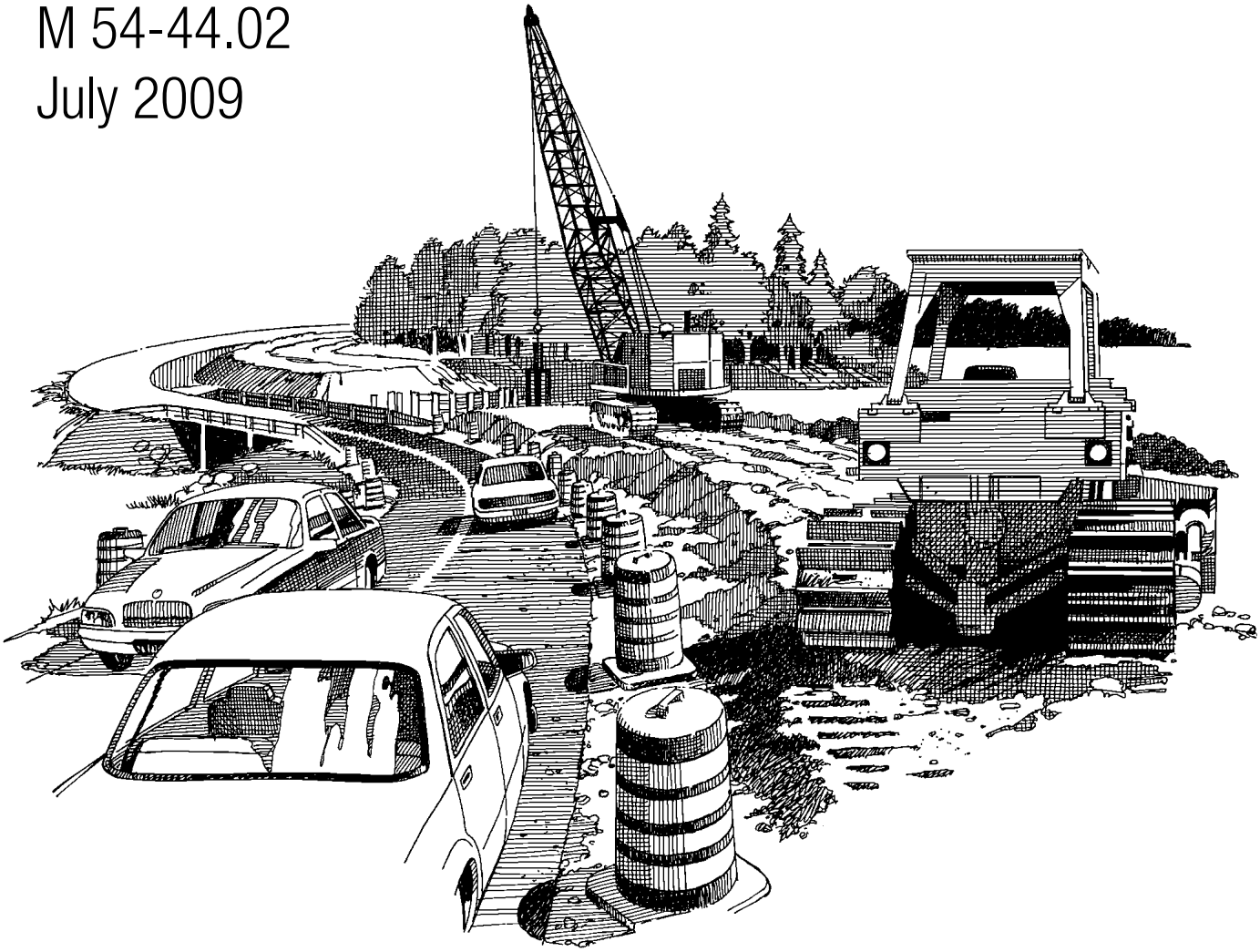
Work Zone Traffic Control Guidelines

M 54-44.02
July 2009



Washington State
Department of Transportation

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Maintenance and Operations Division
Traffic Operations

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Foreword

While this booklet provides interpretive guidance, it does not change the intent of Part VI of the *Manual on Uniform Traffic Control Devices* (MUTCD). The traffic control devices and distances shown in this booklet reflect desired minimums for state routes.

Effective traffic control is essential, not only for the safety of the traveling public, but also for Washington State Department of Transportation (WSDOT) employees whose jobs often require them to be in close proximity to high-speed traffic. The traffic control guidelines in this booklet are intended to reduce field personnel's exposure to the hazards of traffic and offer road users consistent and positive guidance through work zone areas. Safety of crews and the driving public must be an integral part of WSDOT field operations.

We emphasize that these are guidelines and not absolute standards. Some portions of the guidance such as the bold and underlined parts along with charts shown on the plan sheets refer to WSDOT policy and should be considered requirements. If these requirements cannot be physically implemented, then MUTCD standards shall apply as the minimum. The traffic control plans in this booklet are to be used along with sound judgment. Proper planning, a good safety conscious attitude and full participation from the persons involved in the work zone are all prerequisites to good traffic control. Aspects of the roadway environment such as weather, time of day, traffic volumes, traffic speed, roadway geometry, roadside conditions, and your inventory of traffic control devices should all be considered when implementing the guidelines of this booklet.

If you have any questions or needs not addressed here, please consult your Regional Traffic Office staff.

/s/ Don Nelson	/s/ Ted Trepanier	/s/ Chris Christopher
Don Nelson, Director Environmental and Engineering	Ted Trepanier, Co-Director Maintenance and Operations	Chris Christopher, Co-Director Maintenance and Operations

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Chapter 1 General Information

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1.1 Introduction

The primary function of work zone traffic control is to allow vehicles, cyclists, and pedestrians to move safely and easily through or around work areas. Effective temporary traffic control enhances traffic safety and efficiency. Drivers and pedestrians need to be guided in a clear and positive manner while approaching and traversing temporary traffic control zones.

The Traffic Control Plans (TCPs) contained in these guidelines are furnished to be used along with good judgment. Minor modifications may be made, as necessary, to accommodate site conditions; however, a plan's original intent must be maintained. An alternate plan should be considered if substantial revisions are necessary. Consult the Region Traffic Office staff for additional guidance and assistance.

Traffic control plans and procedures consistent with these guidelines should be developed to address the specific needs of work operations that are not included in these guidelines.

The traffic control plans included in these guidelines are not drawn to scale, are typical in nature, and are not intended to satisfy all conditions for all work zones and can generally be adapted to a broad range of conditions. The *Manual on Uniform Traffic Control Devices* (MUTCD) is adopted by the Washington State Department of Transportation (WSDOT) as the legal standard. Principles set forth in Part VI of the MUTCD titled "Temporary Traffic Control" are represented in these guidelines to provide traffic control guidance for common work operations.

These guidelines do not specifically address individual types of work operations. Standards do not allow exceptions based on work type. Many types of work operations such as surveying, maintenance, utility, developer, etc., can be applied to the guidance and plans contained within.

The typical applications (TAs) shown in MUTCD Part 6 may be used as needed to address work operations not shown in this manual. If any of the plans shown in the MUTCD are used keep in mind they meet the minimum

national standards and may not meet the minimum WSDOT requirements. Any use of the TAs or revisions to the TAs are subject to following the intent and guidance as shown in the M 54-44 and must be approved by the region Traffic Engineer prior to implementation.

The plans included in these guidelines are not intended for use in WSDOT contracts on state highways. Typical plans for contract use can be found at www.wsdot.wa.gov/eesc/design/designstandards/psl/wz-1-17/wz-1-17.htm

Additional work zone design information can be found in *Design Manual* M 22-01, Chapter 810, and at the WSDOT Work Zone Safety web page.

1.2 Considerations

1. Provide substantial protection and minimize worker exposure to traffic by applying positive protection and devices in practical ways. Long-term projects may warrant the use of concrete barrier, while short-term projects may be better served by a truck-mounted attenuator (TMA). Always consider the use of positive protection whenever practical.
2. Prior to the beginning of work operations, evaluate all aspects of the work area, including sight distance, traffic speed, volume, road approaches, work duration, and the type of work activity, before deciding on a traffic control plan.
3. After the traffic control plan is implemented, the supervisor (i.e., the person(s) supervising the actual work task(s) for which the TCP was implemented should drive through the work area, at the anticipated speed of the motorists, to determine the effectiveness of the plan. Additional reviews throughout the work shift are recommended to ensure that traffic control devices remain in place. It is important for work occurring during nighttime hours that the devices be reviewed to ensure proper visibility.
4. Whenever the temporary traffic control zone extends more than **2 miles** from the first advance warning signs the devices need to be moved forward in order to maintain appropriate advance warning to drivers.
5. Contact the region traffic management center (TMC) prior to starting work when appropriate, based on region polices to notify them of your work operation. Also coordinate with the region public information officer (PIO) for public notification and to be included in the weekly region construction activity report.
6. Plan ahead for manpower, equipment, and materials (such as signs, channelizing devices, pavement marking materials, etc.) needed for traffic control and whenever possible look for opportunities to combine multiple work operations within a temporary traffic control zone to minimize impact to drivers and for maximum efficiency.

7. The distances shown on the traffic control plans are desirable minimum requirements. Device spacing, buffer space, and sign spacing might require adjustments to provide for site conditions.
8. The Washington State Patrol (WSP) is generally available to assist WSDOT by enforcing excessive speed and impaired driver laws in critical work zone traffic control situations. These may include nighttime lane closures on high volume/high speed freeways or road closures. Contact the Region Traffic Office staff for specific information regarding procedures to utilize the WSP and the *Traffic Manual* M 51-02, Chapter 5, for guidance.
9. Traffic control devices are used to visually guide drivers through work zones. Signing, channelizing devices, arrow panels, and warning beacons all provide a message to the driver. Work zone credibility is established through the proper use of these devices to send correct messages to drivers. Poor work zone credibility has a direct, negative impact on work zone safety by causing driver confusion, frustration, and disrespect.
10. During paving operations, temporary pavement markings shall be maintained throughout the project. Temporary pavement markings shall be installed on the roadway that was paved that day. Temporary pavement markings shall be in accordance with TCD 9 (Temporary Pavement Marking Details) and *Standard Specification* 8-23.
11. Traffic delays due to work zone operations must be anticipated and addressed appropriately. Excessive delays contribute to work zone incidents of road rage or crashes. Traffic capacity issues must be addressed with the Region Traffic Office prior to starting work. Traffic should not be allowed to back up past the advance warning signs. Sign locations may need to be adjusted to fit actual site conditions or additional signs added to the sequence. Use of advance warning signs such as portable changeable message signs (PCMS) and highway advisory radio (HAR) are recommended.

1.3 Work Duration

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

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

1.4 Personal Attributes

Awareness. Routinely working near traffic for extended periods of time can lead to workers becoming complacent to the danger around them. Therefore, it is necessary to continually remind ourselves and those around us of the dangers to which everyone is exposed. ***Pre-activity Safety Plans and daily "tail-gate" meetings are required prior to beginning any work operation to ensure everyone is aware of the task to be performed and their respective duties.***

Alertness. There is no place on a *"traffic exposed"* work crew for a daydreamer or distracter. Each individual, for their own protection and that of the crew, must stay constantly alert and watchful.

Attitude. A positive, safety-conscious attitude on the part of each crewmember will contribute greatly to the overall safety of crew operations.

Responsibility. Each person is responsible for ensuring their own safety and to see all standards are followed. This includes ensuring temporary signs, warning devices, and flag persons are placed appropriately to protect both the motorists and workers. ***Motorist and worker safety are of primary importance.***

1.5 Equipment

1.5.1 Traffic Control Device Crashworthy Requirements

Effective January 1, 2008, all Category II traffic control devices (portable sign stands with signs, type 1, 2, and 3 barricades, and other work zone devices under 100 lbs.) must be compliant with the federal NCHRP 350 crash test requirements. Sign stands must have an identifying label on the stand indicating it meets crashworthy requirements.

1.5.2 Condition and Care of Equipment

All personal equipment and traffic control devices must be kept clean to provide protection for the crew through better visibility to the motorist. The condition of signs and traffic control devices shall be "acceptable or marginal" as defined in the book *Quality Guidelines for Temporary Traffic Control Devices*. A sign or traffic control device determined to be "not acceptable" shall be replaced as soon as possible. Copies of the Quality Guidelines book may be obtained from the American Traffic Safety Services Association (www.atssa.com).

1.5.3 Signs

Signs that are no longer retroreflective (visible and legible at night) or are in poor condition are to be replaced. All standard temporary warning signs are required to be 48 inches x 48 inches diamond shape with black letters or symbols on an orange background consisting of Type X reflective sheeting.

Refer to *Sign Fabrication Manual* M 55-05 for standard sign legends. All signs shall use aluminum sign substrate material. WSDOT maintenance crews are allowed to use roll-up sign material.

Some work areas might require the use of special or regulatory signs, contact region traffic office for assistance with special signs. Use of double-faced (back-to-back) signs or signs made of plywood substrate is not allowed. Sign supports must be in good condition, be capable of withstanding normal wind stresses along the highway and must be crashworthy.

Signs that will be in place at one location continuously for longer than three days must be post mounted.

Minimum sign mounting height for temporary warning signs is 1 foot above the ground. In some locations where the sign is located behind a traffic control device such as a traffic safety drum or temporary barrier, consider raising the minimum height to 3 feet in order to provide additional visibility.

Where it is necessary to add weight to signs for stability, sand bags or other similar ballast may be used, but the height must not be more than 4 inches above the roadway surface and must not interfere with the breakaway features of the deivce. Follow manufacturer recommendation for sign ballasting.

1.5.4 Vehicles

- ***Work Zone Vehicle*** – All construction vehicles, except hauling vehicles, used within the work zone must be equipped with an approved flashing warning beacon. When the beacons are used in conjunction with an arrow board, the flashing beacon should be turned off for a stationary operation once the arrow is setup. Consideration must be given to the location of workers in relation to the work vehicles. Worker safety can be jeopardized if the motorists' attention is focused on the work vehicle and beacon when the workers are at an unexpected location. Additional information on vehicle lighting can be found in *Vehicle and Equipment Warning Light Systems Manual* M 53-54.
- ***Protective Vehicle*** – Usually a stationary vehicle (in stationary work zones) is strategically placed in advance of the work area, between the buffer space and the roll-ahead space, to protect workers from oncoming traffic. The use of a Truck Mounted Attenuator (TMA) on this vehicle is recommended. Allow for roll-ahead distance resulting from an impact. Refer to the data block shown on the TCPs for specific information. The Protective vehicle can be a work vehicle if no other vehicles are available.
- ***Shadow Vehicle*** – Very similar to the protective vehicle but usually a moving vehicle (mobile work zones). All of the above guidelines for the protective vehicle applies to the shadow vehicle **except for the roll-ahead distances only apply to a stationary operation**. An arrow panel or truck mounted Portable Changeable Message Sign (PCMS) may also be used on the shadow vehicle.

1.5.5 Truck Mounted Attenuators

A truck mounted attenuator (TMA) is a portable impact attenuator attached to the rear of a large truck. Ballast is added to the truck to minimize the roll-ahead distance when impacted by a vehicle. The TMA is used as a shield to prevent errant vehicles from entering the work zone. If a TMA is not available, the use of a protective or shadow vehicle is still highly recommended. The TMA shall meet the minimum requirements shown in *Standard Specification* 9-35.12.

Considerations for the use of TMAs:

- ***Speed of Traffic*** – Higher operating speeds leave less reaction time and impacts generally result in more severe injuries and damage. Therefore, the higher the operating speed the more probability that a TMA is necessary.
- ***Type of Activity*** – Mobile, short duration, very short duration, or stationary.
- ***Duration of Project*** – Typically daily maintenance operations are suitable for TMAs, but for longer term operations positive protection from devices such as temporary concrete barrier should be considered.
- ***Roadway Environment*** – Access controlled vs. non-access controlled, urban vs. rural, and roadway geometrics. Access controlled facilities frequently give drivers a false sense of security since interruptions are not expected. Therefore, activities on freeways may be more susceptible to incidents than are activities on non-access controlled facilities, where drivers are generally more alert.
- ***Traffic Volumes*** – More traffic means more worker exposure.
- ***Exposure to Special Hazards*** – Operations involving personnel on foot or located in exposed positions (for example, on the approved platform of a pickup truck placing cones or in a lift-bucket performing overhead operations) are particularly susceptible to severe injuries or death. TMAs should be strongly considered for use in these operations.
- ***Location of Work Area*** – Locations of primary concern are those within the traveled lanes or within frequently used, all-weather shoulders. Activities taking place within the traveled lanes are more likely to become involved in an incident than are shoulder activities.
- ***Roll Ahead Distance*** – The minimum 30-foot roll-ahead distance shown in the BUFFER DATA block on the TCPs is based upon a minimum 15,000 lb. host vehicle weight and a maximum weight in accordance with the manufacturer's recommendations. The distance shown is the recommended minimum distance to be used as per the manufacturer's recommendations for roll-ahead distances for roads 45 mph or less. For speeds higher than 45 mph, a longer roll-ahead may be considered. Keep in mind as the more space is allowed between the TMA and the work area the more opportunity for a vehicle to re-enter the closed work space.

A maximum space of 100 feet is recommended. A protective vehicle is recommended regardless if a TMA is available. If no TMA is used, the protective vehicle shall be strategically located in the field to shield workers and no specific roll-ahead distance has been provided.

1.5.6 Portable Changeable Message Signs (PCMS)

- Recommended for high speed, high volume roadways, or work operations that require a highly visible message.
- Shall ***not*** be used to replace required signs.
- Can be used to replace static message signs for short duration or moving operations, as per approved traffic control plan.
- Place in advance of other temporary traffic control zone signing.
- Shall meet the minimum visibility and legibility standards established in the MUTCD 6F.55 and *Standard Specification* 9-35.5.
- Should be able to read the message twice at the posted speed.
- Each individual display should convey a single thought.
- A complete message cycle should consist of ***no more than two*** displays in sequence. Refer to MUTCD Section 1A.14 for a list of acceptable message abbreviations.
- Bottom of sign panel shall be a minimum of 7 feet above roadway.
- PCMS shall automatically adjust its light source relative to surrounding conditions.
- Messages shall not scroll horizontally or vertically across the sign face.
- Consider use of a truck mounted PCMS for protective vehicles.
- Consider use of permanently located changeable message signs when applicable.
- PCMS should be placed on the shoulder of the roadway, or if practical, further from the traveled lane. They are to be delineated with traffic control devices or shielded with a barrier or crash cushion. When signs are not being used, they are to be removed.
- Except when the PCMS trailer is actually being moved, it shall be detached from the towing vehicle. Towing trailer devices with the display active as a mobile operation is not allowed.

1.5.7 Arrow Panel

- Required on multi-lane roads for all lane closure operations, except during an emergency.
- Arrow panels shall meet the minimum size, visibility, legibility distance, number of elements, and other specifications as shown in the MUTCD Section 6F.56.

- An arrow panel shall not be used on a multi-lane roadway to laterally shift traffic.
- An arrow panel shall not be used on a two-lane, two-way roadway.
- An arrow panel shall only be used in the caution mode when used for shoulder closures.
- Only the ***four-corner flash mode*** shall be used to indicate caution, use of the **Double Diamond mode is not allowed**.
- Use ***only one*** arrow panel per lane being closed (unless used in mobile operations).
- Arrow panel should be used in combination with other appropriate traffic control devices. When arrow panels are not being used, they are to be removed.
- Arrow panel shall be capable of a minimum 50 percent dimming.
- For stationary lane closure, the arrow panel should be located on the shoulder at the beginning of the taper. Where the shoulder is narrow, the arrow panel should be located in the closed lane.
- The arrow panel shall be located behind channelizing devices (unless used in mobile operations).
- An arrow display mounted on a shadow (early warning) vehicle is allowed on mobile lane closure operations.
- Type "C" arrow panels are required for high-speed, long term stationary lane closures. Type "B" arrow panels are allowed for maintenance and mobile lane closure operations. (See MUTCD Part 6F.56 for additional information on arrow panels)
- Except when the arrow trailer is actually being moved, it shall be detached from the towing vehicle. Towing trailer devices with the display active as a mobile operation is not allowed.

1.5.8 Channelizing Devices

Traffic safety cones are the most common devices used to separate and guide traffic past a work area. Cones must be a minimum of 18 inches tall. For high speed, high volume, or nighttime operations, devices must be a minimum of 28 inches tall, and retro-reflectorized. Traffic safety drums must be 36 inches tall and are recommended for use in the tapers on high-speed roadways due to their greater visibility and imposing size. Tall Channelizing devices are a minimum of 42 inches tall, using a tapered cone type shape and are recommended for use on high speed roadways due to their greater visibility.

Maximum spacing requirements are shown on the TCPs. The Taper/ Channelization Device Table (Appendix 1-1) is provided to help select the proper taper lengths and number of devices needed for an operation. Tighter

spacing may be desirable, under some conditions, to enhance motorists' guidance. Refer to Appendix 2-2, Channelizing Device Application Matrix, for additional placement guidance and *Standard Specifications* for additional device information.

1.5.9 Temporary Concrete Barrier

Temporary concrete barrier is designed to prevent intrusion of errant vehicles into work areas and to provide positive protection to work areas. Barrier is recommended for long-term stationary work areas with high exposure to traffic. Refer to *Design Manual* M 22-01, Chapter 710, for site specific placement information.

Consider the following for use of concrete barriers:

- Areas where there is a high potential for injury to workers or "no escape" areas such as internal lane work, work zones in tunnels, bridges, lane expansion work, etc.
- Long-term, stationary jobs (work occupying a location for more than three days).
- Areas of high exposure to workers and motorists such as high speed and high volume of traffic.
- The approach ends of temporary concrete barriers must be adequately protected. If the barrier cannot be mitigated by either tapering outside clearzone, behind guardrail, or buried in the back slope then the end must be fitted with a temporary impact attenuator. Examples of impact attenuators and design considerations for their use are shown in *Design Manual* M 22-01, Chapter 720.

1.5.10 Portable Steel Barrier

Lightweight stackable design reduces transport costs and they are most frequently used in short-term work zones because of the relative ease and rapidity of installation and removal. Lateral displacement is usually in the range of 6 to 8 feet.

1.5.11 Water Filled Barrier

Water filled barriers are longitudinal barrier systems that use light weight modules pinned together and filled with water to form a barrier. They are ***not intended*** as a replacement for concrete barrier but are an improvement over traffic cones and drums to channelize traffic through a work zone. In emergency maintenance situations, they may be considered for short-term use as a substitute for concrete barrier.

Contact the Headquarters Design Office or Region Traffic Office, for advice on use of this device and assistance in determining the deflection space requirement behind the barrier.

1.5.12 Barricades

Generally used to protect spot hazards but can also be used to close roadways and sidewalks with appropriate signing. Barricades can also be used to provide additional protection to work areas. Barricades must be crashworthy and NCHRP 350 approved. The barricades used in work zone applications are portable devices. They are used to control traffic by closing, restricting, or delineating all or a portion of the roadway. There are three primary barricade types:

1. ***Type 1 Barricade*** – Used on lower speed roads and streets to mark a specific hazard.
2. ***Type 2 Barricade*** – Used on higher speed roadways and has more reflective area for nighttime use to mark a specific hazard.
3. ***Type 3 Barricade*** – Used for lane and road closures.

Signs mounted on Type 3 Barricades are allowed provided they are located behind other traffic control devices such as a shoulder or lane closure.

1.5.13 Warning Lights

These lights are either flashing or steady burn (Types A, B, or C or strobe) mounted on channelizing devices, barriers and signs. Secure warning lights to the channelizing device or sign so they will not come loose and become a dangerous flying object if impacted by a vehicle. See the MUTCD Part VI for additional information.

- ***Type A*** – Low-intensity flashing warning light used to warn road users during nighttime hours they are approaching a potentially hazardous area.
- ***Type B*** – High-intensity flashing warning light used to warn road users during both daylight and nighttime hours.
- ***Type C*** – Steady-burn warning light designed to operate 24 hours per day to delineate the edge of the roadway.

1.5.14 Flares

All work vehicles should carry a supply of flares. Use flares only to alert drivers to emergencies and not as routine traffic control device. Emergencies are defined as unexpected events where life threatening conditions, injuries, or property damage may occur unless immediate action is taken. Use caution at accident sites where flammable materials, such as fuel spills, are suspected.

Consider the following for use of flares:

- Primarily used in high hazard conditions only (i.e., accidents, spills, equipment breakdowns, dangerous snow and ice conditions, etc.).
- Use electronic flares or orange/red-glow sticks instead of incendiary flares where flammable materials are suspected.

1.5.15 Temporary and Portable Signal Systems

Temporary traffic control signals are typically used in work zones to control traffic such as temporary one-way operations along a two-lane, two-way highway where one lane is closed and alternating traffic movements are necessary. An example work operation is temporary one-way operations on a bridge. Contact the region traffic office and signal superintendent for specific guidance and advice on the use of these systems. A traffic control plan is required for use of these systems. TCD 11 is provided as an example. Refer to *Standard Specification* 1-10.3(3)K and 9-35.14.

- ***Temporary Signal System*** – Typically a permanent signal system modified in a temporary configuration such as temporary pole locations during intersection construction, span wire systems, adjustment of signal heads to accommodate a construction stage.
- ***Portable Traffic Signal System*** – A trailer mounted traffic signal used in work zones to control traffic. These versatile, portable units allow for alternative power sources such as solar power, generator, and deep cycle marine batteries in addition to AC power.

1.5.16 Automated Flagger Assistance Device (AFAD)

The AFAD is an automated flagging machine that is operated remotely by a flagger located off the roadway and away from traffic. The device is a safety enhancement for projects that use alternating traffic control by physically placing the human flagger off the roadway while maintaining control of the traffic movements approaching the work zone. Contact the Region Traffic Office for specific guidance and advice on the use of these systems. A traffic control plan is required for use of these systems and is available on the WSDOT Work Zone Safety web page and TCD 12.

1.5.17 Highway Advisory Radio (HAR)

Roadside radio system that provides traffic and traveler related information (typically affecting roadway being traveled) via AM radio. The system may be a permanently located transmitter or a portable trailer mounted system that can be moved from location to location as necessary. Contact the Region Traffic Office or Region Signal Superintendent for specific guidance, availability, and advice on the use of these systems.

1.5.18 Specific Warning Sign Requirements

Not all warning signs are shown on the traffic control plans but are required to address specific work zone hazards when conditions warrant, particularly if the hazard is not obvious or cannot be seen by approaching motorists.

Examples:

- Abrupt Lane Edge*
- Motorcycles Use Extreme Caution*
- Bump
- Traffic Revision Ahead
- Road Narrows
- Grooved Pavement*
- Rough Road
- Loose Gravel*
- No Shoulder
- Water Over Roadway

*Refer to 1.8.3 for additional information of motorcycle warning sign.

1.6 Personal Protective Wear

Refer to *Safety Procedures and Guidelines Manual* M 75-01 for guidance and requirement on personal protective equipment.

For specific questions regarding personal protective equipment, contact the Headquarters Safety Office or the Region Safety Office.

1.7 Flagging

Refer to WAC 296-155-305 for specific flagging requirements.

- Flagging should be employed only when all other methods of traffic control are inadequate to direct, or control, traffic.
- **A TCP showing flagger locations is required for any flagging operation.**
- **Minimum standard flagging paddle size allowed is 18 inches. It is recommended that a 24-inch paddle be used to improve visibility and for all high speed operations.**
- Locate the flagger off the traveled portion of the roadway. More than one flagger may be necessary to achieve traffic control in both directions. A means of communication between flaggers must be considered in these situations. Communication by hand-held radio is the recommended procedure.
- Only persons who have successfully completed an approved flagging course and who possess current flagging certification recognized in Washington State can be used as flaggers.
- Freeway characteristics do not lend themselves to effective flagging. High speed multiple lanes and normal driver expectancy do not provide an opportunity for the flagger to actually warn or direct traffic, therefore flagging on freeways and freeway ramps is not normally recommended. However, using a “spotter” may be helpful to protect the work crew.
- A “spotter” shall not be a flagger and the location of the spotter must be in a position that is not in unnecessary danger. The spotter’s duties are to detect errant drivers or other hazards and provide an effective warning to other workers using noise-makers such as a whistle, air horn, or other effective warning device.

- In a mobile flagging operation when the flagger is moving with the operation, all signs associated with the flagger shall be moved ahead whenever work advances to more than **2 miles** from the advance warning signs; also, ***the flagger ahead (symbol or text message) sign must be within 1,500 feet of the flagger***.
- During hours of darkness, flagger stations shall be illuminated without causing glare to the traveling public by using a portable light plant or approved alternative.
- When flagging in the vicinity of signalized intersections, special consideration must be made to address the specific needs to traffic movements. The signal must be either turned off or set to red "flash" mode. **At no time shall traffic be flagged with an active signal.** Contact region signal superintendent for assistance with signal operation.
- ***The placement of a flagger at the center of an intersection to control traffic is not allowed.*** The only person allowed to legally control traffic from the center of an intersection is a uniformed police officer.
- A four-sign sequence is required for flagging on roadways with posted speeds of 45 mph or higher. WSDOT's standard four-sign sequence for "one lane road" situations is in compliance. However, there are situations other than "one lane road" where the four-sign sequence is still required. These situations could be truck crossings, bridge work, surveying, etc., where flaggers are required to stop traffic for a short period of time.
  In these cases, the most appropriate standard warning sign that reflects the roadway condition or work operation should be used in place of the "one lane road ahead" sign to comply with the four-sign sequence requirement. These signs might be:
  - Truck crossing
  - Road machinery
  - Utility work
  - Survey crew
  - Blasting
  - Workers (this sign could be a very generic yet appropriate solution in many cases)

If the above signs are not available or appropriate for the operation, an acceptable alternative would be to repeat the "Flagger Ahead" symbol sign or the "Be Prepared to Stop" sign. Again, the preferred method is to use the sign that most appropriately describes the roadway condition or work operation.

1.7.1 Flagger's Rules of Conduct

1. Be clearly visible to approaching traffic at all times.
2. Do not stand in front of parked/stopped cars.

3. Always be aware of oncoming traffic.
4. Do not step into, or turn your back on the traffic.
5. Stand on the shoulder of the road observing traffic and the work zone. You may have to stand on the opposite side of the road to effectively direct traffic around the work.
6. Choose the best flagging position that will provide the greatest color contrast between you and the background.
7. If at all possible, do not stand in the shade.
8. Never flag from inside a vehicle.
9. Do not lean, sit, or lie on a vehicle.
10. Stand alone. Do not permit a group of workers to congregate around you.
11. Familiarize yourself with the nature of the work being performed. Be able to answer motorists' questions. Be aware of the work in progress.
12. Establish a warning signal with the work crew in case of an emergency.
13. Plan an escape route in case of an emergency.
14. Stay alert! Be ready to respond to an emergency.
15. Record the license number and description of any vehicle whose driver disobeys your instructions and threatens the safety of the work area. Report information to authorities.
16. Be courteous and professional.
17. Keep your mind on your job; do not do any other work when flagging.
18. Do not involve yourself in unnecessary conversation with workers, pedestrians, or motorists.
19. Do not leave your position until you are appropriately relieved.
20. Cover, turn, or remove the "FLAGGER AHEAD" sign, and other conflicting signs, when a flagger is no longer on duty.
21. Always carry your flagger certification card while on the job.

1.8 Pedestrians, Bicycles, and Other Roadway Users

Give consideration to pedestrian and bicycle traffic where appropriate. Provide alternative routes where designated walkways or bicycle routes are temporarily interrupted due to work operations. Alternative routes need to be free of obstructions and hazards (e.g., holes, debris, mud, construction and stored equipment, etc.). Clearly delineate all hazards near or adjacent to the path (e.g., ditches, trenches, excavations, etc.). Refer to MUTCD Part VI, Chapter 6D for additional requirements.

1.8.1 Pedestrians

Most public highways and streets cannot deny access to pedestrians if no other route is available to them. All pre-existing ADA compliant pedestrian facilities within the work zone must continue to comply with ADA requirements for barrier-free access during work operations. Consider the following when addressing pedestrian issues within and around work zones:

- Pedestrians should not be led into conflicts with work site vehicles, equipment, and operations.
- Pedestrians should not be led into conflicts with vehicles moving through or around the work site.
- Pedestrians should be provided with a safe, convenient path that replicates as nearly as practical the most desirable characteristics of the existing sidewalks or a footpath.
- Pedestrians generally will not go out of their way. Make alternate pathways reasonable.
- Do not place signs and other traffic control devices within the pathway that may pose a hazard.
- **Placements of sidewalk closure signs are required in advance of the closure point for pedestrians to make adjustments to their route. It must be recognized that pedestrians are reluctant to retrace their steps to a prior intersection for a crossing.**

1.8.2 Bicycles

- Bicycles have a legal right of access to most highway facilities and provisions for their safe conduct through work zones are necessary.
- Provide for and sign an appropriate alternate route when activities close a designated (signed) bicycle path or shoulder bikeway. Where horizontal separation for bicycles and pedestrians existed prior to work, give consideration to separating during work.
- When laying out alternative bicycle paths, make sure no overhead obstructions present a direct hazard to normal bicycle operation.
- Riding surfaces are important for safe bicycle operation. Loose gravel, uneven surfaces, milled pavement, and various asphaltic tack coats endanger the bicyclist. Consider the condition of the surface the bicyclist will be required to use.

1.8.3 Motorcycles

The driving or roadway surface is also important for motorcycle rider safety. The same surfaces that are a problem for bicyclist are also difficult for motorcyclists. Stability at high speed is a far greater concern for motorcycles than cars on grooved pavement, milled asphalt and tapers from existing pavement

down to milled surfaces. Adequate signing to warn for these conditions to alert the motorcycle rider are required by RCW 47.36.200 and WAC 468-95-305. See TCD 2 for a typical signing layout example.

1.8.4 Schools

Work zone operations in the vicinity of schools require consideration to ensure that conflicts are kept to a minimum. Issues that should be considered are:

- Student path to and from the school
- Bus movements for loading and unloading students
- Coordination with crossing guards
- School hours to minimize impacts

1.8.5 Oversize Loads

Oversized vehicles may exceed the legal width, height, or weight limits for vehicles, but are still allowed to travel on certain state highways. WSDOT Commercial Vehicle Services issues permits that allow the oversized vehicles to use these routes, and in some areas, the Region Maintenance Office also issues permits. If the proposed work zone will not accommodate over legal vehicles, then additional warning signs are necessary and notification to the Commercial Vehicle Services and the Region's Maintenance Offices that issue these permits so they are aware of the restrictions is necessary. On some projects, it may be necessary to designate a detour route for oversized vehicles. A specific and specialized TCP and warning signs should be considered to address oversize load conflicts and this information must be shared with Commercial Vehicle Services for their use in processing permits. Contact the Region Traffic Office for assistance in determining and developing detour route plans.

1.9 Additional Work Zone Considerations

1.9.1 Work Zone Speed Limits

The speed limits on state highways are set by the State Traffic Engineer and cannot be changed without approval. Only use reduced legal speed limits when the safe operating speed of the roadway determines the need to do so. Safety issues such as access points, sight distance, poor roadway condition, and reduced geometric features are some examples of issues that may apply. Speed reduction guidelines are outlined in RCW 47.48.020, the *Construction Manual* (M 41-01), and WSDOT Directive D55-20, "Reduced Speed in Maintenance and Construction Work Zones."

Do not reduce speed limits based on the hope that traffic will slow down when there is no driver perceived need to do so. Proposals to reduce the speed limit for work zones must be submitted to the Region Traffic Office for consideration and Regional Administrator approval.

1.9.2 Worker Protection

"All WSDOT employees are directed to make the safety of workers and the traveling public our highest priority during roadway design, construction, maintenance, and related activities" (excerpt from Executive Order E 1001.01).

Working on or along the highway can present a potentially hazardous work environment. Consider the risk to workers when developing the traffic control plans. An assessment of worker safety should be made prior to beginning work operations.

1.9.3 Buffer Space and Shy Distance

Buffer space is a lateral and/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. A minimum of 2-foot lateral buffer space is recommended.
- Shy distance is the 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.
- Longitudinal buffer is the space between the end of the taper and the protective vehicle. Refer to Appendix 3-3 for additional information.

Devices used to separate the driver from the work space should not encroach into adjacent lanes. If encroachment is necessary, it is recommend to close the adjacent lane to maintain the lateral buffer space.

In the case of short-term 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.

1.9.4 Lane Closure Setup/Takedown

Traffic control measures to close one or more lanes on a multi-lane facility can vary, but in an effort to provide consistency and general guidance on how to best perform the operation, the following sequence has been provided:

1. Advance warning signs are set up on the shoulder of the roadway opposite the lane to be closed.
2. Advance warning signs are set up on the same shoulder as the lane to be closed.

3. A truck-mounted attenuator, with arrow board, is moved into place at the beginning of the closure taper.
4. Channelization devices are placed to mark the taper and the length of the closure as shown on the traffic control plan.

Once the lane is closed, the TMA/arrow board combination may be replaced with an arrow board without attenuator.

If additional lanes are to be closed, this shall be done in sequence with previous lane closures using the same sequence of activities. A truck-mounted attenuator with arrow board is required during the process of closing each additional lane and may be replaced with an arrow board without attenuator after the lane is closed. Each closed lane shall be marked with a separate arrow board at all times.

Traffic control devices (cones, drums, channelizing devices, etc.) for lane closures shall be removed in the reverse order of its installation.

