2 Shift

TA-O3 Center Lane Closure

TA-O4 Street Closure

OTHER

TA-X1 Auxiliary Lane Closure

General Conditions for Typical Applications

- 1) All traffic control devices and measures must be placed per the MUTCD and may require adjustment to fit field conditions.
- 2) Traffic control measures must be implemented under the supervision of a competent person having a card or certificate indicating their completion of an approved work zone traffic control course.
- 3) Provide work notifications according to section 3.7.
- 4) When a project restricts the width, length, height, or weight of vehicles through a work zone or detours trucks around a work zone, Traffic Engineer approval is required.
- 5) Do not close any traffic lanes on busy streets between noon on the day before a legal holiday or holiday weekend and 11:59 p.m. on a legal holiday or the last day of a holiday weekend, except for Thanksgiving, when no lanes may be closed between noon on Wednesday and 11:59 p.m. on the following Sunday.

Table to Determine Distance Represented by Letter Codes Shown on Typical Applications.

| | Speed | Sign Spacing | | Buffer | Device | Taper Length (12ft lane) | | |
|---------------|----------|--------------|---------|--------|-----------|--------------------------|-------------|----------------|
| | S* (mph) | A (min) | A (max) | B | C** (max) | Merge (L) | Shift (L/2) | Shoulder (L/3) |
| LOW SPEED | 20 | 100 | 200 | 50 | 20 | 80 | 40 | 30 |
| | 25 | 100 | 200 | 75 | 25 | 125 | 65 | 45 |
| | 30 | 100 | 200 | 100 | 30 | 180 | 90 | 60 |
| HIGH SPEED | 35 | 200 | 350 | 100 | 35 | 245 | 125 | 85 |
| | 40 | 200 | 350 | 150 | 40 | 320 | 160 | 110 |
| | 45 | 200 | 500 | 180 | 45 | 540 | 270 | 180 |

All distances shown in feet.

* Pre-construction posted speed limit or statutory speed.

** Place traffic control devices on 10ft spacing within intersections, along access radii, and for channelizing bikes.

Formulas for Determining Taper Lengths

| 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































































REGULATORY SIGNS

| | | | | | | | | | | |
|------------------|------------------|--------------------|---------------------|---------------------|--------------------|-------------------|-------------------|-------------------|------------------|-------------------|
| | | | | | | | | | | |
| R1-5b 36"x36" | R2-1 30"x36" | R2-12 24"x36" | R2-6aP 24"x18" | R3-1 18"x18" | R3-2 18"x18" | R3-5 30"x36" | R3-5hP 30"x12" | R3-6 30"x36" | R3-6 30"x36" | R3-7 30"x30" |
| | | | | | | | | | | |
| R3-7a 24"x18" | R3-7a 18"x18" | R3-8 30"x30" | R3-8 30"x30" | R3-8 66"x30" | R3-17 24"x8" | R3-17aP 24"x8" | R3-27 18"x18" | R4-7 24"x30" | R4-7c 18"x30" | |
| | | | | | | | | | | |
| R4-9 24"x30" | R4-11 30"x30" | CR4-22a 12"x18" | CR4-22b 12"x18" | R9-6 12"x18" | R5-1 30"x30" | R5-1a 36"x24" | R5-2 24"x24" | R6-1 36"x12" | R8-8 24"x30" | OR22-7 24"x18" |
| | | | | | | | | | | |
| R9-9 24"x12" | R9-11 24"x18" | OR17-1 30"x36" | OR10-15a 42"x36" | OR10-15b 30"x30" | OR10-15 36"x30" | R11-2 48"x30" | R11-4 60"x30" | R11-3a 60"x30" | R1-2 36"x36" | R1-2aP 36"x30" |

GUIDE SIGNS

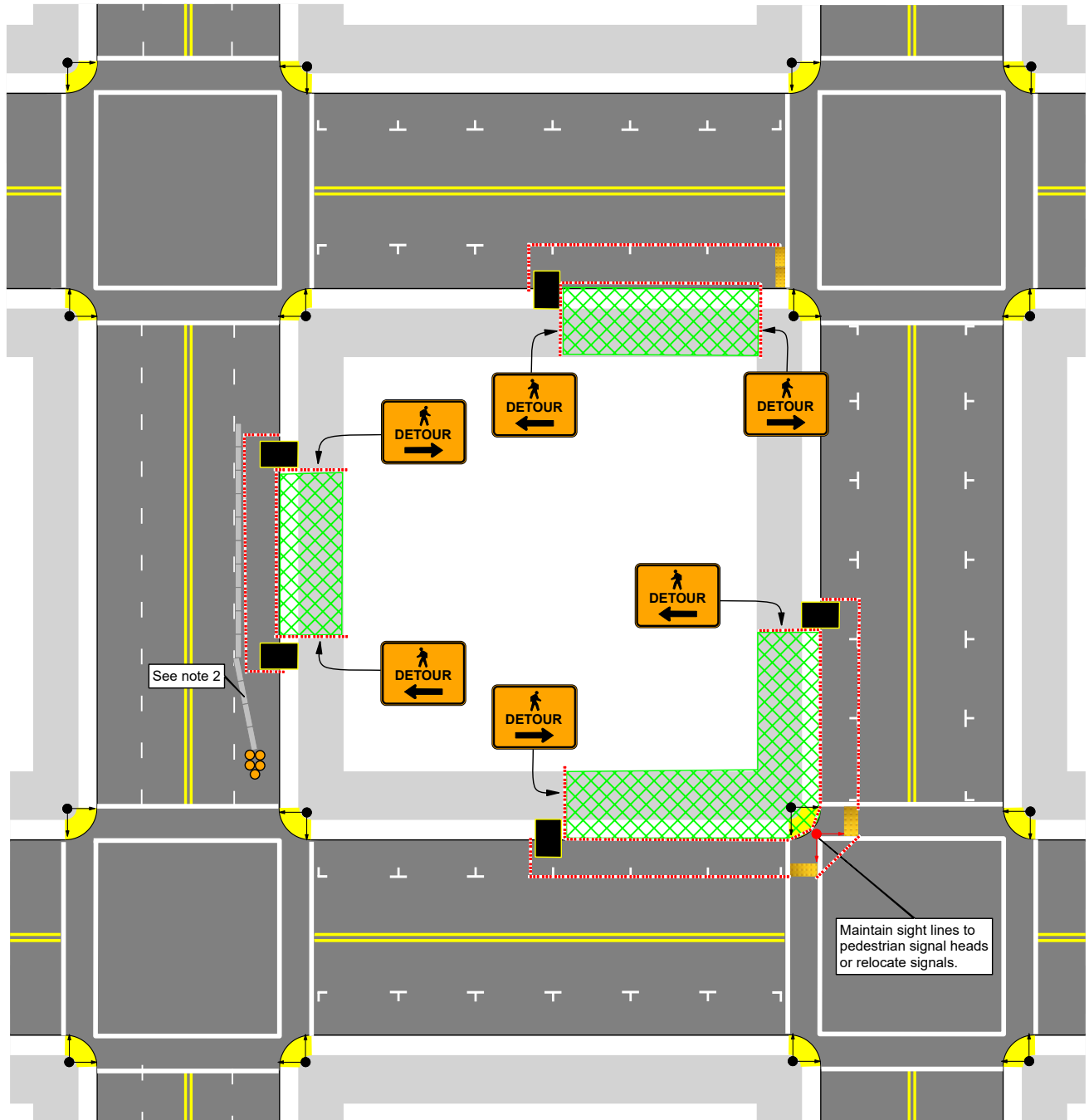
| | | | | | | | | | |
|--------------------|----------------------|------------------|--------------------|-------------------|-------------------|-------------------|------------------|-----------------|-----------------|
| | | | | | | | | | |
| CG20-11 24"x16" | D3-1 12"x30" | D3-1 12"xVar. | G20-5aP 24"x18" | M1-1 24"x24" | M3-1 24"x12" | M4-5 24"x12" | M5-1 21"x15" | M6-1 21"x15" | M5-4 24"x18" |
| | | | | | | | | | |
| M4-10 48"x18" | M4-8 24"x12" | M4-8a 24"x18" | M4-9 30"x24" | CG20-6 30"x36" | M4-9DR 30"x24" | M4-9AR 30"x24" | | | |
| | | | | | | | | | |
| M4-9a 24"x36" | M4-9a MOD 24"x36" | M4-9a 24"x18" | M4-9b 24"x18" | M4-9c 24"x18" | M4-9b 24"x18" | M4-9b 24"x18" | M4-9c 18"x24" | | |

WARNING SIGNS

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  |  |  |  |  |
| W1-1 36"x36" | W1-2 36"x36" | W1-3 36"x36" | W1-4 36"x36" | W1-6 48"x24" | W1-8 18"x24" | W4-1 36"x36" | W4-3 36"x36" | W6-3 36"x36" | W6-4 12"x18" | W12-1 36"x36" |
|  |  |  |  |  |  |  |  |  |  |  |
| W3-1 36"x36" | W3-2 36"x36" | W3-3 36"x36" | W3-5 36"x36" | W13-1 18"x18" | CW20-1a 36"x36" | W12-2 36"x36" | W24-1 36"x36" | W24-1a 36"x36" | W16-1P 24"x18" | W4-7 36"x36" |
|  |  |  |  |  |  |  |  |  |  |  |
| W8-3 36"x36" | W8-11 36"x36" | W8-15 36"x36" | W8-24 36"x36" | W8-1 36"x36" | W8-2 36"x36" | W5-1 36"x36" | CW21-7 36"x36" | OW15-1 36"x36" | W21-6 36"x36" | W23-2 36"x36" |
|  |  |  |  |  |  |  |  |  |  |  |
| W20-1 36"x36" | W20-1 36"x36" | W20-3 36"x36" | C19 36"x36" | W4-1 MOD 36"x36" | W4-1 MOD 36"x36" | W9-3 MOD 36"x36" | W9-3 36"x36" | W20-5R 36"x36" | W20-5L 36"x36" | CW20-5a 36"x36" |
|  |  |  |  |  |  |  |  |  |  |  |
| CW20-5aL 36"x36" | CW23-12 36"x36" | CW23-13 36"x36" | W20-2 36"x36" | OW22-15 36"x36" | W21-5 36"x36" | W4-2 36"x36" | W20-4 36"x36" | W3-4 36"x36" | CW23-2 36"x36" | C30 36"x36" |
|  |  |  |  |  |  |  | | | | |
| CW21-8B 36"x12" | CW21-8C 12"x24" | CW21-8A 24"x12" | W11-2 36"x36" | W16-7p 24"x12" | W16-9p 24"x12" | CW11-3 15"x9" | | | | |

Conditions:

- 1) This plan shows the pedestrian traffic control measures only. Additional traffic control measures may be required to manage vehicular traffic.
- 2) A barrier may be required for positive protection on high-speed or high-volume streets.
- 3) PCD's shall be interconnected and used on both the work zone side & travel lane side of the temporary walkway.
- 4) Attach pedestrian DETOUR signs to top rail of PCD's.
- 5) If furnishing zone (a.k.a. planting strip) exists, place/construct non-slip ADA compliant transition between sidewalk and temporary ramp.



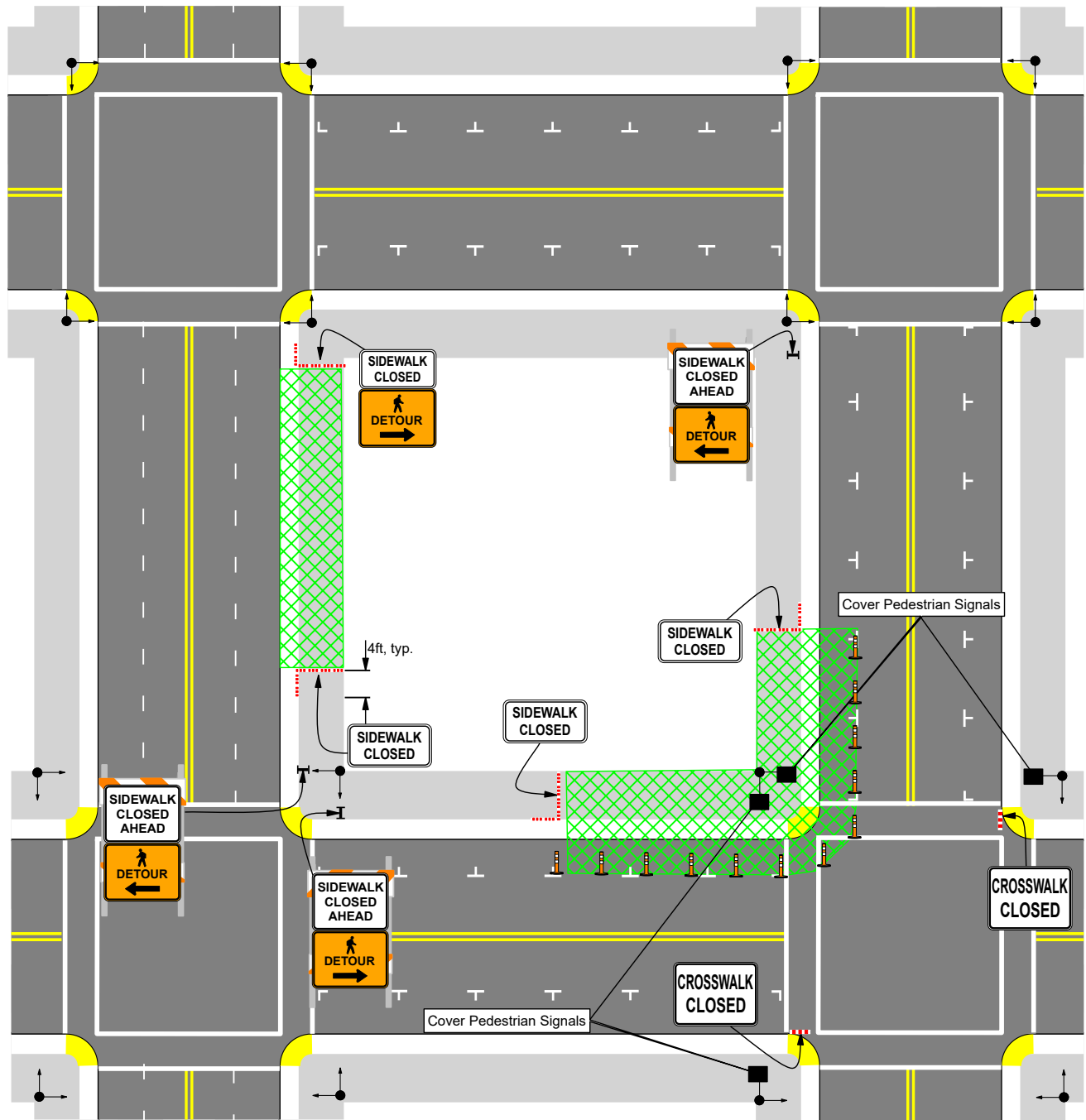
Legend

- Barrier
- Impact Attenuator
- Ped Channelization Device
- Ped Signal
- Temp. Ramp
- Temporary Ped Signal
- Work Area

TA-S1
Diversions

Conditions:

- 1) This plan shows the pedestrian traffic control measures only. Additional traffic control measures may be required to manage vehicular traffic.
- 2) PCD's must be interconnected and used on both the work zone side & travel lane side of the temporary walkway.
- 3) At point of sidewalk or crosswalk closure, barricades or PCD's shall extend across the entire width of closure.



