

Virginia Work Area Protection Manual

*Standards and Guidelines for
Temporary Traffic Control*



May 1, 2005

The Virginia Department of Transportation has published a complete revision of the *Virginia Work Area Protection Manual* effective May 1, 2005. This Manual replaces the previous issue of the *Virginia Work Area Protection Manual* dated January 2003.

This Manual is Virginia's version of Part 6 of the *Manual on Uniform Traffic Control Devices* (MUTCD) 2003 edition and either meets or exceeds the requirements for temporary traffic control established by the Federal Highway Administration. This Manual may also be accessed on the Virginia Department of Transportation web page at www.VirginiaDOT.org. Future revisions to this manual will be posted on the web site only and it will be the responsibility of the holder of this manual to periodically check the web site and replace revised pages.

VIRGINIA WORK AREA PROTECTION MANUAL

INTRODUCTION

Standard:

Traffic control devices shall be defined as all signs, signals, markings, and other devices used to regulate, warn, or guide traffic, placed on, over, or adjacent to a street, highway, pedestrian facility, or bikeway by authority of a public agency having jurisdiction.

Part VI of the Manual On Uniform Traffic Control Devices (MUTCD) is reproduced and modified here as a separate publication to meet the special demand for uniform standards for temporary traffic control during construction and maintenance operations on streets and highways in the Commonwealth of Virginia.

The Manual on Uniform Traffic Control Devices (MUTCD) is incorporated by reference in 23 Code of Federal Regulations (CFR), Part 655, Subpart F and shall be recognized as the national standard for traffic control devices on all public roads open to public travel in accordance with 23 U.S.C. 109(d) and 402(a). The policies and procedures of the Federal Highway Administration (FHWA) to obtain basic uniformity of traffic control devices shall be as described in 23 CFR 655, Subpart F.

Any traffic control device design or application provision contained in this Manual shall be considered to be in the public domain. Traffic control devices contained in this Manual shall not be protected by a patent or copyright, except for the Interstate Shield and any other items owned by the FHWA.

Standard:

The U.S. Secretary of Transportation, under authority granted by the Highway Safety Act of 1966, decreed that traffic control devices on all streets and highways open to public travel in accordance with 23 U.S.C. 109(d) and 402(a) in each State shall be in substantial conformance with the Standards issued or endorsed by the FHWA.

Guidance:

The need for standard controls is especially acute during roadway temporary traffic control operations. Abnormal conditions are the rule, and therefore, traffic is particularly dependent on design, placement, and uniformity of traffic control devices to direct and guide it safely and efficiently through what would otherwise be hazardous areas. The constantly shifting and changing nature of work zone activity on or adjacent to the roadway may require frequent readjustments of traffic control devices in order to handle new situations. Thus, the proper and adequate placement of standard highway signs, signals, pavement markings, channelizing devices, and traffic control devices on roadways in work zones is a continuous responsibility of officials having authority and jurisdiction over the particular roadway. This responsibility includes periodic daytime and nighttime inspection of existing devices and conditions throughout the duration of the temporary traffic control operation.

This Manual is issued to promote a uniform standard of traffic control associated with SPECIAL EVENTS, INCIDENT MANAGEMENT, and WORK AREA PROTECTION along the highways of Virginia. The standards, policies, and objectives contained in this Manual are intended to furnish information and guidance to personnel authorized to do work on the highway right-of-way, and are not intended to establish a legal requirement for installation. Good engineering judgment must be used to arrive at the best traffic controls for a particular worksite, depending on the nature of the activity, location and duration of work, type of roadway, traffic volume and speed, and potential hazard. Thus, while this Manual provides guidelines for design and application of traffic control devices, the Manual is not a substitute for engineering judgment.

It should be recognized that it is not feasible to cover every conceivable situation. The objective of this Manual is to illustrate many of the typical worksites and to describe many common conditions encountered. When circumstances occur which are not specifically covered in this Manual, or which require modification of the instructions contained herein, the judgment of the various levels of operating supervisors must be relied upon to meet the basic objectives. When warranted, the appropriate District Traffic Engineer should be consulted to select or tailor the proper traffic control devices.

Nothing contained herein is intended to abridge or disclaim the Manual on Uniform Traffic Control Devices, but rather to augment and to supplement for the safety of the traveling public.

Support:

23 CFR, Part 655.603 adopts the MUTCD as the national standard for any street, highway, or bicycle trail open to public travel in accordance with 23 U.S.C. 109(d) and 402(a). The “Uniform Vehicle Code (UVC)” is one of the documents referenced in the MUTCD. The UVC contains a model set of motor vehicle codes and traffic laws for use throughout the United States. The States are encouraged to adopt Section 15-117 of the UVC, which states that “No person shall install or maintain in any area of private property used by the public any sign, signal, marking, or other device intended to regulate, warn, or guide traffic unless it conforms with the State manual and specifications adopted under Section 15-104.” Section 15-104 of the UVC adopts the MUTCD as the standard for conformance.

The Standard, Guidance, Option, and Support material described in this edition of the MUTCD provide the transportation professional with the information needed to make appropriate decisions regarding the use of traffic control devices on streets and highways. The material in this edition is organized to better differentiate between Standards that must be satisfied for the particular circumstances of a situation, Guidances that should be followed for the particular circumstances of a situation, and Options that may be applicable for the particular circumstances of a situation.

Throughout this Manual the headings Standard, Guidance, Option, and Support are used to classify the nature of the text that follows. Figures, tables, and illustrations supplement the text and might constitute a Standard, Guidance, Option, or Support. The user needs to refer to the appropriate text to classify the nature of the figure, table, or illustration.

Standard:

When used in this Manual, the text headings shall be defined as follows:

- 1. Standard** — a statement of required, mandatory, or specifically prohibitive practice regarding a traffic control device. All standards are labeled, and the text appears in bold type. The verb shall is typically used. Standards are sometimes modified by Options.
- 2. Guidance** — a statement of highly recommended practice in typical situations, with deviations allowed if engineering judgment or engineering study indicates the deviation to be appropriate. These deviations shall be properly documented when not following guidance stipulations. All Guidance statements are labeled and the text appears in italicized type. The verb should is typically used. Guidance statements are sometimes modified by Options.
- 3. Option** — a statement of practice that is a permissive condition and carries no requirement or recommendation. Options may contain allowable modifications to a Standard or Guidance. All Option statements are labeled, and the text is underlined. The verb may is typically used.
- 4. Support** — an informational statement that does not convey any degree of mandate, recommendation, authorization, prohibition, or enforceable condition. Support statements are labeled, and the text appears in normal font. The verbs shall, should, and may are not used in Support statements.

