



## CHAPTER VIII TRAFFIC CONTROL DEVICES

### SECTION 8-04

### TEMPORARY TRAFFIC CONTROL PLANS

**8-04.1 GENERAL.** This section outlines procedures for the preparation of traffic control plans, and supplements the "Manual on Uniform Traffic Control Devices", hereinafter referred to as the "MUTCD".

A Traffic Control Plan (TCP) is developed for every project. The TCP is an integral part of the planning and design of a project. The scope of the TCP is determined by the complexity of the project and is developed by the designer in the district in cooperation with district construction, maintenance and traffic personnel. Typical traffic control set-ups shall be shown for each work activity within the work zone. A preliminary field check with district construction and traffic is recommended to ensure the TCP will be compatible with field conditions.

In some cases, it may be necessary to obtain traffic count data from the Planning Division to aid in the development of the TCP. This is especially the case where traffic capacity is a significant factor in the design of the TCP. Intersection traffic count data may also be requested from district traffic personnel. Hourly volumes can assist in determining the type of traffic control used, working hour restrictions and other aspects of the TCP. The use of Highway Capacity Software, VISSIM, CORSIM or other computer programs may aid in estimating queue lengths, delays, etc. resulting from the work zone.

When staged construction is used for a project, the stages should be clearly defined in the TCP. Each stage should have a description of the type of work being done during that phase. Stationing should be shown if applicable.

Traffic control sheets must be provided in the traffic control plans showing the location of all traffic control devices. Typical applications of construction zone devices are shown at the end of this section. See Subsection 8-04.23

On all interstate projects, or projects within interstate right of way (regardless of the funding type), the district shall submit a set of traffic control plans and associated JSP's to FHWA for review and approval. The district should submit a complete set of traffic control plans and associated JSP's to the Design Division, 14 weeks prior to the bid opening date (see [Subsection 4-03.16](#)). Upon approval, FHWA will send an approval letter to the district with a copy to the Design Division.

The designer should become familiar with [Standard Plans 612, 616, 617 and 619](#) and [Secs 612, 616, 617 and 619](#) of the Standard Specifications before preparing the traffic control plan.

Contractors are allowed to reuse traffic control devices from job to job, so designers should not specify that all devices on any particular job shall be new.

**8-04.1 (1) COMPONENTS OF A WORK ZONE.** The work zone is composed of the four basic components shown in [Figure 8-04.3](#).

**8-04.1 (1) (a) ADVANCE WARNING AREA.** In the advance warning area, the drivers are informed of what to expect. The advance warning area contains warning signs with appropriate legends, regulatory signs, such as speed reduction signing, changeable message signs and other warning devices. The signs or other warning devices are positioned to give the driver sufficient time to react to the conditions. Warning devices should not be placed too far in advance, as the warning message will lose effectiveness. Suggested advance sign spacing is shown on [Figure 8-04.1](#).

In some cases on high volume routes, traffic backups due to the work activity may extend past the normal advance warning area. In this case, additional signing may be required to warn drivers before they reach the backup. For longer-term activities, alternate route signing and interactive devices or changeable message signs may be considered. Computer programs are available to aid in estimating back ups and delays due to work zones.

In some cases, particularly in urban areas, the advance warning area may extend through an intersection or

interchange. Special considerations such as additional advance signs or adjustments to sign spacing may be needed to assure that all approaching drivers are informed of the conditions.

**8-04.1 (1) (b) TRANSITION AREA.** When redirection of the driver's normal path is required, traffic must be channelized from the normal path to a new path. Transition areas usually involve strategic use of tapers, channelizing devices, signing, pavement marking and other traffic control devices.

**8-04.1 (1) (c) ACTIVITY AREA.** The activity area is the area of the roadway where the work takes place. It is composed of the buffer space, work space, and the traffic space. When work occurs on a high-volume, highly congested facility in an urban area, incident management vehicle access to the work area shall be considered to allow quick response to traffic incidents with a minimum of interruption. This may involve providing storage space at the beginning or end of the activity area, or both. This storage space should not extend into any portion of the buffer space.

**8-04.1 (1) (c) 1. BUFFER SPACES.** Buffer spaces provide a recovery space for an errant vehicle. Buffer spaces may be placed longitudinally or laterally with respect to the direction of traffic flow. Longitudinal buffer spaces should be used whenever practicable. Lateral buffer spaces may be considered based on the type of work. Lateral buffer spaces should be used when practicable between the traffic space and fixed objects or pavement drop-offs. Guidelines for the length of longitudinal buffer spaces are given in Table 8-04.1.

**TABLE 8-04.1  
RECOMMENDED LENGTH OF  
LONGITUDINAL BUFFER SPACES**

POSTED SPEED PRIOR TO CONSTRUCTION, MPH	LENGTH, FT	LENGTH, M
up to 35	120	35
40 to 45	220	65
50 to 55	335	100
60 to 70	550	165

**8-04.1 (1) (c) 2. WORK SPACE.** The work space is the area that is closed to traffic and set aside for workers, equipment and material. Work spaces in stationary operations are delineated with channelizing devices and/or pavement marking and may be protected with a barrier. Since there may be several work spaces within the project limits, each work space should be adequately signed to inform road users and reduce confusion.

The work space may be supplemented by channelizers and/or barricades placed perpendicular to the flow of traffic to deter non-construction related use of closed lanes as shown in Figure 8-04.19. The longitudinal spacing and location of these devices should be developed with the length of the closed lanes, work being performed, and roadway characteristics in mind. For example, a longitudinal spacing of twice the normal sign spacing may be used for a paving operation on a limited access roadway. Whereas, the devices may be located upstream of a pavement repair area on the same type of facility.

**8-04.1 (1) (c) 3. TRAFFIC SPACE.** The traffic space is the area where the traffic is routed around the work space. It is important that the driver is clearly guided into and through the traffic space.

**8-04.1 (1) (d) TERMINATION AREA.** The termination area is used to return traffic to the normal traffic path and operating conditions. The termination area normally extends from the end of the work area to the END ROAD WORK sign or the normal SPEED LIMIT sign.

**8-04.1 (2) TAPERS.**

**8-04.1 (2) (a) TAPER LENGTH.** The length of taper used to close a lane (L) is determined by the speed of traffic

(posted speed prior to construction) and the width of the lane to be closed (lateral distance traffic is shifted). Taper lengths and formulas are shown on [Figure 8-04.1](#).