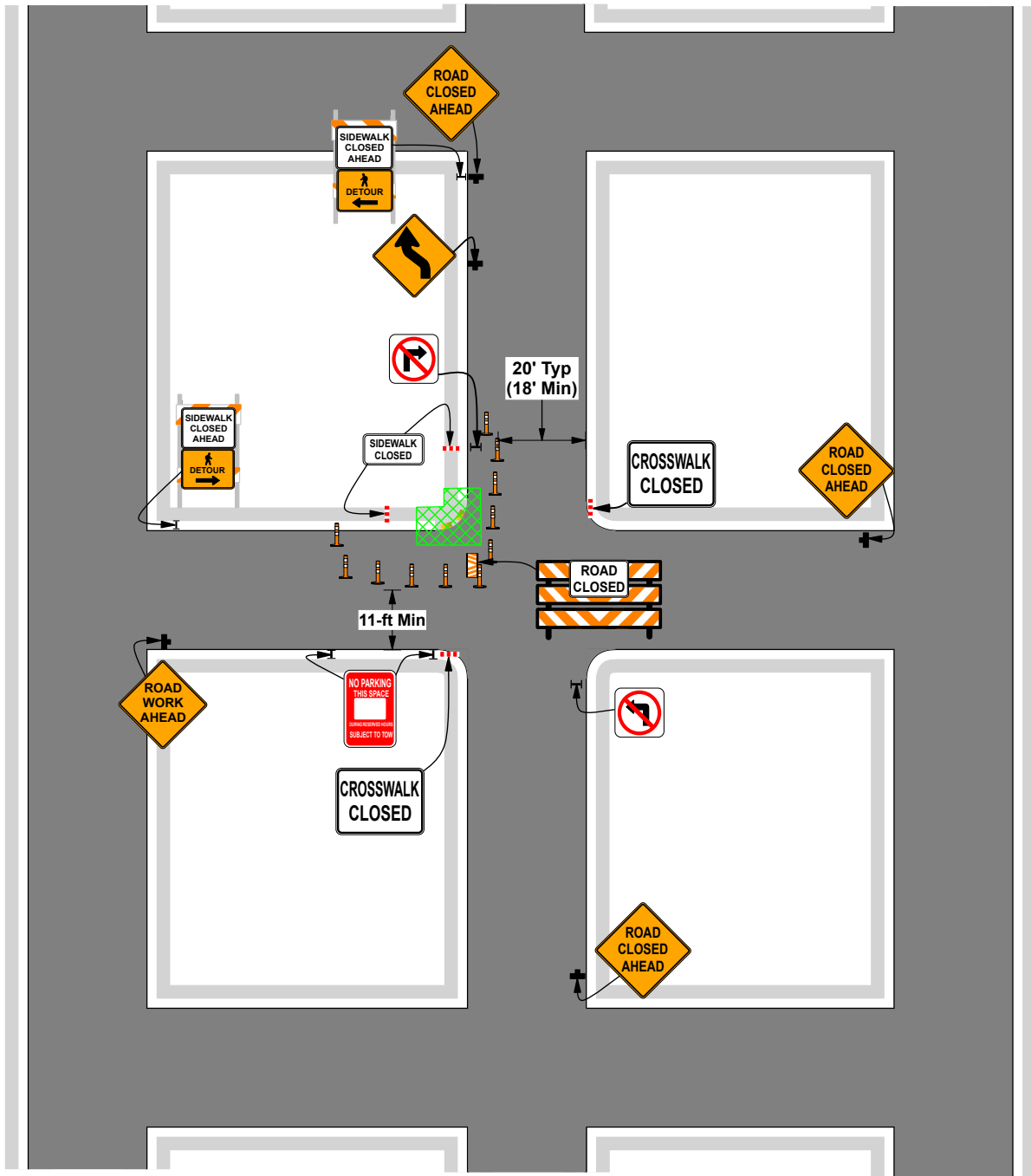
Legend

- Ped Channelization Device
- ⬇ Ped Signal
- ⊥ Type II Barricade
- ▨ Work Space

TA-S2
Detours

Conditions:

- 1) Plan for any work requiring closure of a corner on low volume local service streets.
- 2) Reserve Parking through separate PBOT permit to maintain noted minimum travel lane widths.
- 3) At point of sidewalk or crosswalk closure, barricades or PCD's shall extend across the entire width of closure.



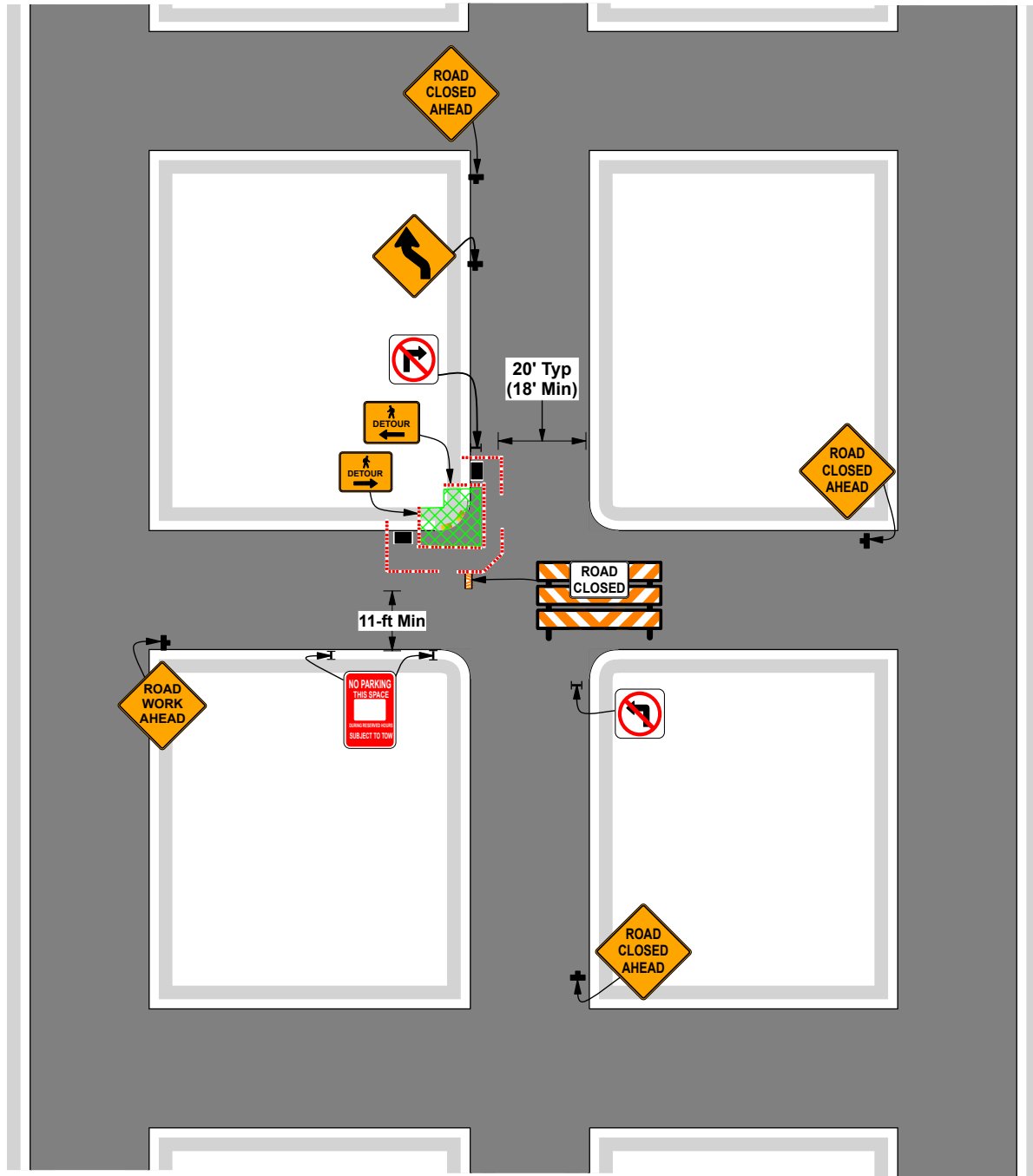
TA-S3
Corner Ramp Working Hrs.

Legend

- ... Ped Channelization Device
- Roll-Up Sign or TSS
- Tubular
- Type II Barricade
- Work Area

Conditions:

- 1) Plan for any work requiring closure of a corner on low volume local service streets.
- 2) Reserve Parking through separate PBOT permit to maintain noted minimum travel lane widths.
- 3) PCD's shall be interconnected and used on both the work zone side & travel lane side of the temporary walkway.
- 4) Attach pedestrian DETOUR signs to top rail of PCD's.
- 5) If furnishing zone (a.k.a. planting strip) exists, place/construct non-slip ADA compliant transition between sidewalk and temporary ramp.



Legend

- ... Ped Channelization Device
- Roll-Up Sign or TSS
- Temp Ramp
- ⌵ Type II Barricade
- ▤ Work Area

TA-S4
Corner Ramp Non-Working Hrs.

Conditions:

- 1) Work on roadways 25 MPH or less.
- 2) Open all travel lanes at the end of the working shift unless otherwise approved by the Traffic Engineer.
- 3) Working hours - BIKES MERGE WITH AUTOS.
- 4) Non-Working hours - Create minimum 5' wide bike path around work zone within the closed travel lane.

* See Typical Applications section 7.2 Sidewalks if sidewalk closure is necessary.

Working Hours

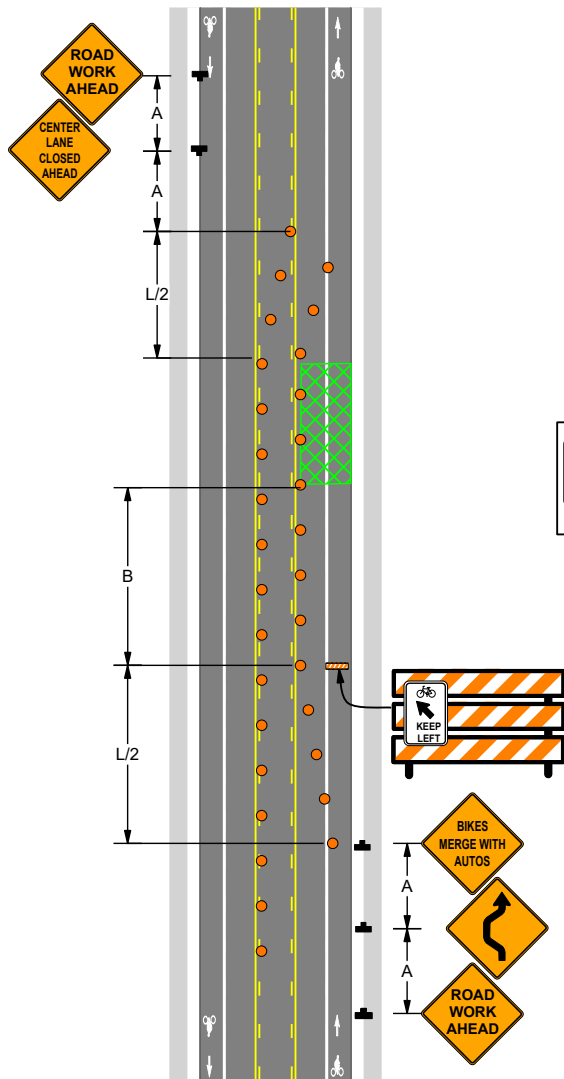


Diagram 1

Non-Working Hours

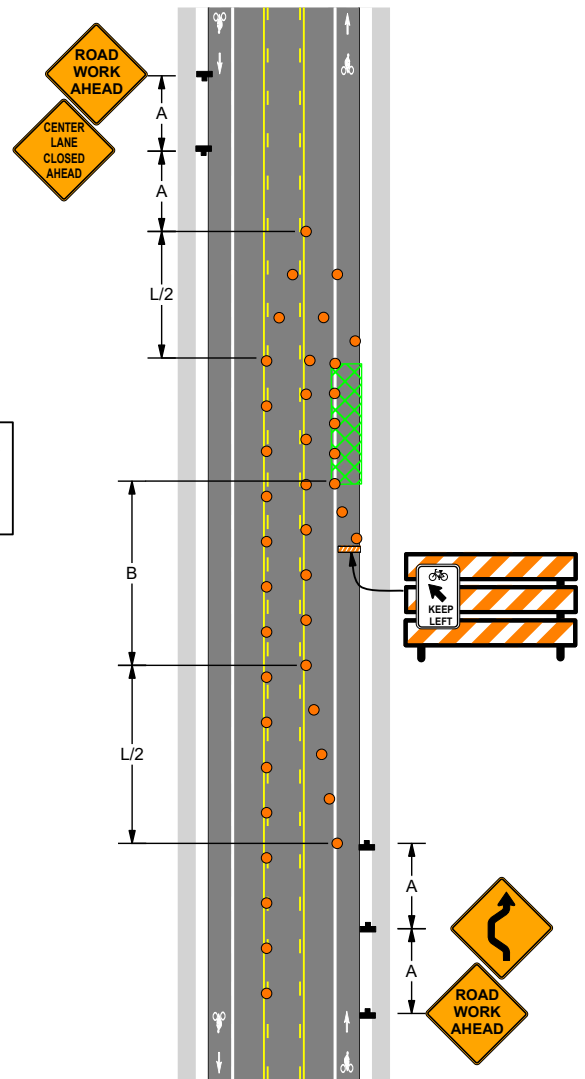


Diagram 2

Remove all parking adjacent to work zones and shifted travel lanes to maintain minimum lane widths.