CHAPTER 6A. GENERAL

Section 6A.01 General

Support:

Whenever the acronym “TTC” is used in this Chapter, it refers to “temporary traffic control”.

Standard:

The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

Support:

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

The primary function of TTC is to provide for the reasonably safe and efficient movement of road users through or around TTC zones while reasonably protecting workers, responders to traffic incidents, and equipment.

Of equal importance to the public traveling through the TTC zone is the safety of workers performing the many varied tasks within the work space. TTC zones present constantly changing conditions that are unexpected by the road user. This creates an even higher degree of vulnerability for the workers and incident management responders on or near the roadway (see Section 6D.03). At the same time, the TTC zone provides for the efficient completion of whatever activity interrupted the normal use of the roadway.

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

No one set of TTC devices can satisfy all conditions for a given project or incident. At the same time, defining details that would be adequate to cover all applications is not practical. Instead, Part 6 displays typical applications that depict common applications of TTC devices. The TTC selected for each situation depends on type of highway, road user conditions, duration of operation, physical constraints, and the nearness of the work space or incident management activity to road users.

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

Standard:

TTC plans and devices shall be the responsibility of the authority of a public body or official having jurisdiction for guiding road users. There shall be adequate statutory authority for the implementation during traffic incidents. Such statutes shall provide sufficient flexibility in the application of TTC to meet the needs of changing conditions and enforcement of needed road user regulations, parking controls, speed zoning, and the management of traffic in the TTC zone.

Support:

Temporary facilities, including reasonably safe pedestrian routes around work sites, are also covered by the accessibility requirements of the Americans with Disabilities Act of 1990 (ADA) (Public Law 101-336, 104 Stat. 327, July 26, 1990. 42 USC 12101-12213 (as amended).

Guidance:

The TTC plan should start in the planning phase and continue through the design, construction, and restoration phases. The TTC plans and devices should follow the principles set forth in Part 6. The management of traffic incidents should follow the principles set forth in Chapter 6I.

Option:

TTC plans may deviate from the typical applications described in Chapter 6H to allow for conditions and requirements of a particular site or jurisdiction.

Support:

The criteria of Part 6 apply to both rural and urban areas. A rural highway is normally characterized by lower volumes, higher speeds, fewer turning conflicts, and less conflict with pedestrians. An urban street is typically characterized by relatively low speeds, wide ranges of road user volumes, narrower roadway lanes, frequent intersections and driveways, significant pedestrian activity, and more businesses and houses.

Section 6A.02 Definitions of Words and Phrases in This Manual**Standard:**

The following select words and phrases have been incorporated from Section 1A.13 of the MUTCD along with some additions for convenience in using this Manual. Additional words and phrases and references exist in Section 1A.13 and shall be applicable when such definitions are not within this Manual. When used in this Manual, the following words and phrases shall have the following meanings:

- 1. Centerline Markings - the yellow pavement marking line(s) that delineates the separation of traffic lanes that have opposite directions of travel on a roadway. These markings need not be at the geometrical center of the pavement.**
- 2. Changeable Message Signs - signs that are capable of displaying more than one message, changeable manually, by remote control, or by automatic control. These signs are referred to as Dynamic Message Signs in the National Intelligent Transportation Systems (ITS) Architecture.**
- 3. Channelizing Line Marking - a wide or double solid white line used to form islands where traffic in the same direction of travel is permitted on both sides of the island.**
- 4. Clear Zone - the total roadside border area, starting at the edge of the traveled way, that is available for an errant driver to stop or regain control of a vehicle. This area might consist of a shoulder, a recoverable slope, and/or a nonrecoverable, traversable slope with a clear run-out area at its toe.**
- 5. Crashworthy – a characteristic of a roadside appurtenance that has been successfully crash tested in accordance with a national standard such as the National Cooperative Highway Research Program Report 350, “Recommended Procedures for the safety Performance Evaluation of Highway Features.”**
- 6. Delineator – a retroreflective device mounted on the roadway surface or at the side of the roadway in a series to indicate the alignment of the roadway, especially at night or in adverse weather.**
- 7. Detectable – Having a continuous edge within 6 inch of the surface so that pedestrians who have visual disabilities can sense its presence and receive usable guidance information.**
- 8. Edge Line Markings - white or yellow pavement marking lines that delineate the right or left edge(s) of a traveled way.**
- 9. Engineering Judgment - the evaluation of available pertinent information, and the application of appropriate principles, Standards, Guidance, and practices as contained in this Manual and other sources, for the purpose of deciding upon the applicability, design, operation, or installation of a traffic control device. Engineering judgment shall be exercised by an engineer, or by an individual working under the supervision of an engineer, through the application of procedures and criteria established by the engineer. Documentation of engineering judgment is not required.**
- 10. Engineering Study - the comprehensive analysis and evaluation of available pertinent information, and the application of appropriate principles, Standards, Guidance, and practices as contained in this Manual and other sources, for the purpose of deciding upon the applicability, design, operation, or installation of a traffic control device. An engineering study shall be**

performed by an engineer, or by an individual working under the supervision of an engineer, through the application of procedures and criteria established by the engineer. An engineering study shall be documented.