- 8-04.1 (2) (b) MERGING TAPERS.** Merging tapers are used to close a lane or combine traffic lanes on multi-lane facilities. It is important that the full length taper (L) be provided where practical. For long-term operations, lane line markings are removed through the merging taper, and temporary edge lines should be provided to guide drivers through the taper and the work area.
- 8-04.1 (2) (c) SHIFTING TAPERS.** Shifting tapers are used to laterally shift a lane or lanes of traffic where merging is not required. Shifting tapers typically have a length of L, although where space is limited, shifting tapers may be reduced to 1/2 L. Where 1/2 L shifting tapers are used, REVERSE CURVE or REVERSE TURN signs, along with any required advisory speed plaques, should be posted prior to the shift. For long-term operations, conflicting pavement markings are removed and temporary markings provided to guide drivers through the tapers and work area. For short-term operations where it is not practical to modify pavement markings, a device spacing of 10 ft. [3 m] is used.
- 8-04.1 (2) (d) SHOULDER TAPERS.** It is important that shoulders are closed prior to shoulder work or through lane closures. This helps to prevent drivers from entering the work zone on the shoulder and helps prevent collisions with flashing arrow panels and other traffic control devices. Shoulder tapers typically have a length of 1/3 L.
- 8-04.1 (2) (e) ONE-LANE, TWO-WAY TAPERS.** Where one lane of a two-lane two-way roadway is closed, a short taper of 100 ft. [30 m] with a device spacing of 20 ft. [6 m] is used to guide drivers into and out of the one-lane two-way section. For long-term operations, centerline markings are removed and temporary edgeline markings provided to guide drivers through the tapers and the work area.
- 8-04.1 (2) (f) TWO-WAY CENTER TURN LANE TAPERS.** A taper length of 1/2 L is used to close a center turn lane. Where space is limited, a shorter taper may be used.
- 8-04.1 (2) (g) CLOSING TAPERS.** A taper of 100 ft. [30 m] per lane with a device spacing of 20 ft. [6 m] is used to help drivers identify the end of the work area.
- 8-04.1 (3) WORK ZONE DURATION.** For design purposes, work zone durations are defined as follows.
- 8-04.1 (3) (a) MOBILE.** Work on the roadway that moves intermittently or continuously.
- 8-04.1 (3) (b) SHORT TERM.** Work that occupies a location up to, and including, 3 days.
- 8-04.1 (3) (c) LONG TERM.** Work that occupies a location more than 3 days.
- 8-04.2 WORK ZONE SIGNING.** The TCP should contain details showing the location of each work zone sign. All existing signs within the project limits are shown on the traffic control plan with a descriptive note indicating "UIP" (use in place), "cover" or "remove". To ensure maximum visibility, existing signs and other physical features (trees, sidewalks, billboards, commercial signs, etc.) must be considered when locating work zone signs.

This section of the Project Development Manual provides guidance on the use of many typical work zone signs and Standard Plan 616.10 lists and specifies the standard work zone signs used on MoDOT projects. Additional information can be found in the MUTCD.

There are three types of signs used in work zones: warning, regulatory and guide (W, R & G).

Work zone warning signs are typically 48 x 48-inch [1200 x 1200 mm], diamond-shaped, black on orange signs with MoDOT fluorescent orange sheeting. Work zone regulatory signs are identical to permanent regulatory signs with MoDOT Type 3 sheeting. Work zone guide signs are generally rectangular in shape and have a black legend on orange background with MoDOT fluorescent orange sheeting; but may come in different sizes, shapes, colors

and sheeting depending on type and purpose of the signing. Sometimes a plate or plaque is affixed to a work zone sign or mounted below it to customize the sign.

The sign mounting method is dependent upon the contractor's operations, and should not be dictated on the plans. See Standard Plan 616.10 for mounting methods, and Standard Plan 903.03 for post installation requirements. The only sign relocations that are paid for are post-mounted signs. We do not pay for temporary or portable sign relocations. If in the judgment of the designer, post-mounted signs will be used on a project, a pay item for Relocated Signs (616-10.10) should be included in the contract documents. Sign quantities are tabulated on the plans, and are paid for by the square foot. The tabulation and any notes concerning the signs shall be consistent throughout the traffic control plan.

Non-standard work zone signs (i.e., legends or sizes not shown on standard plan 616.10) should be designed with the assistance of the Central Office Sign Production Center, as described in [Section 8-03](#). Correspondence with the Central Office Sign Production Center on this design should indicate these are work zone signs. The non-standard work zone signs should be detailed in the plans and listed under "Miscellaneous Signs" on the D-2BS sheet. If the sign cannot be mounted by a method specified by [Standard Plan 616.10](#) and [903.03](#), the mounting method should also be specified in the plans.

- 8-04.2 (1) REGULATORY SIGNS.** These signs are used to impose legal restrictions on the motorists. Regulatory signs are typically rectangular in shape with black lettering on a white background. There are exceptions however, including STOP, YIELD, DO NOT ENTER and WRONG WAY signs.
- 8-04.2 (1) (a) R1-1 (STOP).** A typical application for STOP signs in work zones is where a side street connection that is currently under stop control is temporarily relocated. Due to temporary changes in geometrics or traffic patterns, multi-way STOP signs may be needed. Warrants for multi-way STOP signs are found in Part 2B.07 of the MUTCD.
- 8-04.2 (1) (b) R1-2 (YIELD).** The YIELD sign assigns right-of-way to certain approaches of an intersection. Vehicles controlled by a YIELD sign need to stop only when necessary to avoid interference with other traffic that is given right-of-way.
- 8-04.2 (1) (c) R1-2a (TO ONCOMING TRAFFIC).** The TO ONCOMING TRAFFIC plaque is used to supplement the YIELD sign for one-lane, two-way operations. See Subsection 8-04.15.
- 8-04.2 (1) (d) R2-1 (SPEED LIMIT XX).** SPEED LIMIT signs are used in work zones to set enforceable speed limits through the work zone. Work zone speed limits are shown on [Standard Plan 616.10](#). The actual construction speed limit should be based on these guidelines. Experience and knowledge of anticipated conditions may warrant variance from these guidelines. Additional guidelines are as follows:
- For two-lane roadways, normal SPEED LIMIT signs are typically installed opposite the work zone SPEED LIMIT sign on the opposite approach facing traffic leaving the work zone.
  - Reduced SPEED LIMIT signs are not to be installed on side street approaches or ramps for work limited to main line only. Reduced SPEED LIMIT signs may be installed after the ramp or side street to inform drivers of the work zone speed limit. If the work is on the ramp, or affects the ramp, reduced SPEED LIMIT signs should be used.

If geometrics in the work zone require a lower speed than the speed indicated in Standard Plan 616.10 (i.e., temporary bypass, narrow lanes, etc.), appropriate warning signs with advisory speed plaques shall be used to advise of this specialized situation.

- 8-04.2 (1) (e) SPEED LIMIT AND STROBE LIGHT ASSEMBLY.** This assembly consists of signs R2-1 (SPEED LIMIT XX), S4-4 (WHEN FLASHING), G023-1 (WORK ZONE) and two strobe lights arranged as shown on [Standard Plan 616.10](#). This assembly is used on multi-lane high volume roadways when construction operations are not permitted during peak hours. All normal travel lanes must be available and normal

speed permitted through the work zone during peak volume hours. The speed limit designated on the assembly is only enforceable when the strobe lights are operating. This assembly is a substitute for normal advance signing required to reduce speed through the work zone and eliminates covering or removing the speed control signs during non-working hours. The assembly should only be used in long-term stationary work zones with restrictions on working hours. The REDUCED SPEED AHEAD sign is not used in advance of the speed limit and strobe light assembly. This assembly is paid per each, and includes all signs, strobes, posts and installation.