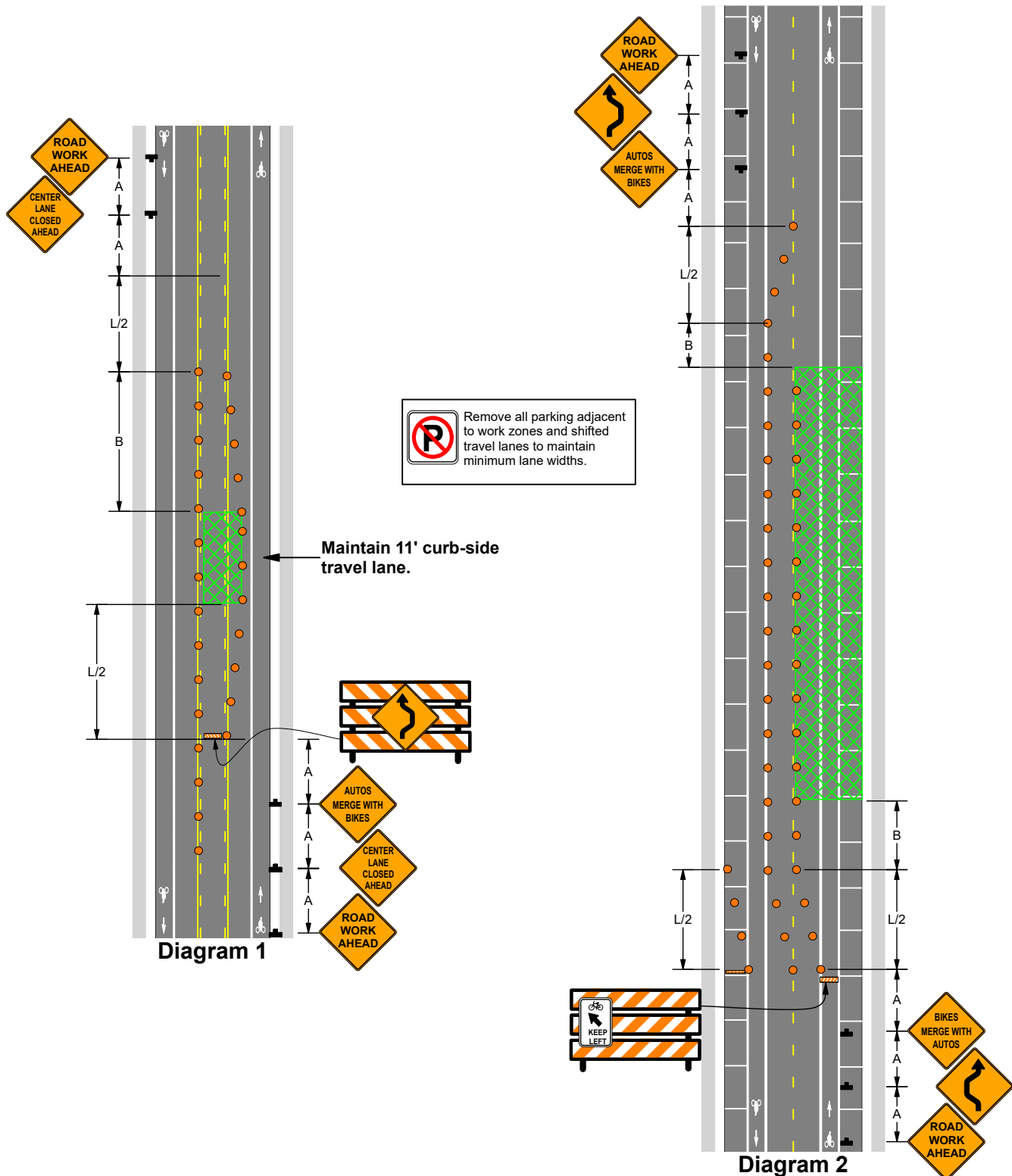
Legend

- Delineator
- Roll-Up Sign or TSS
- Work Area

TA-B1
Low Speed
BIKES MERGE WITH AUTOS

Conditions:

- 1) Work on roadways 25 MPH or less.
- 2) Open all travel lanes at the end of the working shift unless otherwise approved by the Traffic Engineer.
- 3) Working hours - AUTOS MERGE WITH BIKES and/or BIKES MERGE WITH AUTOS.
- 4) Non-Working hours - Open all travel lanes unless otherwise approved by the Traffic Engineer.



Conditions:

- 1) Work on roadways 30 MPH and 35 MPH.
- 2) Drums/Barrels are required along the merge taper.
- 3) Open all travel lanes at the end of the working shift unless approved otherwise by the Traffic Engineer.
- 4) Working hours - BIKES MERGE WITH AUTOS.
- 5) Non-Working hours - Lane closure overnight must be approved by the Traffic Engineer. Create minimum 5' wide bike path around work zone within the closed travel lane.

*** See Typical Applications section 7.2 Sidewalks if sidewalk closure is necessary.**

Working Hours

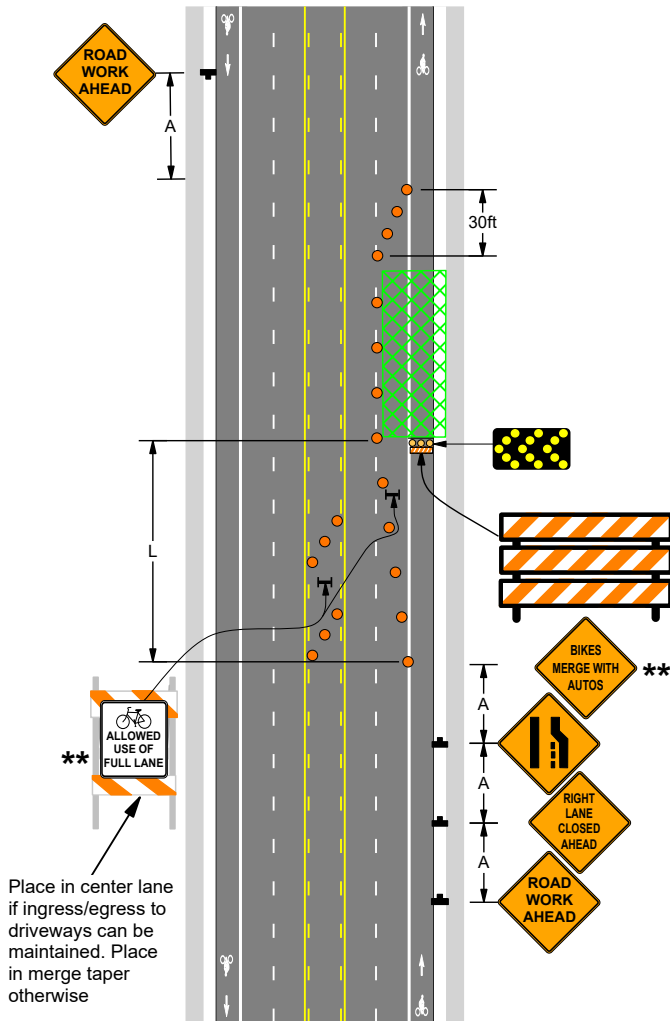


Diagram 1

Non-Working Hours

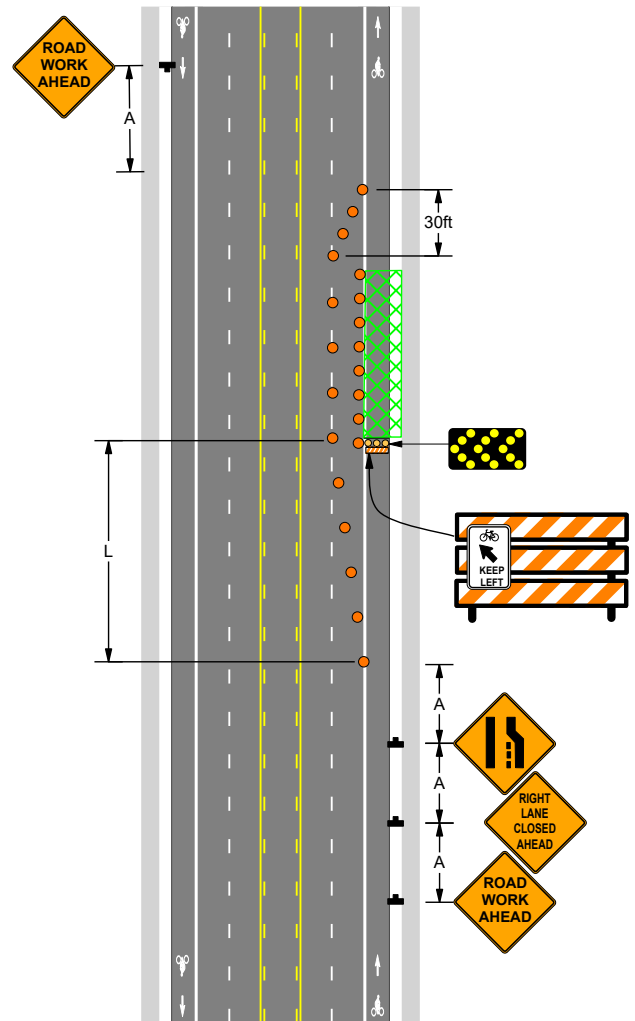


Diagram 2

**** PREFERRED** - If sidewalk remains open, do not place these signs and route bicycles onto sidewalk rather than merging with autos using the signs below attached to a Type II barricade and located at a driveway or ADA ramp. Ensure a ramp back to the bike lane is available.



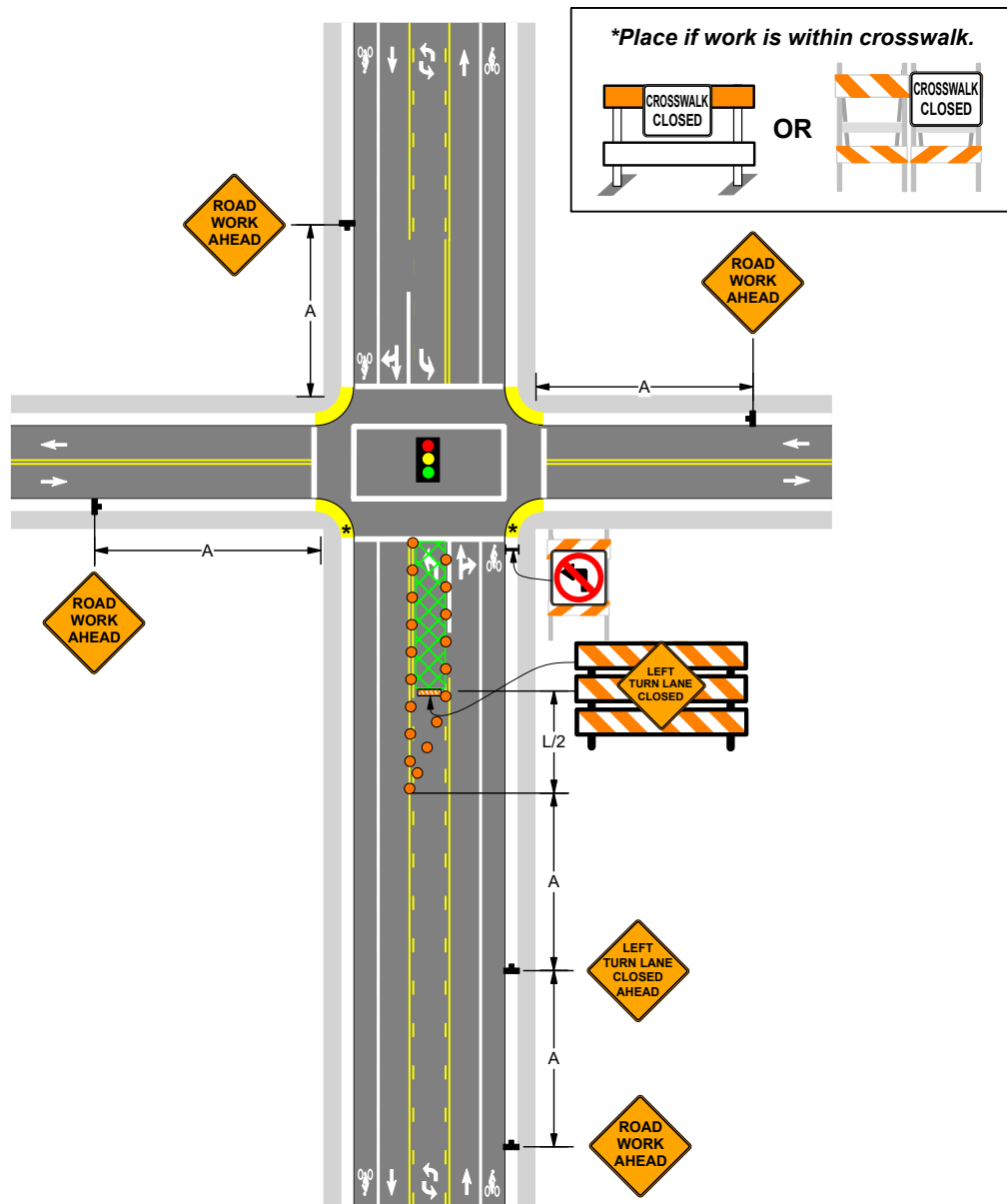
Legend

- Arrow Board
- Delineator
- Roll-Up Sign or TSS
- Work Area




**TA-B3
High Speed Bike Lane Closure**

Conditions:

- 1) If working within a protected left turn lane, contact SSL to disable or bag the left turn signal head.
- 2) If work vehicles will be located over signal detection loops, contact SSL to disable loops or modify signal timing.
- 3) If work encroaches into crosswalk, close the crosswalk using barricades and CROSSWALK CLOSED signs. Bag the pedestrian signal heads and cover the pedestrian push button.