11. **Expressway** – a divided highway with partial control of access.
12. **Flashing (Flashing Mode)** - a mode of operation in which a traffic signal indication is turned on and off repetitively.
13. **Freeway** – a divided highway with full control of access.
14. **Guide Sign** - a sign that shows route designations, destinations, directions, distances, services, points of interest, or other geographical, recreational, or cultural information.
15. **Highway** – a general term for denoting a public way for purposes of travel by vehicular travel, including the entire area within the right-of-way.
16. **Lane Line Markings** - white pavement marking lines that delineate the separation of traffic lanes that have the same direction of travel on a roadway.
17. **Limited Access** – The regulated limitation of public access rights to and from properties abutting a highway facility. Limited access can be either of the following types:
 - (a) **Full Limited Access** – Provides access to selected public roads and prohibits crossings at grade and direct driveway connections.
 - (b) **Partial Limited Access** – Provides access to selected public roads, crossings at grade and some private driveway connections.
18. **Longitudinal Markings** – pavement markings that are generally placed parallel and adjacent to the flow of traffic such as lane lines, centerlines, edge lines, channelizing lines, and others.
19. **Median** - the area between two roadways of a divided highway measured from edge of traveled way to edge of traveled way. The median excludes turn lanes. The median width might be different between intersections, interchanges, and at opposite approaches of the same intersection.
20. **Object Marker** – a device used to mark obstructions within or adjacent to the roadway.
21. **Pedestrian** - a person afoot, in a wheelchair, on skates, or on a skateboard.
22. **Raised Pavement Marker** - a device with a height of at least 0.4 inch mounted on or in a road surface that is intended to be used as a positioning guide or to supplement pavement markings or to mark the position of a fire hydrant.
23. **Regulatory Signs**- -a sign that gives notice to road users of traffic laws or regulations.
24. **Retroreflectivity** - a property of a surface that allows a large portion of the light coming from a point source to be returned directly back to a point near its origin.
25. **Right-of-Way [Assignment]** - the permitting of vehicles and/or pedestrians to proceed in a lawful manner in preference to other vehicles or pedestrians by the display of sign or signal indications.
26. **Road User** - a vehicle operator (including cars, trucks, and motorcycles), bicyclist, or pedestrian within the highway, including workers in temporary traffic control zones.
27. **Rumble Strip** - a series of intermittent, narrow, transverse areas of rough-textured, slightly raised, or depressed road surface that is installed to alert road users to unusual traffic conditions.
28. **Rural Highway** - a type of roadway normally characterized by lower volumes, higher speeds, fewer turning conflicts, and less conflict with pedestrians.
29. **Shared Roadway** - a roadway that is officially designated and marked as a bicycle route, but which is open to motor vehicle travel and upon which no bicycle lane is designated.
30. **Shared-Use Path** - a bikeway physically separated from motorized vehicular traffic by an open space or barrier and either within the highway right-of-way or within an independent alignment. Shared-use paths might also be used by pedestrians, skaters, wheelchair users, joggers, and other nonmotorized users.

31. **Sidewalk** - that portion of a street between the curb line, or the lateral line of a roadway, and the adjacent property line or on easements of private property, intended for use by pedestrians.
32. **Sign** - any traffic control device that is intended to communicate specific information to road users through a word or symbol legend. Signs do not include traffic control signals, pavement markings, delineators, or channelization devices.
33. **Sign Assembly**—a group of signs, located on the same support(s), that supplement one another in conveying information to road users.
34. **Sign Illumination** - either internal or external lighting that shows similar color by day or night. Street, highway, or strobe lighting shall not be considered as meeting this definition.
35. **Sign Legend** - all word messages, logos, and symbol designs that are intended to convey specific meanings.
36. **Sign Panel** - a separate panel or piece of material containing a word or symbol legend that is affixed to the face of a sign.
37. **Speed** - speed is defined based on the following classifications:
 - (a) **Advisory Speed** - a recommended speed for all vehicles operating on a section of highway and based on the highway design, operating characteristics, and conditions.
 - (b) **Average Speed** - the summation of the instantaneous or spot-measured speeds at a specific location of vehicles divided by the number of vehicles observed.
 - (c) **Design Speed** - a selected speed used to determine the various geometric design features of a roadway.
 - (d) **85th-Percentile Speed** - The speed at or below which 85 percent of the motorized vehicles travel.
 - (e) **Operating Speed** - a speed at which a typical vehicle or the overall traffic operates. Operating speed may be defined with speed values such as the average, pace, or 85th-percentile speeds.
 - (g) **Posted Speed** - the speed limit determined by law and shown on Speed Limit signs.
 - (h) **Statutory Speed** - a speed limit established by legislative action that typically is applicable for highways with specified design, functional, jurisdictional and/or location characteristic and is not necessarily shown on Speed Limit signs.
38. **Speed Limit** - the maximum (or minimum) speed applicable to a section of highway as established by law.
39. **Speed Zone** - a section of highway with a speed limit that is established by law but which may be different from a legislatively specified statutory speed limit.
40. **Stop Line** - a solid white pavement marking line extending across approach lanes to indicate the point at which a stop is intended or required to be made.
41. **Temporary Traffic Control Zone** - an area of a highway where road user conditions are changed because of a work zone or incident by the use of temporary traffic control devices, flaggers, police, or other authorized personnel.
42. **Traffic** - pedestrians, bicyclists, ridden or herded animals, vehicles, streetcars, and other conveyances either singularly or together while using any highway for purposes of travel.
43. **Traffic Control Device** - a sign, signal, marking, or other device used to regulate, warn, or guide traffic, placed on, over, or adjacent to a street, highway, pedestrian facility, or bicycle path by authority of a public agency having jurisdiction.
44. **Traffic Control Signal (Traffic Signal)** - any highway traffic signal by which traffic is alternately directed to stop and permitted to proceed.
45. **Traveled Way** - the portion of the roadway for the movement of vehicles, exclusive of the shoulders, berms, sidewalks, and parking lanes.
46. **Truck-Mounted Attenuator** – Energy-absorbing device attached to the rear of trucks to reduce the severity of rear-end crashes.

47. **Urban Street** - a type of street normally characterized by relatively low speeds, wide ranges of traffic volumes, narrower lanes, frequent intersections and driveways, significant pedestrian traffic, and more businesses and houses.
48. **Warning Sign** - a sign that gives notice to road users of a situation that might not be readily apparent.
49. **Warrant** - a warrant describes threshold conditions to the engineer in evaluating the potential safety and operational benefits of traffic control devices and is based upon average or normal conditions. Warrants are not a substitute for engineering judgment. The fact that a warrant for a particular traffic control device is met is not conclusive justification for the installation of the device.
50. **Work Zone** - A work zone is an area of a highway or roadway with construction, maintenance, or utility work activities.
51. **Wrong-Way Arrows** - slender, elongated, white pavement marking arrows placed upstream from the ramp terminus to indicate the correct direction of traffic flow. Wrong-way arrows are intended primarily to warn wrong-way road users that they are going in the wrong direction.

CHAPTER 6B. FUNDAMENTAL PRINCIPLES

Section 6B.01 Fundamental Principles of Temporary Traffic Control

Support:

Whenever the acronym “TTC” is used in this Chapter, it refers to “temporary traffic control”.

Standard:

The needs and control of all road users (motorists, bicyclists, and pedestrians within the highway, including persons with disabilities in accordance with the Americans with Disabilities Act of 1990 (ADA), Title II, Paragraph 35.130) through a TTC zone shall be an essential part of highway construction, utility work, maintenance operations, and the management of traffic incidents.

Support:

Construction, maintenance, utility, and incident zones can all benefit from TTC to compensate for the unexpected or unusual situations faced by road users. When planning for TTC in these zones, it can be assumed that it is appropriate for road users to exercise caution. Even though road users are assumed to be using caution, special care is still needed in applying TTC techniques.

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

During TTC activities, commercial vehicles might need to follow a different route from passenger vehicles because of bridge, weight, clearance, or geometric restrictions. Also, vehicles carrying hazardous materials might need to follow a different route from other vehicles. The Hazardous Materials and National Network signs are included in Sections 2B.52 and 2B.53 of the MUTCD, respectively.