- 8-04.2 (1) (f) **R2-5a (REDUCED SPEED AHEAD).** This sign is only used when the speed reduction is 15 mph [25 km/h] or more below the existing or posted speed limit. The REDUCED SPEED AHEAD sign is always followed by a SPEED LIMIT sign.
- 8-04.2 (1) (g) **R4-1 (DO NOT PASS).** The DO NOT PASS sign may be used on a two- or three-lane roadway at the beginning of, and at intervals within, a work zone where passing is restricted, or in conjunction with the "WORK ZONE FINE" sign. A typical application of this sign is on a temporary two-lane, two-way operation on a normally divided highway.
- 8-04.2 (1) (h) **R4-2 (PASS WITH CARE).** The PASS WITH CARE sign should only be used in conjunction with the "WORK ZONE FINE" sign set-up.
- 8-04.2 (1) (i) **R4-7a (KEEP RIGHT).** The KEEP RIGHT sign is used at the ends of medians, median islands and other obstructions where traffic is required to keep to the right.
- 8-04.2 (1) (j) **R10-6 (STOP HERE ON RED).** This sign may be used at signalized intersections to supplement the pavement stop bar. This sign is typically used with the signal controlled one-lane, two-way operation.
- 8-04.2 (1) (k) **R11-2 (ROAD CLOSED).** This sign is used where the roadway is closed to all traffic except contractor's equipment.
- 8-04.2 (1) (l) **R11-3a (ROAD CLOSED XX MILES AHEAD LOCAL TRAFFIC ONLY).** This sign is used where through traffic must detour to avoid a closure some distance beyond this sign, but where local traffic can move up to the point of closure.
- 8-04.2 (2) **WARNING SIGNS.** Warning signs are used in work zones to give notice of unexpected conditions on or adjacent to a roadway that might not otherwise be apparent. These signs should be located in advance of the condition for which the warning is given to permit the motorist time to respond appropriately. The location and spacing of many of these signs are shown in the figures at the end of this section.

Warning signs should bear the legend "Ahead" in lieu of a definite distance if the signs are to be relocated during the workday.

All work zone warning signs have a black legend on an orange background and are typically diamond shaped with some exceptions. Existing black on yellow permanent warning signs within construction areas may remain in place if the meaning conveyed by such signs does not conflict with current conditions.

- 8-04.2 (2) (a) **WO1-1 AND WO1-3 SERIES (TURN AND REVERSE TURN).** These symbolic signs are used when the design speed of a turn or reverse turn is 30 mph [50 km/h] or less.
- 8-04.2 (2) (b) **WO1-2 AND WO1-4 SERIES (CURVE AND REVERSE CURVE).** These symbolic signs are used when the design speed of a curve or reverse curve is greater than 30 mph [50 km/h] and less than the posted speed limit.
- 8-04.2 (2) (c) **WO1-4b AND WO1-4c SERIES (DOUBLE AND TRIPLE ARROW REVERSE CURVE SIGN).** These symbolic signs may be used to give positive guidance to motorists when two- or three- lanes of traffic are continuous through a reverse curve.

- 8-04.2 (2) (d) WO1-6 AND WO1-7 SERIES (HORIZONTAL ARROW AND DOUBLE HEAD HORIZONTAL ARROW).** These symbolic signs are used in conjunction with Type III barricades. The HORIZONTAL ARROW signs are also used in conjunction with the TURN and REVERSE TURN series signs.
- 8-04.2 (2) (e) WO3-1a (STOP AHEAD).** This symbolic sign is used in advance of a STOP sign that is not visible for a sufficient distance to permit the driver to bring the vehicle to a complete stop. This sign may also be used where a driver would not normally expect STOP sign control.
- 8-04.2 (2) (f) WO3-2a (YIELD AHEAD).** This symbolic sign is used in advance of a YIELD sign that is not visible for a sufficient distance to permit the driver to bring the vehicle to a stop at the YIELD sign or where a driver would not normally expect YIELD sign control.
- 8-04.2 (2) (g) WO3-3 (SIGNAL AHEAD).** This symbolic sign is used in advance of a traffic signal where the minimum visibility requirements described in [Subsection 8-02.10\(1\)](#) cannot be met or where a driver would not normally expect signal control. This sign should be used at temporary traffic signal installations in work zones.
- 8-04.2 (2) (h) WO3-4 (BE PREPARED TO STOP).** This sign is used where conditions require traffic to stop for intermittent periods. This sign is used with the one-lane, two-way operation under YIELD sign control. This sign should also be used with the one-lane, two-way operation under flagger control.
- 8-04.2 (2) (i) WO5-5 (NARROW LANES).** This sign is used on multi-lane highways where the lane width is temporarily reduced.
- 8-04.2 (2) (j) WO6-3 (TWO WAY TRAFFIC).** This symbolic sign is used to give warning of a transition from a divided roadway to a two-lane roadway. This sign shall be used as required at intervals to periodically remind drivers that they are on a two-lane roadway. This sign is used with temporary two-lane, two-way operations on multi-lane divided highways.
- 8-04.2 (2) (k) WO7-3a (NEXT XX MILES PLAQUE).** This sign supplements warning signs only and indicates the distance over which a driver can expect the signed condition. This sign is used where the condition exists for one mile or more. The mileage shown is always rounded to the nearest mile. This sign shall only be installed on the first warning sign indicating the condition.
- 8-04.2 (2) (l) WO8-6 (TRUCK CROSSING).** This sign is used where the plans indicate a temporary truck crossing as shown in Figure 8-04.5.
- 8-04.2 (2) (m) WO8-6c (TRUCK ENTRANCE).** This sign is used where the plans indicate a temporary truck entrance as shown in Figure 8-04.5.
- 8-04.2 (2) (n) WO8-9 (LOW SHOULDER).** These signs may be used to warn of a shoulder condition where there is an elevation difference of less than 2 in. [50 mm] between the shoulder and the travel lane..
- 8-04.2 (2) (o) WO8-9a (SHOULDER DROP-OFF).** These signs are used to warn of a shoulder condition where there is an elevation difference greater than 2 in. [50 mm] between the shoulder and the travel lane during non-working hours. This sign should be used as shown in Std. Plan 619.10.
- 8-04.2 (2) (p) WO8-11 (UNEVEN LANES).** These signs are used during operations that create a substantial difference, 2 in. [50 mm] or more, in elevation between adjacent lanes. This sign should be used as shown in Std. Plan 619.10.
- 8-04.2 (2) (q) WO8-12 (NO CENTER STRIPE).** These signs are used where center stripes on two-lane two-way or three-lane roadways have been temporarily obliterated due to resurfacing or cold milling. These signs are used in combination with temporary pavement marking. The signs are placed at approximately one-mile [1.6 km] intervals and approximately 150 ft. [45 m] from side road intersections. [Standard Plan 620.10](#)

shows the configuration for these signs and pavement markers on a two-lane roadway. This layout should also be included in the TCP.