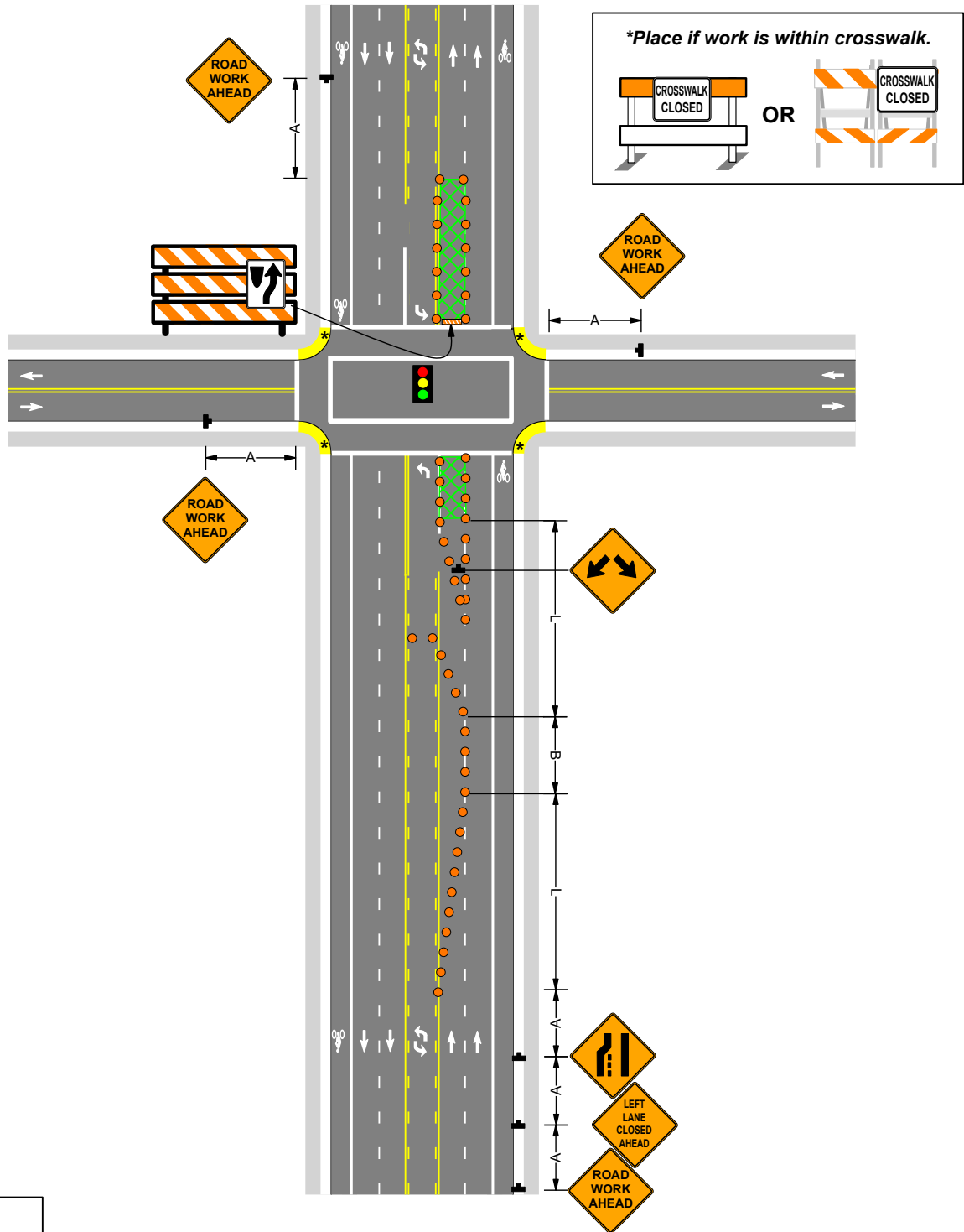
Legend

-  Delineator
-  Roll-Up Sign or TSS
-  Work Space

TA-I1
Left Turn Lane Closure

Conditions:

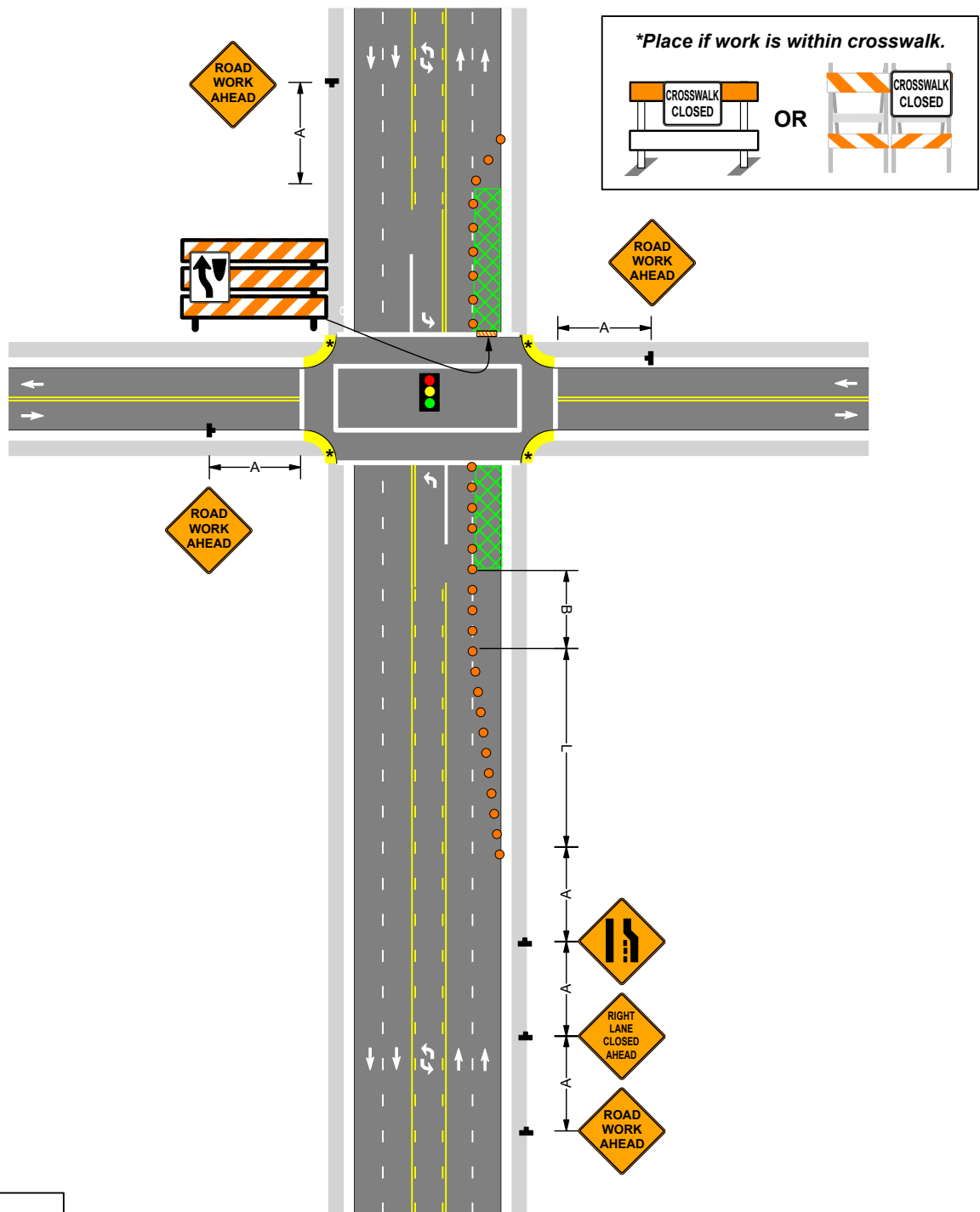
- 1) When work vehicles are located over signal detection loops, contact SSL to disable loops or modify signal timing.
- 2) If work encroaches into crosswalk, close the crosswalk using barricades and CROSSWALK CLOSED signs. Bag the pedestrian signal heads and cover the pedestrian push button.






TA-I2
Interior Lane Closure

Conditions:

- 1) When work vehicles are located over signal detection loops, contact SSL to disable loops or modify signal timing.
- 2) If work encroaches into crosswalk, close the crosswalk using barricades and CROSSWALK CLOSED signs. Bag the pedestrian signal heads and cover the pedestrian push button.



Legend

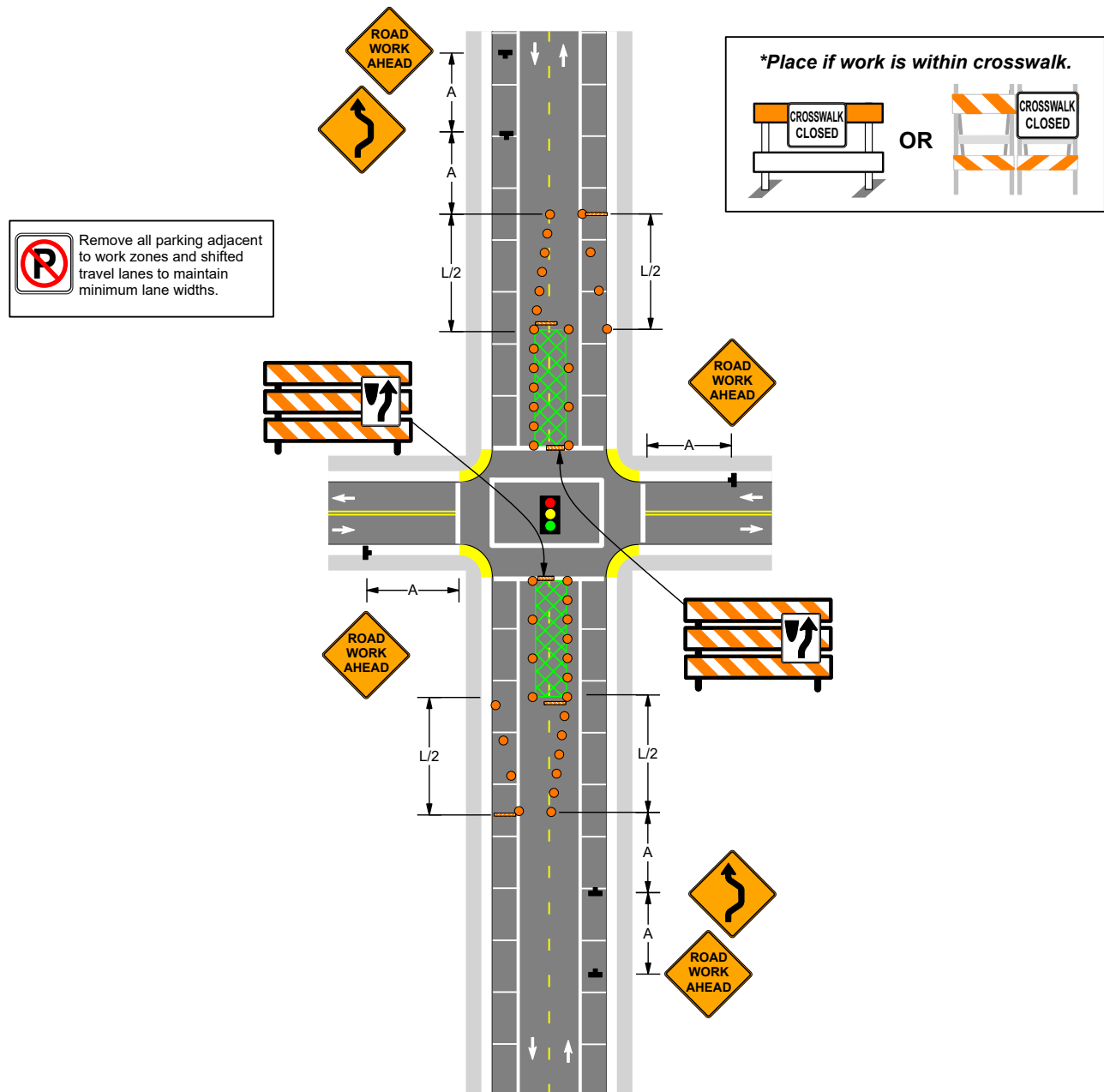
-  Delineator
-  Roll-Up Sign or TSS
-  Work Space

TA-I3




Exterior Lane Closure

Conditions:

- 1) When work vehicles are located over signal detection loops, contact SSL to disable loops or modify signal timing.
- 2) When channelizing devices conflict with pavement markings, space the devices no more than $\frac{1}{2} S$ feet, where S is the speed in mph.
- 3) If work encroaches into crosswalk, close the crosswalk using barricades and CROSSWALK CLOSED signs. Bag the pedestrian signal heads and cover the pedestrian push button.



Legend

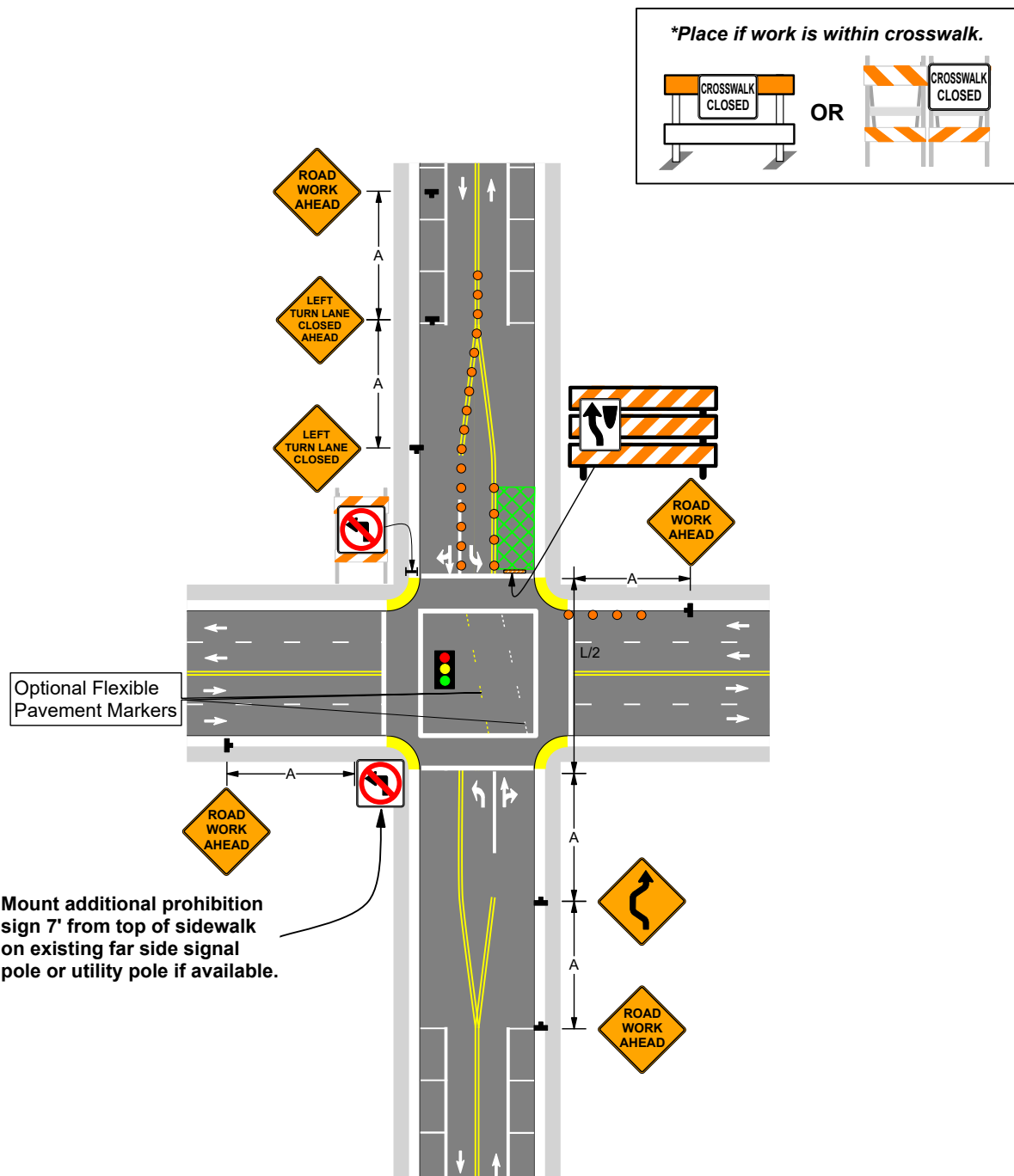
-  Delineator
-  Roll-Up Sign or TSS
-  Work Space

TA-I4




Shift Through Shoulder/Parking

Conditions:

- 1) If working within a protected left turn lane, contact SSL to disable or bag the left turn signal head.
- 2) When channelizing devices conflict with pavement markings, space the devices at no more than $\frac{1}{2}$ S feet, where S is the speed in mph.