1.9.5 Survey Work Zones

For surveying operations along the centerline of a high-volume road, one lane shall be closed following the guidance shown on TCP 1**.**

The guidance and TCPs contained in these guidelines do not reflect a specific type of work operation, which is consistent with the principles of Part VI of the MUTCD. It is intended that survey crews will follow the guidance shown in these guidelines to accommodate their work needs. Moving centerline work operations are not allowed. Survey crews are not allowed any additional flexibility than other work crews to conduct work operations in a safe manner as intended within the established rules and guidance. However, TCPs more specific to survey operations may be considered. If specific plans are necessary or additional guidance is needed, contact the Region Traffic Office for assistance.

1.9.6 Public Information

Accurate and timely reporting of work zone information to the public is a valuable element in the overall traffic control strategy. The use of public information resources, such as project web pages, newspapers, radio, and television can greatly improve the public's perception and acceptance of the necessary delays and other inconveniences caused by the project's construction. Contact the Region Public Information Office for assistance.

Issues to consider are:

- Emergency services coordination so they are aware of the project and can make adjustments to routes if necessary when responding to emergencies.
- Transit organizations, they may require adjustments to bus stop locations within project limits.

- Schools and local business, special considerations may be necessary for them to maintain access to their sites.

1.9.7 Roundabout Traffic Control

For work within the roundabout, initial advance warning signs are required for each approach leg. If the work operation and all work vehicles are off of the travel lanes and island apron, a single Road Work Ahead sign per approach is all that is required. If any of the road approaches to the roundabout cannot access the intersection due to work operations, then either flagging or possibly a detour are required. If the center island apron will be impacted by the work or equipment, treat it as a shoulder closure for the length of work and consider diverting truck traffic due to large vehicle wheel tracking. For multi-lane roundabouts, if work can be done without closing both travel lanes, flaggers may not be needed. Appropriate signs for lane closure at each entry are required.

A traffic control plan needs to be drawn for each individual roundabout specific to the location, a generic typical detail has been provided as a guide, see TCD 13.

1.9.8 Road Closures

This work type requires the complete closure of the roadway in order to pursue the work operation. Advance notification of the closure is required and a signed detour route is required. Closing a highway, street, or ramp, while not always practical, is a desirable option from a safety viewpoint. For the traveling public, closing the road for a short time might be less of an inconvenience than driving through a work zone for an extended period of time.

Workers should not assume that because a road closure is in place that a danger from vehicles does not exist. Even with a posted road closure, the potential may exist for a vehicle to get past a closure point. It is important for workers to remain vigilant and aware of their surroundings at all times.

When it is necessary to close a road, street, or ramp, submit a request to the Region Traffic Office in advance of the need. Per RCW 47.48.010, the Regional Administrator has the authority to close a road, street, or ramp.

If a road closure is feasible, take the following actions:

- Obtain local agency approval; consult with Region Local Programs Office to determine if a detour agreement is necessary.
- Determine if a detour route is available and adequate to handle the detouring traffic volume.
- Determine maximum number of days allowed for the closure.

- Determine if additional traffic control measures are needed at intersections along the detour route and any other locations such as railroad crossings and movable bridges.
- Contact emergency services, schools, and transit organizations, etc.
- Coordinate with the region public information officer for assistance with public notification.
- Before any new detour route or alternate route is opened to traffic, all necessary signs shall be in place.

Short-term closures may be allowed without advance public notification for emergencies or off-peak closure (night closure). Check with the region traffic office prior to implementing a closure.

1.9.9 Detour

This work zone type involves total closure of the roadway. Traffic is rerouted to an adjacent street or roadway to avoid a traffic control work zone operation. Detours should be clearly signed over their entire length so that drivers can easily use existing roadways to return to the original highway. Follow the steps outlined earlier for road closures.

1.9.10 Special Event

Be aware that special events may conflict with the planned work operation and make adjustments to work hours if necessary. Coordinate with event to minimize impacts.

The region's public information officer can provide assistance in the coordination effort.

For any special event (parade, bike event, movie, or television commercials, etc.) on a state route where there is a roadway closure, detour, flagging operation or other traffic control, a traffic control plan is required. Event organizers must coordinate with WSDOT to obtain permits and submit a traffic control plan for approval prior to any event taking place on the state route. Refer to *Traffic Manual* M 52-02, Chapter 7, for additional information.

1.9.11 Work Over Traffic

Work over an open lane of traffic will not be allowed, unless a plan for the protection of the traveling public from debris falling onto the traveled way is approved by the Region Traffic Office. This protection shall remain in place during the work operation and meet the minimum vertical clearance for the roadway.

Checklist for Establishing a Temporary Traffic Control Zone*

Completed	*Item*
❑	Determine the duration of work (Stationary, Short-Duration, Mobile).*
❑	Select hours of work to avoid peak periods (refer to region work hour chart when applicable or contact the Region Traffic Office for assistance).*
❑	Select the appropriate layout(s), using duration, type of roadway, volume, and speed, from guidelines. See volume considerations in Section 3.9.
❑	Determine any modifications to typical layout(s).
❑	Check decision sight distance.
❑	Include intersections and driveways.
❑	Allow for buffer space free of obstructions.
❑	Check the condition of devices (Refer to Quality Guidelines Booklet).
❑	Install devices beginning with the first device the driver will see. Device spacing and layout as per chart shown on TCPs.
❑	Conduct a drive through to check for problems.
❑	Document temporary traffic control zone, problems and major modifications to the layouts.
❑	Continuously maintain devices while in place.
❑	Remove devices as soon as the work is completed, beginning with the last device placed.

*Utilize the Region Traffic Office staff for assistance to address concerns and questions.

Stationary work zones are work activities that exceed one hour but could last for several days or even longer. Signs and channelizing devices are required for stationary work zones. Devices, such as sequential arrow panels, barricades and protective vehicles, may also be used depending on the situation. For longer term projects, temporary concrete barrier, temporary pavement markings, and post mounted signs might be typical devices necessary.

Examples of stationary work zone operations include: paving, light standard repair, sign installation, and bridge repair. Stationary work zone traffic control is usually associated with a substantial work operation that may have many workers, equipment, truck-hauling, and flagging.

Traffic operations, all work activities, workers, and flagger locations must be incorporated into the work zone operation and provided for during planning and selecting the Traffic Control Plans (TCPs).

The following TCPs show typical stationary traffic control setups for a variety of situations commonly encountered.

TCP 1 – ***Typical Alternating One-way Traffic Flagger Controlled***
(For two-lane, two-way roadways with possible intersection.)

TCP 2 – ***Typical Pilot Car Operation***
(This plan supplements the flagger control plan when additional direction is necessary for safety of driver and crews.)

TCP 3 – ***Typical Single-lane Closure for Multi-lane Roadways***
(For multi-lane operations requiring a lane closure.)

TCP 4 – ***Typical Double-lane Closure for Multi-lane Roadways***
(For high-speed work operations requiring two lanes being closed.)

TCP 5 – ***Typical Shoulder Closure – Low Speed (40 mph or Less)***
(Shoulder closure operations for 40 mph or less roadways allowing minor lane encroachment.)

TCP 6 – ***Typical Shoulder Closure – High Speed (45 mph or Higher)***
(Shoulder closure operations 45 mph or higher with no encroachment allowed. Maintain at least a 2-foot buffer space between work and fog line.)

TCP 7 – ***Typical Temporary Off-ramp for Multi-lane Roadways***
(This plan provides a method to maintain an off-ramp connection during a short-term work operation.)

TCP 8 – ***Typical Temporary On-ramp for Multi-lane Roadways (Add Lane Condition)***
(This plan provides a method to maintain an on-ramp connection during a short-term work operation. This allows for the on-ramp traffic to enter the roadway with an add-lane connection.)

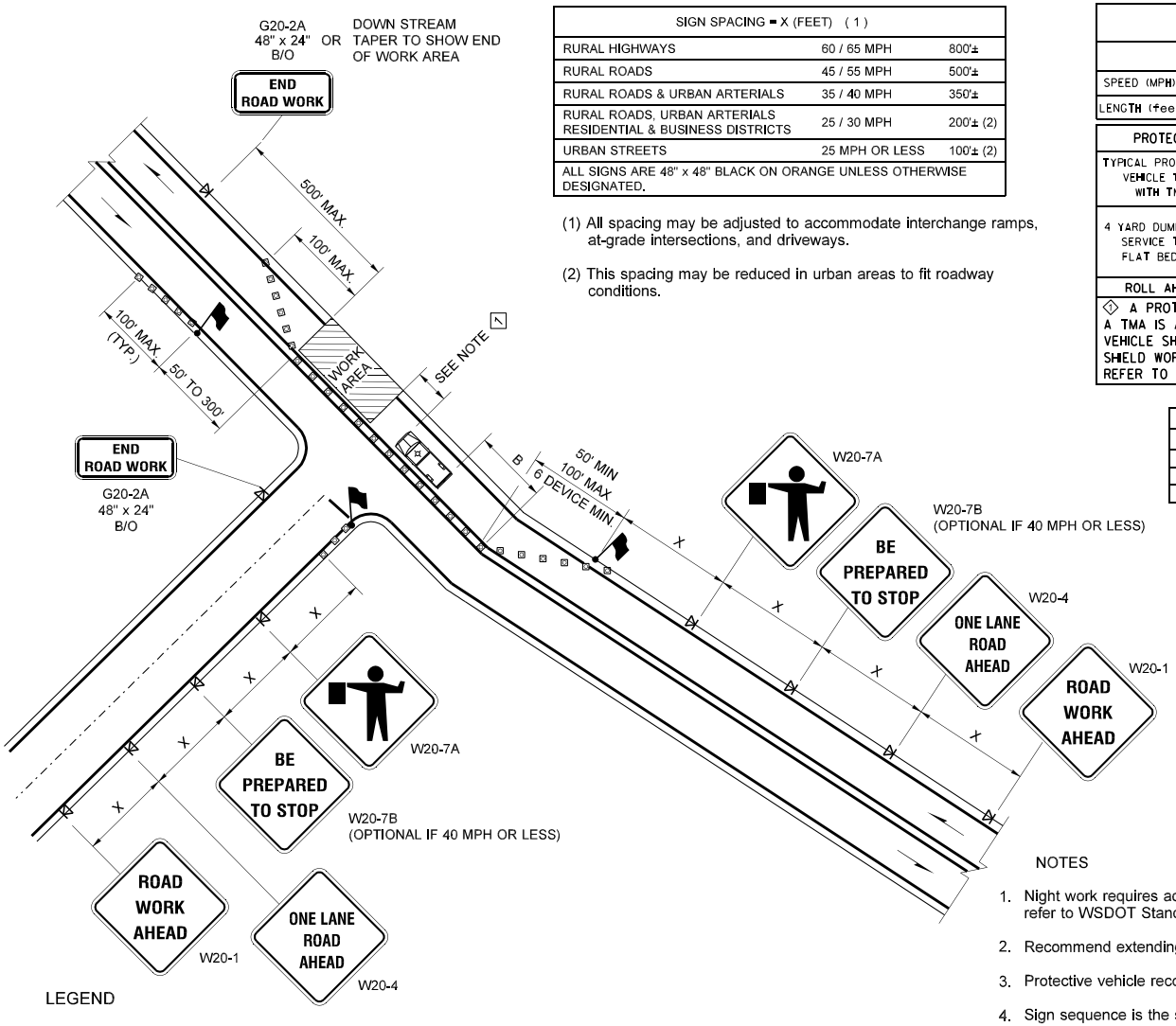
TCP 9 – ***Typical Short-term Temporary On-ramp for Multi-lane Roadways (Merge Condition)***
(This plan provides a method to maintain an on-ramp connection for a short-term work operation. For long-term operations, this merge connection is not appropriate and requires a ramp design to ensure the appropriate taper rates are maintained.)

TCP 10 – ***Typical Right Lane Closure With Shift – 5 Lane Roadway***
(This plan applies to an urban setting with two-way turn pockets. The turn pocket is used to maintain the through movement and the left turn movements are restricted.)

TCP 11 – ***Typical Left Lane and Center Turn Lane Closure – 5 Lane Roadway***
(This plan applies to an urban setting with a two-way turn pocket where the work area is the inside lanes. The through traffic is maintained in the outside lanes and the left-turn movements are restricted.)

TCP 12 – ***Typical Lane Shift – Three Lane Roadway***
(This plan allows maintaining one lane in each direction by utilizing one of the lanes in the multi-lane section for the opposite direction. Example would be a truck climbing lane location.)

TCP 13 – ***Typical Short-term Ramp Closure (On-ramp and Off-ramp)***
(This plan depicts the signing and devices required for both a off-ramp closure operation and an on-ramp closure operation.)



SIGN SPACING = X (FEET) (1)		
RURAL HIGHWAYS	60 / 65 MPH	800'±
RURAL ROADS	45 / 55 MPH	500'±
RURAL ROADS & URBAN ARTERIALS	35 / 40 MPH	350'±
RURAL ROADS, URBAN ARTERIALS RESIDENTIAL & BUSINESS DISTRICTS	25 / 30 MPH	200'± (2)
URBAN STREETS	25 MPH OR LESS	100'± (2)
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

(1) All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.

(2) This spacing may be reduced in urban areas to fit roadway conditions.

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730

PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE		
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN. 100 MAX.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT		
1 A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED. REFER TO CHAPTER 1.5.5 FOR ADDITIONAL INFORMATION		

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50 / 65	40	80
35 / 45	30	60
25 / 30	20	40

NOTES

1. Night work requires additional roadway lighting at flagging stations, refer to WSDOT Standard Specifications for additional details.
2. Recommend extending channelizing device taper across shoulder.
3. Protective vehicle recommended - may be a work vehicle.
4. Sign sequence is the same for both directions of travel on the roadway.
5. When used, the downstream taper device spacing should be 20' O.C.
6. For low-volume situations with short work zones on straight roadways where the flagger is visible to road users approaching from both directions, a single flagger, positioned to be visible from both directions may be used.

LEGEND

FLAGGING STATION

SIGN LOCATION

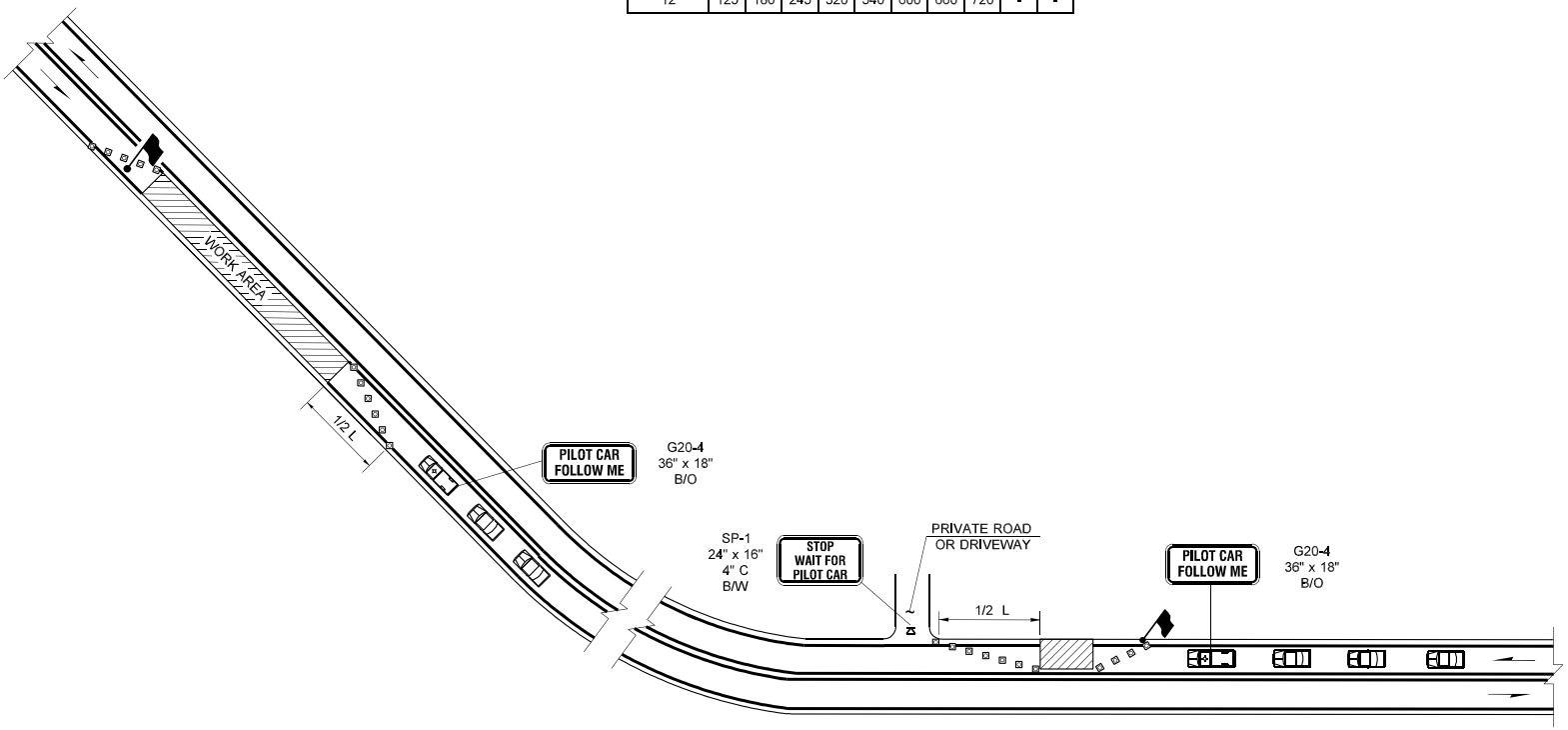
CHANNELIZING DEVICES

PROTECTIVE VEHICLE - RECOMMENDED

TYPICAL ALTERNATING ONE-WAY TRAFFIC FLAGGER CONTROLLED
TCP 1

MINIMUM TAPER LENGTH = L (feet)										
Lane Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	105	150	205	270	450	500	550	-	-	-
11	115	165	225	295	495	550	605	660	-	-
12	125	180	245	320	540	600	660	720	-	-

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50 / 65	40	80
35 / 45	30	60
25 / 30	20	40



NOTES

1. Refer to sheet TCP 1 for additional signing and flagging details not shown.
2. Channelizing devices are recommended along centerline to separate traffic from work operation. Devices are required at tapers to shift traffic movement between lanes and recommended for protection at all flagging stations.
3. Sign SP-1 is recommended for non-stop sign controlled approaches such as private driveways and roads. This sign is not required to be aluminum substrate and can be made of alternative materials.

LEGEND

- FLAGGING STATION
- SIGN LOCATION
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- MOTORIST VEHICLE

TYPICAL PILOT CAR OPERATION
TCP 2

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730

PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE		
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN. 100 MAX.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT		

(1) A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED. REFER TO CHAPTER 1.5.5 FOR ADDITIONAL INFORMATION

MINIMUM TAPER LENGTH = L (feet)										
Lane Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	105	150	205	270	450	500	550	-	-	-
11	115	165	225	295	495	550	605	660	-	-
12	125	180	245	320	540	600	660	720	780	840

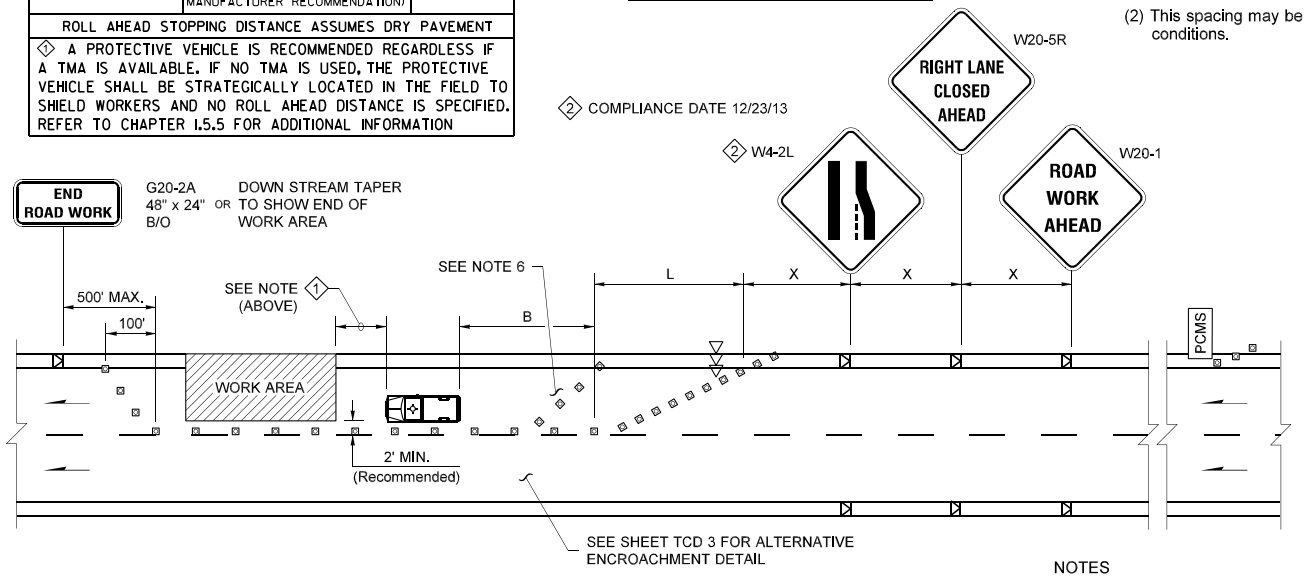
CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50 / 70	40	80
35 / 45	30	60
25 / 30	20	40

SIGN SPACING = X (FEET) (1)		
FREEWAYS & EXPRESSWAYS	55/70 MPH	1500'±(OR AS PER MUTCD)
RURAL HIGHWAYS	60/65 MPH	800'±
RURAL ROADS	45/55 MPH	500'±
RURAL ROADS & URBAN ARTERIALS	35/40 MPH	350'±
RURAL ROADS, URBAN ARTERIALS RESIDENTIAL & BUSINESS DISTRICTS	25/30 MPH	200'± (2)
URBAN STREETS	25 MPH OR LESS	100'± (2)
ALL SIGNS ARE 48" X 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

(1) All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.

(2) This spacing may be reduced in urban areas to fit roadway conditions.

(2) COMPLIANCE DATE 12/23/13



(SAMPLE MESSAGE)

PCMS	
1	2
LANE CLOSED	1 MILE AHEAD
1.5 SEC	1.5 SEC

FIELD LOCATE 1 MILE ± IN ADVANCE OF LANE CLOSURE TAPER.

NOTES

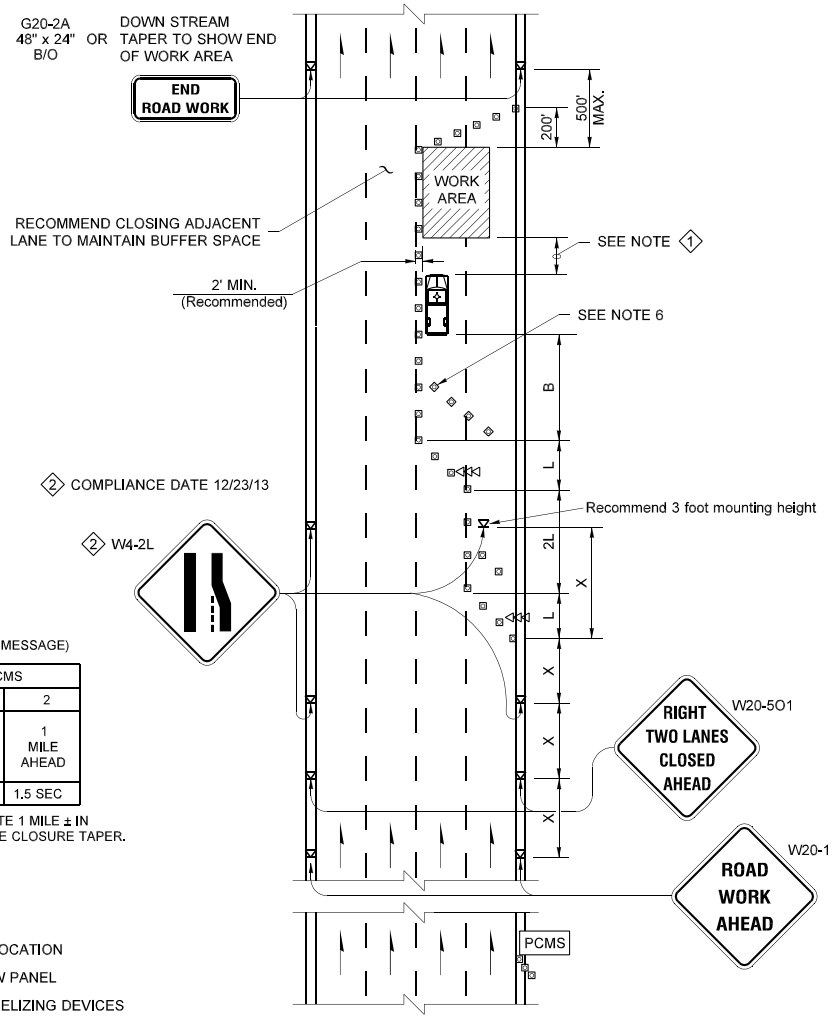
1. Protective vehicle recommended - may be a work vehicle.
2. Contact region Traffic Office for work hour restriction.
3. Recommend extending device taper (L/3) across shoulder.
4. Devices should not encroach into adjacent lanes.
5. PCMS recommended.
6. Use transverse devices in closed lane every 1000'± (recommended).
7. Traffic safety drums recommended for all tapers on high speed roadway. Refer to appendix 2-2 for additional device information.
8. When used, device spacing for the downstream taper should be 20' O.C.

LEGEND

- SIGN LOCATION
- ARROW PANEL
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- PCMS — PORTABLE CHANGEABLE MESSAGE SIGN

TYPICAL SINGLE-LANE CLOSURE FOR MULTI-LANE ROADWAYS
TCP 3

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50 / 70	40	80
40 / 45	30	60



(SAMPLE MESSAGE)

PCMS	
1	2
LANE CLOSED	1 MILE AHEAD
1.5 SEC	1.5 SEC

FIELD LOCATE 1 MILE ± IN ADVANCE OF LANE CLOSURE TAPER.

LEGEND

- SIGN LOCATION
- ARROW PANEL
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- PCMS — PORTABLE CHANGEABLE MESSAGE SIGN

TYPICAL DOUBLE-LANE CLOSURE FOR MULTI-LANE ROADWAYS
TCP 4

SIGN SPACING = X (FEET) (1)		
FREEWAYS & EXPRESSWAYS	55/70 MPH	1500'±(OR AS PER MUTCD)
RURAL HIGHWAYS	60/65 MPH	800'±
RURAL ROADS	45/55 MPH	500'±
RURAL ROADS & URBAN ARTERIALS	35/40 MPH	350'±
RURAL ROADS, URBAN ARTERIALS RESIDENTIAL & BUSINESS DISTRICTS	25/30 MPH	200'± (2)
URBAN STREETS	25 MPH OR LESS	100'± (2)
ALL SIGNS ARE 48" X 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

(1) All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.

(2) This spacing may be reduced in urban areas to fit roadway conditions.

MINIMUM TAPER LENGTH = L (feet)										
Lane Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	-	-	-	270	450	500	550	-	-	-
11	-	-	-	295	495	550	605	660	-	-
12	-	-	-	320	540	600	660	720	780	840

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730

PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE		
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN. 100 MAX.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT		
1 A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED. REFER TO CHAPTER 1.5.5 FOR ADDITIONAL INFORMATION		

NOTES

1. Protective vehicle recommended - may be a work vehicle.
2. Contact region Traffic Office for work hour restriction.
3. Recommend extending device taper (L/3) across shoulder.
4. Devices should not encroach into adjacent lanes.
5. PCMS recommended.
6. Use transverse devices in closed lane every 1000'± (recommended).
7. Traffic safety drums recommended for all tapers on high speed roadway. Refer to appendix 2-2 for additional device information.
8. When used, device spacing for the downstream taper should be 20' O.C.

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730

PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE		
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN. 100 MAX.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT		
(1) A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED. REFER TO CHAPTER 1.5.5 FOR ADDITIONAL INFORMATION		

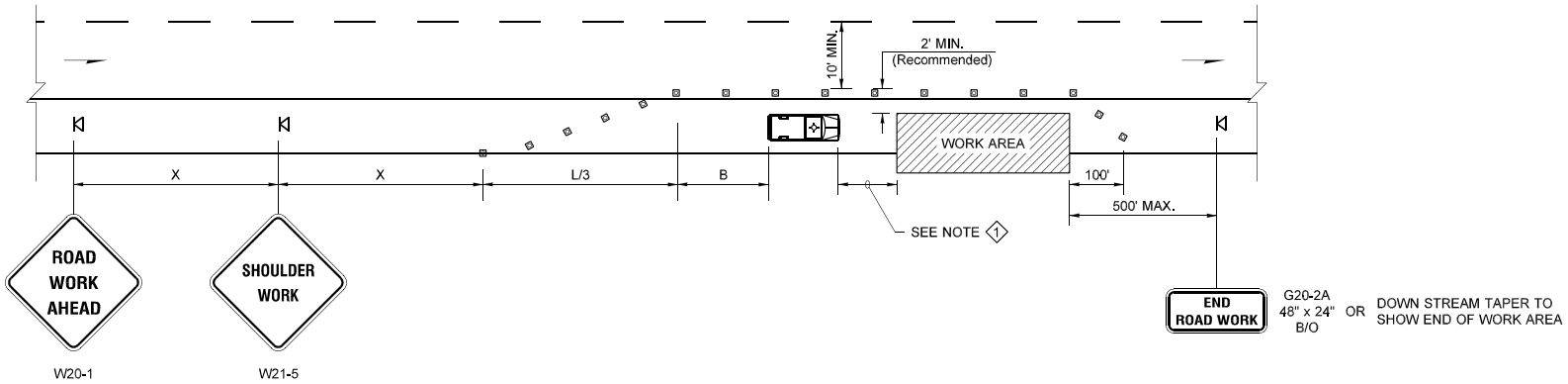
SIGN SPACING = X (FEET) (1)		
RURAL ROADS & URBAN ARTERIALS	35 / 40 MPH	350'±
RURAL ROADS, URBAN ARTERIALS RESIDENTIAL & BUSINESS DISTRICTS	25 / 30 MPH	200'± (2)
URBAN STREETS	25 MPH OR LESS	100'± (2)
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

(1) All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.

(2) This spacing may be reduced in urban areas to fit roadway conditions.

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
35 / 40	30	60
45 / 30	20	40

MINIMUM TAPER LENGTH = L (feet)										
Shoulder Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
6	63	90	123	165	-	-	-	-	-	-
8	84	120	162	210	-	-	-	-	-	-
10	105	150	204	270	-	-	-	-	-	-
3 DEVICES MINIMUM SPACED 10' O.C. IN TAPERS FOR SHOULDER WIDTHS LESS THAN 6 FEET										



NOTES

1. Protective vehicle recommended - may be a work vehicle.
2. When used, device spacing for the downstream taper should be 20' O.C.

LEGEND

- SIGN LOCATION
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED

TYPICAL SHOULDER CLOSURE - LOW SPEED (40 MPH OR LESS)
TCP 5

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730

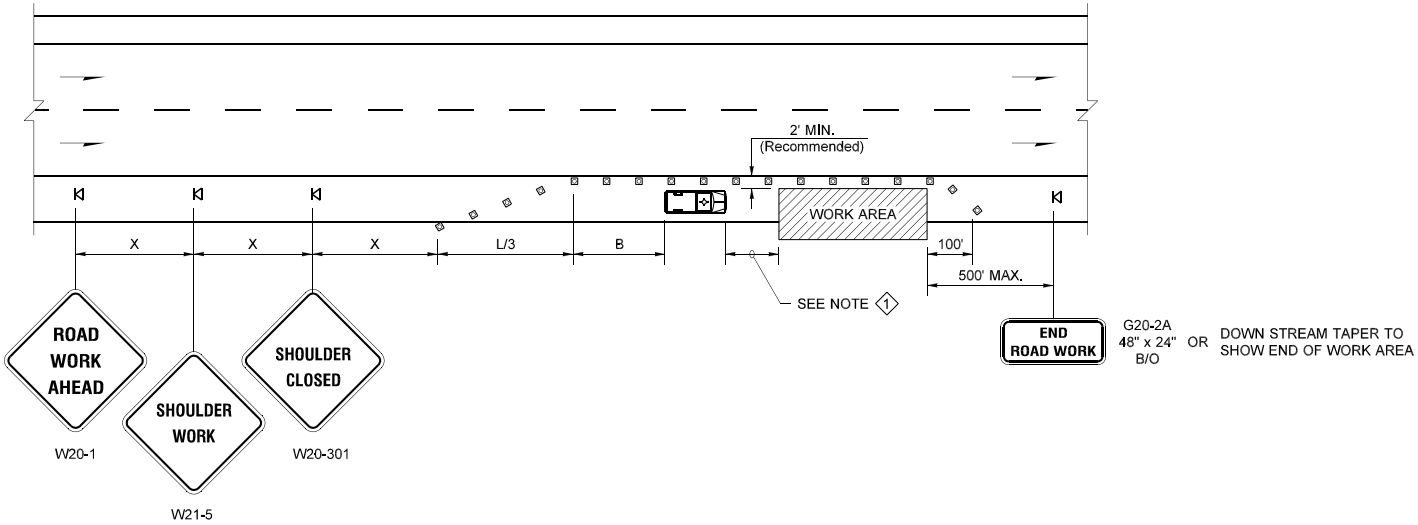
PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE		
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN. 100 MAX.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT		
1 A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED. REFER TO CHAPTER 1.5.5 FOR ADDITIONAL INFORMATION		

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50 / 70	40	80
45 / 50	30	60

SIGN SPACING = X (FEET)		
FREEWAYS & EXPRESSWAYS	55 / 70 MPH	1500'±(OR AS PER MUTCD)
RURAL HIGHWAYS	60 / 65 MPH	800'±
RURAL ROADS	45 / 55 MPH	500'±
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.

MINIMUM TAPER LENGTH = L (feet)										
Shoulder Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
6	-	-	-	-	270	300	330	360	390	420
8	-	-	-	-	360	405	450	480	525	570
10	-	-	-	-	450	510	555	600	660	705
3 DEVICES MINIMUM SPACED 10' O.C. IN TAPERS FOR SHOULDER WIDTHS LESS THAN 6 FEET										



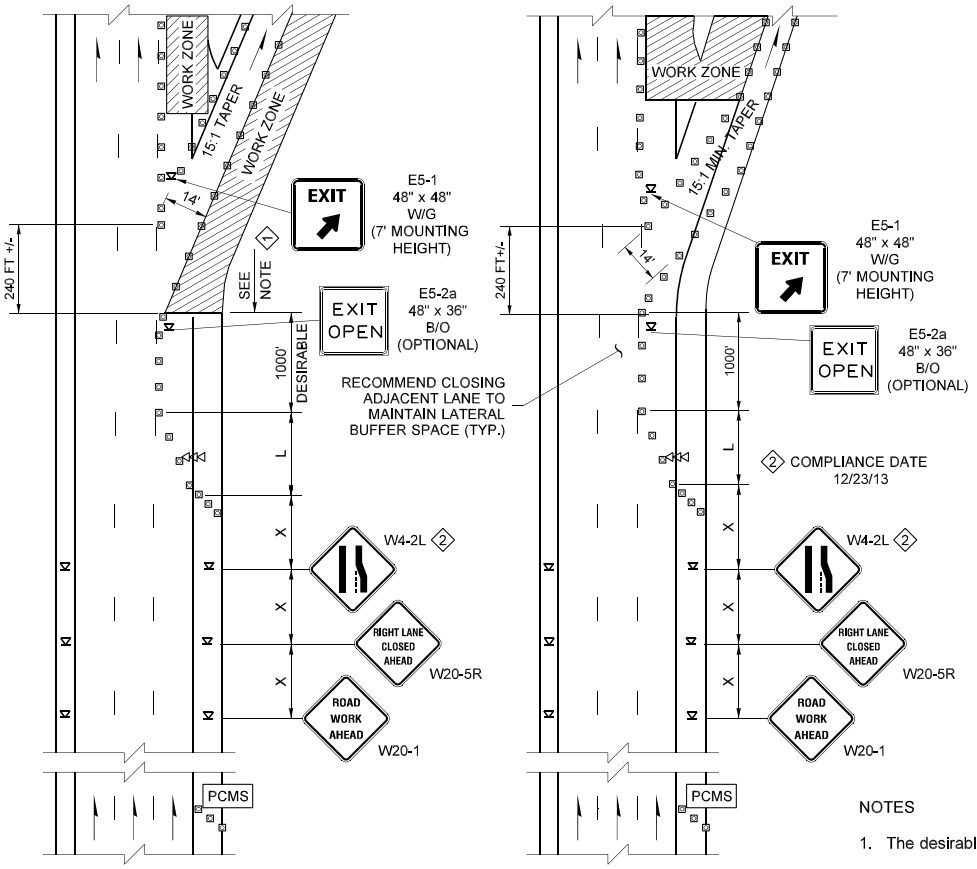
NOTES

1. No encroachment on traveled lane. if encroachment is necessary, lane shall be closed.
2. Protective vehicle recommended - may be a work vehicle.
3. When used, device spacing for the downstream taper should be 20' O.C.