- 8-04.2 (2) (r) **WO12-1 (DOUBLE DOWN ARROW)**. These signs are used at the end of temporary islands or obstructions in the roadway where traffic traveling in the same direction is permitted to pass on either side of the island or obstruction.
- 8-04.2 (2) (s) **WO12-2 SERIES (LOW CLEARANCE)**. These signs are used when the vertical clearance is 15 ft., 2 in. [4.62 m] or less in non-commercial zones and 16 ft., 2 in. (4.93 m) or less in commercial zone limits of Kansas City, Springfield, St. Joseph and St. Louis. The clearance indicated on the signs is the actual clearance less 2 in. [50 mm]. Use the mileage plaque with this assembly in advance of the last interchange or intersection before the restriction.
- 8-04.2 (2) (t) **WO12-3a, b SERIES (OVERHEAD LOW CLEARANCE)**. These signs are mounted on the bridge with low clearance. These signs and the LOW CLEARANCE shoulder mount signs are always used when the low clearance condition outlined in Section 8-04.2(2)(q) exists in work zones.
- 8-04.2 (2) (u) **LOW CLEARANCE/WIDTH RESTRICTION XX' XX" XX MILES AHEAD**. These signs may be used in advance of the last interchange or intersection before a physical height or width restriction. These signs should be used on divided highways. Where a significant amount of traffic will be affected by these restrictions, changeable message signs and/or alternate route signing may be used in addition to these signs.
- 8-04.2 (2) (v) **WO13-1 (ADVISORY SPEED PLAQUES)**. These signs supplement warning signs only, and the message indicates the maximum recommended speed around a curve or through a signed condition. The speed plaque is not used alone and *is not used* to indicate the speed limit.
- 8-04.2 (2) (w) **WO20-2 (DETOUR AHEAD)**. These signs are used in advance of a signed detour. These signs are only installed on the route that is being detoured. Detour signing is used with these signs to guide drivers through the detour. These signs are not used with temporary bypasses or connections unless part or the entire route is on other existing roadways.
- 8-04.2 (2) (x) **WO20-3 (ROAD CLOSED AHEAD)**. These signs are used with detour signing after the ROAD CLOSED XX MILES AHEAD sign and before the ROAD CLOSED sign.
- 8-04.2 (2) (y) **WO20-4 (ONE LANE ROAD AHEAD)**. This sign is used *only* on two-lane highways during one-lane, two-way operation.
- 8-04.2 (2) (z) **WO20-5 (CENTER/RIGHT/LEFT LANE CLOSED AHEAD)**. This sign is used *only* on multi-lane highways with lane closures.
- 8-04.2 (2) (aa) **WO20-6a (RIGHT LANE CLOSED, LEFT/CENTER PLATE)**. This sign is used *only* on multi-lane highways with lane closures.
- 8-04.2 (2) (bb) **WO20-7a (FLAGGER AHEAD)**. These symbolic signs are always used in advance of a flagger. These signs are only displayed when a flagger is present, and shall be covered when the flagger is not present.
- 8-04.2 (2) (cc) **WO20-1 (ROAD WORK AHEAD)**. These signs are typically the first signs in a series of advance work zone signs. The RAMP/BRIDGE plate may also be used with this sign as needed.
- 8-04.2 (2) (dd) **WO21-5b (SHOULDER WORK AHEAD)**. These signs are used in advance of work being performed on the roadway shoulder. These signs are only used when work does not encroach into the traveled way.
- 8-04.2 (2) (ee) **WO22 SERIES (BLASTING ZONE SIGNING)**. These signs are not shown on the traffic control plan due to the various methods of detonation and various locations within a project that may require blasting. These signs, if used, are furnished by the contractor, at the contractor's expense.

- 8-04.2 (2) (ff) RADAR SPEED ADVISORY ASSEMBLY.** These devices contain an active display that indicates the speed of each vehicle as it passes the sign. These devices are recommended on divided highways with lane closures, multi-lane urban or rural resurfacing projects over 5 miles [8 km] and bridge rehabilitation projects with lane restrictions that will last 30 days or more. These devices shall not be used on routes with a posted speed prior to construction less than 50 mph [80 km/h]. Other conditions may warrant the use of this device.
- 8-04.2 (3) OBJECT MARKERS.** Object markers are used in work zones to mark temporary obstructions within or adjacent to the roadway or as channelizing devices.
- 8-04.2 (3) (a) TYPE 1 OBJECT MARKER.** The Type 1 Object Marker is attached to the lead module of sand-filled impact attenuators. No direct payment is made for Type 1 object markers.
- 8-04.2 (3) (b) TYPE 3 OBJECT MARKER.** The Type 3 Object Marker may be used to supplement other channelizing devices in special situations as shown on Figure 8-04.10. When specified, quantities are calculated and shown on the plans.
- 8-04.2 (4) GUIDE SIGNS.** Guide signs are used to guide drivers along highways and provide information to drivers that will help them navigate in the simplest and most direct manner possible. Existing routes have guide signing in place. These guide signs may need to be modified, covered, relocated and/or supplemented to guide drivers through a work zone. PDM [Section 8-03](#), the MoDOT Traffic Manual, and the MUTCD contain information on the types and applications of guide signs. Typical guide signs used in work zones are as follows.
- 8-04.2 (4) (a) EO5-1 (GORE EXIT).** Temporary Gore Exit signs are provided when work in the vicinity of off ramps shifts the gore point of the ramp.
- 8-04.2 (4) (b) GO20-1 (ROAD WORK NEXT XX MILES).** These signs are used for construction projects 2 miles [3.2 km] or greater in length. The mileage on the road construction sign is rounded to the nearest mile.
- 8-04.2 (4) (c) GO20-2 (END ROAD WORK).** These signs are used on all projects where the ROAD WORK AHEAD or ROAD WORK NEXT XX MILES sign is used. If a speed reduction is used, a sign indicating the normal speed limit is also used at the end of the work area.
- 8-04.2 (4) (d) GO23-1 (WORK ZONE) PLAQUE.** These plaques are placed above all SPEED LIMIT and REDUCED SPEED AHEAD signs, except on the SPEED LIMIT sign at the end of the work zone to return traffic to the normal posted speed. These plaques are also placed above all DO NOT PASS and PASS WITH CARE signs. These plaques are used on the above signs regardless of whether the "WORK ZONE FINE" signs are in use.
- 8-04.2 (5) SPECIAL SIGNING.**
- 8-04.2 (5) (a) "DRIVE SMART" SIGN.** This sign is Commission furnished and is used on all projects unless the roadway is closed to traffic and the construction has no effect on existing roadways. District Engineers have discretion whether to use this sign on short-term projects, such as contract leveling course. One 48 in. x 48 in. [1200 mm x 1200 mm] "DRIVE SMART" sign will be placed approximately 500 ft [150 m] before the "ROAD WORK AHEAD" sign or "ROAD WORK NEXT xx MILES" sign for each direction of traffic affected by the project. The Supplemental Revision JSP that describes the installation for this sign is inserted in the proposal by the Design Division. The job estimate should include the appropriate pay item for the installation of this sign and the non-contractual cost of the sign.
- 8-04.2 (5) (b) "POINT OF PRESENCE" SIGN.** This sign is Commission furnished and is to be used on projects deemed prominent by the district. One sign may be placed in each direction of traffic on state highways. These signs should not be used on roadways that are closed to traffic or where the construction has no effect on existing roadways, and should not be placed as to disrupt a sequence of signs (e.g., between RIGHT LANE CLOSED AHEAD and RIGHT LANE CLOSED). The 96 x 48 in. [2400 x 1200 mm]

"POINT OF PRESENCE" sign should be placed in a visible area within the limits of a project. If a visible location within the project is not available this sign may be placed approximately 500 ft [150 m] before the "DRIVE SMART" sign. However, a location remote from the project may reduce the sign's impact after the project is complete and the work zone signs are removed. Because of the sign width, flatter areas are preferable in order to avoid long post lengths in fill sections.