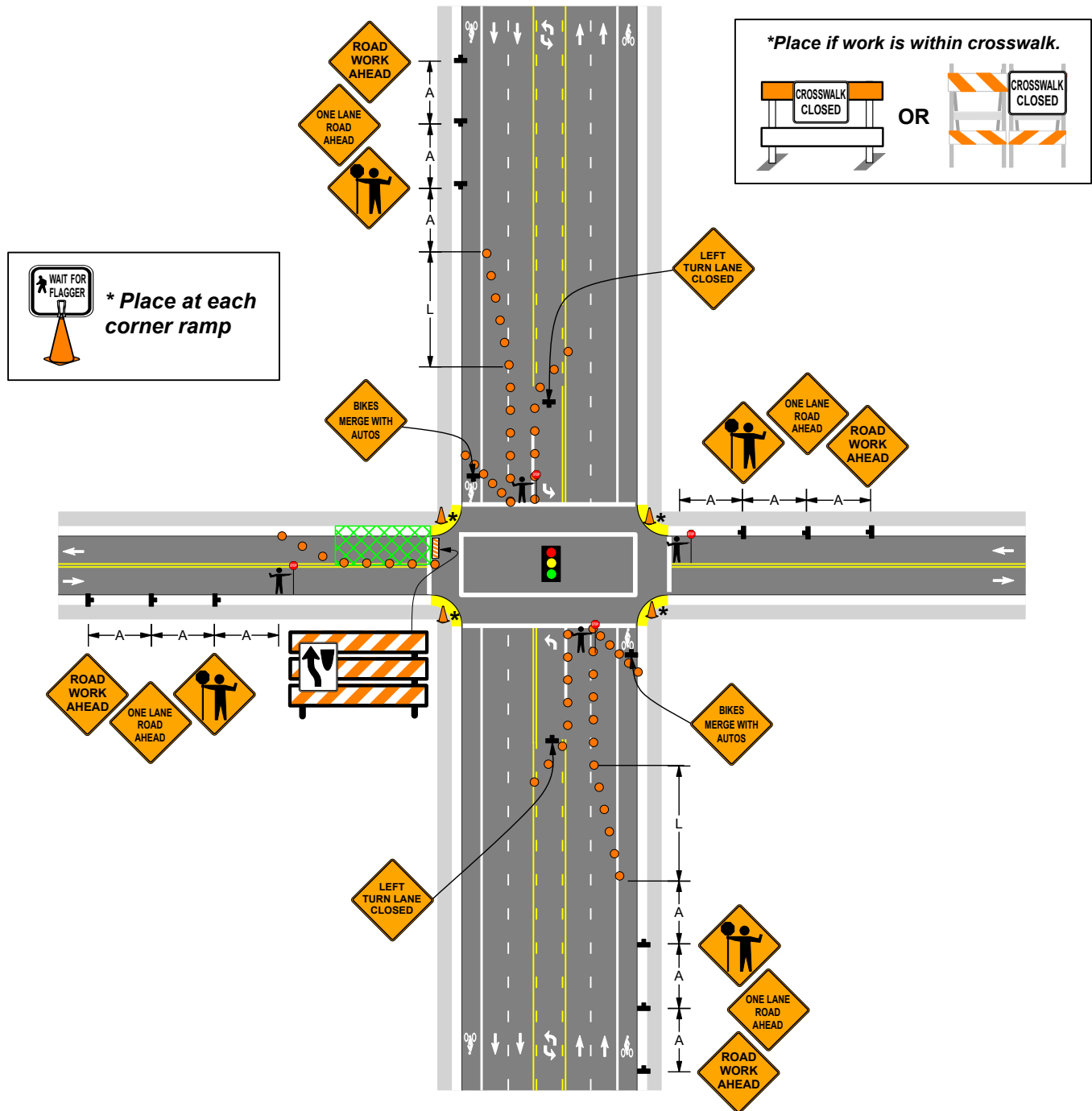
Legend

-  Delineator
-  Roll-Up Sign or TSS
-  Work Space

TA-I5
Shift Through Left Turn Lane (Far Side Work)

Conditions:

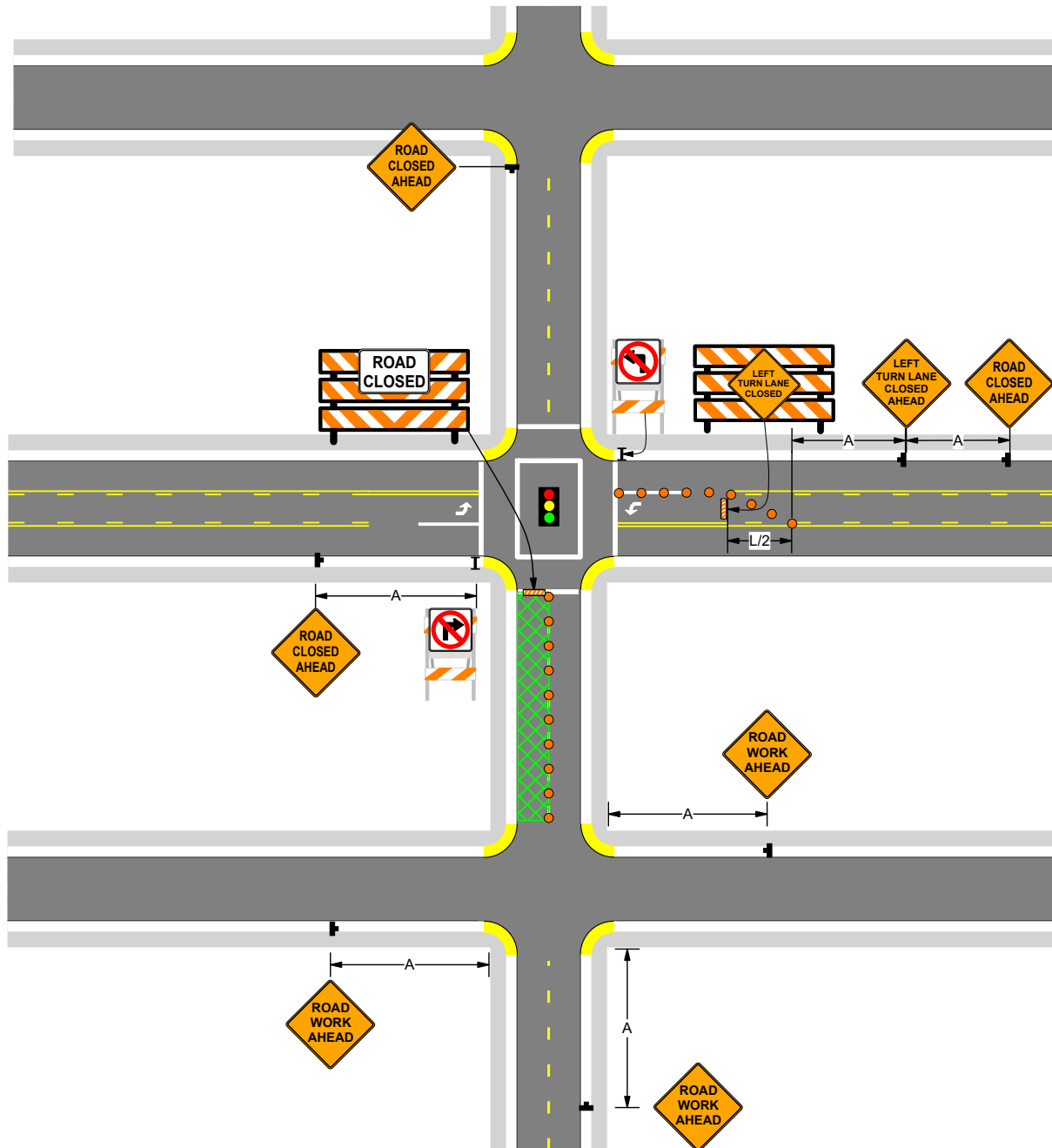
- 1) Contact SSL five working days in advance to schedule signal shut down.
- 2) If work encroaches into crosswalk, close the crosswalk using barricades and CROSSWALK CLOSED signs.
- 3) Sign spacing to be adjusted based on queue lengths. Tables are a beginning guidance for spacing but queues should be monitored and the queue should never extend past the first ROAD WORK AHEAD sign.



TA-I6
Flagging

Conditions:

- 1) Provide and maintain access to business and residence driveways as necessary. Work with adjacent property owners ahead of time to see if any accommodations may be required.
- 3) A detour plan, with additional signing, may be required.



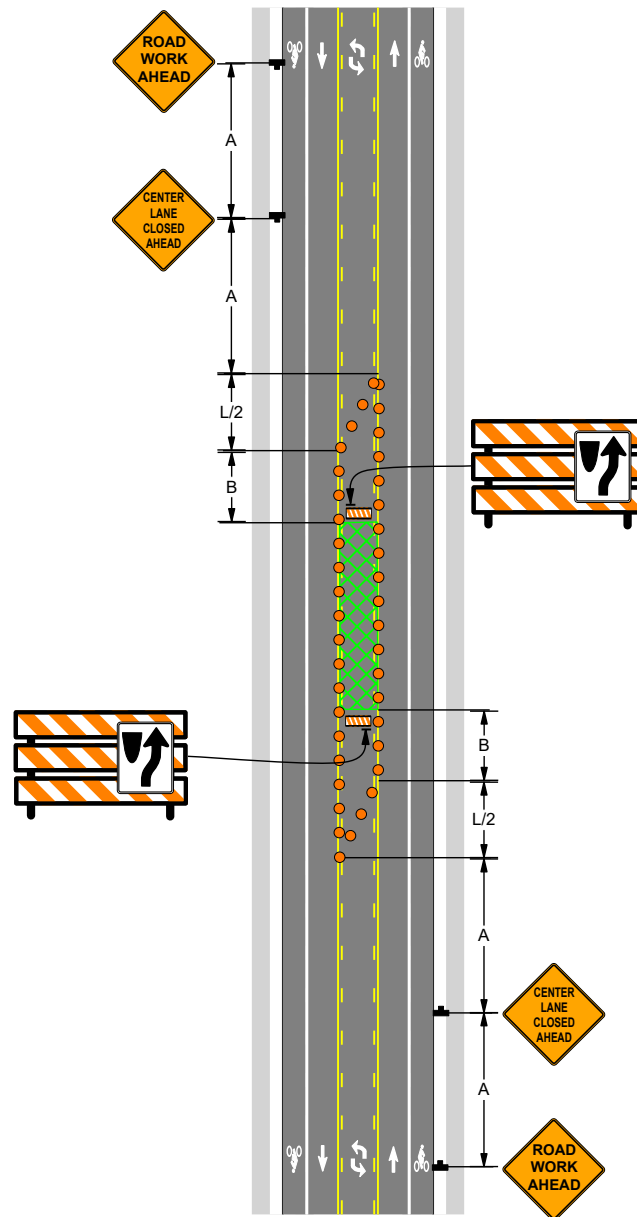
TA-T1
Half-Street Road Closure

Legend




- Delineator
- Roll-up Sign or TSS
- Work Area

Conditions:

- 1) On high-speed streets, use a protection vehicle with beacons, or a truck-mounted arrow board in caution mode between the buffer and the work zone.



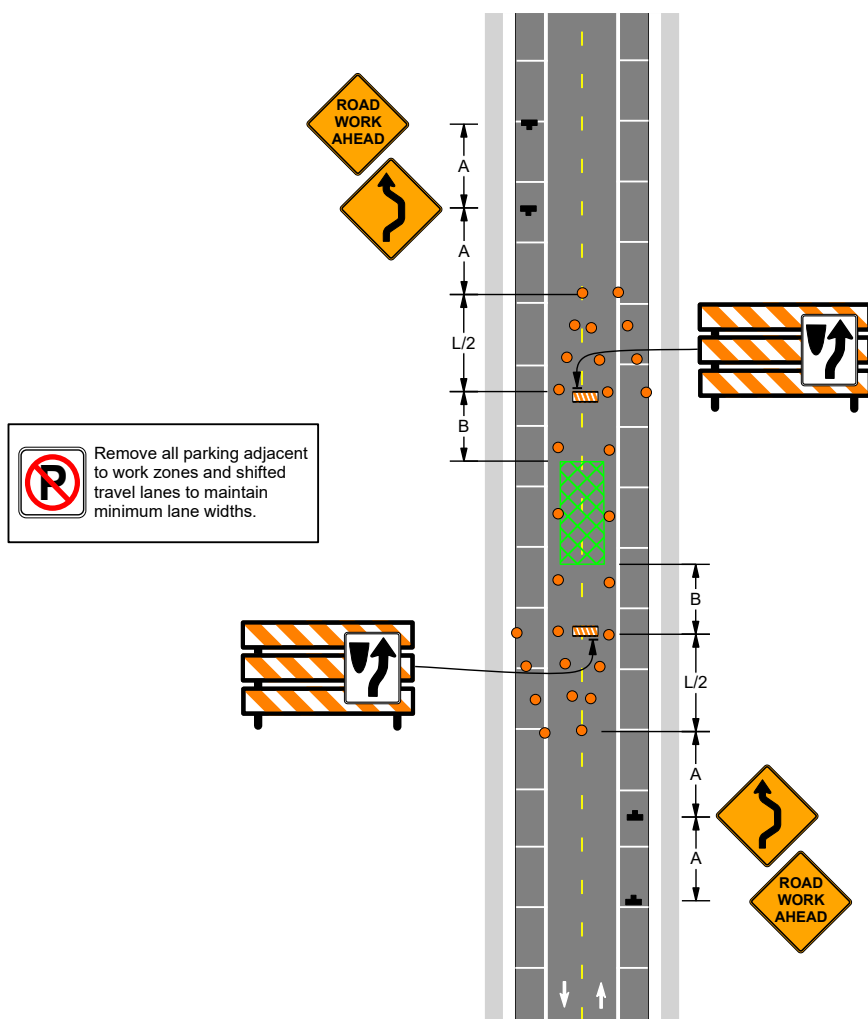
Legend

-  Delineator
-  Roll-up Sign or TSS
-  Work Area




TA-T2
Two-Way Left-Turn Lane Closure

Conditions:

- 1) When channelizing devices conflict with pavement markings, space the devices no more than $\frac{1}{2} S$ feet, where S is the speed in mph.
- 2) Maintain minimum 11' travel lanes when shifting vehicles adjacent to a curb.