Experience has shown that following the fundamental principles of Part 6 will assist road users and help protect workers in the vicinity of TTC zones.

Guidance:

Road user and worker safety and accessibility in TTC zones should be an integral and high-priority element of every project from planning through design and construction. Similarly, maintenance and utility work should be planned and conducted with the safety and accessibility of all motorists, bicyclists, pedestrians (including those with disabilities), and workers being considered at all times. If the TTC zone includes a highway-rail grade crossing, early coordination with the railroad company should take place.

Support:

Formulating specific plans for TTC at traffic incidents is difficult because of the variety of situations that can arise.

Guidance:

General plans or guidelines should be developed to provide safety for motorists, bicyclists, pedestrians, workers, enforcement/emergency officials, and equipment, with the following factors being considered:

- A. The basic safety principles governing the design of permanent roadways and roadsides should also govern the design of TTC zones. The goal should be to route road users through such zones using roadway geometrics, roadside features, and TTC devices as nearly as possible comparable to those for normal highway situations.*
- B. A TTC plan, in detail appropriate to the complexity of the work project or incident, should be prepared and understood by all responsible parties before the site is occupied. Any changes in the TTC plan should be approved by an official knowledgeable (for example, trained and/or certified) in proper TTC practices and documented.*

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

- A. TTC at work and incident sites should be designed on the assumption that drivers will only reduce their speeds if they clearly perceive a need to do so (see Section 6C.01).*
- B. Frequent and abrupt changes in geometrics such as lane narrowing, dropped lanes, or main roadway transitions that require rapid maneuvers, should be avoided.*

- C. Provisions should be made for the reasonably safe operation of work, particularly on high-speed, high-volume roadways.
- D. Road users should be encouraged to use alternative routes that do not include TTC zones.
- E. The need for smooth riding surfaces for motorcyclists should be provided, or advance warning notification given whenever roadway surfaces are disturbed.
- F. Bicyclists and pedestrians, including those with disabilities, should be provided with access and reasonably safe passage through the TTC zone.
- G. Roadway occupancy should be scheduled during off-peak hours and, if necessary, night work should be considered.
- H. Early coordination with officials having jurisdiction over the affected cross streets and providing emergency services should occur before roadway or ramp closings.

Motorists (including cars, trucks, buses, and motorcycles), bicyclists, and pedestrians should be guided in a clear and positive manner while approaching and traversing TTC zones and incident sites. The following principles should be applied:

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

To provide acceptable levels of operations, routine day and night inspections of TTC elements should be performed as follows:

Standard:

Temporary traffic control installations shall be reviewed daily to ensure the functionality of the temporary traffic control devices and compliance to this Manual. These reviews shall be documented on a weekly basis using the Work Zone Safety Checklist form found in Appendix B of this manual including as much detail information as warranted for the type of operation.

Guidance:

Review of temporary traffic control on high speed, high traffic volume projects should also be performed during night and non-work periods (weekends), as well on all projects after severe weather conditions.

Standard:

A review of the temporary traffic control shall be performed for compliance immediately after a change in traffic patterns. Deficiencies in the temporary traffic control shall be corrected and documented as soon as possible.

The review and documentation of the temporary traffic control installation shall be by someone trained and knowledgeable about the fundamental principles of temporary traffic control and related work activities being performed. The individual responsible for temporary traffic control review shall have the authority to halt work until applicable or remedial safety measures are taken.

Support:

Other methods of documentation include written notes, project diary entries, photographs, and video recordings.

Guidance:

When warranted, an engineering study should be made (in cooperation with law enforcement officials) of reported crashes occurring within the temporary traffic control zone. Crash records in temporary traffic control zones should be monitored to identify the need for changes in the temporary traffic control zone.

alternate TTC plan.

Modifications of TTC plans may be necessary because of changed conditions or a determination of better methods of safely and efficiently handling road users.

Guidance:

This alternate or modified plan should have the approval of the responsible highway agency prior to implementation.

Provisions for effective continuity of transit service should be incorporated into the TTC planning process because often public transit buses cannot efficiently be detoured in the same manner as other vehicles (particularly for short-term maintenance projects). Where applicable, the TTC plan should provide for features such as accessible temporary bus stops, pull-outs, and satisfactory waiting areas for transit patrons, including

persons with disabilities, if applicable (see Section 10A.05 for additional light rail transit issues to consider for TTC).

Provisions for effective continuity of railroad service and acceptable access to abutting property owners and businesses should also be incorporated into the TTC planning process.

Reduced speed limits should be used only in the specific portion of the TTC zone where conditions or restrictive features are present. However, frequent changes in the speed limit should be avoided. A TTC plan should be designed so that vehicles can reasonably safely travel through the TTC zone with a speed limit reduction of no more than 10 mph.

Standard:

Speeds shall only be reduced within construction/maintenance work zones by the District Traffic Engineer upon completion of an engineering and traffic investigation warranting the reduction. Documentation of the change shall be performed and maintained.

Guidance:

TTC plans should be designed in accordance with the approach speeds prior to construction when possible.

A reduction of more than 10 mph in the speed limit should be used only when required by restrictive features in the TTC zone. Where restrictive features justify a speed reduction of more than 10 mph, additional driver notification should be provided. The speed limit should be stepped down in advance of the location requiring the lowest speed in ten-mile increments, and additional TTC warning devices should be used.

Reduced speed zoning (lowering the regulatory speed limit) should be avoided as much as practical because drivers will reduce their speeds only if they clearly perceive a need to do so.

Support:

Research has demonstrated that large reductions in the speed limit, such as a 30 mph reduction, increase speed variance and the potential for crashes. Smaller reductions in the speed limit of up to 10 mph cause smaller changes in speed variance and lessen the potential for increased crashes. A reduction in the regulatory speed limit of only up to 10 mph from the normal speed limit has been shown to be more effective.

Section 6C.02 Temporary Traffic Control Zones

Support:

A TTC zone is an area of a highway where road user conditions are changed because of a work zone or an incident through the use of TTC devices, uniformed law enforcement officers, or other authorized personnel.

A work zone is an area of a highway with construction, maintenance, or utility work activities. A work zone is typically marked by signs, channelizing devices, barriers, pavement markings, and/or work vehicles. It extends from the first warning sign or high-intensity rotating, oscillating, or strobe lights on a vehicle to the END ROAD WORK sign or the last TTC device.

An incident area is an area of a highway where temporary traffic controls are imposed by authorized officials in response to a traffic incident, natural disaster, or special event. It extends from the first warning device (such as a sign, light, or cone) to the last TTC device or to a point where road users return to the original lane alignment and are clear of the incident.