Appropriate pay items for the installation of this sign should be included in the estimate and the cost of the sign should be included in the job estimate as a non-contractual cost. The Resident Engineer will order the sign after the project schedule is received. Upon final inspection, District personnel will affix a "Completed As Promised" label to the sign in the specific location shown on the plans. District personnel should remove the signs and sign posts approximately 90 days after the job has been accepted by MoDOT.

The options available to the designer to describe the project are listed below. Any deviations from this list must be approved by the Public Information and Outreach Unit.

- Bridge Construction
- Bridge Improvements
- Bridge Repair
- Intersection Improvement
- Road Improvements
- Road Resurfacing
- New Signals
- New Intersection
- New Pavement
- Signal Improvements
- Pavement Repair Road Widening
- Safety Improvements
- Lane Additions
- New Bridge
- New Interchange

The options available for project completion date on the sign are Spring, Summer, Fall or Winter along with the year.

**8-04.2 (5) (c) CONST-3A ("WORK ZONE FINE" SIGN).** The "WORK ZONE FINE" sign is specified on projects where all the following criteria are met:

- Duration of the work zone is longer than 4 hours.
- Reduced speed limits are in effect.
- Normal posted speed limit is 60 mph [100 km/hr] or greater.
- Workers will be present without positive protection (concrete barrier or guardrail).

Figure 8-04.21 shows the typical placement of the "WORK ZONE FINE" signing sequence.

If a lane closure is used on a roadway with two lanes in the direction of travel, two DO NOT PASS and two PASS WITH CARE signs and a CONST-3X, (SPEEDING/PASSING) plate should be specified. WORK ZONE plaques should be specified for all DO NOT PASS and PASS WITH CARE signs being used as part of the work zone signing sequence. If a lane closure is used on a roadway with three or more lanes in the direction of travel, the DO NOT PASS and PASS WITH CARE signs and the SPEEDING/PASSING plate should not be specified.

### **8-04.3 GUIDELINES FOR WORK ZONE SIGNING APPLICATIONS.**

**8-04.3 (1) DETOUR AND ALTERNATE ROUTE SIGNING.** Detour signing is used when a section of road is closed to through traffic and rerouted over other existing facilities. Detours are used when other methods of traffic

control such as one-lane, two-way operations, lane closures or temporary bypasses cannot be used. Detours are provided over the shortest possible route around the closure that can sufficiently handle the traffic. The existing traffic volumes on the roadway being closed and the detour route, as well as the facility types are considered when determining detour routes. Detours are preferred over state routes, but other local facilities may be considered. A typical detour is shown in [Figure 8-04.9](#). Detours for multi-lane roadways, expressways and freeways can be quite complex and may require a combination of lane closures and modification of existing guide signs, as well as detour signing.

Where city streets, county roads and other public roads are detoured due to road work, detour signing is provided showing the name or number of the road being detoured.

Detour signing is provided at each junction through the detour route as well as confirmation signs where there are long detour sections over the same route.

Detour signing is not used for temporary bypasses or connections. If part or all of the temporary bypass or connection is on other routes, detour signing should be used.

Alternate route signing may be used where lane closures or physical height or width restrictions will have a significant effect on traffic and a viable alternate route is available. Alternate route signing may also be used where temporary bridge weight restrictions are imposed during construction. Alternate route signing is similar to detour signing except that the DETOUR plaque is replaced with an ALTERNATE plaque.

**8-04.3 (2) SIGNING FOR ONE-LANE, TWO-WAY RESURFACING OPERATIONS.** To expedite moving resurfacing operations on two-lane, two-way roadways, a third series of construction zone signs should be provided. [Figure 8-04.13](#) shows this configuration. This configuration should be shown in the TCP and appropriate sign quantities should be provided. A maximum length of work area may also be shown in the TCP.

**8-04.3 (3) SIGNS IN NARROW MEDIANS.** Where signs are installed in narrow medians, the size of signs may need to be reduced to provide sufficient lateral clearance. It is important to retain the diamond shape of warning signs as much as possible. It is not acceptable to use rectangular shapes in lieu of diamond shapes, but the corners of the diamond shaped signs may be clipped to reduce sign width. It is preferable to use 36-inch [900 mm] warning signs rather than to cut the corners of 48-inch [1200 mm] signs. [Figure 8-04.20](#) provides guidelines for signs in narrow medians. Any other sign sizes or shapes used that are not shown in the standard plans are shown in the plans with a layout including lettering size and series.

**8-04.3 (4) SIGNING FOR MOBILE OPERATIONS.** Mobile operations are work activities that move along the road either intermittently or continuously. With mobile operations, the signs and traffic control devices are normally attached to protective or warning trucks that move with the operation. Stationary signs may also be installed at the beginning and end of sections covered by the mobile operation. For intermittent operations, the stops normally do not exceed 15 minutes. For intermittent lane closures with stops exceeding 15 minutes, stationary traffic control should be considered. In addition to warning signs, revolving lights, flashing arrow panels and truck-mounted attenuators are also commonly used with mobile operations.

The most common mobile operation used with construction projects is the installation of pavement marking. A typical layout for pavement marking traffic control is shown on [Standard Plan 620.10](#). For other mobile operations, consult Part VI of the MUTCD.

**8-04.4 CHANGEABLE MESSAGE SIGNS (CMS).** The CMS is used to supplement other work zone signing to advise the driver of unexpected work zone traffic and routing situations or to provide additional information to the driver. CMS's shall not be used to replace or repeat static sign messages. Typical applications where CMS's may be used are as follows:

- Where backups are expected to extend beyond the beginning of the standard sign sequence.
- Where the speed of traffic is expected to drop substantially.
- Where there are extreme changes in alignment or surface conditions.

- To provide additional advance notice of ramp, lane or roadway closures.
- For incident management.

The proposed location(s) and quantity of CMS's are shown on the TCP. The following guidelines are used for the application and placement of the CMS:

- The CMS is typically placed in advance of any other temporary traffic control signing and is not used to replace or repeat other required signing.
- Where used for route diversion, the CMS should be placed far enough in advance of the work site to allow traffic ample opportunity to exit the affected highway.
- The CMS is normally placed off the shoulder of the roadway. CMS's shall not be placed in medians. The CMS shall be delineated with channelizer drums.
- Each CMS shall not convey more than two messages. When two signs are needed to communicate multiple messages, they should be placed on the same side of the roadway, separated by at least 1000 ft. [300 m].

**8-04.5 TYPE III MOVABLE BARRICADES.** A Type III Movable Barricade is a traffic control device consisting of three horizontal panels with appropriate markings mounted on a portable support system used to control traffic by closing, restricting or delineating all or a portion of the right of way. Type III Movable Barricade details are shown in Standard Plan 616.10. When Type III Movable Barricades are used, appropriate signing is provided. Signs are not mounted on the barricades, thus, when a ROAD CLOSED or other sign is required, a separate sign support shall be provided 7 to 10 feet [2.1 to 3.0 m] behind the barricade. See Section 8-04 figures and [Subsection 8-04.1\(1\)\(c\)2](#) for additional guidance. One barricade is required for every 8 feet [2.4 m] of pavement, so a typical roadway with 2 12-foot [3.6 m] lanes will require three barricades. The plans should indicate the number and locations of barricades. When specified, quantities are calculated and shown on the plans.