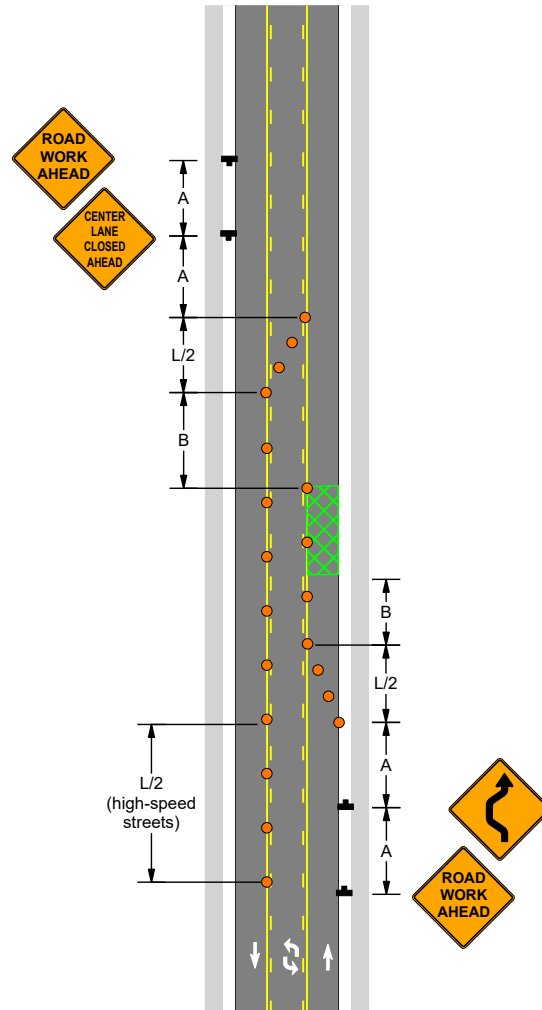
Legend

-  Delineator
-  Roll-up Sign or TSS
-  Work Area

**TA-T3
Work in Center of Road**

Conditions:

- 1) On high-speed streets, use a protection vehicle with beacons, or a truck-mounted arrow board in caution mode between the buffer and the work zone.
- 2) When channelizing devices conflict with pavement markings, space the devices no more than $\frac{1}{2} S$ feet, where S is the speed in mph.



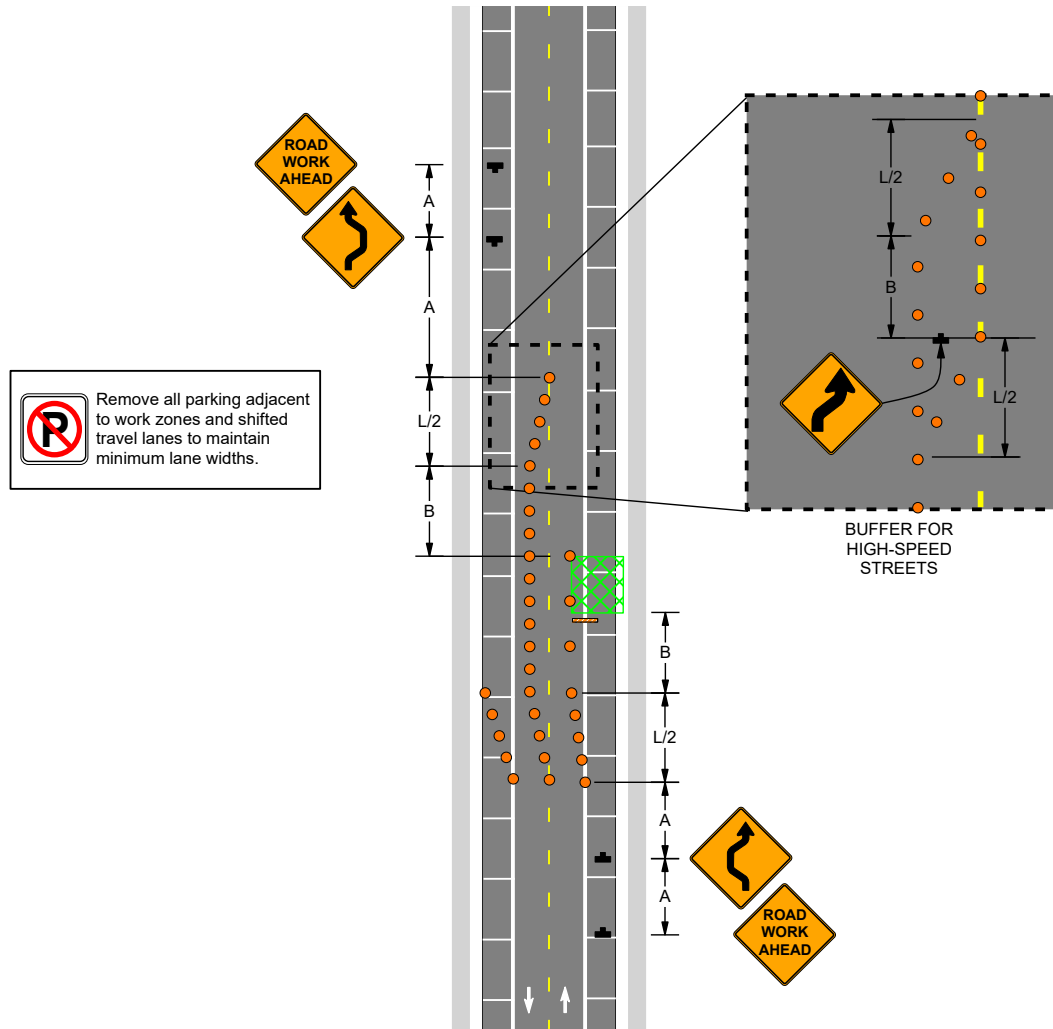
Legend

- Delineator
- Roll-up Sign or TSS
- Work Area




TA-T4
Shift Through Two-Way, Left-Turn Lane

Conditions:

- 1) When channelizing devices conflict with pavement markings, space the devices as no more than $\frac{1}{2} S$ feet, where S is the speed in mph.



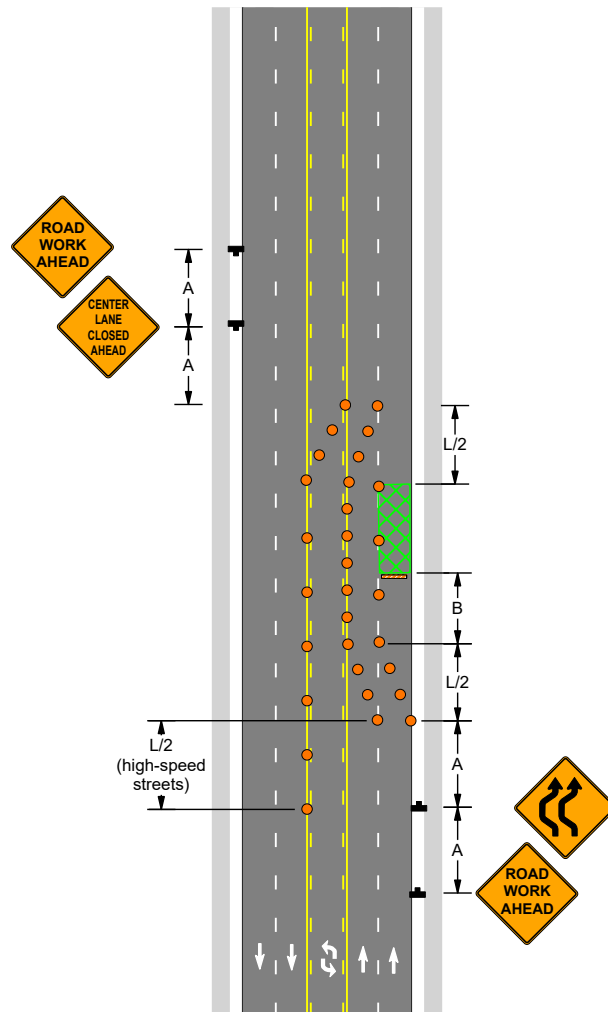
Legend

-  Delineator
-  Roll-up Sign or TSS
-  Work Area




TA-T5 Shift Over Centerline

Conditions:

- 1) When channelizing devices conflict with pavement markings, space the devices as no more than $\frac{1}{2} S$ feet, where S is the speed in mph.



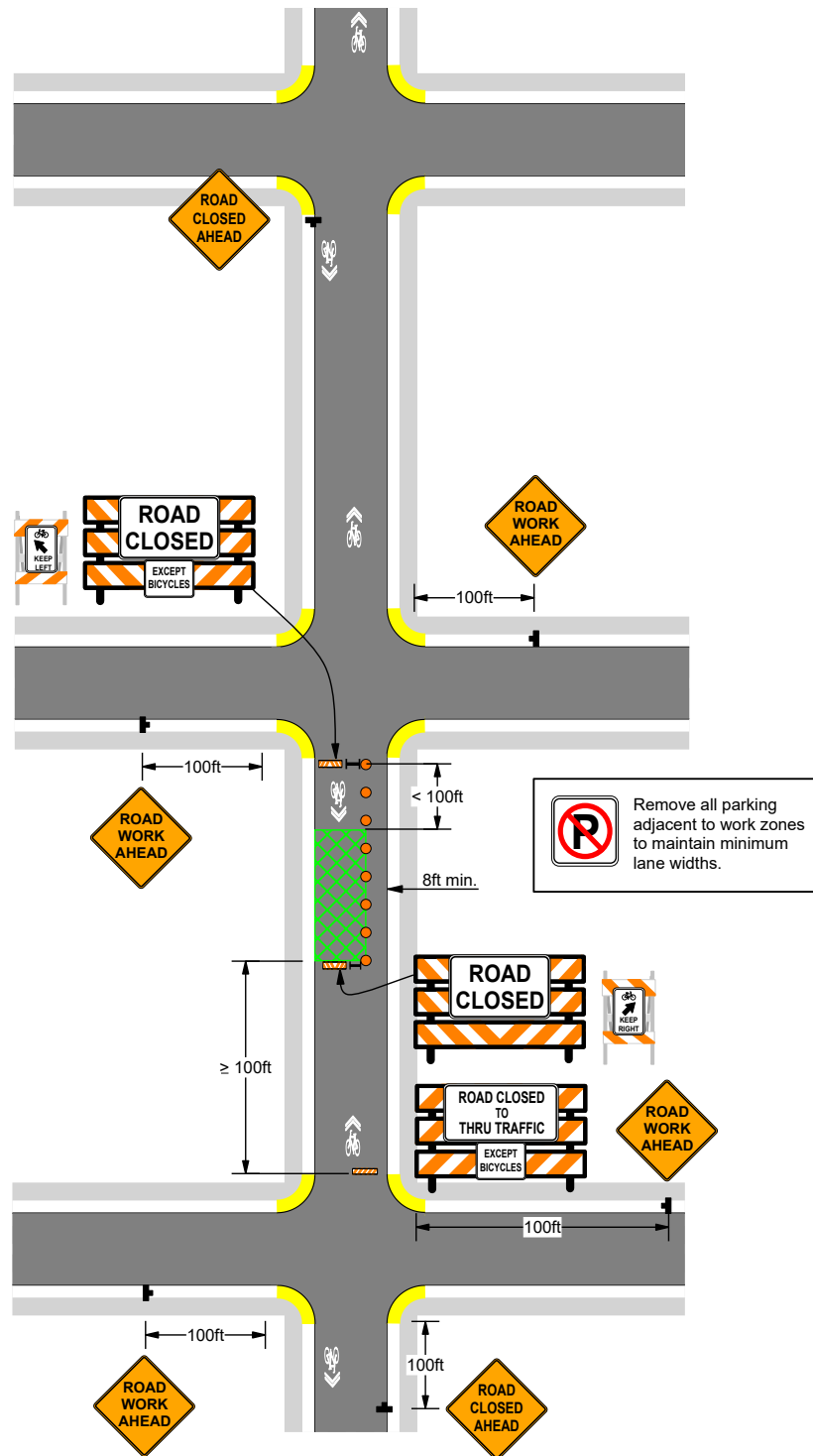
Legend

-  Delineator
-  Roll-up Sign or TSS
-  Work Area

TA-T6
Shift on Multilane Road

Conditions:

- 1) This plan may be used on local service streets with no pavement markings.
- 2) Provide and maintain local access and egress at all times for residents and businesses.



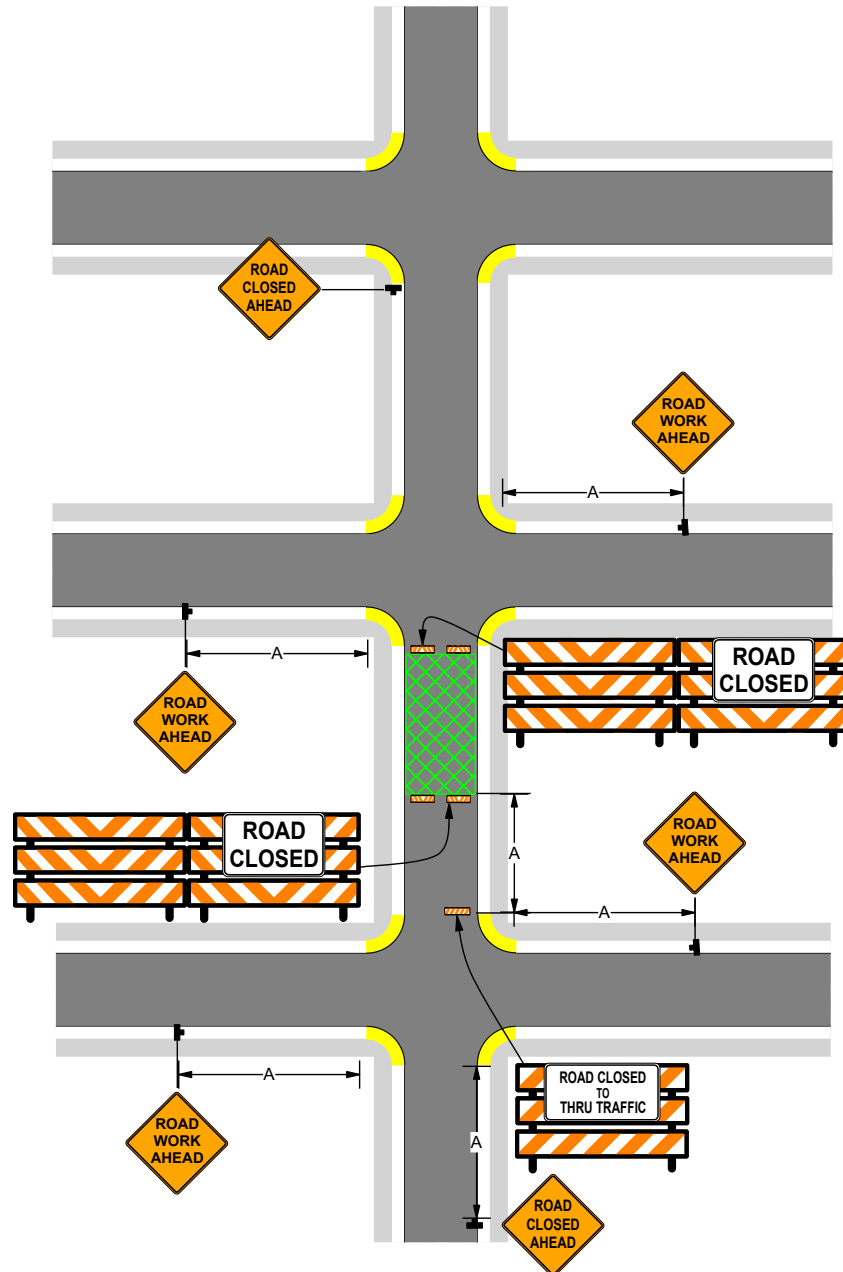
Legend

- Delineator
- Roll-up Sign or TSS
- Work Area




TA-L1
Road Closure on City Bikeway

Conditions:

- 1) This plan may be used on local service streets with no pavement markings.
- 2) Provide and maintain local access and egress at all times for residents and businesses.