Section 6C.03 Components of Temporary Traffic Control Zones

Support:

Most TTC zones are divided into five areas: the advance warning area, the transition area, the buffer space area, the activity area, and the termination area. Figure 6C-1 illustrates these five areas. These five areas are described in Sections 6C.04 through 6C.07.

Section 6C.04 Advance Warning Area

Support:

The advance warning area is the section of highway where road users are informed about the upcoming work zone or incident area.

Option:

The advance warning area may vary from a single sign or high-intensity rotating, oscillating, or strobe lights on a vehicle to a series of signs in advance of the TTC zone activity area.

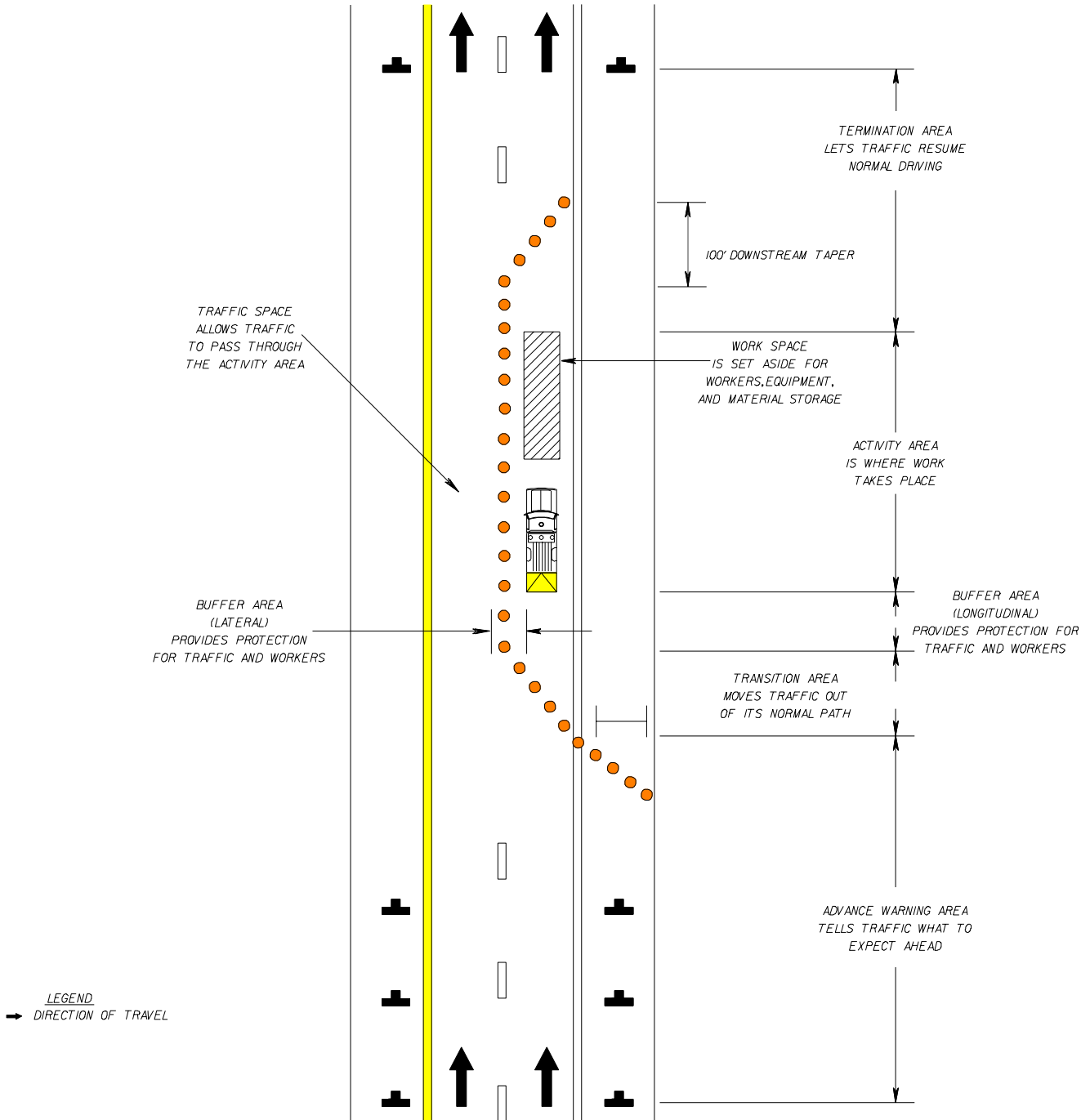


FIGURE 6C-1 COMPONENT PARTS OF A TEMPORARY TRAFFIC CONTROL ZONE

Guidance:

Sign spacing distance should be 1000'-1500' for limited access highways. For all other roadways, the sign spacing should be 500'-800' where the posted speed limit is greater than 45 mph, and 350'-500' where the posted speed limit is 45 mph or less (see Table 6C-1).

Option:

Low speed urban streets with speeds of 25 mph or less may reduce the spacing to 100' - 200' between signs.

Advance warning may be eliminated when the activity area is sufficiently removed from the road users' path so that it does not interfere with the normal flow (See Appendix A for clear zone requirements) and approved by the District Traffic Engineer.

Table 6C-1, Spacing of Advance Warning Signs	
Urban street with 25 mph or less posted speed	100' – 200'
Urban street with 30 to 35 mph posted speed	250' ±
Roadways with 45 mph or less posted speed	350' – 500'
Roadways with greater than 45 mph posted speed	500' – 800'
Limited access highways	1000' – 1500'

Section 6C.05 Transition Area**Support:**

The transition area is that section of highway where road users are redirected out of their normal path. Transition areas usually involve strategic use of tapers, which because of their importance are discussed separately in detail.

Standard:

When redirection of the road users' normal path is required, they shall be channelized from the normal path to a new path.

Support:

In mobile operations, the transition area moves with the work space.

Section 6C.06 Buffer Space Area**Support:**

The 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.

Standard:

Neither work activity nor storage of equipment, vehicles, or material shall occur within a buffer space.

Option:

Buffer spaces may be positioned either longitudinally or laterally with respect to the direction of road user flow. The activity area may contain one or more lateral or longitudinal buffer spaces.

Guidance:

A longitudinal buffer space should be placed in advance of a work space. The longitudinal buffer space may also be used to separate opposing road user flows that use portions of the same traffic lane, as shown in Figure 6C-2.

If a longitudinal buffer space is used, the length should be as shown in Table 6C-2 and is based on the posted speed limit.