**8-04.6 CHANNELIZING DEVICES.** Channelizing devices are commonly used to delineate the traffic path through a work area. Channelizer spacing is shown on [Figure 8-04.1](#). In addition, channelizers may be used as a warning device to mark specific hazards or as described in [Subsection 8-04.1\(1\)\(c\)2](#). Channelizer spacing may be reduced at the discretion of the designer to one-half the spacing shown for off ramp gore areas, intersections, sharp curves, etc. For hazards in or adjacent to the roadway, a spacing of 20 ft. [6 m] or less should be used.

**8-04.6 (1) CONES.** Cones may be used in lieu of drum-like channelizers for daytime operations only. Quantities are not calculated, and no direct payment is made for cones.

**8-04.6 (2) DRUM-LIKE CHANNELIZERS.** Drum-like channelizers are the preferred channelizing devices used in work zones. Drum-like channelizers may be used in daytime or nighttime operations. When specified, quantities are calculated and shown on the plans.

**8-04.6 (3) TRIM-LINE CHANNELIZERS.** Trim-line channelizers may be specified in lieu of drum-like channelizers in ramp areas and intersections where sight distance may be obstructed by using drum-like channelizers. They may also be used in longitudinal sections of channelization where there is inadequate lateral clearance to use drum-like channelizers. Trim-line channelizers may be used in daytime or nighttime operations. When specified, quantities are calculated and shown on the plans.

**8-04.6 (4) DIRECTION INDICATOR BARRICADES.** Direction indicator barricades (DIB) may be specified in lieu of drum-like channelizers for merge tapers in transition areas. Direction indicator barricades should be specified in the shifting tapers shown on Sheet 4 of [Figure 8-04.15](#). When specified, quantities are calculated and shown on the plans.

**8-04.6 (5) TUBULAR MARKERS.** Tubular markers are typically used to divide traffic in temporary two-lane, two-way traffic situations as shown in Standard Plan 616.10. When specified, quantities are calculated and shown on the plans.

**8-04.7 TEMPORARY CONCRETE TRAFFIC BARRIER.** Temporary concrete traffic barrier is a physical device to prevent vehicles from entering the work area or to separate temporary two-lane, two-way traffic situations on

normally divided highways. The use of temporary concrete traffic barrier in lieu of standard temporary traffic control measures is based on engineering judgment. However, temporary concrete traffic barrier is required on bridge rehabilitation jobs with bridge rail replacement and/or full depth repair, and should be considered for any other type of long-term bridge repair work. When specified, quantities are calculated and shown on the plans.

In general, the preferred installation method for temporary concrete traffic barrier is free-standing, which requires a minimum 2-ft [0.6 m] buffer area behind the barrier to allow for lateral deflection in both work areas and lane separation situations. When free-standing installations are used on bridge decks, a 4-ft. [1.2 m] buffer area will be required. Concrete traffic barrier may be placed 6 inches [150 mm] from the edge of bridge decks if tie-down straps are used, however, a 3 ft. [0.9 m] buffer area must be maintained. On bridge decks where lateral deflection cannot be tolerated, the bolt through deck detail will be used. Standard Plan 617.20 illustrates the proper transition from free-standing barrier to barrier with anchor bolts on bridge decks. The method of installation on bridge decks will be determined by Bridge, and will be shown on the bridge plans. The above requirements shall be maintained when developing staging or phasing of work requiring temporary concrete traffic barrier. The lateral deflection limits should be identified on the plans. No design exceptions will be allowed.

Pay items are available for Type F, Type F with Anchoring Systems, and Type F with Tie-Down Strap, as well as pay items for relocating Type F, Type F with Anchoring Systems, and Type F with Tie-Down Strap.

Appropriate channelizing devices and pavement marking are always used in front of barrier tapers for lane closures, shoulder closures or transition areas for temporary bypasses or connections as shown in the PDM figures. Wherever practical, a lateral buffer space should be provided between the edge of the driving lane and the barrier, and a longitudinal buffer space should be provided between the channelizer taper and the barrier taper.

Contractors are not required to paint temporary concrete traffic barriers because delineators are used in lieu of paint. Delineators for temporary concrete traffic barriers are provided at no direct pay as shown on [Standard Plan 617.20](#) and stated in Standard Specification [Sec 617](#). Delineator pay items should only be used to retrofit existing permanent concrete traffic barrier.

- 8-04.7 (1) TEMPORARY CONCRETE TRAFFIC BARRIER END TREATMENTS.** Exposed temporary concrete traffic barrier ends should be treated in one of the following methods (see [Figure 8-04.1](#)).
- 8-04.7 (1) (a) BARRIER FLARE.** The barrier run is flared to the limits of the clear zone. The existing shoulder slope or median slope may be too steep for this type of installation. If this is the case, temporary grading should be provided, or other end treatments should be used. The Roadside Design Guide contains recommended barrier placement in non-level medians. These guidelines also apply to outside shoulders.
- 8-04.7 (1) (b) BARRIER HEIGHT TRANSITION.** A barrier height transition is designed to redirect traffic away from the blunt end of the barrier. A barrier height transition, as shown on Standard Plan 617.00, is installed on the exposed end of the barrier where the posted speed prior to construction on an existing facility or the design speed of a temporary facility is 35 mph [60 km/h] or less. When specified, quantities are calculated and shown on the plans.
- 8-04.7 (1) (c) CRASH CUSHION.** Crash cushions are designed to absorb energy of an impacting vehicle and reduce the force on a passenger to an acceptable level. An approved crash cushion is installed on the exposed end of the barrier where the posted speed prior to construction on an existing facility or the design speed of a temporary facility is greater than 35 mph [60 km/h]. A crash cushion will be required on the upstream end for divided facilities, and on both ends for all two-way facilities. Crash cushions are discussed in [Subsection 8-04.9](#). Applicable pay items should be included in the plans. Special provisions should be provided in the plans for non-standard devices. The types of crash cushions currently used are as follows:
- 8-04.7 (1) (c) (1) IMPACT ATTENUATORS (SAND BARRELS).** This system consists of a group of freestanding sand barrels. Each barrel is designed with a specific weight of sand to absorb the energy of an errant vehicle. Sand barrels are the preferred crash cushions for concrete traffic barrier, and are used when sufficient width is available for their placement. See Standard Plan 612.20 for details. When specified, quantities are calculated and shown on the plans. No direct payment is made for the Type I

object marker on the lead module. An estimate for replacement barrels needs to be included as a separate pay item, typically calculated as one for every ten barrels.