LEGEND

- SIGN LOCATION
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED

TYPICAL SHOULDER CLOSURE - HIGH SPEED (45 MPH OR HIGHER)
TCP 6



BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730

PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE		
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN. 100 MAX.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT		
1 A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED. REFER TO CHAPTER 1.5.5 FOR ADDITIONAL INFORMATION		

MINIMUM TAPER LENGTH = L (feet)										
Lane Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	-	-	-	270	450	500	550	-	-	-
11	-	-	-	295	495	550	605	660	-	-
12	-	-	-	320	540	600	660	720	780	840

SIGN SPACING = X (FEET)		
FREEWAYS & EXPRESSWAYS	55 / 70 MPH	1500'±(OR AS PER MUTCD)
RURAL HIGHWAYS	60 / 65 MPH	800'±
RURAL ROADS	45 / 55 MPH	500'±
RURAL ROADS & URBAN ARTERIALS	35 / 40 MPH	350'±
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50 / 70	40	80
40 / 45	30	60

(SAMPLE MESSAGE)

PCMS	
1	2
LANE CLOSED	1 MILE AHEAD
1.5 SEC	1.5 SEC

FIELD LOCATE 1 MILE ± IN ADVANCE OF LANE CLOSURE TAPER.

LEGEND

- SIGN LOCATION
- ARROW PANEL
- CHANNELIZING DEVICES
- PCMS — PORTABLE CHANGEABLE MESSAGE SIGN - RECOMMENDED

NOTES

1. The desirable ramp width is 14' and a 15:1 ramp taper.
2. G20-2a End Road work sign should be installed 500' beyond the work area or use a down stream taper. When used, device spacing for the down stream taper should be 20' O.C.
3. Protective vehicle recommended - may be a work vehicle.
4. Contact region Traffic Office for work hour restrictions.
5. Recommend extending device taper (L/3) across shoulder.
6. Devices should not encroach into adjacent lanes.
7. Use transverse devices in closed lane every 1000'± (recommended).
8. Traffic safety drums recommended for all tapers on high speed roadway. (Refer to appendix 2-2 for additional device information.)
9. Consider short term closure of ramp.

TYPICAL TEMPORARY OFF-RAMP FOR MULTI-LANE ROADWAYS
TCP 7

MINIMUM TAPER LENGTH = L (feet)										
Lane Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	-	-	-	270	450	500	550	-	-	-
11	-	-	-	295	495	550	605	660	-	-
12	-	-	-	320	540	600	660	720	780	840

SIGN SPACING = X (FEET)		
FREEWAYS & EXPRESSWAYS	55 / 70 MPH	1500'±(OR AS PER MUTCD)
RURAL HIGHWAYS	60 / 65 MPH	800'±
RURAL ROADS	45 / 55 MPH	500'±
RURAL ROADS & URBAN ARTERIALS	35 / 40 MPH	350'±
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

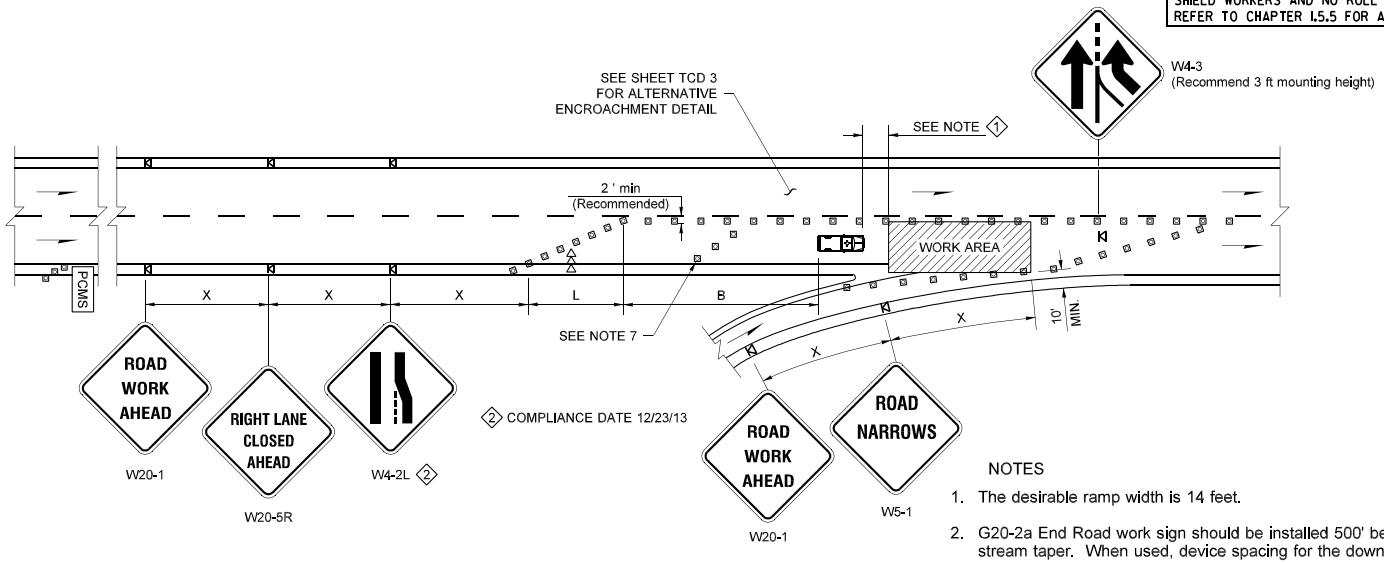
All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730

PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE		
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN. 100 MAX.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT		

1 A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED. REFER TO CHAPTER 1.5.5 FOR ADDITIONAL INFORMATION

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50 / 70	40	80
40 / 45	30	60



(SAMPLE MESSAGE)

PCMS	
1	2
LANE CLOSED	1 MILE AHEAD
1.5 SEC	1.5 SEC

FIELD LOCATE 1 MILE ± IN ADVANCE OF LANE CLOSURE TAPER.

NOTES

1. The desirable ramp width is 14 feet.
2. G20-2a End Road work sign should be installed 500' beyond the work area or use a down stream taper. When used, device spacing for the down stream taper should be 20' O.C.
3. Protective vehicle recommended - may be a work vehicle.
4. Contact region Traffic Office for work hour restriction.
5. Recommend extending device taper (L/3) across shoulder.
6. Devices should not encroach into adjacent lanes.
7. Use transverse devices in closed lane every 1000ft (recommended).
8. Traffic safety drums recommended for all tapers on high speed roadway. (Refer to appendix 2-2 for additional device information)
9. Consider short term closure of ramp.

LEGEND

- SIGN LOCATION
- ARROW PANEL
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- PCMS — PORTABLE CHANGEABLE MESSAGE SIGN - RECOMMENDED

TYPICAL TEMPORARY ON-RAMP FOR MULTI-LANE ROADWAYS
TCP 8

MINIMUM TAPER LENGTH = L (feet)										
Lane Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	-	-	-	270	450	500	550	-	-	-
11	-	-	-	295	495	550	605	660	-	-
12	-	-	-	320	540	600	660	720	780	840

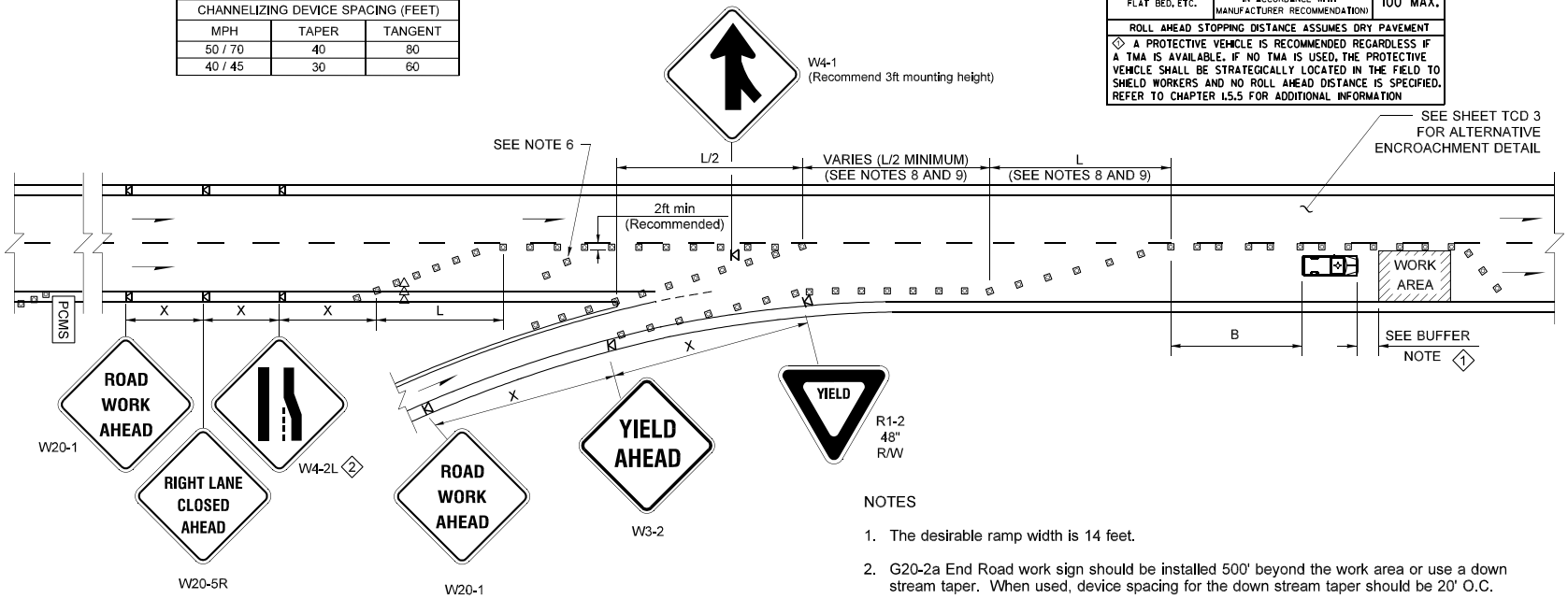
SIGN SPACING = X (FEET)		
FREEWAYS & EXPRESSWAYS	55 / 70 MPH	1500'±(OR AS PER MUTCD)
RURAL HIGHWAYS	60 / 65 MPH	800'±
RURAL ROADS	45 / 55 MPH	500'±
RURAL ROADS & URBAN ARTERIALS	35 / 40 MPH	350'±
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (Feet)	155	200	250	305	360	425	495	570	645	730

PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE		
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (Feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN. 100 MAX.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT		
◇ A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED. REFER TO CHAPTER 1.5.5 FOR ADDITIONAL INFORMATION		

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50 / 70	40	80
40 / 45	30	60



2 COMPLIANCE DATE 12/23/13

(SAMPLE MESSAGE)

PCMS	
1	2
LANE CLOSED	1 MILE AHEAD
1.5 SEC	1.5 SEC

FIELD LOCATE 1 MILE ± IN ADVANCE OF LANE CLOSURE TAPER.

NOTES

1. The desirable ramp width is 14 feet.
2. G20-2a End Road work sign should be installed 500' beyond the work area or use a down stream taper. When used, device spacing for the down stream taper should be 20' O.C.
3. Protective vehicle recommended - may be a work vehicle.
4. Contact region Traffic Office for work hour restrictions.
5. Recommend extending device taper (L/3) across shoulder.
6. Use transverse devices in closed lane every 1000'± (recommended).
7. Traffic safety drums recommended for all tapers on high speed roadway. (Refer to Appendix 2-2 for additional device information)
8. Where inadequate acceleration distance exists for the temporary entrance ramp, consider short term closure of ramp.
9. For long term on-ramp connections, the ramp must be designed in order to meet minimum acceleration and merge requirements. For additional information and assistance contact the region traffic office and refer to the Design Manual and Standard Plans.

LEGEND

- SIGN LOCATION
- ARROW PANEL
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- PCMS — PORTABLE CHANGEABLE MESSAGE SIGN

TYPICAL SHORT-TERM TEMPORARY ON-RAMP FOR MULTI-LANE ROADWAYS
TCP 9

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730

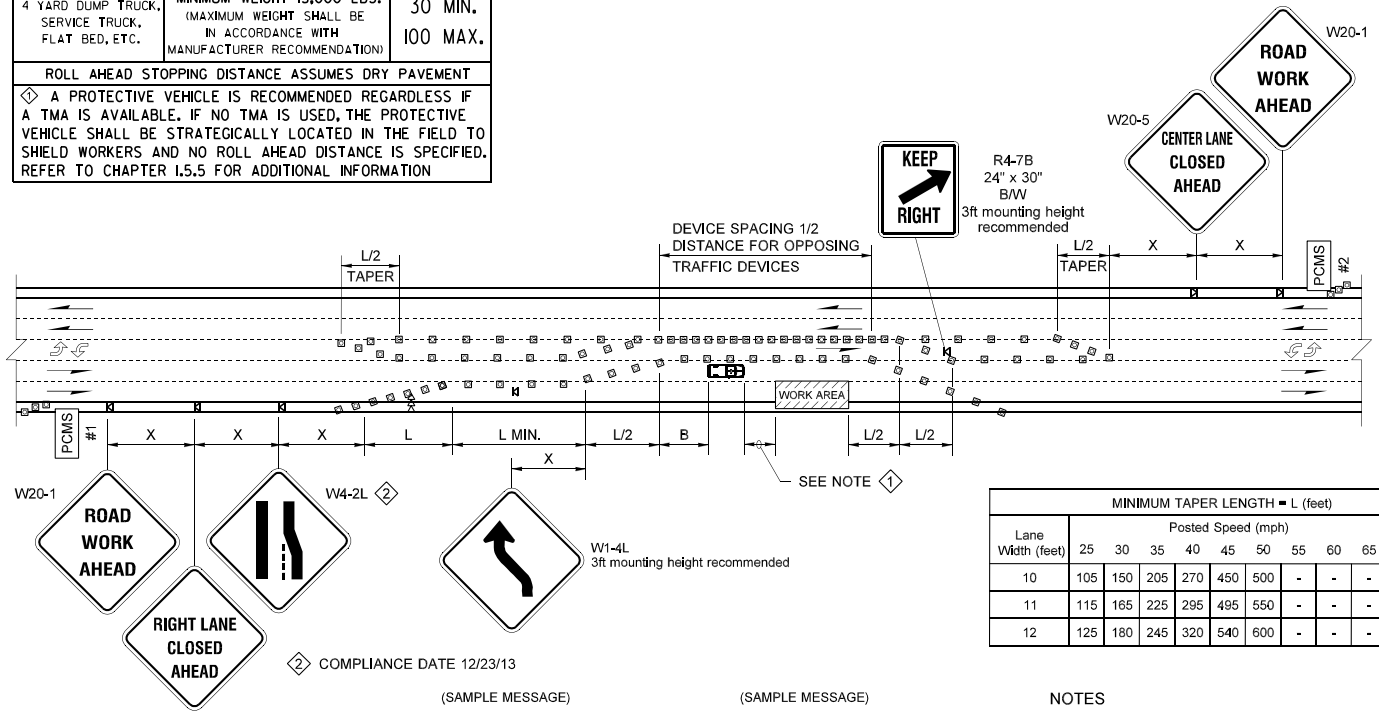
PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE		
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN. 100 MAX.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT		

1 A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED. REFER TO CHAPTER 1.5.5 FOR ADDITIONAL INFORMATION

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50	40	80
35 / 45	30	60
25 / 30	20	40

SIGN SPACING = X (FEET)		
RURAL ROADS	45 / 55 MPH	500'±
RURAL ROADS & URBAN ARTERIALS	35 / 40 MPH	350'±
RURAL ROADS, URBAN ARTERIALS RESIDENTIAL & BUSINESS DISTRICTS	25 / 30 MPH	200'±
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.



2 COMPLIANCE DATE 12/23/13

MINIMUM TAPER LENGTH = L (feet)										
Lane Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	105	150	205	270	450	500	-	-	-	-
11	115	165	225	295	495	550	-	-	-	-
12	125	180	245	320	540	600	-	-	-	-

(SAMPLE MESSAGE)

PCMS #1	
1	2
LANES CLOSED AHEAD	1 MILE AHEAD
1.5 SEC	1.5 SEC

FIELD LOCATE IN ADVANCE OF LANE CLOSURE TAPER.

(SAMPLE MESSAGE)

PCMS #2	
1	2
CENTER LANE CLOSED	NO LEFT TURNING
1.5 SEC	1.5 SEC

FIELD LOCATE IN ADVANCE OF LANE CLOSURE TAPER.

NOTES

1. Protective vehicle recommended - may be a work vehicle.
2. Recommend extending device taper (L/3) across shoulder.
3. Contact region traffic office for work hour restrictions.
4. If the lane shift is short and has minimal curve radius (30 mph or less) use sign W1-3 in lieu of sign W1-4.
5. PCMS recommended for each direction.

LEGEND

- SIGN LOCATION
- ARROW PANEL
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- PCMS — PORTABLE CHANGEABLE MESSAGE SIGN

TYPICAL RIGHT LANE CLOSURE WITH SHIFT - 5 LANE ROADWAY
TCP 10

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730

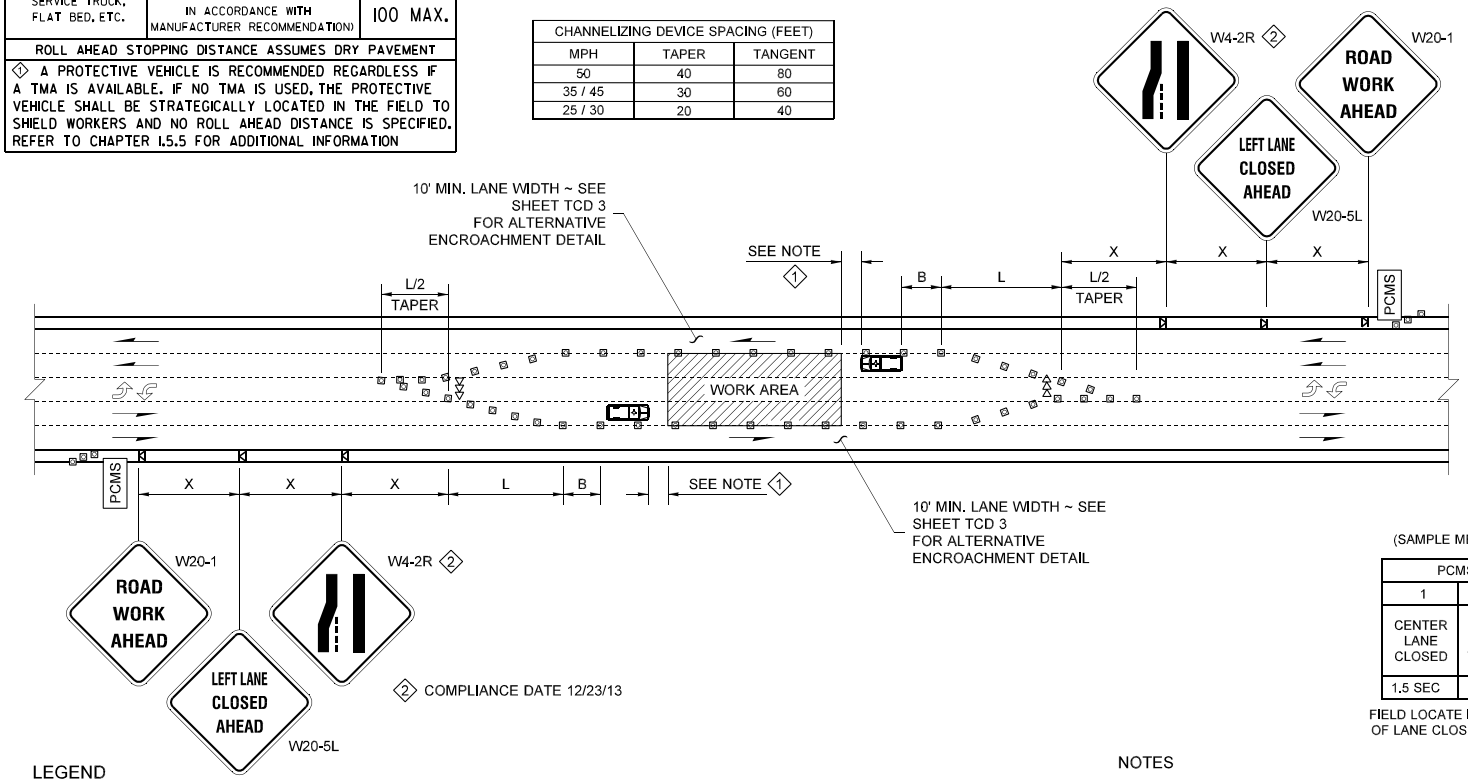
PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE		
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN. 100 MAX.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT		
1 A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED. REFER TO CHAPTER 1.5.5 FOR ADDITIONAL INFORMATION		

SIGN SPACING = X (FEET)		
RURAL ROADS	45 / 55 MPH	500'±
RURAL ROADS & URBAN ARTERIALS	35 / 40 MPH	350'±
RURAL ROADS, URBAN ARTERIALS RESIDENTIAL & BUSINESS DISTRICTS	25 / 30 MPH	200'±
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.

MINIMUM TAPER LENGTH = L (feet)										
Lane Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	105	150	205	270	450	500	-	-	-	-
11	115	165	225	295	495	550	-	-	-	-
12	125	180	245	320	540	600	-	-	-	-

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50	40	80
35 / 45	30	60
25 / 30	20	40



2 COMPLIANCE DATE 12/23/13

(SAMPLE MESSAGE)

PCMS	
1	2
CENTER LANE CLOSED	NO LEFT TURNING
1.5 SEC	1.5 SEC

FIELD LOCATE IN ADVANCE OF LANE CLOSURE TAPER.

LEGEND

- SIGN LOCATION
- ARROW PANEL
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- PCMS — PORTABLE CHANGEABLE MESSAGE SIGN

NOTES

1. Protective vehicle recommended - may be a work vehicle.
2. Contact region traffic office for work hour restrictions.
3. PCMS recommended.

TYPICAL LEFT LANE AND CENTER TURN LANE CLOSURE - 5 LANE ROADWAY
TCP 11

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730

PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE		
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN. 100 MAX.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT		

(1) A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED. REFER TO CHAPTER 1.5.5 FOR ADDITIONAL INFORMATION

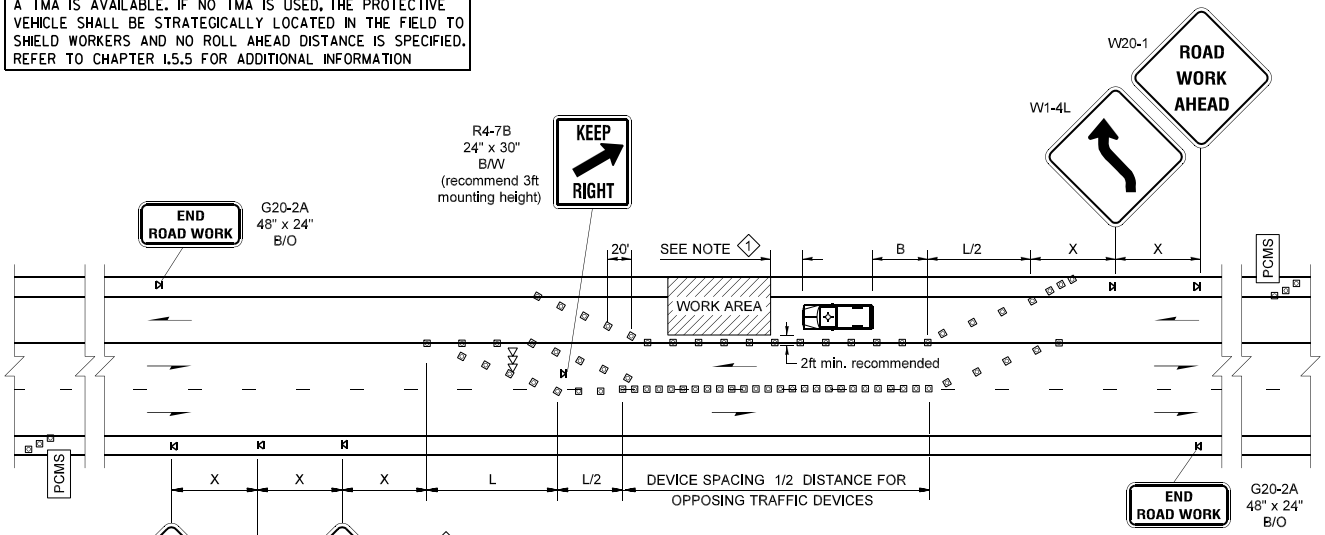
MINIMUM TAPER LENGTH = L (feet)										
Lane Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	105	150	205	270	450	500	550	-	-	-
11	115	165	225	295	495	550	605	660	-	-
12	125	180	245	320	540	600	660	720	-	-

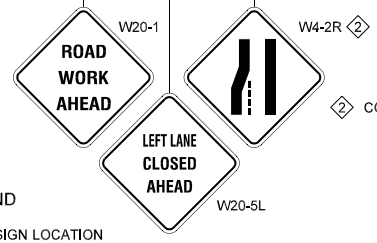
CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50 / 60	40	80
35 / 45	30	60
25 / 30	20	40

SIGN SPACING = X (FEET) (1)		
RURAL HIGHWAYS	60/65 MPH	800'±
RURAL ROADS	45/55 MPH	500'±
RURAL ROADS & URBAN ARTERIALS	35/40 MPH	350'±
RURAL ROADS, URBAN ARTERIALS RESIDENTIAL & BUSINESS DISTRICTS	25/30 MPH	200'± (2)
URBAN STREETS	25 MPH OR LESS	100'± (2)
ALL SIGNS ARE 48" X 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

(1) All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.

(2) This spacing may be reduced in urban areas to fit roadway conditions.





2 COMPLIANCE DATE 12/23/13

(SAMPLE MESSAGE)

PCMS	
1	2
LANE CLOSED	1 MILE AHEAD
1.5 SEC	1.5 SEC

FIELD LOCATE 1 MILE ± IN ADVANCE OF LANE CLOSURE TAPER.

LEGEND

- SIGN LOCATION
- ARROW PANEL
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- PCMS — PORTABLE CHANGEABLE MESSAGE SIGN

NOTES

1. For long term projects, conflicting pavement markings no longer applicable must be removed or obliterated as soon as practicable. Temporary markings shall be used as necessary and signs shall be post mounted.
2. Steady burn warning lights (Type C, MUTCD) should be used on channelizing devices at night for delineation.
3. For speed limits of 30mph or less, use sign W1-3 in lieu of sign W1-4.
4. Recommend extending device taper (L/3) across shoulder.
5. PCMS recommended.
6. Traffic safety drums recommended in tapers. Refer to appendix 2-2 for additional device information.

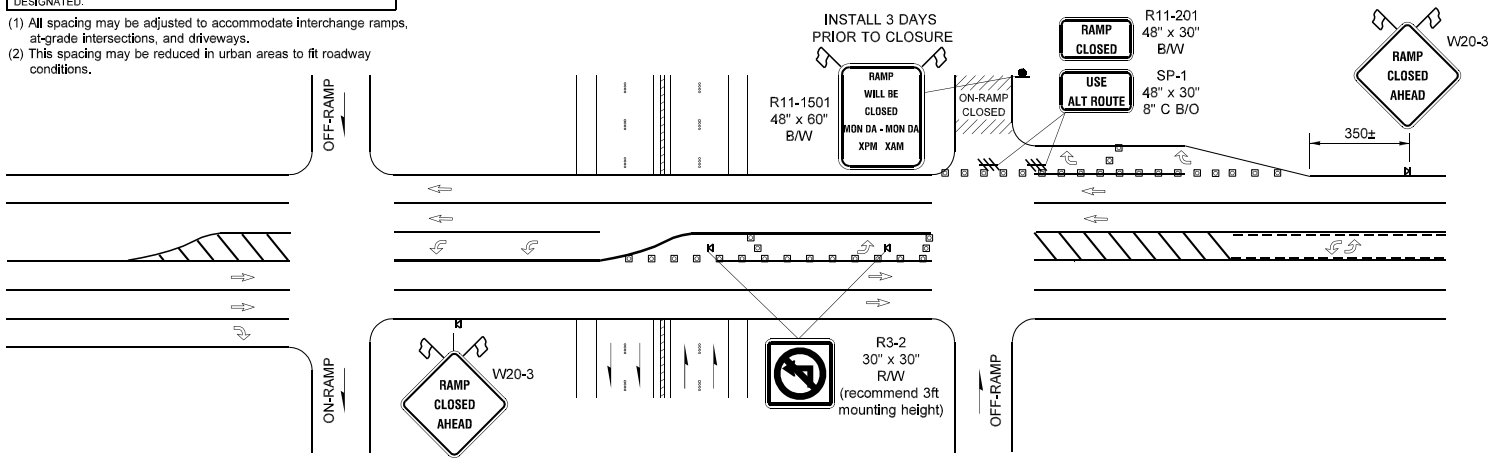
TYPICAL LANE SHIFT - THREE LANE ROADWAY
TCP 12

SIGN SPACING = X (FEET) (1)		
FREEWAYS & EXPRESSWAYS	55/70 MPH	1500'±(OR AS PER MUTCD)
RURAL HIGHWAYS	60/65 MPH	800'±
RURAL ROADS	45/55 MPH	500'±
RURAL ROADS & URBAN ARTERIALS	35/40 MPH	350'±
RURAL ROADS, URBAN ARTERIALS RESIDENTIAL & BUSINESS DISTRICTS	25/30 MPH	200'± (2)
URBAN STREETS	25 MPH OR LESS	100'± (2)
ALL SIGNS ARE 48" X 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

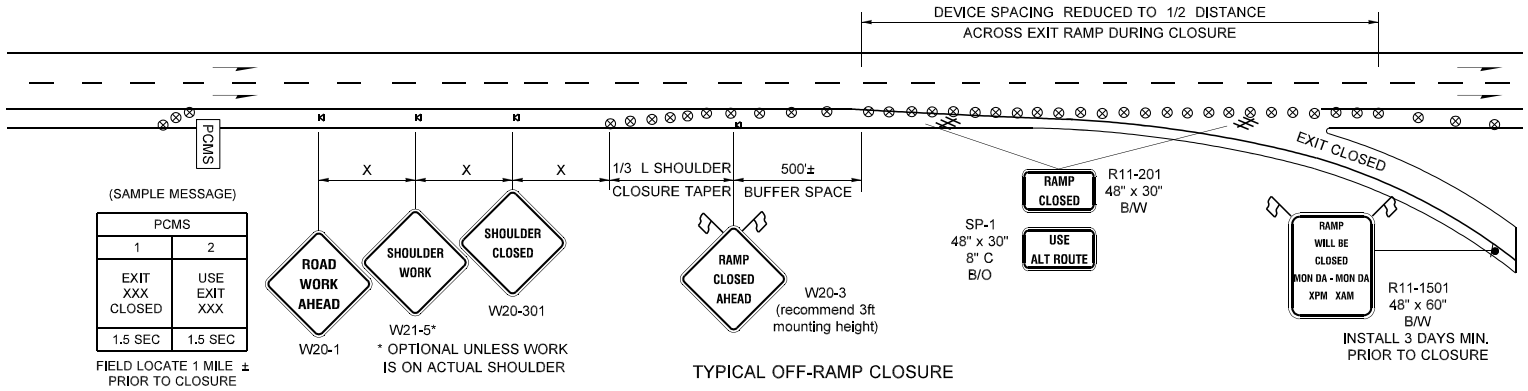
(1) All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.
(2) This spacing may be reduced in urban areas to fit roadway conditions.

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50 / 60	40	80
35 / 45	30	60
25 / 30	20	40

MINIMUM TAPER LENGTH = L (feet)										
Lane Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	105	150	205	270	450	500	550	-	-	-
11	115	165	225	295	495	550	605	660	-	-
12	125	180	245	320	540	600	660	720	780	840



TYPICAL ON-RAMP CLOSURE



TYPICAL OFF-RAMP CLOSURE

LEGEND

- SIGN LOCATION - TRIPOD MOUNT
- SIGN LOCATION - POST MOUNT
- CHANNELIZING DEVICES
- TRAFFIC SAFETY DRUM
- WARNING FLAG - FLUORESCENT RED/ORANGE
- PCMS — PORTABLE CHANGEABLE MESSAGE SIGN (RECOMMENDED)
- TYPE 3 BARRICADE

NOTES

1. Contact region traffic office for work hour restrictions.
2. Typical application shown, adjust for site conditions.

TYPICAL SHORT TERM RAMP CLOSURES
TCP 13

Chapter 3 Short Duration Work Zones

3.1 Introduction
3.2 Guidance
3.3 Key Elements of Short Duration Work Zones
3.4 Short Duration Work Zone Condition
3.5 Consideration and Assessment of Traffic Volumes in Work Zones
3.6 Very Short Duration Work Zones
3.7 Short Duration Work Zone Rules
3.8 Short Duration Work Zones – Do's and Don'ts
3.9 Short Duration and Very Short Duration TCPs

3.1 Introduction

Short duration work zones are planned work activities that last up to 60 minutes. Due to the short work time, simplified traffic control set-ups are allowed to reduce worker traffic exposure. 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.

Careful consideration of traffic and roadway conditions must be given to each work zone prior to selecting the traffic control set-up. Shoulder work and low-speed, low-volume traffic conditions may require only the work vehicle hazard beacon and personal protective equipment. High-speed, high-volume lane work may require a full lane closure set-up, even though the work duration may be 60 minutes or less. Remember, short duration work is not a "short-cut." Instead, it is a method that reduces worker exposure to traffic hazards by using larger, more dominant and mobile equipment instead of many smaller devices (cones may still be recommended since they are quick to set up for small work zones).

Examples of short duration work zone operations include re-lamping, pothole patching and other minor repairs, surveying, bridge inspection, field recon, pre-work layout, etc. Emergencies and incident response are not short duration work zones.

3.2 Guidance

The following guidance applies standards from the MUTCD to provide more specific direction for short duration work zones. It also provides a rationale to assist with selection of appropriate short duration traffic control and safety measures. The included guidance and direction, rules, consideration chart and example TCPs should lead to an informed choice. Remember, there is no single solution that fits all work zones.

- Consider a rolling slowdown operation as shown on TCD 7 for those work operations of a very short duration in which traffic control measures would take more time than the actual work. Typically, rolling slowdowns are desirable for difficult access work zones, such as center lanes or closing all lanes at once on multi-lane highways.
- Consider stationary work zone measures with a full compliment of signs and devices. Some work operations, traditionally classified as short duration, may be conducted as longer term stationary work by linking several work areas together under a lane or shoulder closure. Advantages of linking work operations may include reducing exposure of workers to traffic, efficiencies in completing tasks concurrently, reducing the number of lane closures in the same area, and overall reduction in impacts to traffic.
- Consider mobile operations. Other short duration operations may be conducted as mobile operations by progressing through several work areas and making intermittent stops. Advantages are shortened work operations to install traffic control devices and improved worker safety through use of mobile equipment (TMAs, PCMSs, mobile work vehicles, etc.).
- Consider alternative work operations, materials, and equipment, such as:
  - Combining crews to accomplish work using mobile or stationary work zones, weekend or night closures, and at other identified work locations or on operations that may be difficult to accomplish with a small crew.
  - Identifying “red zones” where short duration work zones are not desirable due to poor traffic conditions (high volume, high speed, weaving areas, bridges, interchanges, etc.).
  - Creating a specialized work zone traffic control crew to support work operations. The specialized team can provide a higher level of efficiency and safety for a crew focused only on the work itself. This can also reduce the overall time duration and worker exposure to traffic hazards.
- Consider resources needed for quick response work (non-emergency):
  - It is important to differentiate between an actual emergency and an emergent condition. An emergency requires immediate response to save lives or prevent serious injury using whatever resources are available, usually in response to a crash or incident. 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. Most “call outs” or damage reports fall into the emergent condition category and although serious to varying degrees, still allow time to plan a reasonable short duration work zone response, even if additional resources are needed after evaluation.

- These operations may be referred to as "call outs," requiring a quick response to a report of debris, urgent repairs, or other situation where the exact nature of the work or location may not be completely known.
- An on-site assessment may allow work to proceed with available equipment and devices. Strategic placement of the work vehicle with warning beacon is important. Devices and signs may also be needed. If work is expected to last more than 60 minutes, additional resources may be needed to implement a traditional stationary work zone. Work may be delayed until the proper work zone equipment and devices are available. Assistance from WSDOT Incidence Response may also be appropriate.

3.3 Key Elements of Short Duration Work Zones

- **Work Location** – This element may be the most obvious but is also the most important, at least initially, since it establishes the relationship to the next three elements. The location directly influences the assessment of hazards, protection and warning. Unique locations with narrow shoulders, bridges, undefined shoulders (no edge stripe), poor sight distance, tight radius curves, etc. require extra consideration.
- **Hazards to Workers and to Traffic** – Traffic volume and speed are the primary hazard concerns for workers in short duration work zones, while unexpected workers or equipment are the primary hazard for drivers.
- **Protection** – Positive worker protection is always recommended when practical but not necessarily required for less hazardous work zones. The use of a properly placed work vehicle can offer valuable protection in any condition.
- **Warning** – Advance warning to drivers is required when working within 15 feet of the edge of the traveled way. Assuming adequate sight distance, the work vehicle warning beacon can provide this warning in short duration zones. Sign(s) may be needed for areas with reduced sight distance.
- **Duration** – As mentioned in previous guidance, short duration work zones can offer safety and mobility benefits, but not at the risk of too much worker exposure to hazards.

3.4 Short Duration Work Zone Condition

Short duration work zones are categorized into three relative condition types. This helps establish a practical application level of traffic control and safety devices based on hazard, protection and warning levels related to work location and duration. The MUTCD allows for simplified traffic control procedures for short duration work, but does not go into detail on what those procedures might be. When selecting a TCP, refer to Work Zone Condition guidance located at the upper, left-hand portion of the TCP.

The condition levels are:

A – Represents the lowest level of work zone impacts and is typified by:

- Low traffic speed and volume.
- Minimum levels of warning, protection and hazards. A work vehicle with warning beacon and personal protective equipment may be adequate.