Support:

Typically, the buffer space is formed as a traffic island and defined by channelizing devices.

When a shadow vehicle, arrow panel, or changeable message sign is placed in a closed lane in advance of a work space, only the area upstream of the vehicle, arrow panel, or changeable message sign constitutes the buffer space.

Option:

The lateral buffer space may be used to separate the traffic space from the work space, as shown in Figure 6C-2, or such areas as excavations or pavement-edge drop-offs. A lateral buffer space also may be used between two travel lanes, especially those carrying opposing flows.

Guidance:

The width of a lateral buffer space should be determined by engineering judgment.

Posted Speed Limit	Distance (Feet)
20	120 ±
25	160 ±
30	200 ±
35	250 ±
40	310 ±
45	360 ±
50	425 ±
55	500 ±
60	570 ±
65	650 ±
70	740 ±

Table 6C-2, Length of the Longitudinal Buffer Space

Option:

When work occurs on a high-volume, highly congested facility, a vehicle storage or staging space may be provided for incident response and emergency vehicles (for example, tow trucks and fire apparatus) so that these vehicles can respond quickly to road user incidents.

Guidance:

If used, an incident response and emergency-vehicle storage area should not extend into any portion of the buffer space.

Section 6C.07 Activity Area

Support:

The activity area is the section of the highway where the work activity takes place. It is comprised of the work space, and the traffic space.

The work space is that portion of the highway closed to road users and set aside for workers, equipment, and material, and a shadow vehicle if one is used upstream. Work spaces are usually delineated for road users by channelizing devices or, to exclude vehicles and pedestrians, by temporary barriers.

Option:

The work space may be stationary or may move as work progresses.

Guidance:

Since there might be several work spaces (some even separated by several miles) within the project limits, each work space should be adequately signed to inform road users and reduce confusion.

The maximum length of the work space should not exceed two miles unless approved by the District Traffic Engineer.

Support:

The traffic space is the portion of the highway in which road users are routed through the activity area.

Section 6C.08 Termination Area**Standard:**

The termination area shall be used to return road users to their normal path. The termination area shall extend from the downstream end of the work area to the last TTC device such as END ROAD WORK signs, if posted.

Option:

An END ROAD WORK sign, a Speed Limit sign, or other signs may be used to inform road users that they can resume normal operations.

A longitudinal buffer space may be used between the work space and the beginning of the downstream taper.

Section 6C.09 TapersOption:

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

Support:

Tapers are created by using a series of channelizing devices and/or pavement markings to move traffic out of or into the normal path. Types of tapers are shown in Figure 6C-2.

Longer tapers are not necessarily better than shorter tapers (particularly in urban areas with characteristics such as short block lengths or driveways) because extended tapers tend to encourage sluggish operation and to encourage drivers to delay lane changes unnecessarily. The test concerning adequate lengths of tapers involves observation of driver performance after TTC plans are put into effect.

Guidance:

The criteria for determining the taper length (L) are shown in Table 6C-2 and should be the minimum used.

The appropriate taper length (L) should be determined using the criteria shown in Tables 6C-2.

The maximum distance in feet between devices in a taper should not exceed 20 feet at posted speeds up to 35 mph, and 40 feet for posted speeds greater than 35 mph.

Support:

A merging taper requires the longest distance because drivers are required to merge into common road space.

Guidance:

A merging taper should be long enough to enable merging drivers to have adequate advance warning and sufficient length to adjust their speeds and merge into a single lane before the end of the transition.

Support:

A shifting taper is used when a lateral shift is needed. When more space is available, a longer than minimum taper distance can be beneficial. Changes in alignment can also be accomplished by using horizontal curves designed for normal highway speeds.

Taper Length Criteria for Temporary Traffic Control Zones	
Type of Taper	Taper Length (L)
Merging	L= Minimum
Shifting	L Desired, 1/2L Minimum
Shoulder	1/3 L Minimum
Two-Way Traffic	100 Feet Maximum
Downstream	100 Feet per Lane
L= Taper Length, W= Width of Offset, S= Posted Speed Limit	

Table 6C-3, Taper Length Criteria

TAPER LENGTH (L)					
POSTED SPEED LIMIT	WIDTH OF OFFSET (FT)				REMARKS
	9	10	11	12	
25 or below	94	105	115	125	L= S ² W/60
30	135	150	165	180	“
35	184	205	225	245	“
40	240	267	294	320	“
45	405	450	495	540	L=SW
50	450	500	550	600	“
55	495	550	605	660	“
60	540	600	660	720	“
65	585	650	715	780	“
70<	630	700	770	840	“
MINIMUM LANE CLOSURE TAPER LENGTH ON ALL LIMITED ACCESS ROADWAYS, REGARDLESS OF POSTED SPEED, SHALL BE 1000 FEET.					