- 8-04.7 (1) (c) (2) PROPRIETARY CRASH CUSHIONS.** These alternate crash cushions may be used when sufficient width is not available for sand barrels. These are typically used on the ends of temporary two-lane, two-way sections on divided highways. Proprietary crash cushions require a paved surface matching the horizontal and vertical slopes of the barrier, and are installed parallel to the direction of traffic. For temporary installations, the typically acceptable Type C crash cushions are the Quadguard-CZ and the ADIEM II. Design details, recommended uses and drawings of these devices can be obtained from the MoDOT website. When these crash cushions are required, a “Type C Crashworthy End Terminal” pay item will need to be included in the contract documents.
- 8-04.7 (2) TEMPORARY GLARE SCREENS.** Temporary glare screens in work zones consist of modular units installed on top of temporary concrete traffic barrier. Temporary glare screens may be used to prevent headlight glare. Glare screens may also be used to block the driver’s view of construction activities. Glare screens should not be used where they could restrict driver visibility and sight distance. Use of these units should be limited due to installation and maintenance concerns to areas where work zone activities could impact the flow of traffic, or geometrics could create a blinding effect on drivers. When specified, quantities are calculated and shown on the plans.
- 8-04.8 PAVEMENT MARKING.** Pavement marking for traffic control guidance will be provided for all projects where appropriate. See [Section 8-05](#) for guidance.
- 8-04.9 LIGHTING DEVICES.** In certain situations it may be desirable or necessary to supplement traffic control devices with lighting devices. The following are acceptable lighting devices.
- 8-04.9 (1) WARNING LIGHTS.** Warning lights are yellow portable, lens-directed, enclosed devices and may be used in either steady burn or flashing mode. Where geometrics of the work zone are such that standard traffic control devices need to be supplemented, warning lights may be warranted. The use of Type A and Type C warning lights should be limited. Quantities for warning lights are calculated independently of the traffic control devices, and are tabulated on the plans.
- 8-04.9 (1) (a) TYPE A (LOW INTENSITY FLASHING).** These flashing lights may be used on drum-like channelizers to warn of an unexpected, isolated hazard. This device should not be used in shifts, tapers or long runs of channelizing devices.
- 8-04.9 (1) (b) TYPE B (HIGH INTENSITY FLASHING).** These flashing lights may be used on advanced warning signs when geometrics, traffic volumes or other conditions warrant increased visibility.
- 8-04.9 (1) (c) TYPE C (STEADY-BURN).** These steady burn lights may be used on drum-like channelizers to delineate traffic in shifts, tapers or long runs or on direction indicator barricades in merging tapers in the work area at night at the designer’s discretion.
- 8-04.10 WORK ZONE LIGHTING.** Work zone lighting consists of two components – work area lighting and overhead lighting, as described in Sec 616 of the specifications. Work zone lighting shall be specified on the plans and included as a pay item when work is required to take place at night, or when lighting needs to be present during non-working hours (i.e. lighting gore areas, crossovers, etc.). Typical work zone lighting may include dirigible lighting, portable light towers, balloon lighting, lights attached to equipment, or post-mounted lights. In some cases, existing lighting or ambient lighting may meet lighting level requirements and negate the need for including work zone lighting as a pay item.

When a project involves stationary operations exceeding 15 continuous days, such as a bridge replacement, interchange or intersection work that occurs at night, temporary fixed lighting should be considered in lieu of work zone lighting. Temporary fixed lighting should also be considered for islands, temporary bypasses, crossovers and connections, and areas of potential conflict, such as temporary ramps, intersections and one-lane, two-way traffic operations that are in place for more than 15 continuous days. These conditions may require lighting even though

the work may not be conducted at night. This type of lighting, while more difficult to design and install, provides more uniform light distribution; thereby, enabling the motorist to better navigate the work zone at night. If temporary fixed lighting is chosen, it must be designed, shown in the plans, and a 901 pay item for “Temporary Lighting” included. Temporary fixed lighting generally includes wood poles, luminaires and power supplies. Refer to Sec 901 of the Standard Specifications for lighting requirements and PDM Section 8-01 for lighting design.

Flagger stations that will be in operation at night are required to be lit. Payment for this is generally included as part of the lump sum for either work zone lighting or temporary lighting.

**8-04.11 FLASHING ARROW PANELS.** Flashing arrow panels should only be used on multi-lane facilities. Flashing arrow panels should be placed on the shoulder at the start of the taper for lane closures. For applications and placement, see the PDM traffic control figures.

Flashing arrow panels are not used with temporary one-lane, two-way operations. Flashing arrow panels are not used to laterally shift one or more lanes of traffic through a temporary bypass or connection. Flashing arrow panels are not used to delineate narrow lanes, islands or fixed objects.

Quantities for flashing arrow panels are estimated and are tabulated on the plans.

**8-04.12 BYPASSES, CROSSOVERS AND TEMPORARY CONNECTIONS.** The plans provide for the construction of bypasses, crossovers or temporary connections for handling traffic where other adequate means of traffic control are not available. The plans show complete details for constructing necessary bypasses, crossovers or connections, including alignment, typical sections, and grading and surfacing quantities.

The design of these temporary facilities receives careful consideration to ensure that an adequate facility will be provided. The following items should be considered when designing temporary bypasses, crossovers or connections: design speed of the approach roadway, design speed of the temporary facility, approach roadway width and the type of construction which requires the temporary facility. Additional geometric information can be gathered from [Figure 4-04.1](#) and [Subsection 4-09.15](#). This element of design is an important aspect of the core team meeting, and should be addressed through that channel.

Drainage structures under temporary facilities are designed for a two-year flood frequency where the facility will carry less than 400 vpd. Drainage structures for facilities with traffic volumes of 400 vpd or more are designed for a five-year flood frequency. Temporary bridges are designed for a ten-year flood frequency, and should be coordinated with Bridge.

The plans provide for the obliteration of all temporary facilities that do not become a part of the completed project, including the removal of drainage structures and facility surfaces. For payment, the components (aggregate, drainage, grading, etc.) of each bypass, crossover and temporary connection are calculated and the quantities added into the plans. Since the cost for removing and obliterating temporary facilities is significant, consideration should be given to utilizing or enhancing existing facilities in lieu of constructing temporary facilities. See appropriate figures in the PDM for appropriate signing.

**8-04.13 DETOURS.** When considering detours, any proposed detour routes must be evaluated to determine the condition of the pavement, capacity of the roadway and geometrics. Sometimes existing city streets and county roads can be improved for use as detours. If other agencies’ facilities are used, an agreement with the local agency having jurisdiction over the roadway will be required. Outer roadways may be constructed early in the project phasing or enhanced to serve as detours. See [Section 4-09](#) for detour signing details.

**8-04.14 TEMPORARY TWO-LANE, TWO-WAY OPERATION.** A temporary two-lane, two-way operation (head-to-head traffic) on one side of a normally divided highway should generally be limited to rural locations. When head-to-head traffic is being considered, the Design Division should be contacted for concurrence. This type of traffic management may be used only after all of the following criteria are addressed and documented:

- The benefit/cost of the two-lane, two-way operation compares favorably to the benefit/cost of other potential traffic control options (e.g., alternate routes, temporary lanes, construction staging, use of shoulders, etc.). The

analysis should include both construction and road user costs associated with each option.

- A capacity analysis of the two-lane, two-way operation confirms this type of traffic management can reasonably accommodate the traffic volumes without detrimental delay to the traveling public.
- The median shoulder width must be adequate for emergency stopping.

When a two-lane, two-way operation is used, the TCP must include provisions for separating opposing traffic throughout the length of the operation with temporary concrete traffic barrier or channelizing devices as shown on Standard Plans 617.20 and 616.10, respectively, except when the two-lane, two-way operation is located on an urban traveled way and the posted speed limit prior to construction is less than 45 mph [70 km/h]. The speed limit for head to head traffic is based on Standard Plan 616.10. At these locations, all obstructions or fixed objects shall have protection provided for both directions of travel. This may require providing temporary installations of impact attenuators or crash cushions for items such as guardrail, bridge ends and barrier walls on what would normally be the downstream side of the obstruction.