B – Represents moderate work zone impacts and is typified by:

- Low or high traffic speed with low to moderate volumes.
- Moderated levels of warning and protection, such as a spotter, cones or PCMS added to condition "A" devices would be typical considerations.

C – Represents the highest impact level and is typified by:

- High traffic speed and volume.
- All applicable traffic control and safety devices should be considered, such as PCMSs, TMAs, and signs.

The short duration work zone condition level does not provide for a complete assessment, but is a valuable tool for balancing duration with other work zone elements. Worker safety cannot be ignored no matter how short the work duration. A common example of this condition is in the interior lane of a high-speed, multi-lane road. Even though the work duration may be very short, mobile or stationary lane closures must be used.

3.5 Consideration and Assessment of Traffic Volumes in Work Zones

Throughout the guidance in the M 54-44, various references are made to traffic volume. These references may be further described as low volume, moderate volume and high volume. Within the context of this document as well as the MUTCD, traffic volume is intended to be a relative term. For example, high volume traffic conditions during rush hour in Seattle are much different than high volume traffic conditions in Colfax, yet both can still be referred to as high volume, given delays and backups.

Your Region Traffic Office can assist with recommendations for work hours in those areas where high volume traffic conditions could cause undesirable backups and delays.

Field crews may need to make on site judgments as to traffic volume conditions. This consideration is very important when performing short duration work, since fewer warning and protective devices may be used. Key information needed to make a judgment of traffic volumes and how work zones affect traffic includes the following:

3.5.1 Work Zone Type

- Lane closures obviously have the greatest impact on traffic, since closed lanes represent a significant reduction in roadway capacity. Worker safety is also a high priority since work is being conducted in the normal traffic path.
- Alternating one-way traffic control with flaggers (AFADs or Portable Signals) can also create significant impacts on traffic since half of the useable roadway may be closed.

Given these considerations for work zone type, the following elements allow for a practical assessment of traffic volumes along the lines of the three short duration conditions, “A”, “B”, and “C”, but can also be used for longer duration stationary work and can apply to mobile work operations.

3.5.2 Traffic Conditions

- Experience and knowledge of historical traffic conditions and operation on a given section of highway can provide as much value in determining a traffic volume condition as actual traffic volume counts.
  - *****BEST PRACTICE***** Some Regions have developed “work hour charts” that list the acceptable or preferred work hours for a particular route and MP location. This is particularly useful in higher volume areas where timing of lane closures is critical. The Region Traffic Office can assist in this area.
- Observations of current traffic conditions can be used to determine the volume condition as follows:
  - **Condition “A” low volume.** Worker awareness of traffic is always essential. At this level vehicles approach the work zone somewhat randomly and generally present a minimal conflict potential. Typified by:
    - Significant gaps in traffic flow.
    - Few vehicles visible at any given time.
    - Random platoons of vehicles.
    - Free flow traffic at the posted speed limit.
    - Near unrestricted access to the work area.
    - Lane closures with minimal delay and backups.
    - Safe walking pace conditions across a 2-lane highway or intersection.
    - Rough estimate of traffic volume at less than 5 vehicles per lane per minute*.

- **Condition "B" moderate volume.** The frequency of vehicles increases and more care and vigilance is required by workers to ensure safe work operations. Typified by:
  - Gaps in traffic are present, but may be more consistent.
  - Vehicles are generally present all the time.
  - Traffic is constant but still flows freely.
  - Generally free flow traffic speed at the posted limit.
  - Lane closure and flagging operations cause delays and backups within acceptable limits.
  - Good work area access but vehicles are usually present.
  - Safe walking pace conditions across a 2-lane highway or intersection exist, but may require waiting for a gap in traffic. A spotter may be used to warn workers of oncoming traffic.
  - Rough estimate of traffic volume at 12 vehicles per lane per minute*.
- **Condition "C" high volume.** Constant awareness and protective measures for workers are required to ensure safe work operations. Vehicles are constantly present at this level. Traffic volumes may adversely impact work operations and higher levels of warning and protection will probably be needed. Typified by:
  - Minimal gaps in traffic.
  - Constantly present vehicles.
  - Restricted or unstable traffic flow.
  - Reduced traffic speeds, as volume starts to approach road capacity.
  - Unacceptable backups and delays. Additional signing may be needed if traffic backs up past warning signs.
  - Safe work area access is generally accompanied with protective devices (TMAs, buffer vehicles, etc.)
  - A safe walking condition across a 2-lane highway or intersection may not exist.
  - A rough estimate of 20 vehicles per lane per minute*.

Traffic conditions need to be monitored throughout the work operation to determine if adjustments are needed to address traffic impacts. A worst case scenario of stopping work and reopening the roadway to traffic may be avoided by planning for the traffic conditions in advance and selecting compatible hours of work.

**Note:* The values used for traffic volumes (volume per lane per minute) are derived from data that fits the *general description* of the given condition, "A", "B" or "C". These are average values that can be used as an indicator or a comparison tool to judge traffic conditions, and may not fit a *specific* location or condition. The Region Traffic Office can assist with specific work hours or provide a closer correlation of the condition values for a given location.

3.6 Very Short Duration Work Zones

The overall guidance of the short duration work zone section of this guidebook applies to work zones that may last up to 60 minutes. However, it is important to recognize that many work operations may take only a few seconds or minutes to perform. These actions might be:

- Debris retrieval, locating drainage structures or other roadway features or components.
- Retrieval of lost cargo, work zone sign, or device installation and removal.
- Crash debris retrieval, a survey "shot," monument or other reference check.
- Crossing or walking along the roadway, motorist assistance.
- Quick repairs intended as a partial or temporary response to damage or failure.

In many cases it is necessary and allowable for workers to walk on a roadway shoulder, cross traffic lanes, or momentarily step into a lane to access work locations or to perform work. These actions can only be accomplished if they are not in conflict with traffic or other hazards and it is safe to do so. See the applicable rules of this section for worker safety and protection.

Very short duration work is typified by the following:

- The primary intent is not to conduct an actual work operation in total, but more related to gathering information, accessing a location, or a non-repetitive action as described above.
- Generally these actions occur at isolated locations or the locations are spaced far enough apart that they would constitute separate work zones.
- Equipment is usually not required, other than the possibility of simple hand tools.
- Stop-gap measures to respond to damage or failures until a permanent repair can be made.

Because of the very short duration and nature of these actions, there is a possibility that adequate work zone measures may not be fully considered. Even though these are very short duration actions, the key work zone elements must still be considered. High worker exposure locations such as in a live

lane and undesirable traffic conditions would still dictate the decision as to the appropriate work zone. It may be acceptable to perform some very short duration actions under work zone condition "A" and "B," with the minimum required equipment and devices. In most cases this would be a strategically placed work vehicle with warning beacon and personal protective equipment. 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, may be a good example of an additional safety measure. The workers ability to maintain awareness of traffic conditions and potential hazards is a key concern.

Normally, specific TCPs are not required for these very short actions since the typical example TCPs for very short duration work zones can cover a wide variety of applications.

It is required to provide advance warning to traffic approaching very short duration work zones on freeways and high speed multi-lane highways as shown on TCP 19A when working in a live lane with a spotter or using a very short duration lane closure.

3.7 Short Duration Work Zone Rules

1. **Live traffic areas (lanes and intersections) in high speed and high volume work locations may not be good candidates for short duration work zones.** Work zone condition "C" would apply to most of these type of locations and may be acceptable based on a positive site assessment and working only on the shoulder or adjacent lane as follows:
   - **No unprotected work in interior lanes of multi-lane roads and no "island" work areas are allowed.**
   - **Lanes of multi-lane roads may only be accessed from the adjacent shoulder** (see TCP 19).
   - **Intersections may be accessed following the same manner and consideration should be given to incorporating the existing intersection control into the work zone traffic control . . . all red signal control or all way stop control may supplement the selected traffic control measures** (see TCPs 27 and 28).
2. **Short duration flagging operations are not allowed.** All flagging requirements must be complied with and there currently is no exception for short duration work. Emergencies are the only exception to full flagging requirements. Flagging is defined by the MUTCD as stopping, directing or alerting road users.

3. **A determination of a safe work location must be made.** A basic determination can be made by observing traffic conditions (speed, volume, location, visibility, etc.) and assessing the following conditions:
   - Is the work location out of the traffic path?
   - Is there sufficient time for a worker to safely walk (not run) to and return from the work location?
   - Are there other hazards at the location that could affect worker safety?
   - Is there an effective contingency or escape plan?
   - Is there adequate sight distance from the work location to approaching traffic (see TCP 26)?

3.8 Short Duration Don'ts and Dos

Don't –

- Take "short cuts" or hurry to accomplish work. Determination of all work zone hazards is a must.
- Run across or "dodge" traffic in live lanes.
- Work in a live lane under adverse traffic conditions or without proper traffic control in place . . . even if it is only for a few minutes or a few seconds.
- Assume that shoulder areas are automatically safe. Distracted, aggressive or impaired drivers may encroach. Also, oversize loads may present a hazard.
- Turn your back to oncoming traffic if possible.
- Put yourself in an unexpected location that may surprise a driver.

Do –

- Use the work vehicle as protection and warning whenever possible.
- Take advantage of any resources providing protection and warning without causing additional exposure. (TMAs, buffer/shadow vehicles, PCMSs, etc.)
- Plan ahead. Poor planning is not a valid excuse for lack of equipment, devices or awareness of traffic conditions.
- Find the safest available location to park or unload equipment.
- Avoid high traffic volume hours and locations. Plan ahead for better traffic conditions or consider alternate work operations.
- Work on the same side of the road as the work vehicle and warning beacon whenever possible.

3.9 Short Duration and Very Short Duration TCPs

The following typical TCPs are a generic pictorial representation of common roadway locations where various work operations are conducted. Depicted on the TCPs are work zone safety and traffic control applications for use with the intended work operations. Typical TCPs are not drawn to scale, but show devices, equipment and data that are intended to be applied in the correct combination along with proper judgment to be safe and comply with approved standards.

TCP 14 – ***Typical Short Duration Lane Closure (Two-Lane, Two-Way Highway Application)***
(This plan depicts typical work zone scenarios that may occur within a lane of a two-lane highway such as a small pavement repair area where it is necessary for workers and/or equipment to occupy a lane for the entire time it takes to make the repair (up to 60 minutes). This could also include narrow shoulder work where workers and equipment must occupy the lane to allow work access to the shoulder.)

TCP 15 – ***Typical Short Duration Lane Closure (Multi-lane Freeway and Highway Application)***
(This plan depicts typical work zone scenarios that may occur in the left or right lane of a multi-lane highway. Center-lane or island type work zones with live traffic on both sides of the work zone are not allowed with this operation; consider a rolling slow down, stationary lane closure or mobile lane closure if these work areas are necessary. As with TCP 14, a small pavement repair may be a typical work operation that occupies the lane for the entire time it takes to make the repair (up to 60 minutes). This could also include narrow shoulder work where workers and equipment must occupy the lane to allow access to the shoulder.)

TCP 16 – ***Typical Short Duration Shoulder Work (Multi-lane Application)***
(This plan depicts typical work zone scenarios that may occur on the left or right shoulder of a multi-lane highway but does not encroach into the lane. The work operation could be related to the roadway shoulder or roadway features such as electrical systems or signs and drainage. Encroachment into the adjacent live lane or the vertical clearance above the live lane is not allowed with this plan. Consider the use of stationary shoulder or lane closure plans if encroachment is necessary.)

TCP 17 – ***Typical Short Duration Work Operation (Intersection Application)***
(This plan depicts typical work zone scenarios that may occur at various "in lane" locations of a common intersection with turn pockets. Work operations could be related to pavement markings, traffic signals or other repair or maintenance activities. Intersections that have traffic signals and a possible need for flaggers should be considered when planning the work and could require a stationary plan.)

TCP 18 – ***Typical Very Short Duration Work Operation (Outside Traveled Way) (Two-lane or Multi-lane Highways)***
(This plan depicts typical work zone scenarios that may occur at various locations outside of live lanes and other live traffic areas such as merge areas and ramp lanes. These "non-traffic" areas outside of the traveled way are very common locations to park a work vehicle to gain access to a location for very short duration work such as inspection, survey shot, field recon, etc. Under conditions "A" or "B" it is acceptable to walk across lane(s) as can be done safely to access a specific location. It is preferable to park the work vehicle on the same side of the roadway.)

TCP 19 – ***Typical Very Short Duration Work Operation (Multi-lane Application, Low Speed, 40 mph or Lower)***
(This plan depicts typical work zone scenarios that may occur at various lane and shoulder locations along a low speed multilane highway for work operations such as; minor pothole repair or other very short duration work that does not actually close or block the lane. As vehicles approach it is incumbent upon the worker to move back to the adjacent shoulder. More than two or three attempts to complete the work may indicate the need for a short duration or stationary work zone TCP.)

TCP 19a – ***Typical Very Short Duration In-lane Work (Multi-lane Freeway and Highway Application, High Speed, 45 mph or Higher)***
(This plan depicts two typical very short duration work zone scenarios that may occur in live high speed traffic lanes. Work operations may include minor pothole or debris removal that may be accomplished without presenting an unacceptable hazard to the worker or traffic. By allowing approaching traffic to pass through the work location using the spotter method to alert the worker to move back to the shoulder as traffic approaches. Work that cannot allow traffic to pass through the work location will need to use the lane closed method or consider a short duration or stationary lane closure.)

TCP 20 – ***Typical Very Short Duration Lane Closure (Two-Lane Highway)***
(This plan depicts two typical very short duration work zone scenarios that may occur in live traffic lanes on either a low or high speed roadway. Work operations such as a minor pothole or debris removal that may be accomplished without presenting an unacceptable hazard to the worker or traffic. By allowing approaching traffic to pass through the work location using the spotter method to alert the worker to move back to the shoulder as traffic approaches. Work that cannot allow traffic to pass through the work location will need to use the lane closed method or consider a short duration or stationary lane closure.)

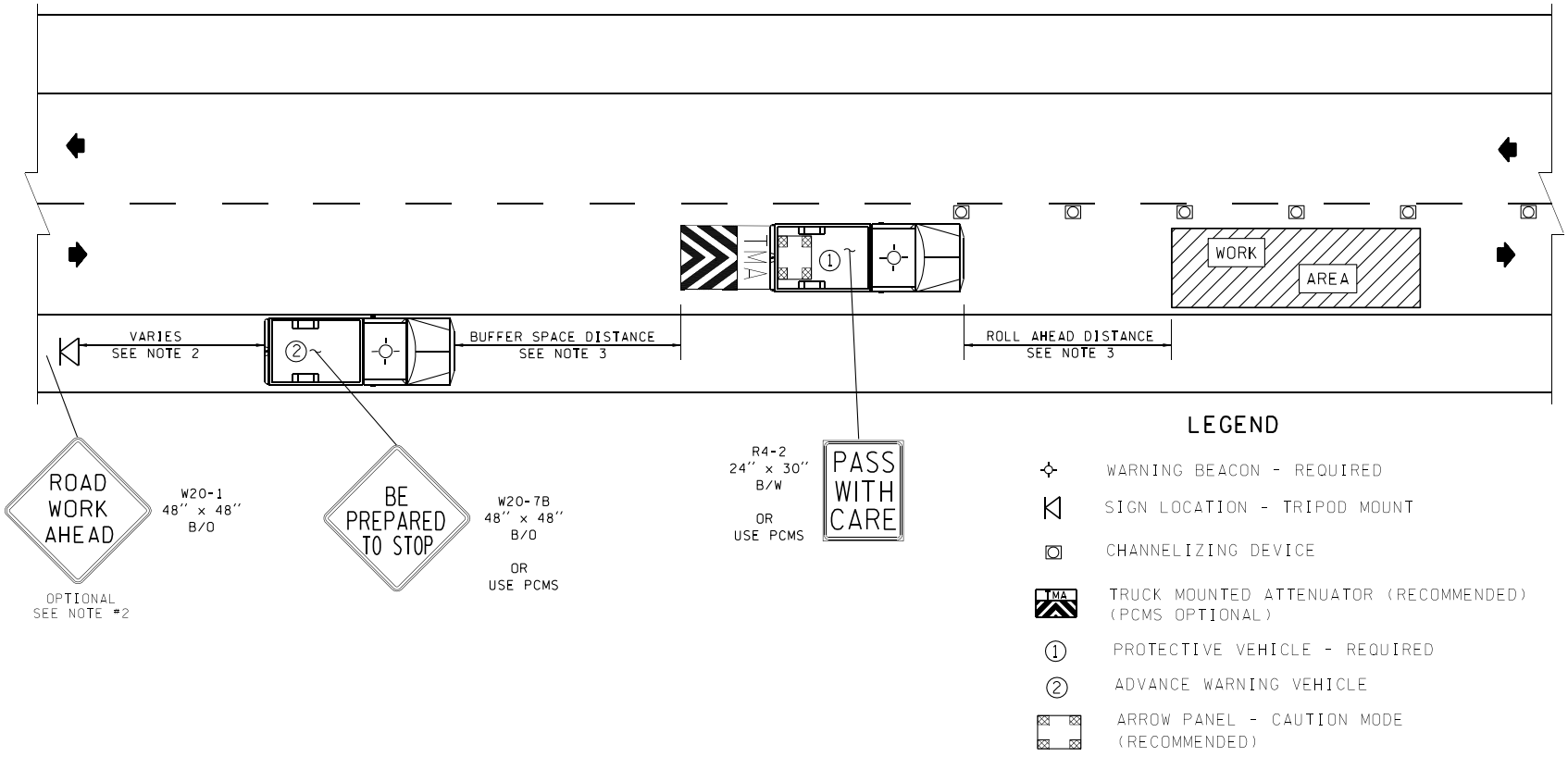
TCP 21 – ***Typical Very Short Duration Work Operation (Intersection Application)***
(This plan depicts typical work zone scenarios that may occur in intersections such as; very short field recon to verify field data, take a survey shot, inspect for damage, observation, etc. See TCP 17 for short duration applications.)

WORK ZONE CONDITION (SEE CONDITION GUIDANCE)

A - ALLOWED, VEHICLE #1 REQUIRED, ALL OTHER DEVICES OPTIONAL.
B - ALLOWED, VEHICLE #1 AND #2 REQUIRED, CONSIDER USE OF SPOTTER, DEVICES AND LOW VOLUME WORK HOURS.
C - NOT RECOMMENDED CONSIDER MOBILE OR STATIONARY TCP'S.

NOTES:

1. STOPPING TRAFFIC FOR UP TO 20 MINUTES MAY ALSO BE ALLOWED.
   (CONTACT & COORDINATE WITH REGION TRAFFIC OFFICE)
2. RESTRICTED SIGHT DISTANCE REQUIRES ADDITIONAL ADVANCE WARNING DEVICES OR SIGNS, SEE TCD 14 FOR SIGHT DISTANCE CHART.
3. REFER TO TAPER AND BUFFER SPACE DETAILS SHOWN ON APPENDIX 3-3 FOR ADDITIONAL INFORMATION.



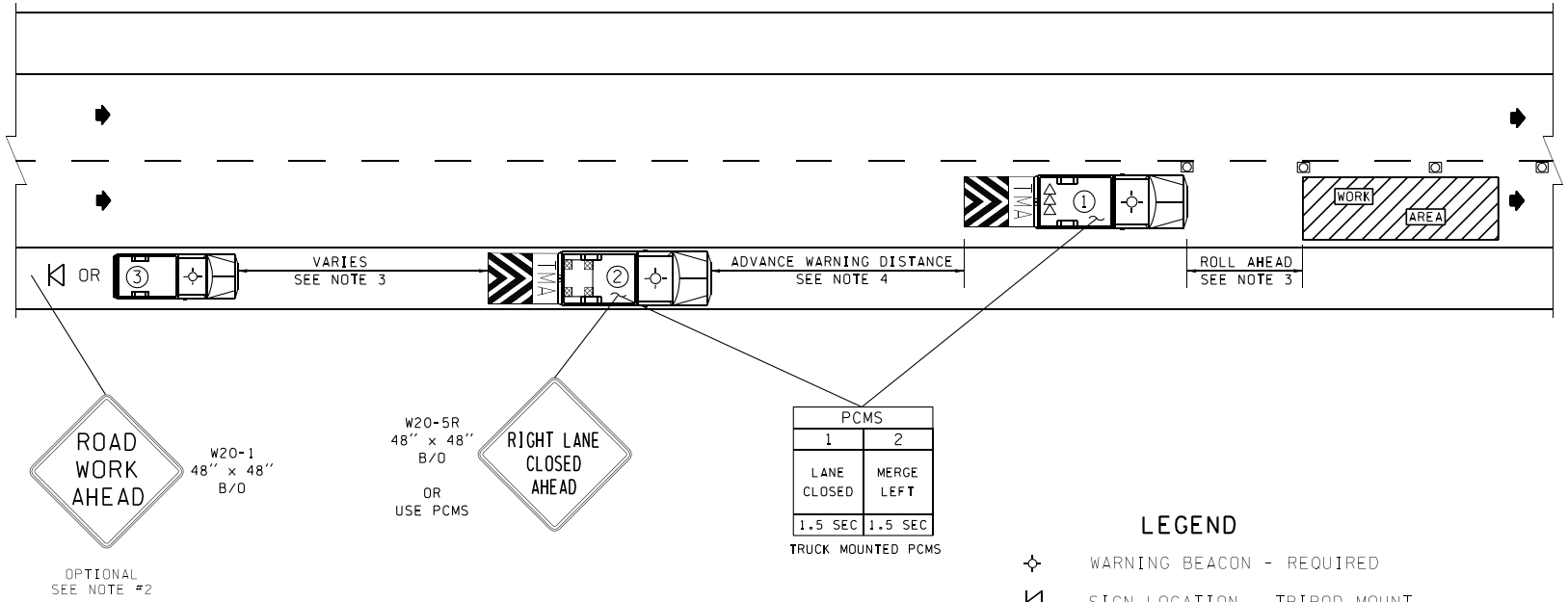
TYPICAL SHORT DURATION LANE CLOSURE
2 LANE OPERATION
TCP 14

WORK ZONE CONDITION (SEE CONDITION GUIDANCE)

A - ALLOWED, VEHICLE #1 REQUIRED, ALL OTHER DEVICES OPTIONAL.
B - ALLOWED, VEHICLE #1 AND #2 REQUIRED, CONSIDER USE OF SPOTTER, DEVICES.
C - NOT RECOMMENDED, CONSIDER MOBILE OR STATIONARY TCP'S.

NOTES:

1. VEHICLE #3 MAY BE NEEDED BASED ON TRAFFIC VOLUMES.
2. RESTRICTED SIGHT DISTANCE REQUIRES ADDITIONAL ADVANCE WARNING DEVICES OR SIGNS, SEE TCD 14 FOR SIGHT DISTANCE CHART.
3. REFER TO TAPER AND BUFFER SPACE DETAILS SHOWN ON APPENDIX 3-3 FOR ADDITIONAL INFORMATION.
4. USE DISTANCE FROM TAPER LENGTH CHART SHOWN ON APPENDIX 3-3.



TYPICAL SHORT DURATION LANE CLOSURE
MULTI-LANE OPERATION
TCP 15

LEGEND

- WARNING BEACON - REQUIRED
- SIGN LOCATION - TRIPOD MOUNT
- CHANNELIZING DEVICE
- TMA — TRUCK MOUNTED ATTENUATOR (RECOMMENDED) (PCMS OPTIONAL)
- ① PROTECTIVE VEHICLE - REQUIRED
- ② PROTECTIVE VEHICLE
- ③ ADVANCE WARNING VEHICLE
- ARROW PANEL - REQUIRED
- ARROW PANEL - CAUTION MODE (RECOMMENDED)

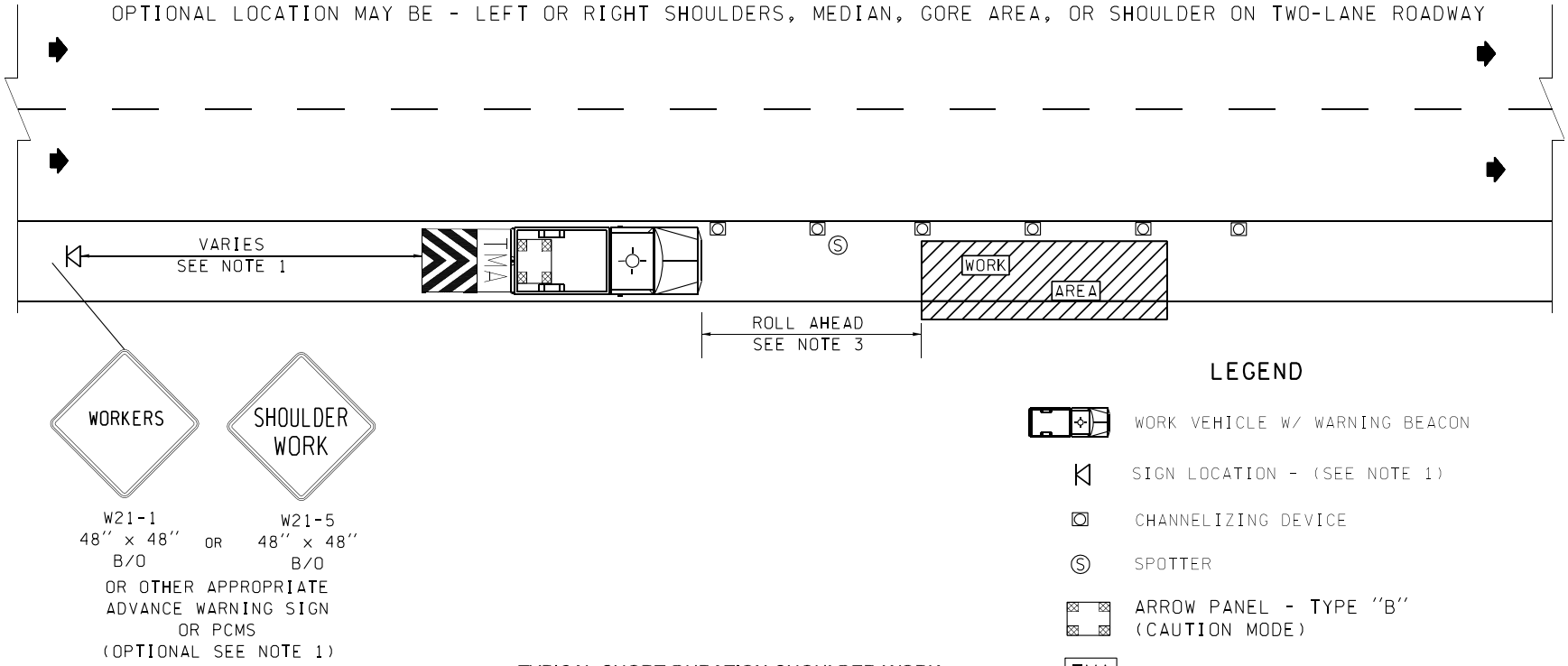
WORK ZONE CONDITION (SEE CONDITION GUIDANCE)

A - ALLOWED - CONSIDER USING A SPOTTER
B - ALLOWED - SPOTTER AND/OR CHANNELIZING DEVICES RECOMMENDED, CONSIDER TMA AND/OR PCMS/ARROW CAUTION MODE.
C - ALLOWED - SPOTTER, CHANNELIZATION DEVICES AND PCMS/ARROW RECOMMENDED, CONSIDER TMA.

NOTES:

1. RESTRICTED SIGHT DISTANCE REQUIRES ADDITIONAL ADVANCE WARNING DEVICES OR SIGNS, SEE TCD 14 FOR SIGHT DISTANCE CHART.
2. NARROW SHOULDERS THAT DO NOT PROVIDE FOR WORK OPERATIONS WITHOUT LANE ENCROACHMENT - 10′ LANE MINIMUM, REQUIRES LANE CLOSURE, USE TCP 14 OR 15.
3. REFER TO TAPER AND BUFFER SPACE DETAILS SHOWN ON APPENDIX 3-3 FOR ADDITIONAL INFORMATION.

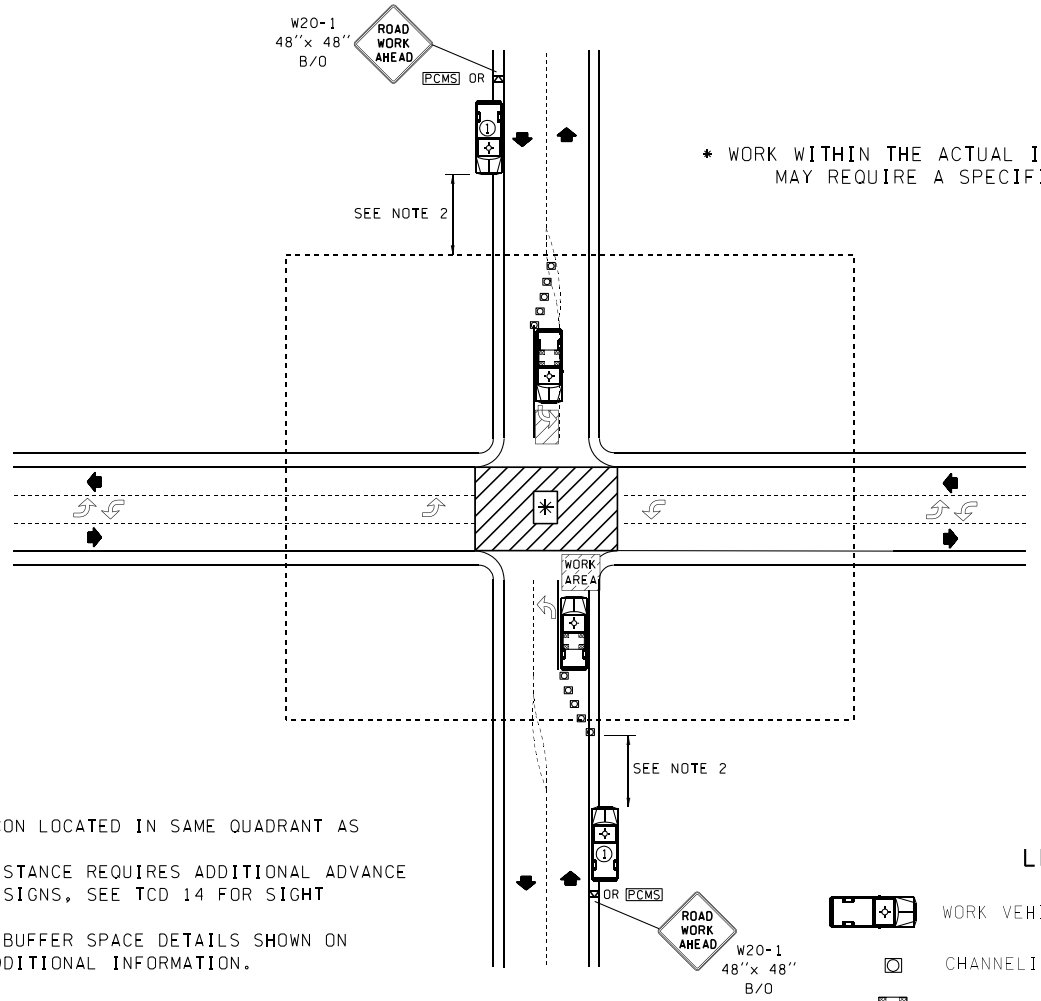
** ROADWAY EXAMPLE REPRESENTS TYPICAL LOCATION.
OPTIONAL LOCATION MAY BE - LEFT OR RIGHT SHOULDERS, MEDIAN, GORE AREA, OR SHOULDER ON TWO-LANE ROADWAY



TYPICAL SHORT DURATION SHOULDER WORK
MULTI-LANE OPERATION
TCP 16

WORK ZONE CONDITION (SEE CONDITION GUIDANCE)

A - ALLOWED - CONSIDER USING A SPOTTER, WORK VEHICLE REQUIRED.
B - ALLOWED - SPOTTER AND/OR CHANNELIZING DEVICES RECOMMENDED, CONSIDER TMA AND/OR PCMS/ARROW CAUTION MODE.
C - ALLOWED - CHANNELIZATION DEVICES AND PCMS/ARROW (CAUTION MODE), TMA, SPOTTER RECOMMENDED, VEHICLE #1 REQUIRED.



NOTES:

1. WORK VEHICLE W/BEACON LOCATED IN SAME QUADRANT AS WORK LOCATION.
2. RESTRICTED SIGHT DISTANCE REQUIRES ADDITIONAL ADVANCE WARNING DEVICES OR SIGNS, SEE TCD 14 FOR SIGHT DISTANCE CHART.
3. REFER TO TAPER AND BUFFER SPACE DETAILS SHOWN ON APPENDIX 3-3 FOR ADDITIONAL INFORMATION.

LEGEND

- WORK VEHICLE W/ WARNING BEACON
- CHANNELIZATION DEVICE
- ARROW PANEL
- SIGN LOCATION - CAUTION MODE
- ① PROTECTIVE VEHICLE #1 REQUIRED

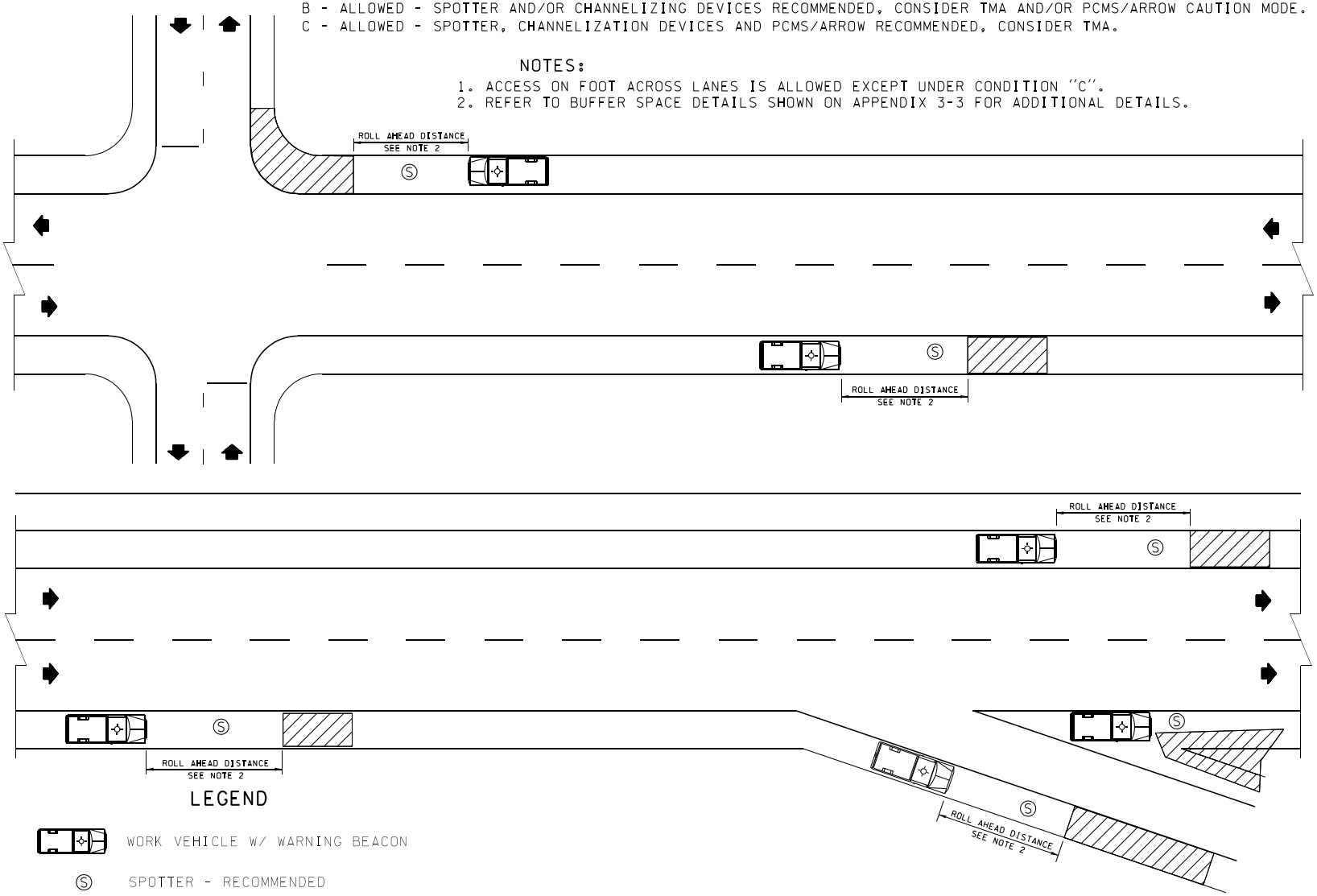
TYPICAL SHORT DURATION WORK OPERATION
INTERSECTION LOCATION
(SEE GUIDANCE TEXT FOR ADDITIONAL DIRECTION)
TCP 17

WORK ZONE CONDITION (SEE CONDITION GUIDANCE)

A - ALLOWED - CONSIDER USING A SPOTTER
B - ALLOWED - SPOTTER AND/OR CHANNELIZING DEVICES RECOMMENDED, CONSIDER TMA AND/OR PCMS/ARROW CAUTION MODE.
C - ALLOWED - SPOTTER, CHANNELIZATION DEVICES AND PCMS/ARROW RECOMMENDED, CONSIDER TMA.