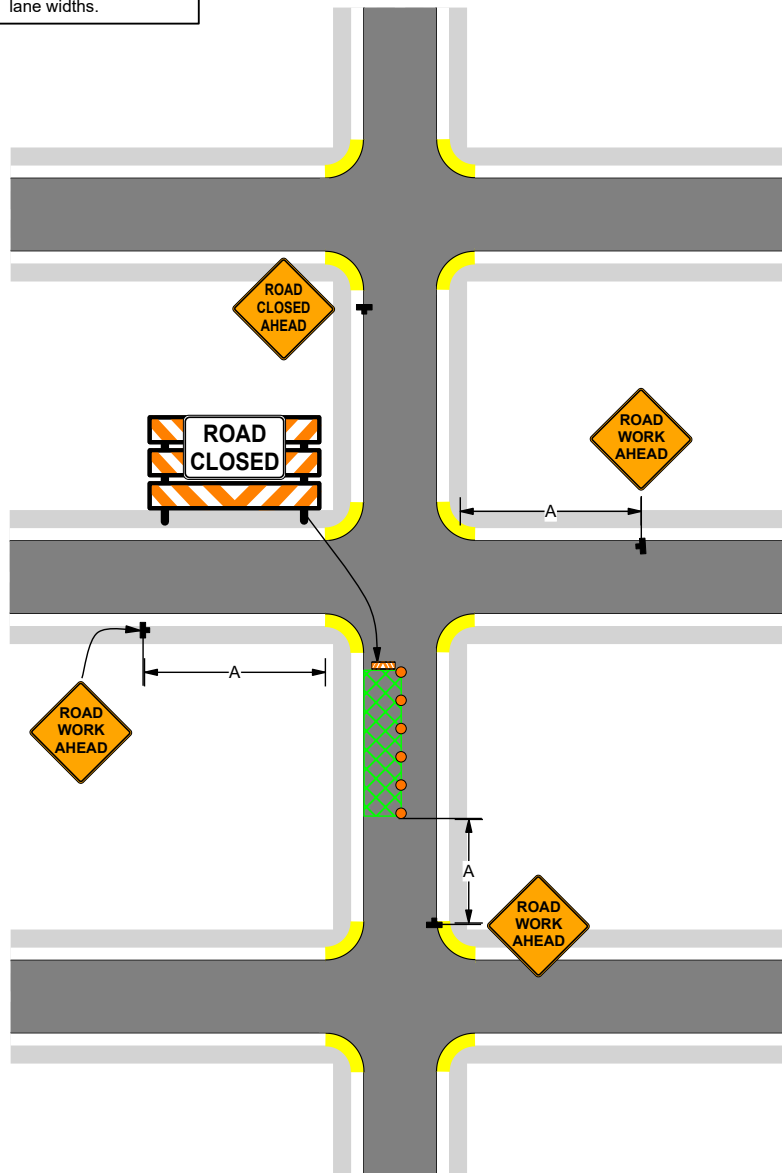
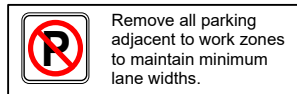
Legend

-  Delineator
-  Roll-up Sign or TSS
-  Work Area

**TA-L2
Road Closure**

Conditions:

- 1) This plan may be used on local service streets with no pavement markings, at least 200ft from a traffic signal.
- 2) Provide and maintain local access and egress at all times for residents and businesses.



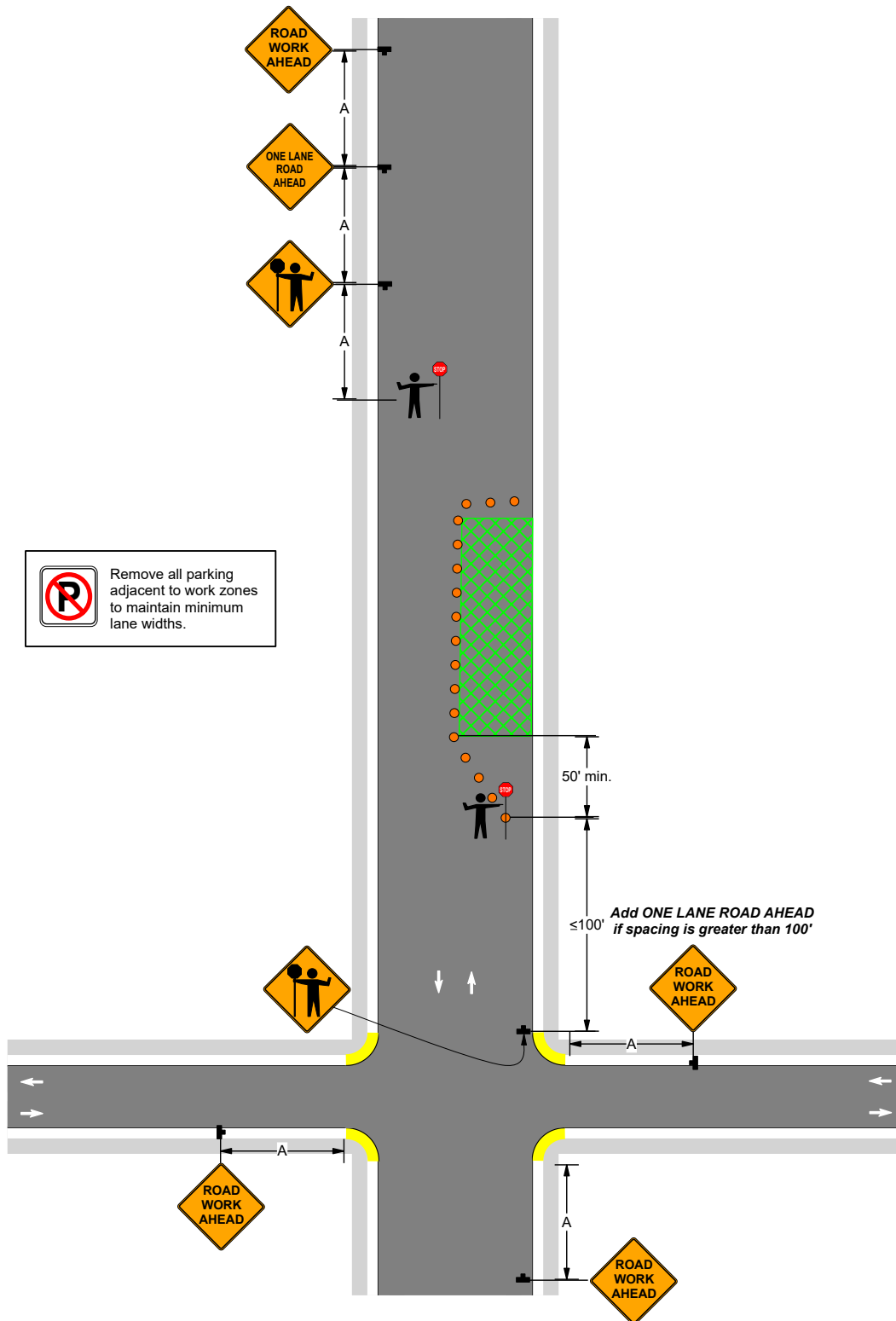
Legend

- Delineator
- Roll-up Sign or TSS
- Work Area

TA-L3
Half-Street Closure

Conditions:

- 1) This plan may be used on local service streets with no pavement markings.
- 2) When flagging near an intersection, the [OREGON FLAGGER SYMBOL] sign should be visible to traffic entering from any side road.



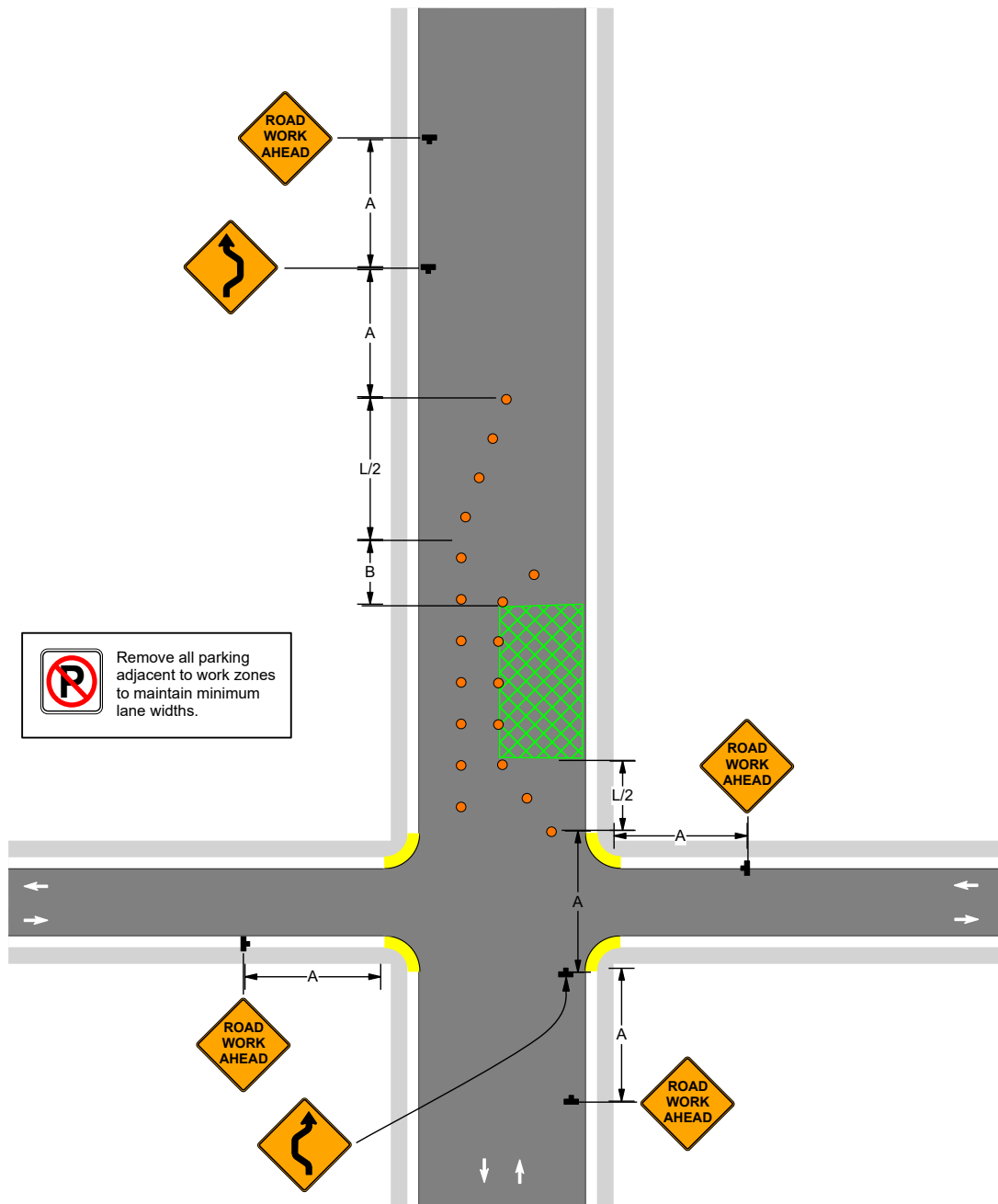
TA-L4
Flagging

Legend

- Delineator
- Roll-up Sign or TSS
- Work Area

Conditions:

- 1) This plan may be used on local service streets with no pavement markings.

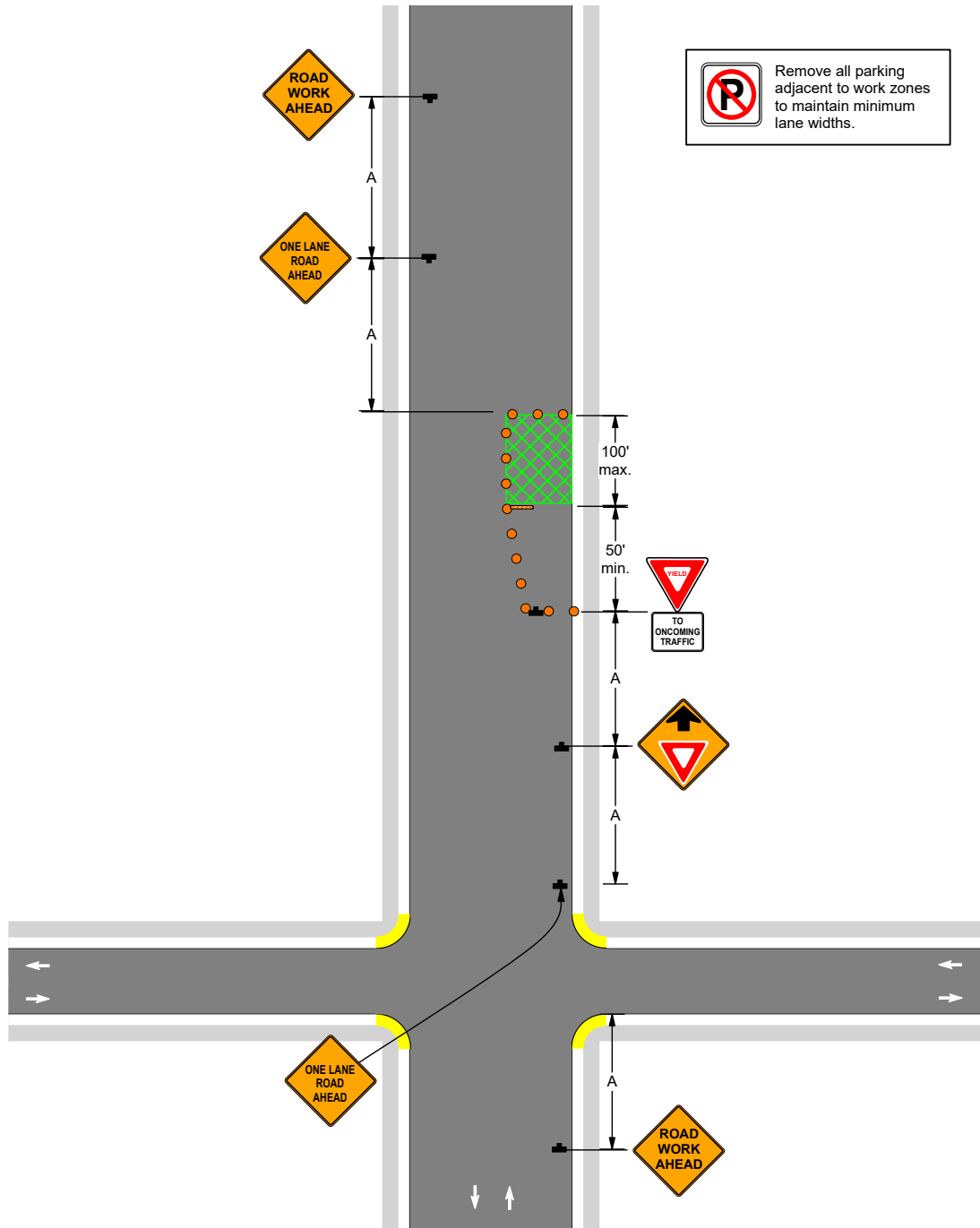


| Legend | |
|--------|---------------------|
| | Delineator |
| | Roll-up Sign or TSS |
| | Work Area |




TA-L5
Shift Over Centerline

Conditions:

- 1) This plan may be used on local service streets with no pavement markings.
- 2) Not for use when sight distance is less than 310ft at each end.