Table 6C-4, Taper Length Chart

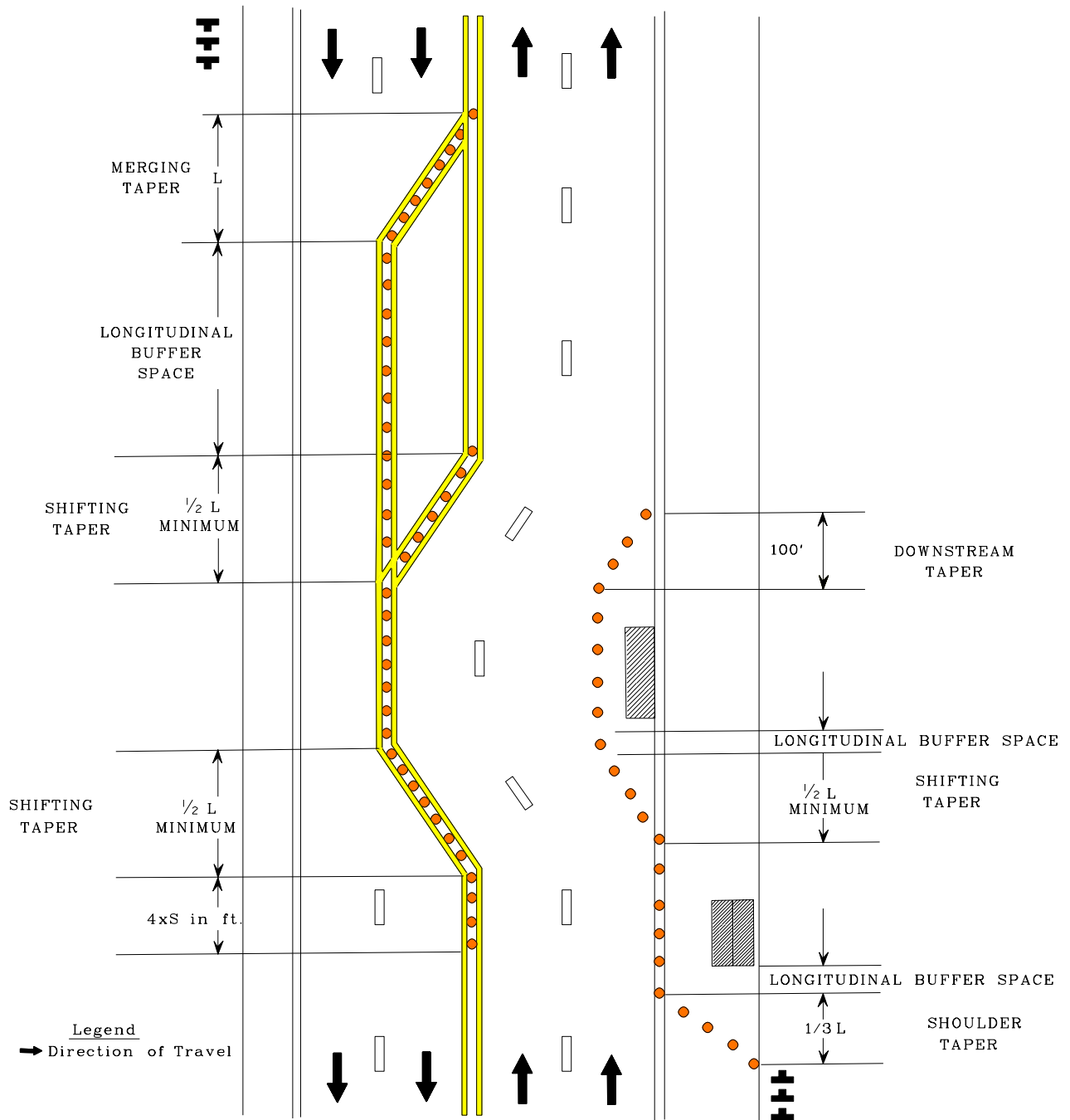


FIGURE 6C-2 TYPES OF TAPERS AND BUFFER SPACES

Guidance:

A shifting taper should have a length of approximately 1/2 L (see Tables 6C-3 and 6C-4).

Support:

A shoulder taper may be beneficial on a high-speed roadway where shoulders are part of the activity area and are closed, or when improved shoulders might be mistaken as a driving lane. In these instances, the same type, but abbreviated, closure procedures used on a normal portion of the roadway can be used.

Guidance:

If used, shoulder tapers should have a length of approximately 1/3 L (see Tables 6C-3 and 6C-4). If a shoulder is used as a travel lane, either through practice or during a TTC activity, a normal merging (L) should be used.

Option:

A downstream taper may be useful in termination areas to provide a visual cue to the driver that access is available back into the original lane or path that was closed.

Guidance:

When used, a downstream taper should have a length of approximately 100 ft per lane with devices placed at a spacing of approximately 20 feet.

Support:

The one-lane, two-way taper is used in advance of an activity area that occupies part of a two-way roadway in such a way that a portion of the road is used alternately by traffic in each direction.

Guidance:

Traffic should be controlled by a flagger or a STOP or YIELD sign. A short taper having a maximum length of 100 feet with channelizing devices at approximately 20 feet spacings should be used to guide traffic into the one-way section.

Support:

An example of a one-lane, two-way traffic taper is shown in Figure 6C-3.

Section 6C.10 Detours and Diversions**Support:**

A detour is a temporary rerouting of road users onto an existing highway in order to avoid a TTC zone.

Guidance:

Detours should be clearly signed over their entire length so that road users can easily use existing highways to return to the original highway.

Support:

A diversion is a temporary rerouting of road users onto a temporary highway or alignment placed around the work area.

Section 6C.11 One-Lane, Two-Way Traffic Control**Standard:**

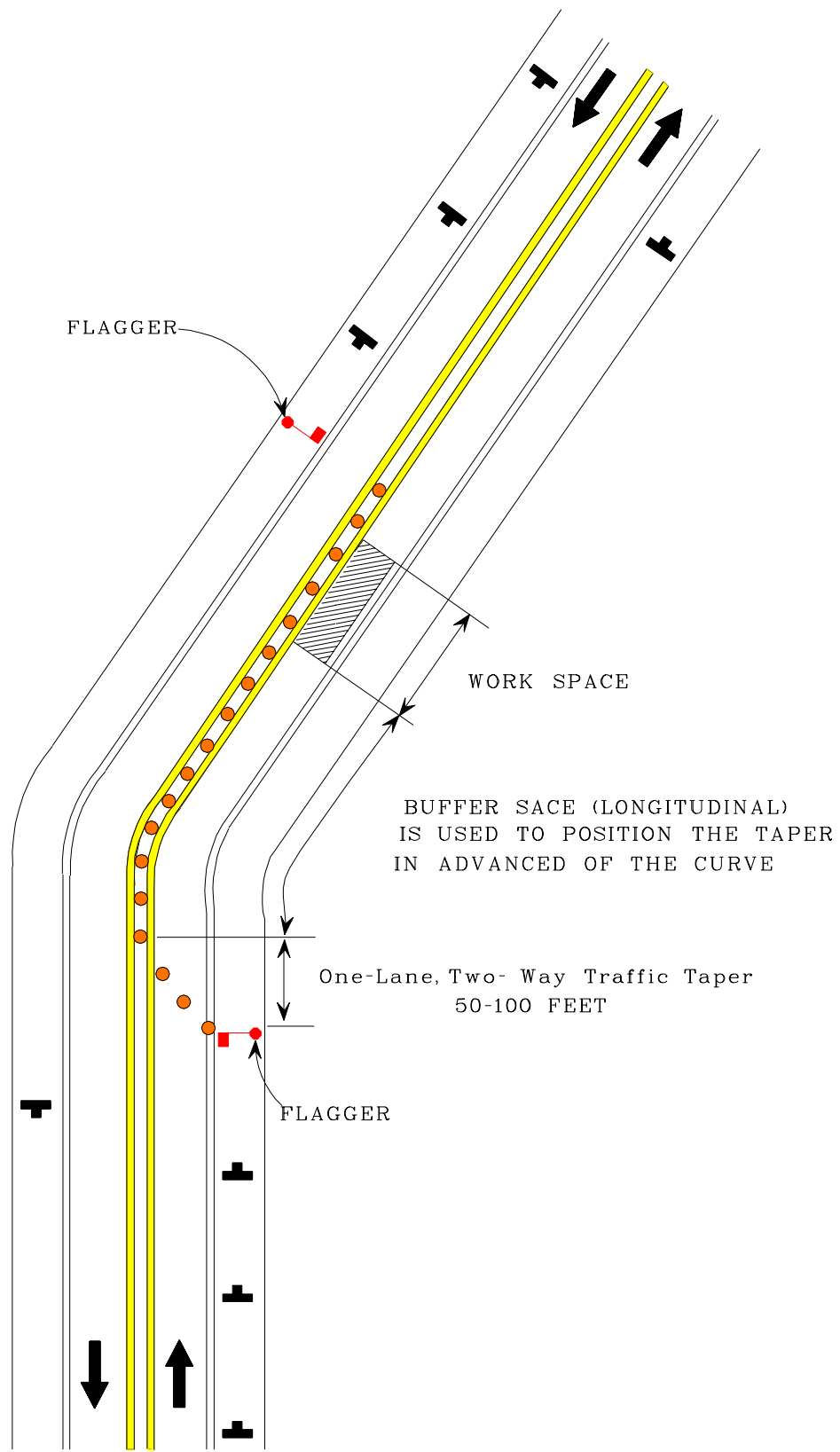
When traffic in both directions must use a single lane for a limited distance, movements from each end shall be coordinated.