NOTES:

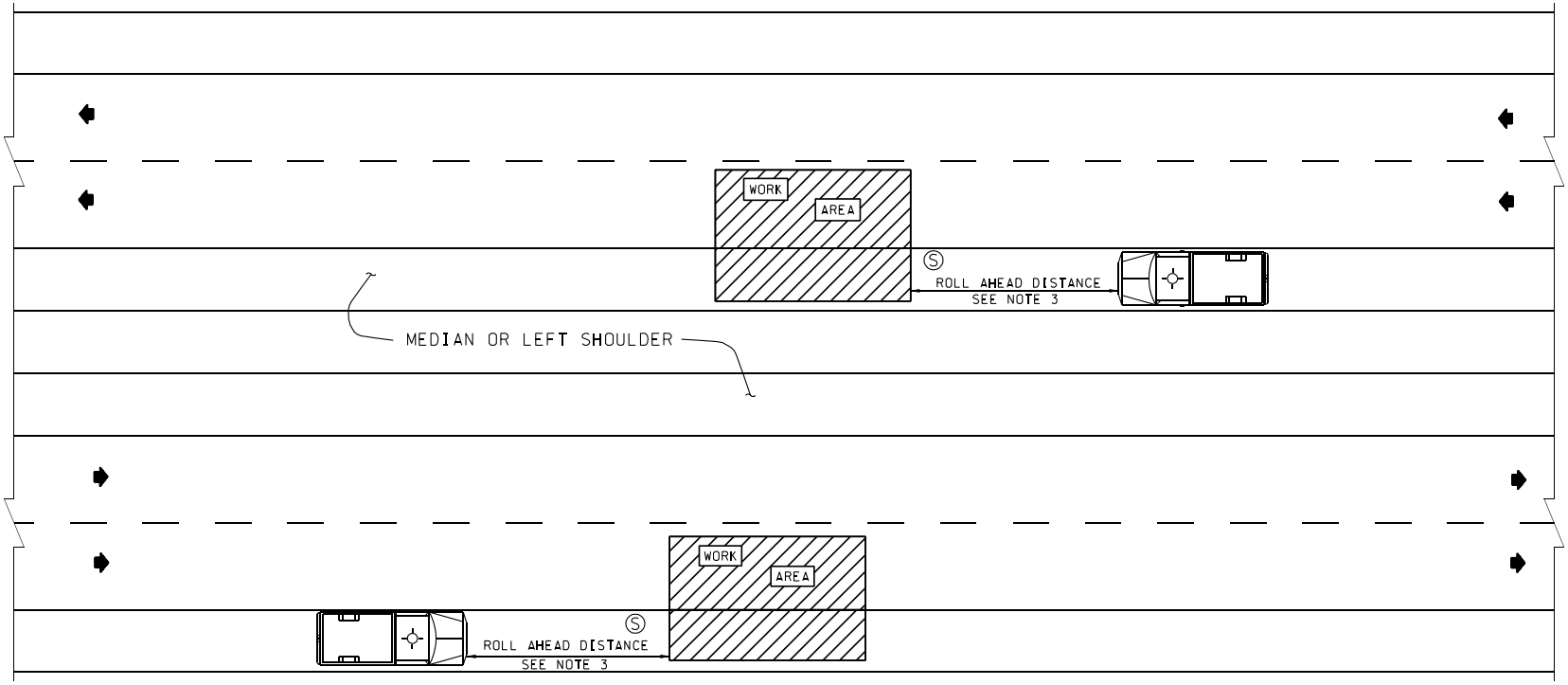
1. ACCESS ON FOOT ACROSS LANES IS ALLOWED EXCEPT UNDER CONDITION "C".
2. REFER TO BUFFER SPACE DETAILS SHOWN ON APPENDIX 3-3 FOR ADDITIONAL DETAILS.



TYPICAL VERY SHORT DURATION WORK OPERATION (OUTSIDE TRAVELED WAY)
(HIGH OR LOW SPEED SHOULDER WORK, MEDIAN, GORE, RAMP SHOULDER, ETC.)
TCP 18

WORK ZONE CONDITION (SEE CONDITION GUIDANCE)

A - ALLOWED - CONSIDER USING A SPOTTER
B - ALLOWED - SPOTTER REQUIRED FOR WORKER ACCESS TO LANE.
C - NOT RECOMMENDED, SEE TCP 19a FOR WORK ZONE REQUIREMENTS.



NOTES:

1. SEE GUIDANCE SECTION FOR WORKER(S) IN LANE
2. RESTRICTED SIGHT DISTANCE REQUIRES ADDITIONAL ADVANCE WARNING DEVICES OR SIGNS, SEE TCD 14 FOR SIGHT DISTANCE CHART.
3. REFER TO TAPER AND BUFFER SPACE DETAILS SHOWN ON APPENDIX 3-3 FOR ADDITIONAL INFORMATION.

LEGEND

PROTECTIVE / WORK VEHICLE WITH WARNING BEACON

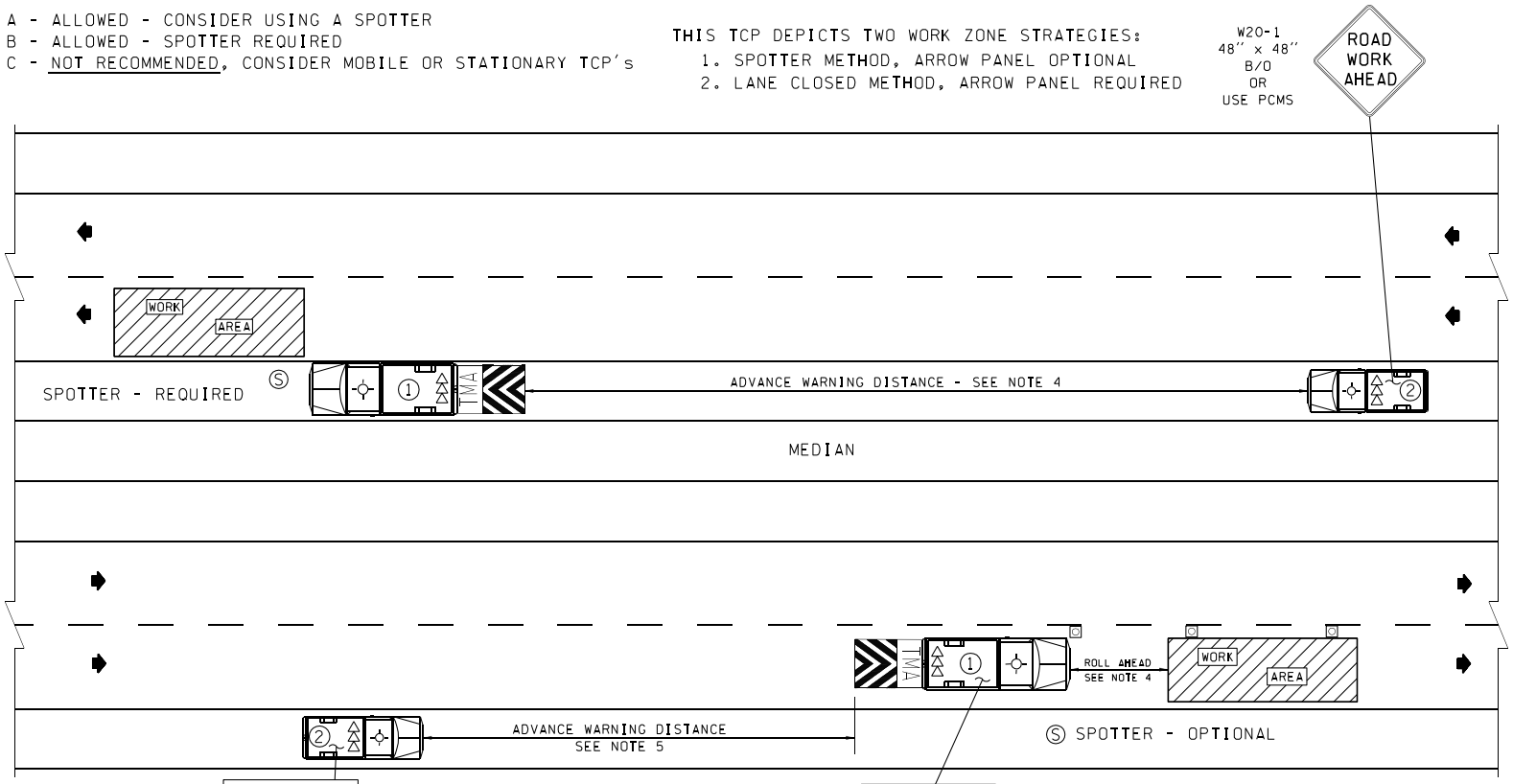
S SPOTTER

TYPICAL VERY SHORT DURATION WORK OPERATION - LOW SPEED (40 MPH OR LESS)
(SEE GUIDANCE TEXT FOR ADDITIONAL DIRECTION)
TCP 19

WORK ZONE CONDITION (SEE CONDITION GUIDANCE)

A - ALLOWED - CONSIDER USING A SPOTTER
B - ALLOWED - SPOTTER REQUIRED
C - NOT RECOMMENDED, CONSIDER MOBILE OR STATIONARY TCP's

THIS TCP DEPICTS TWO WORK ZONE STRATEGIES:
1. SPOTTER METHOD, ARROW PANEL OPTIONAL
2. LANE CLOSED METHOD, ARROW PANEL REQUIRED



PCMS	
1	2
LANE CLOSED	MERGE LEFT
1.5 SEC	1.5 SEC

TRUCK MOUNTED PCMS
(OPTIONAL)

OR

W20-5R
48" x 48"
B/O

PCMS	
1	2
LANE CLOSED	MERGE LEFT
1.5 SEC	1.5 SEC

TRUCK MOUNTED PCMS
(OPTIONAL)

LEGEND

- WARNING BEACON - REQUIRED
- (1) PROTECTIVE / WORK VEHICLE - REQUIRED
- (2) ADVANCE WARNING VEHICLE OR SIGN - REQUIRED
- TMA TRUCK MOUNTED ATTENUATOR (RECOMMENDED) (PCMS OPTIONAL)
- ▷▷▷ ARROW PANEL - SEE NOTES
- CHANNELIZING DEVICE - OPTIONAL

NOTES:
1. FOR LOCATIONS WITH 3 OR MORE LANES, INTERIOR LANE MUST BE CLOSED WITH EITHER A ROLLING SLOWDOWN OPERATION, MOBILE OR STATIONARY LANE CLOSURES.
2. SHOULDER WIDTH MUST ALLOW VEHICLE ACCESS.
3. SPOTTER IS OPTIONAL FOR LANE CLOSURE METHOD. SEE CONDITION NOTES
4. USE DISTANCES SHOWN ON BUFFER DATA CHART APPENDIX 3-3.
5. USE DISTANCE FROM TAPER LENGTH CHART SHOWN ON APPENDIX 3-3.

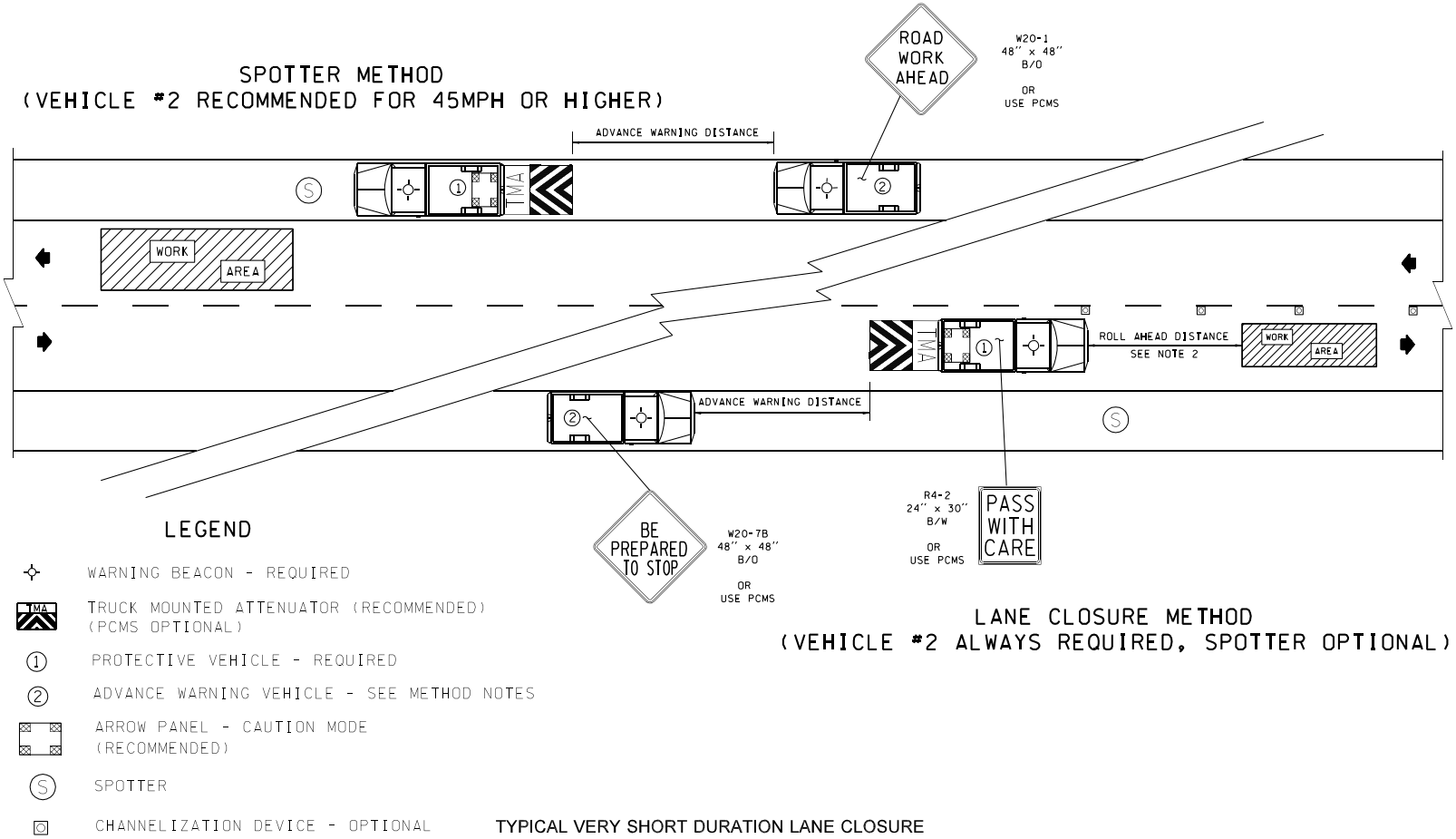
TYPICAL VERY SHORT DURATION IN-LANE WORK
FREEWAY AND MULTI-LANE OPERATION - HIGH SPEED (45 MPH OR HIGHER)
TCP 19a

WORK ZONE CONDITION (SEE CONDITION GUIDANCE)

A - ALLOWED, VEHICLE #1 REQUIRED. (SEE METHOD NOTES FOR INFORMATION ON VEHICLE #2 AND SPOTTER USE)
B - ALLOWED, VEHICLE #1 REQUIRED. (SEE METHOD NOTES FOR INFORMATION ON VEHICLE #2 AND SPOTTER USE)
C - NOT RECOMMENDED, CONSIDER MOBILE OR STATIONARY TCP'S.

NOTES:

1. STOPPING TRAFFIC FOR UP TO 5 MINUTES MAY ALSO BE ALLOWED.
   (CONTACT & COORDINATE WITH REGION TRAFFIC OFFICE)
2. REFER TO TAPER AND BUFFER SPACE DETAILS SHOWN ON APPENDIX 3-3 FOR ADDITIONAL INFORMATION.



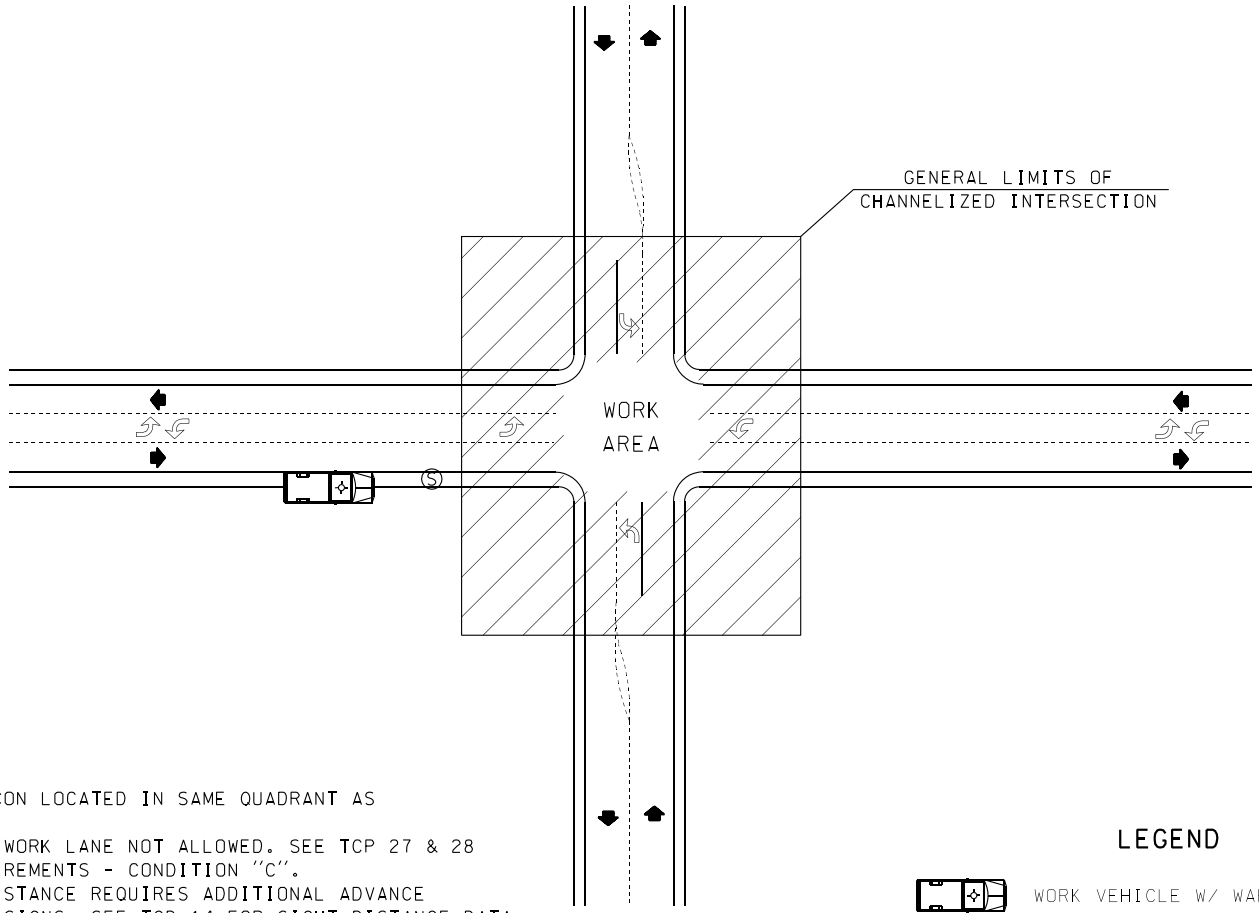
LEGEND

- WARNING BEACON - REQUIRED
- TRUCK MOUNTED ATTENUATOR (RECOMMENDED) (PCMS OPTIONAL)
- PROTECTIVE VEHICLE - REQUIRED
- ADVANCE WARNING VEHICLE - SEE METHOD NOTES
- ARROW PANEL - CAUTION MODE (RECOMMENDED)
- SPOTTER
- CHANNELIZATION DEVICE - OPTIONAL

TYPICAL VERY SHORT DURATION LANE CLOSURE
2 LANE HIGHWAY OPERATION
TCP 20

WORK ZONE CONDITION (SEE CONDITION GUIDANCE)

A - ALLOWED - CONSIDER USING A SPOTTER.
B - ALLOWED - SPOTTER RECOMMENDED CONSIDER ADDITIONAL WARNING SIGNS.
C - NOT ALLOWED - SEE TCP 27 & 28 FOR WORK ZONE REQUIREMENTS.



NOTES:

1. WORK VEHICLE W/BEACON LOCATED IN SAME QUADRANT AS WORK LOCATION.
2. REPEATED ACCESS TO WORK LANE NOT ALLOWED. SEE TCP 27 & 28 FOR WORK ZONE REQUIREMENTS - CONDITION "C".
3. RESTRICTED SIGHT DISTANCE REQUIRES ADDITIONAL ADVANCE WARNING DEVICES OR SIGNS, SEE TCD 14 FOR SIGHT DISTANCE DATA.
4. RECOMMEND WORKING DURING RED PHASE IF SIGNALIZED.
5. REFER TO TAPER AND BUFFER SPACE DETAILS SHOWN ON APPENDIX 3-3 FOR ADDITIONAL INFORMATION.

LEGEND

WORK VEHICLE W/ WARNING BEACON

S SPOTTER

TYPICAL VERY SHORT DURATION WORK OPERATION
INTERSECTION LOCATION
(SEE GUIDANCE TEXT FOR ADDITIONAL DIRECTION)
TCP 21

Mobile work zones are work activities that typically move along the road either intermittently or continuously. Frequent short stops may be used for pothole patching, litter bag pickup, herbicide spraying, lane marker replacement or other similar operations. Channelizing devices, truck mounted signs or Portable Changeable Message Signs (PCMS), warning lights and flaggers may be needed for these operations.

Mobile work zones also include slow moving operations where workers and equipment move along the road without stopping. Operations such as sweeping and paint striping are typical mobile operations. The warning signs move ahead with the work, usually mounted on a shadow vehicle. Truck mounted signs or PCMS, Truck Mounted Attenuator (TMA), and warning lights are some of the devices that may be used for moving operations. Messages for truck mounted PCMSs should conform to standard work messages whenever possible. Contact the Region Traffic Office Staff for assistance with selecting appropriate messages.

Mobile work zones are well suited to maintenance operations and can be an efficient way to accomplish many types of work, but due to the moving nature of these operations it is imperative that the crew is carefully coordinated. Careful consideration of traffic and roadway conditions as they relate to the specific operation must be done prior to starting work.

Many work operations that may have been previously conducted as short-term operations can be significantly improved by converting to a mobile operation. Contact the Region Traffic Office for assistance.

The following TCPs depict typical examples of mobile work zones:

TCP 22 – ***Typical Mobile Left Shoulder Closed (Freeway Application)***
(For work operations that can be accomplished on the shoulder without encroachment into the adjacent lanes.)

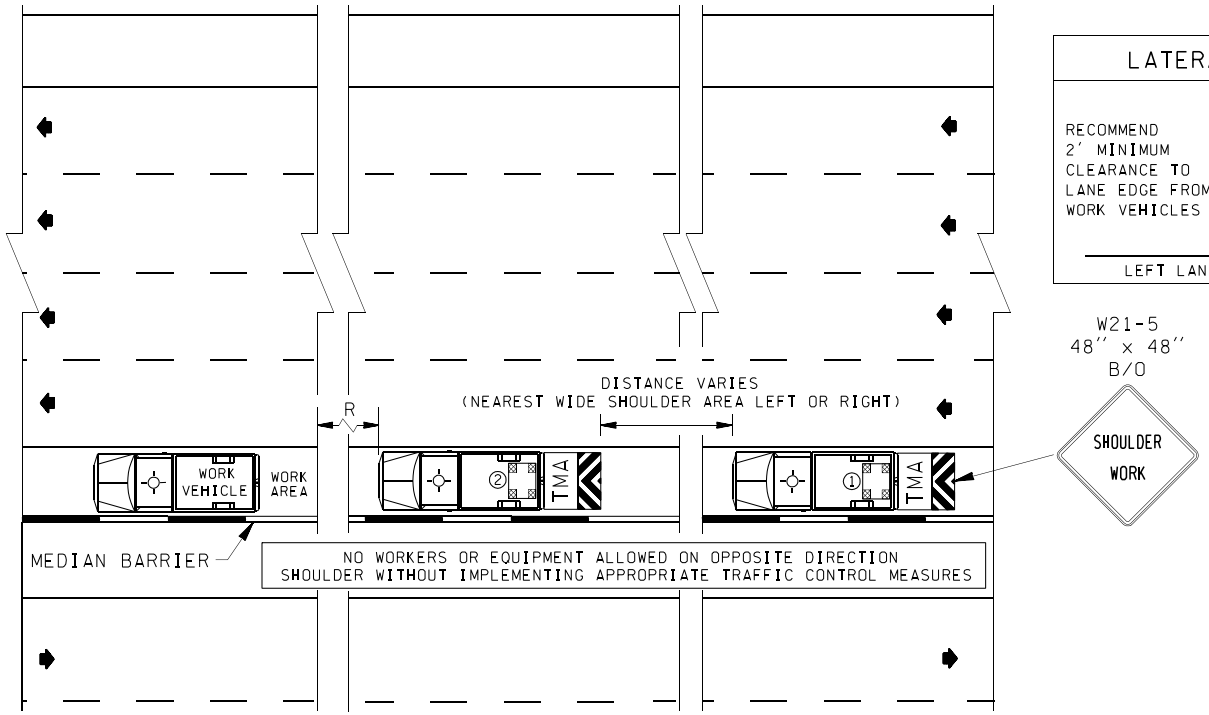
TCP 23 – ***Typical Mobile Left-lane Operation (Freeway Application)***
(For work operations on the left shoulder or in the lane.)

TCP 24 – ***Typical Mobile Middle-lane Operation (Freeway Application)***
(For multi-lane freeway applications where the work takes place in the middle lanes, this plan depicts a mobile double left-lane closure operation.)

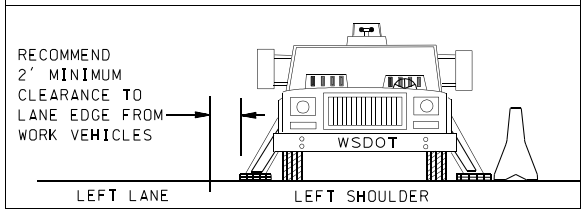
TCP 25 – ***Typical Mobile Lane Closure Operation on a Two-lane Roadway***
(For mobile operations on a rural two-lane, two-way roadway with "in lane" work.)

TCP 26 – ***Typical Mobile Shoulder Closure Operation on a Two-lane Roadway***
(For mobile operations on a rural two-lane, two-way roadway with no encroachment.)

TYPICAL FREEWAY APPLICATION
(ACTUAL NUMBER OF LANES MAY VARY)



LATERAL CLEARANCE DETAIL



W21-5
48" x 48"
B/O

(SAMPLE MESSAGE)

PCMS	
1	2
LEFT SHOULDER CLOSED	SLOW MOVING VEHICLES
1.5 SEC	1.5 SEC

Field locate in advance of shoulder closure. (TRUCK MOUNTED OR TRAILER MOUNTED OPTIONAL)

PROTECTIVE VEHICLE ROLL AHEAD DISTANCE = R
ROLL AHEAD DISTANCES VARY AND SHALL BE DETERMINED IN FIELD BASED ON WORK OPERATION AND SITE SPECIFIC CONDITIONS.
USE OF A TRUCK MOUNTED ATTENUATOR RECOMMENDED

OPERATIONAL NOTES

1. SHADOW VEHICLE #1, MOUNT SHOULDER CLOSURE SIGN ON BACK OF VEHICLE. DO NOT OBSCURE ARROW PANEL. MAINTAIN 1000' TO 1500' OF SIGHT DISTANCE TO APPROACHING TRAFFIC (TMA RECOMMENDED).
2. PROTECTIVE VEHICLE #2, POSITION VEHICLE TO PROVIDE PROTECTION OF CREW. MAINTAIN ROLL-AHEAD DISTANCE (TMA RECOMMENDED).
3. 2' MINIMUM CLEARANCE RECOMMENDED BETWEEN LANE EDGE AND WORK VEHICLE. ADJACENT LANE MUST BE CLOSED IF ADDITIONAL CLEARANCE IS REQUIRED OR IF WORK ACTIVITIES ADVERSELY INFLUENCE TRAFFIC.
4. CONTACT REGION TRAFFIC MANAGEMENT CENTER PRIOR TO WORK BEGIN AND END.
5. PCMS RECOMMENDED.

LEGEND

- ARROW PANEL - TYPE "B" (CAUTION MODE)
- TMA — TRUCK MOUNTED ATTENUATOR
- WARNING BEACON - REQUIRED

TYPICAL MOBILE FREEWAY OPERATION
LEFT SHOULDER CLOSED
TCP 22

(SAMPLE MESSAGE)

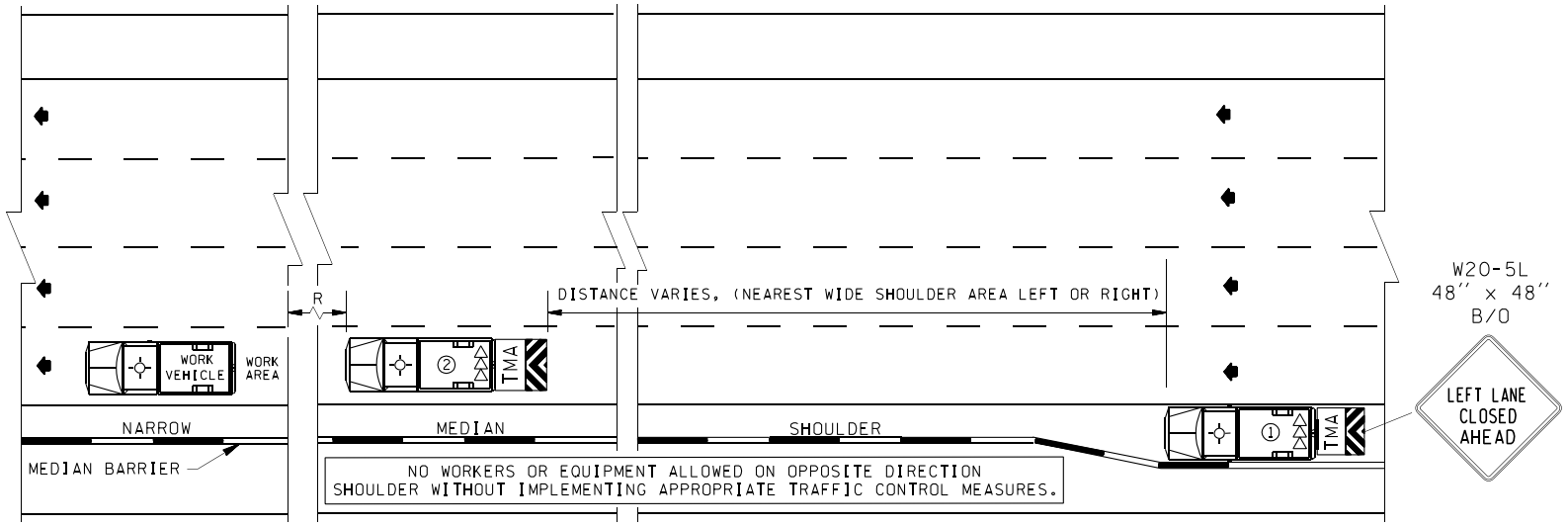
PCMS	
1	2
LEFT LANE CLOSED	MERGE RIGHT
1.5 SEC	1.5 SEC

Field locate in advance of lane closure. (TRUCK MOUNTED OR TRAILER MOUNTED OPTIONAL)

PROTECTIVE VEHICLE ROLL AHEAD DISTANCE = R
ROLL AHEAD DISTANCES VARY AND SHALL BE DETERMINED IN FIELD BASED ON WORK OPERATION AND SITE SPECIFIC CONDITIONS.
USE OF A TRUCK MOUNTED ATTENUATOR RECOMMENDED

TYPICAL FREEWAY APPLICATION

(ACTUAL NUMBER OF LANES MAY VARY)



OPERATIONAL NOTES

1. SHADOW VEHICLE #1, MOUNT LANE CLOSURE SIGN ON BACK OF VEHICLE. DO NOT OBSCURE ARROW PANEL. MAINTAIN 1000' TO 1500' OF SIGHT DISTANCE TO APPROACHING TRAFFIC (TMA RECOMMENDED).
2. PROTECTIVE VEHICLE #2, POSITION VEHICLE TO PROVIDE PROTECTION OF CREW. MAINTAIN ROLL AHEAD DISTANCE (TMA RECOMMENDED).
3. 2' MINIMUM CLEARANCE RECOMMENDED BETWEEN LANE EDGE AND WORK VEHICLE. ADJACENT LANE MUST BE CLOSED IF ADDITIONAL CLEARANCE IS REQUIRED OR IF WORK ACTIVITIES ADVERSELY INFLUENCE TRAFFIC.
4. CONTACT REGION TRAFFIC MANAGEMENT CENTER PRIOR TO WORK BEGINS AND AFTER ENDING.
5. PCMS RECOMMENDED.

LEGEND

▷▷▷ ARROW PANEL - TYPE "B" MIN.

TMA TRUCK MOUNTED ATTENUATOR

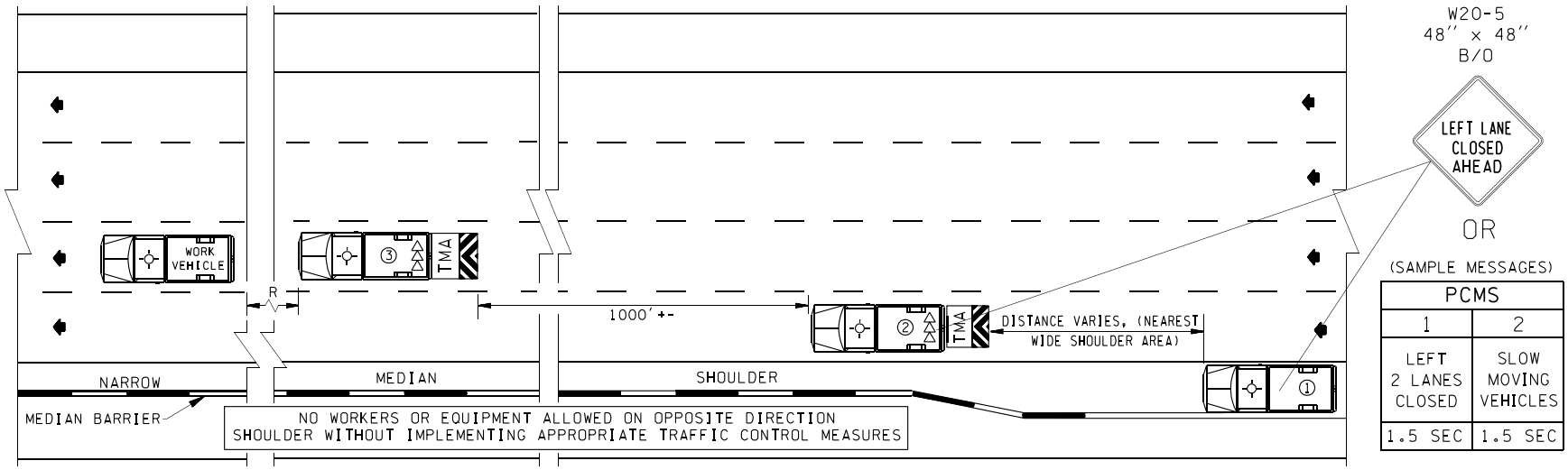
WARNING BEACON - REQUIRED

TYPICAL MOBILE FREEWAY OPERATION
LEFT LANE CLOSURE
TCP 23

PROTECTIVE VEHICLE ROLL AHEAD DISTANCE = R
ROLL AHEAD DISTANCES VARY AND SHALL BE DETERMINED IN FIELD BASED ON WORK OPERATION AND SITE SPECIFIC CONDITIONS.
USE OF A TRUCK MOUNTED ATTENUATOR RECOMMENDED

TYPICAL FREEWAY APPLICATION

(ACTUAL NUMBER OF LANES MAY VARY)



OPERATIONAL NOTES

1. ADVANCE WARNING VEHICLE #1, MOUNT LANE CLOSURE SIGN ON BACK OF VEHICLE. MAINTAIN 1000' TO 1500' SIGHT DISTANCE TO APPROACHING VEHICHLES. (TMA RECOMMENDED)
2. SHADOW VEHICLE #2, MOUNT LANE CLOSURE SIGN ON BACK OF VEHICLE. DO NOT OBSCURE ARROW PANEL. MAINTAIN 1000' TO 1500' OF SIGHT DISTANCE TO APPROACHING TRAFFIC (TMA RECOMMENDED).
3. PROTECTIVE VEHICLE #3, POSITION VEHICLE TO PROVIDE PROTECTION OF CREW. MAINTAIN ROLL AHEAD DISTANCE (TMA RECOMMENDED).
4. 2' MINIMUM CLEARANCE RECOMMENDED BETWEEN LANE EDGE AND WORK VEHICLE. ADJACENT LANE MUST BE CLOSED IF ADDITIONAL CLEARANCE IS REQUIRED OR IF WORK ACTIVITIES ADVERSELY INFLUENCE TRAFFIC.
5. CONTACT REGION TRAFFIC MANAGEMENT CENTER PRIOR TO WORK BEGIN AND END.
6. PCMS RECOMMENDED.

LEGEND

▷▷▷ ARROW PANEL - TYPE "B" MIN.