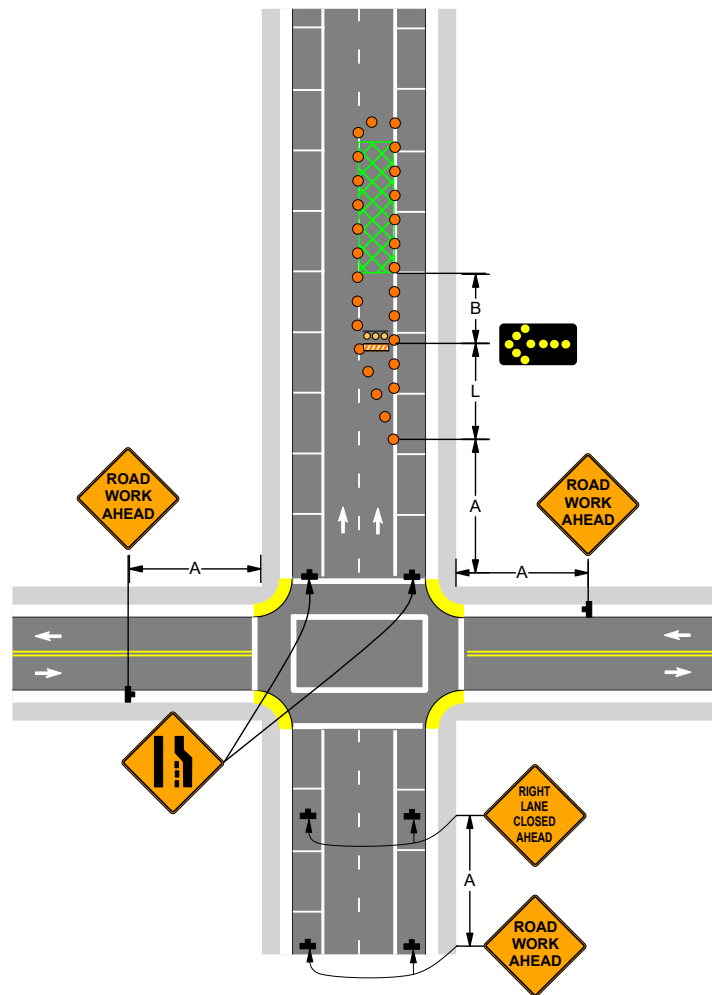
Legend

-  Delineator
-  Roll-up Sign or TSS
-  Work Area

TA-L6
Self-Regulating Lane Closure

Conditions:

- 1) This plan can be used to close either the left or right outside lane on one-way or multilane two-way streets. For closing the left lane, use corresponding LANE CLOSED and [LANE ENDS SYMBOL] signs.
- 2) An arrow board is required on high-speed streets.



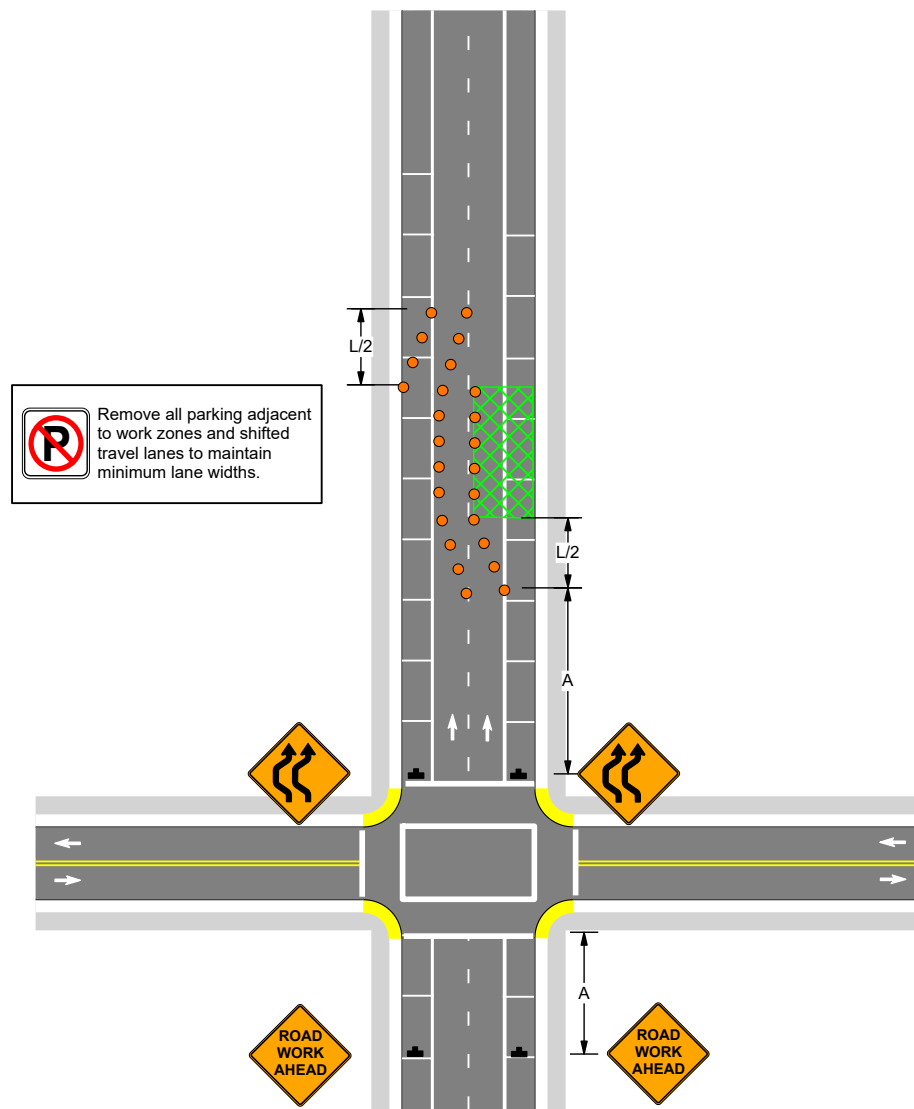
Legend

- Arrow Board
- Delineator
- Roll-up Sign or TSS
- Work Area

**TA-O1
Merge**

Conditions:

- 1) This plan can be used to shift traffic to the right by using corresponding warning signs.
- 2) When channelizing devices conflict with pavement markings, space the devices no more than $\frac{1}{2} S$ feet, where S is the speed in mph.



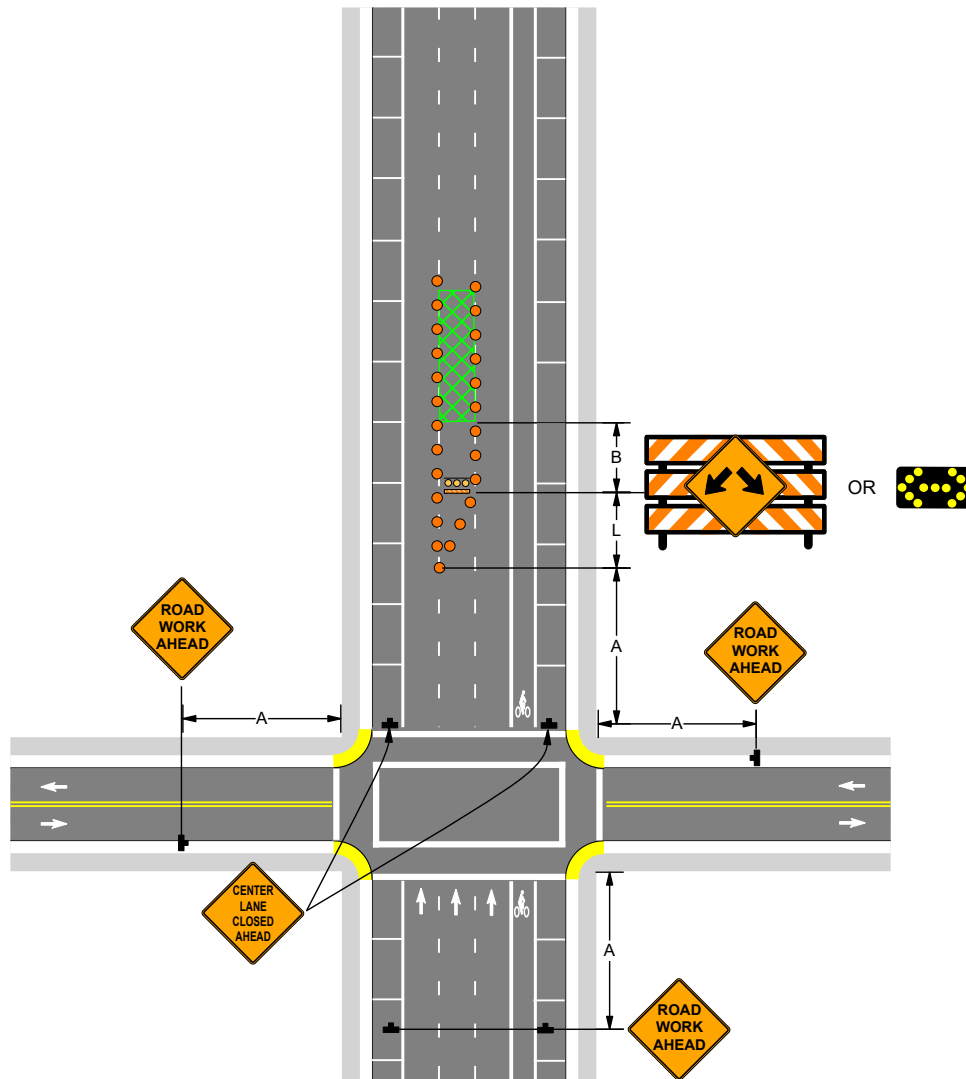
Legend

- Delineator
- Roll-up Sign or TSS
- Work Area





TA-O2
Shift

Conditions:

- 1) The merging taper shall direct traffic into either the right-hand or left-hand lane, but not both.
- 2) An arrow board is required on high-speed streets.



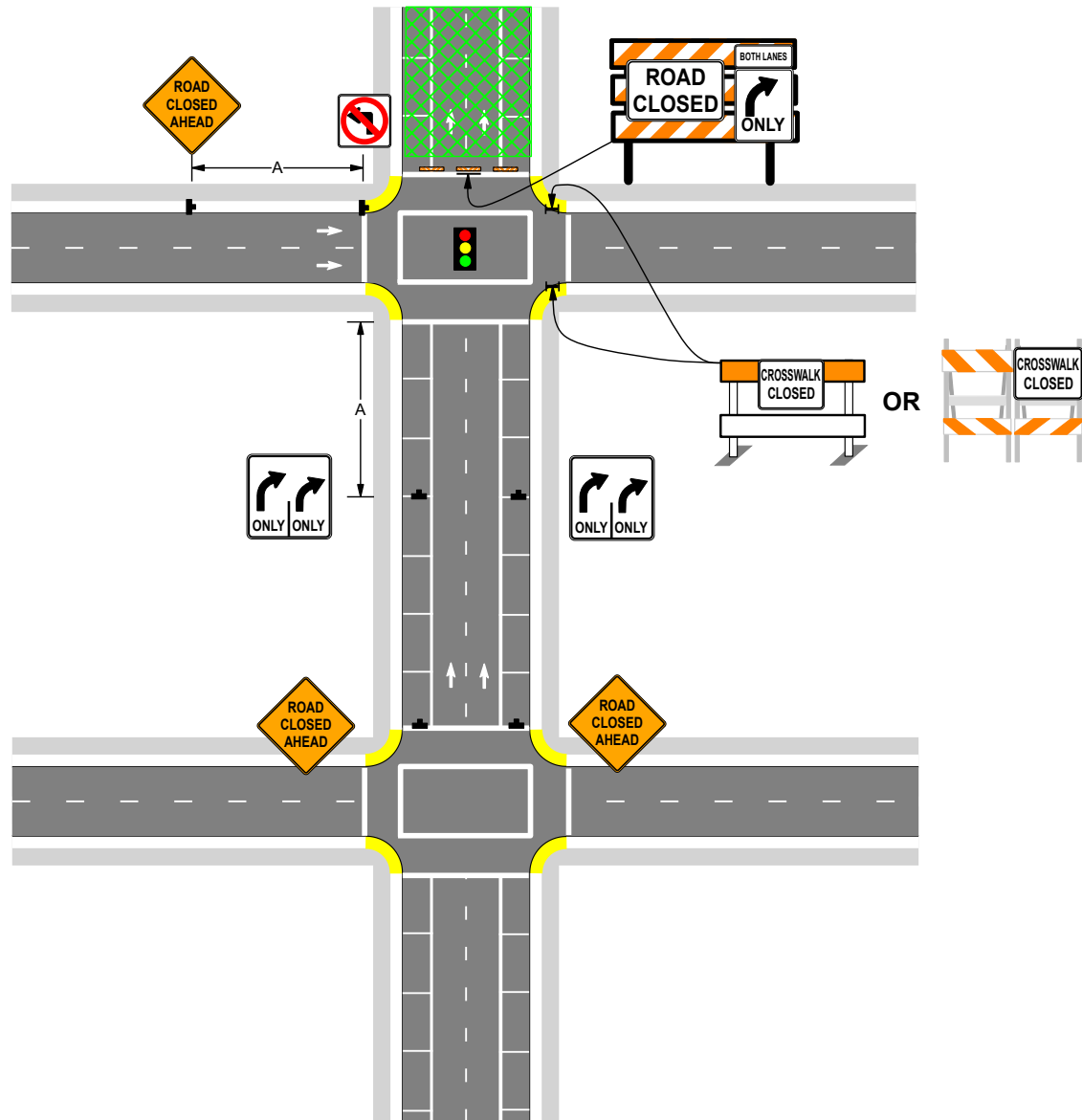
Legend

-  Arrow Board
-  Delineator
-  Roll-up Sign or TSS
-  Work Area




**TA-O3
Center Lane Closure**

Conditions:

- 1) This plan requires Traffic Engineer approval.
- 2) This plan can be used to close streets which require traffic to turn left at the street closure by using corresponding warning and regulatory signs.
- 3) If located at a signalized intersection, bag pedestrian signal heads when closing crosswalk.
- 3) A detour plan, with additional signing, may be required.



Legend

-  Delineator
-  Roll-up Sign or TSS
-  Work Area

TA-O4 Street Closure