Guidance:

Provisions should be made for alternate one-way movement through the constricted section via methods such as flagger control, a flag transfer, a pilot car, traffic control signals, or stop or yield control.

Control points at each end should be chosen to permit easy passing of opposing lanes of vehicles.

If traffic on the affected one-lane roadway is not visible from one end to the other, then flagging procedures, a pilot car with a flagger used as described in Section 6C.14 and 6F.54, or a traffic control signal should be used to control opposing traffic flows.



**EXAMPLE OF A
ONE-LANE, TWO-WAY TRAFFIC TAPER
FIGURE 6C-3**

Support:

At a spot constriction, such as an isolated pavement patch on highways with lower speeds and adequate sight distance, the movement of traffic through one-lane, two-way constrictions tends to be self-regulating.

Section 6C.12 Flagger Method of One-Lane, Two-Way Traffic Control**Option:**

When a one-lane, two-way TTC zone is short enough to allow a flagger to see from one end of the zone to the other, traffic may be controlled by either a single flagger or by a flagger at each end of the section.

Guidance:

When a single flagger is used, the flagger should be stationed on the shoulder opposite the constriction or work space, or in a position where good visibility and traffic control can be maintained at all times. When good visibility and traffic control cannot be maintained by one flagger station, traffic should be controlled by a flagger at each end of the section. One of the flaggers should be designated as the coordinator. Flaggers should be able to communicate with each other orally, electronically, or with manual signals. These manual signals should not be mistaken for flagging signals.

Due to limited room for vehicles to pass activities and equipment occurring on narrow roadways, cones should not be used for channelization on roadways 20 foot or less in width.

Section 6C.13 Flag Transfer Method of One-Lane, Two-Way Traffic Control**Support:**

The driver of the last vehicle proceeding into the one-lane section is given a red flag (or other token) and instructed to deliver it to the flagger at the other end. The opposite flagger, upon receipt of the flag, then knows that it is reasonably safe to allow traffic to move in the other direction. A variation of this method is to replace the use of a flag with an official pilot car that always follows the last road user vehicle proceeding through the section.

Guidance:

The flag transfer method should be employed only where the one-way traffic is confined to a relatively short length of a road, usually not more than 1 mile in length.

Section 6C.14 Pilot Car Method of One-Lane, Two-Way Traffic Control**Option:**

A pilot car may be used to guide a queue of vehicles through the TTC zone or detour.

Guidance:

The operation of the pilot vehicle should be coordinated with flagging operations or other controls at each end of the one-lane section.

Option:

On low volume roadways, a "WAIT FOR PILOT VEHICLE" sign may be used with approval of the District Traffic Engineer.

Standard:

The PILOT CAR FOLLOW ME (G20-4) sign shall be mounted at a conspicuous location on the rear of the vehicle. The pilot car shall also have the name of the contractor or contracting authority prominently displayed.

Section 6C.15 Temporary Traffic Control Signal Method of One-Lane, Two-Way Traffic Control**Option:**

Traffic control signals may be used to control vehicular traffic movements in one-lane, two-way TTC zones as approved by the District Traffic Engineer (see Figure TTC-42.0 and Chapter 4G of the MUTCD). For bridge reconstruction, see Standard TS-1, VIRGINIA ROAD AND BRIDGE STANDARDS.

Section 6C.16 Stop or Yield Control Method of One-Lane, Two-Way Traffic Control**Option:**

STOP or YIELD signs may be used to control traffic on low-volume roads at a one-lane, two-way TTC zone when drivers are able to see the other end of the one-lane, two-way operation and have sufficient visibility of approaching vehicles.

Guidance:

The use of STOP or YIELD signs for traffic control on low-volume roads at a one-lane, two-way work zone should have written approval from the District Traffic Engineer. See warrants for No-Passing Zones at Curves in Chapter 3B of the MUTCD.

If the STOP or YIELD sign is installed for only one direction, then the STOP or YIELD sign should face road users who are driving on the side of the roadway that is closed for the work activity area.

Standard:

All temporary traffic control devices shall be removed as soon as practical when they are no longer needed. When work is suspended for short periods, advance warning signs that are no longer appropriate shall be removed from the roadway, and other inappropriate devices removed from the work area so they are not visible to drivers.

Guidance:

Attention should be given to the maintenance of roadside safety during the life of the TTC zone by applying the following principles:

- A. To accommodate run-off-the-road incidents, disabled vehicles, or emergency situations, unencumbered roadside recovery areas or clear zones should be provided where practical.*
- B. Channelization of road users should be accomplished by the use of pavement markings, signing, and crashworthy, detectable channelizing devices.*
- C. Work equipment, workers' private vehicles, materials, and debris should be stored in such a manner to reduce the probability of being impacted by run-off-the-road vehicles.*

Each person whose actions affect TTC zone safety, from the upper-level management through the field workers, should receive training appropriate to the job decisions each individual is required to make.

Standard:

Only those individuals who are trained in proper TTC practices and have a basic understanding of the principles (established by applicable standards and guidelines, including those of this Manual) shall supervise the selection, placement, and maintenance of TTC devices used for TTC zones and for incident management.

Guidance:

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

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

Standard:

Before any new detour or temporary route is opened to traffic, all necessary signs shall be in place.

All TTC devices shall be removed as soon as practical when they are no longer needed. When work is suspended for short periods of time, TTC devices that are no longer appropriate shall be removed or covered.