TMA TRUCK MOUNTED ATTENUATOR (RECOMMENDED)

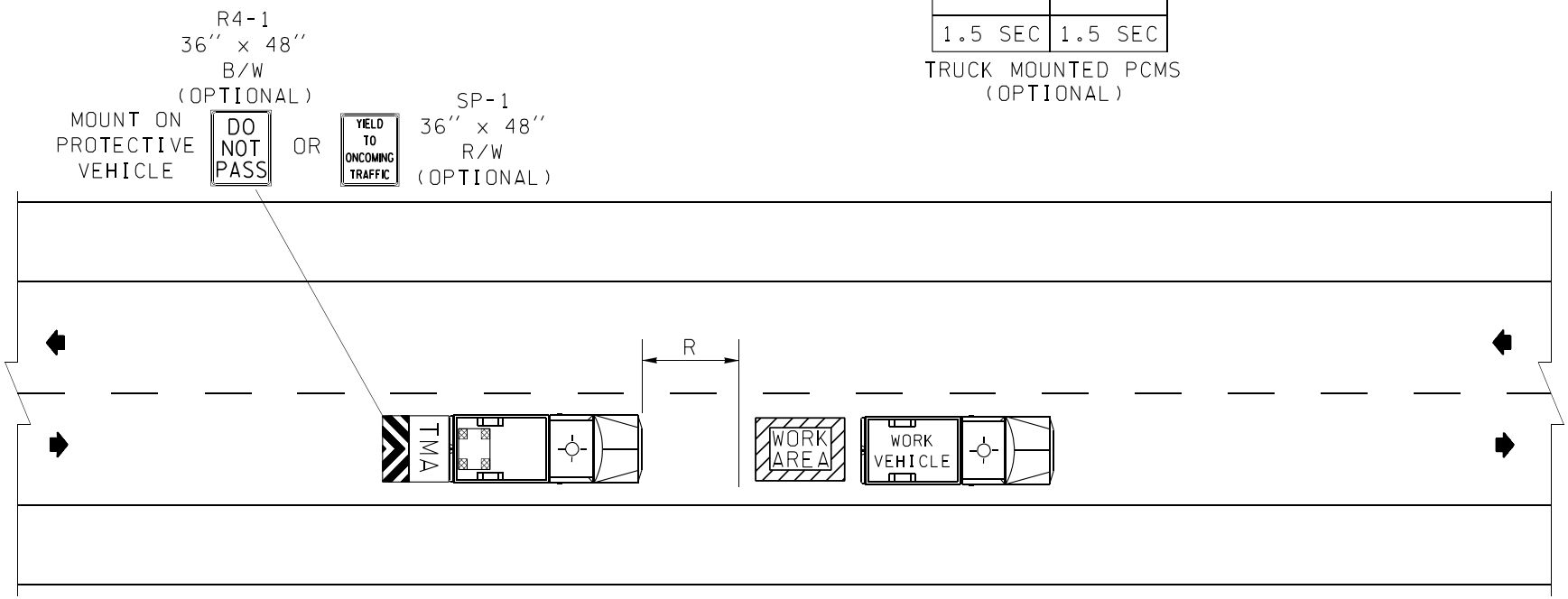
WARNING BEACON - REQUIRED

TYPICAL MOBILE FREEWAY OPERATION
MIDDLE LANE WORK AREA
TCP 24

PROTECTIVE VEHICLE ROLL AHEAD DISTANCE = R
ROLL AHEAD DISTANCES VARY AND SHALL BE DETERMINED IN FIELD BASED ON WORK OPERATION AND SITE SPECIFIC CONDITIONS.
USE OF A TRUCK MOUNTED ATTENUATOR RECOMMENDED

PCMS	
1	2
SLOW MOVING VEHICLE	YIELD TO ONCOMING TRAFFIC
1.5 SEC	1.5 SEC

TRUCK MOUNTED PCMS
(OPTIONAL)



LEGEND

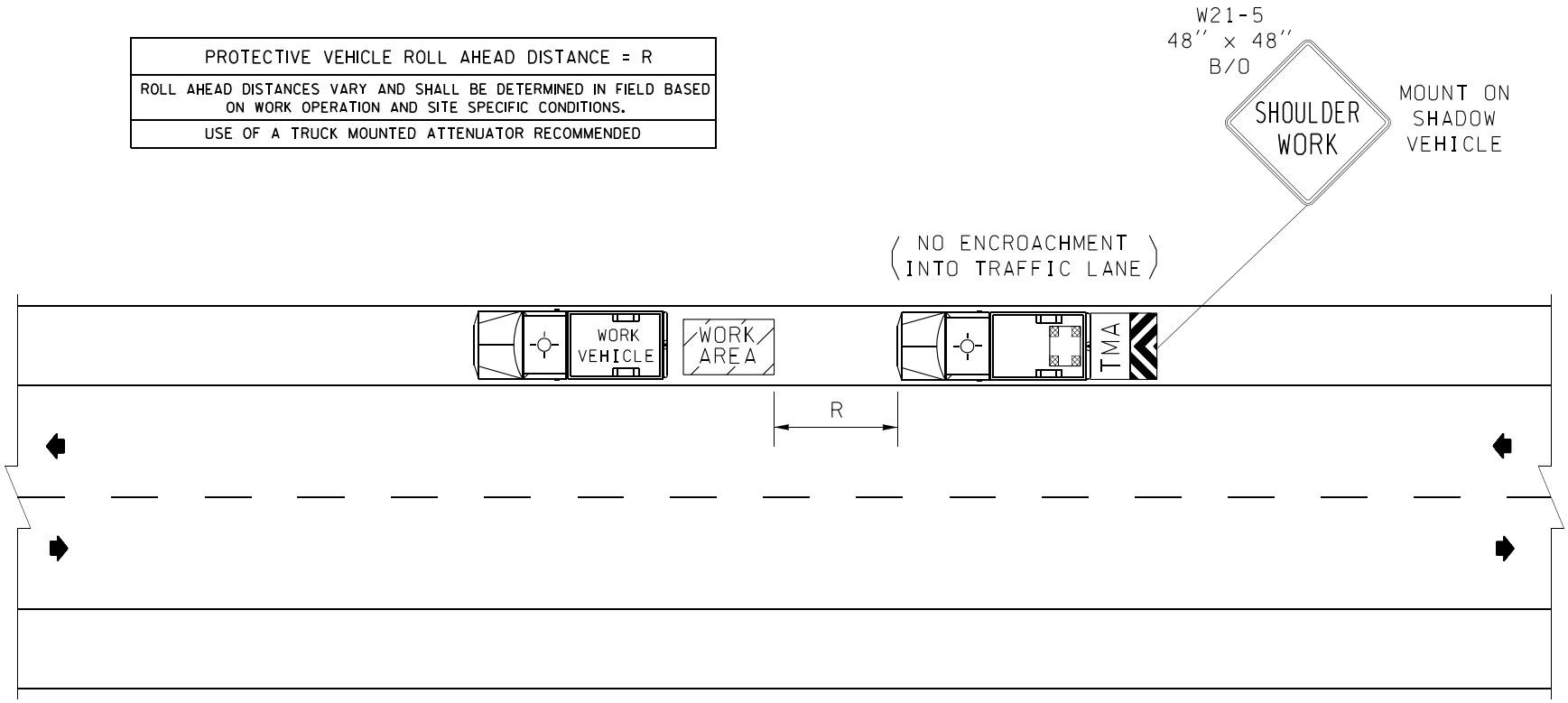
- ARROW PANEL - TYPE "B" (CAUTION MODE)
- TMA — TRUCK MOUNTED ATTENUATOR (RECOMMENDED)
- WARNING BEACON - REQUIRED

OPERATIONAL NOTES

1. WORK VEHICLE AND PROTECTIVE VEHICLE SHALL USE WARNING BEACONS.
2. PROTECTIVE VEHICLE SHALL MAINTAIN 500'-1000' OF SIGHT DISTANCE TO APPROACHING TRAFFIC.
3. CONTACT REGIONAL TRAFFIC OFFICE STAFF FOR ASSISTANCE WITH SPECIFIC IN LANE OPERATIONS SUCH AS STRIPING, FOG SEAL, ETC. THAT REQUIRE ADDITIONAL PLANS AND DETAILS.
4. "DO NOT PASS" SIGN CAN BE REPLACED WITH "PASS WITH CARE" SIGN WHEN APPROPRIATE.
5. PCMS RECOMMENDED.

TYPICAL MOBILE OPERATION
TWO LANE ROADWAY
LANE CLOSURE
TCP 25

PROTECTIVE VEHICLE ROLL AHEAD DISTANCE = R
ROLL AHEAD DISTANCES VARY AND SHALL BE DETERMINED IN FIELD BASED ON WORK OPERATION AND SITE SPECIFIC CONDITIONS.
USE OF A TRUCK MOUNTED ATTENUATOR RECOMMENDED



OPERATIONAL NOTES

1. WORK VEHICLE AND PROTECTIVE VEHICLE SHALL USE WARNING BEACONS.
2. PROTECTIVE VEHICLE SHALL MAINTAIN 500'-1000' OF SIGHT DISTANCE TO APPROACHING TRAFFIC.
3. CONTACT REGIONAL TRAFFIC OFFICE STAFF FOR ASSISTANCE WITH SPECIFIC IN LANE OPERATIONS SUCH AS STRIPING, FOG SEAL, ETC. THAT REQUIRE ADDITIONAL PLANS AND DETAILS.

LEGEND

ARROW PANEL - TYPE "B" (CAUTION MODE)

TMA — TRUCK MOUNTED ATTENUATOR (RECOMMENDED)

WARNING BEACON - REQUIRED

TYPICAL MOBILE OPERATION
TWO LANE ROADWAY
SHOULDER CLOSURE
TCP 26

Traffic control at intersections requires specific attention because traffic is usually in-bound from all directions. The traffic on all approaches needs to be given the same advance warning with the messages on the warning signs to be appropriate for the situation ahead of them. When an intersection is to be controlled by flaggers, always be sure that an existing signal does not give the drivers a conflicting message. For example, do not stop traffic when the signal is green. ***It is required to turn off the signal or set to all red "flash" mode during flagging operations.***

The traffic control plans in this section show a pair of rather complex intersections. In general, use these examples as guidelines and prepare specific traffic control plans for the intersections you will be working in, showing the lanes and turning movements as they appear on the roadway.

The following TCPs depict typical examples of mobile work zones:

TCP 27 – ***Typical Intersection Lane Closure – Three-lane Roadway***
(Typical urban location with two through lanes and a center turn lane that can be used for shifting traffic in order to maintain the through traffic. Intersection control is by flagger direction, and if a signal is present at the location, it is turned off.)

TCP 28 – ***Typical Intersection Lane Closure – Five-lane Roadway***
(Typical urban location with two through lanes each direction and a center turn lane. This plan depicts closing right lanes for work at the intersection and closing the left-turn pockets to aid in the control of the traffic at the intersection. Intersection control is by flagger direction, and if a signal is present at the location, it is turned off.)

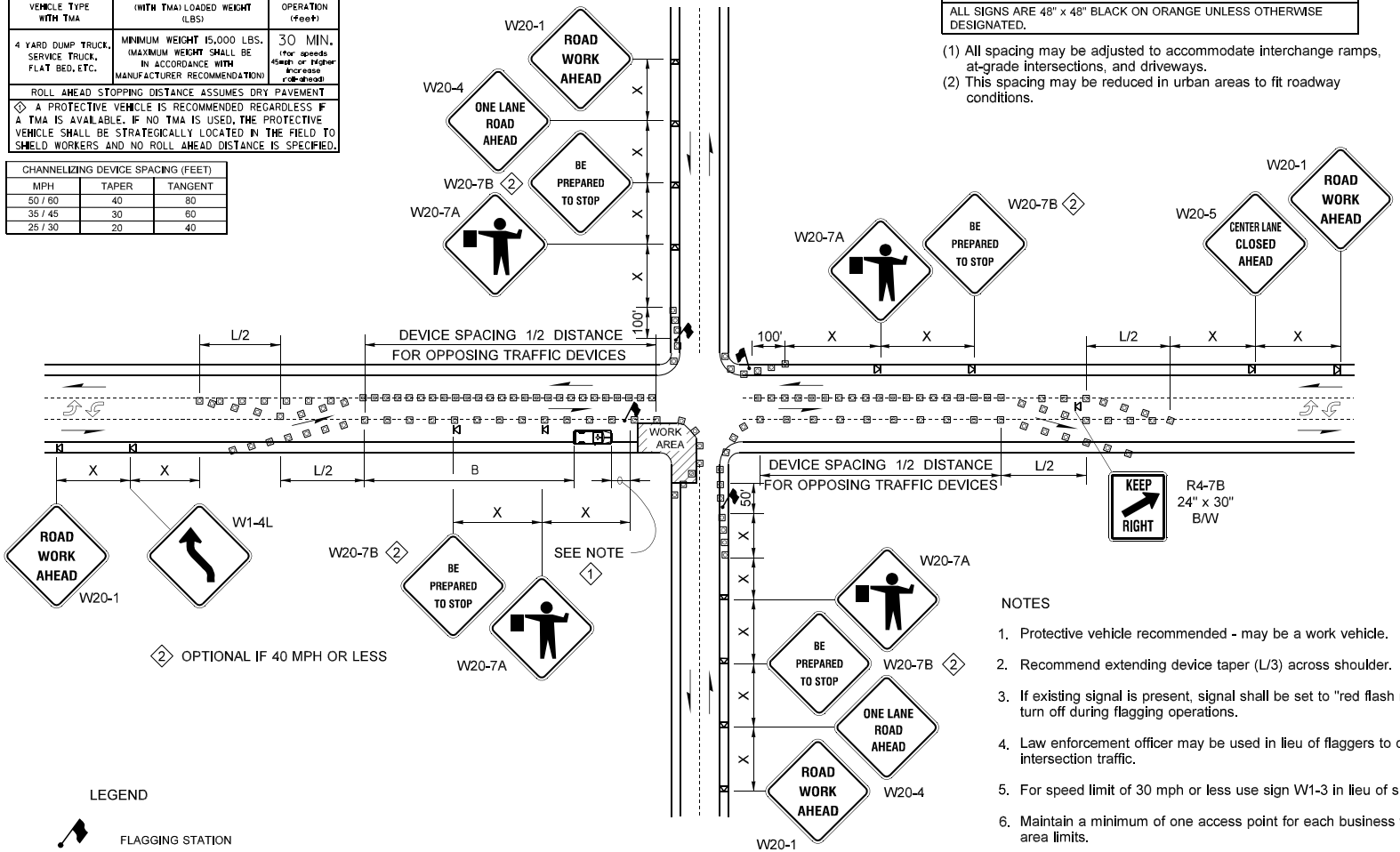
BUFFER DATA									
LONGITUDINAL BUFFER SPACE = B									
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730
PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE										
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)			STATIONARY OPERATION (feet)						
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)			30 MIN. (for speeds 45mph or higher increase roll-ahead)						
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT										
1 A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED.										

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50 / 60	40	80
35 / 45	30	60
25 / 30	20	40

MINIMUM TAPER LENGTH = L (feet)										
Lane Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	105	150	205	270	450	500	550	-	-	-
11	115	165	225	295	495	550	605	660	-	-
12	125	180	245	320	540	600	660	720	-	-

SIGN SPACING = X (FEET) (1)		
RURAL HIGHWAYS	60 / 65 MPH	800'±
RURAL ROADS	45 / 55 MPH	500'±
RURAL ROADS & URBAN ARTERIALS	35 / 40 MPH	350'±
RURAL ROADS, URBAN ARTERIALS RESIDENTIAL & BUSINESS DISTRICTS	25 / 30 MPH	200'± (2)
URBAN STREETS	25 MPH OR LESS	100'± (2)
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

(1) All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.
(2) This spacing may be reduced in urban areas to fit roadway conditions.



LEGEND

- FLAGGING STATION
- SIGN LOCATION
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- WARNING BEACON - REQUIRED

NOTES

1. Protective vehicle recommended - may be a work vehicle.
2. Recommend extending device taper (L/3) across shoulder.
3. If existing signal is present, signal shall be set to "red flash mode" or turn off during flagging operations.
4. Law enforcement officer may be used in lieu of flaggers to control intersection traffic.
5. For speed limit of 30 mph or less use sign W1-3 in lieu of sign W1-4.
6. Maintain a minimum of one access point for each business within work area limits.
7. Consider using PCMS for additional advance warning.

TYPICAL INTERSECTION LANE CLOSURE ~ THREE LANE ROADWAY
TCP 27

MINIMUM TAPER LENGTH = L (feet)										
Lane Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	105	150	205	270	450	500	550	-	-	-
11	115	165	225	295	495	550	605	660	-	-
12	125	180	245	320	540	600	660	720	-	-

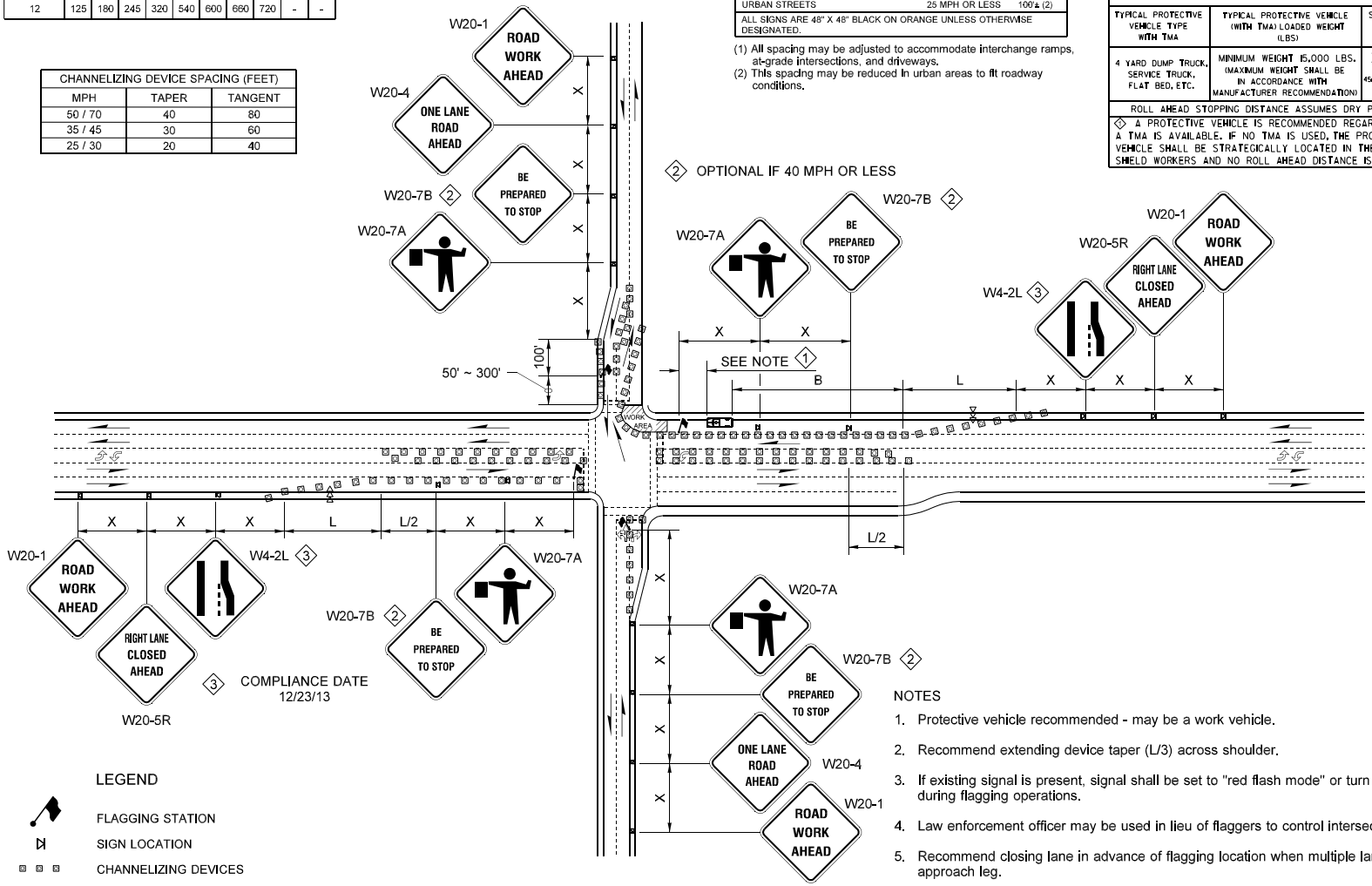
CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50 / 70	40	80
35 / 45	30	60
25 / 30	20	40

SIGN SPACING = X (FEET) (1)		
RURAL HIGHWAYS	60/65 MPH	800'±
RURAL ROADS	45/55 MPH	500'±
RURAL ROADS & URBAN ARTERIALS	35/40 MPH	350'±
RURAL ROADS, URBAN ARTERIALS RESIDENTIAL & BUSINESS DISTRICTS	25/30 MPH	200'± (2)
URBAN STREETS	25 MPH OR LESS	100'± (2)
ALL SIGNS ARE 48" X 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

(1) All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.
(2) This spacing may be reduced in urban areas to fit roadway conditions.

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	-	-
PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE										
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)							STATIONARY OPERATION (feet)		
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)							30 MIN. (for speeds 45mph or higher increase roll-ahead)		
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT										

◇ A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED.



LEGEND

- FLAGGING STATION
- SIGN LOCATION
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- WARNING BEACON - REQUIRED
- ARROW PANEL

NOTES

1. Protective vehicle recommended - may be a work vehicle.
2. Recommend extending device taper (L/3) across shoulder.
3. If existing signal is present, signal shall be set to "red flash mode" or turn off during flagging operations.
4. Law enforcement officer may be used in lieu of flaggers to control intersection traffic.
5. Recommend closing lane in advance of flagging location when multiple lanes are on approach leg.
6. Maintain a minimum of one access point for each business within work area limits.
7. Consider using PCMS for additional advance warning.

TYPICAL INTERSECTION LANE CLOSURE ~ FIVE LANE ROADWAY
TCP 28

The following detail plans show examples which are difficult to show on other traffic control plans or where additional guidance is necessary.

TCD 1 – ***Shoulder Work Area Protection During Non-working Hours***
(This detail provides supplemental guidance to *Standard Specification* 1-07.23(1).)

TCD 2 – ***Typical Example – Motorcycle Warning Sign Detail***
(This detail provides examples for sign placement in using the Motorcycles Use Extreme Caution sign in coordination with specific warning signs. (See RCW 47.36.200 and WAC 468-95-305.)

TCD 3 – ***Typical Example – Lane Closure With Shift***
(For use on multi-lane roadways where the work operation goes to the lane line and the traffic is shifted over onto the existing shoulder in order to maintain some buffer space between the work and traffic.)

TCD 4 – ***Typical Example – Speed Zone Detail for Chip Seal Project***
(Additional guidance for the signing requirements in chip seal projects and projects with reduced work zone speed limits.)

TCD 5 – ***Typical Example – Work Beyond the Shoulder***
(Typical example taken from MUTCD application that details minimum signing requirements for work within 15 feet of the edge of roadway.)

TCD 6 – ***Typical Example – Long-term Shoulder Closure on Freeway***
(Typical example taken from the MUTCD, this plan depicts the signing and channelizing device requirements for shoulder closure operations, particularly operations with barrier.)

TCD 7 – ***Typical Example – Rolling Slowdown***
(See detailed operational guidance that accompanies this plan.)

TCD 8 – ***Typical Example – Emergency Operations***
(See detailed operational guidance that accompanies this plan.)

TCD 9 – ***Temporary Pavement Marking Details***
(This detail sheet is a supplement to *Standard Specification* 8-23 Temporary Pavement Markings and is included to provide descriptions and typical layouts that are not easily described in the specification.)

TCD 10 – ***Typical Example – Temporary Intersection Pedestrian Traffic Control***
(This plan depicts typical signing examples for closing of a sidewalk during work zone operations. Specific pedestrian needs must be considered prior to any work beginning that impacts pedestrian pathways. Special attention must be given to pedestrian ADA accommodations. Consult with Region Traffic Office for assistance with specific issues or needs to provide the appropriate pedestrian controls.)

TCD 11 – ***Typical Example – Temporary Portable Signal***
(This plan provides example of the traffic control signing and device requirements for a portable signal operation. Assistance from the Region Traffic Office and the Region Signal Superintendent may be necessary to adequately address the signal timing needs and any specific details in regard to the location of the portable signal system.)

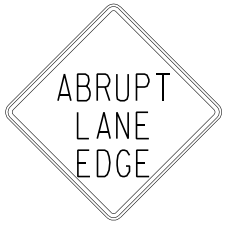
TCD 12 – ***Typical Example – Automated Flagger Assistance Device (AFAD)***
(This plan provides an example of the traffic control signing and device requirements for an alternating one-way traffic operation that utilizes an automated flagger assistance device. The AFAD device can be used in any alternating one-way traffic operation that is typically flagger controlled, the AFAD is a device that is used as a safety enhancement that enables the human flagger to be physically away from traffic in a safe location and remotely operate the device.)

TCD 13 – ***Typical Example – Work Within a Roundabout***
(This example provides general guidance on the signing and device requirements for maintenance work in and around a roundabout location. Each roundabout location is unique and a site specific traffic control plan should be developed for the work operation.)

TCD 14 – ***Typical Mobile Shoulder Operation With Encroachment on a Two-lane Roadway***
(For mobile operations on a rural two-lane, two-way roadway with lane encroachment and limited sight distance.)

WARNING SIGNS

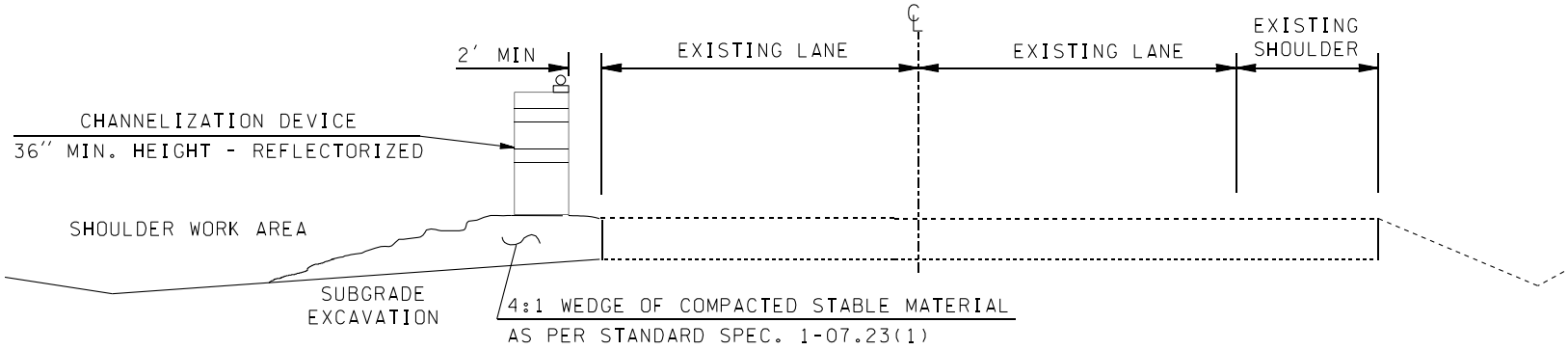
LOCATE AS NEEDED FOR SITE CONDITIONS
TO SUPPLEMENT REQUIRED WARNING SIGNS



W21-801
48" x 48"
B/O

W8-1801
48" x 48"
B/O

W21-1701
48" x 48"
B/O



OPERATIONAL NOTES

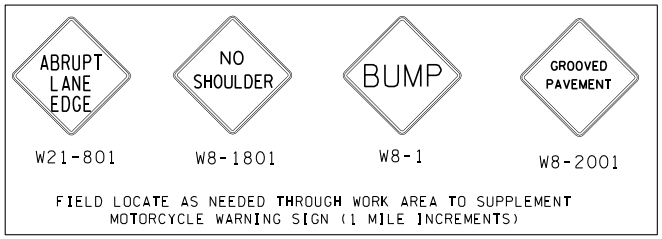
1. SHOULDER EXCAVATION SHALL BE LIMITED TO ONE SIDE OF ROADWAY AT A TIME.
2. TYPE "C" STEADY BURN LIGHTS ARE RECOMMENDED ON CHANNELIZATION DEVICES TO PROVIDE ADDITIONAL DELINEATION.
3. REFER TO STD. SPEC. 1-07.23 FOR ADDITIONAL DETAILS ON THE MITIGATION REQUIREMENTS FOR DROP OFF PROTECTION.
4. REFER TO TCP 6 FOR SHOULDER CLOSURE REQUIREMENTS AND INFORMATION.

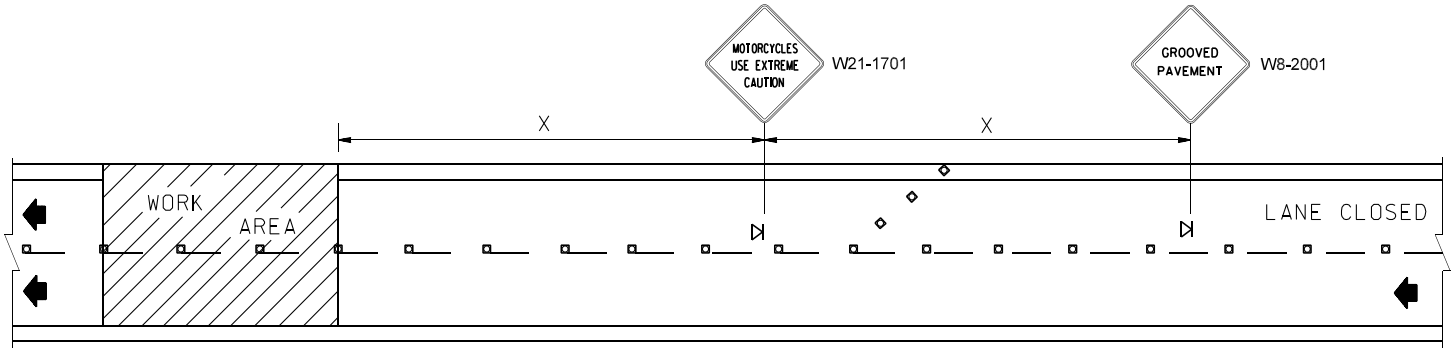
SHOULDER WORK AREA PROTECTION
TCD 1

SIGN SPACING = X (feet) (1)		
Freeways & Expressways	55/70 MPH	1500'+- (OR AS PER MUTCD)
Rural Highways	60/65 MPH	800'+-
Rural Roads	45/55 MPH	500'+-
Rural Roads & Urban Arterials	35/40 MPH	350'+-
Rural Roads, Urban Arterials Residential & Business Districts	25/30 MPH	200'+- (2)
Urban Streets	25 MPH or LESS	100'+- (2)
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

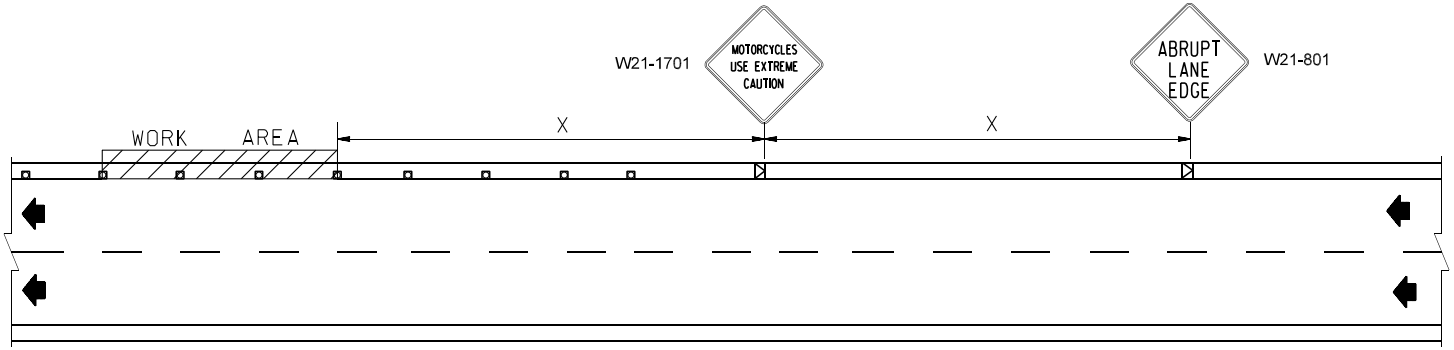
(1) All spacing may be adjusted to accomodate interchange ramps, at-grade intersections, and driveways.
(2) This spacing may be reduced in urban areas to fit roadway conditions.

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50/70	40	80
35/45	30	60
25/30	20	40





TYPICAL SIGNING FOR LANE CLOSURE



TYPICAL SIGNING FOR SHOULDER WORK

NOTES

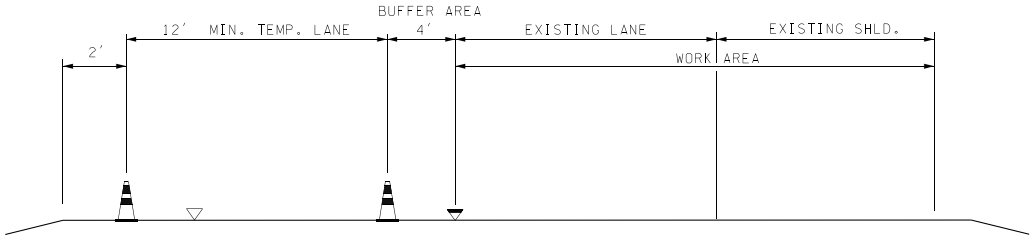
1. REFER TO TCP'S FOR TYPICAL LANE CLOSURE AND SHOULDER CLOSURE SIGNING DETAILS, DEVICE SPACING REQUIREMENTS AND TAPER LENGTHS.

LEGEND

SIGN LOCATION

CHANNELIZING DEVICES

TYPICAL MOTORCYCLE SIGNING DETAIL
TCD 2



TYPICAL SECTION A-A

CHANNELIZING DEVICE

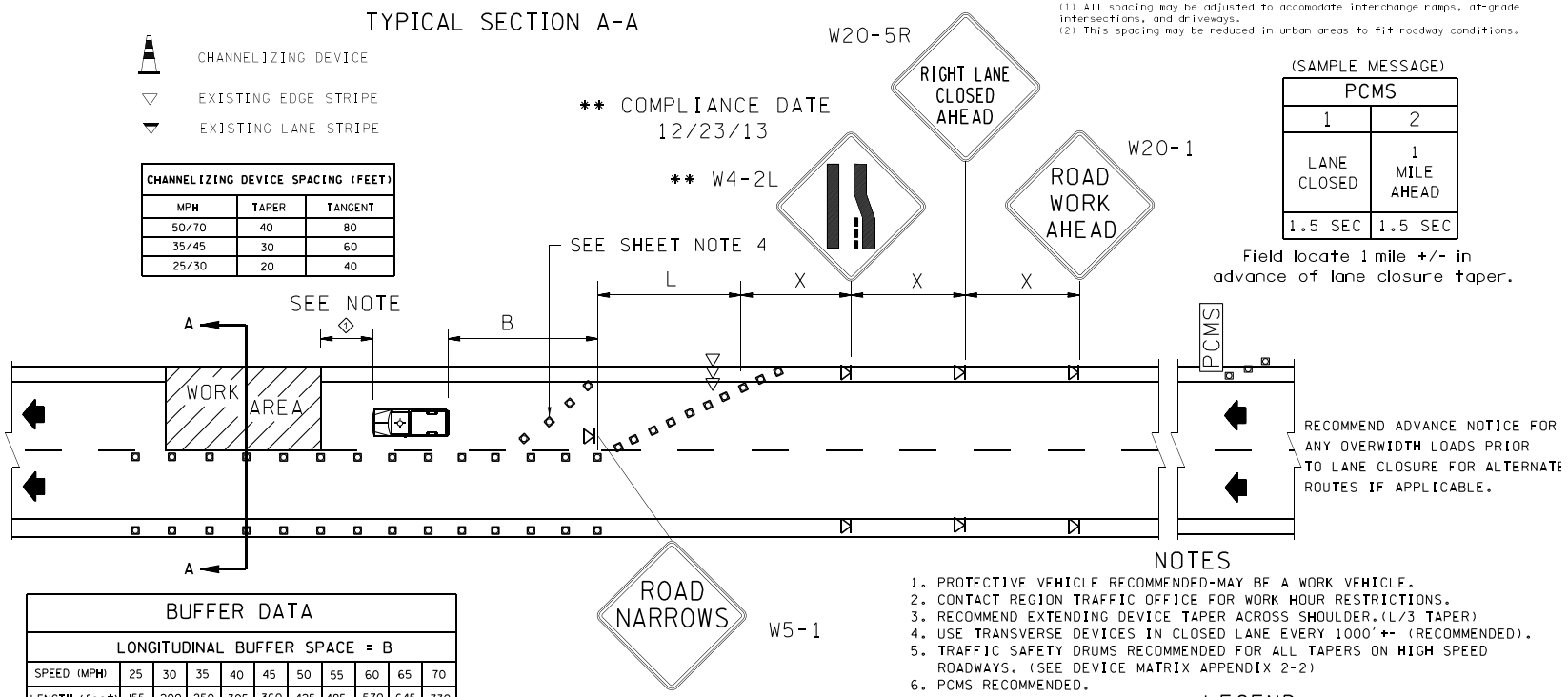
EXISTING EDGE STRIPE

EXISTING LANE STRIPE

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50/70	40	80
35/45	30	60
25/30	20	40

SIGN SPACING = X (feet) (1)		
Freeways & Expressways	55/70 MPH	1500'+- (OR AS PER MUTCD)
Rural Highways	60/65 MPH	800'+-
Rural Roads	45/55 MPH	500'+-
Rural Roads & Urban Arterials	35/40 MPH	350'+-
Rural Roads, Urban Arterials Residential & Business Districts	25/30 MPH	200'+- (2)
Urban Streets	25 MPH or LESS	100'+- (2)
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

(1) All spacing may be adjusted to accomodate interchange ramps, at-grade intersections, and driveways.
(2) This spacing may be reduced in urban areas to fit roadway conditions.



(SAMPLE MESSAGE)

PCMS	
1	2
LANE CLOSED	1 MILE AHEAD
1.5 SEC	1.5 SEC

Field locate 1 mile +/- in advance of lane closure taper.