Crossovers constructed to facilitate two-lane, two-way operation should be designed for speeds not less than 10 mph [15 km/h] below the posted speed limit prior to construction, unless unusual site conditions exist. Crossovers should be located where horizontal and vertical alignments provide sufficient sight distance.

For payment, the components (aggregate, asphalt, drainage, grading, etc.) of each crossover are calculated and the quantities added into the plans.

**8-04.15 TEMPORARY ONE-LANE, TWO-WAY OPERATION.** Temporary one-lane, two-way operations should be considered on a case-by-case basis. One-lane, two-way operations should be avoided when hourly volumes exceed 600 vehicles per hour. When hourly volumes exceed 600 vehicles per hour or conditions in the following subsections cannot be met, the core team should consider alternative construction methods, such as night work, shoulder improvements for maintaining two-way traffic, time restrictions for lane closures, construction during off-peak hours, detours, diversions, etc. Permitted one-lane, two-way operations include the use of flaggers, flaggers with pilot vehicles or work zone traffic signals.

**8-04.15 (1) FLAGGER CONTROL.** Flagger control should be used to control traffic when two-lane, two-way operations will be restored during non-working hours. Generally, flagger control should be limited to 2-mile [3.2 km] maximum segments. The maximum length is specified on the TCP so that the contractor can properly stage the work. For moving operations, such as resurfacing, a third set of signs as described in [Subsection 8-04.3\(2\)](#) is also provided. Pilot vehicles may be specified to supplement flaggers when the length of the one-lane, two-way operation exceeds one-half mile. No direct payment is made for flagger control or pilot vehicles, with the exception of signs and other traffic control devices shown in the [Figure 8-04.13](#).

**8-04.15 (2) TRAFFIC SIGNAL CONTROL.** Traffic signals should be used for bridge work and other construction work on two-lane roadways when two-lane, two-way operation will not be restored during non-working hours. Work zone traffic signals (WZTS) as specified in [Sec 616](#) should be used when the work area requires only two-phase signal operation. Specification of WZTS allows the contractor to use either temporary or portable traffic signals. [Figure 8-04.13](#) shows typical layouts for signal control.

For locations requiring three or more phase signal operation, temporary traffic signals as specified in [Sec 616](#) should be used and designed to meet the traffic control needs at the location. Wood pole span wire signals are used for temporary signals. It is not necessary to itemize components, but the traffic control plans should include proposed pole and signal controller locations, type of signal heads, signing, and signal phasing.

Lighting is provided for any one-lane, two-way traffic operation when WZTS are specified in the contract. A 150-watt luminaire mounted at 30 ft. [9 m] is required on each approach for temporary traffic signals. At each portable traffic signal location, approved overhead lighting providing an average maintained intensity of 0.6 footcandles [6.5 lux] is required.

The item(s) specified, per each, for WZTS and temporary traffic signals consist of one unit at both ends of each

one-lane, two-way operation.

**8-04.16 TEMPORARY SIGNALS AT INTERSECTIONS.** Due to construction detours through an intersection, temporary signals may be warranted at an intersection that is normally unsignalized. The detoured traffic may result from the closing of a ramp or interchange, an intersection or a route. The intersection affected by the detoured traffic may or may not be in the work zone or project limits. Temporary signals are only considered when detours will be in effect for more than 15 continuous days. Both of the following criteria should be met for temporary signals:

The traffic volumes using the intersection during the detour period meet the volume or interruption signal warrants as described in [Section 8-02](#).

The intersection has sufficient geometrics for signalization. Pavement marking may need to be revised for signalization. Temporary widening can be provided to achieve proper geometrics, although the cost of the required widening, the duration of the signalization and the overall benefit of signalization should be weighed before this is considered.

Wood pole span wire signals are used for temporary signals. The signal phasing, location and type of signal heads, and signing are designed as described in [Section 8-02](#). Temporary lighting is provided on the signal poles (silhouette discernment lighting as described in [Section 8-01](#)). Temporary signals are normally pre-timed, although semi-actuated or fully-actuated control may be considered based on conditions. It is not necessary to itemize quantities, but a scaled layout is included in the TCP showing all items, proposed pole and signal controller locations and signal phasing.

**8-04.17 PAVEMENT EDGE TREATMENT.** Criteria for pavement edge treatment is shown on [Standard Plan 619.10](#) and are described in [Section 619](#) of the Standard Specifications. Quantities of pavement edge treatment are estimated at 100 percent of the potential edge treatment for the project based on the type of work being done. Edge treatment is listed on the "2B" sheets by location. Coordination with the Construction Division is recommended.

**8-04.18 LAW ENFORCEMENT SERVICES.** The use of law enforcement should be considered when work zones are situated on high speed, high volume roadways. The use will vary from district to district, and the decision to use law enforcement services should be made by the core team when budgets permit. An agreement will need to be executed between MoDOT and the law enforcement agency contracted with.

**8-04.19 TEMPORARY MEDIAN CROSSOVERS FOR CONSTRUCTION EQUIPMENT.** Temporary median crossovers on divided highways should be considered wherever it is anticipated that construction equipment will be crossing the median. A typical example is an equipment entrance from a borrow area. Temporary median crossovers may also be considered when there is no existing crossovers or interchanges within the vicinity of the work zone.

If temporary median crossovers are provided for construction equipment, the locations and layouts are shown on the TCP. [Figure 8-04.5](#) shows the design for temporary median crossovers.

**8-04.20 TRAFFIC CONTROL FOR NON-MOTORIZED TRAFFIC.** Where existing bicycle or pedestrian facilities or pathways will be affected by road work, the needs of bicycles and pedestrians should be addressed in the TCP. Use the following guidelines if temporary pedestrian facilities are needed:

- Pedestrians should not be led into direct conflicts with work site vehicles, equipment or operations.
- Pedestrians should not be led into direct conflicts with main line traffic moving through or around the work site.
- Pedestrians should be provided with a safe and convenient path that replicates as nearly as possible the most desirable characteristics of existing sidewalks or footpaths.
- Part VI of the MUTCD contains additional information on handling pedestrians in work zones.

**8-04.21 TRANSIT CONSIDERATIONS.** Provisions for effective continuity of transit service need to be considered in developing the TCP. Transit agencies should be contacted if the construction activities or detours will affect transit routes or operations. The TCP should provide features such as temporary bus stops, pull-outs, and waiting areas for

transit patrons if the existing facilities will be affected.

- 8-04.22 SPECIAL PROVISIONS.** The “Work Zone Traffic Management Plan” special provision is required with all plans. This special provision can be modified to include job specific conditions. This purpose of this special provision is not to call the contractor's attention to the standard specifications or to reinforce the standard plans. Construction phases or stages should not be included in this special provision. A job special provision should be created by the district for any traffic control items not covered in the plans, standard plans or standard specifications, coordinated with the Design and Traffic Divisions.
- 8-04.23 TYPICAL APPLICATIONS.** The PDM figures include typical applications and examples of work zone traffic control. Since each project is unique, the figures cannot address every situation. The typical layouts should be used as much as possible in developing the TCP, and may be adjusted to fit conditions using sound engineering judgment.
- 8-04.24 NO DIRECT PAYMENT.** There are many items of work that are considered incidental. These incidental items should not have a pay item included in the plans since their cost is included in the larger activity they are associated with.