RECOMMEND ADVANCE NOTICE FOR ANY OVERWIDTH LOADS PRIOR TO LANE CLOSURE FOR ALTERNATE ROUTES IF APPLICABLE.

NOTES

1. PROTECTIVE VEHICLE RECOMMENDED-MAY BE A WORK VEHICLE.
2. CONTACT REGION TRAFFIC OFFICE FOR WORK HOUR RESTRICTIONS.
3. RECOMMEND EXTENDING DEVICE TAPER ACROSS SHOULDER.(L/3 TAPER)
4. USE TRANSVERSE DEVICES IN CLOSED LANE EVERY 1000'+- (RECOMMENDED).
5. TRAFFIC SAFETY DRUMS RECOMMENDED FOR ALL TAPERS ON HIGH SPEED ROADWAYS. (SEE DEVICE MATRIX APPENDIX 2-2)
6. PCMS RECOMMENDED.

BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730

PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE		
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN. 100 MAX.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT		

◇ A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED. REFER TO CHAPTER 1.5.5 FOR ADDITIONAL INFORMATION

MINIMUM TAPER LENGTH = L (feet)										
LANE WIDTH (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	105	150	205	270	450	500	550	-	-	-
11	115	165	225	295	495	550	605	660	-	-
12	125	180	245	320	540	600	660	720	780	840

TYPICAL LANE CLOSURE WITH SHIFT
TCD 3

LEGEND

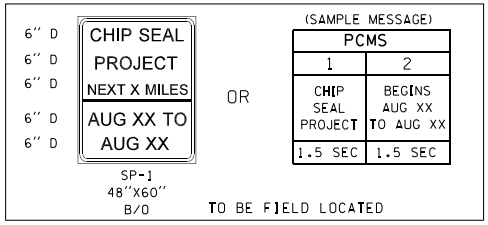
- WARNING BEACON - REQUIRED
- SIGN LOCATION
- ARROW PANEL
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- PCMS PORTABLE CHANGEABLE MESSAGE SIGN

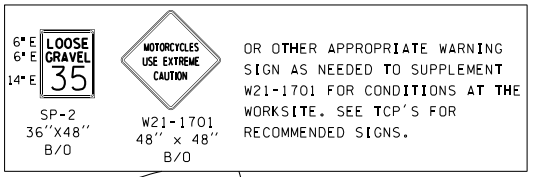
POSTED SPEED	DECELERATION LENGTH NEEDED TO REACH LISTED ADVISORY SPEED - MPH = D					
	10	20	30	40	50	60
70	525	500	425	350	250	150
65	425	400	350	175	N/A*	N/A*
60	350	300	250	175	N/A*	--
55	275	225	175	100	N/A*	--
50	200	150	100	N/A*	--	--
45	125	N/A*	N/A*	--	--	--
40	N/A*	N/A*	N/A*	--	--	--
35	N/A*	N/A*	N/A*	--	--	--
30	N/A*	N/A*	--	--	--	--
25	N/A*	--	--	--	--	--

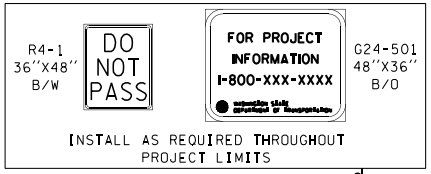
* NO SUGGESTED MINIMUM DISTANCES ARE PROVIDED FOR THESE SPEEDS. AS THE PLACEMENT LOCATION IS DEPENDENT ON SITE CONDITIONS AND OTHER SIGNING TO PROVIDE AN ADEQUATE ADVANCE WARNING FOR THE DRIVER.

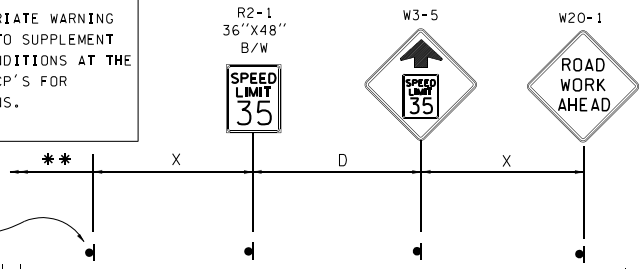
SIGN SPACING = X (feet) (1)		
Freeways & Expressways	55/70 MPH	1500'+- (OR AS PER MUTCD)
Rural Highways	60/65 MPH	800'+-
Rural Roads	45/55 MPH	500'+-
Rural Roads & Urban Arterials	35/40 MPH	350'+-
Rural Roads, Urban Arterials Residential & Business Districts	25/30 MPH	200'+- (2)
Urban Streets	25 MPH or LESS	100'+- (2)
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

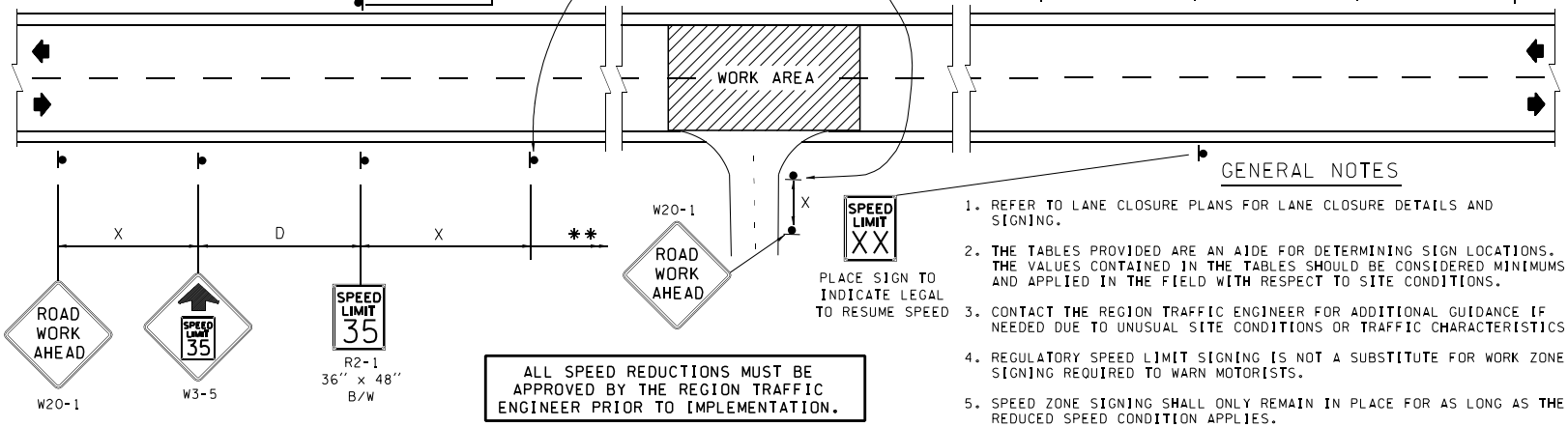
(1) All spacing may be adjusted to accomodate interchange ramps, at-grade intersections, and driveways.
(2) This spacing may be reduced in urban areas to fit roadway conditions.











ALL SPEED REDUCTIONS MUST BE APPROVED BY THE REGION TRAFFIC ENGINEER PRIOR TO IMPLEMENTATION.

GENERAL NOTES

1. REFER TO LANE CLOSURE PLANS FOR LANE CLOSURE DETAILS AND SIGNING.
2. THE TABLES PROVIDED ARE AN AIDE FOR DETERMINING SIGN LOCATIONS. THE VALUES CONTAINED IN THE TABLES SHOULD BE CONSIDERED MINIMUMS AND APPLIED IN THE FIELD WITH RESPECT TO SITE CONDITIONS.
3. CONTACT THE REGION TRAFFIC ENGINEER FOR ADDITIONAL GUIDANCE IF NEEDED DUE TO UNUSUAL SITE CONDITIONS OR TRAFFIC CHARACTERISTICS.
4. REGULATORY SPEED LIMIT SIGNING IS NOT A SUBSTITUTE FOR WORK ZONE SIGNING REQUIRED TO WARN MOTORISTS.
5. SPEED ZONE SIGNING SHALL ONLY REMAIN IN PLACE FOR AS LONG AS THE REDUCED SPEED CONDITION APPLIES.
6. CONTACT THE REGION TRAFFIC OFFICE FOR SPECIAL SIGN ORDERS, SPEED REDUCTION NOTICES, ETC.
7. SEE TCD9 FOR TEMPORARY PAVEMENT MARKING DETAILS.
8. MOTORCYCLE WARNING SIGNS ARE REQUIRED AS PER WAC 468-95-305.
9. SPEED LIMIT REDUCTION SHALL CONFORM TO RCW 47.48.020

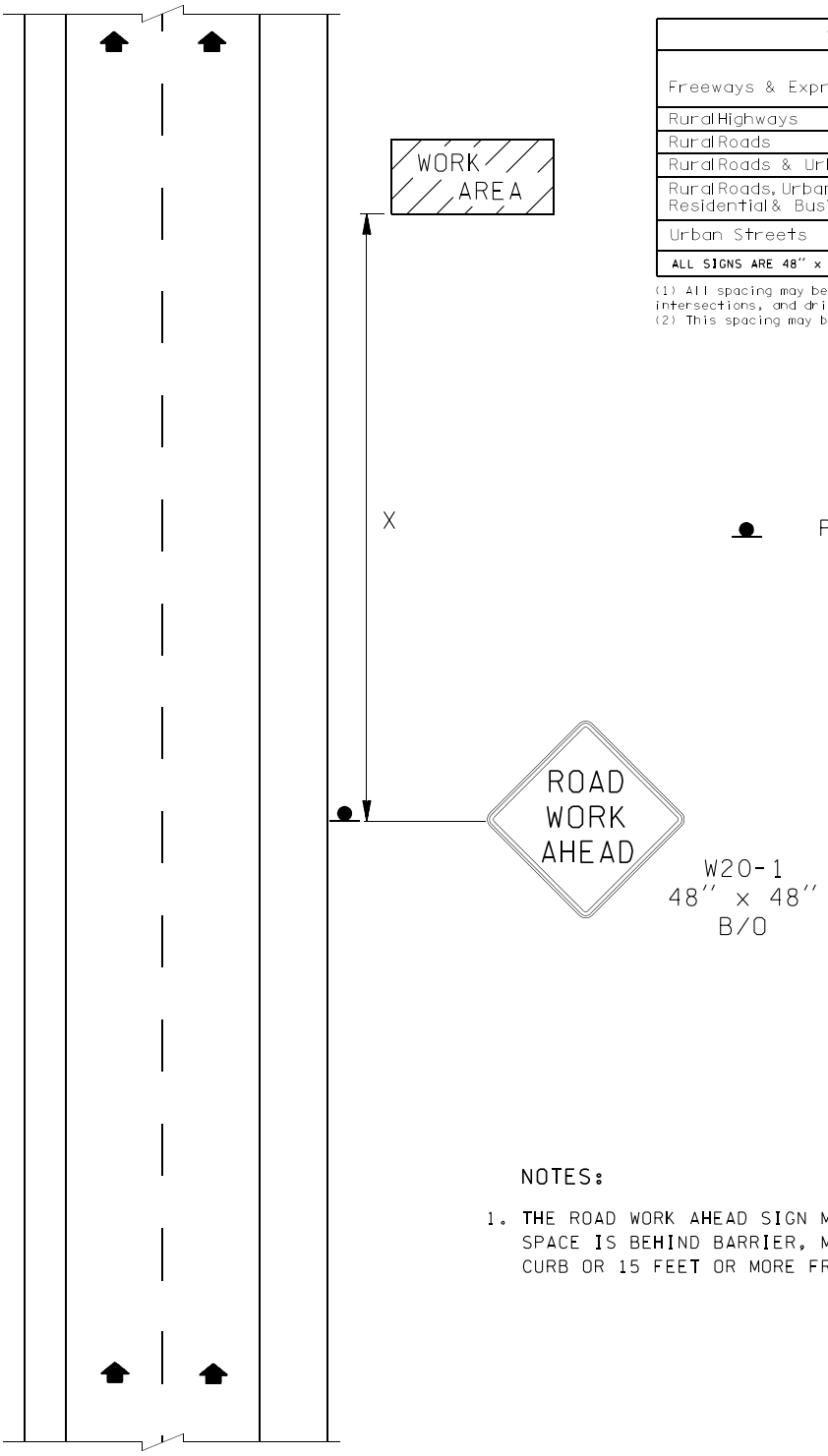
LEGEND

SIGN LOCATION

WORK AREA LIMITS

** CONTINUE SIGNS AS NEEDED BASED ON REQUIRED ROADWAY CONDITION WARNING AS SHOWN ON THE APPROPRIATE TCP.

TYPICAL SPEEDZONE DETAIL CHIP SEAL PROJECTS TCD 4



SIGN SPACING = X (feet) (1)		
Freeways & Expressways	55/70 MPH	1500'+- (OR AS PER MUTCD)
Rural Highways	60/65 MPH	800'+-
Rural Roads	45/55 MPH	500'+-
Rural Roads & Urban Arterials	35/40 MPH	350'+-
Rural Roads, Urban Arterials Residential & Business Districts	25/30 MPH	200'+- (2)
Urban Streets	25 MPH or LESS	100'+- (2)
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

(1) All spacing may be adjusted to accomodate interchange ramps, at-grade intersections, and driveways.
(2) This spacing may be reduced in urban areas to fit roadway conditions.

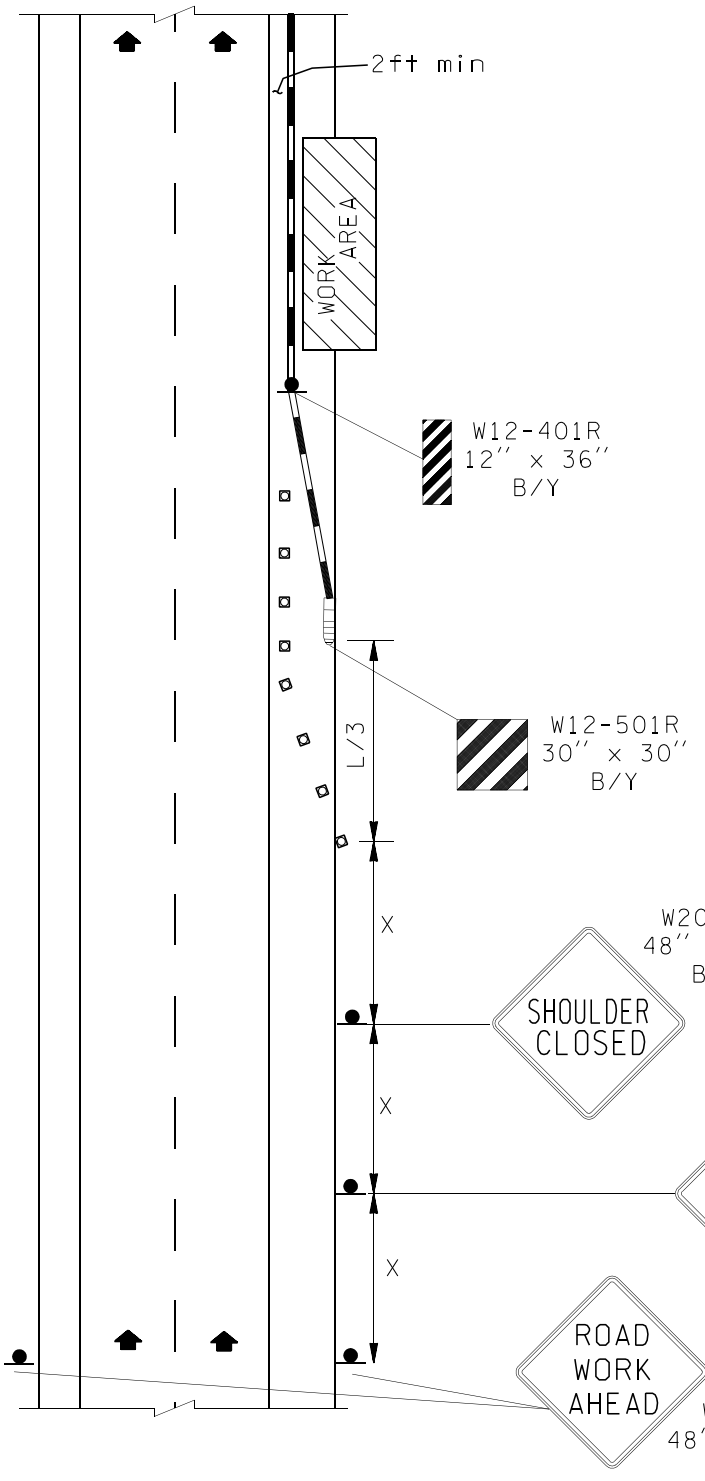
LEGEND

● POST MOUNTED SIGN

NOTES:

1. THE ROAD WORK AHEAD SIGN MAY BE OMITTED WHERE THE WORK SPACE IS BEHIND BARRIER, MORE THAN 24 INCHES BEHIND THE CURB OR 15 FEET OR MORE FROM THE EDGE OF ANY ROADWAY.

WORK BEYOND THE SHOULDER - TCD 5



SIGN SPACING = X (feet) (1)		
Freeways & Expressways	55/70 MPH	1500'+- (OR AS PER MUTCD)
Rural Highways	60/65 MPH	800'+-
Rural Roads	45/55 MPH	500'+-
Rural Roads & Urban Arterials	35/40 MPH	350'+-
Rural Roads, Urban Arterials Residential & Business Districts	25/30 MPH	200'+- (2)
Urban Streets	25 MPH or LESS	100'+- (2)
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

(1) All spacing may be adjusted to accomodate interchange ramps, at-grade intersections, and driveways.
(2) This spacing may be reduced in urban areas to fit roadway conditions.

MINIMUM TAPER LENGTH = L (feet)										
LANE WIDTH (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	-	-	-	270	450	500	550	-	-	-
11	-	-	-	295	495	550	605	660	-	-
12	-	-	-	320	540	600	660	720	780	840

LEGEND

- POST MOUNTED SIGN
- CHANNELIZING DEVICES
- TEMPORARY IMPACT ATTENUATOR
- TEMPORARY CONCRETE BARRIER

CHANNELIZING DEVICE SPACING (feet)		
MPH	TAPER	TANGENT
50/70	40	80
35/45	30	60

BARRIER FLARE RATES	
MPH	TAPER
70	18:1
60	16:1
55	14:1
50	12:1
45	11:1
40 OR BELOW	10:1

NOTES:

1. BARRIER END MUST BE TREATED WITH APPROVED TEMPORARY IMPACT ATTENUATOR APPROPRIATE FOR THE SPECIFIC LOCATION.

TYPICAL LONG-TERM SHOULDER CLOSURE ON FREEWAY - TCD 6

TCD 7 – Rolling Slowdown

A rolling slowdown is a legitimate form of traffic control commonly practiced by the WSP, contractors and highway maintenance crews. This use is valuable for emergency, or **very specific** short duration closures (e.g. to set bridge girders, pick debris from the roadway, to push a blocking disabled to the shoulder, or to pull power lines across the roadway). The traffic control vehicles form a moving blockade across all lanes, which reduces traffic speeds and creates a large gap in traffic, or clear area, allowing very short-term work to be accomplished without completely stopping the traffic.

Other traditional forms of traffic control should be considered first and be the primary choice when possible. If the slowdown is to be a scheduled operation, then the Regional Traffic Office needs to be contacted with a work request so a site specific traffic control plan (TCP) can be developed and/or reviewed and approved. The gap in traffic created by the rolling slowdown, and other traffic issues, should be addressed on an approved TCP. Also, use of WSP is encouraged whenever possible, at a minimum coordination with WSP is necessary.

In the event of debris in the roadway, a blocking disabled vehicle, or other **emergency**, the use of experience and resources at hand, along with sound judgment and common sense, will suffice in lieu of an approved, site specific, TCP. TCD 7 has been developed as a guideline to represent the basic requirements for performing a safe and effective rolling slowdown. Site specific TCPs can be developed based on this plan.

Equipment availability is a prime consideration. Before starting this operation, ensure there are at least one traffic control vehicle (with flashing amber lights) per two lanes, **and** one vehicle to cover every point of access onto the "rolling slowdown" segment of roadway. (Only during emergencies should less than one traffic control vehicle per lane be considered.) Truck mounted PCMS boards stating, "Slow or Stopped Vehicles" are very helpful. **Be sure that every crewmember participating is well briefed and knows what is needed from them. Good communications for this operation are essential!**

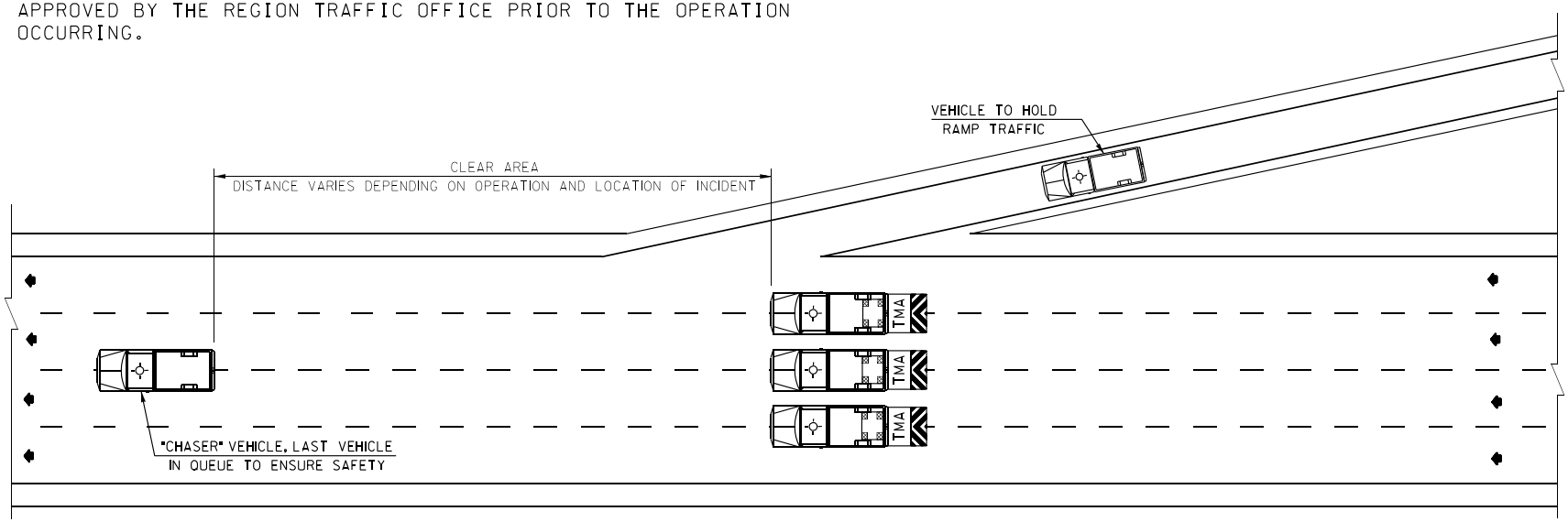
The traffic control vehicles leading the rolling slowdown must enter the roadway far enough upstream from the work operation site to allow a clear area in front of them to develop. The traffic control vehicles will work into position so that each lane is controlled. As in every other form of traffic control, sight distance is important, so that drivers are not surprised. While traveling at a fixed and reduced rate of speed, a gap in traffic must be created which is long enough to provide the estimated time needed for the work to be done.

A separate traffic control vehicle, “chase vehicle,” shall follow the slowest, or last, vehicle ahead of the blockade. When that last vehicle passes, the crew can begin the work operation.

All ramps and entrances to the roadway between the moving blockade and work operation must be temporarily closed using traffic control equipment and personnel. Each of those ramps must remain closed until the crew doing the work gives the “all clear” signal, **or** until the front of the moving blockade passes the closed on-ramp(s).

Radio communications between the work crew and the moving blockade are required so the speed of the blockade can be adjusted, if necessary, to increase or decrease the closure time. Release traffic only after you have confirmation that all workers and their vehicles are clear of the roadway.

THIS PLAN DEPICTS THE MINIMUM REQUIREMENTS TO PERFORM AN EMERGENCY ROLLING SLOWDOWN. IF THE SLOWDOWN IS, OR CAN BE, A PLANNED EVENT, THEN A SITE SPECIFIC TRAFFIC CONTROL PLAN SHOULD BE DEVELOPED AND APPROVED BY THE REGION TRAFFIC OFFICE PRIOR TO THE OPERATION OCCURRING.



(SAMPLE MESSAGE)

TRUCK MOUNTED PCMS	
1	2
SLOW OR STOPPED VEHICLES	DO NOT PASS
1.5 SEC	1.5 SEC

LEGEND

TMA — TRUCK MOUNTED ATTENUATOR (RECOMMENDED)

WARNING BEACON - REQUIRED

ARROW PANEL - CAUTION MODE (REQUIRED)

OPERATIONAL NOTES

1. ALL WORK VEHICLES SHALL USE WARNING BEACONS.
2. THE NUMBER OF VEHICLES SHOWN IS A MINIMUM. IF POSSIBLE USE ONE VEHICLE PER LANE DURING CLOSURE.
3. WSP SHALL BE NOTIFIED AND ON SITE WHEN AVAILABLE.
4. ALL ON-RAMP TRAFFIC SHALL BE STOPPED DURING SLOWDOWN.

TYPICAL ROLLING SLOWDOWN
TCD 7

TCD 8 – Emergency Operations

The immediate response to an emergency situation must, by necessity, make use of whatever devices and equipment are available. Assistance from the Washington State Patrol and WSDOT Incident Response Team may be appropriate. The use of flares is allowed unless flammable material is present, electronic flares or glow sticks are an option for this condition.

Implement the appropriate traffic control plan (lane closure, etc.) if the situation is expected to last longer than 60 minutes. This allows for a short duration operation, until traffic control assistance arrives.

It is important to differentiate between an actual emergency and an emergent condition. An actual emergency requires an immediate response to save lives or prevent serious injury using whatever resources are available, usually in response to a crash or incident. An emergent condition requires an expedient yet planned response to a situation that may have the potential to cause a crash, but the crash has not yet occurred or a crash or other event has caused damage needing repair after the crash event. Most "call outs" or damage reports fall into the emergent condition category and although serious to varying degrees, still allow some period of time to plan a reasonable short duration work zone response, even if additional resources are needed once the condition is evaluated on site.

TCD 8 reflects various conditions and measures that might be applied as part of an emergency response for a natural disaster. More commonly, emergencies are those caused by vehicle crashes, breakdowns or spilled or lost cargo. Response to these types of emergencies is urgent and not specifically addressed by work zone standards. Refer to WSDOT Incident Response Program for guidance.

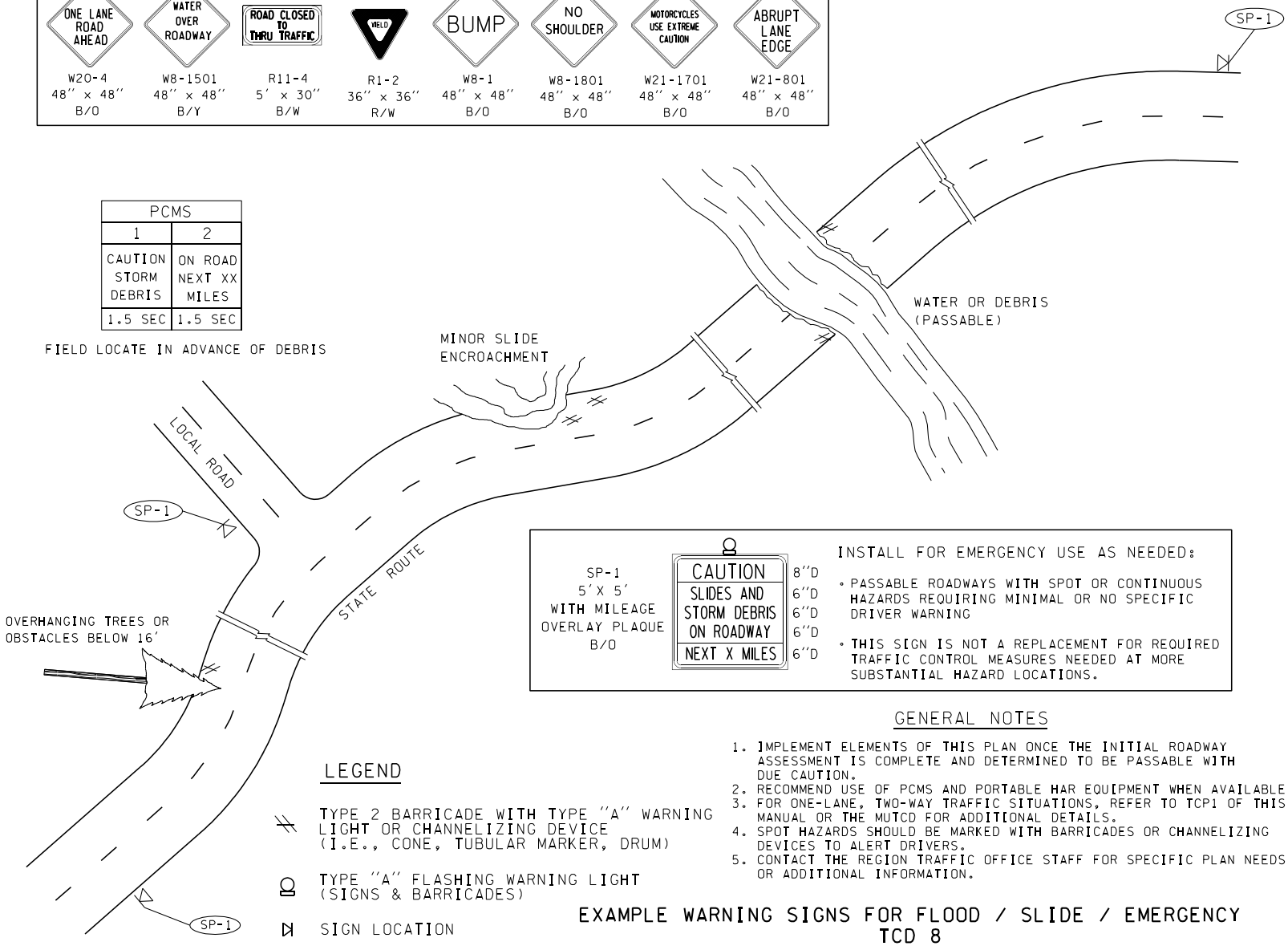
Response to an emergency situation is inherently more dangerous than planned situations. Do not expose yourself to a life-threatening situation. Wait for assistance and protect yourself at all times.

INSTALL THESE OR OTHER WARNING SIGNS AS NEEDED FOR THE SPECIFIC HAZARD.

ONE LANE ROAD AHEAD	WATER OVER ROADWAY	ROAD CLOSED TO THRU TRAFFIC	YIELD	BUMP	NO SHOULDER	MOTORCYCLES USE EXTREME CAUTION	ABRUPT LANE EDGE
W20-4	W8-1501	R11-4	R1-2	W8-1	W8-1801	W21-1701	W21-801
48" x 48"	48" x 48"	5' x 30"	36" x 36"	48" x 48"	48" x 48"	48" x 48"	48" x 48"
B/O	B/Y	B/W	R/W	B/O	B/O	B/O	B/O

PCMS	
1	2
CAUTION STORM DEBRIS	ON ROAD NEXT XX MILES
1.5 SEC	1.5 SEC

FIELD LOCATE IN ADVANCE OF DEBRIS



SP-1
5'X 5'
WITH MILEAGE
OVERLAY PLAQUE
B/O

CAUTION	8"D
SLIDES AND	6"D
STORM DEBRIS	6"D
ON ROADWAY	6"D
NEXT X MILES	6"D

INSTALL FOR EMERGENCY USE AS NEEDED:

- PASSABLE ROADWAYS WITH SPOT OR CONTINUOUS HAZARDS REQUIRING MINIMAL OR NO SPECIFIC DRIVER WARNING
- THIS SIGN IS NOT A REPLACEMENT FOR REQUIRED TRAFFIC CONTROL MEASURES NEEDED AT MORE SUBSTANTIAL HAZARD LOCATIONS.

GENERAL NOTES

1. IMPLEMENT ELEMENTS OF THIS PLAN ONCE THE INITIAL ROADWAY ASSESSMENT IS COMPLETE AND DETERMINED TO BE PASSABLE WITH DUE CAUTION.
2. RECOMMEND USE OF PCMS AND PORTABLE HAR EQUIPMENT WHEN AVAILABLE.
3. FOR ONE-LANE, TWO-WAY TRAFFIC SITUATIONS, REFER TO TCP1 OF THIS MANUAL OR THE MUTCD FOR ADDITIONAL DETAILS.
4. SPOT HAZARDS SHOULD BE MARKED WITH BARRICADES OR CHANNELIZING DEVICES TO ALERT DRIVERS.
5. CONTACT THE REGION TRAFFIC OFFICE STAFF FOR SPECIFIC PLAN NEEDS OR ADDITIONAL INFORMATION.

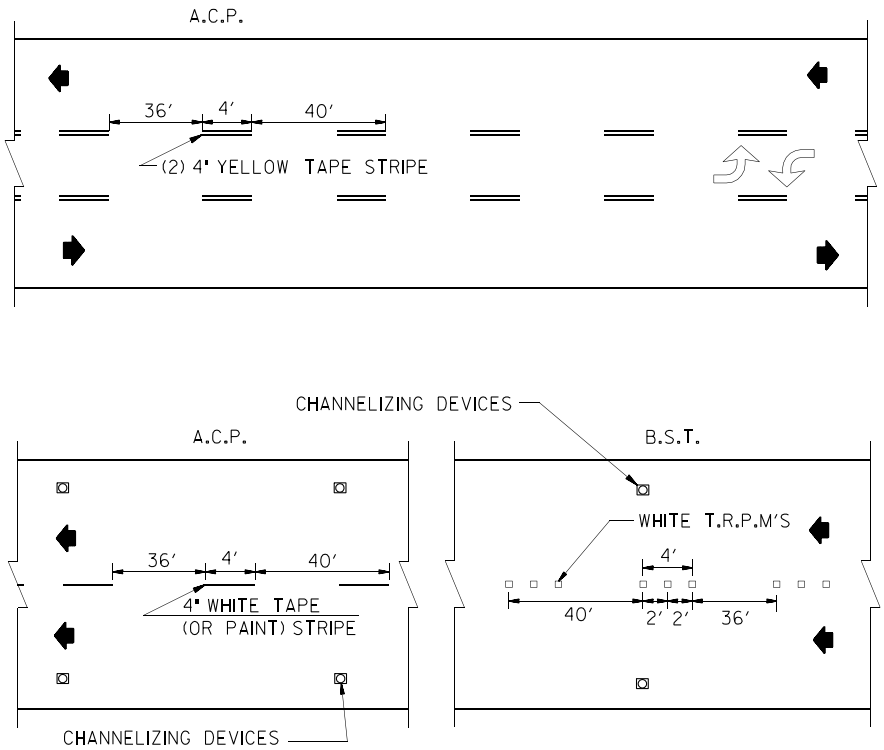
LEGEND

- TYPE 2 BARRICADE WITH TYPE "A" WARNING LIGHT OR CHANNELIZING DEVICE (I.E., CONE, TUBULAR MARKER, DRUM)
- TYPE "A" FLASHING WARNING LIGHT (SIGNS & BARRICADES)
- SIGN LOCATION

EXAMPLE WARNING SIGNS FOR FLOOD / SLIDE / EMERGENCY
TCD 8

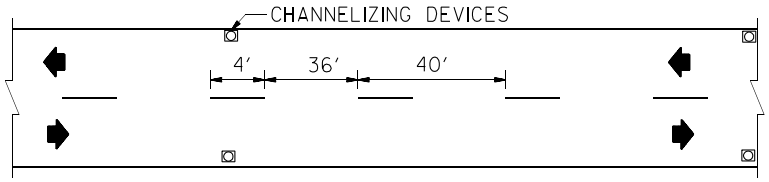
WORK OPERATIONS THAT REMOVE OR OBSCURE EXISTING PAVEMENT MARKINGS MUST PROVIDE FOR TEMPORARY MARKINGS UNTIL THE PERMANENT MARKINGS ARE APPLIED. TEMPORARY MARKINGS MAY BE USED UNTIL IT IS PRACTICAL AND POSSIBLE TO INSTALL PERMANENT MARKINGS. THE DETAILS BELOW SHOW VARIOUS COMMON APPLICATIONS. CONTACT THE REGION TRAFFIC OFFICE FOR ASSISTANCE WITH MORE COMPLEX SITUATIONS.

MULTI-LANE ROADWAYS

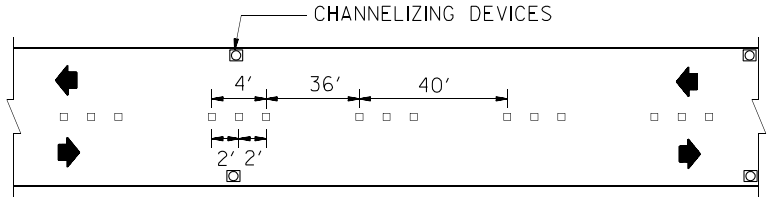


2 LANE ROADWAYS

A.C.P. OVERLAY - TEMPORARY STRIPING TAPE SHALL BE INSTALLED IN CONJUNCTION WITH "PASS WITH CARE" AND "DO NOT PASS" SIGN LOCATIONS.



A.C.P. OVERLAY - TEMPORARY STRIPING TAPE - 4" YELLOW CENTER STRIPE



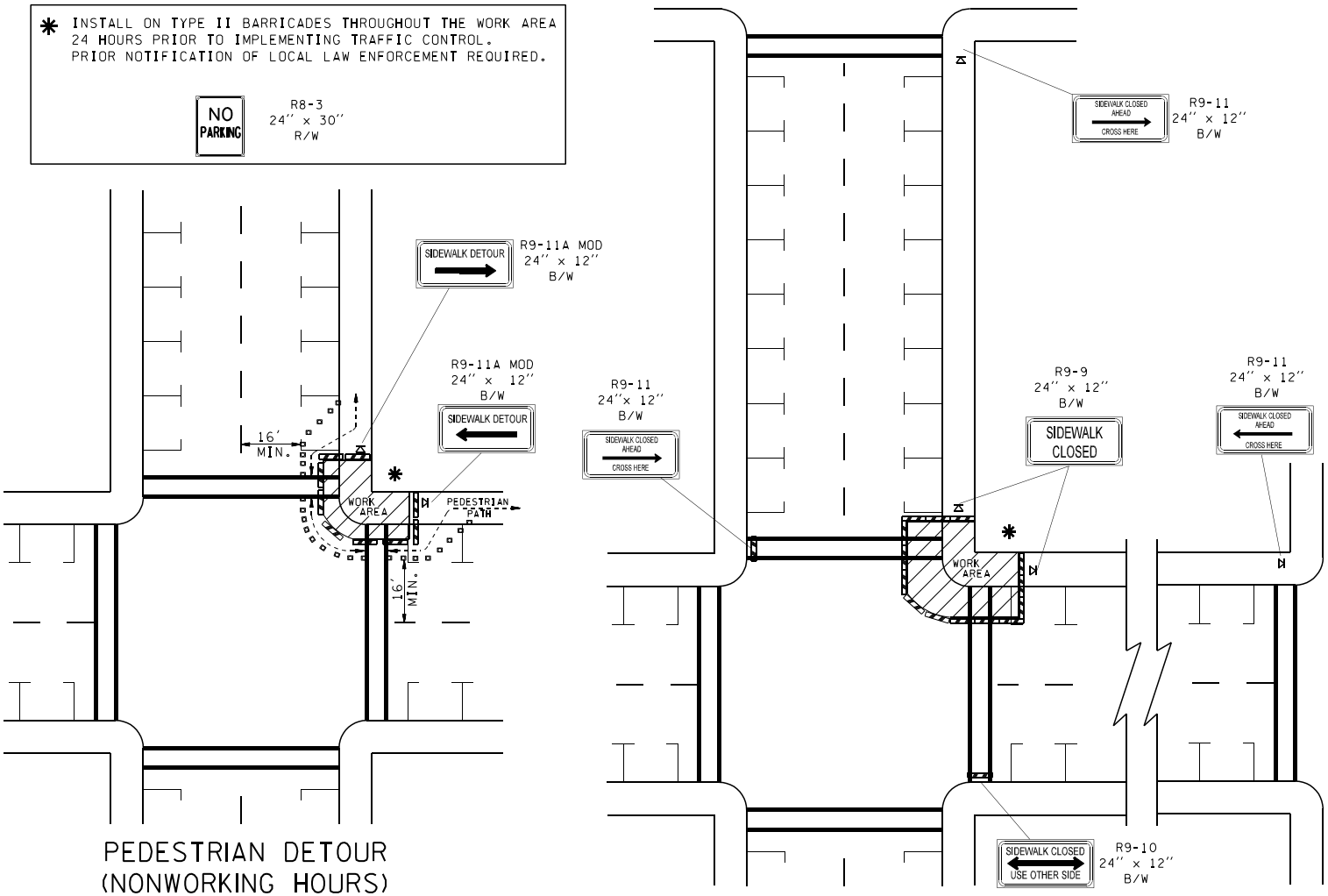
B.S.T. OVERLAY - T.R.P.M.(CHIP SEAL MARKER) - 4" YELLOW CENTER STRIPE

TEMPORARY EDGE STRIPES ARE NOT REQUIRED FOR THE ABOVE SITUATIONS BUT IF USED, T.R.P.M.'S MAY BE USED ON A PATTERN SPACING OF 5′O.C. TO SIMULATE A SOLID LINE. TEMPORARY ROADSIDE DELINEATION WITH CHANNELIZATION DEVICES SHOULD BE CONSIDERED, BUT ARE OPTIONAL.
DO NOT USE A "SKIP" PATTERN OF TAPE STRIPE TO SIMULATE AN EDGE STRIPE.
FOR LONG TERM PROJECTS, A TEMPORARY CHANNELIZATION/PAVEMENT MARKING PLAN SHOULD BE DEVELOPED.

CHANNELIZATION DEVICE SPACING -	TANGENT 200′+-
	CURVES 100′+-
	TAPERS ½ L

T.R.P.M. = TEMPORARY RAISED PAVEMENT MARKER

TEMPORARY PAVEMENT MARKING DETAILS
TCD 9



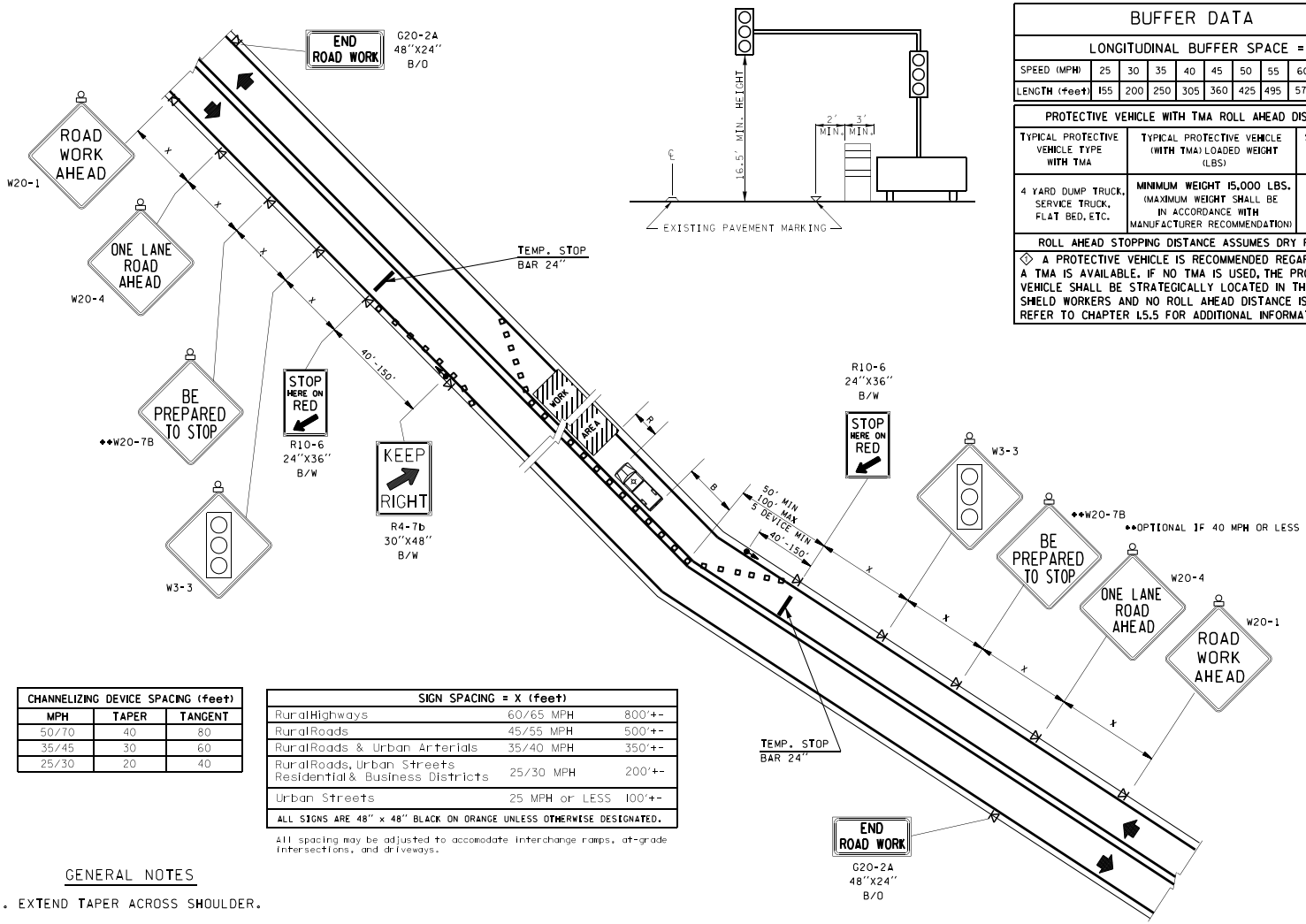
LEGEND

- SIGN LOCATION
- CHANNELIZING DEVICES
- TYPE II BARRICADE

TYPICAL INTERSECTION PEDESTRIAN TRAFFIC CONTROL SIGNING
TCD 10

GENERAL NOTES

1. CONTROLS SHOWN ARE FOR PEDESTRIAN TRAFFIC ONLY.
2. MAINTAIN A MINIMUM WIDTH OF 36" FOR PEDESTRIAN PATH.
3. CONTACT AND COORDINATE IMPACTED TRANSIT AGENCIES PRIOR TO IMPLEMENTING ANY CLOSURES.
4. ADA PEDESTRIAN ACCOMODATIONS MUST BE ADDRESSED AND CONSIDERED FOR ALL WORK OPERATIONS. EXISTING ADA FACILITIES MUST BE MAINTAINED.



BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730

PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE		
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN. 100 MAX.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT		

◇ A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED. REFER TO CHAPTER 1.5.5 FOR ADDITIONAL INFORMATION

CHANNELIZING DEVICE SPACING (feet)		
MPH	TAPER	TANGENT
50/70	40	80
35/45	30	60
25/30	20	40

SIGN SPACING = X (feet)		
Rural Highways	60/65 MPH	800'+-
Rural Roads	45/55 MPH	500'+-
Rural Roads & Urban Arterials	35/40 MPH	350'+-
Rural Roads, Urban Streets Residential & Business Districts	25/30 MPH	200'+-
Urban Streets	25 MPH or LESS	100'+-
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

All spacing may be adjusted to accomodate interchange ramps, at-grade intersections, and driveways.

GENERAL NOTES

1. EXTEND TAPER ACROSS SHOULDER.
2. PROTECTIVE VEHICLE RECOMMENDED - MAY BE A WORK VEHICLE.
3. SIGN SEQUENCE IS THE SAME FOR BOTH DIRECTIONS OF TRAVEL.
4. THE MAXIMUM LENGTH OF WORK AREA CONTROLLED BY ONE-WAY TRAFFIC SIGNAL IS 1500 FT. SIGNAL TIMING SHALL BE ESTABLISHED BY QUALIFIED PERSONNEL.
5. INSTALL NO PASSING STRIPE IF NOT ALREADY IN PLACE.
6. REFER TO STD. SPEC. 1-10.3(3)K AND 9-35.14 FOR ADDITIONAL INFORMATION.
7. POST MOUNT SIGNS FOR LOCATIONS IN PLACE LONGER THAN 3 DAYS.

THIS PLAN MAY NEED TO BE ADJUSTED TO FIT SITE CONDITIONS. REFER TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD) PART VI OR CONTACT THE REGION TRAFFIC ENGINEER FOR SPECIFIC QUESTIONS.

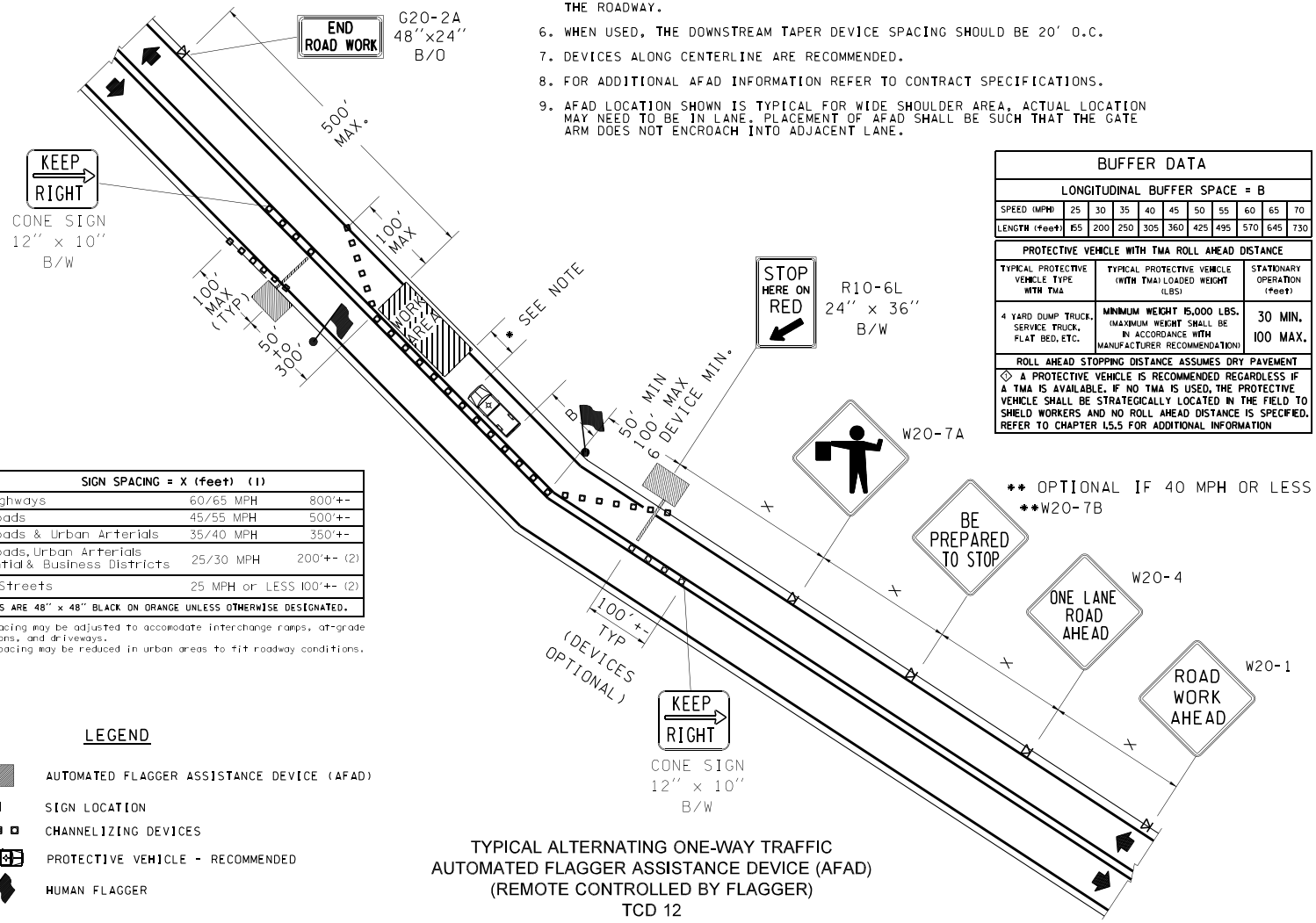
LEGEND

- SIGN LOCATION
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- PORTABLE SIGNAL
- TYPE "B" WARNING LIGHT

TYPICAL ALTERNATING ONE-WAY TRAFFIC
TEMPORARY PORTABLE SIGNAL CONTROLLED
TCD 11

GENERAL NOTES

1. HUMAN FLAGGER IS REQUIRED TO OPERATE EACH AFAD IN USE. THE HUMAN FLAGGER SHALL BE SAFELY LOCATED OUT OF THE LANE OF TRAFFIC TO REMOTELY OPERATE THE DEVICE WHILE MAINTAINING VISUAL CONTACT WITH THE TRAFFIC.
2. NIGHTWORK REQUIRES ADDITIONAL ROADWAY LIGHTING AT FLAGGING STATIONS, REFER TO WSDOT STD. SPECIFICATIONS FOR ADDITIONAL DETAILS.
3. RECOMMEND EXTENDING CHANNELIZING DEVICE TAPER ACROSS SHOULDER.
4. PROTECTIVE VEHICLE RECOMMENDED - MAY BE A WORK VEHICLE.
5. SIGN SEQUENCE IS THE SAME FOR BOTH DIRECTIONS OF TRAVEL ON THE ROADWAY.
6. WHEN USED, THE DOWNSTREAM TAPER DEVICE SPACING SHOULD BE 20' O.C.
7. DEVICES ALONG CENTERLINE ARE RECOMMENDED.
8. FOR ADDITIONAL AFAD INFORMATION REFER TO CONTRACT SPECIFICATIONS.
9. AFAD LOCATION SHOWN IS TYPICAL FOR WIDE SHOULDER AREA, ACTUAL LOCATION MAY NEED TO BE IN LANE. PLACEMENT OF AFAD SHALL BE SUCH THAT THE GATE ARM DOES NOT ENCROACH INTO ADJACENT LANE.



BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730

PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE		
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN. 100 MAX.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT		

◇ A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED. REFER TO CHAPTER 1.5.5 FOR ADDITIONAL INFORMATION

SIGN SPACING = X (feet) (1)		
Rural Highways	60/65 MPH	800'+-
Rural Roads	45/55 MPH	500'+-
Rural Roads & Urban Arterials	35/40 MPH	350'+-
Rural Roads, Urban Arterials Residential & Business Districts	25/30 MPH	200'+- (2)
Urban Streets	25 MPH or LESS	100'+- (2)
ALL SIGNS ARE 48" x 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

(1) All spacing may be adjusted to accomodate interchange ramps, at-grade intersections, and driveways.
(2) This spacing may be reduced in urban areas to fit roadway conditions.

LEGEND

- AUTOMATED FLAGGER ASSISTANCE DEVICE (AFAD)
- SIGN LOCATION
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- HUMAN FLAGGER

TYPICAL ALTERNATING ONE-WAY TRAFFIC
AUTOMATED FLAGGER ASSISTANCE DEVICE (AFAD)
(REMOTE CONTROLLED BY FLAGGER)
TCD 12

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
35 / 45	30	60
25 / 30	20	40

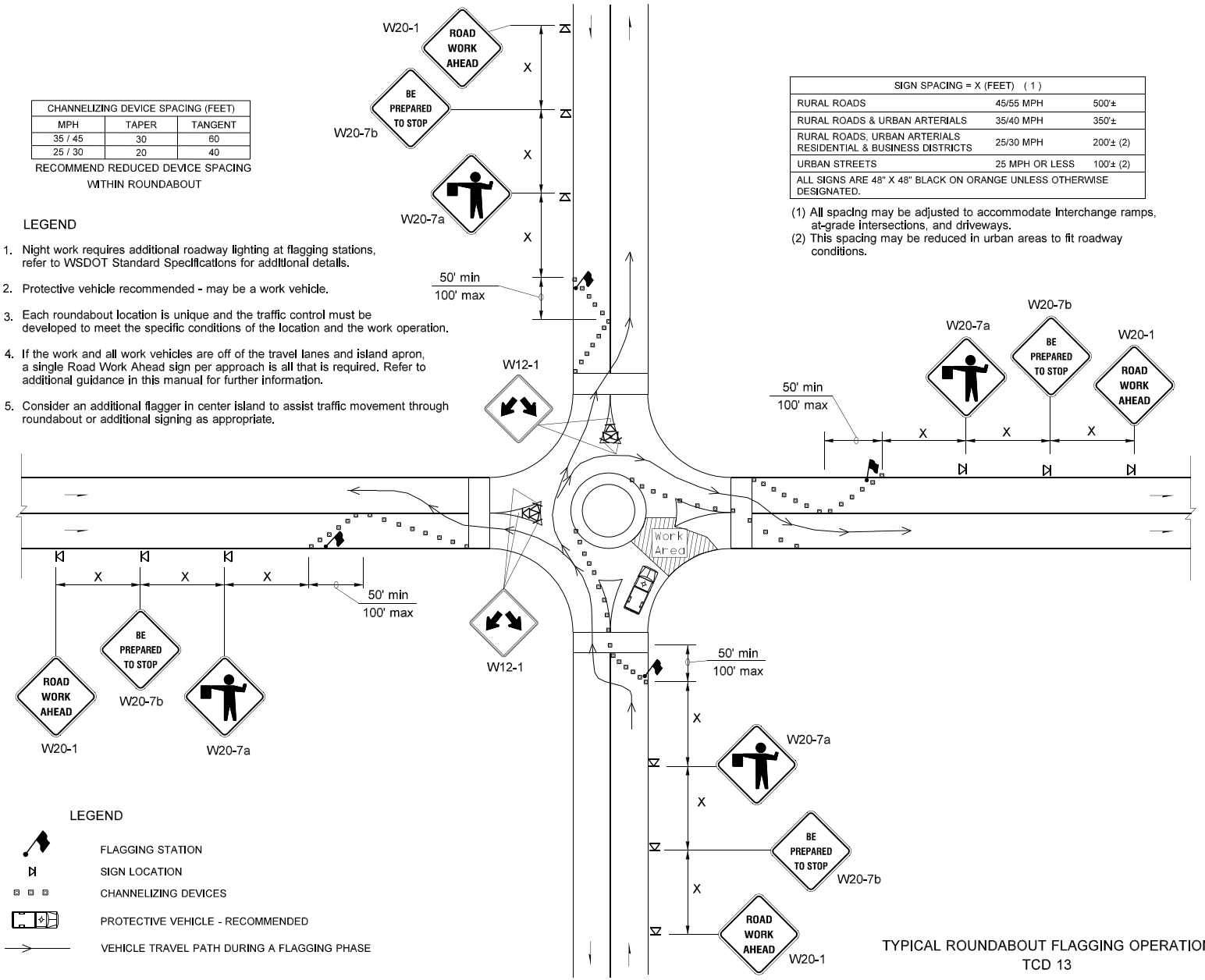
RECOMMEND REDUCED DEVICE SPACING WITHIN ROUNDABOUT

LEGEND

1. Night work requires additional roadway lighting at flagging stations, refer to WSDOT Standard Specifications for additional details.
2. Protective vehicle recommended - may be a work vehicle.
3. Each roundabout location is unique and the traffic control must be developed to meet the specific conditions of the location and the work operation.
4. If the work and all work vehicles are off of the travel lanes and island apron, a single Road Work Ahead sign per approach is all that is required. Refer to additional guidance in this manual for further information.
5. Consider an additional flagger in center island to assist traffic movement through roundabout or additional signing as appropriate.

SIGN SPACING = X (FEET) (1)		
RURAL ROADS	45/55 MPH	500'±
RURAL ROADS & URBAN ARTERIALS	35/40 MPH	350'±
RURAL ROADS, URBAN ARTERIALS RESIDENTIAL & BUSINESS DISTRICTS	25/30 MPH	200'± (2)
URBAN STREETS	25 MPH OR LESS	100'± (2)
ALL SIGNS ARE 48" X 48" BLACK ON ORANGE UNLESS OTHERWISE DESIGNATED.		

(1) All spacing may be adjusted to accommodate interchange ramps, at-grade intersections, and driveways.
(2) This spacing may be reduced in urban areas to fit roadway conditions.

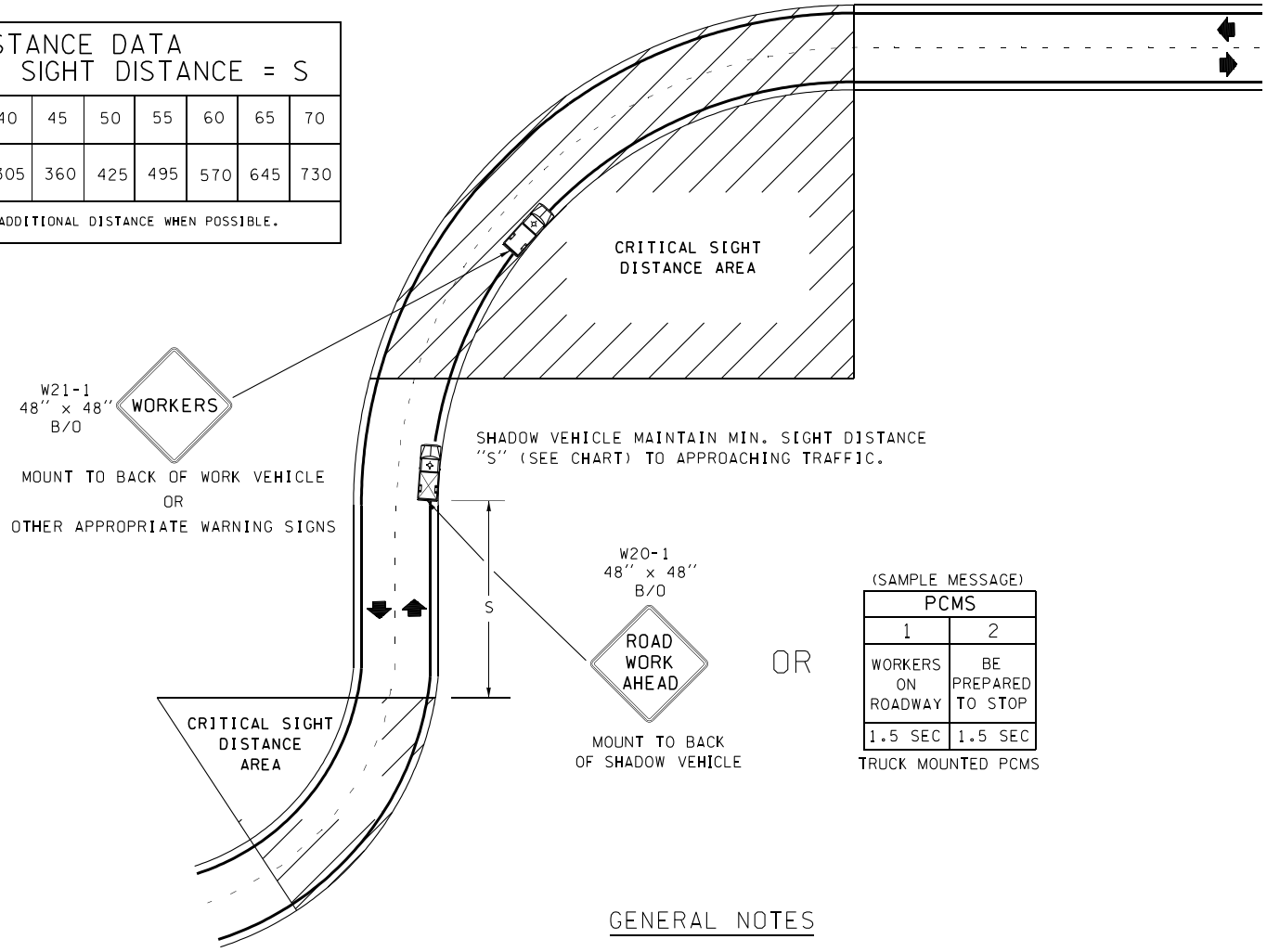


LEGEND

- FLAGGING STATION
- SIGN LOCATION
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE - RECOMMENDED
- VEHICLE TRAVEL PATH DURING A FLAGGING PHASE

TYPICAL ROUNDABOUT FLAGGING OPERATION
TCD 13

SIGHT DISTANCE DATA MINIMUM STOPPING SIGHT DISTANCE = S										
SPEED LIMIT MPH	25	30	35	40	45	50	55	60	65	70
DISTANCE FEET	155	200	250	305	360	425	495	570	645	730
DISTANCES SHOWN ARE MINIMUMS, USE ADDITIONAL DISTANCE WHEN POSSIBLE.										



LEGEND

WORK VEHICLE WITH FLASHING AMBER WARNING BEACON

SHADOW VEHICLE WITH FLASHING AMBER WARNING BEACON (TMA RECOMMENDED, BUT NOT REQUIRED)

GENERAL NOTES

1. DAYLIGHT HOURS ONLY.
2. RADIO CONTACT BETWEEN WORK CREW AND SHADOW VEHICLE REQUIRED.
3. PCMS RECOMMENDED.

TYPICAL MOBILE SHOULDER OPERATION WITH LANE ENCROACHMENT
TCD 14

Merging, Shifting, and Shoulder Taper Lengths and Number of Channelization Devices Used

(All minimums)

Lane Width	10 Feet				11 Feet				12 Feet				Shoulder Tapers (Assumes 10' Shoulders)		
	L		1/2 L		L		1/2 L		L		1/2 L				
MPH	Merging	Devices	Shifting	Devices	Merging	Devices	Shifting	Devices	Merging	Devices	Shifting	Devices	MPH	(ft) Length	Devices
20	70	6	35	3	75	6	40	3	80	6	40	3	20	25	3
25	105	6	55	4	115	7	60	4	125	7	65	4	25	35	3
30	150	8	75	5	165	9	85	5	180	10	90	5	30	50	3
35	205	8	105	5	225	9	115	5	245	9	125	5	35	70	4
40	270	10	135	6	295	11	150	6	320	12	160	6	40	90	4
45	450	16	225	9	495	18	250	9	540	19	270	10	45	150	6
50	500	14	250	8	550	15	275	8	600	16	300	9	50	170	6
55	550	15	275	8	605	16	305	9	660	18	330	9	55	185	6
60	600	16	300	9	660	18	330	9	720	19	360	10	60	200	6
65	650	17	325	9	715	19	370	10	780	21	390	11	65	220	7
70	700	19	350	10	770	20	385	11	840	22	420	12	70	235	7

shoulder taper equals Shoulder Width x Speed / 3

Device Spacing Chart

50/70 mph	40 ft	80 ft
35/45 mph	30 ft	60 ft
25/30 mph	20 ft	40 ft

* The number of channelizing devices listed is the minimum required. Use of more devices should be considered if additional delineation is desired.
** Termination taper, when used should have a minimum length of 100 ft per lane with devices placed approximately 20 ft O.C.

Appendix 2-2 Channelizing Device Application Matrix

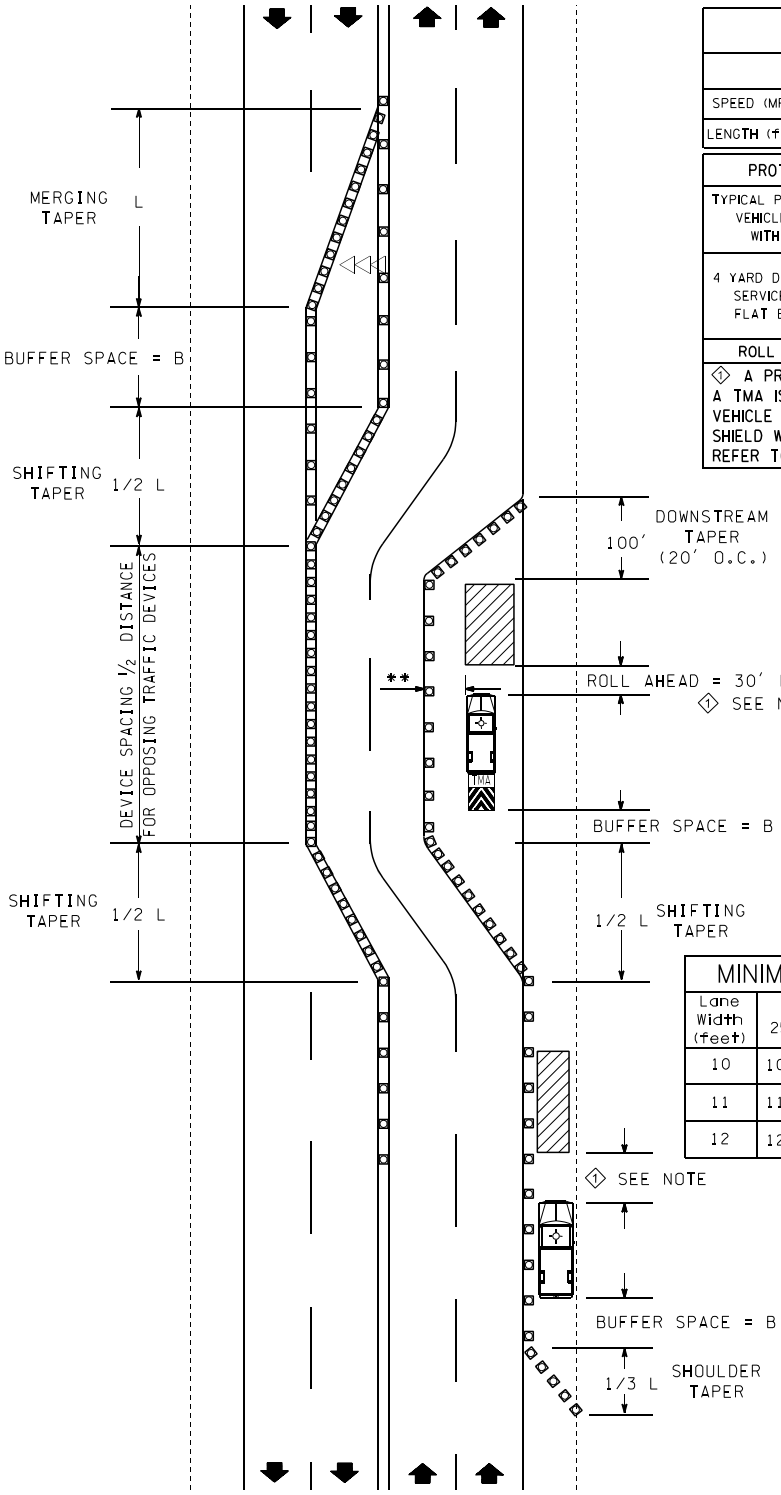
Device Type	Low Speed (40 mph or less)	High Speed (45 mph or greater)
Cones – Tangent	✓	✓
Cones – Taper	✓	A*
Tall Channelizing Devices – Tangent	✓	✓
Tall Channelizing Devices – Taper	✓	✓*
Drums – Tangent	✓	✓
Drums – Taper	✓	R
Tubular Markers	✓	✗*

A – Allowed, consider using a more dominate device.
R – Recommended device.
✓ – May be used in this situation.
✗ – Requires approval by Region Traffic Engineer.
* – Double the amount of devices in taper, use HALF-SPACING column below (20 feet).

Channelizing Device Spacing Chart (Feet)			
MPH	*Half-Spacing*	Taper	Tangent
50/70	20	40	80
35/45	N/A	30	60
25/30	N/A	20	40

Channelization Devices (see MUTCD Part VI and this manual for additional guidance)

- All channelizing devices must comply with the requirements of the MUTCD, NCHRP 350 crash performance requirements, and *Standard Specifications*.
- Cones – Freeway, high speed and night use requires 28 inches minimum height cones with two white retroreflective bands. Low speed daytime use allows 18-inch cones without retroreflective bands.
- Tall Channelizing Devices – 42 inches in height minimum, using a tapered cone type shape of consistent dimensions regardless of orientation to traffic. A minimum of two white and two orange retroreflective horizontal stripes 6 inches wide.
- Drums – 36 inches in height and at least 18 inches wide of consistent dimensions regardless of orientation to traffic. A minimum of two white and two orange retroreflective horizontal stripes 4 to 6 inches wide.
- Tubular Markers – Tubular markers should only be used where space restrictions do not allow for other more dominate devices. Tubular markers may be used to divide opposing traffic lanes, divide open lanes in the same direction and to delineate the edge of a pavement drop off. Freeway, high speed and night use requires a 28-inch minimum height with two white retroreflective bands. Low speed daytime use allows 18-inch tubular markers with one retroreflective band.
- **Flat panel devices and devices with directional stripe patterns are not allowed.**



BUFFER DATA										
LONGITUDINAL BUFFER SPACE = B										
SPEED (MPH)	25	30	35	40	45	50	55	60	65	70
LENGTH (feet)	155	200	250	305	360	425	495	570	645	730

PROTECTIVE VEHICLE WITH TMA ROLL AHEAD DISTANCE		
TYPICAL PROTECTIVE VEHICLE TYPE WITH TMA	TYPICAL PROTECTIVE VEHICLE (WITH TMA) LOADED WEIGHT (LBS)	STATIONARY OPERATION (feet)
4 YARD DUMP TRUCK, SERVICE TRUCK, FLAT BED, ETC.	MINIMUM WEIGHT 15,000 LBS. (MAXIMUM WEIGHT SHALL BE IN ACCORDANCE WITH MANUFACTURER RECOMMENDATION)	30 MIN. 100 MAX.
ROLL AHEAD STOPPING DISTANCE ASSUMES DRY PAVEMENT		

1 A PROTECTIVE VEHICLE IS RECOMMENDED REGARDLESS IF A TMA IS AVAILABLE. IF NO TMA IS USED, THE PROTECTIVE VEHICLE SHALL BE STRATEGICALLY LOCATED IN THE FIELD TO SHIELD WORKERS AND NO ROLL AHEAD DISTANCE IS SPECIFIED. REFER TO CHAPTER 1.5.5 FOR ADDITIONAL INFORMATION

** LATERAL BUFFER SPACE
A LATERAL BUFFER SPACE OF 2 FEET IS RECOMMENDED FOR HIGH SPEED WORK ZONES.

CHANNELIZING DEVICE SPACING (FEET)		
MPH	TAPER	TANGENT
50/70	40	80
35/45	30	60
25/30	20	40

MINIMUM TAPER LENGTH (L) IN FEET										
Lane Width (feet)	Posted Speed (mph)									
	25	30	35	40	45	50	55	60	65	70
10	105	150	205	265	450	500	550	–	–	–
11	115	165	225	295	495	550	605	660	–	–
12	125	180	245	320	540	600	660	720	780	840

LEGEND

- ARROW PANEL
- CHANNELIZING DEVICES
- PROTECTIVE VEHICLE WITH OR WITHOUT TMA - RECOMMENDED
- PROTECTIVE VEHICLE WITH TMA - RECOMMENDED

TAPER AND BUFFER SPACE DETAILS